

WORKSHOP MANUAL

**US VERSION
RIGHT HAND MODEL
EXP UBS**

ISUZU

PubNo. RV99_02-01.E

WORKSHOP MANUAL

1998/1999

UBS

2000

UBS

2002

UBS

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
0A	General Information
0B	Maintenance and Lubrication

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
00	SERVICE INFORMATION
1A	HEATING AND VENTILATION
1B	AIR CONDITIONING
1D	COMPRESSOR OVERHAUL

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

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00	SERVICE INFORMATION
2A	FRONT END ALIGNMENT

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
3C	FRONT SUSPENSION
3D	REAR SUSPENSION; COIL SPRING
3E	WHEELS AND TIRES

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

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4A1	DIFFERENTIAL (FRONT)
4A2A	DIFFERENTIAL (Rear 220mm)
4A2B	DIFFERENTIAL (REAR 244mm)
4B1	DRIVELINE CONTROL SYSTEM (SHIFT ON THE FLY)
4B2	DRIVELINE CONTROL SYSTEM (TOD)
4C	DRIVE SHAFT SYSTEM
4D1	TRANSFER CASE (STANDARD TYPE)
4D2	TRANSFER CASE (TOD)

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
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5B	ANTI-LOCK BRAKE SYSTEM
5C	POWER ASSISTED BRAKE SYSTEM
5D	PARKING BRAKES

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

6VD1 / 6VE1

SECTION No.	CONTRNTS
6A	ENGINE MECHANICAL
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6C	ENGINE FUEL
6D1	ENGINE ELECTRICAL
6D2	IGNITION SYSTEM
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6F	ENGINE EXHAUST
6G	ENGINE LUBRICATION
6H	ENGINE SPEED CONTROL SYSTEM
6J	INDUCTION

4JG2

SECTION No.	CONTRNTS
00	SERVICE INFORMATION
6A	ENGINE MECHANICAL
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6B	ENGINE COOLING
6C	FUEL SYSTEM
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4JX1

SECTION No.	CONTRNTS
6A	ENGINE MECHANICAL
6B	ENGINE COOLING
6C	ENGINE FUEL
6D	ENGINE ELECTRICAL
6E	ENGINE DRIVEABILITY AND EMISSIONS
6F	ENGINE EXHAUST
6G	ENGINE LUBRICATION
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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
7A	AUTOMATIC TRANSMISSION (4L30-E)
7A1	TRANSMISSION CONTROL SYSTEM (4L30-E)
7B	MANUAL TRANSMISSION (AR-5)
7B	MANUAL TRANSMISSION (MUA)
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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
8A	LIGHTING SYSTEM
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8C	ENTERTAINMENT
8D	WIRING SYSTEM
8E	METER AND GAUGE
8F	BODY STRUCTURE
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8H	SECURITY AND LOCKS
8I	SUN ROOF/CONVERTIBLE TOP
8J	EXTERIOR / INTERIOR TRIM

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

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9A	SEAT BELT SYSTEM
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9J1	RESTRAINT CONTROL SYSTEM

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SECTION 0A

GENERAL INFORMATION

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Service Precaution

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

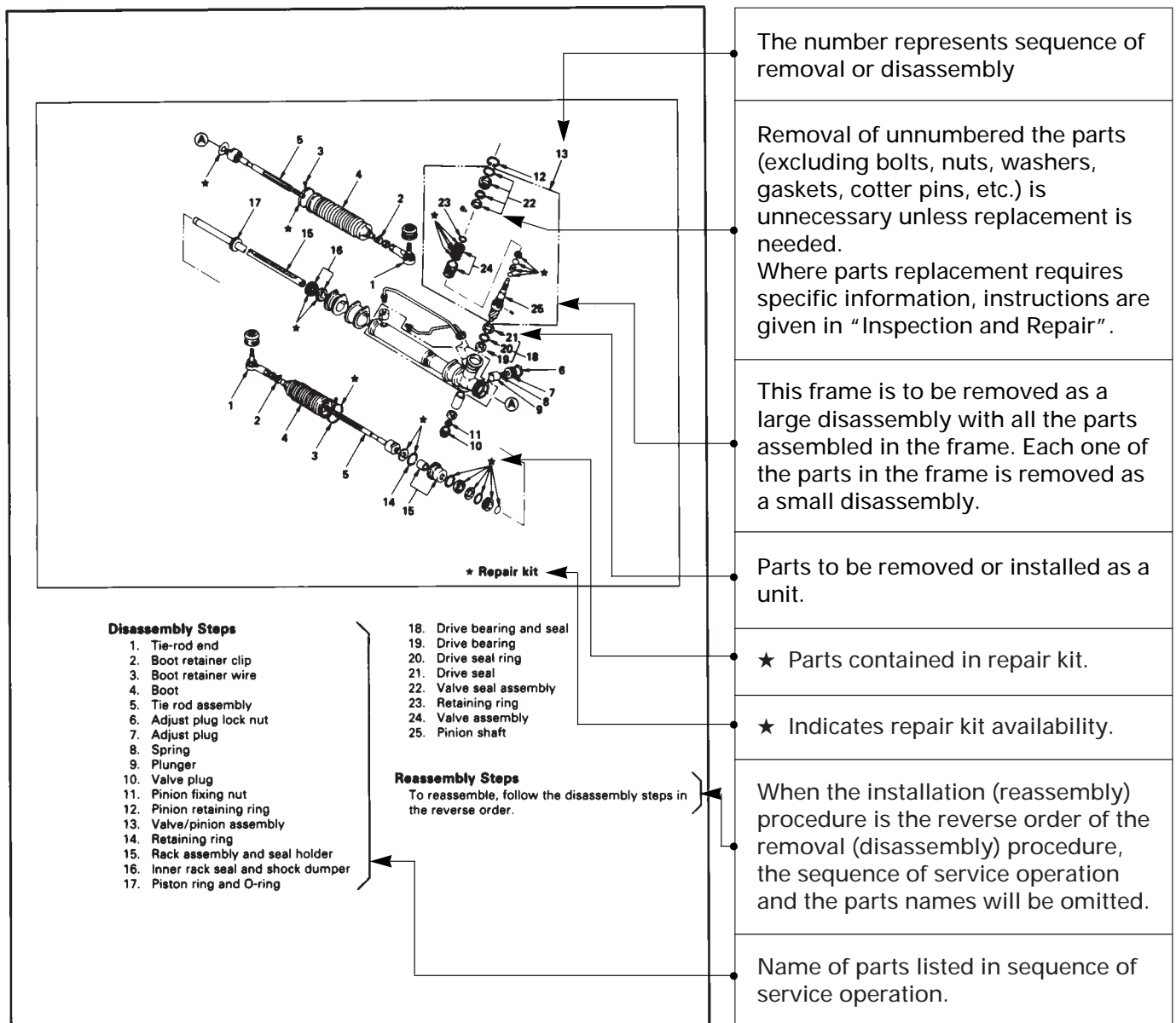
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread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

GENERAL REPAIR INSTRUCTIONS

1. Park the vehicle on level ground and chock the front or rear wheels before lifting the vehicle.
2. Use covers on the vehicle body, seats, and floor to prevent damage and/or contaminations.
3. Disconnect the grounding cable from the battery before performing service operations. This will prevent cable damage or burning due to shortcircuiting.
4. Raise the vehicle with a jack set against the recommended lifting points (see "Lifting instructions" in this section).
5. Support the vehicle on chassis stands.
6. Handle brake fluid and antifreeze solution with great care.
Spilling these liquids on painted surfaces will damage the paint.
7. The use of the proper tool(s) and special tool(s) where specified is essential to efficient, reliable, and safe service operations.
8. Always use genuine ISUZU replacement parts.
9. Discard used cotter pins, gasket, plastic clips, O-rings, oil seals, lock washers, and self-locking nuts at disassembly.
Normal function of these parts cannot be guaranteed if they are reused.
10. Keep the disassembled parts neatly in groups. This will facilitate smooth and correct reassembly.
11. Keep fixing nuts and bolts separate.
Fixing nuts and bolts vary in hardness and design according to installation positions.
12. Clean all parts before inspection or reassembly.
13. Clean the oil ports and other openings with compressed air to make certain that they are free of dirt and obstructions.
14. Lubricate the rotating and sliding faces of all moving parts with oil or grease before installation.
15. Use the recommended liquid gasket to prevent leakage.
16. Carefully observe all nut and bolt torque specifications.
17. When service operation is completed, make a final check to be sure service has been done properly and problem has been corrected.
18. When removing or replacing parts that require refrigerant to be discharged from the air conditioning system, be sure to use the following tools to recover and recycle the Refrigerant-134a (R-134a).
For 134a:
Use the R-134a Refrigerant Recovery/Recovery/Recycling/Recharging/System (ACR⁴) or its equivalent to prevent the discharge of refrigerant into the air.

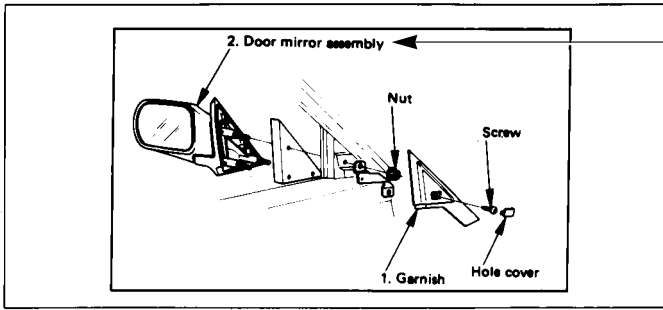
HOW TO USE THIS MANUAL

1. Find the applicable section by referring to the table of contents on the introduction page of each manual.
2. In "Service Information", an opening section of each manual, the troubleshooting, maintenance servicing, service data and/or information on special tools required for the service operations described in the next subsequent sections are arranged and compiled so concisely that you can see at a first glance.
3. Each section except the Service Information section is basically arranged in the following order of headings:
 - General description
 - On-vehicle service
 - Unit repair
4. The service operations are in two groups: one is the "On-vehicle service" where operations can be directly performed on the vehicle, and the other is the "Unit repair" where the operations are done on the work bench after removing the unit from the vehicle.
5. Each service operation section begins with a disassembled view of unit or equipment, which is useful to find relative components, service procedure, availability and contents of repair kits, etc.



0A-4 GENERAL INFORMATION

For illustrations where there are few items to be performed:



The sequence of removal (disassembly) and the parts names will be given.

6. After the illustration, the details of each operation are shown in the order the operations are carried out in the illustration. Refer to the explanations when checking important

information such as the notes in each operation, and places where special tools are to be used and their usage, and the specified service data.

REASSEMBLY

25. Pinion Shaft
 Pinion seal installer: 5-8840-0602-0 (J-38304-9)
 Slide oil seal onto shaft.

6. Adjust Plug Lock Nut
 Adjust plug lock nut wrench: 5-8840-0232-0 (J-35309)

- 1) Tighten the adjust plug to 5 N·m (0.5 kg·m / 43 lb·in), loosen the plug and once again tighten plug to 5 N·m (0.5 kg·m / 43 lb·in).
- 2) Back off plug 26° then tighten the lock nut.
- 3) Check the pinion shaft preload.

Pinion Shaft Preload	N·m (kg·cm / lb·in)
0.6 - 1.6	(6 - 16 / 5.3 - 14.1)

Torque should be between 0.6-1.6 N·m (6-16 kg·cm / 5.3-14.1 lb·in)
 NOTE: Due to tolerances, some sockets will require wrapping shim stock around the stub shaft serrations to make a tight enough fit.

The symbol mark attached to the title indicates the action to be taken in the operations of each title. Example for this case; 1st step - Reassemble pinion shaft

The numbers given to the installation (assembly) procedure are the same as those given in the removal (disassembly) procedure in the illustration. Therefore, start with the larger number during reassembly.

The titles of operations done in the illustration are given in bold letters. They are described in the order of the procedure of the operations.


Special tools are identified with tool name and/or tool number. The drawing illustrates how the tool is used.

Service data and specifications are listed in table.


Important note.


The action symbol indicates the step of service to be followed. Refer to the following paragraph for the meaning of each symbol.

7. In this manual, the following action symbols are used to indicate the type of service operations to be performed.


 ... Remove or disconnect


 ... Install or connect


 ... Disassemble


 ... Reassemble

 ... Align the marks


 ... Correct direction


 ... Inspect


 ... Take measurement


 ... Adjust


 ... Clean


 ... Pay close attention - Important

 ... Tighten to specified torque

 ... Use special tool(s)

 ... Lubricate with oil

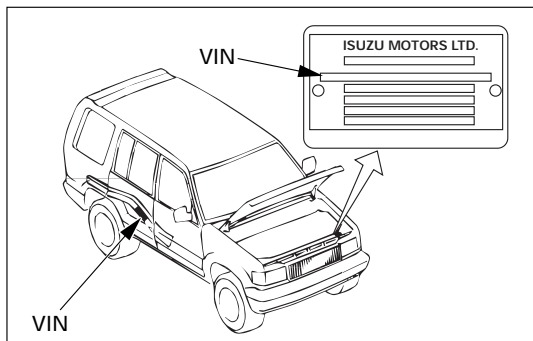
 ... Lubricate with grease

 ... Use liquid gasket

8. The service standard is indicated in terms of "Standard" and "Limit".
The "Standard" means the assembly standard and standard range within which the parts are

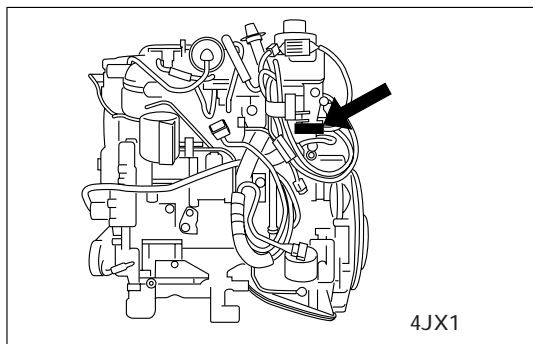
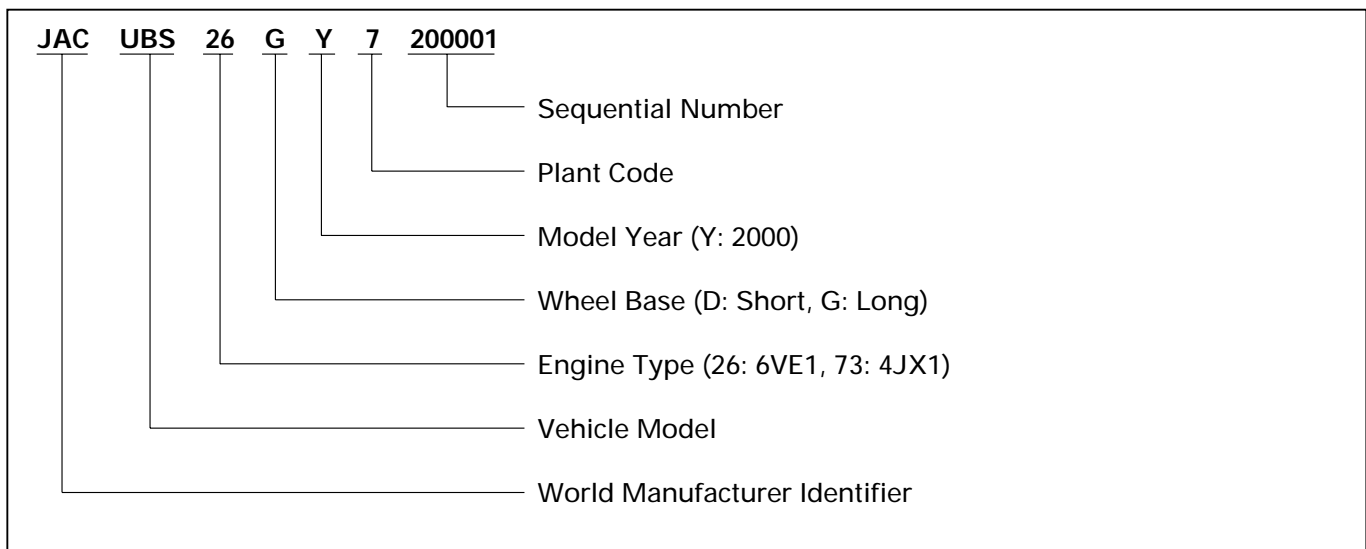
considered serviceable.
"Limit" indicates the limit value (Correction or replacement is necessary when measurement is beyond this limit.)

IDENTIFICATION



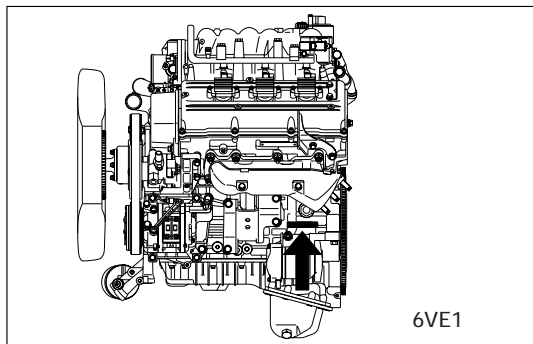
VEHICLE IDENTIFICATION NUMBER (VIN)

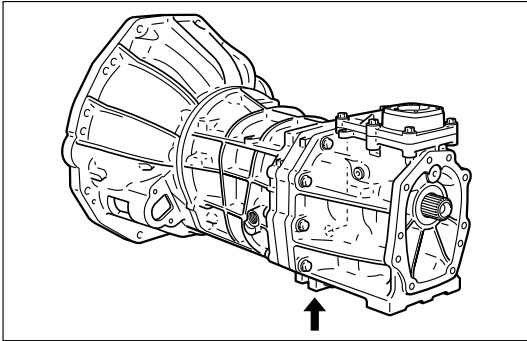
This is the legal identification of the vehicle. It appears on the manufacturer's Plate attached to the left of the engine compartment front end. VIN number is also stamped on the rear right side of the frame.



ENGINE SERIAL NUMBER

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

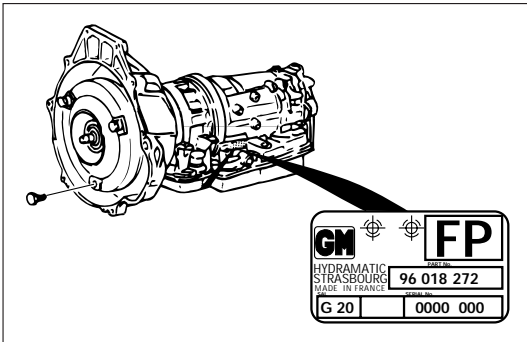




905RW015

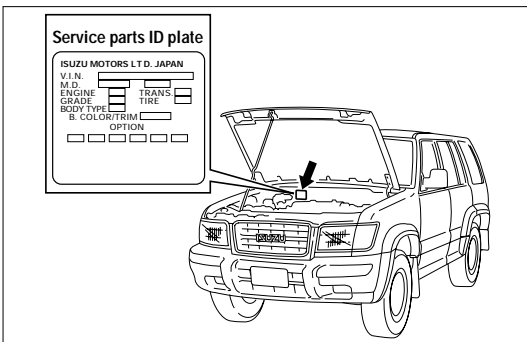
TRANSMISSION SERIAL NUMBER

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



905RW018

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



905RW007

SERVICE PARTS IDENTIFICATION PLATE

The Vehicle Information Plate (Service Parts ID plate) is provided on all vehicle models.

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

Service parts ID plate

ISUZU MOTORS LTD. JAPAN
 V.I.N.
 M.I.D.
 ENGINE TRANS
 GRADE TIRE
 BODY TYPE
 B. COLOR/TRIM
 OPTION

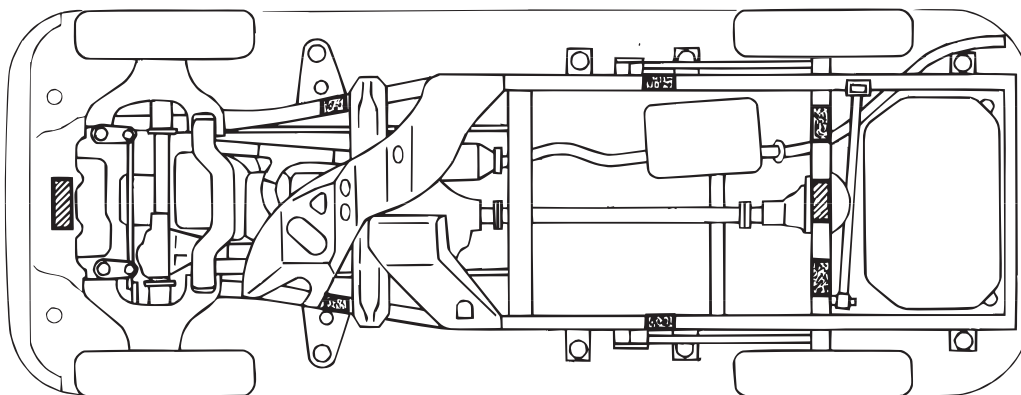
LIFTING INSTRUCTIONS

⚠ CAUTION:

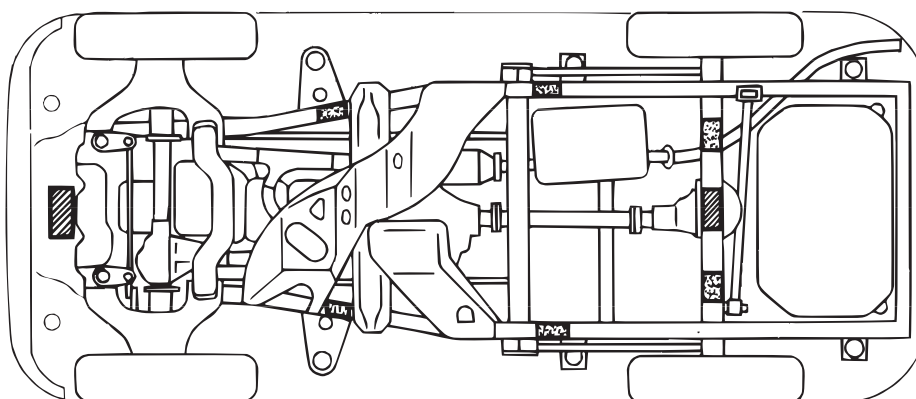
- If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. Raising the vehicle from any other point may result in serious damage.
- When jacking or lifting a vehicle at the frame side rail or other prescribed lift points,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



LIFTING POINTS AND SUPPORTABLE POINT LOCATIONS

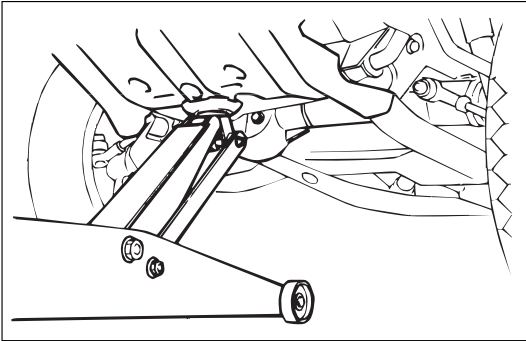
Long wheel Base Model



Short Wheel Base Model

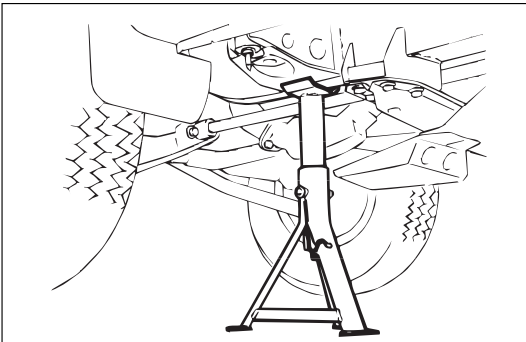


-  Lifting point
-  Supportable point



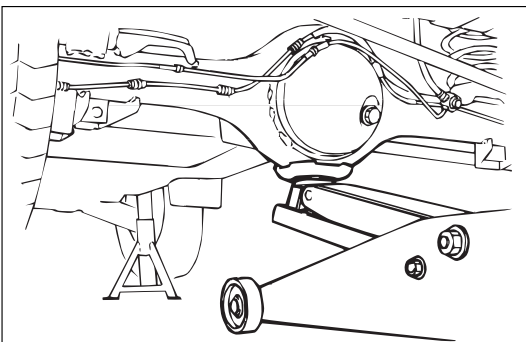
LIFTING POINT; FRONT

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



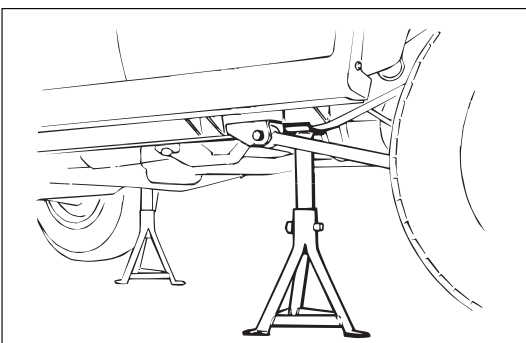
SUPPORTABLE POINT; FRONT

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



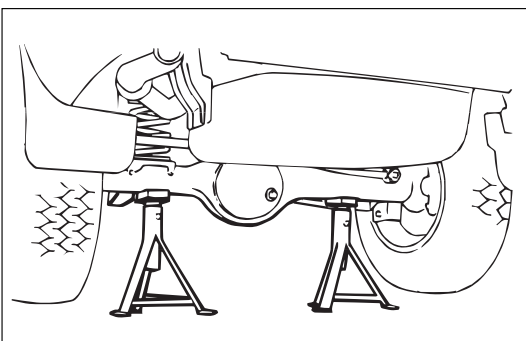
LIFTING POINT; REAR

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



SUPPORTABLE POINT; REAR

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



SUPPORTABLE POINT; REAR

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









TORQUE SPECIFICATIONS

STANDARD BOLTS

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

N·m (kg·m / lb·ft)

N·m (kg·cm / lb·in)

Strength Class Bolt Identification Bolt Diameter x Pitch (mm)	4.8	8.8		9.8
		Refined	Non-Refined	
				
	 No mark			
M 6x1.0	6 60 / 52	7 75 / 65		-
M 8x1.25	13 130 / 113	17 175 / 152		24 240 / 208
M10x1.25	27 (2.8 / 20)	37 (3.8 / 27)		50 (5.1 / 37)
M12x1.25	61 (6.3 / 45)	76 (7.8 / 56)		95 (9.7 / 70)
M14x1.5	96 (9.8 / 71)	116 (11.9 / 86)		142 (14.5 / 105)
M16x1.5	130 (13.3 / 96)	170 (17.3 / 125)		200 (20.4 / 148)
M18x1.5	188 (19.2 / 139)	244 (24.9 / 180)		287 (29.3 / 212)
M20x1.5	258 (26.3 / 190)	337 (34.4 / 249)		396 (40.4 / 292)
M22x1.5	332 (33.9 / 245)	453 (46.3 / 335)		530 (54.1 / 391)
M24x2.0	449 (45.8 / 331)	570 (58.2 / 421)		692 (70.6 / 511)
*M10x1.5	26 (2.7 / 20)	36 (3.7 / 27)		48 (4.9 / 35)
*M12x1.5	57 (5.8 / 42)	71 (7.2 / 52)		89 (9.1 / 66)
*M14x2.0	89 (9.1 / 66)	110 (11.2 / 81)		133 (13.6 / 98)
*M16x2.0	124 (12.7 / 92)	162 (16.5 / 119)		191 (19.5 / 141)

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

FLARE NUTS

N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)

RECOMMENDED LIQUID GASKET

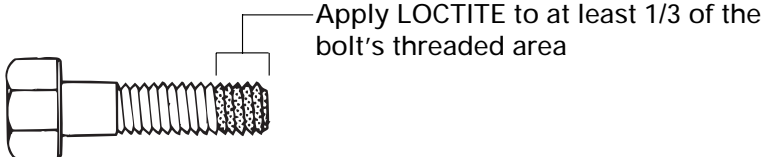
Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	Three Bond 1207B Three Bond 1207C Three Bond 1215 Three Bond 1280	Three Bond Three Bond Three Bond Three Bond	For Engine Repairs For Axle Case Repairs. T/M
Water Base	Three Bond 1141E	Three Bond	For Engine Repairs
Solvent	Three Bond 1104 Belco Bond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

* RTV: Room Temperature Vulcanizer

NOTE:

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

RECOMMENDED THREAD LOCKING AGENTS

LOCTITE Type	LOCTITE Color	Application Steps
LOCTITE 242	Blue	<ol style="list-style-type: none"> Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined. The surfaces must be perfectly dry. Apply LOCTITE to the bolts.  Tighten the bolts to the specified torque. After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.
LOCTITE 262	Red	
LOCTITE 270	Green	
LOCTITE 271	Red	

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

ABBREVIATIONS CHARTS

LIST OF AUTOMOTIVE ABBREVIATIONS WHICH MAY BE USED IN THIS MANUAL

A – Ampere(s)	EAC – Electric Air Control
ABS – Antilock Brake System	EAS – Electric Air Switching
A/C – Air Conditioning	EBCM – Electronic Brake Control Module
ACCEL – Accelerator	ECC – Electronic Climate Control
ACC – Accessory	ECM – Electronic Control Module
Adj – Adjust	ECU – Electronic Control Unit
A/F – Air Fuel Ratio	– Engine Calibration Unit (PROM)
AIR – Air Injection Reaction System	EECS – Evaporative Emission Control System
ALDL – Assembly Line Diagnostic Link	EFE – Early Fuel Evaporation
Alt – Altitude	EFI – Electronic Fuel Injection
AMP – Ampere(s)	EGR – Exhaust Gas Recirculation
ANT – Antenna	EGR/TVS – Exhaust Gas Recirculation/Thermostatic
APS – Absolute Pressure Sensor	– Vacuum Switch
ASM – Assembly	ELC – Electronic Level Control
A/T – Automatic Transmission/Transaxle	ESC – Electronic Spark Control
ATDC – After Top Dead Center	EST – Electronic Spark Control
Auth – Authority	ETR – Electronically Tuned Receiver
Auto – Automatic	EVRV – Electronic Vacuum Regulator Valve (EGR)
BARO – Barometric	Exh – Exhaust
Bat – Battery	°F – Degrees Fahrenheit
Bat+ – Battery Positive Terminal	FF – Front Drive Front Engine
Bbl – Barrel	FL – Fusible Link
BCM – Body Control Module	FLW – Fusible Link Wire
BHP – Brake Horsepower	FRT – Front
BP – Back Pressure	FWD – Front Wheel Drive
BTDC – Before Top Dead Center	4WD – Four Wheel Drive
°C – Degrees Celsius	4x4 – Four Wheel Drive
Cat. Conv. – Catalytic Converter	4 A/T – Four Speed Automatic Transmission/Transaxle
cc – Cubic Centimeter	Gal – Gallon
CCC – Computer Command Control	Gen – Generator
CCOT – Cycling Clutch Orifice Tube	Gov – Governor
CCP – Controlled Canister Purge	g – Gram
CID – Cubic Inch Displacement	Harn – Harness
CL – Closed Loop	HC – Hydrocarbons
CLCC – Closed Loop Carburetor Control	HD – Heavy Duty
CO – Carbon Monoxide	HEI – High Energy Ignition
Coax – Coaxial	Hg – Mercury
Conn – Connector	HiAlt – High Altitude
Conv – Converter	HVAC – Heater-Vent-Air Conditioning
CP – Canister Purge	IAC – Idle Air Control
CPS – Central Power Supply	IC – Integrated Circuit
Crank – Crankshaft	ID – Identification
CTS – Coolant Temperature Sensor	– Inside Diameter
Cu.In. – Cubic Inch	IDI – Integrated Direct Ignition
CV – Constant Velocity	IGN – Ignition
Cyl – Cylinder(s)	ILC – Idle Load Compensator
C ³ I – Computer Controlled Coil Ignition	INJ – Injection
DBM – Dual Bed Monolith	IP – Instrument Panel
Diff – Differential	IPC – Instrument Panel Cluster
DIS – Direct Ignition System	INT – Intake
Dist – Distributor	J/B – Junction Block
DOHC – Double Overhead Camshaft	km – Kilometers
DVM – Digital Voltmeter (10 meg.)	km/h – Kilometer per Hour
DVOM – Digital Volt Ohmmeter	kPa – KiloPascals
DVDV – Differential Vacuum Delay Valve	KV – Kilovolts (thousands of volts)
	KW – Kilowatts

L – Liter	SAE – Society of Automotive Engineers
lb·ft – Foot Pounds	Sec – Secondary
lb·in – Inch Pounds	SFI – Sequential-port Fuel Injection
LF – Left Front	SI – System International
LH – Left Hand	SIR – Supplemental Inflatable Restraint System
LR – Left Rear	SOHC – Single Overhead Camshaft
LS – Left Side	Sol – Solenoid
LWB – Long Wheel Base	SPEC – Specification
L-4 – In-line Four Cylinder Engine	Speedo – Speedometer
MAF – Mass Air Flow	SRS – Supplemental Restraint System
MAN – Manual	ST – Start
MAP – Manifold Absolute Pressure	Sw – Switch
MAT – Manifold Air Temperature	SWB – Short Wheel Base
MEM-CAL – Memory and Calibration Unit	SYN – Synchronize
Max – Maximum	TAC – Thermostatic Air Cleaner
M/C – Mixture Control	Tach – Tachometer
Min – Minimum	TBI – Throttle Body Injection
mm – Millimeter	TCC – Transmission/Transaxle Converter Clutch
MPFI – Multi-Port Fuel Injection	TCM – Transmission/Transaxle Control Module
MPG – Miles per Gallon	TDC – Top Dead Center
MPH – Miles per Hour	Term – Terminal
M/T – Manual Transmission/Transaxle	TEMP – Temperature
MV – Millivolt	TPS – Throttle Position Sensor
NA – Natural Aspirated	TRANS – Transmission/Transaxle
NC – Normally Closed	TURBO – Turbocharger
N·m – Newton Meters	TV – Throttle Valve
NO – Normally Open	TVRS – Television & Radio Suppression
NOx – Nitrogen, Oxides of	TVS – Thermal Vacuum Switch
OD – Outside Diameter	3 A/T – Three Speed Automatic Transmission/ Transaxle
O/D – Over Drive	2WD – Two Wheel Drive
OHC – Overhead Camshaft	4x2 – Two wheel Drive
OL – Open Loop	U-joint – Universal Joint
O ₂ – Oxygen	V – Volt(s)
PAIR – Pulse Air Injection Reactor System	VAC – Vacuum
P/B – Power Brakes	VIN – Vehicle Identification Number
PCV – Positive Crankcase Ventilation	VRRE – Vehicle Refrigerant Recovery and Recycling Equipment
PFI – Port Fuel Injection	V-ref – ECM Reference Voltage
PRESS – Pressure	VRV – Vacuum Reducer Valve
PROM – Programmable Read Only Memory	VSS – Vehicle Speed Sensor
P/N – Park/Neutral	VSV – Vacuum Switching Valve
P/S – Power Steering	V-6 – Six Cylinder “V” Engine
PSI – Pounds per Square Inch	V-8 – Eight Cylinder “V” Engine
Pt. – Pint	W – Watt(s)
Pri – Primary	w/ – With
PWM – Pulse Width Modulated	w/b – Wheel Base
Qt – Quart	w/o – Without
REF – Reference	WOT – Wide Open Throttle
RF – Right Front	
RFI – Radio Frequency Interference	
RH – Right Hand	
RPM – Revolutions per Minute	
RPO – Regular Production Option	
RR – Right Rear	
RS – Right Side	
RTV – Room Temperature Vulcanizing	
RVB – Rear Vacuum Brake	
RVR – Response Vacuum Reducer	
RWAL – Rear Wheel Antilock Brake	
RWD – Rear Wheel Drive	

SECTION 0B

MAINTENANCE AND LUBRICATION

CONTENTS

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Oil Viscosity Chart.....	0B-10

Service Precaution

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

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

MAINTENANCE SCHEDULE

GASOLINE ENGINE MODEL

I: Inspect and correct or replace as necessary A: Adjust
 R: Replace or change T: Tighten to specified torque L: Lubricate

SERVICE INTERVAL:	x 1,000 km	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
(Use odometer reading	x 1,000 miles	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
or months whichever comes first) or months		6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
GASOLINE ENGINE																					
* Engine oil		-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-
* Engine oil filter		-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-
Oil leakage and contamination		-	-	R	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
* Timing belt																					
Spark plugs (For leaded fuel use)										R									R		
Spark plugs (For unleaded fuel use)																					
Exhaust system		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Radiator coolant concentration		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Cooling system for water leakage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
All hoses and pipes in engine compartment for clog or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Fuel filter		-	-	-	-	-	R	-	-	-	-	-	R	-	-	-	-	-	R	-	-
Fuel leakage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Fuel tank		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
* Air cleaner element		-	-	I	-	-	I	-	-	R	-	-	I	-	-	I	-	-	R	-	-
Pre air cleaner		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Engine drive belt		-	-	-	-	-	I	-	-	-	-	-	I	-	-	-	-	-	I	-	-
Valve clearance																					
O ₂ Sensor (For leaded fuel use)		-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-
O ₂ Sensor (For unleaded fuel use)																					R
CLUTCH																					
Clutch fluid		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Clutch pedal travel and free play		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
TRANSMISSION OR TRANSMISSION WITH TRANSFER CASE																					
* Manual transmission with transfer case oil		-	-	R	-	-	I	-	-	R	-	-	I	-	-	R	-	-	I	-	-
* AT Automatic transmission fluid leakage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
*(1) AT Automatic transmission fluid		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I
* AT Transfer case oil		-	-	R	-	-	I	-	-	R	-	-	I	-	-	R	-	-	I	-	-
PROPELLER SHAFT																					
Loose connections		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
* Universal joints and splines for wear		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Universal joints and sliding sleeve (front and rear)		-	-	L	-	-	L	-	-	L	-	-	L	-	-	L	-	-	L	-	-
FRONT AND REAR AXLE																					
* Differential gear oil (Front and rear)		-	-	R	-	-	I	-	-	R	-	-	I	-	-	R	-	-	I	-	-
Shift on the fly system gear oil		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Front axle shaft rubber boot for damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Axle case for distortion or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Axle shafts for distortion or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
STEERING																					
* Power steering fluid		-	-	I	-	-	I	-	-	R	-	-	I	-	-	I	-	-	R	-	-
Oil leakage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
* Steering system for looseness or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Power steering hose		-	-	I	-	-	I	-	-	I	-	-	I	-	-	R	-	-	I	-	-
Steering wheel play		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Steering function		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Right and left turning radius		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheel alignment		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Joint ball for oil leakage or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Joint ball rubber boot for damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
SERVICE BRAKES																					
Brake fluid		-	-	I	-	-	I	-	-	R	-	-	I	-	-	I	-	-	R	-	-
Brake system for fluid leakage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Brake function		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
* Disc brake pads and discs wear		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Brake pedal travel and free play		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-
Pipes and hoses for loose connections or damage		-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-	I	-	-

(1): Adjust or change automatic transmission fluid.
 *Marks: Under severe driving conditions, additional maintenance is required.
 Refer to "Maintenance schedule under severe driving conditions".

0B-4 MAINTENANCE AND LUBRICATION

DIESEL ENGINE MODEL

I: Inspect and correct or replace as necessary A: Adjust
 R: Replace or change T: Tighten to specified torque L: Lubricate

SERVICE INTERVAL:	x 1,000 km	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
(Use odometer reading	x 1,000 miles	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
or months whichever comes first)	or months	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
DIESEL ENGINE																					
* Engine oil		-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R
* Engine oil filter		-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R
Oil leakage and contamination		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Idling speed and acceleration		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Fan belt tension and damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Timing belt																					
Exhaust system		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
All hoses and pipes in engine compartment for clog or damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Valve clearance		-	-	-	A	-	-	-	-	-	A	-	-	-	-	-	A	-	-	-	-
* Air cleaner element		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-
Fuel filter		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-
Radiator coolant concentration		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Cooling system for water leakage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
CLUTCH																					
Clutch fluid		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Clutch pedal travel and free play		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
TRANSMISSION OR TRANSMISSION WITH TRANSFER CASE																					
* Manual transmission with transfer case oil		-	R	-	I	-	-	-	R	-	-	-	I	-	-	-	R	-	-	-	I
* AT Automatic transmission fluid		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
* AT Transfer case oil		-	R	-	I	-	-	-	R	-	-	-	I	-	-	-	R	-	-	-	I
PROPELLER SHAFT																					
Loose connections		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
* Universal joints and splines for wear		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Universal joints and sliding sleeve (front and rear)		-	L	-	L	-	L	-	L	-	L	-	L	-	L	-	L	-	L	-	L
FRONT AND REAR AXLE																					
* Differential gear oil (Front and rear)		-	R	-	I	-	-	-	R	-	-	-	I	-	-	-	R	-	-	-	I
Shift on the fly system gear oil		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
Front axle shaft rubber boot for damage		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
Axle case for distortion or damage		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
Axle shafts for distortion or damage		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
STEERING																					
* Power steering fluid		-	I	-	I	-	I	-	R	-	I	-	I	-	I	-	R	-	I	-	I
Oil leakage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
* Steering system for looseness or damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Power steering hose		-	I	-	I	-	I	-	I	-	I	-	I	-	R	-	I	-	I	-	I
Steering wheel play		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Steering function		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Right and left turning radius		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
Wheel alignment		-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I	-	-	-	I
Joint ball for oil leakage or damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Joint ball rubber boot for damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
SERVICE BRAKES																					
Brake fluid		-	-	-	I	-	-	-	R	-	-	-	I	-	-	-	R	-	-	-	I
Brake system for fluid leakage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Brake function		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
* Disc brake pads and discs wear		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Brake pedal travel and free play		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I
Pipes and hoses for loose connections or damage		-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I	-	I

NOTE: In the 4JXI-TC diesel engine, there is provided sub (2nd) oil filter for fuel injection at the upper part of crank case on the left side of the engine. This oil filter maintenance-free and does not need a periodic replacement. See reverse side the (back) cover for installation location of the sub (2nd) oil filter.

*Marks: Under severe driving conditions, additional maintenance is required.
 Refer to "Maintenance schedule under severe driving conditions".

DIESEL ENGINE MODEL

I: Inspect and correct or replace as necessary A: Adjust
 R: Replace or change T: Tighten to specified torque L: Lubricate

SERVICE INTERVAL:	x 1,000 km	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
(Use odometer reading	x 1,000 miles	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
or months whichever comes first)	or months	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
PARKING BRAKE																					
Parking brake function		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
Parking brake lever travel		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
Cables for looseness or damage and guide for damage		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
Ratchet for wear or damage		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
SUSPENSION																					
Spring leaves for damage		-		-		-		-		-		-		-		-		-		-	
Mount for looseness or damage		-		-		-		-		-		-		-		-		-		-	
Shock absorbers for oil leakage		-		-		-		-		-		-		-		-		-		-	
Shock absorbers mount for looseness		-		-		-		-		-		-		-		-		-		-	
Rubber bushes of suspension wear or damage		-		-		-		-		-		-		-		-		-		-	
Spring action for loss of balance due to weakening		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
Joint ball rubber boot for damage		-		-		-		-		-		-		-		-		-		-	
WHEELS																					
Wheel pins		-	T	-	T	-	T	-	T	-	T	-	T	-	T	-	T	-	T	-	T
Wheel disc for damage		-		-		-		-		-		-		-		-		-		-	
Hub bearing grease		-	-	-	-	-	R	-	-	-	-	-	R	-	-	-	-	-	R	-	-
Front and rear hub bearings for looseness		-		-		-		-		-		-		-		-		-		-	
Tire pressure and damage		-		-		-		-		-		-		-		-		-		-	
Tire rotation		(Rotate as required)																			
OTHERS																					
Bolts and nuts on chassis and body		-		-		-		-		-		-		-		-		-		-	
Lube front free-wheeling hubs		-	-	-	-	-	L	-	-	-	-	-	L	-	-	-	-	-	L	-	-

*Marks: Under severe driving conditions, additional maintenance is required.
 Refer to "Maintenance schedule under severe driving conditions".

0B-6 MAINTENANCE AND LUBRICATION

MAINTENANCE SCHEDULE UNDER SEVERE DRIVING CONDITIONS

Severe driving conditions

- A: Repeated short trips
- B: Driving on rough roads
- C: Driving on dusty roads
- D: Driving in extremely cold weather and/or salted roads

Item	Interval	Condition				
		A	B	C	D	A+D
Engine oil	<input type="checkbox"/> G : Change every 5,000 km (3,000 miles)			●		●
	<input type="checkbox"/> D : Change every 5,000 km (3,000 miles)			●		●
Engine oil filter	<input type="checkbox"/> G : Replace every 10,000 km (6,000 miles)			●		●
	<input type="checkbox"/> D : Replace every 5,000 km (3,000 miles)			●		●
Air cleaner element	<input type="checkbox"/> G : Replace every 20,000 km (12,000 miles)			●		
	<input type="checkbox"/> D : Replace every 40,000 km (25,000 miles)			●		
Power steering fluid	Replace every 50,000 km (30,000 miles)		●	●		
Steering system for looseness or damage	Inspect every 5,000 km (3,000 miles)		●			
Universal joints and sleeves	Inspect for wear and lubricate every 7,500 km (4,500 miles)		●	●		
Transmission with transfer case oil	<input type="checkbox"/> MT : Change every 20,000 km (12,000 miles) after changing at initial 10,000 km (6,000 miles)		●			
	<input type="checkbox"/> AT : Transmission : Change every 32,000 km (20,000 miles)	●	●	●		●
	<input type="checkbox"/> TF : Transfer: Change every 20,000 km (12,000 miles) after changing at initial 10,000 km (6,000 miles)		●			
Differential oil	Change every 20,000 km (12,000 miles) after changing at initial 5,000 km (3,000 miles)		●			
Disc brake pads and discs	Inspect every 5,000 km (3,000 miles)	●	●	●		
Timing belt	<input type="checkbox"/> G : Replace every 120,000 km (75,000 miles)			●		●

EXPLANATION OF COMPLETE VEHICLE MAINTENANCE SCHEDULE

Explanations of the services listed in the preceding Maintenance Schedules are presented in "Service Information" section of each manual.

Replace all questionable parts and note any necessary repairs as you perform these maintenance procedures.

RECOMMENDED FLUIDS, LUBRICANTS AND FUELS

In order to obtain maximum performance and longest service life from your ISUZU vehicles, it is very important to select and use correctly best lubricants and diesel fuels.

When lubricating, be sure to use ISUZU genuine lubricants or recommended lubricants listed below, according to the maintenance schedule for each vehicle model.

The lubrication intervals in the maintenance schedule and the coverage and period of new vehicle warranty are based on the use of ISUZU genuine lubricants or recommended lubricants as given in the chart which will serve as a guide for selecting lubricants of proper brand name.

LUBRICATION	MAKE	BRAND / TYPE	GRADE	
			API	ACEA
Diesel engine crankcase	ISUZU GENUINE ISUZU GENUINE ISUZU GENUINE ISUZU GENUINE EXXON / ESSO EXXON / ESSO MOBIL CALTEX / CHEVRON SHELL ELF TOTAL	BESCO MULTI - Z TYPE CE (10W-30) BESCO MULTI - Z (10W-30) BESCO MULTI - Z SUV (5W-30) BESCO S - 3 (10W, 20W, 30, 40) ESSOLUBE XD-3+ (15W-40) ESSOLUBE XT331 (15W-40) DELVAC HP (15W-40, 20, 30, 40) DELO CXJ (15W-40, 30, 40) RIMURA D (15W-40, 30, 40) PERFORMANCE TROPHY (15W-40) RUBIA XT (15W-40)	CE CD CD CD CG4/CF CG-4/CF CF/CE CF CD/CF CE CF-4	E2/B2 E2/B2 E3 E2
Gasoline engine crankcase	ISUZU GENUINE ISUZU GENUINE ISUZU GENUINE EXXON / ESSO EXXON / ESSO MOBIL CALTEX / TEXACO SHELL ELF TOTAL	BESCO RACING ACE (7.5W-30) BESCO MULTI ACE (7.5W-30) BESCO ACE (10W-30) ESSO SUPERFLO (15W-40, 15W-50, 20W-50) ESSO UNIFLO (15W-40, 15W-50, 20W-50) MOBIL SUPER XHP (15W-40, 15W-50, 20W-50) HAVOLINE FORMULA-3 (15W-40, 20W-50) HELIX SUPER (10W-30) SUPER SPORTI S (15W-40) QUARTZ 5000 (15W-40, 20W-50)	SG SF SE SJ SJ SJ SJ SJ SG SJ	 A2 A2 A3 A2
Manual transmission Transfer case	ISUZU GENUINE EXXON / ESSO EXXON / ESSO MOBIL CALTEX / TEXACO SHELL ELF TOTAL	BESCO GEAR OIL TRANSAXLE (5W-30) ESSOLUBE XD-3+ (15W-40) ESSOLUBE XT331 (15W-40) MOBIL SUPER (10W-30) HAVOLINE FORMULA-3 (15W-40, 20W-50) RIMURA D (15W-40) SUPER SPORTI S (15W-40) QUARTZ 5000 (15W-40, 20W-50)	SG CG-4/CF CG-4/CF SH SH CD/CF SG/CD SJ/CF	E2/B2 E2/B2 A2/B2
Differential Shift on the fly system (GL-5 only)	ISUZU GENUINE ISUZU GENUINE EXXON / ESSO MOBIL CALTEX SHELL ELF TOTAL	BESCO GEAR OIL SH (80W-90, 90, 140) BESCO SHIFT ON THE FLY (75W-90) GEAR OIL GX (85W-90) MOBILUBE HD (80W-90, 85W-140) THURBAN GL-5 EP (80W-90, 85W-140) SPIRAX HD (90, 140) TRANSELF TYPE B (80W-90, 85W-140) TRANSMISSION TM (80W-90, 85W-140)	GL-5 GL-5 GL-5 GL-5 GL-5 GL-5 GL-5 GL-5	
Differential (Limited Slip Differential)	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX ELF TOTAL	BESCO GEAR OIL LSD (140) GEAR OIL LSA (90) MOBILUBE HD LS (80W-90) GEAR OIL LSD (90) TRANSELF TYPE BLS (90) TRANSMISSION DA (85W-90)	GL-5 GL-5 GL-5 GL-5 GL-5 GL-5	

0B-8 MAINTENANCE AND LUBRICATION

LUBRICATION	MAKE	BRAND / TYPE	GRADE	
			API	ACEA
Automatic transmission Power steering	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX SHELL ELF TOTAL	BESCO ATF II, ATF III ESSO ATF D (DEXRON® II-D) MOBIL ATF (DEXRON® III) ATF HD (DEXRON® II) SHELL DONAX TA (DEXRON® II-D) ELFMATIC G3 (DEXRON® III) TOTAL FLUID IID (DEXRON® II-D)		
Propeller shaft sliding yoke, Universal joint Grease fitting (General purpose grease)	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX / TEXACO SHELL TOTAL	BESCO L-2 GREASE (No.2), L-3 GREASE (No.3) RONEX MP (No.2) MOBILGREASE HP 222 (No.2) STARPLEX-2 (No.2) SHELL RETINAX A (No.2) MULTIS EP2, EP3 (No.2, No.3)		
Propeller shaft sliding yoke Universal joint (General purpose grease) (in Molybdenum)	ISUZU GENUINE EXXON / ESSO EXXON / ESSO CALTEX TOTAL	ONE LUBER MO GREASE BEACON Q2 (No.2) MULTIPURPOSE GREASE (Moly) (No.2) MOLYTEX GREASE EP2 (No.2) TOTAL MULTIS MS2 (No.2)		
Engine cooling system	ISUZU GENUINE TEXACO / CALTEX	BESCO LLC SUPER TYPE E HAVOLINE EXTENDED LIFE ANTIFREEZE COOLANT HAVOLINE XLC EXTENDED LIFE COOLANT 6280		

FLUID	TYPE
Clutch and brake fluid reservoir	Besco brake fluid (For light duty) Hydraulic brake fluid SAE J1703 FMVSS 116 DOT.3 grade

NOTE:

When the recommended lubricants are specified in the workshop manual, follow them.

DIESEL FUEL/APPLICABLE STANDARD

JIS (JAPANESE INDUSTRIAL STANDARD)	Based on K2204 GAS OIL
DIN (DEUTSCHE INDUSTRIE NORMEN)	Based on EN590 : 1997
SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)	Based on SAE J-313C
BS (BRITISH STANDARD)	Based on BS EN590 : 1997

NOTE:

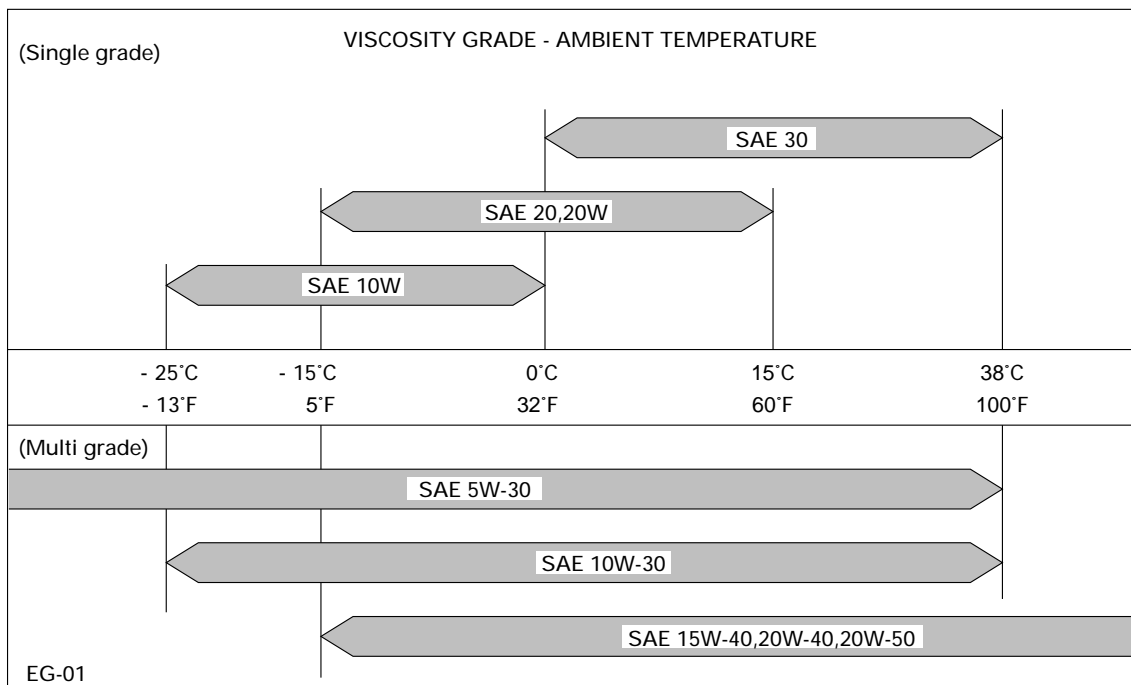
Use the applicable standard or equivalent for diesel fuels.

OIL VISCOSITY CHART

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

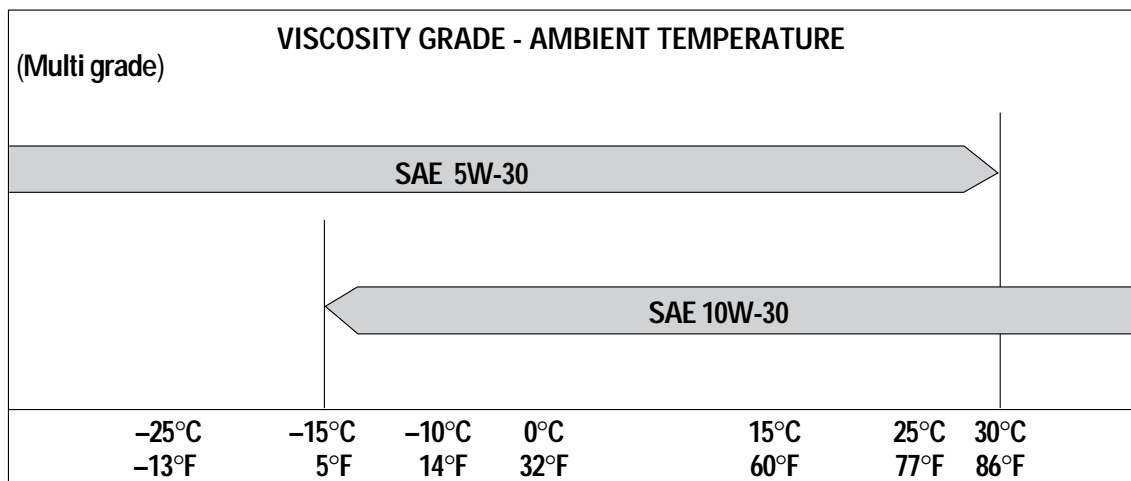
OIL VISCOSITY CHART FOR GASOLINE ENGINE

APPLY GASOLINE ENGINE OIL



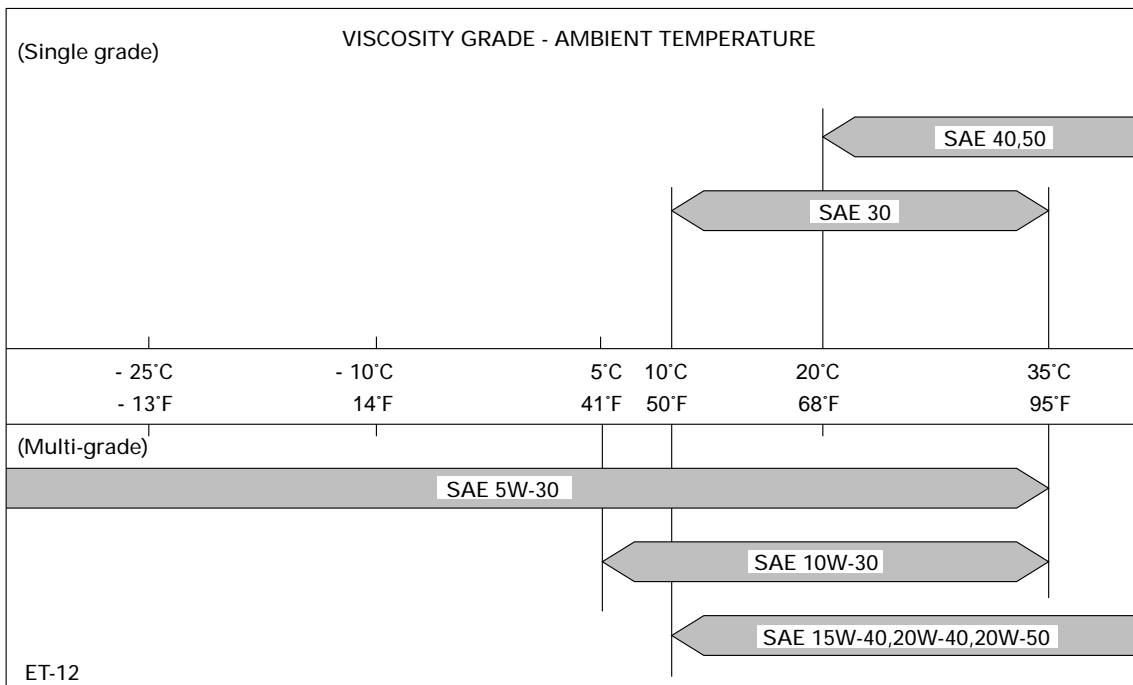
OIL VISCOSITY CHART FOR DIESEL ENGINE

APPLY DIESEL ENGINE OIL



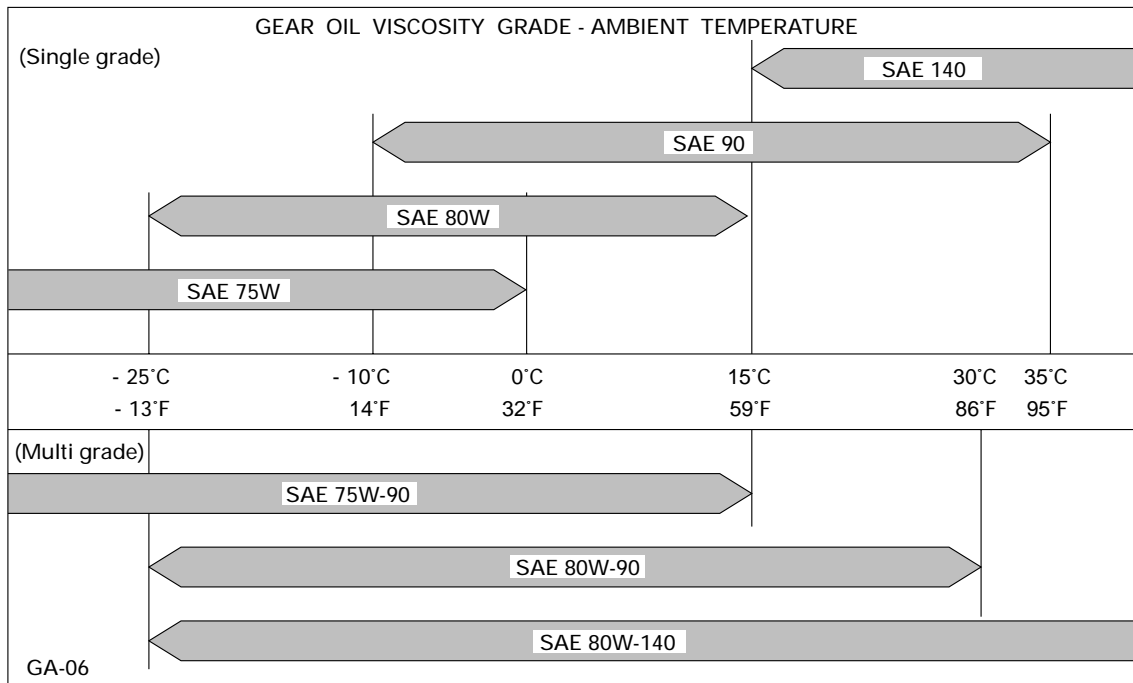
OIL VISCOSITY CHART FOR MANUAL TRANSMISSION AND TRANSFER CASE

APPLY ENGINE OIL



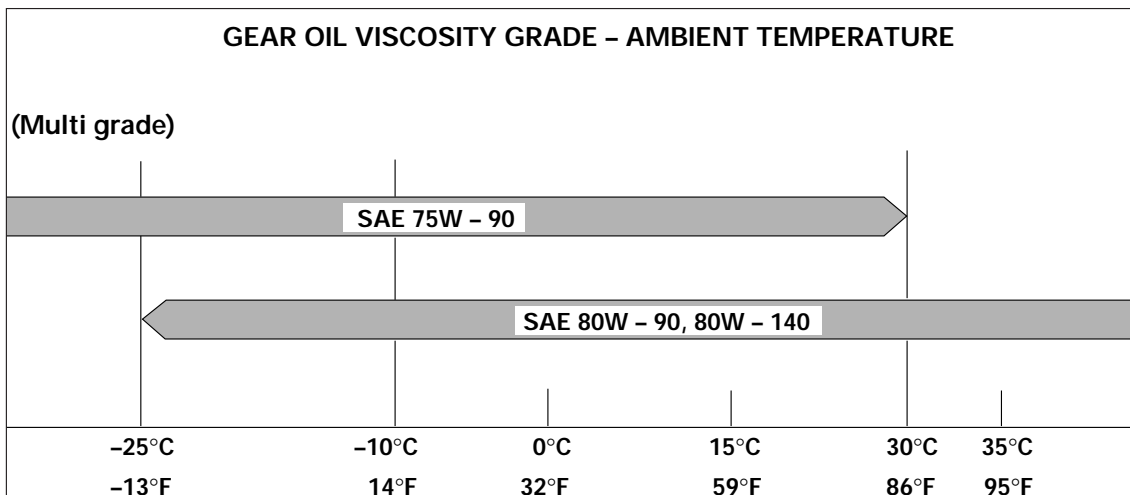
OIL VISCOSITY CHART FOR FRONT AXLE (Manual and Auto locking hub model) AND REAR AXLE

APPLY GEAR OIL



OIL VISCOSITY CHART FOR FRONT AXLE (Shift on the fly model)

APPLY GEAR OIL



SECTION 00
SERVICE INFORMATION

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Special Tools	00-52

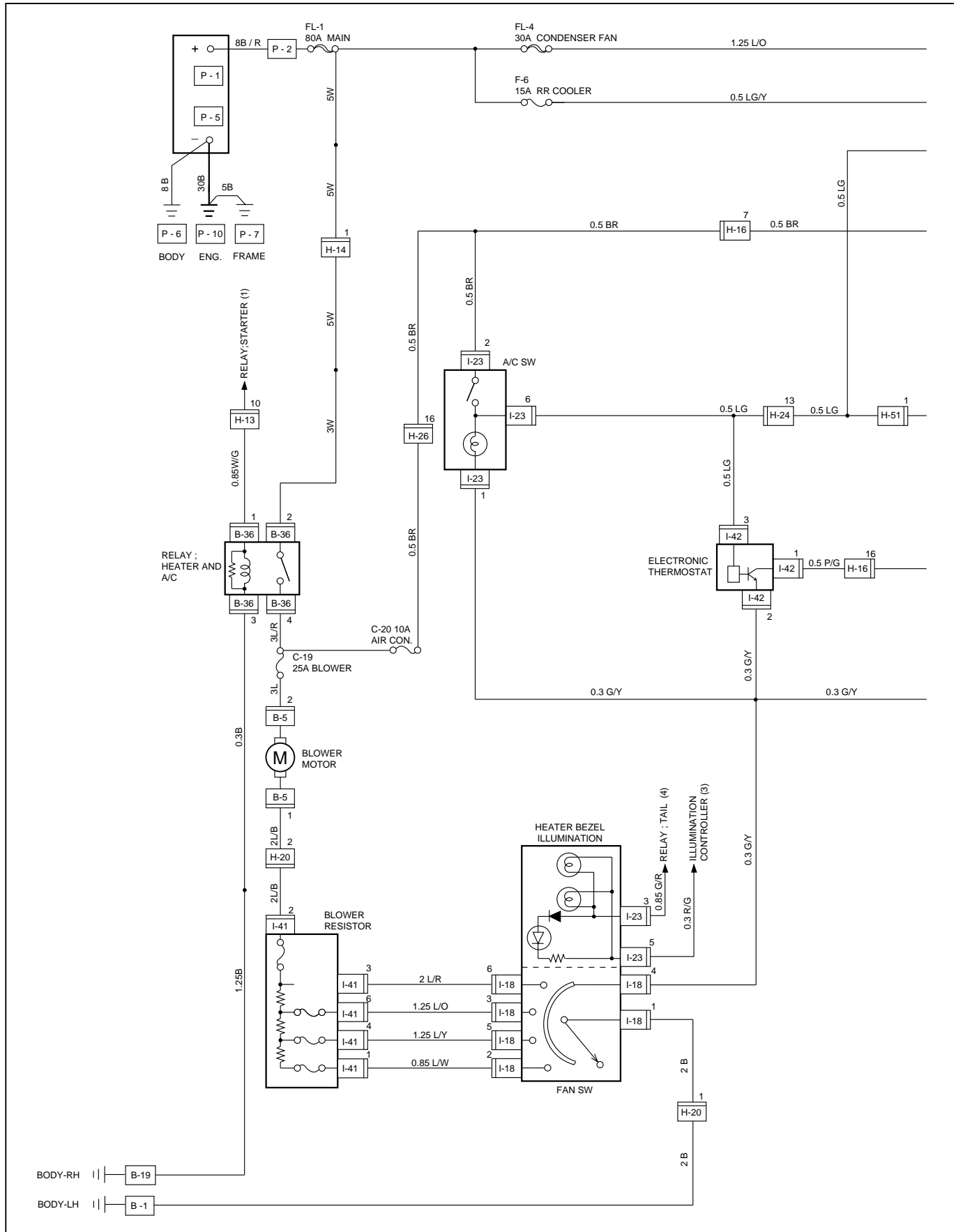
TROUBLESHOOTING

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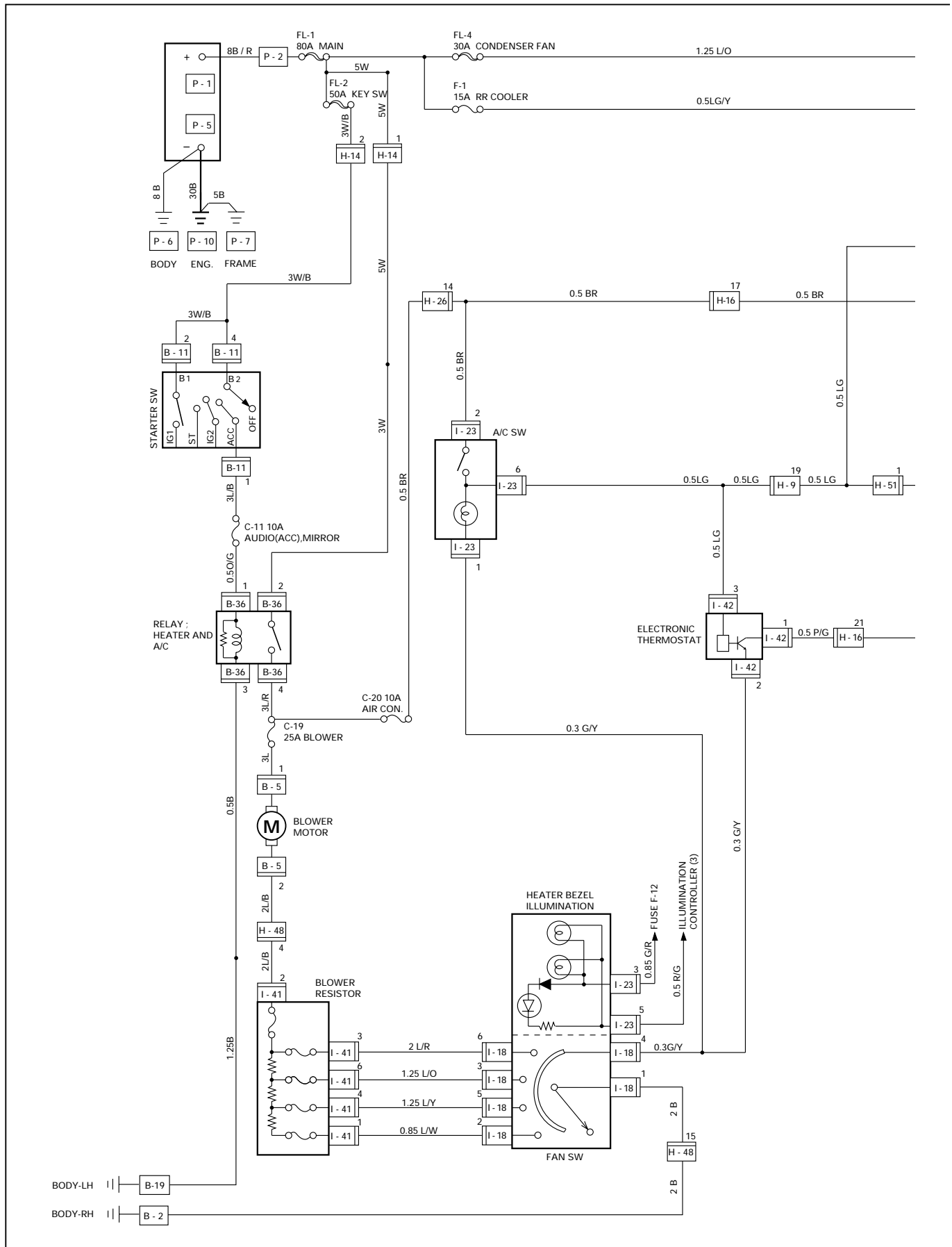
CIRCUIT DIAGRAM

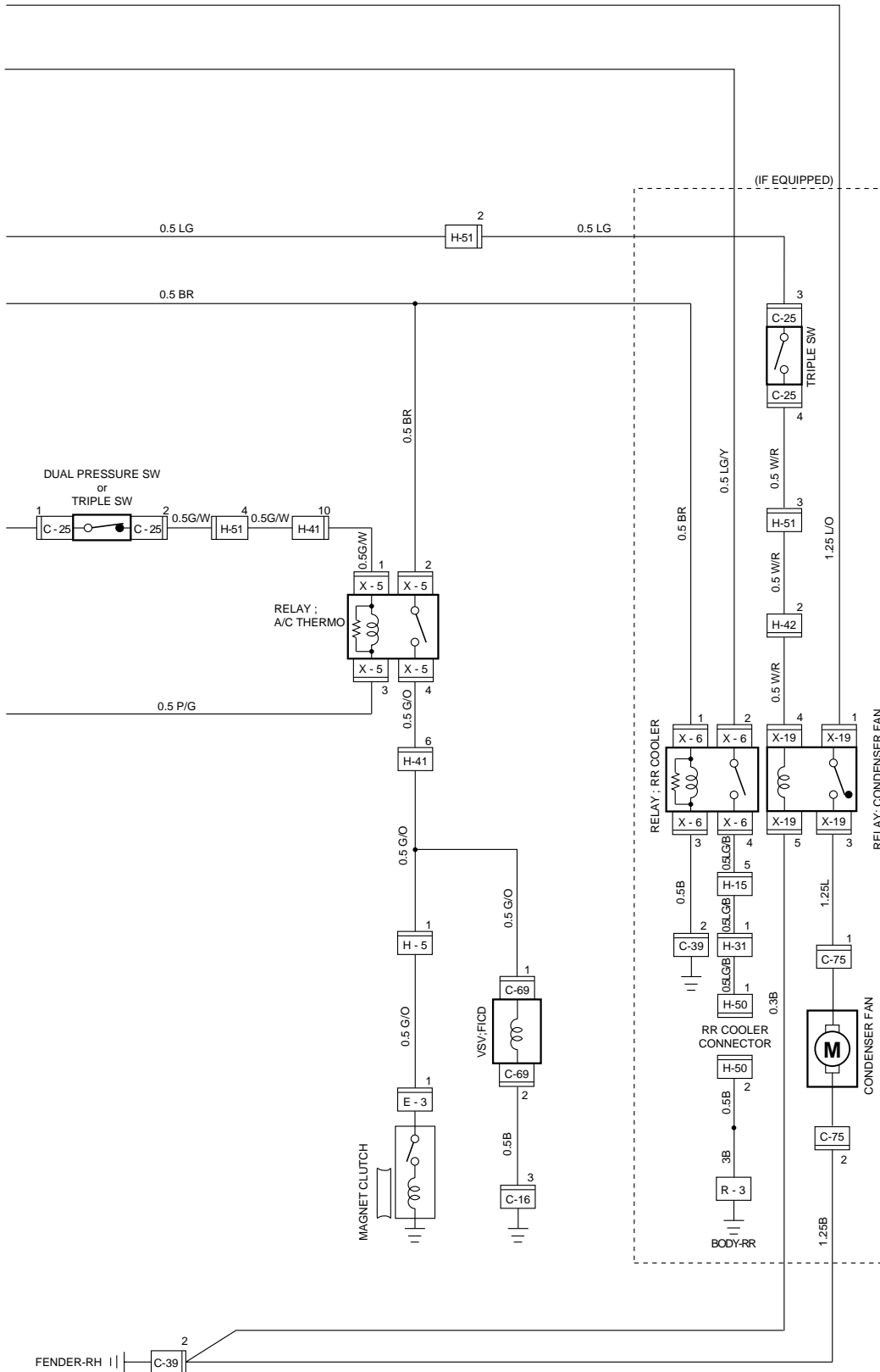
6VD1/6VE1 (RHD)

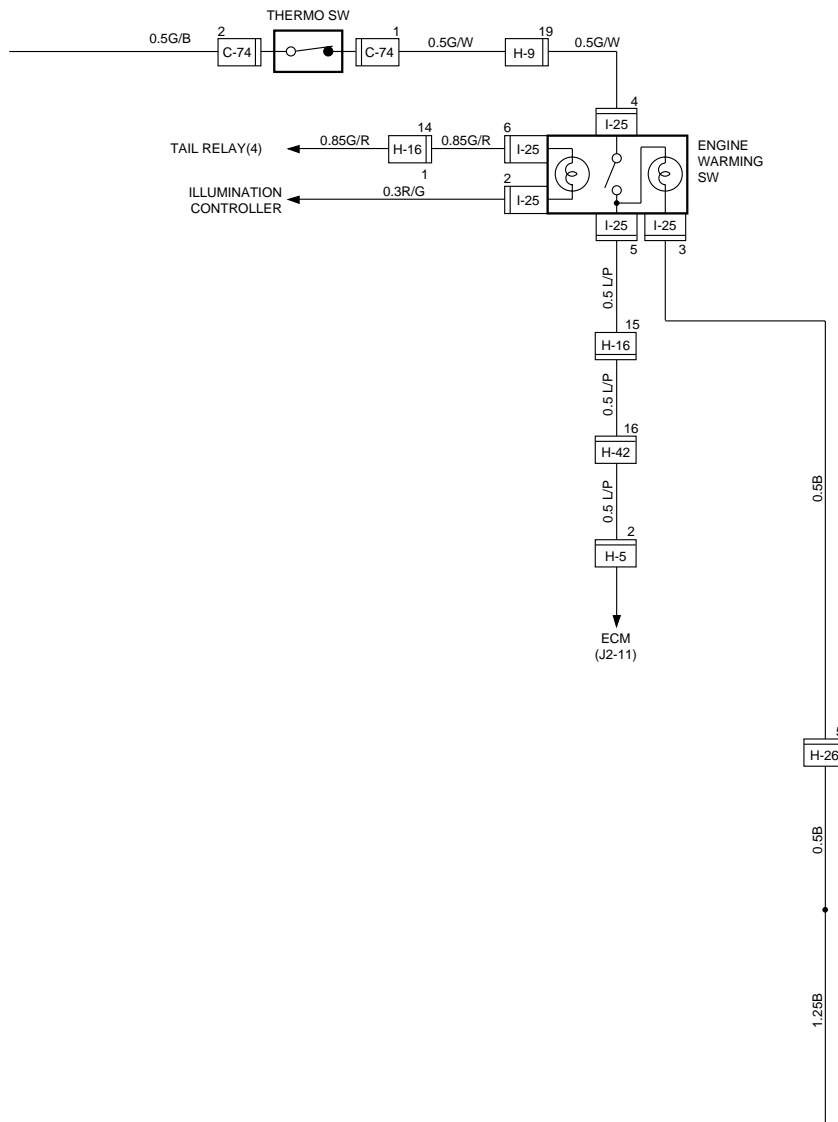


00 - 10 SERVICE INFORMATION

4JG2 (LHD)

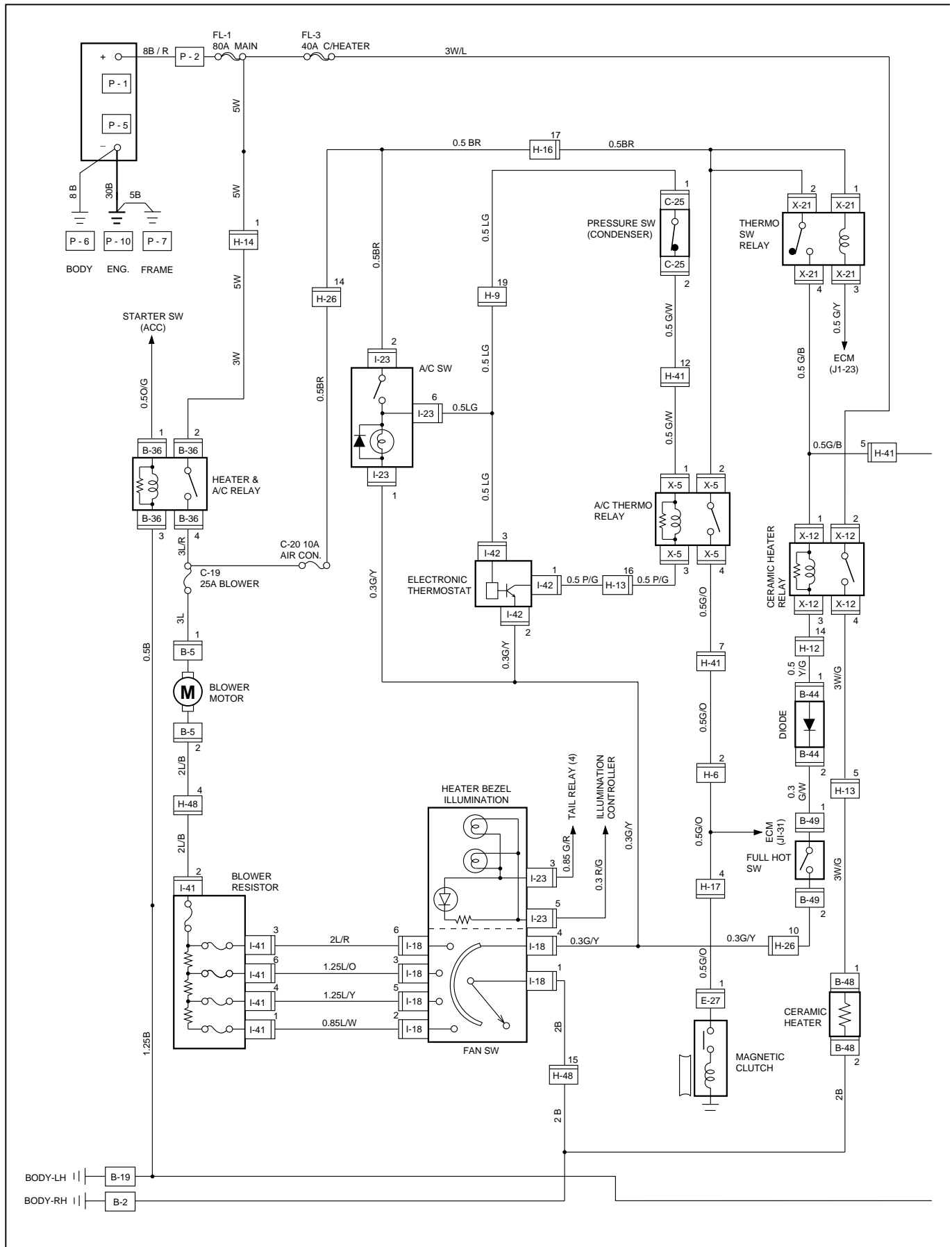


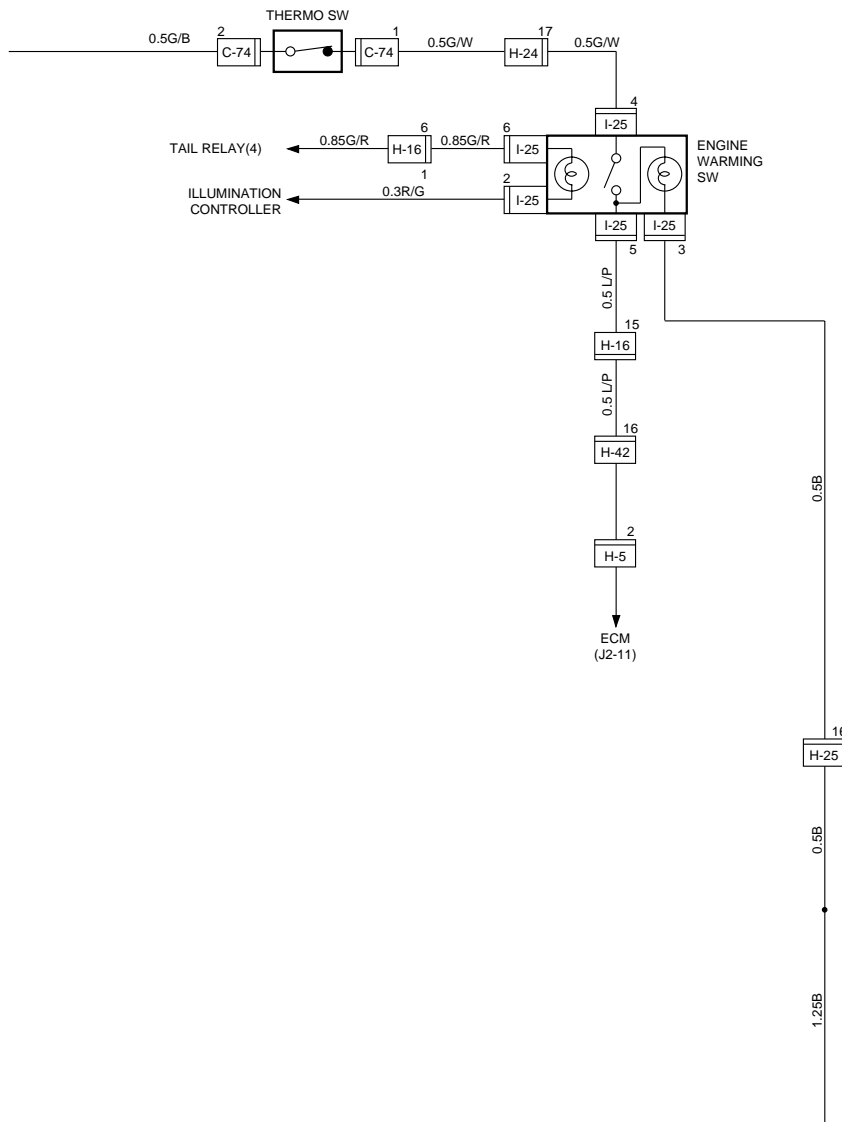




00 - 14 SERVICE INFORMATION

4JX1 (LHD)





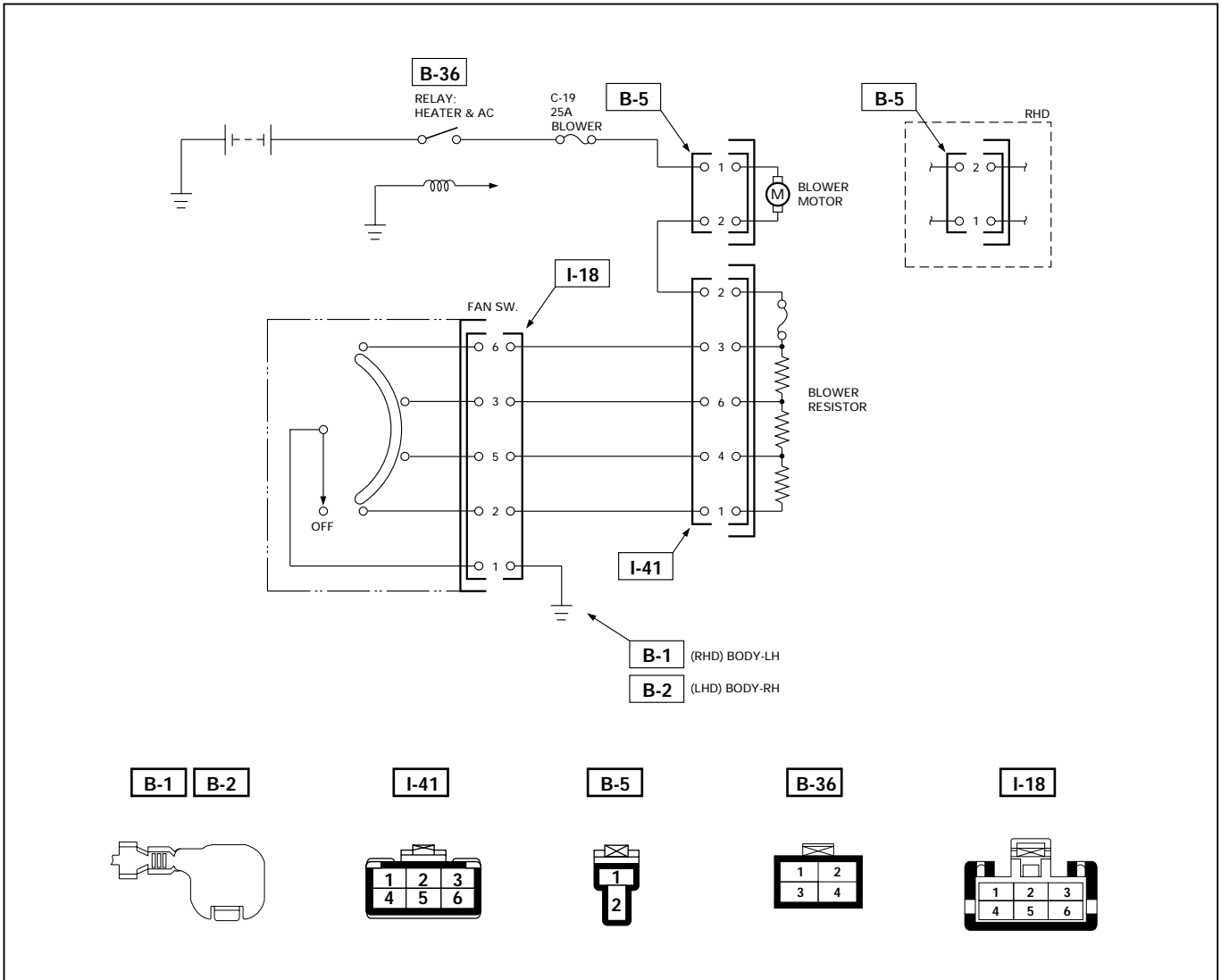
HEATING CYCLE TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	CORRECTION
No heating or Insufficient heating.	<ol style="list-style-type: none"> 1. Blower motor does not run, or runs improperly. 2. Engine coolant temperature is low. 3. Insufficient engine coolant. 4. Circulation volume of engine coolant is insufficient. 5. Heater core clogged or collapsed. 6. The heater core is not provided with air sent from the blower motor. 7. Duct connections defective or unsealing. 8. Ceramic heater defective. 	<ul style="list-style-type: none"> • Refer to “FAN CONTROL KNOB (FAN SWITCH)” Troubleshooting. • Check the engine coolant temperature after warming up the engine and check the thermostat. Replace as necessary. • Add engine coolant as required. • Check if the water hose to the heater core is clogged, collapsed or twisted. Repair or replace as necessary. • Check water pump function. Repair or replace as necessary. • Clean or replace as necessary. • Repair the temperature control link unit or mode doors. • Repair or adjust the control cables. • Repair or replace as necessary. • Refer to “CERAMIC HEATER” Troubleshooting.
Control knob moves but mode door does not operate.	<ol style="list-style-type: none"> 1. Cable attaching clip is not correct. 2. Link unit of heater unit or blower assembly defective. 	<ul style="list-style-type: none"> • Repair. • Repair.
The mode door cannot be set to the mode selected.	<ol style="list-style-type: none"> 1. Link unit of heater unit or blower assembly defective 2. Control cable is not adjusted. 	<ul style="list-style-type: none"> • Repair. • Adjust.

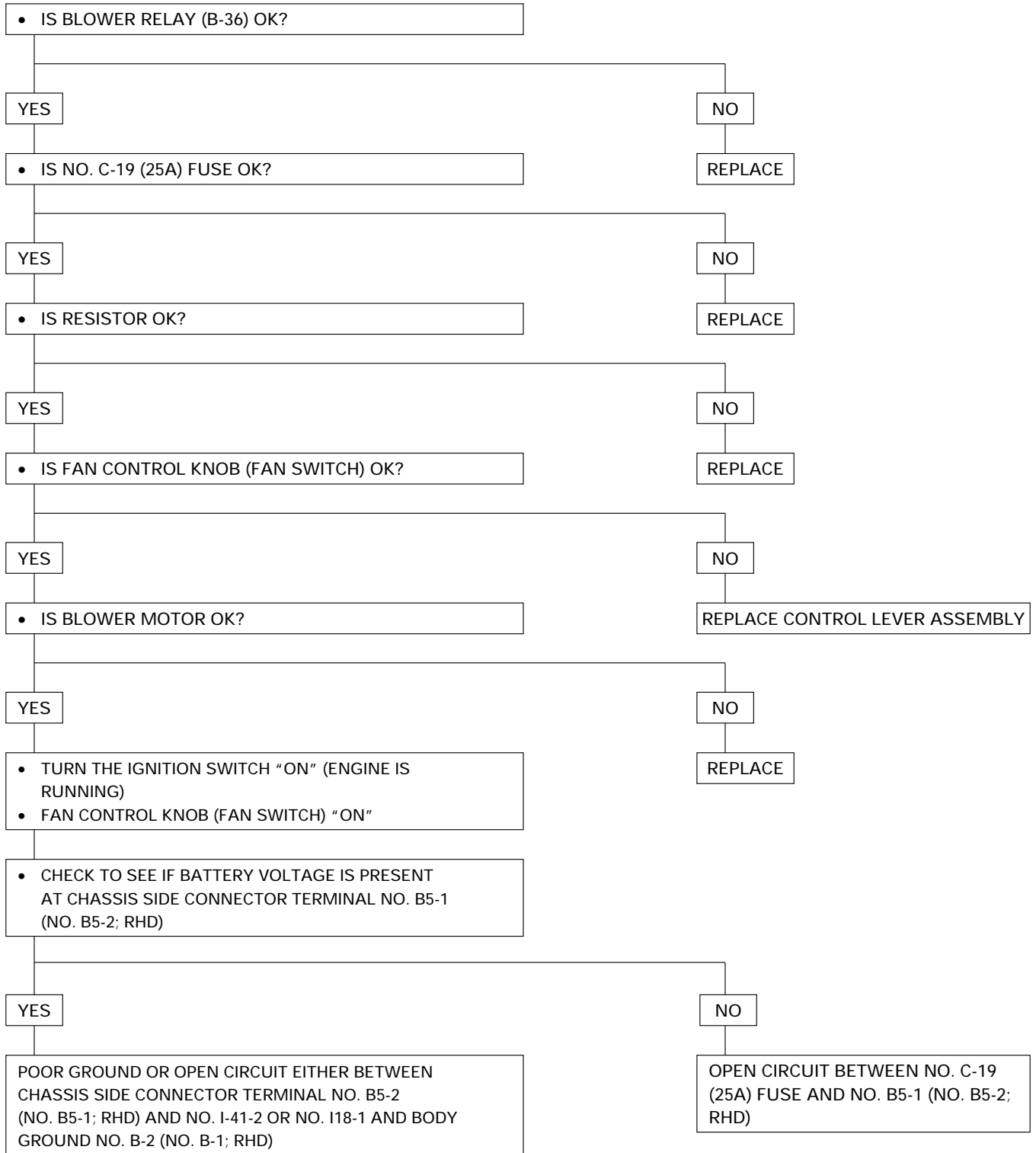
FAN CONTROL KNOB (FAN SWITCH)

Current flows to the blower motor through the Heater & A/C relay (B-36) to activate the rotation of the blower motor by turning "ON" the fan control

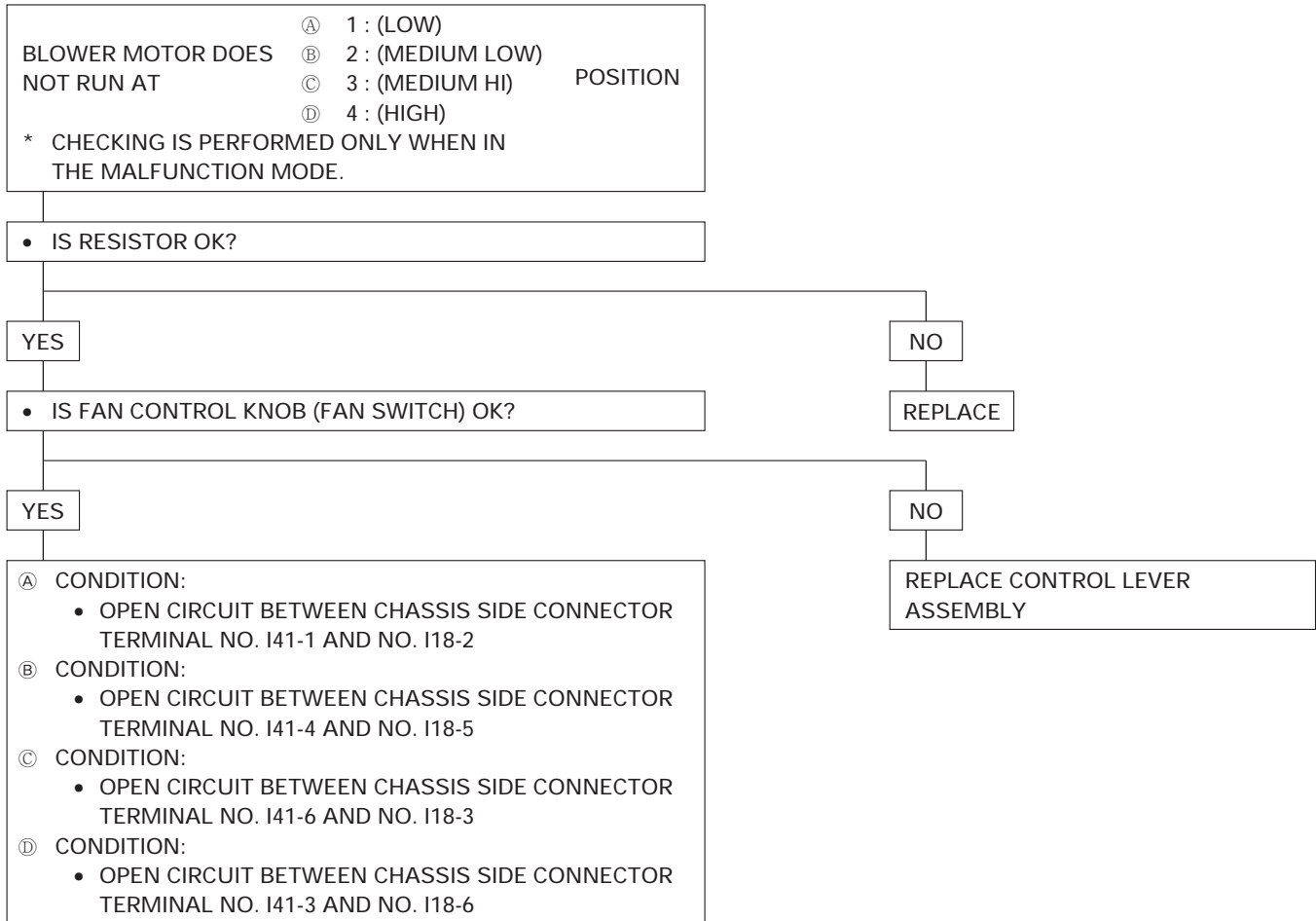
knob (fan switch). Blower motor speed is controlled in stages by the resistor, by operating the switch from "LOW" to "HIGH."



BLOWER MOTOR DOES NOT RUN



BLOWER MOTOR DOES NOT RUN IN CERTAIN POSITION



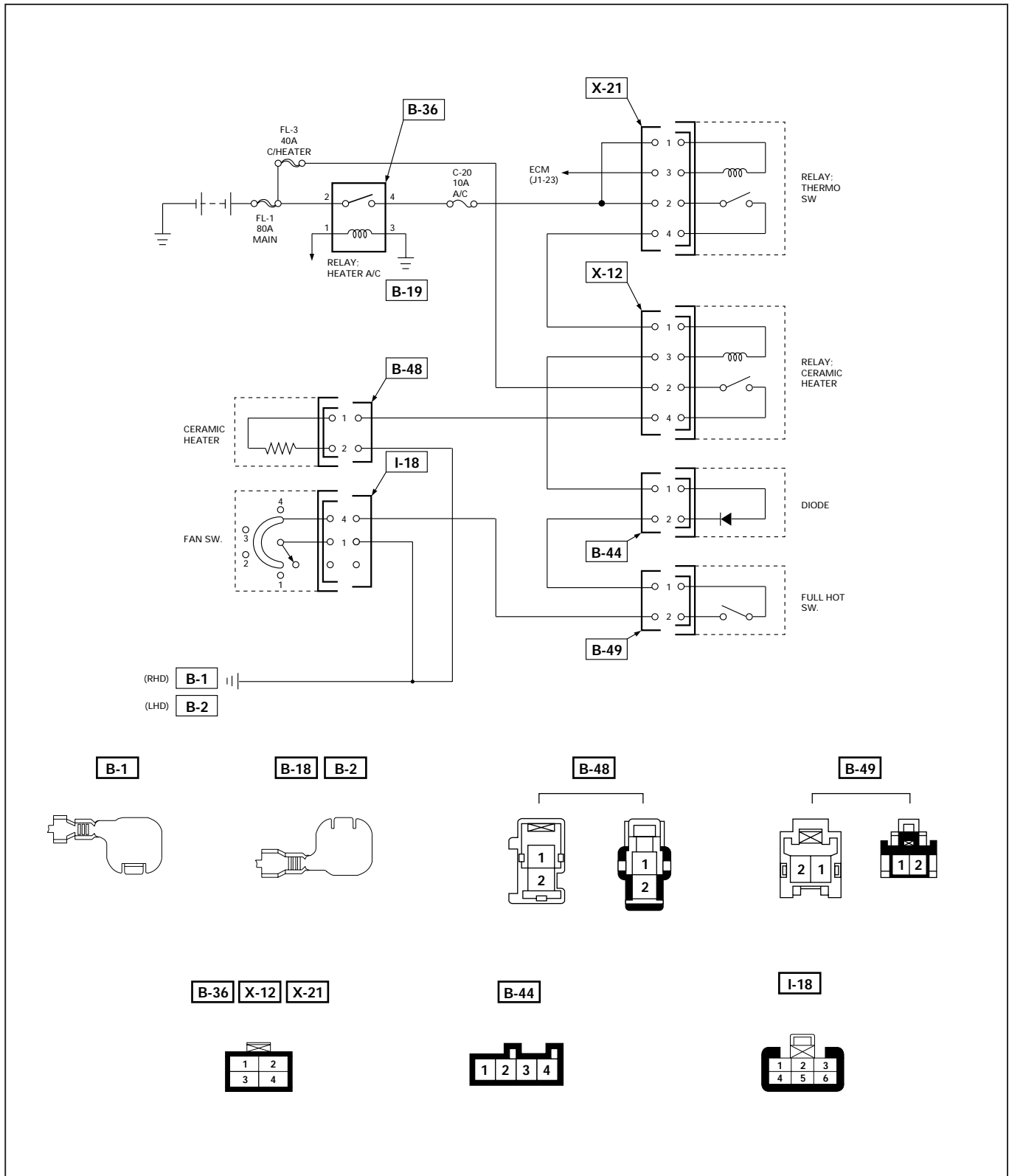
BLOWER MOTOR DOES NOT STOP AT "OFF" POSITION



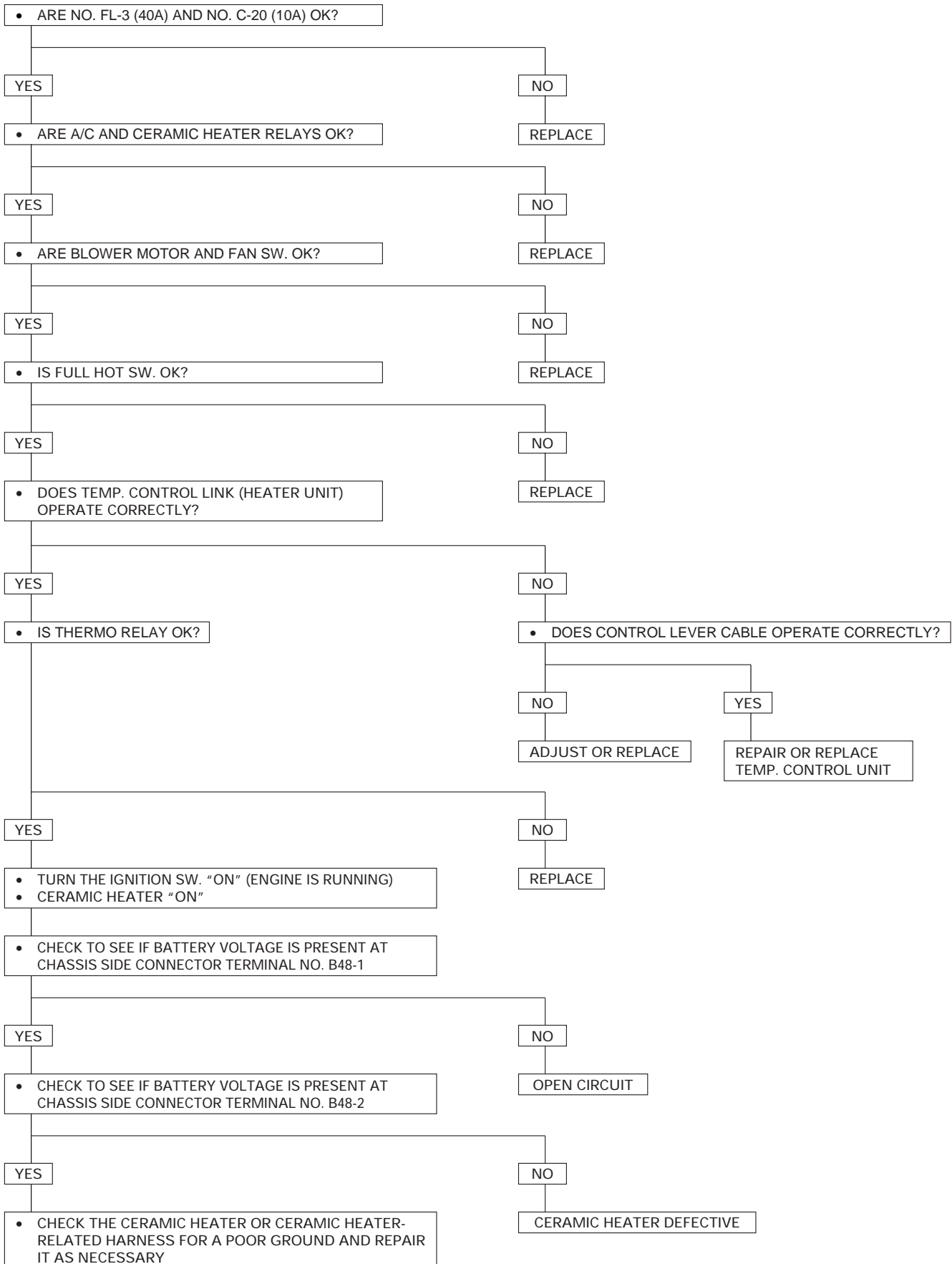
CERAMIC HEATER

When the fan control knob (fan switch) turns on with the temperature control knob set to "FULL HOT" (full hot switch "ON"), the ceramic heater in the heater unit turns on and the blow temperature goes up. When the ceramic heater turns on, FICD

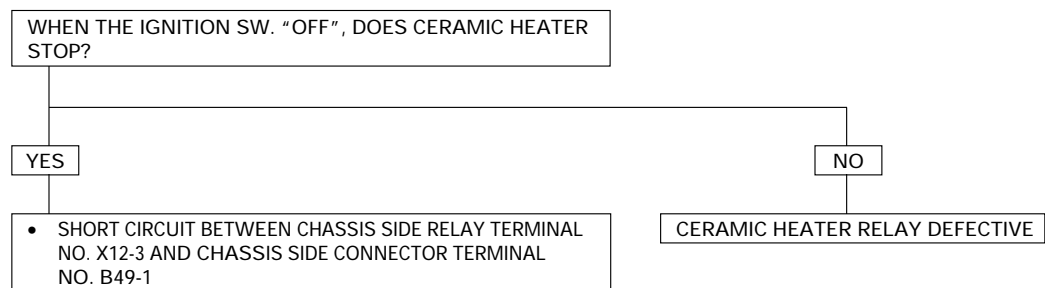
starts to operate at the same time. When either one of the fan switch, the full hot switch or the thermo switch (which turns on when the coolant temperature gets below 80°C (176°F) turns off, the ceramic heater also turns off.



CERAMIC HEATER DOES NOT OPERATE



CERAMIC HEATER DOES NOT STOP



AIR CONDITIONING CYCLE TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	CORRECTION
No cooling or insufficient cooling	<ol style="list-style-type: none"> 1. Magnetic clutch does not run 2. Compressor is not rotating properly <ul style="list-style-type: none"> • Drive belt loosened or broken • Magnetic clutch face is not clean and slips • Incorrect clearance between magnetic drive plate and pulley • Compressor oil leaks from shaft seal or shell • Compressor seized 3. Insufficient or excessive charge of refrigerant 4. Leaks in the refrigerant system 5. Condenser clogged or insufficient radiation 6. Temperature control link unit of the heater unit defective 7. Unsteady operation due to foreign substance in expansion valve 8. Poor operation of electronic thermostat 	<ul style="list-style-type: none"> • Refer to "MAGNETIC CLUTCH" troubleshooting • Adjust the drive belt to the specified tension or replace the drive belt • Clean the magnetic clutch face or replace • Adjust the clearance (Refer to Section 1D "COMPRESSOR OVERHAUL") • Replace the compressor • Replace the compressor • Discharge and recover refrigerant. Recharge to specified amount. • Check refrigerant system for leaks and repair as necessary. Discharge and recover refrigerant. Recharge to specified amount. • Clean the condenser or replace as necessary • Check radiator or condenser fan function • Repair the link unit • Replace the expansion valve • Check electronic thermostat and replace as necessary
Insufficient velocity of cooling air	<ol style="list-style-type: none"> 1. Evaporator clogged or frosted 2. Air leaking from cooling unit or air duct 3. Blower motor does not rotate properly 	<ul style="list-style-type: none"> • Check evaporator core and replace or clean the core • Check evaporator and duct connection, then repair as necessary • Refer to Section 00 for "FAN CONTROL KNOB (FAN SWITCH)" troubleshooting

* For the execution of the charging and discharging operation in the table above, refer to the "RECOVERY, RECYCLING, EVACUATING AND CHARGING" in section 1B.

CHECKING REFRIGERANT SYSTEM WITH MANIFOLD GAUGE

Conditions;

- Ambient temperature at approx. 25 ~ 30°C (77 ~ 86°F)
- Run the engine at Idling
- A/C switch is "ON"
- Run the blower motor at "4" (high) position
- Temperature control knob sets at "MAX COLD"
- Air source selector lever at "CIRC"
- Close the all doors

Normal pressures kpa (kg·cm² / PSI);

Low-pressure side:

Approx. 147 – 294 (1.5 – 3.0 / 21 – 43)

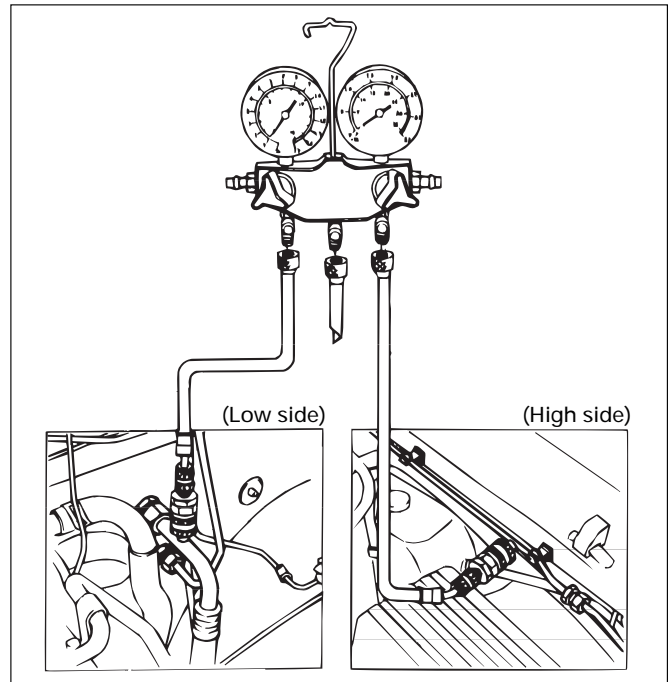
High-pressure side:

Approx. 1373 – 1863 (14 – 19 / 199 – 270)

Connect the manifold gauge

Low-pressure hose (LOW)~Suction side

High-pressure hose (HI)~Discharge side



RESULT	SYMPTOM	TROUBLE CAUSE	CORRECTION
Discharge (High) pressure gauge abnormally high	Reduced or no air flow through the condenser	<ul style="list-style-type: none"> • Condenser clogged or dirty • Radiator (condenser) fan does not operate properly 	<ul style="list-style-type: none"> • Clean • Check cooling fan operation
	No bubbles in sight glass when condenser is cooled by water (Insufficient cooling)	<ul style="list-style-type: none"> • Excessive refrigerant in system 	<ul style="list-style-type: none"> • Check sight glass. (See "Reading Sight Glass") • Discharge and recover refrigerant. Recharge to specified amount
	After stopping air conditioning, pressure drops approx. 196 kPa (28 PSI) quickly	<ul style="list-style-type: none"> • Air in system 	<ul style="list-style-type: none"> • Evacuate and charge refrigerant system
Discharge (High) pressure gauge abnormally low	Insufficient cooling and excessive bubbles in the sight glass	<ul style="list-style-type: none"> • Insufficient refrigerant in system 	<ul style="list-style-type: none"> • Check sight glass. (See "Reading Sight Glass") • Check for leaks • Discharge and recover refrigerant. Recharge to specified amount
	Low pressure gauge indicates vacuum	<ul style="list-style-type: none"> • Clogged or defective expansion valve 	<ul style="list-style-type: none"> • Replace the expansion valve
	Frost or dew on refrigerant line before and after receiver/ drier or expansion valve, and low pressure gauge indicates vacuum	<ul style="list-style-type: none"> • Restriction caused by debris or moisture in receiver/drier 	<ul style="list-style-type: none"> • Check system for restriction and replace receiver/drier
	After turning off air conditioning, high and low pressure gauge balanced quickly	<ul style="list-style-type: none"> • Compressor seal defective • Poor compression due to defective compressor gasket 	<ul style="list-style-type: none"> • Replace or repair compressor
	Low pressure gauge is lowered after condenser is cooled by water	<ul style="list-style-type: none"> • Excessive refrigerant in system 	<ul style="list-style-type: none"> • Discharge and recover refrigerant • Recharge to specified amount
Suction (Low) pressure gauge abnormally high	Low pressure hose temperature around the compressor refrigerant line connector is lower than around evaporator	<ul style="list-style-type: none"> • Unsatisfactory valve operation due to defective temperature sensor of expansion valve • Expansion valve opens too long 	<ul style="list-style-type: none"> • Replace the expansion valve
	After turning off air conditioning, high and low pressure gauge is balanced quickly	<ul style="list-style-type: none"> • Compressor gasket is defective 	<ul style="list-style-type: none"> • Replace
	Air conditioning turns off before passenger compartment is sufficiently cool	<ul style="list-style-type: none"> • Electronic thermostat defective 	<ul style="list-style-type: none"> • Check the electronic thermostat and replace as necessary

* For the charging and discharging operations in the table above, refer to "RECOVERY, RECYCLING, EVACUATION AND CHARGING" in this section.

00 – 26 SERVICE INFORMATION

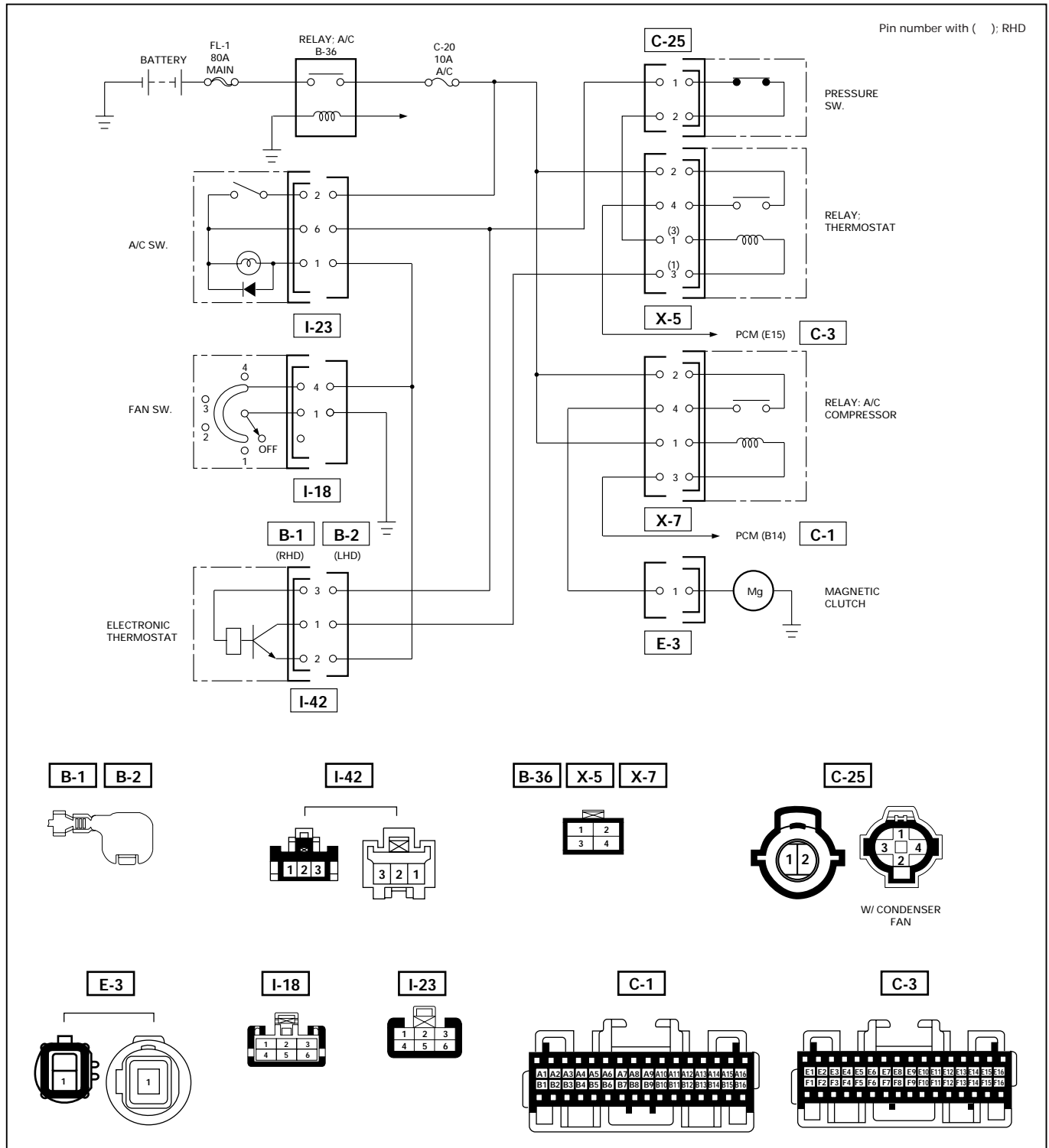
RESULT	SYMPTOM	TROUBLE CAUSE	CORRECTION
Suction (Low) pressure abnormally low	Condenser is not hot and excessive bubble in sight glass	<ul style="list-style-type: none"> • Insufficient refrigerant 	<ul style="list-style-type: none"> • Check sight glass.(See “Reading Sight Glass”) • Check for leaks • Discharge and recover refrigerant. Recharge to specified amount
	Frost on the expansion valve inlet line	<ul style="list-style-type: none"> • Expansion valve clogged 	<ul style="list-style-type: none"> • Replace the expansion valve
	A distinct difference in temperature between the inlet and outlet refrigerant lines of the receiver/drier	<ul style="list-style-type: none"> • Receiver/drier clogged 	<ul style="list-style-type: none"> • Replace the receiver/drier
	Expansion valve outlet refrigerant line is not cold and low-pressure gauge indicates vacuum	<ul style="list-style-type: none"> • The temperature sensor of the expansion valve is defective, and the valve cannot regulate the correct flow of the refrigerant 	<ul style="list-style-type: none"> • Replace the expansion valve
	Discharge temperature is low and air flow from vents is restricted	<ul style="list-style-type: none"> • Frozen evaporator core fins 	<ul style="list-style-type: none"> • Check electronic thermostat and replace as necessary
	Low-pressure gauge reading is low, or a vacuum reading may be shown	<ul style="list-style-type: none"> • Clogged or blocked refrigerant line 	<ul style="list-style-type: none"> • Replace refrigerant line
Suction (Low) and Discharge (High) pressure abnormally high	No bubbles in sight glass after condenser is cooled by water (Insufficient cooling)	<ul style="list-style-type: none"> • Excessive refrigerant in system 	<ul style="list-style-type: none"> • Check sight glass.(See “Reading Sight Glass”) • Discharge and recover refrigerant. Recharge to specified amount
	Reduce air flow through condenser	<ul style="list-style-type: none"> • Condenser clogged • Radiator (condenser) fan does not rotate properly 	<ul style="list-style-type: none"> • Clean • Check cooling fan operation
	Suction (Low) pressure hose is not cold	<ul style="list-style-type: none"> • Air in system 	<ul style="list-style-type: none"> • Evacuate and charge refrigerant
Suction (Low) and Discharge (High) pressure abnormally low	Insufficient cooling and excessive bubbles in the sight glass	<ul style="list-style-type: none"> • Insufficient refrigerant in system 	<ul style="list-style-type: none"> • Check sight glass. (See “Reading Sight Glass”) • Check for leaks • Discharge and recover refrigerant. Recharge to specified amount

MAGNETIC CLUTCH

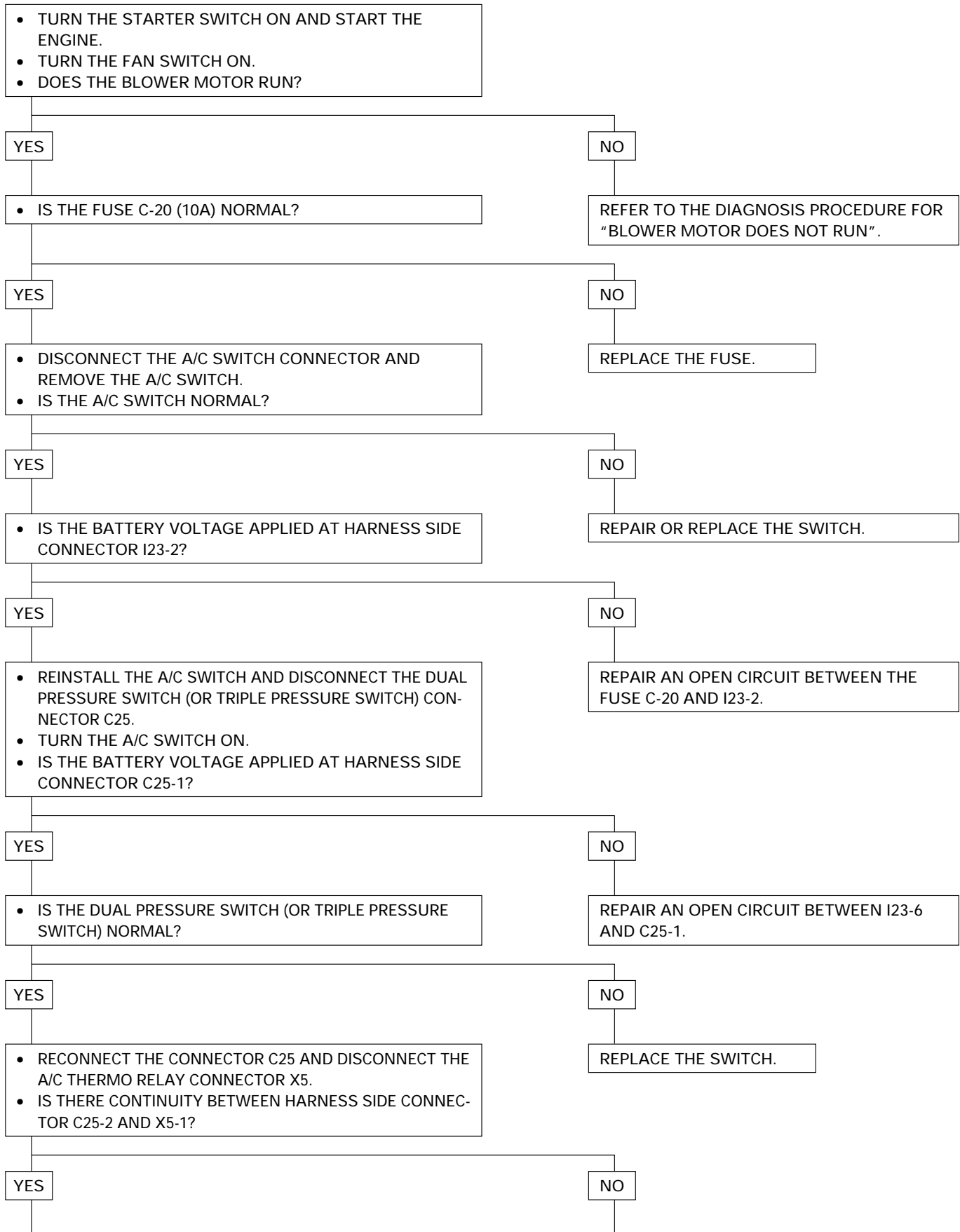
When the A/C switch and the fan control knob (fan switch) are turned on with the engine running, current flows through the thermostat and the compressor relay to activate the magnetic clutch. The air conditioning can be stopped by turning off the A/C switch or the fan control knob (fan switch). However, even when the air conditioning is in oper-

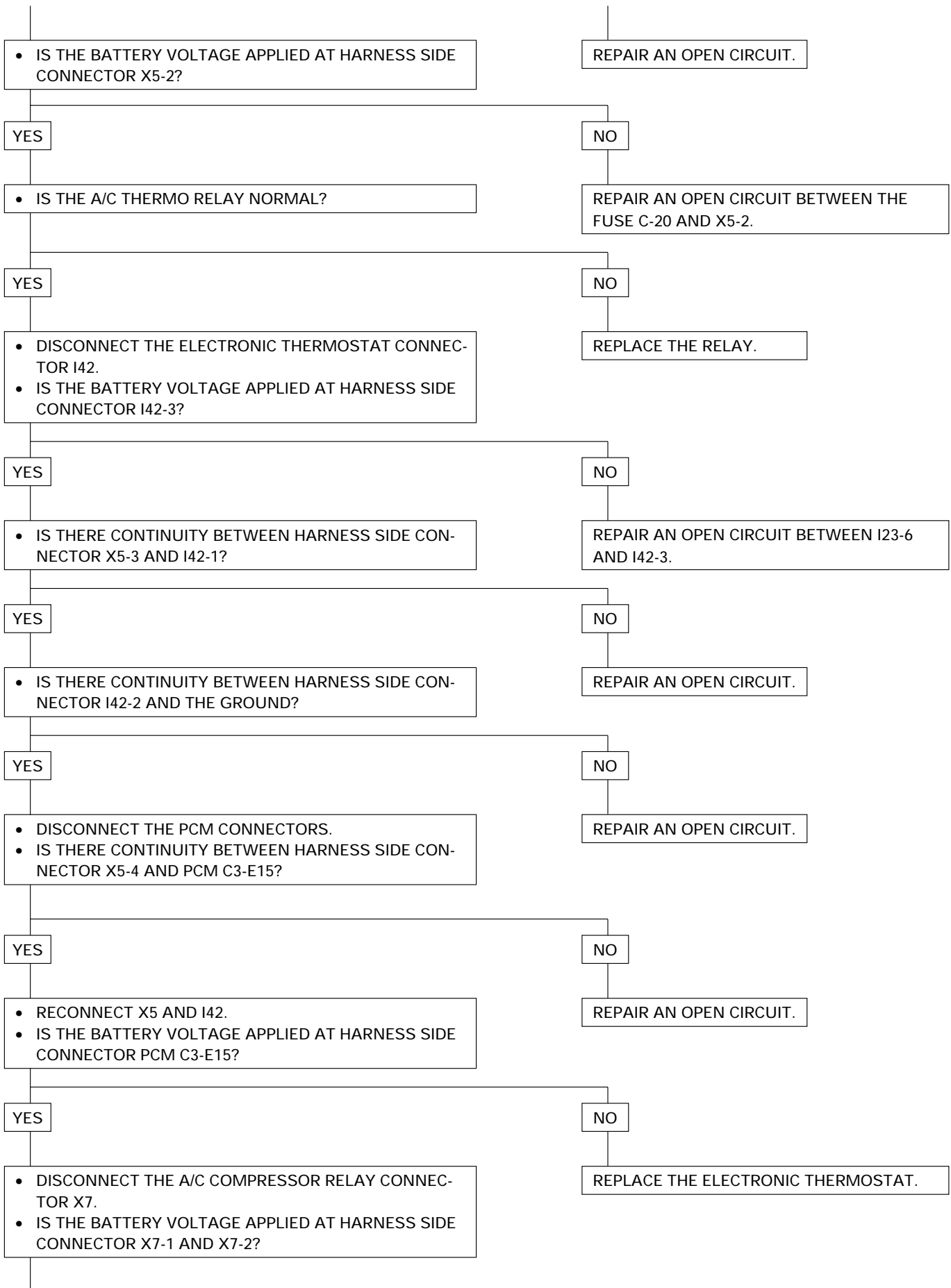
ation, the electronic thermostat, the pressure switch or the PCM (6VD1/6VE1 Engine) is used to stop the air conditioning temporarily by turning off the magnetic clutch in the prearranged conditions to reduce the engine load which is being caused by the rise in the engine coolant temperature, and the acceleration of the vehicle, etc.

6VD1/6VE1 ENGINE

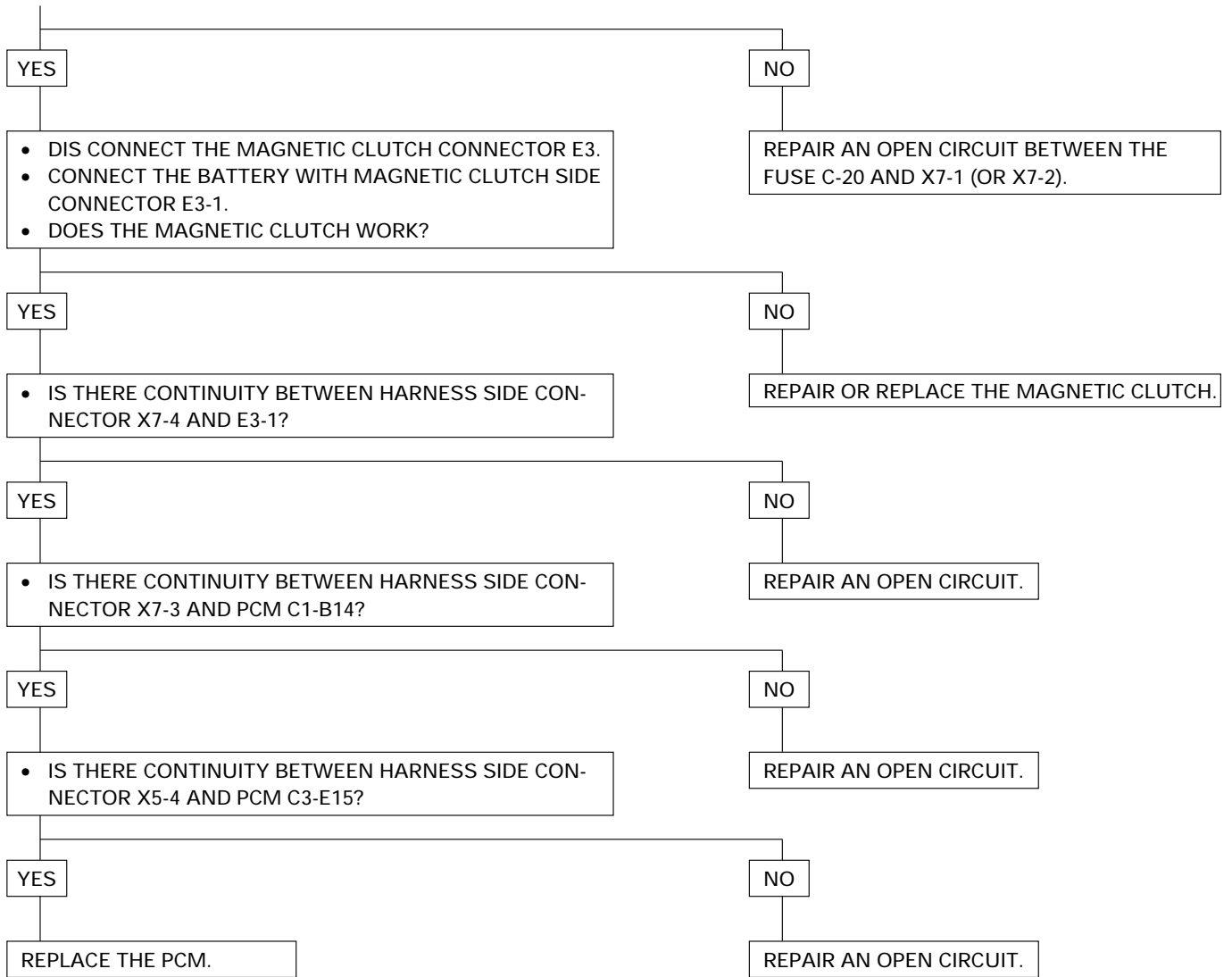


MAGNETIC CLUTCH DOES NOT RUN

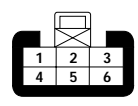
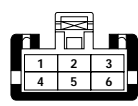
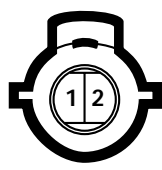
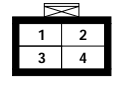
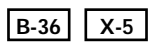
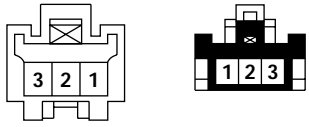
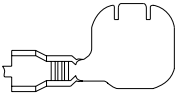
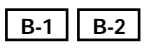
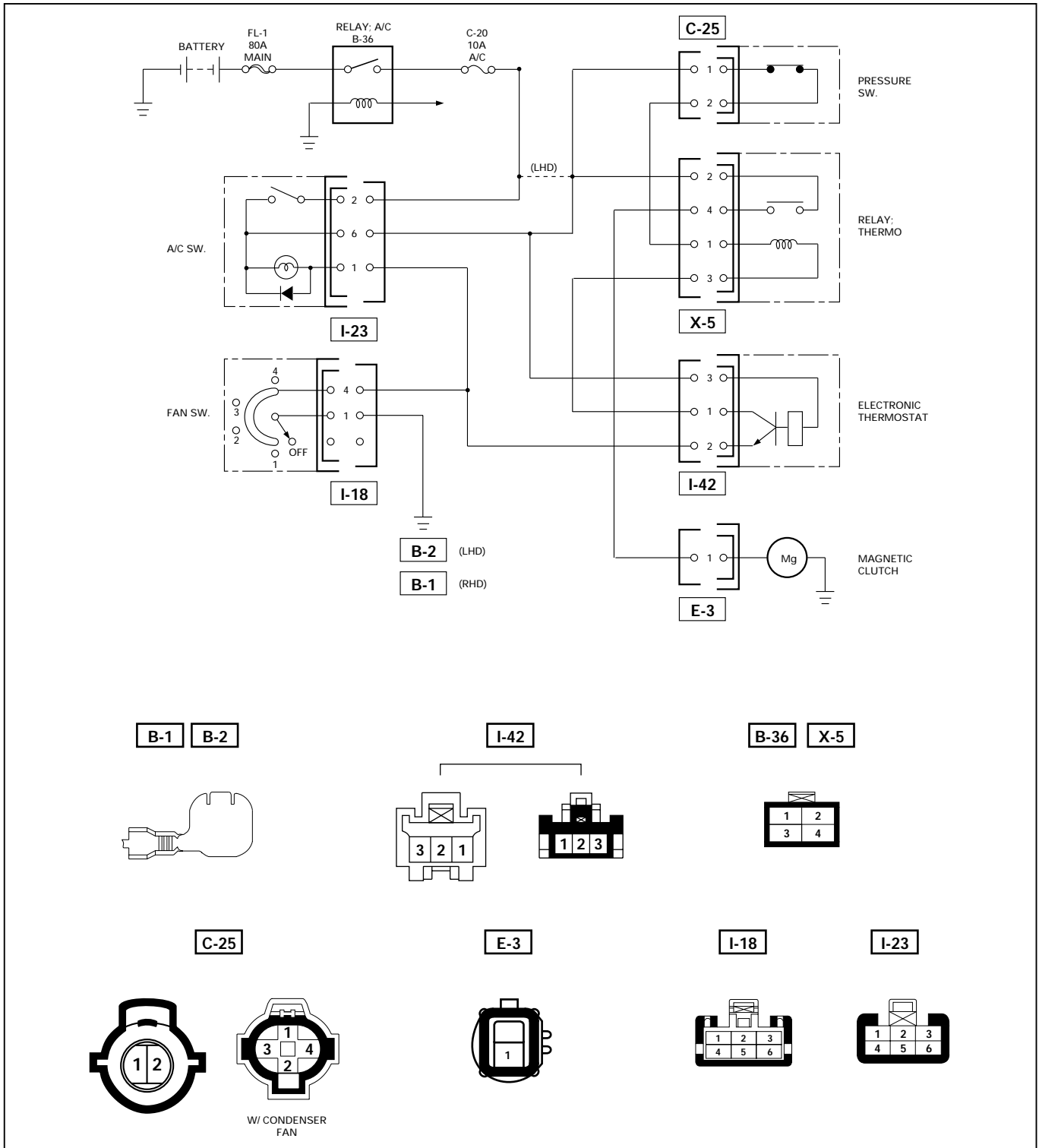




00 - 30 SERVICE INFORMATION

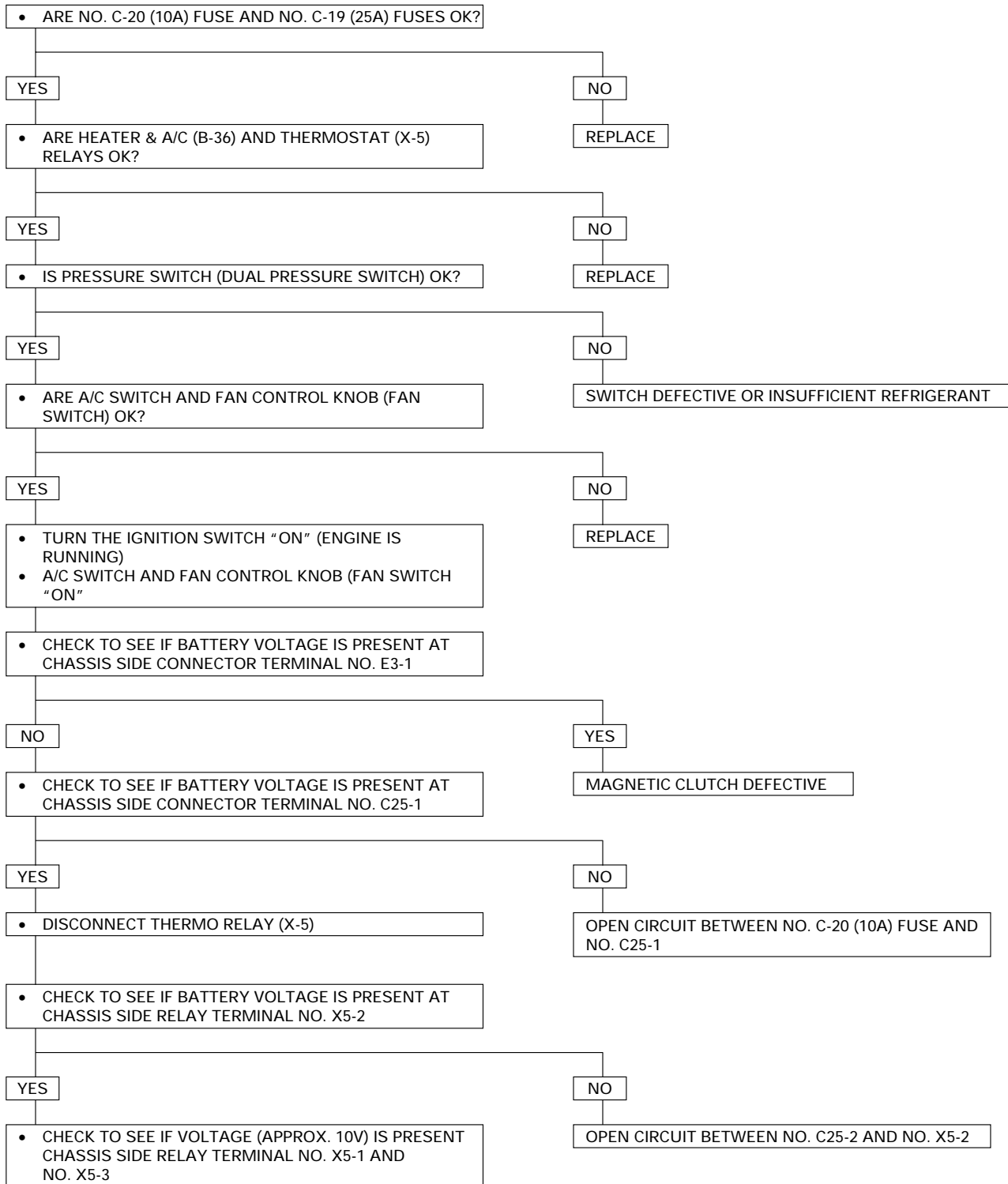


4JG2 ENGINE



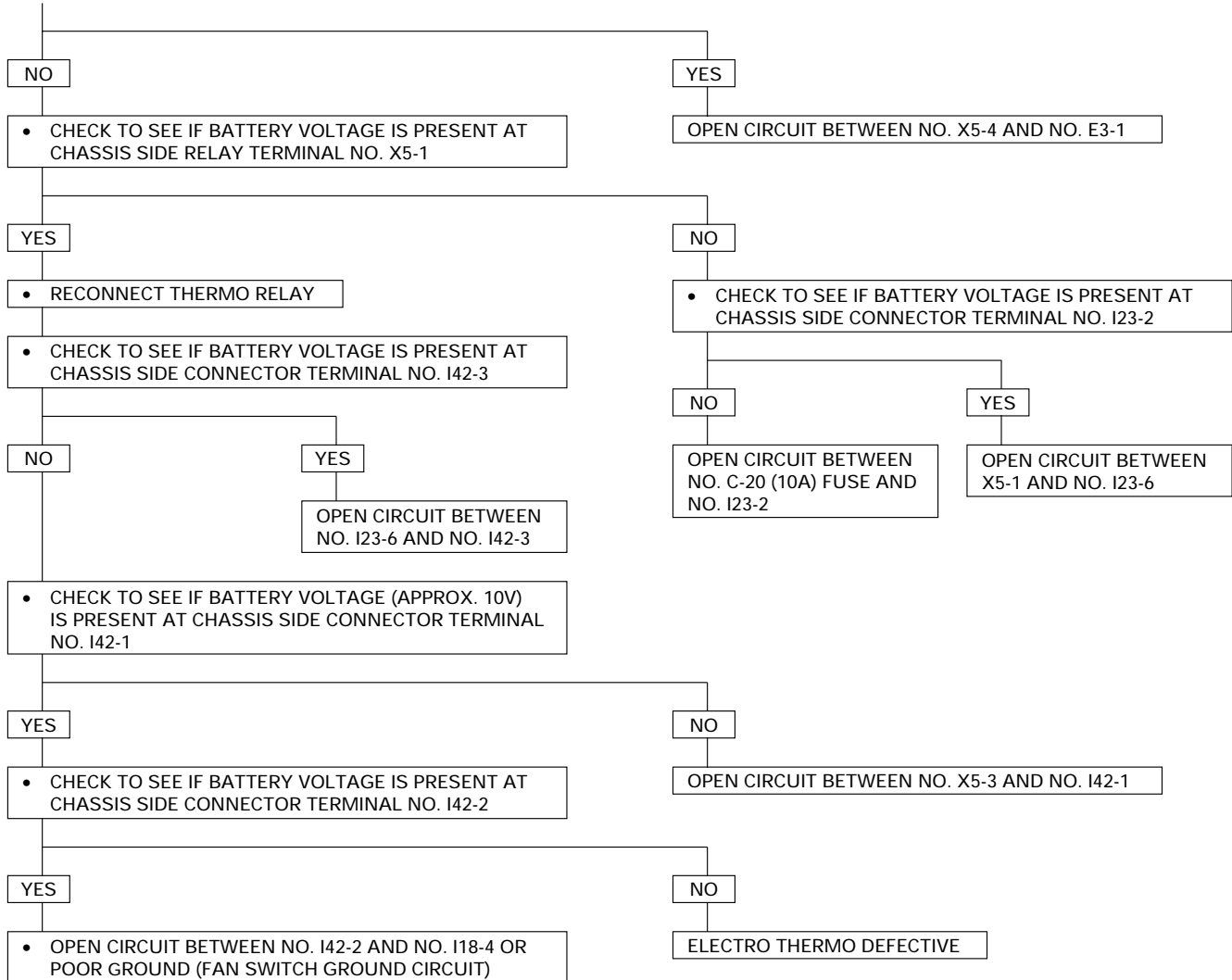
W/ CONDENSER FAN

MAGNETIC CLUTCH DOES NOT RUN

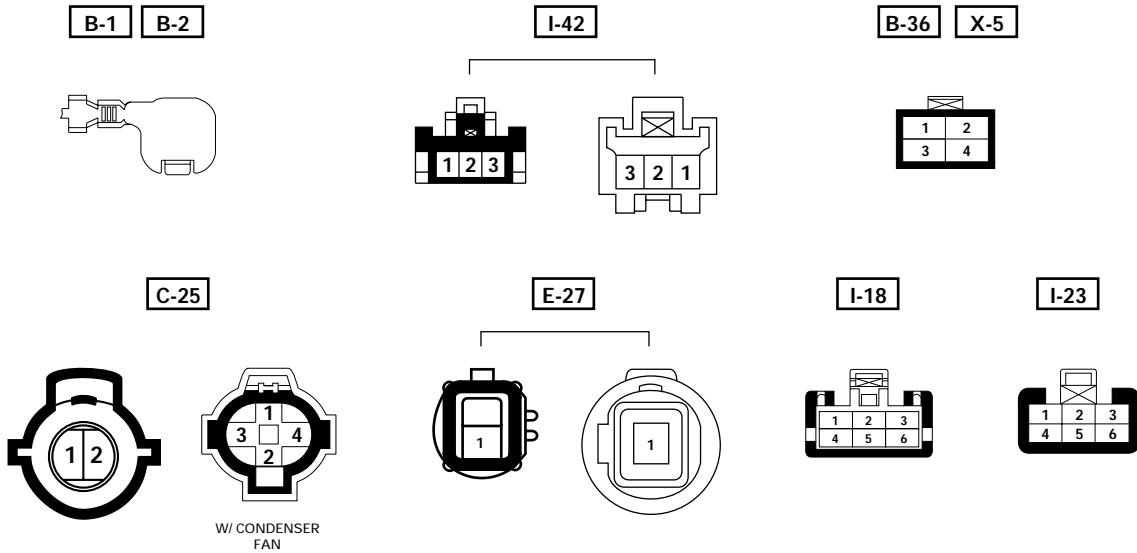
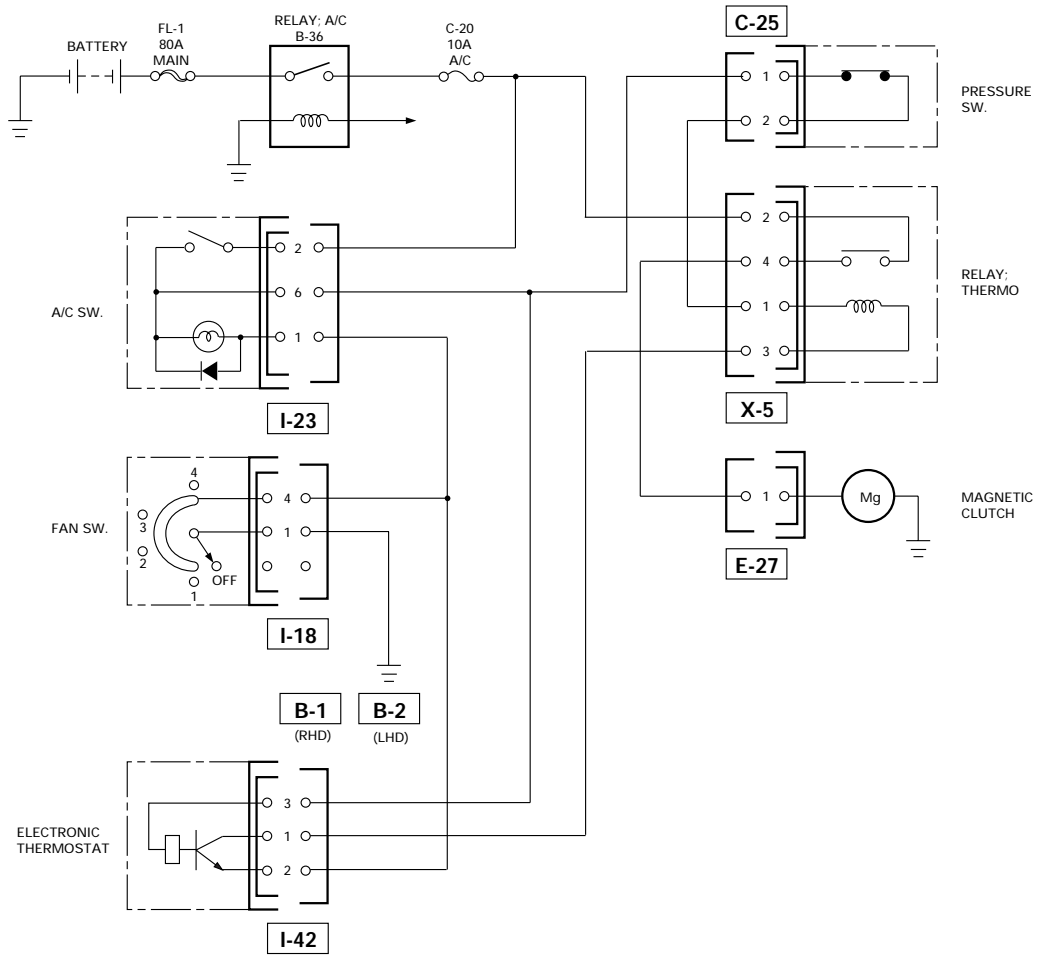


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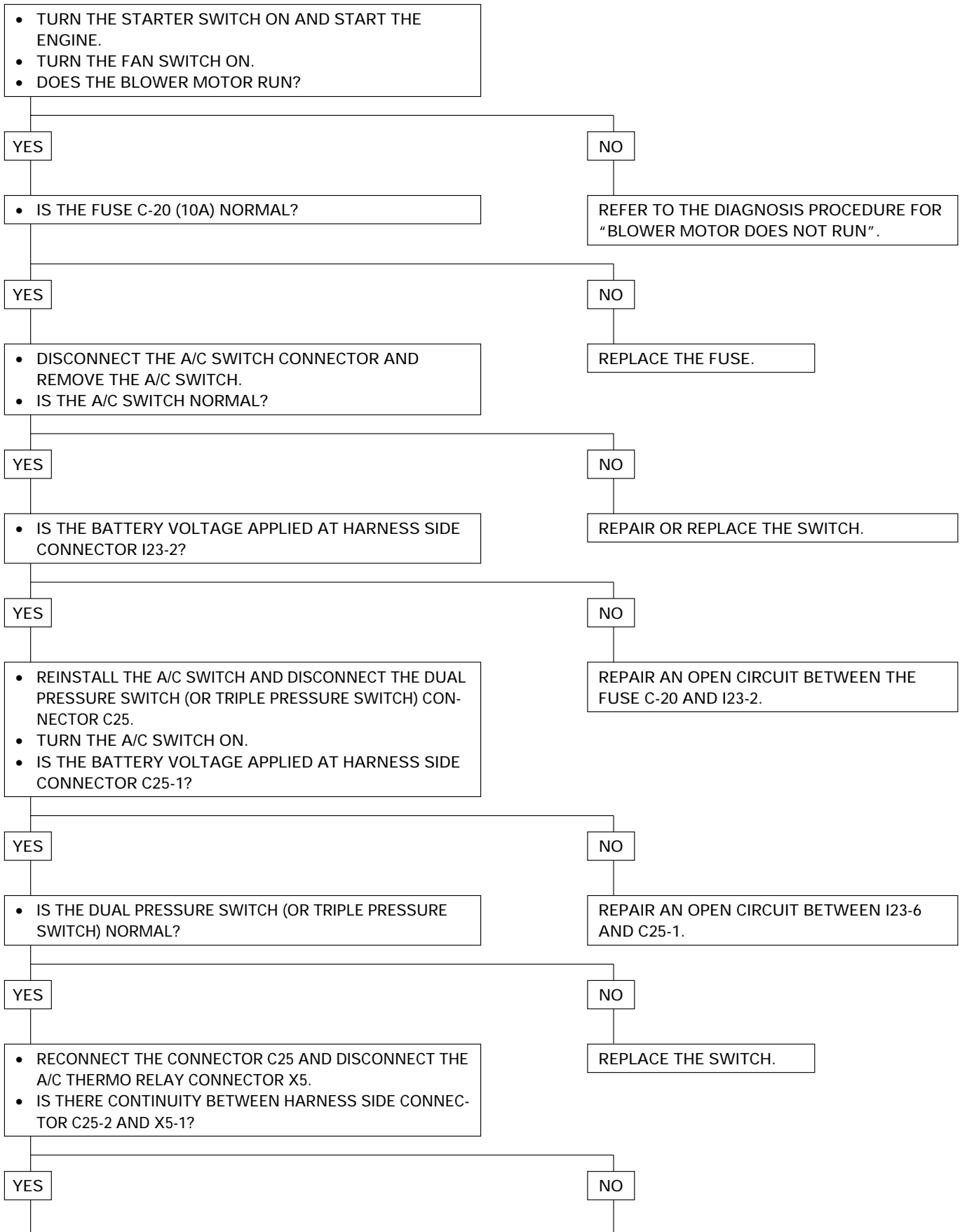
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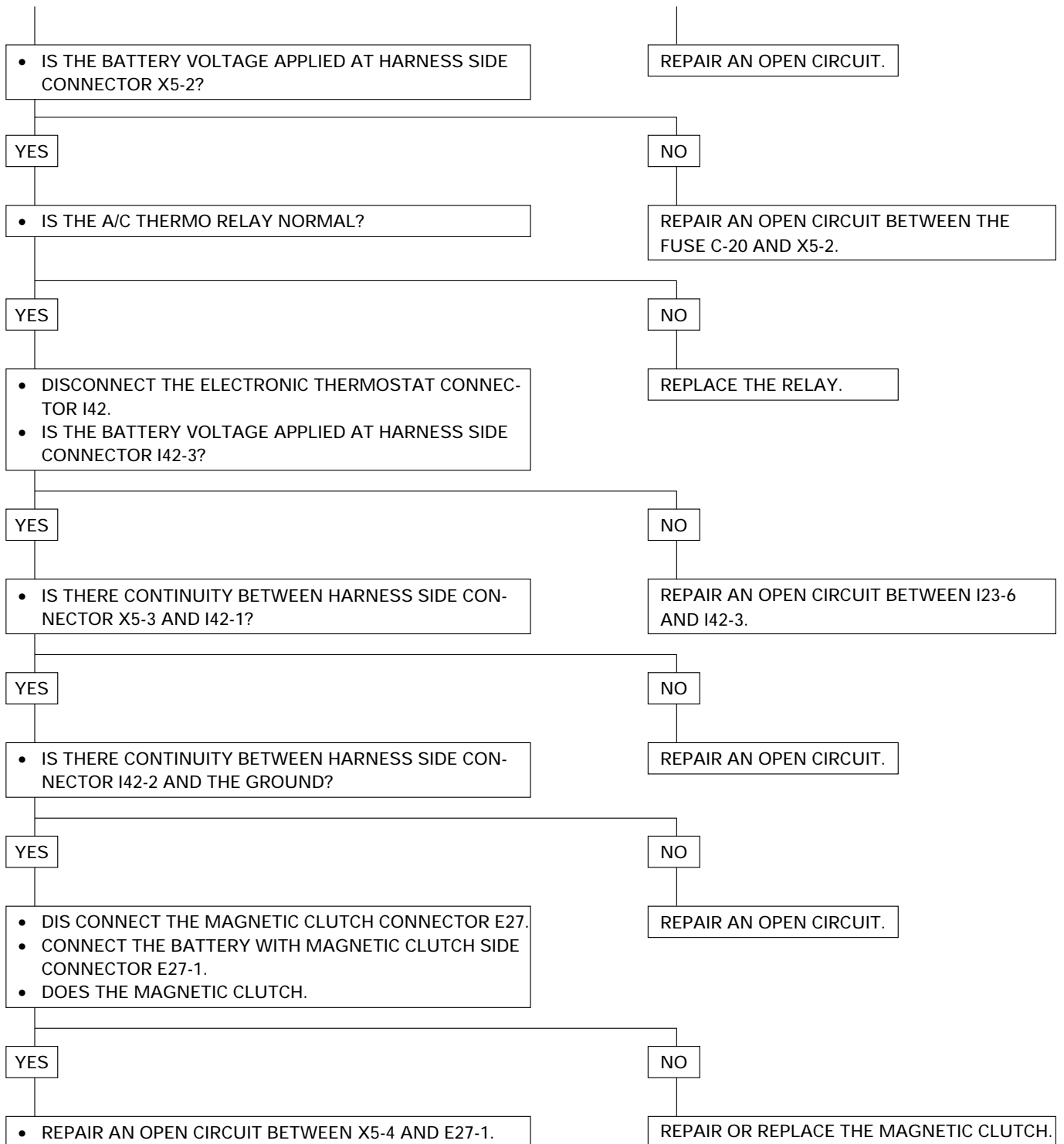
4JX1 ENGINE



MAGNETIC CLUTCH DOES NOT RUN



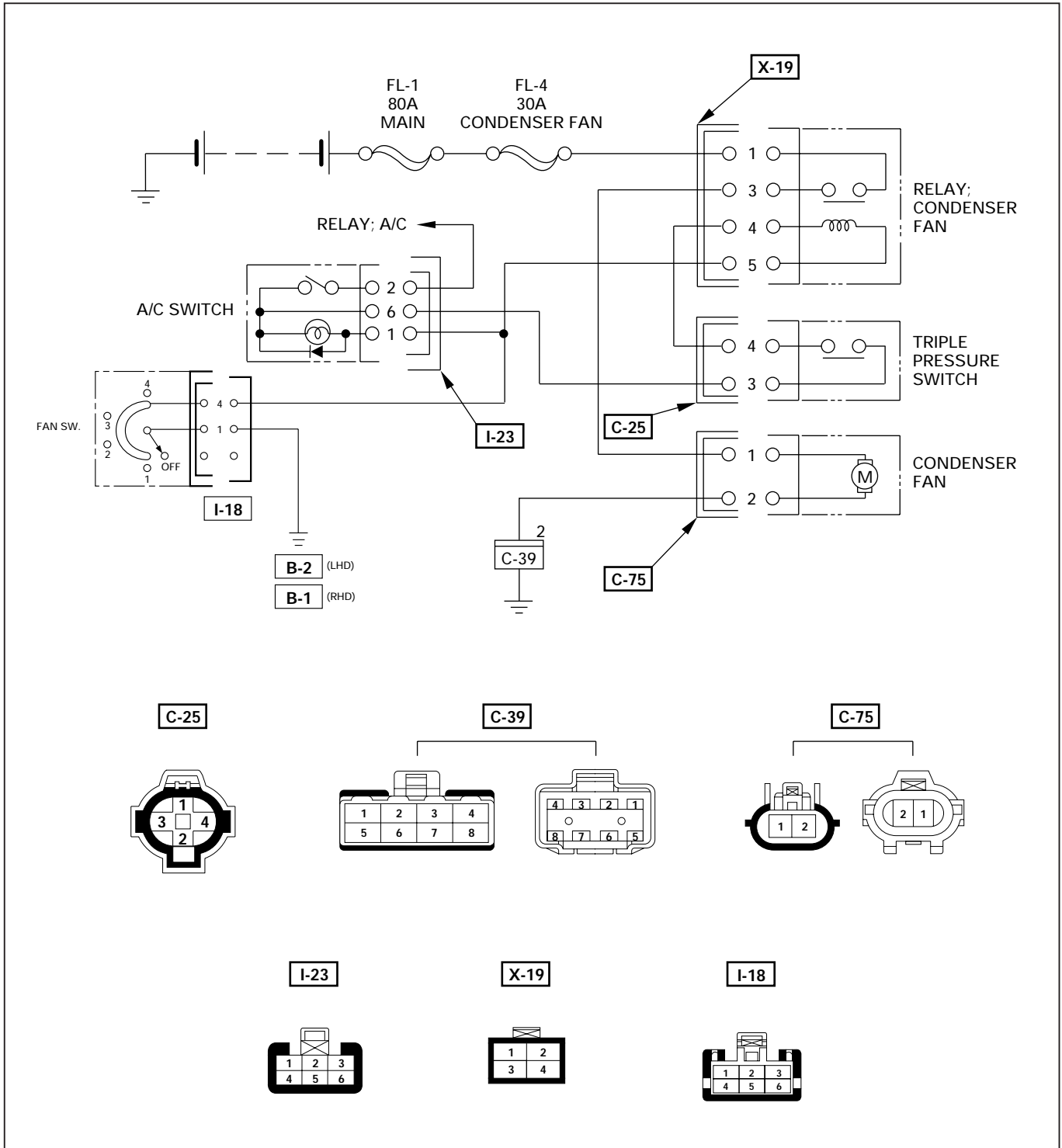
00 - 36 SERVICE INFORMATION



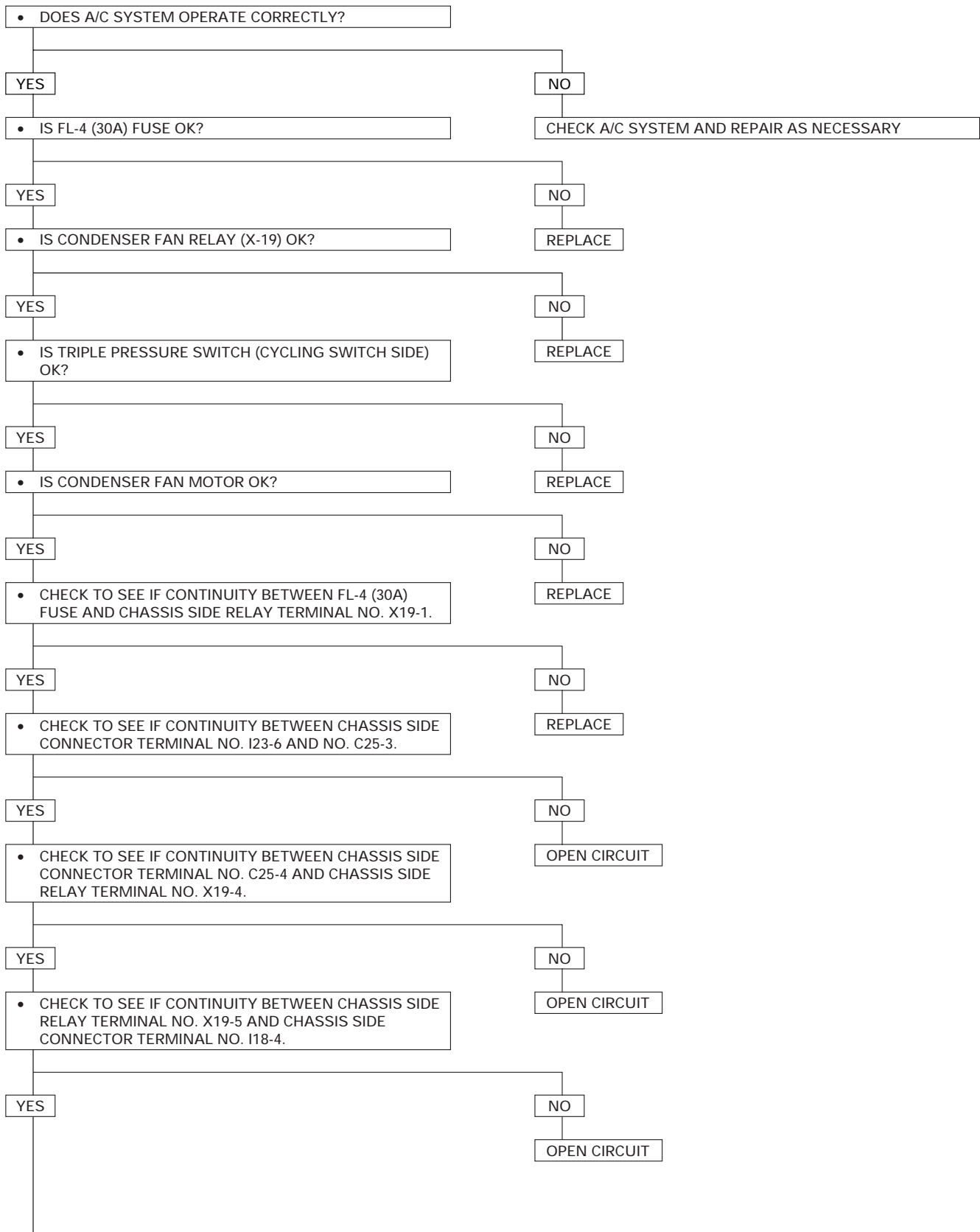
CONDENSER FAN

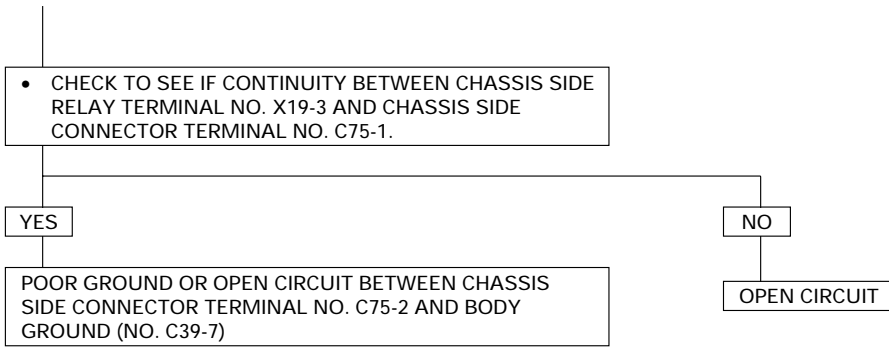
When the cycling switch, which controls the condenser fan of the triple pressure switch while the A/C switch is on, senses the refrigerant pressure

and the condenser fan turns on, the motor operates via the condenser fan relay.

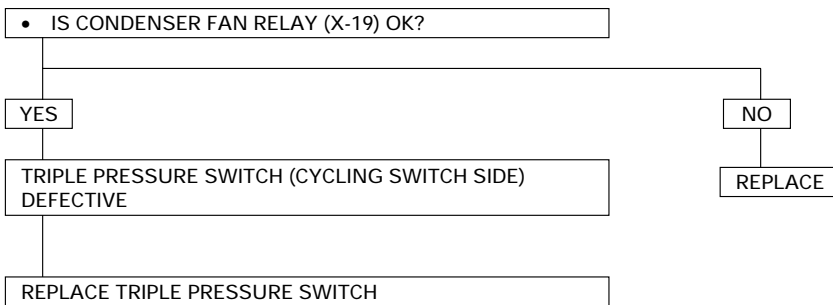


CONDENSER FAN DOES NOT RUN





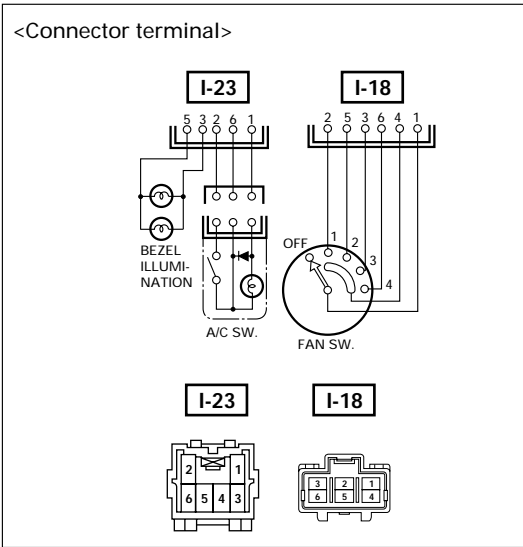
CONDENSER FAN DOES NOT STOP



COMPRESSOR TROUBLESHOOTING

ITEM	PROBLEM	POSSIBLE CAUSES	CORRECTION
1	Noise from compressor	1. Defective rotor/piston 2. Defective bearing (DKS-15CH) 3. Defective shaft	Replace compressor/cylinder and shaft assembly Replace cylinder and shaft assembly Replace compressor/cylinder and shaft assembly
2	Noise from magnetic clutch face	1. Defective bearing 2. Defective clutch 3. Clearance between drive plate and pulley not standard	Replace magnetic clutch Replace magnetic clutch Adjust the clearance or replace magnetic clutch
3	Insufficient cooling	1. Defective gasket 2. Defective rotor/reed valve 3. Defective trigger valve/suction valve	Replace compressor/gasket Replace compressor/valve plate Replace compressor/suction valve
4	Not rotating	1. Defective rotor/piston 2. Defective shaft 3. Rotating parts seized due to insufficient oil	Replace compressor/cylinder and shaft assembly Replace compressor/cylinder and shaft assembly Replace compressor
5	Oil and/or gas leakage	1. Defective seal 2. Defective O-ring	Replace compressor/shaft seal Replace

INDIVIDUAL INSPECTION

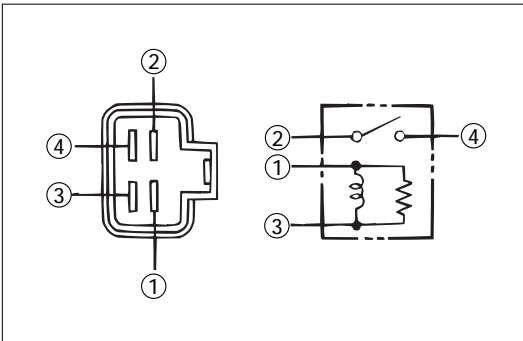


FAN CONTROL KNOB (FAN SWITCH) AND A/C SWITCH



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

SW. position		I-18						I-23		
		Terminal No. 1	2	3	4	5	6	1	2	6
FAN SW.	OFF									
	1	○	○	○	○					
	2	○	○	○	○					
	3	○	○	○	○					
A/C SW.	OFF							○	○	○
	ON							○	○	○



HEATER & A/C, THERMOSTAT, COMPRESSOR, CONDENSER FAN AND CERAMIC HEATER RELAY

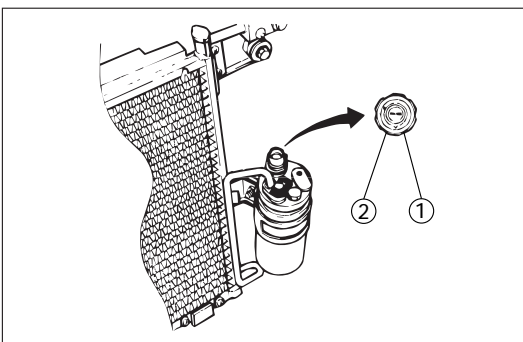


Check for continuity between the relay terminals.

② - ④ No continuity

(When battery voltage is applied between ① - ③)

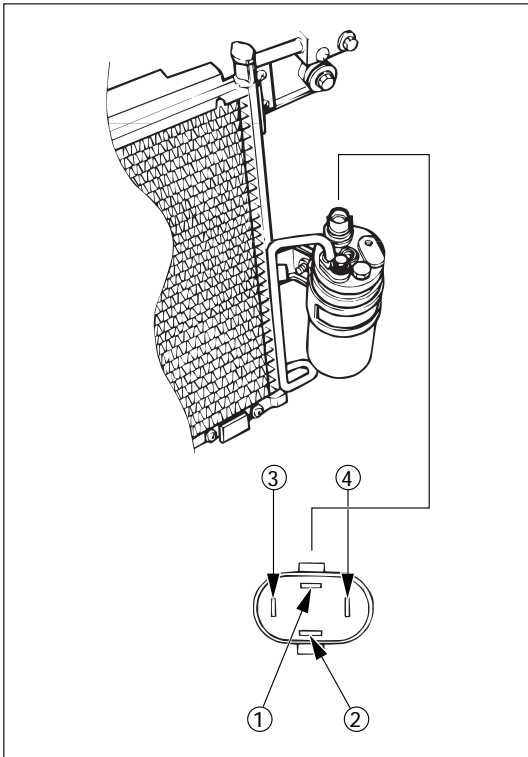
② - ④ Continuity



DUAL PRESSURE SWITCH



Disconnect pressure switch connector and check for continuity between pressure switch side connector terminals.



TRIPLE PRESSURE SWITCH (W/CONDENSER FAN)



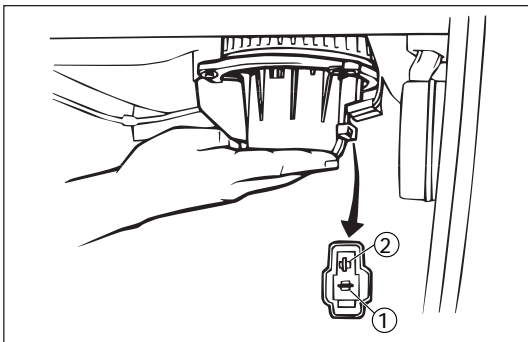
- 1) Disconnect the connector and check for continuity between pressure switch side connector terminal.
- 2) Reconnect the connector to activate the A/C switch, and check to see if there is continuity between the chassis side connectors and the fan operates.

[A/C OFF]

Terminal No.	Control	Continuity
① - ②	Magnetic Clutch	Continuity
③ - ④	Condenser Fan	No Continuity

[A/C ON]

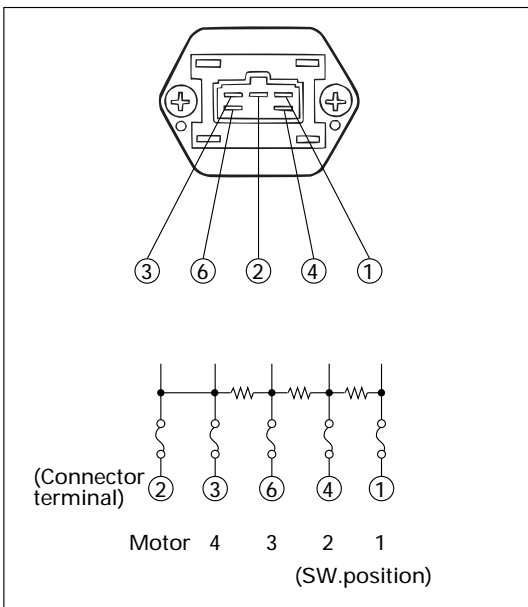
Refrigerant Pressure	Terminal No.	Continuity	Fan
1079±98 kPa (11.0±1.0 kg·cm ² / 156±14 psi)	③ - ④	No Continuity	OFF
1471±98 kPa (15.0±1.0 kg·cm ² / 213±14 psi)		Continuity	ON



BLOWER MOTOR



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

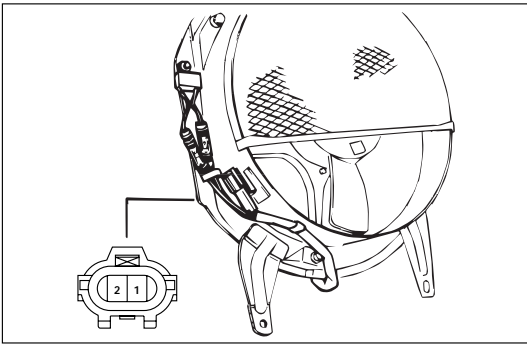


RESISTOR



- 1) Disconnect resistor (I-41) connector.
- 2) Check for continuity and resistance between the terminals of the resistor.

Terminal No.	1	2	3	4	6	Normal Operating Resistance
1	○—○					2.4Ω
2		○—○				0.90Ω
3			○—○			0.28Ω
4				○—○		-

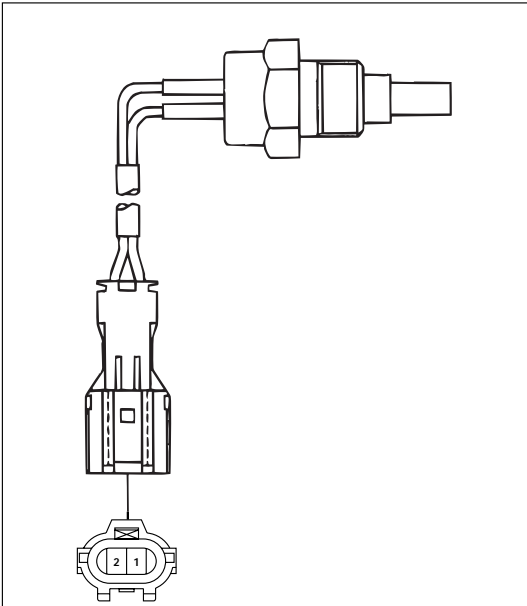


CONDENSER FAN

- 1) Disconnect the condenser fan connector (C-75).
- 2) Connect the battery positive terminal to the No. 1 terminal and negative to No. 2.



- 3) Be sure to check to see if condenser fan operates correctly.

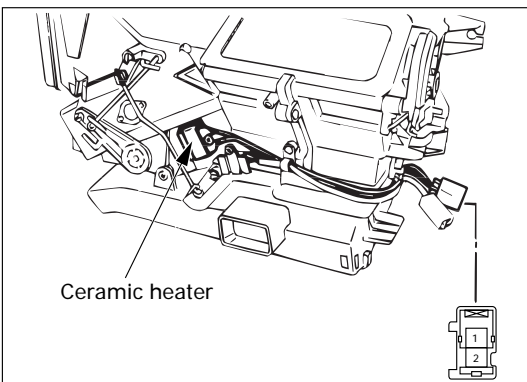


THERMO SWITCH (ENGINE)



With the environmental temperature of the switch set to the following conditions, check to see if there is any continuity between the switch side connector terminals.

Ambient Temperature	Terminal No.	Continuity
Above 77 – 83°C (170.6–181.4°F)	① – ②	No Continuity

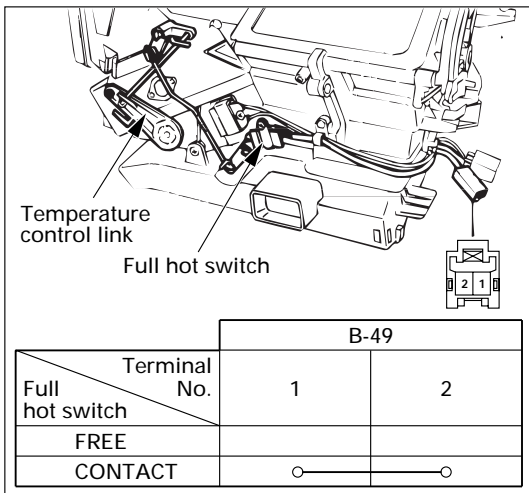


CERAMIC HEATER



Disconnect the ceramic heater connector and check for continuity between ceramic heater side connector terminals.

Connector No.	B-48	
Terminal	1	2
Continuity	○	○



FULL HOT SWITCH

- 1) With the temperature control knob set to the full hot position, check to see visually if the temperature control link of the heater unit operate correctly and if the link contacts securely with the full hot switch.
- 2) Disconnect the full hot switch connector.
- 3) With the full hot switch contacted, check to see if there is any continuity between the switch side connector terminals.



MAIN DATA AND SPECIFICATIONS

HEATER UNIT		
Temperature control		Reheat air mix system
Capacity	(Kcal./hr.)	3,700
Air flow	(m ³ /hr.)	280
HEATER CORE		
Type		Fin & tube type
Element dimension	mm (in.)	161 (6.3) × 163 (6.4) × 45 (1.8)
Radiating area	m ²	Approx. 2.1
EVAPORATOR ASSEMBLY		
Capacity	(Kcal./hr.)	4,200
Air flow	(m ³ /hr.)	470
EVAPORATOR CORE		
Type		Al-laminate louver fin type
Element dimension	mm (in.)	235 (9.3) × 224 (8.8) × 74 (2.9)
EXPANSION VALVE		
Type		External pressure equalizer type
THERMOSTAT SWITCH		
Type		Electronic thermostat
	°C (F)	OFF: 3.5 ± 0.5 (38.3 ± 0.9)
		ON: 5.0 ± 0.5 (41.0 ± 0.9)
CONDENSER		
Type		Parallel flow
Radiation performance	(Kcal./hr.)	11,500
RECEIVER/DRIER		
Type		Assembly includes sight glass with dual (triple) pressure switch
Internal volume	cc (Imp. fl oz)	300 (8.5)
PRESSURE SWITCH		
Type		Dual pressure switch
	kPa (kg·cm ² / PSI)	<ul style="list-style-type: none"> • Low pressure control <ul style="list-style-type: none"> ON: 205.9 ± 30 (2.1 ± 0.3 / 29.9 ± 4) (Except 6VD1 / 6VE1, LHD model) 186 ± 30 (1.9 ± 0.3 / 27 ± 4) (only for 6VD1/ 6VE1, LHD model) OFF: 176 ± 20 (1.8 ± 0.2 / 26 ± 3) • High pressure control <ul style="list-style-type: none"> ON: 2354 ± 196 (24.0 ± 2.0 / 341 ± 28) OFF: 2942 ± 196 (30.0 ± 2.0 / 427 ± 28)
		Triple pressure switch (W/Condenser fan)
		<ul style="list-style-type: none"> • Low pressure control <ul style="list-style-type: none"> ON: 186 ± 30 (1.9 ± 0.3 / 27 ± 4) OFF: 176 ± 20 (1.8 ± 0.2 / 26 ± 3) • Medium pressure control <ul style="list-style-type: none"> ON: 1471 ± 98 (15.0 ± 1.0 / 213 ± 14) OFF: 1079 ± 98 (11.0 ± 1.0 / 156 ± 14) • High pressure control <ul style="list-style-type: none"> ON: 2354 ± 196 (24.0 ± 2.0 / 341 ± 28) OFF: 2942 ± 196 (30.0 ± 2.0 / 427 ± 28)
REFRIGERANT		
Type/Specified amount	g (lbs)	HFC-134a / 750 (1.65)

6VD1/6VE1 (RHD) & 6VD1 (LHD) (SAUDI/PHILIPPINE)

COMPRESSOR		
Model		DKV-14D
Type		Vane rotary (Invariable)
Number of vanes		5
Rotor diameter	mm (in.)	64 (2.52)
Stroke	mm (in.)	8.75 (0.34)
Displacement	cc (Imp fl oz)	140 (3.9)
Maximum speed	(rpm)	7,000 (up to 8,400)
Direction of rotation		Clockwise (Front-side view)
Lubrication system		Pressure differential type
Lubricant	cc (Imp fl oz)	ZXL-200PG, 150 (4.2)
		ISUZU PART NO.
		8-97101-336-0
Refrigerant	g (lbs.)	HFC-134a, 750 (1.65)
Shaft seal		Lip type
Weight	kg (lbs.)	3.6 (7.94)
MAGNETIC CLUTCH		
Type		Electromagnetic single-plate dry clutch
Rated voltage		12 Volts D.C.
Current consumption	(A)	3.7
Starting torque	N·m (kg·m / lb-ft)	39 (4.0 / 30)
Direction of rotation		Clockwise (Front-side view)
Weight	kg (lbs.)	2.2 (4.9)

6VD1/6VE1 (LHD) Except SAUDI/PHILIPPINE

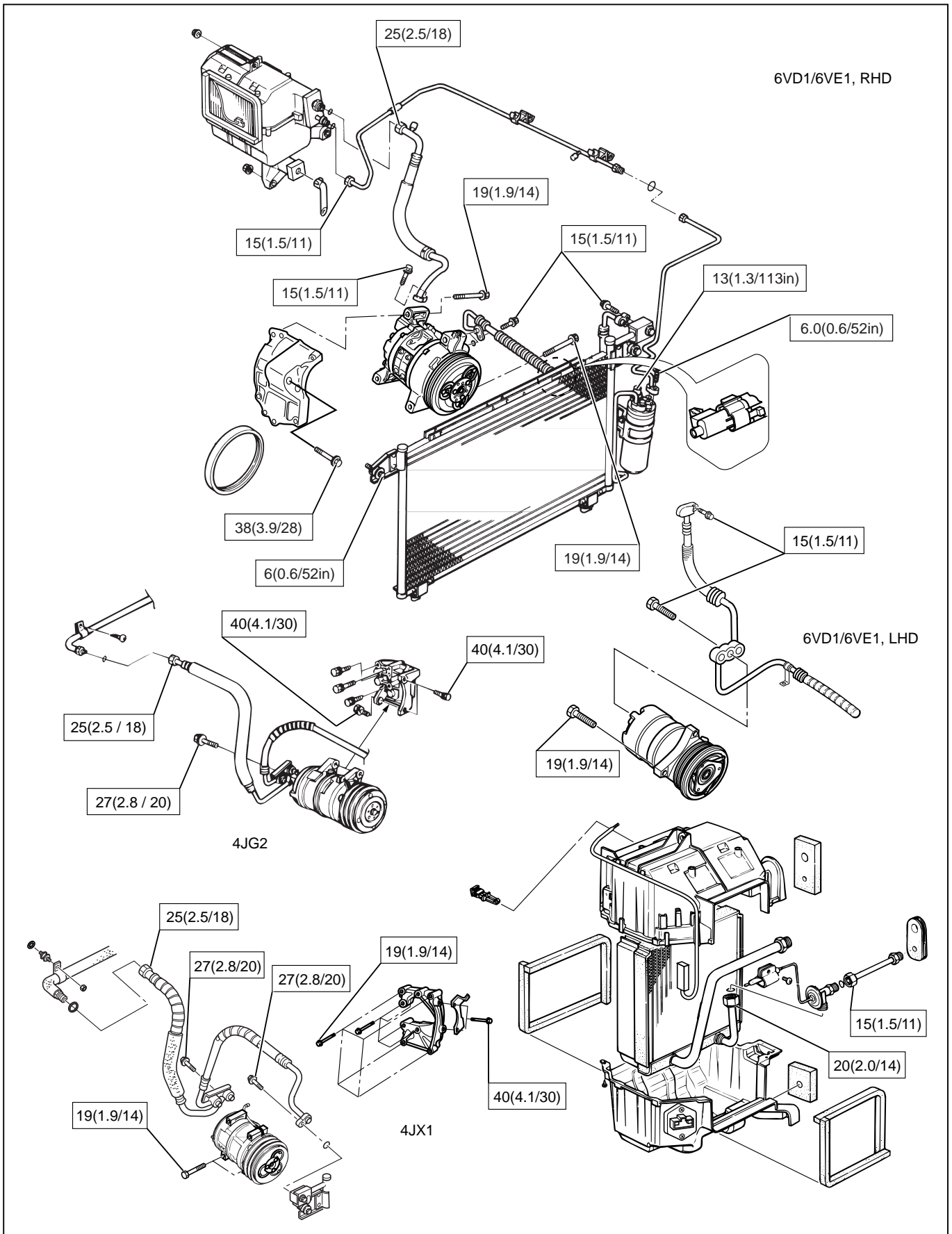
COMPRESSOR		
Model		HD6
Type		Vane rotary (Invariable)
Number of vanes		6
Rotor diameter	mm (in.)	64 (2.52)
Stroke	mm (in.)	24 (0.94)
Displacement	cc (Imp fl oz)	164 (4.59)
Maximum speed	(rpm)	9,000
Direction of rotation		Clockwise (Front-side view)
Lubrication system		Pressure differential type
Lubricant	cc (Imp fl oz)	SD2-231, 150 (4.2)
Refrigerant	g (lbs.)	R-134a, 750 (1.65)
Shaft seal		Lip type
Weight	kg (lbs.)	6.8 (14.99)
MAGNETIC CLUTCH		
Type		Electromagnetic single-plate dry clutch
Rated voltage		12 Volts D.C.
Current consumption	(A)	3.7
Starting torque	N·m (kg·m / lb-ft)	39 (4.0 / 30)
Direction of rotation		Clockwise (Front-side view)
Weight	kg (lbs.)	2.2 (4.9)

4JG2/4JX1

COMPRESSOR		
Model		DKS-15CH
Type		Swash plate type
Number of cylinder		6
Bore	mm (in.)	36 (1.4)
Stroke	mm (in.)	24 (0.94)
Displacement	cc (Imp fl oz)	147 (4.1)
Maximum speed	(rpm)	7,000 (up to 8,400)
Direction of rotation		Clockwise (Front-side view)
Lubrication system		Pressure differential type
Lubricant	cc (Imp fl oz)	ZXL-100PG, 150 (4.2)
		ISUZU PART NO.
		8-97101-338-0
Refrigerant	g (lbs.)	HFC-134a, 750 (1.65)
Shaft seal		Lip type
Weight	kg (lbs.)	4.1 (9.0)
MAGNETIC CLUTCH		
Type		Electromagnetic single-plate dry clutch
Rated voltage		12 Volts D.C.
Current consumption	(A)	3.7
Starting torque	N·m (kg·m / lb·ft)	49 (5.0 / 36)
Direction of rotation		Clockwise (Front-side view)
Weight	kg (lbs.)	2.3 (5.1)

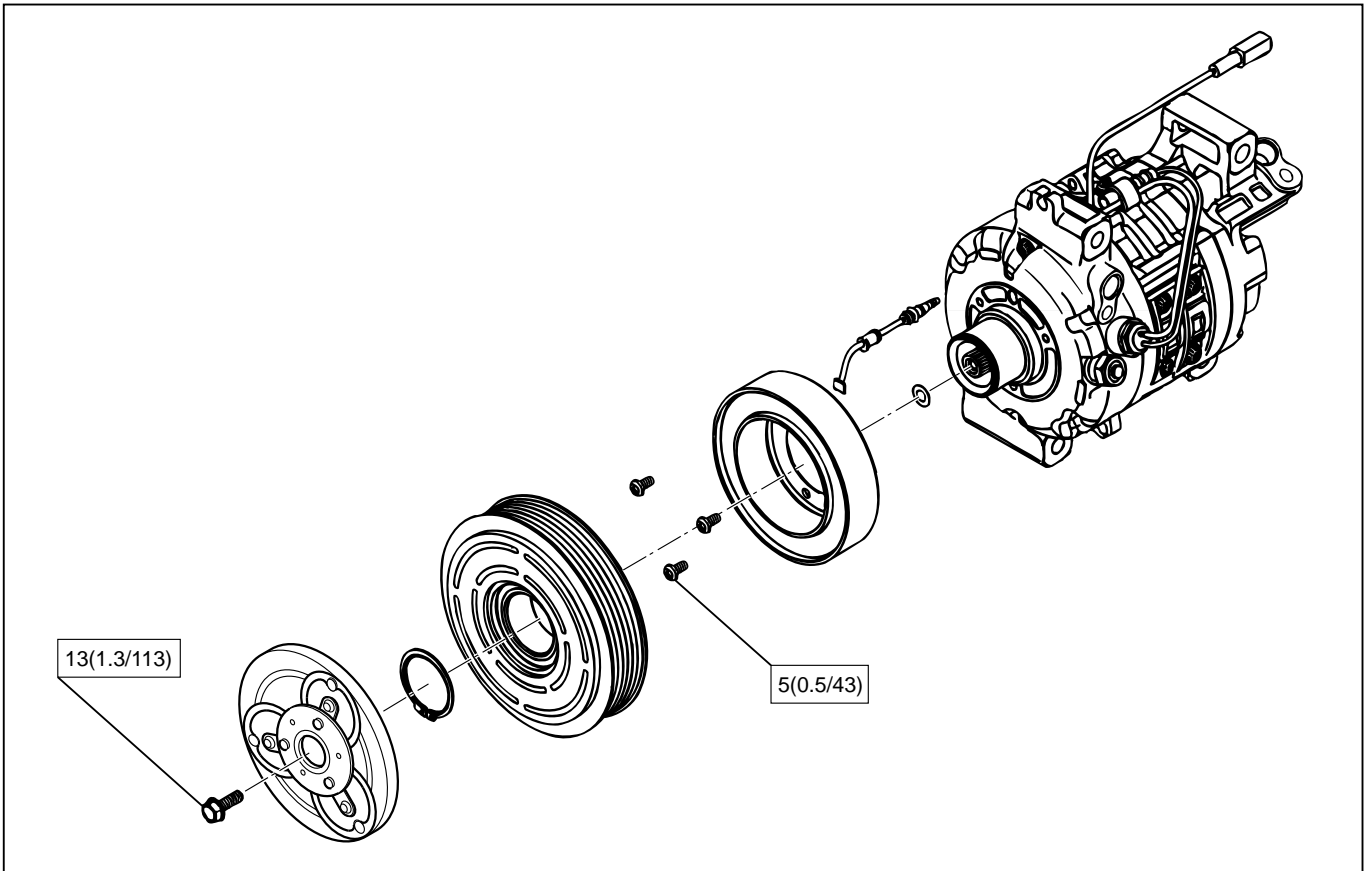
FIXING TORQUE

N·m (kg·m / lb·ft)



DKV-14D TYPE

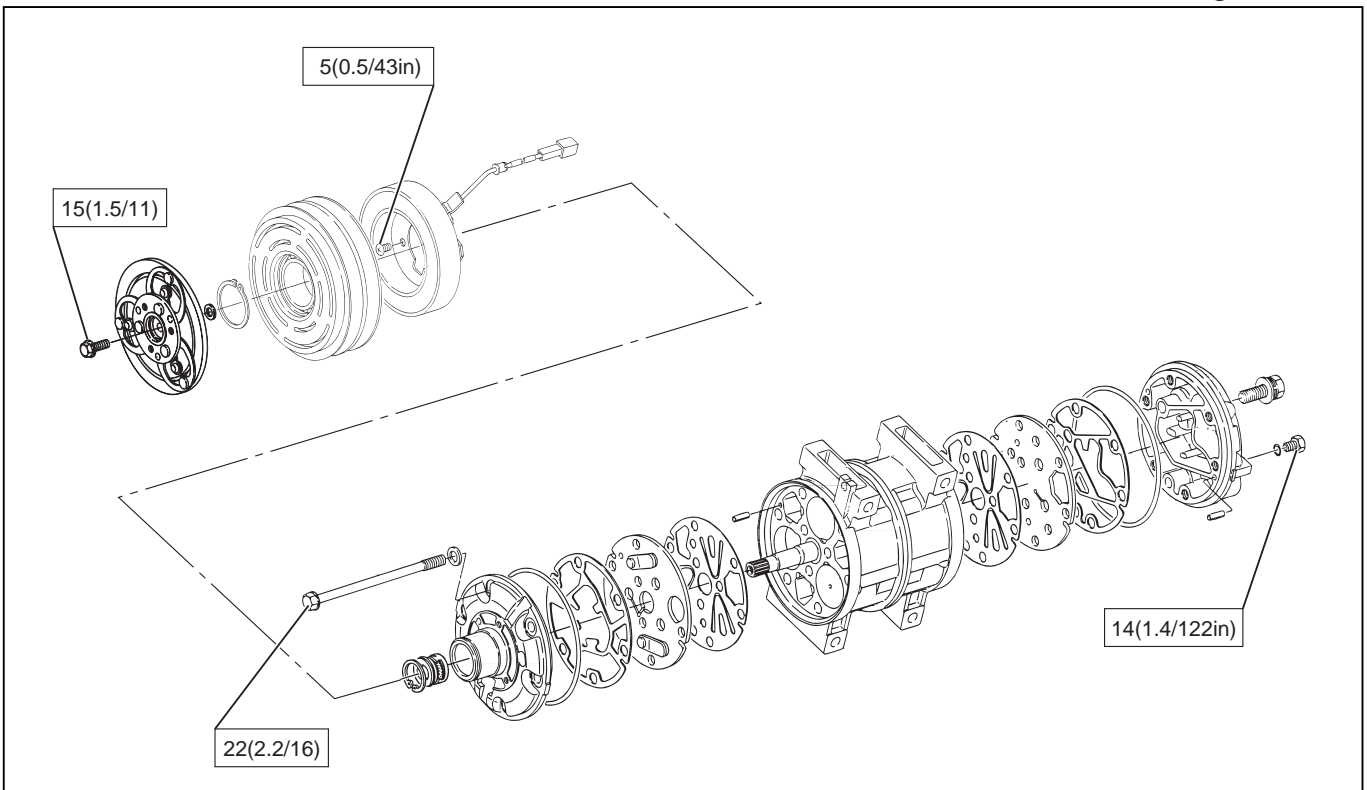
N·m (kg·m / lb·in)



871RY00027

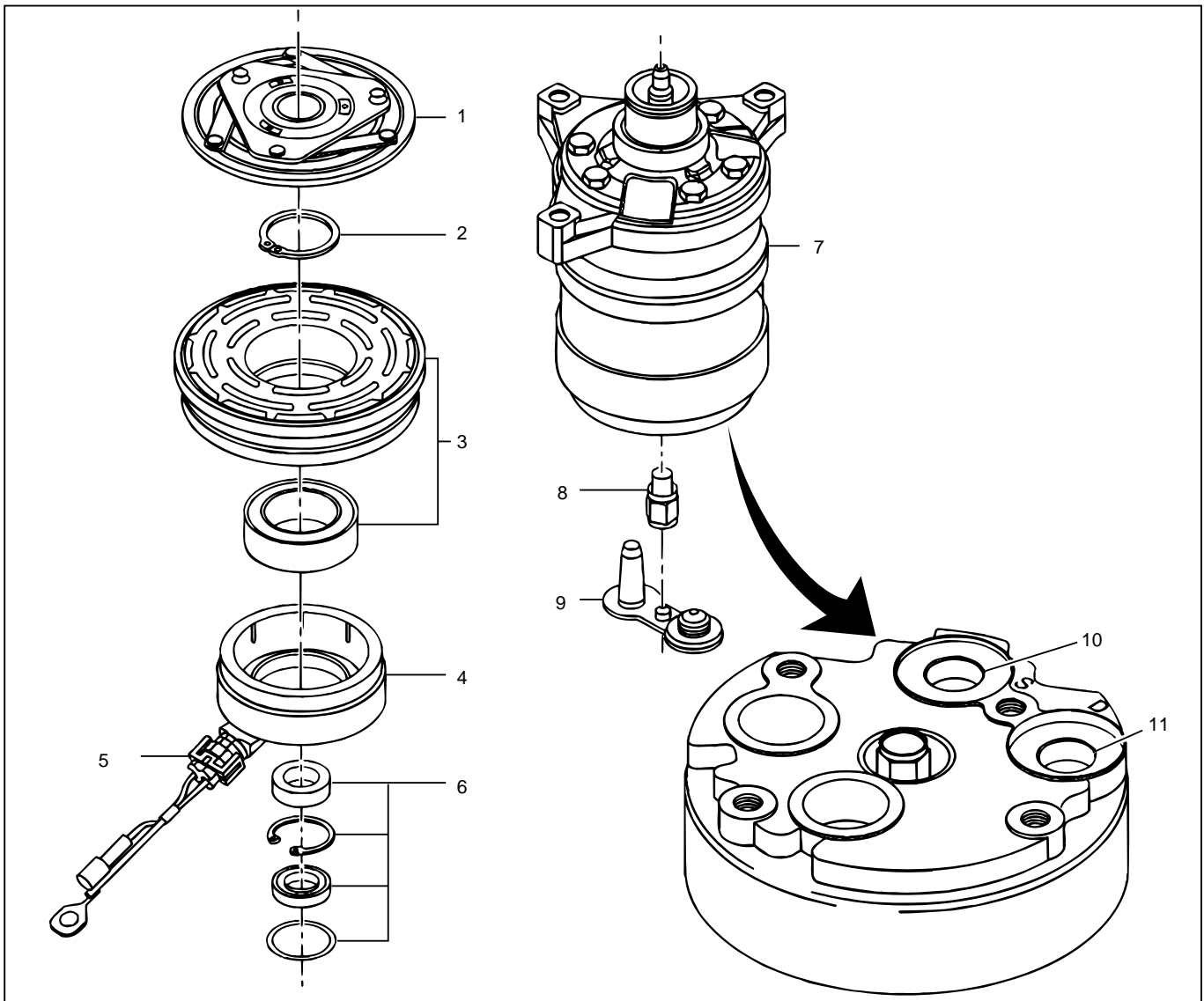
DKS-15CH TYPE

N·m (kg·m / lb·ft)



871RY00026

HEATING, VENTILATION AND AIR CONDITIONING(HVAC)



871RW002

Legend

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

Caution

The operations described below are based on bench overhaul with the compressor removed from the vehicle, except as noted. They have been prepared in order of accessibility of the components. When a compressor is removed from the vehicle for servicing, the amount of PAG lubricant remaining in the compressor should be drained, measured and recorded. This PAG lubricant should then be discarded and an equal amount of new PAG lubricant added to the compressor. The service compressor is shipped without PAG oil. When service procedures require, use only Isuzu approved PAG oil.

Metric Thread Size Information

Compressor to mounting bracket bolts(Front)

M10×1.5 - 6H

Compressor to mounting bracket bolts(Rear)

M8×1.25 - 6H

Suction-discharge port screw

M10×1.5 - 6H

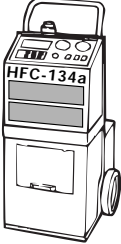
Compressor shaft

M9×1.25 - 6H

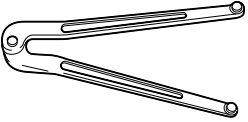
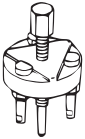

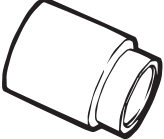
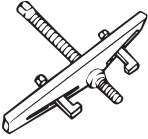



Internal hub-clutch drive assembly

M22×1.5 - 6H

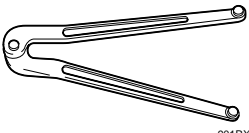
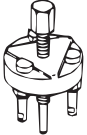


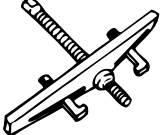
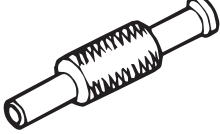
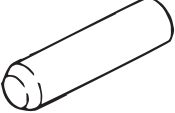


SPECIAL TOOLS

ILLUSTRATION	PARTS NO.	PARTS NAME
	5-8840-0629-0 (J-39500-A)	ACR ⁴ (115V 60Hz)
	5-8840-0630-0 (J-39500-220A)	ACR ⁴ (220-240V 50/60Hz)
	5-8840-0631-0 (J-39500-220ANZ)	ACR ⁴ (220-240V 50/60Hz Australian model)
	ACR ⁴ : HFC-134a Refrigerant Recovery / Recycling /Recharging / System	

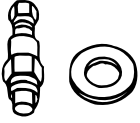
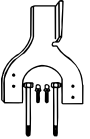

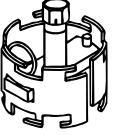

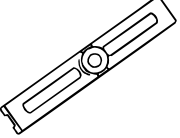

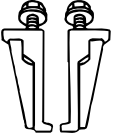
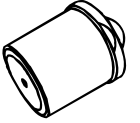


DKV-14D TYPE

ILLUSTRATION	PARTS NO.	PARTS NAME
 <small>901RX056</small>	5-8840-2007-0 (J-7624)	Drive plate holder
	5-8840-0122-0 (J-33944-A)	Drive plate puller
	5-8840-0621-0 (J-33944-4)	Forcing screw
	5-8840-0620-0 (J-38424)	Pulley puller pilot
	5-8840-0111-0 (J-8433)	Pulley puller
	5-8840-0622-0 (J-24092-2)	Pulley puller leg
	5-8840-0118-0 (J-33940)	Pulley installer
	5-8840-0007-0 (J-8092)	Drive handle

DKS-15CH TYPE

ILLUSTRATION	PARTS NO.	PARTS NAME
 <p style="text-align: right; font-size: small;">901RX056</p>	5-8840-2007-0 (J-7624)	Drive plate holder
	5-8840-0122-0 (J-33944-A)	Drive plate puller
	5-8840-0621-0 (J-33944-4)	Forcing screw
	5-8840-0121-0 (J-33943)	Pulley puller pilot
	5-8840-0111-0 (J-8433)	Pulley puller
	5-8840-120-0 (J-33942)	Shaft seal remover and installer
	5-8840-0368-0 (J-34614)	Shaft seal guide
	5-8840-0118-0 (J-33940)	Pulley installer
	5-8840-0007-0 (J-8092)	Drive handle

DELPHI Harrison HD6/HDT6 Special Tools

ILLUSTRATION	TOOL NO.	TOOL NAME
 <p>901RW012</p>	5-8840-2610-0 (J-33013-B)	Hub and Clutch Drive Plate Asm. remover
 <p>901RW013</p>	5-8840-2615-0 (J-33026)	Compressor Holding Fixture
 <p>901RW015</p>	5-8840-2612-0 (J-33023-A)	Puller Pilot
 <p>901RW016</p>	5-8840-2617-0 (J-41552)	Pulley Puller
 <p>901RW017</p>	5-8840-2611-0 (J-33017)	Pulley and Bearing Assembly Installer
 <p>901RW018</p>	5-8840-0111-0 (J-8433-1)	Puller Bar
 <p>901RW019</p>	5-8840-0111-0 (J-8433-3)	Forcing Screw
 <p>901RW020</p>	5-8840-2614-0 (J-33025)	Clutch Coil Installer Adapter
 <p>901RW021</p>	5-8840-2613-0 (J-33024)	Clutch Coil Installer Adapter
 <p>901RW024</p>	5-8840-2629-0 (J-23128-A)	Seal Seat Remover and Installer
 <p>901RW025</p>	5-8840-2630-0 (J-9553-01)	O-Ring Remover

00 - 56 SERVICE INFORMATION

ILLUSTRATION	TOOL NO.	TOOL NAME
 <small>901RW026</small>	5-8840-2609-0 (J-33011)	O-Ring Installer
 <small>901RW027</small>	5-8840-0368-0 (J-34614)	Shaft Seal Protector
 <small>901RW032</small>	5-8840-2616-0 (J-39893)	Pressure Testing Connector

SECTION 1A

HEATING AND VENTILATION



CAUTION

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used.

Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque values must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

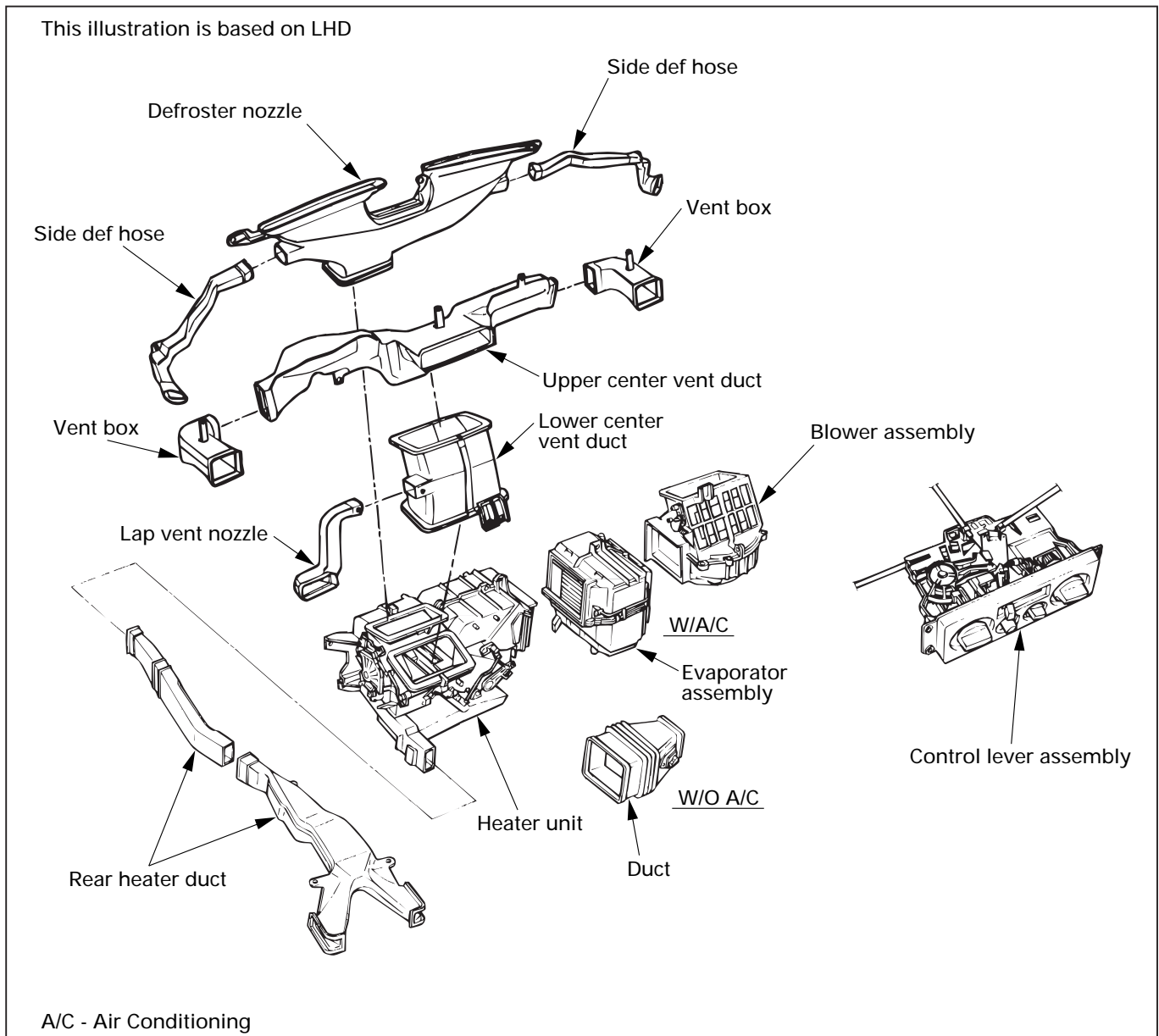
HEATER

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

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

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

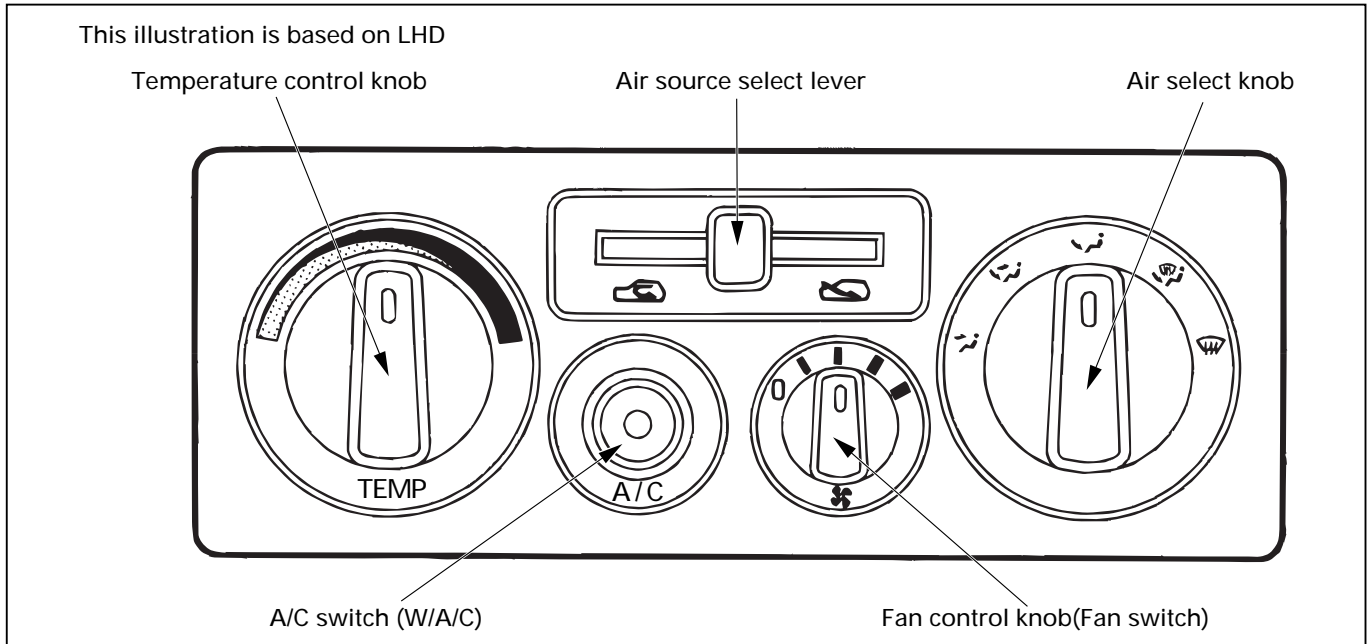
The air select knob, with its different modes, also allows you to select and maintain the most comfortable passenger compartment temperature. The air source select lever is used to select either "FRESH" for the introduction of the outside air, or "CIRC" for the circulation of the inside air. When the lever is set to "FRESH", the outside air is always taken into the passenger compartment. When setting the lever to "CIRC" position, the circulation of air is restricted only to the inside air with no introduction of the outside air and the air in the passenger compartment gets warm quickened. However, the lever is normally set to "FRESH" to prevent the windshield from clouding.



CONTROL LEVER ASSEMBLY

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

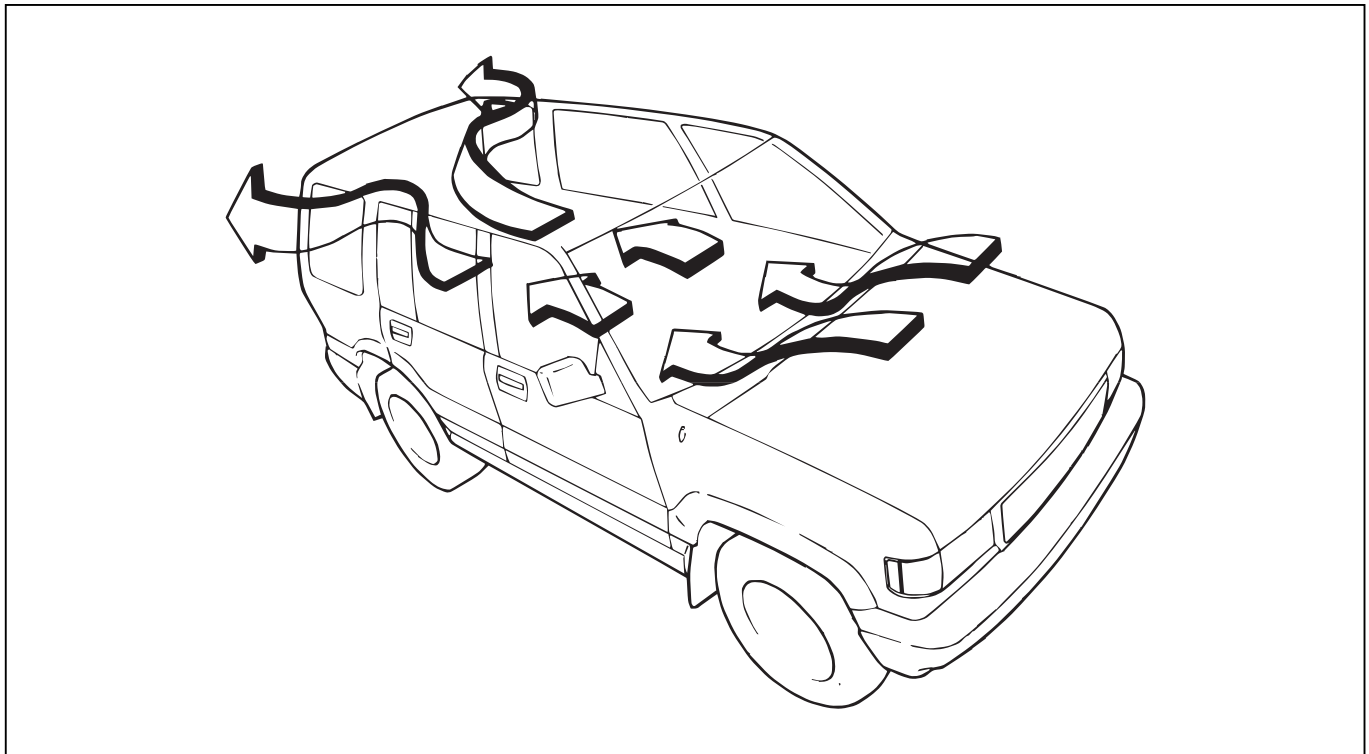
The fan control is used to control the amount of air sent out by the resistor at four levels from "LOW" to "HIGH".



VENTILATION

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

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



1A - 4 HEATING AND VENTILATION

AIR SELECT KNOB

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

1. **Vent** - In this position, air is discharged from the upper air outlet. Air quantity is controlled by the fan control knob.
2. **Bi-Level** - In this position, air flow is divided between the upper air outlets and the foot air outlets, with warmer air delivered to the floor outlets than the air delivered to the upper air outlets.
3. **Foot** - In this position, air flow is delivered to the foot while sending approx. 30% of total amount of air to the windshield
4. **Def/Foot** - In this position, air flow is delivered to the foot, while sending approx. 40% of total amount of air to the windshield.
5. **Defrost** - In this position, most of the air is delivered to the windshield and a small amount is delivered to the side windows.

Moving the air source select lever to the "CIRC" position provides quickest heat delivery by closing the blower assembly mode door. In this position, outside air is not delivered to the passenger compartment.

AIR SOURCE SELECT LEVER

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

FAN CONTROL KNOB

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

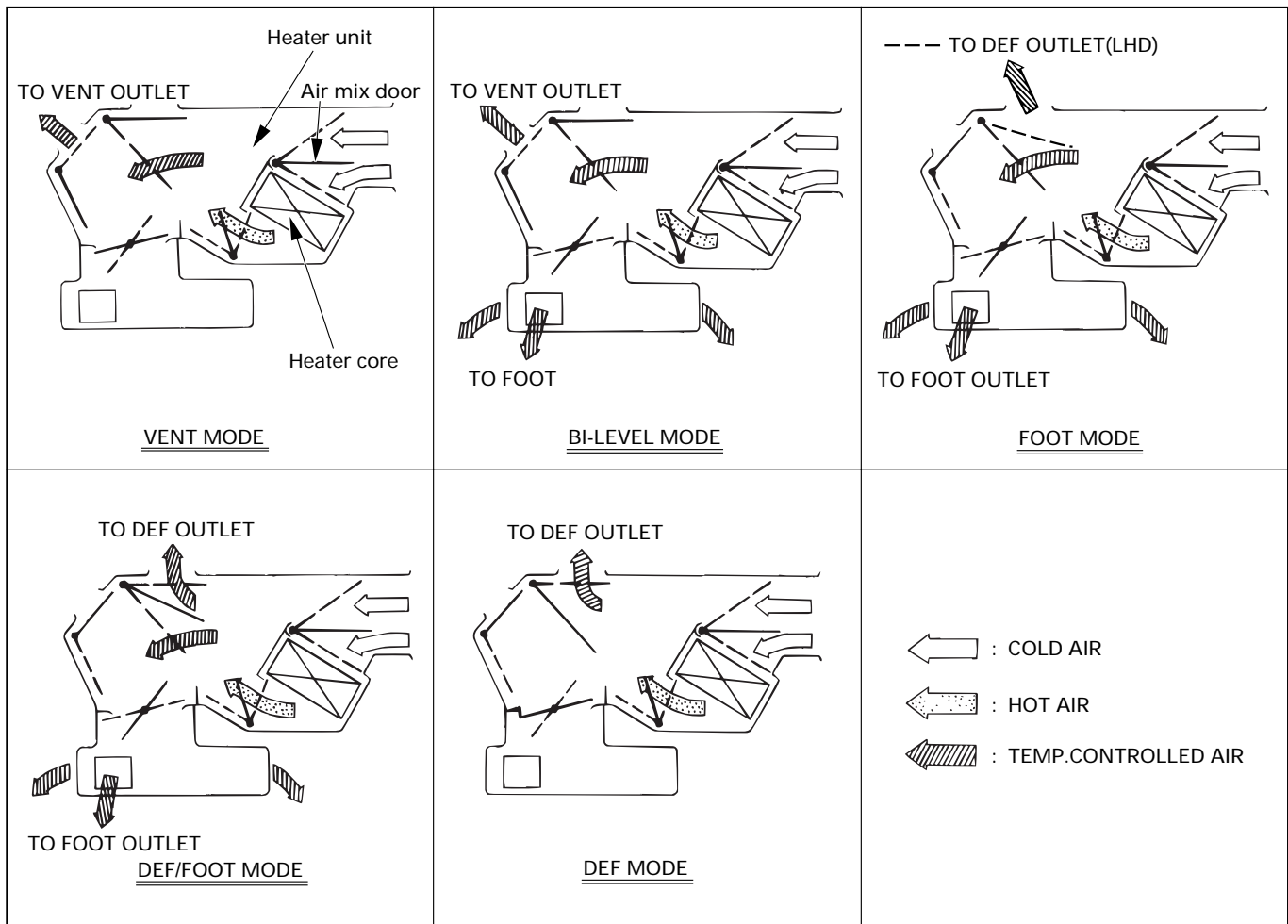
1. Low
2. Medium Low
3. Medium High
4. High

TEMPERATURE CONTROL KNOB

When the temperature control knob is in the "COLD" position, the air mix door closes to block the flow of air to the heater core.

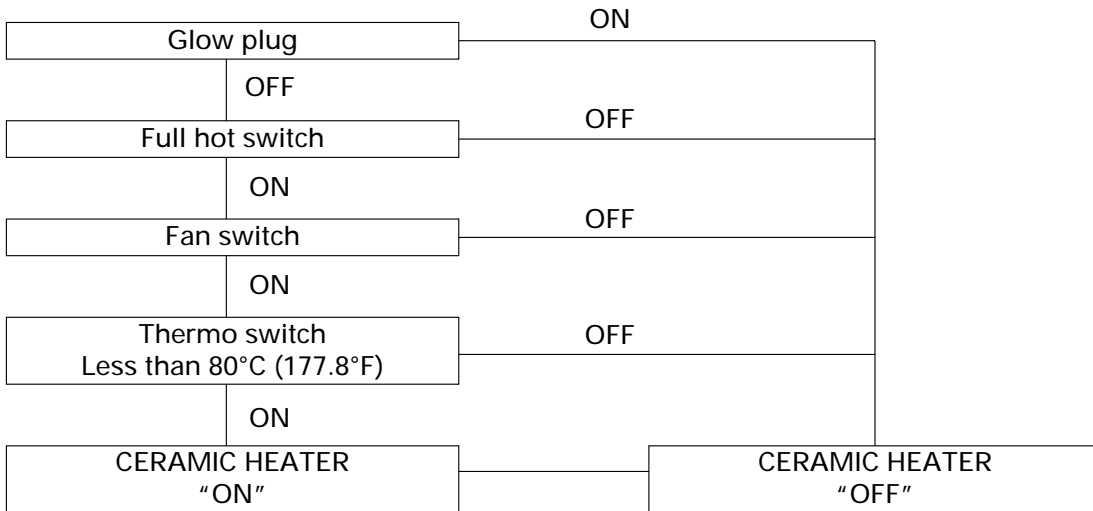
When the temperature control knob is in the "HOT" position, the air mix door opens to allow air to pass through the heater core and heat the passenger compartment.

Placing the knob in an intermediate position will cause a lesser or greater amount of air to reach the heater core. In this mode the passenger compartment temperature can be regulated.

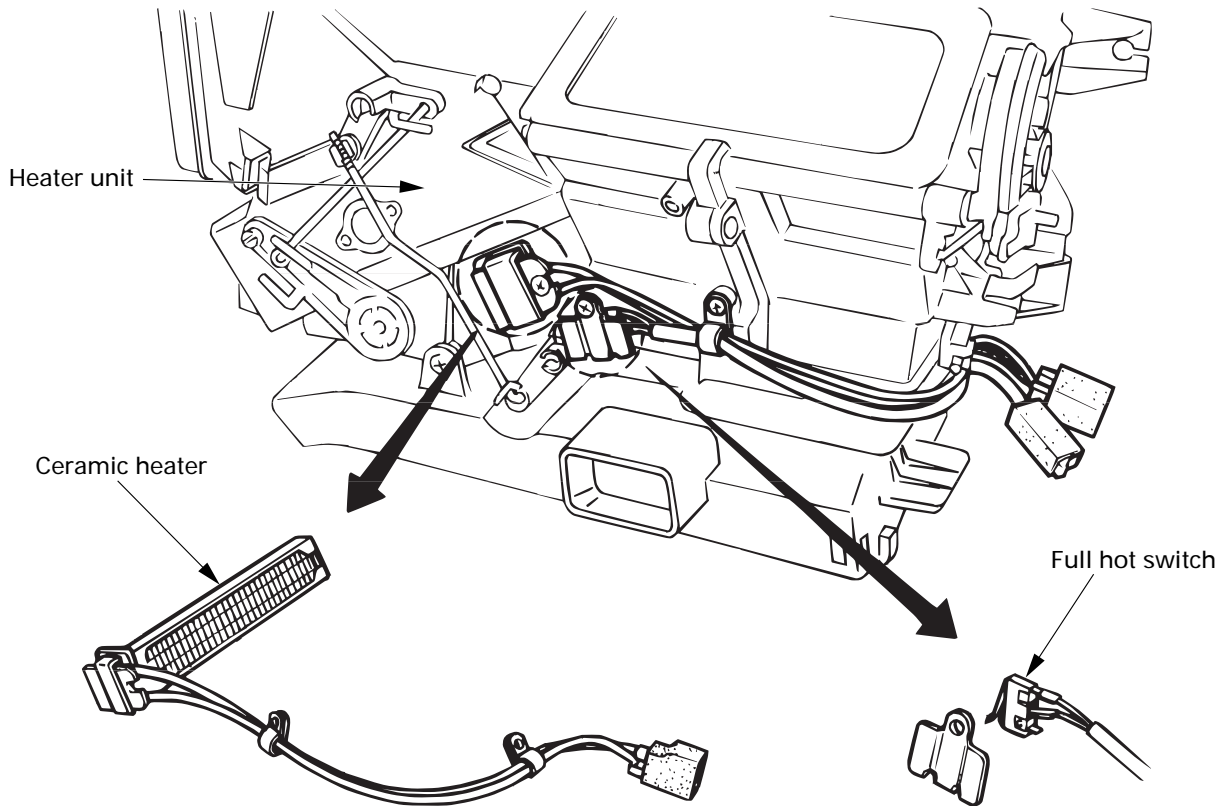


CERAMIC HEATER

When the fan control knob (fan switch) turns on with the temperature control knob set to "FULL HOT" (full hot switch "ON"), the ceramic heater in the heater unit gets hot, thus causing the heater blow temperature of diesel vehicle to get high to improve the heating performance (Since the engine coolant temperature of diesel vehicle is low, its blow temperature is also low.)

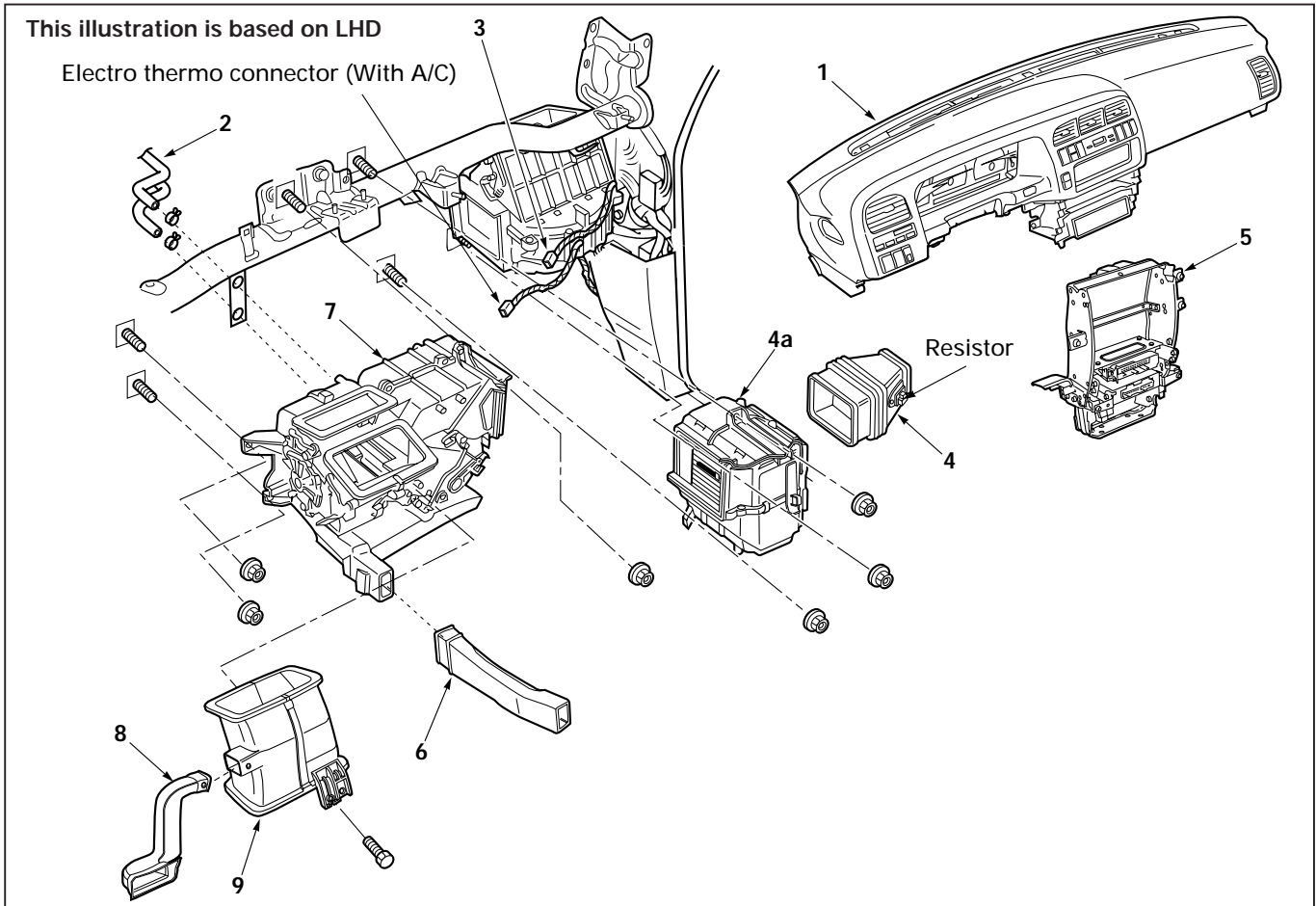


This illustration is based on RHD



ON-VEHICLE SERVICE

HEATER UNIT



Removal Steps

1. Instrument panel assembly
2. Water hose
3. Resistor connector
4. Duct
- 4a. Evaporator assembly (A/C only)
5. Instrument panel center bracket
6. Rear heater duct
7. Heater unit
8. Lap vent nozzle
9. Center ventilation lower duct

Installation Steps

To install, follow the removal steps in the reverse order



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Drain engine coolant
- Discharge and recover refrigerant (W/A/C)
(Refer to Section 1B "REFRIGERANT RECOVERY")

1. Instrument Panel Assembly

Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.

2. Water Hose

Disconnect water hoses at heater unit.

3. Resistor Connector

4. Duct

4a. Evaporator Assembly

Refer to Section 1B "AIR CONDITIONING" for Evaporator Assembly removal procedure.

5. Instrument panel center bracket

6. Rear Heater Duct

7. Heater Unit

8. Lap vent nozzle

9. Center ventilation lower duct



INSTALLATION

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

1. When handling the ECM and the control unit, be careful not to make any improper connection of the connectors.

2. Adjust control lever assembly cables.

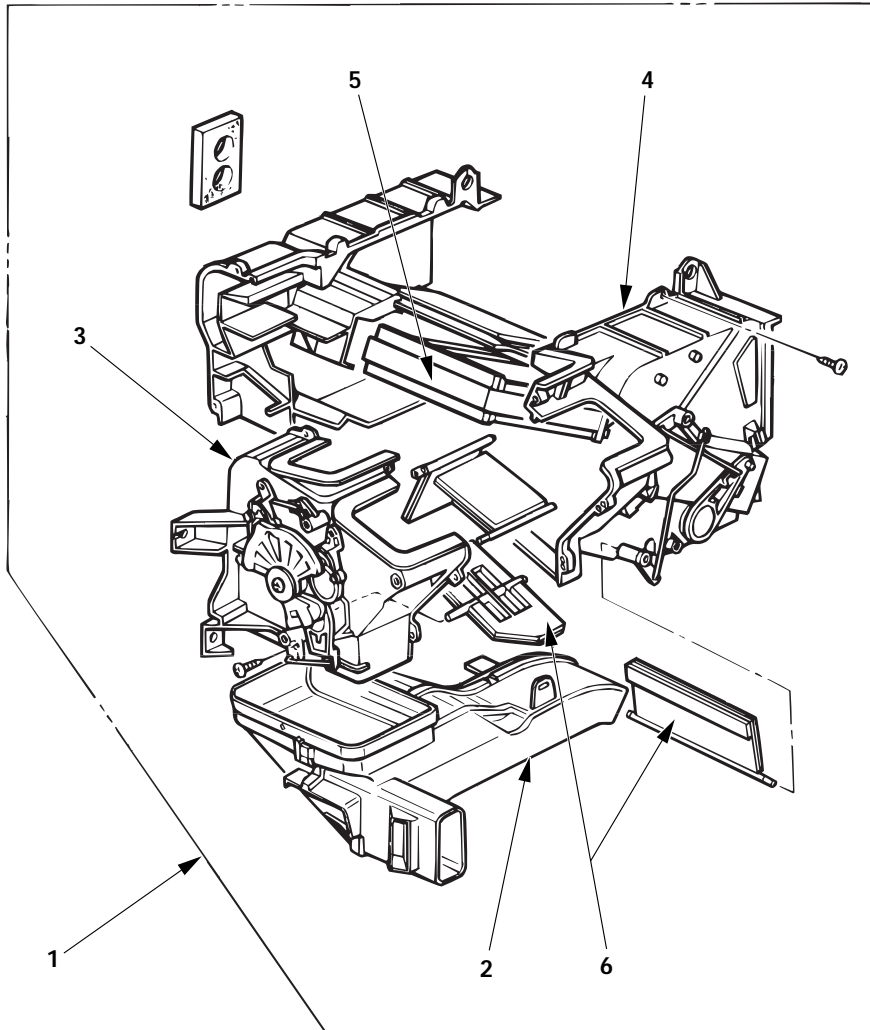


Refer to "CONTROL LEVER ASSEMBLY" installation steps in this section.

3. When installing the heater unit, defroster nozzle and center vent duct, be sure that proper seal is made, without any gap between them.

HEATER CORE AND/OR MODE DOOR

This illustration is based on LHD



Removal Steps

1. Heater unit
2. Duct
3. Case (Mode control)
4. Case (Temperature control)
5. Heater core
6. Mode door

Installation Steps

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

REMOVAL

Preparation:

- Disconnect the battery ground cable
- Drain engine coolant

1. Heater Unit

Refer to "HEATER UNIT" removal procedure in this section.

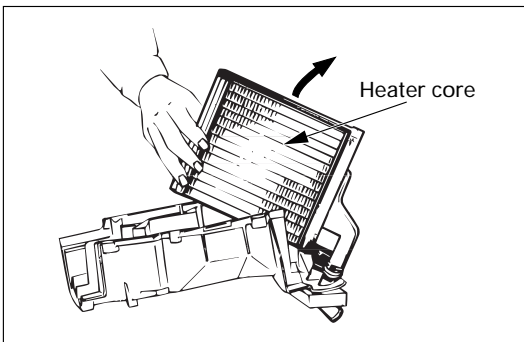
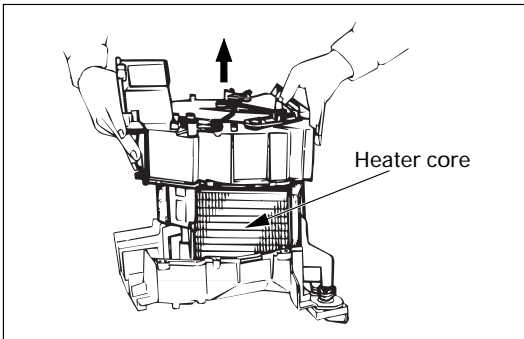
2. Duct

3. Case (Mode Control)

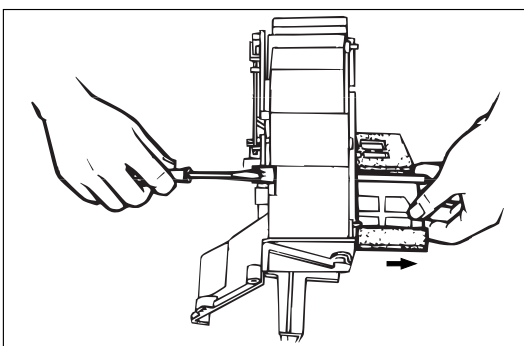
Do not remove link unit at this step.

4. Case (Temperature Control)

Separate two halves of core case.



5. Heater Core



6. Mode Door

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

INSTALLATION

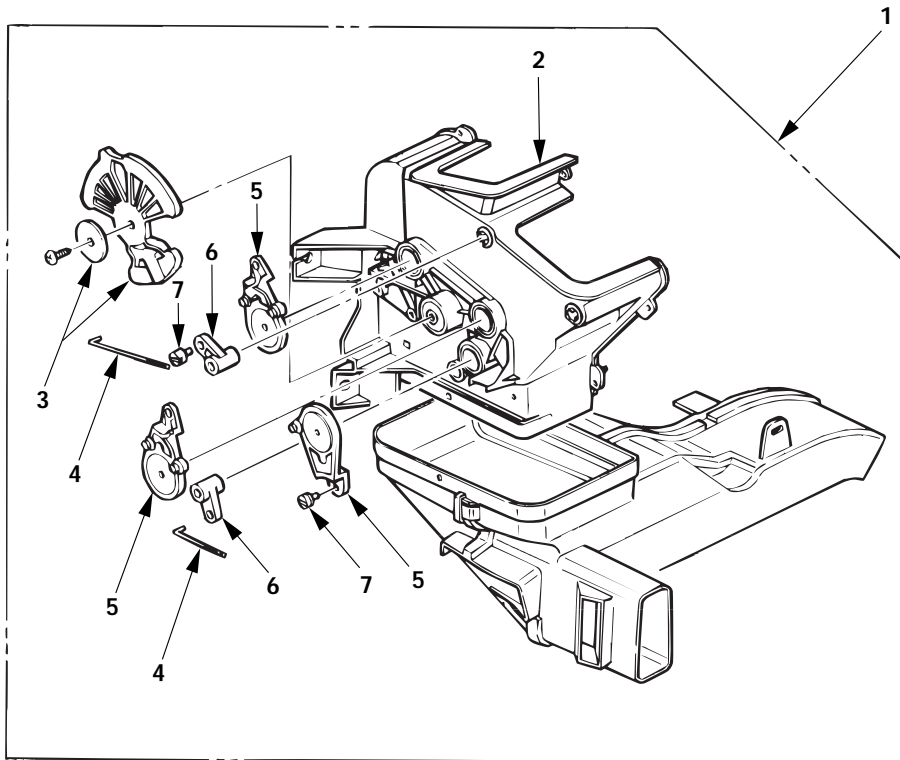
To install, follow the removal steps in the reverse order, noting the following point:

1. Check that each mode door operates properly.

1A - 10 HEATING AND VENTILATION

HEATER MODE CONTROL LINK UNIT

This illustration is based on LHD



Removal Steps

1. Heater unit
2. Case (Mode control)
3. Washer and mode main lever
4. Rod
5. Mode sub-lever
6. Door lever
7. Clip

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Drain engine coolant

1. Heater Unit

Refer to "HEATER UNIT" removal procedure in this section.

2. Case (Mode Control)

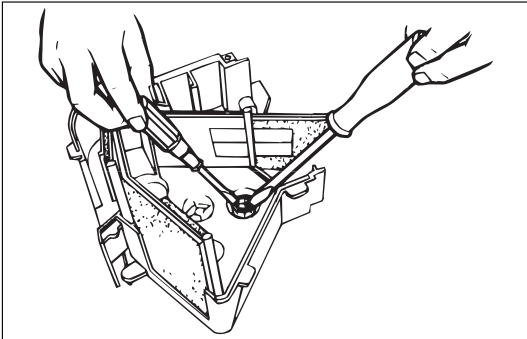
Remove the case (Mode control) from heater unit.

3. Washer and Mode Main Lever

4. Rod

5. Mode Sub-Lever

Press the tab of the sub-lever inward, and take out the sub-lever.



6. Door Lever

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



INSTALLATION

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



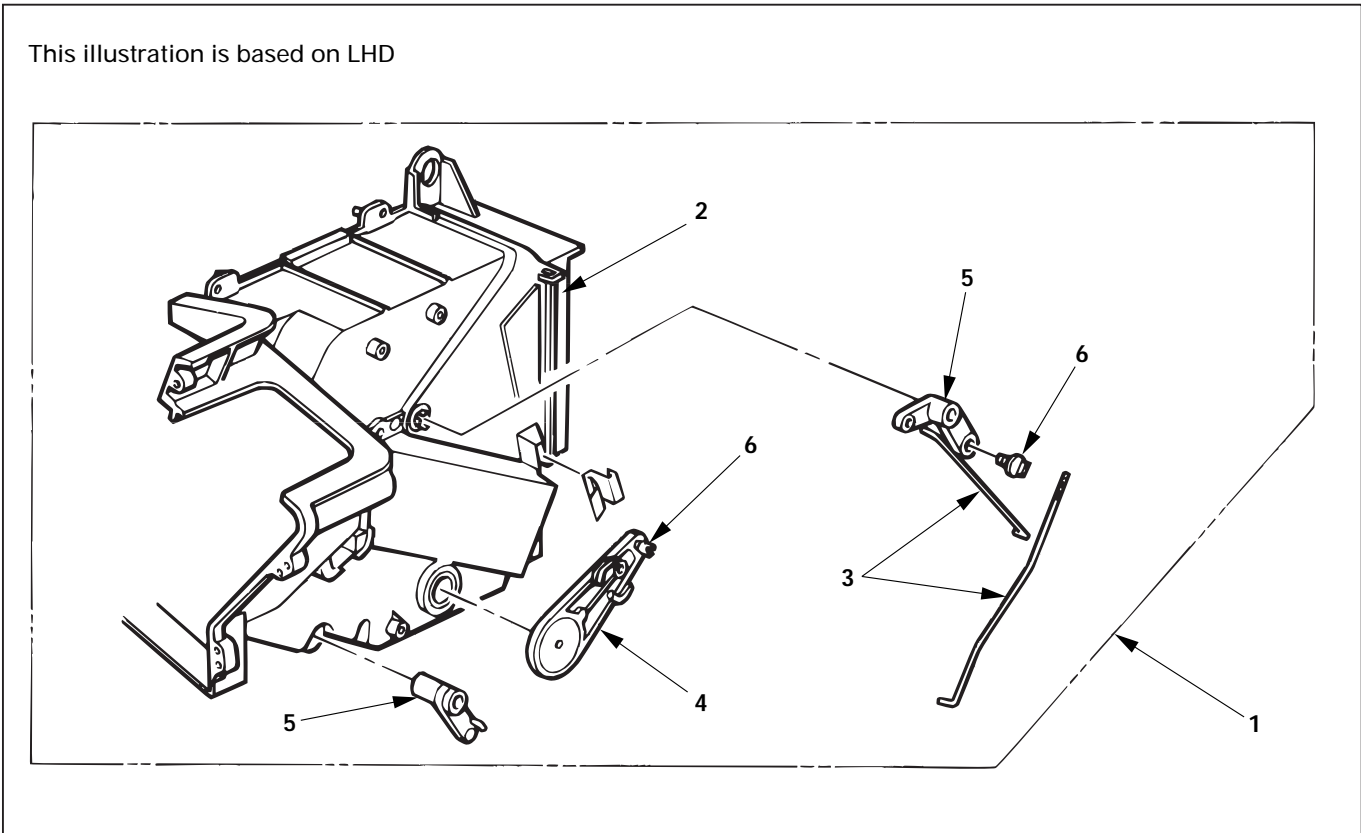
1. Apply grease to mode sub-lever and to the abrasive surface of the heater unit.



2. After installing the link unit, check to see if the link unit operates correctly.

HEATER TEMPERATURE CONTROL LINK UNIT

This illustration is based on LHD



Removal Steps

1. Heater unit
2. Case (Temperature control)
3. Rod
4. Sub-lever
5. Door lever
6. Clip

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Drain engine coolant

1. Heater Unit

Refer to "HEATER UNIT" removal procedure in this section.

2. Case (Temperature Control)

Remove the case (Temperature control) from the heater unit.

3. Rod

4. Sub-Lever

5. Door Lever

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

6. Clip



INSTALLATION

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

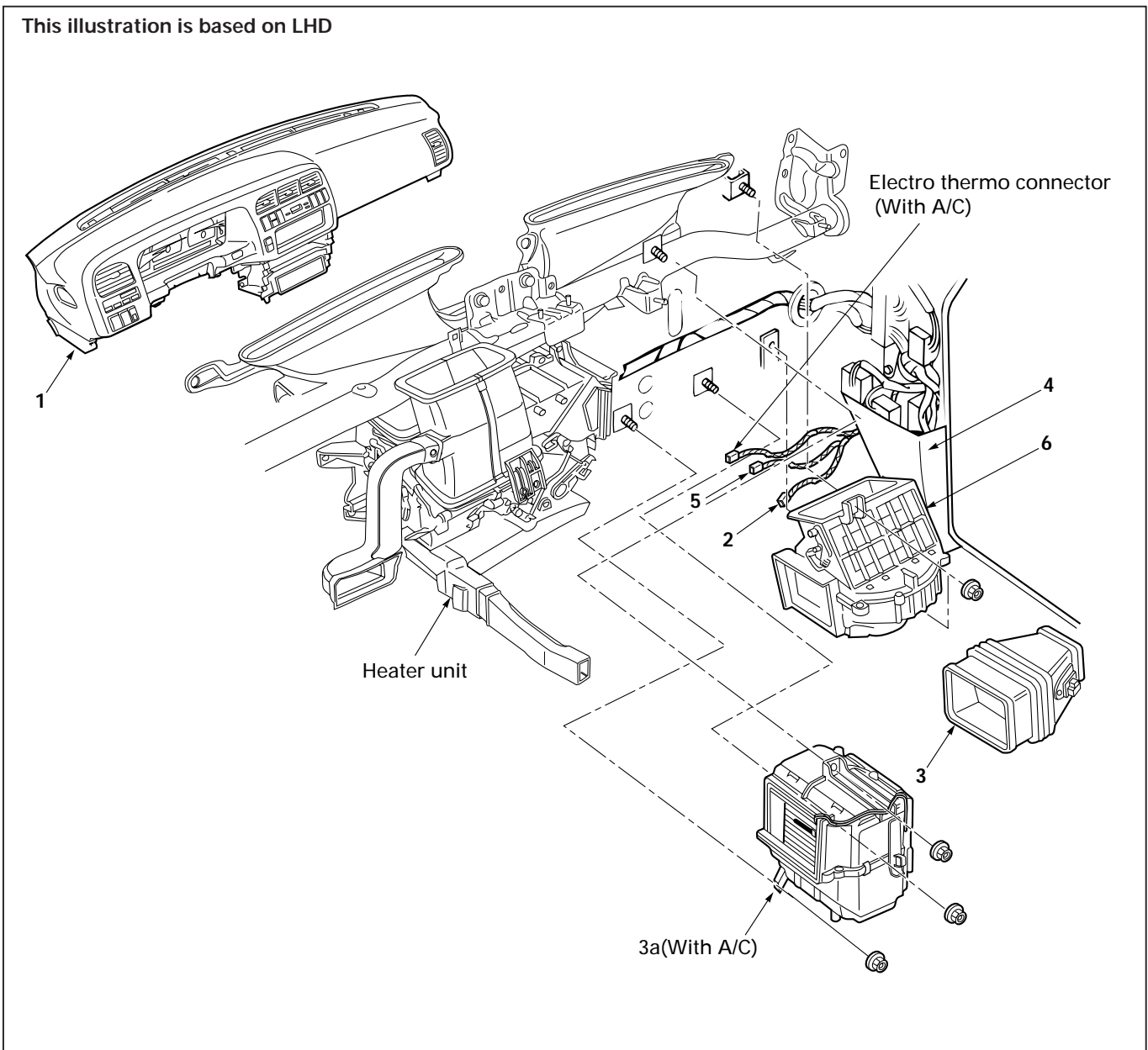


1. Apply grease to sub-lever and to the abrasive surface of the heater unit.



2. After installing the link unit, check to see if the link unit operates correctly.

BLOWER ASSEMBLY



Removal Steps

1. Instrument panel assembly
2. Resistor connector
3. Duct
- 3a. Evaporator assembly (A/C only)
4. Kick panel
5. Blower motor connector
6. Blower assembly

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (W/A/C)
(Refer to Section 1B "REFRIGERANT RECOVERY")

1. Instrument Panel Assembly

Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.

2. Resistor Connector

3. Duct

3a. Evaporator Assembly (A/C only)

Refer to Section 1B "AIR CONDITIONING" for EVAPORATOR ASSEMBLY removal procedure.

4. Kick panel

5. Blower Motor Connector

6. Blower Assembly



INSTALLATION

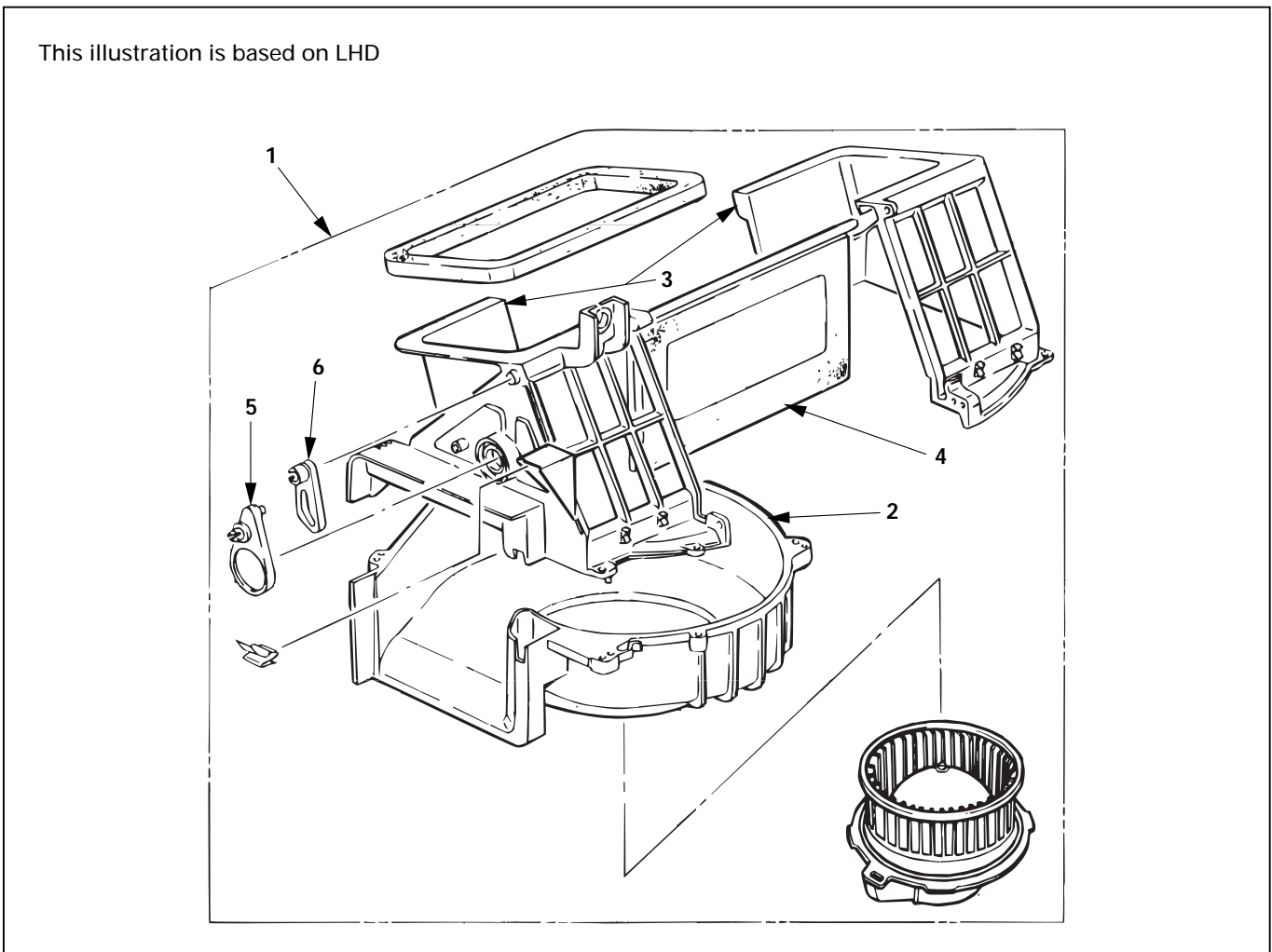
To install, follow the removal steps in the reverse order, noting the following point:



1. Adjust Control Lever Assembly Cables

Refer to "CONTROL LEVER ASSEMBLY" installation procedure in this section.

BLOWER LINK UNIT AND/OR MODE DOOR



Removal Steps

1. Blower assembly
2. Lower case
3. Upper case
4. Mode door
5. Sub-lever
6. Door lever

Installation Steps

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



REMOVAL

Preparation:

Disconnect the battery ground cable

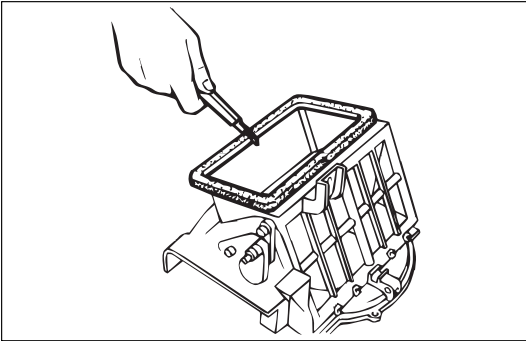
1. Blower Assembly

Refer to "BLOWER ASSEMBLY" removal procedure in this section.

2. Lower Case

3. Upper Case

Separate upper case and slit the lining parting face with a knife.



INSTALLATION

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



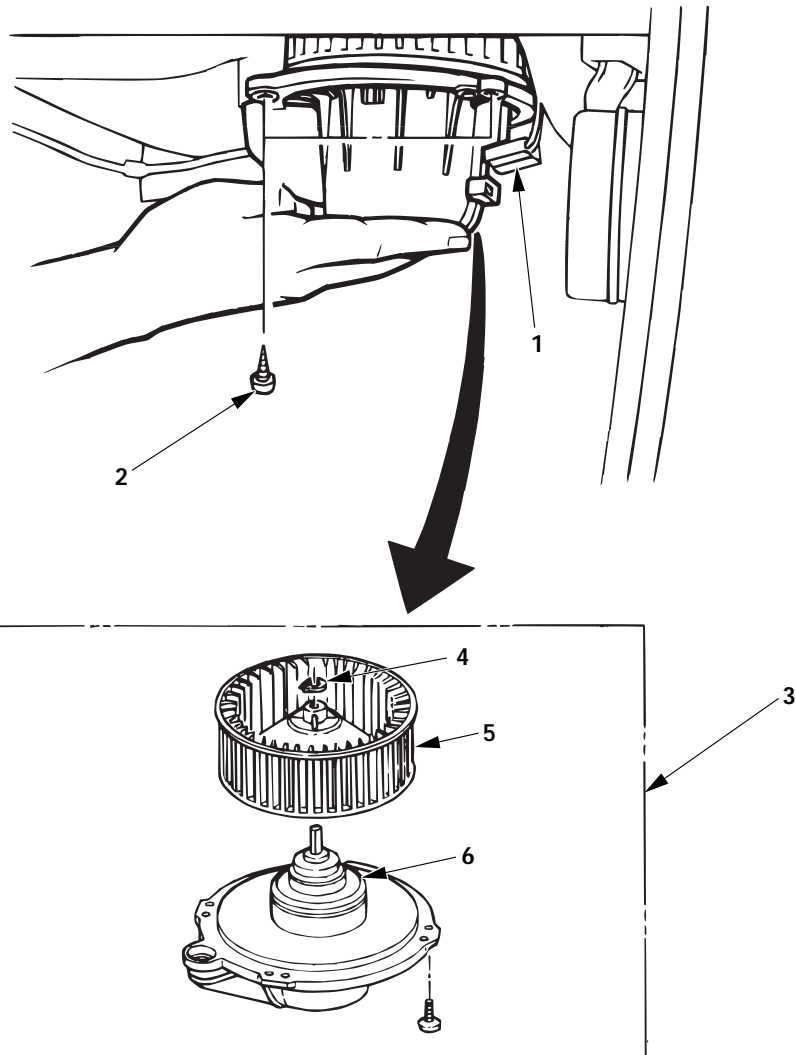
1. Apply grease to the door lever and to the abrasive surface of the upper case.



2. Apply an adhesive to parting face of lining when assembling upper case.

BLOWER MOTOR

This illustration is based on LHD



Removal Steps

1. Blower motor connector
2. Attaching screw
3. Blower motor assembly
4. Clip
5. Fan
6. Blower motor

Installation Steps

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

 **REMOVAL**

Preparation:

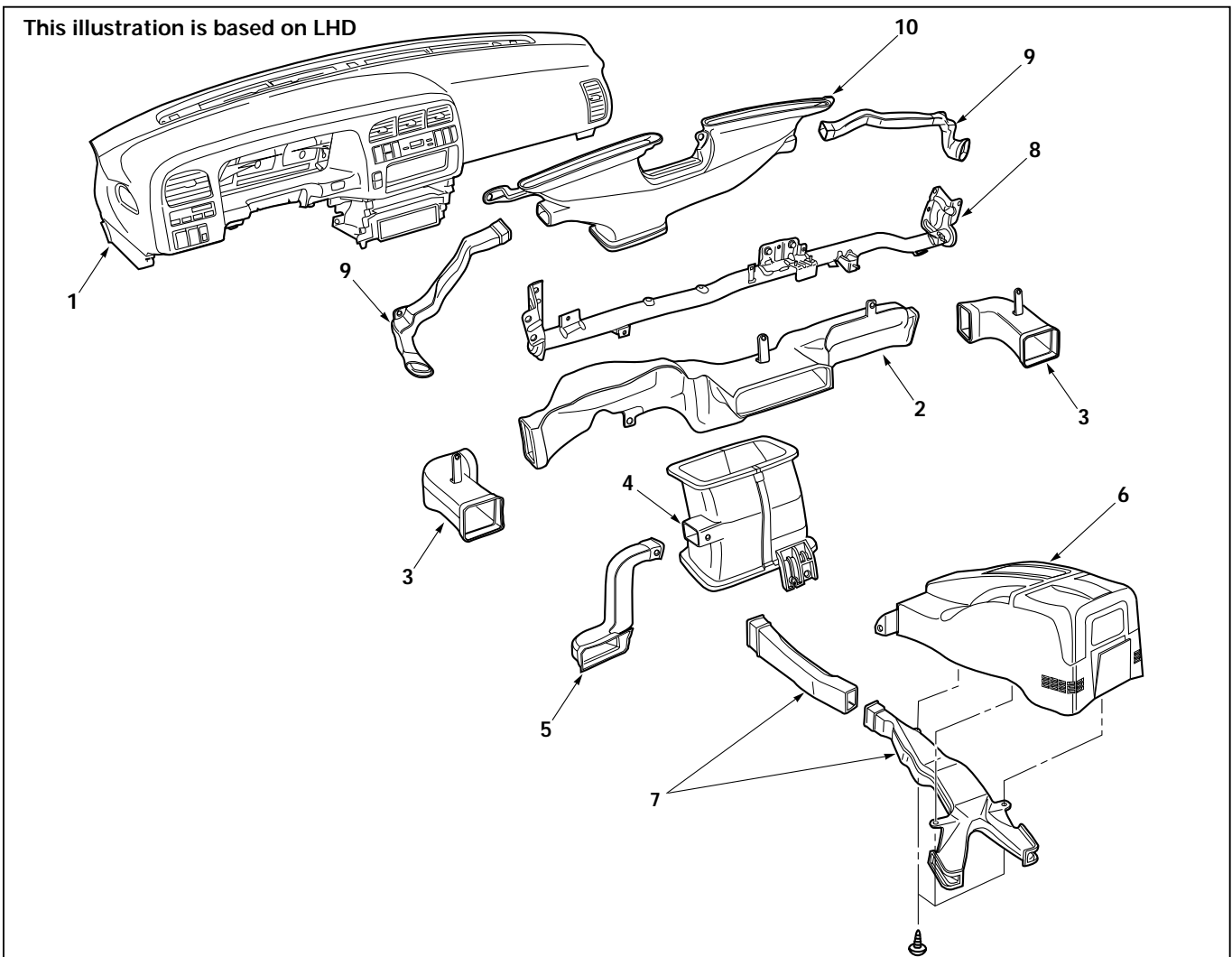
Disconnect the battery ground cable

1. **Blower Motor Connector**
2. **Attaching Screw**
3. **Blower Motor Assembly**
4. **Clip**
5. **Fan**
6. **Blower Motor**

 **INSTALLATION**

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

REAR HEATER DUCT, DEFROSTER NOZZLE AND VENTILATION DUCT



Removal Steps

1. Instrument panel assembly
2. Center ventilation upper duct
3. Side ventilation duct
4. Center ventilation lower duct
5. Driver lap duct
6. Center console
7. Rear heater duct
8. Cross beam assembly
9. Side defroster nozzle
10. Center defroster nozzle

Installation Steps

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



REMOVAL

Preparation:

Disconnect the battery ground cable

1. **Instrument panel assembly**
 - Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.
2. **Center ventilation upper duct**
3. **Side ventilation duct**
4. **Center ventilation lower duct**
5. **Driver lap duct**
6. **Center console**
7. **Rear heater duct**
 - Refer to Section 10 "BODY" for CONSOLES removal procedure.
8. **Cross beam assembly**
 - Refer to Section 10 "BODY" for CROSS BEAM ASSEMBLY removal procedure.
9. **Side defroster nozzle**
10. **Center defroster nozzle**

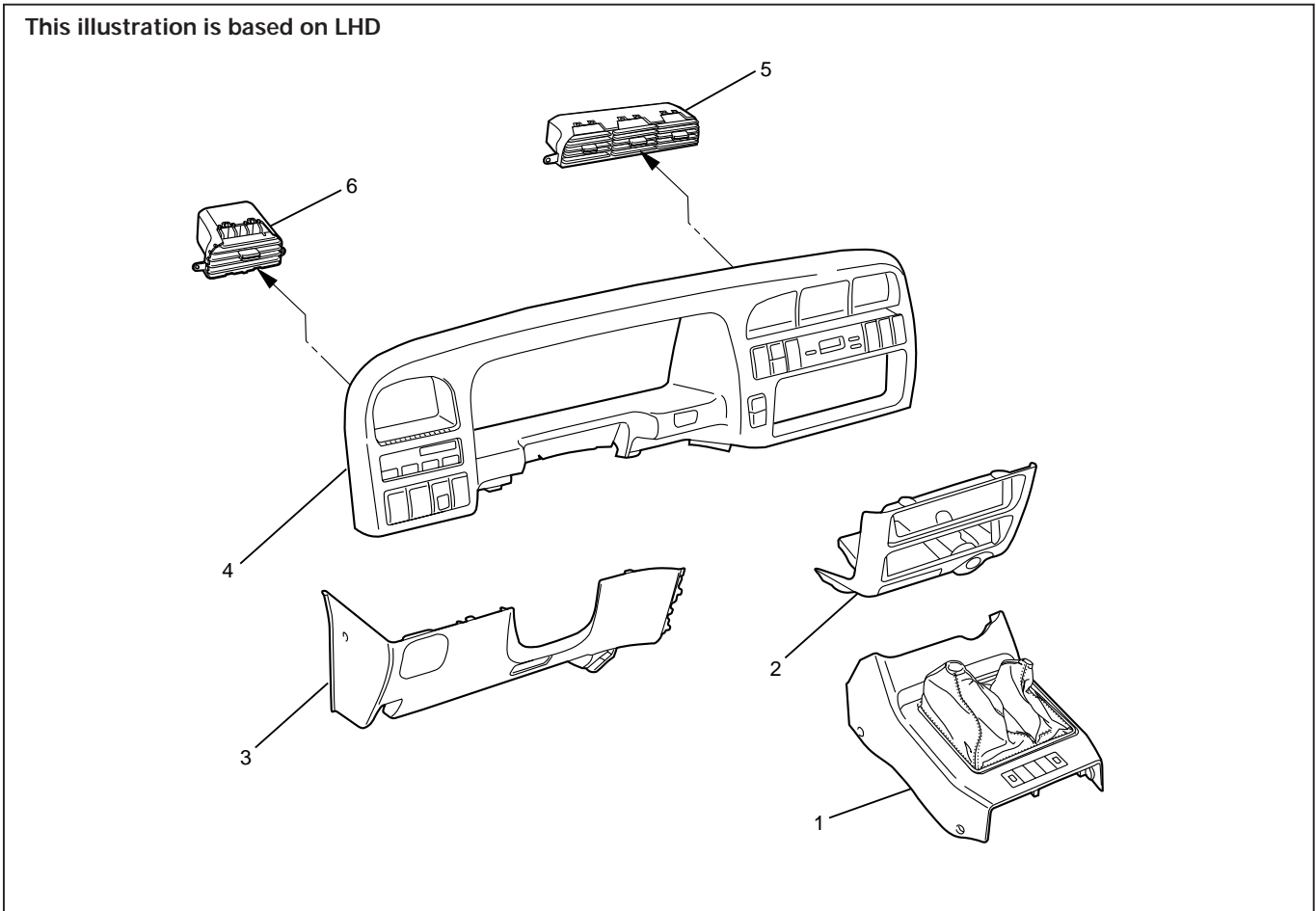


INSTALLATION

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

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

CENTER AND/OR SIDE VENT



740RW168

Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Instrument panel driver lower cover assembly
4. Meter cluster assembly
5. Center vent
6. Side vent

Installation Steps

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



REMOVAL

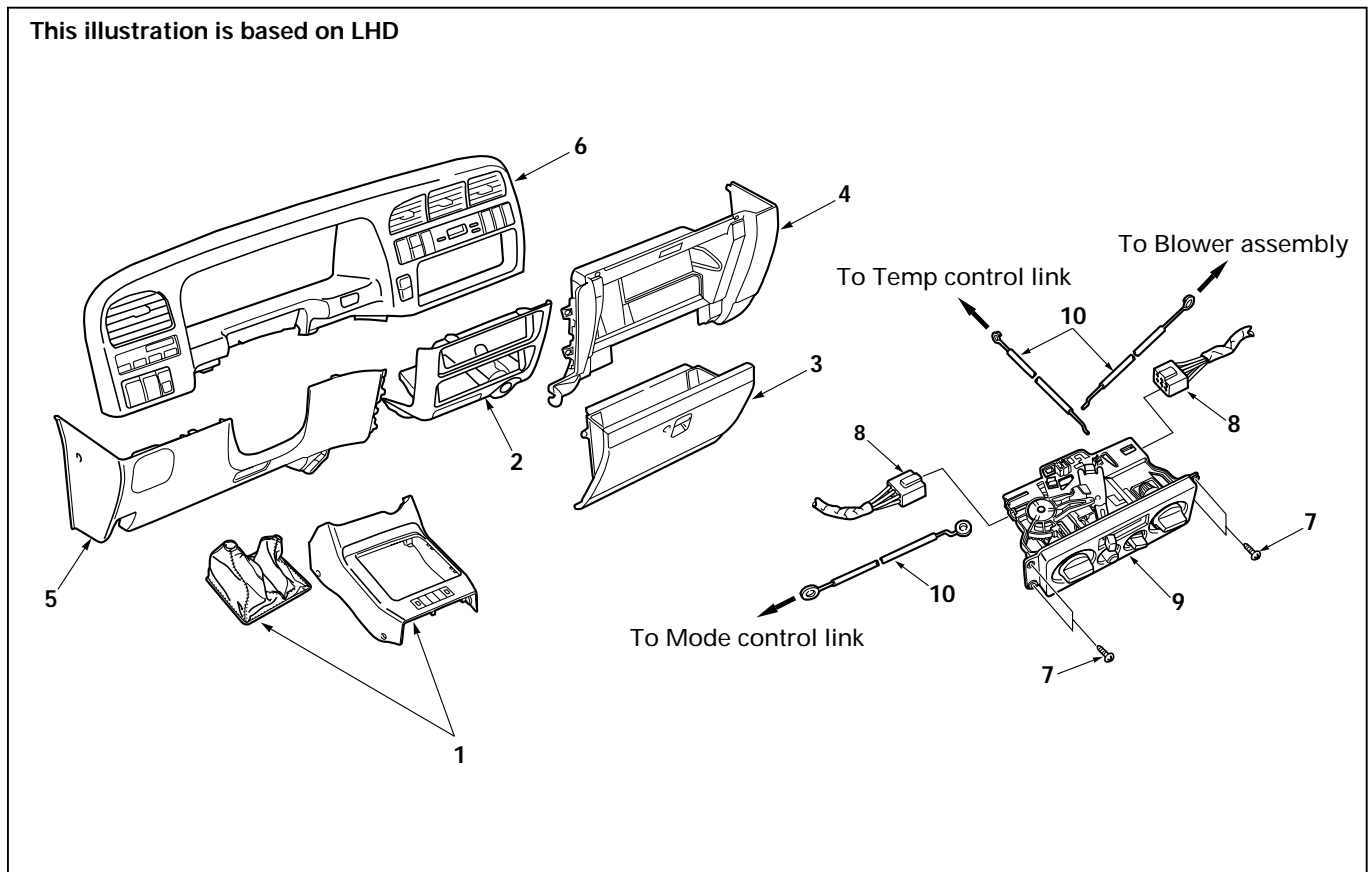
1. **Front console assembly**
2. **Lower cluster assembly**
3. **Instrument panel driver lower cover assembly**
4. **Meter cluster assembly**
 - Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.
5. **Center vent**
 - Remove screws and the center vent from center cluster while prying up the center vent catch portions.
6. **Side vent**
 - Remove screws and the side vent from center cluster while prying up the side vent catch portions.



INSTALLATION

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

CONTROL LEVER ASSEMBLY AND/OR CONTROL CABLES



Removal Steps

1. Center console assembly
2. Lower cluster assembly
3. Glove box
4. Instrument panel passenger lower cover assembly
5. Instrument panel driver lower cover assembly
6. Meter cluster assembly
7. Attaching screws
8. Fan switch and air conditioning switch connector
9. Control lever assembly
10. Control cable

Installation Steps

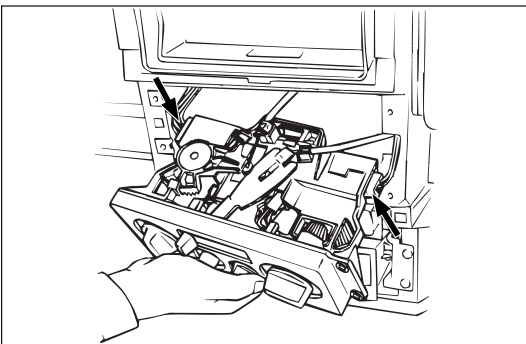
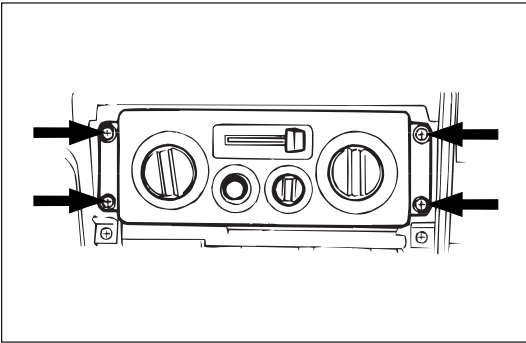
To install, follow the removal steps in the reverse order.

**REMOVAL****Preparation:**

Disconnect the battery ground cable

1. **Front console assembly**
2. **Lower cluster assembly**
3. **Glove box**
4. **Instrument panel passenger lower cover**
5. **Instrument panel driver lower cover**
6. **Meter cluster assembly**
Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.
7. **Attaching Screws**

Remove the 4 attaching screws and disconnect the control lever cables at heater unit and blower assembly.



8. **Fan Switch and A/C Switch Connector**
Pull the control lever assembly out and disconnect the connectors.

9. **Control Lever Assembly**
10. **Control Cable**



INSTALLATION

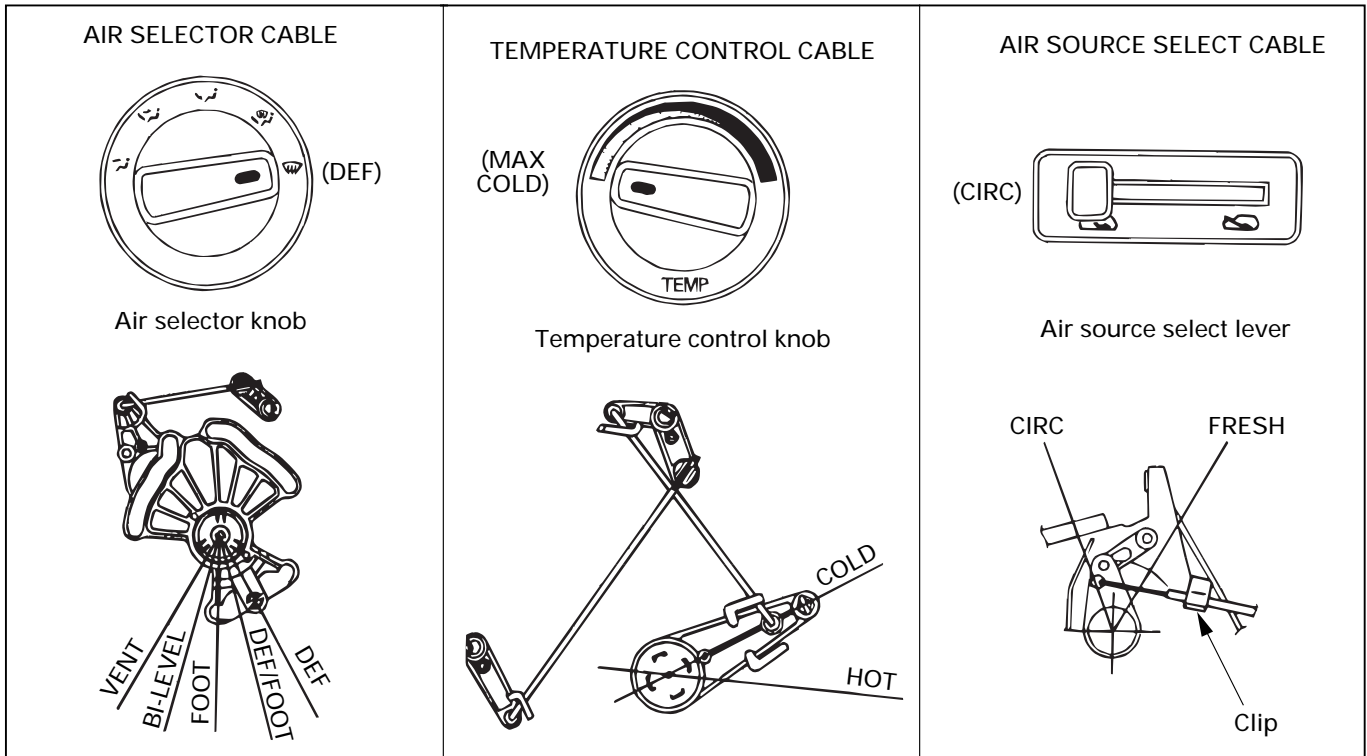
To install, follow the removal steps in the reverse order, noting the following points:

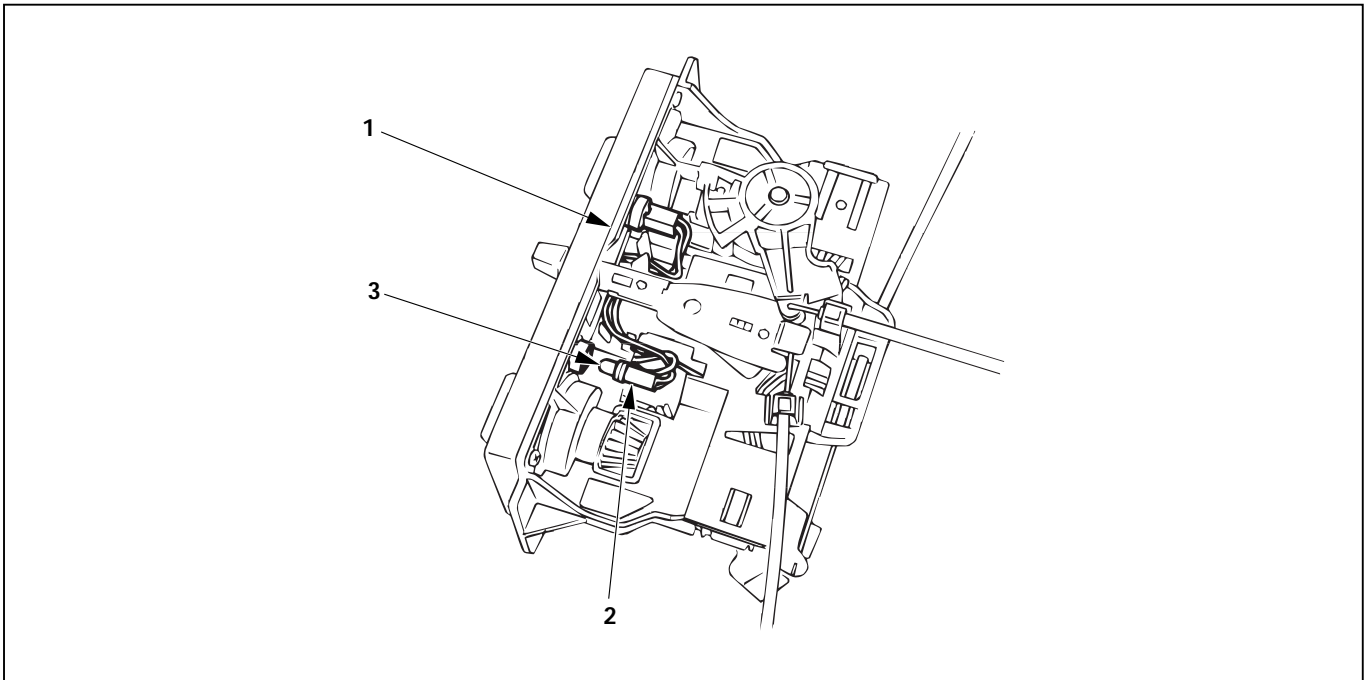


1. Adjust the control cables
 - Air source control cable
 - 1) Slide the control lever to the left ("CIRC" position).
 - 2) Connect the control cable at the "CIRC" position of the link unit of blower assembly and fix it with the clip.
 - Temperature control cable
 - 1) Turn the control knob to the left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



2. Check control cable operation.



CONTROL PANEL ILLUMINATION BULB**Removal Steps**

1. Control lever assembly
2. Bulb socket
3. Illumination bulb

Installation Steps

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

**REMOVAL****Preparation:**

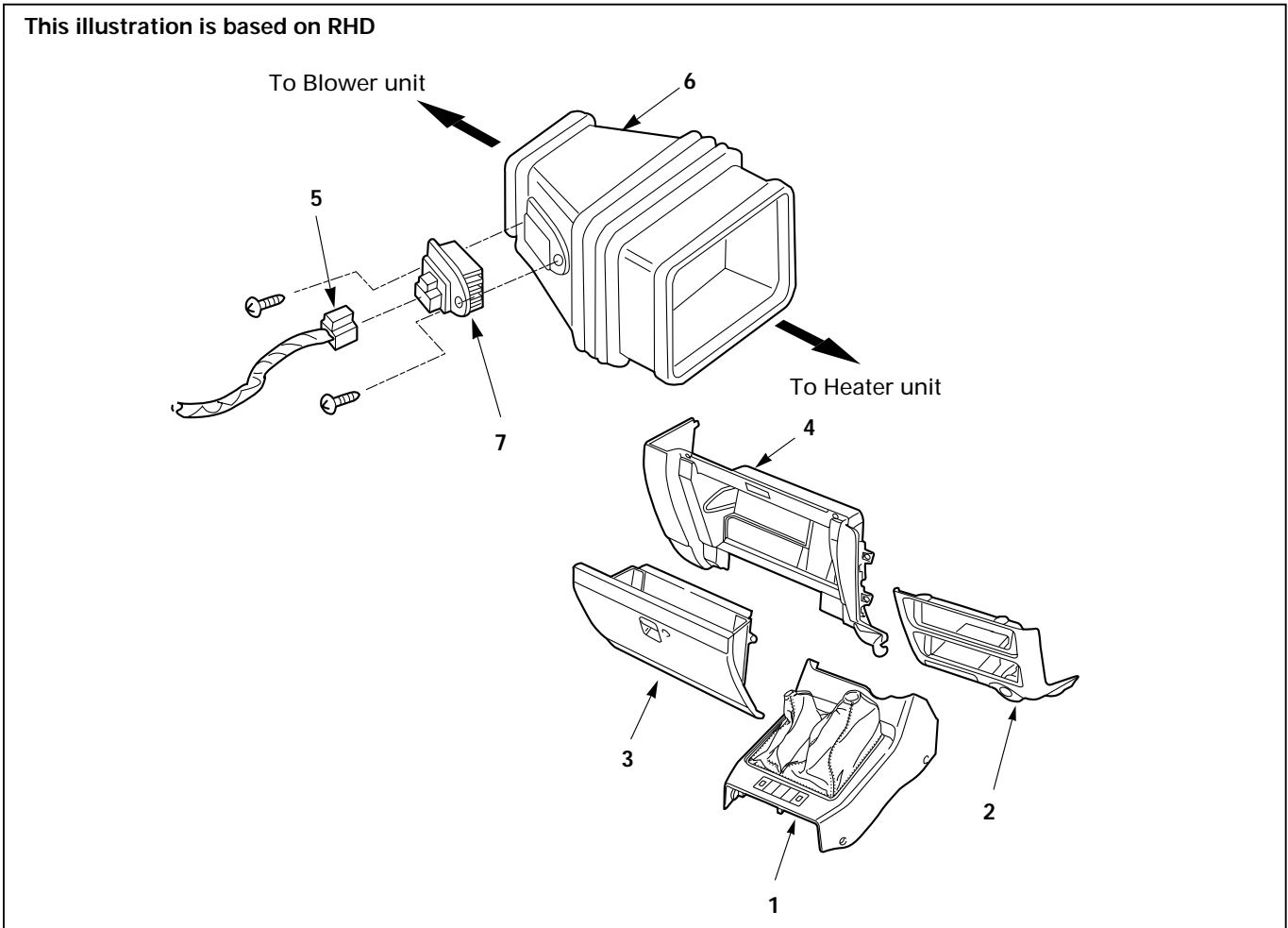
Disconnect the battery ground cable

1. **Control Lever Assembly**
Refer to "CONTROL LEVER ASSEMBLY" removal procedure in this section.
2. **Bulb Socket**
Pull out the socket from the panel by turning it counterclockwise.
3. **Illumination Bulb**
Pull the illumination bulb from socket.

**INSTALLATION**

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

RESISTOR



Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Glove box
4. Instrument panel passenger lower cover
5. Resistor connector
6. Duct (Heater only)
7. Resistor

Installation Steps

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



REMOVAL

Preparation:

Disconnect the battery ground cable

1. **Front console assembly**
2. **Lower cluster assembly**
3. **Glove box**
4. **Instrument panel passenger lower cover**
Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.
5. **Resistor connector**
6. **Duct (Heater only)**
7. **Resistor**

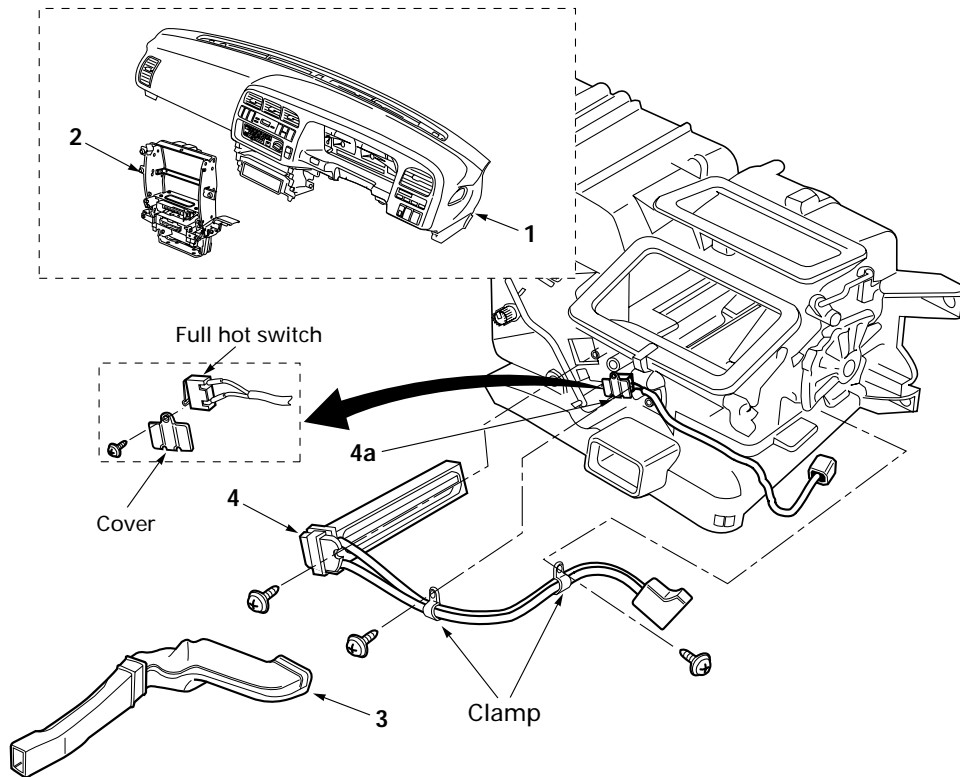


INSTALLATION

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

CERAMIC HEATER AND/OR FULL HOT SWITCH

This illustration is based on RHD



Removal Steps

1. Instrument panel assembly
2. Instrument panel center bracket
3. Rear heater duct
4. Ceramic heater assembly
- 4a. Full hot switch

Installation Steps

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



REMOVAL

Preparation:

Disconnect the battery ground cable

1. Instrument panel assembly

Refer to Section 10 "BODY" for "INSTRUMENT PANEL ASSEMBLY" removal procedure.

2. Instrument panel center bracket

Refer to Section 10 "CROSS BEAM ASSEMBLY" removal procedure.

3. Rear heater duct

4. Ceramic heater

- 1) Disconnect the connector and remove the heater fixing screw and heater harness fixing clamps.
- 2) Pull the ceramic heater out from heater unit.

4a. Full hot switch

Disconnect the switch connector and remove the switch fixing screw and switch harness fixing clamp.



INSTALLATION

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

1. The installation should be made with care so that there is continuity between the switch side connector terminals when the knob is set to the "Full Hot" position.
2. Be sure to handle the EGR and the ABS control unit with care to avoid the disengagement of connectors.

SECTION 1B

AIR CONDITIONING



CAUTION

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used.

Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque values must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

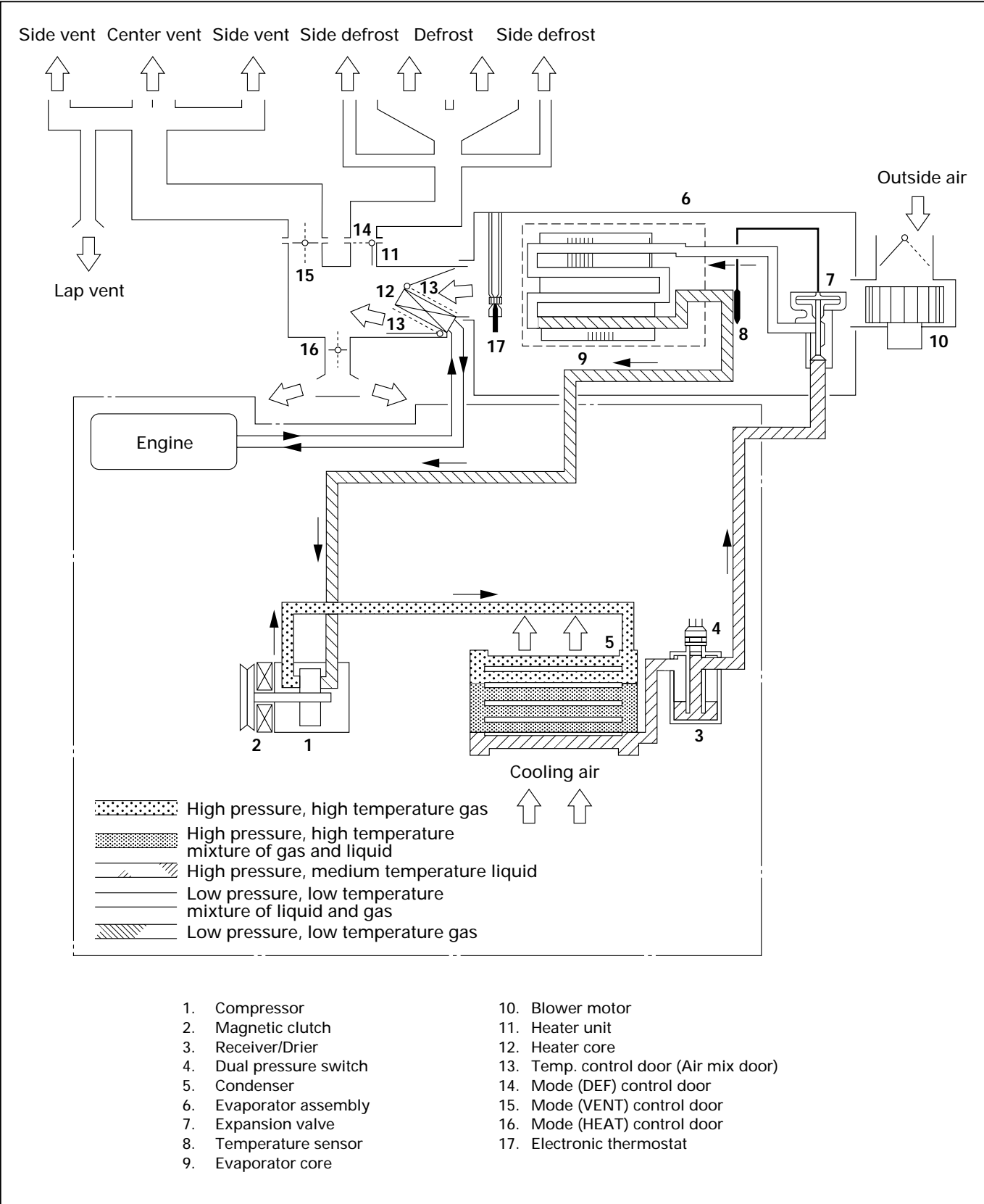
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GENERAL DESCRIPTION

AIR CONDITIONING REFRIGERANT CYCLE CONSTRUCTION



1B – 4 AIR CONDITIONING

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

EVAPORATION

The refrigerant is changed from a liquid to a gas inside the evaporator. The refrigerant mist that enters the evaporator vaporizes readily. The liquid refrigerant removes the required quantity of heat (latent heat of vaporization) from the air around the evaporator core cooling fins and rapidly vaporizes. Removing the heat cools the air, which is then radiated from the fins and lowers the temperature of the air inside the vehicle.

The refrigerant liquid sent from the expansion valve and the vaporized refrigerant gas are both present inside the evaporator and the liquid is converted to gas.

With this change from liquid to gas, the pressure inside the evaporator must be kept low enough for vaporization to occur at a lower temperature.

Because of that, the vaporized refrigerant is sucked into the compressor.

COMPRESSION

The refrigerant is compressed by the compressor until it is easily liquefied at normal temperature.

The vaporized refrigerant in the evaporator is sucked into the compressor. This action maintains the refrigerant inside the evaporator at a low pressure so that it can easily vaporize, even at low temperatures close to 0°C (32°F).

Also, the refrigerant sucked into the compressor is compressed inside the cylinder to increase the pressure and temperature to values such that the refrigerant can easily liquefy at normal ambient temperatures.

CONDENSATION

The refrigerant inside the condenser is cooled by the outside air and changes from gas to liquid.

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

EXPANSION

The expansion valve lowers the pressure of the refrigerant liquid so that it can easily vaporize.

The process of lowering the pressure to encourage vaporization before the liquefied refrigerant is sent to the evaporator is called expansion. In addition, the expansion valve controls the flow rate of the refrigerant liquid while decreasing the pressure.

That is, the quantity of refrigerant liquid vaporized inside the evaporator is determined by the quantity of heat which must be removed at a prescribed vaporization temperature. It is important that the quantity of refrigerant be controlled to exactly the right value.

COMPRESSOR

The compressor performs two main functions:

It compresses low-pressure and low-temperature refrigerant vapor from the evaporator into high-pressure and high-temperature refrigerant vapor to the condenser. And it pumps refrigerant and refrigerant oil through the A/C system.

6VD1/6VE1 engine on RHD model is equipped with an invariable capacity five-vane rotary compressor (DKV-14D Type).

The compressor sucks and compresses refrigerant by the rotation of the vane installed to the shaft, and always discharges a fixed amount of refrigerant independent of the load of refrigerant.

The thermo sensor is installed to the front head of the compressor to protect it by stopping its operation when the refrigerant gas is insufficient or when the temperature is abnormally high.

- OFF 160 ± 5°C (320.0 ± 41°F)
- ON 135 ± 5°C (275.0 ± 41°F)

Diesel Engine models and 6VD1/6VE1 engine on LHD model are equipped with a swash plate type compressor

Swash plate compressors have a swash (slanted) plate mounted on the shaft. When the shaft turns, the rotation of the swash plate is converted to reciprocating piston motion which sucks in and compresses the refrigerant gas.

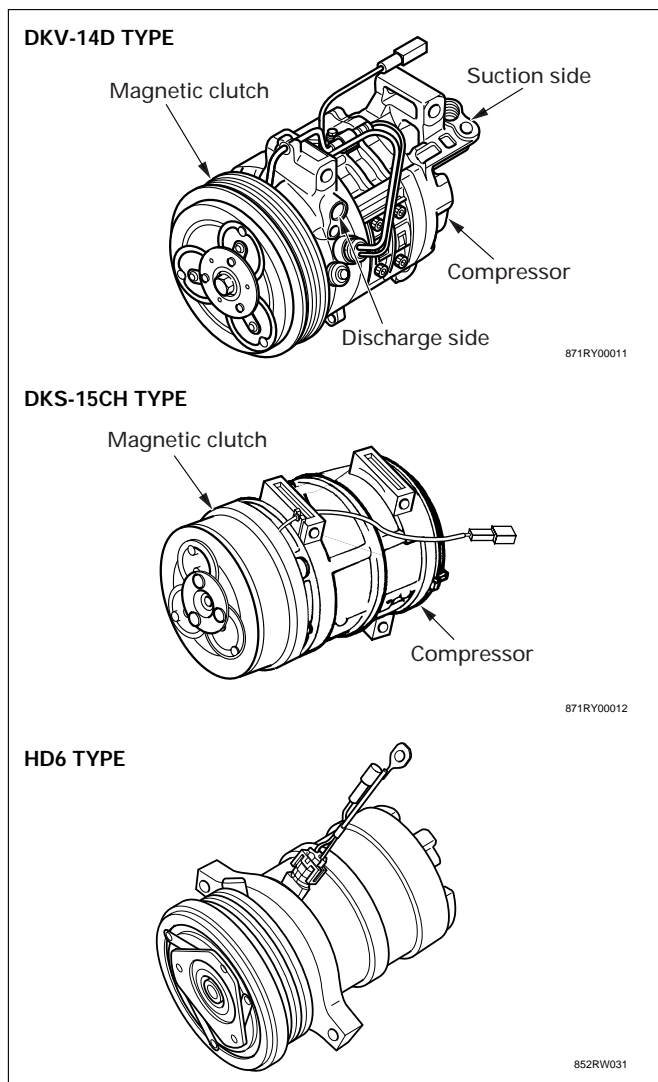
Shaft seal (Lip type) is installed between the valve plate and shaft & cylinder head to prevent refrigerant gas leaks. A specified amount of compressor oil is contained in the oil pan.

This oil is supplied to the cylinders, bearings, etc., by an oil pump which is connected to the swash plate shaft.

With some compressors the differential between the intake pressure and discharge pressure generated while the compressor is operating is used for lubrication instead of an oil pump. The specified amount of the DKV-14D, DKS-15CH and HD6 compressors oil is 150cc (4.2 Imp fl oz). Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil. If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction. The magnetic clutch connector is a waterproof type.

MAGNETIC CLUTCH

The compressor is driven by the drive belt from the crank pulley of the engine. If the compressor is activated each time the engine is started, this causes too much load to the engine. The magnetic clutch transmits the power from the engine to the compressor and activates it when the air conditioning is "ON". Also, it cuts off the power from the engine to the compressor when the air conditioning is "OFF". (Magnetic clutch repair procedure can be found in Section 1D.)



CONDENSER

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

RECEIVER/DRIER

The receiver/drier performs four functions;

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

A receiver/drier may fail due to a restriction inside the body of the unit. A restriction at the inlet to the receiver/drier will cause high pressures. Outlet restrictions will be indicated by low pressure and little or no cooling. An excessively cold receiver/drier outlet may indicate a restriction. The receiver/drier of this vehicle is made of aluminum with a smaller tank. It has 300 cc (8.5 Imp fl oz) refrigerant capacity. The refrigerant line connection has a bolt at the block joint, for easy servicing.

1B – 6 AIR CONDITIONING

DUAL PRESSURE SWITCH

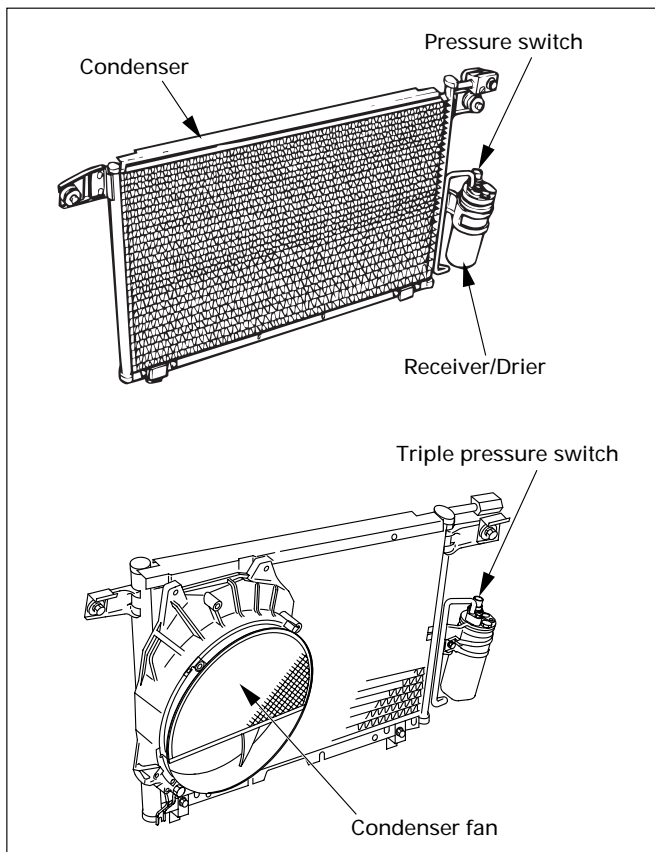
The dual pressure switch is installed on the upper part of the receiver/drier, to detect excessively high pressure (high pressure switch) and prevent compressor seizure due to the refrigerant leaking (low pressure switch), switching the compressor "ON" or "OFF" as required.

The pressure switch connector is waterproof type.

- Low-pressure control kpa (kg·cm² / PSI)
Compressor
ON: 205.9 ± 30 (2.1 ± 0.3 / 30 ± 4)
(Except 6VD1 / 6VE1, LHD model)
186 ± 30 (1.9 ± 0.3 / 27 ± 4)
(only for 6VD1 / 6VE1, LHD model)
OFF: 176 ± 20 (1.8 ± 0.2 / 26 ± 3)
- High-pressure control
Compressor
ON: 2354 ± 196 (24.0 ± 2.0 / 341 ± 28)
OFF: 2942 ± 196 (30.0 ± 2.0 / 427 ± 28)

TRIPLE PRESSURE SWITCH

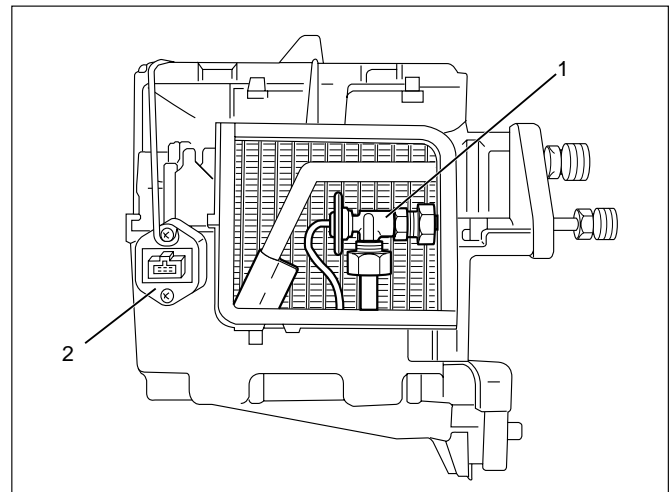
Triple pressure switch is installed atop the receiver/drier. This switch is constructed with a unitized type of two switches. One of them is a low and high pressure switch (Dual pressure switch) to switch "ON" or "OFF" the magnetic clutch as a result of irregularly high-pressure or low-pressure of the refrigerant. The other one is a medium pressure switch (Cycling switch) to switch "ON" or "OFF" the condenser fan sensing the condenser high side pressure.



- Low-pressure control kpa (kg·cm²/PSI)
Compressor
ON: 186 ± 30 (1.9 ± 0.3 / 27 ± 4)
OFF: 176 ± 20 (1.8 ± 0.2 / 26 ± 3)
- Medium-pressure control
Condenser fan
ON: 1471 ± 98 (15.0 ± 1.0 / 213 ± 14)
OFF: 1079 ± 98 (11.0 ± 1.0 / 156 ± 14)
- High-pressure control
Compressor
ON: 2354 ± 196 (24.0 ± 2.0 / 341 ± 28)
OFF: 2942 ± 196 (30.0 ± 2.0 / 427 ± 28)

EXPANSION VALVE

This expansion valve (1) is internal pressure type and it is installed at the evaporator intake port. The expansion valve converts the high pressure liquid refrigerant sent from the receiver/drier to a low pressure liquid refrigerant by forcing it through a tiny port before sending it to the evaporator (2). This type of expansion valve consists of a temperature sensor, diaphragm, ball valve, ball seat, spring adjustment screw, etc. The temperature sensor contacts the evaporator outlet pipe, and converts changes in temperature to pressure. It then transmits these to the top chamber of the diaphragm. The refrigerant pressure is transmitted to the diaphragms bottom chamber through the external equalizing pressure tube. The ball valve is connected to the diaphragm. The opening angle of the expansion valve is determined by the force acting on the diaphragm and the spring pressure. The expansion valve regulates the flow rate of the refrigerant. Accordingly, when a malfunction occurs to this expansion valve, both discharge and suction pressures get low, resulting in insufficient cooling capacity of the evaporator.



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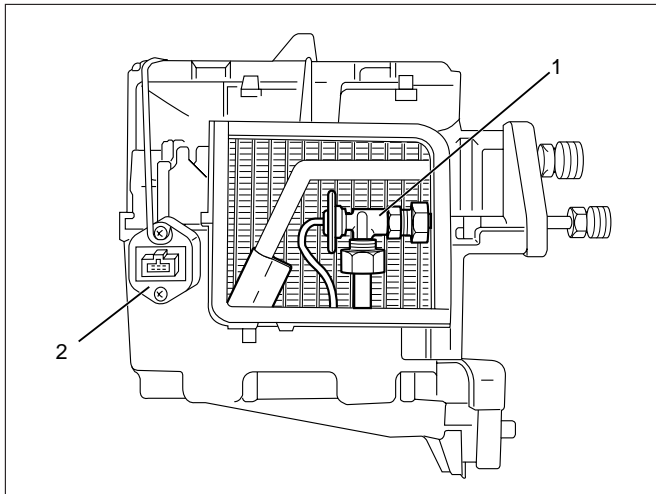
EVAPORATOR

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

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

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

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

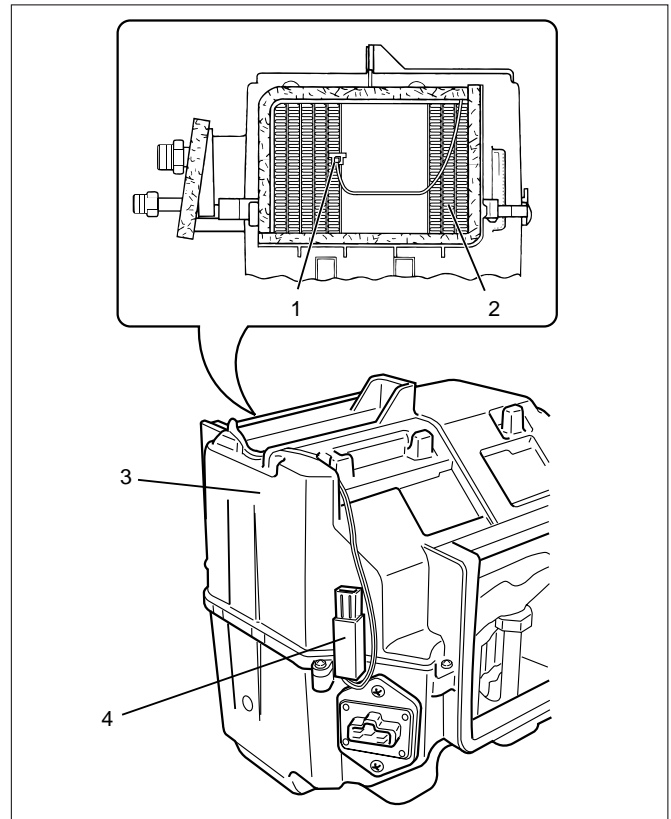


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ELECTRONIC THERMOSTAT

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

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



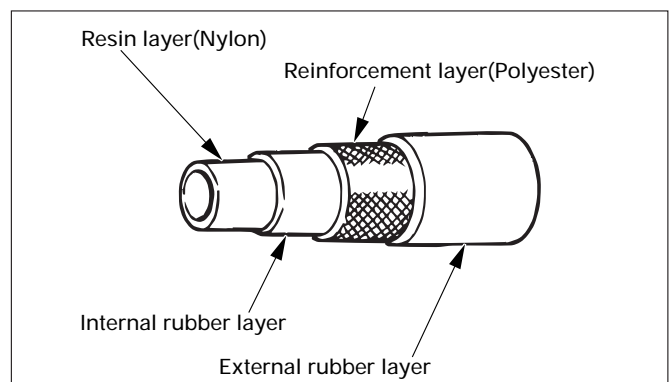
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REFRIGERANT LINE

Restrictions in the refrigerant line will be indicated by:

1. Suction line; A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or not cooling.
2. Discharge line; A restriction in the discharge line generally will cause the discharge line to leak.
3. Liquid line; A liquid line restriction will be evidenced by low discharge and suction pressure and insufficient cooling.

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

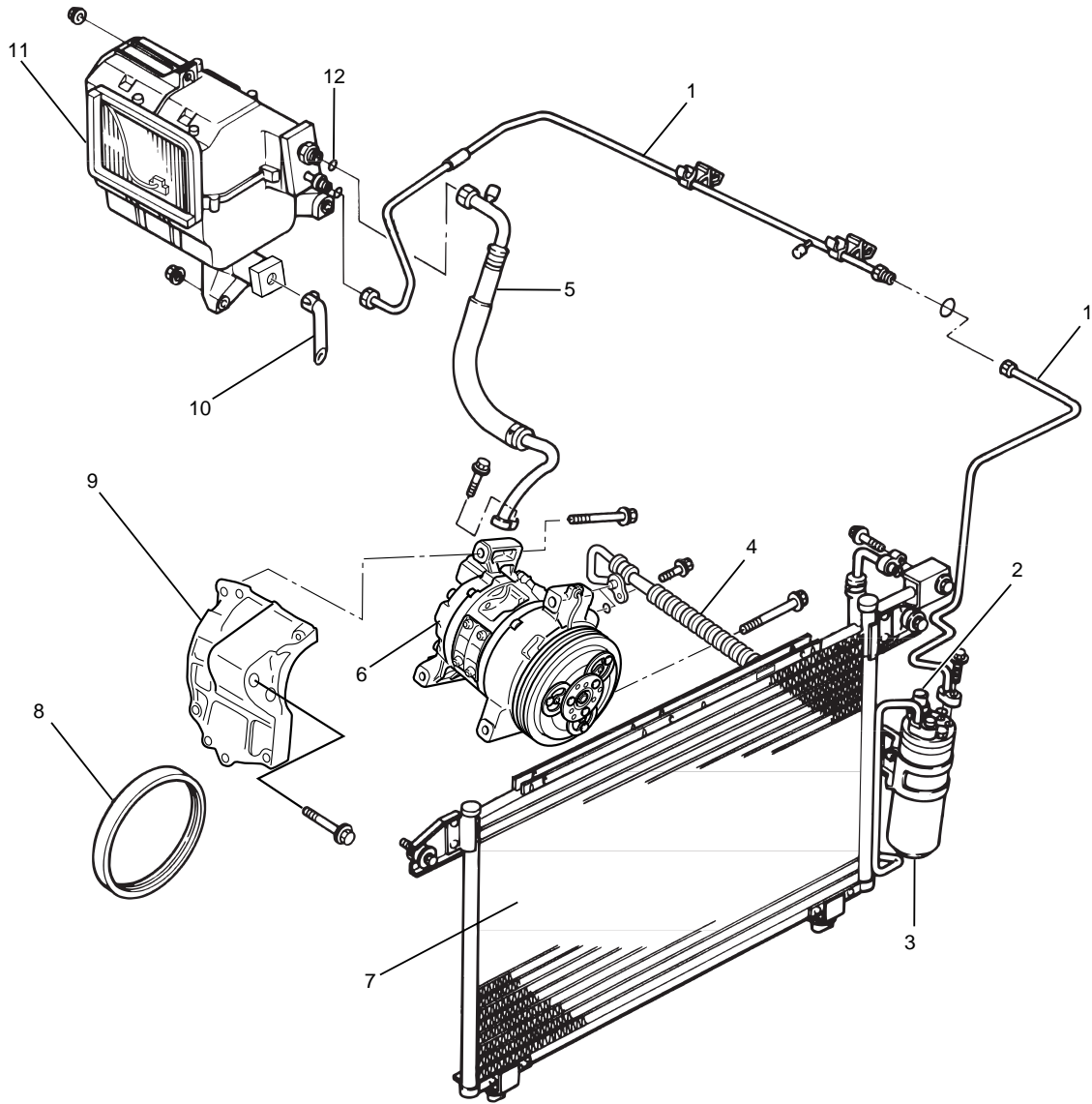


SERVICE CHARGE VALVES

The charging hoses have a quick-joint type fitting, to reduce refrigerant loss during removal and installation.

AIR CONDITIONING PARTS

6VD1/6VE1 (RHD)



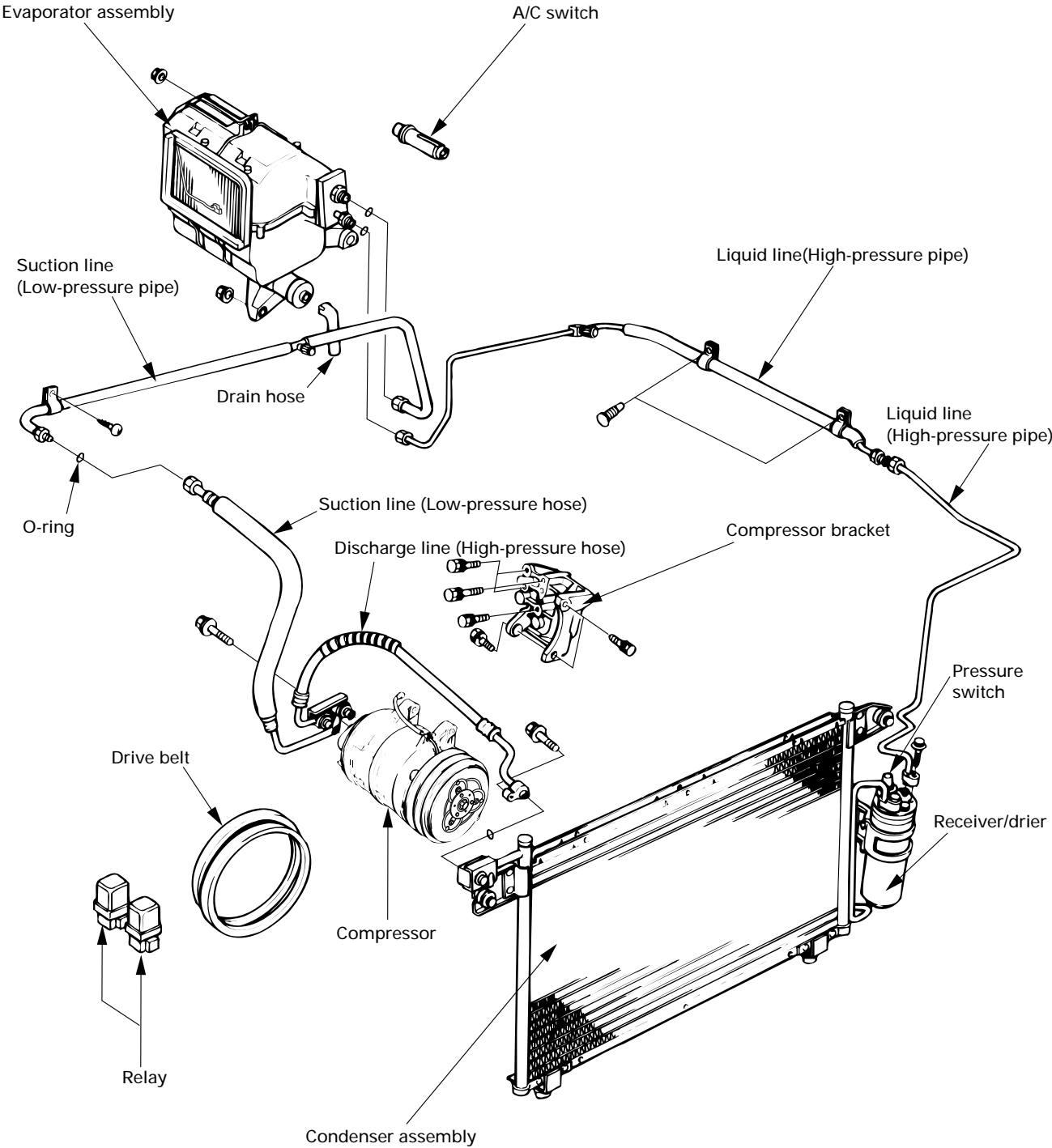
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Legend

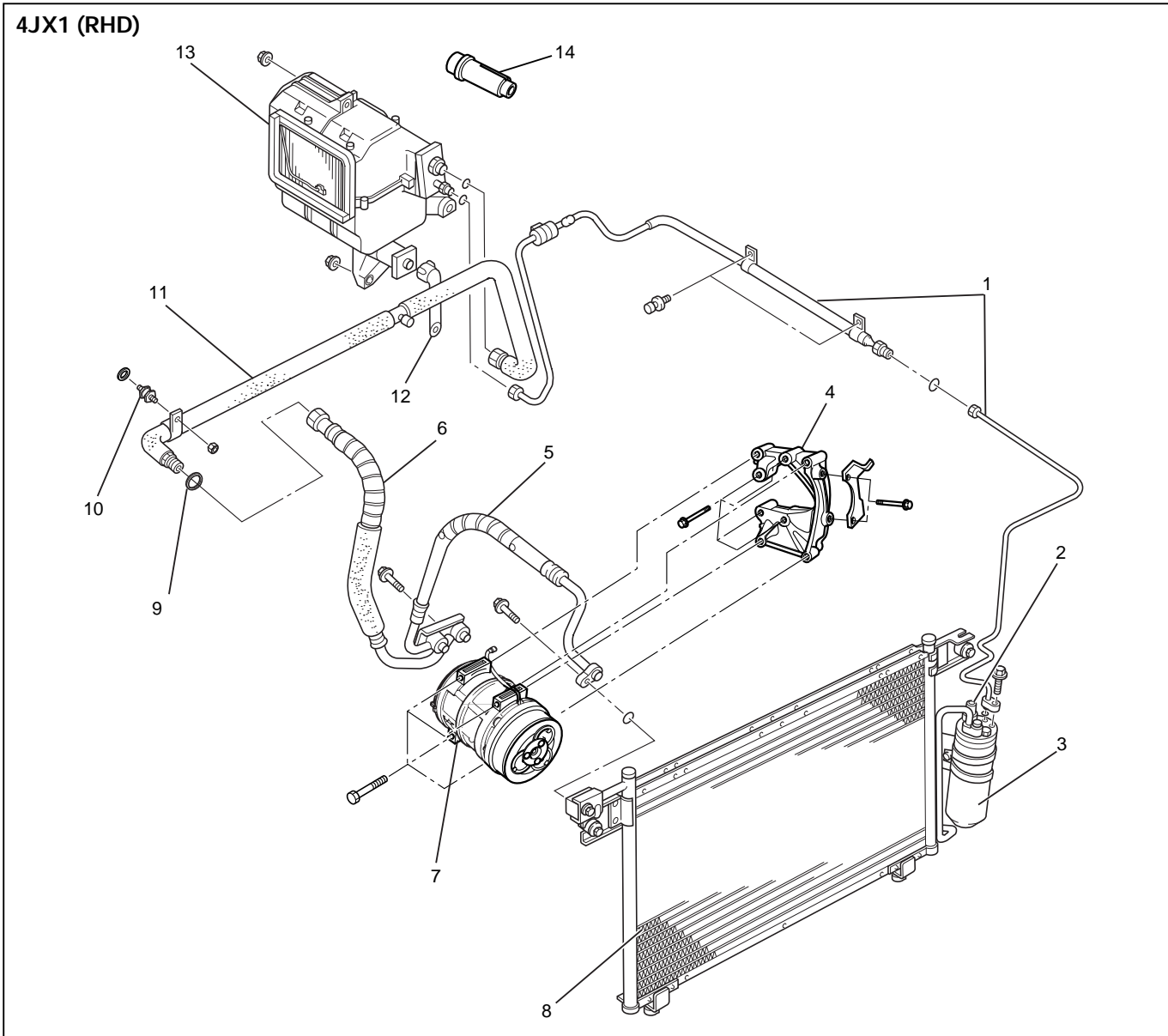
- | | |
|---|--------------------------|
| (1) Liquid Line (High-Pressure Pipe) | (7) Condenser Assembly |
| (2) Pressure Switch | (8) Serpentine Belt |
| (3) Receiver Drier | (9) Compressor Bracket |
| (4) Discharge Line (High-Pressure Hose) | (10) Drain Hose |
| (5) Suction Line (Low-Pressure Hose) | (11) Evaporator Assembly |
| (6) Compressor | (12) O-ring |

4JG2 (R/LHD)

This illustration is based on RHD



1B - 10 AIR CONDITIONING

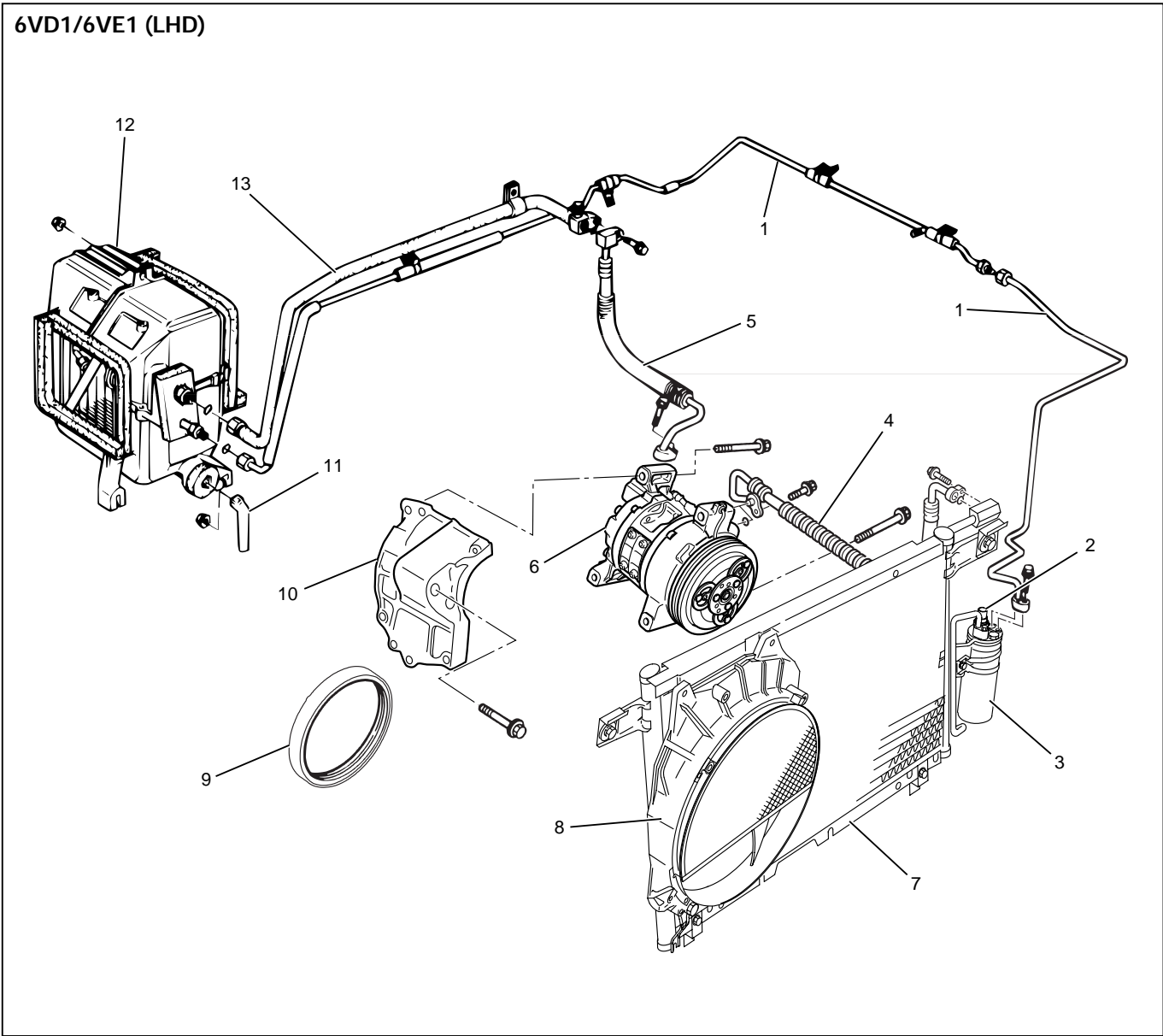


852RY00005

Legend

- | | |
|---|---------------------------------------|
| (1) Liquid Line (High- Pressure Pipe) | (8) Condenser Assembly |
| (2) Pressure Switch | (9) O-ring |
| (3) Receiver Drier | (10) Insulator Pipe |
| (4) Compressor Bracket | (11) Suction Line (Low Pressure Pipe) |
| (5) Discharge Line (High-Pressure Hose) | (12) Drain Hose |
| (6) Suction Line (Low-Pressure Hose) | (13) Evaporator Assembly |
| (7) Compressor | (14) A/C Switch |

6VD1/6VE1 (LHD)



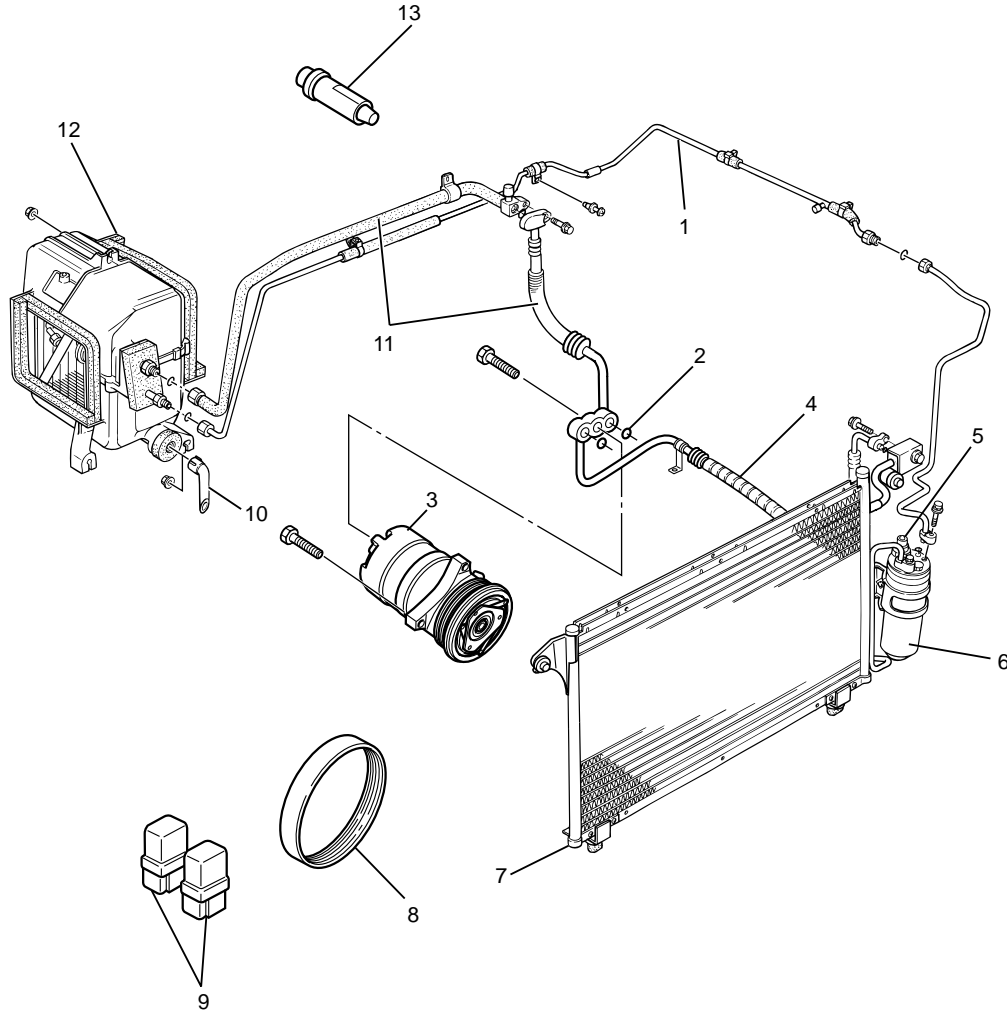
852RY00012

Legend

- (1) Liquid Line (High-Pressure Pipe)
- (2) Pressure Switch
- (3) Receiver Drier
- (4) Discharge line (High-Pressure Hose)
- (5) Suction Line (Low-Pressure Hose)
- (6) Compressor
- (7) Condenser Assembly
- (8) Condenser Fan
- (9) Serpentine Belt
- (10) Compressor Bracket
- (11) Drain Hose
- (12) Evaporator Assembly
- (13) Suction Line (Low-Pressure Pipe)

1B - 12 AIR CONDITIONING

Delphi Harrison (LHD-V6)



852RW009

Legend

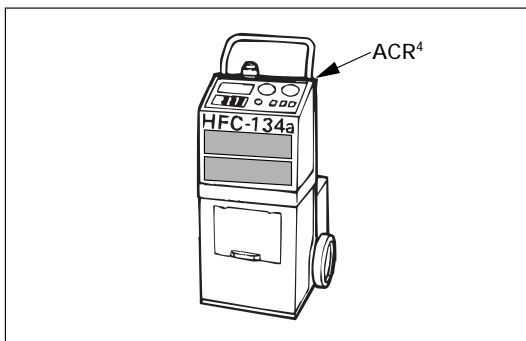
- | | |
|---|---------------------------------------|
| (1) Liquid Line (High-Pressure Pipe) | (7) Condenser Assembly |
| (2) O-ring | (8) Serpentine Belt |
| (3) Compressor | (9) Relay |
| (4) Discharge line (High-Pressure Hose) | (10) Drain Hose |
| (5) Pressure Switch | (11) Suction Line (Low-pressure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

ON-VEHICLE SERVICE

PRECAUTIONS FOR REPLACEMENT OR REPAIR OF AIR CONDITIONING PARTS

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

- Keep your work area clean.
- Always wear safety goggles and protective gloves when working on refrigerant systems.
- Beware of the danger of carbon monoxide fumes caused by running the engine.
- Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioning system.
- When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- Keep moisture and contaminants out of the system. When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately. Never remove the caps or plugs until the lines or parts are reconnected or installed.
- When disconnecting or reconnecting the lines, use two wrenches to support the line fitting, to prevent from twisting or other damage.
- Always install new O-rings whenever a connection is disassembled.
- Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this section must be performed in the following sequence:



- 1) Using the ACR⁴ (HFC-134a Refrigerant Recovery/ Recycling/ Recharging/ System) or equivalent to thoroughly discharge and recover the refrigerant.

ACR⁴ (115V 60Hz) : 5-8840-0629-0 (J-39500-A)

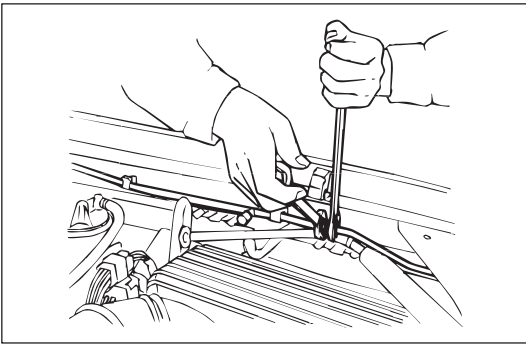
ACR⁴ (220-240V 50/60Hz)

: 5-8840-0630-0 (J-39500-220A)

ACR⁴ (220-240V 50/60Hz Australian model)

: 5-8840-0631-0 (J-39500-220ANZ)

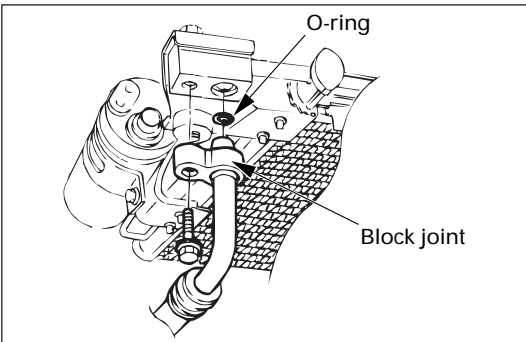
- 2) Remove and replace the defective part.
- 3) After evacuation, charge the air conditioning system and check for leaks.



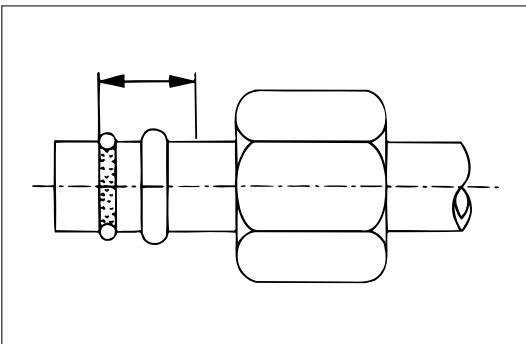
REPAIR OF REFRIGERANT LEAKS

Refrigerant Line Connections

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



When connecting the refrigerant line at the block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt.

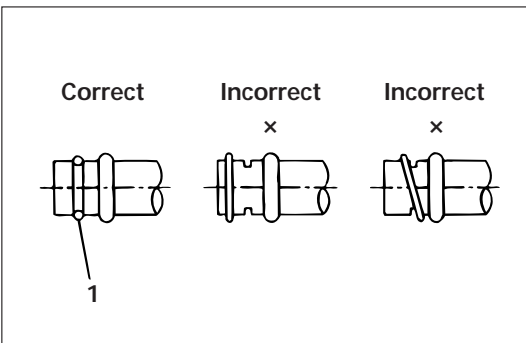


Apply specified compressor oil to the O-rings prior to connecting.

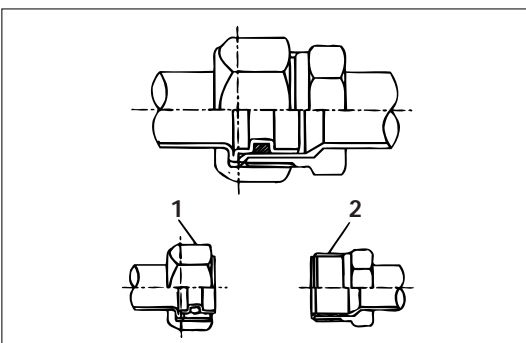


CAUTION:

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



O-rings must be closely aligned with raised portion of refrigerant line.



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




(Refer to "SERVICE INFORMATION" for Fixing Torque in section 00)

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852RY00015


852RY00016

LEAK AT REFRIGERANT LINE CONNECTIONS

- 1)  Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
 - Use two wrenches to prevent twisting and damage to the Line.
 - Do not over tighten.
- 2) Perform a leak test on the refrigerant line fitting.
- 3) If the leak is still present, discharge and recover the refrigerant from the system.
- 4) Replace the O-rings.
 - O-rings cannot be reused. Always replace with new ones.
- 5)  Be sure to apply specified compressor oil to the new O-rings.
- 6)  Retighten the refrigerant line fitting to the specified torque.
 - Use two wrenches to prevent twisting and damage to the line.
- 7) Evacuate, charge and retest the system.

LEAK IN THE HOSE

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

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

COMPRESSOR LEAKS

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

RECOVERY, RECYCLING, EVACUATION AND CHARGING**Handling Refrigerant-134a (HFC-134a)**

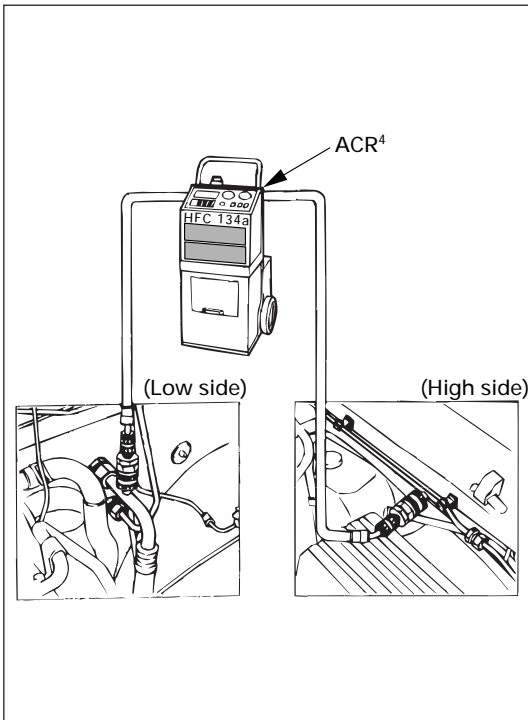
Air conditioning systems contain HFC-134a.

This is a chemical mixture which requires special handling procedures to avoid personal injury.

- Always wear safety goggles and protective gloves.
- Always work in a well-ventilated area. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.
- If HFC-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.
- If it is necessary to transport or carry any container of HFC-134a in a vehicle, do not carry it in the passenger compartment.
- If it is necessary to fill a small HFC-134a container from a large one, never fill the container completely. Space should always be allowed above the liquid for expansion.
- Keep HFC-134a containers stored below 40 °C (104°F).

⚠ WARNING

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



🗨 REFRIGERANT RECOVERY

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

ACR⁴ (115V 60Hz) : 5-8840-0629-0 (J-39500-A)

ACR⁴ (220-240V 50/60Hz)

: 5-8840-0630-0 (J-39500-220A)

ACR⁴ (220-240V 50/60Hz Australian model)

: 5-8840-0631-0 (J-39500-220ANZ)

- 1) Connect the high and low charging hoses of the ACR⁴ (or equivalent) as shown
- 2) Recover the refrigerant by following the ACR⁴ Manufacture's Instructions.
- 3) When a part is removed, put a cap or a plug on the connecting portion so that dust, dirt or moisture cannot get into it.

🗨 REFRIGERANT RECYCLING

Recycle the refrigerant recovered by ACR⁴ or equivalent. For the details of the actual operation, follow the steps in the ACR⁴ Manufacture's Instructions.

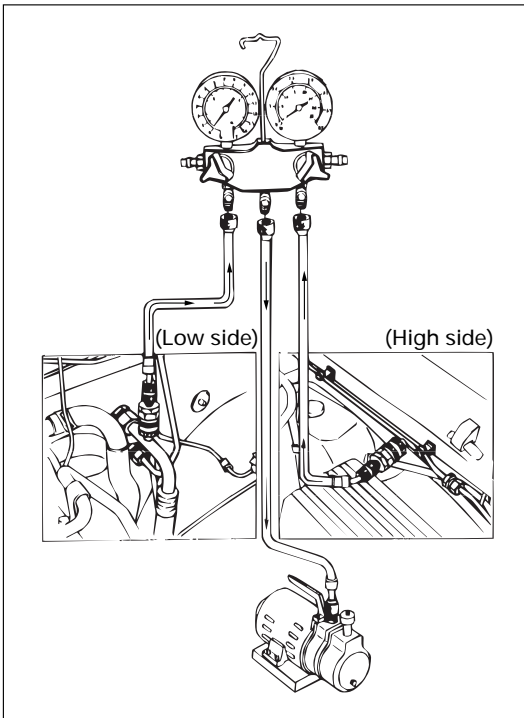
ACR⁴ (115V 60Hz) : 5-8840-0629-0 (J-39500-A)

ACR⁴ (220-240V 50/60Hz)

: 5-8840-0630-0 (J-39500-220A)

ACR⁴ (220-240V 50/60Hz Australian model)

: 5-8840-0631-0 (J-39500-220ANZ)



EVACUATION OF THE REFRIGERANT SYSTEM

NOTE:

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

Air and moisture in the refrigerant will cause problems in the air conditioning system.

Therefore, before charging the refrigerant, be sure to evacuate air and moisture thoroughly from the system.

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



CHARGING THE REFRIGERANT SYSTEM

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

These include using ACR⁴ (HFC-134a Refrigerant Recovery/ Recycling/ Recharging/ System) or equivalent and direct charging with a manifold gauge charging station.

ACR⁴ (115V 60Hz) : 5-8840-0629-0 (J-39500-A)

ACR⁴ (220-240V 50/60Hz)

: 5-8840-0630-0 (J-39500-220A)

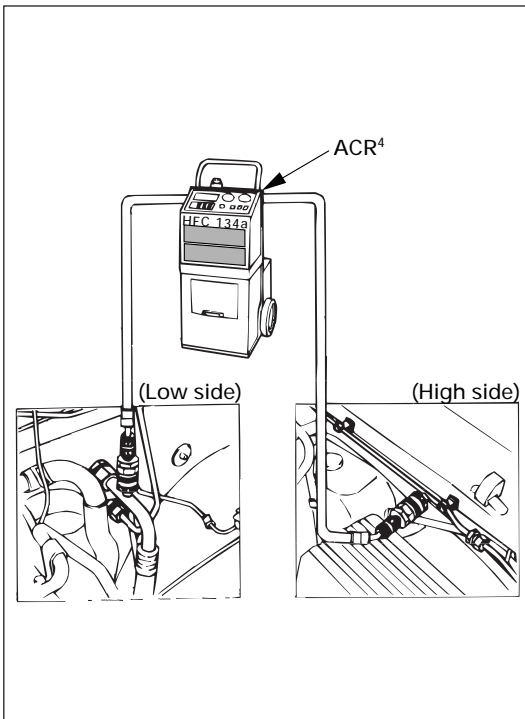
ACR⁴ (220-240V 50/60Hz Australian model)

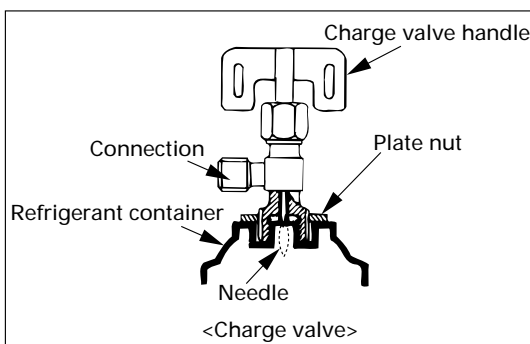
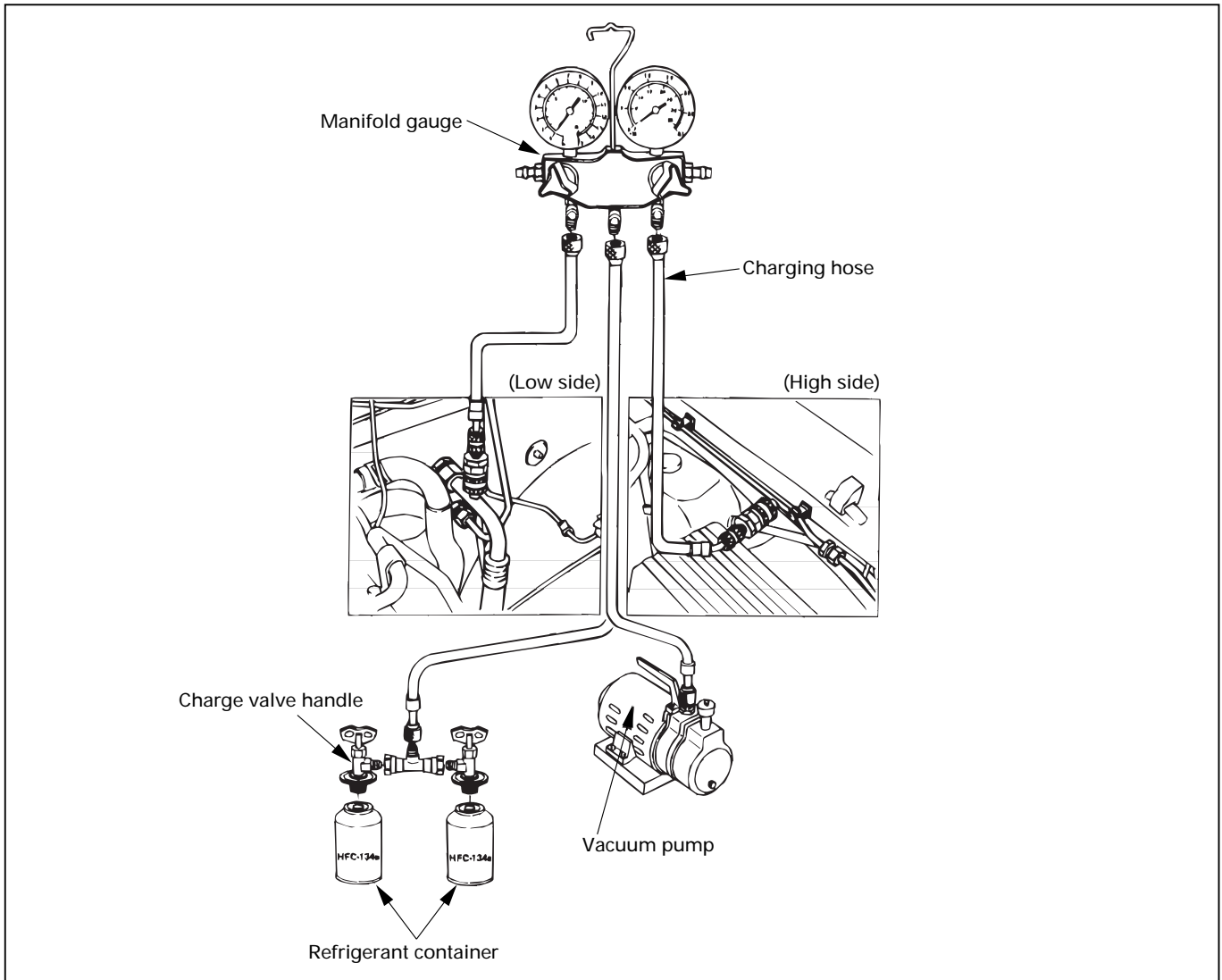
: 5-8840-0631-0 (J-39500-220ANZ)

Charging procedure

- **ACR⁴ (or equivalent) method**

For the charging of refrigerant recovery by ACR⁴, follow the manufacture's instruction.





• **Direct charging with a manifold gauge charging station method**

Handling the charging valve handle when installing refrigerant container.

- 1) Before attaching the charge valve to the refrigerant container, turn the charge valve handle counterclockwise until the needle is fully retracted.
- 2) Turn the plate nut counterclockwise until it reaches its highest position relative to the charge valve.
- 3) Install the charge valve onto the refrigerant container.
- 4) Turn the plate nut clockwise and connect the center hose of the manifold gauge to the charge valve.
- 5) Tighten the plate nut sufficiently by hand. Then turn the charge valve handle clockwise to lower the needle and bore a hole in the refrigerant container.
- 6) Turn the charge valve handle counterclockwise to raise the needle. The refrigerant in the refrigerant container is charged into the air conditioning system by the operation of the manifold gauge.
 - Be absolutely sure not to reuse the emptied refrigerant container.

- 1) Make sure the evacuation process is correctly completed.
- 2) Connect the center-hose of the manifold gauge to the refrigerant container.
 - Turn the charge valve handle counterclockwise to purge the charging line and purge any air existing in the center-hose of the manifold gauge.
- 3) Open the low-pressure hand valve and charge the refrigerant about 200 g(0.44 lbs.).
 - Make sure the high-pressure hand valve is closed.
 - Avoid charging the refrigerant by turning the refrigerant container upside down.
- 4) Close the low-pressure hand valve of the manifold gauge.
 - Check to ensure that the degree of pressure does not charge.
- 5) Check the refrigerant leaks by using a HFC-134a leak detector.
 - If a leak occurs, repair the leak connection, and start all over again from the first step of evacuation.
- 6) If no leaks are found, open the low-pressure hand valve of the manifold gauge. Then continue charging refrigerant to the system.
 - When charging the system becomes difficult:
 - (1) Run the engine at Idling and close the all vehicle doors.
 - (2) A/C switch is "ON".
 - (3) Set the fan control knob (fan switch) to its highest position.



WARNING

BE ABSOLUTELY SURE NOT TO OPEN THE HIGH-PRESSURE HAND VALVE. SHOULD THE HIGH-PRESSURE HAND VALVE BE OPENED, THE HIGH-PRESSURE REFRIGERANT GAS WOULD FLOW BACKWARD, AND THIS MAY CAUSE THE REFRIGERANT CONTAINER TO BURST.

- 7) When the refrigerant container is emptied, use the following procedure to replace it with a new refrigerant container.
 - (1) Close the low pressure hand valve.
 - (2) Raise the needle upward and remove the charge valve.
 - (3) Reinstall the charge valve to the new refrigerant container.
 - (4) Purge any air existing in the center hose of the manifold gauge.

- 8) Charge the system to the specified amount and then close the low-pressure hand valve.

Refrigerant Amount	g(lbs.)
--------------------	---------

750 (1.65)	
------------	--

DELPH1HD6/HT6	g(lbs.)
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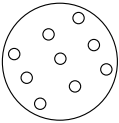
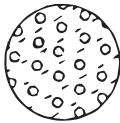
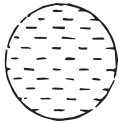
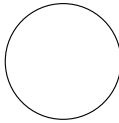
600 (1.32)	
------------	--

- A fully charged system is indicated by the sight glass on the receiver/driver being free of any bubbles(Refer to "Reading Sight Glass").
- Check the high and low pressure value of the manifold gauge.
- Check for refrigerant leaks by using a HFC-134a leak detector.

Immediately after charging refrigerant, both high and low pressures are slightly high and to the left of the gauge, but they settle down to the guide pressure valves as shown below:

- Ambient temperature; 25 ~ 30°C (77 ~ 86°F)
 - Guide pressure
 - High-pressure side;
Approx. 1373 – 1863 kPa (14 – 19 kg·cm² / 199 – 270 PSI)
 - Low-pressure side;
Approx. 147 – 294 kPa (1.4 – 3.0 kg·cm² / 21 – 43 PSI)
- 9) Close the low pressure hand valve and charge valve of the refrigerant container.
- 10) Stop the air conditioning and the engine.
- 11) Disconnect the high and low pressure hoses from the manifold gauge fittings.

Reading Sight Glass

High and low pressure pipe temperature	The high pressure pipe is hot and the low pressure pipe is cold. There is a distinct difference in temperature between them.	The high pressure pipe is warm and the low pressure pipe is cool. There is no great difference in temperature between them.	There is little difference in temperature between the high pressure pipe and the low pressure pipe.	The high pressure pipe is hot and the low pressure pipe is slightly warm. There is a difference in temperature between them.
Sight glass condition	Almost transparent. A flow of bubbles can be seen, but they disappear when the throttle is opened.	A flow of bubbles always can be seen. It appears sometimes transparent, and sometimes frothy.	Something like fog faintly can be seen.	Even at idle with the fan at "HI" (with the window fully open), the bubbles cannot be seen.
				
Air conditioner cycle condition	OK	NG (Not enough refrigerant)	NG (Almost no refrigerant)	NG (Too much refrigerant)

The sight glass provides accurate diagnosis only under the following conditions.

If the vehicle can be tested under these conditions, check the sight glass appearance and compare to the chart.

- * Engine speed Idling
- * A/C switch "ON"
- * Blower fan operating at highest speed
- * Air source selector lever at "RECIRC"
- * Temperature control knob at coldest position
- * Ambient temperature below 30°C (86°F) and humidity below 70% (See NOTE 1)
- * High side pressure less than 1863 kPa (19 kg·cm² / 270 PSI) (See NOTE 2)

NOTE 1

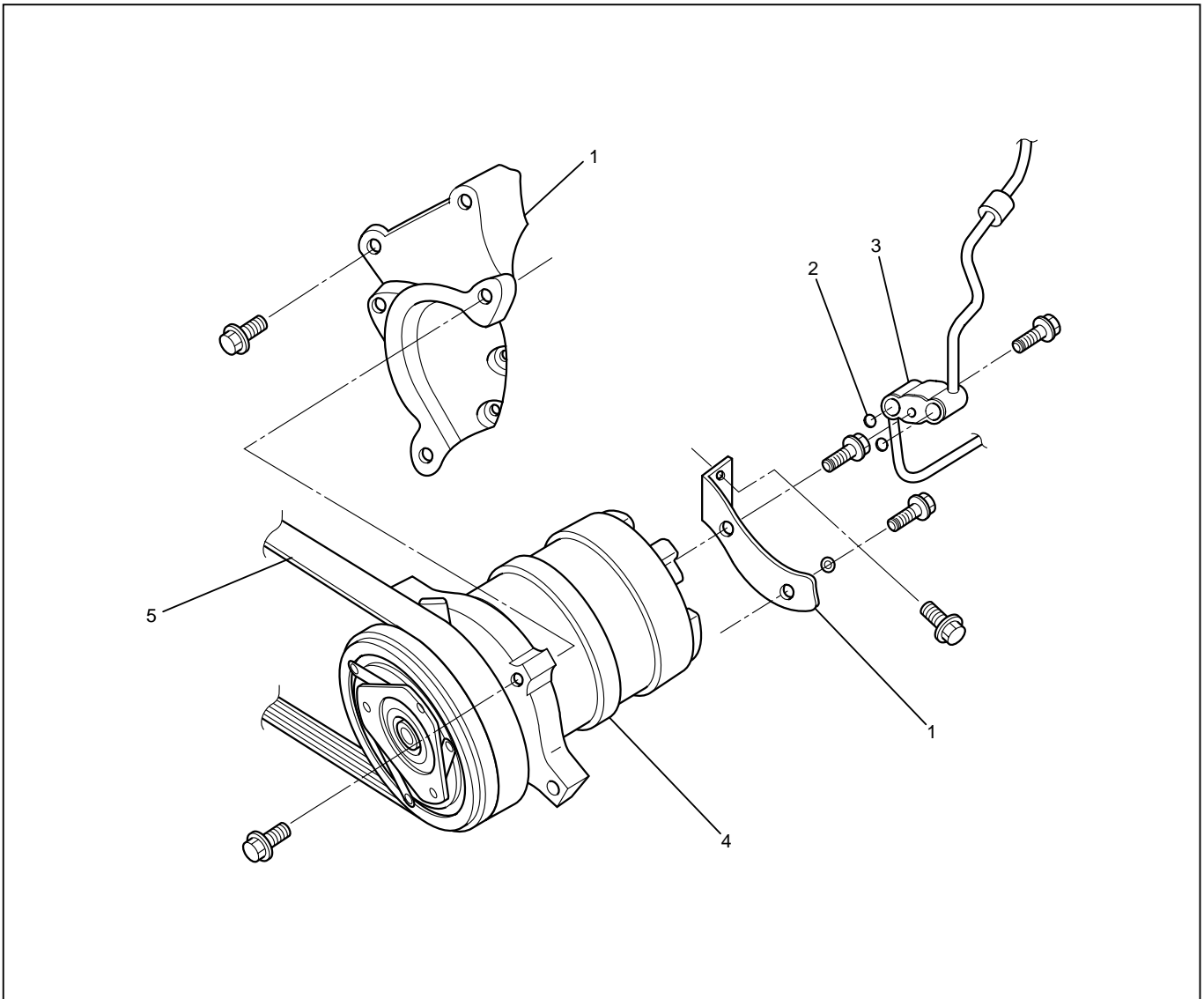
If the vehicle cannot be moved to a testing location that meets these specifications, then the sight glass cannot be used for diagnosis. You must discharge and recover the refrigerant, then recharge the system with the specified amount of refrigerant. Then continue checking the system performance.

NOTE 2

If the high side pressure is greater than stated, the sight glass cannot be used for diagnosis. You must discharge and recover the refrigerant, then recharge the system with the specified amount of refrigerant. Then continue checking system performance.

Compressor Assembly and Associated Parts

6VD1/6VE1 (LHD)



852RW010

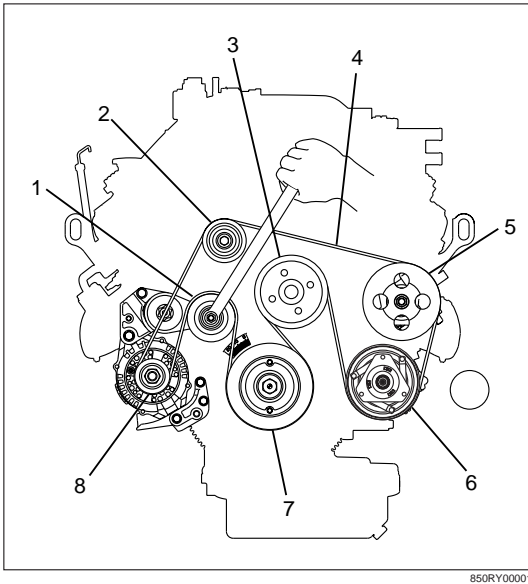
Legend

1. Compressor Bracket
2. Seal Washer
3. Refrigerant Line Connector
4. Compressor
5. Serpentine Belt

Removal

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

1B – 24 AIR CONDITIONING



Legend

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

4. Remove serpentine belt.
 - Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.
5. Disconnect refrigerant line connector.
 - When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line
6. Remove compressor.

Installation

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

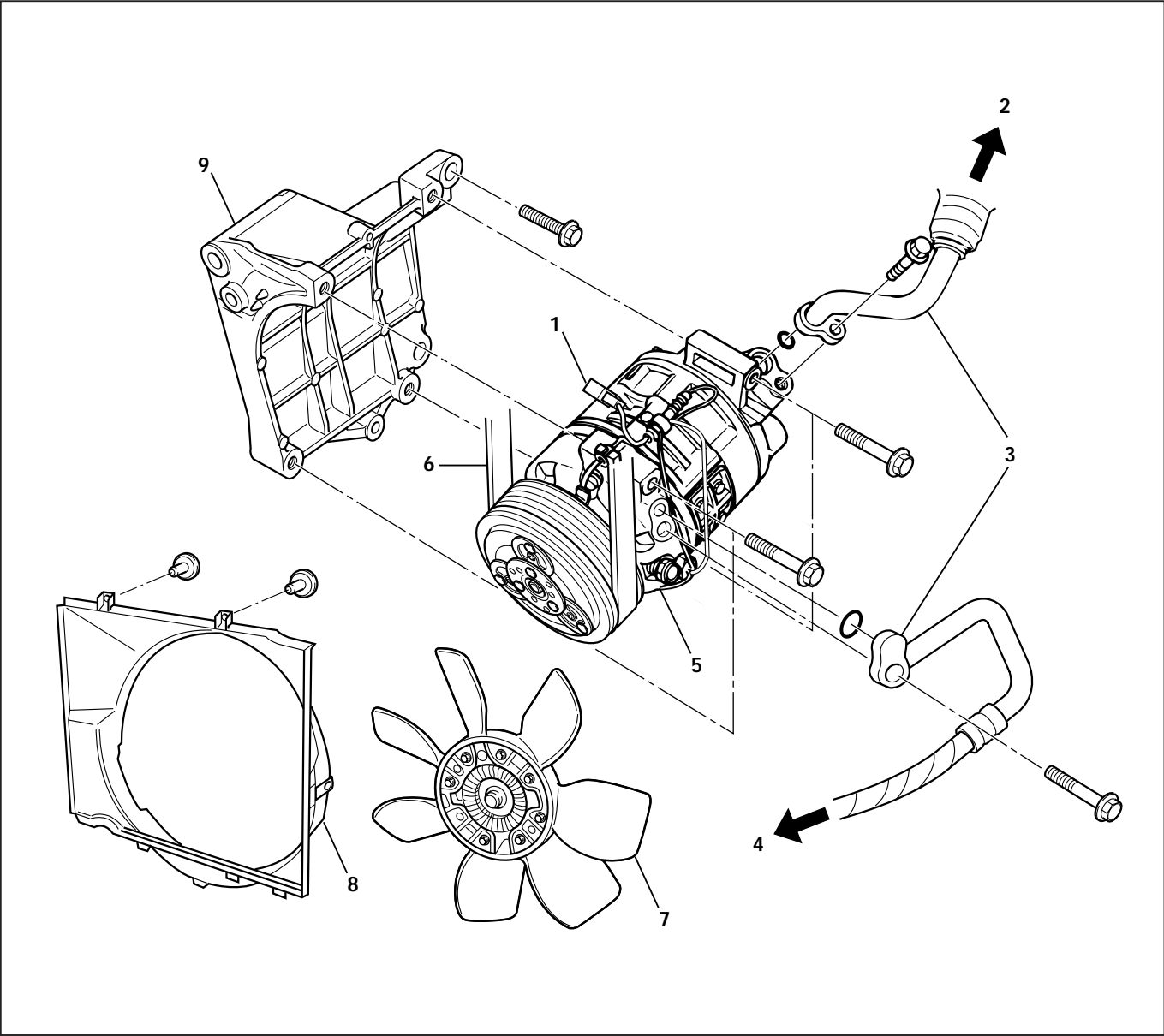
Compressor Fixing Torque	N·m (kg·m / lb·ft)
	19 (1.9 / 14)
- 2) Connect refrigerant line connector.
 - Tighten the refrigerant line connector fixing bolts to the specified torque

Refrigerant Line Bolt Torque	N·m (kg·m / lb·ft)
	15 (1.5 / 11)

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

COMPRESSOR

6VD1/6VE1 (RHD) & 6VD1 (LHD SAUDI/PHILIPPIN)



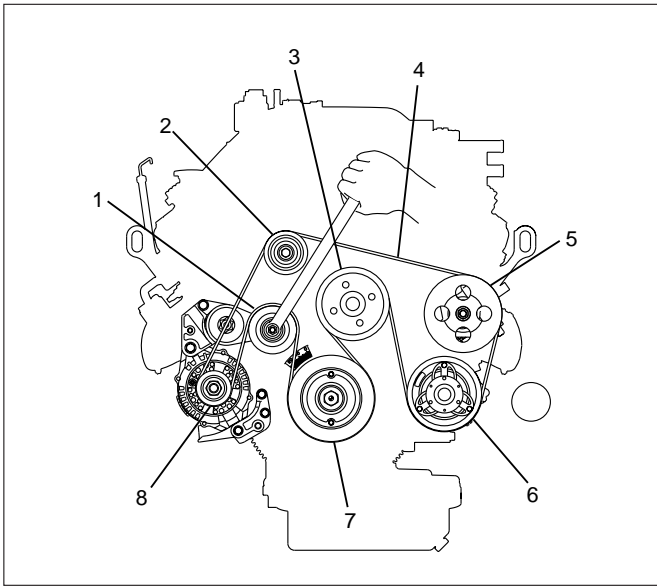
852RY0007

Legend

- (1) Magnetic Clutch Harness Connector
- (2) To Evaporator
- (3) Refrigerant Line Connector
- (4) To Condenser
- (5) Compressor
- (6) Serpentine Belt
- (7) Radiator Fan
- (8) Radiator Fan Shroud
- (9) Compressor Bracket

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
 - Refer to Refrigerant Recovery in this section.
3. Disconnect magnetic clutch harness connector.
4. Remove radiator fan shroud.
5. Remove radiator fan.
 - When the fan is removed, be sure to tighten the fan fixing nuts temporarily to their original positions.
6. Remove serpentine belt.
 - Move serpentine belt tensioner to loose side using wrench, then remove serpentine belt.



Legend

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

Installation

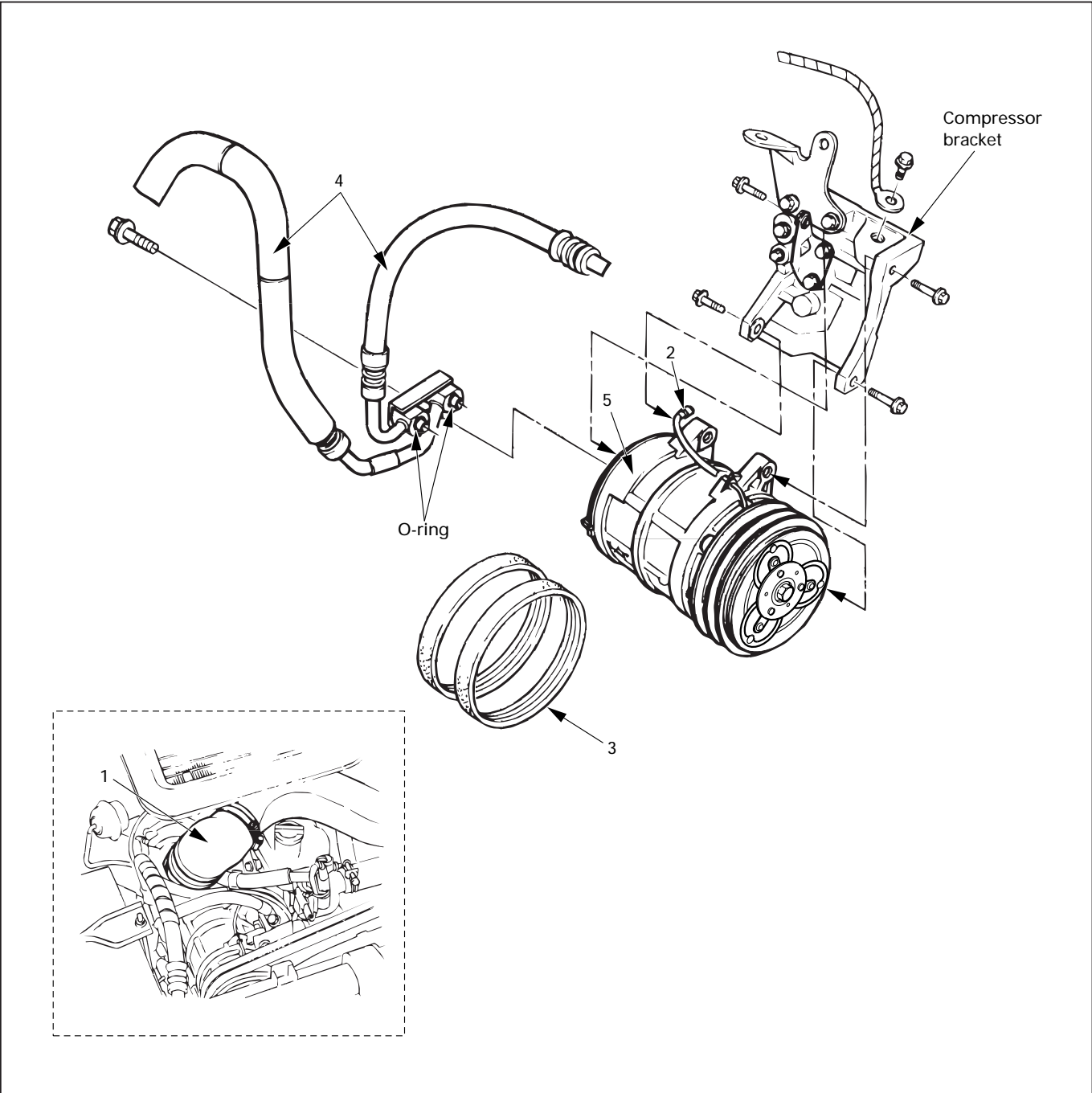
1. Install compressor.
 - Tighten the compressor fixing bolts to the specified torque.

Compressor Fixing Torque	N·m (kg·m / lb·ft)
	19 (1.9 / 14)
2. Connect refrigerant line connector.
 - Tighten the refrigerant line connector fixing bolts to the specified torque.

Refrigerant Line Bolt Torque	N·m (kg·m / lb·ft)
	15 (1.5 / 11)
 - O-rings cannot be reused. Always replace with new ones.
 - Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
3. Install serpentine belt.
 - Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator fan.
5. Install radiator fan shroud.
6. Connect magnetic clutch harness connector.

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

4JG2 ENGINE



871RY00013

Removal Steps

- 1. Air duct
- 2. Magnetic clutch harness connector
- 3. Drive belt
- 4. Refrigerant line connector
- 5. Compressor

Installation Steps

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

REMOVAL

Preparation:

- Battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section)

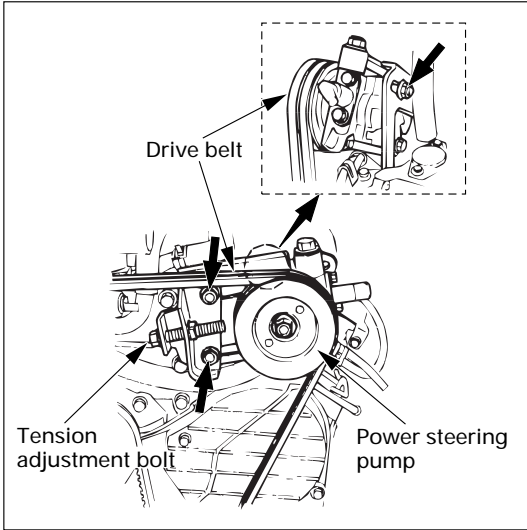
1. Air Duct (Turbo to air cleaner)

Cover up the air duct connecting portion to prevent foreign materials from getting into the turbo and the air cleaner.

2. Magnetic Clutch Harness Connector

3. Drive Belt

Loosen the power steering pump unit fixing bolts, then loosen the drive belt adjustment bolt and remove the drive belt.



4. Refrigerant Line Connector

5. Compressor

INSTALLATION

5. Compressor

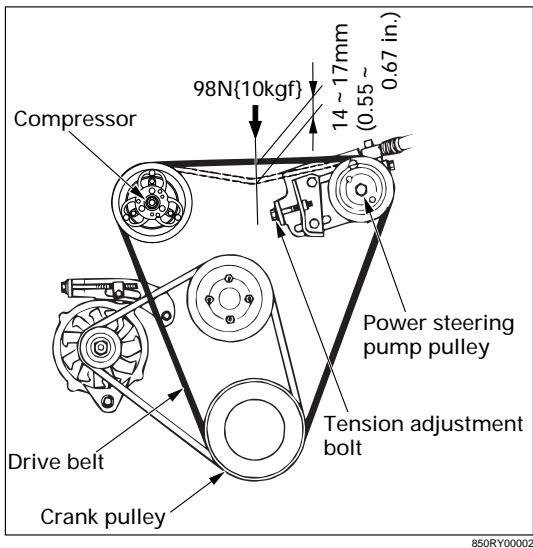
Tighten the compressor fixing bolts to the specified torque.

Compressor Bolt Torque	N·m (kg·m / lb·ft)
	40 (4.1 / 30)

4. Refrigerant Line Connector

- O-rings cannot be reused. Always replace with new ones.
- Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
- Tighten the refrigerant line connector to the specified torque.

Refrigerant Line Bolt Torque	N·m (kg·m / lb·ft)
	27 (2.8 / 20)



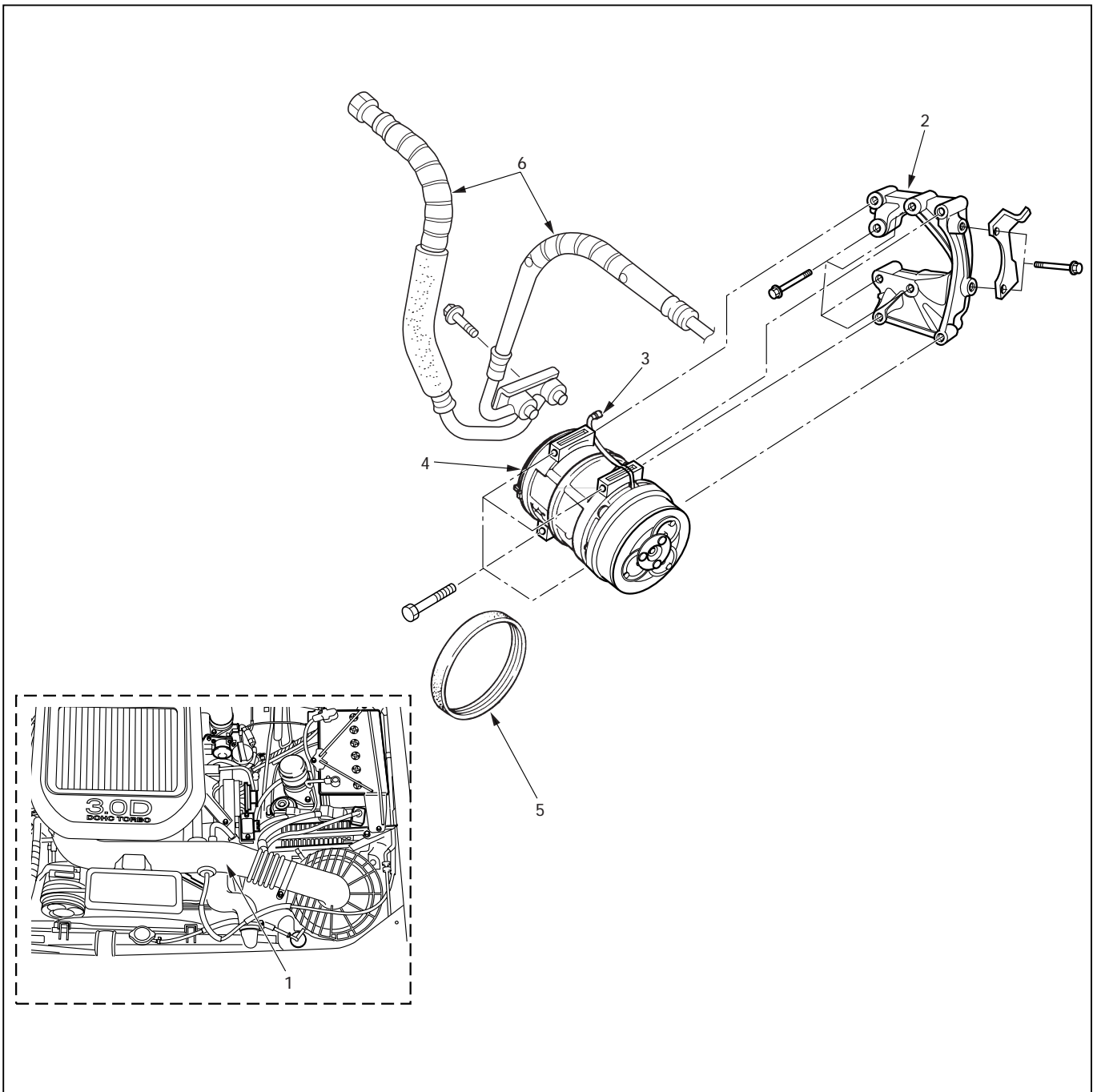
3. Drive Belt

- 1) Temporary tighten the power steering pump unit fixing bolts.
- 2) Push the drive belt when the force of 98N (10kgf), and adjust the drive belt tension by tightening drive belt tension adjustment bolt, till the $14 \sim 17\text{ mm}$ ($0.55 \sim 0.67\text{ in.}$) of deflection of the belt is obtained. Then tighten the power steering pump fixing bolts.

2. Magnetic Clutch Harness Connector

1. Air Duct (Turbo to air cleaner)

4JX1 ENGINE



852RY00011

Removal Steps

1. Air duct
2. Compressor bracket
3. Magnetic clutch harness connector
4. Compressor
5. Drive belt
6. Refrigerant line connector

Installation Steps

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

REMOVAL

Preparation:

- Battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section)

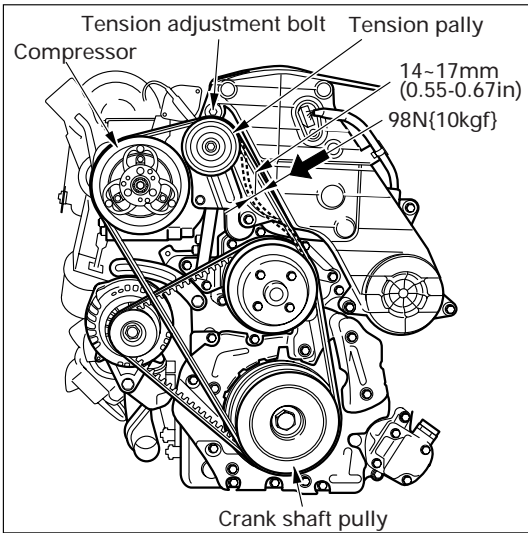
1. Air Duct (Turbo to air cleaner)

Cover up the air duct connecting portion to prevent foreign materials from getting into the turbo and the air cleaner.

2. Magnetic Clutch Harness Connector

3. Drive Belt

Loosen the power steering pump unit fixing bolts, then loosen the drive belt adjustment bolt and remove the drive belt.



850RY00003

4. Refrigerant Line Connector

5. Compressor

INSTALLATION

5. Compressor

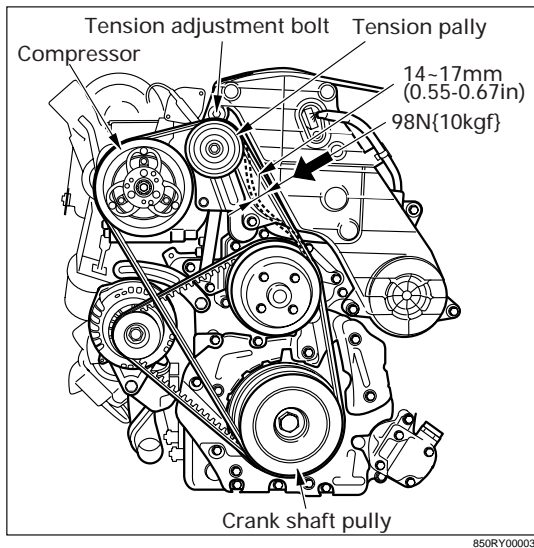
Tighten the compressor fixing bolts to the specified torque.

Compressor Bolt Torque	N·m (kg·m / lb·ft)
	40 (4.1 / 30)

4. Refrigerant Line Connector

- O-rings cannot be reused. Always replace with new ones.
- Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
- Tighten the refrigerant line connector to the specified torque.

Refrigerant Line Bolt Torque	N·m (kg·m / lb·ft)
	27 (2.8 / 20)



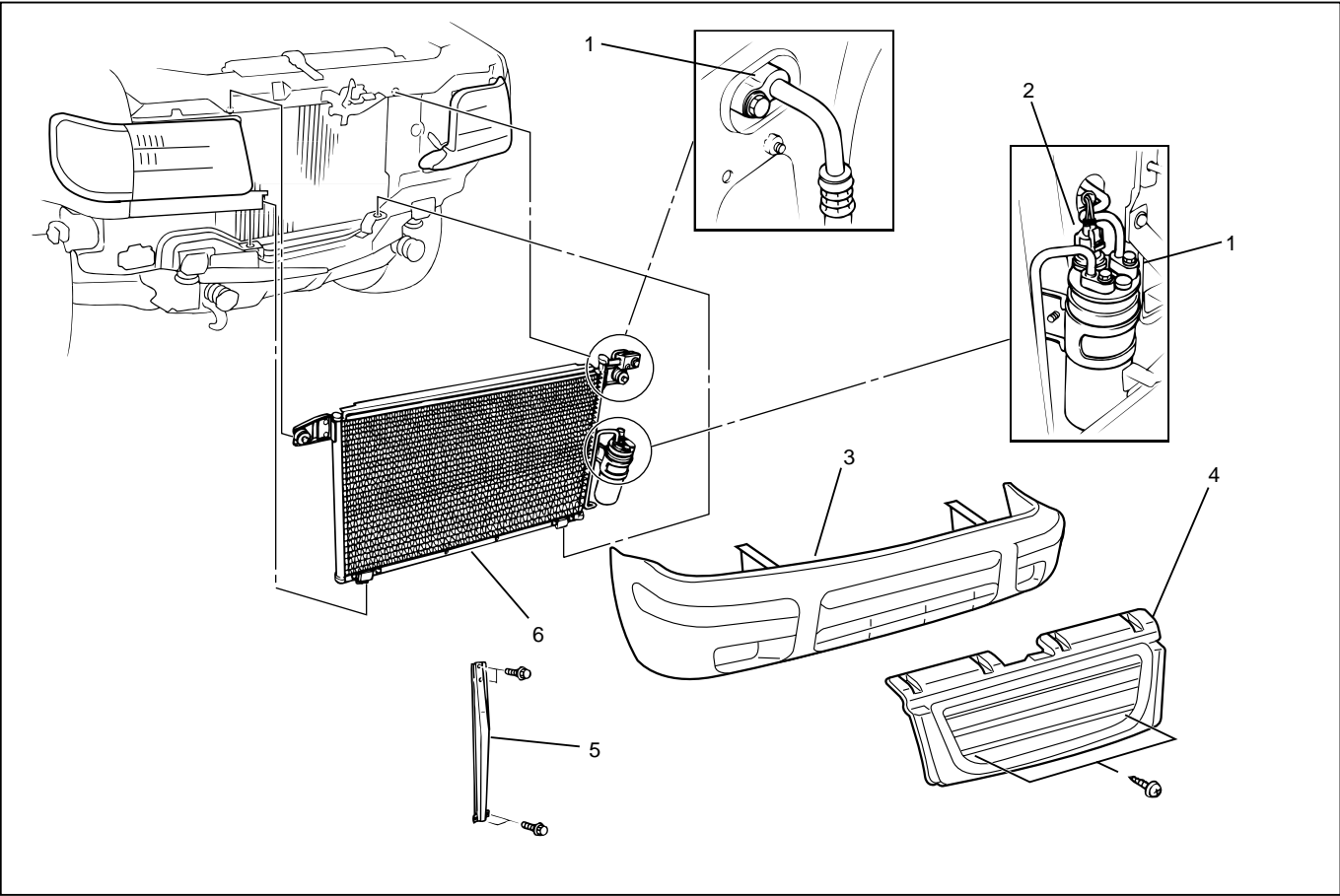
3. Drive Belt

- 1) Temporary tighten the power steering pump unit fixing bolts.
- 2) Push the drive belt when the force of 98N {10kgf}., and adjust the drive belt tension by tightening drive belt tension adjustment bolt, till the 14 ~ 17 mm (0.55 ~ 0.67 in) of deflection of the belt is obtained. Then tighten the power steering pump fixing bolts.

2. Magnetic Clutch Harness Connector

1. Air Duct (Turbo to air cleaner)

CONDENSER ASSEMBLY (LHD V6 WITHOUT CONDENSER FAN)



875RW001

Legend

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



REMOVAL

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



INSTALLATION

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

Condenser Fixing Torque	N·m (kg·m / lb·in)
	6 (0.6 / 52)



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

Inlet Line Torque	N·m (kg·m / lb·ft)
	15 (1.5 / 11)



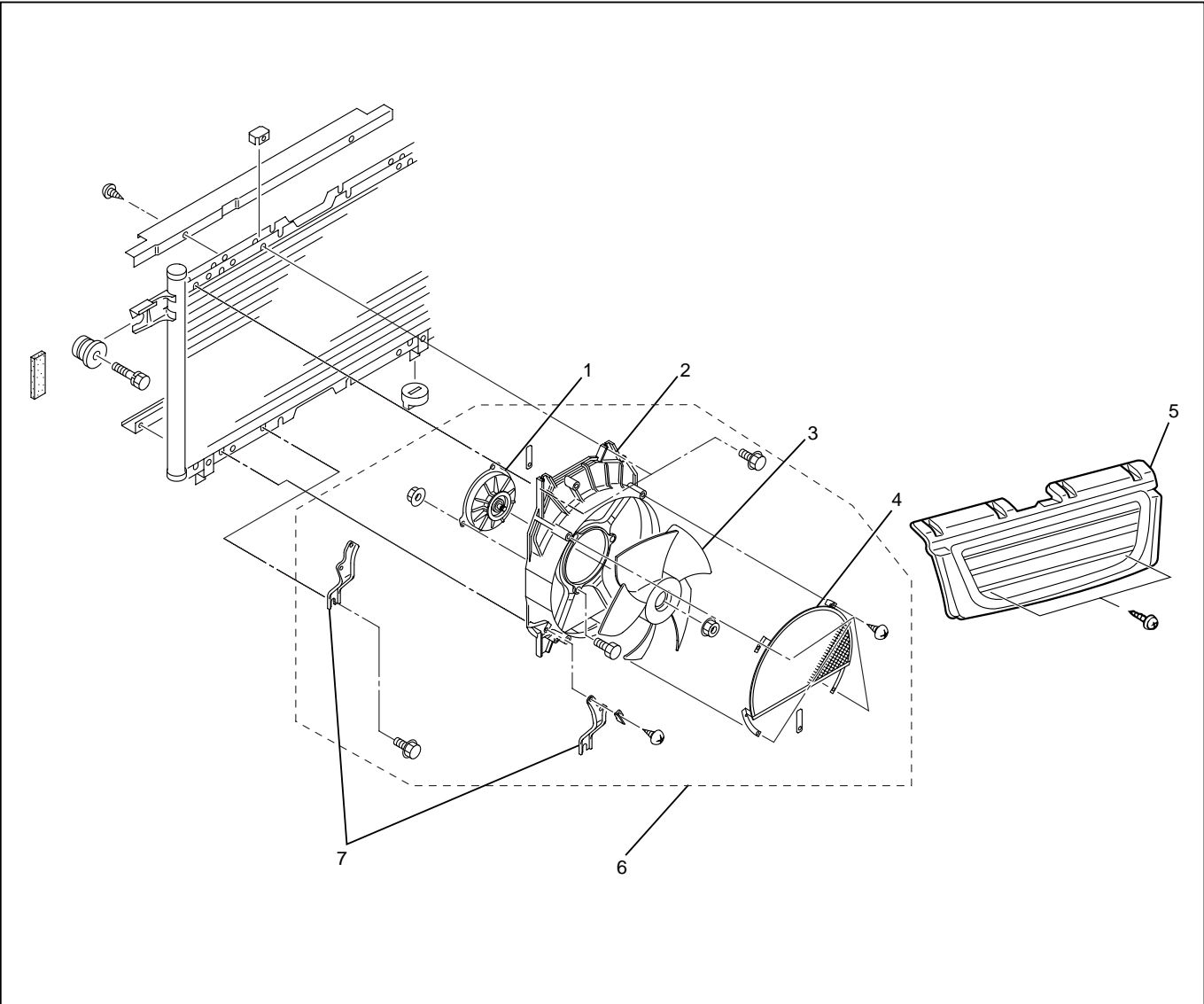
- Tighten the outlet line connector fixing bolt to the specified torque.

Outlet Line Torque	N·m (kg·m / lb·in)
	6 (0.6 / 52)



- O-rings cannot be reused. Always replace with new ones.
 - Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line..
3. Connect pressure switch connector.
 4. Install engine hood front end stay.
 5. Install front bumper assembly.
 6. Install radiator grille.

CONDENSER FAN MOTOR



875RY00002

Removal Steps

- (1) Condenser Fan Motor
- (2) Fan Motor Shroud
- (3) Motor Fan
- (4) Condenser Unit Net
- (5) Radiator Grille
- (6) Condenser Fan Assembly
- (7) Shroud Bracket

Removal

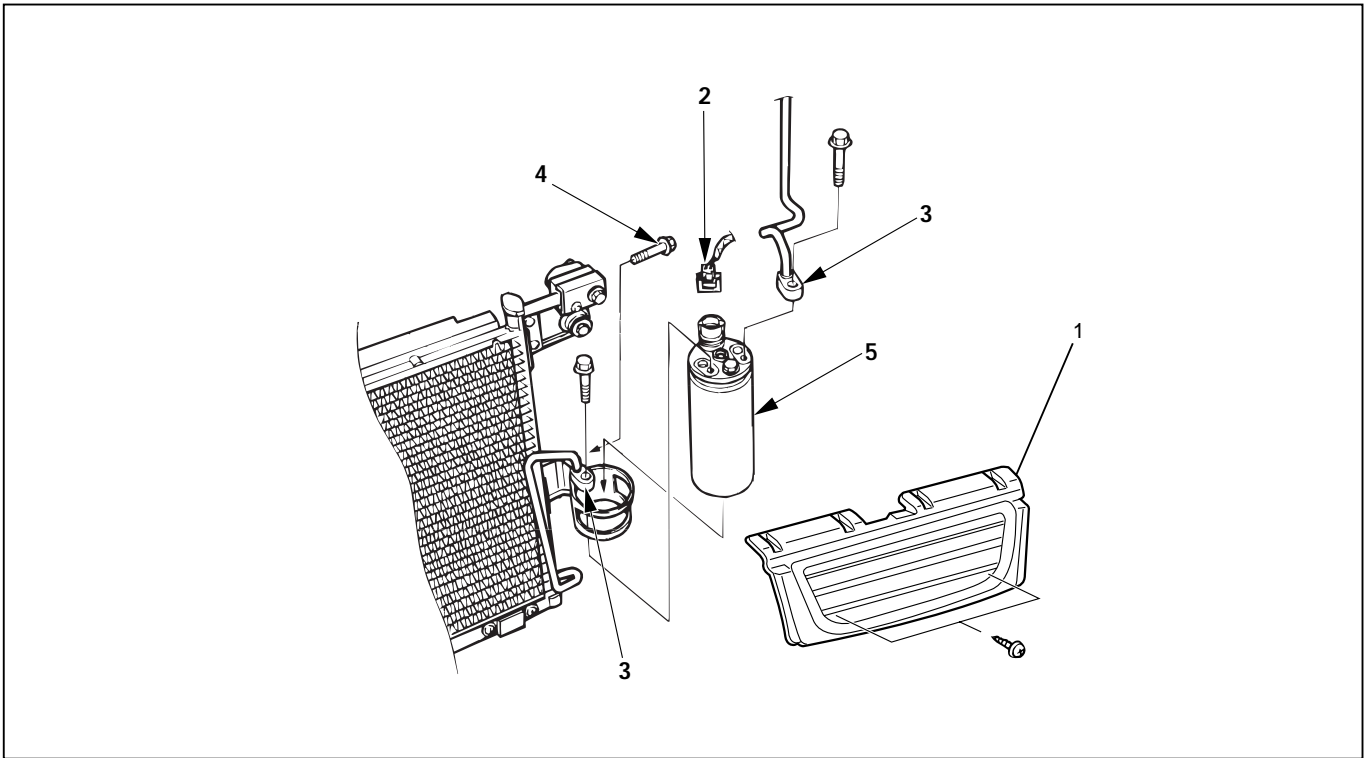
1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
 - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove condenser fan assembly.
 - Disconnect the fan motor connector and remove the 4 fixing bolts.
5. Remove condenser unit net.
 - Remove the 4 fixing screws.
6. Remove motor fan.
7. Remove condenser fan motor.

Installation

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

1. Route the fan motor harness in its previous position and fix it securely with clip and bracket.

RECEIVER/DRIER



Removal Steps

1. Radiator grille
2. Pressure switch connector
3. Refrigerant line
4. Bracket bolt
5. Receiver/drier

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section.)

1. **Radiator Grille**
2. **Pressure Switch Connector**
3. **Refrigerant Line**
When removing the line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
4. **Bracket Bolt**
5. **Receiver/Drier**
Loosen the bolt, then, using care not to touch or bend the refrigerant line, carefully pull out the receiver/drier.



INSTALLATION

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



1. If installing a new receiver/drier, be sure to add 30 cc (0.8 Imp fl oz) of new compressor oil to a new one.
2. Put the receiver/drier in the bracket, and connect with the refrigerant line. Check that no excessive force is imposed on the line. Fasten the bracket bolt to the receiver/drier.
3. Tighten the line to the specified torque.

Refrigerant Line Bolt Torque	N·m (kg·m / lb·in)
------------------------------	--------------------

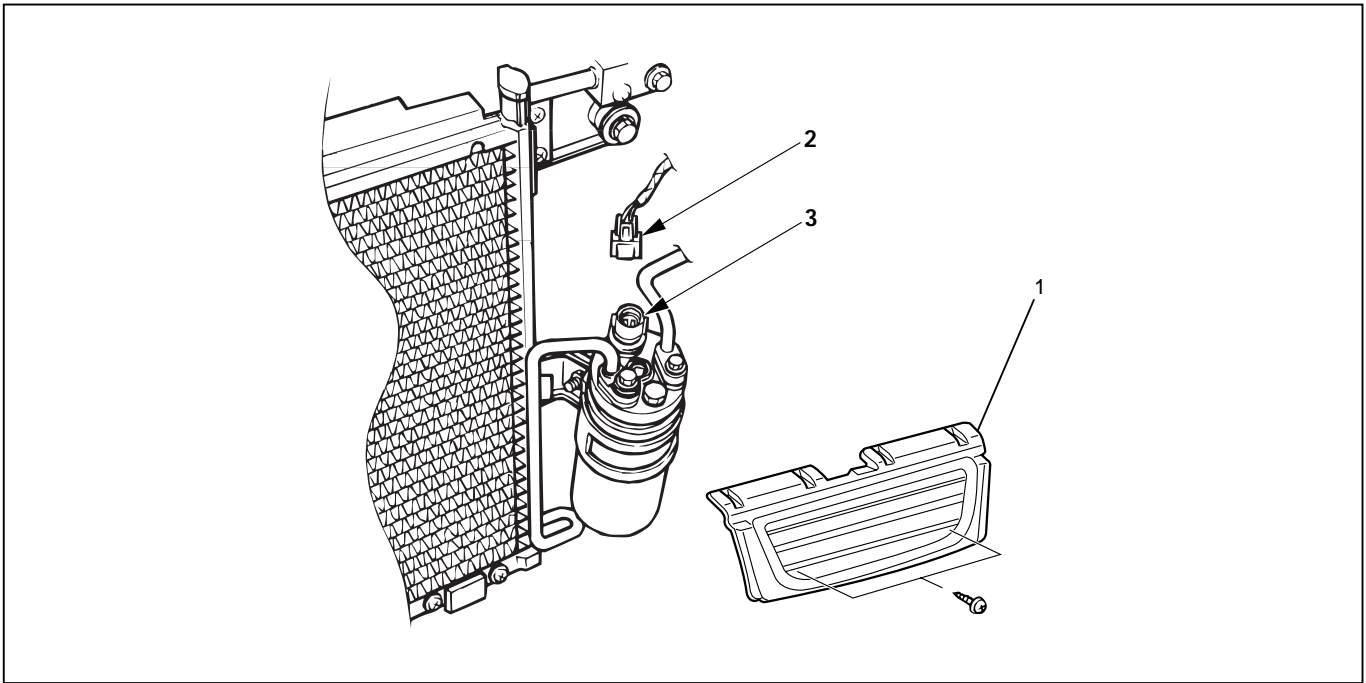


6 (0.6 / 52)

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



PRESSURE SWITCH



Removal Steps

1. Radiator grille
2. Pressure switch connector
3. Pressure switch

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section.)

1. **Radiator Grille**
2. **Pressure Switch Connector**
3. **Pressure Switch**

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



INSTALLATION

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

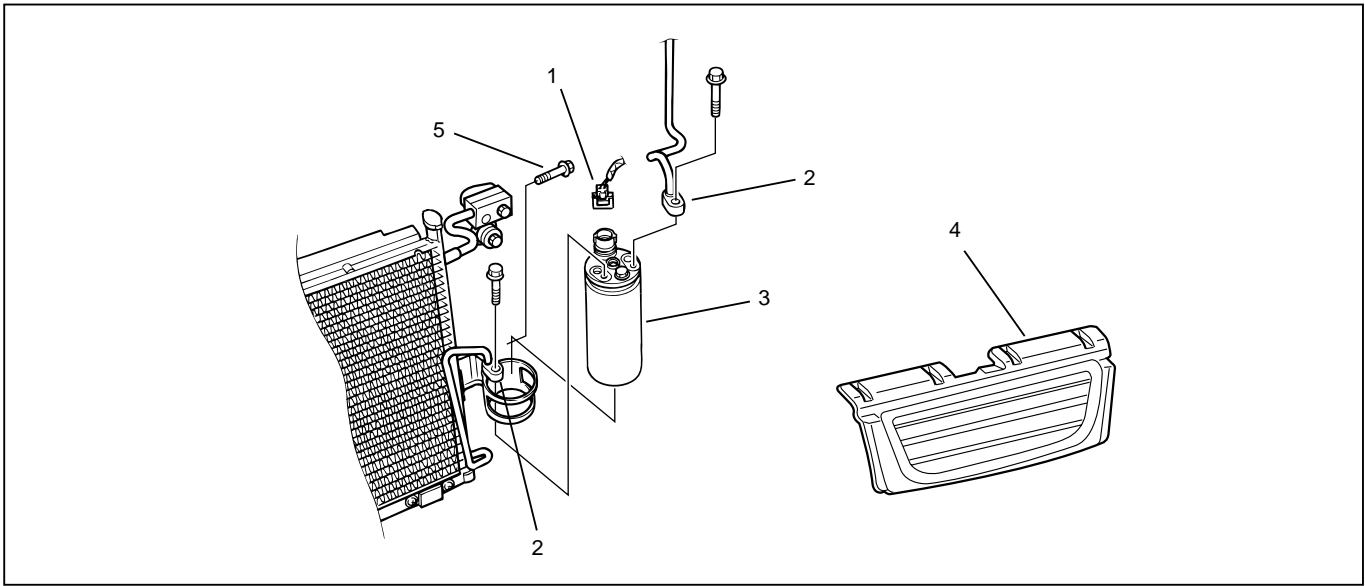
1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.



Pressure Switch Torque N·m (kg·m / lb·in)



Receiver/Drier and Associated Parts (LHD V6 without Condenser Fan)



875RW002

Legend

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



REMOVAL

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



INSTALLATION

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

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

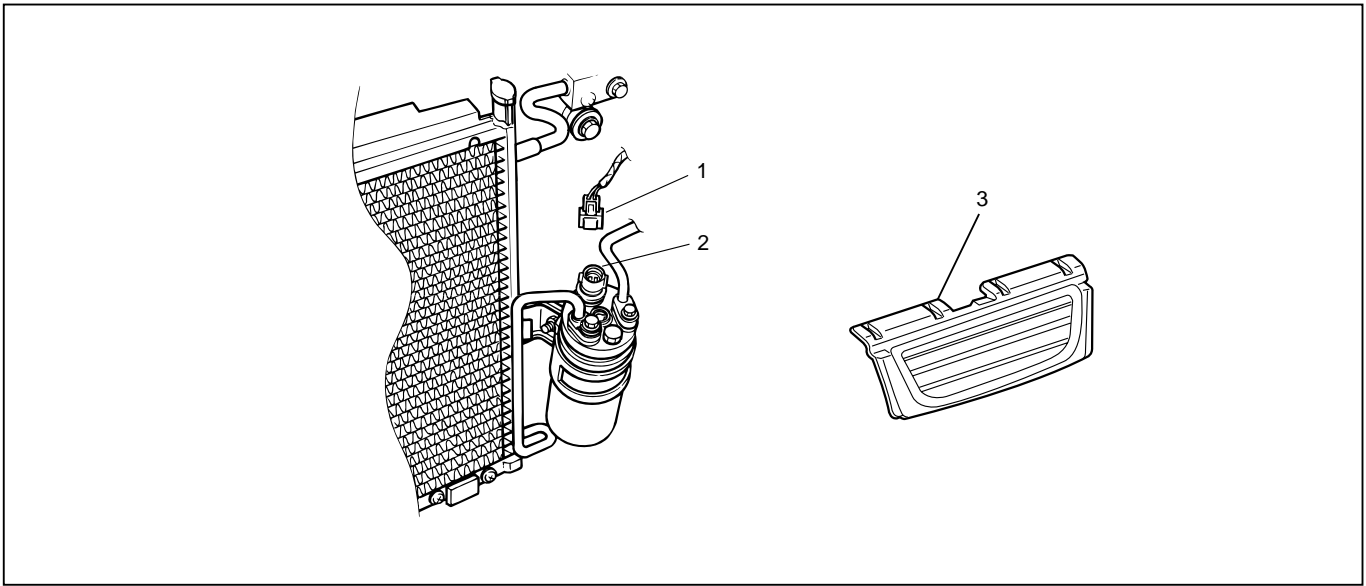
Refrigerant Line Bolt Torque N·m (kg·m / lb·in)

6 (0.6 / 52)



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

Pressure Switch and Associated Parts



875RW005

Legend

- 1. Pressure switch connector
- 2. Pressure switch
- 3. Radiator Grille



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section.)

1. Radiator Grille
2. Pressure Switch Connector
3. Pressure Switch

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



INSTALLATION

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

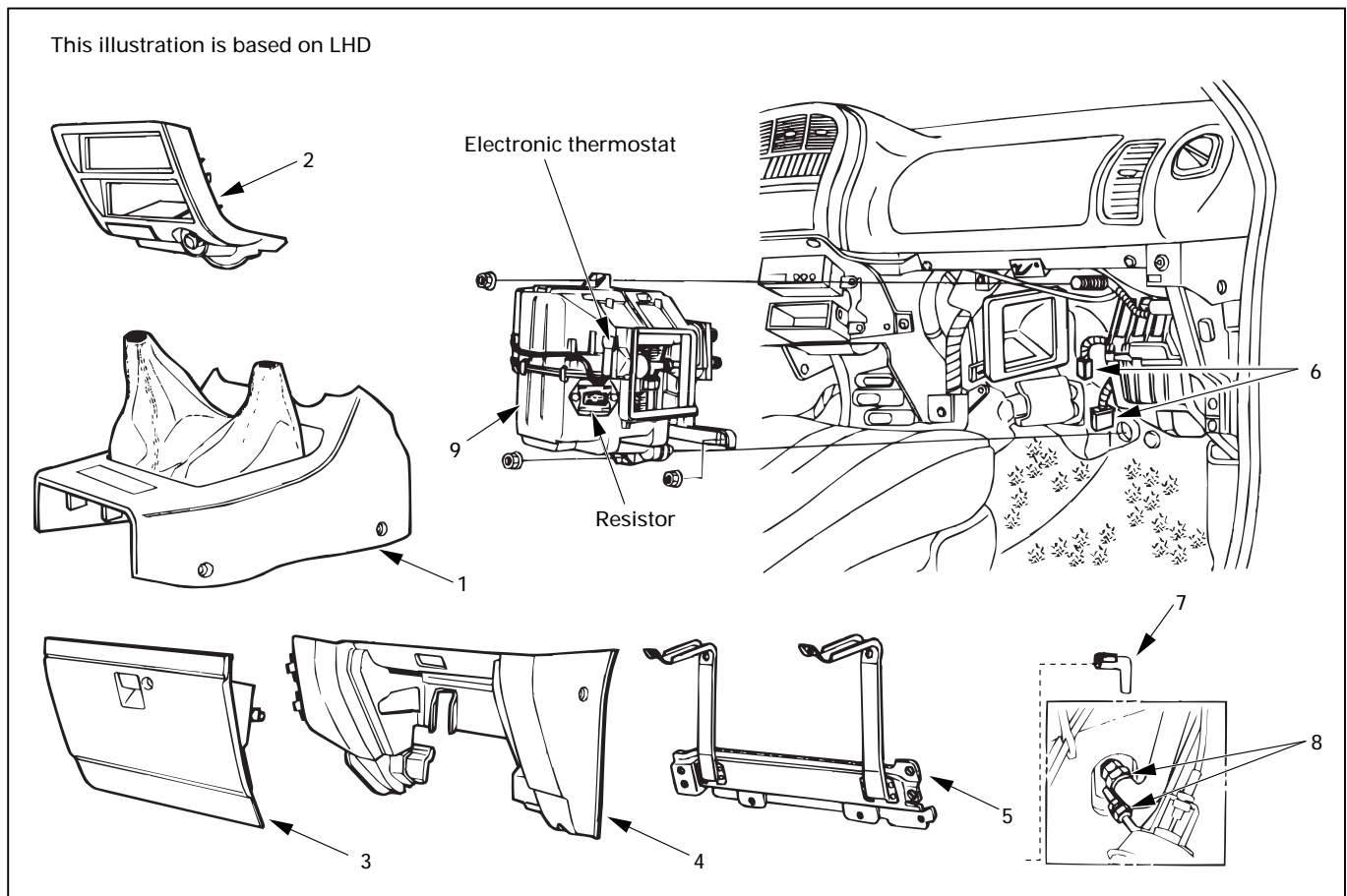
1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.

Pressure Switch Torque N·m (kg·m / lb·in)



13 (1.3 / 113)

EVAPORATOR ASSEMBLY



850RW0001

Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Glove box
4. Instrument panel passenger lower cover assembly
5. Passenger knee bolster reinforcement assembly
6. Resistor and electronic thermostat connector
7. Drain hose
8. Refrigerant line
9. Evaporator assembly

Installation Steps

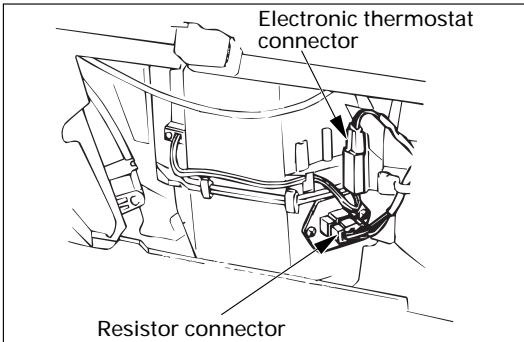
To install, follow the removal steps in the reverse order.

 **REMOVAL**

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section.)

1. **Front Console Assembly**
2. **Lower Cluster Assembly**
3. **Glove Box**
4. **Instrument Panel Passenger Lower Cover Assembly**
5. **Passenger Knee Bolster Reinforcement Assembly**
 - Refer to Section 10 "BODY" for INSTRUMENT PANEL ASSEMBLY removal procedure.
6. **Resistor and Electronic Thermostat Connector**



7. **Drain Hose**
8. **Refrigerant Line**
 - Use a back-up wrench when disconnecting and reconnecting the refrigerant lines.
 - When removing the refrigerant line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
9. **Evaporator Assembly**

 **INSTALLATION**

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



1. To install a new evaporator assembly, add 50cc (1.4 Imp fl oz) of new compressor oil to a new core.
2. Tighten the refrigerant outlet line to the specified torque.

Outlet Line Torque	N·m (kg·m / lb·ft)
25 (2.5 / 18)	



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

Inlet Line Torque	N·m (kg·m / lb·ft)
15 (1.5 / 11)	



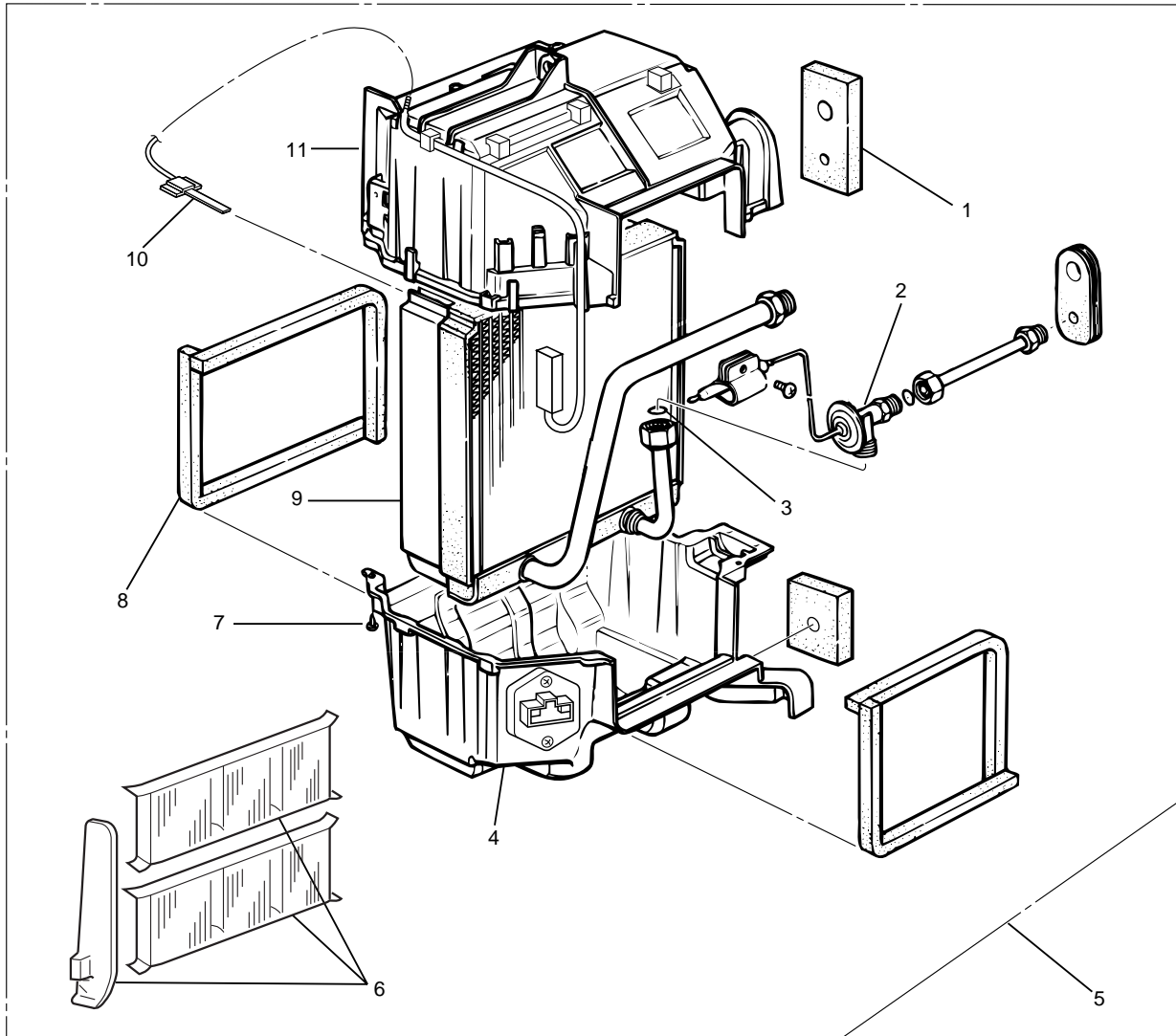
4. O-rings cannot be reused. Always replace with new ones.



5. Be sure to apply new compressor oil to the O-rings when connecting lines.

EVAPORATOR CORE AND/OR EXPANSION VALVE

This illustration is based on LHD



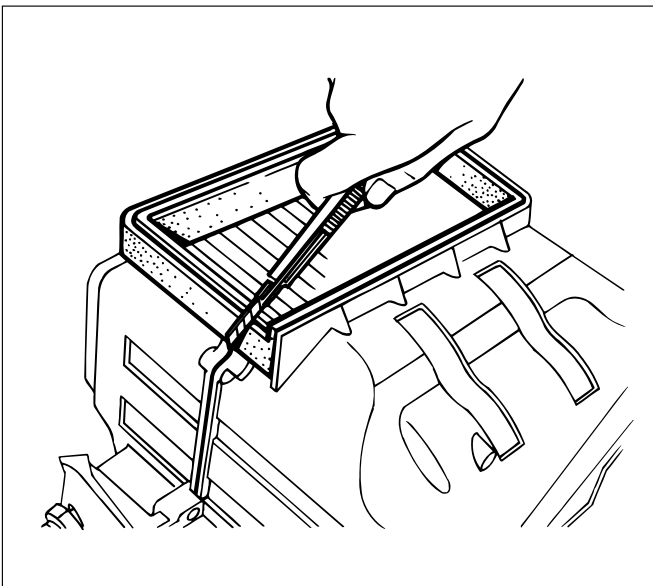
874RY00012

Legend

- | | |
|-------------------------|----------------------------|
| (1) Lining | (7) Attaching Screw |
| (2) Expansion Valve | (8) Lining |
| (3) O-ring | (9) Evaporator Core |
| (4) Lower Case | (10) Electronic Thermostat |
| (5) Evaporator Assembly | (11) Upper Case |
| (6) Pollen Filter | |

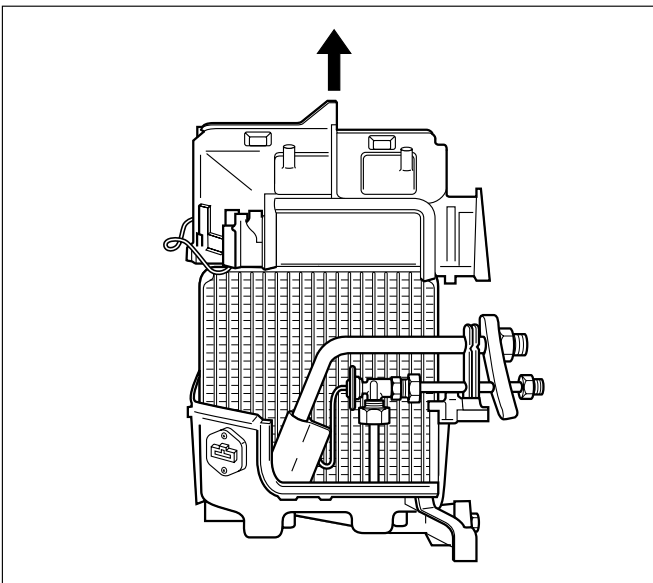
Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
 - Refer to Refrigerant Recovery in this section.
3. Remove evaporator assembly.
 - Refer to Evaporator Assembly in this section.
4. Remove pollen filter.
5. Pull the sensor from the evaporator assembly.
6. Remove attaching screw.
7. Remove upper case.
8. Remove lower case.
 - Slit the case parting face with a knife since the lining is separated when removing the evaporator.



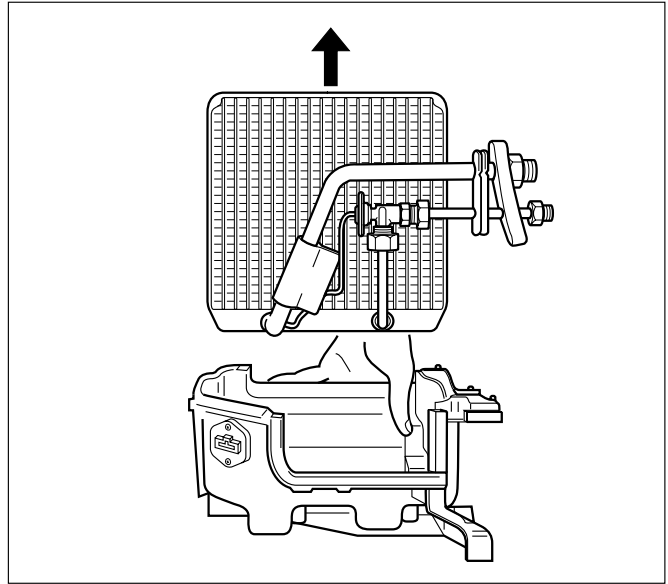
874RS006

- Lift to remove the upper case.



874RY0005

9. Remove evaporator core.



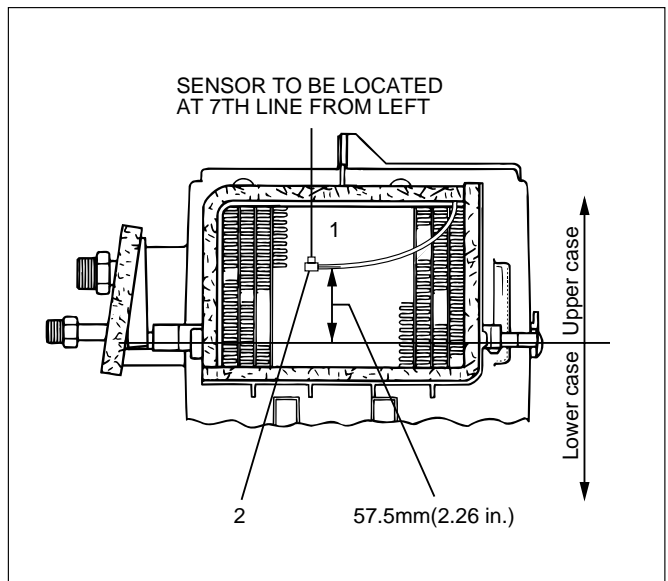
874RY0006

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

Installation

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

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

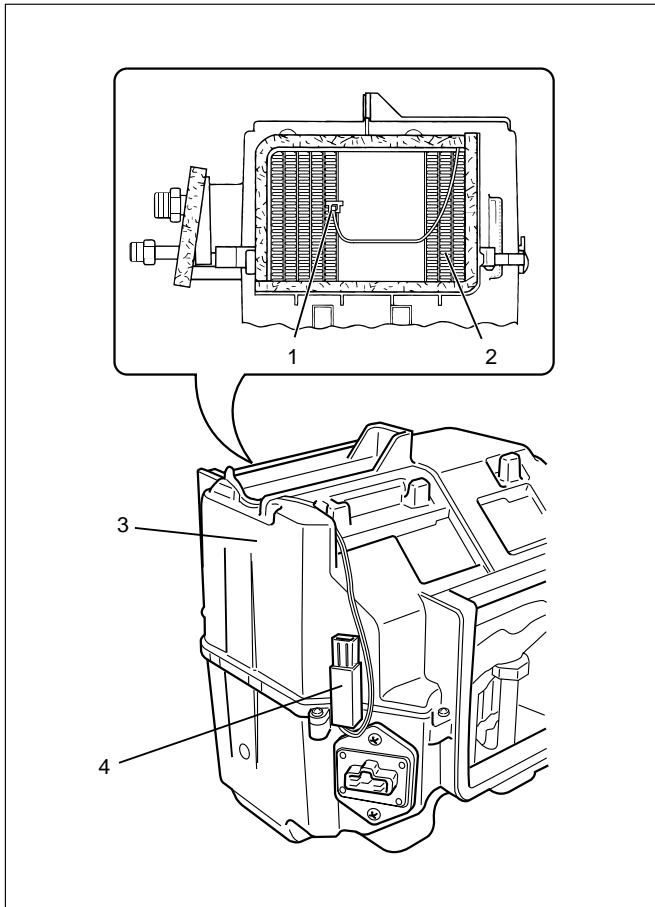


874RX021

1B – 46 AIR CONDITIONING

4. O-rings cannot be reused, Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.
6. Be sure to install the sensor and the insulator on the place where they were before.
7. To install a new evaporator core, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
8. Tighten the refrigerant lines to the specified torque. Refer to Main Data and Specifications for Torque Specifications in this section.
9. Apply an adhesive to the parting face of the lining when assembling the evaporator assembly.

ELECTRONIC THERMOSTAT



874RX022

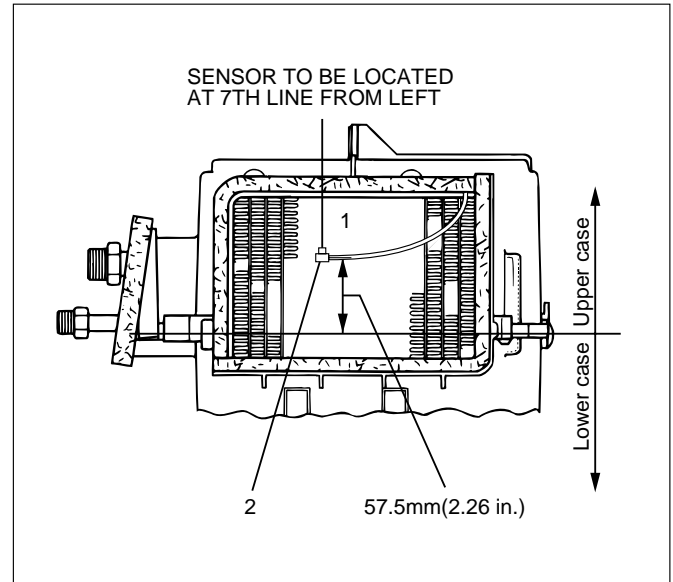
Legend

- (1) Thermo Sensor
- (2) Evaporator Core
- (3) Evaporator
- (4) Thermostat Unit

Installation

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

1. Install the thermostat sensor to the evaporator core specified position with the clip.
2. The sensor is installed on the core with the clip and it must not interfere with the core.

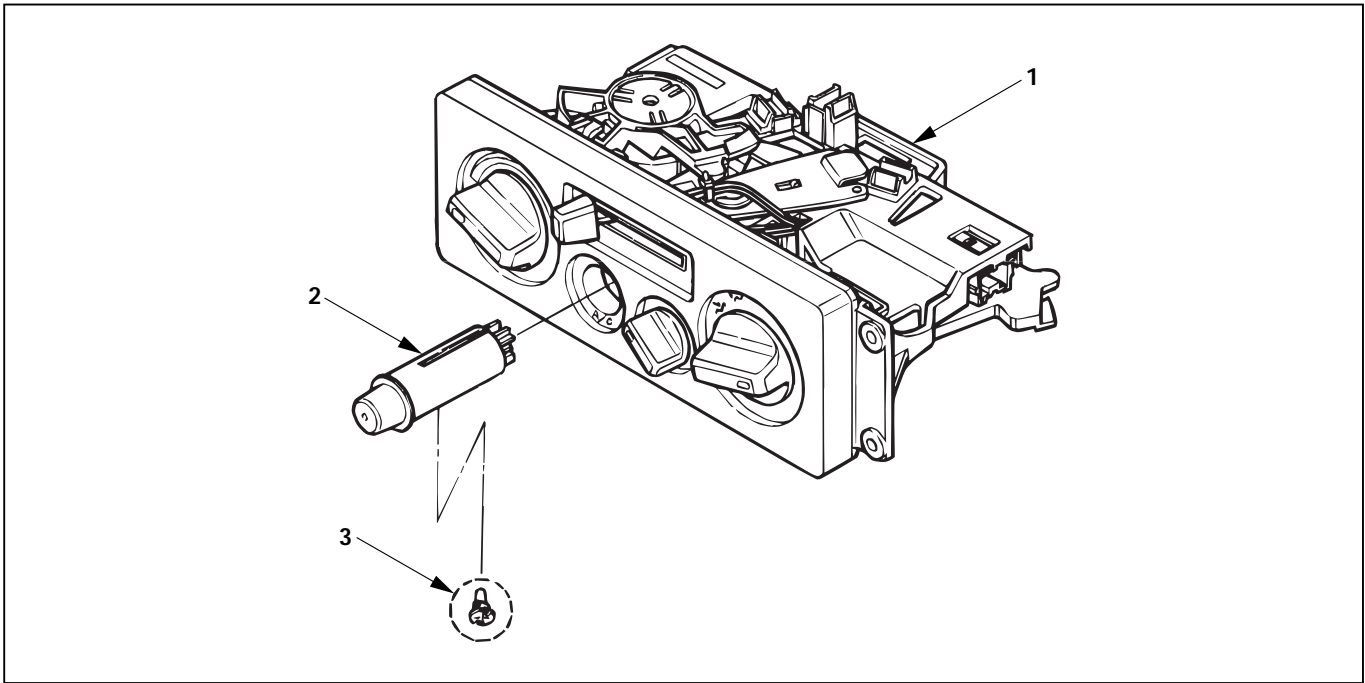


874RX021

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
 - Refer to Refrigerant Recovery in this section.
3. Remove evaporator assembly.
 - Refer to Evaporator Assembly removal procedure in this section.
4. Remove electronic thermostat.
 - Pull the sensor from the evaporator assembly.

A/C SWITCH AND ILLUMINATION BULB



Removal Steps

1. Control lever assembly
2. A/C switch
3. Illumination bulb

Installation Steps

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

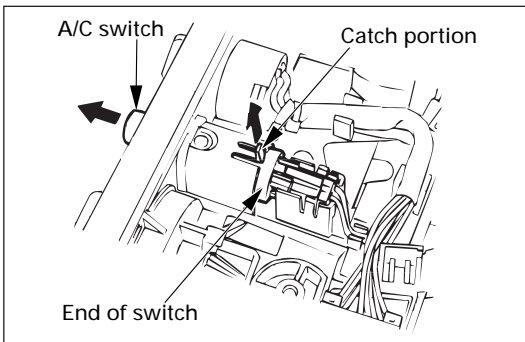


REMOVAL

Preparation:

Disconnect the battery ground cable

1. **Control Lever Assembly**
Refer to Section 1A "CONTROL LEVER ASSEMBLY" removal procedure.
2. **A/C Switch**
Raise up the catch portion of the switch and remove the switch while pushing it toward the outside.



3. **Illumination Bulb**

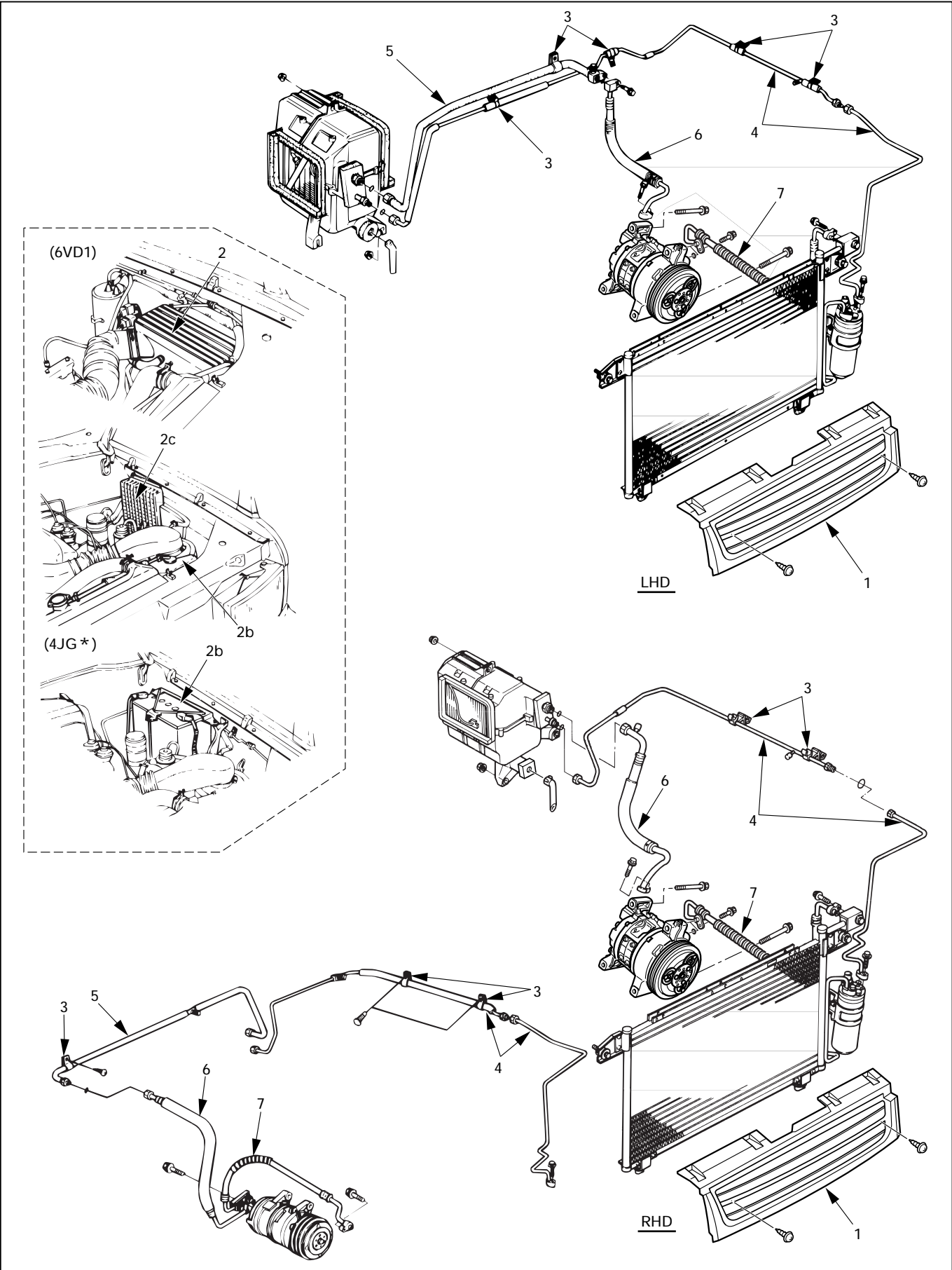
Turn the illumination bulb counterclockwise to remove.



INSTALLATION

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

REFRIGERANT LINE



Removal Steps

1. Radiator grille
2. Air cleaner
 - 2a. Dust
 - 2b. Battery and reserver tank
 - 2c. Air cleaner cover
3. Clip and clamp
4. Liquid line (High-pressure pipe)
5. Suction line (Low-pressure pipe)
6. Suction line (Low-pressure hose)
7. Discharge line (High-pressure hose)

Installation Steps

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



REMOVAL

Preparation:

- Disconnect the battery ground cable
- Discharge and recover refrigerant (Refer to "REFRIGERANT RECOVERY" in this section.)

1. Radiator Grille
2. Air Cleaner
 - 2a. Duct
 - 2b. Battery and Reserver Tank
 - 2c. Air Cleaner Cover
3. Clip and Clamp
4. Liquid Line (High-pressure pipe)
5. Suction Line (Low-pressure pipe)
6. Suction Line (Low-pressure hose)
7. Discharge Line (High-pressure hose)
 - Use a back-up wrench when disconnecting and reconnecting the refrigerant lines.
 - When removing the refrigerant line connecting part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.



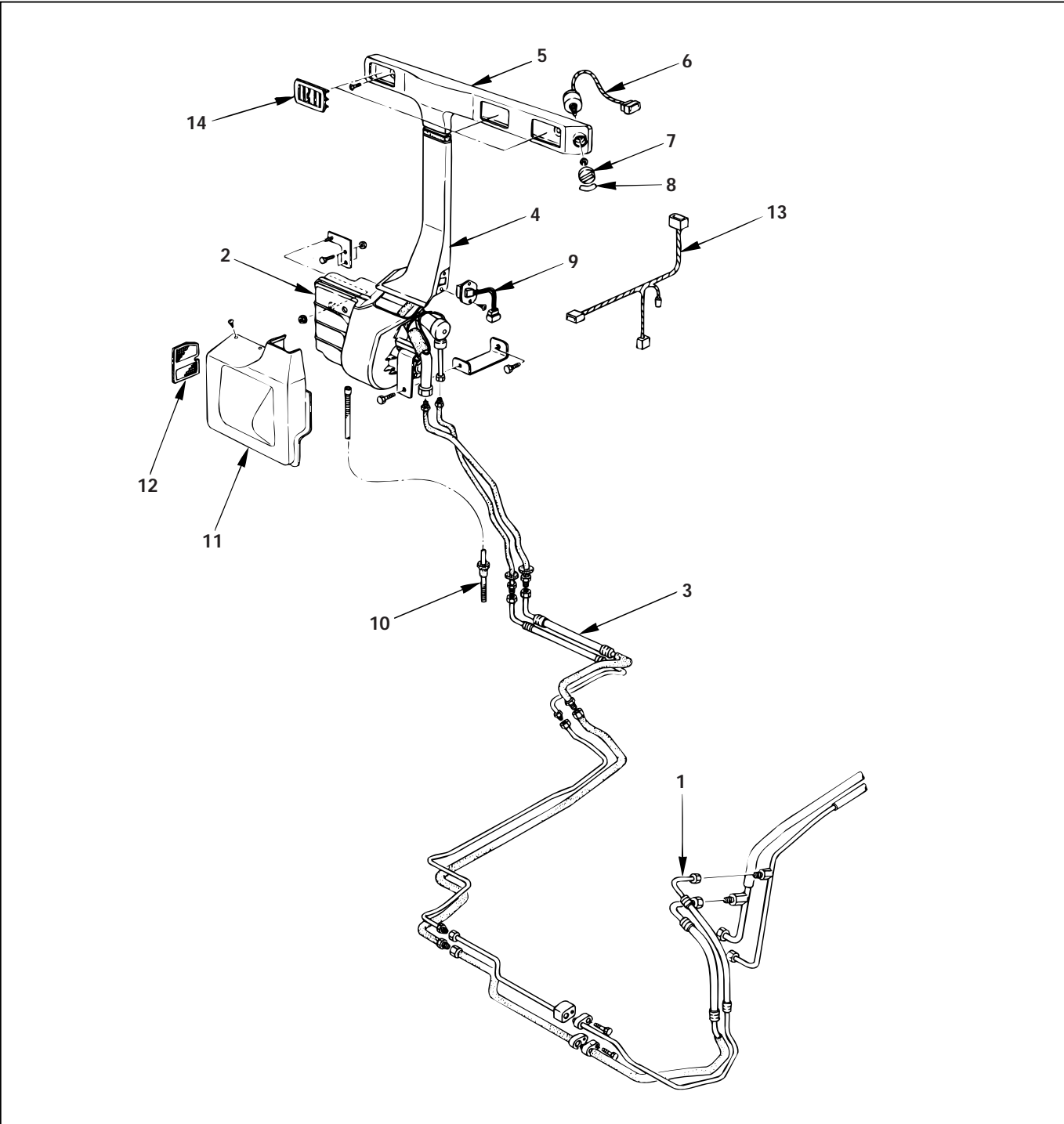
INSTALLATION

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



1. O-rings cannot be reused. Always replace new ones.
2. Be sure to apply compressor oil to the O-rings when connecting refrigerant lines.
3. Tighten the refrigerant line to the specified torque. (Refer to "SERVICE INFORMATION" for FIXING TORQUE in section 00.)

REAR COOLER PARTS

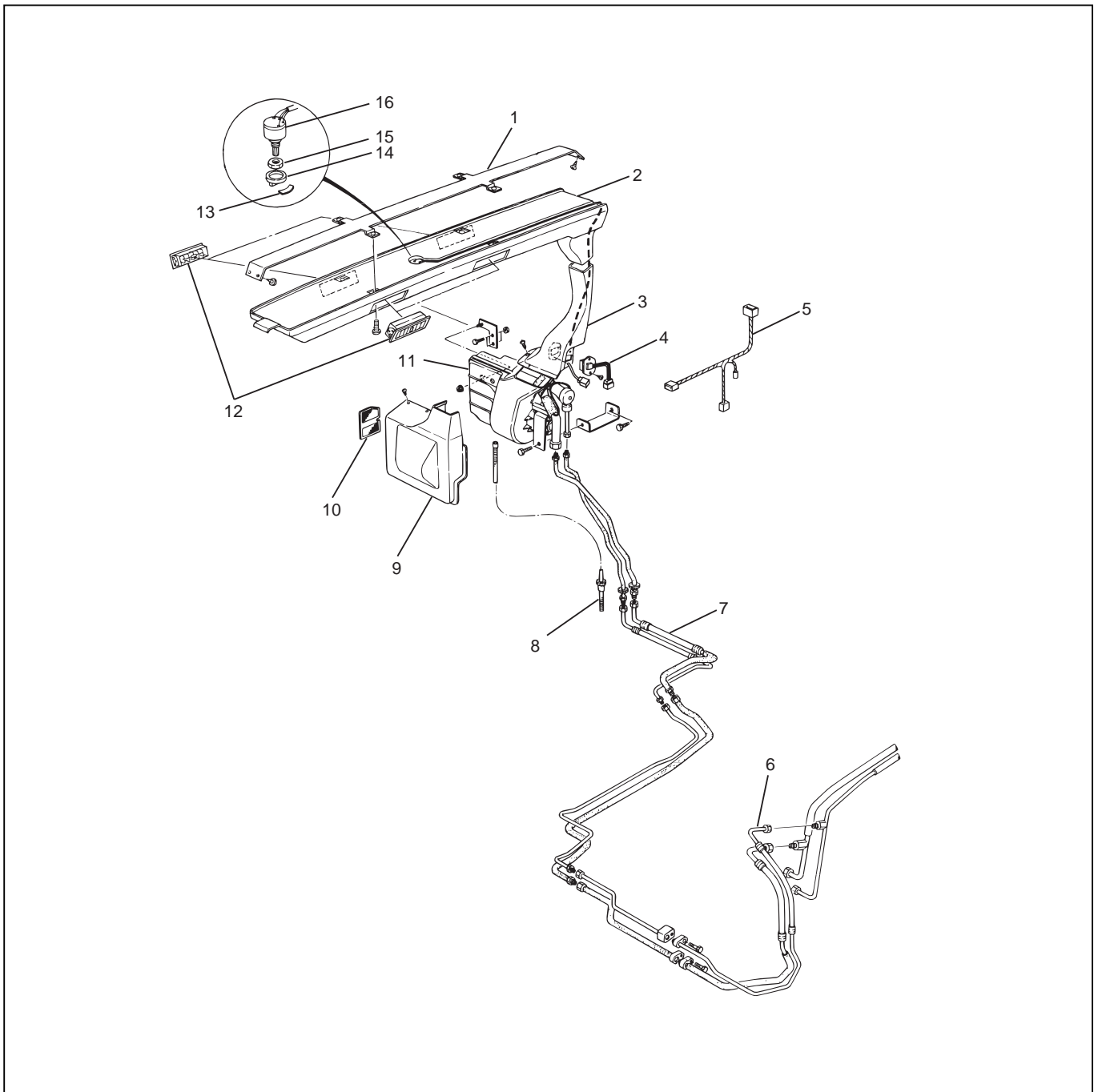


855RY0002

Legend

- (1) Liquid Line (high pressure pipe)
- (2) Cooling Unit
- (3) Suction Line (low pressure pipe)
- (4) Duct Assembly
- (5) Duct Assembly
- (6) Switch
- (7) Knob
- (8) Panel
- (9) Resistor
- (10) Drain Hose
- (11) Cover Assembly
- (12) Filter
- (13) Wire Harness
- (14) Grille Assembly

REAR COOLER PARTS (ROOF DUCT TYPE)

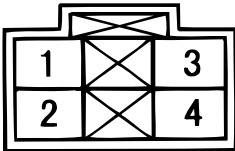
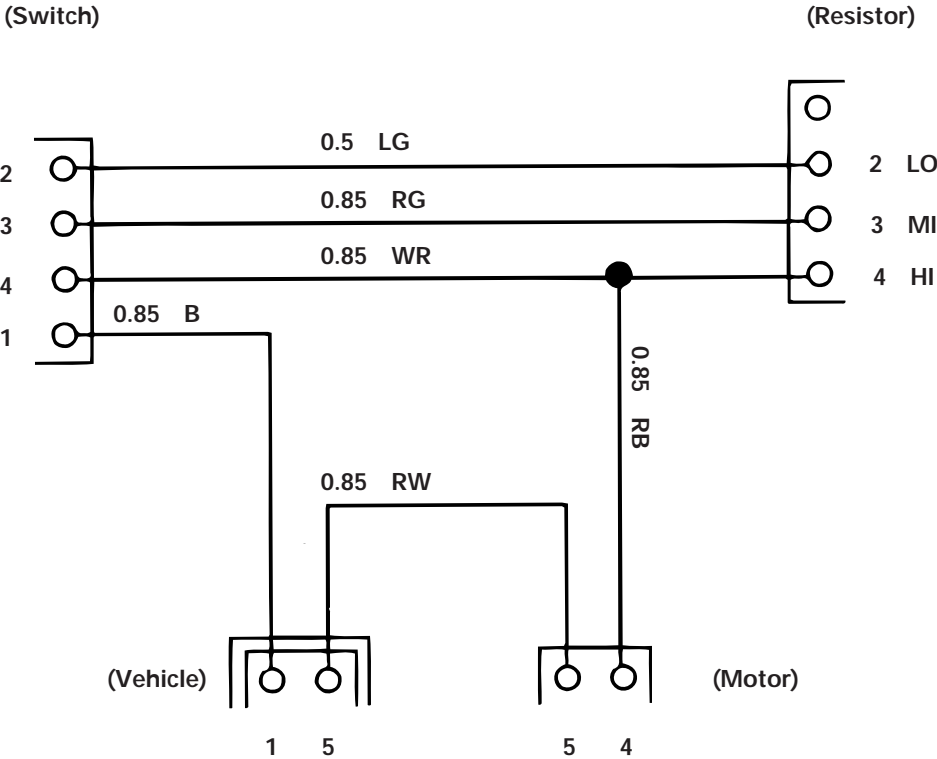


855RY00001

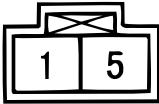
Legend

- | | |
|--------------------------------------|-------------------------|
| (1) Roof Duct Bracket | (9) Cover Assembly |
| (2) Roof Duct | (10) Filter |
| (3) Lower Duct | (11) Cooling Unit |
| (4) Resistor | (12) Grille Assembly |
| (5) Wire Harness | (13) Panel |
| (6) Liquid Line (high pressure pipe) | (14) Knob |
| (7) Suction Line (low pressure pipe) | (15) Nut |
| (8) Drain Hose | (16) Fan Control Switch |

WIRING DIAGRAM



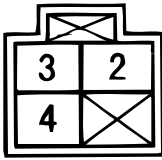
Switch



Vehicle



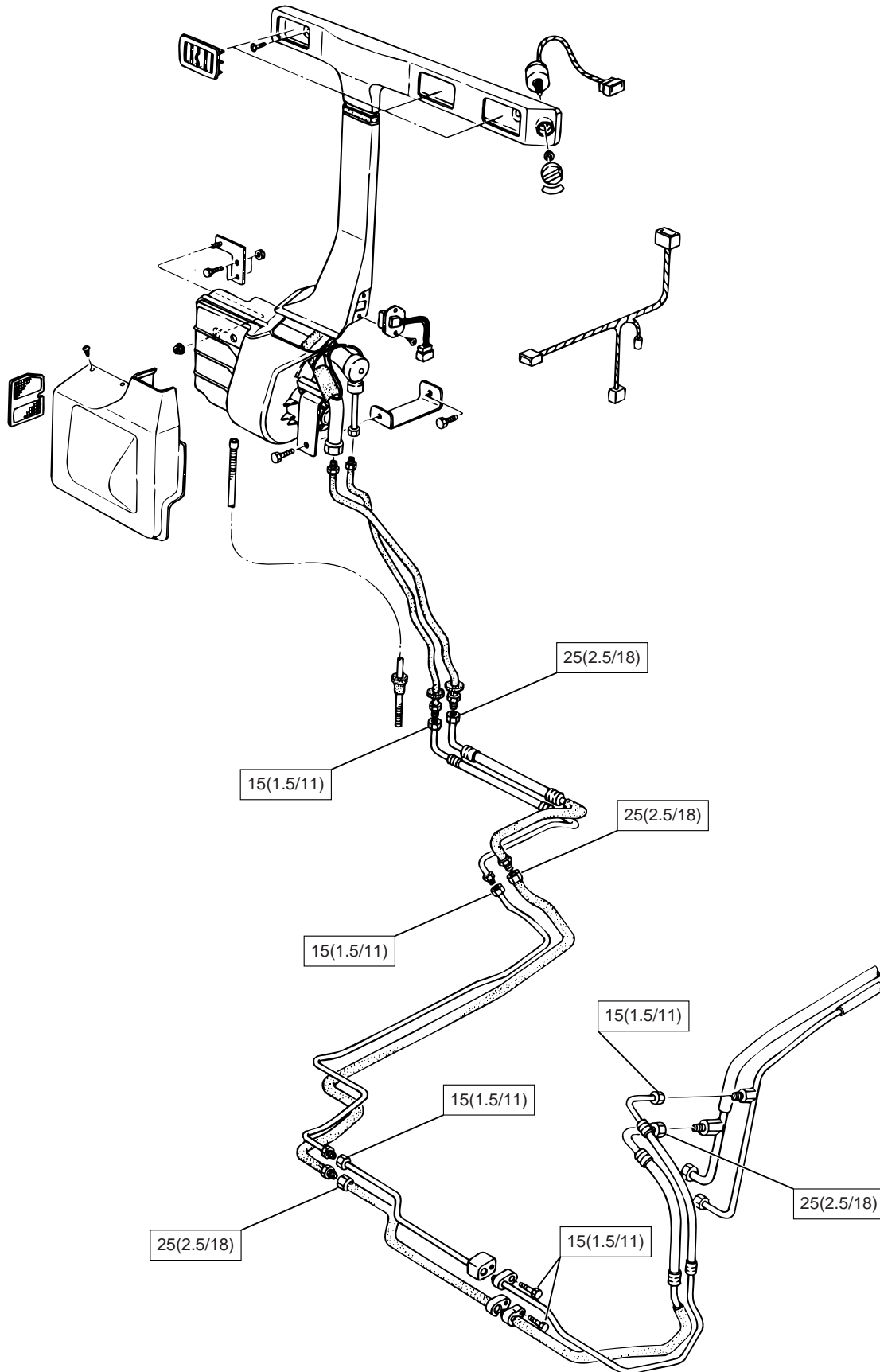
Motor



Resistor

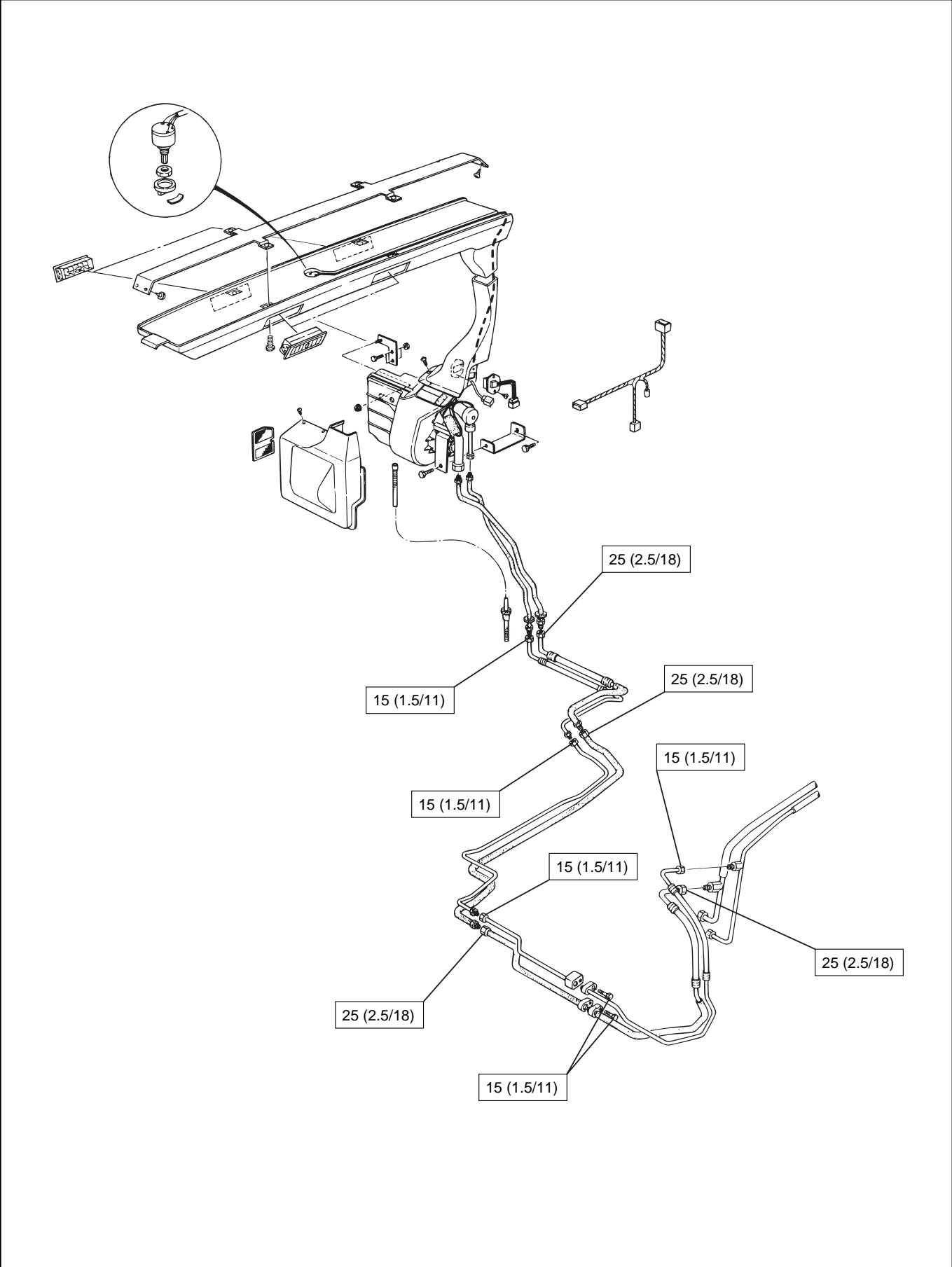
TORQUE SPECIFICATIONS

N·m (kg·m/ib·ft)



TORQUE SPECIFICATIONS (ROOF DUCT TYPE)

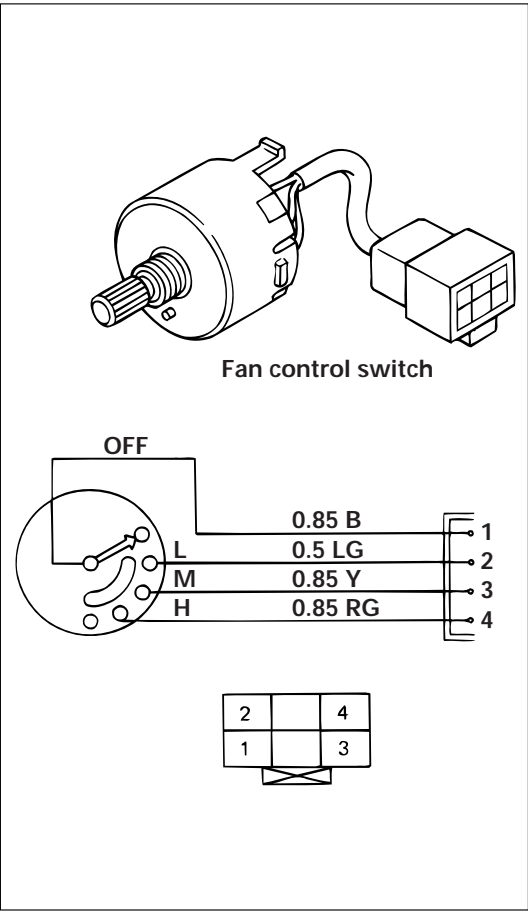
N·m (kg·m/ib·ft)



DIAGNOSIS

Rear Air Conditioning Cycle Diagnosis

Condition	Possible Cause	Correction
No cooling or insufficient cooling	Front air conditioner not switched on.	Switch front A/C switch ON.
	Other	See front air conditioner workshop manual.
Insufficient velocity of cooling air	Clogged filter	Clean or replace cooling unit filter.
	Other	See front air conditioner workshop manual.



825RY00058

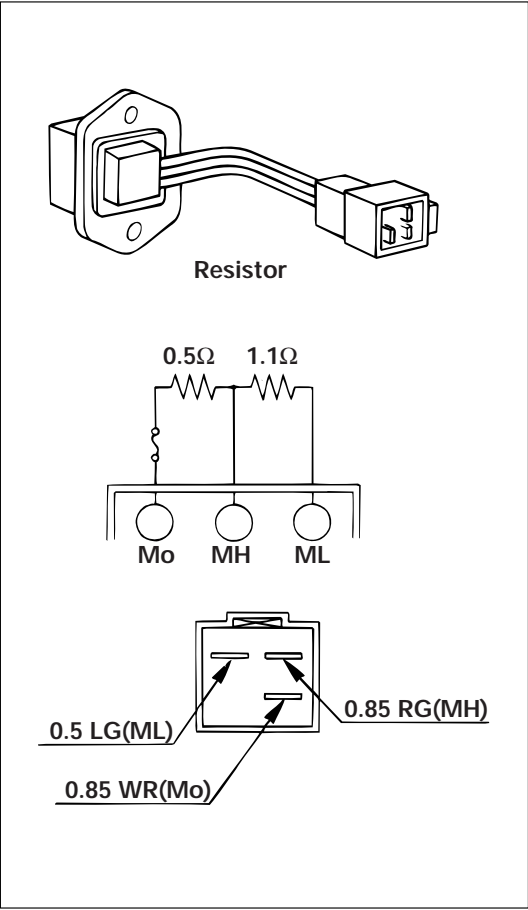
FAN CONTROL SWITCH

Inspection

Using an electric circuit tester, check continuity between terminals.

If not as specified, replace the switch.

	1	2	3	4
OFF				
LOW	○	○		
MEDIUM	○		○	
HIGH	○			○



826RY00016

RESISTOR

Inspection

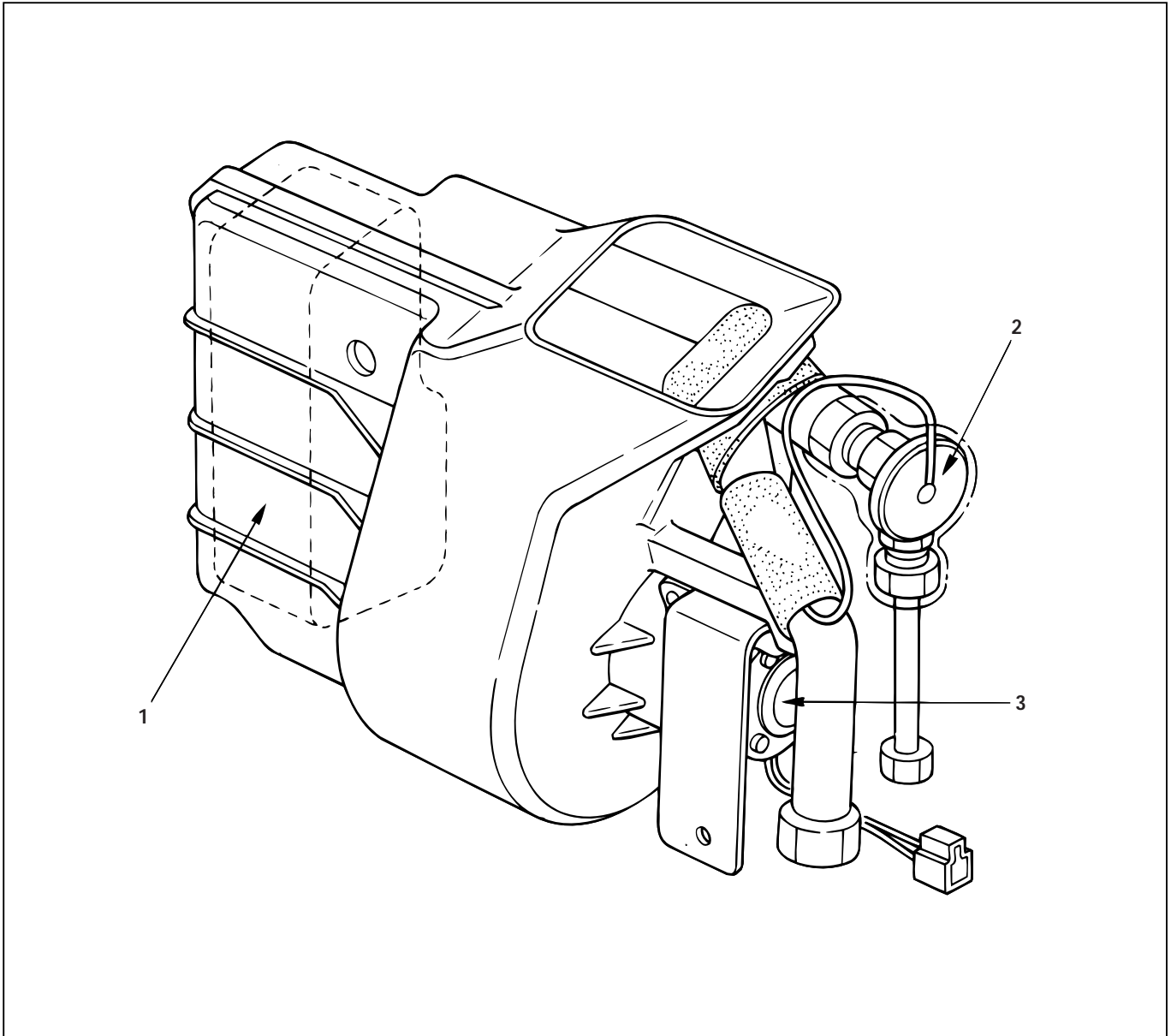
Using an electric circuit tester, check the resistance between the terminals specified below.

If the resistances are not as specified, replace the resistor.

Terminal	Resistance (Ω)
Mo ~ MH	0.5
Mo ~ ML	1.6

COOLING UNIT

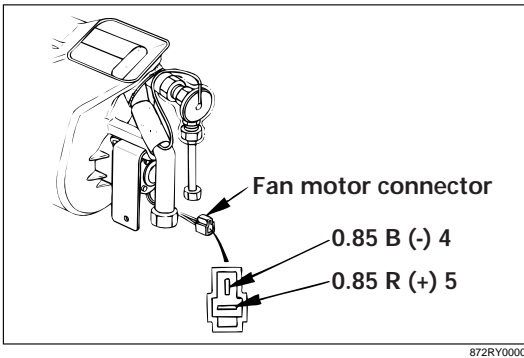
Main Components



872RY00001

Legend

- (1) Evaporator Assembly
- (2) Expansion Valve
- (3) Fan Motor



FAN MOTOR

Inspection

1. Disconnect the fan motor connector from the A/C harness.
2. Connect the battery's positive terminal to the No.5 terminal of the fan motor and the negative terminal to the No.4 terminal.
3. Check that the fan motor operates correctly.

FULL AUTOMATIC AIR CONDITIONING SYSTEM

GENERAL DESCRIPTION

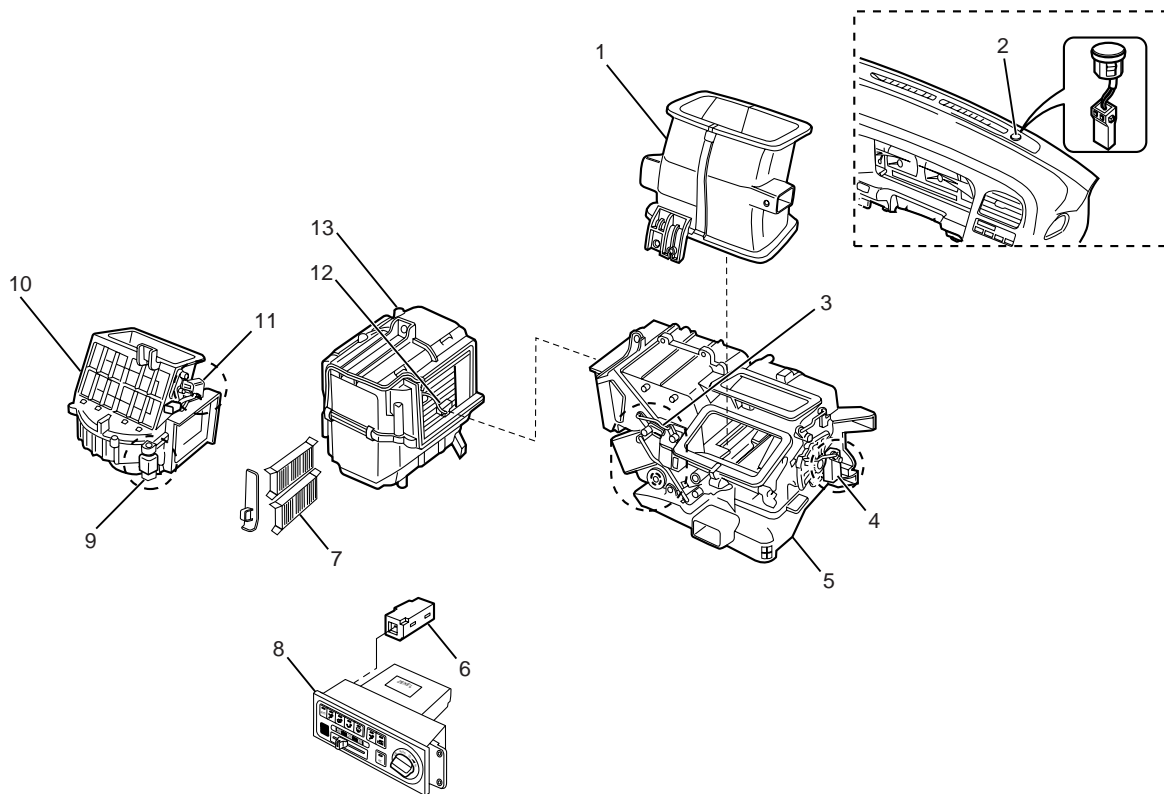
Using a variety of sensors, this full automatic heater and air conditioner accurately senses outside air temperature, solar radiation quantity, evaporator's blowing temperature, heater core coolant temperature and interior temperature, then enters these data to the automatic heater/air conditioner control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

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

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

Full Automatic Air Conditioner Parts Configuration

This illustration is based on RHD



865RY0004

Legend

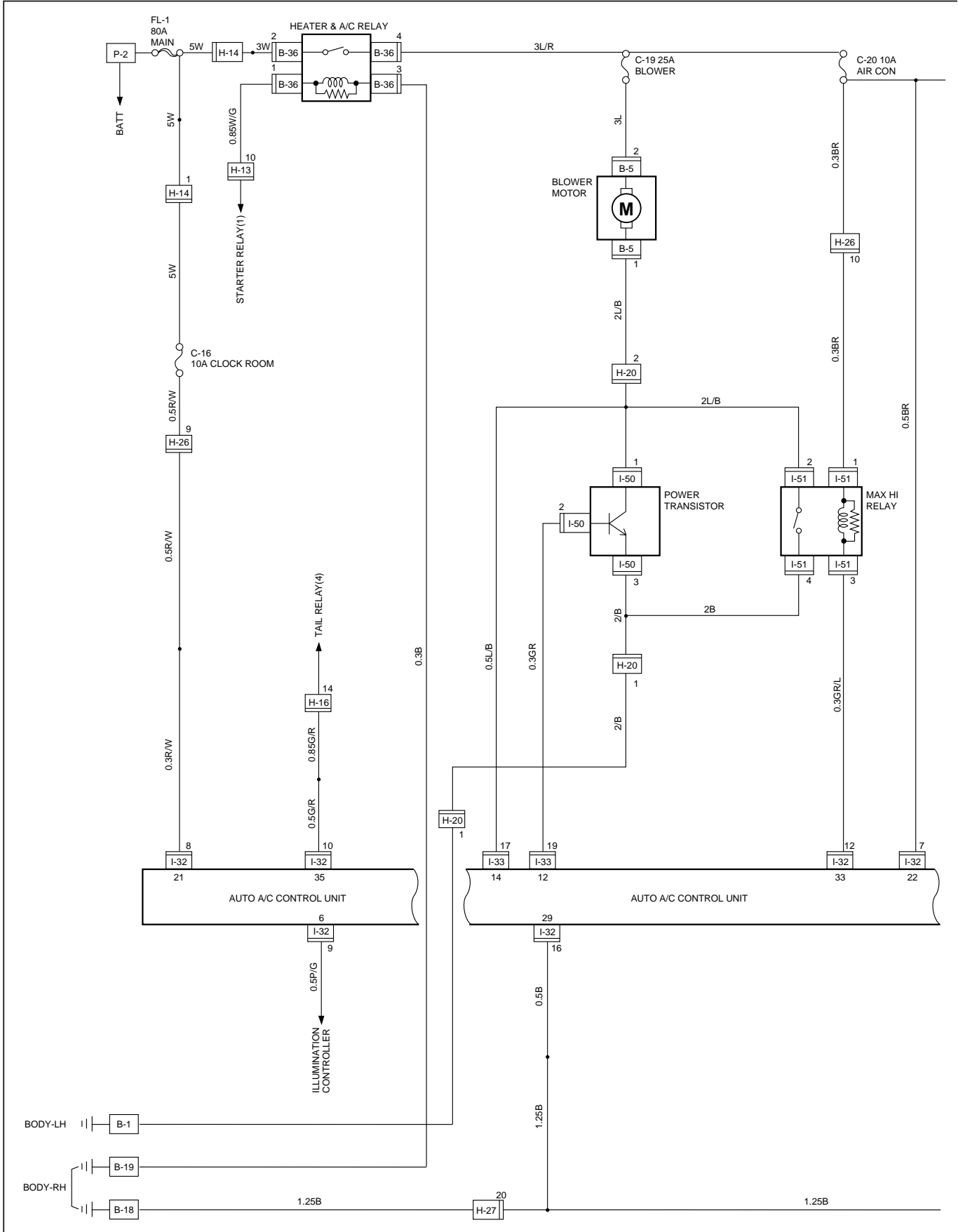
- | | |
|---------------------------|--|
| (1) Lower Center Vent Box | (7) Pollen Filter |
| (2) Sun Sensor | (8) Automatic Air Conditioner Control Unit |
| (3) Mix Actuator | (9) Max-High Relay |
| (4) Mode Actuator | (10) Blower Unit |
| (5) Heater Unit | (11) Intake Actuator |
| (6) In Car Sensor | (12) Duct Sensor |
| | (13) Evaporator Assembly |

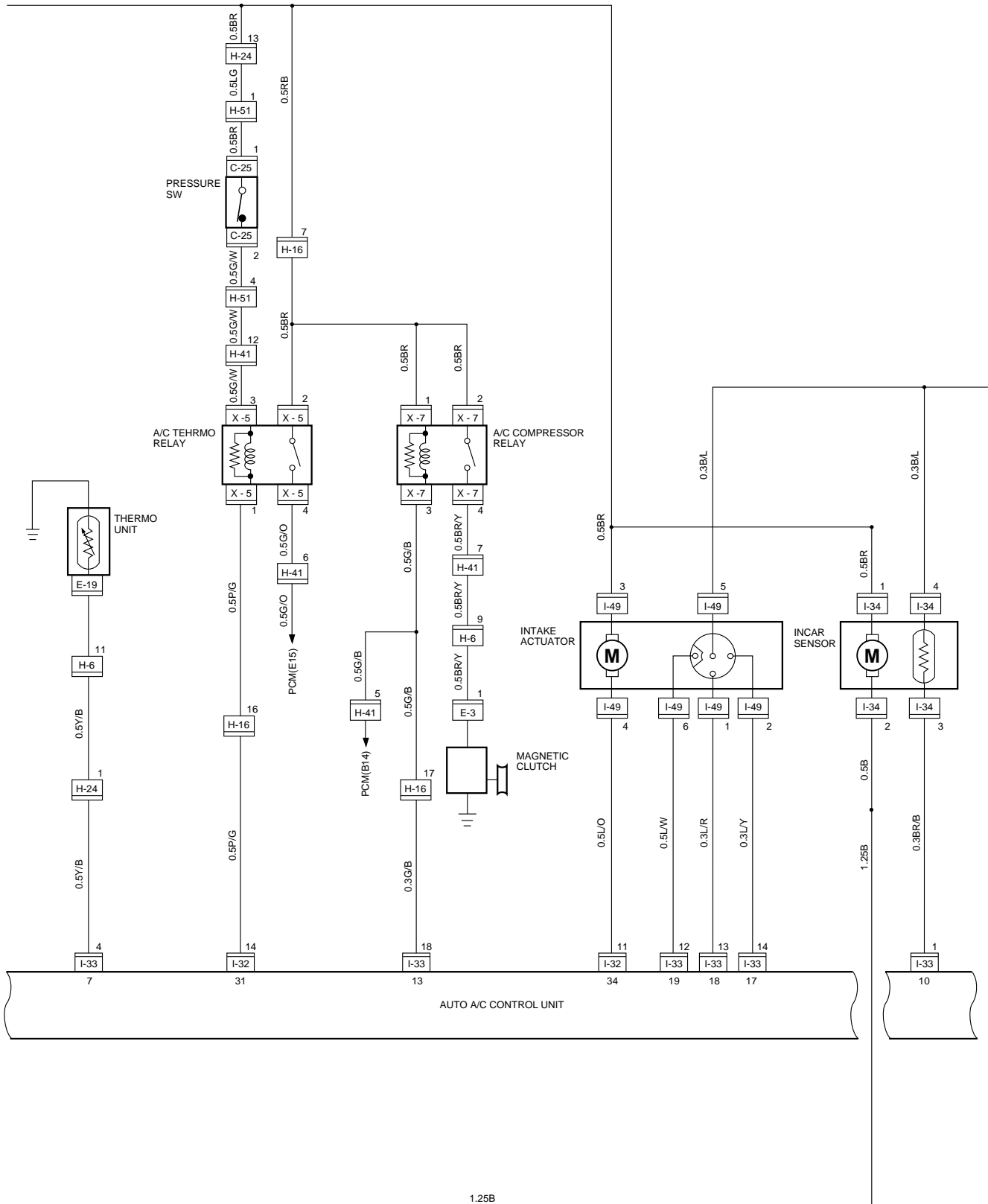
MEMO

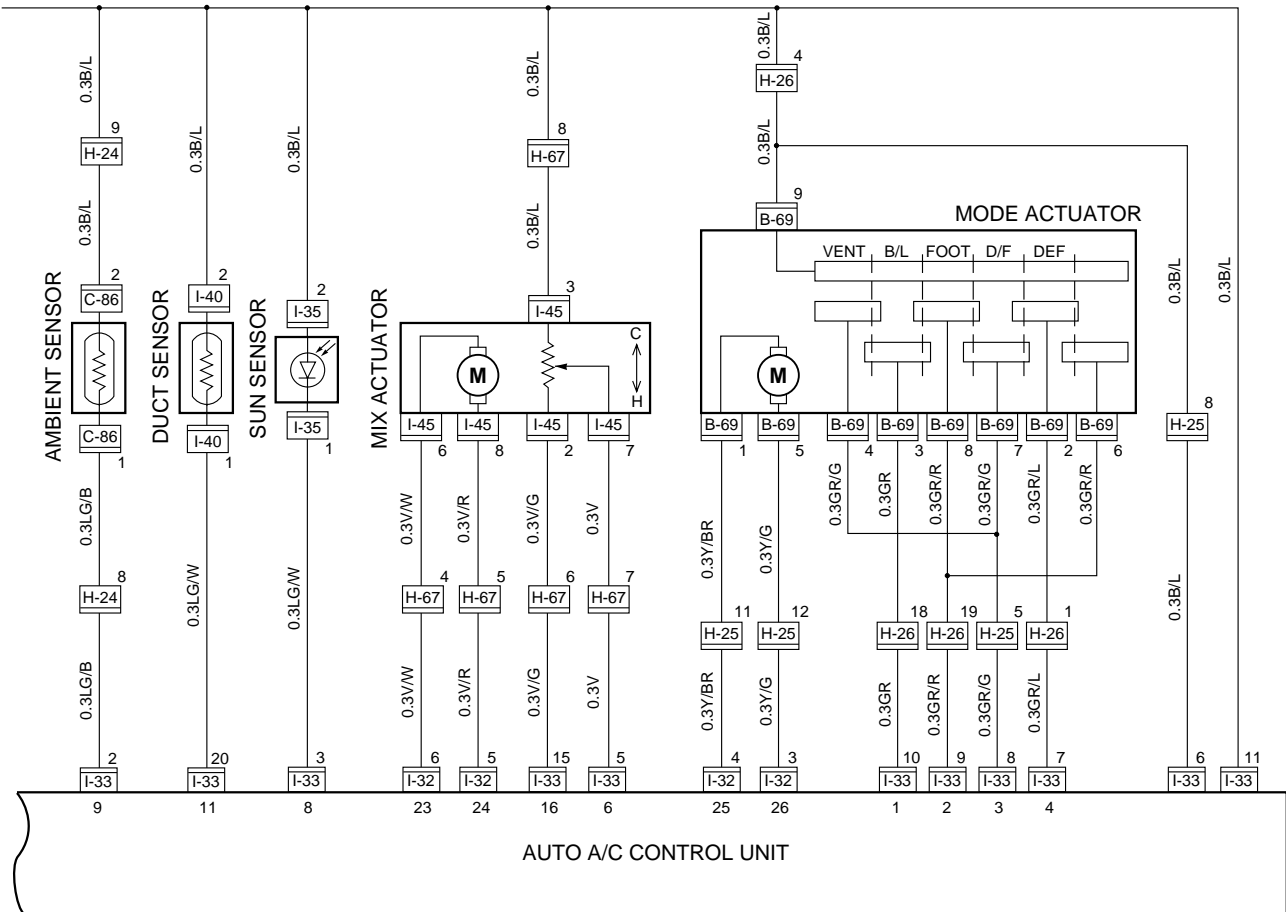
A series of horizontal dotted lines for writing.

CIRCUIT DIAGRAM

6VE1 (RHD)





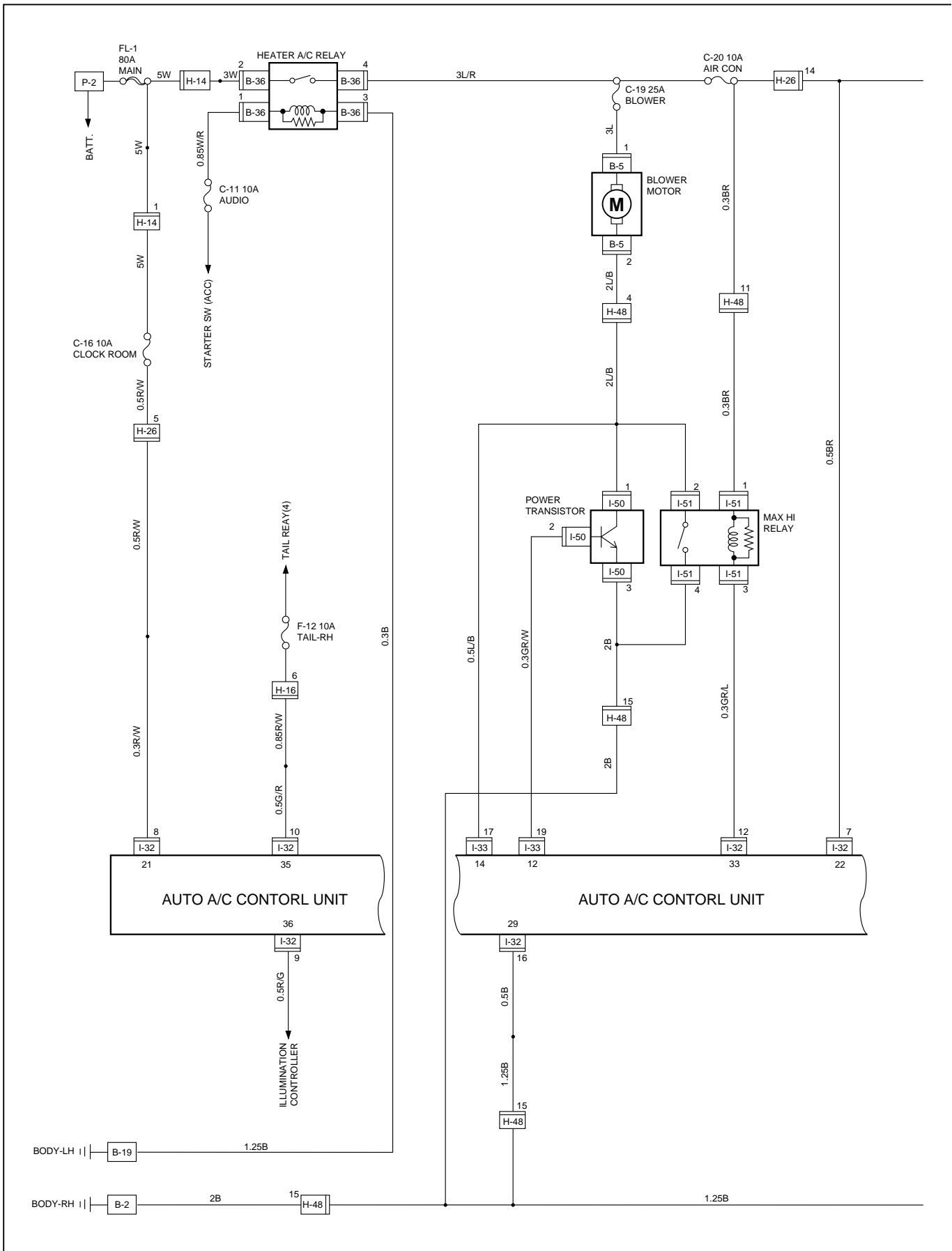


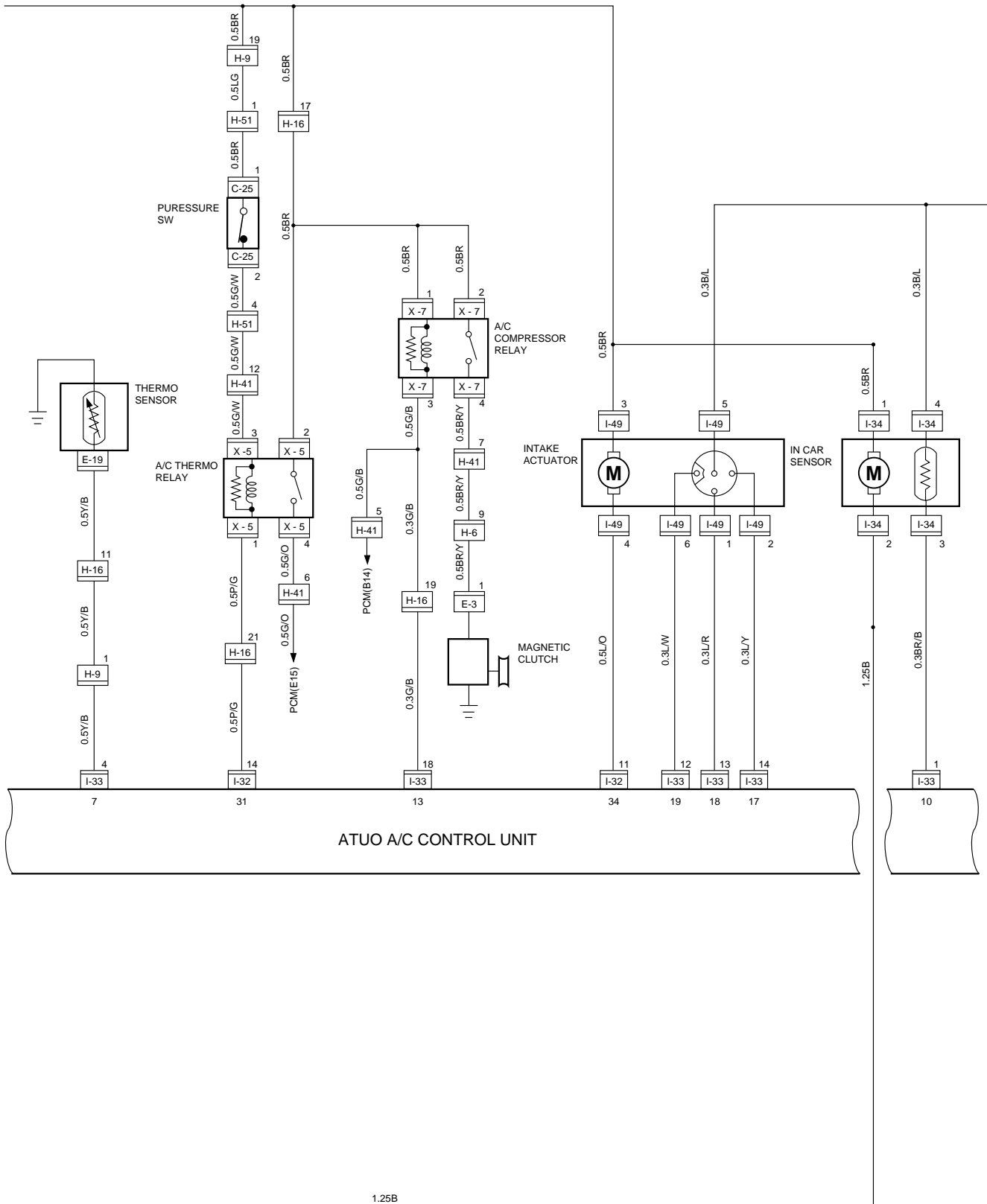
MEMO

Dotted lines for writing content.

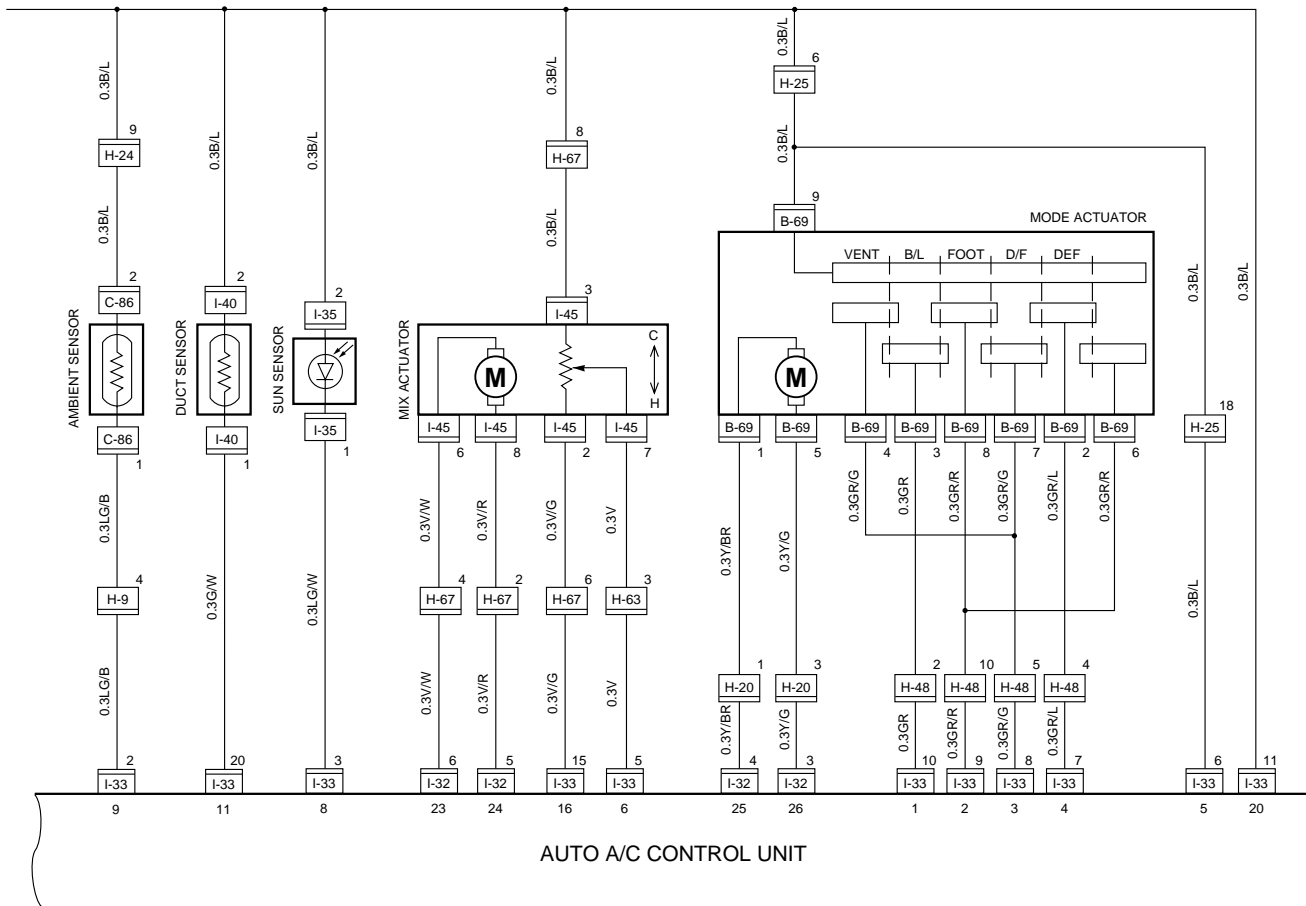
1B-66 AIR CONDITIONING

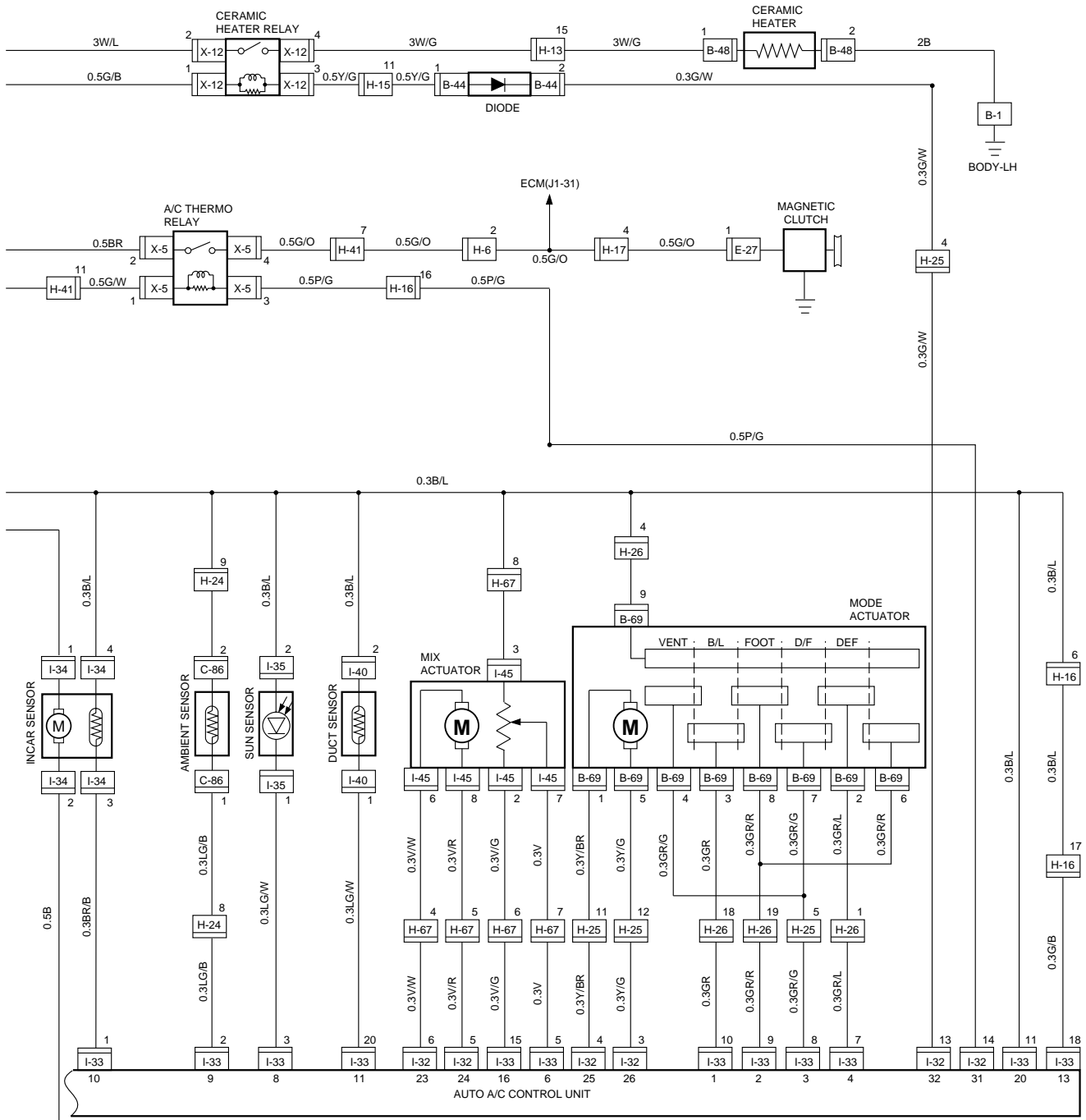
6VE1 (LHD)





1.25B

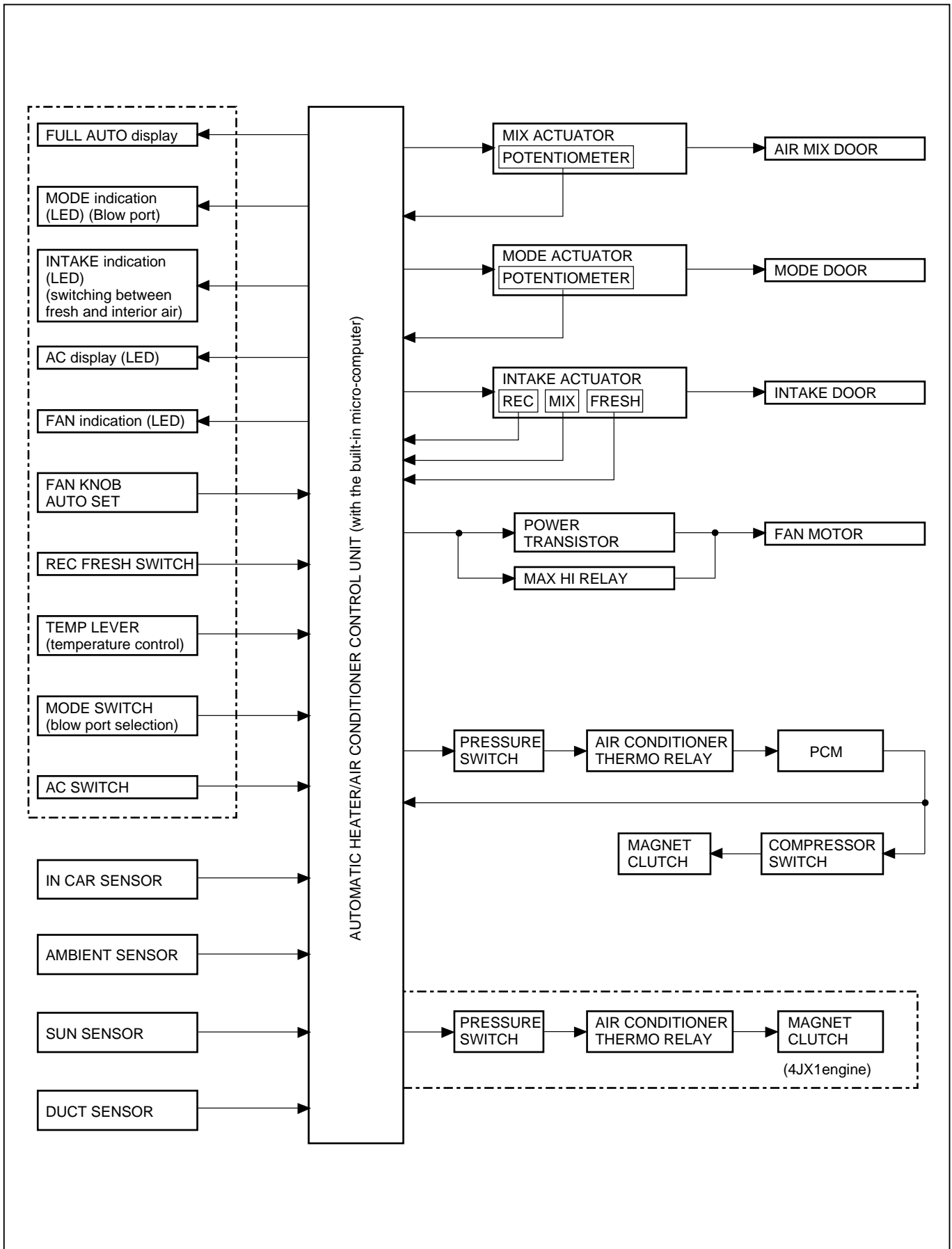




FUNCTIONS AND FEATURES

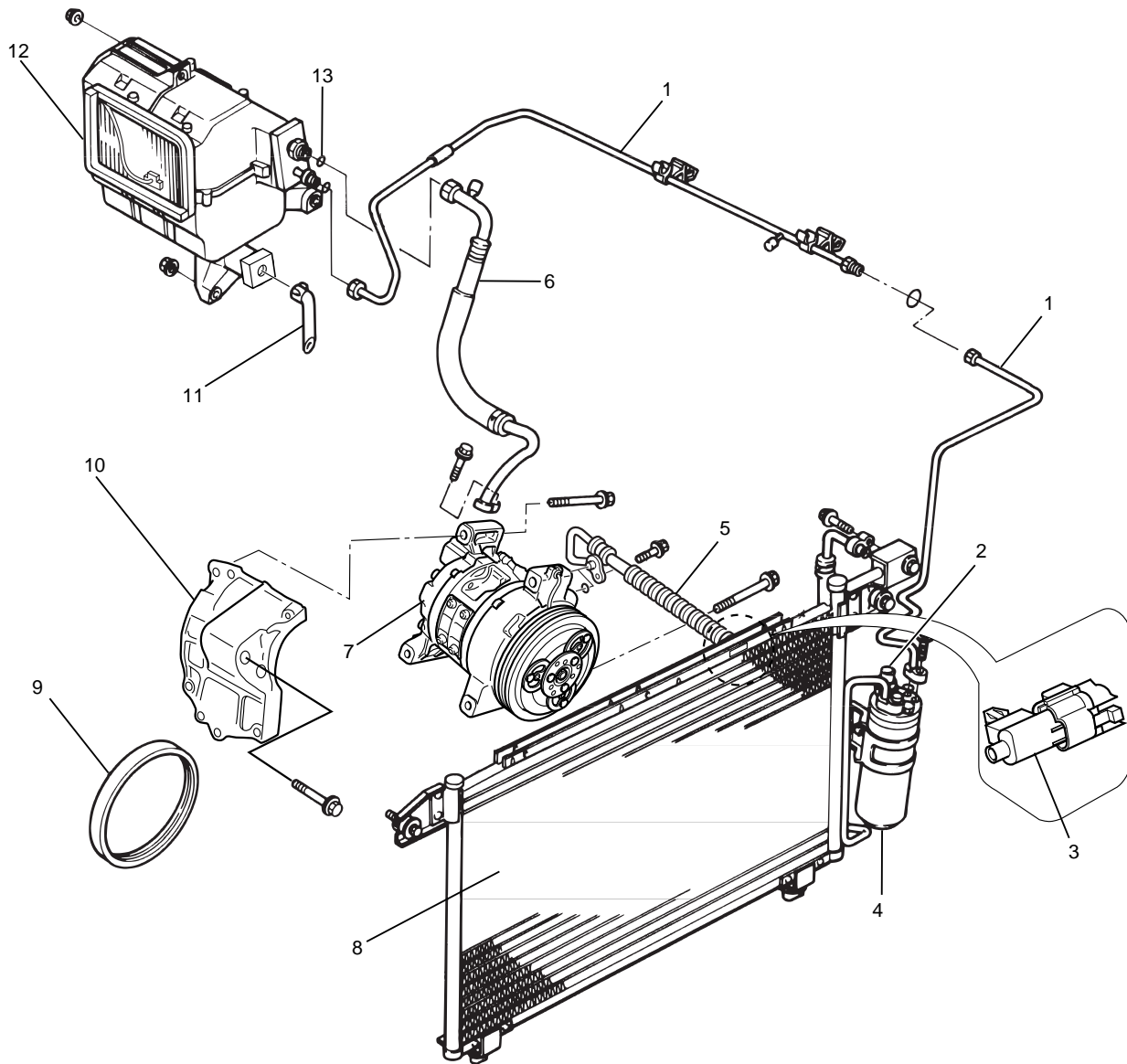
- **Automatic interior temperature control**
This function enables to maintain the interior temperature at the level specified from the temperature control switch despite of changes in factors such as vehicle speeds, outside air temperature and number of passengers.
- **Maximum cooling and heating function**
You can select FC (Full cool, namely maximum cooling temperature) or FH (Full heat, maximum heating temperature) from the temperature control lever.
- **Automatic air flow control**
Air flow is automatically and consecutively fine tuned according to the specified interior temperature and changes in aperture of the heater unit mix door.
- **Mode (blow port) control**
This function automatically selects either one of the VENT, BI-LEVEL, FOOT or DEP mode for the blow port according to changes of temperature on the blow port. Using the mode switch allows you to select a desired blow port manually.
- **Intake (switching between the fresh air intake and circulation of interior air) control**
The intake (switching between fresh air intake and circulation of interior air) mode automatically selects either FRESH (fresh air intake), MIX or RECIRC (interior air circulation) according to changes of the blow port temperature. Using the intake switch allows you to select a desired intake port manually (in the manual operation, FRESH and RECIRC modes alone are available). Pressing the DEF (defrost) mode switch selects the FRESH (fresh air intake).
- **Cooler start-up timing control**
This function is used for maintaining the air flow at "LOW" level until the evaporator is sufficiently cooled down. It is intended to prevent a large volume of hot air being blowing into inside of a vehicle when the cooler is turned on in hot summer season.
- **Heater start-up timing control**
This function is used for maintained the air flow at "LOW" level and also for maintaining the defrost mode until temperature of coolant in the heater core is sufficiently heated. It is intended to prevent a large volume of cool air being blown into inside of a vehicle when the heater is turned on in cold winter season.
- **Solar radiation quantity offset control**
The photodiode on the solar radiation sensor determines solar radiation quantity accurately to offset interior temperature quickly.
- **Switch position storing function**
This function is used for storing switch positions being selected in the immediately preceding operation, namely the last time the ignition has been turned off. It simplifies the setup procedures when restarting the system.
- **Self-diagnosis function**
The self-diagnosis function turned on from the panel switch makes your troubleshooting easier (for detail of this function, refer to the section titled "Self-Diagnosis").

FULL AUTOMATIC AIR CONDITIONER BLOCK DIAGRAM



AIR CONDITIONING PARTS

6VE1 (RHD)

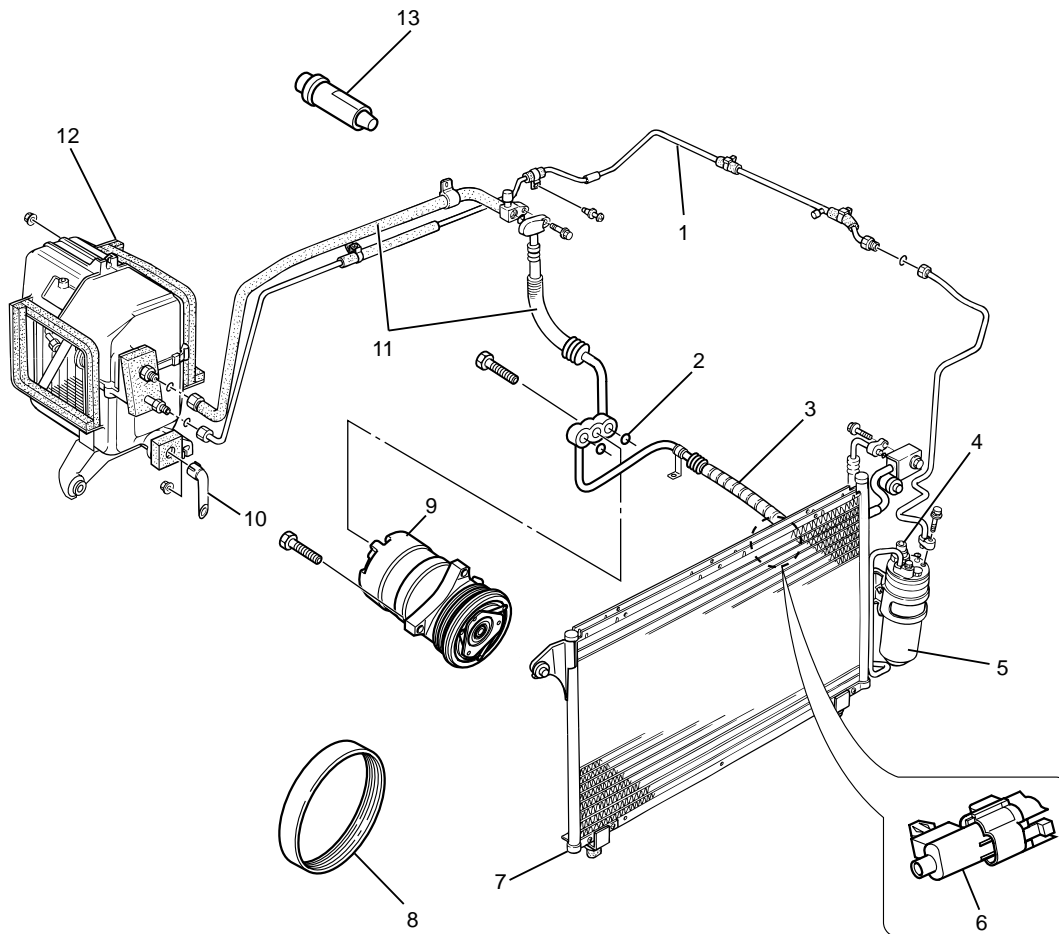


852RY00001

Legend

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

6VE1 (LHD)

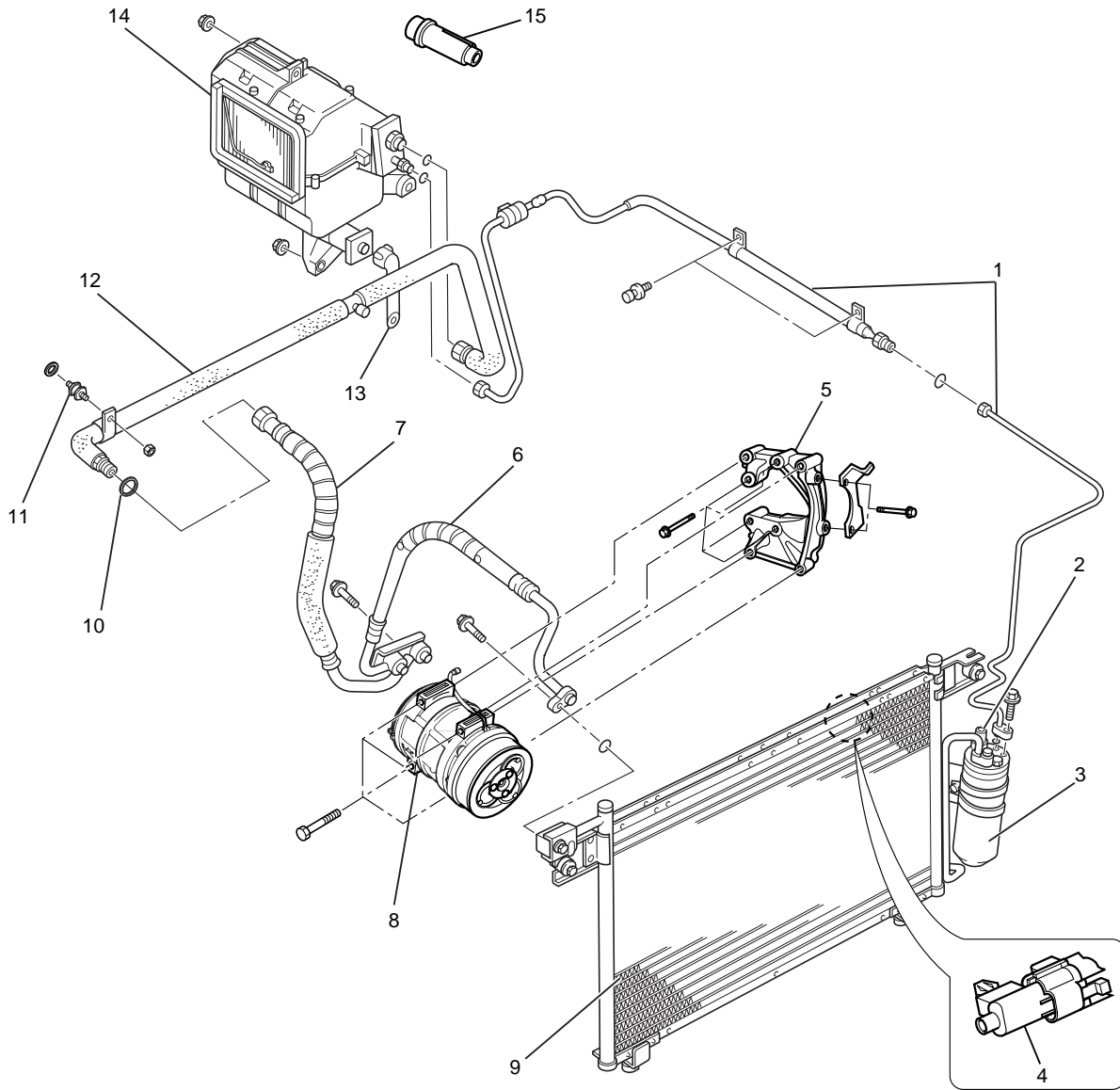


852RY00002

Legend

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

4JX1 (RHD)

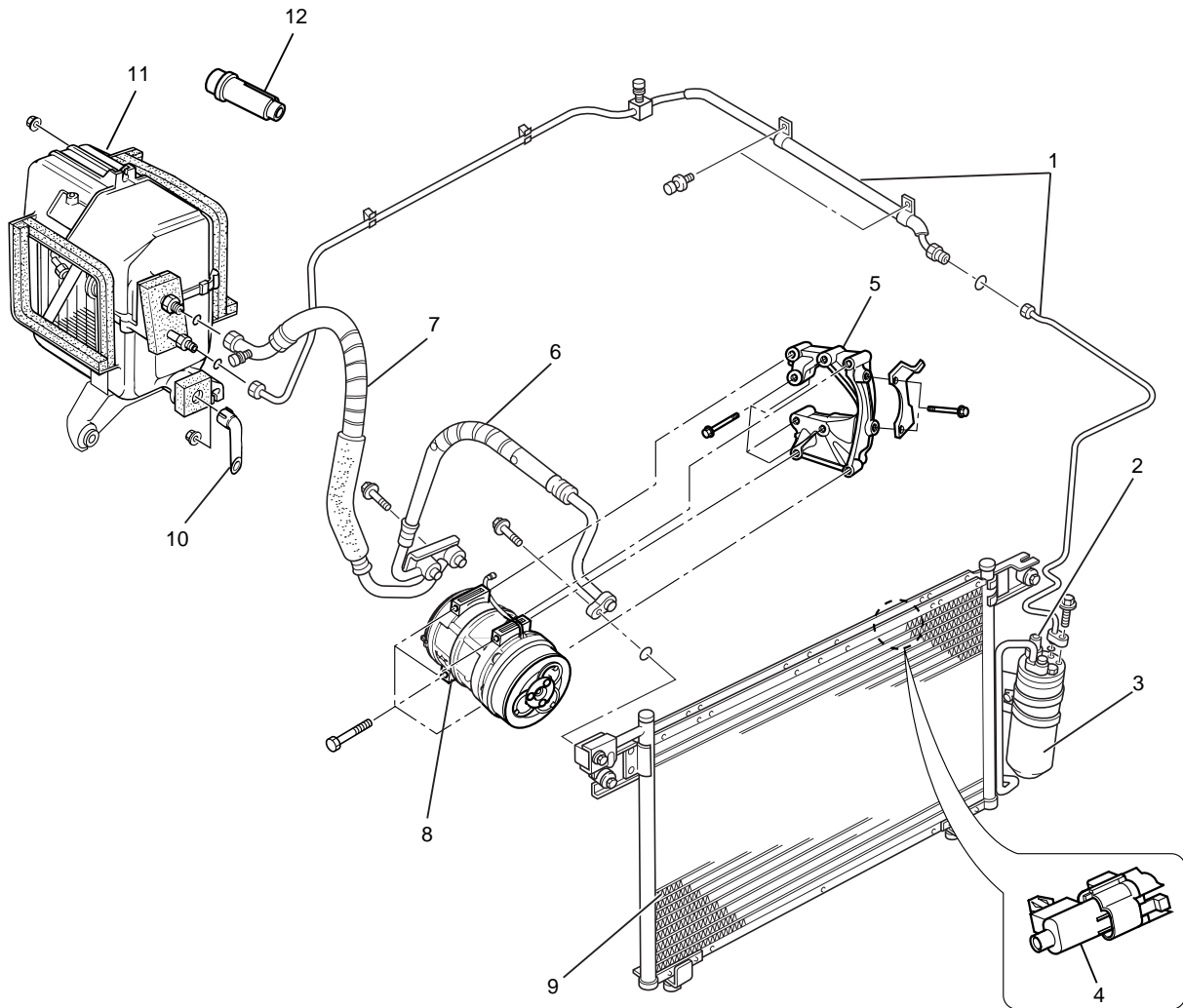


852RY00003

Legend

- | | |
|---|---------------------------------------|
| (1) Liquid Line (High-Pressure Pipe) | (8) Compressor |
| (2) Pressure Switch | (9) Condenser Assembly |
| (3) Receiver Drier | (10) O-ring |
| (4) Ambient Sensor | (11) Insulator Pipe |
| (5) Compressor Bracket | (12) Suction Line (Low-Pressure Pipe) |
| (6) Discharge Line (High-Pressure Hose) | (13) Drain Hose |
| (7) Suction Line (Low-Pressure Hose) | (14) Evaporator Assembly |
| | (15) A/C Switch |

4JX1 (LHD)

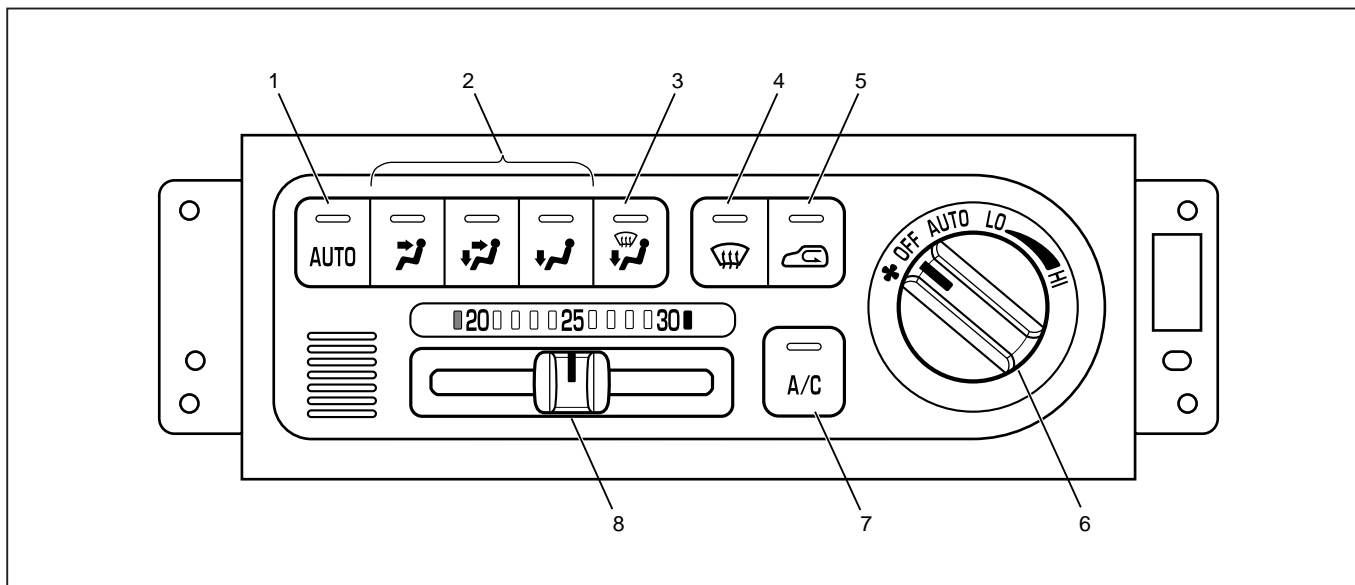


852RY00004

Legend

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

Control Panel Layout

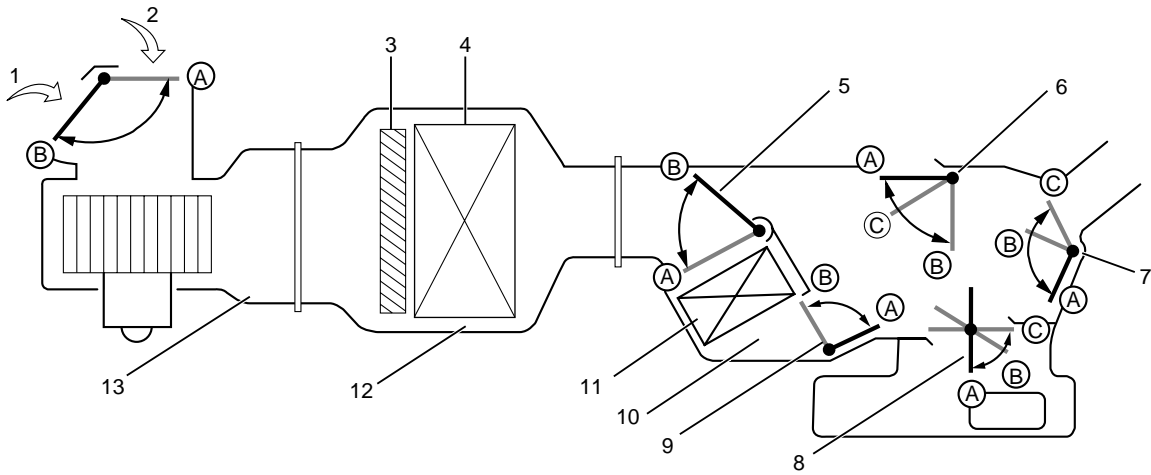


865RY00005

Legend

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

Air Control Functions



	Mode Position					Display of Intake Status		Set Temperature		
	VENT	BI-LEVEL	FOOT	DEF/FOOT	DEF	 ON OFF		Blue	White	Red
								FULL COLD	20~30	FULL HOT
Vent Door	(A)	(B)	(C)	(C)	(C)	—	—	—	—	—
Foot Door	(C)	(B)	(A)	(B)	(C)	—	—	—	—	—
DEF Door	(A)	(A)	(A)	(C)	(B)	—	—	—	—	—
Intake Door	—	—	—	—	—	(A)	(B)	—	—	—
Air Mix Door	—	—	—	—	—	—	—	(A)	(A ~ B)	(B)
Sub Air Mix Door	—	—	—	—	—	—	—	(B)	(B ~ A)	(A)

C01RY00001

Legend

- (1) Interior Air Intake
- (2) Fresh Air Intake
- (3) Pollen Filter
- (4) Evaporator Core
- (5) Air Mix Door
- (6) DEF Door
- (7) Vent Door
- (8) Foot Door
- (9) Sub Air Mix Door
- (10) Heater Unit
- (11) Heater Core
- (12) Evaporator Unit
- (13) Blower Unit

OPERATION AND FUNCTIONS OF CONTROL PANEL SWITCHES

1. Auto Switch

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

<Indication>

- The AUTO LED comes on.
- Currently selected mode for the Mode and Intake are respectively indicated.

2. Mode Switch

<Indication>

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

<Indication>

- Turns off the Auto LED.
- Currently selected blow port is indicated.

3. DEF Switch

Press this switch to select the DEF mode.

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

<Indication>

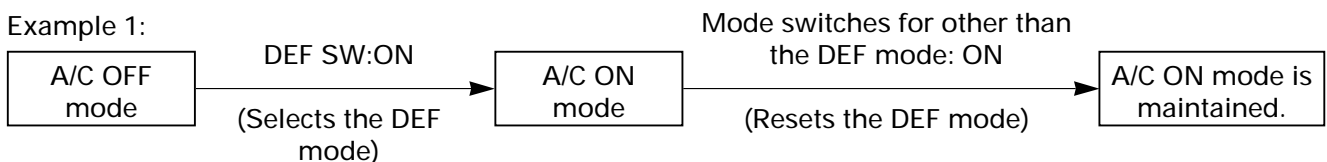
*1: When the manual REC is selected for the Intake, the manual REC is maintained.

*2: The ON mode is enabled only when the fan is turned on, and also the compressor is turned on because of the given outside air temperature level.

<Indication>

- The Auto LED is turned off.
- DEF is indicated for the blow port, A/C LED comes on (only when the fan is turned on), and status display is provided for the Intake.

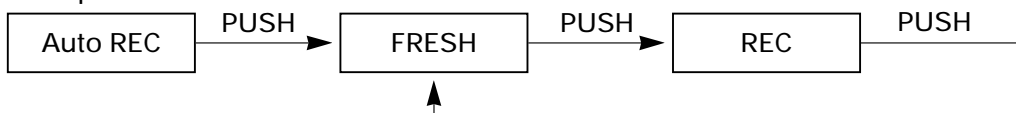
Example 1:



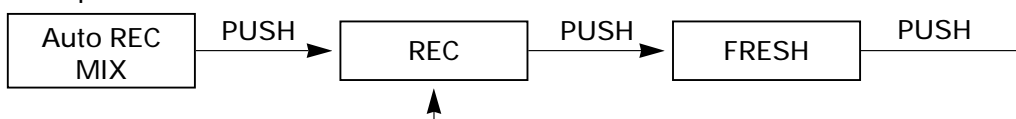
4. Intake Switch

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

Example 1:

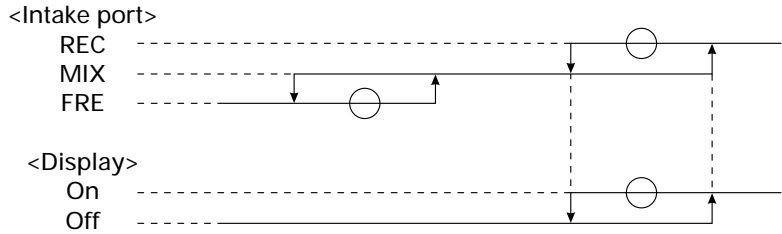


Example 2:



<Indication>

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



5. Fan Switch

- (1) Sets the fan to the specified mode.
- (2) Even when the fan switch is turned off, status display for the Model and Intake is maintained.

6. Temperature Control Knob

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

<MAX Control>

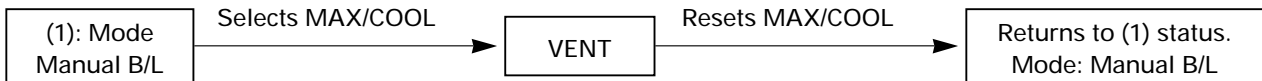
	Mix	Fan	Mode	Intake	A/C
MAX/COOL	Full cool	MAX/HI	VENT	REC*1	ON mode*2
MAX/HEAT	Full hot	AUTO/HI	FOOT*3	FRESH	Current status is maintained

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

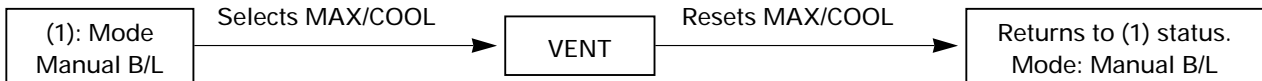
*2: The ON mode is available only when ON is selected for the fan as well as for the cold outside air ON/OFF selection.

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

Example 1:



Example 2:



<Indication>

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

7. Air Conditioning Switch

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

<Indication>

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

OVERVIEW OF CONSTRUCTION, MOVEMENT AND CONTROL OF MAJOR PARTS OF FULL AUTOMATIC AIR CONDITIONER SYSTEM

Automatic Heater/Air Conditioner Control Unit

Equipped with the built-in micro-computer, this control unit operates on signals from sensors and input signals from switches to offer total control of the blower fan, and actuators used for the mode door, intake door and air mix door.

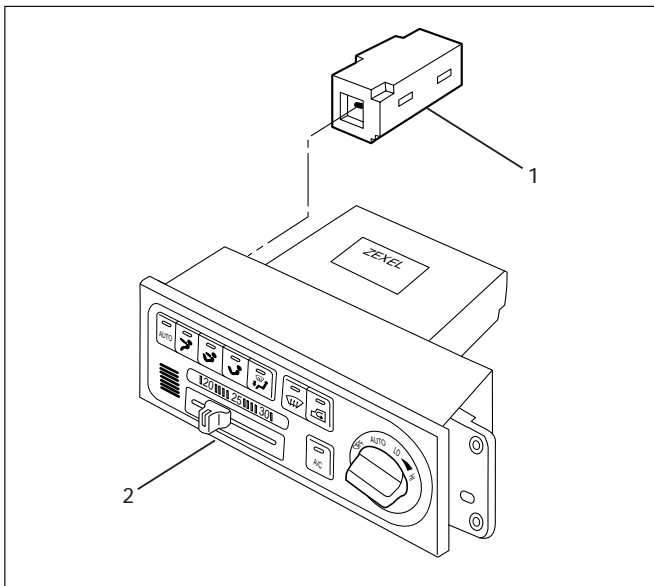
Its self-diagnosis function enables quicker access to a failed part and its more accurate troubleshooting.

In Car Sensor

It is a sensor used for detecting room temperature of a vehicle. This sensor converts a given room temperature into a resistance value before entering the data to the automatic heater/air conditioner control unit.

This in car sensor unites the power driven aspirator and the motor fan so that a small amount of room air may be constantly fed to the sensor.

This sensor is provided on the control panel.



Legend

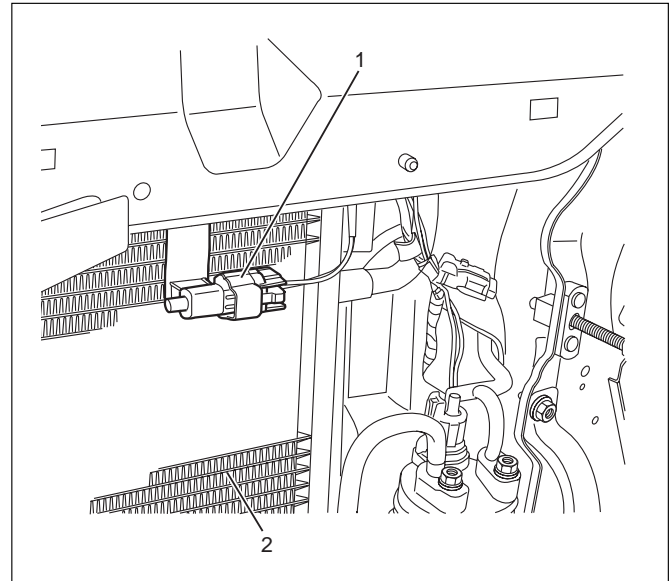
- (1) In Car Sensor
- (2) Full Automatic Air Conditioner Control Unit

Ambient Sensor

This sensor is used for detecting temperature outside the vehicle. It converts a given outside air temperature into a resistance value before entering the data to the automatic heater/air conditioner control unit.

Thermal effects from the condenser and radiator during idling after a run can be measured and offset the automatic amplifier.

This sensor is provided on the side plate situated at upper right side of the condenser.



Legend

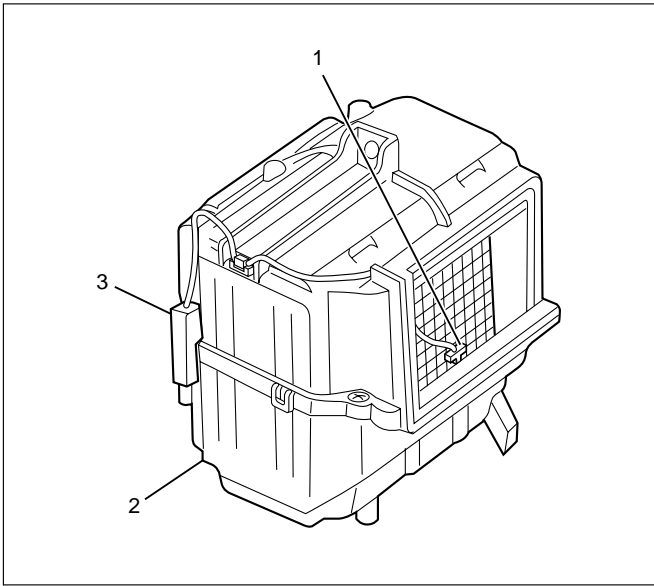
- (1) Ambient Sensor
- (2) Condenser Assembly

• Duct Sensor

The sensor is the sensor to detect temperature change of the side of evaporator blower coming by fresh recirculation of intake door or "on" "off" of compressor.

The temperature is converted to resistant rate. And it works as thermostat to control to prevent freezing of evaporator.

This sensor is installed in the upper case of evaporator.



860RX013

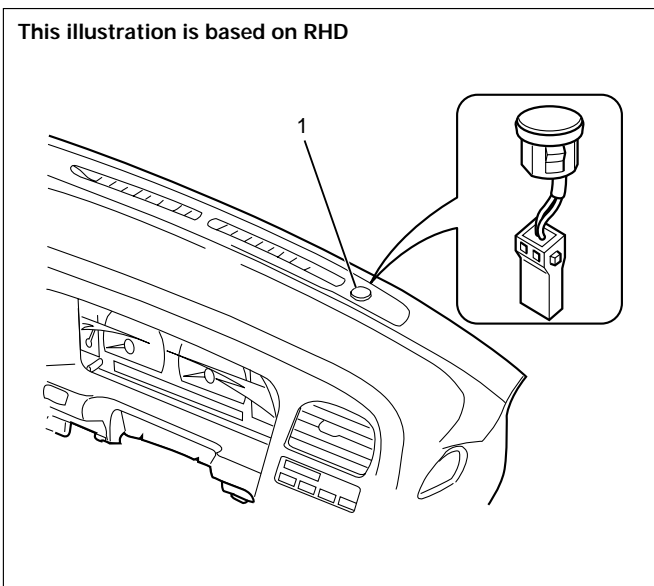
Legend

- (1) Duct Sensor
- (2) Evaporator Assembly
- (3) Amplifierblock

In Car Sensor

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

This sensor is provided at top of the defroster grill.



826RY00001

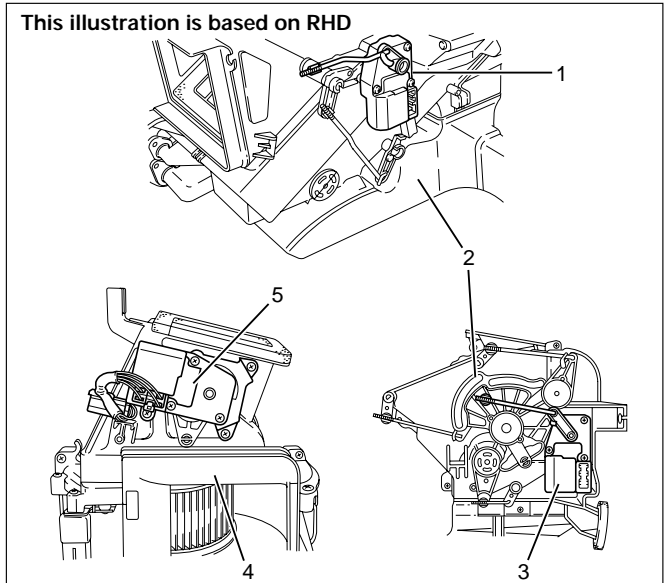
Legend

- (1) Sun Sensor

Actuator

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

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

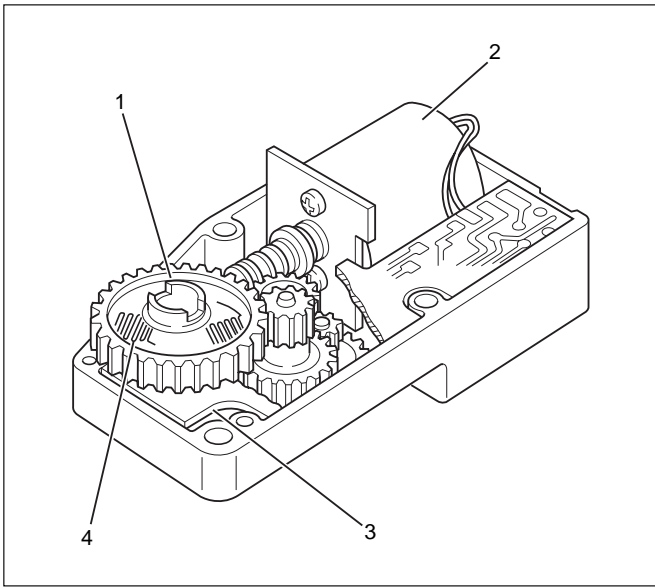


860RX012

Legend

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

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

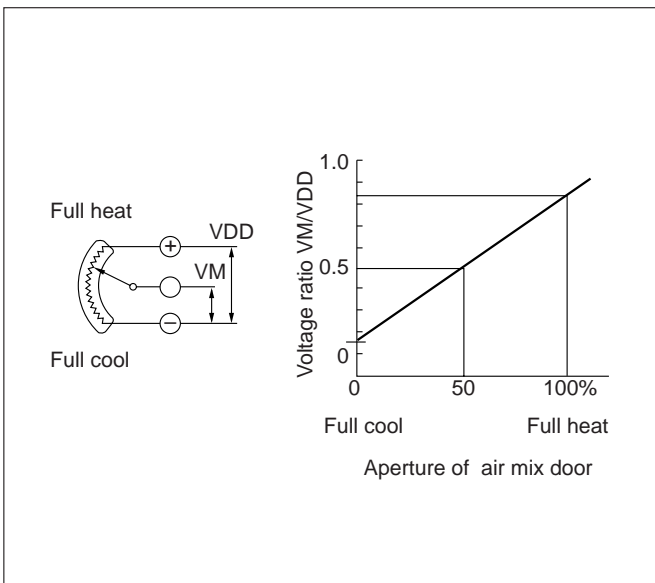


860RW026

Legend

- (1) Out put Axis
- (2) Motor
- (3) Printed Circuit Board
- (4) Sliding Contact

The mode and mix actuators are common actuators with the built-in potentiometer. For the intake actuator, the contact switch type is selected. The potentiometer is a register assembled to the printed circuit board of the mix and mode actuators. It detects the air mix door position specified by rotation of the output axis as a ratio of the variable terminal (VM) voltage against the reference voltage (VDD: 5V), then signals the value to the automatic heater/air conditioner control unit.



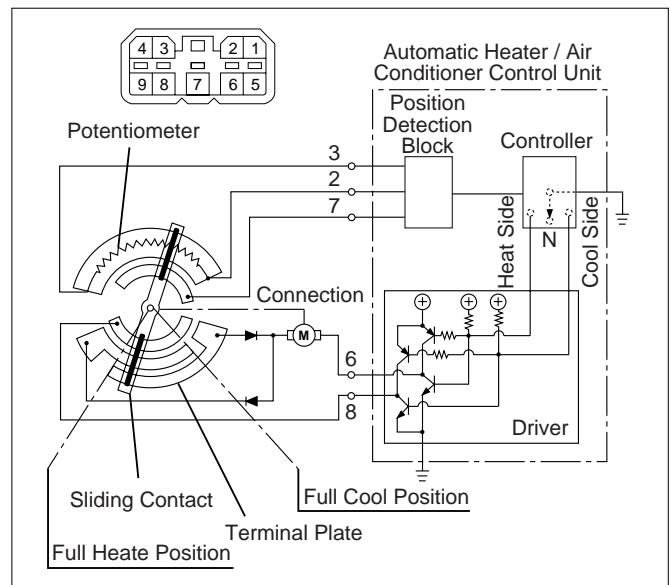
C01RX016

• **Movement of Mix Actuator**

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

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

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



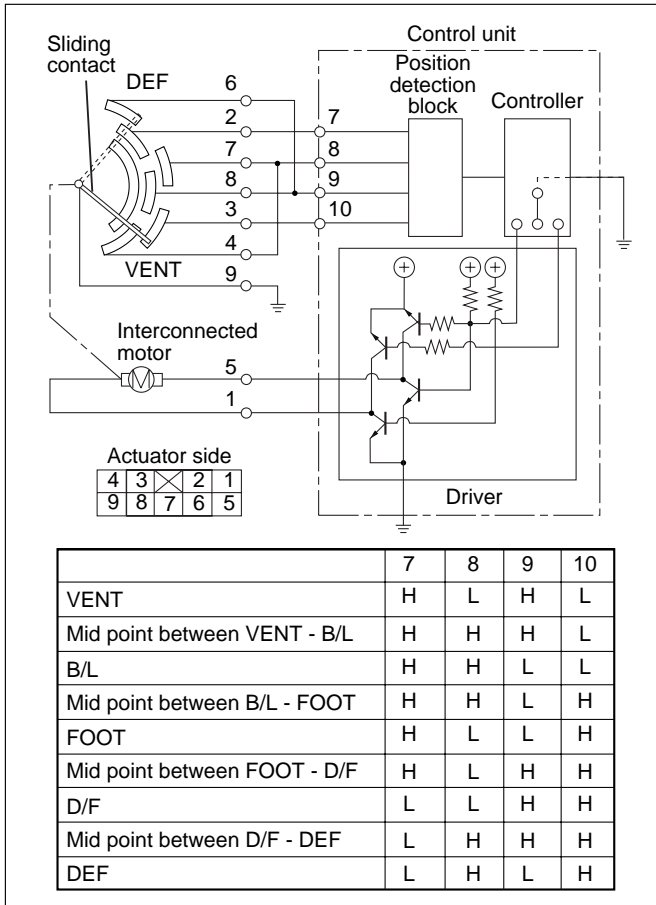
C01RX005

• **Movement of Mode Actuator**

As target position of the mode door is decided on the controller of the control unit, the control unit reads the position detection signal from the actuator to select the clockwise or counter clockwise motor rotation direction.

Grounding the controller VENT or DEF side after the direction selection activates the transistor on the driver, thus turning on the motor rotation. Accompanying the motor rotation, the sliding contact rotates, too. When the target position is reached, the controller on the control unit returns to the neutral and the motor stops.

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



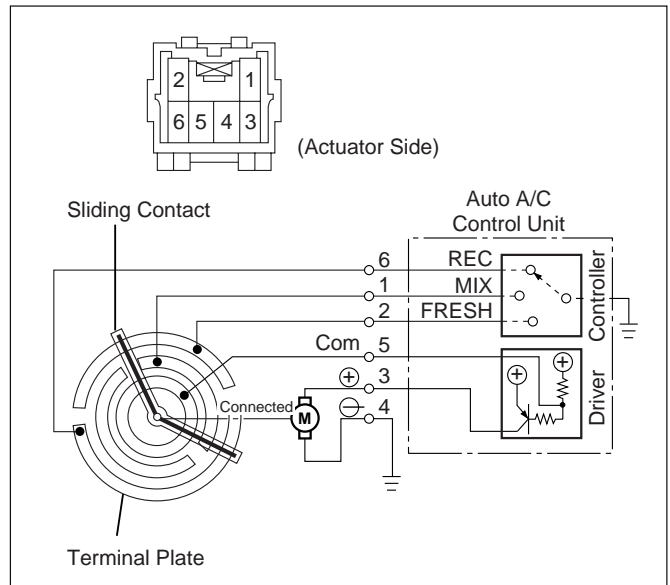
C01RX017

• **Movement of Intake Actuator**

The controller on the automatic heater/air conditioner control unit selects an intake mode to be used.

As the Terminal No.5 [I-49] is grounded via the sliding contact on the terminal plate, the transistor on the driver is activated, thus turning on the motor rotation. Then, accompanying move of the motor, the sliding contact rotates until grounding of the Terminal No.5 [I-49] is removed, thus stopping the motor.

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



C01RX006

OVERVIEW OF AUTOMATIC CONTROL OF FULL AUTOMATIC AIR CONDITIONER

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

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

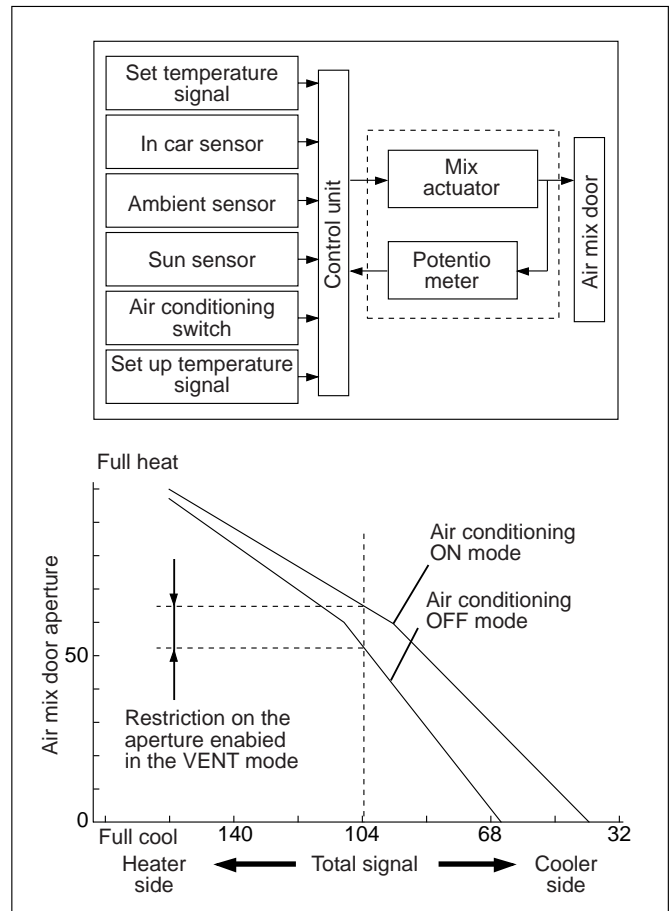
1. Interior Temperature Control

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

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

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

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



C01RY00011

2. Air Flow Control

- In the Auto Mode

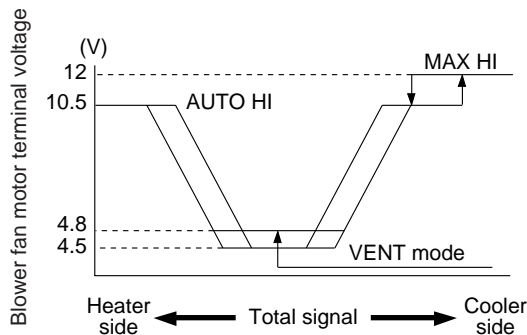
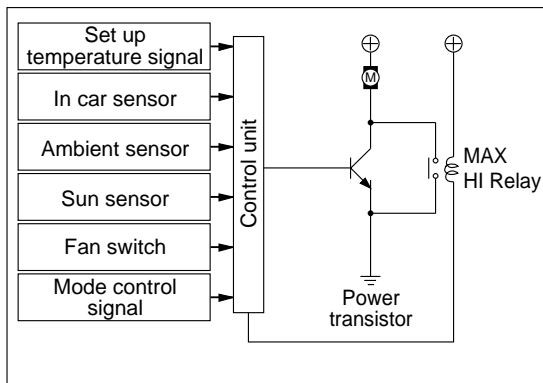
The automatic heater/air conditioner control unit operates on the setup temperature signal and other sensor signals to derive the total signal. Then, the control unit adjusts base potential of the power transistor to match it to the voltage pattern of the target fan so that stage-less fan speed control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

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

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

- In the Manual Mode

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



C01RY00008

3. Mode (Blow Port) Control

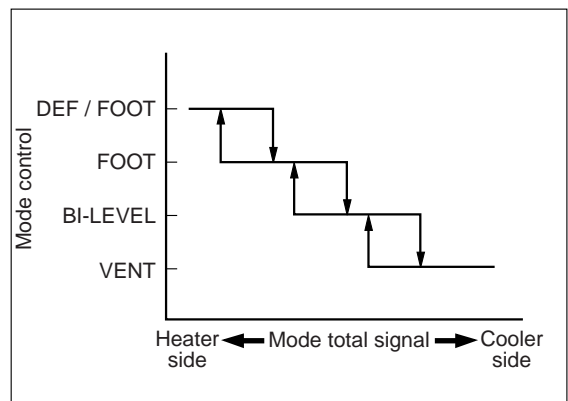
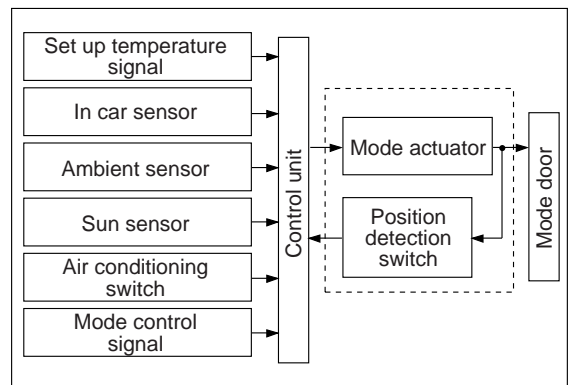
The automatic heater/air conditioner control unit operates on the setup temperature from the control switch, and temperature and solar radiation quantify from the sensors to determine the total mode control signal. According to the pattern specified by this signal, the control unit selects either one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

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

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

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

- Operating the DEF mode switch selects the DEF for the blow port mode.



C01RY00009

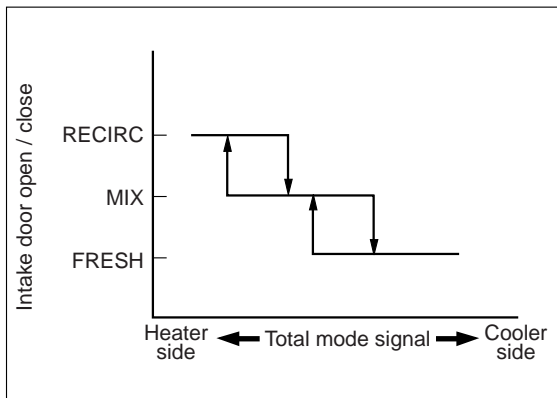
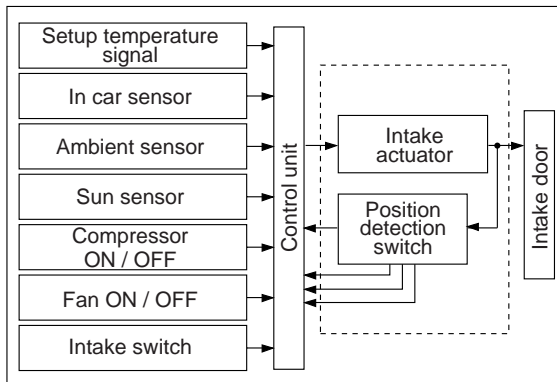
4. Intake (Fresh air/interior air switching) Control

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

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

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

- In the Manual Operation
Pressing the FRESH (fresh air intake) or the RECIRC (room air circulation) accordingly selects the FRESH or RECIRC mode.
- When the DEF Mode Switch is depressed
The intake mode is fixed to the FRESH. When the MANU REC is selected, however, the mode is fixed the RECIRC.
- When the Mode Switch is depressed
If the automatic intake control is selected, the intake is fixed to the currently selected mode.

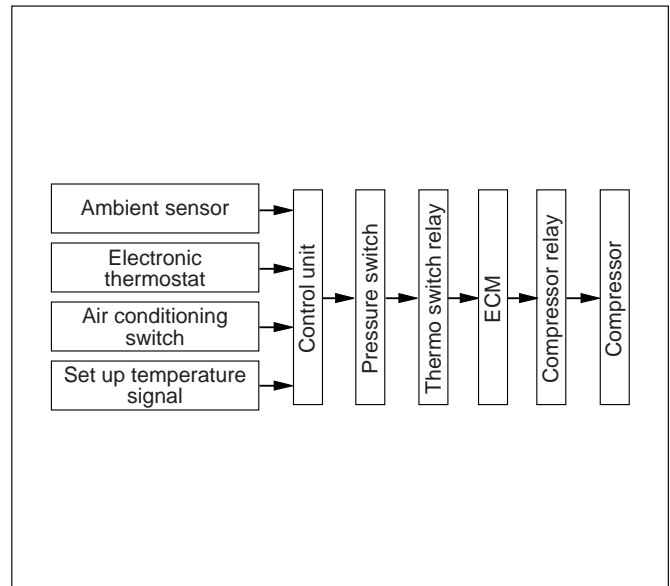


C01RY00012

5. Compressor Control

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

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



C01RY00010

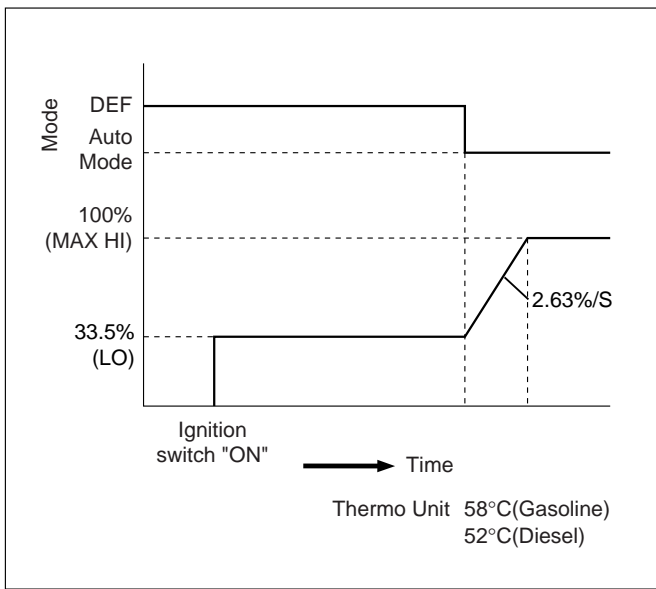
6. Heating Start Timing Control

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

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

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

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

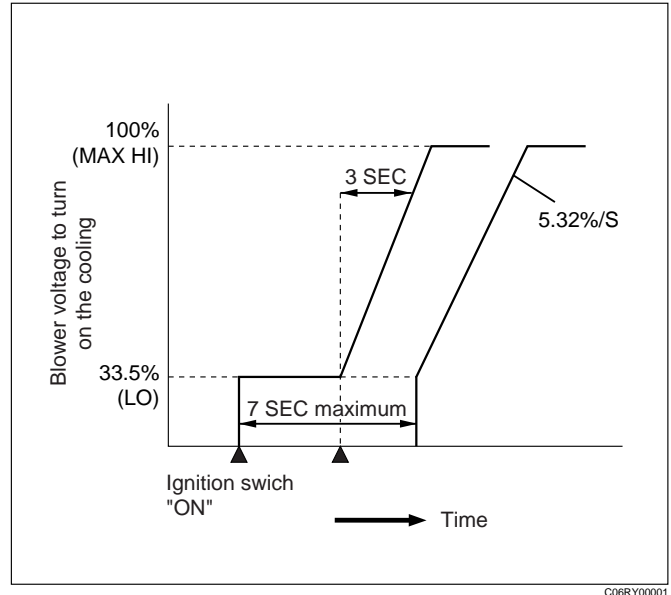


7. Cooling Start Timing Control

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

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

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



TROUBLESHOOTING

Troubleshooting, Its Overview and Procedures

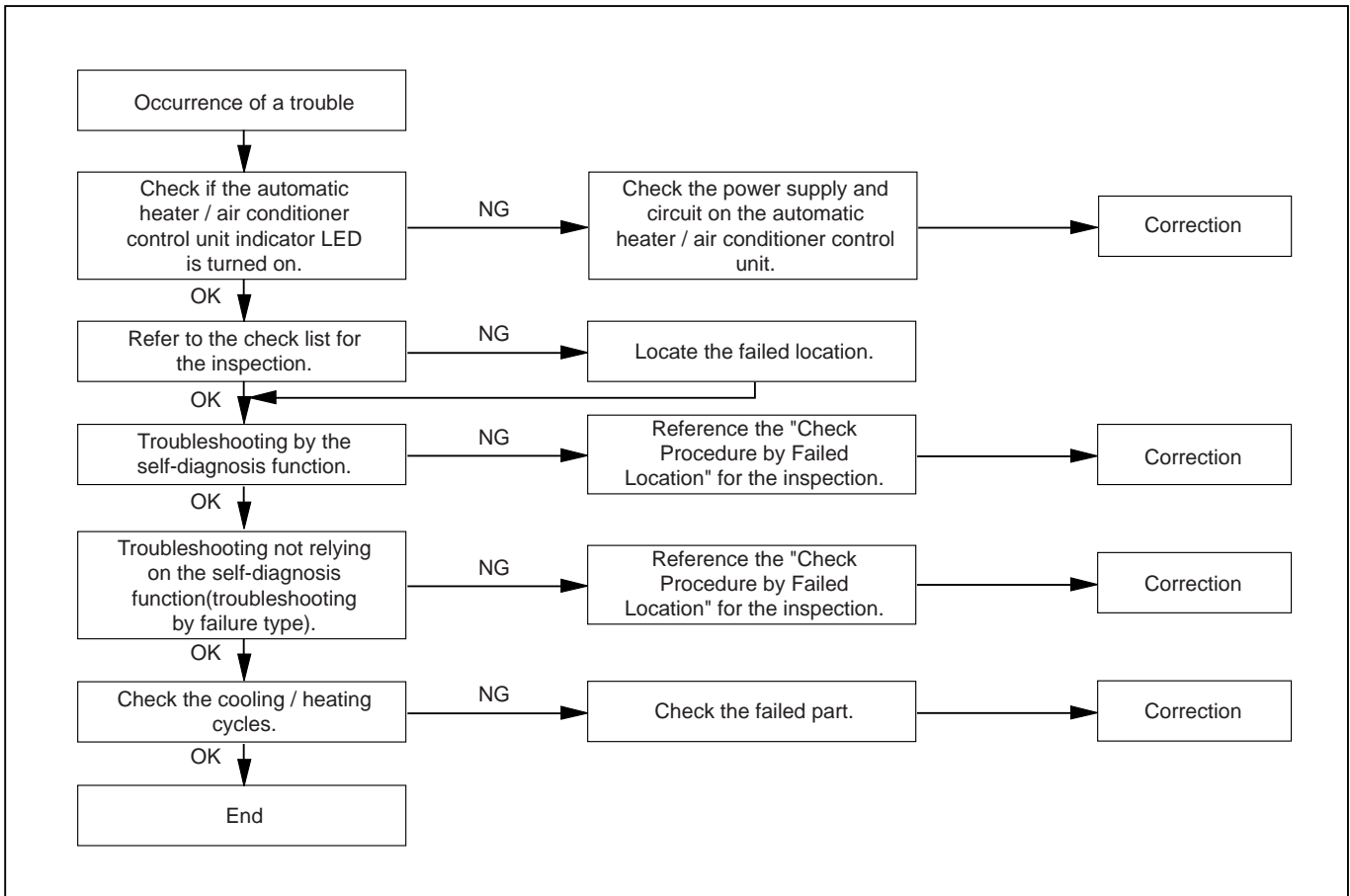
The full automatic heater and air conditioner equips with the "Self-Diagnosis Function" to check its major components.

This function makes access to the sensors, actuators and blower fan motor system easier when checking them up and, when a failed part is located, this function restores its original performance.

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

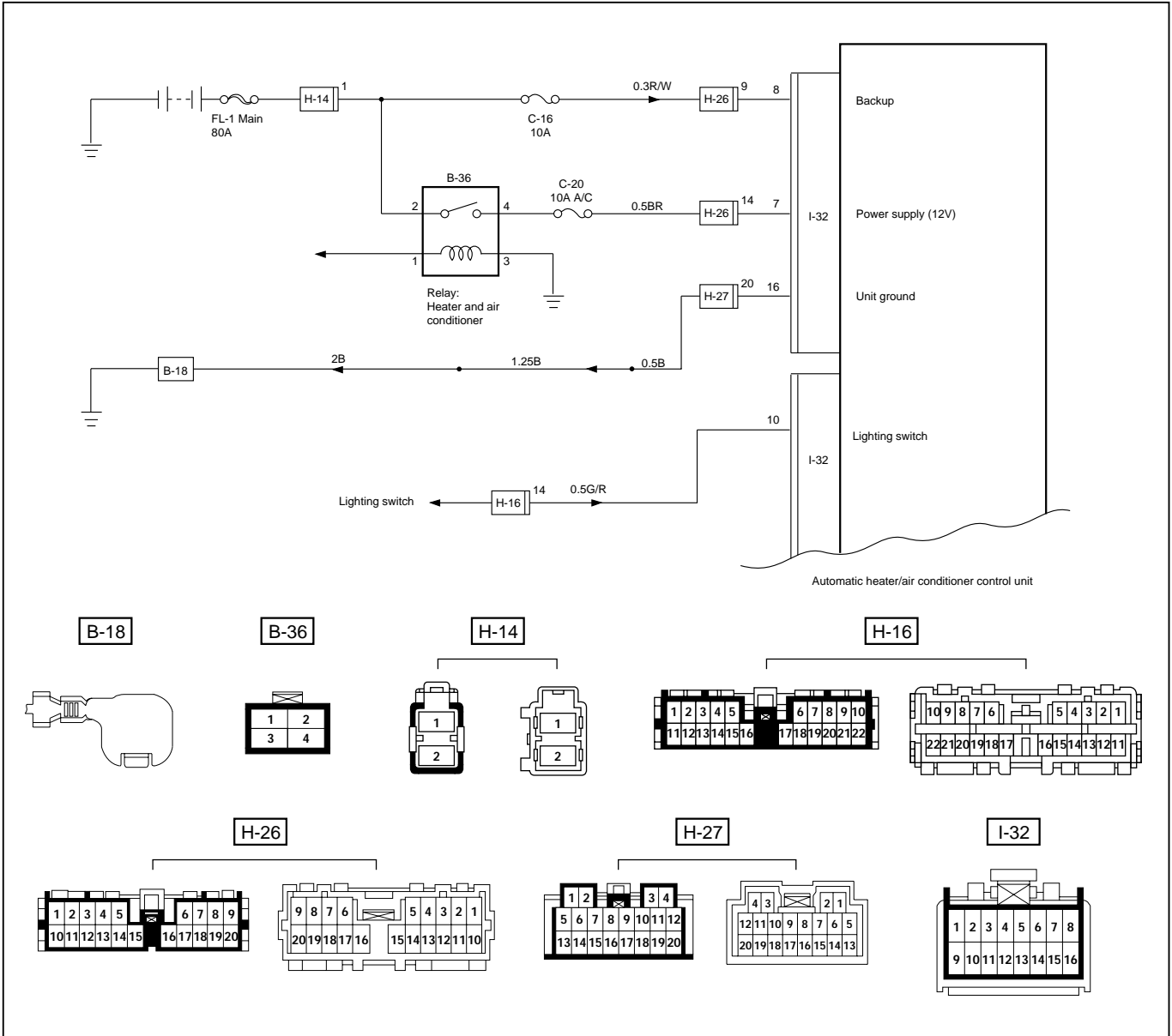
The following illustrates basic troubleshooting flow.

1. Basic Troubleshooting Flow



Check of Auto Amplifier (Automatic air conditioner control unit) Power Supply System

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

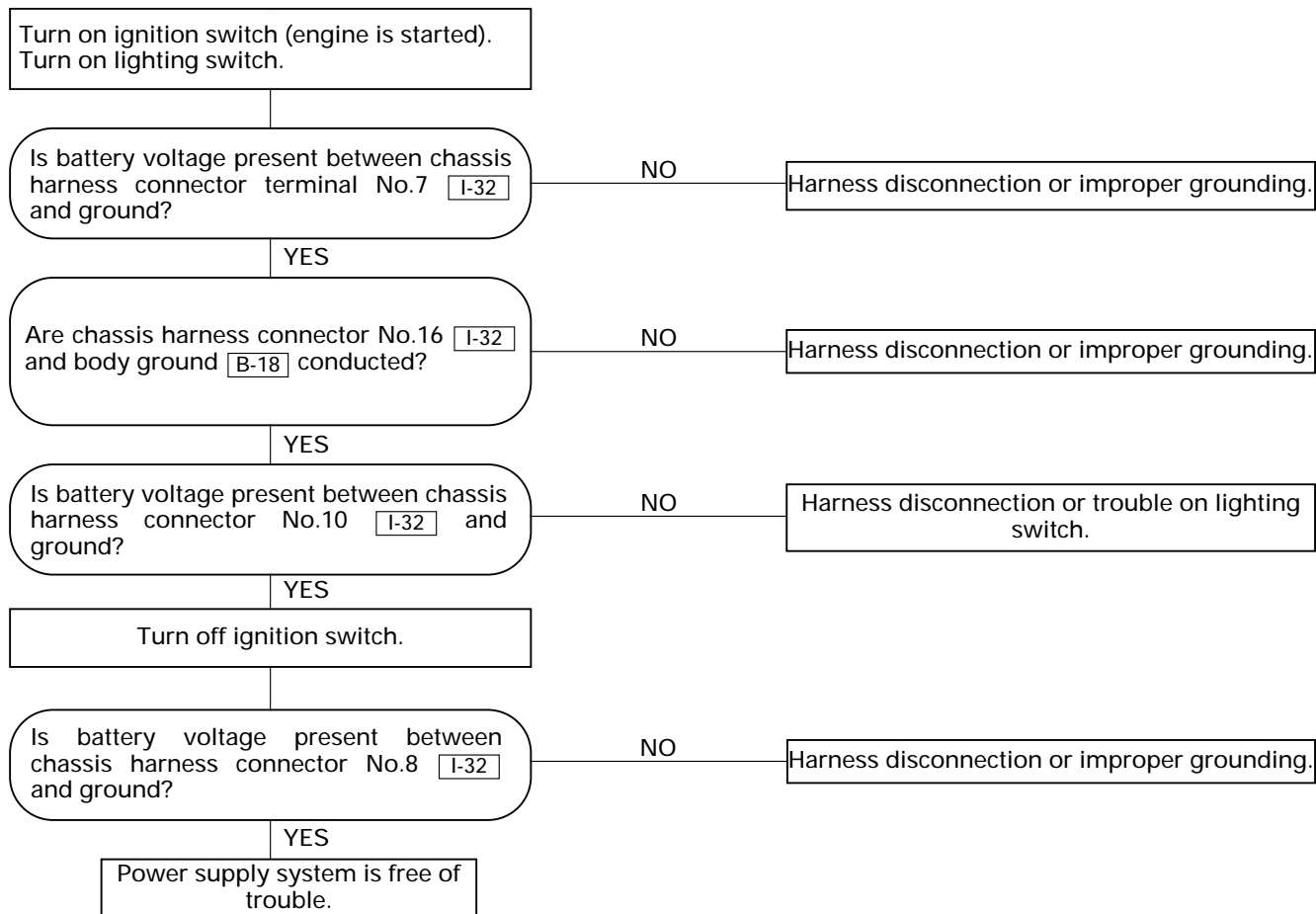


D08RY00175

Check of auto amplifier power supply circuit and grounding circuit.

Chart A

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






Performance and Movement checklist for Automatic Air Conditioner Related Parts

Start the engine, and when the engine coolant reached 60°C check performance and movement of the related parts according the following checklist.

1. Performance Check Using the Manual Switch

No.	Item	Checking Approach		Acceptance criteria
		Condition	Operation	
1	Blowing temperature (check movement of air mix door)	Auto switch must be turned on (FAN-AUTO MODE-AUTO)	(1) Select FC for the setup temperature. (2) Select FH for the setup temperature. → Then, select the MAX Control.	(1) Cold air shall be blown out. (2) Hot air shall be blown out.
2	Airflow volume (check movement of the mode door)	Set temperature to 25.0°C.	(1) Turn the fan knob off. (2) Turn the fan knob from LOW to HI.	(1) The fan shall be stopped, thus stopping air blow, too. (2) Airflow volume shall change from LOW to HI.
3	Blowing temperature (check movement of the mode door)	Set temperature to 25.0°C. Set the fan knob to HI.	Press the mode switch to change the blow port mode sequentially from the VENT through BI-LEVEL, FOOT up to DEF.	LED corresponding to each mode shall be turned on and the blow port mode shall be switched smoothly.
4	The interior/outside air switching mode (check movement of intake door)	Set temperature to 25.0°C.	Turn the LED off using the interior/outside air switch (this introduces the outside air intake mode). Then, the set fan knob to HI and press the interior/outside switch to turn on the LED.	The LED indication shall be switched from OFF to ON accompanying a change in air blowing sound.
5	Compressor	Set the temperature to FC. (Outside air temperature is 0C or above and interior temperature at ordinary temperature.)	Press the "OFF" switch. (1) Press the Auto switch. (2) Press the Air Conditioner switch.	(1) As the fan knob is set to the Auto position, the A/C switch LED shall come on and the compressor shall be turned on. (2) As the A/C LED comes off, the compressor shall be turned off.

2. Check of Full Auto Function

No.	Item	Checking Approach		Acceptance criteria
		Condition	Operation	
1	Full Auto function	FAN KNOB "AUTO" MODE SW "AUTO"	Select FC for the temperature.	<p>The LED shall come on. Cold air shall be blown out.</p> <p>The following LEDs shall come on:</p> <ul style="list-style-type: none"> • Blow port mode :  F01RX002 • Intake mode • Fan speed : MAX HI • A/C
			Change the temperature gradually starting with 20°C up to 30°C.	<p>The following phenomena shall be recognized.</p> <ul style="list-style-type: none"> • Temperature of blown air: Cold air is changed to hot air. • Change in the air flow volume. • The blow port mode LED indication changes in the following sequence: <p style="text-align: center;">  (VENT) (BI-LEVEL) (FOOT) </p> <p style="text-align: right;">F01RX003</p>
			Select FH for the temperature.	<p>Cold air shall be blown out. The following LEDs shall come on.</p> <ul style="list-style-type: none"> • Blow port mode :  F01RX004 • Fan speed: Max Hi

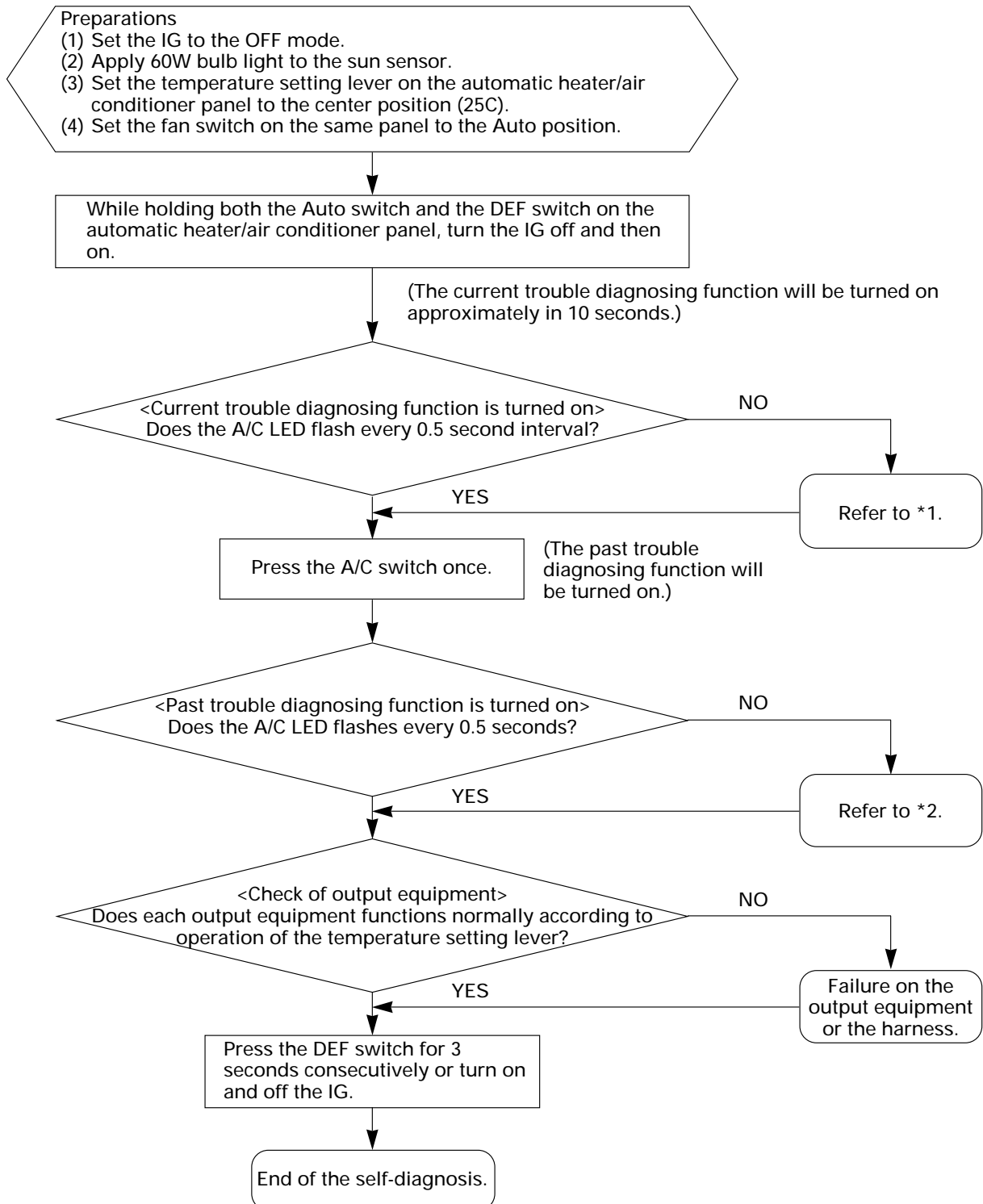
TROUBLESHOOTING WITH SELF-DIAGNOSIS FUNCTION

1. Overview of Self-Diagnosis Function

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

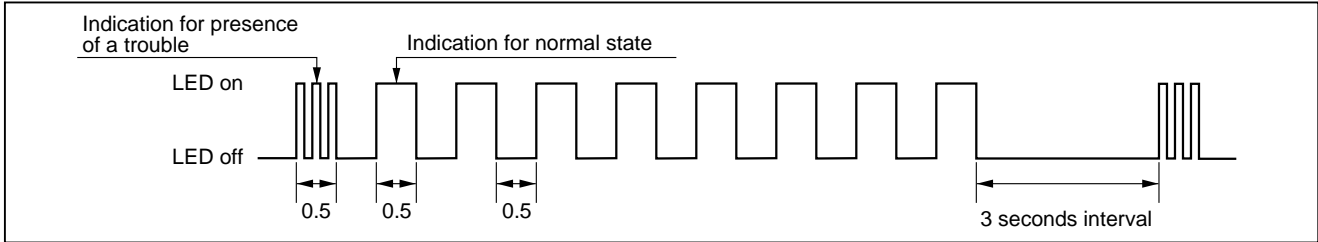
For turning on the self-diagnosis function and switching of the check step, refer to the flow chart given below. You can reset the self-diagnosis function by turning the ignition switch off or turning the DEF switch on for 3 seconds.

2. Self-Diagnosis Operation Procedure



***1. Displaying the Current Trouble Diagnosing Table**

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



F01RX010

Items for Current Trouble Diagnosis

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

F01RY00008

As shown above, display of result along nine items is repeated with 3-second interval in between.

Note 1: When checking the solar radiation sensor, apply sufficient light using a 60W bulb.

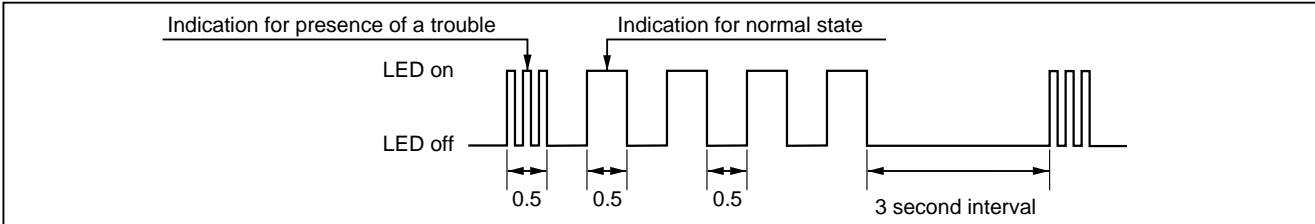
Otherwise, it can be diagnosed as failed.

Note 2: If the temperature setting lever is set on both ends (one set to 18°C, blue scale = Full cool and the other to 31°C, red scale = Full hot), they can be diagnosed as failed.

Note 3: Likewise, the fan switch can be diagnosed as failed if set on both ends.

*2. Displaying the Past Trouble Diagnosing Table

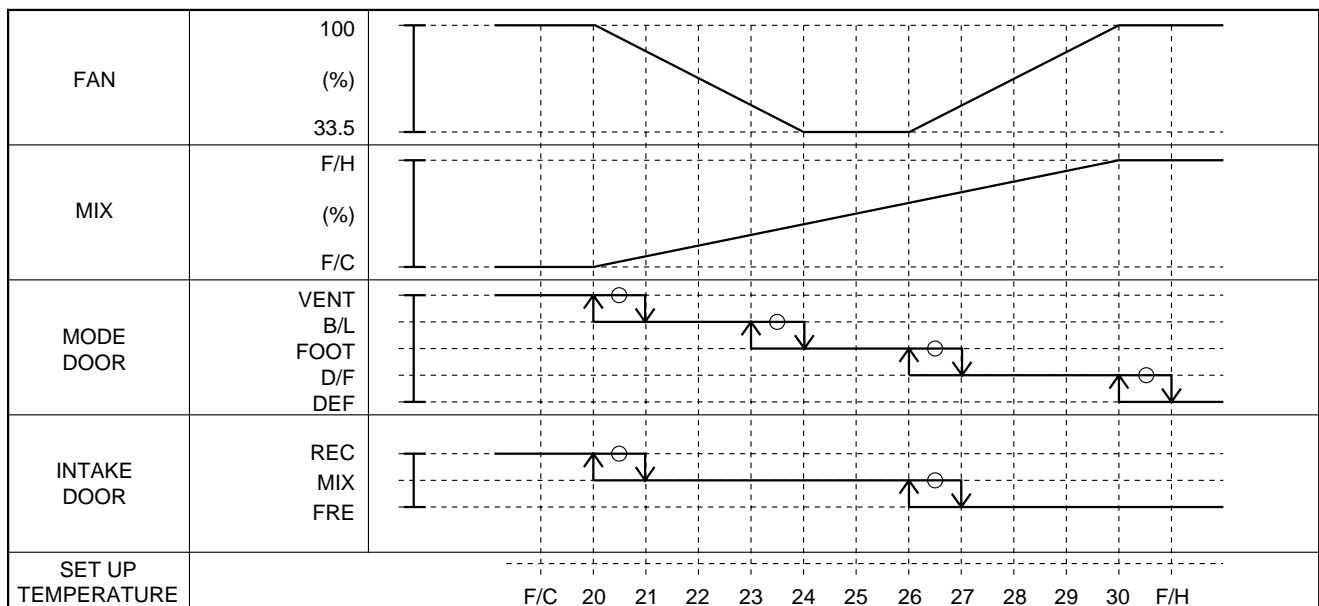
The past trouble diagnosis displays only the items on which trouble has recurred 16 times in the past. If you press the air conditioning switch once while the current trouble diagnosis is taking place, display of the past trouble diagnosis will appear on the indicator lamp (LED) of the air conditioning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



Items for Past Trouble Diagnosis

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

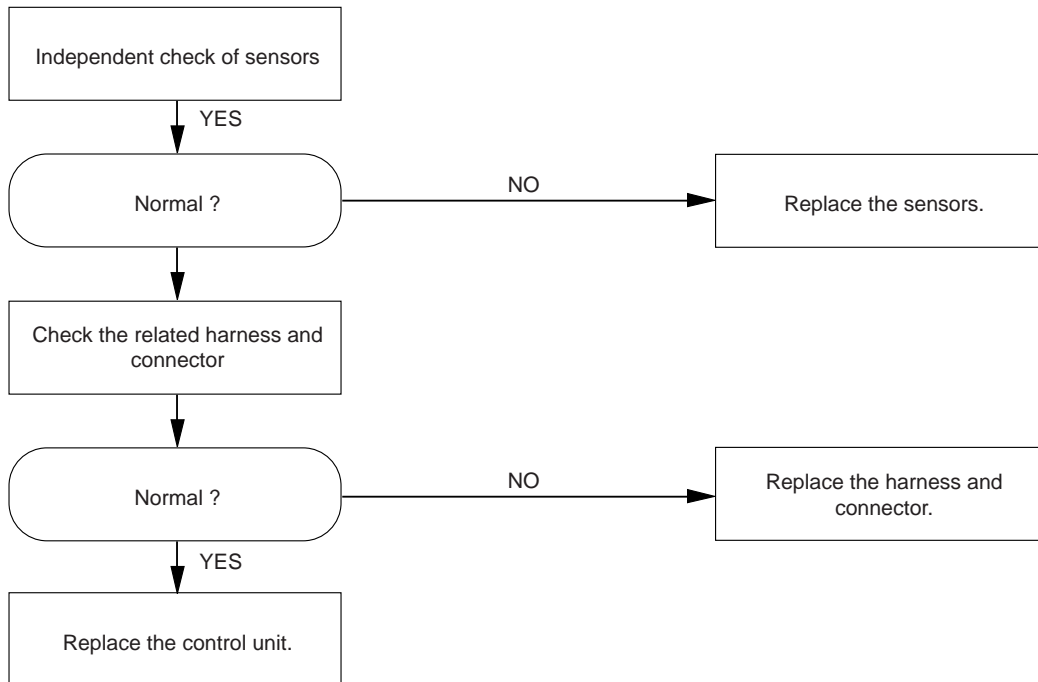
*3. Check of Output Equipment



INSPECTION BY FAILED LOCATION

Inspection of the Sensors

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



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

Chart 1: In Car Sensor

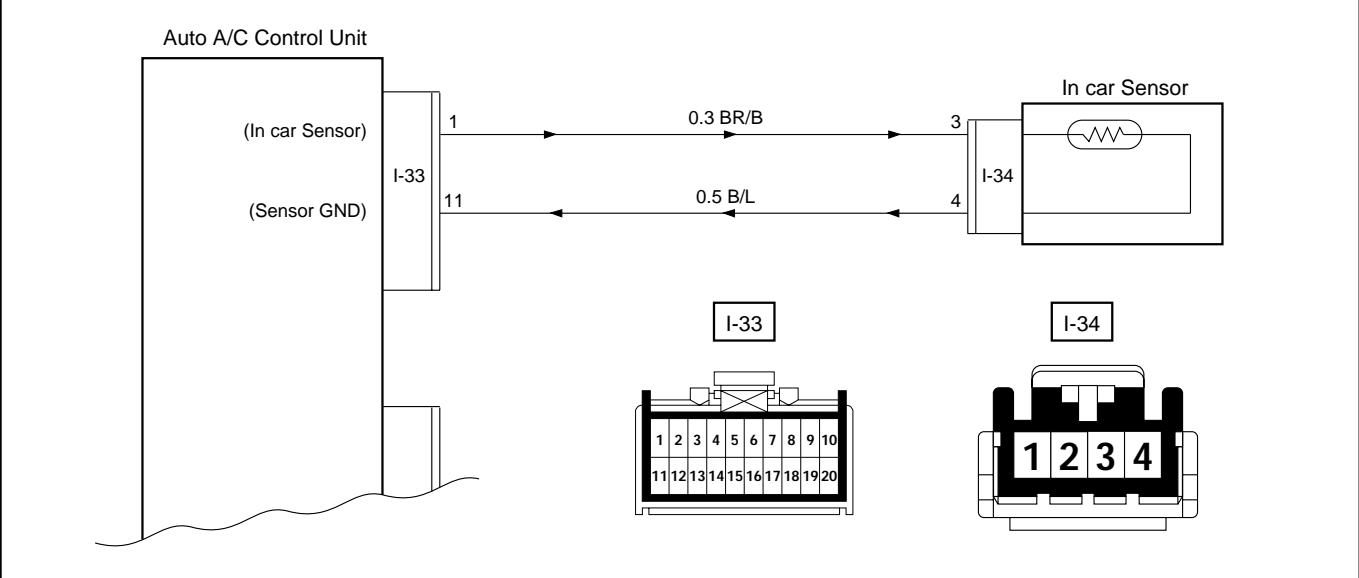
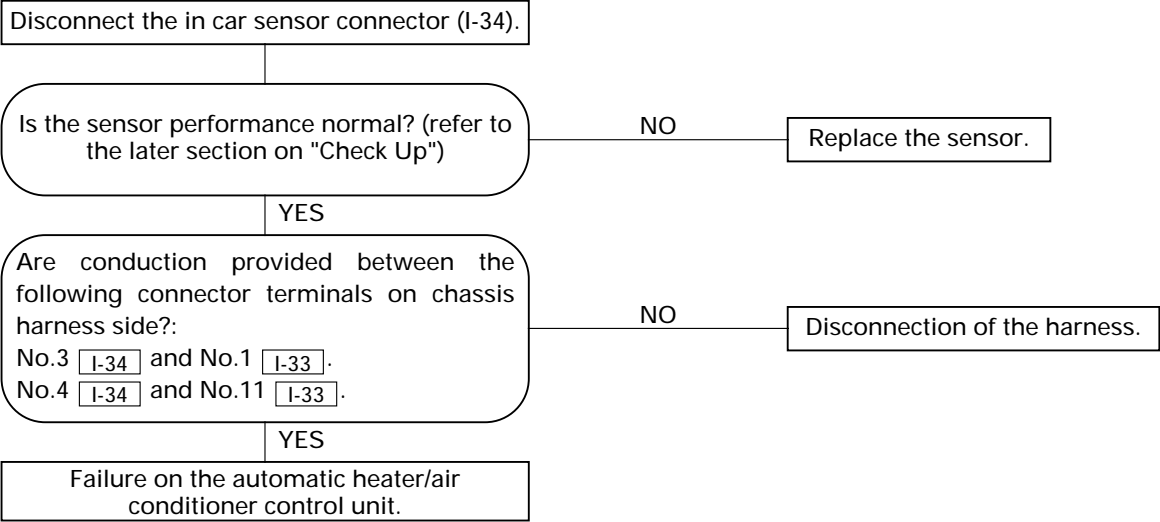


Chart 2: Ambient Sensor

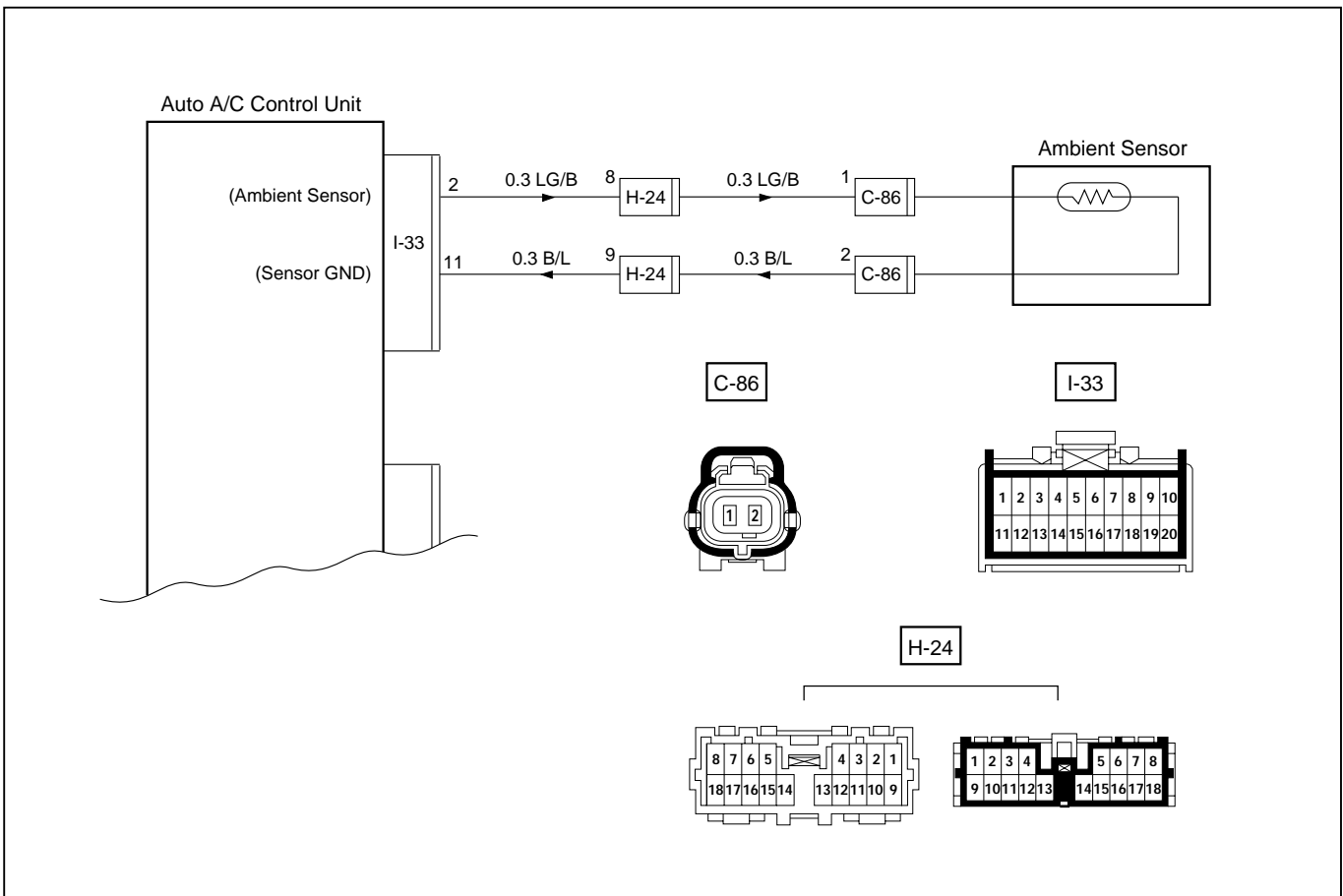
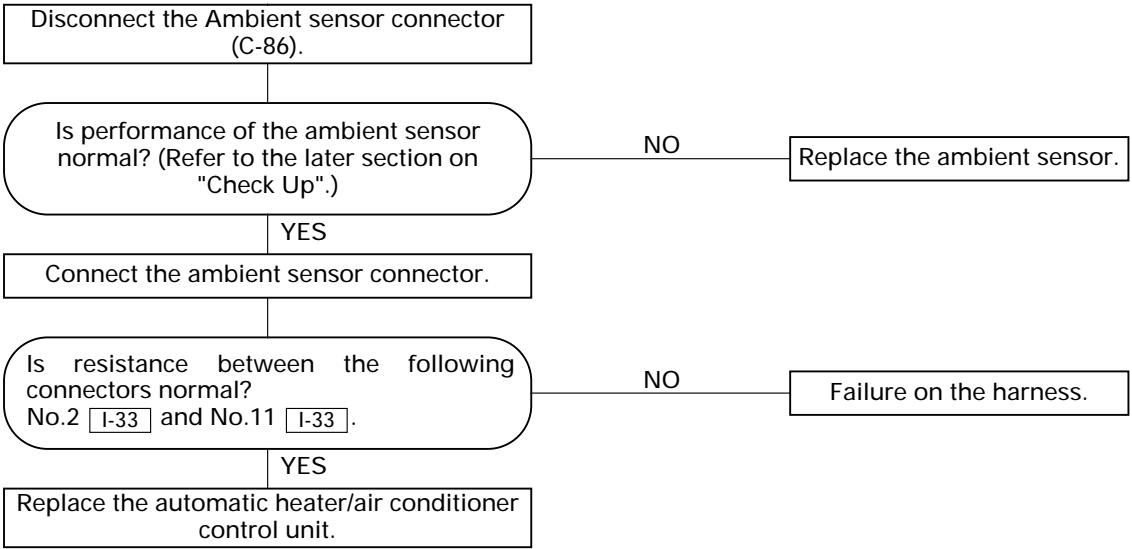
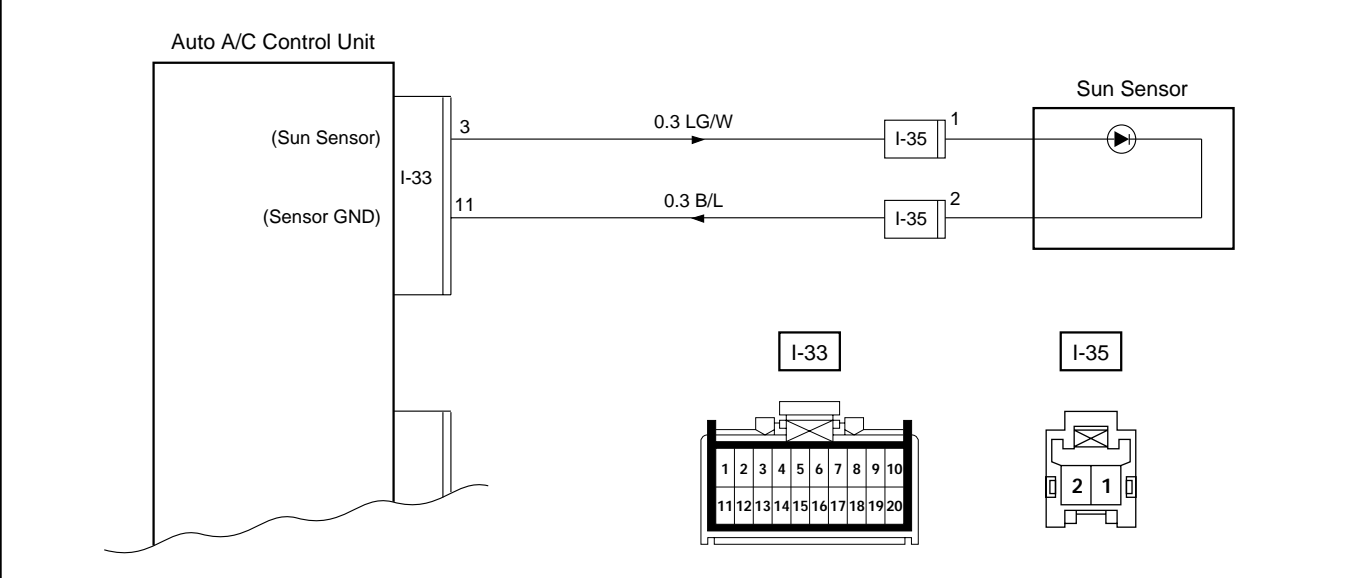
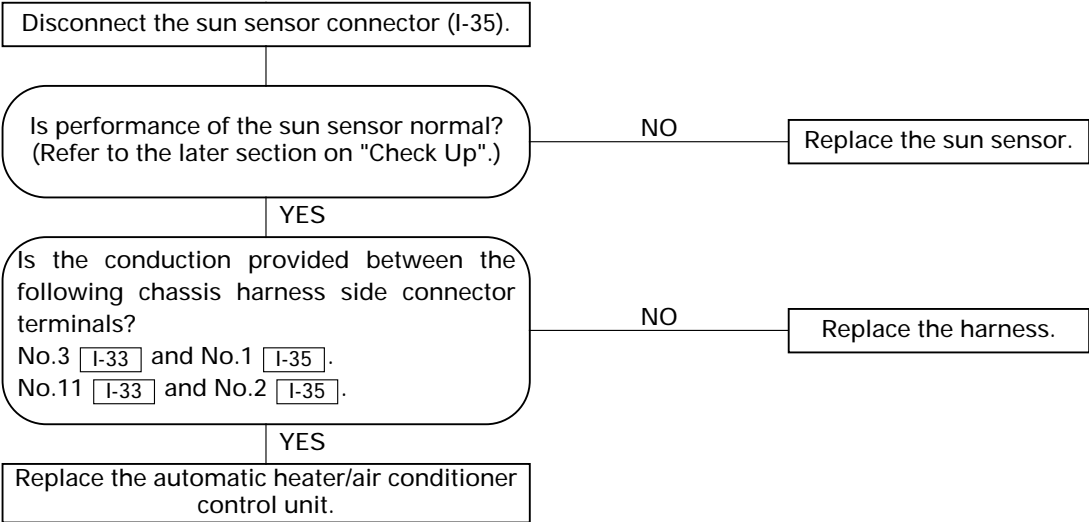
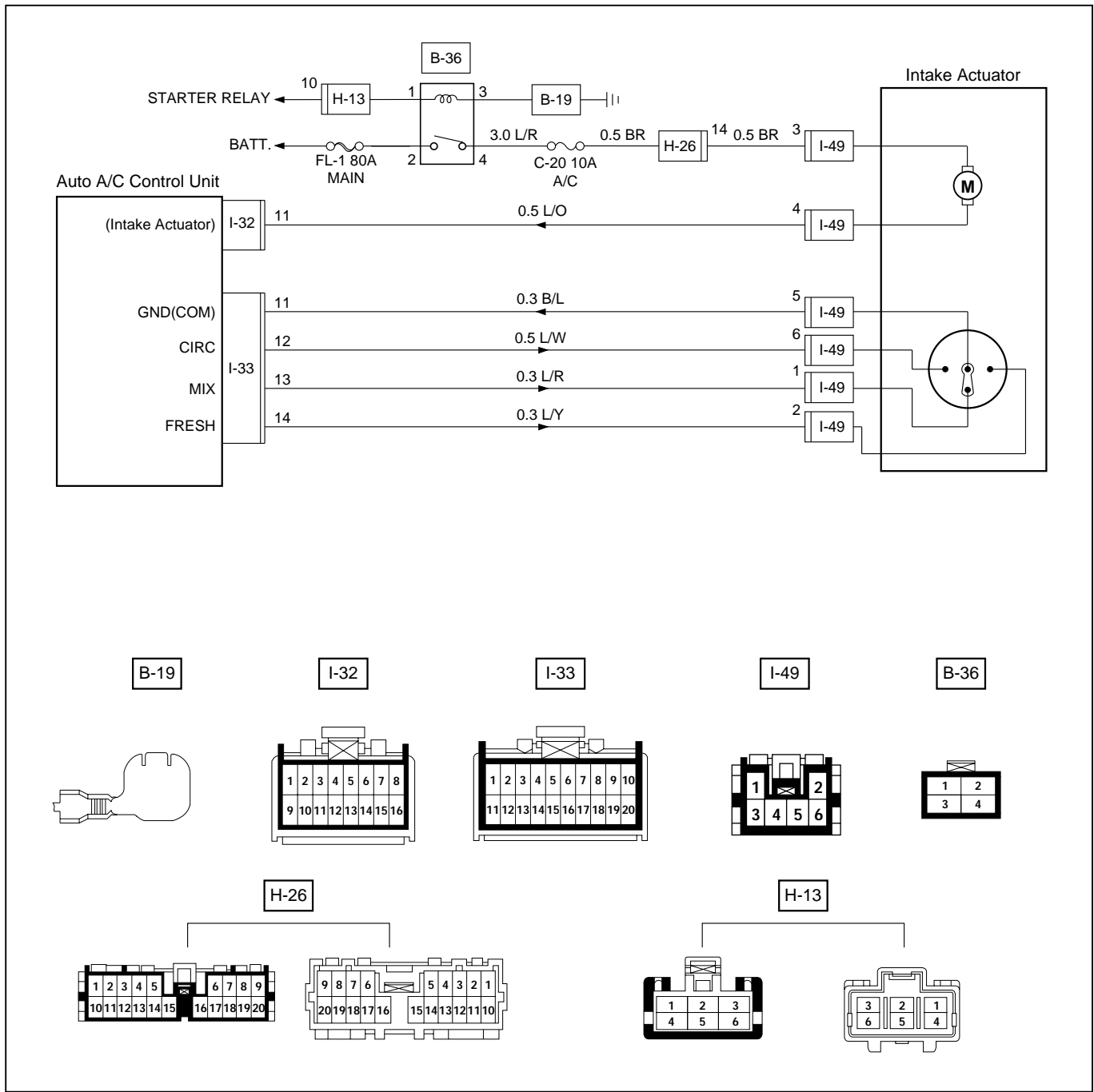


Chart 3: Sun Sensor



Inspection of the Intake Actuator System



D08RY00178

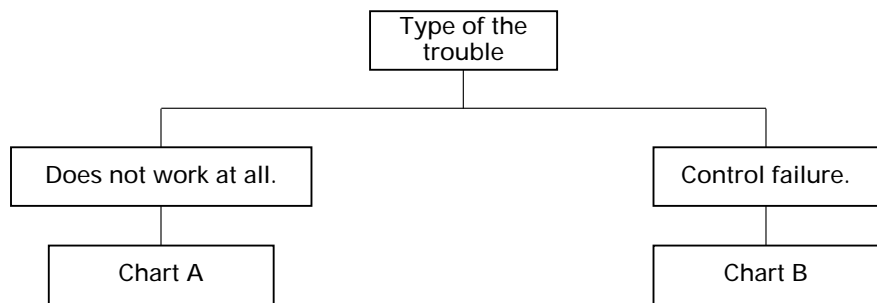


Chart A: Does Not Work At All

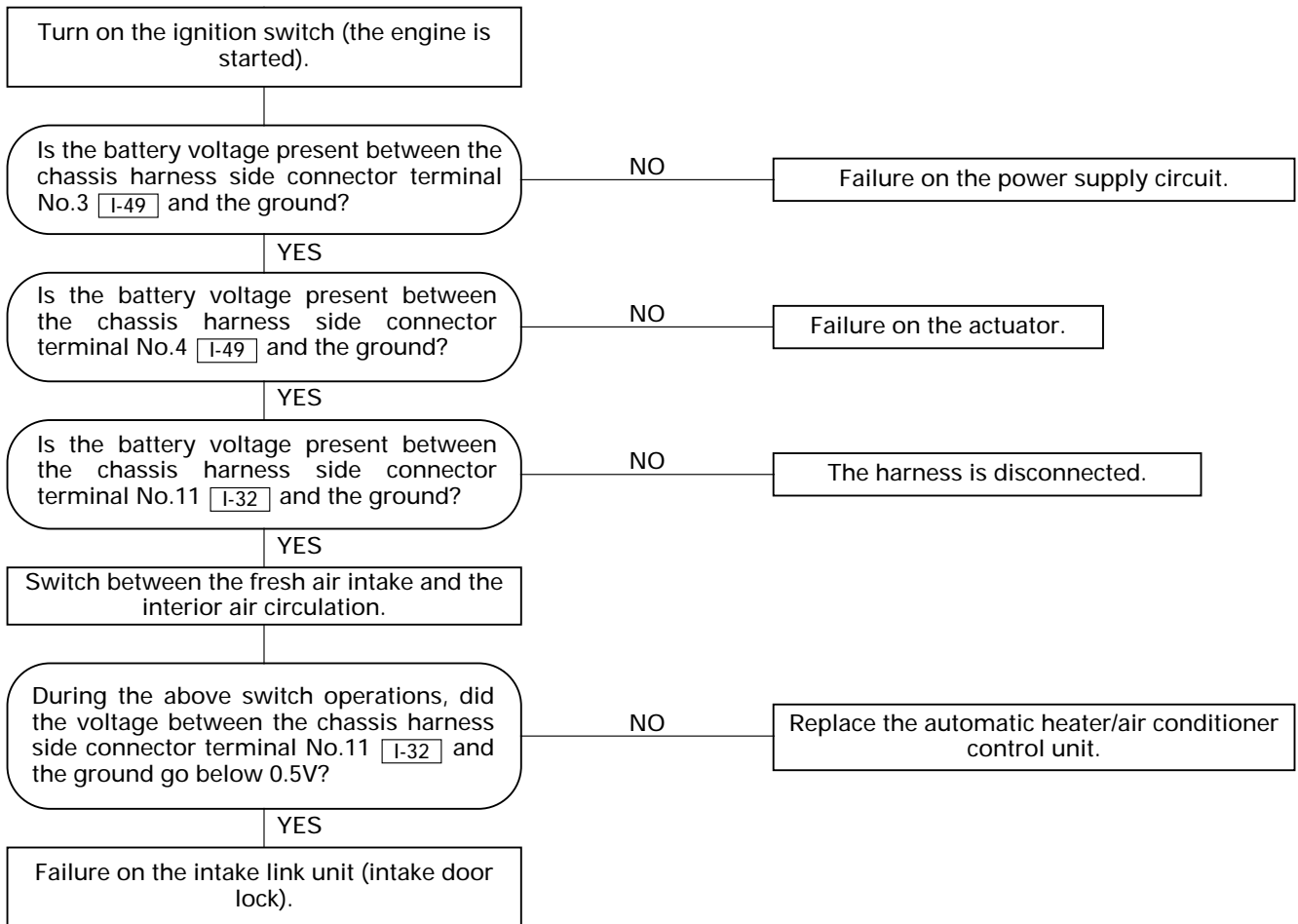
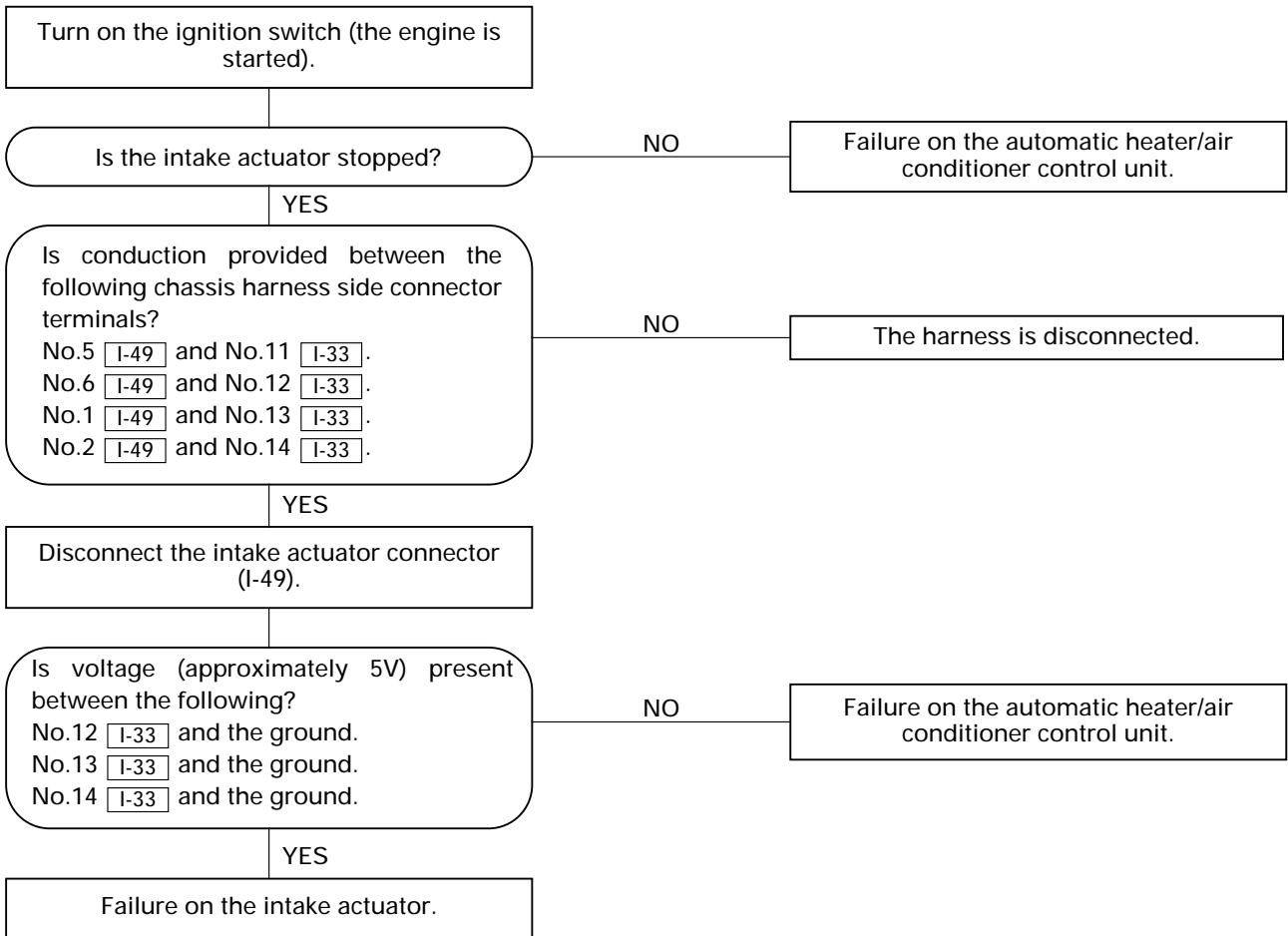
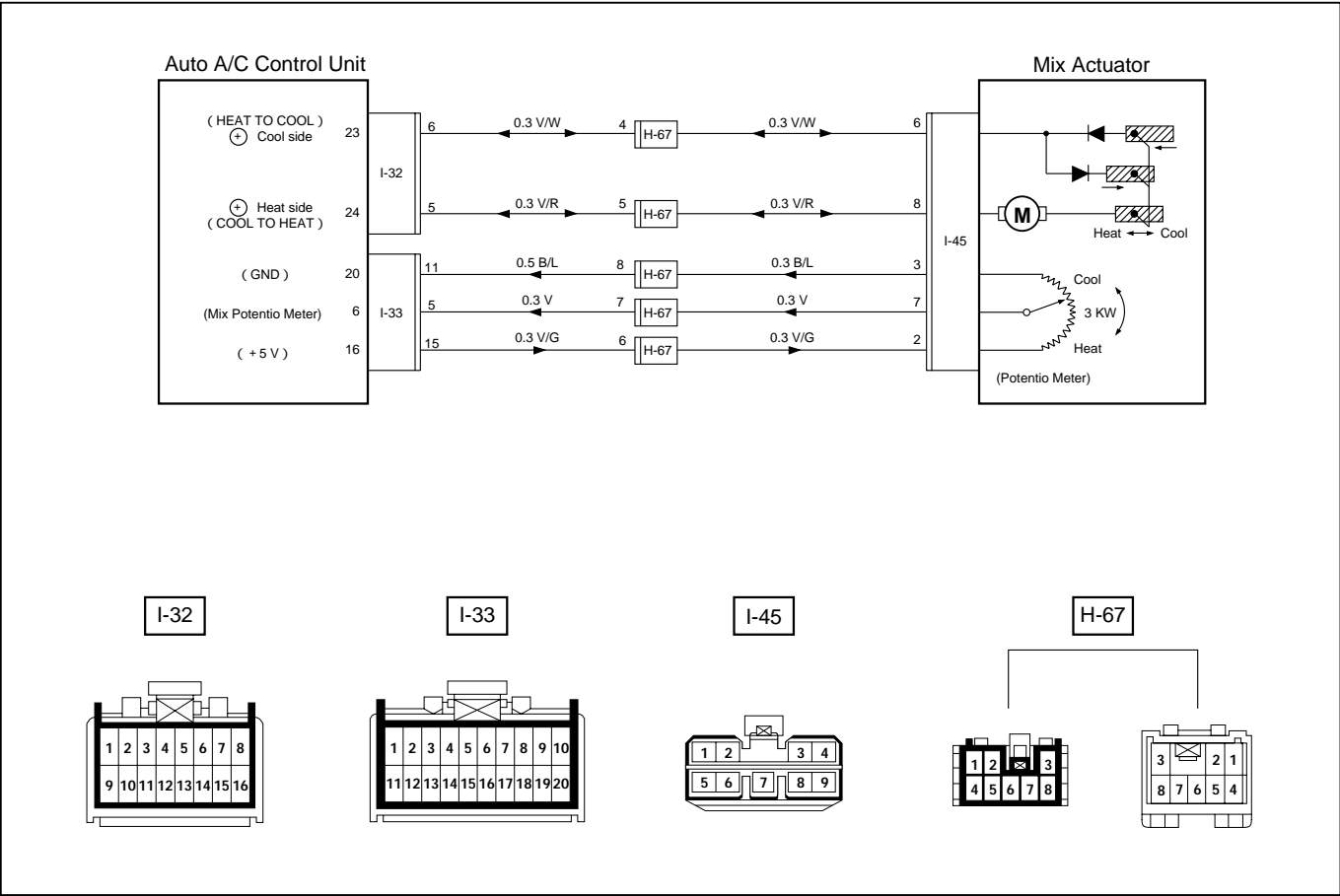


Chart B: Failure on the Intake Control



Inspection of the Mix Actuator System



D08RY00179

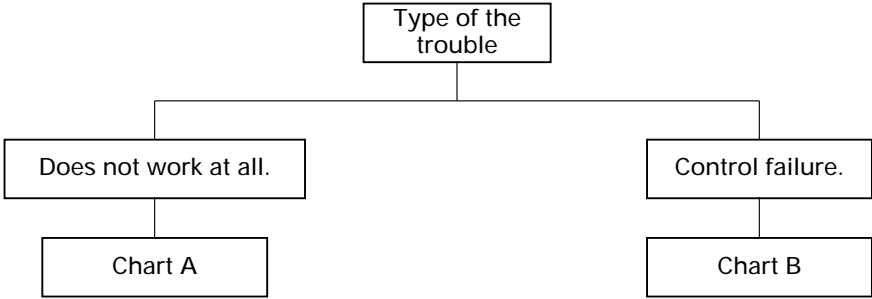


Chart A: Does Not work At All

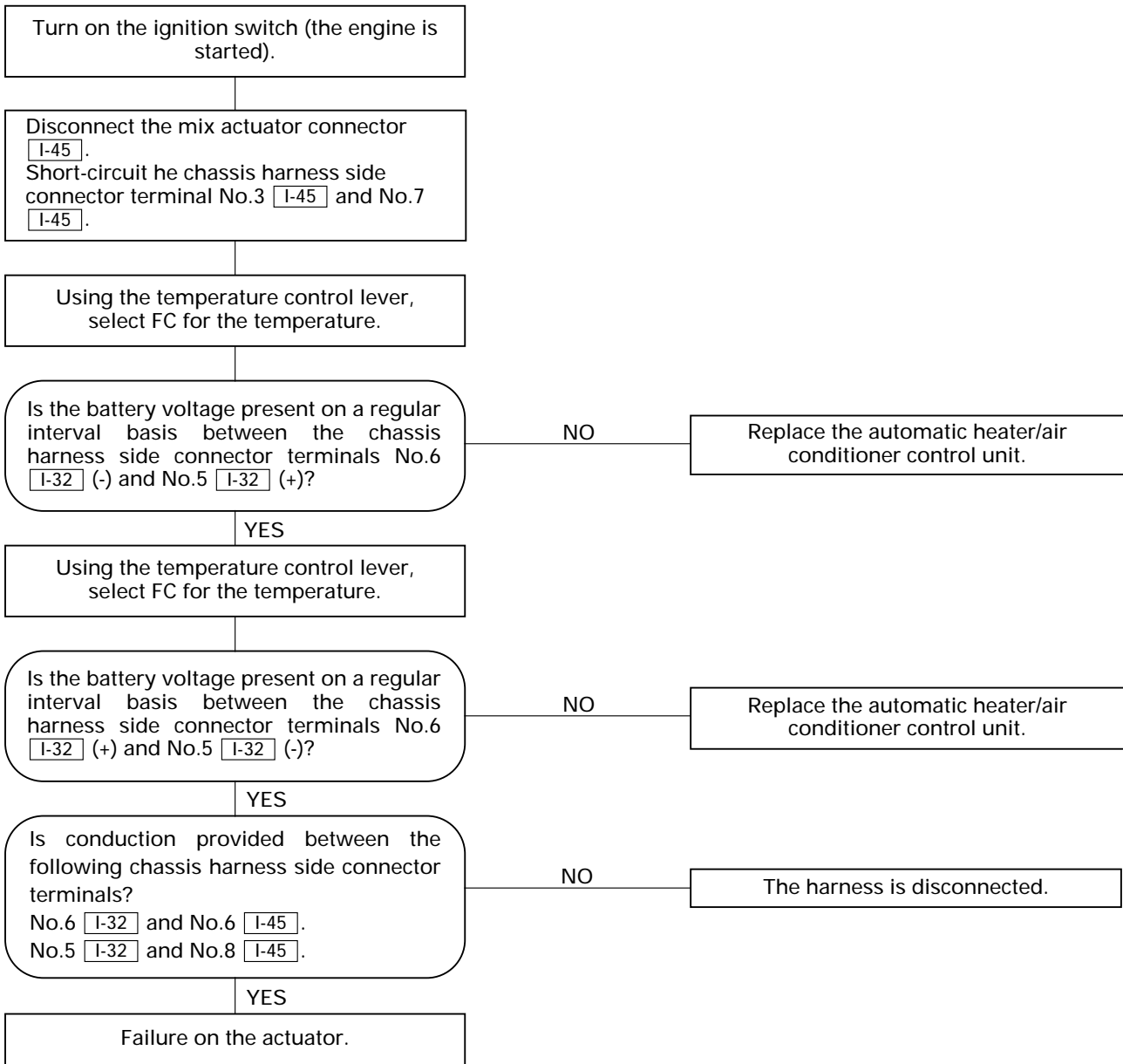
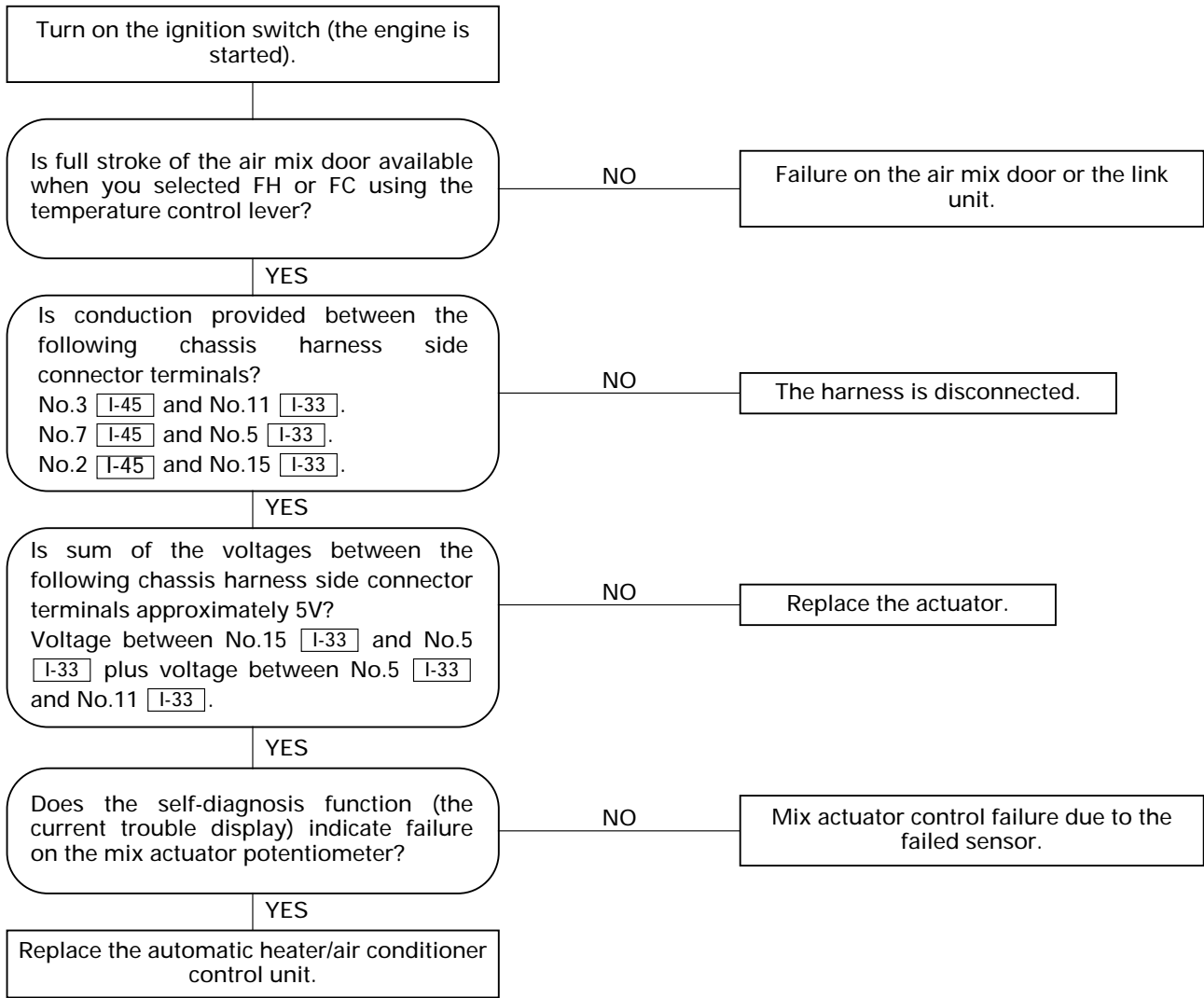
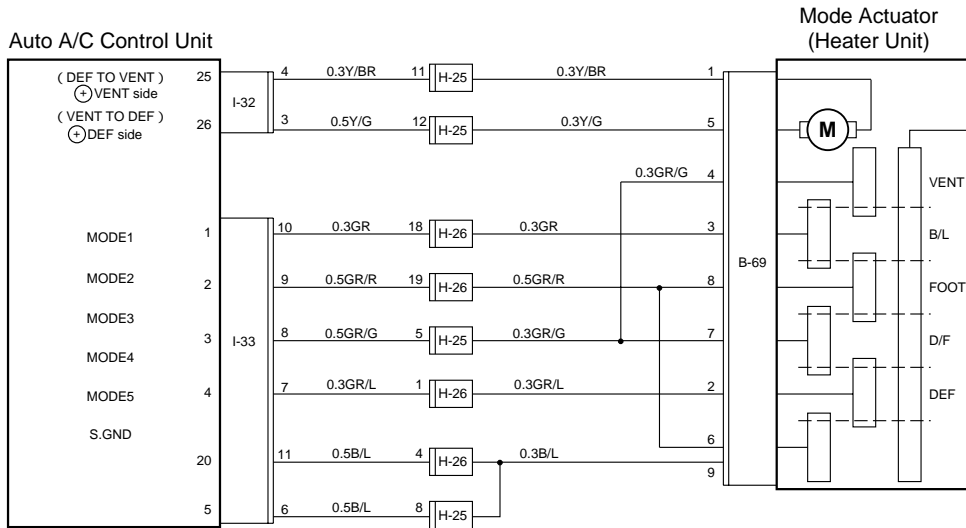


Chart B: Mix Actuator Control Failure



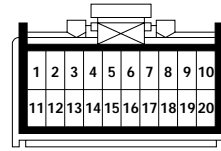
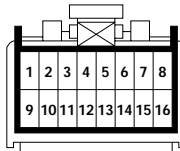
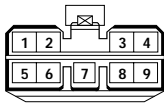
Inspection of the Mode Actuator System



B-69

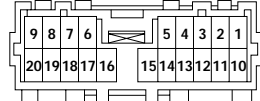
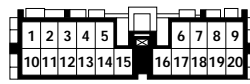
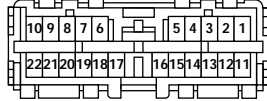
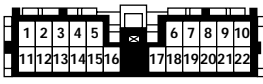
I-32

I-33



H-25

H-26



D08RY00180

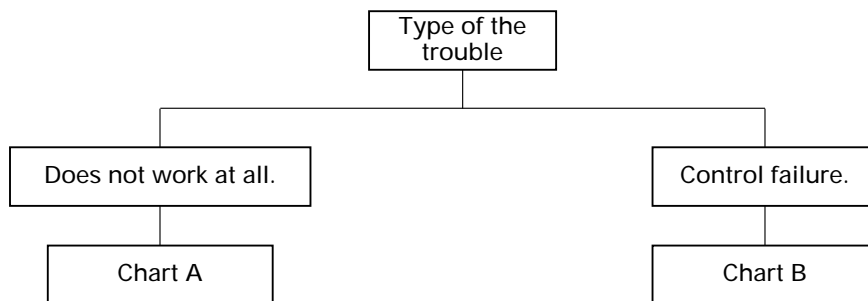


Chart A: Does Not Work At All

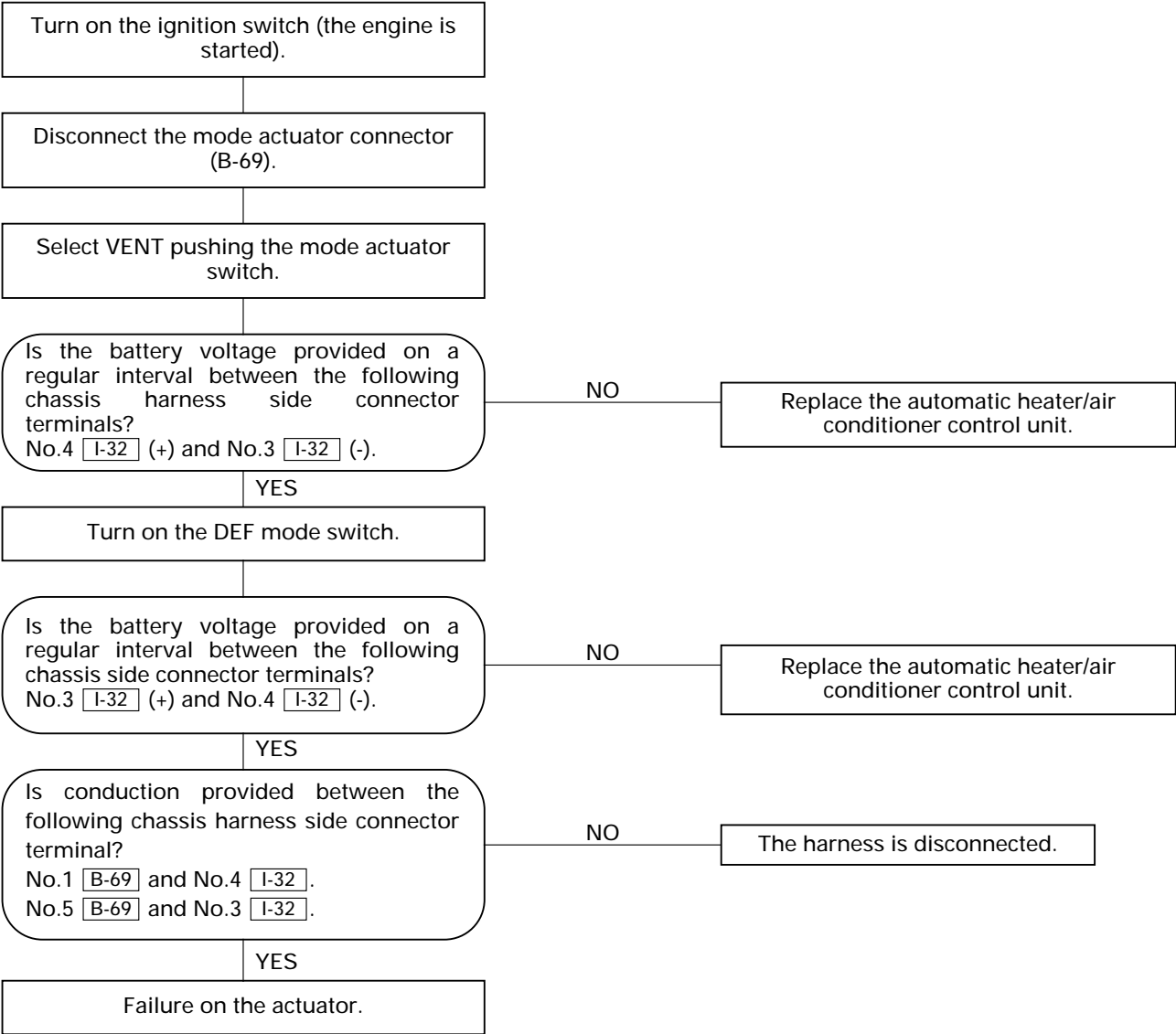
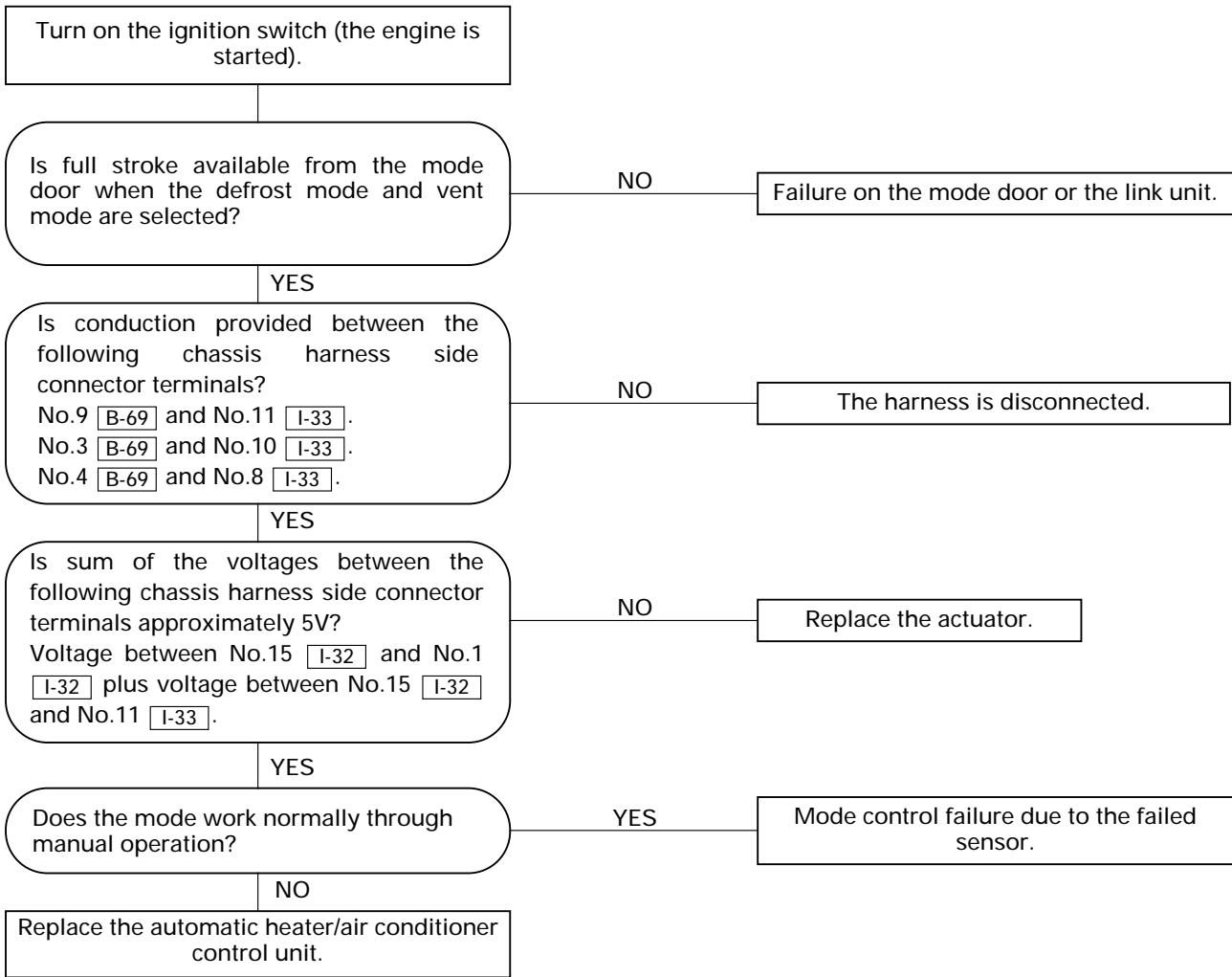


Chart B: Mode Actuator Control Failure



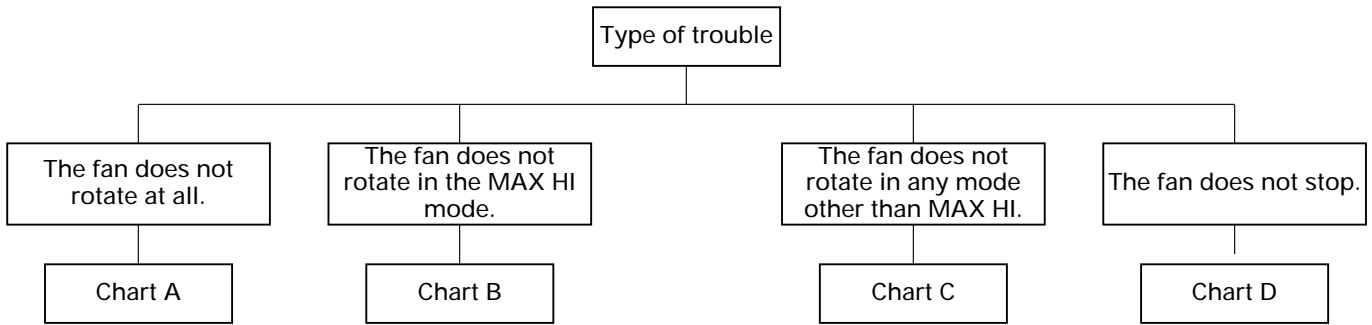


Chart A: Fan Does Not Rotate At All

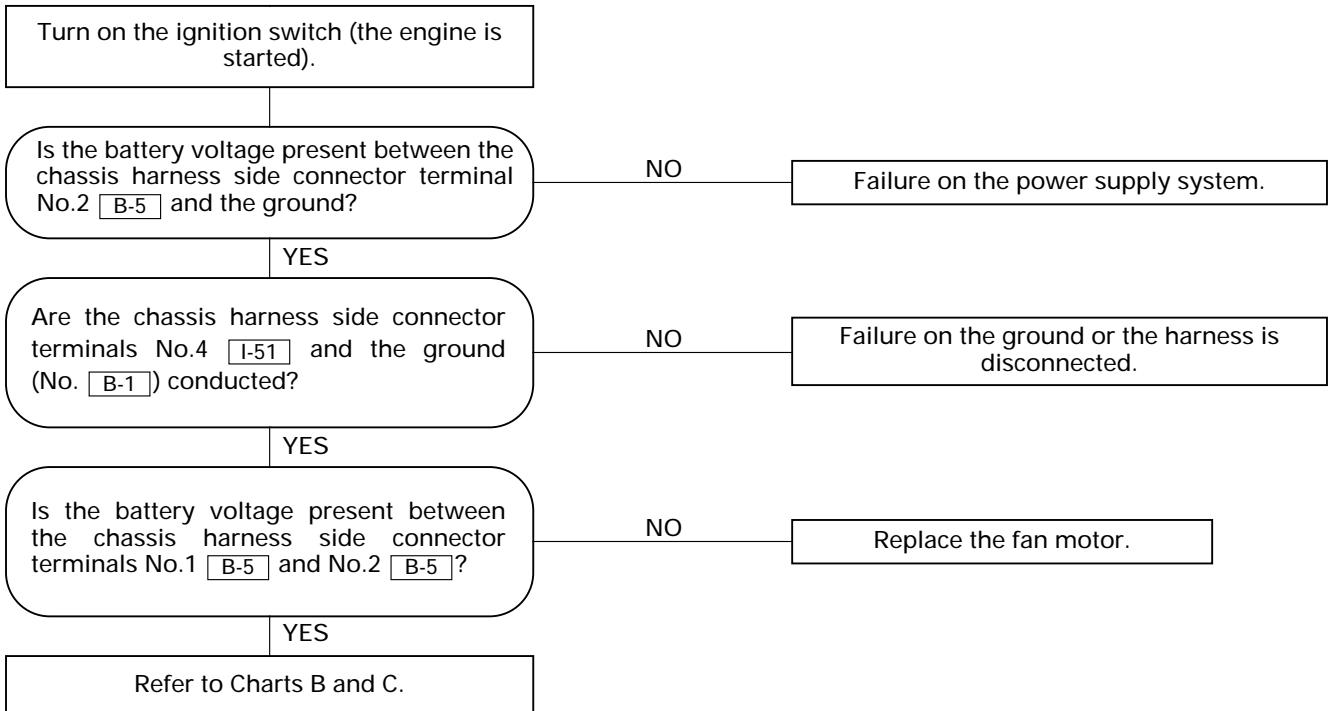


Chart B: Fan Does Not Rotate in MAX HI Mode

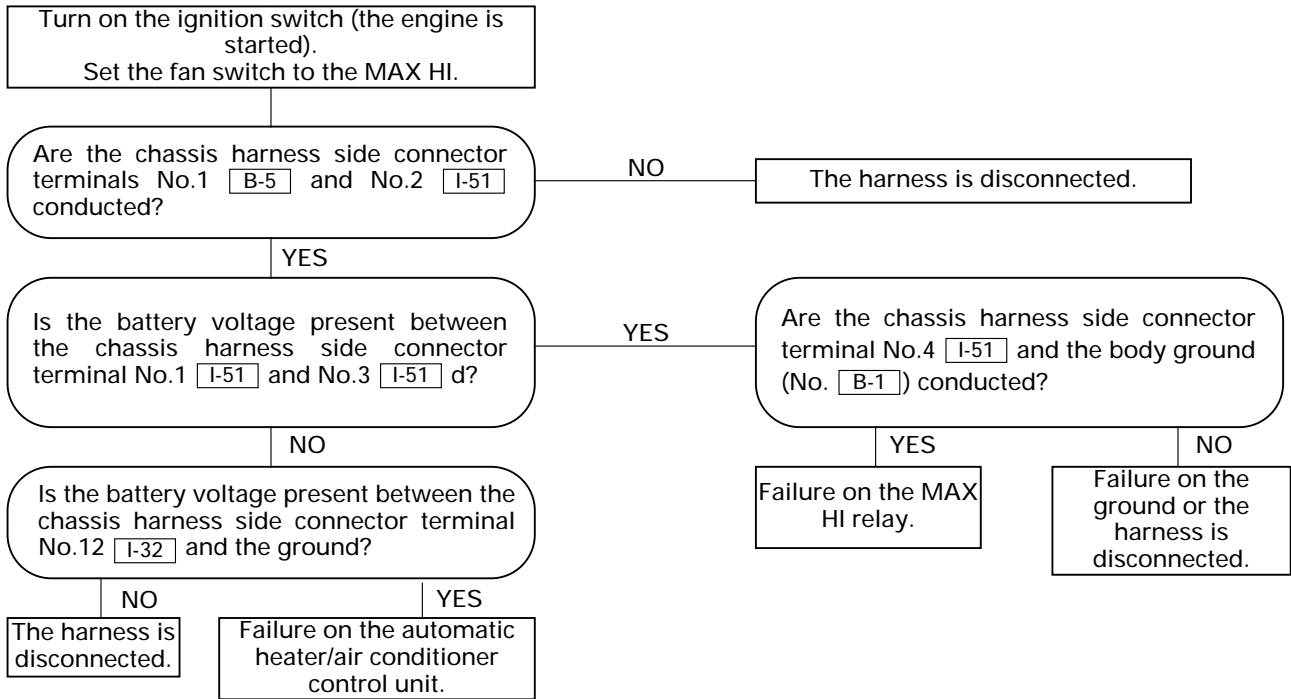


Chart C: Fan Does Not Rotate In Any Mode Other Than MAX HI

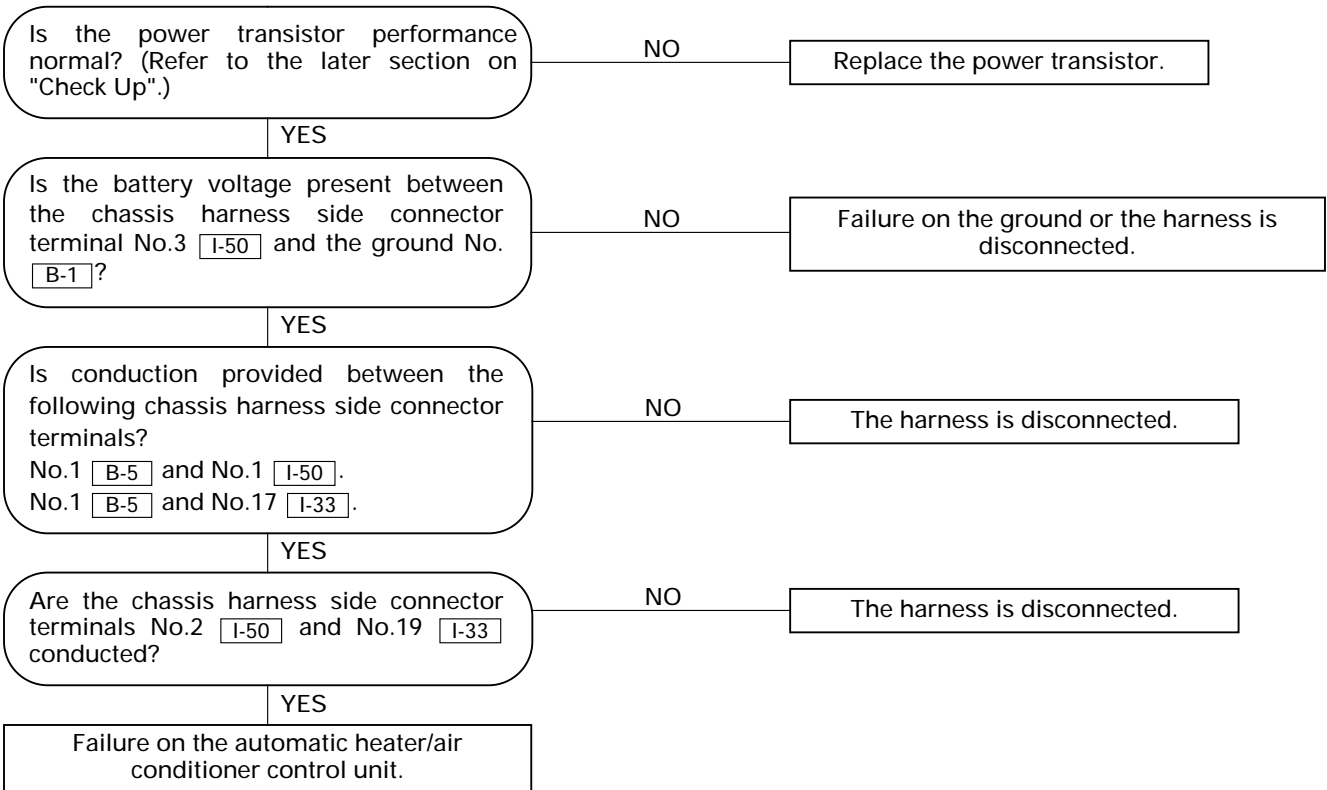


Chart D: Fan Does Not Stop

Is the power transistor performance normal? (Refer to the later section on "Check Up".)

NO → Replace the power transistor.

YES

Is the MAX HI relay performance normal? (Refer to the later section on "Check Up".)

NO → Replace the relay.

YES

Turn on the ignition switch (the engine is started).

Is the battery voltage present between the chassis harness side connector terminals No.1 **I-51** and No.3 **I-51**?

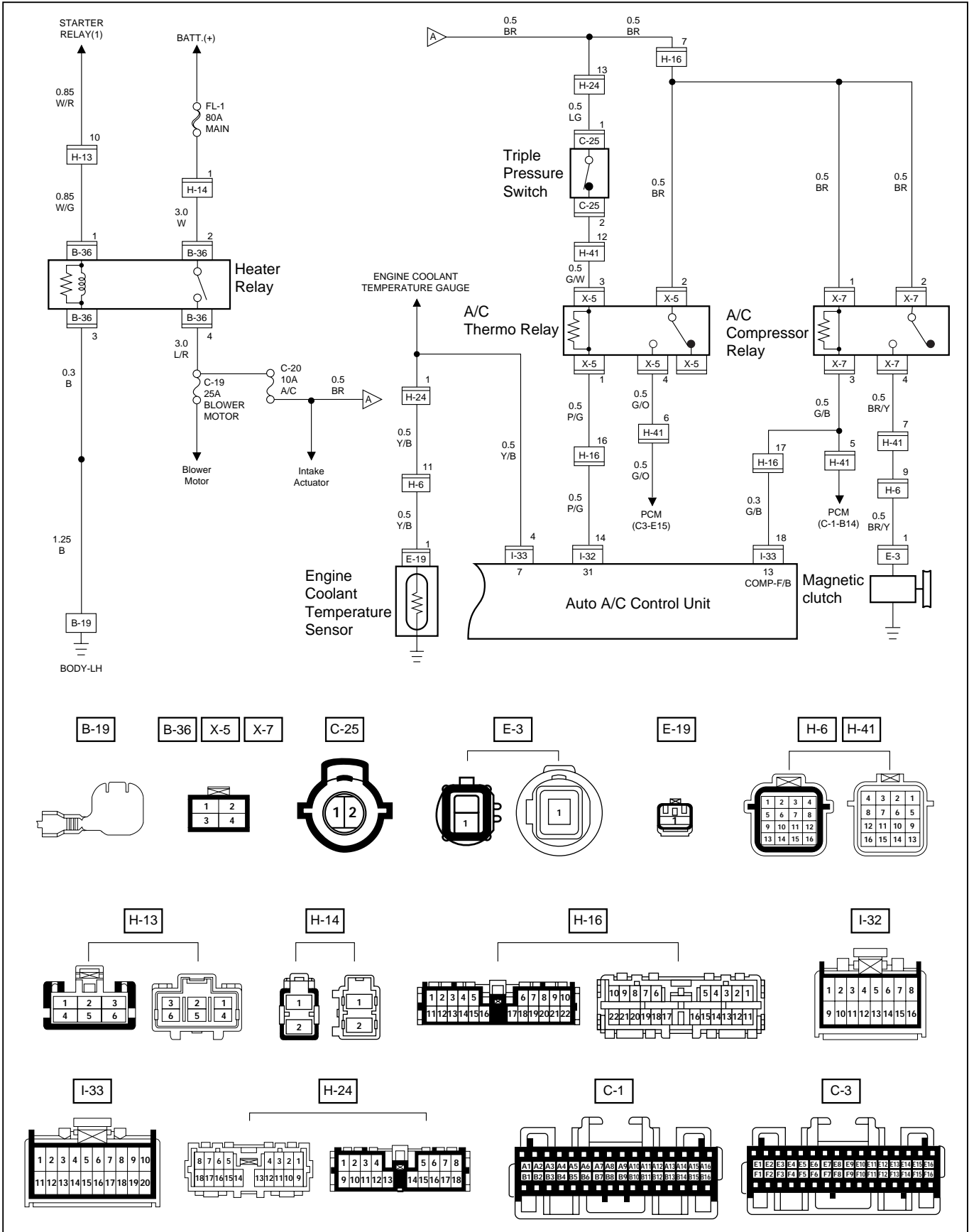
YES → Failure on the automatic heater/air conditioner control unit. Or, the harness line is short circuited between the chassis harness side connector terminals No.3 **I-51** and No.12 **I-32**.

NO

The chassis harness side connector terminals No.1 **B-5** and No.2 **I-51**, or No.1 **B-5** and No.1 **I-50** is short circuited.

Inspection of the Magnet Clutch System

6VE1 Engine



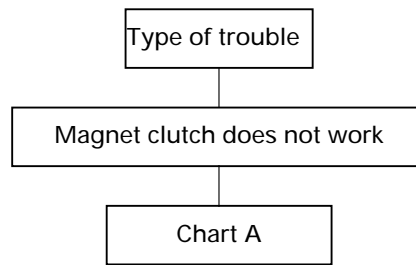
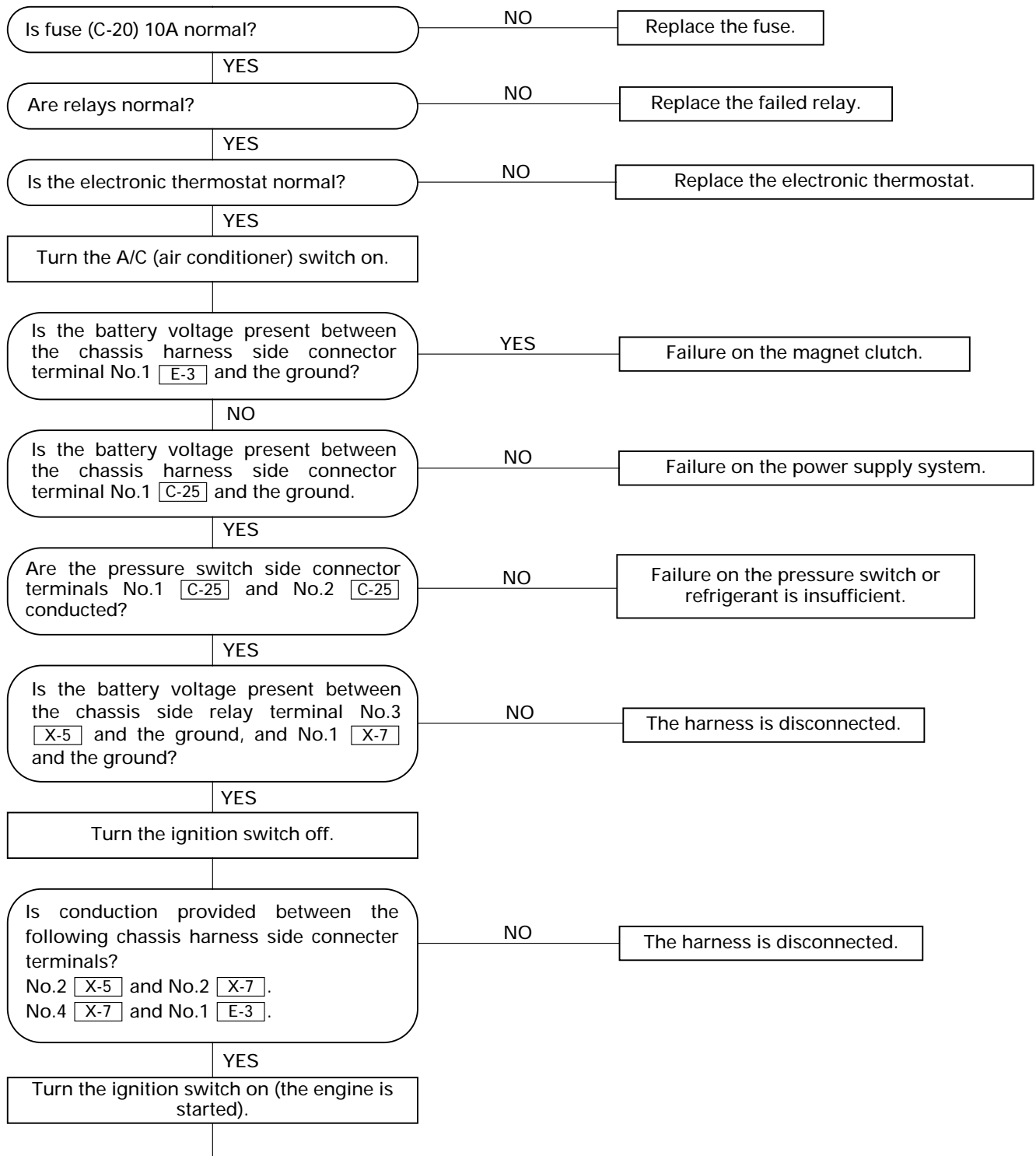
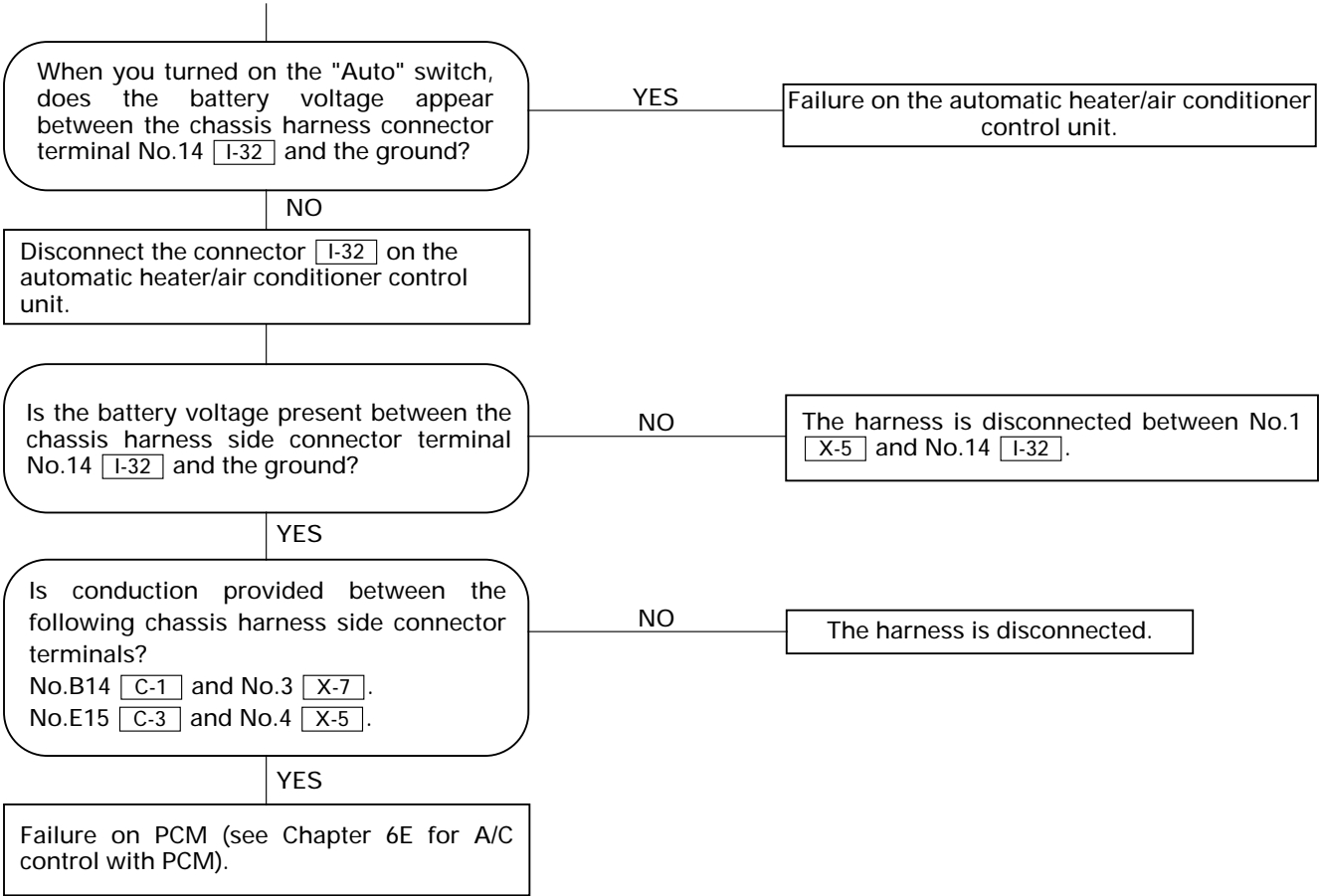


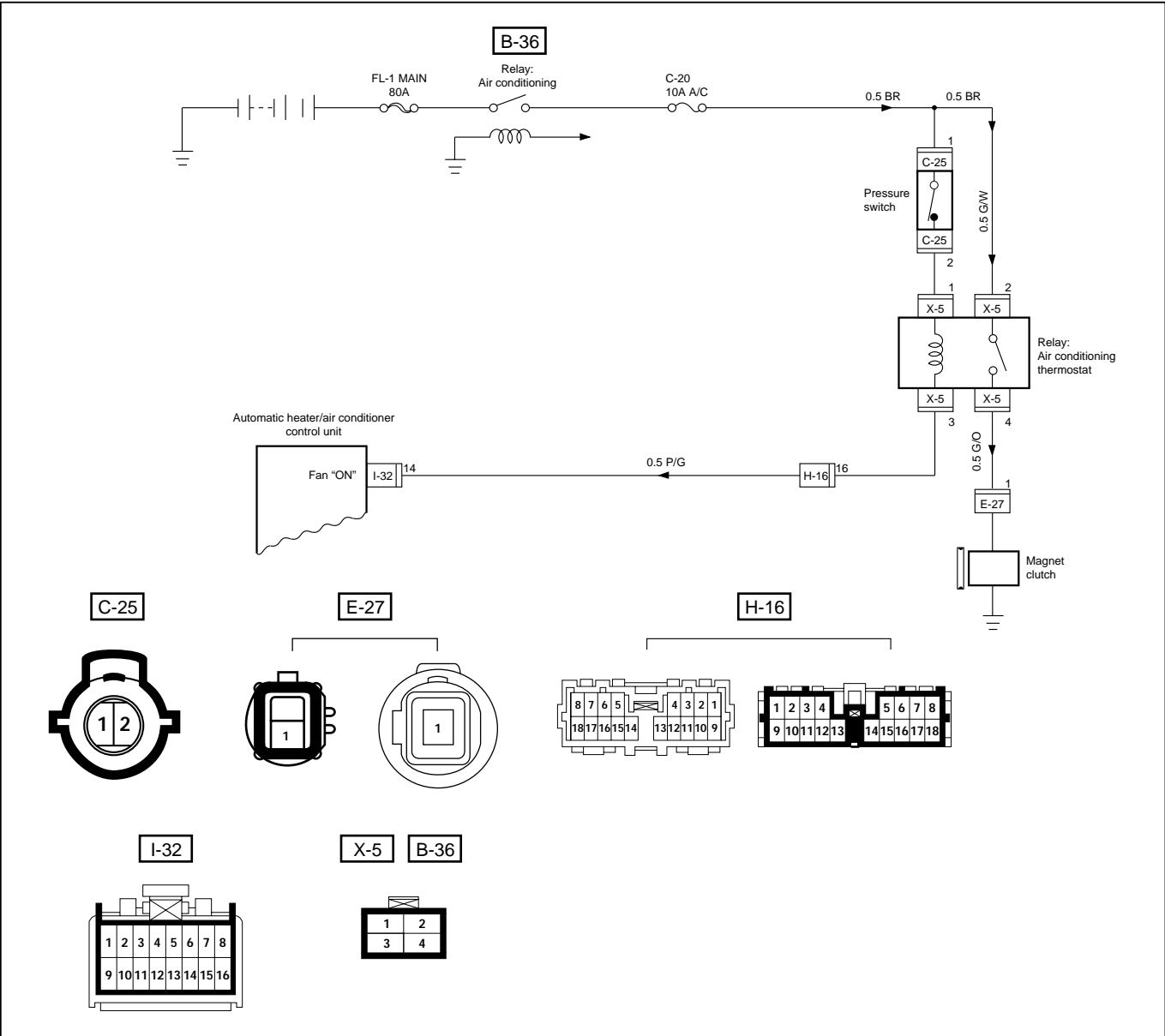
Chart A: Magnet Clutch Does Not work



1B-120 AIR CONDITIONING



4JX1 Engine



D08RY00183

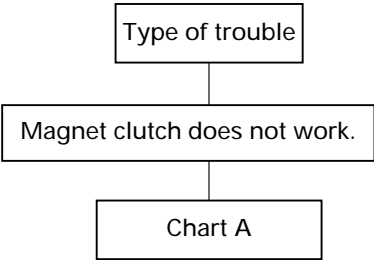
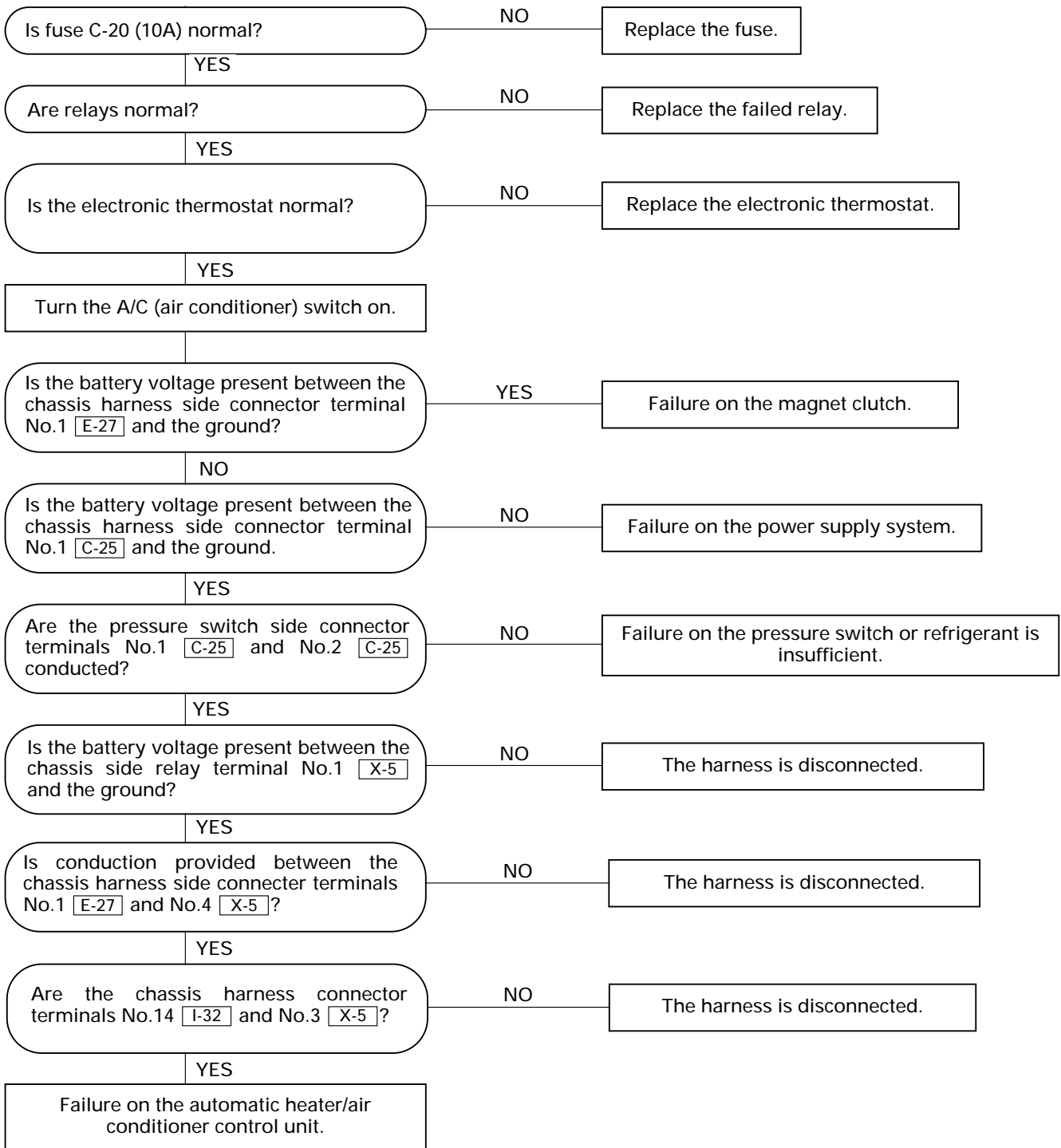
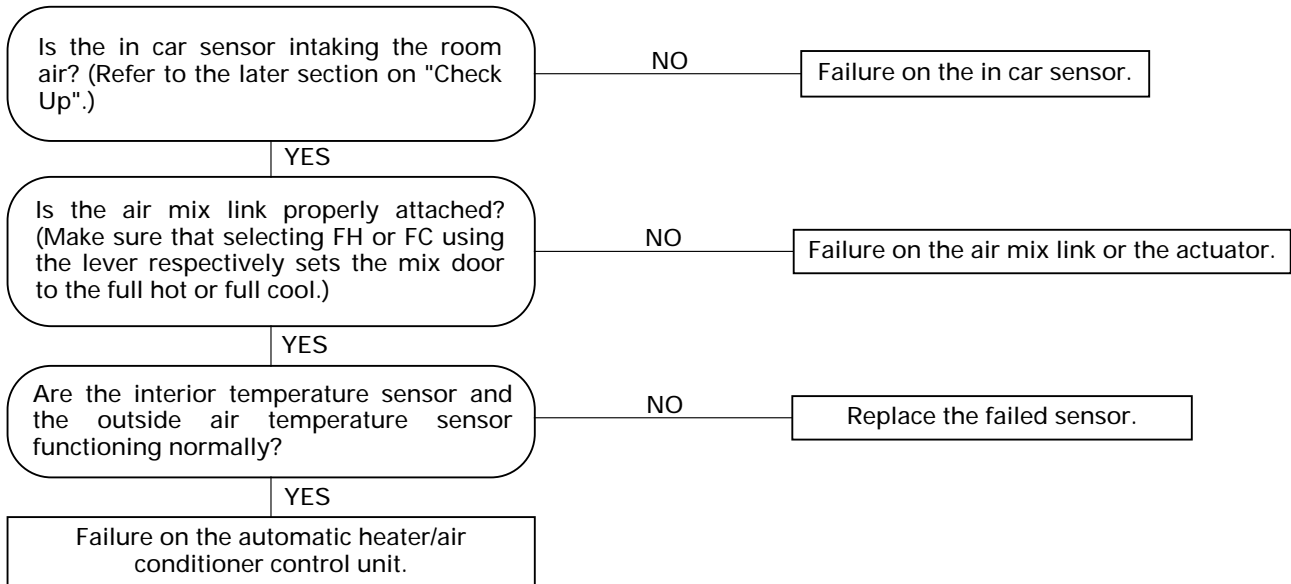


Chart A: Magnet Clutch Does Not Work



Inspection of the Air Conditioner Room Temperature Setup System

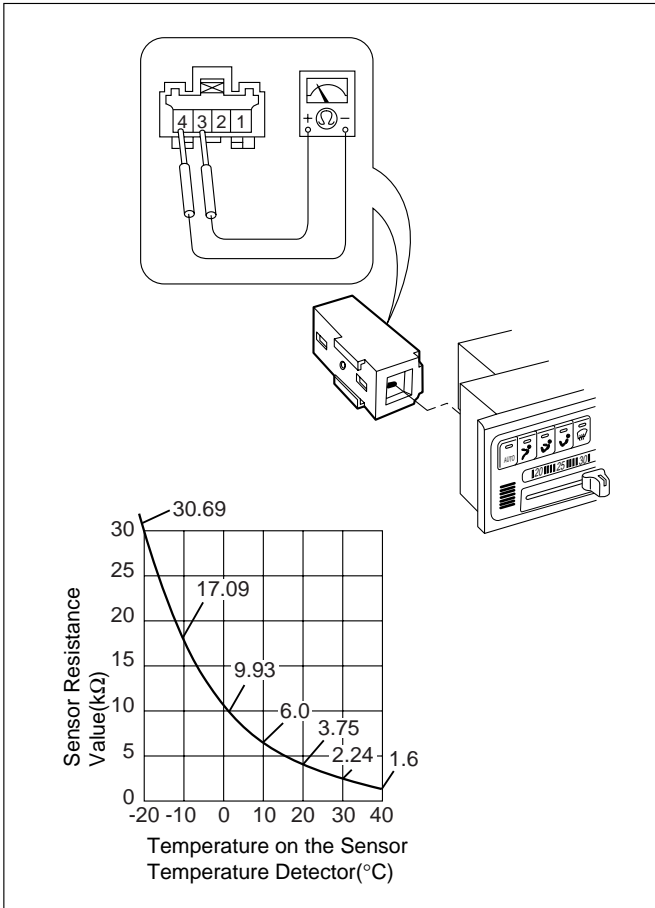
• Conflicts Between the Set Temperature and Actual Room Temperature



INDIVIDUAL INSPECTION

In Car Sensor

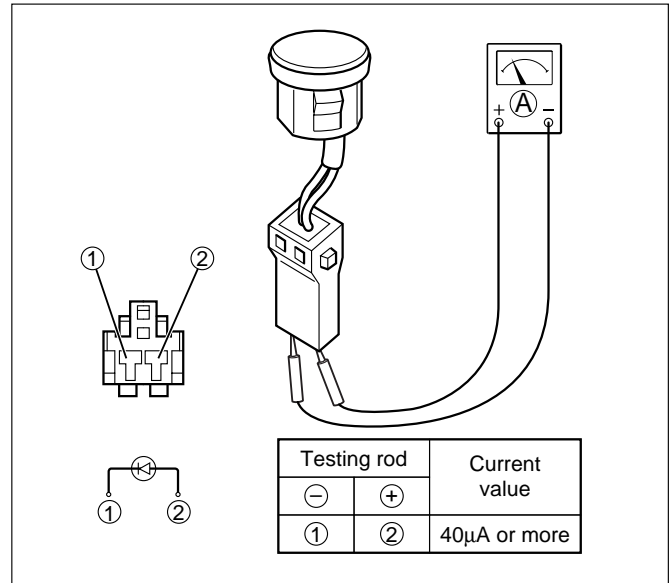
1. Disconnect the in car sensor connector (I-34).
2. Measure resistance between the in car sensor side terminal No.3 [I-34] and No.4 [I-34].



865RX007

Sun Sensor

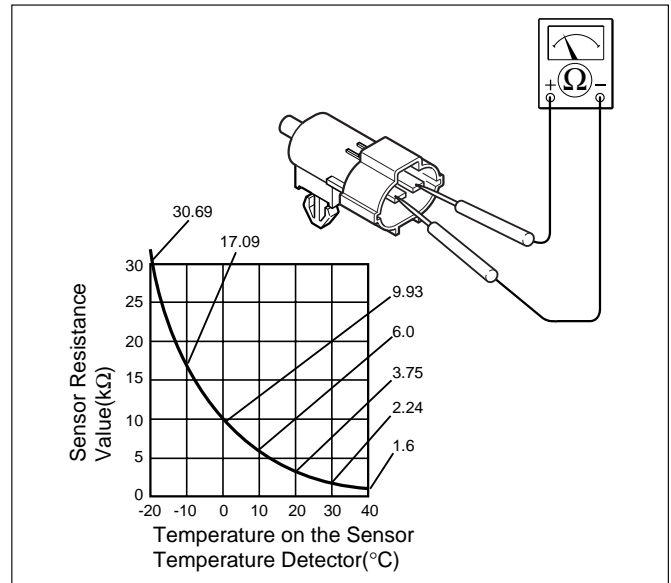
1. Disconnect the sun sensor connector (I-35).
2. Measure the current value on the sun sensor when placed it approximately 15 cm away from 60W incandescent lamp.



D06RY0001

Ambient Sensor

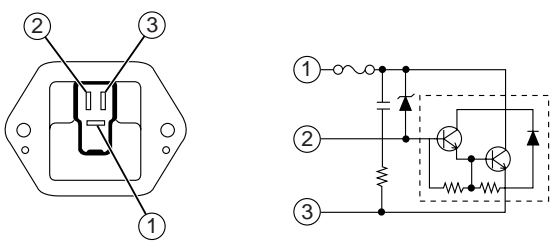
1. Disconnect the connector (C-86) on the ambient sensor.
2. Measure resistance between the ambient sensor side terminals.



C01RX012

Power Transistor

1. Remove the power transistor connector (I-47) from the evaporator assembly.
2. Check the conduction between the power transistor side terminals.

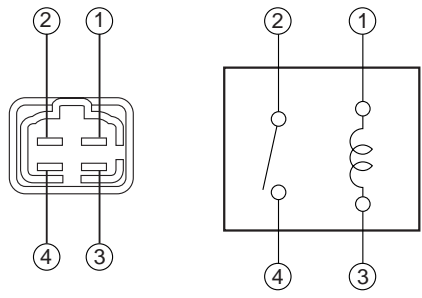


Terminal No.	1	2	3	Conduction
Testing rod	-	+		Conducted (50Ω maximum)
	-		+	Conducted (100Ω maximum)
	+	-		Not conducted
	+	-		Conducted (220Ω maximum)
		-	+	Not conducted

C01RY00002

MAX HI Relay

1. Remove the MAX HI relay connector (B-64) from the blower assembly.
2. Check the conduction between the MAX HI relay side terminals.



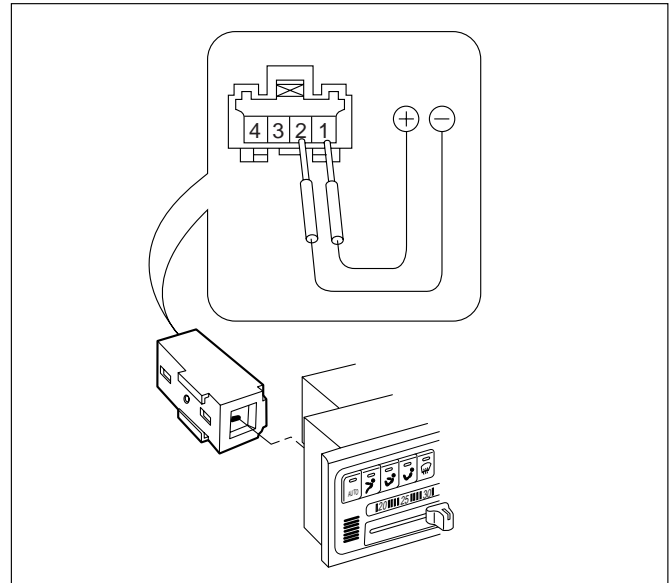
No continuity between terminals (2) and (4).

Continuity between terminal (2) and (4) when battery voltage is applied between (1) and (3).

C01RY00003

In Car Sensor

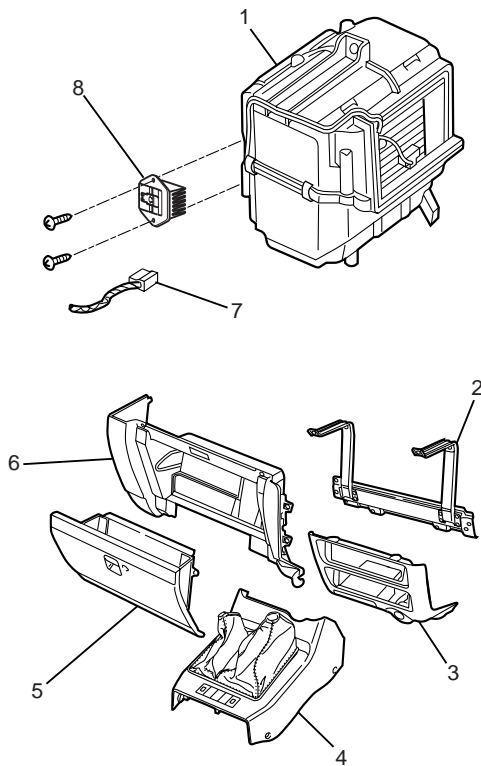
1. Turn on the ignition switch (the engine is started). Start the air conditioner in "Full Auto".
2. Make sure that the in car sensor suctions cigarette smokes and such.
3. Dismount the in car sensor from the automatic heater/air conditioner control unit. Connect (+) end and (-) end of the battery to the aspirator motor side terminals No.1 I-34 and No.2 I-34, respectively, then check if the motor runs normally.



ON-VEHICLE SERVICE

Power Transistor

This illustration is based on RHD



874RY0001

Legend

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

Removal

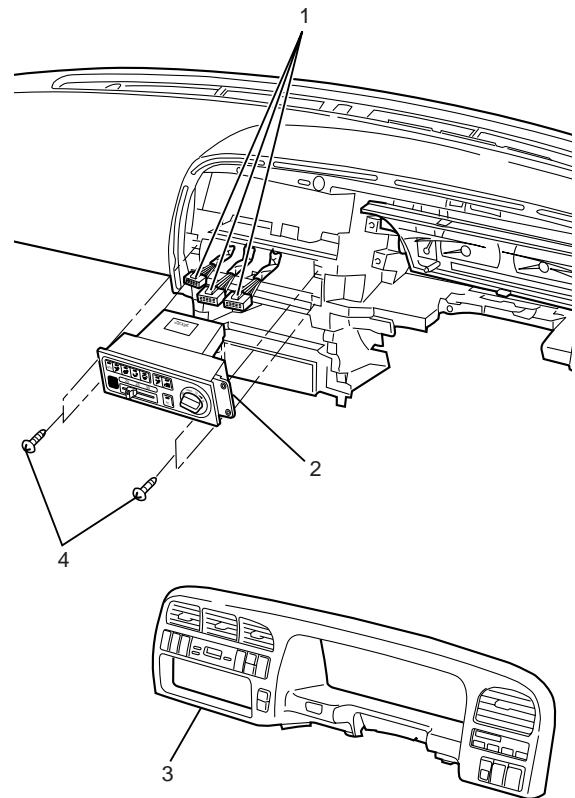
1. Remove front console.
2. Remove lower cluster.
3. Remove glove box.
4. Remove instrument panel passenger lower cover.
5. Remove passenger knee bolster reinforcement.
6. Disconnect the power transistor connector.
7. Remove power transistor.

Installation

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

Automatic Heater/Air Conditioner Control Unit

This illustration is based on RHD



865RY0007

Legend

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

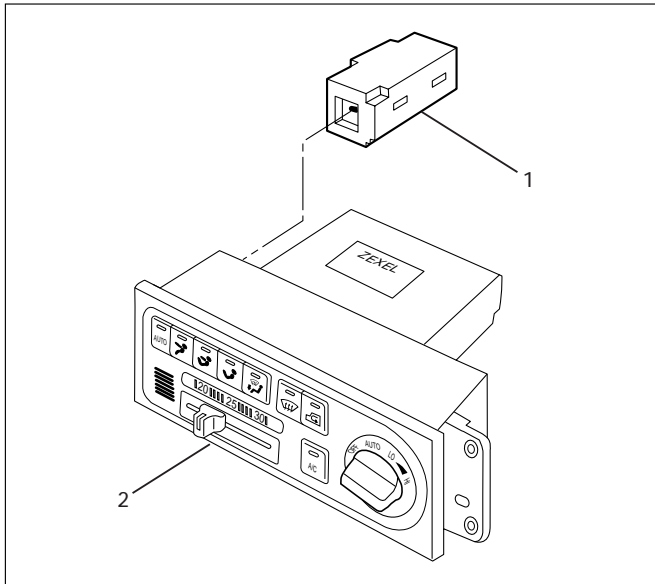
Removal

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

Installation

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

In Car Sensor



865RY00006

Legend

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

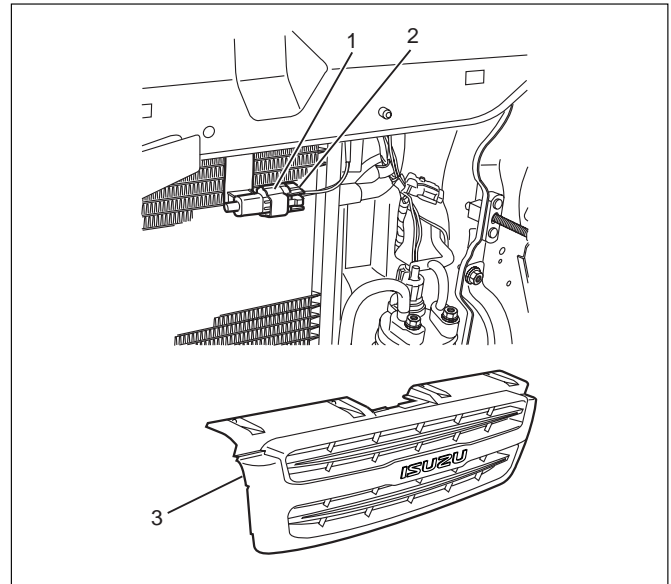
Removal

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

Installation

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

Ambient Sensor



875RY00001

Legend

- (1) Ambient Sensor
- (2) Sensor Connector
- (3) Radiator Grill

Removal

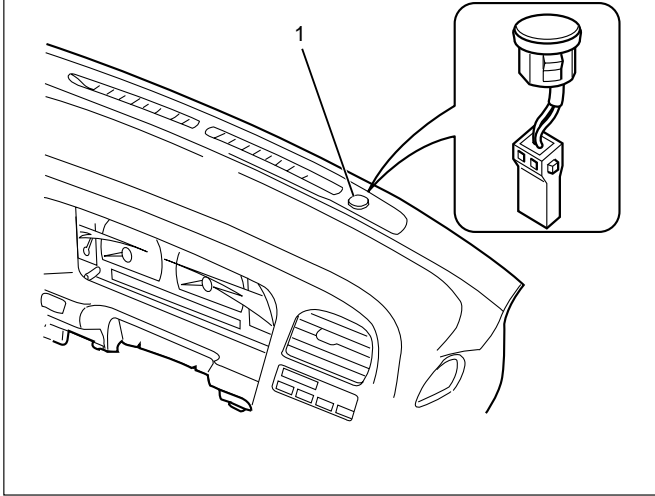
1. Disconnect the battery ground cable.
2. Remove radiator grille.
 - Refer to Radiator Grille in Body Structure section.
3. Disconnect the ambient sensor connector.
4. Remove the ambient sensor.

Installation

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

Sun Sensor

This illustration is based on RHD



826RY00001

Legend

- (1) Sun Sensor

Removal

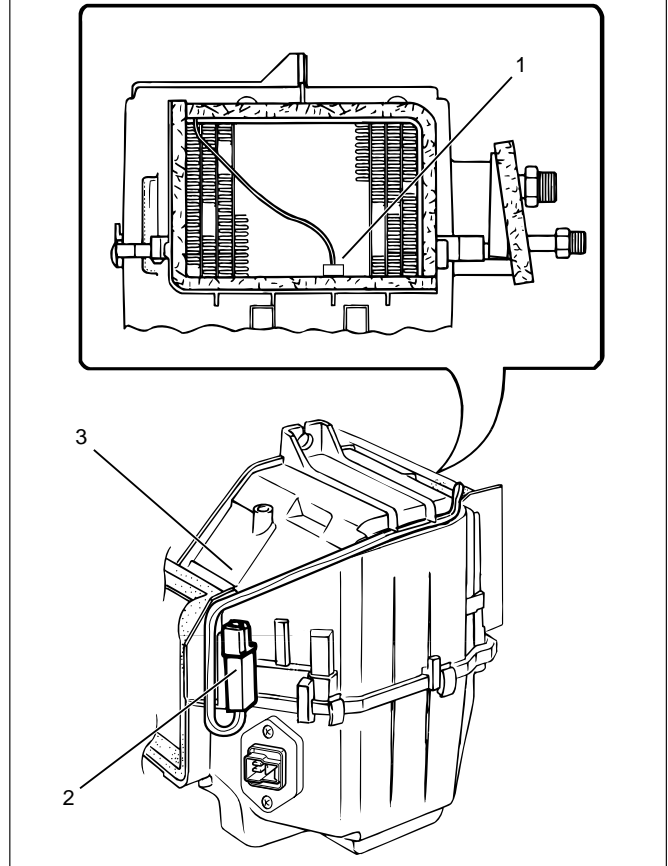
1. Disconnect the battery ground cable.
2. Remove the sun sensor.
3. Disconnect the sun sensor connector.

Installation

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

Electronic Thermostat

This illustration is based on RHD



874RY00002

Legend

- (1) Duct Sensor
(2) Thermostat Assembly
(3) Evaporator Assembly

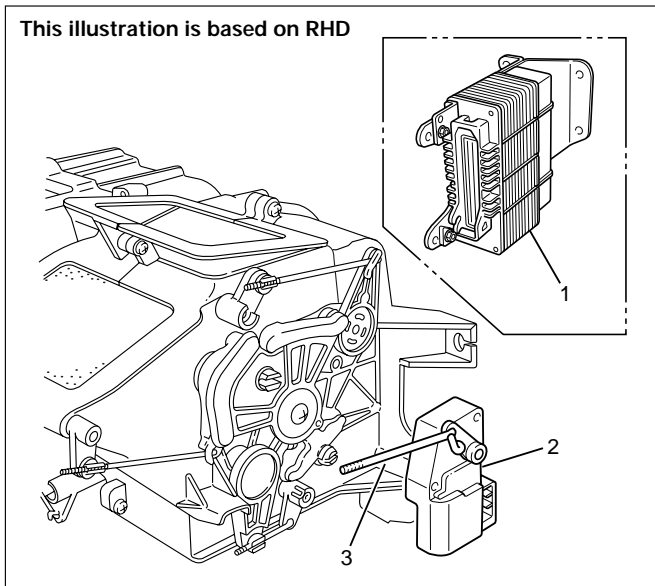
Removal

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

Installation

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

Mode Actuator



Legend

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

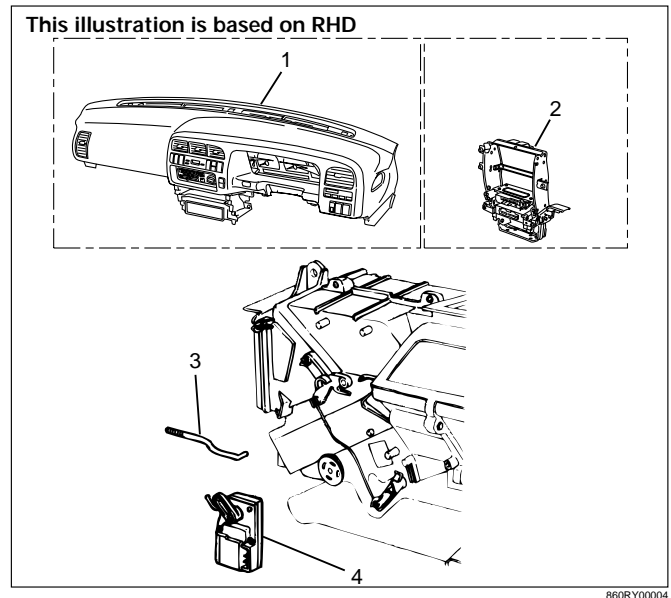
Removal

1. Disconnect the battery ground cable.
2. Remove the A/T control unit.
 - The connector shall remain connected.
3. Remove the actuator rod.
4. Remove the mode actuator.

Installation

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

MIX Actuator



Legend

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

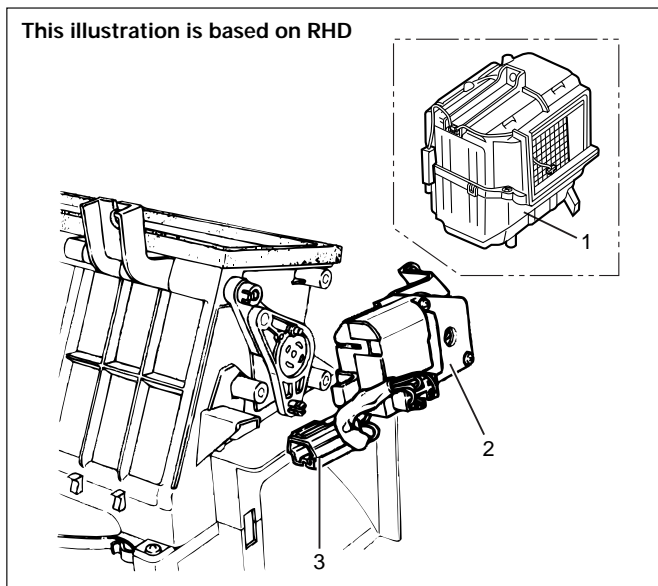
Removal

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

Installation

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

Intake Actuator



Legend

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

Removal

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

Installation

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

SECTION 1D

COMPRESSOR OVERHAUL



CAUTION

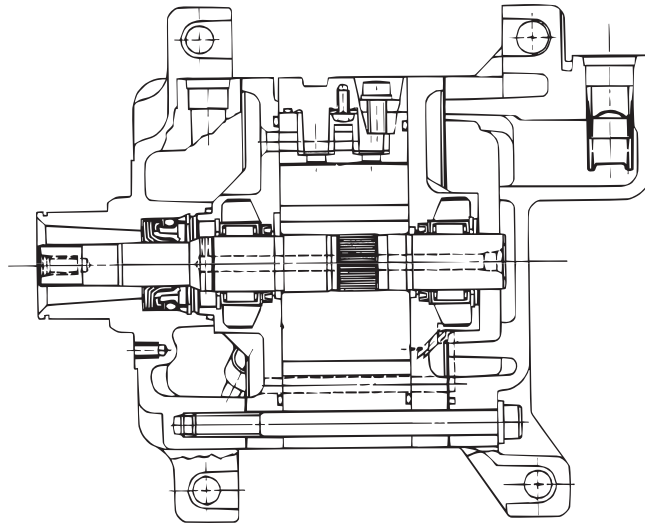
When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used.

Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque values must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

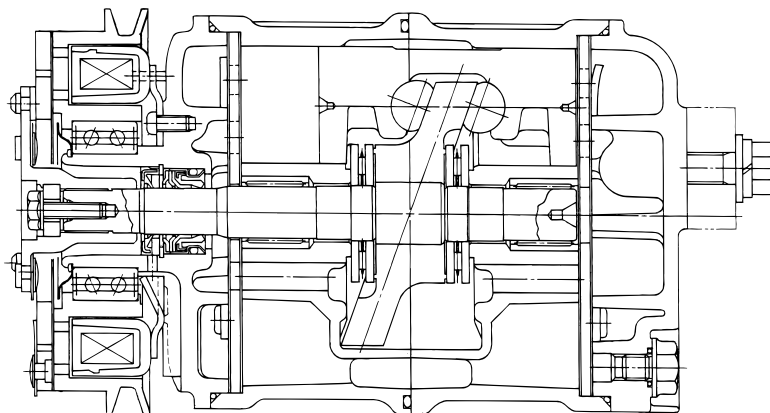
CONTENTS

	PAGE
General Description	1D- 2
General Information	1D- 4
Compressor Oil	1D- 4
Service Procedures	1D- 6
DKV-14D Type Compressor	1D- 6
DKS-15CH Type Compressor	1D-10
HD6 Type Compressor	1D-18

GENERAL DESCRIPTION



DKV-14D TYPE



DKS-15CH TYPE

871RY00014

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor

should be cleaned before any "On-Vehicle" repair, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene, or equivalent

solvent, and dried with dry air. Use only lint free cloths to wipe parts.

The operations described below are based on bench overhaul with compressor removed from the car, except as noted. They have been prepared in order of accessibility of the components. When the compressor is removed from the car for servicing, the oil remaining in the compressor should be discarded and new refrigerant oil added to the compressor.

Magnetic clutch assembly repair procedures require that the system be discharged of refrigerant. (Refer to Section 1B for "REFRIGERANT RECOVERY".)

Compressor malfunction will appear in one of four ways: noise, seizure, leakage or low discharge pressure. Resonant compressor noises are not cause for alarm; however, irregular noise or rattles may indicate broken parts or excessive clearances due to wear. To check seizure, de-energize the magnetic clutch and check to see if the drive plate can be rotated. If rotation is impossible, the compressor is seized. Low discharge pressure may be due to a faulty internal seal of the compressor, or a restriction in the compressor. Low discharge pressure may also be due to an insufficient refrigerant charge or a restriction elsewhere in the system. These possibilities should be checked prior to servicing the compressor. If the compressor is inoperative, but is not seized, check to see if current is being supplied to the magnetic clutch coil terminals.

The compressor has vanes built into a rotor which is mounted on a shaft.

When the shaft rotates, the vanes built into the cylinder block assembly are opened by centrifugal force.

This changes the volume of the space formed by the rotor and cylinder, resulting in the intake and compression of the refrigerant gas. The discharge valve and the valve stopper, which protects the discharge valve, are built into the cylinder block assembly. There is no suction valve but a shaft seal is installed between the shaft and head; a trigger valve, which applies back pressure to the vanes, is installed in the cylinder block and a refrigerant gas temperature sensor is installed in the front head.

The specified quantity of compressor oil is contained in the compressor to lubricate the various parts using the refrigerant gas discharge pressure.

6VD1 engine is equipped with an invariable capacity five-vane rotary compressor (DKV-14D Type).

The compressor sucks and compresses refrigerant by the rotation of the vane installed to the shaft, and always discharges a fixed amount of refrigerant independent of the load of refrigerant.

The thermo sensor is installed to the front head of the compressor to protect it by stopping its operation when the refrigerant gas is insufficient or when the temperature get abnormally high.

- OFF $160 \pm 5^{\circ}\text{C}$ ($320.0 \pm 9.0^{\circ}\text{F}$)
- ON $135 \pm 5^{\circ}\text{C}$ ($275.0 \pm 9.0^{\circ}\text{F}$)

4JG2 Engine are provided with a swash plate type compressor (DKS-15CH Type)

Swash plate compressors have a swash (slanted) plate mounted on the shaft. When the shaft turns, the rotation of the swash plate is converted to reciprocating piston motion which sucks in and compresses the refrigerant gas.

Shaft seal (Lip type) is installed between the valve plate and shaft & cylinder head to prevent refrigerant gas leaks. A specified amount of compressor oil is contained in the oil pan.

This oil is supplied to the cylinders, bearings, etc., by an oil pump which is connected to the swash plate shaft.

With some compressors the differential between the intake pressure and discharge pressure generated while the compressor is operating is used for lubrication instead of an oil pump.

Three pistons are arranged at 120g intervals around the center of the swash plate shaft. These pistons are connected to the ends of the swash plate through shoe disks and balls.

The rotation of the swash plate causes reciprocating movement of the piston inside the cylinders, with each piston operating as two cylinders. Because of that, the compressor operates as though it has 6 cylinders.

The specified amount of the compressors oil is 150cc (4.2 Imp fl oz).

Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.

If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.

GENERAL INFORMATION

COMPRESSOR OIL

OIL SPECIFICATION

- The HFC-134a system requires a synthetic (PAG) compressor oil.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

DKV-14D : ZXL-200PG
(ISUZU PART NO. 8-97101-336-0)

DKS-15CH : ZXL-100PG
(ISUZU PART NO. 8-97101-338-0)

HANDLING OF OIL

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately.
- The compressor oil must be stored in steel containers, not in plastic containers.

COMPRESSOR OIL CHECK

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

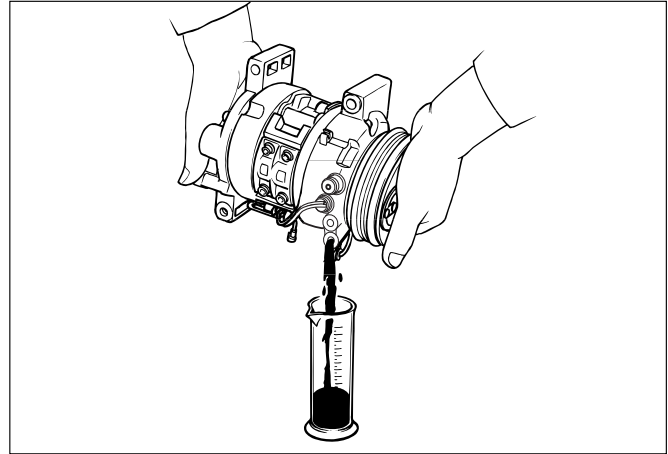
Oil Capacity

Capacity total in system	150cc (4.2 Imp fl oz)
Compressor (Service parts) charging amount	150cc (4.2 Imp fl oz)

Checking and Adjusting for Used Compressor

- 1) Perform Oil return operation.
(Refer to "Oil Return Operation" in this section.)
- 2) Discharge refrigerant and remove the compressor.
- 3) Drain the compressor oil and measure the extracted oil with a measuring cylinder.
- 4) If the amount of oil drained is much less than 90cc (2.5 Imp fl oz), some refrigerant may have leaked out. Conduct leak tests on connections of each system, and if necessary, repair or replace faulty parts.

- 5) Check the compressor oil for contamination.
(Refer to "Contamination of Compressor Oil" in this section.)



871RX020

- 6) Adjust oil level following the procedure below.

Collected Amount	Charging Amount
more than 90cc (2.5 Imp fl oz)	same as collected amount
less than 90cc (2.5 Imp fl oz)	90cc (2.5 Imp fl oz)

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

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

- 1) Discharge refrigerant and remove the compressor.
- 2) Drain the compressor oil and measure the extracted oil with a measuring cylinder.
- 3) Check the oil for contamination.
- 4) If more than 90cc (2.5 Imp fl oz) of oil is extracted from the compressor, supply same amount of oil to the compressor to be installed. If the amount of oil extracted is less than 90cc (2.5 Imp fl oz), recheck the compressor oil in the following order:
- 5) Supply 90cc (2.5 Imp fl oz) of oil to the compressor and install it onto the vehicle.
- 6) Perform oil return operation.
- 7) Remove the compressor and recheck the amount of oil.
- 8) Adjust the compressor oil, if necessary.

Collected Amount	Charging Amount
more than 90cc (2.5 Imp fl oz)	same as collected amount
less than 90cc (2.5 Imp fl oz)	90cc (2.5 Imp fl oz)

Checking and Adjusting for Compressor Replacement

150cc (4.2 Imp fl oz) of oil is charged in compressor (service parts). So it is necessary to drain the proper amount of oil from the new compressor.

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

Amount of oil drained from used compressor	Draining amount of oil from new compressor
less than 90cc (2.5 Imp fl oz)	Same as drained amount
more than 90cc (2.5 Imp fl oz)	90cc (2.5 Imp fl oz)

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

CONTAMINATION OF COMPRESSOR OIL

Unlike engine oil, no cleaning agent is added to the compressor oil. Even if the compressor runs for a long period of time (approximately 1 season), the oil never becomes contaminated as long as there is nothing wrong with the compressor or its method of use.

Inspect the extracted oil for any of the following conditions:

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

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

OIL RETURN OPERATION

There is close affinity between the oil and the refrigerant. During normal operation, part of the oil recirculates with the refrigerant in the system.

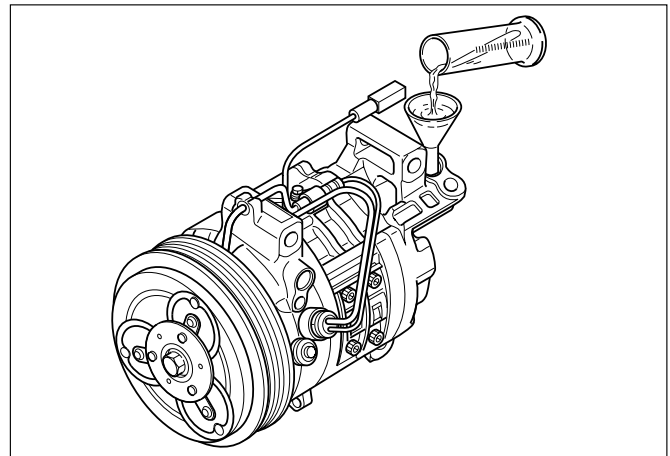
When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

- 1) Open the all doors and engine hood.
- 2) Start the engine and A/C switch is "ON" and Set the fan control knob at its highest position.
- 3) Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
- 4) Stop the engine.

REPLACEMENT OF COMPONENT PARTS

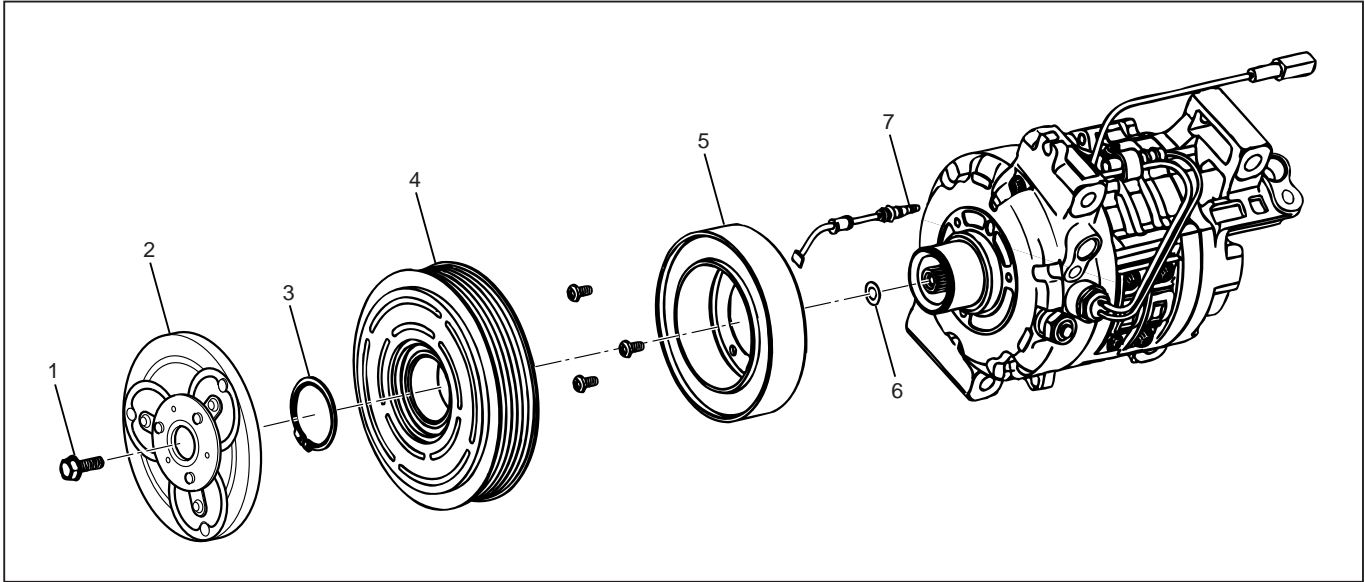
When replacing system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of oil
Evaporator	50cc (1.4 Imp fl oz)
Condenser	30cc (0.8 Imp fl oz)
Receiver/drier	30cc (0.8 Imp fl oz)



SERVICE PROCEDURE

DKV-14D TYPE COMPRESSOR



871RX012

Legend

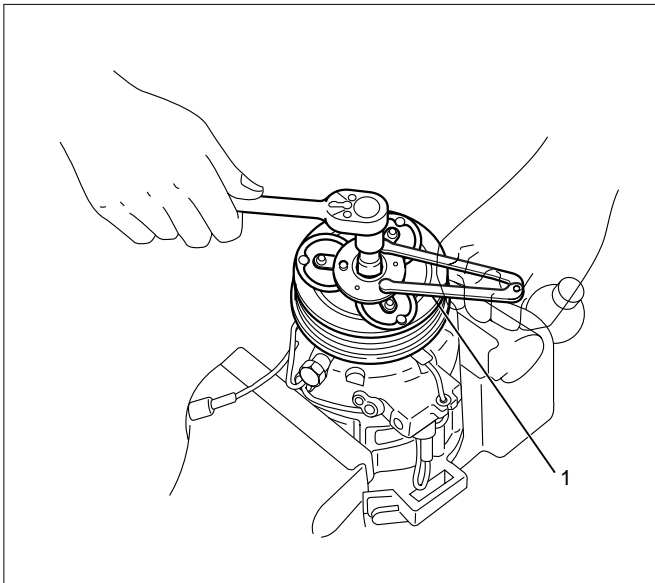
- (1) Drive Plate Bolt
- (2) Drive Plate
- (3) Snap Ring

- (4) Pulley Assembly
- (5) Field Coil
- (6) Shim(s)
- (7) Lead Wire

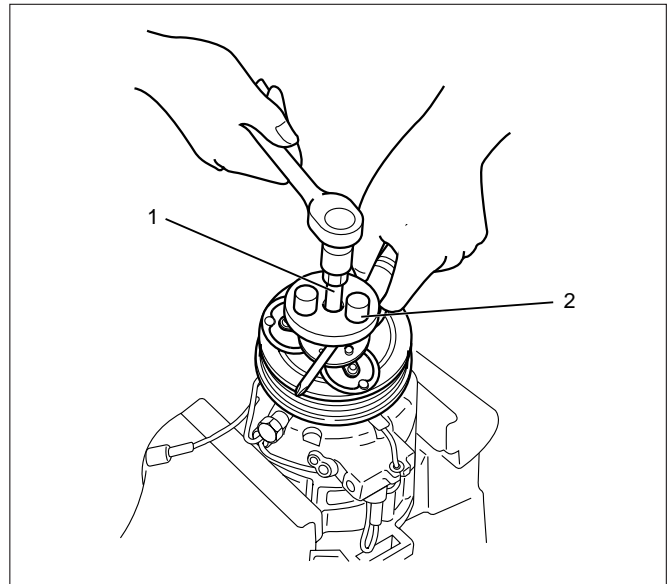
Removal

1. Remove drive plate bolt by using drive plate holder J-7624 (1) to prevent the drive plate from rotating.

2. Remove drive plate by using drive plate puller J-33944-A (2) and forcing screw J-33944-4 (1).



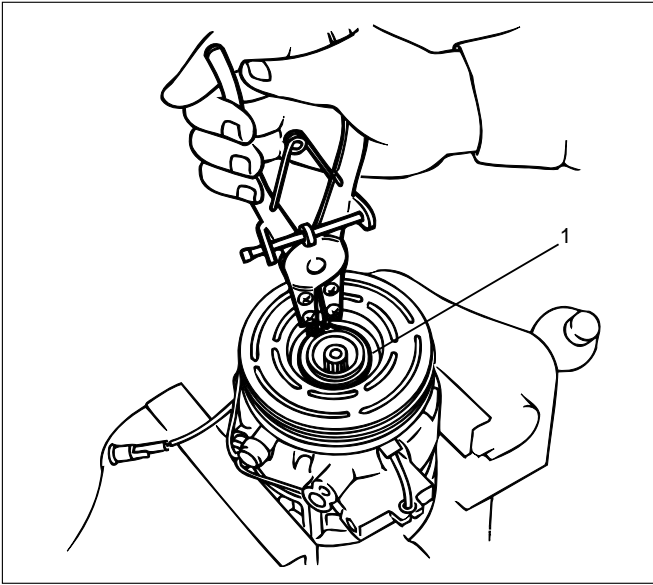
901RX055



871RX016

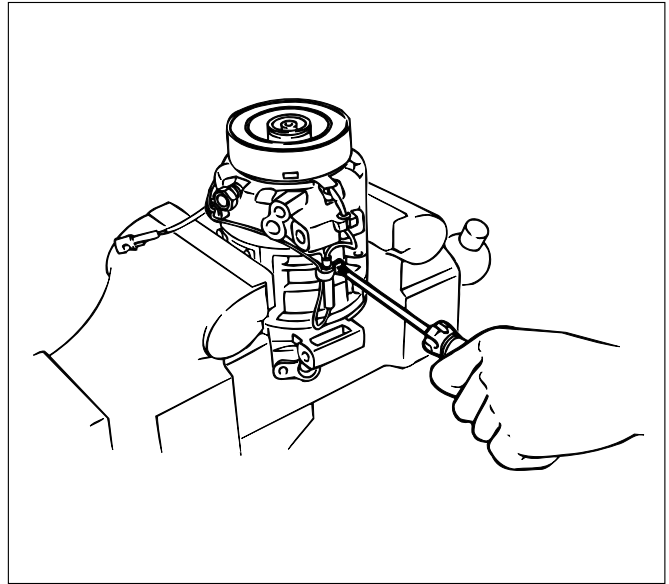
3. Remove shim(s).

4. Remove snap ring (1) by using snap ring pliers.



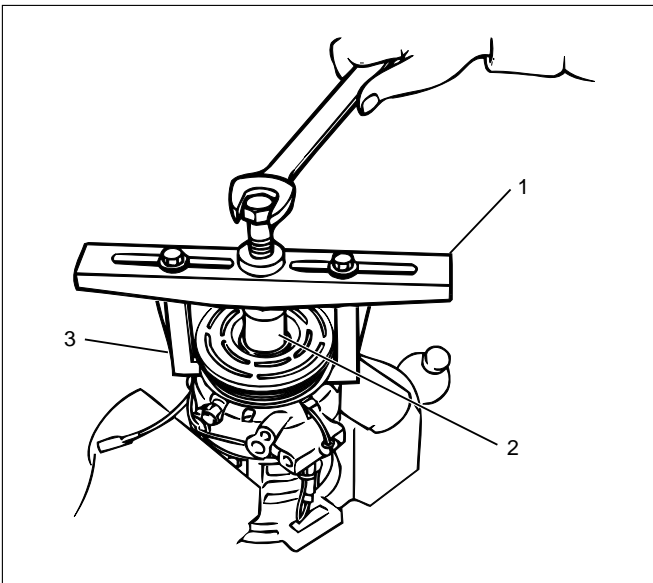
871RW016

6. Loosen screw and disconnect the coil lead wire connector.



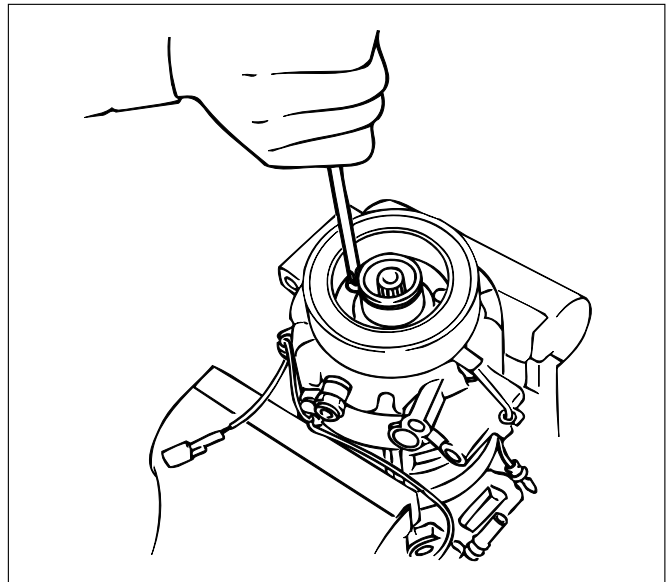
871RS010

5. Remove pulley assembly by using pulley puller pilot J-38424 (2), pulley puller J-8433 (1) and pulley puller leg J-24092-2 (3).



871RX031

7. Loosen three screws and remove the field coil.



871RS011

Inspection and Repair

Drive Plate

If the frictional surface shows signs of damage due to excessive heat, the drive plate and pulley should be replaced.

Pulley Assembly

Check the appearance of the pulley assembly. If the frictional surface of the pulley shows signs of excessive grooving due to slippage, both the pulley and drive plate should be replaced. The frictional surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

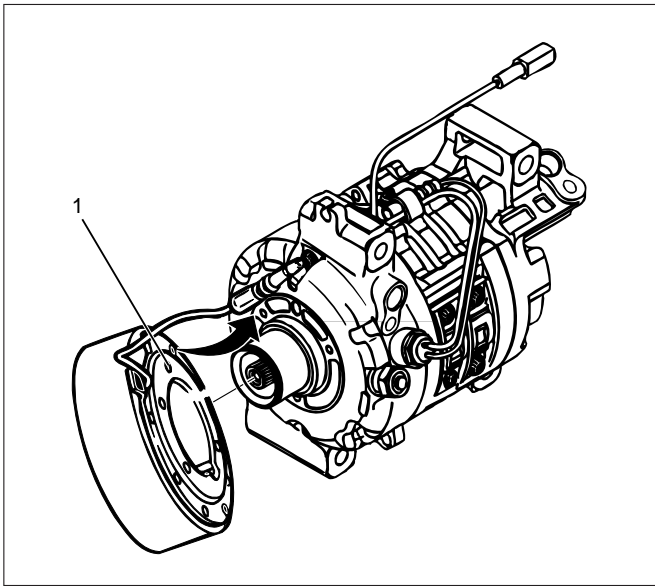
Coil

Check coil for loose connector or cracked insulation.

Installation

1. Install field coil.

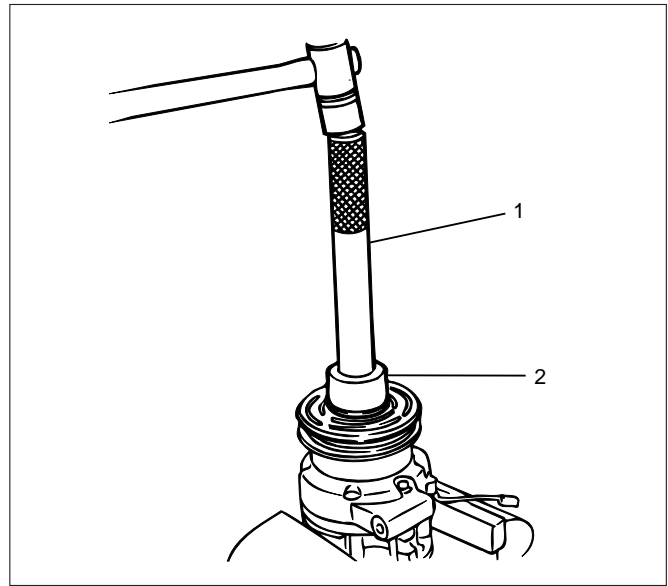
- Align the located portion (1) of the field coil and compressor.



- Tighten the mounting screw to the specified torque.
Torque: 5N-m (44 lb in)

2. Connect the lead wire connector with the rubber hold and tighten the screw.

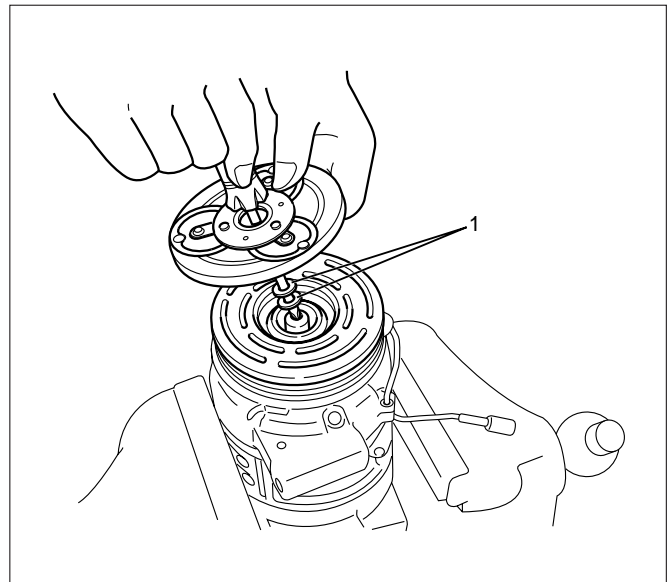
3. Install pulley assembly by using pulley installer J-33940-A (2) and drive handle J-8092 (1).



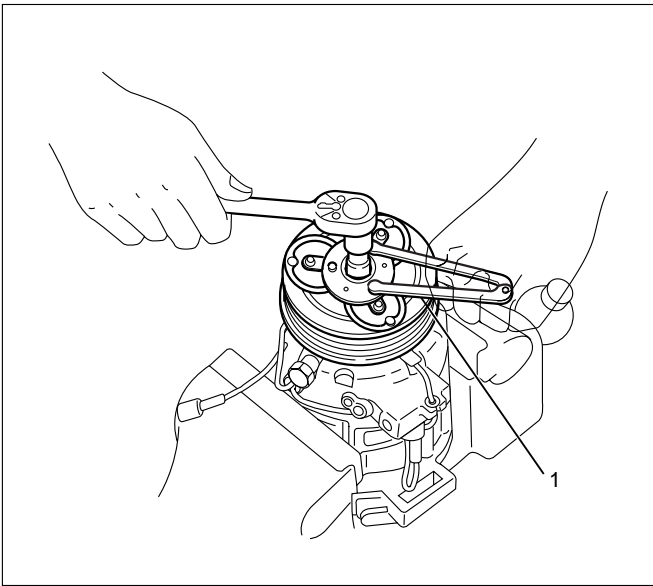
4. Install snap ring.

5. Install shim(s).

6. Install the drive plate to the compressor drive shaft together with the original shim(s)(1). Press the drive plate by hand.

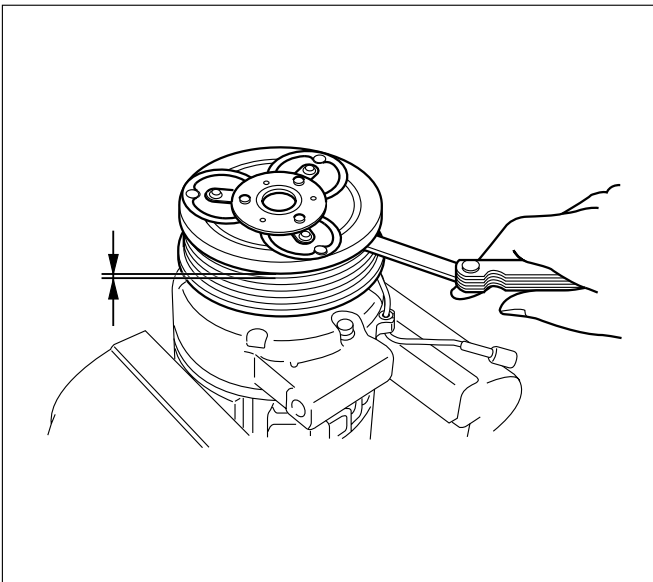


7. Install drive plate bolt by using drive plate holder J-7624 (1) to prevent the drive plate from rotating.



901RX055

- Tighten the drive plate bolt to the specified torque.
Torque: 13 N·m (113 lb in)
- After tightening the drive plate bolt, check to be sure the pulley rotates smoothly.
- Check to be sure that the clutch clearance is between 0.3-0.6 mm (0.01-0.02 in.)



871RX014

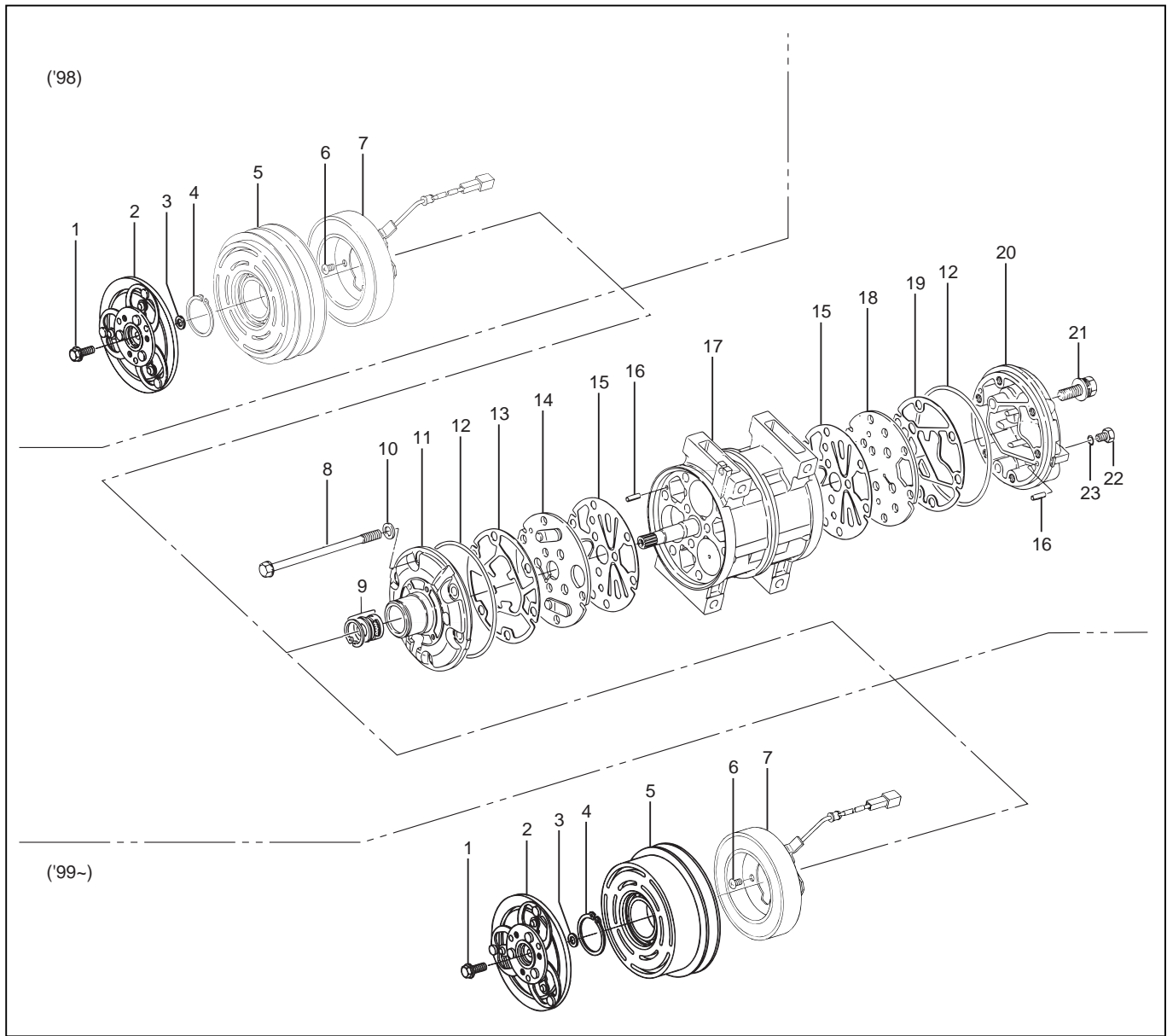
- If necessary, install adjusting shim(s).
- Adjusting shims are available in the following thickness.

Thickness

- 0.1 mm (0.0039 in.)
- 0.3 mm (0.0118 in.)
- 0.5 mm (0.0197 in.)

1D - 10 COMPRESSOR OVERHAUL

DKS-15CH TYPE COMPRESSOR



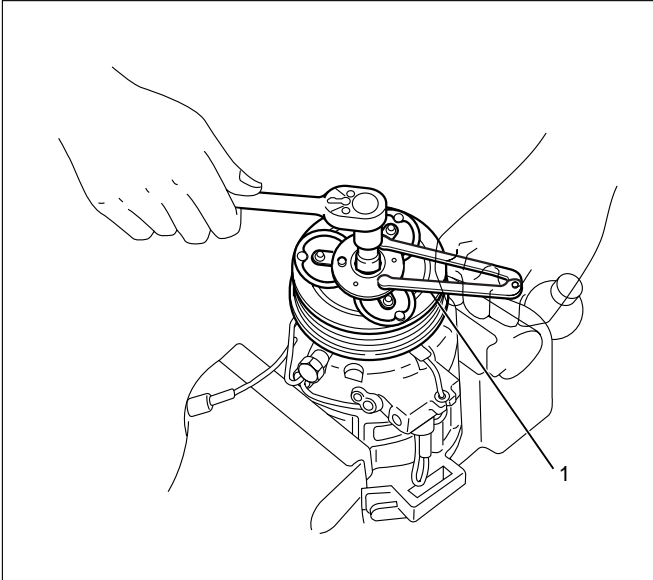
871RY00015

Legend

- | | |
|--------------------------|----------------------------------|
| (1) Drive Plate Bolt | (12) O-Ring |
| (2) Drive Plate | (13) Gasket |
| (3) Shim | (14) Front Valve Plate |
| (4) Snap Ring | (15) Front Suction Valve |
| (5) Pulley Assembly | (16) Pin |
| (6) Screw | (17) Cylinder and Shaft Assembly |
| (7) Field Coil | (18) Rear Valve Plate |
| (8) Through Bolt | (19) Gasket |
| (9) Shaft Seal Assembly | (20) Rear Cylinder Head |
| (10) Gasket | (21) Bolt |
| (11) Front Cylinder Head | (22) Oil Drain Plug |
| | (23) O-Ring |

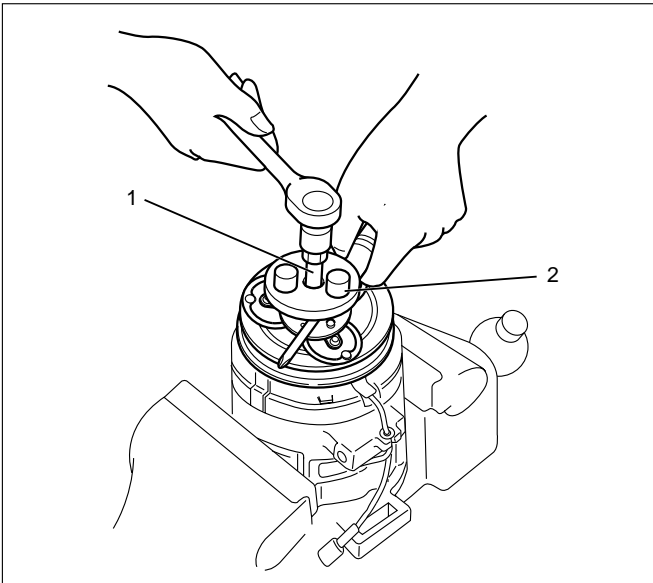
Removal

1. Remove drive plate bolt by using drive plate holder J-7624 (1) to prevent the drive plate from rotating.



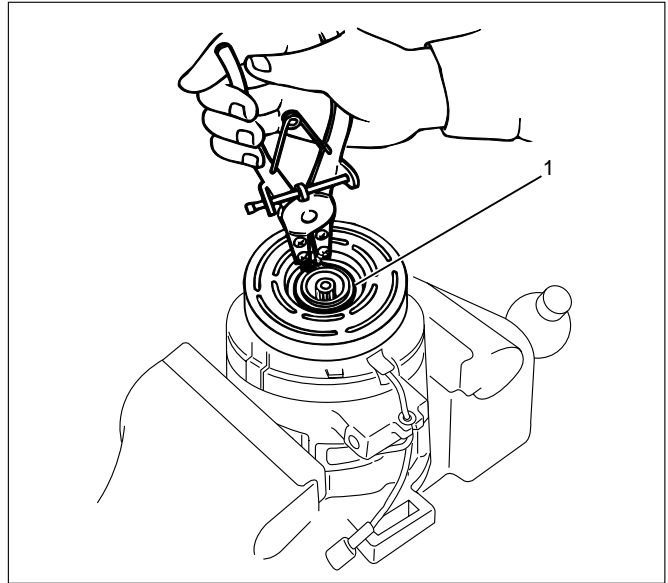
901RX056

2. Remove drive plate by using drive plate puller J-33944-A (2) and forcing screw J-33944-4 (1).



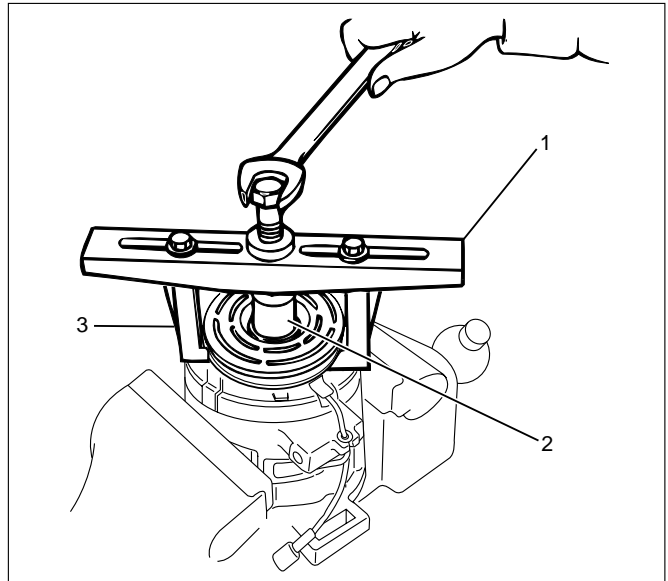
871RY0003

3. Remove shim(s).
4. Remove snap ring (1) by using snap ring pliers.



871RY0004

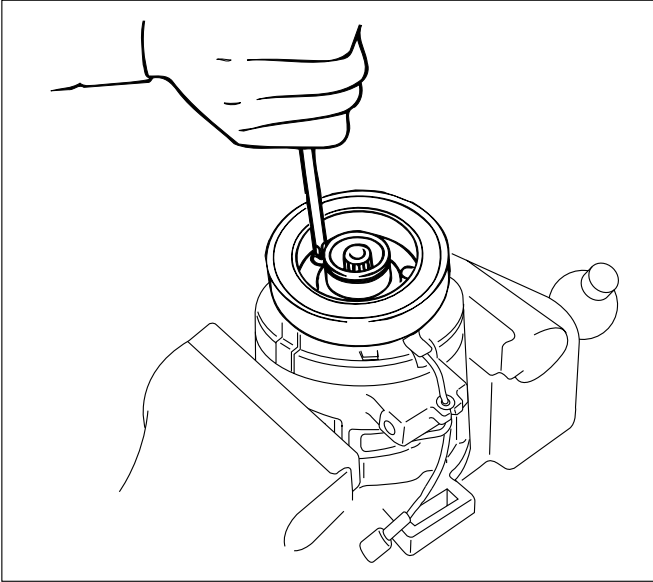
5. Remove pulley assembly by using pulley puller pilot J-38424 (2), pulley puller J-8433 (1) and pulley puller leg J-24092-2 (3).



871RY0005

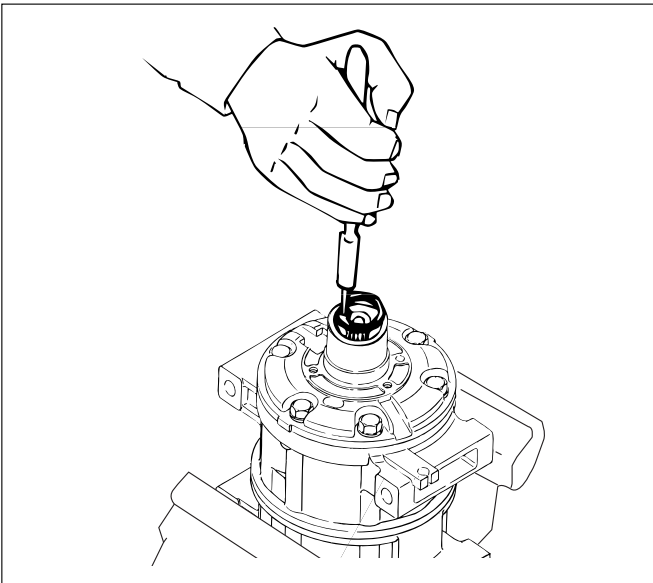
1D - 12 COMPRESSOR OVERHAUL

6. Loosen three screws and remove the field coil.



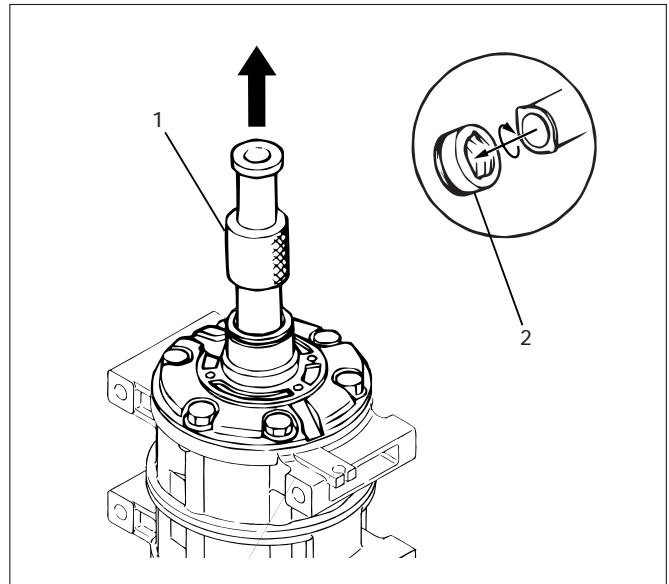
871RY00006

7. Remove snap ring by using snap ring pliers.



871RY00017

8. Remove shaft seal assembly (2) by using shaft seal remover J-33942 (1).



871RY00018

- Engage the remover hook with the shaft seal assembly groove and slowly draw the shaft seal assembly out.

NOTE

The shaft seal is precision-machined and its critical parts are finished to extremely close tolerances. The assembly must be handled with great care, it slips face demanding particularly careful handling.

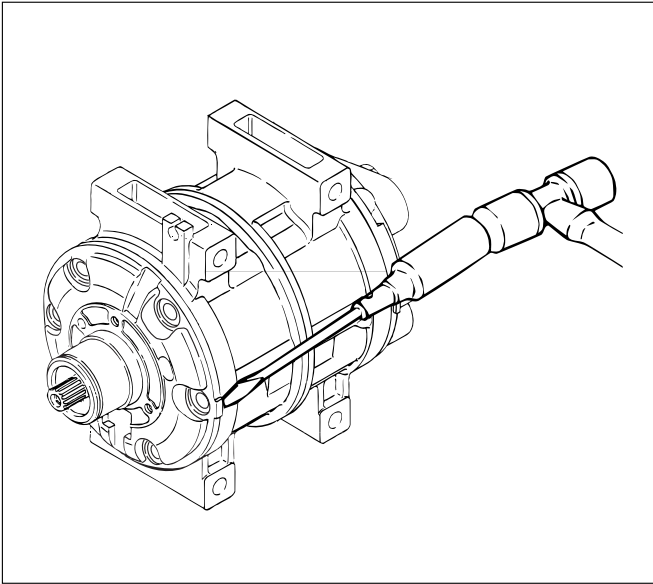
The shaft seal can not be reused. Install a new shaft seal at reassembly.

Take care not to scratch or otherwise damage the shaft seal face.

Keep the shaft seal free from lint and dirt.

9. Remove through bolt.

10. Remove front cylinder head.



11. Remove o-ring.

- Alternately tap the projections on the circumference of the front cylinder head with a screwdriver and a plastic hammer to remove the front cylinder head.

12. Remove gasket.

13. Remove front valve plate.

14. Remove front suction valve.

NOTE

Check the front valve plate for scratching and bending.

Check the front valve plate and the front cylinder head for nicks and burrs on the sealing surface.

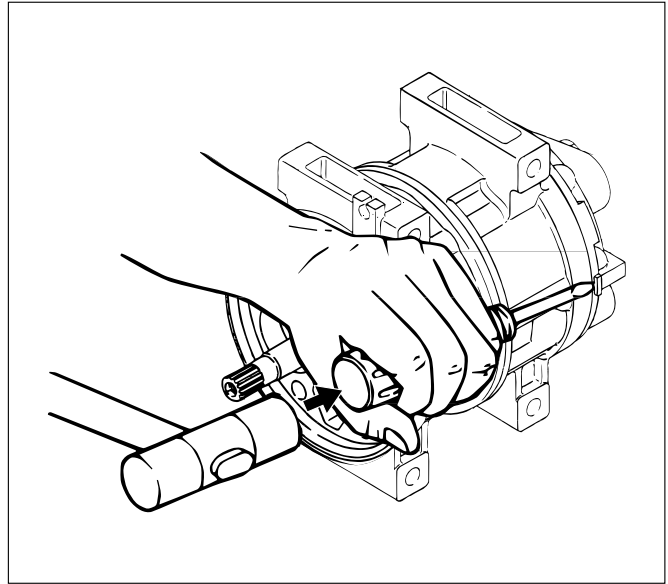
Buff or replace the valve plate and cylinder head if nicks and burrs are present.

Check that the front valve plate passage is free from obstructions.

Check the front valve plate and the cylinder head for cracks.

Replace the valve plate and cylinder head if cracks are present.

15. Remove rear cylinder head.



16. Remove o-ring.

- Alternately tap the projections on the circumference of the rear cylinder head with a screwdriver and a plastic hammer to remove the rear cylinder head.

17. Remove gasket.

18. Remove rear valve plate.

19. Remove rear suction valve.

20. Remove cylinder and shaft assembly.

NOTE

Check the rear valve plate for scratching and bending.

Check the rear valve plate and the rear cylinder head for nicks and burrs on the sealing surface.

Buff or replace the valve plate and cylinder head if nicks and burrs are present.

Check that the rear valve plate passage is free from obstructions.

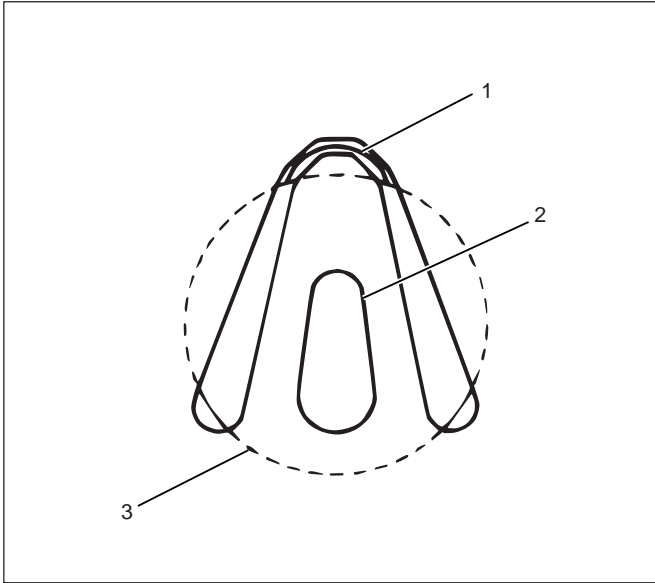
Check the rear valve plate and the cylinder head for cracks.

Replace the valve plate and cylinder head if cracks are present.

1D - 14 COMPRESSOR OVERHAUL

Installation

1. Install cylinder and shaft assembly.
 - Clamp the cylinder shaft assembly in a vise.
The rear side of the cylinder shaft assembly must be facing up.
2. Install rear suction valve.
 - Apply a coat of new compressor oil to the new suction valve (2).
Install the suction valve by aligning it with the spring pin and the cylinder valve relief grooves.



871RY00021

Legend

- (1) Escape Groove
- (2) Suction Valve
- (3) Piston

3. Install rear valve plate.
 - Apply a coat of new compressor oil to the new valve plate.
Install the valve plate to the suction valve by aligning it with the spring pin.

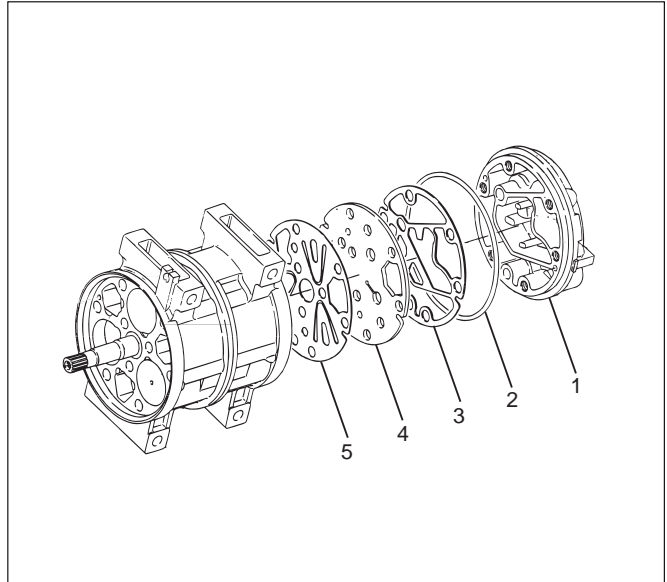
NOTE

Do not mix up the front and rear valve plate.

4. Install gasket.
 - Apply a coat of new compressor oil to the new gasket.
Install the gasket (3) to the valve plate (4).
5. Install o-ring (2).

6. Install rear cylinder head (1).

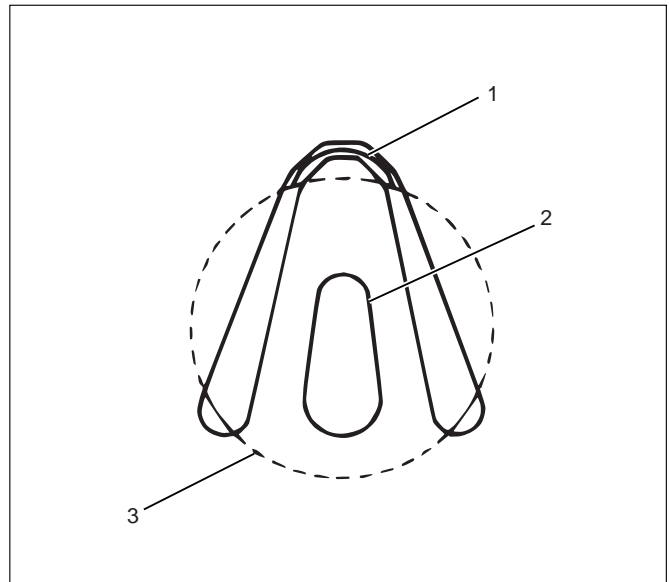
- Apply a coat of new compressor oil to the new o-ring (2).
Install the o-ring (2) to the rear cylinder head (1).
Install the rear cylinder head.
Top the rear cylinder head (1) into place with a plastic hammer.



871RY00022

7. Install front suction valve.

- Set the cylinder shaft assembly with the front side facing up.
Apply a coat of new compressor oil to the new suction valve (2).
Install the suction valve (2) by aligning it with the spring pin and the cylinder valve relief grooves.



871RY00021

Legend

- (1) Escape Groove
- (2) Suction Valve
- (3) Piston

8. Install front valve plate.

- Apply a coat of new compressor oil to the new valve plate.
Install the valve plate to the suction valve by aligning it with the spring pin.

NOTE

Do not mix up the front and rear valve plates.

9. Install gasket

- Apply new compressor oil to the new gasket.
- Install the gasket to the valve plate by aligning it with the spring pin.

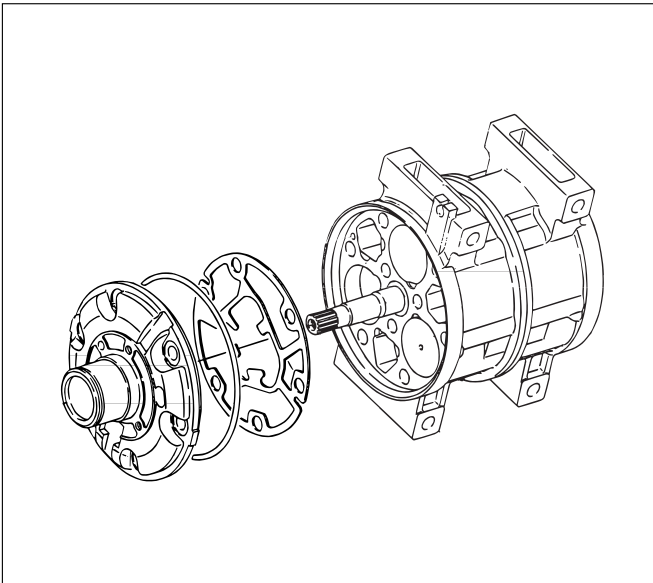
10. Install o-ring.

11. Install front cylinder head.

- Apply a coat of new compressor oil to the new O-ring.
Install the O-ring to the front cylinder head.
Install the front cylinder head.
Tap the front cylinder head into place with a plastic hammer.

NOTE

When installing the cylinder head, be careful that the end of the drive shaft does not damage the shaft seal assembly surface in the cylinder head.



871RY00023

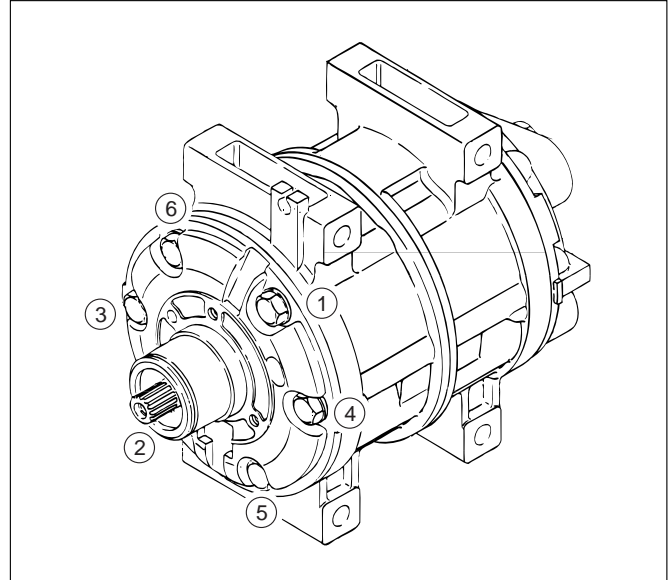
12. Install through bolt.

- Gaskets cannot be reused. Always replace new ones. Tighten the bolts to the specified torque a little at a time in the sequence shown in the illustration.

Torque: 22N·m (16 lb·ft)

NOTE

Rotate the compressor drive shaft two or three times to make sure that it moves smoothly.



871RY00016

1D - 16 COMPRESSOR OVERHAUL

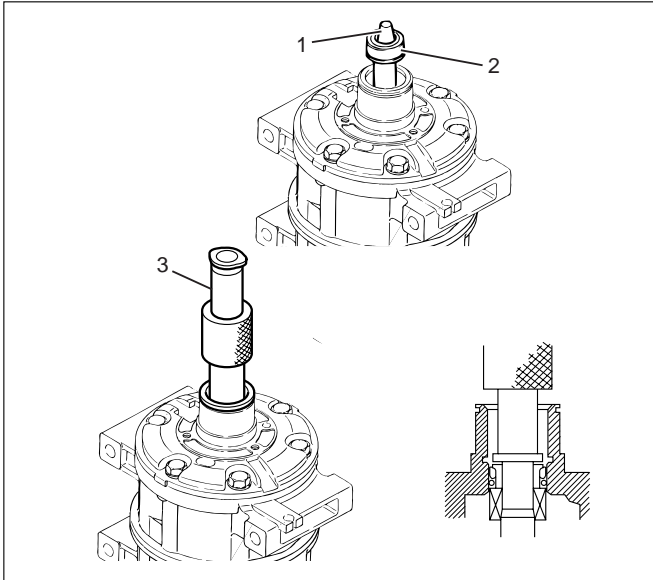
13. Install shaft seal assembly.

- Clean the sealing portion of the compressor and shaft seal (2).

Install the shaft seal guide J-34614 (1) onto the end of the drive shaft.

Apply new compressor oil to the shaft seal guide.

Install the shaft seal (2) onto the compressor drive shaft head by using shaft seal installer J-33942 (3).



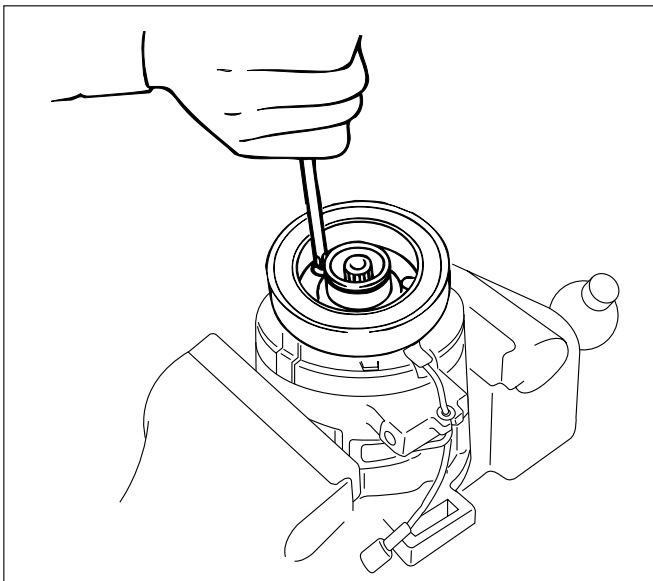
14. Install snap ring.

15. Install field coil.

16. Install lead wire connector.

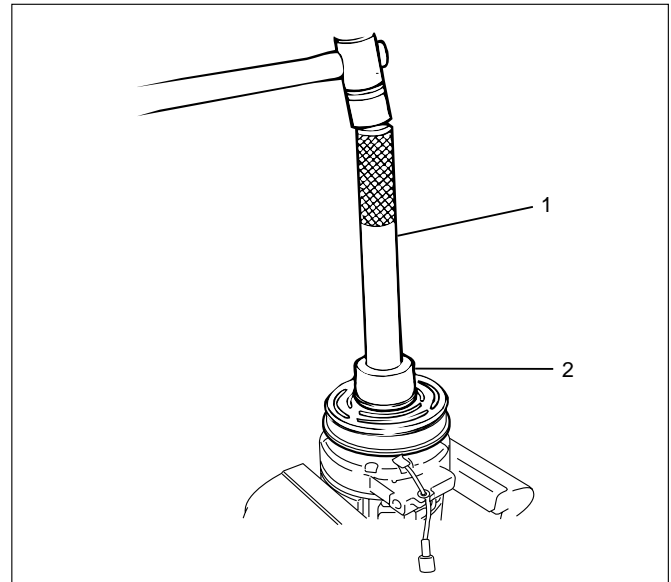
- Install the field coil to the compressor.
Lead wire must be facing up.
Tighten the field coil fixing screws to the specified torque.

Torque: 5N·m (44 lb·in)



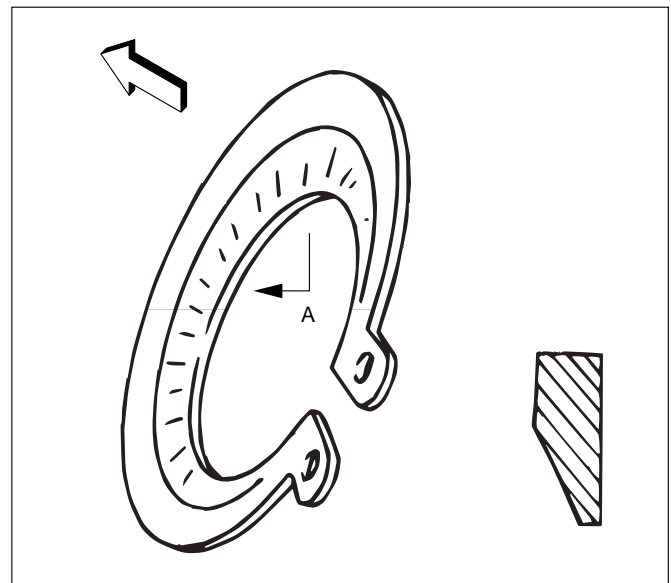
17. Install pulley assembly.

- Using pulley installer J-33940 (2) and drive handle J-8092 (1) to install the pulley assembly.



18. Install snap ring.

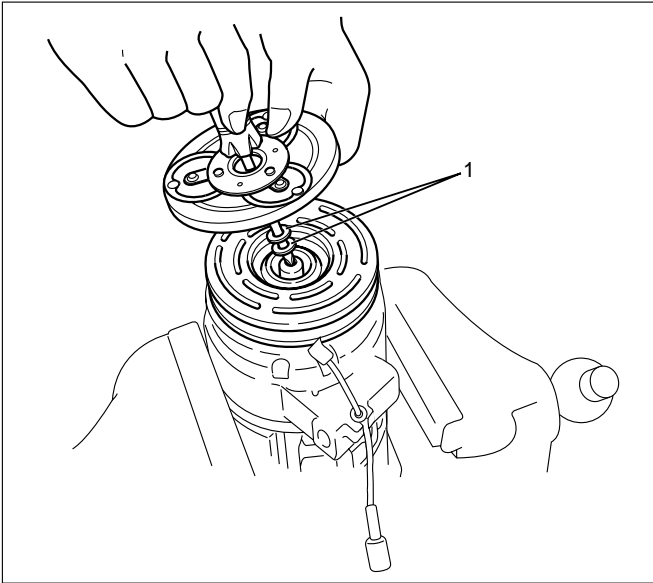
- Install the snap ring with the inside indented portion facing out.



19. Install shim(s).

20. Install drive plate.

- Install the drive plate to the compressor drive shaft together with the original shim(s) (1) press the drive plate by hand.



871RY00009

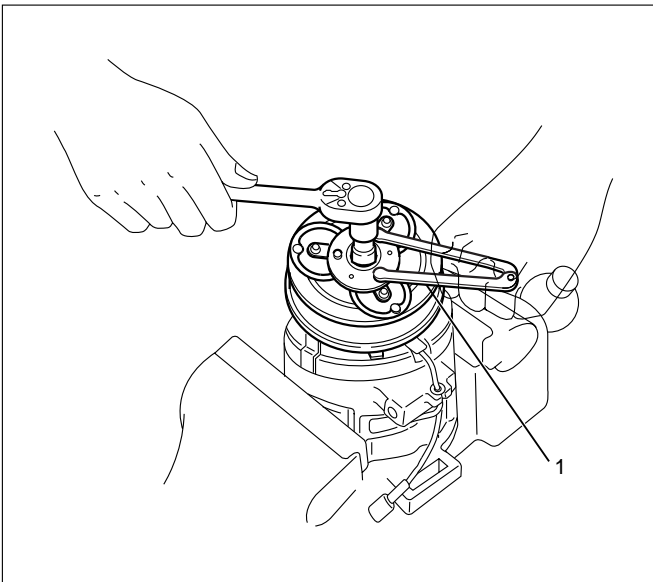
21. Install drive plate bolt by using drive plate holder J-7624 (1) to prevent the drive plate from rotating.

- Tighten the bolt to the specified torque.

Torque: 15N·m (11 lb·in)

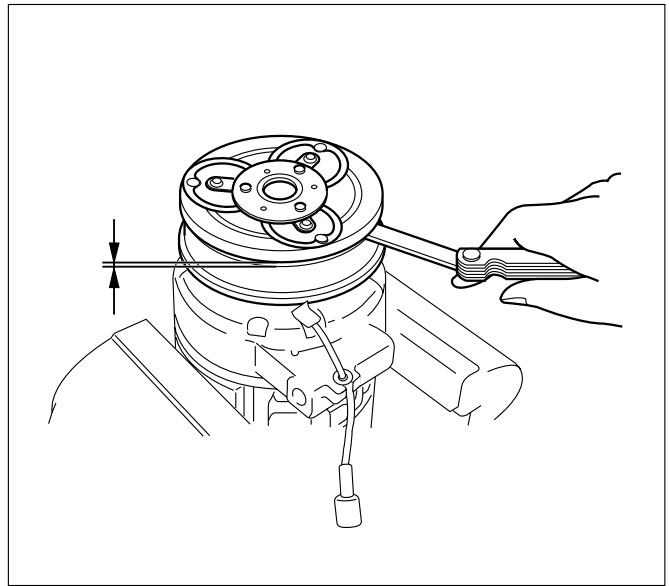
NOTE

After tightening the bolt, check to be sure the pulley rotates smoothly.



901RY00010

- Check to be sure that the clutch clearance is between 0.3–0.6 mm (0.01–0.02 in.)



871RY00007

- If necessary, install adjusting shim(s).
- Adjusting shims are available in the following thickness.

Thickness

- 0.1 mm (0.0039 in.)
- 0.3 mm (0.0118 in.)
- 0.5 mm (0.0197 in.)

HD6 TYPE COMPRESSOR

Metric Thread Size Information

Compressor to mounting bracket bolts (Front)

M10 × 1.5 – 6H

Compressor to mounting bracket bolts (Rear)

M8 × 1.25 – 6H

Suction-discharge port screw

M10 × 1.5 – 6H

Compressor shaft

M9 × 1.25 – 6H

Internal hub-clutch drive assembly

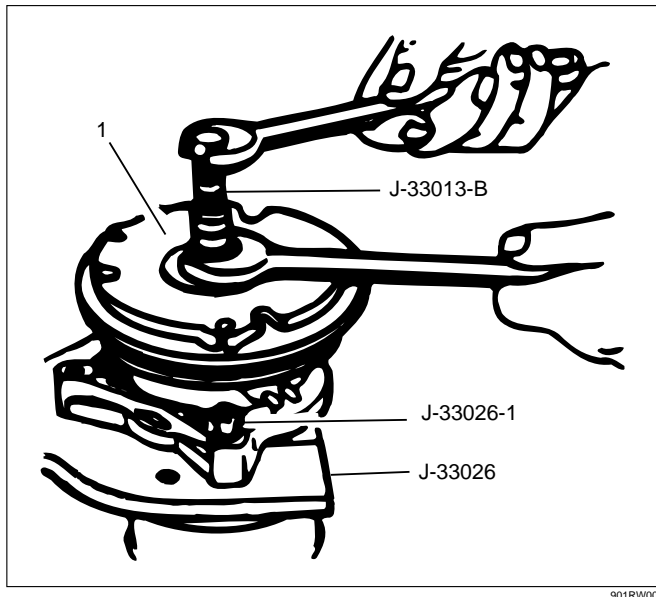
M22 × 1.5 – 6H

COMPRESSOR CLUTCH PLATE AND HUB ASSEMBLY

Removal

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

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

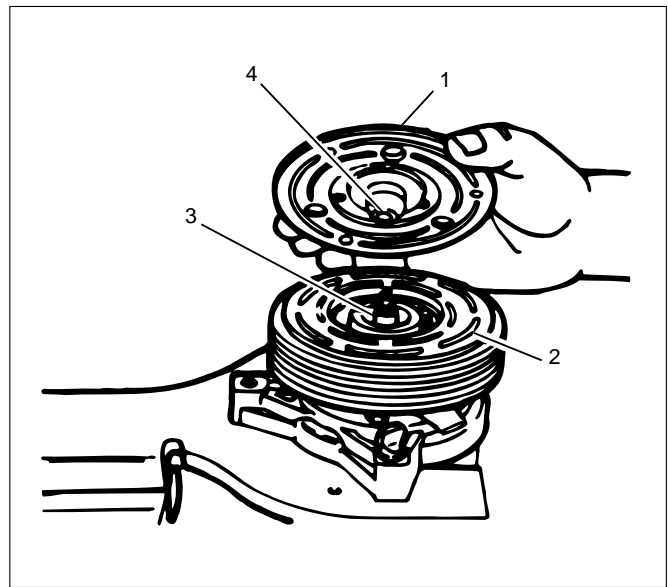


3. Remove the shaft key and retain for reassembly.

Installation

1. Install the shaft key into the hub key groove. Allow the key to project approximately 3.2 mm (1/8 in) out of the keyway. The shaft key is curved slightly to provide an interference fit in the hub key groove.

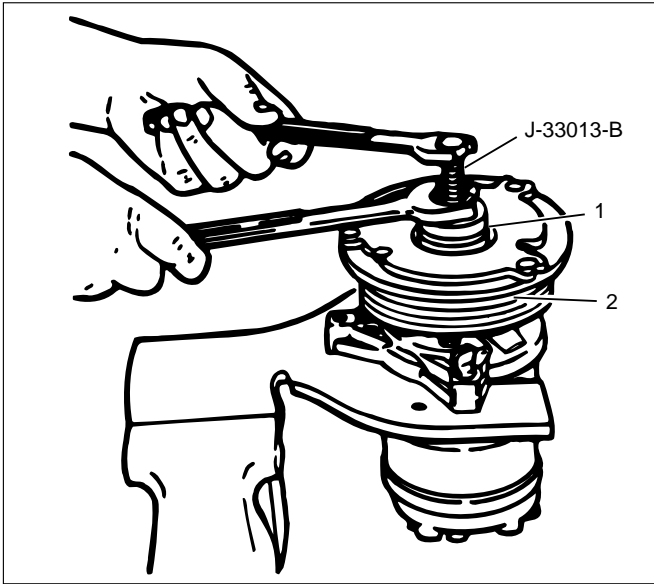
2. Be sure the frictional surface of the clutch plate and the clutch rotor (2) are clean before installing the clutch plate and hub assembly (1).
3. Align the shaft key (4) with the shaft keyway (3) and place the clutch plate and the hub assembly onto the compressor shaft.



871RW003

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

CAUTION: If the center screw is threaded fully onto the end of the compressor shaft. or if the body of the installer is held and the center screw is rotated, the key will wedge and will break the clutch hub.

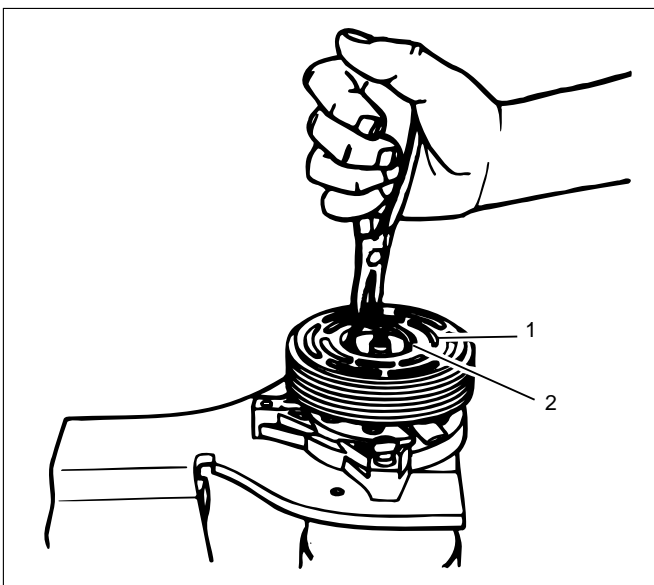


901RW002

COMPRESSOR CLUTCH ROTOR AND/OR BEARING

Removal

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

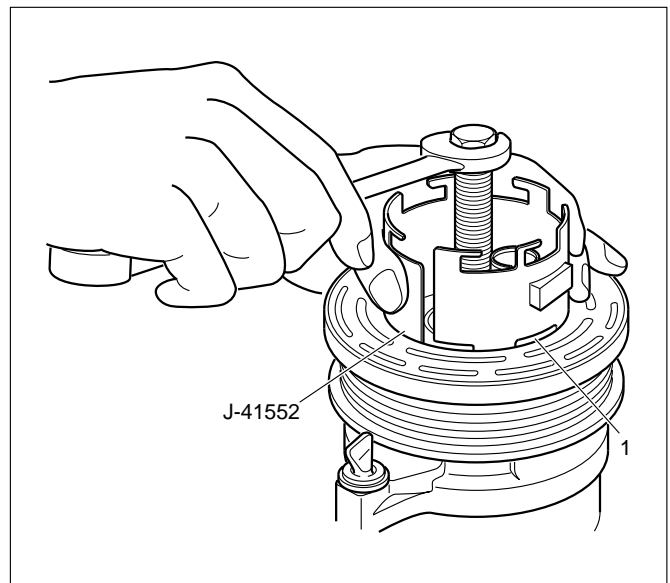


901RW003

3. Install pulley rotor and bearing puller guide J-33023-A to the front head and install J-41552 pulley rotor and bearing puller down into the inner circle of slots (1) in the rotor. Turn the J-41552 puller clockwise in the slots in the rotor.

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

4. Hold the J-41552 puller in place and tighten the puller screw against the puller guide to remove the pulley rotor and bearing assembly.



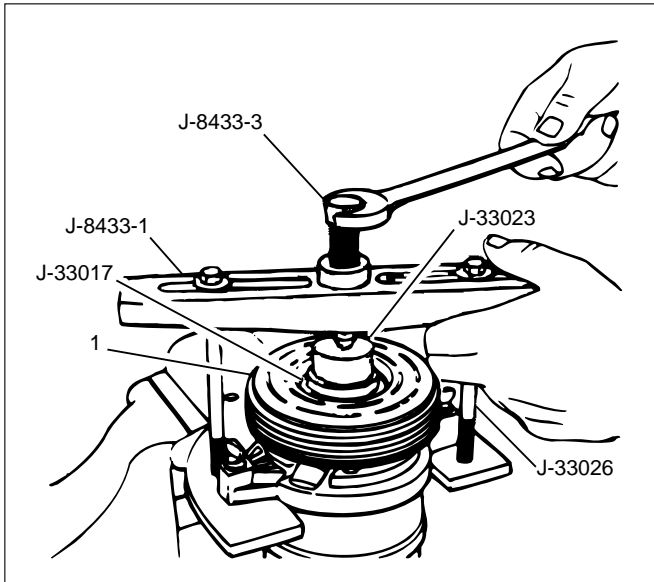
871RW007

Installation

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

1D - 20 COMPRESSOR OVERHAUL

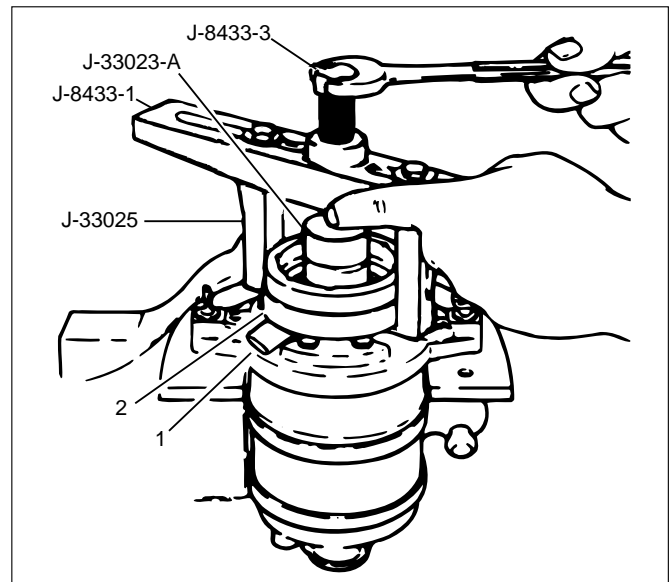
3. Position puller crossbar J-8433-1 on the puller pilot J-33023-A and assemble the two J-33026 through bolts and washers through the puller bar slots and thread them into the J-33026 holding fixture. The thread of the through bolts should engage the full thickness of the holding fixture.
4. Tighten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



COMPRESSOR CLUTCH COIL

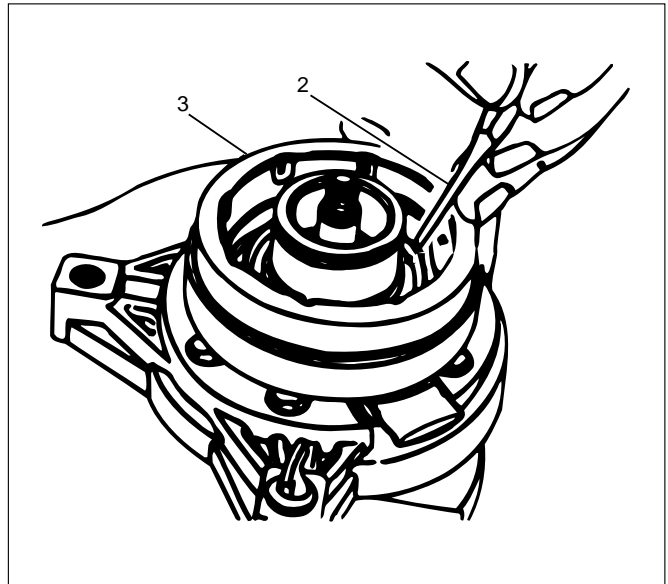
Removal

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



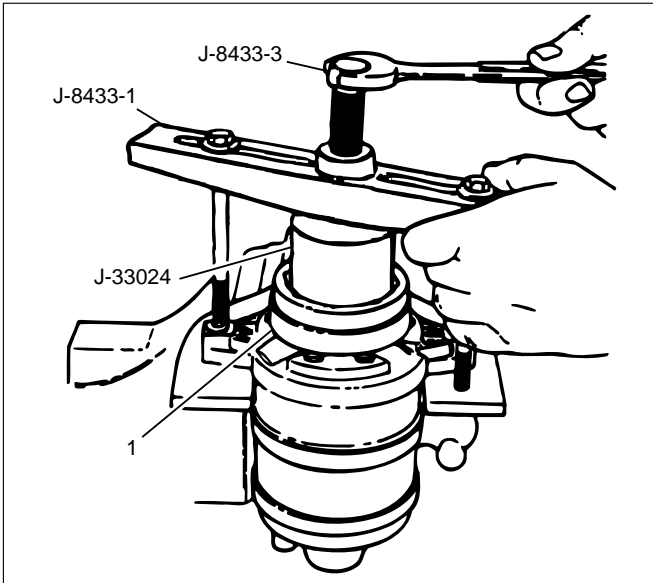
Installation

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



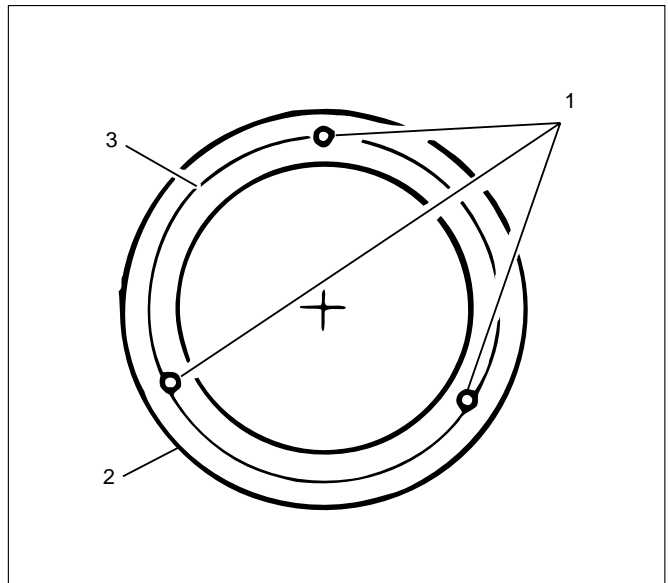
871RW004

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



901RW007

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



871RW005

Legend

- (1) Stake Front Head 0.28–0.35 mm Deep (0.10–0.15 in)
- (2) Clutch Coil Housing
- (3) Front Head Surface

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

COMPRESSOR SHAFT SEAL

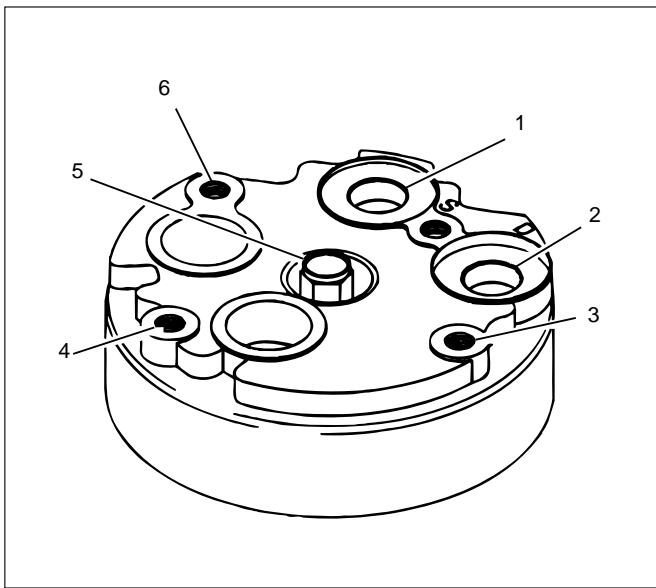
Service Precaution

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

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

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

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



871RW006

Legend

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

Seal Leak Detection

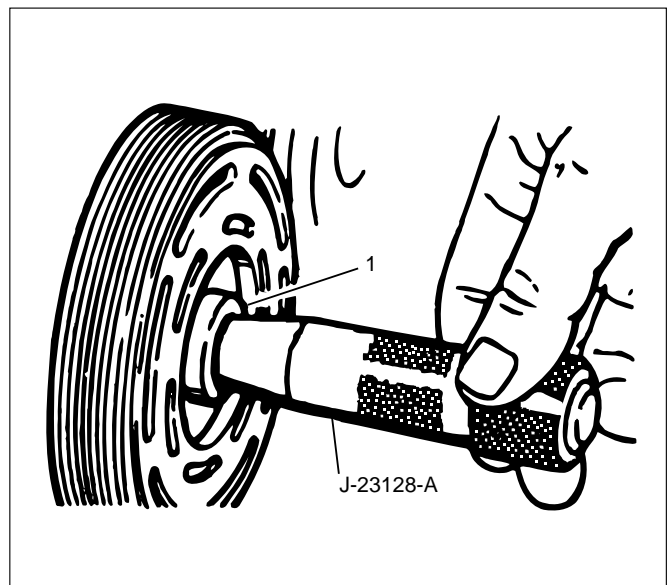
A shaft seal should not be changed because of small amounts of oil found on an adjacent surface but only after actual refrigerant leakage is found using an approved leak detector.

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

Removal

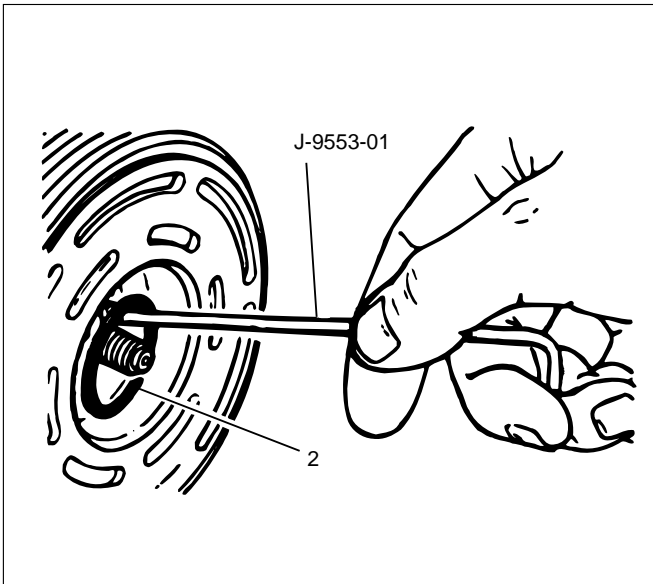
1. Recover the refrigerant using Refrigerant Recovery System.
2. Loosen and reposition compressor in mounting brackets, if necessary.
3. Remove clutch plate and hub assembly from compressor as described previously.
4. Remove the shaft seal retainer ring, using snap ring pliers.
5. Thoroughly clean inside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

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



901RW008

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



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

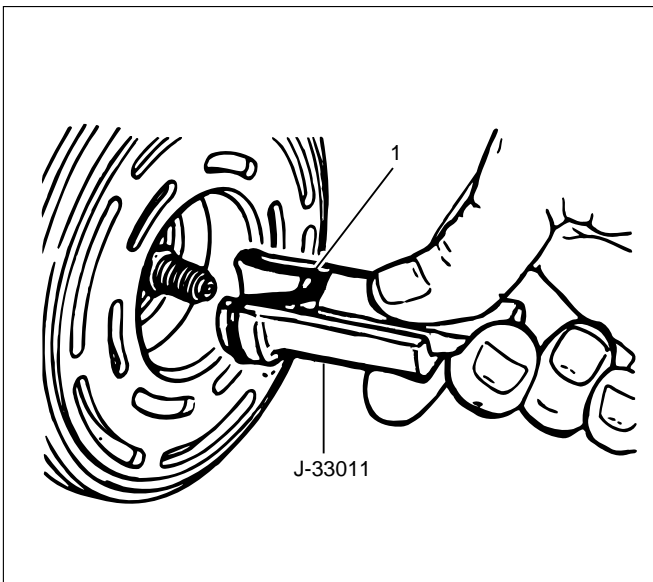
Cleaning

Thoroughly clean O-ring seal groove in front head.

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

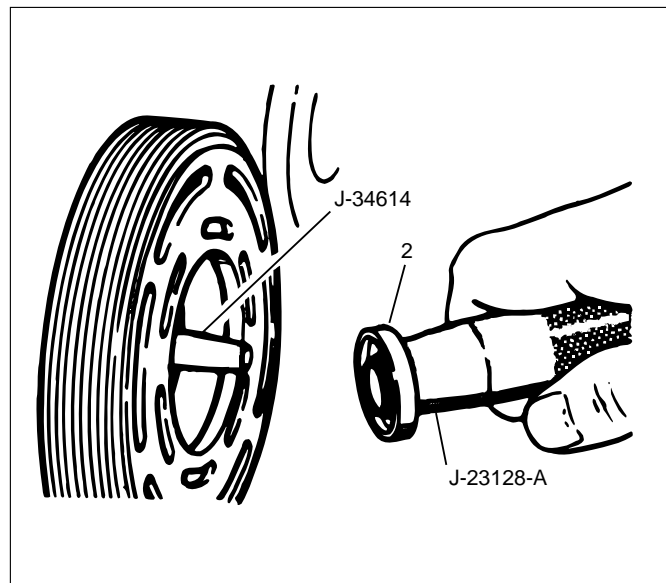
Installation

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



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

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



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

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6. Remove any excess oil resulting from installing the new seal parts from the shaft and inside the compressor neck.
7. Install the clutch plate and hub assembly as described previously.

COMPRESSOR PRESSURE RELIEF VALVE

Removal

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

Installation

1. Clean valve seat area on rear head.

COMPRESSOR OIL

Compressor Oil Check

The oil used to lubricate the compressor is circulating with the refrigerant.

Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

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

Checking and Adjusting Oil Quantity for Used Compressor

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

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

8. Reinstall compressor belt and tighten bracket.
9. Evacuate and charge the refrigerant system.

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

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

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

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

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

Checking and Adjusting for Compressor Replacement

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

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

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

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

Contamination of Compressor Oil

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

Inspect the extracted oil for any of the following conditions:

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

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

Oil Return Operation

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

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

Replacement of Component Parts

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

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

Compressor Leak Testing (External and Internal)

Bench-Check Procedure

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

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

SECTION 00

SERVICE INFORMATION

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TROUBLESHOOTING

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GENERAL INFORMATION

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To identify the symptom, always road test the vehicle first.

Proceed with the following preliminary inspections and correct any defects which are found.

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

GENERAL TROUBLESHOOTING

Problem	Possible Cause	Correction
Vehicle Pulls	<ol style="list-style-type: none"> 1. Mismatched or uneven tires. 2. Tires not adequately inflated. 3. Broken or sagging springs. 4. Radial tire lateral force. 5. Improper wheel alignment. 6. Brake dragging in one wheel. 7. Loose, bent or broken front or rear suspension parts. 8. Faulty shock absorbers. 	Replace tire. Adjust tire pressure. Replace spring. Replace tire. Adjust wheel alignment. Repair brake. Tighten or replace the appropriate suspension part(s). Replace shock absorber.
Abnormal or Excessive Tire Wear	<ol style="list-style-type: none"> 1. Sagging or broken spring. 2. Tire out of balance. 3. Improper wheel alignment. 4. Faulty shock absorber. 5. Hard driving. 6. Overloaded vehicle. 7. Tires not rotated periodically. 8. Worn or loose road wheel bearings. 9. Wobbly wheel or tires. 10. Tires not adequately inflated. 	Replace spring. Balance or replace tire. Check front end alignment. Replace shock absorber. Replace tire. Replace tire and reduce load. Replace or rotate tire. Replace wheel bearing. Replace wheel or tire. Adjust the pressure.
Shimmy, Shake or Vibration	<ol style="list-style-type: none"> 1. Tire or wheel out of balance. 2. Loose wheel bearings. 3. Worn steering linkage ball joints. 4. Worn upper or lower end ball joints. 5. Excessively upper wheel runout. 6. Blister or bump on tire. 7. Excessive loaded radial run out of tire/wheel assembly. 8. Improper wheel alignment. 9. Loose or worn steering linkage. 10. Loose steering gear. 11. Tires not adequately inflated. 12. Loose, bent or broken front or rear suspension parts. 13. Faulty shock absorber. 14. Hub bearing preload misadjustment. 	Balance wheels or replace tire/or wheel. Replace wheel bearing. Replace ball joints. Replace ball joints. Repair or replace wheel and/or tire. Replace tire. Replace tire or wheel. Check wheel alignment. Tighten or replace steering linkage. Tighten housing bolts. Adjust tire pressure. Tighten or replace the appropriate suspension parts. Replace shock absorber. Adjust preload.

GENERAL TROUBLESHOOTING (CONT.)

Problem	Possible Cause	Correction
Wheel Tramp or Hop	<ol style="list-style-type: none"> 1. Blister or bump on tire. 2. Improper shock absorber operation 	<p>Replace tire. Replace shock absorber.</p>
Hard Steering	<ol style="list-style-type: none"> 1. Bind in steering linkage ball studs, upper or lower end ball joint. 2. Improper wheel alignment. 3. Steering gear misadjustment. 4. Tire not adequately inflated. 5. Bind in steering column or shaft. 6. Improper power steering system operation. 	<p>Replace ball joints.</p> <p>Check wheel alignment. Check and adjust steering gear preload.</p> <p>Inflate tires to proper pressure. Repair or replace.</p> <p>Repair or replace. Refer to "Power steering system troubleshooting."</p>
Too Much Play In Steering	<ol style="list-style-type: none"> 1. Wheel bearings worn. 2. Loose steering gear or linkage. 3. Steering gear misadjustment. 4. Worn or loose steering shaft universal joint. 5. Worn steering linkage ball joints. 6. Worn upper or lower end ball joints. 	<p>Replace wheel bearings. Retighten or repair.</p> <p>Inspect and adjust steering gear preload. Retighten or replace steering shaft.</p> <p>Replace ball joints. Replace ball joints.</p>
Poor Steering Wheel Returnability	<ol style="list-style-type: none"> 1. Bind in steering linkage ball joints. 2. Bind in upper or lower end ball joints. 3. Bind in steering column and shaft. 4. Bind in steering gear. 5. Improper wheel alignment. 6. Tires not adequately inflated. 7. Loose steering wheel nut. 8. Worn wheel bearing. 	<p>Replace ball joints. Replace ball joints. Repair or replace. Check and repair steering gear. Adjust wheel alignment. Adjust tire pressure. Retighten. Replace.</p>
Abnormal Noise	<ol style="list-style-type: none"> 1. Worn, sticky or loose upper or lower end ball joint, steering linkage ball joints or drive axle joints. 2. Faulty shock absorbers. 3. Worn upper or lower control arm bushing. 4. Loose stabilizer bar. 5. Loose wheel nuts. 6. Loose suspension bolts or nuts. 7. Broken or otherwise damaged wheel bearings. 8. Broken suspension springs. 9. Loose steering gear. 10. Faulty steering gear. 	<p>Replace.</p> <p>Replace or repair. Replace. Retighten bolts. Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required. Retighten suspension bolts or nuts. Replace wheel bearing.</p> <p>Replace spring. Retighten mounting bolt. Check and adjust steering gear.</p>

GENERAL TROUBLESHOOTING (CONT.)

Problem	Possible Cause	Correction
Wandering or Poor Steering Stability	<ol style="list-style-type: none"> 1. Mismatched or unevenly worn tires. 2. Loose steering linkage ball joints. 3. Faulty shock absorbers. 4. Loose stabilizer bar. 5. Broken or sagging springs. 6. Steering gear misadjustment. 7. Improper wheel alignment. 	Replace tire or inflate tires to proper pressure. Replace ball joints. Replace shock absorber. Tighten or replace stabilizer bar or bushings. Replace spring (pairs). Check or adjust steering gear. Adjust wheel alignment.
Erratic Steering When Bracking	<ol style="list-style-type: none"> 1. Worn wheel bearings. 2. Broken or sagging springs. 3. Leaking caliper. 4. Warped discs. 5. Badly worn brake pads. 6. Tires are inflated unequally. 	Replace wheel bearings. Replace spring (pairs). Repair or replace caliper. Replace brake disc. Replace brake pads. Inflate tires to proper pressure.
Low or Uneven Trim Height	<ol style="list-style-type: none"> 1. Broken or sagging springs. 2. Vehicle overloaded. 3. Incorrect springs. 	Replace springs (In pairs) Reduce load. Adjust or replace torsion bar.
Suspension Bottoms	<ol style="list-style-type: none"> 1. Vehicle overloaded. 2. Faulty shock absorber. 3. Incorrect, broken or sagging springs. 	Reduce load. Replace shock absorber. Replace springs.
Body Leans	<ol style="list-style-type: none"> 1. Loose stabilizer bar. 2. Faulty shock absorbers, struts or mounting. 3. Broken or sagging springs. 4. Vehicle overloaded. 	Tighten stabilizer bar bolts or replace bushings. Replace shock absorber. Replace springs (In pairs) Reduce load.
Cupped Tires	<ol style="list-style-type: none"> 1. Worn wheel bearings. 2. Excessive tire or wheel runout. 3. Worn ball joints. 4. Tire out of balance. 	Replace wheel bearings. Replace tire or wheel. Replace ball joints. Adjust tire balance.

POWER STEERING SYSTEM

HISSING NOISE

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

Problem	Possible Cause	Correction
Rattle or Chucking Noise	<ol style="list-style-type: none"> 1. Pressure hose touching other parts of vehicle. 2. Tie rod ends loose. 3. Loose steering gear mounting. 4. Steering gear misadjustment. 	Adjust hose position. Do not bend tubing by hand. Tighten or replace tie rod end. Tighten steering gear mounting. Check and adjust steering gear preload.
Poor Return of Steering Wheel to Center	<ol style="list-style-type: none"> 1. Improper front wheel alignment. 2. Wheel bearing worn. 3. Tie rod end binding. 4. Ball joint binding. 5. Tight or frozen steering shaft bearing. 6. Steering gear misadjustment. 7. Sticky or plugged steering gear valve. 8. Entry of air in the power steering system. 	Adjust front wheel alignment. Replace front wheel bearing. Replace tie rod end. Replace ball joint. Replace steering assembly. Adjust the steering gear. Repair or replace steering gear valve. Bleed the system.
Momentary Increase in Effort When Turning Wheel Fast to Right or Left	<ol style="list-style-type: none"> 1. High internal leakage. 2. Power steering fluid level low. 	Repair steering gear. Replenish fluid.
Steering Wheel Surges or Jerks When Turning Especially During Parking	<ol style="list-style-type: none"> 1. Insufficient pump pressure. 2. Sticky steering gear valve. 3. Power steering fluid level low. 	Repair pump assembly. Repair or replace steering gear. Replenish fluid.
Excessive Wheel Kick Back or Loose Steering	<ol style="list-style-type: none"> 1. Air in system. 2. Tie rod end loose. 3. Wheel bearing worn. 	Bleed hydraulic system. Tighten tie rod end. Replace wheel bearing.
Hard Steering or Lack of Power Assist	<ol style="list-style-type: none"> 1. Sticky steering gear valve. 2. Insufficient pump pressure. 3. Excessive internal pump leakage. 4. Excessive internal steering gear leakage. 5. Power steering fluid level low. 	Repair or replace steering gear valve. Repair pump assembly. Repair pump assembly. Repair steering gear. Replenish fluid.

POWER STEERING PUMP

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

Problem	Possible Cause	Correction
Low Pressure Due to Steering Pump	<ol style="list-style-type: none"> 1. Relief valve sticking or inoperative. 2. Side plate not flat against cam ring. 3. Extreme wear of cam ring. 4. Scored side plate or rotor. 5. Vanes sticking in rotor slots. 6. Cracked or broken side plate. 7. High internal leakage. 	Replace relief valve. Replace side plate. Replace cam ring. Replace side plate or rotor. Repair or replace vanes and rotor. Replace side plate. Repair internal leakage.
Low Pressure Due to Steering Gear	<ol style="list-style-type: none"> 1. Scored housing bore. 2. Damaged O-ring or seal ring in the ball nut. 	Replace housing. Replace O-ring or seal ring.
Growling Noise in Steering Pump	<ol style="list-style-type: none"> 1. Excessive back pressure in hoses or steering unit caused by restriction. 2. Scored side plate or rotor. 3. Worn cam ring. 	Repair steering unit or pump. Replace side plate or rotor. Replace cam ring.
Groaning Noise in Steering Pump	<ol style="list-style-type: none"> 1. Air in the fluid. 2. Low fluid level. 3. Pump mounting loose. 	Bleed hydraulic system. Replenish fluid. Tighten mounting bolt.
Rattling Noise in Steering Pump	<ol style="list-style-type: none"> 1. Vanes sticking in rotor slots. 2. Vane improperly installed. 	Repair or replace vanes and rotor. Repair rotor and vane.
Swishing Noise in Steering Pump	<ol style="list-style-type: none"> 1. Damaged relief valve. 	Replace relief valve.
Whining Noise in Steering Pump	<ol style="list-style-type: none"> 1. Scored side plate and vanes. 2. Damaged relief valve. 	Replace side plate and vanes. Replace relief valve.

STEERING COLUMN

LOCK SYSTEM

Problem	Possible Cause	Correction
Will Not Unlock	<ol style="list-style-type: none"> 1. Damaged lock cylinder. 2. Damaged sector. 3. Damaged park lock cable. 	Replace lock cylinder. Replace lock cylinder. Replace park lock cable.
Will Not Lock	<ol style="list-style-type: none"> 1. Lock spring broken or worn. 2. Damaged lock cylinder. 3. Ignition switch stuck. 4. Park lock cable damaged. 	Replace lock cylinder. Replace lock cylinder. Repair or replace ignition switch. Replace park lock cable.
Key Cannot Be Removed in "OFF-LOCK"	<ol style="list-style-type: none"> 1. Ignition switch is not set correctly. 2. Damaged lock cylinder. 3. Faulty shift lock mechanism. 	Correct ignition switch. Replace lock cylinder. Repair or replace the shift lock mechanism.

COLUMN

Problem	Possible Cause	Correction
Noise in Column	<ol style="list-style-type: none"> 1. Universal joint loose. 2. Shaft lock snap ring not seated. 	Tighten joint. Place snap ring in proper position.

STEERING COLUMN (CONT.)

TURN SIGNAL SWITCH

This troubleshooting covers mechanical problems only. See Section 8 for turn signal switch electrical diagnosis.

Problem	Possible Cause	Correction
Turn Signal Will Not Stay in Turn Position	<ol style="list-style-type: none"> 1. Foreign material or loose parts preventing movement of yoke. 2. Broken or missing detent or canceling spring. 	Repair or replace signal switch. Replace signal switch.
Turn Signal Will Not Cancel	<ol style="list-style-type: none"> 1. Loose switch mounting screws. 2. Switch or anchor bosses broken. 3. Broken, missing or out of position detent, return or canceling spring. 4. Worn canceling cam. 	Tighten mounting screws. Replace turn signal switch. Replace turn signal switch. Replace turn signal switch.
Turn Signal Difficult to Operate	<ol style="list-style-type: none"> 1. Turn signal switch arm loose. 2. Yoke broken or distorted. 3. Loose or misplaced springs. 4. Foreign parts and/or material. 5. Loose turn signal switch mounting screws. 	Tighten arm screw. Replace turn signal switch. Replace turn signal switch. Repair turn signal switch. Tighten mounting screws.
Turn Signal Will Not Indicate Lane Change	<ol style="list-style-type: none"> 1. Broken lane change pressure pad or spring hanger. 2. Broken, missing or misplaced lane change spring. 3. Base of wire damaged. 	Replace turn signal switch. Replace turn signal switch. Replace turn signal switch.
Hazard Switch Cannot Be Turned Off	<ol style="list-style-type: none"> 1. Foreign material between hazard switch to turn signal switch body. 	Repair or replace hazard switch.
No Turn Signal Lights	<ol style="list-style-type: none"> 1. Electrical failure in chassis harness. 2. Inoperative turn signal flasher unit. 3. Loose chassis harness connector. 	Refer to Section 8 "Electrical Troubleshooting". Replace flasher unit. Repair loose connector.
Front or Rear Turn Signal Lights Not Flashing	<ol style="list-style-type: none"> 1. Burned-out damaged turn signal bulb. 2. High resistance connection to ground at bulb socket. 3. Loose chassis harness connector. 	Replace bulb. Repair bulb socket. Repair loose connector.

MAIN DATA AND SPECIFICATIONS

FRONT END ALIGNMENT

Caster		$2^{\circ} 10' \pm 45'$
Camber		$0^{\circ} \pm 30'$
King pin inclination		$12^{\circ} 30' \pm 30'$
Toe-in	mm (in)	$0 \pm 2 (0 \pm 0.08)$
Max. steering angle	(inside)	$34^{\circ +0^{\circ}}_{-2^{\circ}}$
	(outside)	32°

POWER STEERING

Steering gear		Integral, ball screw
Type		16.3 : 1
Gear ratio		
Oil pump		Vane
Type		ATF DEXRON® - E or
Operating fluid		

SERVICE STANDARD

Items	Service Standard	Service Limit
POWER STEERING GEAR Sector shaft outside diameter mm (in)	32.0 (1.26)	31.7 (1.25)
POWER STEERING PUMP Fluid pressure (When the engine is normal operating temperature, increase engine speed to 1500rpm.) kpa (kg/cm ² /psi)	9300 - 9800 (6VD1) (95 - 100 / 1350 - 1420) (6VE1) 9800 - 10300 (4JG2) (100 - 105 / 1420 - 1490) (4JX1)	-----
STEERING WHEEL Free play mm (in)	0 - 30 (0 - 1.18)	-----

SERVICING

STEERING



INSPECTION

Visual check

Check the following parts:

- Oil leakage.
- Steering system for looseness or damage.
- Steering function
- Joint ball for oil leakage or damage.
- Joint ball rubber boot for damage.

MAINTENANCE

The hydraulic system should be kept clean and fluid level in the reservoir should be checked at regular intervals and fluid added when required. Refer to "MAINTENANCE AND LUBRICATION" in section 0B of the manual for type of fluid to be used and intervals for filling.

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

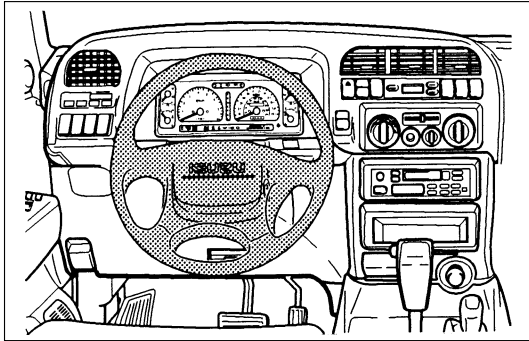
All tubes, hoses, and fittings should be inspected for leakage at regular intervals. Fittings must be tight. Make sure the clips, clamps and supporting tubes and hoses are in place and properly secured.

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

FLUID LEVEL

1. Run the engine until the power steering fluid reaches normal operating temperature, about 55°C (130°F), then shut the engine off.
2. Check the level of fluid in the reservoir.
3. If the fluid level is low, add power steering fluid as specified in "MAINTENANCE AND LUBRICATION" in section 0B to the proper level and install the receiver cap.
4. When checking the fluid level after the steering system has been serviced, air must be bled from the system. Refer to "Bleeding the Power Steering System" in this section.

STEERING WHEEL FREE PLAY ADJUSTMENT



INSPECTION

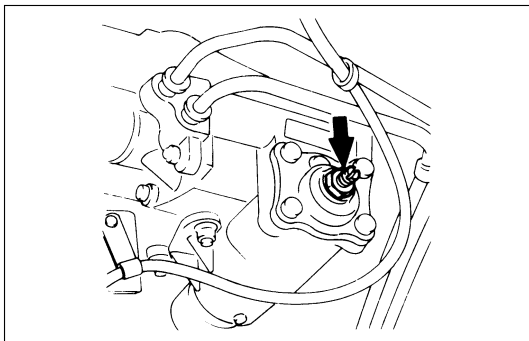
1. Check the amount of steering wheel play by turning the wheel in both directions until the tires begin to move with the front wheels properly in the straight ahead position.

NOTE:

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

Steering Wheel Free Play	mm (in)
	0 - 30 (0 - 1.18)

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



ADJUSTMENT

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

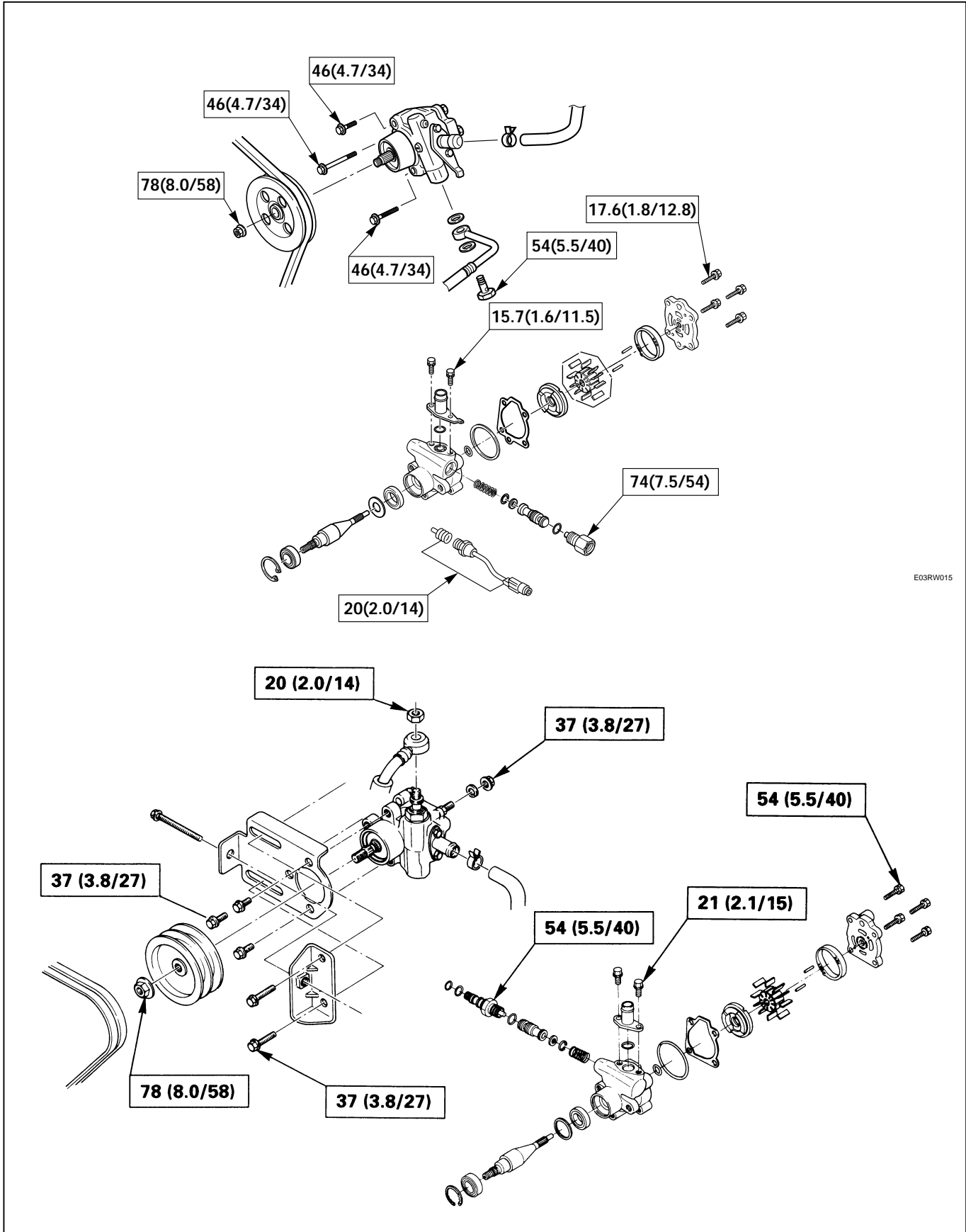


Lock Nut Torque	N·m (kg·m/lb·ft)
	41 (4.2 / 30)

FIXING TORQUE

Power Steering

N·m (kg·m/lb·ft)

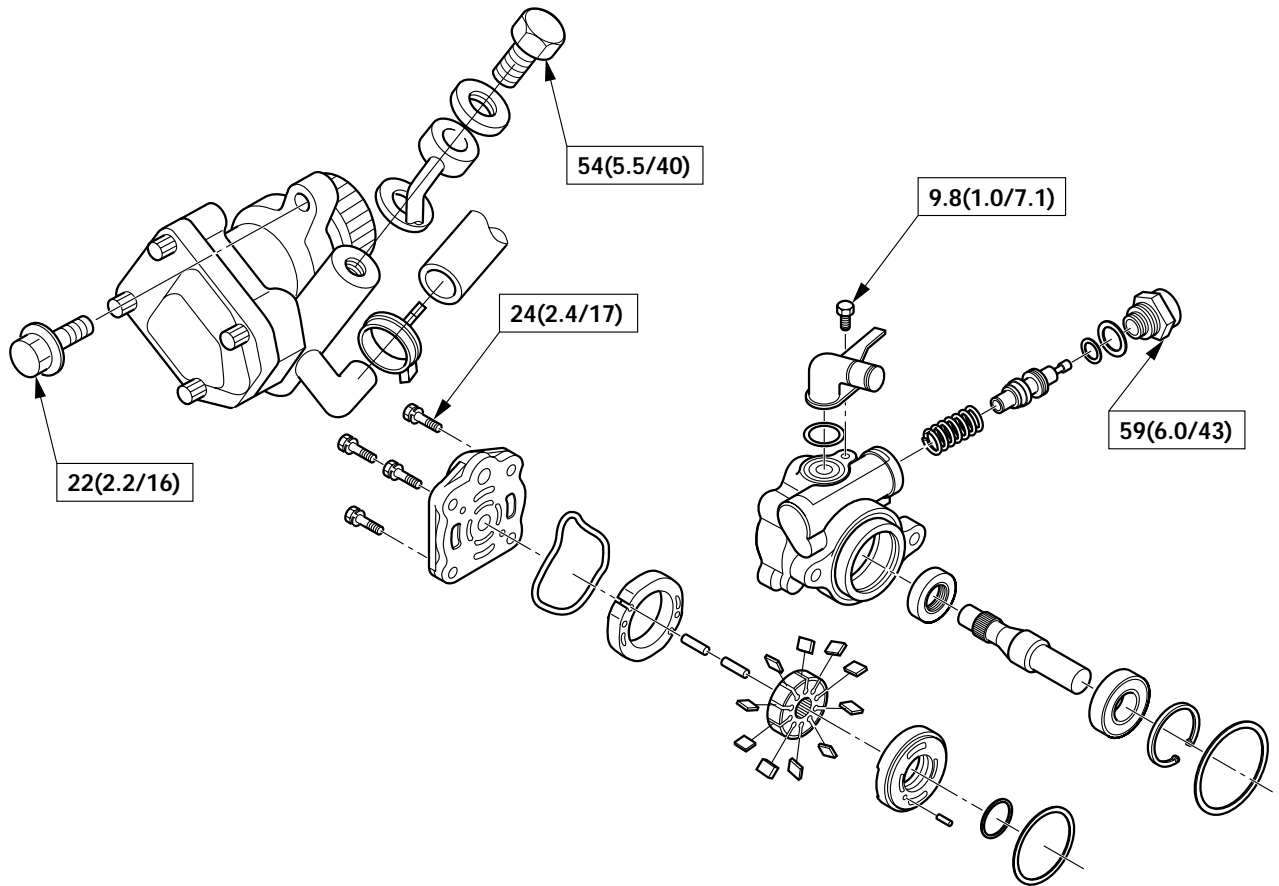


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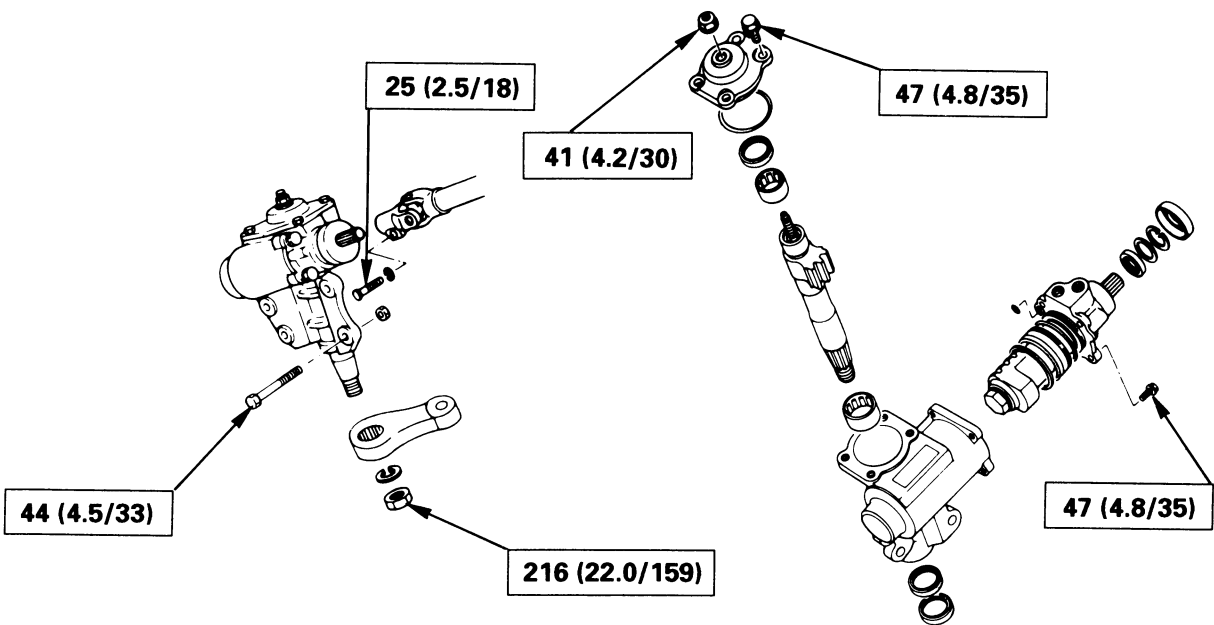
Power Steering (Cont.)

N·m (kg·m/lb·ft)

These illustrations are based on the LHD model.



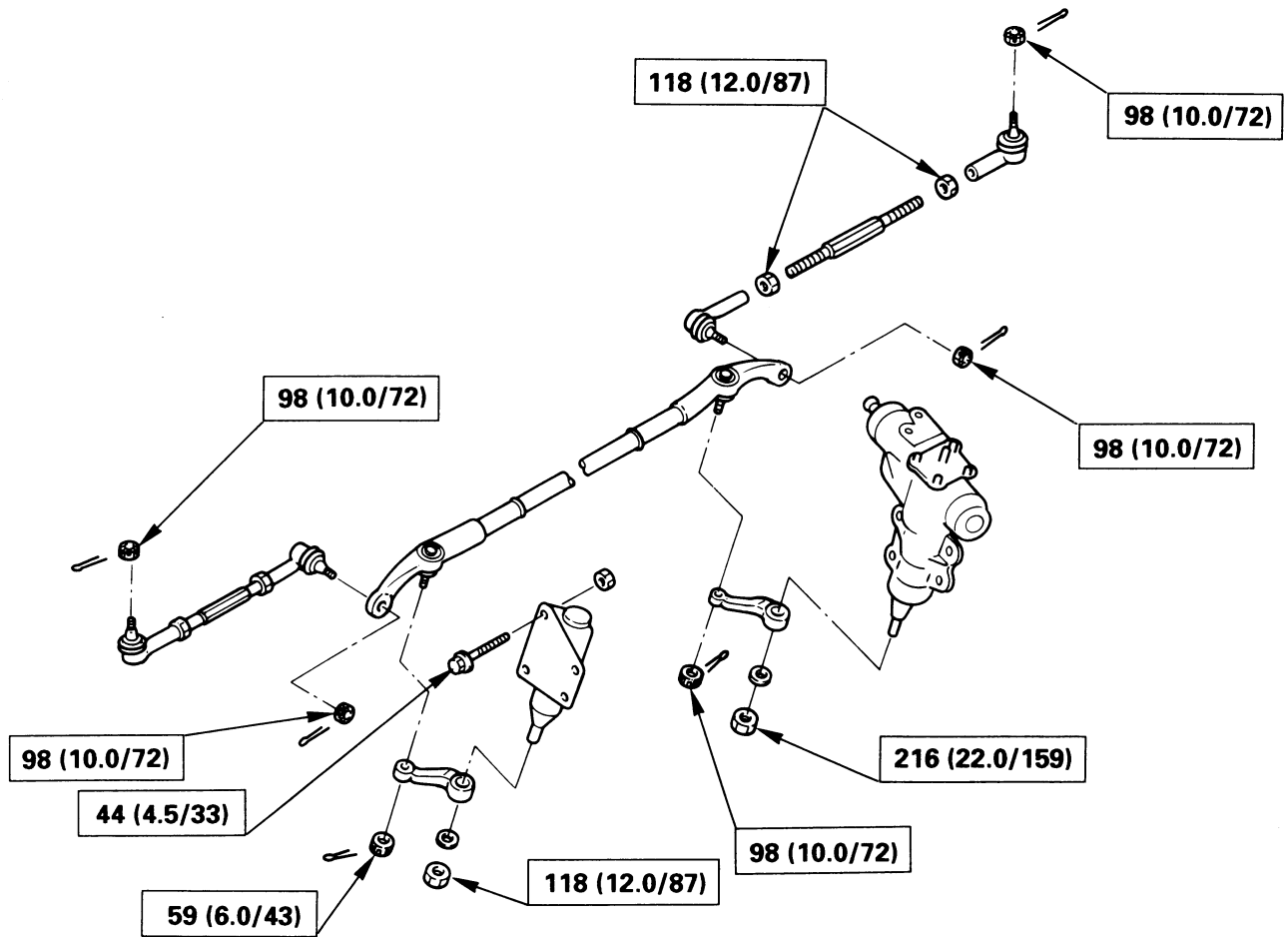
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Steering Linkage

N·m (kg·m/lb·ft)

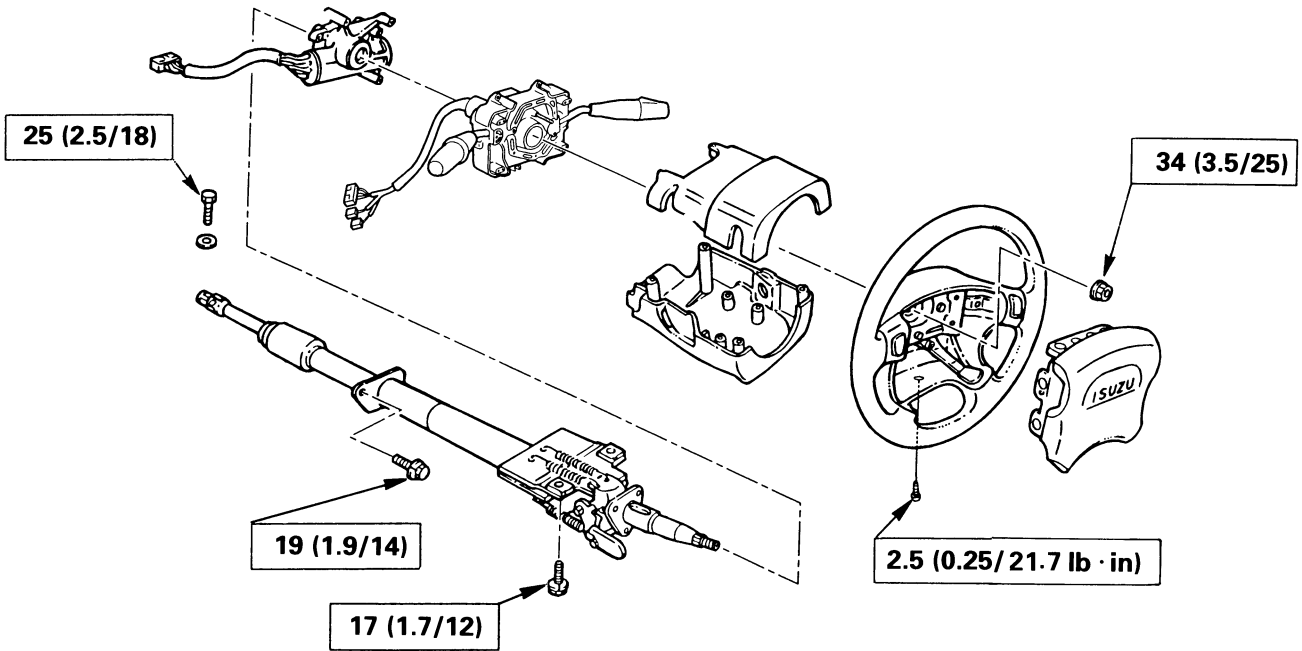
These illustrations are based on the LHD model.



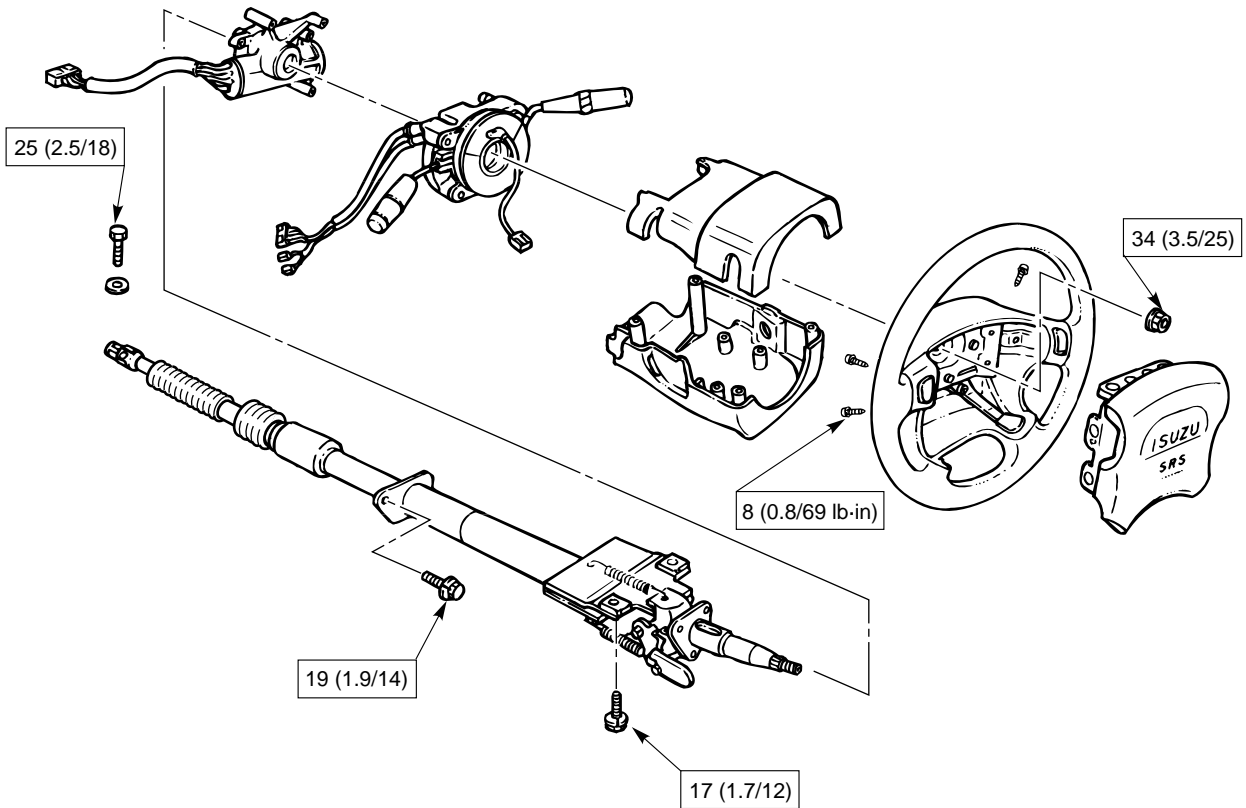
Steering Column

N·m (kg·m/lb·ft)


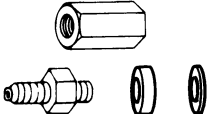
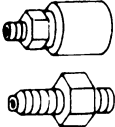
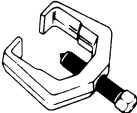
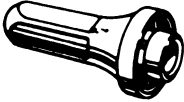
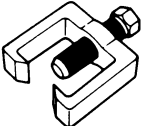
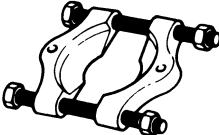
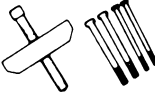
This illustration is based on the LHD model.



This illustration is based on the LHD model.



SPECIAL TOOLS

Illustration	Part No.	Part Name
	5-8840-0135-0 (J-29877-A)	Tester: Power steering
	5-8840-2297-0 (J-39213)	Adapter: Power steering tester For 6VD1, 6VE1, 4JX1
	5-8840-0136-0 (J-33996)	Adapter: Power steering tester For 4JG2
	5-8840-2005-0 (J-29107)	Remover: Pitman arm
	5-8522-0026-0 (J-26508)	Installer: Extension housing oil seal
	5-8840-2121-0 (J-36831)	Remover: Tie rod end
	5-8840-0015-0 (J-22912-01)	Remover: Relay lever
	5-8521-0016-0 (J-29752)	Remover: Steering wheel

MEMO

A series of horizontal dotted lines for writing.

SECTION 2A

FRONT END ALIGNMENT

CONTENTS

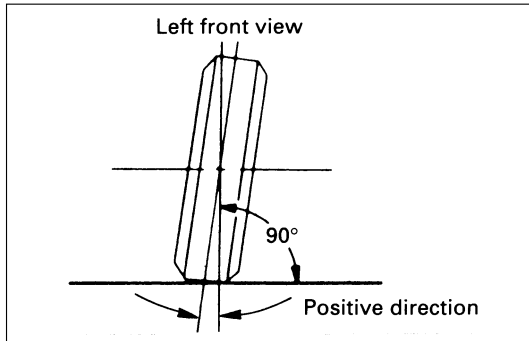
	PAGE
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On-Vehicle Service.....	2A - 3
Inspection	2A - 3
Trim Height Adjustment	2A - 3
Caster Adjustment	2A - 4
Camber Adjustment	2A - 4
Toe-in Adjustment	2A - 5
Maximum Steering Angle Adjustment	2A - 5

GENERAL DESCRIPTION

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

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

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

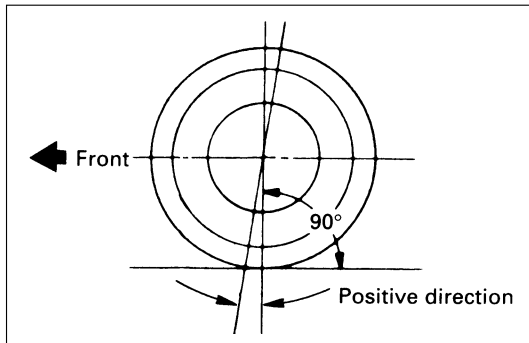


DEFINITION OF TERMS

CAMBER

Camber is the inward or outward tilting of the front wheels from the vertical. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward at the top, the camber is negative (-). The amount of tilt measured in degrees from the vertical is called the camber angle.

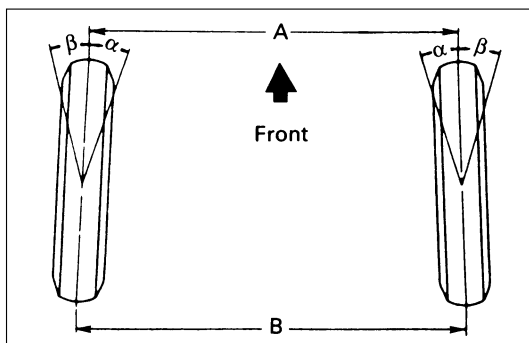
If camber is extreme or unequal between the wheels, improper steering and excessive tire wear will result. Negative camber causes wear on the inside tire, while positive camber causes wear to the outside.



CASTER

Caster is the tilting of the wheel axis either forward or backward from the vertical (when viewed from the side of the vehicle). A backward tilt is positive(+) and a forward tilt is negative(-).

On the short and long arm type suspension you cannot see a caster angle without a special instrument, but if you look straight down from the top of the upper control arm to the ground, the ball joints do not line up (fore and aft) when a caster angle other than 0 degree is present. With a positive angle, the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line.



TOE-IN

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

ON-VEHICLE SERVICE

INSPECTION

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

INSPECT

1. Tires for proper inflation pressure. Refer to "Wheels and Tires" in section 3E.
2. Front wheel bearings for proper adjustment. Refer to "Front Wheel Drive" in section 4C.
3. Ball joints, tie rod ends and relay rods. If excessive looseness is noted, correct before adjusting. Refer to "Steering Linkage" in section 2A.
4. Wheel and tires for run-out. Refer to "Wheels and Tires" in section 3E.
5. Trim height. If not within specifications, the correction must be made before adjusting caster.
6. Steering gear for looseness at the frame.
7. Shock absorbers for leaks or any noticeable noise. Refer to "Front Suspension" in section 3C.
8. Control arms or stabilizer bar attachment for looseness. Refer to "Front Suspension" in section 3C.
9. Alignment equipment. Follow the manufacturer's instructions.
10. Level of the vehicle. The vehicle must be on a level surface.

TRIM HEIGHT ADJUSTMENT

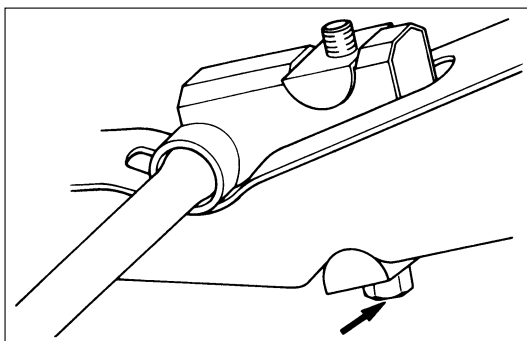
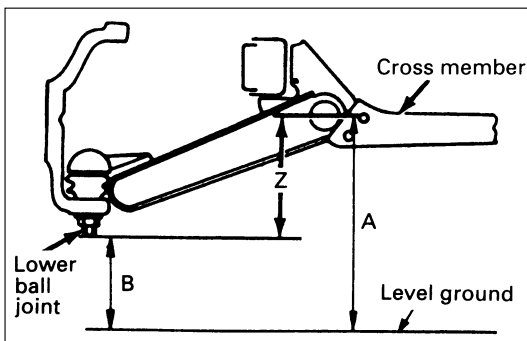
Adjust the trim height by means of the adjusting bolt on the height control arms.



CAUTION:

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

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



Trim Height(Z)	mm(in)
	139 ± 5 (5.47 ± 0.2)

CASTER ADJUSTMENT

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

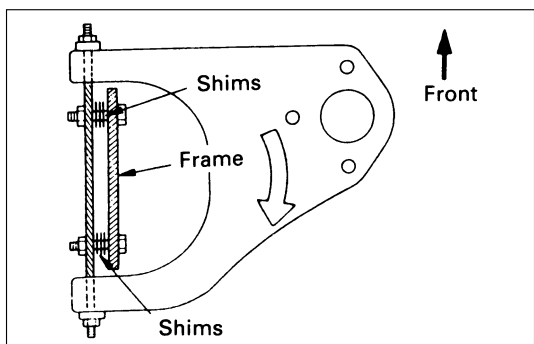
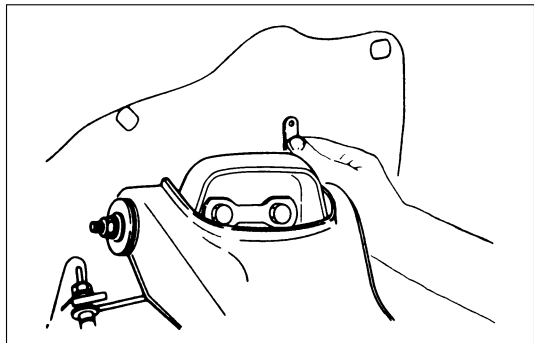
Caster Angle
1998 model

$2^{\circ} 10' \pm 45'$

2000 model and later

RH	$2^{\circ} 22' \pm 45'$
----	-------------------------

LH	$2^{\circ} 10' \pm 45'$
----	-------------------------



CAUTION:
Left and right side to be equal within 30'

NOTE:
Difference of the caster shim front/rear thickness shall be 3.2 mm (0.126 in) or less. Overall thickness of caster shim and camber shim shall be 10.8 mm (0.425 in) or less.



Tighten the fulcrum pin bolt to the specified torque.
Fulcrum Pin Bolt Torque N·m (kg·m/lb·ft)
152 (15.5 / 112)

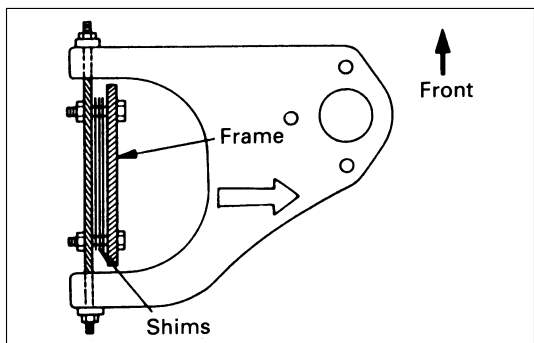
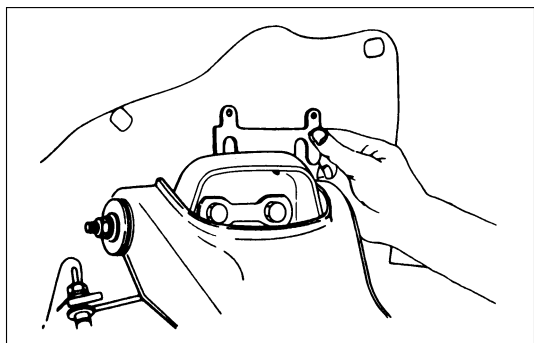
CAMBER ADJUSTMENT

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

Wheel Alignment Specification

Camber Angle	$0^{\circ} \pm 30'$
--------------	---------------------

King pin inclination	$12^{\circ} 30' \pm 30'$
----------------------	--------------------------



CAUTION:
Left and right side to be equal within 30'

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



Tighten the fulcrum pin bolt to the specified torque.
Fulcrum Pin Bolt Torque N·m (kg·m/lb·ft)
152 (15.5 / 112)

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

TOE-IN ADJUSTMENT

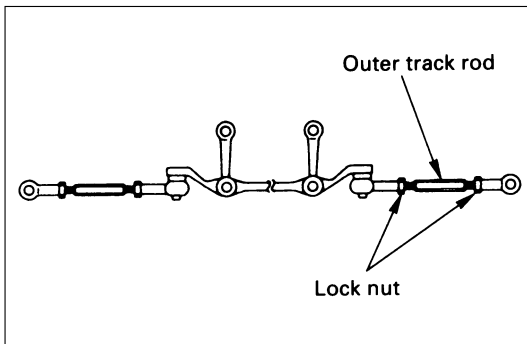
- To adjust the toe-in angle, loosen the lock nuts on the outer track rods and turn the outer track rods. Turn both rods the same amount, to keep the steering wheel centered.

Toe-in	mm(in)
0 ± 2 (0 ± 0.08)	



- Tighten the lock nut to the specified torque.

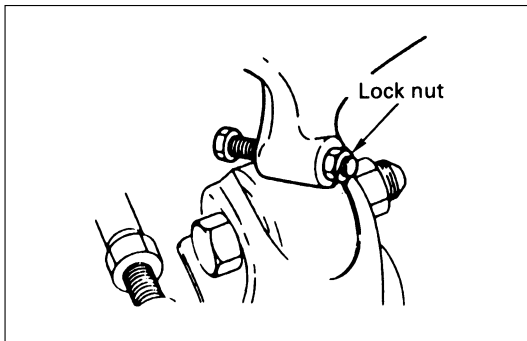
Lock Nut Torque	N·m (kg·m/lb·ft)
118 (12.0 / 87)	



MAXIMUM STEERING ANGLE ADJUSTMENT

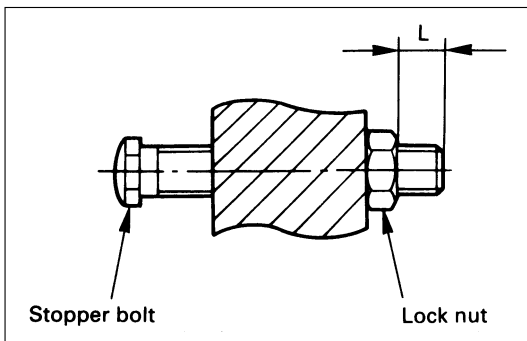
The maximum steering angle of the front wheels can be adjusted with the stopper bolts under the frame side members.

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



NOTE:

The maximum protruding length (L) of stopper bolt from the lock nut should be 10 mm (0.4 in) or less.



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

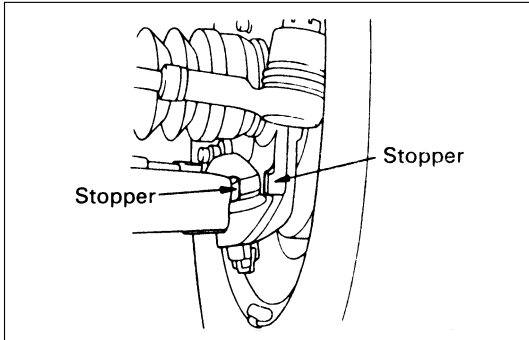
Maximum Steering Angle

Inside wheel	$34^{\circ} \begin{smallmatrix} +0^{\circ} \\ -2^{\circ} \end{smallmatrix}$
Outside wheel	32°

NOTE:

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

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



6. Tighten the lock nut to the specified torque.

Lock Nut Torque	N·m (kg·m/lb·ft)
23 (2.3 / 17)	

SECTION 2A

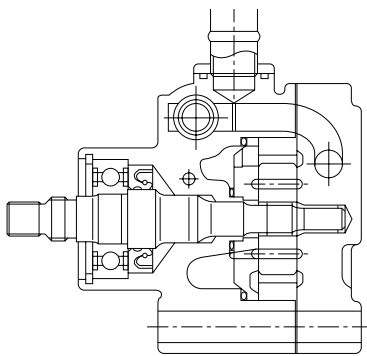
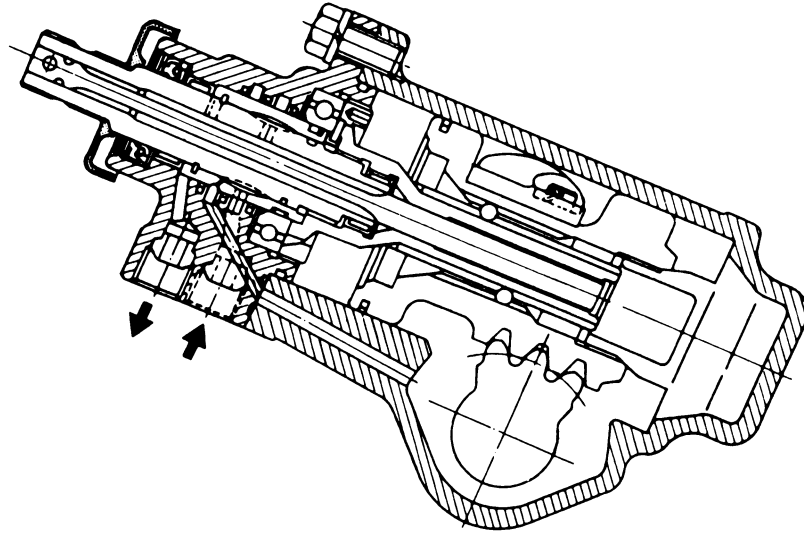
POWER STEERING

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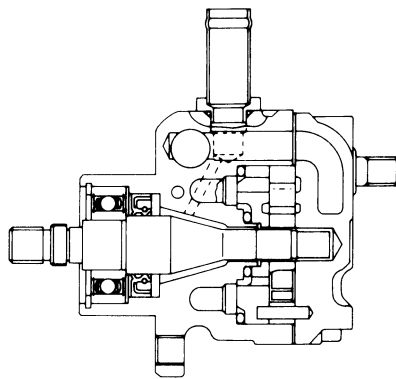
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Power Steering Pump (4JX1 Engine Model).....	2A - 36

GENERAL DESCRIPTION

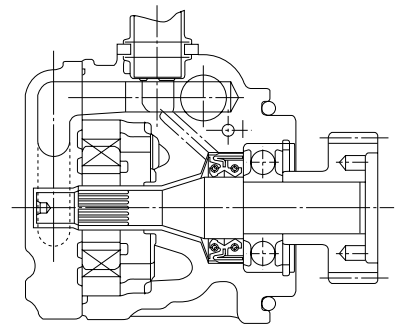
This illustration is based on the LHD model.



6VD1, 6VE1 Engine Models



4JG2 Engine Model



4JX1 Engine Model

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

POWER STEERING GEAR

The power steering gear has a recirculating ball system which acts as a rolling thread between the worm shaft and the rack piston. When the worm shaft is turned right, the rack piston moves up in gear. Turning the worm shaft left moves the rack piston down in gear. The rack piston teeth mesh with the sector, which is part of the sector shaft. Turning the worm shaft turns the sector shaft, which turns the wheels through the steering linkage.

The control valve in the steering gear directs the power steering fluid to either side of the rack piston. The rack piston converts the hydraulic pressure into a mechanical force. If the steering system becomes damaged and loses hydraulic pressure, the vehicle can be controlled manually.

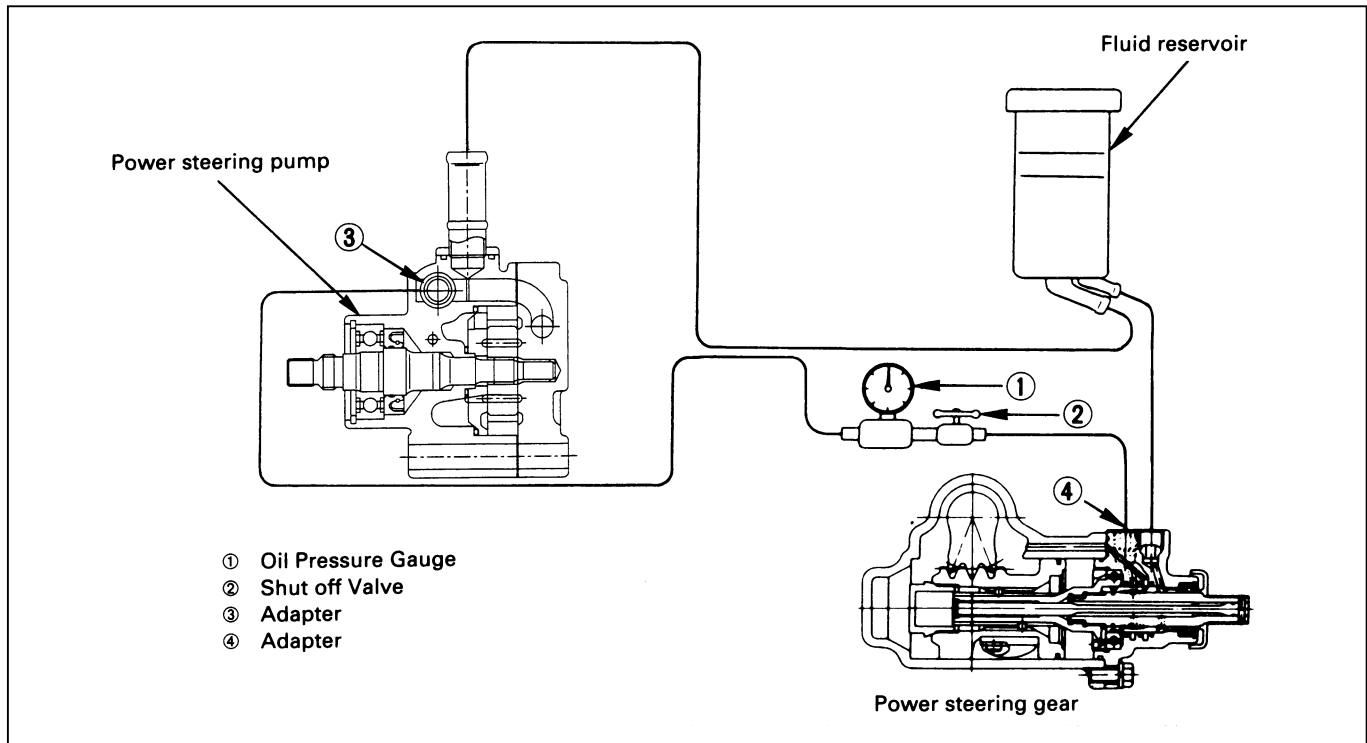
HYDRAULIC PUMP

The hydraulic pump is vane-type design. There are two bore openings at the rear of the pump housing. The smaller opening contains the pressure line union and flow control valve.

PRESSURE SWITCH (6VD1, 6VE1 Engine)

When hydraulic pressure reaches 3650 ± 350 kPa (530 ± 50 PSI), the pressure switch closes causing ECM to actuate the idle air control valve to prevent the overload-induced engine speed down. The switch opens when hydraulic pressure drops to 3150 ± 350 kPa (460 ± 50 PSI).

POWER STEERING SYSTEM TEST




TEST PROCEDURE

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

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


INSPECT

- Pump reservoir for proper fluid level.
 - Pump belt for proper tension.
 - Pump driver pulley condition.
1. Place a container under the pump to catch the fluid when disconnecting or connecting the hoses.
 2. With the engine NOT running, disconnect the pressure hose at the power steering pump and install Power Steering tester. The gage must be between the shutoff valve and pump. Open the shutoff valve.

 Tester: 5-8840-0135-0 (J-29877-A)
 Adapter: 5-8840-2297-0 (For 6VD1, 6VE1, 4JX1)
 5-8840-0136-0 (For 4JG2)

3. Check the fluid level. Fill the reservoir with power steering fluid, to the "Full" mark. Start the engine then turn the steering wheel and momentarily hold it against a stop. Turn off and check the connections at tester for leakage.
4. Bleed the system. Refer to "Bleeding the Power Steering System" in this section.
5. Start the engine and check the pump fluid level. Add power steering fluid if required. When the engine is at normal operating temperature, increase engine speed to 1500 rpm.

CAUTION:

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

6. Fully close the shutoff valve. Record the highest pressures.
 - If the pressure recorded is within 9300-9800 kPa (1350-1420 psi) For 6VD1, 6VE1, and 9800-10300 kPa (100-105 kg/cm² / 1420-1490 psi) For 4JG2, 4JX1, the pump is functioning within its specifications.
 - If the pressure recorded is higher than 9800 kPa (1420 psi) For 6VD1, 6VE1, and 10300 kPa (105 kg/cm² / 1490 psi) For 4JG2, 4JX1, the valve in the pump is defective.

- If the pressure recorded is lower than 9300 kPa (1350 psi) For 6VD1, 6VE1, and 9800 kPa (100 kg/cm² / 1420 psi) For 4JG2, 4JX1, the valve or the rotating group in the pump is defective.
7. If the pump pressure are within specifications, leave the valve open and turn (or have someone else turn) the steering wheel fully in both directions. Record the highest pressures and compare with the maximum pump pressure recorded in step 6. If this pressure cannot be built in either (or one) side of the power steering gear, the power steering gear is leaking internally and must be disassembled and repaired.
 8. Shut the engine off, remove the testing gage, reconnect the pressure hose, check the fluid level and make the needed repairs.
 9. If the problem still exists, the steering and front suspension must be thoroughly examined.

ON-VEHICLE SERVICE

BLEEDING THE POWER STEERING SYSTEM

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

BLEEDING PROCEDURE

When bleeding the system, and any time fluid is added to the power steering system, be sure to use only power steering fluid as specified in "MAINTENANCE AND LUBRICATION" in section 0B.

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



INSPECT

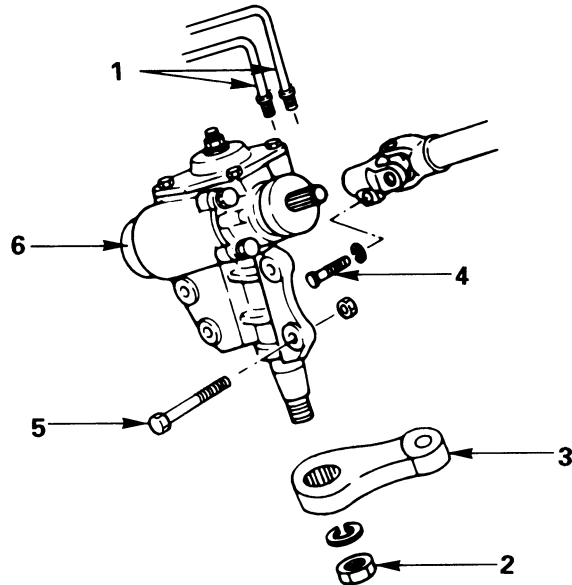
- Belt for tightness.
- Pulley for looseness or damage. The pulley should not wobble with the engine running.
- Make sure that hose and pipes are properly fitted.
- Fluid level and fill to the proper level.

FLUSHING THE POWER STEERING SYSTEM

1. Raise the front end of the vehicle off the ground until the wheels are free to turn.
2. Remove the fluid return line at the reservoir inlet connector and plug the connector. Position the line toward a large container to catch the draining fluid.
3. While running the engine at idle, fill the reservoir with new power steering fluid. Turn the steering wheel in both directions. Do not contact wheel stops or hold the wheel in a corner, or fluid will stop and the pump will be in pressure relief mode. A sudden overflow from the reservoir may develop if the wheel is held at a stop.
4. While refilling the reservoir, check the draining fluid for contamination. If foreign material is still evident, replace all lines, disassemble and clean or replace the power steering system components. Do not re-use any drained power steering fluid.
5. Install all the lines and hoses. Fill the system with new power steering fluid and bleed the system as described in "Bleeding The Power Steering System". Operate the engine for about 15 minutes.

STEERING GEAR

These steps are based on the LHD model.



Removal Steps

1. Pipe
2. Nut
3. Pitman arm
4. Universal joint bolt
5. Gear box mounting bolt and nut
6. Gear box

Installation Steps

6. Gear box
5. Gear box mounting bolt and nut
4. Universal joint bolt
3. Pitman arm
2. Nut
1. Pipe

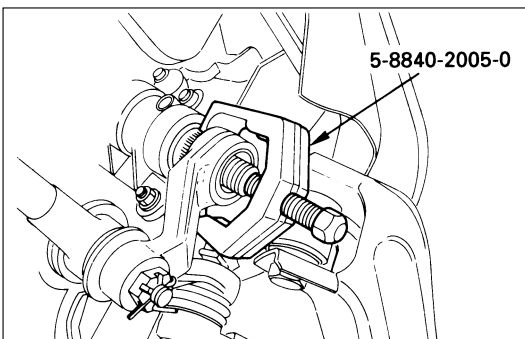
REMOVAL

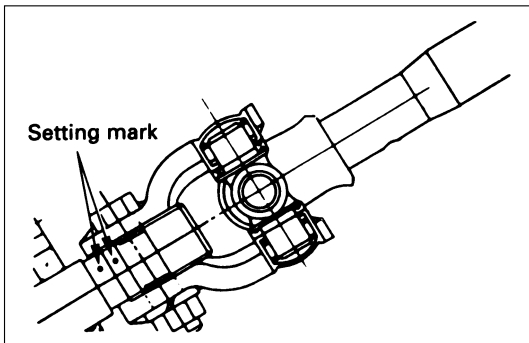
Preparation:

- 1) Remove the stone guard.
- 2) Remove the lower fan shroud. Refer to "Engine cooling" in section 6B1.
- 3) Disconnect stabilizer bar at the stabilizer links. Loosen stabilizer bracket fixing nuts.

1. Pipe
2. Nut

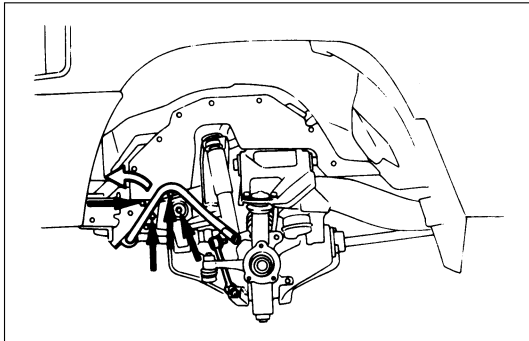
3. Pitman Arm
Pitman arm remover: 5-8840-2005-0 (J-29107)





4. **Universal Joint Bolt**

Make a setting mark across the coupling flange and worm shaft to ensure reassembly of the parts in the original position.



5. **Gear Box Mounting Bolt and Nut**

Push the stabilizer bar aside and remove the bolts and nuts.

6. **Gear Box**

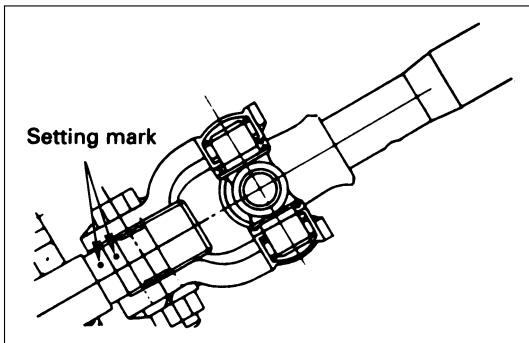


INSTALLATION



6. **Gear Box**

Align the setting marks made at removal.



5. **Gear Box Mounting Bolt and Nut**

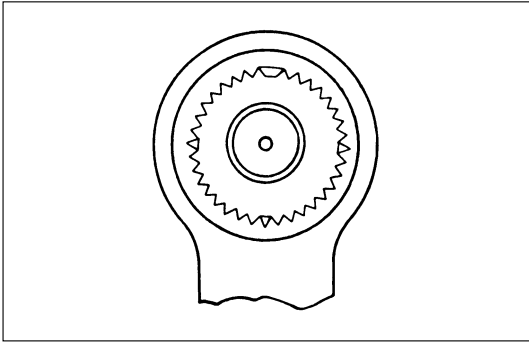
Gear Box Mounting

Bolt and Nut Torque	N·m (kg·m/lb·ft)
	44 (4.5 / 33)



4. **Universal Joint Bolt**

Coupling Clamp Bolt Torque	N·m (kg·m/lb·ft)
	25 (2.5 / 18)



3. **Pitman Arm**
Align the notched tooth.



- 2 **Nut**

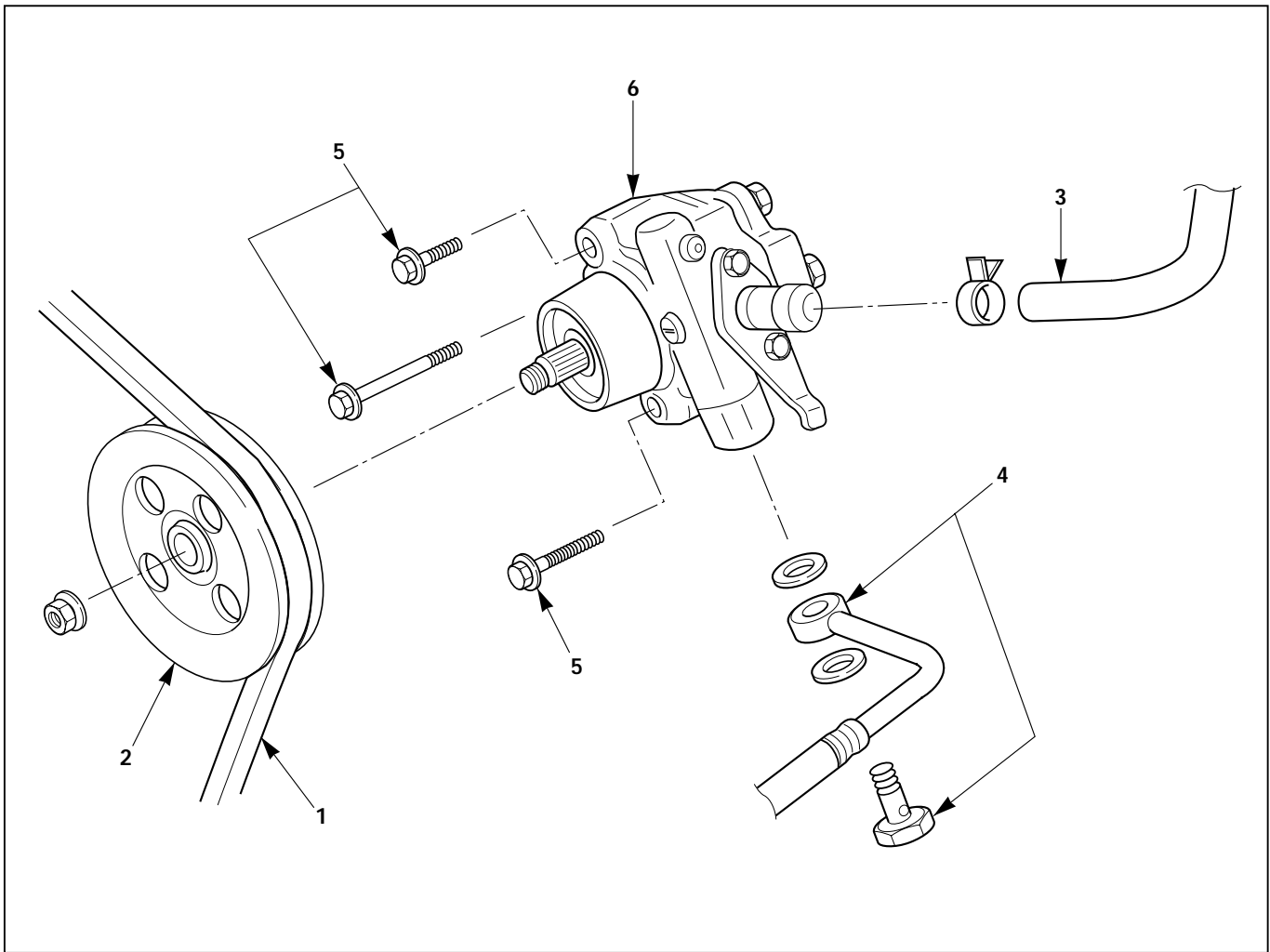
Pitman Arm Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
216 (22.0 / 159)	
<hr/>	



1. **Pipe**

Pipe Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
44 (4.5 / 33)	
<hr/>	

POWER STEERING PUMP (6VD1, 6VE1 Engine Models)



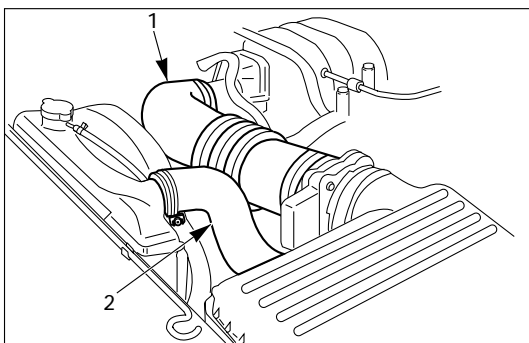
436RW006

Removal Steps

1. Drive belt
2. Pulley
3. Hose, suction
4. Hose, flexible
5. Bolt
6. Pump assembly

Installation Steps

6. Pump assembly
5. Bolt
4. Hose, flexible
3. Hose, suction
2. Pulley
1. Drive belt



436RW005

REMOVAL

Preparation:

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

1. Drive Belt
2. Pulley
3. Hose, Suction
4. Hose, Flexible
5. Bolt
6. Pump Assembly

**CAUTION:**

When removing the pump assembly, be careful not to damage the wiring harness under the pump housing.

**INSTALLATION**

6. Pump Assembly

Connect the harness under the pump housing.



5. Bolt

Pump Bolt Torque	N·m(kg·m/lb·ft)
46 (4.7 / 34)	



4. Hose, Flexible

Eye Bolt Torque	N·m (kg·m/lb·ft)
54 (5.5 / 40)	



3. Hose, Suction

2. Pulley

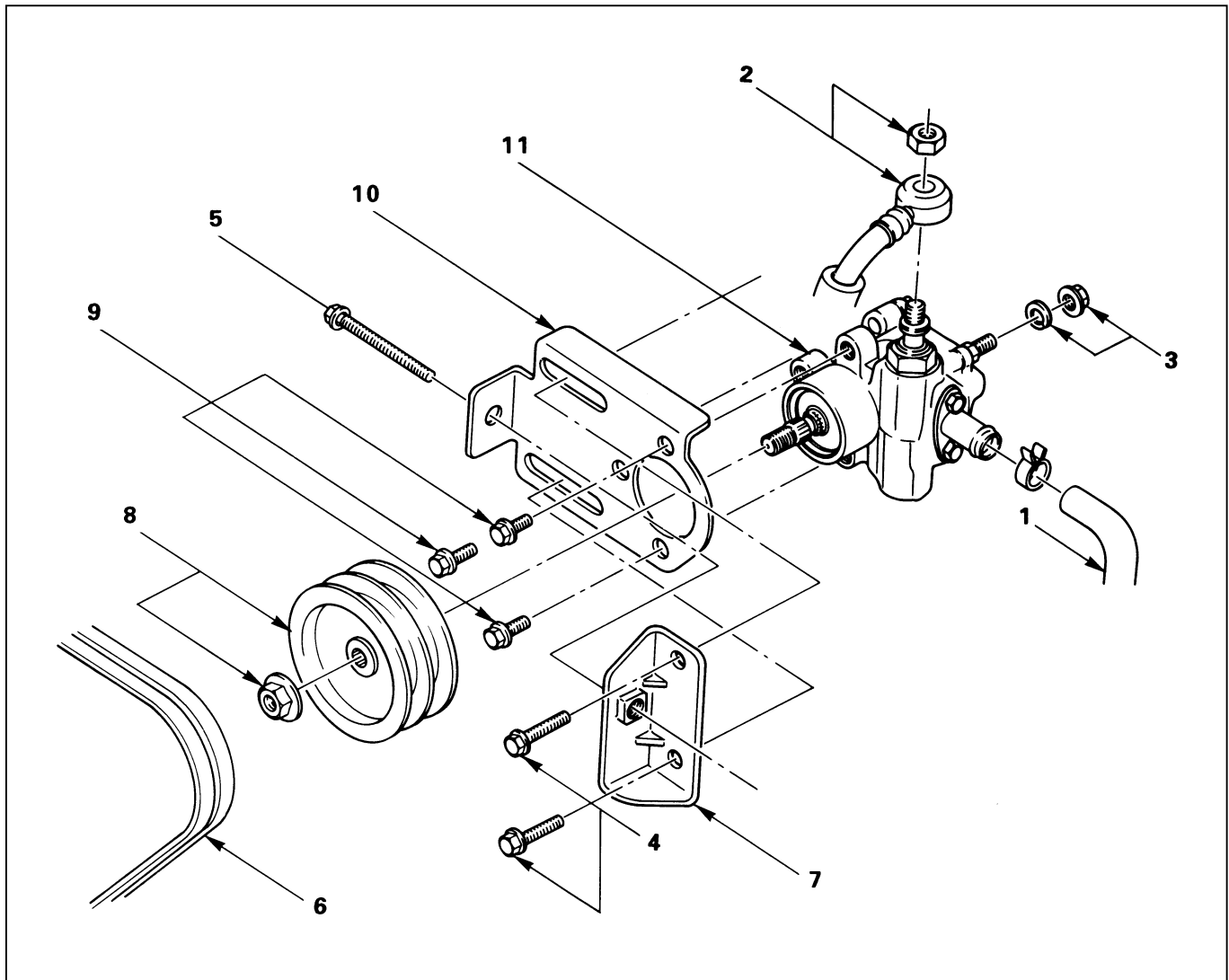
Install the pulley onto the power steering pump and tighten the nut to specified torque.

Pulley Nut Torque	N·m (kg·m/lb·ft)
78 (8.0 / 58)	

1. Drive Belt

- Install the air cleaner duct and the radiator upper hose.
- Refill the engine coolant.
- Fill and bleed the system. Refer to "Bleeding the Power Steering System" in this section.

POWER STEERING PUMP (4JG2 Engine Model)



Removal Steps

1. Hose, suction
2. Hose, flexible
3. Adjust nut
4. Bolt
5. Adjust bolt
6. Belt
7. Bracket
8. Pulley
9. Bolt
10. Bracket
11. Pump assembly

Installation Steps

11. Pump assembly
10. Bracket
9. Bolt
8. Pulley
7. Bracket
6. Belt
5. Adjust bolt
4. Bolt
3. Adjust nut
2. Hose, flexible
1. Hose, suction

REMOVAL

Preparation:

- Place a drain pan below the pump.
1. **Hose, Suction**
 2. **Hose, Flexible**
 3. **Adjust Nut**
 4. **Bolt**
 5. **Adjust Bolt**
 6. **Belt**
 7. **Bracket**
 8. **Pulley**
 9. **Bolt**
 10. **Bracket**
 11. **Pump Assembly**

INSTALLATION

11. **Pump Assembly**
10. **Bracket**



9. **Bolt**

Pump Bolt Torque	N·m (kg·m/lb·ft)
<u>37 (3.8 / 27)</u>	



8. **Pulley**

Pulley Nut Torque	N·m (kg·m/lb·ft)
<u>78 (8.0 / 58)</u>	

7. **Bracket**
6. **Belt**
5. **Adjust Bolt**



4. **Bolt**

After adjusting drive belt tension, tighten bolt to specified torque.

Bracket Bolt Torque	N·m (kg·m/lb·ft)
<u>37 (3.8 / 27)</u>	



3. **Adjust Nut**

After adjusting drive belt tension, tighten bolt to specified torque.

Adjust Nut Torque	N·m (kg·m/lb·ft)
<u>37 (3.8 / 27)</u>	



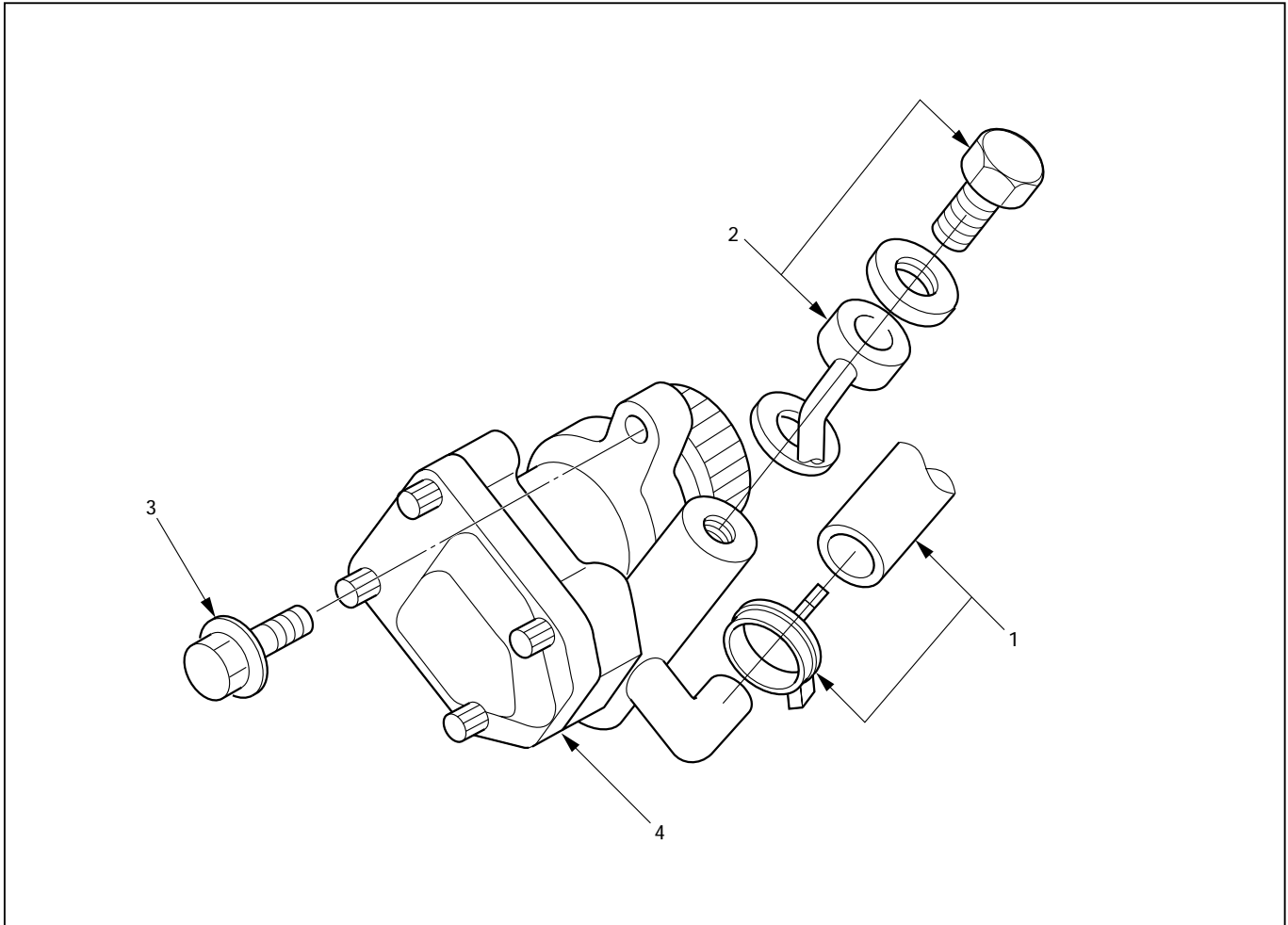
2. **Hose, Flexible**

Hose Nut Torque	N·m (kg·m/lb·ft)
<u>20 (2.0 / 14)</u>	

1. **Hose, Suction**

Fill and bleed the system. Refer to "Bleeding the Power Steering System" in this section.

POWER STEERING PUMP (4JX1 Engine Model)



436RW009

Removal Steps

1. Hose, suction
2. Hose, flexible
3. Bolt
4. Pump assembly

Installation Steps

4. Pump assembly
3. Bolt
2. Hose, flexible
1. Hose, suction



REMOVAL

Preparation:

- Place a drain pan below the pump.
1. **Hose, Suction**
 2. **Hose, Flexible**
 3. **Bolt**
 4. **Pump Assembly**



INSTALLATION

4. **Pump Assembly**



3. **Bolt**

Bolt Torque	N·m (kg·m/lb·ft)
<hr/>	
22 (2.2 / 16)	
<hr/>	



2. **Hose, Flexible**

Hose, Bolt Torque	N·m (kg·m/lb·ft)
<hr/>	
54 (5.5 / 40)	
<hr/>	

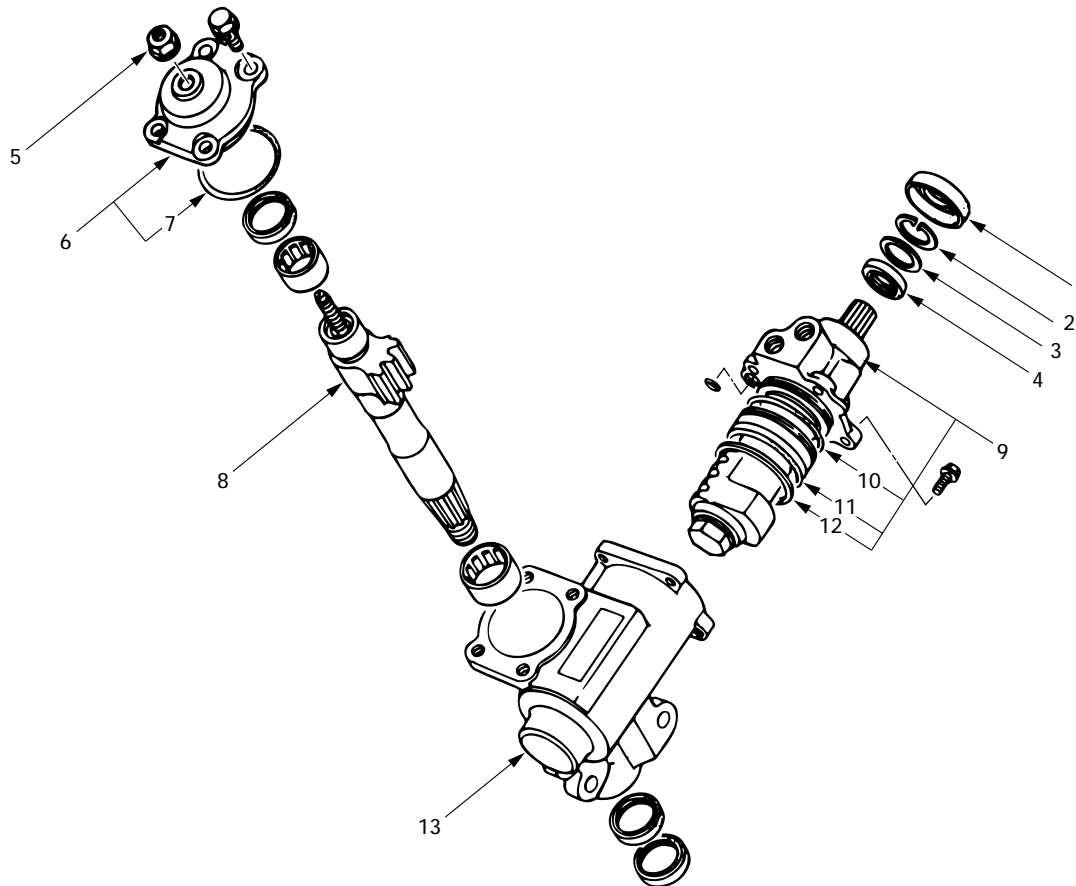
1. **Hose, Suction**

Fill and bleed the system. Refer to "Bleeding the Power Steering System" in this section.

UNIT REPAIR

STEERING GEAR

These steps are based on the LHD model.



440RW004

Disassembly Steps

1. Dust cover
2. Retaining ring
3. Back up ring
4. Oil seal
5. Lock nut
6. Top cover assembly
7. O-ring
8. Sector shaft
9. Ball-nut and valve housing assembly
10. O-ring
11. Seal ring
12. O-ring
13. Gear box

Reassembly Steps

13. Gear box
12. O-ring
11. Seal ring
10. O-ring
9. Ball-nut and valve housing assembly
8. Sector shaft
7. O-ring
6. Top cover assembly
5. Lock nut
4. Oil seal
3. Back up ring
2. Retaining ring
1. Dust cover



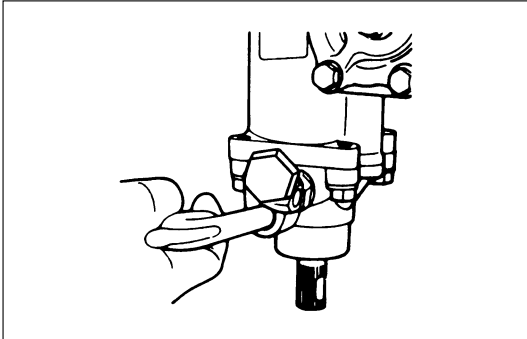
DISASSEMBLY



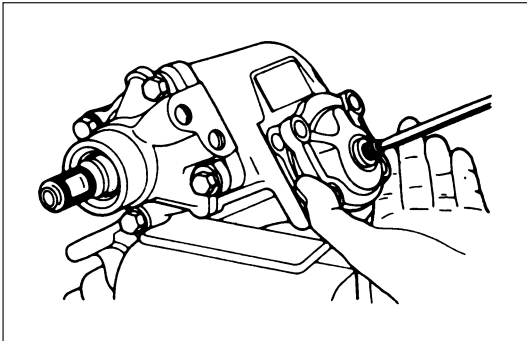
CAUTION:

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

1. **Dust Cover**
2. **Retaining Ring**
3. **Back up Ring**
4. **Oil Seal**
 - 1) Clean the faces of the extended stub shaft.
 - 2) Plug the hose fitting on the inlet side.
 - 3) Remove the oil seal by blowing compressed air through the hole in the outlet side.



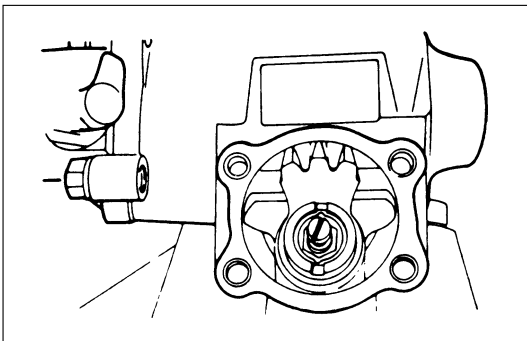
5. **Lock Nut**
Remove the adjusting screw lock nut and turn the adjusting screw counterclockwise to remove the preload between the sector gear and the rack piston, then remove the top cover bolts.
6. **Top Cover Assembly**
Holding the top cover stationary, turn the adjusting screw clockwise to raise and free to cover, then remove the cover.

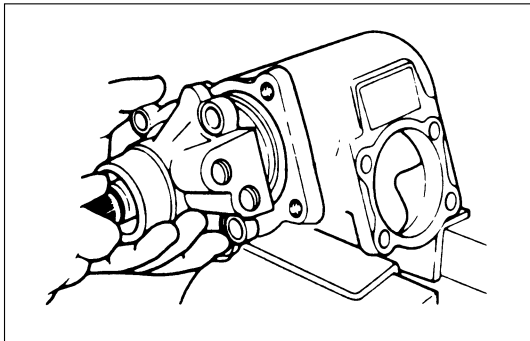


7. O-ring

8. Sector Shaft

Bring the stub shaft into straight-ahead position. Do not force the sector shaft off the gear box with a hammer or other impact tools.





9. Ball-nut and Valve Housing Assembly

It is strongly advisable to always keep the ball nut and valve housing assembly in a horizontal position, or the rack piston will fall off onto the end of the worm, causing the rack piston to slip out of the worm shaft and the balls to fall out.

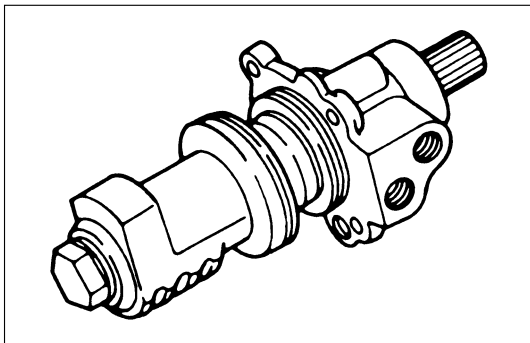
- 10. O-ring
- 11. Seal Ring
- 12. O-ring
- 13. Gear Box



INSPECTION AND REPAIR

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

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

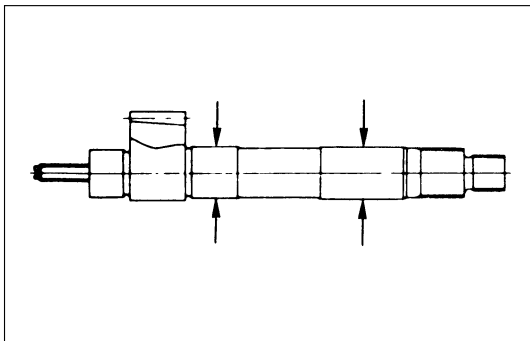


Ball-nut Rotation

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

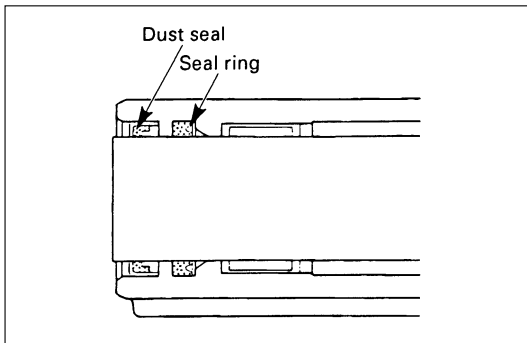
NOTE:

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



Check sector shaft outside diameter.

Sector Shaft Outside Diameter		mm(in)
Standard	Limit	
32.0 (1.260)	31.7 (1.248)	



Seal Ring Setting



Note the setting direction. Always install a new part.



Apply a thin coat of power steering fluid to lip of each part.

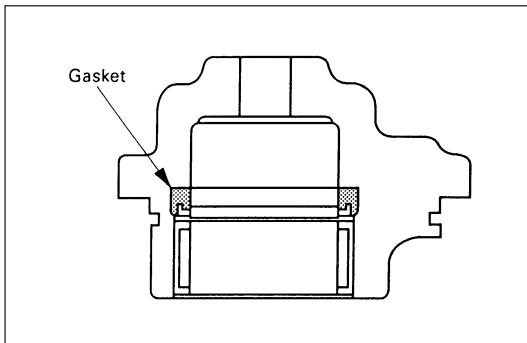
Dust Seal Setting



Note the setting direction. Always install a new part.



Apply a thin coat of power steering fluid to lip of each part.



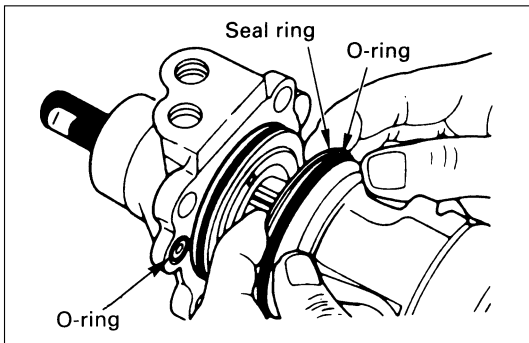
Gasket Setting



Note the setting direction. Always install a new part.



Apply a thin coat of power steering fluid to lip of each part.



REASSEMBLY

13. Gear Box



12. O-ring

Apply a thin coat of grease.



11. Seal Ring

Apply a thin coat of grease.



10. O-ring

Apply a thin coat of grease.

9. Ball-nut and Valve Housing Assembly

1) It is strongly advisable to always keep the ball screw and valve housing assembly in a horizontal position (avoid holding it vertically), or the rack piston will fall off onto the end of the worm, causing the rack piston to slip out of the worm shaft and ball to fall out.

2) Be careful not to drop the O-ring into the valve housing.

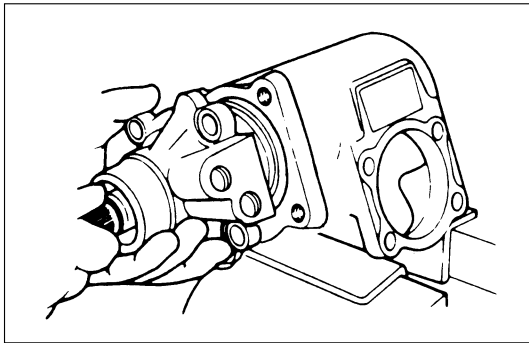
3) Tighten the valve housing bolts to the specified torque.



Valve Housing Bolt Torque

N·m (kg·m/lb·ft)

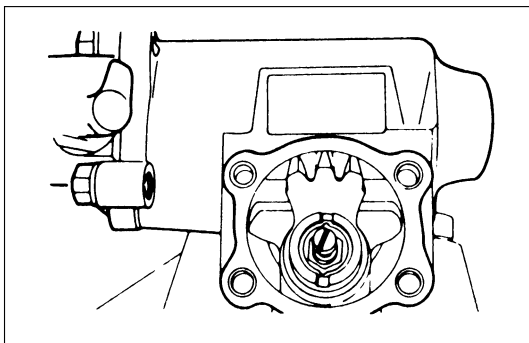
47 (4.8 / 35)



8. Sector Shaft

1) Tape the sector shaft serrations to protect the seal ring from damage.

2) Align the center tooth of ball nut with that of the sector shaft.

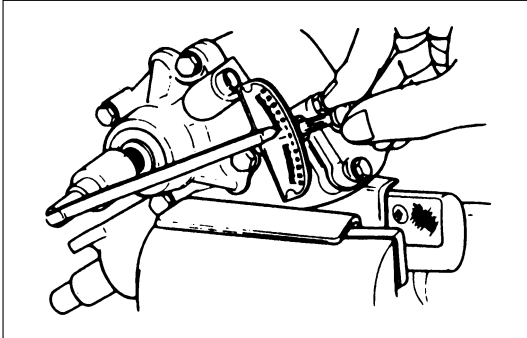


7. **O-ring**



6. **Top Cover Assembly**

Top Cover Bolt Torque	N·m (kg·m/lb·ft)
47 (4.8 / 35)	



5. **Lock Nut**

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

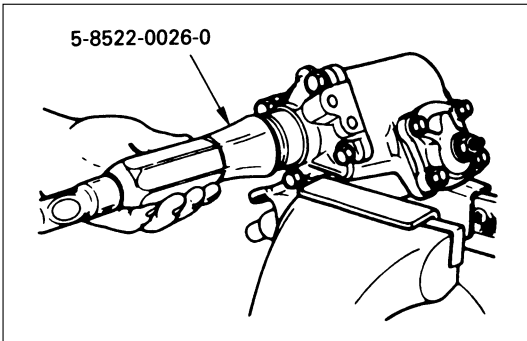
- 1) With the worm gear rotating, set it to the straight ahead position.
- 2) Set the worm shaft preload to below 1N·m (10kg·cm / 9 lb·in) with the sector shaft adjusting screw.
- 3) Measure the worm shaft preload with the worm gear turned 45° both to the right and to the left. The worm gear preload in these positions should be 0.4 - 0.6 N·m (4 - 6 kg·cm / 3.5 - 5.2 lb·in) lower than in the straight ahead position.
- 4) Lock the sector shaft adjusting screw with the lock nut.

Lock Nut Torque	N·m (kg·m/lb·ft)
41 (4.2 / 30)	



4. **Oil Seal**

Installer: 5-8522-0026-0 (J-26508)



3. **Back up Ring**

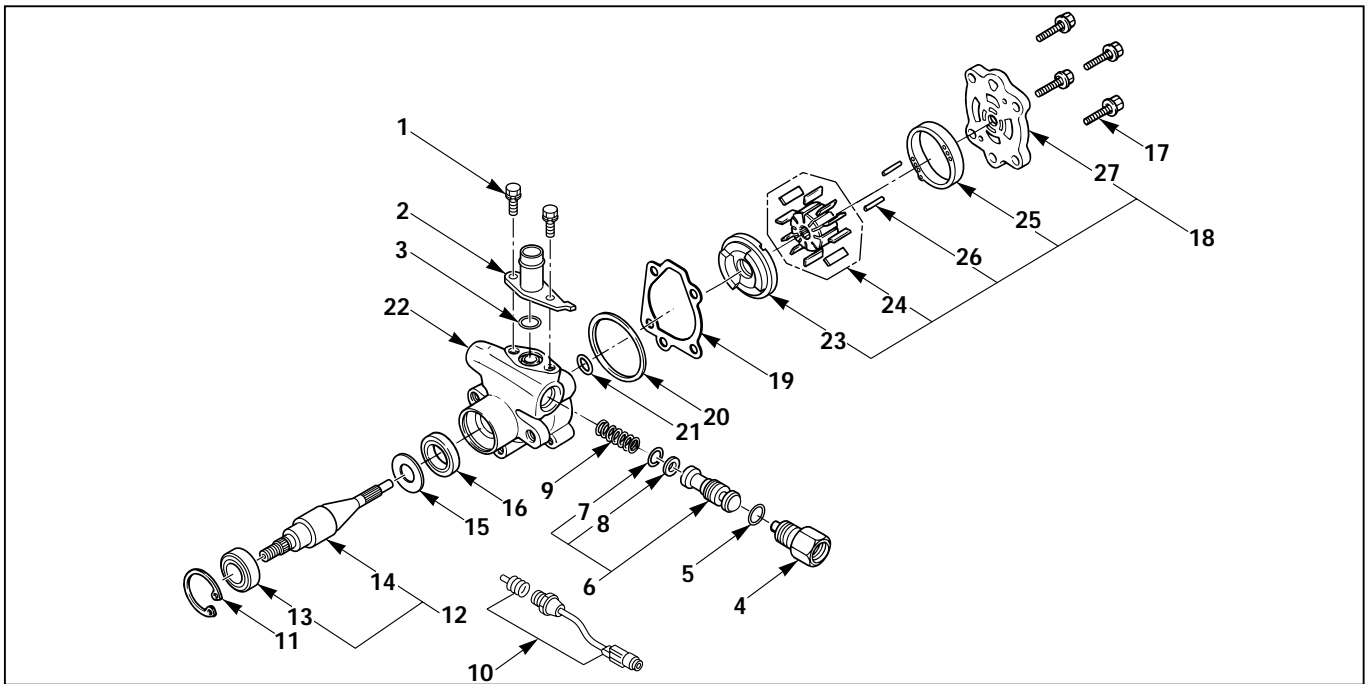
Position the chamfered face (outer circumference) towards the oil seal.

2. **Retaining Ring**

position the chamfered face (outer circumference) toward the oil seal.

1. **Dust Cover**

POWER STEERING PUMP (6VD1, 6VE1 Engine Models)



412RW055

Disassembly Steps

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Bolt 2. Pipe, suction 3. O-ring 4. Connector 5. O-ring 6. Valve 7. Retaining ring 8. Filter 9. Spring 10. Pressure switch 11. Retaining ring 12. Shaft assembly 13. Bearing 14. Shaft | <ol style="list-style-type: none"> 15. Retaining ring 16. Oil seal 17. Bolt 18. Rear housing assembly and pump cartridge 19. Gasket 20. O-ring 21. O-ring 22. Front housing 23. Pressure plate 24. Rotor and vane 25. Cam 26. Pin 27. Rear housing |
|---|---|

Reassembly Steps

- | | |
|---|---|
| <ol style="list-style-type: none"> 27. Rear housing 26. Pin 25. Cam 24. Rotor and vane 23. Pressure plate 22. Front housing 21. O-ring 20. O-ring 19. Gasket 18. Rear housing assembly and pump cartridge 17. Bolt 16. Oil seal 15. Retaining ring | <ol style="list-style-type: none"> 14. Shaft 13. Bearing 12. Shaft assembly 11. Retaining ring 10. Pressure switch 9. Spring 8. Filter 7. Retaining ring 6. Valve 5. O-ring 4. Connector 3. O-ring 2. Pipe, suction 1. Bolt |
|---|---|

DISASSEMBLY

Preparation:

Clean oil pump with solvent (plug the discharge and suction port, to prevent the entry of solvent). Be careful not to expose the oil seal of shaft assembly to solvent.

1. Bolt
2. Pipe, Suction
3. O-ring
4. Connector
5. O-ring
6. Valve Assembly
7. Retaining Ring
8. Filter
9. Spring
10. Pressure switch
11. Retaining Ring
12. Shaft Assembly
13. Bearing
14. Shaft
15. Retaining Ring
16. Oil Seal



CAUTION:

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

17. Bolt
18. Rear Housing Assembly and Pump Cartridge
19. Gasket
20. O-ring
21. O-ring
22. Front Housing
23. Pressure Plate
24. Rotor and Vane
25. Cam
26. Pin
27. Rear Housing



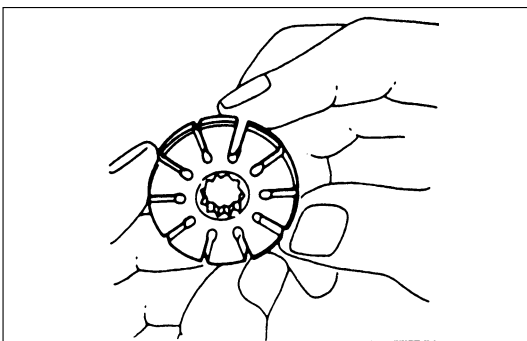
INSPECTION AND REPAIR

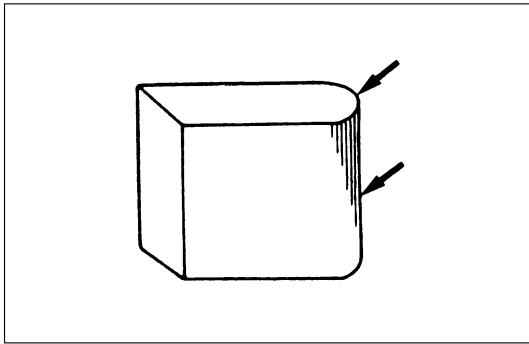
Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

Rotor

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly.

When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.





Vane

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

Cam

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

Side plate

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

Valve

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

Shaft

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

O-ring, oil seal, retaining ring

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



REASSEMBLY

27. Rear Housing

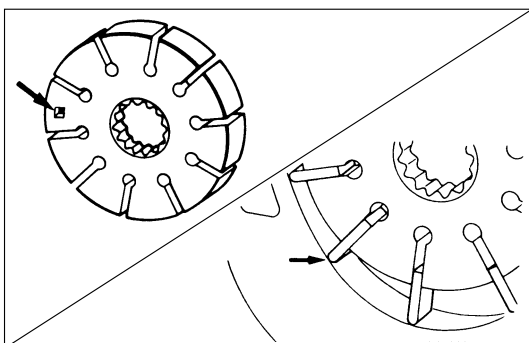
26. Pin

25. Cam



24. Rotor and Vane

1. Install the rotor with its punch mark facing the front housing.
2. Install the vanes with curved face in contact with the inner wall of the cam.



23. Pressure Plate

**CAUTION:**

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

22. Front Housing

21. O-ring

20. O-ring

Be sure to discard used O-rings, and always use new parts for installation.

19. Gasket

Be sure to discard used parts, and always use new parts for installation.

18. Rear Housing Assembly and Pump Cartridge



17. Bolt

Rear Housing Bolt Torque	N·m (kg·m/lb·ft)
	17.6 (1.8 / 12.8)

16. Oil Seal

Be sure to discard used parts, and always use new parts for installation.

**CAUTION:**

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

15. Retaining Ring

14. Shaft

13. Bearing

12. Shaft Assembly

11. Retaining Ring



10. Pressure switch

Pressure Switch Torque	N·m (kg·m/lb·ft)
	20 (2.0 / 14)

9. Spring

8. Filter

7. Retaining Ring

6. Valve

5. O-ring

Be sure to discard used parts, and always use new parts for installation.



4. Connector

Connector Torque	N·m (kg·m/lb·ft)
	74 (7.5 / 54)

3. O-ring

Be sure to discard used parts, and always use new parts for installation.

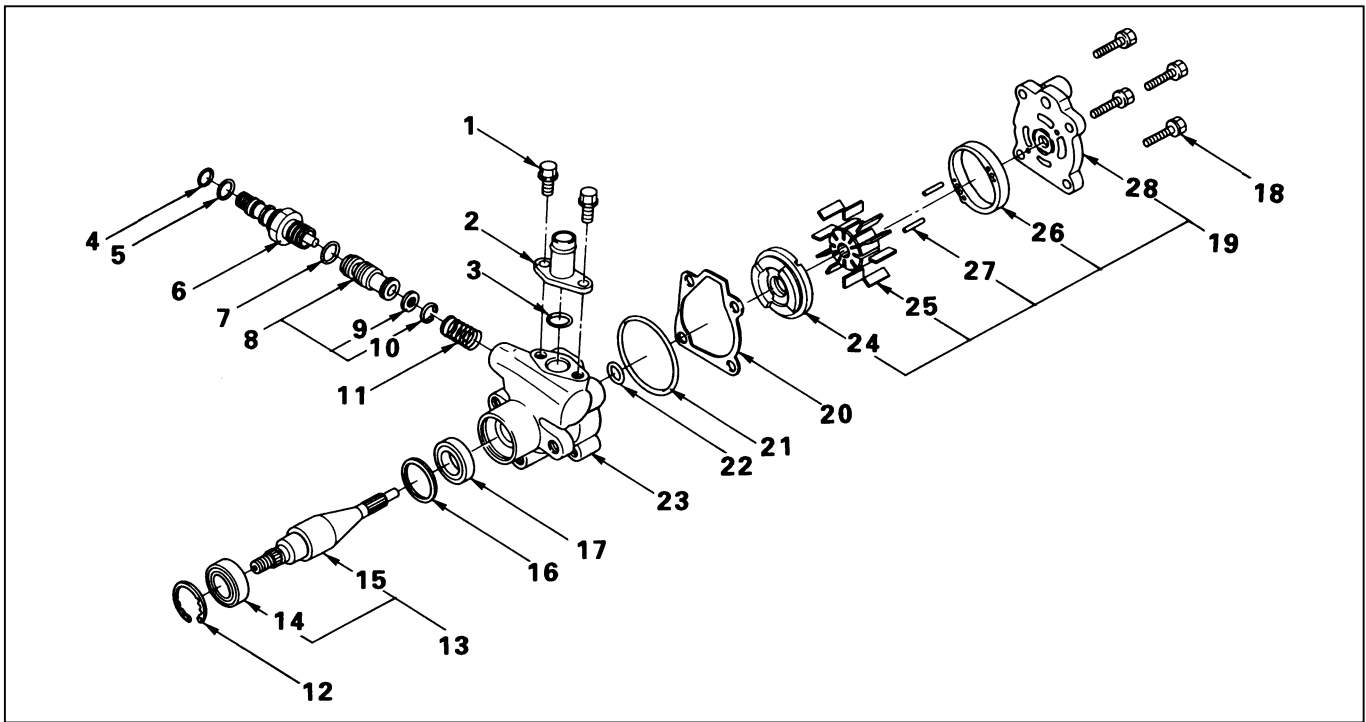
2. Pipe, Suction



1. Bolt

Suction Pipe Bolt Torque	N·m (kg·m/lb·ft)
	15.7 (1.6 / 11.5)

POWER STEERING PUMP (4JG2 Engine Model)



Disassembly Steps

- | | |
|--------------------|--|
| 1. Bolt | 16. Retaining ring |
| 2. Pipe, suction | 17. Oil seal |
| 3. O-ring | 18. Bolt |
| 4. O-ring | 19. Rear housing assembly and pump cartridge |
| 5. O-ring | 20. Gasket |
| 6. Connector | 21. O-ring |
| 7. O-ring | 22. O-ring |
| 8. Valve | 23. Front housing |
| 9. Retaining ring | 24. Pressure plate |
| 10. Filter | 25. Rotor and vane |
| 11. Spring | 26. Cam |
| 12. Retaining ring | 27. Pin |
| 13. Shaft assembly | 28. Rear housing |
| 14. Bearing | |
| 15. Shaft | |

Reassembly Steps

- | | |
|--|--------------------|
| 28. Rear housing | 14. Bearing |
| 27. Pin | 13. Shaft assembly |
| 26. Cam | 12. Retaining ring |
| 25. Rotor and vane | 11. Spring |
| 24. Pressure plate | 10. Filter |
| 23. Front housing | 9. Retaining ring |
| 22. O-ring | 8. Valve |
| 21. O-ring | 7. O-ring |
| 20. Gasket | 6. Connector |
| 19. Rear housing assembly and pump cartridge | 5. O-ring |
| 18. Bolt | 4. O-ring |
| 17. Oil seal | 3. O-ring |
| 16. Retaining ring | 2. Pipe, suction |
| 15. Shaft | 1. Bolt |



DISASSEMBLY

Preparation:

Clean oil pump with solvent (its plug discharge and suction port to prevent the entry of solvent). Be careful not to expose the oil seal of shaft assembly to solvent.

1. Bolt
2. Pipe, Suction
3. O-ring
4. O-ring
5. O-ring
6. Connector
7. O-ring
8. Valve
9. Retaining Ring
10. Filter
11. Spring
12. Retaining Ring
13. Shaft Assembly
14. Bearing
15. Shaft
16. Retaining Ring
17. Oil Seal



CAUTION:

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

18. Bolt
19. Rear Housing Assembly and Pump Cartridge
20. Gasket
21. O-ring
22. O-ring
23. Front Housing
24. Pressure Plate
25. Rotor and Vane
26. Cam
27. Pin
28. Rear Housing



REASSEMBLY

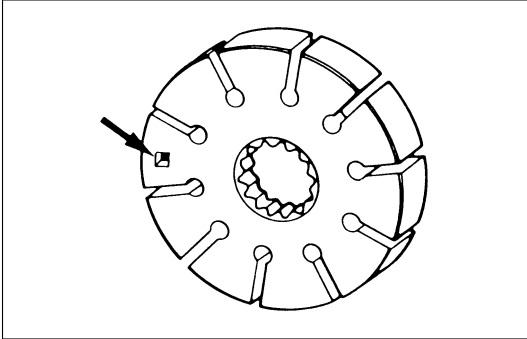
28. Rear Housing

27. Pin

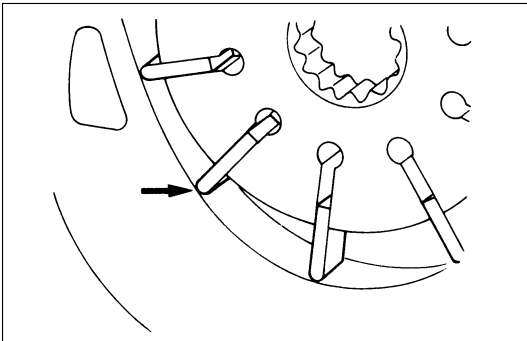
26. Cam

25. Rotor and Vane

Install the rotor with its punch mark facing the front housing.



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



24. Pressure Plate



CAUTION:

When install pressure plate, be careful not to damage its inner surface. Damaged pressure plate may cause poor pump performance, pump seizure or oil leakage.

23. Front Housing

22. O-ring

Be sure to discard used parts, and always used new parts for installation.

21. O-ring

Be sure to discard used parts, and always used new parts for installation.

20. Gasket

Be sure to discard used parts, and always used new parts for installation.

19. Rear Housing Assemble and Pump Cartridge



18. Bolt

Rear Housing Bolt Torque	N·m (kg·m/lb·ft)
--------------------------	------------------

54 (5.5 / 40)

17. O-ring

Be sure to discard used parts, and always used new parts for installation.

**CAUTION:**

When install pressure plate, be careful not to damage its inner surface. Damaged pressure plate may cause poor pump performance, pump seizure or oil leakage.

16. Retaining Ring
15. Shaft
14. Bearing
13. Shaft Assembly
12. Retaining Ring
11. Spring
10. Filter
9. Retaining Ring
8. Valve
7. O-ring

Be sure to discard used parts, and always used new parts for installation.

**6. Connector**

Connector Torque	N·m (kg·m/lb·ft)
	54 (5.5 / 40)

5. O-ring

Be sure to discard used parts, and always used new parts for installation.

4. O-ring

Be sure to discard used parts, and always used new parts for installation.

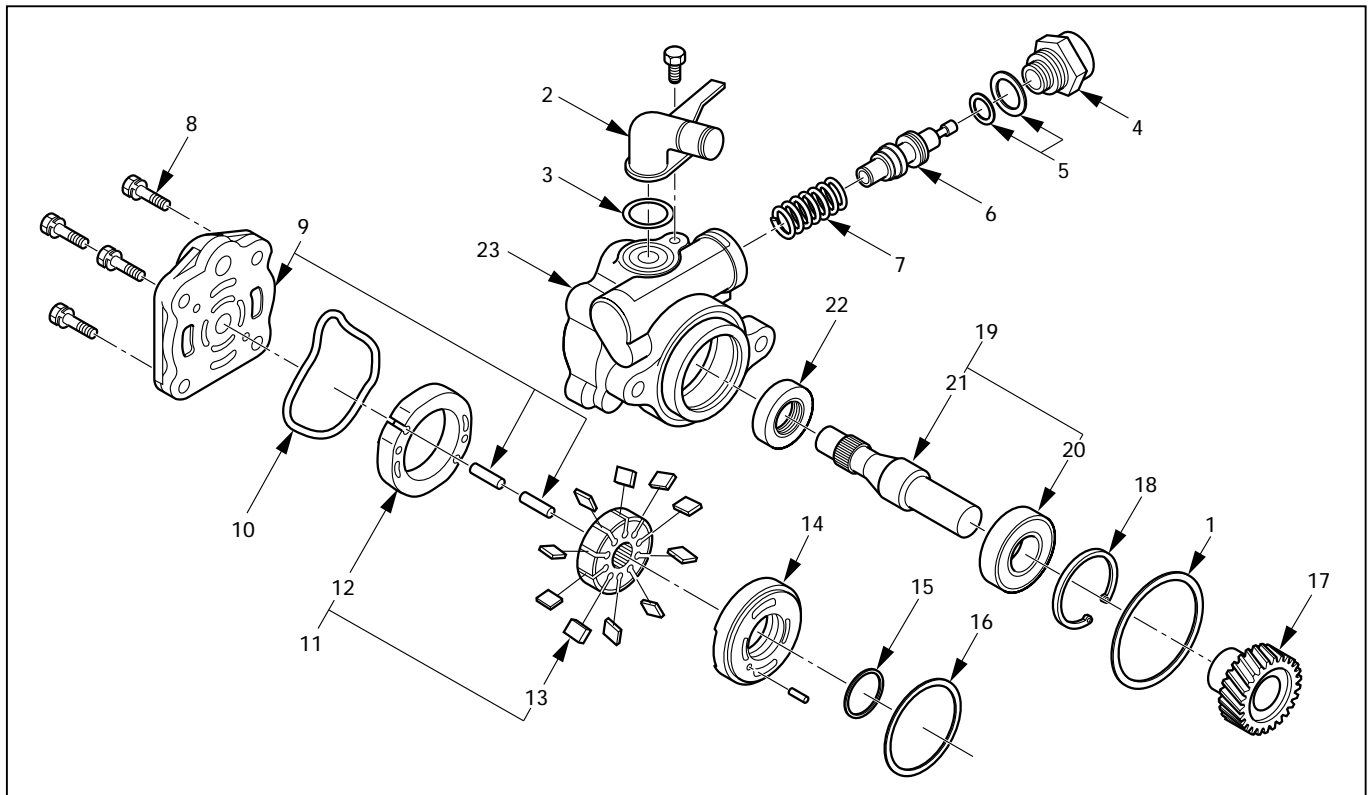
3. O-ring

Be sure to discard used parts, and always used new parts for installation.

2. Pipe, Suction**1. Bolt**

Suction Pipe Bolt Torque	N·m (kg·m/lb·ft)
	21 (2.1 / 15)

POWER STEERING PUMP (4JX1 Engine Model)



412RW048

Disassembly Steps

- | | |
|--------------------------|--------------------|
| 1. O-ring | 13. Rotor and vane |
| 2. Pipe, suction | 14. Pressure plate |
| 3. O-ring | 15. O-ring |
| 4. Connector | 16. O-ring |
| 5. O-ring | 17. Gear |
| 6. Valve | 18. Retaining ring |
| 7. Spring | 19. Shaft assembly |
| 8. Bolt | 20. Bearing |
| 9. Rear housing assembly | 21. Shaft |
| 10. O-ring | 22. Oil seal |
| 11. Pump cartridge | 23. Front housing |
| 12. Cam | |

Reassembly Steps

- | | |
|--------------------|--------------------------|
| 23. Front housing | 11. Pump cartridge |
| 22. Oil seal | 10. O-ring |
| 21. Shaft | 9. Rear housing assembly |
| 20. Bearing | 8. Bolt |
| 19. Shaft assembly | 7. Spring |
| 18. Retaining ring | 6. Valve |
| 17. Gear | 5. O-ring |
| 16. O-ring | 4. Connector |
| 15. O-ring | 3. O-ring |
| 14. Pressure plate | 2. Pipe, suction |
| 13. Rotor and vane | 1. O-ring |
| 12. Cam | |



DISASSEMBLY

Preparation:

Clean oil pump with solvent (plug the discharge and suction port to prevent the entry of solvent). Be careful not to expose the oil seal of shaft assembly to solvent.

1. O-ring
2. Pipe, Suction
3. O-ring
4. Connector
5. O-ring
6. Valve
7. Spring
8. Bolt
9. Rear Housing Assembly
10. O-ring
11. Pump Cartridge
12. Cam
13. Rotor and Vane
14. Pressure Plate
15. O-ring
16. O-ring
17. Gear
18. Retaining Ring
19. Shaft Assembly
20. Bearing
21. Shaft
22. Oil seal



CAUTION:

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

23. Front Housing



REASSEMBLY

23. Front Housing

22. Oil Seal

Be sure to discard used parts, and always use new parts for installation.

21. Shaft

20. Bearing

19. Shaft Assembly

18. Retaining Ring

17. Gear

16. O-ring

Be sure to discard used parts, and always use new parts for installation.

15. O-ring

Be sure to discard used parts, and always use new parts for installation.

14. Pressure Plate

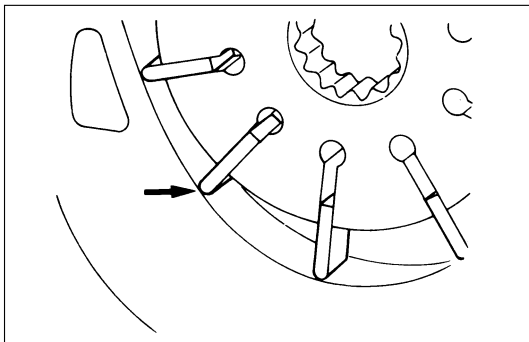


CAUTION:

When install pressure plate, be careful not to damage its inner surface. Damaged pressure plate may cause poor pump performance, pump seizure or oil leakage.

13. Rotor and Vane

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



12. Cam

11. Pump Cartridge

10. O-ring

Be sure to discard used parts, and always use new parts for installation.

9. Rear Housing Assembly



8. Bolt

Rear Housing Bolt Torque N·m (kg·m/lb·ft)

24 (2.4 / 17)

7. Spring**6. Valve****5. O-ring**

Be sure to discard used parts, and always use new parts for installation.

**4. Connector**

Connector Torque	N·m (kg·m/lb·ft)
59 (6.0 / 43)	

3. O-ring

Be sure to discard used parts, and always use new parts for installation.

**2. Pipe, Suction**

Suction Pipe Bolt Torque	N·m (kg·m/lb·ft)
9.8 (1.0 / 7.1)	

1. O-ring

Be sure to discard used parts, and always use new parts for installation.

MEMO

A series of horizontal dotted lines for writing.

SECTION 2A

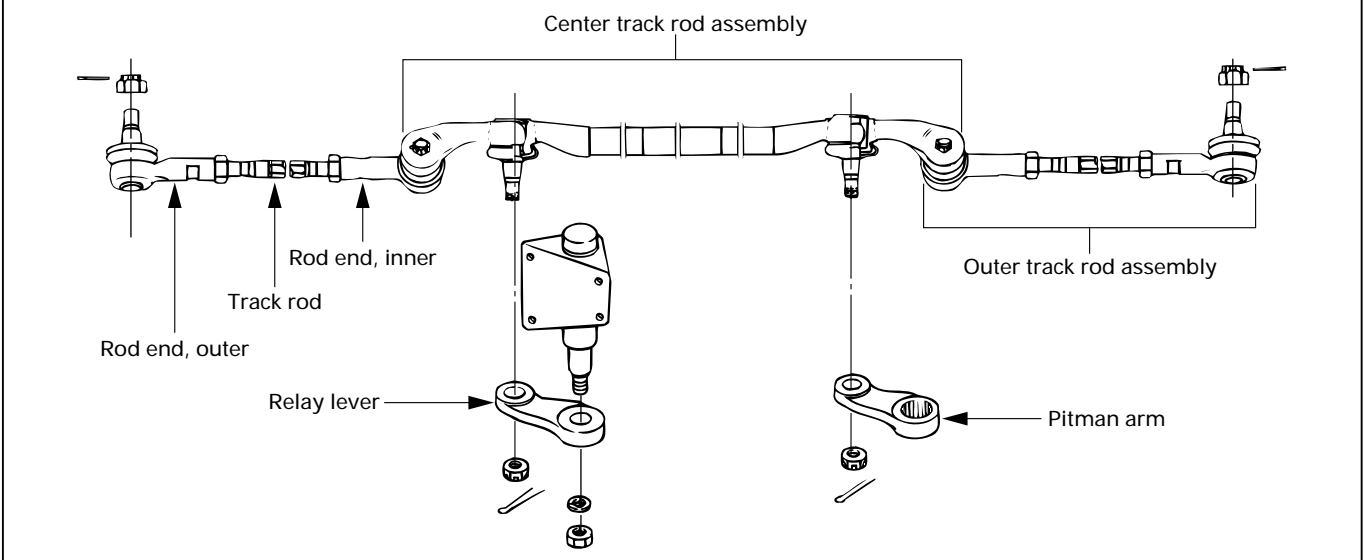
STEERING LINKAGE

CONTENTS

	PAGE
General Description	2A - 42
On-Vehicle Service	2A - 43
Center Track Rod Assembly	2A - 43
Outer Track Rod Assembly	2A - 46
Relay Lever	2A - 49

GENERAL DESCRIPTION

This illustration is based on the LHD model.



The steering linkage consists of a pitman arm, relay lever, center track rod and two adjustable outer track rods.

When the steering wheel is turned, the gear rotates the pitman arm which forces the center track rod to one side. The outer track rods, connected to the center track rod by ball studs, transfer the steering force to the wheels. The outer track rods are adjustable and are used for toe-in adjustments. The center track rod is supported by the pitman arm and relay lever. The relay lever pivots on a support attached to the frame.

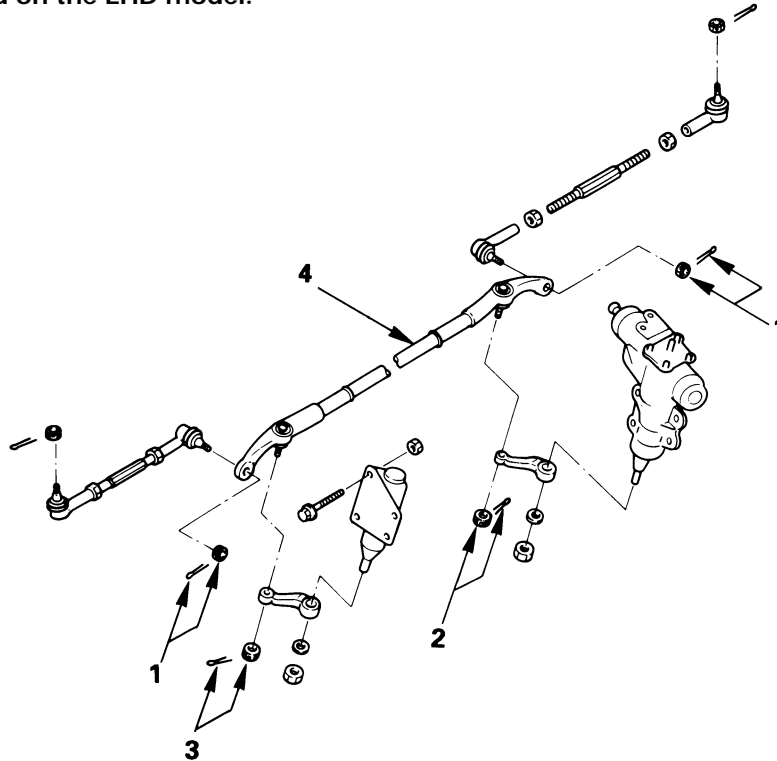
The overall condition of the steering linkage affects steering performance. If parts are bent, damaged, worn or poorly lubricated, improper and possibly dangerous steering action will result.

Whenever any steering linkage components are repaired or replaced, check the steering geometry and front end alignment. Refer to Front End Alignment (Sec. 3A).

ON-VEHICLED SERVICE

CENTER TRACK ROD ASSEMBLY

These steps are based on the LHD model.



Removal Steps

1. Nut and cotter pin
2. Nut and cotter pin, pitman arm
3. Nut and cotter pin relay lever
4. Center track rod assembly

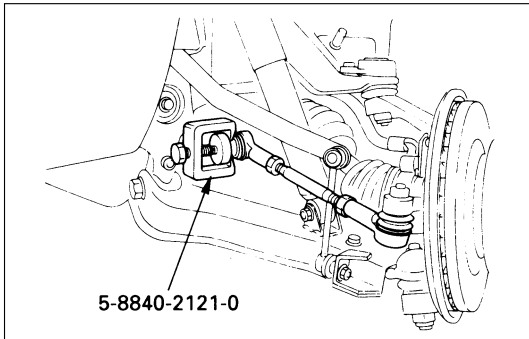
Installation Steps

4. Center track rod assembly
3. Nut and cotter pin relay lever
2. Nut and cotter pin, pitman arm
1. Nut and cotter pin

REMOVAL

Preparation:

Raise the vehicle and support the frame with suitable safety stands.



1. Nut and Cotter Pin

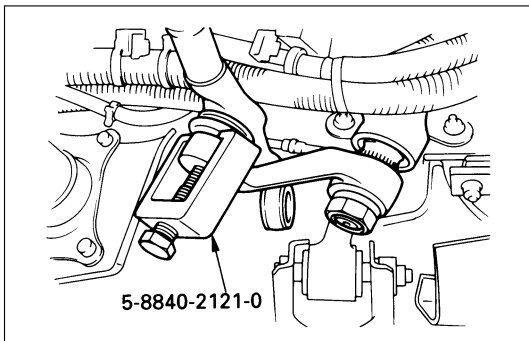
Disconnect outer track rod assembly from the center track rod.

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.



2. Nut and Cotter Pin, Pitman Arm

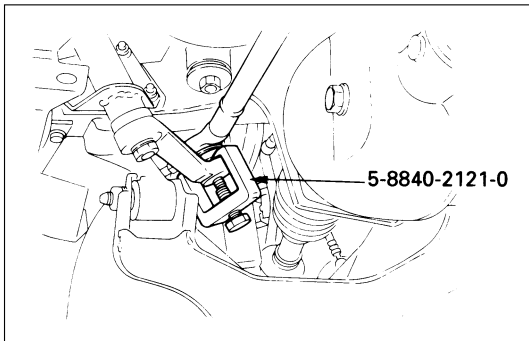
Remove pitman arm from the center track rod (Fig. 3B3-4)

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.



3. Nut and Cotter Pin, Relay Lever

Remove relay lever from the center track rod.

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.

4. Center Track Rod Assembly



INSPECTION AND REPAIR

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

Check the following parts.

- Ball joint (Boot, screws and tapered surfaces)



INSTALLATION

4. Center Track Rod Assembly



3. Nut and Cotter Pin, Relay Lever

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

Relay Lever Nut Torque	N·m (kg·m/lb·ft)
59 (6.0 / 43)	



2. Nut and Cotter Pin, Pitman Arm

Tighten the nut to the specified torque, with just enough additional torque to align cotter pin hole. Install new cotter pin.

Pitman Arm Nut Torque	N·m (kg·m/lb·ft)
98 (10.0 / 72)	



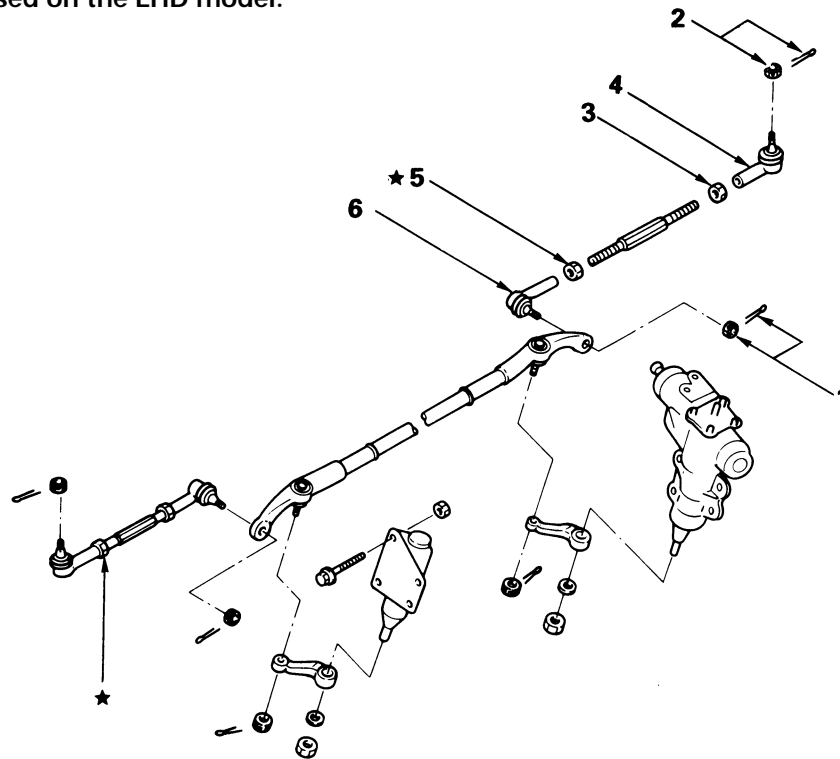
1. Nut and Cotter Pins

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

Center Track Rod Nut Torque	N·m (kg·m/lb·ft)
98 (10.0 / 72)	

OUTER TRACK ROD ASSEMBLY

These steps are based on the LHD model.



Removal Steps

1. Nut and cotter pin, center track rod
2. Nut and cotter pin, knuckle arm
3. Lock nut, outer
4. Rod end assembly outer
5. Lock nut, inner
6. Rod end assembly, inner

★ The screw is threaded counterclockwise.

Installation Steps

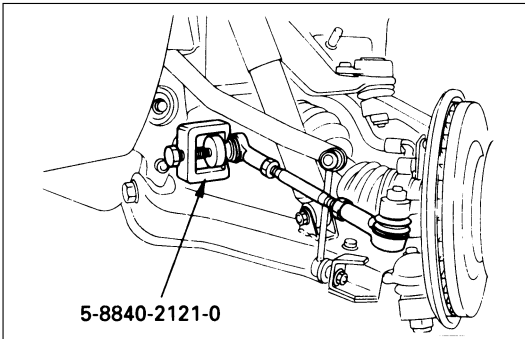
6. Rod end assembly, inner
5. Lock nut, inner
4. Rod end assembly outer
3. Lock nut, outer
2. Nut and cotter pin, knuckle arm
1. Nut and cotter pin, center track rod

REMOVAL

Preparation:

Remove wheel and tire assembly.

Refer to "Wheels and Tires" in section 3E.



1. Nut and Cotter Pin, Center Track Rod

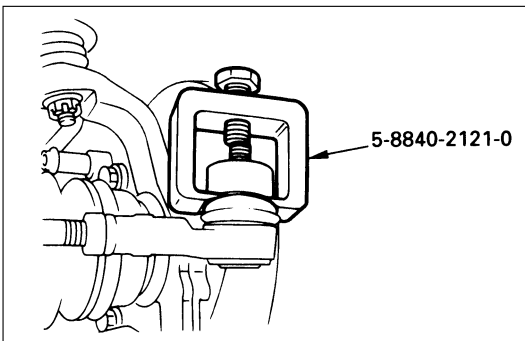
Disconnect outer track rod assembly at the center track rod.

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.



2. Nut and Cotter Pin, Knuckle Arm

Remove outer track rod assembly from the knuckle arm.

Remover: 5-8840-2121-0 (J-36831)



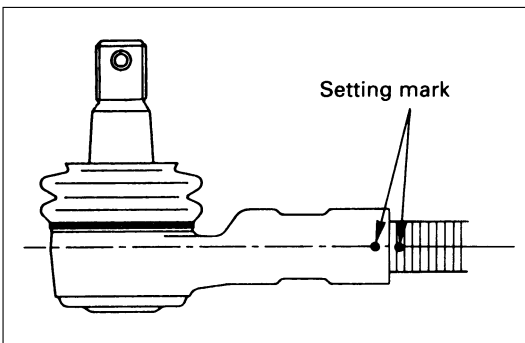
CAUTION:

Be careful not to break the ball joint boot.

3. Lock Nut, Outer

NOTE:

In either outer rod, the screw on the right side of the vehicle is threaded counterclockwise.



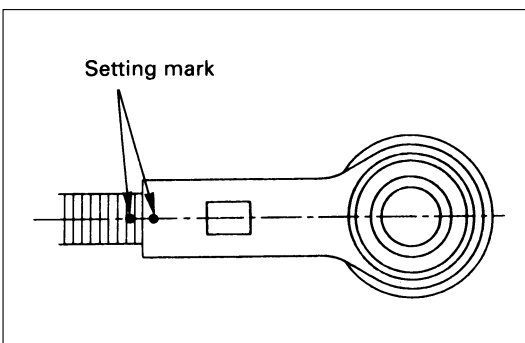
4. Rod End Assembly, Outer

Apply setting marks to ensure reassembly of the parts in their original position.

5. Lock Nut, Inner

NOTE:

In either outer rod, the screw on the right side of the vehicle is threaded counterclockwise.



6. Rod End, Inner

Apply setting marks to ensure reassembly of the parts in their original position.



INSPECTION AND REPAIR

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

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



INSTALLATION



6. Rod End, Inner

Align the setting marks applied during disassembly.



5. Lock Nut, Inner

Lock Nut Torque	N·m (kg·m/lb·ft)
118 (12.0 / 87)	

NOTE:

In either outer rod, the screw on the right side of the vehicle is threaded counterclockwise.



4. Rod End Assembly, Outer

Align the setting marks applied during disassembly.



3. Lock Nut, Outer

Lock Nut Torque	N·m (kg·m/lb·ft)
118 (12.0 / 87)	



2. Nut and Cotter pin, Knuckle Arm

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

Knuckle Arm Nut Torque	N·m (kg·m/lb·ft)
98 (10.0 / 72)	



1. Nut and Cotter Pin, Center Track Rod

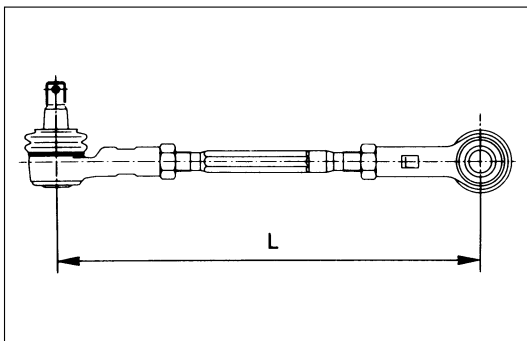
Tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Track Rod Nut Torque	N·m (kg·m/lb·ft)
98 (10.0 / 72)	

NOTE:

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

Rod Length (L)	mm (in)
328.3 (12.93) : Wide Tread	
299 (11.77) : Narrow Tread	

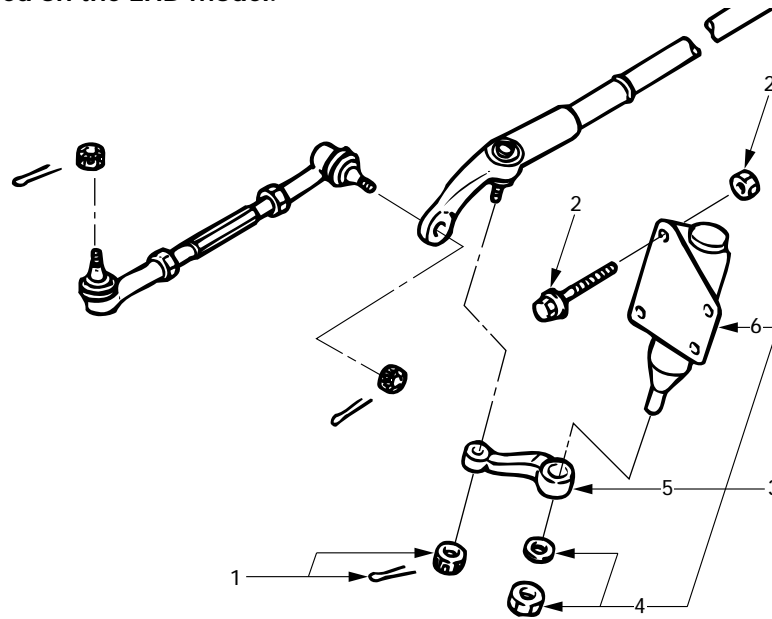


NOTE:

Adjust the toe-in. Refer to “Front End Alignment” in section 3A.

RELAY LEVER

These steps are based on the LHD model.



433RW005

Removal Steps

1. Nut and cotter pin
2. Bolt and nut
3. Relay lever and Bracket
4. Nut and washer
5. Relay lever
6. Bracket

Installation Steps

6. Bracket
5. Relay lever
4. Nut and washer
3. Relay lever and bracket
2. Bolt and nut
1. Nut and cotter pin



REMOVAL

Preparation:

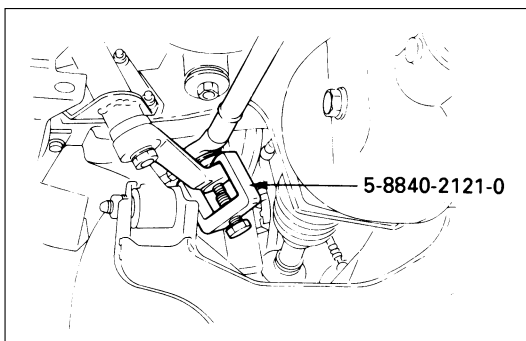
Raise the vehicle and support the frame with suitable safety stands.

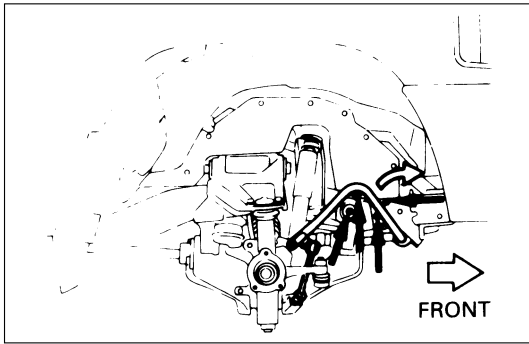


1. Nut and Cotter pin

Disconnect relay lever at the center track rod.

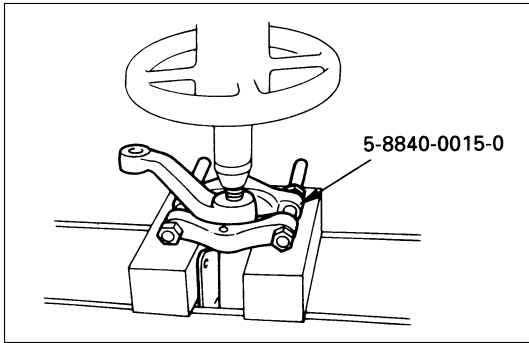
Remover: 5-8840-2121-0 (J-36831)





2. Bolt and Nut

Remove stabilizer bar bolts and nuts and push the stabilizer bar aside and remove the bolts and nuts.



3. Relay Lever and Bracket

4. Nut and Washer

5. Relay Lever

Remove relay lever from the bracket.

Remover: 5-8840-0015-0 (J-22912-01)

6. Bracket



INSTALLATION

6. Bracket

5. Relay Lever

4. Nut and Washer



Relay Lever Nut Torque	N·m (kg·m/lb·ft)
118 (12.0 / 87)	

3. Relay Lever and Bracket

2. Bolt and Nut



Bracket Nut Torque	N·m (kg·m/lb·ft)
44 (4.5 / 33)	

1. Nut and Cotter Pin

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



Relay Lever Nut Torque	N·m (kg·m/lb·ft)
59 (6.0 / 43)	

SECTION 2A

SUPPLEMENTAL RESTRAINT SYSTEM STEERING WHEEL & COLUMN

⚠ CAUTION:
 When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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Steering Wheel Replacement	2A - 57
Combination Switch Replacement	2A - 60
Lock Cylinder Replacement	2A - 64
Steering Column Replacement	2A - 69

GENERAL DESCRIPTION

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

For detailed explanation about SRS, refer to Section 9J "SUPPLEMENTAL RESTRAINT SYSTEM (SRS)" of manual.

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

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

The column may be disassembled and reassembled. To insure the energy absorbing action, it is important that the specified screws, bolts and nuts be used only as designated and that they are tightened to the specified torque.

When the column is removed from the vehicle, a sharp blow on the end of steering shaft or shift lever, leaning on the column assembly, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.



WARNING

THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS. SAFE HANDLING OF INFLATOR MODULES REQUIRES FOLLOWING THE PROCEDURES DESCRIBED BELOW FOR BOTH LIVE AND DEPLOYED MODULES. SAFETY PRECAUTIONS MUST BE FOLLOWED

WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY (AIR BAG). AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AN AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT. TO AVOID DEPLOYMENT WHEN TROUBLE SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

ON-VEHICLE SERVICE

SRS CONNECTORS



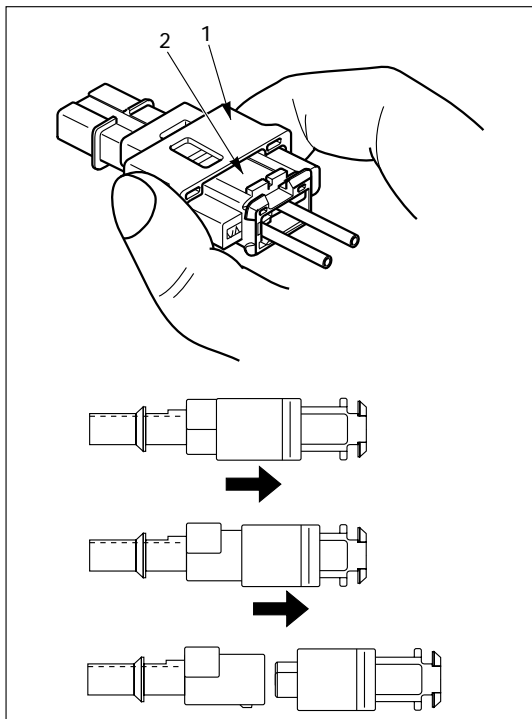
CAUTION:

The special yellow color connectors are used for supplemental restraint system-air bag circuit. When removing the cable harness, do not pull the cables. Otherwise, cable disconnection may occur. When connect the SRS connector, insert the connector completely. Imperfect locking may cause malfunction of SRS circuit.



REMOVAL

To remove the connector, hold the cover insulator(1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator(2).



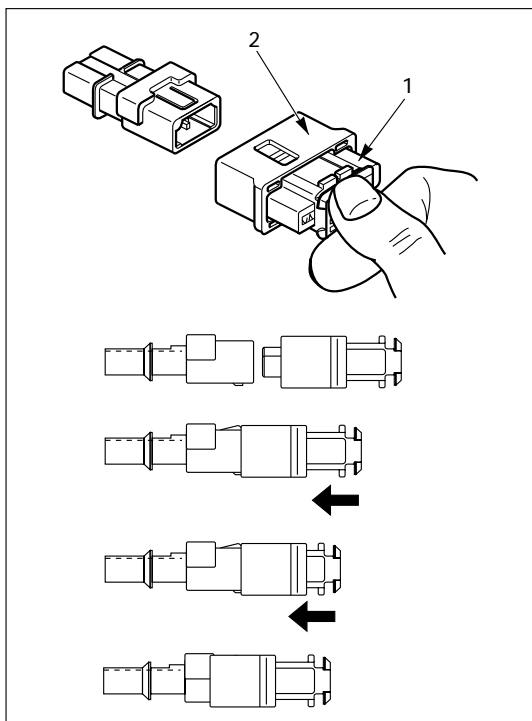
827RW035



INSTALLATION

To install the connector, hold the socket insulator(1) and insert it. The cover insulator slides and connector will be locked.

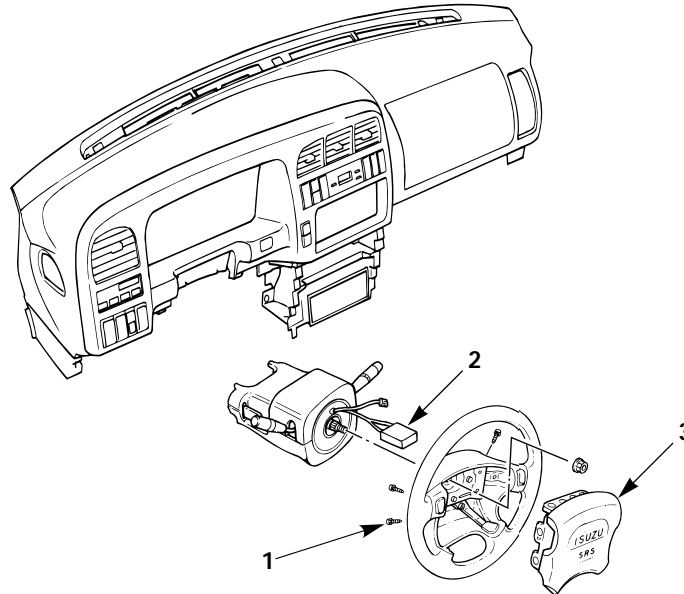
Do not hold the cover insulator(2).



827RW034

INFLATOR MODULE REPLACEMENT

These steps are based on the LHD model.



827RS049

Removal Steps

1. Fixing bolt
2. Module connector
3. Inflator module

Installation Steps

3. Inflator module
2. Module connector
1. Fixing bolt

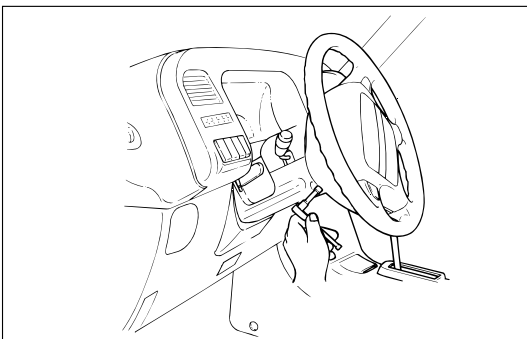
REMOVAL

Preparation:

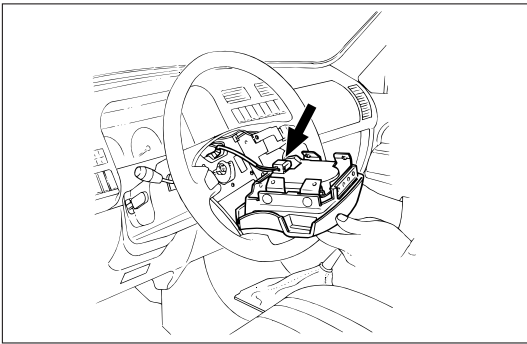
- 1) Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
- 2) Turn the ignition switch to "LOCK".
- 3) Disconnect the battery ground cable, and wait at least 5 minutes.
- 4) Disconnect the yellow 2way SRS connector located under the steering column.

1. Fixing Bolt

Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX, driver or equivalent until the inflator module can be released from steering assembly.



827RS014

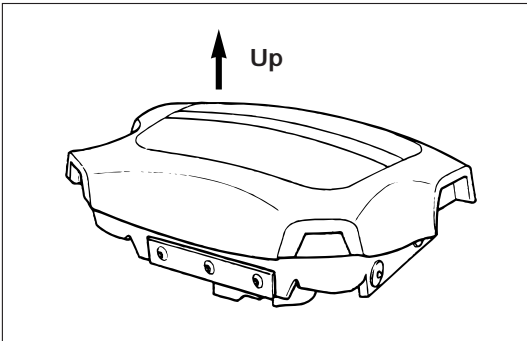


827RS015

2. Module Connector

Disconnect the yellow 2way SRS connector located behind the inflator module.

3. Inflator Module



827RS016



INSPECTION AND REPAIR



WARNING

THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY BE RESULT.

The Inflator module consists of a cover, air bag, inflator, and retainer. Inspect the Inflator module mainly for the following:

- 1) Check for holes, cracks, severe blemishes and deformation on the cover.
- 2) Check that the retainer is not deformed.
- 3) Check for defects such as damage and breakage in the lead wire of the squib.

If an abnormality is found as the result of the inspection, replace the Inflator module with a new one.



INSTALLATION

3. Inflator Module



CAUTION:

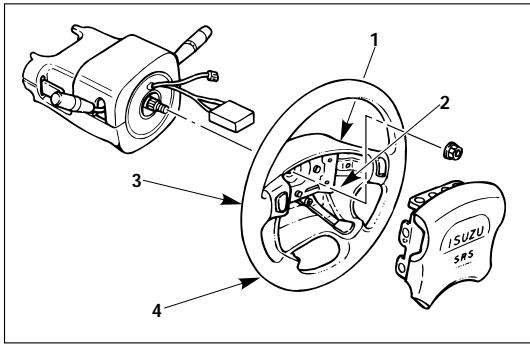
- Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UBS".
- When replace the inflator module, use only same parts number assembly. If different parts number assembly is installed, the air bag system can not function correctly because it has different characteristic.

2. Module Connector

Support the module and carefully connect the module connector.

NOTE:

Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.



827RS017

1. Fixing Bolt

- 1) Secure the module with one bolt to relieve weight on the connector wire.
- 2) Tighten bolts to specified sequence as figure.

N·m (kg·m/lb·in)

8 (0.8 / 69)



- 3) Connect the yellow 2way SRS connector located under the steering column.
- 4) Connect the battery ground cable.
- 5) Set ignition to "ON" while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Section 9J.

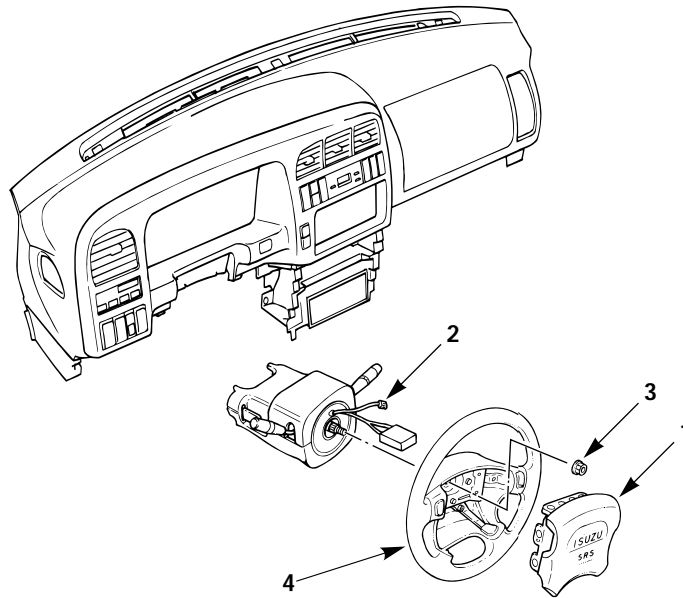
STEERING WHEEL REPLACEMENT



CAUTION:

Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the slide block which maintains column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon, as hammering could loosen slide block which maintains column rigidity.

These steps are based on the LHD model.



430RS016

Removal Steps

1. Inflator module
2. Horn lead
3. Steering wheel fixing nut
4. Steering wheel

Installation Steps

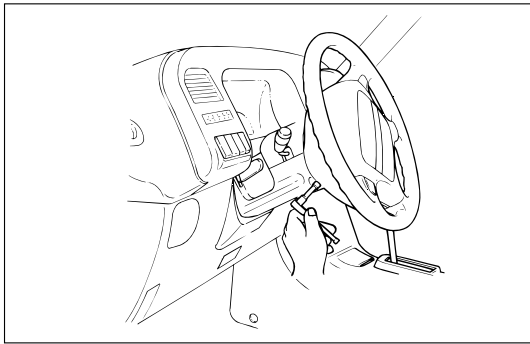
4. Steering wheel
3. Steering wheel fixing nut
2. Horn lead
1. Inflator module



REMOVAL

Preparation:

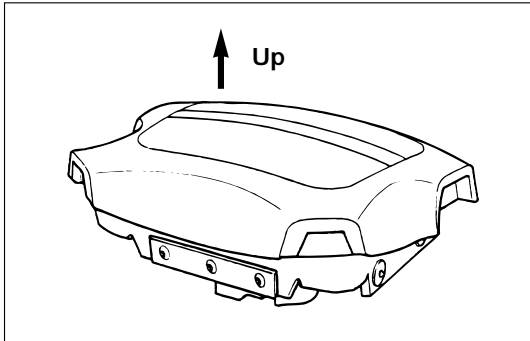
- 1) Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
- 2) Turn the ignition switch to "LOCK".
- 3) Disconnect the battery ground cable, and wait at least 5 minutes.
- 4) Disconnect the yellow 2way SRS connector located under the steering column.



827RS014

1. Inflator Module

- 1) Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.
- 2) Disconnect the yellow 2way SRS connector located behind the inflator module.



827RS016



WARNING

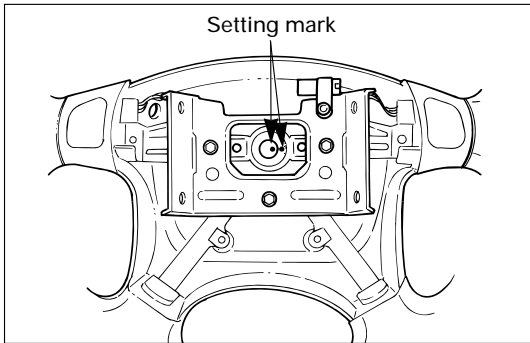
THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.

2. Horn Lead

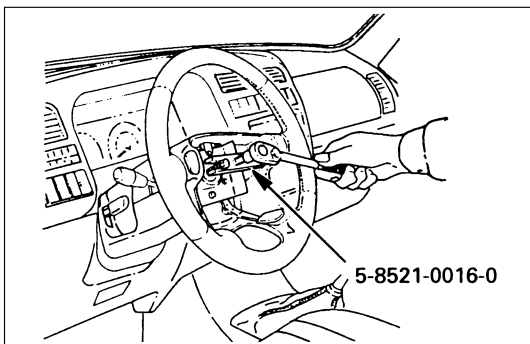
3. Steering Wheel Fixing Nut

4. Steering Wheel

- 1) Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



430RS004



5-8521-0016-0



- 2) Move the front wheels to the straight ahead position and use special tool.

Steering wheel remover: 5-8840-0016-0 (J-29752)

NOTE:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

INSTALLATION

4. Steering Wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to install the steering wheel. The setting shaft is designed as an energy absorbing unit.



3. Steering Wheel Fixing Nut

Steering Wheel Nut Torque	N·m (kg·m/lb·ft)
	34 (3.5 / 25)

2. Horn Lead

1. Inflator Module

- 1) Support the module and carefully connect the module connector.



CAUTION:

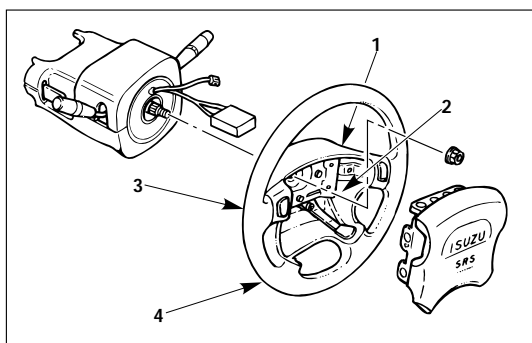
- Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UBS".
- When replace the inflator module, use only same parts number assembly. If different parts number assembly is installed, the air bag system can not function correctly because it has different characteristic.

NOTE:

Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinches.

- 2) Secure the module with one bolt to relieve weight on the connector wire.
- 3) Tighten bolts to specified sequence as figure.

Inflator module Bolt Torque	N·m (kg·m/lb·in)
	8 (0.8 / 69)

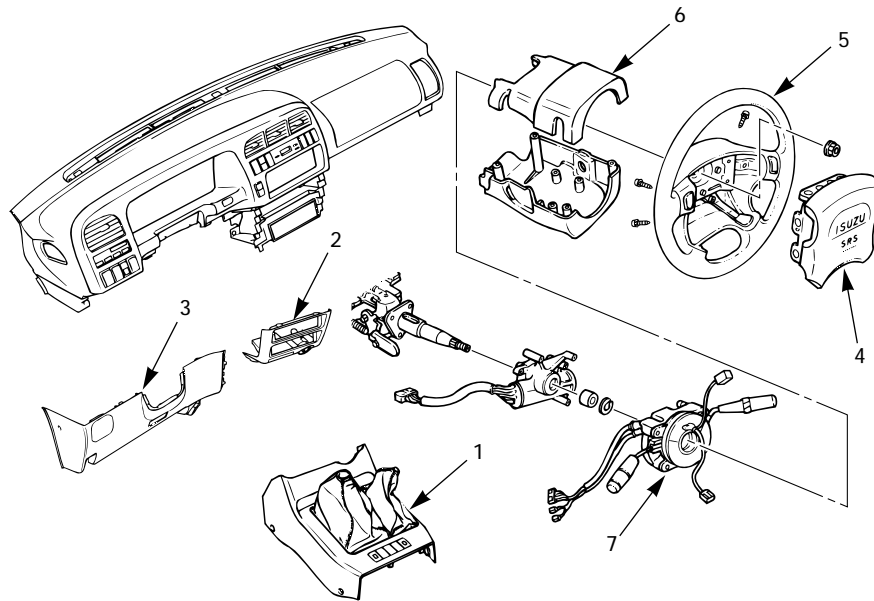


827RS017

- 4) Connect the yellow 2way SRS connector located under the steering column.
- 5) Connect the battery ground cable.
- 6) Set ignition to "ON" while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Section 9J.

COMBINATION SWITCH REPLACEMENT

These steps are based on the LHD model.



431RT001

Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Inflator module
5. Steering wheel
6. Steering column cover
7. Combination switch and SRS coil assembly

Installation Steps

7. Combination switch and SRS coil assembly
6. Steering column cover
5. Steering wheel
4. Inflator module
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

REMOVAL

Preparation:

- 1) Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
- 2) Turn the ignition switch to "LOCK".
- 3) Disconnect the battery ground cable, and wait at least 5 minutes.
- 4) Disconnect the yellow 2way SRS connector located under the steering column.

CAUTION:

The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

1. Front Console Assembly

- 1) Remove the transmission (for M/T) and transfer control lever knob.
- 2) Disconnect the wiring harness connectors.

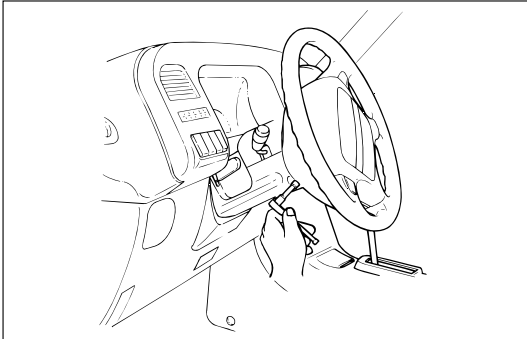
2. Lower Cluster Assembly

3. Steering Lower Cover

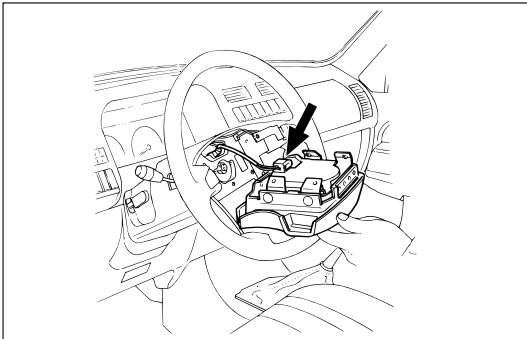
Remove the engine hood opening lever.

4. Inflator Module

- 1) Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.

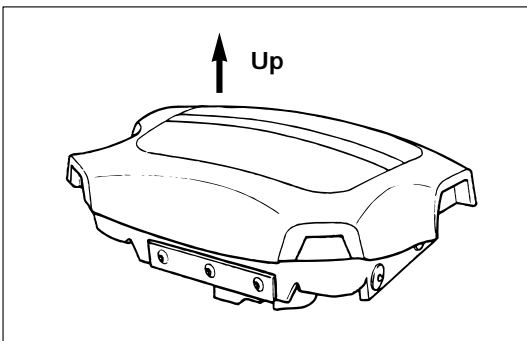


827RS014



827RS015

- 2) Disconnect the yellow 2way SRS connector located behind the inflator module.



827RS016

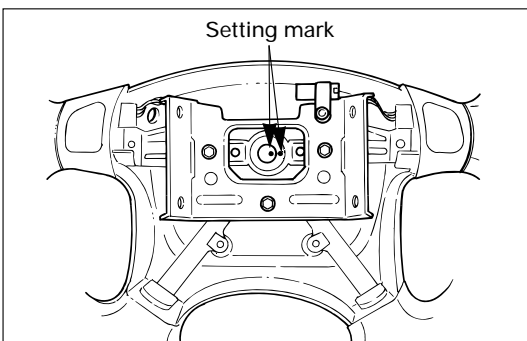


WARNING

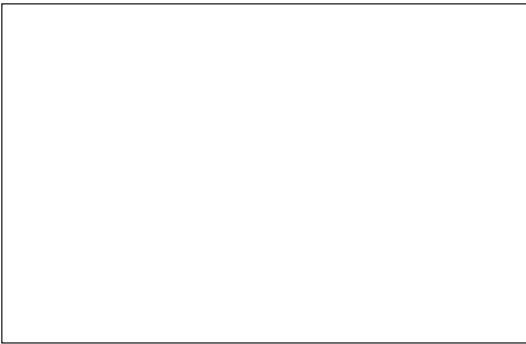
THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF AN ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.

5. Steering Wheel

Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



430RS004



Use special tool. Remove the steering wheel.
Move the tires to the straight ahead position before removing the steering wheel.

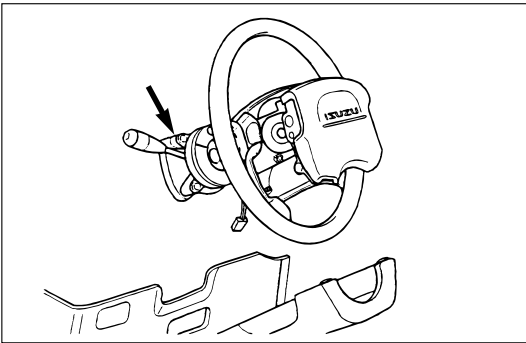


Steering wheel remover: 5-8840-0016-0 (J-29752)



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



825RS046

6. Steering Column Cover

7. Combination Switch and SRS Coil Assembly

- 1) Disconnect the wiring harness connectors located under the steering column.
- 2) Remove the combination switch assembly with SRS coil.

NOTE:

The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



INSTALLATION

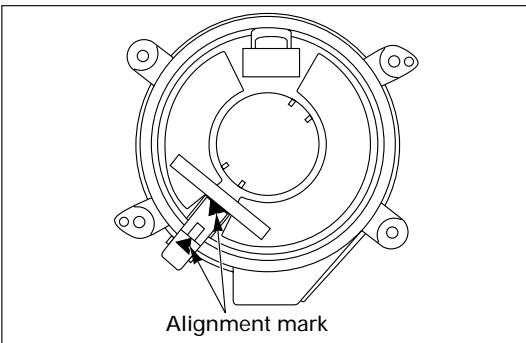
7. Combination Switch and SRS Coil Assembly

- 1) After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2way connector located under the steering column.
- 2) Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

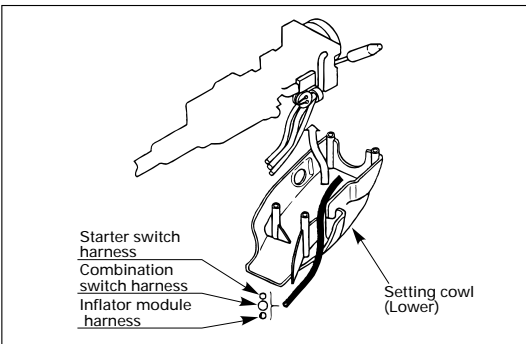


CAUTION:

When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



826RW027



825RS048

6. Steering Column Cover

When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.

5. Steering Wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



Tighten the steering wheel fixing nut to the specified torque.

Steering Wheel Nut Torque	N·m (kg·m/lb·ft)
	34 (3.5 / 25)

4. Inflator Module

- 1) Support the module and carefully connect the module connector.



CAUTION:

- Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UBS".
- When replace the inflator module, use only same parts number assembly. If different parts number assembly is installed, the air bag system can not function correctly because it has different characteristic.

NOTE:

Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

- 2) Secure the module with one bolt to relieve weight on the connector wire.
- 3) Tighten bolts to specified sequence as figure.

Inflator Module Bolt Torque	N·m (kg·m/lb·in)
	8 (0.8 / 69)



3. Steering Lower Cover

Install the engine hood opening lever.

2. Lower Cluster Assembly

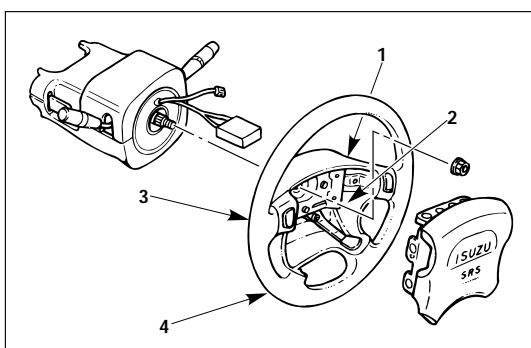
1. Front Console Assembly

- 1) Install the transmission (for M/T) and transfer control lever knob.
- 2) Install the wiring harness connectors.

Connect the battery ground cable.

Turn the ignition to "ON" while watching warning light.

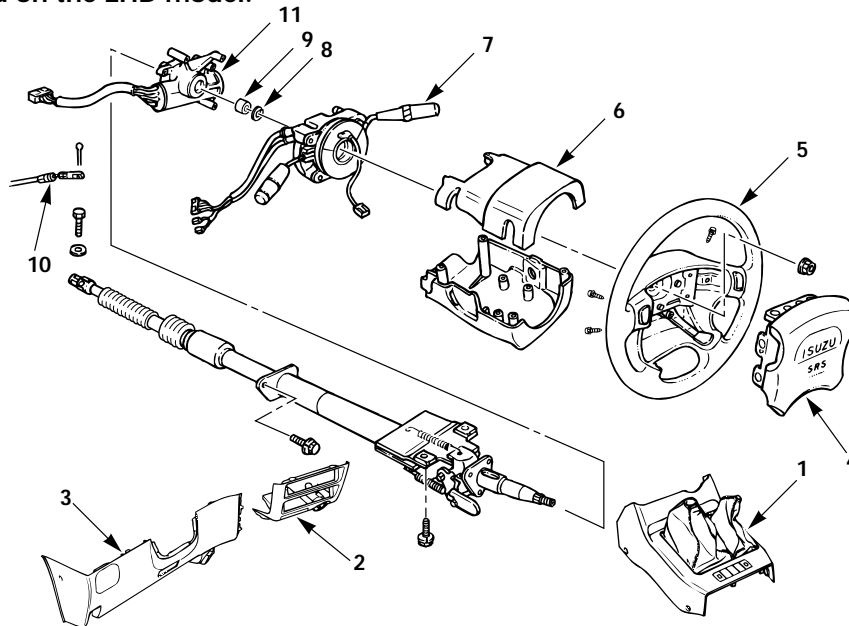
Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Section 9J.



827RS017

LOCK CYLINDER REPLACEMENT

These steps are based on the LHD model.



431RT003

Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Inflator module
5. Steering wheel
6. Steering column cover
7. Combination switch and SRS coil assembly
8. Snap ring
9. Cushion rubber
10. Shift lock cable (for A/T)
11. Lock cylinder assembly

Installation Steps

11. Lock cylinder assembly
10. Shift lock cable (for A/T)
9. Cushion rubber
8. Snap ring
7. Combination switch and SRS coil assembly
6. Steering column cover
5. Steering wheel
4. Inflator module
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

REMOVAL

Preparation:

- 1) Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
- 2) Turn the ignition switch to "LOCK".
- 3) Disconnect the battery ground cable, and wait at least 5 minutes.
- 4) Disconnect the yellow 2way SRS connector located under the steering column.



CAUTION:

The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

1. Front Console Assembly

- 1) Remove the transmission (for M/T) and transfer control lever knob.
- 2) Disconnect the wiring harness connectors.

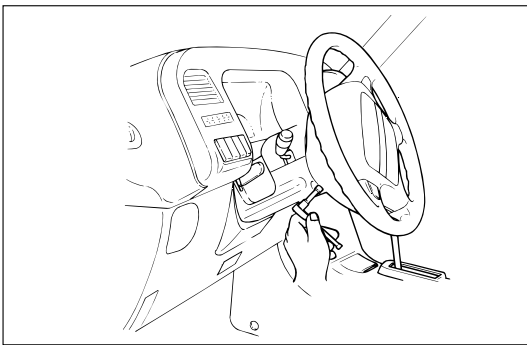
2. Lower Cluster Assembly

3. Steering Lower Cover

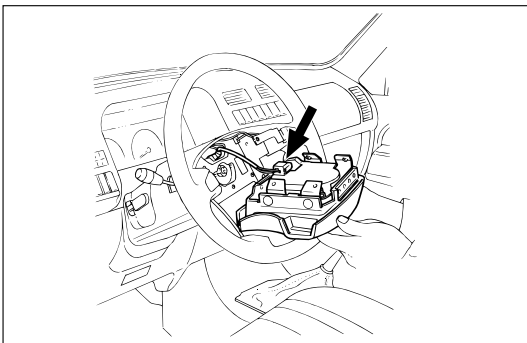
Remove the engine hood opening lever.

4. Inflator Module

- 1) Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.

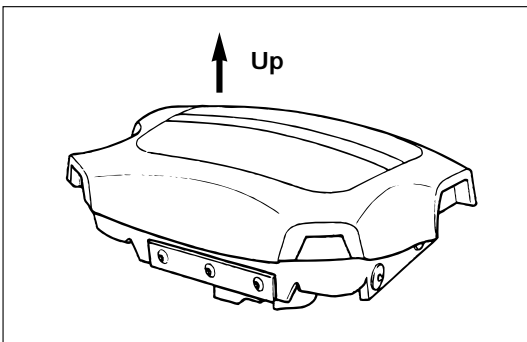


827RS014



827RS015

- 2) Disconnect the yellow 2way SRS connector located behind the inflator module.

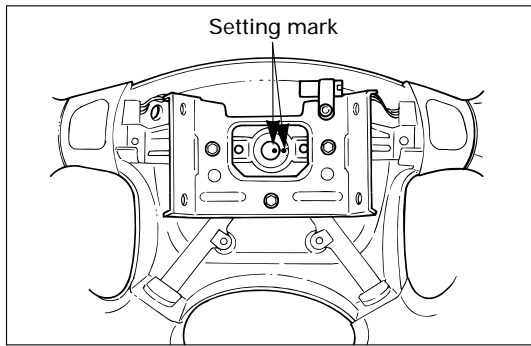


827RS016

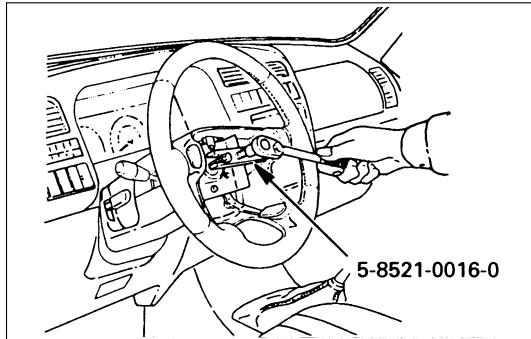


WARNING

THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF AN ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



430RS004



5. Steering Wheel

Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.

Use special tool. Remove the steering wheel. Move the tires to the straight ahead position before removing the steering wheel.

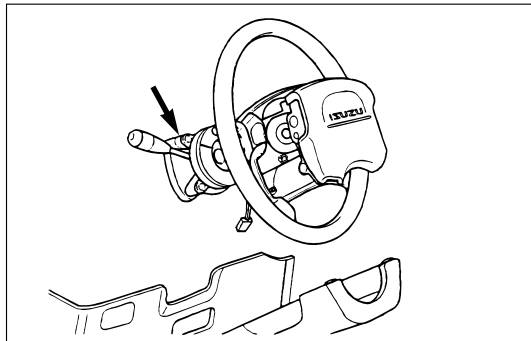


Steering wheel remover: 5-8840-0016-0 (J-29752)



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



825RS046

6. Steering Column Cover

7. Combination Switch and SRS Coil Assembly

- 1) Disconnect the wiring harness connectors located under the steering column.
- 2) Remove the combination switch assembly with SRS coil.

NOTE:

The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

8. Snap Ring

9. Cushion Rubber

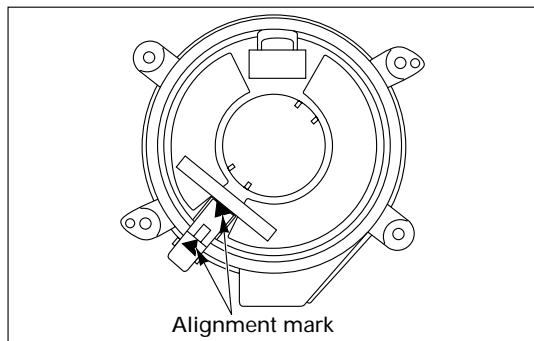
10. Shift Lock Cable (for A/T)

11. Lock Cylinder Assembly

Disconnect the starter switch harness connector located under the steering column.

INSTALLATION

11. Lock Cylinder Assembly
10. Shift Lock Cable (for A/T)
9. Cushion rubber
8. Snap ring
7. Combination Switch and SRS Coil Assembly
 - 1) After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2way connector located under the steering column.
 - 2) Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

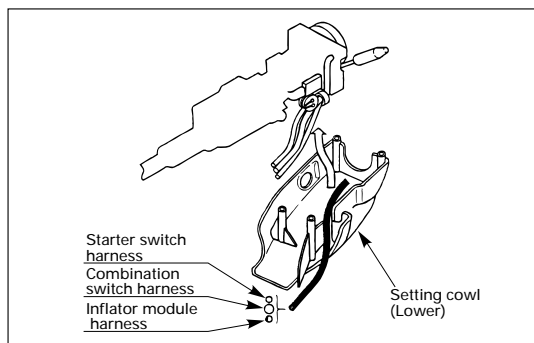


826RW027



CAUTION:

When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RS048

6. Steering Column Cover

When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.

5. Steering Wheel

Align the setting marks made when removing.



CAUTION:

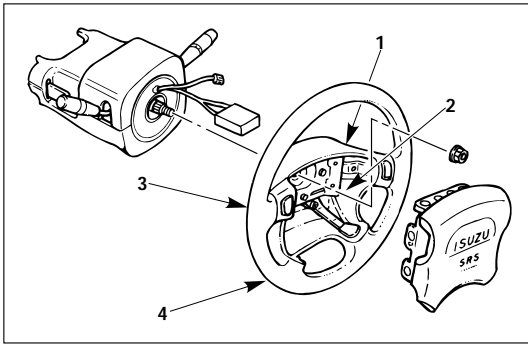
Never apply force to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

Tighten the steering wheel fixing nut to the specified torque.



Steering Wheel Nut Torque N·m (kg·m/lb·ft)

34 (3.5 / 25)



827RS017

4. Inflator Module

- 1) Support the module and carefully connect the module connector.



CAUTION:

- Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UBS".
- When replace the inflator module, use only same parts number assembly. If different parts number assembly is installed, the air bag system can not function correctly because it has different characteristic.

NOTE:

Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

- 2) Secure the module with one bolt to relieve weight on the connector wire.
- 3) Tighten bolts to specified sequence as figure.

Inflator Module Bolt Torque	N·m (kg·m/lb·in)
	8 (0.8 / 69)



3. Steering Lower Cover

Install the engine hood opening lever.

2. Lower Cluster Assembly

1. Front Console Assembly

Connect the wiring harness connectors.

Install the transmission (for M/T) and transfer control lever knob.

Connect the yellow 2way SRS connector located under the steering column.

Connect the battery ground cable.

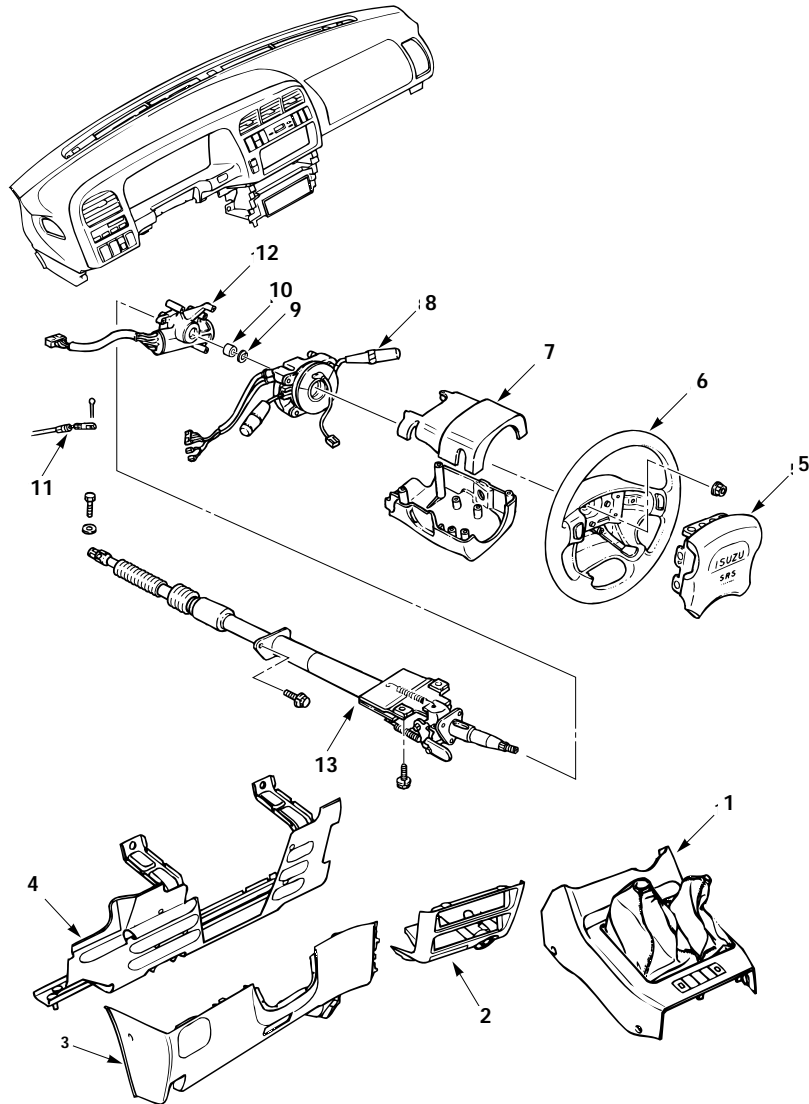


SYSTEM INSPECTION

- Turn the ignition to "ON" while watching warning light.
- Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Section 9J.

STEERING COLUMN REPLACEMENT

These steps are based on the LHD model.



431RT002

Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Driver knee bolster (reinforcement)
5. Inflator module
6. Steering wheel
7. Steering column cover
8. Combination switch and SRS coil assembly
9. Snap ring
10. Cushion rubber
11. Shift lock cable (for A/T)
12. Lock cylinder assembly
13. Steering column assembly

Installation Steps

13. Steering column assembly
12. Lock cylinder assembly
11. Shift lock cable (for A/T)
10. Cushion rubber
9. Snap ring
8. Combination switch and SRS coil assembly
7. Steering column cover
6. Steering wheel
5. Inflator module
4. Driver knee bolster (reinforcement)
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

↔ REMOVAL

Preparation:

- 1) Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
- 2) Turn the ignition switch to "LOCK".
- 3) Disconnect the battery ground cable, and wait at least 5 minutes.
- 4) Disconnect the yellow 2way SRS connector located under the steering column.



CAUTION:

The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel.

Failure to do so will cause the SRS coil assembly to become uncentered which will cause damage to the SRS coil assembly.

1. Front Console Assembly

Disconnect the transmission (for M/T) and transfer control lever knob.

Disconnect the wiring harness connectors.

2. Lower Cluster Assembly

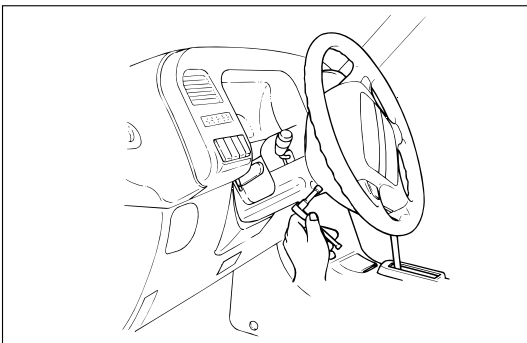
3. Steering Lower Cover

Remove the engine hood opening lever.

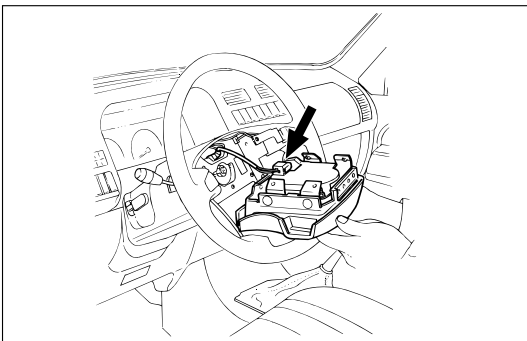
4. Driver Knee Bolster (Reinforcement)

5. Inflator Module

- 1) Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.

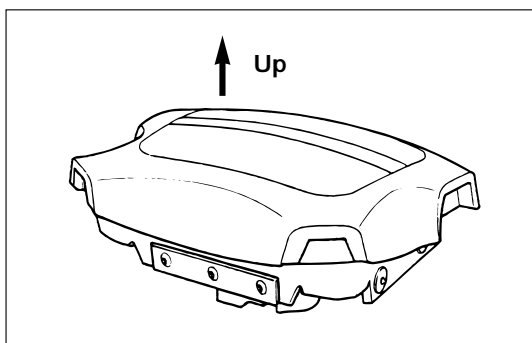


827RS014



827RS015

- 2) Disconnect the yellow 2way SRS connector located behind the inflator module.

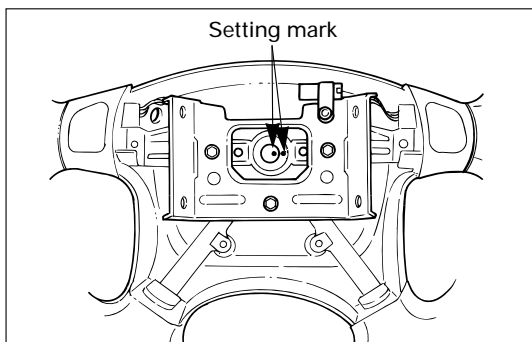


827RS016



WARNING

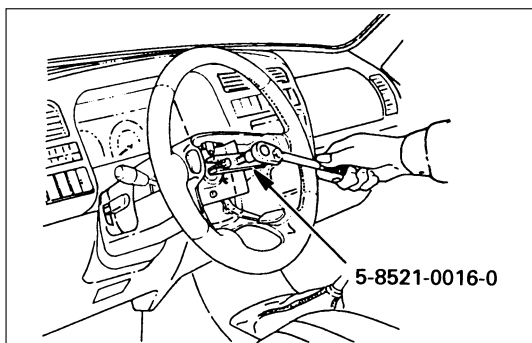
THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF AN ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



430RS004

6. Steering Wheel

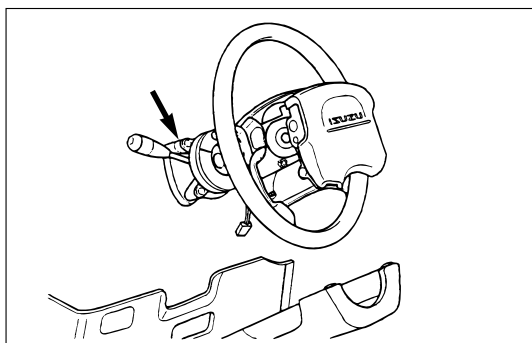
Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



Use special tool. Remove the steering wheel. Move the tires to the straight ahead position before removing the steering wheel.



Steering wheel remover: 5-8840-0016-0 (J-29752)



825RS046

7. Steering Column Cover

8. Combination Switch and SRS Coil Assembly

- 1) Disconnect the wiring harness connectors located under the steering column.
- 2) Remove the combination switch assembly with SRS coil.

NOTE:

The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

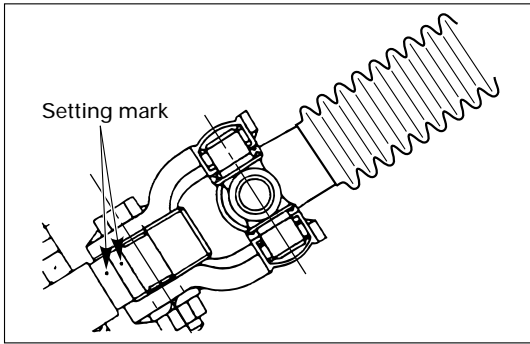
9. Snap Ring

10. Cushion Rubber

11. Shift Lock Cable (for A/T)

12. Lock Cylinder Assembly

Disconnect the starter switch harness connector located under the steering column.



431RV003

13. Steering Column Assembly

Apply a setting mark across the universal joint and steering shaft to reassemble the parts in their original position.

NOTE:

A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.

⇔ INSTALLATION

13. Steering Column Assembly

Align the setting marks on the universal joint and steering shaft made during removal.



Tighten the steering column fixing bolt (dash panel) to the specified torque.

Steering Column Bolt Torque	N·m (kg·m/lb·ft)
	19 (1.9 / 14)



Tighten the steering column fixing bolt (pedal bracket) to the specified torque.

Steering Column Bolt Torque	N·m (kg·m/lb·ft)
	17 (1.7 / 13)



Tighten the universal joint to the specified torque.

Universal Joint Torque	N·m (kg·m/lb·ft)
	25 (2.5 / 18)

12. Lock Cylinder Assembly

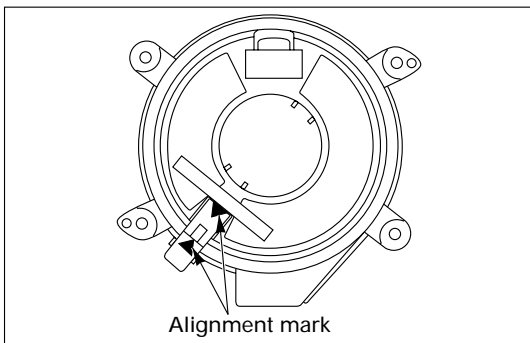
11. Shift Lock Cable (for A/T)

10. Cushion Rubber

9. Snap Ring

8. Combination Switch

- 1) After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2way connector located under the steering column.
- 2) Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

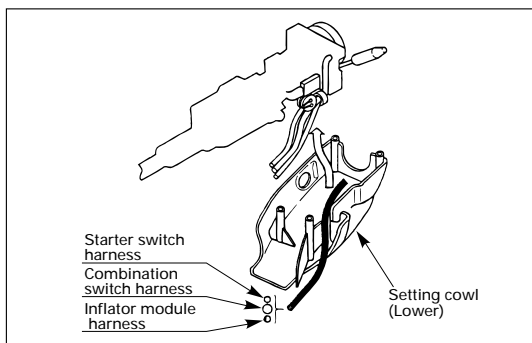


826RW027



CAUTION:

When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RS048

7. Steering Column Cover

When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.

6. Steering Wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft if designed as an energy absorbing unit.



Tighten the steering wheel fixing nut to the specified torque.

Steering Wheel Nut Torque	N·m (kg·m/lb·ft)
	34 (3.5 / 25)

5. Inflator Module

- 1) Support the module and carefully connect the module connector.



CAUTION:

- Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UBS".
- When replace the inflator module, use only same parts number assembly. If different parts number assembly is installed, the air bag system can not function correctly because it has different characteristic.

NOTE:

Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

- 2) Secure the module with one bolt to relieve weight on the connector wire.
- 3) Tighten bolts to specified sequence as figure.

Inflator Module Bolt Torque	N·m (kg·m/lb·in)
	8 (0.8 / 69)



4. Driver Knee Bolster (Reinforcement)

3. Steering Lower Cover

Install the engine hood opening lever.

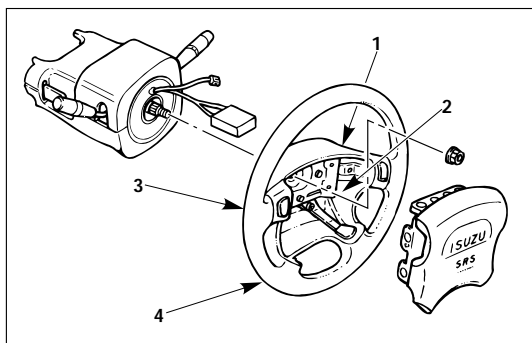
2. Lower Cluster Assembly

1. Front Console Assembly

Connect the wiring harness connectors.
Install the transmission (for M/T) and transfer control lever knob.

Connect the yellow 2way SRS connector located under the steering column.

Connect the battery ground cable.



827RS017



SYSTEM INSPECTION

Turn the ignition to "ON" while watching warning light.

Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Section 9J.

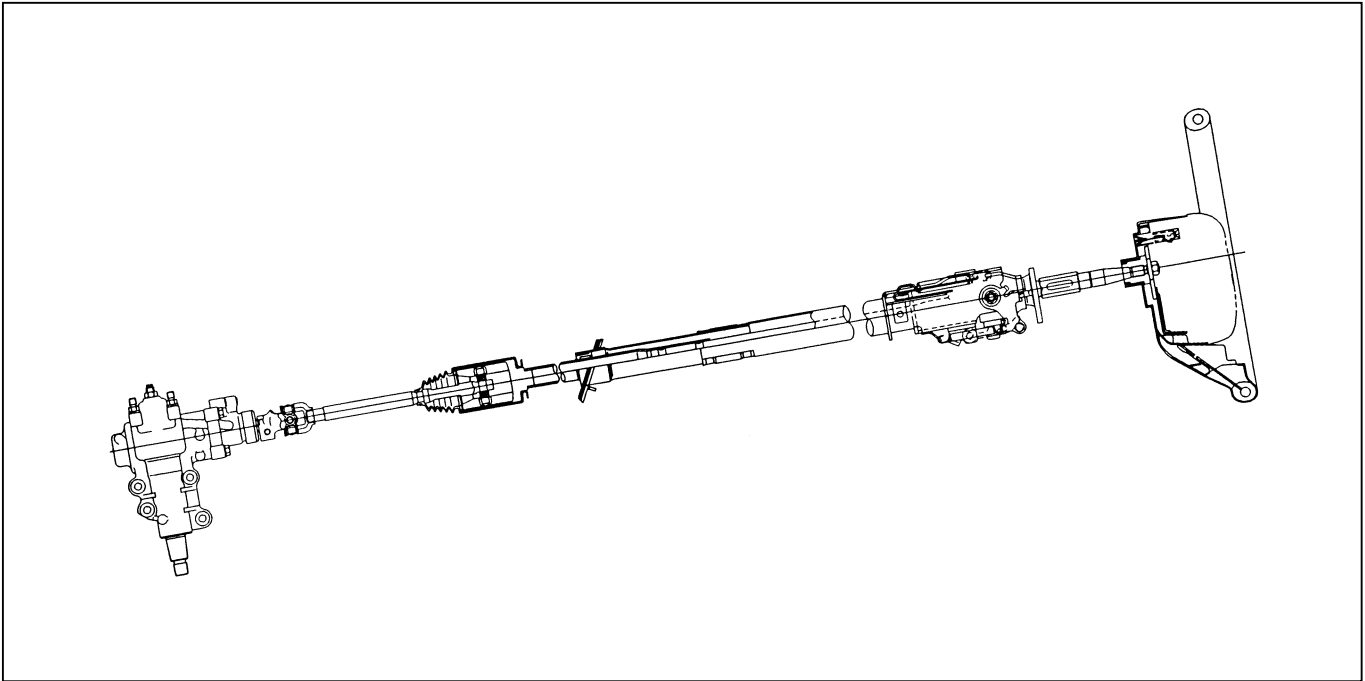
SECTION 2A

STEERING COLUMN

CONTENTS

	PAGE
General Description	2A - 76
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Steering Wheel Replacement	2A - 77
Combination Switch Replacement	2A - 79
Lock Cylinder Replacement	2A - 81
Steering Column Replacement	2A - 84

GENERAL DESCRIPTION



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

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

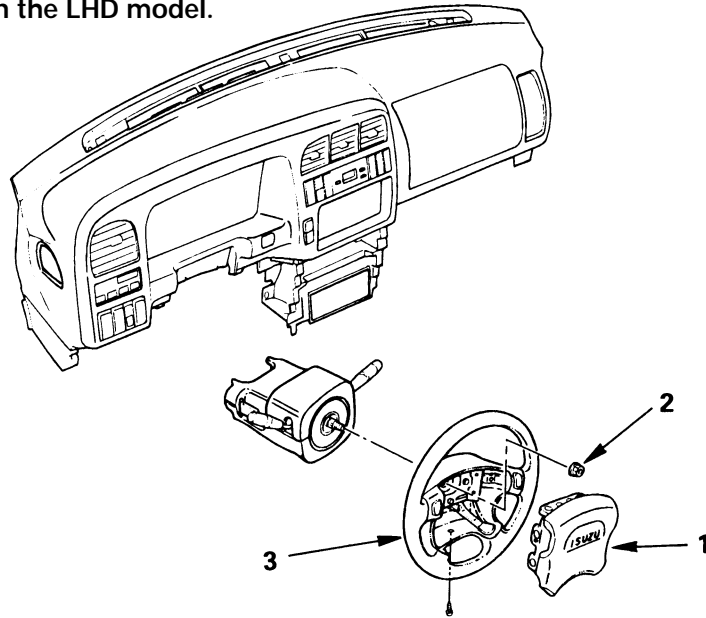
The column may be disassembled and reassembled. To insure the energy absorbing action, it is important that the specified screws, bolts and nuts be used only as designated and that they are tightened to the specified torque.

When the column is removed from the vehicle, a sharp blow on the end of steering shaft leaning on the column assembly, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.

ON-VEHICLE SERVICE

STEERING WHEEL REPLACEMENT

These steps are based on the LHD model.



Removal Steps

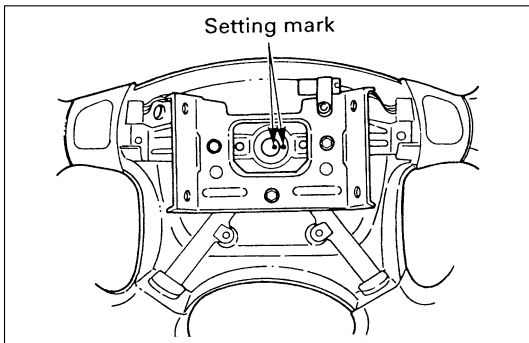
1. Center pad
2. Nut
3. Steering wheel

Installation Steps

3. Steering wheel
2. Nut
1. Center pad

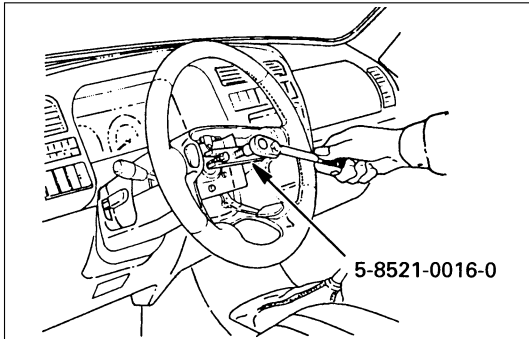
REMOVAL

1. **Center Pad**
 - 1) Remove the center pad attaching screw from the steering wheel under side.
 - 2) Disconnect the harness.
 - 3) Remove the center pad from the center of the steering wheel.
2. **Nut**



3. Steering Wheel

- 1) Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



- 2) Use special tool.

Steering wheel remover: 5-8840-0016-0 (J-29752)

NOTE:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



INSTALLATION

3. Steering Wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to install the steering wheel. The steering shaft is designed as an energy absorbing unit.



2. Nut

Steering Wheel Nut Torque	N·m (kg·m/lb·ft)
34 (3.5 / 25)	



1. Center pad

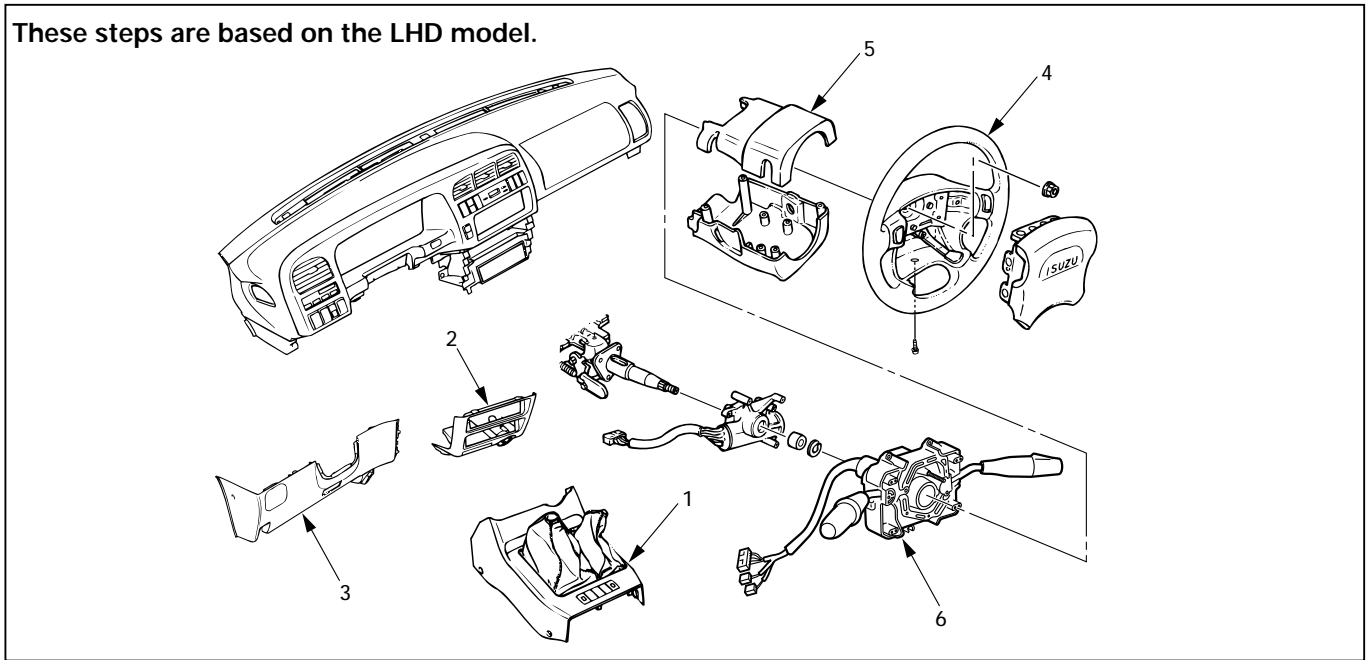
Fit four projections of pad in holes on the steering wheel side.

Tighten the screws on the lower side of the pad.

Center Pad Nut Torque	N·m (kg·m/lb·in)
2.5 (0.25 / 21.7)	

COMBINATIONS SWITCH REPLACEMENT

These steps are based on the LHD model.



431RW021

Removal Steps

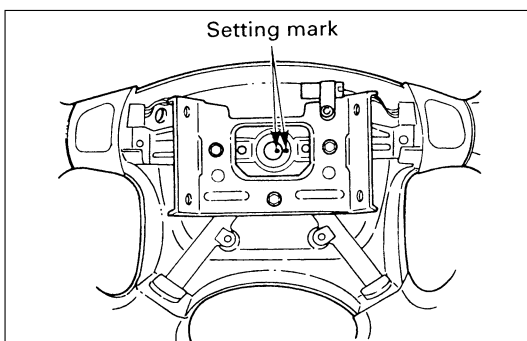
1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Steering wheel
5. Steering column cover
6. Combination switch

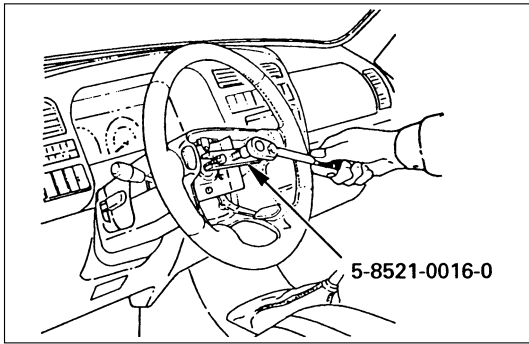
Installation Steps

6. Combination switch
5. Steering column cover
4. Steering wheel
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

REMOVAL

1. **Front console assembly**
 - 1) Remove the transmission (for M/T) and transfer control lever knob.
 - 2) Disconnect the wiring harness connectors.
2. **Lower cluster assembly**
3. **Steering lower cover**
Remove the engine hood opening lever.
4. **Steering wheel**
Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.





Use special tool. Remove the steering wheel.
Move the tires to the straight ahead positions before removing the steering wheel.



Steering wheel remover:5-8840-0016-0(J-29752)



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

5. **Steering column cover**

6. **Combination switch**

Disconnect the wiring harness connector.



INSTALLATION

6. **Combination switch**

After installations of combinations switch assembly, connect the combination switch wiring harness connector.

5. **Steering column cover**

4. **Steering wheel**

Align the setting marks made when removing.



CAUTION:

Never apply force to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



Tighten the steering wheel fixing nut to the specified torque.

Steering wheel Nut Torque	N·m (kg·m/lb·ft)
	34 (3.5 / 25)

3. **Steering lower cover**

Install the engine hood opening lever.

2. **Lower cluster assembly**

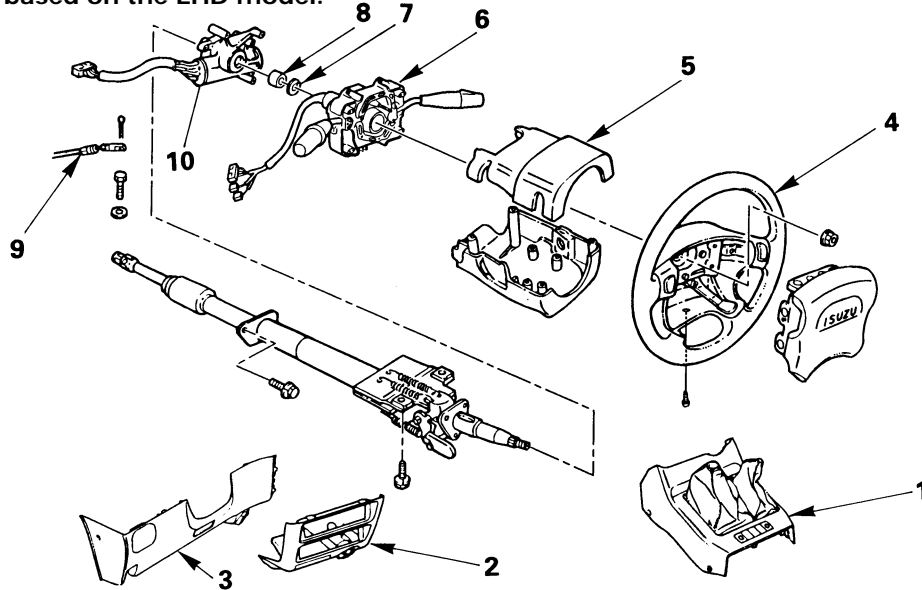
1. **Front console assembly**

Install the transmission (for M/T) and transfer control lever knob.

Install the wiring harness connectors.

LOCK CYLINDER REPLACEMENT

These steps are based on the LHD model.



Removal Steps

1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Steering wheel
5. Steering column cover
6. Combination switch
7. Snap ring
8. Cushion rubber
9. Shift lock cable (for A/T)
10. Lock cylinder assembly

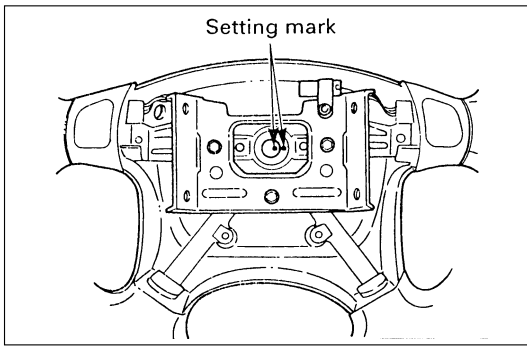
Installation Steps

10. Lock cylinder assembly
9. Shift lock cable (for A/T)
8. Cushion rubber
7. Snap ring
6. Combination switch
5. Steering column cover
4. Steering wheel
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

REMOVAL

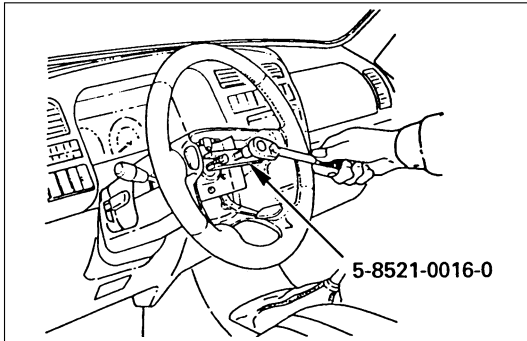
1. **Front console assembly**
 - 1) Remove the transmission (for M/T) and transfer control lever knob.
 - 2) Disconnect the wiring harness connectors.
2. **Lower cluster assembly**
3. **Steering lower cover**

Remove the engine hood opening lever.



4. Steering wheel

Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



Use special tool. Remove the steering wheel. Move the tires to the straight ahead positions before removing the steering wheel.

Steering wheel remover: 5-8840-0016-0 (J-29752)



5. Steering column cover

6. Combination switch

Disconnect the wiring harness connectors.

7. Snap ring

8. Cushion rubber

9. Shift lock cable (for A/T)

10. Lock cylinder assembly

Disconnect the starter switch harness connector located under the steering column.



INSTALLATION

10. Lock cylinder assembly

9. Shift lock cable (for A/T)

8. Cushion rubber

7. Snap ring

6. Combination switch

After installations of combinations switch assembly, connect the combination switch wiring harness connector.

5. Steering column cover

4. Steering wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

Tighten the steering wheel fixing nut to the specified torque.



Steering wheel Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
34 (3.5 / 25)	
<hr/>	

3. Steering lower cover

Install the engine hood opening lever.

2. Lower cluster assembly

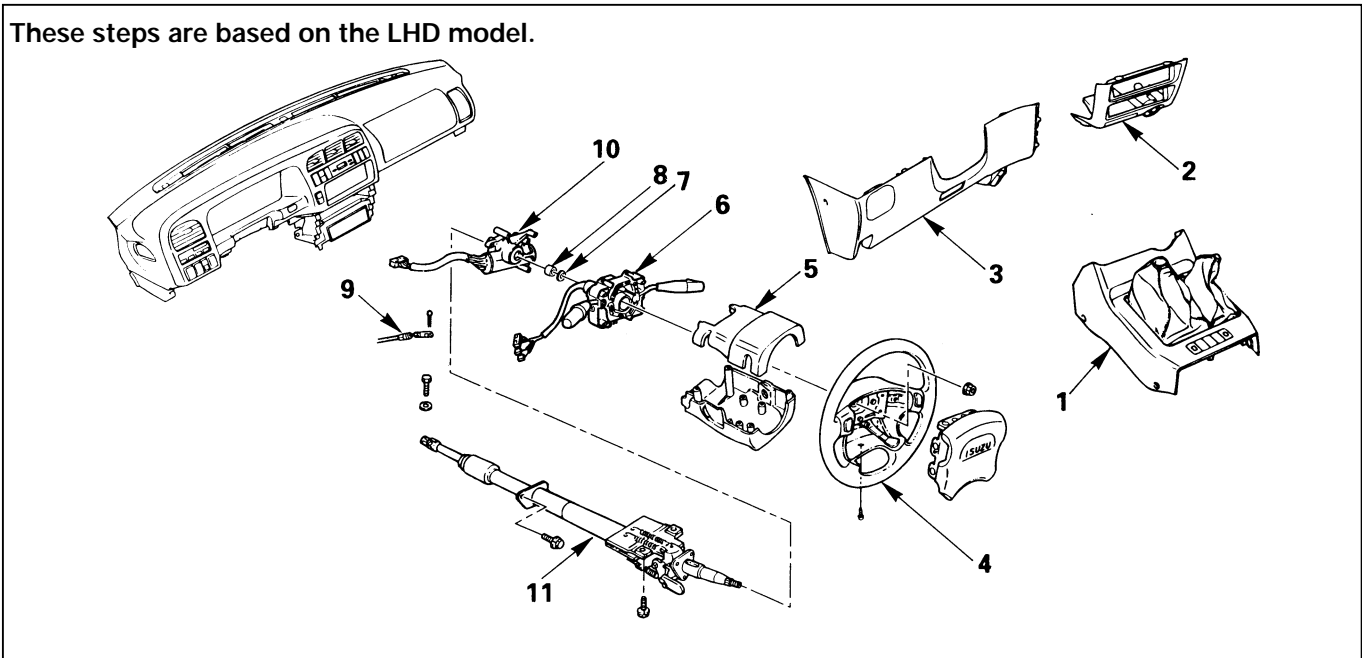
1. Front console assembly

Connect the wiring harness connectors.

Install the transmission (for M/T) and transfer control lever knob.

STEERING COLUMN REPLACEMENT

These steps are based on the LHD model.



Removal Steps

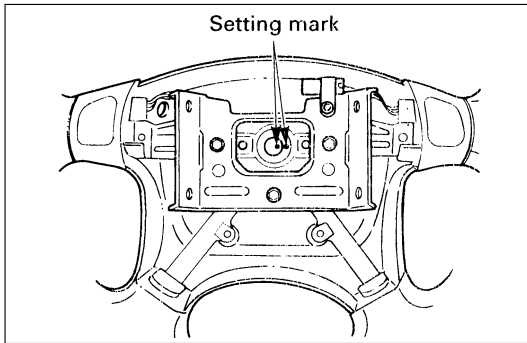
1. Front console assembly
2. Lower cluster assembly
3. Steering lower cover
4. Steering wheel
5. Steering column cover
6. Combination switch
7. Snap ring
8. Cushion rubber
9. Shift lock cable (for A/T)
10. Lock cylinder assembly
11. Steering column assembly

Installation Steps

11. Steering column assembly
10. Lock cylinder assembly
9. Shift lock cable (for A/T)
8. Cushion rubber
7. Snap ring
6. Combination switch
5. Steering column cover
4. Steering wheel
3. Steering lower cover
2. Lower cluster assembly
1. Front console assembly

↔ REMOVAL

1. **Front console assembly**
Disconnect the transmission (for M/T) and transfer control lever knob.
Disconnect the wiring harness connectors.
2. **Lower cluster assembly**

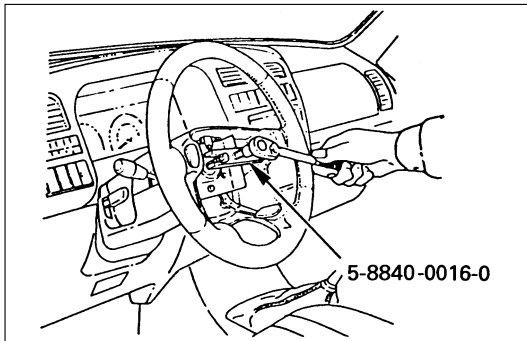


3. Steering lower cover

Remove the engine hood opening lever.

4. Steering wheel

Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



Use special tool. Remove the steering wheel.

Move the tires to the straight ahead positions before removing the steering wheel.

Steering wheel remover:5-8840-0016-0(J-29752)



5. Steering column cover

6. Combination switch

Disconnect the wiring harness connectors.

7. Snap ring

8. Cushion rubber

9. Shift lock cable (for A/T)

10. Lock cylinder assembly

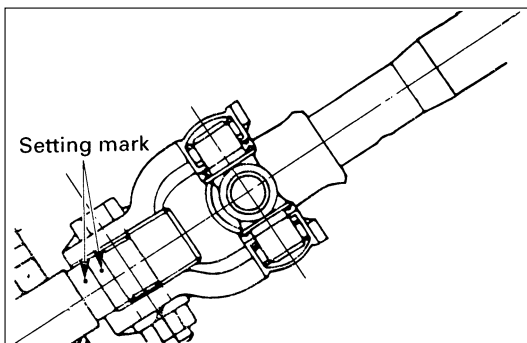
Disconnect the starter switch harness connector located under the steering column.

11. Steering column assembly

Apply a setting mark across the universal joint and steering shaft to reassembly the parts in their original position.

NOTE:

A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.



 **INSTALLATION**

11. Steering column assembly

Align the setting marks on the universal joint and steering shaft made during removal.



Tighten the steering column fixing bolt (dash panel) to the specified torque.

Steering Column Bolt Torque	N·m (kg·m/lb·ft)
19 (1.9 / 14)	



Tighten the steering column fixing bolt (pedal bracket) to the specified torque.

Steering Column Bolt Torque	N·m (kg·m/lb·ft)
17 (1.7 / 13)	



Tighten the universal joint to the specified torque.

Universal Joint Torque	N·m (kg·m/lb·ft)
25 (2.5 / 18)	

10. Lock cylinder assembly

9. Shift lock cable (for A/T)

8. Cushion rubber

7. Snap ring

6. Combination switch

After installation of combination switch assembly, connect the combination switch wiring harness connector.

5. Steering column cover

4. Steering wheel

Align the setting marks made when removing.



CAUTION:

Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



Tighten the steering wheel fixing nut to the specified torque.

Steering wheel Nut Torque	N·m (kg·m/lb·ft)
34 (3.5 / 25)	

3. Steering lower cover

Install the engine hood opening lever.

2. Lower cluster assembly

1. Front console assembly

Connect the wiring harness connectors.

Install the transmission (for M/T) and transfer control

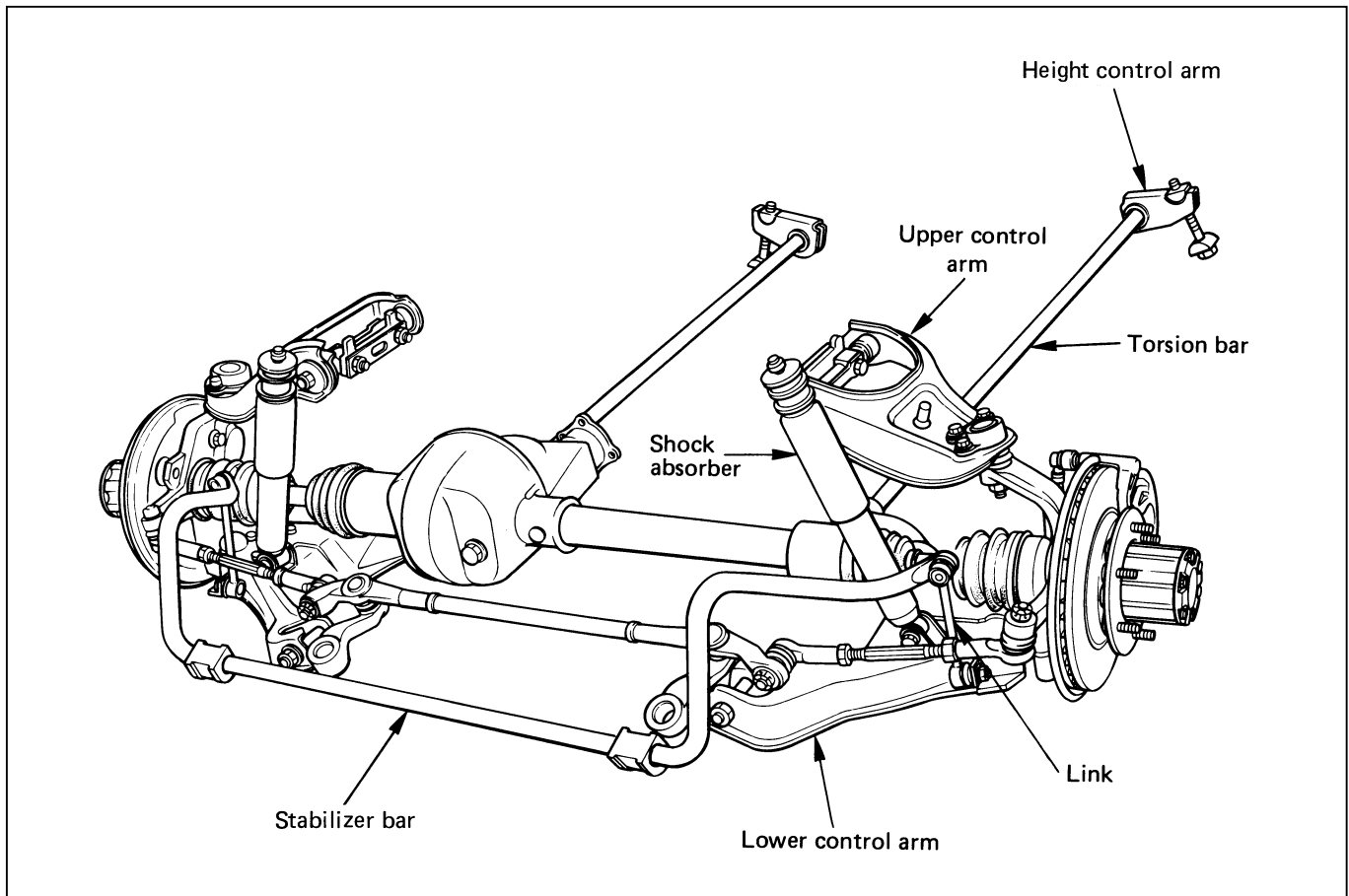
SECTION 3C

FRONT SUSPENSION

CONTENTS

	PAGE
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On-Vehicle Service	3C - 3
Shock Absorber	3C - 3
Stabilizer Bar	3C - 5
Torsion Bar	3C - 7
Knuckle	3C - 10
Upper Control Arm	3C - 14
Lower Control Arm	3C - 18
Upper Ball Joint	3C - 22
Lower Ball Joint	3C - 25

GENERAL DESCRIPTION



The front suspension is designed to allow each wheel to compensate for changes in the road surface level without greatly affecting the opposite wheel. Each wheel is independently connected to the frame by a steering knuckle, ball joint assemblies, and upper and lower control arms. The front wheels are held in proper relationship to each other by two outer track rods which are connected to steering arms on the knuckles and to a center track rod.

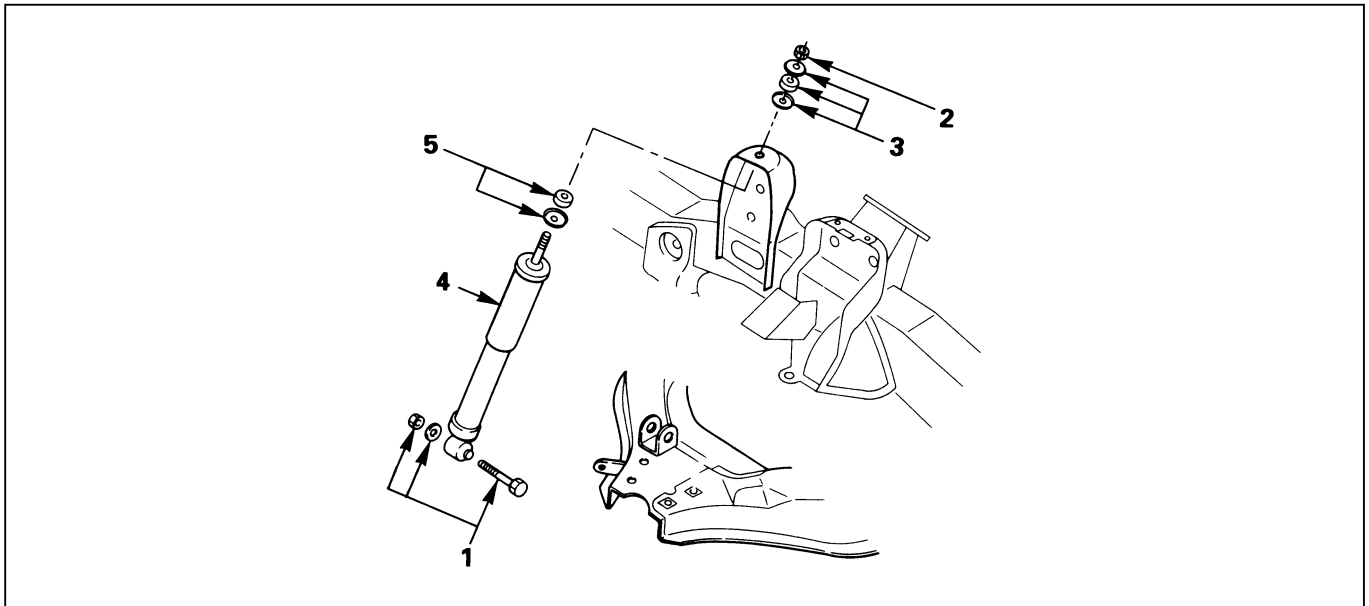
All models have a front suspension system consisting of control arms, stabilizer bar, shock absorber and a torsion bar. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into a height control arm at the crossmember. Vehicle trim height is controlled by adjusting this arm. Shock absorbers are mounted between the brackets on the frame and the lower control arms.

The lower portion of each shock absorber is attached to the lower control arm by a bolt and nut. The upper portion of each shock absorber extends through a frame bracket and is secured with two rubber bushings, three retainers and a nut. Ball joint assemblies are bolted to the outer end of the upper and lower control arm and are attached to the steering knuckle by nuts and cotter pins. The inner ends of the upper control arm have pressed in bushings. Bolts passing through the bushing, attach the control arm to the frame. The inner ends of the lower control arm are attached to the frame by bolts passing through the bushings, which are pressed in the frame.

Side roll of the front suspension is controlled by a spring steel stabilizer bar. It is mounted in rubber bushings, which are held to the crossmember by brackets. The ends of the stabilizer are connected to the lower control arms by link bolts isolated by rubber bushings.

ON-VEHICLE SERVICE

SHOCK ABSORBER



Removal Steps

1. Bolt, nut and washer
2. Nut
3. Rubber bushing and washer
4. Shock absorber
5. Rubber bushing and washer

Installation Steps

5. Rubber bushing and washer
4. Shock absorber
3. Rubber bushing and washer
2. Nut
1. Bolt, nut and washer

REMOVAL

Preparation:

- 1) Raise the vehicle and support it with suitable safety stands.
- 2) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.
 1. **Bolt, Nut and Washer**
 2. **Nut**
 3. **Rubber Bushing and Washer**
 4. **Shock Absorber**
 5. **Rubber Bushing and Washer**

INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

- Shock absorber
- Rubber bushing

 **INSTALLATION**

- 5. Rubber Bushing and Washer
- 4. Shock Absorber
- 3. Rubber Bushing and Washer
- 2. Nut

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
20 (2.0 / 14)	
<hr/>	

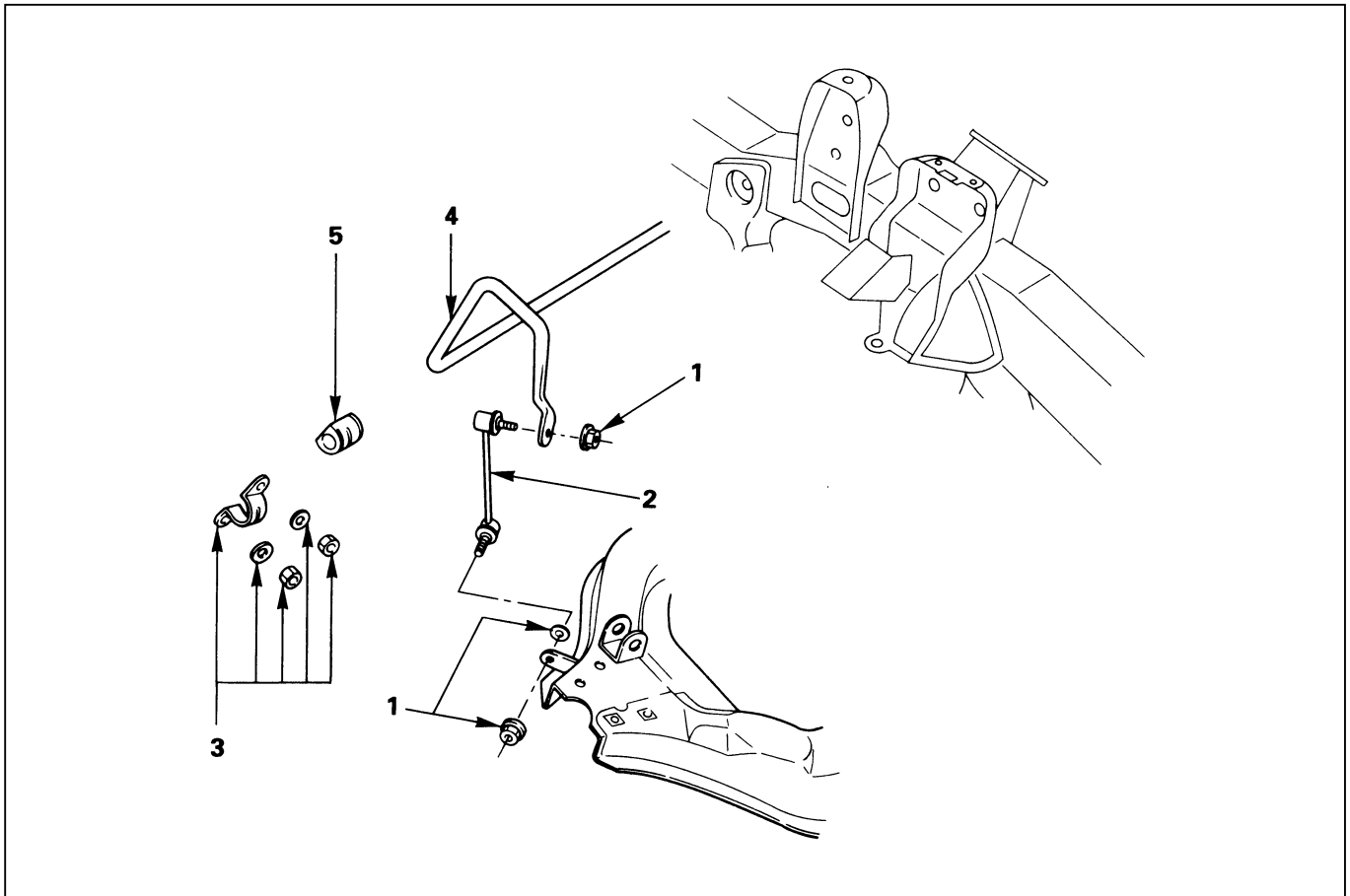


- 1. Bolt, Nut and Washer

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
82 (8.4 / 61)	
<hr/>	



STABILIZER BAR



Removal Steps

1. Nut and washer
2. Link
3. Bracket
4. Stabilizer bar
5. Rubber bushing

Installation Steps

5. Rubber bushing
4. Stabilizer bar
3. Bracket
2. Link
1. Nut and washer



REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove the stone guard.
- 3) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.

1. Nut and Washer



CAUTION:

Be careful not to break the ball joint boot.

2. Link
3. Bracket
4. Stabilizer Bar
5. Rubber Bushing



INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

- Stabilizer bar
- Rubber bushing
- Link ball joint



INSTALLATION

5. Rubber Bushing
4. Stabilizer Bar
3. Bracket



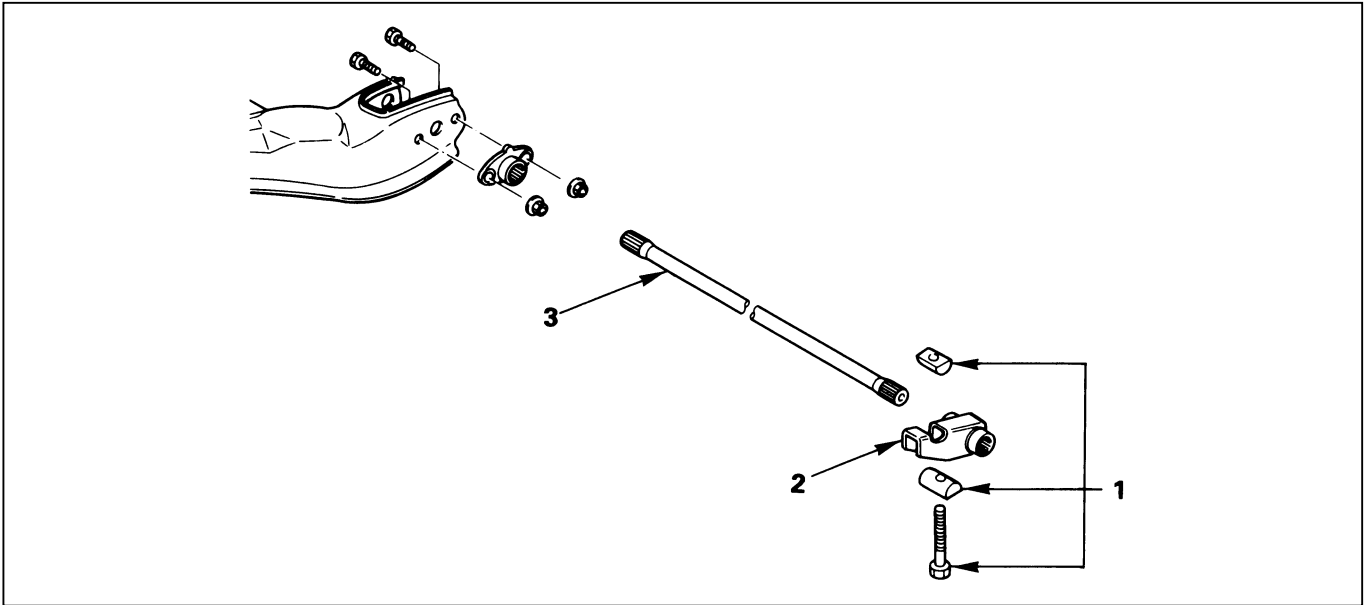
Bracket Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
22 (2.2 / 16)	
<hr/>	

2. Link
1. Nut and Washer



Link Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
50 (5.1 / 37)	
<hr/>	

TORSION BAR



Removal Steps

1. Adjust bolt, end piece and seat
2. Height control arm
3. Torsion bar

Installation Steps

3. Torsion bar
2. Height control arm
1. Adjust bolt, end piece and seat

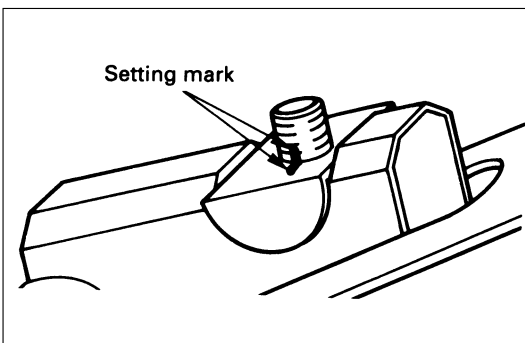
↔ REMOVAL

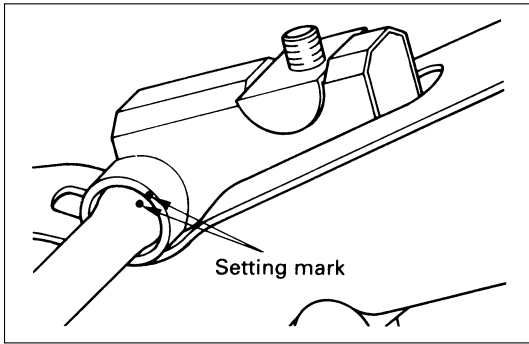
Preparation:

Raise the vehicle and support the frame with suitable safety stands.

1. Adjust Bolt, End Piece and Seat

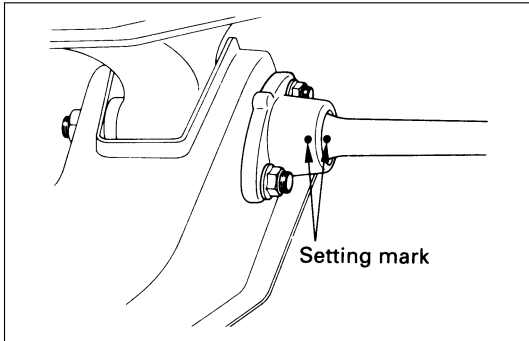
Apply the setting marks to the adjust bolt and end piece.





2. Height Control Arm

Apply the setting marks to the height control arm and torsion bar.



3. Torsion Bar

Apply the setting marks to the torsion bar and lower control arm.



INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

Check the following parts:

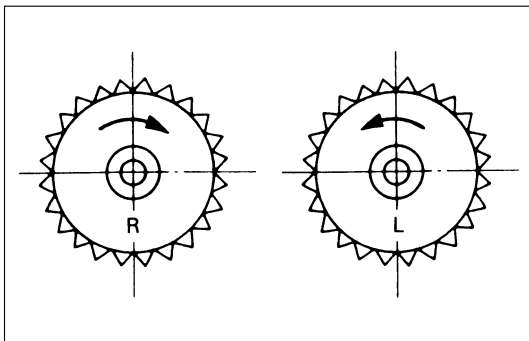
- Torsion bar
- Height control arm
- Adjust bolt
- Rubber seat



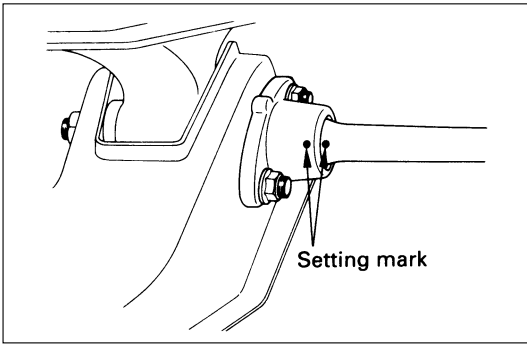
INSTALLATION

3. Torsion Bar

Make sure the bars are on their correct respective sides.



Apply grease to the serrated portions.



Align the setting marks.

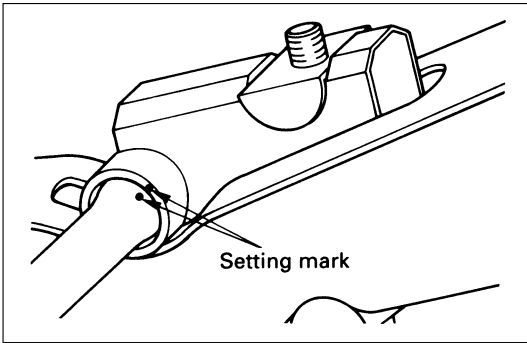


2. Height Control Arm

Apply grease to the portion that fits into the bracket.



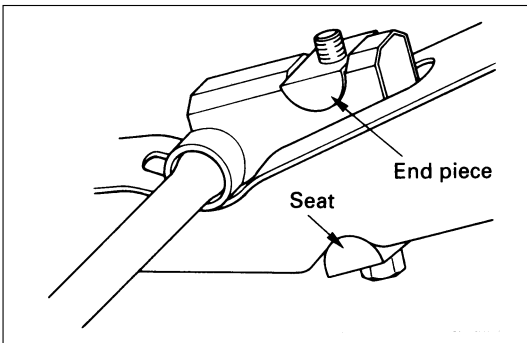
Align the setting marks.



Apply grease to the bolt portion of the end piece.



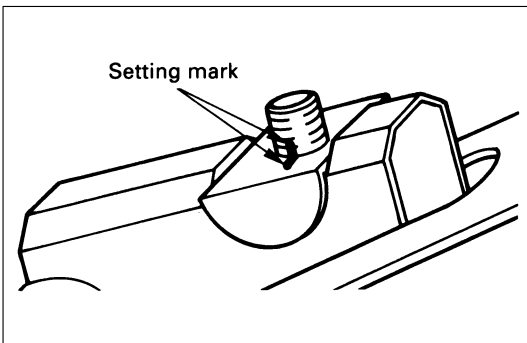
Apply grease to the portion of the seat that fits into the bracket.



Apply grease to the serrated portions.

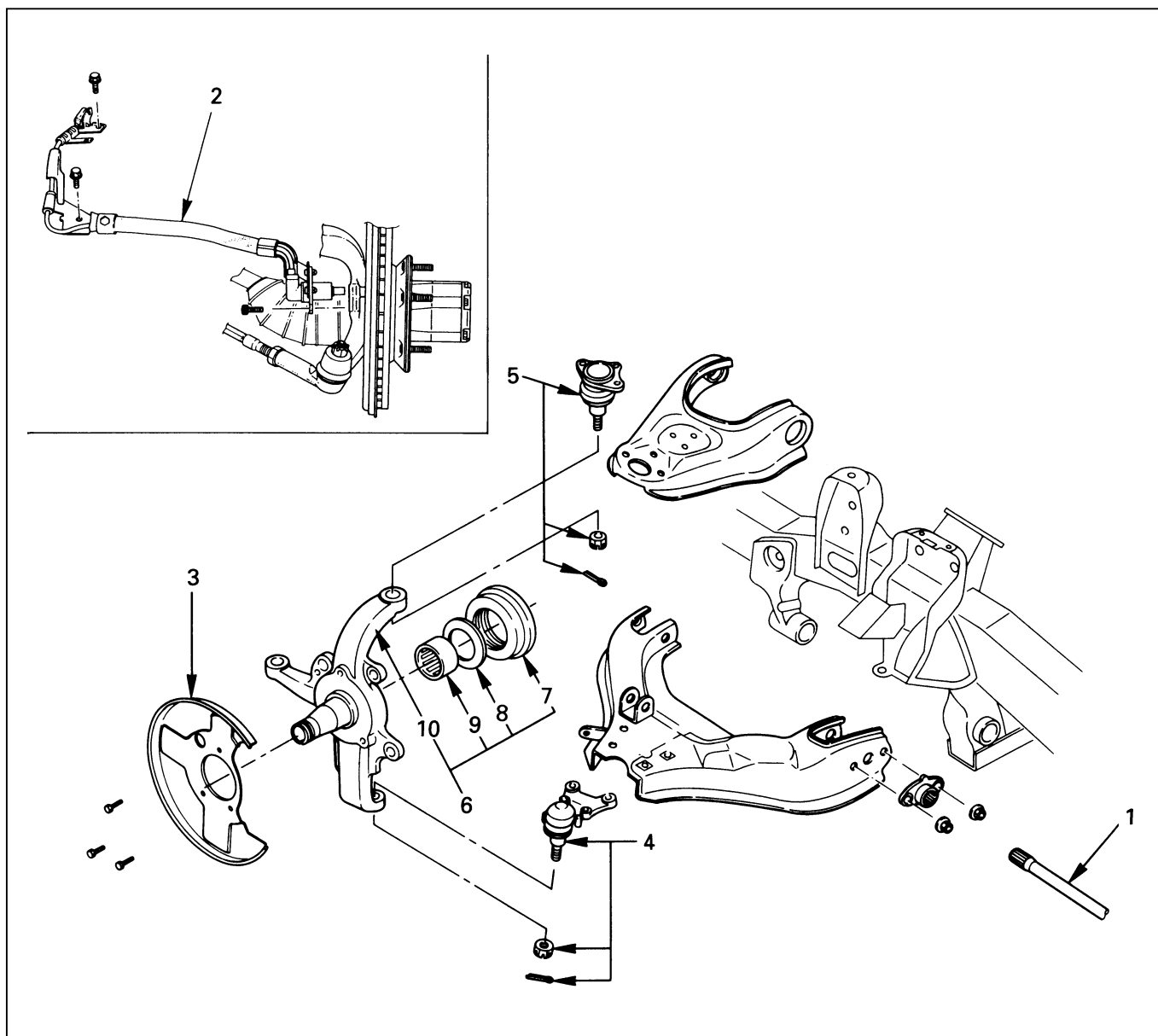
1. Adjust Bolt and Seat

Turn the adjust bolt to the setting mark applied during disassembly.



NOTE:
Adjust the trim height. Refer to "Front End Alignment" in section 3A.

KNUCKLE



Removal Steps

1. Torsion bar
2. Wheel speed sensor (if equipped with ABS)
3. Back plate
4. Lower ball joint
5. Upper ball joint
6. Knuckle assembly
7. Oil seal
8. Thrust washer
9. Needle bearing
10. Knuckle

Installation Steps

10. Knuckle
9. Needle bearing
8. Thrust washer
7. Oil seal
6. Knuckle assembly
5. Upper ball joint
4. Lower ball joint
3. Back plate
2. Wheel speed sensor (if equipped with ABS)
1. Torsion bar

REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.
- 3) Remove the brake caliper. Refer to "Brakes" in section 5.
- 4) Remove the hub assembly. Refer to "Hub and Disk" in section 4C.
- 5) Remove outer track rod from the knuckle. Refer to "Steering Linkage" in section 2A.

1. Torsion Bar

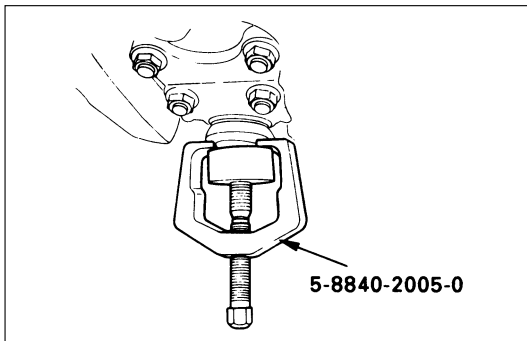
Loosen torsion bar by height control arm adjust bolt. Refer to "Torsion bar" in this section.

2. Wheel speed sensor (if equipped with ABS)

3. Back Plate

4. Lower Ball Joint

Remover: 5-8840-2005-0 (J-29107)

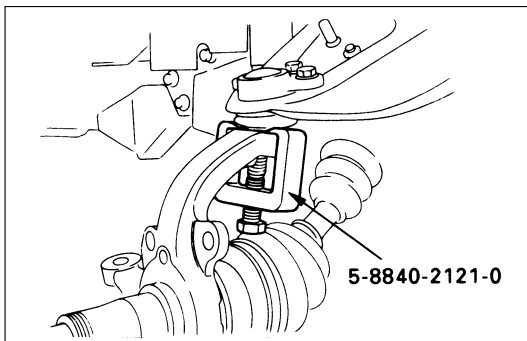


CAUTION:

Be careful not to break the ball joint boot.

5. Upper Ball Joint

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.

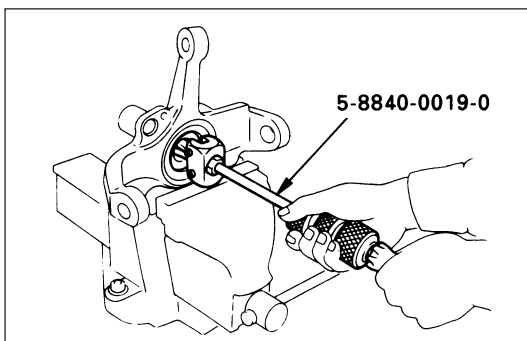
6. Knuckle Assembly

7. Oil Seal

8. Washer

9. Needle Bearing

Remover: 5-8840-0019-0 (J-23907)



10. Knuckle

 **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

Check the following parts:

- Knuckle
- Needle bearing
- Thrust washer

 **INSTALLATION**

10. Knuckle

9. Needle Bearing



Before installation, apply appropriate amount of multipurpose type grease to the new bearing (Approx. 5 g).



Installer: 5-8840-2128-0 (J-36838) and 5-8840-0007-0 (J-8092)



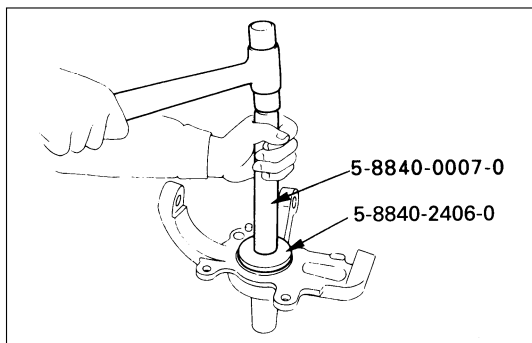
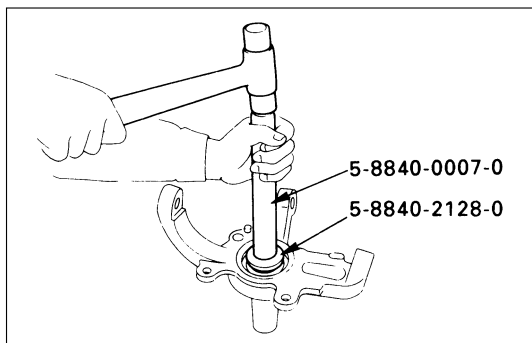
8. Washer

Apply multipurpose type grease to the thrust washer, and install it with chamfered side facing knuckle.



7. Oil Seal

Use a new oil seal, and apply multipurpose type grease to the area surrounded by the lip (approx. 2 g).



After fitting the oil seal to the installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer.

Installer: 5-8840-2406-0 (J-41468) and 5-8840-0007-0 (J-8092)



6. Knuckle Assembly

5. Upper Ball Joint

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

Upper Ball Joint Nut Torque	N·m (kg·m/lb·ft)
	98 (10.0 / 72)

**4. Lower Ball Joint**

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

Lower Ball Joint Nut Torque N·m (kg·m/lb·ft)

147 (15.0 / 108)

3. Back Plate**2. Wheel Speed Sensor (if equipped with ABS)**

Tighten the bolt to the specified torque.

Wheel Speed Sensor Bolt Torque N·m (kg·m/lb·in)

8 (0.8 / 69)

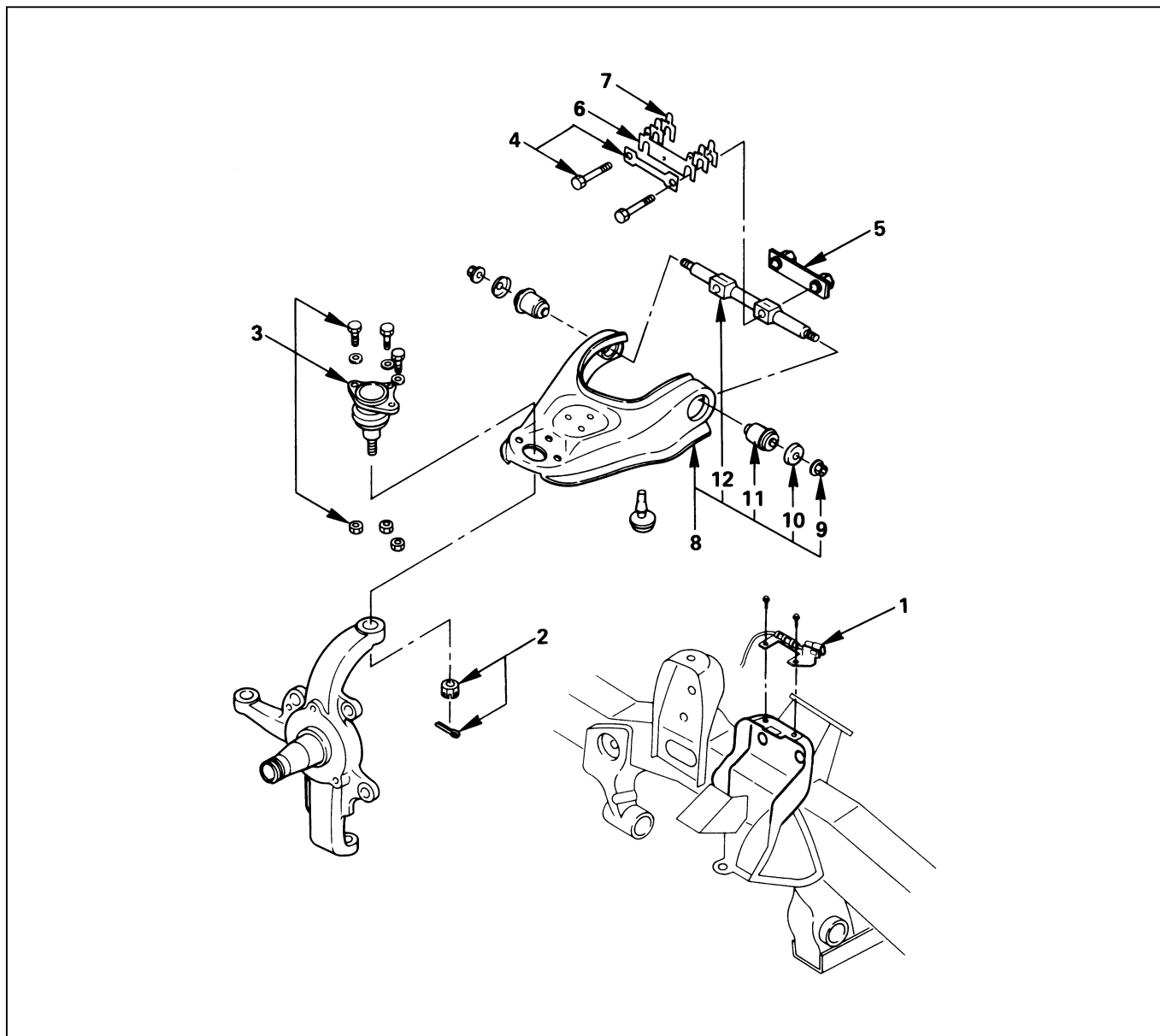
1. Torsion Bar

Refer to "Torsion Bar" in this section.

NOTE:

Adjust the trim height. Refer to "Front End Alignment" in section 2A.

UPPER CONTROL ARM



Removal Steps

1. Speed sensor cable (if equipped with ABS)
2. Nut and cotter pin
3. Upper ball joint
4. Bolt and plate
5. Nut assembly
6. Camber shims
7. Caster shims
8. Upper control arm assembly
9. Nut
10. Plate
11. Bushing
12. Fulcrum pin

Installation Steps

12. Fulcrum pin
11. Bushing
10. Plate
9. Nut
8. Upper control arm assembly
7. Caster shims
6. Camber shims
5. Nut assembly
4. Bolt and plate
3. Upper ball joint
2. Nut and cotter pin
1. Speed sensor cable (if equipped with ABS)

REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.
- 3) Remove the brake caliper and disconnect flexible hose. Refer to "Brakes" in section 5.
- 4) Support lower control arm with a jack.

1. Speed Sensor Cable (if equipped with ABS)

2. Nut and Cotter Pin

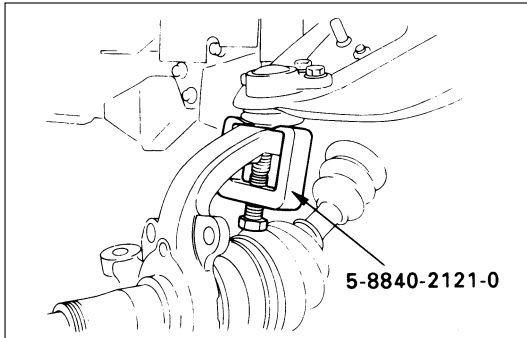
Remove the upper ball joint from the knuckle.

Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.



3. Upper Ball Joint

4. Bolt and Plate

5. Nut Assembly

6. Camber Shims

Note the positions and number of shims.

7. Caster Shims

Note the positions and number of shims.

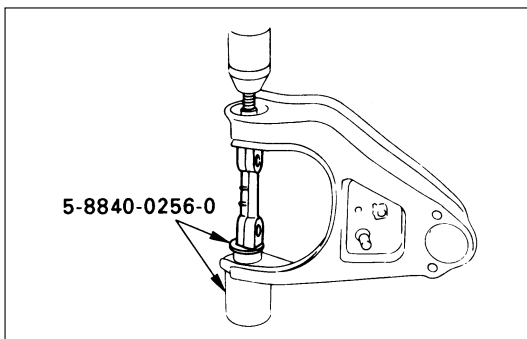
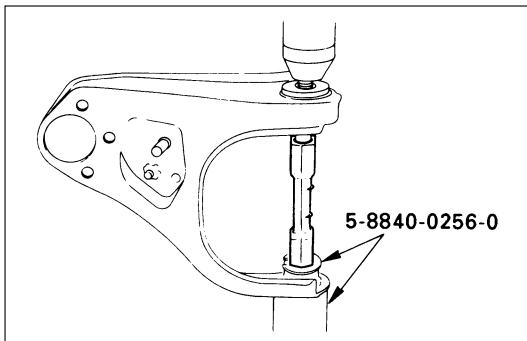
8. Upper Control Arm Assembly

9. Nut

10. Plate

11. Bushing

Remover: 5-8840-0256-0 (J-29755)



12. Fulcrum Pin



INSPECTION AND REPAIR

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

- Upper control arm
- Bushing
- Fulcrum pin



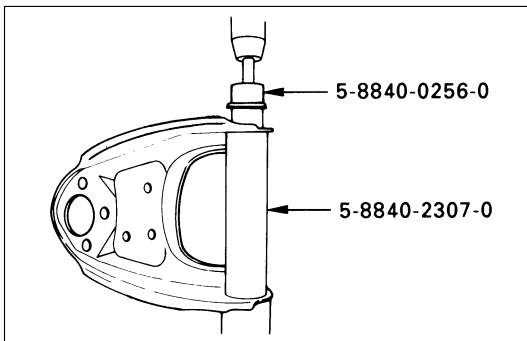
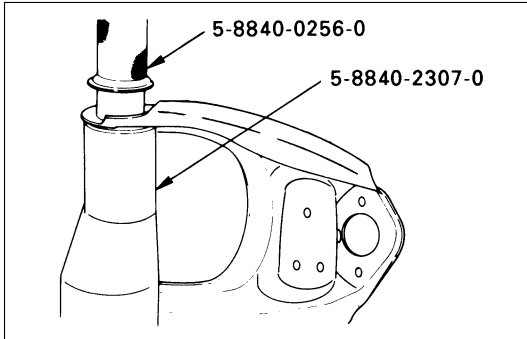
INSTALLATION

12. Fulcrum Pin



11. Bushing

Installer: 5-8840-0256-0 (J-29755) and 5-8840-2307-0 (J-39376)



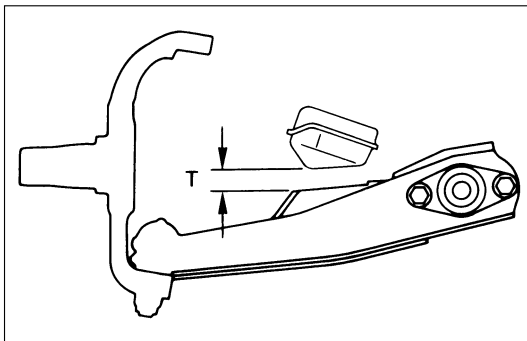
10. Plate

9. Nut

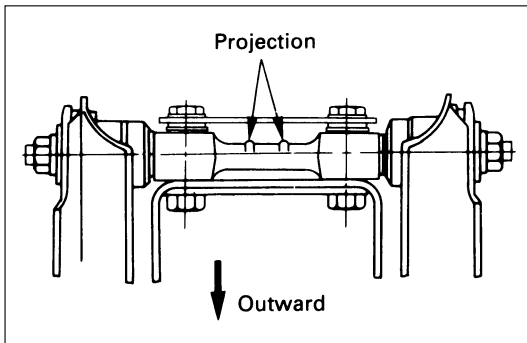
Tighten fulcrum pin nut finger-tight.

NOTE:

Torque fulcrum pin nut after adjusting buffer clearance.

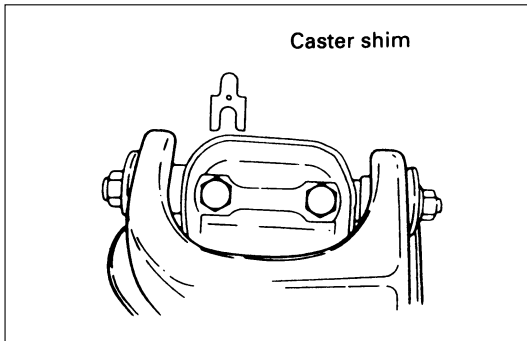


Buffer Clearance (T)	mm (in)
23 (0.91) Wide Tread	
24 (0.94) Narrow Tread	
Fulcrum Pin Nut Torque	N·m (kg·m/lb·ft)
108 (11.0 / 80)	



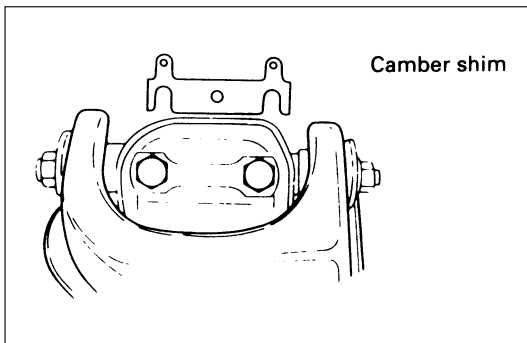
8. Upper Control Arm Assembly

Install upper control arm assembly with the fulcrum pin projections turned inward.



7. Caster Shims

Install the caster shims between the chassis frame and fulcrum pin.



6. Camber Shims

Install the camber shims between the chassis frame and fulcrum pin.

5. Nut Assembly



4. Bolt and Plate

Fulcrum Pin Bolt Torque	N·m (kg·m/lb·ft)
152 (15.2 / 112)	



3. Upper Ball Joint

Upper Ball Joint Nut Torque	N·m (kg·m/lb·ft)
57 (5.8 / 42)	



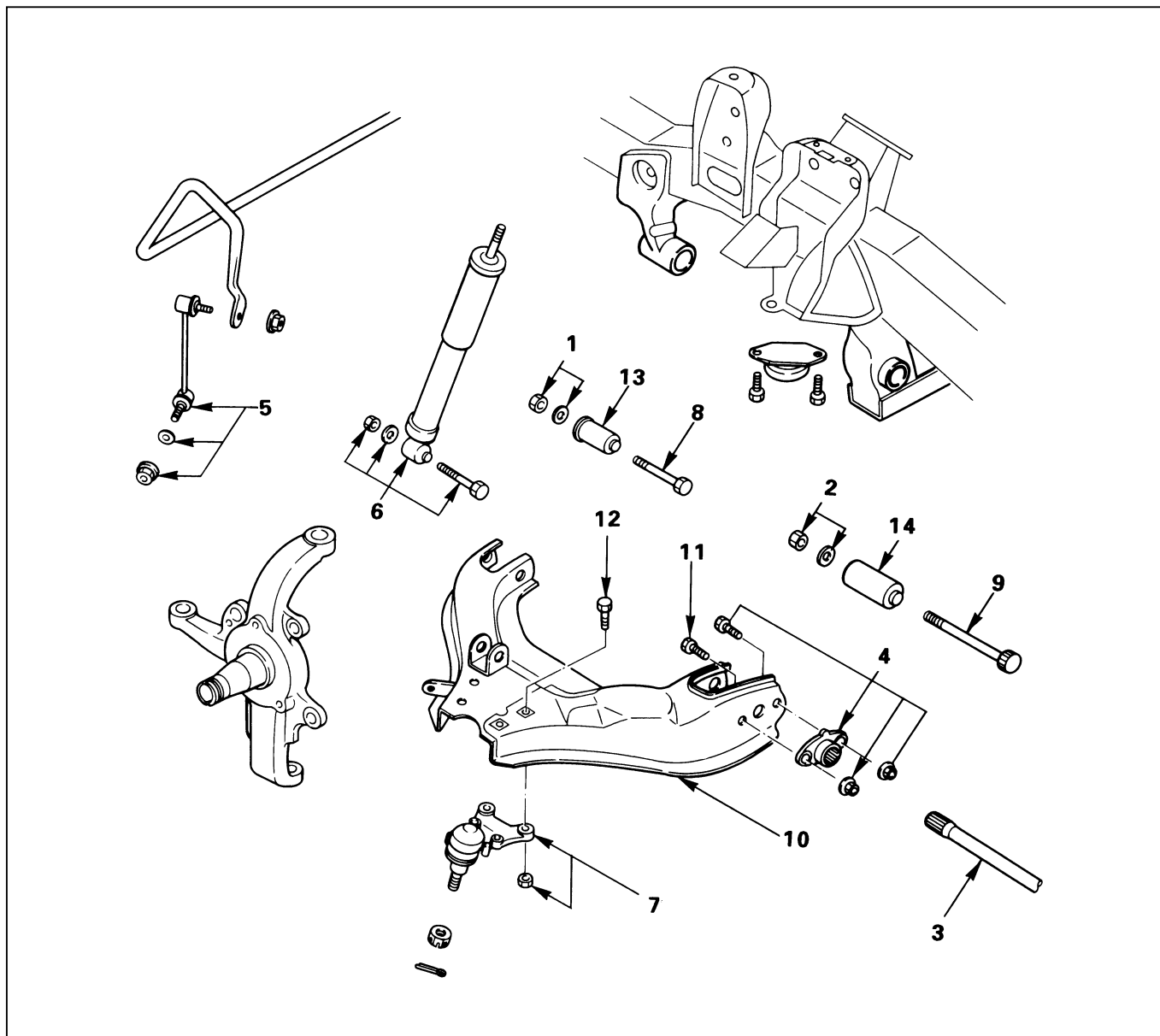
2. Nut and Cotter Pin

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

Upper Ball Joint Nut Torque	N·m (kg·m/lb·ft)
98 (10.0 / 72)	

1. Speed Sensor Cable (if equipped with ABS)

LOWER CONTROL ARM



Removal Steps

1. Nut and washer, front
2. Nut and washer, rear
3. Torsion bar
4. Torsion bar arm
5. Stabilizer link
6. Shock absorber
7. Lower ball joint
8. Bolt, front
9. Bolt, rear
10. Lower control arm
11. Bolt, torsion bar arm
12. Bolt, lower ball joint
13. Bushing, front
14. Bushing, rear

Installation Steps

14. Bushing, rear
13. Bushing, front
12. Bolt, lower ball joint
11. Bolt, torsion bar arm
10. Lower control arm
9. Bolt, rear
8. Bolt, front
7. Lower ball joint
6. Shock absorber
5. Stabilizer link
4. Torsion bar arm
3. Torsion bar
2. Nut and washer, rear
1. Nut and washer, front

↔ REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.
- 3) Remove the outer track rod from the knuckle. Refer to "Steering Linkage" in section 2A.
- 4) Remove the retaining ring from the front axle driving shaft to release the shaft from hub. Refer to "Front Axle" in section 4C.
- 5) Support lower control arm with a jack.

1. Nut and Washer, Front

2. Nut and Washer, Rear

3. Torsion Bar

Refer to "Torsion Bar" in this section.

4. Torsion Bar Arm Bracket

5. Stabilizer Link

Disconnect the link at the lower control arm.

6. Shock Absorber

Remove the shock absorber lower end from the lower control arm.

7. Lower Ball Joint

Remove the lower ball joint from the lower control arm.

8. Bolt, Front

9. Bolt, Rear

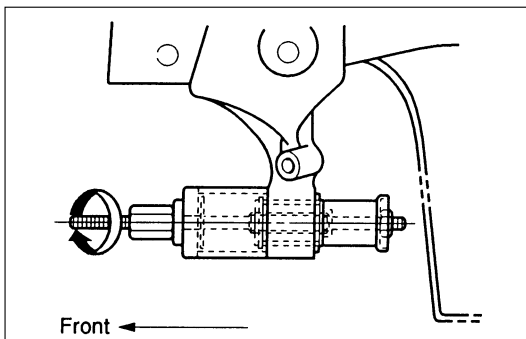
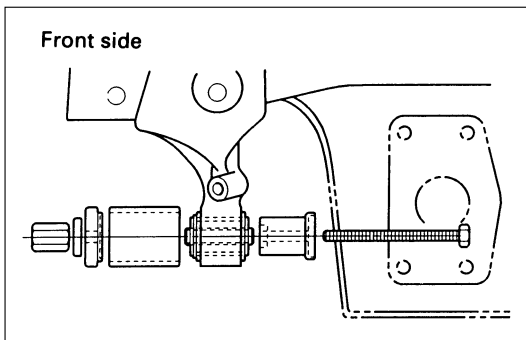
10. Lower Control Arm

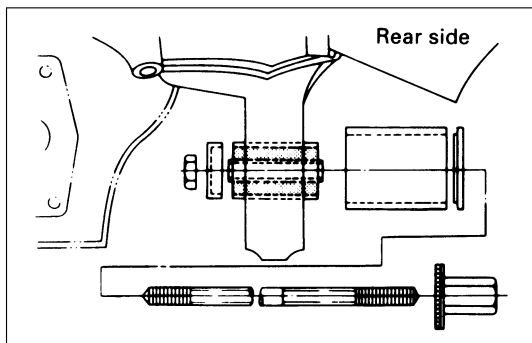
11. Bolt, Torsion Bar Arm

12. Bolt, Lower Ball Joint

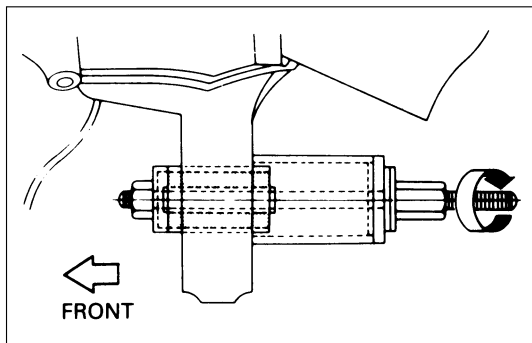
13. Bushing, Front

Remover: 5-8840-2123-0 (J-36833)





14. Bushing, Rear
Remover: 5-8840-2124-0 (J-36834)



INSPECTION AND REPAIR

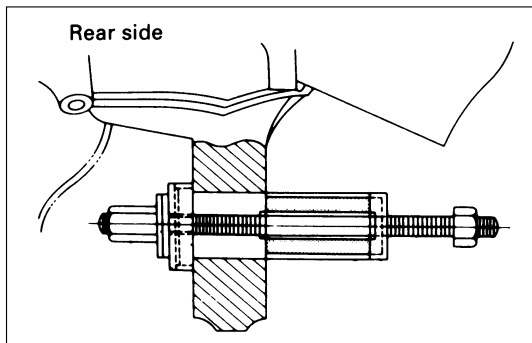
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

Check the following parts:

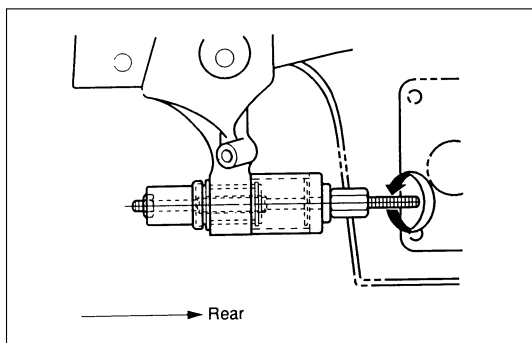
- Lower control arm
- Bushing



INSTALLATION



14. Bushing, Rear
Installer: 5-8840-2124-0 (J-36834)



13. Bushing, Front
Installer: 5-8840-2123-0 (J-36833)

- 12. Bolt, Lower Ball Joint
- 11. Bolt, Torsion Bar Arm
- 10. Lower Control Arm
- 9. Bolt, Rear
- 8. Bolt, Front



7. Lower Ball Joint

Lower Ball Joint Nut Torque	N·m (kg·m/lb·ft)
103 (10.5 / 76)	



6. Shock Absorber

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
82 (8.4 / 61)	



5. Stabilizer Link

Link Nut Torque	N·m (kg·m/lb·ft)
50 (5.1 / 37)	



4. Torsion Bar Arm Bracket

Torsion Bar Arm Bracket Nut Torque	N·m (kg·m/lb·ft)
116 (11.8 / 85)	

3. Torsion Bar

Refer to "Torsion Bar" in this section.

2. Nut and Washer, Rear

Tighten lower link nut finger-tight.

NOTE:

Torque lower control arm nut after adjusting buffer clearance.



Buffer Clearance (T)	mm (in)
23 (0.91) Wide Tread	
24 (0.94) Narrow Tread	



Lower Arm Rear Nut Torque	N·m (kg·m/lb·ft)
196 (20.0 / 145)	

1. Nut and Washer, Front

Tighten lower link nut finger-tight.

NOTE:

Torque lower control arm nut after adjusting buffer clearance.



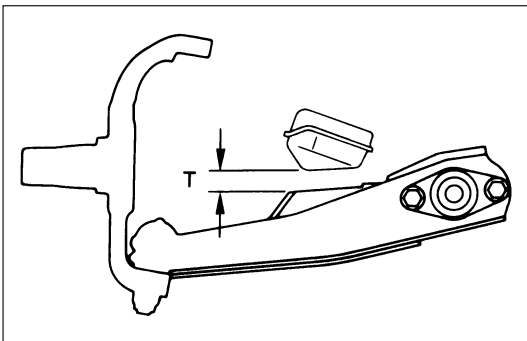
Buffer Clearance (T)	mm (in)
23 (0.91) Wide Tread	
24 (0.94) Narrow Tread	



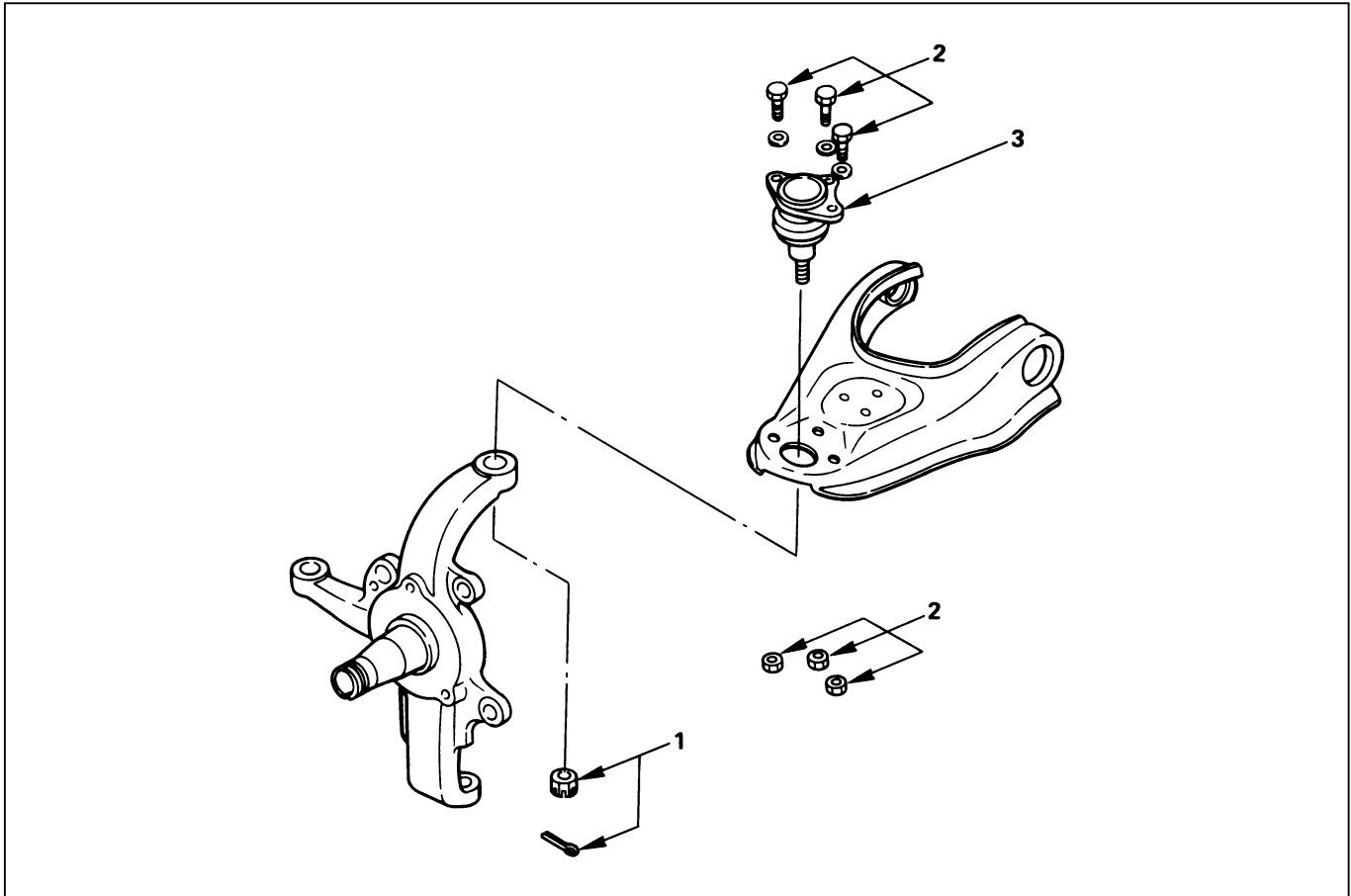
Lower Arm Front Nut Torque	N·m (kg·m/lb·ft)
157 (16.0 / 116)	

NOTE:

Adjust the trim height. Refer to "Front End Alignment" in section 2A.



UPPER BALL JOINT



Removal Steps

1. Nut and cotter pin
2. Bolt, nut and washer
3. Upper ball joint

Installation Steps

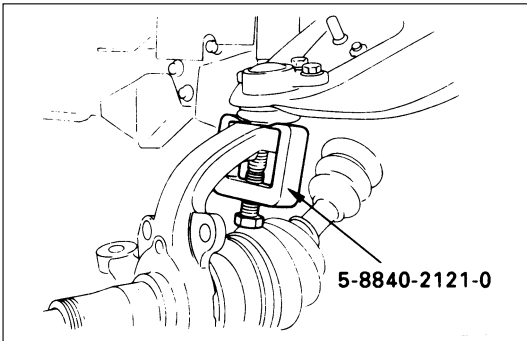
3. Upper ball joint
2. Bolt, nut and washer
1. Nut and cotter pin



REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove the speed sensor from the knuckle (if equipped with ABS).



1. Nut and Cotter Pin

Remove the upper ball joint from the knuckle.
Remover: 5-8840-2121-0 (J-36831)



CAUTION:

Be careful not to break the ball joint boot.

2. Bolt, Nut and Washer

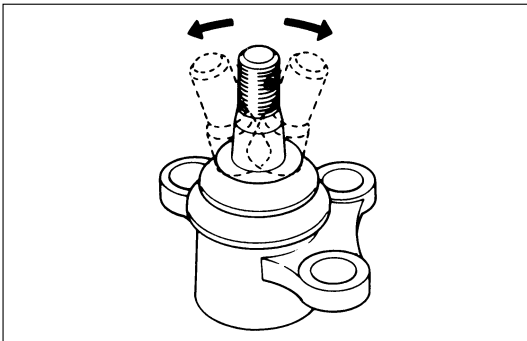
3. Upper Ball Joint



INSPECTION AND REPAIR

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.

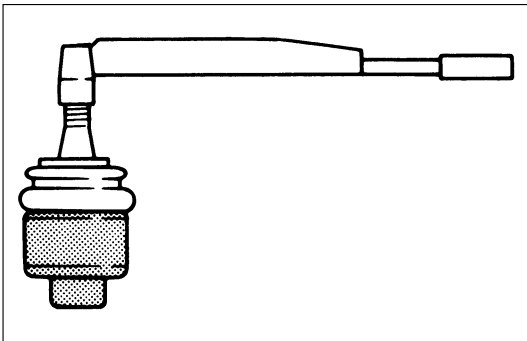


Inspect screw/taper area of ball for flaws.

If any defects are found by the above inspections, replace the ball joint assembly with new one.



After moving the ball joint 4 or 5 times, attach nut then measure the preload.



Upper Ball Joint Preload	N·m (kg·m/lb·in)
--------------------------	------------------

0.5 – 3.2 (0.05 – 0.33 / 4.3 – 28.6)

If the above limits specified are exceeded, replace the ball joint assembly.



INSTALLATION

3. Upper Ball Joint



2. Bolt, Nut and Washer

Upper Ball Joint Bracket Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
57 (5.8 / 42)	
<hr/>	

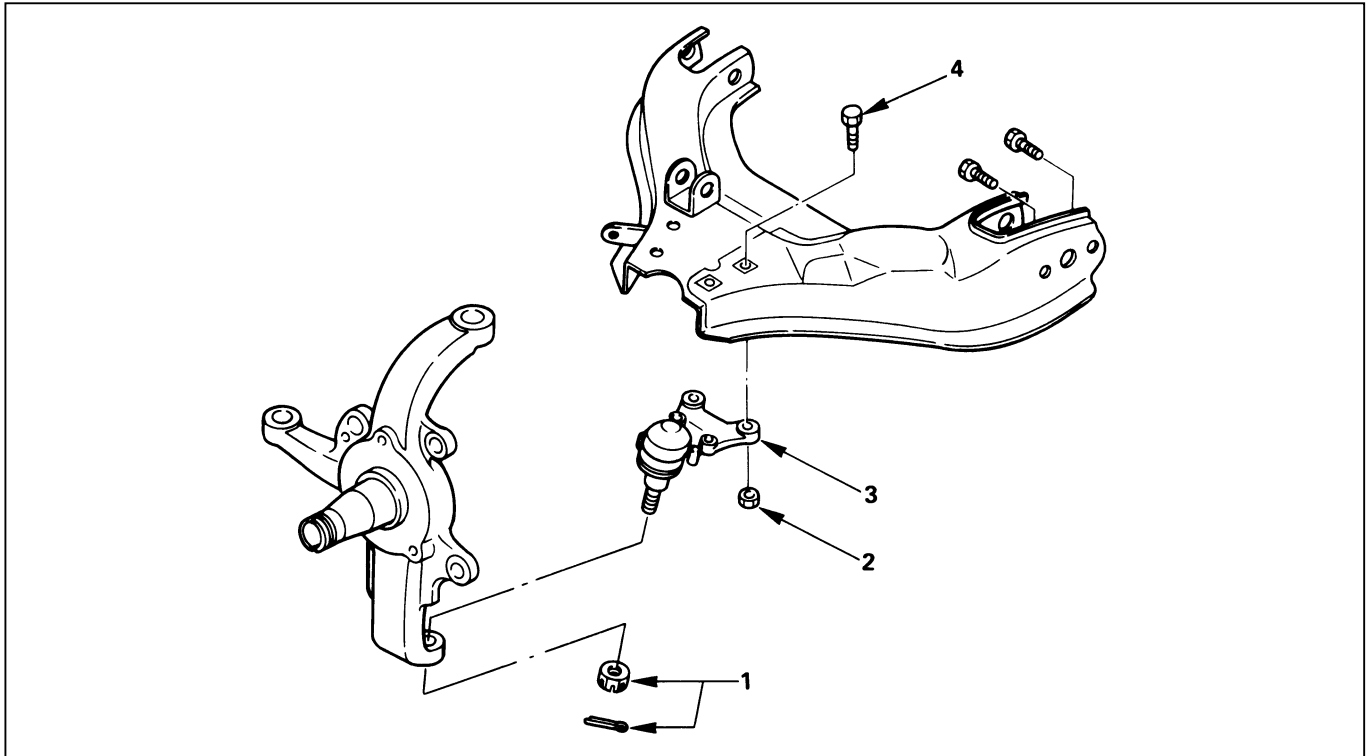


1. Nut and Cotter Pin

Tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

Upper Ball Joint Nut Torque	N·m (kg·m/lb·ft)
<hr/>	
98 (10.0 / 72)	
<hr/>	

LOWER BALL JOINT



Removal Steps

1. Nut and cotter pin
2. Nut
3. Lower ball joint
4. Bolt

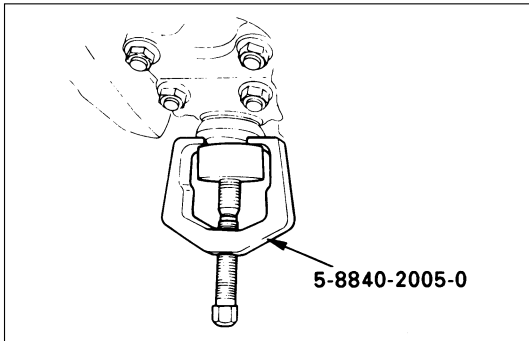
Installation Steps

4. Bolt
3. Lower ball joint
2. Nut
1. Nut and cotter pin

↔ REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove wheel and tire assembly. Refer to "Wheels and Tires" in section 3E.
- 3) Remove the outer track rod from the knuckle. Refer to "Steering Linkage" in section 2A.
- 4) Remove the retaining ring from the front axle driving shaft to release the shaft from hub. Refer to "Front Axle" in section 4C.
- 5) Support lower control arm with a jack.



1. Nut and Cotter Pin

Remove the upper ball joint from the knuckle.
Remover: 5-8840-2005-0 (J-29107)



CAUTION:

Be careful not to break the ball joint boot.

2. Nut

3. Lower Ball Joint

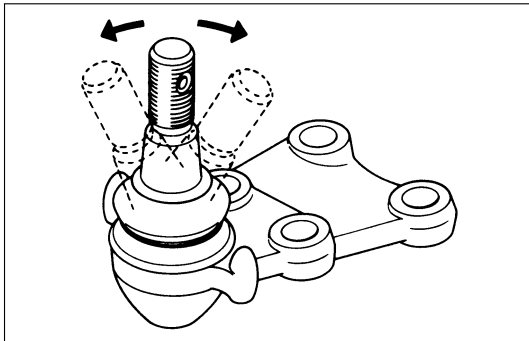
4. Bolt



INSPECTION AND REPAIR

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.



Inspect screw/taper area of ball for flaws.

If any defects are found by the above inspections, replace the ball joint assembly with new one.

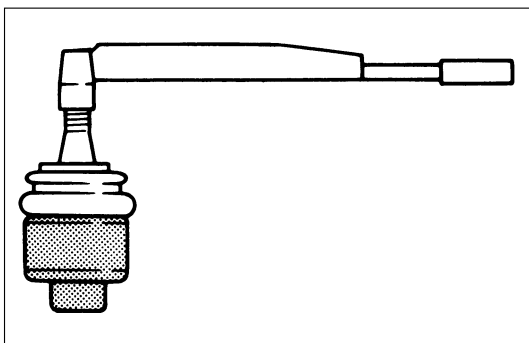
After moving the ball joint 4 or 5 times, attach nut then measure the preload.



Lower Ball Joint Preload	N·m (kg·m/lb·in)
--------------------------	------------------

0.5 - 6.4 (0.05 - 0.65 / 4.3 - 56.4)

If the above limits specified are exceeded, replace the ball joint assembly.





INSTALLATION

4. Bolt



3. Lower Ball Joint

2. Nut

Lower Ball Joint Bracket Nut Torque	N·m (kg·m/lb·ft)
-------------------------------------	------------------

103 (10.5 / 76)



1. Nut and Cotter Pin

Tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

Lower Ball Joint Nut Torque	N·m (kg·m/lb·ft)
-----------------------------	------------------

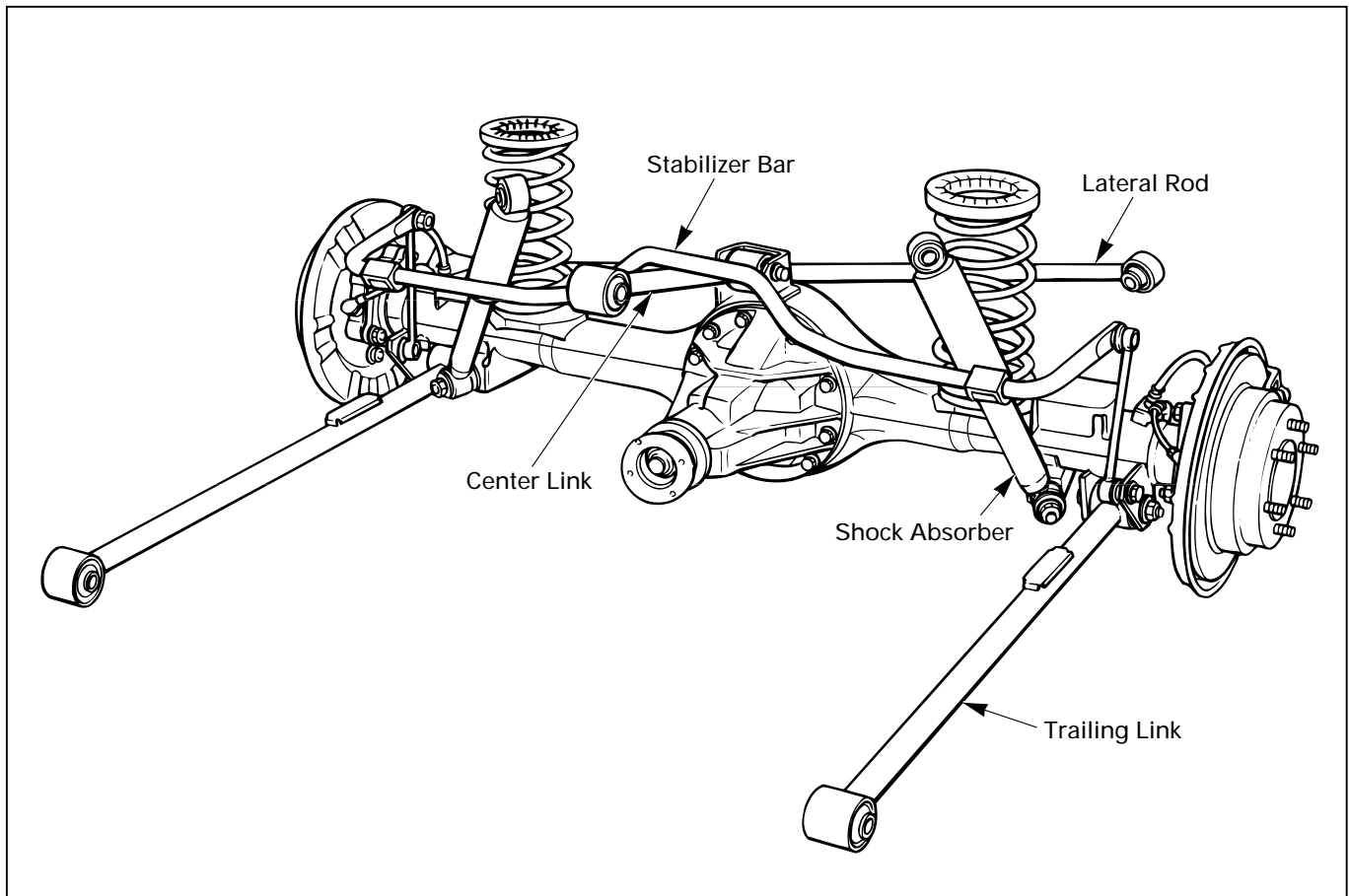
147 (15.0 / 108)

SECTION 3D
REAR SUSPENSION;
COIL SPRING

CONTENTS

	PAGE
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Shock Absorber	3D - 6
Trailing Link	3D - 8
Center Link	3D - 10
Lateral Rod	3D - 12
Stabilizer Bar	3D - 15

GENERAL DESCRIPTION



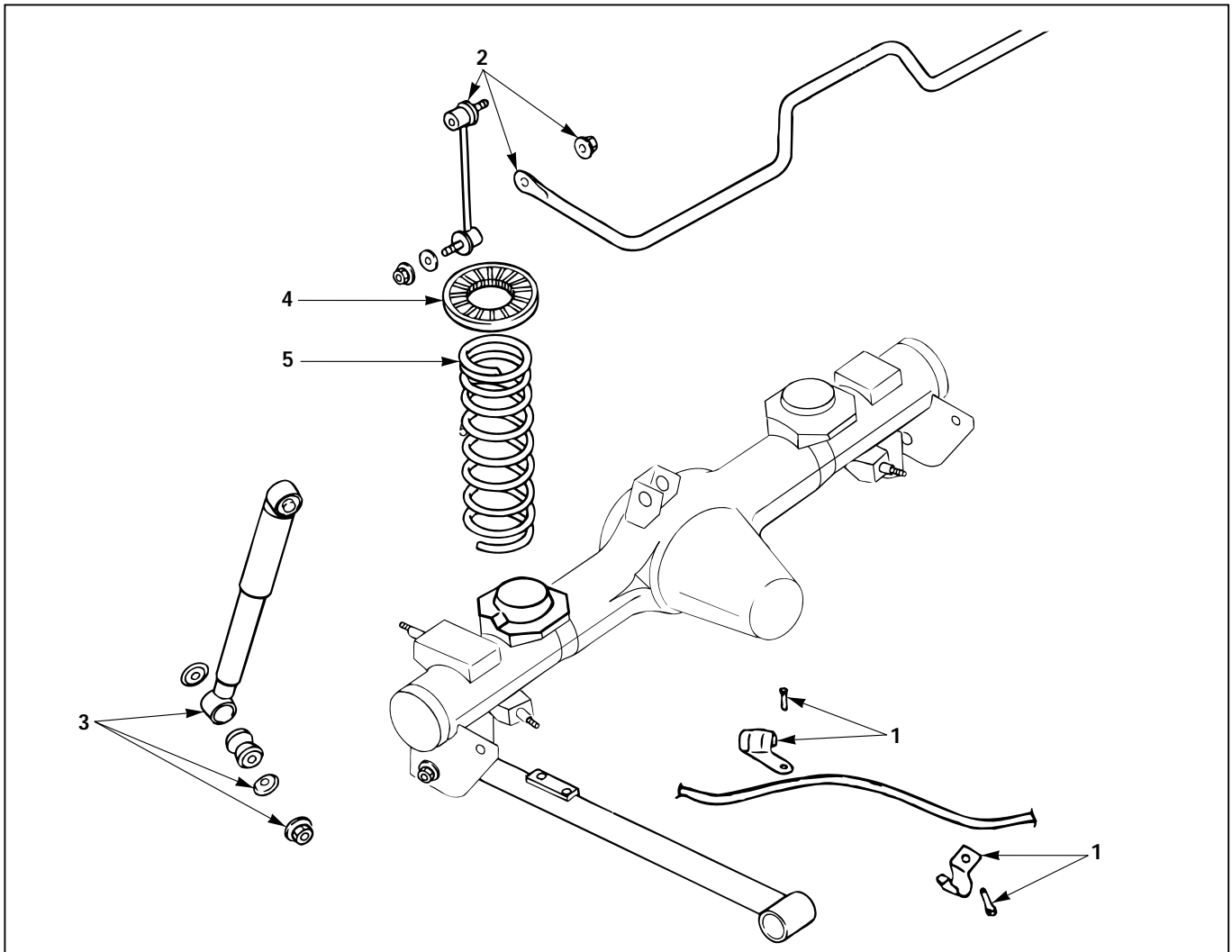
C03RW003

The rear suspension is a 4-link, coil spring type suspension with a stabilizer, consisting of two trailing links, center link, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in

improved stability, riding comfort, and rough road maneuverability. Each link connects the axle housing with the frame through a rubber bushing. The axle housing is supported by the trailing links and center link longitudinally and by the lateral rod latitudinally.

ON-VEHICLE SERVICE

COIL SPRING



460RW024

Removal Steps

1. Parking brake cable bracket
2. Stabilizer bar
3. Shock absorber
4. Insulator
5. Coil spring

Installation Steps

5. Coil spring
4. Insulator
3. Shock absorber
2. Stabilizer bar
1. Parking brake cable bracket

↔ REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Support the rear axle case with a jack.
 1. **Parking Brake Cable Bracket**
Remove the parking brake cable from the trailing link.
 2. **Stabilizer Bar**
Disconnect the stabilizer bar at the stabilizer link.
 3. **Shock Absorber**
Remove the shock absorber from the axle case.
 4. **Insulator**
 5. **Coil Spring**
Remove the insulator and coil spring while lowering the rear axle case.



CAUTION:

Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.



INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

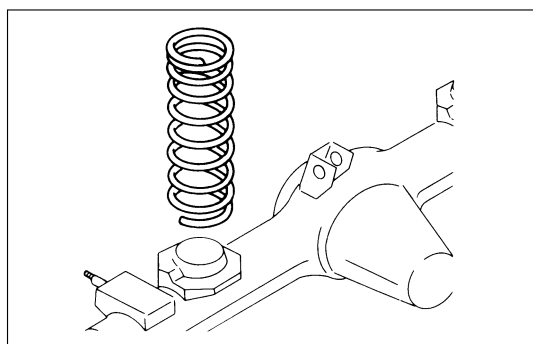
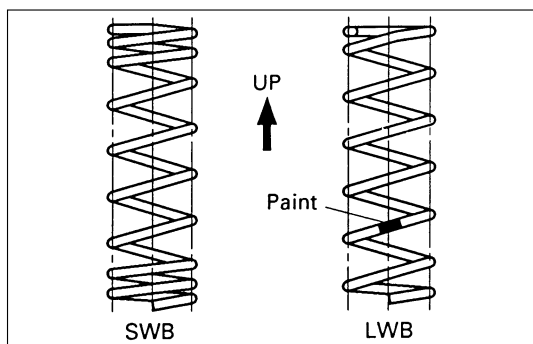
- Coil spring
- Insulator



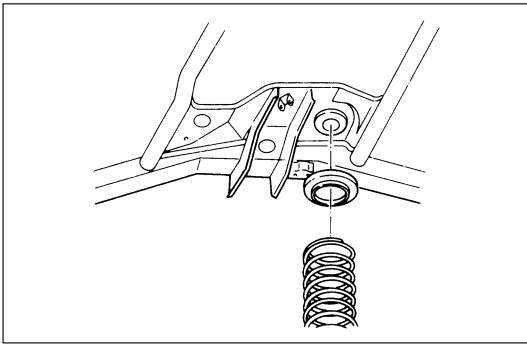
INSTALLATION

5. Coil Spring

Make sure that the coil spring is installed in the proper position.



Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.



4. Insulator

Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring to set the spring seat on the frame side.



3. Shock Absorber

Tighten the nut lightly, and retighten to the specified torque after the vehicle is at curb height.

NOTE:

When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
	78 (8.0 / 58)

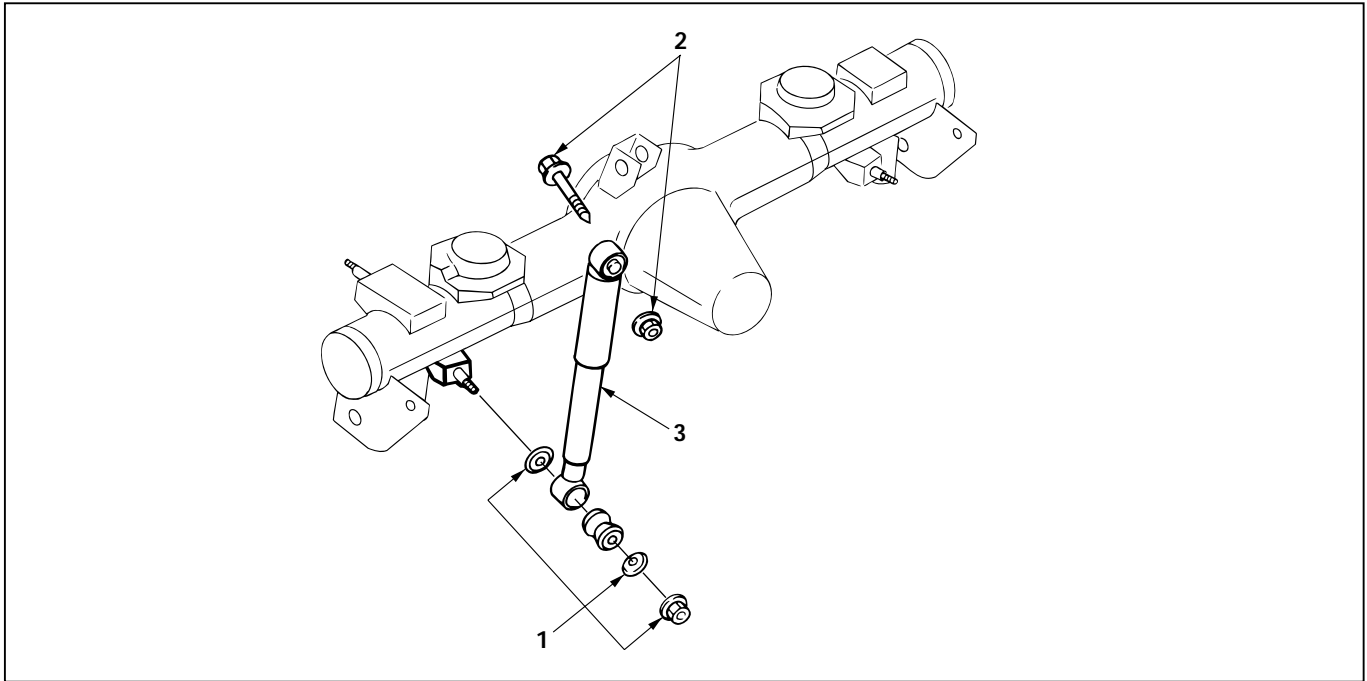


2. Stabilizer Bar

Stabilizer Bar Nut Torque	N·m (kg·m/lb·ft)
	50 (5.1 / 37)

1. Parking Brake Cable Bracket

SHOCK ABSORBER



461RW003

Removal Steps

1. Nut and washer
2. Bolt, nut and washer
3. Shock absorber

Installation Steps

3. Shock absorber
2. Bolt, nut and washer
1. Nut and washer



REMOVAL

1. Nut and Washer
2. Bolt, Nut and Washer
3. Shock Absorber



INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

- Shock absorber
- Rubber bushing (Axle side)



INSTALLATION

3. Shock Absorber

NOTE:

When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.



2. Bolt, Nut and Washer

NOTE:

Tighten the bolt and nut lightly, and retighten to the specified torque after the vehicle is at curb height.

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
	95 (9.7 / 70)



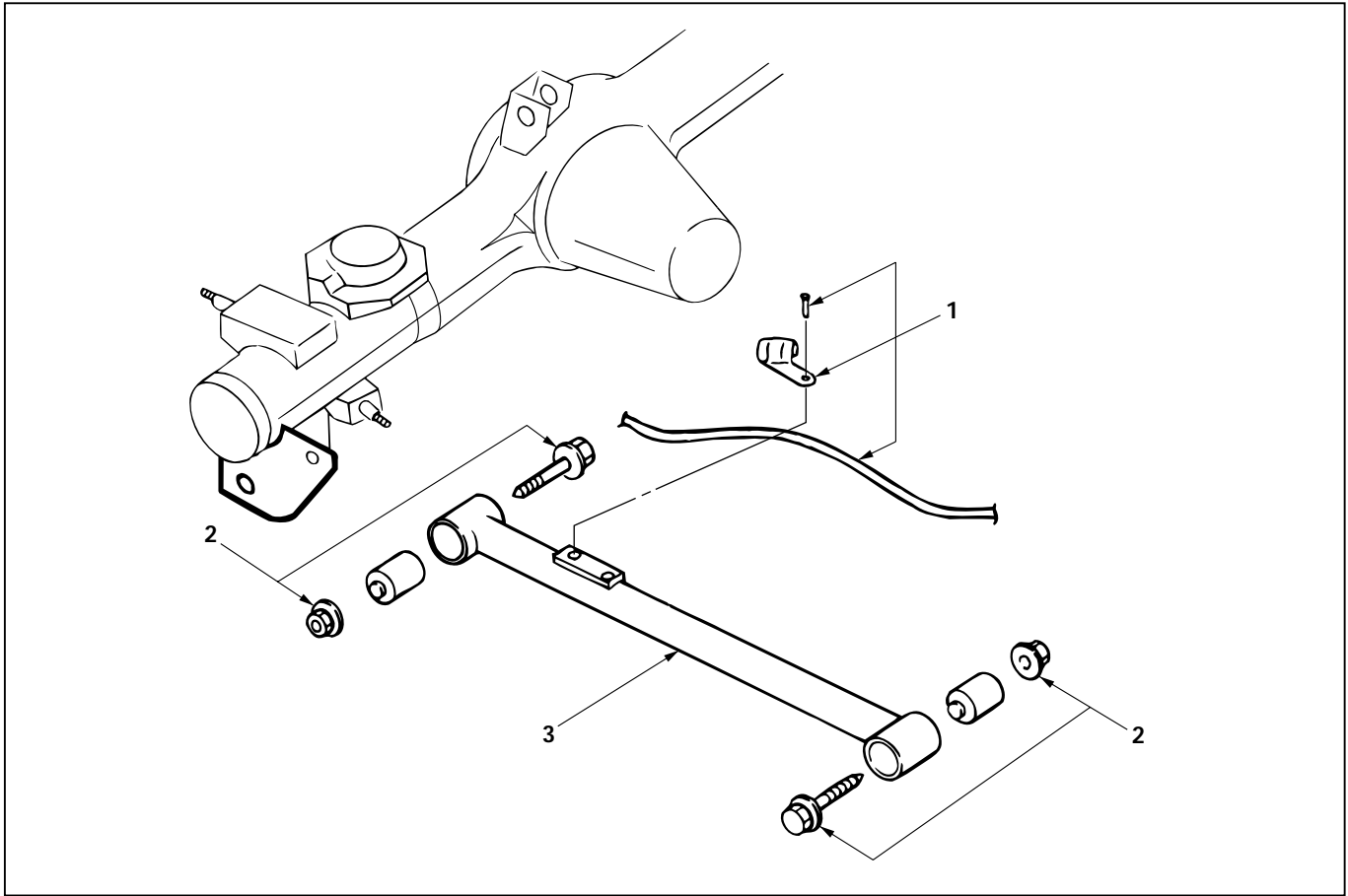
1. Nut and Washer

NOTE:

Tighten the bolt and nut lightly, and retighten to the specified torque after the vehicle is at curb height.

Shock Absorber Nut Torque	N·m (kg·m/lb·ft)
	78 (8.0 / 58)

TRAILING LINK



460RW025

Removal Steps

1. Parking brake cable
2. Bolt and nut
3. Trailing link

Installation Steps

3. Trailing link
2. Bolt and nut
1. Parking brake cable



REMOVAL

1. **Parking Brake Cable**
Remove the parking brake cable from the trailing link.
2. **Bolt and Nut**
3. **Trailing Link**



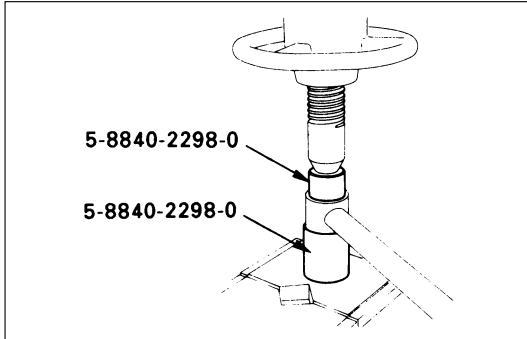
INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. **Trailing Link**
2. **Rubber Bushing**



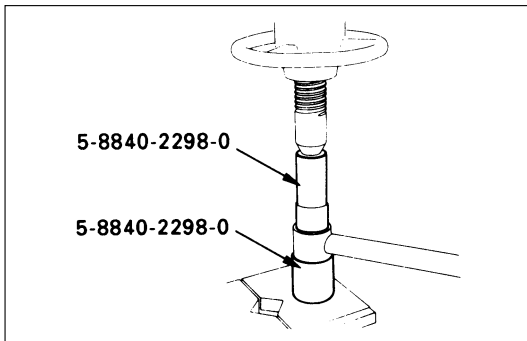
Remove the rubber bushing.
Remover: 5-8840-2298-0 (J-39214)



Install the rubber bushing.
Installer: 5-8840-2298-0 (J-39214)

NOTE:

When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.



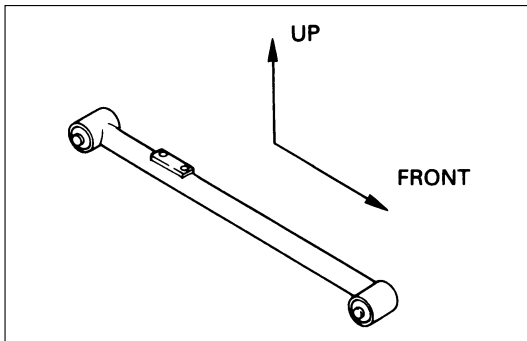
INSTALLATION



3. **Trailing Link**
Make sure that the trailing link is in its correct position.

NOTE:

When mounting trailing link, be sure not to use grease on bushings or any other nearby part.



2. **Bolt and Nut**

NOTE:

Tighten the bolts and nuts lightly, and retighten to the specified torque after the vehicle is at curb height.

Trailing Link Nut Torque	N·m (kg·m/lb·ft)
	137 (14.0 / 101)

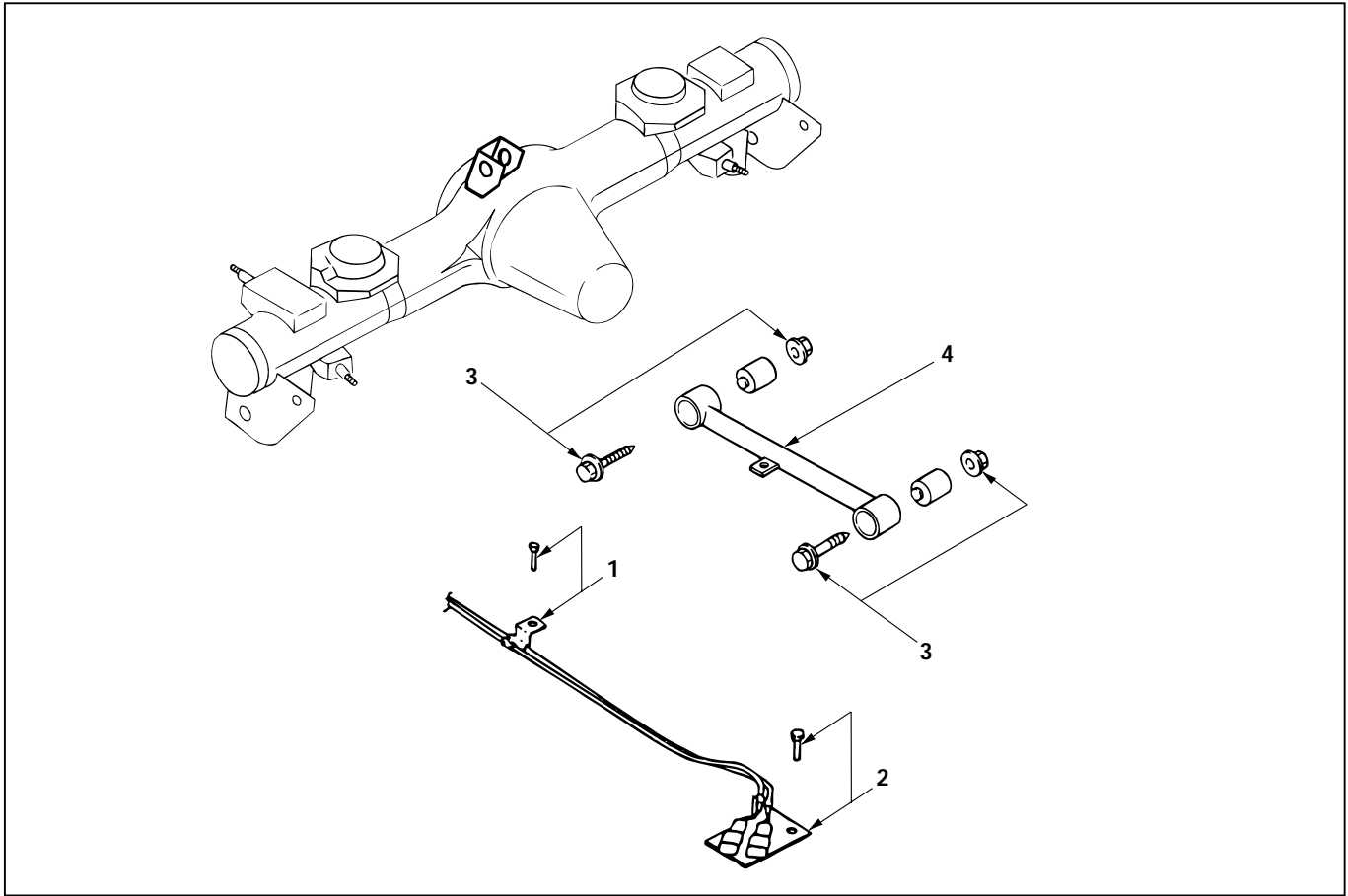
1. **Parking Brake Cable**



CAUTION:

The parking brake cable should not be overstrained or slackened.

CENTER LINK



460RW026

Removal Steps

1. Speed sensor cable
(If equipped with ABS)
2. Speed sensor cable bracket
(If equipped with ABS)
3. Bolt and nut
4. Center link

Installation Steps

4. Center link
3. Bolt and nut
2. Speed sensor cable bracket
(If equipped with ABS)
1. Speed sensor cable
(If equipped with ABS)

REMOVAL

1. **Speed Sensor Cable (If equipped with ABS)**
Remove the speed sensor cable from the center link.
2. **Speed Sensor Cable Bracket (If equipped with ABS)**
Remove the speed sensor cable bracket from the frame.
3. **Bolt and Nut**
4. **Center Link**



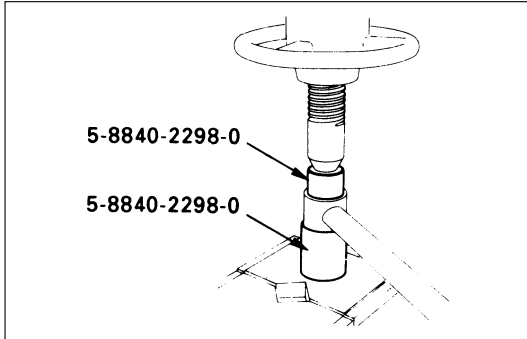
INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Center Link
2. Rubber Bushing



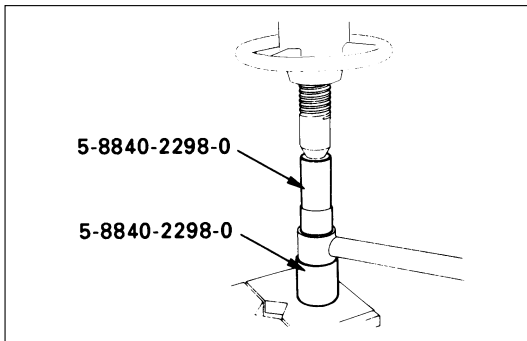
Remove the rubber bushing.
Remover: 5-8840-2298-0 (J-39214)



Install the rubber bushing.
Installer: 5-8840-2298-0 (J-39214)

NOTE:

When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.



INSTALLATION

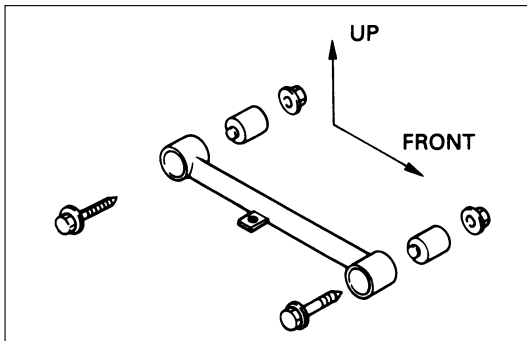


4. Center Link

Make sure that the center link is in its correct position.

NOTE:

When mounting center link, be sure not to use grease on bushings or any other nearby part.



3. Bolt and Nut

NOTE:

Tighten the bolts and nuts lightly, and retighten to the specified torque after the vehicle is at curb height.

Center Link Nut Torque	N-m (kg-m/lb-ft)
------------------------	------------------

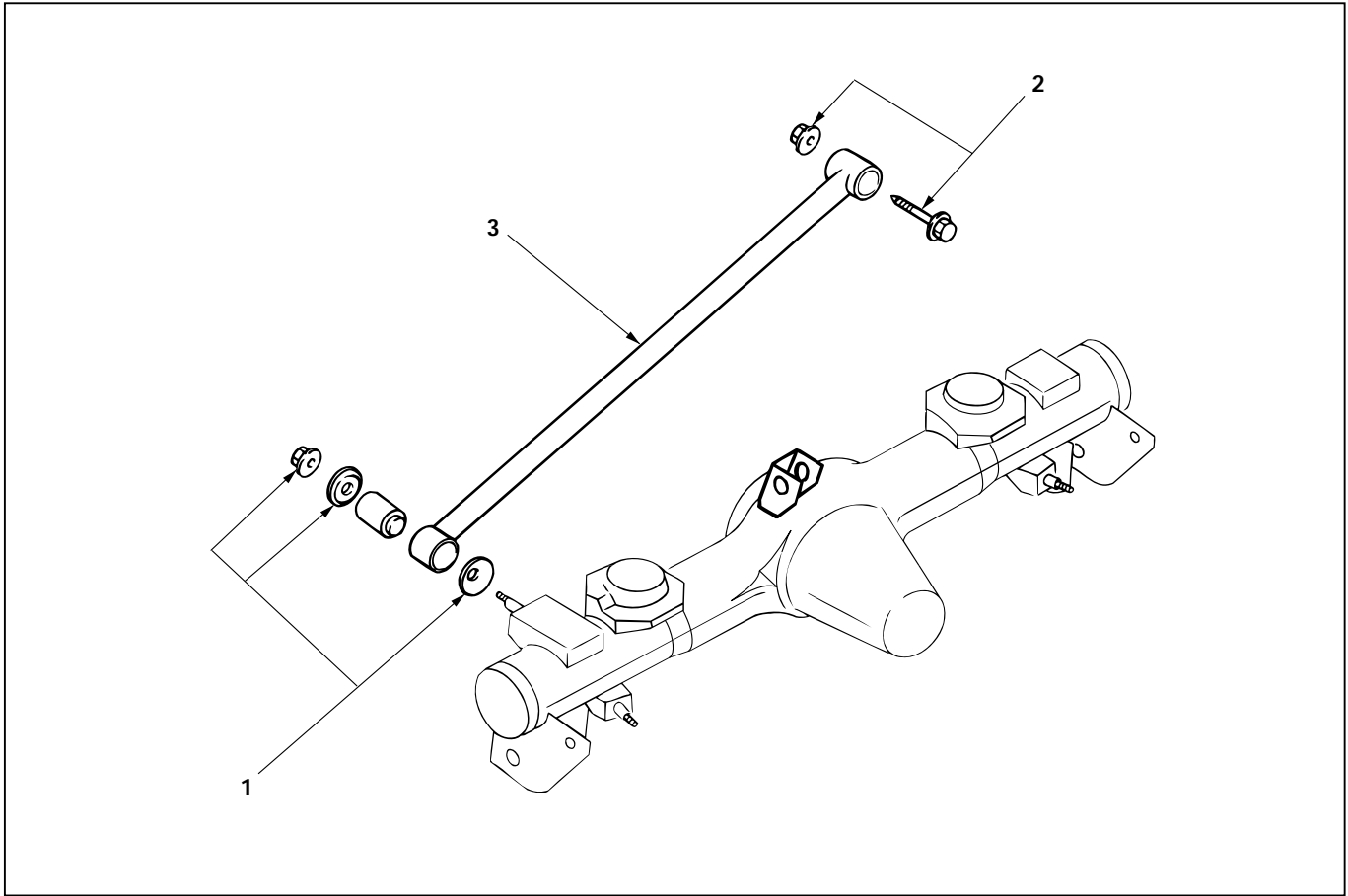


137 (14.0 / 101)

2. Speed Sensor Cable Bracket

1. Speed Sensor Cable

LATERAL ROD



460RW027

Removal Steps

1. Nut and washer
2. Bolt and nut
3. Lateral rod

Installation Steps

1. Nut and washer
2. Bolt and nut
3. Lateral rod



REMOVAL

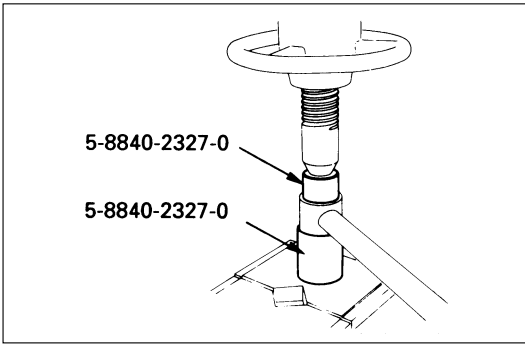
1. Nut and Washer
2. Bolt and Nut
3. Lateral Rod



INSPECTION AND REPAIR

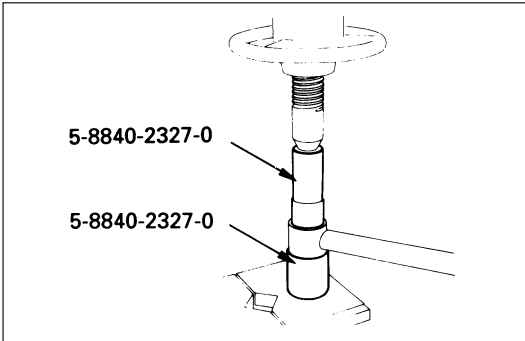
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Lateral Rod



2. Rubber Bushing (Axle side)

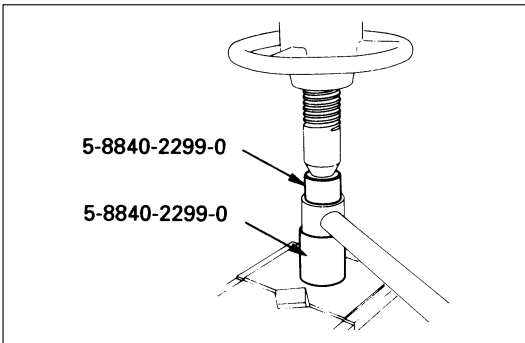
Remove the rubber bushing (Axle side).
Remover: 5-8840-2327-0 (J-39792)



Install the rubber bushing (Axle side).
Installer: 5-8840-2327-0 (J-39792)

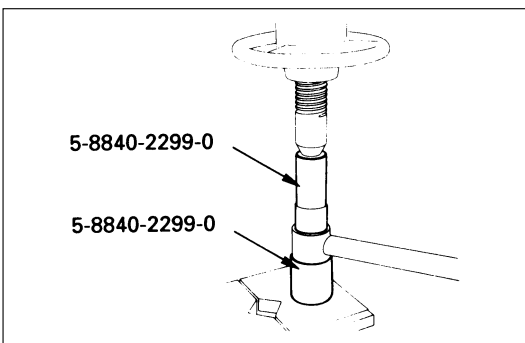
NOTE:

When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



3. Rubber Bushing (Frame side)

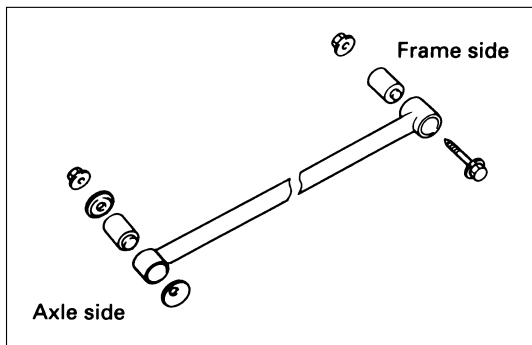
Remove the rubber bushing (Frame side).
Remover: 5-8840-2299-0 (J-39215)



Install the rubber bushing (Frame side).
Installer: 5-8840-2299-0 (J-39215)

NOTE:

When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



INSTALLATION

- 3. **Lateral Rod**
 Make sure that the lateral rod is in its correct position.
NOTE:
 When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.

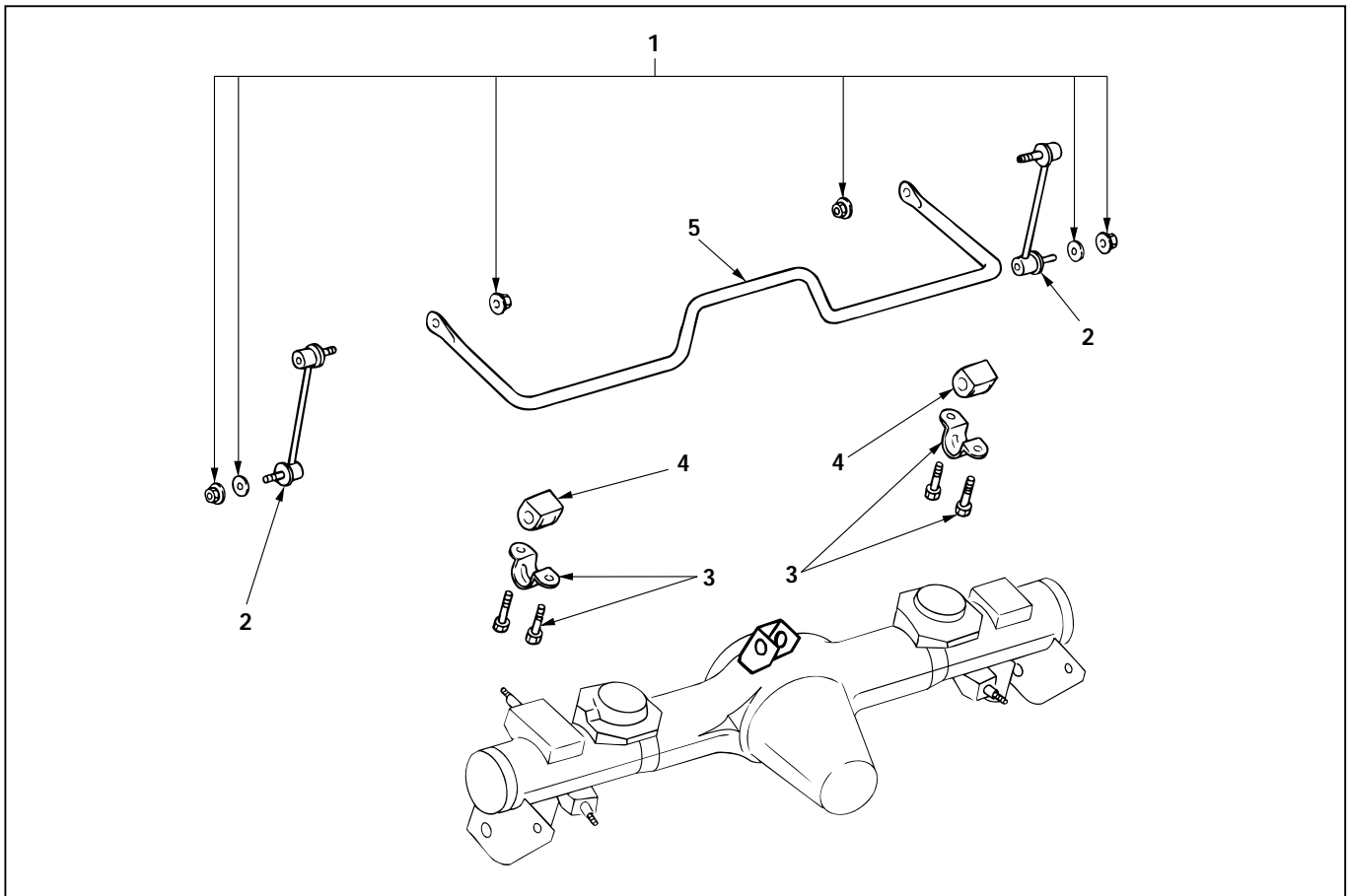
- 2. **Bolt and Nut**
NOTE:
 Tighten the bolt and nut lightly, and retighten to the specified torque after the vehicle is at curb height.

Lateral Rod Nut Torque	N·m (kg·m/lb·ft)
137 (14.0 / 101)	

- 1. **Nut and Washer**
NOTE:
 Tighten the nut lightly, and retighten to the specified torque after the vehicle is at curb height.

Lateral Rod Nut Torque	N·m (kg·m/lb·ft)
78 (8.0 / 58)	

STABILIZER BAR



460RW028

Removal Steps

1. Nut and washer
2. Link
3. Bracket
4. Rubber bushing
5. Stabilizer bar

Installation Steps

5. Stabilizer bar
4. Rubber bushing
3. Bracket
2. Link
1. Nut and washer

REMOVAL

Preparation:

- 1) Raise the vehicle and support the frame with suitable safety stands.
- 2) Remove wheel and tire assembly.
Refer to "Wheels and Tires" in section 3E.

1. Nut and Washer



CAUTION:

Be careful not to break the ball joint boot.

2. Link
3. Bracket
4. Rubber Bushing
5. Stabilizer Bar



INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

- Stabilizer bar
- Rubber bushing
- Link ball joint



INSTALLATION

5. Stabilizer Bar
4. Rubber Bushing



3. Bracket

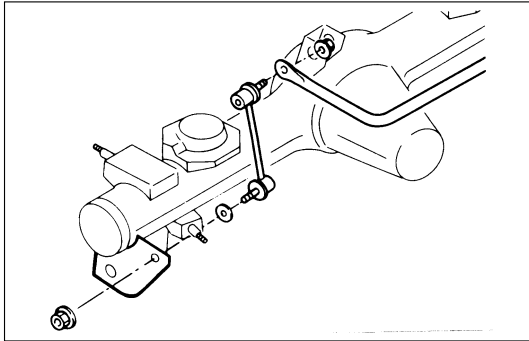
Bracket Bolt Torque	N·m (kg·m/lb·ft)
22 (2.2 / 16)	

2. Link



1. Nut and Washer

Link Nut Torque	N·m (kg·m/lb·ft)
50 (5.1 / 37)	



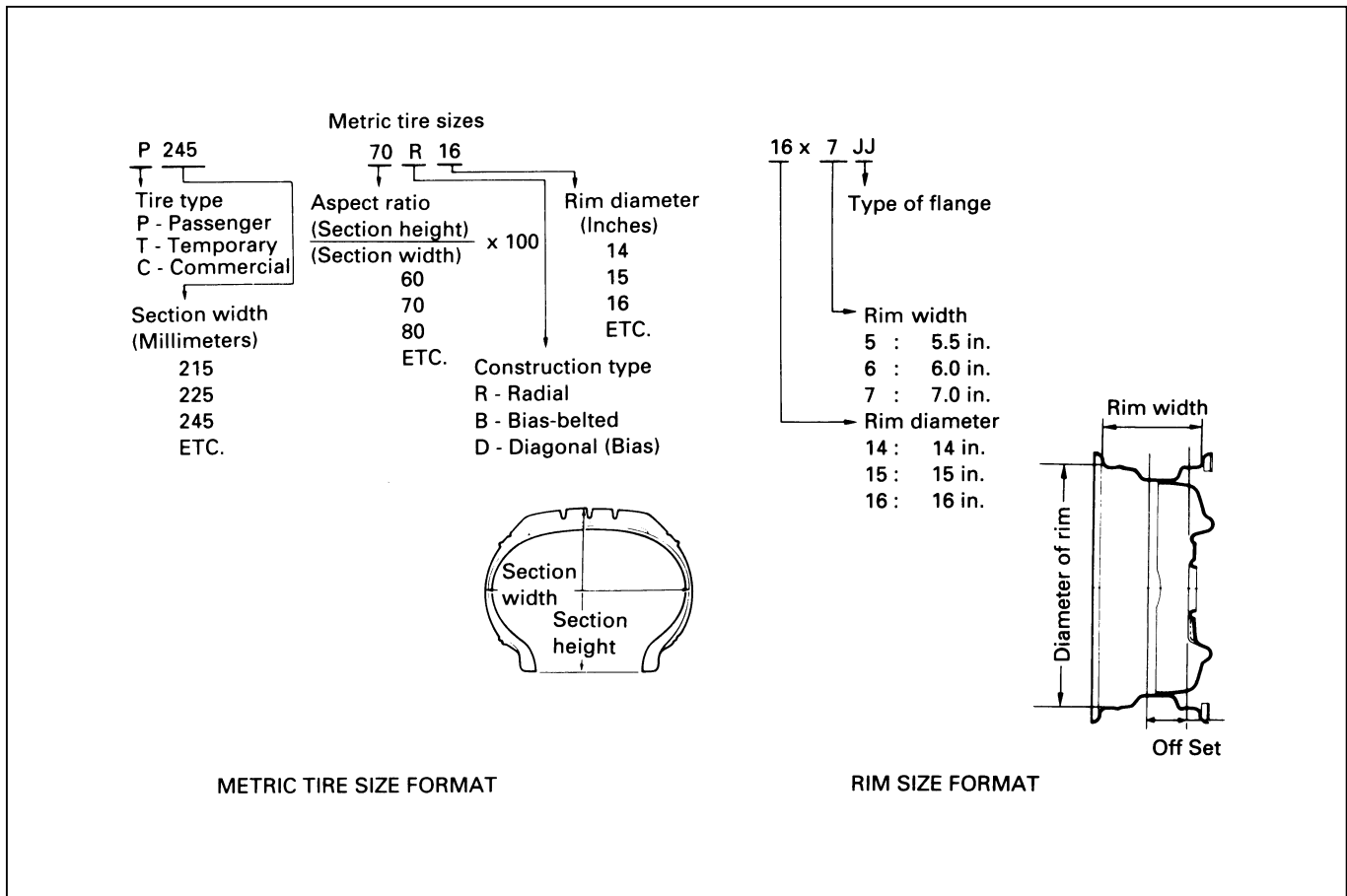
SECTION 3E

WHEELS AND TIRES

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On-Vehicle Service	3E - 3
Wheels	3E - 3
Unit Repair	3E - 4
Tires	3E - 4
Wheels	3E - 5
General Balance Procedure	3E - 5
Balancing Wheel and Tire	3E - 6

GENERAL DESCRIPTION

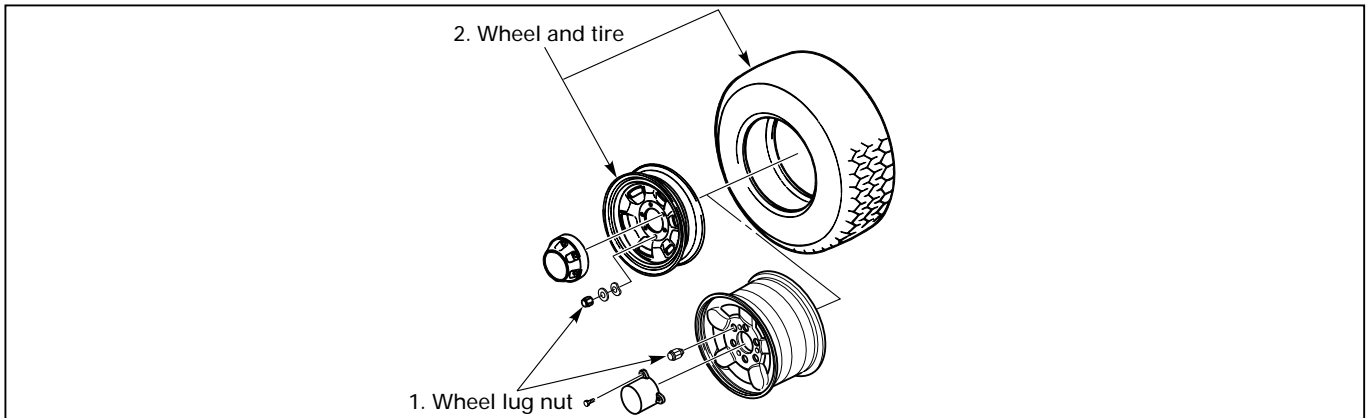


Replacement wheels or tires must be equivalent to the originals in load capacity, specified dimension and mounting configuration. Improper size or type may affect bearing life, brake performance, speedometer/odometer calibration, vehicle ground clearance and tire clearance to the body and chassis.

All models are equipped with metric sized steel belted radial tires. Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase premature and uneven wear.

ON-VEHICLE SERVICE

WHEELS



480RV004

Removal Steps

1. Wheel lug nut
2. Wheel and tire

Installation Steps

2. Wheel and tire
1. Wheel lug nut

REMOVAL

1. **Wheel Lug Nut**
Loosen wheel nut by approximately 180° (half a rotation) and raise the vehicle. Then remove the nuts.
2. **Wheel and Tire**

NOTE:

Never use heat to loosen a tight wheel lug nut. The application of heat to the hub can shorten the life of the wheel and may cause damage to wheel bearings.

INSTALLATION

1. **Wheel and Tire**
2. **Wheel Lug Nut**
Tighten the wheel lug nuts to the specified torque in numerical order.

Wheel Lug Nut Torque	N-m (kg-m/lb-ft)
	118 (12.0 / 87)

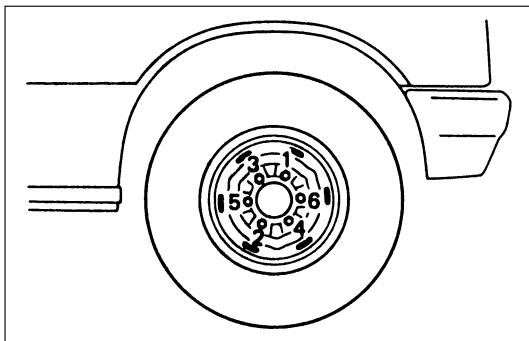


CAUTION:

Before installing wheels, remove any build-up of corrosion on the wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving.

NOTE:

Valve caps should be on the valve stems to keep dust and water out.



UNIT REPAIR

TIRES

REPLACEMENT

When replacement is necessary, the original metric size should be used. Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with tire having the most tread, to equalize braking traction.



CAUTION:

Do not mix different types of tires such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

TIRE MOUNTING

Remove valve cap on valve stem and deflate the tire. Then use a tire changing machine to mount or dismount tires.

Follow the equipment manufacturer's instruction. Do not use hand tools or tire lever alone to change tires as they may damage the tire beads or wheel rim.

TIRE DISMOUNTING

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, and light rust. Before mounting a tire, the bead area should be well lubricated with an approved tire lubricant.

After mounting, inflate the tire to 196 kPa (28 psi) so that beads are completely seated. Inflate the air to specified pressure and install valve cap to the stem



WARNING:

NEVER STAND OVER TIRE WHEN INFLATING. BEAD MAY BREAK WHEN BEAD SNAPS OVER RIM'S SAFETY HUMP AND CAUSE SERIOUS PERSONAL INJURY.

NEVER EXCEED 240 kPa (35 psi) PRESSURE WHEN INFLATING. IF 240 kPa (35 psi) PRESSURE WILL NOT SEAT BEADS, DEFLATE, RE-LUBRICATE AND RE-INFLATE. OVER INFLATION MAY CAUSE THE BEAD TO BREAK AND CAUSE SERIOUS PERSONAL INJURY.

TIRE REPAIR

There are many different materials on the market used to repair tires.

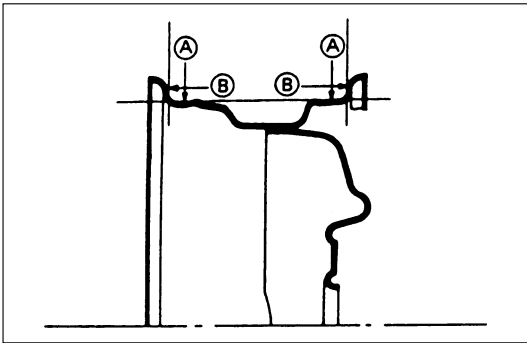
Manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from the tire manufacturer if they are not included with the repair kit.

WHEELS

REPLACEMENT

Damaged wheels and wheels with excessive runout must be replaced.

Wheel Runout at Rim (Based on Hub bore.)



		Steel	Aluminum	
Ⓐ	Vertical play: Less than	mm(in)	1.5 (0.059)	0.7 (0.028)
Ⓑ	Horizontal play: Less than	mm(in)	1.5 (0.059)	0.7 (0.028)

GENERAL BALANCE PROCEDURE

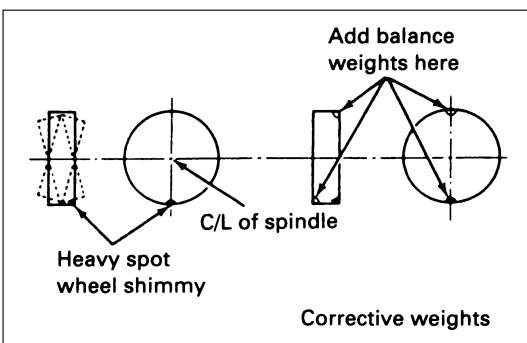
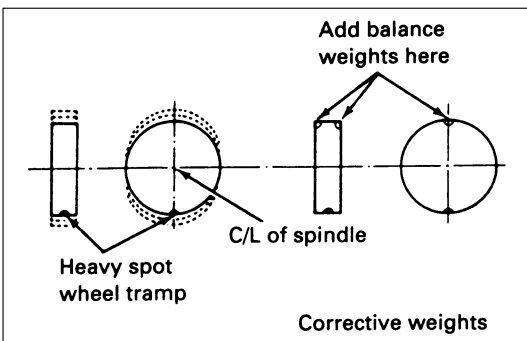
Deposits of mud, etc. must be cleaned from the inside of the rim.

The tire should be inspected for the following: match mount paint marks, bent rims, bulges, irregular tire wear, proper wheel size and inflation pressure. Then balance according to the equipment manufacturer's recommendations.

There are two types of wheel and tire balance.

Static balance is the equal distribution of weight around the wheel.

Assemblies that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



Dynamic balance is the equal distribution of weight on each side of the wheel center-line so that when the tire spins there is not tendency for the assembly to move from side to side. Assemblies that are dynamically unbalanced may cause shimmy.



WARNING:

STONES SHOULD BE REMOVED FROM THE TREAD TO AVOID OPERATOR INJURY DURING SPIN BALANCING AND TO OBTAIN A GOOD BALANCE.

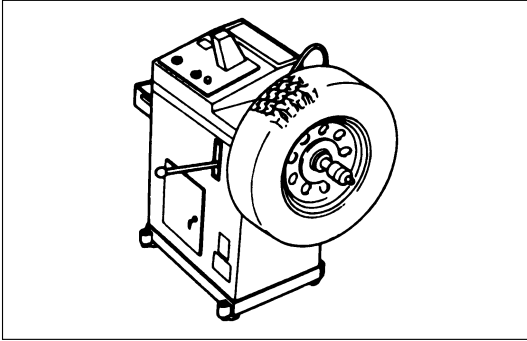
BALANCING WHEEL AND TIRE

ON-VEHICLE BALANCING

On-Vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

OFF-VEHICLE BALANCING

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic balance. Although they do not correct for drum or disc unbalance (as on-vehicle spin balancing does), they are very accurate.



DRIVELINE/AXLE

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DIFFERENTIAL (FRONT)

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Front Drive Axle Assembly and		Reassembly	4A1-23
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Removal	4A1-5	Special Tools	4A1-28

Service Precaution

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

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

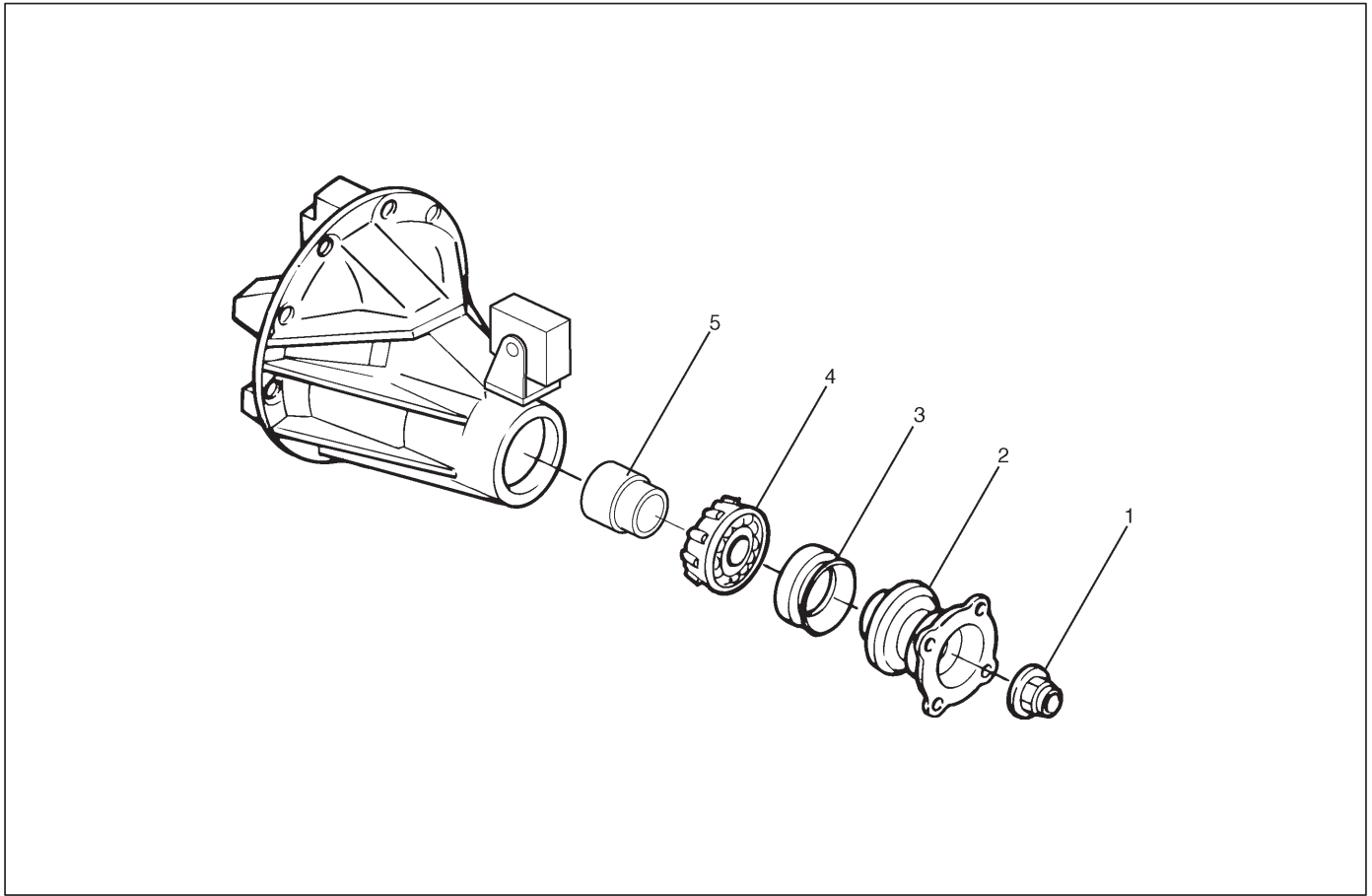
Front Drive Axle

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
"Clank" When Accelerating From "Coast"	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Adjust or replace the steering gear.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Pinion Shaft Oil Seal

Pinion Shaft Oil Seal and Associated Parts



415RW015

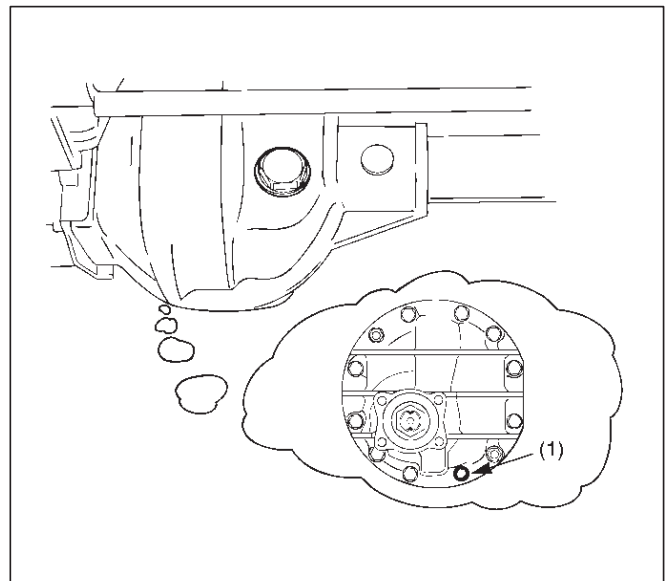
Legend

- (1) Flange Nut
- (2) Flange

- (3) Oil Seal
- (4) Outer Bearing
- (5) Collapsible Spacer

Removal

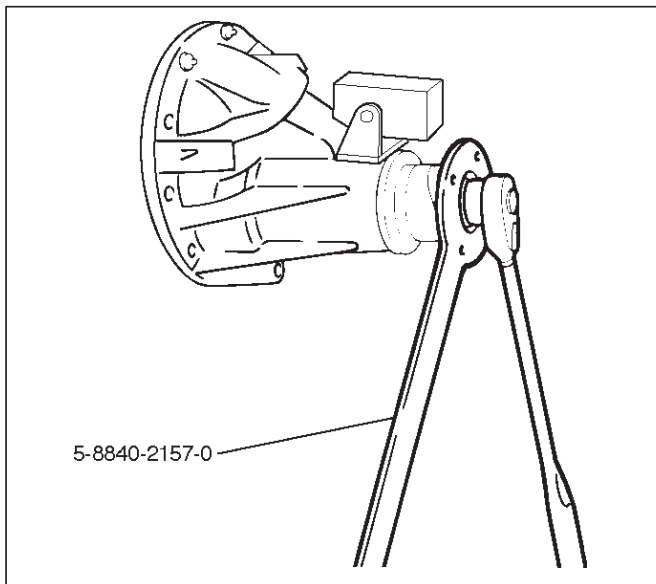
1. Raise the vehicle and support it at the frame.
The hoist must remain under the front axle housing.
2. Drain the front axle oil by loosening the drain plug(1).



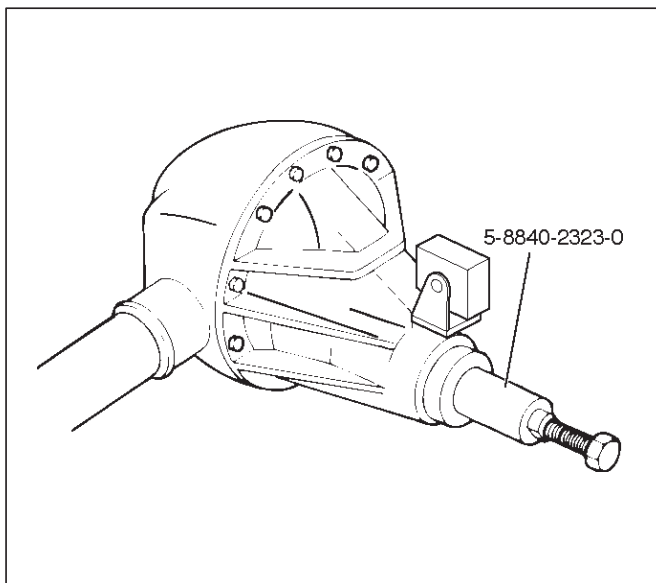
412RS001

4A1-4 DIFFERENTIAL (FRONT)

3. Remove the front propeller shaft. Refer to Front Propeller Shaft in this section.
4. Remove flange nut by using pinion flange holder 5-8840-2157-0.



5. Remove flange.
6. Remove oil seal.
7. Remove outer bearing by using remover 5-8840-2323-0.



8. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

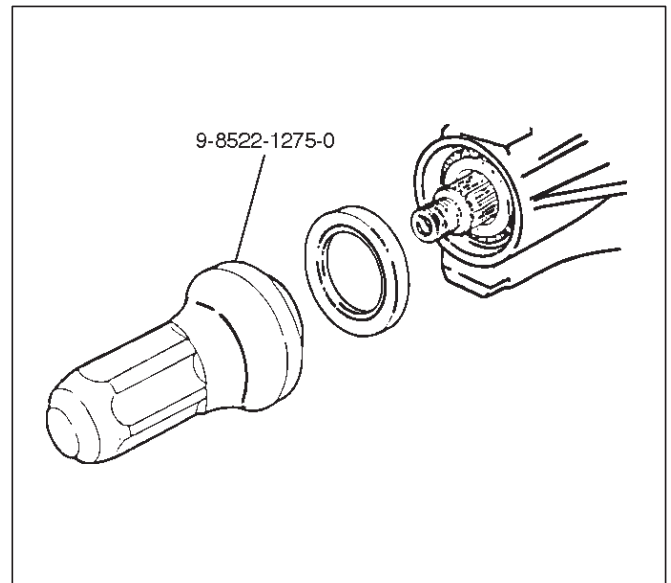
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer. Discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. Install oil seal, use oil seal installer 9-8522-1275-0 to install a new oil seal that has been soaked in axle lubricant.

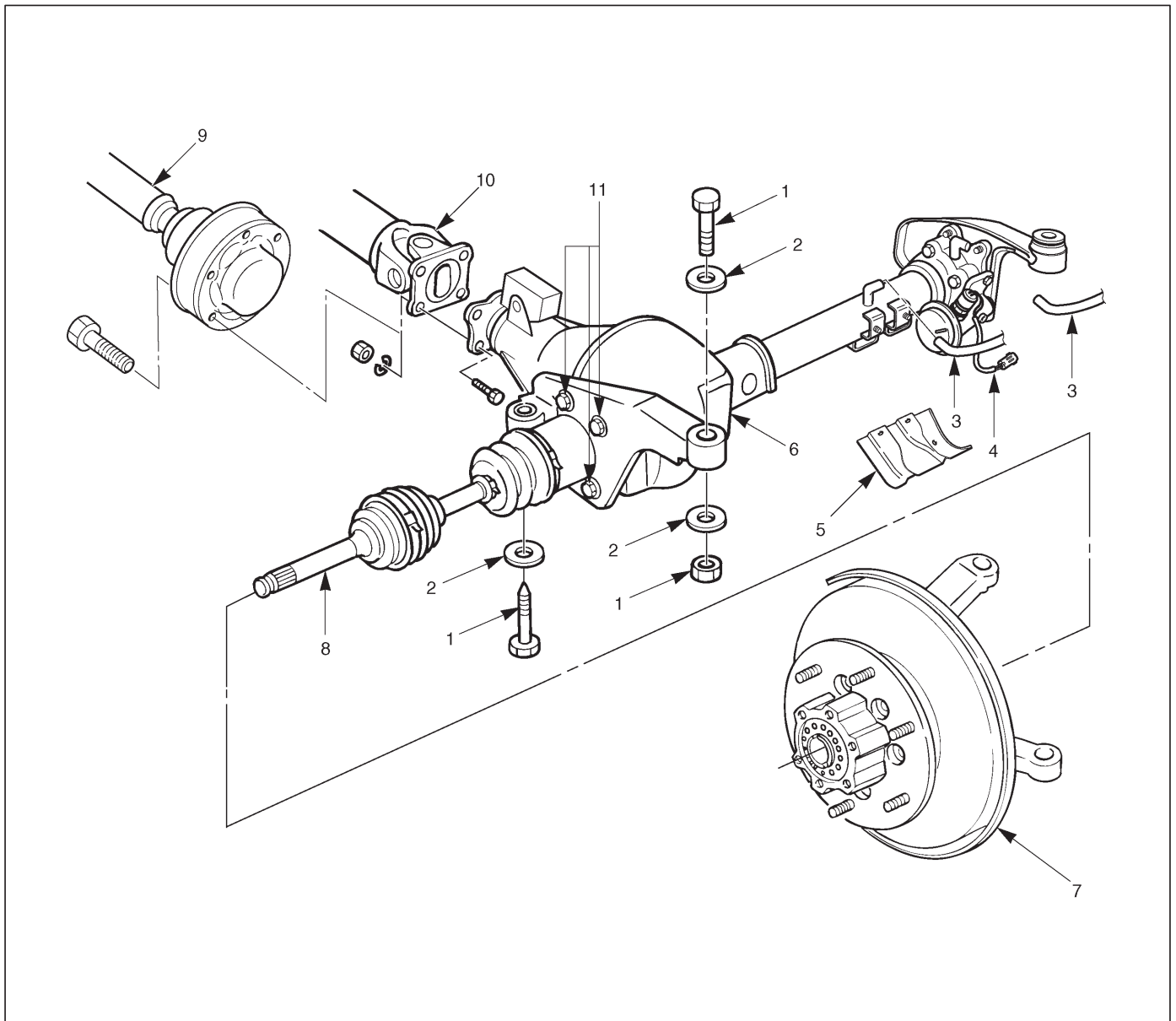


4. Install flange.
5. Install flange nut, refer to Differential Assembly for flange nut reassembly in this section.

NOTE: Discard the used nut and install a new one.

Front Drive Axle Assembly

Front Drive Axle Assembly and Associated Parts



412RW001

Legend

- | | |
|--|---|
| (1) Mounting Bolt and Nut | (6) Front Axle Case Assembly and Front Drive Shaft Assembly (LH side) |
| (2) Washer and Spacer | (7) Hub Assembly (Disc, Back Plate and Knuckle) |
| (3) Breather Hose (with Shift on the Fly) | (8) Front Drive Shaft Assembly (RH side) |
| (4) Shift Switch Connector (with Shift on the Fly) | (9) Propeller Shaft (With TOD) |
| (5) Protector (with Shift on the Fly) | (10) Propeller Shaft |
| | (11) Bolt |

Removal

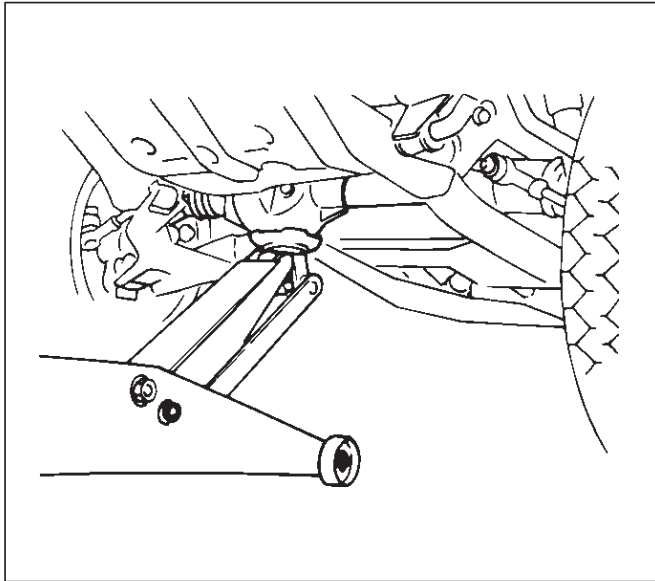
1. Jack up the vehicle and support it using jack stands.
2. Remove the tire and wheel.

4A1-6 DIFFERENTIAL (FRONT)

3. Remove the drain bolt to drain differential oil.

NOTE:

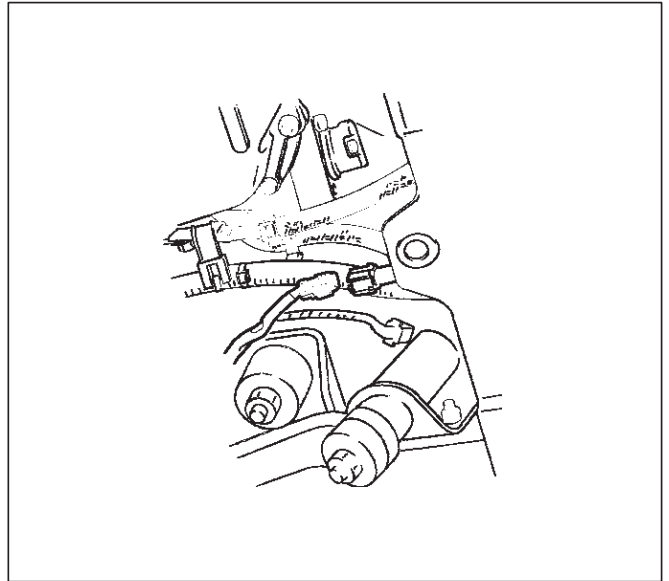
- a. During the work, be sure that the diff case is supported by the jack.



412RS003

- b. Remove the brake caliper fixing bolt and hang the caliper. Refer to Front Disc Brake Caliper Assembly in Brake section.
- c. Remove the antilock brake system speed sensor (if equipped). Refer to Front Wheel Speed Sensor in Brakes section.
4. Remove the hub assembly (Disc, back plate and knuckle), refer to Front Hub and Disc in this section.
5. Disconnect the knuckle and the suspension arm. Refer to Suspension section.
6. Remove steering link and arm assembly, refer to Steering Linkage in Steering section.
7. Remove suspension crossmember.
8. Remove propeller shaft, refer to Front Propeller Shaft in this section.
9. Remove protector (Shift on the fly model).
10. Remove breather hose (Shift on the fly model).
11. Remove the hose clip (Shift on the fly model).
12. Disconnect breather hose from front drive axle tube and disconnect housing (Shift on the fly model).
13. Disconnect vacuum hose from actuator (Shift on the fly model).

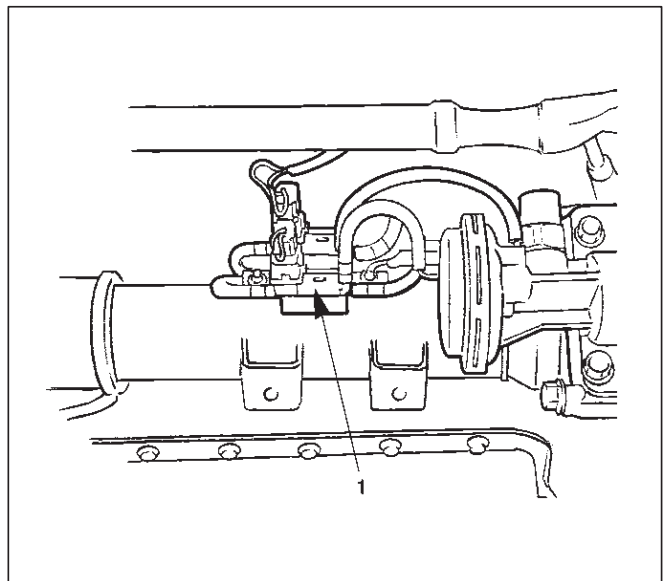
14. Disconnect shift switch connector (Shift on the fly model).



412RS031

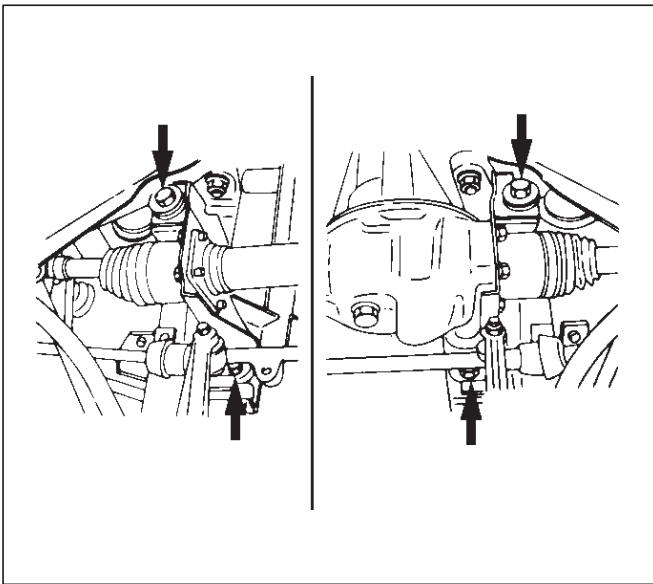
15. Remove VSV assembly (1) (Shift on the fly model).

NOTE: Be sure not to remove hose and connector from VSV asm.



412RW002

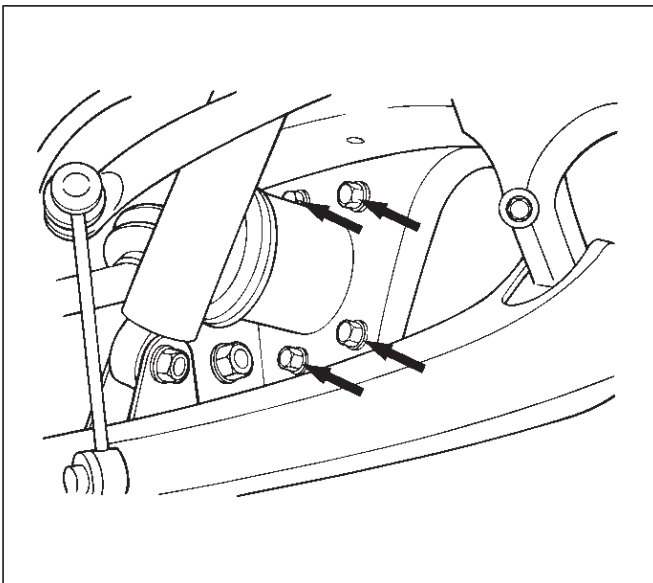
16. Remove mounting bolt and nut.



412RS004

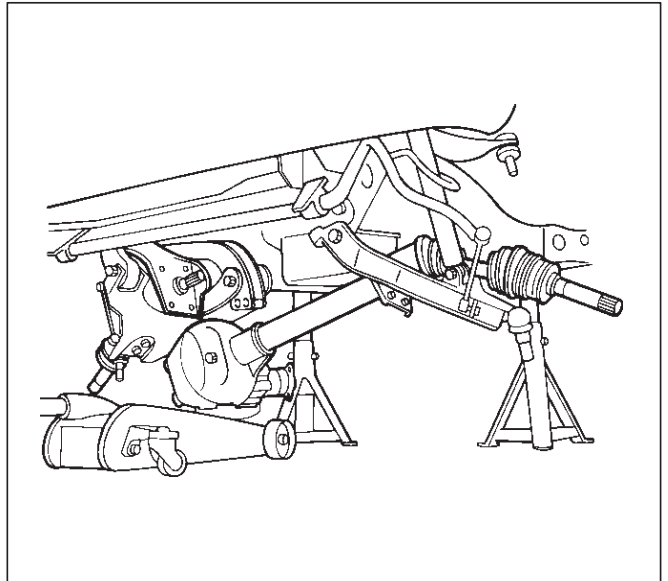
17. Remove washer and spacer.

18. Remove the mounting bracket fixing bolt.



412RS005

19. Lower the vehicle and disconnect the RH front drive shaft assembly, then remove the front axle case assembly and front drive shaft assembly (LH).



412RS006

20. Remove front drive shaft assembly (RH).

Installation

1. Install front drive shaft assembly (RH) and lay the assembly on the lower arm.
2. Install front axle case assembly and front drive shaft assembly (LH) and place the axle case on the jack, connect to the front drive shaft assembly (RH) before installing to the vehicle.
3. Install bolt and tighten the mounting bracket fixing bolt to the specified torque.

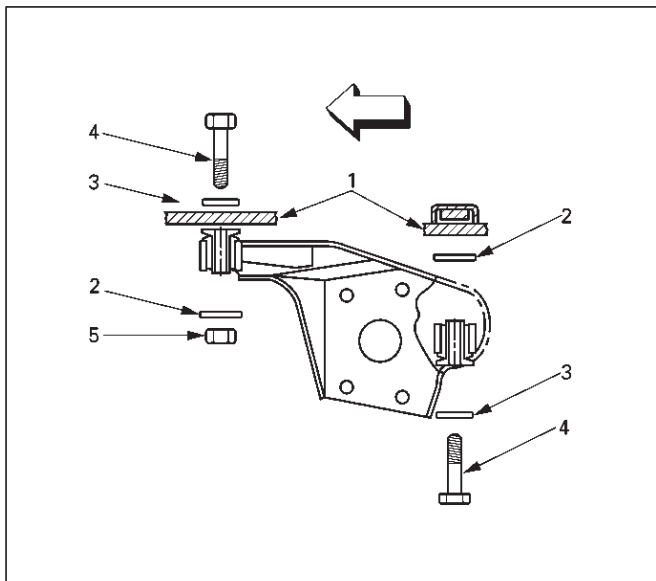
Torque: 116 N·m (11.8kg·m/85 lb ft)

4. Install washer and spacer.

4A1-8 DIFFERENTIAL (FRONT)

5. Tighten the mounting bolt and nut to the specified torque.

Torque: 152 N·m (15.5kg·m/112 lb ft)



412RW005

Legend

- (1) Frame
- (2) Spacer
- (3) Washer
- (4) Bolt
- (5) Nut

6. Install VSV assembly and tighten nuts to specified torque (Shift on the fly model).

Torque: 8 N·m (0.8kg·m/69 lb in)

7. Install the shift switch connector (Shift on the fly model).

NOTE: Be careful not to permit the entry of dust into the connector.

8. Install the actuator side of vacuum hose (Shift on the fly model).

NOTE: Be careful not to permit the entry of dust into the hose.

9. Connect breather hose and install the hose clip (Shift on the fly model).

10. Install protector and tighten bolts to specified torque (Shift on the fly model).

Torque: 26 N·m (2.7kg·m/20 lb ft)

11. Install propeller shaft, refer to Front Propeller Shaft in this section.

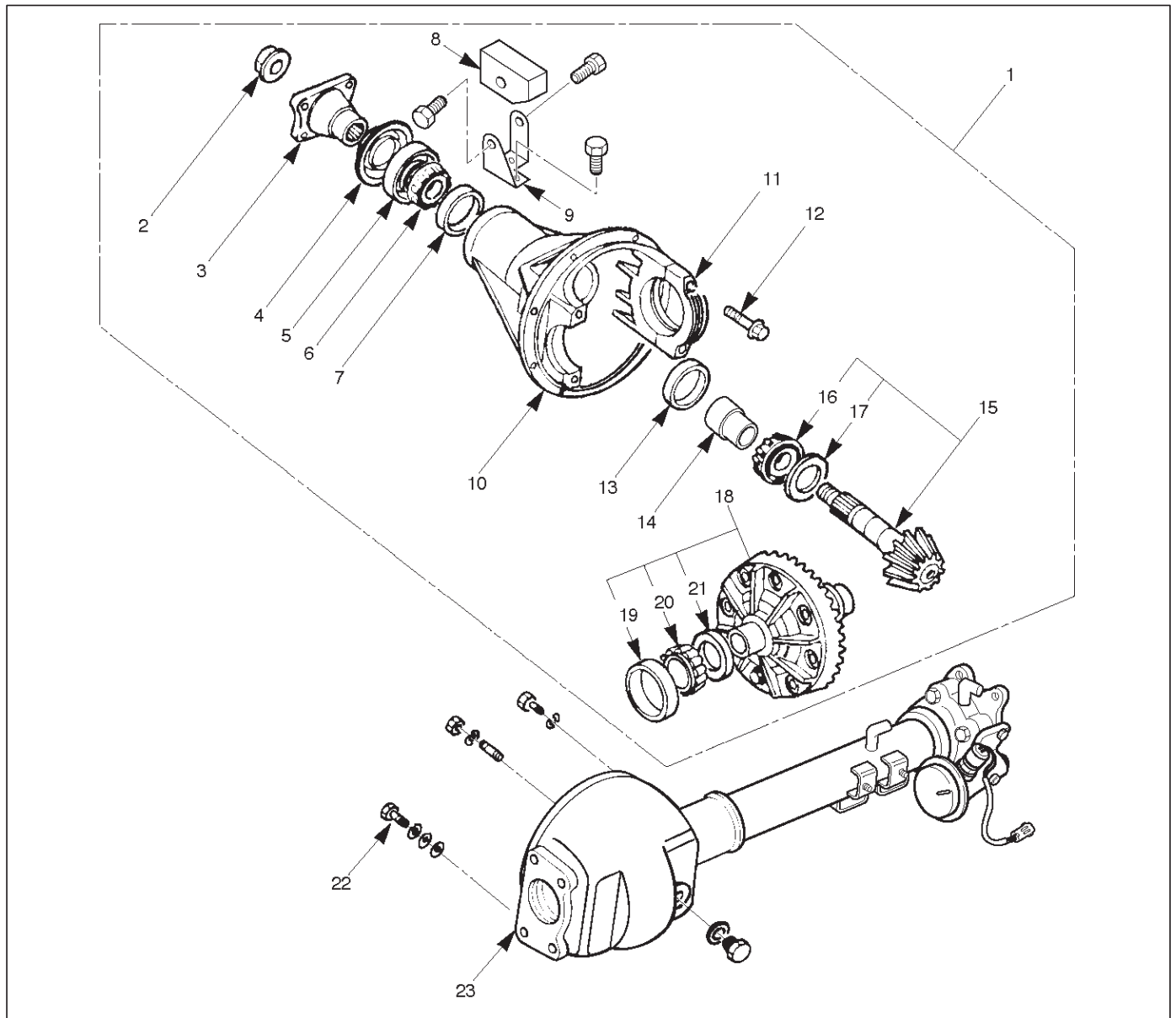
12. Install suspension crossmember.

13. Steering link and arm assembly, refer to Steering Linkage in Steering section.

14. Install hub assembly (Disc, back plate and knuckle), refer to Front Hub and Disc in this section.

Differential Assembly

Disassembled View



415RW001

Legend

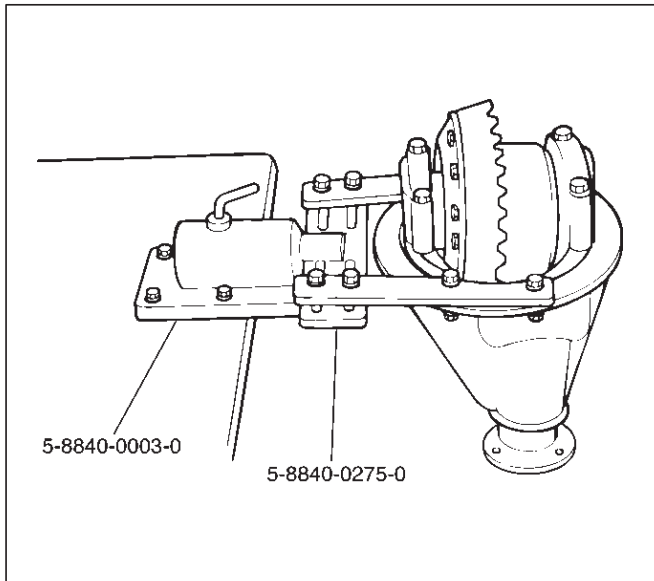
- | | |
|------------------------------|-------------------------------|
| (1) Differential Assembly | (12) Bolt |
| (2) Flange Nut | (13) Inner Bearing Outer Race |
| (3) Flange | (14) Collapsible Spacer |
| (4) Dust Cover | (15) Pinion Gear |
| (5) Oil Seal | (16) Inner Bearing |
| (6) Outer Bearing | (17) Adjust Shim |
| (7) Outer Bearing Outer Race | (18) Diff Cage Assembly |
| (8) Damper | (19) Side Bearing Outer Race |
| (9) Bracket | (20) Side Bearing |
| (10) Differential Carrier | (21) Adjust Shim |
| (11) Bearing Cap | (22) Bolt |
| | (23) Axle Case |

Disassembly

1. Remove differential carrier fixing bolt.
2. Remove differential assembly.

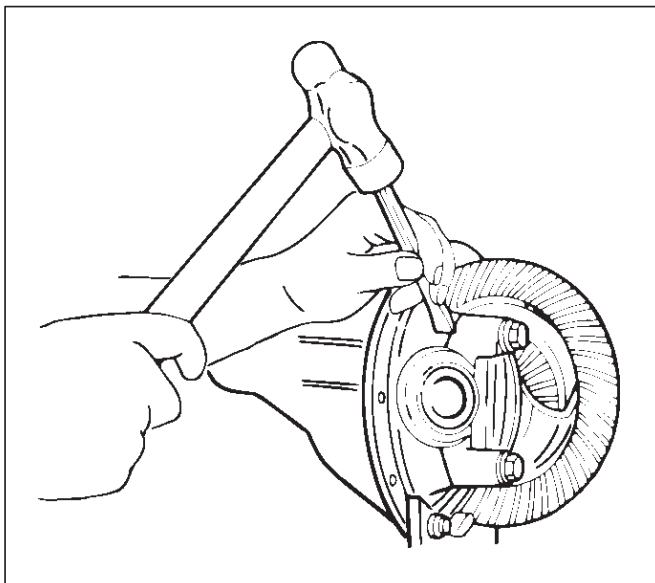
4A1-10 DIFFERENTIAL (FRONT)

3. Using holding fixture 5-8840-0275-0 and holding fixture base 5-8840-0003-0, fix the differential assembly to the bench.



4. Remove bearing cap bolt.

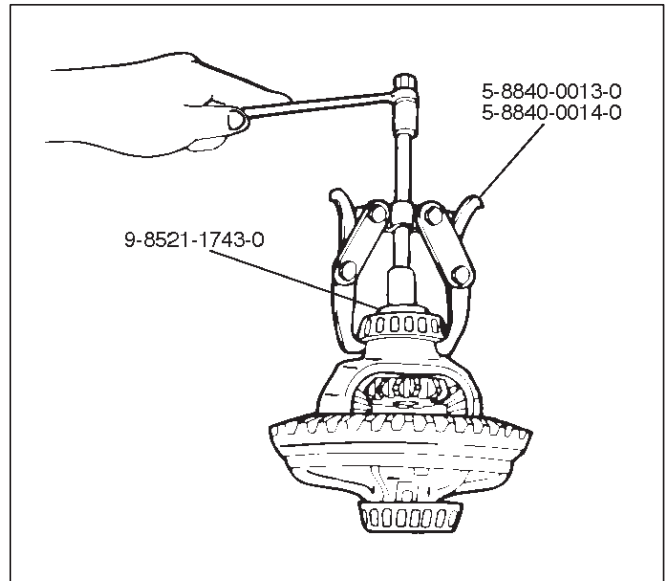
5. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



6. Remove differential cage assembly.

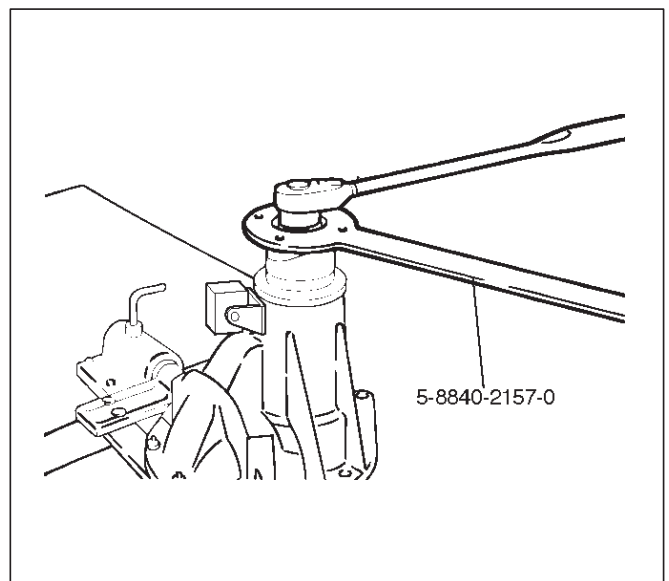
7. Remove side bearing outer race, after removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.

8. Remove side bearing, using remover 5-8840-0013-0, 5-8840-0014-0 and adapter 9-8521-1743-0.



9. Remove adjust shim, note the thickness and position of the shims removed.

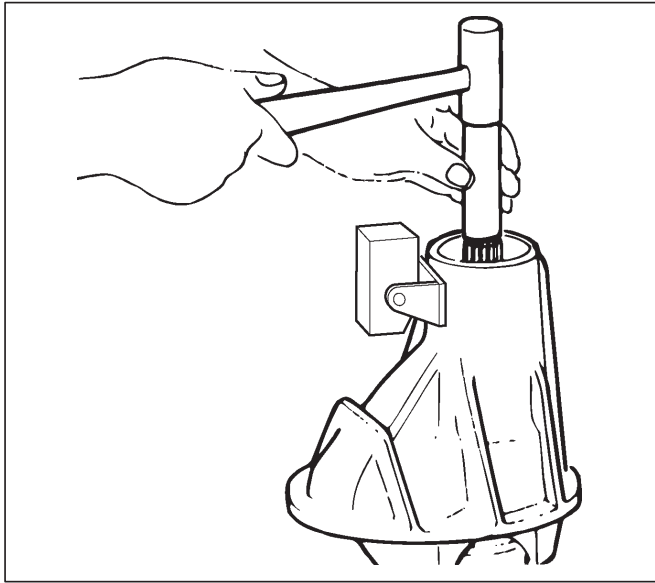
10. Remove the flange nut using holding wrench 5-8840-2157-0 after raising up its staked parts completely.



11. Remove flange.

12. Remove dust cover.

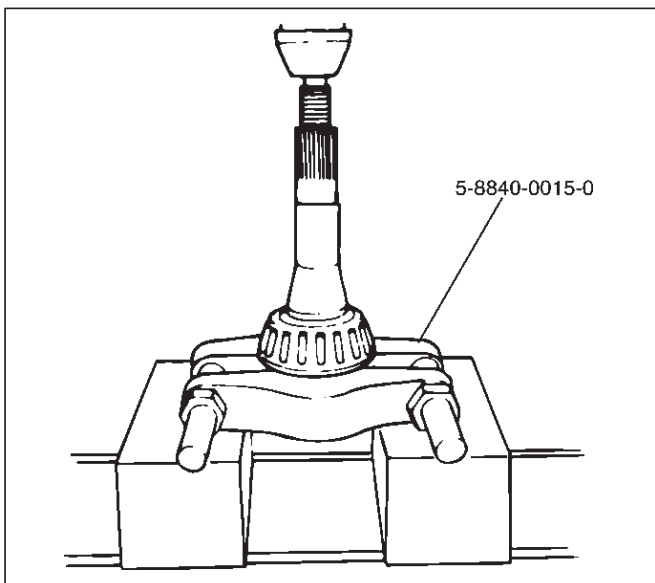
13. Remove the drive pinion assembly using a soft metal rod and a hammer.



425RW041

14. Remove collapsible spacer.

15. Remove the inner bearing using a separator 5-8840-0015-0 and a press.



415RW033

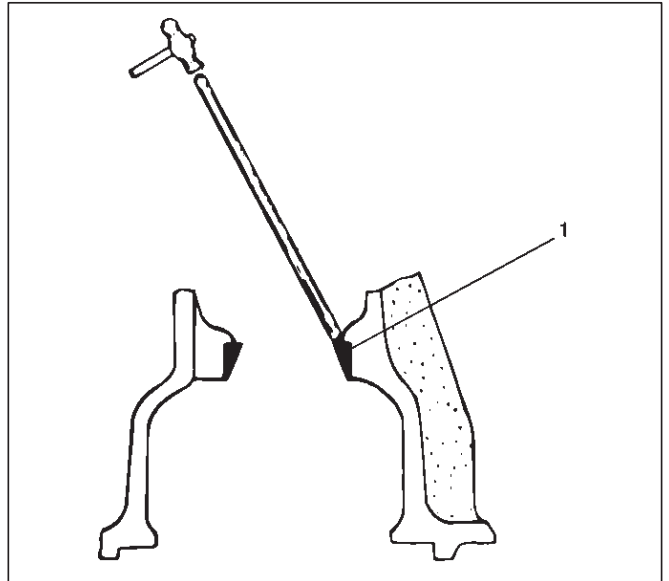
16. Remove adjust shim.

17. Remove inner bearing outer race.

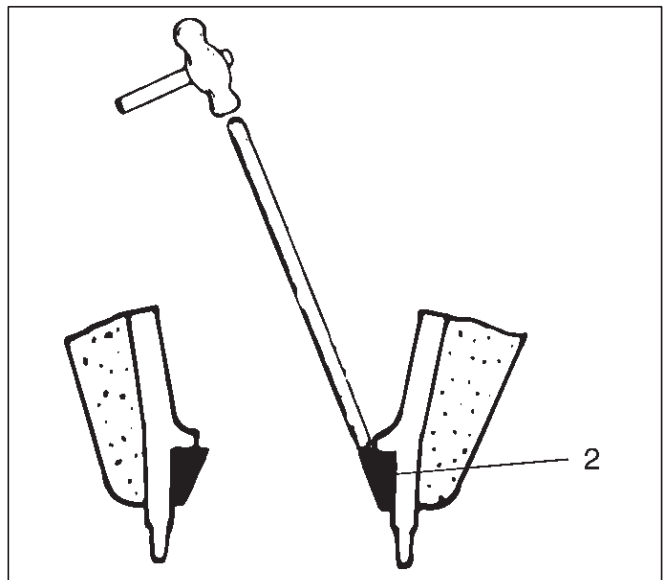
18. Remove oil seal.

19. Remove outer bearing.

20. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.



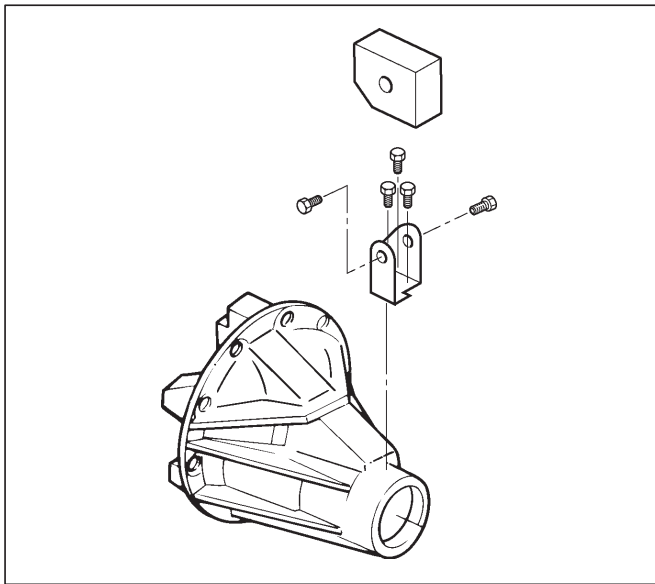
425RS014



425RS015

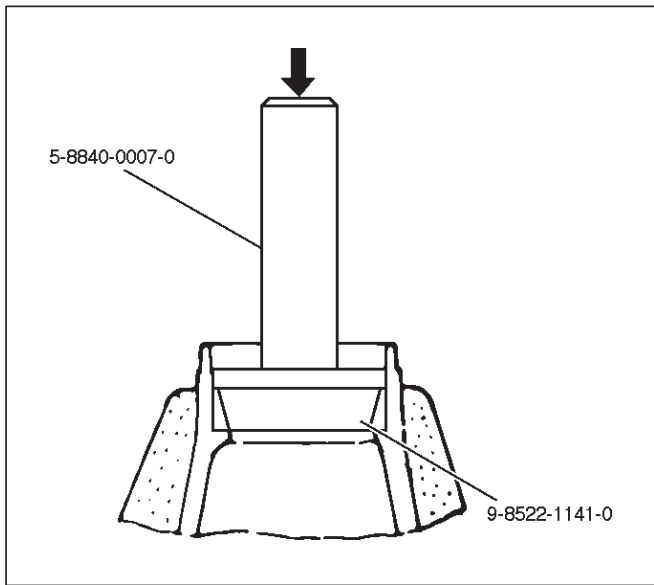
4A1-12 DIFFERENTIAL (FRONT)

21. Remove damper and bracket.

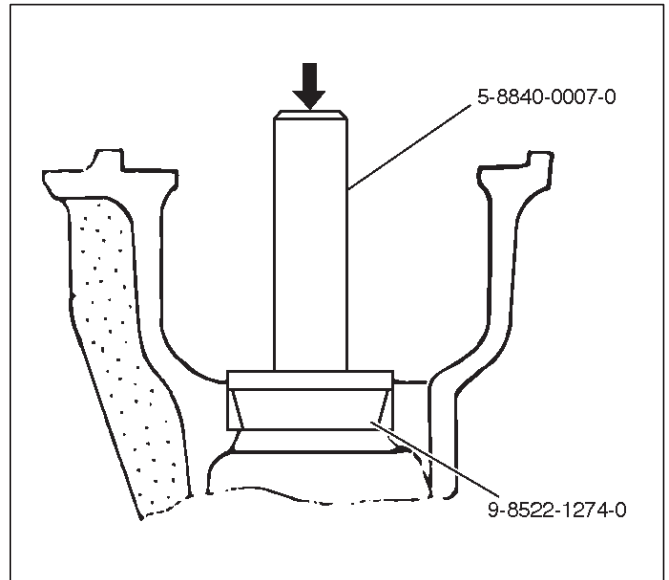


Reassembly

1. Using installer 9-8522-1141-0 and grip 5-8840-0007-0, install outer bearing outer race.



2. Using installer 9-8522-1274-0 and grip 5-8840-0007-0, install Inner bearing outer race.



3. Install adjust shim and adjust drive pinion mounting distance

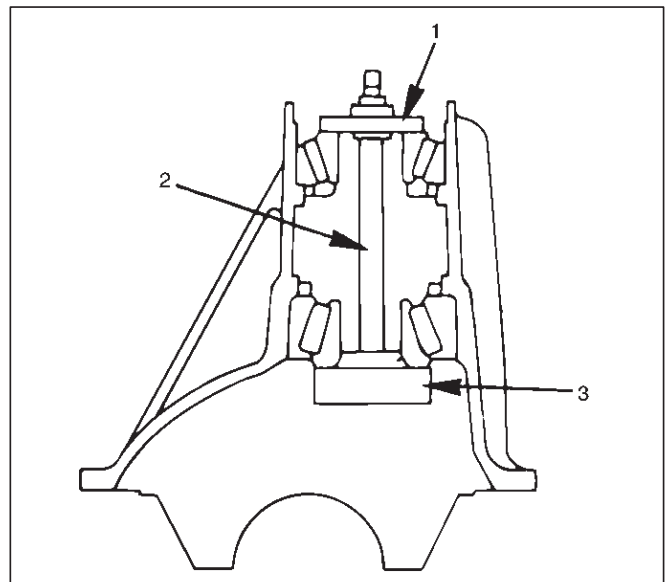
1. Apply gear oil to the inner and outer drive pinion bearing.

Clean the pinion setting gauge set.

Then install the gauge set together with the inner and outer bearings.

2. Tighten the nut to the specified torque.

Torque: 2.3 N-m (0.23kg-m/20 lb in)



Legend

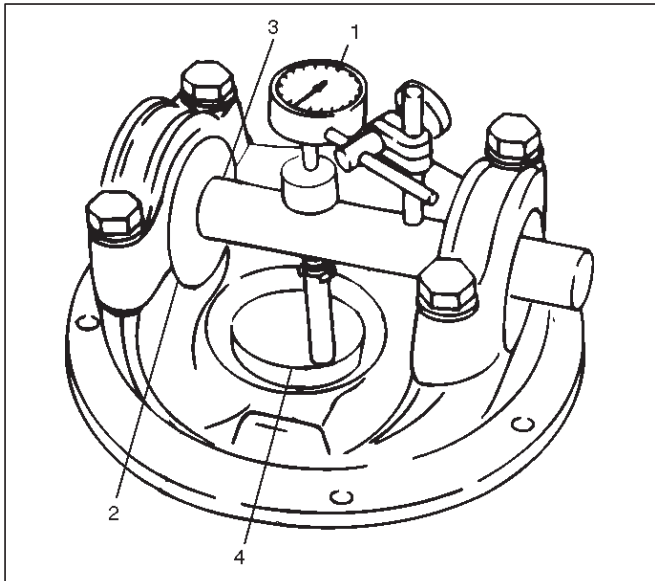
(1) Pilot : 5-8840-2085-0

(2) Nut and Bolt : 5-8840-2089-0

(3) Gauge Plate : 5-8840-2087-0

3. Clean the side bearing bores. Install the dial indicator with the discs and arbor. Install and tighten the bearing caps to the specified torque.

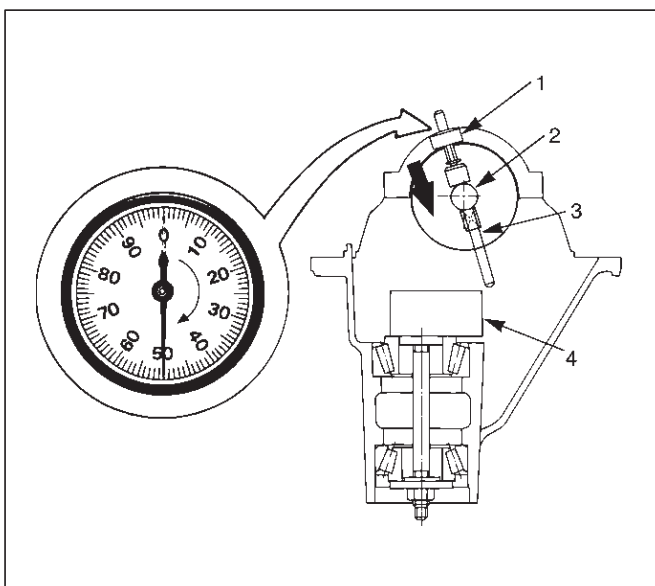
Torque: 98 N-m (10kg-m/72 lb ft)



Legend

- (1) Dial Indicator: 5-8840-0126-0
- (2) Disc (2 pcs.): 5-8840-2088-0
- (3) Arbor: 5-8840-0128-0
- (4) Gauge Plate: 5-8840-2087-0

4. Set the dial indicator to "0". Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.

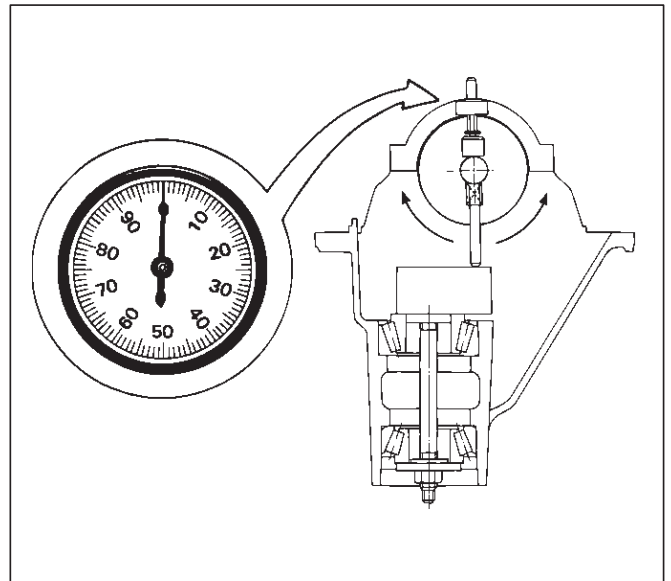


Legend

- (1) Dial Indicator
- (2) Ganging Arbor
- (3) Plunger
- (4) Gauge Plate

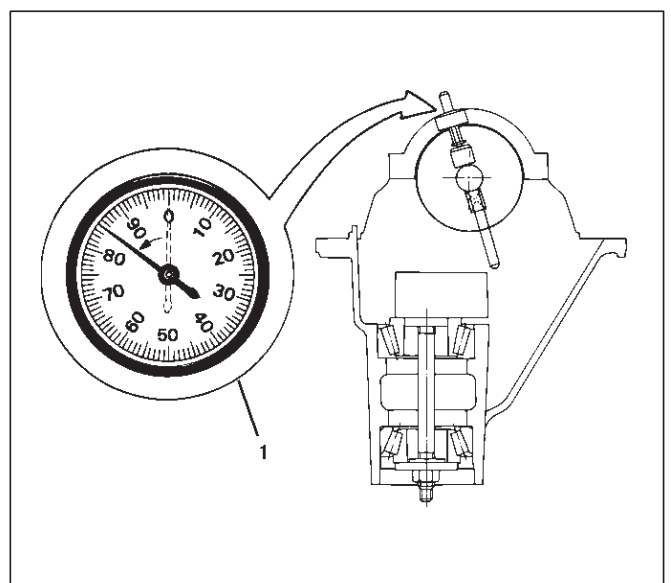
5. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest deflection. At this point, once again set the dial indicator to "0".

Repeat the procedure to verify the "0" setting.



6. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.

Record the number the dial indicator needle points to.



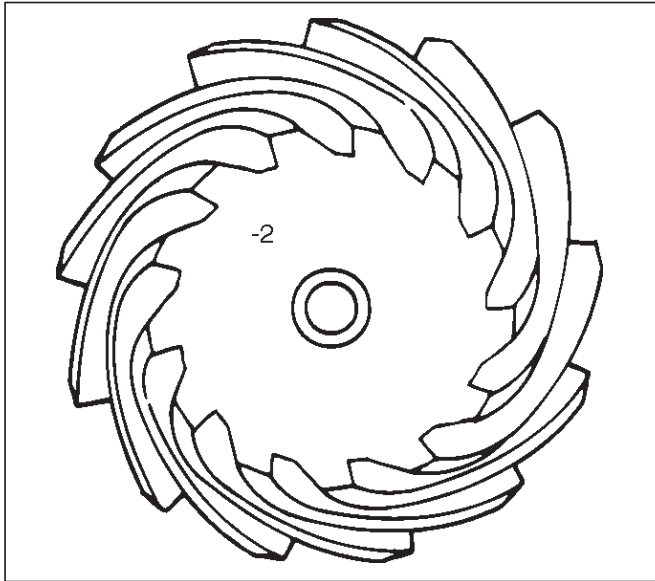
Legend

- (1) Example=Dial indicator reading of 0.085

4A1-14 DIFFERENTIAL (FRONT)

- Record the pinion depth code on the head of the drive pinion.

The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code "0", the pinion is "nominal".



425RS023

8. Select the shim using the chart:

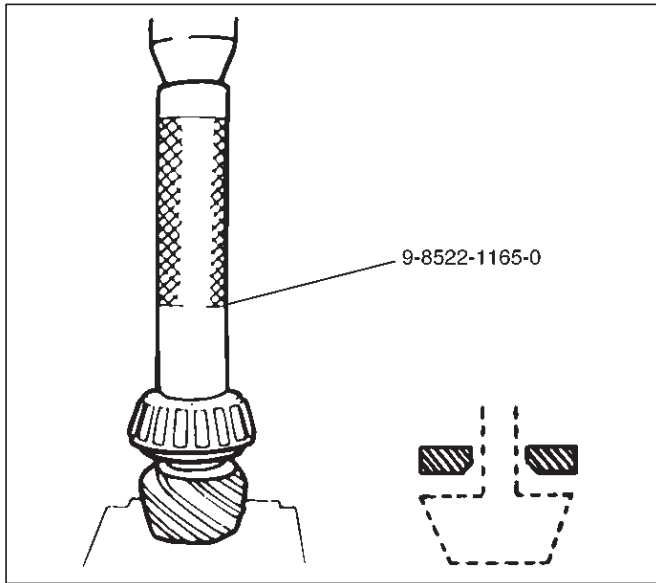
Pinion marking	+10	+8	+6	+4	+2	0	-2	-4	-6	-8	-10
Dial indicator reading (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)
0.081											2.18 (0.0858)
0.082										2.18 (0.0858)	2.20 (0.0866)
0.083									2.18 (0.0858)	2.20 (0.0866)	2.23 (0.0882)
0.084								2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)
0.085							2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)
0.086						2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)
0.087					2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)
0.088				2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)
0.089			2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)
0.090		2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)
0.091	2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)
0.092	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)
0.093	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)
0.094	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)
0.095	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)
0.096	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)
0.097	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)	
0.098	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)		
0.099	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)			
0	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)				
0.001	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)					
0.002	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)						
0.003	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)							
0.004	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)								
0.005	2.54 (0.1000)	2.56 (0.1008)									
0.006	2.56 (0.1008)										

NOTE: When ordering shims, find the part number in the parts catalog by using the thickness of shims listed in the above table.

4. Place the shim on the drive pinion, with the chamfered side turned towards the pinion head then install the inner bearing onto the pinion using an installer 9-8522-1165-0 and a press.

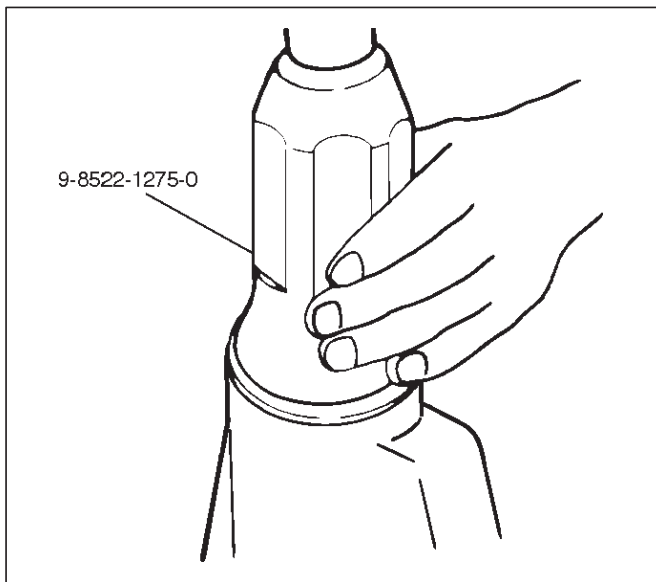
4A1-16 DIFFERENTIAL (FRONT)

NOTE: Do not apply pressure to the roller cage and apply pressure only to the inner race.



5. Discard the used collapsible spacer and install a new one.
6. Install pinion gear.
7. Install outer bearing.
8. Use oil seal installer 9-8522-1275-0 to install a new oil seal that has been soaked in rear axle lubricant.

NOTE: Take care to use a front differential oil seal, NOT the rear differential oil seal.

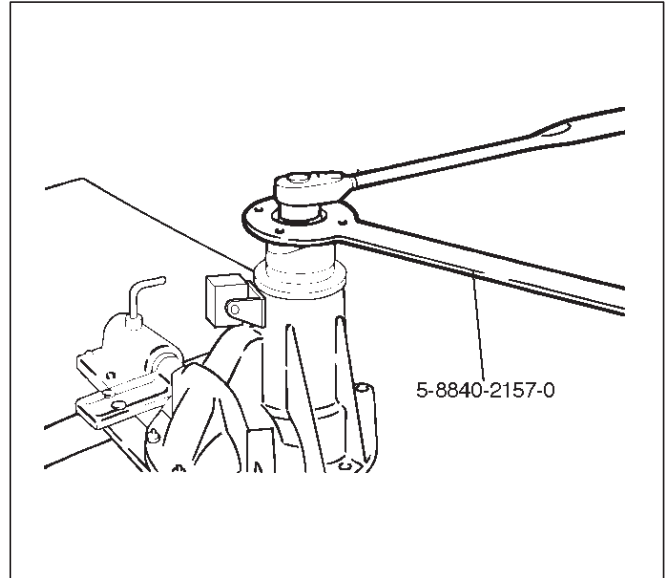


9. Install dust cover.
10. Install flange.
11. Install flange nut.
 1. Apply lubricant to the pinion threads.

2. Tighten the nut to the specified torque using the pinion flange holder 5-8840-2157-0.

Torque: 177-275N-m (18-28kg-m/130-203 lb ft)

NOTE: Discard used flange nut and install new one and do not over tighten the flange nut.

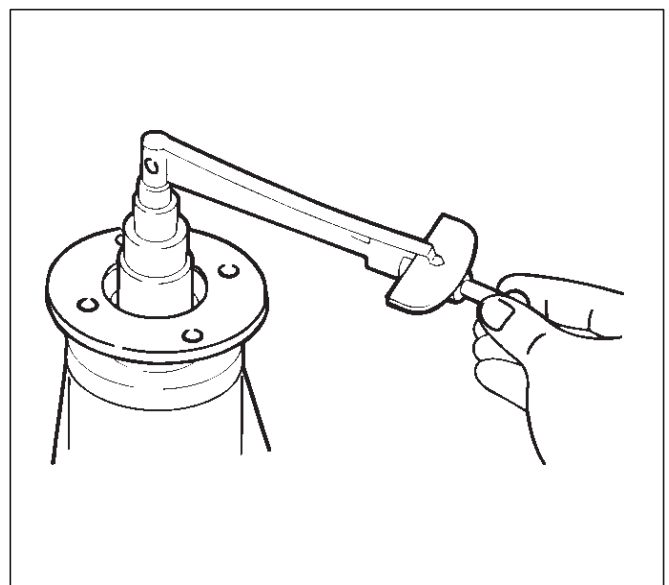


3. Adjust pinion bearing preload.
 - a. Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
 - b. Continue tightening flange nut until the specified starting torque is obtained.

Starting torque:

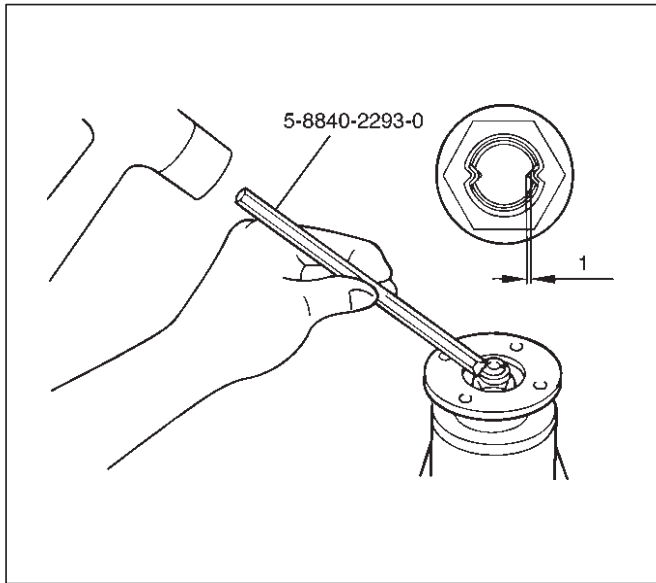
New bearing 0.7-1.1 N-m(0.065-0.115kg-m/5.64-9.98 lb in)

Used bearing 0.4-0.5N-m(0.033-0.057kg-m/2.86-4.94 lb in)



4. Using punch 5-8840-2293-0, stake the flange nut at two points.

NOTE: When staking, be sure to turn the nut to insure that there is no change in bearing preload. Make sure of preload again as instructed in 3).



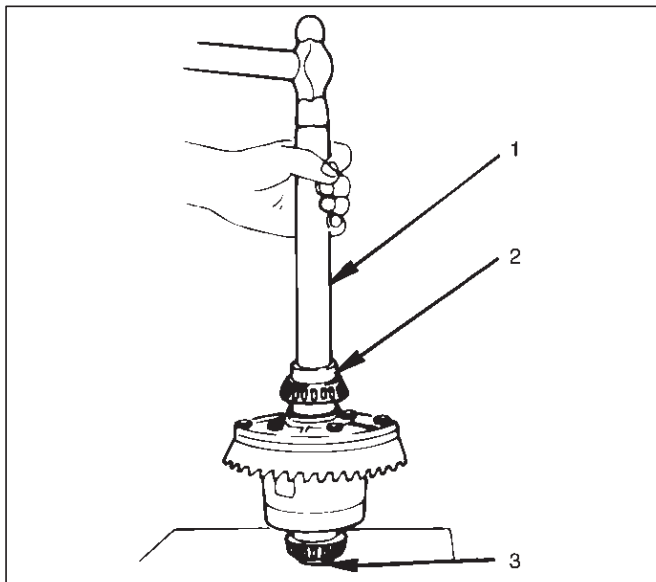
415RW019

Legend

- (1) 1.3mm or less

12. Install adjust shim.

1. Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.

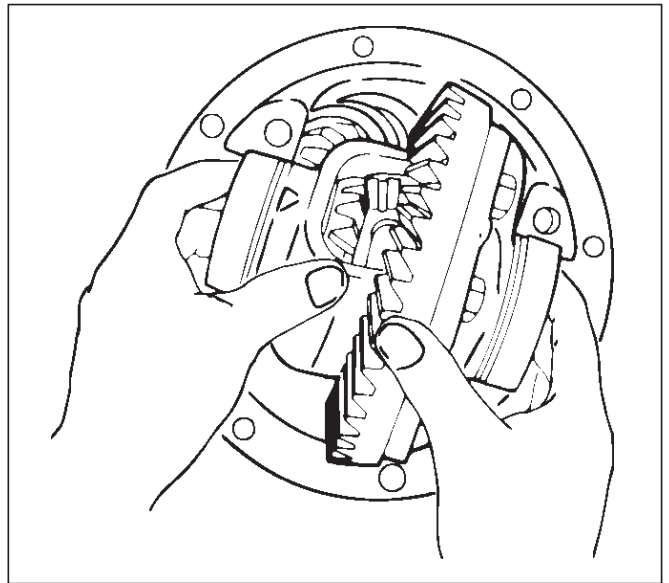


425RS029

Legend

- (1) Drive handle:5-8840-0007-0
- (2) Installer:9-8522-1164-0
- (3) Pilot:9-8521-1743-0

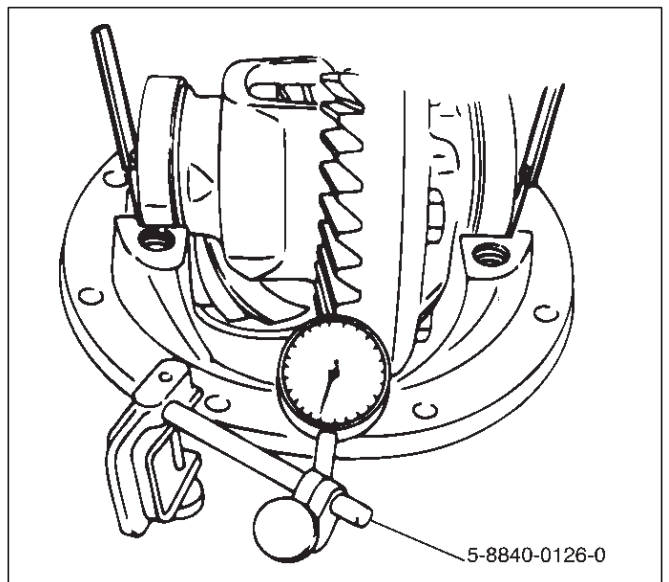
2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

Mount the dial indicator 5-8840-0126-0 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.

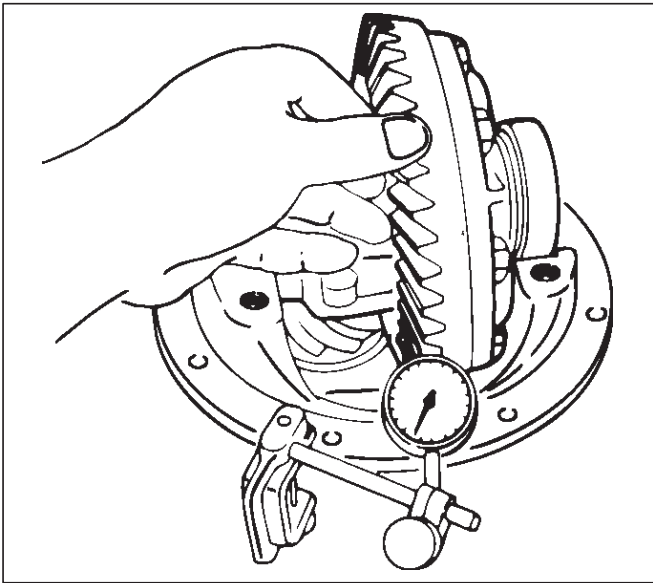


425RW049

4A1-18 DIFFERENTIAL (FRONT)

- Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

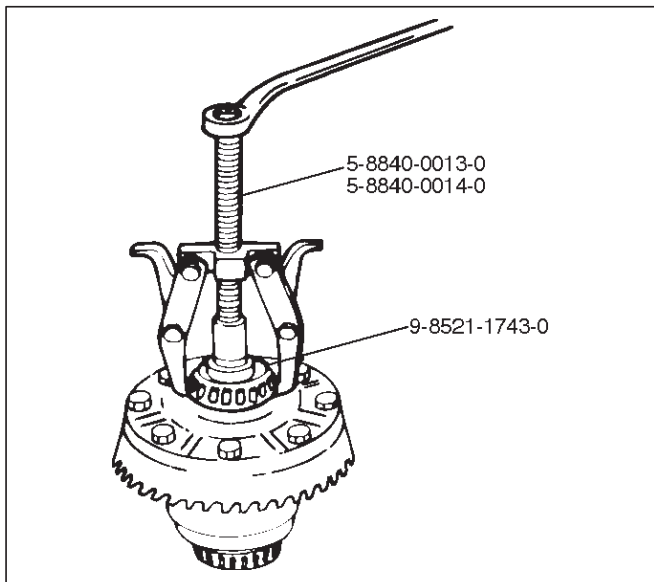
Backlash: 0.13–0.18 mm(0.005 –0.007 in)



425RS032

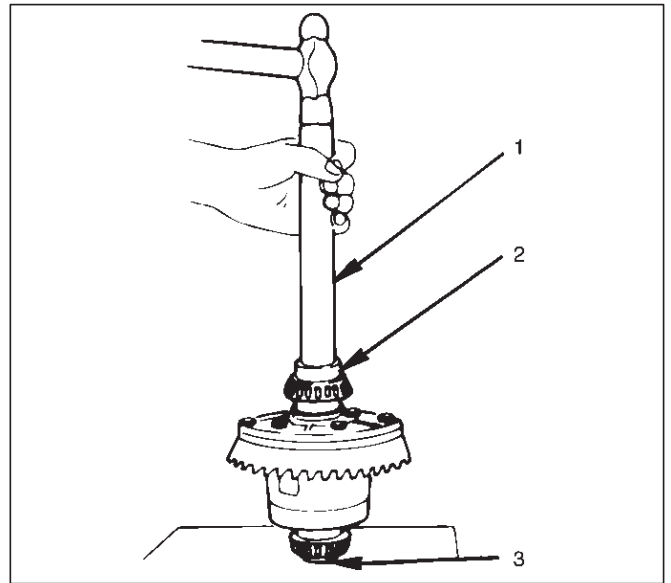
With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.

- Use bearing remover 5-8840-0013-0 and 5-8840-0014-0 and pilot 9-8521-1743-0 to remove side bearing.



415RW020

- Install the side bearings together with the selected shims.

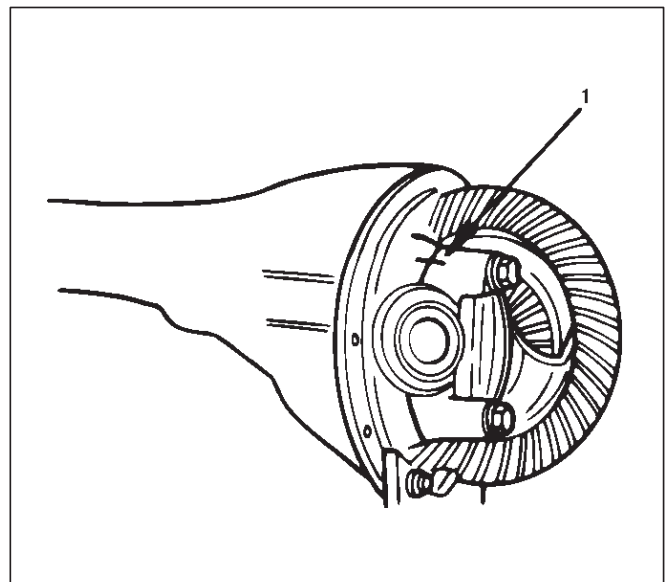


425RS029

Legend

- (1) Drive Handle:5-8840-0007-0
- (2) Installer: 9-8522-1164-0
- (3) Pilot: 9-8521-1743-0

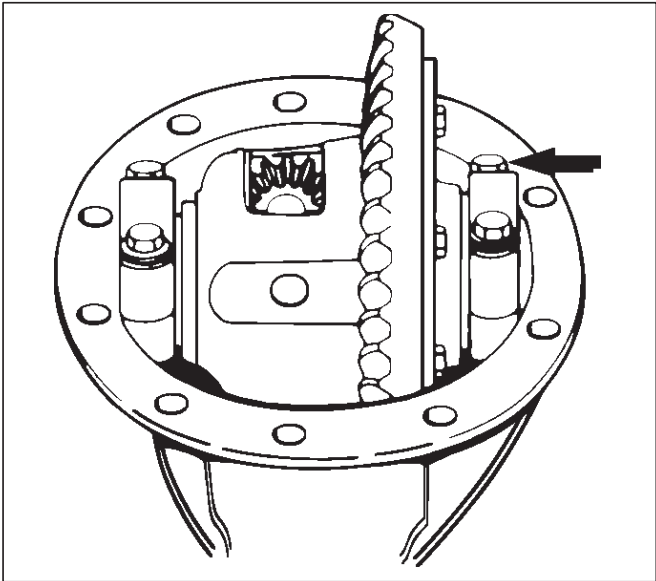
- Install side bearing outer race.
- Install differential cage assembly.
- Install bearing cap then align the setting marks(1) applied at disassembly.



425RS035

17. Tighten the cap bolt to the specified torque.

Torque: 98 N-m (10kg-m/72 lb ft)

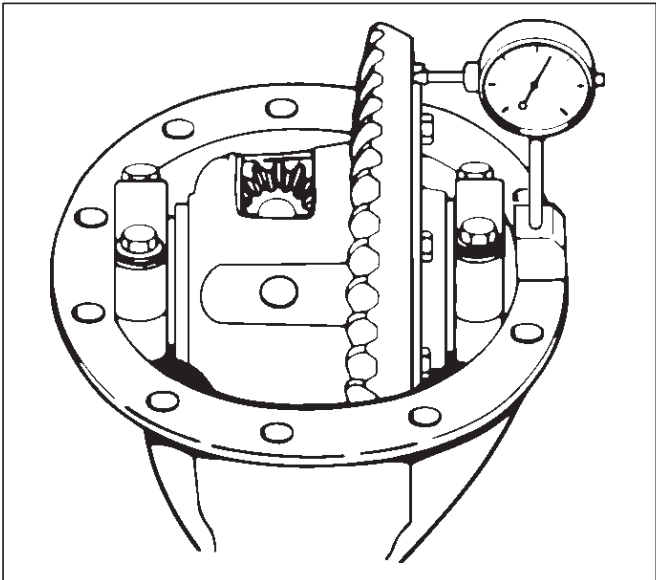


425RS036

1. Measure the amount of run-out of the ring gear at its rear face.

Standard: 0.02 mm (0.001 in)

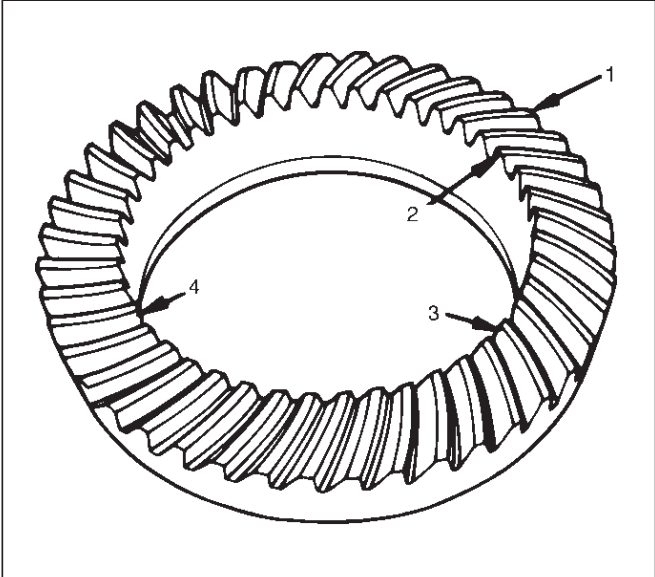
Limit: 0.05 mm (0.002 in)



425RS037

Gear Tooth Contact Pattern Check and Adjustment

1. Apply a thin coat of prussian blue or equivalent to the faces of the 7-8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.

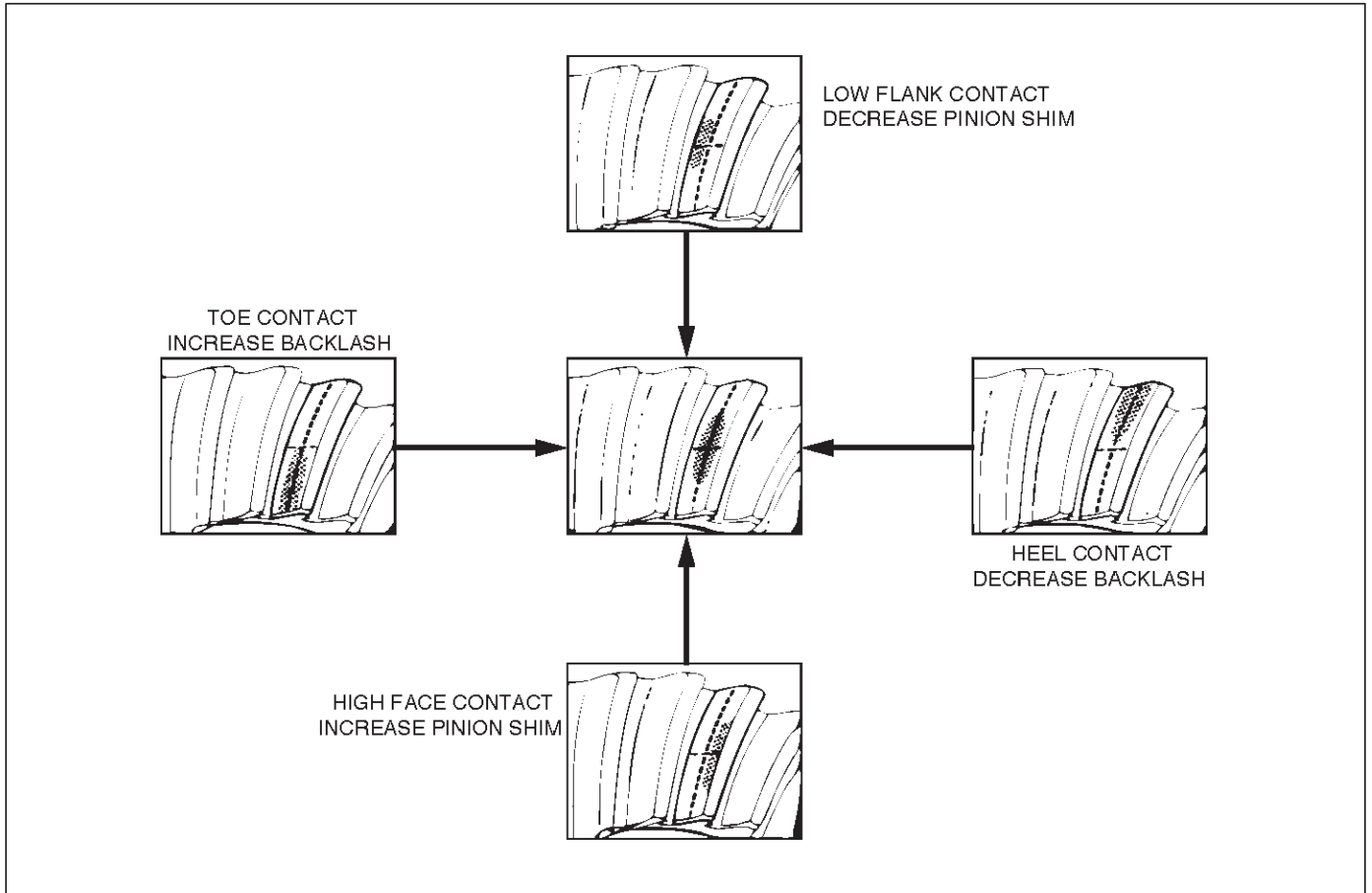


425RS038

Legend

- (1) Heel
- (2) Toe
- (3) Concave Side (Coast)
- (4) Convex Side (Drive)

4A1-20 DIFFERENTIAL (FRONT)

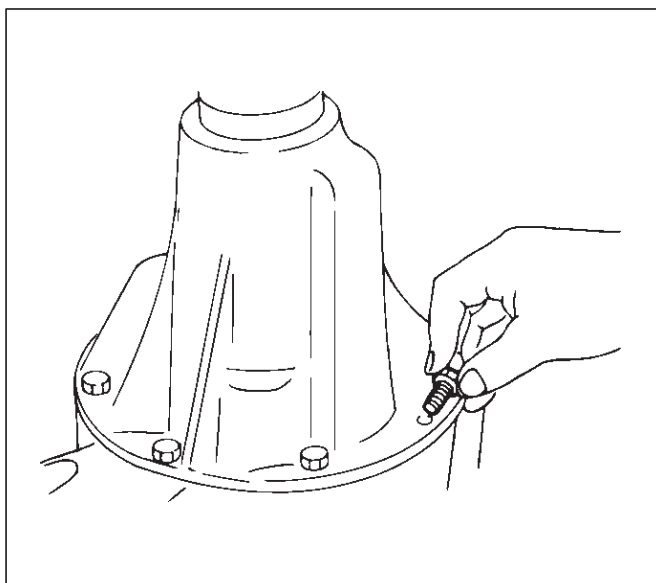


425RS039

18. Install differential assembly.

1. Clean the faces of the front axle case and differential carrier.
Apply Three Bond TB1215 or equivalent to the sealing side of the axle case and the carrier.
2. Attach the differential case and the carrier assembly to the front axle case and tighten the nuts and bolts.

Torque: 25 N·m (2.5kg·m/19 lb ft)



415RS014

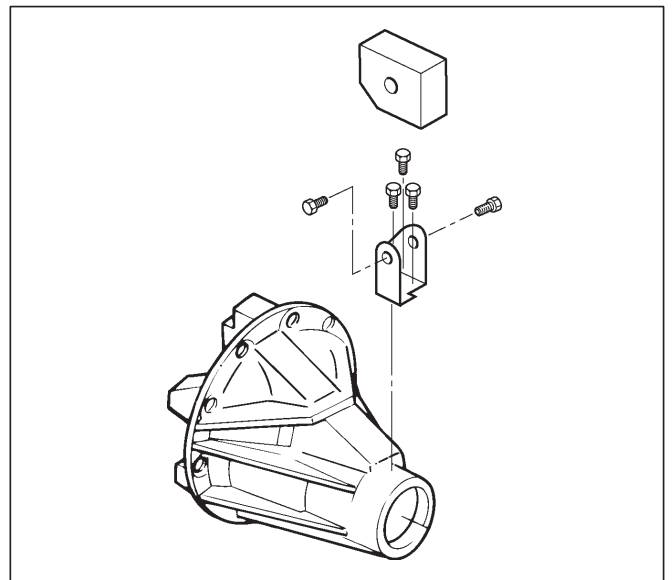
3. Fill the axle case with hypoid gear lubricant, to just below the filler hole.

Lubricant capacity: 1.4 liter(1.2 Imp qt/1.5 US qt)

19. Install damper.

1. Clean the faces and bolt thread hole of differential carrier.
2. Install the bracket with new bolts.
3. Install the damper to the bracket with new bolts.

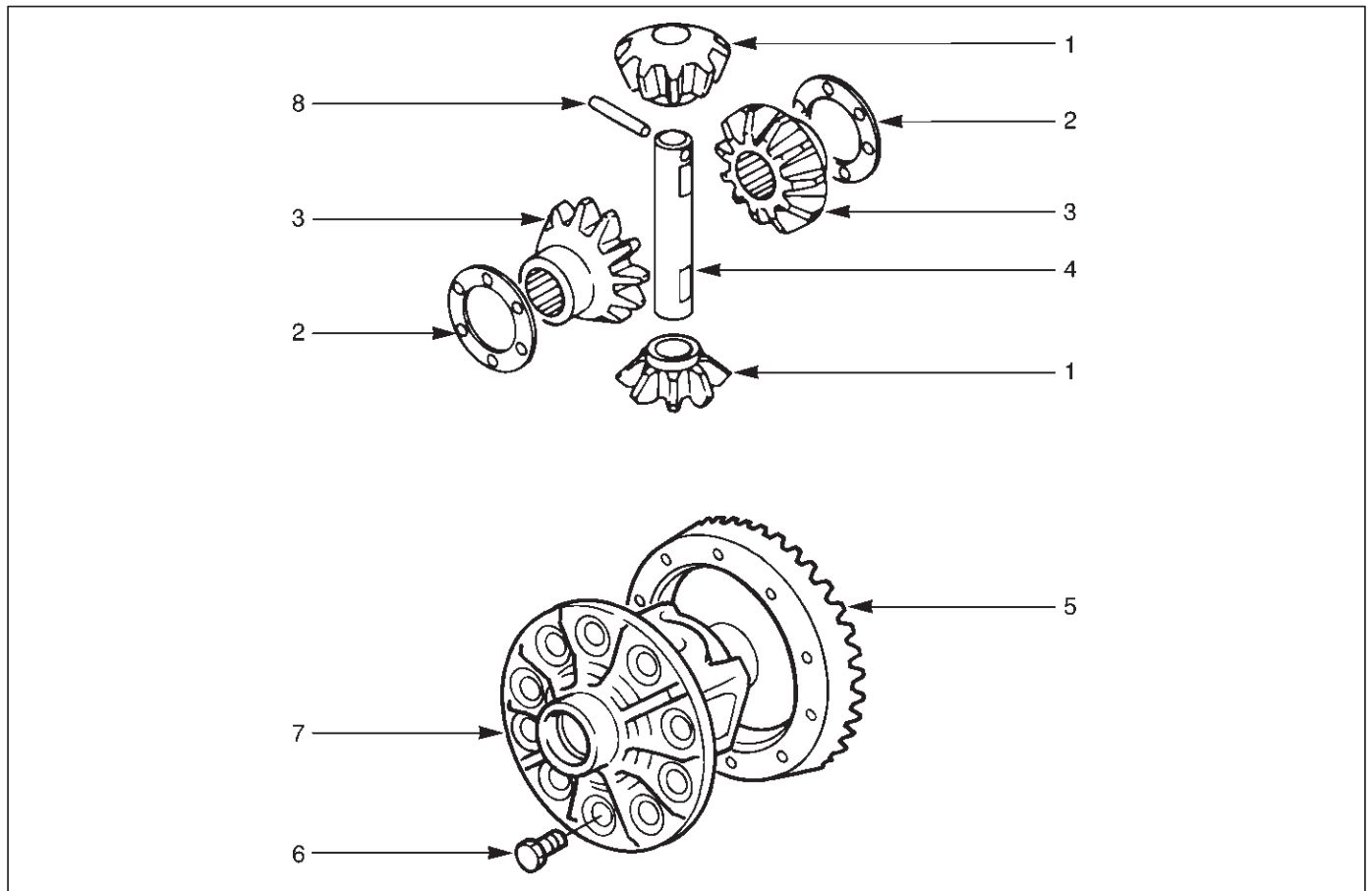
Torque: 25 N·m (2.5kg·m/19 lb ft)



425RW042

Differential Cage Assembly

Disassembled View



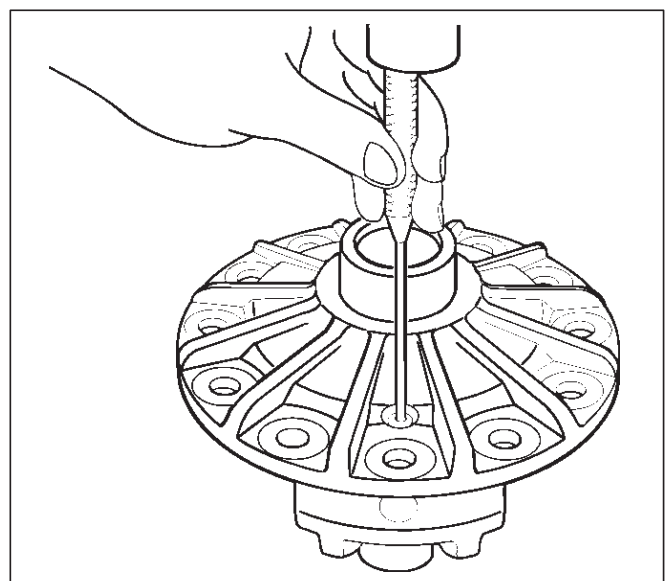
415RS015

Legend

- | | |
|-------------------|-----------------------|
| (1) Pinion Gear | (5) Ring Gear |
| (2) Thrust Washer | (6) Bolt |
| (3) Side Gear | (7) Differential Cage |
| (4) Cross Pin | (8) Lock Pin |

Disassembly

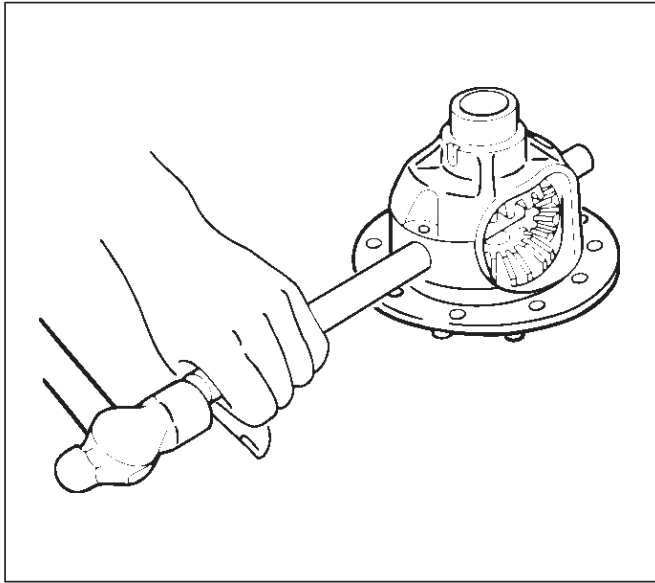
1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin, break staking on the lock pin, using a 5 mm (0.20 in) diameter drill.



425RS042

4A1-22 DIFFERENTIAL (FRONT)

4. Remove the cross pin, using a soft metal rod and a hammer.



425RS043

5. Remove pinion gear.
6. Remove side gear.
7. Remove thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

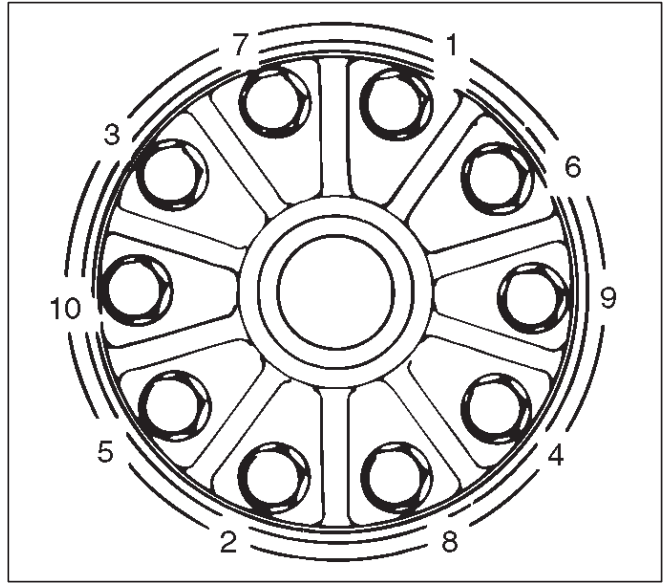
1. Ring gear, pinion gear
2. Bearing
3. Side gear, pinion gear, cross pin
4. Differential cage, carrier
5. Thrust washer
6. Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Clean the ring gear threaded holes to remove the locking agent.
3. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.
4. Discard used bolts and install new ones.

Torque: 108 N·m (11kg·m/80 lb ft)

5. Tighten the fixing bolts in a diagonal sequence as illustrated.

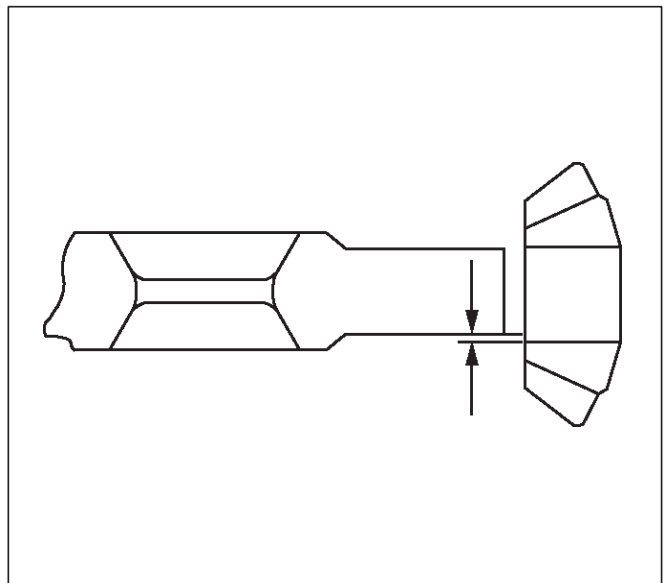


415RS016

Clearance between the differential pinion and the cross pin measurement:

Standard: 0.06 – 0.12 mm (0.002–0.005 in)

Limit: 0.2 mm (0.008 in)

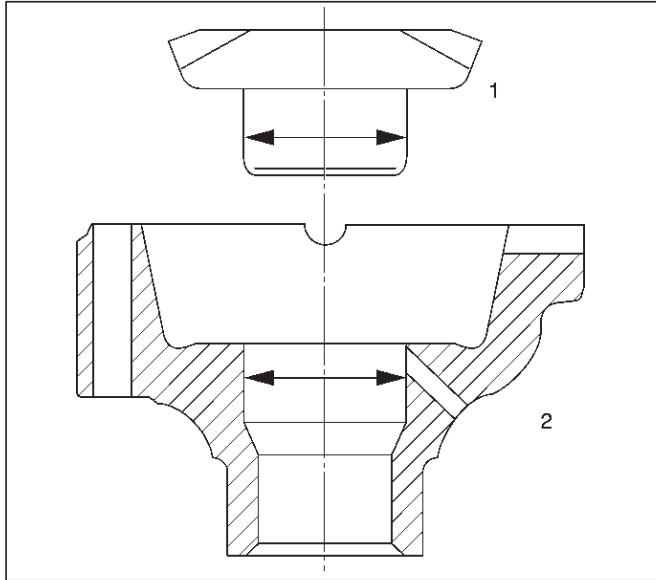


425RS045

Clearance between the side gear and the differential box:

Standard: 0.03–0.10 mm (0.001–0.004 in)

Limit: 0.15 mm(0.006 in)



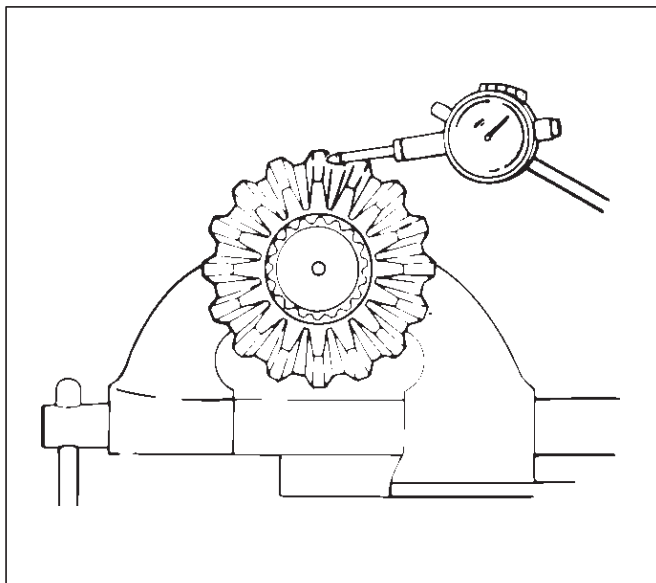
Legend

- (1) Side Gear
- (2) Differential Box

Play in splines between the side gear and the axle shaft:

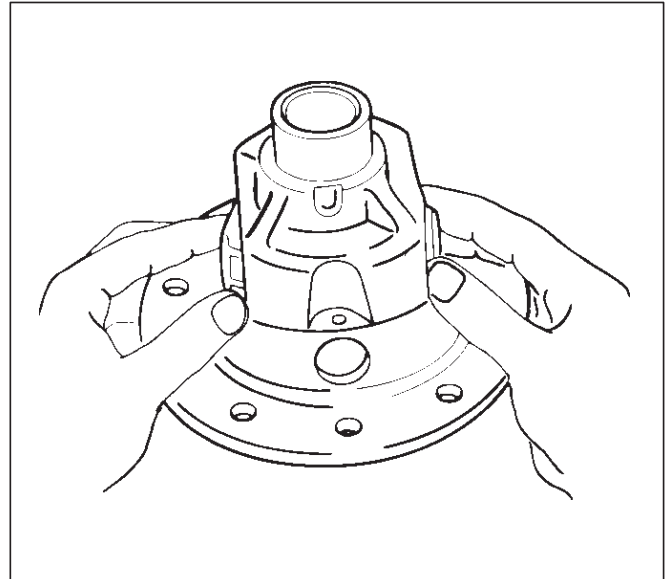
Standard: 0.08–0.36 mm(0.003 –0.014 in)

Limit:0.5m (0.02 in)

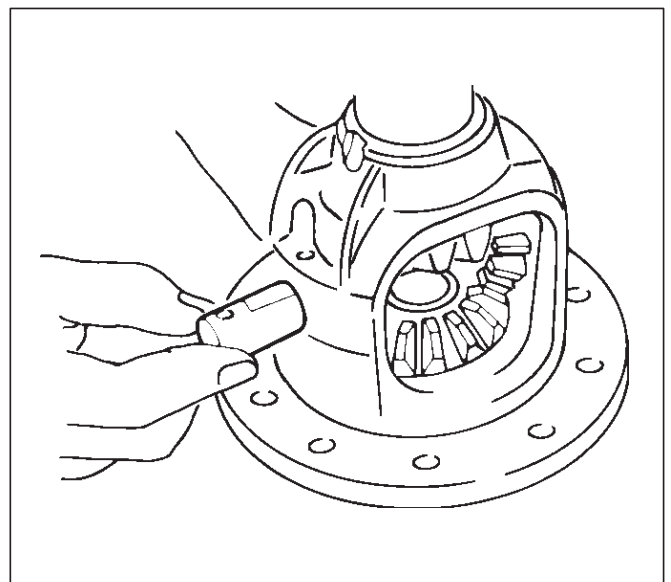


Reassembly

1. Install thrust washer.
2. Install side gear.
3. Install the pinion gear by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.



4. Install cross pin.
 1. Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.



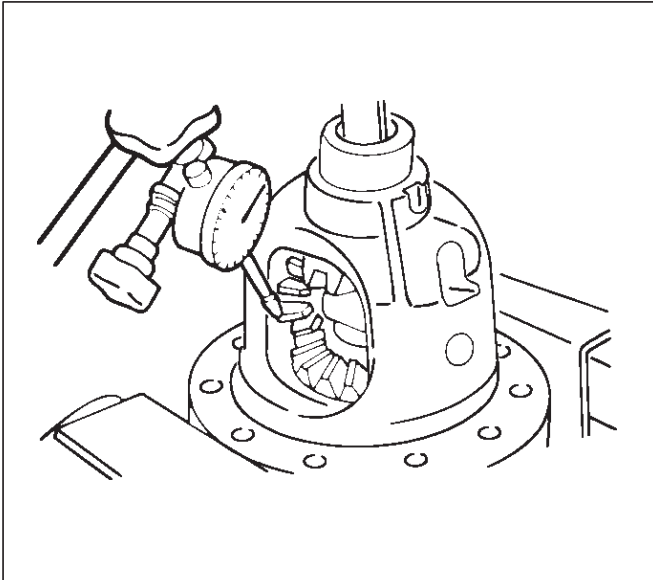
2. Adjust the backlash between the side gear and the pinion gear.

Backlash:0.03 – 0.08 mm (0.001– 0.003 in)

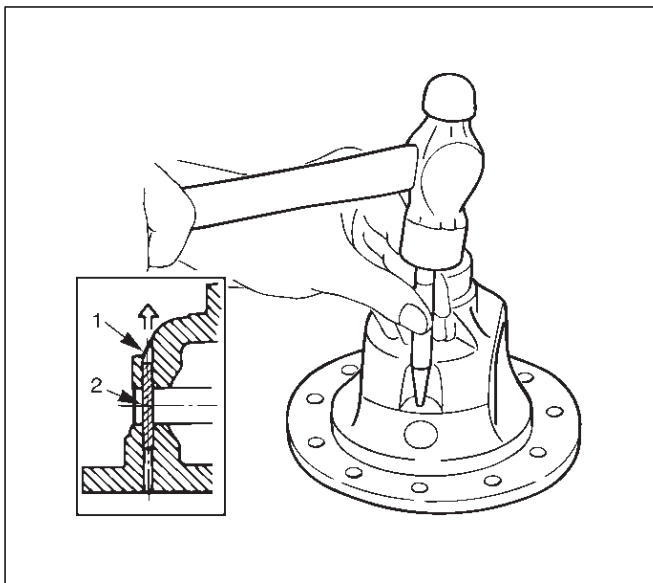
4A1-24 DIFFERENTIAL (FRONT)

Thickness of thrust washers available:

1.00 mm, 1.05 mm, 1.10 mm (0.039 in, 0.041 in, 0.043 in)



5. Install lock pin. After lock pin installation, stake the cage to secure the lock pin.



Legend

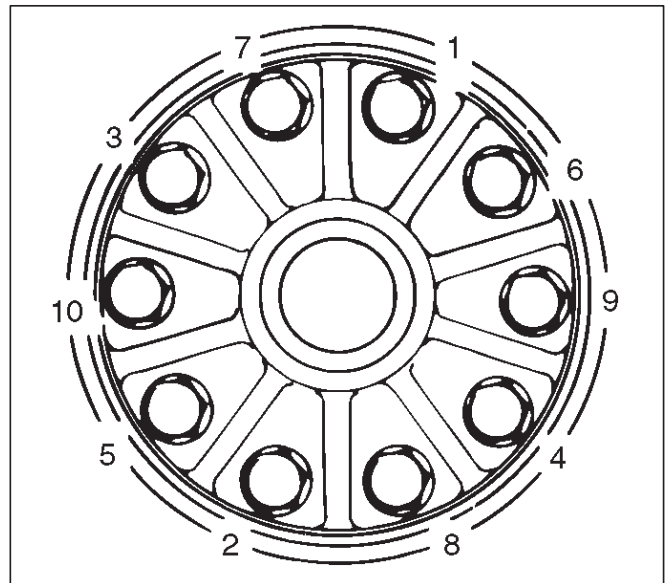
- (1) Staked Portion
- (2) Lock Pin

6. Clean the ring gear threaded holes to remove the locking agent. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.

7. Tighten the bolts in diagonal sequence as illustrated.

Torque: 108 N·m (11kg·m/80 lb ft)

NOTE: Discard used bolts and install new ones.



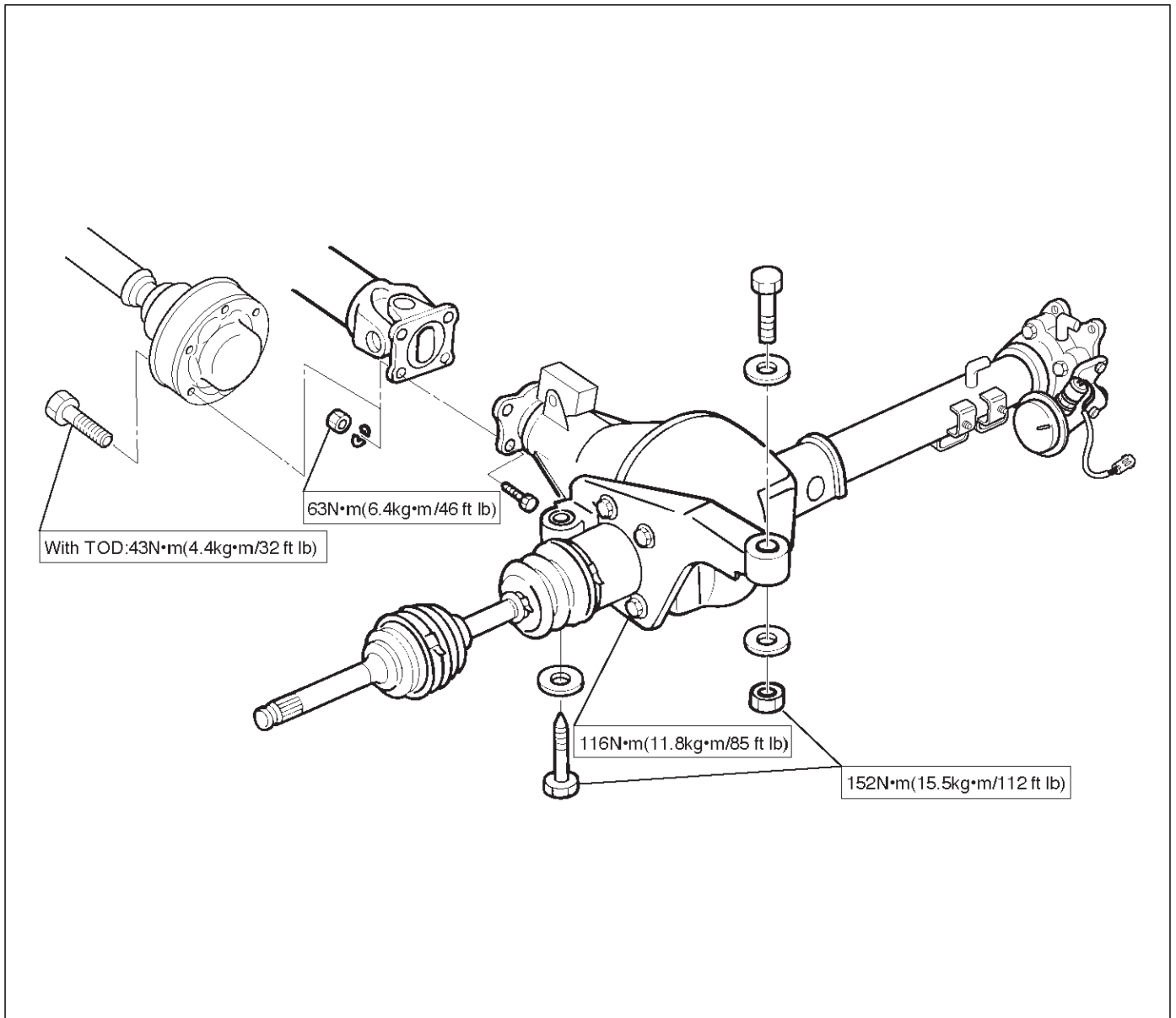
Main Data and Specifications

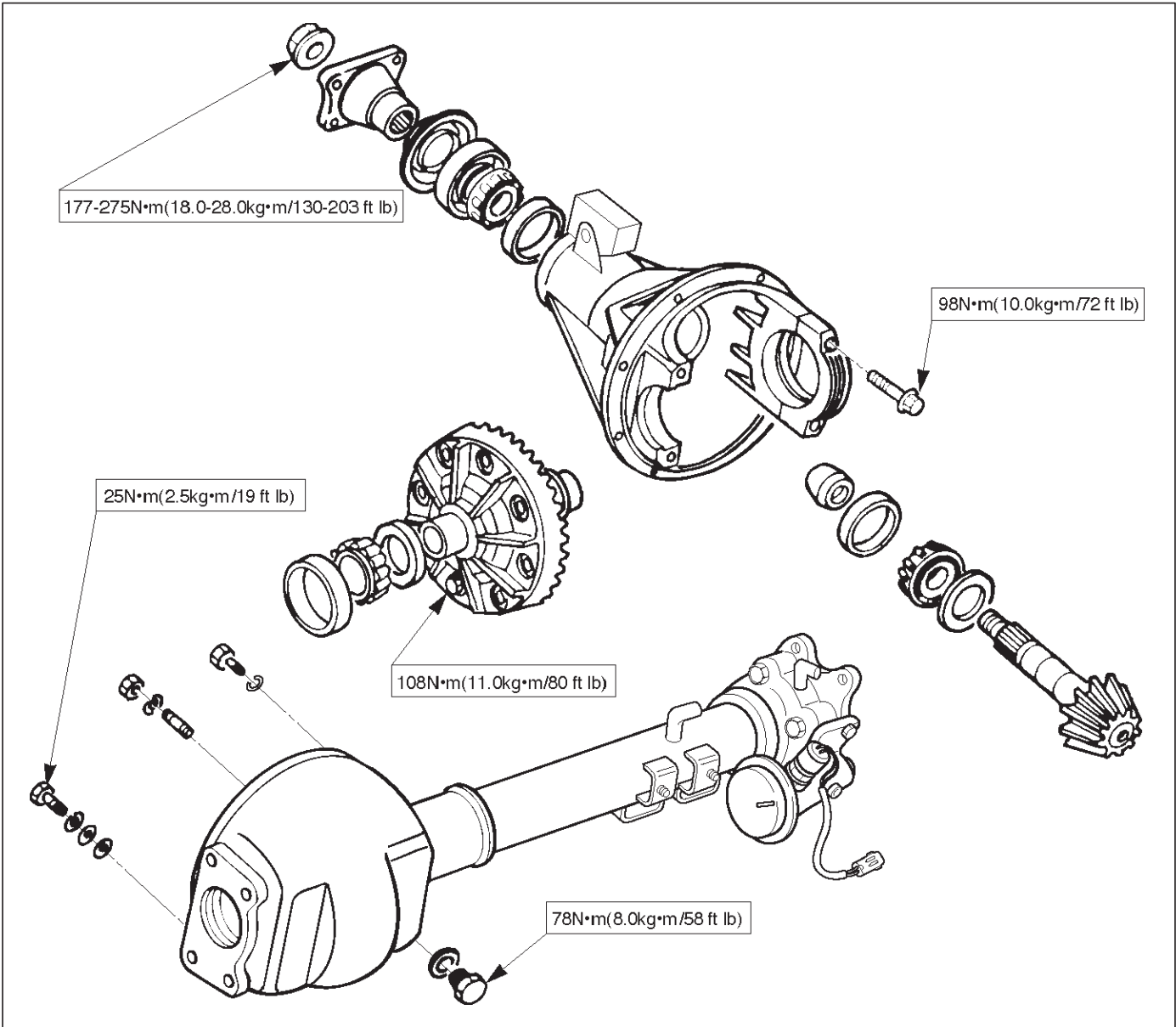
General Specifications

Axle tube Type		It consists of the duct, a cast iron housing and the axle tube.
Gear type		Hypoid
Gear ratio	(to 1)	4.100(6VE1) 4.300(4JX1, 6VE1) 4.555(4JG2-TC, 6VD1) 4.777(4JG2)
Differential type		Two pinion
Oil capacity	liter (Imp qt/US qt)	1.4 (1.2/1.5) (Differential) 0.12 (0.11/0.13) (Actuator Housing: Shift on the fly)
Type of lubricant		75W-90 GL-5 (Multi grade type) Refer to General Information
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint)

4A1-26 DIFFERENTIAL (FRONT)

Torque Specifications





4A1-28 DIFFERENTIAL (FRONT)

Special Tools


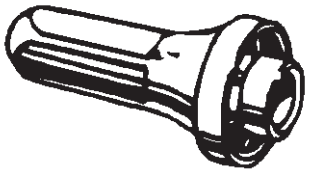
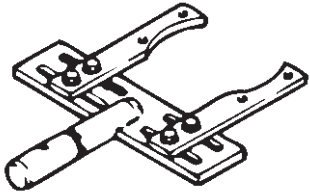
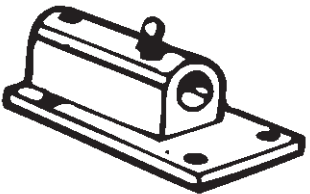
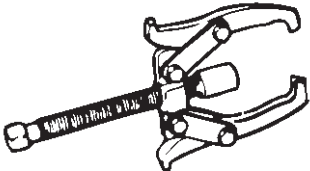
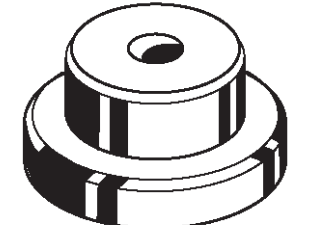
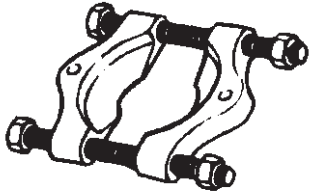
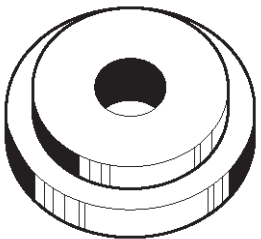
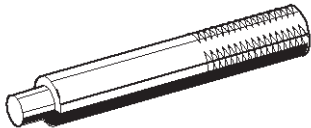
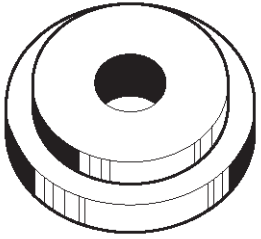
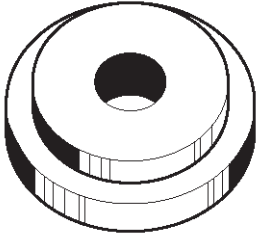
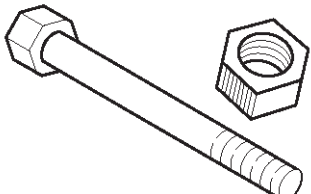
ILLUSTRATION	TOOL NO. TOOL NAME
 <small>901RS210</small>	5-8840-2157-0 (J-37221) Holder; Pinion flange
 <small>901RS222</small>	9-8522-1275-0 (J-24250) Installer; Oil seal
 <small>901RS212</small>	5-8840-0275-0 (J-37264) Differential holding fixture (Use with 5-8840-0003-0 base)
 <small>901RS213</small>	5-8840-0003-0 (J-3289-20) Holding fixture base
 <small>901RS214</small>	5-8840-0013-0 5-8840-0014-0 (J-22888) Puller; Side bearing
 <small>901RS228</small>	9-8521-1743-0 (J-8107-2) Adapter; Side bearing plug

ILLUSTRATION	TOOL NO. TOOL NAME
 <small>901RS226</small>	5-8840-0015-0 (J-22912-01) Separator
 <small>901RS240</small>	9-8522-1141-0 (J-24256) Installer; Outer bearing outer race
 <small>901RS241</small>	5-8840-0007-0 (J-8092) Driver handle
 <small>901RS240</small>	9-8522-1274-0 (J-24252) Installer; Inner bearing outer race
 <small>901RS223</small>	5-8840-2085-0 (J-21777-42) Pilot
 <small>901RS242</small>	5-8840-2089-0 (J-23597-9) Nut and bolt

DIFFERENTIAL (FRONT) 4A1-29

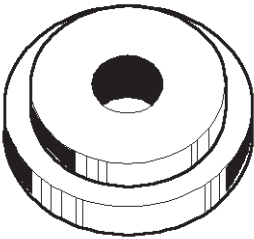
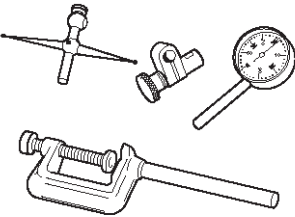
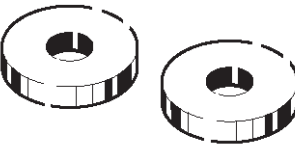
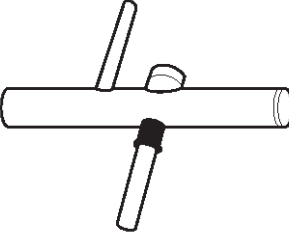
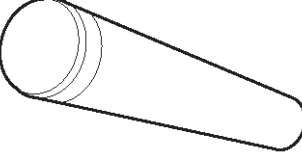
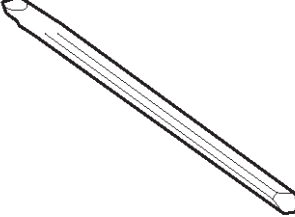
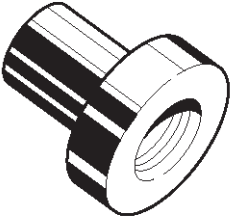
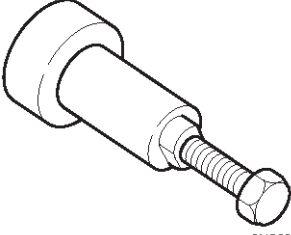
ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS243</p>	<p style="text-align: center;">5-8840-2087-0 (J-23597-7) Gauge plate</p>
 <p style="text-align: right; font-size: small;">901RS224</p>	<p style="text-align: center;">5-8840-0126-0 (J-8001) Dial indicator</p>
 <p style="text-align: right; font-size: small;">901RS244</p>	<p style="text-align: center;">5-8840-2088-0 (J-23597-8) Disc</p>
 <p style="text-align: right; font-size: small;">901RS226</p>	<p style="text-align: center;">5-8840-0128-0 (J-23597-1) Arbor</p>
 <p style="text-align: right; font-size: small;">901RS227</p>	<p style="text-align: center;">9-8522-1165-0 (J-6133-01) Installer; Pinion bearing</p>
 <p style="text-align: right; font-size: small;">901RS228</p>	<p style="text-align: center;">5-8840-2293-0 (J-39209) Punch; End nut lock</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS245</p>	<p style="text-align: center;">9-8522-1164-0 (J-24244) Installer; Side bearing</p>
 <p style="text-align: right; font-size: small;">901RS230</p>	<p style="text-align: center;">5-8840-2323-0 (J-39602) Remover; Outer bearing</p>

MEMO

DRIVELINE/AXLE

DIFFERENTIAL (Rear 220mm)

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Installation	4A2A-7	Inspection and Repair	4A2A-26
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Differential Assembly and Associated Parts	4A2A-8	Main Data and Specifications	4A2A-32
Removal	4A2A-8	Special Tools	4A2A-34

Service Precaution

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

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

4A2A-2 DIFFERENTIAL (REAR 220mm)

General Description

The rear axle assembly is of the semi-floating type in which the vehicle weight is carried on the axle housing. The center line of the pinion gear is below the center line of the ring gear (hypoid drive).

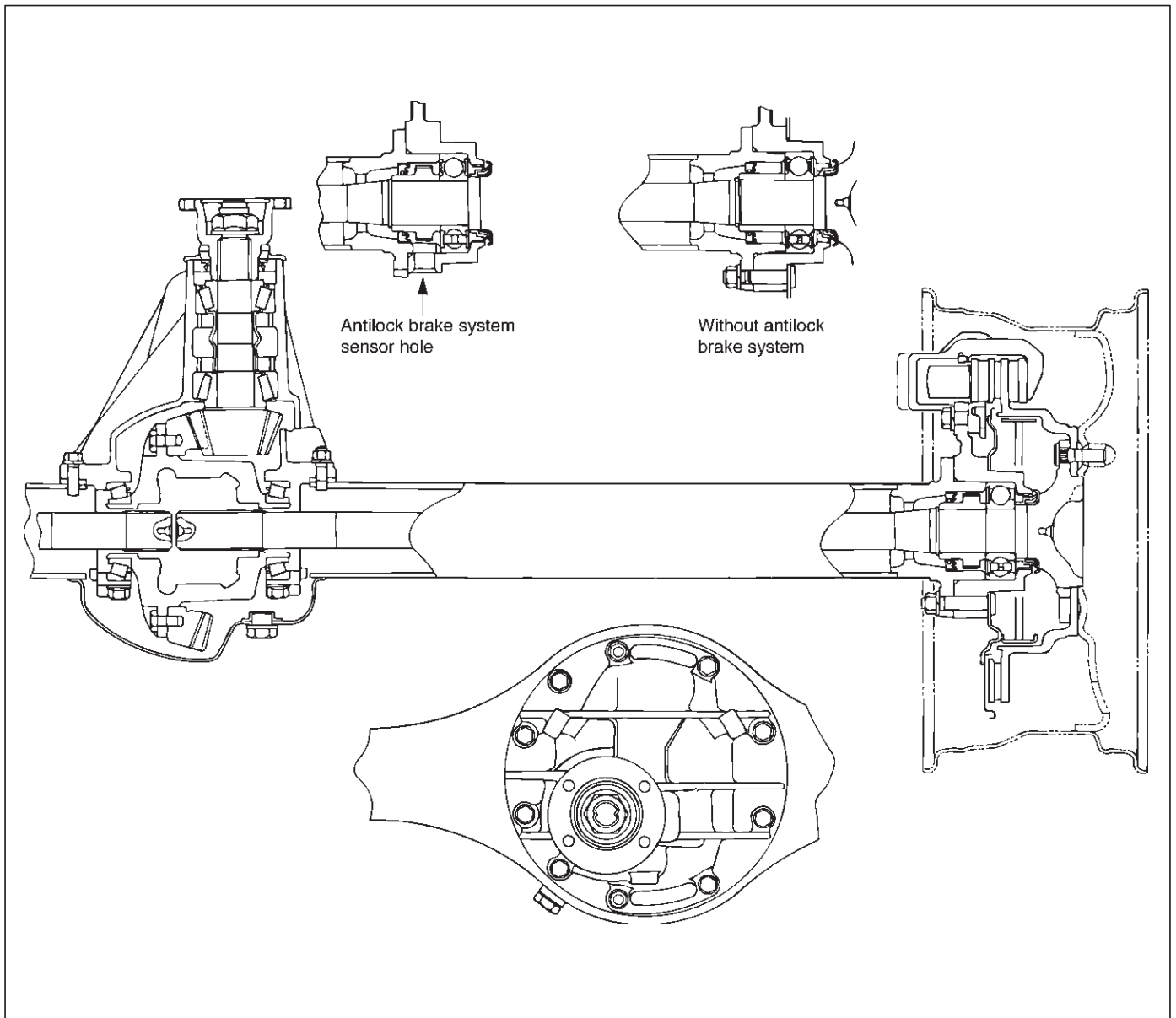
All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a banjo type axle housing.

The 8.7 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this

driving force at a 90 degree angle from the propeller shaft to the drive shafts.

The axle shafts are supported at the wheel end of the shaft by a roller bearing.

The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.



The ring gear is bolted onto the differential cage with 12 bolts.

The differential cage is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using selective shims and spacers between the bearing and the axle housing. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which

are pressed onto the differential cage. Two bearing caps are used to hold the differential into the rear axle housing. The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a liquid gasket between the differential carrier and the axle housing.

Diagnosis

Many noises that seem to come from the rear axle actually originate from other sources such as tires, road surface, wheel bearings, engine, transmission, muffler, or body drumming. Investigate to find the source of the noise before disassembling the rear axle. Rear axles, like any other mechanical device, are not absolutely quiet but should be considered quiet unless some abnormal noise is present.

To make a systematic check for axle noise, observe the following:

1. Select a level asphalt road to reduce tire noise and body drumming.
2. Check rear axle lubricant level to assure correct level, and then drive the vehicle far enough to thoroughly warm up the rear axle lubricant.
3. Note the speed at which noise occurs. Stop the vehicle and put the transmission in neutral. Run the engine speed slowly up and down to determine if the noise is caused by exhaust, muffler noise, or other engine conditions.
4. Tire noise changes with different road surfaces; axle noises do not. Temporarily inflate all tires to 344 kPa (3.5kg/cm², 50 psi) (for test purposes only). This will change noise caused by tires but will not affect noise caused by the rear axle.

Rear axle noise usually stops when coasting at speeds under 48 km/h (30 mph); however, tire noise continues with a lower tone. Rear axle noise usually changes when comparing pull and coast, but tire noise stays about the same.

Distinguish between tire noise and rear axle noise by noting if the noise changes with various speeds or sudden acceleration and deceleration. Exhaust and axle noise vary under these conditions, while tire noise remains constant and is more pronounced at speeds of 32 to 48 km/h (20 to 30 mph). Further check for tire noise by driving the vehicle over smooth pavements or dirt roads (not gravel) with the tires at normal pressure. If the noise is caused by tires, it will change noticeably with changes in road surface.

5. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing drive and coast. Light application of the brake while holding vehicle speed steady will often cause wheel bearing noise to diminish. Front wheel bearings may be checked for noise by jacking up the wheels and spinning them or by shaking the wheels to determine if bearings are loose.
6. Rear suspension rubber bushings and spring insulators dampen out rear axle noise when correctly installed. Check to see that there is no link or rod loosened or metal-to-metal contact.
7. Make sure that there is no metal-to-metal contact between the floor and the frame.

After the noise has been determined to be in the axle, the type of axle noise should be determined, in order to make any necessary repairs.

Gear Noise

Gear noise (whine) is audible from 32 to 89 km/h (20 to 55 mph) under four driving conditions.

1. Driving under acceleration or heavy pull.
2. Driving under load or under constant speed.
3. When using enough throttle to keep the vehicle from driving the engine while the vehicle slows down gradually (engine still pulls slightly).
4. When coasting with the vehicle in gear and the throttle closed. The gear noise is usually more noticeable between 48 and 64 km/h (30 and 40 mph) and 80 and 89 km/h (50 and 55 mph).

Bearing Noise

Bad bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise frequently “wow-wows” at bearing rpm, indicating a bad pinion or rear axle side bearing. This noise can be confused with rear wheel bearing noise.

Rear Wheel Bearing Noise

Rear wheel bearing noise continues to be heard while coasting at low speed with transmission in neutral. Noise may diminish by gentle braking. Jack up the rear wheels, spin them by hand and listen for noise at the hubs. Replace any faulty wheel bearings.

Knock At Low Speeds

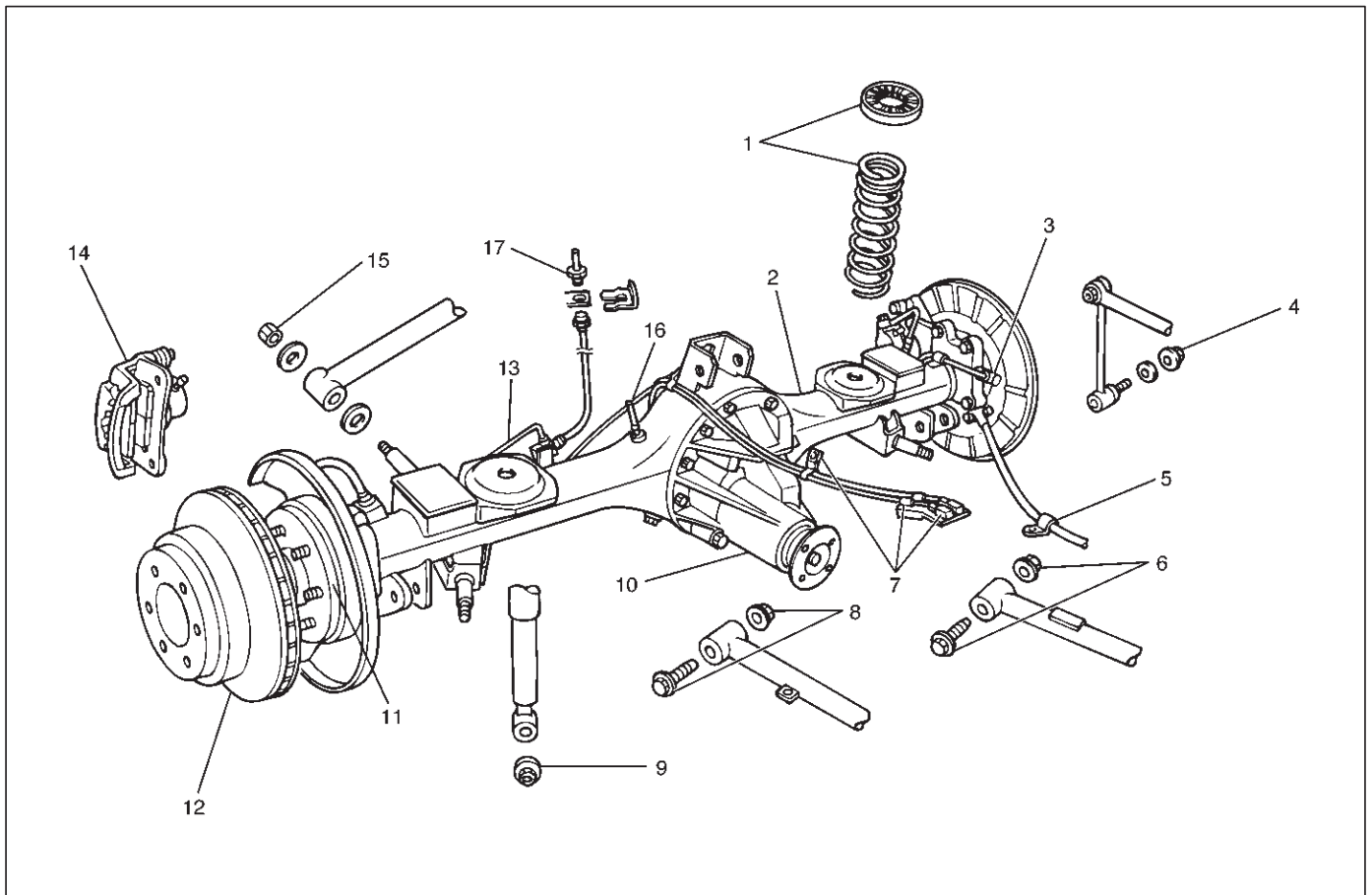
Low speed knock can be caused by worn universal joints or a side gear hub counter bore in the cage that is worn oversize. Inspect and replace universal joints or cage and side gears as required.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by a worn rear axle pinion shaft, a worn cage, excessive clearance between the axle and the side gear splines, excessive clearance between the side gear hub and the counterbore in the cage, worn pinion and side gear teeth, worn thrust washers, or excessive drive pinion and ring gear backlash. Remove worn parts and replace as required. Select close-fitting parts when possible. Adjust pinion and ring gear backlash.

Axle Housing

Axle Housing and Associated Parts



420RW022

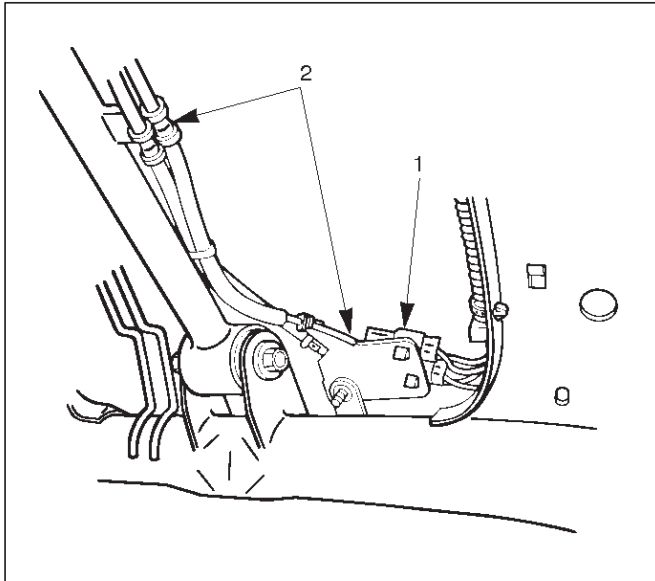
Legend

- | | |
|---|----------------------------|
| (1) Coil Spring and Insulator | (9) Nut |
| (2) Axle Housing Assembly | (10) Differential Assembly |
| (3) ABS Speed Sensor and Harness(if equipped) | (11) Axle Shaft Assembly |
| (4) Nut | (12) Brake Disc |
| (5) Parking Brake Cable | (13) Brake Pipe |
| (6) Bolt and Nut | (14) Brake Caliper |
| (7) Antilock Brake System (ABS) Connector and Bracket (if equipped) | (15) Nut |
| (8) Bolt and Nut | (16) Breather Hose |
| | (17) Flare Nut |

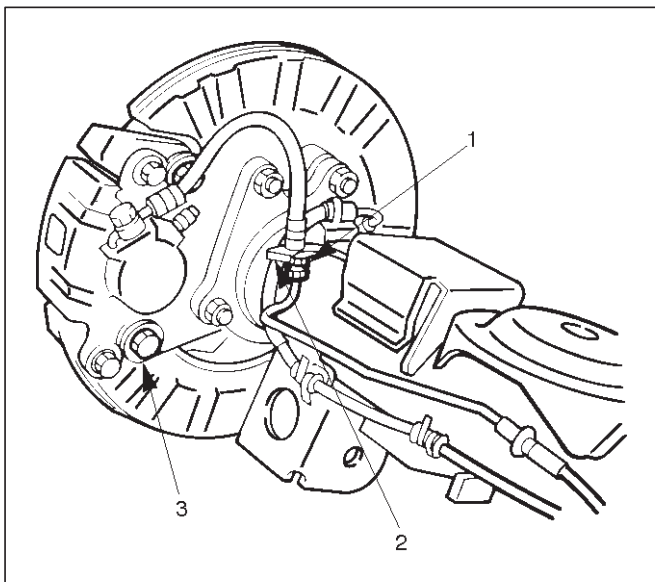
Removal

1. Raise the vehicle and support it with suitable safety stands.
The hoist must remain under the rear axle housing.
2. Drain brake fluid. Refer to Hydraulic Brakes in Brake section.
3. Remove rear wheels and tires. Refer to Wheel in Suspension section.
4. Remove propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Drain the rear axle oil into a proper container.
6. Remove parking brake cable, release the connection between the cable fixing clip equalizer. Refer to Parking Brakes in Brake section.
7. Move the clip aside and pull out the breather hose.

8. Disconnect the ABS connectors (1) and remove the brackets (2) attached to the frame and center link (ABS model only).



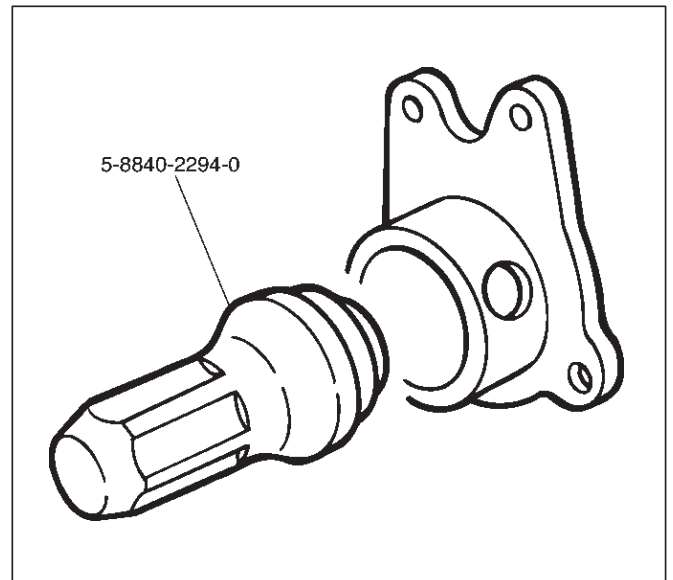
9. Loosen the brake tube flare nut, remove the clip and take out the brake tube.
10. Remove the shock absorber fixing nut from the axle housing.
11. Remove the stabilizer linkage mounting nut from the axle housing.
12. Remove the lateral rod fixing nut from the axle housing.
13. Remove the center link mounting bolt and nut from the axle housing.
14. Remove the trailing link fixing bolt and nut from the axle housing.
15. Jack down and remove the coil spring and insulator.
16. Axle housing assembly can be separated from the vehicle on completion of steps 1 – 11.
17. Remove the brake caliper fixing bolt (3), loosen the flare nut (1), release the clip (2) and take out the brake caliper together with the flexible hose.



18. Remove brake disc.
19. Remove antilock brake system speed sensor fixing bolt and the clip and bracket on the axle housing (ABS model only).
20. Remove the brake pipe clip and fixing bolt on the axle housing and take out the brake pipe.
21. Remove the bearing holder fixing nut and take out the axle shaft assembly, be sure not to damage the oil seal by the spline of the shaft, Refer to Axle Shaft in this section.
22. Remove differential assembly, refer to Differential Assembly in this section.

Oil Seal Replacement

Remove the oil seal, carefully not to damage the housing, and mount new oil seal using oil seal installer 5-8840-2294-0.



Installation

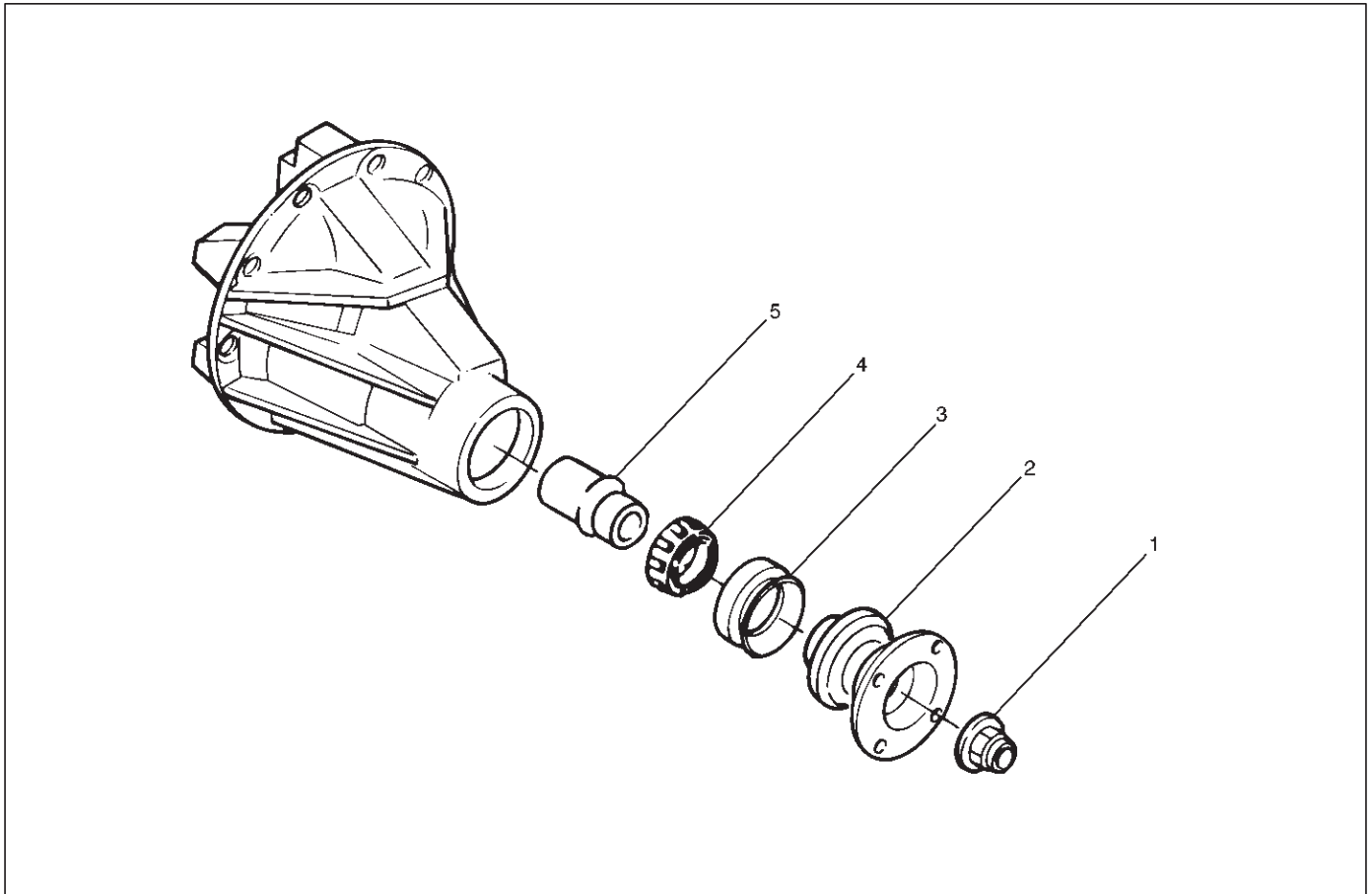
1. Install differential assembly, refer to Differential Assembly in this section.
2. Install axle shaft assembly then tighten the bearing holder mounting nut to the specified torque. Be sure not to damage the oil seal by the spline of the shaft.
Torque: 74N-m (7.5kg-m/54lb ft)
3. Install brake pipe.
4. Connect antilock brake system (ABS) speed sensor and harness, refer to 4-Wheel Anti-Lock Brake System (ABS) in Brake section (ABS model only).
5. Install brake disc.
6. Install brake caliper. Refer to Disk Brakes in Brake section.
7. Install axle housing assembly.
8. Install coil spring and insulator.
9. Install the trailing link fixing bolt and nut to the axle housing. For the procedures in items 9-13, refer to Suspension section.
10. Install the center link bolt and nut to the axle housing.

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11. Install the lateral rod fixing nut to the axle housing.
12. Install the stabilizer linkage mounting nut to the axle housing.
13. Install the shock absorber fixing nut to the axle housing.
14. Install brake tube flare nut, Refer to Disk Brakes in Brake section.
15. Install ABS connector and bracket (ABS model only).
16. Connect breather hose.
17. Install parking brake cable, Refer to Parking Brakes in Brake section.
18. Bleed brakes. Refer to Hydraulic Brakes in Brake section.

Pinion Oil Seal

Pinion Oil Seal and Associated Parts



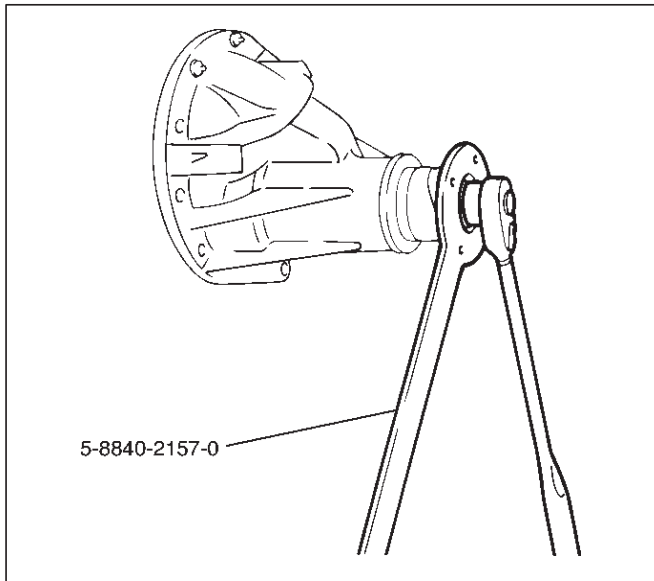
Legend

- | | |
|---------------------------|------------------------|
| (1) Flange Nut and Washer | (3) Oil Seal |
| (2) Flange | (4) Outer Bearing |
| | (5) Collapsible Spacer |

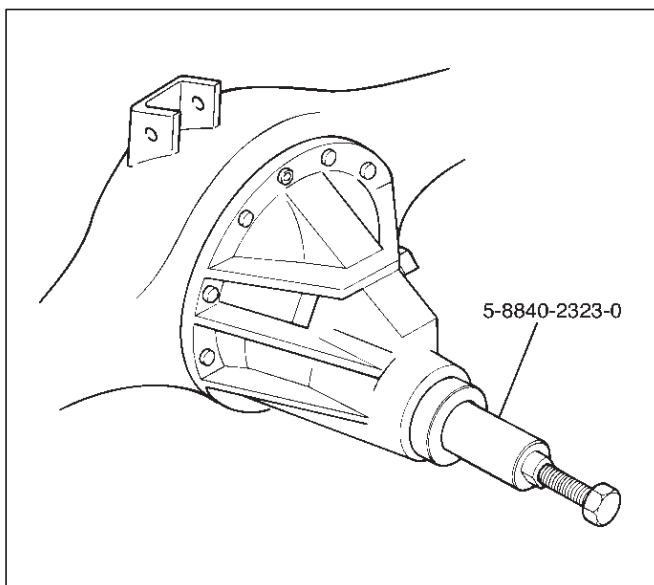
Removal

1. Remove the rear propeller shaft. Refer to Rear Propeller Shaft in this section.
2. Drain the rear axle oil.

3. Remove flange nut and washer by using pinion flange holder 5-8840-2157-0 after raising up its staked parts completely.



4. Remove flange.
5. Remove oil seal.
6. Remove outer bearing by using remover 5-8840-2323-0.



7. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

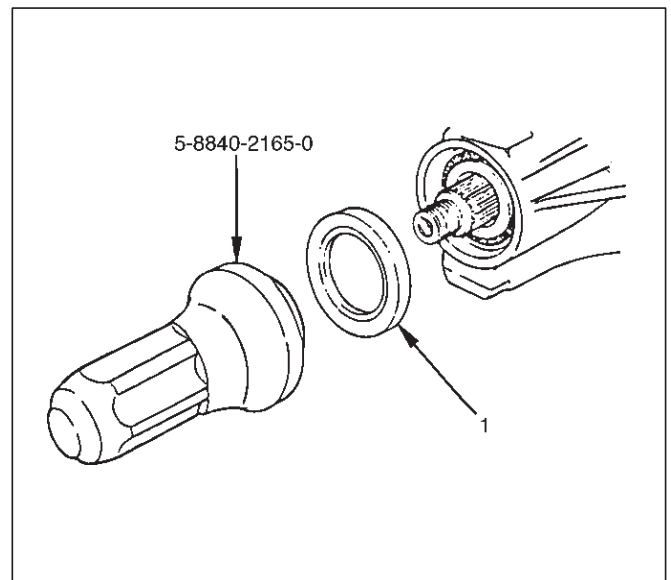
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer, discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. By using the seal installer 5-8840-2165-0, install a new oil seal (1) that has grease on seal lip.

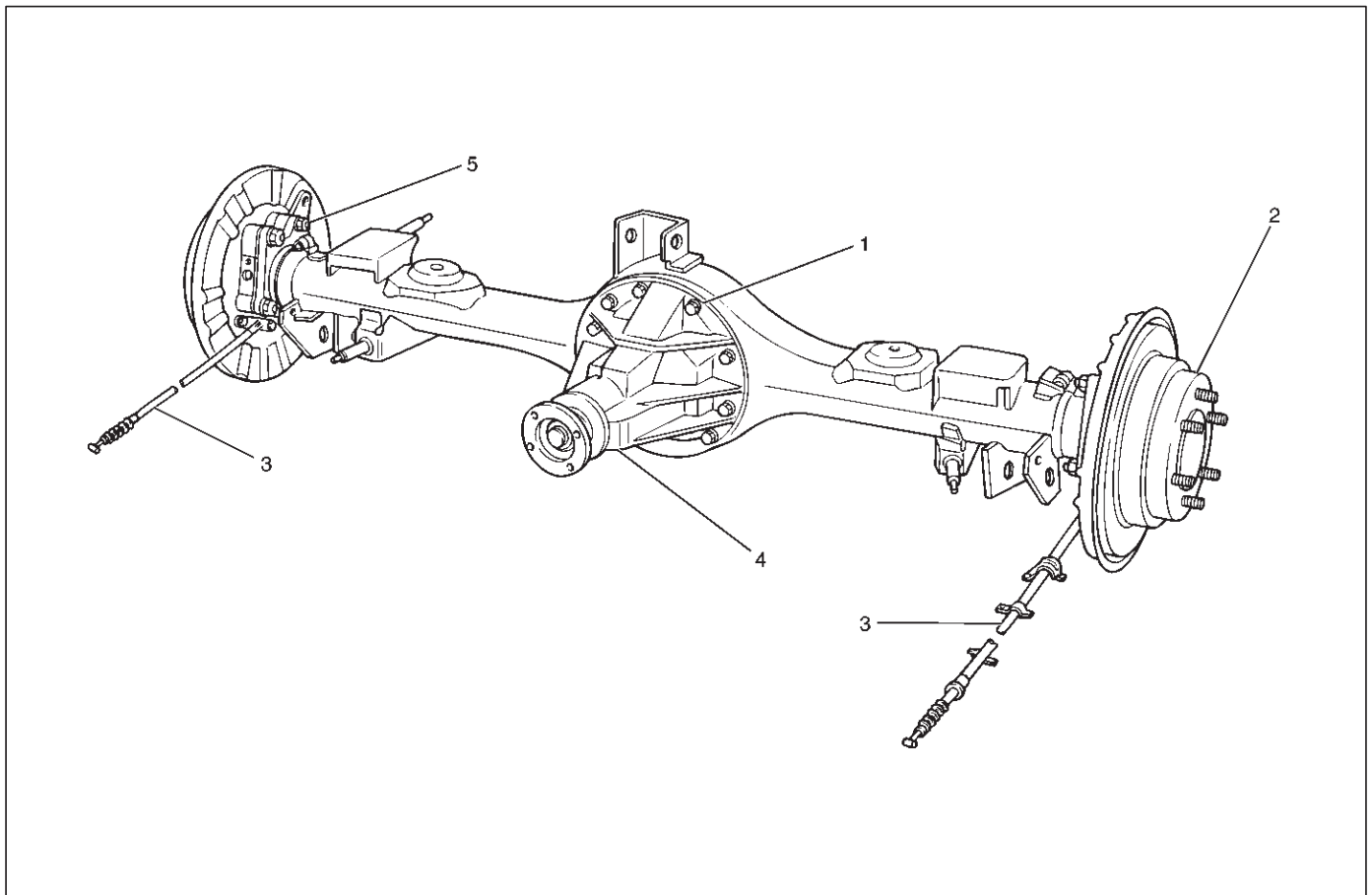


4. Install flange.
5. Install flange nut and washer. Refer to Differential Assembly in this section for flange nut reassembly.

NOTE: Discard the used nut and install a new one.

Differential Assembly

Differential Assembly and Associated Parts



425RW055

Legend

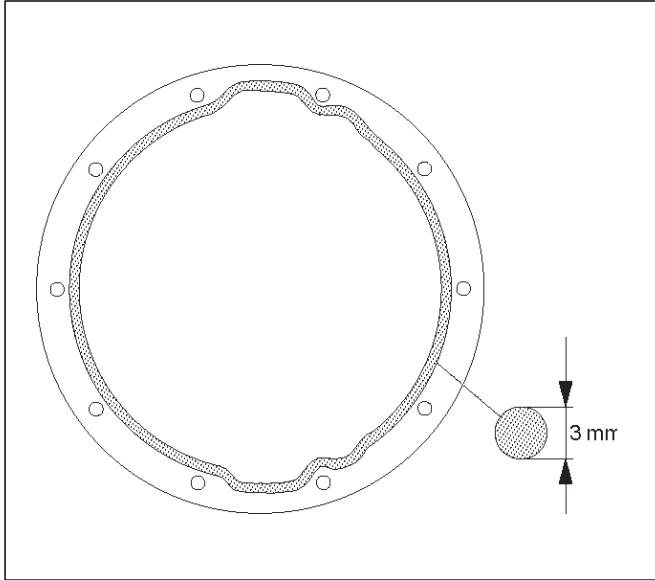
- | | |
|-------------------------|---------------------------|
| (1) Bolt and Nut | (3) Parking Brake Cable |
| (2) Axle Shaft Assembly | (4) Differential Assembly |
| | (5) Nut |

Removal

1. Jack up and support the frame with stands.
2. Remove the wheel and tire. Refer to Wheel in Steering section.
3. Drain the differential oil.
4. Remove the propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Remove the ABS speed sensor (ABS model only). Refer to 4-Wheel Anti-lock Brake System (ABS) in Brake section.
6. Remove the parking brake cable fastening clip and disconnect the equalizer section. Refer to Parking Brakes in Brake section.
7. Remove the bearing holder fixing nuts.
8. Remove axle shaft assembly, be sure not to damage the oil seal by axle shaft.
9. Remove differential carrier mounting bolts and nuts.
10. Remove differential assembly.

Installation

1. Clean the contact surfaces of the axle and differential carrier. As shown in the drawing, apply Three Bond TB1215 or equivalent then install differential assembly.



425RS006

2. Install bolt and nut. Tighten the differential carrier mounting bolts and nuts to the specified torque.

Torque:Nuts 44N-m (4.5kg-m/33lb ft)

Bolts 66N-m (6.7kg-m/48lb ft)

3. Install axle shaft assembly. Be sure not to damage the oil seal by axle shaft.
4. Install nut, refer to Axle Shaft in this section.
5. Install parking brake cable, refer to Parking Brakes in Brake section.

NOTE: After completing the assembling work, fill the prescribed gear oil to the filler hole.

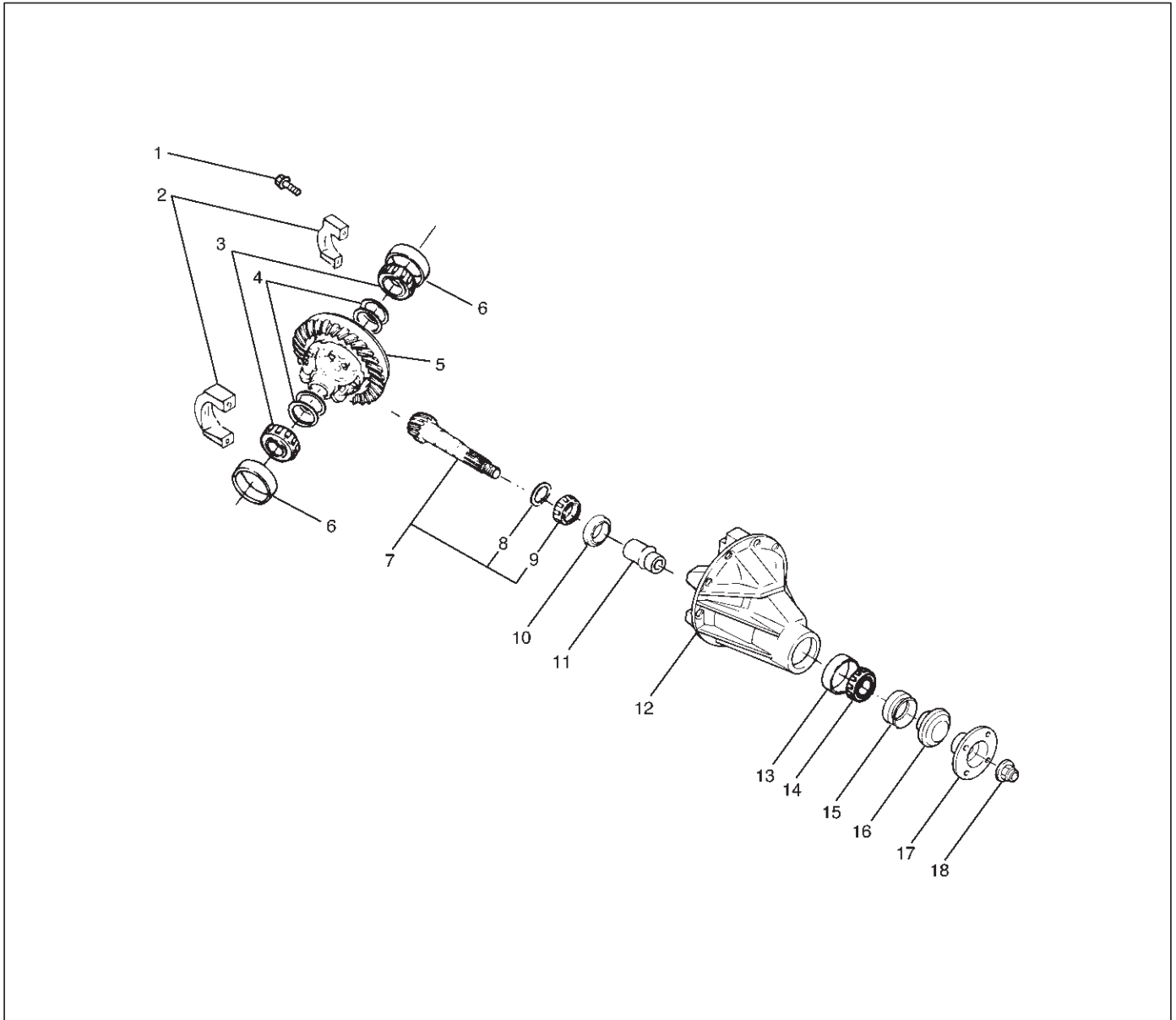
Lubricant capacity: 1.8 liter (1.6 Imp qt/1.9US qt)

6. Tighten the oil filler plug to the specified torque.

Torque: 78N-m (8.0kg-m/58lb ft)

4A2A-10 DIFFERENTIAL (REAR 220mm)

Disassembled View



415RW035

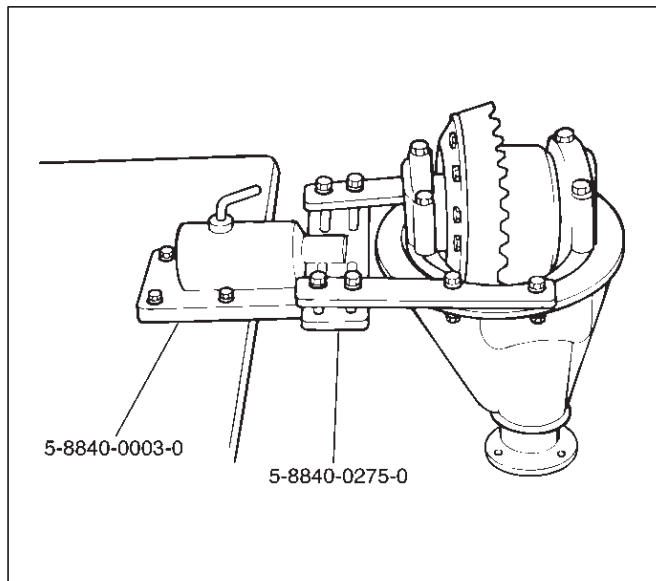
Legend

- | | |
|-----------------------------|-------------------------------|
| (1) Bolt | (10) Inner Bearing Outer Race |
| (2) Bearing Cap | (11) Collapsible Spacer |
| (3) Side Bearing | (12) Differential Carrier |
| (4) Adjust Shim | (13) Outer Bearing Outer Race |
| (5) Diff Cage Assembly | (14) Outer Bearing |
| (6) Side Bearing Outer Race | (15) Oil Seal |
| (7) Pinion Gear | (16) Dust Cover |
| (8) Adjust Shim | (17) Flange |
| (9) Inner Bearing | (18) Flange Nut |

DIFFERENTIAL (REAR 220mm) 4A2A-11

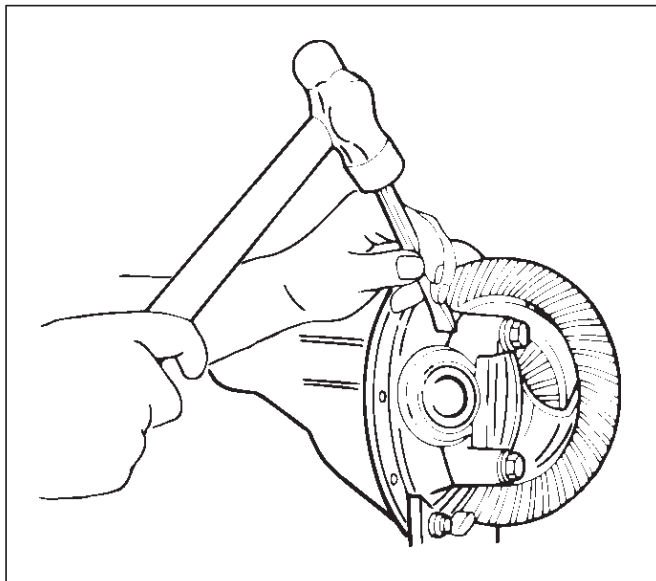
Disassembly

1. Using holding fixture 5-8840-0275-0 and holding fixture base 5-8840-0003-0, fix the differential assembly to the bench.



425RW046

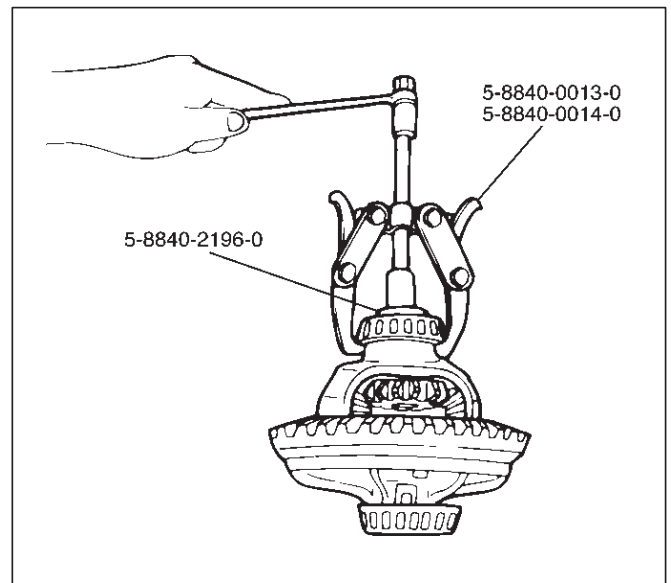
2. Remove bearing cap bolt.
3. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



425RS009

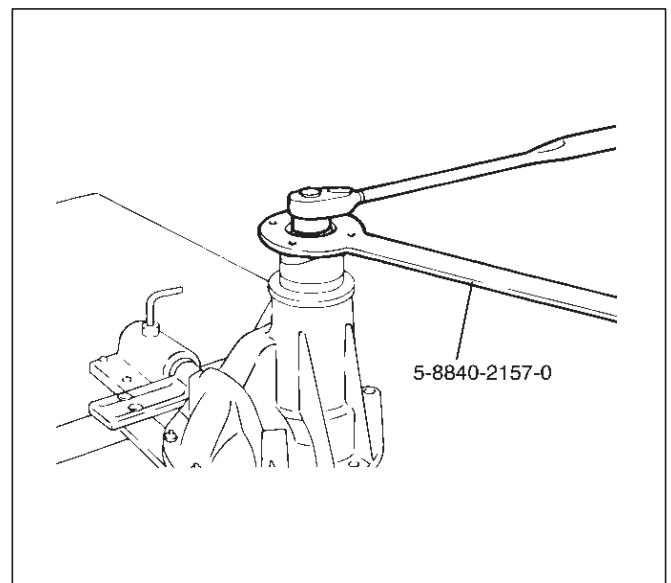
4. Remove differential cage assembly.
5. Remove side bearing outer race, after removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.

6. Remove side bearing, using remover 5-8840-0013/0014-0 and adapter 5-8840-2196-0.



415RW031

7. Remove adjust shim, note the thickness and position of the shims removed.
8. Remove the flange nut using holding wrench 5-8840-2157-0 after raising up its staked parts completely.

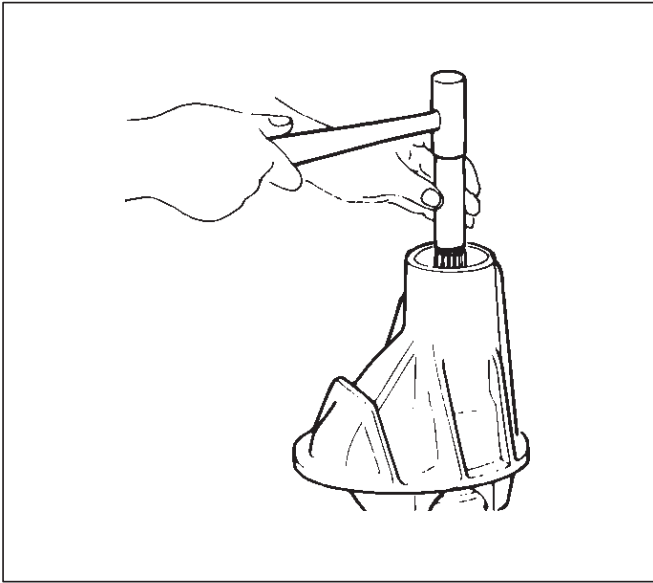


425RW057

9. Remove flange.
10. Remove dust cover.

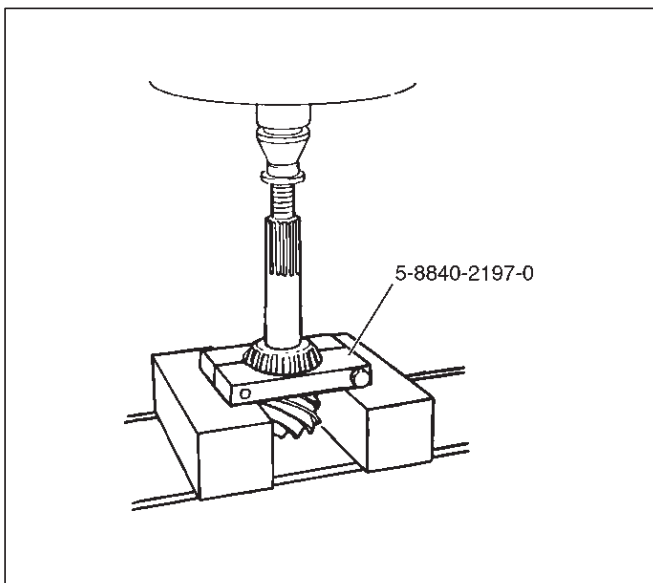
4A2A-12 DIFFERENTIAL (REAR 220mm)

11. Remove the drive pinion assembly using a soft metal rod and a hammer.



425RW056

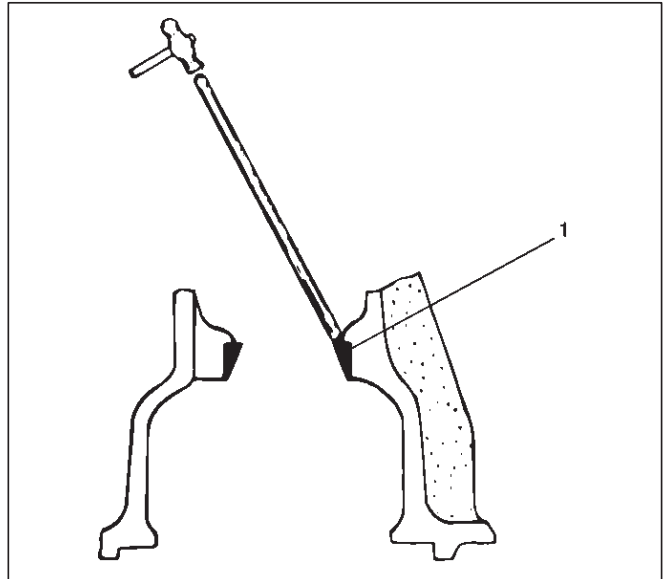
12. Remove collapsible spacer.
13. Remove the inner bearing using a separator 5-8840-2197-0 and a press.



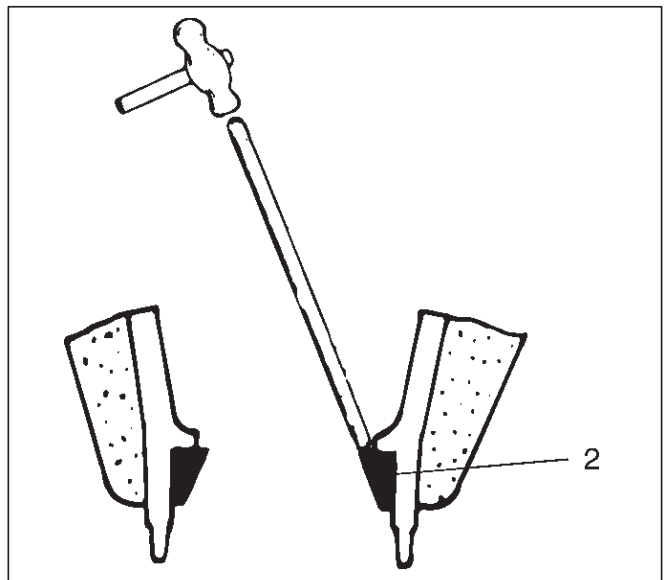
415RW039

14. Remove adjust shim.
15. Remove inner bearing outer race.
16. Remove oil seal.
17. Remove outer bearing.

18. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.



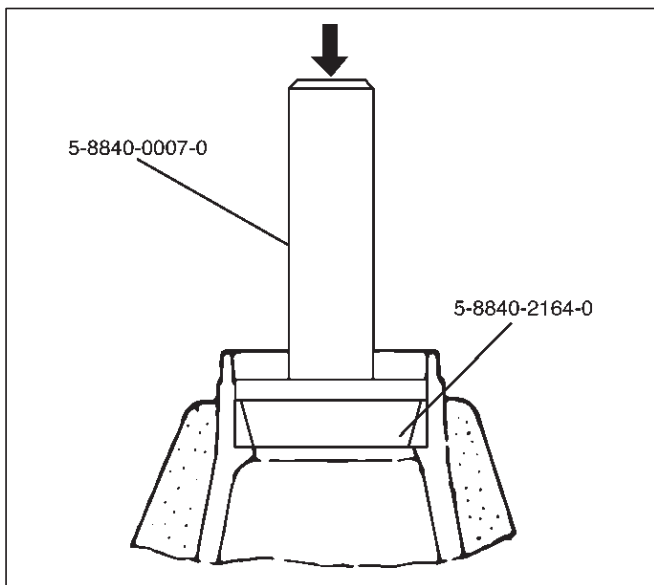
425RS014



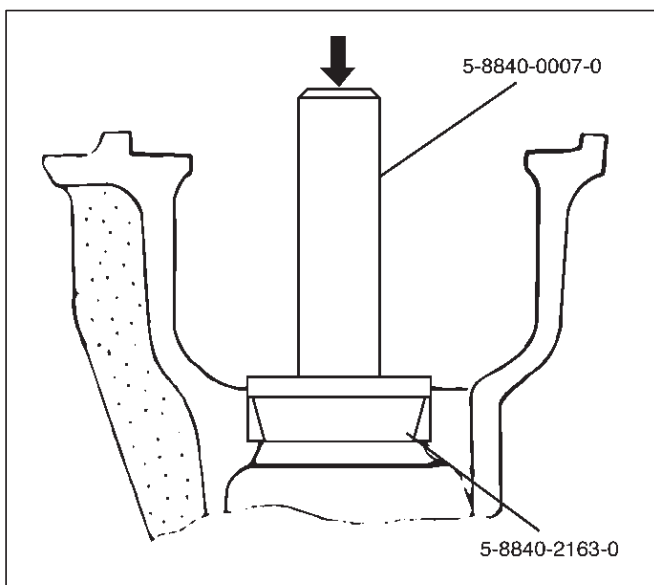
425RS015

Reassembly

1. Using installer 5-8840-2164-0 and grip 5-8840-0007-0, install outer bearing outer race.



2. Using installer 5-8840-2163-0 and grip 5-8840-0007-0, install Inner bearing outer race.

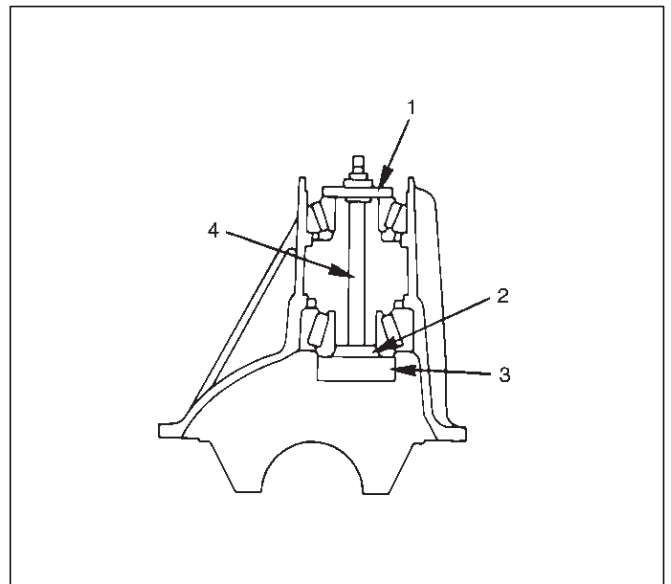


3. Install adjust shim and adjust drive pinion mounting distance

1. Apply gear oil to the inner and outer drive pinion bearing.
Clean the pinion setting gauge set.
Then install the gauge set together with the inner and outer bearings.

2. Tighten the nut to the specified torque.

Torque: 2.3 N-m (0.23kg-m/20 lb in)

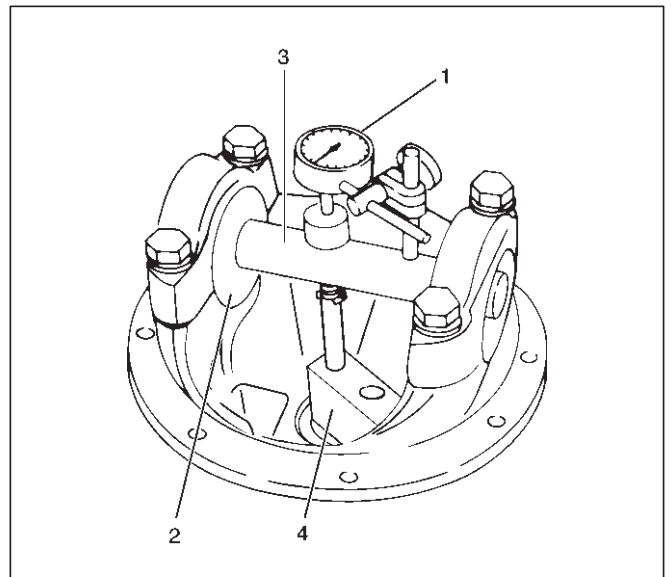


Legend

- (1) Front Pilot: 5-8840-2085-0
- (2) Rear Pilot: 5-8840-0129-0
- (3) Gauge Plate: 5-8840-2166-0
- (4) Bolt and Nut: 5-8840-0127-0

3. Clean the side bearing bores. Install the dial indicator with the discs and arbor. Install and tighten the bearing caps to the specified torque.

Torque: 108 N-m (11.0kg-m/80 lb ft)

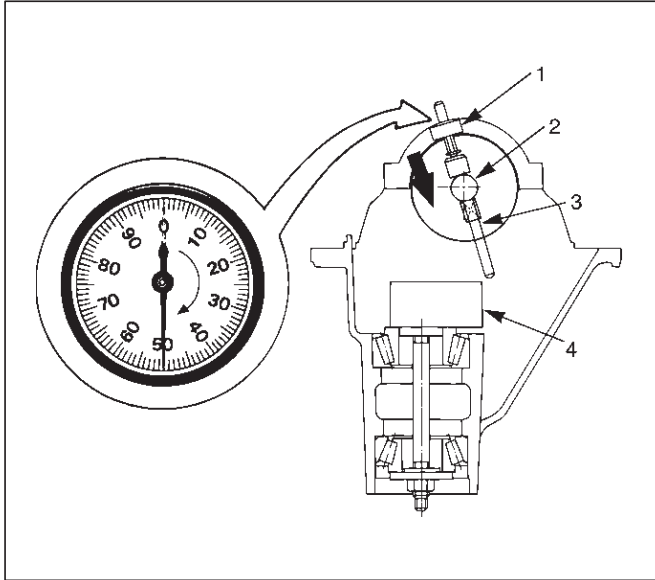


Legend

- (1) Dial Indicator: 5-8840-0126-0
- (2) Disc (2 pcs.): 5-8840-2167-0
- (3) Arbor: 5-8840-0128-0
- (4) Gauge Plate: 5-8840-2166-0

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- Set the dial indicator to "0". Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.

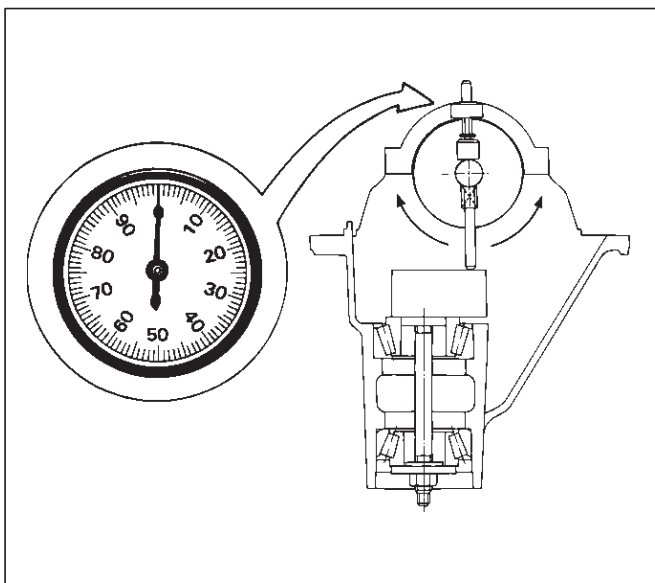


Legend

- Dial Indicator
- Gauging Arbor
- Plunger
- Gauge Plate

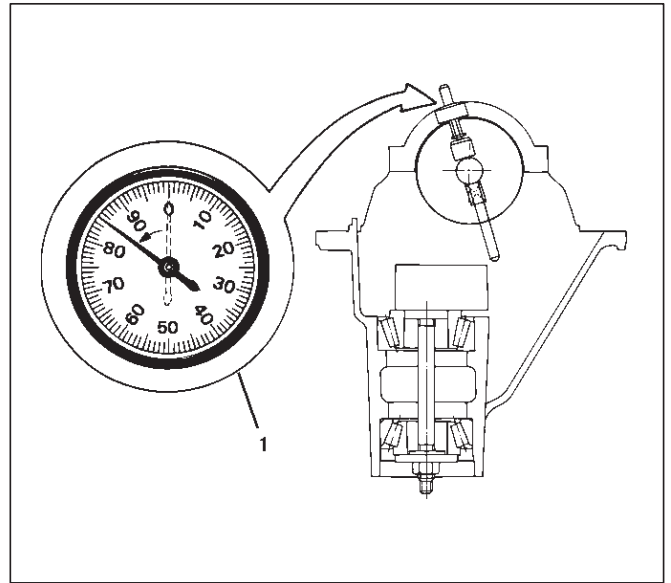
- Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest deflection. At this point, once again set the dial indicator to "0".

Repeat the procedure to verify the "0" setting.



- After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.

Record the number the dial indicator needle points to.

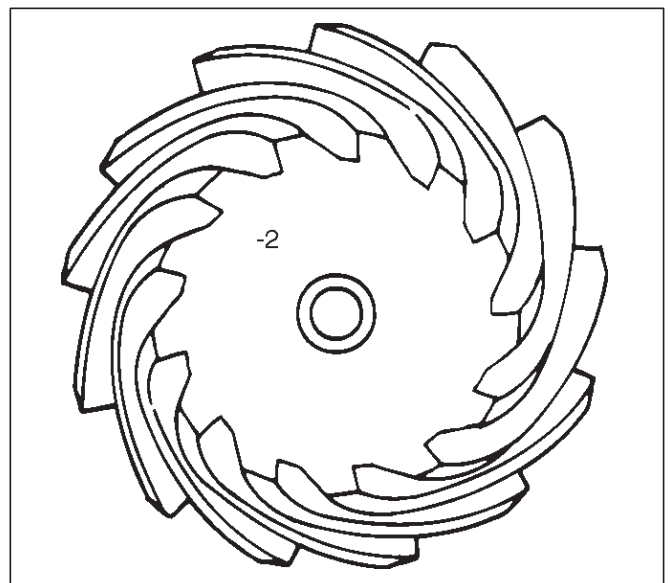


Legend

- Example=Dial indicator reading of 0.085

- Record the pinion depth code on the head of the drive pinion.

The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code "0", the pinion is "nominal".



- Select the shim using the chart;

DIFFERENTIAL (REAR 220mm) 4A2A-15

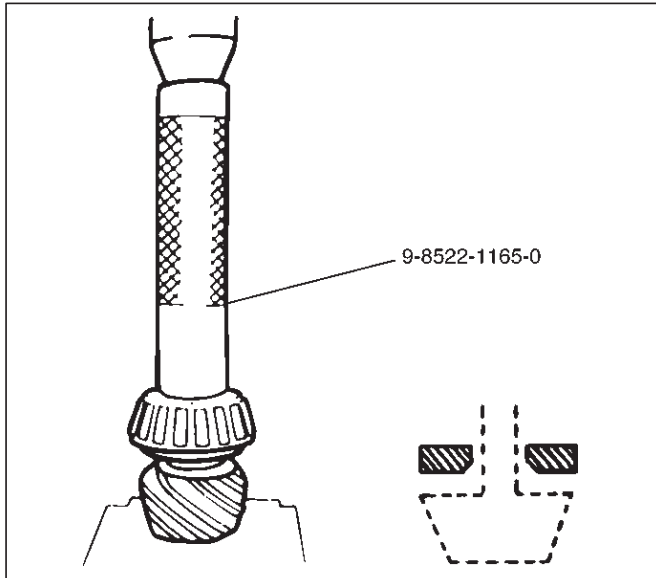
Pinion marking Dial indicator reading (Inches)	+10	+8	+6	+4	+2	0	-2	-4	-6	-8	-10
0.073										1.94 (0.0764)	1.96 (0.0772)
0.074									1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)
0.075								1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)
0.076						1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)
0.077						1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)
0.078				1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)
0.079			1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)
0.080	1.94 (0.0764)	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)
0.081	1.96 (0.0772)	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)
0.082	1.98 (0.0779)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)
0.083	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)
0.084	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)
0.085	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)
0.086	2.08 (0.0819)	2.10 (0.0827)	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)
0.087	2.12 (0.0835)	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)
0.088	2.14 (0.0842)	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)
0.089	2.16 (0.0850)	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)
0.090	2.18 (0.0858)	2.20 (0.0866)	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)	
0.091	2.22 (0.0874)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)			
0.092	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)				
0.093	2.26 (0.0890)	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)					
0.094	2.28 (0.0898)	2.30 (0.0906)	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)						
0.095	2.32 (0.0913)	2.34 (0.0921)	2.36 (0.0929)								
0.096	2.34 (0.0921)	2.36 (0.0929)									
0.097	2.36 (0.0929)										

NOTE: When ordering shims, find the part number in the parts catalog by using the thickness of shims listed in the above table.

4A2A-16 DIFFERENTIAL (REAR 220mm)

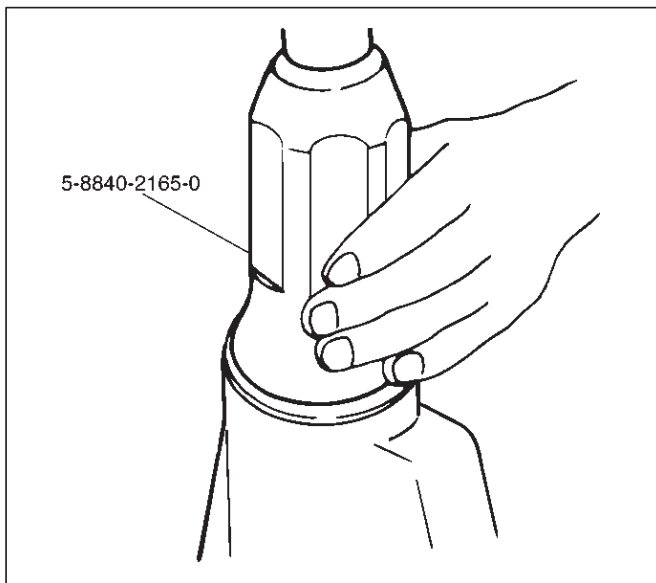
- Place the shim on the drive pinion, with the chamfered side turned towards the pinion head then install the inner bearing onto the pinion using an installer 9-8522-1165-0 and a press.

NOTE: Do not apply pressure to the roller cage and apply pressure only to the inner race.



- Discard the used collapsible spacer and install a new one.
- Install pinion gear.
- Install outer bearing.
- Use oil seal installer 5-8840-2165-0 to install a new oil seal that has been soaked in rear axle lubricant.

NOTE: Take care to use a front differential oil seal, NOT the rear differential oil seal.

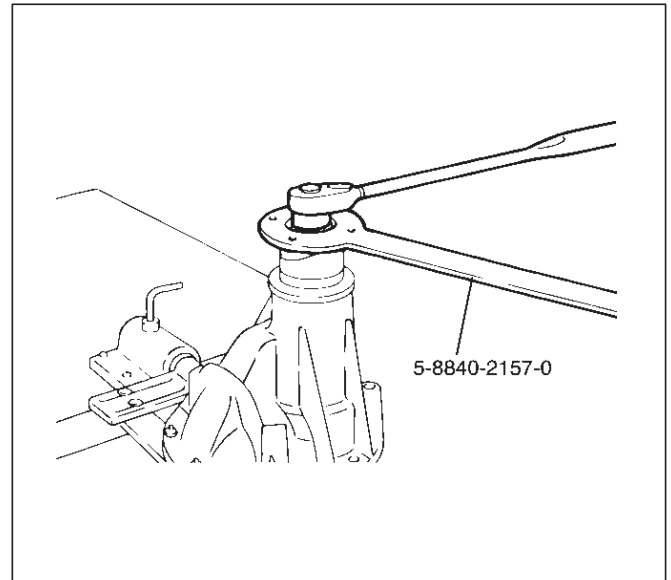


- Install dust cover.
- Install flange.
- Install flange nut.
 - Apply lubricant to the pinion threads.

- Tighten the nut to the specified torque using the pinion flange holder 5-8840-2157-0.

Torque: 245-294N-m (25.0-28.0kg-m/181-217 lb ft)

NOTE: Discard used flange nut and install new one and do not over tighten the flange nut.

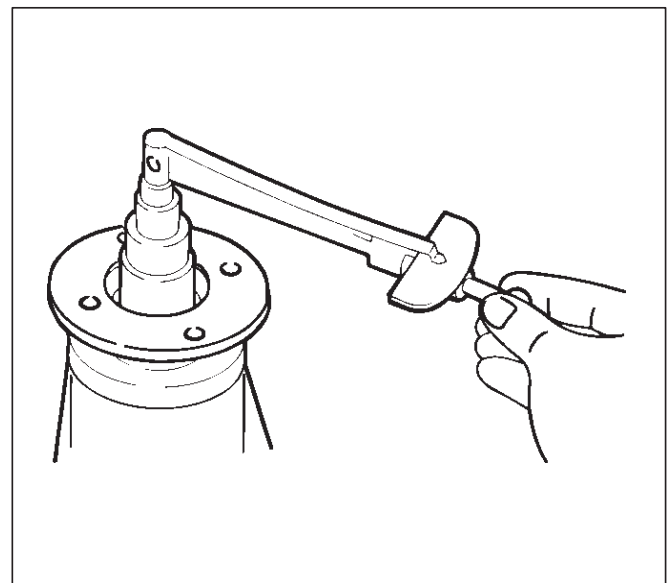


- Adjust pinion bearing preload.
 - Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
 - Continue tightening flange nut until the specified starting torque is obtained.

Starting torque:

New bearing 0.7-1.3 N-m(0.07-0.13kg-m/6.08-11.28 lb in)

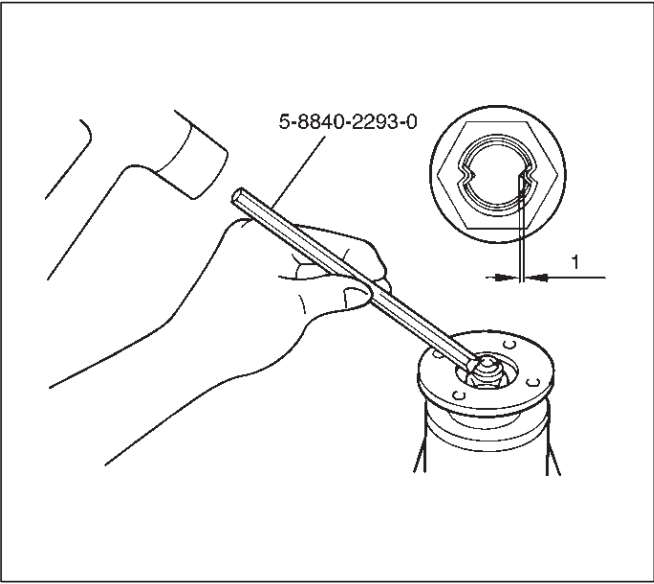
Used bearing 0.4-0.6N-m(0.04-0.06kg-m/3.04-5.64 lb in)



- Using punch 5-8840-2293-0, stake the flange nut at two points.

DIFFERENTIAL (REAR 220mm) 4A2A-17

NOTE: When staking, be sure to turn the nut to insure that there is no change in bearing preload. Make sure of preload again as instructed in 3).



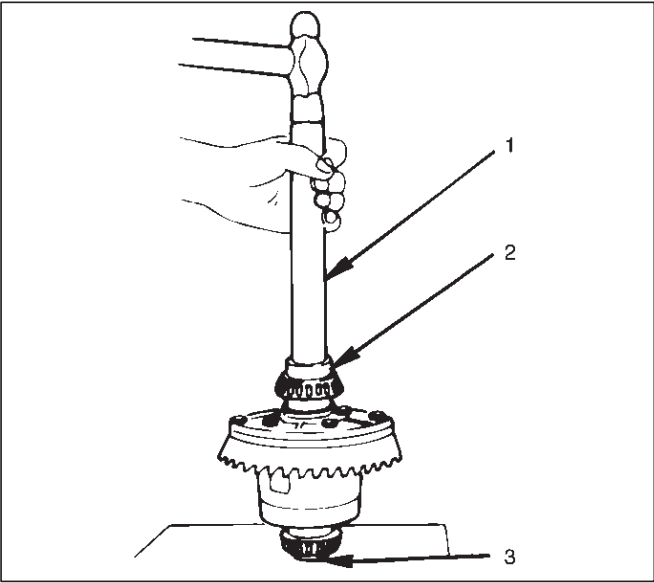
415RW019

Legend

- (1) 1.5mm or less

12. Install adjust shim.

1. Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.

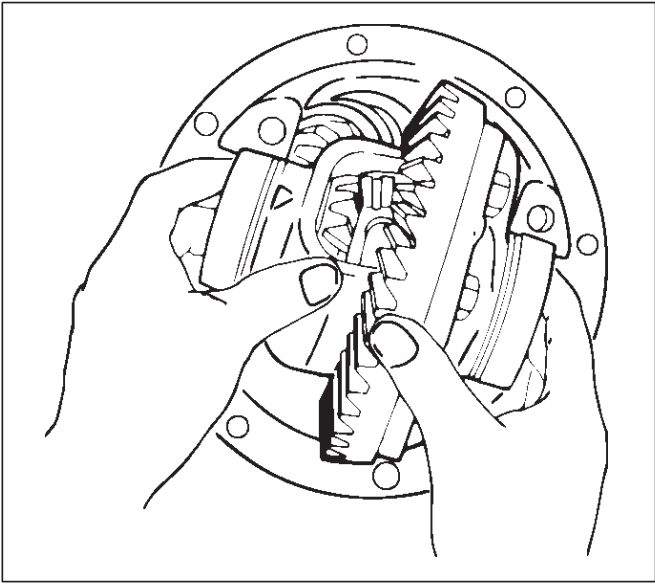


425RS029

Legend

- (1) Drive handle: 5-8840-0007-0
- (2) Installer: 5-8840-2162-0
- (3) Pilot: 5-8840-2196-0

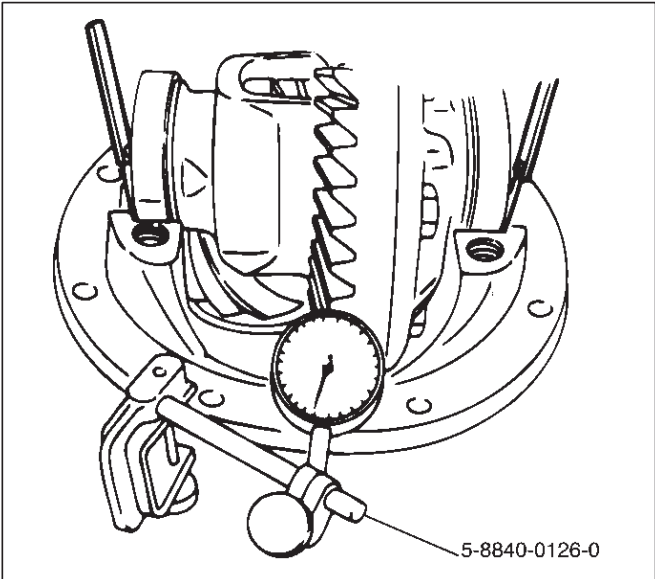
2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

Mount the dial indicator 5-8840-0126-0 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.

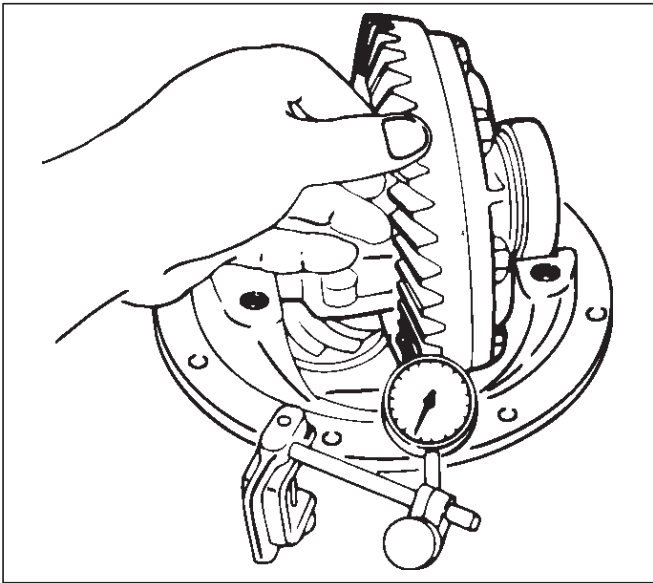


425RW049

4A2A-18 DIFFERENTIAL (REAR 220mm)

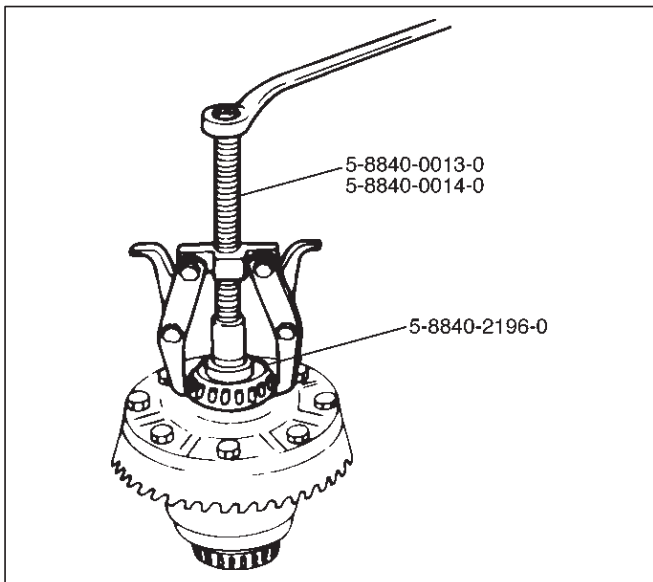
- Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

Backlash: 0.15–0.2 mm(0.006 –0.008 in)

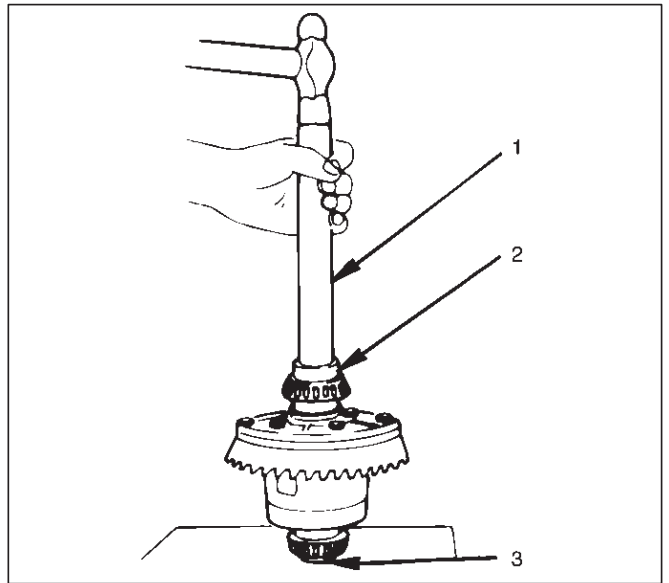


With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.

- Use bearing remover 5-8840-0013/0014-0 and pilot 5-8840-2196-0 to remove side bearing.



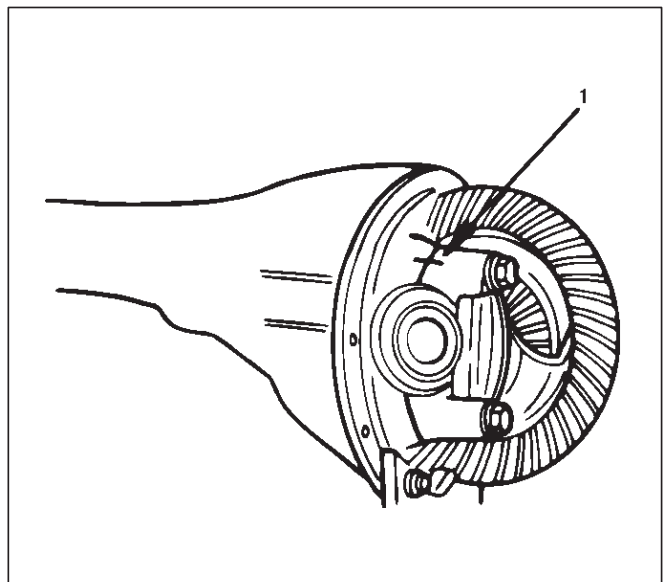
- Install the side bearings together with the selected shims.



Legend

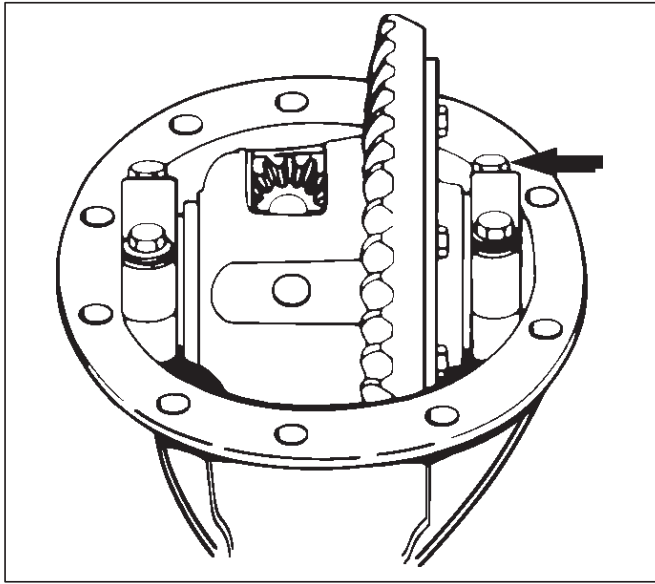
- (1) Drive Handle: 5-8840-0007-0
- (2) Installer: 5-8840-2162-0
- (3) Pilot: 5-8840-2196-0

- Install side bearing outer race.
- Install differential cage assembly.
- Install bearing cap then align the setting marks(1) applied at disassembly.



17. Tighten the cap bolt to the specified torque.

Torque: 108 N·m (11.0kg·m/80 lb ft)

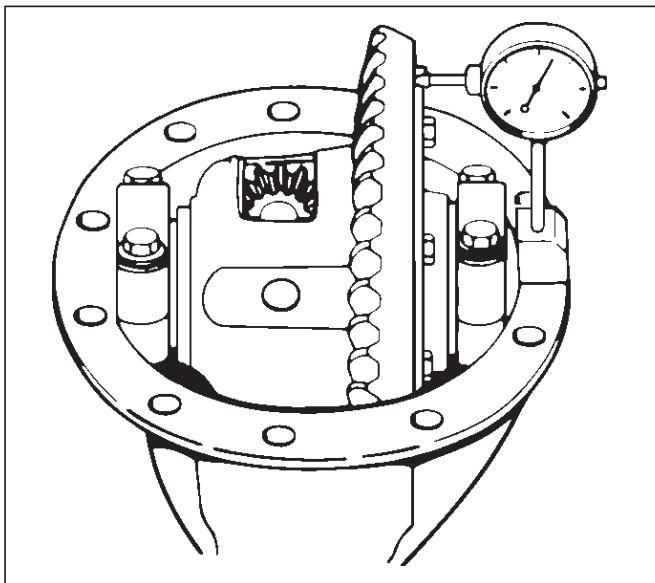


425RS036

1. Measure the amount of run-out of the ring gear at its rear face.

Standard: 0.02 mm (0.001 in)

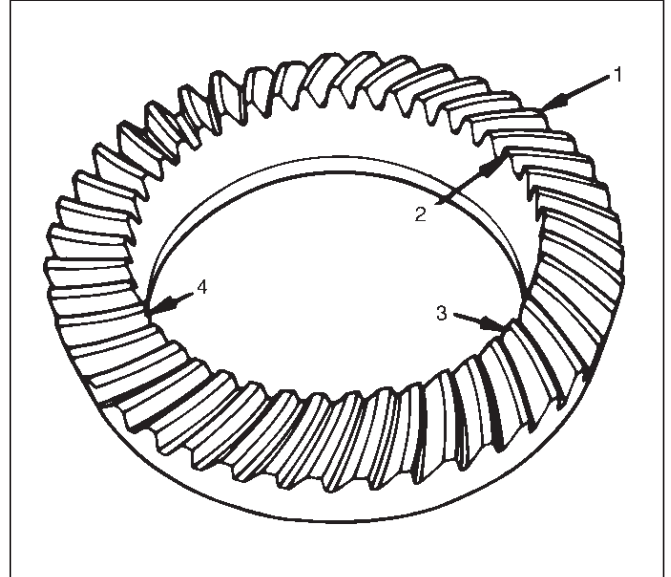
Limit: 0.05 mm (0.002 in)



425RS037

Gear Tooth Contact Pattern Check and Adjustment

1. Apply a thin coat of prussian blue or equivalent to the faces of the 7-8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.

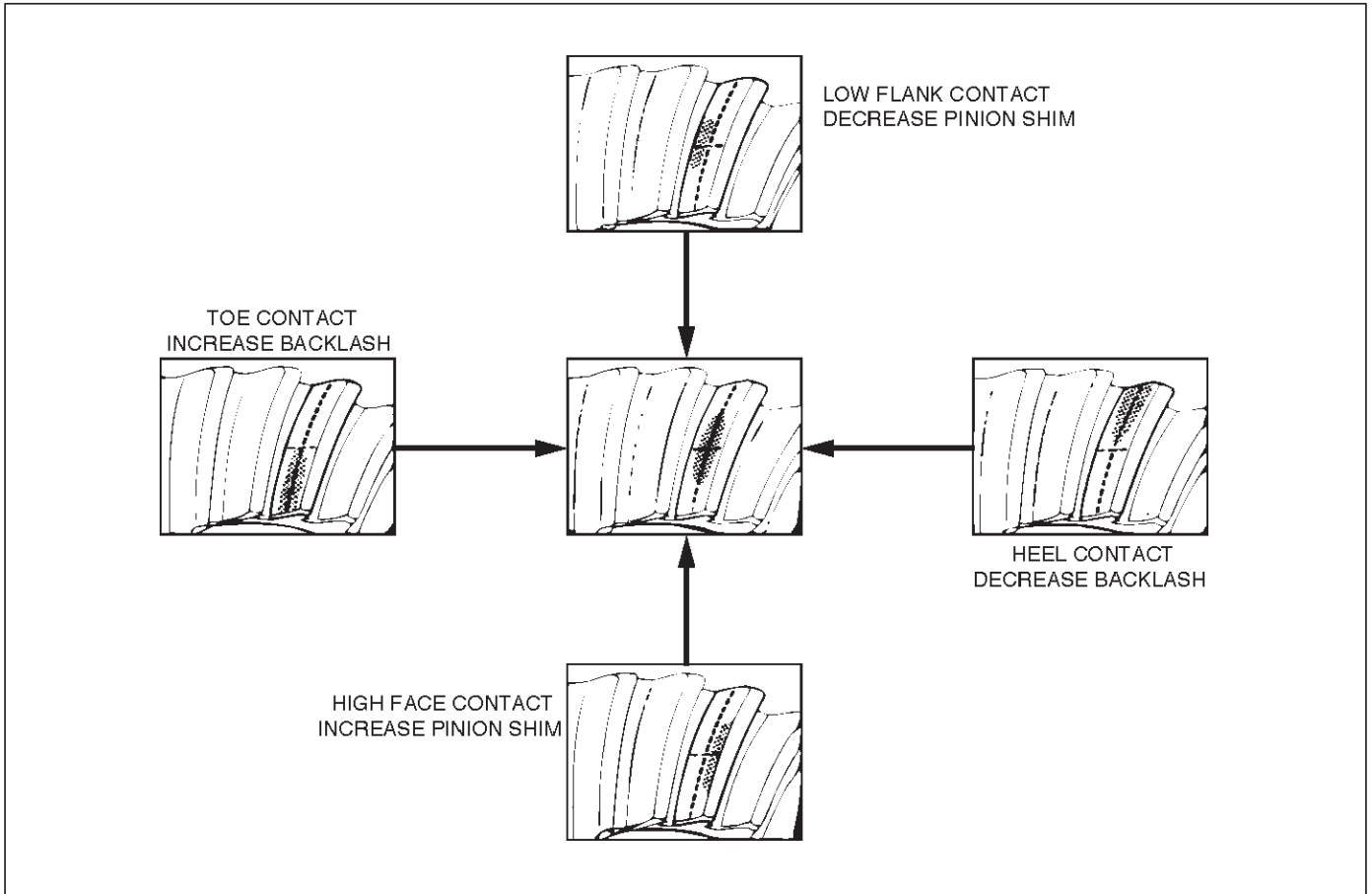


425RS038

Legend

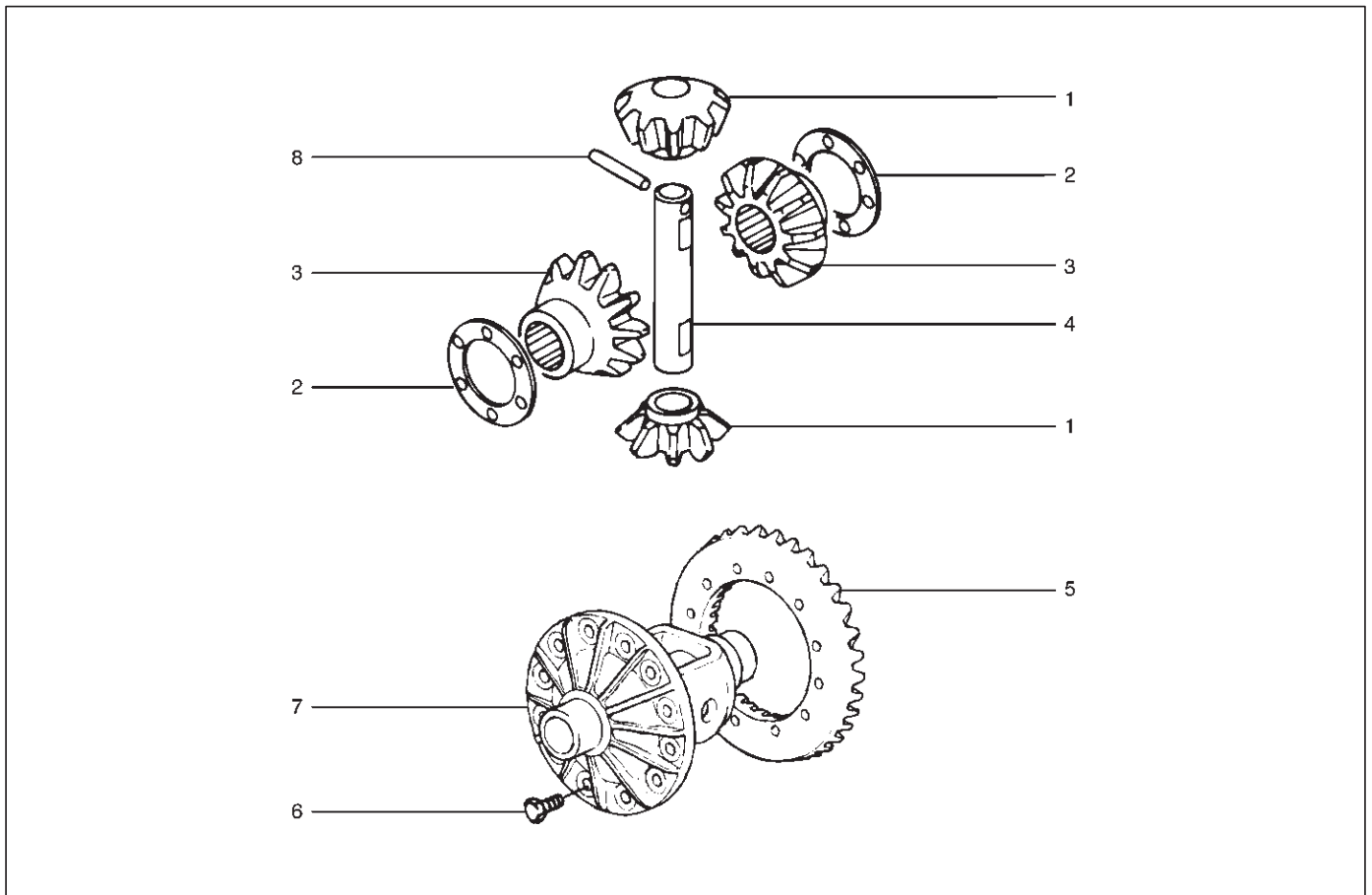
- (1) Heel
- (2) Toe
- (3) Concave Side(Coast)
- (4) Convex Side(Drive)

4A2A-20 DIFFERENTIAL (REAR 220mm)



Differential Cage Assembly

Disassembled View



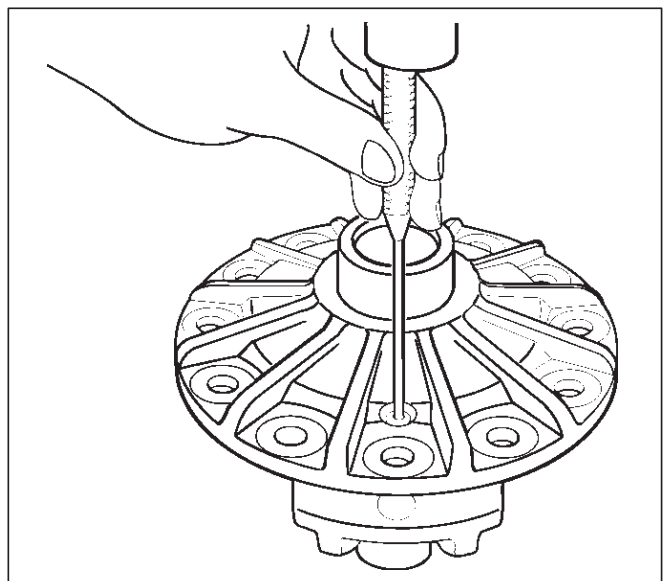
415RW034

Legend

- | | |
|-------------------|-----------------------|
| (1) Pinion Gear | (5) Ring Gear |
| (2) Thrust Washer | (6) Bolt |
| (3) Side Gear | (7) Differential Cage |
| (4) Cross Pin | (8) Lock Pin |

Disassembly

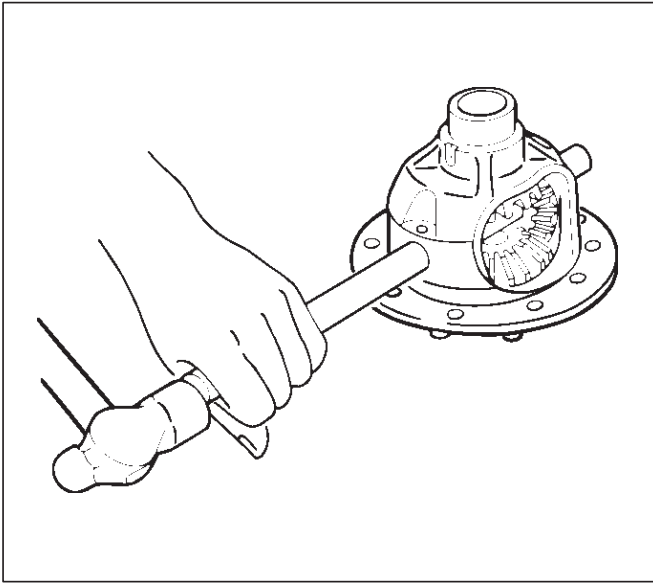
1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin, break staking on the lock pin, using a 5 mm (0.20 in) diameter drill.



425RS042

4A2A-22 DIFFERENTIAL (REAR 220mm)

4. Remove the cross pin, using a soft metal rod and a hammer.



425RS043

5. Remove pinion gear.
6. Remove side gear.
7. Remove thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

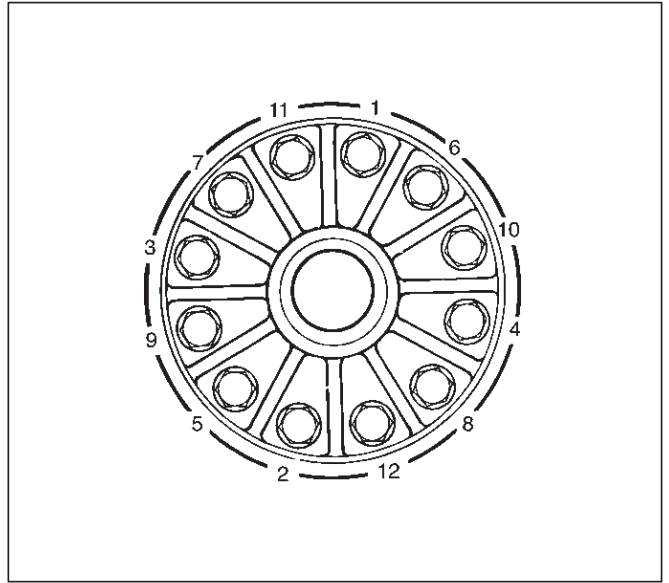
1. Ring gear, pinion gear
2. Bearing
3. Side gear, pinion gear, cross pin
4. Differential cage, carrier
5. Thrust washer
6. Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Clean the ring gear threaded holes to remove the locking agent.
3. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.
4. Discard used bolts and install new ones.

Torque: 108 N·m (11.0kg·m/80 lb ft)

5. Tighten the fixing bolts in a diagonal sequence as illustrated.

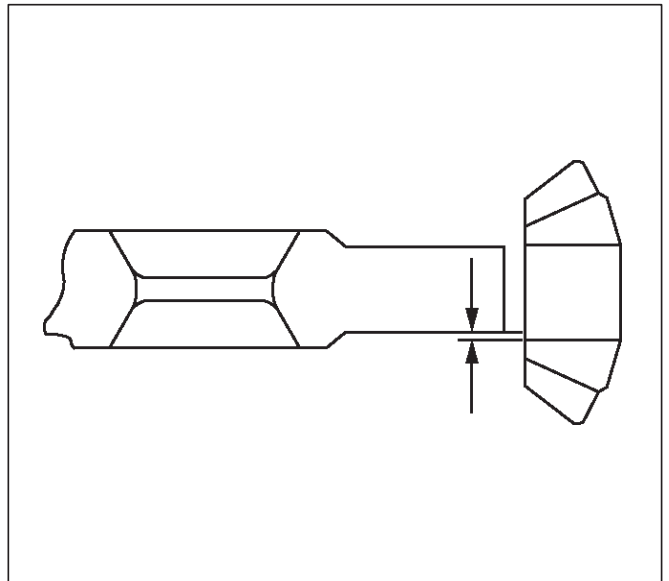


415RW036

Clearance between the differential pinion and the cross pin measurement:

Standard: 0.06 – 0.12 mm (0.002–0.005 in)

Limit: 0.2 mm (0.008 in)

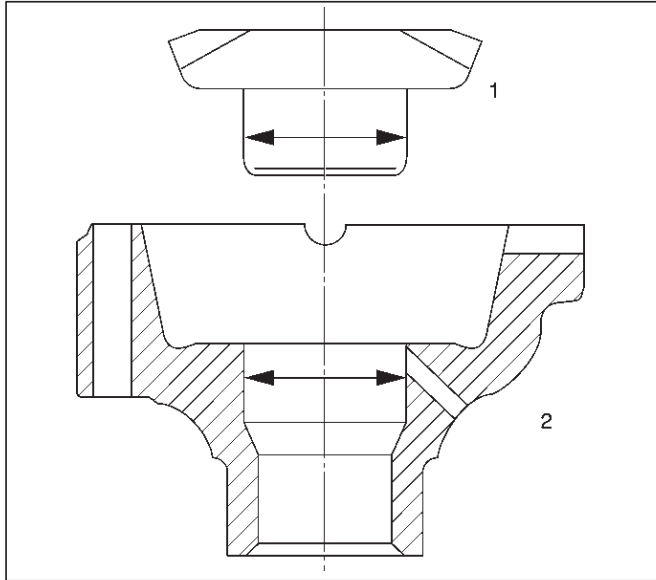


425RS045

Clearance between the side gear and the differential box:

Standard: 0.05–0.12 mm (0.002–0.005 in)

Limit: 0.15 mm(0.006 in)



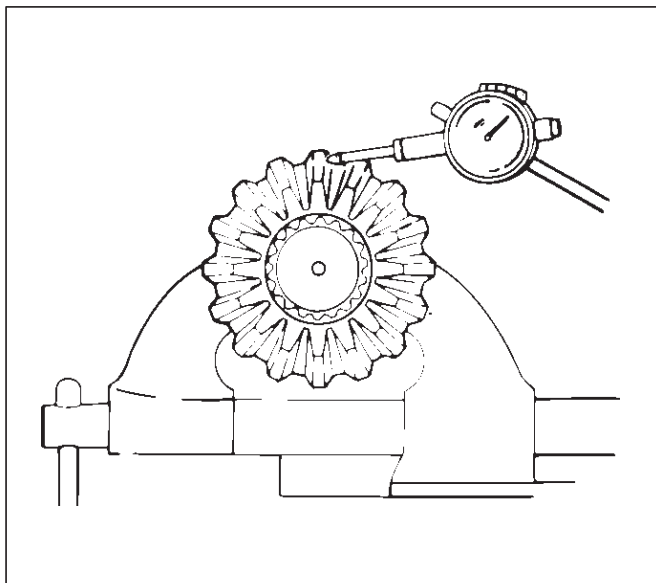
Legend

- (1) Side Gear
- (2) Differential Box

Play in splines between the side gear and the axle shaft:

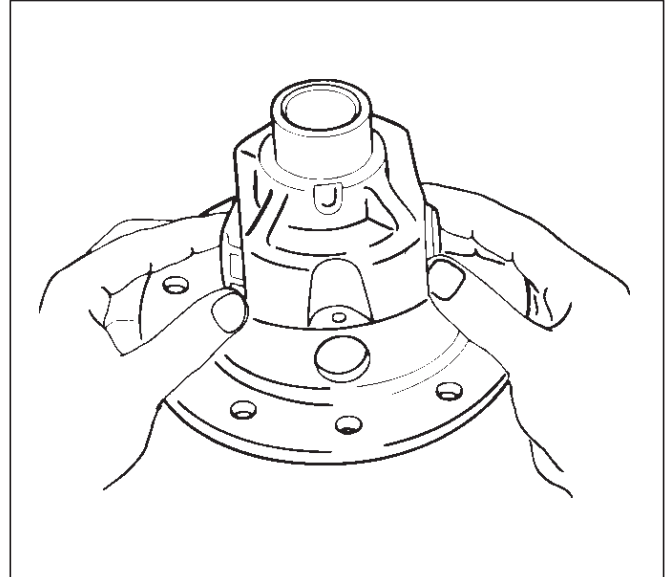
Standard: 0.07–0.38 mm(0.003 –0.014 in)

Limit:0.5m (0.02 in)

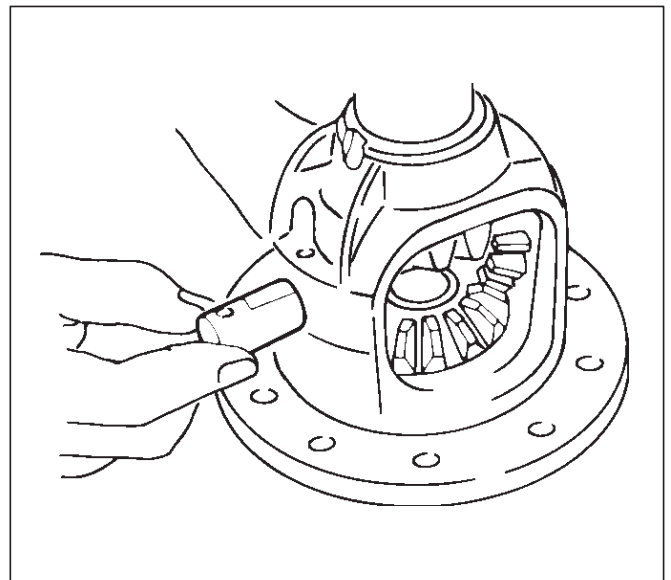


Reassembly

1. Install thrust washer.
2. Install side gear.
3. Install the pinion gear by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.



4. Install cross pin.
 1. Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.



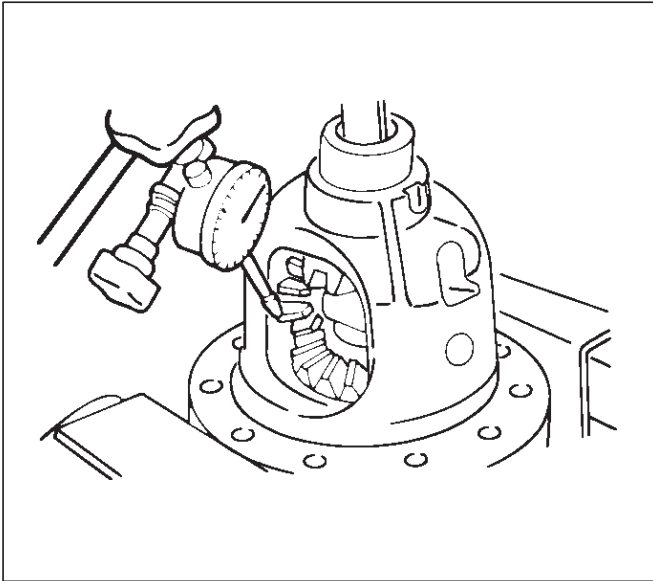
2. Adjust the backlash between the side gear and the pinion gear.

Backlash:0.13 – 0.18 mm (0.005– 0.007 in)

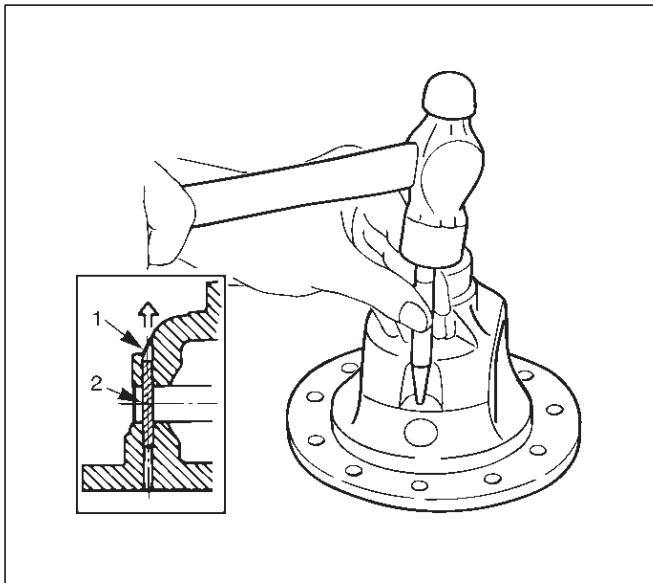
4A2A-24 DIFFERENTIAL (REAR 220mm)

Thickness of thrust washers available:

0.80 mm, 0.90 mm, 1.00 mm, 1.10 mm, 1.20 mm,
1.30 mm (0.031 in, 0.035 in, 0.039 in, 0.043 in,
0.047 in, 0.051 in)



5. Install lock pin. After lock pin installation, stake the cage to secure the lock pin.



Legend

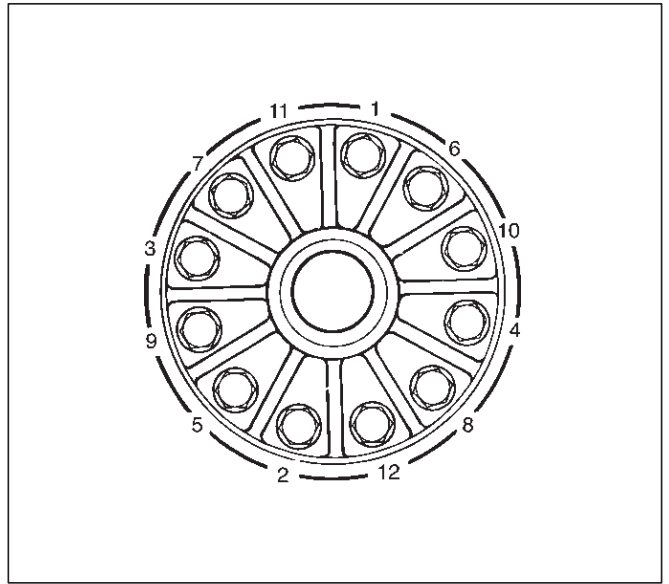
- (1) Staked Portion
- (2) Lock Pin

6. Clean the ring gear threaded holes to remove the locking agent. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.

7. Tighten the bolts in diagonal sequence as illustrated.

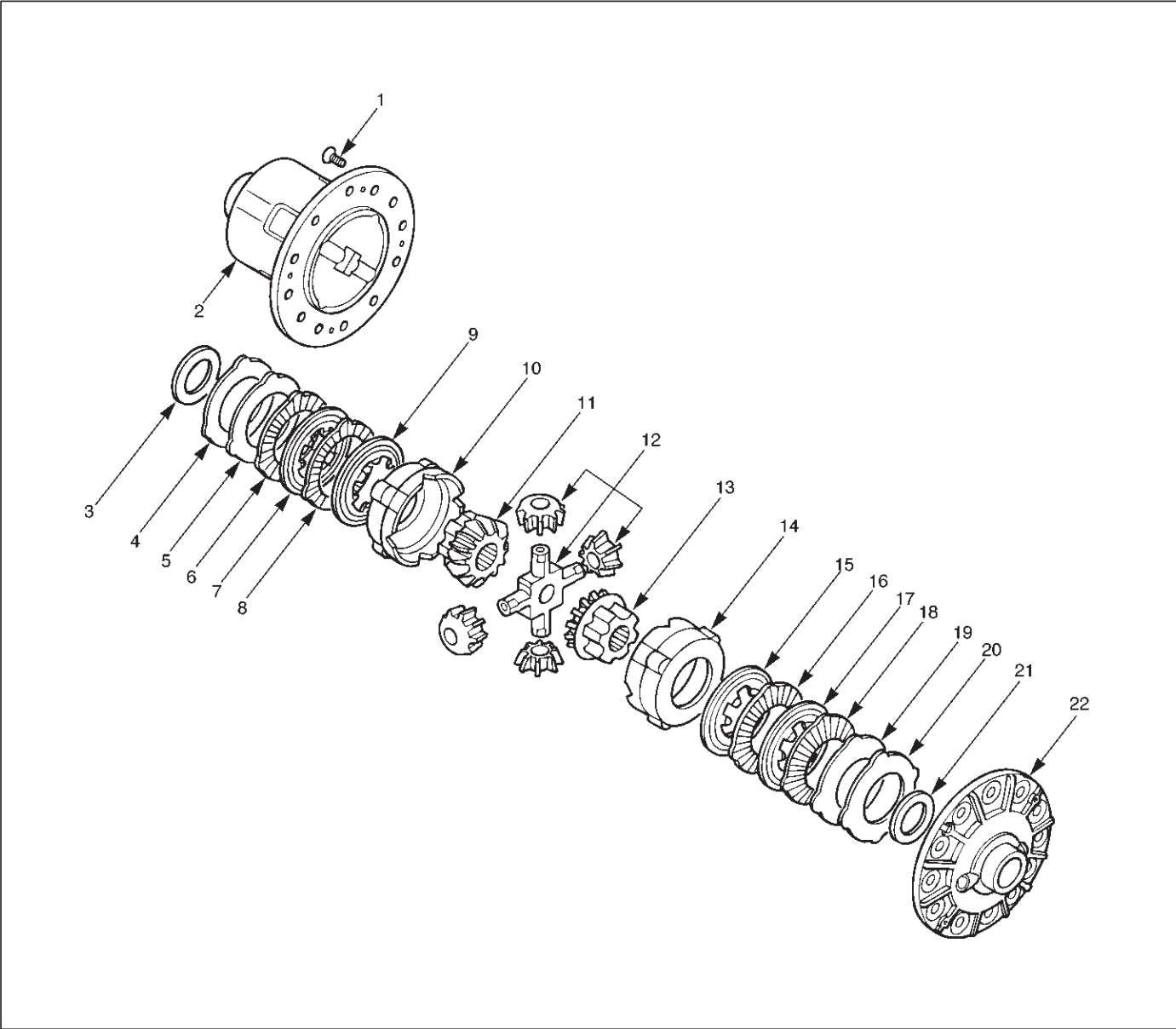
Torque: 108 N·m (11.0kg·m/80 lb ft)

NOTE: Discard used bolts and install new ones.



Limited Slip Differential

Disassembled View



425RS053

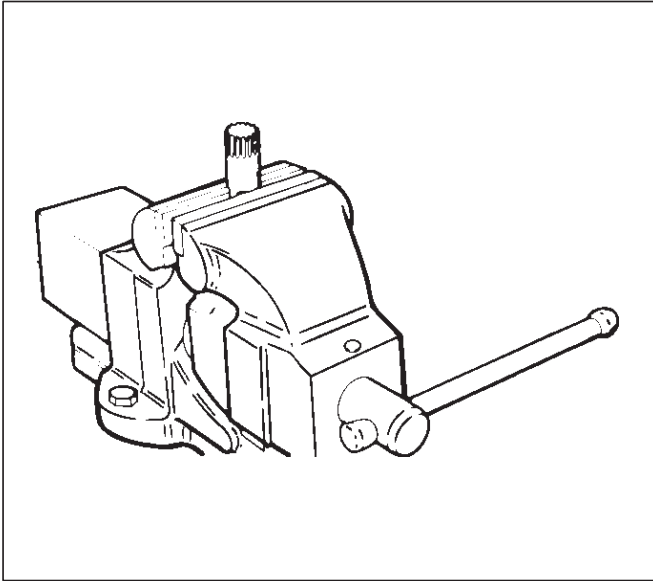
Legend

- (1) Screw
- (2) Differential cage A
- (3) Thrust washer
- (4) Spring disc
- (5) Spring disc
- (6) Friction plate
- (7) Friction disc
- (8) Friction plate
- (9) Friction disc
- (10) Pressure ring
- (11) Side gear
- (12) Pinion and pinion shaft
- (13) Side gear
- (14) Pressure ring
- (15) Friction disc
- (16) Friction plate
- (17) Friction disc
- (18) Friction plate
- (19) Spring disc
- (20) Spring disc
- (21) Thrust washer
- (22) Differential cage B

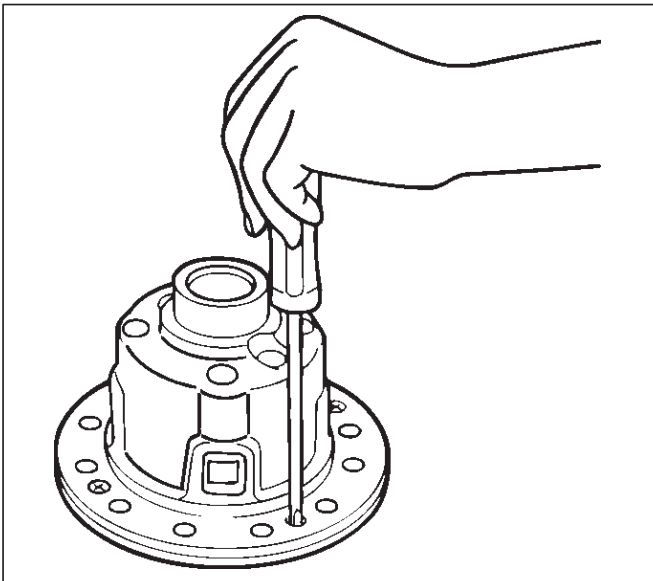
4A2A-26 DIFFERENTIAL (REAR 220mm)

Disassembly

1. Using special tool, 5-8840-2381-0, grip it with a vice, and set the differential.



2. Gradually and evenly loosen the 4 fixing screws of the differential cages A and B.



3. Remove Differential cage A.
4. Remove Thrust washer.
5. Remove Spring disc.

NOTE: When removing the spring disc, friction disc, and friction plate, place them in order for clear distinction of left and right use.

6. Remove Spring disc.

7. Remove Friction plate.
8. Remove Friction disc.
9. Remove Friction plate.
10. Remove Friction disc.
11. Remove Pressure ring.
12. Remove Side gear.
13. Remove Pinion and pinion shaft.
14. Remove Side gear.
15. Remove Pressure ring.
16. Remove Friction disc.
17. Remove Friction plate.
18. Remove Friction disc.
19. Remove Friction plate.
20. Remove Spring disc.
21. Remove Spring disc.
22. Remove Thrust washer.
23. Remove Differential cage B.

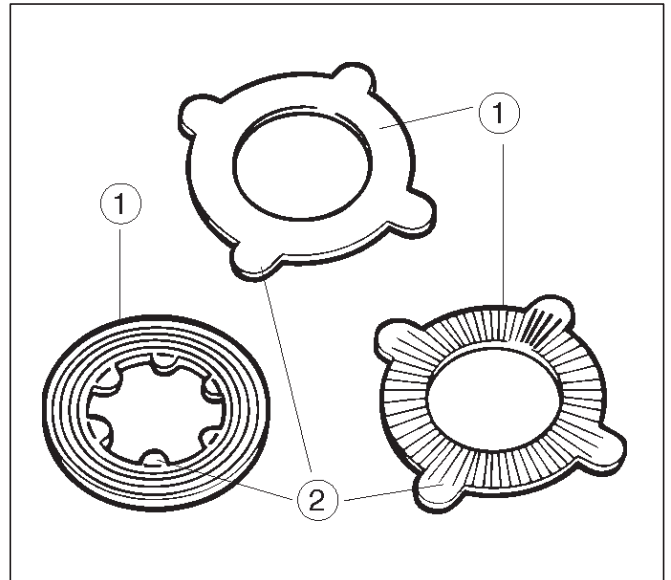
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

Visual check

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

- Friction disc, friction plate and spring disc

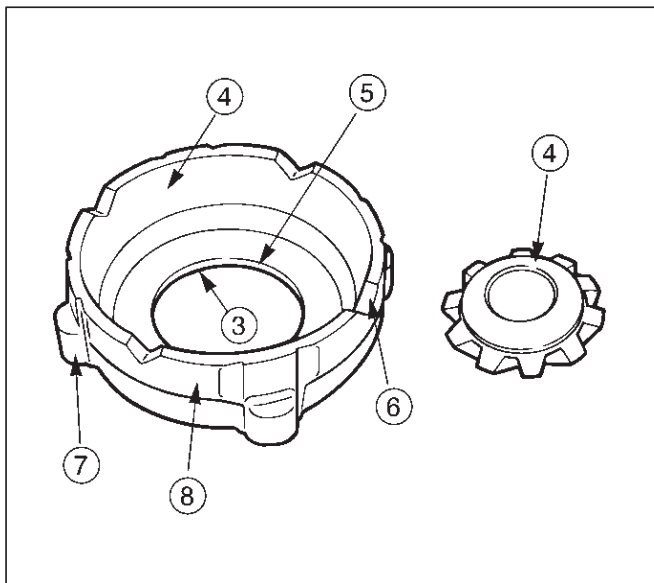


Legend

- (1) Sliding surfaces
- (2) Projections

DIFFERENTIAL (REAR 220mm) 4A2A-27

• Pressure ring

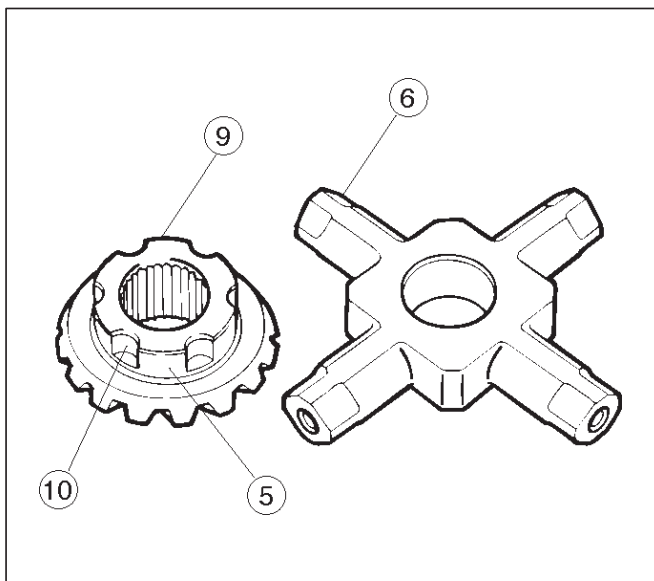


425RS057

Legend

- (3) Sliding surface with the friction disc. When nicks or scratches are found, polish with an oil stone and repair on a level block using a compound.
- (4) Sliding spherical surface with the pinion gear.
- (5) Sliding surface with the side gear.
- (6) V-shaped groove of the pressure ring and V-shaped section of the pinion shaft.
- (7) Fitting section with the case.
- (8) Face contacting the inner surface of the differential case. Repair burrs and nicks using an oil stone.

• Thrust washer

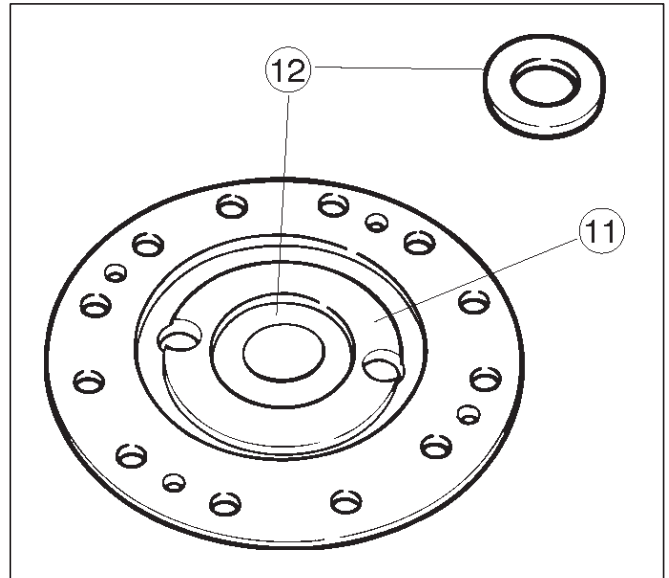


425RS058

Legend

- (9) Sliding surface with the side gear or case.
- (10) Peripheral groove of the side gear.
Repair light nicks and burrs using an oil stone.

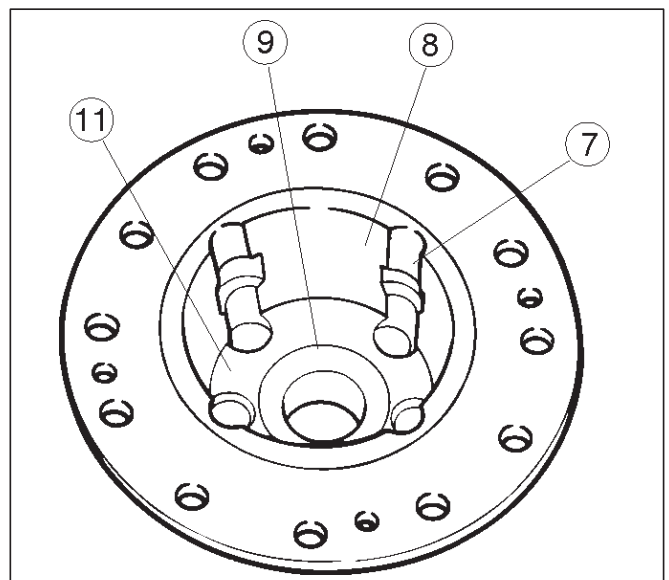
• Case



425RS059

Legend

- (11) Contact surface with the spring disc.
- (12) Inner groove of the differential cage B.
Repair light nicks and burrs using an oil stone.



425RS060

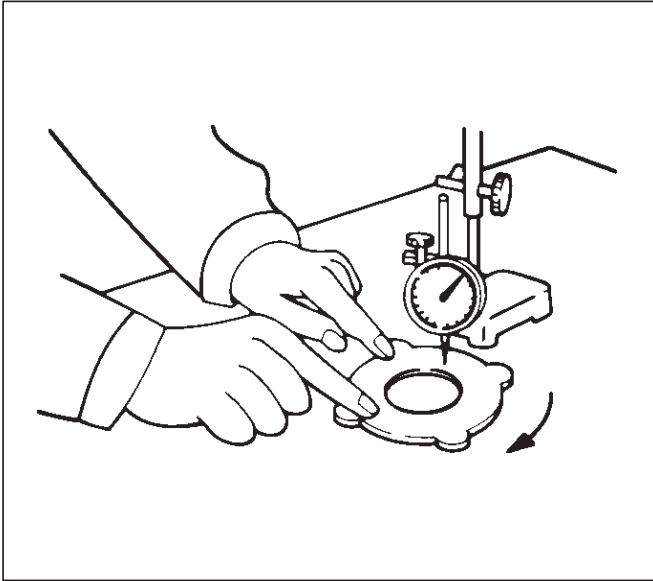
4A2A-28 DIFFERENTIAL (REAR 220mm)

Legend

- (7) Fitting section with the case.
- (8) Face contacting the inner surface of the differential case.
Repair burrs and nicks using an oil stone.
- (9) Sliding surface with the side gear or case.
- (11) Contact surface with spring disc.

Measure the Deformation of the friction disc & plate.

Limit: 0.08 mm (0.003 in)



425RS061

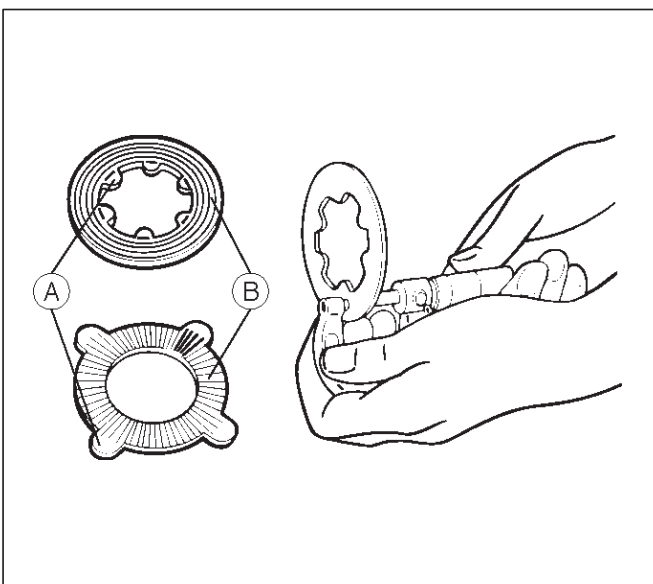
Measure the wear of the friction plate & disc

Limit(A-B): 0.1 mm (0.004 in)

Remarks:

A=Inner or outer projections

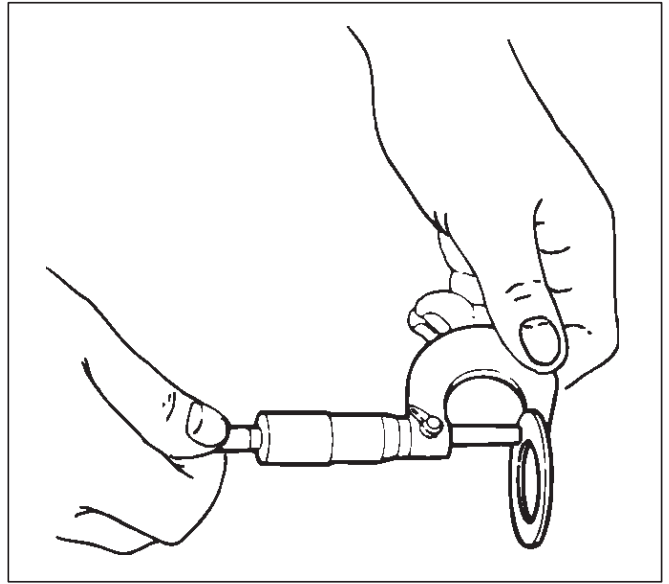
B=Sliding surface subjected to abrasion



425RS062

Measure the wear of the thrust washer

Limit: 1.3 mm (0.05 in)



425RS063

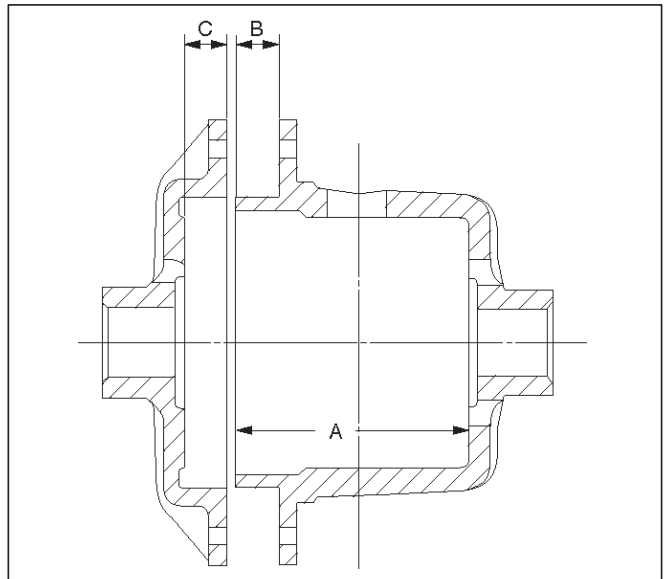
Reassembly

Adjust the clearance between the friction disc and plate.

1. Measuring the depth of the differential cage.

Standard (A-B): 80.58 mm (3.17 in)

(C): 10.58 mm (0.41 in)

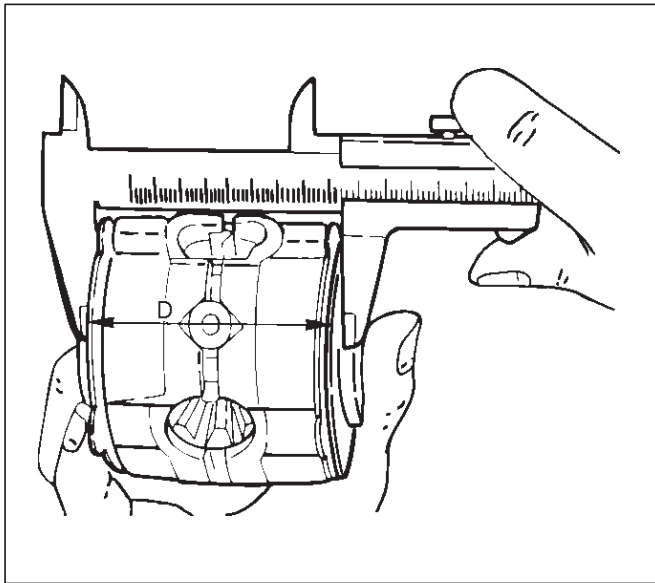


425RS064

2. Measuring the overall length of the pressurering, friction disc and friction plate.

- Mount the pinion shaft in the pressurering and then install the friction disc & plate.

- Measure the length between the plates over the V-groove. (D)



425RS065

3. After measuring dimensions A, B, C and D, make adjustment in the following manner:

- Measure the thickness (E) of the spring disc.
1.75mm (0.069in) ×4 discs

4. Select the friction disc & plate so as to satisfy the following equation:

$$\{(A-B)+C\}-(D+E)=0.06-0.20\text{mm (0.002-0.008in)}$$

Also, the total size difference of the friction disc & plate and spring disc should be 0.05mm (0.02in) or less.

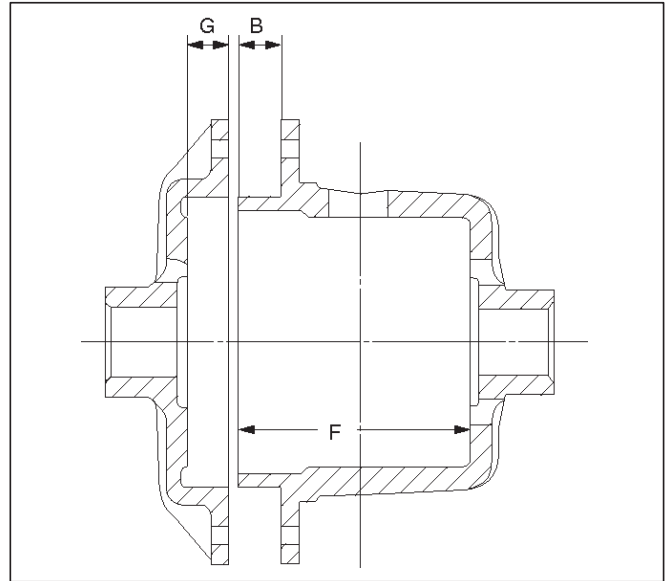
Thickness :1.75–1.85mm(0.069–0.073 in)

Backlash adjustment of the side gear in the direction of the shaft

1. Measuring the depth of the differential cage.

(F-B): 82.03 mm (3.23 in)

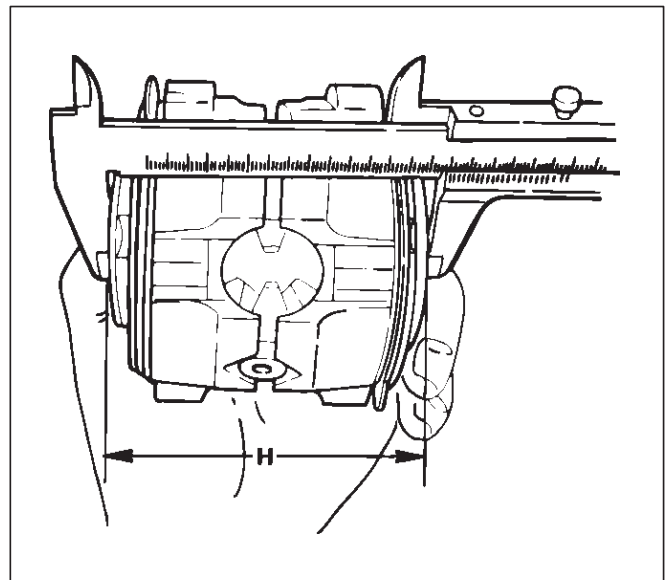
(G): 12.03 mm (0.47 in)



425RS066

2. Measuring the dimension between the thrust washers at both ends.

- Assemble the side gear, pinion, pinion shaft, pressure ring and thrust washer, and pressing the pressure ring to the pinion shaft in the direction of the shaft to make the clearance 0.
- Have the side gear contact to the pinion to make the backlash 0.
- Measure the dimension (H) between thrust washers at both ends.



425RS067

4A2A-30 DIFFERENTIAL (REAR 220mm)

3. After measuring dimensions of each of the above sections, proceed with the adjustment in the following manner:

Adjust the clearance to satisfy the equation below.

$$\{(F - B) + G - H\} = 0.05 - 0.20 \text{ mm}$$

Also, select the thrust washers so that the dimensional difference between the back surfaces of the left and right pressure rings to the thrust washers is 0.05mm or less.

Thickness : 1.5mm (0.059 in)

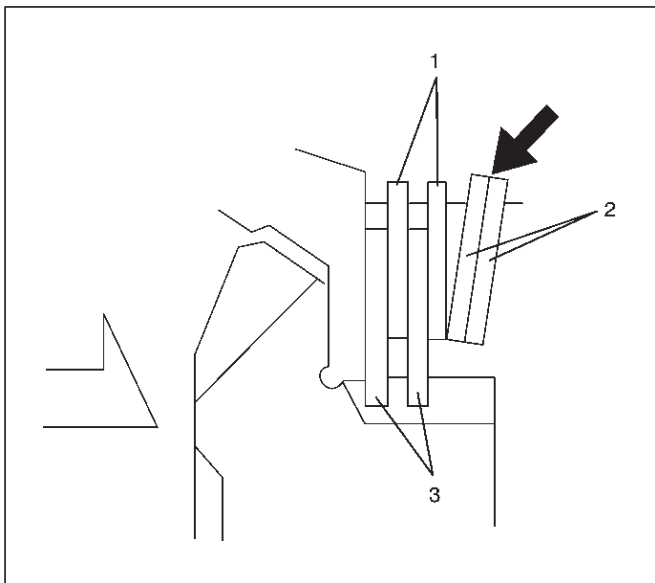
1.6 mm(0.063 in)

1.7 mm(0.067 in)

NOTE: When assembling the parts, apply recommended gear oil sufficiently to each of the parts, especially, to the contact surfaces and sliding surfaces.

1. Install Differential cage B.
2. Install Thrust washer.
3. Install Spring disc.

- When assembling the spring disc, make sure the mounting direction is correct as shown in figure.



425RS066

Legend

- (1) Friction Plate
- (2) Spring Disc
- (3) Friction Disc

4. Install Spring disc.
5. Install Friction plate.
6. Install Friction disc.
7. Install Friction plate.
8. Install Friction disc.
9. Install Pressure ring.
10. Install Side gear.
11. Install Pinion and pinion shaft.
12. Install Side gear.
13. Install Pressure ring.
14. Install Friction disc.

15. Install Friction plate.

16. Install Friction disc.

17. Install Friction plate.

18. Install Spring disc.

- When assembling the spring disc, make sure the mounting direction is correct.

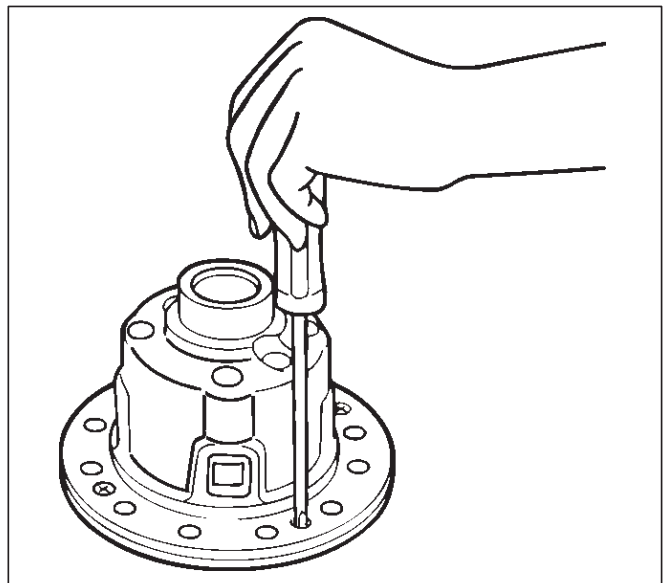
19. Install Spring disc.

20. Install Thrust washer.

21. Install Differential cage A.

22. Install Screw.

- Matching the guide marks of the differential cages A and B, tighten the screws evenly in the diagonal order.



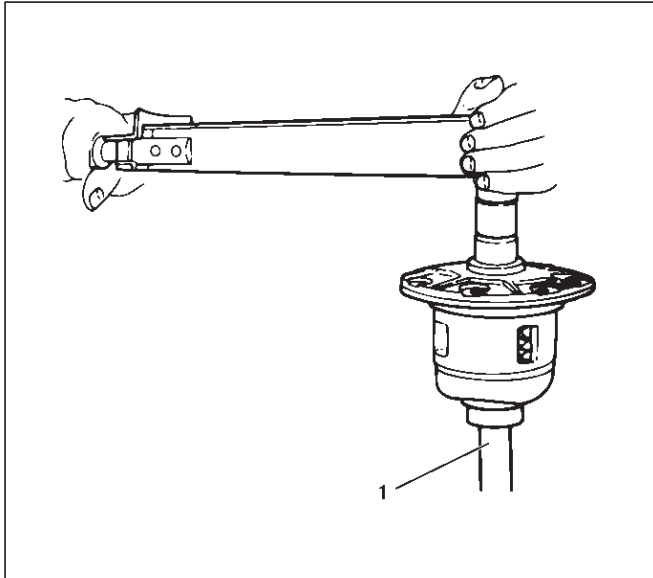
425RS065

23. Check the operation.

- Measure the starting torque using the side gear holder.

Starting torque:

64 – 98 N·m (6.5 – 7.3 kg·m/ 47 – 72lb ft)



425RW065

Legend

(1) Side Gear Holder : 5-8840-2381-0

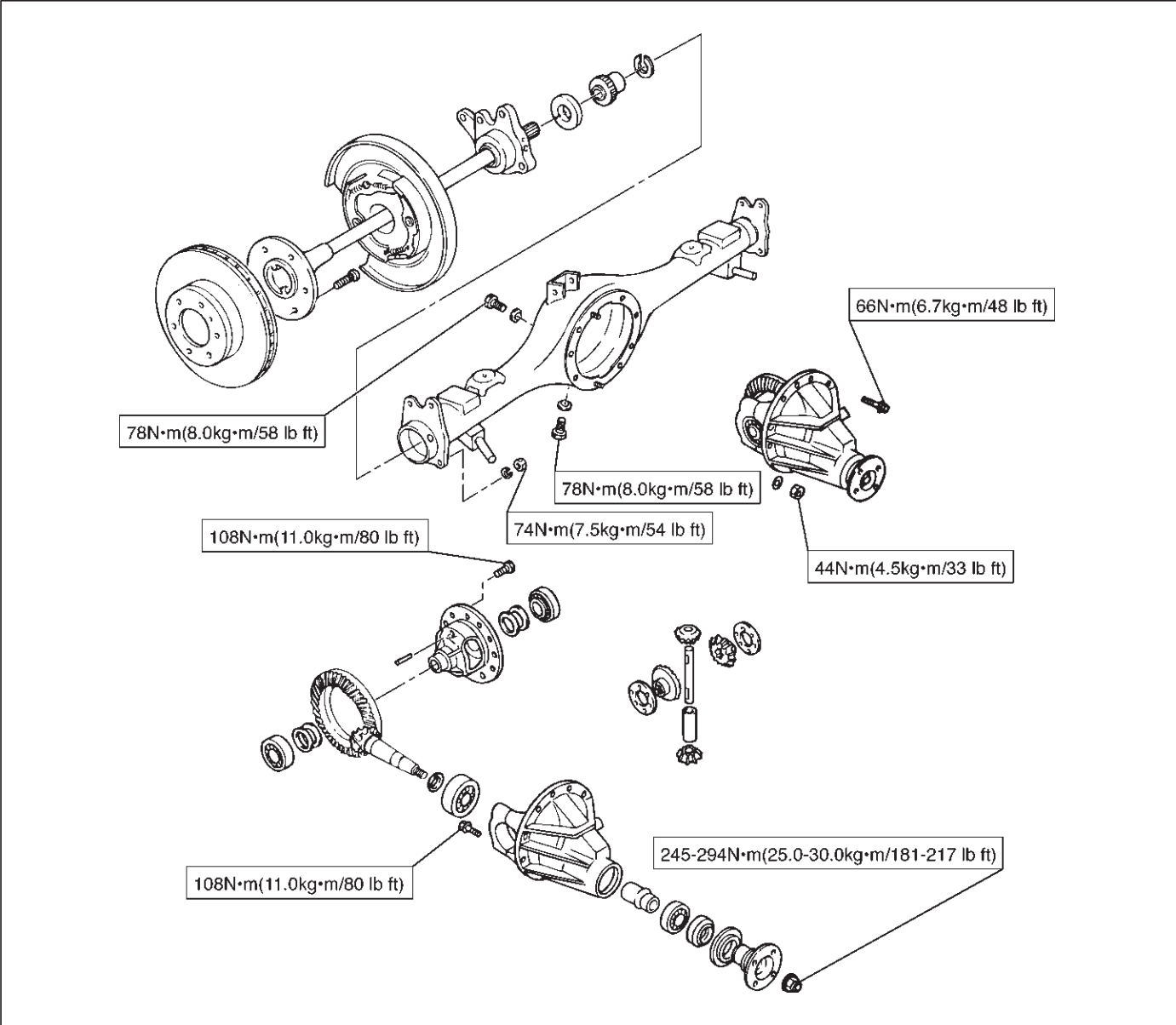
4A2A-32 DIFFERENTIAL (REAR 220mm)

Main Data and Specifications

General Specifications


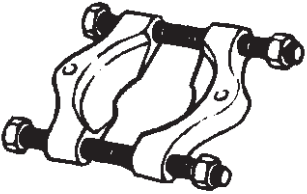
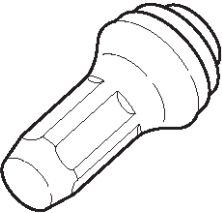
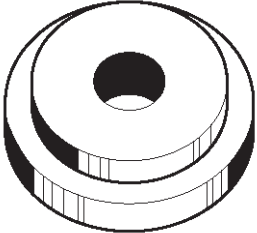
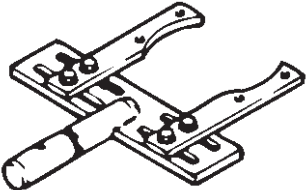
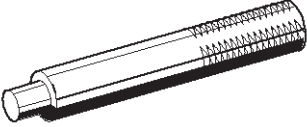
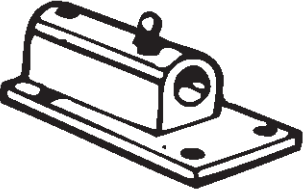
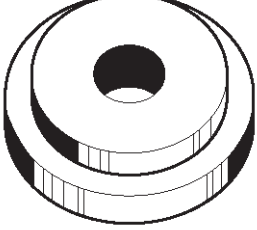
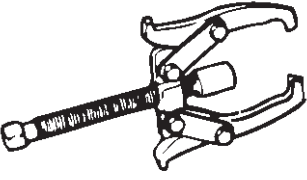
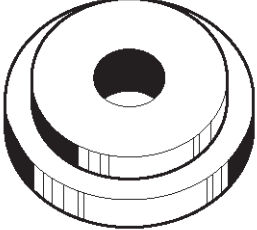
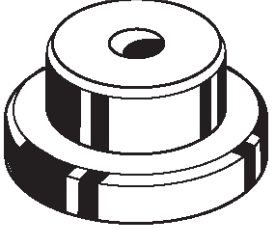
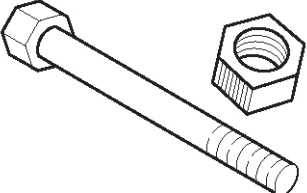
Rear axle	
Type	Banjo, Semi-floating
Rear axle Size	220mm(8.66in)
Gear type	Hypoid
Gear ratio (to 1)	4.555(6VD1,4JG2-TC) 4.777(4JG2)
Differential type	Two pinion
Lubricant Grade	GL-5: (Standard differential)
	GL-5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL-5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	1.8liter(1.6 Imp qt/1.9 US qt)

Torque Specifications



4A2A-34 DIFFERENTIAL (REAR 220mm)

Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME	ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS210</p>	<p style="text-align: center;">5-8840-2157-0 (J-37221) Holder; Pinion flange</p>	 <p style="text-align: right; font-size: small;">901RS236</p>	<p style="text-align: center;">5-8840-2197-0 (J-22912-01) Separator</p>
 <p style="text-align: right; font-size: small;">901RS205</p>	<p style="text-align: center;">5-8840-2294-0 (J-24250) Installer; Oil seal</p>	 <p style="text-align: right; font-size: small;">901RS240</p>	<p style="text-align: center;">5-8840-2164-0 (J-24256) Installer; Outer bearing outer race</p>
 <p style="text-align: right; font-size: small;">901RS212</p>	<p style="text-align: center;">5-8840-0275-0 (J-37264) Differential holding fixture (Use with 5-8840-0003-0)</p>	 <p style="text-align: right; font-size: small;">901RS24</p>	<p style="text-align: center;">5-8840-0007-0 (J-8092) Driver handle</p>
 <p style="text-align: right; font-size: small;">901RS213</p>	<p style="text-align: center;">5-8840-0003-0 (J-3289-20) Holding fixture base</p>	 <p style="text-align: right; font-size: small;">901RS240</p>	<p style="text-align: center;">5-8840-2163-0 (J-24252) Installer; Inner bearing outer race</p>
 <p style="text-align: right; font-size: small;">901RS214</p>	<p style="text-align: center;">5-8840-0013-0 5-8840-0014-0 (J-22888) Puller; Side bearing</p>	 <p style="text-align: right; font-size: small;">901RS220</p>	<p style="text-align: center;">5-8840-2085-0 (J-21777-42) Front Pilot</p>
 <p style="text-align: right; font-size: small;">901RS238</p>	<p style="text-align: center;">5-8840-2196-0 (J-8107-2) Adapter; Side bearing plug</p>	 <p style="text-align: right; font-size: small;">901RS242</p>	<p style="text-align: center;">5-8840-0127-0 (J-23597-9) Nut and bolt</p>

DIFFERENTIAL (REAR 220mm) 4A2A-35

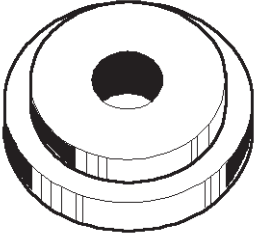
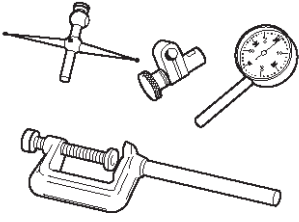
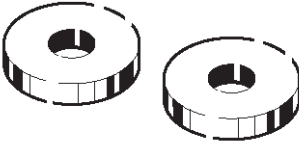
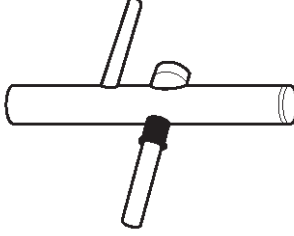
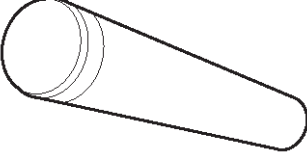
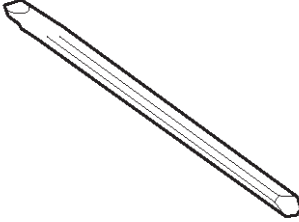
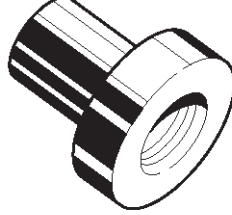
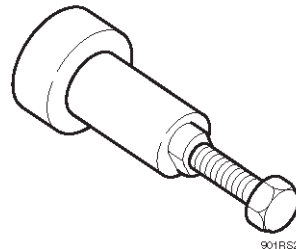
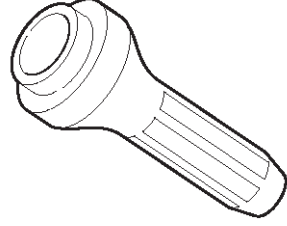
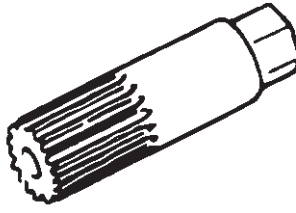
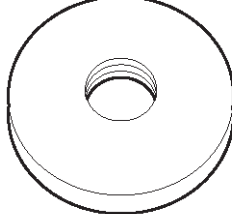
ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS243</p>	<p>5-8840-2166-0 (J-23597-7) Gauge plate</p>
 <p style="text-align: right; font-size: small;">901RS224</p>	<p>5-8840-0126-0 (J-8001) Dial indicator</p>
 <p style="text-align: right; font-size: small;">901RS244</p>	<p>5-8840-2167-0 (J-23597-8) Disc</p>
 <p style="text-align: right; font-size: small;">901RS226</p>	<p>5-8840-0128-0 (J-23597-1) Arbor</p>
 <p style="text-align: right; font-size: small;">901RS227</p>	<p>9-8522-1165-0 (J-6133-01) Installer; Pinion bearing</p>
 <p style="text-align: right; font-size: small;">901RS228</p>	<p>5-8840-2293-0 (J-39209) Punch; End nut lock</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS245</p>	<p>5-8840-2162-0 (J-24244) Installer; Side bearing</p>
 <p style="text-align: right; font-size: small;">901RS230</p>	<p>5-8840-2323-0 (J-39602) Remover; Outer bearing</p>
 <p style="text-align: right; font-size: small;">901RS211</p>	<p>5-8840-2165-0 (J-37263) Installer; Pinion oil seal</p>
 <p style="text-align: right; font-size: small;">901RW350</p>	<p>5-8840-2381-0 (J-41033) Holder; Side gear</p>
 <p style="text-align: right; font-size: small;">901RS222</p>	<p>5-8840-0129-0 (J-23597-12) Rear pilot</p>

MEMO

DRIVELINE/AXLE

DIFFERENTIAL (REAR 244mm)

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Service Precaution

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

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

General Description

The rear axle assembly is of the semi-floating type in which the vehicle weight is carried on the axle housing. The center line of the pinion gear is below the center line of the ring gear (hypoid drive).

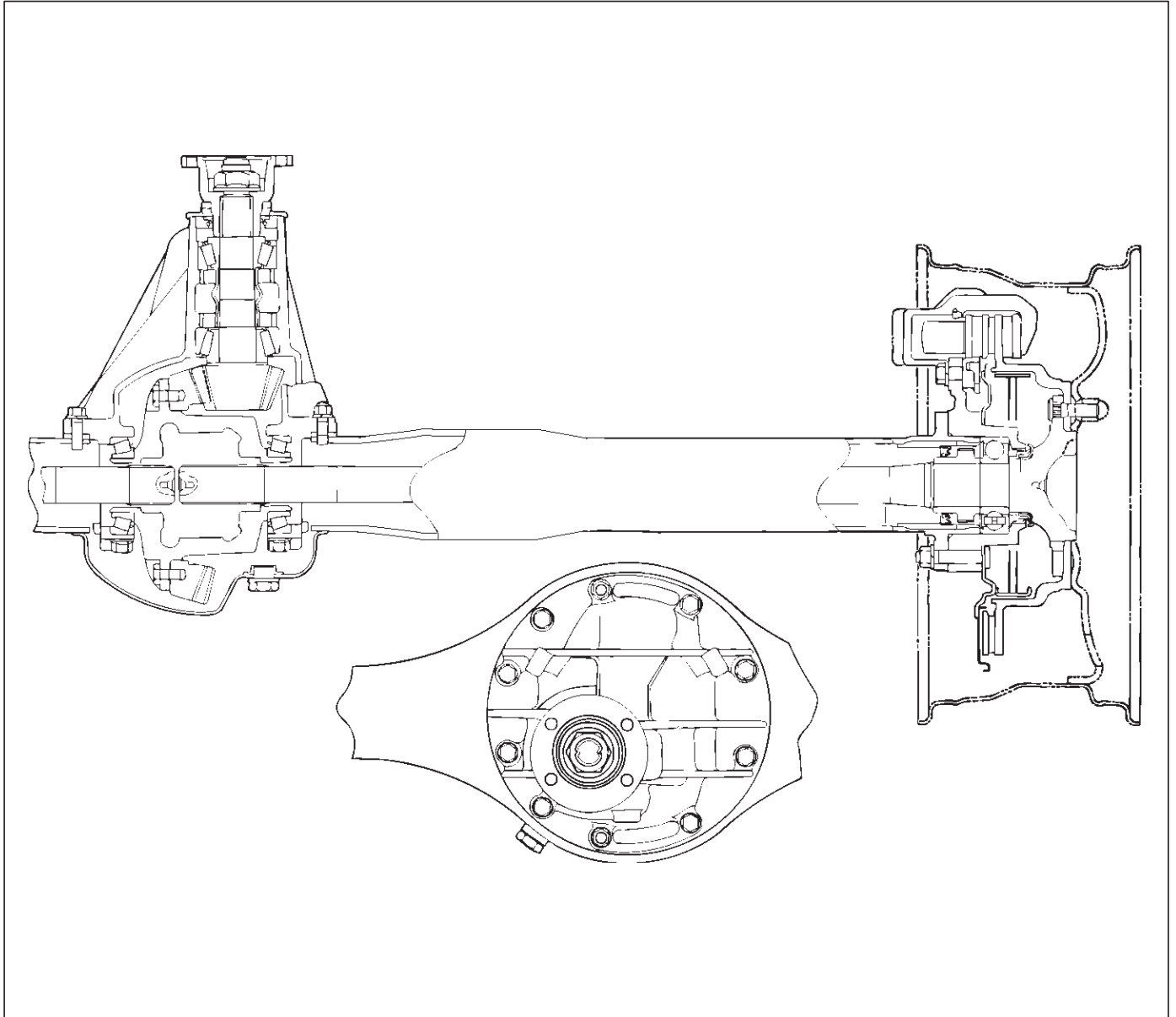
All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a banjo type axle housing.

The 9.61 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this

driving force at a 90 degree angle from the propeller shaft to the drive shafts.

The axle shafts are supported at the wheel end of the shaft by a roller bearing.

The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.



The ring gear is bolted onto the differential cage with 12 bolts.

The differential cage is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using selective shims and spacers between the bearing and the axle housing. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which

are pressed onto the differential cage. Two bearing caps are used to hold the differential into the rear axle housing. The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a liquid gasket between the differential carrier and the axle housing.

Diagnosis

Many noises that seem to come from the rear axle actually originate from other sources such as tires, road surface, wheel bearings, engine, transmission, muffler, or body drumming. Investigate to find the source of the noise before disassembling the rear axle. Rear axles, like any other mechanical device, are not absolutely quiet but should be considered quiet unless some abnormal noise is present.

To make a systematic check for axle noise, observe the following:

1. Select a level asphalt road to reduce tire noise and body drumming.
2. Check rear axle lubricant level to assure correct level, and then drive the vehicle far enough to thoroughly warm up the rear axle lubricant.
3. Note the speed at which noise occurs. Stop the vehicle and put the transmission in neutral. Run the engine speed slowly up and down to determine if the noise is caused by exhaust, muffler noise, or other engine conditions.
4. Tire noise changes with different road surfaces; axle noises do not. Temporarily inflate all tires to 344 kPa (3.5kg/cm², 50 psi) (for test purposes only). This will change noise caused by tires but will not affect noise caused by the rear axle.

Rear axle noise usually stops when coasting at speeds under 48 km/h (30 mph); however, tire noise continues with a lower tone. Rear axle noise usually changes when comparing pull and coast, but tire noise stays about the same.

Distinguish between tire noise and rear axle noise by noting if the noise changes with various speeds or sudden acceleration and deceleration. Exhaust and axle noise vary under these conditions, while tire noise remains constant and is more pronounced at speeds of 32 to 48 km/h (20 to 30 mph). Further check for tire noise by driving the vehicle over smooth pavements or dirt roads (not gravel) with the tires at normal pressure. If the noise is caused by tires, it will change noticeably with changes in road surface.

5. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing drive and coast. Light application of the brake while holding vehicle speed steady will often cause wheel bearing noise to diminish. Front wheel bearings may be checked for noise by jacking up the wheels and spinning them or by shaking the wheels to determine if bearings are loose.
6. Rear suspension rubber bushings and spring insulators dampen out rear axle noise when correctly installed. Check to see that there is no link or rod loosened or metal-to-metal contact.
7. Make sure that there is no metal-to-metal contact between the floor and the frame.

After the noise has been determined to be in the axle, the type of axle noise should be determined, in order to make any necessary repairs.

Gear Noise

Gear noise (whine) is audible from 32 to 89 km/h (20 to 55 mph) under four driving conditions.

1. Driving under acceleration or heavy pull.
2. Driving under load or under constant speed.
3. When using enough throttle to keep the vehicle from driving the engine while the vehicle slows down gradually (engine still pulls slightly).
4. When coasting with the vehicle in gear and the throttle closed. The gear noise is usually more noticeable between 48 and 64 km/h (30 and 40 mph) and 80 and 89 km/h (50 and 55 mph).

Bearing Noise

Bad bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise frequently “wow-wows” at bearing rpm, indicating a bad pinion or rear axle side bearing. This noise can be confused with rear wheel bearing noise.

Rear Wheel Bearing Noise

Rear wheel bearing noise continues to be heard while coasting at low speed with transmission in neutral. Noise may diminish by gentle braking. Jack up the rear wheels, spin them by hand and listen for noise at the hubs. Replace any faulty wheel bearings.

Knock At Low Speeds

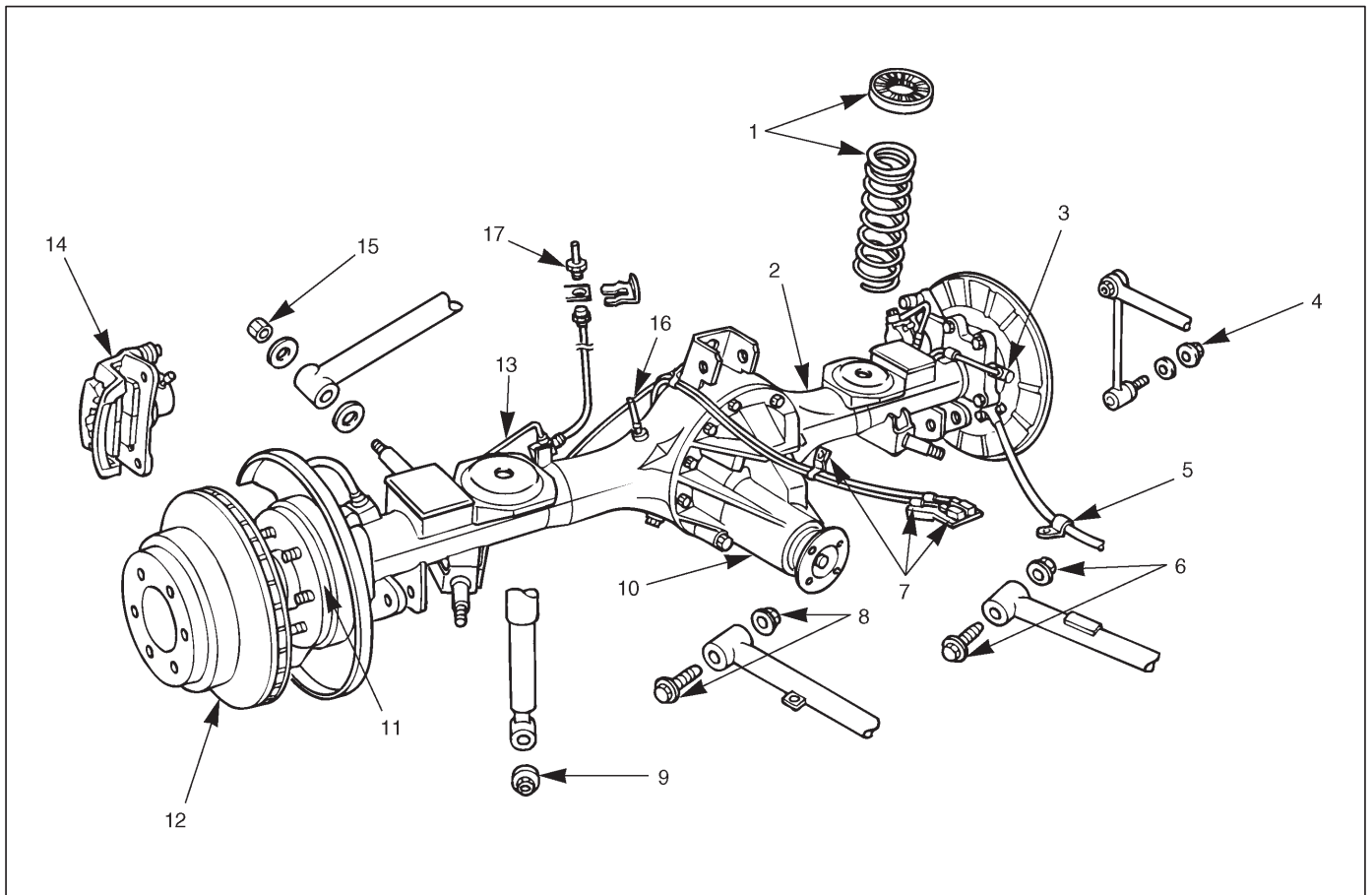
Low speed knock can be caused by worn universal joints or a side gear hub counter bore in the cage that is worn oversize. Inspect and replace universal joints or cage and side gears as required.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by a worn rear axle pinion shaft, a worn cage, excessive clearance between the axle and the side gear splines, excessive clearance between the side gear hub and the counterbore in the cage, worn pinion and side gear teeth, worn thrust washers, or excessive drive pinion and ring gear backlash. Remove worn parts and replace as required. Select close-fitting parts when possible. Adjust pinion and ring gear backlash.

Axle Housing

Axle Housing and Associated Parts



420RW001

Legend

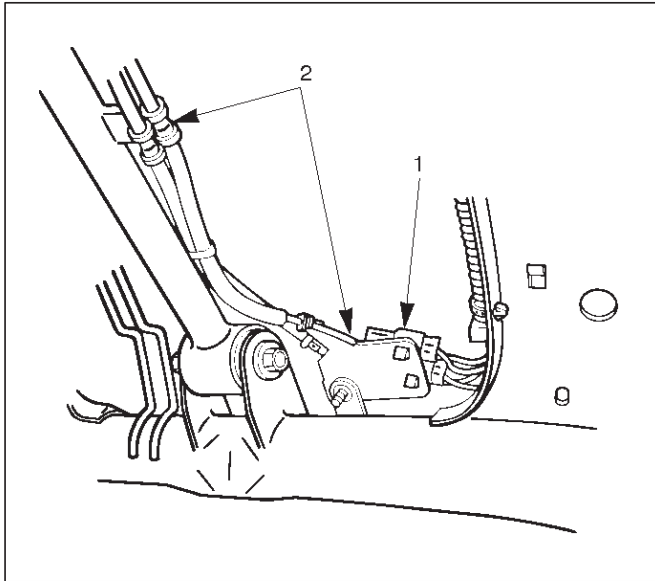
- | | |
|--|----------------------------|
| (1) Coil Spring and Insulator | (8) Bolt and Nut |
| (2) Axle Housing Assembly | (9) Nut |
| (3) ABS Speed Sensor and Harness (if so equipped) | (10) Differential Assembly |
| (4) Nut | (11) Axle Shaft Assembly |
| (5) Parking Brake Cable | (12) Brake Disc |
| (6) Bolt and Nut | (13) Brake Pipe |
| (7) Antilock Brake System (ABS) Connector and Bracket (if so equipped) | (14) Brake Caliper |
| | (15) Nut |
| | (16) Breather Hose |
| | (17) Flare Nut |

Removal

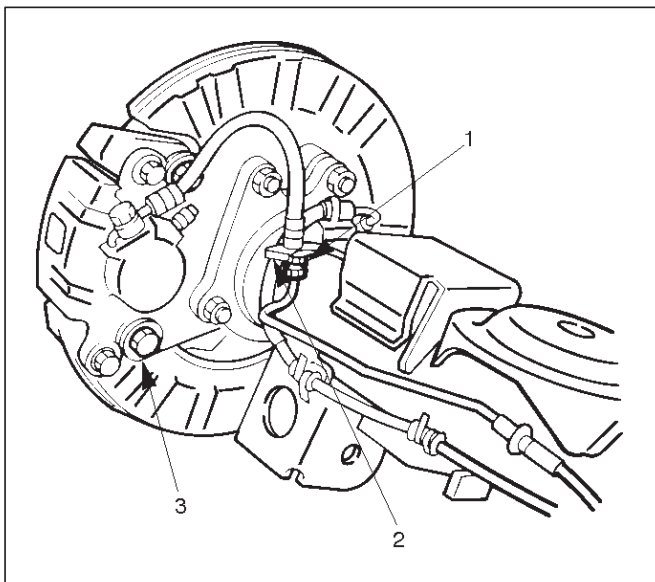
1. Raise the vehicle and support it with suitable safety stands.
The hoist must remain under the rear axle housing.
2. Drain brake fluid. Refer to Hydraulic Brakes in Brakes section.
3. Remove rear wheels and tires. Refer to Wheel in Suspension section.

4. Remove propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Drain the rear axle oil into a proper container.
6. Remove parking brake cable, release the connection between the cable fixing clip equalizer. Refer to Parking Brakes in Brakes section.
7. Move the clip aside and pull out the breather hose.

8. Disconnect the ABS connectors (1) and remove the brackets (2) (if so equipped) attached to the frame and center link.



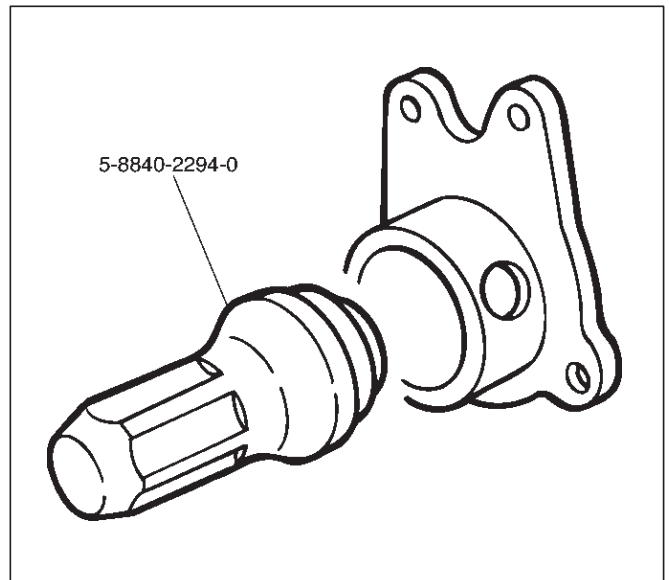
9. Loosen the brake tube flare nut, remove the clip and take out the brake tube.
10. Remove the shock absorber fixing nut from the axle housing.
11. Remove the stabilizer linkage mounting nut from the axle housing.
12. Remove the lateral rod fixing nut from the axle housing.
13. Remove the center link mounting bolt and nut from the axle housing.
14. Remove the trailing link fixing bolt and nut from the axle housing.
15. Jack down and remove the coil spring and insulator.
16. Axle housing assembly can be separated from the vehicle on completion of steps 1 – 11.
17. Remove the brake caliper fixing bolt (3), loosen the flare nut (1), release the clip (2) and take out the brake caliper together with the flexible hose.



18. Remove brake disc.
19. Remove antilock brake system speed sensor fixing bolt and the clip and bracket (if so equipped) on the axle housing.
20. Remove the brake pipe clip and fixing bolt on the axle housing and take out the brake pipe.
21. Remove the bearing holder fixing nut and take out the axle shaft assembly, be sure not to damage the oil seal by the spline of the shaft, Refer to Axle Shaft in this section.
22. Remove differential assembly, refer to Differential Assembly in this section.

Oil Seal Replacement

Remove the oil seal, carefully not to damage the housing, and mount new oil seal using oil seal installer 5-8840-2294-0



Installation

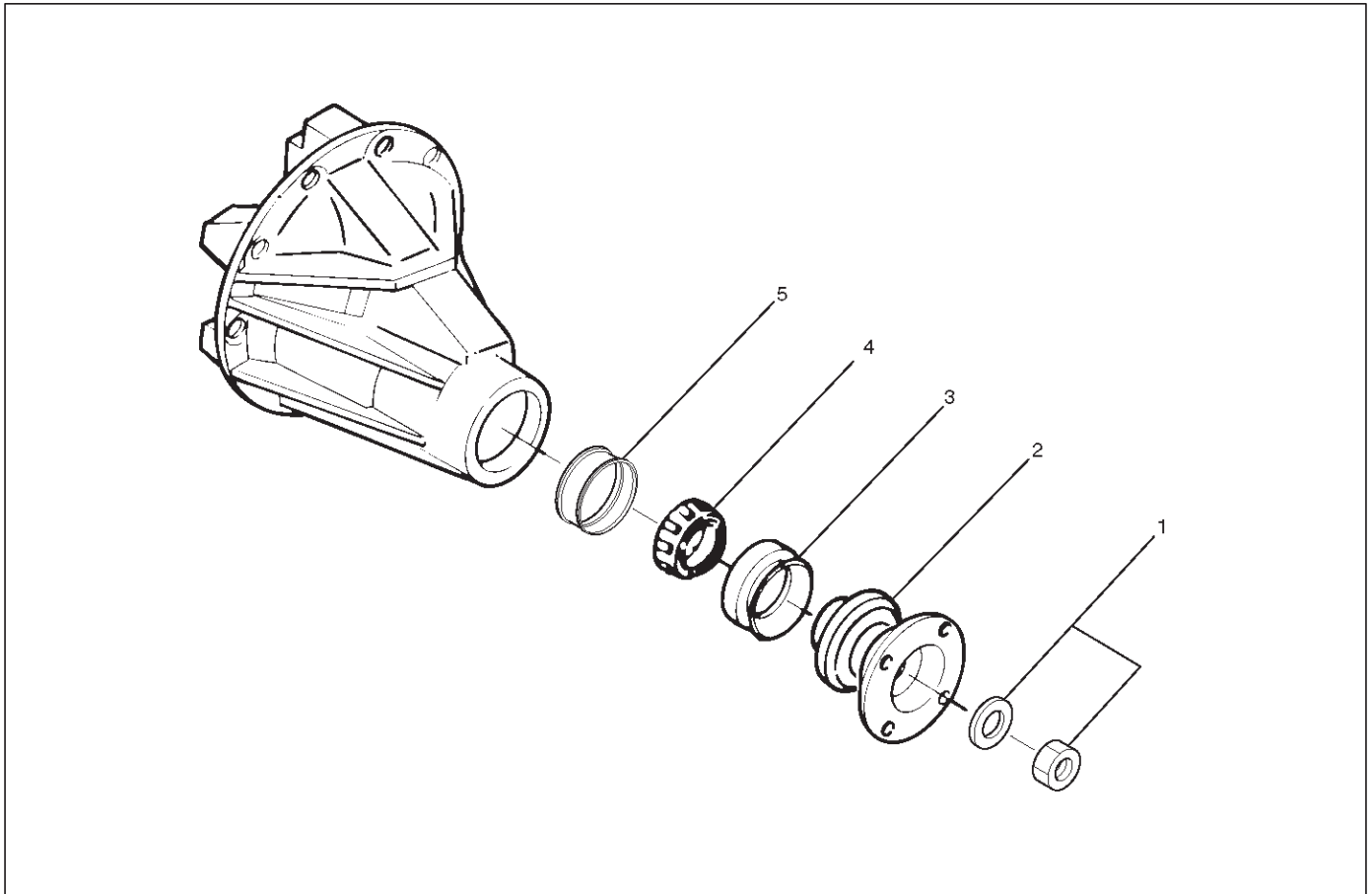
1. Install differential assembly, refer to Differential Assembly in this section.
2. Install axle shaft assembly then tighten the bearing holder mounting nut to the specified torque. Be sure not to damage the oil seal by the spline of the shaft.
Torque: 74N-m (7.5kg-m/54 lb ft)
3. Install brake pipe.
4. Connect antilock brake system (ABS) speed sensor and harness (if so equipped), refer to Anti-Lock Brake System in Brake section.
5. Install brake disc.
6. Install brake caliper. Refer to Disk Brakes in Brake section.
7. Install axle housing assembly.
8. Install coil spring and insulator.
9. Install the trailing link fixing bolt and nut to the axle housing. For the procedures in items 9-13, refer to Suspension section.
10. Install the center link bolt and nut to the axle housing.

4A2B-6 DIFFERENTIAL (REAR 244mm)

11. Install the lateral rod fixing nut to the axle housing.
12. Install the stabilizer linkage mounting nut to the axle housing.
13. Install the shock absorber fixing nut to the axle housing.
14. Install brake tube flare nut, Refer to Disk Brakes in Brake section.
15. Install ABS connector and bracket (if so equipped).
16. Connect breather hose.
17. Install parking brake cable, Refer to Parking Brakes in Brake section.
18. Bleed brakes. Refer to Hydraulic Brakes in Brake section.

Pinion Oil Seal

Pinion Oil Seal and Associated Parts



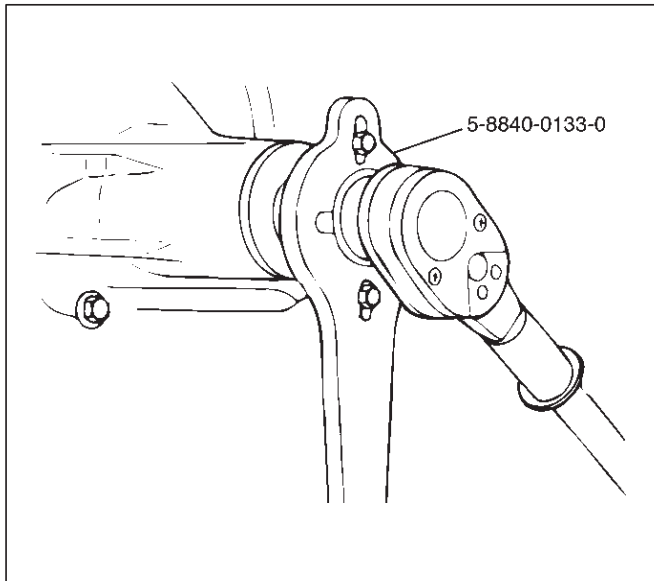
Legend

- | | |
|---------------------------|------------------------|
| (1) Flange Nut and Washer | (3) Oil Seal |
| (2) Flange | (4) Outer Bearing |
| | (5) Collapsible Spacer |

Removal

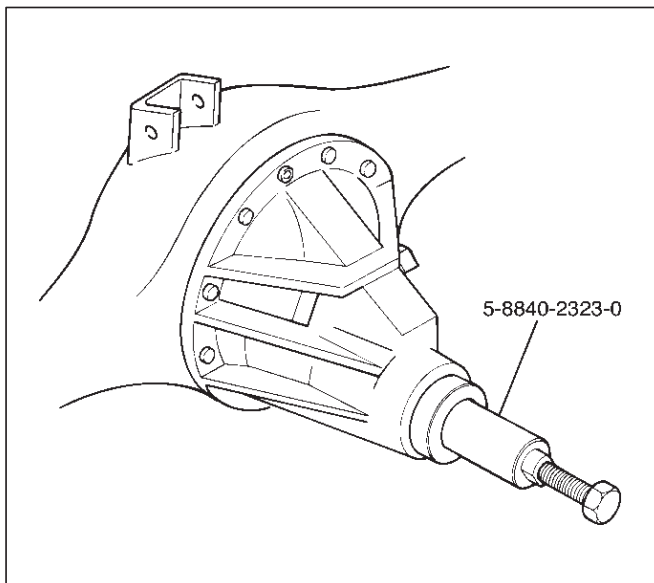
1. Remove the rear propeller shaft. Refer to Rear Propeller Shaft in this section.
2. Drain the rear axle oil.

3. Remove flange nut and washer by using pinion flange holder 5-8840-0133-0 after raising up its staked parts completely.



415RW040

4. Remove flange.
5. Remove oil seal.
6. Remove outer bearing by using remover 5-8840-2323-0.



425RW066

7. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

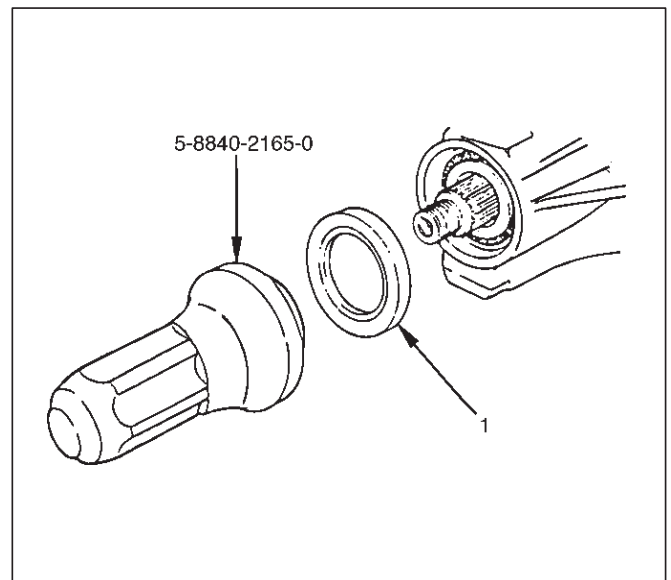
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer, discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. By using the seal installer 5-8840-2165-0, install a new oil seal (1) that has grease on seal lip.



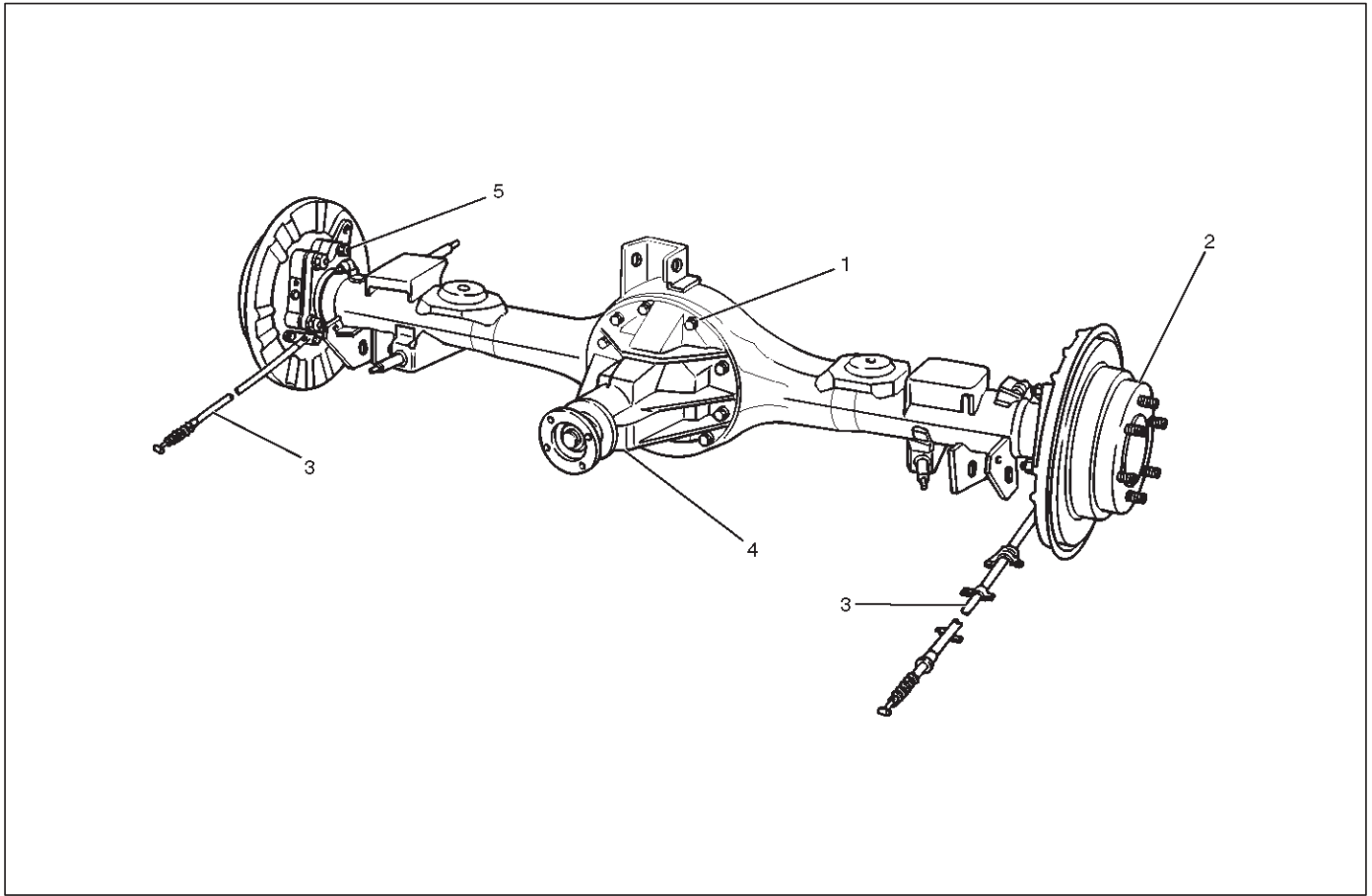
425RW050

4. Install flange.
5. Install flange nut and washer. Refer to Differential Assembly in this section for flange nut reassembly.

NOTE: Discard the used nut and install a new one.

Differential Assembly

Differential Assembly and Associated Parts



425RW044

Legend

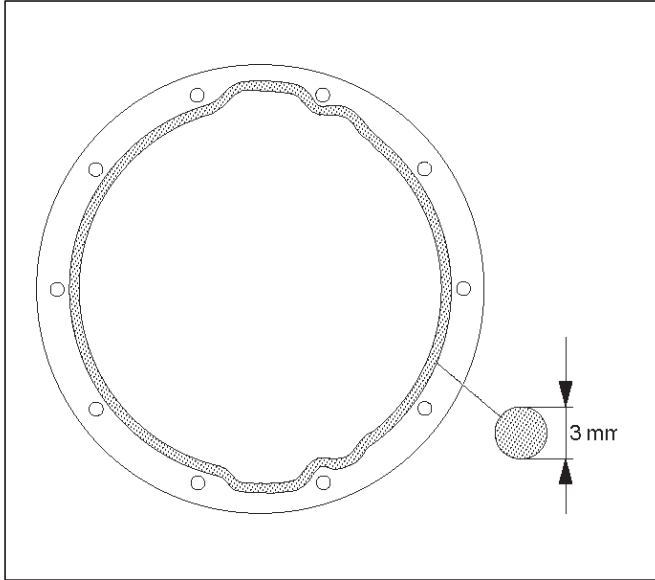
- | | |
|-------------------------|---------------------------|
| (1) Bolt and Nut | (3) Parking Brake Cable |
| (2) Axle Shaft Assembly | (4) Differential Assembly |
| | (5) Nut |

Removal

1. Jack up and support the frame with stands.
2. Remove the wheel and tire. Refer to Wheel in Steering section.
3. Drain the differential oil.
4. Remove the propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Remove the ABS speed sensor. Refer to Anti-lock Brake System in Brakes section.
6. Remove the parking brake cable fastening clip and disconnect the equalizer section. Refer to Parking Brakes in Brake section.
7. Remove the bearing holder fixing nuts.
8. Remove axle shaft assembly, be sure not to damage the oil seal by axle shaft.
9. Remove differential carrier mounting bolts and nuts.
10. Remove differential assembly.

Installation

1. Clean the contact surfaces of the axle and differential carrier. As shown in the drawing, apply Three Bond TB1215 or equivalent then install differential assembly.



2. Install bolt and nut. Tighten the differential carrier mounting bolts and nuts to the specified torque.

Torque:Nuts 44N-m (4.5kg-m/33 lb ft)

Bolts 64N-m (6.5kg-m/47 lb ft)

3. Install axle shaft assembly. Be sure not to damage the oil seal by axle shaft.
4. Install nut, refer to Axle Shaft in this section.
5. Install parking brake cable, refer to Parking Brakes in Brake section.

NOTE: After completing the assembling work, fill the prescribed gear oil to the filler hole.

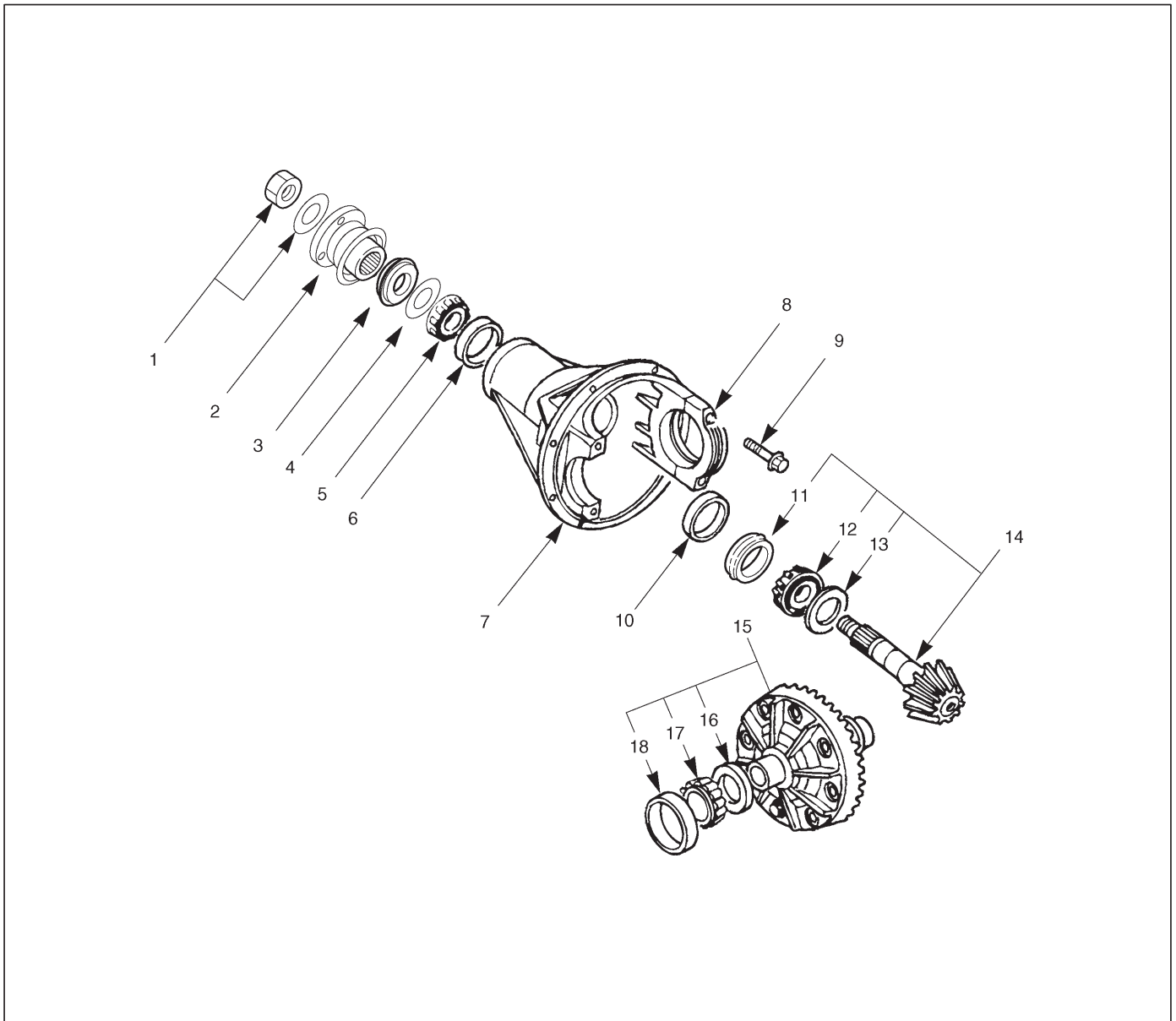
Lubricant capacity: 3.0 liter (2.6 Imp qt/3.2 US qt)

6. Tighten the oil filler plug to the specified torque.

Torque: 78N-m (8.0kg-m/58 lb ft)

4A2B-10 DIFFERENTIAL (REAR 244mm)

Disassembled View



415RW002

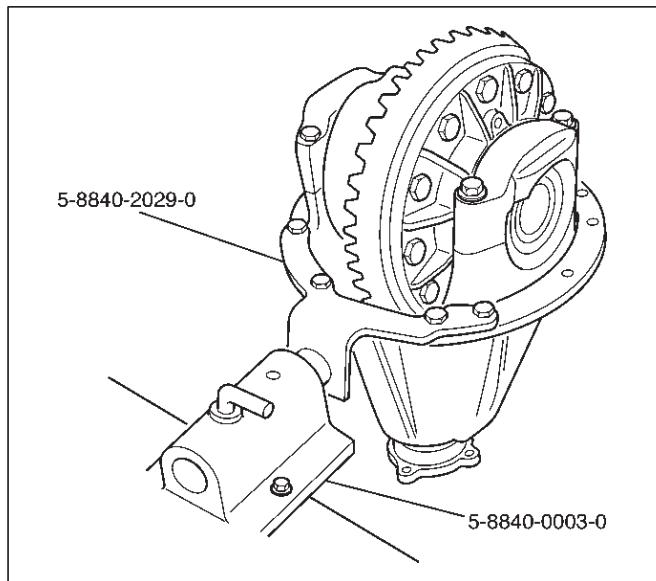
Legend

- | | |
|------------------------------|---------------------------------------|
| (1) Flange Nut and Washer | (10) Inner Bearing Outer Race |
| (2) Flange | (11) Collapsible Spacer |
| (3) Oil Seal | (12) Inner Bearing |
| (4) Oil Seal Slinger | (13) Adjust Shim (Pinion Position) |
| (5) Outer Bearing | (14) Drive Pinion Shaft |
| (6) Outer Bearing Outer Race | (15) Adjust Shim (Diff Cage Assembly) |
| (7) Diff Carrier | (16) Diff Preload/Backlash |
| (8) Bearing Cap | (17) Side Bearing |
| (9) Bolt | (18) Side Bearing Outer Race |

DIFFERENTIAL (REAR 244mm) 4A2B-11

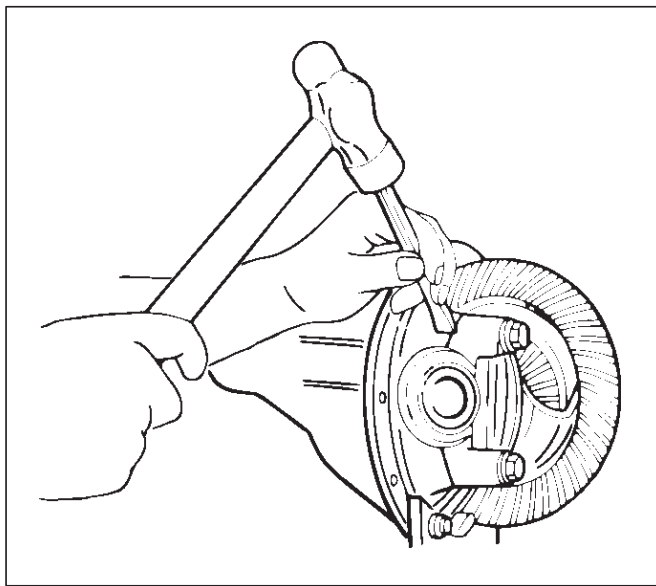
Disassembly

1. Using holding fixture 5-8840-2029-0 and holding fixture base 5-8840-0003-0, fix the differential assembly to the bench.



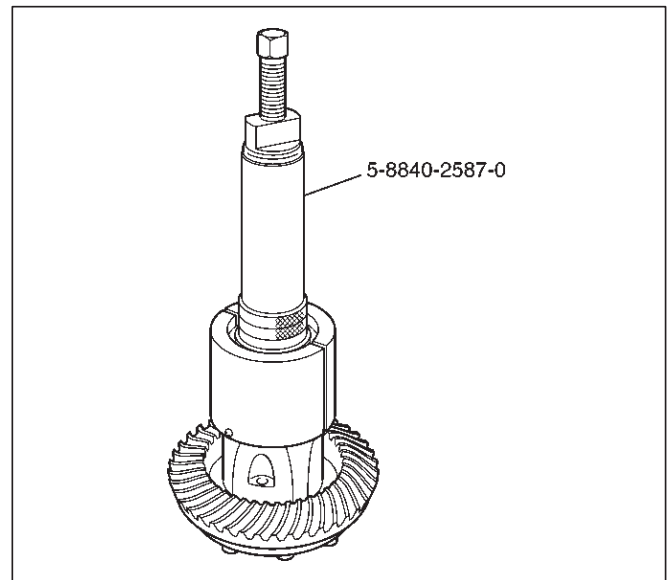
425RW058

2. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



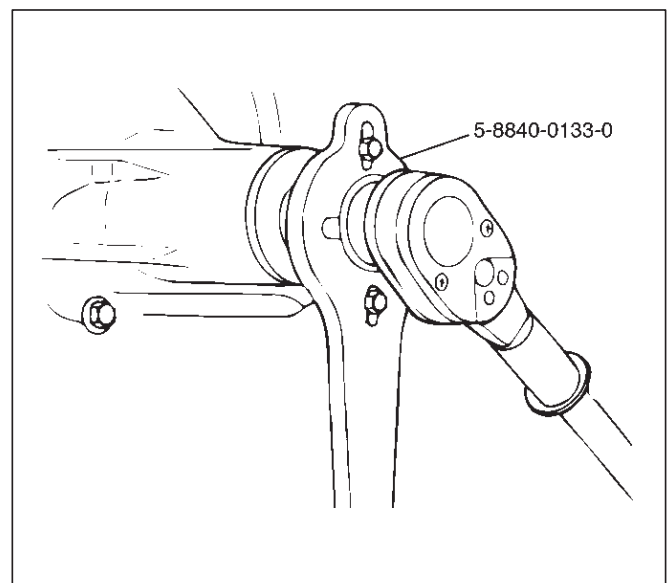
425RS009

3. Remove differential cage assembly.
4. Remove side bearing outer race. After removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.
5. Remove side bearing by using remover 5-8840-2587-0 and adapter 5-8840-2576-0. Select collet halves 44803 in remover kit 5-8840-2587-0 for side bearing removal and insert is not required for this operation.



415RW041

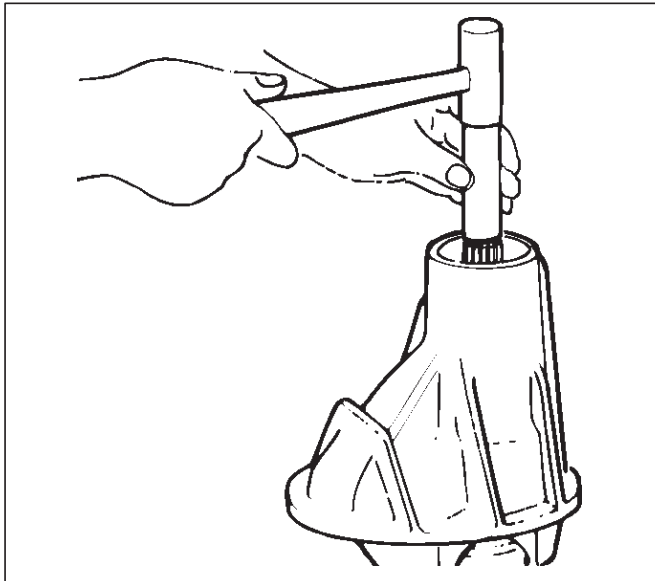
6. Note the thickness and position of the shims then remove adjust shim.
7. Remove the flange nut and washer by using pinion flange holder 5-8840-0133-0 after raising up its staked parts completely.



415RW040

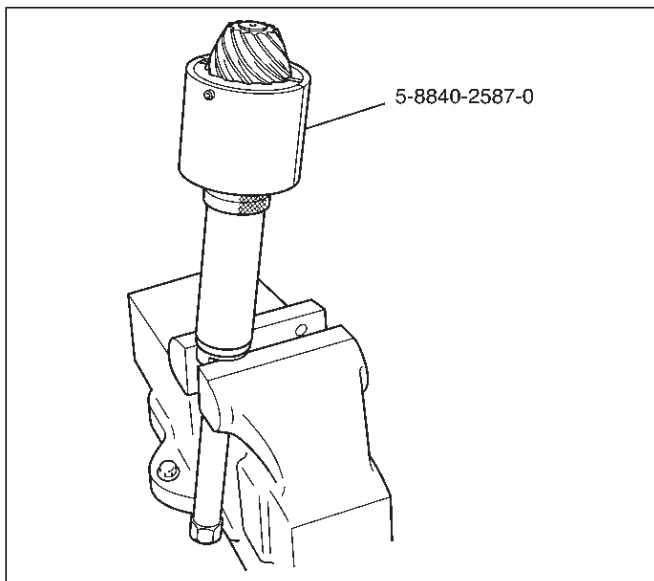
4A2B-12 DIFFERENTIAL (REAR 244mm)

8. Removed flange assembly.
9. Remove the drive pinion assembly using a soft metal rod and a hammer.



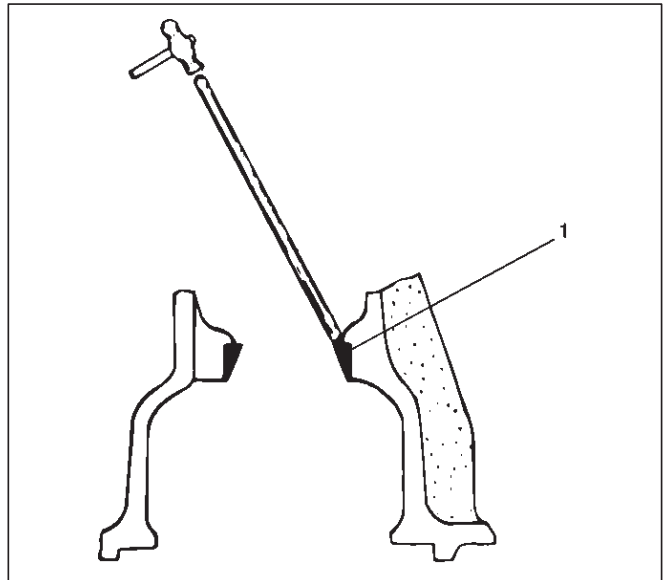
425RS012

10. Remove collapsible spacer.
11. Remove the inner bearing by using remover 5-8840-2587-0. Select insert 303174 and collet halves 44803 in remover kit 5-8840-2587-0 for inner bearing removal.

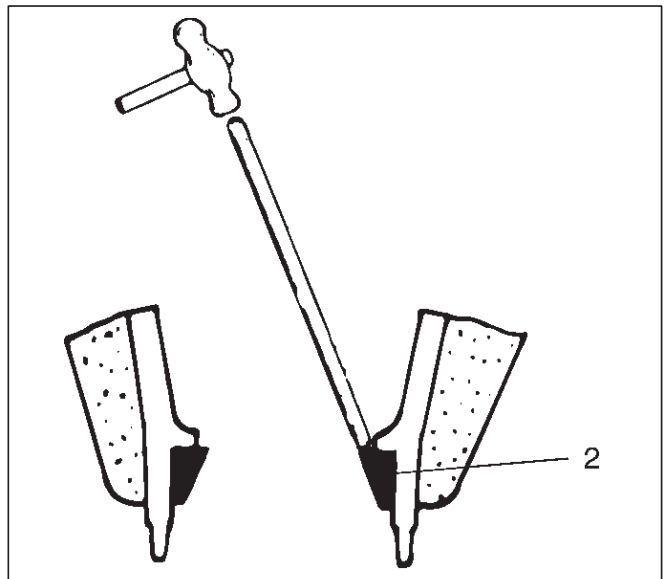


415RW042

12. Remove adjust shim.
13. Remove oil seal.
14. Remove oil seal slinger.
15. Remove outer bearing.
16. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.



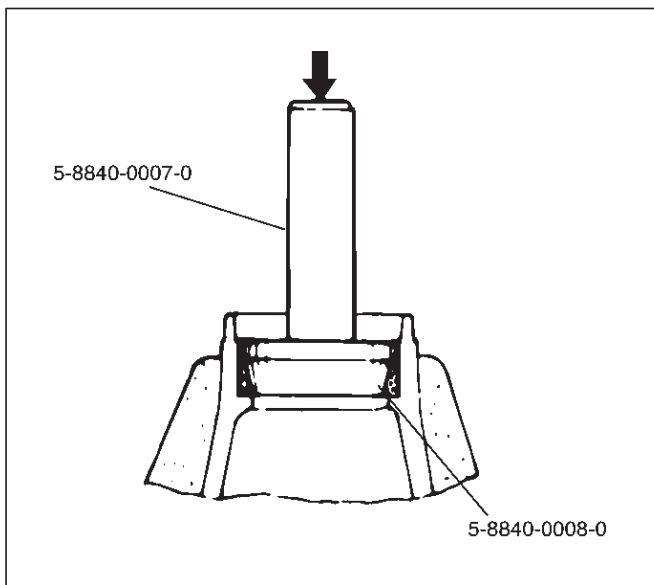
425RS014



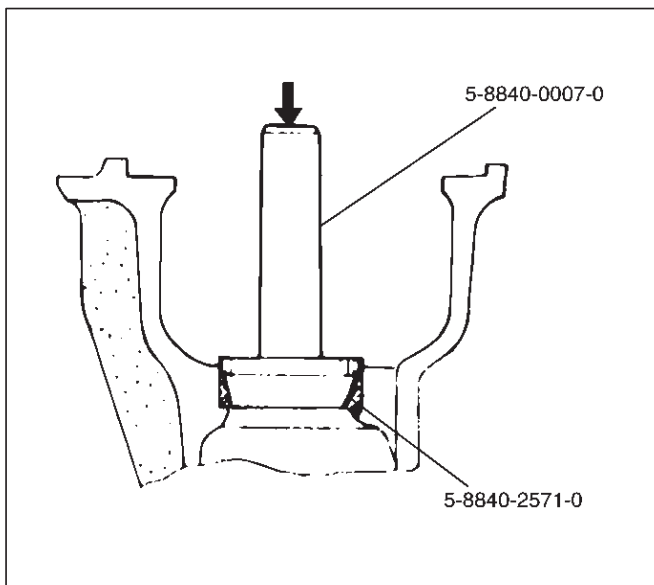
425RS015

Reassembly

1. Install outer bearing outer race by using installer 5-8840-0007-0 and grip 5-8840-0008-0.



2. Install inner bearing outer race by using installer 5-8840-2571-0 and grip 5-8840-0007-0.



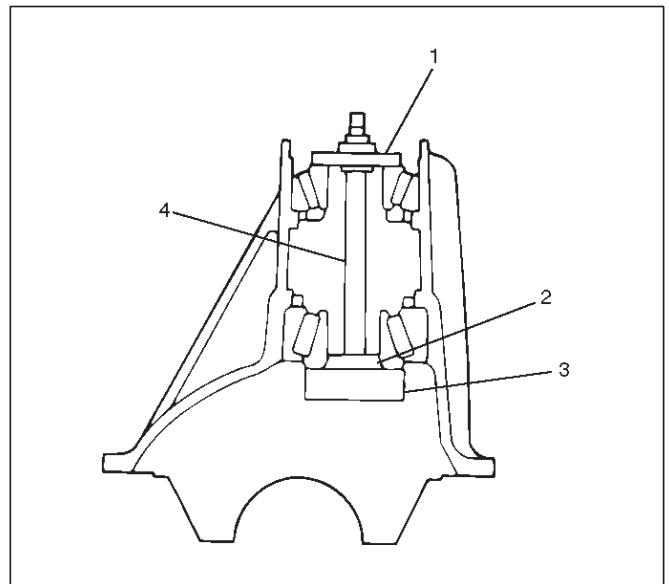
3. Adjust the drive pinion mounting distance as follows:

1. Apply gear oil to the inner and outer drive pinion bearing. Clean the pinion setting gauge set. Then install the gauge set together with the inner and outer bearings.

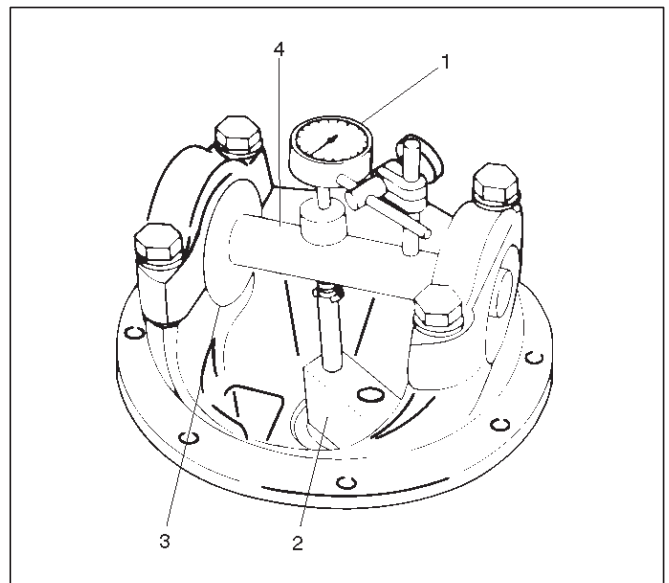
Install gauge plate 5-8840-2572-0 (3), inner pilot 5-8840-2573-0 (2), stud and nut 5-8840-0127-0 (4) and outer pilot 5-8840-2575-0 (1) through inner and outer bearings.

2. Tighten the nut to the specified torque.

Torque: 2.3 N-m (23kg-cm/20 lb in)



3. Clean the side bearing bores. Place discs and dial indicator on to arbor, and place tool into position in side bearing bores. Install and tighten the bearing caps to the specified torque.

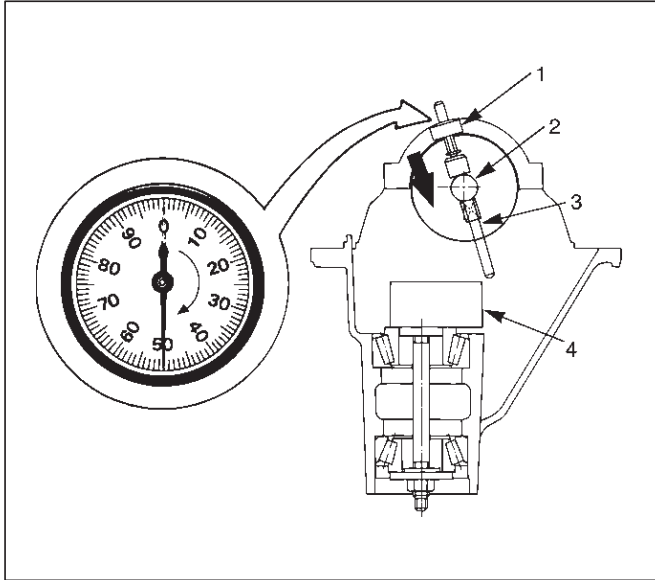


Legend

- (1) Dial Indicator: 5-8840-0126-0
- (2) Gauge Plate: 5-8840-2572-0
- (3) Disc (2 pcs.): 5-8840-2577-0
- (4) Arbor: 5-8840-0128-0

4A2B-14 DIFFERENTIAL (REAR 244mm)

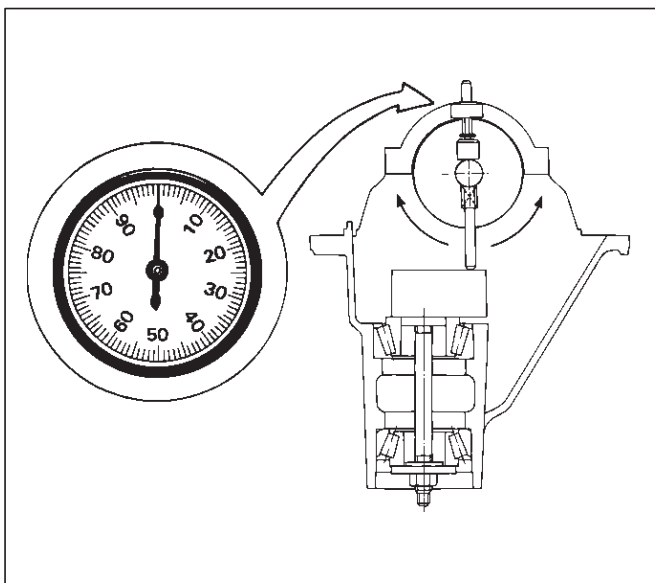
- Set the dial indicator 5-8840-0126-0 to "0". Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.



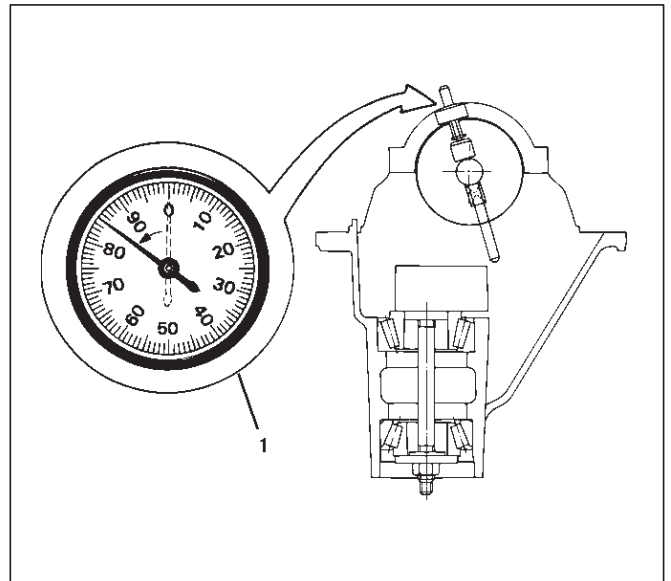
Legend

- Dial Indicator
- Gauging Arbor
- Plunger
- Gauge Plate

- Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest deflection. At this point, once again set the dial indicator to "0". Repeat the procedure to verify the "0" setting.



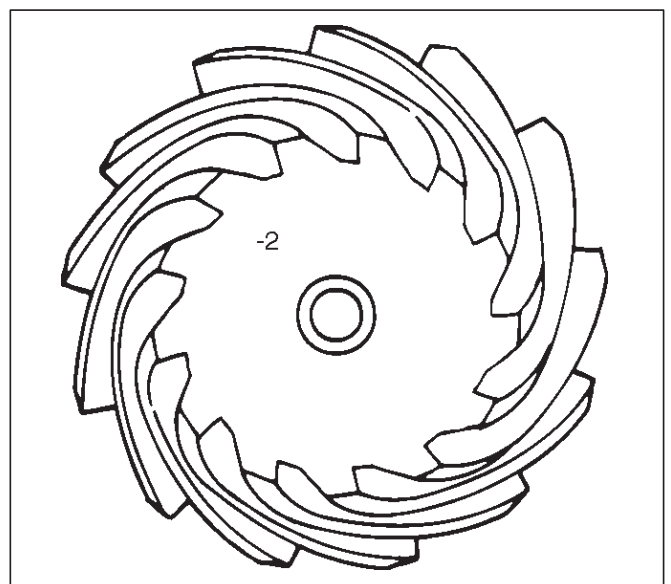
- After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate. Record the number the dial indicator needle points to.



Legend

- Example=Dial indicator reading of 0.085

- Record the pinion depth code on the head of the drive pinion. The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code "0", the pinion is "nominal".



DIFFERENTIAL (REAR 244mm) 4A2B-15

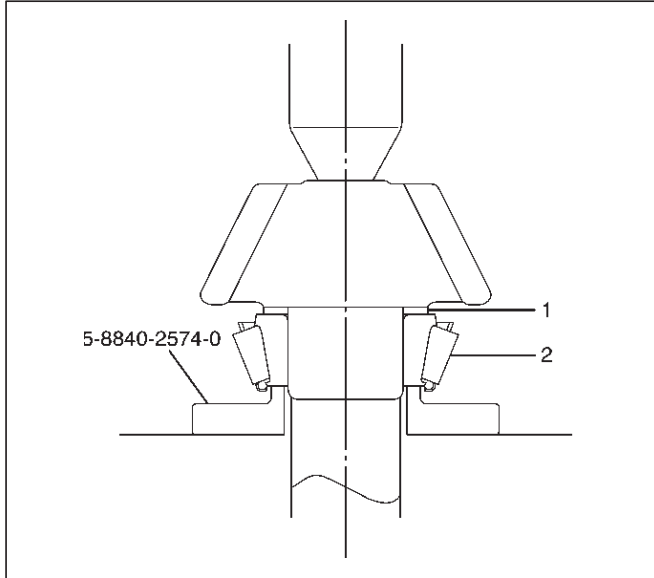
8. Select the shim thickness using the chart;

Pinion marking Dial indicator reading (Inches)	+3 (Inches)	+2 (Inches)	+1 (Inches)	0 (Inches)	-1 (Inches)	-2 (Inches)	-3 (Inches)
0.024							0.027
0.025						0.027	0.028
0.026					0.027	0.028	0.029
0.027				0.027	0.028	0.029	0.030
0.028			0.027	0.028	0.029	0.030	0.031
0.029		0.027	0.028	0.029	0.030	0.031	0.032
0.030	0.027	0.028	0.029	0.030	0.031	0.032	0.033
0.031	0.028	0.029	0.030	0.031	0.032	0.033	0.034
0.032	0.029	0.030	0.031	0.032	0.033	0.034	0.035
0.033	0.030	0.031	0.032	0.033	0.034	0.035	0.036
0.034	0.031	0.032	0.033	0.034	0.035	0.036	0.037
0.035	0.032	0.033	0.034	0.035	0.036	0.037	0.038
0.036	0.033	0.034	0.035	0.036	0.037	0.038	0.039
0.037	0.034	0.035	0.036	0.037	0.038	0.039	0.040
0.038	0.035	0.036	0.037	0.038	0.039	0.040	0.041
0.039	0.036	0.037	0.038	0.039	0.040	0.041	0.042
0.040	0.037	0.038	0.039	0.040	0.041	0.042	0.043
0.041	0.038	0.039	0.040	0.041	0.042	0.043	0.044
0.042	0.039	0.040	0.041	0.042	0.043	0.044	0.045
0.043	0.040	0.041	0.042	0.043	0.044	0.045	0.046
0.044	0.041	0.042	0.043	0.044	0.045	0.046	0.047
0.045	0.042	0.043	0.044	0.045	0.046	0.047	0.048
0.046	0.043	0.044	0.045	0.046	0.047	0.048	0.049
0.047	0.044	0.045	0.046	0.047	0.048	0.049	0.050
0.048	0.045	0.046	0.047	0.048	0.049	0.050	0.051
0.049	0.046	0.047	0.048	0.049	0.050	0.051	0.052
0.050	0.047	0.048	0.049	0.050	0.051	0.052	0.053
0.051	0.048	0.049	0.050	0.051	0.052	0.053	0.054
0.052	0.049	0.050	0.051	0.052	0.053	0.054	0.055
0.053	0.050	0.051	0.052	0.053	0.054	0.055	0.056
0.054	0.051	0.052	0.053	0.054	0.055	0.056	0.057
0.055	0.052	0.053	0.054	0.055	0.056	0.057	0.058
0.056	0.053	0.054	0.055	0.056	0.057	0.058	0.059
0.057	0.054	0.055	0.056	0.057	0.058	0.059	0.060
0.058	0.055	0.056	0.057	0.058	0.059	0.060	0.061
0.059	0.056	0.057	0.058	0.059	0.060	0.061	0.062
0.060	0.057	0.058	0.059	0.060	0.061	0.062	0.063
0.061	0.058	0.059	0.060	0.061	0.062	0.063	0.064
0.062	0.059	0.060	0.061	0.062	0.063	0.064	0.065
0.063	0.060	0.061	0.062	0.063	0.064	0.065	
0.064	0.061	0.062	0.063	0.064	0.065		
0.065	0.062	0.063	0.064	0.065			
0.066	0.063	0.064	0.065				
0.067	0.064	0.065					
0.068	0.065						

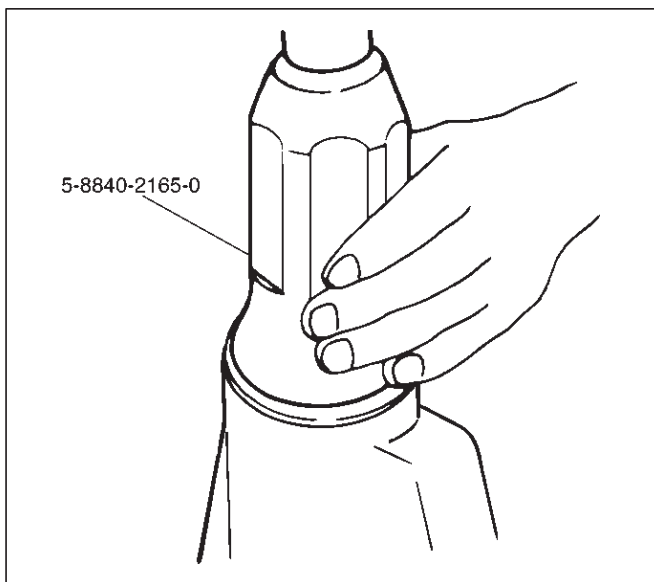
4A2B-16 DIFFERENTIAL (REAR 244mm)

- Place the shim (1) on the drive pinion, then install the inner bearing (2) onto the pinion by using installer 5-8840-2574-0 and a press .

NOTE: Do not apply pressure to the roller cage. Apply pressure only to the inner race.



- Install collapsible spacer. Discard the used collapsible spacer and install a new one.
- Install drive pinion shaft assembly.
- Install outer bearing and oil seal slinger.
- Use oil seal installer 5-8840-2165-0 to install a new oil seal that has grease on seal lip.

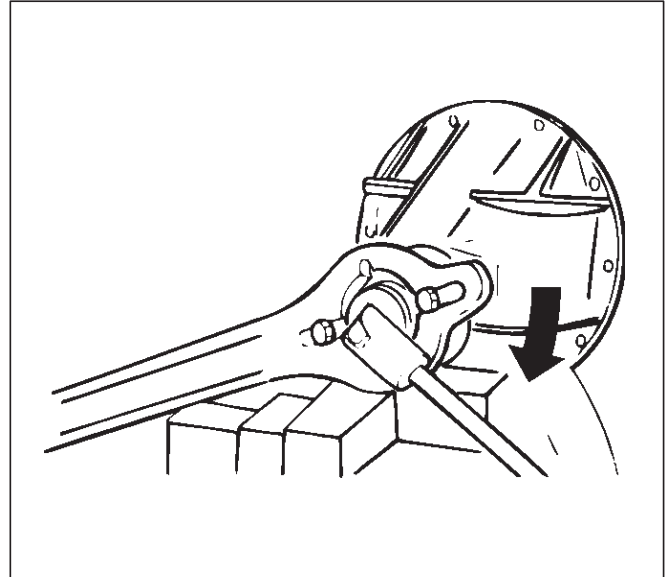


- Install flange assembly.

- Install flange nut and washer.

- Apply lubricant to the pinion threads.
- Using the pinion flange holder 5-8840-0133-0, tighten the nut only enough to remove the shaft end play.

NOTE: Discard used flange nut and install new one.

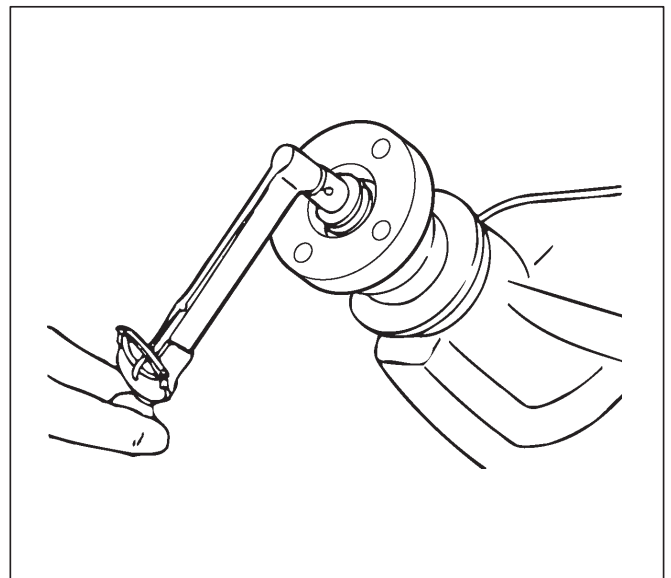


- Adjust pinion bearing preload.
 - Measure the bearing preload by using a torque meter and note the scale reading required to rotate the flange.
 - Continue tightening flange nut until the specified starting torque is obtained.

Starting torque: 1.1–1.6 N·m (11–16kg·cm/10–14 lb in)

NOTE:

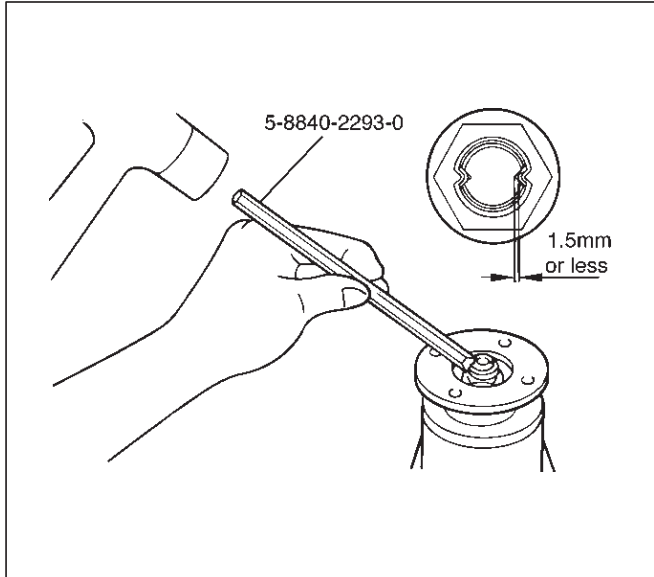
- Do not overtighten or loosen and then retighten the nut.
- Pinion nut torque should be in the range of 298–380 N·m (30.4–38.8kg·m/220–281 lb ft).



DIFFERENTIAL (REAR 244mm) 4A2B-17

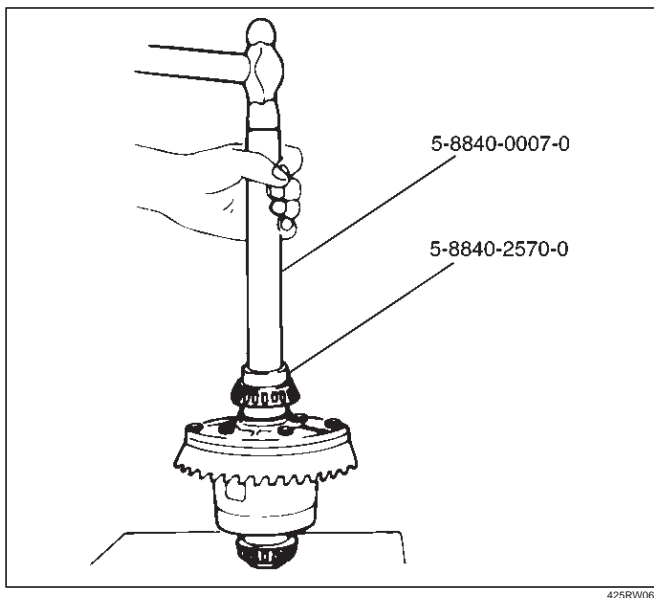
- Using punch 5-8840-2293-0, stake the flange nut at two points.

NOTE: When staking, be sure to turn the nut to ensure that there is no change in bearing preload. Make sure of preload again as instructed in 3).

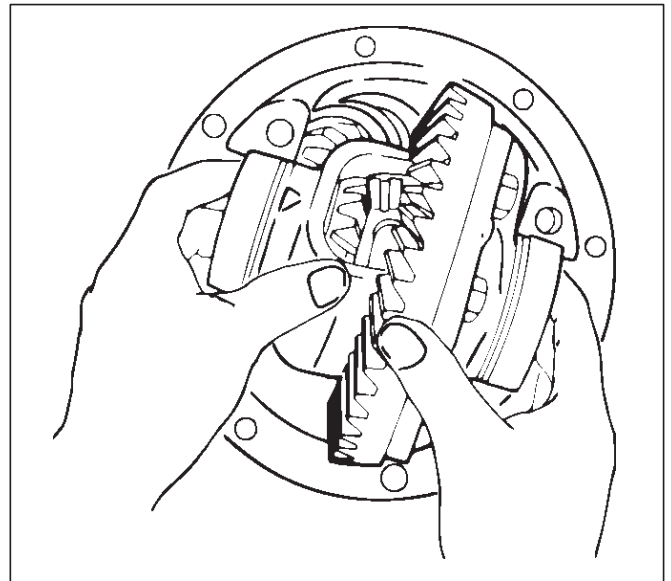


11. Adjust ring gear backlash.

- Attach the side bearing to the differential assembly without shims by using installer 5-8840-2570-0 and grip 5-8840-0007-0.

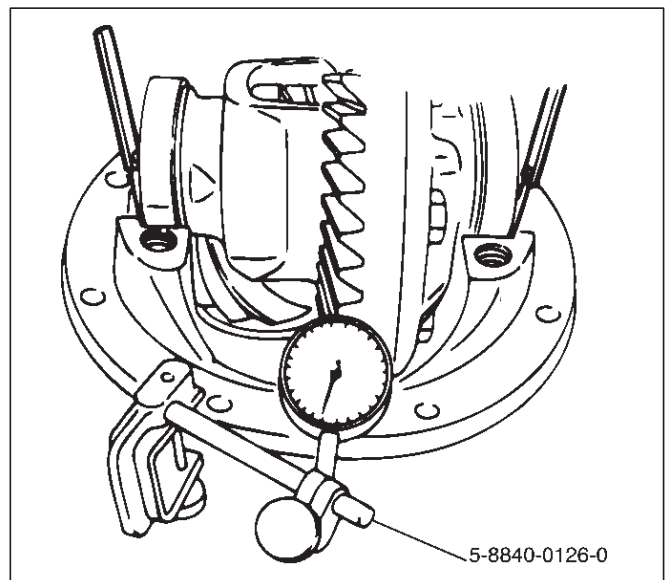


- Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



- Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

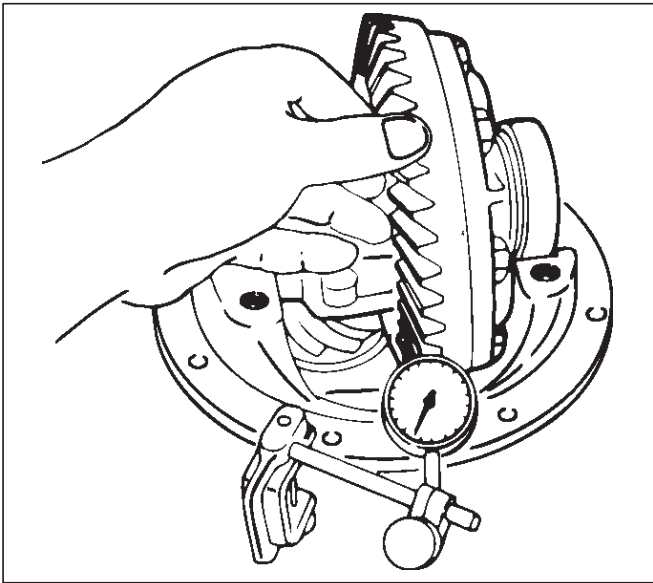
Mount the dial indicator 5-8840-0126-0 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.



4A2B-18 DIFFERENTIAL (REAR 244mm)

- Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

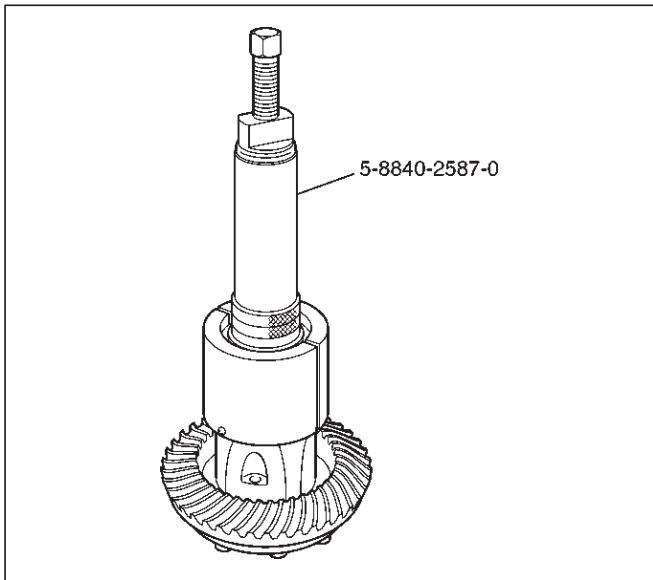
Backlash: 0.13– 0.2mm (0.005– 0.008in)



425RS032

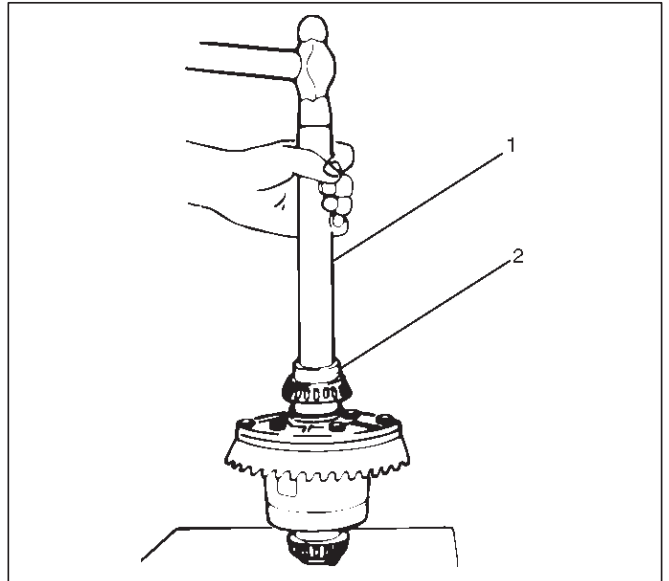
With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.

- Remove side bearing by using remover 5-8840-2587-0 and adapter 5-8840-2576-0.



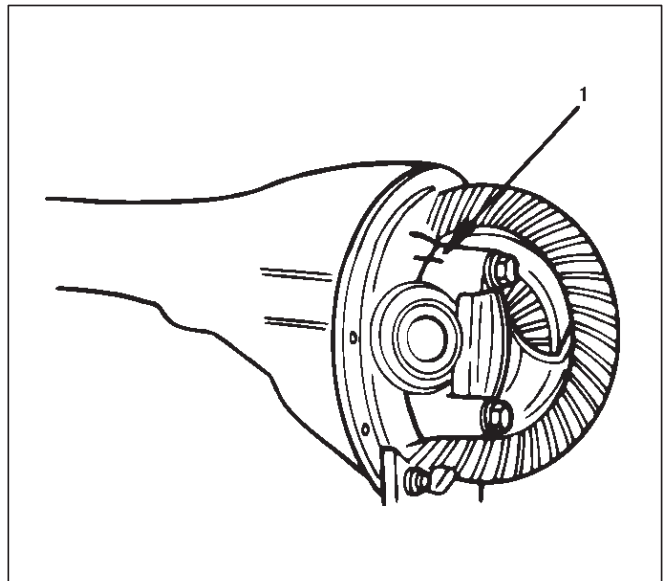
415RW041

- Install the side bearings together with the selected shims by using installer 5-8840-2570-0 (2) and grip 5-8840-0007-0 (1).



425RW032

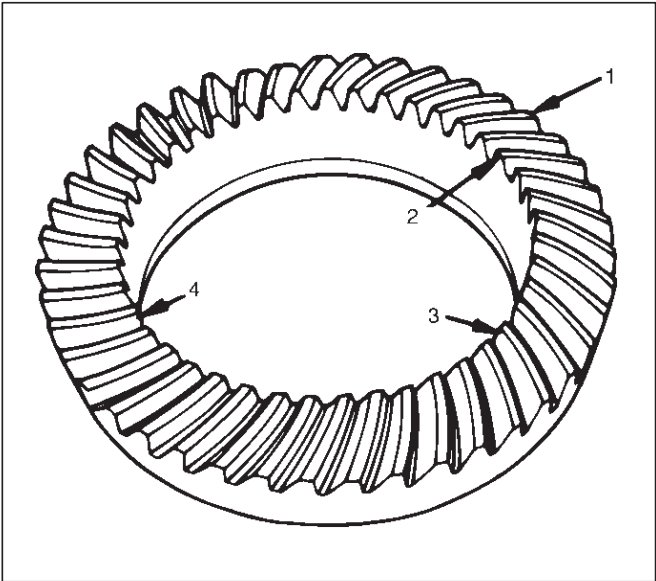
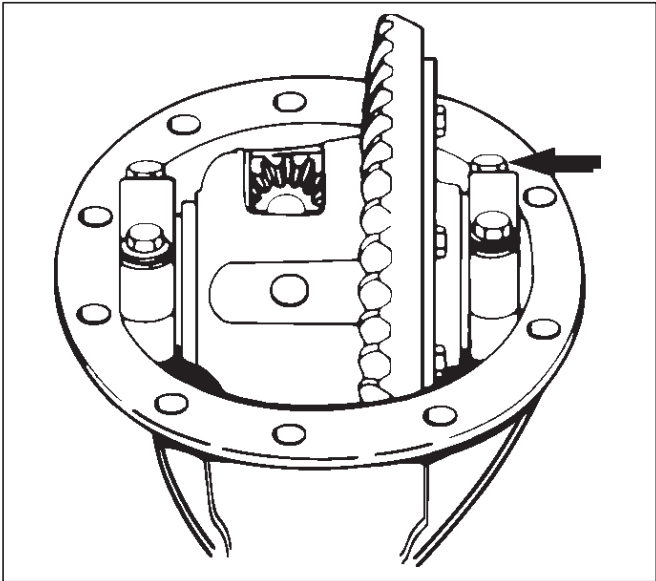
- Install side bearing outer race.
- Install differential cage assembly.
- Align the setting marks (1) applied at disassembly then install the bearing cap.



425RS035

16. Tighten the bolt to the specified torque.

Torque:108N-m (11.0kg-m/80 lb ft)

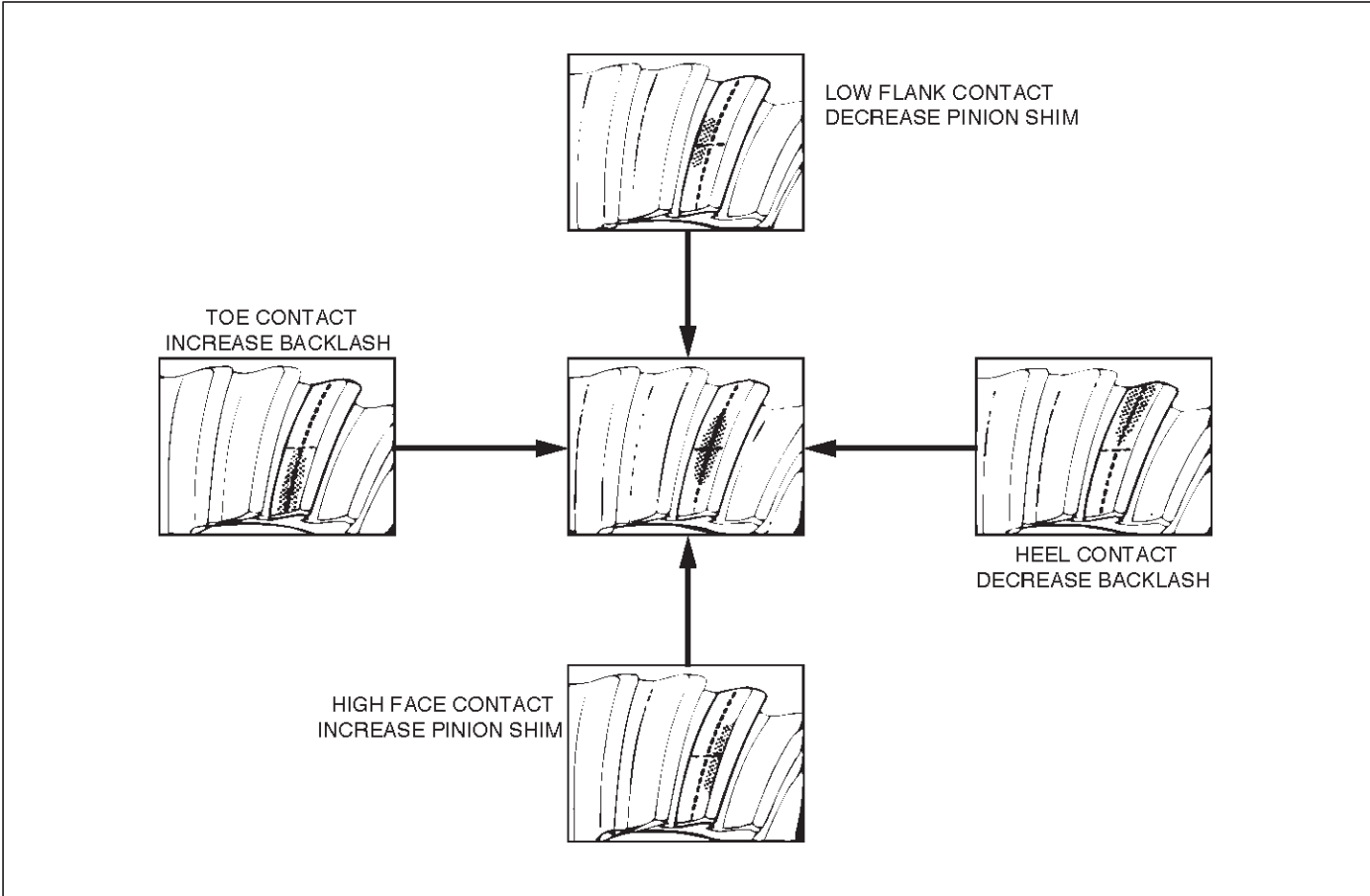


Legend

- (1) Heel
- (2) Toe
- (3) Concave Side(Coast)
- (4) Convex Side(Drive)

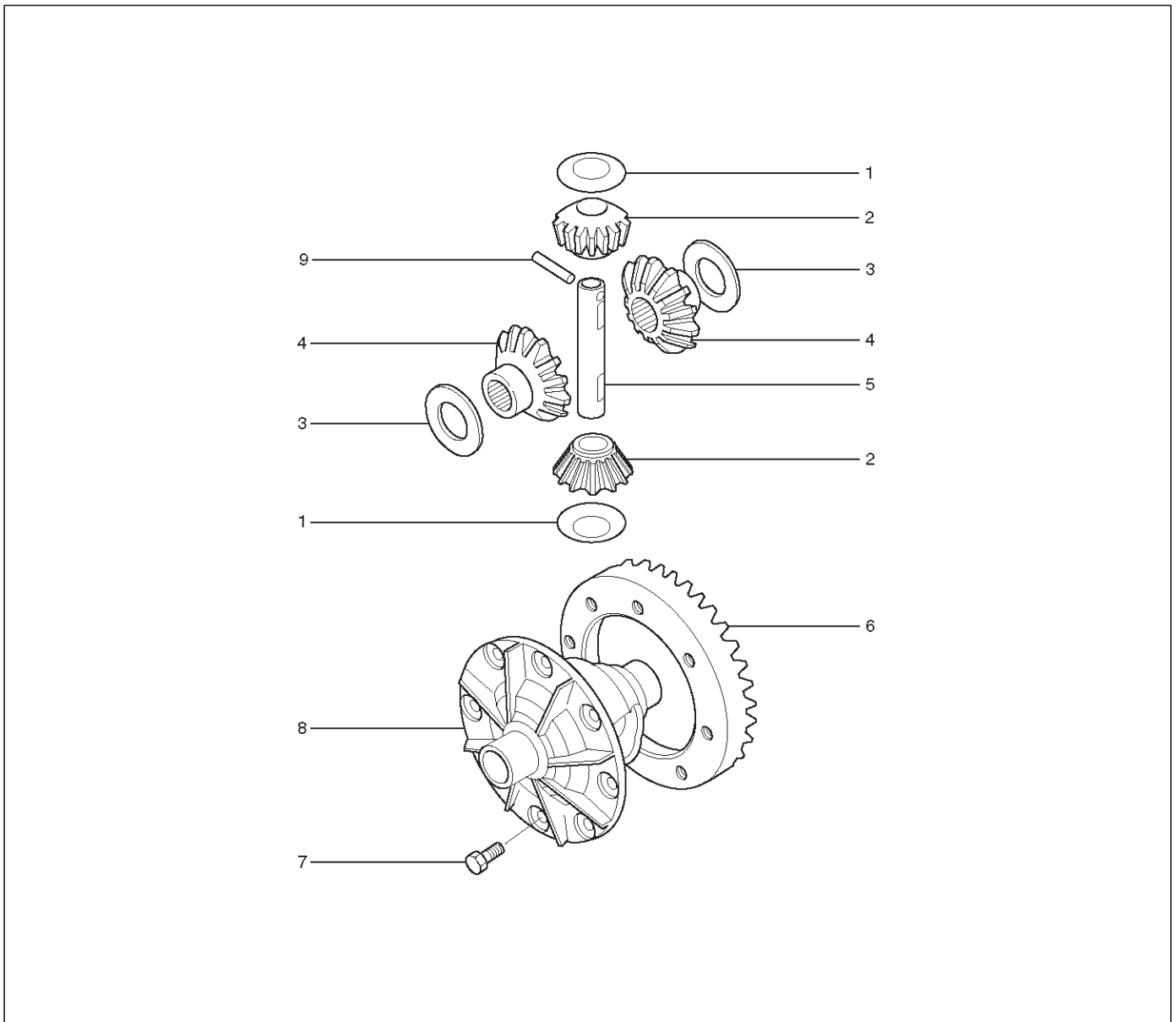
Gear Tooth Contact Pattern Check and Adjustment

1. Apply a thin coat of Prussian blue or equivalent to the faces of the 7-8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.



Differential Cage Assembly

Disassembled View



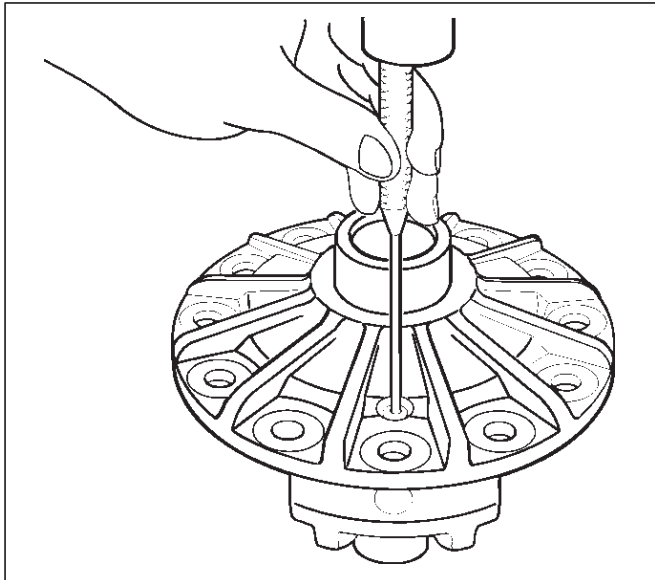
415RW010

Legend

- | | |
|-------------------------------------|------------------------|
| (1) Thrust Washer (for Pinion Gear) | (5) Differential Shaft |
| (2) Pinion Mate Gear | (6) Ring Gear |
| (3) Thrust Washer(for Side Gear) | (7) Bolt |
| (4) Side Gear | (8) Differention Cage |
| | (9) Lock Pin |

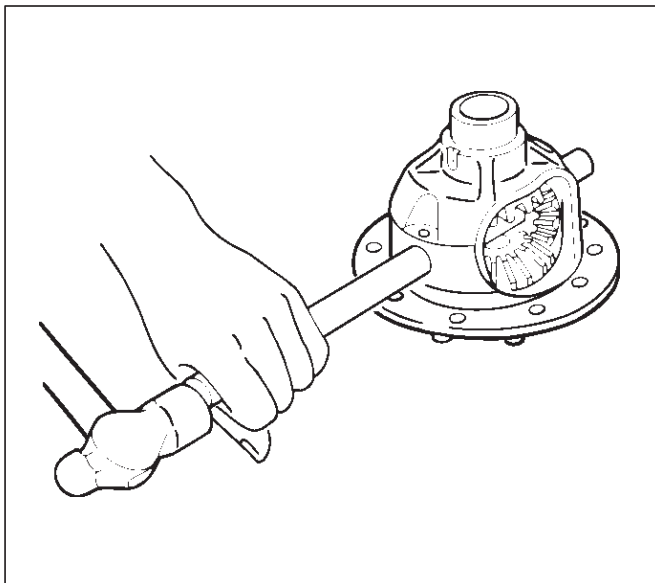
Disassembly

1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin using a small drift.



425RS042

4. Remove the differential shaft by using a hard metal rod and a hammer.



425RS043

5. Remove pinion mate gear and thrust washer.
6. Remove side gear and thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

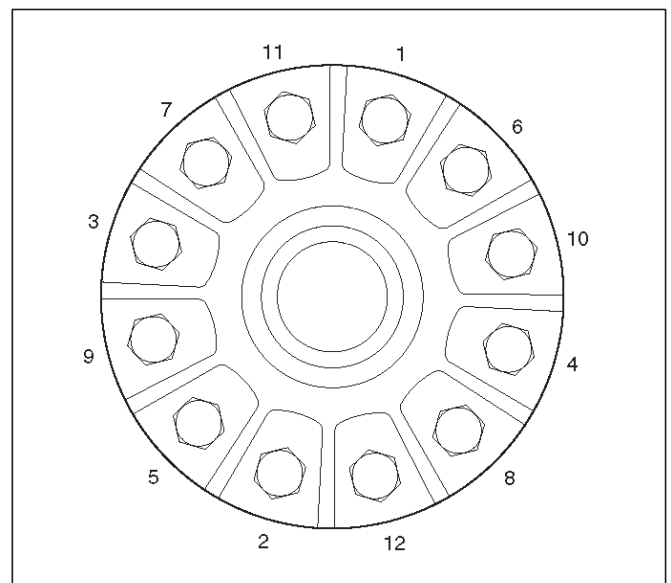
- Ring gear, pinion gear
- Bearing

- Side gear, pinion mate gear, differential shaft
- Differential cage, carrier
- Thrust washer
- Oil seal

Ring gear replacement:

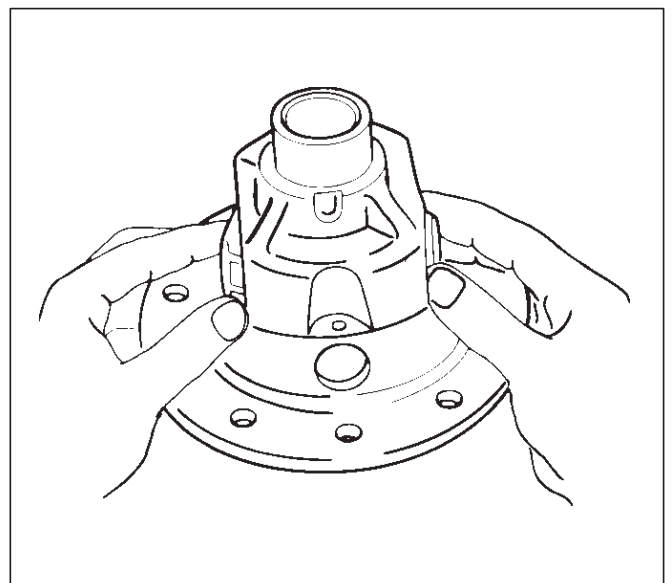
1. The ring gear should always be replaced with the drive pinion as a set.
2. Discard used bolts and install new ones.
3. Tighten the fixing bolts in a diagonal sequence as illustrated.

Torque: 177N-m (18.0kg-m/130 lb ft)



425RW033

Reassembly

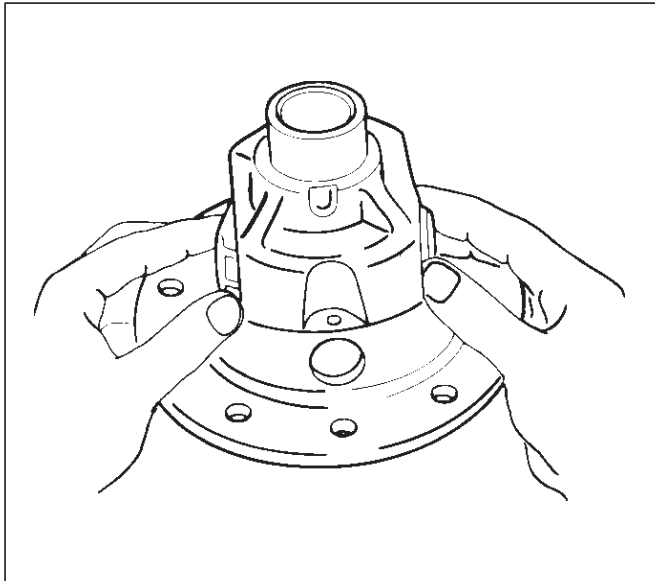


425RS048

1. Install side gear with thrust washer.

4A2B-22 DIFFERENTIAL (REAR 244mm)

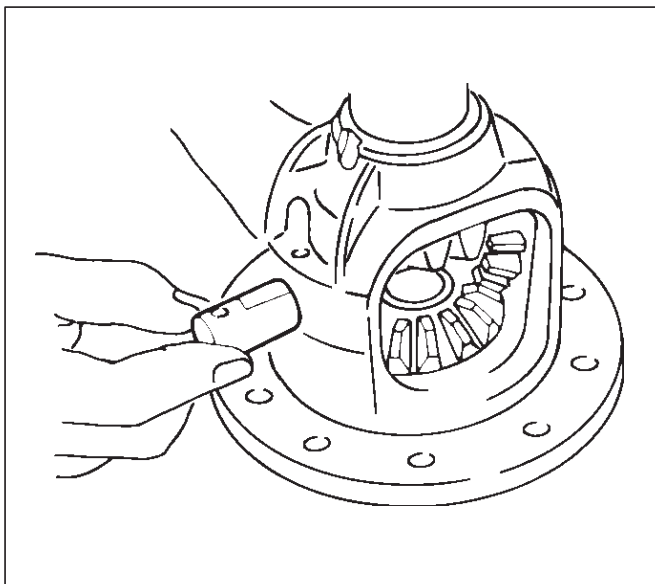
2. Install the pinion mate gear with thrust washer by engaging it with the side gears while turning both pinion mate gears simultaneously in the same direction.



425RS046

3. Install differential shaft.

1. Be sure to install the differential shaft so that it is in alignment with the lock pin hole in the differential cage.



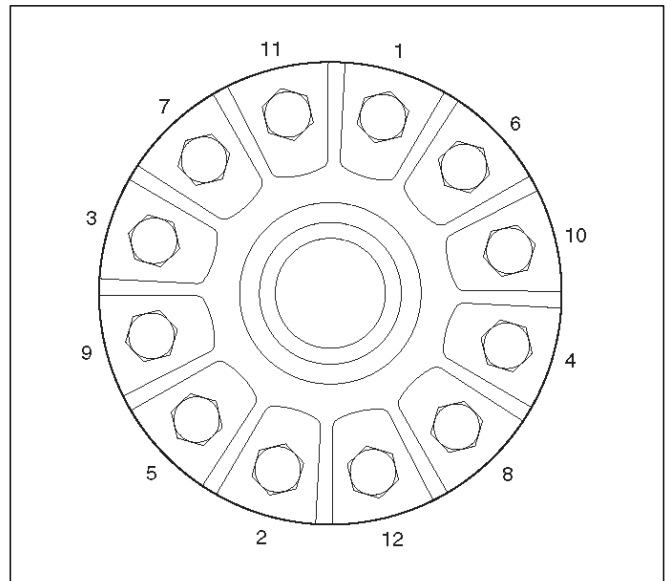
425RS049

4. Install lock pin.
After lock pin installation, stake the case to secure the lock pin.
5. Install ring gear.

6. Tighten the bolts in diagonal sequence as illustrated.

Torque: 177N-m (18.0kg-m/130 lb ft)

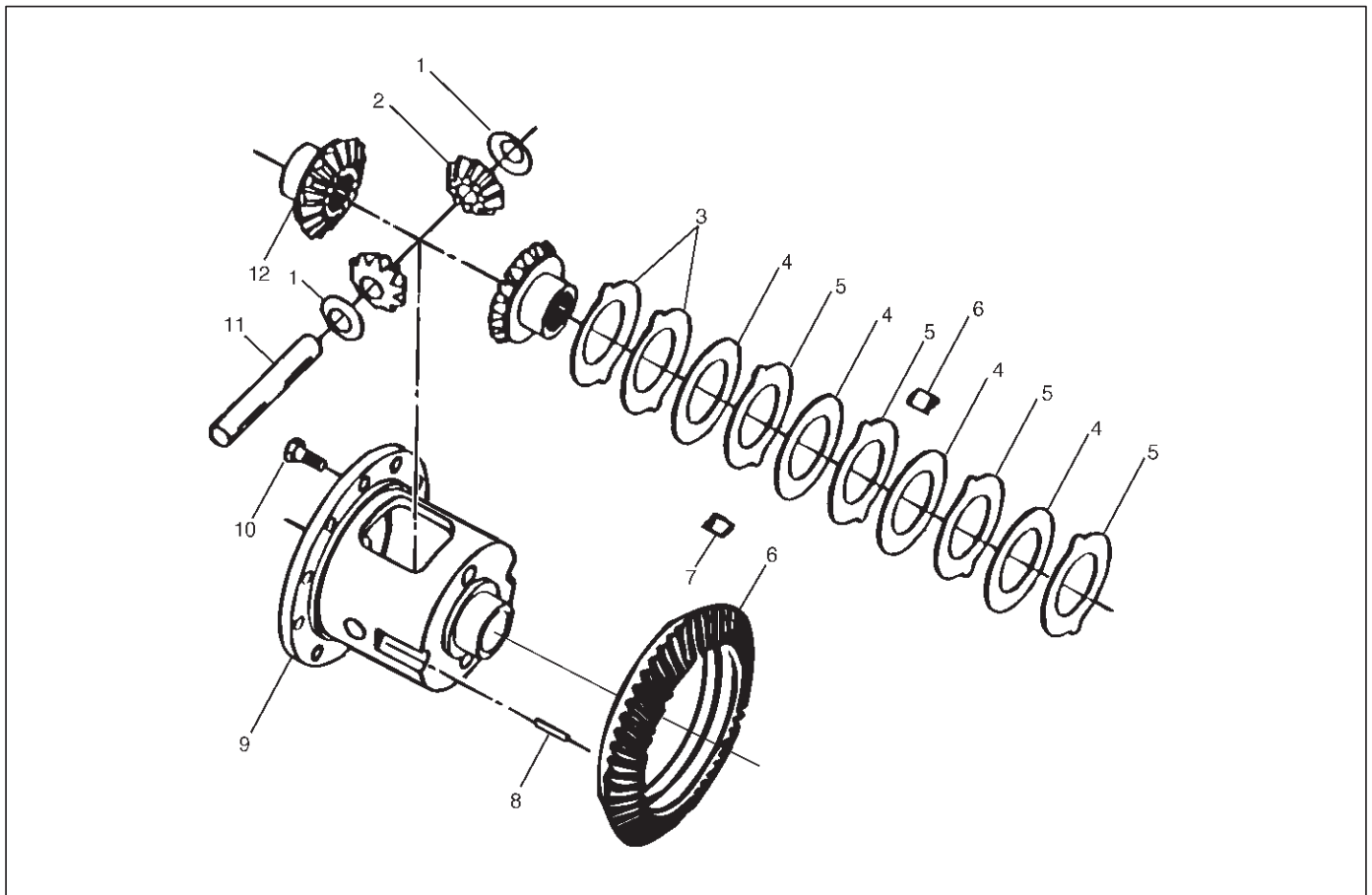
NOTE: Discard used bolts and install new ones.



425RW033

Locking Differential Assembly

Disassembled View



425RW027

Legend

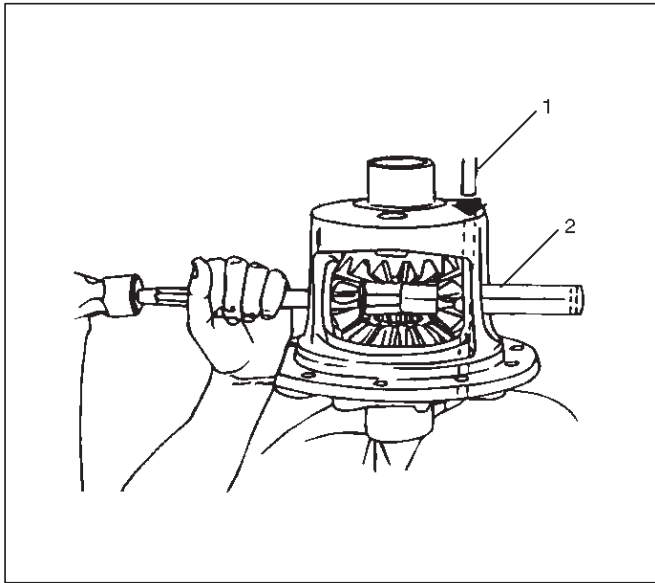
- | | |
|---|---------------------------------|
| (1) Thrust Washer–Differential Pinion Mate Gear | (7) Differential Plate Retainer |
| (2) Pinion Mate Gear | (8) Lock Pin |
| (3) Dished Spacer | (9) Differential Case |
| (4) Disc | (10) Ring Gear Bolts |
| (5) Plate | (11) Differential Shaft |
| (6) Ring Gear | (12) Differential Side Gear |

Disassembly

1. Remove ring gear.
2. Place one of the axle shafts, which was removed from the assembly, into a vise. Tighten shaft in vise firmly. The spline end of the shaft is not to exceed 3 inches (76.2 mm) above the top of the vise. Position the differential on the shaft with the ring gear side down.
3. Remove Lock pin (1) from differential shaft using a punch.

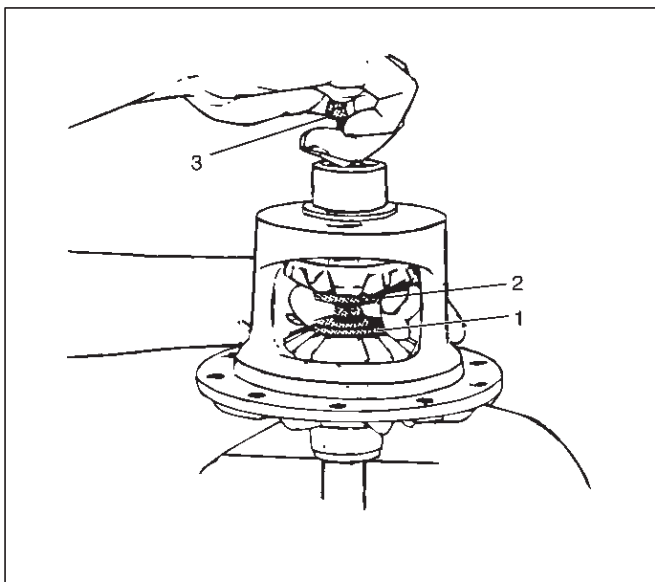
4A2B-24 DIFFERENTIAL (REAR 244mm)

4. Remove Differential shaft (2) using hammer and punch.
Place shop towel behind case to prevent differential shaft from dropping out of case.



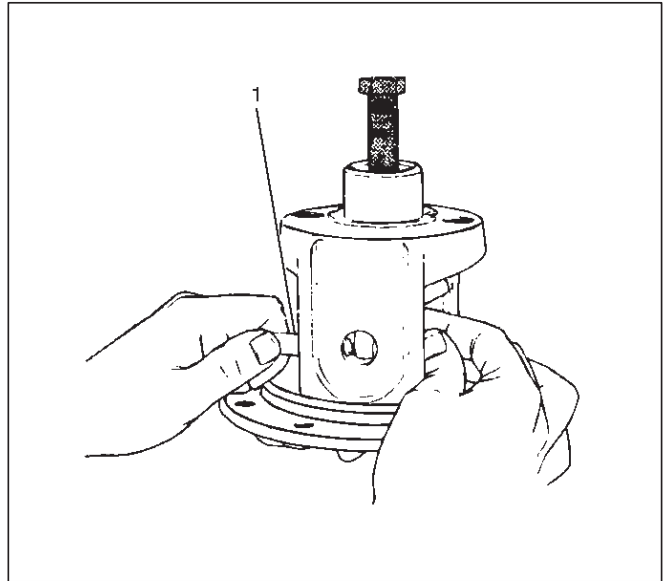
5. Assemble clutch pack unloading tool 5-8840-2586-0.

- Install cap (1) to the bottom differential side gear.
- Install threaded screw cap (2) to top differential side gear. Thread forcing screws (3) into threaded screw cap until it becomes centered into the bottom cap.



- Tighten forcing screw until tight enough to collapse dished spacers and allow looseness between side and pinion mate gears.

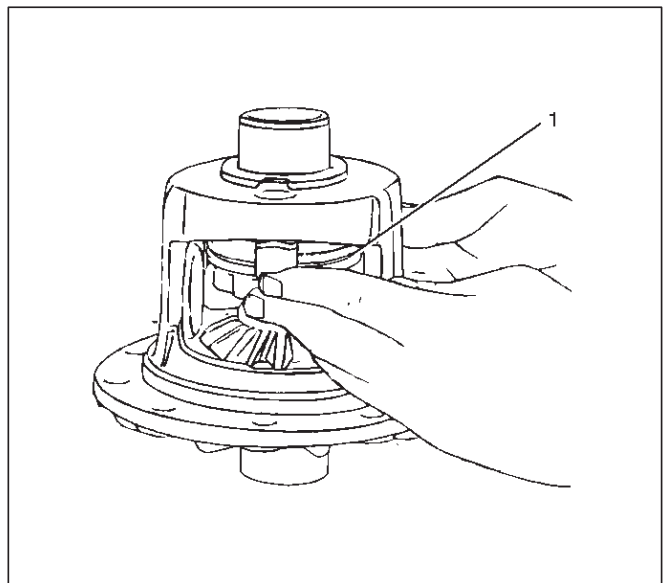
6. Both pinion mate gear thrust washers using a shim stock (1) of 0.51 mm (0.020 in.) or equivalent tool to push out washers.



7. Relieve tension of dished spacers by loosening forcing screw.

NOTE:

- You may have to adjust the forcing screw slightly to allow the case to rotate.
- Insert differential shaft into its hole of case. Pull on shaft and rotate case until pinion mate gears can be removed.
 - Remove pinion mate gears.
 - Hold side gear top clutch pack (1) with one hand and remove positraction unloading tools.



DIFFERENTIAL (REAR 244mm) 4A2B-25

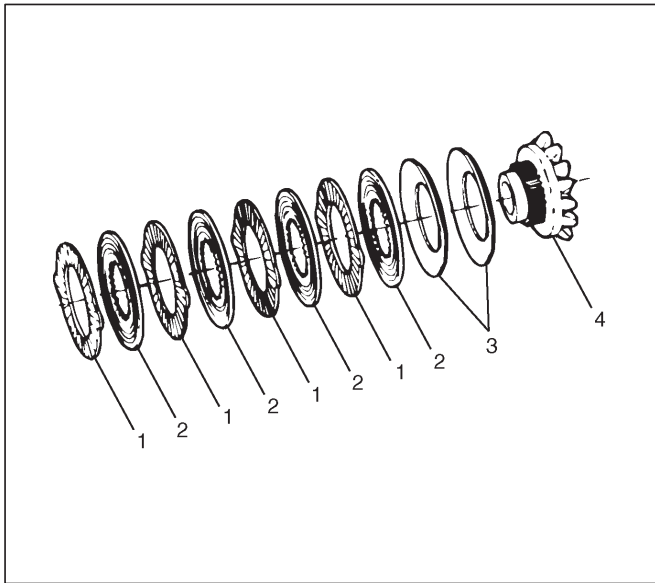
11. Remove top side gear and clutch pack.

NOTE:

- Keep the stack of plates and discs intact and in exactly the same position while they are being removed.
12. Remove case from holder. Turn case with flange or ring gear side up to allow side gear and clutch pack to be removed from case.
13. Remove differential plate retainer from both clutch packs to allow separation of the plates and discs.

NOTE:

- Keep the discs and plates in the same order as they were removed.



425RW009

Legend

- (1) Differential Plate
- (2) Differential Disc
- (3) Dished Spacer
- (4) Side Gear

Inspection and Repair

Cleaning

- All parts with solvent.

Visual Inspection

- Clean all parts with solvent.
- Plates and Discs. If any one disc or plate in either stack shows evidence of excessive wear or scoring, the complete stack is to be replaced on both sides.
- Side Gears and Pinion Mate Gears. The gear teeth of these parts should be checked for extreme wear and possible cracks. The external teeth of the side gear, which retain the concentric groove discs, should also be checked for wear or cracks.
- If replacement of one gear is required due to wear, etc., then both side gears, pinion mate gears, and thrust washers are to be replaced.

- Differential Shaft. If excessive wear is evident, the differential shaft should be replaced.
- Differential Plate Retainers. If wear is evident on any one of the differential plate retainers, all four retainers must be replaced.
- Differential Case. If scoring, wear or metal pickup is evident on the machined surfaces, replacement of the case is necessary.

Reassembly

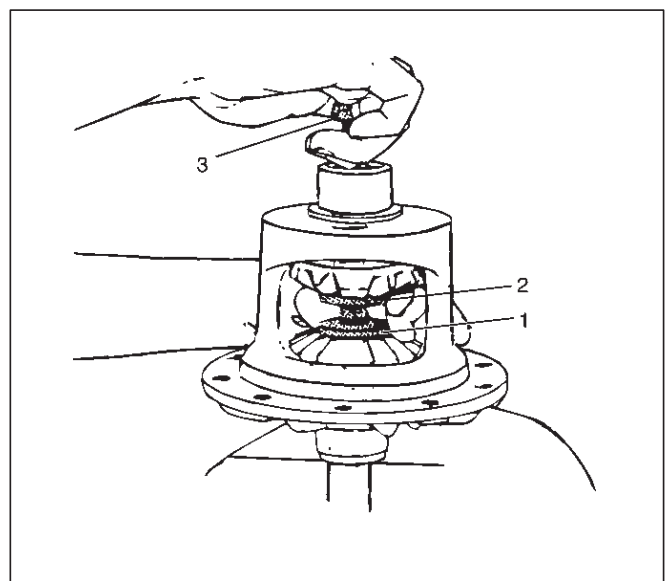
1. Lubricate thrust face of side gears, plates and discs with the proper limited slip rear axle lubricant.
2. Assemble plates and discs in exactly in the same position as they were removed, regardless of whether they are new or original.
3. Install differential plate retainer to ears of plates.

NOTE:

- Make sure both retainers are completely seated on ears of plates.
4. Install clutch pack and side gear into bottom side gear bore. Make sure clutch pack stays assembled to side gear splines, and that retainers are completely seated into pockets of case.

NOTE:

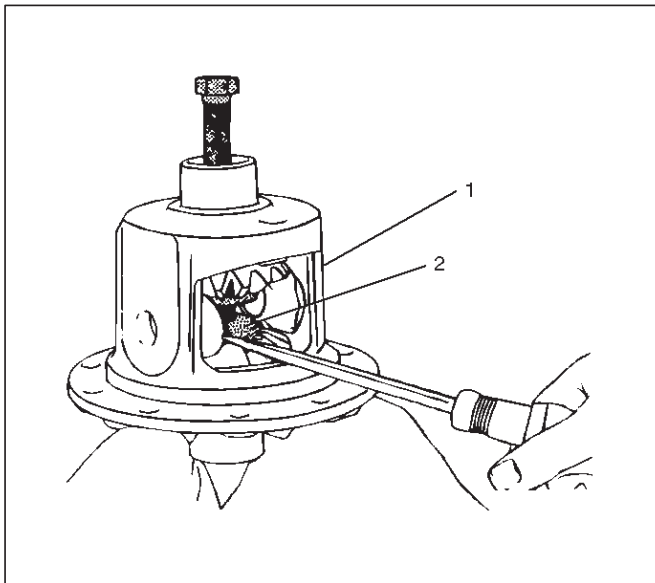
- To prevent clutch pack from falling out of case, hold clutch pack in place by hand while repositioning case on bench.
5. Install other side gear and clutch pack. Make sure clutch pack stays assembled to side gear splines, and retainers are completely seated into pockets of case.
 6. Hold clutch pack in position and assemble special tool 5-8840-2586-0, screw cap (2), cap (1) and forcing screw (3). Tighten forcing screw into bottom cap to hold both clutch packs in position.
 7. With tools assembled to case, position case on shaft by aligning splines of side gear with those of shaft. Tighten forcing screw to compress clutch packs in order to provide clearance for pinion mate gears.



425RW064

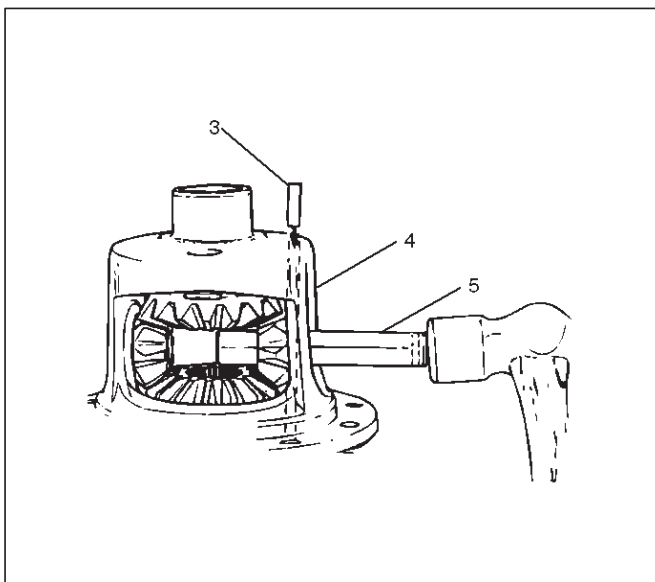
4A2B-26 DIFFERENTIAL (REAR 244mm)

8. Install pinion mate gears.
 - Place the pinion mate gears into the differential 180 degrees apart.
9. While holding gears in place, insert differential shaft in its hole of case. Pull on shaft and rotate case, allowing gears to turn. Make sure that holes in pinion mate gears align with holes in case.
 - It may be necessary to adjust tension on forcing screw to rotate case.
10. Tighten forcing screw to compress the clutch packs, to allow installation of tapered washers.
11. Lubricate tapered washers (2), and assemble into case (1). Use a small screw driver to push washers into place. Remove tools.



425RW012

12. Position differential shaft in case and drive in with hammer. Be sure lock pin hole of differential shaft (5) is properly aligned to allow installation of lock pin (3). Be sure that thrust washers and differential pinion gears are aligned with the differential case (4). Install new lock pin to proper depth using a punch. Stake (peen) metal of case over pin in two places, 180 degrees apart.

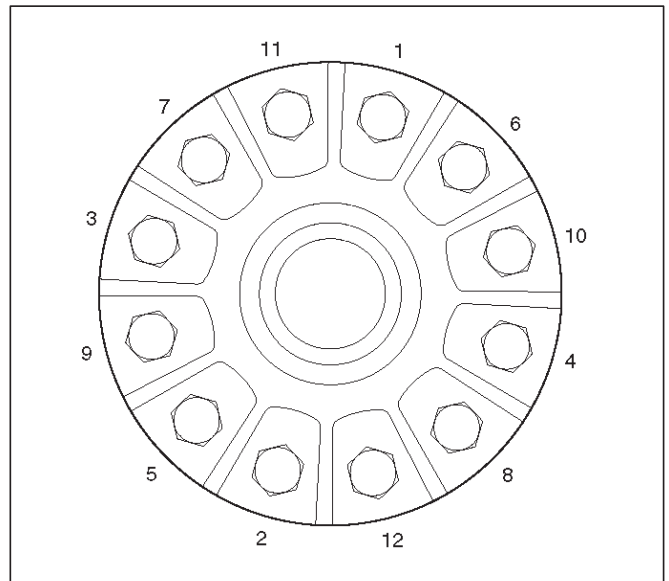


425RW013

13. Install ring gear and tighten the bolts in diagonal sequence as illustrated.

Torque: 177N-m (18.0kg-m/130 lb ft)

NOTE: Discard used bolts and install new ones.



425RW033

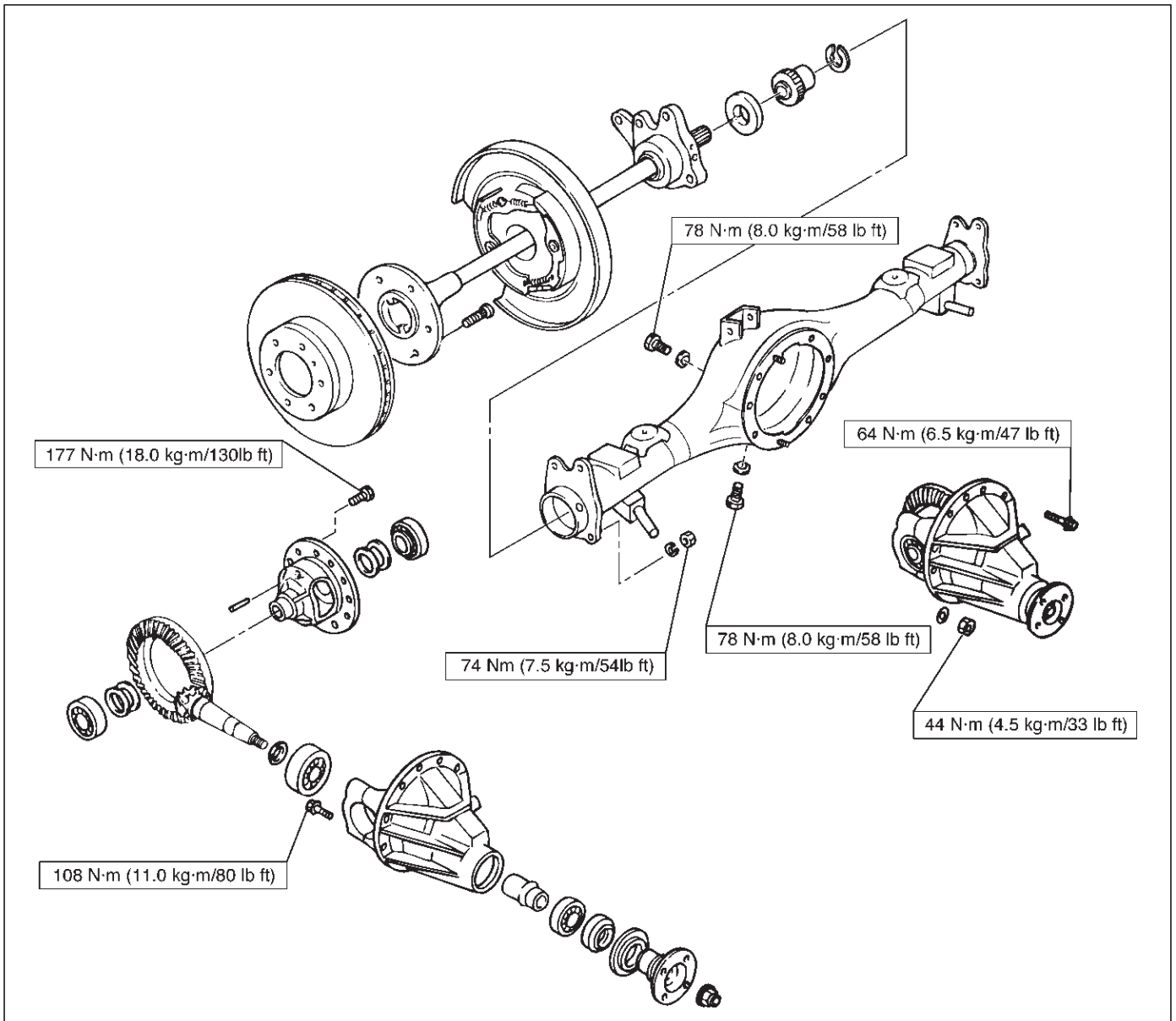
Main Data and Specifications

General Specifications

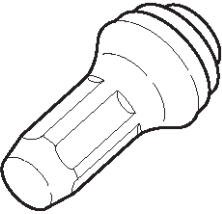
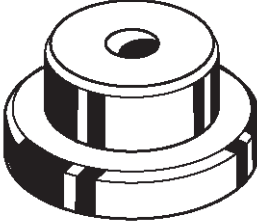
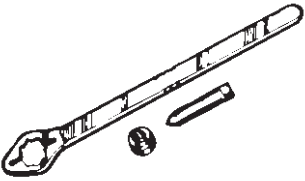
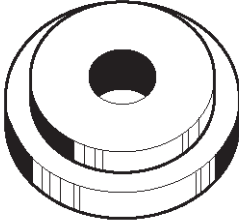
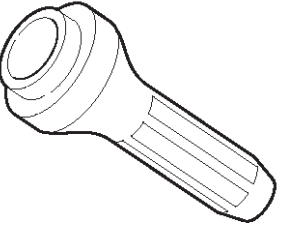
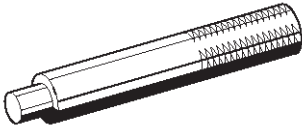

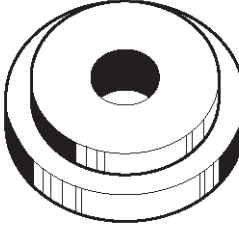
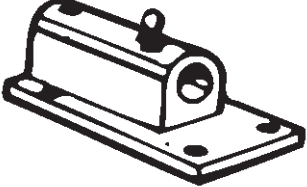
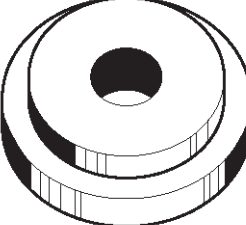

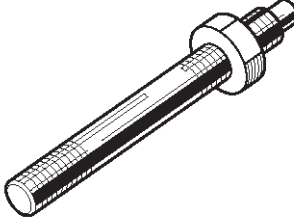
Rear axle	
Type	Banjo, Semi-floating
Rear axle Size	244 mm (9.61 in)
Gear type	Hypoid
Gear ratio (to 1)	4.100(6VE1 with A/T) 4.300(6VE1 with M/T,4JX1)
Differential type	Two pinion
Lubricant Grade	GL-5: (Standard differential)
	GL-5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL-5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	3.0 liter (2.6 Imp qt/3.2 US qt)

4A2B-28 DIFFERENTIAL (REAR 244mm)

Torque Specifications



Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME	ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS206</p>	<p>5-8840-2294-0 (J-39210) Installer; Axle shaft inner seal</p>	 <p style="text-align: right; font-size: small;">901RS215</p>	<p>5-8840-2576-0 (J-8107-3) Adapter; Side bearing plug</p>
 <p style="text-align: right; font-size: small;">901RW037</p>	<p>5-8840-0133-0 (J-8614-01) Pinion flange holder</p>	 <p style="text-align: right; font-size: small;">901RS217</p>	<p>5-8840-0008-0 (J-8611-01) Installer; Outer bearing outer race</p>
 <p style="text-align: right; font-size: small;">901RS211</p>	<p>5-8840-2165-0 (J-37263) Installer; Pinion oil seal</p>	 <p style="text-align: right; font-size: small;">901RS218</p>	<p>5-8840-0007-0 (J-8092) Grip</p>
 <p style="text-align: right; font-size: small;">901RW038</p>	<p>5-8840-2029-0 (J-42832) Holding fixture</p>	 <p style="text-align: right; font-size: small;">901RS219</p>	<p>5-8840-2571-0 (J-42831) Installer; Inner bearing outer race</p>
 <p style="text-align: right; font-size: small;">901RS213</p>	<p>5-8840-0003-0 (J-3289-20) Holding fixture base</p>	 <p style="text-align: right; font-size: small;">901RS220</p>	<p>5-8840-2575-0 (J-42824) Pilot; Outer</p>
 <p style="text-align: right; font-size: small;">901RW039</p>	<p>5-8840-2587-0 (J-42379) Remover; Bearing</p>	 <p style="text-align: right; font-size: small;">901RS221</p>	<p>5-8840-0127-0 (J-21777-43) Nut & Stud</p>

4A2B-30 DIFFERENTIAL (REAR 244mm)

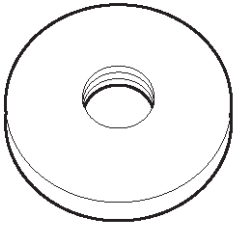
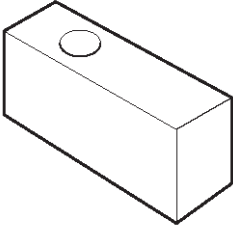
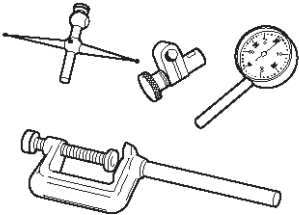
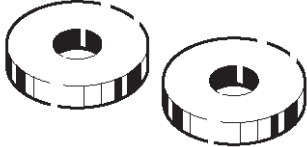
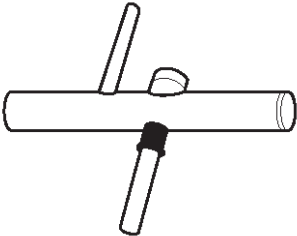
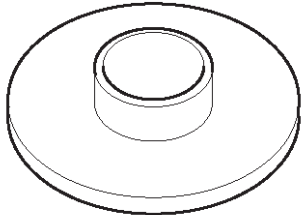
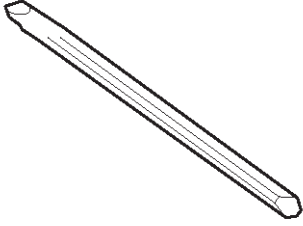
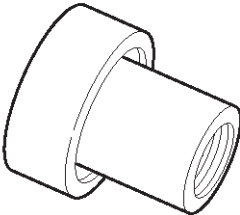
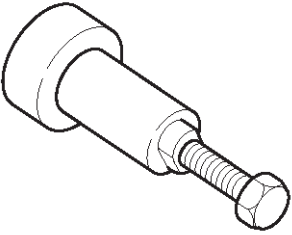
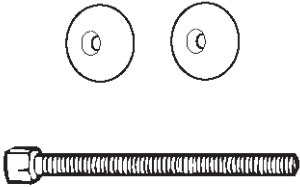
ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS222</p>	<p>5-8840-2573-0 (J-42827) Pilot; Inner</p>
 <p style="text-align: right; font-size: small;">901RS223</p>	<p>5-8840-2572-0 (J-42826) Gage plate</p>
 <p style="text-align: right; font-size: small;">901RS224</p>	<p>5-8840-0126-0 (J-8001) Dial indicator</p>
 <p style="text-align: right; font-size: small;">901RS225</p>	<p>5-8840-2577-0 (J-42825) Disc (2 required)</p>
 <p style="text-align: right; font-size: small;">901RS226</p>	<p>5-8840-0128-0 (J-23597-1) Arbor</p>
 <p style="text-align: right; font-size: small;">901RS208</p>	<p>5-8840-2574-0 (J-42828) Installer; Pinion bearing</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RS228</p>	<p>5-8840-2293-0 (J-39209) Punch; End nut lock</p>
 <p style="text-align: right; font-size: small;">901RS229</p>	<p>5-8840-2570-0 (J-42829) Installer; Side bearing</p>
 <p style="text-align: right; font-size: small;">901RS230</p>	<p>5-8840-2323-0 (J-39602) Remover; Outer bearing</p>
 <p style="text-align: right; font-size: small;">901RW064</p>	<p>5-8840-2586-0 (J-39858) Clutch pack unloading tool kit Includes Screw cap, Cap and Forcing screw</p>

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM (SHIFT ON THE FLY)

CONTENTS

Service Precaution	4B1-1	Functions of Indicator Lamp	4B1-11
Shift on the Fly System (Lever Type)	4B1-2	Diagnosis	4B1-11
Outline of Shift on the Fly System (Lever Type)	4B1-2	Front Axle Diagnosis	4B1-30
Shift on the Fly Vacuum Piping and Electric Equipment (For Lever Control Type)	4B1-3	Shift on the Fly Vacuum Piping and Electric Equipment (For Push Button Type)	4B1-32
Vacuum Piping Diagram	4B1-3	Vacuum Piping Diagram	4B1-32
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Outline of Shift on the Fly System (Push Button Type)	4B1-7	4WD Control Unit Associated Parts	4B1-36
		Removal	4B1-37
		Installation	4B1-37

Service Precaution

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

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

Shift on the Fly System (Lever Type)

Outline of Shift on the Fly System (Lever Type)

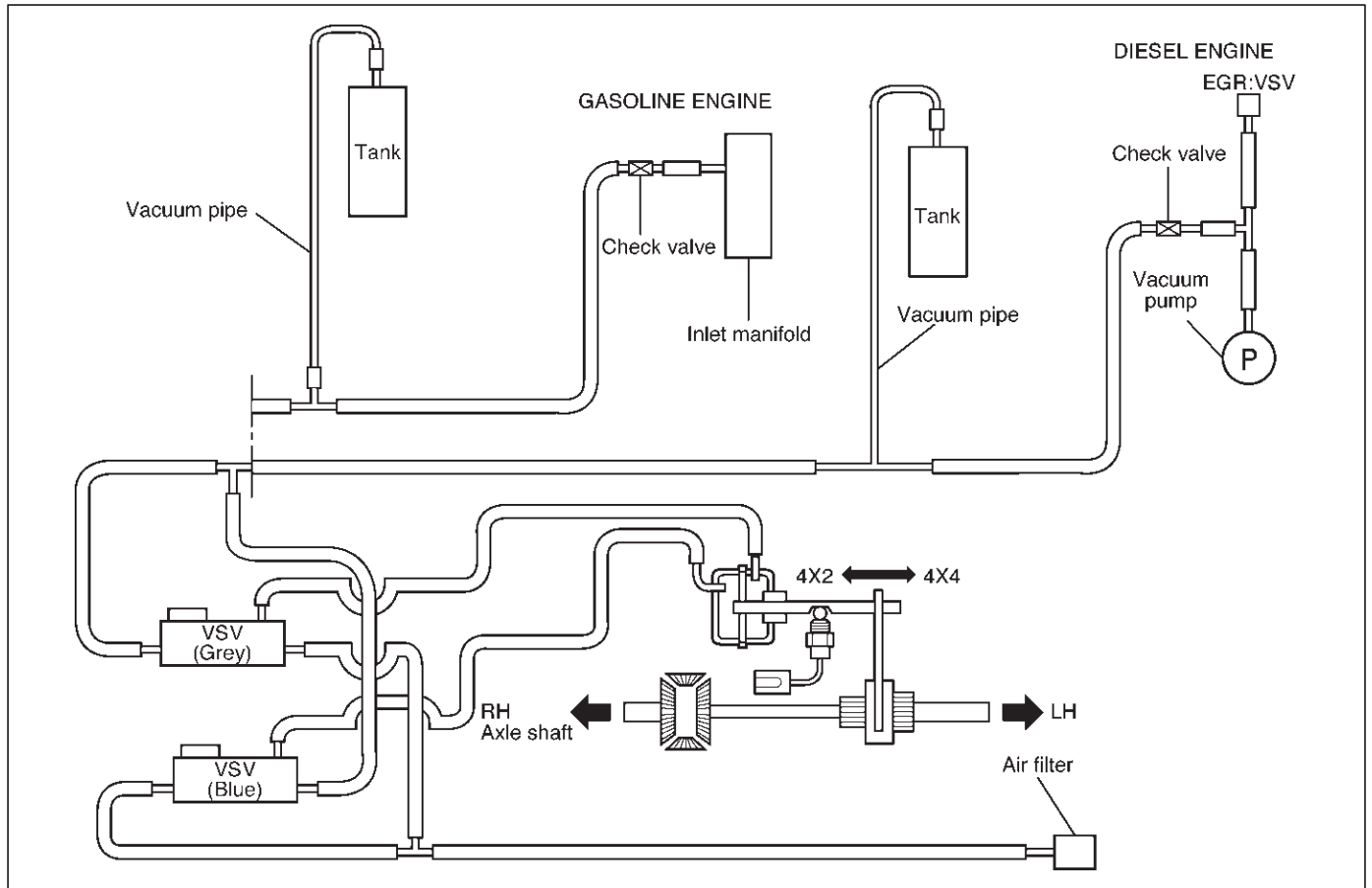
The shift on the fly system (Lever type) switches between 2 wheel drive (2WD) and 4 wheel drive (4WD) by driver's shifting the transfer control lever on the floor.

This system controls below operations.

1. Connecting front wheels to, and disconnecting them from, the front axles by vacuum actuator.
2. Indicator on instrument panel.
3. 4WD signal to Electronic Hydraulic Control Unit for brake system (If anti-lock brake system is equipped).

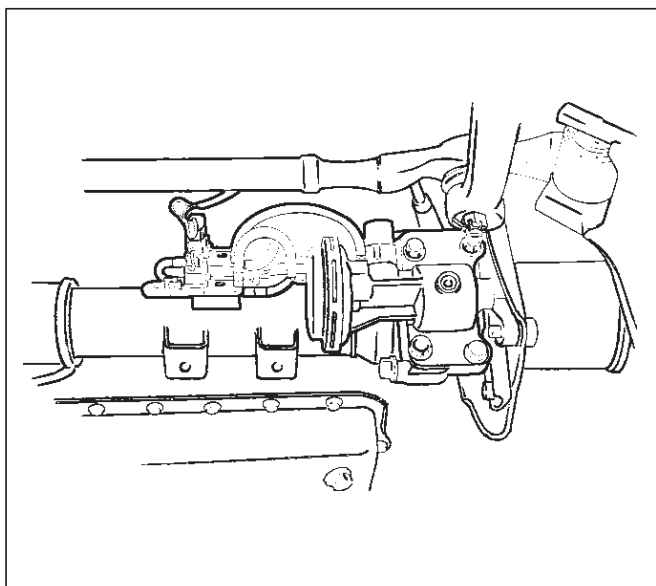
Shift on the Fly Vacuum Piping and Electric Equipment (For Lever Control Type)

Vacuum Piping Diagram



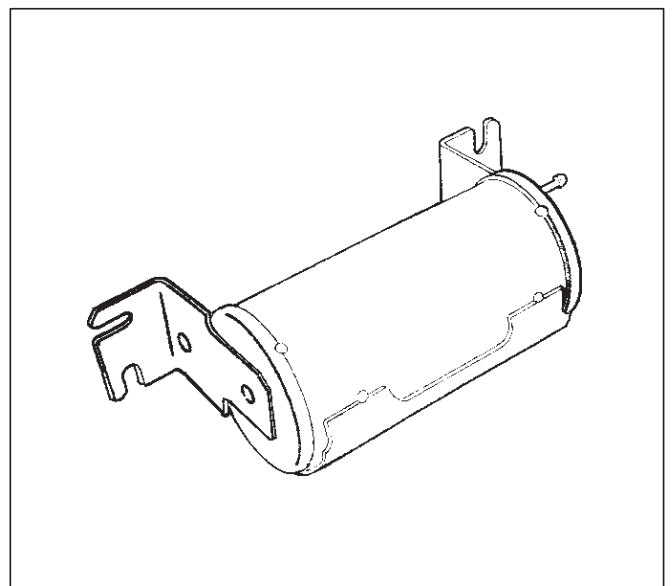
C04RW015

VSV Assembly, Actuator Assembly



412RS032

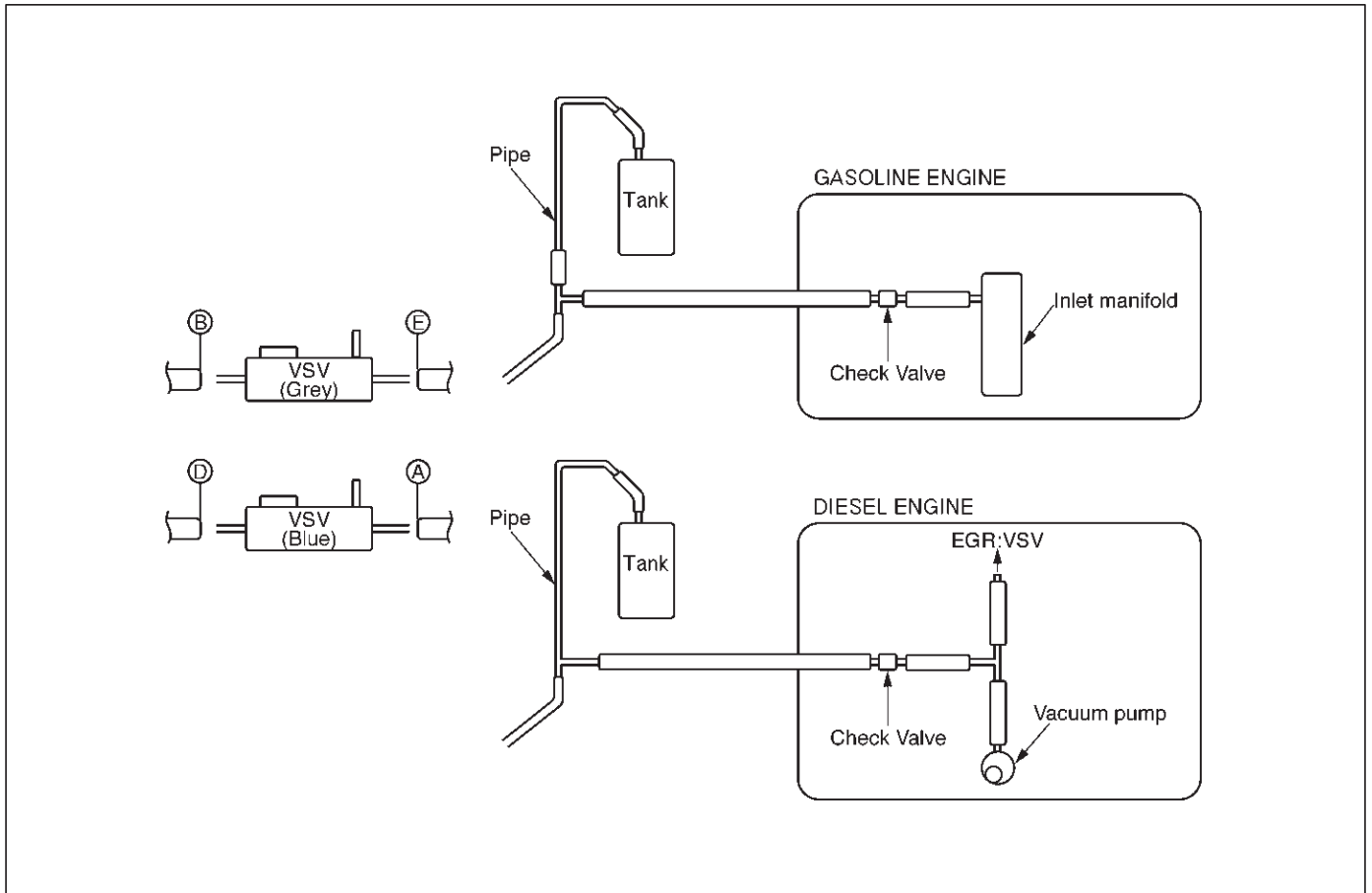
Vacuum Tank



412RS033

Inspection and Repair

Vacuum Piping



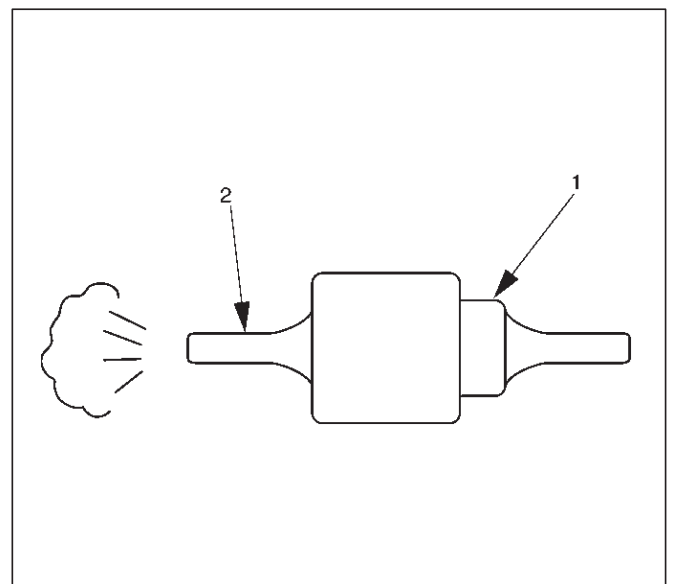
C04RW016

1. Pull out the Hose A in figure and install a vacuum gauge.
2. Plug up Hose B in figure to prevent the leak of vacuum.
3. Start the engine and measure vacuum 2 or 3 minutes afterward.
4. Repeat 1) and 2) but with Hose A plugged and Hose B pulled out.
5. If vacuum measures -400mmHg , or if it shows a sudden drop immediately after engine stop, inspect the hose, tank, and pipe for damage.

NOTE: Be careful not to permit the entry of dust and water during inspection.

6. Pull out Hose D in above illustration.
7. Plug Hose E in above illustration.
8. Make sure that Hose D in above illustration is under atmospheric pressure.
9. Pull out Hose E and plug Hose D, and make sure that Hose E is under atmospheric pressure.
10. If Check 8) or 9) has revealed stoppage, check and see that there is no bend, foreign matter in the hose or in the filter. If there is trouble, repair or replace.

Check Valve



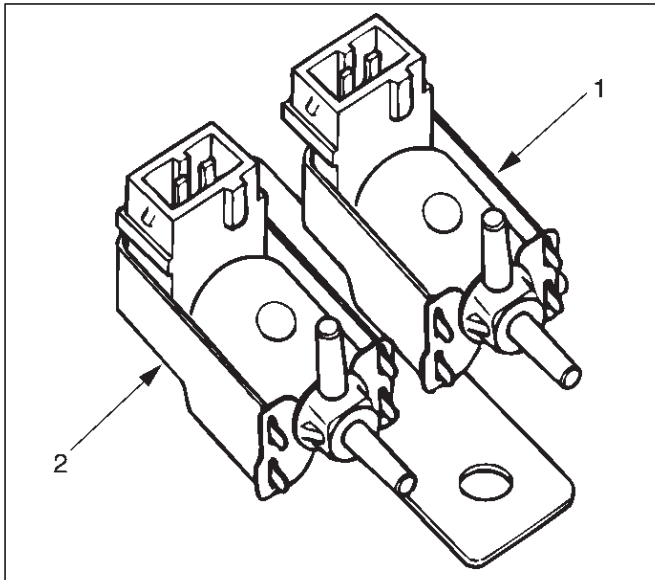
C04RS004

1. Apply vacuum from the orange colored side(1).
Vacuum: -400mmHg
2. Check leakage of vacuum.
3. Make sure that vacuum cannot be applied from the black colored side(2).

4. If vacuum is not applicable as much as -400mmHg, and if there is resistance on the intake side, replace with a new check valve.

VSV Assembly

Inspect the vehicle side harness as follows:



Legend

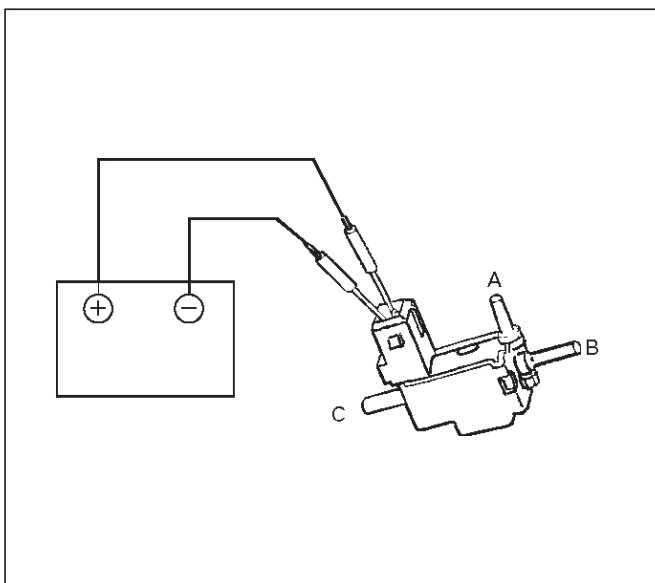
- (1) Grey
- (2) Blue

1. Remove connector.
2. Shift transfer lever to 2H and start the engine.

NOTE: Do not move the vehicle while inspection.

3. Make sure that there is continuity in the vehicle side of harness. If there is no continuity, check transfer shift switch and wiring.

Inspect both VSVs as follows:



1. With battery not connected (Usual).

A-C: There is continuity

B: Closed

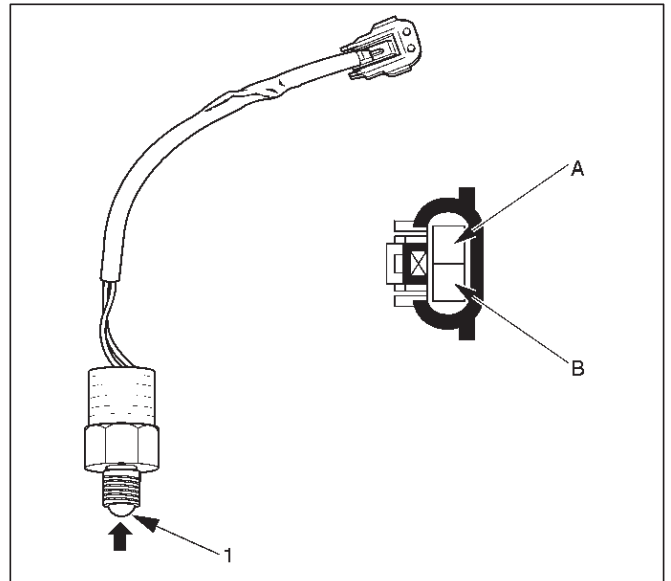
2. With battery connected

A - B: There is continuity

C: Closed

3. If 1) and 2) fail, replace with a new VSV.

Axle Position Switch



1. With ball (1) being free

A - B: There is continuity

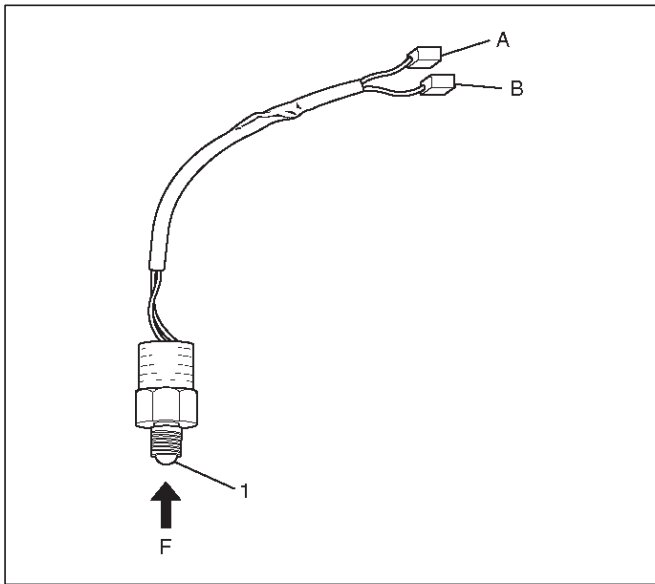
2. With ball forced into the switch

A - B: No continuity

3. If 1) and 2) fail, replace with a new switch.

4B1-6 DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Transfer Position Switch



412RW040

Legend

(1) Ball

1. With ball being free.
A-B : There is continuity.
2. With ball forced into the switch.
A-B : No continuity.
3. If 1) and 2) fail, replace with a new switch.

Shift on the Fly System (Push Button Type)

Outline of Shift on the Fly System (Push Button Type)

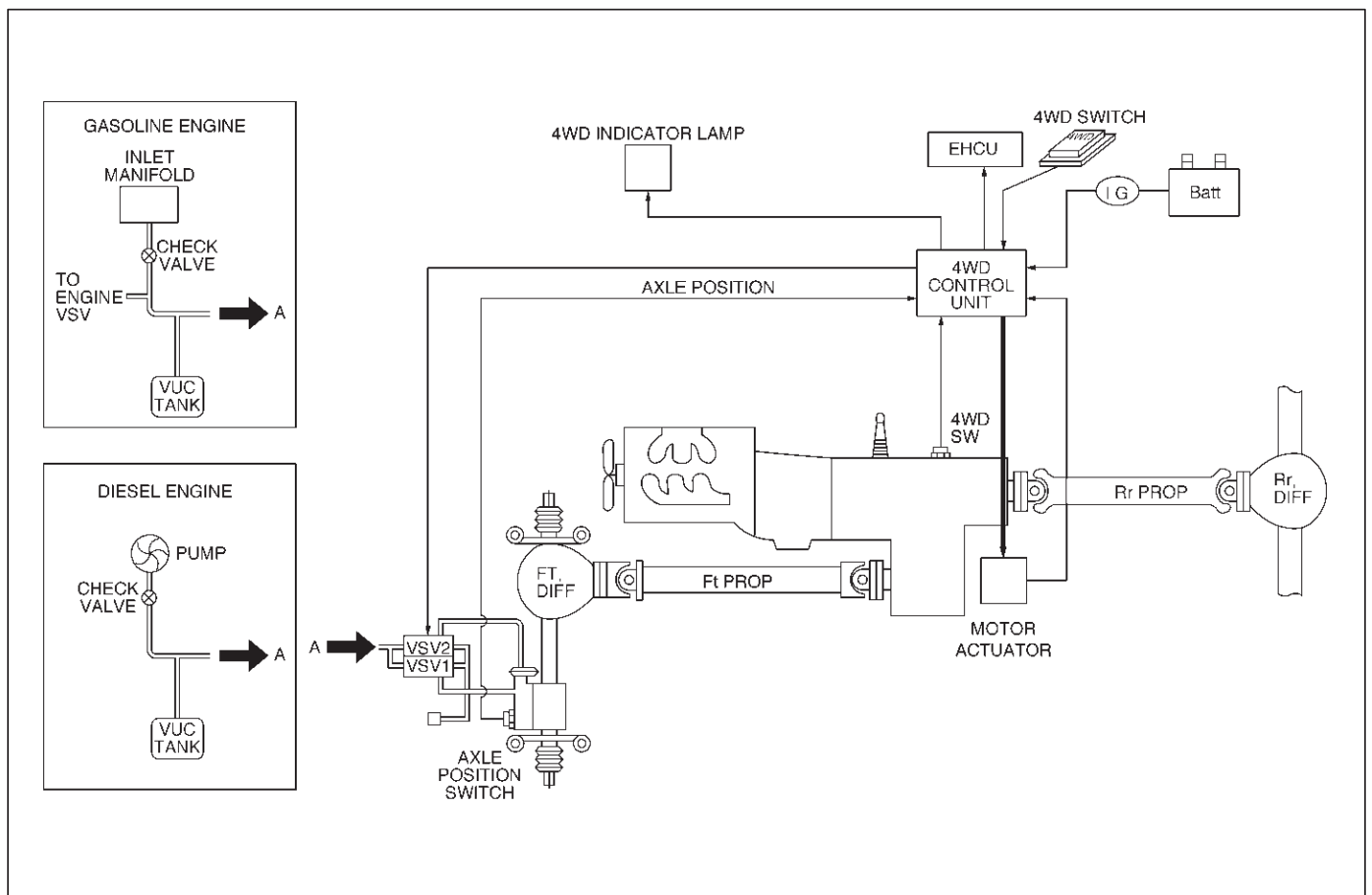
The shift on the fly system switches between 2 wheel drive (2WD) and 4 wheel drive (4WD) electrically by driver's pressing the 4WD switch (push button type) on instrument panel.

This system controls below operations. (Shifting between "4H" and "4L" must be performed by transfer control lever on the floor.)

1. Shifting the transfer front output gear (Connecting to, and disconnecting from, front propeller shaft by motor actuator).

2. Retrieval of shifting the transfer front output gear.
3. Connecting front wheels to, and disconnecting them from, the front axles by vacuum actuator.
4. Indicator on instrument panel.
5. 4WD out signal to other Electronic Hydraulic Control Unit (If anti-lock brake system is equipped).

System Diagrams



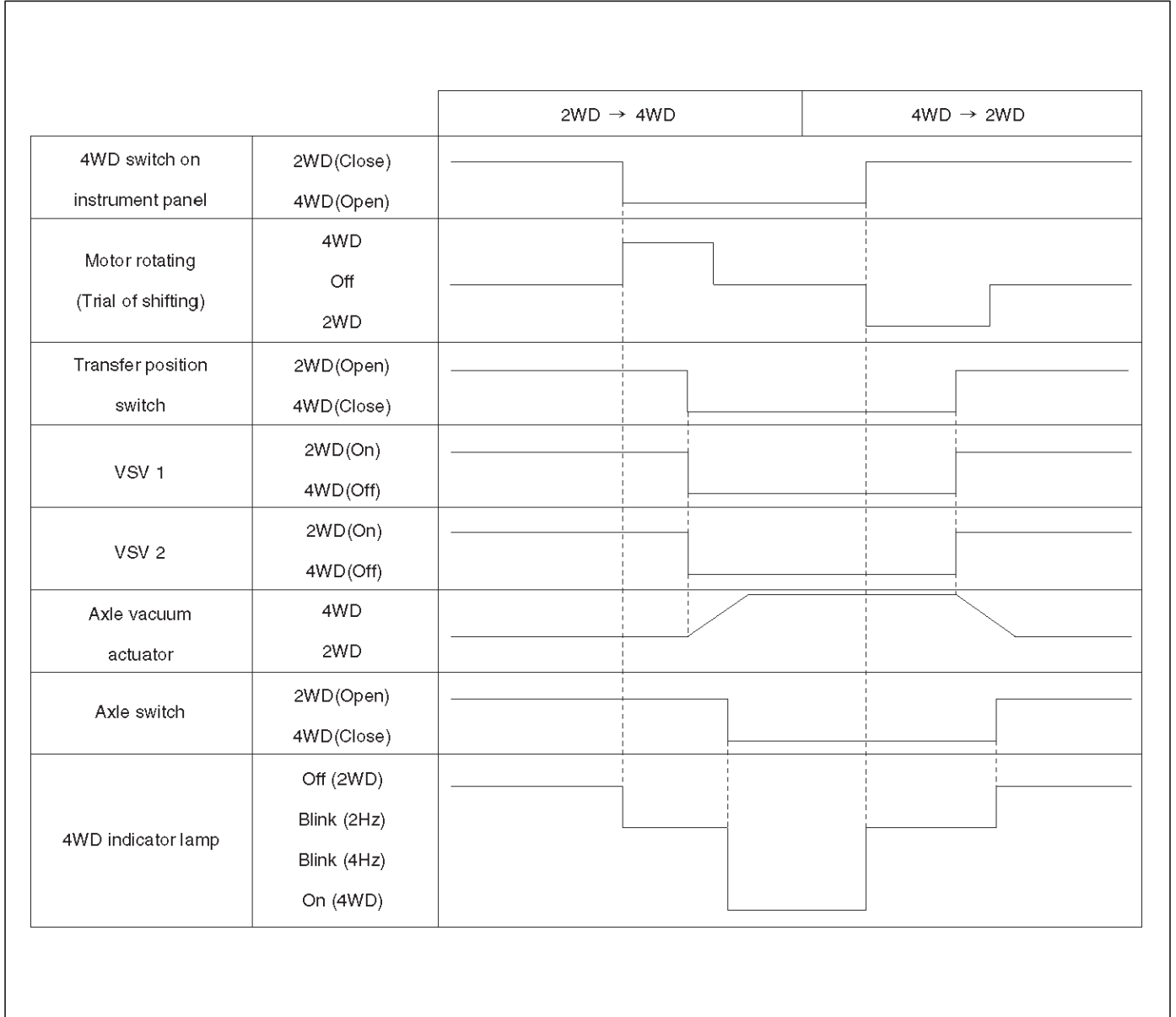
4B1-8 DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Normal Operation

The motor actuator mounted on transfer rear case is driven by signal from 4WD switch on instrument panel. After complete the connecting transfer front output gear to, or disconnecting it from, front propeller shaft, condition

of the transfer position switch changes. The vacuum solenoid valve (VSV) is driven by the signal from transfer position switch and the vacuum actuator connects front wheels to, or disconnect them from, front axles.

Time Chart of Shifting Under Normal Condition

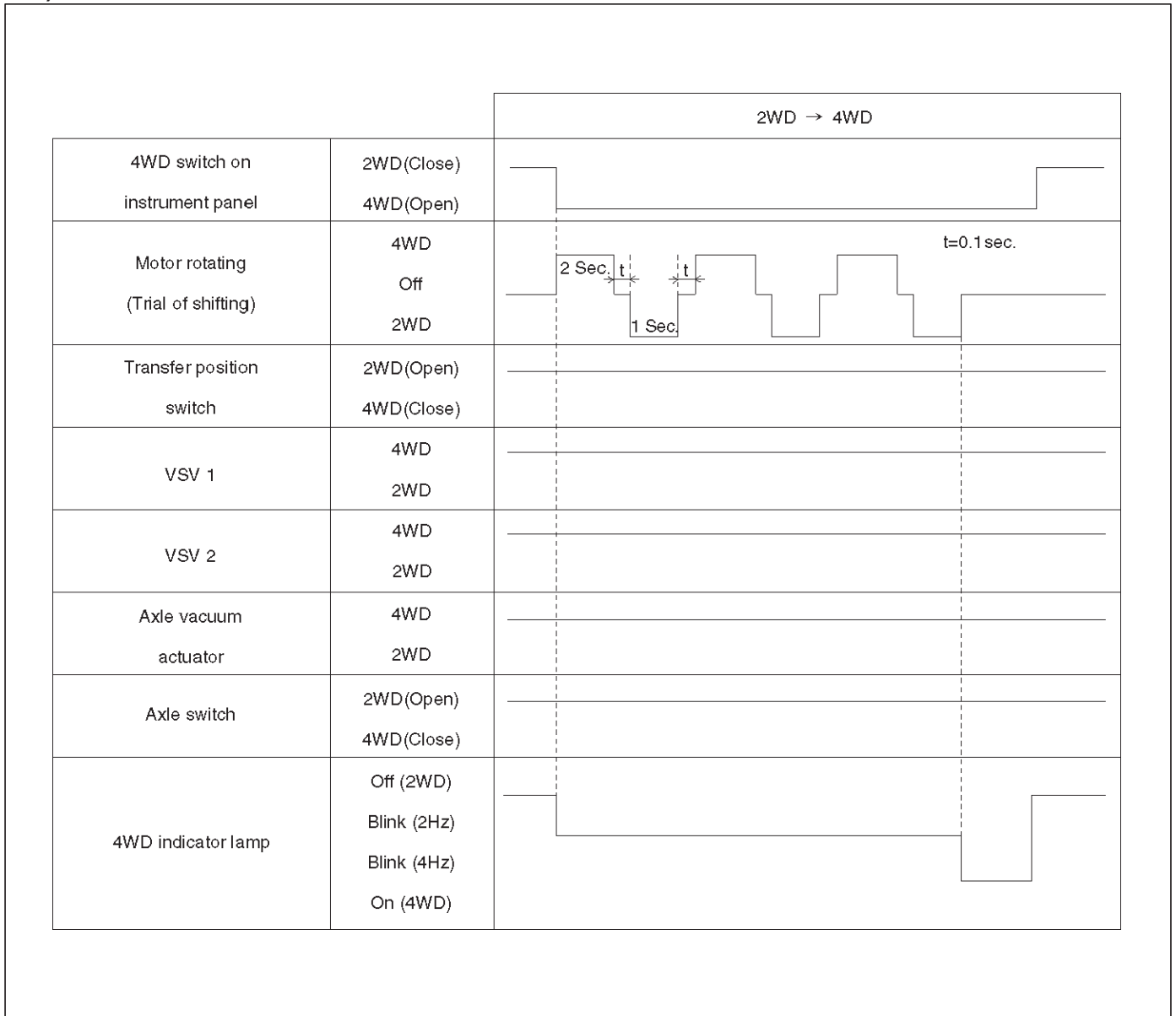


Retrial

The motor actuator starts transfer gear shifting after signal from 4WD switch on instrument panel has been received. But the shifting may be impossible in cold weather or under high speed condition. When 2 seconds have passed since transfer gear shifting started and the transfer position switch dose not turn on (the gear engagement is not completed), the motor reverses its rotation for 1.2 seconds and tries again to shift transfer

gear. This procedure is repeated 3 times in maximum. While this procedure, 4WD indicator lamp blinks by 2 Hz. If the transfer position switch does not turn on after aforementioned procedure has been repeated 3 times, the gear shifting is stopped and 4WD indicator lamp's blinking changes from 2Hz to 4Hz to notify driver that the gear shifting is stopped. This blinking of indicator lamp continues until 4WD switch is returned from 4WD to 2WD.

Time Chart of Shifting Under Severe Condition (re-trial)

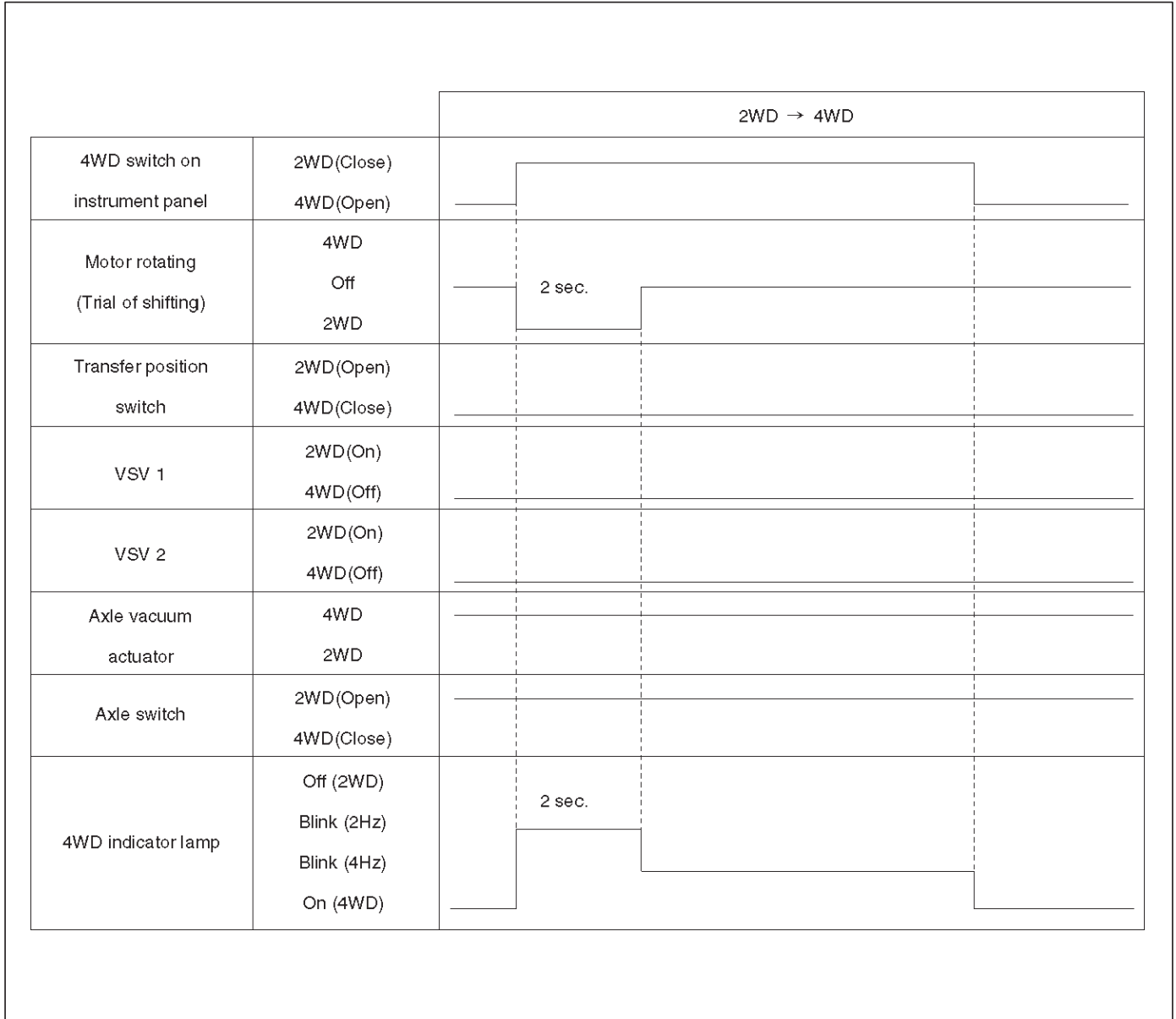


4B1-10DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Warning at “4L” position :In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at “4L” condition is impossible. Therefore, the transfer position switch can not be turned off by 4WD

switch when vehicle is in “4L” condition. In the case this condition continues for 2 seconds, the shifting to 2WD is stopped and the indicator lamp’s blinking changes from 2Hz to 4Hz to notify driver of wrong operation.

Time Chart of Shifting from 4WD to 2WD at “4L” Condition



F04RW005

4WD out signal to other Electronic Hydraulic Control

Unit : 4WDcontrol unit sends 4WD out signal to other Electronic Hydraulic Control Unit as below.

4WD out signal (Period)	Vehicle Condition	Transfer position switch	Front axle switch
120 ms	2WD	2WD (Open)	2WD (Open)
240 ms	4WD	4WD (Close)	4WD (Close)

Functions of Indicator Lamp

Indication of vehicle condition : Indicator lamp is controlled by 4WD control unit and shows vehicle conditions as below.

Indicator	Vehicle condition	4WD switch	Transfer position switch	Front axle switch
Off	2WD	Off (Close)	2WD (Open)	2WD (Open)
On	4WD	On (Open)	4WD (Close)	4WD (Close)
Blink (2Hz)	Operating	On (Open)	4WD (Close)	2WD (Open)
		Off (Close)	2WD (Open)	4WD (Close)
Blink (4Hz)	Stop operating	On (Open)	2WD (Open)	2WD (Open)
		Off (Close)	4WD (Close)	4WD (Close)

Bulb check : To check the bulb of indicator lamp, the indicator lamp comes on when ignition key is turned on, and goes off when the engine is started.

Retrials from 2WD to 4WD : In cold weather or under high speed condition, the gear shifting (engagement)

sometimes does not complete by 3 trials. In such case, the indicator lamp inform driver of this incident as aforementioned chart (shown at Retrial in Outline of shift on the fly system).

Diagnosis

Before Judging That Troubles Occur (Unfaulty mode)

When Switching from 2WD to 4WD

1. In case that blinking frequency of the 4WD indicator changes from 2Hz to 4Hz.

When heavy synchronization load is needed, the motor actuator tries the shifting transfer gear three times including the activation shifting. While the motor actuator tries shifting, the indicator blinks by 2Hz. If the third shifting fails, the indicator's blinking changes from 2Hz to 4Hz at the same time that the motor actuator shifted back to 2WD.

Heavy synchronization load occurs by:

- extremely lower temperature.
- higher speed, rotation difference of wheels during cornering.

Solution 1: Operate again after stop the vehicle or slow down.

2. In case that the 4WD indicator continues blinking by 2Hz for more than 11.5 seconds.

When there is rotation difference of wheels or there is phase difference between front wheels and axles, it is difficult to connect front wheels to front axles. The blinking by 2Hz shows that shifting the transfer gear or connecting the front wheels is in the middle of operating. In above case, the indicator's blinking by 2Hz shows that connecting the front wheels is not completed (because the indicator's blinking changes to 4Hz when the shifting transfer gear is impossible.). And removal of rotation or phase difference make connecting the front wheels possible.

Solution 2: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

When switching from 4WD to 2WD

1. In case that the 4WD indicator continues blinking by 2Hz .

The 4WD indicator continues blinking by 2Hz until both shifting the transfer gear and disconnecting the front wheels are completed when switching 4WD to 2WD. When driveline is loaded with torsional torque, the shifting transfer gear and disconnecting front wheels are impossible. In this case, removal of torsional torque on driveline make the shifting transfer gear and disconnecting front wheels possible.

Solution 3: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

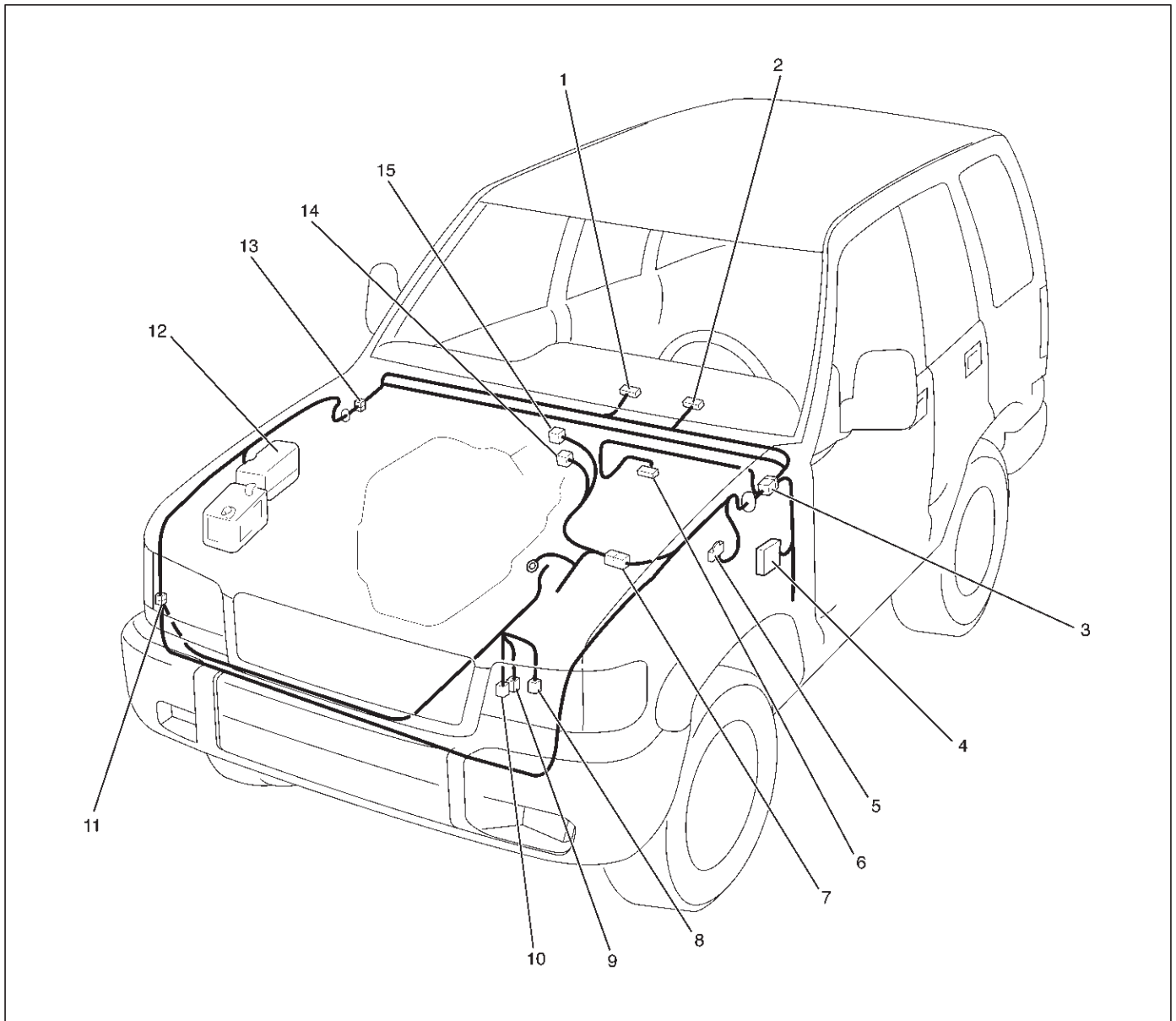
2. In case that the 4WD indicator's blinking changes from 2Hz to 4Hz.

Check the position of transfer lever. Is it at "4L" position? In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at "4L" condition is impossible.

Solution 4: Push the 4WD switch to 4WD, shift the transfer lever to "High" position and re-operate the 4WD switch to 2WD.

4B1-12DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Parts Location (LHD / Diesel Engine Model)

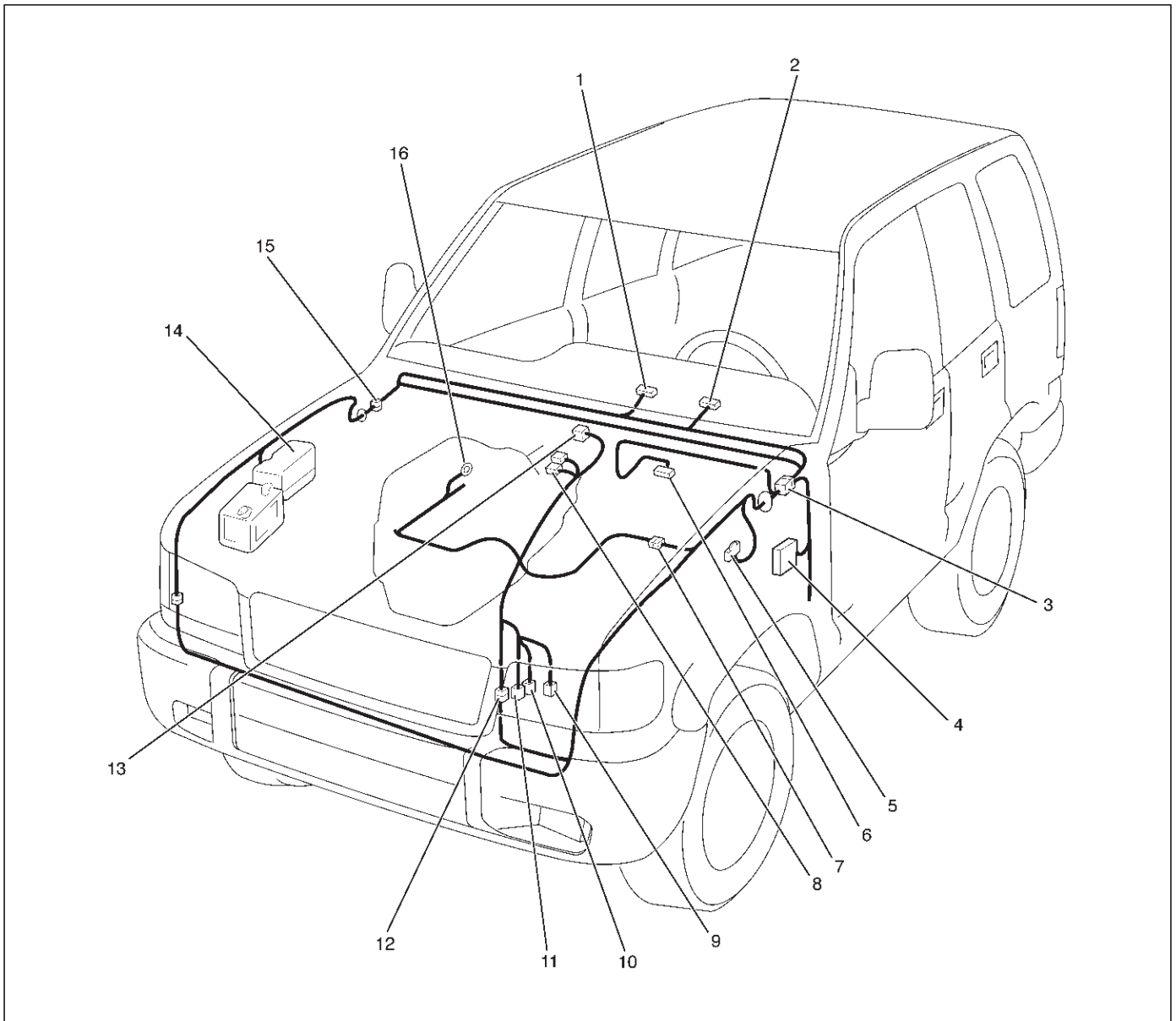


D08RW852

Legend

- | | |
|--------------------------|-----------------------|
| (1) I-12 | (8) P-17 |
| (2) I-9 | (9) P-18 |
| (3) H-7, H-8, H-24, H-25 | (10) P-19 |
| (4) Fuse Box | (11) H-60 |
| (5) C-16 | (12) Relay & Fuse Box |
| (6) C-94 | (13) H-12, H-16 |
| (7) H-4, H-5 | (14) E-21 |
| | (15) E-45 |

Parts Location (LHD / Gasoline Engine Model)



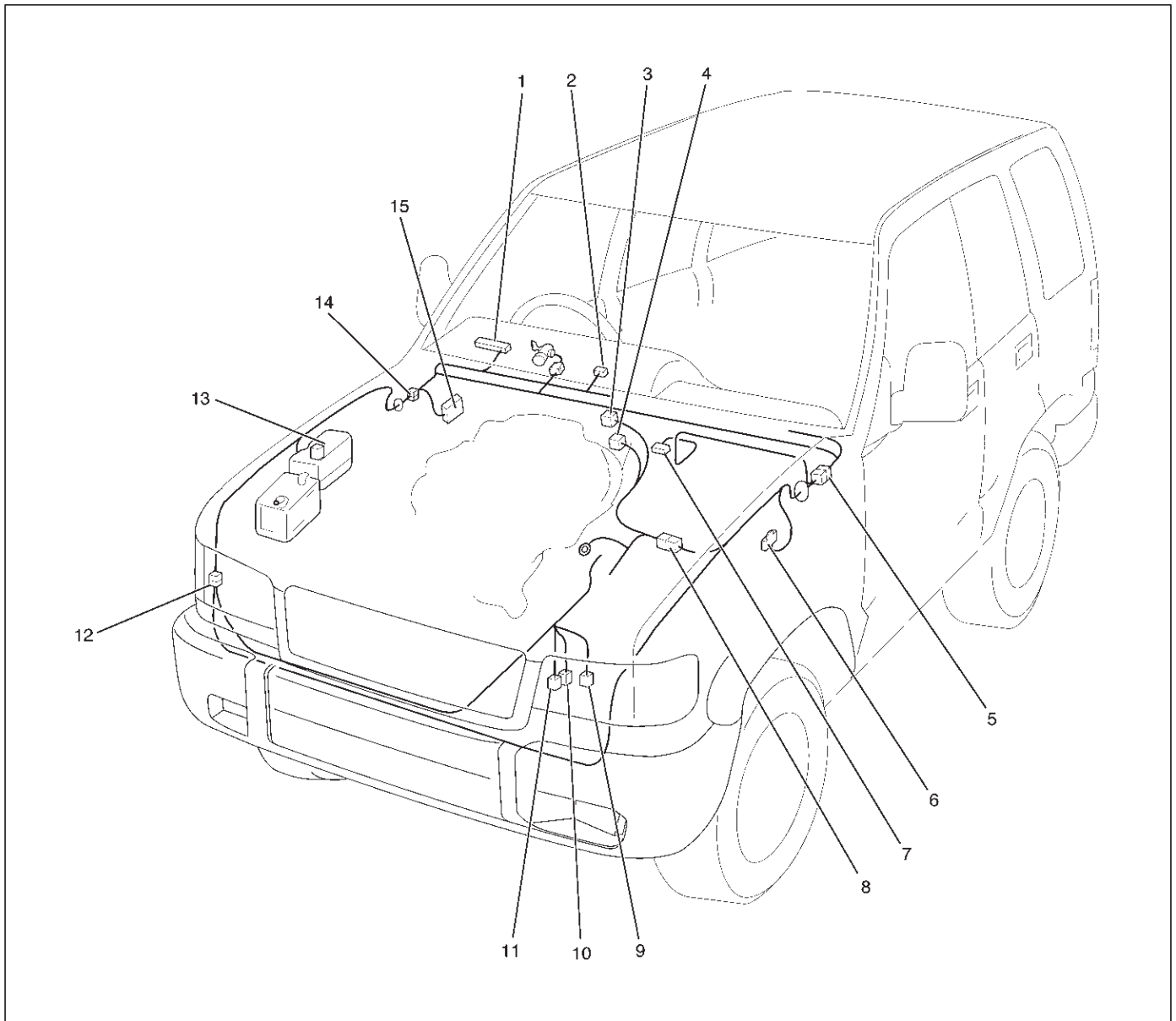
D08RW854

Legend

- | | |
|--------------------------|-----------------------|
| (1) I-12 | (9) M-22 |
| (2) I-9 | (10) M-23 |
| (3) H-7, H-8, H-24, H-25 | (11) M-24 |
| (4) Fuse Box | (12) H-10 |
| (5) C-16 | (13) M-26 |
| (6) C-94 | (14) Relay & Fuse Box |
| (7) H-5 | (15) H-12, H-16 |
| (8) M-11, M-12 | (16) E-30 |

4B1-14DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Parts Location (RHD / Diesel Engine Model)

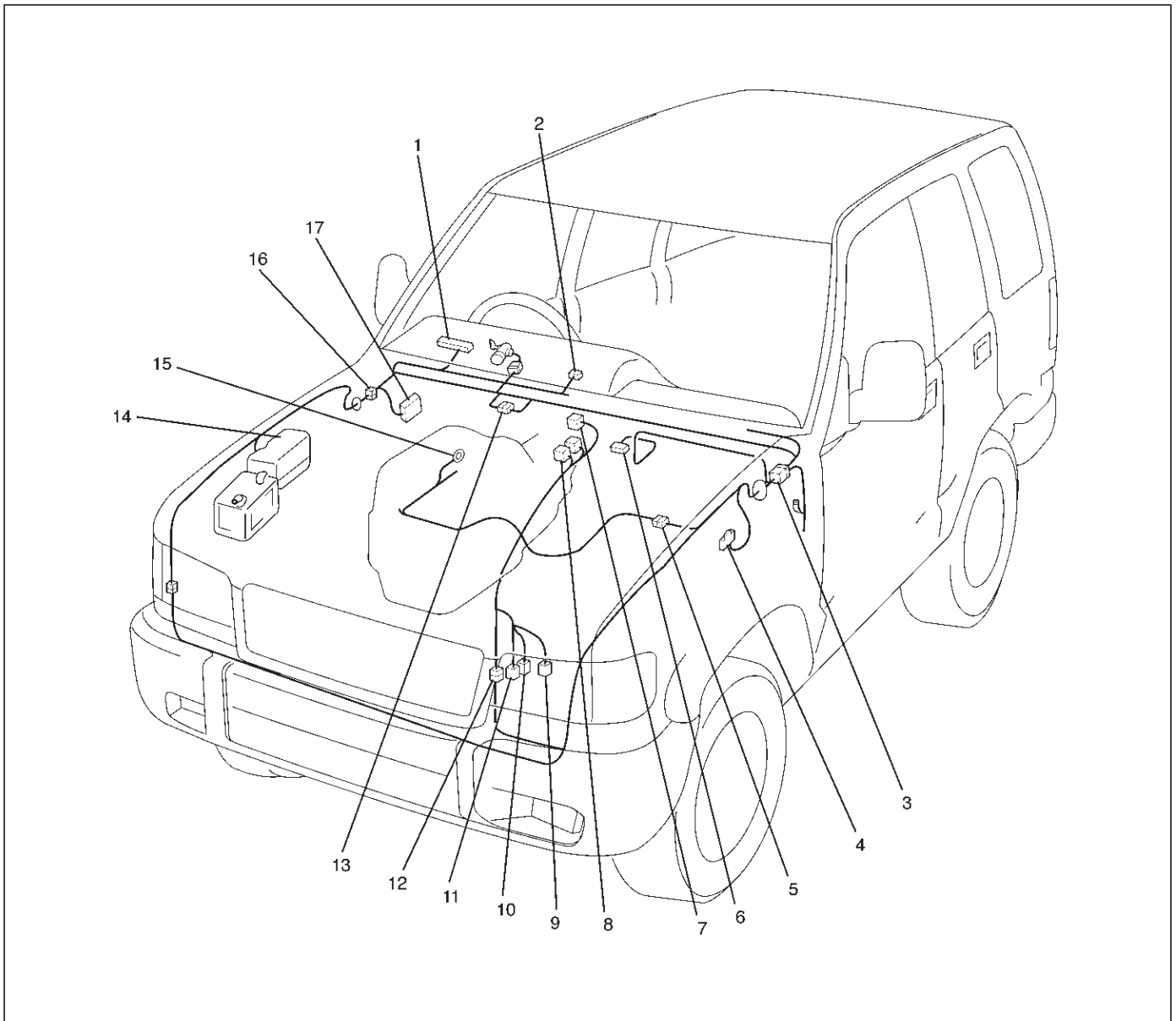


D08RW831

Legend

- | | |
|--------------|-----------------------------------|
| (1) I-9 | (8) H-4, H-5 |
| (2) I-12 | (9) P-17 |
| (3) E-45 | (10) P-18 |
| (4) E-21 | (11) P-19 |
| (5) H-7, H-9 | (12) H-60 |
| (6) C-16 | (13) Relay & Fuse Box |
| (7) C-94 | (14) H-15, H-16, H-25, H-26, H-27 |
| | (15) Fuse Box |

Parts Location (RHD / Gasoline Engine Model)



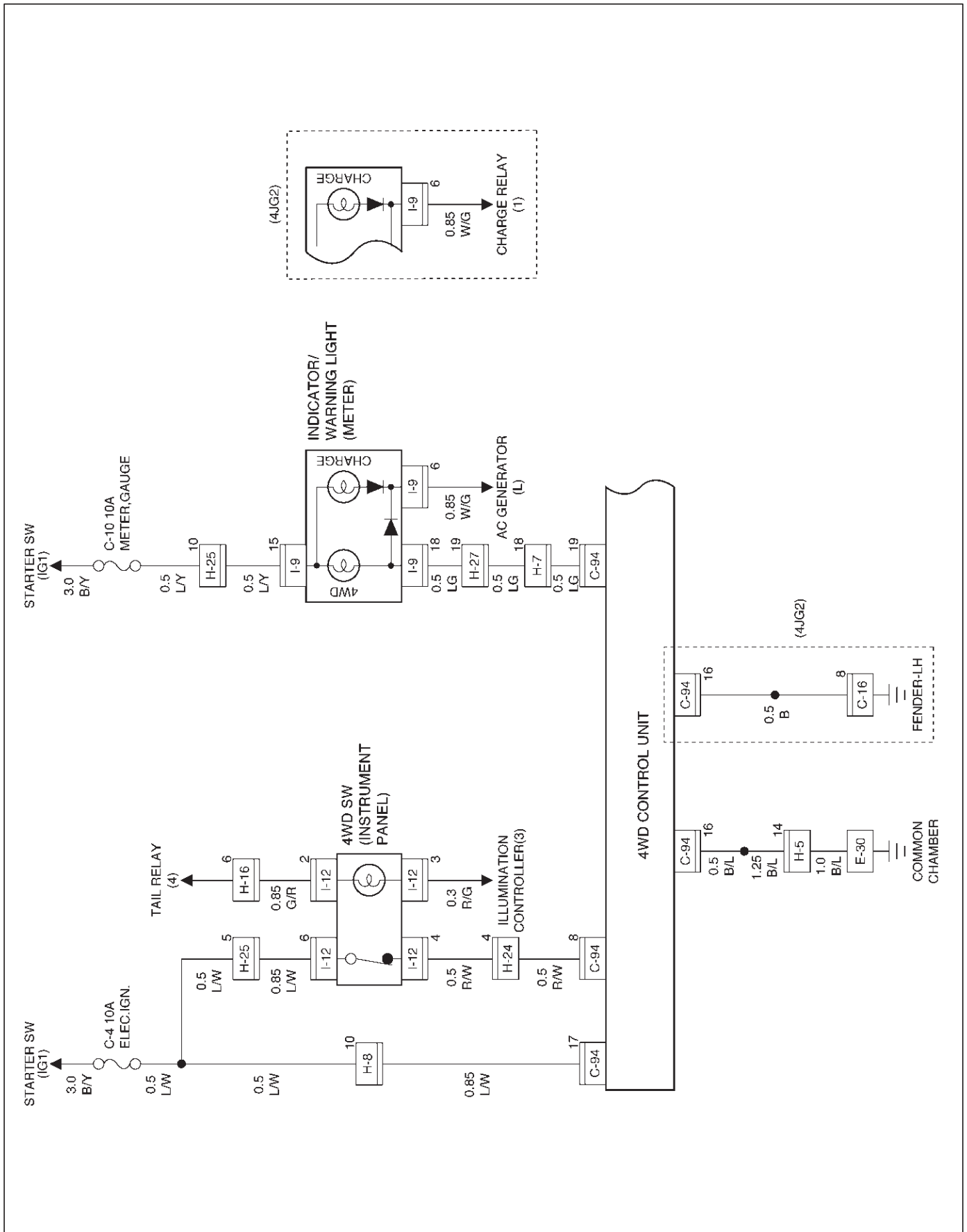
D06RW853

Legend

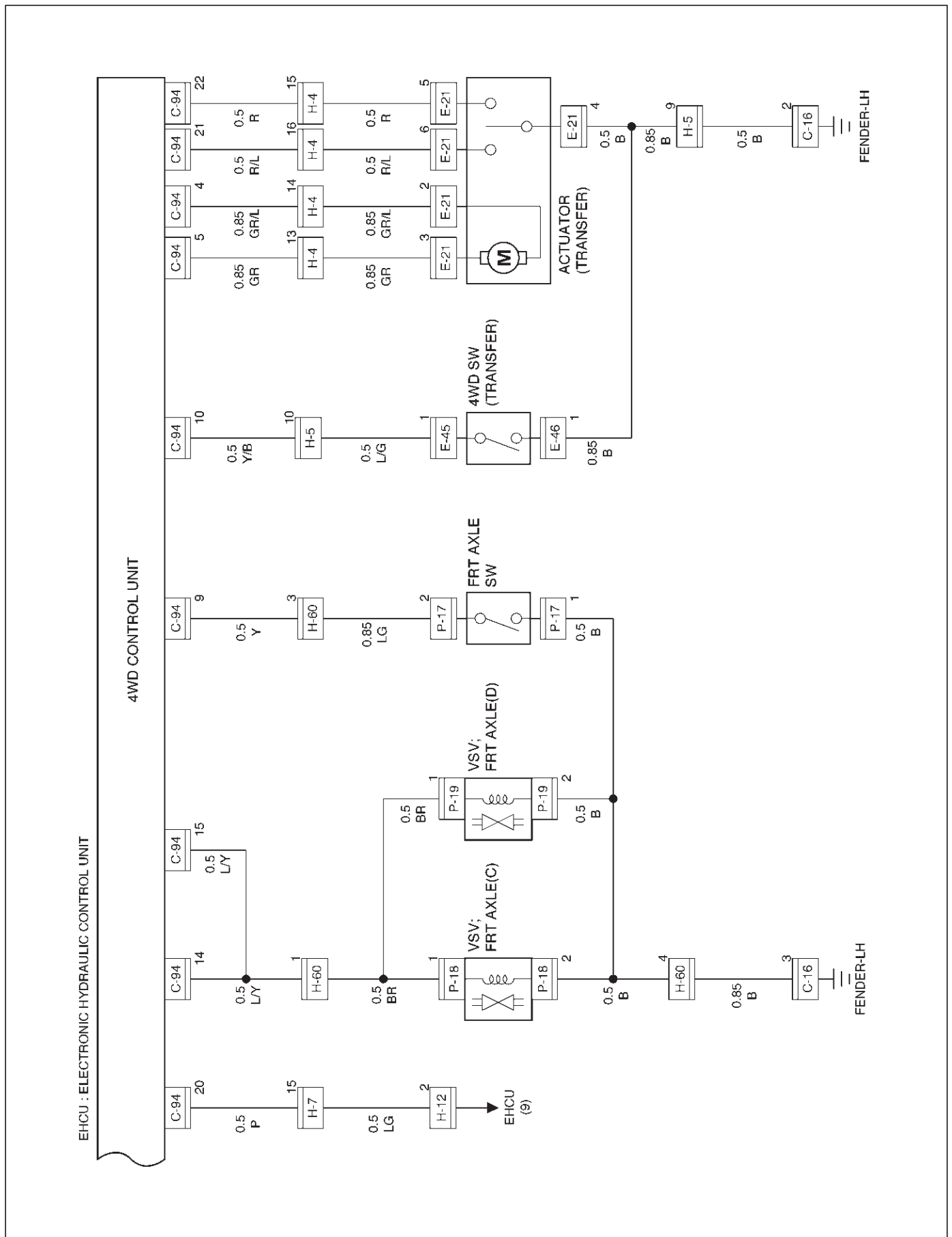
- | | |
|----------------|-----------------------------------|
| (1) I-9 | (9) M-22 |
| (2) I-12 | (10) M-23 |
| (3) H-7, H-9 | (11) M-24 |
| (4) C-16 | (12) H-10 |
| (5) H-5 | (13) H-12 |
| (6) C-94 | (14) Relay & Fuse Box |
| (7) M-26 | (15) E-30 |
| (8) M-11, M-12 | (16) H-15, H-16, H-25, H-26, H-27 |
| | (17) Fuse Box |

4B1-16DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Wiring Diagram (LHD Model)

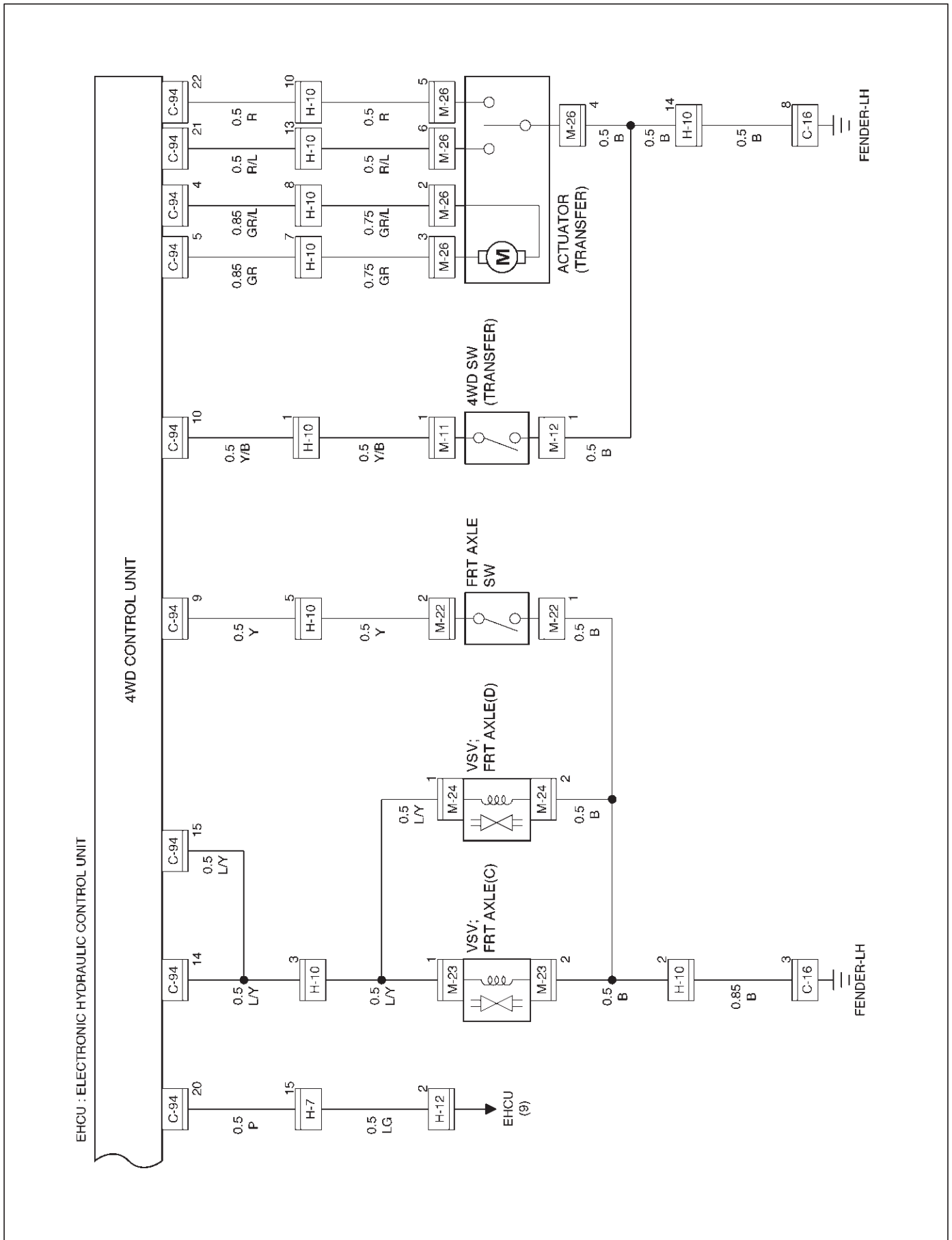


Wiring Diagram (LHD / Diesel Engine Model)

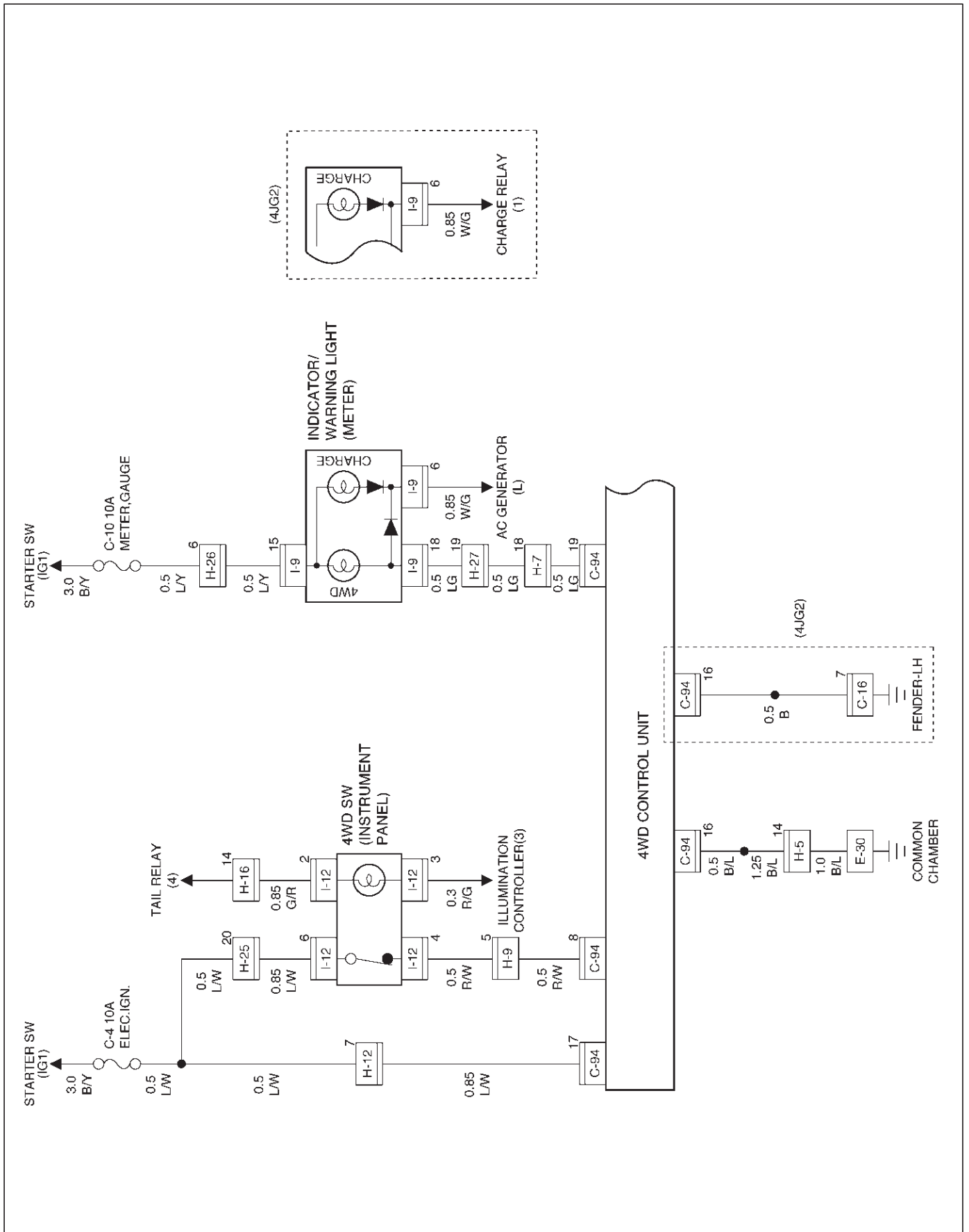


4B1-18DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Wiring Diagram (LHD / Gasoline Engine Model)

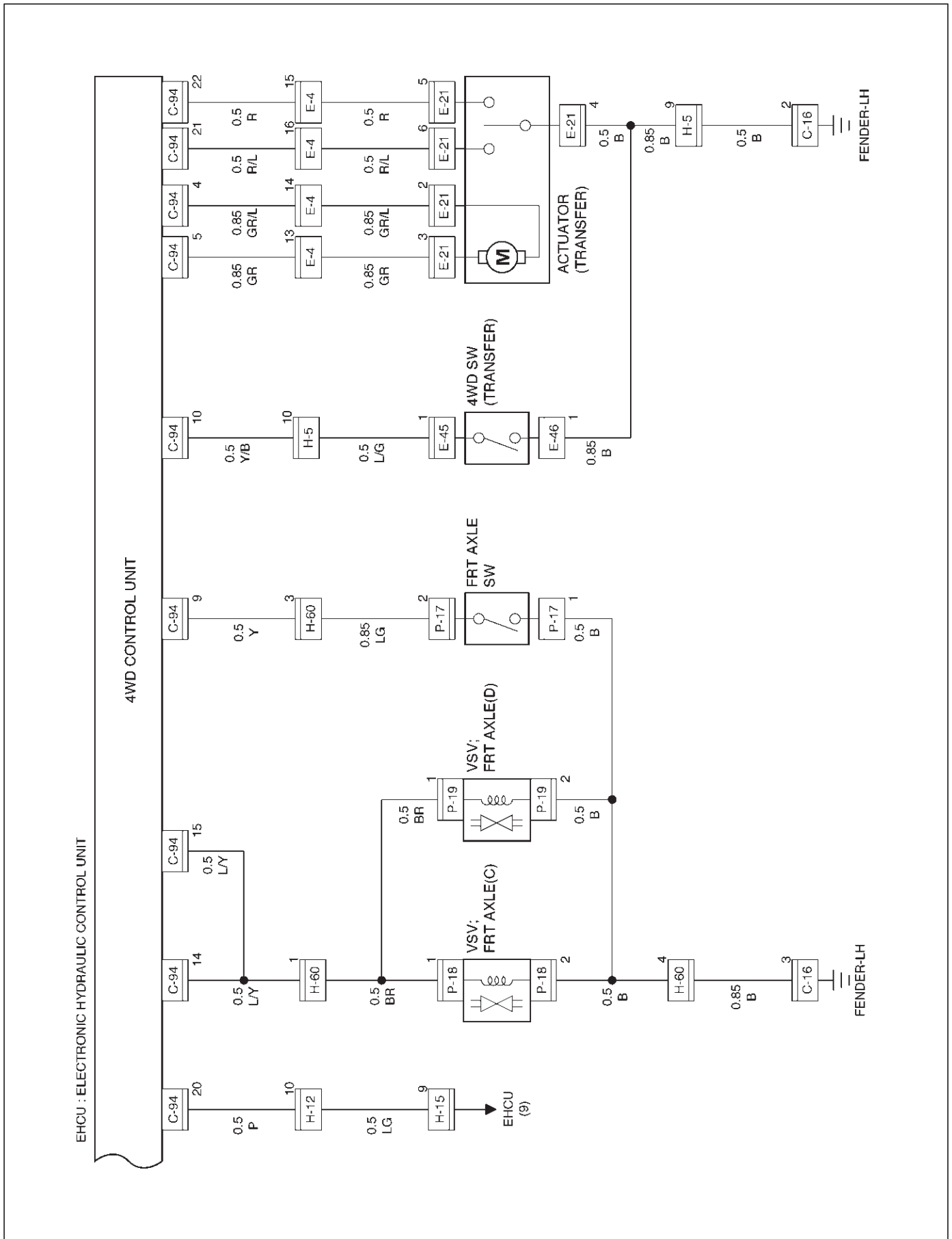


Wiring Diagram (RHD Model)

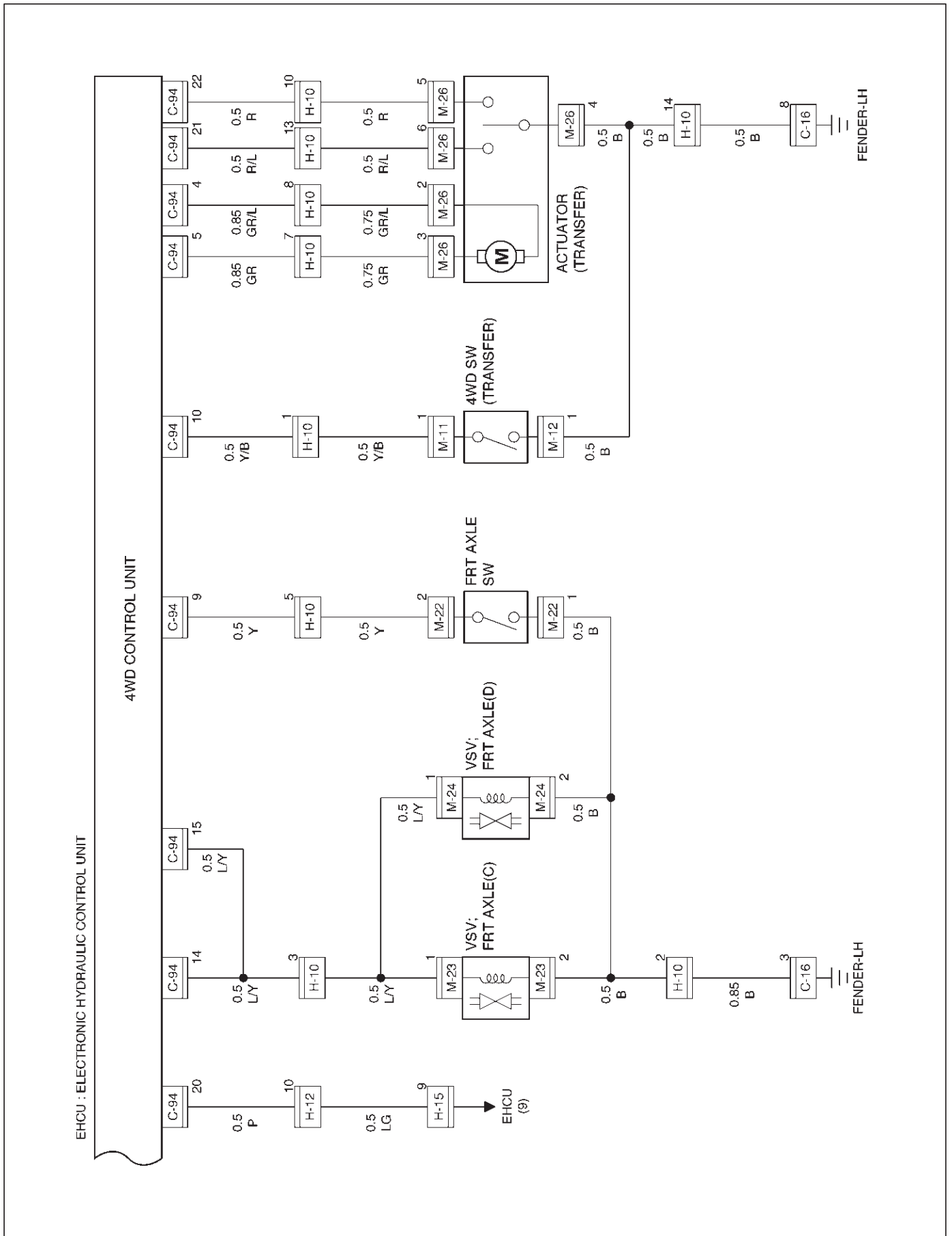


4B1-20DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Wiring Diagram (RHD / Diesel Engine Model)



Wiring Diagram (RHD / Gasoline Engine Model)







4B1-22DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Connector List

No.	Connector face	No.	Connector face
C-16		H-8 (LHD)	
C-94		H-8 (RHD)	
E-21		H-9 (LHD)	
E-30		H-9 (RHD)	
E-45		H-10	
H-4		H-12 (LHD)	
H-5		H-12 (RHD)	
H-7		H-15 (LHD)	

No.	Connector face	No.	Connector face
H-15 (RHD)		H-60	
H-16 (LHD)		I-9	
H-16 (RHD)		I-12	
H-24 (LHD)		M-11	
H-24 (RHD)		M-12	
H-25		M-22	
H-26		M-23	
H-27		M-24	

4B1-24DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

No.		No.	Connector face
M-26			
P-17			
P-18			
P-19			

Diagnosis of the Faults Based on the Status of 4WD Indicator Lamp, 4WD Switch and T/F Change Lever

Diagnosis charts are shown on below. If troubles can not be solved after every chart was traced, troubles may occur in the 4WD control unit. In this case, replace the 4WD control unit and trace every chart again.

Fault on switching from 2WD to 4WD

1. In case that 4WD indicator's blinking changes from 2Hz to 4Hz after Solution 1 is carried out.

Faults occur in the motor actuator or the transfer case assembly. Remove the motor actuator and check function. If problem was found and it was repaired, try **Solution 1** again. After that, disassemble the transfer case assembly for check and repair or replace. If incident is not improved after above mentioned actions were taken, replace the 4WD control unit.

2. In case that 4WD indicator does not blink nor light, when switching from 2WD to 4WD.

Step	Action	Yes	No
1	Is ignition turned on?	Go to Step 2	Turn on the ignition and trace this chart from start.
2	Does the indicator light comes on when the engine is not started?	Go to Step 3	Burning out of indicator lamp or disconnection of harness wire. Trace this chart from the start after repair or replace.
3	Start the engine. Is the 4WD switch turned from 2WD to 4WD?	Short-circuit (body short) on harness of the 4WD switch. Fault of the 4WD switch (holding the closed condition). Trace this chart from the start after repair or replace.	Push the 4WD switch to 4WD.

4B1-26DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

3. Case that the indicator keeps blinking by 2Hz after aforementioned Solution 2 is carried out.

Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try Solution 2 after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Go to Step 3	Disconnection of the motor actuator harness wiring. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after replace. Internal faults of transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.
3	Pull out the hoses from vacuum actuator and operate 4WD switch. Is there negative pressure on either of hoses?	Go to Step 4	Faults on the transfer position switch or its harness. Trace this chart from the start after repair or replace. Faults on the VSV main body, its harness or vacuuming system. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.
4	Check the axle switch. Were problems found?	Internal faults on axle switch. Trace this chart from the start after replace.	Disconnection on the axle harness. Trace this chart from the start after repair or replace. Faults on Front Axle ASM. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.

DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY) 4B1-27

Fault on switching from 4WD to 2WD

1. Case that indicator does not blink nor turn out.

Step	Action	Yes	No
1	Does the indicator turn out by ignition off?	Go to Step 2	Short circuit of the indicator harness.
2	Is the 4WD switch on 2WD position?	Disconnection on the 4WD switch harness or breakdown of the 4WD switch in open state. Trace this chart from the start after repair or replace.	Turn the 4WD switch to 2WD position. Trace this chart from the start.

4B1-28DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

2. Case that indicator keeps 2Hz blinking after aforementioned Solution 3 is carried out.

Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try Solution 3 after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace. Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after or replace.	Go to Step 3
3	Pull out the hoses from vacuum actuator and operate 4WD switch. Is there negative pressure on either of hoses?	Go to Step 4	Faults on the transfer position switch or its harness. Trace this chart from the start after repair or replace. Faults on the VSV main body, its harness or vacuuming system. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.
4	Check the axle switch. Were problems found?	Internal faults on axle switch. Trace this chart from the start after replace. Faults on Front Axle ASM. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.	Short circuit (body short) or disconnection of the axle harness. Trace this chart from the start after repair or replace.

DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY) 4B1-29

3. Case that indicator's blinking changes to 4Hz after aforementioned Solution 4 is carried out.

Step	Action	Yes	No
1	Can the transfer lever be operated from High to 4L or vice versa?	<p>Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace.</p> <p>Faults on the motor actuator. Trace this chart from the start after replace.</p> <p>Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.</p>	<p>Faults on the 4WD control unit. Trace this chart from the start after replace.</p>

4B1-30DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

Front Axle Diagnosis

- When the 4WD switch is operated from 4H to 2H, indicator light does not go out.

Step	Action	Yes	No
1	Drive slow 100 — 200m after a few minutes" idling. Has indicator light gone out?	All right.	Go to Step 2
2	Jack up front tires. Does the right side of front wheel rotate when the left side of front wheel is rotated?	Go to Step 4	Go to Step 3
3	1. Check the actuator switch. 2. Check the circuit to indicator. Was a problem found?	Trace this chart from the start after repair or replace.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.
4	1. Check the VSV valve. 2. Check the circuit to VSV valve. Was a problem found?	Trace this chart from the start after repair or replace.	Go to Step 5
5	Is vacuum piping all right? (tank, hose, & pipe damage or trouble)	Go to Step 6	Trace this chart from the start after repair or replace.
6	Does actuator work all right?	Trace this chart from the start.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.

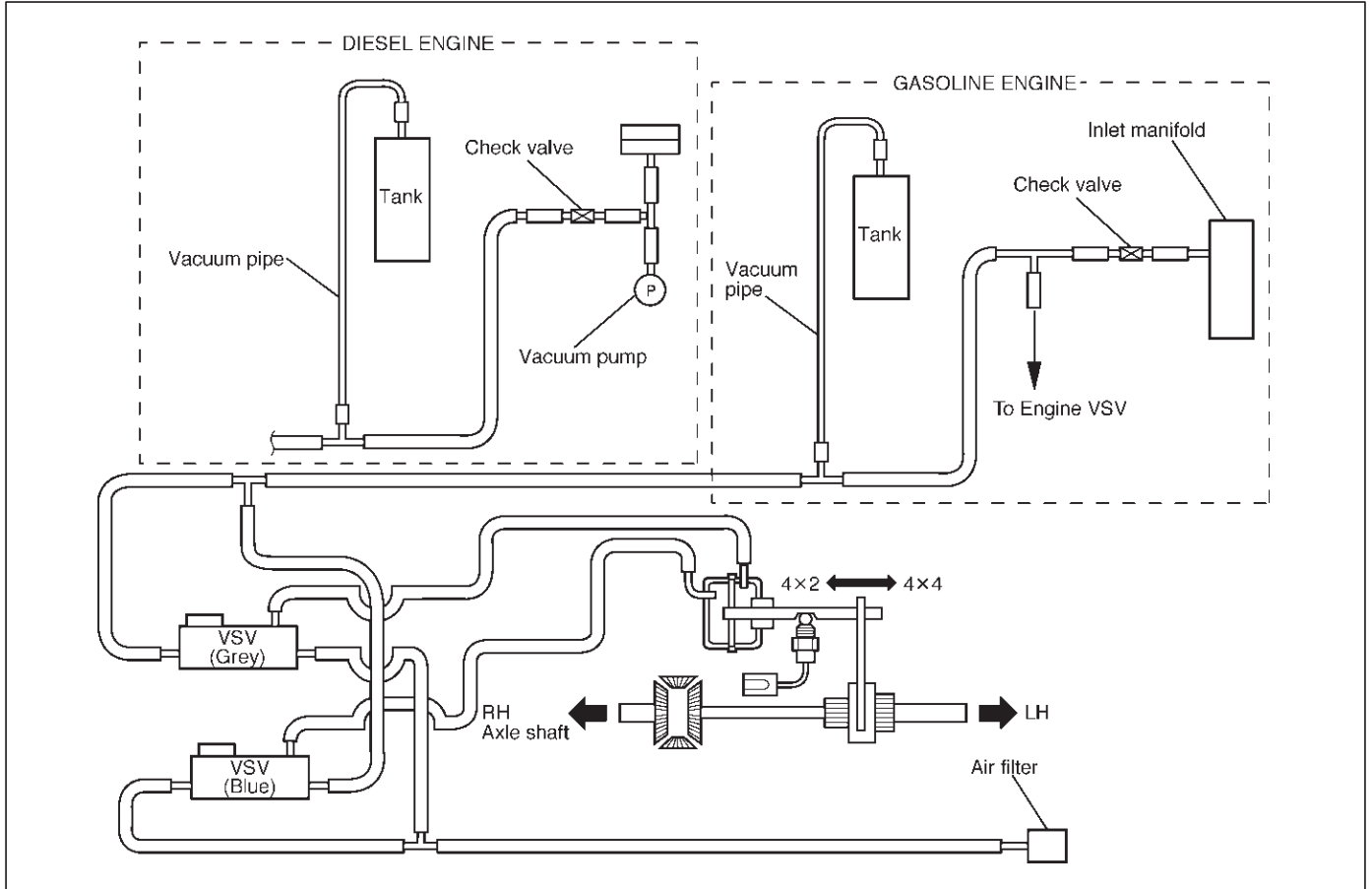
DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY) 4B1-31

- When the 4WD switch is operated from 2H to 4H, indicator light is not actuated.

Step	Action	Yes	No
1	Drive slow 100 — 200m after a few minutes" idling. Has indicator light actuated?	All right.	Go to Step 2
2	Jack up front tires. Does not the right side of front wheel rotate when the left side of front wheel is rotated?	Go to Step 4	Go to Step 3
3	1. Check the actuator switch. 2. Check the circuit to indicator. Was a problem found?	Trace this chart from the start after repair or replace.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.
4	1. Check the VSV valve. 2. Check the circuit to VSV valve. Was a problem found?	Trace this chart from the start after repair or replace.	Go to Step 5
5	Is vacuum piping all right? (tank, hose, & pipe damage or trouble)	Go to Step 6	Trace this chart from the start after repair or replace.
6	Does actuator work all right?	Trace this chart from the start.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.

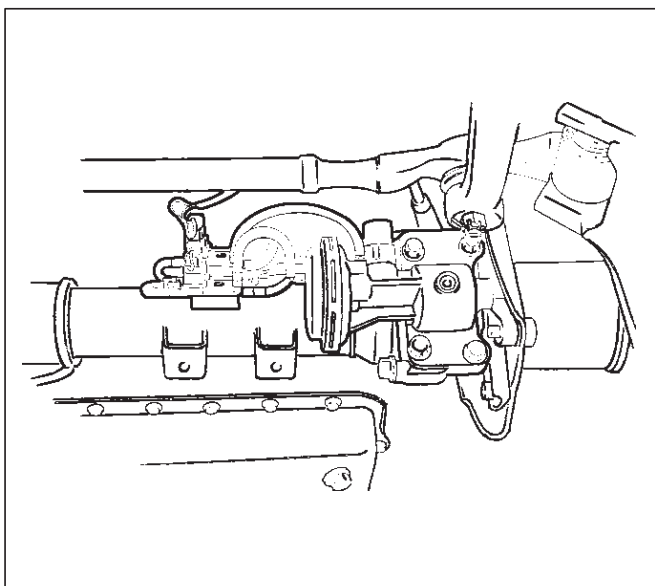
Shift on the Fly Vacuum Piping and Electric Equipment (For Push Button Type)

Vacuum Piping Diagram



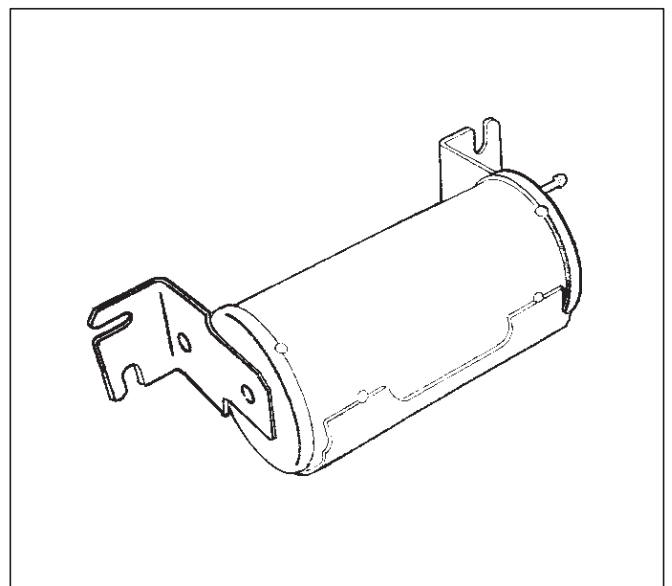
C04RW013

VSV Assembly, Actuator Assembly



412RS032

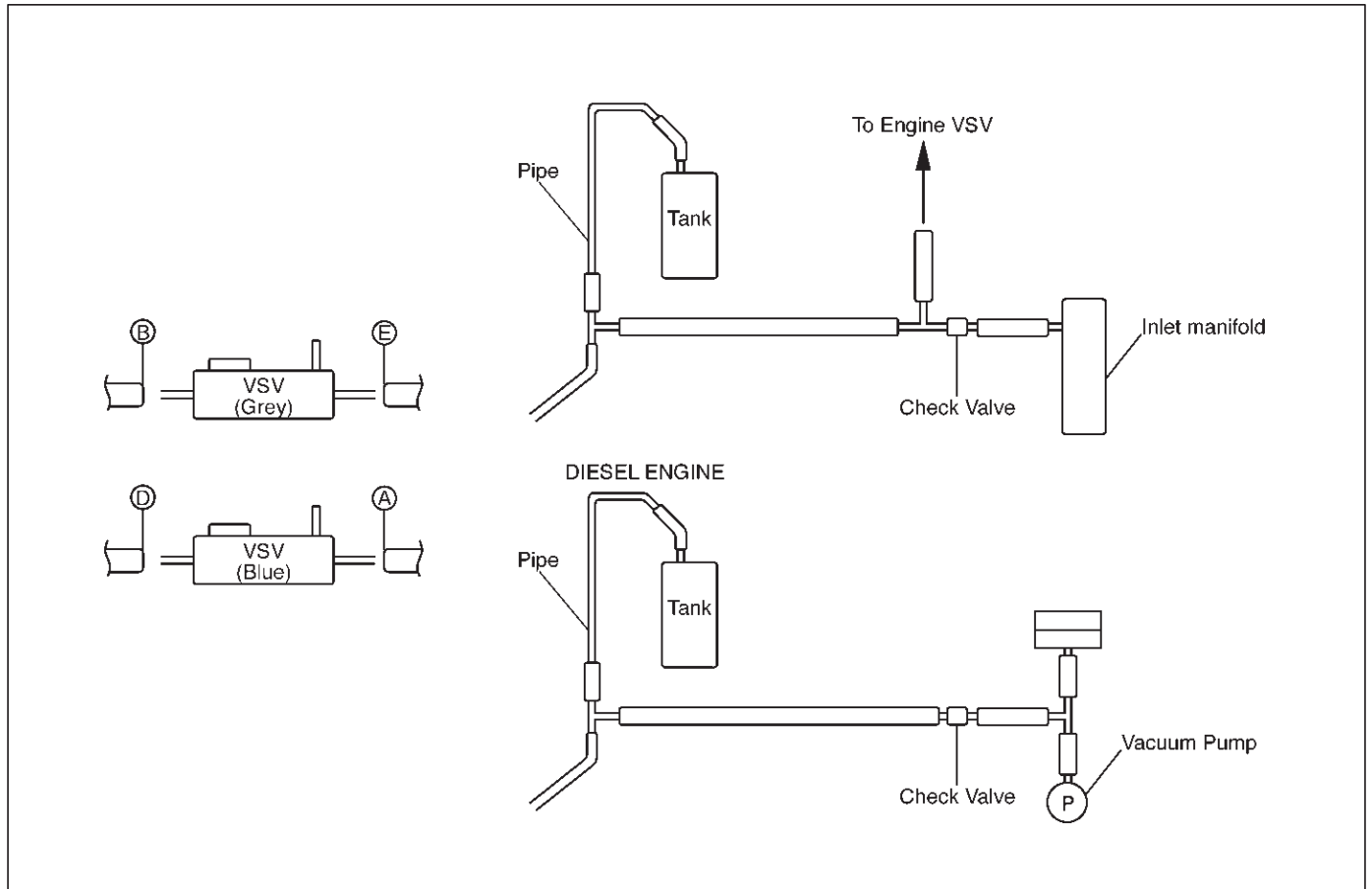
Vacuum Tank



412RS033

Inspection and Repair

Vacuum Piping



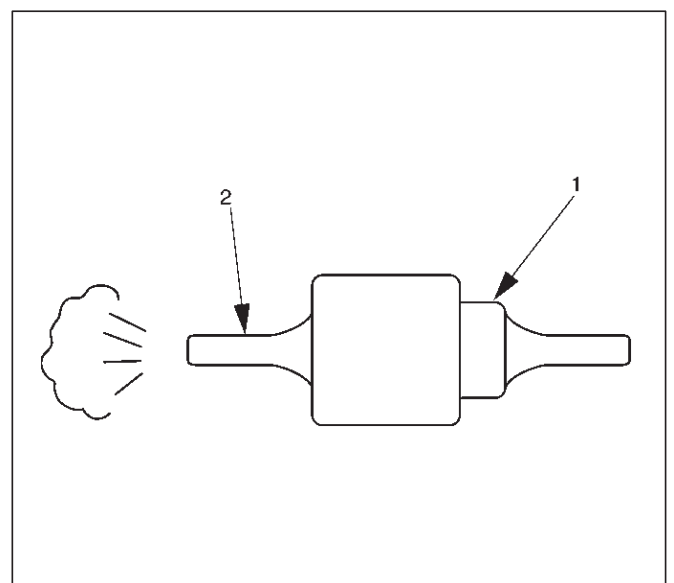
C04RW014

1. Pull out the Hose A in figure and install a vacuum gauge.
2. Plug up Hose B in figure to prevent the leak of vacuum.
3. Start the engine and measure vacuum 2 or 3 minutes afterward.
4. Repeat 1) and 2) but with Hose A plugged and Hose B pulled out.
5. If vacuum measures -400mmHg , or if it shows a sudden drop immediately after engine stop, inspect the hose, tank, and pipe for damage.

NOTE: Be careful not to permit the entry of dust and water during inspection.

6. Pull out Hose D in above illustration.
7. Plug Hose E in above illustration.
8. Make sure that Hose D in above illustration is under atmospheric pressure.
9. Pull out Hose E and plug Hose D, and make sure that Hose E is under atmospheric pressure.
10. If Check 8) or 9) has revealed stoppage, check and see that there is no bend, foreign matter in the hose or in the filter. If there is trouble, repair or replace.

Check Valve



C04RS004

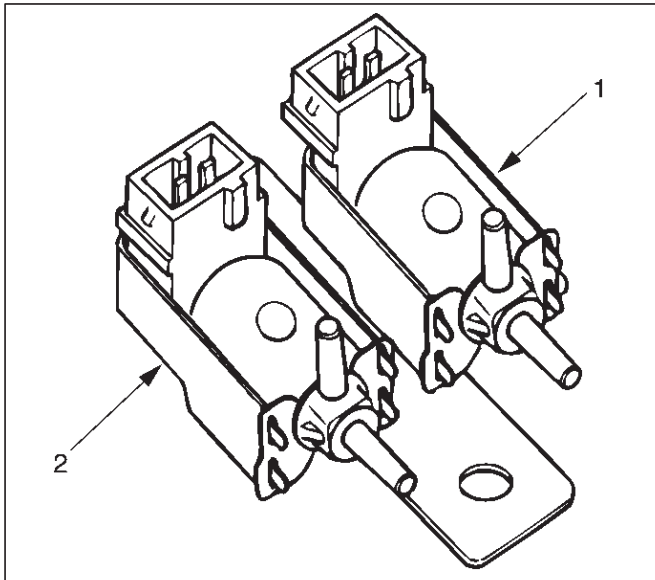
1. Apply vacuum from the orange colored side(1).
Vacuum: -400mmHg
2. Check leakage of vacuum.
3. Make sure that vacuum cannot be applied from the black colored side(2).

4B1-34 DRIVE LINE CONTROL SYSTEM (SHIFT ON THE FLY)

4. If vacuum is not applicable as much as -400mmHg, and if there is resistance on the intake side, replace with a new check valve.

VSV Assembly

Inspect the vehicle side harness as follows:



412RS071

Legend

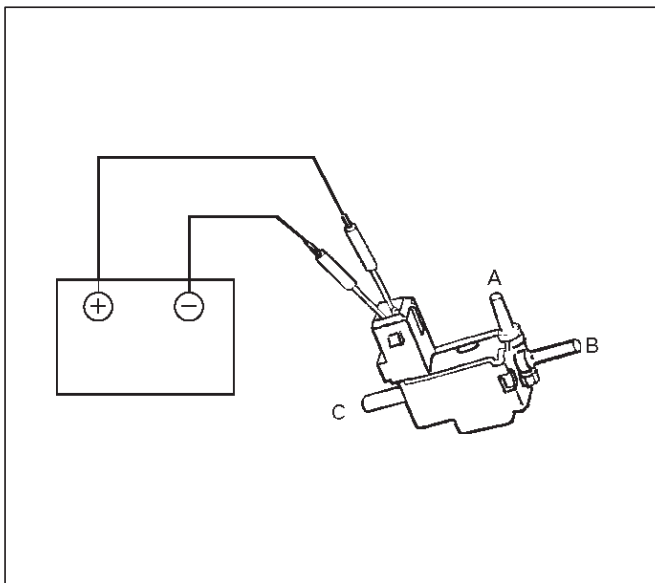
- (1) Grey
- (2) Blue

1. Remove connector.
2. Shift transfer lever to 2H and start the engine.

NOTE: Do not move the vehicle while inspection.

3. Make sure that there is continuity in the vehicle side of harness. If there is no continuity, check transfer shift switch and wiring.

Inspect both VSVs as follows:



F04RS004

1. With battery not connected (Usual).

A-C: There is continuity

B: Closed

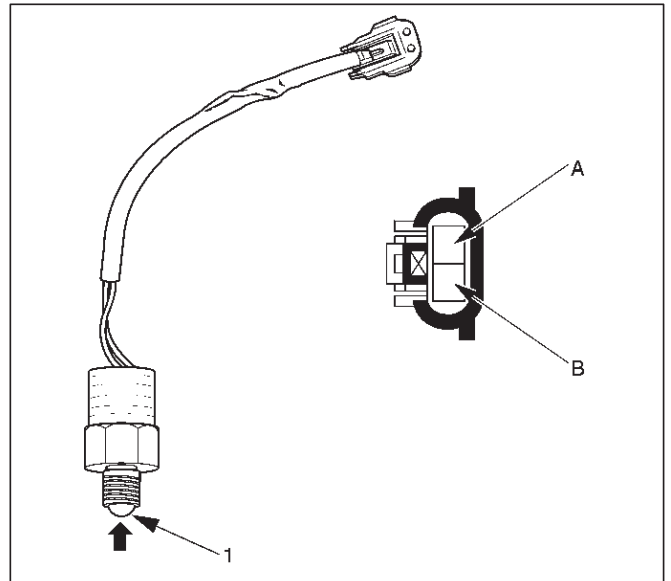
2. With battery connected

A - B: There is continuity

C: Closed

3. If 1) and 2) fail, replace with a new VSV.

Axle Position Switch



412RS048

1. With ball (1) being free

A - B: There is continuity

2. With ball forced into the switch

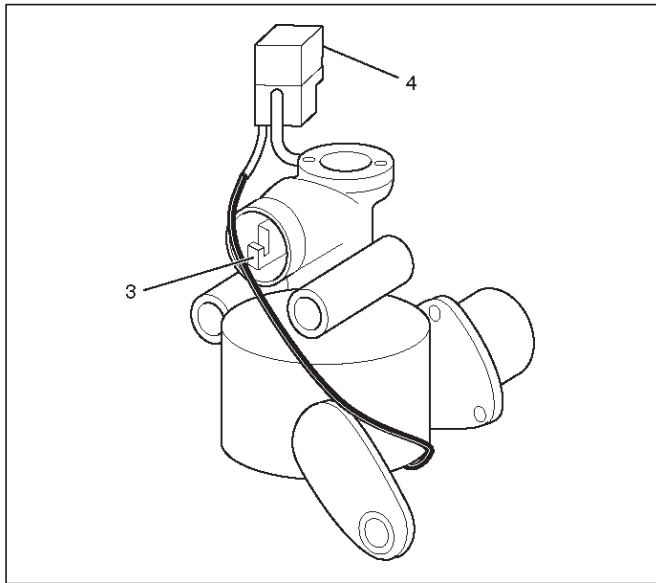
A - B: No continuity

3. If 1) and 2) fail, replace with a new switch.

Motor Actuator Assembly

Inspect the function of the motor actuator assembly as follows:

1. Disassemble the motor actuator from transfer rear case.



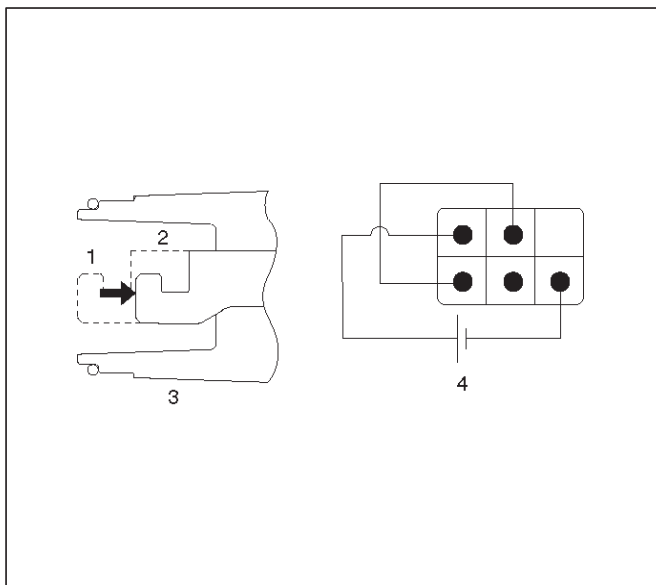
412RW037

Legend

- (3) Shift Rod
- (4) Connector

2. Connect the terminals as shown in figure.

Shift rod of the motor actuator moves and stops at 4WD position.



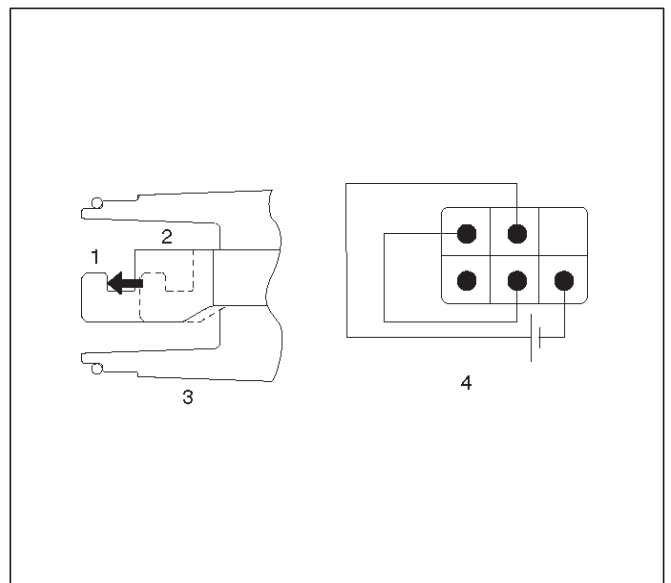
412RW038

Legend

- (1) 2WD
- (2) 4WD
- (3) Shift Rod
- (4) Connector

3. Connect the terminals as shown in figure.

Shift rod of the motor actuator moves and stops at 2WD position.



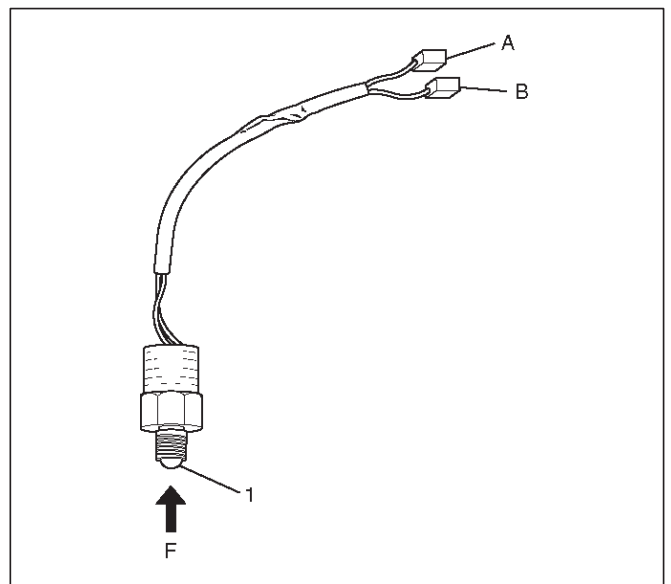
412RW039

Legend

- (1) 2WD
- (2) 4WD
- (3) Shift Rod
- (4) Connector

4. If 2) and 3) fail, replace with a new motor actuator.

Transfer Position Switch



412RW040

Legend

- (1) Ball

1. With ball being free.

A-B : There is continuity.

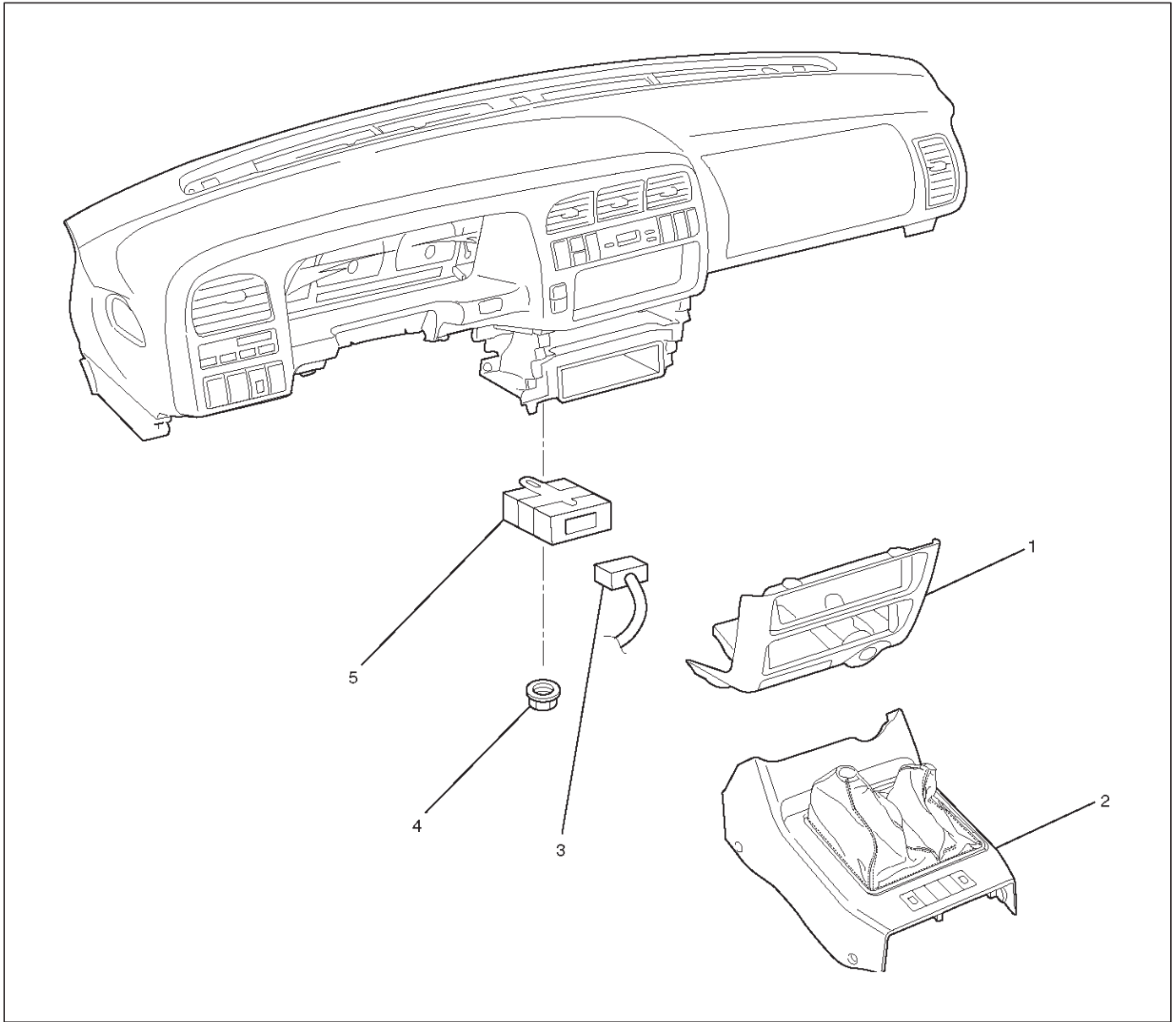
2. With ball forced into the switch.

A-B : No continuity.

3. If 1) and 2) fail, replace with a new switch.

4WD Control Unit (For Push Button Type)

4WD Control Unit Associated Parts



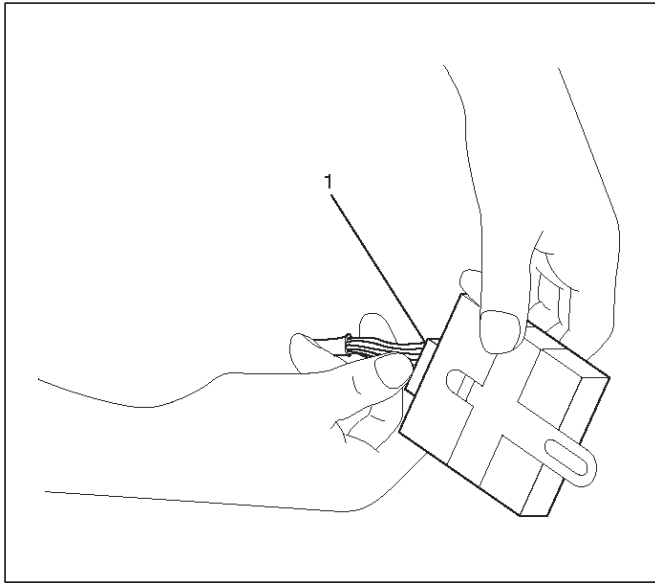
Legend

- (1) Lower Cluster Assembly
- (2) Front Console Assembly

- (3) Harness Connector
- (4) Nut
- (5) 4WD Control Unit

Removal

1. Remove lower cluster assembly and front console assembly.
Refer to Interior Trim in Body and Accessories section.
2. Remove nut.
3. Remove 4WD control unit.
4. Disconnect harness connector (1).



412RW045

Legend

- (1) Harness Connector
-

Installation

1. Connect harness connector, then install 4WD control unit.
2. Install lower cluster assembly and front console assembly.

MEMO

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM (TOD)

CONTENTS

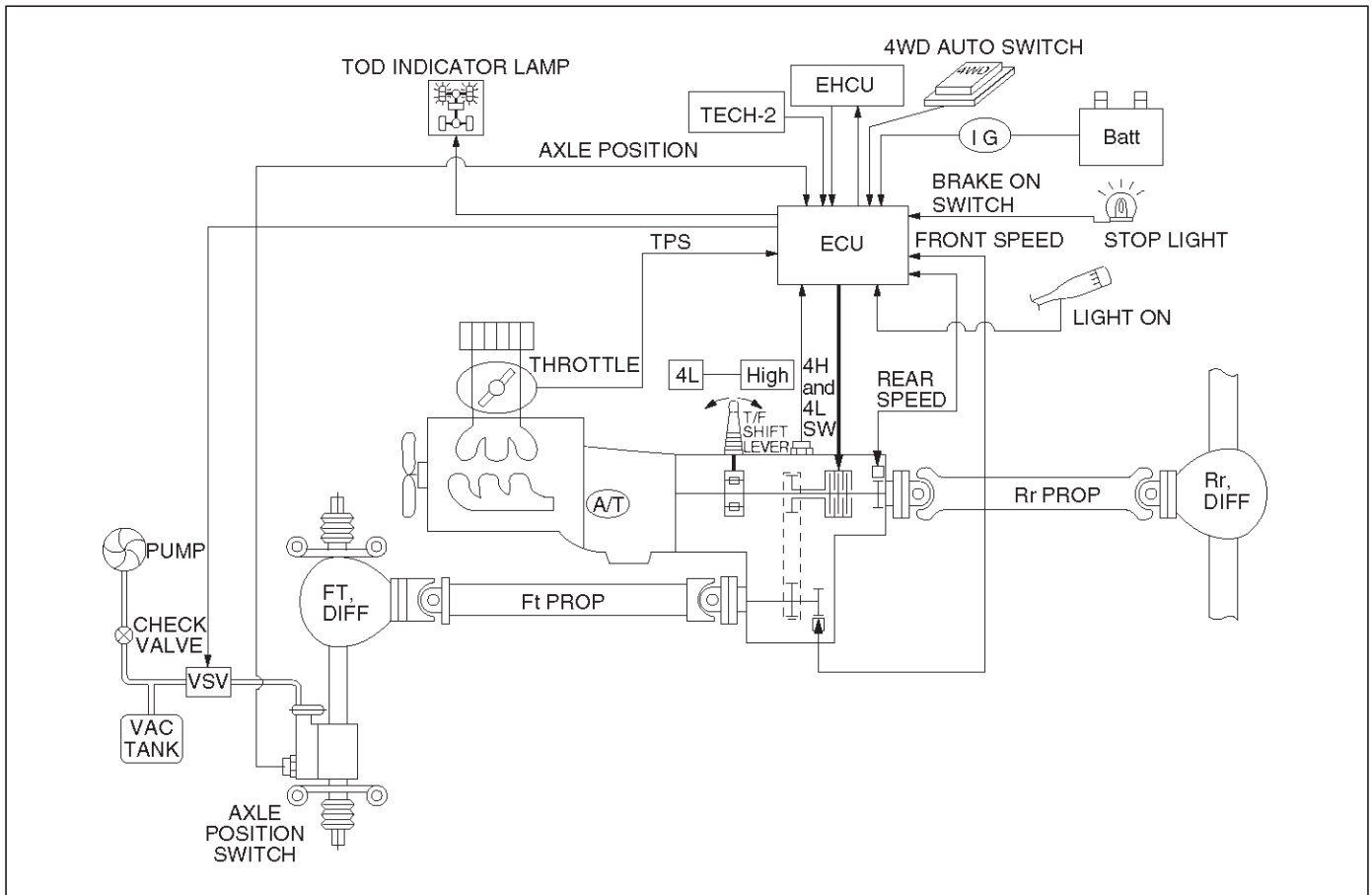
Service Precaution	4B2-1	Connector List	4B2-21
General Description	4B2-2	Checking Failed Pin	4B2-23
System Components	4B2-4	Checking Failed TOD Control Unit Pin	4B2-26
Parts Location	4B2-4	Diagnostic Trouble Codes	4B2-30
Functions of Indicator Lamp	4B2-8	Diagnosis from Trouble Codes	4B2-31
Diagnosis	4B2-12	Trouble Diagnosis Depending on The Status of TOD Indicator	4B2-58
Basic Diagnostic Flow Chart	4B2-16	Diagnosis from Symptom	4B2-86
Parts Location	4B2-17		
Circuit Diagram	4B2-18		

Service Precaution

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

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

General Description



C07RW014-1

TOD (Torque on Demand) system is traction state control system to vehicle.

Transfer Position and Drive Mode

Three drive modes can be selected through operation of 4WD switch and transfer lever.

Transfer Position	TOD SW	Mode	Drive mode
HIGH	ON (NORMAL)	2H	Rear wheel drive
	OFF (PUSHED)	TOD	Electronically controlled torque split four wheel drive
4L	ON/OFF	4L	Low-speed mechanical lock-up four wheel drive

The electronic control unit (ECU) judges the signals from the transfer lever and controls the transfer drive mode and shift-on-the-fly system status.

TOD Control

The TOD position usually drives the rear wheels, and transmits the torque to the front wheels with the help of electronically controlled torque split mechanism according to running conditions encountered. The driving force is directly transmitted to the rear wheels. This force is split by the transfer and delivered to the front wheels. The magnitude of the torque transmitted to the front wheels is controlled by changing the pressing force of the electromagnetic multi plate disk clutch built in the transfer unit. The pressing force of the clutch is controlled by

changing the voltage to the electromagnetic coil mounted to the rear of the clutch. When the clutch is completely disengaged, the rear wheels are driven. When the clutch is completely engaged, a rigid four wheel drive mode is obtained. The torque split status is controlled continuously between the rear wheel and four wheel drive modes. This system includes front and rear speed sensors, and throttle position sensor that monitors the engine output.

The control unit receives signals sent from these sensors and changes the pressing force of the electromagnetic multi plate disk clutch to determine the torque distribution on the front and rear wheels. Therefore, when the slip of the rear wheels is increased against the current torque level in the normal rear wheel drive mode, the control unit

detects the slip condition, determines the optimum torque based on the feedback control logic, and increases the torque to the front wheels.

The control unit uses the signal from the throttle position sensor to predict the future vehicle condition and the intention of the driver with respect to acceleration and deceleration, and determines the initial torque distribution using these data and the information from the speed sensors.

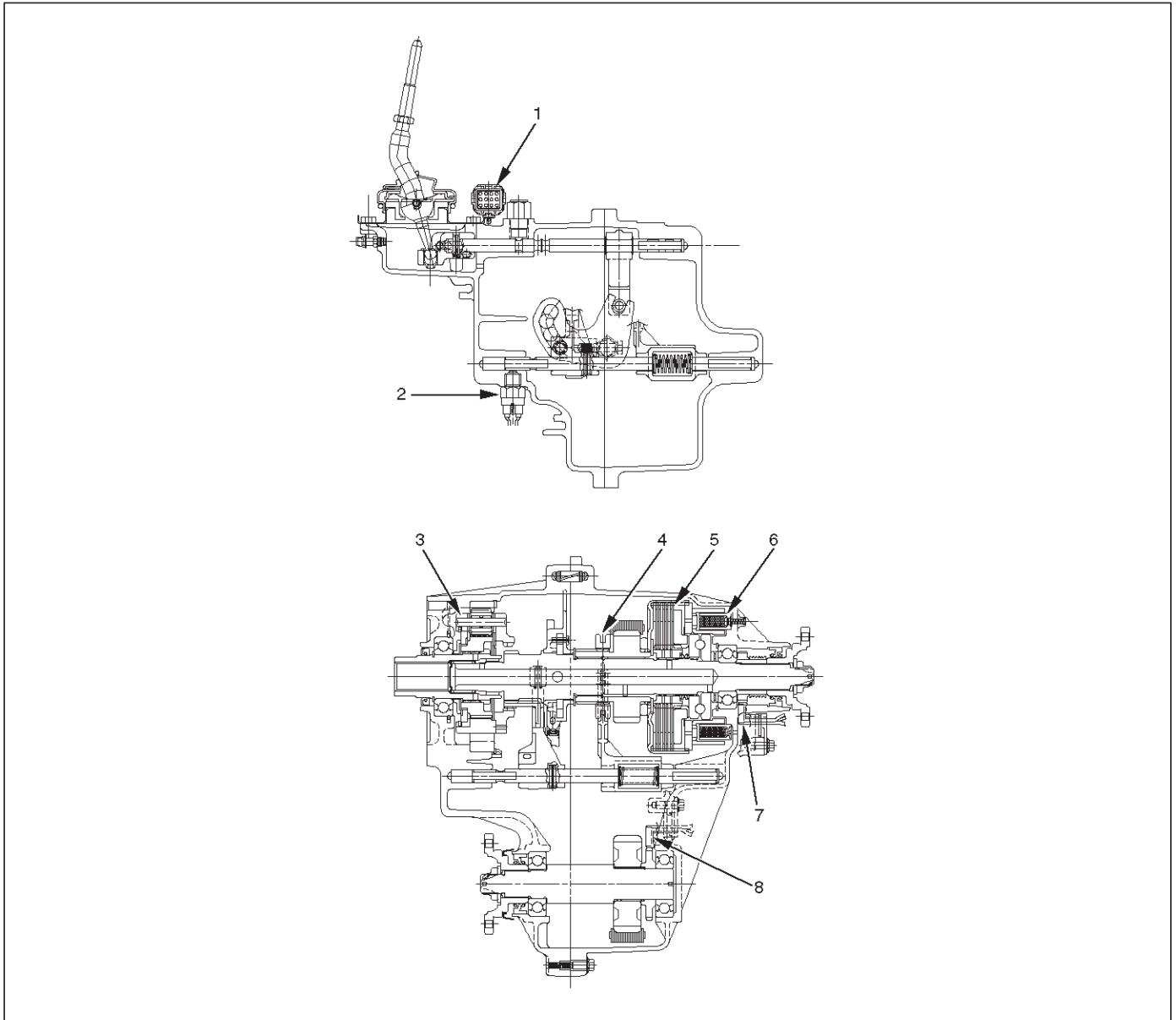
In case of small circle turning in the parking lot, for example, the control unit minimizes the clutch pressing force restrict a braking phenomenon. When the ABS becomes active, the control unit optimizes the clutch pressing force to ensure stable braking.

TOD Indicator Control

The TOD indicator on the instrument panel informs the driver of the current working status of the transfer unit. The information consists of two items: the drive mode (2H, TOD, 4L, transition) and the torque split status of the TOD (torque distribution level). The indicator can display occasional errors and corresponding error codes.

System Components

Parts Location



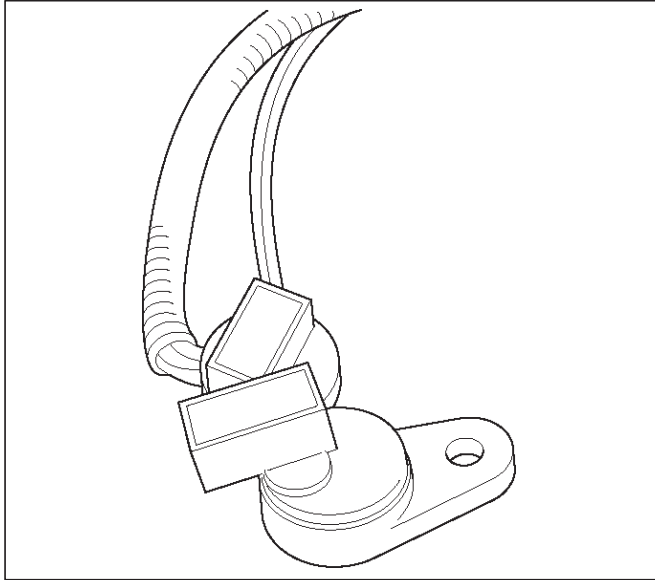
A07RW020

Legend

- | | |
|---------------------------------|----------------------------------|
| (1) T/F Connector | (5) Multi Plate Disk Clutch Pack |
| (2) 4H Switch and 4L Switch | (6) Electromagnetic Coil |
| (3) High-Low Planetary Gear Set | (7) Rear Speed Sensor |
| (4) Mechanical Lock | (8) Front Speed Sensor |

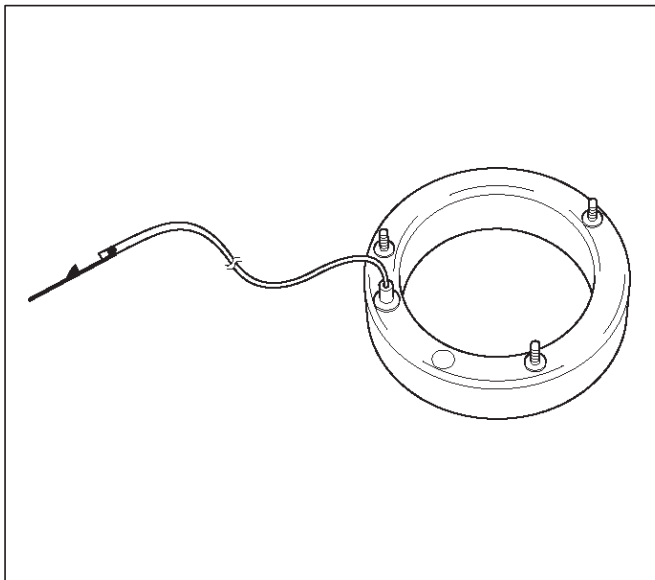
Front and Rear Speed Sensors

The sensors are built in the transfer case, detect the rotation of rotors directly coupled to the propeller shafts. Thirty rectangular pulses are output per one rotation of the propeller shaft.



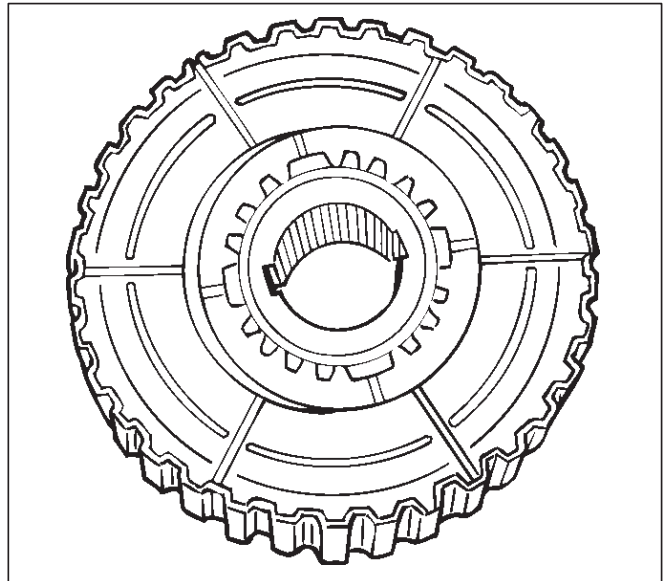
Electromagnetic Coil

Receives the duty signals from the TOD control unit and controls the pressing force of the clutch pressure cam.



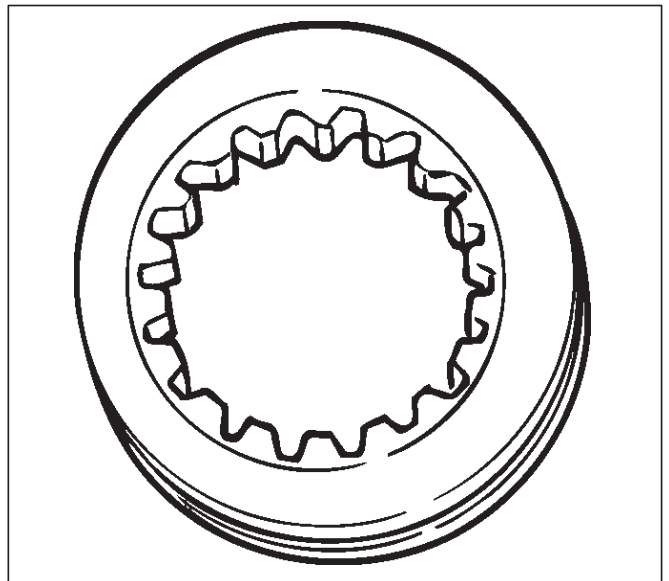
Multi Plate Disk Clutch Pack

Transmits the torque determined by the clutch pressing force to the front propeller shaft via the front drive chain.



Mechanical Lock Sleeve

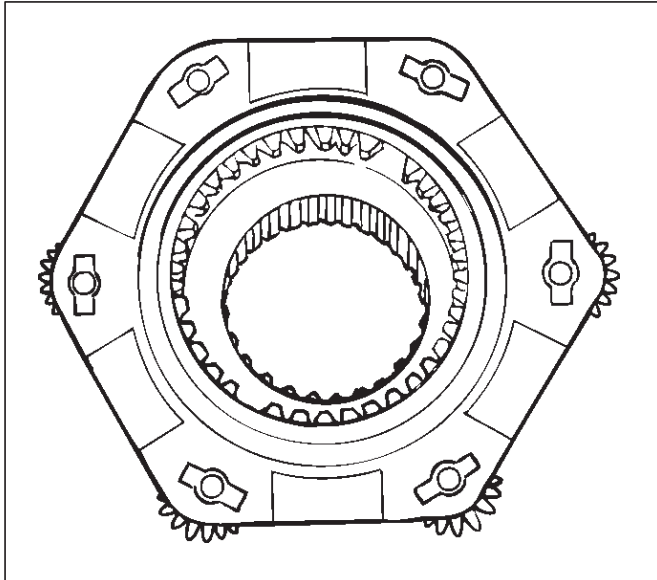
Couples the front and rear propeller shaft mechanically when the transfer shaft is in the 4L position.



4B2-6 DRIVE LINE CONTROL SYSTEM (TOD)

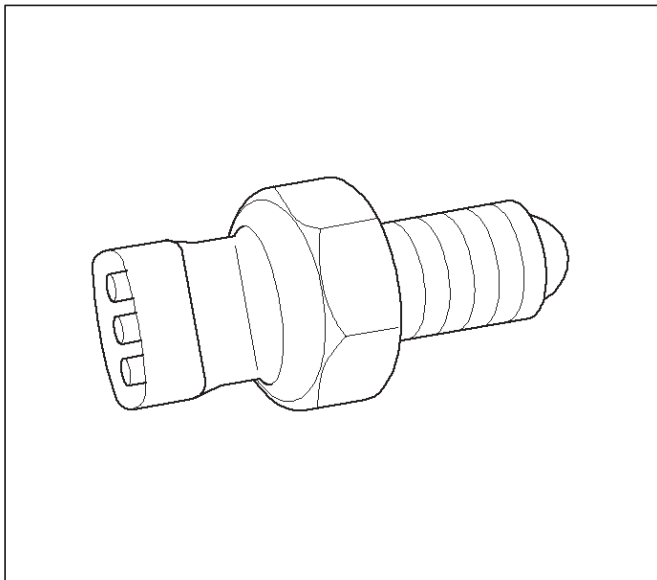
High-Low Planetary Gear Set

Establishes an auxiliary transmission mechanism. When the transfer shift lever is set to the 2H or TOD position, the reduction gear ratio is 1.000 and the corresponding driving force is generated. When the transfer shift lever is set to the 4L position, the reduction gear ratio is 2.480 and the corresponding driving force is generated.



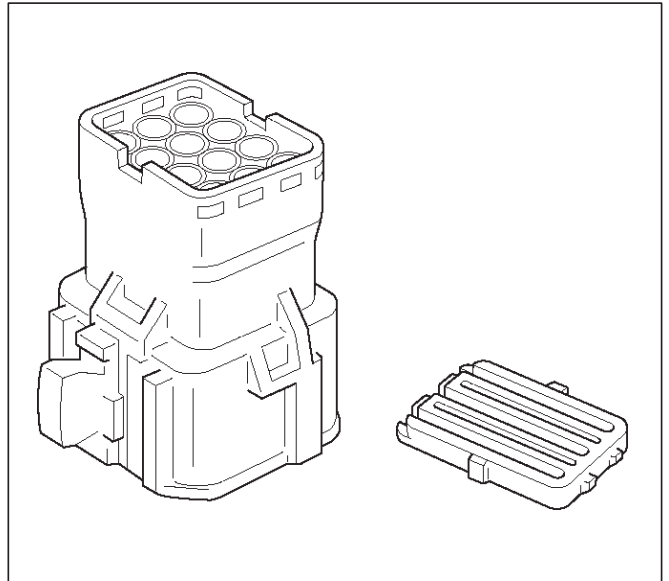
4H and 4L Switches

Detects the shift position of the transfer from the movement of the transfer lever and outputs signals to the TOD control unit.



Transfer Connector

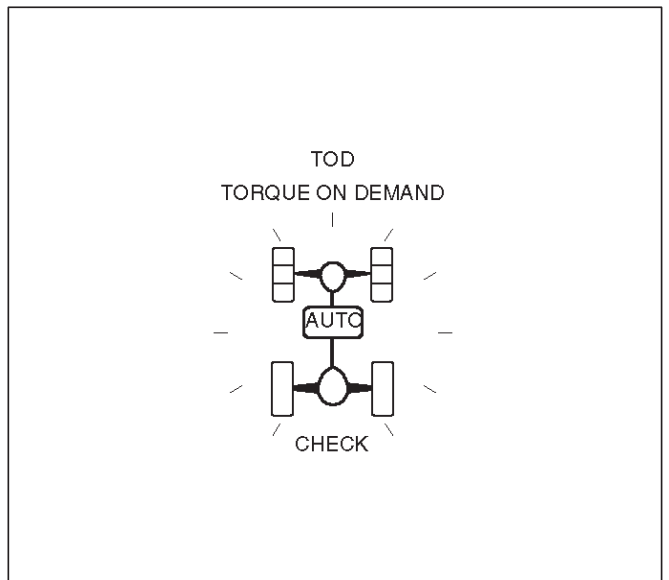
Transmits the input and output signals of the speed sensors, electromagnetic coil, and 4H and 4L switches to the vehicle harness. A waterproof 12-pin type is used.



TOD Indicator Lamps (on the instrument panel)

Inform the following items.

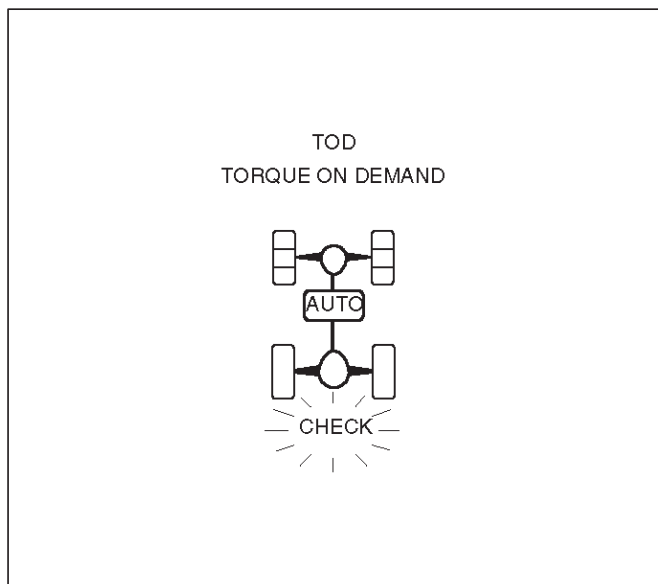
- Bulb check
- Drive mode
- ABS IN status
- BRAKE ON status



Check Lamp

Inform the following items.

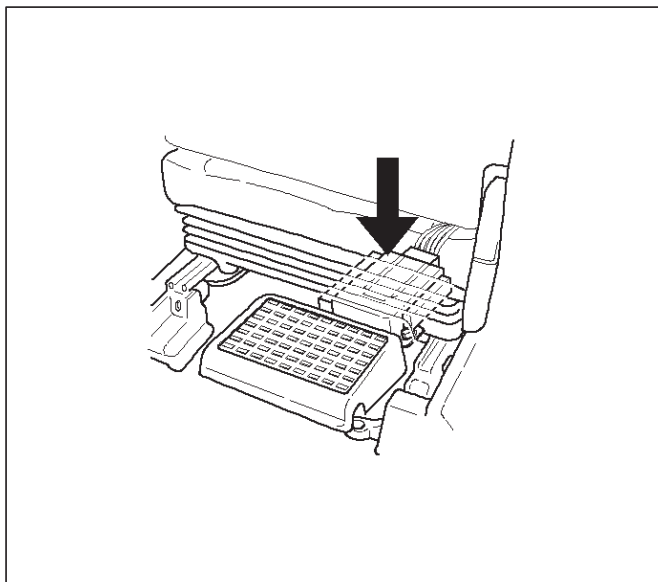
- Bulb check
- Fail (fail alarm)
- Trouble code
- Diesel/gasoline MAP



821RW078

TOD ECU












This control unit is mounted to the front right hand seat via a special bracket.



F07RW029

Functions of Indicator Lamp

TOD Indicator Lamps

Output condition					Indicator indicate state	Remark	4WD Auto sw state	Each sw state			
ECU Terminal No.								4WD SW point of contact	4H SW	4L SW	AXLE SW
25	26	27	28	29							
1	1	1	1	0	 2H Mode			ON	OFF	OFF	OFF
0	0	0	1	0	 4L Mode			ON / OFF	OFF	ON	ON
1	1	1	1	1	 N Mode			ON / OFF	ON	ON	OFF
1	1	1	0	0	 TOD Mode1	Traction distribution about 0:100		OFF	OFF	OFF	ON
1	1	0	0	0	 TOD Mode2	Traction distribution about 15:85					
1	0	0	0	0	 TOD Mode3	Traction distribution about 30:70					
0	0	0	0	0	 TOD Mode4	Traction distribution about 50:50					

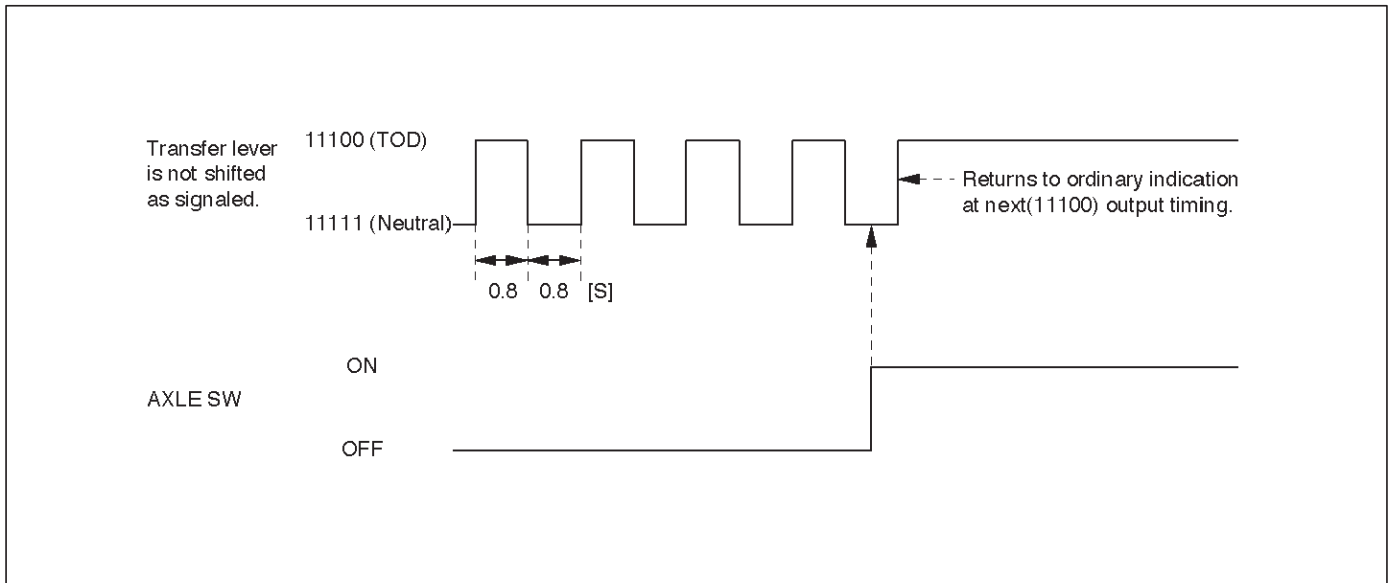
1=12V 0=GND

NOTE : Traction distribution is about a standard.

Indication During Transition of Transfer Lever

When the transfer lever is shifted, and the signals from the AXLE switch do not comply with the signal conditions of the 4H and 4L switch, the transfer lever position signals generated by the 4H and 4L switch and the N position signals are repeatedly output at an interval of 0.8 second.

NOTE: After the transfer lever is set to the specified position and the AXLE switch generates compliant signals, the normal output status is returned.

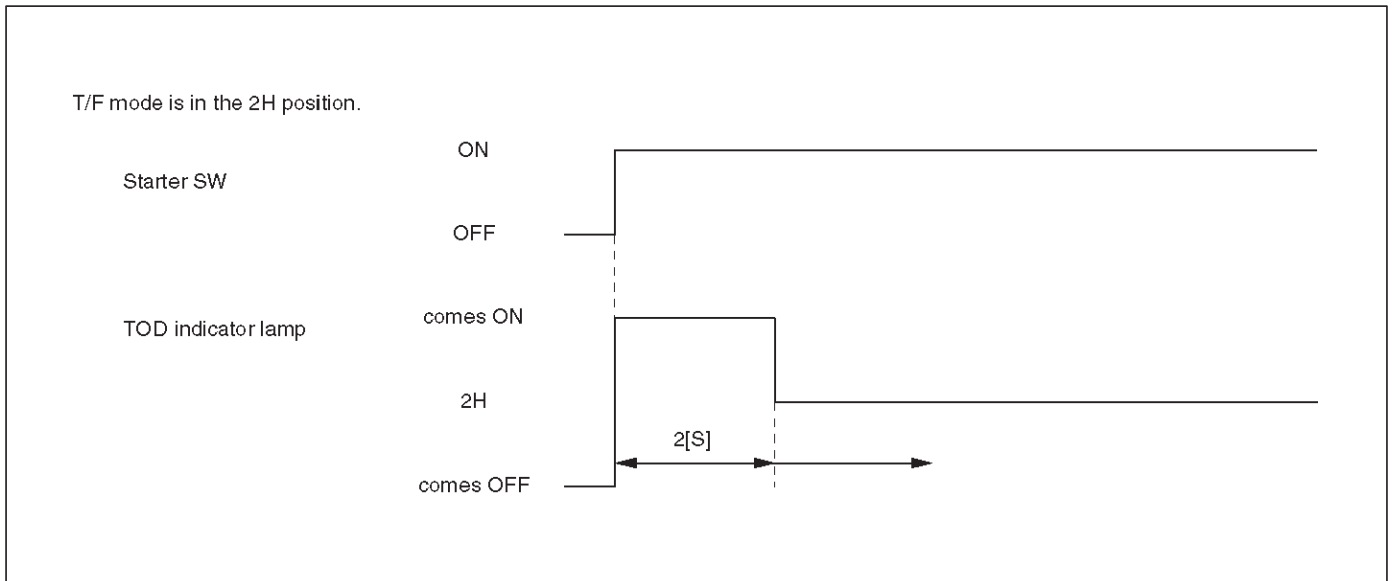


C07RW061

Bulb Check

When the starter switch is turned on, the TOD indicator lamps go on as shown below.

NOTE: Once the starter switch is turned on, all the TOD indicator lamps are lit for two seconds even if the transfer lever is in any position.

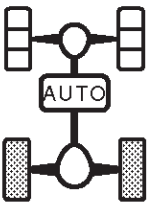
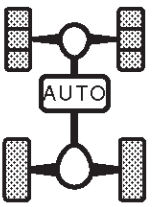
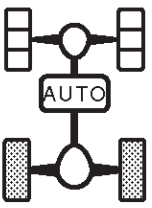
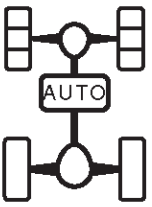


C07RW016

4B2-10 DRIVE LINE CONTROL SYSTEM (TOD)

Simplified checking method of ABS IN and BRAKE ON signals:

In the event that any of the signal inputs listed below are observed while the self-diagnostic code is being displayed (the self-diagnostic connector is short-circuited to GND), you can simply check the ABS IN and BRAKE ON signals as shown in the figures below.

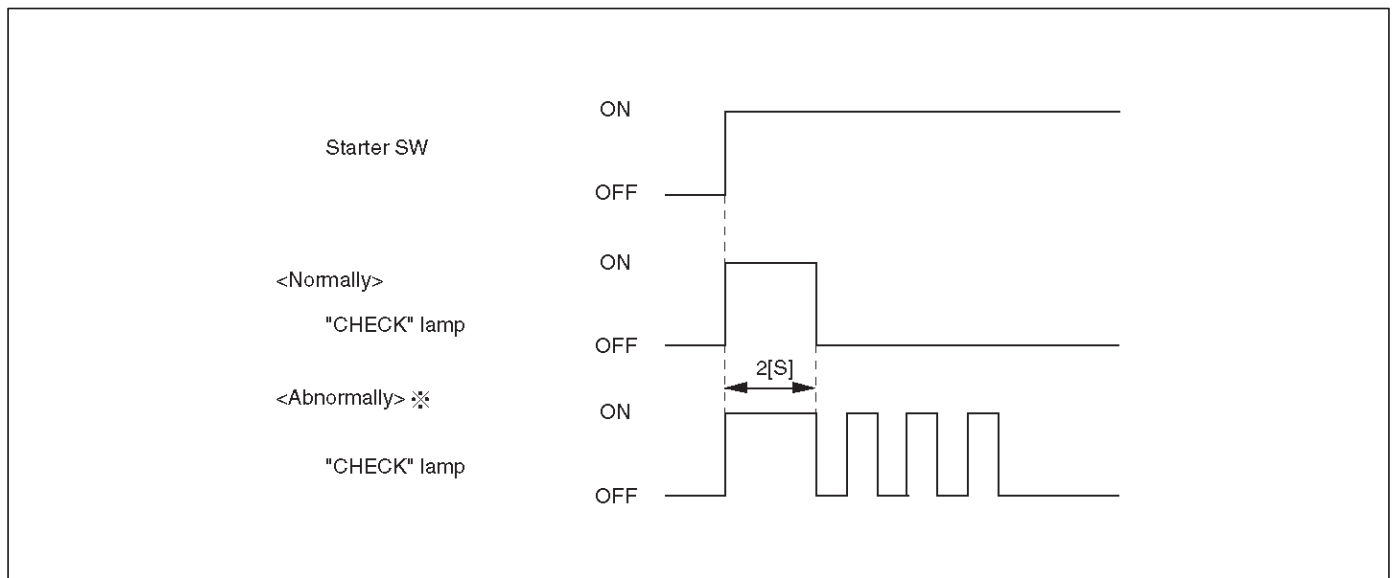
1		<ul style="list-style-type: none"> • In case of ABS IN signal being inputted, TOD indicator light is on as illustrated while the signal is inputted.
2		<ul style="list-style-type: none"> • In case of BRAKE ON signal being inputted, TOD indicator light is on as illustrated while the signal is inputted.
3		<ul style="list-style-type: none"> • When "1, 2" signals are inputted simultaneously, signal "1" (ABS IN) is indicated preferentially.
4		<ul style="list-style-type: none"> • In cases other than "1, 2, 3", the indication is always as illustrated. (This is light-off mode) • TOD indicator light returns to usual control (mode) at 12 km/h or more.

C07RW017

Check Lamp

Check Lamp Valve Check

When the starter switch is turned on in the normal state, the control unit turns on the CHECK lamp to check the bulb.



C07RW019

The CHECK lamp also has the following functions.

D-G MAP recognition and display (The control unit displays what type of vehicle, diesel or gasoline vehicle, it recognizes.)

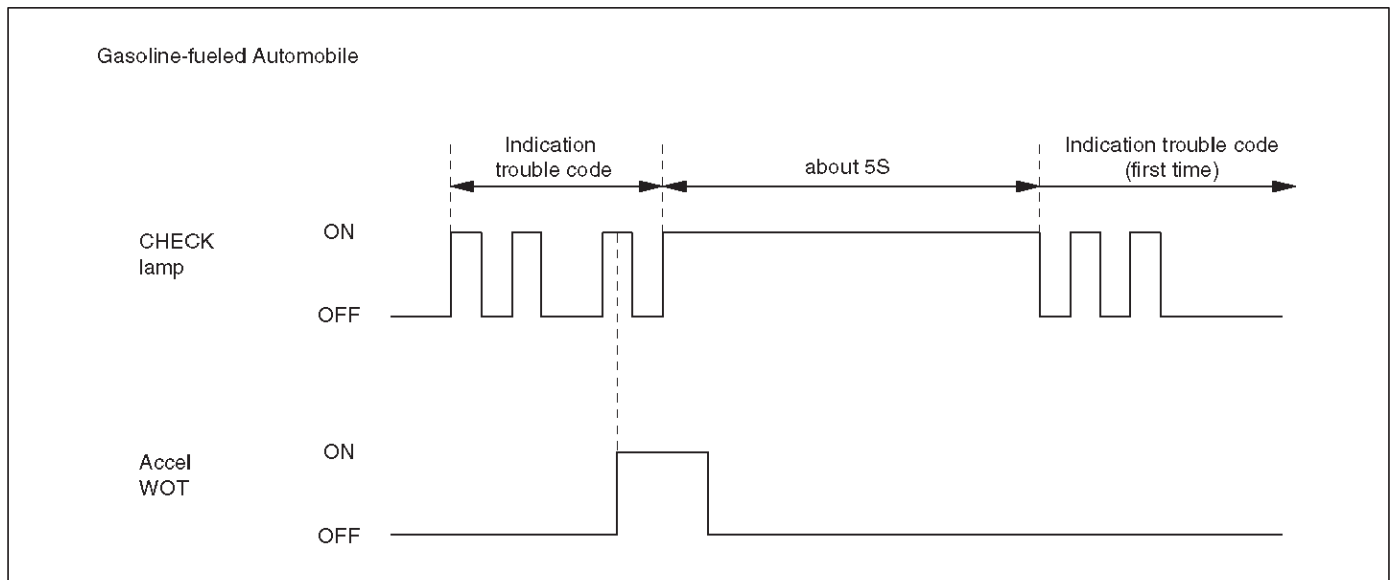
1. Short-circuit the self-diagnostic connector.
2. Turn on the starter switch. (Displays with respect to the self-diagnosis begin to appear.)

NOTE: Do not start the engine.

3. Shift the transfer lever to the neutral position between HIGH and 4L.
4. After all the conditions in 1 through 3 above are met, set the throttle to the WOT (wide open throttle) position (i.e., full open position). The display of the self-diagnosis is temporarily suspended, and the CHECK lamp begins to display that MAP is recognized by the TPS (throttle position sensor) according to the current conditions.

NOTE: If the TPS has failed, this function might not work.

1. When the control unit recognizes the vehicle as gasoline type, the CHECK lamp is turned on for five seconds and this mode is repeated at an interval of 0.3 second.
2. When the control unit recognizes the vehicle as diesel type, the CHECK lamp is turned off for five seconds and this mode is repeated at an interval of 0.3 seconds.
3. Upon completion of step 4, the system resumes the self-diagnosis. (The self-diagnosis is executed from the beginning.)
5. Turn off the starter switch once. When above conditions are met again in the future, the TPS MAP control can be started.



4B2-12 DRIVE LINE CONTROL SYSTEM (TOD)

Diagnosis

General Information Diagnosis

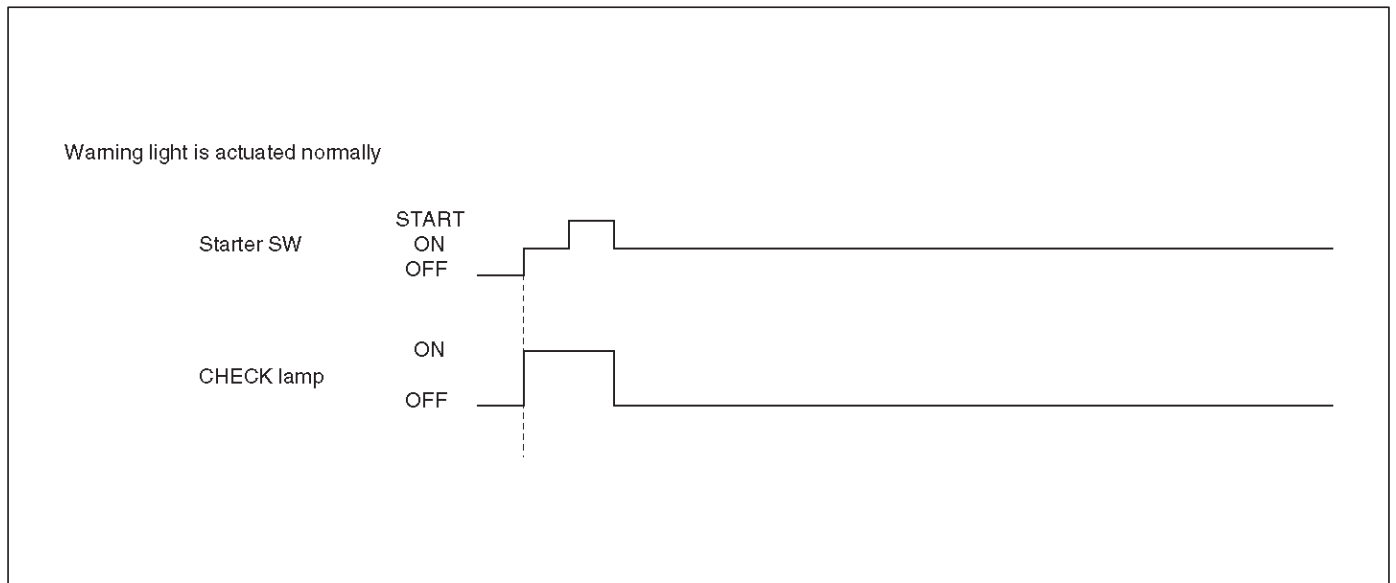
The troubles on TOD are classified into the group that can be identified by the lighting status of the TOD indicator lamps and those that can be recognized as abnormal phenomena of the vehicle by the driver.

The troubles that can be identified by the lighting status of the TOD indicator lamps are examined by the procedures

Self-diagnosis

The control unit has a function of self-diagnosis. If a trouble occurs in the course of system startup, the control unit blinks the CHECK lamp and saves the trouble code.

“Diagnosis from Trouble Codes” and “Trouble Diagnosis Depending on The Status of TOD indicator”. The troubles that can be recognized as abnormal phenomena of the vehicle by the driver are examined by the procedure “Diagnosis from symptom”.



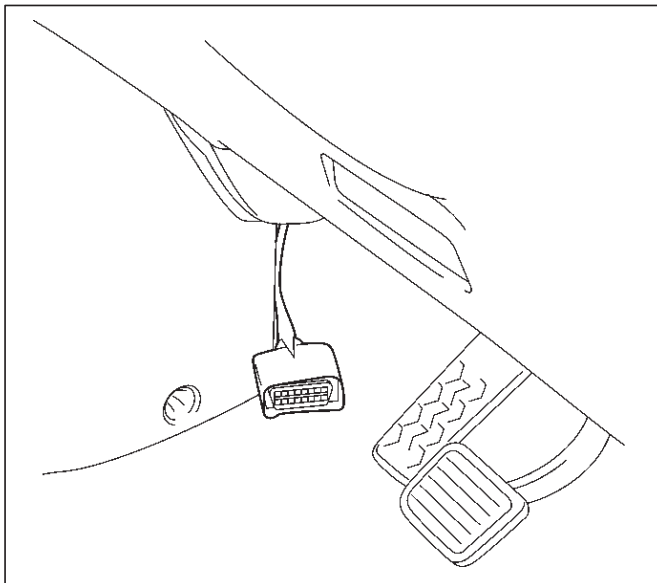
C07RW021

NOTE: If an intermittent fault occurs, the control unit stops blinking upon removal of the fault. The trouble code is saved to the control unit.

Indication Method of Trouble Code

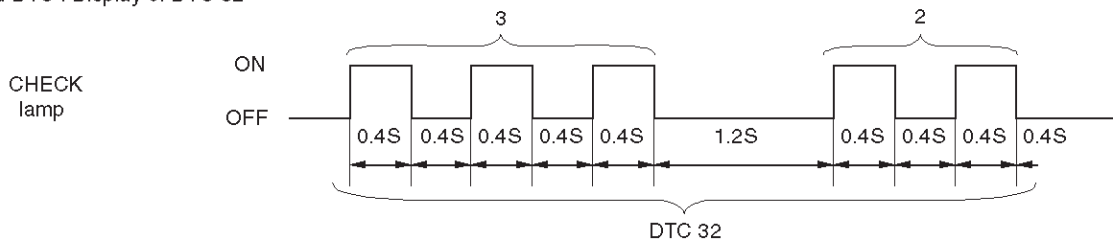
- Short-circuit terminal 8 of the self-diagnostic connector to GND to display the trouble code on the CHECK lamp.

- If no trouble codes exist, code "12" is displayed continuously.
- If trouble codes exist, code "12" is displayed three times, and the trouble codes, starting from the smaller code number, are displayed three times respectively.

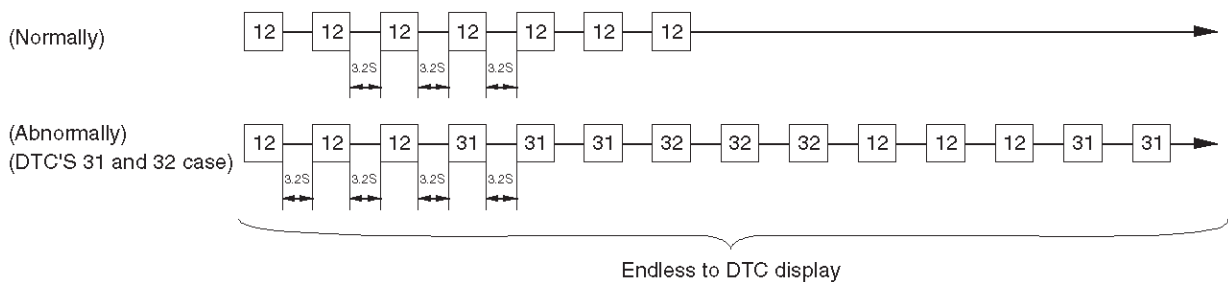


810RW308

How to read DTC : Display of DTC 32



An example of DTC display



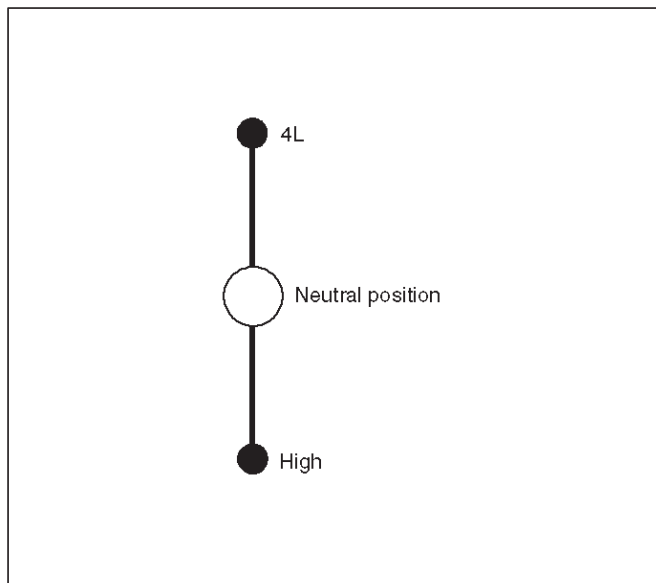
4B2-14 DRIVE LINE CONTROL SYSTEM (TOD)

How to Clear The Trouble Code

The trouble codes saved to the control unit can be deleted by the following procedure if the starter switch is being in the OFF position.

1. Shift the transfer lever to the neutral position between HIGH and 4L, and short-circuit the self-diagnostic connector.

NOTE: The neutral position between HIGH and 4L refers to the point that turns off the TOD indicator lamps. (However, be sure to check the position before short-circuiting the self-diagnostic connector.)



C07RW011

2. Turn on the starter switch while maintaining the state of step 1, and step on the brake pedal five times within five seconds from the first step on. (Note that "five times" includes the first step on). (The TOD indicator lamps display the 4L mode whenever the brake pedal is stepped on.)
3. If the conditions shown in steps 1 and 2 are met, clear the trouble codes saved to the control unit. (After the codes are completely deleted, the code 12 that indicates the normal condition is continuously displayed.)

Precautions on Diagnosis

Replacement of Control Unit

The control unit itself rarely fails. In most cases, the harnesses have failed (e.g. short-circuit) to cause secondary troubles. Other cases include that the cause has been unknown due to intermittent occurrence of troubles and the troubles are removed accidentally along with replacement of control unit, resulting in misjudgment of cause. Therefore, before replacing the control unit, check the connector joints and whether the unspecified current flows in the control unit due to short-circuit between harnesses.

Trouble Intermittently Observed

Troubles intermittently observed are mostly attributable to temporary imperfect connection of harnesses and connectors.

When such troubles are found, check the associated circuit according to the following procedure.

1. Check whether improper connectors are plugged in or connector terminals are completely engaged.
2. Check whether the terminals are deformed or damaged. If yes, remove the deformation or damage and connect the terminals securely.
3. It is likely that wires in the harness are falsely broken. Therefore, in examination of failed harness circuit, shake the harness for check to such extent that the harness will not be damaged.

Test Run of Filed TOD Vehicle

If the TOD indicator lamps experienced faulty operation even once in the past, the failed portion can be identified by use of the procedure "Diagnosis from Trouble Codes" or "Trouble Diagnosis Depending on The Status of TOD Indicator". If the troubles that are only recognized as abnormal phenomena of the vehicle by the driver are observed, conduct the test run in the following procedure to reproduce the faulty phenomena and diagnose the fault for each phenomenon.

1. Start the engine, and check that the TOD indicator lamps are turned on for about two seconds for initial check; the CHECK lamp goes off; and the TOD indicator lamps display the specified drive mode. (If the CHECK lamp starts blinking, read the trouble codes and identify the failed portion.)
2. While keeping the vehicle standstill, operate the 4WD switch and shift the transfer lever to change the modes: 2H mode → TOD mode → 4L mode → TOD mode → 2H mode. Check that the TOD indicator lamps correctly display the status whenever the mode is changed. If the transition status is displayed during the shift operation, run the vehicle a little to complete shifting.
3. Slowly start the vehicle in the TOD mode, and add the power to accelerate to at least 40 km/h and maintain the speed for about two minutes. Apply the brake to completely stop the vehicle. Repeat this test pattern at least three times.
4. Turn the steering to the right end (or left end) in the TOD mode, and slowly start the vehicle and make a circle five times. Next, conduct the same test in the 2H mode.
5. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h. Keep the established speed, carefully change the mode in the sequence "TOD mode → 2H mode → TOD mode" while checking that the shift is complete in each mode change. After the test, apply the brake to completely stop the vehicle.
6. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h. Apply the brake strongly so that the ABS works, and completely stop the vehicle.

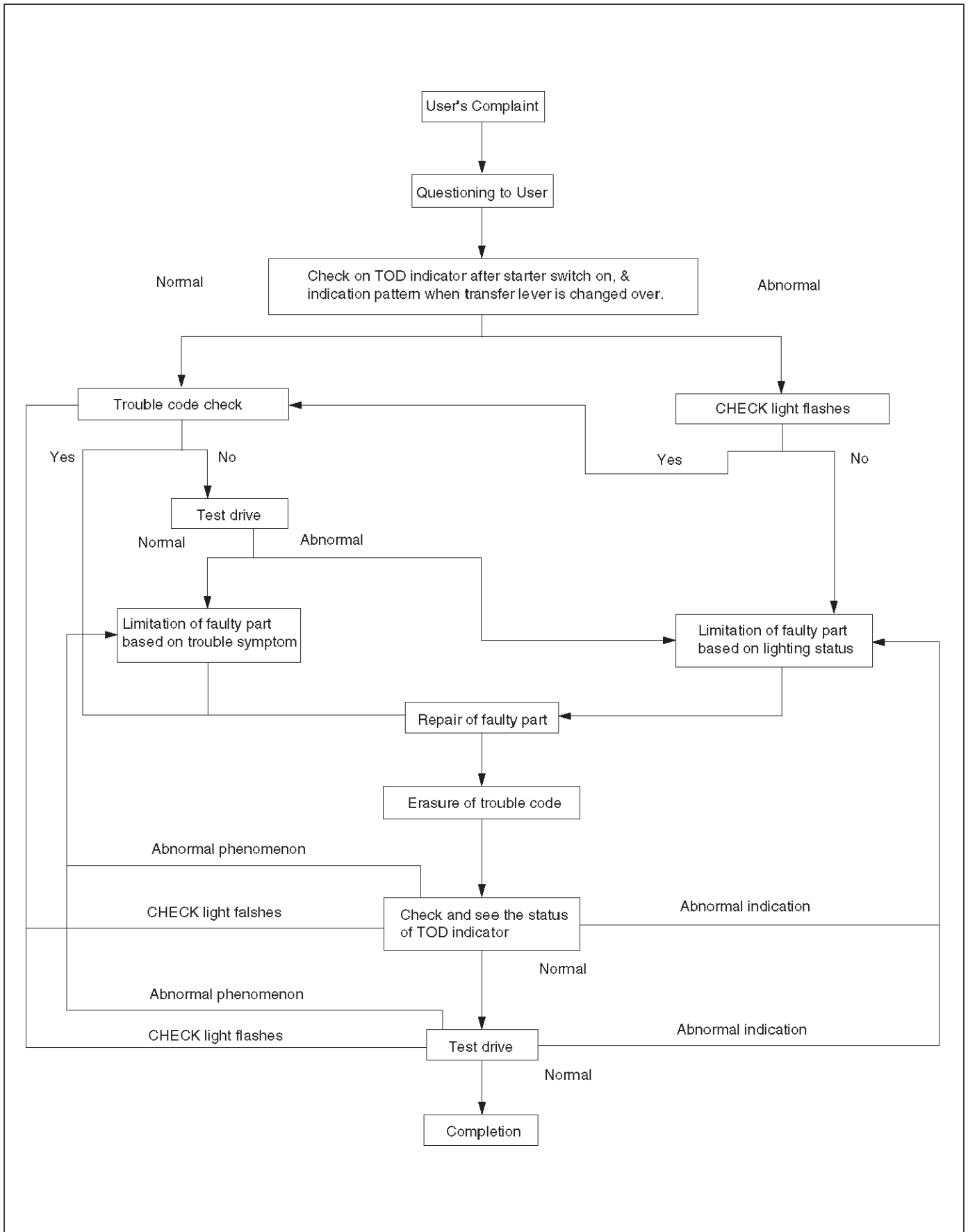
7. Slowly start the vehicle in the 4L mode, and accelerate to at least 20 km/h. Apply the brake to completely stop the vehicle.

If the CHECK lamp starts blinking during the test run, read the trouble codes and give appropriate maintenance according to the fault diagnostic procedure. If the TOD indicator lamps are lit abnormally during the run, check the lighting condition and give appropriate maintenance according to the fault diagnostic procedure. Even if the phenomena are not observed, try to reproduce the abnormal state reported by the customer to the possible extent.

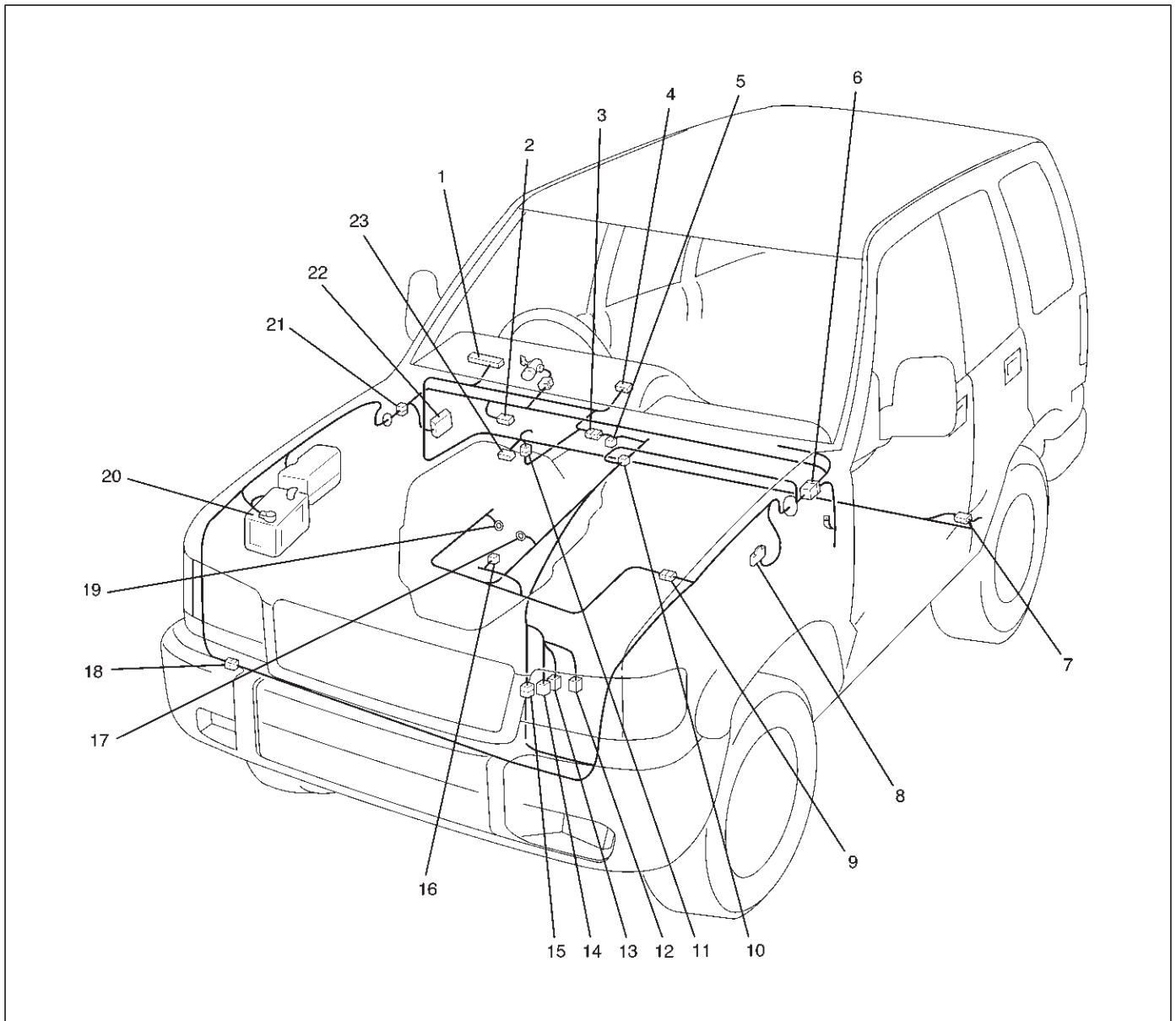
Post-Repair Check

As long as the starter is not turned off, the TOD indicator lamps continue blinking even after the failed control unit is repaired. Therefore, upon completion of repair, be sure to turn off the starter switch once and then turn on it to conduct the test run sequence specified in steps 1 through 6 above and check that the TOD indicator lamps no longer show any faulty status.

Basic Diagnostic Flow Chart



Parts Location



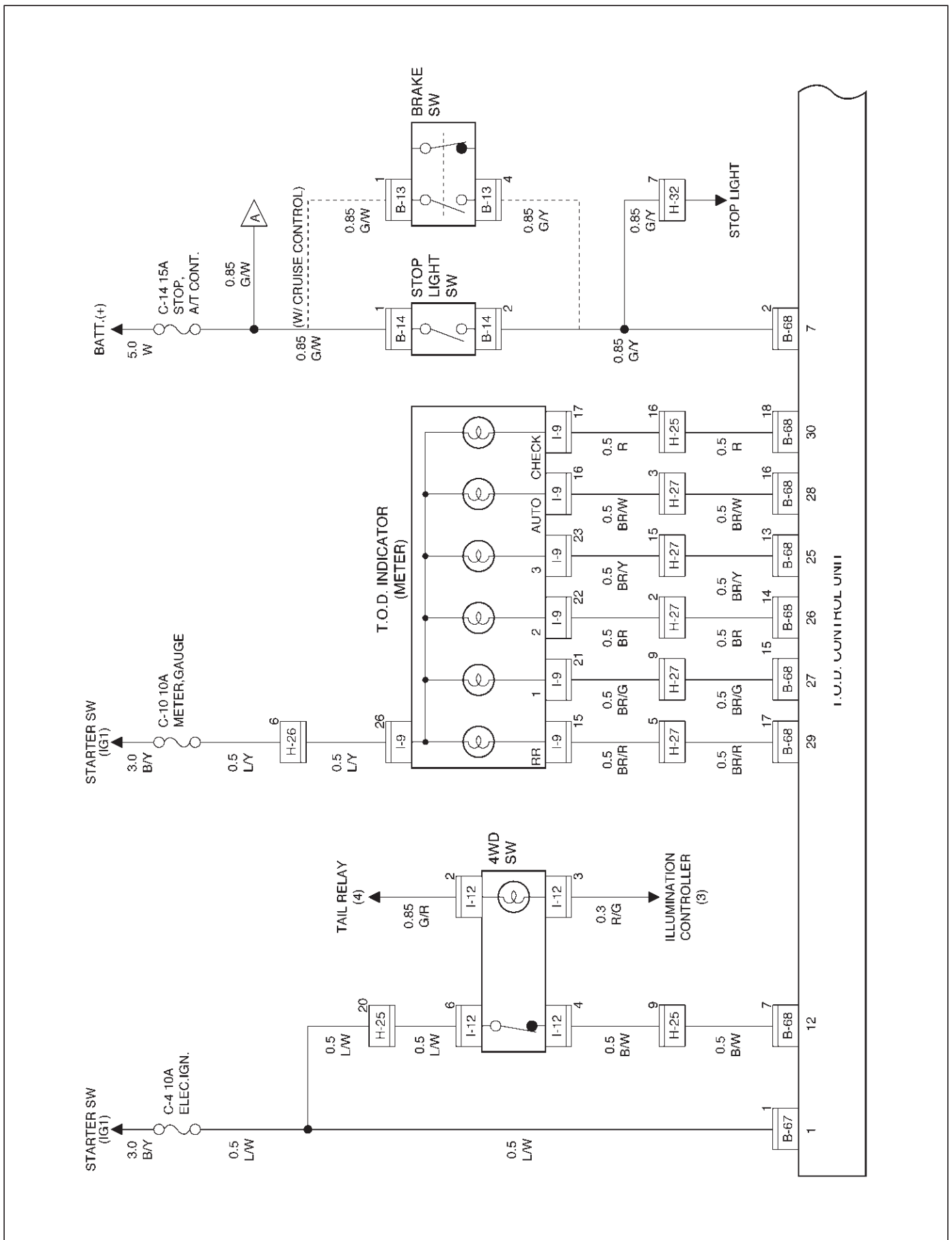
D08RW621

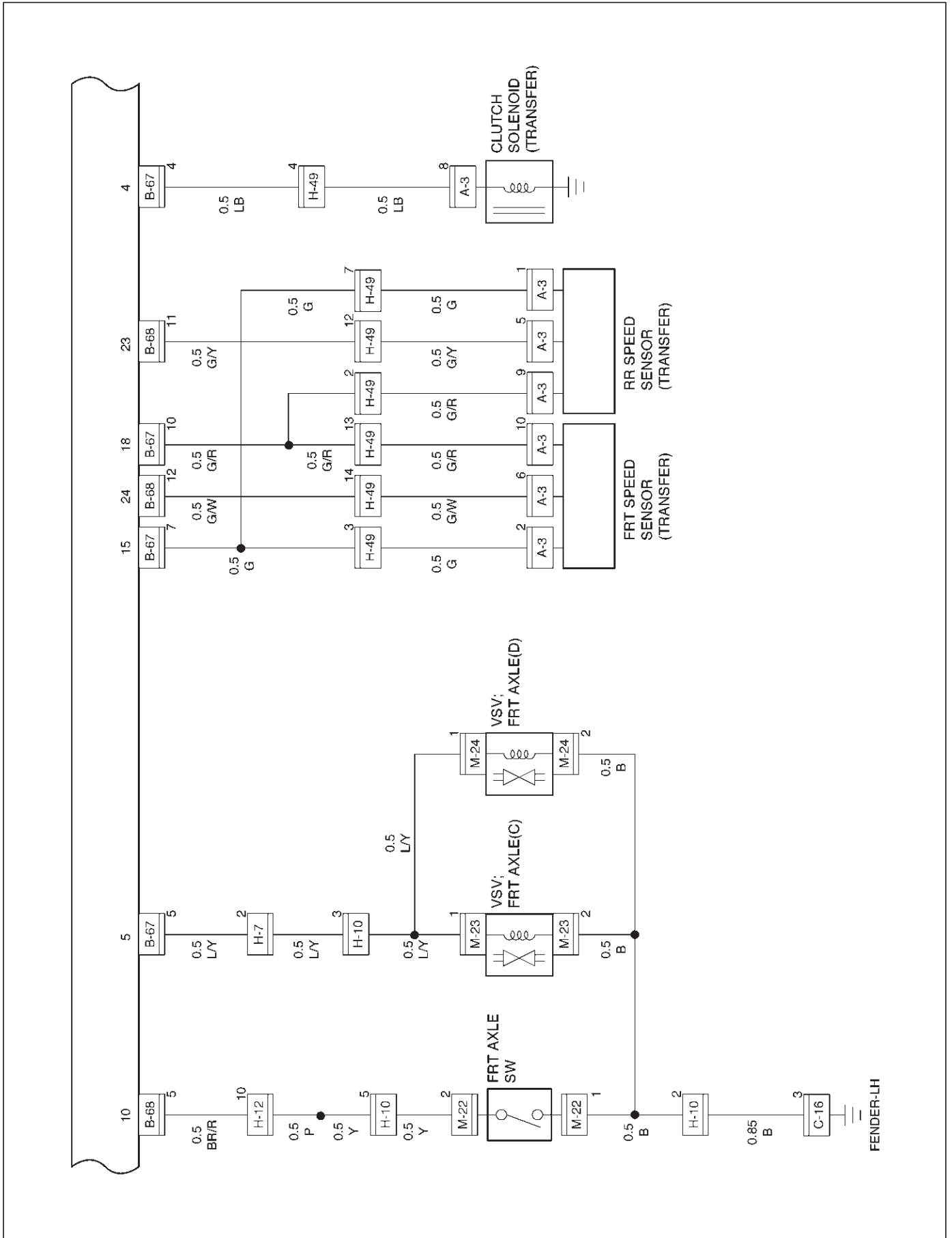
Legend

- | | |
|------------------|-----------------------|
| (1) I-9 | (12) M-22 |
| (2) B-13 or B-14 | (13) M-23 |
| (3) H-12 | (14) M-24 |
| (4) I-12 | (15) H-10 |
| (5) A-3 | (16) E-5 |
| (6) H-7, H-8 | (17) E-29 |
| (7) H-32 | (18) H-42 |
| (8) C-16 | (19) E-30 |
| (9) H-5, H-6 | (20) Battery |
| (10) C-63 | (21) H-13, H-15, H-26 |
| (11) H-49 | (22) Fuse Box |
| | (23) B-67, B-68 |

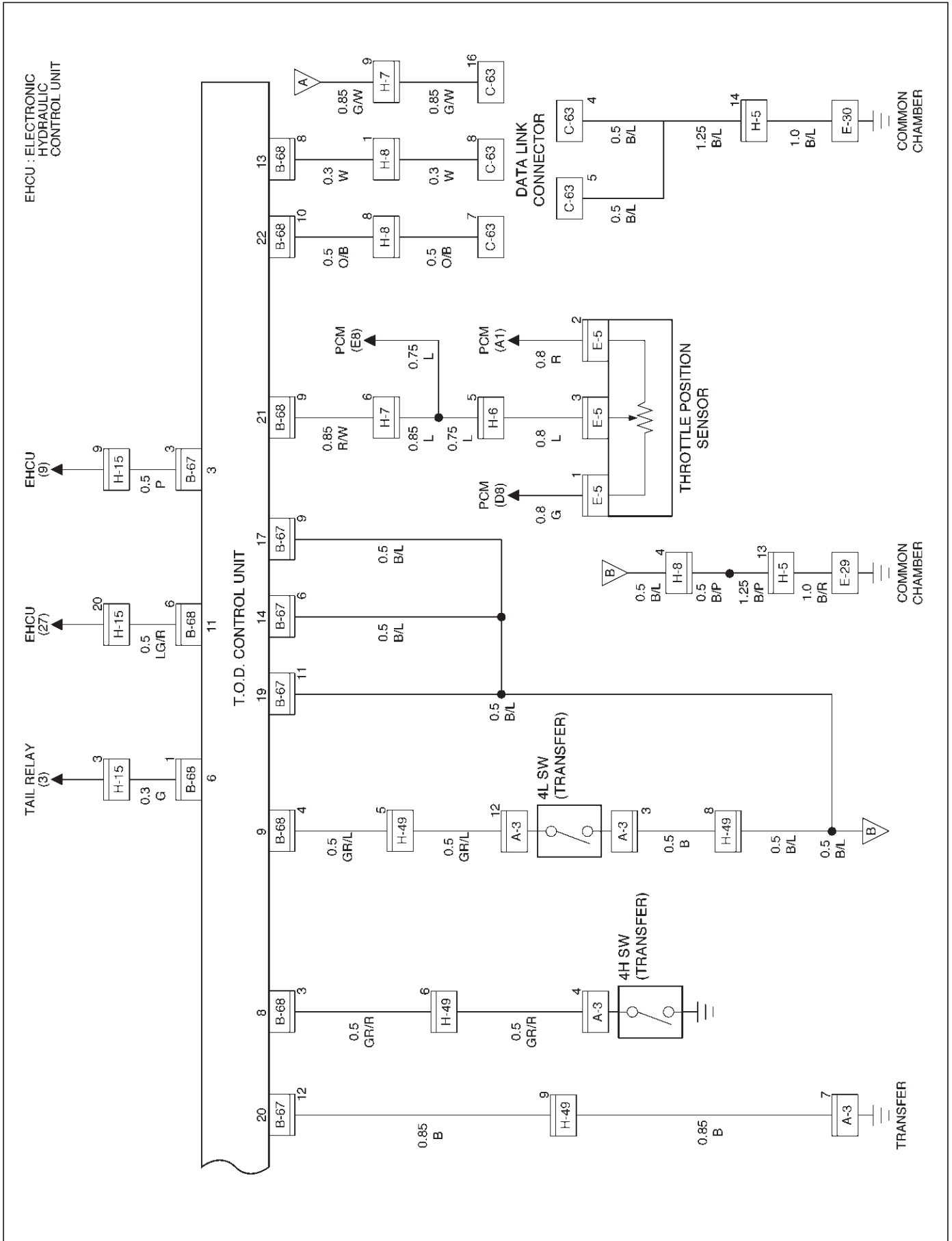
4B2-18 DRIVE LINE CONTROL SYSTEM (TOD)

Circuit Diagram


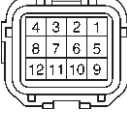


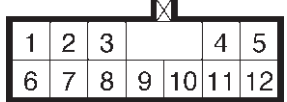
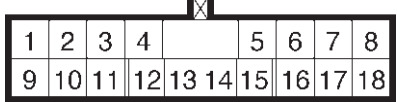
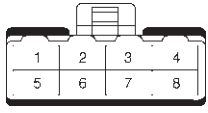
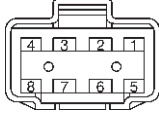
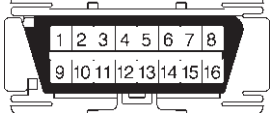
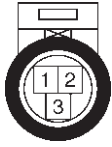
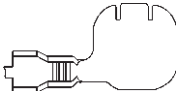

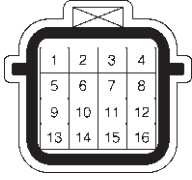
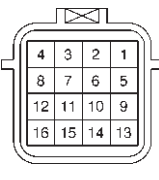
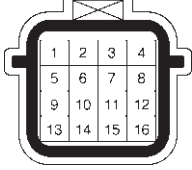
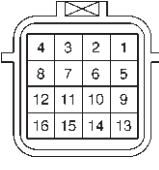
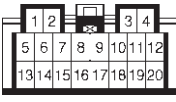
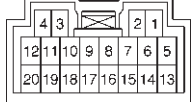




4B2-20 DRIVE LINE CONTROL SYSTEM (TOD)



Connector List

No.	Connector face	
A-3		
B-13		
B-14		
B-67		
B-68		
C-16		
C-63		
E-5		
E-29		
E-30		
H-5		
H-6		
H-7		

4B2-22 DRIVE LINE CONTROL SYSTEM (TOD)

No.	Connector face	
H-8		
H-10		
H-12		
H-15		
H-25		
H-26		
H-27		
H-32		
H-49		
I-9		
I-12		
M-22		
M-23		
M-24		

Checking Failed Pin Connector Pin Assignment

- ECU pin assignment

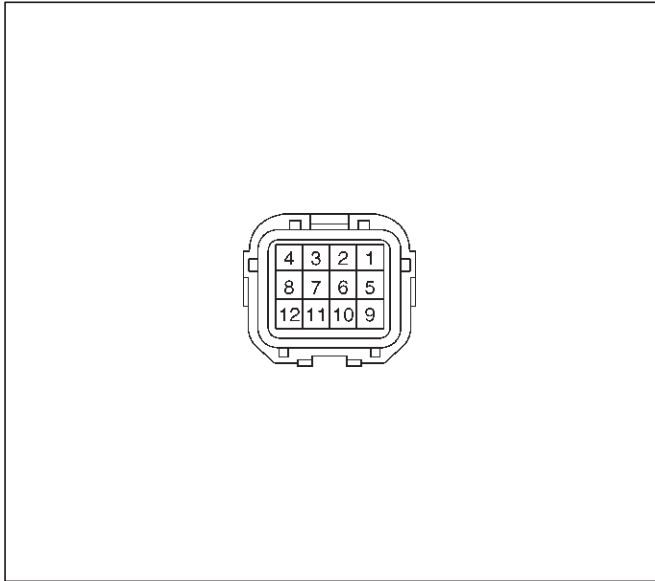


4B2-24 DRIVE LINE CONTROL SYSTEM (TOD)

No.	NAME	CONTENTS
1	VIG	Power supply (IG)
2	N.C	Not used
3	4WD OUT	4WD signal output
4	SOL (+)	Electromagnetic solenoid
5	ADC (+)	Axle disconnect output
6	LIGHTING SW	Lighting SW input
7	BRAKE	Brake SW input
8	4H SW	4H SW input
9	4L SW	4L SW input
10	AXEL SW	AXEL SW input
11	ABS IN	Operation signal input
12	TOD SW	TOD SW input
13	DIAG	Self-diagnosis input
14	D-G MAP	D-G MAP recognition input (Only V6 engine)
15	Ref.	Vehicle speed sensor supply
16	N.C	Not used
17	US/JAP	Destination recognition input
18	COM (-)	Vehicle speed sensor GND
19	S-GND	Sensor GND
20	P-GND	Power GND
21	TPS	Throttle position sensor
22	TECH 2	TECH 2 output
23	Rer. Sig	Rear vehicle speed sensor input
24	Fr. Sig	Front vehicle speed sensor input
25	IND.a	4WD display signal a
26	IND.b	4WD display signal b
27	IND.c	4WD display signal c
28	IND.AUTO	AUTO display output
29	IND Rr	Rear display output
30	CHECK	TOD warning lamp

Reference

- Transfer connector pin assignment (connector on the transfer case)
for inspection of transfer pins.



No.	NAME	CONTENTS
1	Ref. (Rer.)	Rear speed sensor reference output
2	Ref. (Frt.)	Front speed sensor reference output
3	SW GND	SW GND
4	4H SW (+)	4H SW plus terminal
5	Rer. (+)	Rear speed sensor plus
6	Frt. (+)	Front speed sensor plus
7	POWER GND	Power GND
8	SOL (+)	Electromagnetic solenoid
9	COM (-) (Rer.)	Rear speed sensor GND
10	COM (-) (Frt.)	Front speed sensor GND
11	NC	Not used
12	4L SW (+)	4L SW plus terminal

4B2-26 DRIVE LINE CONTROL SYSTEM (TOD)

Checking Failed TOD Control Unit Pin

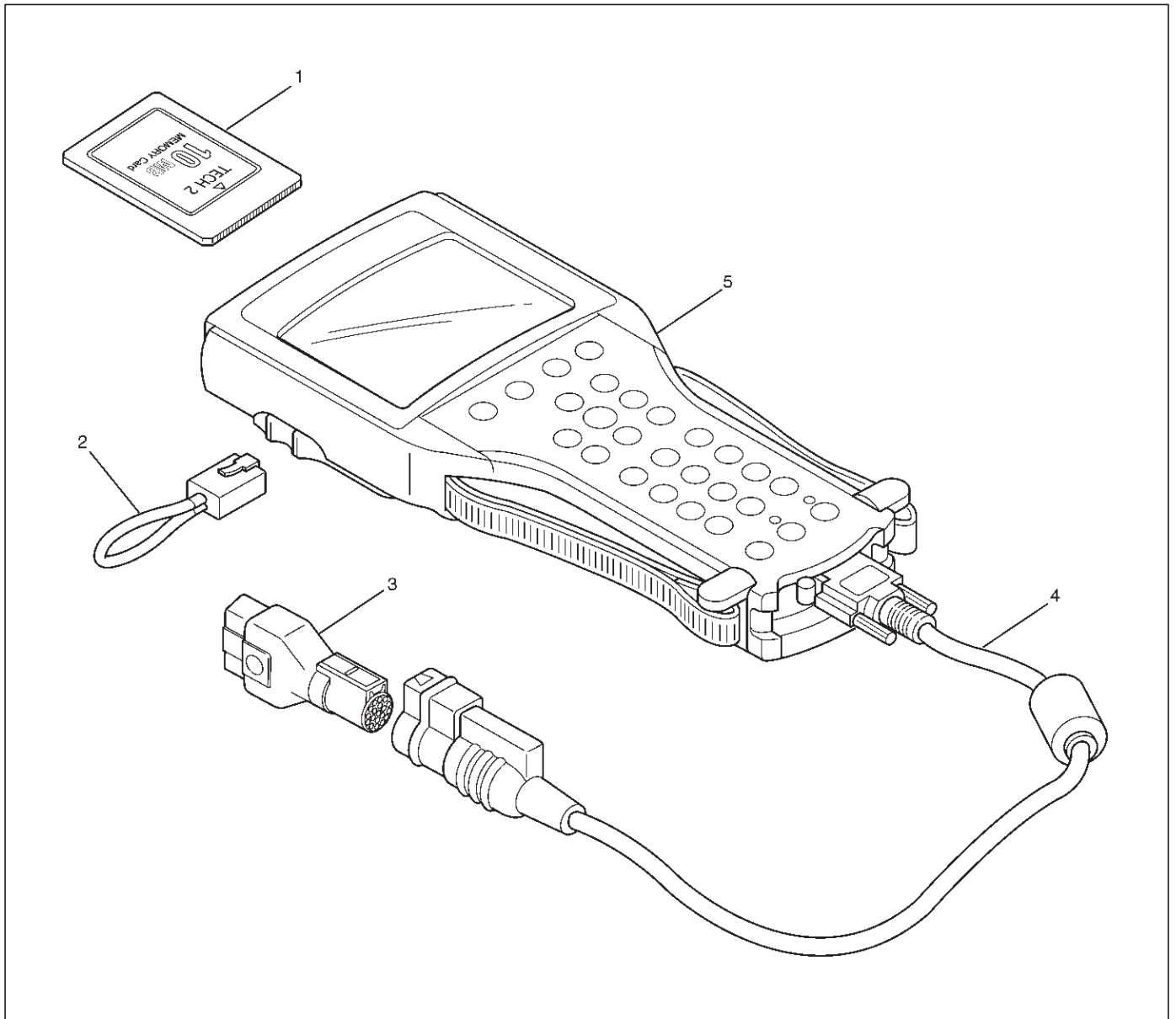
NOTE:

1. Unplug the ECU connector and the pins, unless otherwise specified.
2. Before removing the ECU, turn off the ignition switch.
3. If the standard values are not observed, check the pins with other testers.

Check Pin No.	Circuit to be tested	Ignition Switch Position	Engine State	Multimeter Scale/ Range	Measure between Pin Number	Standard Value	Note
14	D-G MAP	OFF	STOP	δ	14, 19	Continuity : OK (Gasoline)	
20	P-GND	OFF	STOP	δ	20, 19	Continuity : OK	
19	GND	OFF	STOP	δ	19, GND	Continuity : OK	
8	4H SW	OFF	STOP	δ	8, 19	No continuity (high, 4L) and continuity (N) : OK	
9	4L SW	OFF	STOP	δ	9, 19	No continuity (high) and continuity (4L, N) : OK	
10	AXLE SW	ON	RUN	δ	10, 19	Continuity : OK	Remove ECU and start the engine. Move the vehicle forth and back to connect axle surely.
13	DIAG	OFF	STOP	δ	13 (TOD), 8 (DLC Connector)	Continuity : OK	DLC connector terminal 8
25	IND.a	ON	STOP	DCV	25 (+), 19 (-)	8.0 ~14.5 V	Lighting SW ON : 0V Lighting SW OFF : 8.0 ~14.5 V
26	IND.b	ON	STOP	DCV	26 (+), 19 (-)	8.0 ~14.5 V	
27	IND.c	ON	STOP	DCV	27 (+), 19 (-)	8.0 ~14.5 V	
30	CHECK LAMP	ON	STOP	DCV	30 (+), 19 (-)	8.0 ~14.5 V	
11	ABS IN	ON	STOP	DCV	11 (+), 19 (-)	11.5 ~14.5 V	
15	Ref.	ON	STOP	DCV	15 (+), 19 (-)	5 ~9 V	Connect ECU
24	Ft.(+)	ON	STOP	DCV	24 (+), 19 (-)	0.7 ~6 V	Connect ECU (off one tooth of speed sensor ring) and move the vehicle making sure of voltage change.
23	Rr.(+)	ON	STOP	DCV	23 (+), 19 (-)	0.7 ~6 V	Connect ECU (off one tooth of speed sensor ring) and move the vehicle making sure of voltage change.
18	COM(-)	ON	STOP	DCV	18 (+), 19 (-)	0V	Connect ECU
1	Vig	ON	STOP	DCV	1 (+), 19 (-)	8 ~14.5 V	
7	BRAKE	OFF	STOP	DCV	7 (+), 19 (-)	8 ~14.5 V	Press brake pedal
21	TPS	ON	STOP	DCV	21 (+), 19 (-)	0.2 ~4.6 V	Step on the accelerator pedal and make sure that voltage changes.
3	4WD OUT	OFF	STOP	δ	3, 19	7 ~12 kδ	Disconnect battery GND terminal
5	ADC(+)	OFF	STOP	δ	5, 19	10 ~30 δ	Disconnect battery GND terminal
4	SOL(+)	OFF	STOP	δ	4, 19	1.0 ~5.0 δ	Disconnect battery GND terminal
12	TOD SW	ON	STOP	DCV	12 (+), 19 (-)	SW OFF : 0 V SW ON : 8.0 ~14.5 V	SW OFF : Contact point open SW ON : Contact point close
6	LIGHTING	ON	STOP	DCV	6 (+), 19 (-)	SW OFF : 8.0 ~14.5 V SW ON : 0 V	
28	AUTO INDI	ON	STOP	DCV	28 (+), 19 (-)	TOD : 0 V 2H & 4L : 8.0 ~14.5 V	Lighting SW ON : 0V Lighting SW OFF : 8.0 ~14.5 V
29	RR INDI	ON	STOP	DCV	29 (+), 19 (-)	0 V	
17	US/JAP	OFF	STOP	δ	17 (+), 19 (-)	No continuity : OK	

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW180

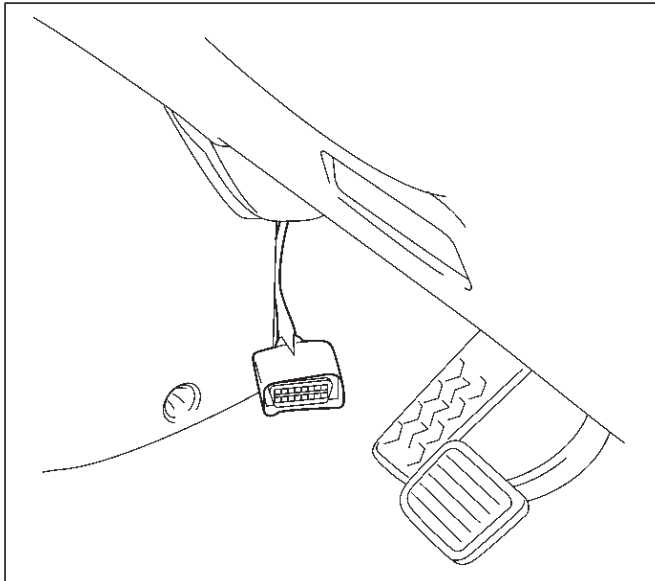
Legend

- | | |
|--------------------------------|-----------------------|
| (1) PCMCIA Card | (3) SAE 16/19 Adaptor |
| (2) RS 232 Loop Back Connector | (4) DLC Cable |
| | (5) Tech-2 |

4B2-28 DRIVE LINE CONTROL SYSTEM (TOD)

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
 2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
 3. Connect the DLC cable to the Tech 2 (5)
 4. Mark sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle ALDL/DLC connector.



810RW308

6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

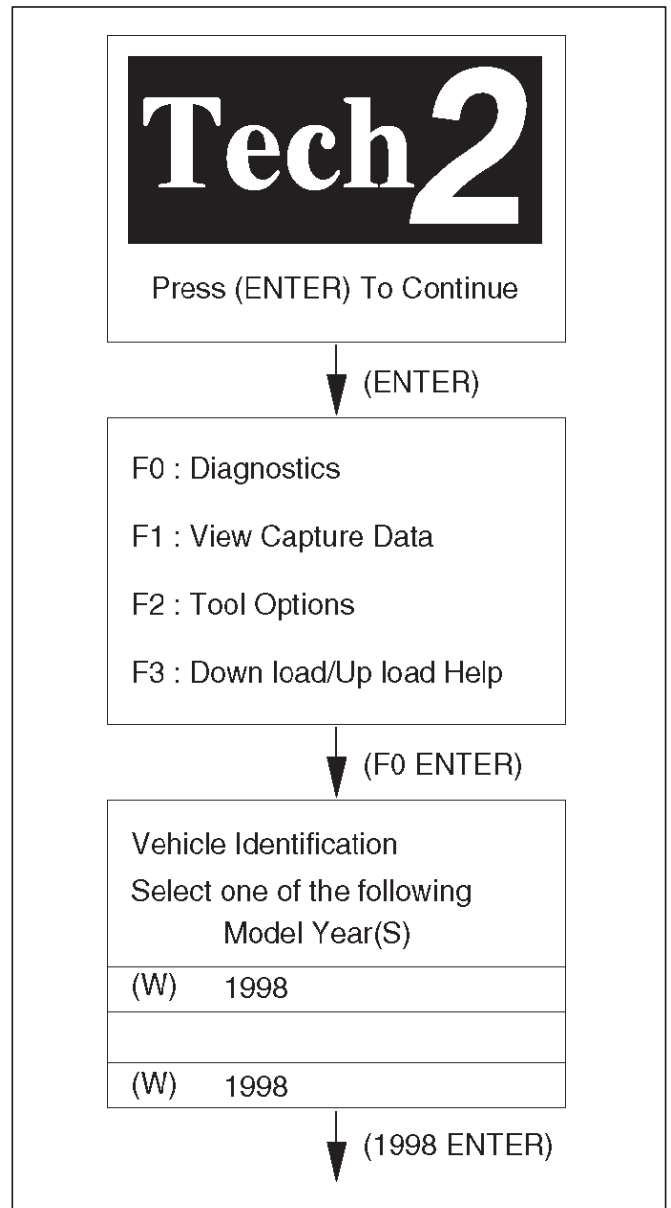


060RW009

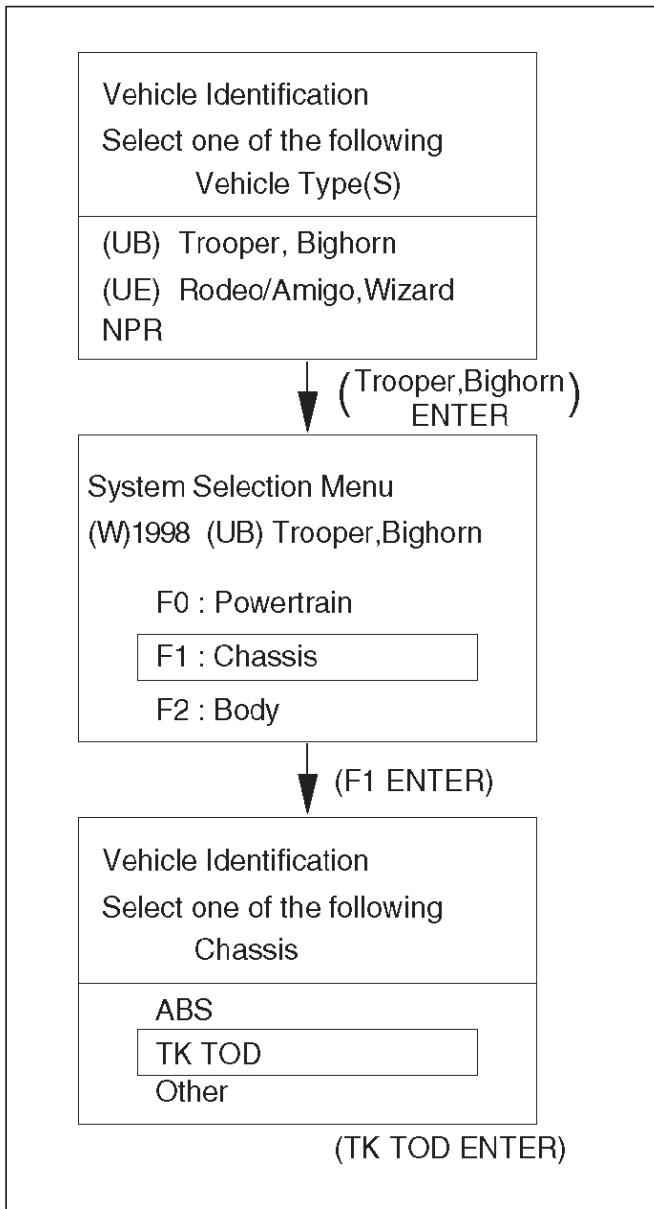
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RW014



4B2-30 DRIVE LINE CONTROL SYSTEM (TOD)

Diagnostic Trouble Codes

Code	Item	Diagnosis	Check flow No.
12	Start code	Normal	—
13	Ref	Shorted GND	6
14	Front speed sensor	Input abnormality (open, sig or com)	2
15	Ref	Shorted VB	6
16	Front speed sensor	Input abnormality	3
21	TPS	Shorted or disconnected wiring, abnormality in input	7
23	ECU	CPU abnormality	1
24	Rear speed sensor	Input abnormality (open, sig or com)	5
25	CHECK lamp	Shorted	14
26	EMC (+)	Shorted GND	10
27	Rear speed sensor	Input abnormality	4
28	ADC (+) & AXLE SW	Output abnormality	11
31	EMC (+)	Shorted or disconnected coil/wiring	9
32	ADC (+)	Shorted or disconnected coil/wiring	12
33	ADC (+)	Shorted GND	13
34	D-G MAP	Input abnormality	8
35	CHECK lamp	Shorted or disconnected wiring	14
36	ECU	CPU abnormality	1
37	ECU	CPU abnormality	1
38	ECU	CPU abnormality	1

TPS : Throttle Position Sensor

EMC : Electromagnetic coil

ADC : Shift on the fly (Axle Dis Connect)

D-G MAP : Discrimination engine type

Diagnosis from Trouble Codes

- Diagnose the TOD based on the fault that has been saved to the control unit according to the system self-diagnostic function.

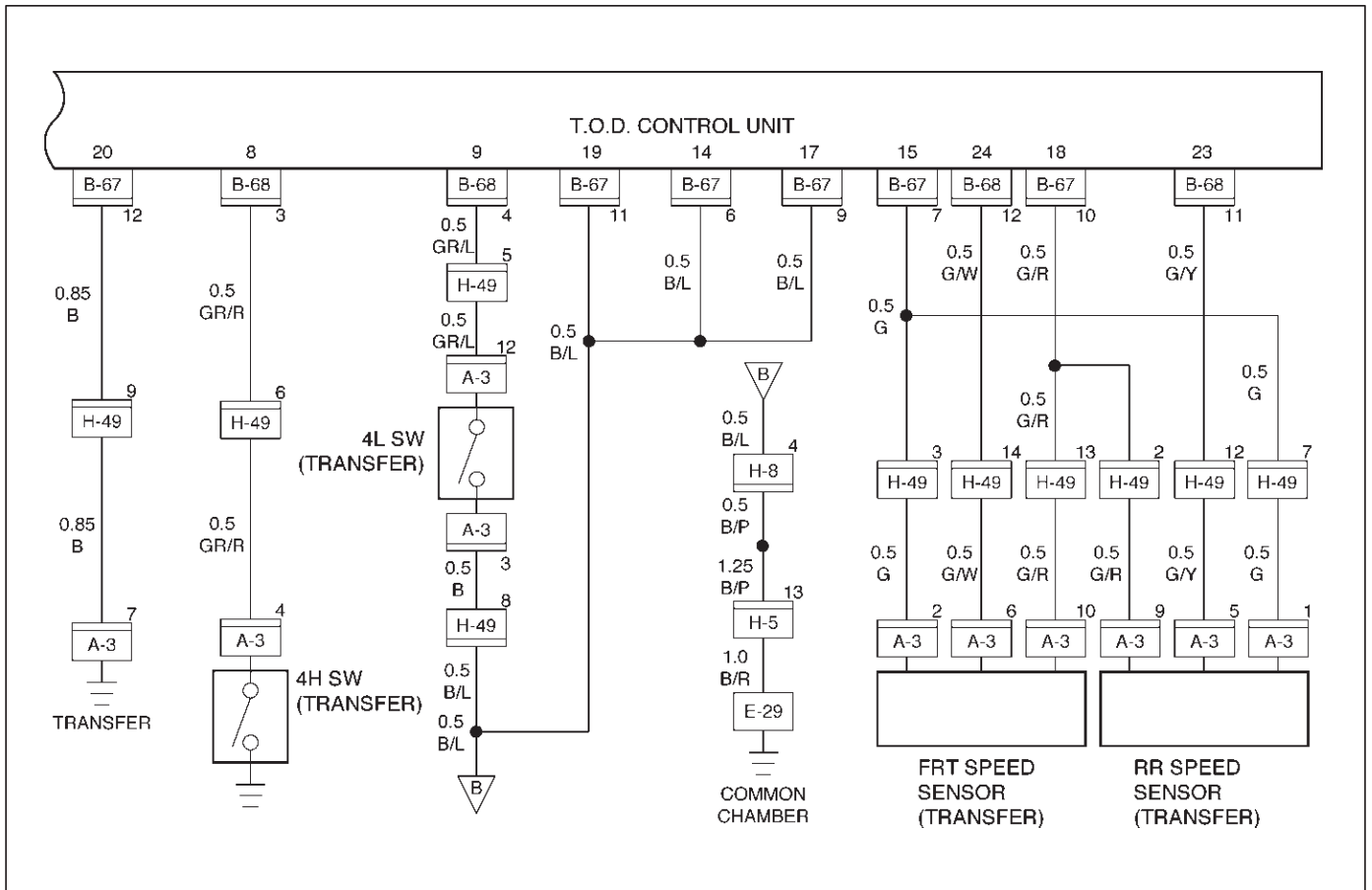
Check flow	Trouble code	Phenomenon	Standard
1	23, 36, 37, 38	The ECU is failed.	—

Step	Action	Yes	No
1	Turn on the starter switch. Is the trouble reproduced?	Replace the ECU and conduct the test run. Go to Step 3	Go to Step 2
2	1. Clear the trouble codes. 2. Conduct the test run. Is the trouble reproduced during the test run?	Replace the ECU and conduct the test run. Go to Step 3	The trouble is not reproduced. Refer to "Troubles intermittently observed". Go to Step 3
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 3

4B2-32 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
2	14	Front speed sensor signal open or GND short, speed sensor com open.	0.3 > sensor voltage

NOTE: The following procedure shows the case that the front or rear sensor reference or common grounding line is broken.



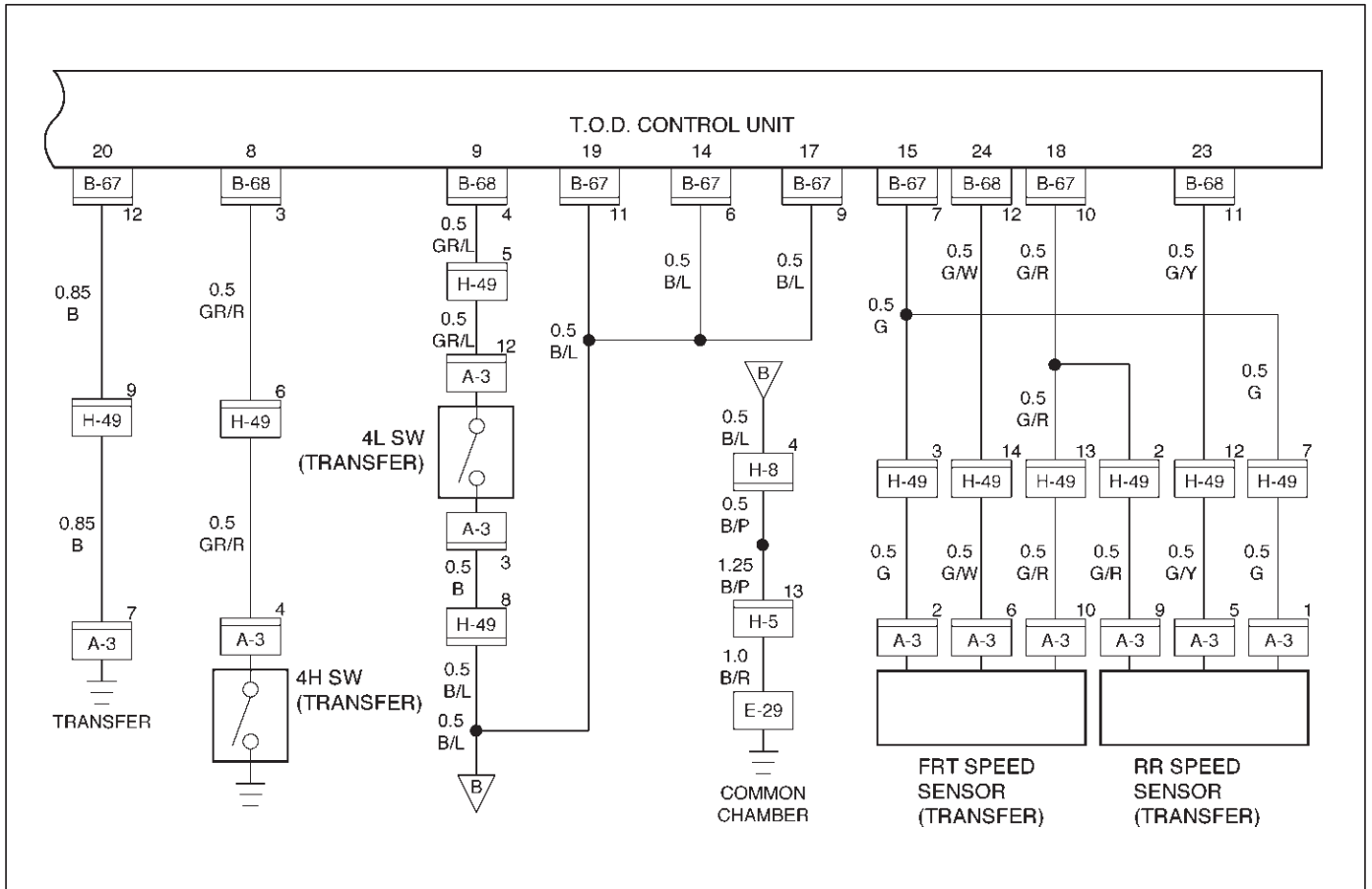
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-33

Step	Action	Yes	No
1	1. Start the engine. 2. Select 4H (TOD) mode. Is the memory except DTC 14?	Go to Step 3	Go to Step 2
2	Is the continuity harness of terminal 24 (vehicle side terminal of the front speed sensor)?	Replace speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
3	Is the memory DTC 24?	Go to Step 4	Refer to other trouble check flow. Go to Step 2
4	Is the continuity between harness of terminal 23 and 24 (vehicle side terminal of the front and rear speed sensor)?	Go to Step 5	Repair the circuit. Go to Step 6
5	Is the continuity between harness of terminal 18 and 15 (vehicle side terminal of the speed sensor COM and ref)?	Replace front and rear speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 6

4B2-34 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
3	16	The front speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = GAS: 832 Hz (at 50 km/h)

NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.



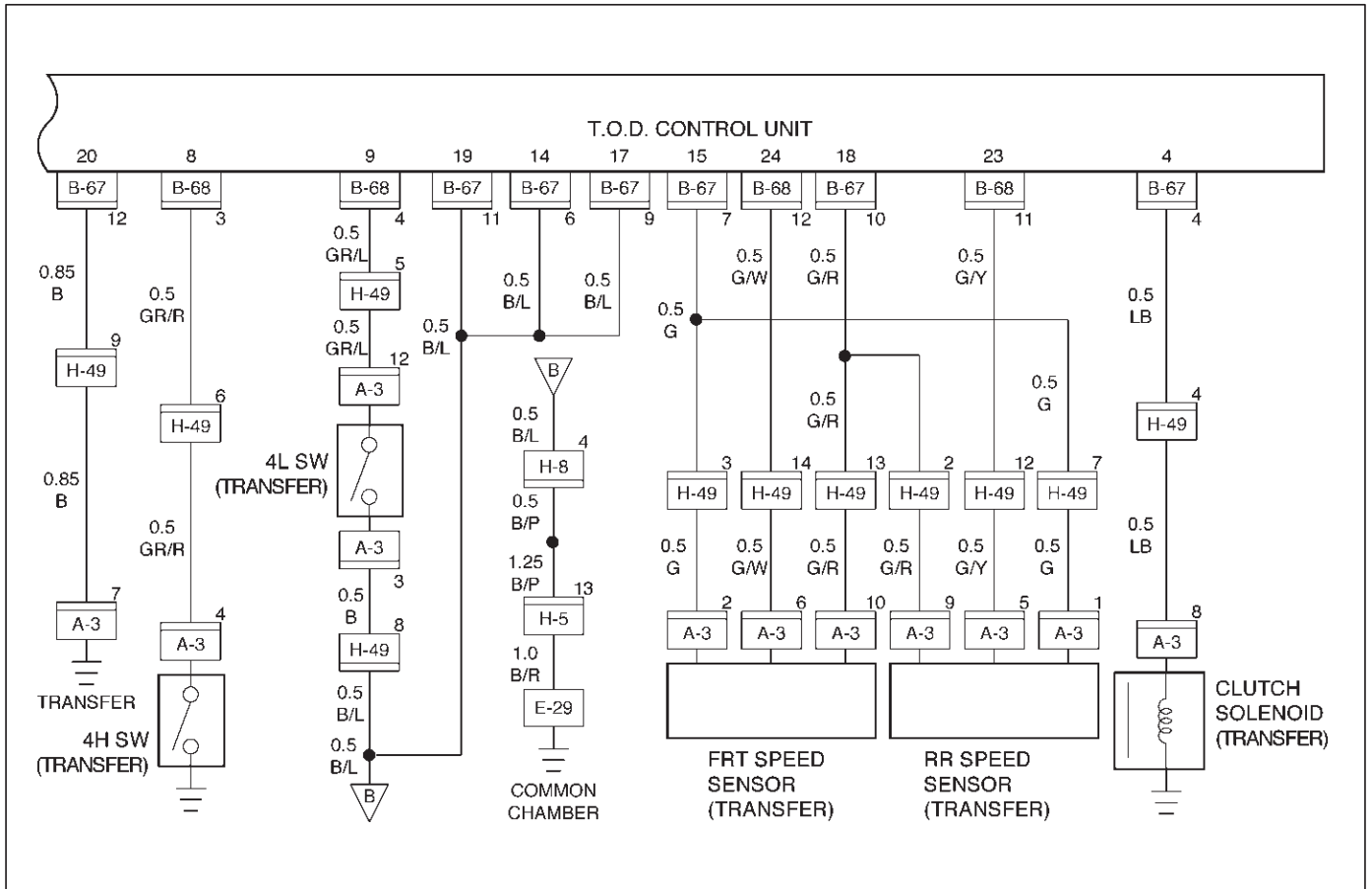
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-35

Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH-2's front speed sensor indication change with vehicle speed?	Go to Step 2	Repair and inspection front speed sensor tone wheel. Go to Step 4
2	Is the continuity harness of terminal 24 (vehicle side terminal of the front speed sensor)?	Replace speed sensor. Go to Step 3	Repair the circuit. Go to Step 3
3	1. Clear the trouble code. While running at 40 kph in TOD mode for 30 consecutive sec, is trouble code reissued?	Replace ECU. Go to Step 4	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 4

4B2-36 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
4	27	The rear speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = 832 Hz (at 50 km/h)

NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.



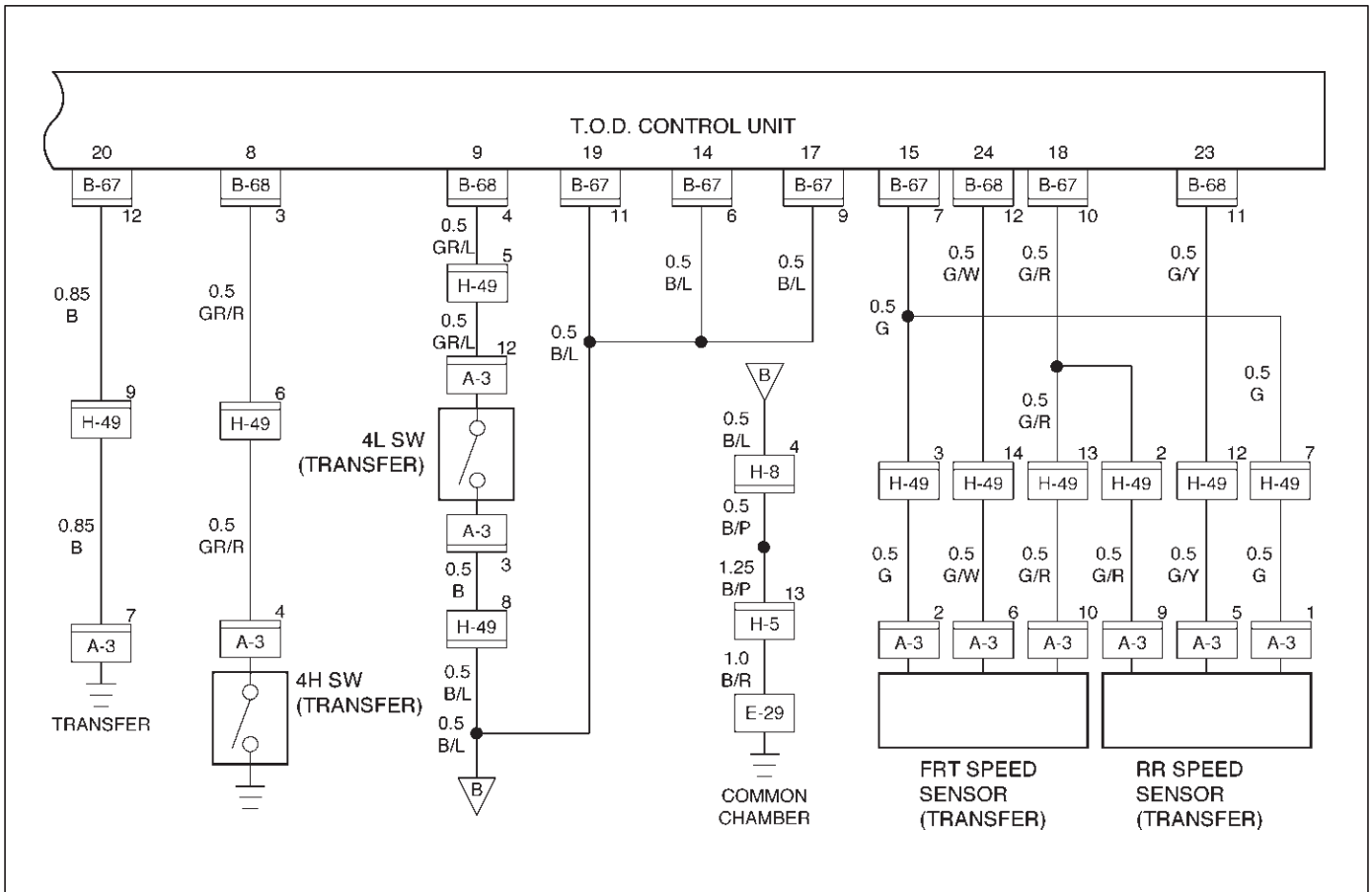
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-37

Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH-2's rear speed sensor indication change with vehicle speed?	Go to Step 2	Repair and inspection rear speed sensor tone wheel. Go to Step 4
2	Is the continuity harness of terminal 23 (vehicle side terminal of the rear speed sensor)?	Replace speed sensor. Go to Step 3	Repair the circuit. Go to Step 3
3	1. Clear the trouble code. While running at 40 kph in TOD mode for 30 consecutive sec, is trouble code reissued?	Replace EUC. Go to Step 4	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 4

4B2-38 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
5	24	Rear speed sensor signal open or GND short, speed sensor COM open.	0.3 > sensor voltage

NOTE: The following procedure shows the case that the front or rear sensor reference or common grounding line is broken.



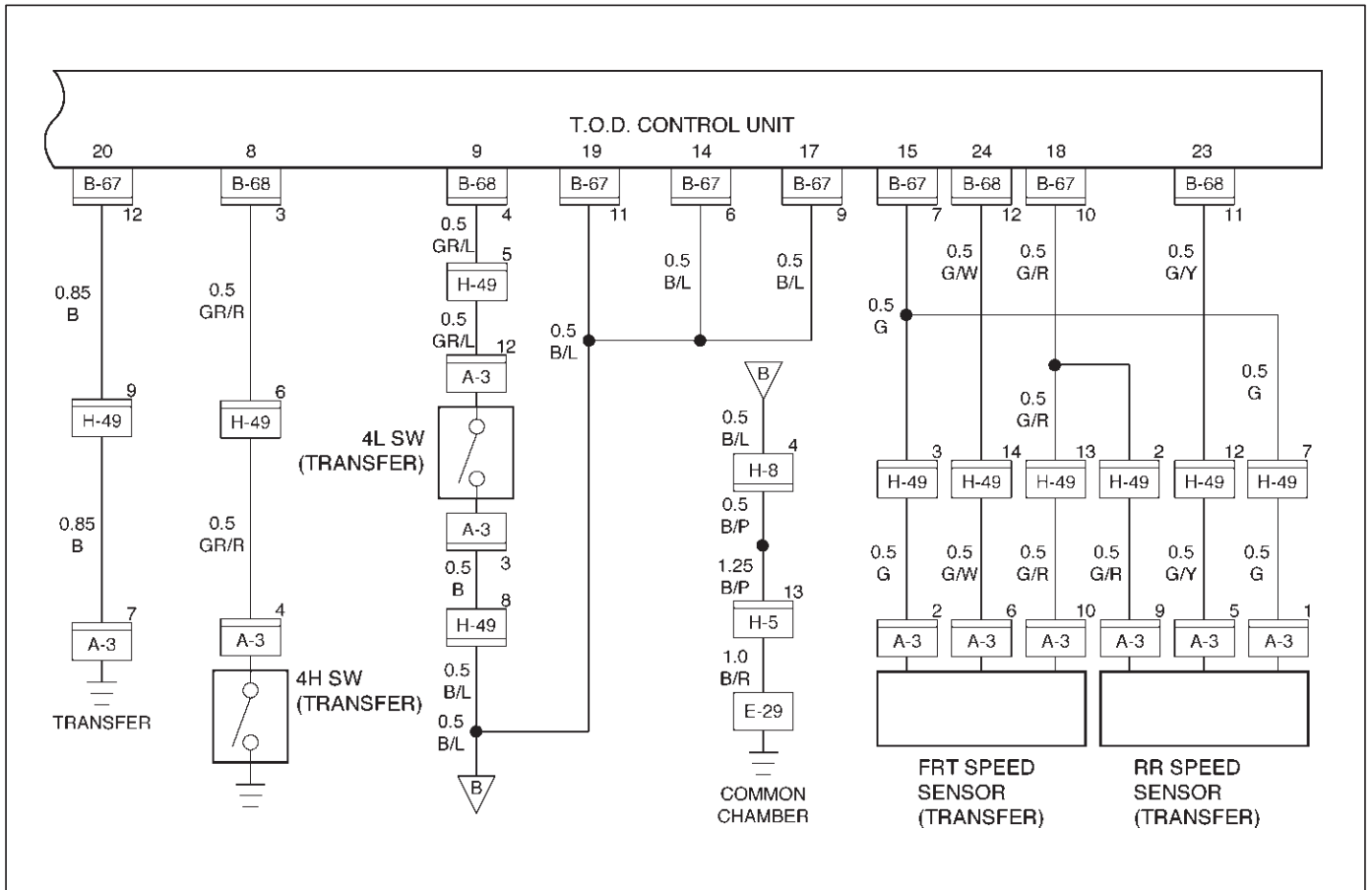
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-39

Step	Action	Yes	No
1	1. Start the engine. 2. Select 4H (TOD) mode. Is the memory except DTC 24?	Go to Step 3	Go to Step 2
2	Is the continuity harness of terminal 23 (vehicle side terminal of the rear speed sensor)?	Replace speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
3	Is the memory DTC 14?	Go to Step 4	Refer to other trouble check flow. Go to Step 2
4	Is the continuity between harness of terminal 23 and 24 (vehicle side terminal of the front and rear speed sensor)?	Go to Step 5	Repair the circuit Go to Step 6
5	Is the continuity between harness of terminal 15 and 18 (vehicle side terminal of the speed sensor COM and ref)?	Replace front and rear speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 6

4B2-40 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
6	13	The reference is short-circuited to GND.	Reference \approx 5 V
	15	The reference Vb is short-circuited.	

If the reference wire (15) is short-circuited to GND, the speed signal is not generated. If the wire is short-circuited to the battery voltage, the signal level becomes faulty.



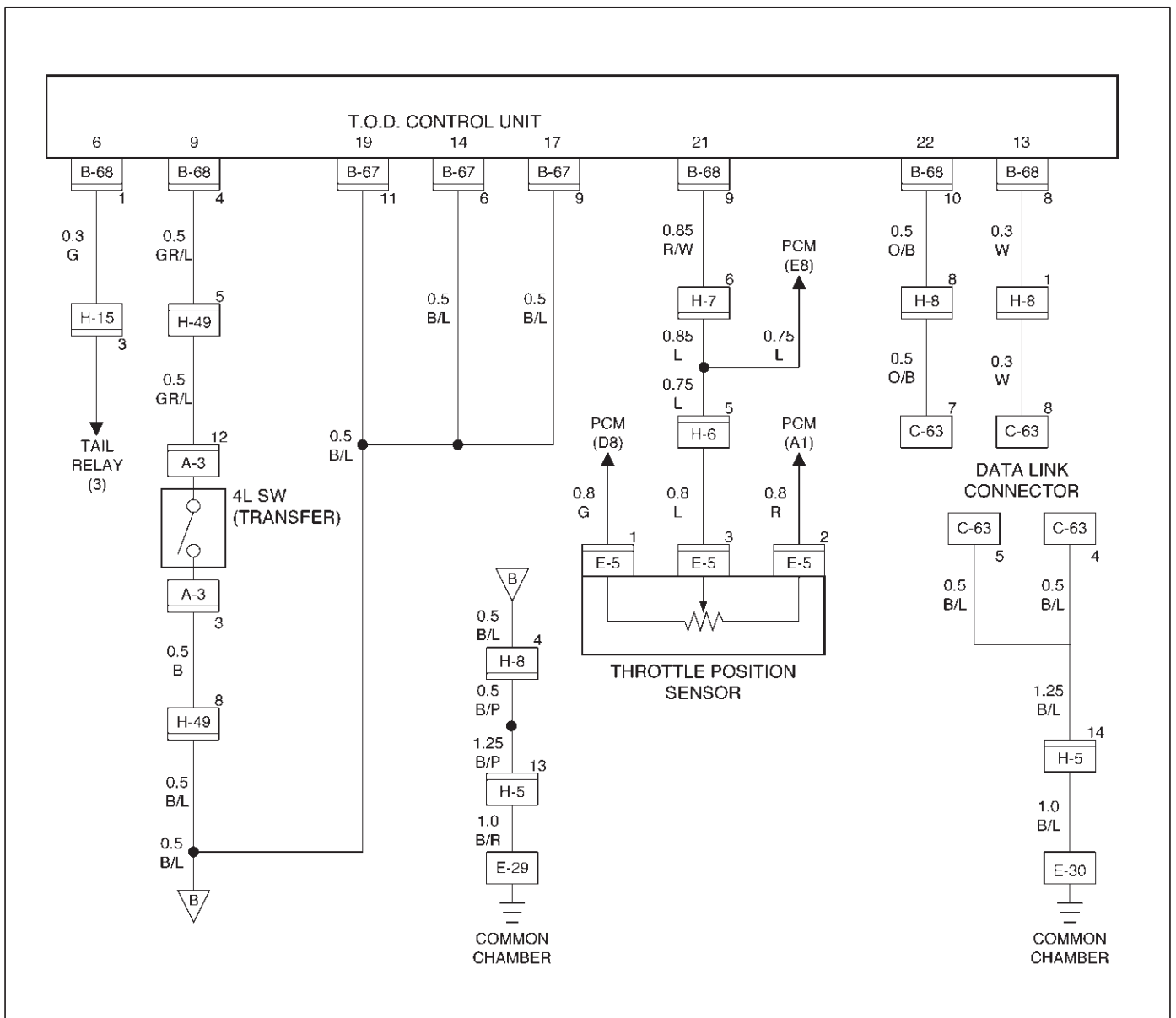
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-41

Step	Action	Yes	No
1	1. Start the engine. Does the voltage between terminals 15 and 19 meet the standard 5V?	Go to Step 8	Go to Step 2
2	Is the voltage below the standard?	Go to Step 3	Go to Step 7
3	1. Turn off the starter switch. 2. Disconnect the ECU connector. Is the continuity established between vehicle harness terminals (B-67)7 and (B-67)11?	Go to Step 4	The ECU is failed. Replace the ECU. Go to Step 8
4	1. Disconnect the H-49 connector. Is the continuity established between floor harness connector terminals (H-49)3 and (H-49)9?	Go to Step 5	Go to Step 6
5	1. Disconnect the A-3 connector. Is the continuity established between transfer harness connector terminals (A-3)2 and (A-3)7?	Replace the front speed sensor. Go to Step 8	The reference harness for the front speed sensor is short-circuited to GND. Repair the circuit. Go to Step 8
6	1. Disconnect the A-3 connector. Is the continuity established between transfer harness connector terminals (A-3)1 and (A-3)7?	Replace the rear speed sensor. Go to Step 8	The reference harness for the rear speed sensor is short-circuited to GND. Repair the circuit. Go to Step 8
7	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Is the battery voltage observed between harness connector terminals (B-67)7 and (B-67)11?	Repair the harness circuit. Go to Step 8	The ECU has failed. Replace the ECU. Go to Step 8
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow"	Go to Step 8

4B2-42 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard								
7	21	The voltage of the throttle position sensor (TPS) is faulty.	<table border="1"> <thead> <tr> <th colspan="2">V</th> </tr> <tr> <th colspan="2">Gasoline</th> </tr> </thead> <tbody> <tr> <td>Idling</td> <td>0.44 ~ 0.87</td> </tr> <tr> <td>Wide open throttle (WOT)</td> <td>3.7 ~ 4.6</td> </tr> </tbody> </table>	V		Gasoline		Idling	0.44 ~ 0.87	Wide open throttle (WOT)	3.7 ~ 4.6
V											
Gasoline											
Idling	0.44 ~ 0.87										
Wide open throttle (WOT)	3.7 ~ 4.6										

The signal voltage from the TPS deviates from the standard range.



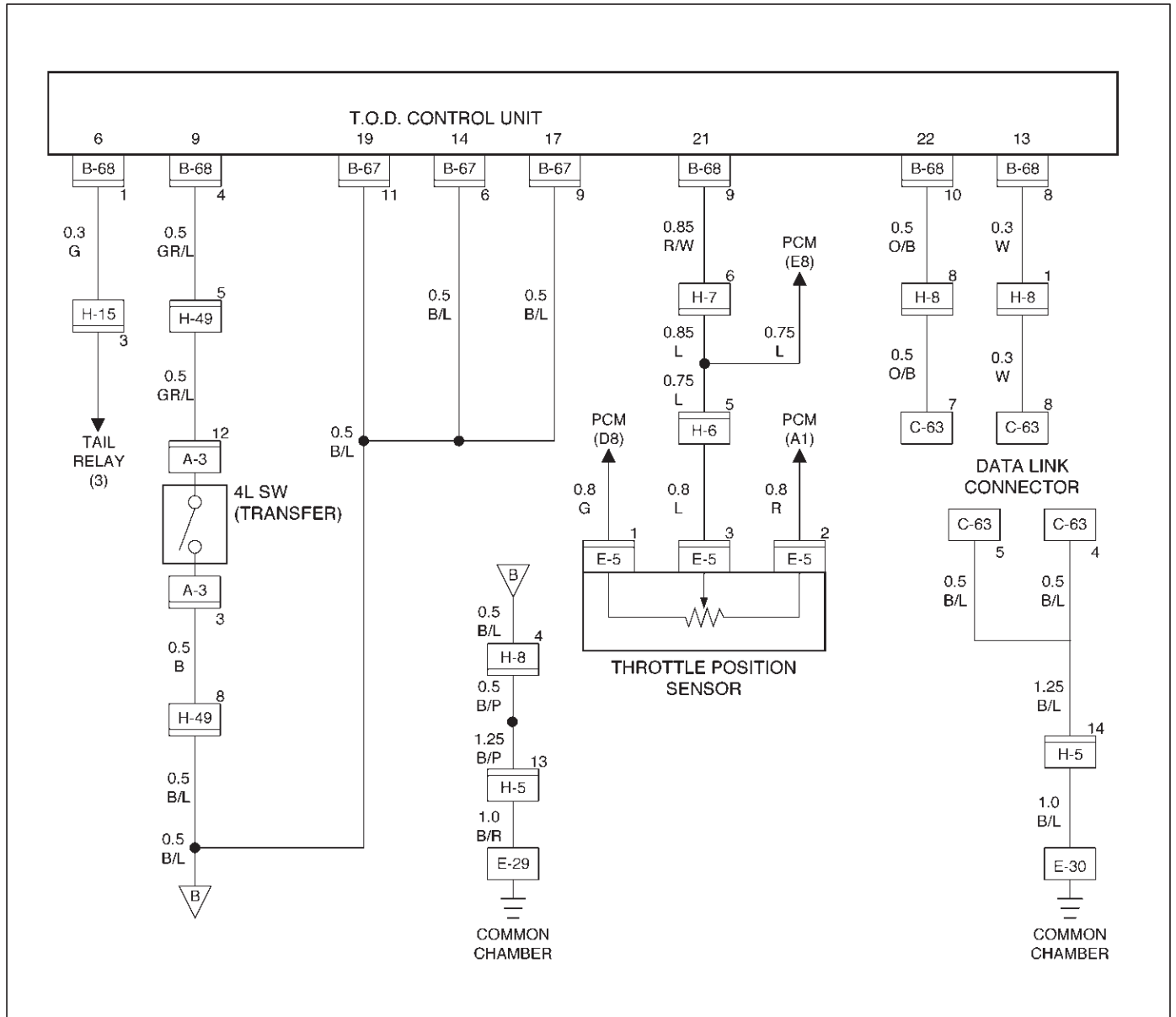
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-43

Step	Action	Yes	No
1	1. Turn off the starter switch. Is the battery voltage normal?	Go to Step 2	Charge or replace the battery. Go to Step 6
2	1. Turn on the starter switch. Does the voltage between terminals 21 and 19 fall within the standard range above?	Go to Step 6	Go to Step 3
3	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Does the voltage between terminals (B-68)9 and (B-67)11 fall within the standard range above?	The ECU has failed. Replace the ECU. Go to Step 6	Go to Step 4
4	Is the harness healthy?	Go to Step 5	Repair the harness. Go to Step 6
5	Is the TPS healthy?	Go to Step 6	Replace the TPS. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Go to Step 6

4B2-44 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
8	34	The diesel/gasoline engine identification signal is faulty.	Gasoline: Continuity established

The engine identification signals of 6VE1 and 4JX1 are changed each other.

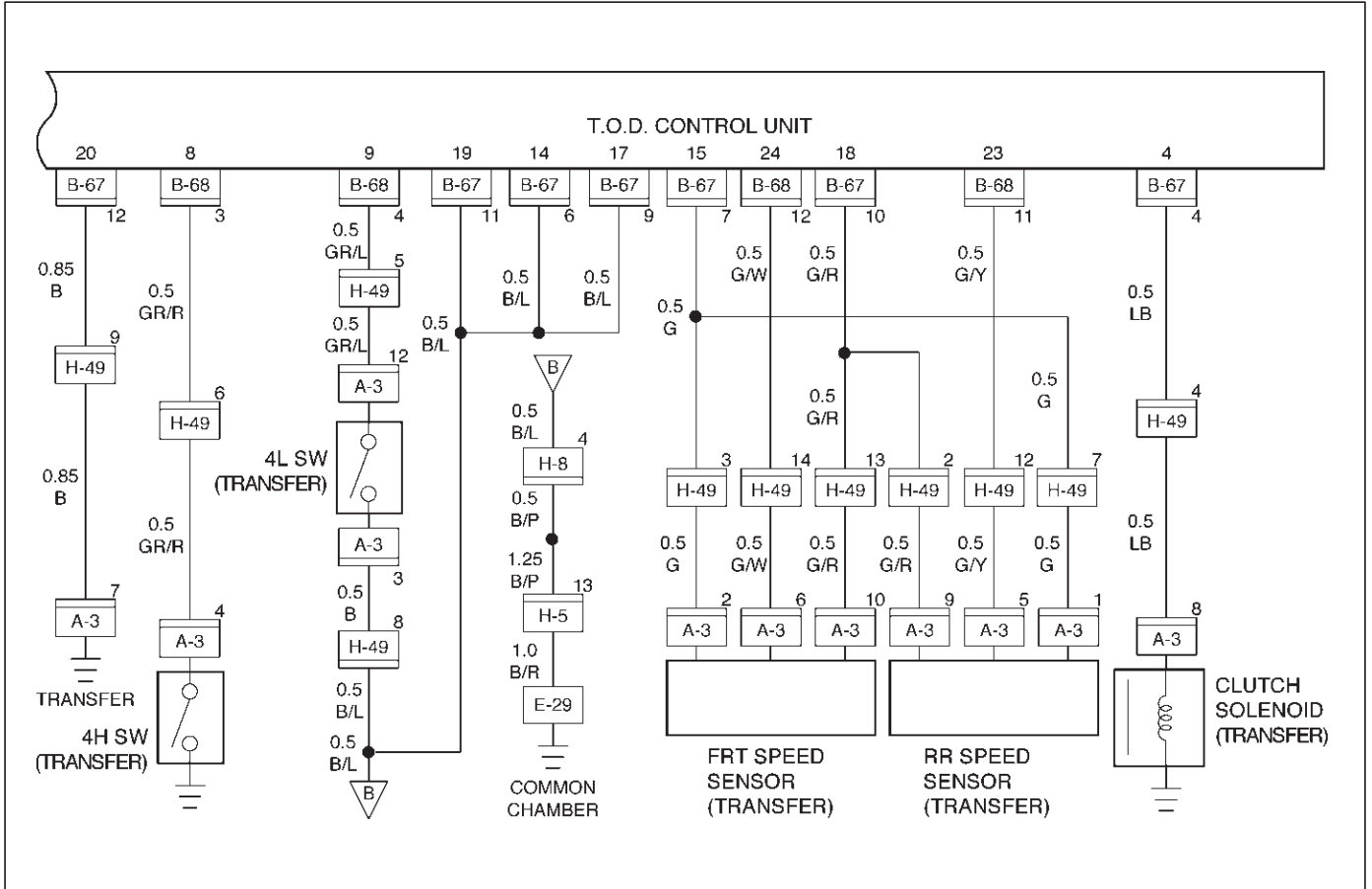


6VE1

Step	Action	Yes	No
1	1. Turn off the starter switch. Is the continuity established between terminals 14 and 19?	Go to Step 2	The harness is broken. Repair the circuit. Go to Step 3
2	1. Turn on the starter switch. Does the voltage between terminals 14 and 19 indicate 0V?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed" Go to Step 3	The ECU has failed. Replace the ECU. Go to Step 3
3	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 3

4B2-46 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
9	31	The electromagnetic coil is broken.	—

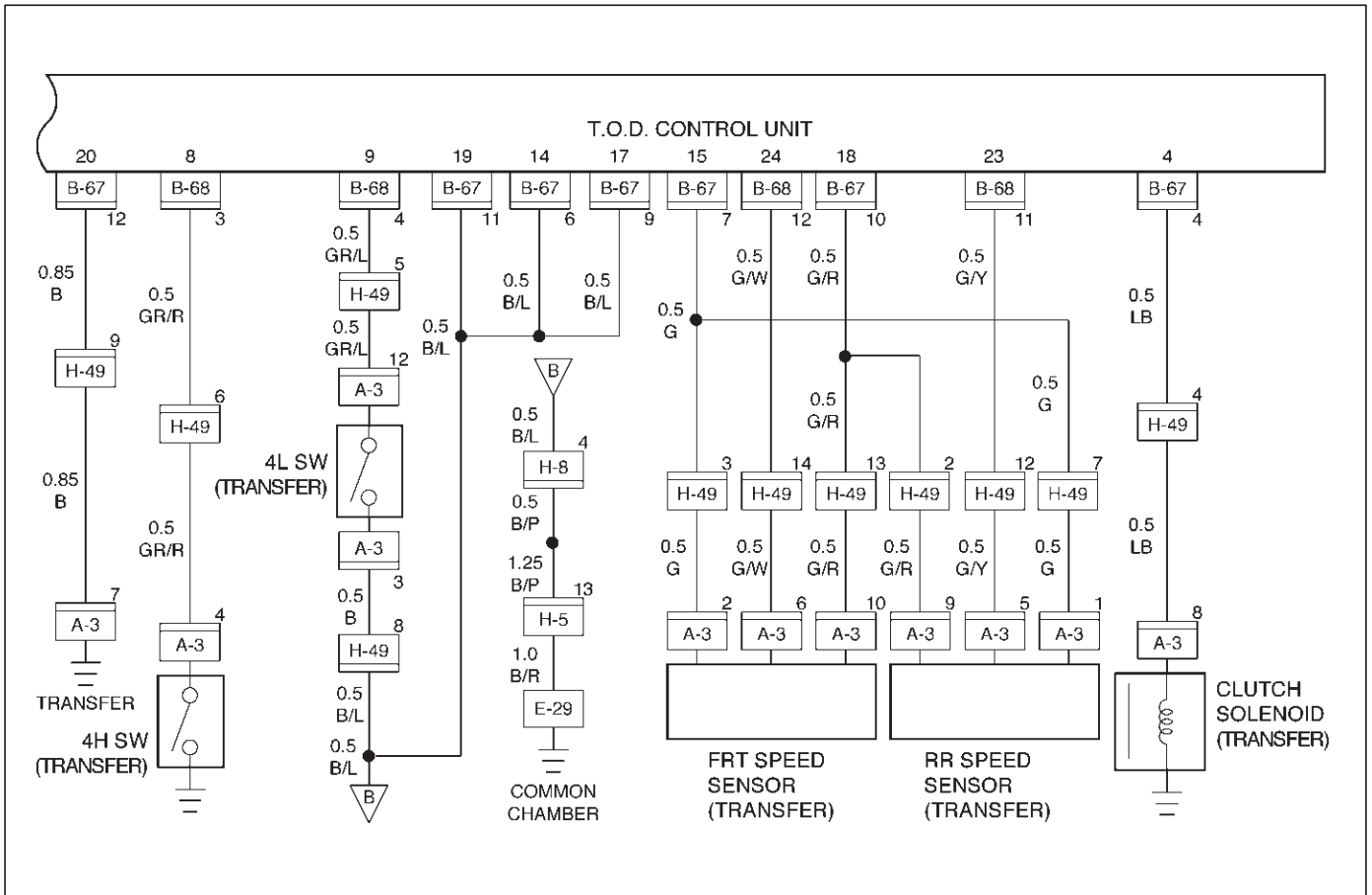


DRIVE LINE CONTROL SYSTEM (TOD) 4B2-47

Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the continuity established between terminals (B-67)4 and (B-67)12?	Go to Step 2	Go to Step 4
2	1. Connect the ECU connector. 2. Start the engine. 3. Set the TOD mode. Does the voltage between terminals 4 and 20 indicate at least 0.4V?	Go to Step 3	The ECU has failed. Replace the ECU. Go to Step 5
3	Is the battery voltage always observed between terminals 4 and 20?	The harness is short-circuited on the battery. Repair the circuit. Go to Step 5	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 5
4	1. Disconnect the M-27 connector. Is the continuity established between transfer connector terminals (A-3)8 and (A-3)7?	The harness is broken. Repair the circuit. Go to Step 5	Replace the transfer electromagnetic coil (solenoid clutch). Go to Step 5
5	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 5

4B2-48 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
10	26	The electromagnetic coil GND is short-circuited.	Resistance: 1.0 to 5.0 ohm (at ordinary temperature)



DRIVE LINE CONTROL SYSTEM (TOD) 4B2-49

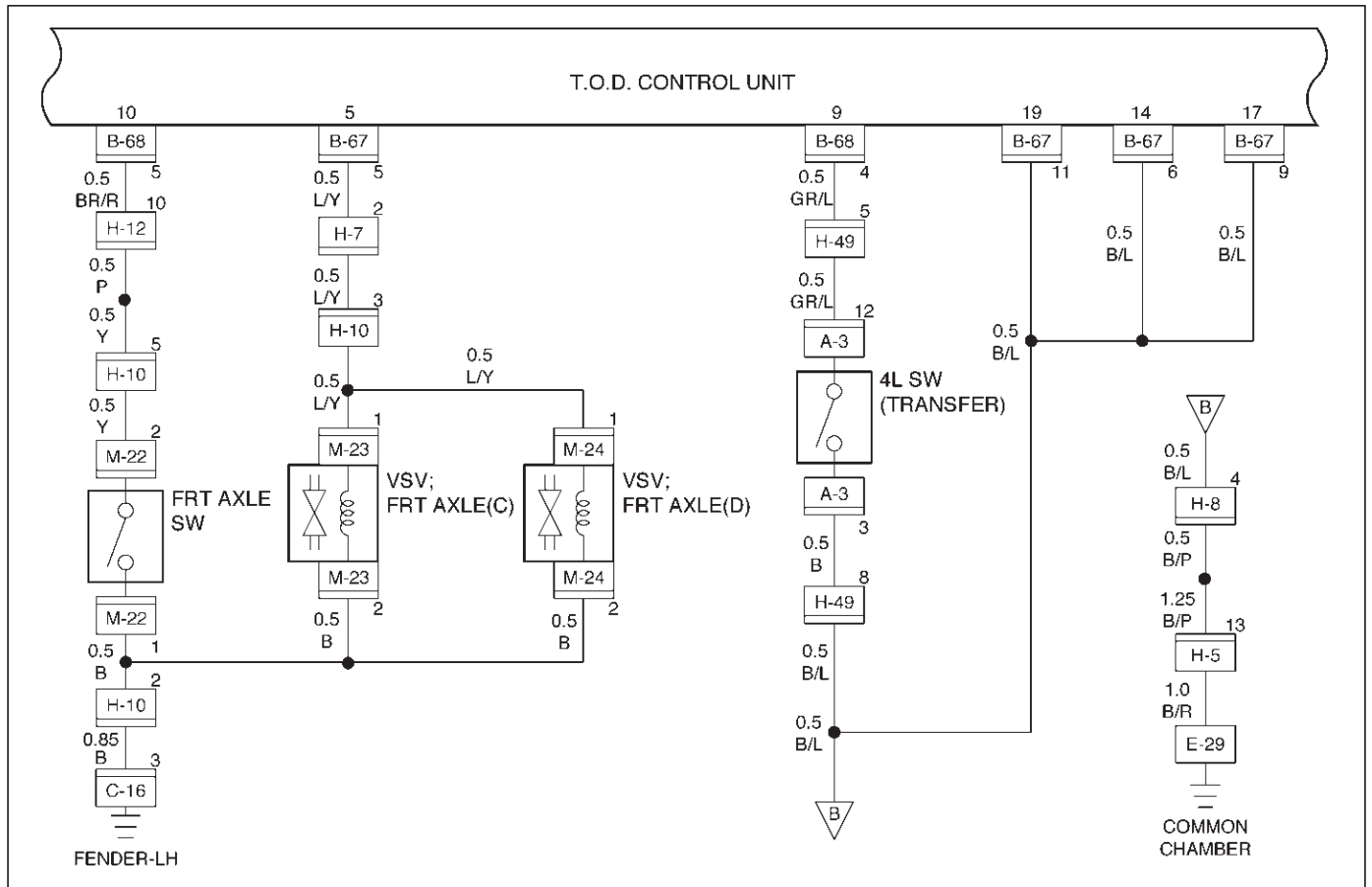
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Does the resistance between terminals (B-67)4 and (B-67)12? indicate 1.0 to 5.0 ohm?	Go to Step 2	Go to Step 3
2	1. Connect the ECU connector. 2. Start the engine. 3. Set the TOD mode. When the throttle is operated between full close and full open positions, does the voltage between terminals 4 and 20 indicate at least 0.1 to 1.0 V?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
3	Does the resistance between transfer connector terminals (A-3)8 and (A-3)7 indicate 1.0 to 5.0ohm?	The harness is broken. Repair the circuit. Go to Step 4	Replace the transfer electromagnetic coil. Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

4B2-50 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
11	28	The shift on the fly system (front hub) works incorrectly.	—

NOTE: The shift on the fly system is not changed between 2WD and 4WD modes normally.

CAUTION: If code 32 or 33 is also observed, remove the trouble associated with code 32 or 33 first.



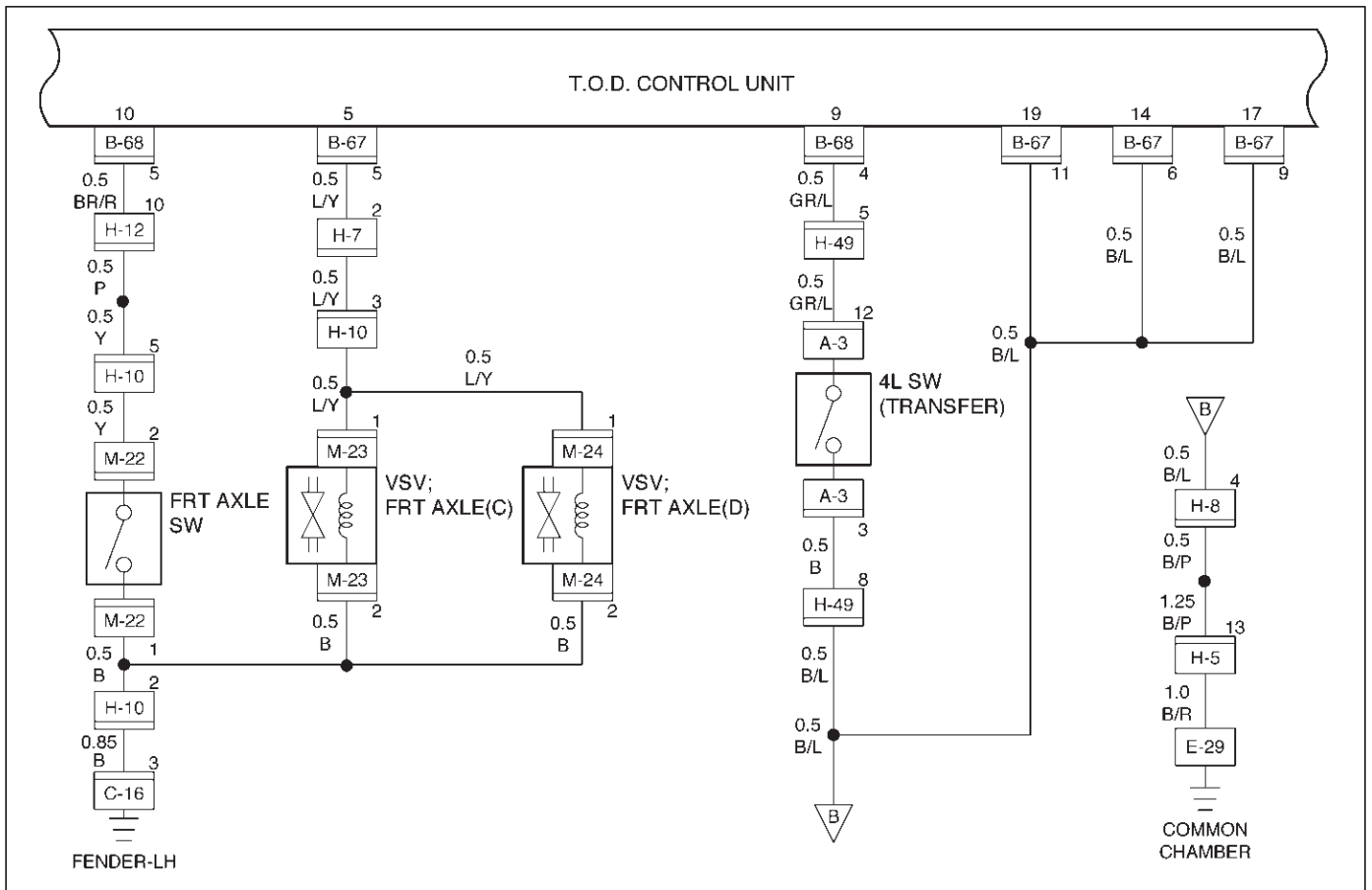
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-51

Step	Action	Yes	No
1	1. Turn on the starter switch. 2. Set the transfer to the 2H mode. Is the battery voltage observed between terminals 5 and 19?	Go to Step 2	Go to Step 5
2	Is the battery voltage observed between terminals 10 and 19?	Go to Step 3	Go to Step 6
3	1. Set the transfer to the high (TOD) mode. Does the voltage between terminals 5 and 19 indicate 0V?	Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 7
4	Does the voltage between terminals 10 and 19 indicate 0V?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 7	The shift on the fly system is failed (refer to Section 4C "Front Axle" of Chassis Repair Manual). Go to Step 7
5	Does the TOD indicator show the 2H mode?	The ECU has failed. Replace the ECU. Go to Step 7	See "Trouble Diagnosis Depending on The Status of TOD Indicator". Go to Step 7
6	Set the transfer to the high (TOD) mode. Does the voltage between terminals 5 and 19 indicate 0V?	The shift on the fly system has failed (refer to Section 4C "Front Axle" of Chassis Repair Manual). Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 7

4B2-52 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
12	32	The on/off signal (ADC) line of the shift on the fly system (front hub) is broken, or the line is short-circuited to the battery.	—

NOTE: The on/off signal line of the shift on the fly system is broken, or the line is short-circuited to the battery.



DRIVE LINE CONTROL SYSTEM (TOD) 4B2-53

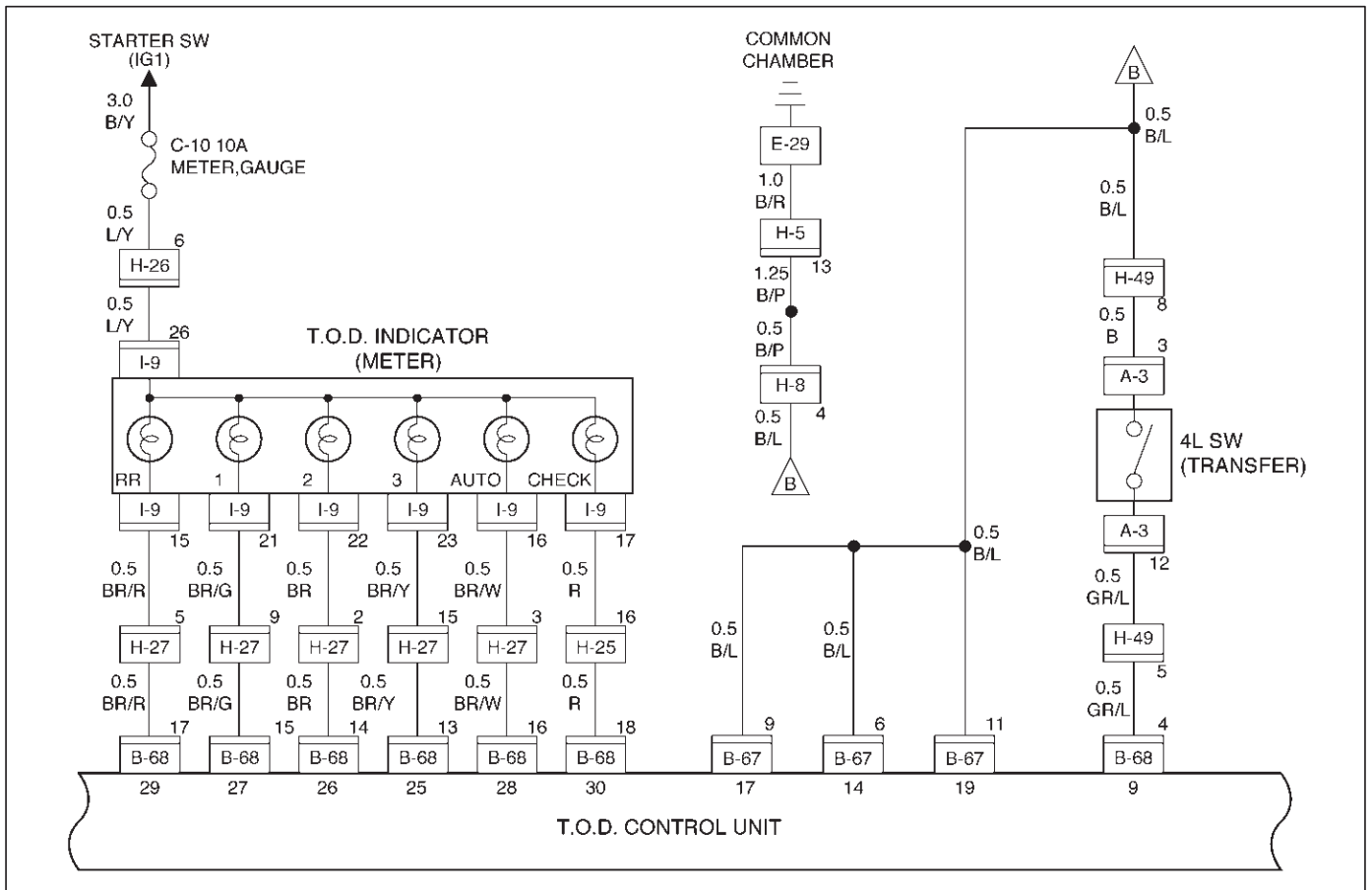
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the continuity established between terminals (B-67)5 and (B-67)11?	Go to Step 2	The harness is broken. Repair the circuit. Go to Step 3
2	Does the voltage between terminals 5 and 19 indicate 0V?	Go to Step 3	The battery is short-circuited. Repair the circuit. Go to Step 4
3	1. Turn off the starter switch. 2. Connect ECU connector. 3. Turn on the starter switch. 4. Set the transfer to the 2H mode. Is the battery voltage observed between terminals 5 and 19?	The phenomenon is not reproduced Refer to "Troubles intermittently observed". Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

4B2-54 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
13	33	The ADC line is short-circuited to GND.	—

NOTE:

- The on/off signal line of the shift on the fly system is short-circuited to GND.
- The system enters into the fail-safe mode because of fusing or system protection.
(If a short-circuit is observed on GND, the output to the on/off signal line becomes 0V.)



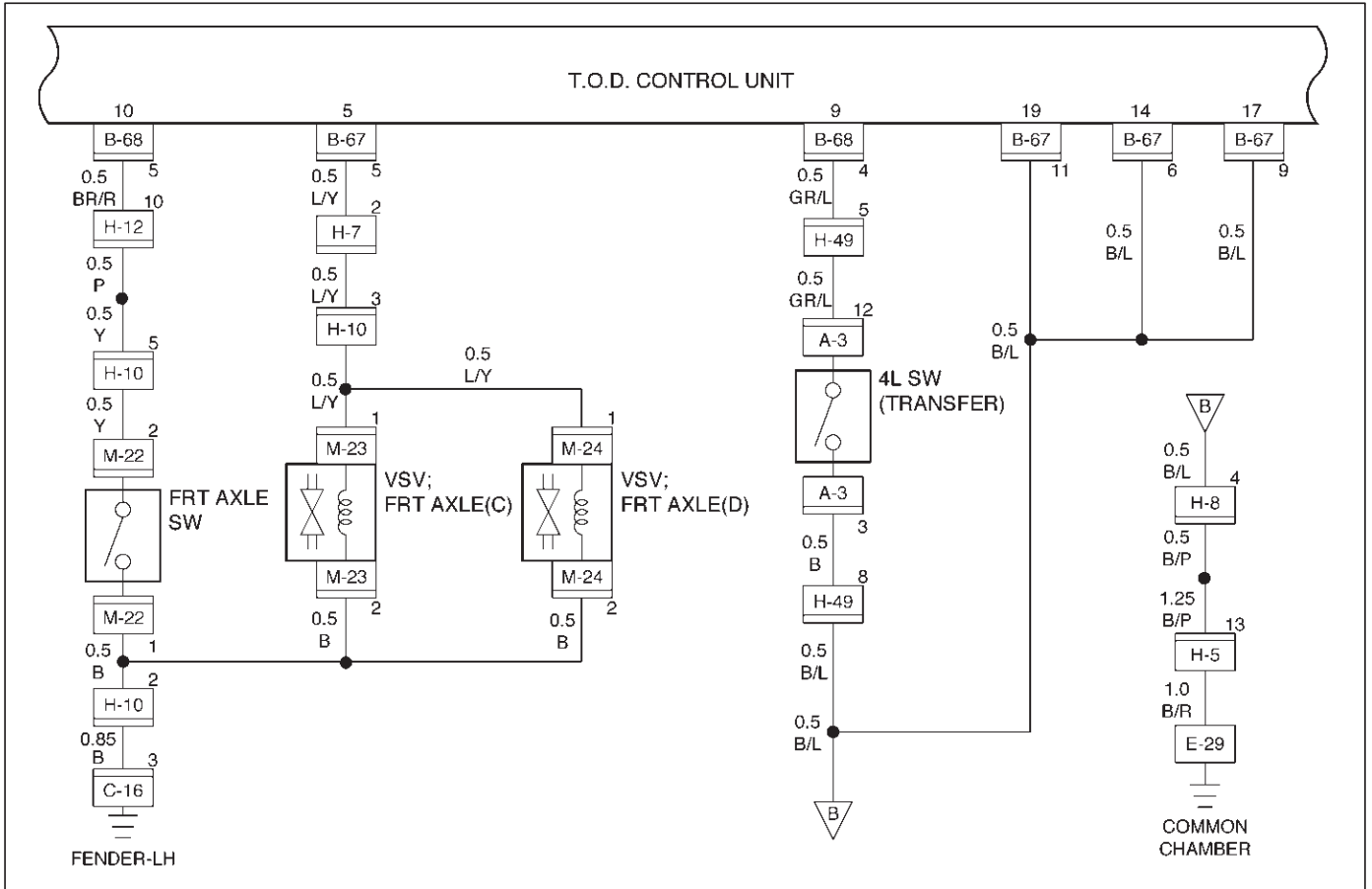
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-55

Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Does the resistance between terminals 5 and 19 meet the standard, $R = 21 \pm 4$ ohms?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 4	Go to Step 2
2	Is the resistance between terminals 5 and 19 $R < 2$ ohms?	The signal line circuit of the shift on the fly system is short-circuited to GND. Repair the circuit. Go to Step 3	Go to Step 3
3	Is the resistance between terminals 5 and 19 $R = 9 \pm 7$ ohms?	The signal line circuit of the shift on the fly system is layer short-circuited*. Replace the valve (VSV). Go to Step 3	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

*Layer short-circuit : The coil is damaged by overcurrent.

4B2-56 DRIVE LINE CONTROL SYSTEM (TOD)

Check flow	Trouble code	Phenomenon	Standard
14	25	The CHECK lamp indicator line is short-circuited to the battery.	—
	35	The line is broken or short-circuited to GND.	—



DRIVE LINE CONTROL SYSTEM (TOD) 4B2-57


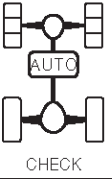
Step	Action	Yes	No
1	1. Turn on the starter switch. Is the CHECK lamp always turned on?	Go to Step 2	Go to Step 3
2	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Is the CHECK lamp always turned on?	The CHECK circuit is short-circuited to GND. Repair the circuit. Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
3	Turn on the starter switch. Is the CHECK lamp always turned off?	Go to Step 4	Go to Step 6
4	Turn on the starter switch. Is the battery voltage observed between terminals 30 and 19?	Go to Step 5	The CHECK circuit wires are broken or the CHECK lamp is failed. Repair the circuit. Go to Step 7
5	Turn off the starter switch. Is the battery voltage observed between terminals 30 and 19?	The battery is short-circuited. Repair the CHECK lamp circuit. Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
6	Turn on the starter switch. Does the CHECK lamp go off two seconds after?	The phenomenon is not reproduced Refer to "Troubles intermittently observed". Go to Step 7	Go to Step 7
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 7

4B2-58 DRIVE LINE CONTROL SYSTEM (TOD)

Trouble Diagnosis Depending on The Status of TOD Indicator

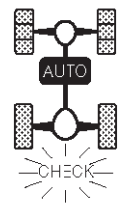
Functional check with TOD indicator light is conducted prior to check on Charts A-H.

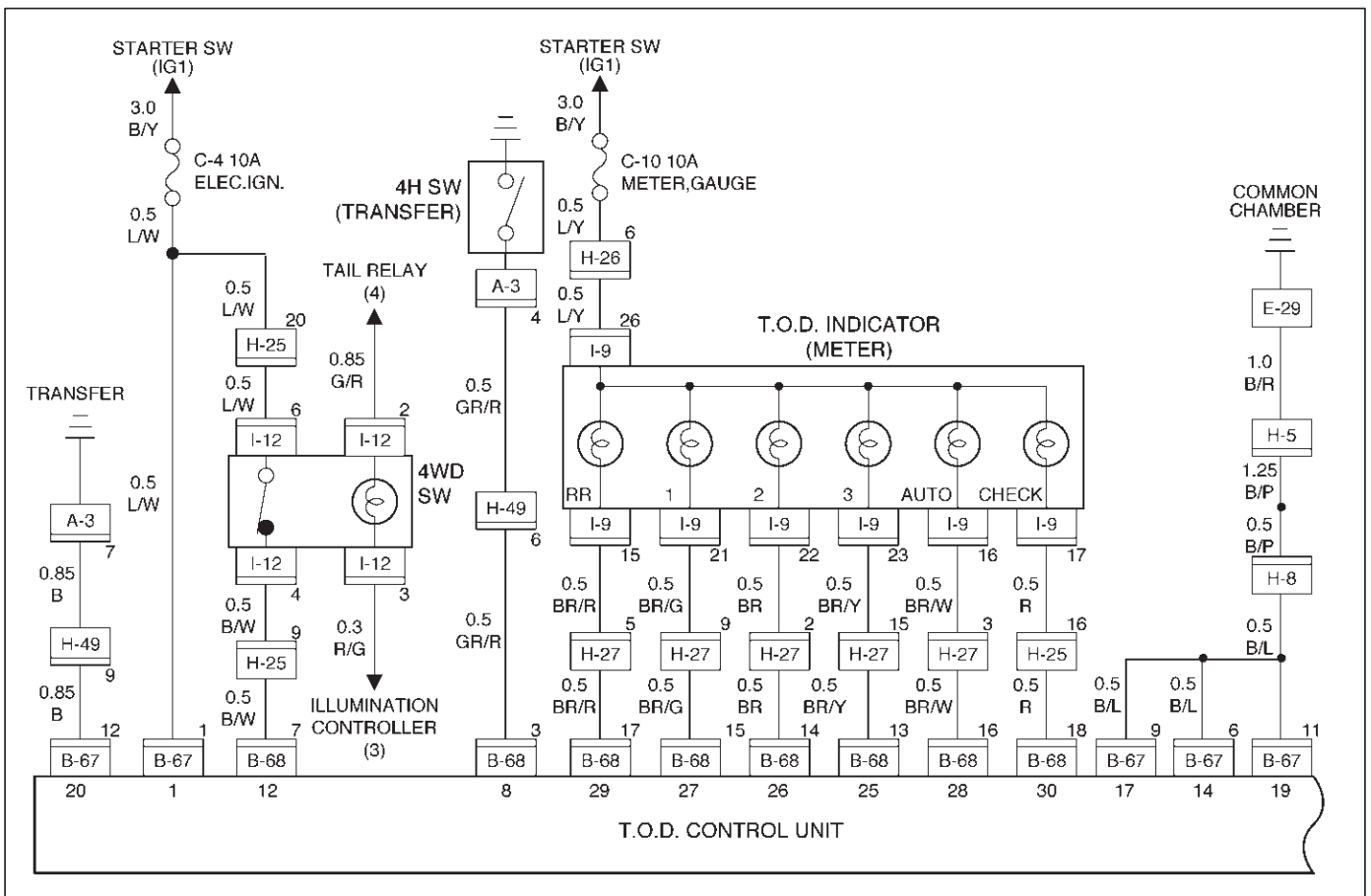
- After the starter is switched on, check and see if the status has become as tabulated below.

ECU Terminal 25	ECU Terminal 26	ECU Terminal 27	ECU Terminal 28	ECU Terminal 29	TOD Indicator indicate state
Short to terminal 20	Short to terminal 20	Short to terminal 20	Short to terminal 20	Short to terminal 20	 CHECK
Open	Open	Open	Open	Open	 CHECK

C07/RW012

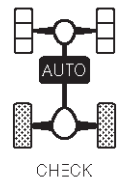
- If the status is as tabulated above, there is no problem. If not as tabulated above, inspect the harness.

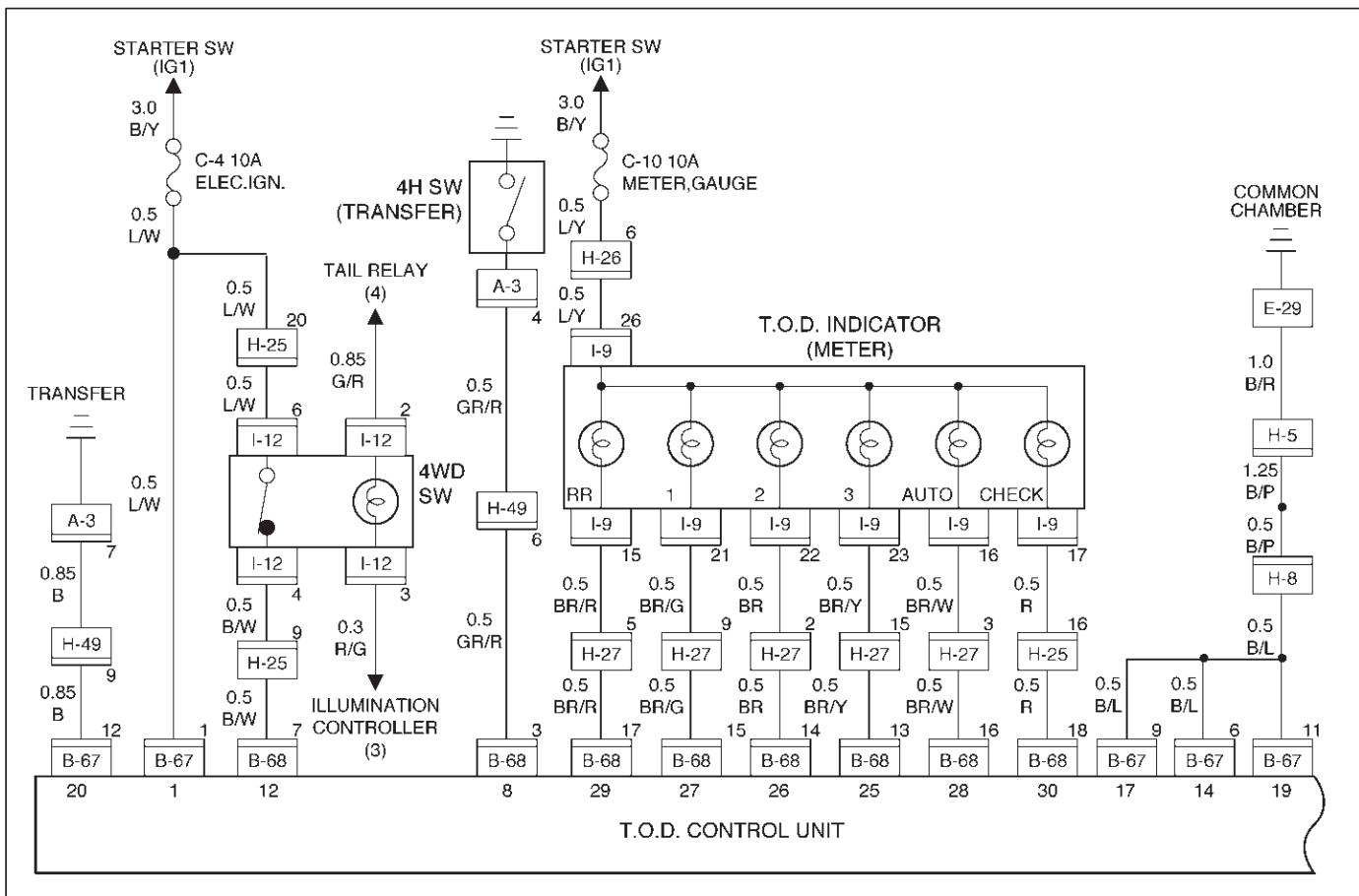
Chart A	Indicator drive circuit	
Function of circuit	The circuit informs the indicator of the working condition of the ECU.	
Fail condition	All the TOD indicator lamps and CHECK lamp are lit, and go off momentarily at an interval of about two seconds.	
Indicator lamp status		—
Transfer position	TOD, 4L	—



4B2-60 DRIVE LINE CONTROL SYSTEM (TOD)

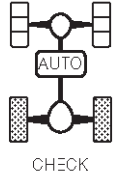
Step	Action	Yes	No
1	Turn on the starter switch. Is the battery voltage observed between terminals 1 and 19?	The ECU has failed. Replace the ECU. Go to Step 2	Check the battery circuit. Go to Step 2
2	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Go to Step 2

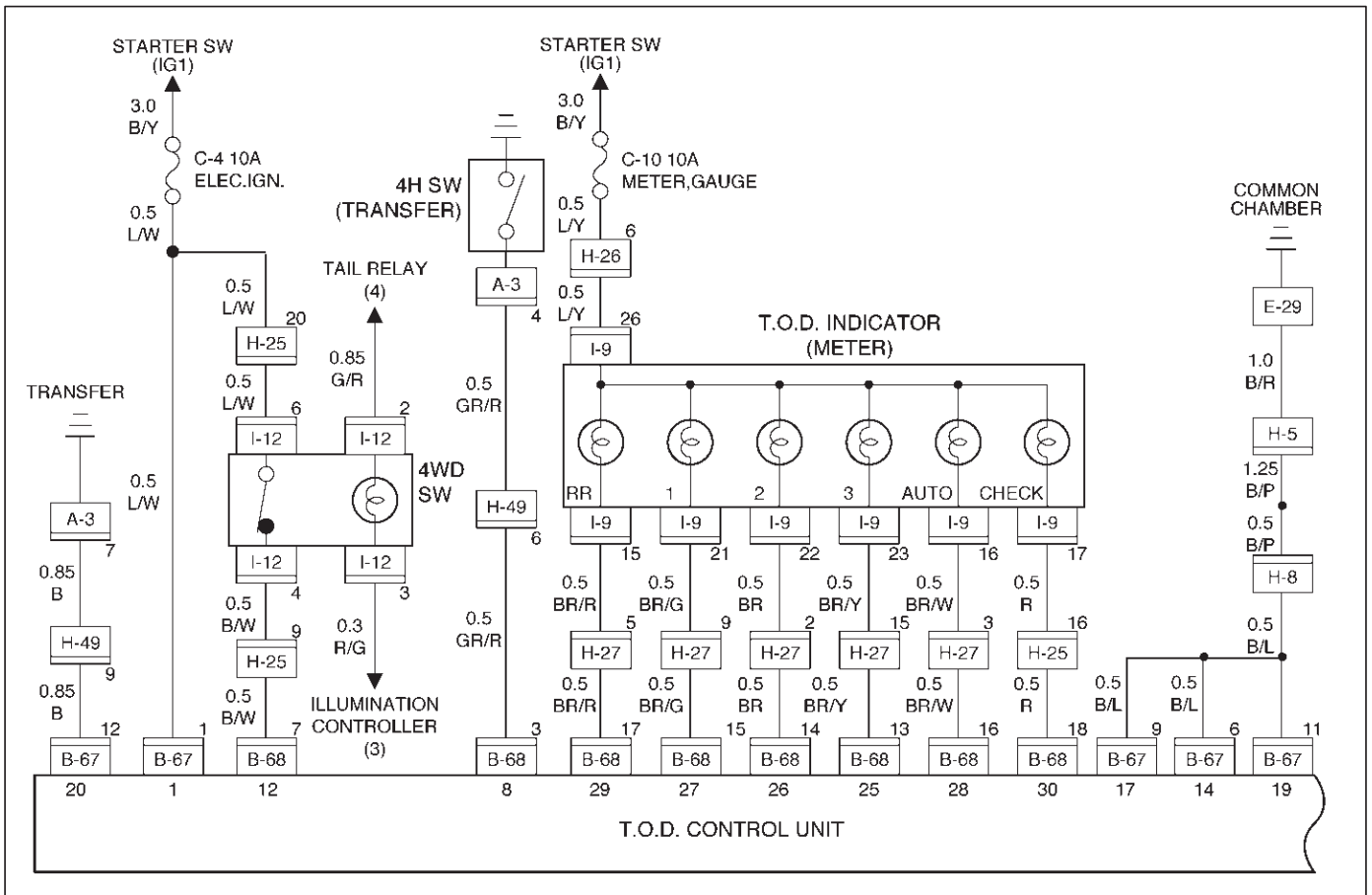
Chart B-1	The 4WD switch circuit wires are broken or short-circuited to the GND	
Function of circuit	—	
Fail condition	Even after the transfer mode is selected from TOD to 2H, the indicator lamp status is not changed.	
Indicator lamp status		—
Transfer position	2H	—



4B2-62 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
1	1. Turn on the starter switch. When the 4WD SW is selected to the 4WD position, is 0 V observed between terminal 12 and 19?	Go to Step 2	Repair the 4WD SW circuit. Go to Step 4
2	When the 4WD SW is selected to the 2WD position, is 12 V observed between terminals 12 and 19?	Go to Step 3	Repair the 4WD SW circuit. Go to Step 4
3	When the transfer lever is shifted to the 4L position, is battery voltage observed between terminals 28 and 19?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 4	Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

Chart B-2	The 4WD switch circuit is short to battery.
Function of circuit	—
Fail condition	Even after the transfer mode is selected from 2H to TOD, the indicator lamp status dose not change.
Indicator lamp status	 <p>CHECK</p>
Transfer position	TOD

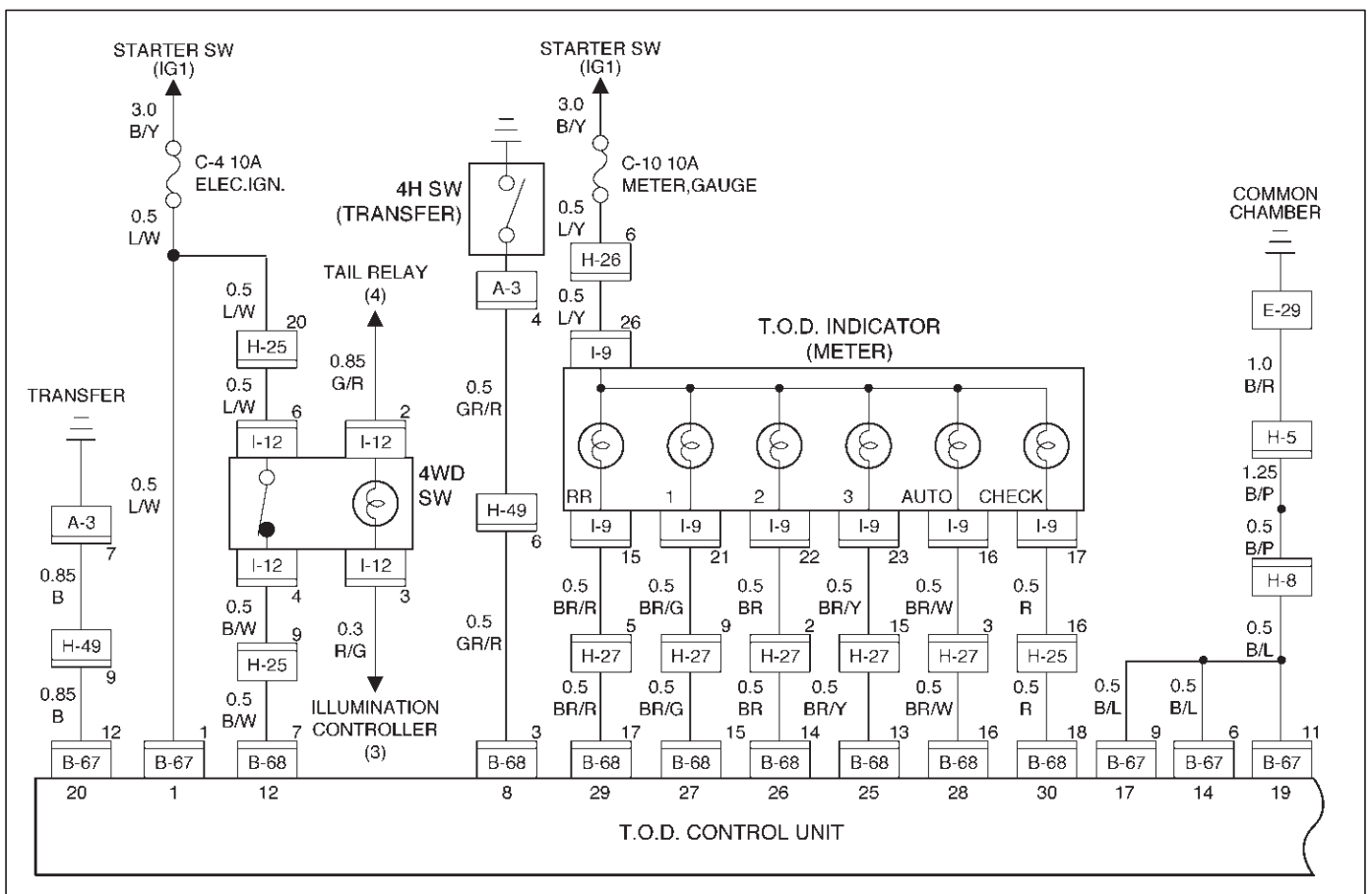


4B2-64 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
1	When the 4WD SW is selected to the 4WD position, is 0 V observed between terminal 12 and 19?	Go to Step 2	Repair the 4WD SW circuit. Go to Step 7
2	When the 4WD SW is selected to the 2WD position, is 12 V observed between terminals 12 and 19?	Go to Step 3	Repair the 4WD SW circuit. Go to Step 7
3	1. Disconnect the ECU connector. Is the continuity established between terminals (B-67)1 and (B-68)13?	Go to Step 4	Replace TOD indicator lamp bulb. Go to Step 7
4	Is the continuity established between terminals (B-67)1 and (B-68)14?	Go to Step 5	Replace TOD indicator lamp bulb. Go to Step 7
5	Is the continuity established between terminals (B-67)1 and (B-68)15?	Go to Step 6	Replace TOD indicator lamp bulb. Go to Step 7
6	Is the continuity established between terminals (B-67)1 and (B-68)16?	Replace ECU. Go to Step 7	Replace TOD indicator lamp bulb. Go to Step 7
7	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 7

DRIVE LINE CONTROL SYSTEM (TOD) 4B2-65

Chart C-1	4H switch circuit wires are broken or the battery is short-circuited.
Function of circuit	—
Fail condition	When the 4WD SW is 4WD mode. When the lever is shifted from 4L to HIGH, the 4L mode remains on the indicator and the TOD mode is displayed without turning off the previous mode.
Indicator lamp status	
Transfer position	4L <—> Neutral <—> TOD



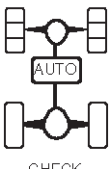
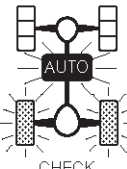
4B2-66 DRIVE LINE CONTROL SYSTEM (TOD)

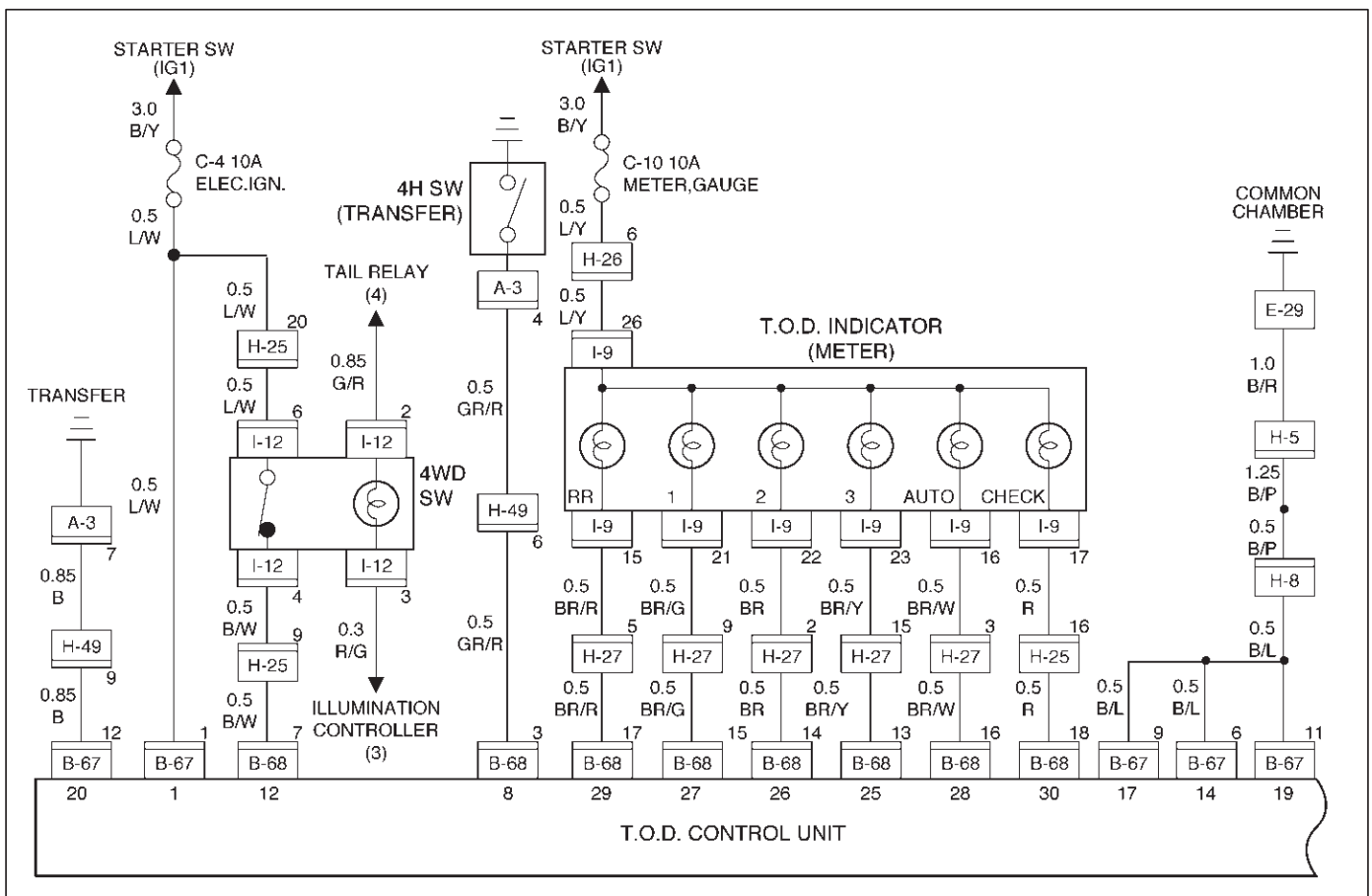
Step	Action	Yes	No
1	1. Turn on the starter switch. When the transfer lever is shifted to the high position, is 5V observed between terminals 8 and 19 (4H switch)?	Go to Step 2	Go to Step 4
2	When the transfer lever is shifted to the 4L position, is 5V observed between terminals 8 and 19 (4H switch)?	Go to Step 3	Go to Step 4
3	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 8 and 19 (4H switch)?	Replace the ECU. Go to Step 4	Go to Step 4
4	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. When the transfer lever is shifted to the high position, is 12V observed between terminals 8 and 19 (4H switch)?	Go to Step 5	Go to Step 7
5	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 8 and 19 (4H switch)?	Go to Step 6	Go to Step 7
6	When the transfer lever is shifted to the 4L position, is 12V observed between terminals 8 and 19 (4H switch)?	The 4H switch circuit battery is short-circuited between ECU and transfer. Repair the circuit. Go to Step 14	Go to Step 7
7	Turn off the starter switch. When the transfer lever is shifted to the neutral position, is the continuity established between terminals 8 and 19 (4H switch)?	Go to Step 8	Go to Step 10
8	When the transfer lever is shifted to the high position, is the continuity established between terminals 8 and 19?	Go to Step 10	Go to Step 9
9	When the transfer lever is shifted to the 4L position, is the continuity established between terminals 8 and 19?	Go to Step 14	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 10
10	When the transfer lever is shifted to the neutral position, is the continuity established between terminals (A-3)4 and (A-3)7?	Go to Step 11	Repair the transfer assembly. Go to Step 14
11	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (A-3)4 and (A-3)7?	Repair the transfer assembly. Go to Step 14	Go to Step 12
12	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (B-68)3 and (A-3)4?	Repair the transfer assembly. Go to Step 14	Go to Step 13

DRIVE LINE CONTROL SYSTEM (TOD) 4B2-67

Step	Action	Yes	No
13	Is the continuity established between transfer terminals (A-3)4 and body?	The ECU has failed. Replace the ECU. Go to Step 14	The harness is broken between terminal (A-3)4 and GND. Repair the circuit. Go to Step 14
14	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 14

4B2-68 DRIVE LINE CONTROL SYSTEM (TOD)

Chart C-2	The 4H switch circuit is short-circuited to GND.	
Function of circuit	—	
Fail condition	When the transfer lever is shifted to 4L, the indicator lamp status is not changed. When the transfer lever is shifted to High, the indicator lamp blinks at TOD mode.	
Indicator lamp status	 <p>CHECK</p>	 <p>Blinking</p>
Transfer position	4L	High (TOD)



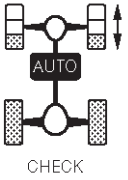
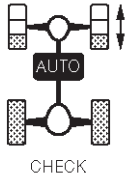
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-69

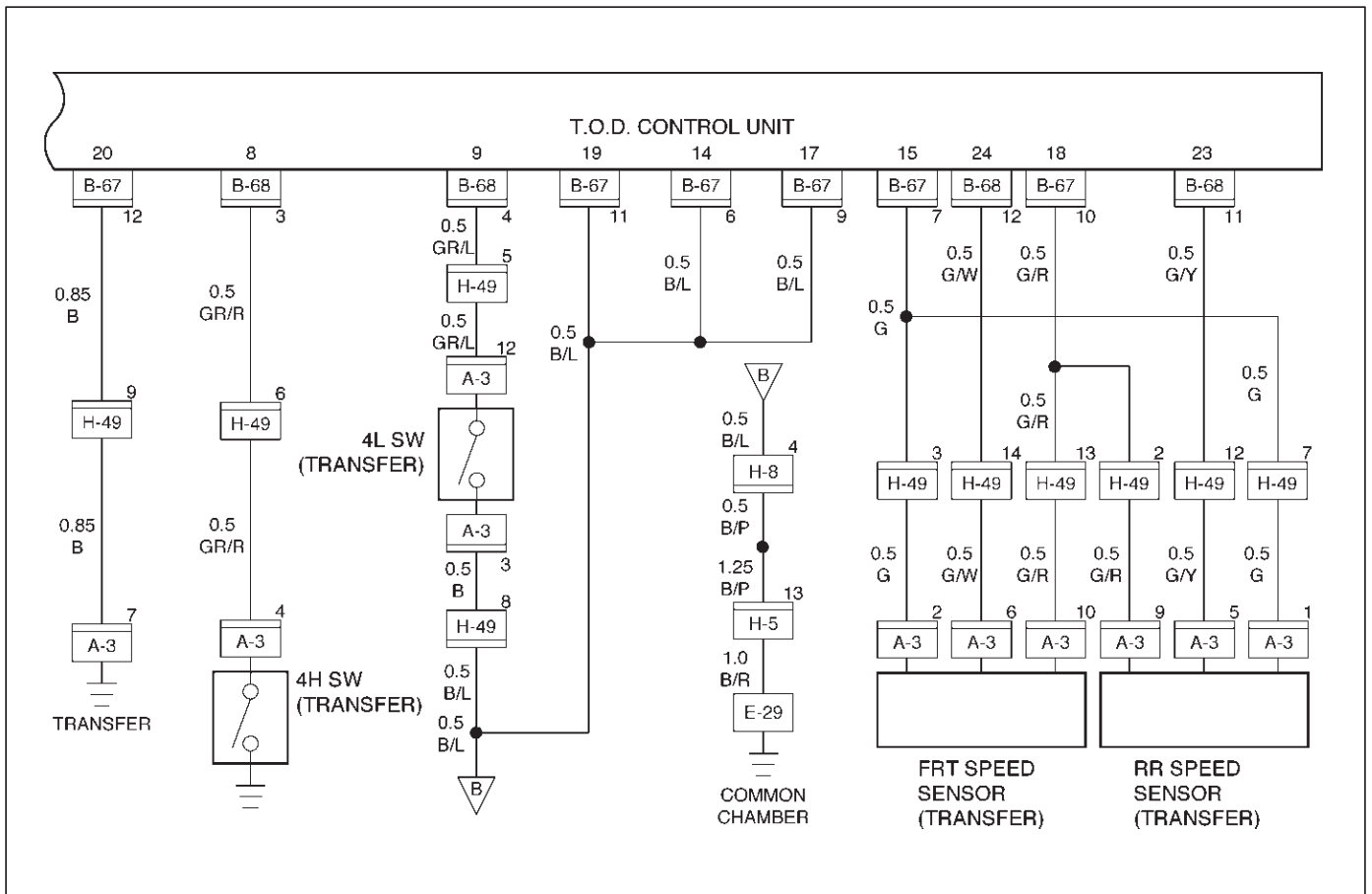
Step	Action	Yes	No
1	When the transfer lever is shifted to the High position, is 5V observed between terminals 8 and 19 (4H switch)?	Go to Step 2	Go to Step 14
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 8 and 19 (4H switch)?	Go to Step 3	Go to Step 14
3	When the transfer lever is shifted to the 4L position, is 5V observed between terminals 8 and 19 (4H switch)?	Go to Step 4	Go to Step 14
4	1. Turn off the starter switch. Is the continuity established between terminals 1 and 25?	Go to Step 5	Replace TOD indicator lamp bulb. Go to Step 23
5	Is the continuity established between terminals 1 and 26?	Go to Step 6	Replace TOD indicator lamp bulb. Go to Step 23
6	Is the continuity established between terminals 1 and 27?	Go to Step 7	Replace TOD indicator lamp bulb. Go to Step 23
7	Is the continuity established between terminals 1 and 28?	Go to Step 8	Replace TOD indicator lamp bulb. Go to Step 23
8	Is the continuity established between terminals 1 and 29?	Go to Step 9	Replace TOD indicator lamp bulb. Go to Step 23
9	1. Turn on the starter switch. 2. Shift the transfer lever is shifted to the 4L position. Is 0 V observed between terminals 25 and 20?	Go to Step 10	The ECU has failed. Replace the ECU. Go to Step 23
10	Is 0 V observed between terminals 26 and 20?	Go to Step 11	The ECU has failed. Replace the ECU. Go to Step 23
11	Is 0 V observed between terminals 27 and 20?	Go to Step 12	The ECU has failed. Replace the ECU. Go to Step 23
12	Is 12 V observed between terminals 28 and 20?	Go to Step 13	The ECU has failed. Replace the ECU. Go to Step 23
13	Is 0 V observed between terminals 29 and 20?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 23	The ECU has failed. Replace the ECU. Go to Step 23

4B2-70 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
14	1. Turn off the starter switch. 2. Disconnect the ECU connector. When the transfer lever is shifted to the neutral position, is the continuity established between terminals (B-68)3 and (B-67)11 (4H switch)?	Go to Step 15	Go to Step 17
15	When the transfer lever is shifted to the high position, is the continuity established between terminals (B-68)3 and (B-67)11?	Go to Step 17	Go to Step 16
16	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B-68)3 and (B-67)11?	The ECU has failed. Replace the ECU. Go to Step 23	Go to Step 17
17	1. Disconnect the H-49 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (H-49)6 and (B-68)3?	Go to Step 18	Go to Step 20
18	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (H-49)6 and (B-68)3?	Go to Step 20	Go to Step 19
19	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (H-49)6 and (B-68)3?	Go to Step 20	GND is short-circuited between terminals (B-68)3 and (H-49)6. Repair the circuit. Go to Step 23
20	1. Disconnect the A-3 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (A-3)4 and (B-68)3?	Go to Step 21	Repair the transfer assembly. Go to Step 23
21	When the transfer lever is shifted to the high position, is the continuity established between terminals (A-3)4 and (B-68)3?	Repair the transfer assembly. Go to Step 23	Go to Step 22
22	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (A-3)4 and (B-68)3?	Repair the transfer assembly. Go to Step 23	GND is short-circuited between terminals (B-68)3 and (A-3)4. Repair the circuit. Go to Step 23
23	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 23

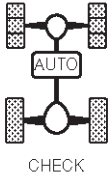
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-71

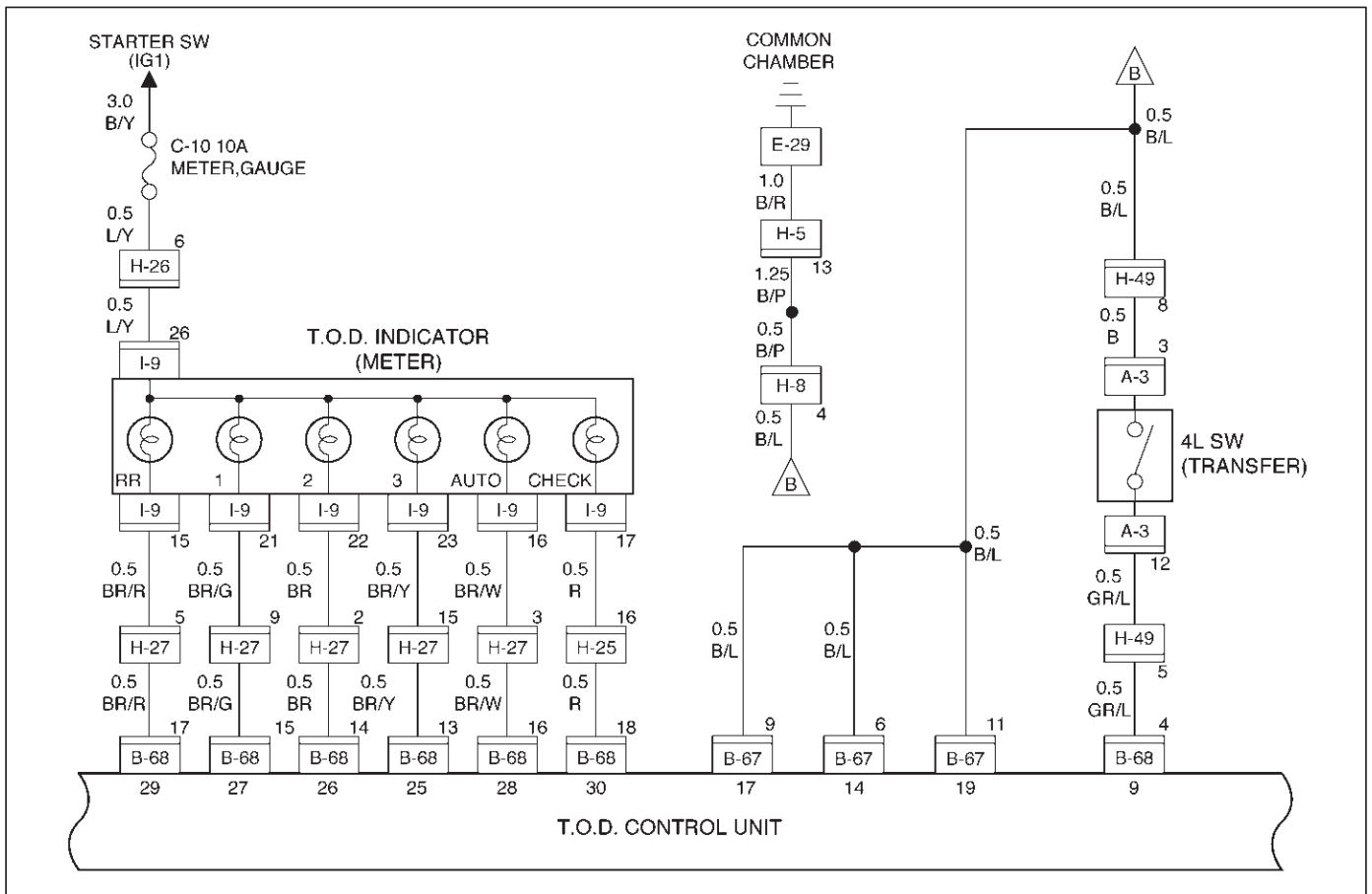
Chart D-1	4L switch circuit wires are broken or the battery is short-circuited.	
Function of circuit	—	
Fail condition	The TOD mode is displayed in the neutral position between high and 4L. When the lever is shifted to the 4L position, the TOD mode is displayed.	
Indicator lamp status		
Transfer position	4L	Neutral



4B2-72 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
1	Turn on the starter switch. When the transfer lever is shifted to the high position, is 5V observed between terminals 9 and 19 (4L switch)?	Go to Step 2	Go to Step 4
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 9 and 19 (4L switch)?	Go to Step 3	Go to Step 4
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 9 and 19 (4L switch)?	The ECU has failed. Replace the ECU. Go to Step 4	Go to Step 4
4	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. When the transfer lever is shifted to the high position, is 12V observed between terminals (B-68)4 and (B-67)11?	Go to Step 5	Go to Step 7
5	When the transfer lever is shifted to the neutral position, is 0V observed between terminals (B-68)4 and (B-67)11?	Go to Step 6	Go to Step 7
6	When the transfer lever is shifted to the 4L position, is 0V observed between terminals (B-68)4 and (B-67)11?	The 4L switch circuit battery is short-circuited between ECU and transfer. Repair the circuit Go to Step 13	Go to Step 7
7	Turn off the starter switch. When the transfer lever is shifted to the high position, is the continuity established between terminals (B-68)3 and (B-67)11?	Go to Step 10	Go to Step 8
8	When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (B-68)4 and (B-67)11?	Go to Step 9	Go to Step 10
9	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B-68)4 and (B-67)11?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 13	Go to Step 10
10	1. Disconnect the A-3 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between transfer connector terminals (A-3)12 and GND?	Wires are broken between transfer connector (A-3) and floor connector (H-49). Repair the circuit. Go to Step 11	Repair the transfer assembly. Go to Step 13
11	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (A-3)12 and GND?	Go to Step 12	Repair the transfer assembly. Go to Step 13
12	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (A-3)12 and GND?	Repair the transfer assembly. Go to Step 13	Go to Step 13
13	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 13

Chart D-2	The 4L switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	The 4L mode is displayed even in the 2H or TOD.
Indicator lamp status	
Transfer position	HIGH (2H or TOD)



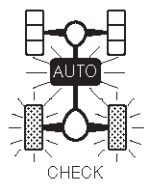
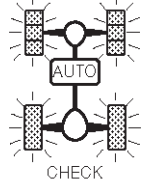
4B2-74 DRIVE LINE CONTROL SYSTEM (TOD)

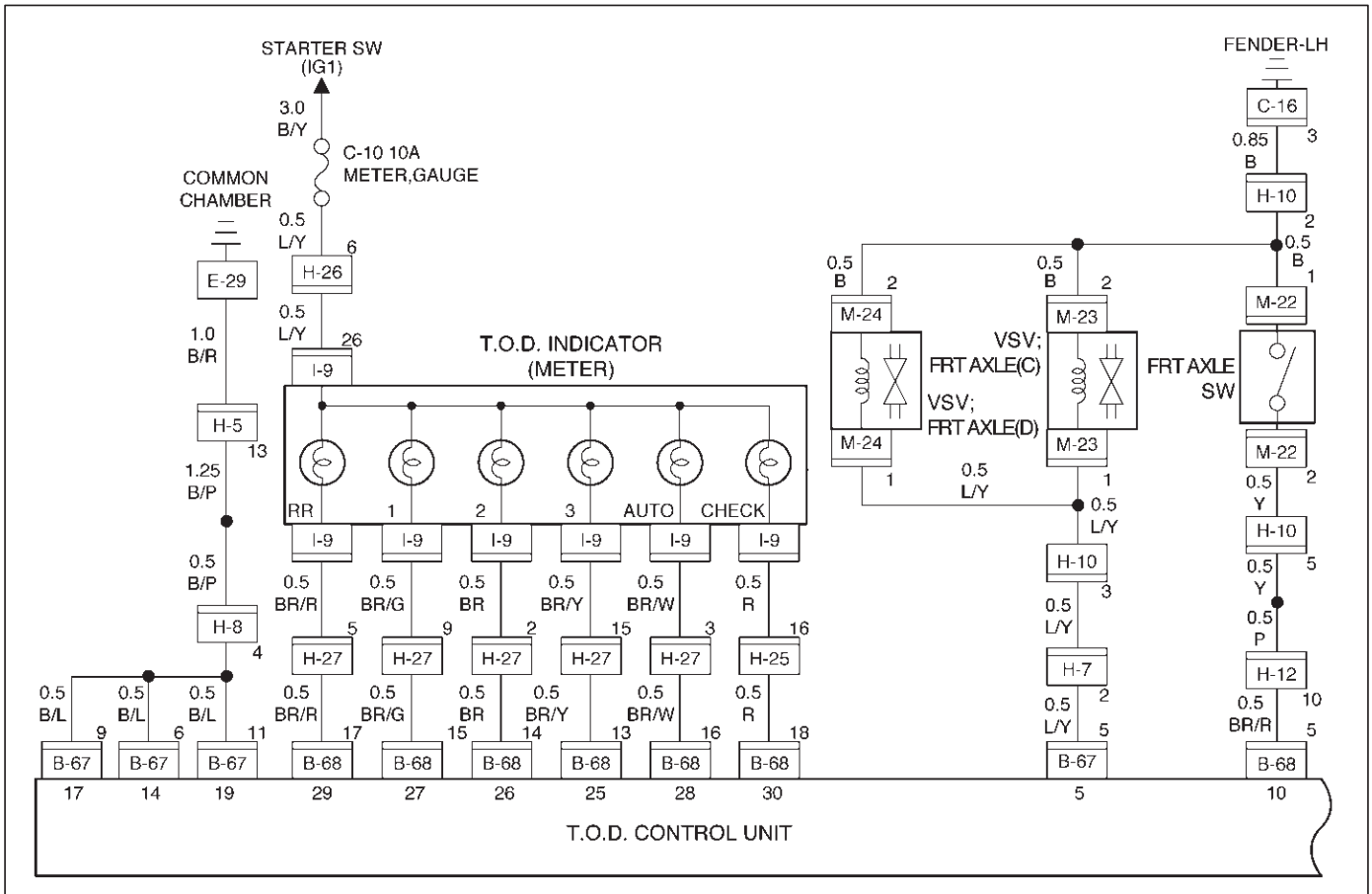
Step	Action	Yes	No
1	When the transfer lever is shifted to the high position, is 5V observed between terminals 9 and 19 (4L switch)?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 9 and 19 (4L switch)?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 9 and 19 (4L switch)?	Go to Step 4	Go to Step 7
4	1. Shift the 4WD SW to the 2H position. Is 12V observed between terminals 25 and 19?	Go to Step 5	The ECU has failed. Replace the ECU. Go to Step 16
5	Is 12V observed between terminals 26 and 19?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 16
6	Is 12V observed between terminals 27 and 19?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 16	The ECU has failed. Replace the ECU. Go to Step 16
7	1. Turn off the starter switch. 2. Disconnect the ECU connector. When the transfer lever is shifted to the neutral position between High and 4L, is the continuity established between terminals (B-68)4 and (B-67)11?	Go to Step 8	Go to Step 10
8	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B-68)4 and (B-67)11?	Go to Step 9	Go to Step 10
9	When the transfer lever is shifted to the high position, is the continuity established between terminals (B-68)4 and (B-67)11?	Go to Step 10	The ECU has failed. Replace the ECU. Go to Step 16
10	1. Disconnect the H-49 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (H-49)5 and (B-67)11?	Go to Step 11	Go to Step 13
11	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (H-49)5 and (B-67)11?	Go to Step 12	Go to Step 13
12	When the transfer lever is shifted to the high position, is the continuity established between terminals (H-49)5 and (B-67)11?	Go to Step 13	GND is short-circuited between terminals (B-68)4 and (H-49)5. Repair the circuit. Go to Step 16
13	1. Disconnect the A-3 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (A-3)12 and GND?	Go to Step 14	Repair the transfer assembly. Go to Step 16

DRIVE LINE CONTROL SYSTEM (TOD) 4B2-75

Step	Action	Yes	No
14	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (A-3)12 and GND?	Go to Step 15	Repair the transfer assembly. Go to Step 16
15	When the transfer lever is shifted to the high position, is the continuity established between terminals (A-3)12 and GND?	Repair the transfer assembly. Go to Step 16	GND is short-circuited between terminals (H-49)5 and (A-3)12. Repair the circuit. Go to Step 16
16	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 16

4B2-76 DRIVE LINE CONTROL SYSTEM (TOD)

Chart E-1	AXLE switch circuit wires are broken.	
Function of circuit	—	
Fail condition	Both the TOD and 4L modes are disabled. (The transition status is not removed.)	
Indicator lamp status	 <p>Blinking</p>	 <p>Blinking</p>
Transfer position	TOD	4L

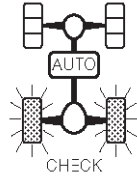


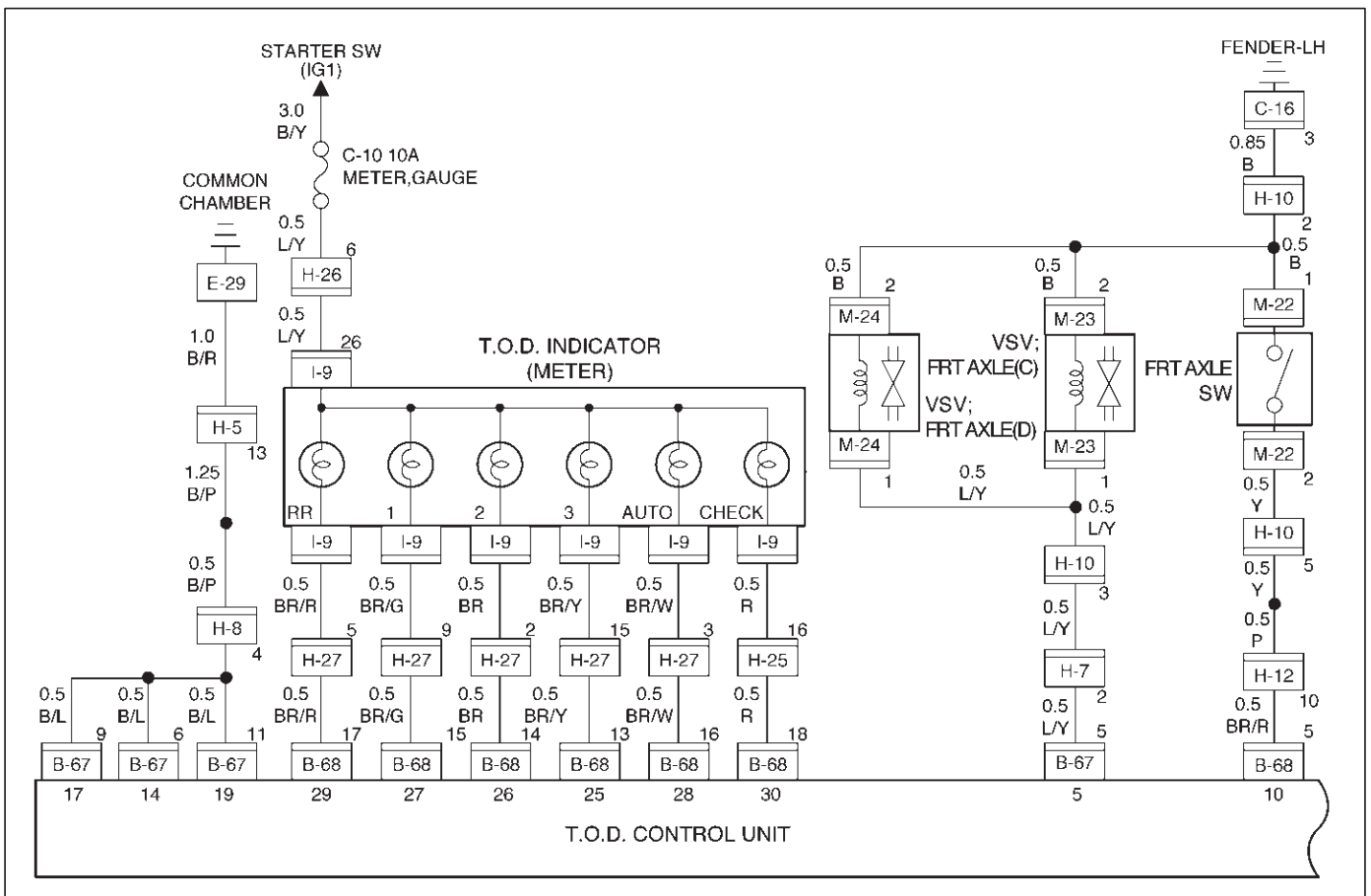
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-77

Step	Action	Yes	No
1	Start the engine. When the transfer lever is shifted to the neutral position between high and 4L, is 5V observed between terminals 10 and 19?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the high position and 4WD switch shifted to 4WD position, is 0V observed between terminals 10 and 19?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 10 and 19?	The ECU has failed. Replace the ECU. Go to Step 4	Go to Step 7
4	Shift the transfer lever to the 4L position. Is 0V observed between terminals 25 and 19?	Go to Step 5	The ECU has failed. Replace the ECU. Go to Step 19
5	Is 0V observed between terminals 26 and 19?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 19
6	Is 0V observed between terminals 27 and 19?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
7	When the transfer lever is shifted to the 2H position, is the battery voltage observed between terminals 5 and 19?	Go to Step 8	Go to Step 11
8	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 5 and 19?	Go to Step 9	Go to Step 11
9	When the transfer lever is shifted to the high position (TOD mode), is 0V observed between terminals 5 and 19?	Go to Step 10	Go to Step 11
10	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 5 and 19?	Go to Step 12	Go to Step 11
11	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
12	1. Turn off the starter switch. 2. Disconnect the ECU connector. Does the resistance between terminals (B-67)5 and (B-67)11 meet the standard, $17 < R < 25$ ohm?	Go to Step 13	Repair the circuit or replace the VSV. Go to Step 16
13	1. Turn on the starter switch. When the 4WD SW is selected to the 2WD position, is the battery voltage supplied to each VSV?	Go to Step 14	Repair the circuit or replace the VSV. Go to Step 16
14	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage supplied to each VSV?	Go to Step 15	Repair the circuit or replace the VSV. Go to Step 19

4B2-78 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
15	When the transfer lever is shifted to the high position and 4WD switch shifted to 4WD position, is 0V observed on each VSV?	Go to Step 16	Repair the circuit or replace the VSV. Go to Step 19
16	When the transfer lever is shifted to the 4L position, is 0V observed on each VSV?	Go to Step 17	Repair the circuit or replace the VSV. Go to Step 19
17	Is the vacuum pressure supplied to the VSV?	Go to Step 18	Repair the vacuum system. Go to Step 19
18	Can the single AXLE switch enable and disable the continuity?	Repair the shift on the fly system (refer to Section 4C "Front Axle"). Go to Step 19	Replace the AXLE switch (refer to Section 4C "Drive Shaft System" of Chassis Repair Manual). Go to Step 19
19	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 19

Chart E-2	The AXLE switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	Even after the 4WD SW is select to the 2WD position, the 2WD mode is not enabled. (The transition status is not removed.)
Indicator lamp status	
Transfer position	2H



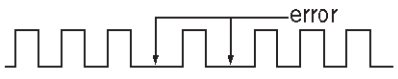
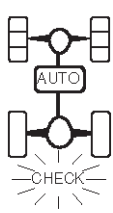
4B2-80 DRIVE LINE CONTROL SYSTEM (TOD)

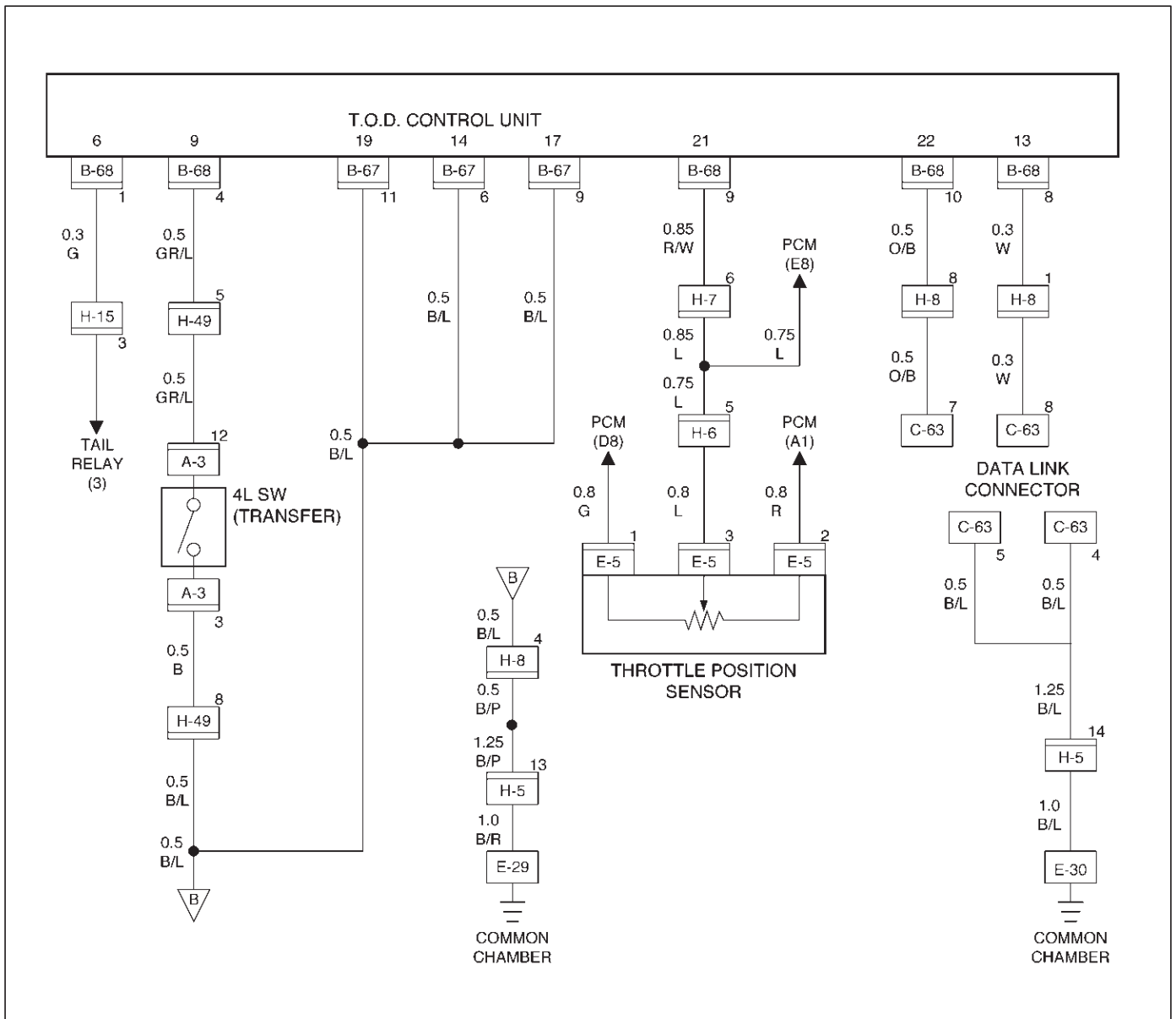
Step	Action	Yes	No
1	Start the engine. When the transfer lever is shifted to the neutral position between high and 4L, is 5V observed between terminals 10 and 19?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the high position and 4WD switch shifted to 4WD position, is 0V observed between terminals 10 and 19?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 10 and 19?	Go to Step 4	Go to Step 7
4	Select the 4WD SW to the 2WD position. Is 12V observed between terminals 25 and 19?	Go to Step 5	Go to Step 19
5	Is 12V observed between terminals 26 and 19?	Go to Step 6	Go to Step 19
6	Is 12V observed between terminals 27 and 19?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
7	When the 4WD SW is select to the 2WD position, is the battery voltage observed between terminals 5 and 19?	Go to Step 8	Go to Step 11
8	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 5 and 19?	Go to Step 9	Go to Step 11
9	When the transfer lever is shifted to the high position and 4WD switch shifted to 4WD position, is 0V observed between terminals 5 and 19?	Go to Step 10	Go to Step 11
10	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 5 and 19?	Go to Step 12	Go to Step 11
11	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
12	1. Turn off the starter switch. 2. Disconnect the ECU connector. Does the resistance between terminals (B-67)5 and (B-67)11 meet the standard, $17 < R < 25$ ohm?	Go to Step 13	Repair the circuit or replace the VSV. Go to Step 19
13	1. Connect the ECU connector. 2. Turn on the starter switch. When the 4WD SW is select to the 2WD position, is the battery voltage supplied to each VSV?	Go to Step 14	Repair the circuit or replace the VSV. Go to Step 19
14	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage supplied to each VSV?	Go to Step 15	Repair the circuit or replace the VSV. Go to Step 19
15	When the transfer lever is shifted to the high position and 4WD switch shifted to 4WD position, is 0V observed on each VSV?	Go to Step 16	Repair the circuit or replace the VSV. Go to Step 19

DRIVE LINE CONTROL SYSTEM (TOD) 4B2-81

Step	Action	Yes	No
16	When the transfer lever is shifted to the 4L position, is 0V observed on each VSV?	Go to Step 17	Repair the circuit or replace the VSV. Go to Step 19
17	Is the vacuum pressure supplied to the VSV?	Go to Step 18	Repair the vacuum system. Go to Step 19
18	Can the single AXLE switch enable and disable the continuity?	Repair the shift on the fly system Refer to Section 4C "Front Axle". Go to Step 19	Replace the AXLE switch Refer to Section 4C "Drive Shaft System". Go to Step 19
19	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 19

4B2-82 DRIVE LINE CONTROL SYSTEM (TOD)

Chart G	The trouble codes are displayed.
Function of circuit	—
Fail condition	The CHECK lamp continues blinking irregularly. 
Indicator lamp status	
Transfer position	—

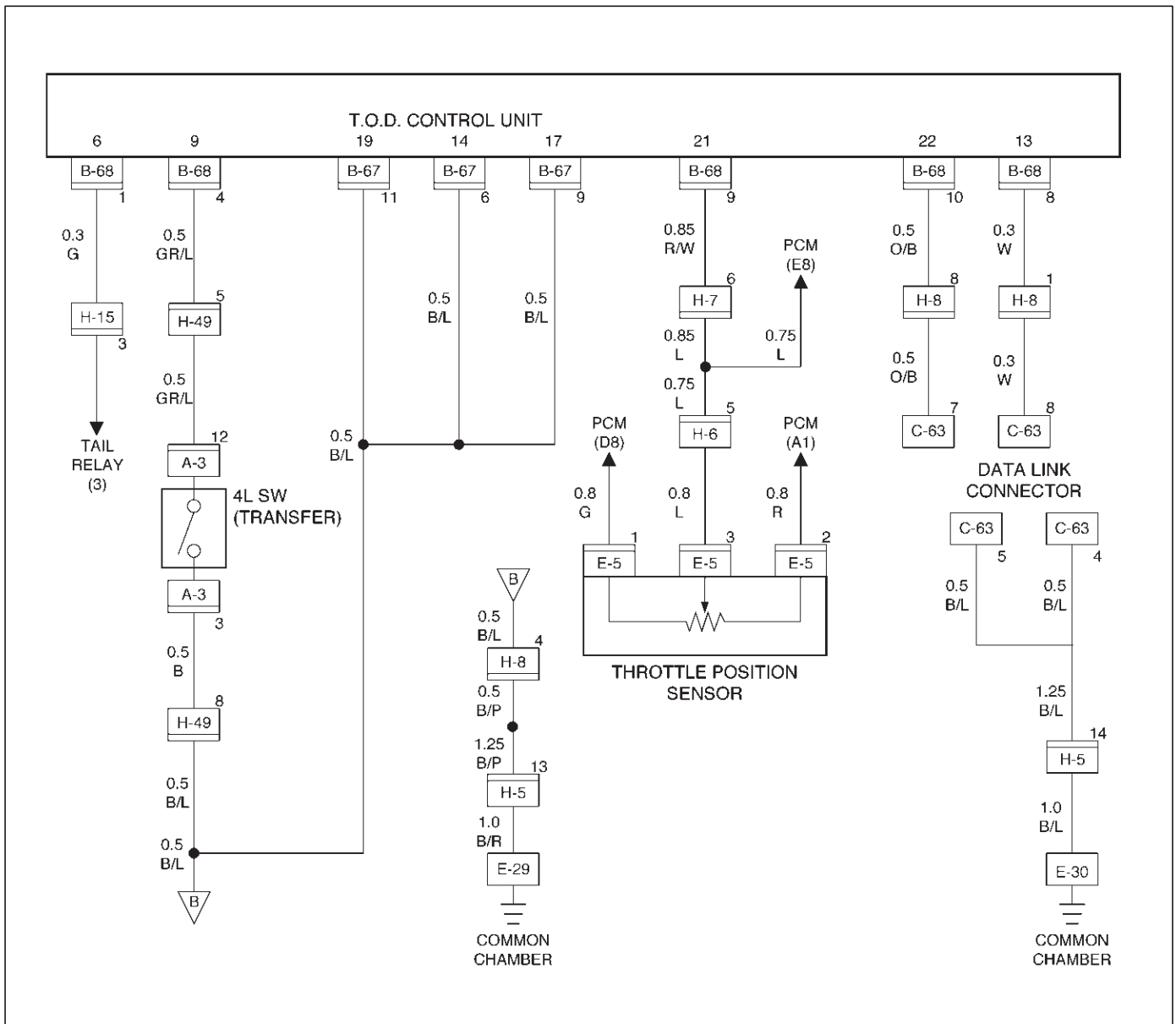


DRIVE LINE CONTROL SYSTEM (TOD) 4B2-83

Step	Action	Yes	No
1	Disconnect the ECU connector from ECU. Is the continuity established between terminals (B-68)8 and (B-67)11?	Go to Step 2	The ECU has failed. Replace the ECU. Go to Step 3
2	Is the self-diagnostic connector short-circuited?	Go to Step 3	Open the self-diagnostic connector. Go to Step 3
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Repeat the "Diagnosis Flow".	Go to Step 3

4B2-84 DRIVE LINE CONTROL SYSTEM (TOD)

Chart H	lighting switch circuit
Function of circuit	Reads in the status of lighting switch and reduces the indicator brightness at night.
Fail condition	Even if the lighting switch is pressed on and off, brightness does not change.
Indicator lamp status	
Transfer position	All position (example TOD mode)



DRIVE LINE CONTROL SYSTEM (TOD) 4B2-85

Step	Action	Yes	No
1	1. Disconnect ECU terminal. 2. Turn on the starter switch. Is battery voltage observed between ECU terminals (B-68)1 and (B-67)11?	Go to Step 2	Wirers are broken lighting SW circuit. Repair the circuit. Go to Step 4
2	Turn lighting SW "ON". Is 0 V observed between ECU terminal (B-68)1 and (B-67)11?	Go to Step 3	Lighting SW circuit battery short. Repair the circuit. Go to Step 4
3	Connect ECU terminal. While the lighting switch is pressed on and off, does the brightness of the indicator change?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed" Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

4B2-86 DRIVE LINE CONTROL SYSTEM (TOD)

Diagnosis from Symptom

Troubles that are not indicated by the warning lamp are listed in the table below. These troubles are caused by the faults that cannot be detected by the self-diagnostic function of the control unit.

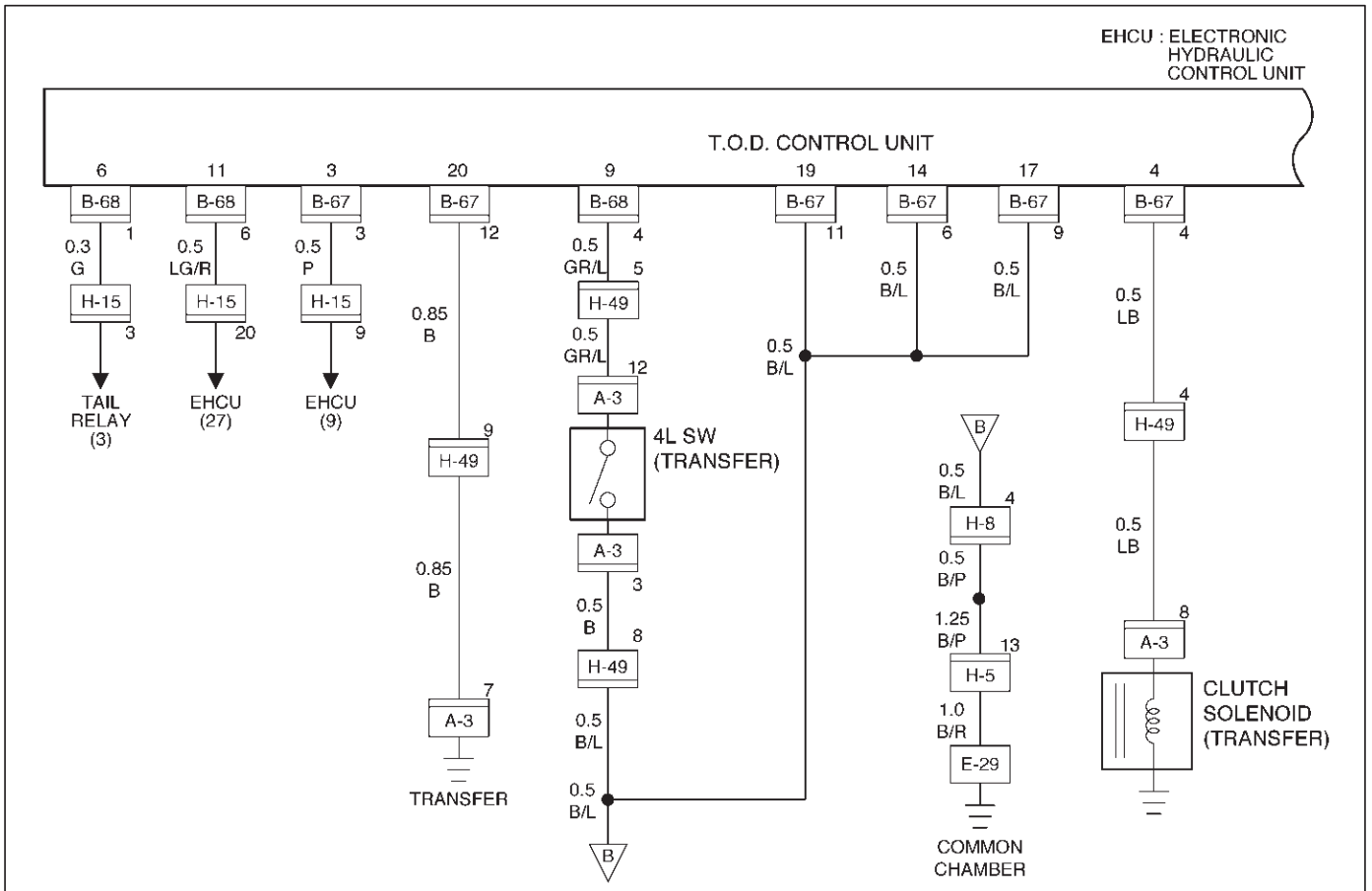
If this type of trouble is observed, interview the customer and conduct test runs to reproduce the trouble,

cross-check the reported trouble with the listed phenomena, and diagnose and analyze the trouble on the item by item basis.

	Phenomena	Major cause	Corrective action
1	The tight corner braking is observed when the vehicle is subject to full steering.	<ul style="list-style-type: none">● The standard tires are not used.● The tire pressure is incorrect.● The tires are worn in uniformity.● The transfer or wiring is imperfect.● The limited slip differential is failed.	Check and recondition the vehicle according to Chart 1.
2	Even if the 4WD SW is select to the 4WD position, the 4WD mode is not active, resulting in remarkable rear wheel spin.	<ul style="list-style-type: none">● The transfer or wiring is imperfect.● The shift on the fly system is failed.	Check and recondition the vehicle according to Chart 2.
3	<ul style="list-style-type: none">● When the 4WD SW is select to the 4WD position, the drive resistance of the 4WD system is too large to get sufficient running speed.● Noised drive line.	<ul style="list-style-type: none">● The standard tires are not used.● The tire pressure is incorrect.● The tires are worn in uniformity.● The transfer or wiring is imperfect.● The limited slip differential is	Check and recondition the vehicle according to Chart 1.
4	The shift on the fly system (front axle) generates gear noises.	<ul style="list-style-type: none">● The wiring is imperfect.● The full automatic free wheel hub is failed.	Check and recondition the vehicle according to Chart 3.
5	The braking distance gets long even when the ABS is active.	<ul style="list-style-type: none">● The wiring is imperfect.● The ABS is failed.	Check and recondition the vehicle according to Chart 4.

DRIVE LINE CONTROL SYSTEM (TOD) 4B2-87

Chart 1	The tight corner braking is observed.
Function of circuit	—
Fail condition	When the vehicle is subject to full steering in the TOD mode, the drive resistance gets large or the judder occurs. Otherwise, the above phenomenon is observed only when the brake is applied.



4B2-88 DRIVE LINE CONTROL SYSTEM (TOD)

Step	Action	Yes	No
1	Are the front and rear tires in specified size?	Go to Step 2	Replace the tires with specified ones, and service the new tires. Go to Step 16
2	Is the tire pressure correct?	Go to Step 3	Replace the tires with specified ones, and service the new tires. Go to Step 16
3	Are the tires free from abnormal wear?	Go to Step 4	Replace the tires with specified ones, and service the new tires. Go to Step 16
4	Are different types of tires used?	Go to Step 5	Replace the tires with specified ones, and service the new tires. Go to Step 16
5	<ol style="list-style-type: none"> 1. Start the engine. 2. Shift the transfer lever to the high (TOD) position. 3. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. <p>Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.</p>	Go to Step 6	Go to Step 11
6	<ol style="list-style-type: none"> 1. Shift the transfer lever to the 2H position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. <p>Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.</p>	Go to Step 7	Go to Step 14
7	Is an LSD mounted to the rear differential?	Go to Step 8	Go to Step 9
8	Is the genuine LSD oil used in the rear differential?	Go to Step 9	Replace the differential oil. Go to Step 16
9	Does the engine output the power correctly?	Go to Step 10	Check the engine. Go to Step 16
10	Do the speed sensors work correctly? (Check trouble codes.)	The ECU has failed. Replace the ECU. Go to Step 16	Replace the speed sensors. Go to Step 16
11	Is the tight corner braking observed only when the brake is applied?	Go to Step 12	Conduct full steering under WOT. Go to Step 5
12	<ol style="list-style-type: none"> 1. Turn off the starter switch. 2. Disconnect the ECU connector. <p>Is the battery voltage observed between terminals (B-68)6 and (B-67)11?</p>	Go to Step 13	Repair the circuit of terminal 6 (ABS IN). Go to Step 16

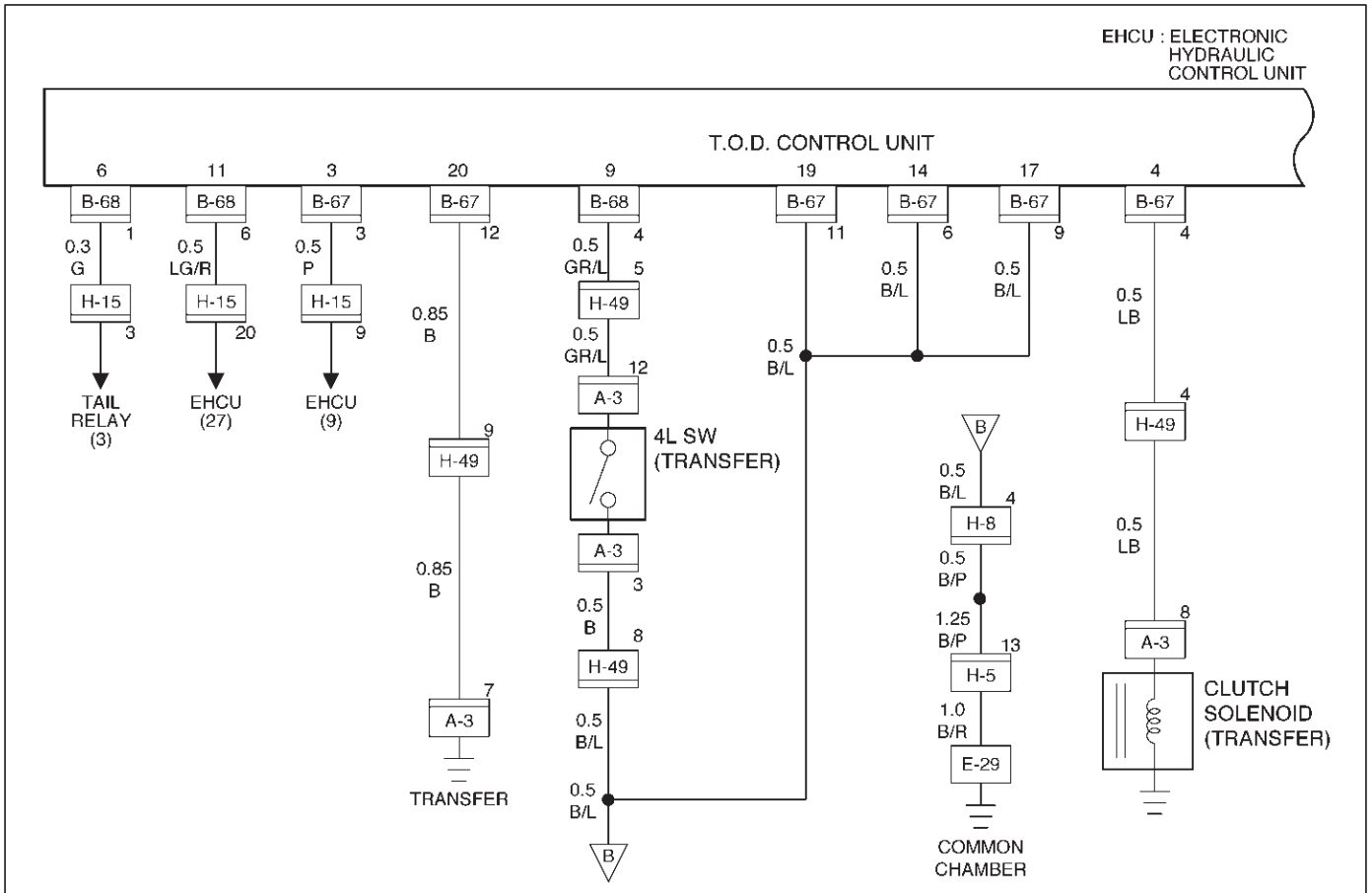
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-89

Step	Action	Yes	No
13	1. Apply the brake and fully turn the steering to the left (or right) end, and start the creep run. Does the voltage between terminals 4 and 20 range between 0.1 and 1.0V?	Repair the transfer assembly. Go to Step 16	The ECU has failed. Replace the ECU. Go to Step 16
14	1. Shift the transfer lever to the high (TOD) position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the voltage between terminals 4 and 20 range between 0.1 and 1.0V?	Go to Step 15	Go to Step 13
15	1. Select the 4WD SW to the 2WD position. 2. Jack up the right front wheel. Does the front tire rotate smoothly?	Repair the transfer assembly. Go to Step 16	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 16
16	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 16

*NOTE: Before checking this item, run the vehicle more than 10 meters with the steering wheel in straight position so that the 4L mechanical lock sleeve can be released certainly.

4B2-90 DRIVE LINE CONTROL SYSTEM (TOD)

Chart 2	The 4WD mode is not active.
Function of circuit	—
Fail condition	The rear wheels spin in the TOD mode, so the driving torque is not transmitted to the front wheels. The indicator lamps will not show the 4L and TOD status.

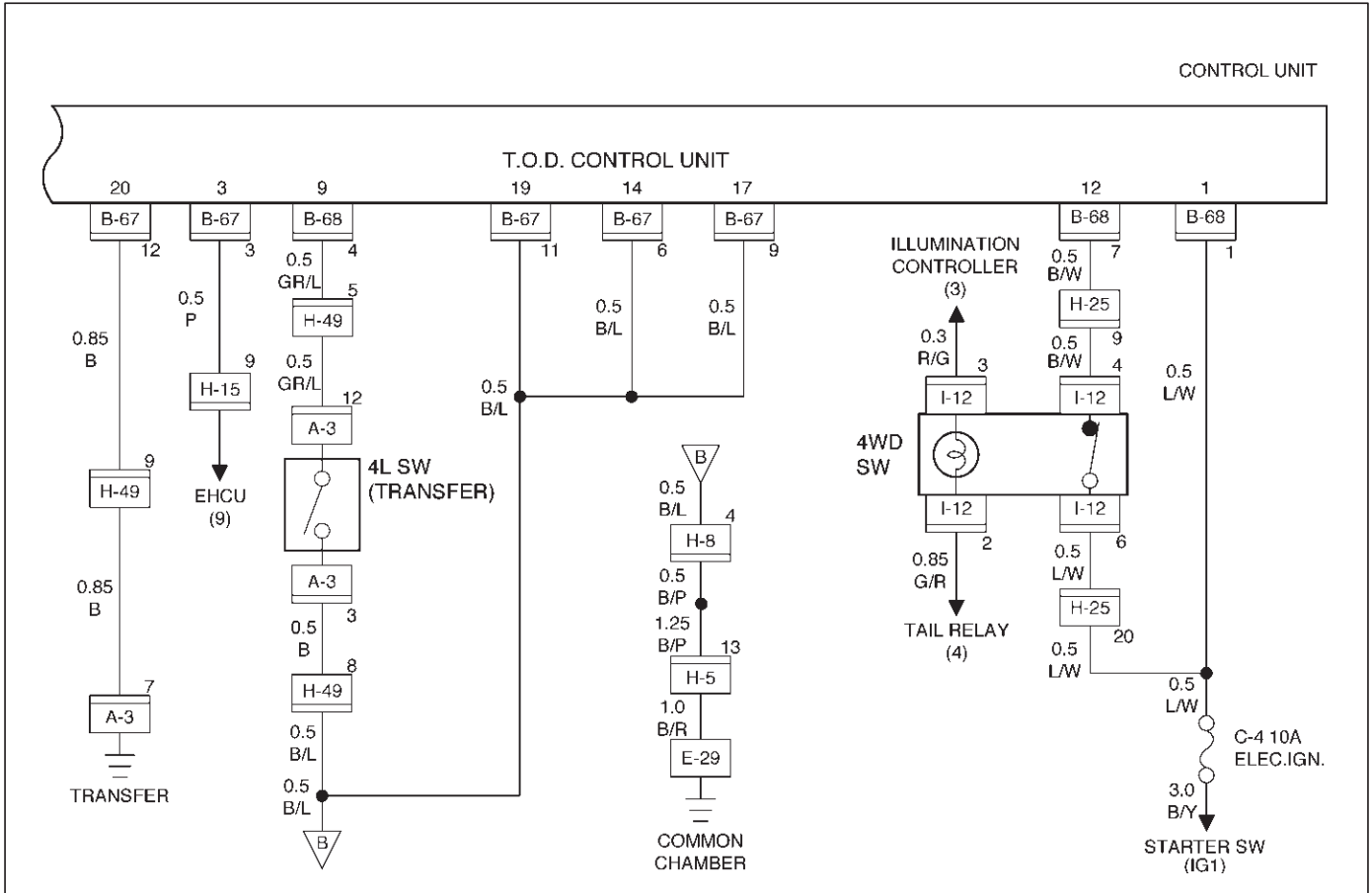


DRIVE LINE CONTROL SYSTEM (TOD) 4B2-91

Step	Action	Yes	No
1	Is the trouble code 31 or 26 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 7	Go to Step 2
2	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 7	Go to Step 3
3	When the transfer lever is in the specified position, do the TOD indicator lamps show the correct status?	Go to Step 4	Examine the trouble based on "Trouble Diagnosis Depending on The Status of TOD Indicator". Go to Step 7
4	Shift the transfer lever to the 4L position, fully turn the steering to the left (or right) end, and start the creep run. Does the tight corner braking occur?	Go to Step 5	Repair the transfer assembly. Go to Step 7
5	1. Shift the transfer lever to the high (TOD) position. 2. Turn on the starter switch. Does the voltage between terminals 4 and 20 indicate at least 0.1V while the throttle is completely open?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 7
6	Does the voltage between terminals 4 and 20 indicate at least 3V while the throttle is completely closed?	The TOD clutch is worn. Repair the transfer assembly. Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
7	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 7

4B2-92 DRIVE LINE CONTROL SYSTEM (TOD)

Chart 3	The shift on the fly system generates gear noises. (The fuel economy is bad in the 2H mode.)
Function of circuit	—
Fail condition	When the vehicle is run in the 2H mode, the shift on the fly system generates gear noises or the front wheel gears are engaged to generate a shock.

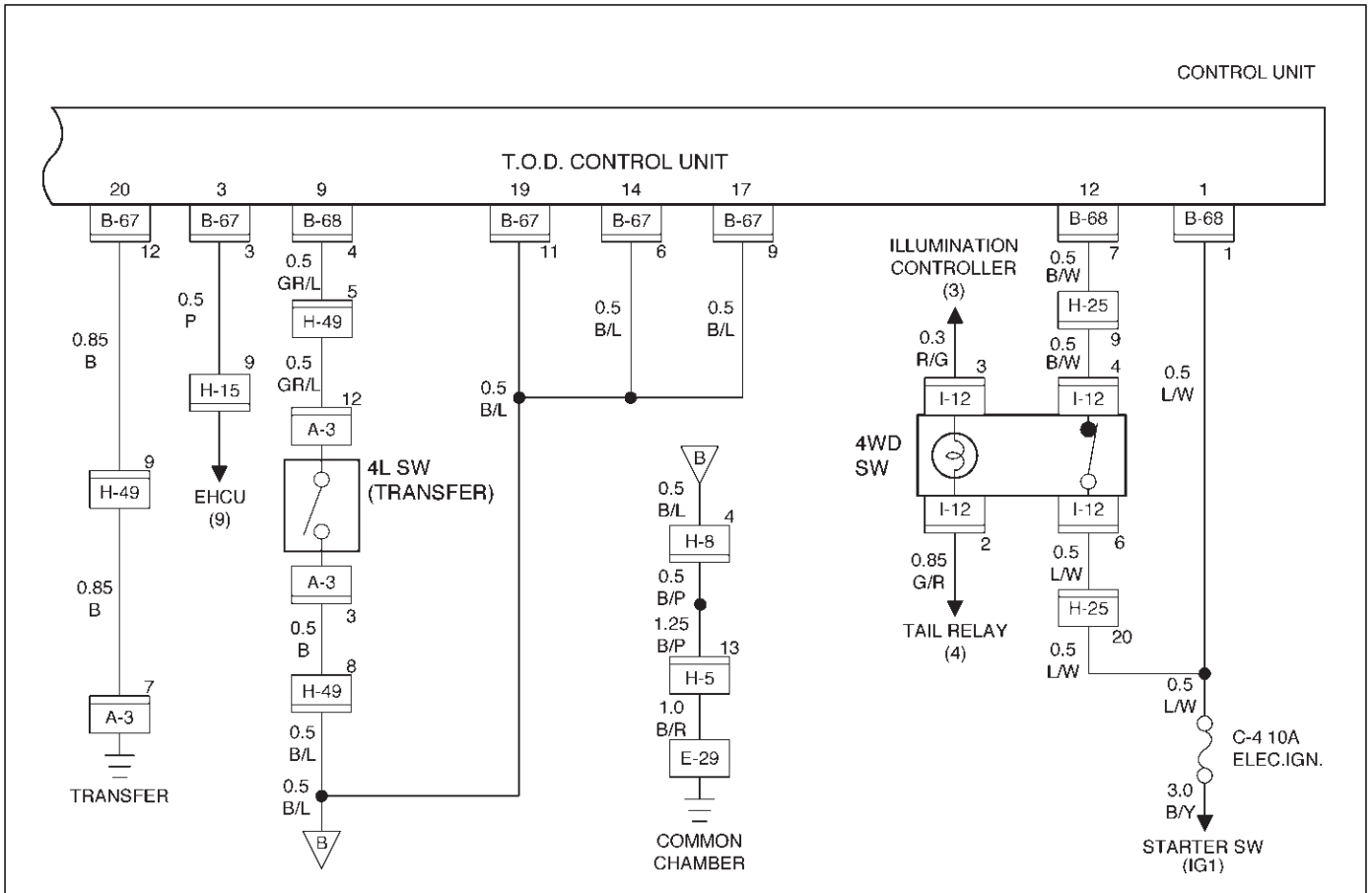


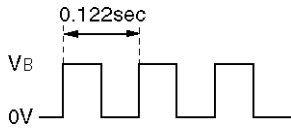
DRIVE LINE CONTROL SYSTEM (TOD) 4B2-93

Step	Action	Yes	No
1	Do the indicator lamps show the correct status?	Go to Step 2	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 2
2	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 6	Go to Step 3
3	Turn on the starter switch. Is the battery voltage observed between terminals 1 and 20?	Go to Step 4	Go to Step 5
4	When the 4WD SW is select to the 2WD position, are the front axle gears correctly disengaged (and when the left front tire is jacked up and turned, is the front propeller shaft standstill)?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 6	The shift on the fly system is failed (refer to Section 4C "Drive Shaft System"). Go to Step 6
5	Does the battery voltage maintain the correct level?	Repair the battery circuit. Go to Step 6	Repair the battery and charging system. Go to Step 6
6	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 6

4B2-94 DRIVE LINE CONTROL SYSTEM (TOD)

Chart 4	The braking distance gets long even when the ABS is active.
Function of circuit	—
Fail condition	Enough deceleration is not obtained and the braking distance gets long even when the ABS is active in the 2H mode.



Step	Action	Yes	No
1	Are the brake and ABS systems healthy?	Go to Step 2	Repair the brake and ABS. Go to Step 4
2	Turn on the starter switch. Is the battery voltage observed between terminals 1 and 20?	Go to Step 3	Repair the battery system. Go to Step 4
3	1. Select the 4WD SW to the 2WD position. 2. The voltage between terminals 3 and 19 range between 7.5 and 16V (0.24 seconds make a cycle)  Does the voltage within the range specified?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

DRIVELINE/AXLE

DRIVE SHAFT SYSTEM

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Disassembly	4C-24	Universal Joint Reassembly	4C-53
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Service Precaution

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

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

General Description

This publication contains essential removal, installation, adjustment and maintenance procedures.

The front axle utilizes a central disconnect type front axle/transfer case system.

The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) drive shaft joints connected by an axle shaft.

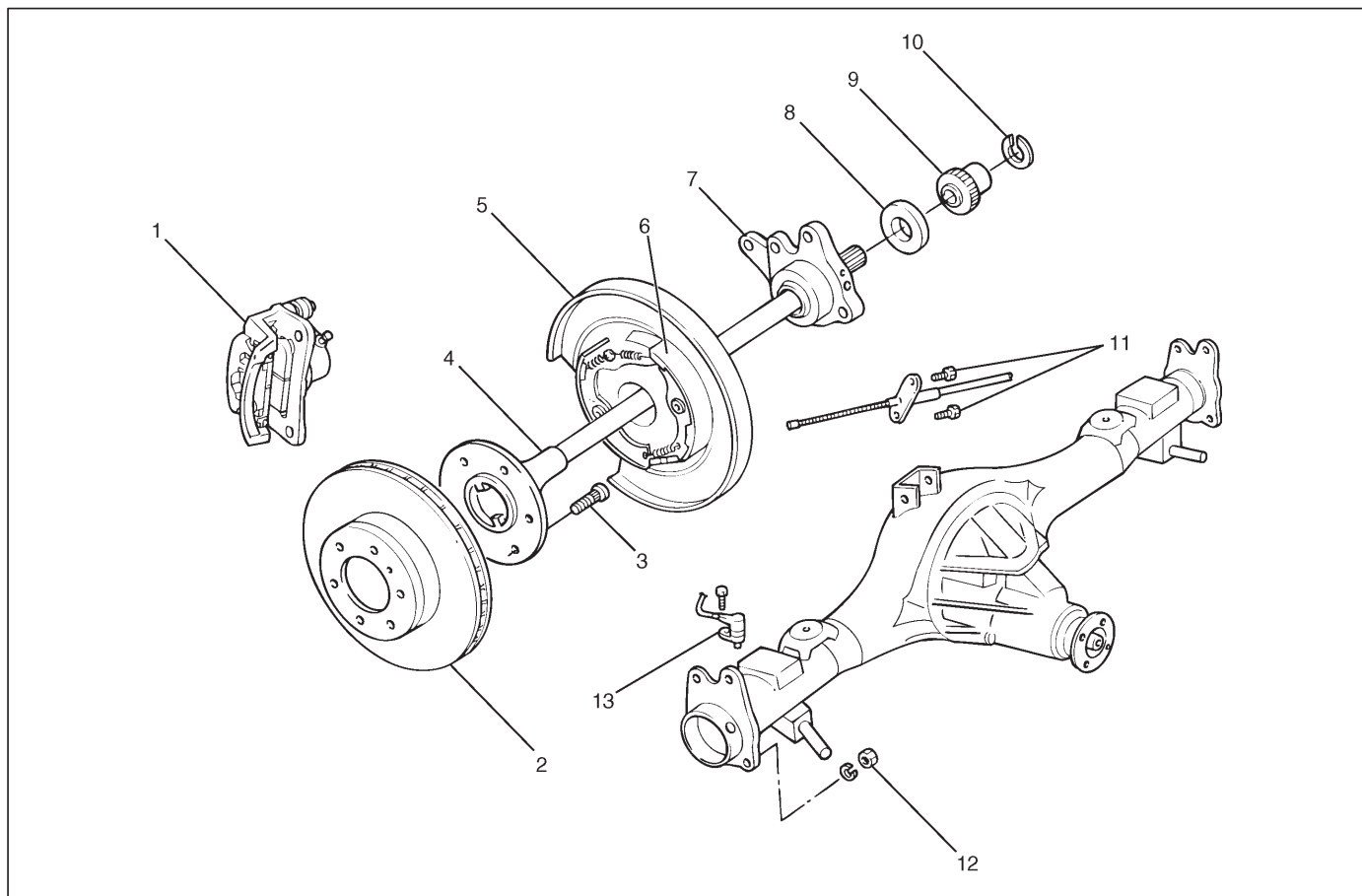
For description of propeller shaft and universal joint, refer to Front/Rear Propeller Shaft in this section.

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
"Clank" When Accelerating From "Coast"	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Adjust or replace the steering gear.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Rear Axle Shaft

Rear Axle Shaft and Associated Parts



420RW014

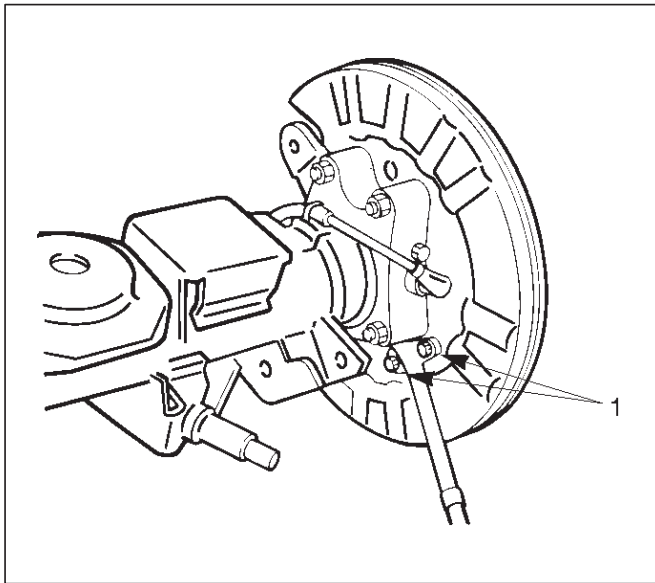
Legend

- | | |
|----------------------------|--|
| (1) Brake Caliper | (8) Bearing |
| (2) Brake Disc | (9) Retainer |
| (3) Wheel Pin | (10) Snap Ring |
| (4) Axle Shaft Assembly | (11) Bolt |
| (5) Back Plate | (12) Nut |
| (6) Parking Brake Assembly | (13) Antilock Brake System (ABS) Speed Sensor (if so equipped) |
| (7) Bearing Holder | |

Removal

1. Raise the vehicle.
2. Remove tires and wheels. Refer to Wheel in Steering section.
3. Remove brake caliper. Use a wire to attach the brake caliper to the frame. Refer to Disk Brakes in Brake section.
4. Remove brake disc.
5. Remove ABS sensor (if so equipped).
6. Remove Parking brake assembly. Refer to Parking Brakes in Brake section.

7. Remove the parking brake cable mounting bolts(Behind the back plate)(1).



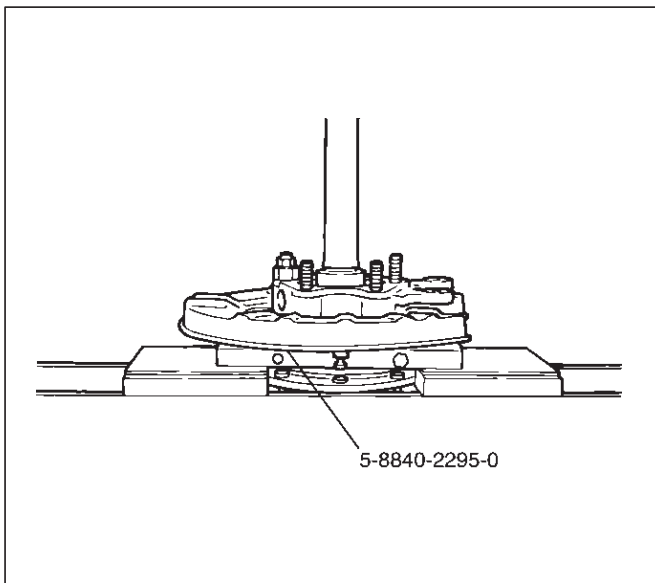
311RS001

8. Remove the bearing holder mounting nuts.
9. Remove axle shaft assembly.

NOTE: Be sure not to damage the oil seal.

10. Remove snap ring.

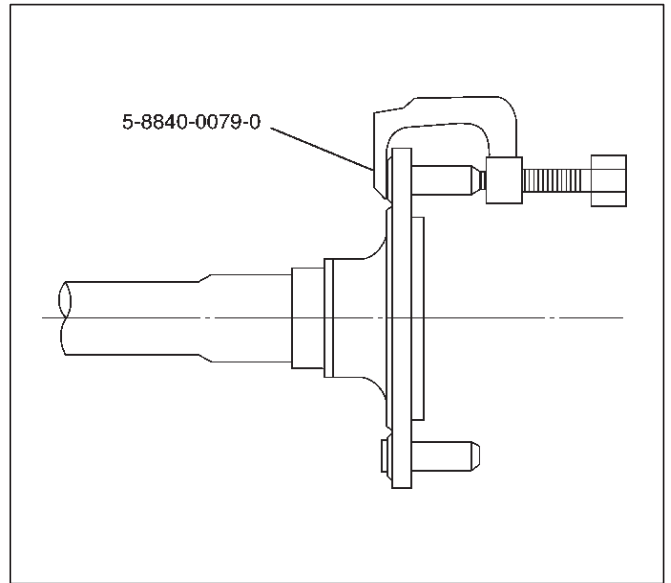
11. Using a bearing remover 5-8840-2295-0 and press, remove retainer together with the bearing holder.



420RW024

12. Remove bearing.
13. Remove bearing holder.
14. Remove back plate.

15. Remove the wheel pins using a remover 5-8840-0079-0.



420RW023

Inspection and Repair

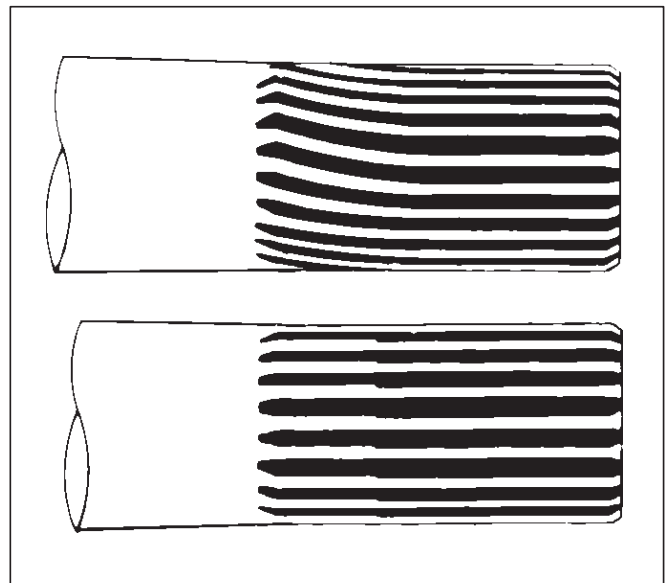
Make necessary correction or parts replacement if wear, corrosion or any other abnormal conditions are found through inspection.

Visual Check:

Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Axle shaft
2. Bearing

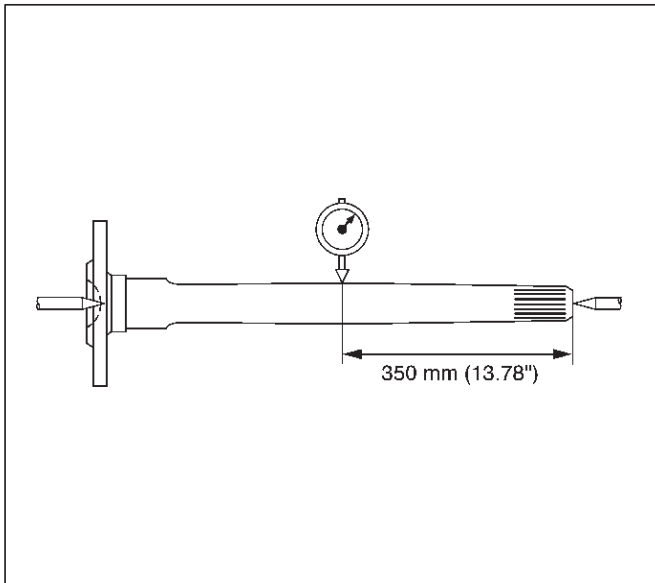
When checking the axle shaft, pay special attention to the splined portions and replace the shaft if distortion or step wear is noticeable. Correct slight step wear with a grinder.



420RS008

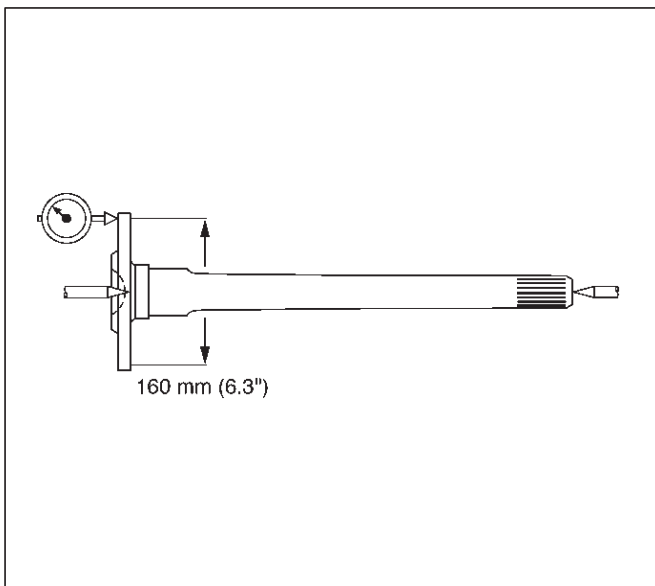
Axle Shaft Run-out

Limit: 1.0 mm (0.039 in)



Axle Shaft Flange Run-out

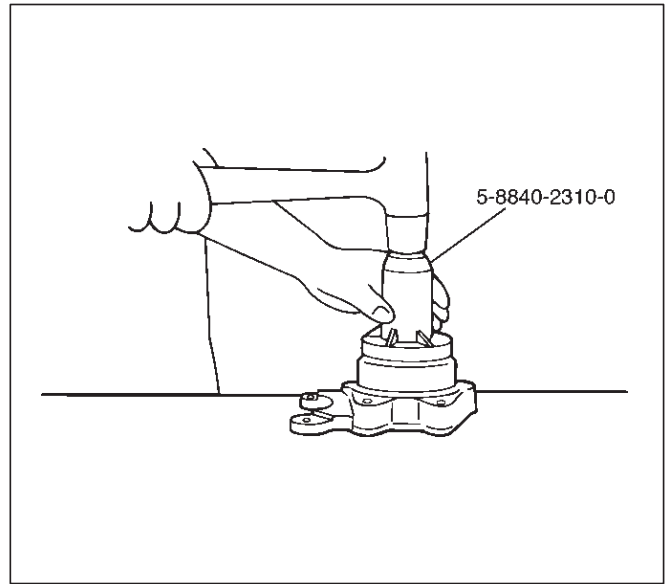
Limit: 0.08 mm (0.003 in)



Oil Seal Replacement

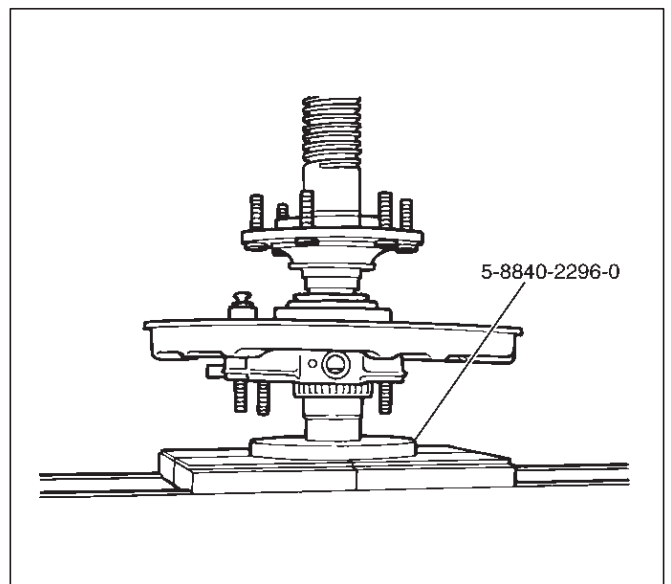
Remove the oil seal carefully not to damage the bearing holder bore .

When installing, use oil seal installer 5-8840-2310-0.



Installation

1. Install wheel pin.
2. Install back plate.
3. Install bearing holder.
4. Install bearing.
5. Install retainer by using a bearing installer 5-8840-2296-0, press fit together with the bearing.



6. Install snap ring.
7. Install axle shaft assembly.

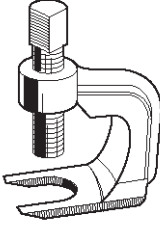
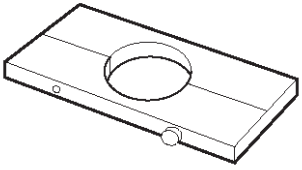
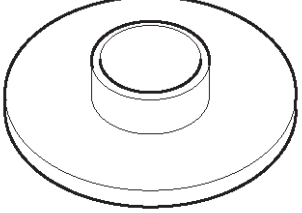
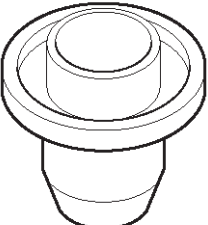
NOTE: Be sure not to damage the oil seal.

8. Tighten the bearing holder mounting nut to the specified torque.

Torque: 74N-m (7.5kg-m/54 lb ft)

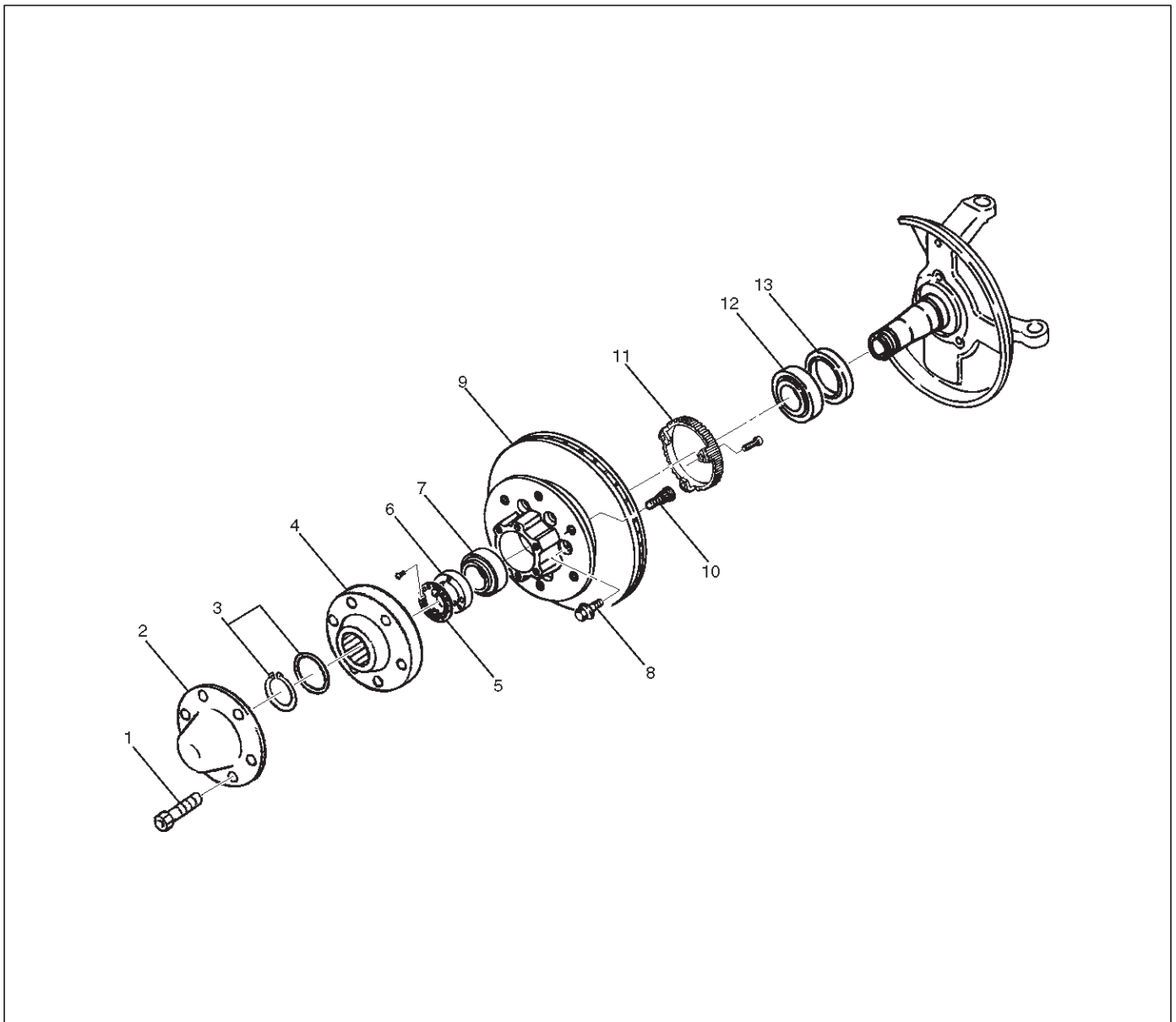
9. Fix the parking brake cable mounting bolt (Behind the back plate).
10. Install parking brake assembly, refer to Parking Brakes in Brake section.
11. Install antilock brake system sensor (if so equipped).
12. Install brake disc.
13. Install brake caliper, refer to Disk Brakes in Brake section.

Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RS206</p>	<p>5-8840-0079-0 (J-6627-A) Wheel pin remover</p>
 <p>901RS207</p>	<p>5-8840-2295-0 (J-39211) Remover; Axle shaft bearing</p>
 <p>901RS208</p>	<p>5-8840-2296-0 (J-39212) Installer; Axle shaft bearing</p>
 <p>901RS209</p>	<p>5-8840-2310-0 (J-39379) Installer; Outer axle seal</p>

Front Hub and Disc (with Shift on the Fly)

Disassembled View



411RW001

Legend

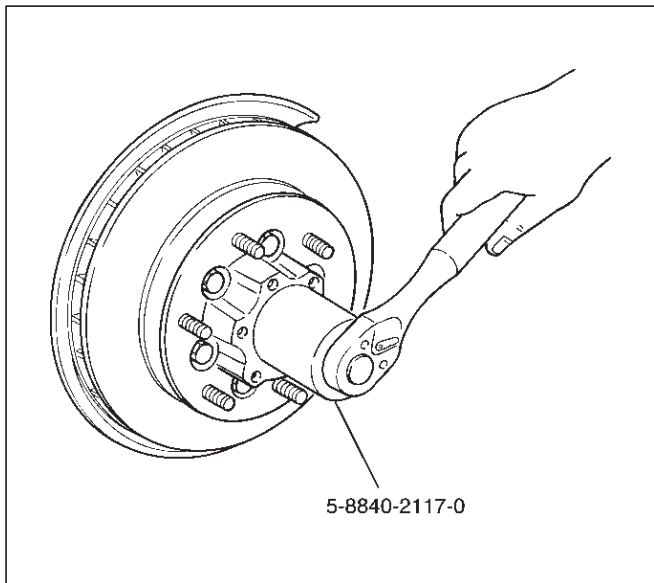
- | | |
|--------------------------------|------------------------------------|
| (1) Bolt | (7) Outer Bearing |
| (2) Cap | (8) Bolt |
| (3) Snap Ring and Shim | (9) Hub and Disc Assembly |
| (4) Hub Flange | (10) Wheel Pin |
| (5) Lock Washer and Lock Screw | (11) ABS Sensor Ring (If equipped) |
| (6) Hub Nut | (12) Inner Bearing |
| | (13) Oil Seal |

Disassembly

1. Before disassembly, select the 2WD position.
2. Jack up the front of vehicle and support frame with jack stands.
3. Remove the disc brake caliper assembly and hang it on the frame with wires. Refer to Front Disc Brake Caliper Assembly in Brakes section.
4. Remove bolt.
5. Remove cap.
6. Remove snap ring and shim.
7. Remove hub flange.

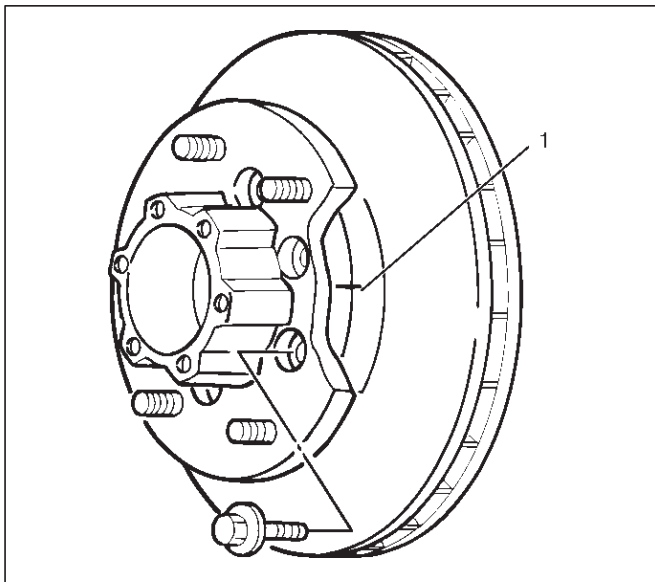
4C-10 DRIVE SHAFT SYSTEM

8. Remove lock washer and lock screw.
9. Use wrench 5-8840-2117-0, remove hub nut.



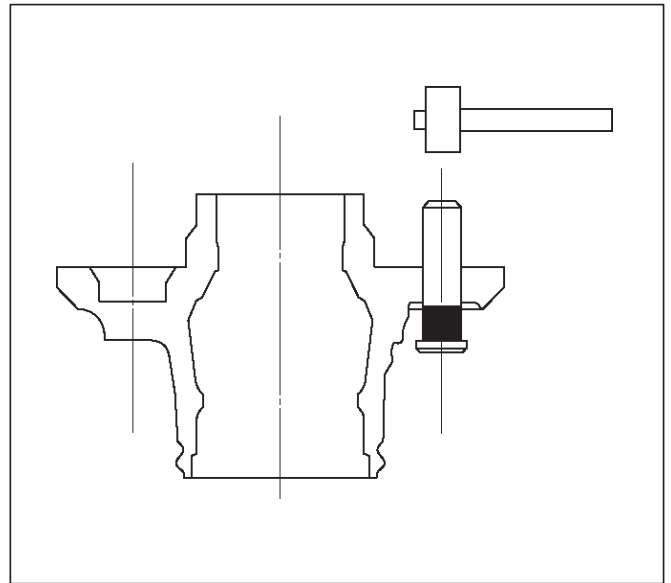
411RW005

10. Remove hub and disc assembly.
11. Remove ABS sensor ring (If equipped).
12. Remove outer bearing.
13. Remove oil seal.
14. Remove inner bearing.
15. Remove bolt, if necessary, replace the wheel pin in the following manner.
 - Apply a scribe mark(1) to disc to hub.
 - Clamp the hub and disc assembly in a vise, using protective pads. Remove the 6 disc-to-hub retaining bolts.



411RS003

- Place hub on a suitable work surface and remove the studs by using a hammer.



411RS004

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

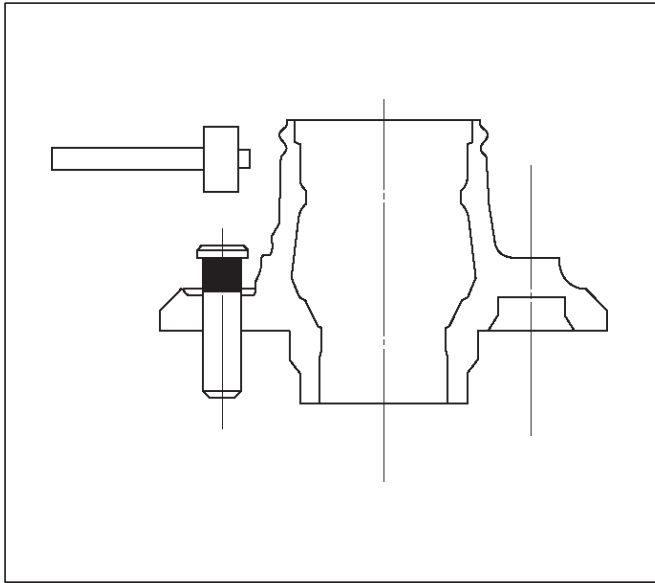
- Hub
- Hub bearing oil seal
- Knuckle spindle
- Disc
- Caliper
- Shift on the fly system parts (Cap, Hub flange, Shim, Snap ring)
- ABS sensor ring (If equipped)

For inspection and servicing of disc caliper and related parts, refer to Brakes section.

Reassembly

1. Install wheel pin.

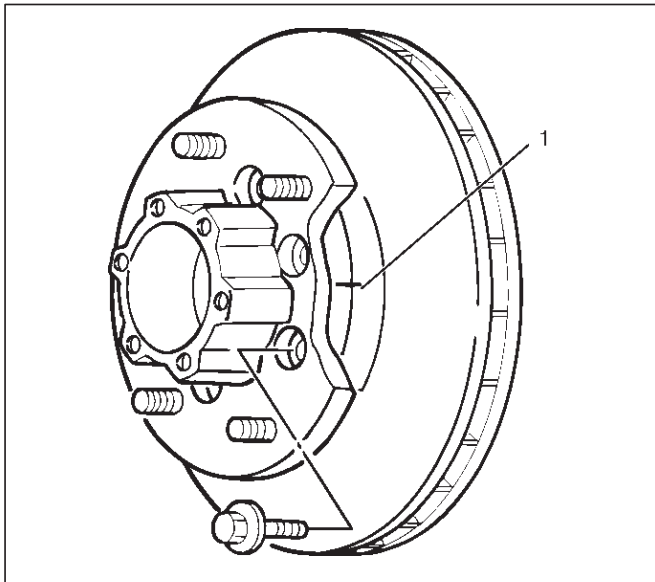
- Place the hub on a wood workbench or a block of wood approx. 6" by 6" to protect the wheel stud ends and threads.
 - Insert a wheel stud using a hammer.
- Be sure the wheel stud is started squarely and seats completely.



411RS005

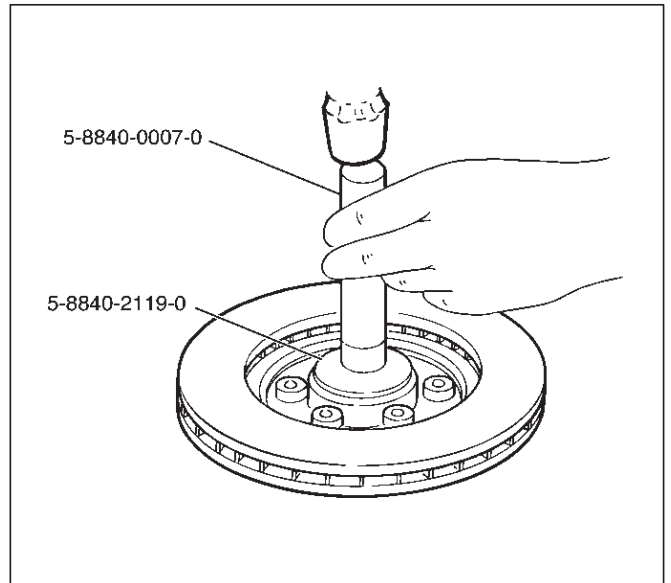
2. Align scribe marks(1) and attach the hub to the disc, then tighten the bolts to the specified torque.

Torque: 103 N·m (10.5 kg·m/76 lb ft)



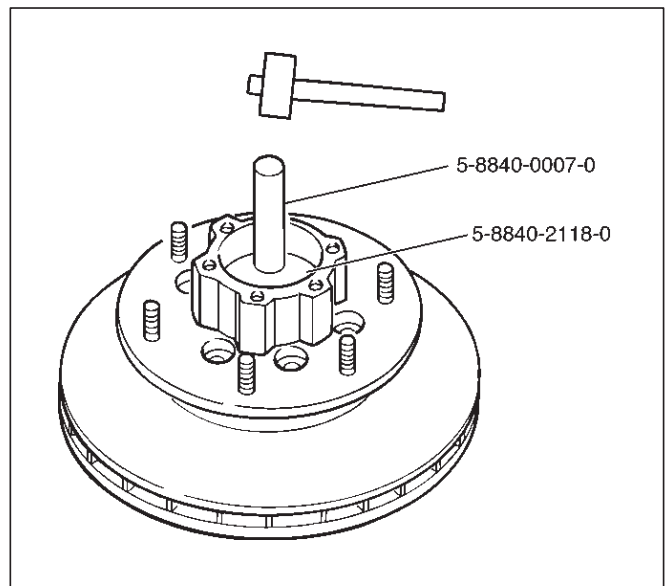
411RS003

3. Use installer 5-8840-2119-0 and grip 5-8840-0007-0, then install the inner bearing by driving it into the hub.



411RW006

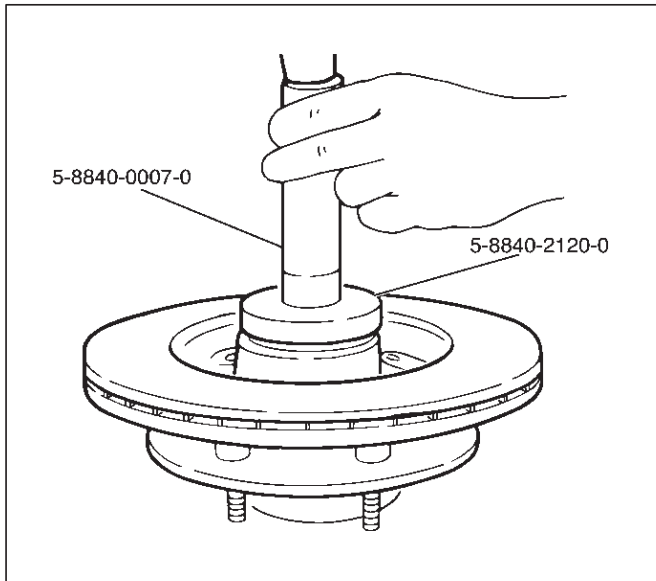
4. Use installer 5-8840-2118-0 and grip 5-8840-0007-0, then install the outer bearing by driving it into the hub.



411RW007

4C-12 DRIVE SHAFT SYSTEM

5. Apply grease (NLGI No.2 or equivalent) to the lip portion, then install oil seal by using installer 5-8840-2120-0 and grip 5-8840-0007-0.



6. Install ABS sensor ring, then tighten the bolts to the specified torque.

Torque: 18 N·m (1.8 kg·m/13 lb ft)

7. Install hub and disc assembly.

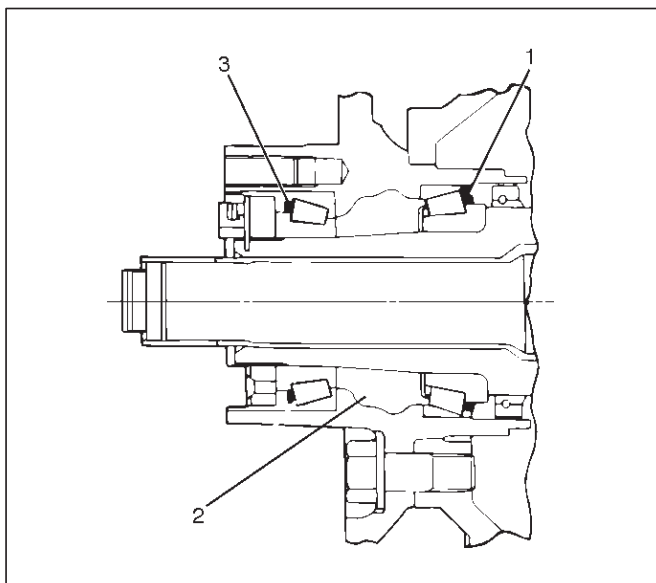
- Apply grease in the hub.
- Apply wheel bearing type grease NLGI No. 2 or equivalent to the outer and inner bearing.

Grease Amount

Hub: 35 g (1.23 oz)

Outer bearing: 10 g (0.35 oz)

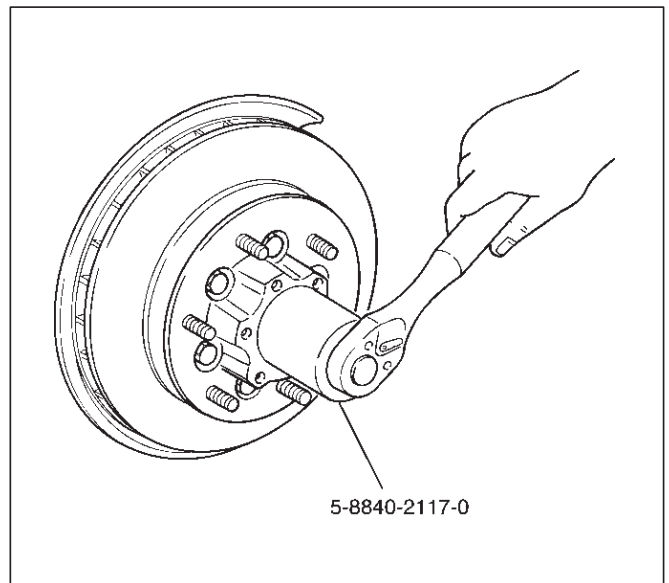
Inner bearing: 15 g (0.53 oz)



Legend

- (1) Inner Bearing
- (2) Hub
- (3) Outer Bearing

8. Install hub nut. Turn the place where there is a chamfer in the tapped hole to the outer side, then attach the nut by using front hub nut wrench 5-8840-2117-0.



Preload Adjustment

1. Tighten the hub nut to 29 N·m (3.0 kg·m/22 lb ft), then fully loosen the nut.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

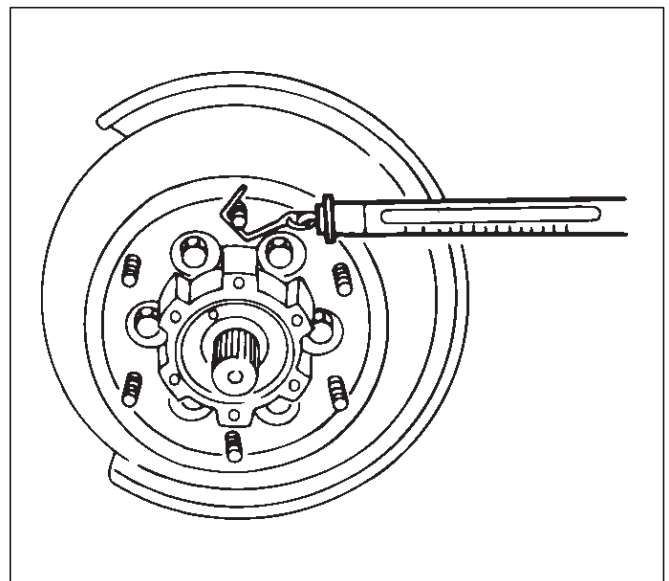
New bearing and New oil seal

Bearing Preload: 20 – 25 N (2.0–2.5 kg/4.4 – 5.5 lb)

Used bearing and New oil seal

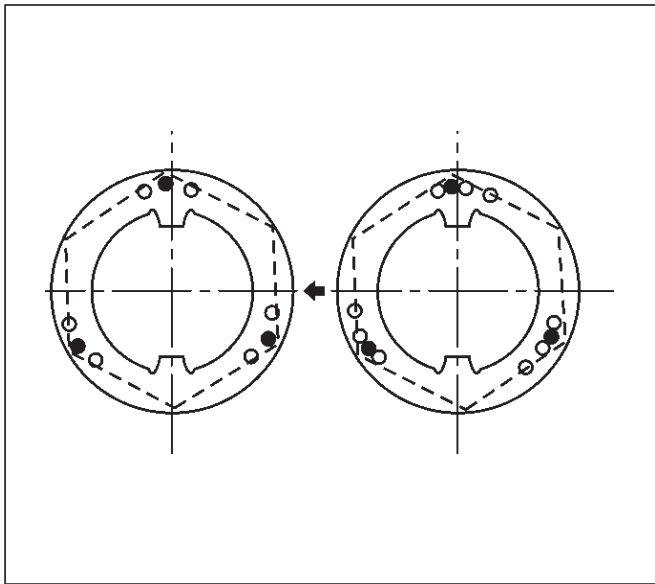
Bearing Preload: 12 – 18 N (1.2–1.8 kg/2.6 – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



9. Install lock washer and lock screw in the following manner.

- Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.
- If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.
- If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.
- Screw is to be fastened tightly so its head may come lower than the surface of the washer.



411RS012

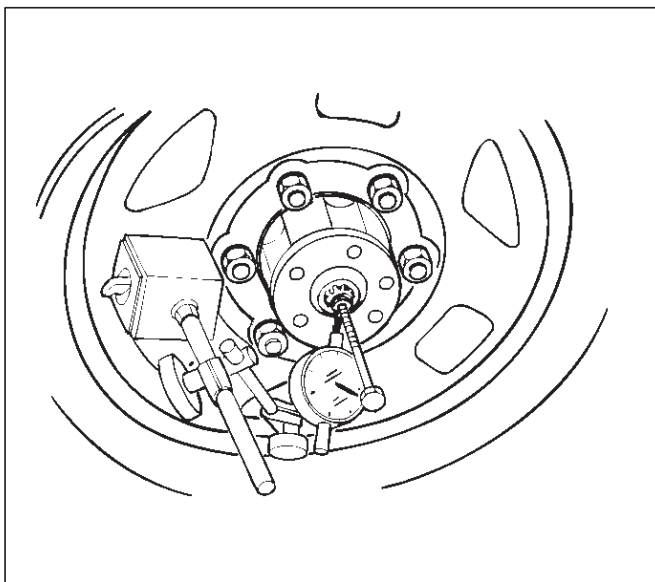
10. Apply adhesive (LOCTITE 515 or equivalent) to both joining flange faces then install hub flange.

11. Install snap ring and shim.

- Adjust the clearance between the free wheeling hub body and the snap ring.

Clearance: 0 mm–0.3 mm (0 in–0.012 in)

Shims Available: 0.2 mm, 0.3 mm, 0.5 mm, 1.0 mm (0.008 in, 0.012 in, 0.020 in, 0.039 in)



411RW002

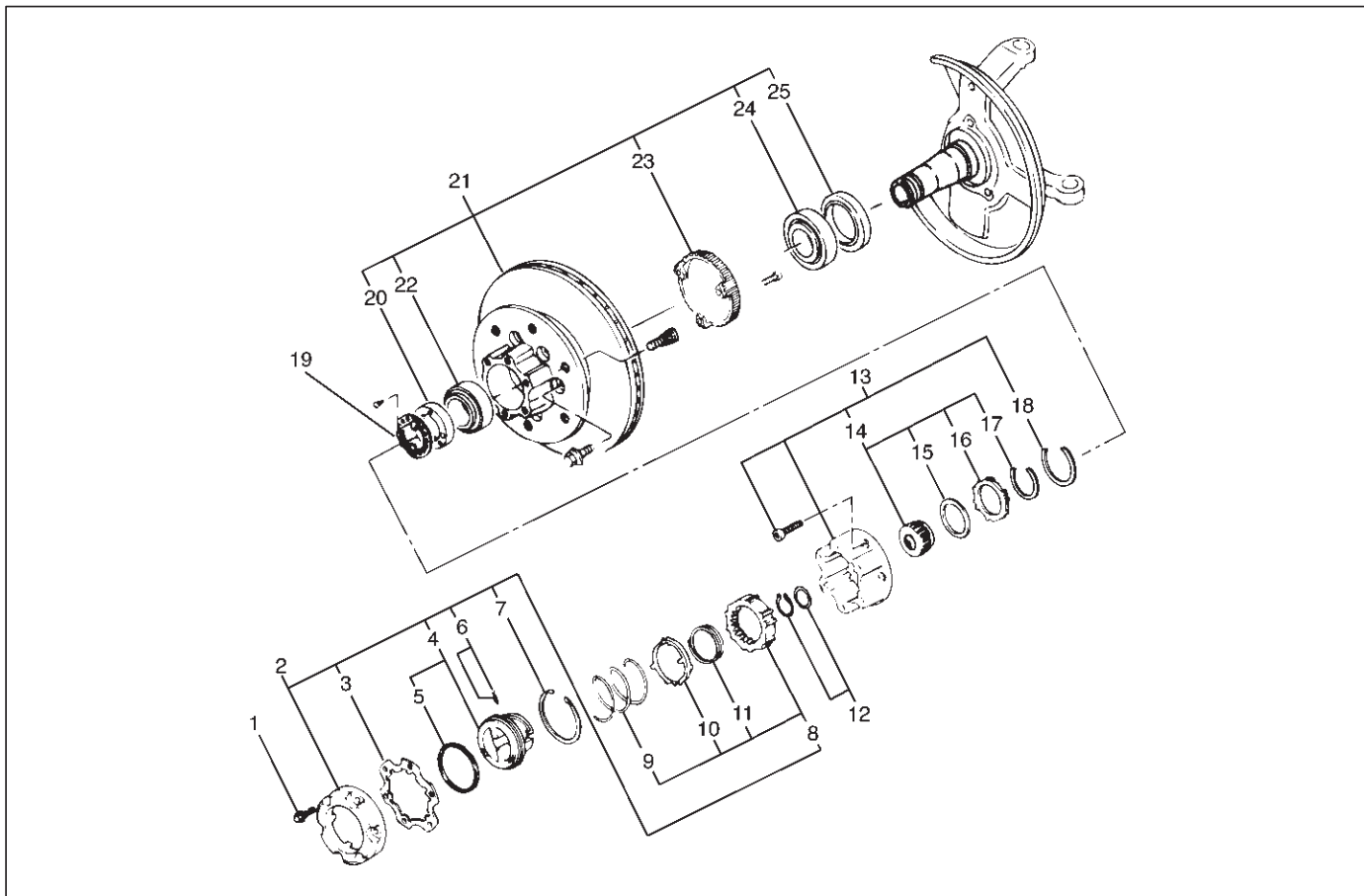
12. Install hub cap.

13. Tighten the bolts to the specified torque.

Torque: 59 N·m (6.0 kg·m/43 lb ft)

Front Hub and Disc with Manual Locking Hub

Disassembled View



411RW009

Legend

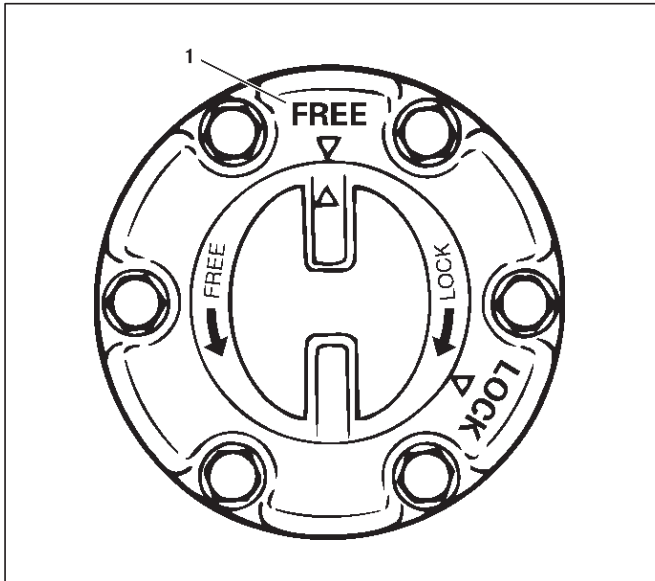
- | | |
|----------------------------|---------------------------------------|
| (1) Bolt | (13) Body Assembly |
| (2) Cover Assembly | (14) Inner Assembly |
| (3) Gasket | (15) Spacer |
| (4) Knob | (16) Ring |
| (5) X-ring | (17) Snap Ring |
| (6) Detent Ball and Spring | (18) Snap Ring |
| (7) Snap Ring | (19) Lock Washer and Lock Screw |
| (8) Clutch Assembly | (20) Hub Nut |
| (9) Compression Spring | (21) Hub and Disc Assembly |
| (10) Follower | (22) Outer Bearing Outer Race |
| (11) Retaining Spring | (23) ABS Sensor Ring (if so equipped) |
| (12) Snap Ring and Shim | (24) Inner Bearing Outer Race |
| | (25) Oil Seal |

Disassembly

1. Before disassembly, jack up the front of vehicle and support frame with jack stands.
2. Remove the disc brake caliper assembly and hang it on the frame with wires. Refer to Front Disk Brake Caliper Assembly in Brakes section.

3. Remove bolt.

Before removal, shift transfer lever into "2H" position, set free wheeling hub knob into "FREE" position (1), and run the vehicle about 50m (160 ft).



411RW010

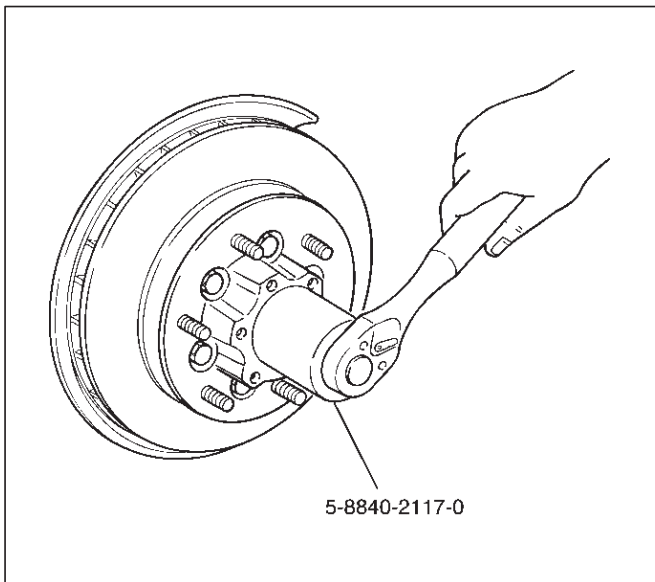
4. Remove cover assembly.

5. Remove snap ring and shim.

6. Remove body assembly.

7. Remove lock washer and lock screw.

8. Remove hub nut by using wrench 5-8840-2117-0.



411RW005

9. Remove hub and disc assembly.

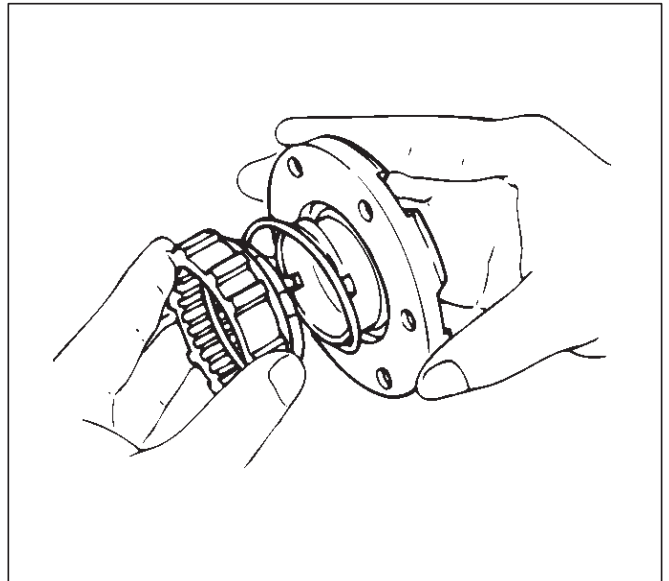
10. Remove ABS sensor ring (If equipped).

11. Remove outer bearing outer race.

12. Remove oil seal.

13. Remove inner bearing outer race.

14. While pushing follower knob against cover, turn clutch assembly clockwise and then remove clutch assembly from knob.



411RW011

15. Remove gasket.

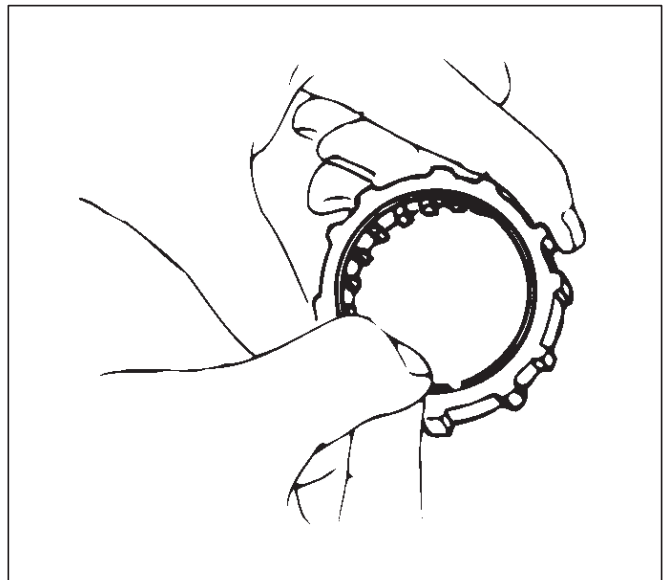
16. Remove snap ring.

17. Remove knob.

18. Remove compression spring.

19. Remove follower.

20. Remove retaining spring from clutch assembly by turning it counterclockwise.



411RW012

21. Remove dedent ball and spring.

22. Remove X-ring.

23. Remove snap ring.

24. Remove inner assembly.

25. Remove snap ring.

26. Remove ring.

27. Remove spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

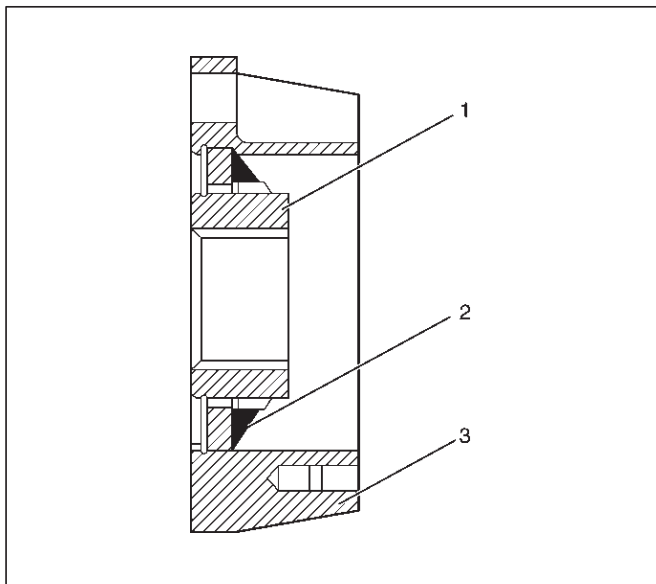
Check the following parts.

- Hub
- Hub bearing, oil seal
- Knuckle spindle
- Disc
- Caliper
- Free wheeling hub parts (Clutch, knob, follower, inner, ring and spring)
- ABS sensor ring (if so equipped)

For inspection and servicing of disc caliper, and relative parts, refer to Brakes section.

Reassembly

1. Install spacer.
Apply about 1 g wheel bearing grease to both face of spacer.
2. Install ring.
Apply about 3 g wheel bearing grease to inside face of ring.
3. Install snap ring
Assembly with grease surplus being left unwiped up as illustrated.



411RW013

Legend

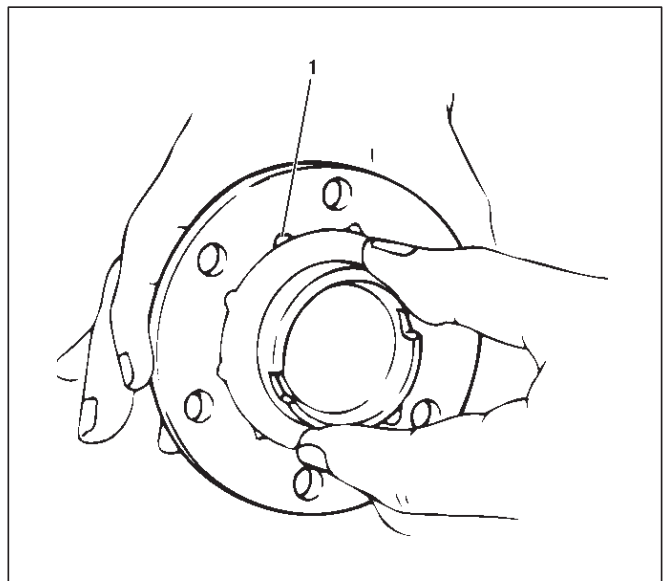
- (1) Inner Assembly
- (2) Apply Grease
- (3) Body

4. Install inner assembly.
Apply grease to splined portion of body.
5. Install snap ring.

6. Install X-ring.
Apply wheel bearing grease to hub lock ring and fit it in knob paying attention to mounting direction.

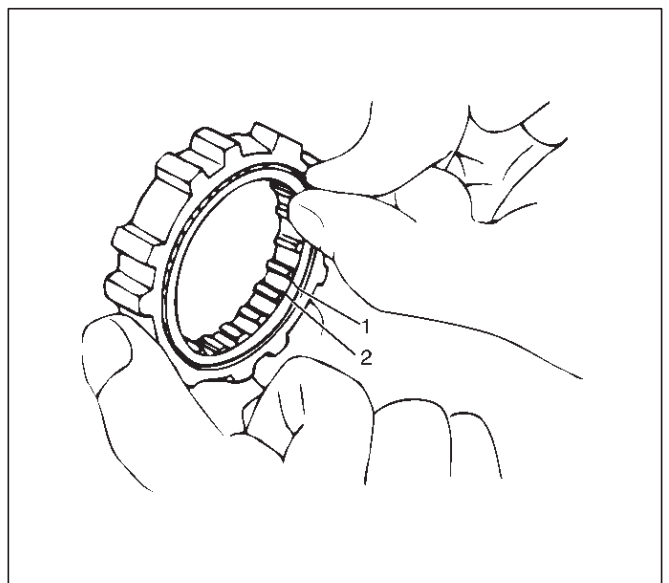
NOTE: After fitting, make sure that the hub lock ring is not twisted.

7. Apply wheel bearing grease to ball and spring and fit them in knob.
8. Install knob.
 1. Apply grease to outer circumference of knob and inner circumference of cover.
 2. Align detent ball (1) to a groove cut in the cover.



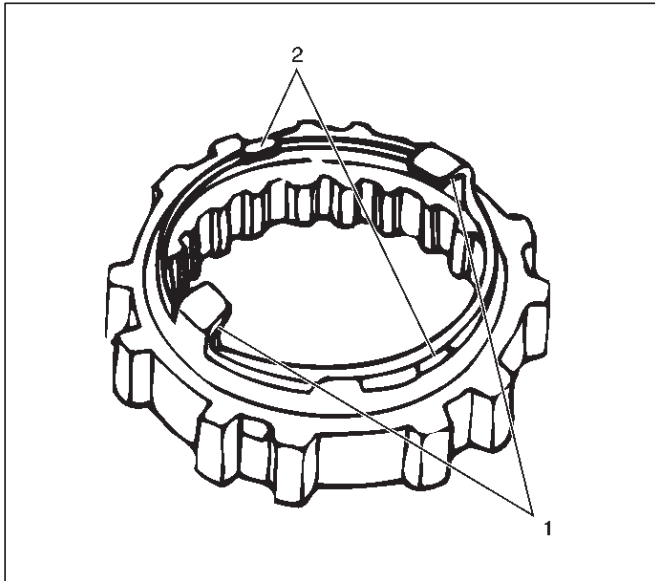
411RW014

9. Install snap ring.
Turn the smoother face to knob side.
10. Align the end of retaining spring (1) with clutch spring groove (2) and fit in the spring.



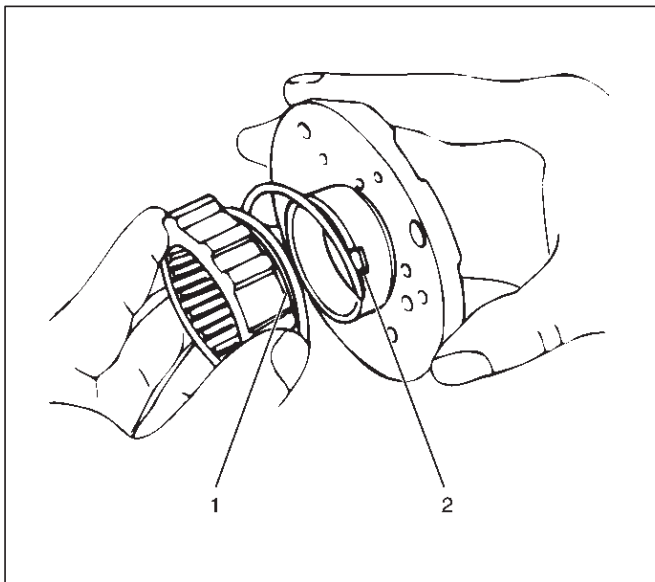
411RW015

11. Install follower to clutch so that follower nails (large) (1) will come closer to the bent portion of retaining spring by aligning follower stopper nail with outer teeth of clutch. Then, fit in with follower's nails (small) (2) caught in spring.



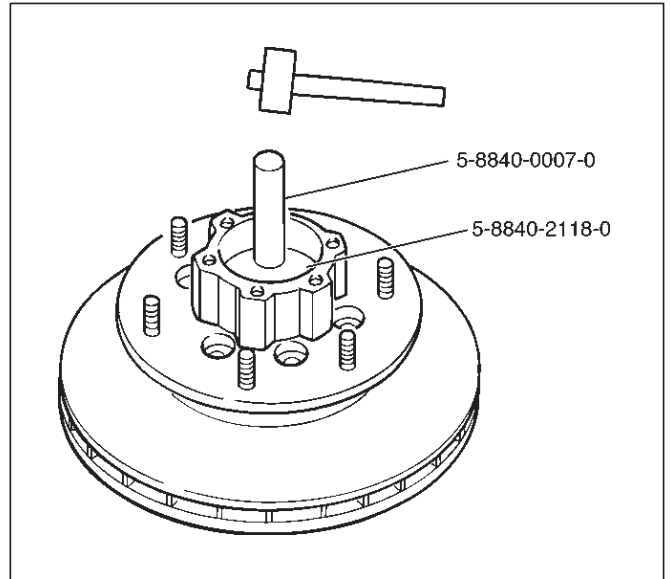
411RW016

12. Install compression ring.
Turn the smaller diameter side toward follower and fit spring in clutch.
13. Align follower nail (1) to handle groove (2), and then assemble clutch with knob by pushing and turning clutch counterclockwise to knob.



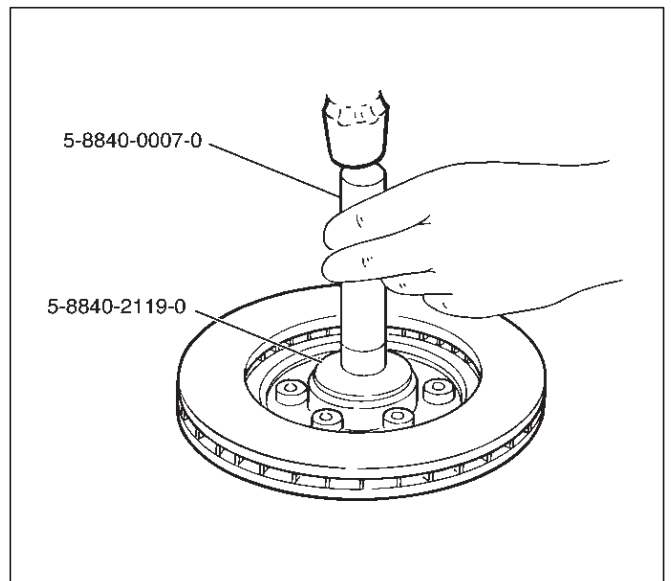
411RW017

14. Install gasket.
Make sure that there is no breakage, etc.
15. Install outer bearing outer race by driving it into the hub, by using installer 5-8522-2118-0 and grip 5-8840-0007-0.



411RW007

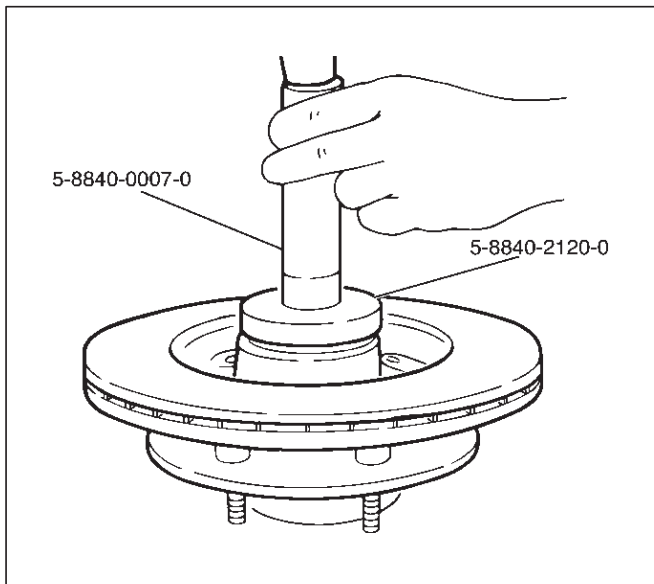
16. Install inner bearing outer race by driving it into the hub, by using installer 5-8840-2119-0 and grip 5-8840-0007-0.



411RW006

4C-18 DRIVE SHAFT SYSTEM

17. Install oil seal by using installer 5-8840-2120-0 and grip 5-8840-0007-0.
Apply grease (NLGI No.2 or equivalent) to the lip portion.



18. Install ABS sensor ring (if so equipped).
Tighten the bolts to the specified torque.

Torque: 18 N·m (1.8 kg·m/13 lb ft)

19. Install hub and disc assembly.
1. Apply grease in the hub.
 2. Apply wheel bearing type grease NLGI No.2 or equivalent to the outer and inner bearing.

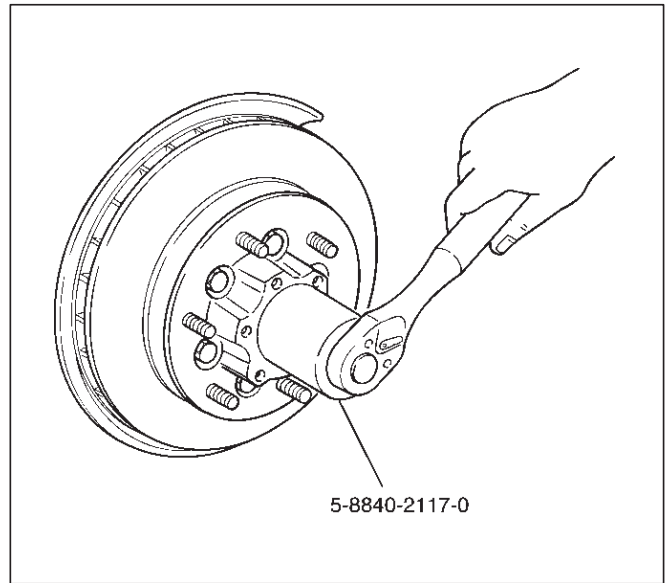
Grease Amount

Hub: 35 g (1.23 oz)

Outer bearing: 10 g (0.35 oz)

Inner bearing: 15 g (0.53 oz)

20. Install hub nut.
1. Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut by using wrench 5-8840-2117-0.



Preload Adjustment

Tighten the hub nut to 29 N·m (3.0 kg·m/22 lb-ft), then fully loosen the nut.

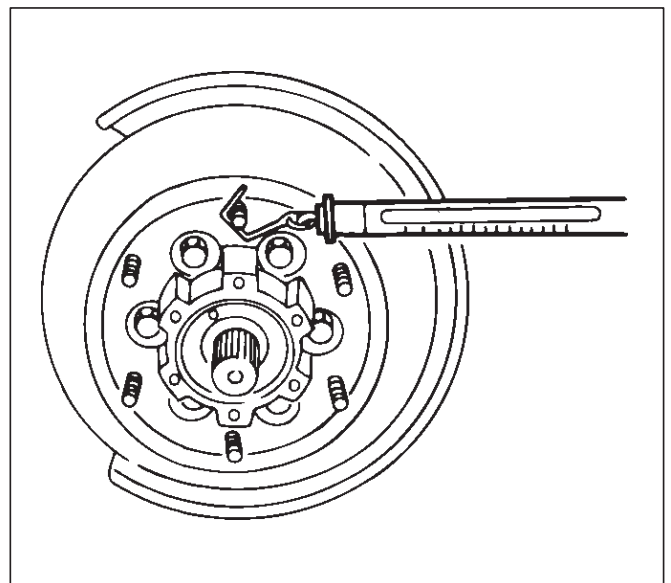
Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

Bearing Preload

**New bearing and New oil seal:
20-25N (2-2.5 kg/4.4-5.5 lb)**

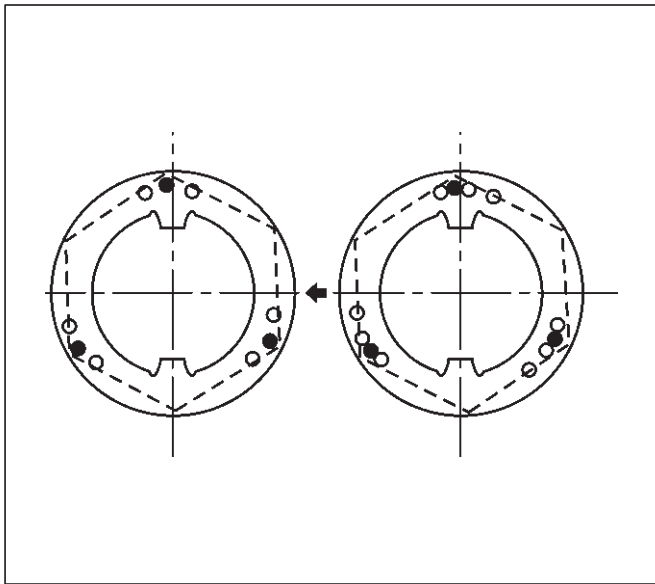
**Used bearing and New oil seal:
12-18N (1.2-1.8 kg/2.6-4.0 lb)**

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



21. Install lock washer and lock screw in the following manner.

- Turn the side with larger diameter of the tapered bore to the vehicle outer side, and attach the washer.
- If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.
- If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.
- Screw is to be fastened tightly so its head may come lower than the surface of the washer.



22. Install body assembly.

- Apply adhesive (LOCTITE 515 or equivalent) to both joining faces.
- Tighten the bolts to the specified torque.

Torque: 59 N·m (6.0 kg·m/43 lb ft)

23. Install snap ring and shim.

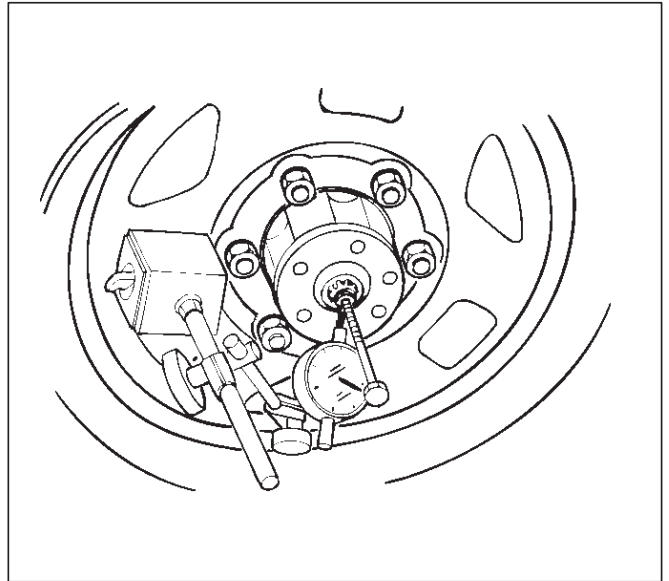
Adjust the clearance between the free wheeling hub body and the snap ring.

Clearance:

0-0.3mm (0-0.012in)

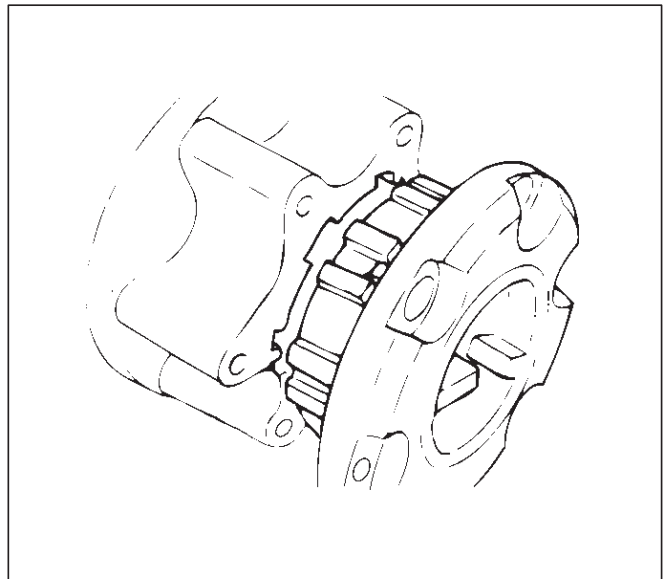
Shims Available:

0.2mm, 0.3mm, 0.5mm, 1.0mm, (0.008in, 0.012in, 0.020in, 0.039in)



24. Install cover assembly.

Align stopper nails (1) to grooves of body (2).

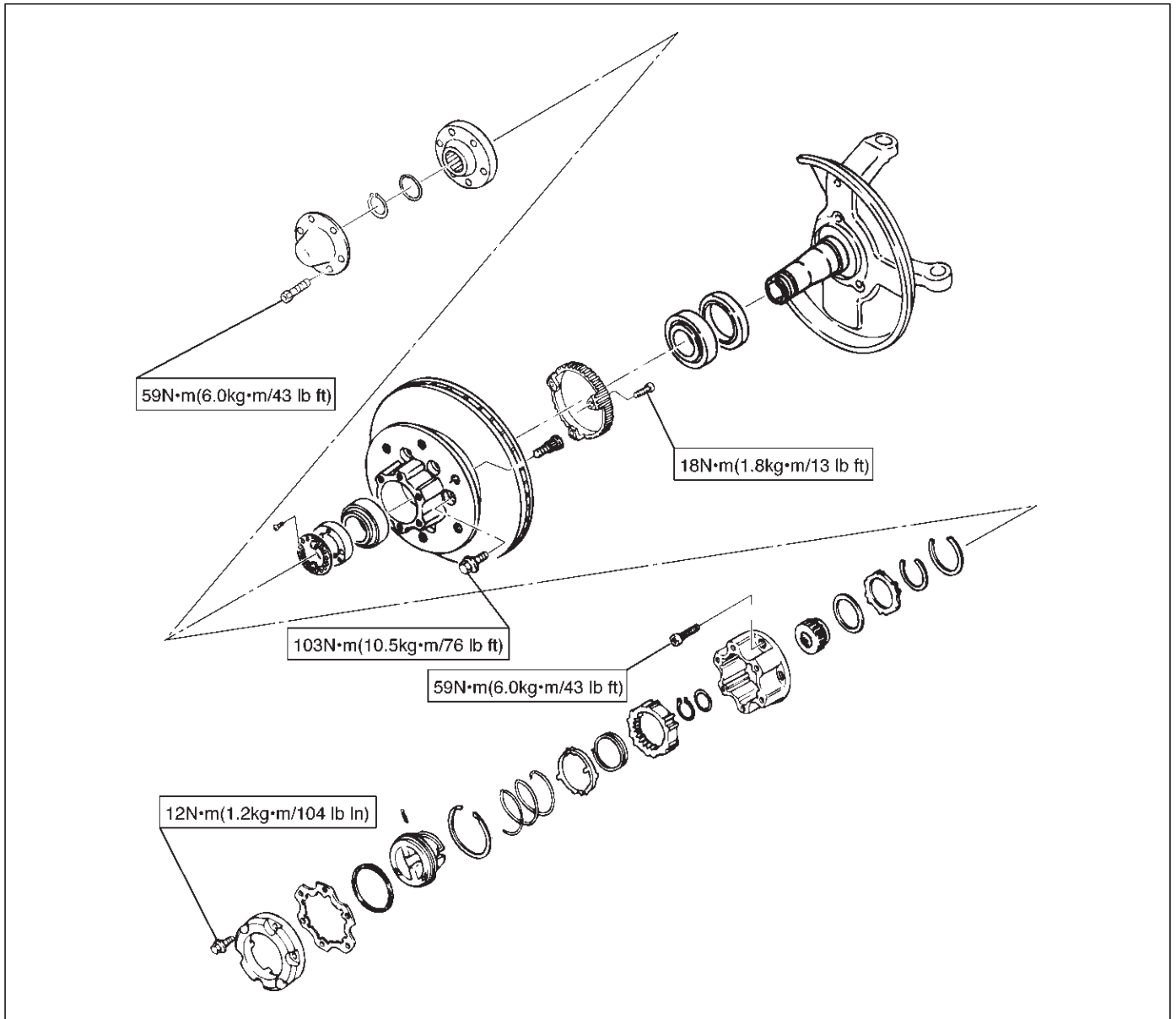


25. Tighten the cover bolts to the specified torque.

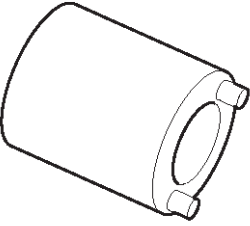
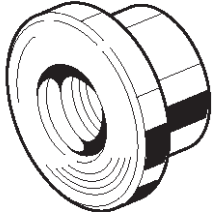
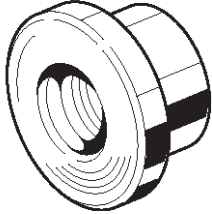
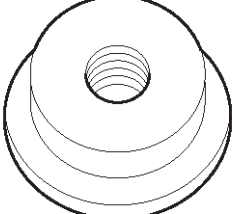
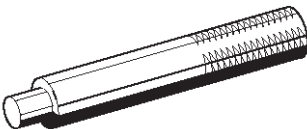
Torque: 12 N·m (1.2 kg·m/104 lb in)

Main Data and Specifications

Torque Specifications



Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RS246</p>	<p>5-8840-2117-0 (J-36827) Wrench; Hub nut</p>
 <p>901RS247</p>	<p>5-8840-2119-0 (J-36829) Installer; Inner bearing</p>
 <p>901RS248</p>	<p>5-8840-2118-0 (J-36828) Installer; Outer bearing</p>
 <p>901RS249</p>	<p>5-8840-2120-0 (J-36830) Installer; Oil seal</p>
 <p>901RS241</p>	<p>5-8840-0007-0 (J-8092) Grip</p>

Front Drive Shaft Joint

Front Drive Shaft Joints Replacement

- Refer to Front Drive Axle Assembly Replacement in this section, and refer to Front Hub and Disc in Suspension section.

Front Hub Bearing Preload Check

Check the hub bearing preload at the wheel pin.

New bearing and New oil seal

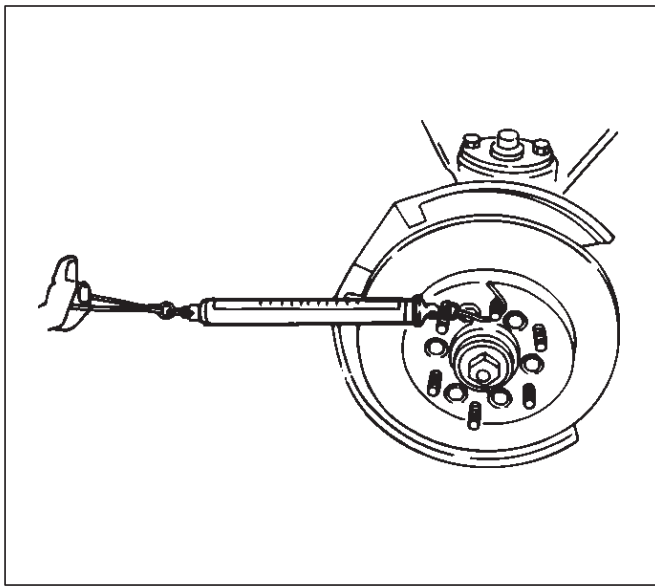
Preload: 20 – 25 N (2.0 – 2.5 kg/4.4–5.5 lb)

New bearing and New oil seal

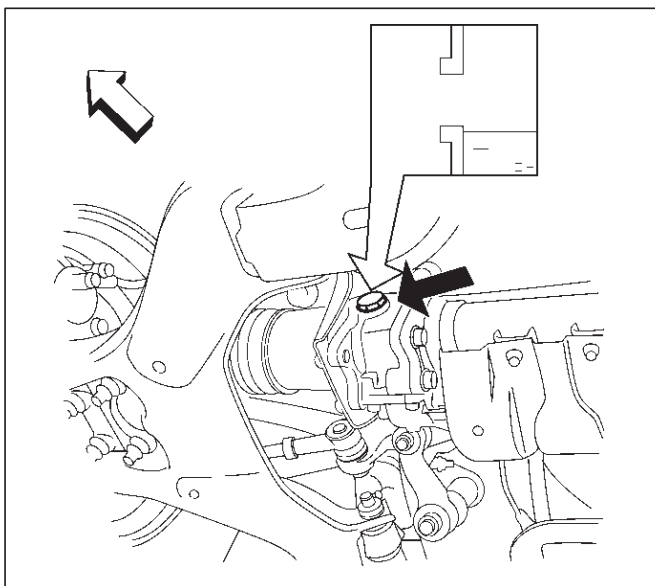
Preload: 12 –18 N (1.2 – 1.8 kg/2.6–4.0 lb)

1. Open filler plug and make sure that the oil is up to the plug port.
If the level oil is low, replenish with gear oil GL-5 grade.
2. Tighten the filler plug to specified torque.

Torque: 7.8 N-m (7.9 kg-cm/58 lb in)



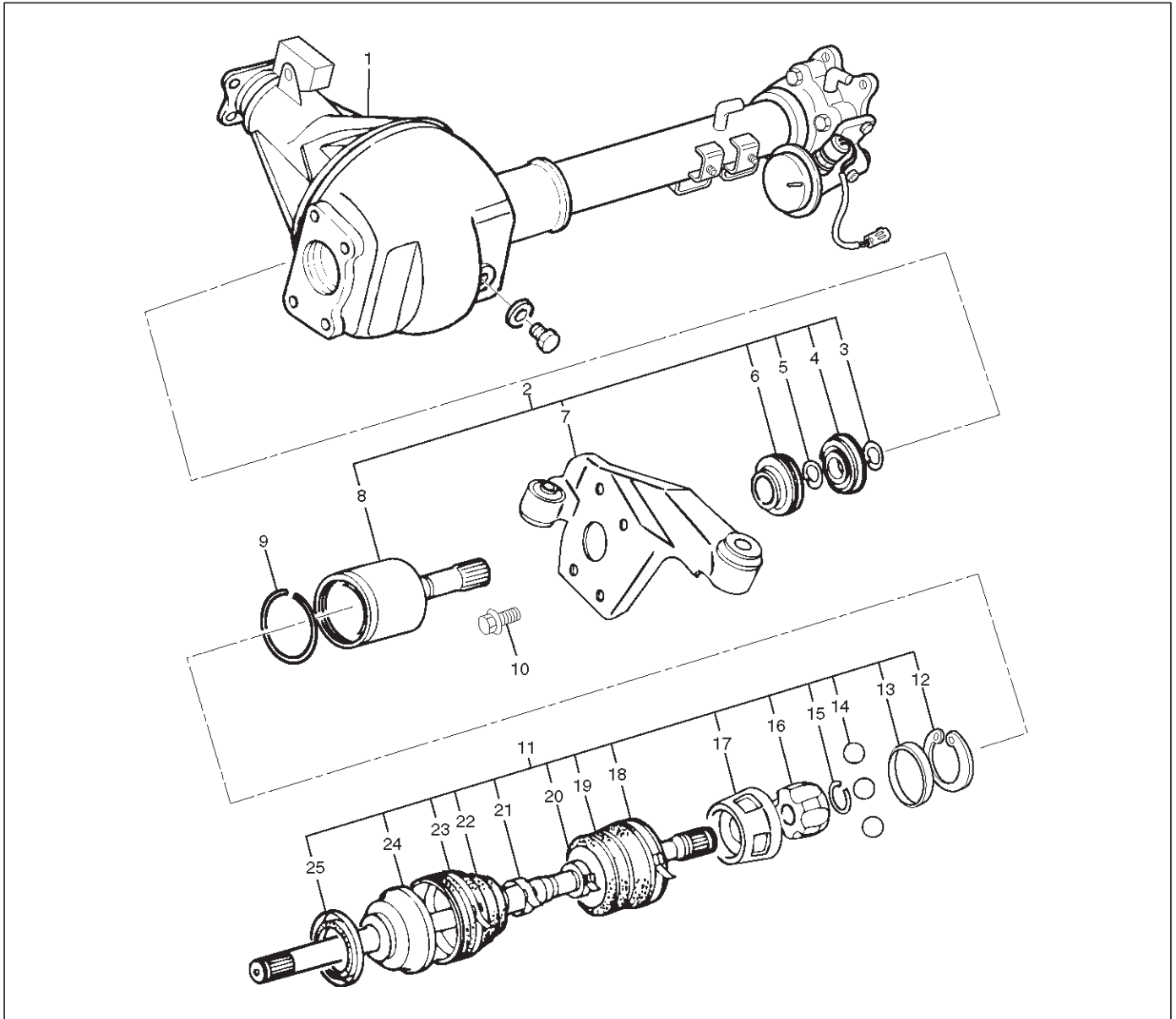
Inspection Of Shift On The Fly System Gear Oil



Front Axle Drive Shaft

Front Axle Drive Shaft and Associated Parts

This illustration is based on the model equipped with shift on the fly system.



412RW003

Legend

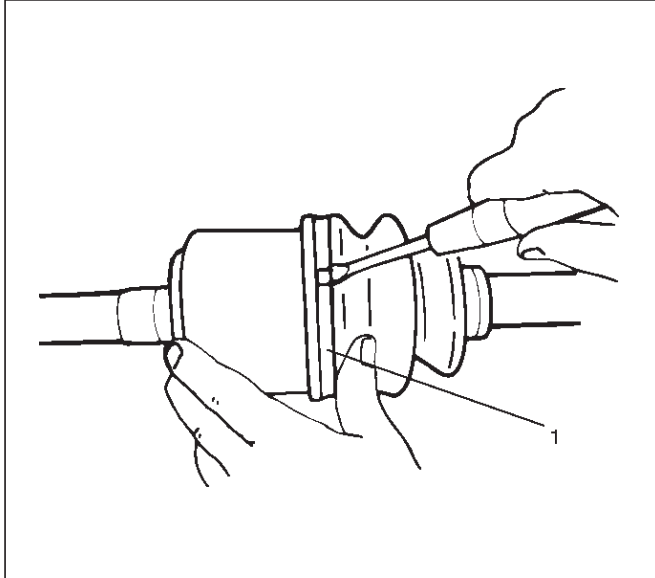
- | | |
|---------------------------------|--------------------|
| (1) Axle Case and Differential | (13) Spacer |
| (2) DOJ Case Assembly | (14) Ball |
| (3) Snap Ring | (15) Snap Ring |
| (4) Bearing | (16) Ball Retainer |
| (5) Snap Ring | (17) Ball Guide |
| (6) Oil Seal | (18) Band |
| (7) Bracket | (19) Bellows |
| (8) DOJ Case | (20) Band |
| (9) Circlip | (21) Band |
| (10) Bolt | (22) Bellows |
| (11) Drive Shaft Joint Assembly | (23) Band |
| (12) Snap Ring | (24) BJ Shaft |
| | (25) Dust Seal |

4C-24 DRIVE SHAFT SYSTEM

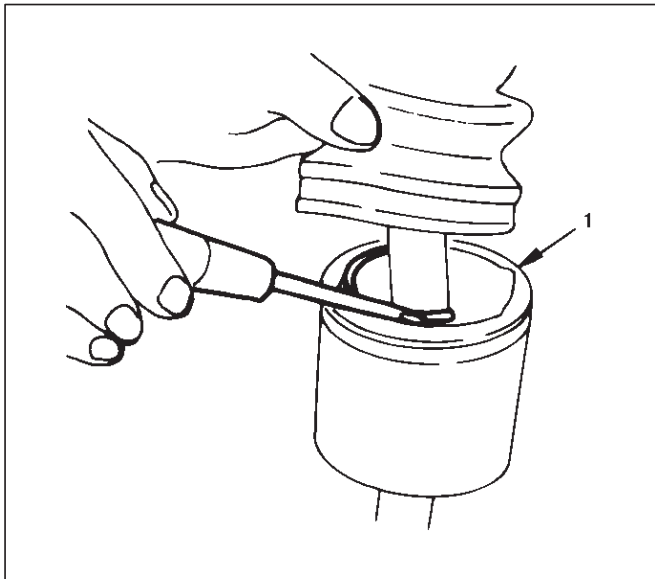
Disassembly

NOTE: For the left side, follow the same steps as right side.

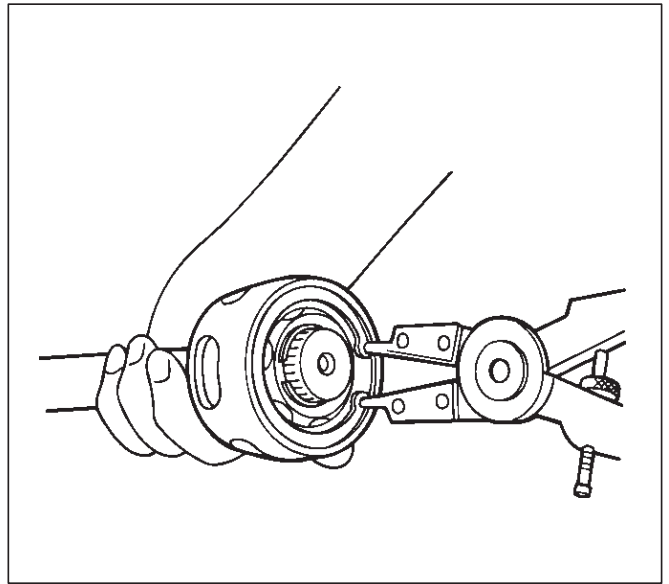
1. Raise the hooked end of the band (1) with a screwdriver or equivalent.



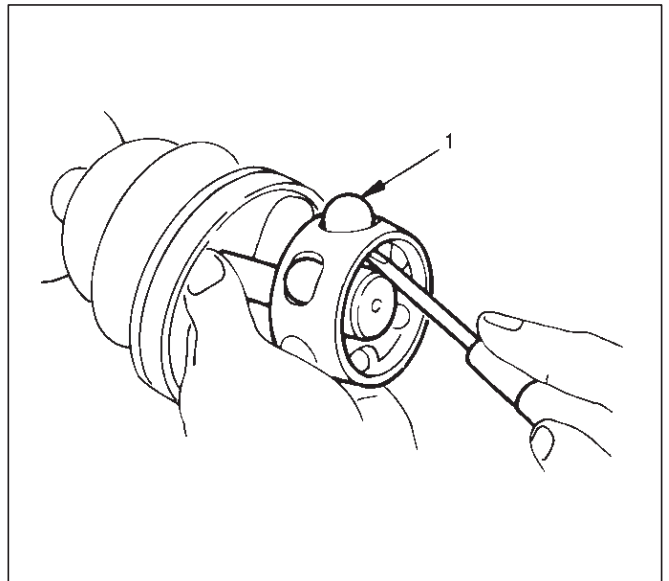
2. Remove band.
3. Pry off circlip (1) with a screwdriver or equivalent.



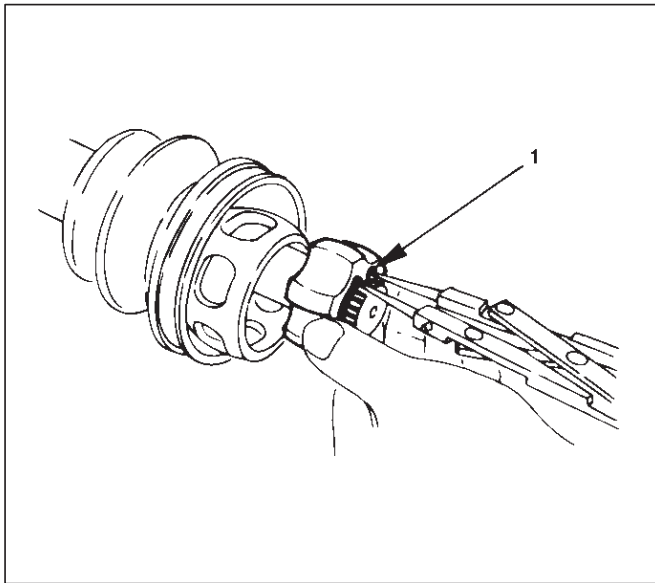
4. Remove drive shaft joint assembly.
5. Using snap ring pliers, remove the snap ring.



6. Remove spacer.
7. Remove the six balls (1) with a screwdriver or equivalent.

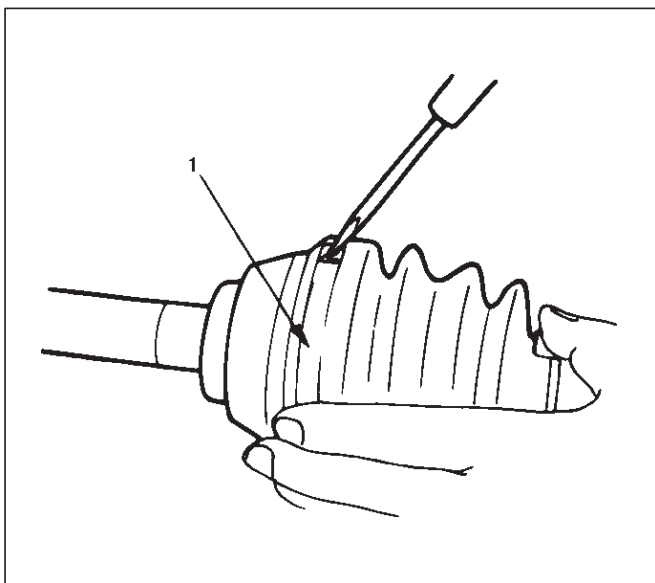


8. Using snap ring pliers, remove the snap ring (1) fastening the ball retainer to the center shaft.



9. Remove ball retainer, ball guide and bellows.

10. Raise the hooked end of the band (1) with a screwdriver or equivalent.



11. Remove band.
12. Remove bellows.
13. Remove dust seal.
14. Remove BJ shaft assembly.
15. Remove the mounting bracket fixing bolts, and then remove DOJ case assembly from the axle case.
16. Remove snap ring and bearing.
17. Remove snap ring and oil seal.
18. Remove bracket.

Inspection and Repair

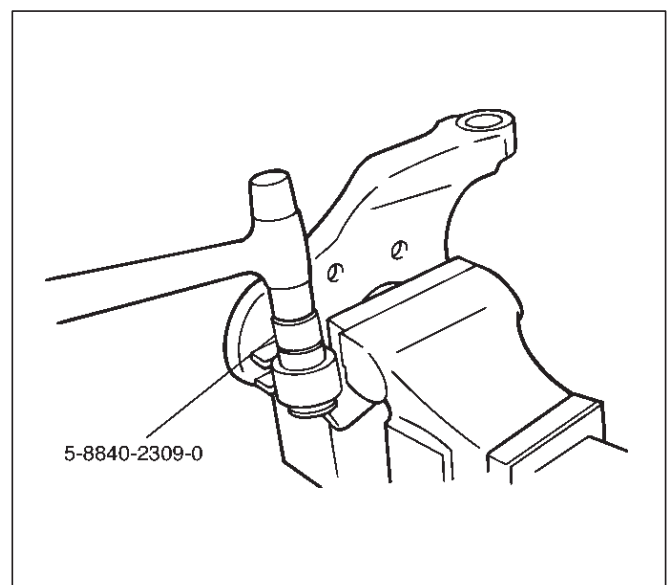
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts:

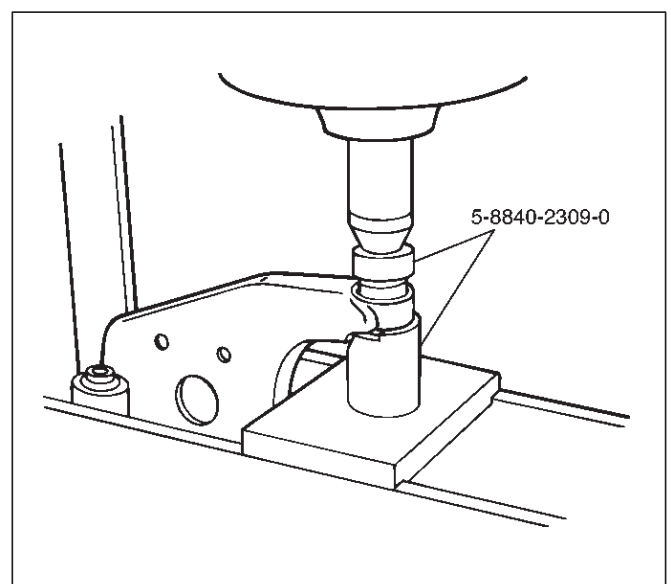
1. Drive shaft joint assembly
2. DOJ case, ball, ball guide, ball retainer
3. Bellows
4. Bearing
5. Dust seal, oil seal

Bushing Replacement

- Remove the bushings using a remover 5-8840-2309-0 and hammer.



- By using installer and base 5-8840-2309-0, press fit the bushings into the bracket.

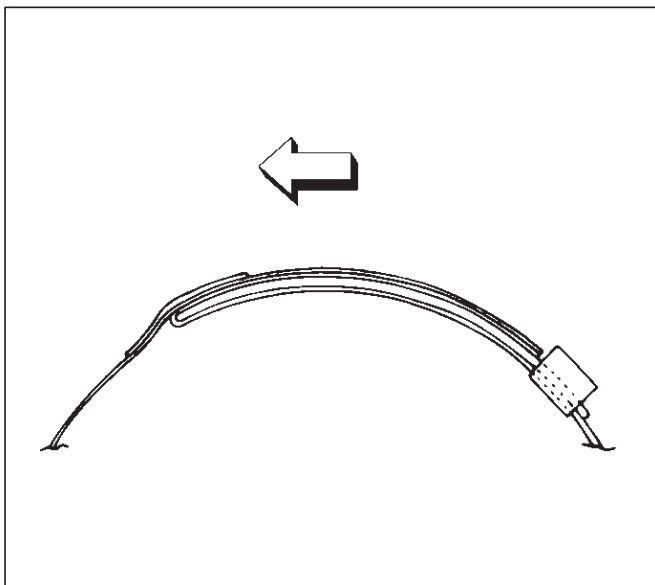


Reassembly

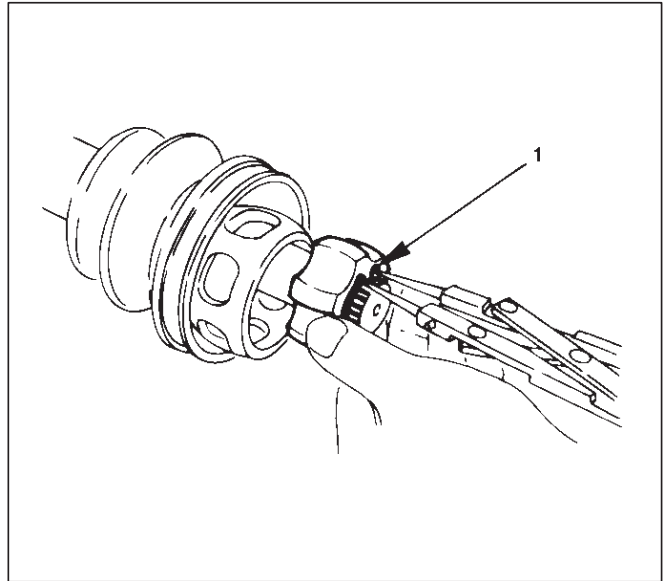
1. Install DOJ case to bracket.
2. Install oil seal and fix snap ring.
3. Install bearing and fix snap ring.
4. Install bracket to axle case. Tighten the bracket bolt to the specified torque.

Torque: 116 N·m (11.8 kg·m/85 lb ft)

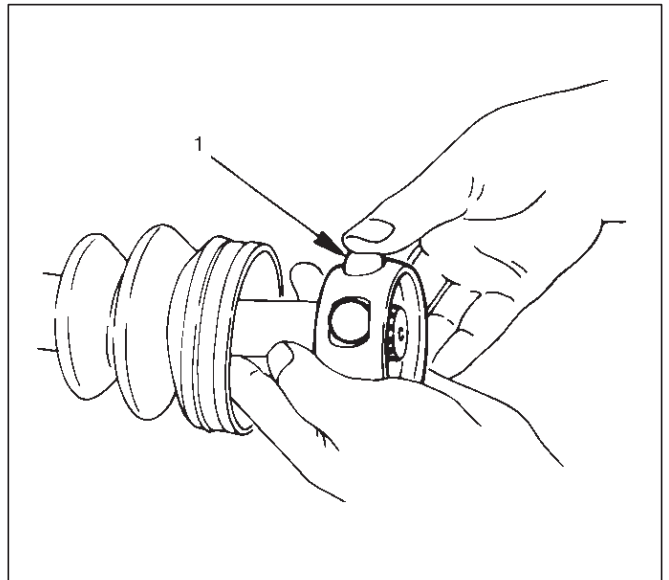
5. Apply 150g of the specified grease in BJ .
6. Install dust seal .
7. Apply a thin coat of grease to the shaft for smooth installation then install bellows.
8. Install band. Note the setting direction. After installation, check that the bellows is free from distortion.



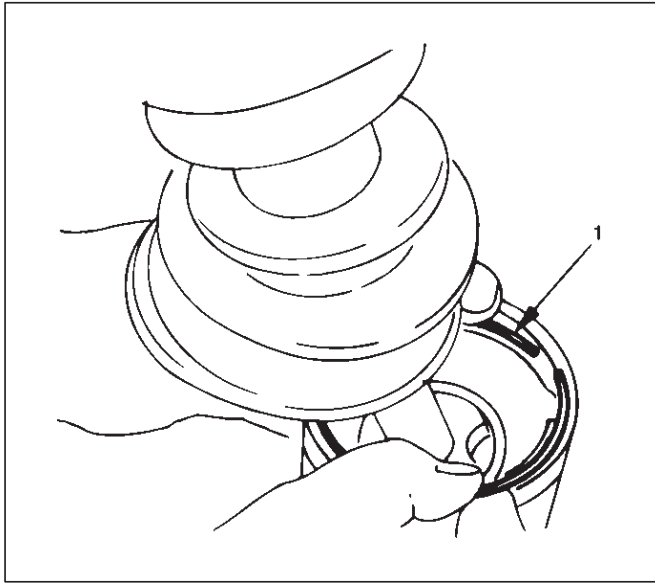
9. Install another bellows and fix band.
10. Install the ball guide with the smaller diameter side ahead onto the shaft.
11. Install ball retainer.
12. Using snap ring pliers, install the snap ring (1) securing the ball retainer to the shaft.



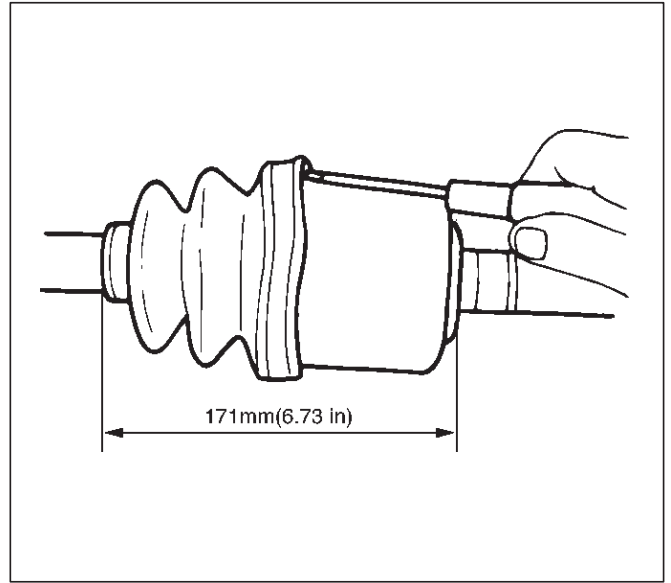
13. Align the track on the ball (1) retainer with the window in the cage, and install the six balls into position.



14. Install spacer.
15. Install snap ring.
16. Enclose 150g of the specified grease in DOJ case, then install drive shaft joint assembly. After reassembly, move the DOJ longitudinally several times to get to fit.
17. Install the circlip (1) so that open ends are positioned away from the ball groove.

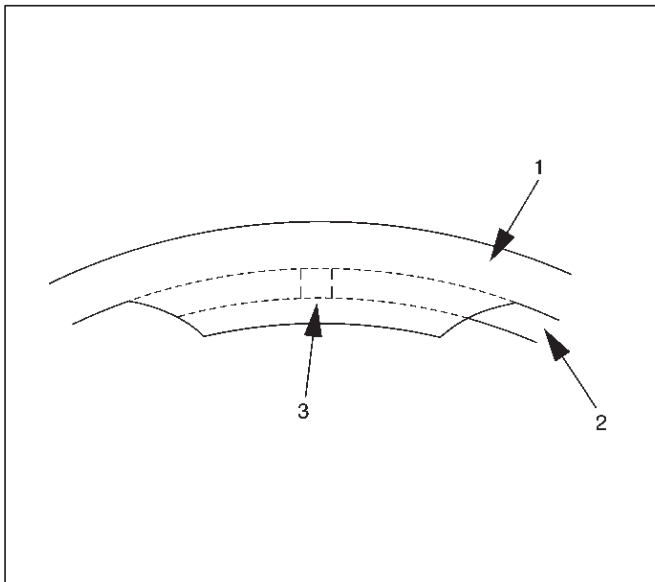


412RS019



412RW053

19. Install Band. After installation, check that the bellows is free from distortion.



412RS020

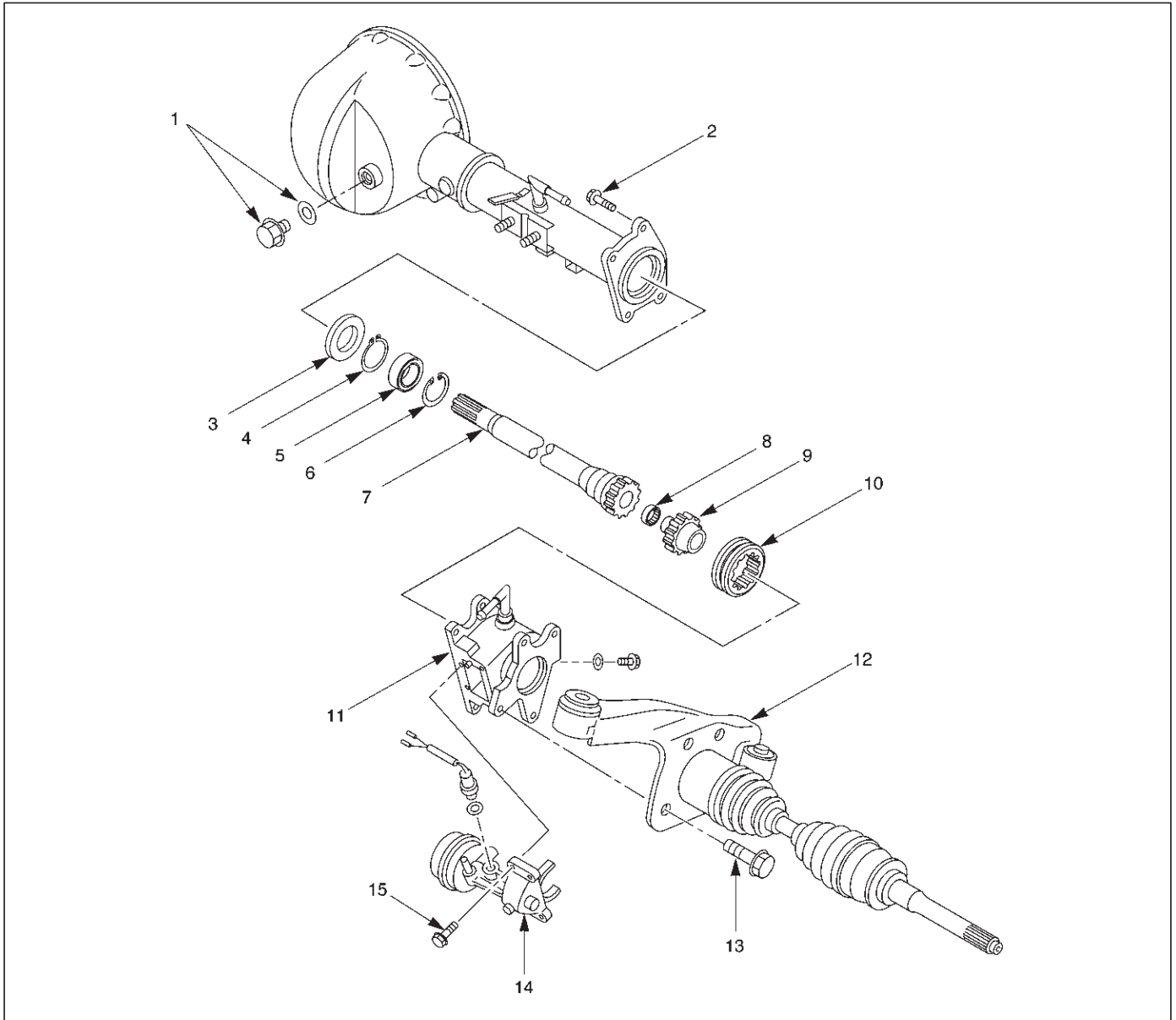
Legend

- (1) Outer Case
- (2) Circlip
- (3) Open Ends

18. Install bellows. Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.

Shift On The Fly System

Shift On The Fly System and Associated Parts



412RW004

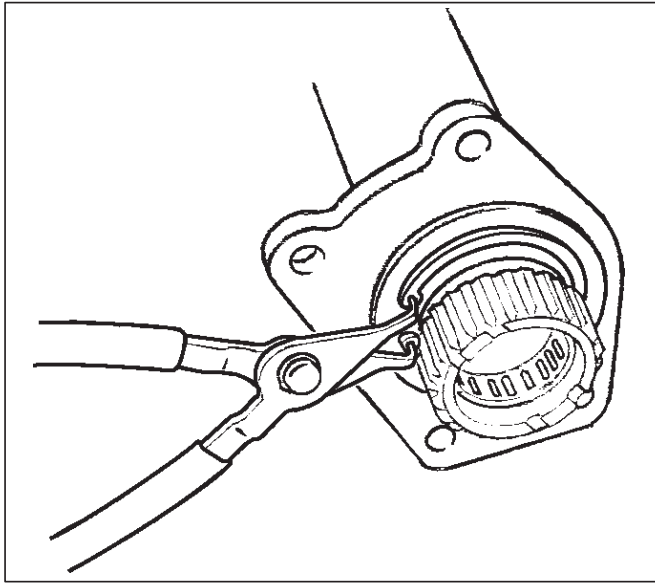
Legend

- | | |
|-------------------------|---|
| (1) Filler Plug | (8) Needle Bearing |
| (2) Bolt | (9) Clutch Gear |
| (3) Oil Seal | (10) Sleeve |
| (4) Snap Ring(External) | (11) Housing |
| (5) Inner Shaft Bearing | (12) Front Axle Drive Shaft (LH side)with Bracket |
| (6) Snap Ring(Internal) | (13) Bolt |
| (7) Inner Shaft | (14) Actuator Assembly |
| | (15) Bolt |

Disassembly

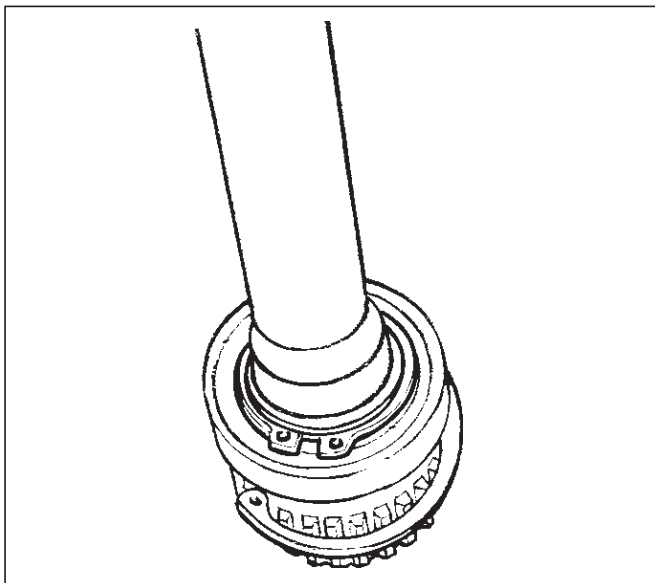
1. Remove filler plug and gasket, drain oil.
2. Loosen mounting bracket fitting bolts and remove front axle drive shaft from front axle case.
3. Remove Actuator Assembly and draw out actuator ASM.
4. Remove housing.
5. Remove sleeve.
6. Remove clutch gear.

7. Remove snap ring from front axle case by using snap ring pliers.



412RW017

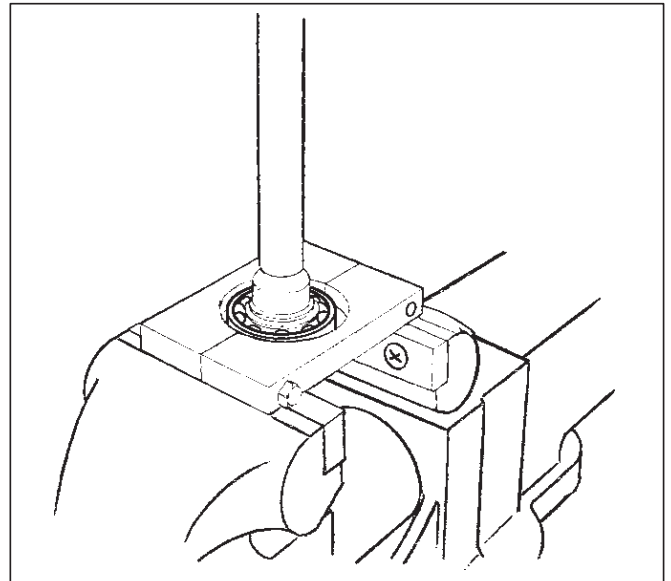
8. Take out inner shaft from front axle case.
 9. Remove snap ring from inner shaft by using snap ring pliers.



412RW016

10. Remove inner shaft bearing by using a remover 5-8840-2197-0 and press.

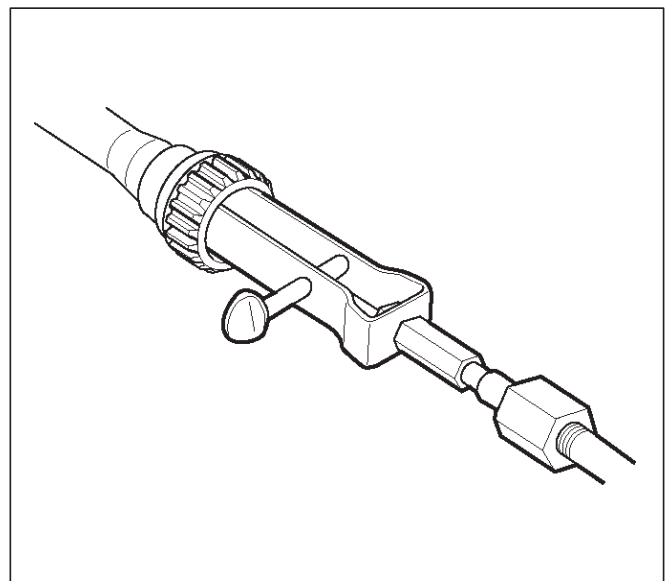
NOTE: Be careful not to damage the shaft.



412RW015

11. Remove needle bearing from inner shaft by using a remover 5-8840-0027-0 and sliding hammer 5-8840-0084-0.

NOTE: Be careful not to damage the shaft.



412RS045

12. Remove oil seal from front axle case.

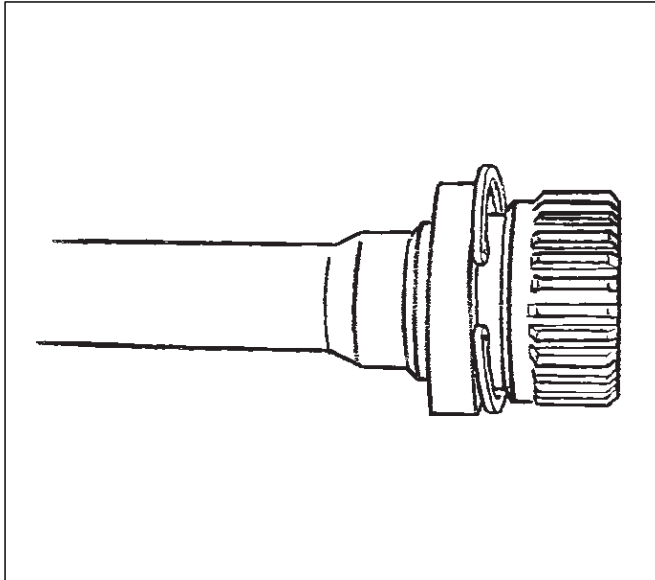
NOTE: Be careful not to damage the front axle case.

Inspection and Repair

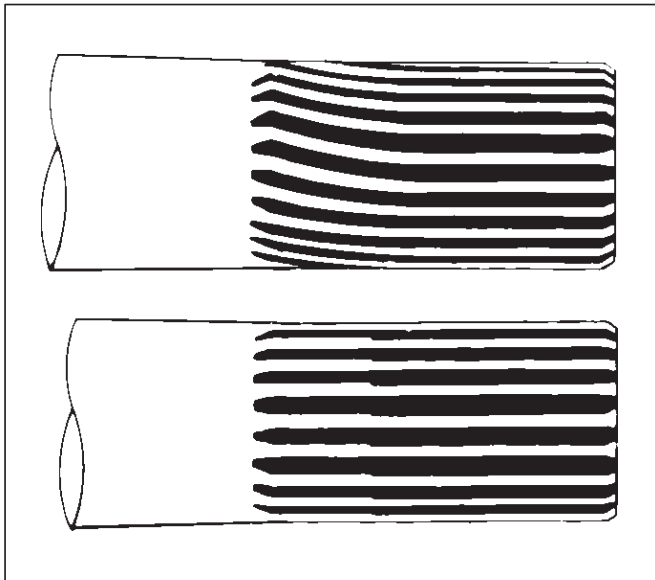
Inspect the removed parts. If there are abnormalities such as wear and damage, take corrective action or replace.

Visual Check

1. Check and see if the inner shaft has any abnormalities such as wear and damage.



2. When inspecting the inner shaft, be sure to check and see if its splined part is twisted, worn, or cracked. If so, replace with a new shaft. In case of an abnormality in its gear part (a slide with sleeve), replace the shaft.

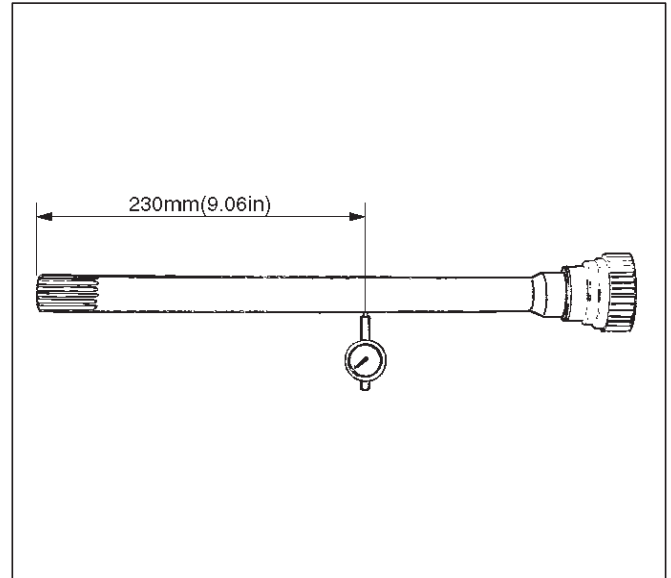


Inner Shaft Run-Out

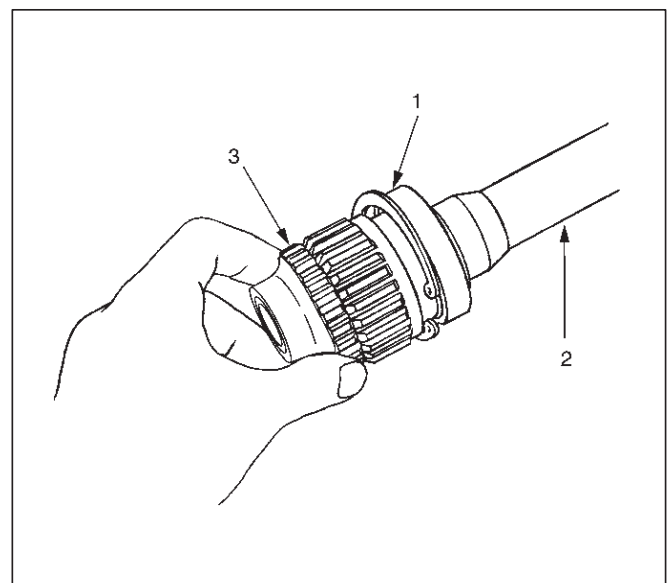
With both end centers supported, rotate the shaft slowly and measure deflection with a dial gauge.

Limit: 0.5 mm (0.02 in)max.

NOTE: Do not heat the shaft to correct its bend.



Inner Shaft Bearing



Legend

- (1) Inner Shaft Bearing
- (2) Inner Shaft
- (3) Clutch Gear

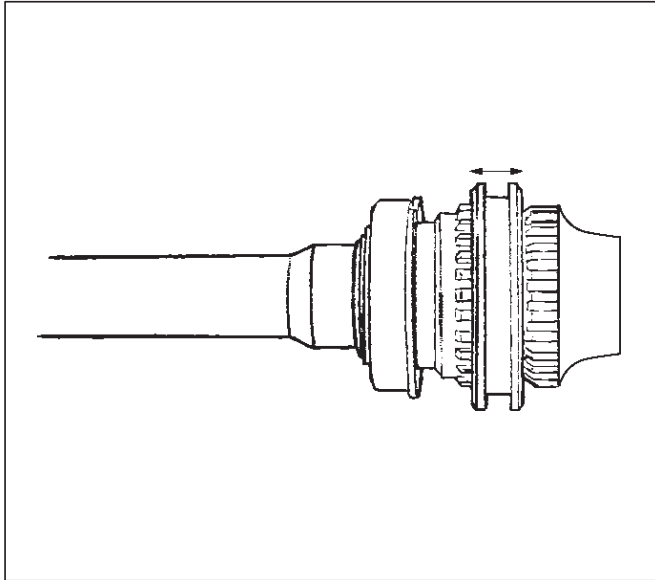
1. Inspect the state of inner shaft bearing. If any abnormality such as roughness is found, replace with a new inner shaft bearing.
2. Insert a clutch gear and check the state of needle bearing.
3. If there is an abnormality such as roughness, replace the needle bearing.

Sleeve Condition

Check and see that there is no wear, damage, or cracking in the sleeve.

NOTE: Close inspection of the groove and inner gear are required because those are important parts.

Sleeve Function



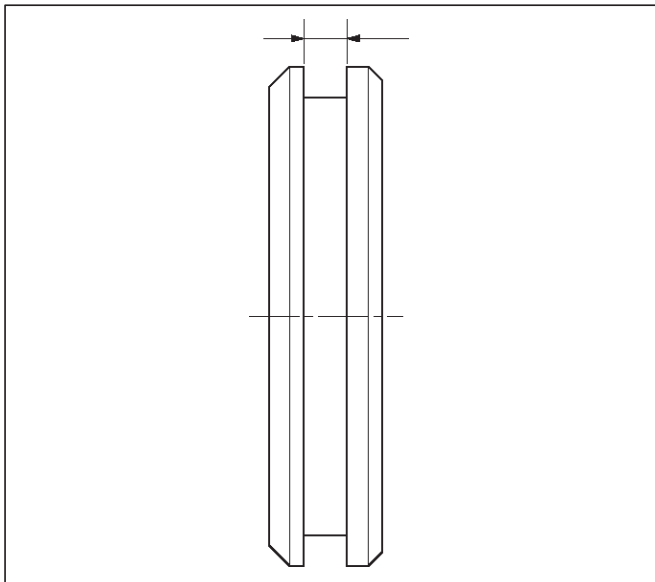
412RW011

Operate the sleeve with the inner shaft combined with the clutch gear. If roughness is felt, replace the sleeve.

NOTE: Gear oil should be applied to the contact surface of gear.

Check the width of sleeve center groove.

Limit: 7.1 mm (0.28 in) max.

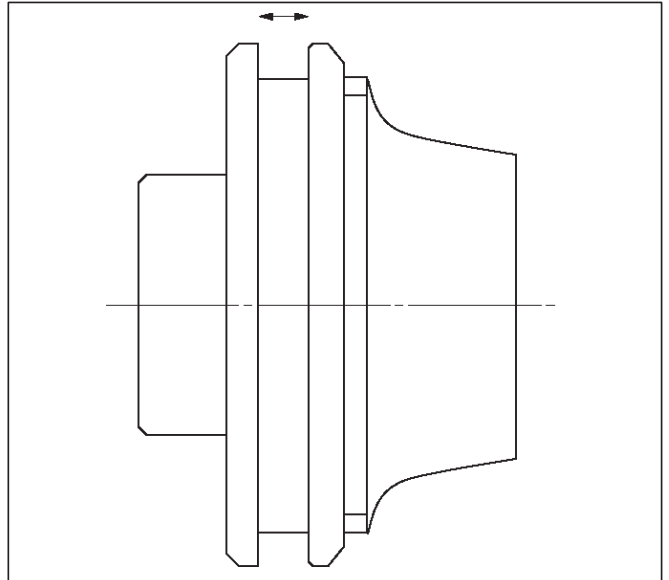


412RW022

Clutch Gear Condition

Check and see that there is no wear, damage, cracking, or any other abnormality in the clutch gear.

Clutch Gear Function



412RW010

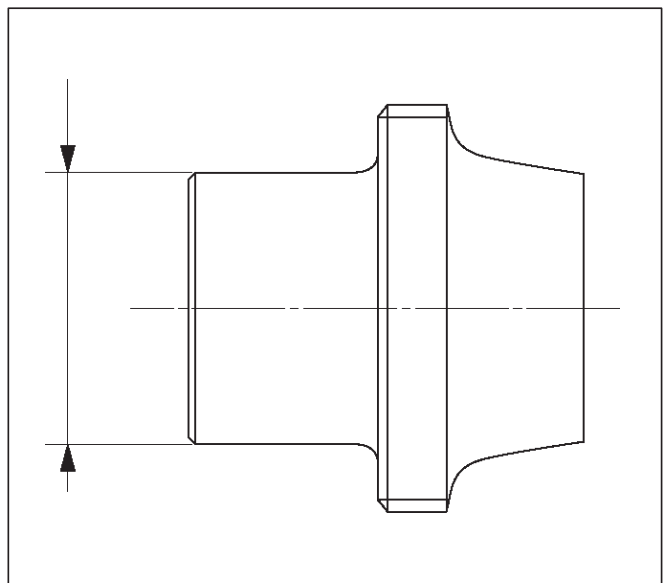
If there is an abnormality such as roughness when operated in combination with sleeve, replace the clutch gear.

NOTE: When inspecting, gear oil should be applied to the contact surface of gear.

Clutch Gear Journal Diameter

Make sure of the size illustrated.

Limit: 36.98 mm (1.456 in) min.



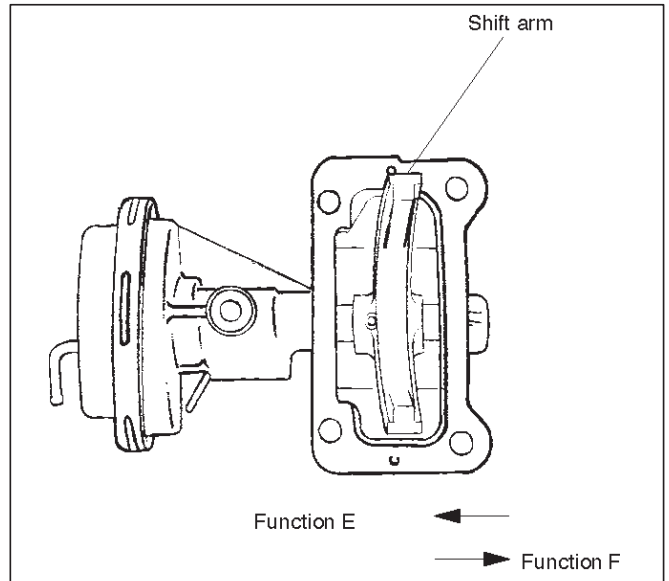
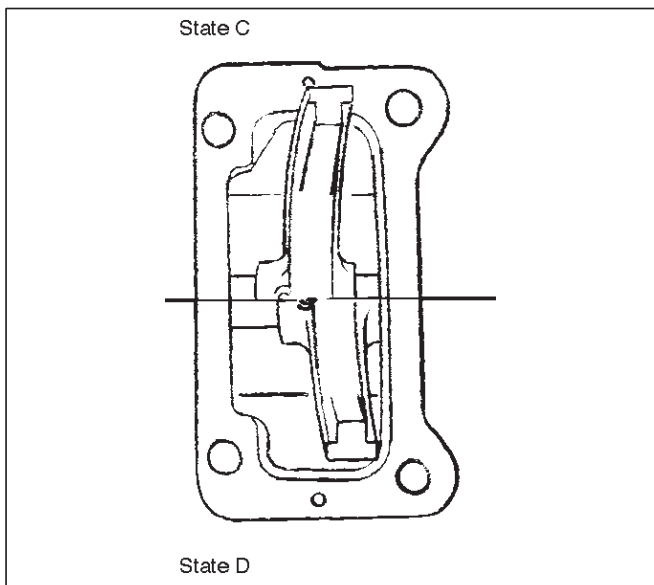
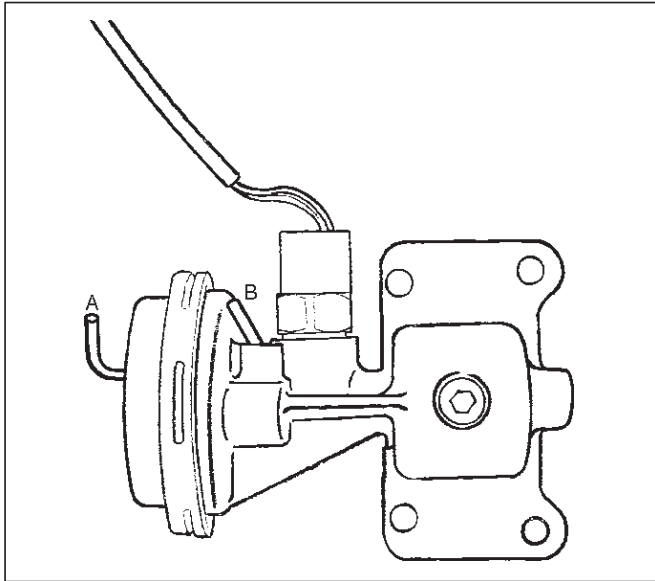
412RW009

4C-32 DRIVE SHAFT SYSTEM

Actuator

Check and see that there is no damage, cracking, or other abnormality.

Functional Check



Disconnect the shift position switch and make sure of function with a vacuum of -400 mmHg applied to Ports A and B, in accordance with the table below.

State	Port A	Port B	Function
C	-400 mmHg	A/P	E
D	A/P	-400 mmHg	F

If there is an abnormality, replace the actuator as an assembly.

NOTE:

1. If the actuator works under -400 mmHg or less, there is no functional problem.
2. Be careful not to permit the entry of water or dust into the ports of the actuator.

Dimensional Check

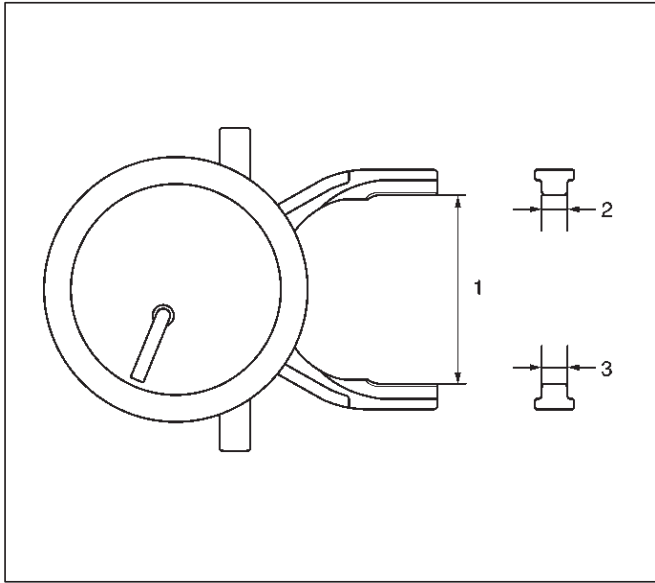
Measure illustrated sizes 1, 2, and 3.

Limit

1=64.3 mm (2.53 in) max.

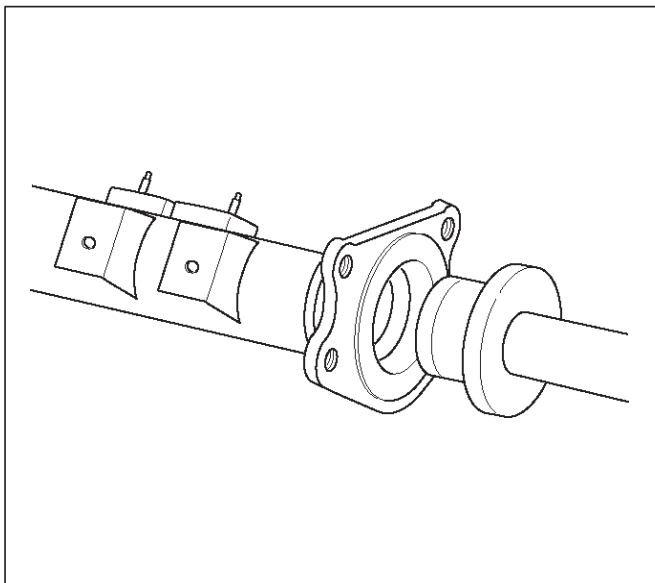
2=6.7 mm (0.26 in) min.

3=6.7 mm (0.26 in) min.

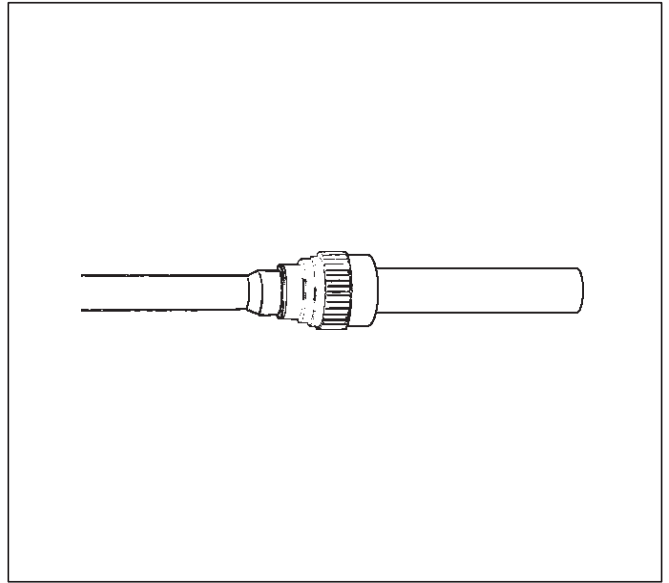


Reassembly

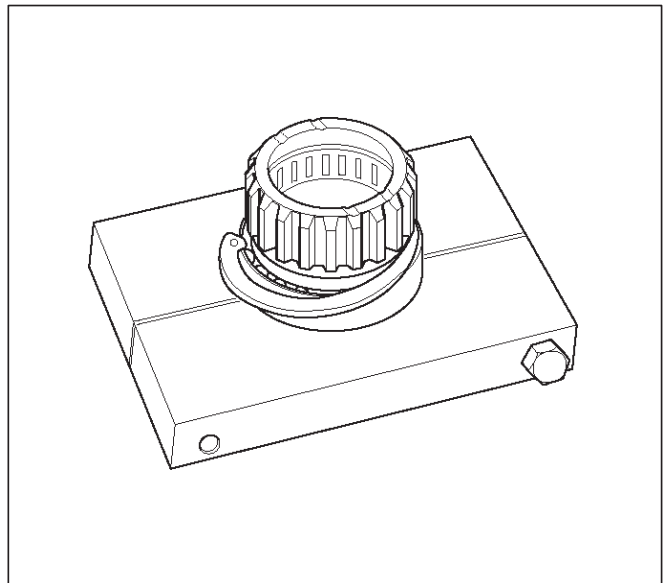
1. Install the new oil seal which has been immersed in differential gear oil, by using an oil seal installer 5-8840-2407-0 and grip 5-8840-0007-0.



2. Force a new needle bearing into inner shaft by using a installer 5-8840-2408-0 and grip 5-8840-0007-0.



3. Place a new snap ring(internal) in inner shaft.
Force a new inner shaft bearing into the inner shaft by using a installer 5-8840-2197-0 and press.



4. Install snap ring(external).

NOTE: Be careful not to damage the inner shaft.

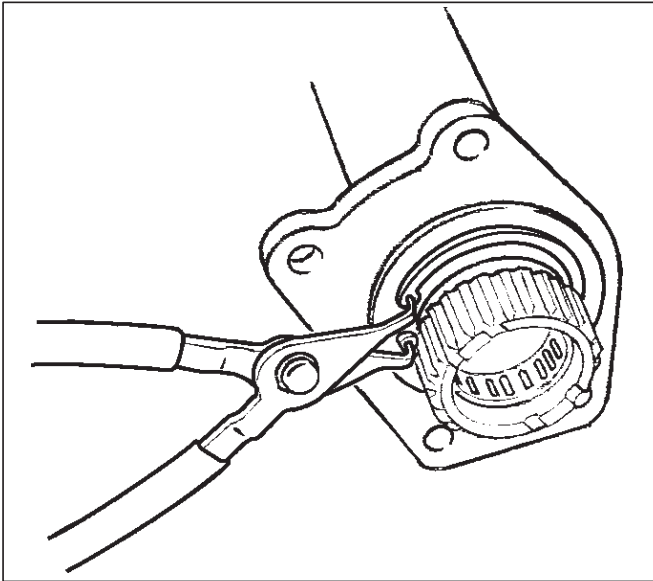
5. Clean the housing contact surface of the front axle case and insert inner shaft assembly into the front axle case.

4C-34 DRIVE SHAFT SYSTEM

NOTE: Be careful not to damage seal.

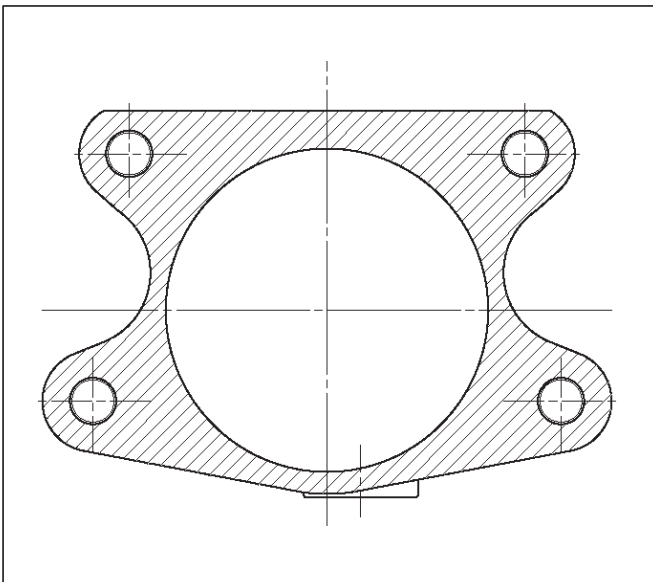
6. Install snap ring (internal) in the groove of front axle case.

NOTE: Be sure to install the snap ring properly.



412RW017

7. Apply differential gear oil to clutch gear, then install clutch gear.
8. Apply differential gear oil to sleeve, then install sleeve.
9. Clean contact surface with the front axle and actuator mounting surface. Apply liquid gasket to the contact surface on the front axle case, then install in the housing.



412RW023

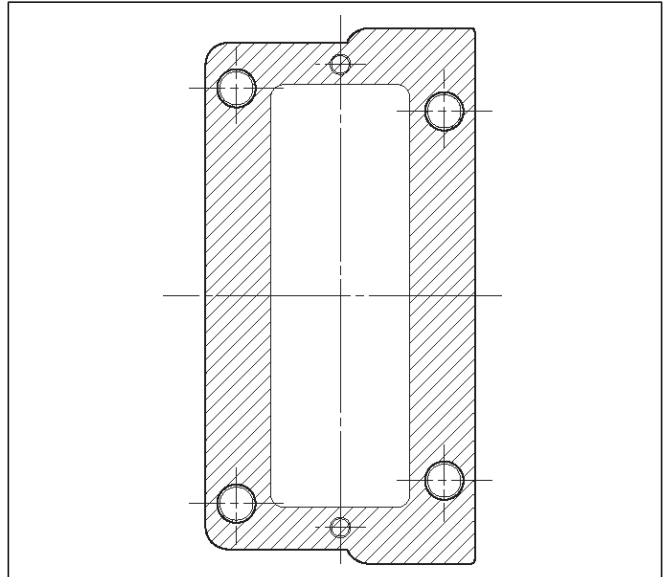
10. Tighten bolts to specified torque.

Torque: 116N-m (11.8 kg-m/85 lb ft)

11. Clean the actuator contact surface with the housing then Install and tighten shift position switch to specified torque.

Torque: 39N-m (4.0 kg-m/29 lb ft)

12. Apply liquid gasket to the contact surface on the actuator side.



412RW012

13. Align shift arm with the groove of sleeve and install the actuator.

14. Tighten bolts to specified torque.

Torque: 13N-m (1.3 kg-m/113 lb in)

15. Install front axle drive shaft and mounting bracket. Tighten fitting bolts to specified torque.

Torque: 116N-m (11.8 kg-m/85 lb ft)

16. Pour specified amount of differential gear oil to filler plug.

Front Differential

Oil Capacity: 1.4lit (1.23 Imp qt/1.48 US qt)

Actuator Housing

Oil Capacity: 0.12lit (0.10 Imp qt/0.13 US qt)

17. Install filler plug through gasket and tighten to specified torque.

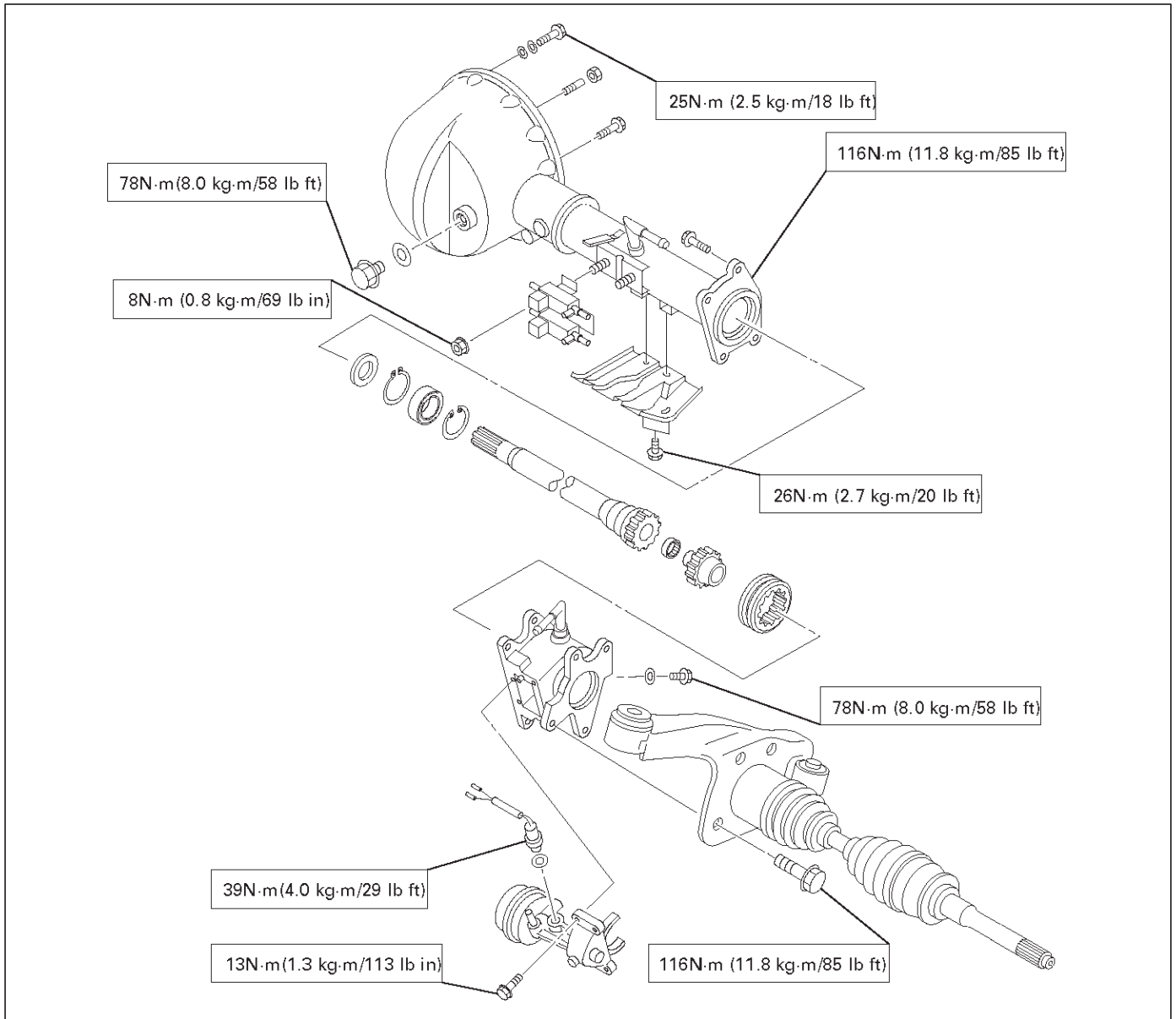
Torque: 78N-m (58lb ft)

Main Data and Specifications

General Specifications

Front drive axle oil capacity	1.4 liter (1.23 Imp qt/1.48 US qt)(Differential)
	0.12 liter (0.10 Imp qt/0.13 US qt)(Actuator Housing:Shift on the fly)
Type of lubricant	GL-5 (Multi grade type) Refer to chart in General Information
Axle shaft type	Constant velocity joint(Birfield joint type and double offset joint)

Torque Specifications



Special Tools

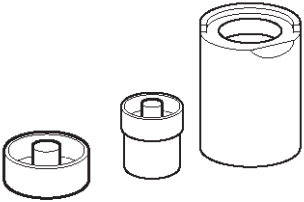
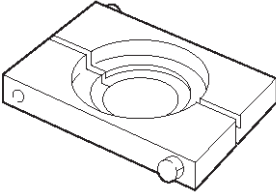
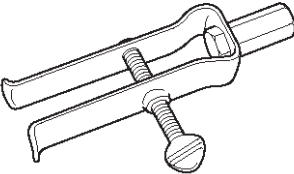
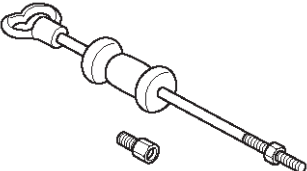
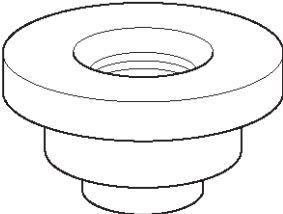
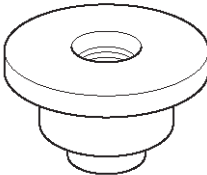
ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RS223</p>	<p>5-8840-2309-0 (J-39378) Remover and Installer; Front Axle mount bushing</p>
 <p>901RS216</p>	<p>5-8840-2197-0 (J-37452) Remover and Installer; Inner shaft bearing</p>
 <p>901RS224</p>	<p>5-8840-0027-0 (J- 26941) Remover; Bearing needle</p>
 <p>901RS226</p>	<p>5-8840-0084-0 (J-2619-01) Hammer; Sliding</p>
 <p>901RS226</p>	<p>5-8840-2407-0 (J-41693) Installer; Oil seal</p>
 <p>901RS177</p>	<p>5-8840-2408-0 (J-41694) Installer; Bearing needle</p>

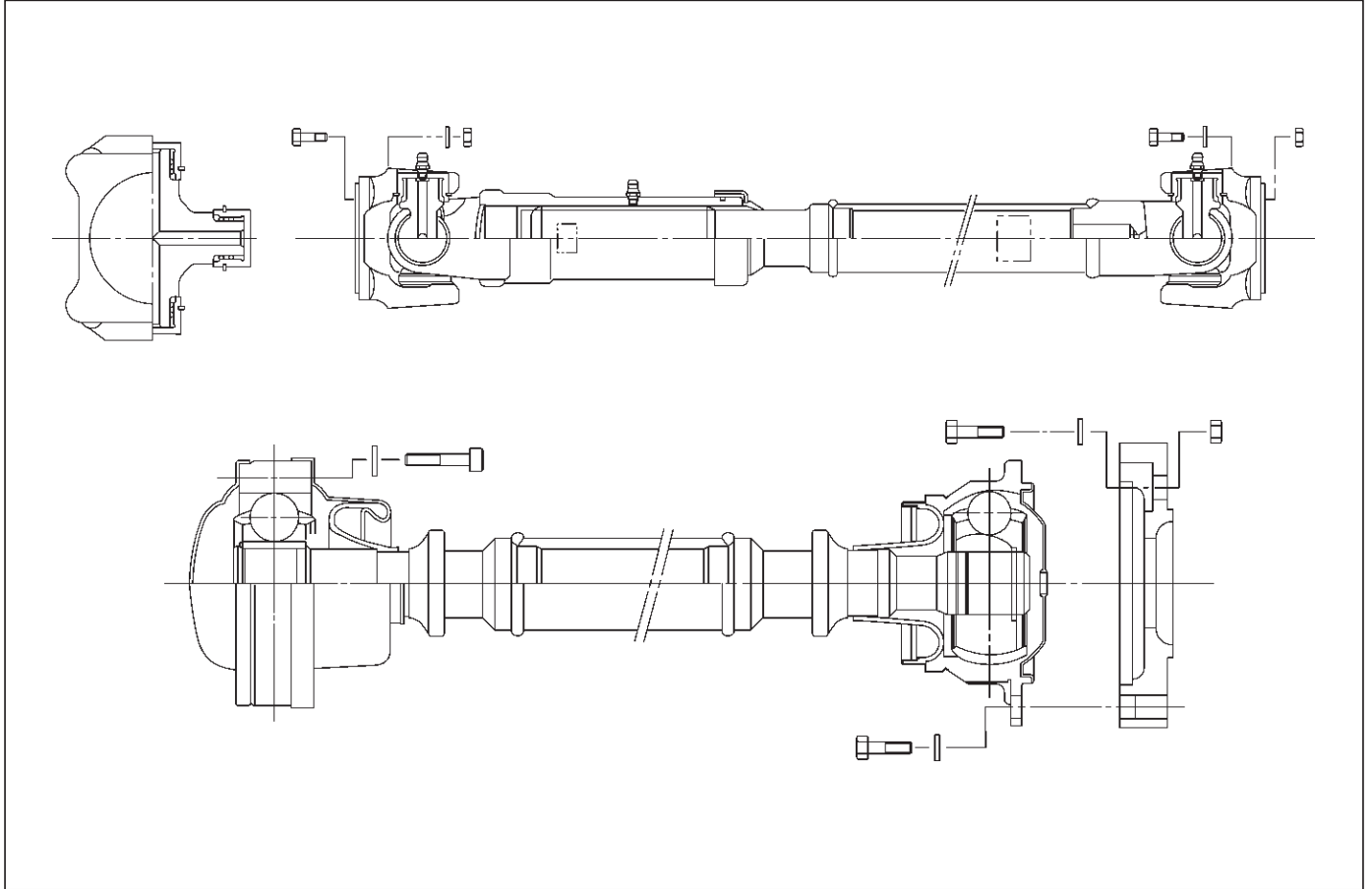
ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RS285</p>	<p>5-8840-0007-0 (J-8092) Grip</p>

Front Propeller Shaft

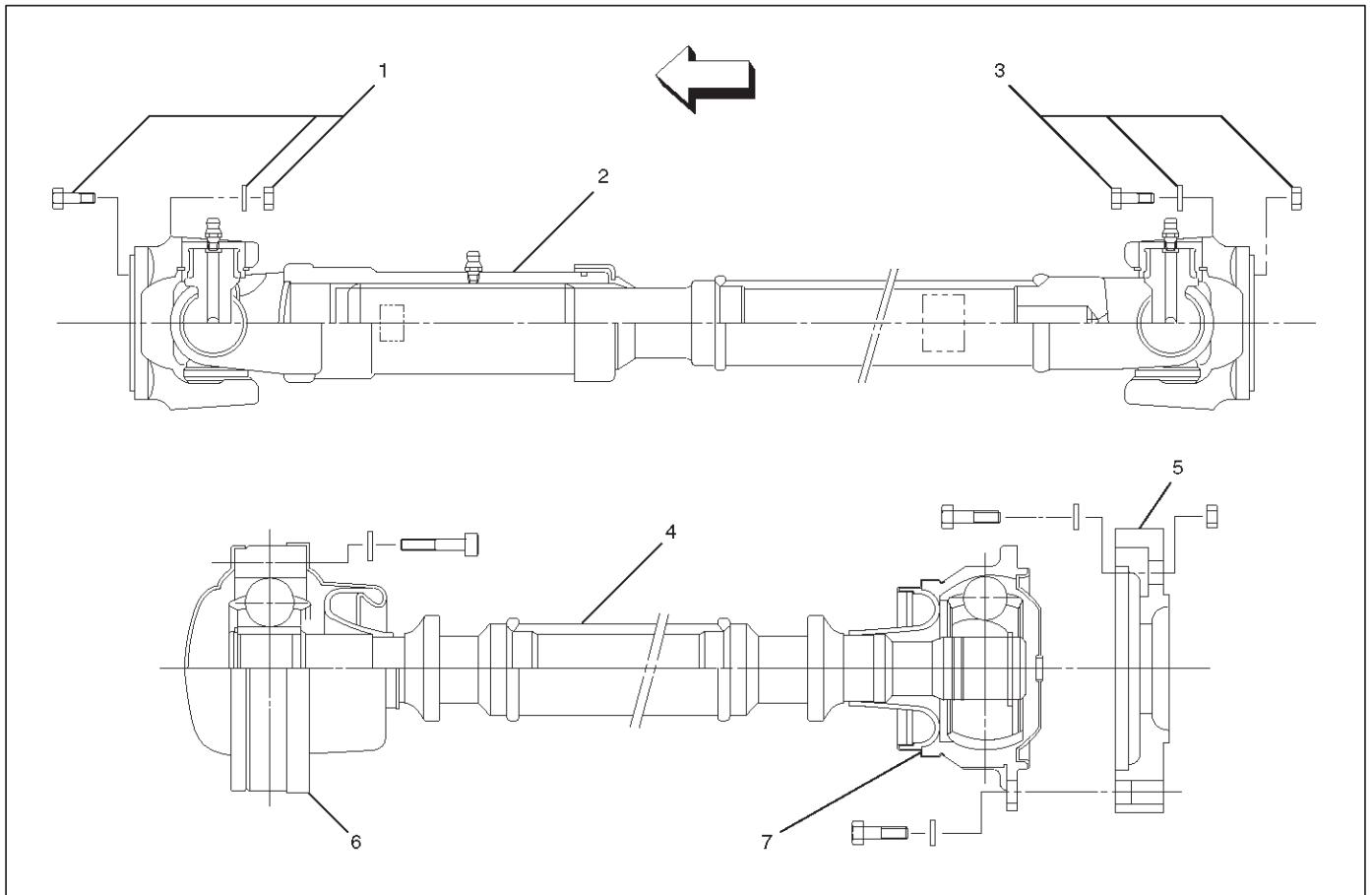
General Description

Since the propeller shaft is balanced carefully, welding or any other modifications are not permitted.

Alignment marks should be applied to each propeller shaft before removal.



Front Propeller Shaft and Associated Parts



401RW058

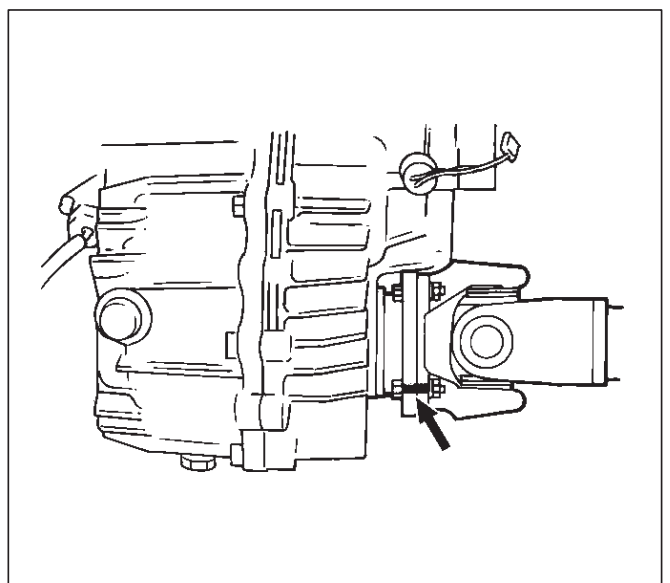
Legend

- | | |
|--|--------------------------------------|
| (1) Bolt, Nut and Washer (Front Axle Side) | (4) Front Propeller Shaft (with TOD) |
| (2) Front Propeller Shaft | (5) Coupling |
| (3) Bolt, Nut and Washer (Transfer Side) | (6) LJ Constant Velocity Joint |
| | (7) BJ Constant Velocity Joint |

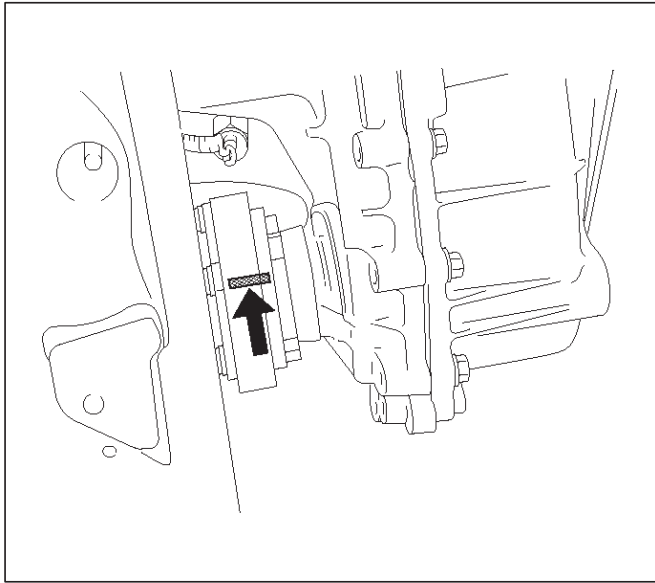
Removal

1. Jack up the vehicle and support it on the chassis stands.
2. Gear shift lever should be placed in neutral position and parking brake released.
3. Remove the exhaust and transfer protectors.

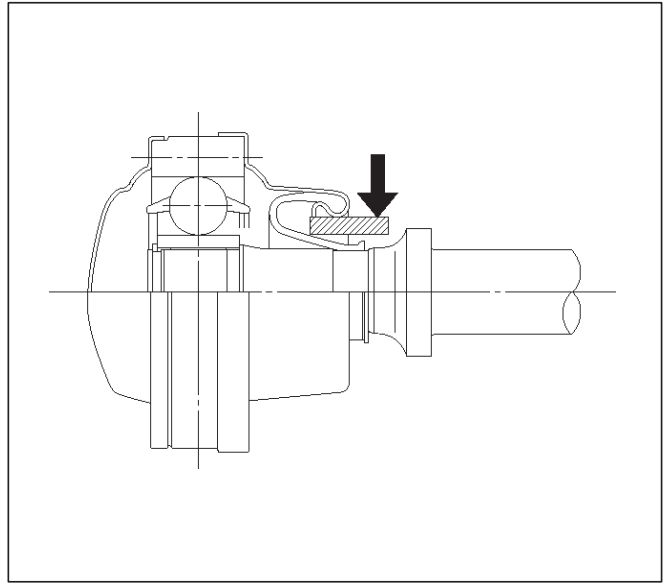
NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



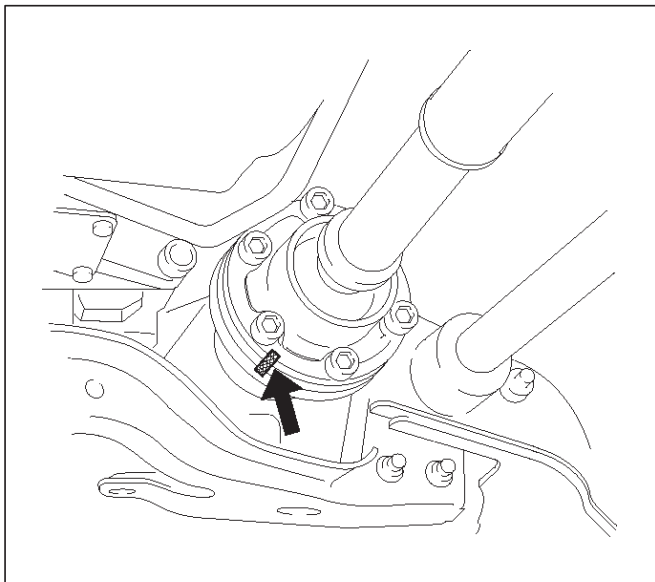
401RS020



401RW053



401RW051



401RW052

4. Remove bolt, nut and washer (Front axle side).
5. Remove bolt, nut and washer (Transfer side).
6. Remove front propeller shaft.

NOTE: If equipped with torque on demand (TOD), when removing, installing or carrying for front propeller shaft, be sure to wind a piece of cloth round the part of the boot with which fittings may interfere so that the boot can be protected. The boot may be damaged if bending force is applied to the constant velocity joint of the shaft.

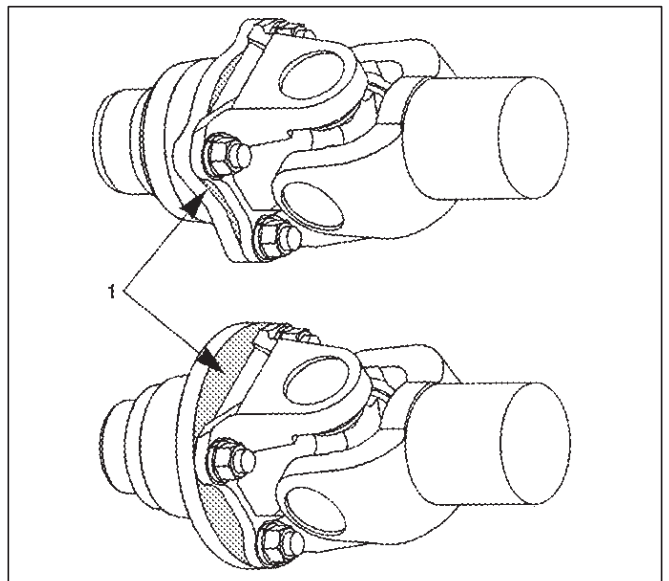
Installation

NOTE: Never install the shaft assembly backwards. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which was applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

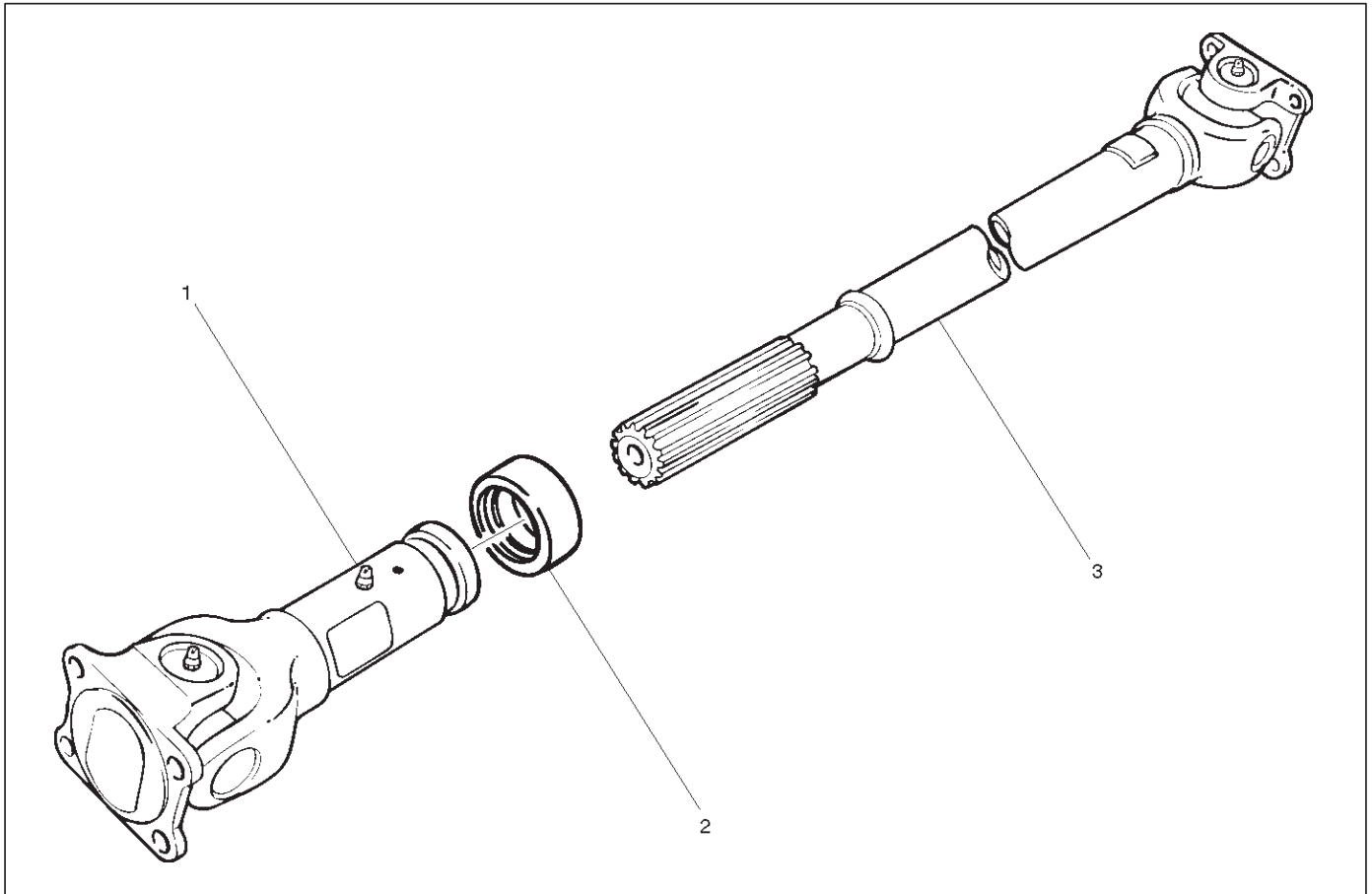
Torque: 63 N-m (6.4 kg-m/46 lb ft)

2. Install the exhaust and transfer protectors.
3. After installing the propeller shaft, be sure to apply black paint (1) to exposed area (other than connecting surface) of the entire surface of flange coupling .



401RS019

Disassembly (Except TOD 4x4)



401RW057

Legend

(1) Sleeve Yoke

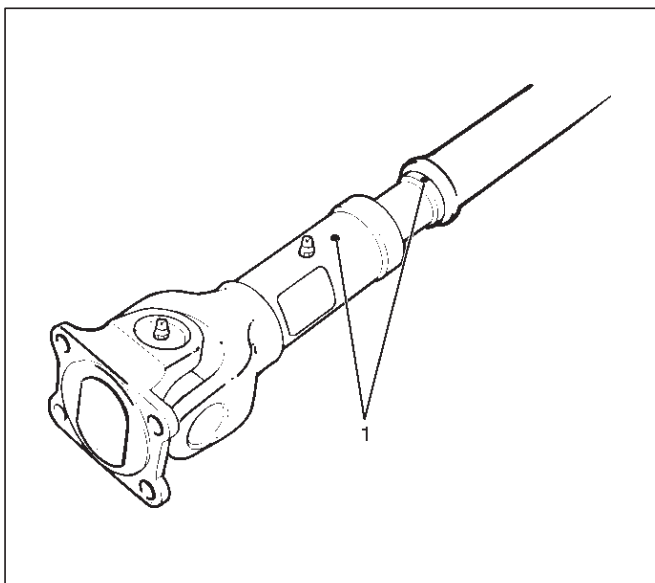
(2) Seal

(3) Tube Assembly

1. Apply alignment marks (1) on the sleeve yoke and tube assembly then remove sleeve yoke.

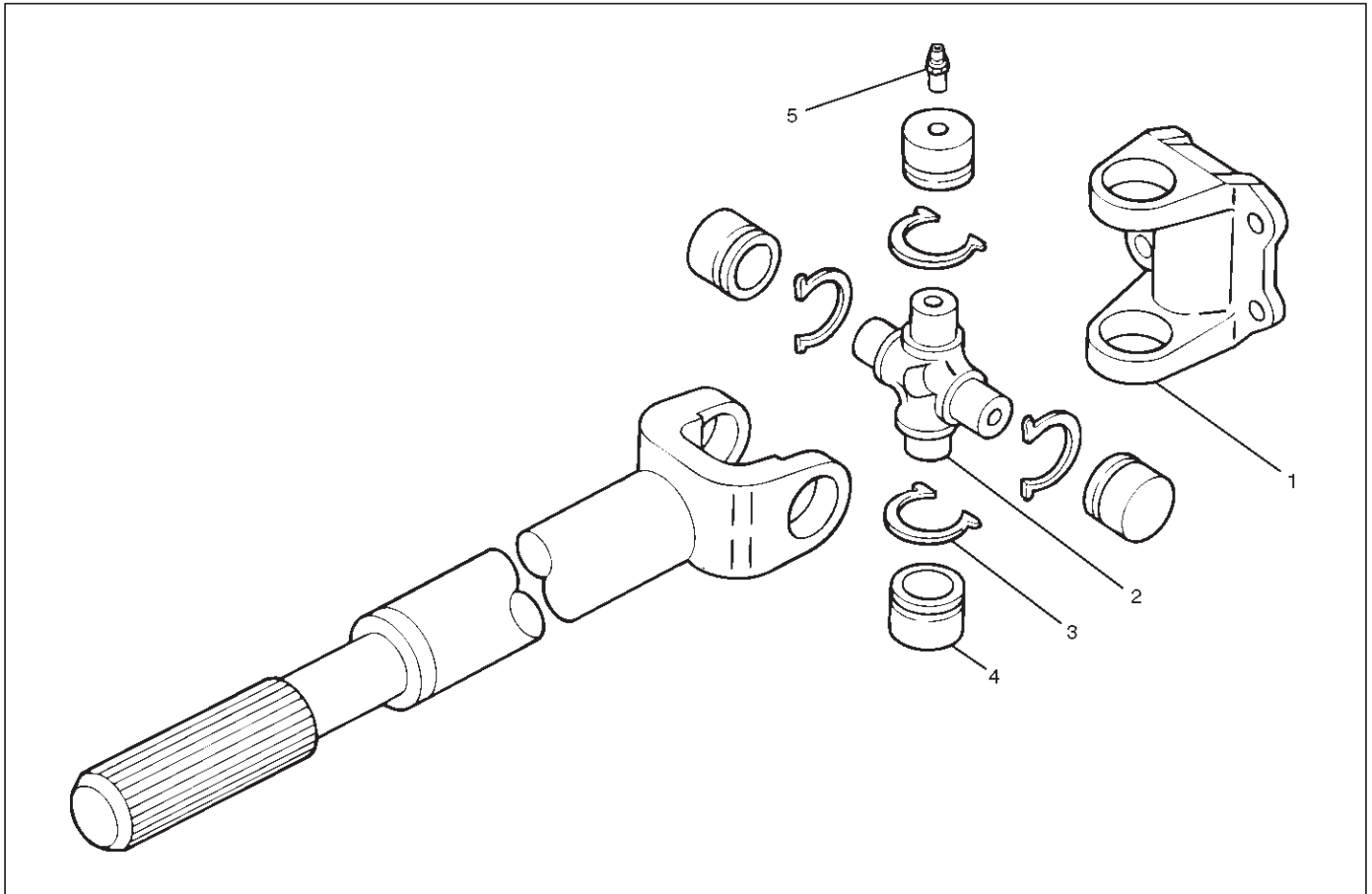
2. Remove seal.

3. Remove tube assembly.



401RW056

Universal Joint Disassembly



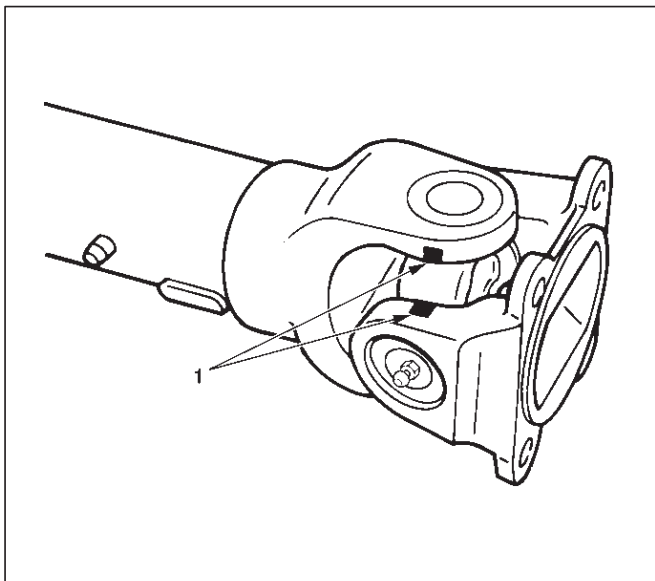
401RW055

Legend

- (1) Flange Yoke
- (2) Spider

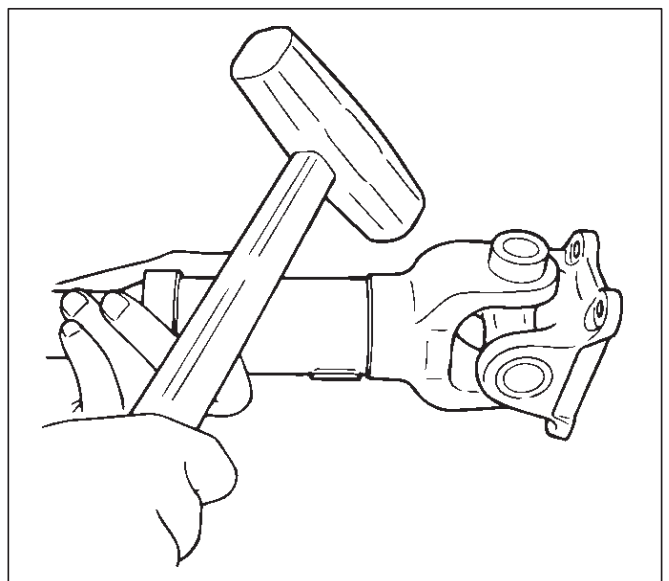
- (3) Snap Ring
- (4) Needle Roller Bearing
- (5) Grease Fitting

1. Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RS028

2. Tap out the needle roller bearing by gently striking the shoulder of the yoke, using a mallet or a copper hammer.



401RS006

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3. Make sure of proper position for reinstallation by applying setting marks, then remove spider .

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

NOTE: When any part of the journal assembly (spider, needle roller bearing) requires replacement, be sure to replace the entire assembly.

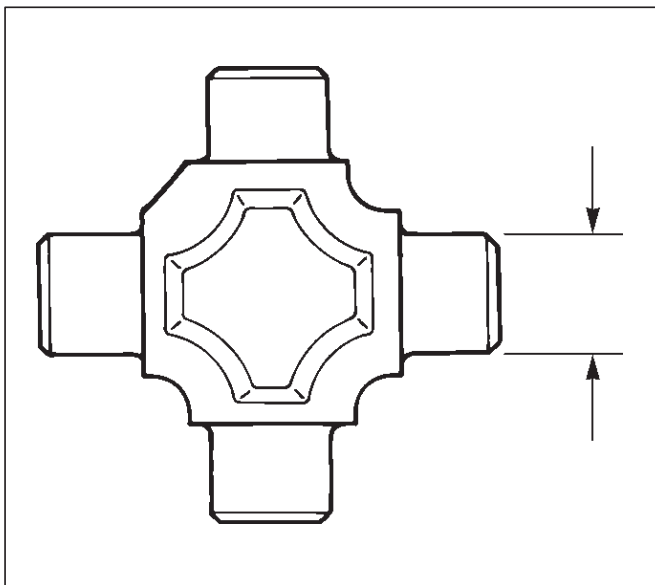
Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange
5. Constant velocity joint

Outside Diameter of Spider Pin

Standard: 17.00 mm (0.669 in)

Limit: 16.90 mm (0.665 in)



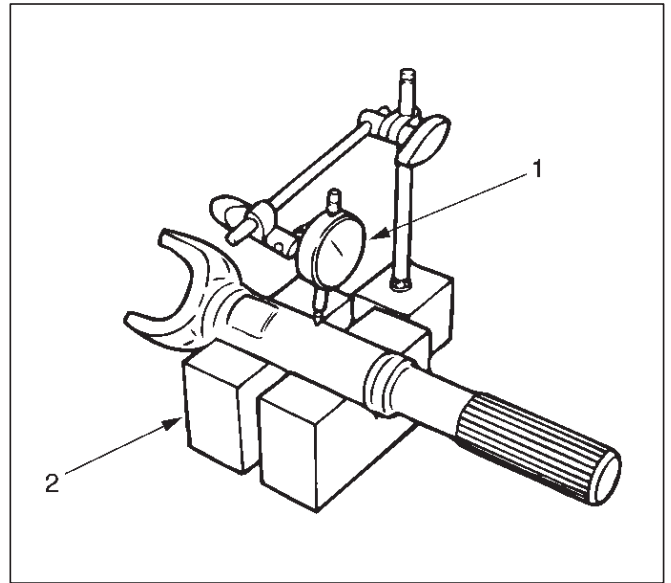
401RS007

Propeller Shaft Run-out

Support the ends of the propeller shaft on V-blocks (2) and check for run-out by holding the probe of a dial indicator (1) in contact with the center part of the shaft. If the amount of run-out is beyond the standard value for assembly, correct with a bench press or replace the shaft with a new propeller shaft assembly.

Standard: 0.3 mm (0.012 in)

Limit: 0.5 mm (0.02 in)



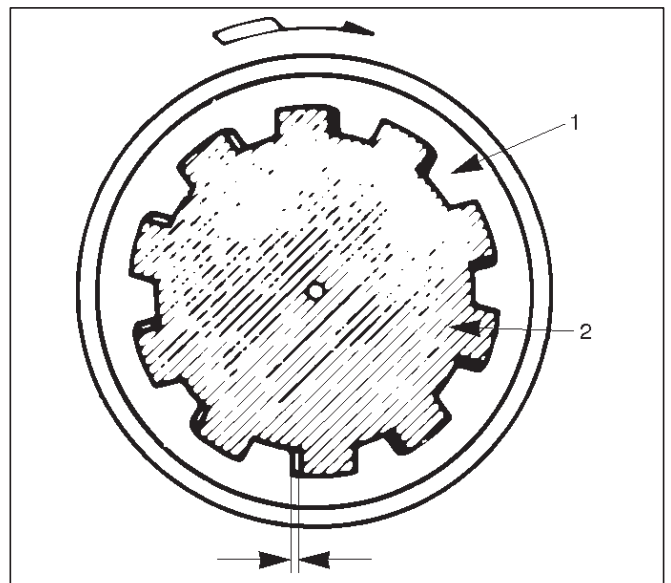
401RS027

Play in Splines in Normal Direction of Rotation

Check the amount of play between the sleeve yoke (1) and the propeller shaft spline (2) in the direction of rotation, using a pointed feeler gauge.

Standard: 0.073 – 0.156 mm (0.003 – 0.006 in)

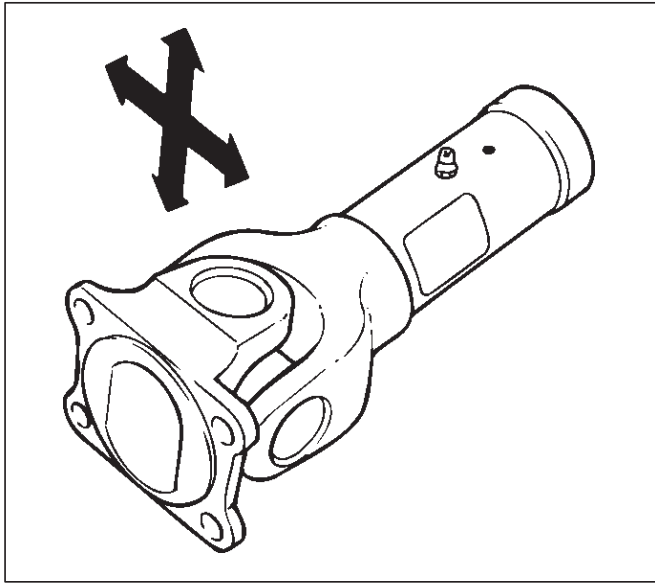
Limit: 0.3 mm (0.012 in)



401RS009

Play in Universal Joint

Limit: Less than 0.1 mm (0.004 in)



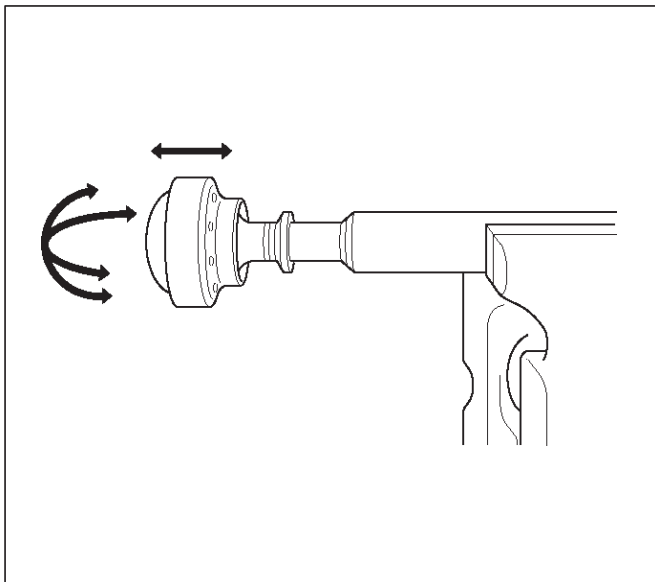
401RS010

Constant Velocity Joint

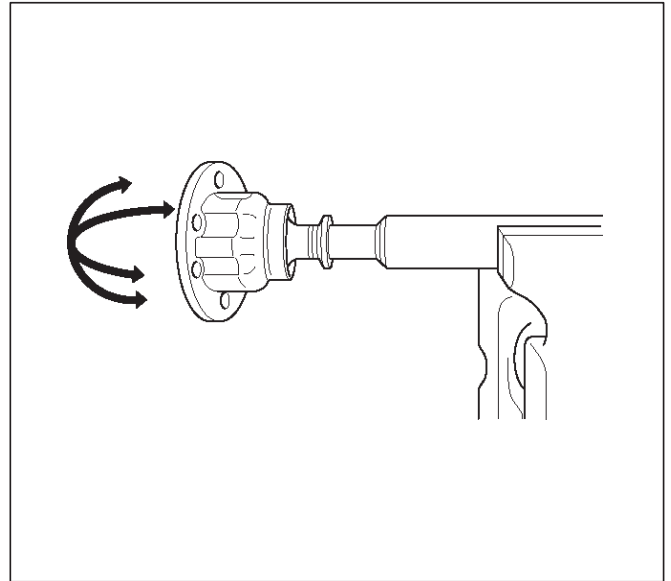
NOTE: LJ and BJ constant velocity joints are unremovable types. Check the joint for play and the boot for damage, wear, and leak of grease. If abnormality is found, replace propeller shaft as an assembly.

Play in Constant Velocity Joint

Fix the shaft in a vise through pieces of wood, and try to move the joint vertically, right and left, and back and forth to make sure of smooth motions and no remarkable play.



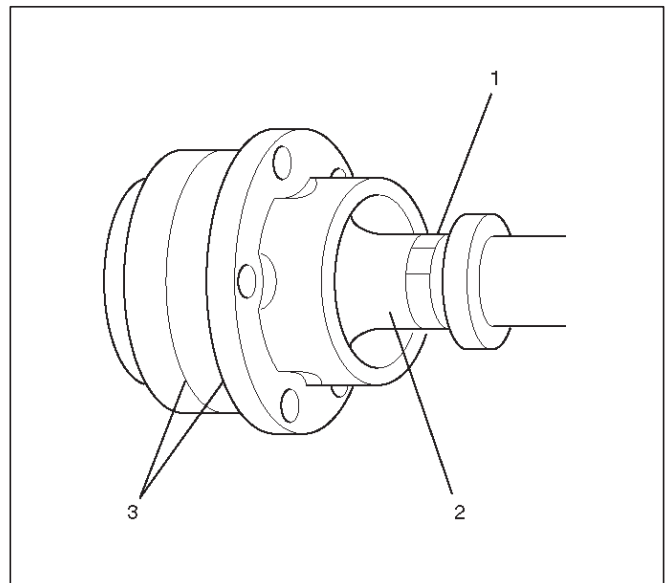
401RW050



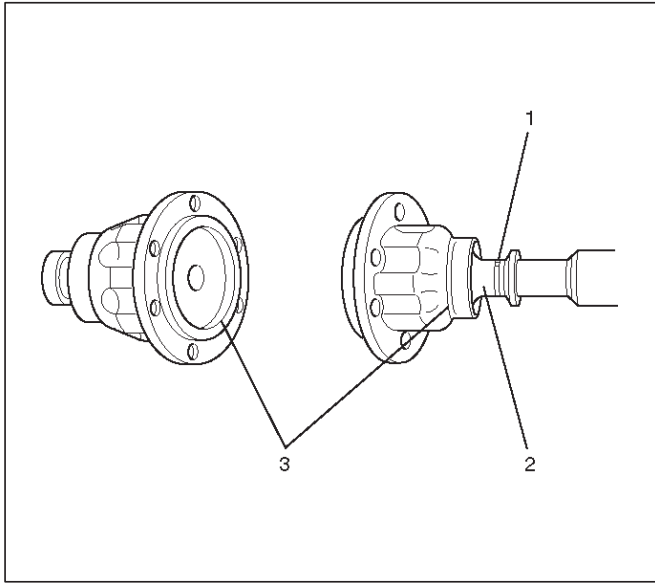
401RW049

Boot of Constant Velocity Joint

Check the boot (2) for crack, damage and grease leak, and the boot band (1) for loosening and damage. Check the both sides of the joint and make sure that there is no leak of grease from the cover press-in parts(3).



401RW048

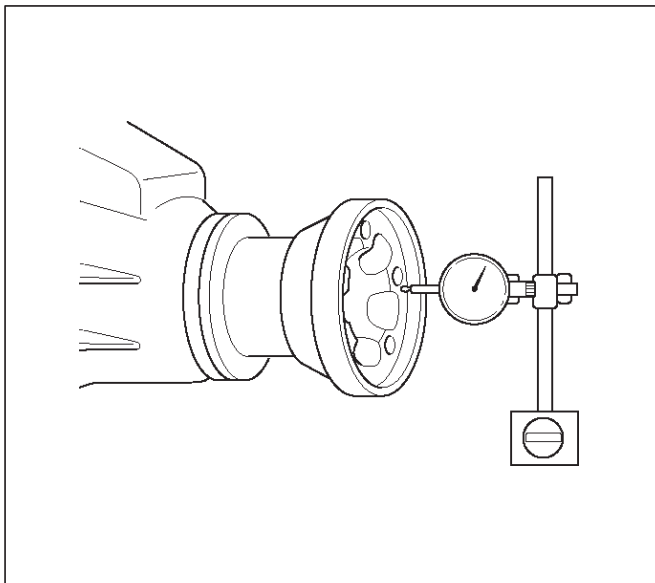


401RW047

Front Axle Flange Run-out

1. Set a dial gage at right angle near the outer circumference of the flange face and check the run-out of the flange face.

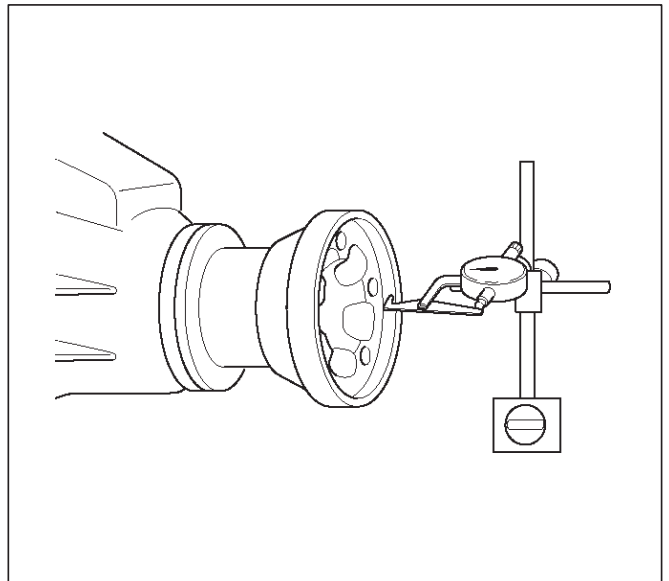
Limit: 0.15 mm (0.006 in)



401RW046

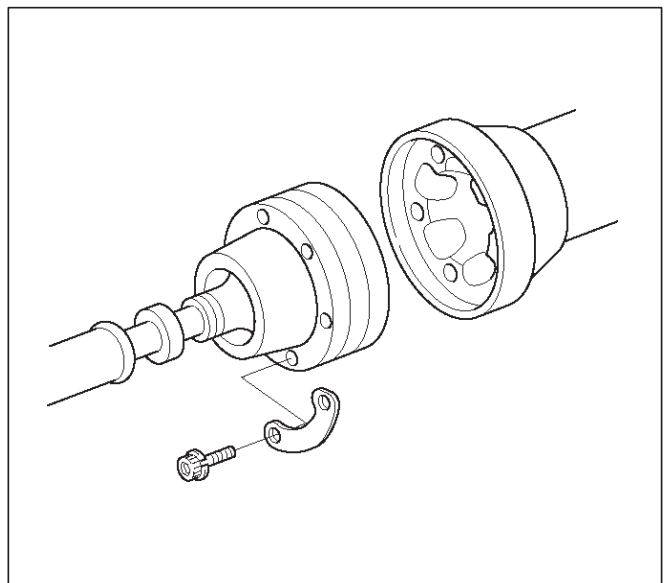
2. Set a dial gage at right angle near the inner circumference and check the run-out of the flange.

Limit: 0.15 mm (0.006 in)



401RW045

3. If vibration is felt during the 4H AUTO drive, disconnect the propeller shaft at the front axle. Reinstall the propeller shaft at 60°, 120°, 180°, 240°, and 300° and conduct test drive in each position and check if there is vibration.

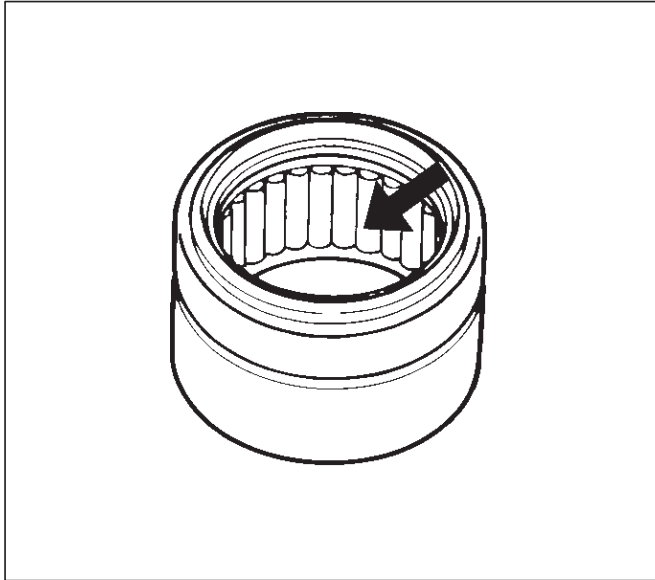


401RW044

Universal Joint Reassembly

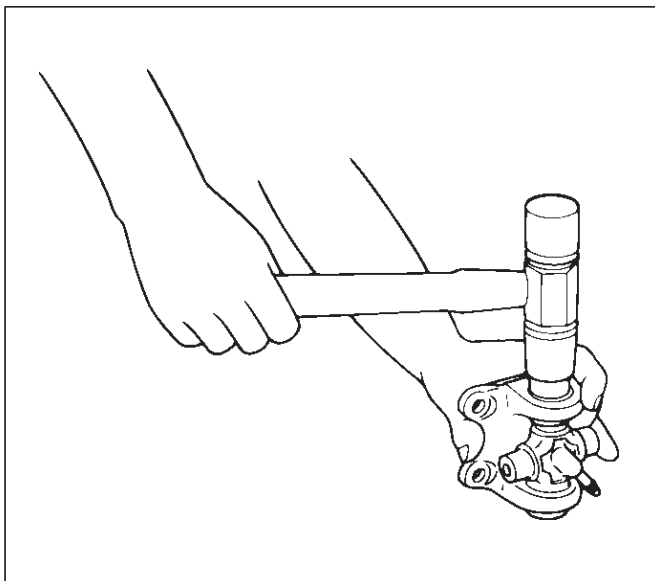
1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Apply a molybdenum–disulfide grease or a multi–purpose type grease NLGI No. 2 to inside of the bearing cap.

Grease Amount: Approx. 1.2 g (0.042 oz)

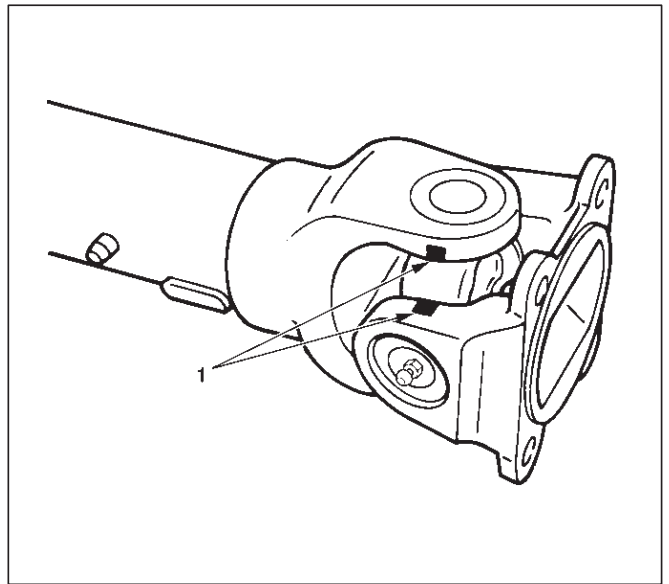


3. Using either a mallet (or copper hammer) or a press, install the needle roller bearing into the yoke so that the snap ring can be installed in its groove.

CAUTION: The needle roller bearing cannot be installed smoothly if it is set at an incorrect angle with the flange and excessive hammering will damage the needle roller bearing.



4. Align setting marks (1) and join the yokes.



5. Install snap ring.

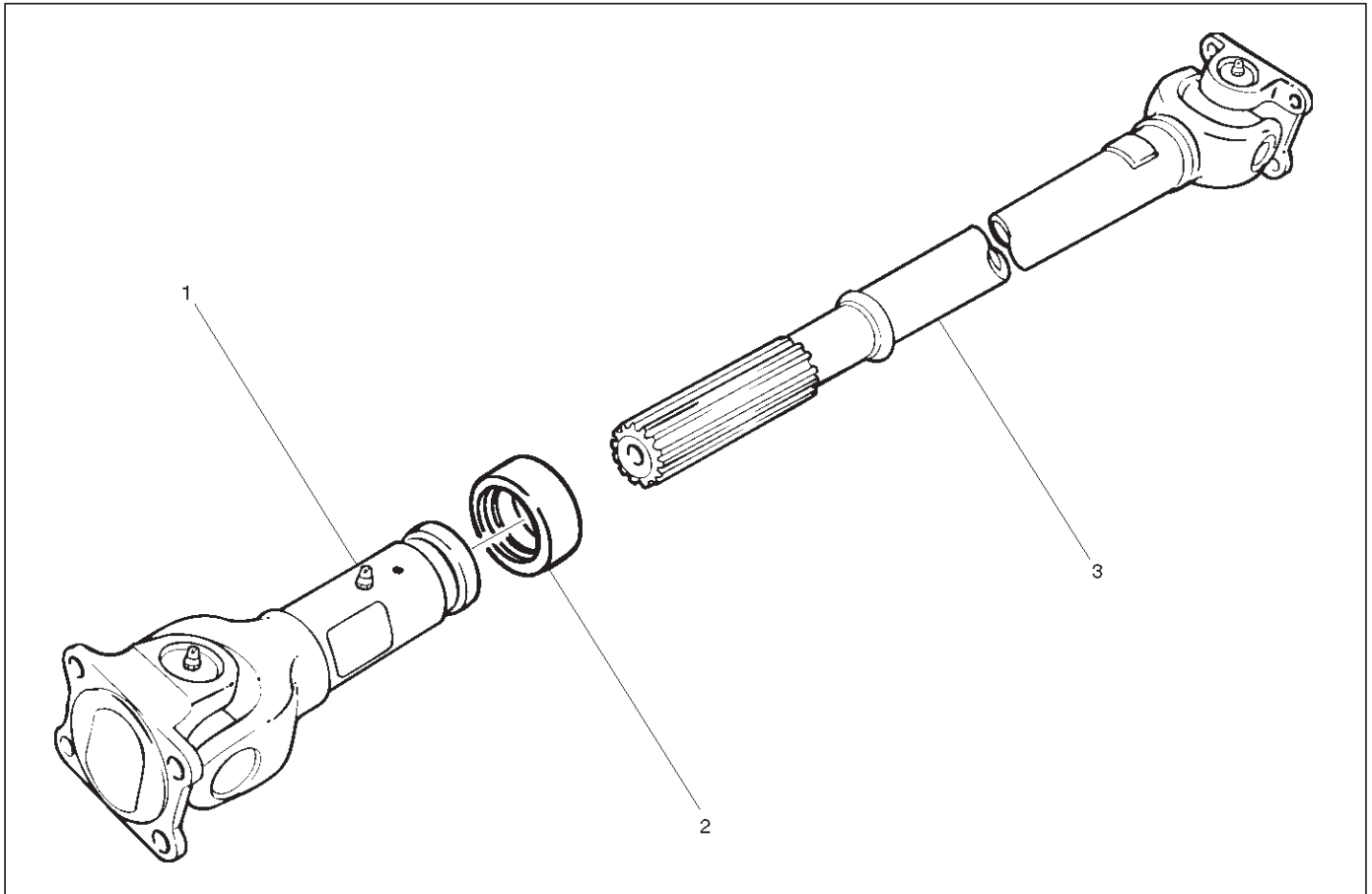
NOTE: Discard used snap rings and install new ones. When the bearing cap is in position, select and attach a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm (0.004 in).

Snap ring thickness and Identification color

- 1.5 mm (0.059 in); Blue
- 1.53 mm (0.060 in); White
- 1.59 mm (0.063 in); Yellow
- 1.62 mm (0.064 in); Green
- 1.68 mm (0.066 in); Not colored

NOTE: Be sure to use snap rings of the same thickness on both sides.

Reassembly (Except TOD 4×4)



401RW057

Legend

(1) Sleeve Yoke

(2) Seal

(3) Tube Assembly

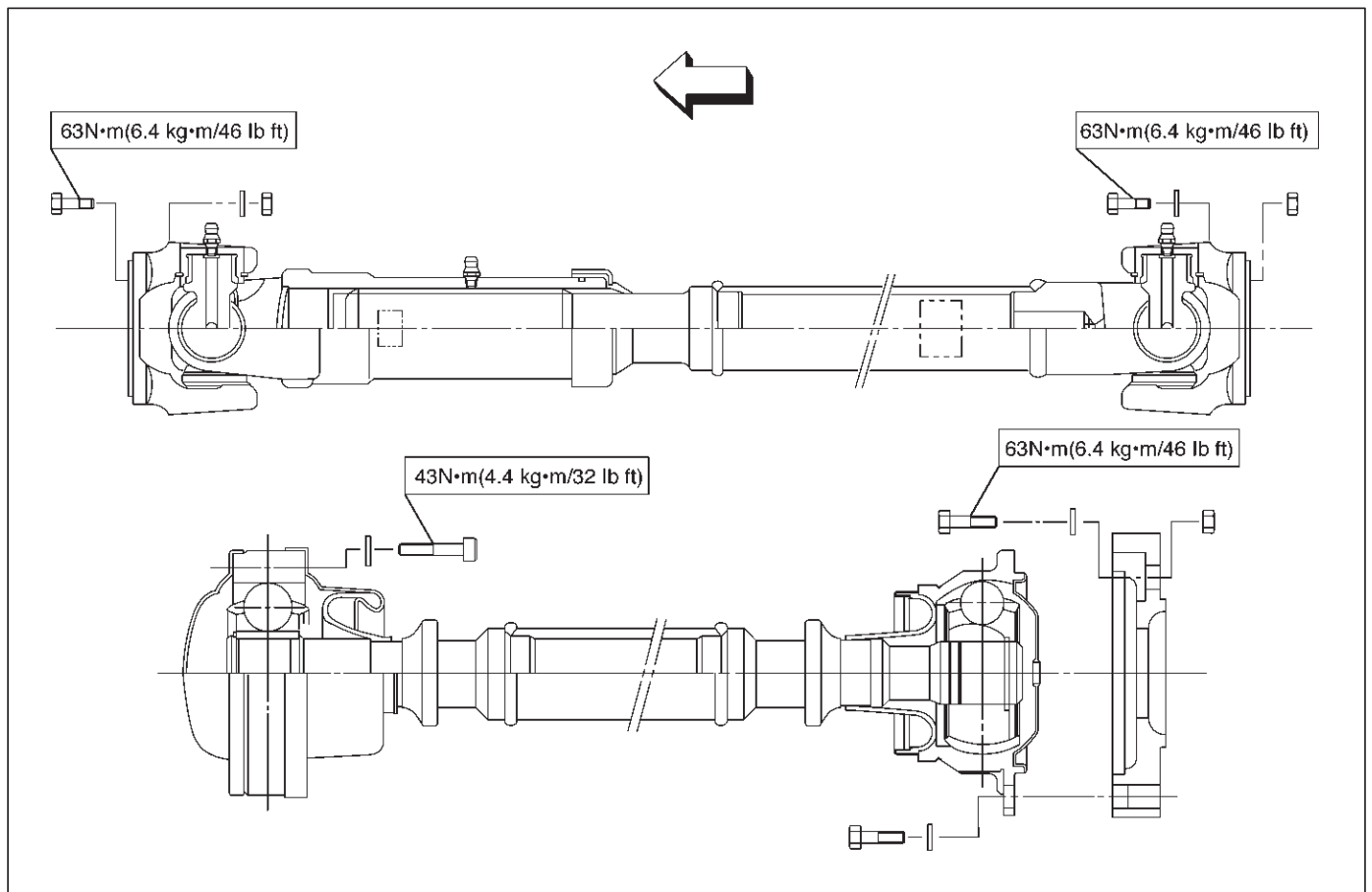
1. Discard used seal and install new one.
2. Align the alignment marks and install tube assembly to sleeve yoke.

Main Data and Specifications

General Specifications

Engine	6VE1 (3.5L)			6VD1 (3.2L)			4JX1 (3.0L)		4JG2 (3.1L)	
Transmission	M/T	A/T	A/T with TOD	M/T	A/T	A/T with TOD	M/T	A/T	M/T	A/T
Construction	Hollow steel tube with yoke and spider type universal joint		Hollow steel tube with constant velocity joints	Hollow steel tube with yoke and spider type universal joint		Hollow steel tube with constant velocity joints	Hollow steel tube with yoke and spider type universal joint			
Outside diameter	40.0mm (1.57 in)									
Length	559mm (22.01in)	559mm (22.01in)	577mm (22.72in)	393mm (15.47in)	559mm (22.01in)	577mm (22.72in)	627mm (24.69in)	627mm (24.69in)	421mm (16.57in)	627mm (24.69in)

Torque Specifications

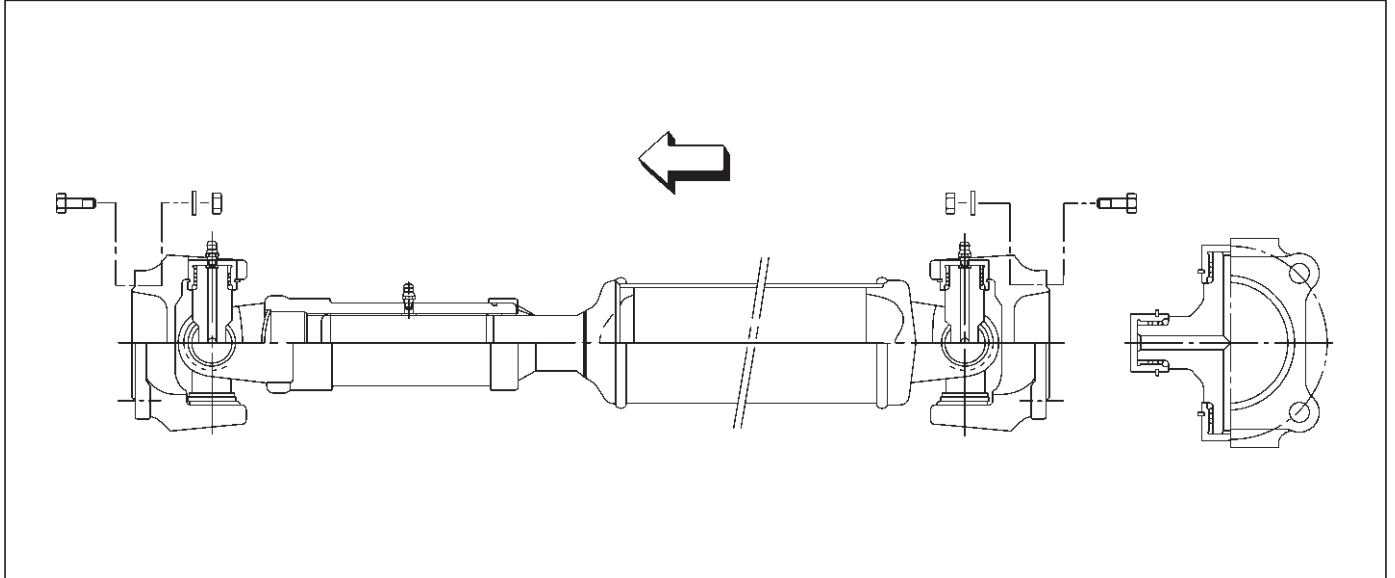


Rear Propeller Shaft

General Description

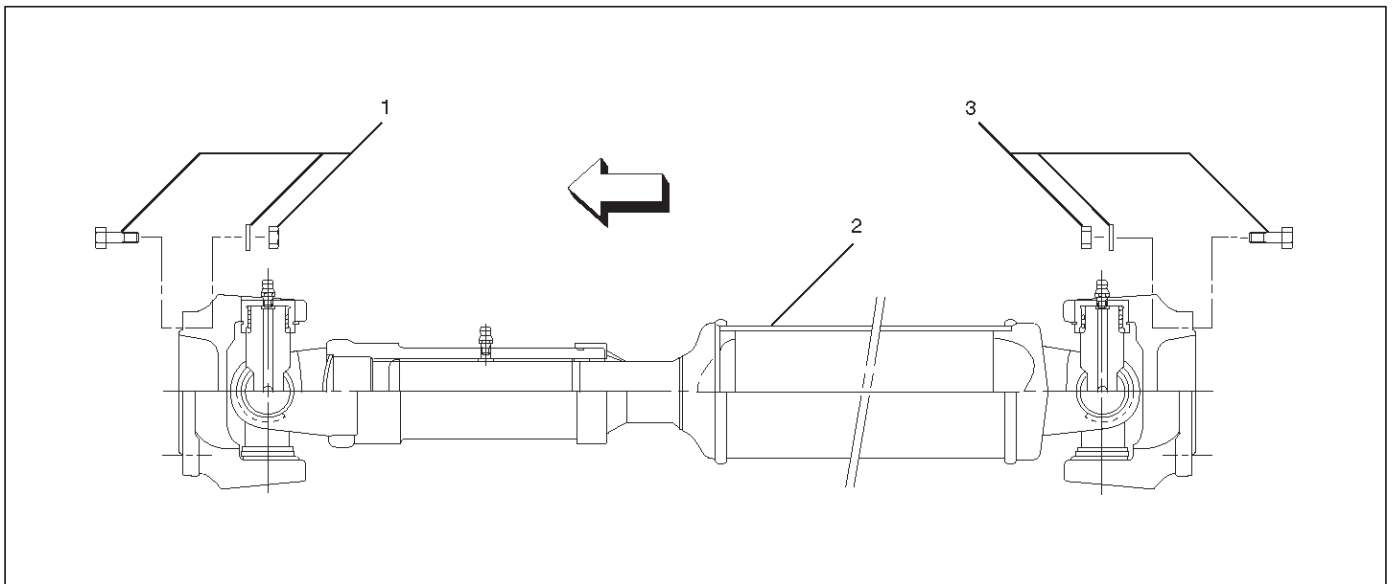
Since the propeller shaft is balanced carefully, welding or any other modifications are not permitted.

Alignment marks should be applied to each propeller shaft before removal.



401RW003

Rear Propeller Shaft and Associated Parts



401RW059

Legend

(1) Bolt, Nut and Washer

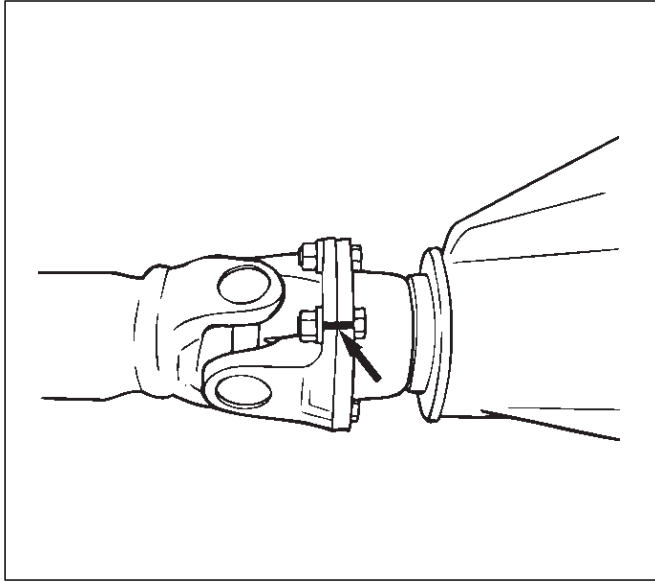
(2) Rear Propeller Shaft

(3) Bolt, Nut and Washer

Removal

1. Jack up the vehicle and support it on the chassis stands.
2. Gear shift lever should be placed in neutral position and parking brake released.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.



3. Remove bolt, nut and washer (Rear axle side).
4. Remove bolt, nut and washer (Transfer side).
5. Remove rear propeller shaft.

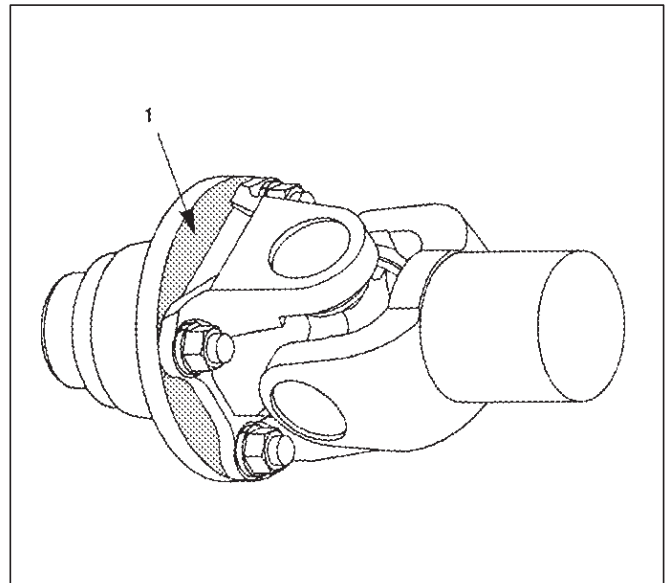
Installation

NOTE: Never install the shaft assembly backwards.

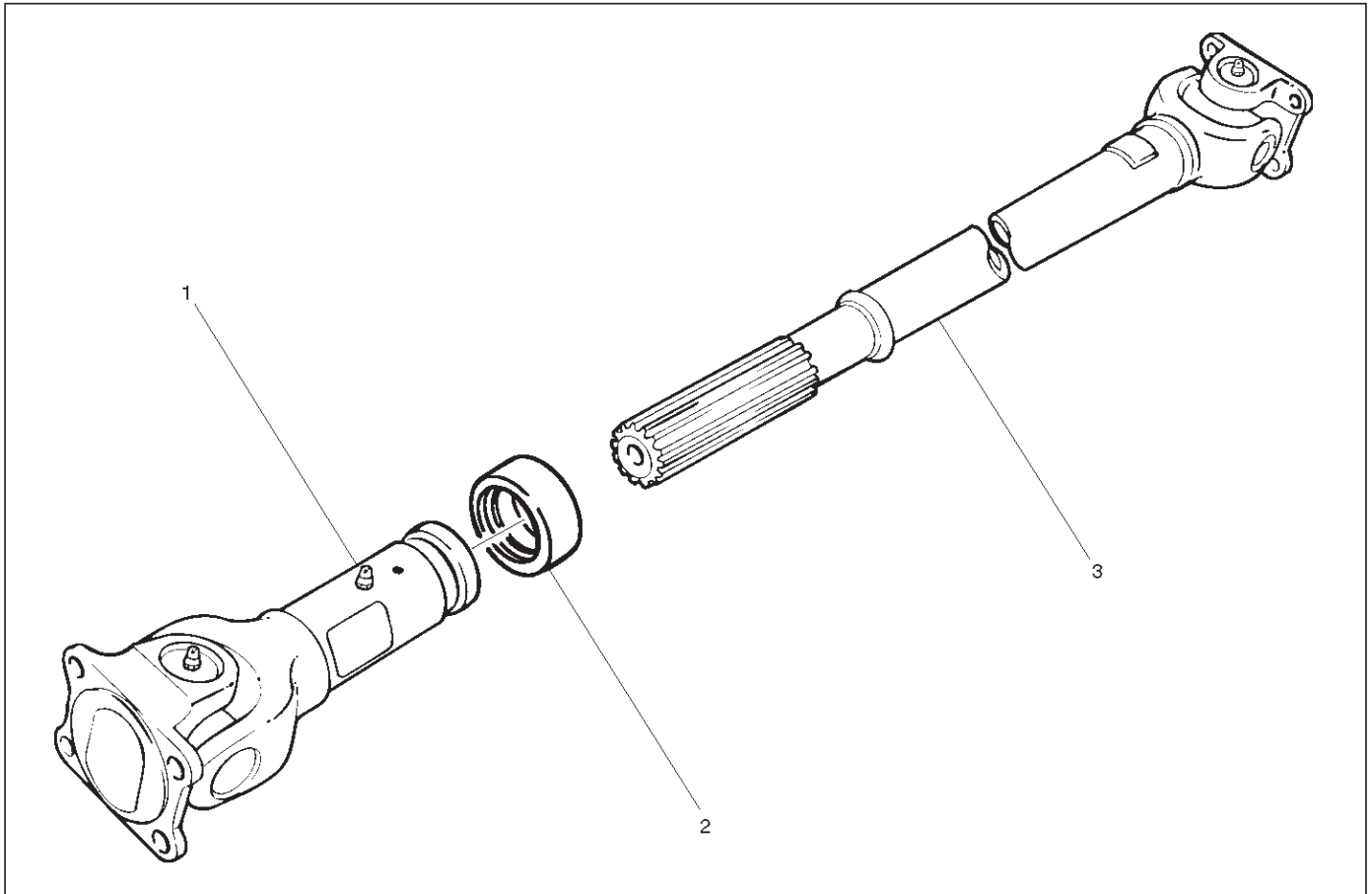
1. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.
2. Align the mark which is applied at removal .
Install rear propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m (6.4 kg·m/46 lb ft)

3. After installing the propeller shaft, be sure to apply black paint (1) to exposed area (other than connecting surface) of the entire surface of flange coupling .



Disassembly



401RW057

Legend

(1) Sleeve Yoke

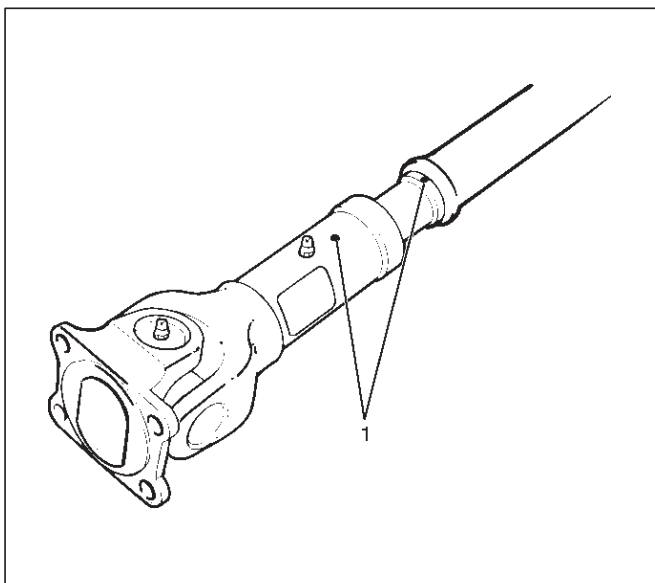
(2) Seal

(3) Tube Assembly

1. Apply alignment marks (1) on the sleeve yoke and tube assembly then remove sleeve yoke.

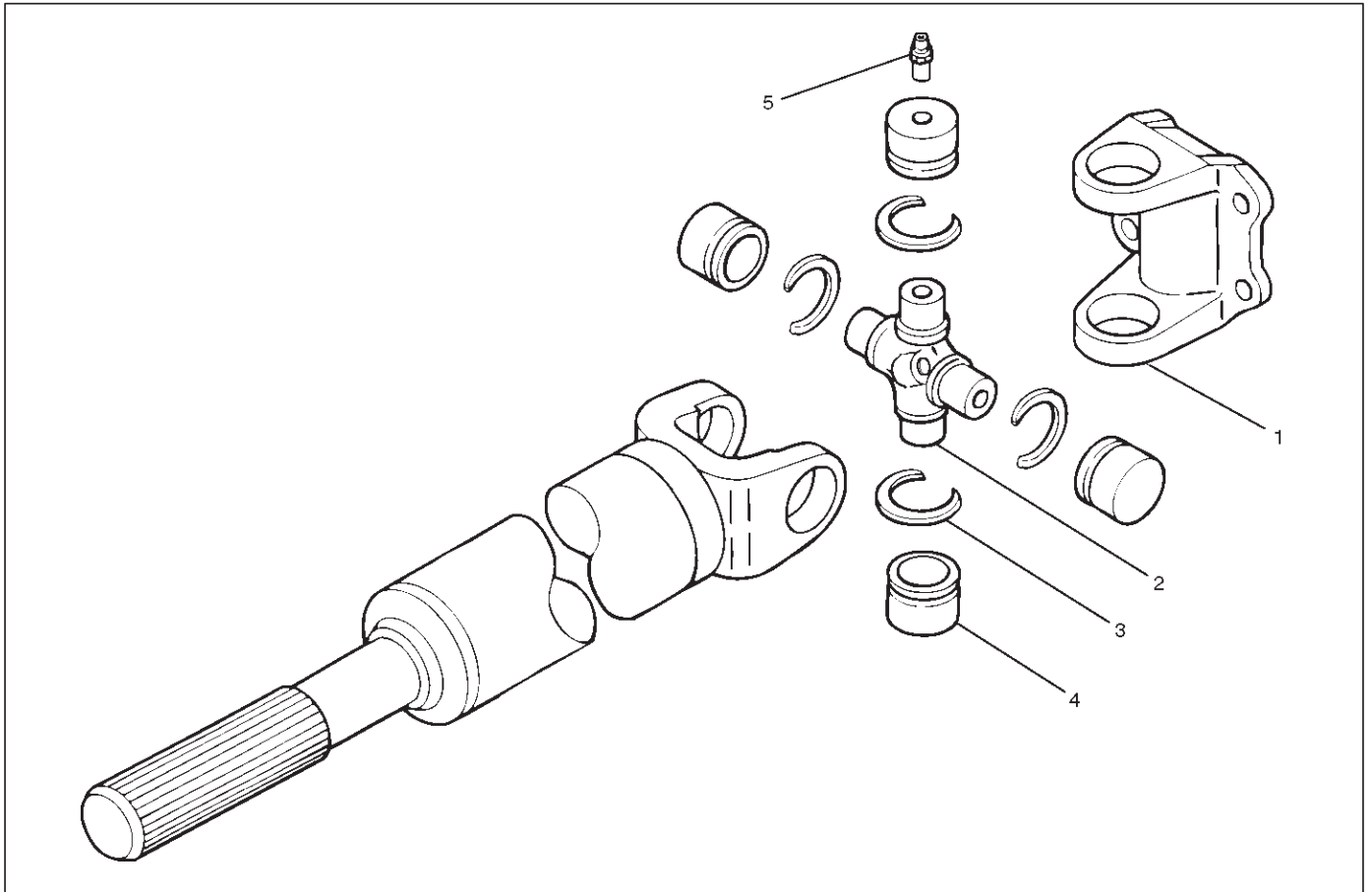
2. Remove seal.

3. Remove tube assembly.



401RW056

Universal Joint Disassembly

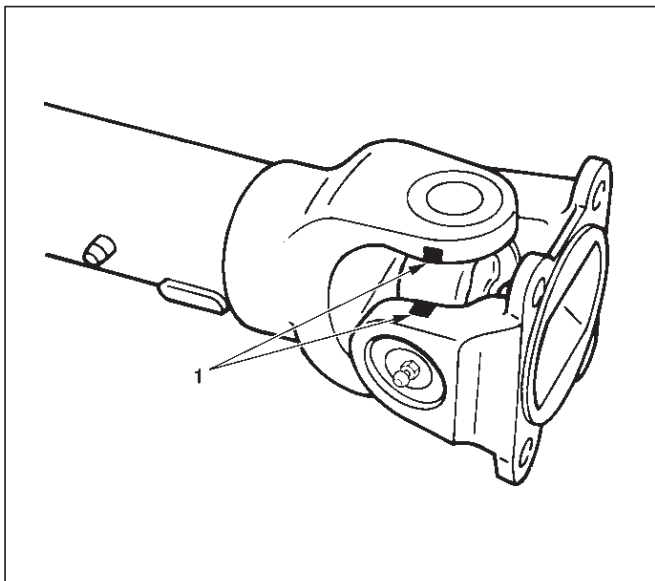


401RW054

Legend

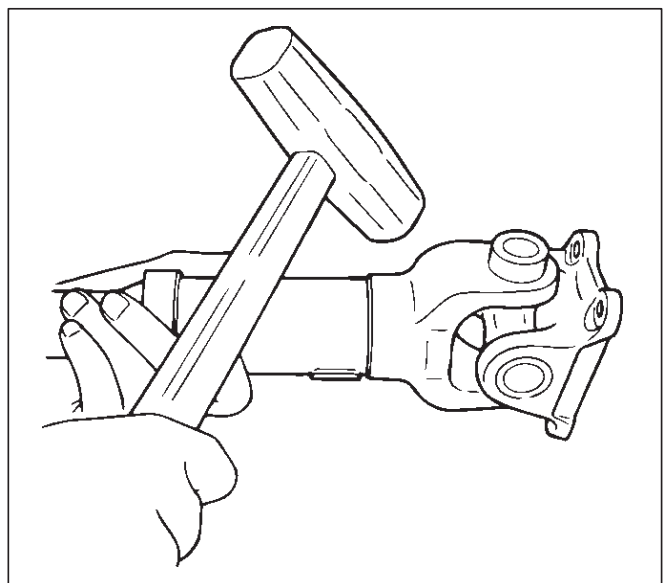
- (1) Flange Yoke
- (2) Spider with Grease Fitting
- (3) Snap Ring
- (4) Needle Roller Bearing
- (5) Grease Fitting

1. Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RS028

2. Tap out the needle roller bearing by gently striking the shoulder of the yoke, using a mallet or a copper hammer.



401RS006

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3. Make sure of proper position for reinstallation by applying setting marks, then remove spider with grease fitting.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

NOTE: When any part of the journal assembly (spider, needle roller bearing, grease fitting) requires replacement, be sure to replace the entire assembly.

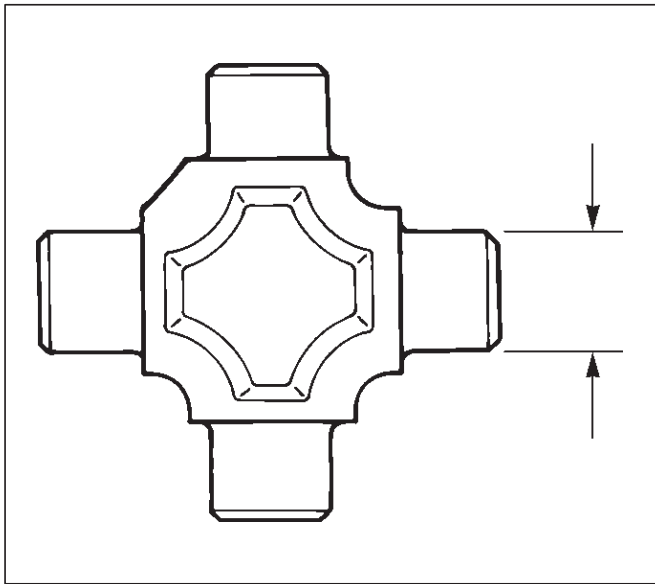
Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange

Outside Diameter of Spider Pin

Standard: 17.00 mm (0.669 in)

Limit: 16.90 mm (0.665 in)

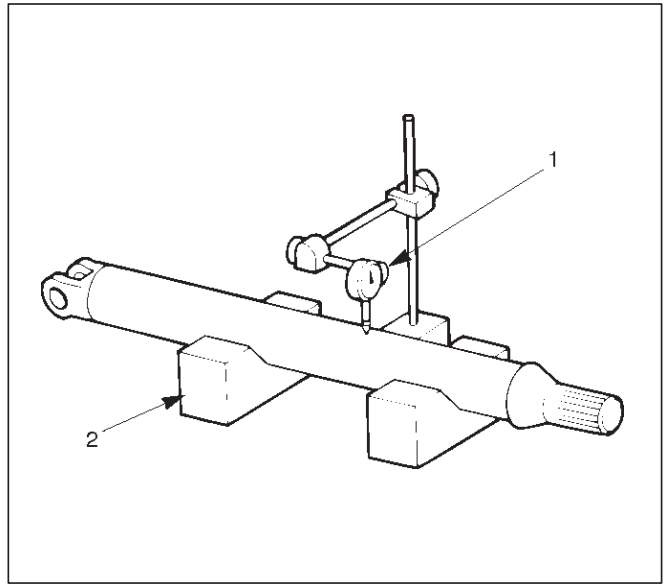


Propeller Shaft Run-out

Support the ends of the propeller shaft on V-blocks (2) and check for run-out by holding the probe of a dial indicator (1) in contact with the center part of the shaft. If the amount of run-out is beyond the standard value for assembly, correct with a bench press or replace the shaft with a new propeller shaft assembly.

Standard: 0.3 mm (0.012 in)

Limit: 0.5 mm (0.02 in)

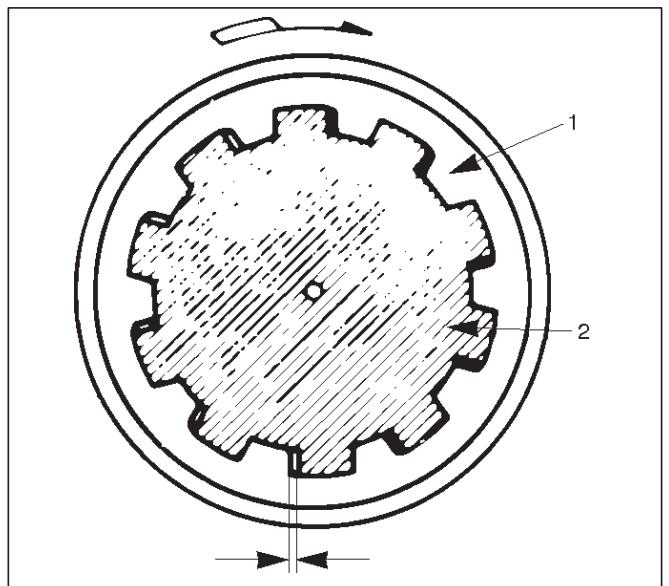


Play in Splines in Normal Direction of Rotation

Check the amount of play between the sleeve yoke (1) and the propeller shaft spline (2) in the direction of rotation, using a pointed feeler gauge.

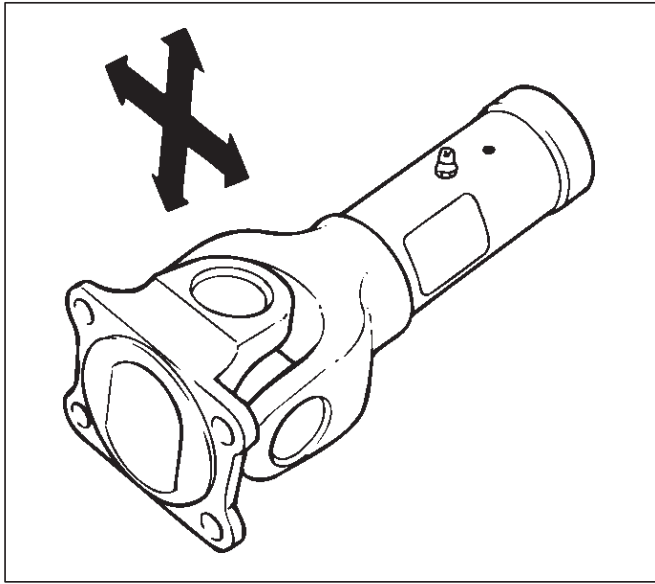
Standard: 0.073 – 0.156 mm (0.003 – 0.006 in)

Limit: 0.3 mm (0.012 in)

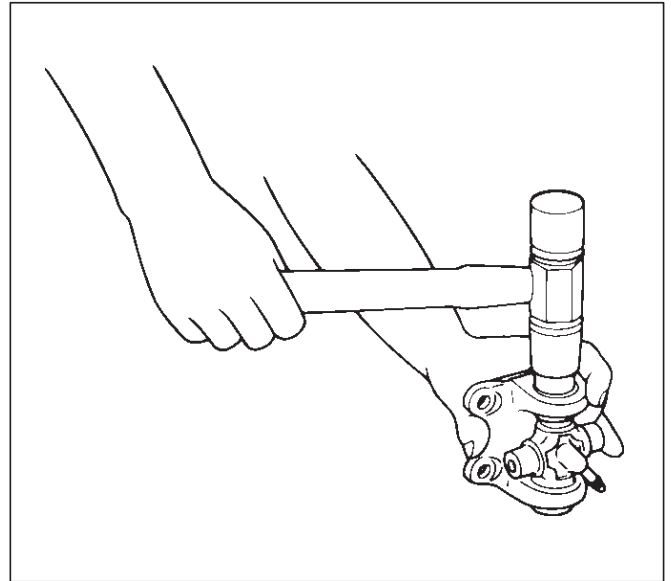


Play in Universal Joint

Limit: Less than 0.1 mm (0.004 in)



401RS010



401RS012

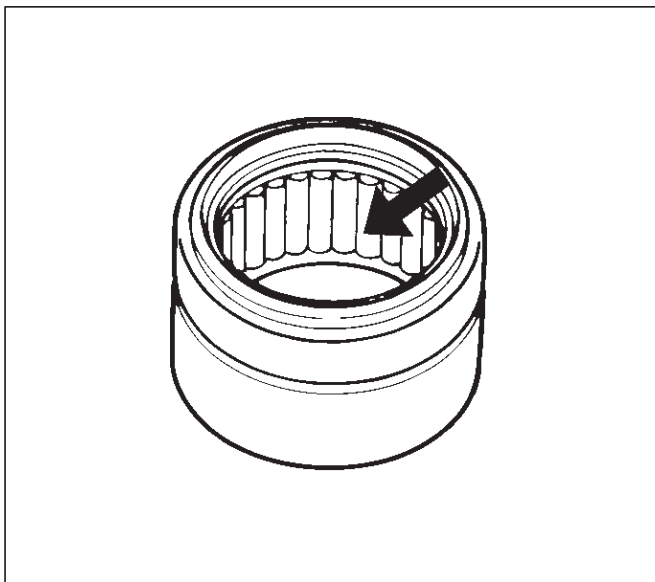
4. Align setting marks (1) and join the yokes.

NOTE: Assemble the spider and spline yoke so that their grease fittings are arranged on the same side.

Universal Joint Reassembly

1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Before installing needle roller bearing, apply a molybdenum–disulfide grease or a multi–purpose type grease NLGI No. 2 to inside of the bearing cap.

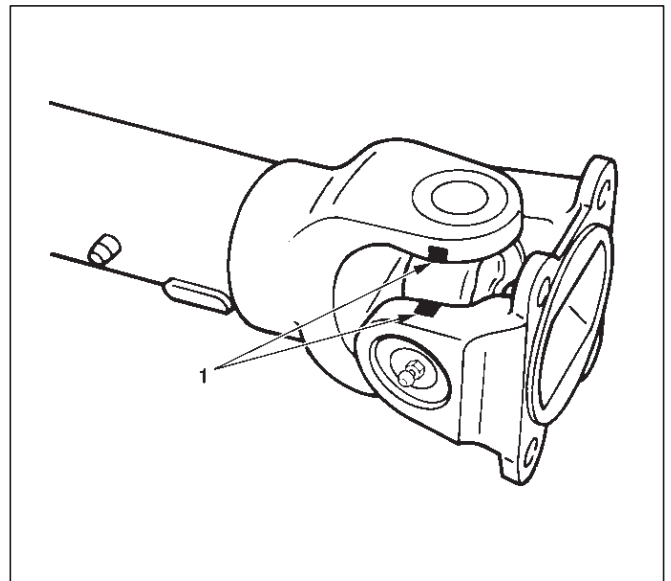
Grease Amount: Approx. 1.2 g (0.042 oz)



401RS011

3. Using either a mallet (or copper hammer) or a press, install the needle roller bearing into the yoke so that the snap ring can be installed in its groove.

CAUTION: The needle roller bearing cannot be installed smoothly if it is set at an incorrect angle with the flange and excessive hammering will damage the needle roller bearing.



401RS028

5. Install snap ring.

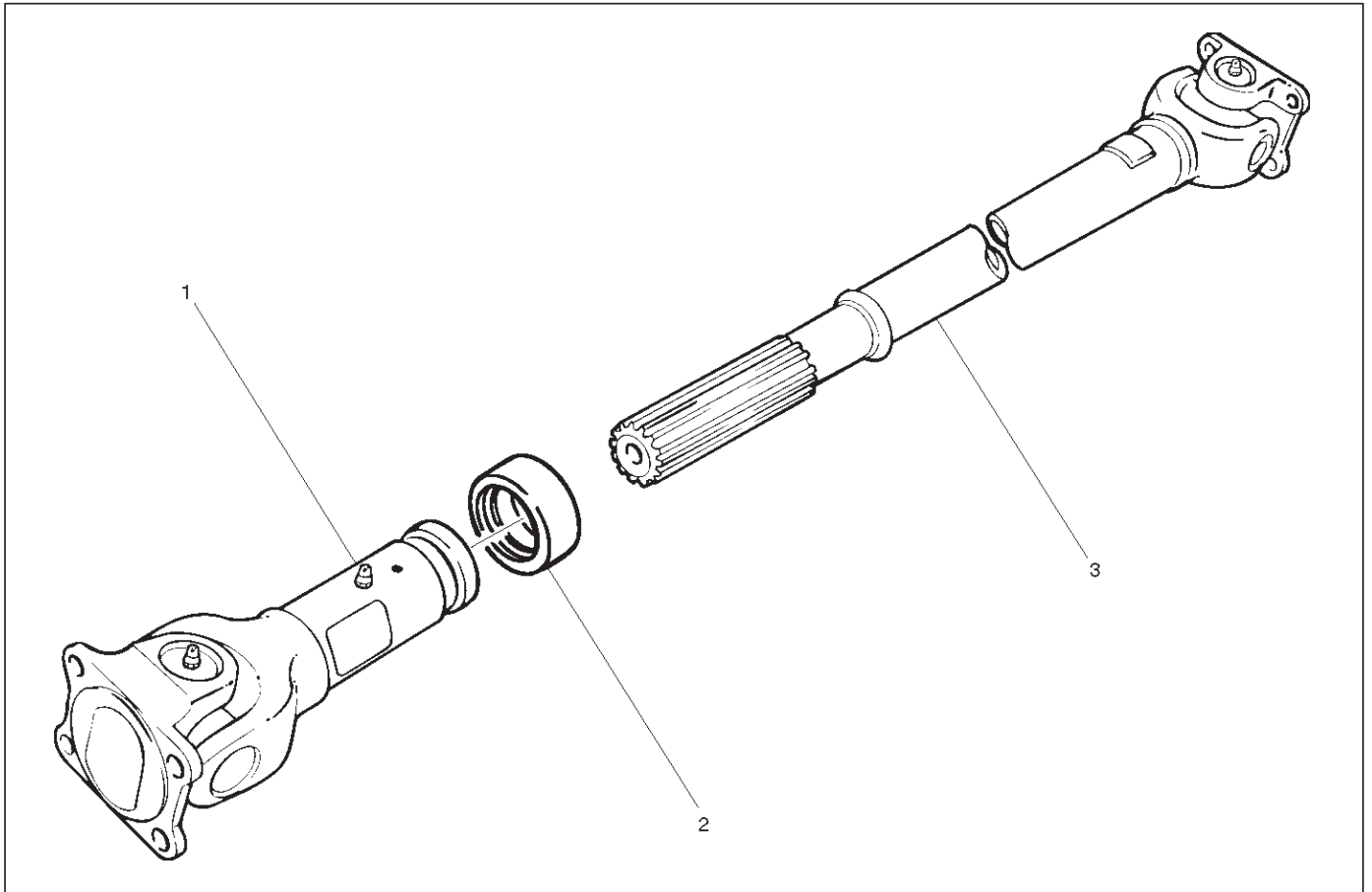
NOTE: Discard used snap rings and install new ones. When the bearing cap is in position, select and attach a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm (0.004 in).

Snap ring thickness and identification color

- 1.5 mm (0.059 in): Blue
- 1.545 mm (0.061 in): White
- 1.59 mm (0.063 in): Yellow
- 1.635 mm (0.064 in): Green
- 1.68 mm (0.066 in): Not colored

NOTE: Be sure to use snap rings of the same thickness on both sides.

Reassembly



401RW057

Legend

(1) Sleeve Yoke

(2) Seal

(3) Tube Assembly

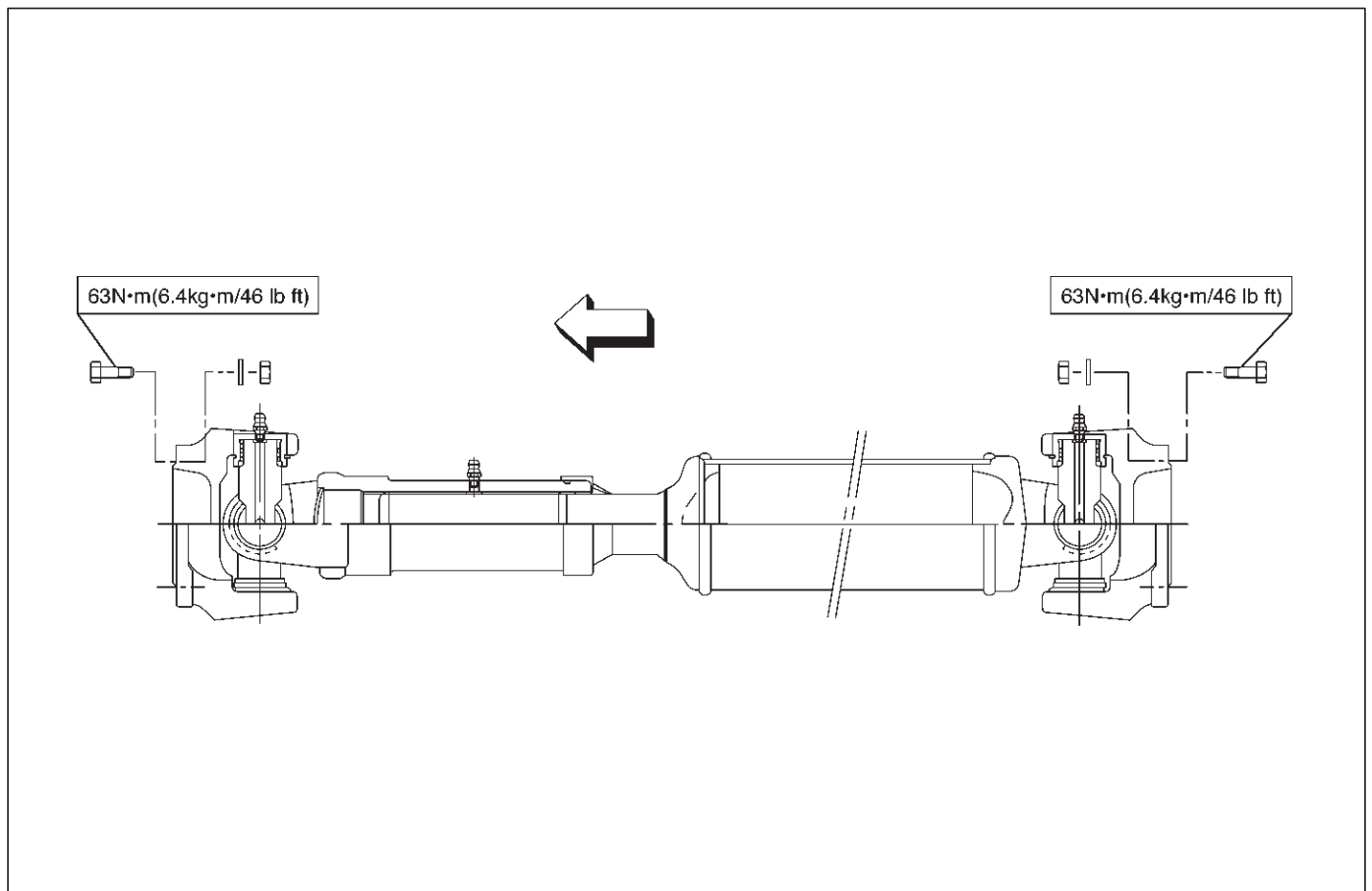
1. Discard used seal and install new one.
2. Align the alignment marks and install tube assembly to sleeve yoke.

Main Data and Specifications

General Specifications

Engine		6VE1 (3.5L)			6VD1 (3.2L)			4JX1 (3.0L)		4JG2 (3.1L)	
Transmission		M/T	A/T	A/T with TOD	M/T	A/T	A/T with TOD	M/T	A/T	M/T	A/T
Construction		Hollow steel tube with yoke and spider type universal joint									
Length	S W B	668mm (26.30in)	—	846mm (33.31in)	678mm (26.69in)	—	604mm (23.78in)	810mm (31.89in)	—		
	L W B	1093mm (43.03in)	1075mm (42.32in)	1271mm (50.04in)	1103mm (43.43in)	1083mm (42.64in)	1029mm (40.51in)	1236mm (48.66in)	1037mm (40.83in)		
Outside diameter	S W B	68.9mm (2.71in)	—	68.9mm (2.71in)		—	68.9mm (2.71in)		—		
	L W B	68.9mm (2.71in)		82.6mm (3.25in)	68.9mm (2.71in)			82.6mm (3.25in)	68.9mm (2.71in)		

Torque Specifications



DRIVELINE/AXLE

TRANSFER CASE (STANDARD TYPE)

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Removal	4D1-8	Disassembly	4D1-23
Installation	4D1-8	Inspection and Repair	4D1-24
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		Special Tools	4D1-46

Service Precaution

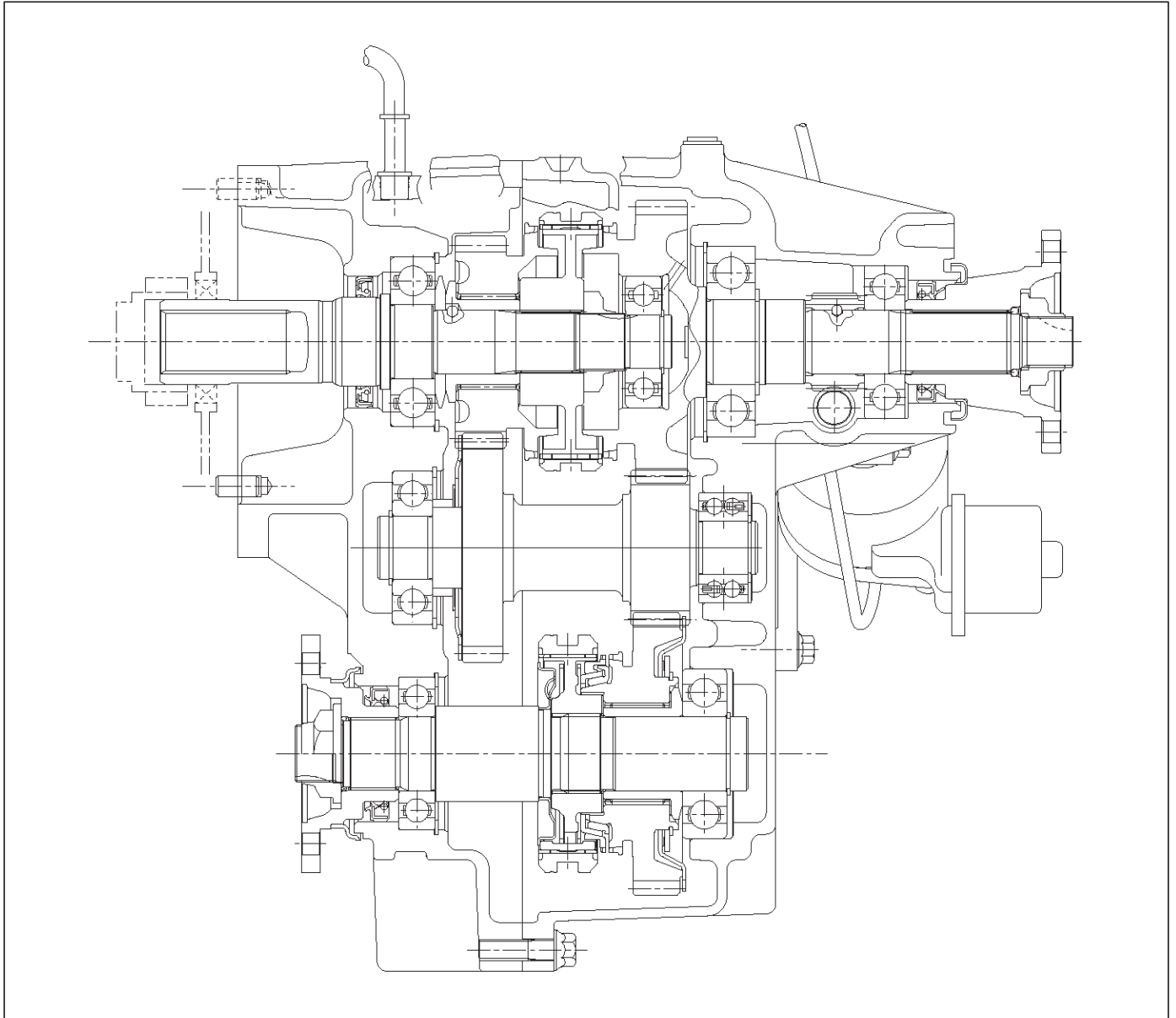
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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

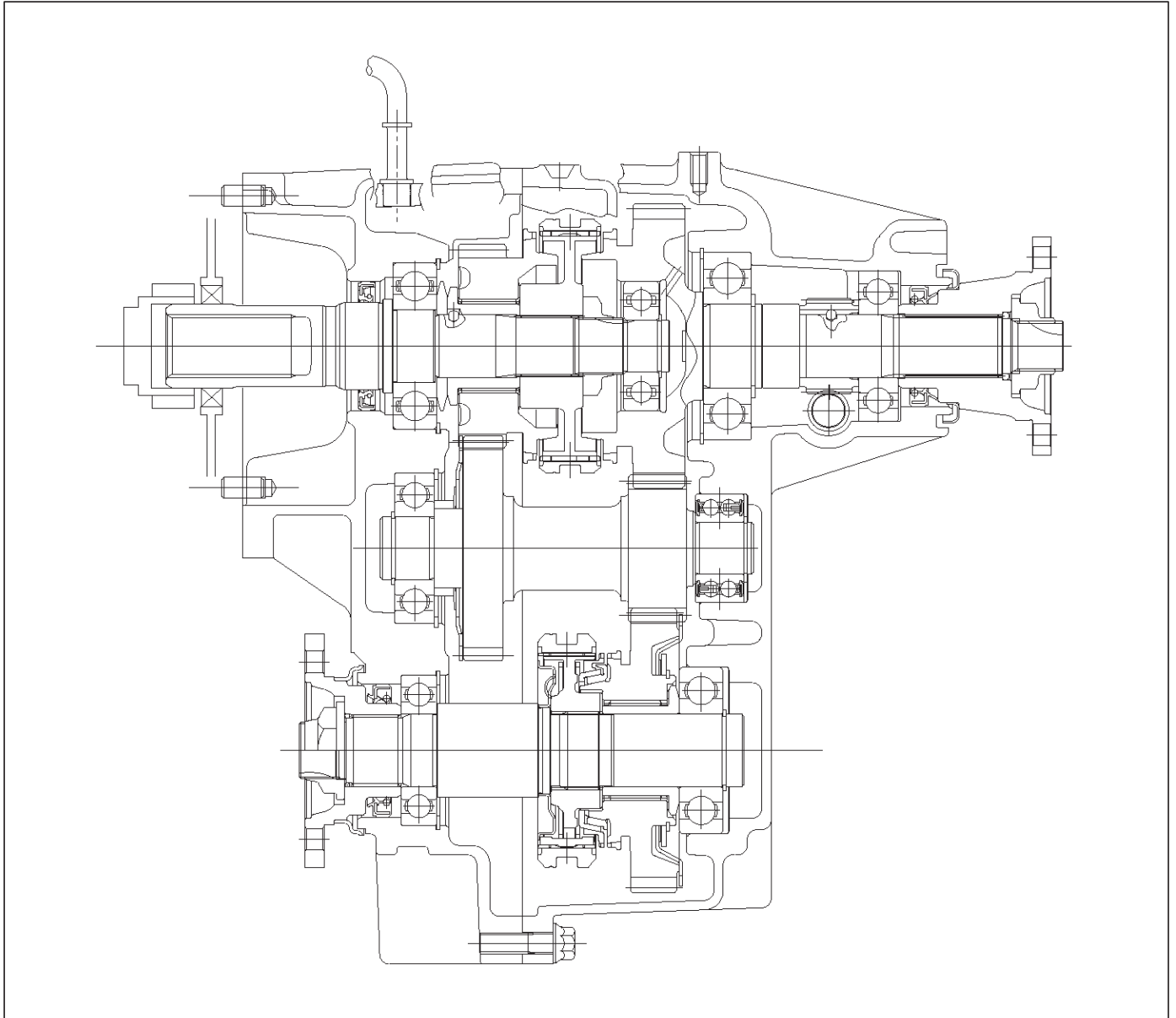
4D1-2 TRANSFER CASE (STANDARD TYPE)

General Description

M/T, W/Shift On The Fly, W/4WD Switch, model

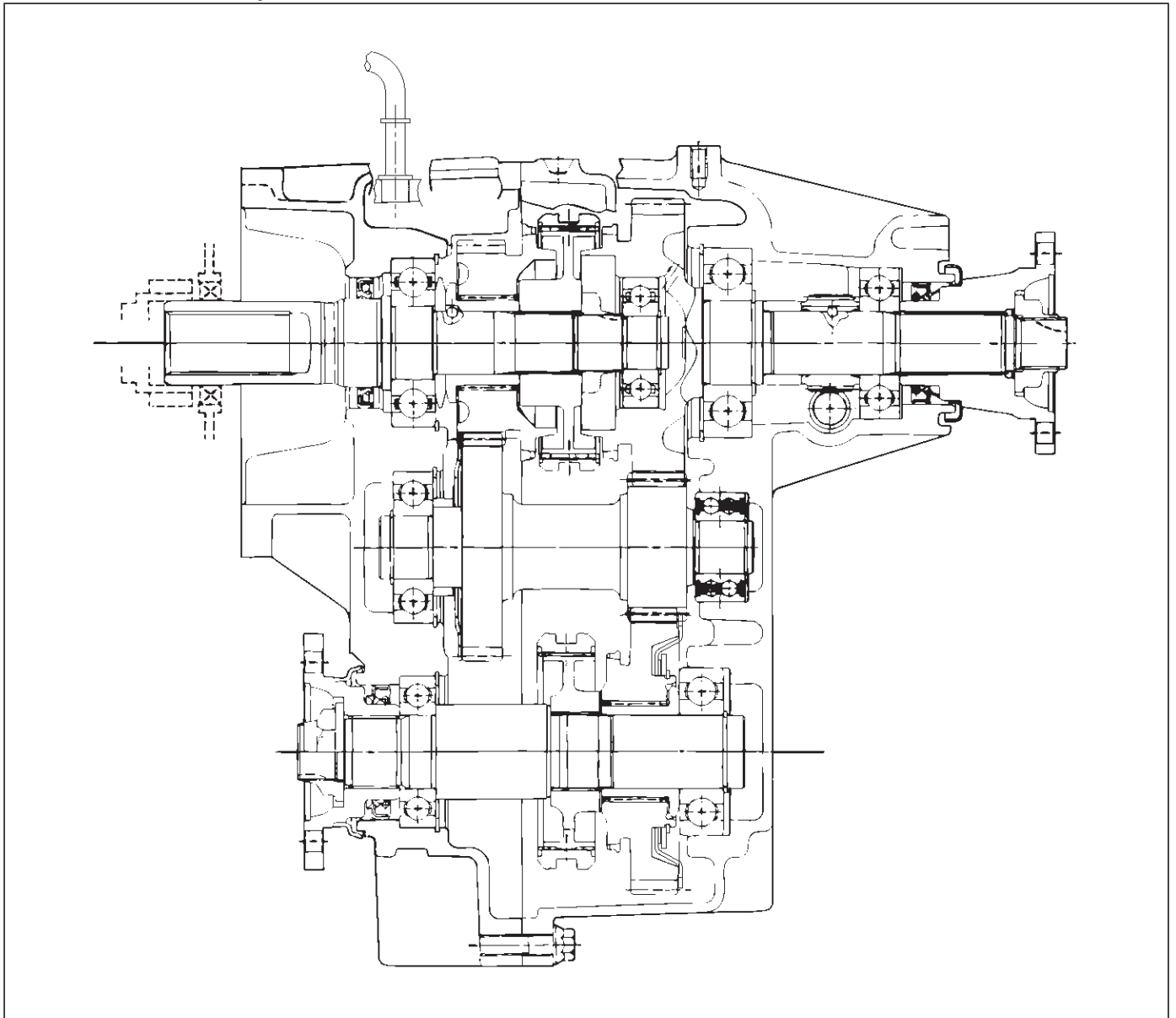


M/T, W/Shift On The Fly, WO/4WD Switch, model

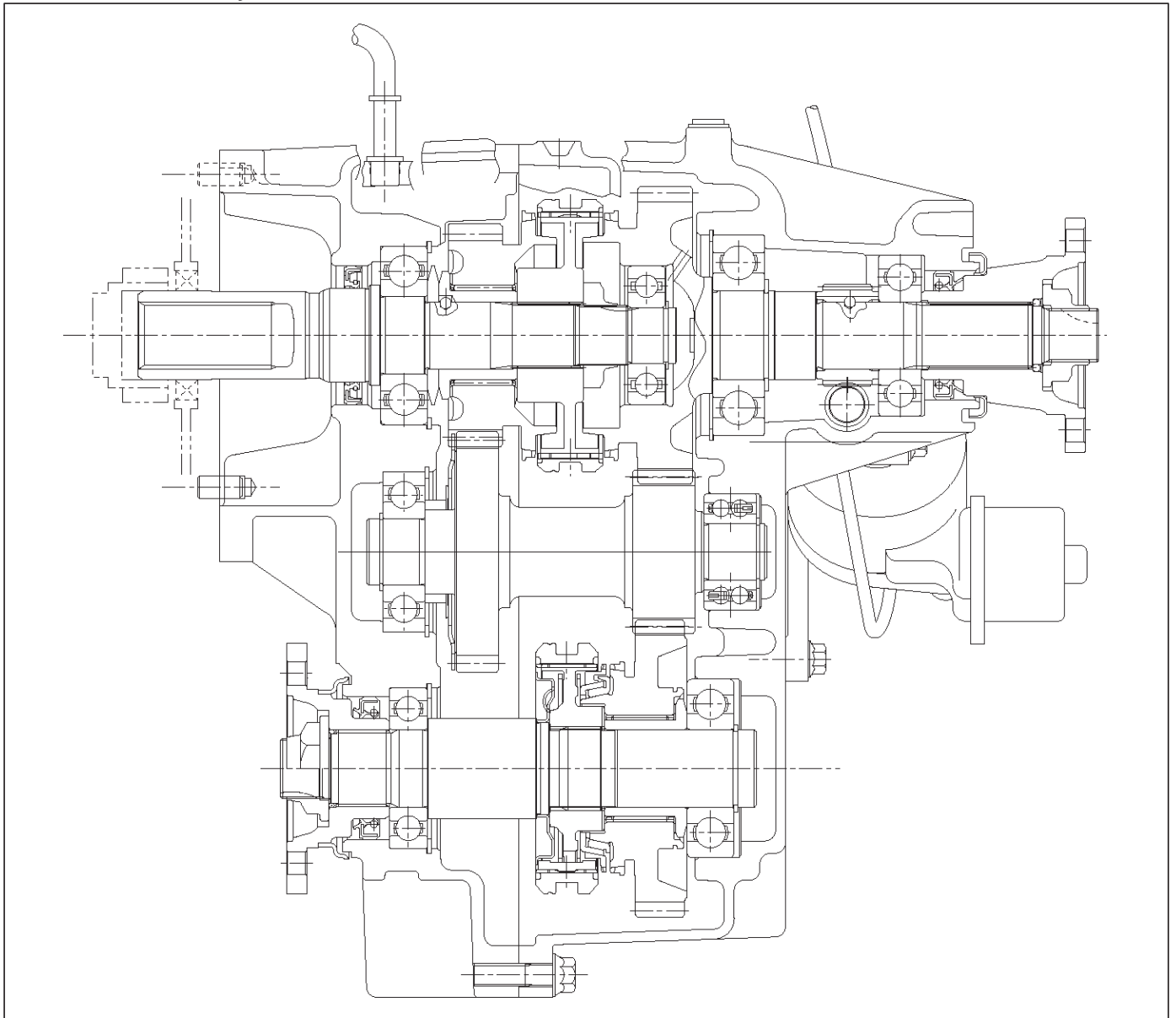


4D1-4 TRANSFER CASE (STANDARD TYPE)

M/T, WO/Shift On The Fly, WO/4WD Switch, model

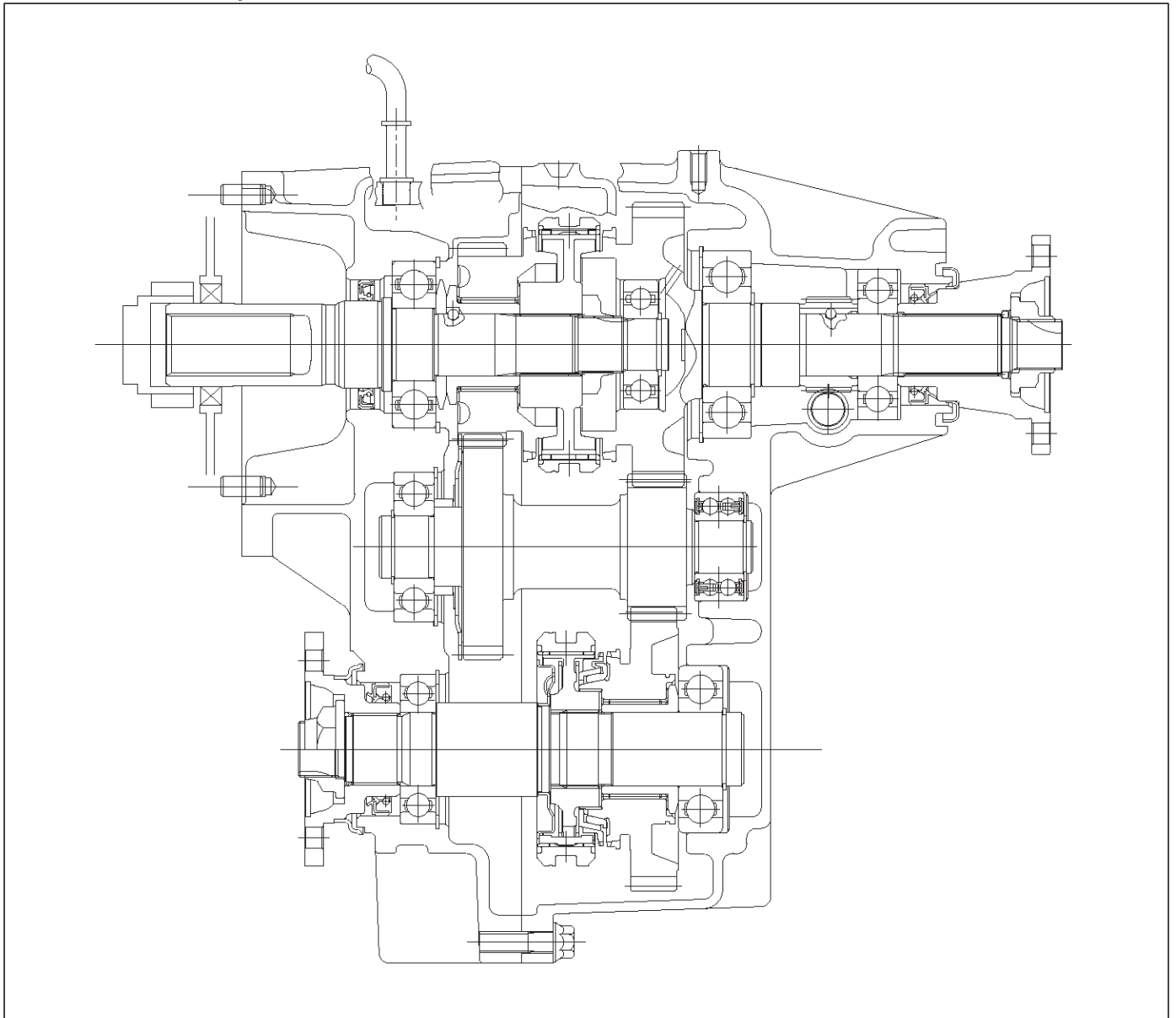


A/T, W/Shift On The Fly, W/4WD Switch, model

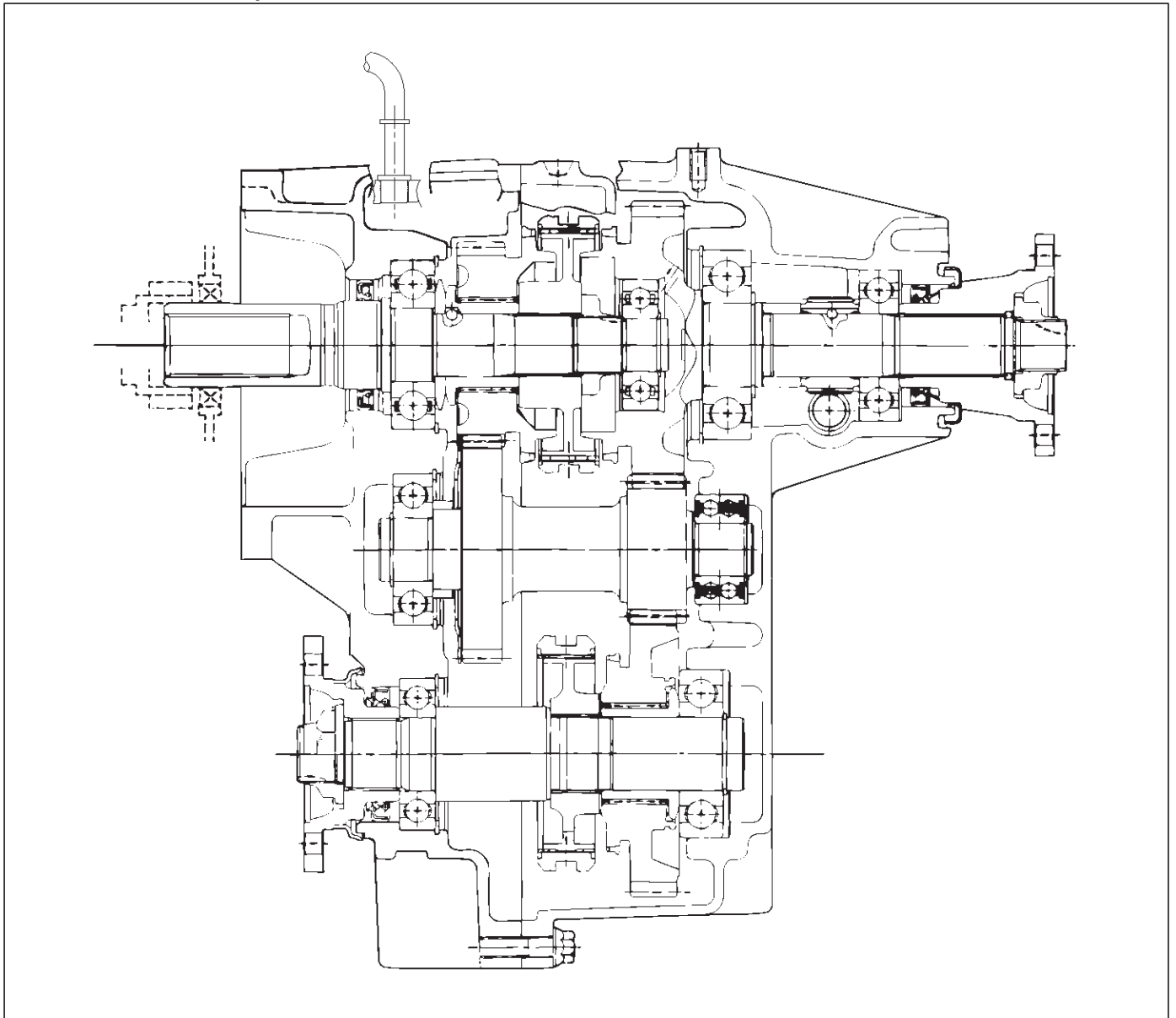


4D1-6 TRANSFER CASE (STANDARD TYPE)

A/T, W/Shift On The Fly, WO/4WD Switch, model



A/T, WO/Shift On The Fly, WO/4WD Switch, model



A07RW055

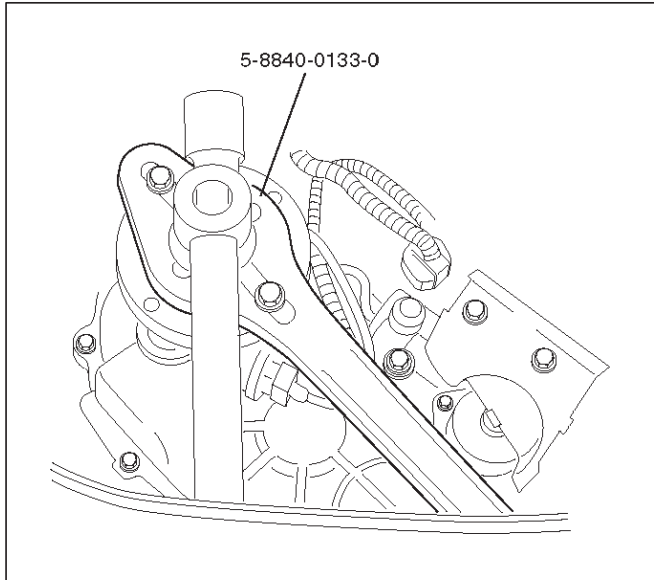
The transfer case is used to provide a means of providing power flow to the front axle. The transfer case also provides a means of disconnecting the front axle, providing better fuel economy and quieter operation when the vehicle is driven on improved roads where four wheel drive is not required. In addition, the transfer case provides an additional gear reduction when placed in low range, which is useful when difficult off-road conditions are encountered.

A floor mounted shift lever is used to select the high-low range. When four wheel drive switch has been turned on, the four wheel drive indicator light is designed to come on when the front axle has been engaged.

Transfer Rear Oil Seal

Removal

1. Disconnect the rear propeller shaft from the transfer case side.
2. Remove end nut and rear companion flange, using the companion flange holder 5-8840-0133-0 (J-8614-11).

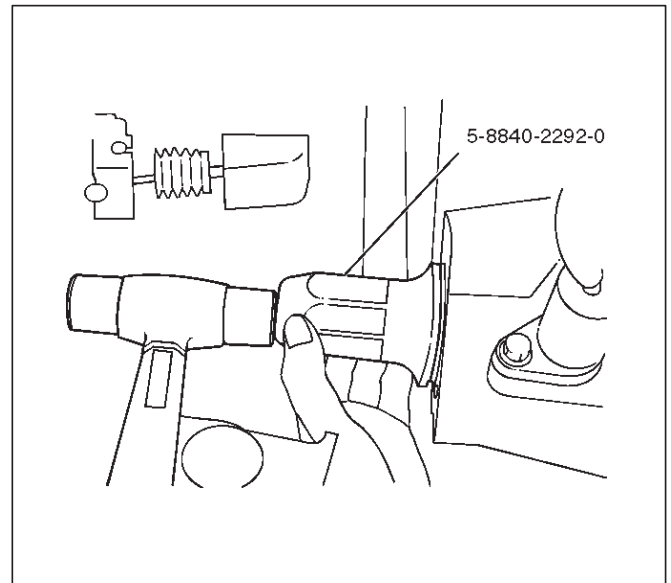


3. Use the universal puller to remove the rear companion flange and O-ring.
4. Remove the oil seal from the transfer case.

Installation

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

1. Install oil seal and apply engine oil to the oil seal outer surfaces.
2. Apply the recommended grease (BESCO L2) or equivalent to the oil seal lip.
3. Use the oil seal installer 5-8840-2292-0 (J-39208) to install the rear seal to the transfer rear case.

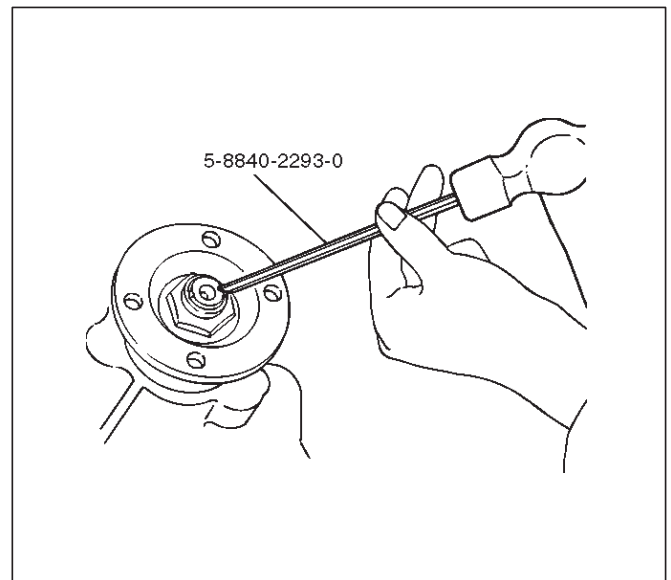


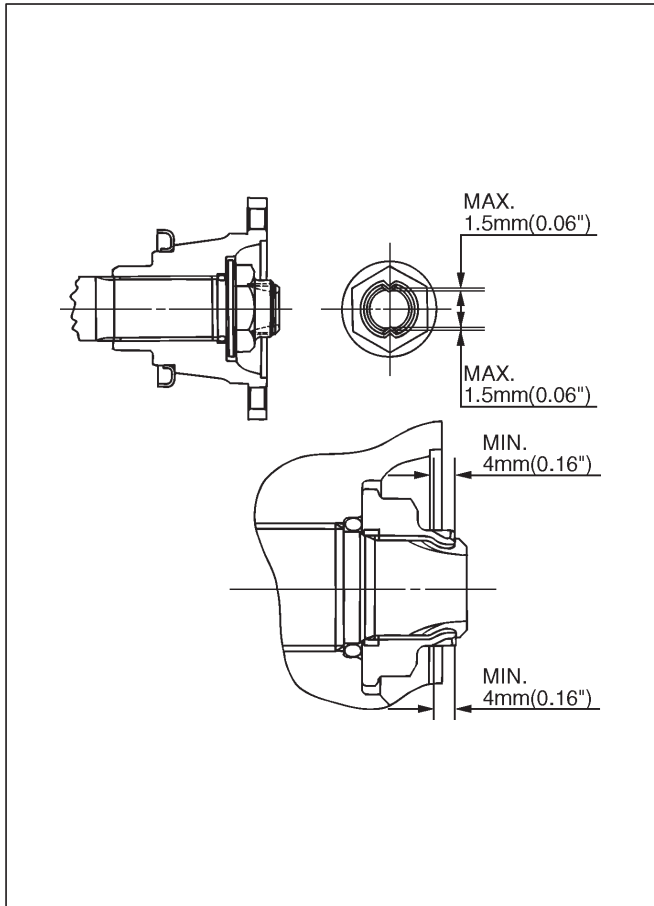
4. Install the rear companion flange and O-ring.
5. Use the companion flange holder 5-8840-0133-0 (J-8614-11) to install a new end nut and tighten to the specified torque.

Torque: 167 N·m (17.0kg·m/123 lb ft)

6. Use the punch 5-8840-2293-0 (J-39209) to stake the end nut at two spots.

NOTE: Be sure to confirm that there is no crack at the staked portion of the end nut after staking.





266RW002

7. Connect the rear propeller shaft to the transfer case and tighten to the specified torque.

Torque: 63 N·m (6.4kg·m/46 lb ft)

Transfer Case Assembly

Removal

NOTE: Before removing the transmission & transfer assembly from the vehicle, change the transfer mode to 2WD by pushing button switch on dash panel. (4WD Switch Model)

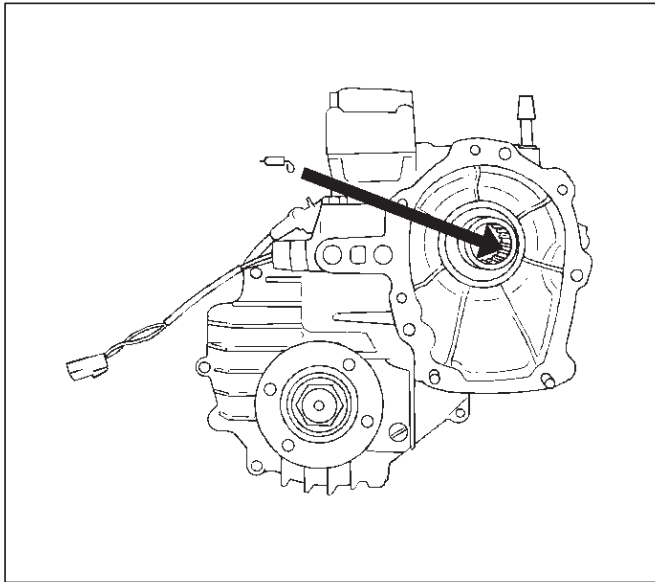
1. Disconnect the battery ground cable.
2. Drain the transfer case fluid, if overhauling the transfer case assembly.
3. Remove the exhaust and transfer protectors.
4. Remove the rear and front propeller shafts from the transfer case side.
5. Remove the transfer control lever knob.
6. Disconnect the harness connectors and remove the front console.
7. Remove the selector lever assembly. Refer to Selector Lever in the Section 7A.
8. Remove the transfer control lever.
9. Disconnect the 4WD switch connector, speed sensor harness connector and 2WD-4WD actuator harness connector (4WD Switch Model) from the transmission harness.
10. Support the transfer case with a transmission jack.
11. Remove the transmission-transfer bolts and the nut (M/T).
12. Remove the transfer case assembly from the vehicle.

4D1-10 TRANSFER CASE (STANDARD TYPE)

Installation

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

1. Apply a thin coat of molybdenum disulfide grease to the input shaft spline and install the transfer case assembly to the vehicle.



260RW001

2. Tighten the transmission-transfer bolts and the nut (M/T) to the specified torque.

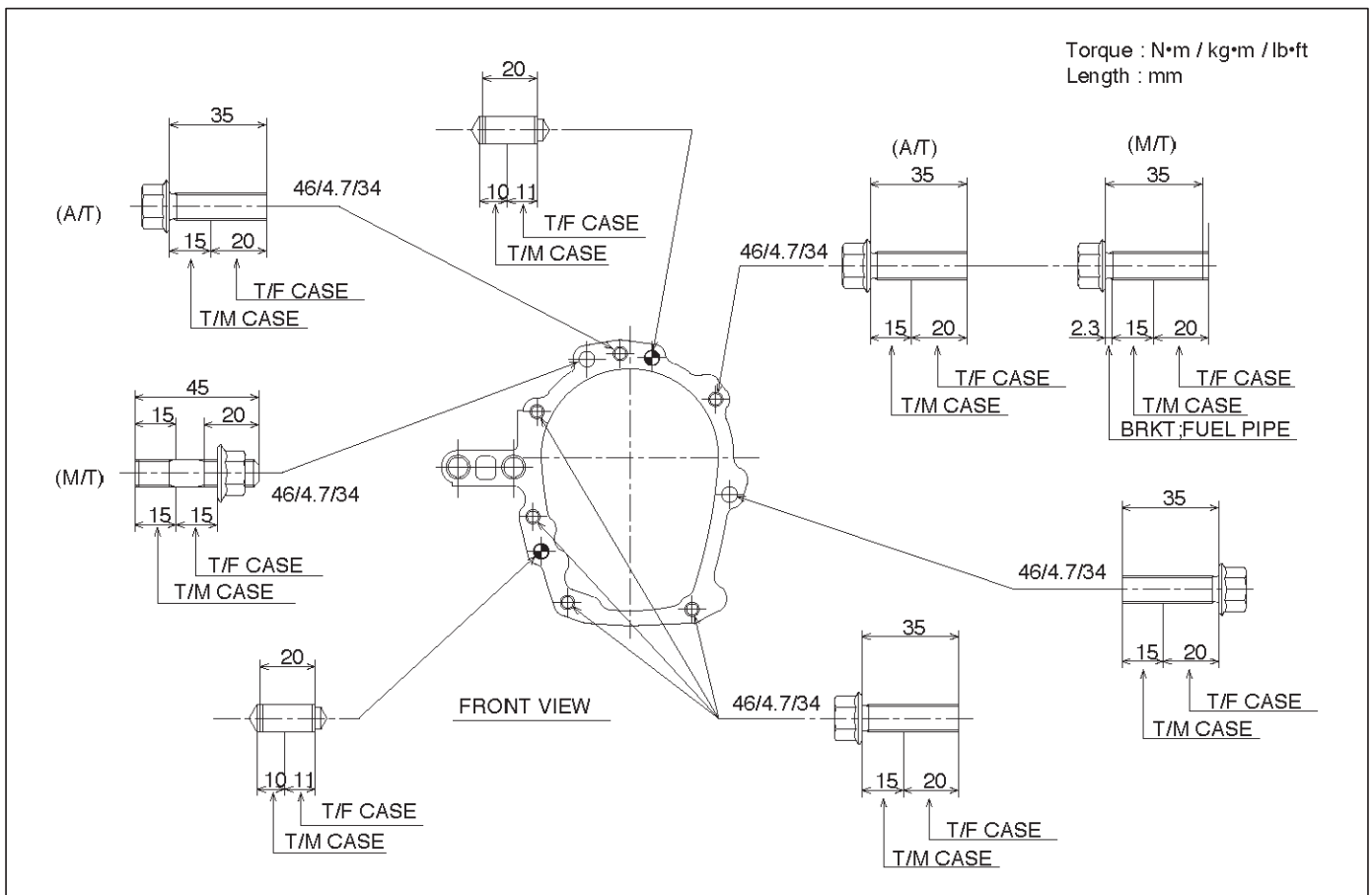
Torque: 46 N·m (4.7kg·m/34 lb ft)

3. Tighten the propeller shaft bolts to the specified torque.

Torque: 63 N·m (6.4kg·m/46 lb ft)

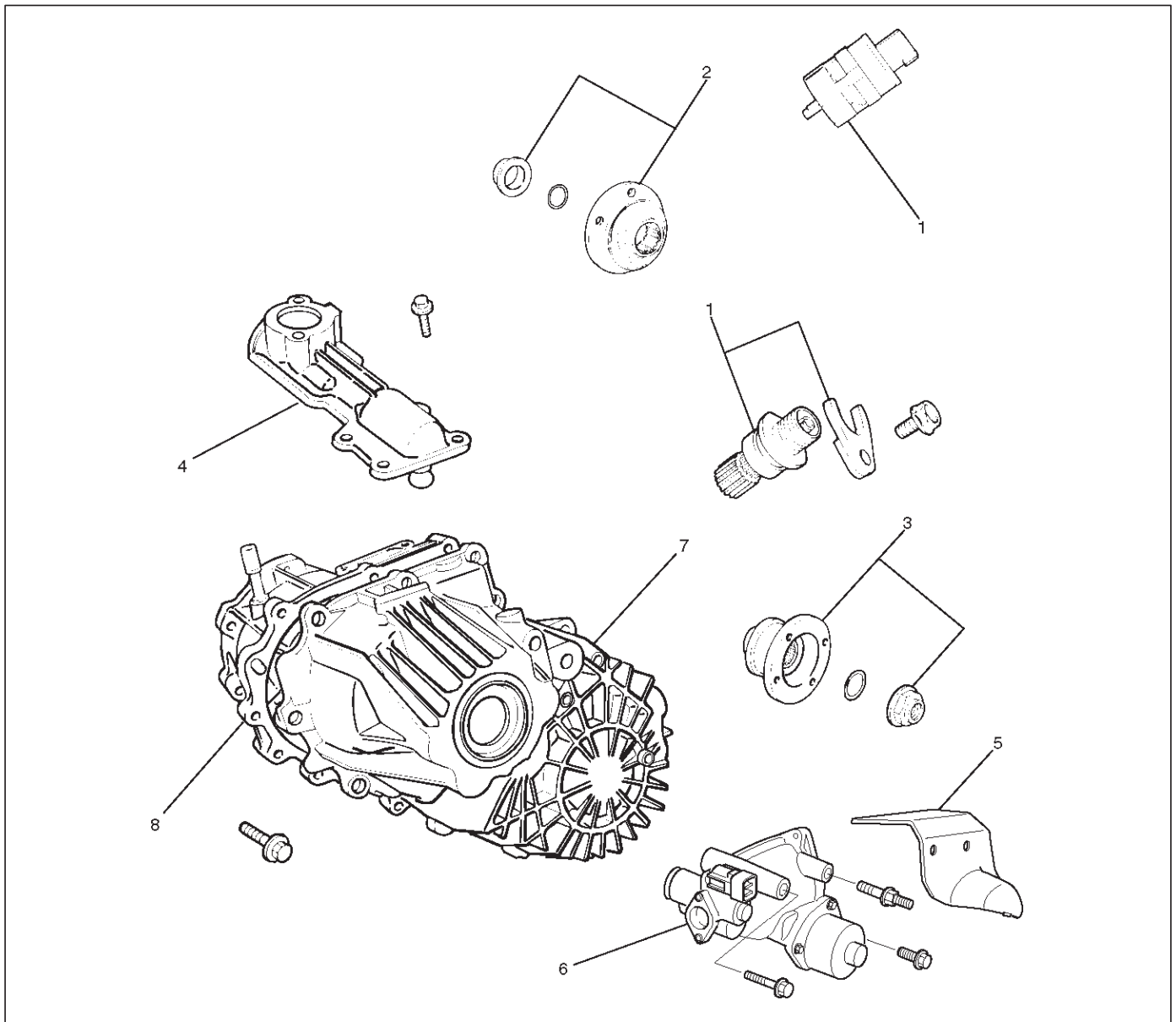
4. Tighten the transfer protector bolts to the specified torque.

Torque: 37 N·m (3.8kg·m/27 lb ft)



Transfer Rear Cover Assembly (4WD Switch Model)

Transfer Rear Cover Assembly and Associated Parts



220RW102

Legend

- | | |
|---|-------------------------------------|
| (1) Speedometer Sensor, Speedometer Driven Gear and Plate | (4) Control Box Assembly |
| (2) Front Companion Flange | (5) 2WD-4WD Actuator Heat Protector |
| (3) Rear Companion Flange | (6) 2WD-4WD Actuator Assembly |
| | (7) Transfer Rear Cover Assembly |
| | (8) Transfer Case Assembly |

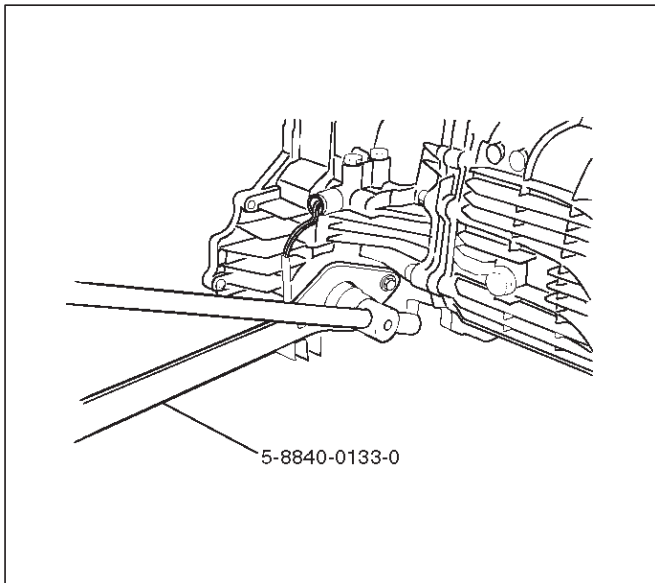
4D1-12 TRANSFER CASE (STANDARD TYPE)

Removal

1. Remove the speedometer sensor.
2. Remove the plate.
3. Remove the speedometer driven gear bushing and driven gear.

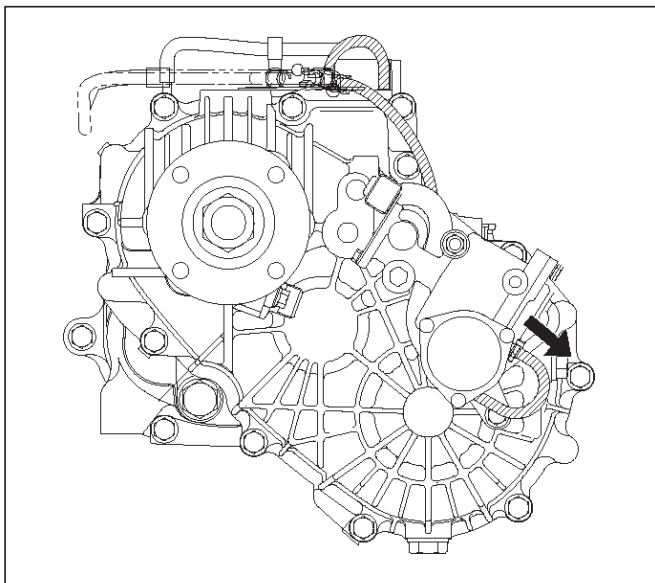
NOTE: Apply a reference mark to the driven gear bushing before removal.

4. Remove the front companion flange and the rear companion flange, using the flange companion holder 5-8840-0133-0 (J-8614-11) to remove the end nuts.

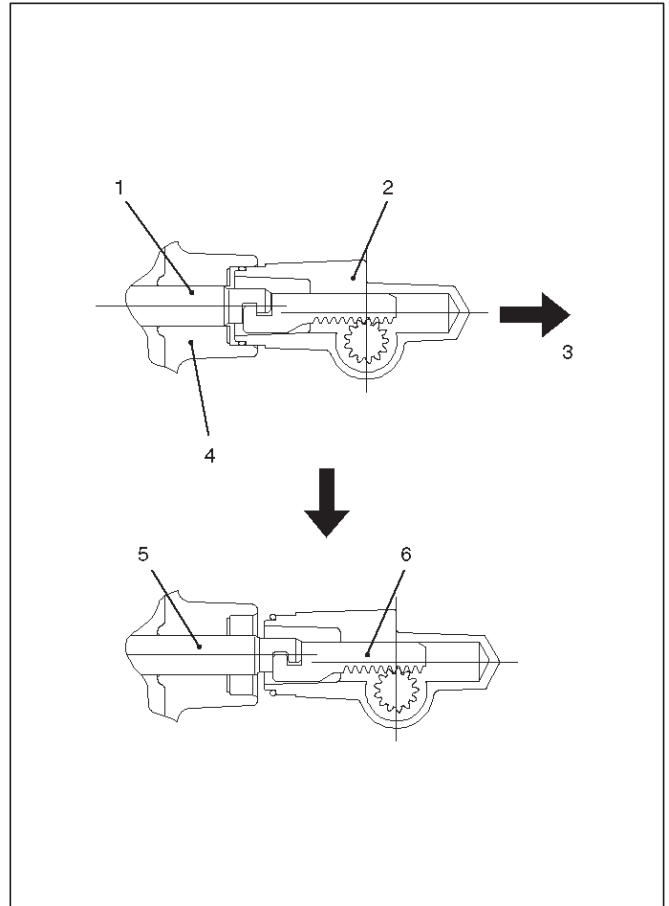


NOTE: Use a universal puller to remove the rear companion flange.

5. Disconnect the actuator breather hose and the transfer breather hose from the control box.
6. Remove the control box assembly.
7. Disconnect the actuator breather hose and remove the 2WD-4WD actuator heat protector from the 2WD-4WD actuator assembly.



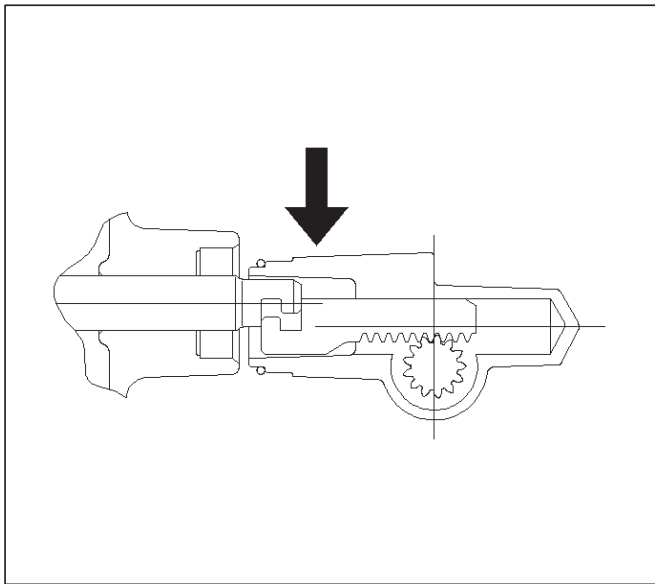
8. Remove the 2WD-4WD actuator assembly bolts.
9. Pull the 2WD-4WD actuator assembly with 2WD-4WD shift rod.



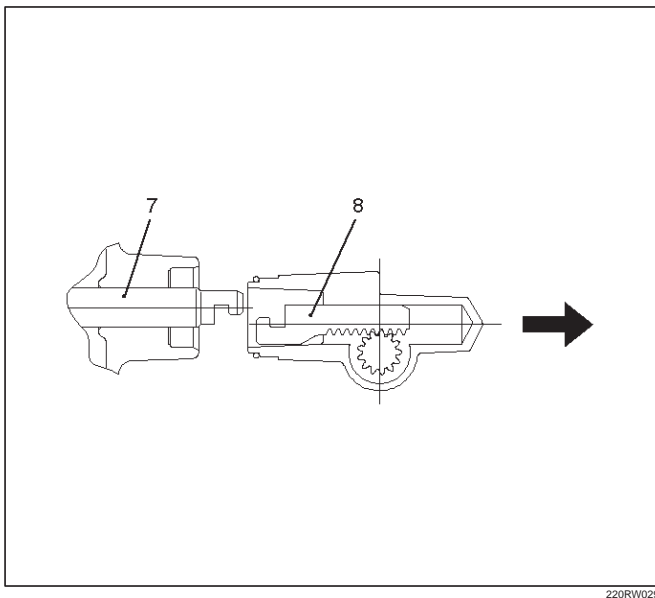
Legend

- (1) Shift Rod: 2WD-4WD (Position: 2WD)
- (2) 2WD-4WD Actuator Assembly
- (3) Pull Cover
- (4) Rear Cover Assembly
- (5) Position: 4WD
- (6) Mode: 2WD

10. Offset the actuator assembly.



11. Remove the actuator assembly.



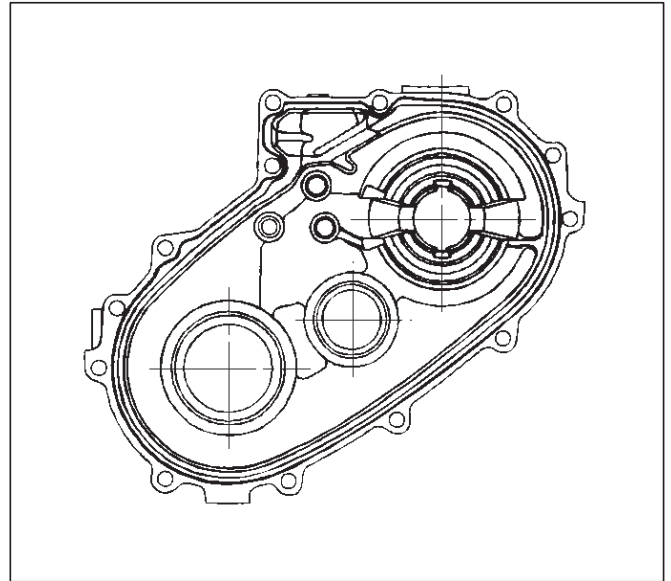
Legend

- (7) Position: 4WD
- (8) Mode: 2WD

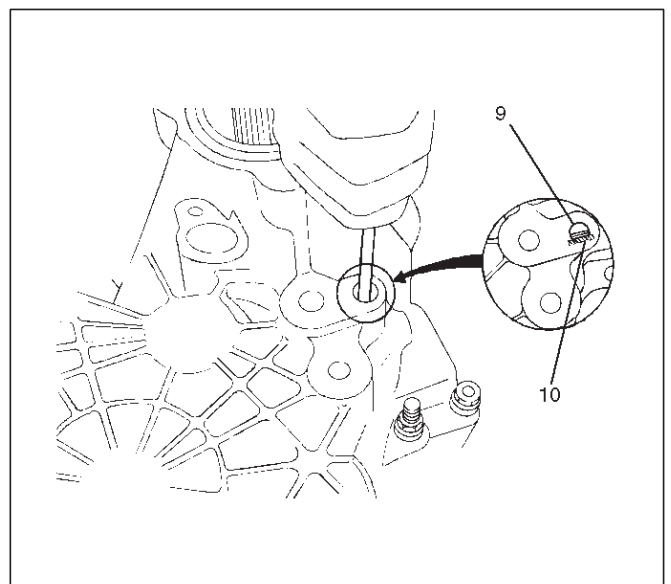
12. Remove the transfer rear cover assembly from the transfer case assembly.

Installation

1. Apply the recommended liquid gasket (LOCTITE 17430) or its equivalent to the transfer rear cover fitting faces.



2. Install the transfer rear cover assembly to the transfer case assembly.
3. Perform the following steps before fitting the transfer rear case:
 1. Shift the high-low shift rod to the 4H side.
 2. The cut-away portion of the select rod head (9) should align with that of the rear case hole's stopper (10).

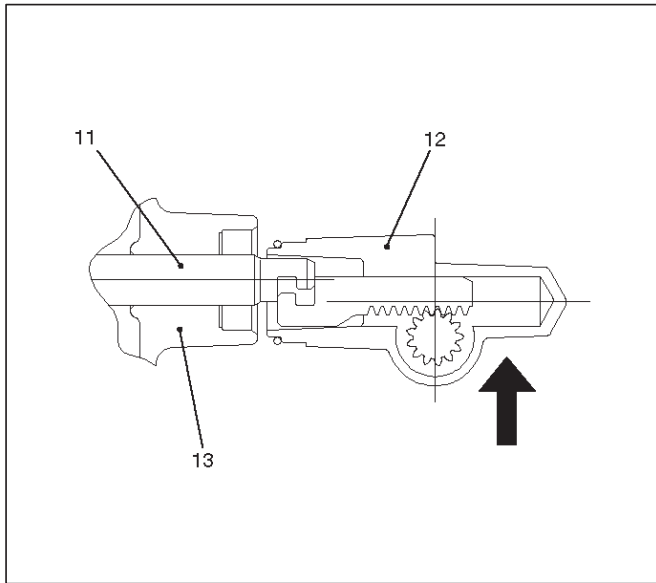


4. Tighten the transfer rear case bolts to the specified torque.

Torque: 37 N-m (3.8kg-m/27 lb ft)
5. Shift the 2WD-4WD shift rod (11) to the 4WD side.

4D1-14 TRANSFER CASE (STANDARD TYPE)

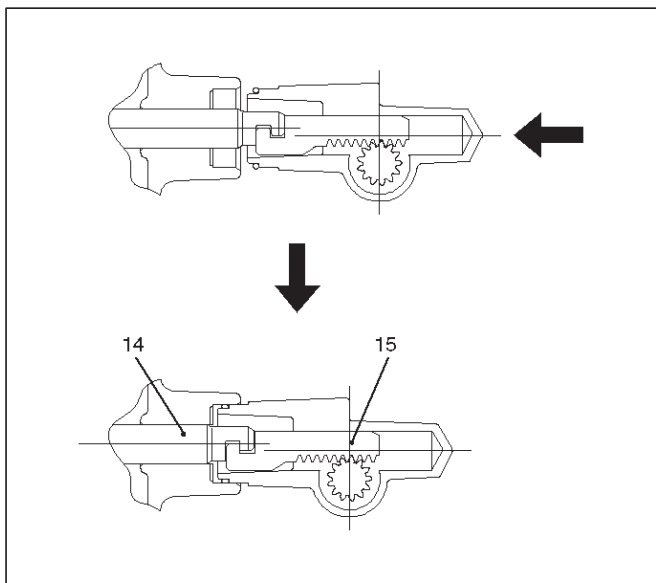
6. Join the rod grooves of 2WD-4WD actuator assembly (12) and shift rod (11).



Legend

- (11) Shift Rod: 2WD-4WD (Position: 4WD)
(12) 2WD-4WD Actuator Assembly (Mode: 2WD)
(13) Rear Cover Assembly

7. Push the 2WD-4WD actuator assembly (12) with 2WD-4WD shift rod (11) till the shift rod (11) reaches the 2WD position.



Legend

- (14) Position: 2WD
(15) Mode: 2WD

8. Tighten the 2WD-4WD actuator bolts to the specified torque.

Torque: 19 N-m (1.9kg-m/14 lb ft)

9. Install the actuator heat protector.

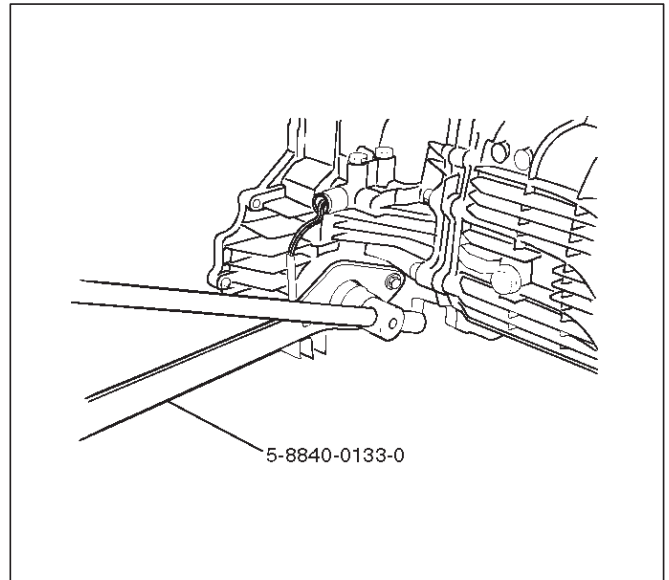
10. Connect the actuator breather hose to the actuator.

11. Install the control box assembly.

Torque: 19 N-m (1.9kg-m/14 lb ft)

12. Connect the breather hoses to the control box.

13. Install the rear companion flange and front companion flange, using the companion flange holder 5-8840-0133-0 (J-8614-11) to tighten the flange nuts to the transfer case.



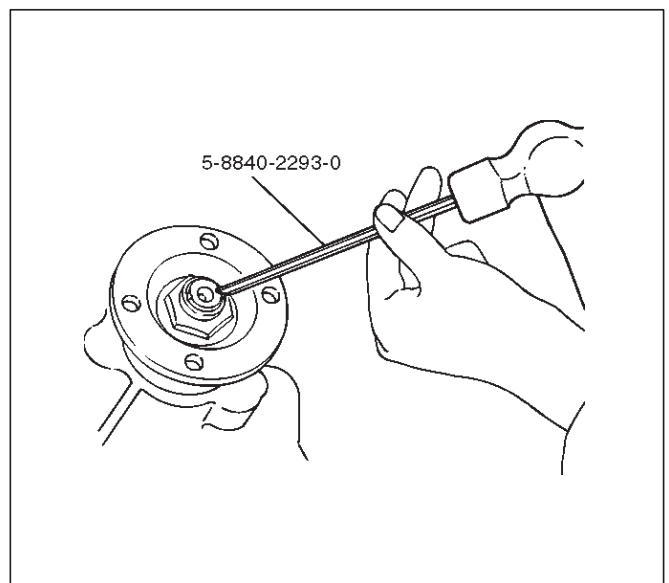
14. Tighten the new transfer flange nuts to the specified torque.

Torque

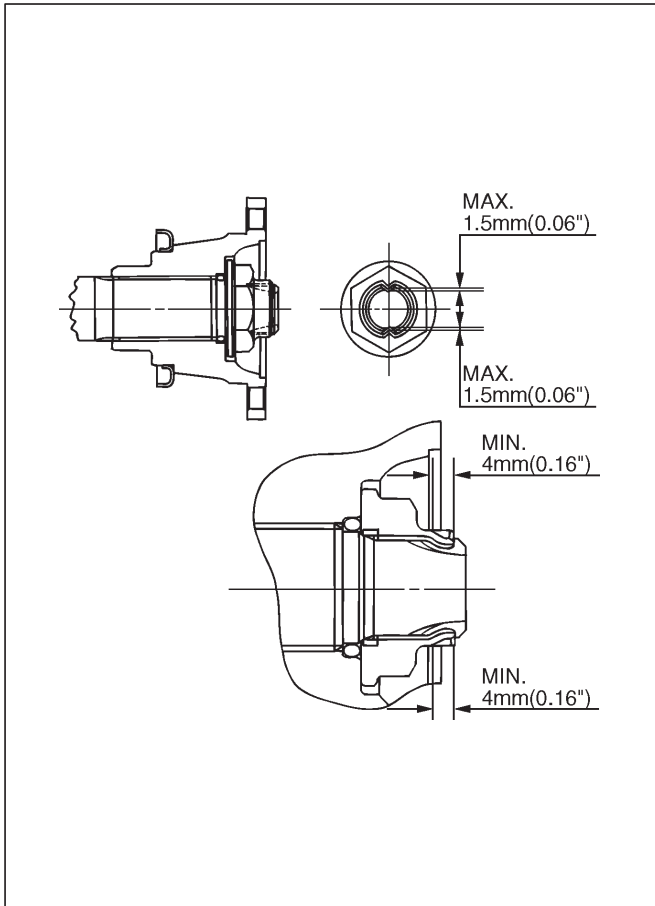
Rear companion flange: 167 N-m (17.0kg-m/123 lb ft)

Front companion flange: 137 N-m (14.0kg-m/101 lb ft)

15. Use the punch 5-8840-2293-0 (J-39209) to stake the rear companion flange nut at two spots.



TRANSFER CASE (STANDARD TYPE) 4D1-15



16. Stake the front companion flange nut at one spot.

NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.

17. Install the O-ring (8) to the speedometer driven gear bushing (7).

18. Install the driven gear to the speedometer driven gear bushing (7).

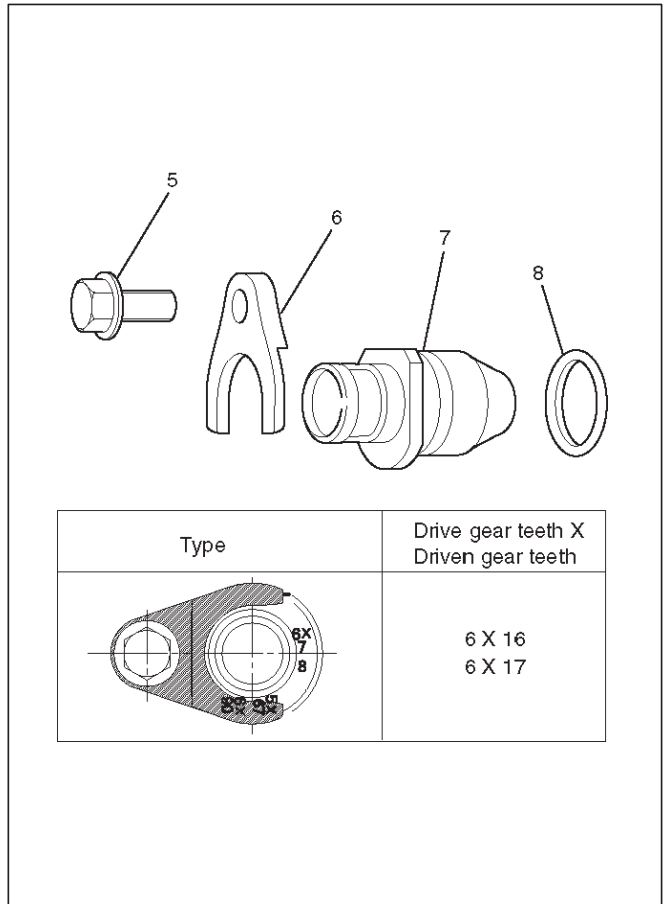
19. Install the speedometer driven gear assembly to the transfer rear cover.

20. Install the plate (6) to the transfer rear case and tighten to the specified torque.

Torque: 15 N·m (1.5kg·m/11 lb ft)

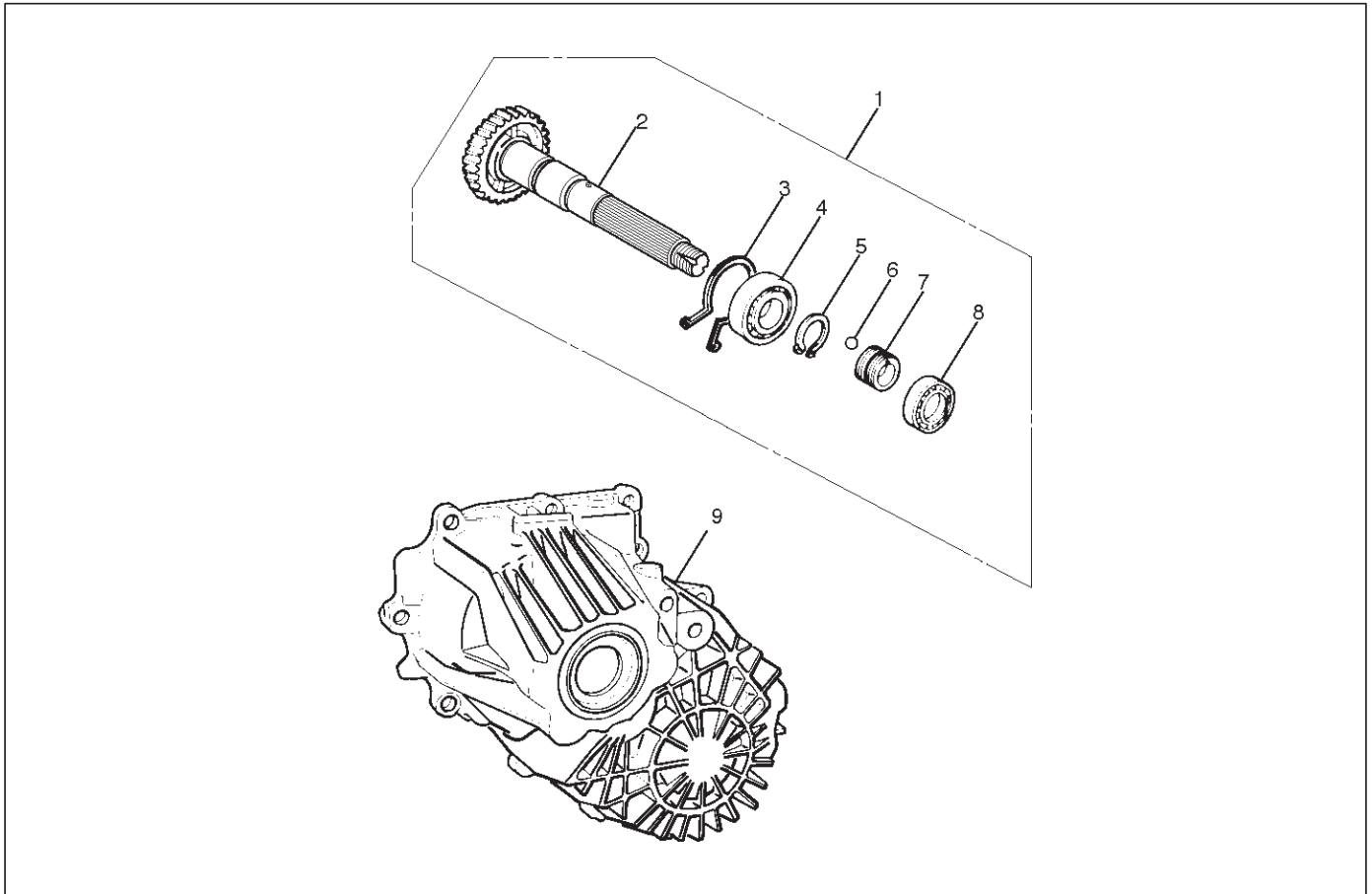
21. Install the speedometer sensor and tighten to the specified torque.

Torque: 27 N·m (2.8kg·m/20 lb ft)



4D1-16 TRANSFER CASE (STANDARD TYPE)

Disassembly

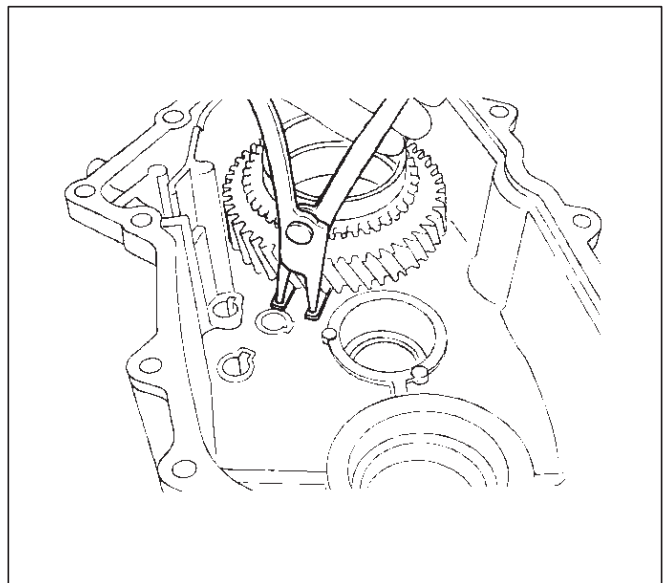


226RW154

Legend

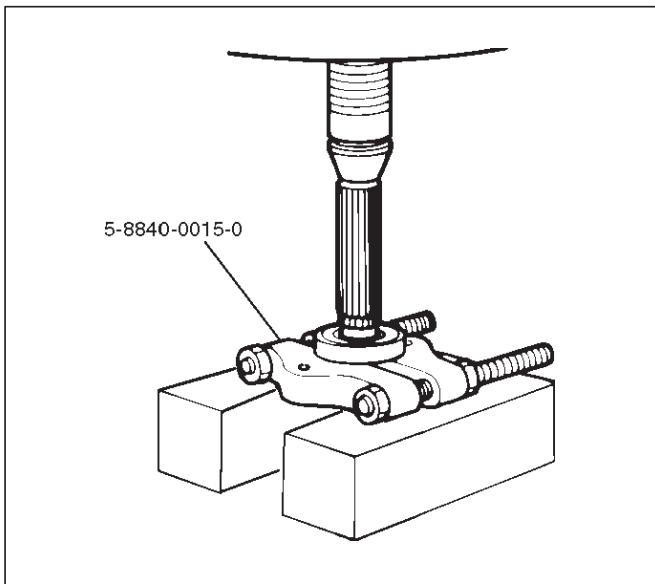
- | | |
|--------------------------------|---|
| (1) Rear Output Shaft Assembly | (5) Bearing Snap Ring |
| (2) Rear Output Shaft | (6) Ball |
| (3) Bearing Snap Ring | (7) Speedometer Drive Gear |
| (4) Ball Bearing | (8) Ball Bearing |
| | (9) Transfer Rear Cover (with oil seal) |

1. Remove the bearing snap ring (3), using a pair of snap ring pliers.

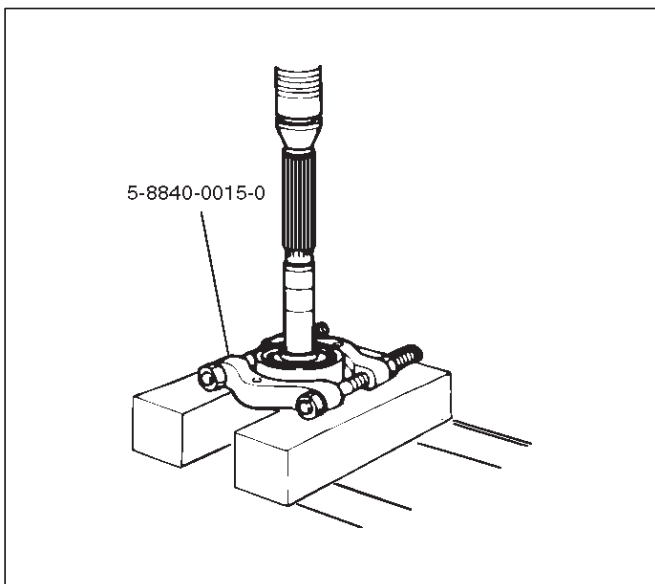


226RS060

2. Remove the rear output shaft assembly (1) from the transfer rear cover (with oil seal).
3. Remove ball bearing (8), using a bench press and the bearing remover 5-8840-0015-0 (J-22912-01).



4. Remove the speedometer drive gear (7).
5. Remove the ball (6).
6. Remove the bearing snap ring (5), using a pair of snap ring pliers.
7. Remove the ball bearing (4) from the rear output shaft, using a bench press and the bearing remover 5-8840-0015-0 (J-22912-01).



Inspection and Repair

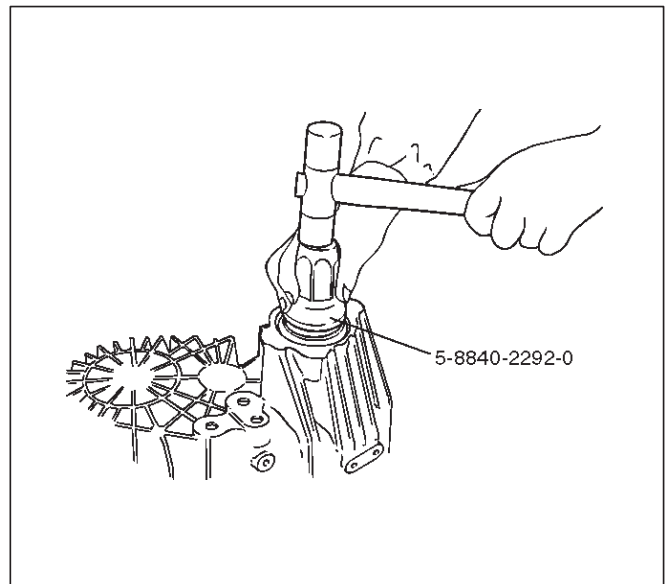
Refer to "TRANSFER CASE ASSEMBLY" in this section for inspection and repair.

Reassembly

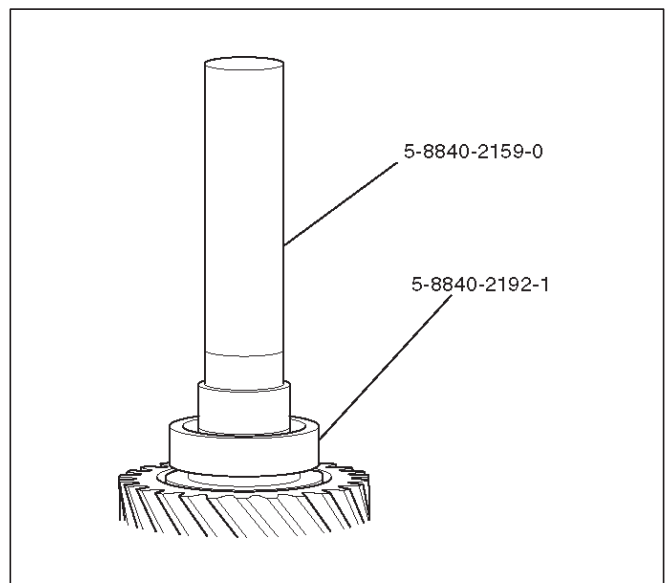
1. Install transfer rear cover (with oil seal).

Oil seal replacement

- Remove the oil seal from the transfer rear cover.
- Apply engine oil to the oil seal outer surfaces.
- Fill in recommended grease (BESCO L2) or equivalent in the oil seal lip.
- Use the oil seal installer 5-8840-2292-0 (J-39208) to install the rear oil seal to the transfer rear cover.

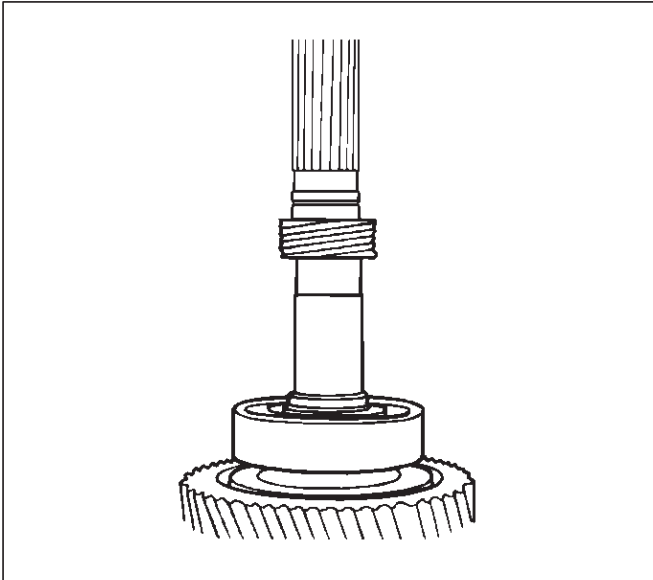


2. Set the snap ring (3), and install ball bearing (4) to the rear output shaft (2), using the ball bearing installer 5-8840-2159-0 (J-37223) and the adapter 5-8840-2192-1 (J-37486-A).



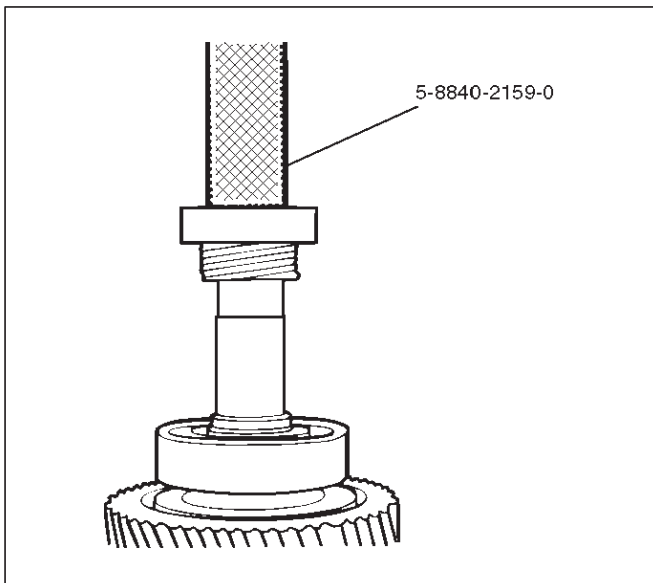
4D1-18 TRANSFER CASE (STANDARD TYPE)

3. Install the bearing snap ring (5).
4. Install the ball (6).
5. Install the speedometer drive gear (7).



226RS064

6. Install ball bearing (8), using the ball bearing installer 5-8840-2159-0 (J-37223).

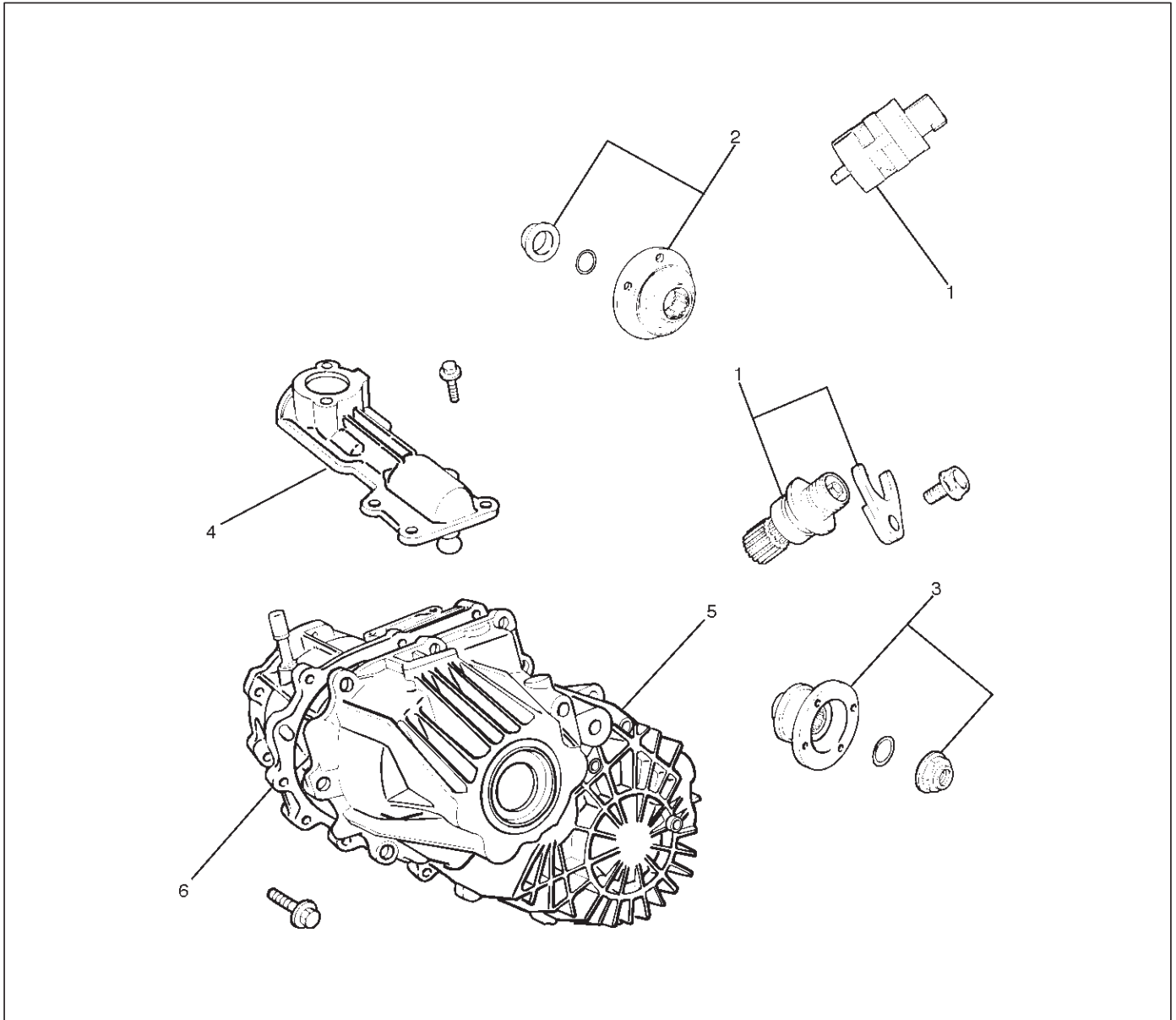


226RW188

7. Install the rear output shaft assembly (1) to the transfer rear cover.
 8. Install the bearing snap ring (3).
- NOTE: The snap ring must be fully inserted into the transfer rear case snap ring groove.

Transfer Rear Cover Assembly (Except 4WD Switch Model)

Transfer Rear Cover Assembly and Associated Parts



220RW116

Legend

- | | |
|---|----------------------------------|
| (1) Speedometer Sensor, Speedometer Driven Gear and Plate | (3) Rear Companion Flange |
| (2) Front Companion Flange | (4) Control Box Assembly |
| | (5) Transfer Rear Cover Assembly |
| | (6) Transfer Case Assembly |

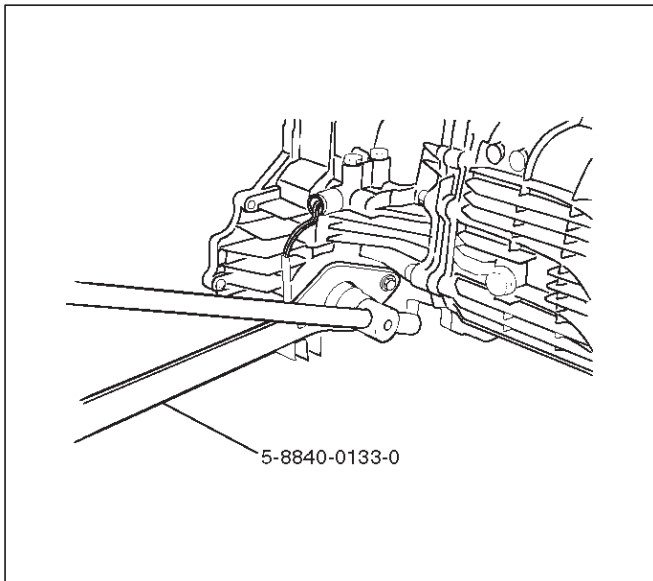
4D1-20 TRANSFER CASE (STANDARD TYPE)

Removal

1. Remove the speedometer sensor.
2. Remove the plate.
3. Remove the speedometer driven gear bushing and driven gear.

NOTE: Apply a reference mark to the driven gear bushing before removal.

4. Remove the front companion flange and the rear companion flange, using the flange companion holder 5-8840-0133-0 (J-8614-11) to remove the end nuts.

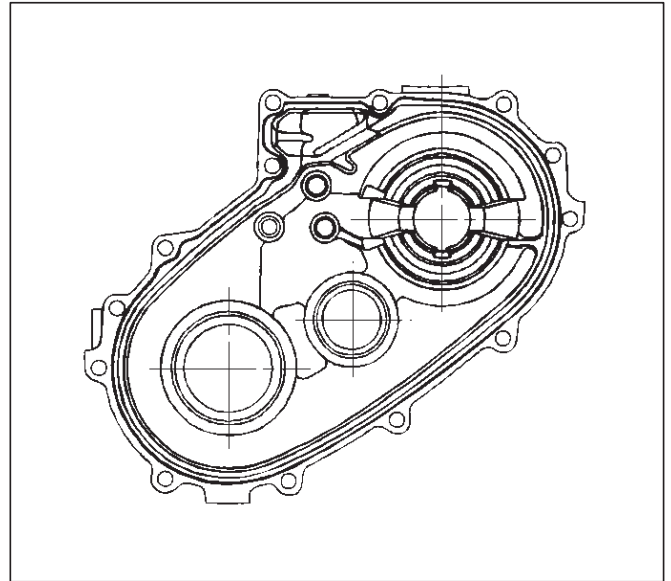


NOTE: Use a universal puller to remove the rear companion flange.

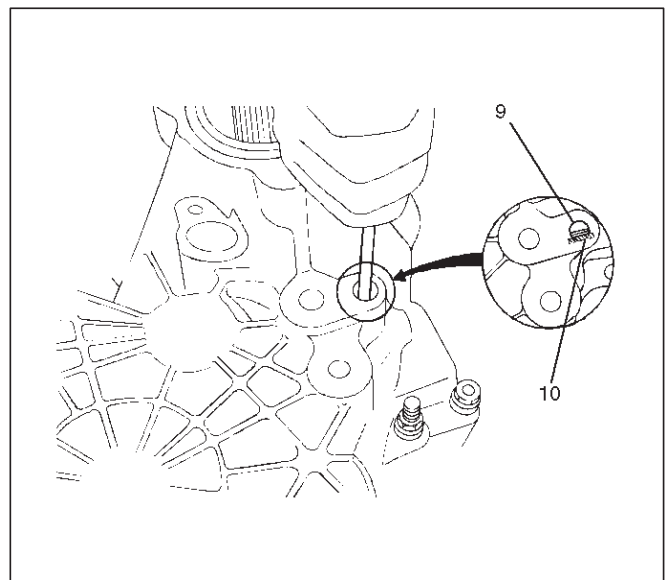
5. Disconnect the transfer breather hose from the control box.
6. Remove the control box assembly.
7. Remove the transfer rear cover assembly from the transfer case assembly.

Installation

1. Apply the recommended liquid gasket (LOCTITE 17430) or its equivalent to the transfer rear cover fitting faces.



2. Install the transfer rear cover assembly to the transfer case assembly.
3. Perform the following steps before fitting the transfer rear case:
 1. Shift the high-low shift rod to the 4H side.
 2. Turn the select rod counterclockwise so that the select block projection may enter into the 2WD-4WD shift block.
 3. The cut-away portion of the select rod head (9) should align with that of the rear case hole's stopper (10).



4. Tighten the transfer rear case bolts to the specified torque.

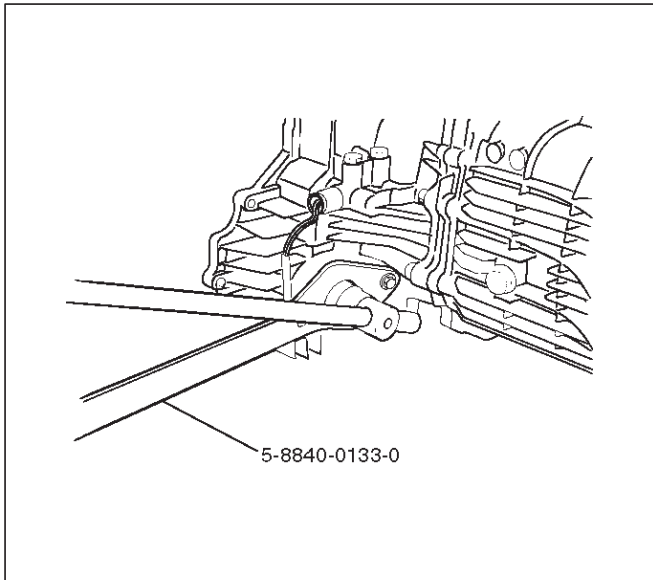
Torque: 37 N·m (3.8kg·m/27 lb ft)

5. Install the control box assembly.

Torque: 19 N·m (1.9kg·m/14 lb ft)

6. Connect the breather hoses to the control box.

7. Install the rear companion flange and front companion flange, using the companion flange holder 5-8840-0133-0 (J-8614-11) to tighten the flange nuts to the transfer case.



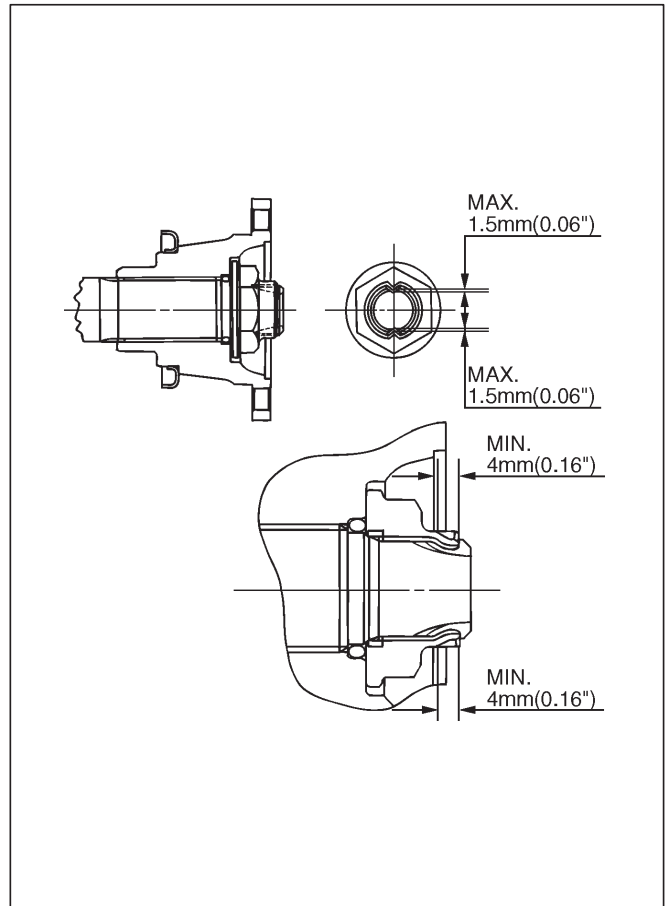
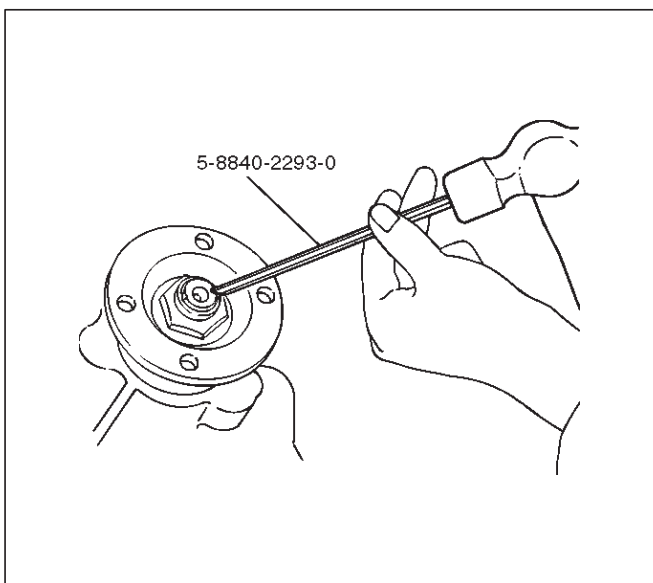
8. Tighten the new transfer flange nuts to the specified torque.

Torque

Rear companion flange: 167 N·m (17.0kg·m/123 lb ft)

Front companion flange: 137 N·m (14.0kg·m/101 lb ft)

9. Use the punch 5-8840-2293-0 (J-39209) to stake the rear companion flange nut at two spots.



10. Stake the front companion flange nut at one spot.

NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.

11. Install the O-ring (8) to the speedometer driven gear bushing (7).

12. Install the driven gear to the speedometer driven gear bushing (7).

13. Install the speedometer driven gear assembly to the transfer rear cover.

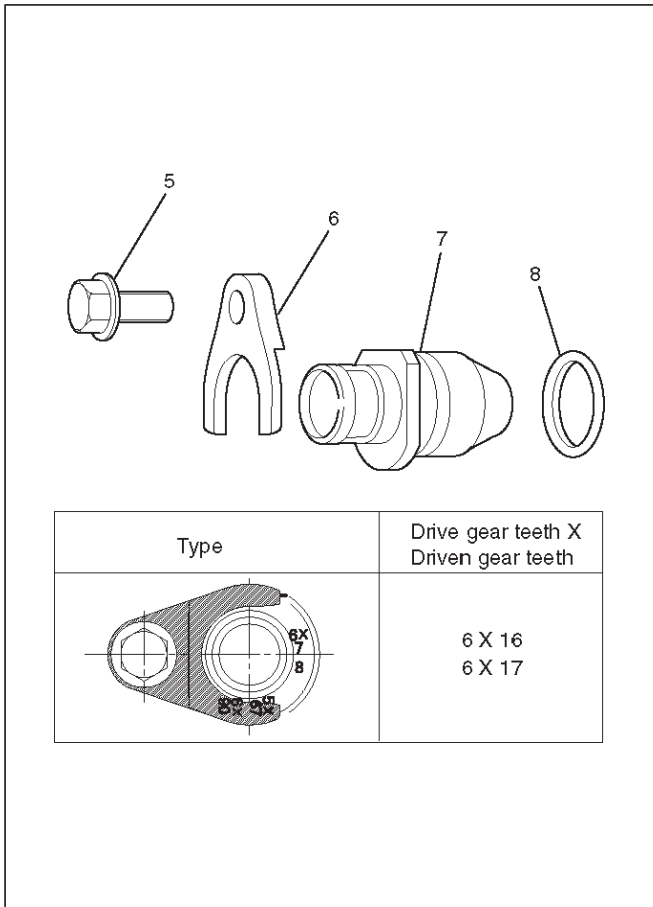
14. Install the plate (6) to the transfer rear case and tighten to the specified torque.

Torque: 15 N·m (1.5kg·m/11 lb ft)

4D1-22 TRANSFER CASE (STANDARD TYPE)

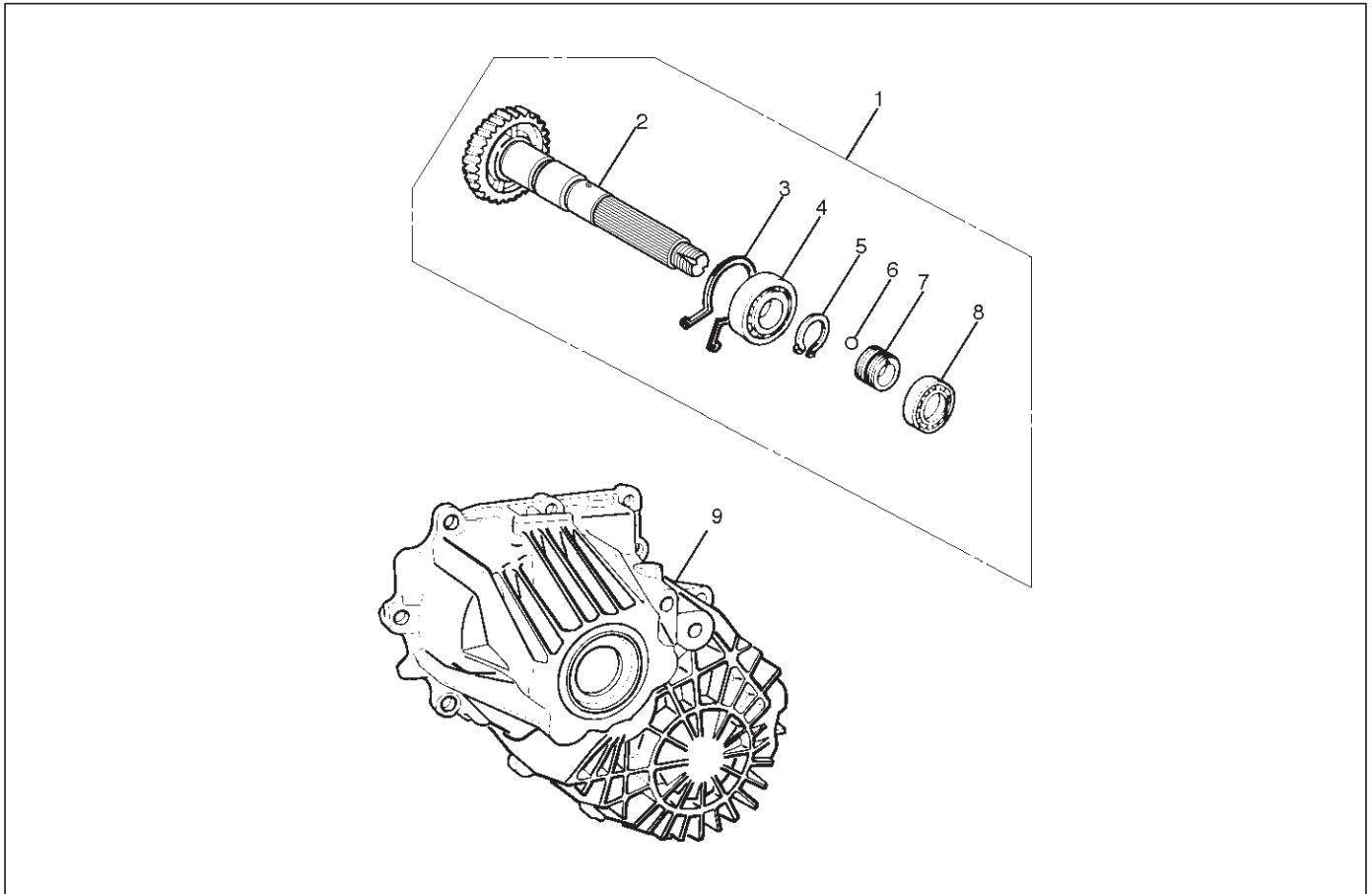
15. Install the speedometer sensor and tighten to the specified torque.

Torque: 27 N·m (2.8kg·m/20 lb ft)



225RW014

Disassembly

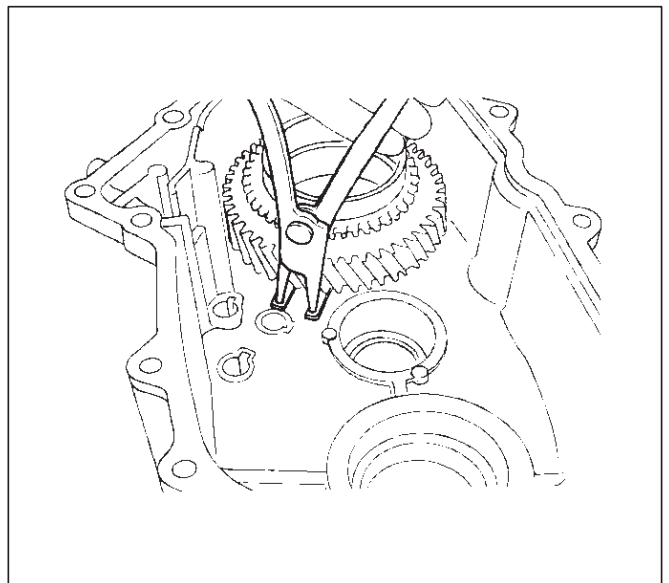


226RW154

Legend

- | | |
|--------------------------------|---|
| (1) Rear Output Shaft Assembly | (5) Bearing Snap Ring |
| (2) Rear Output Shaft | (6) Ball |
| (3) Bearing Snap Ring | (7) Speedometer Drive Gear |
| (4) Ball Bearing | (8) Ball Bearing |
| | (9) Transfer Rear Cover (with oil seal) |

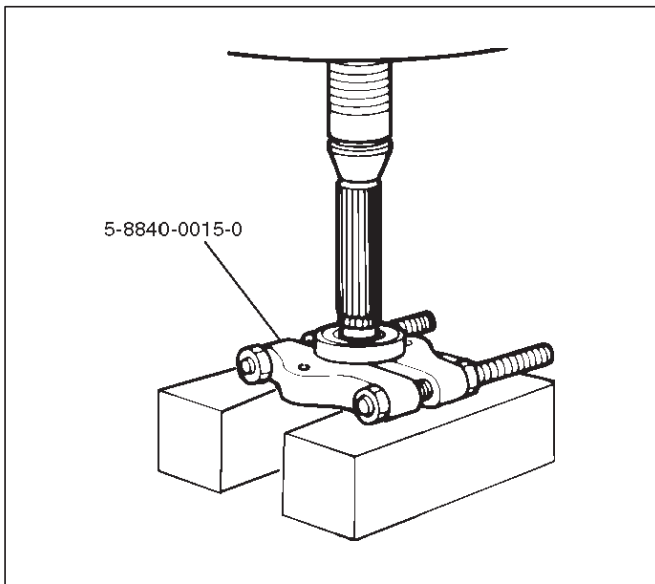
1. Remove the bearing snap ring (3), using a pair of snap ring pliers.



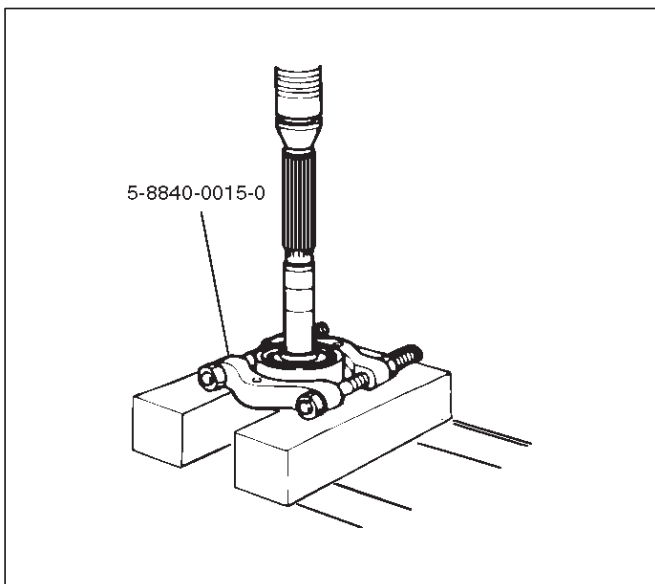
226RS060

4D1-24 TRANSFER CASE (STANDARD TYPE)

2. Remove the rear output shaft assembly (1) from the transfer rear cover (with oil seal).
3. Remove ball bearing (8), using a bench press and the bearing remover 5-8840-0015-0 (J-22912-01).



4. Remove the speedometer drive gear (7).
5. Remove the ball (6).
6. Remove the bearing snap ring (5), using a pair of snap ring pliers.
7. Remove the ball bearing (4) from the rear output shaft, using a bench press and the bearing remover 5-8840-0015-0 (J-22912-01).



Inspection and Repair

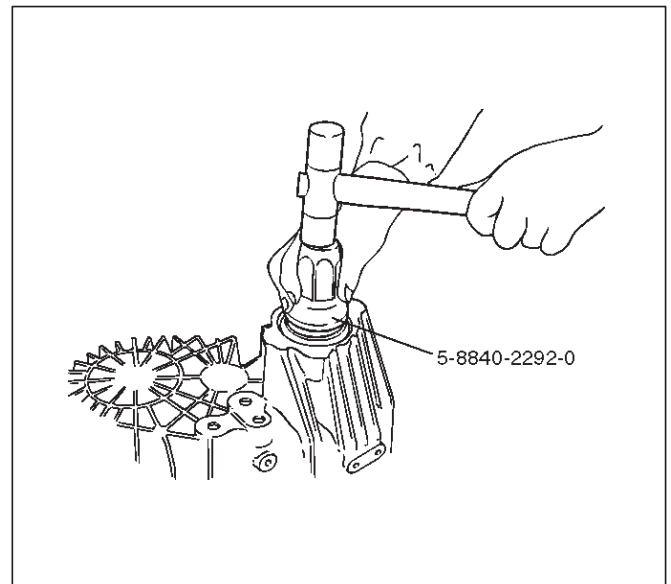
Refer to "TRANSFER CASE ASSEMBLY" in this section for inspection and repair.

Reassembly

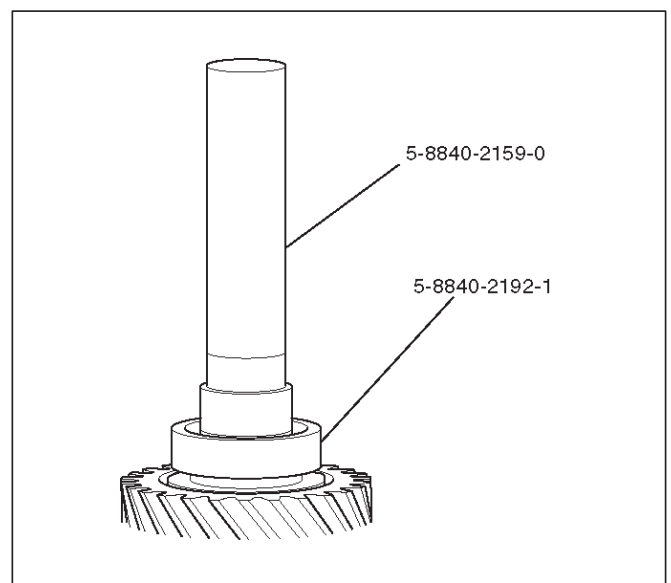
1. Install transfer rear cover (with oil seal).

Oil seal replacement

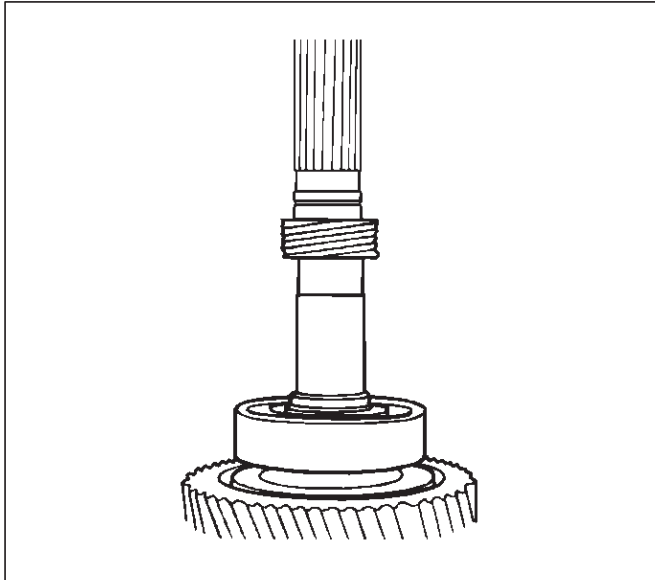
- Remove the oil seal from the transfer rear cover.
- Apply engine oil to the oil seal outer surfaces.
- Fill in recommended grease (BESCO L2) or equivalent in the oil seal lip.
- Use the oil seal installer 5-8840-2292-0 (J-39208) to install the rear oil seal to the transfer rear cover.



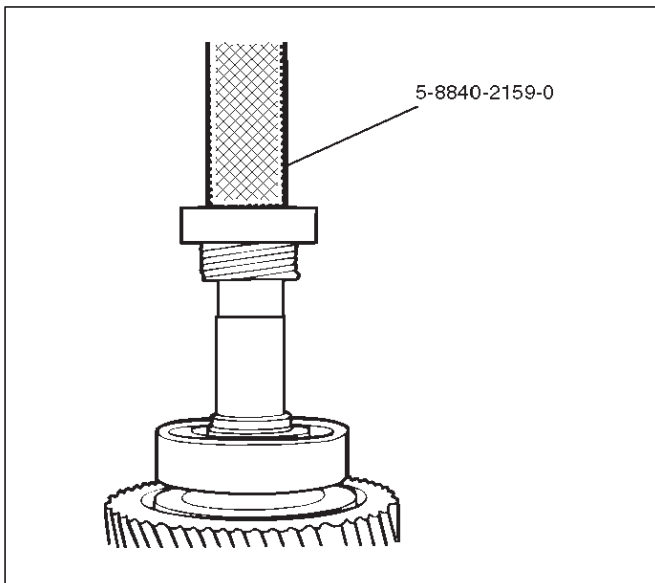
2. Set the snap ring (3), and install ball bearing (4) to the rear output shaft (2), using the ball bearing installer 5-8840-2159-0 (J-37223) and the adapter 5-8840-2192-1 (J-37486-A).



3. Install the bearing snap ring (5).
4. Install the ball (6).
5. Install the speedometer drive gear (7).



6. Install ball bearing (8), using the ball bearing installer 5-8840-2159-0 (J-37223).

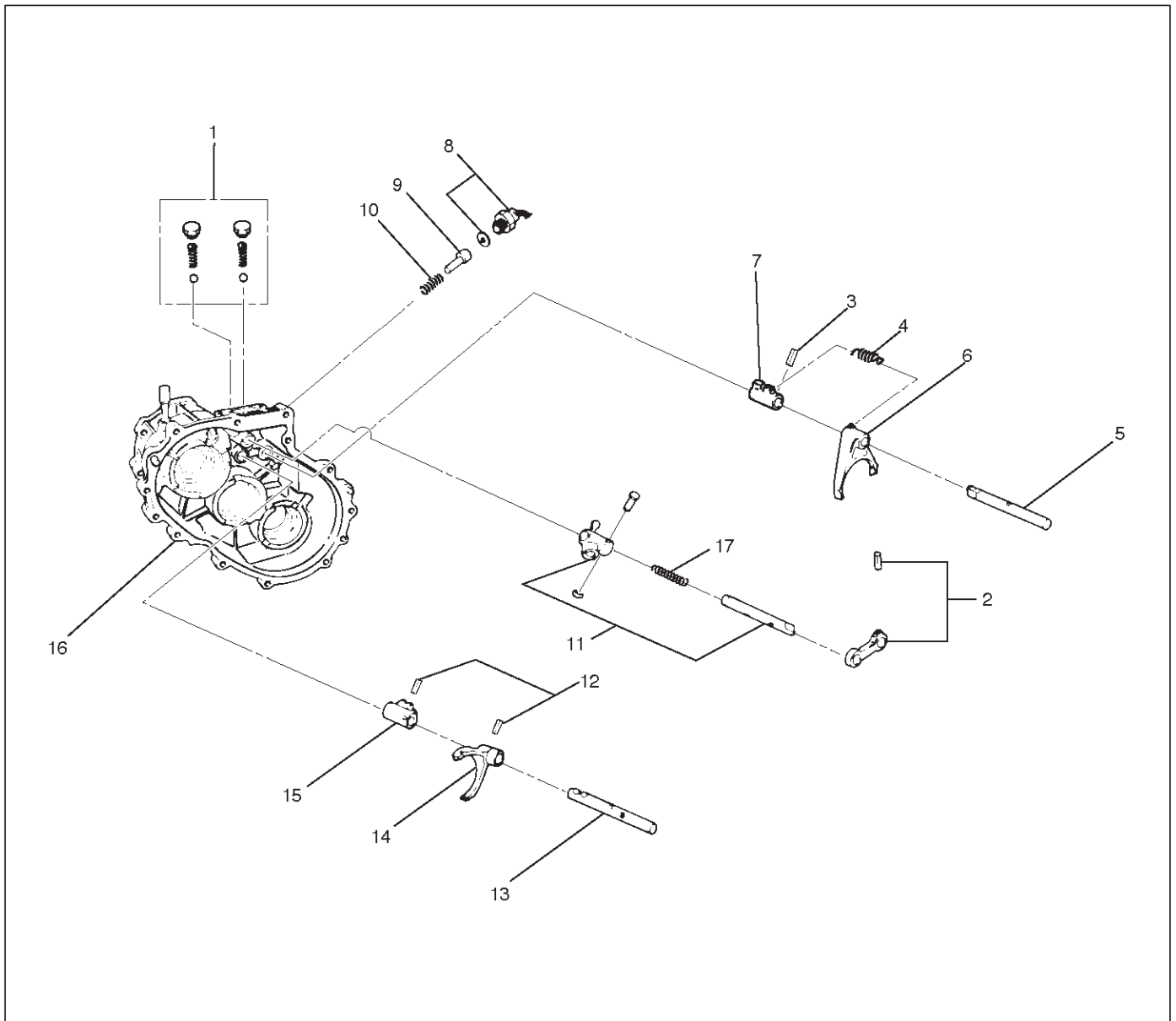


7. Install the rear output shaft assembly (1) to the transfer rear cover.
8. Install the bearing snap ring (3).

NOTE: The snap ring must be fully inserted into the transfer rear case snap ring groove.

Detent, Shift Arm, and Interlock Pin

Disassembled View



262RW074

Legend

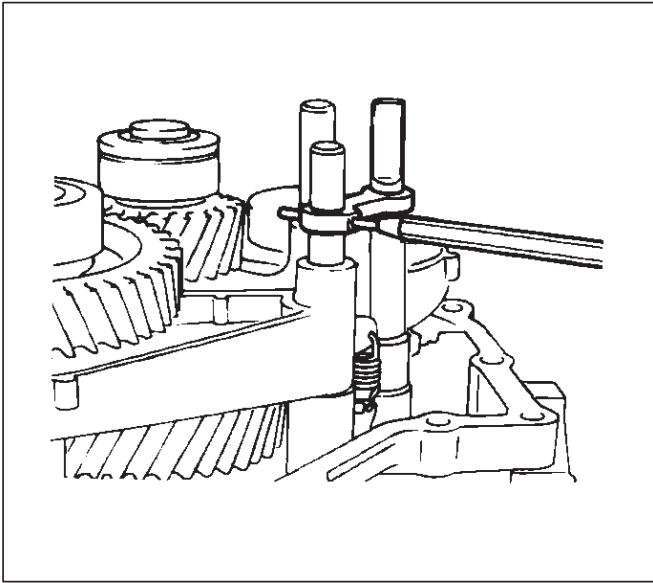
- | | |
|----------------------------------|---|
| (1) Detent Ball, Spring and Plug | (9) Interlock Pin |
| (2) Spring Pin and Bridge | (10) Spring |
| (3) Spring Pin | (11) Select Rod Assembly |
| (4) Spring | (12) Spring Pin |
| (5) 2WD-4WD Shift Rod | (13) High-Low Shift Rod |
| (6) Shift Arm | (14) Shift Arm |
| (7) Shift Block | (15) Shift Block |
| (8) 4WD Indicator Switch | (16) Transfer Case |
| | (17) Spring (Except Shift On The Fly Model) |

Disassembly

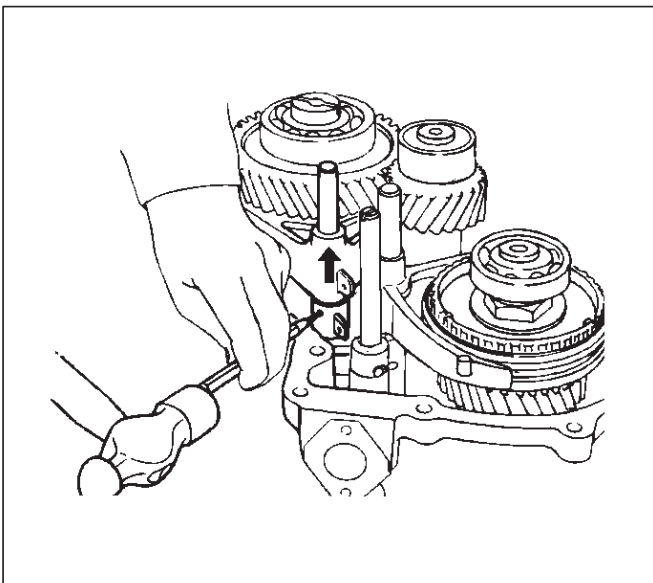
1. Remove the detent ball, spring and plug (1).

TRANSFER CASE (STANDARD TYPE) 4D1-27

2. Use a spring pin remover to remove the spring pin (2) from the bridge (2).

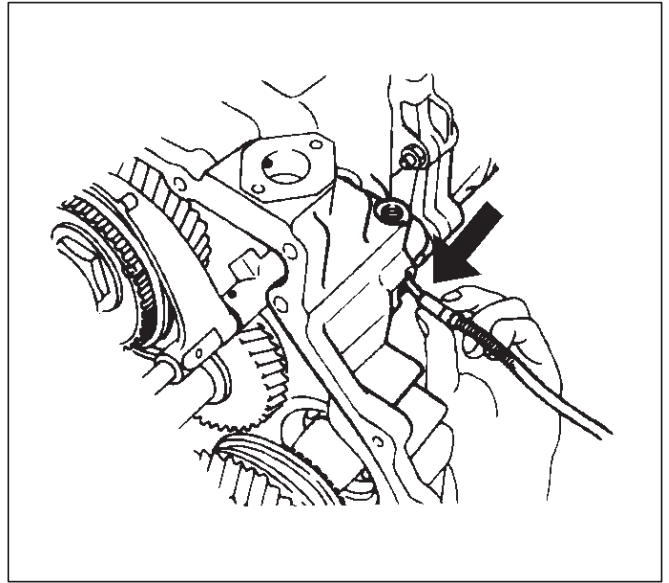


3. Remove the spring (4).
4. Engage the 2WD-4WD sleeve with the front output gear. Remove the spring pin (3) from the block (7). Remove the 2WD-4WD shift rod (5).

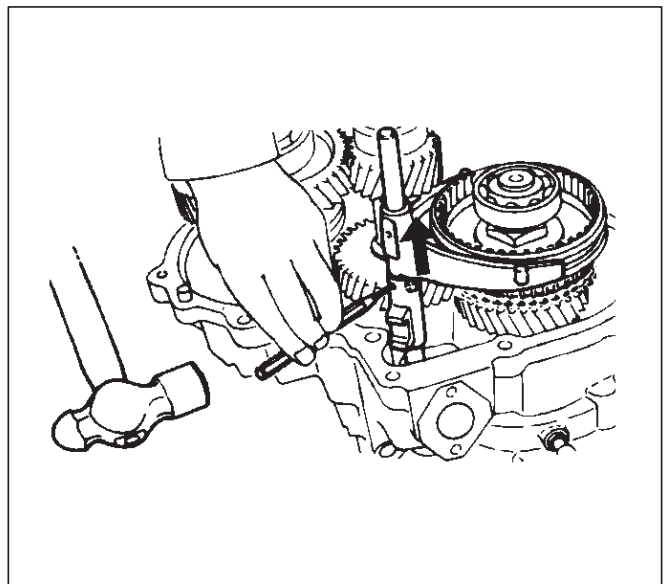


5. Remove the shift arm (6).
6. Remove the shift block (7).
7. Remove the 4WD indicator switch (8).

8. Use a magnetic tool to remove the interlock pin (9) and spring (10) from the transfer case (16).



9. Remove the select rod assembly (11).
10. Use a spring pin remover to remove the shift arm spring pins (12) from the shift arm (14) and shift block (15). Remove the high-low shift rod (13) from the transfer case (16).



11. Remove the shift arm (14).
12. Remove the shift block (15) from the transfer case (16).

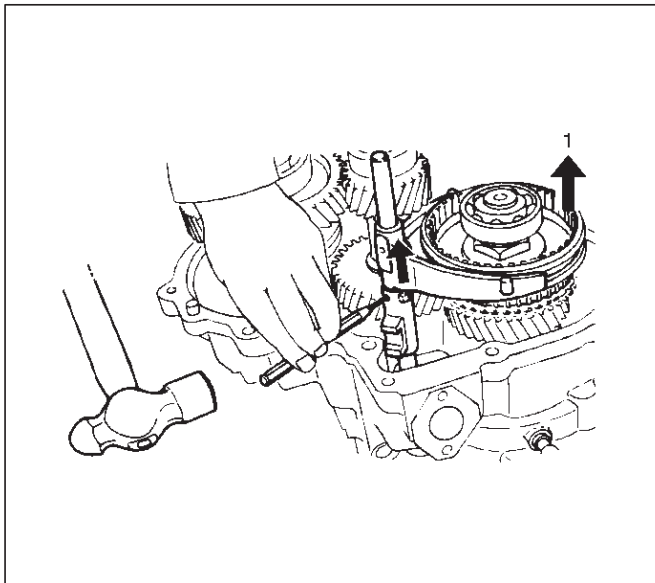
4D1-28 TRANSFER CASE (STANDARD TYPE)

Inspection and Repair

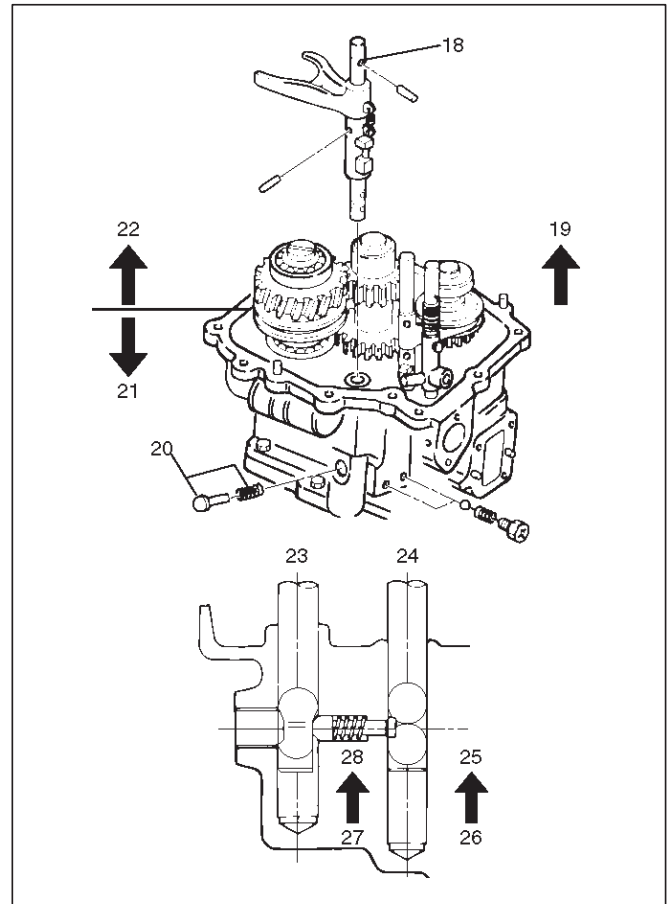
Refer to "TRANSFER CASE ASSEMBLY" in this section for inspection and repair.

Reassembly

1. Place the shift block (15) in the transfer case (16).
2. Set the shift arm (14) on the High-Low sleeve.
3. Push the High-Low shift rod (13) through the shift arm (14) and block (14).
4. Engage the High-Low sleeve with the 4H (1) side.
5. Install the spring pins (12) to the shift block (15) and shift arm (14).



6. Install the select rod assembly (11), joining its lever to the shift block groove.
7. Engage the High-Low sleeve with the 4H side and install the interlock pin (9) and spring (10) in the proper direction.
8. Place the 2WD-4WD shift block (7) in the transfer case (16).
9. Set the 2WD-4WD shift arm (6) on the 2WD-4WD sleeve.
10. Push the 2WD-4WD shift rod (5) through the 2WD-4WD shift arm (6) and 2WD-4WD shift block (7).
11. Install the 2WD-4WD shift rod (5) with the interlock pin pushed in.



Legend

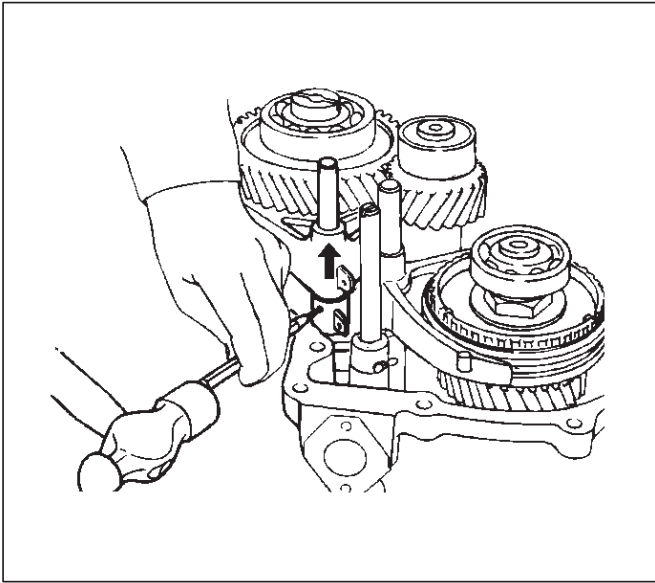
- (18) 2WD-4WD
- (19) 4H Side
- (20) Interlock pin
- (21) 2WD
- (22) 4WD
- (23) Rod: 2-4
- (24) Rod: H-L
- (25) 4H
- (26) 4L
- (27) 4x2
- (28) 4x4

12. Install the 4WD indicator switch and gasket (8). Tighten to the specified torque.

Torque: 39 N·m (4.0kg·m/29 lb ft)

13. Install the spring (4).

14. Engage the 2WD-4WD sleeve with the 4WD side and install the spring pin (3).

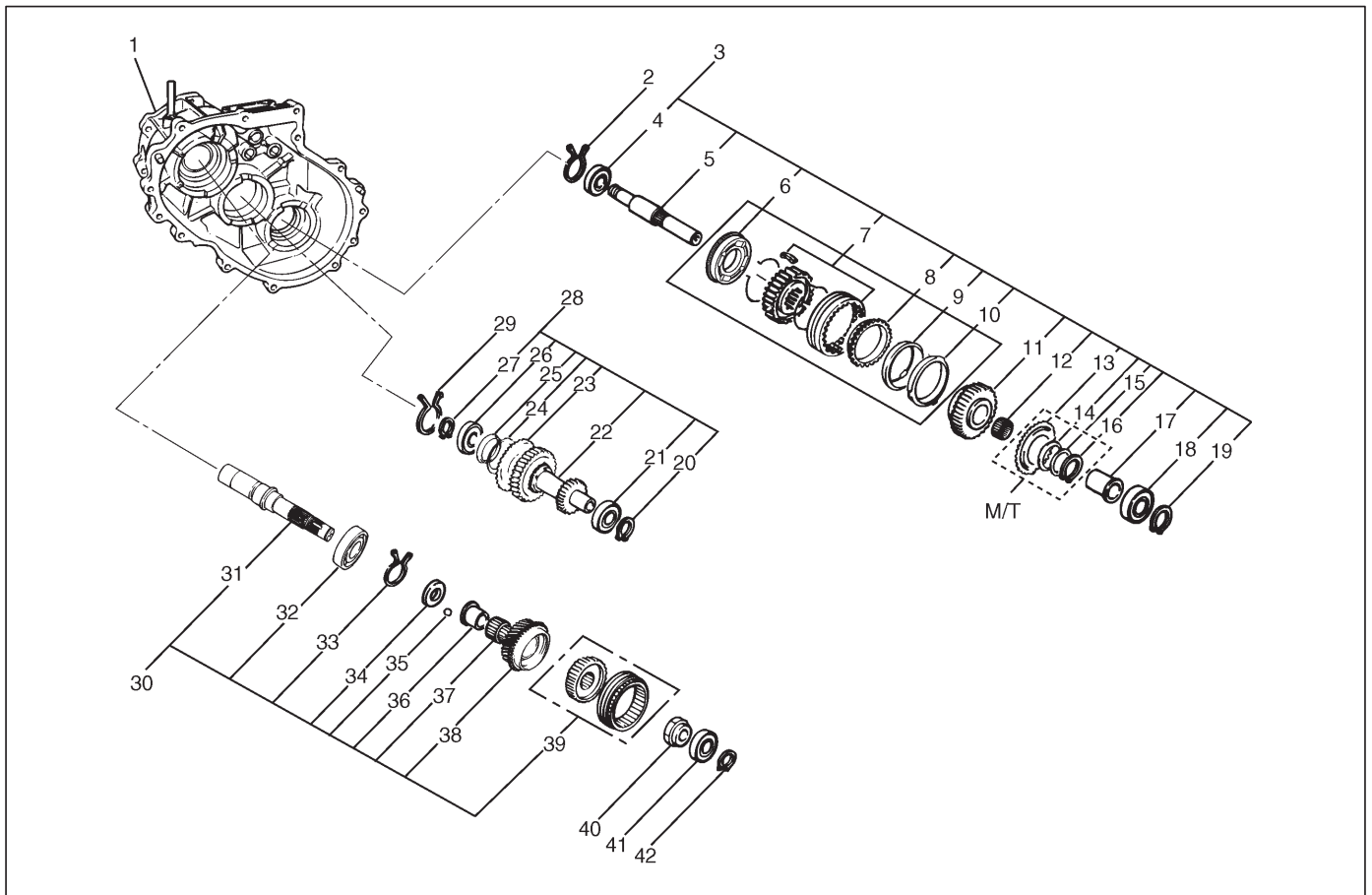


15. Install the spring pin and bridge (2).
16. Install the detent ball, spring and plug and tighten the plug (1) to the specified torque.

Torque: 25 N·m (2.5kg·m/18 lb ft)

Transfer Case Assembly

Disassembled View



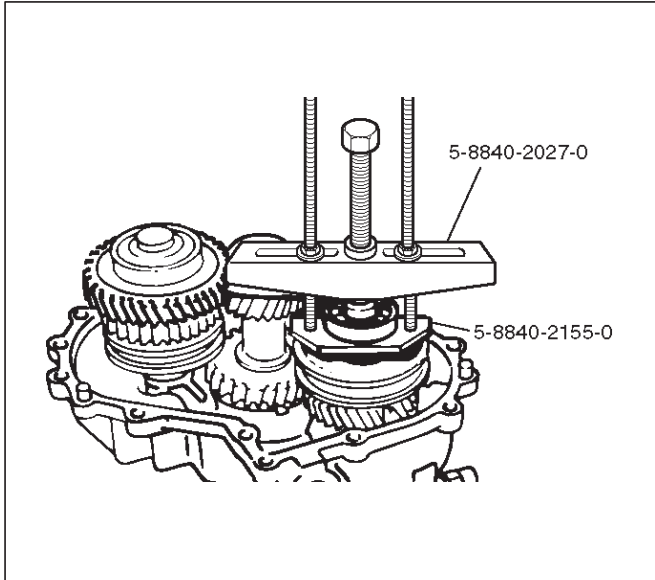
226RW132

Legend

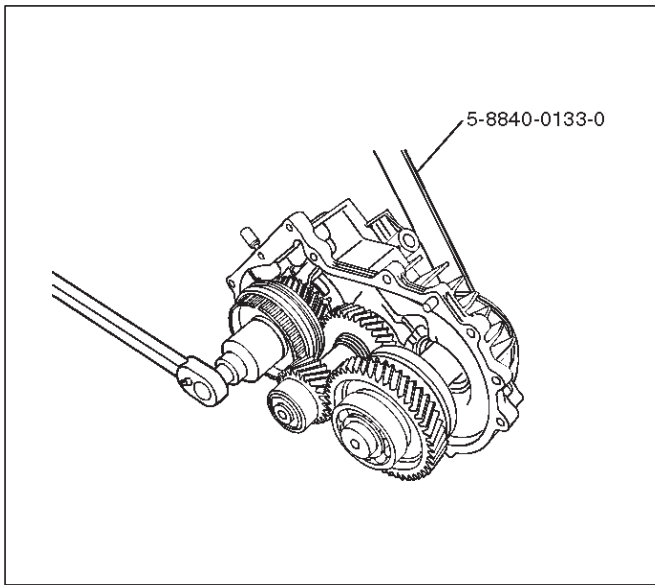
- | | |
|--|--|
| (1) Transfer Case (with oil seal) | (22) Counter Gear |
| (2) Bearing Snap Ring | (23) Sub-Gear (anti-lash plate) |
| (3) Front Output Gear Assembly | (24) Belleville Spring |
| (4) Ball Bearing | (25) Spacer |
| (5) Front Output Shaft | (26) Ball Bearing |
| (6) Stopper Plate (Shift On The Fly model) | (27) Snap Ring |
| (7) 2WD-4WD Clutch Hub and Sleeve Assembly | (28) Counter Gear Assembly |
| (8) Block Ring (Shift On The Fly model) | (29) Bearing Snap Ring |
| (9) Outside Ring (Shift On The Fly model) | (30) Input Shaft Assembly |
| (10) Inside Ring (Shift On The Fly model) | (31) Input Shaft |
| (11) Front Output Gear | (32) Ball Bearing |
| (12) Needle Bearing | (33) Snap Ring |
| (13) Sub-Gear (anti-lash plate) (M/T) | (34) Plate |
| (14) Belleville Spring (M/T) | (35) Ball |
| (15) Spacer (M/T) | (36) Bearing Collar |
| (16) Sub-Gear Snap Ring (M/T) | (37) Needle Bearing |
| (17) Bearing Collar | (38) Transfer Input Gear |
| (18) Ball Bearing | (39) High-Low Clutch Hub and Sleeve Assembly |
| (19) Bearing Snap Ring | (40) Lock Nut |
| (20) Snap Ring | (41) Ball Bearing |
| (21) Ball Bearing | (42) Bearing Snap Ring |

Disassembly

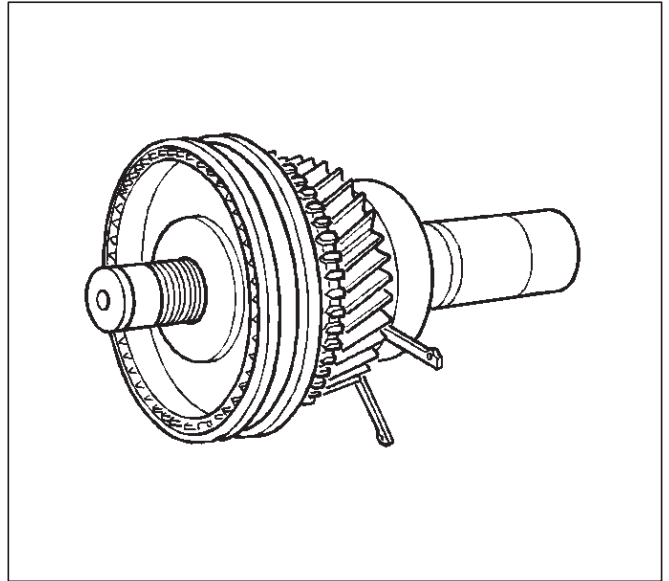
1. Use a pair of snap ring pliers to remove the snap ring (42).
2. Use a bearing remover 5-8840-2155-0 (J-37217) and puller 5-8840-2027-0 (J-37487) to remove the ball bearing (41).



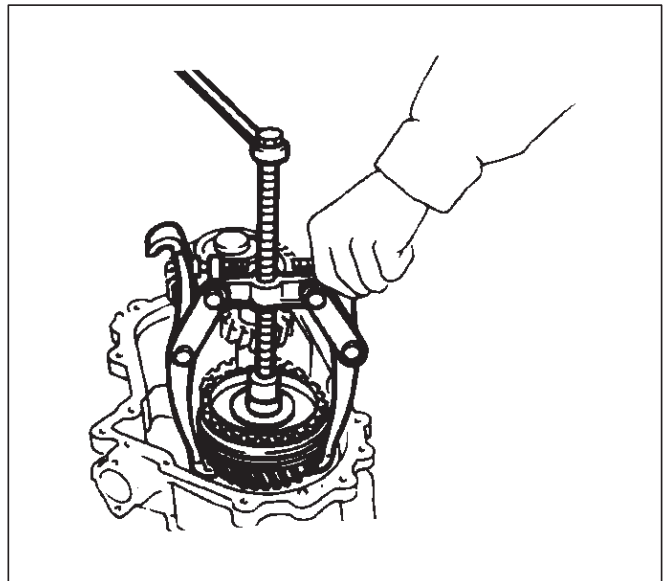
3. Install the front companion flange temporarily.
4. Use the Companion flange holder 5-8840-0133-0 (J-8614-11) and lock nut wrench 5-8840-2156-0 (J-37219) to remove the lock nut (40).



5. Remove the front companion flange.
6. Remove the snap ring (33) from the transfer case (1).
7. Remove the input shaft assembly (30) from the transfer case.



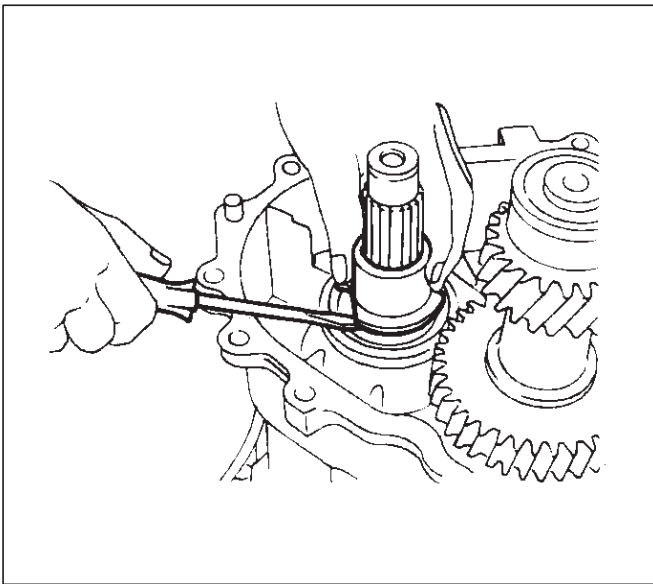
8. Use a universal puller to remove the high-low clutch hub and sleeve (39), and transfer input gear (38).



9. Remove needle bearing (37).

4D1-32 TRANSFER CASE (STANDARD TYPE)

10. Remove the bearing collar (36).

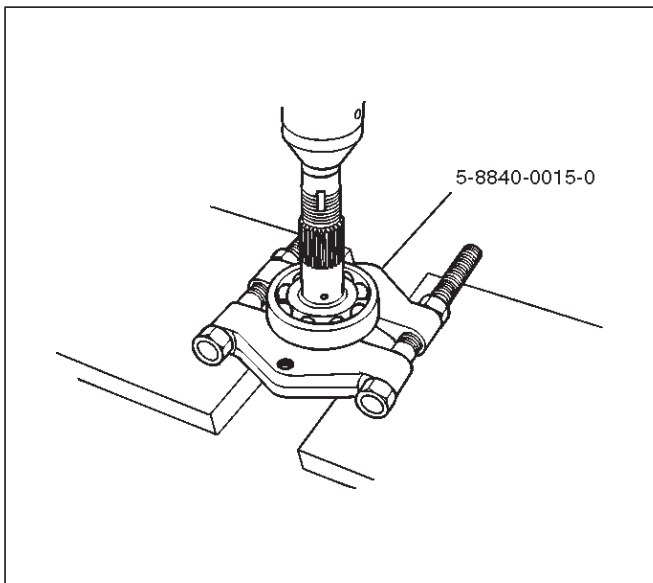


226RS071

11. Remove the ball (35).

12. Remove the plate (34).

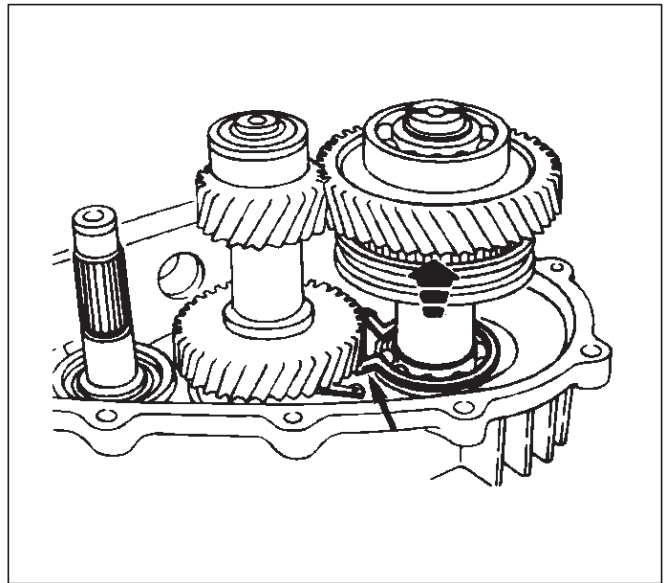
13. Use a bench press and the ball bearing remover 5-8840-0015-0 (J-22912-01) to remove the ball bearing (32) from input shaft (31).



265RW013

14. Remove the bearing snap ring (2) from the transfer case, using a pair of snap ring pliers.

15. Use a plastic hammer to tap the front output gear assembly (3) free.



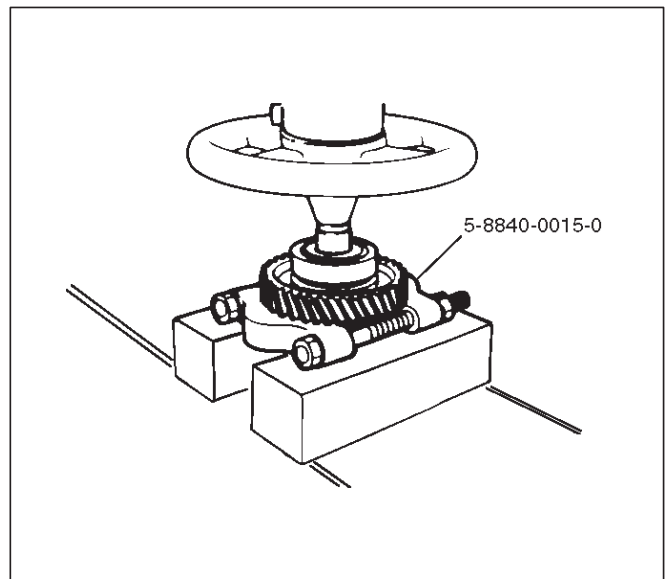
262RS009

16. Remove the bearing snap ring (19). Remove the ball bearing (18) and bearing collar (17) together with front output gear assembly: including following parts.

17. Use a bench press and the bearing remover 5-8840-0015-0 (J-22912-01) to remove the following parts.

18. Remove the sub-gear snap ring (16), spacer (15), Belleville spring (14), and sub-gear (anti-lash plate) (13). (M/T)

19. Remove the front output gear (11) and needle bearing (12).



262RW070

20. Remove the inside ring (10). (Shift On The Fly model)

21. Remove the outside ring (9). (Shift On The Fly model)

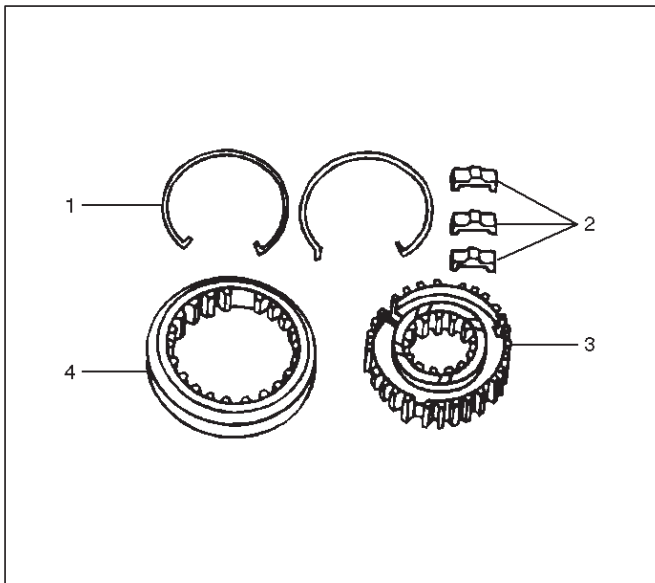
22. Remove the block ring (8). (Shift On The Fly model)

23. Use a bench press and bearing remover 5-8840-0015-0 (J-22912-01) to remove the 2WD-4WD clutch hub and sleeve assembly (7) and stopper plate (6). (Shift On The Fly model)

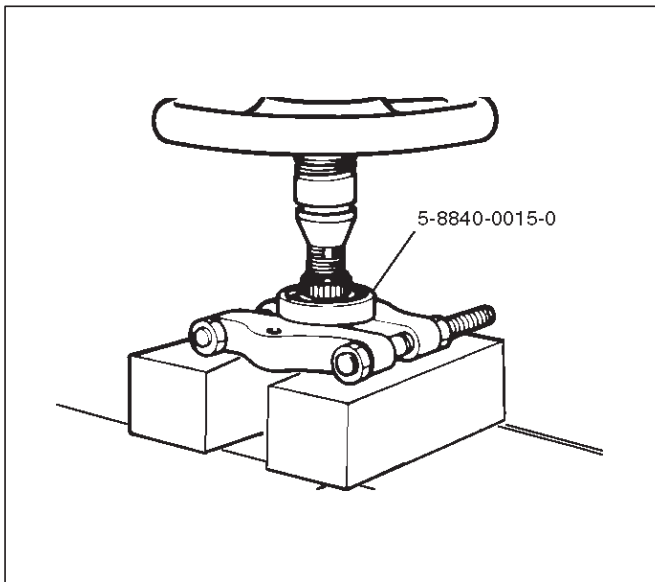
NOTE: Do not reuse the stopper plate. (Shift On The Fly model)

24. Disassemble the 2WD-4WD clutch hub and sleeve assembly.

- Springs (1) (Shift On The Fly model)
- Inserts (2) (Shift On The Fly model)
- Clutch Hub (3)
- Sleeve (4)



25. Use a bench press and the ball bearing remover 5-8840-0015-0 (J-22912-01) to remove the ball bearing (4) from front output shaft (5).

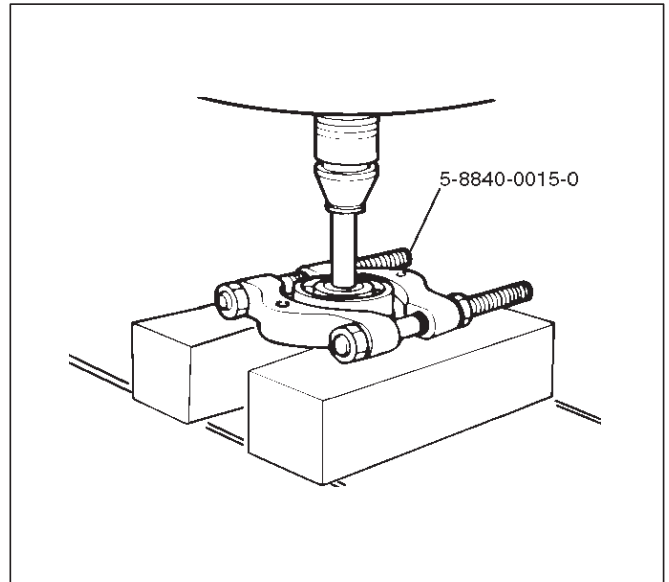


26. Remove bearing snap ring (29) from transfer case.
27. Remove the counter gear assembly (28) from the transfer case (1).
28. Use a pair of snap ring pliers to remove the snap ring (20).

29. Use a bench press and the bearing remover 5-8840-0015-0 (J-22912-01) to remove the ball bearing (21).

30. Use a pair of snap ring pliers to remove the snap ring (27).

31. Use a bench press and the bearing remover 5-8840-0015-0 (J-22912-01) to remove the ball bearing (26).



32. Remove the spacer (25).
33. Remove the belleville spring (24).
34. Remove the sub-gear (anti-lash plate) (23) from the counter gear (22).

Inspection and Repair

1. Make the necessary repair or parts replacement if wear, damage or any other abnormal conditions are found during inspection.
2. Wash all parts thoroughly in clean solvent. Be sure all old lubricant, metallic particles, dirt, or foreign material are removed from the surfaces of every part. Apply compressed air to each oil feed port and channel in each case half to remove any obstructions or cleaning solvent residue.

Gears

1. Inspect all the gear teeth for signs of excessive wear or damage and check all the gear splines for burrs, nicks, wear or damage. Remove the minor nicks or scratches on an oil stone. Replace any part exhibiting excessive wear or damage.

Front Output Gear Inside Diameter

1. Use an inside dial indicator to measure the gear inside diameter.

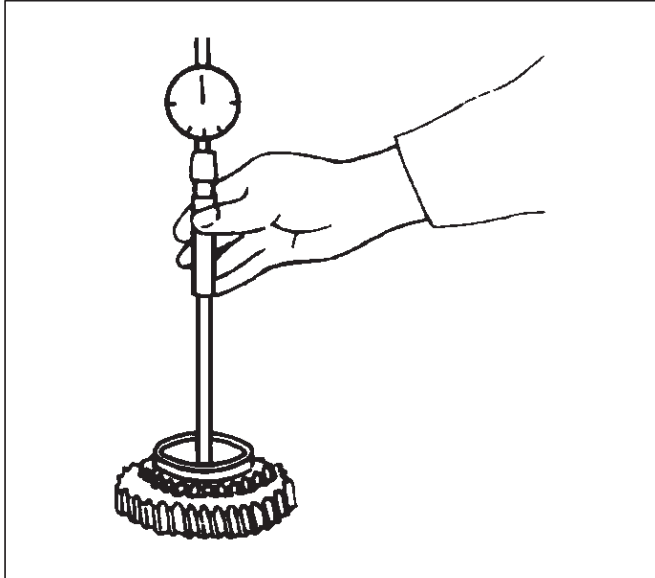
4D1-34 TRANSFER CASE (STANDARD TYPE)

2. If the measured value exceeds the specified limit, the gear must be replaced.

Gear inside diameter

Standard : 48.000–48.013 mm (1.8898–1.8903 in)

Limit : 48.10 mm (1.894 in)



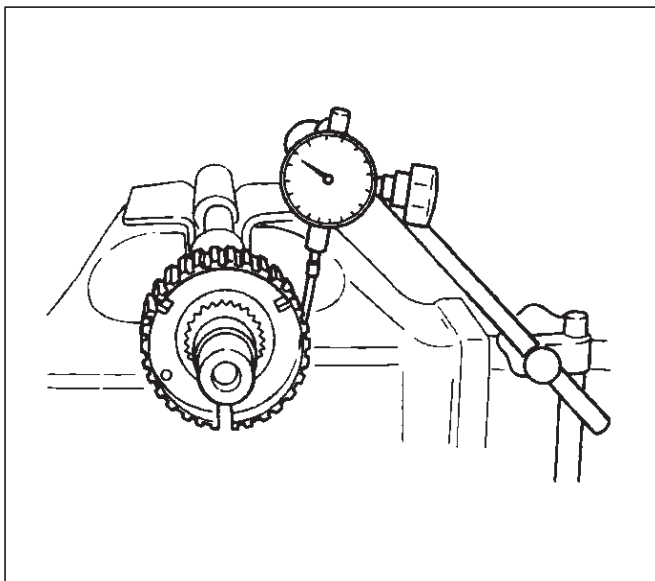
Clutch Hub Spline Play

1. Set a dial indicator to the clutch hub to measured.
2. Move the clutch hub as far as possible to both the right and the left.
Note the dial indicator reading.
3. If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch hub spline play

Standard : 0–0.1 mm (0–0.004 in)

Limit : 0.2 mm (0.008 in)



Bearings

1. Inspect the condition of all the needles and ball bearings. Wash bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings.

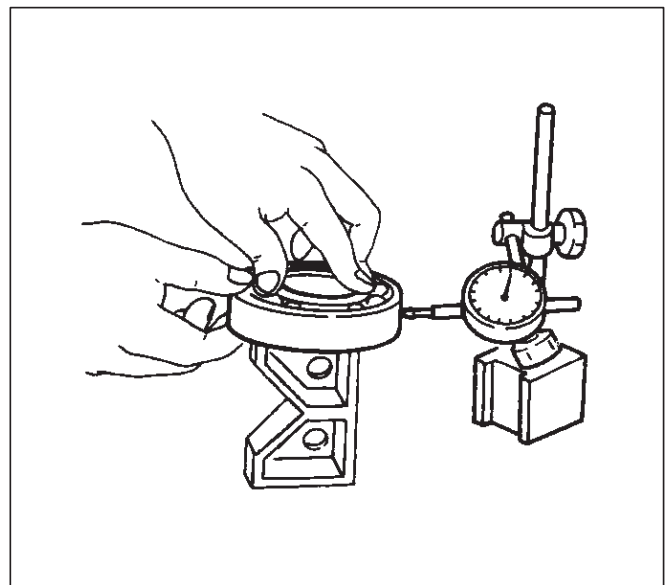
NOTE: Do not allow the bearings to spin. Turn them slowly by hand. Spinning bearings may damage the rollers.

2. Lubricate the bearings with a light oil and check them for roughness by slowly turning the race by hand.

Ball Bearing Play

1. Use a dial indicator to measure the ball bearing play.
2. If the measured value exceeds the specified limit, the ball bearing must be replaced.

Limit : 0.2 mm (0.008 in)



Synchronizers

The synchronizer hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled.

Clean synchronizer components with clean solvent and air dry.

Inspect the components for the following:

- Teeth for wear, scuffs, nicks, burrs or breaks.
- Keys and springs for wear, cracks or distortion, replace if these conditions are present.
- If scuffed, nicked or burred conditions cannot be corrected with a soft stone or crocus cloth, replace the component.

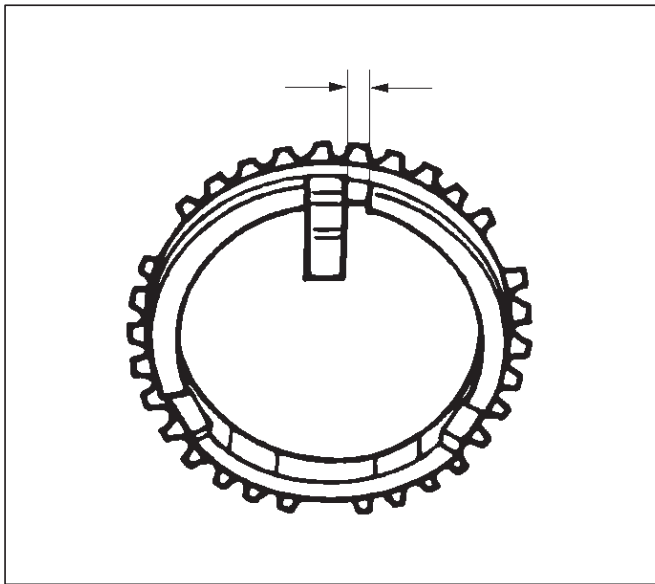
Block Ring and Insert Clearance

1. Use a vernier caliper to measure the clearance between the block ring and the insert.
2. If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block ring and insert clearance

Standard : 2.46–2.74 mm (0.097–0.108 in)

Limit : 3.0 mm (0.118 in)



226RS037

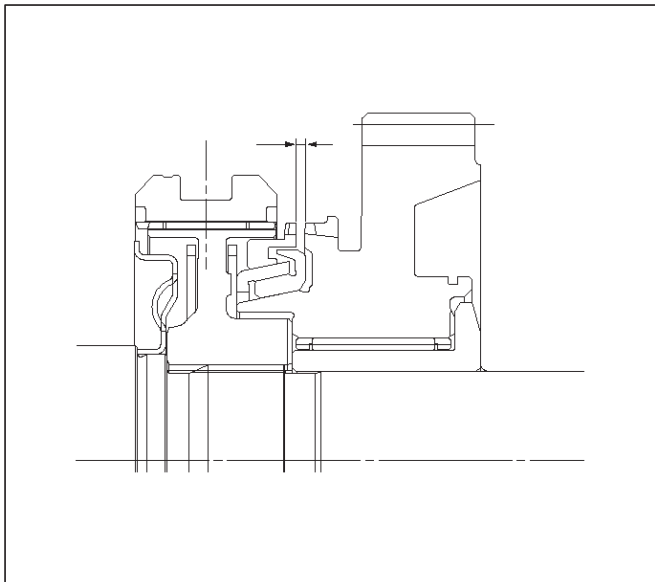
2WD-4WD 3-Cone Synchronizer (Shift On The Fly model)

1. Use a thickness gauge to measure the clearance between the block ring and the dog teeth.
2. If the measured value exceeds the specified limit, the 2WD-4WD synchronizer assembly must be replaced.

Block ring and insert clearance

Standard : 1.5 mm (0.059 in)

Limit : 0.8 mm (0.031 in)



226RW142

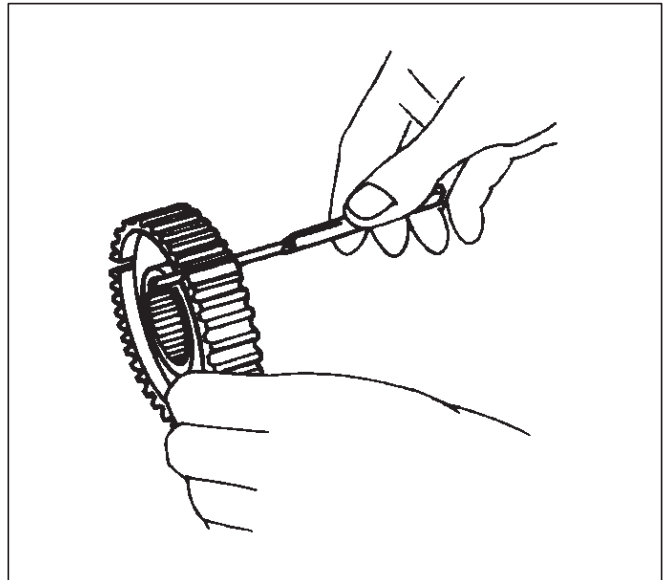
Clutch Hub and Insert Clearance

1. Use a thickness gauge to measure the clearance between the clutch hub and the insert.
2. If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch hub and insert clearance

Standard : 0.01-0.19 mm (0.0004-0.0075 in)

Limit : 0.3 mm (0.012 in)



226RS038

Detent Springs

1. Inspect the springs for distortion, cracks or wear. Replace if these conditions are present.

Detent Spring Free Length

1. Use a vernier caliper to measure the detent spring free length.

4D1-36 TRANSFER CASE (STANDARD TYPE)

2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent spring free length

Detent ball

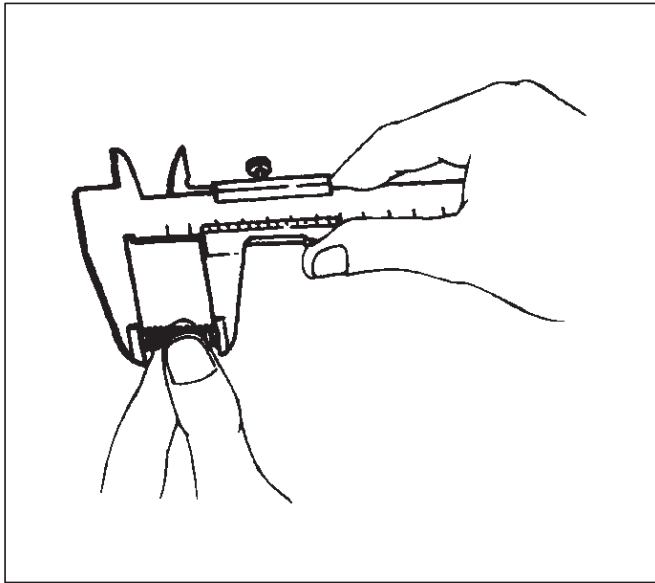
Standard : 23.4 mm (0.921 in)

Limit : 22.8 mm (0.898 in)

Interlock pin

Standard : 1.59 mm (0.063 in)

Limit : 1.53 mm (0.060 in)



Detent Spring Tension

1. Use a spring tester to measure the detent spring tension.
2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent spring free length

Detent ball

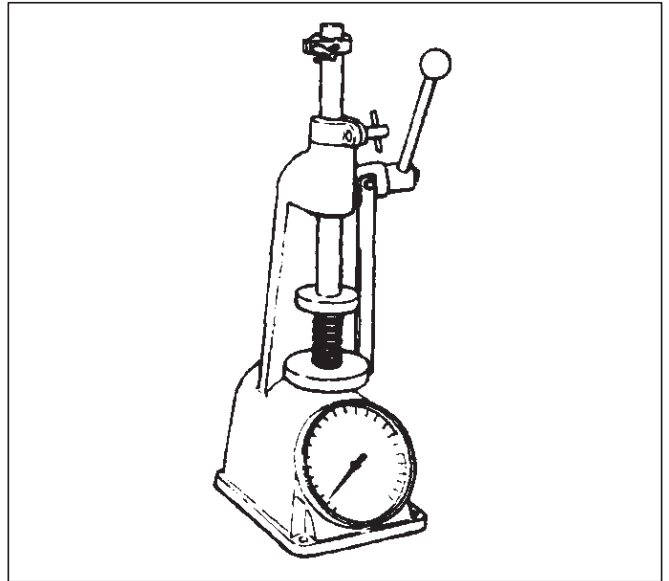
Compressed height : 18.7 mm (0.736 in)

Standard : 68.6–88.2 N (7.0–9.0kg/15.4–19.8 lb)

Interlock pin

Compressed height : 11.5 mm (0.453 in)

Standard : 9.8 N (1.0kg/2.2 lb)



Shift Arm

1. Inspect the shift arms for wear, distortion or scoring. Replace if these conditions are present.

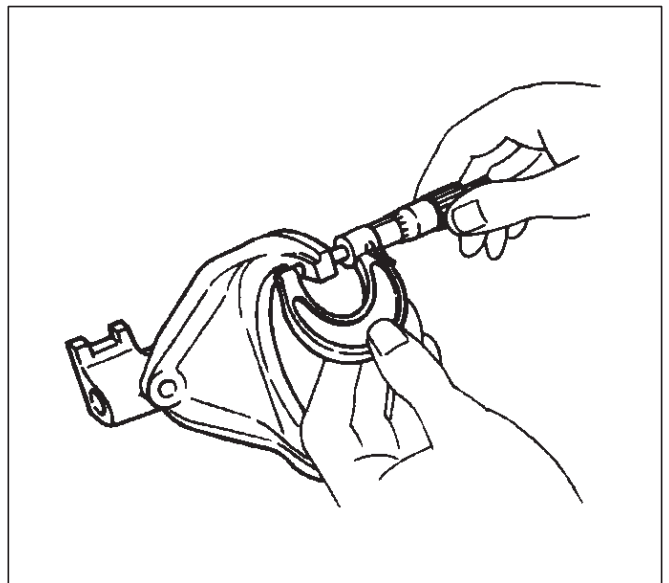
Shift Arm Thickness

1. Use a micrometer to measure the shift arm thickness.
2. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift arm thickness

Standard : 9.60–9.85 mm (0.378–0.388 in)

Limit : 9.0 mm (0.354 in)

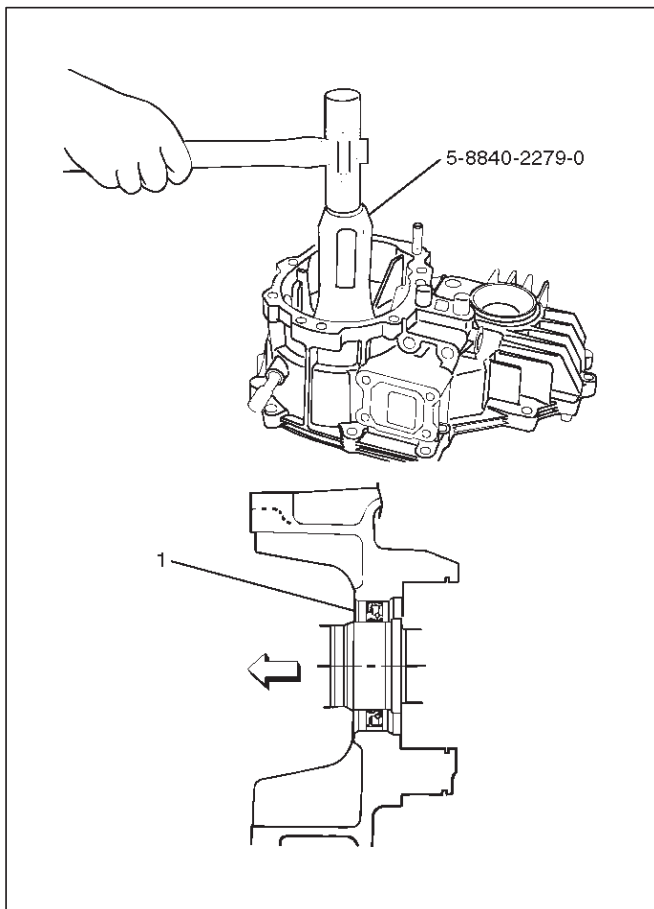


Reassembly

1. Put the transfer case (with oil seal) as the following illustration.

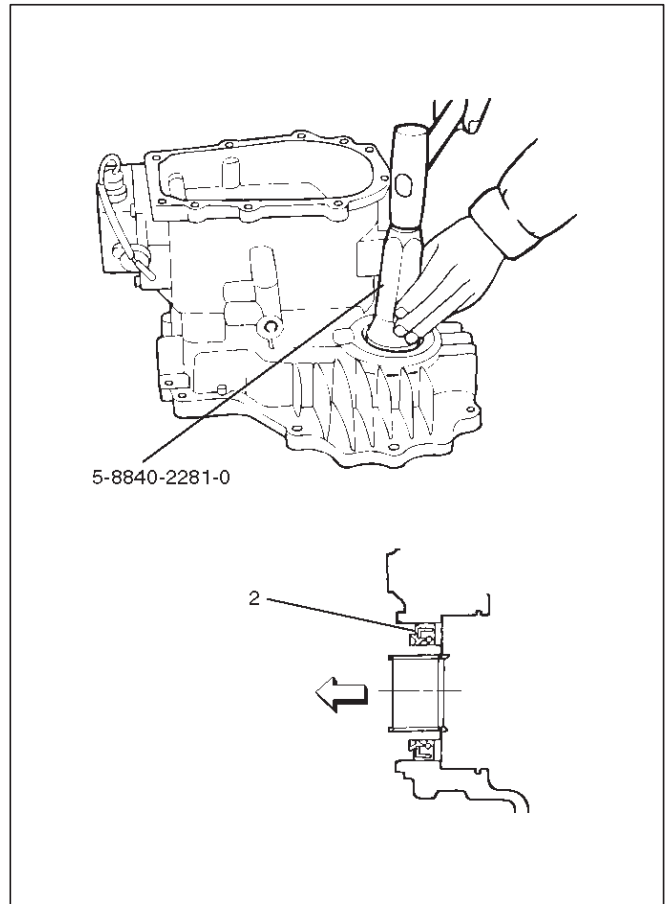
Input shaft oil seal (1) replacement

1. Remove the oil seal from the transfer case.
2. Apply engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer 5-8840-2279-0 (J-38592) to install the oil seal to the transfer case.



Front output shaft oil seal (2) replacement

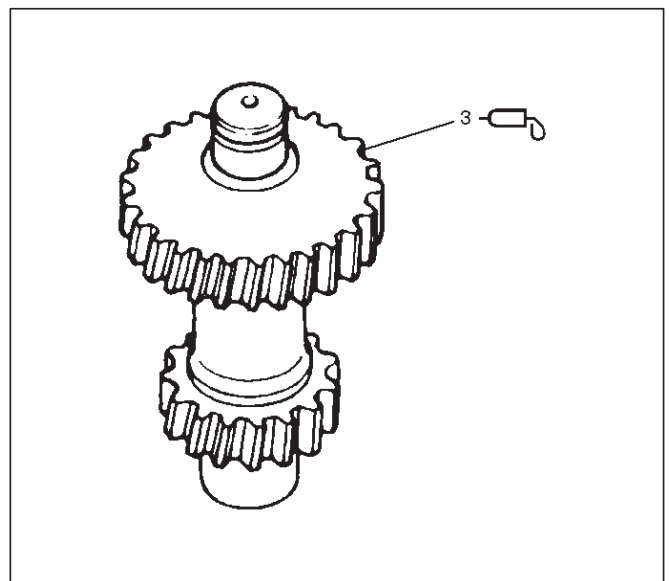
1. Remove the oil seal from the transfer case.
2. Apply engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer 5-8840-2281-0 (J-38594) to install the oil seal to the transfer case.



Legend

- (2) Front output shaft oil seal

2. Apply chassis grease (3) to the sub-gear (23) and the counter gear (22) thrust surfaces.



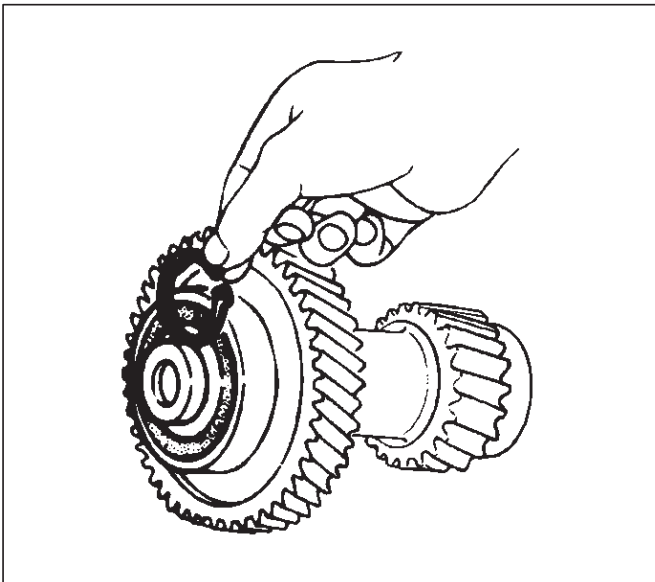
4D1-38 TRANSFER CASE (STANDARD TYPE)

3. Install the sub-gear (23) to the counter gear (22).
4. Install the belleville spring (24).
5. Install the spacer (25) and put the snap ring (29) on the sub-gear (23).
6. Install the ball bearing (26), using a bench press.
7. Select a snap ring that will allow the minimum axial play.

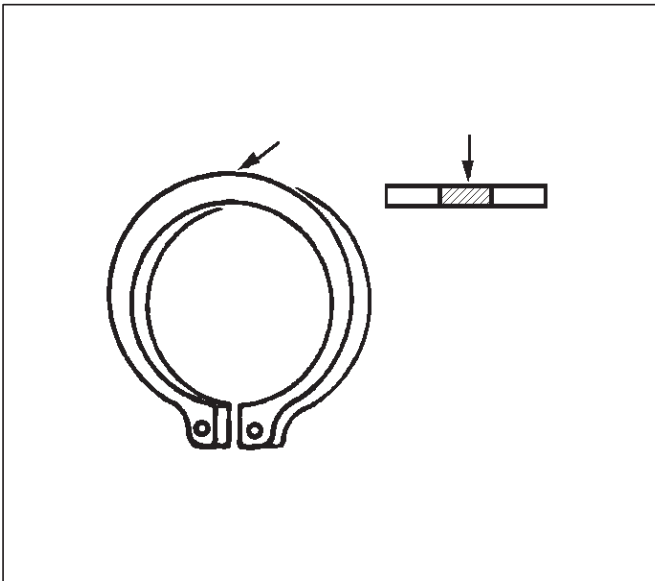
Clearance : 0-0.1 mm (0-0.004 in)

Snap ring availability:	
Thickness	Color-coding
1.50 mm (0.059 in)	White
1.55 mm (0.061 in)	Yellow
1.60 mm (0.063 in)	Blue

8. Use a pair of snap ring pliers to install the snap ring (27) to the counter gear (22).



226RS170

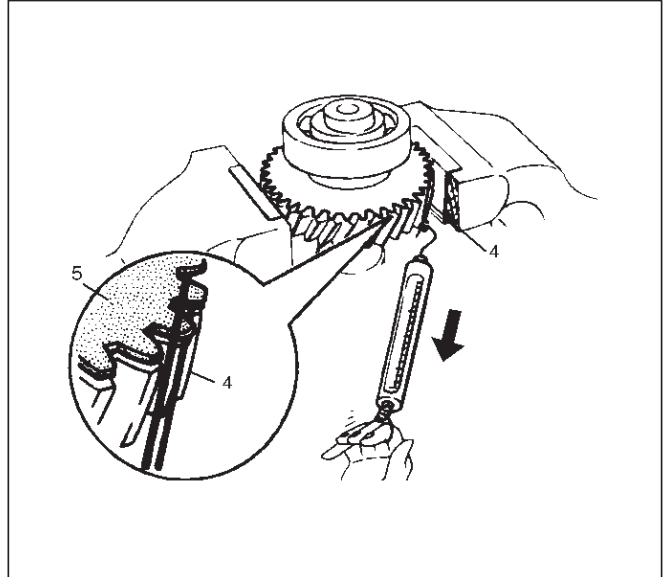


226RS021

Sub-Gear (anti-lash plate) Preload

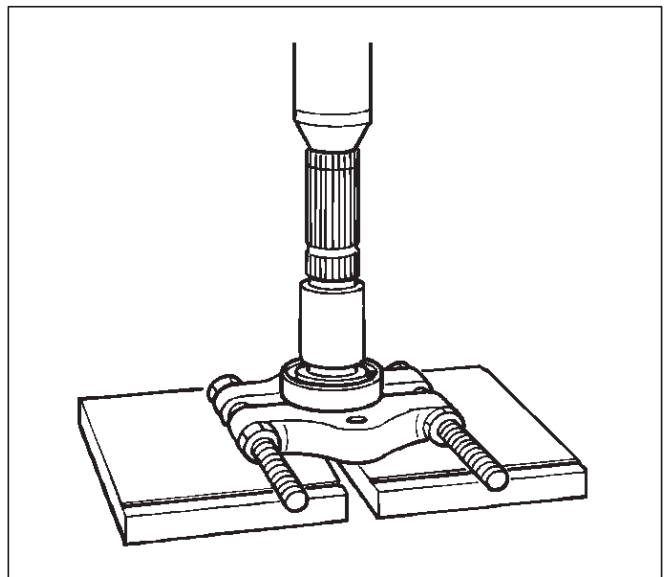
1. Hook a length of piano wire (4) over one of the sub-gear (5) teeth.
2. Attach the other end of the piano wire (4) to a spring balancer.
3. Measure the sub-gear preload.

Preload : 59-98 N (6.0-10kg/13-22 lb)



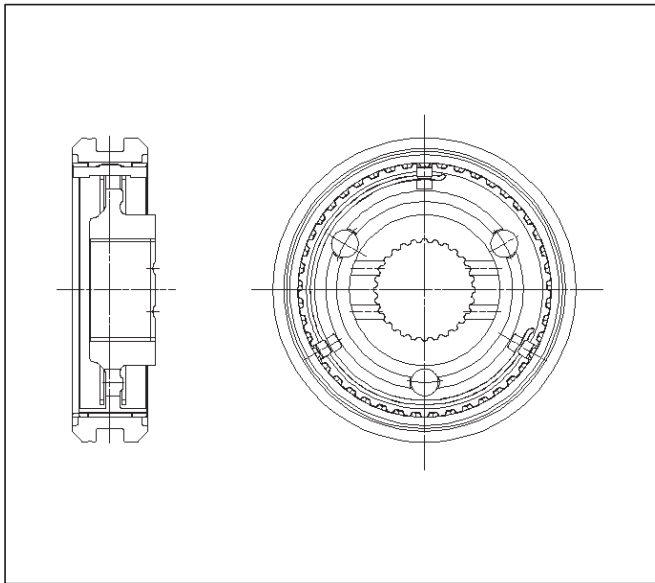
226RS075

9. Install ball bearing (21), using a bench press.
 10. Install snap ring (20).
 11. Install the counter gear assembly (28) to the transfer case (1).
 12. Use a pair of snap ring pliers to install the snap ring (29) to the transfer case (1).
- NOTE:** The snap ring must be fully inserted into the transfer case snap ring groove.
13. Use a bench press to install the ball bearing (4) to the front output shaft (5).



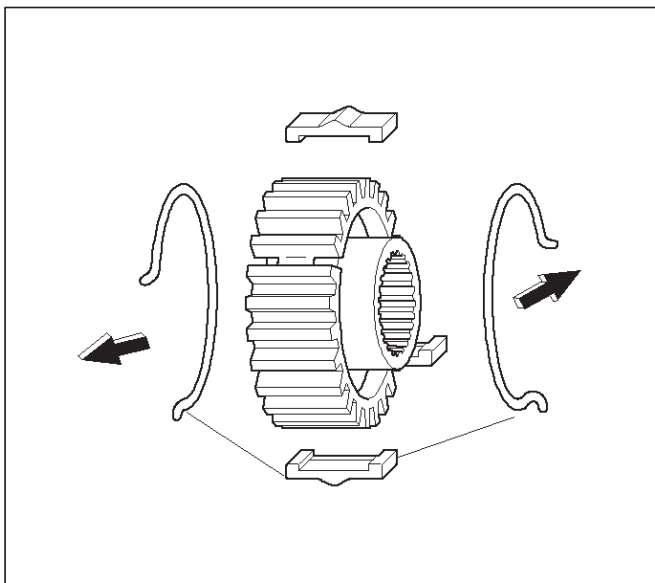
262RS012

14. Assemble the 2WD-4WD clutch hub and sleeve assembly (7).



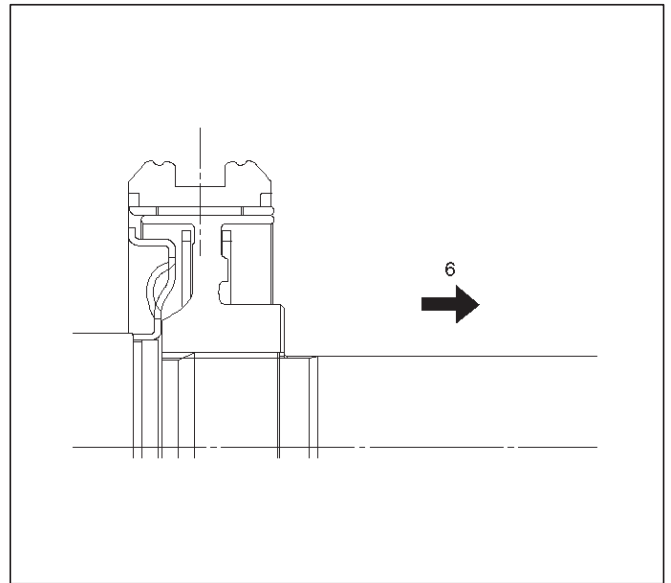
226RW140

15. Engage the springs in the same insert with the open ends away from each other. (Shift On The Fly model)



226RW141

16. Place the snap ring (2), a new stopper plate (6) (Shift On The Fly model) and the clutch sleeve and hub assembly (7) on the front output shaft (5).



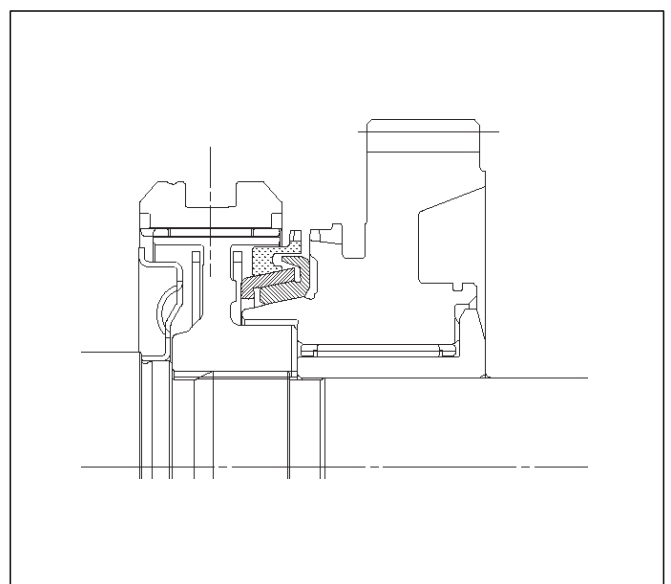
226RW135

Legend

(6) Front Output Gear

- 17. The clutch hub face (with the heavy boss) must be facing the front output gear side.
- 18. Use a bench press to slowly force the clutch hub and sleeve assembly (7) together with the stopper plate (6) (Shift On The Fly model) into place.
- 19. Align the inserts with the block ring insert grooves. Install the block ring (8) (Shift On The Fly model) to the clutch sleeve and hub assembly (7).
- 20. Install the outside ring (9) (Shift On The Fly model), inside ring (10) (Shift On The Fly model) and needle bearing (12) to the front output gear (11) and bearing collar (17).

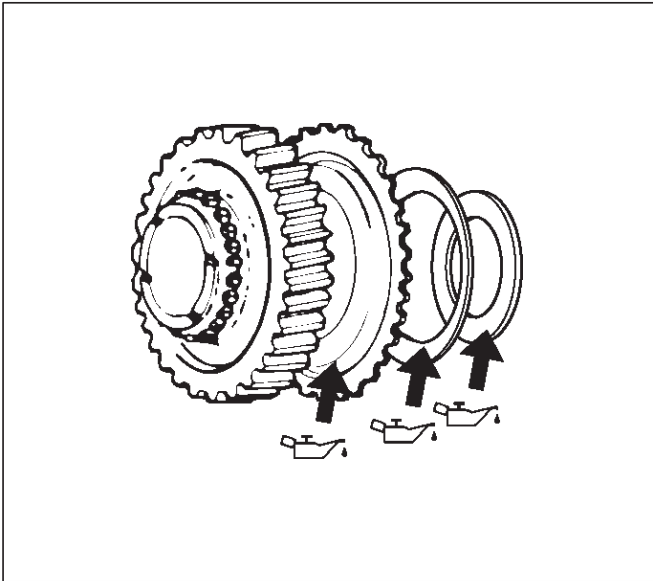
NOTE: Coat all parts with transmission oil before installing them.



226RW139

4D1-40 TRANSFER CASE (STANDARD TYPE)

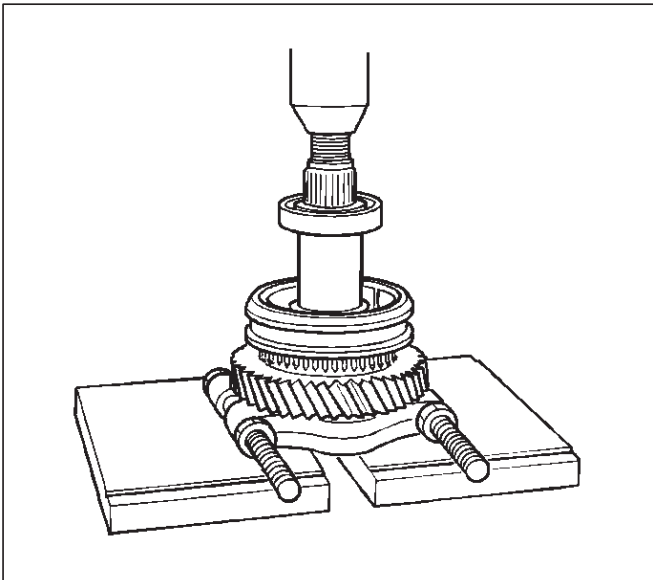
21. Apply engine oil to the thrust surfaces of the sub-gear (13), the belleville spring (14), and the spacer (15). (M/T)



22. Install the sub-gear (anti-lash plate) (13), belleville spring (14), and spacer (15) to the front output gear (11). (M/T)

23. Install the sub-gear snap ring (16). (M/T)

24. Use a bench press to install the needle bearing collar (17) together with the front output gear, aligning inside ring claw with block ring groove.



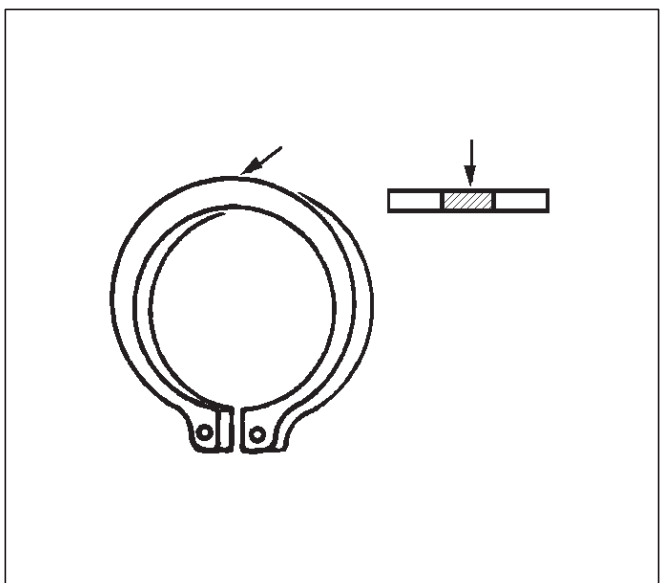
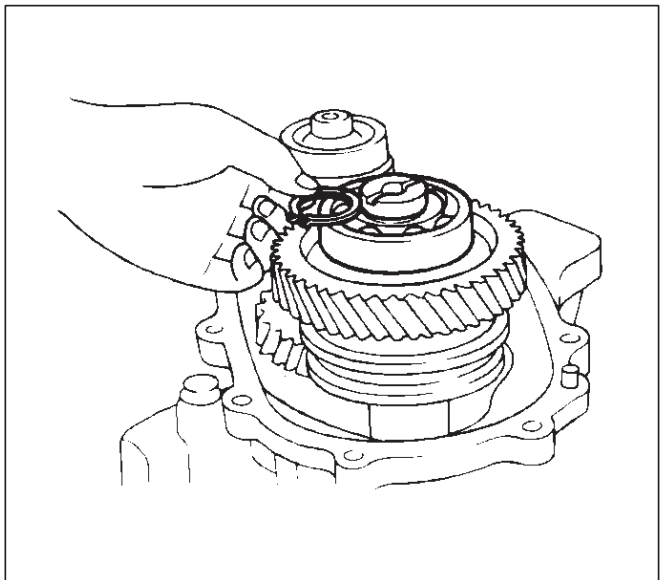
25. Install ball bearing (18), using a bench press.

26. Select a snap ring that will allow the minimum axial play.

Clearance : 0-0.1 mm (0-0.004 in)

Snap ring availability:

Snap ring thickness	Color coding
1.55 mm (0.061 in)	White
1.60 mm (0.063 in)	Yellow
1.65 mm (0.065 in)	Blue
1.70 mm (0.067 in)	Pink
1.75 mm (0.069 in)	Green
1.80 mm (0.071 in)	Brown
1.85 mm (0.073 in)	Red
1.90 mm (0.075 in)	Orange



TRANSFER CASE (STANDARD TYPE) 4D1-41

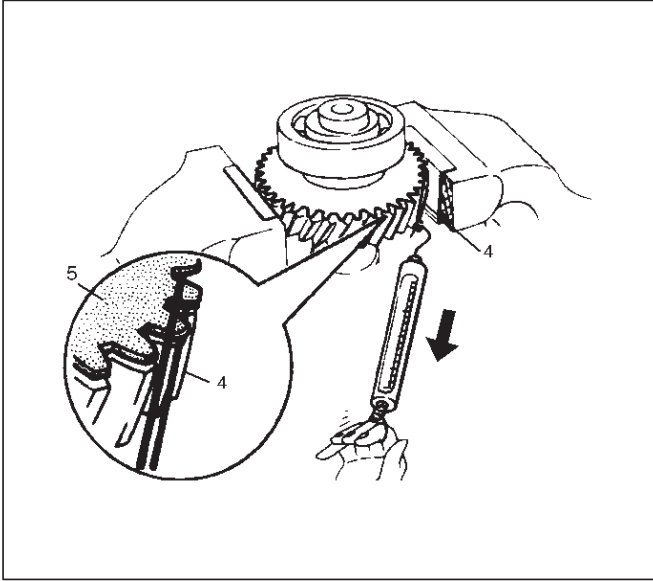
27. Use a pair of snap ring pliers to install the snap ring (19) to the output shaft (5).

Sub gear (anti lash plate) preload (M/T)

1. Hook a length of piano wire (4) over one of the sub-gear (5) teeth.
2. Attach the other end of the piano wire to (4) a spring balancer.
3. Measure the sub-gear preload.

Preload: 59–98 N (6.0–10.0kg/13–22 lb)

(M/T)

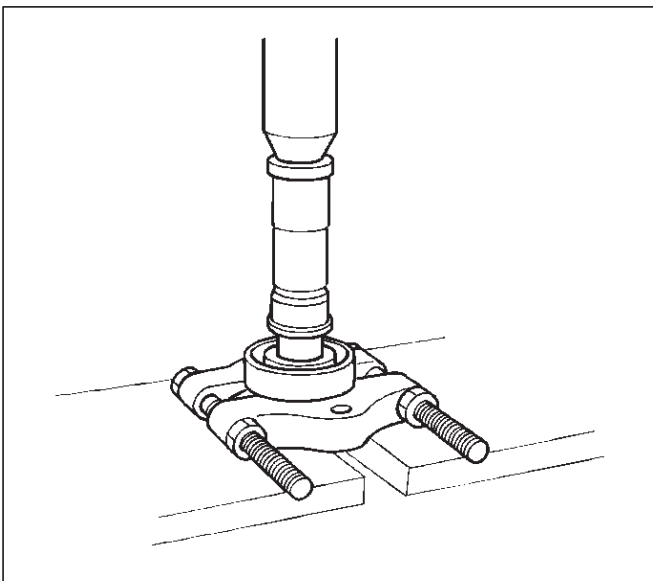


28. Install front output gear assembly (3) to the transfer case (1).

29. Use a pair of snap ring pliers to install the snap ring (2) to the transfer case (1).

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

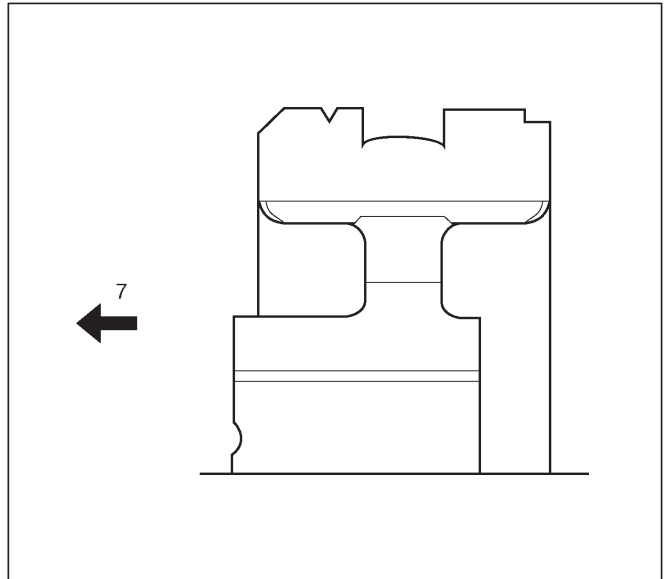
30. Use a bench press to install the ball bearing (32) to the input shaft (31).



31. Install the plate (34), ball (35), and bearing collar (36) and place the snap ring (33).

32. Install the needle bearing (37) and input gear (38).

33. The clutch hub face (with the heavy boss) must be facing the transfer input gear side (7).



34. Install the high-low clutch hub and sleeve (39), using a bench press.

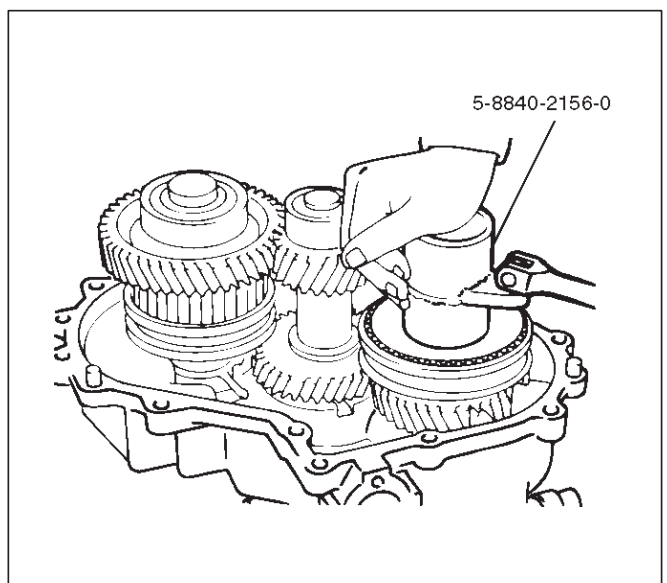
35. Install the input shaft assembly (30) to the transfer case (1).

36. Install the snap ring (33) to the transfer case (1).

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

37. Install the front companion flange temporarily and use the flange holder 5-8840-0133-0 (J-8614-11) and lock nut wrench 5-8840-2156-0 (J-37219) to install the lock nut (40).

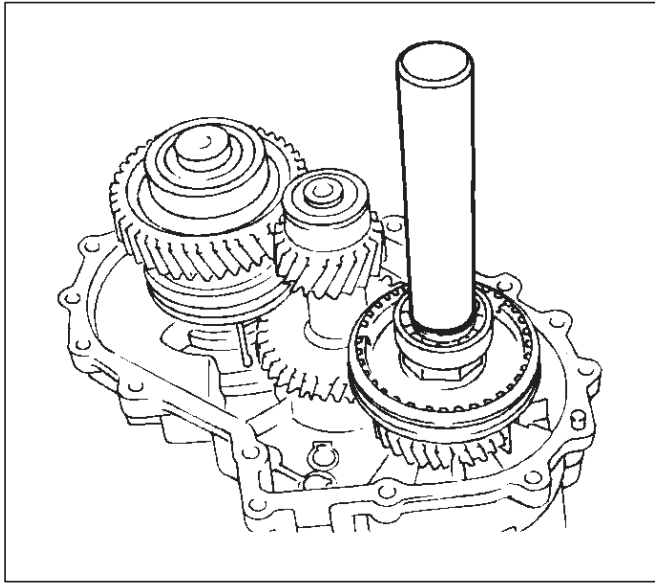
Torque: 137 N·m (14.0kg·m/101 lb ft)



38. Use the punch to stake the lock nut (40) at one spot.

4D1-42 TRANSFER CASE (STANDARD TYPE)

39. Use a suitable drift and hammer to install the ball bearing (41).



40. Install the bearing snap ring (42).

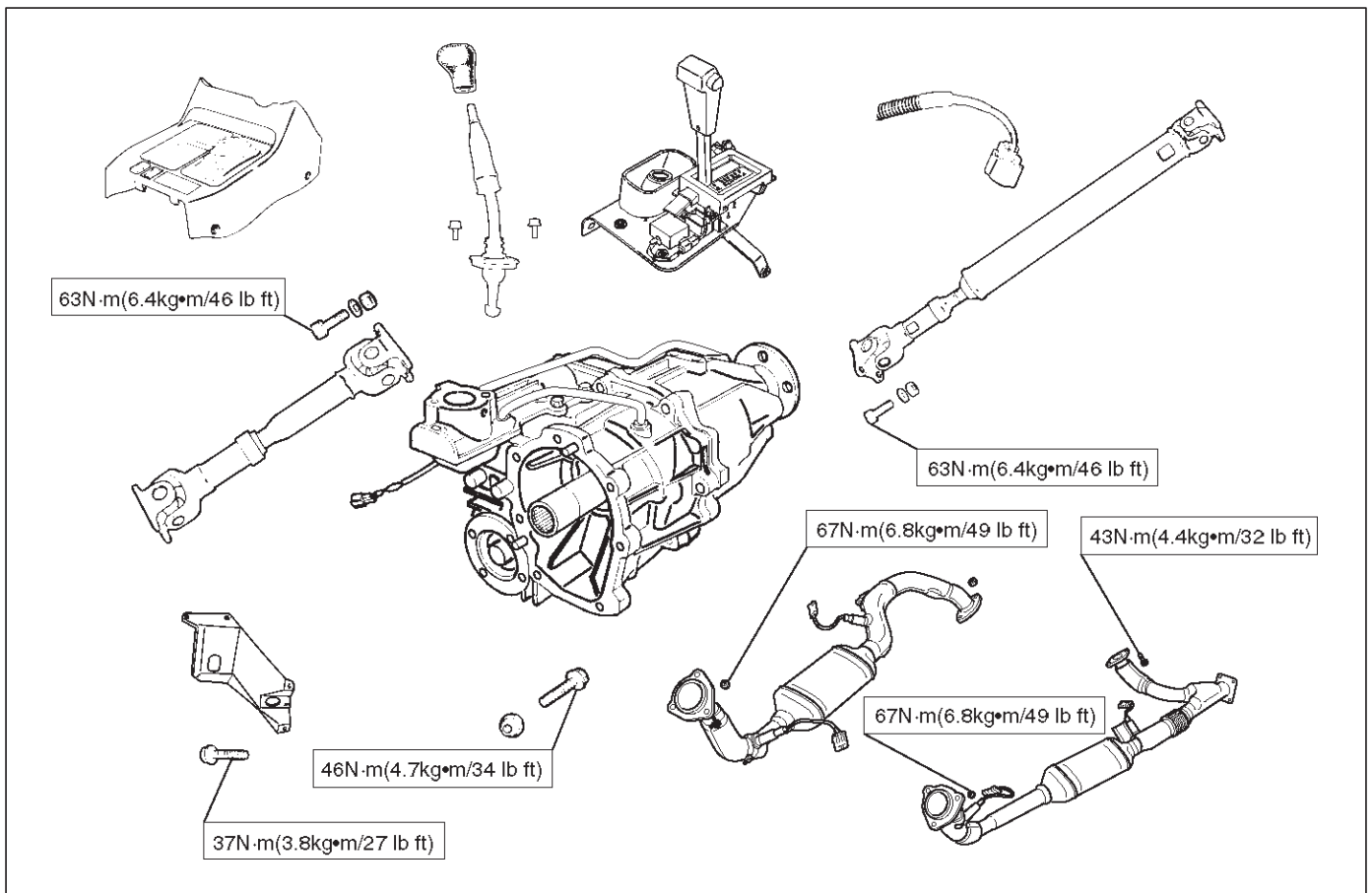
226RS079

Main Data and Specifications

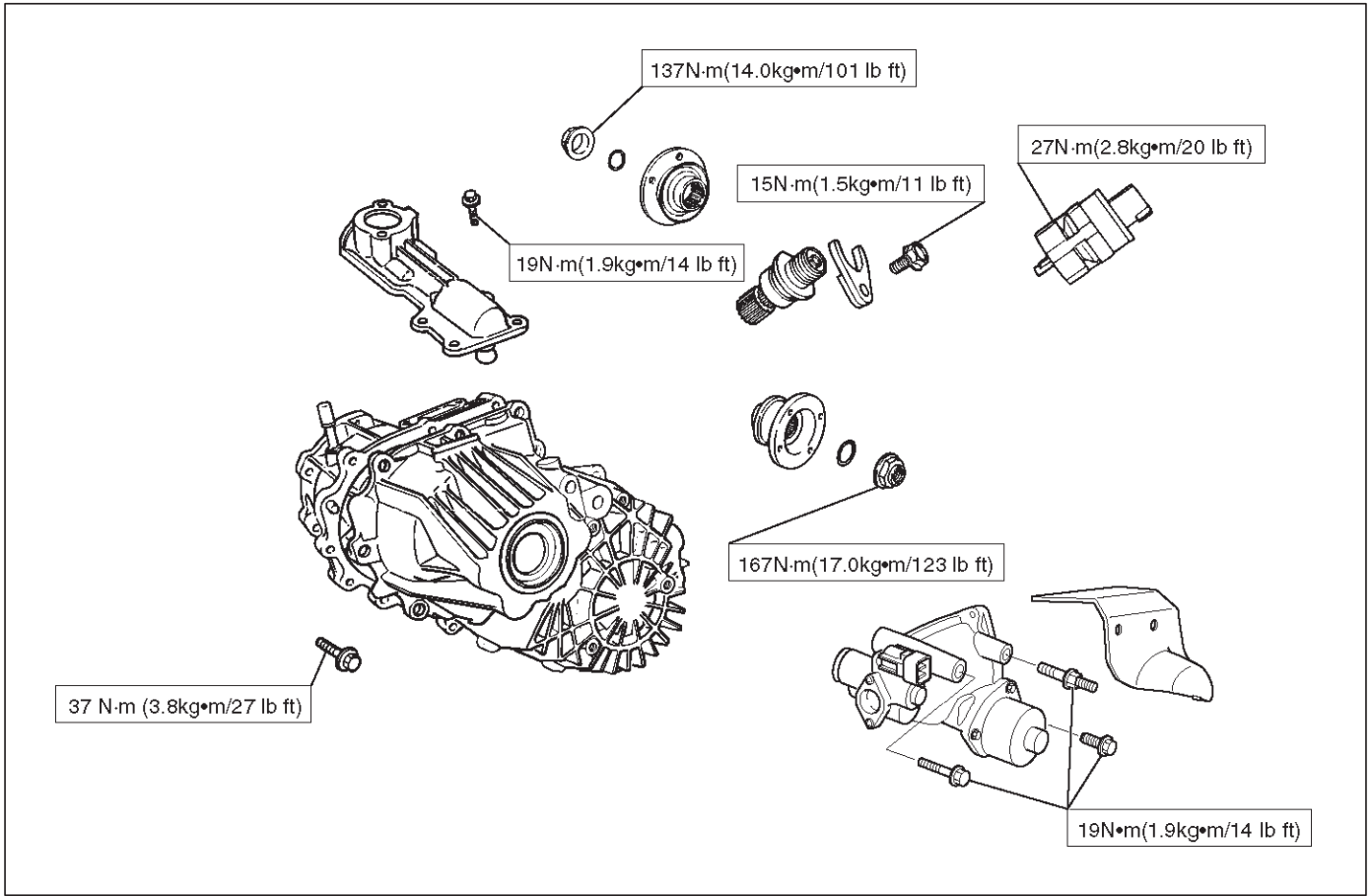
General Specifications

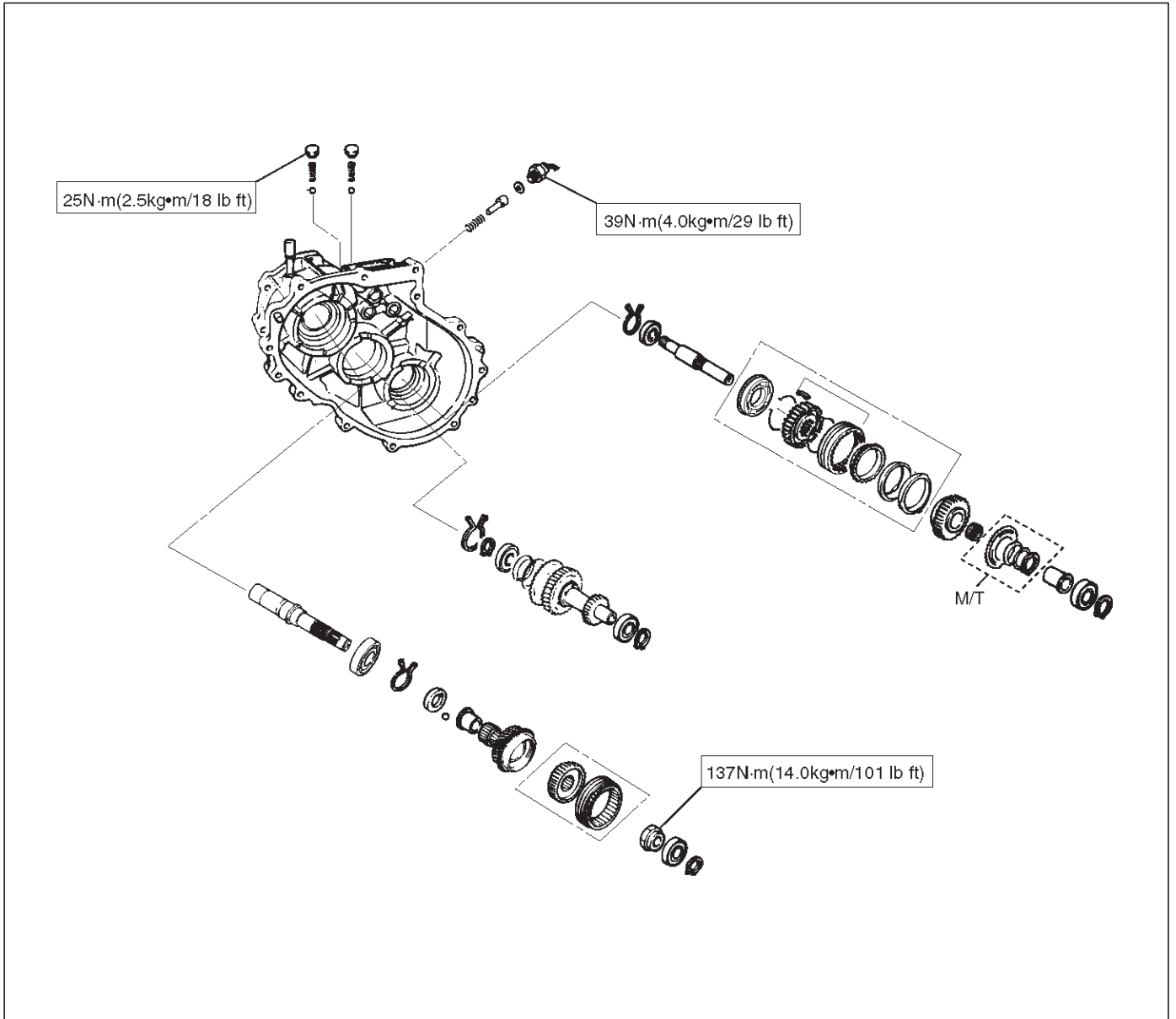
Type	W/Shift On The Fly System model Synchronized type gears shifting between the 2 and 4 wheel drive mode. Constant mesh type gears shifting between "low" and "high". WO/Shift On The Fly System model Constant mesh type gears shifting between the 2 and 4 wheel drive mode, and between "low" and "high".
Control method	W/4WD Switch model Electric control with the button switch on the instrument panel for gear shifting between the 2 and 4 wheel drive mode. Remote control with the gear shift lever on the floor for gear shifting between "low and high" . WO/4WD Switch model Remote control with the gear shift lever on the floor for gear shifting.
Gear ratio	High; 1.000 Low; 2.050
Oil capacity	1.45 lit. (1.53 U.S. quart)
Type of lubricant	Engine oil Refer to chart in Section 0

Torque Specifications



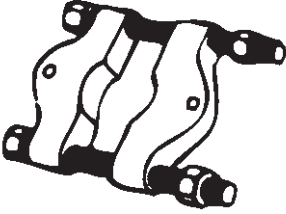
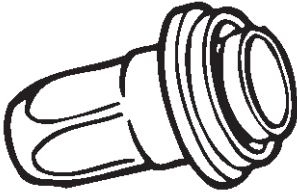
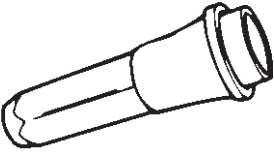
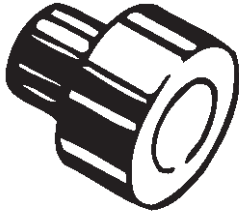
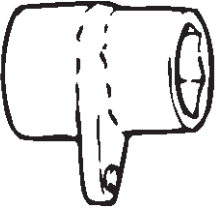
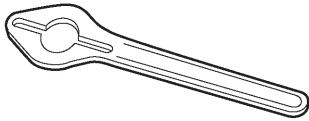

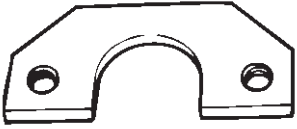
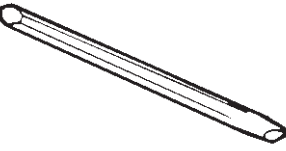
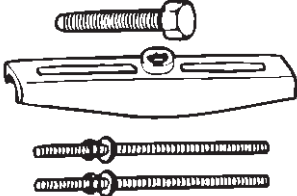

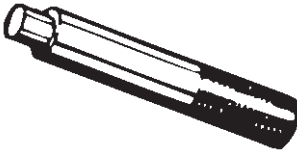
4D1-44 TRANSFER CASE (STANDARD TYPE)





4D1-46 TRANSFER CASE (STANDARD TYPE)

Special Tools

ILLUSTRATION	PART NO. PART NAME	ILLUSTRATION	PART NO. PART NAME
 <p style="text-align: right; font-size: small;">901RS268</p>	<p>5-8840-0015-0 (J-22912-01) Bearing remover/installer</p>	 <p style="text-align: right; font-size: small;">901RS272</p>	<p>5-8840-2292-0 (J-39208) Rear oil seal installer</p>
 <p style="text-align: right; font-size: small;">901RS269</p>	<p>5-8840-2279-0 (J-38592) Transfer case oil seal installer</p>	 <p style="text-align: right; font-size: small;">901RS273</p>	<p>5-8840-2192-1 (J-37486-A) Bearing installer adapter</p>
 <p style="text-align: right; font-size: small;">901RS265</p>	<p>5-8840-2156-0 (J-37219) Mainshaft nut wrench</p>	 <p style="text-align: right; font-size: small;">901RW071</p>	<p>5-8840-0133-0 (J-8614-11) Flange holder</p>
 <p style="text-align: right; font-size: small;">901RS267</p>	<p>5-8840-2159-0 (J-37223) Rear output shaft and bearing installer</p>	 <p style="text-align: right; font-size: small;">901RS274</p>	<p>5-8840-2155-0 (J-37217) Mainshaft end bearing remover</p>
 <p style="text-align: right; font-size: small;">901RS263</p>	<p>5-8840-2293-0 (J-39209) Punch, end nut</p>	 <p style="text-align: right; font-size: small;">901RS262</p>	<p>5-8840-2027-0 (J-37487) Puller</p>
 <p style="text-align: right; font-size: small;">901RS271</p>	<p>5-8840-2281-0 (J-38594) Front output shaft oil seal installer</p>	 <p style="text-align: right; font-size: small;">901RS266</p>	<p>5-8840-0007-0 (J-8092) Driver handle</p>

DRIVELINE/AXLE

TRANSFER CASE (TOD)

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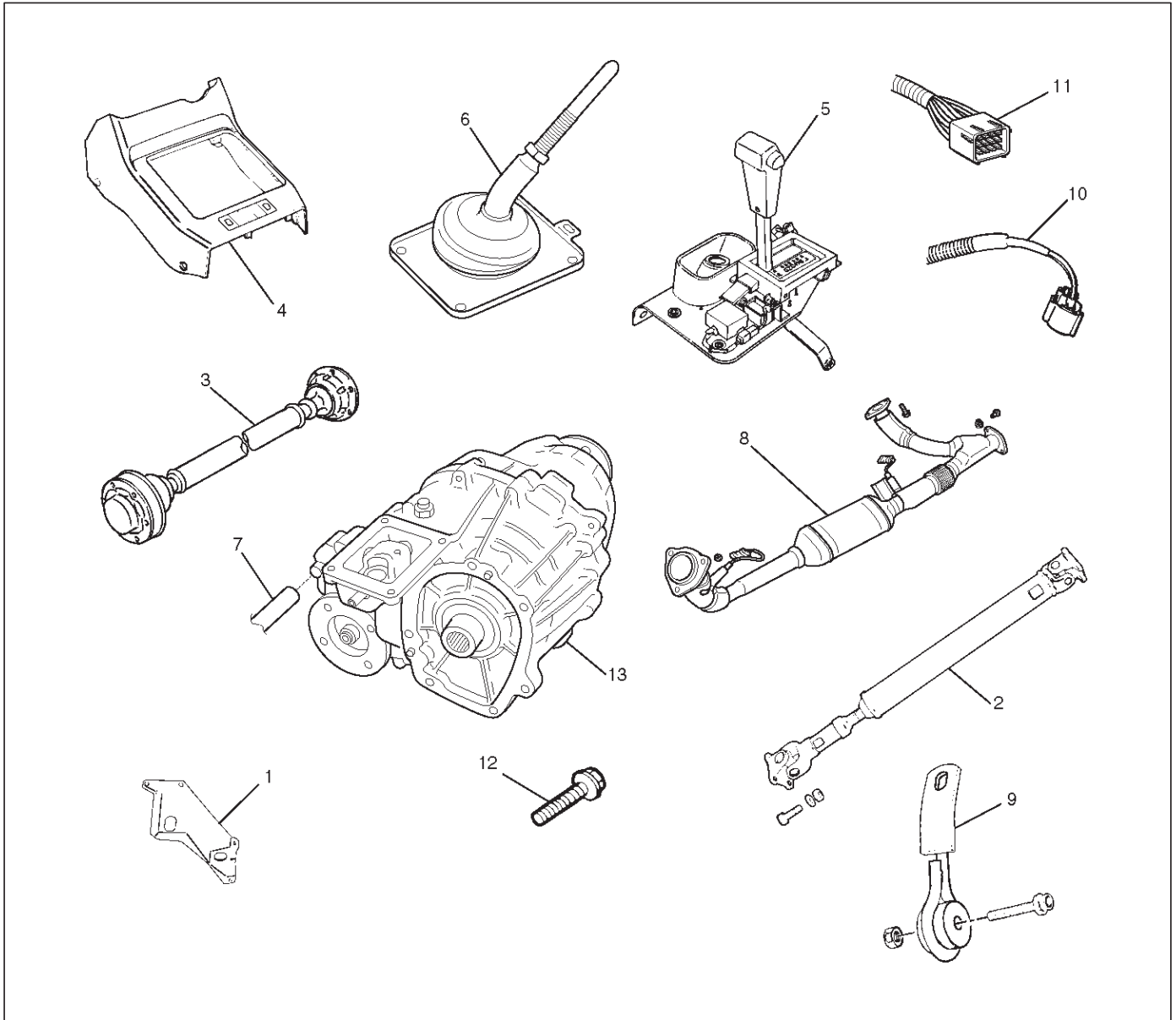
Service Precaution

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

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

Transfer Case Assembly

Removal



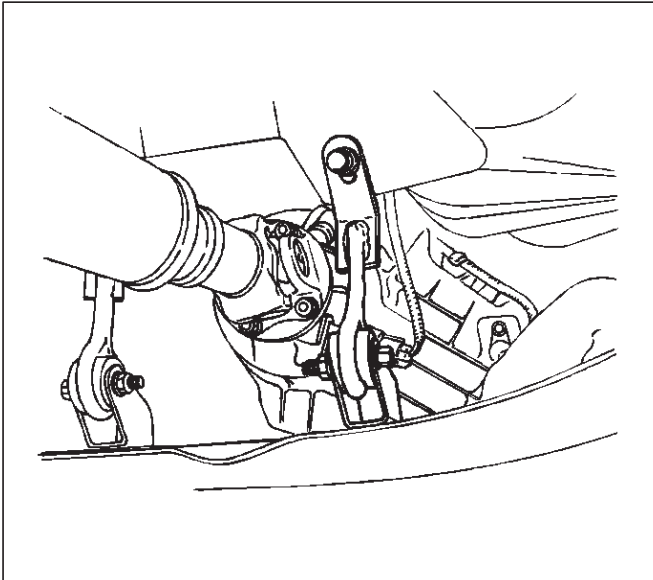
F07RW083

Legend

- | | |
|------------------------------|---------------------------|
| (1) Front Propeller Shaft | (7) Exhaust Pipe |
| (2) Front Console | (8) Rear Propeller Shaft |
| (3) Transfer Control Lever | (9) Seat Belt Tension Rod |
| (4) Selector Lever Assembly | (10) Transfer Case Bolt |
| (5) Transfer Connector | (11) Transfer Protector |
| (6) Wiring Harness Connector | (12) Breather Hose |
| | (13) Transfer Case |

1. Disconnect the ground cable.
2. Remove the transfer protector.
3. Remove the rear propeller shaft from the transfer case.
4. Remove the front propeller shaft from the transfer case.
5. Remove the shift control rod from the select lever assembly.

6. Disconnect the wiring harness connector and shift lock cable and then remove the front console.
7. Remove the selector lever assembly and put it aside.
8. Remove the transfer control lever.
9. Disconnect the breather hose.
10. Remove the left front exhaust pipe fixing bolts and nuts, and put the exhaust pipe aside.
11. Remove the left seat belt tension rod and put the rear proper shaft aside.



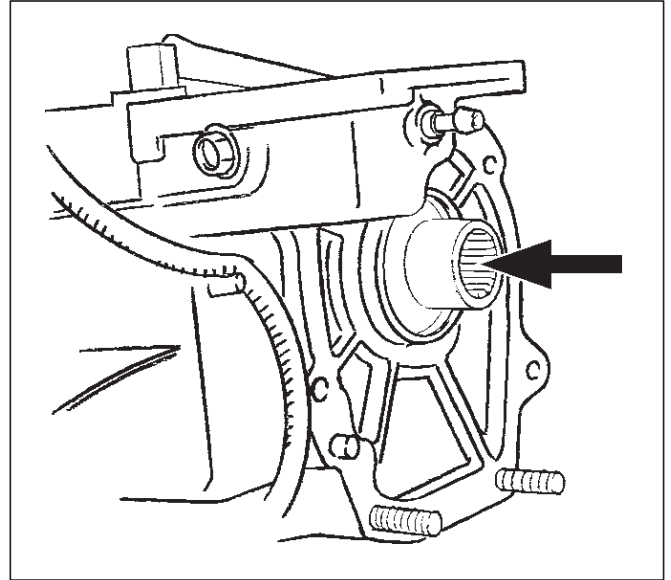
260RW006

12. Remove the silencer.
13. Disconnect the transfer connector from the top of the transfer case.
14. Disconnect the speed sensor harness connector.
15. Remove the fuel pipe clip fixing bolt on the transfer case.
16. Support the transmission with a jack.
17. Remove the seven bolts from the transfer case.
18. Remove transfer case assembly.

Installation

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

1. Apply a thin coat of grease (Besco L2) or equivalent to the input shaft spline.



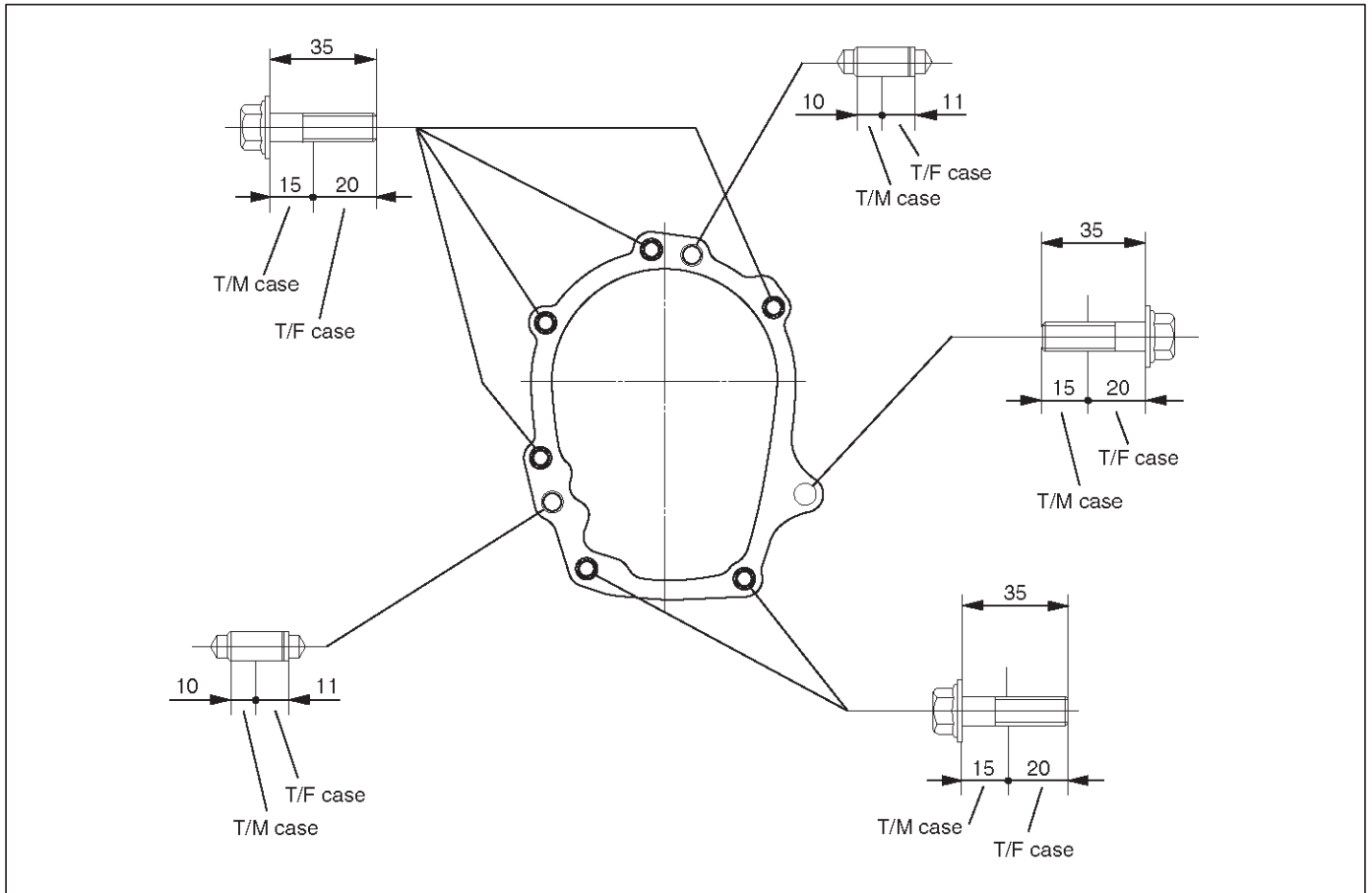
261RW024

2. Mount the transfer case.

4D2-4 TRANSFER CASE (TOD)

3. Tighten the transfer case bolts (see the figure below).

Torque : 46 N·m (4.7 kg·m/34 lb ft)



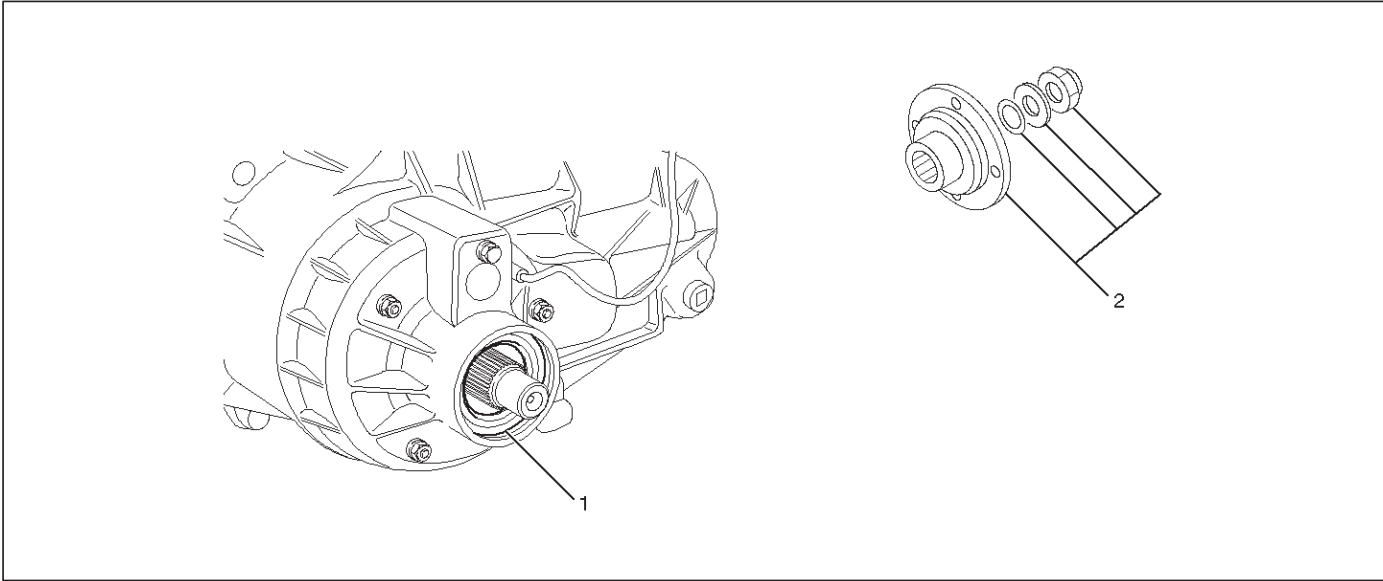
261RW004-1

4. Tighten the propeller shaft bolts.

Torque : 63 N·m (6.4 kg·m/46 lb ft)

Transfer Rear Oil Seal

Transfer Rear Oil Seal and Associated Parts



261RW005

Legend

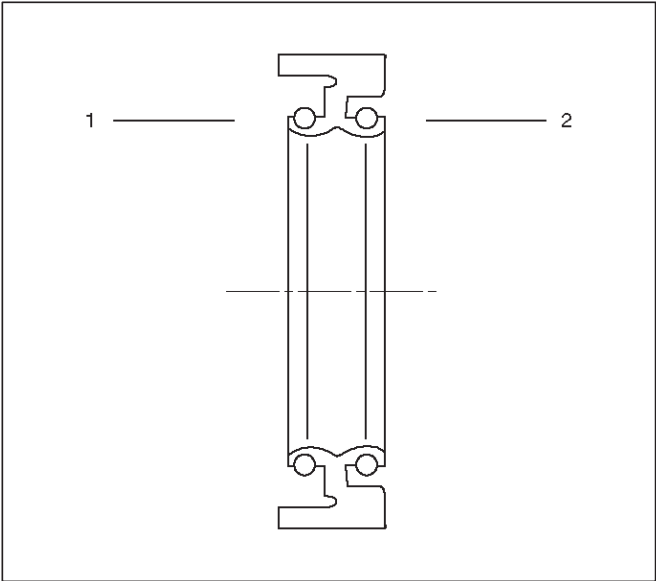
- (1) Oil Seal
- (2) End Nut and Rear Companion Flange

Removal

1. Remove the rear propeller shaft from the transfer case.
2. Using the flange holder 5-8840-0133-0 (J-8614-11), remove the end nut.
3. Using the universal puller, remove the rear companion flange, washer and O-ring.
4. Remove the oil seal from the transfer rear case.

Installation

1. Apply engine oil to the oil seal outer surfaces. Fill the oil seal lip with grease (Besco L2).



261RW006

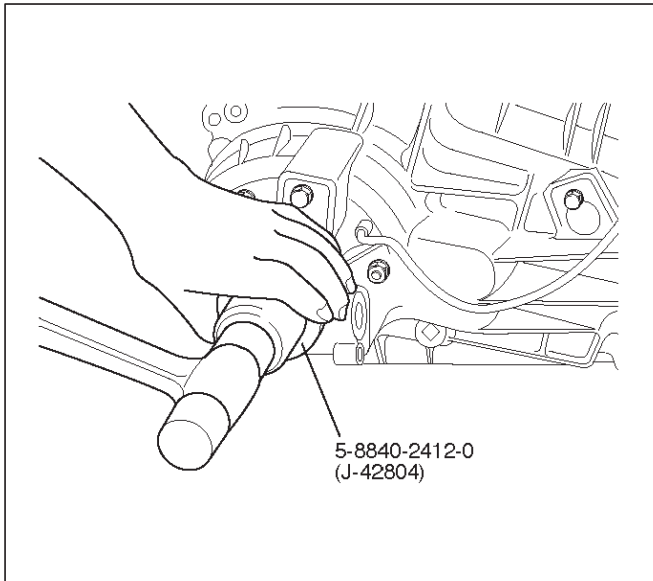
Legend

- (1) Inside
- (2) Outside

4D2-6 TRANSFER CASE (TOD)

- Using the oil seal installer 5-8840-2412-0 (J-42804), install the oil seal.

NOTE: When installing the oil seal, pay attention to the direction.



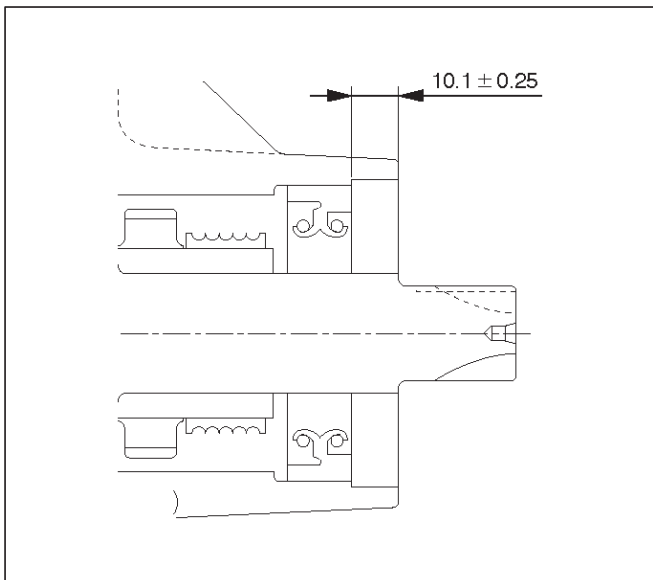
261RW051

Rear Output Shaft Oil Seal

Distance between the transfer case end and oil seal.

NOTE: When installing the oil seal to the specified dimension, be careful not to damage it.

Distance : 9.85 — 10.35mm (0.39 — 0.41 in)



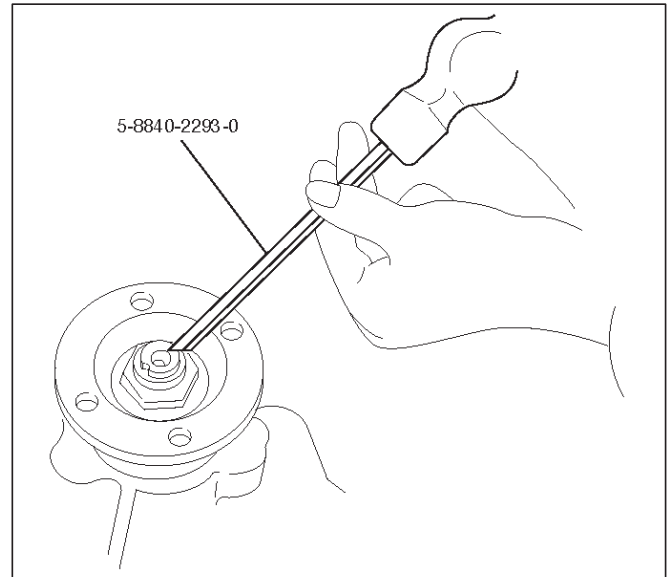
A04RW004

- Mount the rear companion flange, O-ring, washer, and nut to the transfer case in this order.
- Using the flange holder 5-8840-0133-0 (J-8614-11), install a new end nut.

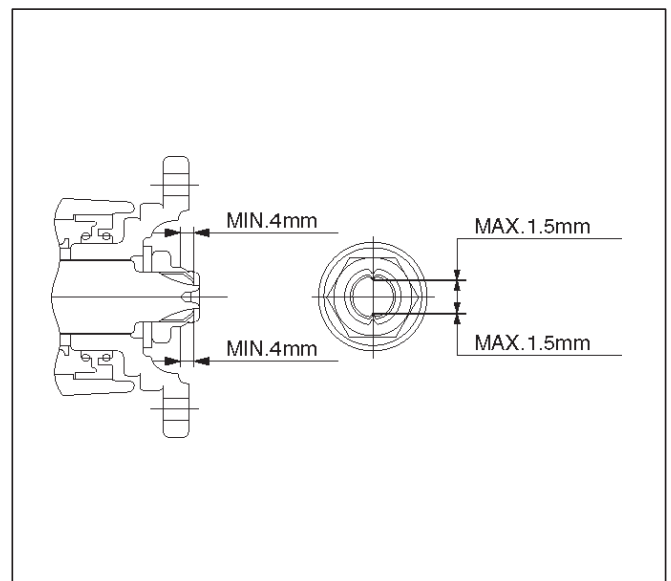
Torque : 167 N-m (17 kg-m /123 lb ft)

- Using the punch 5-8840-2293-0 (J-39209), stake the end nut at two spots.

NOTE: Check the staked end nut is free from cracks.



266RW028



260RW007

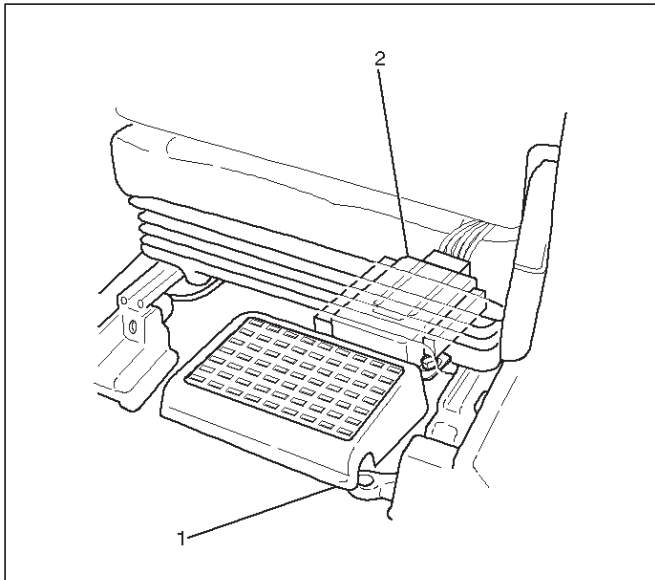
- Install the rear propeller shaft to the transfer case and tighten to the specified torque.

Torque : 63 N-m (6.4 kg-m /46 lb ft)

TOD ECU

Removal

1. Disconnect the ground cable.
2. Move the right-hand seat forward and remove the second seat foot rest (1).
3. Disconnect the connector from the ECU (2).
4. Remove the bolts and detach the ECU (2) from the bracket.



F07RW021

Installation

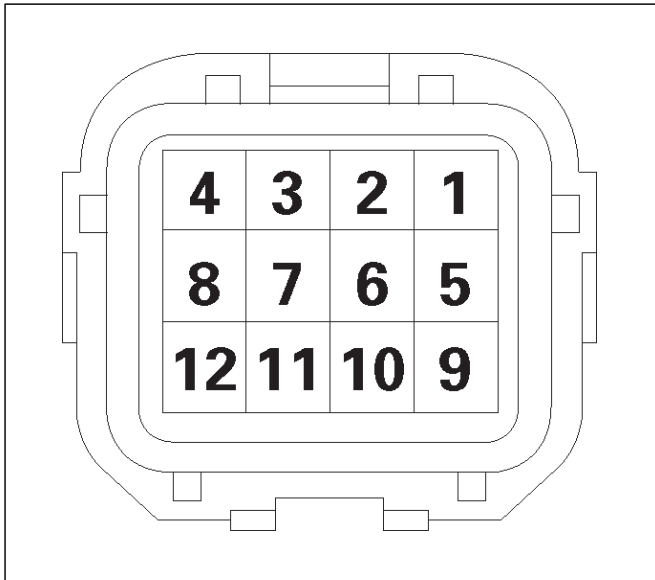
1. Perform the removal step in reverse order.

Unit Repair

Inspection

Before disassembling and after assembling, check the following items on the transfer connector terminals.

No.	NAME	CONTENTS
1	Ref . (Ref .)	Rear speed sensor reference output
2	Ref . (Frt .)	Front speed sensor reference output
3	SW GND	SW GND
4	4H SW (+)	4H SW plus terminal
5	Rer . (+)	Rear speed sensor plus
6	Frt . (+)	Front speed sensor plus
7	POWER GND	Power GND
8	SOL (+)	Electromagnetic solenoid
9	COM (-) (Ref .)	Rear speed sensor GND
10	COM (-) (Frt .)	Front speed sensor GND
11	NC	
12	4L SW (+)	4L SW plus terminal



810RW002

4H and 4L switches

Check whether the 4H switch (terminals 4 and 7) and 4L switch (terminals 12 and 3) work as specified in the table below. If yes, the continuity is established on these switches. If not, check the switches, shift rails, transfer case, and rear cover, and replace the failed parts.

SHIFT POSITION	PIN 4 (4 to 7)	PIN 12 (3 to 12)
HIGH	OFF	OFF
(NEUTRAL)	ON	ON
4L	OFF	ON

Power GND

Check that there is a continuity between the power GND pin (terminal 7) and transfer case. If not, replace the grounding wire.

Resistance of electromagnetic coil

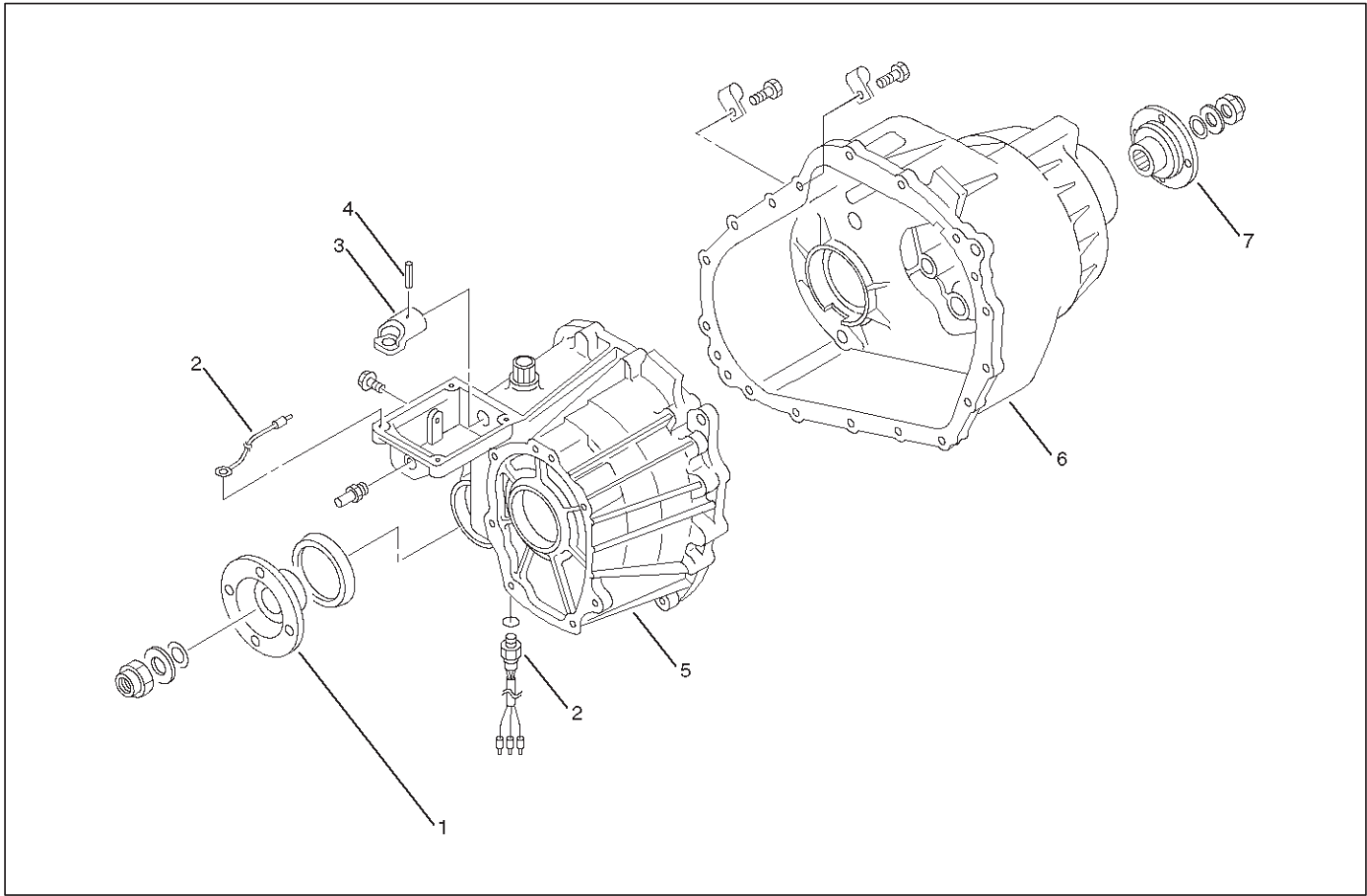
Check the resistance between electromagnetic clutch solenoid (terminal 8) and power GND (terminal 7). If not, replace the electromagnetic coil.

Standard : 1.4 ~ 2.0 δ

Allowable : 1.0 ~ 5.0 δ

Transfer Case

Disassembled View



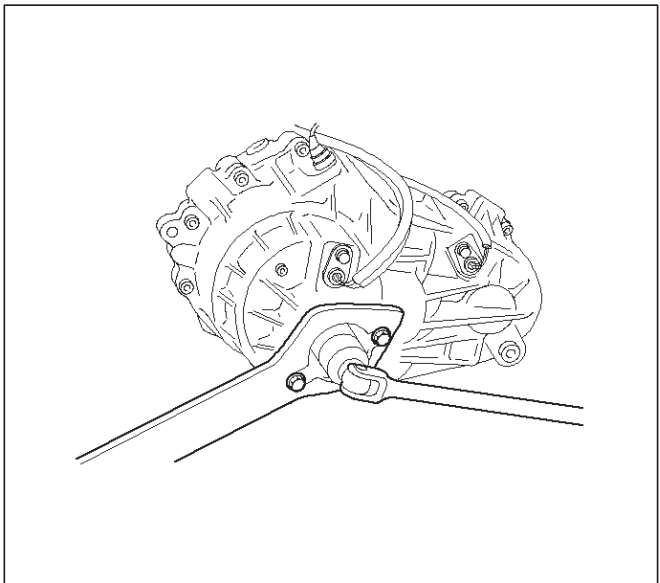
266RW004

Legend

- | | |
|--|-----------------------------|
| (1) Front Companion Flange | (4) Spring Pin |
| (2) 4H and 4L Switch, Ground Cable, and Center Connector | (5) Transfer Case Assembly |
| (3) Offset Lever | (6) Transfer Cover Assembly |
| | (7) Rear Companion Flange |

Disassembly

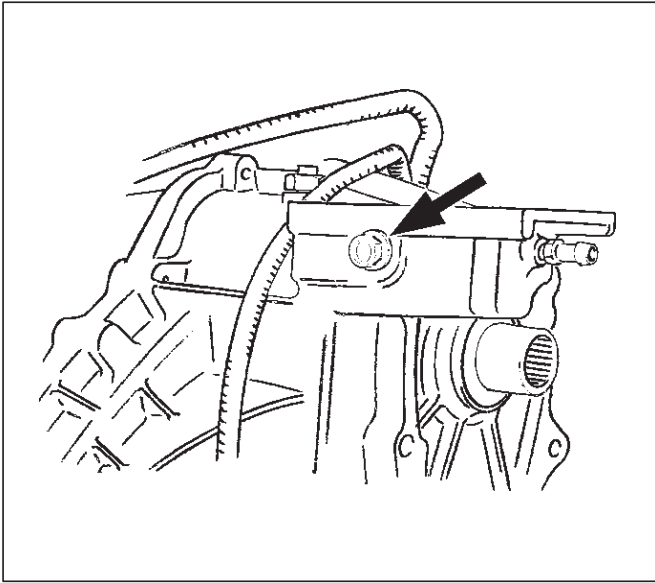
1. Remove the drain plug from the transfer case and drain the oil.
2. Disconnect the 4H and 4L switch and ground cable.
3. Remove the clip fixing the harness.
4. Using the flange holder 5-8840-0133-0 (J-8614-11), remove the flange nut, and remove front companion flange.
5. Using the flange folder 5-8840-0133-0 (J-8614-11), remove the flange nut, and remove rear companion flange.



266RW005

4D2-10 TRANSFER CASE (TOD)

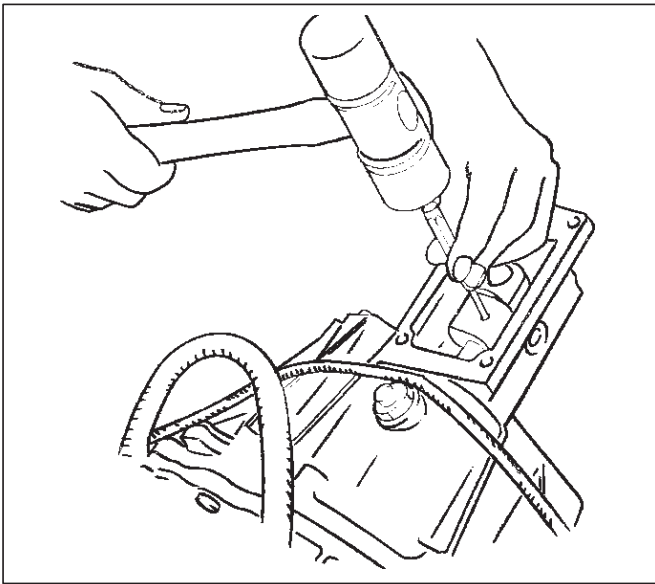
6. Remove the offset lever set bolt on the right side.



261RW015

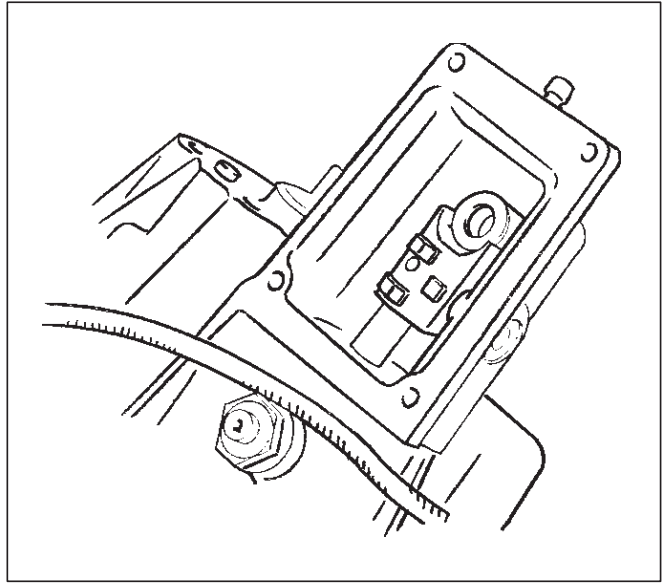
7. Remove the offset lever lock spring pin.

NOTE: When removing the spring pin, note the recess position of the pin.



261RW016

8. Remove the offset lever.



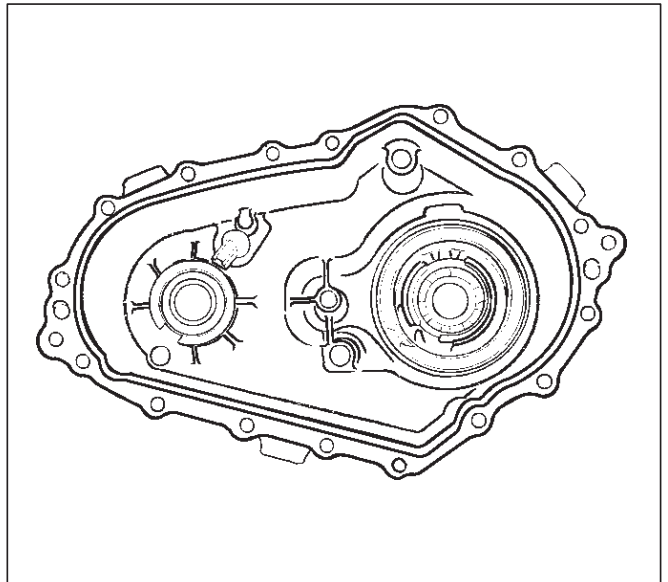
261RW017

9. Remove the sixteen bolts and detach the transfer cover assembly from the transfer case assembly.

NOTE: When removing the transfer cover assembly, be careful not to damage the oil seal.

Reassembly

1. Apply liquid gasket (Loctite 598 or equivalent) uniformly to the mating face that contacts the transfer case.



261RW023

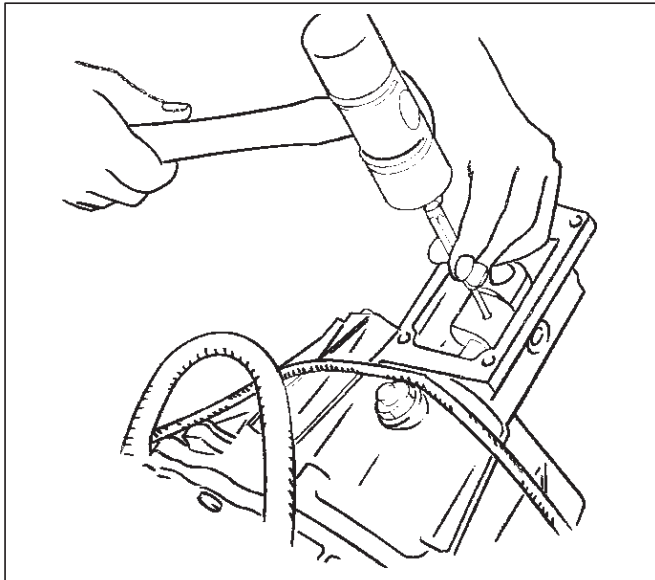
2. Tighten the sixteen bolts to the specified torque.

Torque : 31 N·m (3.2 kg·m/23 lb ft)

3. Wind the sealing tape around the drain plug thread and tighten the plug to the specified torque.

Torque : 25 N·m (2.5 kg·m/18 lb ft)

4. Mount the offset lever to the transfer shift and install the spring pin.



5. Attach the O-ring and washer to the companion flange.

NOTE: Securely push the O-ring to the hollow of the companion flange, and then attach the washer.

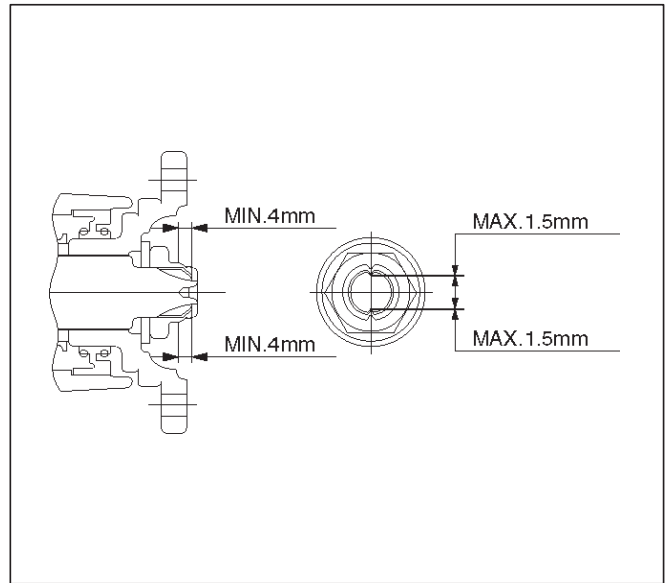
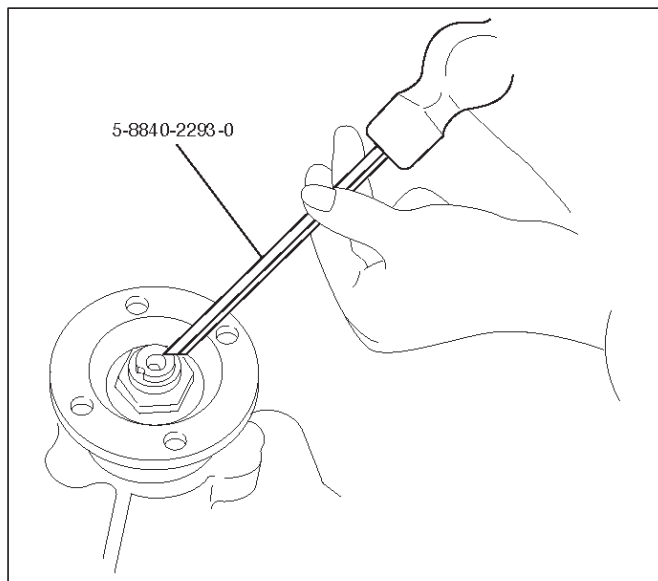
6. Use the flange holder 5-8840-0133-0 (J-8614-11) to tighten the flange nut.

7. Tighten the flange nut to the specified torque.

Torque : 167 N·m (17.0 kg·m/123 lb ft)

8. Using the punch 5-8840-2293-0 (J-39209), securely stake the flange nut at two spots.

NOTE: Check the staked flange nut is free from cracks.



9. Fix the harness with the clip.

10. Tighten the 4L and 4H switch to the specified torque.

Torque : 24 N·m (2.4 kg·m/17 lb ft)

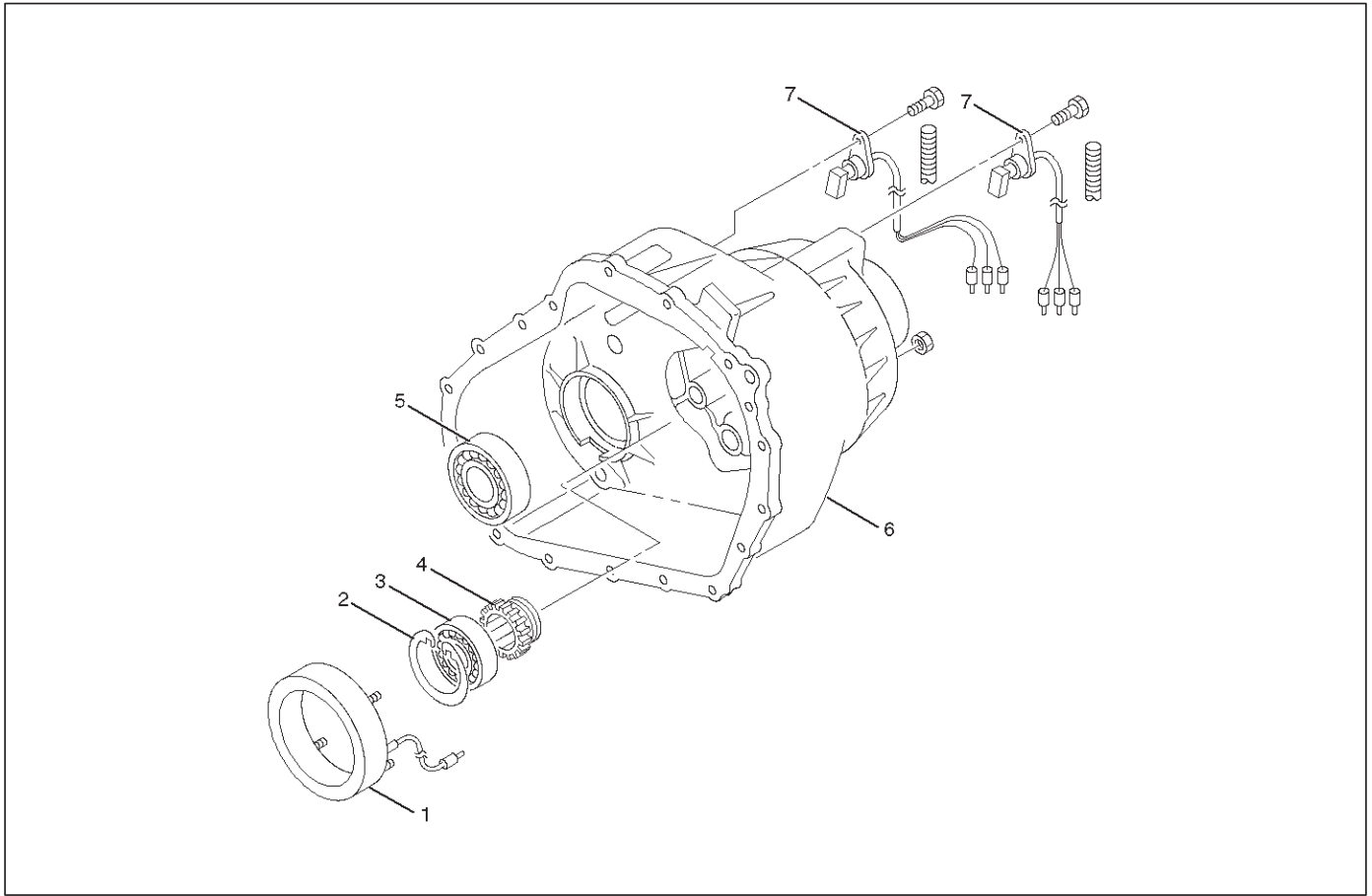
11. Fill the transfer case with ATF II or III (1.9 liters).

12. Wind the sealing tape around the filler plug thread and tighten the plug to the specified torque.

Torque : 25 N·m (2.5 kg·m/18 lb ft)

Transfer Cover Assembly

Disassembled View



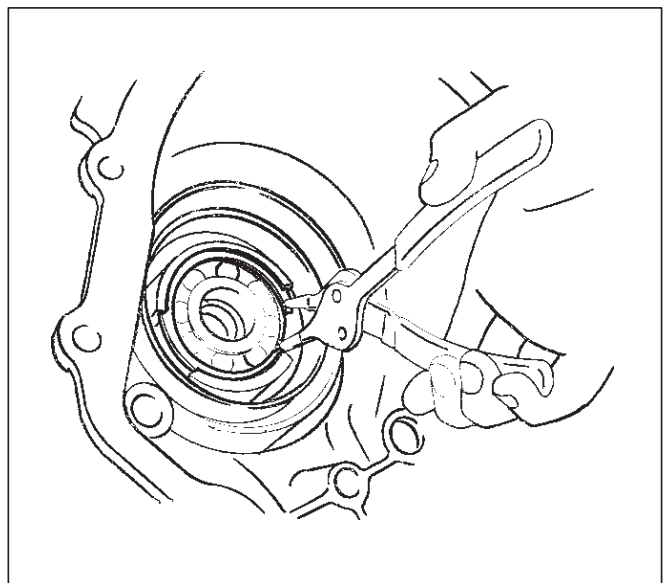
261RW007

Legend

- | | |
|-------------------|----------------------------------|
| (1) Coil Assembly | (4) Speed Gear and Tone Wheel |
| (2) Snap Ring | (5) Ball Bearing |
| (3) Ball Bearing | (6) Transfer Cover Assembly |
| | (7) Front and Rear Speed Sensors |

Disassembly

1. Using snap ring pliers, remove the snap ring.

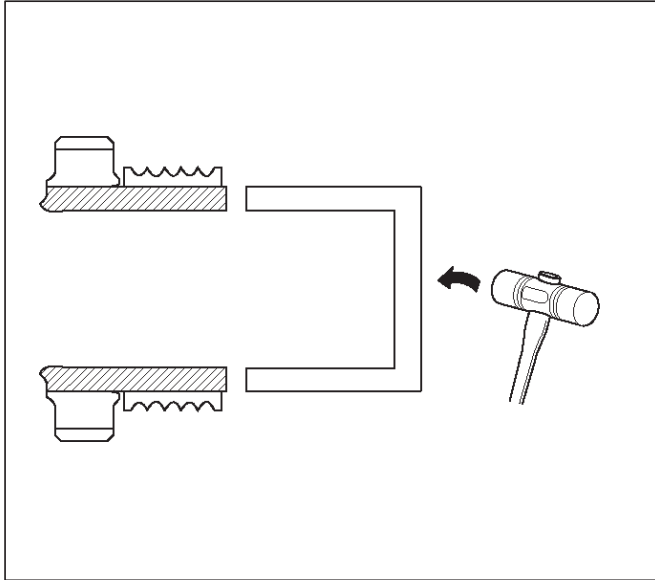


261RW047

TRANSFER CASE (TOD) 4D2-13

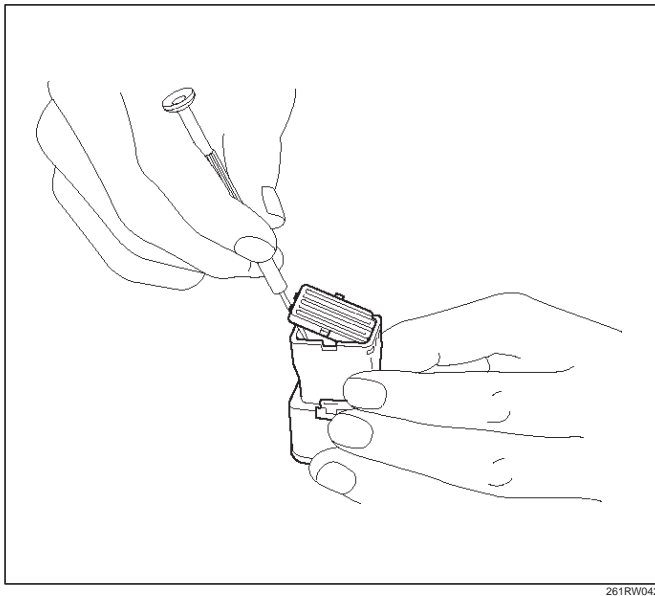
2. Strike the speed gear and tone wheel with a rod or other appropriate tool from the outside of the transfer cover assembly, and remove the ball bearing and speed gear and tone wheel.

NOTE: Be careful not to damage the speed gear teeth.



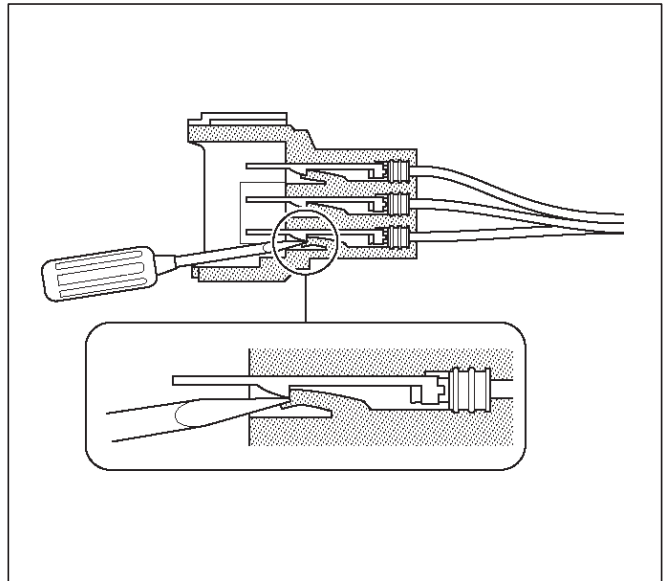
3. Remove the stopper plate on the back with a precision screwdriver or other appropriate tool starting from the small lock of the plate.

NOTE: Be careful not to damage the stopper plate during the work.

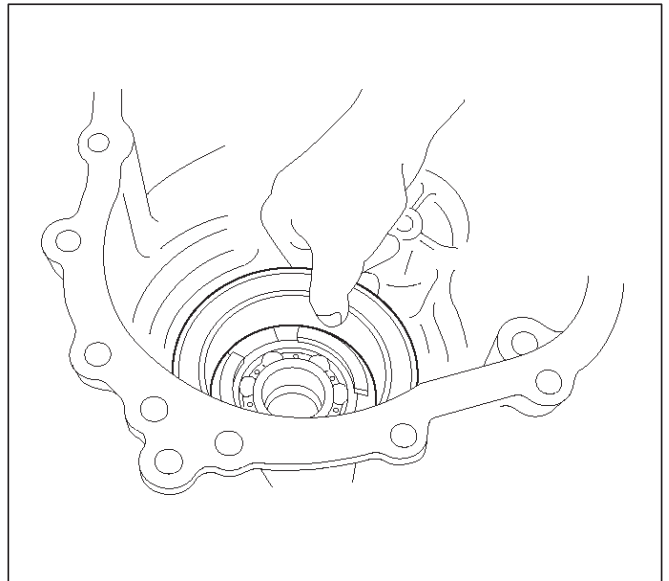


4. Using a terminal pull-out tool or an equivalent tool, push down the lock to unlatch the terminal for the coil assembly, and pull the terminal out.

NOTE: Be careful not to damage other terminals.

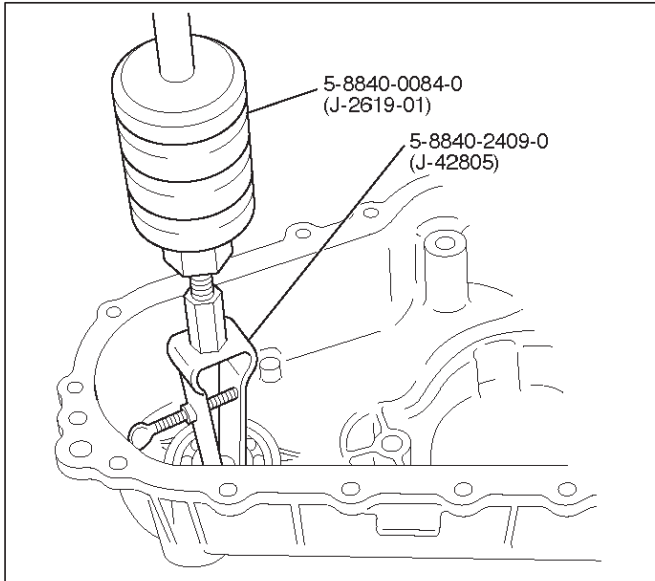


5. Remove the fixing nuts of the coil assembly from the outside of the transfer cover assembly. Remove the coil assembly from the transfer cover.



4D2-14 TRANSFER CASE (TOD)

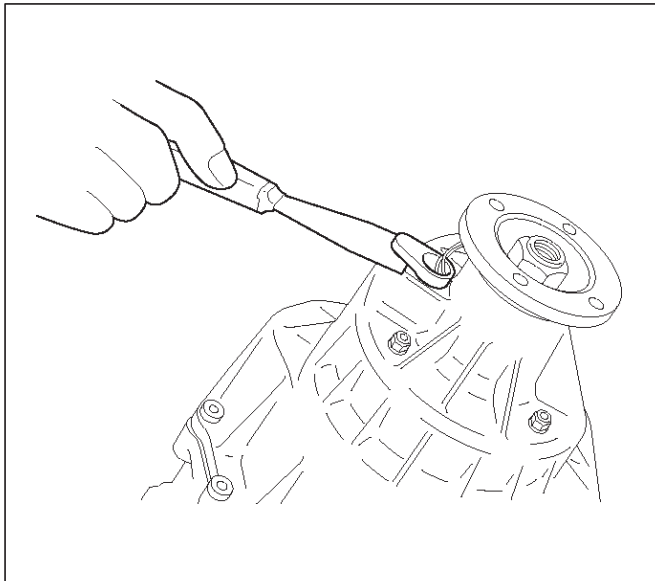
6. Using the bearing remover 5-8840-2409-0 (J-42805) and slide hammer 5-8840-0084-0 (J-2619-01), remove the ball bearing for the front output shaft.



901RW234

7. Remove the bolts and front and rear speed sensors.

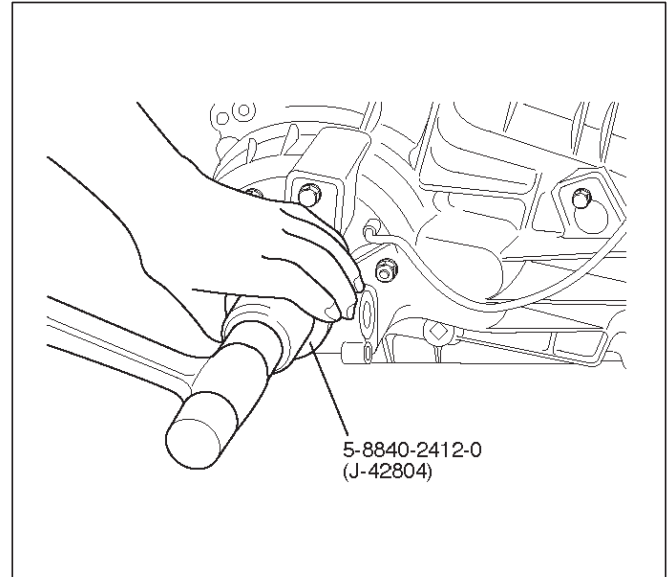
NOTE: Be careful not to damage the speed sensors during the work.



261RW033

Reassembly

1. Remove the oil seal from the transfer cover assembly.
2. Apply oil to the circumference of the new oil seal and fill the lip with grease (Besco L2 or equivalent).
3. Using the oil seal installer 5-8840-2412-0 (J-42804), install the oil seal to the transfer cover assembly.



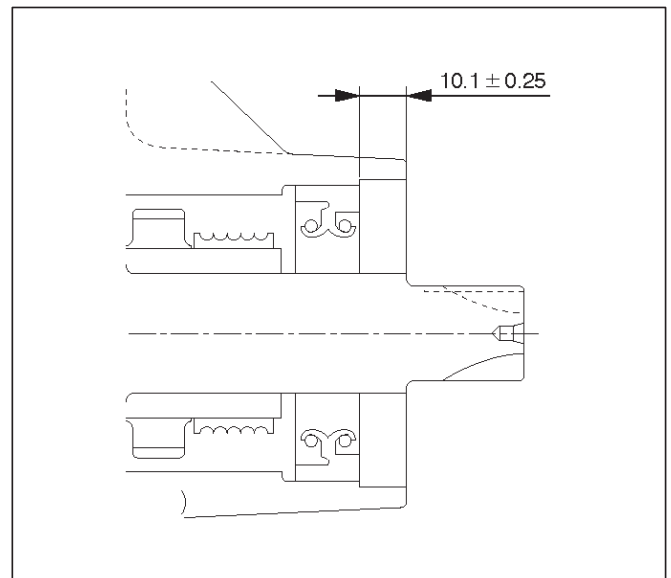
261RW051

Rear Output Shaft Oil Seal

Distance between the transfer case end and oil seal.

NOTE: When installing the oil seal to the specified dimension, be careful not to damage it.

Dimension : 9.85 — 10.35mm (0.39 — 0.41 in)



A04RW004

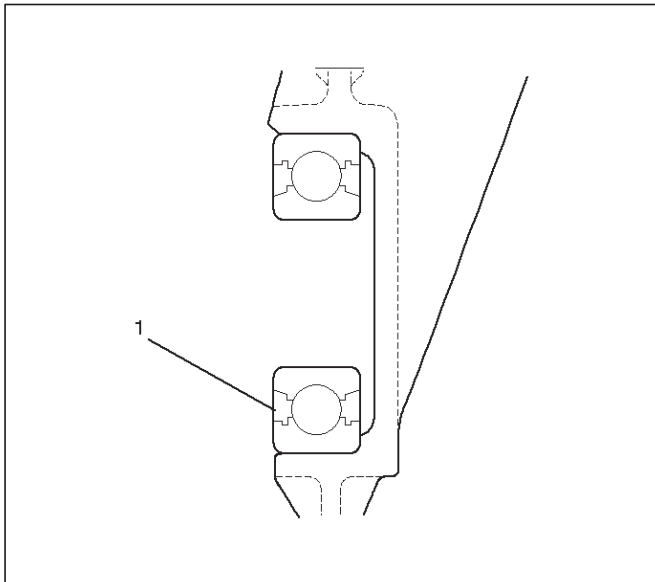
4. Apply a thin coat of grease to the seal ring of each front and rear speed sensor, and mount the sensors carefully.

5. Tighten the bolts to the specified torque.

Torque : 5 N·m (0.5 kg·m/43 lb in)

NOTE: Pay attention not to mount the front (or rear) sensor to the rear (or front) sensor position.

6. Install the ball bearing (1) for the front output shaft as flat as shown in the figure.



261RW008

7. Mount the coil assembly and tighten the nuts to the specified torque.

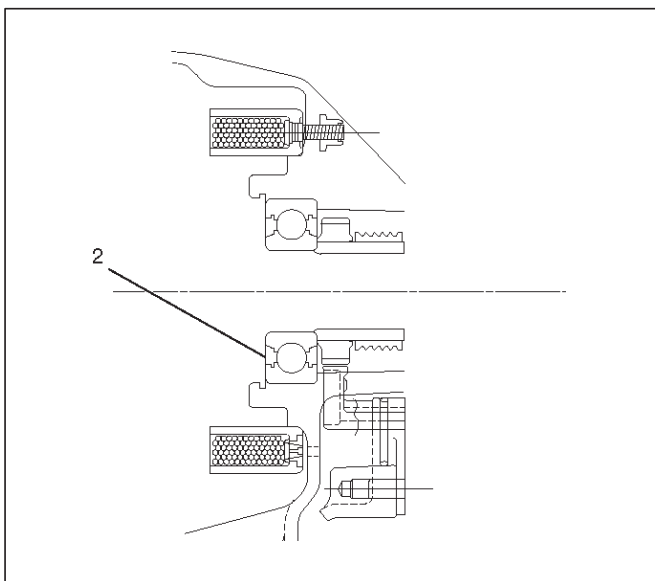
Torque : 10 N·m (1.0 kg·m/87 lb in)

8. Connect the terminal in the central connector.

NOTE: Be careful not to damage other terminals.

9. Install speed gear and tone wheel.

10. Mount the ball bearing (2) as flat as shown in the figure.



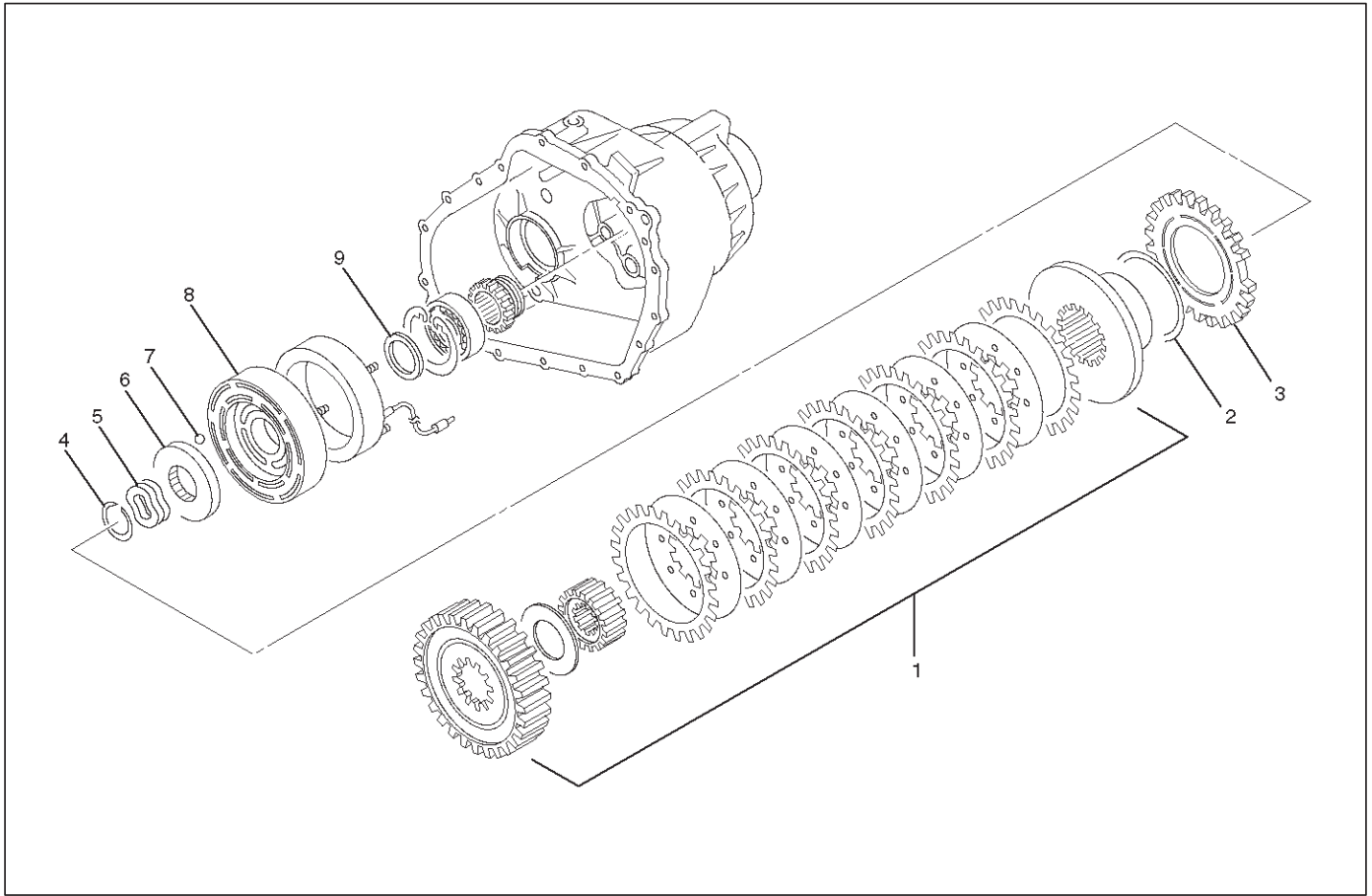
261RW009-1

11. Using snap ring pliers, install the snap ring to the transfer cover assembly.

NOTE: Securely install the snap ring to the groove of the transfer cover assembly.

Transfer Case Assembly Clutch Pack and Clutch Cam

Disassembled View



266RW006

Legend

- (1) Clutch Pack Assembly
- (2) Insulator Washer
- (3) Armature Plate
- (4) Snap Ring

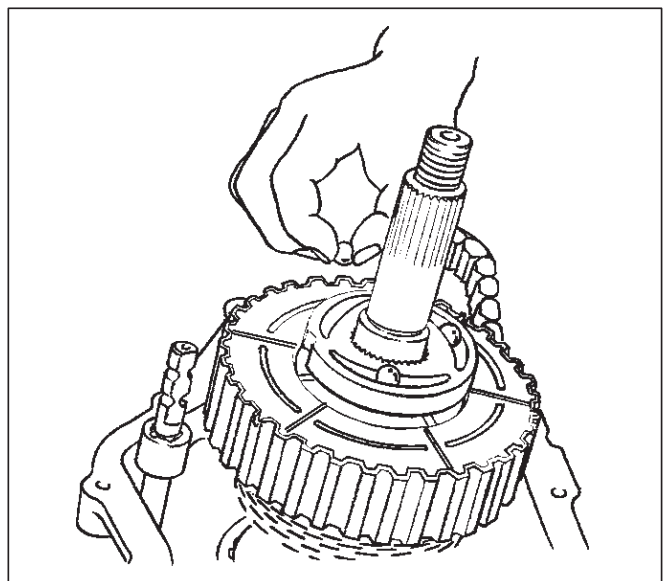
- (5) Wave Spring
- (6) Cam Pulley
- (7) Cam Ball
- (8) Cam and Coil Housing
- (9) Thrust Bearing

Disassembly

1. Remove the thrust bearing.
2. Remove the cam and coil housing.

NOTE: When the cam and coil housing is removed, the cam balls may be detached together with the housing. Be careful not to lose the ball.

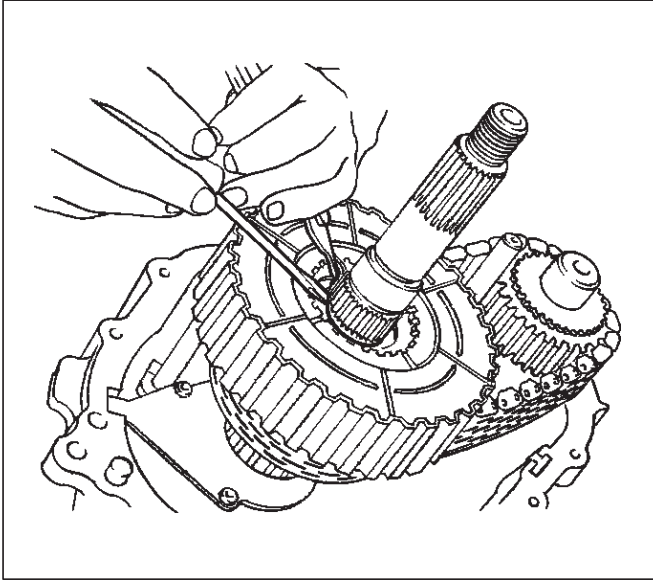
3. Remove the cam ball.



266RW013

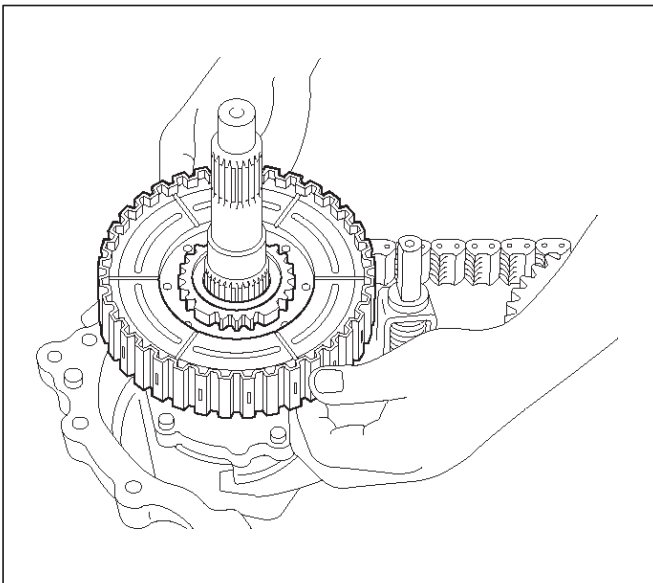
4. Remove the cam pulley.
5. Remove the wave spring.
6. Using snap ring pliers, remove the snap ring.

NOTE: Be careful not to damage the snap ring.



266RW009

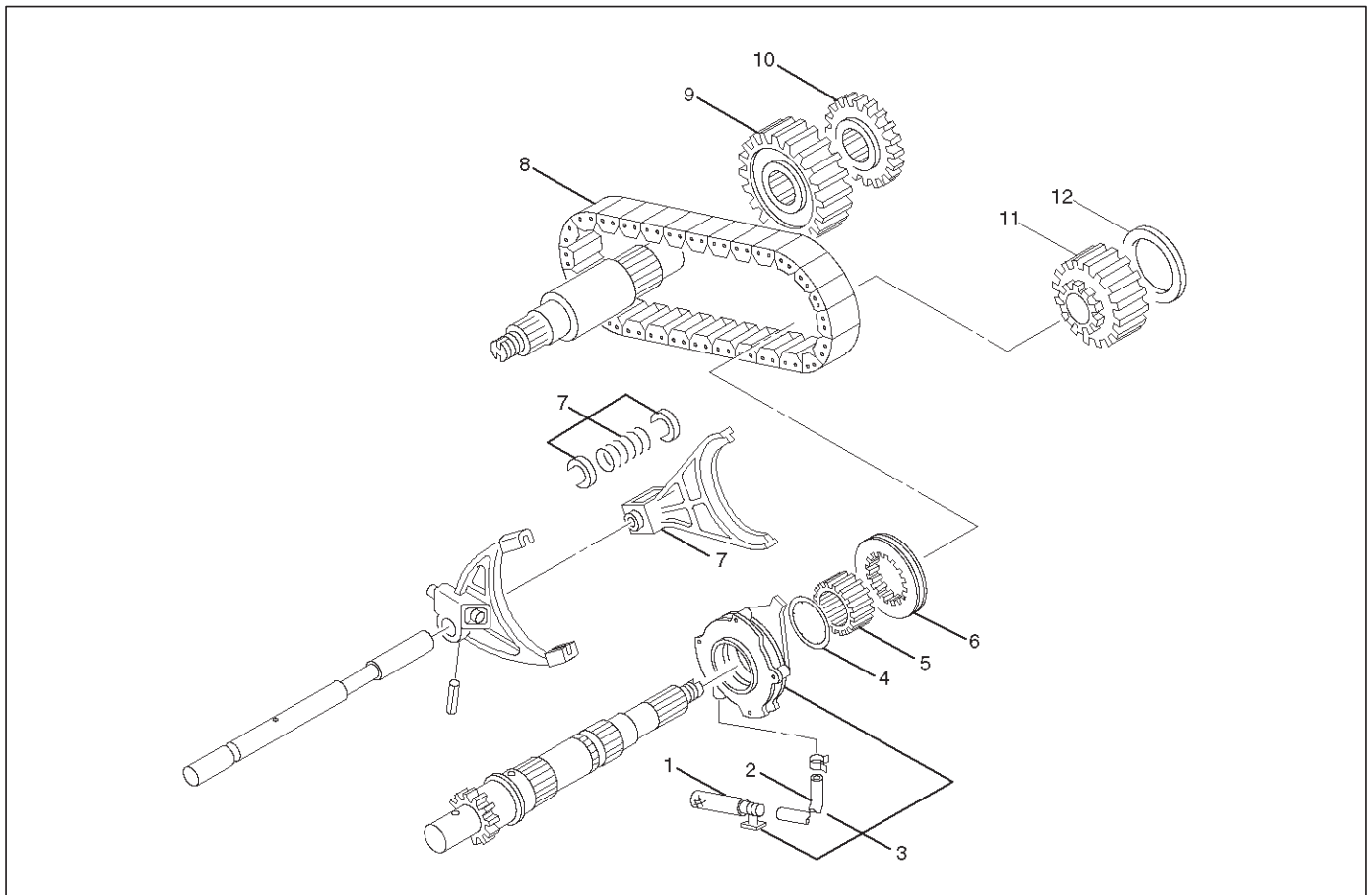
7. Remove the armature plate.
8. Remove the insulator washer.
9. Remove the clutch pack assembly as a package.



266RW017

Sprocket and Mechanical Lock

Disassembled View



266RW008

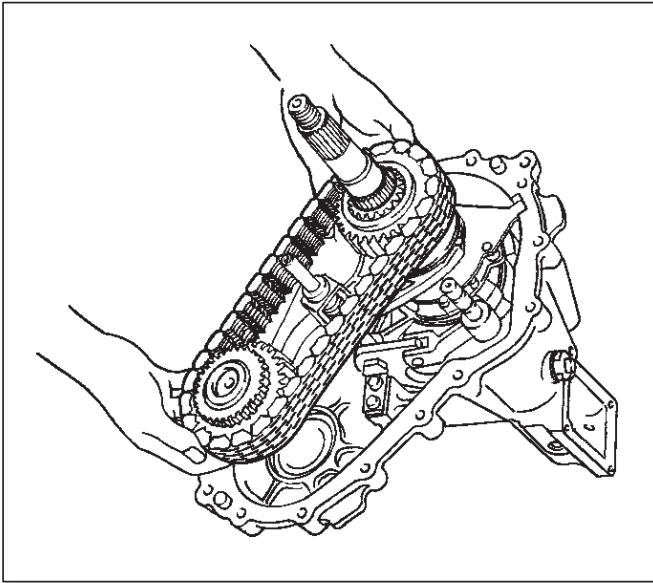
Legend

- | | |
|-------------------------|--------------------------|
| (1) Strainer | (7) Lock-up Fork |
| (2) Hose | (8) Chain |
| (3) Oil Pump Assembly | (9) Lower Drive Sprocket |
| (4) Thrust Washer | (10) Front Tone Wheel |
| (5) Mechanical Lock Hub | (11) Drive Sprocket |
| (6) Lock-up Sleeve | (12) Sprocket Spacer |

Disassembly

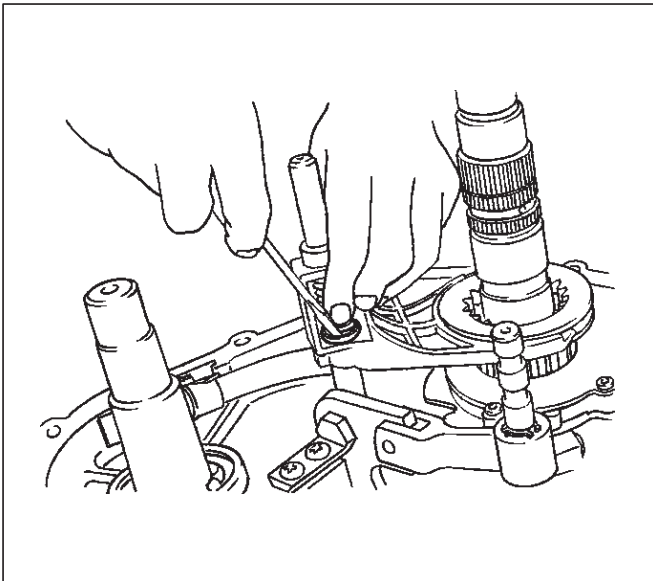
1. Remove the sprocket spacer.
2. Remove the front tone wheel.

3. Remove the drive sprocket, lower drive sprocket, and chain together from the front and rear output shafts.



266RW010

4. Remove the mechanical lock hub.
5. Remove the lock-up fork.
6. Remove the spring retainer from the connection between rail shaft and lock-up fork.
7. Remove the lock-up sleeve.

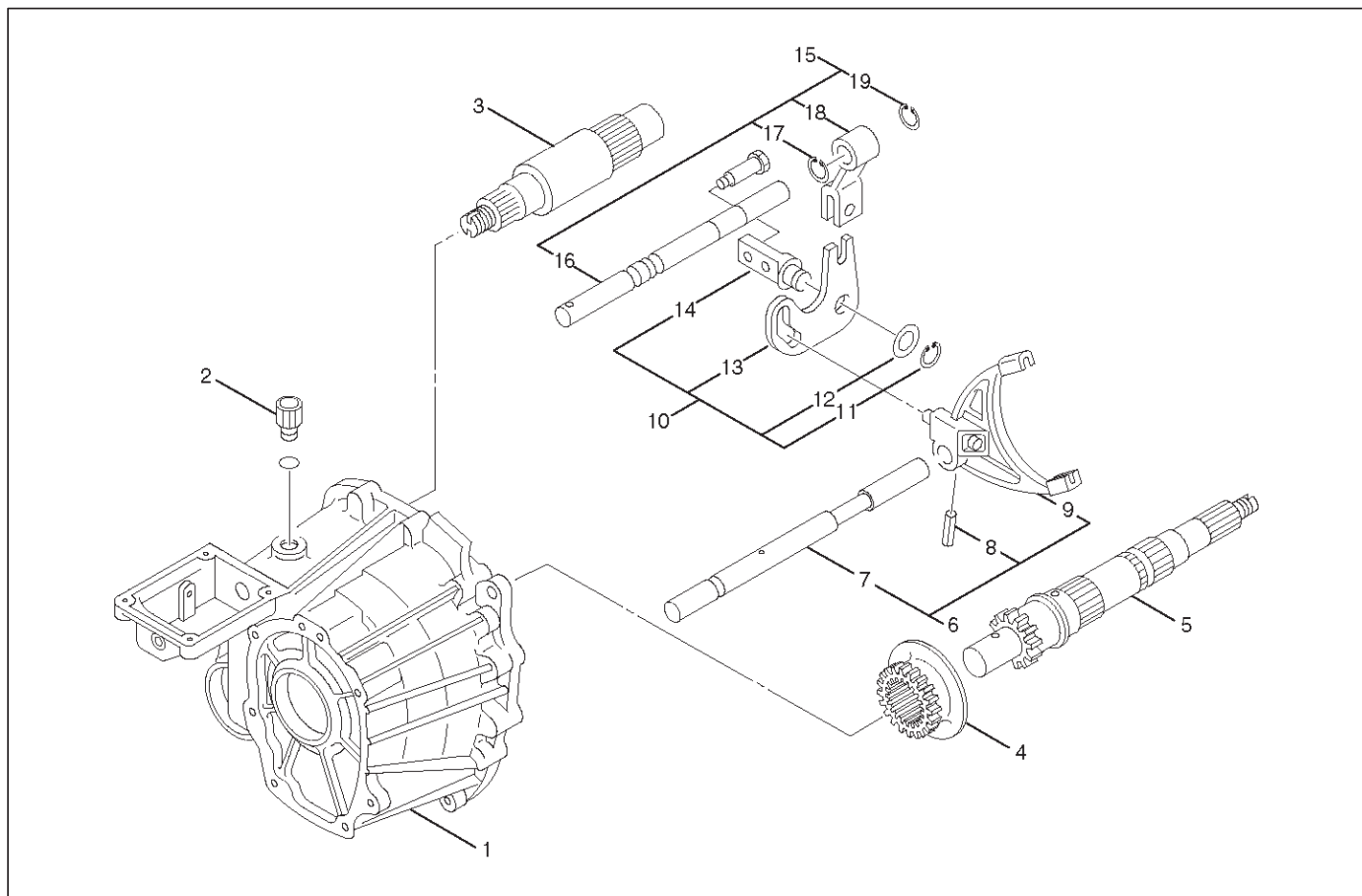


261RW018

8. Remove the thrust washer.
9. Remove the magnet from the strainer set position together with the oil pump assembly.
10. Remove the strainer from the oil pump assembly.
11. Remove the hose from the oil pump assembly.

Output Shafts and Shift Control Shaft

Disassembled View



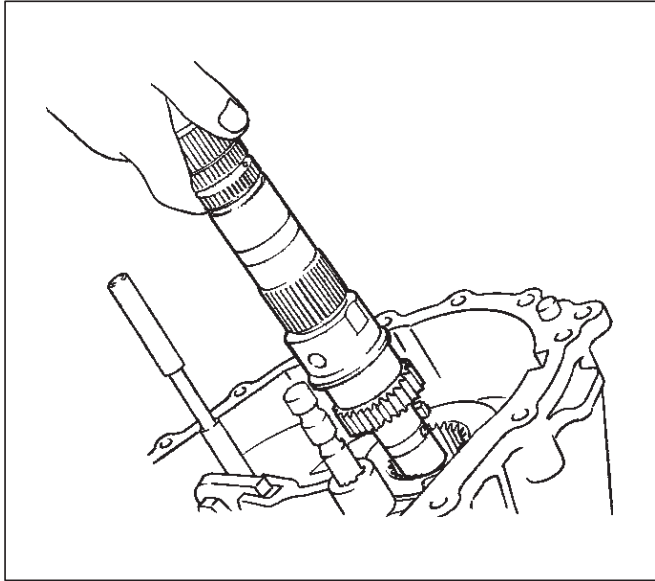
261RW010-1

Legend

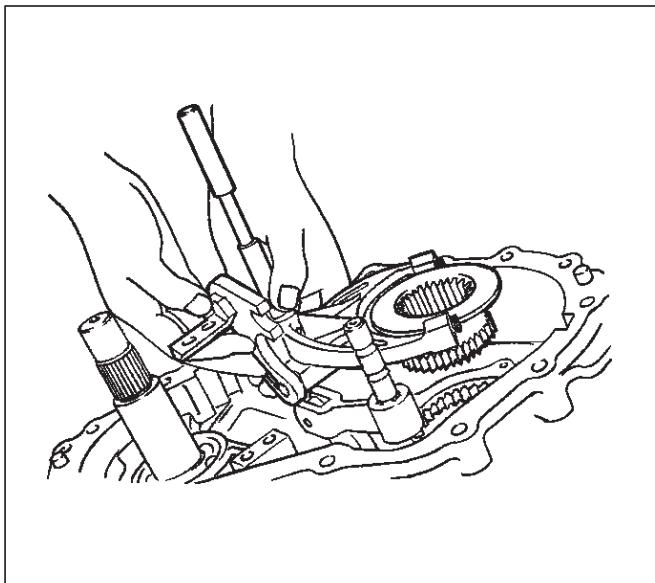
- | | |
|-----------------------------|-------------------------------|
| (1) Transfer Case Assembly | (10) Cam Assembly |
| (2) Detent Spring | (11) Snap Ring |
| (3) Front Output Shaft | (12) Washer |
| (4) Reduction Hub | (13) Cam |
| (5) Output Shaft | (14) Cam Pilot Block |
| (6) Reduction Fork Assembly | (15) Shifter Shaft Assembly |
| (7) Lock-up Shaft | (16) Shifter Lever Shaft |
| (8) Spring Pin | (17) Snap Ring |
| (9) Reduction Fork | (18) Reduction Lever Assembly |
| | (19) Snap Ring |

Disassembly

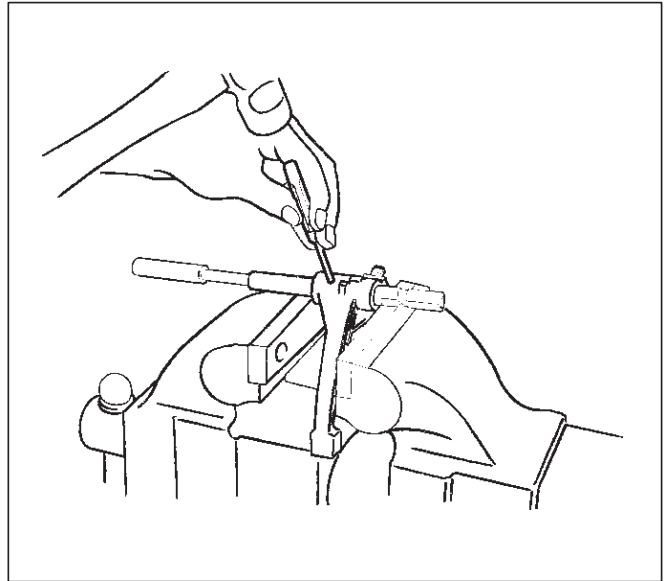
1. Remove the output shaft.



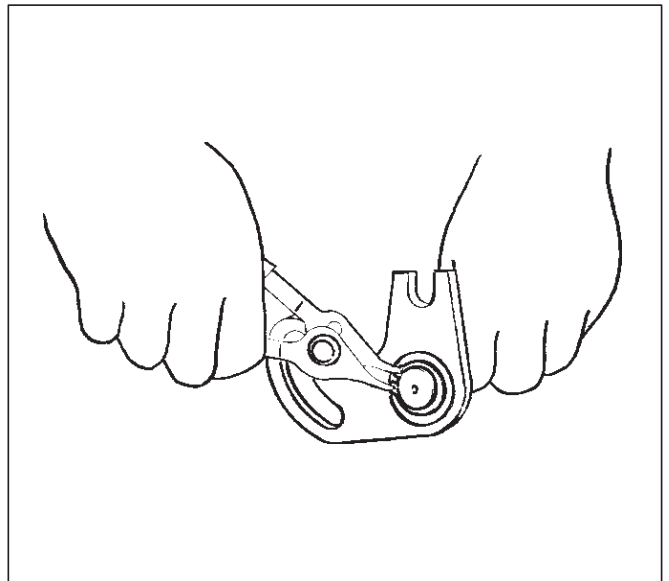
2. Remove the detent spring.
3. Remove the cam pilot block bolts.
4. Remove the shifter shaft assembly and cam assembly.



5. Remove the spring pin that fixes the reduction fork to the lock-up shaft.



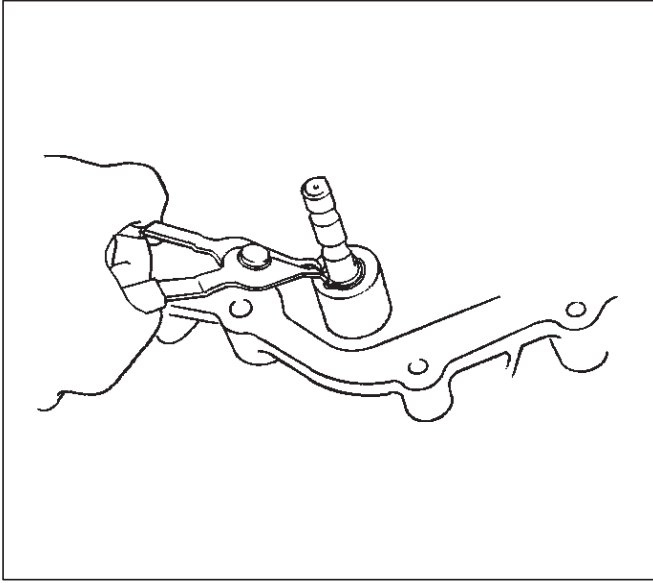
6. Remove the reduction fork.
7. Remove the lock-up shaft.
8. Using snap ring pliers, remove the snap ring from cam pilot block.



9. Remove the washer.
10. Remove the cam.
11. Remove the cam pilot block.

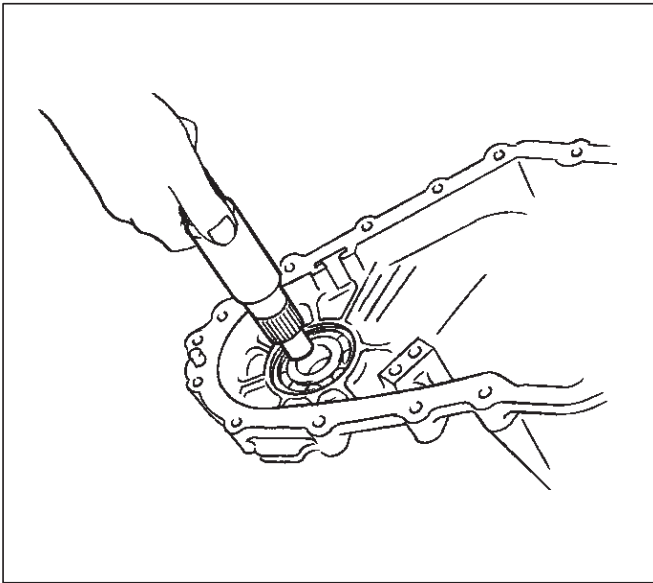
4D2-22 TRANSFER CASE (TOD)

- Using snap ring pliers, remove the snap ring from shifter lever shaft.



261RW021

- Remove the reduction lever assembly.
- Remove the snap ring.
- Remove the shifter lever shaft.
- Remove the front output shaft.

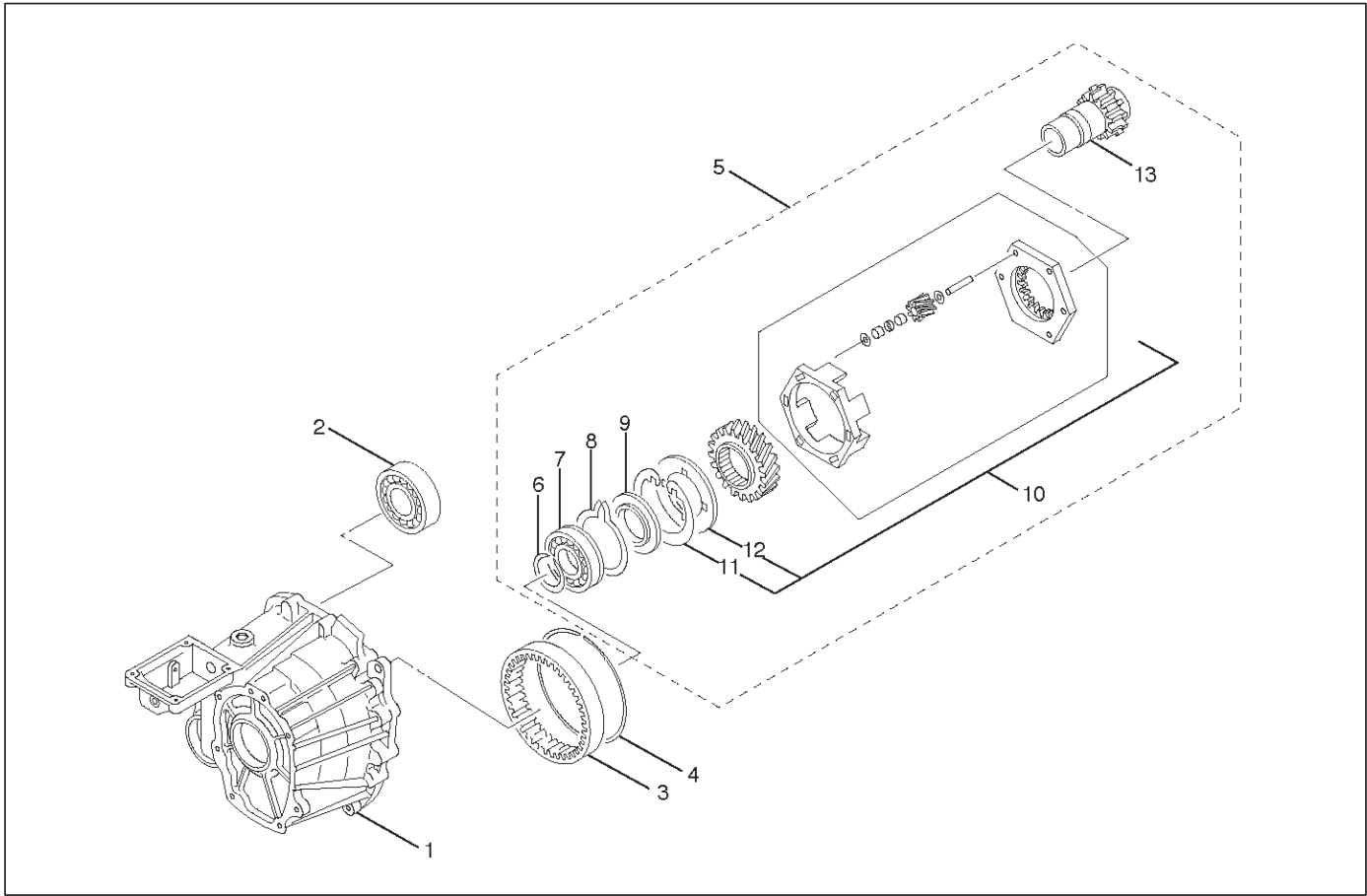


266RW012

- Remove the transfer case assembly.

Transfer Case

Disassembled View



265RW015

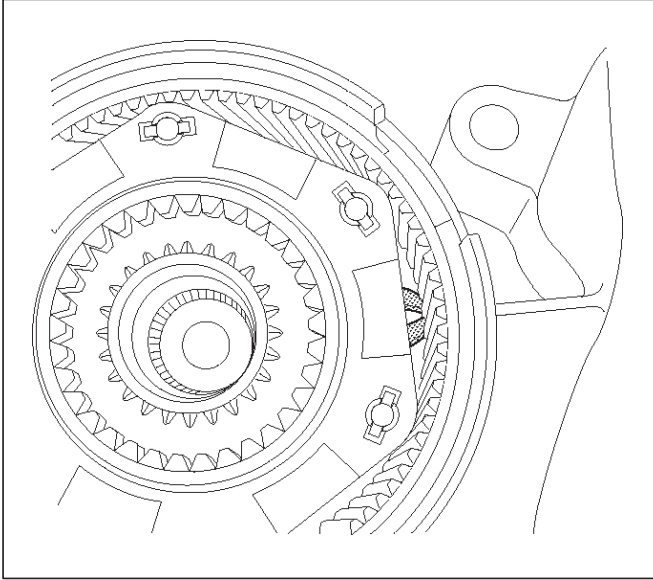
Legend

- (1) Transfer Case
- (2) Ball Bearing
- (3) Ring Gear
- (4) Snap Ring
- (5) Input Shaft and Carrier Assembly
- (6) Snap Ring
- (7) Ball Bearing
- (8) Snap Ring
- (9) Thrust Plate
- (10) Carrier Assembly
- (11) Snap Ring
- (12) Circular Hub
- (13) Input Shaft

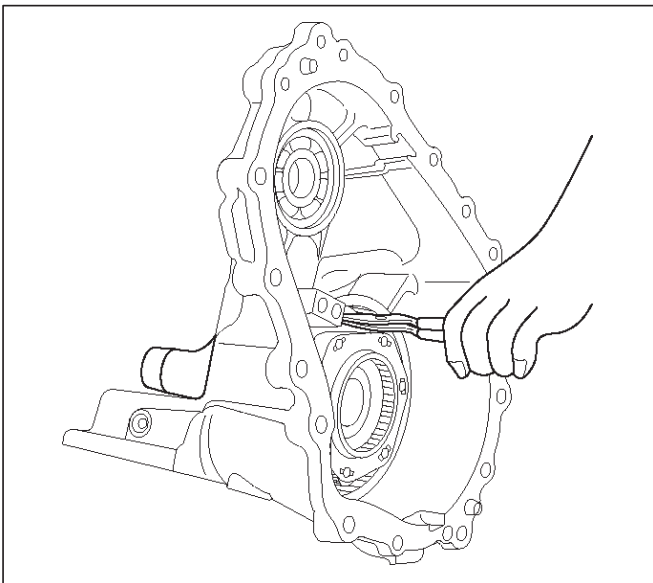
4D2-24 TRANSFER CASE (TOD)

Disassembly

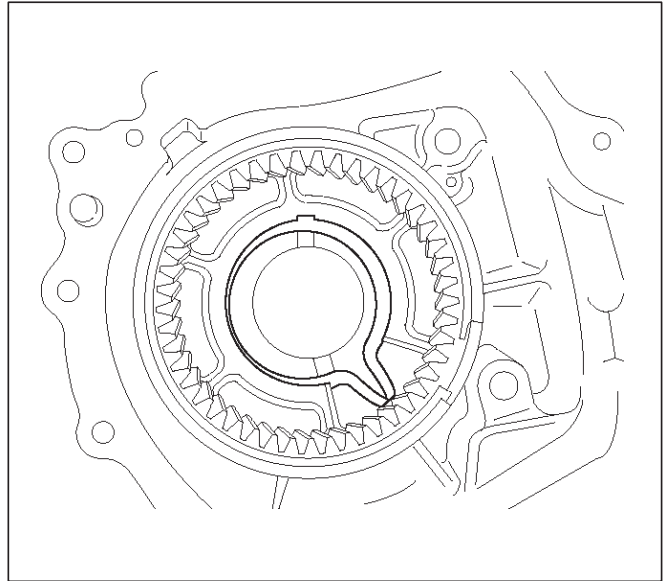
1. Remove the ball bearing (for front output shaft).
2. Expand the snap ring through the opening in the planetary gear assembly.



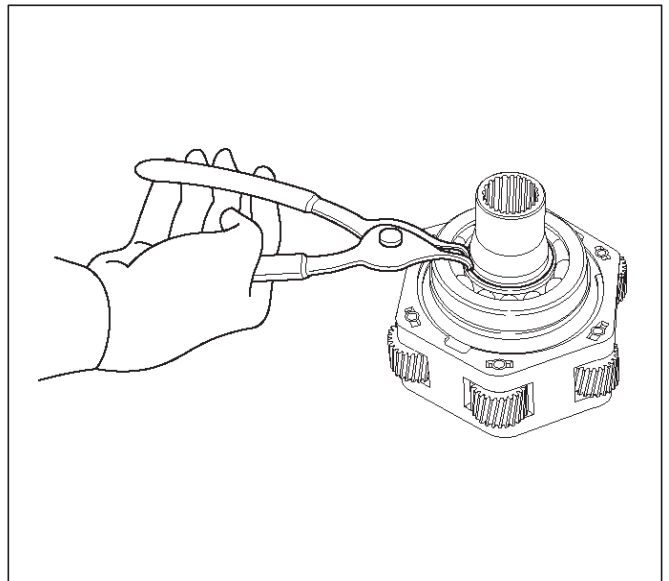
3. While expanding the snap ring, remove the input shaft, ball bearing, carrier assembly, and thrust plate from the transfer case.



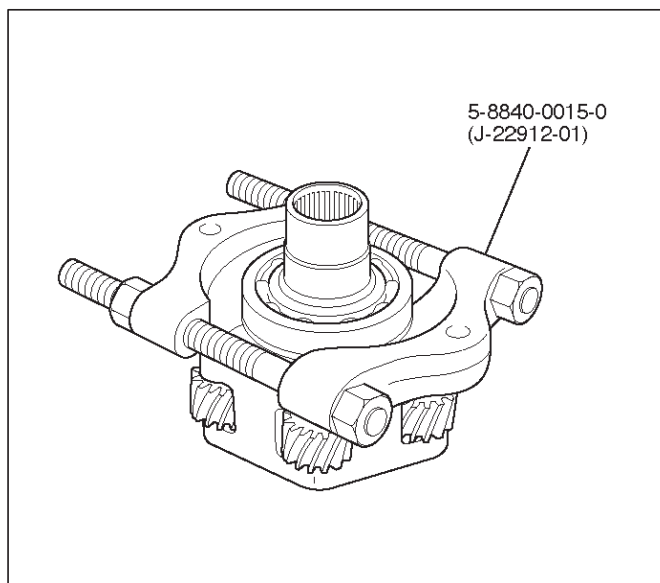
4. Remove the snap ring from the transfer case.



5. Using snap ring pliers, remove the snap ring before the ball bearing.

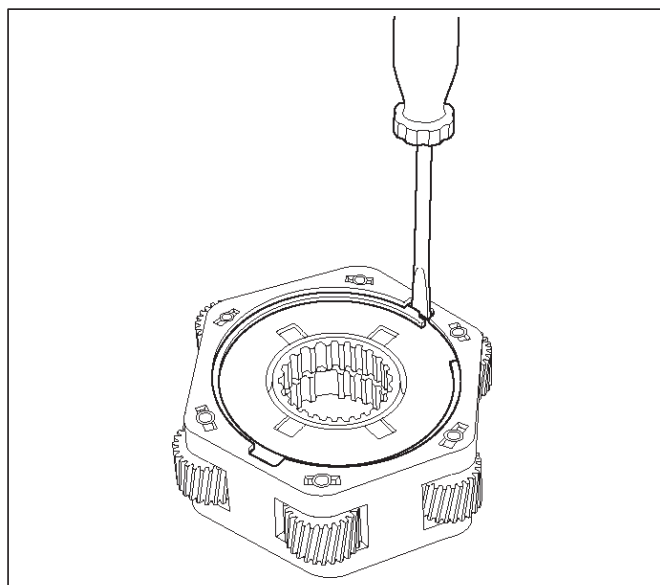


6. Using the bearing remover 5-8840-0015-0 (J-22912-01), remove the ball bearing from the input shaft.



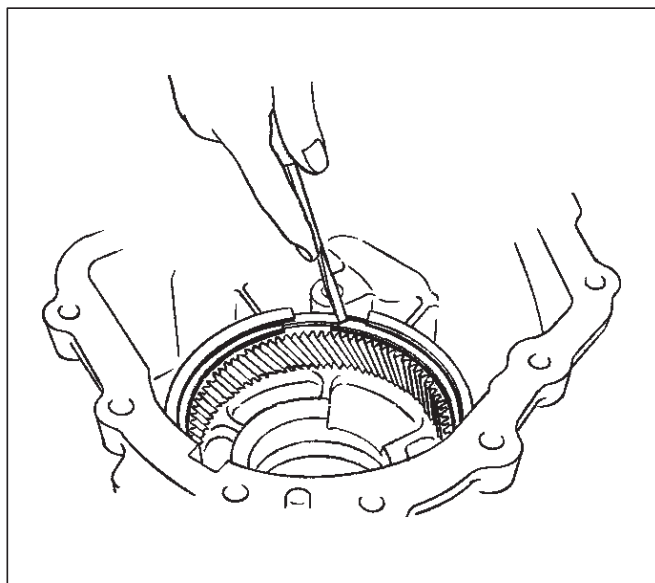
265RW014

- 7. Remove the thrust plate.
- 8. Remove the carrier assembly.
- 9. Remove the snap ring from the carrier assembly.



265RW006

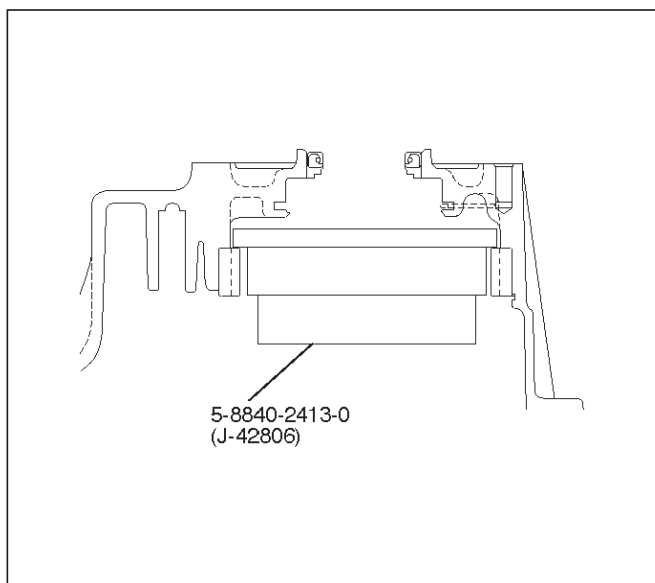
- 10. Remove the circular hub.
- 11. Remove the snap ring before the ring gear.



261RW025

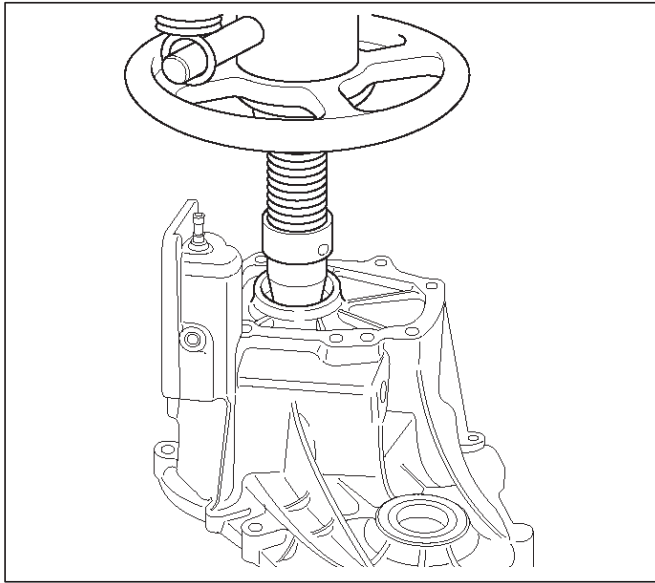
12. Using the replacer 5-8840-2413-0 (J-42806), remove the ring gear.

NOTE: Removing the ring gear needs a high-load press. This means the transfer case may be damaged. To remove and replace the ring gear, it is recommended that the transfer case assembly should be replaced.



261RW050

4D2-26 TRANSFER CASE (TOD)



Inspection and Repair

When wear, damage, or any other defects are observed during the inspection, the part or parts must be repaired or replaced. Wash all the parts with clean solvent, and check that old oil, metallic particles, dirt, or foreign materials are completely removed. Blow the air into oil holes and grooves to remove foreign materials or residual detergent.

Chain

- Check whether the face that contacts the sprocket is free from excessive wear or damage. If defects are observed, replace the part.
- If the chain interference mark is found on the inside wall of the transfer cover or the chain is so slack that a skipped engagement occurs between the chain and sprocket, replace the chain.

Sprocket

- Check whether the sprocket tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline. Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.
- If excessive wear or damage is observed on the sprocket inside sliding surface, replace the part.

Gear

Check whether the gear tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline. Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.

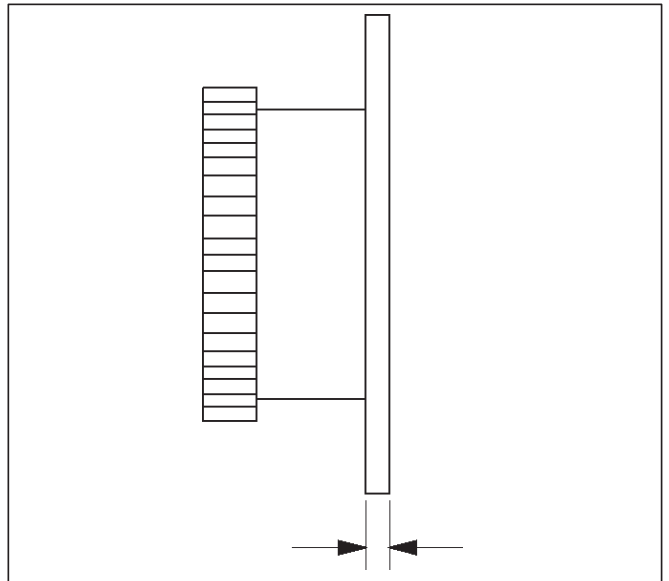
Thickness of Reduction Hub

- Measure the thickness with a micrometer.

- If the measurement exceeds the limit, replace the reduction hub.

Standard : 3.05-3.30 mm (0.120-0.130 in)

Allowable limit : 2.5 mm (0.098 in)



Lock-up Sleeve

Mount the mechanical lock hub, drive sprocket assembly, and lock-up sleeve to the output shaft.

If the lock-up sleeve does not move smoothly, replace the sleeve.

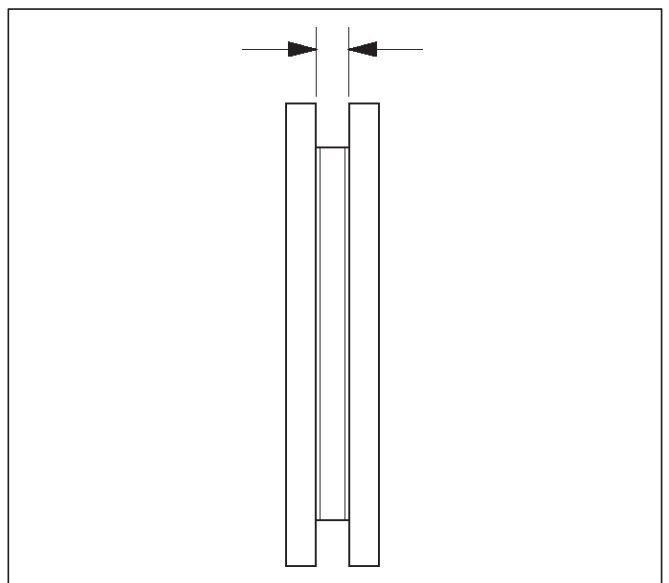
NOTE: Apply ATF to the area engaging the gear.

Thickness of Lock-up Sleeve

- If the measurement exceeds the limit, replace the lock-up sleeve.

Standard : 7.16-7.32 mm (0.282-0.288 in)

Allowable limit : 7.9 mm (0.311 in)



Reduction Fork

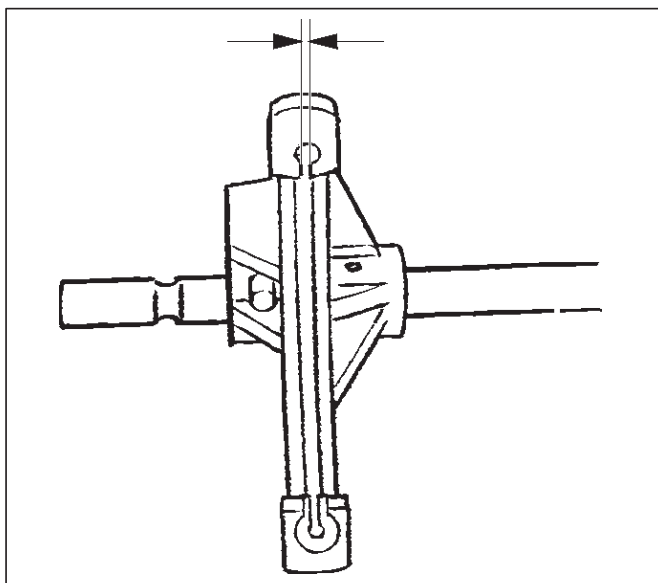
Check the reduction fork and shaft for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness of Reduction Fork

- If the measurement exceeds the limit, replace the reduction fork.

Standard : 3.41-3.79 mm (0.134-0.149 in)

Allowable limit : 4.4 mm (0.173 in)



261RW026

Lock-up Fork

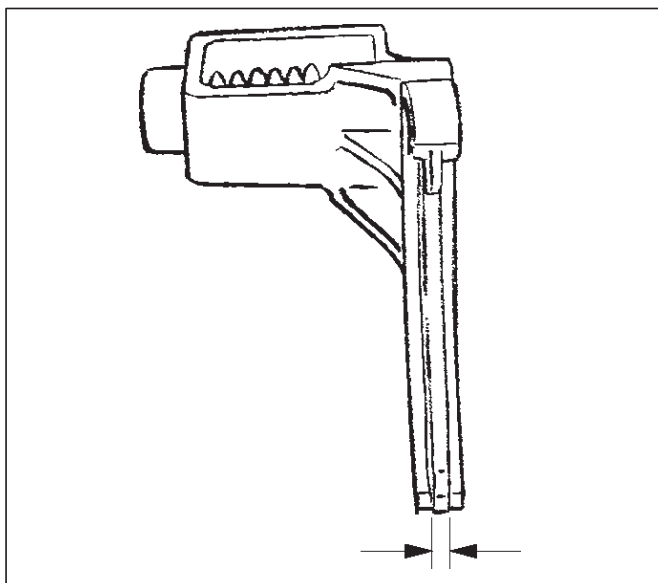
- Check the lock-up fork and shaft for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness Lock-up Fork

If the measurement exceeds the limit, replace the lock-up fork.

Standard : 6.99-7.09 mm (0.275-0.279 in)

Allowable limit : 6.3 mm (0.248 in)



261RW027

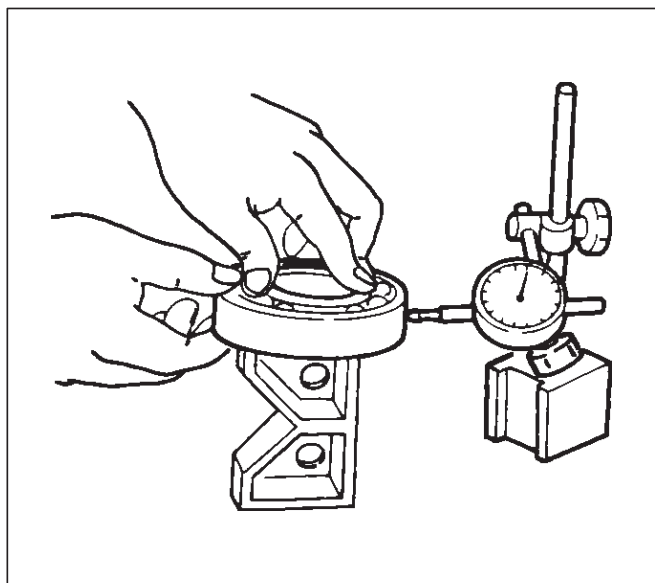
Bearing

Check the profile of the needle, roller, ball, and thrust bearings. Wash the bearings with clean solvent completely, and dry with air.

NOTE: If the bearing is rotated excessively, the rollers may be damaged. So, rotate the bearing slowly with your hand. Apply grease to the bearing, and check the smoothness of the bearing while slowly rotating the race with your hand.

- Use a dial indicator to measure the ball bearing play.

Allowable limit : 0.23 mm (0.009 in)



226RW143

Lock-up Fork Spring

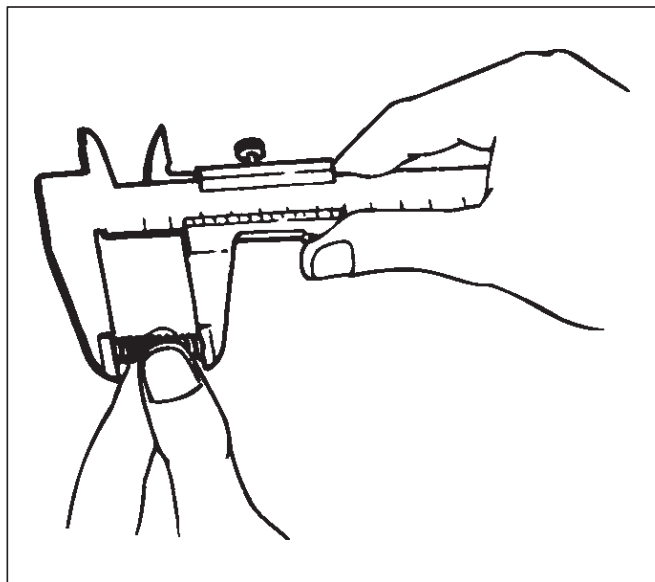
Check the lock-up fork spring for distortion, cracking, and wear. If defects are observed, replace the part.

Free Length of the Lock-up Fork Spring

- If the measurement exceeds the limit, replace the spring.

Standard : 60.96 mm (2.40 in)

Allowable limit : 55.0 mm (2.17 in)



220RW045

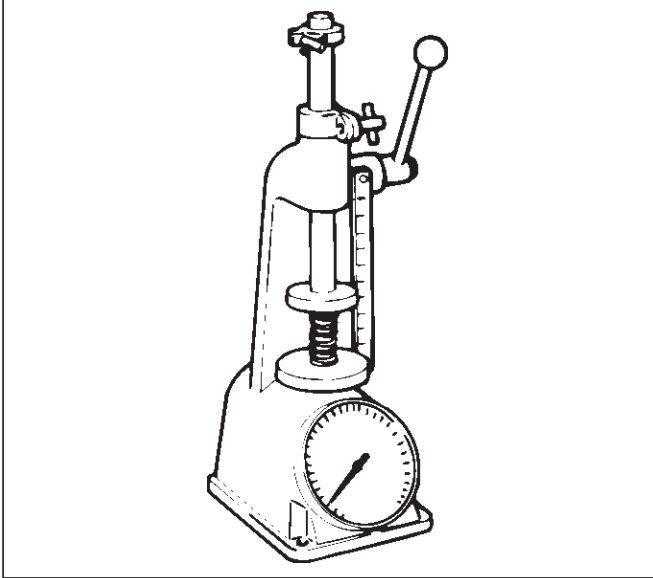
4D2-28 TRANSFER CASE (TOD)

Tension of Lock-up Fork Spring

- If the measurement exceeds the limit, replace the spring. (When compressed to 41.4 mm)

Standard : 27.1-33.8 N {2.76-3.45 kg/6.08-7.61 lb}

Allowable limit : 24.5 N {2.5 kg/5.5 lb}



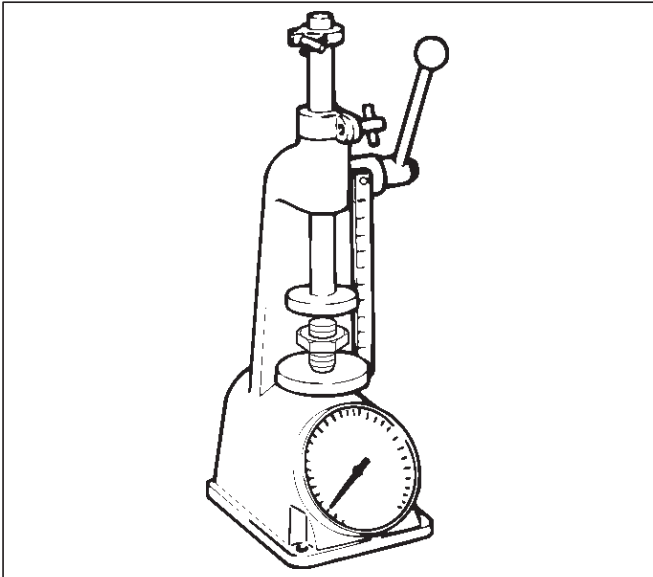
014RW048

Tension of Detent Spring Assembly

- If the measurement exceeds the limit, replace the spring. N {kg} (When compressed by 3 mm from the free length)

Standard : 139 N -203 {14.2-20.7 kg/31.3-45.6 lb}

Allowable limit : 130 N {13.3 kg/29.3 lb}



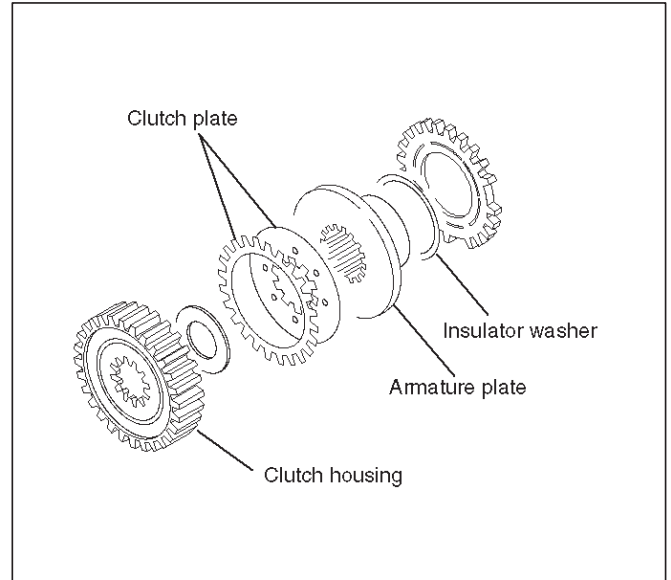
261RW041

Oil Pump

- Remove foreign materials from the strainer. If the strainer is damaged, replace it.
- If the area into which the shaft is inserted is excessively worn or damaged, replace the pump.

Multi Plate Disk Clutch

- If the burned, mirror-surfaced clutch facing, or scraping is observed on the clutch plates, clutch housing, armature plate, and insulator washer, replace the part or parts.



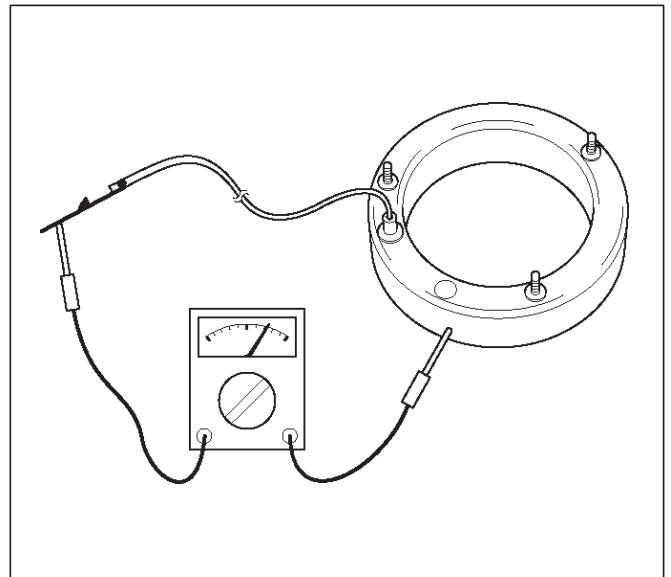
266RW003

Coil Assembly

- Check the resistance of the coil with a tester. If defects are observed, replace the assembly.
* (ordinary temperature)

Standard : 1.4-2.0 δ

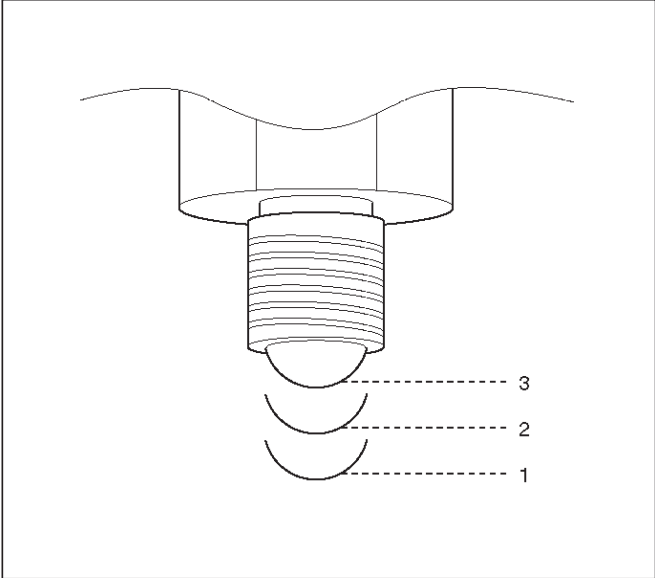
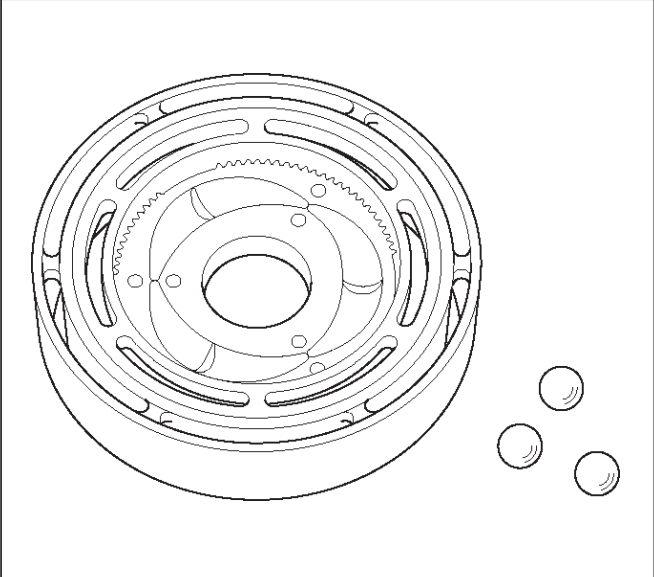
Allowable limit : 1.0-5.0 δ



261RW031

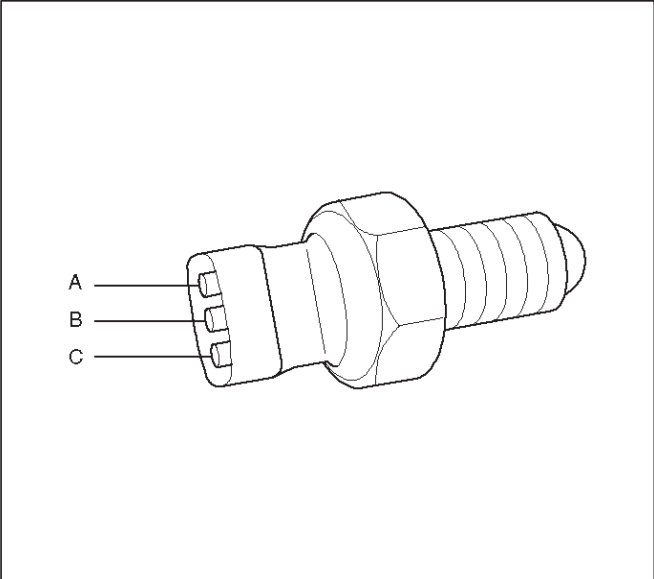
Cam Pulley, Cam Ball, and Cam&Coil Housing

- Check the cam balls and cam for excessive wear or damage. If defective, replace the parts. 4H and 4L switches.



The Parts 4H and 4L Switch

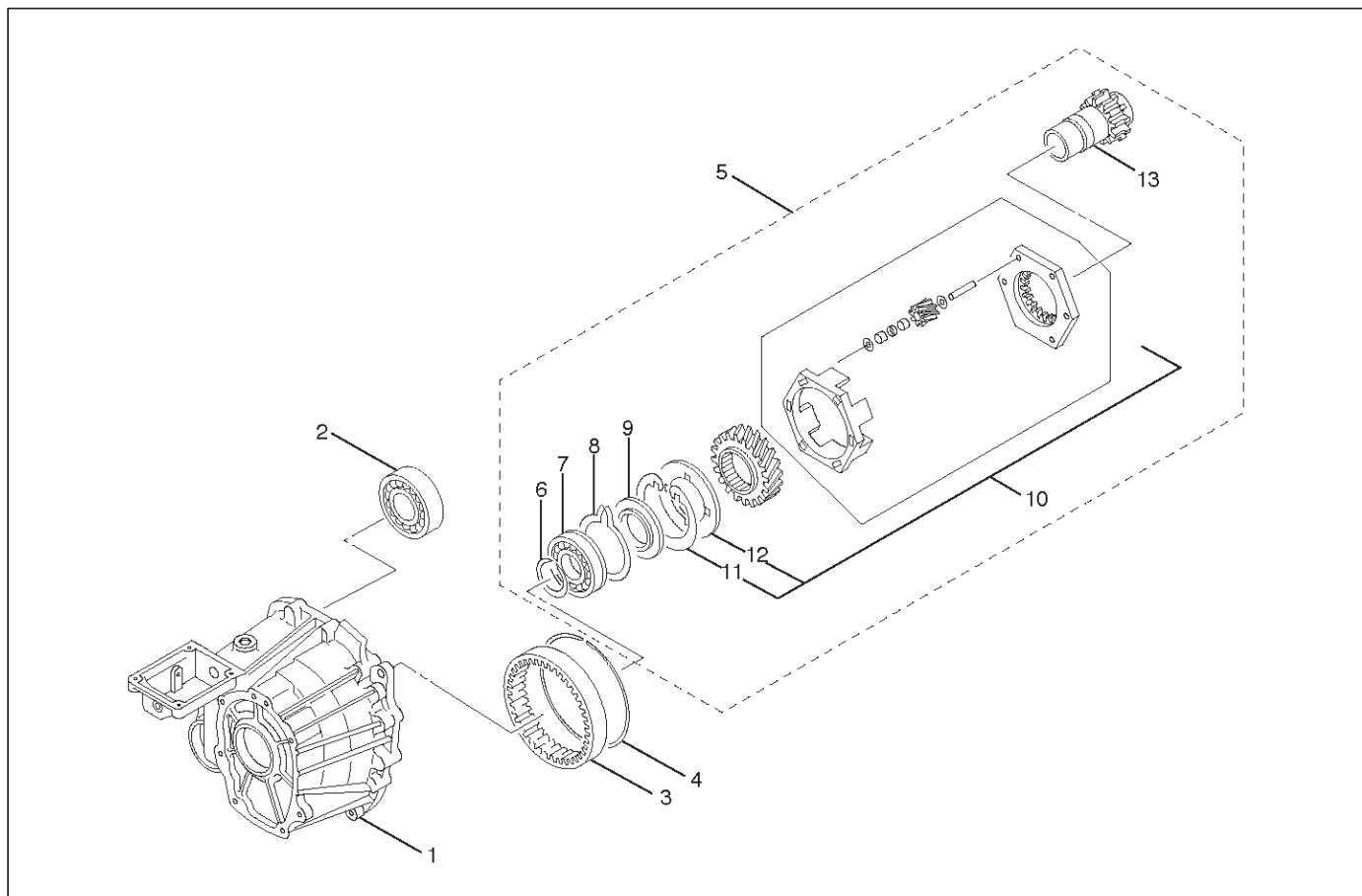
- Check the continuity of 4H and 4L switch.



Switch Stroke	4H Switch Signal	4L Switch Signal	The corresponding position of transfer lever
	B to Switch Body	A to C	
1	Open	Open	High
2	Open	Close	4L
3	Close	Close	Neutral

Transfer Case

Disassembled View



265RW015

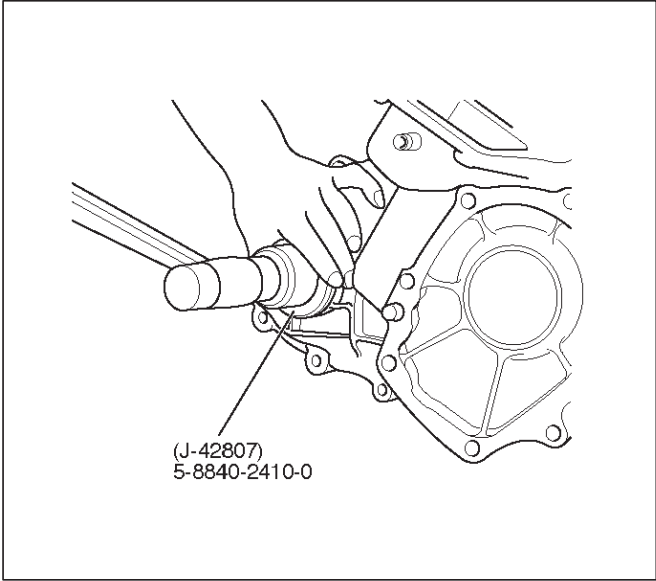
Legend

- | | |
|--------------------------------------|-----------------------|
| (1) Transfer Case | (7) Ball Bearing |
| (2) Ball Bearing | (8) Snap Ring |
| (3) Ring Gear | (9) Thrust Plate |
| (4) Snap Ring | (10) Carrier Assembly |
| (5) Input Shaft and Carrier Assembly | (11) Snap Ring |
| (6) Snap Ring | (12) Circular Hub |
| | (13) Input Shaft |

Reassembly

1. Remove the oil seal from the transfer case.
2. Apply engine oil to the circumference of the new oil seal and fill the lip with grease (Besco L2 or equivalent).

3. Using the front output shaft oil seal installer 5-8840-2410-0 (J-42807), install the oil seal to the transfer case.

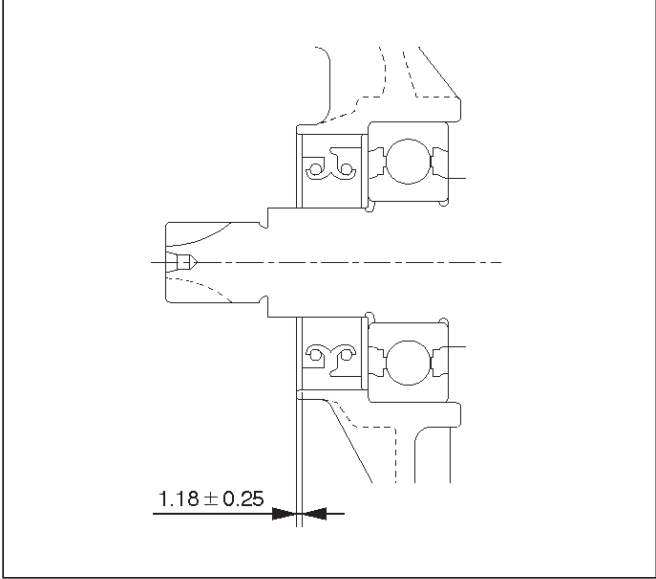


Front Output Shaft Oil Seal

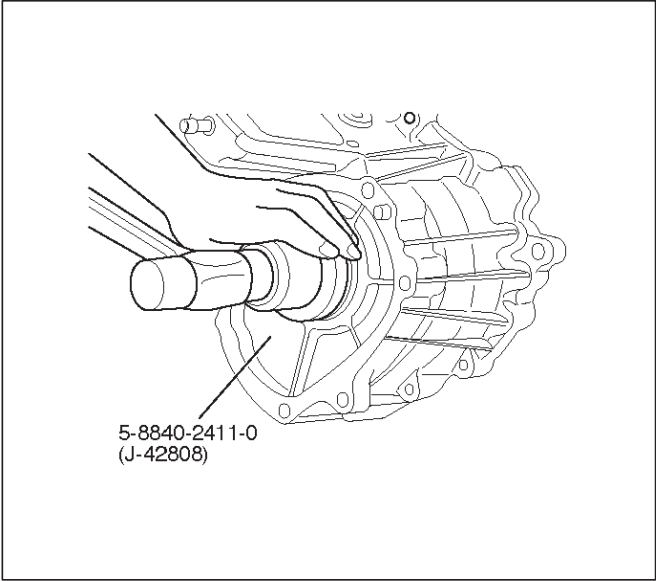
Distance between the transfer case end and oil seal.

NOTE: When installing the oil seal to the specified dimension, be careful not to damage it.

Distance : 0.93 — 1.43mm (0.037 — 0.056 in)



4. Using the input shaft (main) oil seal installer 5-8840-2411-0 (J-42808), install the oil seal to the transfer case.

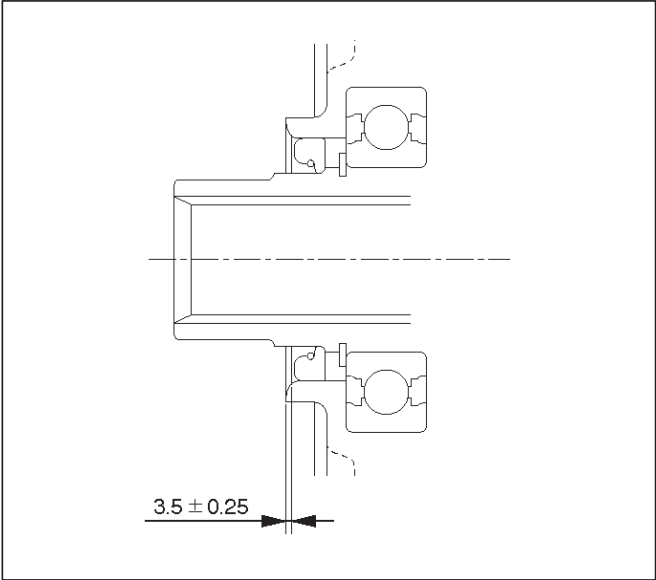


Input Shaft Oil Seal

Distance between the transfer case end and oil seal.

NOTE: When installing the oil seal to the specified dimension, be careful not to damage it.

Distance : 3.25 — 3.75mm (0.13 — 0.15 in)

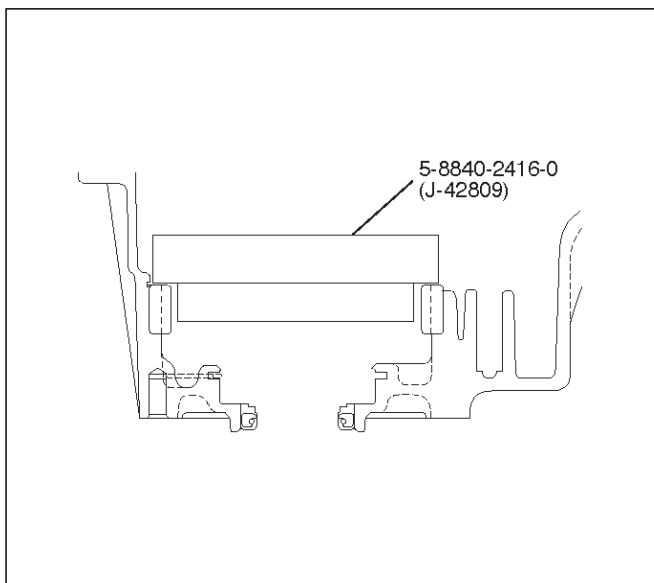


4D2-32 TRANSFER CASE (TOD)

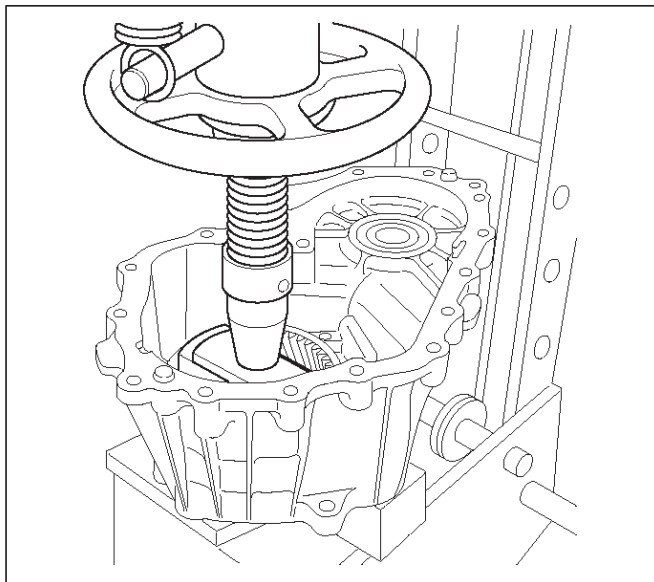
5. Using the installer 5-8840-2416-0 (J-42809), press-fit the ring gear.

Pay attention to the following points.

- Identify the correct direction of gear.
- Do not damage the gear.
- Do not press-fit the ring gear slantingly.
- Press-fit the ring gear to the innermost.
- Remove burrs generated by press-fitting.
- If the transfer case has serrations, match them with those of the gear and press-fit the gear.



261RW054



261RW034

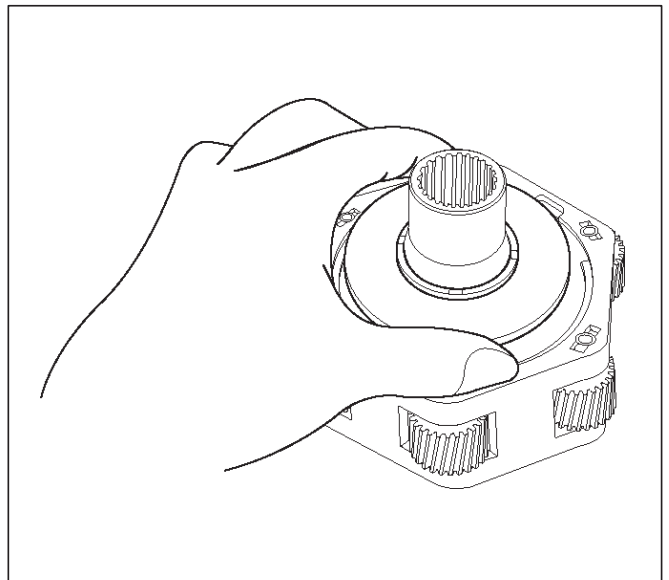
6. Install the snap ring to the transfer case.

7. Install the circular hub.

8. Install the snap ring to the carrier.

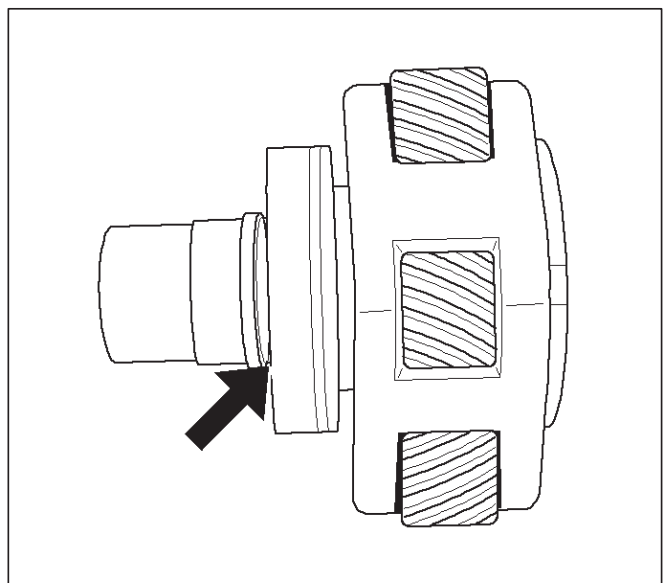
9. Mount the carrier assembly to the input shaft.

10. Check the direction of thrust plate and mount it to the input shaft.



265RW008

11. Mount the ball bearing to the input shaft so that the snap ring will be installed to the input shaft.

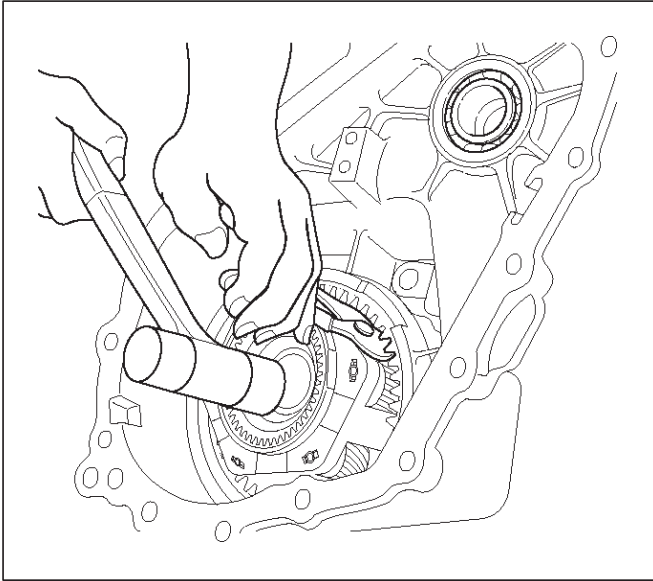


265RW003

12. Install the snap ring to the input shaft.

13. Install the snap ring to the transfer case.

- Using the snap ring pliers, expand the snap ring through the opening between the ring gear and carrier assembly and securely install the input shaft and carrier assembly.

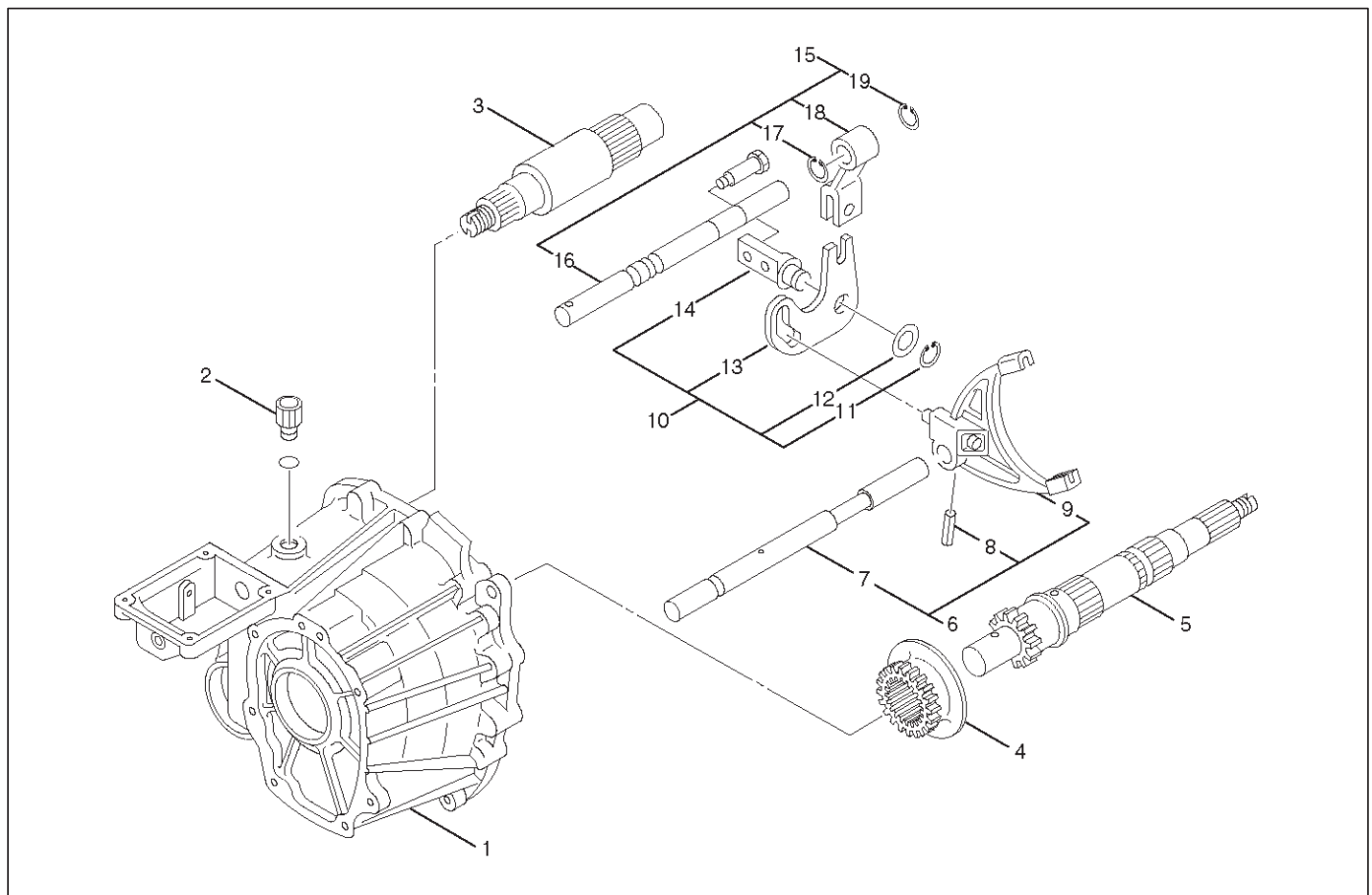


261RW036

- Install the ball bearing (for front output shaft)

Output Shafts and Shift Control Shaft

Disassembled View



261RW010-1

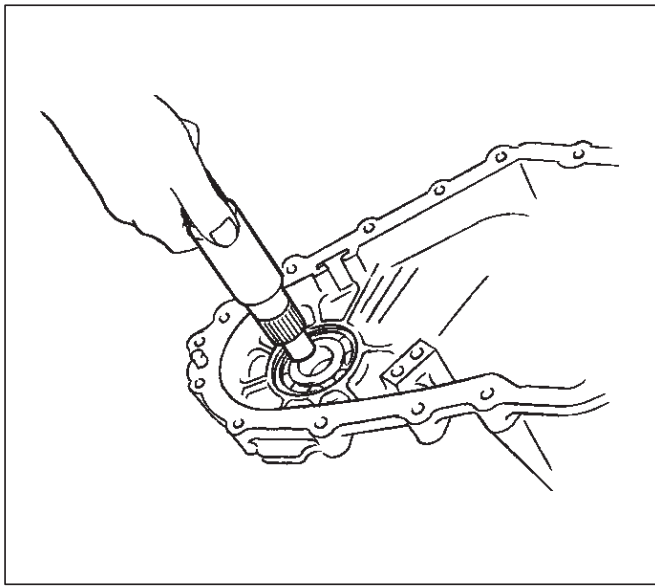
Legend

- | | |
|-----------------------------|-------------------------------|
| (1) Transfer Case Assembly | (10) Cam Assembly |
| (2) Detent Spring | (11) Snap Ring |
| (3) Front Output Shaft | (12) Washer |
| (4) Reduction Hub | (13) Cam |
| (5) Output Shaft | (14) Cam Pilot Block |
| (6) Reduction Fork Assembly | (15) Shifter Shaft Assembly |
| (7) Lock-up Shaft | (16) Shifter Lever Shaft |
| (8) Spring Pin | (17) Snap Ring |
| (9) Reduction Fork | (18) Reduction Lever Assembly |
| | (19) Snap Ring |

Reassembly

1. Apply ATF to the inside of the ball bearing for the front output shaft.

2. Mount the front output shaft to the transfer case.

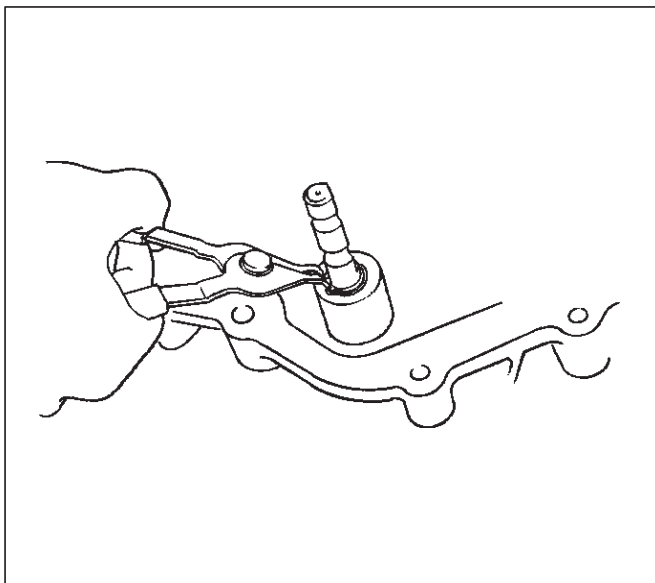


266RW012

3. Install the shifter lever shaft.

4. Install the snap ring.

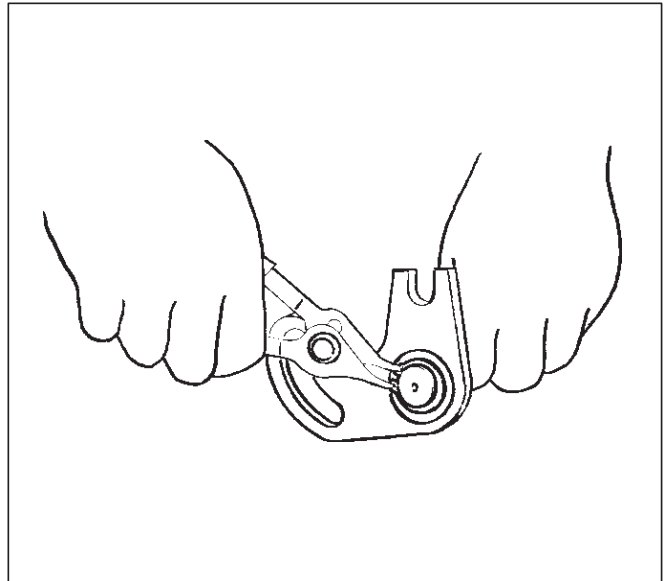
5. Install the reduction lever assembly to the shifter lever shaft and fix the assembly with the snap ring.



261RW021

6. Install the cam to the cam pilot block.

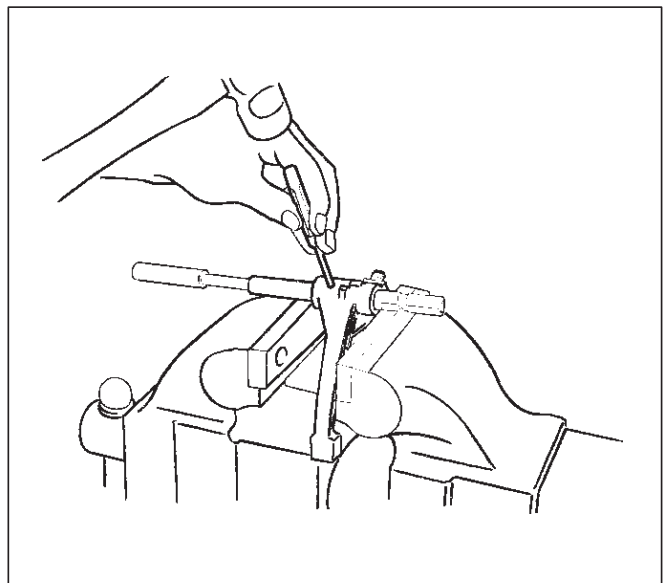
7. Attach the washer to the cam pilot block and fix the washer with the snap ring.



261RW029

8. Mount the reduction fork to the lock-up shaft.

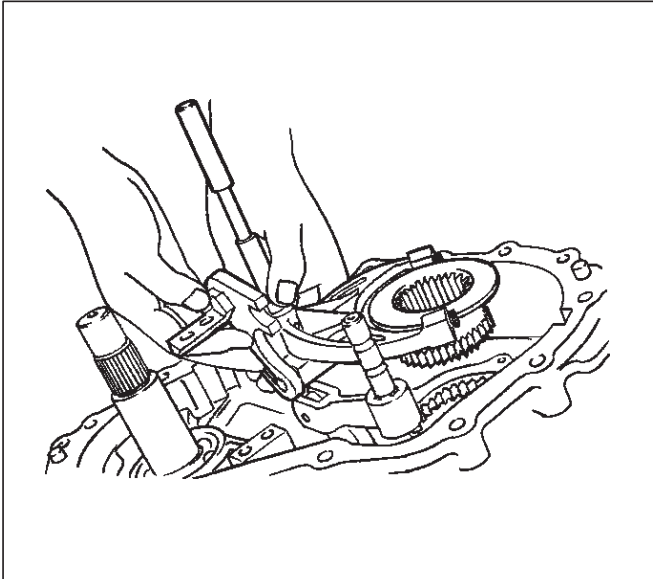
9. Install the spring pin to the reduction fork and lock-up roll.



261RW020

4D2-36 TRANSFER CASE (TOD)

10. Install the reduction fork assembly together with reduction hub to the transfer case assembly.
11. Install the shifter shaft assembly.



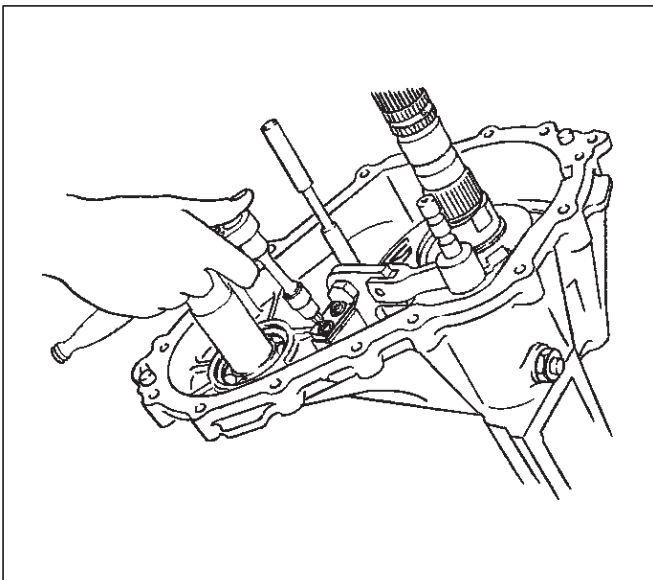
261RW019

12. Tighten the cam pilot block set bolts to the specified torque.

Torque : 12 N·m (1.2 kg·m/104 lb in)

13. Tighten the detent spring to the specified torque.

Torque : 24 N·m (2.4 kg·m/17 lb in)

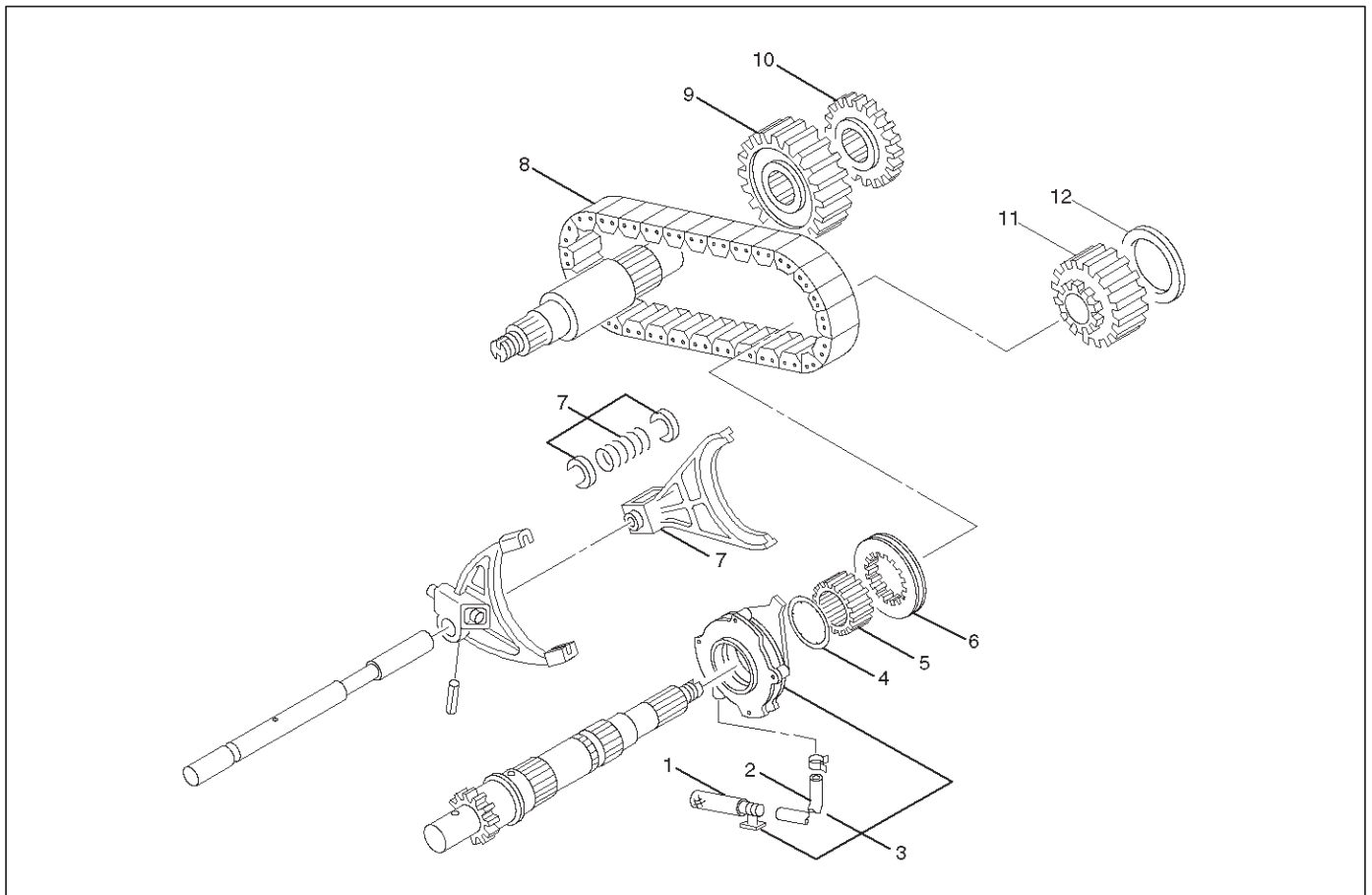


261RW022

14. Apply ATF to the needle bearing inside the input shaft assembly.
15. Install the output shaft to the transfer case.

Sprocket and Mechanical Lock

Disassembled View



266RW008

Legend

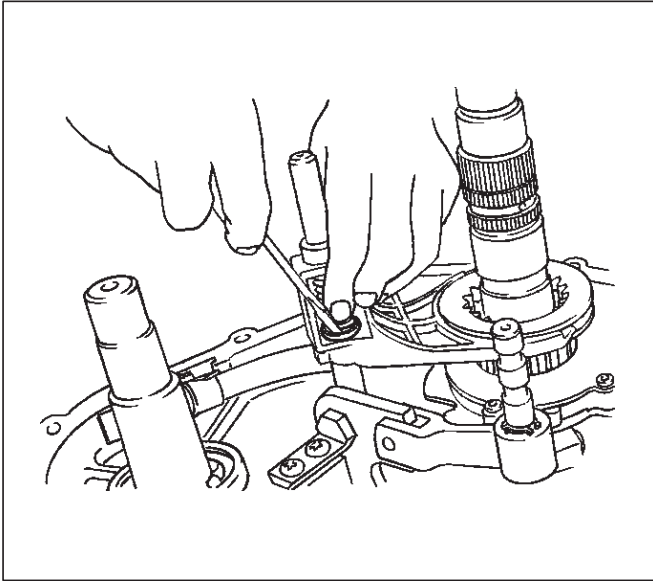
- | | |
|-------------------------|--------------------------|
| (1) Strainer | (7) Lock-up Fork |
| (2) Hose | (8) Chain |
| (3) Oil Pump Assembly | (9) Lower Drive Sprocket |
| (4) Thrust Washer | (10) Front Tone Wheel |
| (5) Mechanical Lock Hub | (11) Drive Sprocket |
| (6) Lock-up Sleeve | (12) Sprocket Spacer |

Reassembly

1. Connect the hose and strainer to the oil pump assembly.
2. Install the oil pump assembly to the output shaft and set the magnet to the strainer position.
3. Install the thrust washer.
4. Install the spring to the lock-up fork.

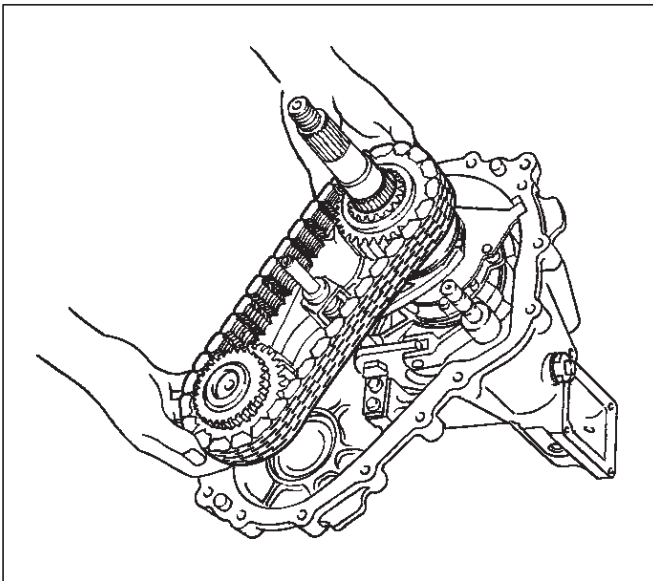
4D2-38 TRANSFER CASE (TOD)

5. Install the lock-up sleeve together with the lock-up fork to the output shaft and lock-up shaft assembly.
6. Install the spring retainers to the lock-up fork.



261RW018

7. Install the mechanical lock hub.
8. Apply ATF to the chain.
9. Engage the chain to both sprockets.
10. Install the chain and sprocket assembly to both output shafts.

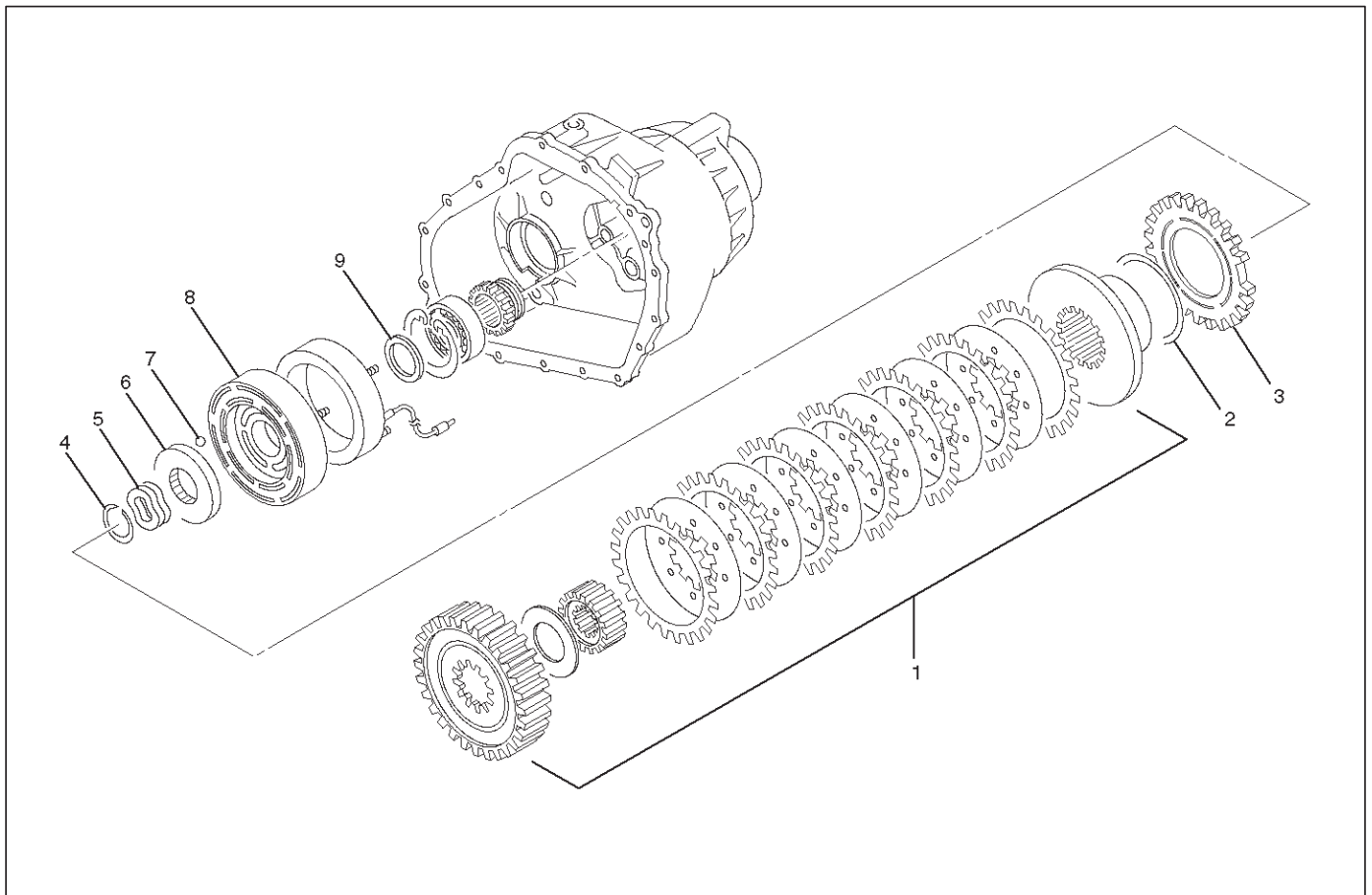


266RW010

11. Install the front tone wheel and sprocket spacer.

Clutch Pack and Clutch Cam

Disassembled View



266RW006

Legend

- | | |
|--------------------------|--------------------------|
| (1) Clutch Pack Assembly | (5) Wave Spring |
| (2) Insulator Washer | (6) Cam Pulley |
| (3) Armature Plate | (7) Cam Ball |
| (4) Snap Ring | (8) Cam and Coil Housing |
| | (9) Thrust Bearing |

Reassembly

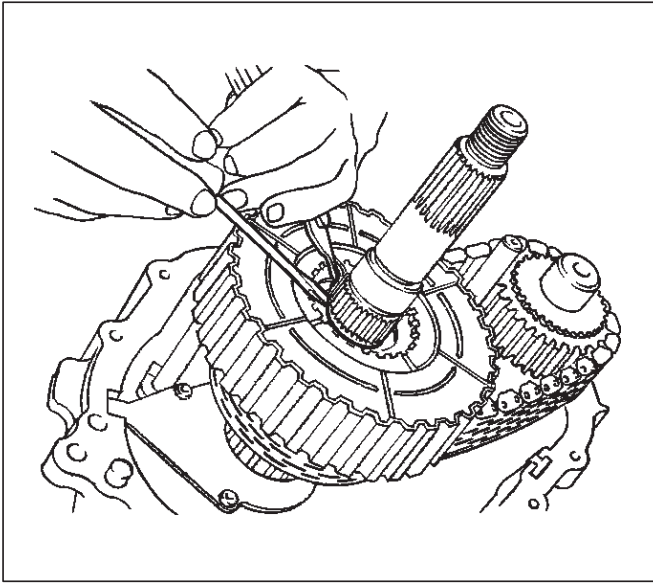
1. Mount the clutch pack assembly to which the multi plate disk clutch is already installed to the output shaft.

NOTE: Mount the clutch pack assembly while adjusting the phase of both the clutch housing and drive sprocket.

2. Install the insulator washer.
3. Install the armature plate.

4D2-40 TRANSFER CASE (TOD)

4. Using snap ring pliers, install the snap ring.

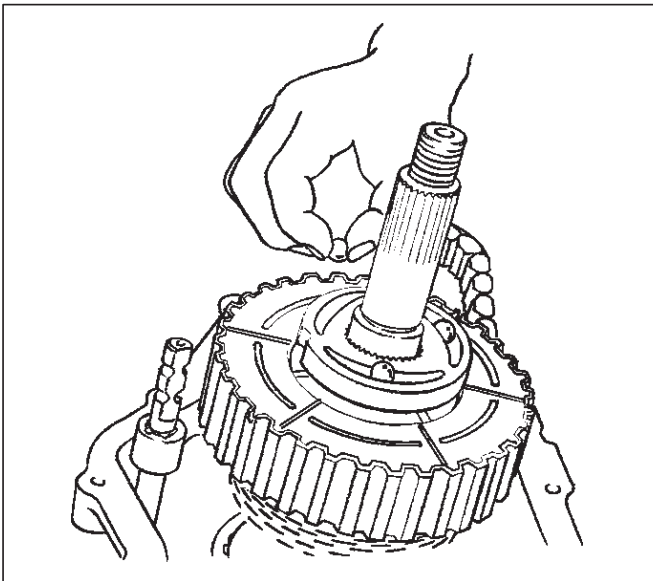


266RW009

5. Install the wave spring.

6. Install the cam pulley.

7. Place a ball on each groove of the cam pulley.



266RW013

8. Install the cam and coil housing.

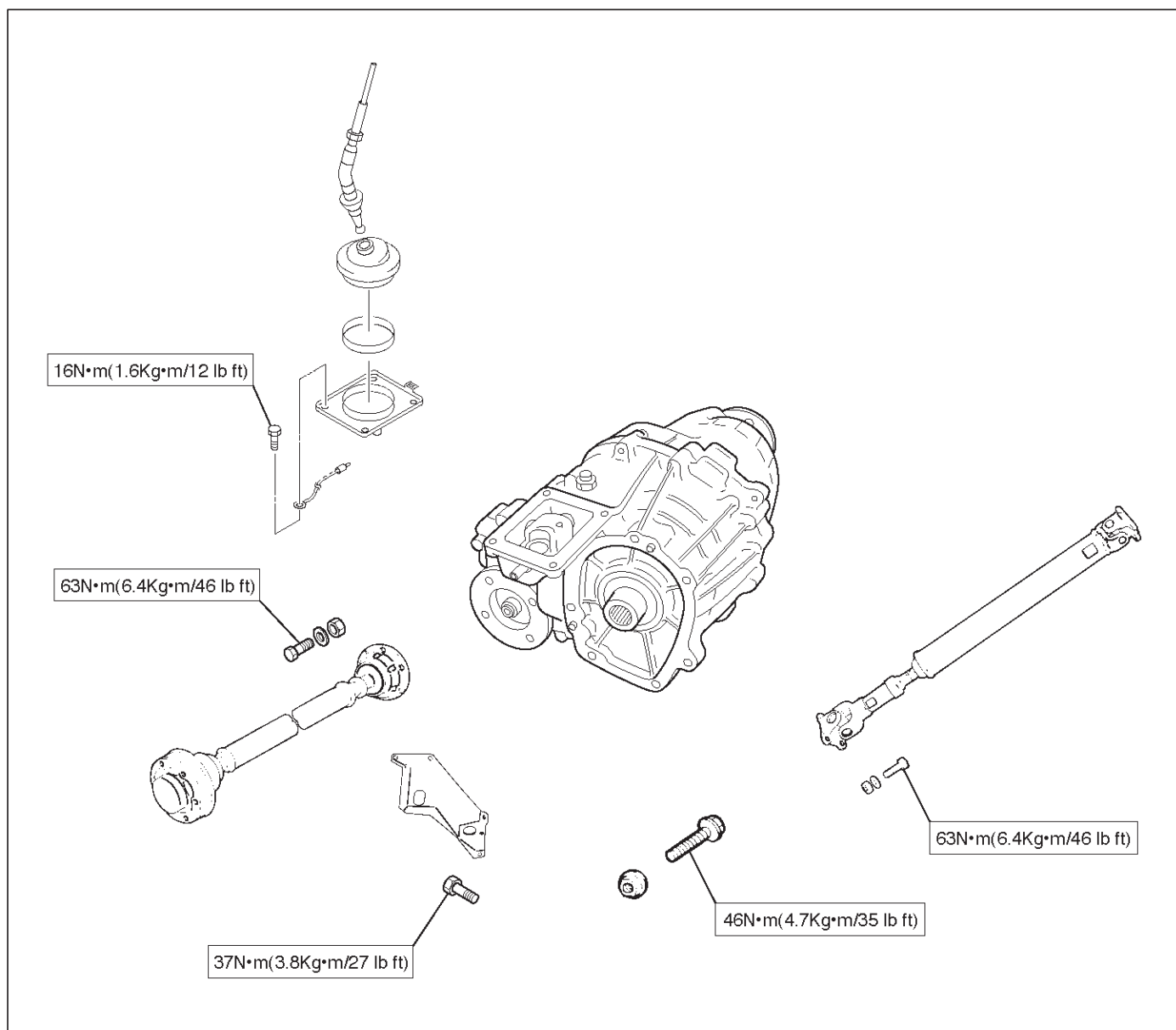
9. Install the thrust bearing.

Main Data and Specifications

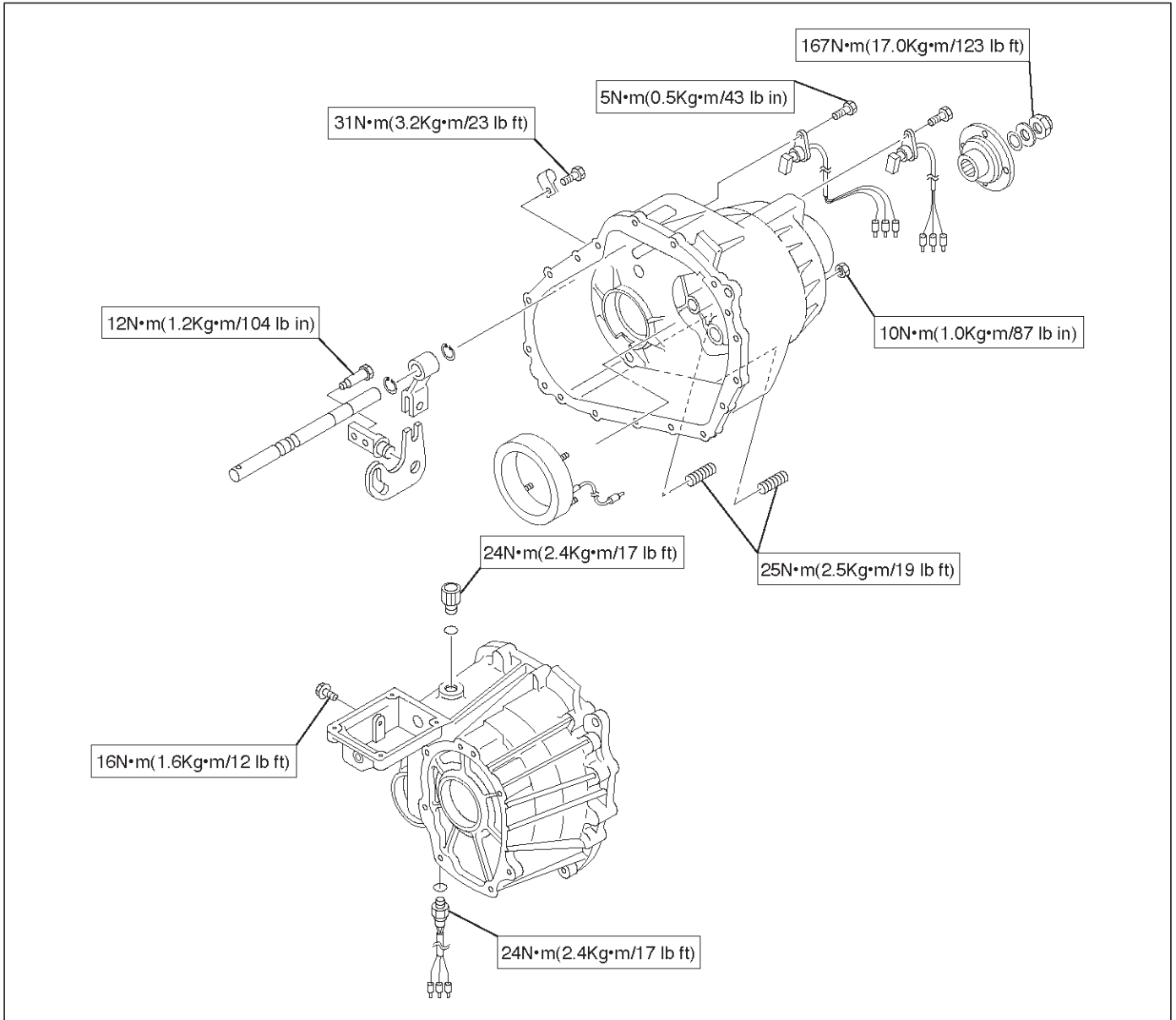
Leading Particulars

Type	2H TOD 4L	Transfer case with low range reduction mechanism Rear wheel drive Electronically controlled torque split four wheel drive Low-speed mechanical lock-up four wheel drive
Control system		Floor direct control
Gear ratio	H L	1.000 2.480
Oil quantity, Lit		1.9
Oil		ATF DEXRON®-IIE or ATF DEXRON®-III

Torque Specifications



4D2-42 TRANSFER CASE (TOD)



Special Tools

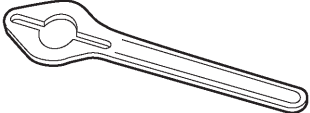
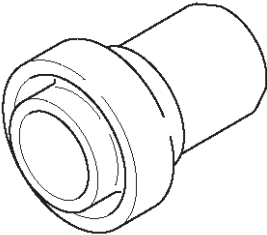
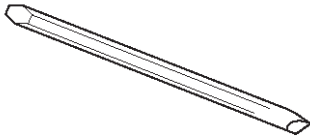
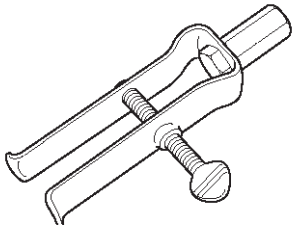
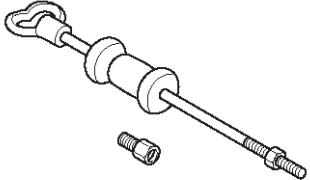
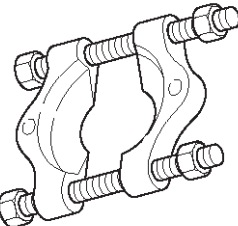

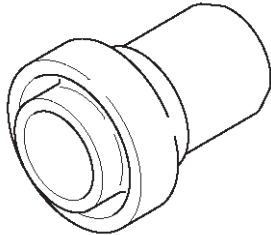
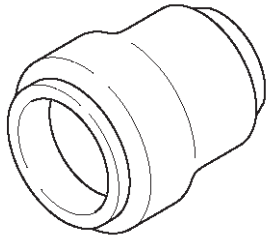
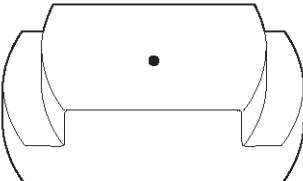
ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW071</p>	<p>5-8840-0133-0 (J-8614-11) Flange Holder</p>
 <p>901RW095</p>	<p>5-8840-2412-0 (J-42804) Rear Oil Seal Installer</p>
 <p>901RW089</p>	<p>5-8840-2293-0 (J-39209) Punch</p>
 <p>901RW094</p>	<p>5-8840-2409-0 (J-42805) Bearing Remover</p>
 <p>901RW096</p>	<p>5-8840-0084-0 (J-2619-01) Slide Hammer</p>
 <p>901RW091</p>	<p>5-8840-0015-0 (J-22912-01) Bearing Remover</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW093</p>	<p>5-8840-2413-0 (J-42806) Ring Gear Replacer</p>
 <p>901RW095</p>	<p>5-8840-2410-0 (J-42807) Front Out Oil Seal Installer</p>
 <p>901RW097</p>	<p>5-8840-2411-0 (J-42808) Input Shaft Oil Seal Installer</p>
 <p>901RW098</p>	<p>5-8840-2416-0 (J-42809) Ring Gear Installer</p>

BRAKES

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Anti-lock Brake System	5B	Parking Brakes	5D

BRAKE CONTROL SYSTEM

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Service Precaution

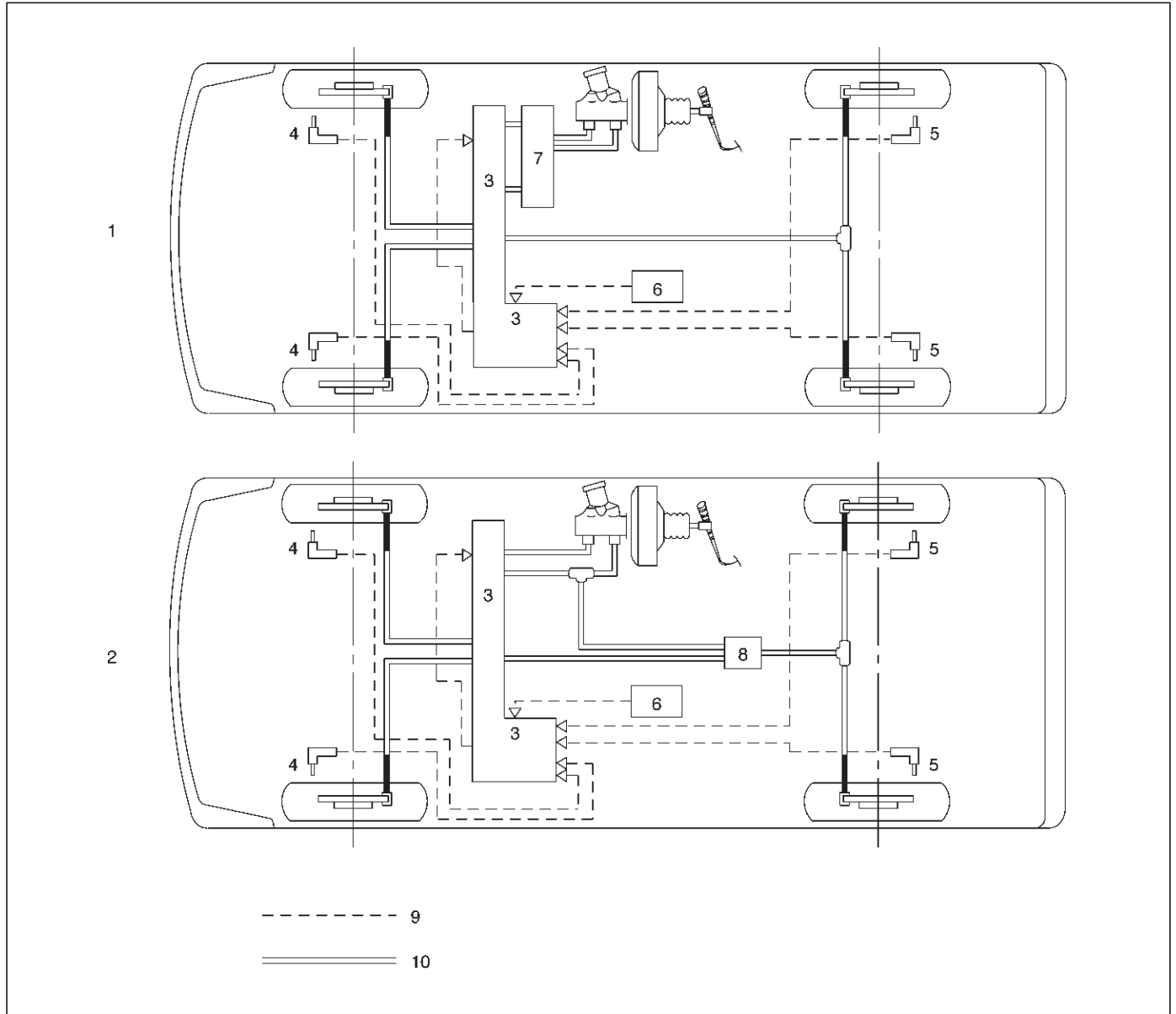
WARNING: IF SO EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM (SRS), REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCUC) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.

This system helps the driver maintain greater control of the vehicle under heavy braking conditions.



Legend

- | | |
|---|---|
| (1) With P&B Valve Model | (6) G-Sensor |
| (2) With LSPV Model | (7) Proportioning and Bypass (P&B) Valve |
| (3) Electronic Hydraulic Control Unit (EHCUC) | (8) Load Sensing Proportioning Valve (LSPV) |
| (4) Front Wheel Speed Sensor | (9) Electronic Line |
| (5) Rear Wheel Speed Sensor | (10) Hydraulic Line |

System Components

Electronic Hydraulic Control Unit (EHCUC), four Wheel Speed Sensors, Warning Light, and G-sensor.

Electronic Hydraulic Control Unit (EHCUC)

The EHCUC consists of ABS control circuits, fault detector, and a fail-safe. It drives the hydraulic unit according to the signal from each sensor, cancelling ABS to return to

5A-4 BRAKE CONTROL SYSTEM

normal braking when a malfunction has occurred in the ABS.

The EHCU has a self-diagnosing function which can indicate faulty circuits during diagnosis.

The EHCU is mounted on the engine compartment front right side. It consists of a Motor, Plunger Pump, Solenoid Valves and Check Valve.

On the outside, the relay box containing a motor relay and a valve relay is installed.

Solenoid Valves: Reduces or holds the caliper fluid pressure for each front disc brake or both rear disc brakes according to the signal sent from the EHCU.

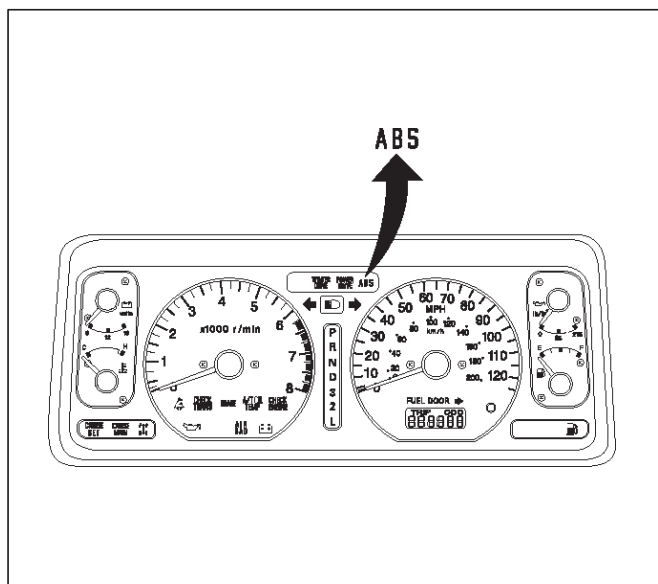
Reservoir: Temporarily holds the brake fluid that returns from the front and rear disc brake caliper so that pressure of front disc brake caliper can be reduced smoothly.

Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.

Motor: Drives the pump according to the signal from EHCU.

Check Valve: Controls the brake fluid flow.

ABS Warning Light



Vehicles equipped with the Anti-lock Brake System have an amber "ABS" warning light in the instrument panel. The "ABS" warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCU). In case of an electronic malfunction, the EHCU will turn "ON" the "ABS" warning light and disable the Anti-lock braking function.

The "ABS" light will turn "ON" for approximately three seconds after the ignition switch is to the "ON" position. If the "ABS" light stays "ON" after the ignition switch is the "ON" position, or comes "ON" and stays "ON" while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the axle shaft bearing holder on the rear wheels.

The rotor is press-fit in the axle shaft.

The flux generated from electrodes magnetized by a magnet in the sensor varies due to rotation of the rotor, and the electromagnetic induction generates alternating voltage in the coil. This voltage draws a "sine curve" with the frequency proportional to rotor speed and it allows detection of wheel speed.

G-Sensor

The G-sensor installed inside the center console detects the vehicle deceleration speed and sends a signal to the EHCU. In 4WD operation, all four wheels may be decelerated in almost the same phase, since all wheels are connected mechanically.

This tendency is noticeable particularly on roads with low friction coefficient, and the ABS control is adversely affected.

The G-sensor judges whether the friction coefficient of road surface is low or high, and changes the EHCU's operating system to ensure ABS control.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal "bump" will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.

When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a constant force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor.

This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS
Anti-lock Brake System

CKT
Circuit

DLC
Data Link Connector

EHCU
Electronic Hydraulic Control Unit

FL
Front Left

FR
Front Right

GEN
Generator

MV
Millivolts

RL
Rear Left

RR
Rear Right

RPS
Revolution per Second

VDC
Volts DC

VAC
Volts AC

W/L
Warning Light

WSS
Wheel Speed Sensor

General Diagnosis

General Information

ABS malfunction can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.

In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.

Please refer to Section 5C for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- Box Wrench
- Brake Fluid
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCUC) which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCUC circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position.

Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to

observe these precautions may result in Anti-lock Brake System damage.

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCUC and valve block connectors should be disconnected before the welding operation begins.
- The EHCUC and valve block connectors should never be connected or disconnected with the ignition "ON".
- EHCUC of the Anti-lock Brake System are not separately serviceable and must be replaced as assemblies. Do not disassemble any component which is designated as non-serviceable in this Section.
- If only rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

If the battery has been discharged

The engine may stall if the battery has been completely discharged and the engine is started via jumper cables. This is because the Anti-lock Brake System (ABS) requires a large quantity of electricity. In this case, wait until the battery is recharged, or set the ABS to a non-operative state by removing the fuse for the ABS (40A). After the battery has been recharged, stop the engine and install the ABS fuse. Start the engine again, and confirm that the ABS warning light does not light.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

5A-6 BRAKE CONTROL SYSTEM

Test Driving ABS Complaint Vehicles

In case that there has been an malfunction in the lighting pattern of "ABS" warning light, the fault can be located in accordance with the "DIAGNOSIS BY "ABS" WARNING LIGHT ILLUMINATION PATTERN" . In case of such trouble as can be detected by the driver as a vehicle symptom, however, it is necessary to give a test drive following the test procedure mentioned below, thereby reproducing the symptom for trouble diagnosis on a symptom basis:

1. Start the engine and make sure that the "ABS" W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.
2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.
3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.
8. If the abnormality has been detected, repair in accordance with the "SYMPTOM DIAGNOSIS" .

NOTE:

- Be sure to give a test drive on a wide, even road with little traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

"ABS" Warning Light

When ABS trouble occurs and actuates when possible the "ABS" warning light, the trouble code corresponding to the trouble is stored in the EHCUC. Only the ordinary brake system is available when the ABS is turned off. When the "ABS" warning light is actuated, if the starter switch is set ON after setting it OFF once, the EHCUC checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light works normally even though the trouble code is stored.

NOTE: Illumination of the "ABS" warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

Normal Operation

"ABS" Warning Light

When the ignition is first moved from "OFF" to "RUN" , the amber "ABS" warning light will turn "ON" . The "ABS" warning light will turn "ON" during engine starting and will usually stay "ON" for approximately three seconds after the ignition switch is returned to the "ON" position. The warning light should remain "OFF" at all other times.

Basic Diagnostic Flow Chart

Step	Action	Yes	No
1	1. Customer complaint. 2. Questioning to customer. 3. Basic inspection (Refer to "Basic inspection procedure") Using TECH 2?	Go to Step 2	Go to Step 4
2	Make sure of DTC by mode "F0: Diagnostic Trouble Codes". Is EHCUC including DTC?	Go to Step 3	Go to Step 5
3	1. Repair of faulty part. 2. Elimination of DTC. 3. Inspection of "ABS" W/L Illumination pattern with ignition SW "ON". 4. Test drive. Does repeat trouble?	Repeat the diagnosis if the symptom or DTC appears again Go to Step 1	Go to Step 5
4	Check if the DTC is stored. Is EHCUC including DTC?	Go to Step 3	Trouble diagnosis based on symptom (Refer to "SYMPTOM DIAGNOSIS") Go to Step 3
5	1. Reconnect all components and ensure all component are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Finished	Go to Step 5

Basic Inspection Procedure

1. Basic Inspection of System Brake

Step	Action	Yes	No
1	Is the fluid level normal?	Go to Step 2	Replenish with fluid. Go to Step 2
2	Does fluid leak?	Repair. Go to Step 3	Go to Step 3
3	Is the booster functioning normal?	Go to Step 4	Repair. Go to Step 4
4	Is the pad and rotor normal?	Go to Step 5	Repair. Go to Step 5
5	Reconnect all components and ensure all component are properly mounted. Was this step finished?	Finished	Go to Step 5

2. Inspection of Front Axle Switch

Step	Action	Yes	No
1	Turn the key switch on and shift the T/F to 4WD position. Does the 4WD light come on?	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Finished	Go to Step 2

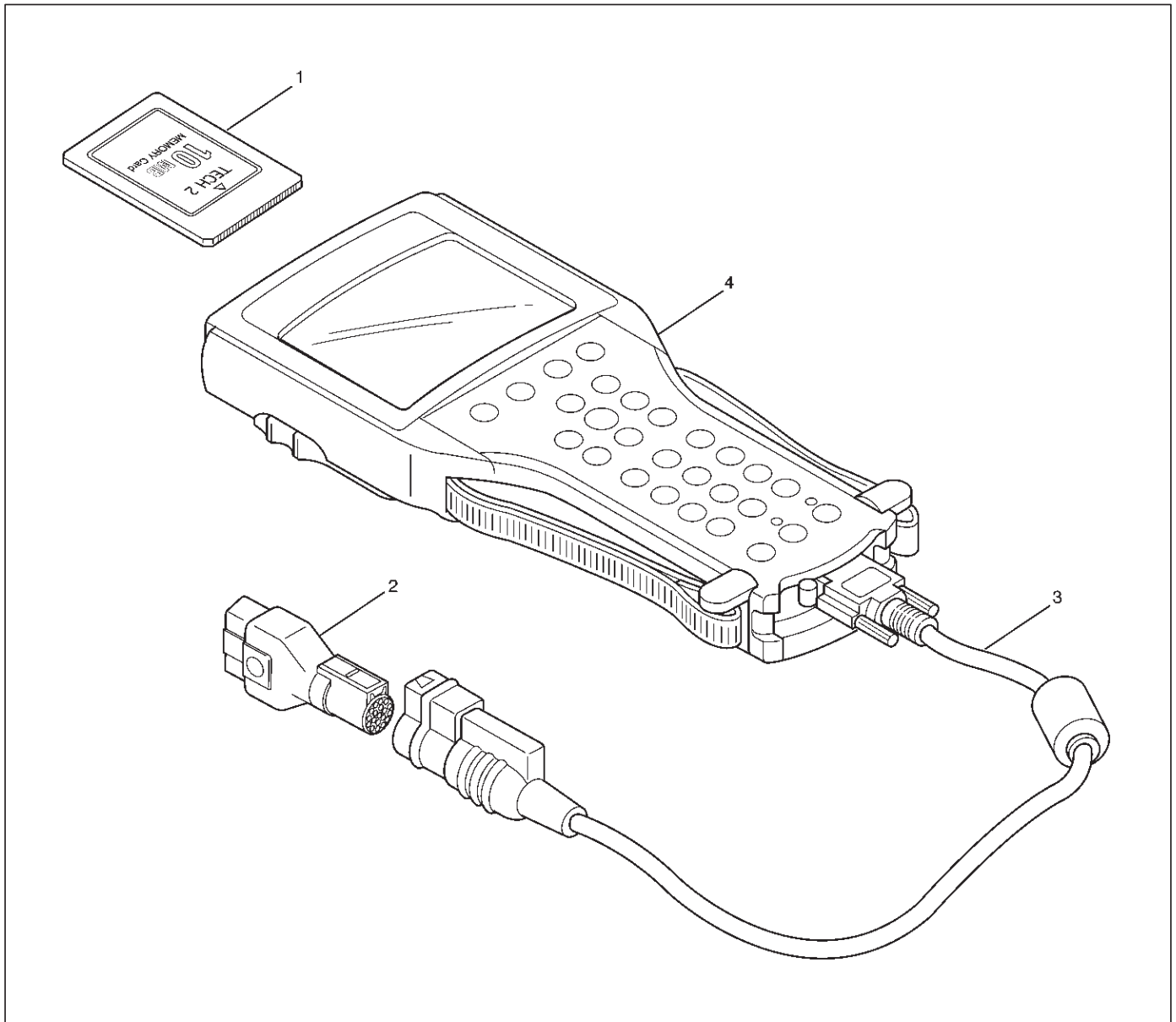
3. Ground Inspection

Step	Action	Yes	No
1	Are ABS—related ground points ok?	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Finished	Go to Step 2

5A-8 BRAKE CONTROL SYSTEM

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



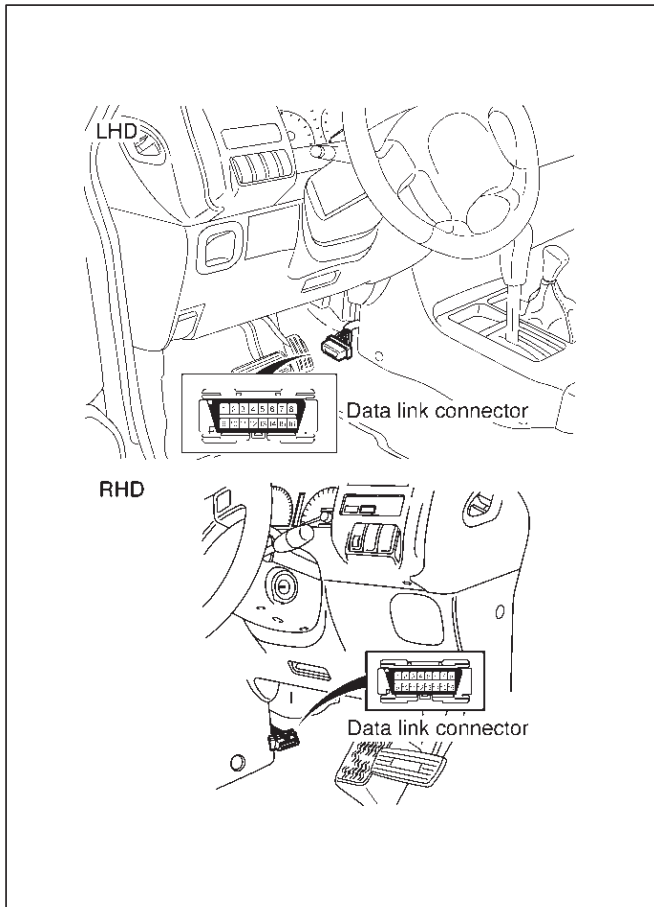
Legend

- (1) PCMCIA Card
- (2) SAE 16/19 Adaptor

- (3) DLC Cable
- (4) Tech-2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (4).
 2. Connect the SAE 16/19 adapter (2) to the DLC cable (3).
 3. Connect the DLC cable to the Tech 2 (4).
 4. Make sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC connector.



6. The vehicle ignition turns on.
7. Power up the Tech 2.

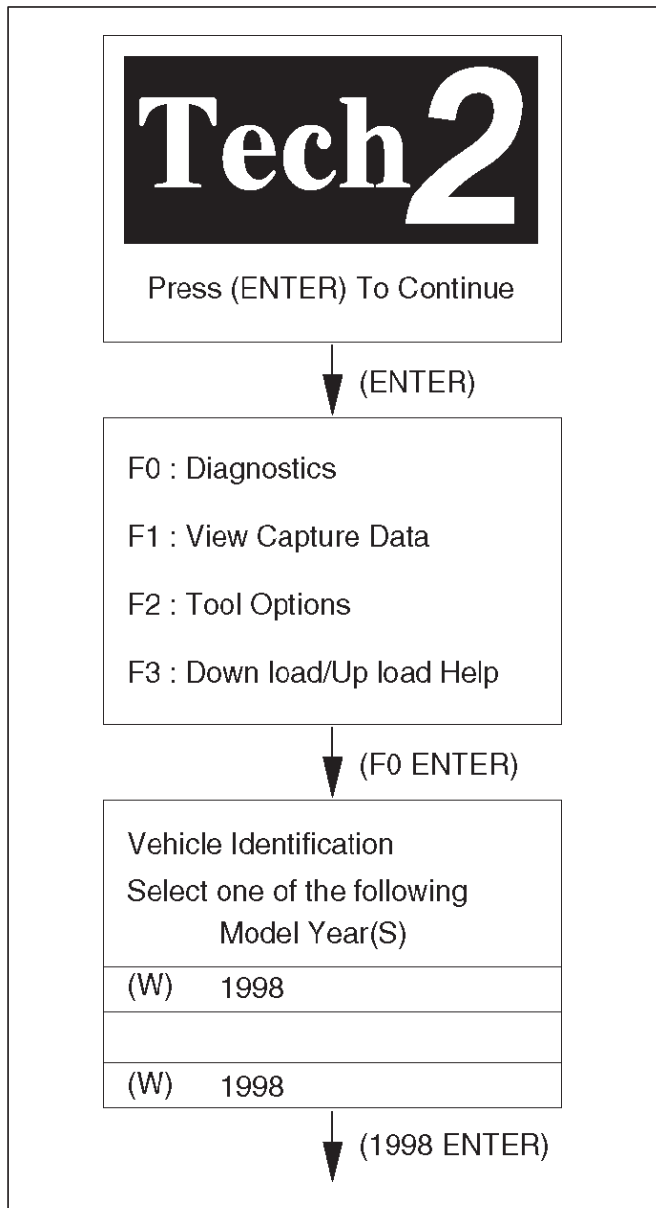
8. Verify the Tech 2 power up display.



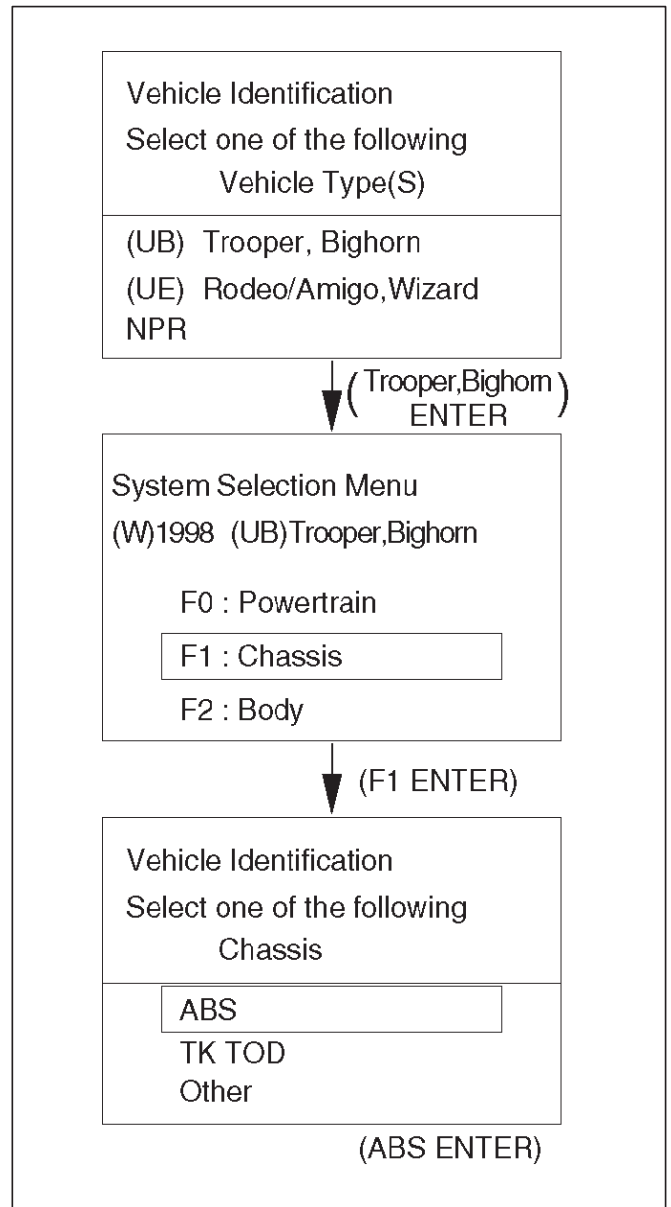
5A-10 BRAKE CONTROL SYSTEM

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RW014



060RW020

Data List

Display	Content	OK/NG Criteria for Data
Battery Voltage	Voltage	<ul style="list-style-type: none"> ● Between 10-16.9V
Brake Light Switch	Open/Close	<ul style="list-style-type: none"> ● Open(0V) when pedal is released
		<ul style="list-style-type: none"> ● Closed(12V) when pedal is depressed.
Front Left Wheel Speed Front Right Wheel Speed Rear Left Wheel Speed Rear Right Wheel Speed	MPH(km/h)	<ul style="list-style-type: none"> ● Start the vehicle and make sure of linear change in each wheel speed. ● Turn each wheel by hand and make sure that each speed data change.
Wheel Sensor Status	OK/NG	<ul style="list-style-type: none"> ● To be OK usually
G-sensor	Low/High	<ul style="list-style-type: none"> ● To be Low usually
Transfer Monitor(TOD)	2 Wheel Drive 4 Wheel Drive	<ul style="list-style-type: none"> ● When 2WD: 2 Wheel Drive ● When 4WD: 4 Wheel Drive
Off-Road Switch (Transmission Input)	Active/Inactive	<ul style="list-style-type: none"> ● When shift lever position is 1, 2 and R: Active (M/T)
		<ul style="list-style-type: none"> ● When shift lever position is L and R: Active (A/T)
Valve Relay	Active/Inactive	<ul style="list-style-type: none"> ● To be Active usually
ABS State	ON/OFF	<ul style="list-style-type: none"> ● To be OFF usually
ABS Relay	Active/Inactive	<ul style="list-style-type: none"> ● To be Active usually
Return Pump Relay	Active/Inactive	<ul style="list-style-type: none"> ● To be Inactive usually
Front Left Isolation Valve	Active/Inactive	<ul style="list-style-type: none"> ● To be Inactive usually
Front Left Dump Valve		
Front Right Isolation Valve		
Front Right Dump Valve		
Rear Isolation Valve		
Rear Dump Valve		
ABS Warning Lamp	ON/OFF	<ul style="list-style-type: none"> ● To be ON usually (while engine stopped)

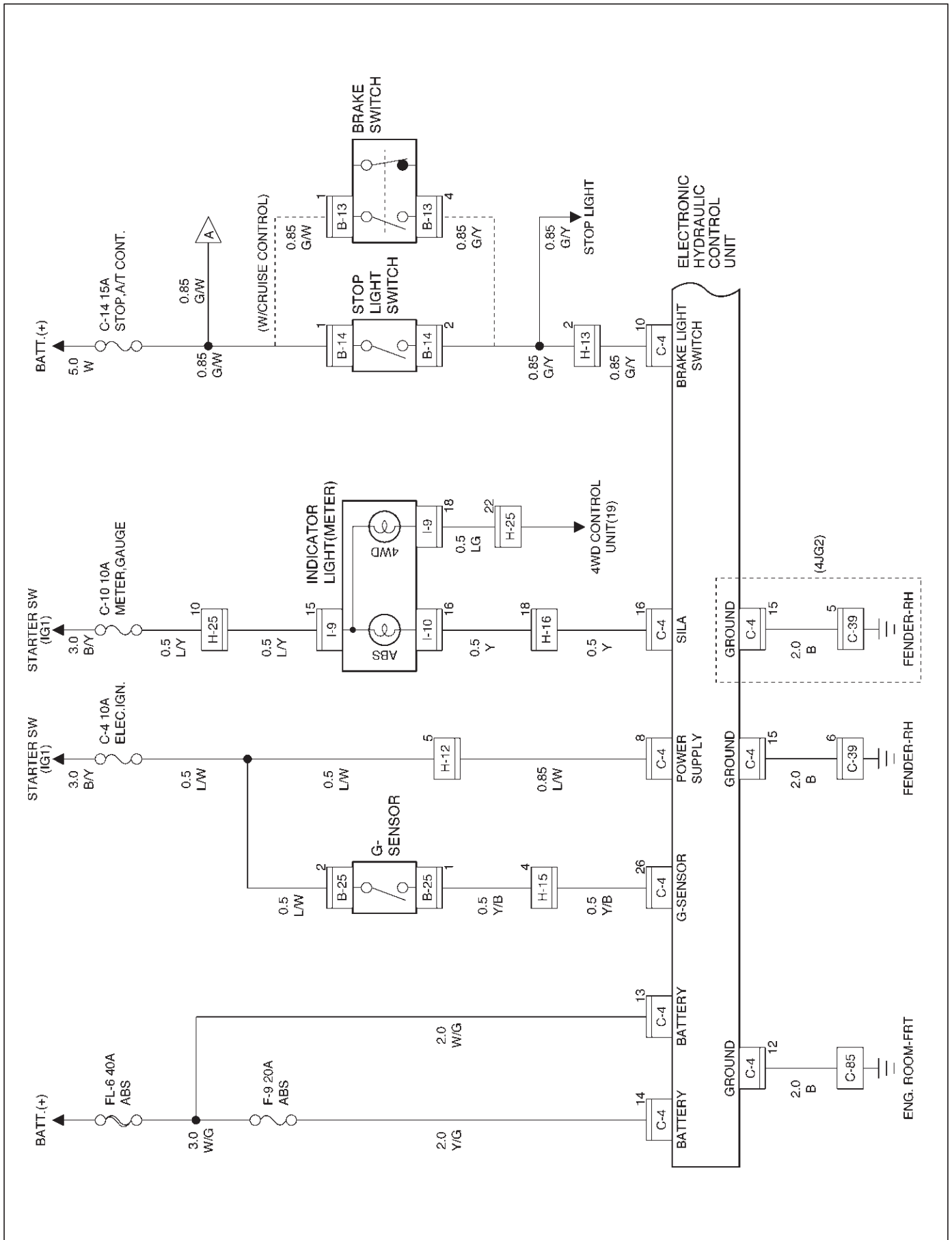
5A-12 BRAKE CONTROL SYSTEM

EHCUC Connector Pin-out Checks

- Disconnect Electronic Brake Control Module.
- Perform checks with high impedance digital multimeter (5-8840-0366-0) or equivalent.

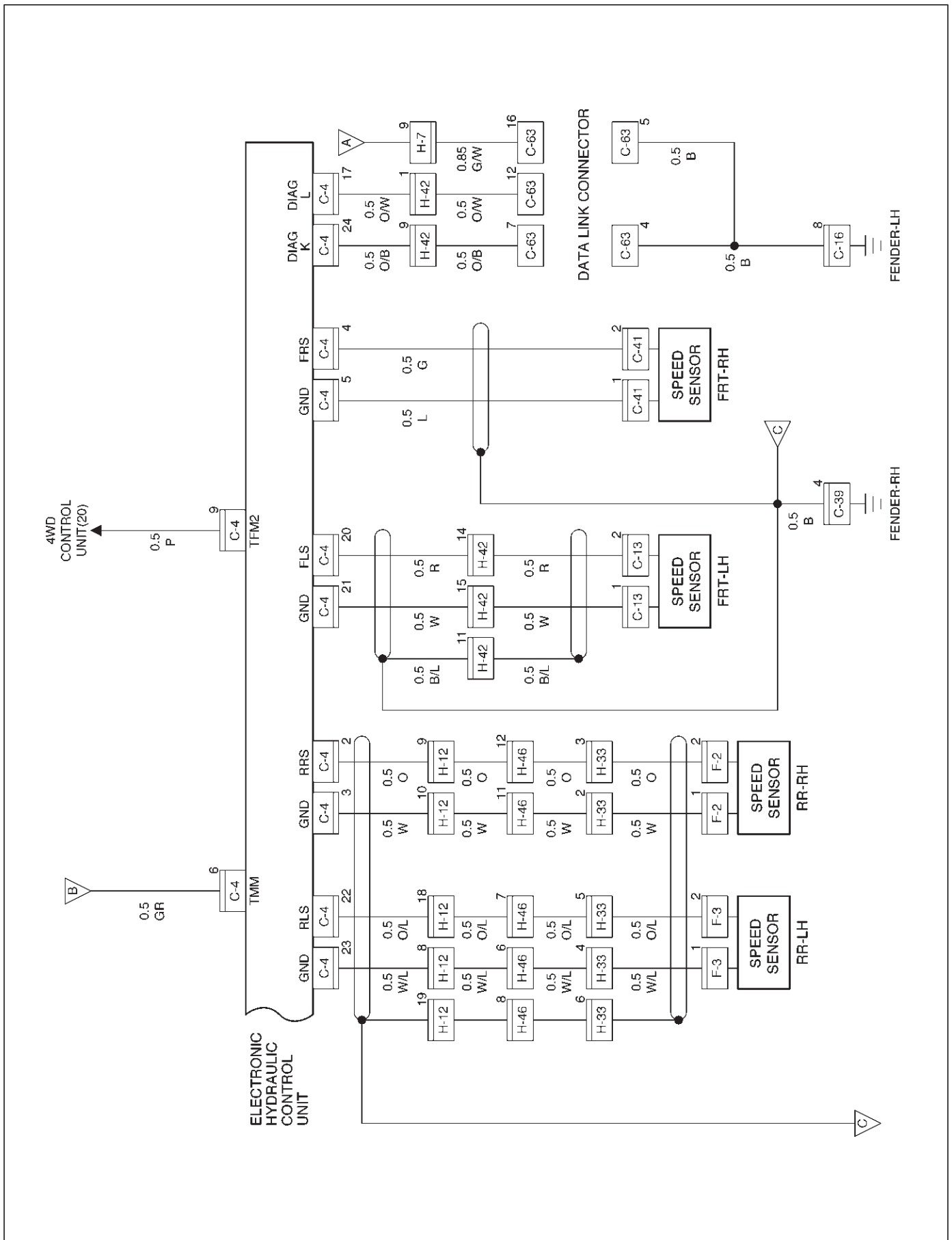
No.	Circuit to be Tested	Ignition Switch Position	Multimeter Scale/Range	Measure between Pin Number	Nominal Value	Note
1	Ignition enable	OFF	20DCV	8 (+), 15 (-)	0V to 0.1V	
		ON	20DCV	8 (+), 15 (-)	11.5V to 14.5V	
2	Stop light switch	OFF	20DCV	10, 15	10.5V to 14.5V	Press brake pedal
3	Ground connection	OFF	200 δ	12, Ground 15, Ground	Less than 2 δ	
4	FL speed sensor	OFF	2k δ	20, 21	1.3k to 1.9k δ	Internal Resistance
		OFF	200k δ	20, 15	more than 100k δ	Insulation Resistance
		OFF	200mACV	20, 21	more than 200mV	Turn wheel at 1RPS
5	FR speed sensor	OFF	2k δ	4, 5	1.3k to 1.9k δ	Internal Resistance
		OFF	200k δ	4, 15	more than 100k δ	Insulation Resistance
		OFF	200mACV	4, 5	more than 200mV	Turn wheel at 1RPS
6	RL speed sensor	OFF	2k δ	22, 23	1.3k to 1.9k δ	Insulation Resistance
		OFF	200k δ	22, 15	more than 100k δ	Internal Resistance
		OFF	200mACV	22, 23	more than 200mV	Turn wheel at 1RPS
7	RR speed sensor	OFF	2k δ	2, 3	1.3k to 1.9k δ	Internal Resistance
		OFF	200k δ	2, 15	more than 100k δ	Insulation Resistance
		OFF	200mACV	2, 3	more than 200mV	Turn wheel at 1RPS
8	G-sensor	ON		26,8	1k to 2k δ	Horizontal vehicle
9	Transmission Input	ON	20DCV	6 (+), 15 (-)	Less than 6V (Shift lever position – L, R) 6.6 to 9.0V (other shift position)	A/T Battery voltage 12V
					More than 9.6V (Shift lever position – 1, 2, R) 6.6 to 9.0V (other shift position)	M/T Battery voltage 12V

Circuit Diagram (LHD model / 6VD1 and 4JG2)

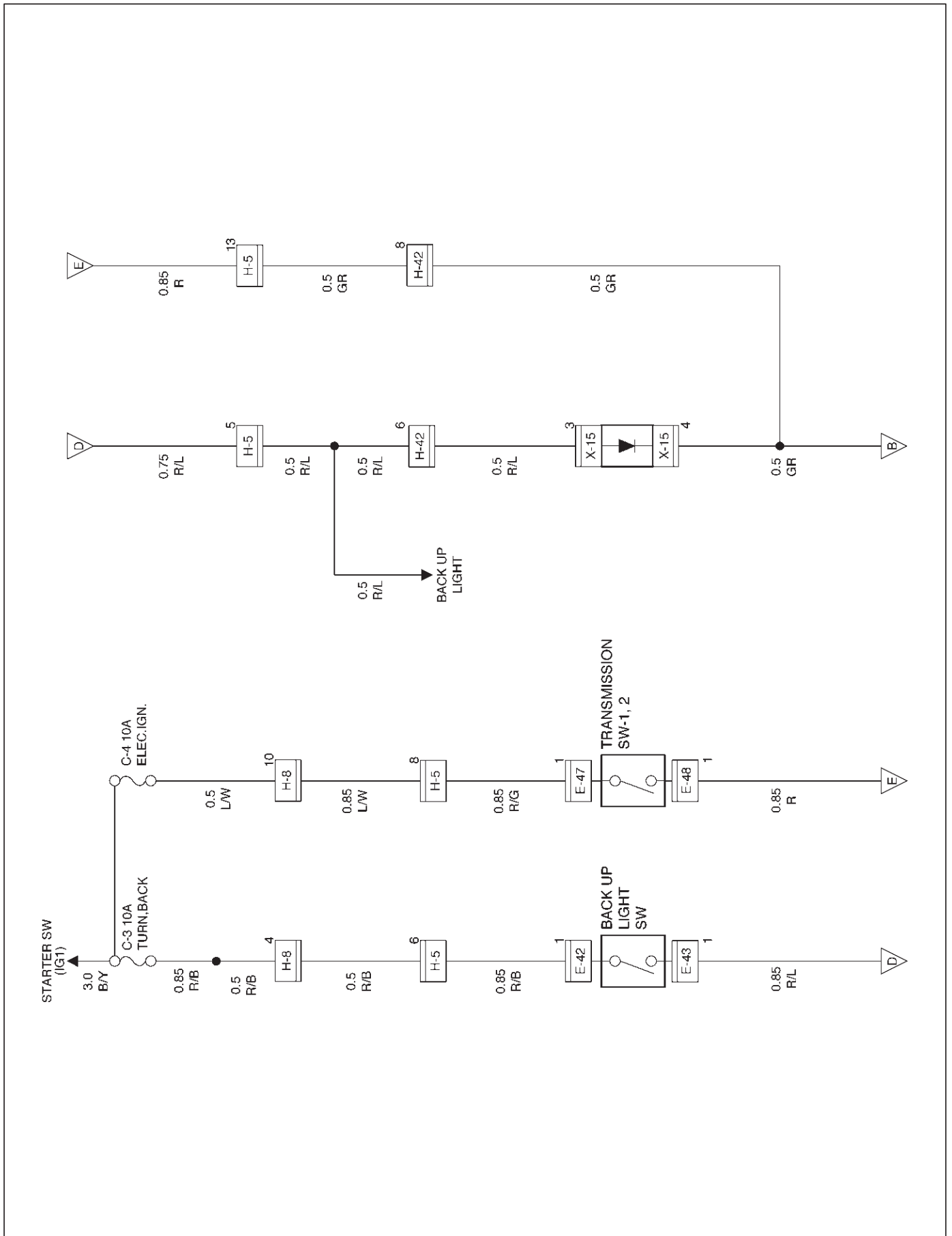


5A-14 BRAKE CONTROL SYSTEM

Circuit Diagram (LHD model / 4JG2)

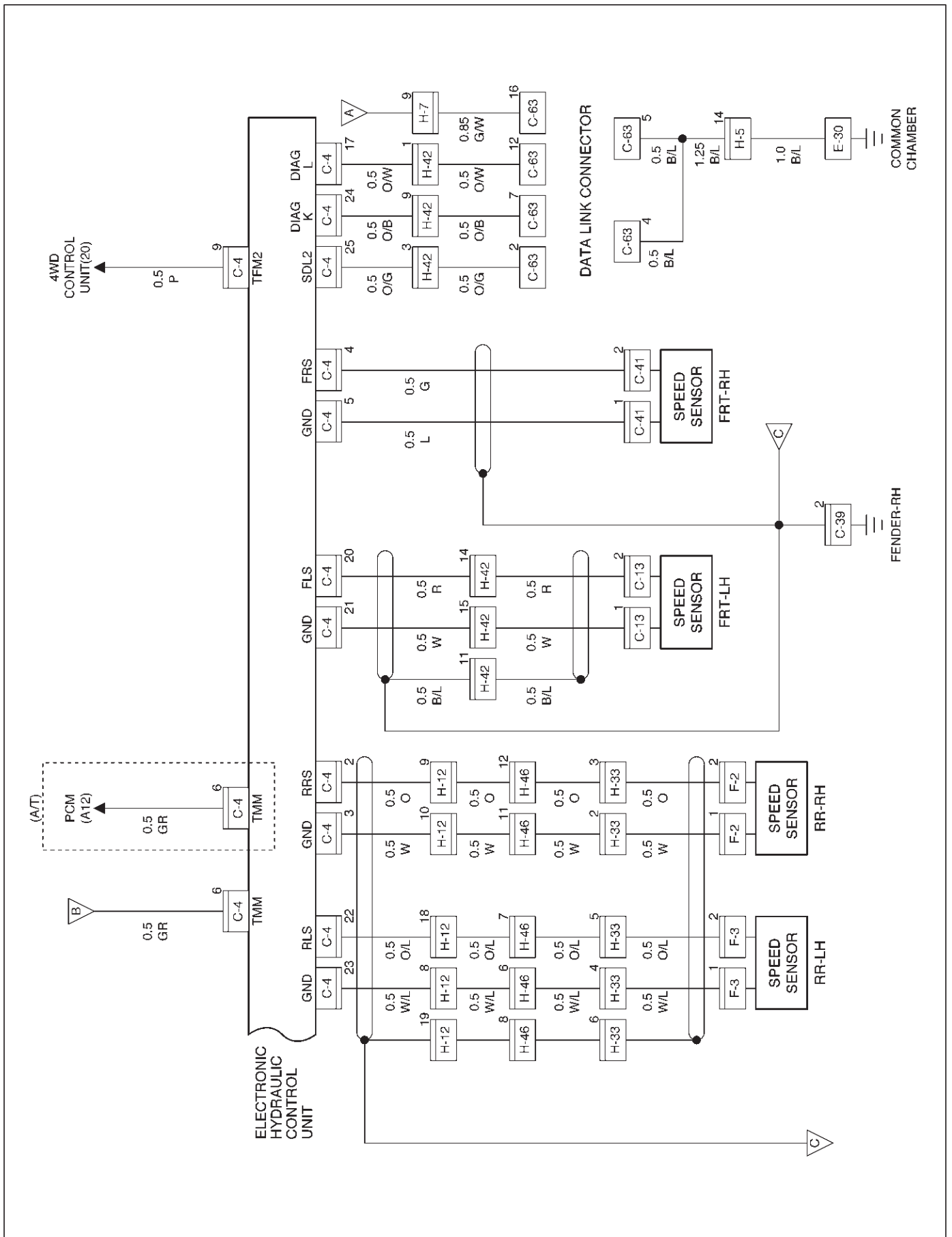


Circuit Diagram (LHD model / 4JG2)

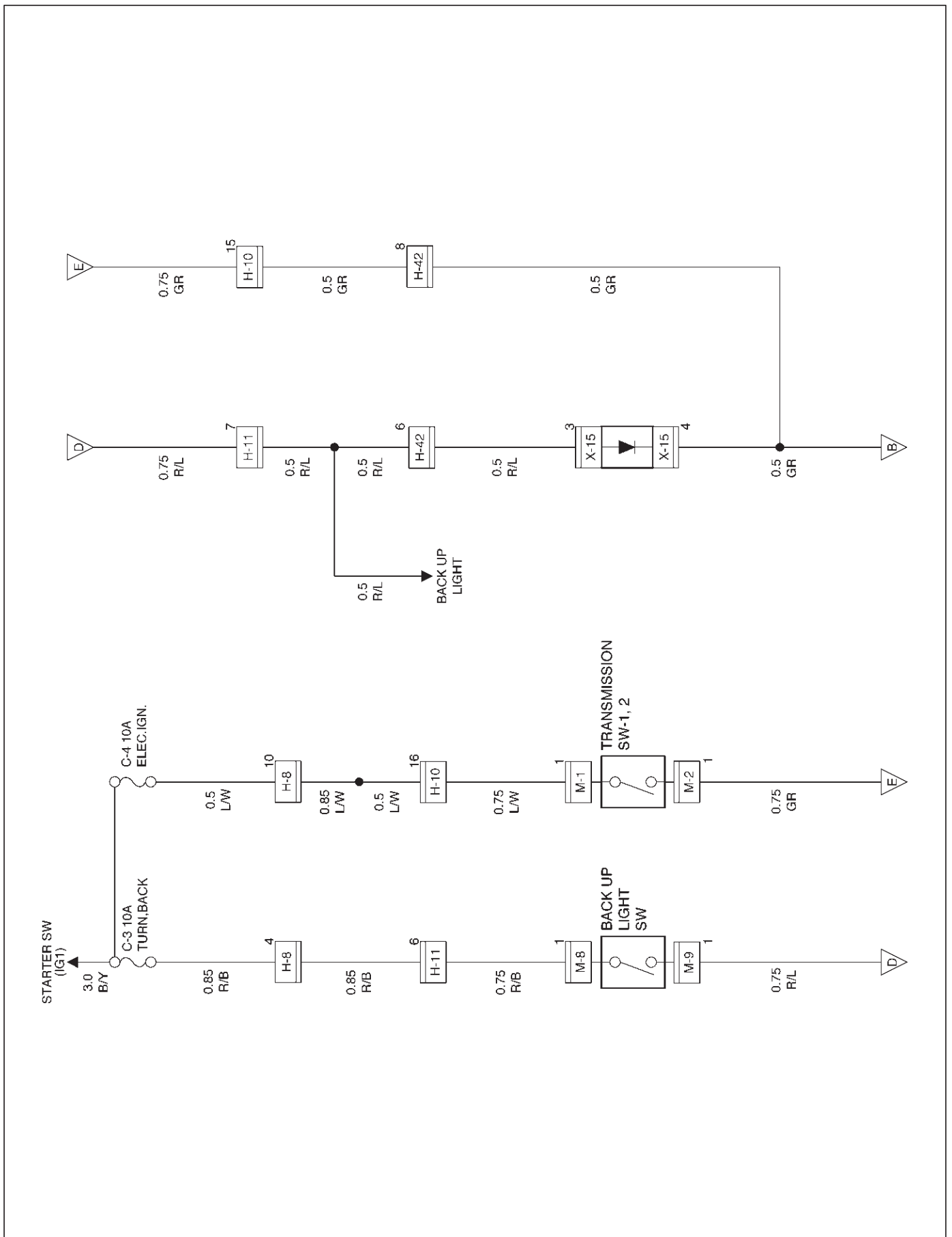


5A-16 BRAKE CONTROL SYSTEM

Circuit Diagram (LHD model / 6VD1)



Circuit Diagram (LHD model / 6VD1)



5A-18 BRAKE CONTROL SYSTEM

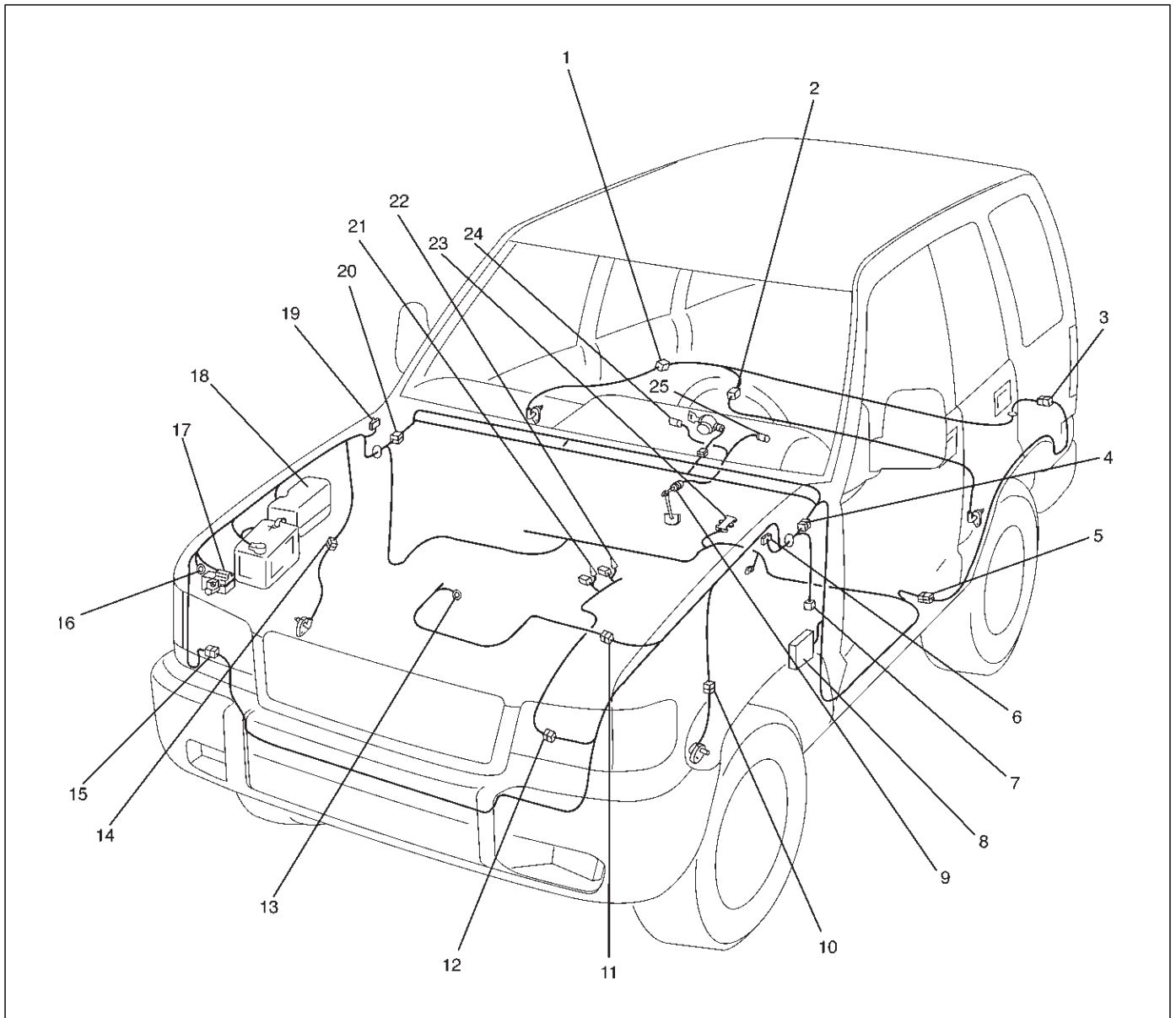
Connector List (LHD model)

No.	Connector face	No.	Connector face
B-13		C-85	
B-14		E-30	
B-25		E-42	
C-4		E-43	
C-13		E-47	
C-16		E-48	
C-39		F-2	
C-41		F-3	
C-63		H-5	

No.	Connector face	No.	Connector face
H-7		H-33	
H-8		H-42	
H-10		H-46	
H-11		I-9	
H-12		I-10	
H-13		M-1	
H-15		M-8	
H-16			
H-25			

5A-20 BRAKE CONTROL SYSTEM

Part Location (LHD model)

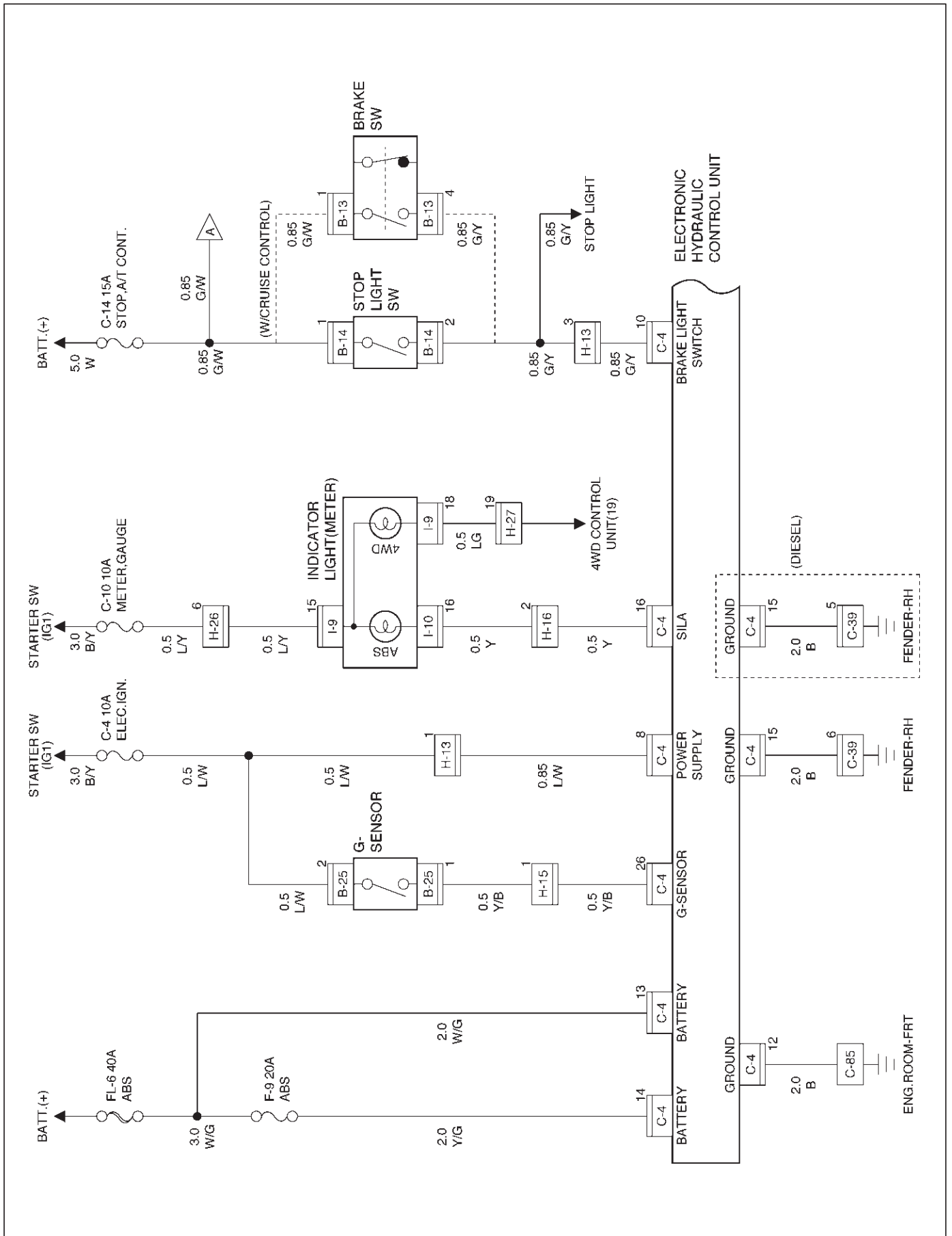


D08RW808

Legend

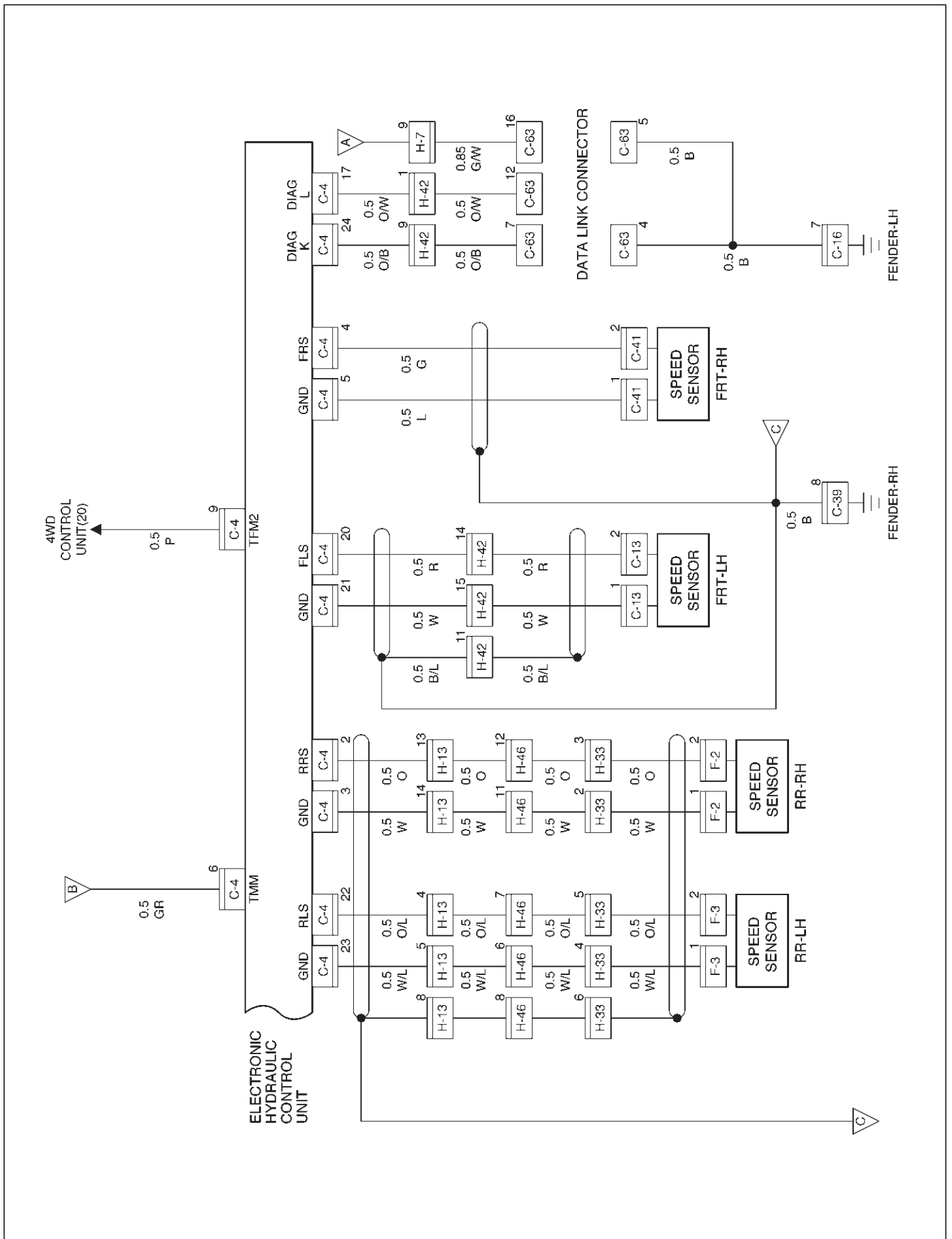
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|--------------------|-----------------------------|
| (1) F-2 | (13) E-30 |
| (2) F-3 | (14) C-41 |
| (3) H-33 | (15) H-42 |
| (4) H-7, H-8, H-25 | (16) C-85 |
| (5) H-46 | (17) C-4 (EHCUC) |
| (6) C-16 | (18) Relay & Fuse Box |
| (7) C-63 | (19) C-39 |
| (8) Fuse Box | (20) H-12, H-13, H-15, H-16 |
| (9) B-13 or B-14 | (21) E-47, E-48, M-1 |
| (10) C-13 | (22) E-42, E-43, M-8 |
| (11) H-5 | (23) B-25 |
| (12) H-10, H-11 | (24) I-10 |
| | (25) I-9 |

Circuit Diagram (RHD model / 6VD1 and 4JG2)

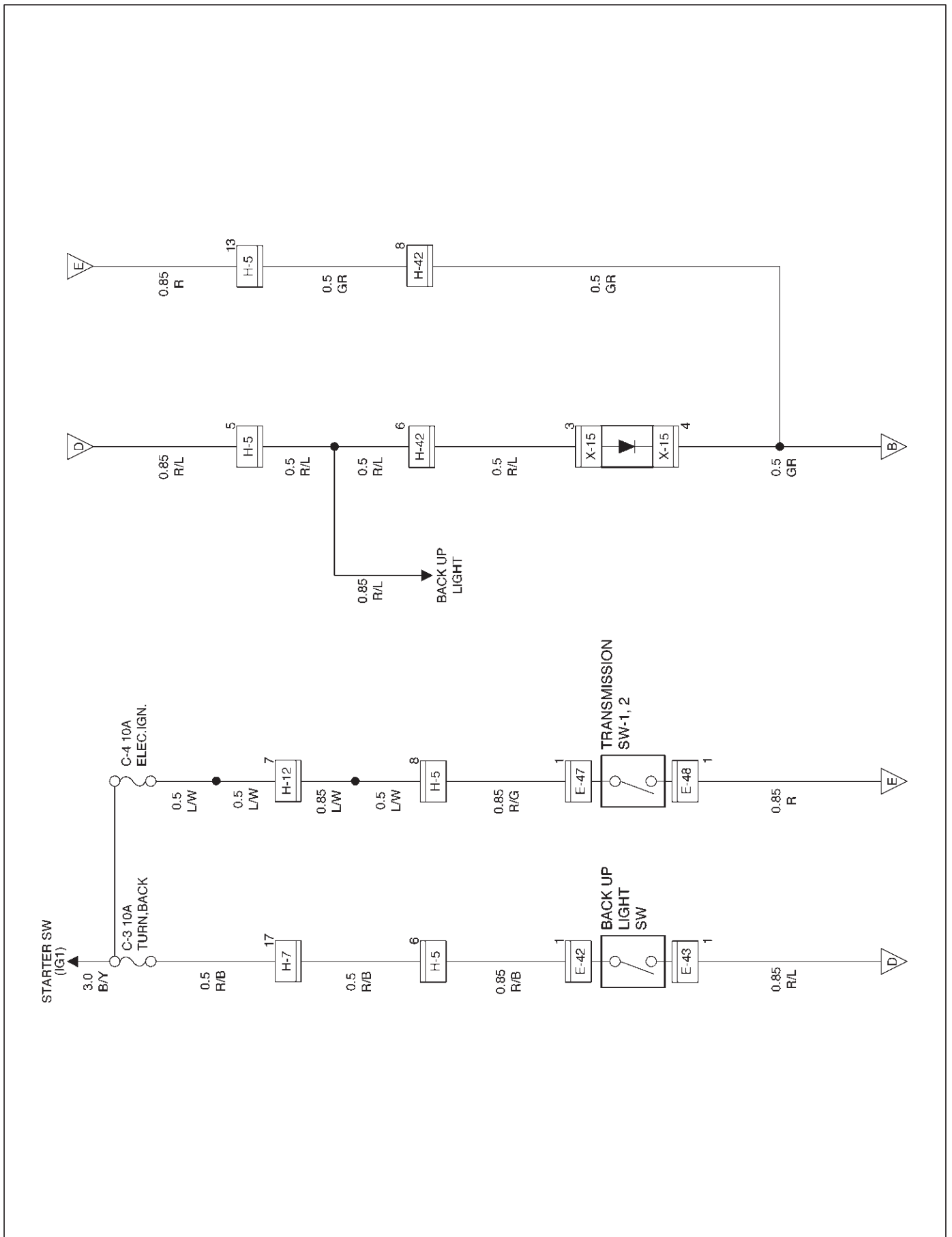


5A-22 BRAKE CONTROL SYSTEM

Circuit Diagram (RHD model / 4JG2)

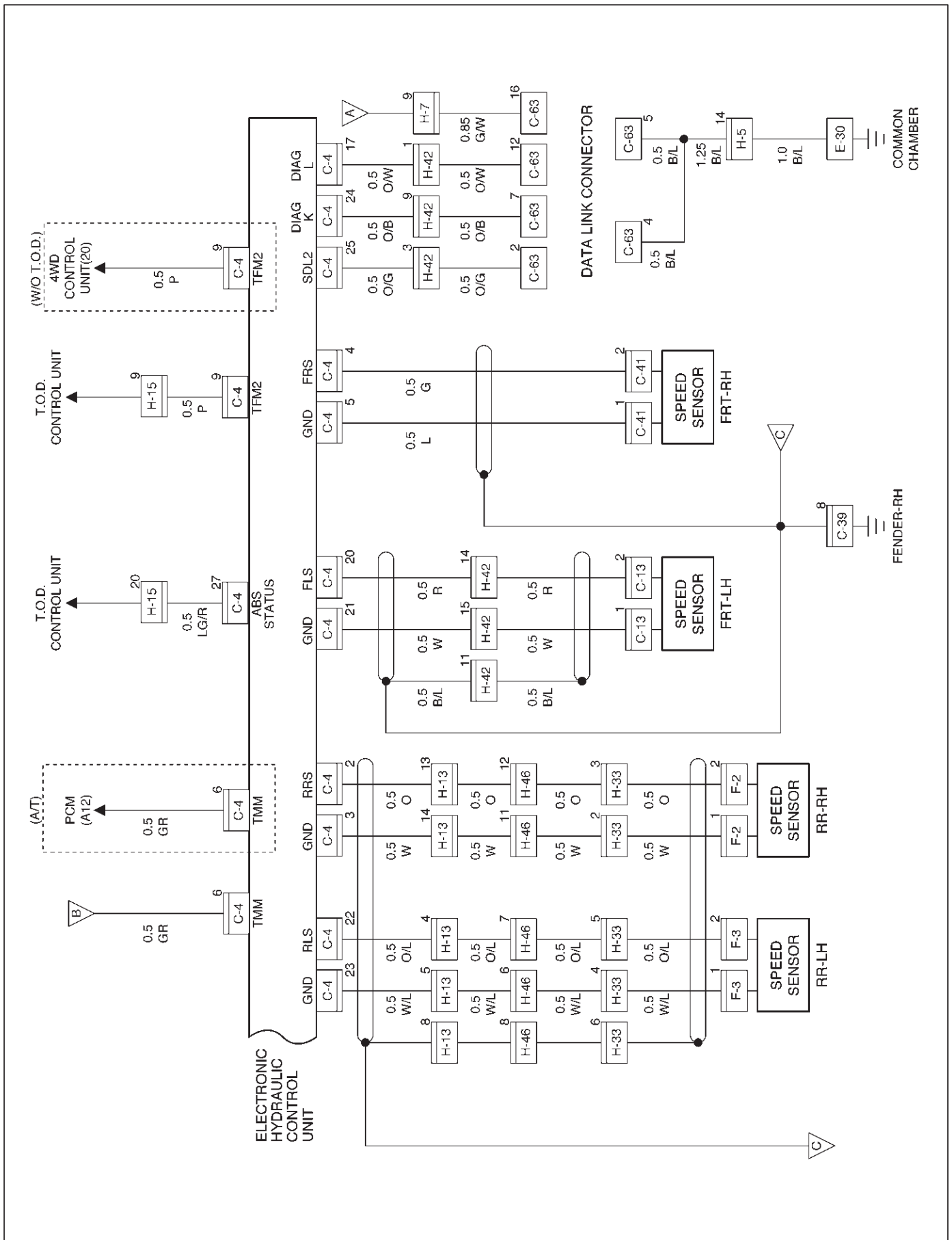


Circuit Diagram (RHD model / 4JG2)

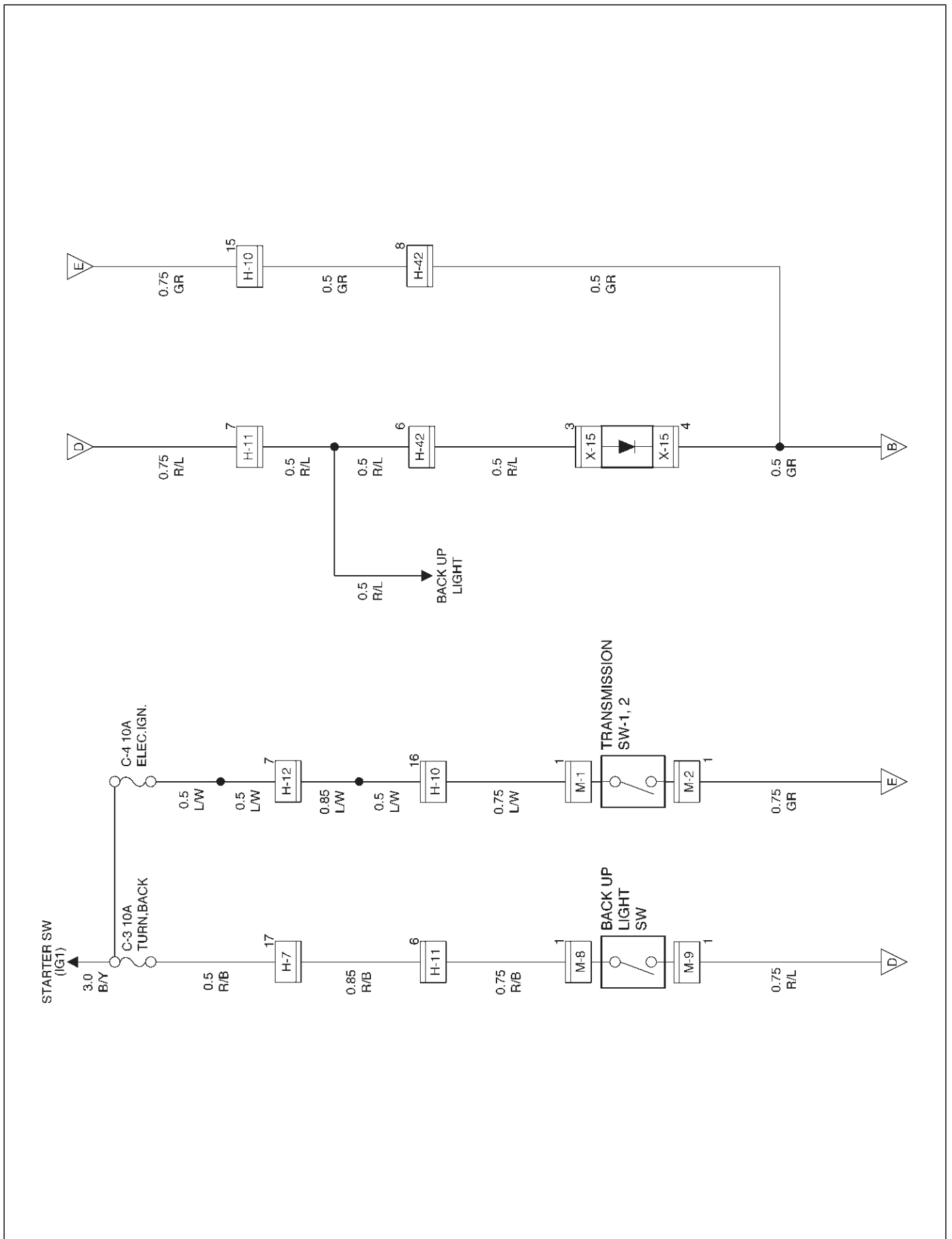


5A-24 BRAKE CONTROL SYSTEM

Circuit Diagram (RHD model / 6VD1)

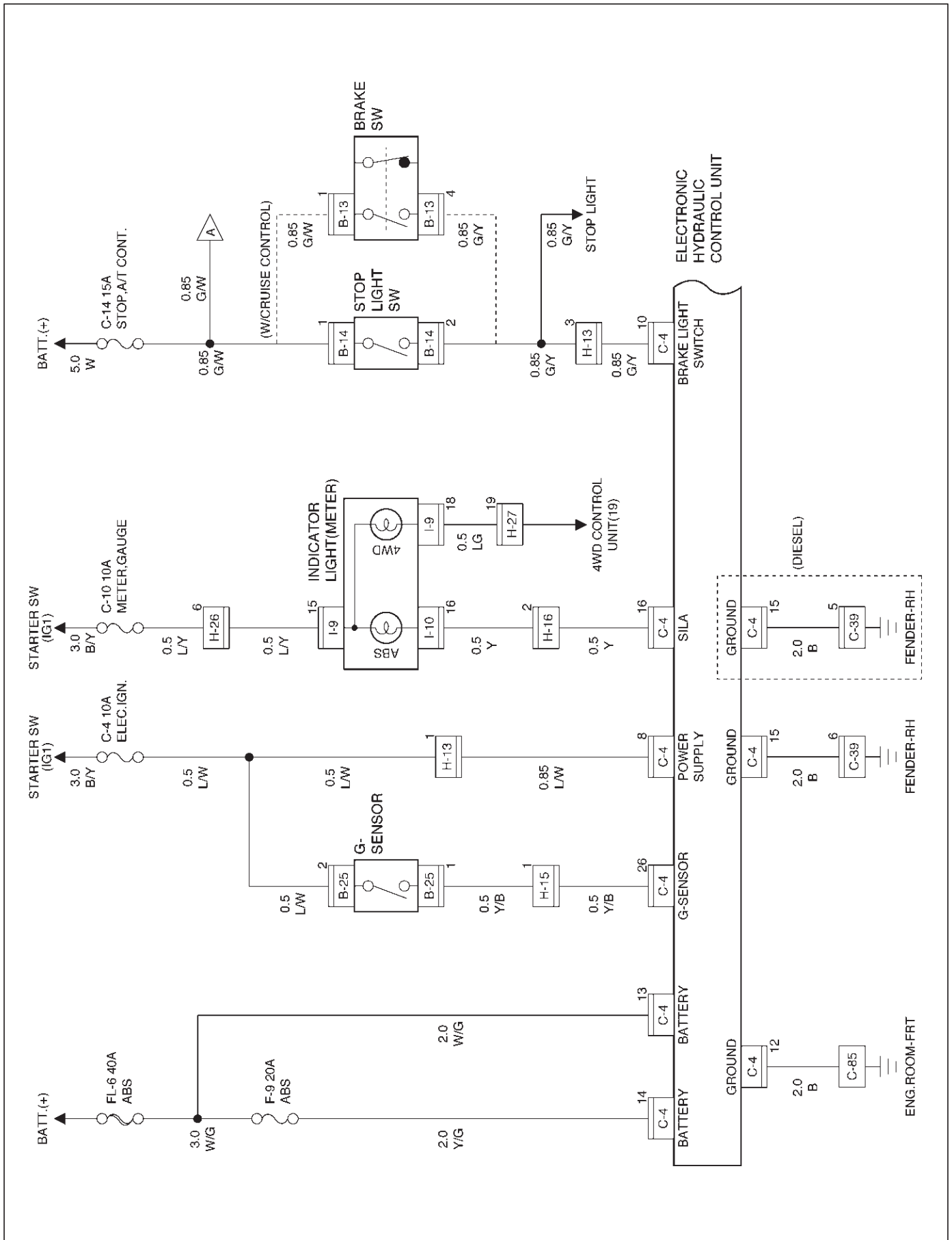


Circuit Diagram (RHD model / 6VD1)

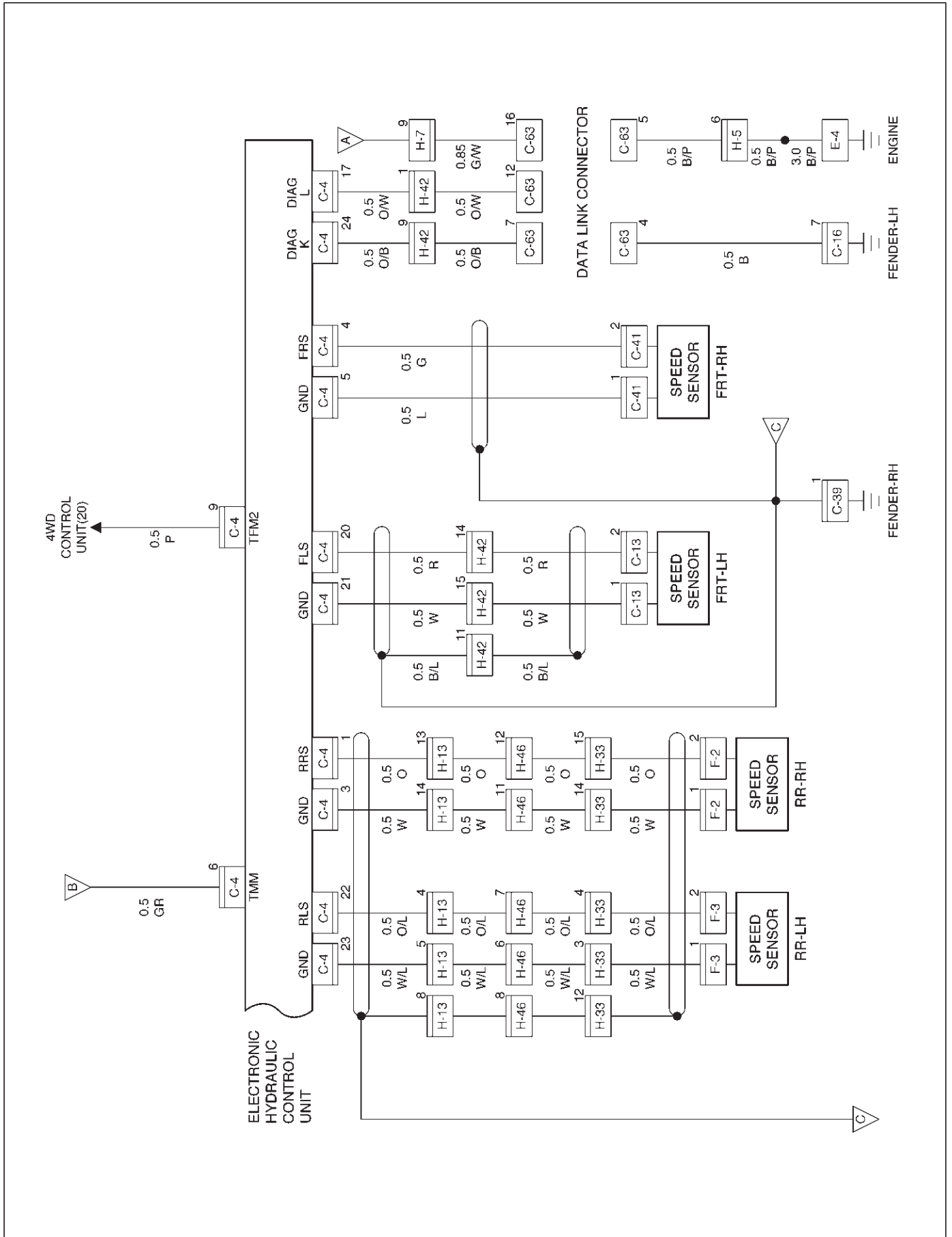


5A-26 BRAKE CONTROL SYSTEM

Circuit Diagram (RHD model / 6VE1 and 4JX1)

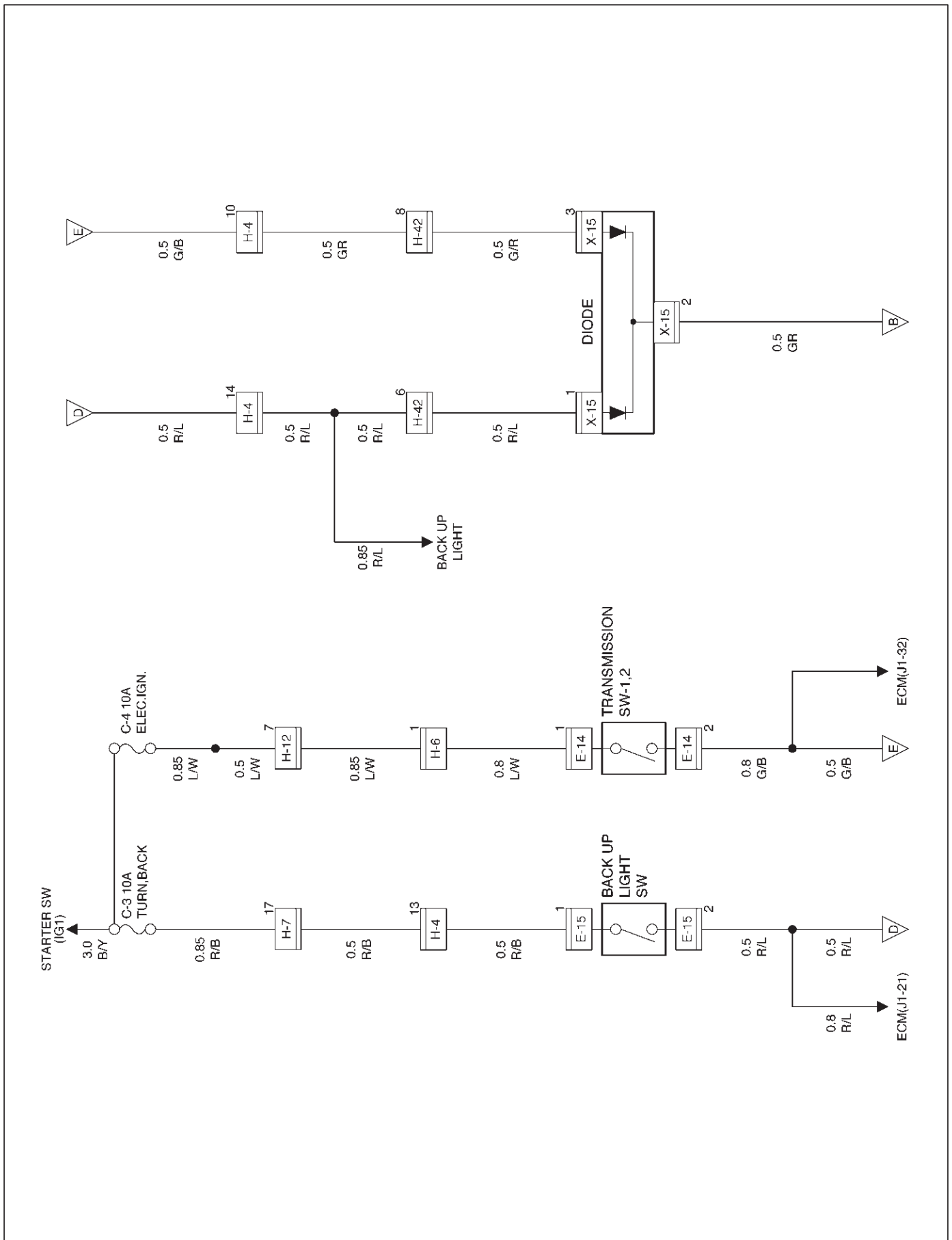


Circuit Diagram (RHD model / 4JX1)

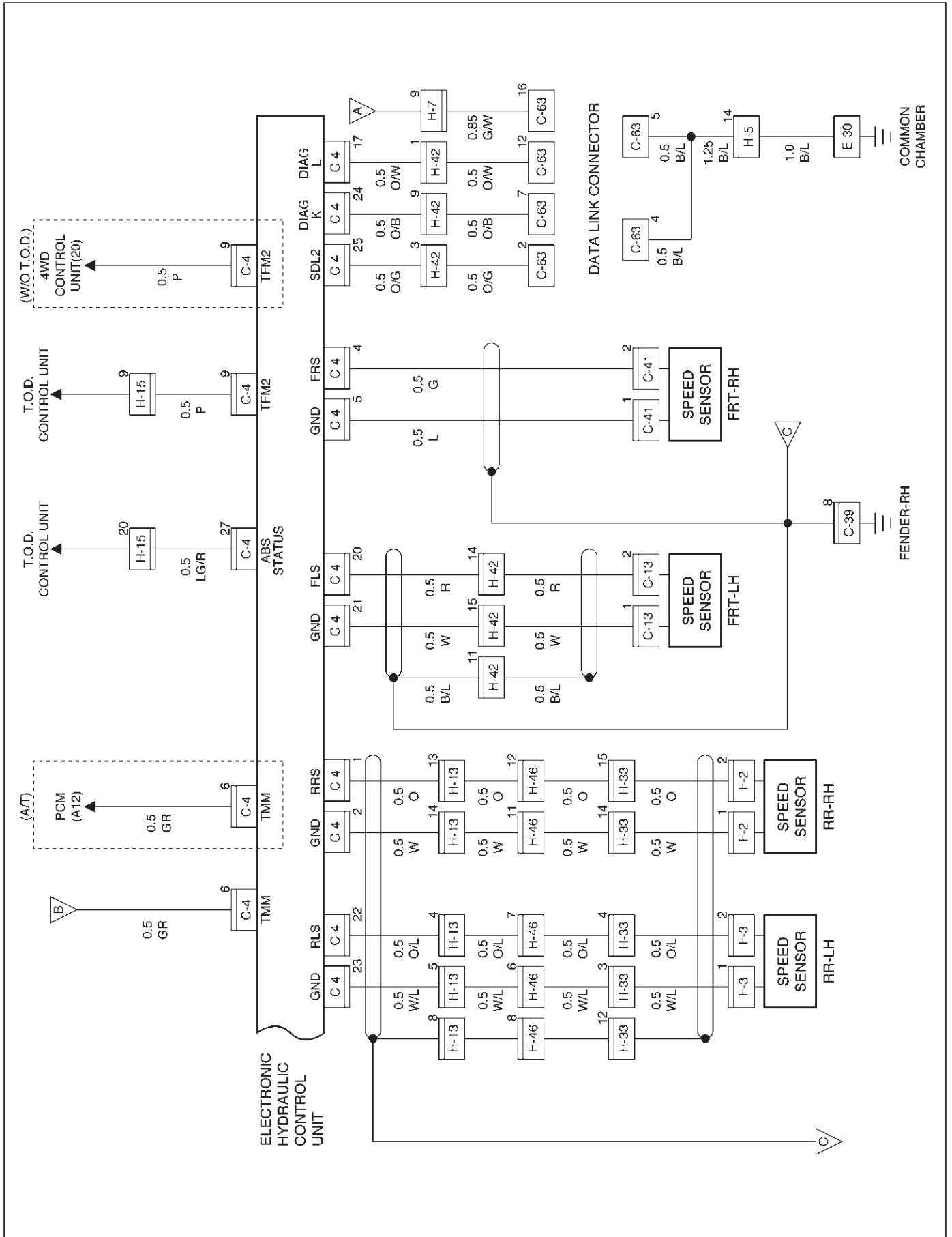


5A-28 BRAKE CONTROL SYSTEM

Circuit Diagram (RHD model / 4JX1)

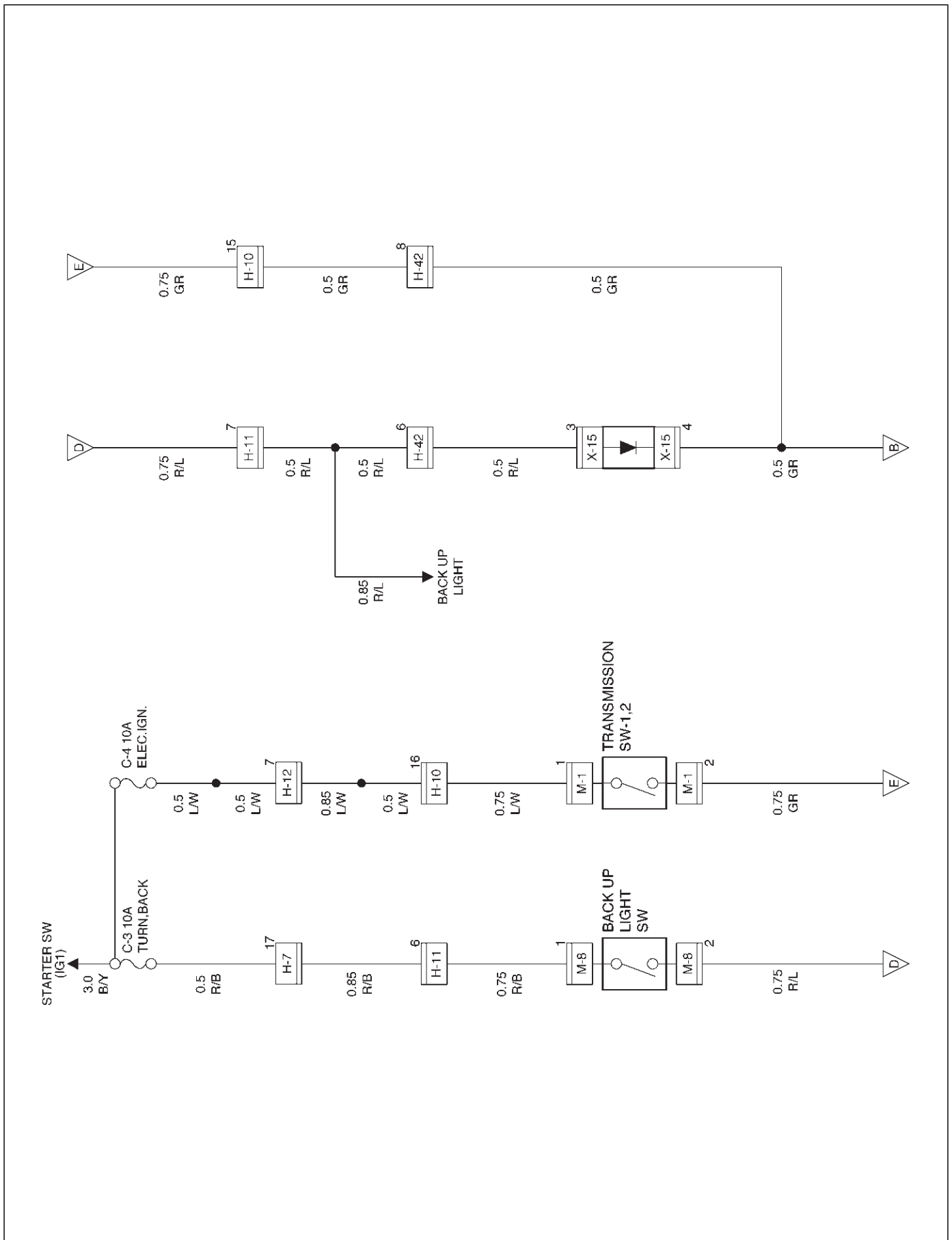


Circuit Diagram (RHD model / 6VE1)



5A-30 BRAKE CONTROL SYSTEM


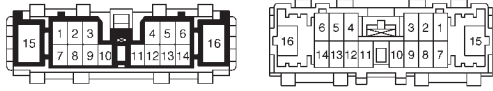

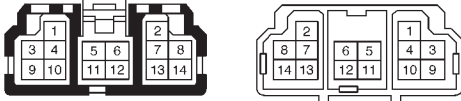
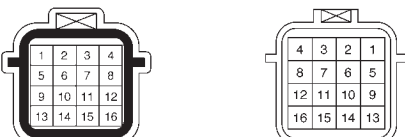
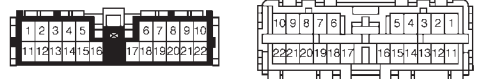
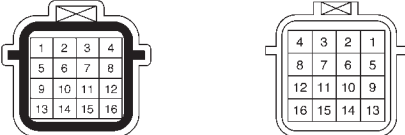
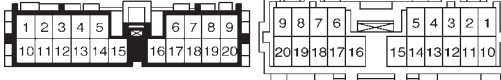
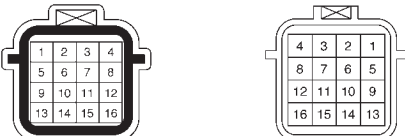








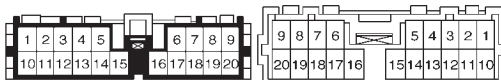
Circuit Diagram (RHD model / 6VE1)

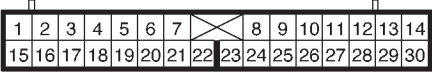
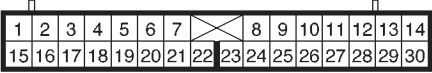


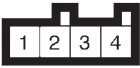


Connector List (RHD model)

No.	Connector face	No.	Connector face
B-13		C-85	
B-14		E-4	
B-25		E-14	
C-4		E-15	
C-13		E-30	
C-16		E-42	
C-39		E-43	
C-41		E-47	
C-63		E-48	

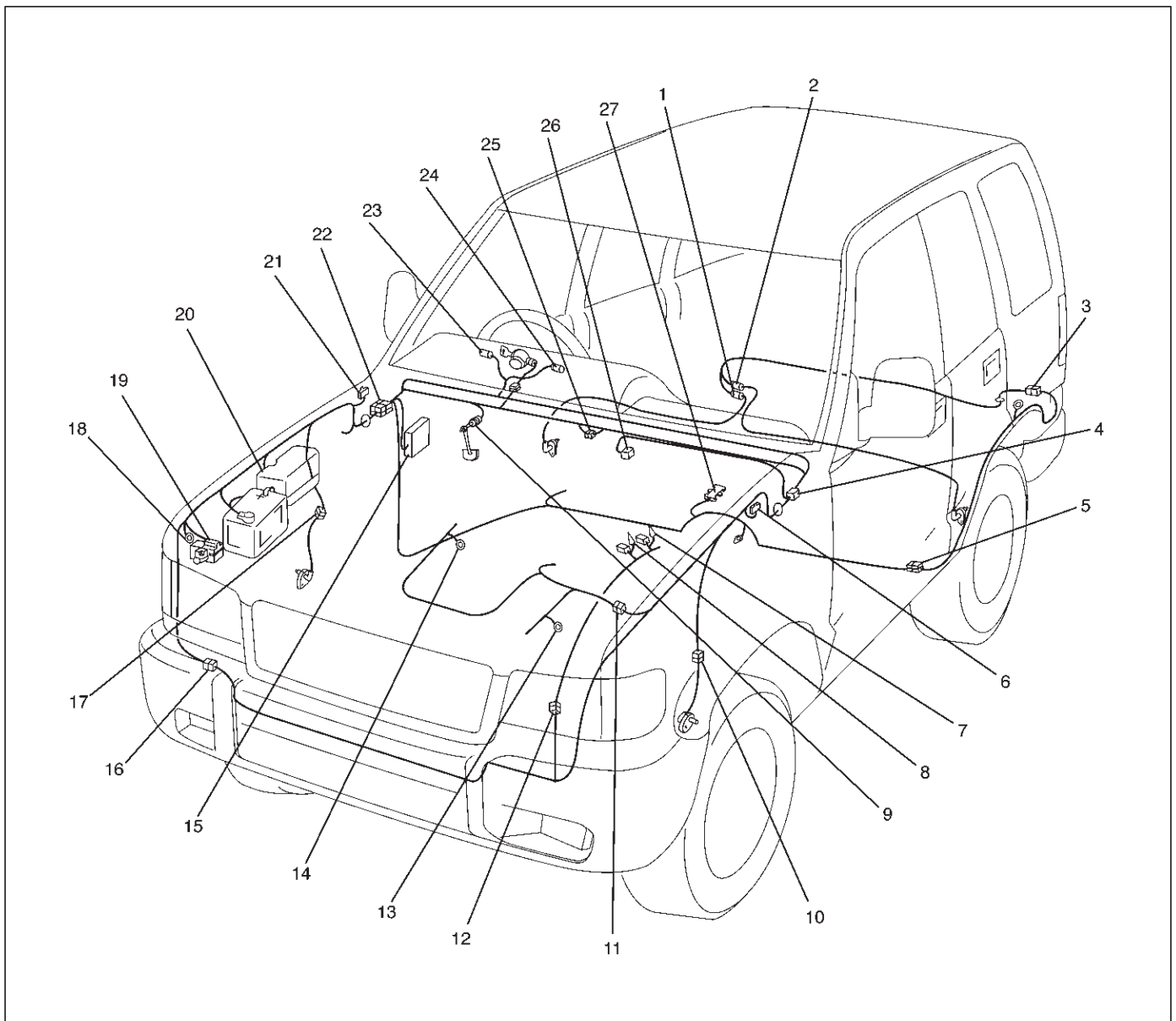
5A-32 BRAKE CONTROL SYSTEM

No.	Connector face	No.	Connector face
F-2		H-13	
F-3		H-15	
H-4		H-16	
H-5		H-26	
H-6		H-27	
H-7		H-33	
H-10		H-41	
H-11		H-42	
H-12		H-46	

No.	Connector face	No.	Connector face
I-9			
I-10			
M-1			
M-8			
X-15			

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Part Location (RHD model)



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Legend

- | | |
|---------------------|-----------------------------------|
| (1) F-2 | (14) E-30 (4GJ2, 6VD1/6VE1) |
| (2) F-3 | (15) Fuse Box |
| (3) H-33 | (16) H-42 |
| (4) H-7 | (17) C-41 |
| (5) H-46 | (18) C-85 |
| (6) C-16 | (19) C-4 (EHCU) |
| (7) E-42, E-43, M-8 | (20) Relay & Fuse Box |
| (8) E-47, E-48, M-1 | (21) C-39 |
| (9) B-13 or B-14 | (22) H-13, H-15, H-16, H-26, H-27 |
| (10) C-13 | (23) I-10 |
| (11) H-4, H-5, H-6 | (24) I-9 |
| (12) H-10, H-11 | (25) H-12 |
| (13) E-4 (4JX1) | (26) C-63 |
| | (27) B-25 |

Symptom Diagnosis

The symptoms that cannot be indicated by the warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.

4. Brake pedal feel is abnormal.

5. Braking sound (from EHCUC) is heard while not braking.

These are all attributable to problems which cannot be detected by EHCUC self-diagnosis. Use the customer complaint and a test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without TECH 2	With TECH 2
1	ABS works frequently but vehicle does not decelerate.	Chart A-1	Chart TA-1
2	Uneven braking occurs while ABS works.	Chart A-2	—
3	The wheels are locked.	Chart A-3	Chart TA-3
4	Brake pedal feel is abnormal.	Chart A-4	—
5	Braking sound (from EHCUC) is heard while not braking.	Chart A-5	Chart TA-5

Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Yes	No
1	1. Turn key off. 2. G Sensor connector and EHCUC connector disconnected. Is there continuity between EHCUC terminals 26 and 8?	Go to Step 2	Go to Step 3
2	Connect EHCUC connector. Is there continuity between the G sensor and the EHCUC?	Go to Step 3	Repair circuit. Go to Step 1
3	Is the G sensor normal? (Refer to chart B-5)	Go to Step 4	Replace G sensor. Go to Step 11
4	Is braking force distribution normal between the front and rear of the vehicle?	Go to Step 5	Repair brake parts. Go to Step 11
5	Are axle parts installed normally?	Go to Step 6	Repair axle parts. Go to Step 11
6	Is there play in each wheel speed sensor?	Repair wheel speed sensor. Go to Step 11	Go to Step 7
7	Is there damage, or powered iron sticking to each wheel speed sensor/sensor ring?	Replace sensor or sensor ring. Go to Step 11	Go to Step 8
8	Is the output of each wheel speed sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 9	Replace wheel speed sensor or repair harness. Go to Step 11
9	Is the input of transmission normal? (Refer to chart C-2 or TC-2)	Go to Step 10	Replace switch or repair harness. Go to Step 11

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Step	Action	Yes	No
10	Is the input of 4WD controller normal?	Go to Step 11	Replace controller or repair harness. Go to Step 11
11	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 11

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each wheel speed sensor by mode "F1: Data Display". Is the output of each sensor normal?	Go to Step 2	Replace wheel speed sensor. Go to Step 3
2	Return to Chart A-1. Was the Chart A-1 finished?	Go to Step 3	Go to Step 2
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Yes	No
1	Is there play in each sensor?	Repair. Go to Step 5	Go to Step 2
2	Is there damage or powdered iron sticking to each sensor/sensor ring?	Repair. Go to Step 5	Go to Step 3
3	Is the output of each sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is brake pipe connecting order correct?	Replace EHCU. Go to Step 5	Reconnect brake pipe correctly. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 5

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Yes	No
1	Is ABS working?	Go to Step 2	Go to Step 6
2	Is vehicle speed under 10 km/h (6mph)?	Normal.	Go to Step 3
3	Is sensor output normal? (Chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 9
4	Is transmission input normal? (Chart C-2 or TC-2)	Go to Step 5	Replace SW or repair harness. Go to Step 9

Step	Action	Yes	No
5	Is front 4WD controller normal?	Replace EHCU. Go to Step 9	Replace 4WD controller or repair harness. Go to Step 9
6	Is transmission input normal? (Chart C-2 or TC-2)	Go to Step 7	Replace SW or repair harness Go to Step 9
7	Is front 4WD controller normal?	Go to Step 8	Replace 4WD controller or repair harness. Go to Step 9
8	Is hydraulic unit grounded properly?	Replace EHCU. Go to Step 9	Correct. Go to Step 9
9	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 9

Chart A-4 Brake Pedal Feed Is Abnormal

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to Step 2	Go to Step 3
2	1. Turn the ignition switch off. 2. Disconnected EHCU connector. 3. Measure voltage between the EHCU connector terminal 10 and 15 when brake pedal is depressed. Is the voltage equal to the battery voltage?	Go to Step 4	Harness NG between brake SW and EHCU. Go to Step 7
3	Is stop light fuse C-14 normal?	Go to Step 5	Replace fuse C-14. Go to Step 7
4	Is there continuity between EHCU connector terminals, 12 and 15 to body ground?	Go to Step 6	Repair body grounded harness. Go to Step 7
5	Is the brake SW normal?	Repair stop light harness. Go to Step 7	Replace brake SW. Go to Step 7
6	Is the check harness/connector for suspended disconnection?	Hydraulic system leakage or air entry (Refer to servicing "Leakage or brake fluid") Go to Step 7	Repair harness. Go to Step 7
7	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 7

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Chart A-5, TA-5 Braking Sound (From EHCU) Is Heard While Not Braking

Step	Action	Yes	No
1	Is this the first time the vehicle is being driven after starting the engine?	It is self checking sound. Normal.	Go to Step 2
2	Is vehicle speed under 10 km/h (6 mph)?	It is self checking sound. Normal.	Go to Step 3
3	Check for the following condition: <ul style="list-style-type: none"> ● At the time of shift down or clutch operation. ● At the time of low δ drive (ice or snow road) or rough road drive. ● At the time of high-speed turn. ● At the time of passing curb. ● At the time of operating electrical equipment switches. ● At the time of racing the engine (over 5000 rpm). Did it occur under any one condition above?	ABS may sometime be actuated even when brake pedal is not applied.	Go to Step 4
4	Is there play in each sensor/wheel speed sensor rings?	Go to Step 5	Repair. Go to Step 7
5	Damage or powdered iron sticking to each sensor/wheel speed sensor ring?	Go to Step 6	Repair. Go to Step 7
6	Is each sensor output normal?(Refer to chart C-1 or TC-1).	Check harness/connector for suspected disconnection. If no disconnection is found, replace EHCU. Go to Step 7	Repair. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 7

Diagnostic Trouble Codes

Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

Code	Item	Diagnosis	Chart No.
12	Start Code	Normal	—
14	EHCU Function	Abnormality in input/output, operational and control circuits	B-2
15	Power Voltage Drop		B-3
16	CLASS-2 Communication Line Abnormality		B-4
21	G-sensor	Wiring disconnection	B-5
23	Transmission Input	Input abnormality	B-6
24	Transfer Monitor		B-7
32	Motor & Motor Relay	Shorted or disconnected coil	B-8
35	Valve Relay	Shorted or disconnected coil/wiring	B-9
41	FL Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-10
42	FL Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-11
43	FR Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-12
44	FR Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-13
45	Rear Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-14
46	Rear Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-15
51	FL Wheel Speed Sensor	Disconnected coil/wiring	B-16
52	FR Wheel Speed Sensor	Disconnected coil/wiring	B-17
53	RL Wheel Speed Sensor	Disconnected coil/wiring	B-18
54	RR Wheel Speed Sensor	Disconnected coil/wiring	B-19
61	FL Wheel Speed Sensor	Shorted coil/wiring	B-20
62	FR Wheel Speed Sensor	Shorted coil/wiring	B-21
63	RL Wheel Speed Sensor	Shorted coil/wiring	B-22
64	RR Wheel Speed Sensor	Shorted coil/wiring	B-23
65	Sensor Signal Input	Wrong number of teeth	B-24

Diagnosis By “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated during driving, trouble should be diagnosed on a illumination pattern basis as follows:

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally		Normal
2	Warning light is not lit		Warning light lighting circuit trouble→Go to Chart B-1
3	Warning light remains ON		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
4	Warning light is actuated while driving		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.

Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCU stores the fault identification and disables the ABS.

1. How to display and erase DTCs:

NOTE:

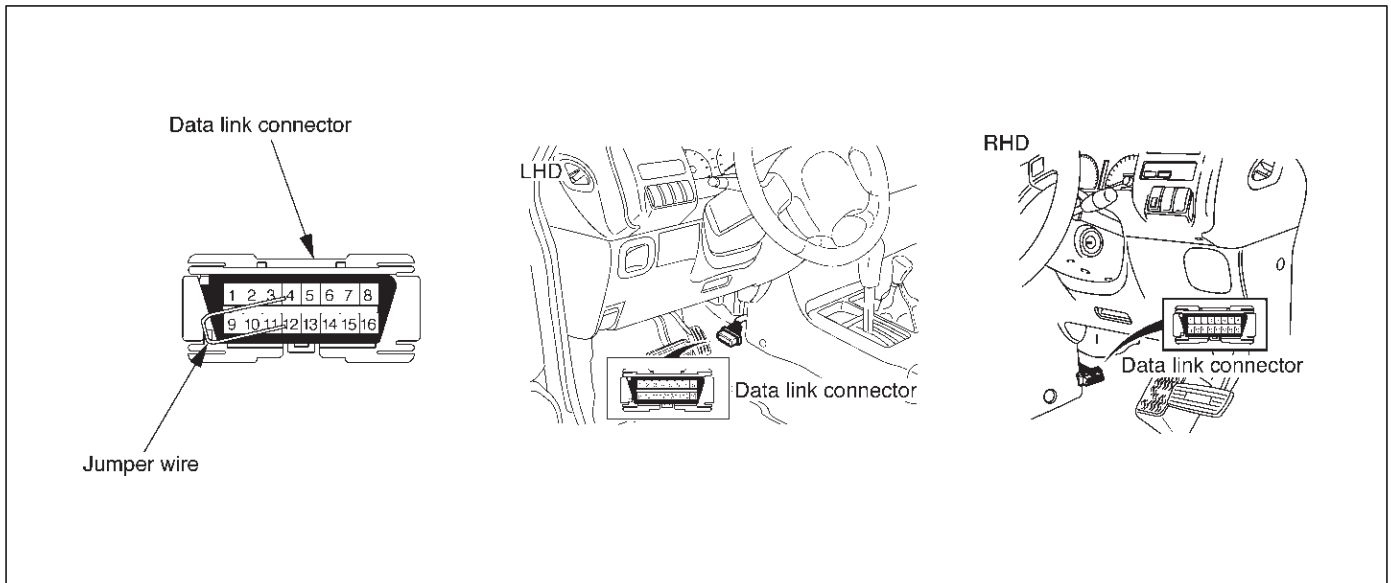
- If DTCs are not displayed, harness C-4 connector terminal 30 and I-10 connector terminal 2 may be disconnected. Repair the harness and try DTC display again.

- DTCs can be displayed also by TECH2. Select mode “F0: Diagnostic Trouble Codes” from Application Menu.

1. How to start DTC display:

- Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed. (Unless these two conditions are satisfied, DTC display cannot be started.)
- With IGN OFF, connect #12 terminal with #4 terminal or #5 terminal (GND). Then turn IGN ON.

The DLC is located behind the center console



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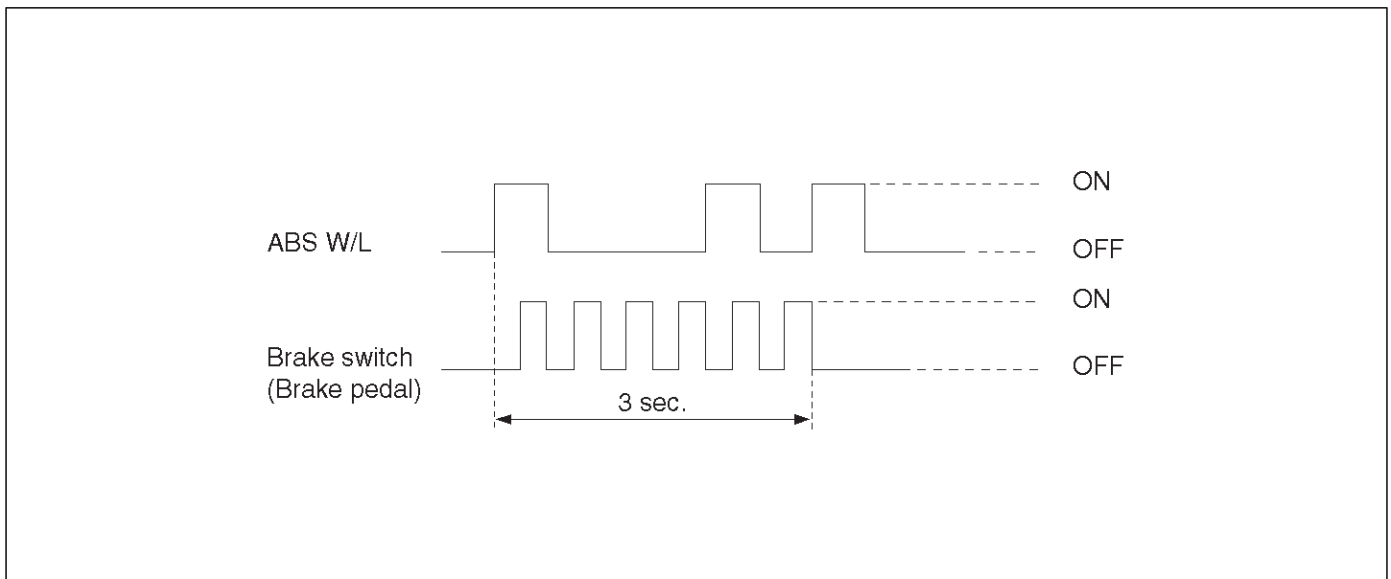
- Keep #12 terminal connected with #4 terminal or # 5 terminal (GND) during DTC display. (If #12 terminal is separated from #4 terminal or # 5 terminal (GND) during display, display will stop.)

2. DTC display:

- DTC is displayed by blinking warning light.
- Double-digit display.
- First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)

3. How to erase code:

- Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.
- The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedal depressed).



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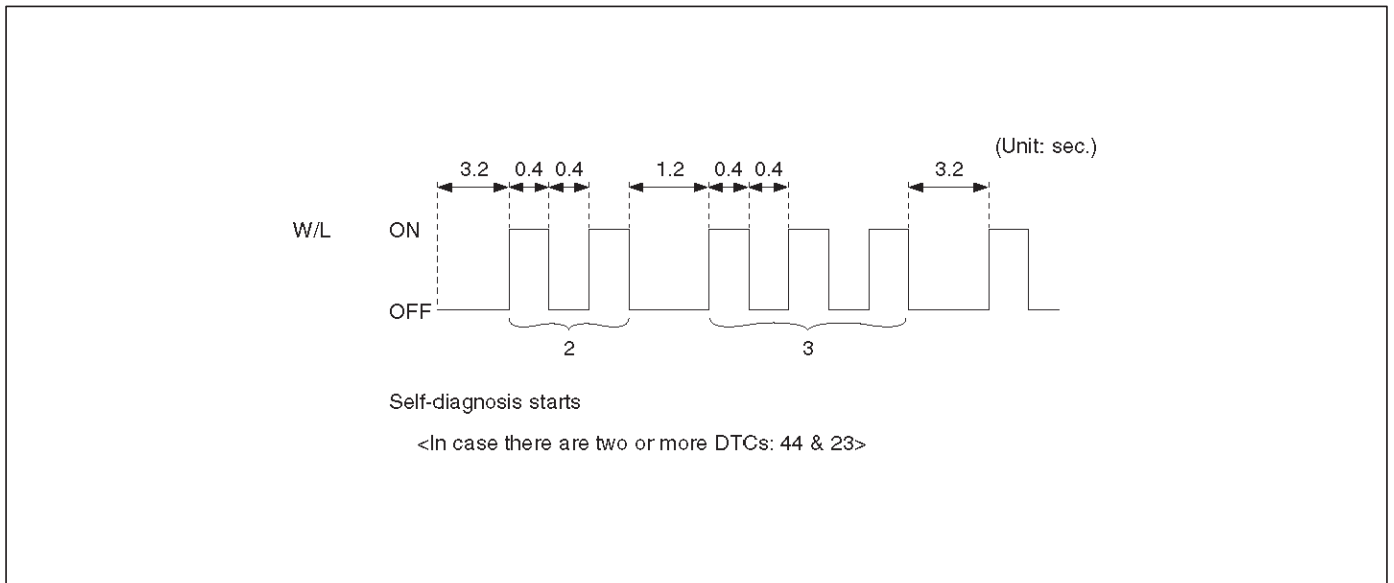
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4. Notes

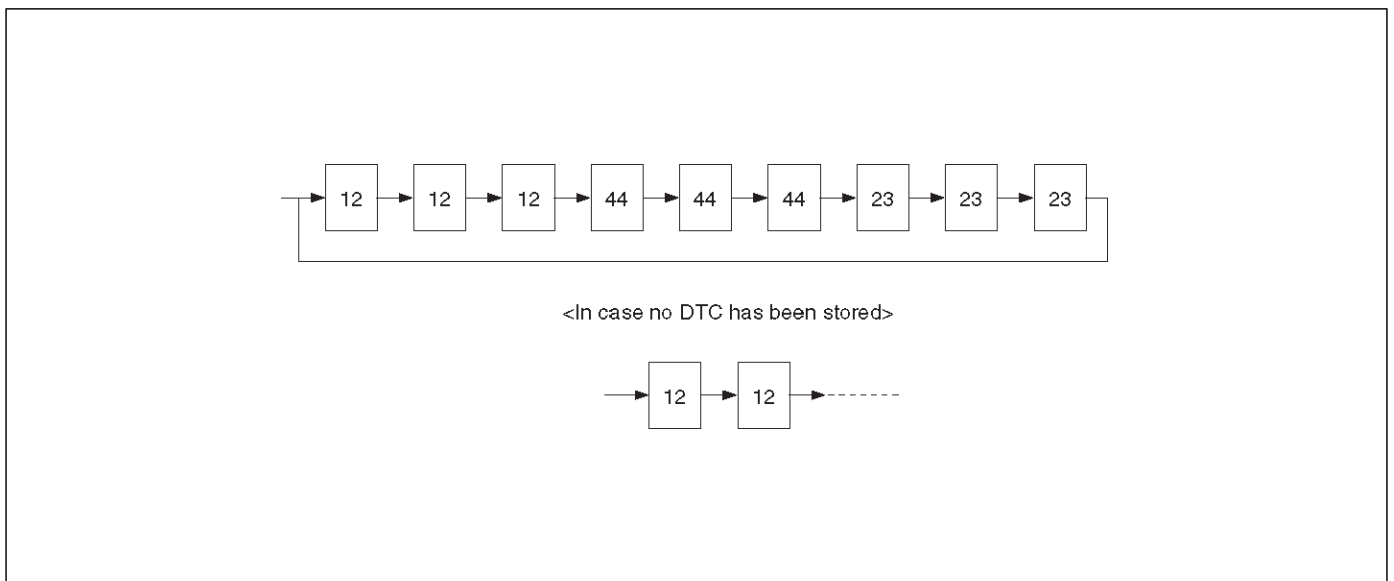
- If the following should occurs during Diagnostic Trouble Code (DTC) display the display will be discontinued. After initial check, the status that is under the control of ABS will be returned :
 - The vehicle starts (The wheels turn) or the brake pedal is depressed.
- Up to 3 different codes can be stored.
- If the ABS should turn OFF due to an intermittent defect, the system will be restored at the next key cycle, if the initial check finds no abnormality (when IGN is switched from OFF to ON).

5. An example of DTC display

Display of DTC 23



After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)



The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes)

Chart B-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Yes	No
1	Is W/L fuse C-10 disconnected?	Replace fuse. Go to Step 5	Go to Step 2
2	Is W/L burnt out?	Replace W/L bulb. Go to Step 5	Go to Step 3
3	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Turn the key ON. 4. Measure the voltage between EHCUC connector terminal 13 and 14. Is the voltage equal to the battery voltage?	Go to Step 4	Repair harness and connector. Go to Step 5
4	Is there continuity between EHCUC connector terminals, 12 and 15 and body ground.	Check harness for suspected disconnection. No fault found: Replace EHCUC. Go to Step 5	Repair harness and connector. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 5

Chart B-2 EHCUC Abnormality (DTC 14)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect the EHCUC connector. 3. Inspect EHCUC ground. Is there resistance between the EHCUC connector terminals, 12 and 15 and body ground?	Go to Step 2	Repair the body ground harness. Go to Step 3
2	1. Turn the key off, connect the EHCUC. 2. Erase the trouble code. 3. Turn Ignition off, then on, to perform system self-check. 4. If warning light remains on, display trouble codes once again. Is the check trouble code 14?	Replace EHCUC. Go to Step 3	Inspect in accordance with the DTC displayed.
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

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Chart B-3 Power Voltage Drop (DTC 15)

Step	Action	Yes	No
1	Is the battery voltage normal? (Battery capacity check)	Go to Step 2	Charge or replace battery. Go to Step 2
2	1. Turn the key off. 2. Disconnect EHCU connector. 3. Turn the key on. Is the voltage between EHCU connector terminals 8 and 15, higher than 10V?	Check harness connector for suspected disconnection. Fault found: Repair, and perform system self-check. No fault found: replace EHCU. Go to Step 3	Repair harness or connector. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-4 CLASS-2 Communication Line Abnormality (DTC 16)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU and PCM connector. Is there continuity between EHCU connector terminals 25 and ground?	Go to Step 2	Repair harness or connector. Go to Step 3
2	1. Connect EHCU connector. 2. Clear diagnostic trouble code. 3. Turn the key on. Is the diagnostic trouble code 16 shown on the displayed?	Check the PCM harness. Refer to 6E section. Go to Step 3	Replace EHCU. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-5 G-Sensor Circuit (DTC 21)

Step	Action	Yes	No
1	Vehicle placed horizontal. Is the resistance between the G sensor connector terminals 1 and 2 within 4.0-6.0 k Ω ?	Check harness connector for short. Fault found : Repair , and perform system self-check. No fault found : replace EHCU. Go to Step 3	Go to Step 2
2	Is the bracket installed horizontally?	Go to Step 4	Repair or replace bracket. Go to Step 4
3	Remove G sensor. Is the resistance between the G sensor connector terminals 1 and 2 within 1.0-2.0 k Ω when G sensor is horizontal?	Go to Step 4	Replace G sensor. Go to Step 5
4	Measure resistance between G sensor connector terminals 1 and 2 within 4.0-6.0 k Ω when G sensor tilted to 30° or more?	Harness between EHCU and G sensor is faulty and short. Repair the harness Go to Step 5	Replace G sensor. Go to Step 5
5	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 5

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Chart B-6 Abnormal Transmission Input (DTC 23)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. Is there continuity between EHCUC connector terminal 6 to 15 (Gear position-P(A/T), N(M/T))?	Shorted switch harness. Repair switch or harness. Go to Step 6	Go to Step 2
2	Is the vehicle an A/T model?	Go to Step 3	Go to Step 4
3	Turn the key on and measure the voltage between EHCUC connector terminal 6 and 15. Is the 6V under when the gear position is L, and R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
4	Turn the key on and measure the voltage between EHCUC connector terminal 6 and 15. Is the 9.6V over when the gear position is 1, 2, R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
5	Is there 6.6 to 9.0V when the gear position is 3, 4, 5 and N(M/T) or 2,3,D,N and P(A/T)(Battery voltage 12V)?	Suspected harness/connector short power source/GND. Suspected shorted transmission SW. Fault found: repair, and perform system self-check. No fault found: replace EHCUC. Go to Step 6	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 6

Chart B-7 Transfer Monitor (DTC 24)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. Is the EHCUC connector terminal 9 line normally?	Go to Step 2	Repair Go to Step 3
2	Is the TOD ECU or 4WD controller normal?	Replace EHCUC. Go to Step 3	Repair or replace TOD ECU or 4WD contrdr. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-8 EHCUC Pump Motor And Motor Relay Circuit (DTC 32)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Measure voltage between EHCUC connector terminal 13 and body ground. Is the voltage equal to battery voltage?	Go to Step 2	Repair fuse/harness between battery and EHCUC connector terminal 13. Go to Step 3
2	Is there continuity between EHCUC connector terminal 12 and ground?	Go to Step 3	Repair between EHCUC connector terminal 12 and ground. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-9 EHCUC Pump Valve And Valve Relay Circuit (DTC 35)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Measure voltage between EHCUC connector terminal 14 and body ground. Is the voltage equal to battery voltage?	Replace EHCUC. Go to Step 2	Repair fuse and harness EHCUC connector terminal 14 and battery. Go to Step 2
2	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 2

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Chart B-10 FL Isolation Solenoid Valve Abnormality (DTC 41)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

Chart B-11 FL Dump Solenoid Valve Abnormality (DTC 42)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

Chart B-12 FR Isolation Solenoid Valve Abnormality (DTC 43)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

Chart B-13 FR Dump Solenoid Valve Abnormality (DTC 44)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

Chart B-14 Rear Isolation Solenoid Valve Abnormality (DTC 45)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

Chart B-15 Rear Dump Solenoid Valve Abnormality (DTC 46)

Step	Action	Yes	No
1	Was the "EHCUC Connector Pin-out Checks" performed?	Go to Step 2	Go to "EHCUC Connector Pin-out Checks".
2	Is the EHCUC connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart".
3	1. Replace the EHCUC. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the "Basic Diagnostic Flow Chart".	Go to Step 3

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Chart B-16 FL Speed Sensor Disconnection (DTC 51)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 20 and 21. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-17 FR Speed Sensor Disconnection (DTC 52)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 4 and 5. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-18 RL Speed Sensor Disconnection (DTC 53)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 22 and 23. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the RL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart B-19 RR Speed Sensor Disconnection (DTC 54)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 2 and 3. Is the resistance between 1.3K and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3.	Go to Step 2
2	Measure the RR speed sensor resistance at the sensor connector. Is the sensor resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

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Chart B-20 FL Speed Sensor Short Circuit (DTC 61)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector 3. Measure the FL speed sensor resistance between EHCUC connector terminals 20 and 21. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCUC. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-1-1 or TC-1)	Check for faults in harness between speed sensor and EHCUC. Fault found: repair, and perform system self-check. No fault found: replace EHCUC. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-21 FR Speed Sensor Short Circuit (DTC 62)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Measure the FR speed sensor resistance between EHCUC connector terminals 4 and 5. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCUC. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-1-2 or TC-1)	Check for faults in harness between speed sensor and EHCUC. Fault found: repair, and perform system self-check. No fault found: replace EHCUC. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat "Basic diagnostic flow chart."	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

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Chart B-22 RL Speed Sensor Short Circuit (DTC 63)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector 3. Measure the RL speed sensor resistance between EHCUC connector terminals 22 and 23. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the RL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCUC. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-1-3 or TC-1)?	Check for faults in harness between speed sensor and EHCUC. Fault found: repair, and perform system self-check. No fault found: replace EHCUC. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-23 RR Speed Sensor Short Circuit (DTC 64)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Measure the RR speed sensor resistance between EHCUC connector terminals 2 and 3. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the RR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCUC. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-1-4 or TC-1)	Check for faults in harness between speed sensor and EHCUC. Fault found: repair, and perform system self-check. No fault found: replace EHCUC. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat "Basic diagnostic flow chart."	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

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Chart B-24 Sensor Signal Input Abnormality (DTC 65)

Step	Action	Yes	No
1	Using TECH 2?	Go to Step 2	Go to Step 3
2	1. Connect TECH 2. 2. Select Snap shot manual trigger. 3. With wheel speed data displayed, run the vehicle when speed has arrived at 30 km/h (18 mph). 4. Check speed data on each wheel (refer to the criterion given below). *1 Is the abnormal sensor condition found?	Replace. Go to Step 8	Go to Step 3 All the sensors should follow the following flowchart (without using TECH 2).
3	Is there play in sensor/sensor ring?	Repair. Go to Step 8	Go to Step 4
4	Is there powdered iron sticking to sensor/sensor ring?	Repair. Go to Step 8	Go to Step 5
5	Is there a broken tooth or indentation in sensor ring?	Replace sensor ring. Go to Step 8	Go to Step 6
6	Is there play in wheel bearing?	Adjust or repair. Go to Step 8	Go to Step 7
7	Is the check wiring between sensor and EHCUC normal?	Replace EHCUC. Go to Step 8	Repair, and perform system self-check. Go to Step 8
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat "Basic diagnostic flow chart."	Go to Step 8

Sensor Signal Abnormality Criteria using TECH 2

1. While driving, the speed of one or two wheels 25% or more higher than that of the other wheels.
 2. The speed of one or two wheels is 10 km/h (6 mph) or more higher than that of the other wheels.
 3. During steady driving, wheel speed changes abruptly.
- *1 The vehicle must run on a level paved road.

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop.

Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

It is important to verify that the correct tires are installed on vehicle.

Unit Inspection Procedure

This section describes the following inspection procedures referred to during "SYMPTOM DIAGNOSIS" and "DIAGNOSIS BY 'ABS' WARNING LIGHT ILLUMINATION PATTERN":

	without TECH 2	with TECH 2
Wheel Speed Sensor Output Inspection	Chart C-1-1 to C-1-4	Chart TC-1
Transmission SW Inspection	Chart C-2	Chart TC-2

Chart C-1-1 FL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle, With all four wheels off the ground. Measure the AC voltage between EHCU connector terminals while turning FL wheel at a speed of 1 RPS: Is voltage between EHCU connector terminals 20 and 21 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (C-13) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit in harness between wheel speed sensor connector and EHCU. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

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Chart C-1-2 FR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	<p>1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCUC connector terminals while turning FR wheel at a speed of 1 RPS:</p> <p>Is voltage between EHCUC connector terminals 4 and 5 under 200 mV?</p>	Go to Step 2	Ok. Go to Step 3
2	<p>1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2.</p> <p>Is resistance between connector (C-41) terminals 1 and 2 within 1.3k - 1.9k ohms?</p>	<p>Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCUC. Inspect and correct the connector or harness Go to Step 3</p>	<p>Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3</p>
3	<p>Reconnect all components and ensure all components are properly mounted.</p> <p>Was this step finished?</p>	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart C-1-3 RL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	<p>1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCUC connector terminals while turning RL wheel at a speed of 1 RPS:</p> <p>Is voltage between EHCUC connector terminals 22 and 23 under 200 mV?</p>	Go to Step 2	Ok. Go to Step 3
2	<p>1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2.</p> <p>Is resistance between connector (F-3) terminals 1 and 2 within 1.3k - 1.9k ohms?</p>	<p>Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCUC. Inspect and correct the connector or harness Go to Step 3</p>	<p>Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3</p>
3	<p>Reconnect all components and ensure all components are properly mounted.</p> <p>Was this step finished?</p>	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart C-1-4 RR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCUC connector terminals while turning RR wheel at a speed of 1 RPS: Is voltage between EHCUC connector terminals 2 and 3 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (F-2) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCUC. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart TC-1 Sensor Output Inspection Procedure (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Go to Step 2
2	Check the sensor harness for suspected disconnection (Check while shaking harness/connector). Is the sensor harness connection normal?	Replace speed sensor. Go to Step 3	Repair. Go to Step 6
3	While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Go to Step 4
4	Check the sensor rotor. Is the sensor rotor normal?	Go to Step 6	Replace sensor rotor. Go to Step 5
5	While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Repair harness or connector between EHCUC and speed sensor. Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 6

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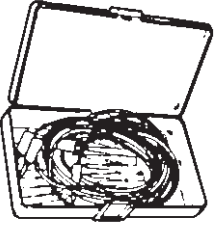
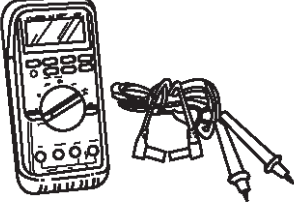
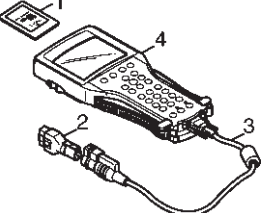
Chart C-2 Transmission Input Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCUC connector. Is there continuity between EHCUC connector terminals 6 and 15 (Gear position-P(A/T), N(M/T))?	Shorted switch harness. Repair switch or harness. Go to Step 6	Go to Step 2
2	Is the vehicle an A/T model?	Go to Step 3	Go to Step 5
3	Turn the key on and measure voltage between EHCUC connector terminals 6 and 15. Is there less than 6V when the gear position is L, and R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
4	Turn the key on and measure the voltage between EHCUC connector terminal 6 and 15. Is there more than 9.6V when the gear position is 1, 2, R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
5	Measure the voltage between EHCUC connector terminals 6 and 15. Is there 6.6 to 9.0V when the gear position is 3, 4, 5 and N(M/T) or 2,3,D,N and P(A/T)(Battery voltage 12V)?	Go to Step 6	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 6

Chart TC-2 Transmission Input Inspection Procedure (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Select Data List. Is this vehicle an A/T model ?	Go to Step 2	Go to Step 4
2	Is "Off-Road Switch(Transmission Input): Active" when the shift lever is the L and R?	Go to Step 3	Go to Step 6
3	Is "Off-Road Switch(Transmission Input): Inactive" when the shift lever is other than the L and R?	Go to Step 7	Go to Step 6
4	Is "Off-Road Switch(Transmission Input): Active" when the shift lever is in 1, 2 and R?	Go to Step 5	Go to Step 6
5	Is "Off-Road Switch(Transmission Input): Inactive" when the shift lever is other than the 1, 2 and R?	Go to Step 7	Go to Step 6
6	1. Abnormal T/M SW, inhibitor SW, or harness. 2. Repair T/M SW, inhibitor SW, or harness. Is the T/M SW, inhibitor SW, or harness repaired?	Go to Step 7	Go to Step 6
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 7

Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW074</p>	<p>5-8840-0385-0 (J-35616) Connector test adapter kit</p>
 <p>901RS153</p>	<p>5-8840-0366-0 (J-39200) High impedance multimeter</p>
	<p>(1) PCMCIA Card (2) SAE 16/19 Adapter (3) DLC Cable (4) Tech-2</p>

BRAKES

ANTI-LOCK BRAKE SYSTEM

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Service Precaution

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

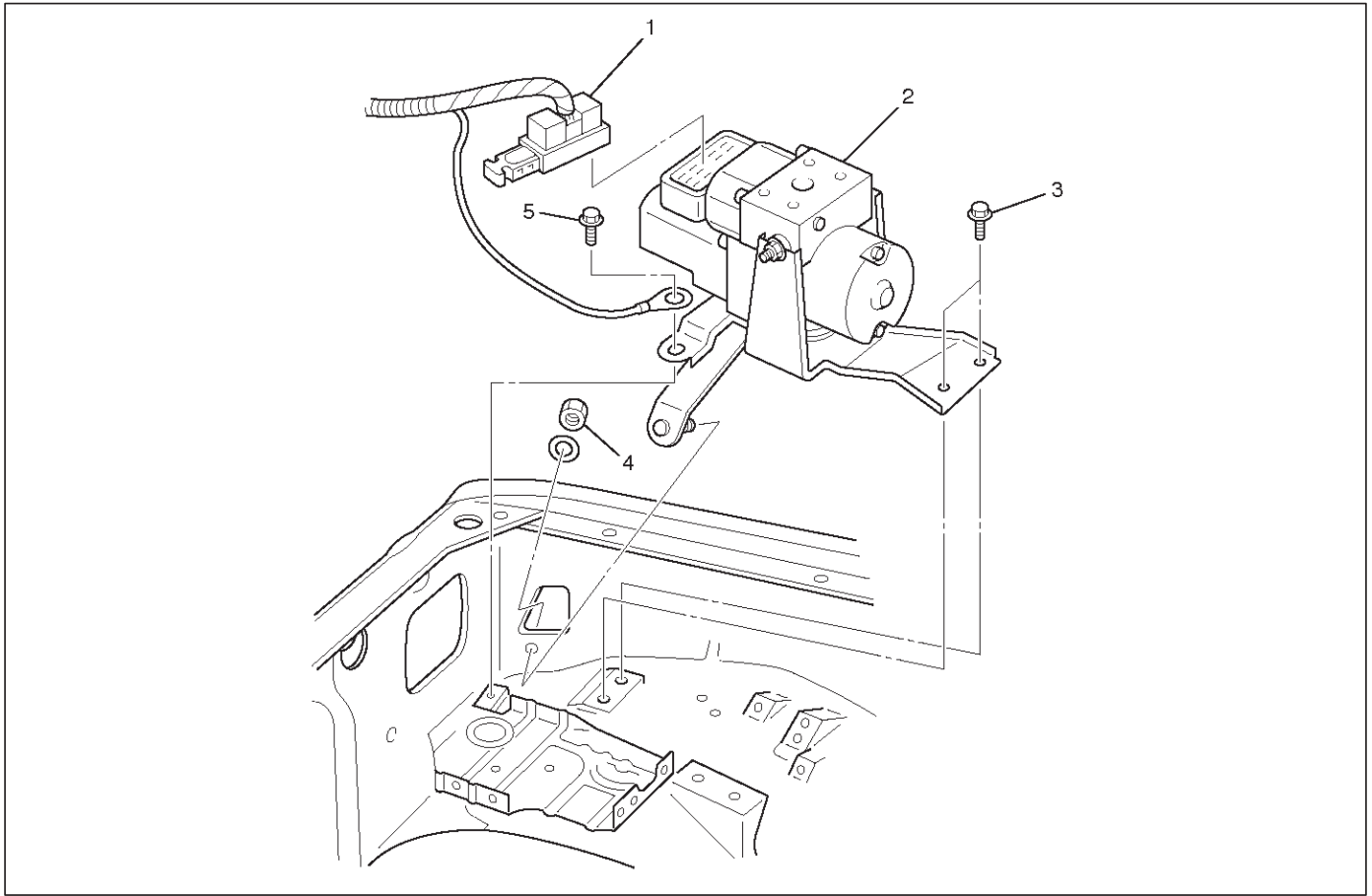
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread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

CAUTION: Replace all components included in repair kits used to service this system. Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use shop air with in-line lubricators on brake parts, as damage to rubber components may result. If any hydraulic component is removed or brake line disconnected, it may be necessary to bleed part or all of the brake system.

NOTE: The use of rubber hoses or parts other than those furnished specifically for the Anti-lock Brake System may lead to functional problems requiring major overhaul.

Electronic Hydraulic Control Unit

Electronic Hydraulic Control Unit and Associated Parts



350RW013

Legend

- (1) Connector
- (2) Hydraulic Unit ASM

- (3) Bolts
- (4) Nut
- (5) Bolt

Removal

1. Remove battery ASM.
2. Remove harness connector.
3. Remove EHCU fixing nuts.
4. Remove brake pipes.
 - After disconnecting brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
5. Remove hydraulic unit fixing nuts.

Installation

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

Torque

Hydraulic unit fixing nuts : 22 N·m (2.2kg-m/16 lb ft)

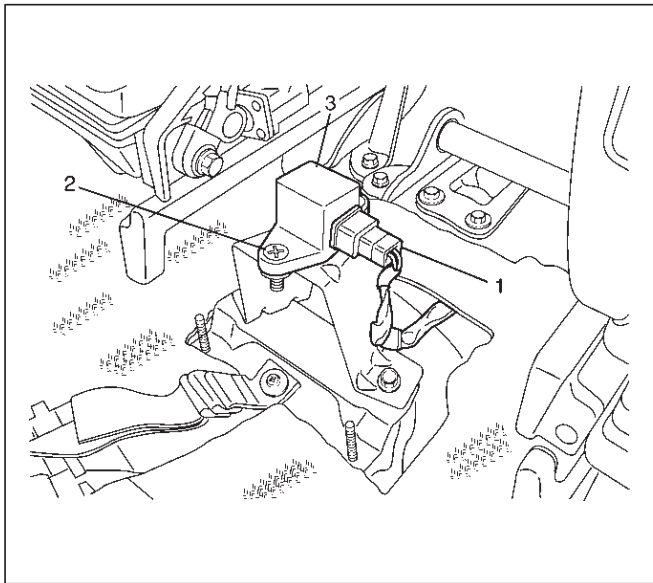
Ground cable : 14 N·m (1.4kg-m/10 lb ft)

Brake pipe (joint bolts) : 16 N·m (1.6kg-m/12 lb ft)

- After installing the hydraulic unit, bleed brakes completely. Refer to Servicing in Power Assisted Brake System section.

G-Sensor

Removal



1. Remove center console.
 - Refer to Consoles in Body and Accessories section.
2. Remove clip from G-sensor connector (1), then disconnect connector.
3. Remove G-sensor assembly fixing bolt (2).
4. Remove G-sensor assembly (3).

Inspection and Repair

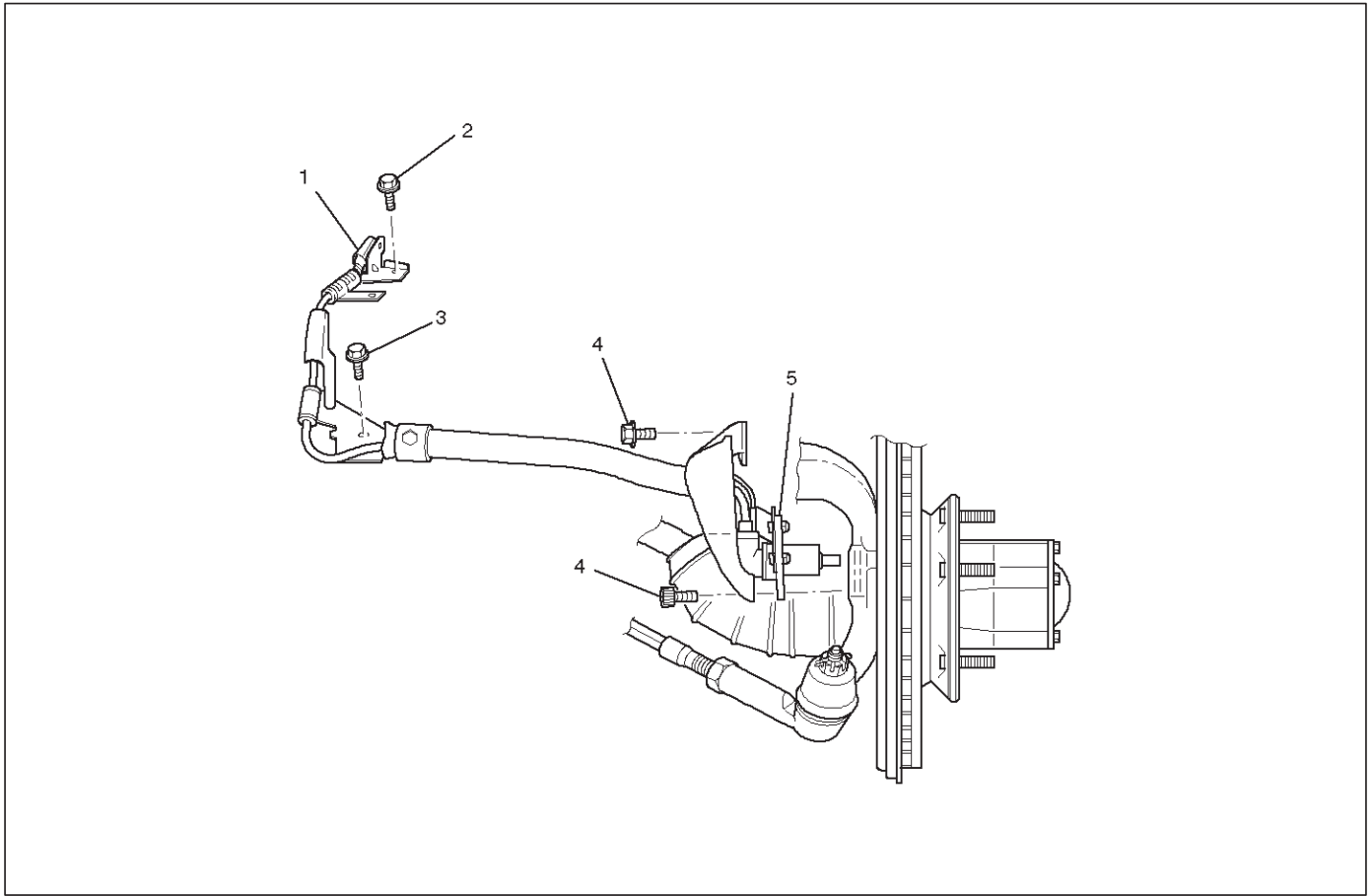
Refer to Chart B-5 in Brake Control System section.

Installation

1. Install G-sensor assembly (3).
 - Care should be taken so that the G-sensor is not installed in the wrong direction.
2. Install G-sensor assembly fixing bolt (2).
 - Tighten the fixing bolt to the specified torque.
Torque : 10 N·m (1.0kg-m/87 lb in)
3. Install G-sensor wiring connector (1).
4. Install center console.
 - Refer to Consoles in Body and Accessories section.

Front Wheel Speed Sensor

Front Wheel Speed Sensor and Associated Parts



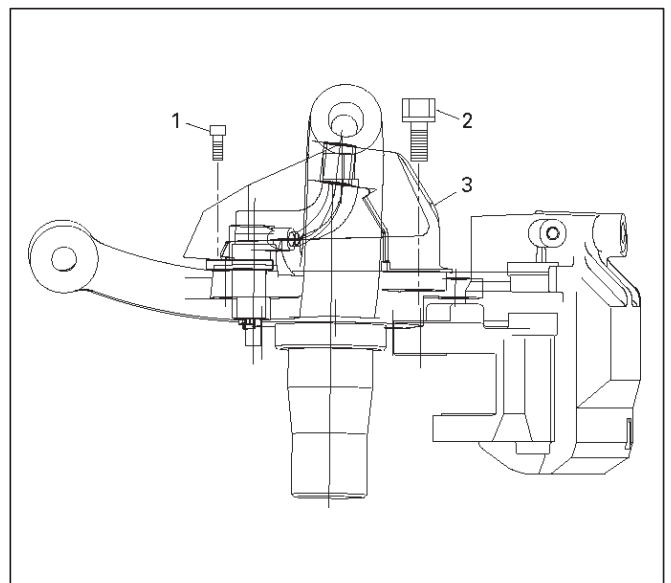
350RW012

Legend

- | | |
|---|--|
| (1) Speed Sensor Connector | (3) Sensor Cable Fixing Bolt (Lower side) |
| (2) Sensor Cable Fixing Bolt (Upper side) | (4) Sensor Cable Fixing Bolt (Sensor side) |
| | (5) Speed Sensor |

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolt (Upper side).
3. Remove sensor cable fixing bolt (Lower side).
4. Remove the speed sensor cable fixing bolts (1) and caliper fixing bolt (2) from caliper side speed sensor cable bracket (3).



350RW010

5. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary.
To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the sensor ring assembly. Refer to Front Hub and Disc in Drive Shaft System section.

NOTE: Confirm that a white line marked on the cable is not twisted when connecting the speed sensor cable.

5. Install speed sensor connector.

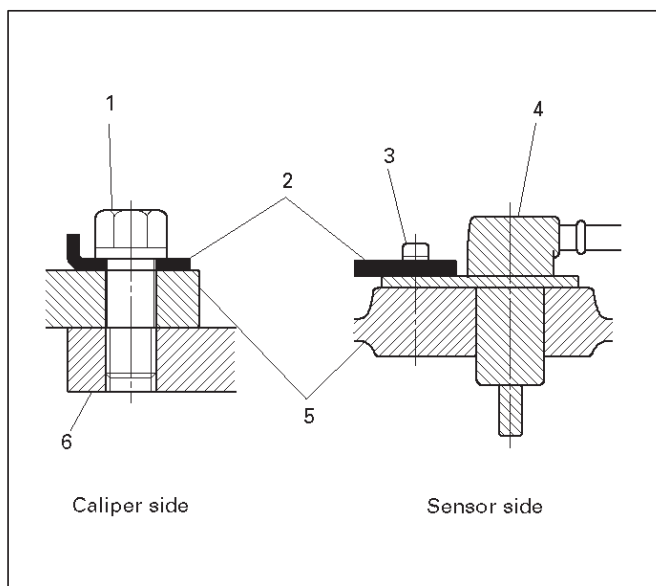
Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.

Torque

Sensor side : 8 N·m (0.8kg·m/69 lb in)

Caliper side : 155 N·m (15.8kg·m/115 lb ft)



350RW011

Legend

- (1) Caliper Fixing Bolt
- (2) Bracket
- (3) Sensor Fixing Bolt
- (4) Sensor
- (5) Knuckle
- (6) Brake Caliper

3. Install speed sensor cable fixing bolt (Lower side) and tighten the fixing bolt to the specified torque.

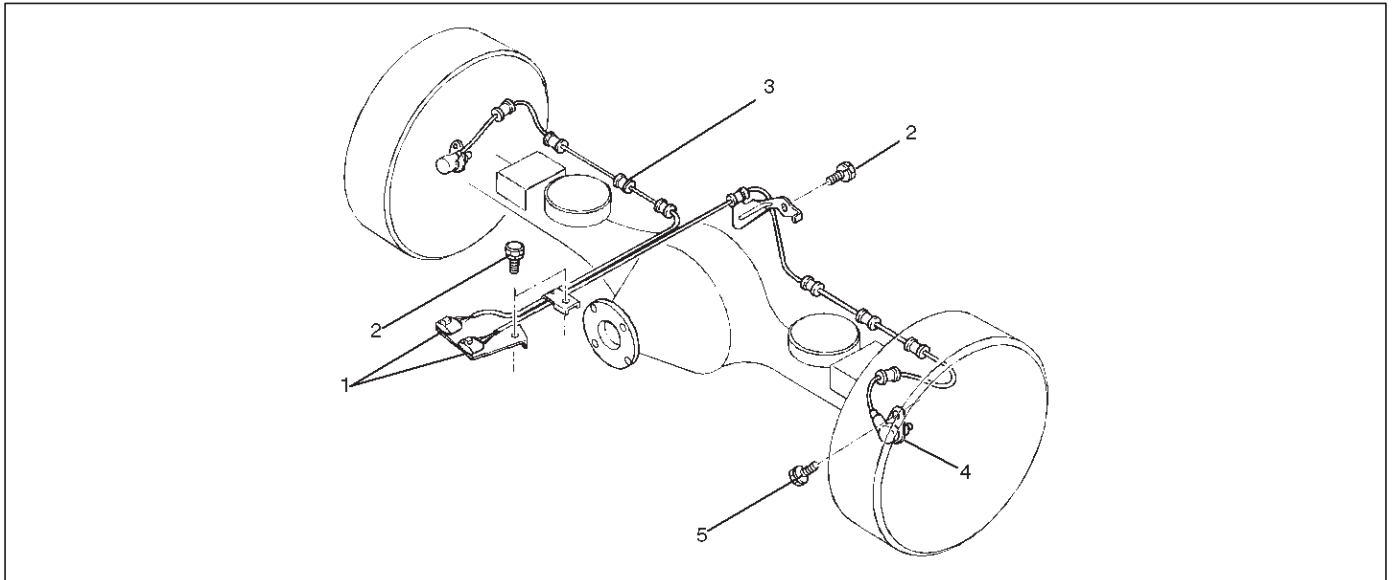
Torque : 24 N·m (2.4kg·m/18 lb ft)

4. Install speed sensor cable fixing bolt (Upper side) and tighten the fixing bolt to the specified torque.

Torque : 6 N·m (0.6kg·m/52 lb in)

Rear Wheel Speed Sensor

Rear Wheel Speed Sensor and Associated Parts



350RW008

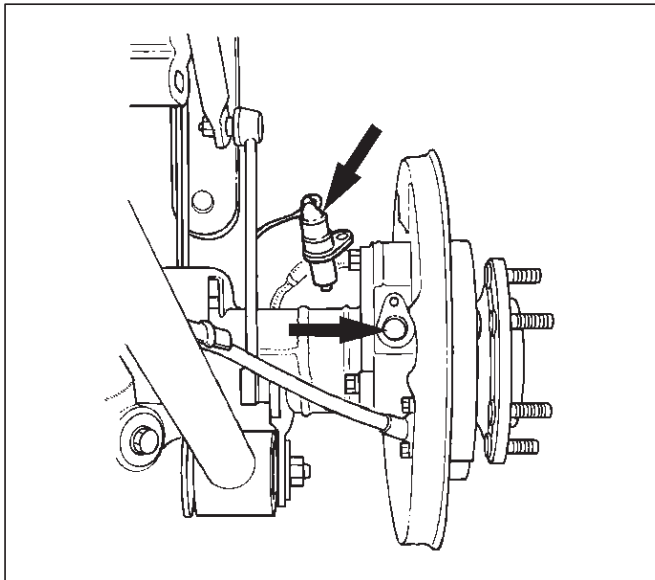
Legend

- | | |
|------------------------------|------------------------|
| (1) Speed Sensor Connector | (3) Clip (11 pieces) |
| (2) Sensor Cable Fixing Bolt | (4) Speed Sensor |
| | (5) Sensor Fixing Bolt |

Removal

1. Remove speed sensor connector.
2. Remove clip.
3. Remove sensor cable fixing bolt.
4. Remove sensor fixing bolt.
5. Remove speed sensor.

2. Check the pole piece for damage, and replace the speed sensor if necessary.
3. Check the speed sensor cable for a short or an open, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping. If damaged replace the axle shaft assembly. Refer to Front Hub and Disc in Drive Shaft System section.



350RS035

Installation

1. Install the speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install the sensor fixing bolt and tighten it to the specified torque.

Torque : 18 N·m (1.8kg·m/13 lb ft)

3. Install the sensor cable fixing bolt and tighten it to the specified torque.

Torque : 24 N·m (2.4kg·m/18 lb ft)

NOTE: Confirm that the cable is not twisted when connecting the speed sensor cable.

4. Install clip.
5. Install speed sensor connector.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.

SECTION 5C

POWER ASSISTED BRAKE SYSTEM

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SERVICE PRECAUTION

WARNING:

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

CAUTION:

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

BRAKE SYSTEM DIAGNOSIS

ROAD TESTING THE BRAKES

Brake Test

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt so that all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight of the vehicle toward wheels on one side or if the roadway is so rough that wheels tend to bounce. Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires. Locked wheels and sliding tires do not indicate brake efficiency, since heavily braked but turning wheels will stop the vehicle in less distance than locked wheels. More tire-to-road friction is present with a heavily braked turning tire than with a sliding tire.

The standard brake system is designed and balanced to avoid locking the wheels except at very high deceleration levels.

It is designed this way because the shortest stopping distance and best control is achieved without brake lock-up.

Because of high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

External Conditions That Affect Brake Performance

1. Tires: Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, identical in size, and the tread pattern of right and left tires must be approximately equal.
2. Vehicle loading: A heavily loaded vehicle requires more braking effort.
3. Wheel Alignment: Misalignment of the wheels, particularly in regard to excessive camber and caster, will cause the brakes to pull to one side.

BRAKE FLUID LEAKS

With engine running at idle and the transmission in "Neutral", depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking.

Check the master cylinder fluid level. While a slight drop in reservoir level will result from normal lining wear, an abnormally low level in reservoir indicates a leak in the system. The hydraulic system may be leaking internally as well as externally. Refer to "Master Cylinder Inspection". Also, the system may appear to pass this test but still have slight leakage. If fluid level is normal, check the vacuum booster push

rod length. If an incorrect length push rod is found, adjust or replace the push rod. Check the brake pedal travel and the parking brake adjustment.

When checking the fluid level, the master cylinder fluid level may be low from the "MAX" mark if the front and rear linings are worn. This is not abnormal.

WARNING LIGHT OPERATION

When the ignition switch is in the START position, the "BRAKE" warning light should glow and go OFF when the ignition switch returns to the ON position.

The following conditions will activate the "BRAKE" light:

1. Parking brake applied. The light should be ON whenever the parking brake is applied and the ignition switch is ON.
2. Low fluid level. A low fluid level in the master cylinder will turn the "BRAKE" light ON.
3. During engine cranking the "BRAKE" light should remain ON. This notifies the driver that the warning circuit is operating properly.
4. Low vacuum warning light. The vacuum warning device is equipped on the diesel engine equipped vehicles. The "BRAKE" light comes on when the reserved vacuum is lowered to a critical level or power brake line is damaged.

NOTE:

Depressing the brake pedal repeatedly may cause the brake warning light to come ON when the engine is running at idling speed or at low speed. This is because the amount of vacuum is used more than that supplied by the vacuum pump, however, no problem will occur actually.

If the lamp is still lighting even after 2 or 3 seconds at idling speed, the vacuum line may be defective.

ANTILOCK BRAKE SYSTEM (ABS)

Refer to Brake Control System for inspection and diagnosis procedure of the hydraulic unit.

TROUBLESHOOTING

Condition	Possible Cause	Correction
Brake Pull	<ol style="list-style-type: none"> 1. Tire inflation pressures unequal. 2. Front wheel alignment incorrect. 3. Unmatched tires on same axle. 4. Restricted brake pipes or hoses. 5. Water or oil on brake pads. 6. Brake pads hardened. 7. Brake pads worn excessively. 8. Brake rotor worn or scored. 9. Disc brake caliper malfunctioning. 10. Front hub bearing preload incorrect. 11. Loose suspension parts. 12. Loose calipers. 	<ol style="list-style-type: none"> 1. Adjust 2. Adjust 3. Tire with approx. the same amount of tread should be used on the same axle. 4. Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake piping. 5. Clean or replace. 6. Replace. 7. Replace. 8. Grind or replace. 9. Clean or replace. 10. Adjust or replace. 11. Check all suspension mountings. 12. Check and tighten bolts to specifications.
Brake Roughness-or Chatter (Pulsates)	<ol style="list-style-type: none"> 1. Excessive lateral runout. 2. Parallelism not within specifications. 3. Wheel bearings not adjusted. 4. Pad reversed (steel against iron). 	<ol style="list-style-type: none"> 1. Check per instructions. If not within specifications, replace or machine the rotor. 2. Check per instructions. If not within specifications, replace or machine the rotor. 3. Adjust wheel bearings to correct specifications. 4. Replace brake pad and machine rotor to within specifications.
Excessive Pedal Effort	<ol style="list-style-type: none"> 1. Malfunctioning vacuum booster. 2. Partial system failure. 3. Excessively worn pad. 4. Piston in caliper stuck or sluggish. 5. Fading brakes due to incorrect pad. 6. Vacuum leak to vacuum booster. 7. Check direction of check valve within vacuum hose. 8. Grease on the brake pads. 	<ol style="list-style-type: none"> 1. Check vacuum booster operation and repair, if necessary. 2. Check front and rear brake system for failure and repair. Also, check brake warning light. If a failed system is found, the light should indicate a failure. 3. Check and replace pads in sets. 4. Remove caliper and rebuild. 5. Remove and replace with original equipment pad or equivalent. 6. Check for ruptured or loose hose. 7. Correct vacuum hose direction. 8. Replace or clean.
Excessive Brake Pedal Travel	<ol style="list-style-type: none"> 1. Air in hydraulic circuit. 2. Level of brake fluid in reservoir too low. 3. Master cylinder push rod clearance excessive. 4. Leakage in hydraulic system. 	<ol style="list-style-type: none"> 1. Bleed hydraulic circuit. 2. Replenish brake fluid reservoir to specified level and bleed hydraulic circuit as necessary. 3. Adjust. 4. Correct or replace defective parts.

5C – 6 POWER ASSISTED BRAKE SYSTEM

Condition	Possible Cause	Correction
Brake Drag	<ol style="list-style-type: none"> 1. Master cylinder pistons not returning correctly. 2. Restricted brake pipes or hoses. 3. Parking brake maladjusted. 4. Parking brake lining clearance insufficient. 5. Brake pedal free play insufficient. 6. Piston in master cylinder sticking. 7. Piston in disc brake caliper sticking. 8. Brake pads sticking in caliper. 9. Return spring weakened. 10. Parking brake binding. 11. Front hub bearing preload incorrect. 12. Parking brake shoes not returning. 13. Obstructions in hydraulic circuit. 14. Rotor warped excessively. 15. Rear brake drum distorted. 16. Parking cable sticking. 	<ol style="list-style-type: none"> 1. Adjust stop light switch and vacuum booster operating rod. If necessary, rebuild. 2. Check for soft hoses or damaged pipes, and replace with new hoses and new double-walled steel brake piping. 3. Adjust. 4. Adjust. 5. Adjust brake pedal height or power cylinder operating rod. 6. Replace. 7. Replace piston seals. 8. Clean. 9. Replace. 10. Overhaul parking brakes and correct. 11. Adjust or replace. 12. Correct or replace brake back plate and brake shoe as necessary. 13. Clean. 14. Grind or replace. 15. Grind or replace. 16. Clean or replace.
Grabbing or Uneven Braking Action (All conditions listed under "Pulls")	<ol style="list-style-type: none"> 1. Malfunctioning vacuum booster. 2. Binding brake pedal mechanism. 3. Corroded caliper assembly. 	<ol style="list-style-type: none"> 1. Check operation and correct as necessary. 2. Check and lubricate, if necessary. 3. Clean and lubricate.
Brake Noisy	<ol style="list-style-type: none"> 1. Brake pads worn. 2. Brake pads hardened. 3. Brake pads in poor contact with rotor. 4. Brake disc(s) warped, worn or damaged. 5. Disc brake anti-squeak shims fatigued. 6. Front hub bearings loose or preload is incorrect. 7. Brake disc rusted. 	<ol style="list-style-type: none"> 1. Replace. 2. Replace. 3. Correct. 4. Grind or replace. 5. Replace. 6. Adjust or replace. 7. Grind or replace.
Poor Brake Action	<ol style="list-style-type: none"> 1. Master cylinder faulty. 2. Vacuum booster faulty. 3. Level of brake fluid in reservoir too low. 4. Air in hydraulic circuit. 5. Disc brake caliper faulty. 6. Water or oil on brake pads. 7. Brake pads in poor contact with rotor. 8. Brake pads worn. 9. Brake disc rusted. 10. Check valve in vacuum hose faulty. 	<ol style="list-style-type: none"> 1. Correct or replace. 2. Correct or replace. 3. Replenish and bleed. 4. Bleed. 5. Clean or replace. 6. Clean or replace. 7. Correct. 8. Replace. 9. Grind or replace. 10. Correct or replace.

MAIN DATA AND SPECIFICATIONS

MASTER CYLINDER Type Piston Bore Diameter	mm (in)	Dual-circuit 25.4 (1.000)
VACUUM BOOSTER Diaphragm Diameter Push Rod Stroke Plunger Diameter Push Rod Diameter	Front; mm (in) Rear; mm (in) mm (in) mm (in) mm (in)	205 (8.07) (Gasoline) / 180 (7.09) (Diesel) 230 (9.06) (Gasoline) / 205 (8.07) (Diesel) More than 32.0 (1.26) 10.13 (0.399) 27.4 (1.08)
FRONT DISC BRAKE Type Pad Dimension Adjusting Method Piston Diameter Disc (Rotor) Type Disc (Rotor) Thickness Disc (Rotor) Effective Diameter	cm ² (in ²) mm (in) mm (in) mm (in) mm (in)	Floating, Pin Slide 55 (8.52) Self-adjusting 60.33 (2.38) Ventilated 26 (1.02) 222 (8.74)
REAR DISC BRAKE Type Pad Dimension Adjusting Method Piston Diameter Disc (Rotor) Type Disc (Rotor) Thickness Disc (Rotor) Effective Diameter	cm ² (in ²) mm (in) mm (in) mm (in) mm (in)	Floating, Pin Slide 33 (5.11) Self-adjusting 41.3 (1.63) Ventilated 18 (0.71) 269.2 (10.60)

SERVICE STANDARD

HYDRAULIC BRAKE FLUID	DOT 3 grade
BRAKE PEDAL Pedal Free Play mm (in) Pedal Height (LHD / RHD) mm (in) Stop Light Switch Clearance mm (in)	6 to 10 (0.23 to 0.39) 208 to 218 (8.19 to 8.58) / 211 to 221 (8.31 to 8.70) 0 to 0.2 (0 to 0.008)
FRONT DISC BRAKE Pad Thickness Minimum Limit mm (in) Disc (Rotor) Maximum Runout mm (in) Disc (Rotor) Maximum Parallelism mm (in) Disc (Rotor) Minimum Wear Dimensions (Thickness) mm (in) Disc (Rotor) Minimum Refinish Dimensions (Thickness) mm (in)	1.0 (0.039) 0.13 (0.005) 0.010 (0.0004) 24.60 (0.969) 24.97 (0.983)
REAR DISC BRAKE Pad Thickness Minimum Limit mm (in) Disc (Rotor) Maximum Runout mm (in) Disc (Rotor) Maximum Parallelism mm (in) Disc (Rotor) Minimum Wear Dimensions (Thickness) mm (in) Disc (Rotor) Minimum Refinish Dimensions (Thickness) mm (in)	1.0 (0.039) 0.13 (0.005) 0.010 (0.0004) 16.60 (0.654) 16.97 (0.668)

SERVICING

FILLING MASTER CYLINDER RESERVOIR



CAUTION:

- 1) Use only specified brake fluid. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system. Water mixed with brake fluid lowers the fluid boiling point. Keep all fluid containers capped to prevent contamination.
- 2) Always fill the master cylinder reservoir when the engine is cold.
- 3) Never allow the brake fluid to come in contact with the painted surfaced.

The master cylinder reservoir must be kept properly filled to ensure adequate reserve and to prevent air and moisture from entering the hydraulic system. However, because of expansion due to heat absorbed from the brakes and the engine, the reservoir must not be overfilled. The brake fluid reservoir is on the master cylinder, which is located under the hood on the driver side of the cowl. Thoroughly clean reservoir cap before removal to avoid getting dirt into reservoir. Remove cap and diaphragm. Add fluid as required to bring level to the "MAX" mark on the reservoir tank. Use "DOT 3" Hydraulic Brake Fluid. If the fluid cap diaphragm is stretched, return it to the original position before installing.

DETERIORATION OF BRAKE FLUID

Using any other brake fluid than specified or brake fluid with mineral oil or water mixed in will drop the boiling point of brake fluid. It may, in turn, result in vapor lock or deteriorated rubber parts of the hydraulic system. Be sure to change brake fluid at specified intervals.

If rubber parts are deteriorated, remove all the system parts and clean them with alcohol. Prior to reassembly, dry the cleaned parts with air to remove the alcohol. Replace all hoses and rubber parts of the system.

LEAKAGE OF BRAKE FLUID

With engine idling, set shift lever in the neutral position and continue to depress brake pedal at a constant pedal application force.

Should the pedal stroke become deeper gradually, leak from the hydraulic pressure system is possible.

Make sure by visual check that there is no leak.

BLEEDING BRAKE HYDRAULIC SYSTEM

A bleeding operation is necessary to remove air from the hydraulic brake system whenever air is introduced into the hydraulic system. It may be necessary to bleed the hydraulic system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder. If a brake pipe is disconnected at one wheel, only that wheel cylinder/caliper needs to be bled. If pipes are disconnected at any fitting located between master cylinder and brakes, then the brake system served by the disconnected pipe must be bled.

1. For 4-wheel Antilock Brake System (ABS) equipped vehicle, be sure to remove the ABS main fuse 40A located at the relay and fuse box before bleeding air. If you attempt to bleed air without removing the main fuse, air cannot be let out thoroughly, and this may cause damage to the hydraulic unit. After bleeding air, be sure to replace the ABS main fuse back to its original position.
2. Set the parking brake completely, then start the engine.

NOTE:

The vacuum booster will be damaged if the bleeding operation is performed with the engine off.

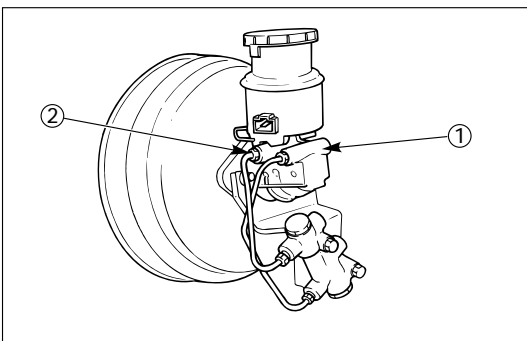
3. Remove the master cylinder reservoir cap.
4. Fill the master cylinder reservoir with brake fluid. Keep the reservoir at least half full during the air bleeding operation.
5. Always use new brake fluid for replenishment.
6. In replenishing brake fluid, take care that air bubbles do not enter the brake fluid.
 - When the master cylinder is replaced or overhauled, first bleed the air from the master cylinder, then from each wheel cylinder and caliper following the procedures described below.

Bleeding the Master Cylinder

7. Disconnect the rear wheel brake pipe ① from the master cylinder. Check the fluid level and replenish as necessary. If replenished, leave the system for at least one minute.
8. Depress the brake pedal slowly once and hold it depressed.
9. Completely seal the delivery port of the master cylinder where the pipe was disconnected with your finger, then release the brake pedal slowly.
10. Release your finger from the delivery port when the brake pedal returns completely.
11. Repeat steps 7 through 9 until the brake fluid comes out of the delivery port during step 7.

NOTE:

Do not allow the fluid level in the reservoir to go below the half-way mark.



12. Reconnect the brake pipe ① to the master cylinder and tighten the pipe.
13. Depress the brake pedal slowly once and hold it depressed.
14. Loosen the rear wheel brake pipe ① at the master cylinder.
15. Retighten the brake pipe, then release the brake pedal slowly.
16. Repeat steps 13 through 15 until no air comes out from the port when the brake pipe is loosened.

NOTE:

Be very careful not to allow the brake fluid to come in contact with painted surfaces.

17. Bleed the air from the front wheel brake pipe connection ② by repeating steps 7 through 16.

Bleeding the Caliper

18. Bleed the air from each wheel in the order listed below.

LHD models:

- 1) Right rear caliper
- 2) Left rear caliper
- 3) Load sensing proportioning valve (only for Europe and South Africa)
- 4) Right front caliper
- 5) Left front caliper

RHD models:

- 1) Left rear caliper
- 2) Right rear caliper
- 3) Load sensing proportioning valve (only for Europe and South Africa)
- 4) Left front caliper
- 5) Right front caliper

Conduct air bleeding from the wheels in the above order. If no brake fluid comes out, it suggests that air is mixed in the master cylinder. In this case, bleed air from the master cylinder in accordance with Steps 7 through 17, and then bleed air from the caliper.

19. Place the proper size box end wrench over the bleeder screw.
20. Cover the bleeder screw with a transparent tube, and submerge the free end of the transparent tube in a transparent container containing brake fluid.
21. Pump the brake pedal slowly three (3) times (once/sec), then hold it depressed.
22. Loosen the bleeder screw until fluid flows through the tube.
23. Retighten the bleeder screw.
24. Release the brake pedal slowly.
25. Repeat step 21 through 24 until the air is completely removed. It may be necessary to repeat the bleeding procedure 10 or more times for front wheels and 15 or more times for rear wheels.
26. Go to the next wheel in the sequence after each wheel is bled. Be sure to monitor reservoir fluid level.

27. Depress the brake pedal to check if you feel “sponginess” after the air has been removed from all wheel cylinders and calipers. If the pedal feels “spongy”, the entire bleeding procedure must be repeated.
28. After the bleeding operation is completed on each individual wheel, check the level of brake fluid in the reservoir and replenish up to the “MAX” level if necessary.
29. Attach the reservoir cap.
 - If the diaphragm inside the cap is deformed, reform it and install.
30. Stop the engine.

FLUSHING BRAKE HYDRAULIC SYSTEM

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Approximately one quart of fluid is required to flush the hydraulic system.

The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contains the slightest trace of mineral oil. All rubber parts that have been subjected to a contaminated fluid must be replaced.

BRAKE PIPES AND HOSES

The hydraulic brake system components are interconnected by special steel piping and flexible hoses. Flexible hoses are used between the frame and the front calipers, the frame and rear axle case and the rear axle and the rear calipers.

When the hydraulic pipes have been disconnected for any reason, the brake system must be bled after reconnecting the pipe; refer to “Bleeding Brake Hydraulic System” in this section.

BRAKE HOSE INSPECTION

The brake hoses should be inspected at least twice a year. The brake hose assembly should be checked for road hazard, cracks and chafing of the outer cover, and for leaks and blisters. Inspect for proper routing and mounting of the hose. A brake hose that rubs on suspension components will wear and eventually fail. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.



CAUTION:

Never allow brake components such as calipers to hang from the brake hoses, as damage to the hoses may occur.

CHECKING BRAKE PEDAL HEIGHT

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows:

Adjust Brake Pedal

1. Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring. Pedal height (L2) must be measured after starting the engine and revving it several times.

Pedal Free Play (L1)	mm (in)
6 - 10 (0.23 - 0.39)	

Pedal Height (L2)		mm (in)
LHD	RHD	
208 - 218 (8.19 - 8.58)	211 - 221 (8.31 - 8.70)	

NOTE:

Pedal free play (L1) must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

2. If the measured value is not within the above range, adjust the brake pedal as follows:
 - a) Disconnect the stop light switch connector.
 - b) Loosen the stop light switch lock nut.
 - c) Rotate the stop light switch so that it moves away from the brake pedal.
 - d) Loosen the lock nut on the push rod.
 - e) Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.
 - f) Tighten the lock nut to the specified torque.

Lock Nut Torque	N·m (kg·m/lb·ft)
20 (2.0 / 15)	

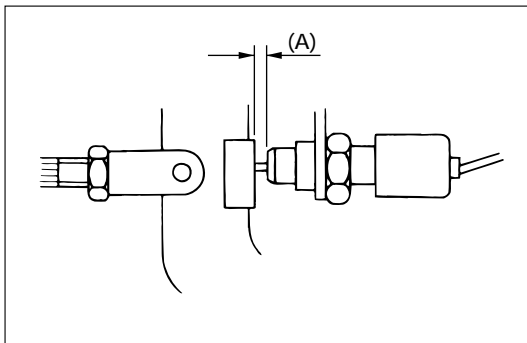
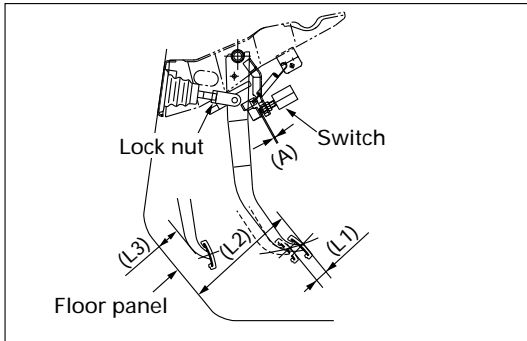
- g) Adjust the stop light switch to the specified clearance (between switch housing and brake pedal) by rotating the switch housing.

Clearance	mm (in)
0 - 0.2 (0 - 0.008)	

NOTE:

While adjusting the installation of the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

- h) Tighten the stop light switch lock nut.
- i) Connect the stop light switch connector.



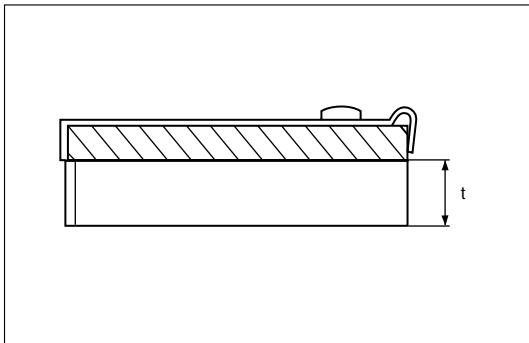
CHECKING BRAKE PEDAL TRAVEL

1. Pedal height (L3) must be measured after starting the engine and removing it several times to apply vacuum to the vacuum booster fully.

NOTE:

Pedal height (L3) must be 100 mm (3.9 in)/85 mm (3.5 in) (LHD/RHD) or more when about 50 kg (110.25 lb) of stepping force is applied.

2. If the measured value is lower than the above range, air existing in the hydraulic system is suspected and perform bleeding procedure.



FRONT AND REAR DISC BRAKE PADS INSPECTION

Check the outer pad by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (t) is worn to within 1.0 mm (0.039 in) of the pad itself.

The disc pads have a wear indicator that makes a noise when the pad wears to where replacement is required.



Minimum Limit	mm (in)
	1.0 (0.039)

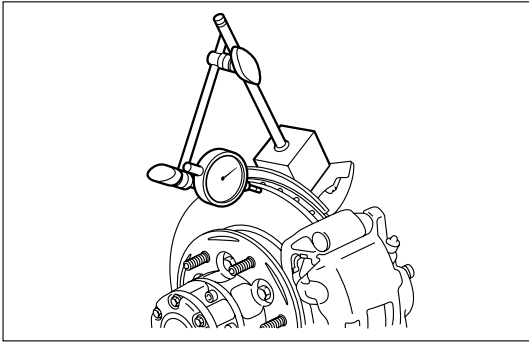
SERVICING THE FRONT BRAKE ROTOR

In the manufacturing of the front brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. The maintenance of these tolerances provide the surface necessary to assure smooth brake operation.

LATERAL RUNOUT

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as "rotor wobble".

This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

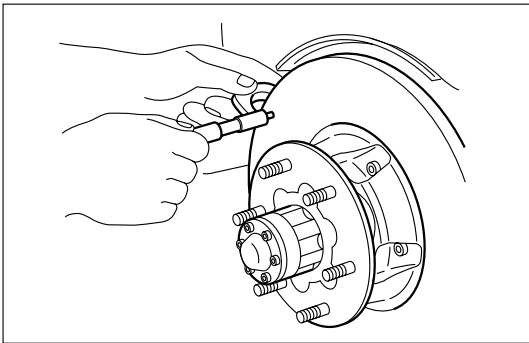


CHECKING LATERAL RUNOUT

1. Adjust the wheel bearing correctly.
 - Refer to Front Hub and Disc in Driveline / Axle Section.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 29 mm (1.14 in) from the rotor edge.
3. Move the rotor one complete rotation.
 - The lateral runout should not exceed 0.13 mm (0.005 in).



Maximum Runout	mm (in)
0.13 (0.005)	



PARALLELISM

Parallelism is the measurement of the thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 29 mm (1.14 in) from the edge of the rotor.

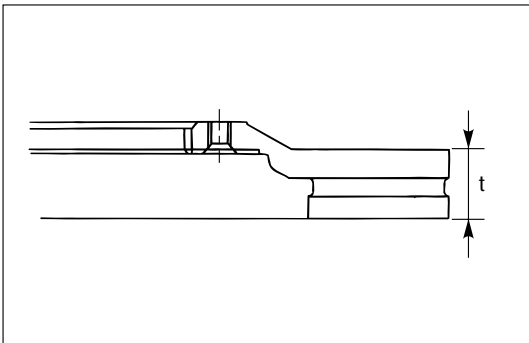
The rotor thickness must not vary more than 0.010 mm (0.004 in) from point to point.



Maximum Parallelism	mm (in)
0.010 (0.0004)	

REPLACING FRONT BRAKE ROTORS

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.



REFINISHING FRONT BRAKE ROTORS

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 24.60 mm (0.969 in). The minimum refinish dimension is 24.97 mm (0.983 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 24.97 mm (0.983 in). Do not use a brake rotor that will not meet the specification.



Minimum Wear Dimension	mm (in)
24.60 (0.969)	

Refinish Dimension	mm (in)
24.97 (0.983)	

SERVICING THE REAR BRAKE ROTOR

In the manufacturing of the rear brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. The maintenance of these tolerances provide the surface necessary to assure smooth brake operation.

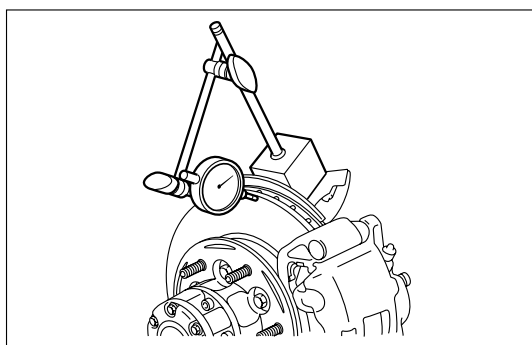
LATERAL RUNOUT

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.

This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

CHECKING LATERAL RUNOUT

1. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 22 mm (0.87 in) from the rotor edge.
2. Move the rotor one complete rotation.
 - The lateral runout should not exceed 0.13 mm (0.005 in).

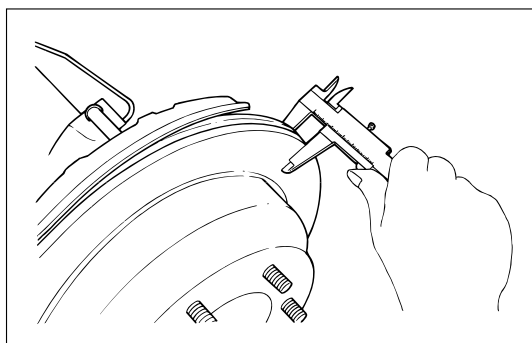


Maximum Runout	mm (in)
	0.13 (0.005)

PARALLELSIM

Parallelism is the measurement of the thickness of the rotor at four or more points around the circumference of the rotor. All measurements must be made at 22 mm (0.87 in) from the edge of the rotor.

The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.



Maximum Parallelism Variation	mm (in)
	0.010 (0.0004)

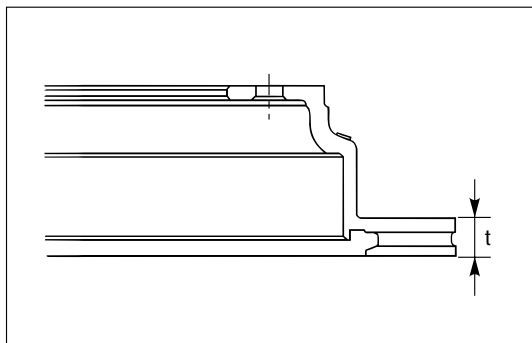
REPLACING REAR BRAKE ROTORS

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

REFINISHING REAR BRAKE ROTORS

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 16.60 mm (0.654 in). The refinish dimension is 16.97 mm (0.668 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance.



Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor does not meet the minimum thickness of 16.97 mm (0.668 in). Do not use a brake rotor that will not meet the specification.

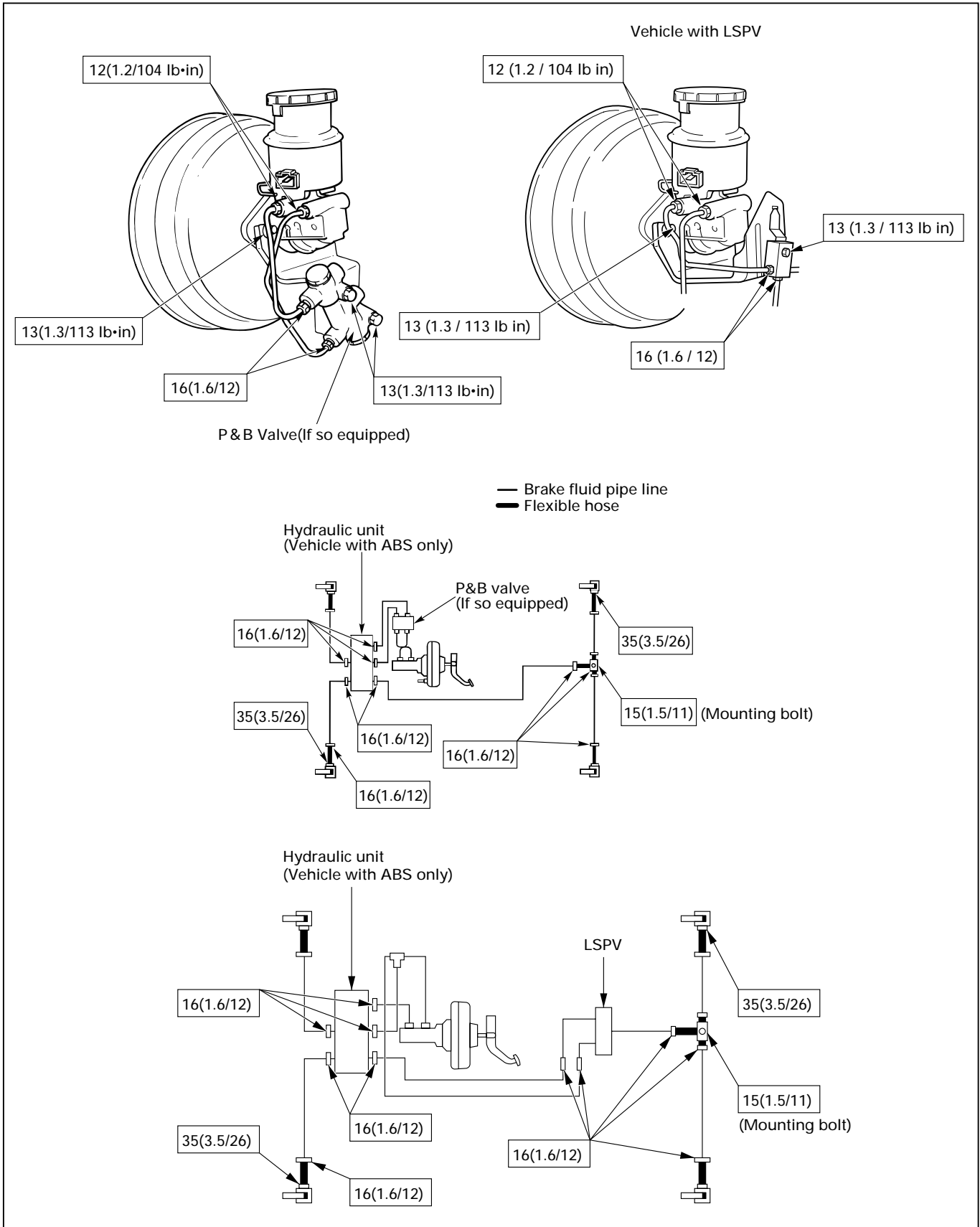


Minimum Wear Dimension	mm (in)
<hr/>	
16.60 (0.654)	
<hr/>	
Refinish Dimension	mm (in)
<hr/>	
16.97 (0.668)	
<hr/>	

FIXING TORQUE

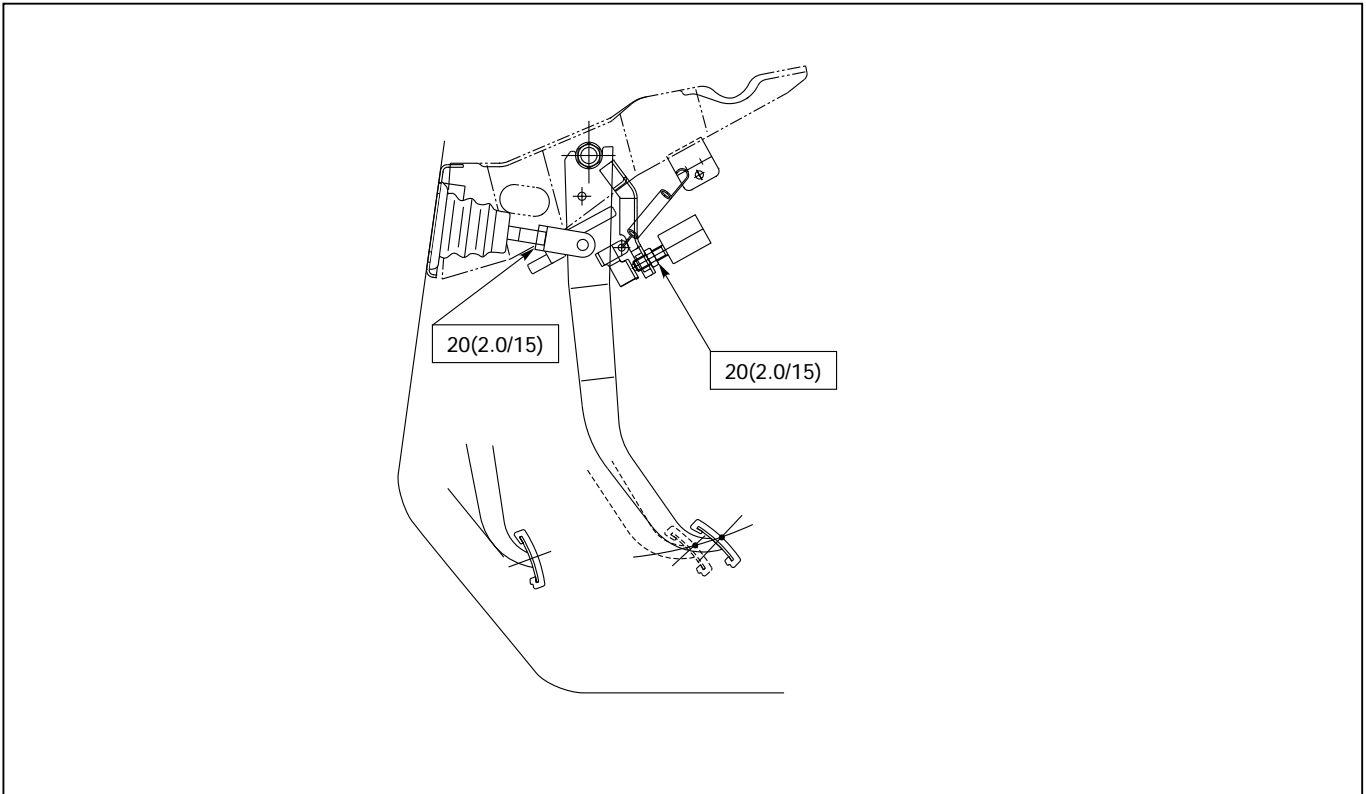
Brake Hydraulic Lines

N·m (kg·m/lb·ft)



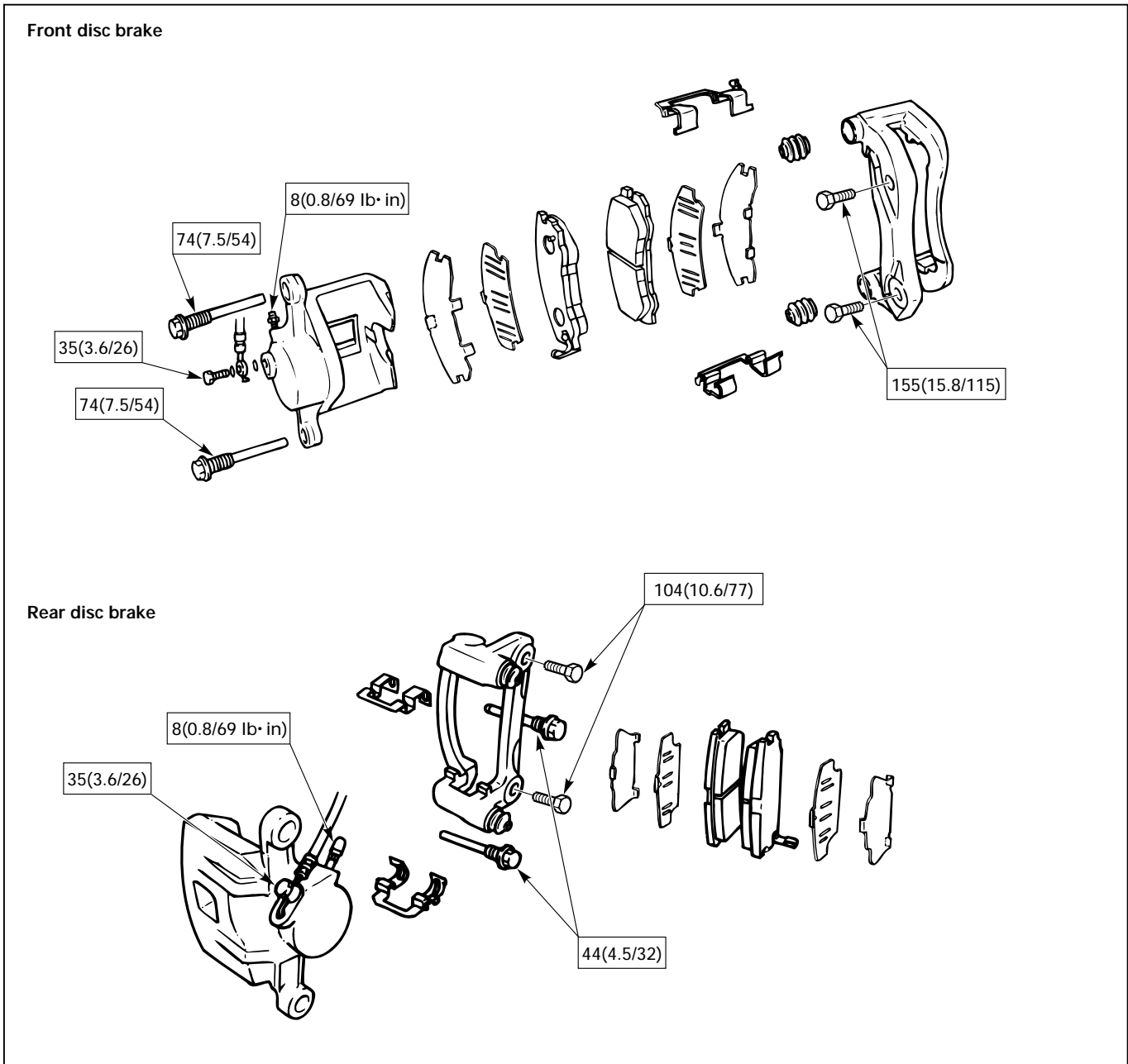
Brake Pedal

N·m (kg·m/lb·ft)



Front and Rear Brakes

N·m (kg·m/lb·ft)



SPECIAL TOOLS

ILLUSTRATION	PART NO.	PARTNAME
	5-8840-2306-0 (J-39242)	Primary piston holder (including master cylinder attachment and master cylinder plug)
	5-8840-0277-0 (J-24460-01)	Radiator cap tester
	5-8840-2300-0 (J-39216)	Push rod gauge
	5-8840-0279-0 (J-23738-A)	Vacuum pump
	5-8840-2305-0 (J-39241)	Push rod support

GENERAL DESCRIPTION

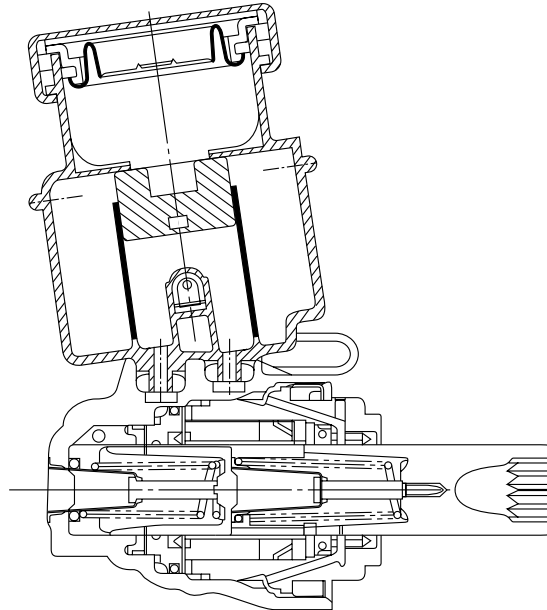
MASTER CYLINDER

The master cylinder contains two pistons that supply the hydraulic pressure for a dual-circuit braking system. The primary piston provides the fluid pressure to the front brakes, while the secondary piston provides the fluid pressure to the rear brakes. If the pressure is lost from either system, the remaining system will function to stop the vehicle.



CAUTION:

- 1) The master cylinder is not repairable. If found defective, it must be replaced as complete assembly.
- 2) If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
- 3) The torque values specified are for dry, unlubricated fasteners.
- 4) Perform service operations on a clean bench free from all mineral oil materials.



VACUUM BOOSTER

This booster is a tandem vacuum unit with a diaphragm effective diameter 205 mm + 230 mm (gasoline engine model) / 180 mm + 205 mm (diesel engine model). In normal operating mode, with the service brakes in the released position, the tandem vacuum booster operates with vacuum on both sides of its diaphragms. When the brakes are applied, air at atmospheric pressure is admitted to one side of each diaphragm to provide the power assist. When the service brake is released, the atmospheric air is shut off from the one side of each diaphragm. The air is then drawn from the booster through the vacuum check valve to the vacuum source.

**CAUTION:**

- 1) If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
- 2) The torque values specified are for dry, unlubricated fasteners.
- 3) The vacuum booster is not repairable and must be replaced as complete assembly.

DISC BRAKES

The disc brake assembly consists of a caliper, piston, rotor, pad assembly and support bracket. The caliper assembly has a single bore and is mounted to the support bracket with 2 mounting bolts. The support bracket allows the caliper to move laterally against the rotor. The caliper is a one-piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

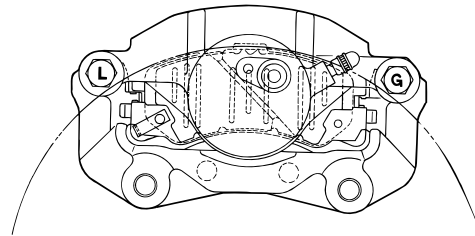
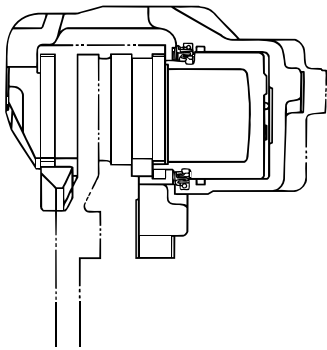
NOTE:

- 1) Replace all components included in repair kits used to service this caliper.
- 2) Lubricate rubber parts with clean brake fluid to ease assembly.
- 3) If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
- 4) Replace pads in axle sets only.
- 5) The torque values specified are for dry, unlubricated fasteners.
- 6) Perform service operation a clean bench free from all mineral oil materials.

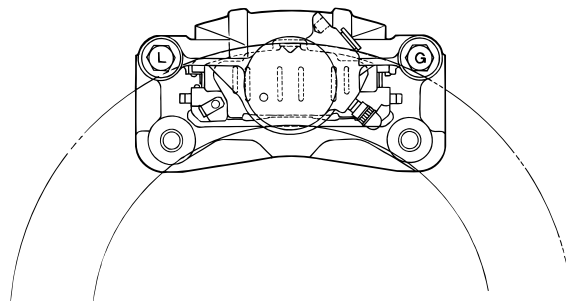
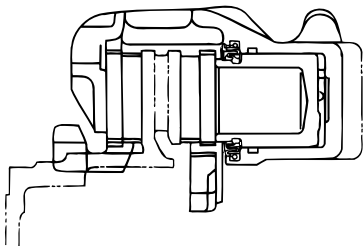
OPERATION

Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move (slide) the caliper inward resulting in a clamping action on the rotor. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Front disc brakes

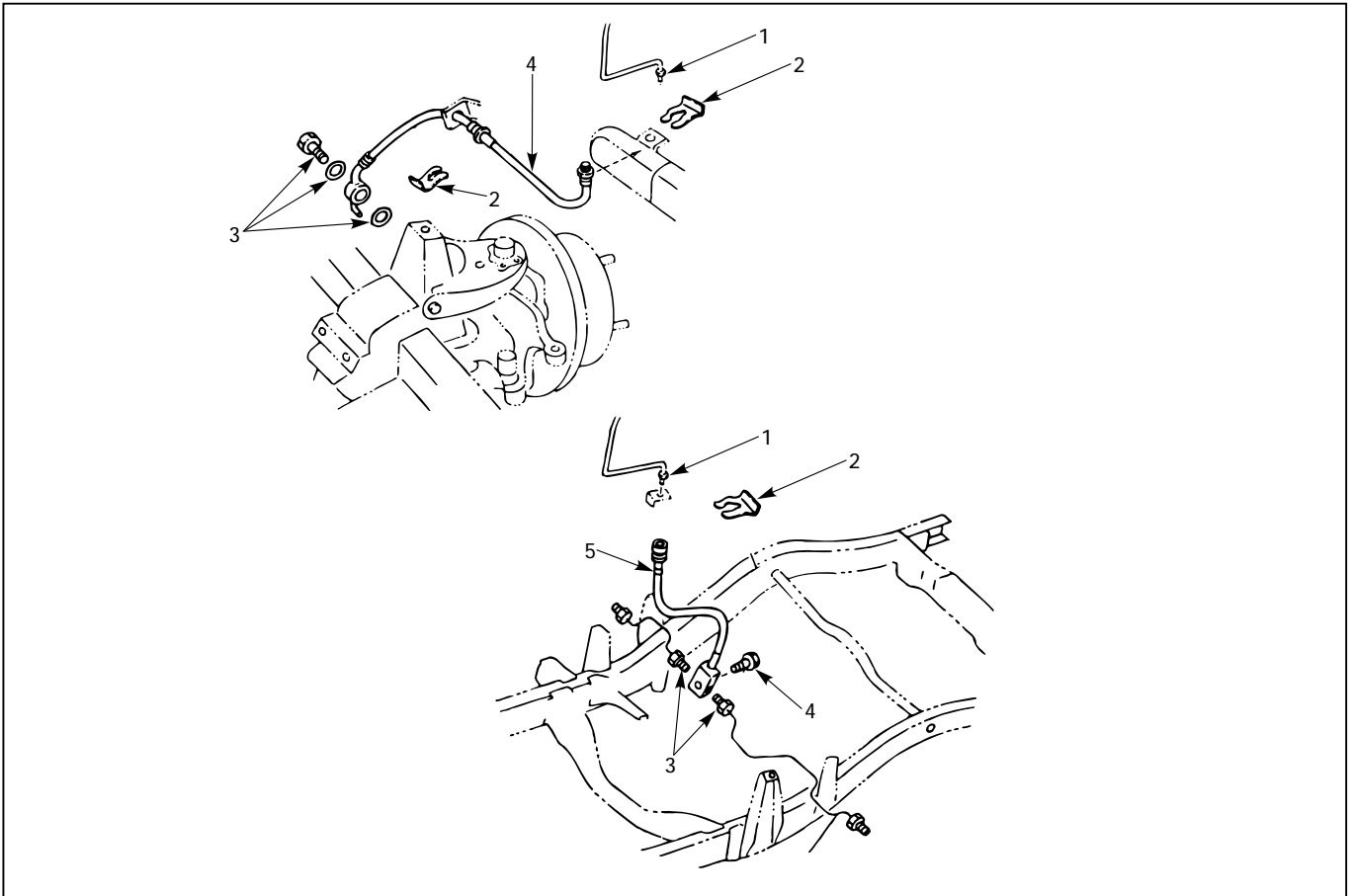


Rear disc brakes



ON-VEHICLE SERVICE

BRAKE HOSE REPLACEMENT



Front/Rear Caliper Brake Hose

Removal Steps

1. Brake pipe
2. Clip
3. Bolt and gasket
4. Hose

Installation Steps

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

Rear Axle Brake Hose

Removal Steps

1. Brake pipe
2. Clip
3. Brake pipe
4. Bolt
5. Hose

Installation Steps

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

 **REMOVAL**

Preparation:

- 1) Raise the vehicle and support it with suitable safety stands.
- 2) Remove wheel and tire assembly.
- 3) Clean dirt, grease, and other foreign material off the hose fittings at both ends.

Front/Rear Caliper Brake Hose

1. Brake Pipe
2. Clip
3. Bolt and Gasket
4. Hose

Rear Axle Brake Hose


1. Brake Pipe
2. Clip
3. Brake Pipe
4. Bolt
5. Hose

 **INSTALLATION**


To install, follow the removal steps in the reverse order, noting the following points. After installing the brake hoses, bleed brakes as described in this section.

Front/Rear Caliper Brake Hose

1. Tighten the brake pipes to the specified torque.

	Brake Pipe Torque	N·m(kg·m/lb·ft)
		16 (1.6 / 12)

2. Tighten the bolt to the specified torque.


	Bolt Torque	N·m(kg·m/lb·ft)
		35 (3.5 / 26)

NOTE:


- Always use new copper gaskets.
- Be sure to put the hooked edge of the flexible hose end into the anti-rotation cavity.

Rear Axle Brake Hose

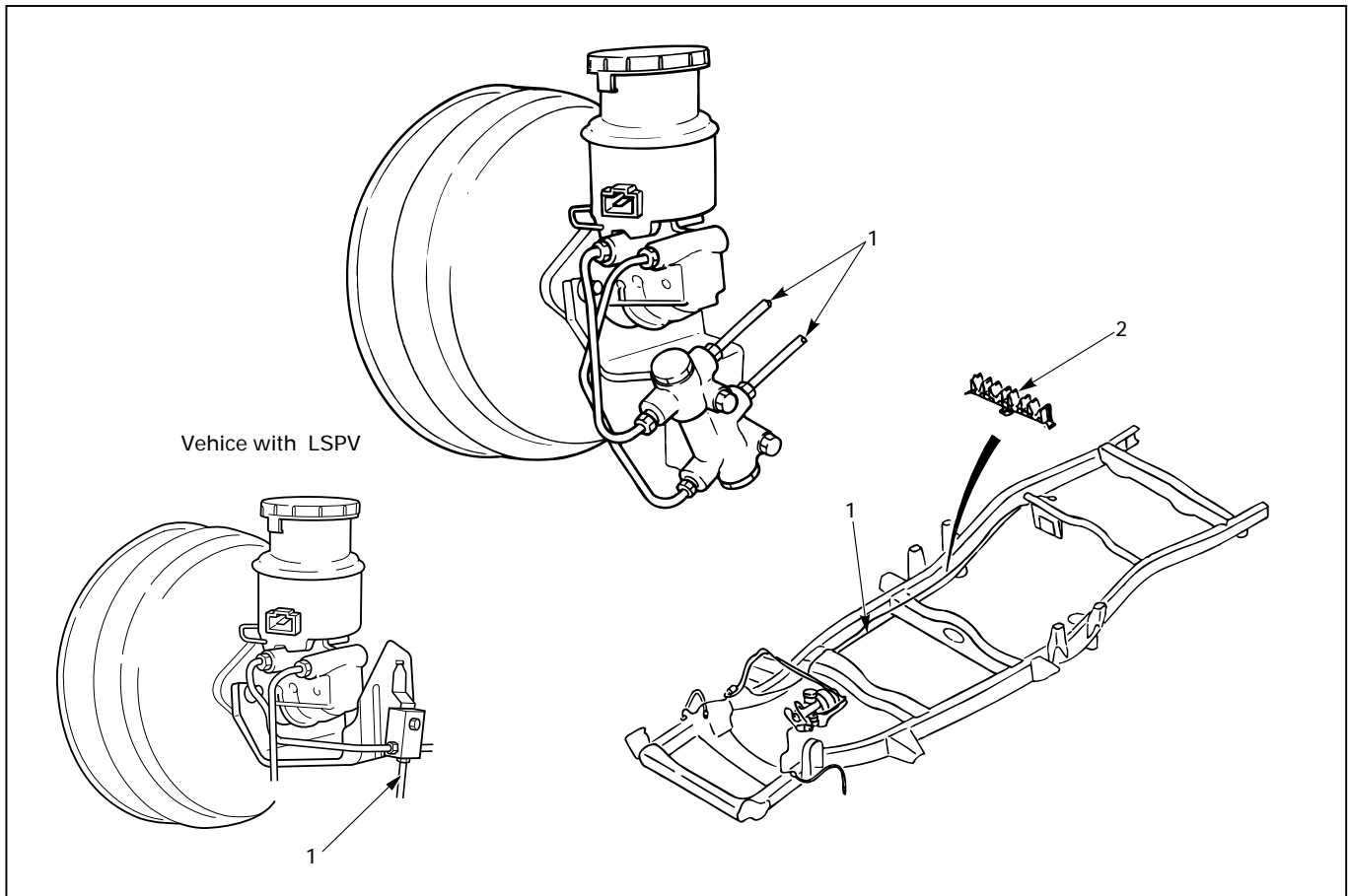
1. Tighten the brake pipes to the specified torque.

	Brake Pipe Torque	N·m(kg·m/lb·ft)
		16 (1.6 / 12)

2. Tighten the bolt to the specified torque.

	Bolt Torque	N·m(kg·cm/lb·in)
		13 (130 / 113)

BRAKE PIPE REPLACEMENT

**Removal Steps**

1. Brake pipe
2. Plastic clip

Installation Steps

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

**REMOVAL****Preparation:**

- 1) Raise the vehicle and support it with suitable safety stands.
- 2) Remove wheel and tire assembly as necessary.
- 3) Clean dirt, grease, and other foreign material off the pipe fittings at both ends.

1. Brake Pipe
2. Plastic Clip



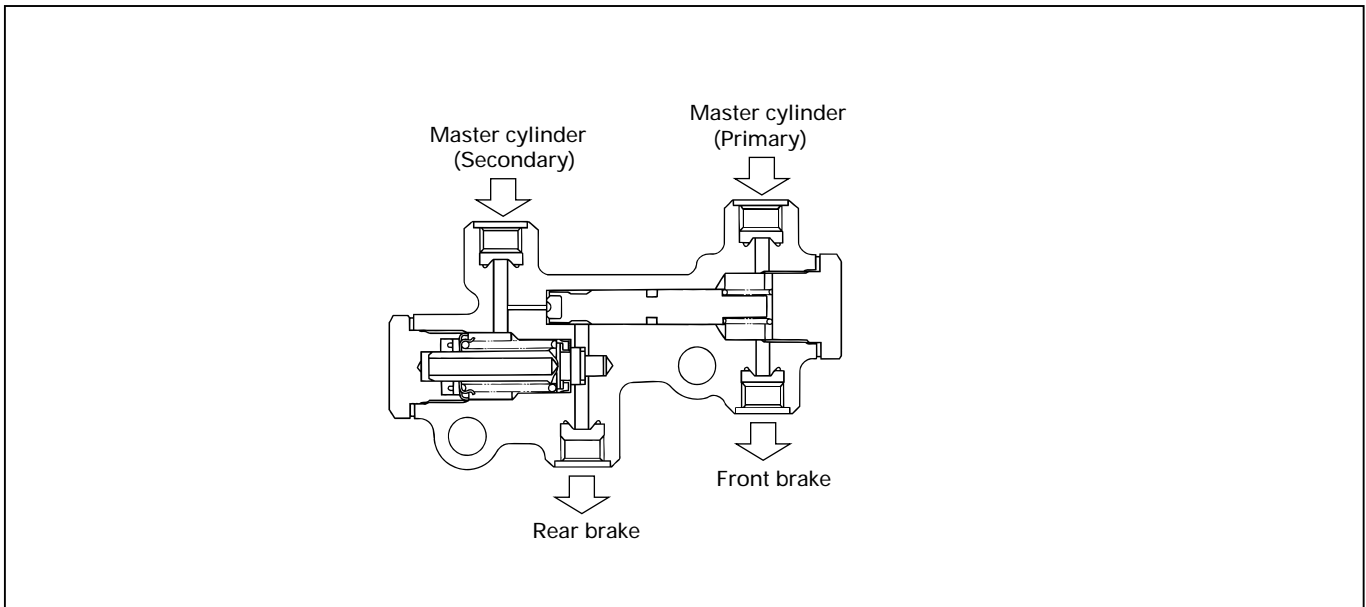
INSTALLATION

To install, follow the removal steps in the reverse order, noting the following points. After installing the brake pipes, bleed brakes as described in this section.
 1. Tighten the brake pipes to the specified torque.



Brake Pipe Torque		N·m(kg·m/lb·ft)
Master Cylinder Side	Others	
12 (1.2/9)	16 (1.6/12)	

P & B (PROPORTIONING AND BYPASS) VALVE



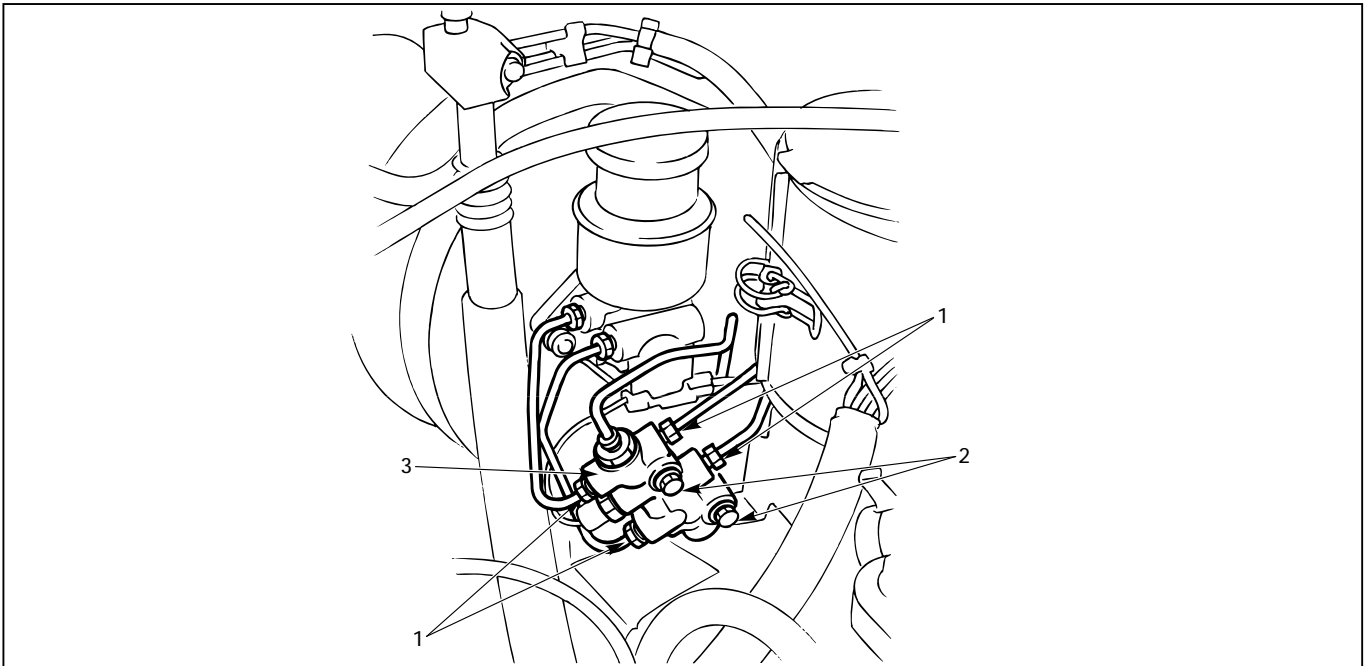
The P & B valve contains two sections, each serving a different function.

The proportioning section of the P & B valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock-up on the vehicles with light rear wheel loads.

The valve has a By-pass feature which assures full system pressure to the rear brakes in the event of a front brake malfunction, also full front pressure is retained in the event of rear brake malfunction.

The P & B valve is not repairable and must be replaced as a complete assembly.

P & B VALVE REPLACEMENT



Removal Steps

1. Hydraulic pipes
2. Bolt
3. P & B valve

Installation Steps

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



REMOVAL

- P & B valve is not repairable and must be replaced as a complete assembly.
- Care must be taken to prevent brake fluid from contacting any painted surface.

1. Hydraulic Pipes

- Plug the pipes to prevent the loss of fluid or the entrance of dirt.

2. Bolt

3. P & B Valve



INSTALLATION

3. P & B Valve

2. Bolt



Bolt Torque	N·m(kg·cm/lb·in)
<u>13 (130/113)</u>	

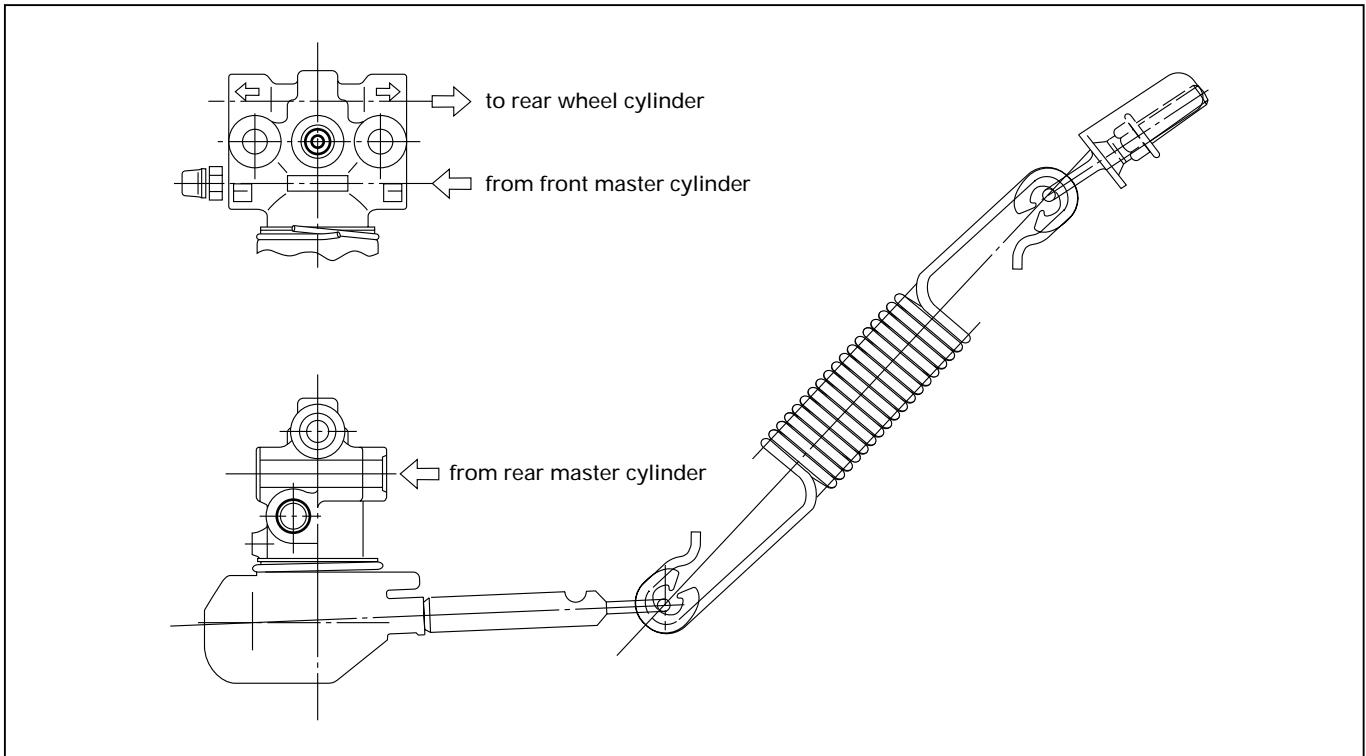
1. Hydraulic Pipes



Hydraulic Pipe Torque	N·m(kg·m/lb·ft)
<u>16 (1.6/12)</u>	

After installing the brake pipes, bleed brakes as described in Bleeding Brake Hydraulic System this section.

LOAD SENSING PROPORTIONING VALVE (LSPV) (FOR EUROPE AND SOUTH AFRICA)



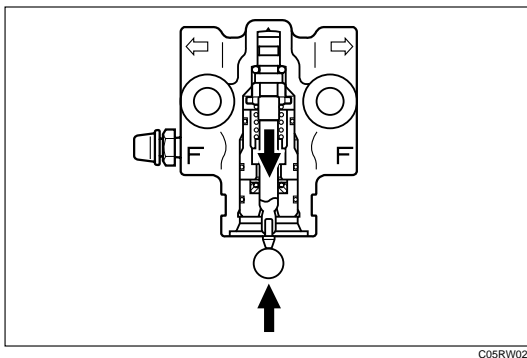
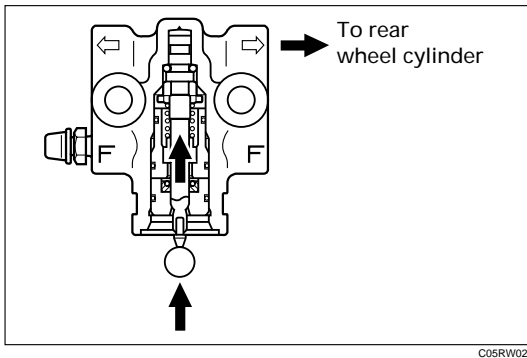
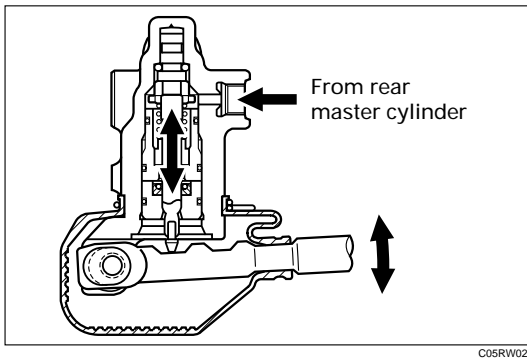
F05RW003

Structure and Operation

The following is an explanation of the structure and operation of the linkage type load sensing device. This device controls the fluid pressure to the rear brakes in accordance with changes in rear axle load (vertical displacements of the rear axle springs).

- Structure
This device consists of a load sensing lever and a valve.
The valve is mounted through a bracket to the frame. One end of the load sensing lever is fixed to the valve at the frame and the other end to the rear axle housing through a spring.





- Operation

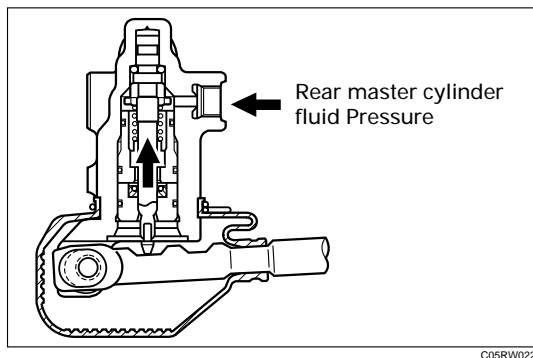
- 1) Outline

When the L.S.P.V. (Load Sensing Proportioning Valve) detects a change in load weight, the load sensing lever moves. Its reaction force is transmitted to the bottom of the load sensing valve to secure an optimum rear wheel cylinder fluid pressure break point in proportion to the actual load weight.

Besides, if the front brake system should fail, the device is designed to prevent the master cylinder fluid pressure from decreasing and to apply it directly to the rear wheel cylinder to obtain a sufficient braking performance.

- 2) Operation

- (1) When the fluid pressure is under the break point. The fluid pressure of the rear master cylinder passes through a clearance between the valve seal and the piston and acts on the rear wheel cylinder. At this moment, a downward force is applied to the piston. However, the compression spring force and reaction force of the load sensing lever keep the piston in the upper position by pushing upwards. (See the left figure.)
- (2) When the fluid pressure is equal to the break point. As the rear wheel cylinder pressure increases, it surpasses the compression spring force and reaction force of the load sensing lever, causing the piston to move downwards, so that the piston butts against the valve seal to shut off the fluid line between the master cylinder and rear wheel cylinder. (See the left figure.)
- (3) When the fluid pressure is over the break point. When the fluid pressure increases further, the piston moves upwards. The moment the piston comes apart from the valve seal, fluid pressure is applied to the rear wheel cylinder and the piston moves downwards so that the fluid line is shut off again. This process goes on repeatedly to control the fluid pressure to the rear wheel cylinder.



C05RW02Z

- (4) When the front brake system fails. When there is a failure in the front brake system, the fluid pressure from the front master cylinder decreases. As a result, the balance between the front and rear brake side fluid pressures is lost at the control valve sleeve so that the control valve sleeve moves upwards. The control valve sleeve strikes against the piston, thereby pushing the piston upwards. Accordingly, the fluid pressure of the rear master cylinder is not decreased and is applied directly to the rear wheel cylinder to secure a sufficient braking performance of the rear brakes. (See the left figure.)



Valve Maintenance

In the case of fluid leak or other abnormalities, faulty valve should be replaced.

Note:

The load sensing proportioning valve is not repairable and must be replaced as a complete assembly.



ADJUSTMENT PROCEDURE OF LSPV

1. Adjust the rear axle weight by loading the laggage compartment as necessary.

Rear Axle Weight	N (kg / lb)
10,300 (1,050 / 2,315)	

Note:

The rear axle weight should be adjusted to the specified value with a man seated in the driver seat.

2. Check the rear wheel cylinder fluid pressure. Install the pressure gauge on bleeder screws on the front and rear brakes.
 - a. Depress the brake pedal slowly until the front wheel cylinder fluid pressure reaches 7845 kPa (80 kg/cm² / 114 psi)

Note:

- The brake pedal should be depressed gradually until specified pressure is reached without pumping or adjusting foot pressure.
- If the front wheel cylinder fluid pressure rises above 7845 kPa (80 kg/cm² / 114 psi), release the pedal fully, then depress the pedal again.

- b. Hold the front wheel cylinder fluid pressure at 7845 kPa (80 kg/cm² / 114 psi) for 2 seconds, check the rear wheel cylinder fluid pressure.

Rear wheel cylinder fluid pressure	kPa (kg/cm ² / psi)
	6374±539 (65±5.5 / 924±78)

- c. If the rear wheel cylinder fluid pressure is not within the specified range, adjust the fluid pressure.

3. Adjust the rear wheel cylinder fluid pressure. The fluid pressure can be adjusted by the bolt projection (1) or bolt projection (2).

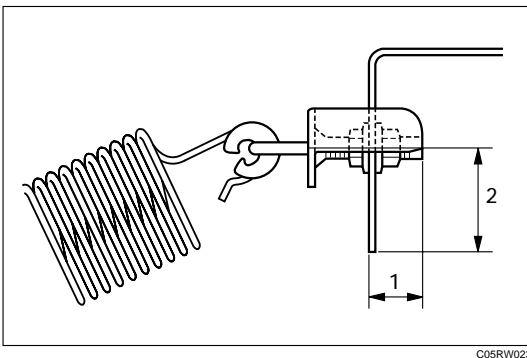
- a. If the fluid pressure is lower than specified range, increase the dimension (1) or (2).
 - b. If the fluid pressure is higher than the specified range, decrease the dimension (1) or (2).

Reference:

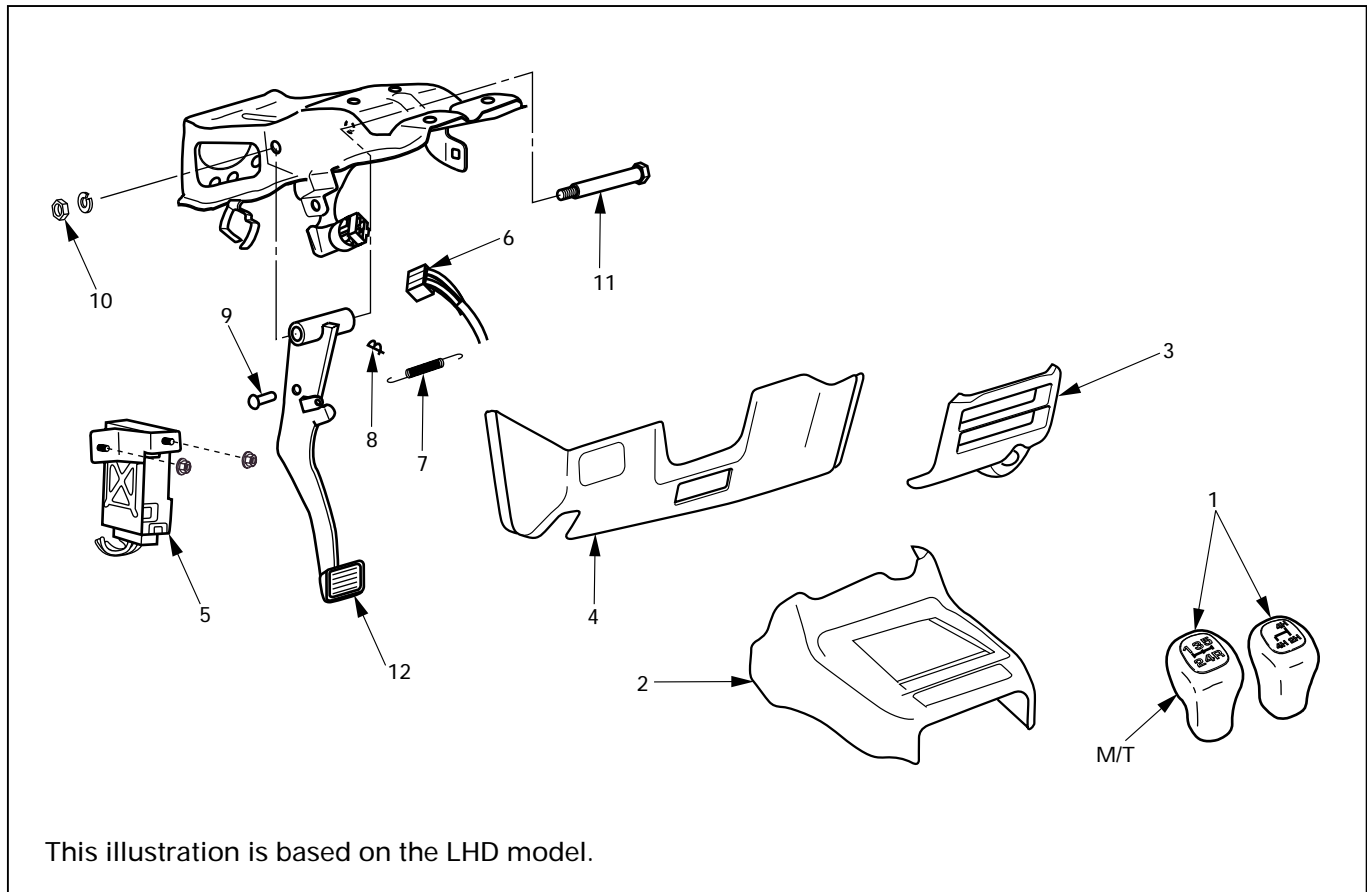
Dimension (1): The fluid pressure can be adjusted about 196 kPa (2 kg/cm² / 28 psi) by one turning of the nut.

Dimension (2): The fluid pressure can be adjusted about 98 kPa (1 kg/cm² / 14 psi) by sliding the bolt position (per 1 mm / 0.039 in).

4. Check the rear wheel cylinder fluid pressure. If the rear wheel cylinder fluid pressure is not within the specified range, try the adjustment again.
5. Bleed the brake hydraulic line and check the fluid leak.



BRAKE PEDAL REPLACEMENT



Removal Steps

1. Shift knob
2. Front console assembly
3. Lower cluster assembly
4. Instrument panel driver lower cover assembly
5. Anti-theft controller
6. Stoplight switch connector
7. Return spring
8. Snap pin
9. Pin
10. Nut
11. Pin, fulcrum
12. Brake pedal

Installation Steps

12. Brake pedal
11. Pin, fulcrum
10. Nut
9. Pin
8. Snap pin
7. Return spring
6. Stoplight switch connector
5. Anti-theft controller
4. Instrument panel driver lower cover assembly
3. Lower cluster assembly
2. Front console assembly
1. Shift knob



REMOVAL

1. Shift Knob
2. Front Console Assembly
3. Lower Cluster Assembly
4. Instrument Panel Driver Lower Cover Assembly
5. Anti-theft Controller
6. Stoplight switch Connector
7. Return Spring
8. Snap Pin
9. Pin
10. Nut
11. Pin, Fulcrum
12. Brake Pedal



INSTALLATION

12. Brake Pedal
11. Pin, Fulcrum



- Apply grease to the entire circumference of the fulcrum pin.

10. Nut

Bolt and Nut Torque

N·m (kg·m / lb·ft)



33 (3.3 / 24)

9. Pin



- Apply grease to the entire circumference of the push rod pin.

8. Snap Pin



- Adjust pedal free travel. Refer to "Brake Pedal Adjustment" previously in this section.

7. Return Spring

6. Stoplight Switch Connector

5. Anti-theft Connector

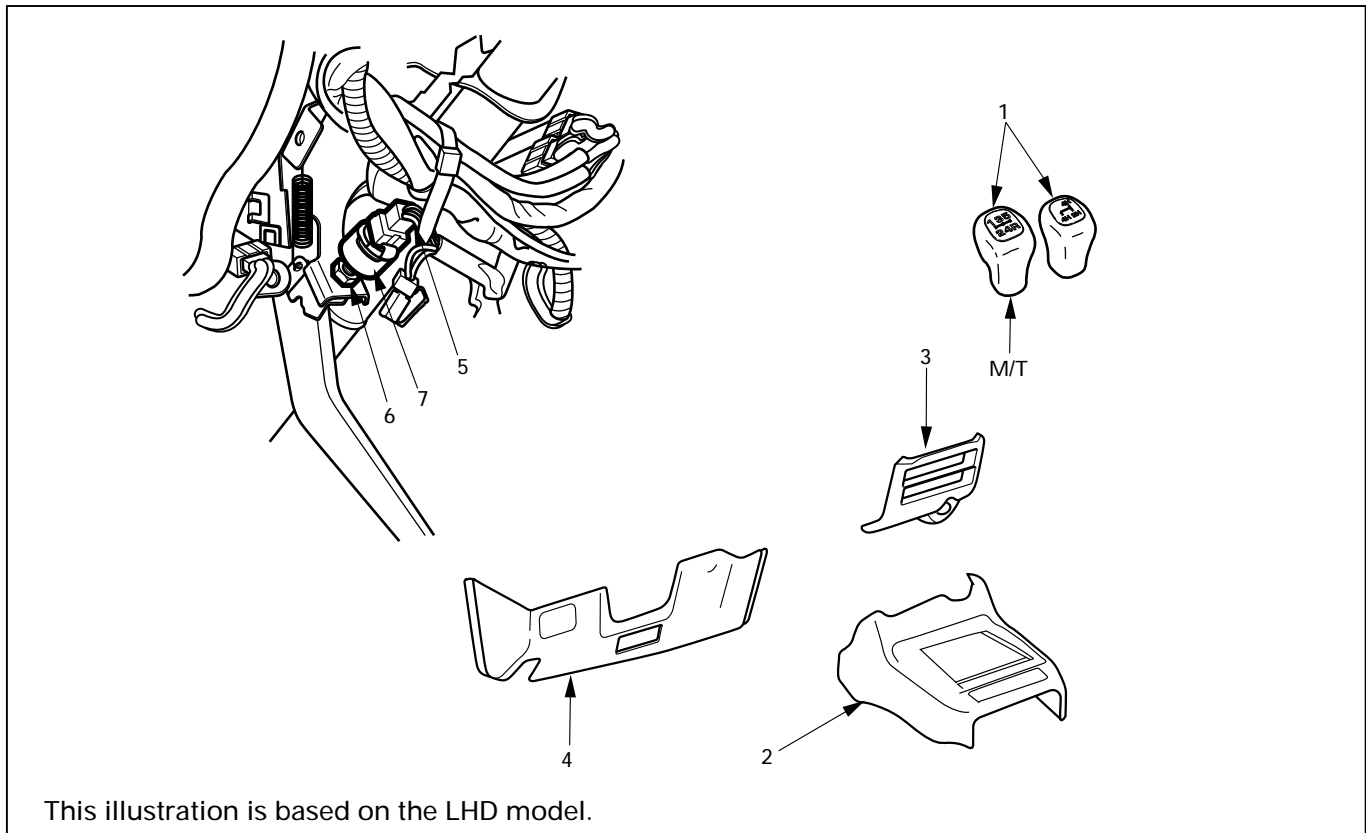
4. Instrument Panel Driver Lower Cover Assembly

3. Lower Cluster Assembly

2. Front Console Assembly

1. Shift Knob

STOPLIGHT SWITCH REPLACEMENT



Removal Steps

1. Shift Knob
2. Front Console Assembly
3. Lower Cluster Assembly
4. Instrument Panel Driver Lower Cover Assembly
5. Stoplight Switch Connector
6. Lock Nut
7. Switch

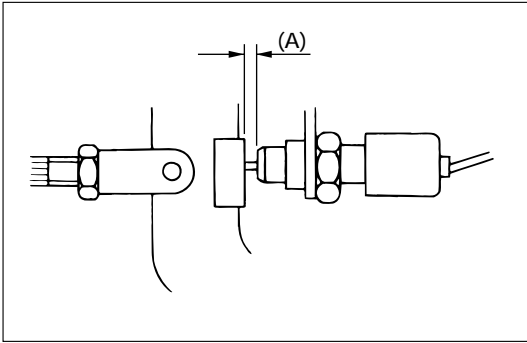
Installation Steps

7. Switch
6. Lock Nut
5. Stoplight Switch Connector
4. Instrument Panel Driver Lower Cover Assembly
3. Lower Cluster Assembly
2. Front Console Assembly
1. Shift Knob



REMOVAL

1. Shift Knob
2. Front Console Assembly
3. Lower Cluster Assembly
4. Instrument Panel Driver Lower Cover Assembly
5. Stoplight Switch Connector
6. Lock Nut
7. Switch



INSTALLATION

7. Switch

- Adjust the stoplight switch to the specified clearance (between switch housing and brake pedal) by rotating the switch housing.



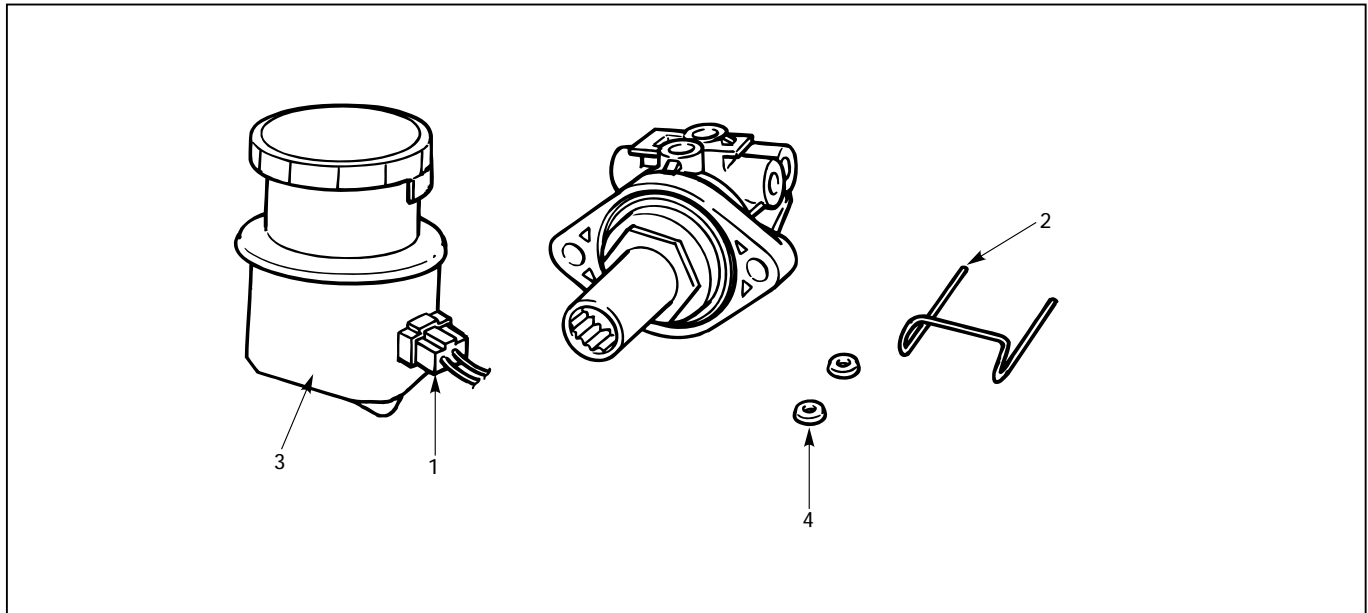
Clearance	mm (in)
0 - 0.2 (0 - 0.008)	

NOTE:

While adjusting the installation of the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

- Shift Knob
- Front Console Assembly
- Lower Cluster Assembly
- Instrument Panel Driver Lower Cover Assembly
- Stoplight Switch Connector
- Lock Nut

FLUID RESERVOIR TANK

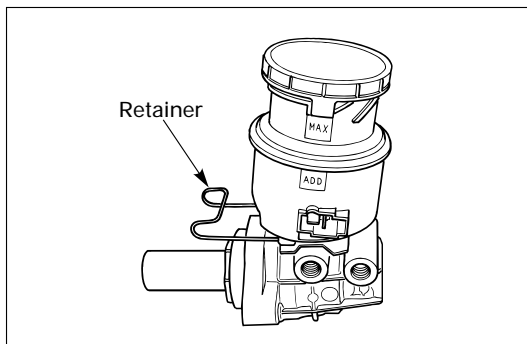


Removal Steps

1. Electrical connector
2. Retainer
3. Fluid reservoir
4. O-ring

Installation Steps

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

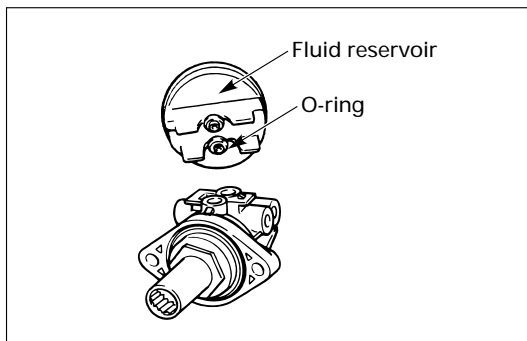


REMOVAL

NOTE:

Before removing fluid reservoir, remove brake fluid from fluid reservoir.

1. Electrical Connector
2. Retainer
3. Fluid Reservoir
 - The fluid level sensor is built into the fluid reservoir. It cannot be removed for servicing.
4. O-ring

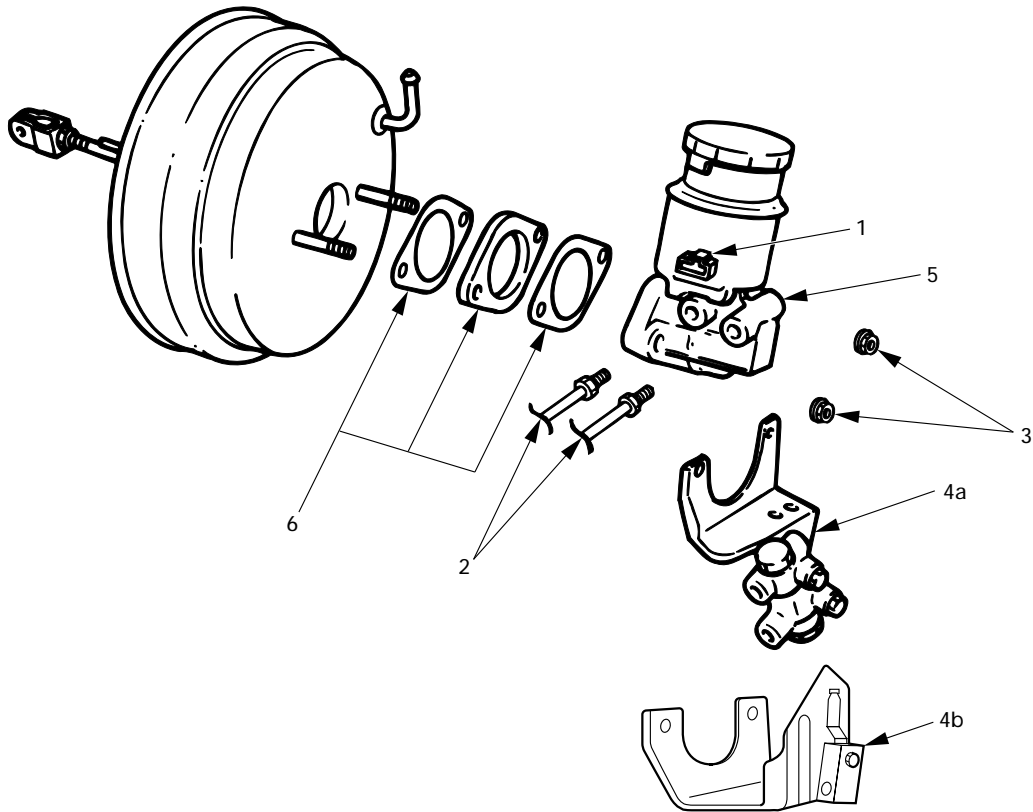


INSTALLATION

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

4. O-ring
 - O-ring must be set onto the fluid reservoir, before installing fluid reservoir.

MASATER CYLINDER ASSEMBLY



This illustration is based on the LHD model.

330RW015

Removal Steps

1. Electrical connector
2. Brake pipes
3. 2 attaching nuts
- 4a. P&B valve and bracket
- 4b. 3-way connector and bracket (Vehicle with LSPV only)
5. Master cylinder
6. Spacer and 2 gaskets

Installation Steps

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



REMOVAL

CAUTION:

When removing master cylinder from vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

1. Electrical Connector
2. Brake Pipes
 - After disconnecting the brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
3. 2 Attaching Nuts
- 4a. P & B Valve and Bracket
- 4b. 3-way Connector and Bracket (Vehicle with LSPV Only)
5. Master Cylinder
6. Spacer and 2 Gaskets



INSTALLATION

6. Spacer and 2 Gaskets
5. Master Cylinder
 - When replacing the master cylinder or vacuum booster or both, always measure the vacuum booster push rod protrusion and adjust it as necessary. (Refer to Vacuum Booster Assembly in this section.)
- 4a. P & B Valve and Bracket
- 4b. 3-way Connector and Bracket (Vehicle with LSPV Only)
3. 2 Attaching Nuts



- Tighten the attaching nuts to the specified torque.

Attaching Nut Torque	N·m (kg·cm / lb·in)
	13 (130 / 113)

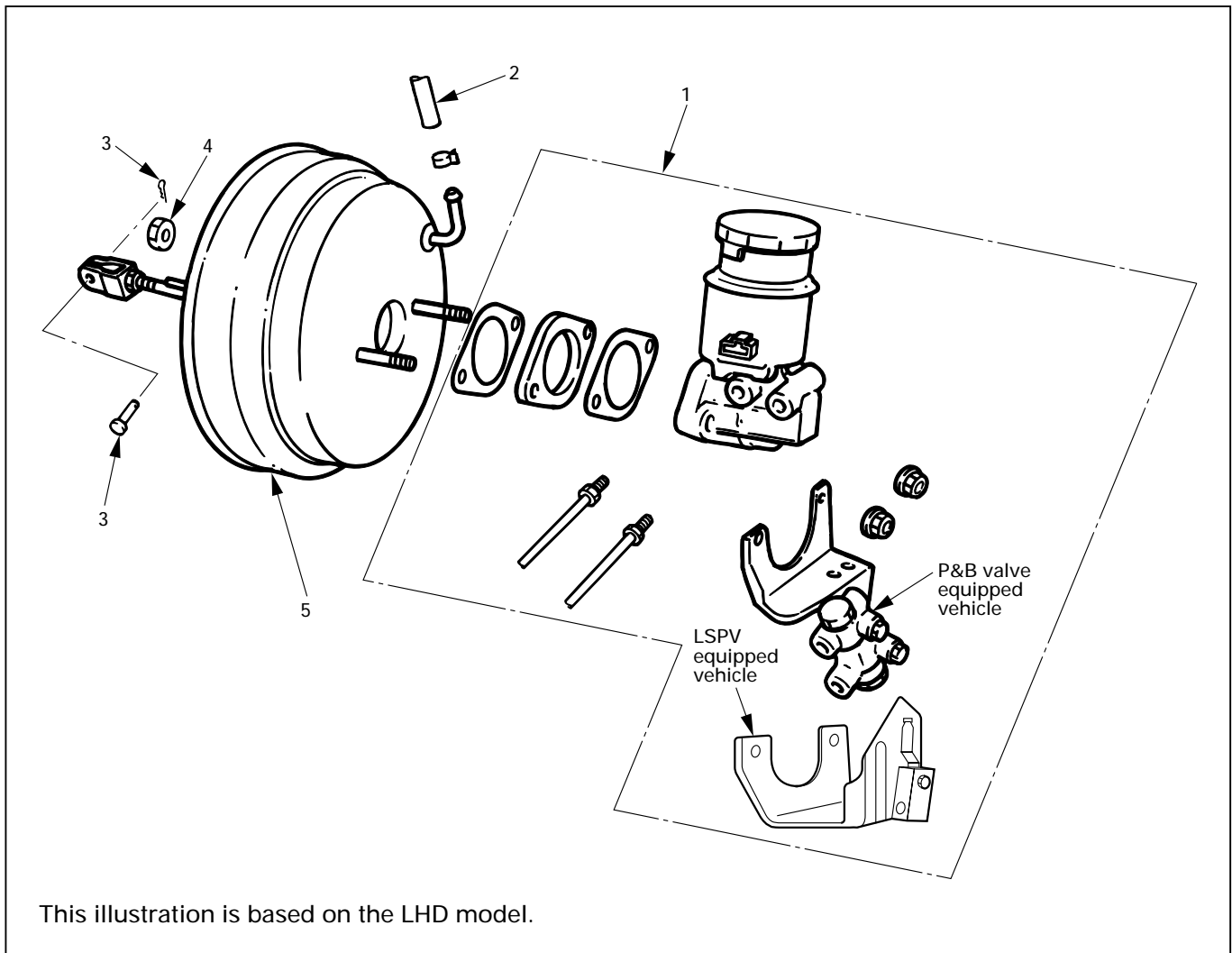


2. Brake Pipes
 - Tighten the brake pipe to the specified torque.

Brake Pipe Torque	N·m (kg·m / lb·ft)	
	Master Cylinder Side	Others
	12 (1.2 / 9)	16 (1.6 / 12)

1. Electrical Connector

VACUUM BOOSTER ASSEMBLY



331RW010

Removal Steps

1. Master cylinder
2. Vacuum hose
3. Yoke clevis
4. Vacuum booster fixing nut
5. Vacuum booster

Installation Steps

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

REMOVAL

- Before removing the vacuum booster assembly, disconnect and remove brake pipes.

1. Master Cylinder

- Refer to Master Cylinder Assembly in this Section.

CAUTION:

When removing master cylinder from vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

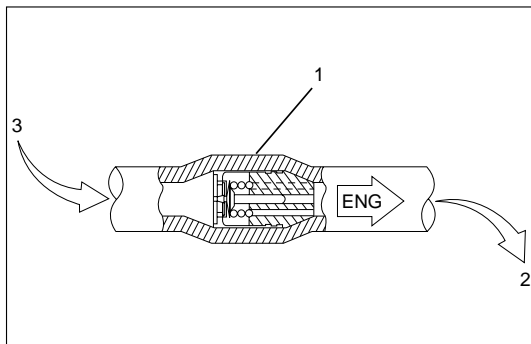
2. Vacuum Hose

3. Yoke Clevis

- Disconnect the yoke clevis from the brake pedal.

4. Vacuum Booster Fixing Nut

5. Vacuum Booster



360RX001



INSPECTION AND REPAIR

Vacuum Hose

Inspect the check valve (1), which is installed inside the vacuum hose.

- 1) Air should pass freely from the vacuum booster side (3) to the engine side (2).
- 2) Air should not pass from the engine side (2) to the vacuum booster side (3). If it does, the check valve is inoperative and vacuum hose must be replaced.



INSTALLATION

5. Vacuum Booster

Vacuum booster push rod adjustment.



NOTE:

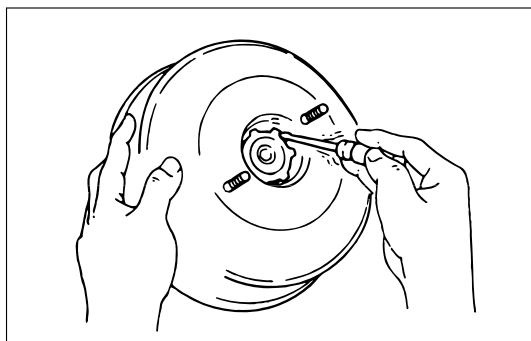
When replacing either master cylinder or vacuum booster, be sure to measure push rod, and adjust required.

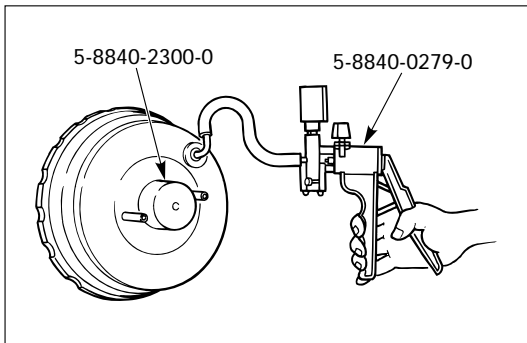
Push rod gauge: 5-8840-2300-0 (J-39216)

Vacuum pump: 5-8840-0279-0 (J-23738-A)

Push rod support: 5-8840-2305-0 (J-39241)

- 1) Remove retainer from vacuum booster front shell using a small screwdriver. Then gently draw plate and seal assembly out of the shell inside.

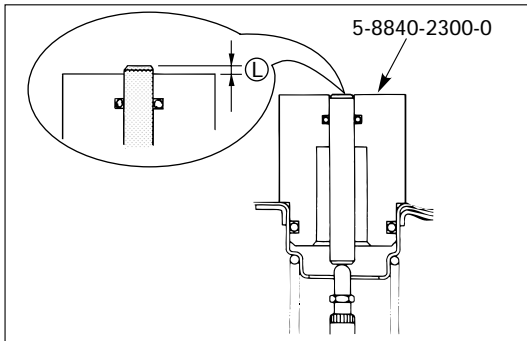




- 2) Set push rod gauge on vacuum booster, and apply negative pressure by means of vacuum pump so that the pressure in the vacuum booster becomes 500 mm Hg.

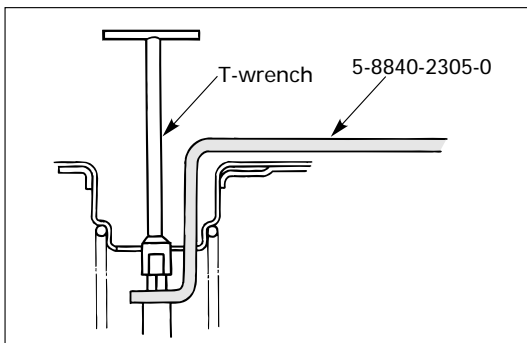
NOTE:

Be sure to apply **NEGATIVE** pressure after installing a push rod gauge on vacuum booster.



- 3) Measure dimension \textcircled{L}

Dimension \textcircled{L} (Standard)	mm
	0 ± 0.1



- 4) If dimension \textcircled{L} is out of the standard range, adjust push rod using the special tool.
- 5) Mount plate and seal assembly in vacuum booster front shell. Then install retainer.

4. Vacuum Booster Fixing Nut



Vacuum Booster Fixing Nut Torque	N-m (kg-m / lb-ft)
	21 (2.1 / 16)

3. Yoke Clevis

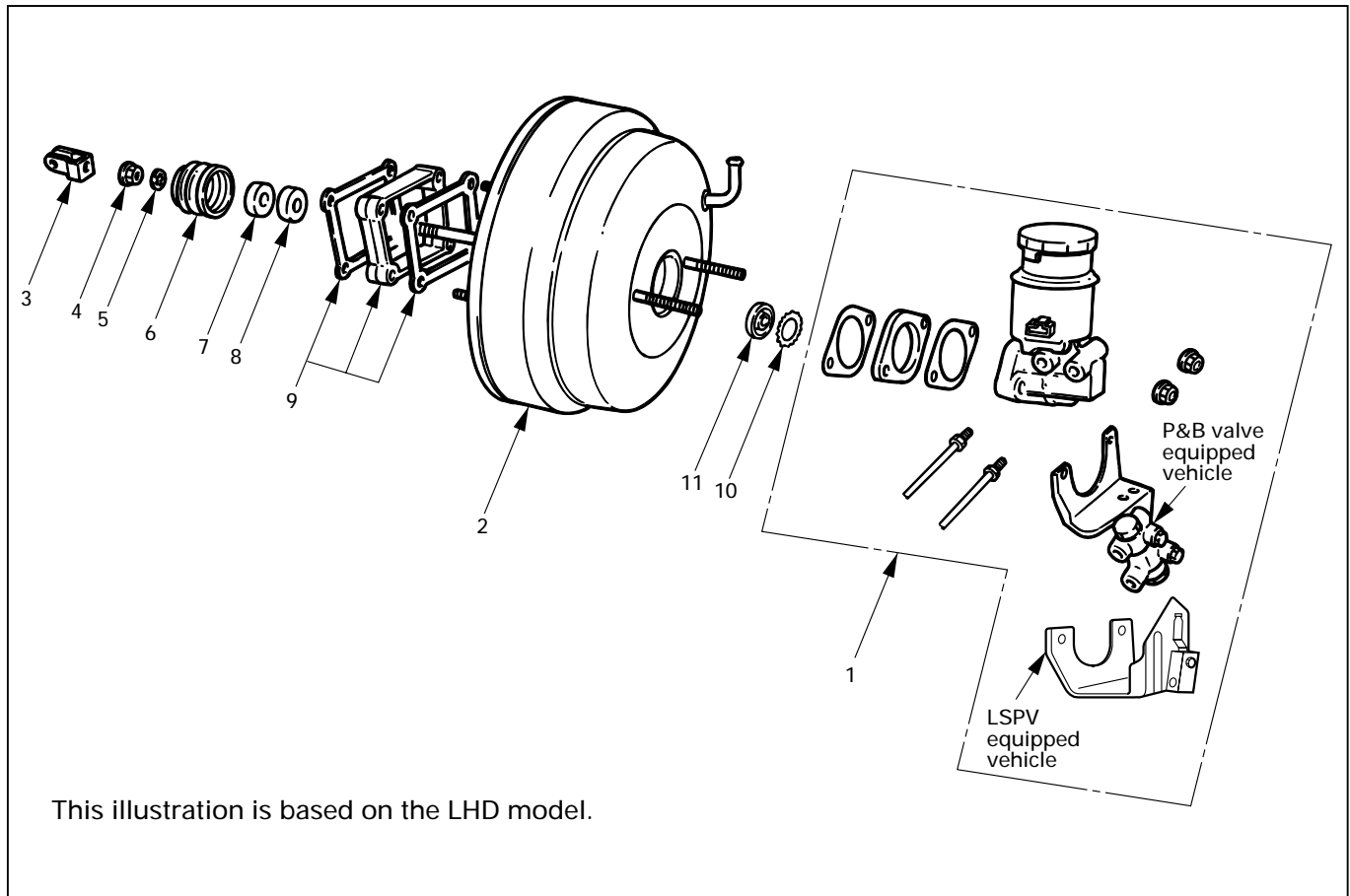
2. Vacuum Hose

- In case of the gasoline engine model, make sure that the arrow on the hose points in the direction of the engine.

1. Master Cylinder

- Refer to Master Cylinder Assembly in this Section.

EXTERIOR COMPONENTS



331RW011

Removal Steps

1. Master cylinder
2. Vacuum booster
3. Yoke clevis
4. Lock nut
5. Retaining clip
6. Valve body guard
7. Silencer
8. Filter
9. 2 gaskets and spacer
10. Retainer
11. Plate and seal assembly

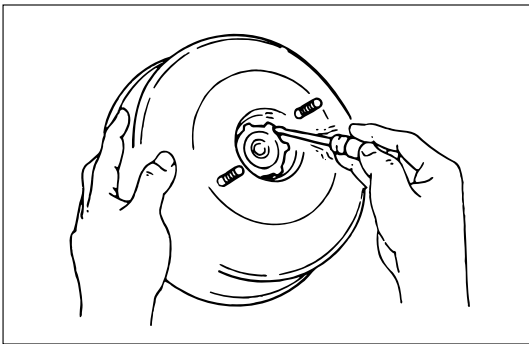
Installation Steps

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



REMOVAL

1. **Master Cylinder**
 - Refer to Master Cylinder Assembly in this Section.
2. **Vacuum Booster**
 - Refer to Vacuum Booster Assembly in this section.
3. **Yoke Clevis**
4. **Lock Nut**
5. **Retaining Clip**
6. **Valve Body Guard**
7. **Silencer**
8. **Filter**
9. **2 gaskets and Spacer**
10. **Retainer**
 - Use a small screwdriver to pry out the retainer. Gently pull out the plate and seal assembly from the shell.



11. **Plate and Seal Assembly**



INSPECTION AND REPAIR

Visual Check:

Make necessary parts replacement if cuts, nicks, excessive wear, or other abnormal conditions are found through inspection. Check the following parts.

- 1) Yoke clevis
- 2) Valve body guard
- 3) Silencer
- 4) Filter
- 5) Plate and seal assembly



INSTALLATION

11. **Plate and Seal Assembly**
10. **Retainer**
9. **2 gaskets and Spacer**
8. **Filter**
7. **Silencer**
6. **Valve Body Guard**
5. **Retaining Clip**
4. **Lock Nut**



Lock Nut Torque N·m (kg·m / lb·ft)

20 (2.0 / 15)

3. Yoke Clevis

2. Vacuum Booster

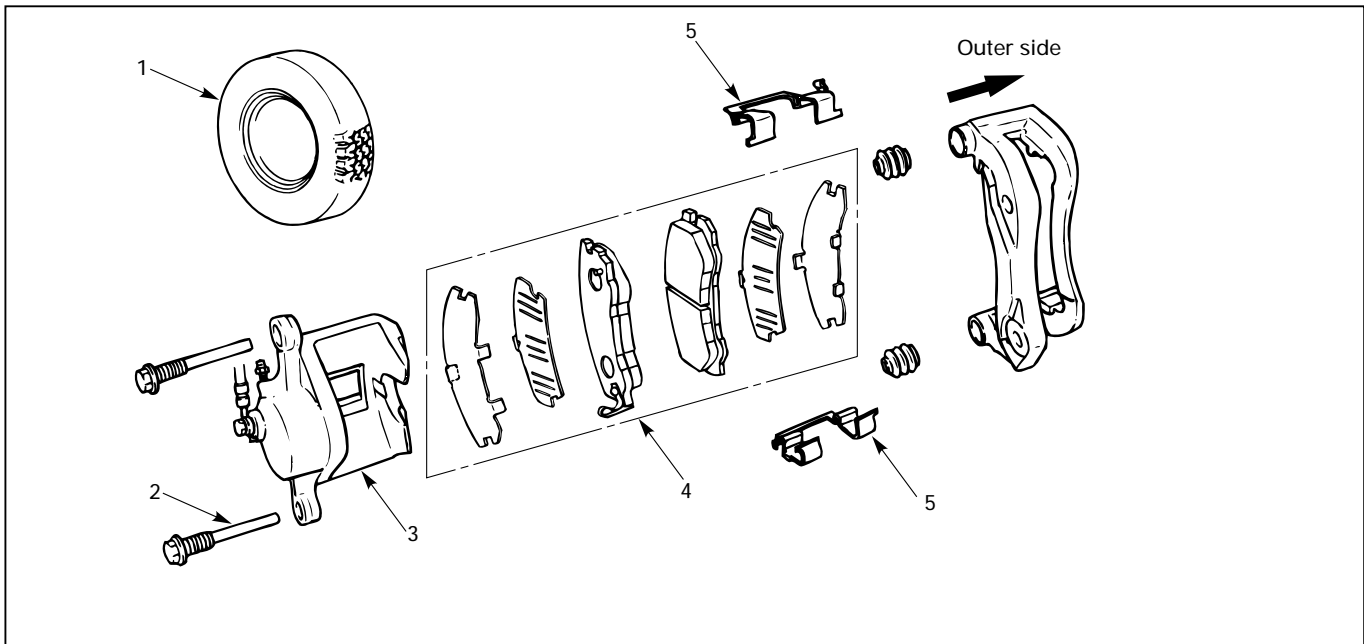
- Refer to Vacuum Booster Assembly in this section.

1. Master Cylinder

- 1) Refer to Master Cylinder Assembly in this Section.
- 2) After installation, perform brake pedal check and adjustment. Refer to Checking Brake Pedal Height / Travel in this section.

FRONT DISC BRAKE

BRAKE PADS REPLACEMENT



Removal Steps

1. Wheel and tire assembly
2. Lock bolt
3. Caliper assembly
4. Pad assembly with shim
5. Clip

Installation Steps

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



REMOVAL

NOTE:

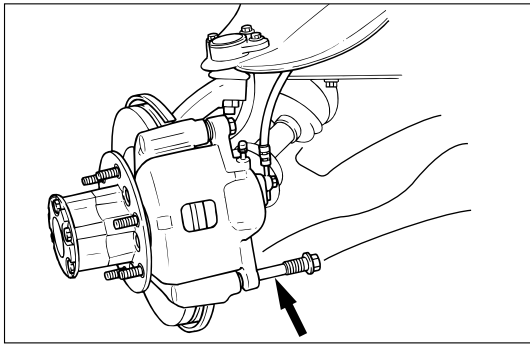
If a squealing noise occurs from the front brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

Preparation:

- 1) Draw out two-thirds of the brake fluid from the reservoir.
- 2) Raise the vehicle and support it with suitable safety stands.

1. Wheel and Tire Assembly

- Refer to Wheels and Tires in Suspension section.



2. Lock Bolt

3. Caliper Assembly

- Support the caliper assembly so that the brake hose is not stretched or damaged.

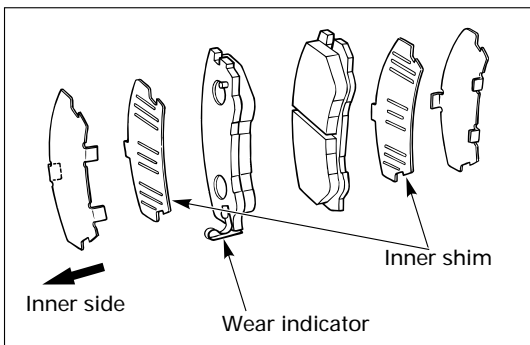
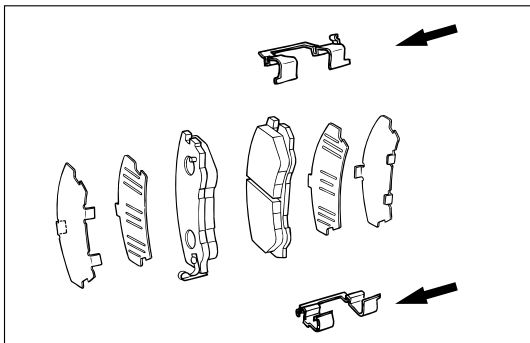
4. Pad Assembly with Shim

5. Clip



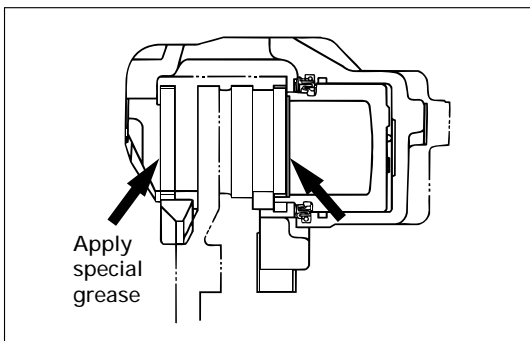
INSTALLATION

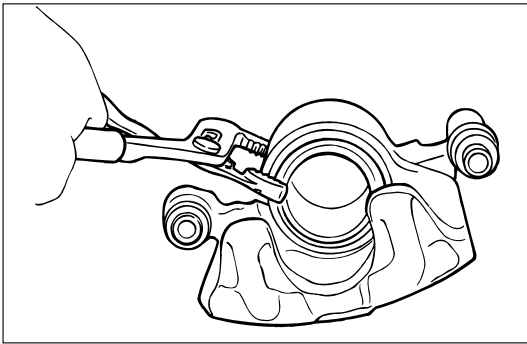
5. Clip



4. Pad Assembly with Shim

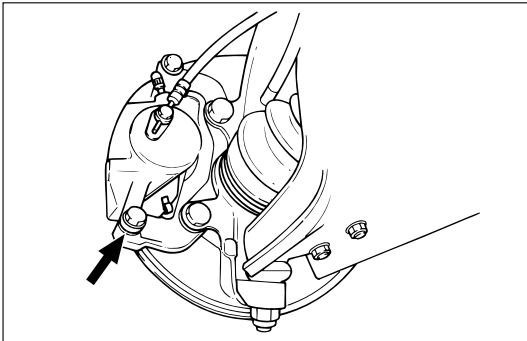
- Apply special grease (approx 0.2 g) to both contacting surfaces of inner shims. Wipe off extruded grease after installing.





3. Caliper Assembly

- 1) Use adjustable pliers to bottom the piston into the caliper bore. Be careful not to damage the piston dust boot.
- 2) Do not damage the flexible hose by twisting or pulling it.



2. Lock Bolt

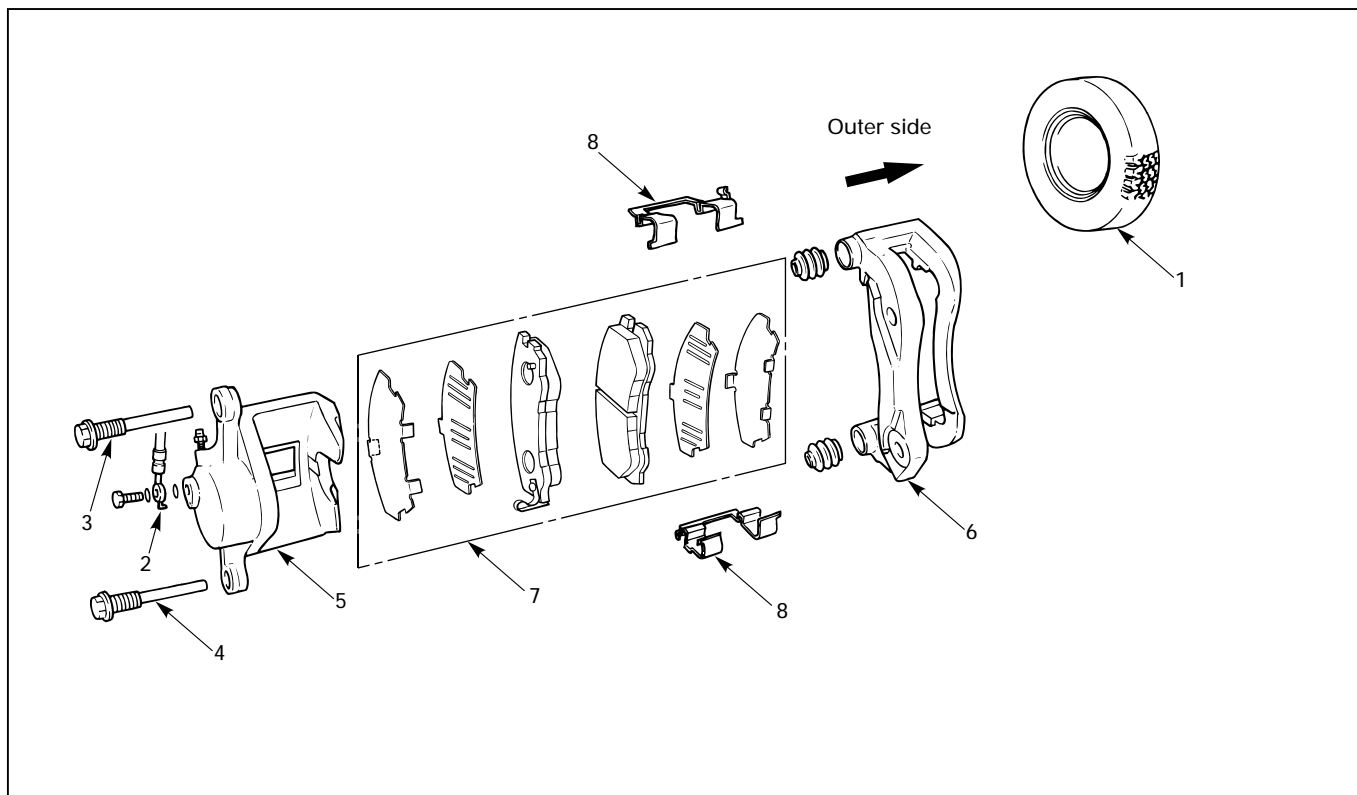


Lock Bolt Torque	N·m (kg·m / lb·ft)
	74 (7.5 / 54)

1. Wheel and Tire Assembly

- 1) Refer to Wheels and Tires in Suspension section.
- 2) Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

CALIPER REPLACEMENT



Removal Steps

1. Wheel and tire assembly
2. Brake flexible hose
3. Guide bolt
4. Lock bolt
5. Caliper assembly
6. Support bracket with pad assembly
7. Pad assembly with shim
8. Clip

Installation Steps

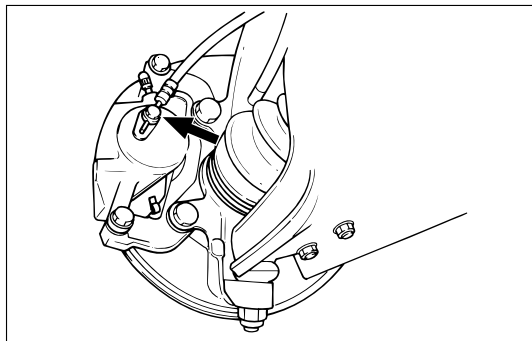
To install, follow the removal steps in the reverse order.

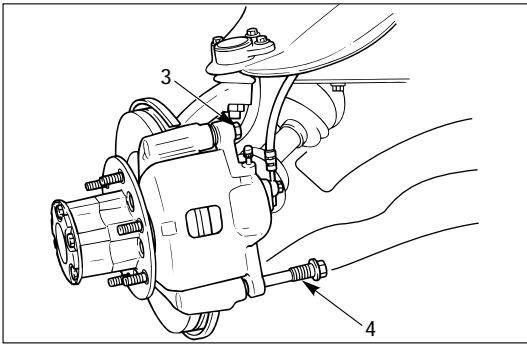


REMOVAL

Raise the vehicle and support with suitable safety stands

1. **Wheel and Tire Assembly**
 - Refer to Wheels and Tires in Suspension section.
2. **Brake Flexible Hose**
 - 1) Remove the bolt and gaskets, then disconnect the flexible hose from the caliper.
 - 2) After disconnecting the flexible hose, cap or tape the openings to prevent entry of foreign material.
 - 3) Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.





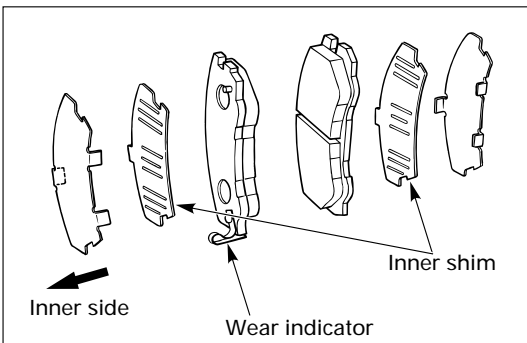
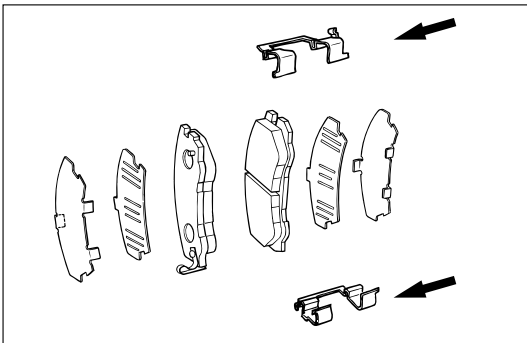
- 3. Guide Bolt
- 4. Lock Bolt

- 5. Caliper Assembly
- 6. Support Bracket with Pad Assembly
 - Take care not to damage the flexible brake hose when removing the support bracket.
- 7. Pad Assembly with Shim
 - Mark the lining locations if they are to be reinstalled.
- 8. Clip

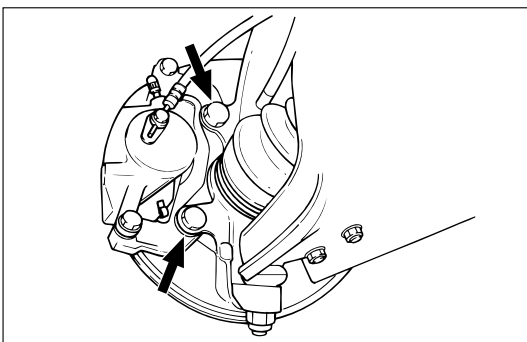


INSTALLATION

- 8. Clip

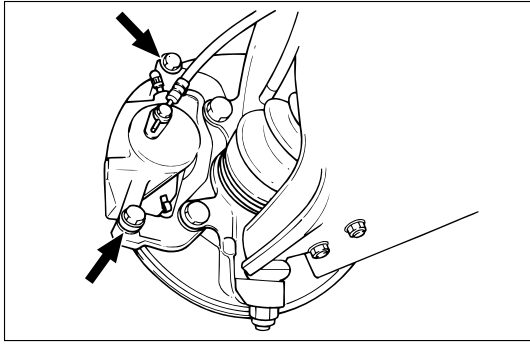


- 7. Pad Assembly with Shim
 - Apply special grease (approx 0.2 g) to the both contacting surfaces of inner shims. Wipe off extruded grease after installing.



- 6. Support Bracket

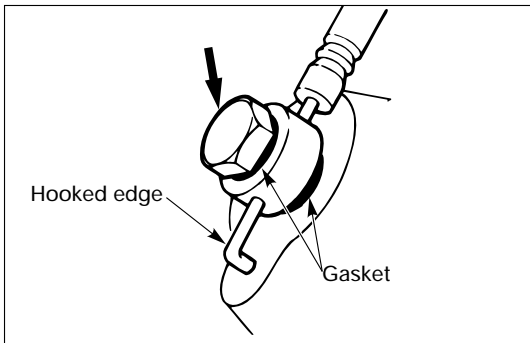
Support Bracket Torque	N·m (kg·m / lb·ft)
	155 (15.8 / 115)



5. Caliper Assembly

4, 3. Lock Bolt and Guide Bolt

Lock Bolt and Guide Bolt Torque	N·m (kg·m / lb·ft)
	74 (7.5 / 54)



2. Brake Flexible Hose

- 1) Always use new gaskets.
- 2) Be sure to put the hooked edge of the flexible hose end into the anti-rotation cavity.

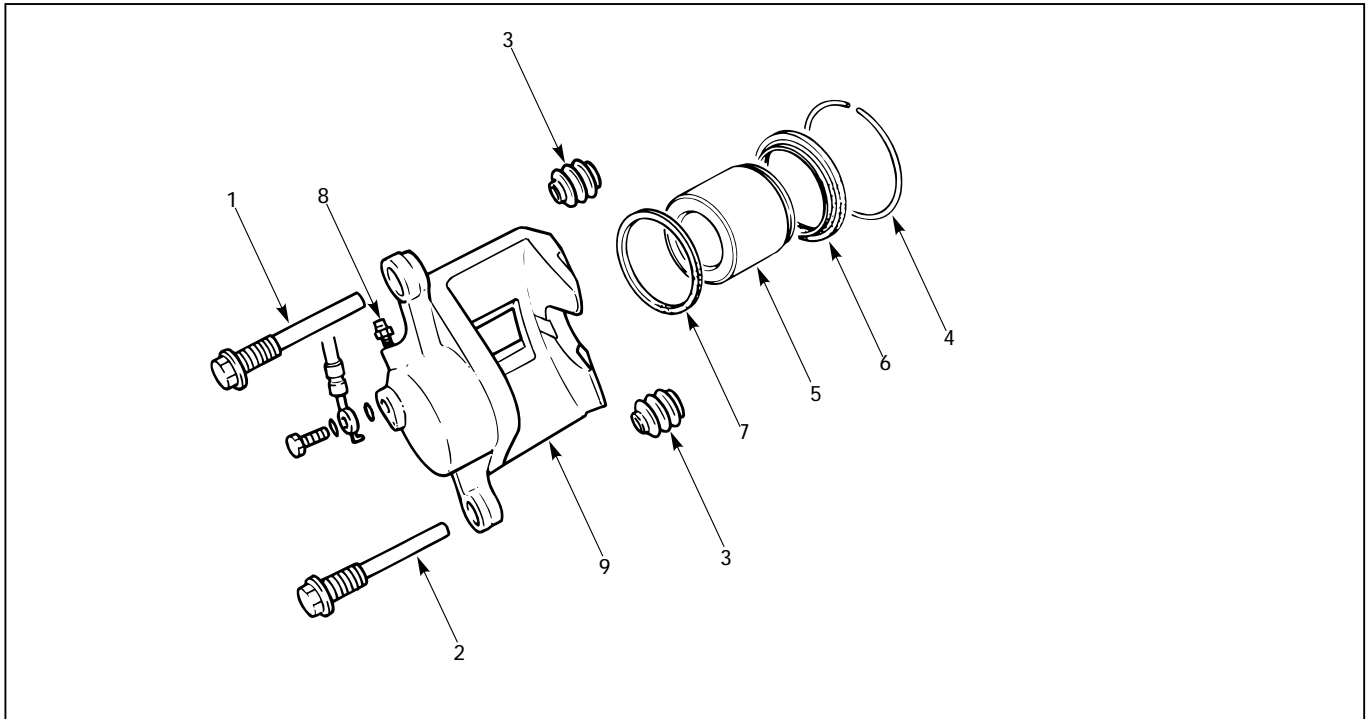


Brake Flexible Hose Torque	N·m (kg·m / lb·ft)
	35 (3.5 / 26)

1. Wheel and Tire Assembly

- 1) Refer to Wheels and Tires in Suspension section.
- 2) Bleed brakes. Refer to Bleeding Brake Hydraulic System in this section.

REBUILDING THE CALIPER



Disassembly Steps

1. Guide bolt
2. Lock bolt
3. Dust boot; guide bolt and lock bolt
4. Dust boot ring
5. Piston
6. Dust boot; piston
7. Piston seal
8. Bleeder with cap
9. Caliper body

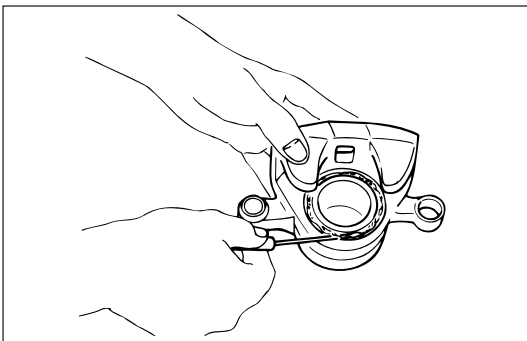
Reassembly Steps

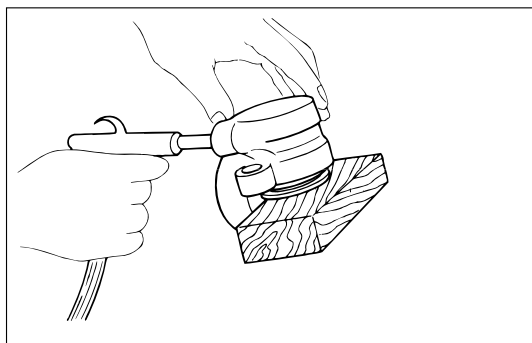
9. Caliper body
8. Bleeder with cap
7. Piston seal
5. Piston
6. Dust boot; piston
4. Dust boot ring
3. Dust boot; guide bolt and lock bolt
2. Lock bolt
1. Guide bolt



DISASSEMBLY

1. Guide Bolt
2. Lock Bolt
3. Dust Boot; Guide Bolt and Lock Bolt
4. Dust Boot Ring
 - Using a small screwdriver, remove the dust boot ring.





5. Piston

- Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of dust boot.



WARNING:

DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.



CAUTION:

Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.

6. Dust Boot; Piston

7. Piston Seal

8. Bleeder with Cap

9. Caliper Body



INSPECTION AND REPAIR

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts;

- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Guide bolt, Lock bolt
- Support bracket

NOTE:

The piston seal, boot ring and dust boot are to be replaced each time the caliper is overhauled.

Discard these used rubber parts and replace with new ones.



REASSEMBLY

9. Caliper Body

8. Bleeder with Cap

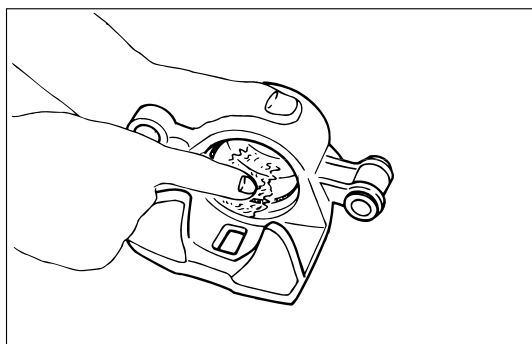


Bleeder Torque	N·m (kg·cm / lb·in)
	8 (80 / 69)

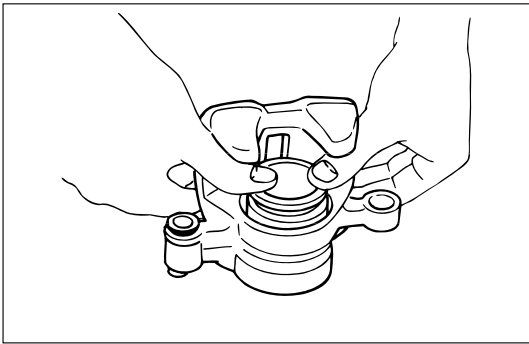
7. Piston Seal



- Apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.

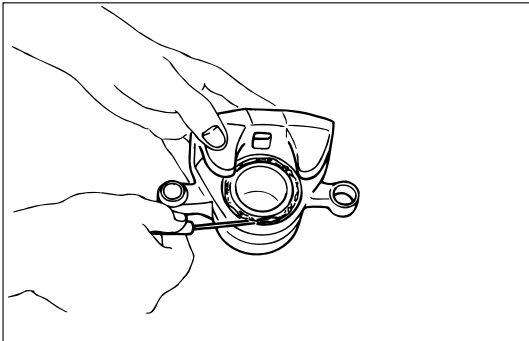


5. Piston



6. Dust Boot; Piston

- When inserting the piston into the cylinder, use finger pressure only. Do not use a mallet or other impact tools, since damage to the cylinder wall or piston seal can result.



4. Dust Boot Ring

- Apply special grease (Approx. 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.

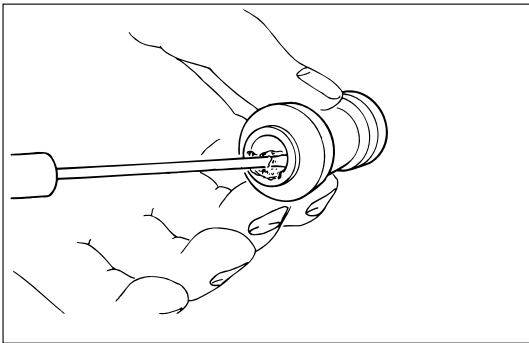


3. Dust Boot; Guide Bolt and Lock Bolt



2, 1. Lock Bolt and Guide Bolt

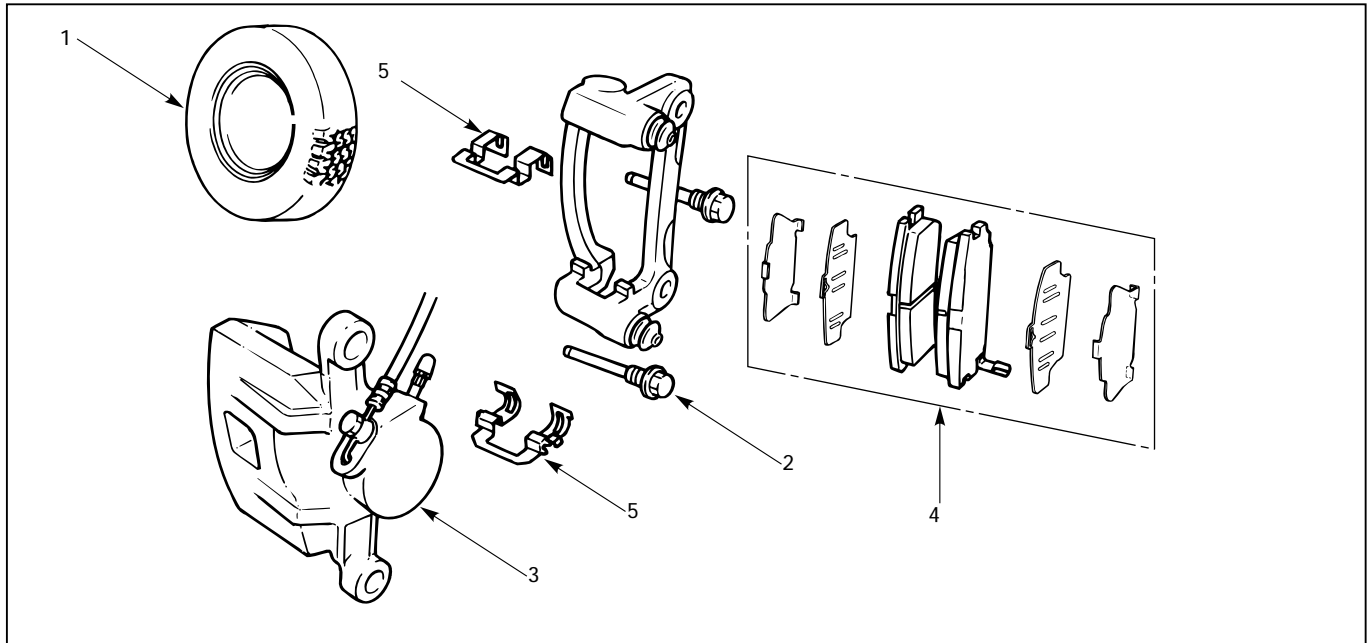
Lock and Guide Bolt Torque	N-m (kg-m / lb-ft)
74 (7.5 / 54)	



- Install the dust boot on the support bracket after applying special grease (Approx. 1 g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.

REAR DISC BRAKE

BRAKE PADS REPLACEMENT



Removal Steps

1. Wheel and tire assembly
2. Lock bolt
3. Caliper assembly
4. Pad assembly with shim
5. Clip

Installation Steps

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

REMOVAL

NOTE:

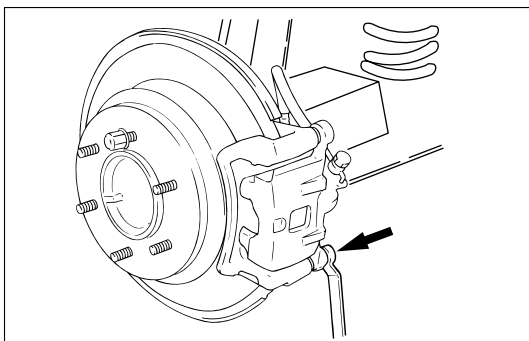
If a squealing noise occurs from the rear brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

- 1) Draw out two-thirds of the brake fluid from the reservoir.
- 2) Raise the vehicle and support it with suitable safety stands.

1. Wheel and Tire Assembly

- Refer to Wheels and Tires in Suspension section.

2. Lock Bolt



3. Caliper Assembly

- Support the caliper assembly so that the brake hose is not stretched or damaged.

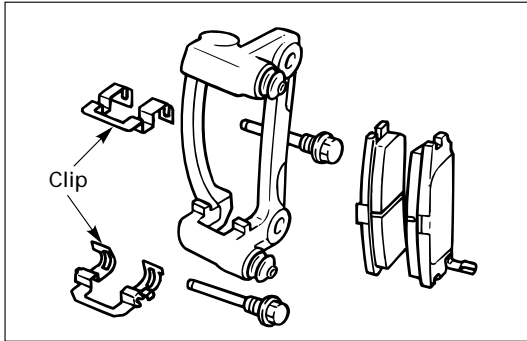
4. Pad Assembly with Shim

5. Clip



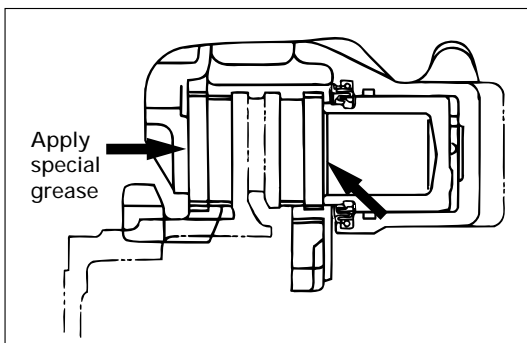
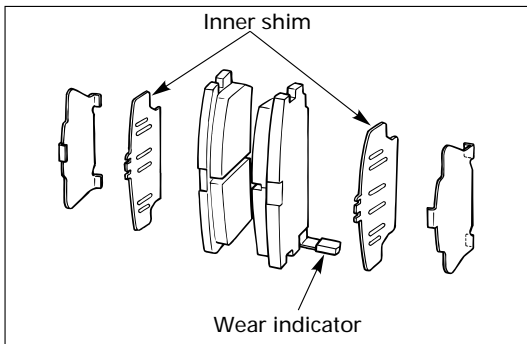
INSTALLATION

5. Clip



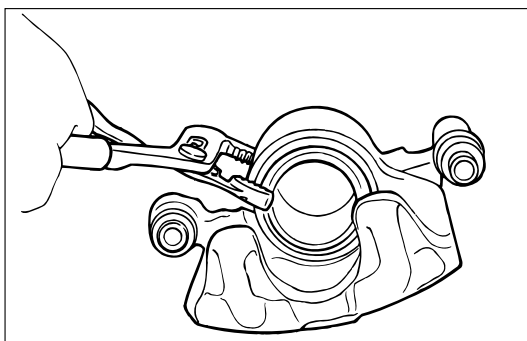
4. Pad Assembly with Shim

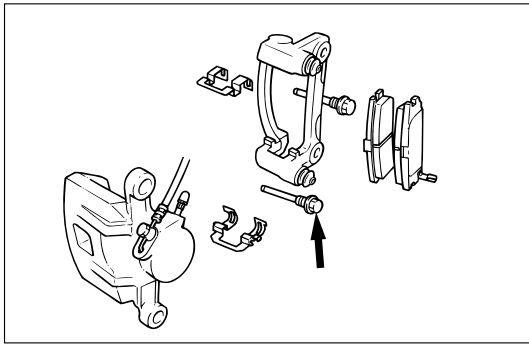
- Apply special grease (approx. 0.2 g) to both contacting surfaces of inner shims. Wipe off extruded grease after installing.



3. Caliper Assembly

- 1) Use adjustable pliers to bottom the piston into the caliper bore. Be careful not to damage the piston dust boot.
- 2) Do not damage the flexible hose by twisting or pulling it.





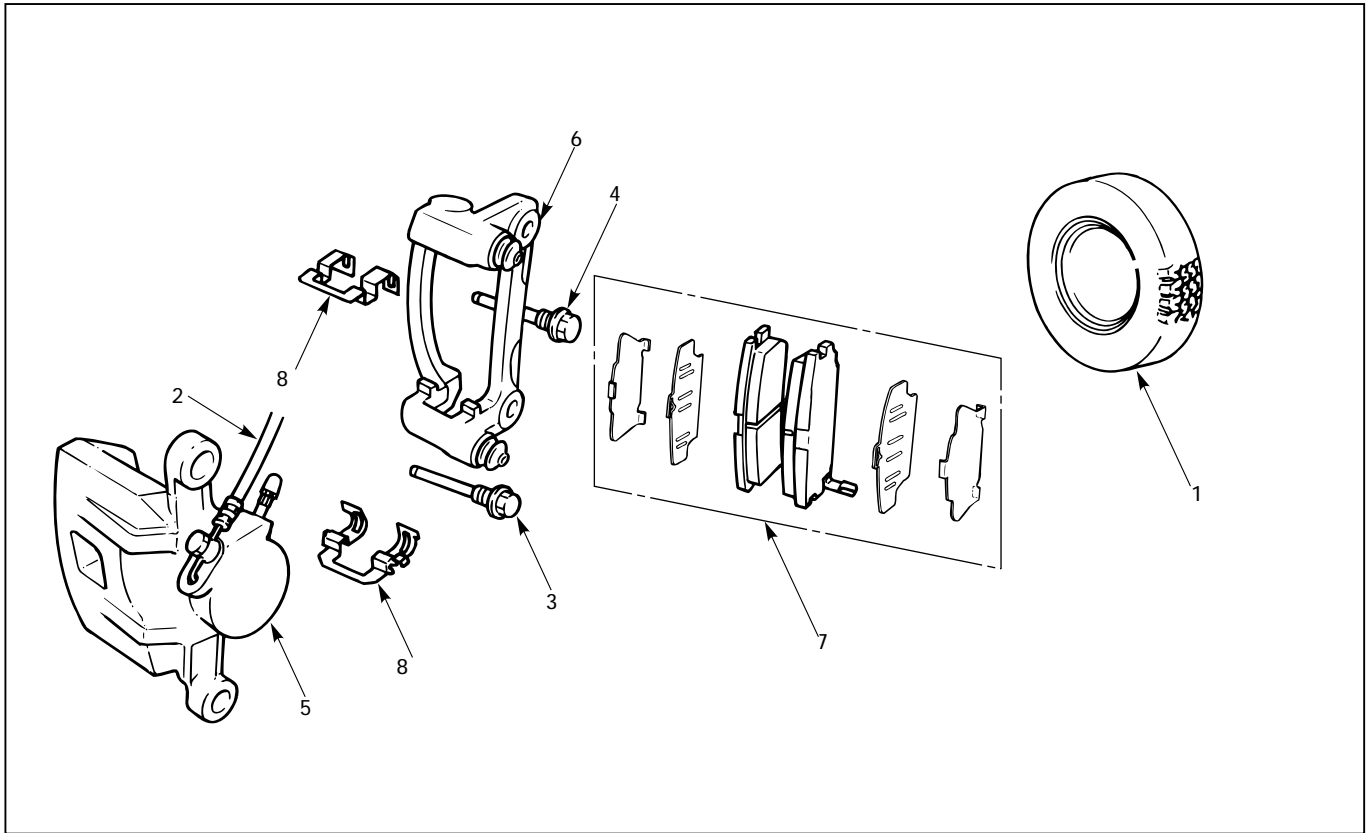
2. Lock Bolt

Lock Bolt Torque	N·m (kg·m / lb·ft)
	44 (4.5 / 32)

1. Wheel and Tire Assembly

- 1) Refer to Wheels and Tires in Suspension section.
- 2) Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

CALIPER REPLACEMENT



Removal Steps

1. Wheel and tire assembly
2. Brake flexible hose
3. Lock bolt
4. Guide bolt
5. Caliper assembly
6. Support bracket
7. Pad assembly with shim
8. Clip

Installation Steps

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



REMOVAL

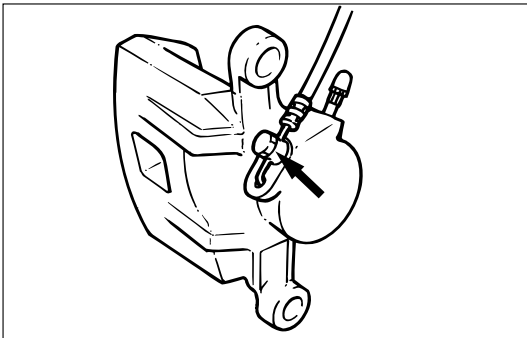
- Raise the vehicle and support with suitable safety stands.

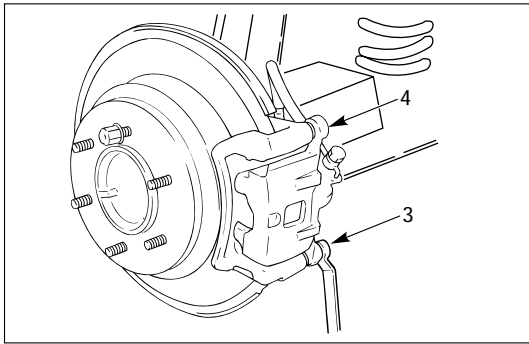
1. Wheel and Tire Assembly

- Refer to Wheels and Tires in Suspension section.

2. Brake Flexible Hose

- 1) Remove the bolt and gaskets, then disconnect the flexible hose from the caliper.
- 2) After disconnecting the flexible hose, cap or tape the openings to prevent entry of foreign material.
- 3) Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.





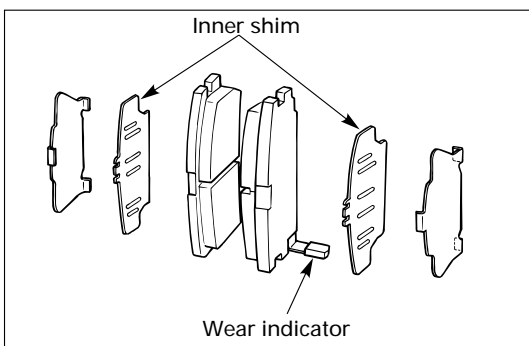
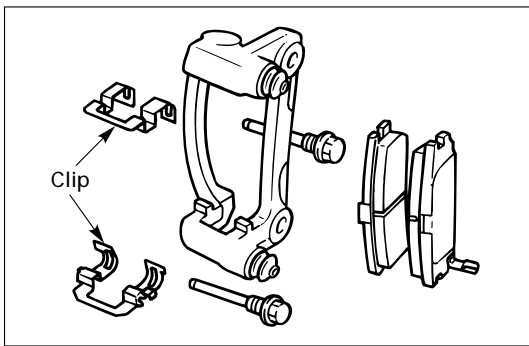
- 3. Lock Bolt
- 4. Guide Bolt

- 5. Caliper Assembly
- 6. Support Bracket
 - Take care not to damage the flexible brake hose when removing the support bracket.
- 7. Pad Assembly with Shim
 - Mark the lining locations if they are to be reinstalled.
- 8. Clip

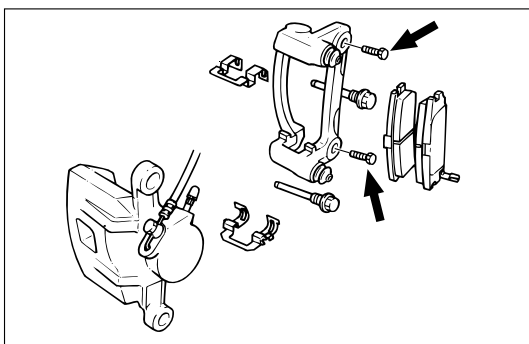


INSTALLATION

- 8. Clip



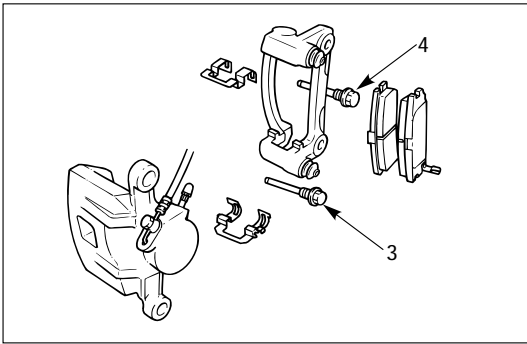
- 7. Pad Assembly with Shim
 - Apply special grease (approx. 0.2 g) to both contacting surfaces of inner shims. Wipe off extruded grease after installing.



- 6. Support Bracket

Support Bracket Torque	N·m (kg·m / lb·ft)
	104 (10.6 / 77)

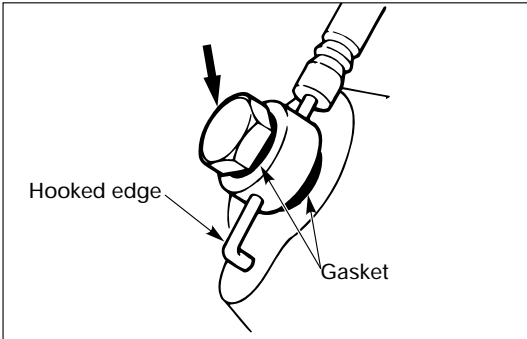
- 5. Caliper Assembly



4. Guide Bolt

3. Lock Bolt

Lock Bolt Torque	N·m (kg·m / lb·ft)
	44 (4.5 / 32)



2. Brake Flexible Hose

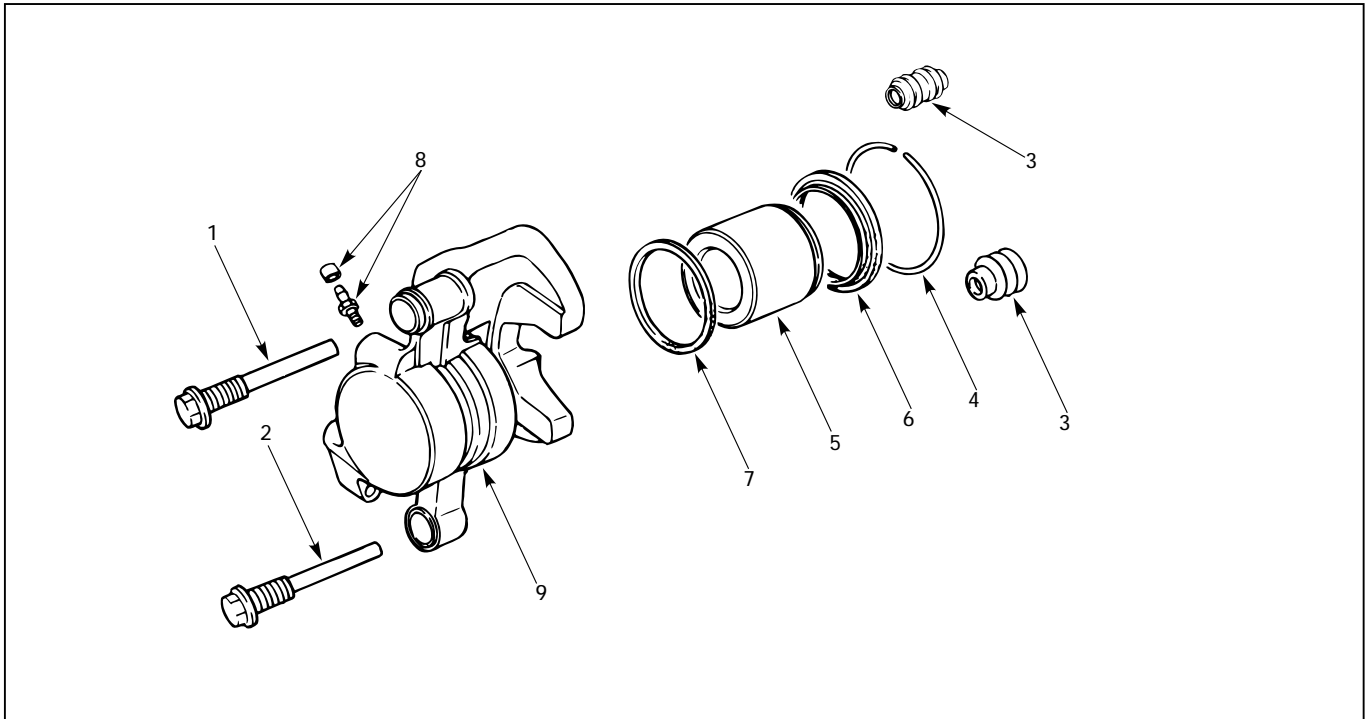
- 1) Always use new gaskets.
- 2) Be sure to put the hooked edge of the flexible hose end into the anti-rotation cavity.

Brake Flexible Hose Torque	N·m (kg·m / lb·ft)
	35 (3.5 / 26)

1. Wheel and Tire Assembly

- 1) Refer to Wheels and Tires in Suspension section.
- 2) Bleed brakes.

REBUILDING THE CALIPER



Disassembly Steps

1. Guide bolt
2. Lock bolt
3. Dust boot
4. Dust boot ring
5. Piston
6. Dust boot; piston
7. Piston seal
8. Bleeder with cap
9. Caliper body

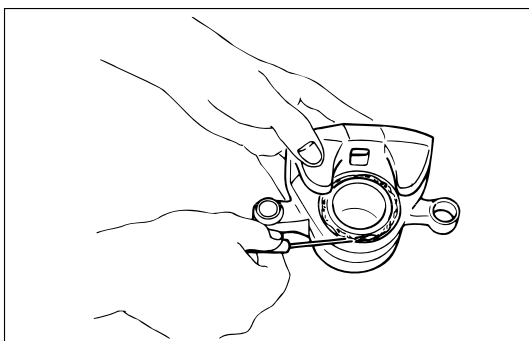
Reassembly Steps

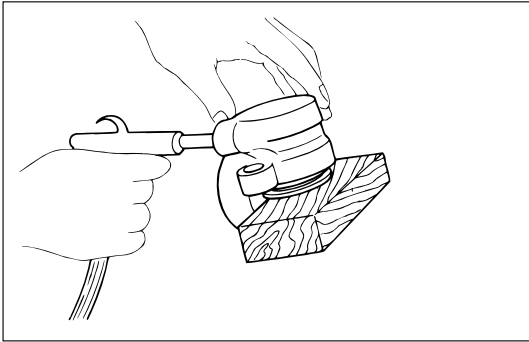
9. Caliper body
8. Bleeder with cap
7. Piston seal
5. Piston
6. Dust boot; piston
4. Dust boot ring
3. Dust boot
2. Lock bolt
1. Guide bolt



DISASSEMBLY

1. Guide Bolt
2. Lock Bolt
3. Dust Boot
4. Dust Boot Ring
 - Using a small screwdriver, remove the dust boot ring.





5. Piston

- Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of dust boot.



WARNING:

DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.



CAUTION:

Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.

6. Dust Boot; Piston

7. Piston Seal

8. Bleeder with Cap

9. Caliper Body



INSPECTION AND REPAIR

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.

Check the following parts;

- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Slide pin
- Support bracket

NOTE:

The piston dust seal and dust boot are to be replaced each time the caliper is overhauled.

Discard these used rubber parts and replace with new ones.



REASSEMBLY

9. Caliper Body

8. Bleeder with Cap



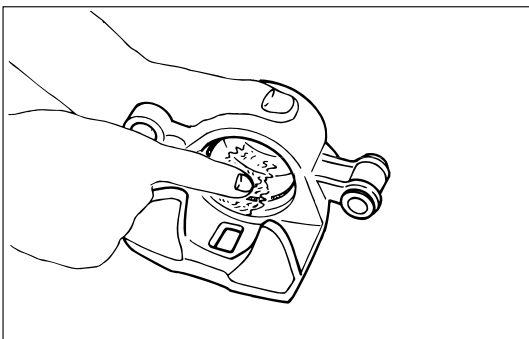
Bleeder Torque	N·m (kg·cm / lb·in)
	8 (80 / 69)

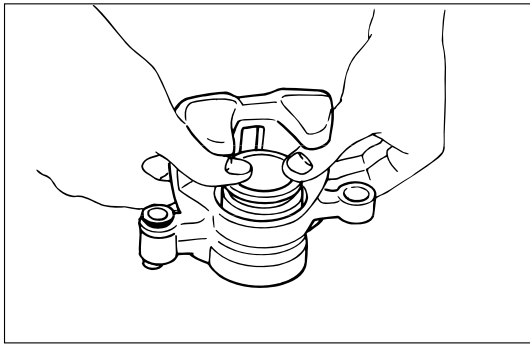
7. Piston Seal

- Apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



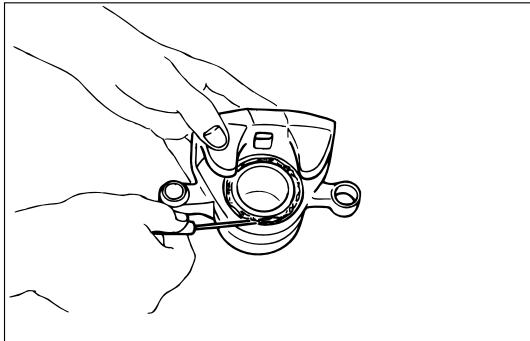
5. Piston





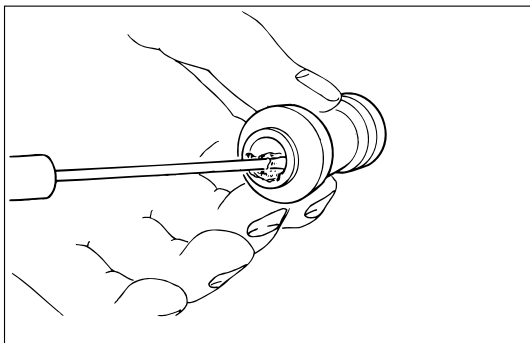
6. Dust Boot; Piston

- When inserting the piston into the cylinder, use finger pressure only. Do not use a mallet or other impact tools, since damage to the cylinder wall or piston seal can result.



4. Dust Boot Ring

- Apply special grease (Approx. 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.



3. Dust Boot

- Install the dust boot on the support bracket after applying special grease (Approx 1 g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.

2. Lock Bolt

1. Guide Bolt



Guide Bolt Torque	N·m (kg·m / lb·ft)
	44 (4.5 / 32)

UNIT REPAIR

MASTER CYLINDER

The master cylinder is not repairable and must be replaced as complete assembly if found defective.

INSPECTION

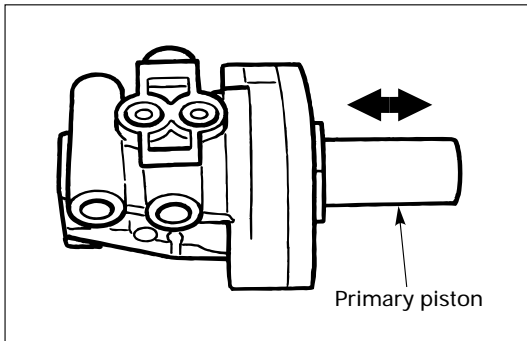
Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check.



Visual check

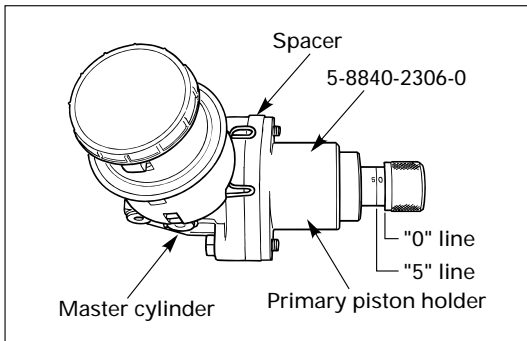
Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection;

- Master cylinder body
- Fluid reservoir
- O-ring



FUNCTIONAL INSPECTION OF MASTER CYLINDER PISTON

Push the primary piston with your fingers to check that it travels smoothly. If the motion is questionable, replace the master cylinder as a complete assembly.



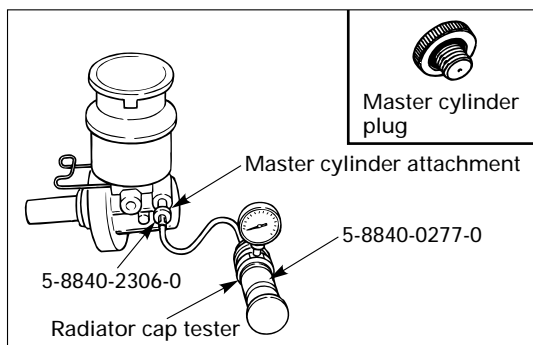
FUNCTIONAL INSPECTION OF MASTER CYLINDER

Inspect the master cylinder for function as follows. If any abnormal function is found, replace with a new one.



Primary piston holder: 5-8840-2306-0 (J-39242) (including master cylinder attachment and master cylinder plug)

- Install the primary piston holder onto the master cylinder with the spacer (2 bolts) with its adjusting bolt screwed in up to the "0" line.



Radiator cap tester: 5-8840-0277-0 (J-24460-01)

- Connect master cylinder attachment with the end of radiator cap tester, and apply air pressure with the cap tester. Make sure there is no rise in pressure and that with the adjusting bolt further screwed in 5 mm (align the adjusting bolt to the "5" line). There should be a pressure increase of 49 kpa (0.5 kg/cm²/7.1 psi) or more.



NOTE:

When checking the front (or primary) side, be sure to mount master cylinder plug in the rear (or secondary) port.

	"0" line	"5" line
Apply air pressure to the front and rear ports	No pressure rise.	Pressure increase of 49 kpa (0.5 kg/cm ² /7.1 psi) more
Remarks	Check port into the atmospheric pressure chamber	Checks air tightness of the pressure chamber



NOTE:

- 1) Do not use an air compressor, as the air from compressor is mixed with compressor oil.
- 2) When installing the master cylinder onto the vacuum booster, always adjust vacuum booster push rod. (Refer to Vacuum Booster Assembly in this section.)
- 3) After the master cylinder is installed onto the vehicle, check for leakage, pedal travel and pedal free play.

VACUUM BOOSTER

- The vacuum booster cannot be disassembled for repair. Replace a defective vacuum booster with a new one.

SECTION 5D

PARKING BRAKES

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Main Data and Specifications	5D- 2
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Fixing Torque.....	5D- 5
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Parking Brake Lever Replacement	5D- 7
Parking Brake Cable	5D- 9

SERVICE PRECAUTION

WARNING:

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

CAUTION:

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

MAIN DATA AND SPECIFICATIONS

<p>REAR PARKING BRAKE</p> <p>Type</p> <p>Lining Dimensions cm² (in²)</p> <p>Adjusting Method</p> <p>Rear Drum (in Disc)</p> <p>Inside Diameter mm (in)</p> <p>Parking Brake Lever Stroke</p>	<p>Duo-servo</p> <p>121.2 (18.79)</p> <p>Manual Adjusting</p> <p>210 (8.27)</p> <p>6 to 7 notches</p> <p>When pulled with a force of 30 kg (66 lb)</p>
---	---

SERVICE STANDARD

<p>REAR PARKING BRAKE</p> <p>Rear Drum (in Disc) Minimum Wear</p> <p>Inside Diameter mm (in)</p> <p>Parking Brake Lining Thickness</p> <p>Minimum Limit mm (in)</p> <p>Parking Brake Lever Stroke</p>	 <p>211.4 (8.32)</p> <p>1.0 (0.039)</p> <p>6 to 7 notches</p> <p>When pulled with a force of 30 kg (66 lb)</p>
--	--

SERVICING

REAR DRUM (IN DISC) INSIDE DIAMETER CHECK

Check the rear drum inside diameter by measuring at more than two portions as shown in the figure.

If the inside diameter is greater than the limit, replace the rear rotor.



Rear Drum Inside Diameter		mm (in)
Standard	Limit	
210.0 (8.27)	211.4 (8.32)	

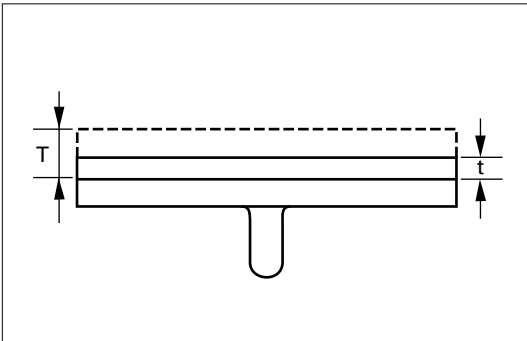
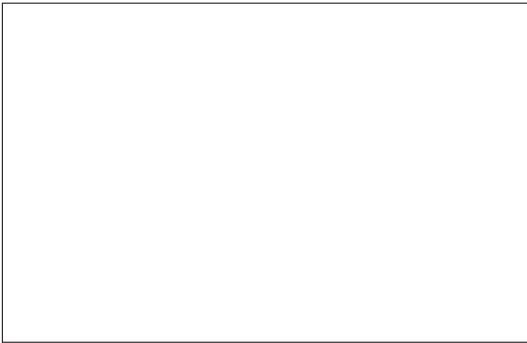
PARKING BRAKE LINING INSPECTION

Check the shoe assemblies for wear by removing the brake drum rotor.

Replace the shoe assemblies, if the lining thickness is less than 1.0 mm (0.039 in).



Minimum Limit	mm (in)
1.0 (0.039)	



PARKING BRAKE ADJUSTMENT

1. Adjustment of Parking Brake Assembly

- Prior to lever stroke adjustment, adjust the rear brake shoe/rotor (drum) gap. Perform this procedure by loosening the adjust nut of the equalizer.
 - a) Remove the adjusting hole plug (rubber) and turn the shoe adjusting screw downward with a small screwdriver so that shoes will expand until they get into close touch with the rotor. (Turn down the adjusting screw notch by notch until the rotor does not turn.)
 - b) Turn the adjusting screw in the opposite direction (upward) until the rotor can be turned lightly. Standard number of notches to turn upward: 7 or 8.
Turn the rotor and make sure that there is no brake dragging.

2. Adjustment of Parking Brake Cable

- a) Turn the equalizer nut so that the parking brake lever travels 6 or 7 notches when pulled up with a force of 30 kg (66 lb).
- b) Make sure there is no brake dragging and tighten the cable lock nut.



Cable Lock Nut Torque	N·m (kg·cm/lb·in)
6 (60 / 52)	

3. Break-in of Parking Brake Shoe

- When poor braking effect possibly resulting from insufficient break-in is felt, or just after replacement of parking brake shoe, be sure to conduct break-in by driving vehicle as follows:
 - a) Forward 50 km/h (30 mph) x 400 m (About 30 seconds) with a lever pull force of 15 kg (33 lb), and
 - b) Backward 10 km/h (6 mph) x 50 m (18 seconds) with a lever pull force of 15kg (33 lb).

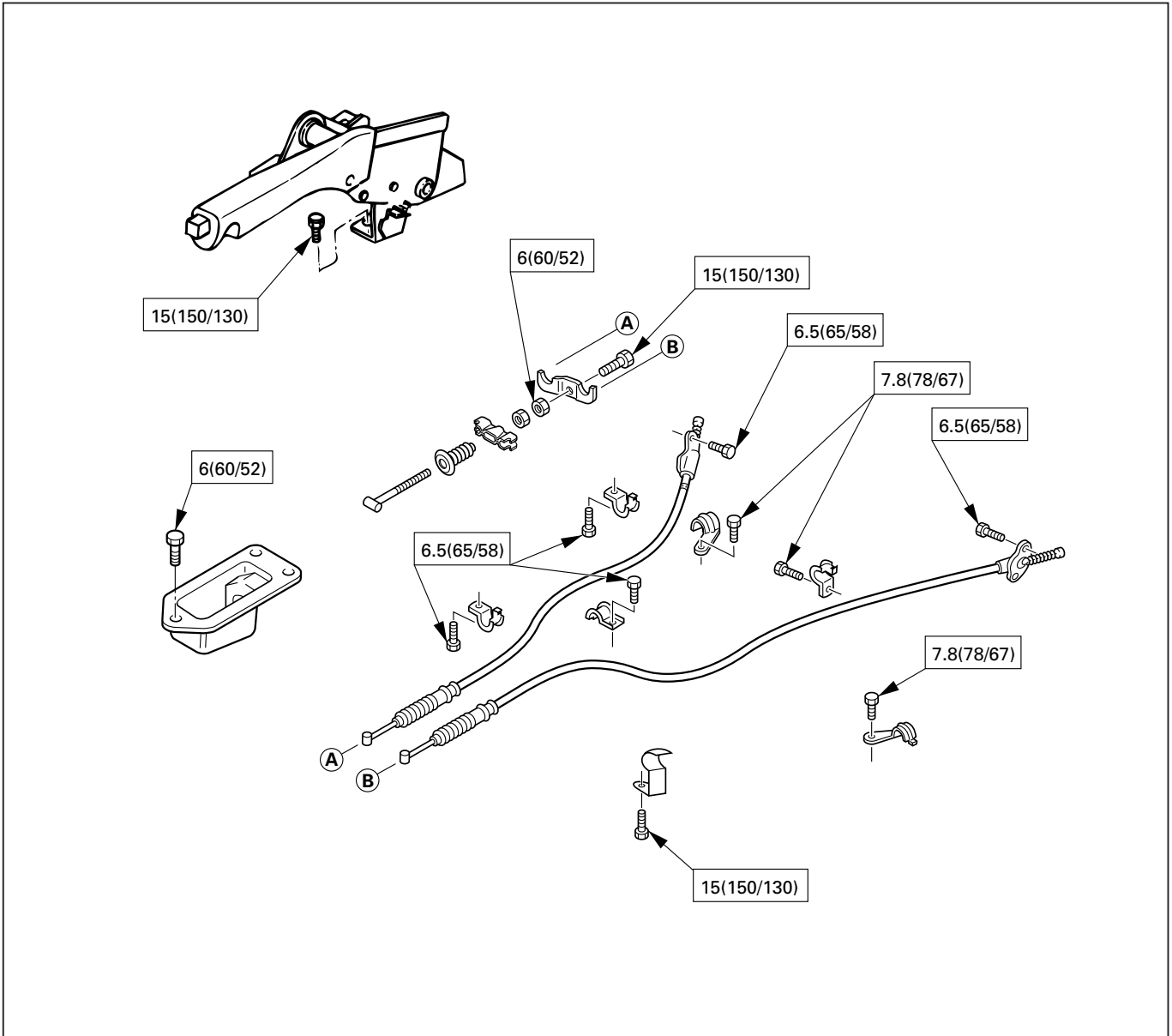
NOTE:

Break-in procedure must be performed under the safety conditions and traffic rules.

- If braking effect still remains poor after the above break-in, wait for some time until parking brake shoe cools down and repeat the procedures a) and b) notes above.
- On completion of break-in, inspect parking brake lever stroke, and if the lever does not come within the specified number of notches when pulled up, readjust.
- Excessive break-in may cause premature wear of the parking brake lining.

FIXING TORQUE

N·m (kg·m/lb·ft)

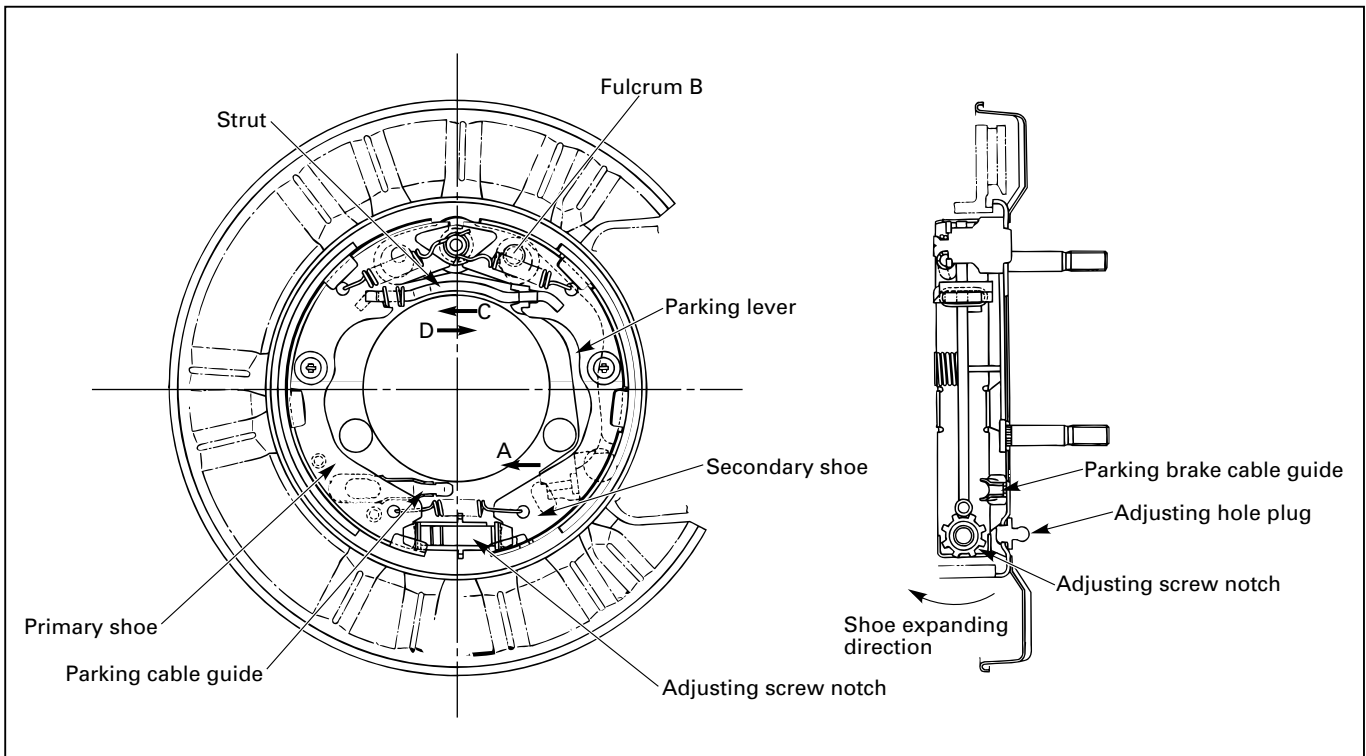


GENERAL DESCRIPTION

Pulling up the parking brake lever by hand will set the parking brake. Once pulled up, the lever is held by means of a ratchet type lock until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed to obtain sufficient braking force when parking on slopes. When the parking brake is set, or when the ignition SW is in the "ON" position, the brake warning light illuminates. The rear wheel parking brake is a duo-servo brake (mechanical inside expansion type) built-in to rear disc brake. Parking brake adjustment is made through the adjusting hole (bored through back plate). Parking brake lever stroke should be adjusted to 6 or 7 notches.

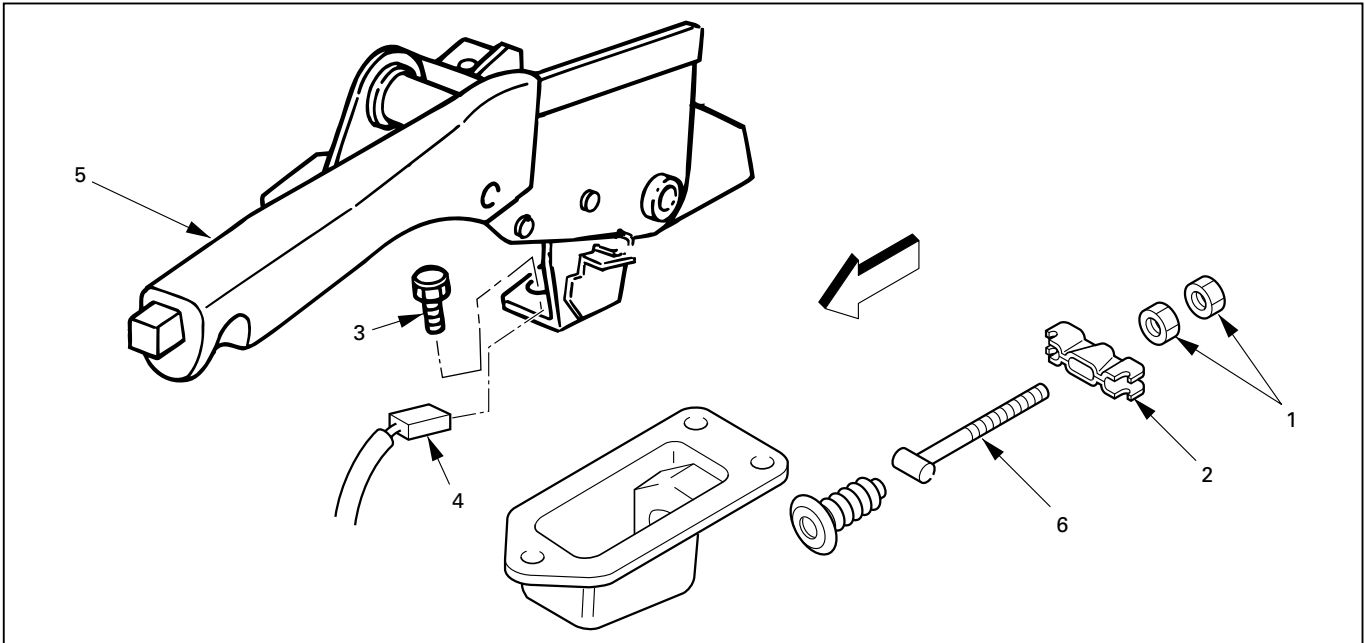
OPERATION

When pulled in the direction "A", the parking lever presses the secondary shoe against the brake drum using the lever/shoe joint "B" as a fulcrum and pushes the strut in the direction "C". The strut, in turn, presses the primary shoe against the brake drum. Counter force "D" to the primary shoe is transmitted again to the secondary shoe through the fulcrum "B". The secondary shoe contacts the drum, thereby producing braking effect. Clearance which may result from worn parking brake shoe lining can be adjusted by turning the adjusting screw



ON-VEHICLE SERVICE

PARKING BRAKE LEVER REPLACEMENT



331RW007

Removal Steps

1. Adjusting nut
2. Equalizer
3. Bolt
4. Switch connector
5. Parking brake lever
6. Parking brake front cable

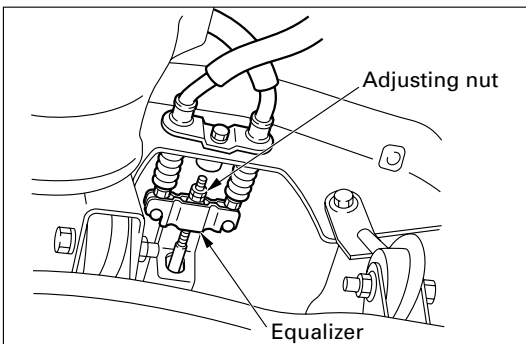
Installation Steps

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



REMOVAL

1. **Adjusting Nut**
2. **Equalizer**
3. **Bolt**
Remove the center console as described in Body and Accessories section.
Then remove the fixing bolt.
4. **Switch Connector**
5. **Parking Brake Lever**
6. **Parking Brake Front Cable**



331RW008



INSTALLATION

6. Parking Brake Front Cable



5. Parking Brake Lever

- Apply grease (BESCO L-2 or equivalent) to front cable contact point.

4. Switch Connector

3. Bolt

- Tighten the parking brake lever fixing bolt to the specified torque.



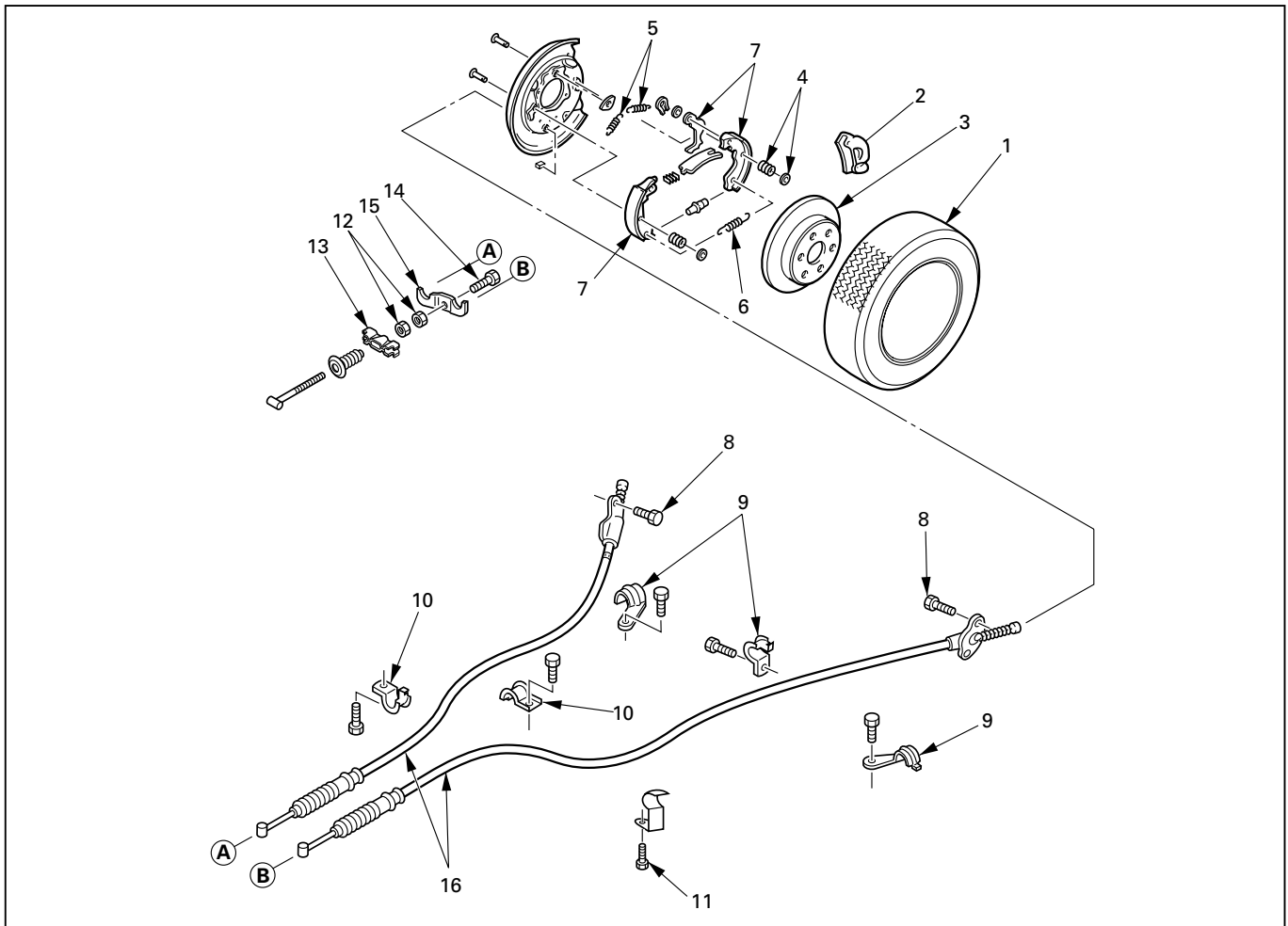
Bolt Torque	N·m (kg·m / lb·ft)
<hr/>	
15 (1.5 / 11)	
<hr/>	

- Install the center console.

2. Equalizer

1. Adjusting Nut

PARKING BRAKE CABLE



331RW009

Removal Steps

1. Rear wheels
2. Caliper assembly
3. Rotor (Drum)
4. Holding spring
5. Return spring; upper
6. Return spring; lower
7. Shoe assembly
8. Cable fixing bolt
9. Clip
10. Clip
11. Clip
12. Adjust nut
13. Equalizer
14. Bolt
15. Retaining plate
16. Parking brake cable

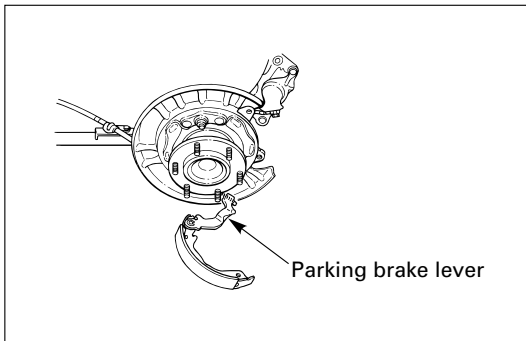
Installation Steps

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



REMOVAL

1. **Rear Wheels**
2. **Caliper Assembly**
 - Remove 2 bolts to remove the caliper assembly from the support bracket. (Refer to Rear Disc Brakes in Power Assisted Brake System section.) Temporarily hang the caliper with wire to avoid stretching the brake hose.
3. **Rotor (Drum)**
4. **Holding Spring**
5. **Return Spring; Upper**
6. **Return Spring; Lower**
7. **Shoe Assembly**
 - Remove the brake shoe assembly. Then remove the parking brake cable from the parking brake lever.
8. **Cable Fixing Bolt**
9. **Clip**
10. **Clip**
11. **Clip**
12. **Adjust Nut**
13. **Equalizer**
14. **Bolt**
15. **Retaining Plate**
16. **Parking Brake Cable**



INSTALLATION

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



15. **Parking Brake Cable**
 - Apply grease (BESCO L-2 or equivalent) to the connecting portion of the rear cable and equalizer.



12. **Adjust Nut**
 - Tighten the adjust nut to the specified torque.



Adjust Nut Torque	N·m (kg·cm / lb-in)
<u>6 (60 / 52)</u>	

- To adjust the parking brake, refer to Parking Brake Adjustment in this section.



11. **Clip**
 - Tighten the fixing bolt to the specified torque.



Fixing Bolt Torque	N·m (kg·cm / lb-in)
<u>15 (150 / 130)</u>	



10. **Clip**
 - Tighten the fixing bolt to the specified torque.



Fixing Bolt Torque	N·m (kg·cm / lb-in)
<u>6.5 (65 / 58)</u>	

9. Clip

- Tighten the fixing bolt to the specified torque.



Fixing Bolt Torque	N-m (kg-cm / lb-in)
7.8 (78 / 67)	

8. Cable Fixing Bolt

- Tighten the cable fixing bolt to the specified torque.

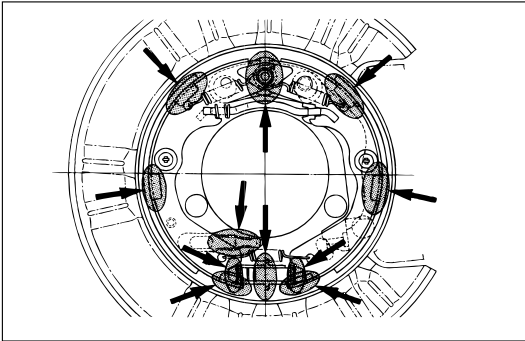


Cable Fixing Bolt Torque	N-m (kg-cm / lb-in)
6.5 (65 / 58)	



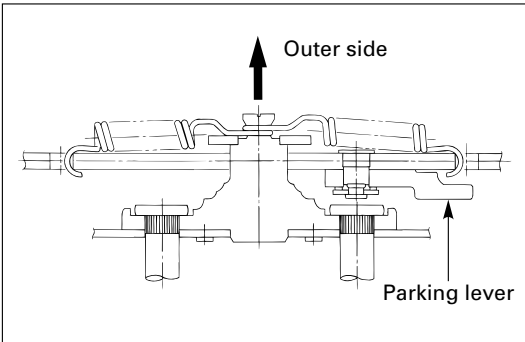
7. Shoe Assembly

- After installation of the shoe and cable assembly, apply special grease (included in the repair kit) to the following portions indicated in the left figure.



5. Return Spring; Upper

- The parking brake lever side (secondary side) return spring must be installed on the outer side of the primary side return spring.



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Service Precaution

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

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

General Description

Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The six cylinders of this engine are identified by numbers; Right side cylinders 1, 3 and 5, Left side cylinders 2, 4 and 6, as counted from crankshaft pulley side to flywheel side.

General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance:

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick-up unit.
- The 12-volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

Cylinder Block

The cylinder block is made of aluminum die-cast casting for 75° V-type six cylinders. It has a rear plate integrated structure and employs a deep skirt. The cylinder liner is cast and the liner inner diameter and crankshaft journal diameter are classified into grades. The crankshaft is supported by four bearings of which width of No.3 bearing on the body side is different in order to support the thrust bearing. The bearing cap is made of nodular cast iron and each bearing cap uses four bolts and two side bolts.

Cylinder Head

The cylinder head, made of aluminum alloy casting employs a pent-roof type combustion chamber with a spark plug in the center. The intake and exhaust valves are placed in V-type design. The ports are cross-flow type.

Valve Train

Intake and exhaust camshaft on the both side of banks are driven through an camshaft drive gear by timing belt. The valves are operated by the camshaft and the valve clearance is adjusted to select suitable thickness shim.

Intake Manifold

The intake manifold system is composed of the aluminum cast common chamber and intake manifold attached with six fuel injectors.

Exhaust Manifold

The exhaust manifold is made of nodular cast iron.

Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin is made of chromium steel is offset 1mm toward the thrust side, and the thrust pressure of piston to the cylinder wall varies gradually as the piston travels. The connecting rods are made of forged steel. The connecting rod bearings are graded for correct seize selection.

Crankshaft and Bearings

The crankshaft is made of Ductile cast-iron. Pins and journals are graded for correct size selection for their bearing.

Engine Lubrication

The oil discharged by a trochoid-type oil pump driven by the crankshaft is fed through full-flow oil filter and to the oil gallery provided under the crankshaft bearing cap. The oil is then led to the crankshaft journals and cylinder head. The crank pins are lubricated with oil from crankshaft journals through oil holes. Also, an oil jet is fed to each cylinder from crankshaft journals on the connecting rod for piston cleaning. The oil pan flange is dealt with liquid packing only; do not deform or damage the flange surface during removal or installation.

Engine Diagnosis

Hard Starting

1. Starting Motor Does Not Turn Over

Troubleshooting Procedure

Turn on headlights and starter switch.

Condition	Possible cause	Correction
Headlights go out or dim considerably	Battery run down or under charged	Recharge or replace battery
	Terminals poorly connected	Clean battery posts and terminals and connect properly
	Starting motor coil circuit shorted	Overhaul or replace
	Starting motor defective	Overhaul or replace

2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

Spark Test

Disconnect an igniton coil from any spark plug. Connect the spark plug tester 5-8840-0607-0, start the engine, and check if a spark is generated in the spark plug tester. Before starting the engine, make sure that the spark plug

tester is properly grounded. To avoid electrical shock, do not touch the part where insulation of the igniton coil is broken while the engine is running.

Condition	Possible cause	Correction
Spark jumps across gap	Spark plug defective	Clean, adjust spark gap or replace
	Ignition timing incorrect	Refer to Ignition System
	Fuel not reaching fuel injector(s) or engine	Refer to item 3 (Trouble in fuel system)
	Valve timing incorrect	Adjust
	Engine lacks compression	Refer to item 4 (Engine lacks compression)
No sparking takes place	Ignition coil disconnected or broken	Connect properly or replace
	Electronic Ignition System with module	Replace
	Poor connections in engine harness	Correct
	Powertrain Control Module cable disconnected or defective	Correct or replace

3. Trouble In Fuel System

Condition	Possible cause	Correction
Starting motor turns over and spark occurs but engine does not start.	Fuel tank empty	Fill
	Water in fuel system	Clean
	Fuel filter clogged	Replace filter
	Fuel pipe clogged	Clean or replace
	Fuel pump defective	Replace
	Fuel pump circuit open	Correct or replace
	Evaporative Emission Control System circuit clogged	Correct or replace
	Multipoint Fuel Injection System faulty	Refer to "Electronic Fuel Injection" section

4. Engine Lacks Compression

Condition	Possible cause	Correction
Engine lacks compression	Spark plug loosely fitted or spark plug gasket defective	Tighten to specified torque or replace gasket
	Valve timing incorrect	Adjust
	Cylinder head gasket defective	Replace gasket
	Valve incorrectly seated	Lap valve
	Valve stem seized	Replace valve and valve guide
	Valve spring weakened or broken	Replace
	Cylinder or piston rings worn	Overhaul engine
	Piston ring seized	Overhaul engine.

Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.
If the compression pressure obtained falls below the limit, engine overhaul is necessary.

Limit; 1000 kPa (145 psi)

Rough Engine Idling or Engine Stalling

Condition	Possible cause	Correction
Trouble in fuel injection system	Idle air control valve defective	Replace
	Throttle shutting off incomplete	Correct or replace
	Throttle position sensor circuit open or shorted	Correct or replace
	Fuel injector circuits open or shorted	Correct or replace
	Fuel injectors damaged	Replace
	Fuel pump relay defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or poor connections	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or poor connections	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Intake Air Temperature sensor circuit open or poor connections	Correct or replace
	Intake Air Temperature sensor defective	Replace
	Knock Sensor (KS) cable broken or poor connections	Correct or replace
	KS defective	Replace
	KS Module circuits open or ground	Correct or replace
	KS Module defective	Replace
Vehicle Speed Sensor circuit open or shorted	Correct or replace	
Vehicle Speed Sensor defective	Replace	
Trouble in emission control system	Powertrain Control Module defective	Replace
	Exhaust Gas Recirculation Valve circuit open or poor connections	Correct or replace
	Exhaust Gas Recirculation Valve faulty	Replace
	Canister purge valve circuit open or poor connections	Correct or replace
	Canister purge valve defective	Replace
	Evaporative Emission Canister Purge control valve defective	Replace
	Trouble in ignition system	Refer to "Hard Start"

Condition	Possible cause	Correction
Others	Engine lacks compression	Refer to "Hard Start"
	Valve incorrectly seated	Lap valve
	Air Cleaner Filter clogged	Replace filter element
	Valve timing incorrect	Readjust
	Idle air control valve broken	Replace
	Fast idle solenoid defective	Replace
	Positive Crankcase Ventilation valve defective or clogged	Replace

Rough Engine Running

Condition	Possible cause	Correction
Engine misfires periodically	Ignition coil layer shorted	Replace
	Spark plugs fouling	Clean or install hotter type plug
	Spark plug(s) insulator nose leaking	Replace
	Fuel injector(s) defective	Replace
	Powertrain control module faulty	Replace
Engine knocks periodically	Spark plugs running too hot	Install colder type spark plugs
	Powertrain control module faulty	Replace
Engine lacks power	Spark plugs fouled	Clean
	Fuel injectors defective	Replace
	Mass Airflow Sensor or Intake Airflow Sensor circuit defective	Correct or replace
	Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective	Correct or replace
	Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective	Correct or replace
	Powertrain Control Module faulty	Replace
	Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective	Correct or replace
	Throttle Position Sensor or Throttle Position Sensor circuit defective	Correct or replace
	Knock Sensor or Knock Sensor circuits defective	Correct or replace
	Knock Sensor Module or Knock Sensor Module circuits defective	Correct or replace

Hesitation

Condition	Possible cause	Correction
Hesitation on acceleration	Throttle Position Sensor adjustment incorrect	Replace throttle valve assembly
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Excessive play in accelerator linkage	Adjust or replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure (MAP) Sensor circuit open or shorted	Correct or replace
	MAP Sensor defective	Replace
	Intake Air Temperature (IAT) Sensor circuit open or shorted	Correct or replace
	Knock Sensor (KS) Circuit open or poor connections	Correct or replace
	KS defective	Replace
	KS Module circuits open or shorted	Correct or replace
	KS Module defective	Replace
	IAT Sensor defective	Replace
Hesitation at high speeds (Fuel pressure too low)	Fuel tank strainer clogged	Clean or replace
	Fuel pipe clogged	Clean or replace
	Fuel filter clogged	Replace
	Defective fuel pump system	Check and replace
	Fuel Pressure Control Valve leaking	Replace
Hesitation at high speeds (Fuel injector not working normally)	Power supply or ground circuit for Multiport Fuel Injection System shorted or open	Check and correct or replace
	Fuel Injector defective	Replace
	Cable of Multiport Fuel Injection System circuit open or poor connections	Correct or replace

Condition	Possible cause	Correction
Hesitation at high speeds	Powertrain Control Module defective	Replace
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	MAP Sensor cable broken or poor connections	Correct or replace
	MAP Sensor defective	Replace
	IAT Sensor circuit open or poor connections	Correct or replace
	IAT Sensor defective	Replace
	KS circuit open or poor connections	Correct or replace
	KS defective	Replace
	KS Module circuit open or shorted	Correct or replace
	KS Module defective	Replace
	Throttle valve not fully opened	Check and correct or replace
Air Cleaner Filter clogged	Replace filter element	
Power supply voltage too low	Check and correct or replace	

6A-10 ENGINE MECHANICAL

Engine Lacks Power

Condition	Possible cause	Correction
Trouble in fuel system	Fuel Pressure Control Valve not working normally	Replace
	Fuel injector clogged	Clean or replace
	Fuel pipe clogged	Clean
	Fuel filter clogged or fouled	Replace
	Fuel pump drive circuit not working normally	Correct or replace
	Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit	Clean or replace
	Water in fuel system	Clean
	Inferior quality fuel in fuel system	Use fuel of specified octane rating
	Powertrain Control Module supplied poor voltage	Correct circuit
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Mass Airflow Sensor not working normally	Replace
	Manifold Absolute Pressure Sensor not working normally	Replace
	Intake Air Temperature Sensor not working normally	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
Powertrain Control Module defective	Replace	
Trouble in intake or exhaust system	Air Cleaner Filter clogged	Replace filter element
	Air duct kinked or flattened	Correct or replace
Ignition failure	—————	Refer to Hard Start Troubleshooting Guide
	Heat range of spark plug inadequate	Install spark plugs of adequate heat range
	Ignition coil defective	Replace

ENGINE MECHANICAL 6A-11

Condition	Possible cause	Correction
Engine overheating	Level of Engine Coolant too low	Replenish
	Fan clutch defective	Replace
	Incorrect fan installed	Replace
	Thermostat defective	Replace
	Engine Coolant pump defective	Correct or replace
	Radiator clogged	Clean or replace
	Radiator filler cap defective	Replace
	Level of oil in engine crankcase too low or wrong engine oil	Change or replenish
	Resistance in exhaust system increased	Clean exhaust system or replace defective parts
	Throttle Position Sensor adjustment incorrect	Replace with Throttle Valve ASM
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Cylinder head gasket damaged	Replace
Engine overcooling	Thermostat defective	Replace (Use a thermostat set to open at 82° C (180° F))
Engine lacks compression	—————	Refer to Hard Start
Others	Tire inflation pressure abnormal	Adjust to recommended pressures
	Brake drag	Adjust
	Clutch slipping	Adjust or replace
	Level of oil in engine crankcase too high	Correct level of engine oil
	Exhaust Gas Recirculation Valve defective	Replace

Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other

moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

Condition	Possible cause	Correction
Noise from crank journals or from crank bearings (Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating)	Oil clearance increased due to worn crank journals or crank bearings	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crankshaft out of round	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crank bearing seized	Crank bearing seized. Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing

Troubleshooting Procedure

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective

bearing by listening for abnormal noise that stops when spark plug is shorted out.

6A-12 ENGINE MECHANICAL

Condition	Possible cause	Correction
Noise from connecting rods or from connecting rod bearings (Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated)	Bearing or crankshaft pin worn	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Crankpin out of round	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Connecting rod bent	Correct or replace
	Connecting rod bearing seized	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing

Troubleshooting Procedure

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

Condition	Possible cause	Correction
Piston and cylinder noise (Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up)	Piston clearance increased due to cylinder wear	Replace piston and cylinder body
	Piston seized	Replace piston and cylinder body
	Piston ring broken	Replace piston and cylinder body
	Piston defective	Replace pistons and others

Troubleshooting Procedure

Short out each spark plug and listen for change in engine noise.

Condition	Possible cause	Correction
Piston pin noise (Piston makes noise each time it goes up and down)	Piston pin or piston pin hole worn	Replace piston, piston pin and connecting rod assy

Troubleshooting Procedure

The slapping sound stops when spark plug on bad cylinder is shorted out.

Condition	Possible cause	Correction
Timing belt noise	Timing belt tension is incorrect	Replace pusher or adjust the tension pulley or replace timing belt
	Tensioner bearing defective	Replace
	Timing belt defective	Replace
	Timing pulley defective	Replace
	Timing belt comes in contact with timing cover	Replace timing belt and timing cover
Valve noise	Valve clearance incorrect	Replace adjusting shim
	Valve and valve guide seized	Replace valve and valve guide
	Valve spring broken or weakened	Replace
	Valve seat off-positioned	Correct
	Camshaft worn out	Replace
Crankshaft noise	Crankshaft end play excessive (noise occurs when clutch is engaged)	Replace thrust bearing

Condition	Possible cause	Correction
Engine knocking	Preignition due to use of spark plugs of inadequate heat range	Install Spark Plugs of adequate heat range
	Carbon deposits in combustion chambers	Clean
	Fuel too low in octane rating	Replace fuel
	Wide Open Throttle enrichment system failure	Refer to Section 6E
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Engine overheating	Refer to "Engine Lacks Power"
Others	Water pump defective	Replace
	Drive belt slipping	Replace auto tensioner or drive belt

Abnormal Combustion

Condition	Possible cause	Correction
Trouble in fuel system	Fuel pressure control valve defective	Replace
	Fuel filter clogged	Replace
	Fuel pump clogged	Clean or replace
	Fuel tank or fuel pipe clogged	Clean or replace
	Fuel injector clogged	Clean or replace
	Fuel pump relay defective	Replace
	Power supply cable for fuel pump broken or poor connections	Reconnect, correct or replace
	Mass Airflow (MAF) sensor circuit open or defective	Correct or replace
	MAF Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or shorted	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature (ECT) Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Throttle Position Sensor adjustment incorrect	Readjust
	Throttle Position Sensor defective	Replace
	Throttle Position Sensor connector poor connections	Reconnect
	Vehicle Speed Sensor cable poor connections or defective	Correct or replace
	Vehicle Speed Sensor loosely fixed	Fix tightly
Vehicle Speed Sensor in wrong contact or defective	Replace	
Powertrain Control Module cable poor connections or defective	Correct or replace	

6A-14 ENGINE MECHANICAL

Condition	Possible cause	Correction
Trouble in emission control system	Heated Oxygen Sensor circuit open	Correct or replace
	Heated Oxygen Sensor defective	Replace
	Signal vacuum hose loosely fitted or defective	Correct or replace
	EGR Valve circuit open or shorted	Correct or replace
	Exhaust Gas Recirculation Valve defective	Replace
	ECT Sensor circuit open or shorted	Correct or replace
	Canister Purge Valve circuit open or shorted	Correct or replace
	Canister Purge Valve defective	Replace
	ECT Sensor defective	Replace
	Positive Crankcase Ventilation (PCV) valve and hose clogged	Correct or replace
	Evaporator system	Refer to Section 6E
Trouble in ignition system	—————	Refer to "Engine Lacks Power"
Trouble in cylinder head parts	Carbon deposits in combustion chamber	Remove carbon
	Carbon deposit on valve, valve seat and valve guide	Remove carbon

Engine Oil Consumption Excessive

Condition	Possible cause	Correction
Oil leaking	Oil pan drain plug loose	Retighten or replace gasket
	Crankcase fixing bolts loosened	Retighten
	Oil pan setting bolts loosened	Retighten
	Oil pan gasket broken	Replace gasket
	Front cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Head cover fixing bolts loose or gasket broken	Retighten or replace gasket
	Oil cooler adapter cracked	Replace
	Oil cooler center bolt loose	Retighten
	Oil cooler O-ring broken	Replace
	Oil cooler piping loose or broken	Retighten or replace
	Oil filter adapter cracked	Replace
	Oil filter attaching bolt loose or rubber gasket broken	Retighten or replace oil filter
	Oil cooler broken	Replace
	Crankshaft front or rear oil seal defective	Replace oil seal
	Oil pressure unit loose or broken	Retighten or replace
	Blow-by gas hose broken	Replace hose
	Positive Crankcase Ventilation Valve clogged	Clean
Engine/Transmission coupling failed	Replace oil seal	

Condition	Possible cause	Correction
Oil leaking into combustion chambers due to poor seal in valve system	Valve stem oil seal defective	Replace
	Valve stem or valve guide worn	Replace valve and valve guide
Oil leaking into combustion chambers due to poor seal in cylinder parts	Cylinders and pistons worn excessively	Replace cylinder body assembly and pistons
	Piston ring gaps incorrectly positioned	Correct
	Piston rings set with wrong side up	Correct
	Piston ring sticking	Replace cylinder body assembly and pistons
	Piston ring and ring groove worn	Replace pistons and others
	Return ports in oil rings clogged	Clean piston and replace rings
Positive Crankcase Ventilation System malfunctioning	Positive Crankcase Ventilation Valve clogged	Clean
Others	Improper oil viscosity	Use oil of recommended S.A.E. viscosity
	Continuous high speed driving and/or severe usage such as trailer towing	Continuous high speed operation and/or severe usage will normally cause increased oil consumption

Fuel Consumption Excessive

Condition	Possible cause	Correction
Trouble in fuel system	Mixture too rich or too lean due to trouble in fuel injection system	Refer to "Abnormal Combustion"
	Fuel cut function does not work	Refer to "Abnormal Combustion"
Trouble in ignition system	Misfiring or abnormal combustion due to trouble in ignition system	Refer to "Hard Start" or "Abnormal Combustion"
Others	Engine idle speed too high	Reset Idle Air Control Valve
	Returning of accelerator control sluggish	Correct
	Fuel system leakage	Correct or replace
	Clutch slipping	Correct
	Brake drag	Correct
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system	Refer to "Abnormal Combustion"	

Lubrication Problems

Condition	Possible cause	Correction
Oil pressure too low	Wrong oil in use	Replace with correct engine oil
	Relief valve sticking	Replace
	Oil pump not operating properly	Correct or replace
	Oil pump strainer clogged	Clean or replace strainer
	Oil pump worn	Replace
	Oil pressure gauge defective	Correct or replace
	Crankshaft bearing or connecting rod bearing worn	Replace
Oil contamination	Wrong oil in use	Replace with correct engine oil
	Oil filter clogged	Replace oil filter
	Cylinder head gasket damage	Replace gasket
	Burned gases leaking	Replace piston and piston rings or cylinder body assembly
Oil not reaching valve system	Oil passage in cylinder head or cylinder body clogged	Clean or correct

Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
 - a. Check the viscosity of the oil.
 - b. Change the oil if the viscosity is outside the specified standard.
 - c. Refer to the "Maintenance and Lubrication" section of this manual.
2. Check the engine oil level.
 The level should fall somewhere between the "ADD" and the "FULL" marks on the oil level dipstick.
 If the oil level does not reach the "ADD" mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80°C).
6. Measure the oil pressure.
**Oil pressure should be:
 392-550 kPa (56.9-80.4 psi) at 3000 rpm.**
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

Malfunction Indicator Lamp

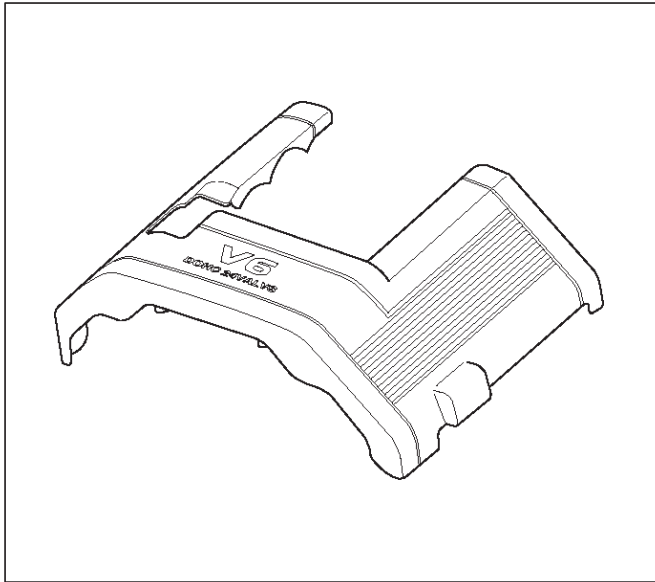
The instrument panel "CHECK ENGINE" Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

Condition	Possible cause	Correction
"CHECK ENGINE" MIL does not illuminate at the starting of engine	Bulb defective	Replace
	MIL circuit open	Correct or replace
	Command signal circuit to operate self diagnostic system shorted	Correct or replace
	Engine Control Module (PCM) cable loosely connected, disconnected or defective	Correct or replace
	PCM defective	Replace
"CHECK ENGINE" MIL illuminates, and stays on	Deterioration of heated oxygen sensor internal element	Replace
	Heated oxygen sensor connector terminal improper contact	Reconnect properly
	Heated oxygen sensor lead wire shorted	Correct
	Heated oxygen sensor circuit open	Correct or replace
	Deterioration of engine coolant temperature sensor internal element	Replace
	Engine coolant temperature sensor connector terminal improper contact	Reconnect properly
	Engine coolant temperature sensor lead wire shorted	Correct
	Engine coolant temperature sensor circuit open	Correct or replace
	Throttle position sensor open or shorted circuits	Correct or replace
	Deterioration of crankshaft position sensor	Replace
	Crankshaft position sensor circuit open or shorted	Correct or replace
	Vehicle speed sensor circuit open	Correct or replace
	Manifold absolute pressure sensor circuit open or shorted	Correct or replace
	Intake air temperature sensor circuit open or shorted	Correct or replace
	Fuel injector circuit open or shorted	Correct or replace
	PCM driver transistor defective	Replace PCM
	Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory)	Replace PCM

Cylinder Head Cover LH

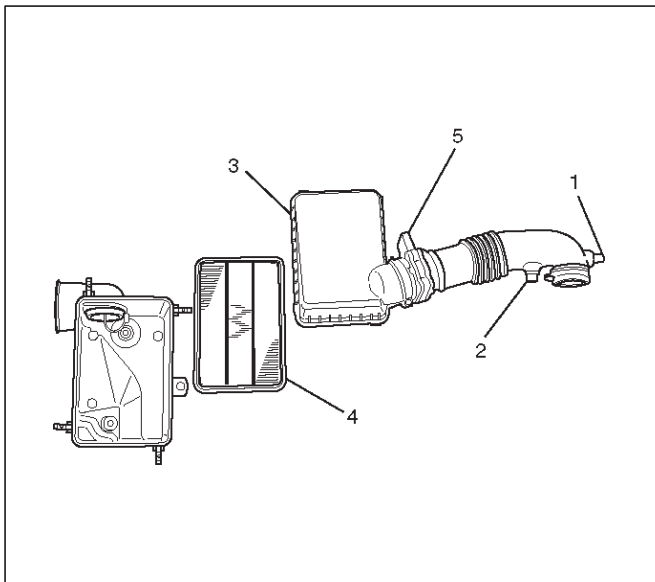
Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from faucet bottom of radiator.
3. Remove engine cover from the dowels on the common chamber.



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4. Remove air cleaner duct assembly (3) and air cleaner element (4).

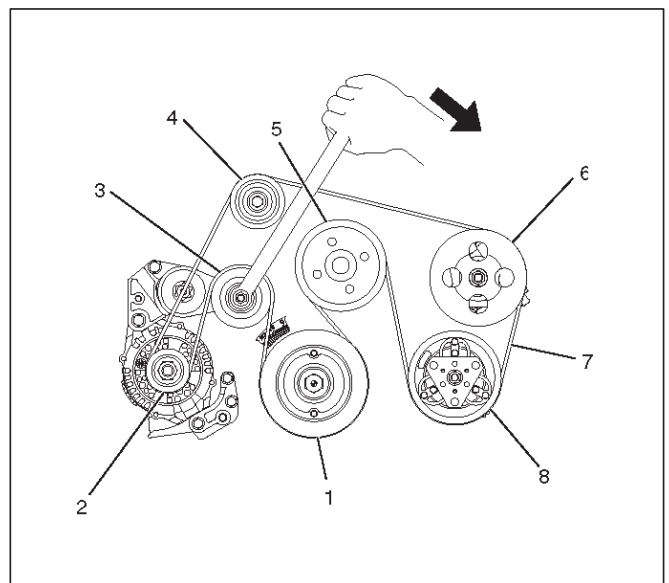


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Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element
- (5) Mass Air Flow Sensor

5. Disconnect following wiring connectors and bonding cable:
 - Manifold Absolute Pressure (MAP) sensor
 - Vacuum Switching Valve (VSV) for Induction Air Control Valve (IACV) actuator
 - Ignition coils for left bank
 - Fuel injectors for left bank
 - Idle air control (IAC) valve
 - Throttle position sensor (TPS)
 - Bonding cable
 - Others as necessitated
6. Disconnect following vacuum hoses:
 - Brake master VAC
 - Canister
 - VSV for IACV actuator
 - Duty solenoid valve
 - PCV
7. Disconnect radiator upper and lower hoses
8. Remove engine harness from the cylinder head cover.
9. Remove the upper fan guide.
10. Remove cooling fan and clutch assembly.
11. Remove drive belt by pushing down the auto tensioner using spanner as illustrated.



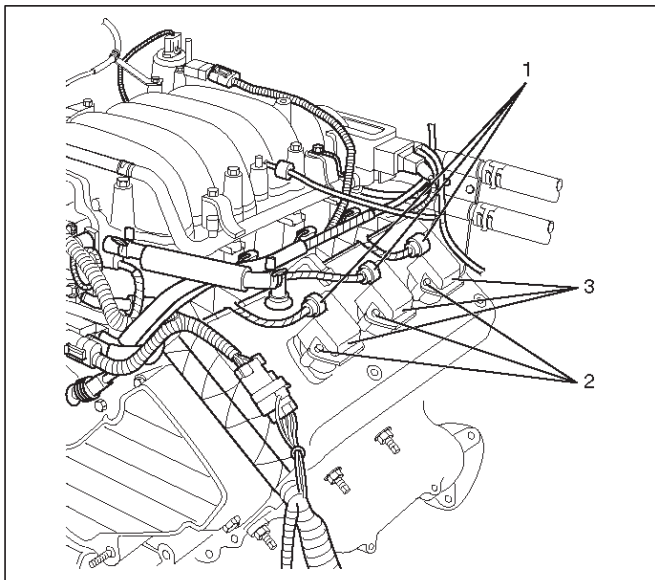
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NOTE: Disconnect the mass air flow (MAF) sensor connector, intake air temperature (IAT) sensor connector, and positive crankcase ventilation (PCV) hose before hand the air cleaner duct assembly is removed.

Legend

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

- 12. Remove power steering oil pump pulley.
- 13. Remove fan pulley and bracket assembly.
- 14. Remove idle pulley assembly.
- 15. Remove auto tensioner assembly.
- 16. Remove crankshaft pulley using 5-8840-0133-0 crankshaft holder.
- 17. Remove timing belt covers from the right bank side to the left bank side in order.
- 18. Remove ignition coil assemblies for the left side bank.



060RW018

Legend

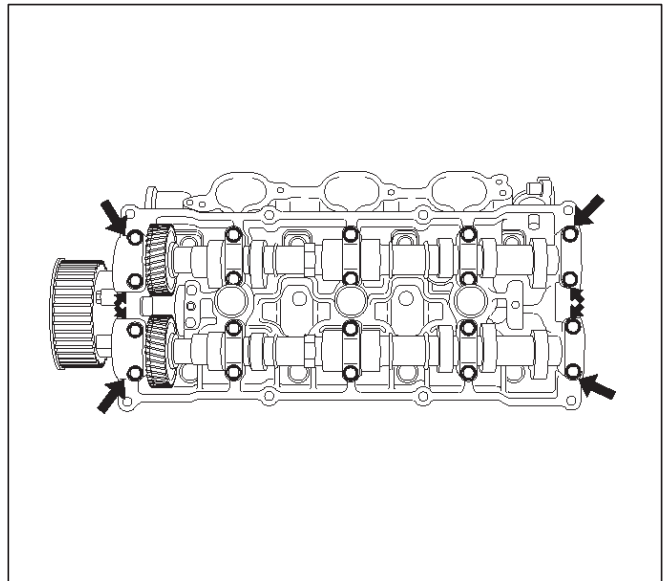
- (1) Ignition Coil Connectors
- (2) Bolts
- (3) Ignition Coil Assemblies

- 19. Remove cylinder head cover assembly.

Installation

- 1. Install cylinder head cover.
 - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
 - Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bracket on front and rear sides.

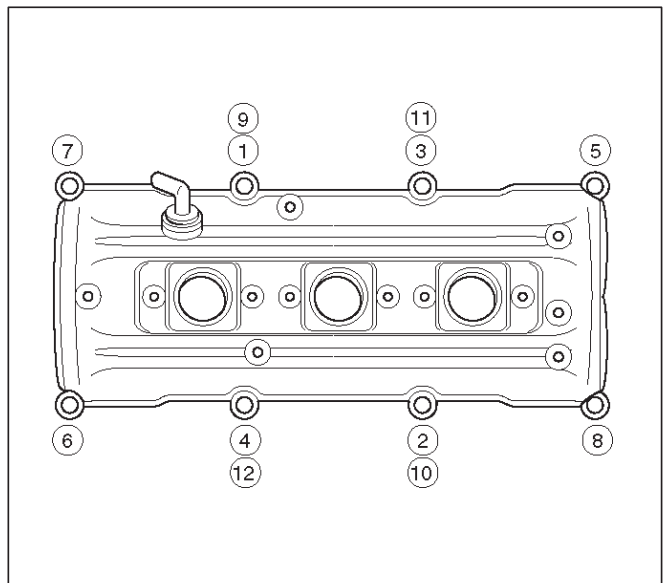
- The cylinder head cover must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



014RW144

- Tighten bolts to the specified torque.

Torque : 9 N-m (0.9 Kg-m/78 lb in)



010RW008

- 2. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

Torque : 4 N-m (0.4 Kg-m/35 lb in)

- 3. Install timing belt covers from left bank side to right bank side, and tighten the fixing bolts and nut to the specified torque.

Torque : 19 N-m (1.9 Kg-m/14 lb ft)

- 4. Install crankshaft pulley and tighten the fixing bolt using 5-8840-0133-0 crankshaft holder to the specified torque.

Torque : 167 N-m (17.0 Kg-m/123 lb ft)

6A-20 ENGINE MECHANICAL

5. Install auto tensioner assembly and tighten the fixing bolts to the specified torque.

Torque :

Shorter Bolt : 20 N·m (2.0 Kg-m/14 lb ft)

Longer Bolt : 39 N·m (4.0 Kg-m/29 lb ft)

6. Install idle pulley and bracket assembly and tighten the fixing bolt to the specified torque.

Torque : 52 N·m (5.3 Kg-m/38 lb ft)

7. Install fan pulley and bracket assembly and tighten the fixing bolts and nut to the specified torque.

Torque : 22 N·m (2.2 Kg-m/16 lb ft)

8. Install power steering oil pump pulley and tighten the fixing bolt to the specified torque.

Torque : 78 N·m (8.0 Kg-m/58 lb ft)

9. Install drive belt by pushing down the auto tensioner using spanner as shown in the removal step of drive belt.

10. Install cooling fan and clutch assembly and tighten the fixing bolts to the specified torque.

Torque : 10 N·m (1.0 Kg-m/87 lb in)

11. Install upper fan guide and clip both side and tighten the fixing bolts to the specified torque.

Torque : 4 N·m (0.4 Kg-m/35 lb in)

12. Install engine harness and tighten the fixing bolts of the retaining clip and bracket to the specified torque.

Torque : 4 N·m (0.4 Kg-m/35 lb in)

13. Connect radiator upper and lower hoses and clip them securely.

14. Connect vacuum hoses of those which were disconnected in the removal step.

15. Connect wiring connectors and bonding cable of those which were disconnected in the removal step.

16. Install air cleaner element and air cleaner duct assembly, and clip the both end securely.

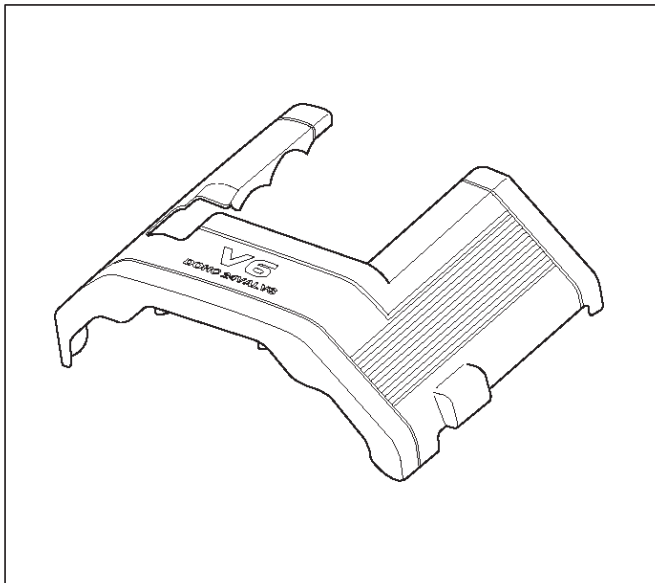
17. Connect MAF sensor connector, IAT sensor connector and PCV hose.

18. Install engine cover mating with the dowels.

Cylinder Head Cover RH

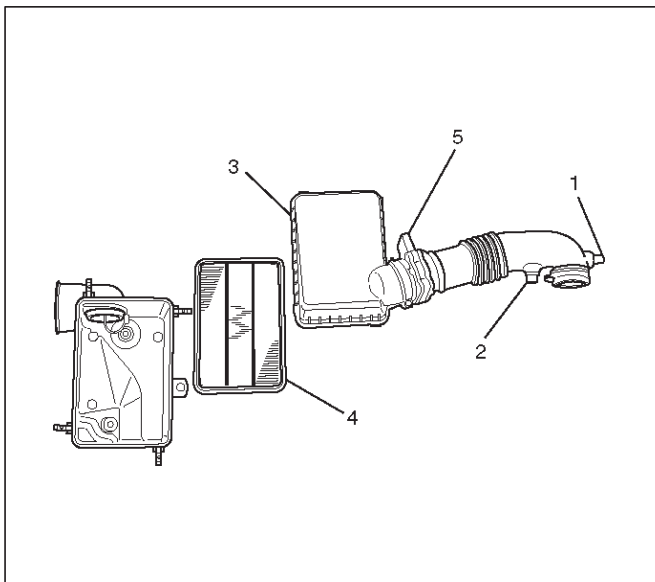
Removal

1. Disconnect battery ground cable.
2. Remove battery from the vehicle.
3. Drain engine coolant from faucet bottom of radiator.
4. Remove engine cover from the dowels on the common chamber.



F06RW018

5. Remove air cleaner duct assembly (3) and air cleaner element (4).



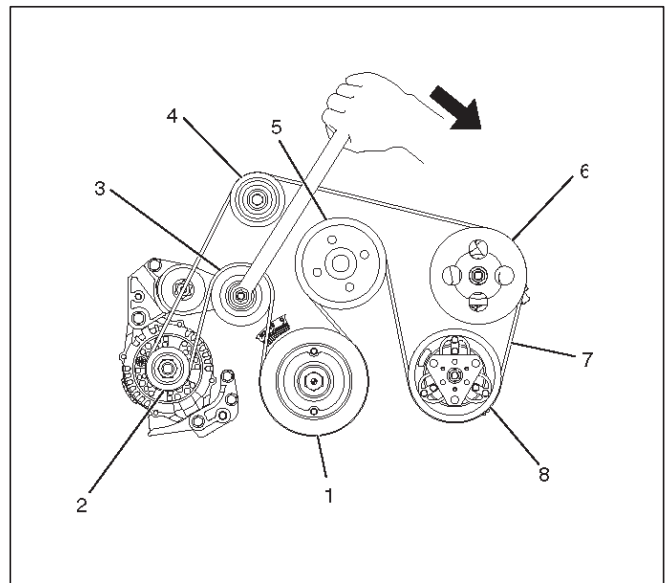
130RW001

Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element
- (5) Mass Air Flow Sensor

NOTE: Disconnect the mass air flow (MAF) sensor connector, intake air temperature (IAT) sensor connector, and positive crankcase ventilation (PCV) hose before hand the air cleaner duct assembly is removed.

6. Disconnect following wiring connectors and bonding cable:
 - Exhaust Gas Recirculation (EGR) valve
 - Fuel injectors for right bank
 - Ignition coils for right bank
 - Bonding cable
 - Othres as necessitated
7. Disconnect radiator upper and lower hoses.
8. Remove engine harness from the cylinder head cover.
9. Remove the upper fan guide.
10. Remove cooling fan and clutch assembly.
11. Remove drive belt by pushing down the auto tensioner using spanner as illustrated.



F06RW019

Legend

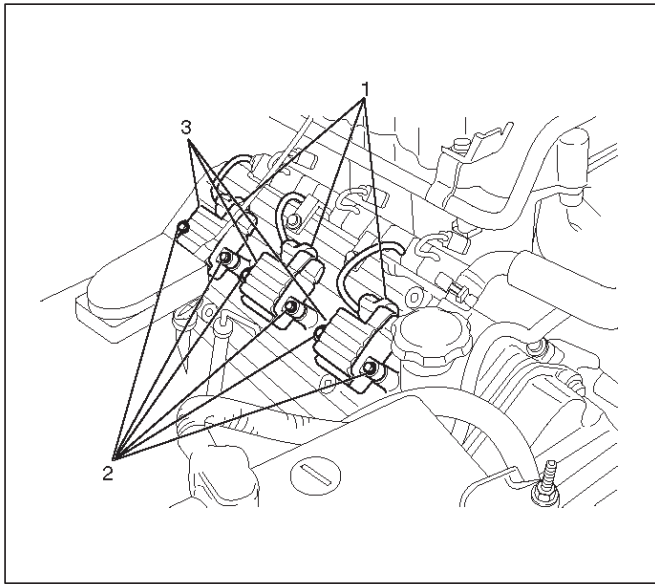
- (1) Crankshaft Pulley
- (2) Generator
- (3) Auto Tensioner
- (4) Idle Pulley
- (5) Cooling Fan Pulley
- (6) Power Steering Oil Pump
- (7) Drive Belt
- (8) Air Conditioner Compressor

12. Remove fan pulley and bracket assembly.
13. Remove idle pulley assembly.
14. Remove auto tensioner assembly.
15. Remove crankshaft pulley using 5-8840-0133-0 crankshaft holder.

6A-22 ENGINE MECHANICAL

16. Remove timing belt covers for right bank side.

17. Reomve timing belt covers for right bank side.



Legend

- (1) Ignition Coil Connectors
- (2) Bolts
- (3) Ignition Coil Assemblies

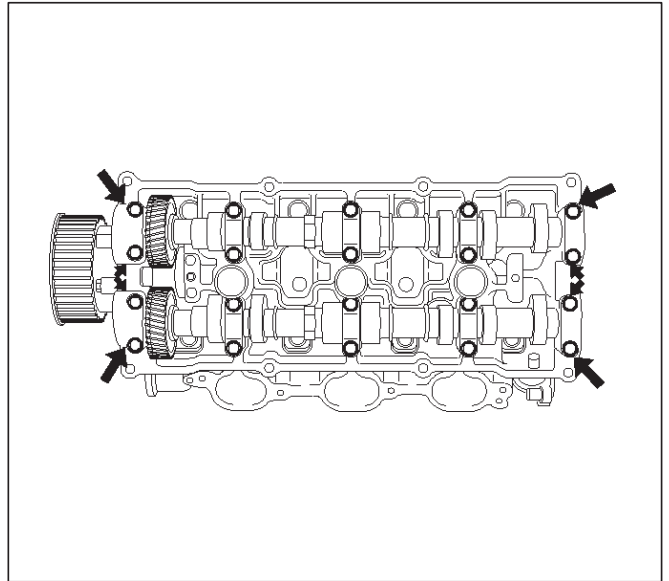
18. Remove ignition coil assemblies for the right side bank.

19. Remove cylinder head cover assembly.

Installation

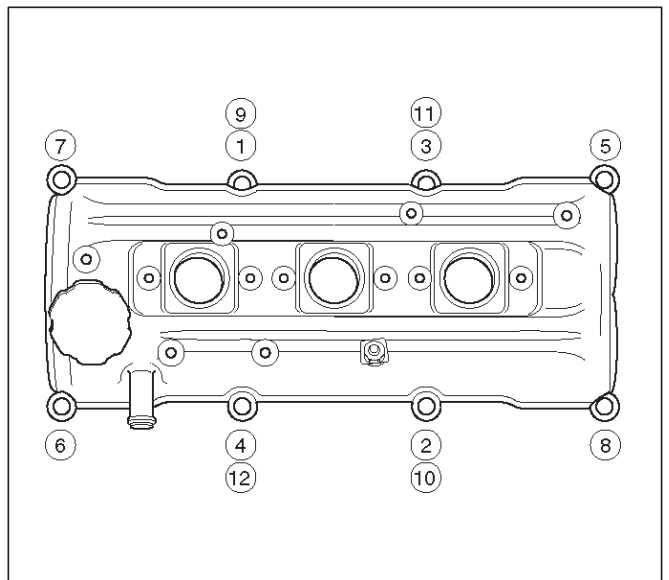
1. Install cylinder head cover.

- Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
- Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bracket on front and rear sides.
- The cylinder head cover must be installed within 5 minutes after sealant application before the sealant hardens.



- Tighten bolts in turn to the specified torque.

Torque : 8.8 N-m (0.9 Kg-m/78 lb in)



2. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

Torque : 4 N-m (0.4 Kg-m/35 lb in)

3. Install timing belt cover and tighten the fixing bolts and nut to the specified torque.

Torque : 19 N-m (1.9 Kg-m/14 lb ft)

4. Install crankshaft pulley and tighten the fixing bolt using 5-8840-0133-0 crankshaft holder to the specified torque.

Torque : 167 N-m (17 Kg-m/123 lb ft)

5. Install auto tensioner assembly and tighten the fixing bolts to the specified torque.

Torque :

Shorter Bolt : 20 N-m (2.0 Kg-m/14.8 lb ft)

Longer Bolt : 39 N-m (4.0 Kg-m/28.8 lb ft)

6. Install idle pulley assembly and tighten the fixing bolt to the specified torque.

Torque : 52 N·m (5.3 Kg·m/38.4 lb ft)

7. Install fan pulley and bracket assembly and tighten the fixing bolts and nut to the specified torque.

Torque : 22 N·m (2.2 Kg·m/16.2 lb ft)

8. Install drive belt by pushing down the auto tensioner using spanner as shown in the removal step of drive belt.

9. Install cooling fan clutch assembly and tighten the fixing bolts to the specified torque.

Torque : 10 N·m (1.0 Kg·m/88.5 lb in)

10. Install upper fan guide and clip both side and tighten the fixing bolts to the specified torque.

Torque : 4 N·m (0.4 Kg·m/35.4 lb in)

11. Install engine harness and tighten the fixing bolts of the retaining clip and brackets to the specified torque.

Torque : 4 N·m (0.4 Kg·m/35.4 lb in)

12. Connect radiator upper and lower hoses and clip them securely.

13. Connect wiring connectors and bonding cable of those which were disconnected in the removal step.

14. Install air cleaner element and air cleaner duct assembly, and the clip both end securely.

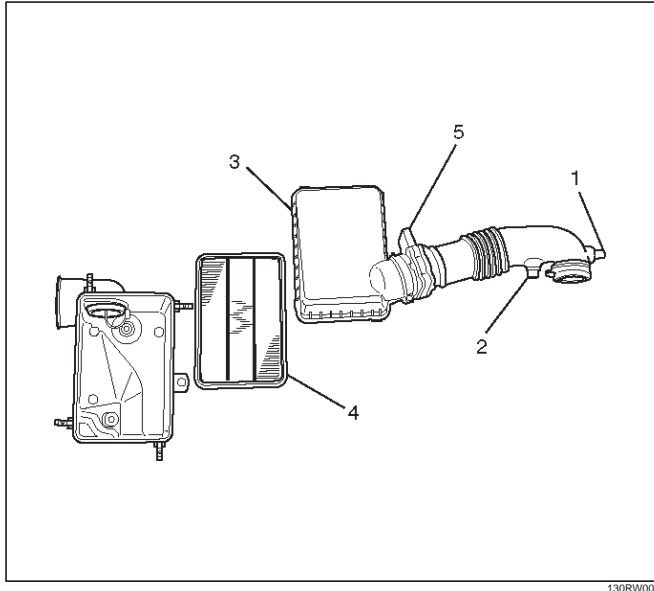
15. Connect MAF sensor connector, IAT sensor connector and PCV hose.

16. Install engine cover mating with the dowels.

Common Chamber

Removal

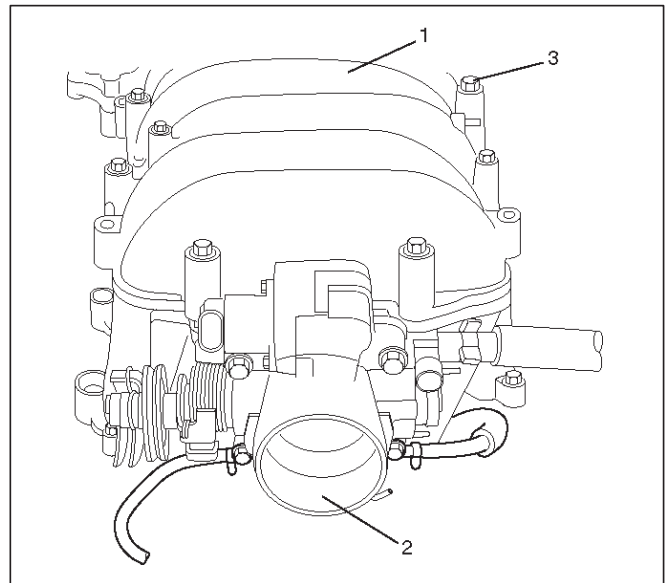
1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.



Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element
- (5) Air Flow Sensor

3. Disconnect accelerator pedal cable from throttle body and cable bracket.
4. Disconnect vacuum booster hose from common chamber.
5. Disconnect connector from manifold absolute pressure sensor, idle air control valve, throttle position sensor, solenoid valve, electric vacuum sensing valve, and EGR valve.
6. Disconnect vacuum hose on canister VSV and positive crankcase ventilation hose, fuel rail assembly with pressure control valve bracket.
7. Remove ventilation hose from throttle valve and intake duct and remove water hose.
8. Remove the four throttle body fixing bolts.
9. Remove exhaust gas recirculation valve assembly fixing bolt and nut on common chamber and remove EGR valve assembly.
10. Remove two bolts from common chamber rear side for remove fuel hose bracket.
11. Remove common chamber four bolts and four nuts then remove the common chamber.



Legend

- (1) Common Chamber
- (2) Throttle Valve Assembly
- (3) Bolt

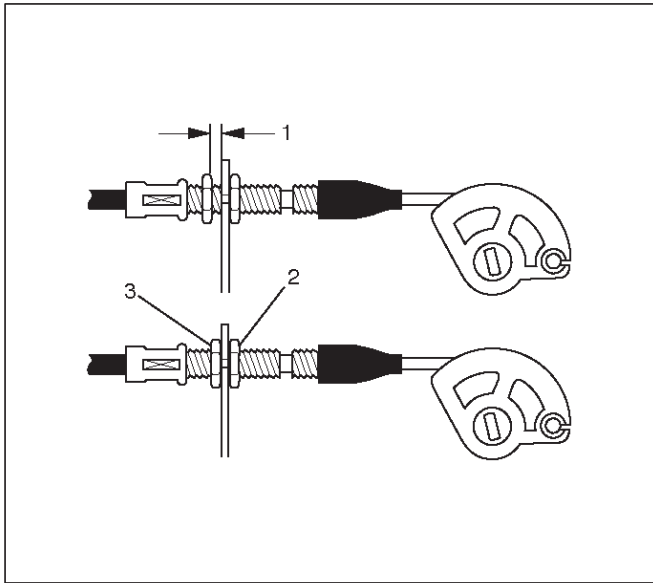
Installation

1. Install common chamber and tighten bolts and nuts to the specified torque.
 - Torque :**
 - Bolt : 25 N·m (2.5 Kg-m/18 lb ft)**
 - Nut : 25 N·m (2.5 Kg-m/18 lb ft)**
2. Install fuel hose bracket and tighten bolts to specified torque.
 - Torque : 10 N·m (1.0 Kg-m/89 lb in)**
3. Install exhaust gas recirculation valve assembly and tighten bolt and nut to the specified torque.
 - Torque : 25 N·m (2.5 Kg-m/18 lb ft)**
4. Install throttle body and tighten bolts to the specified torque.
 - Torque : 25 N·m (2.5 Kg-m/18 lb ft)**
5. Install ventilating hose to throttle valve and intake duct.
6. Connect vacuum hoses on canister VSV and positive crankcase ventilation hose. Tighten bolts for fuel rail assembly with pressure control valve bracket.
 - Torque : 25 N·m (2.5 Kg-m/18 lb ft)**
7. Connect each connector without fail.
8. Connect vacuum booster hose.
9. Connect accelerator pedal cable.
 - Accelerator pedal cable adjustment
 1. Loosen the adjusting nut and screw cap.
 2. Pull outer cable while fully closing the throttle valve.

3. Tighten adjusting nut and lock nut temporarily.
4. Loosen adjusting nut by three turns and tighten lock nut.

Then manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

If it does not reach the stopper screw, repeat from step 1.

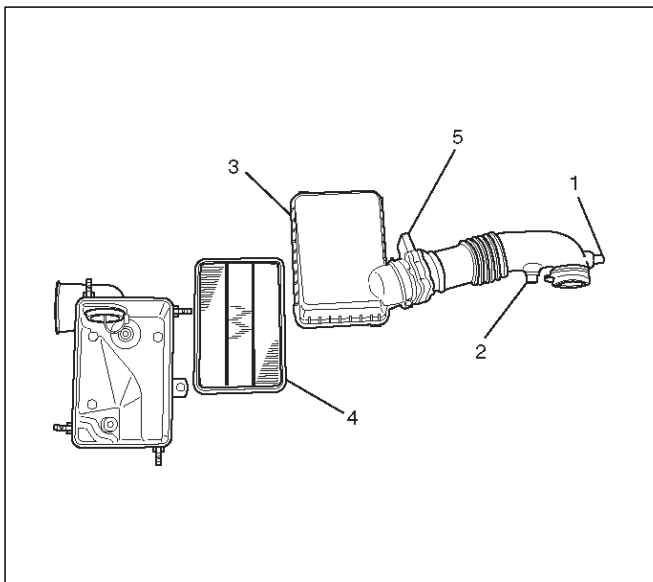


035RW004

Legend

- (1) Clearance
- (2) Lock Nut
- (3) Adjusting Nut

10. Install air cleaner duct assembly.



130RW001

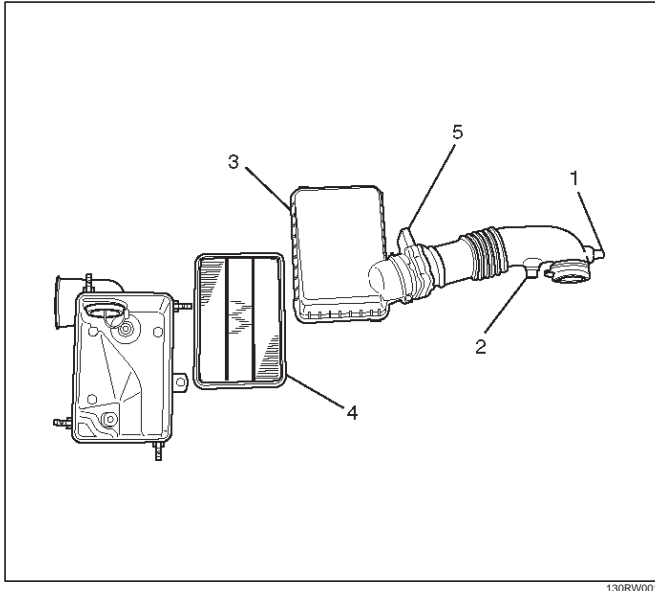
Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element.
- (5) Mass Air Flow Sensor

Exhaust Manifold LH

Removal

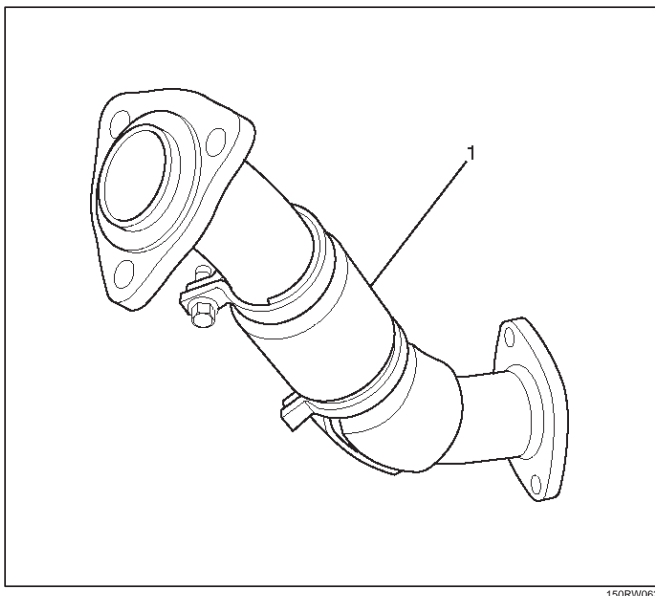
1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.



Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element
- (5) Mass Air Flow Sensor

3. Remove exhaust front pipe three stud nuts from exhaust side and two nuts from rear end of exhaust front pipe.



Legend

- (1) Exhaust Front Pipe LH

4. Remove heat protector two fixing bolts then the heat protector.

5. Remove a bolt on engine LH side for air conditioner (A/C) compressor bracket and loosen two bolts for A/C compressor then move A/C compressor to front side.
6. Remove exhaust manifold eight fixing nuts and remove exhaust manifold from the engine.

Installation

1. Install exhaust manifold and tighten exhaust manifold fixing nuts to the specified torque with new nuts.

Torque: 57 N·m (5.8 Kg·m/42 lb ft)

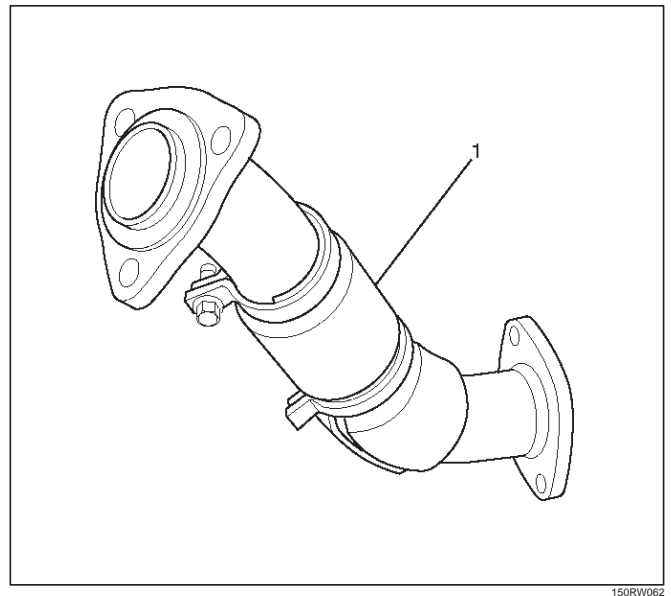
2. Install heat protector.

3. Install exhaust front pipe and tighten three stud nuts and two nuts to the specified torque.

Torque :

Stud nuts: 67 N·m (6.8 Kg·m/49 lb ft)

Nuts: 43 N·m (4.4 Kg·m/32 lb ft)



Legend

- (1) Exhaust Front Pipe LH

4. Set A/C compressor to normal position and tighten two bolts and a bolt to the specified torque.

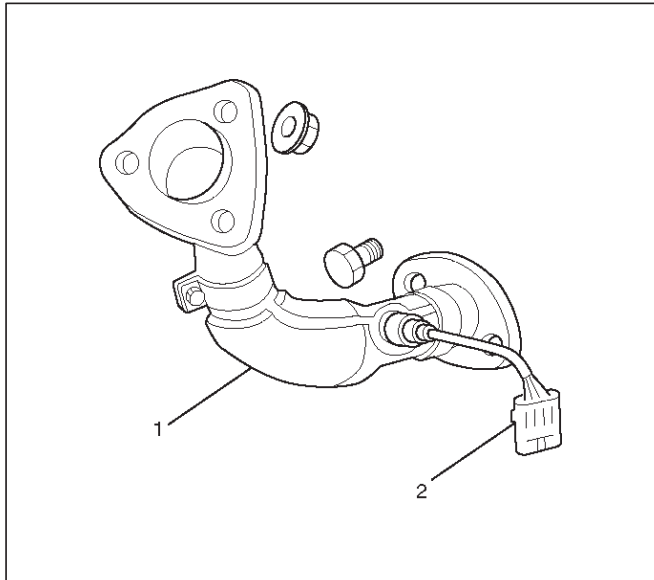
Torque : 40 N·m (4.1 Kg·m/30 lb ft)

5. Install air cleaner duct assembly.

Exhaust Manifold RH

Removal

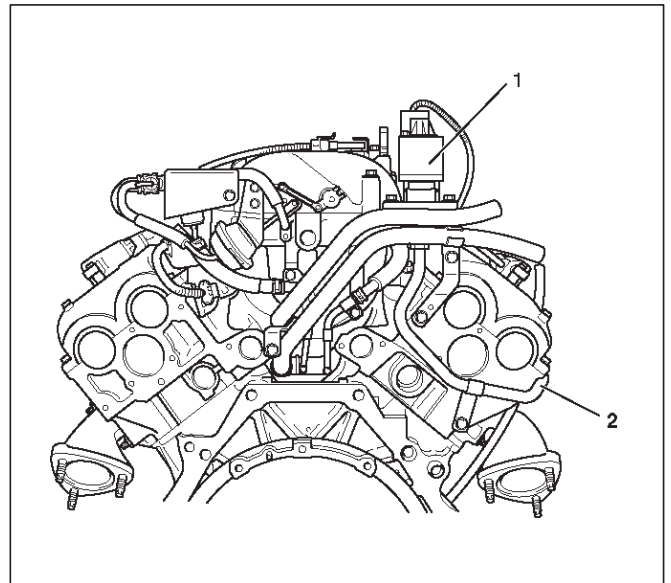
1. Disconnect battery ground cable.
2. Remove torsion bar. Refer to removal procedure in Front Suspension section.
3. Remove exhaust front pipe three stud nuts and two nuts then disconnect exhaust front pipe.



Legend

- (1) Exhaust Front Pipe RH
- (2) O₂ Sensor (for IGM)

4. Remove heat protector two fixing bolts then the heat protector.
5. Remove exhaust gas recirculation (EGR) pipe fixing bolt and nut from exhaust manifold, remove a nut from EGR valve and a bolt from rear side of cylinder head for bracket of EGR pipe then remove the EGR pipe.



Legend

- (1) Exhaust Gas Recirculation (EGR) Valve
- (2) EGR Pipe

6. Remove exhaust manifold eight fixing nuts then the exhaust manifold.

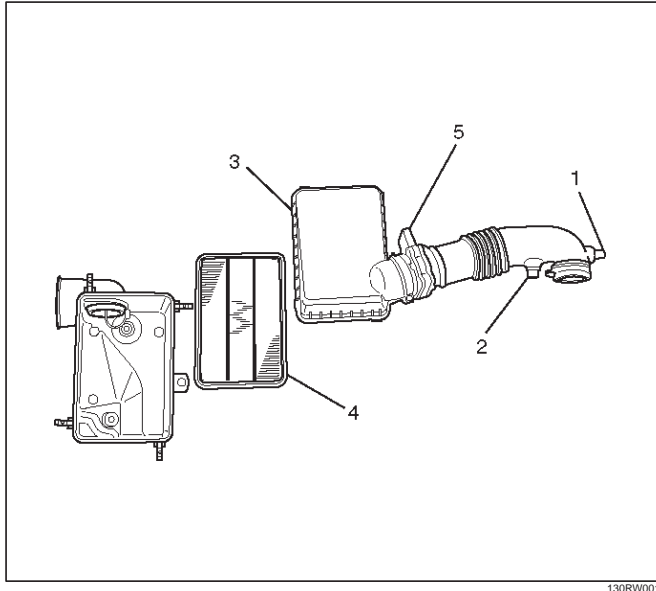
Installation

1. Install exhaust manifold and tighten bolts to the specified torque.
Torque : 57 N·m (5.8 Kg-m/42 lb ft)
2. Install the EGR pipe, tighten bolt and nut on exhaust manifold to specified torque.
Torque : 28 N·m (2.9 Kg-m/21 lb ft)
Tighten nut to EGR valve to the specified torque.
Torque : 44 N·m (4.5 Kg-m/33 lb ft)
Tighten the bolt for EGR pipe bracket to specified torque.
Torque : 25 N·m (2.5 Kg-m/18 lb ft)
3. Install heat protector
4. Install exhaust front pipe and tighten three stud nuts and two nuts to the specified torque.
Torque:
Stud nuts: 67 N·m (6.8 Kg-m/49 lb ft)
Nuts: 43 N·m (4.4 Kg-m/32 lb ft)
5. Install the torsion bar and readjust the vehicle height. Refer to installation and vehicle height adjustment procedure for Front Suspension.

Crankshaft Pulley

Removal

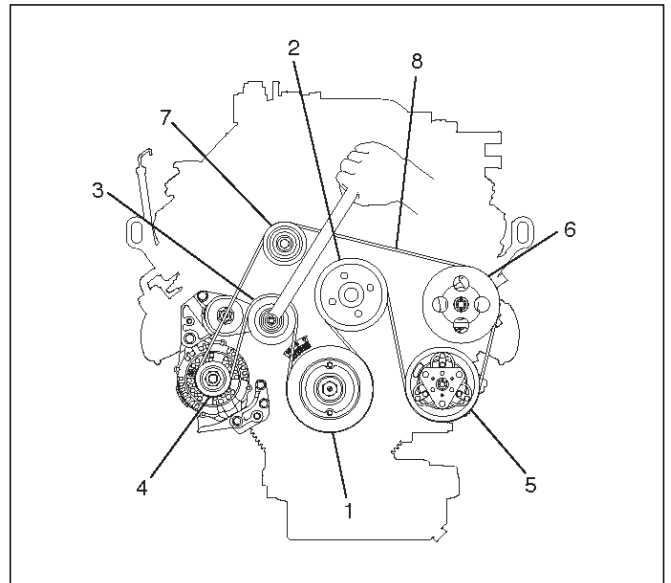
1. Disconnect battery ground cable.
2. Remove air cleaner assembly.



Legend

- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Cleaner Element
- (5) Mass Air Flow Sensor

3. Remove radiator upper fan shroud from radiator.
4. Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



Legend

- (1) Crankshaft Pulley
- (2) Cooling Fan Pulley
- (3) Tensioner
- (4) Generator
- (5) Air Conditioner Compressor
- (6) Power Steering Oil Pump
- (7) Serpentine Belt

5. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
6. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley then remove center bolt and pulley.

Installation

1. Install crankshaft pulley using J-8614-01 crankshaft holder, hold the crankshaft pulley and tighten center bolt to the specified torque.

Torque : 167 N·m (17.0 Kg·m/123 lb ft)

2. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (2.2 Kg·m/16 lb ft) for fan pulley and fan bracket.

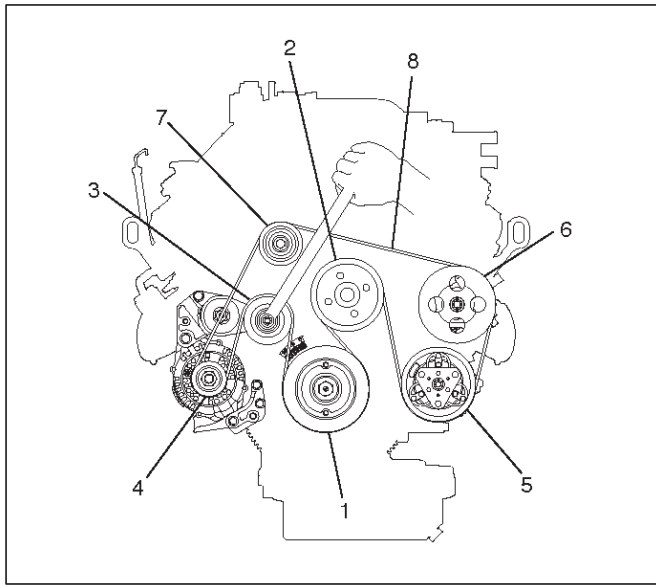
Torque : 10 N·m (1.0 Kg·m/88.5 lb in) for fan and clutch assembly.

3. Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator upper fan shroud.
5. Install air cleaner assembly.

Timing Belt

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.
3. Remove radiator upper fan shroud from radiator.
4. Move drive belt tensioner to loose side using wrench then remove drive belt.



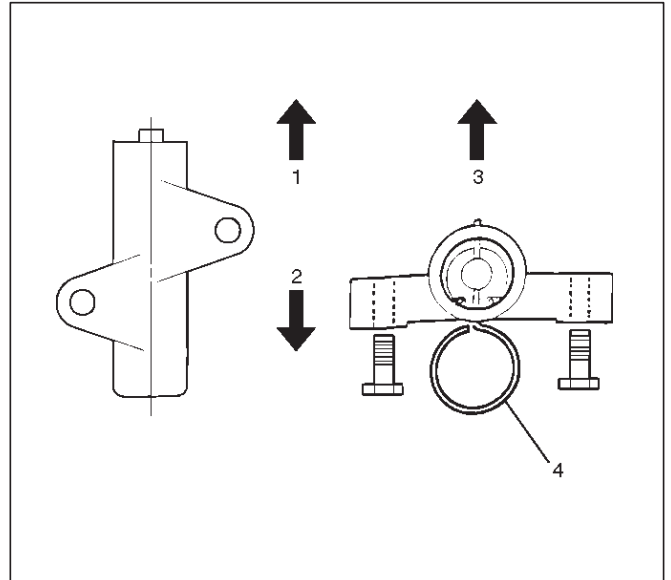
850RW001

Legend

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

5. Remove cooling fan assembly four nuts, then the cooling fan assembly.
6. Remove cooling fan drive pulley assembly.
7. Remove idle pulley assembly.
8. Remove serpentine belt tensioner assembly.
9. Remove power steering pump assembly.
10. Remove crankshaft pulley assembly using 5-8840-0133-0 crankshaft holder, hold crankshaft pulley remove center bolt, then the pulley.
11. Remove right side timing belt cover then left side timing belt cover.
12. Remove lower timing belt cover
13. Remove pusher.

CAUTION: The pusher prevents air from entering the oil chamber. Its rod must always be facing upward.



014RW011

Legend

- (1) Up Side
- (2) Down Side
- (3) Direction For Installation
- (4) Locking Pin

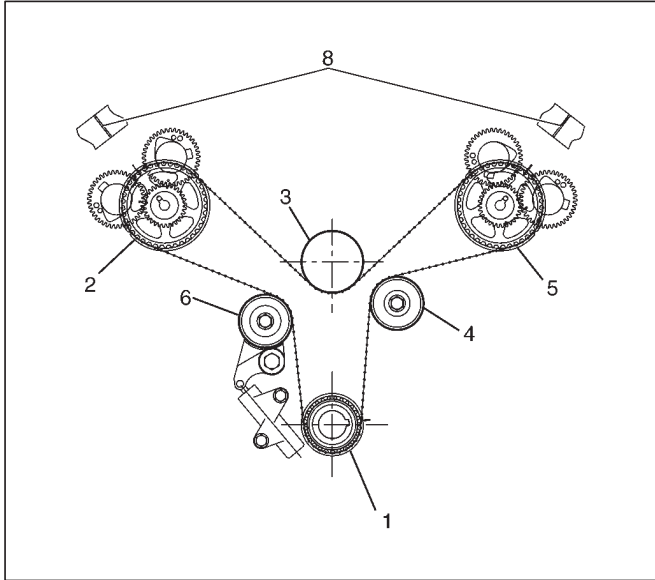
14. Remove timing belt.

CAUTION:

1. Do not bend or twist the belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm.
2. Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.
3. Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.
4. Store timing belt in a cool and dark place. Never expose the belt direct sunlight or heat.

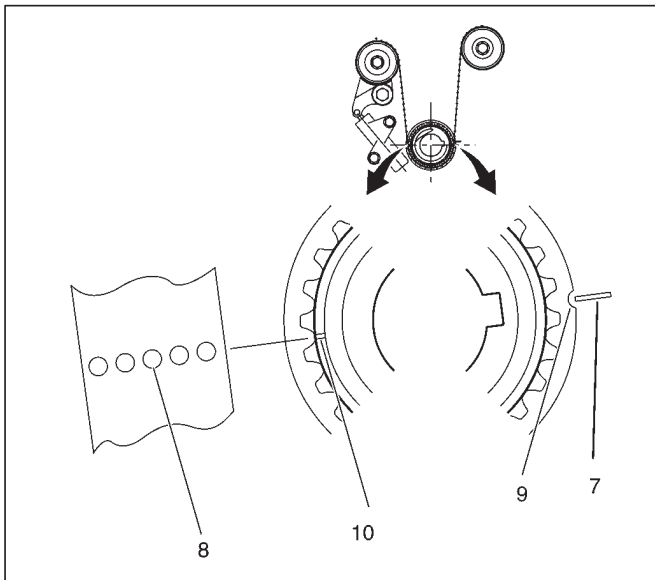
Installation

NOTE: For correct belt installation, the letter on the belt must be able to be read as viewed from the front of the vehicle.



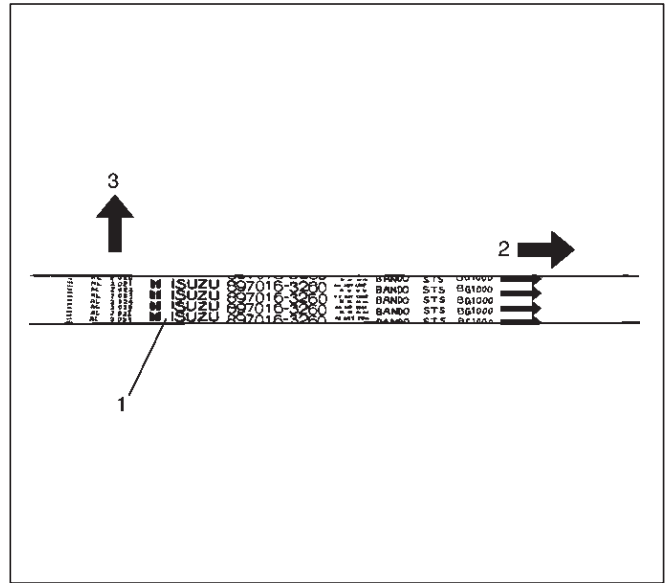
Legend

- (1) Crankshaft Timing Pulley
- (2) RH Bank Camshaft Drive Gear Pulley
- (3) Water Pump Pulley
- (4) Idle Pulley
- (5) LH Bank Camshaft Drive Gear Pulley
- (6) Tension Pulley



Legend

- (7) Alignment Mark on Oil Pump.
- (8) Alignment Mark on Timing Belt
- (9) Alignment Mark (notch) on Crankshaft Timing Pulley.
- (10) Alignment Mark (groove) on Crankshaft Timing Pulley.



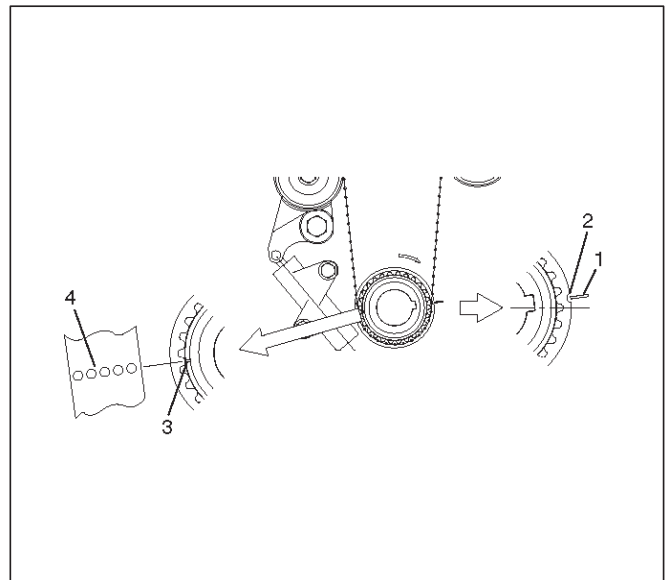
Legend

- (1) Timing Belt
- (2) Engine Rotation Direction
- (3) Cylinder Head Side

1. Install timing belt.

1. Align the mark (notch) of crankshaft timing pulley (2) with mark on oil pump (1).
Align the mark (groove) on the crankshaft timing pulley (3) with alignment mark (white dots line) on the timing belt (4).

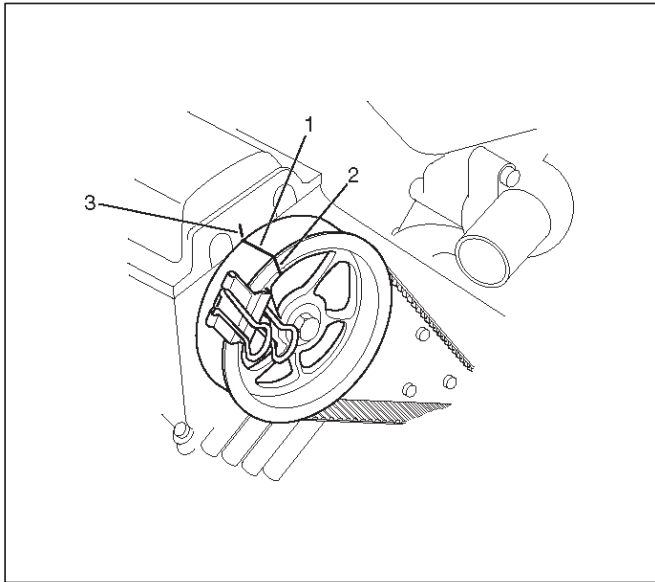
NOTE: When timing marks are aligned, No.2 piston will be on Top Dead Center.



Legend

- (1) Alignment Mark on Oil Pump
- (2) Groove on Crankshaft Timing Pulley
- (3) Alignment Mark on Crankshaft Timing Pulley
- (4) Alignment Mark on Timing Belt

2. Align the alignment mark on the RH bank camshaft drive gear pulley (2) to the alignment mark of the cylinder head cover RH (3).
3. Align the alignment mark (white line) on the timing belt (1) with alignment mark on the RH bank camshaft drive gear pulley (2) (on the left side as viewed from the front of the vehicle) and put the timing belt on the camshaft drive gear pulley.
Secure the belt with a double clip or equivalent clip.



014RW0004

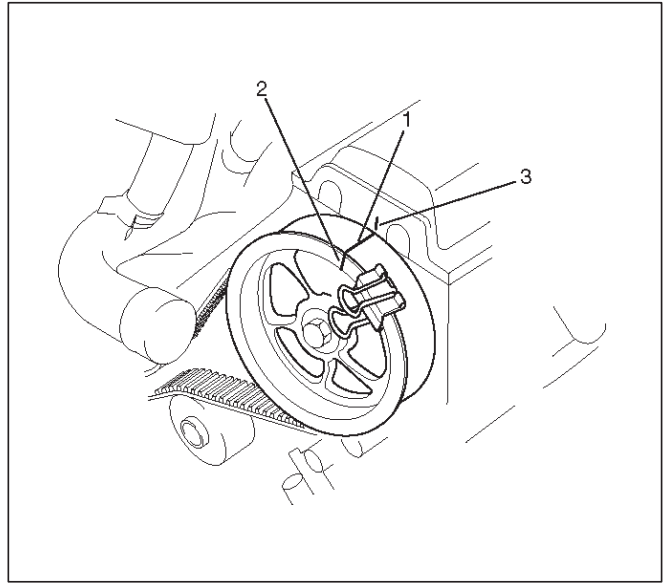
Legend

- (1) Alignment Mark on Timing Belt (White line).
- (2) Alignment Mark on Camshaft Drive Gear Pulley.
- (3) Alignment Mark on Cylinder Head Cover RH.

4. Align the alignment mark on the LH bank camshaft drive gear pulley (2) to the alignment mark of the cylinder head cover LH (3).
5. Align the alignment mark (white line) on the timing belt (1) with the alignment mark on the LH bank camshaft drive gear pulley (2).

When aligning the timing marks, use a wrench to turn the camshaft drive gear pulley, then set the timing mark between timing belt and camshaft drive gear pulley and put the timing belt on the camshaft drive gear pulley.
Secure the belt with a double clip or equivalent clip.

NOTE: It is recommended for easy installation that the belt be secured with a double clip or equivalent clip after it is installed the timing belt to each pulley.



014RW0005

Legend

- (1) Alignment Mark on Timing Belt (White line).
- (2) Alignment Mark on Camshaft Drive Gear Pulley.
- (3) Alignment Mark on Cylinder Head Cover LH.

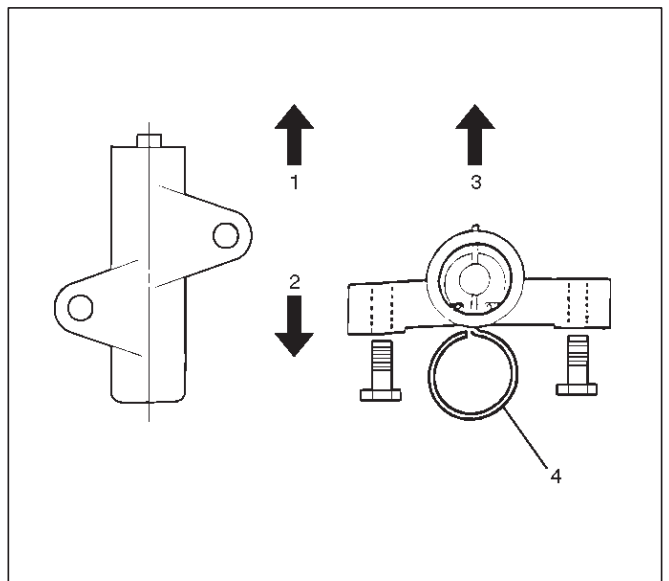
6. Install crankshaft pulley temporarily and tighten center bolt by hand (do not use a wrench).
Turn the crankshaft pulley clockwise to give some belt slack between the crankshaft timing pulley and the RH bank camshaft drive gear pulley.

2. Install pusher and tighten bolt to the specified torque.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)

1. Install the pusher while pushing the tension pulley to the belt.
2. Pull out pin from the pusher.

NOTE: When reusing the pusher, press the pusher with approximately 100Kg to retract the rod, and insert a pin (1.4 mm piano wire).



014RW011

6A-32 ENGINE MECHANICAL

Legend

- (1) Up Side
- (2) Down Side
- (3) Direction for Installation
- (4) Locking Pin

3. Remove double clips or equivalent clips, from timing belt pulleys.

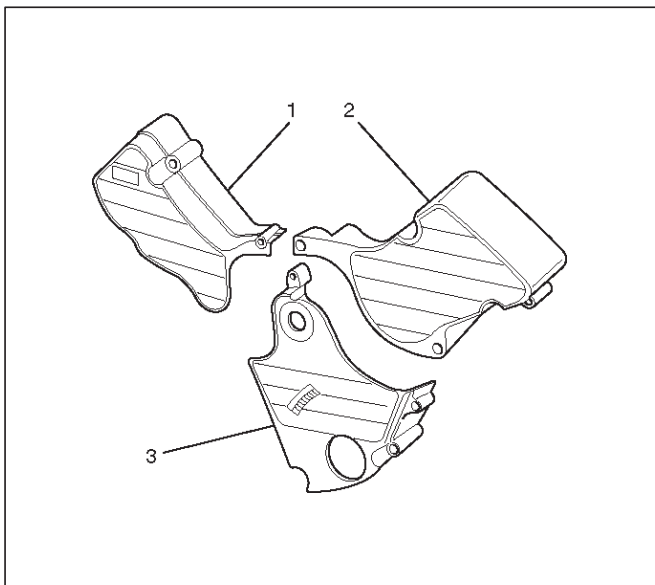
Turn the crankshaft pulley clockwise by two turns.

3. Install timing belt cover.

Remove crankshaft pulley that was installed in step 1 item 5.

Tighten bolts to the specified torque.

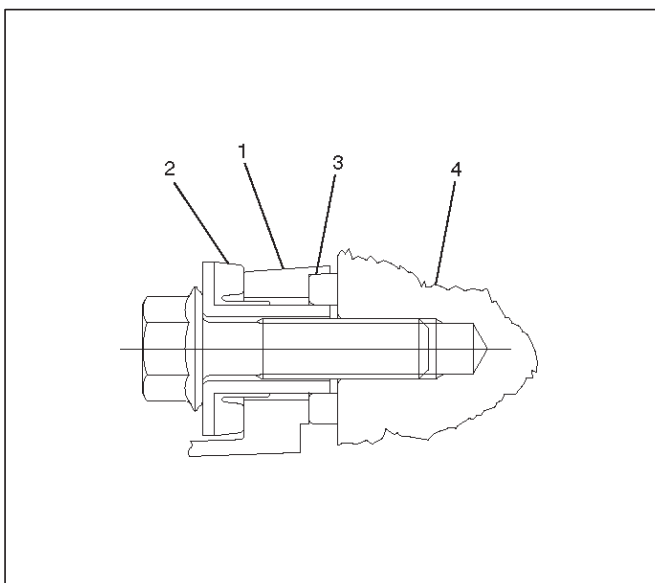
Torque: 19 N-m (1.9 Kg-m/14 lb ft)



020RW004

Legend

- (1) Timing Belt Cover RH
- (2) Timing Belt Cover LH
- (3) Timing Belt Cover Lower



020RW003

Legend

- (1) Timing Belt Cover
- (2) Rubber Bushing
- (3) Sealing Rubber
- (4) Cylinder Body

4. Install crankshaft pulley using 5-8840-0133-0, hold the crankshaft pulley and tighten center bolt to the specified torque.

Torque : 167 N-m (17.0 Kg-m/123 lb ft)

5. Install fan pulley bracket and tighten fixing bolts to the specified torque.

Torque : 22 N-m (2.2 Kg-m/16 lb ft)

6. Install power steering pump assembly and tighten to the specified torque.

Torque :

M8 bolt : 22 N-m (2.2 Kg-m/16 lb ft)

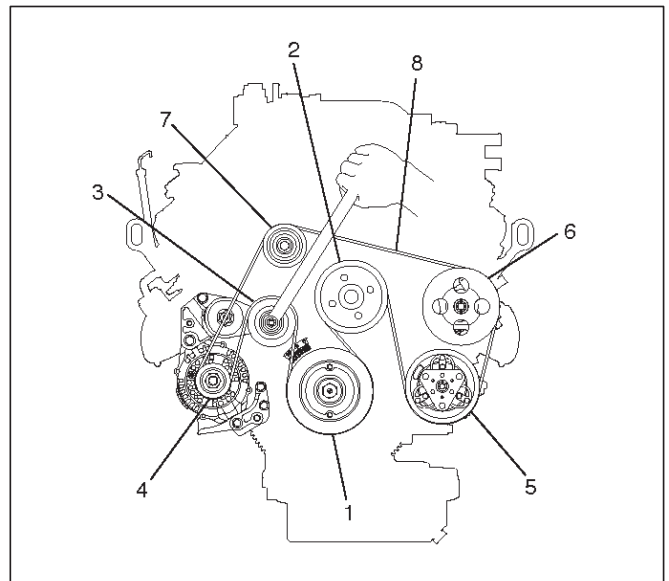
M10 bolt : 46 N-m (4.7 Kg-m/34 lb ft)

7. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N-m (2.2 Kg-m/16 lb ft) for fan pulley and fan bracket.

Torque : 10 N-m (1.0 Kg-m/88.5 lb in) for fan and clutch assembly.

8. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



850RW001

Legend

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

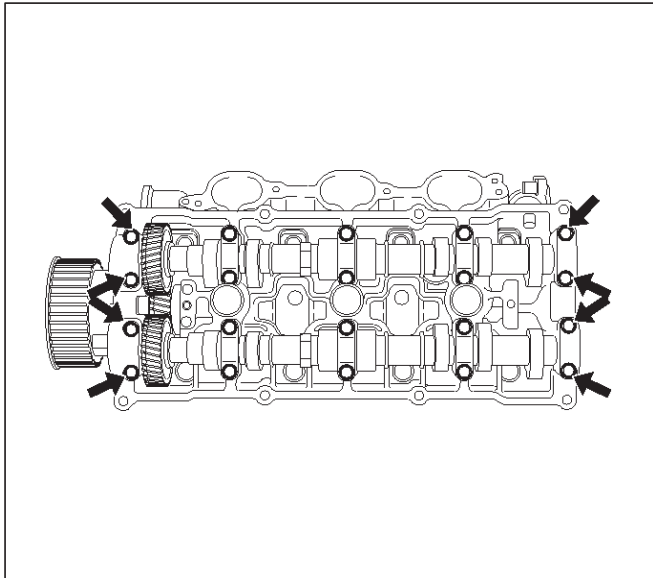
9. Install radiator upper fan shroud.

10. Install air cleaner assembly.

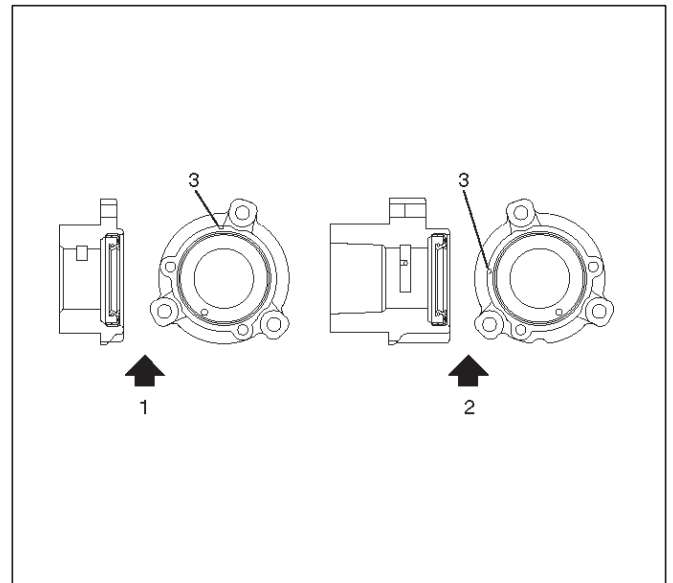
Camshaft

Removal

1. Disconnect battery ground cable.
2. Remove crankshaft pulley.
 - Refer to removal procedure for Crankshaft Pulley in this manual.
3. Remove timing belt.
 - Refer to removal procedure for Timing Belt in this manual.
4. Remove cylinder head cover LH.
 - Refer to removal procedure for Cylinder Head Cover LH in this manual.
5. Remove cylinder head cover RH.
 - Refer to removal procedure for Cylinder Head Cover RH in this manual.
6. Remove twenty fixing bolts from inlet and exhaust camshaft bracket on one side bank, then camshaft brackets.



7. Remove camshaft assembly.
8. Remove fixing bolt for camshaft drive gear pulley.
9. Remove three fixing bolts from camshaft drive gear retainer, then camshaft drive gear assembly.



Legend

- (1) Right Bank
- (2) Left Bank
- (3) Timing Mark on Retainer

Installation

1. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

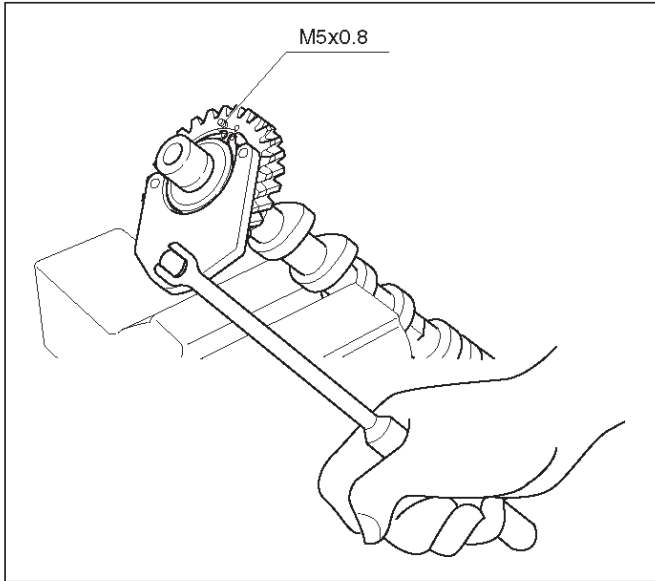
Torque : 10 N·m (1.0 Kg·m/89 lb in)

2. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

Torque : 98 N·m (10.0 Kg·m/72 lb ft)

3. Tighten sub gear setting bolt.

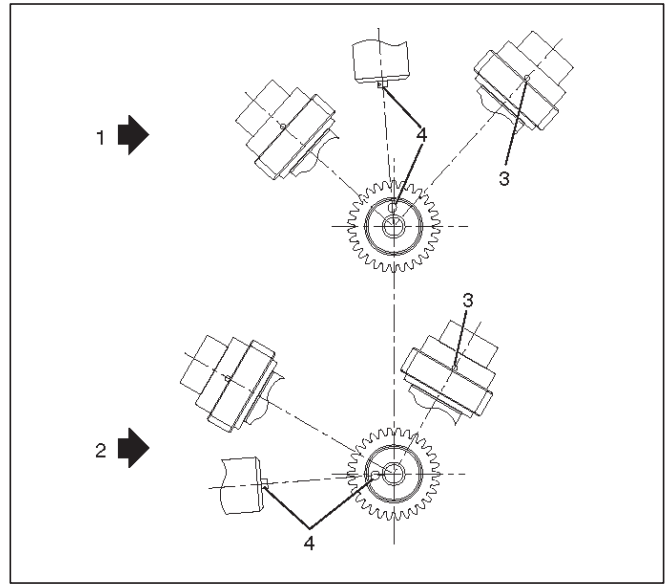
1. Use the 5-8840-2443-0 gear spring lever to turn sub gear to right direction until it aligns with the M5 bolt hole between camshaft driven gear and sub gear.
2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.



014RW041

4. Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.

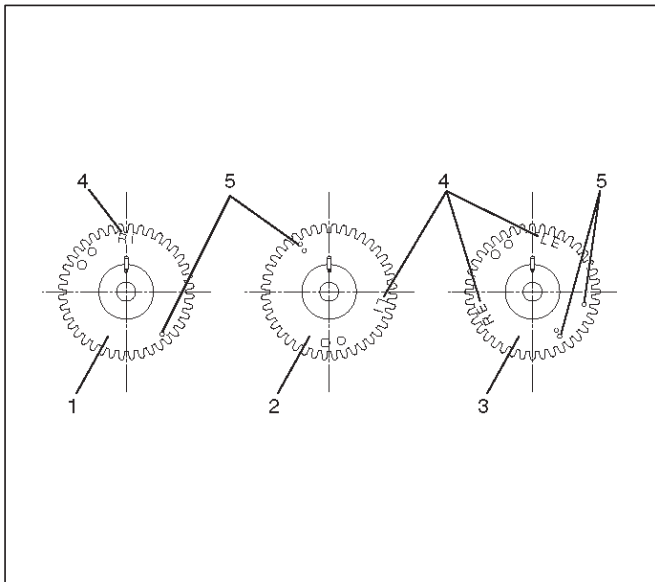
1. Apply engine oil to camshaft journal and bearing surface of camshaft bracket.
2. Align timing mark on intake camshaft (one dot for right bank, two dot for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW023

Legend

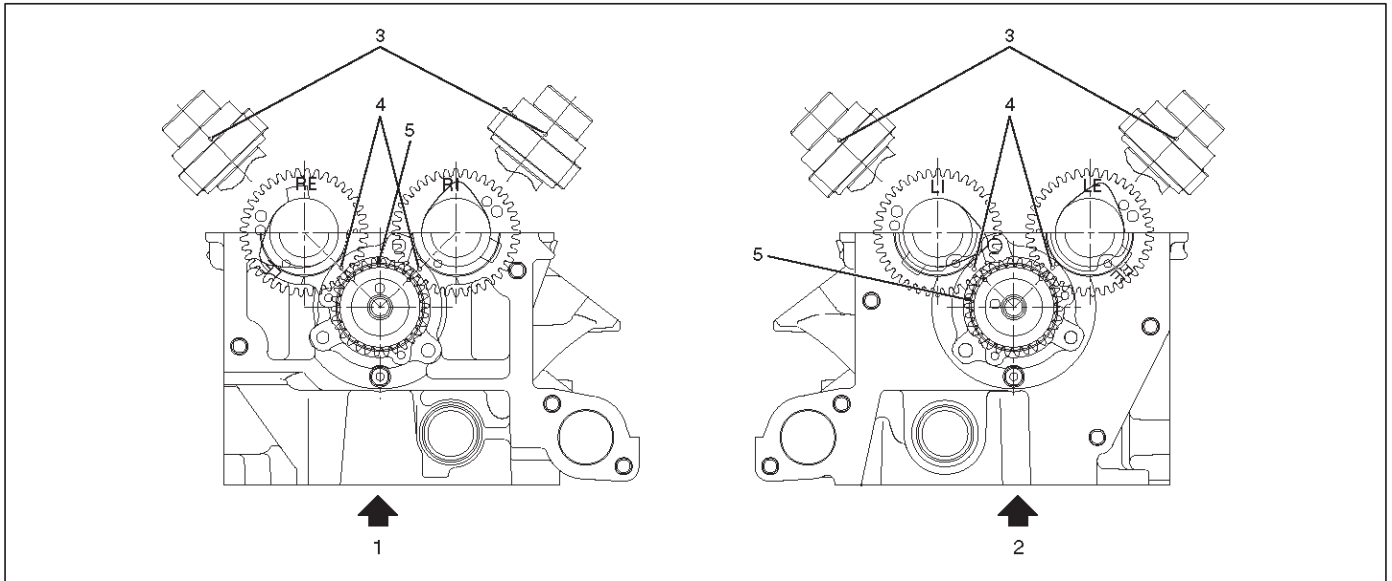
- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin



014RW020

Legend

- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discrimination Mark
(LI: Left bank intake, RI: Right bank intake)
(LE: Left bank exhaust, RE: Right bank exhaust)



014RW024

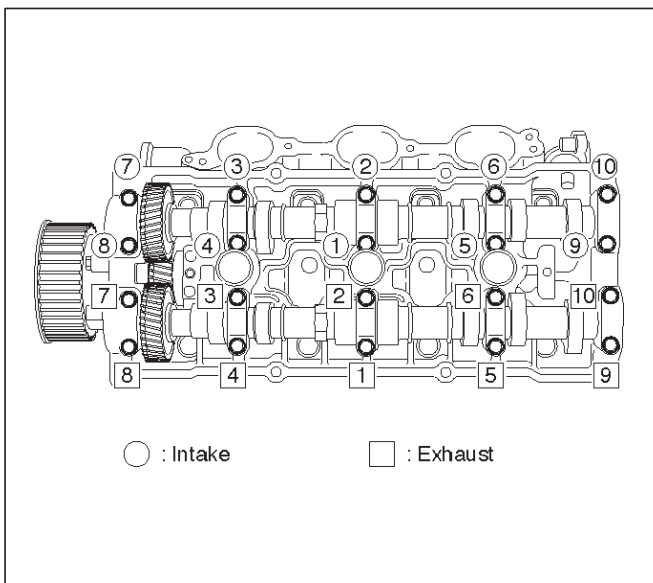
Legend

- (1) Right Bank
- (2) Left Bank

- (3) Alignment Mark on Camshaft Drive Gear
- (4) Alignment Mark on Camshaft
- (5) Alignment Mark on Retainer

- 3. Tighten twenty bolts on numerical order on one side bank as shown in the illustration.

Torque : 10 N·m (1.0 Kg·m/89 lb in)



014RW031

- 5. Install cylinder head cover RH.
 - Refer to installation procedure for CYLINDER HEAD COVER RH in this manual.
- 6. Install cylinder head cover LH.
 - Refer to installation procedure for CYLINDER HEAD COVER LH in this manual.
- 7. Install timing belt.
 - Refer to installation procedure for TIMING BELT in this manual.

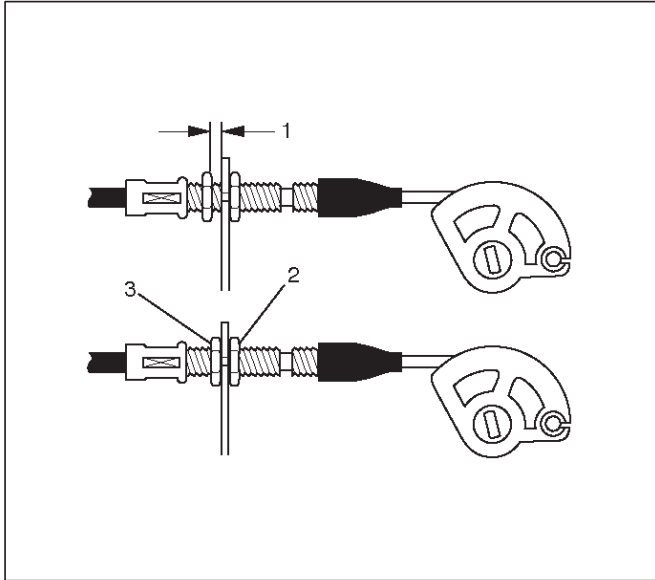
- 8. Install crankshaft pulley.
 - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.
- Accelerator pedal cable adjustment
1. Loosen adjusting nut and lock nut.
 2. Pull outer cable while closing fully the throttle valve.
 3. Tighten adjusting nut and lock nut temporarily.

6A-36 ENGINE MECHANICAL

- Loosen adjusting nut by three turns and tighten lock nut.

Then, manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

If it does not reach the stopper screw, repeat from step 1.



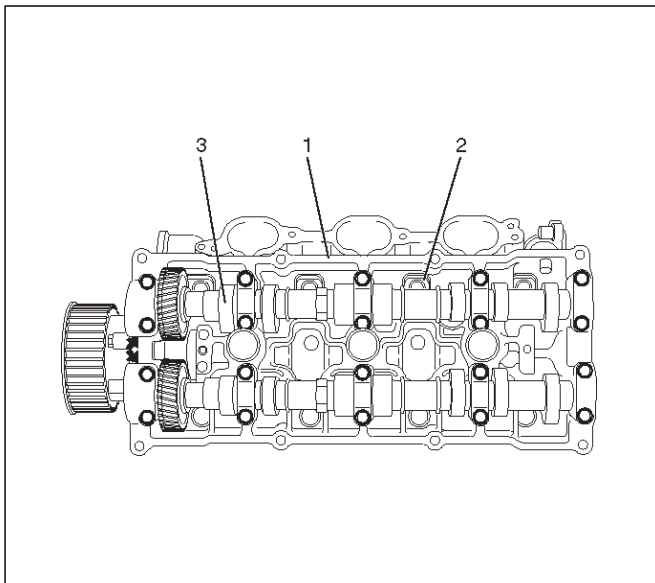
Legend

- (1) Clearance
 - (2) Lock Nut
 - (3) Adjusting Nut
-

Cylinder Head

Removal

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Drain radiator coolant.
4. Drain engine oil.
5. Remove crankshaft pulley.
 - Refer to removal procedure for Crankshaft Pulley in this manual.
6. Remove timing belt.
 - Refer to removal procedure for Timing Belt in this manual.
7. Remove cylinder head cover LH.
 - Refer to removal procedure for Cylinder Head Cover LH in this manual.
8. Remove cylinder head cover RH.
 - Refer to removal procedure for Cylinder Head Cover RH in this manual.
9. Remove common chamber.
 - Refer to removal procedure for Common Chamber in this manual.
10. Remove cylinder head assembly.
 1. Loosen eight bolts for tight cylinder head.
 2. Remove cylinder head assembly.



014RW028

Legend

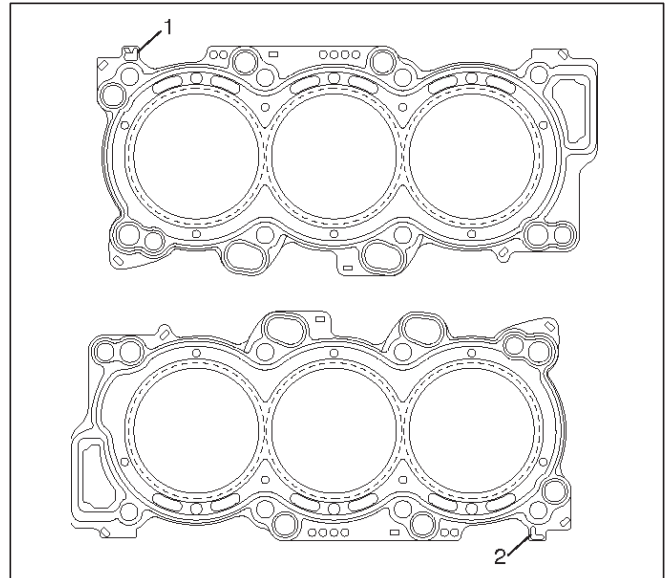
- (1) Cylinder Head
- (2) Cylinder Head Bolt
- (3) Camshaft

Installation

1. Install cylinder head assembly to cylinder block.
 1. Put cylinder head gasket on the cylinder block.

NOTE: There is discrimination mark "R" for right bank and "L" for left bank on the cylinder head gasket as shown in the illustration.

Do not reuse cylinder head gasket.



011RW005

2. Align dowel pin hole to dowel pin on the cylinder block.
3. Tighten two bolts temporarily by hand to prevent the cylinder head assembly from moving.
4. Using 9-8511-4209-0 cylinder head bolt wrench, tighten bolts in numerical order as shown in the illustration to the specified torque.

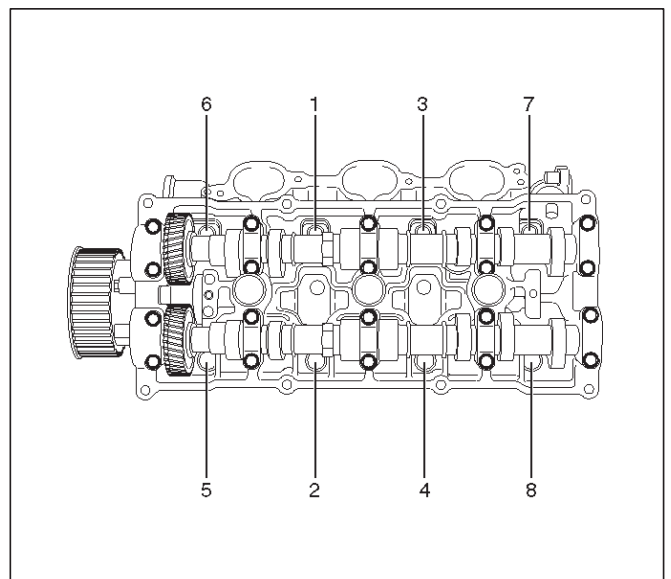
NOTE: Do not reuse cylinder head bolts.

Do not apply any lubricant to the cylinder head bolts.

Torque :

Temporary : 29 N-m (3.0 Kg-m/21 lb ft)

Final : 64 N-m (6.5 Kg-m/47 lb ft)



014RW029

6A-38 ENGINE MECHANICAL

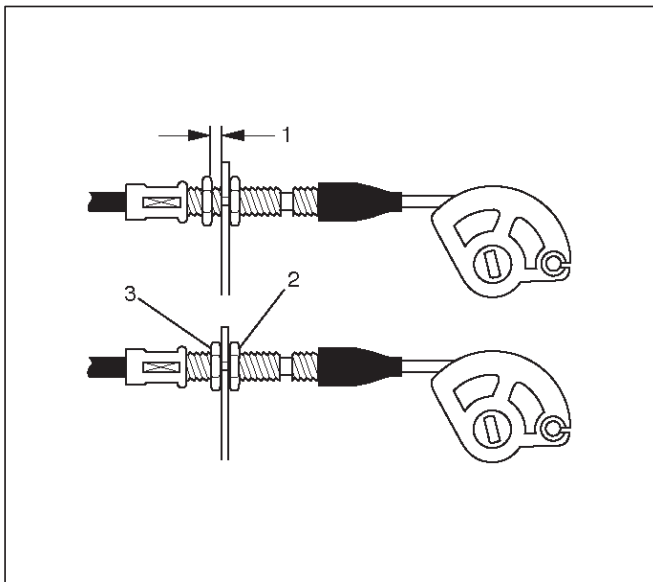
2. Install common chamber.
 - Refer to installation procedure for Common Chamber in this manual.
3. Install cylinder head cover RH.
 - Refer to installation procedure for Cylinder Head Cover RH in this manual.
4. Install cylinder head cover LH.
 - Refer to installation procedure for Cylinder Head Cover LH in this manual.
5. Install timing belt.
 - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
 - Refer to installation procedure for Crankshaft Pulley in this manual.

Accelerator pedal cable adjustment

1. Loosen adjusting nut and lock nut.
2. Pull outer cable while closing fully the throttle valve.
3. Tighten adjusting nut and lock nut temporarily.
4. Loosen adjusting nut by three turns and tighten lock nut.

Then, manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

If it does not reach the stopper screw, repeat from step 1.



Legend

- (1) Clearance
 - (2) Lock Nut
 - (3) Adjusting Nut
-

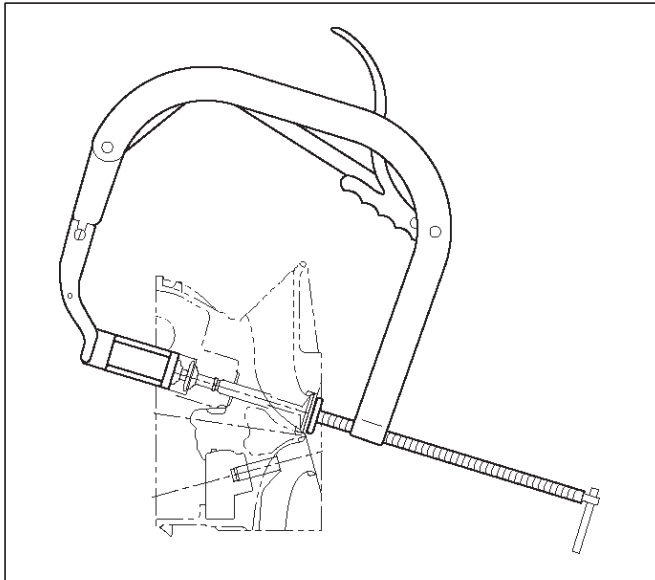
Valve Stem Oil Controller , Valve Spring and Valve Guide

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
 - Drain engine coolant.
3. Remove cylinder head assembly.
 - Refer to removal procedure for Cylinder Head in this manual.
4. Remove camshaft.
 - Refer to removal procedure for Camshaft in this manual.
5. Remove tappets with shim.

NOTE: Do not damage shim surface.

6. Remove valve springs using 5-8840-2446-0 valve spring compressor and 5-8840-2547-0 valve spring compressor adapter then remove upper valve spring seat and lower seat.

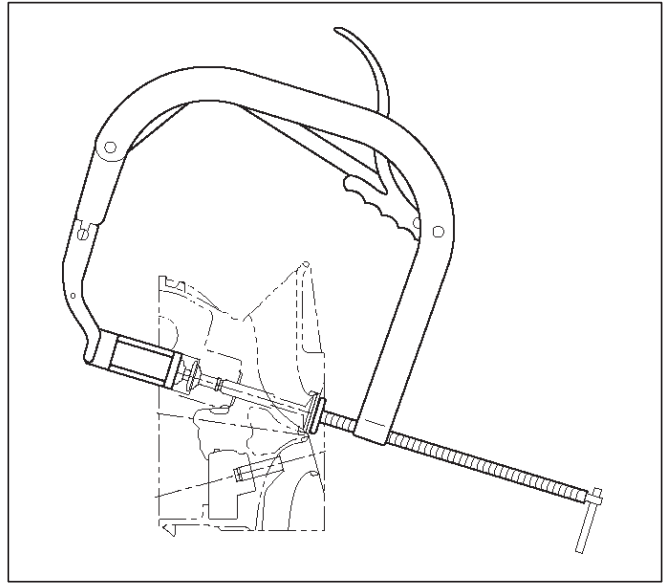


014RW042

7. Remove oil controller using 5-8840-0623-0 oil controller remover, remove each valve stem oil controller.
8. Remove valve guide using 5-8840-2549-0 valve guide replacer.

Installation

1. Install valve guide using 5-8840-2442-0 valve guide installer.
2. Install oil controller using 5-8840-0624-0 oil controller installer.
3. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper valve spring seat, using 5-8840-2446-0 valve spring compressor and 5-8840-2547-0 valve spring compressor adapter to install the split collars.

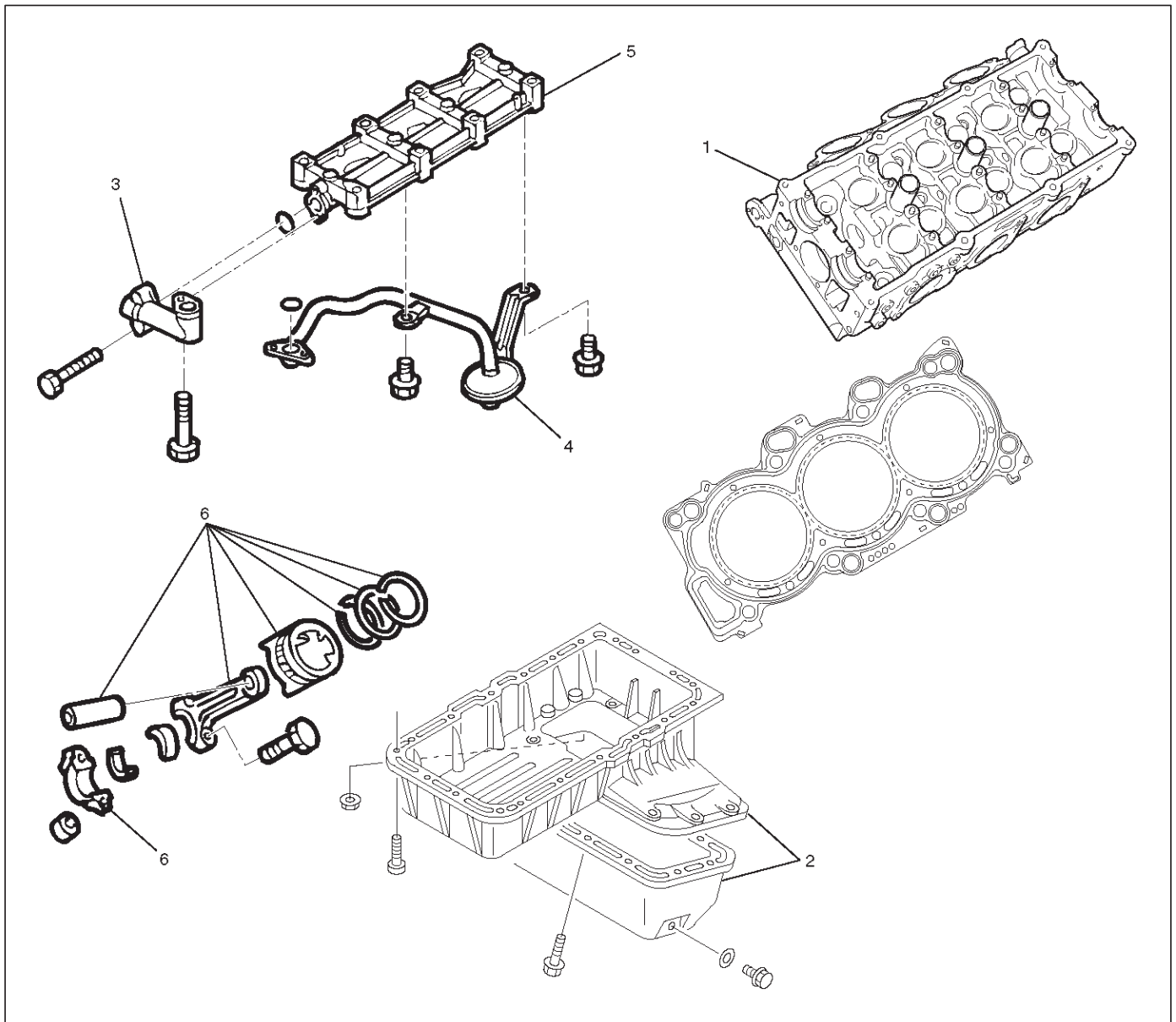


014RW042

4. Install tappet with shim.
5. Install camshaft assembly.
 - Refer to installation procedure for Camshaft in this manual.
6. Install cylinder head assembly.
 - Refer to installation procedure for Cylinder Head in this manual.
7. Fill engine oil until full level.
8. Fill engine coolant.

Piston, Piston Ring and Connecting Rod

Removal



Legend

- (1) Cylinder Head
- (2) Crankcase with Oil Pan
- (3) Oil Pipe

- (4) Oil Strainer
- (5) Oil Gallery
- (6) Piston with Connecting Rod Assembly

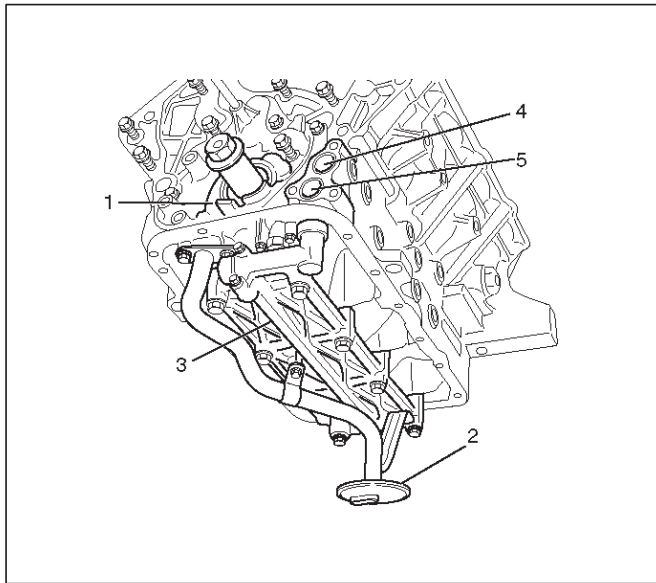
1. Remove cylinder head assembly.

- Refer to removal procedure for Cylinder Head in this manual.

2. Remove crankcase with Oil Pan.

- Refer to removal procedure for Oil Pan and Crankcase in this manual.

3. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.



050RW002

Legend

- (1) Oil Pump
- (2) Oil Strainer
- (3) Oil Gallery
- (4) From Oil Filter
- (5) To Oil Filter

- 4. Remove three fixing bolts, oil pipe with O-ring.
- 5. Remove eight fixing bolts, oil gallery.
- 6. Remove piston with connecting rod assembly, before removing the bearing cap, remove carbon on the top of cylinder bore and push piston with connecting rod out from the top of cylinder bore.

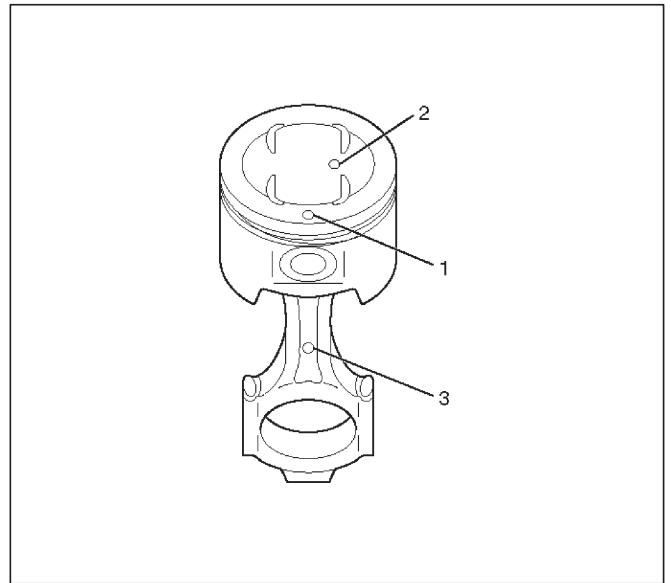
Installation

- 1. Install piston with connecting rod assembly.
 - Apply engine oil to cylinder bore, connecting rod bearing and crank pin. When installing the piston, its front mark must face the engine front side.
 - The bearing cap number must be the same as connecting rod number.
 - Apply engine oil to the thread and seating surface of each nut.
 - Tighten nuts to the specified torque.

Torque : 54 N·m (5.5 Kg·m/40 lb ft)

- After tightening the nuts, make sure that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces and connecting rod bearing fitting surfaces.



015RW003

Legend

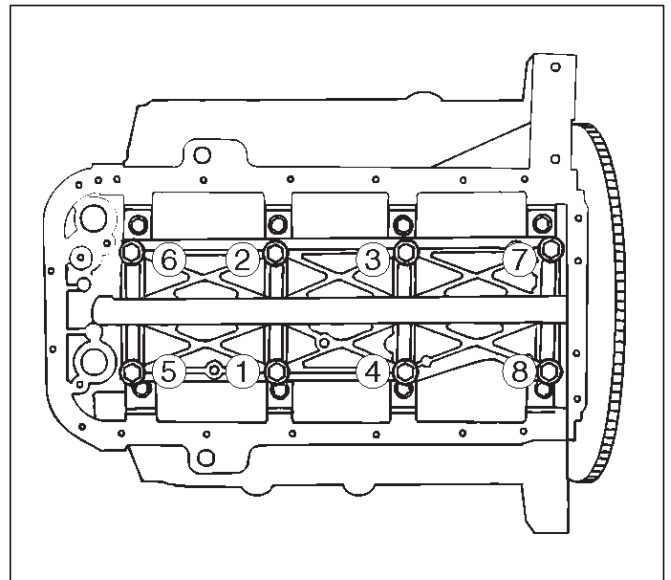
- (1) Piston Front Mark
- (2) Piston Grade
- (3) Connecting Rod Front Mark

2. Install oil gallery and tighten the bolts in two steps, in the order shown in illustration.

Torque :

1st step : 29 N·m (3.0 Kg·m/21 lb ft)

2nd step : 55°-65°



051RS009

3. Install oil pipe with O-ring.

Torque : 10 N·m (1.0 Kg·m/89 lb in)

4. Install oil strainer assembly with O-ring.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)

5. Install crankcase with Oil Pan.

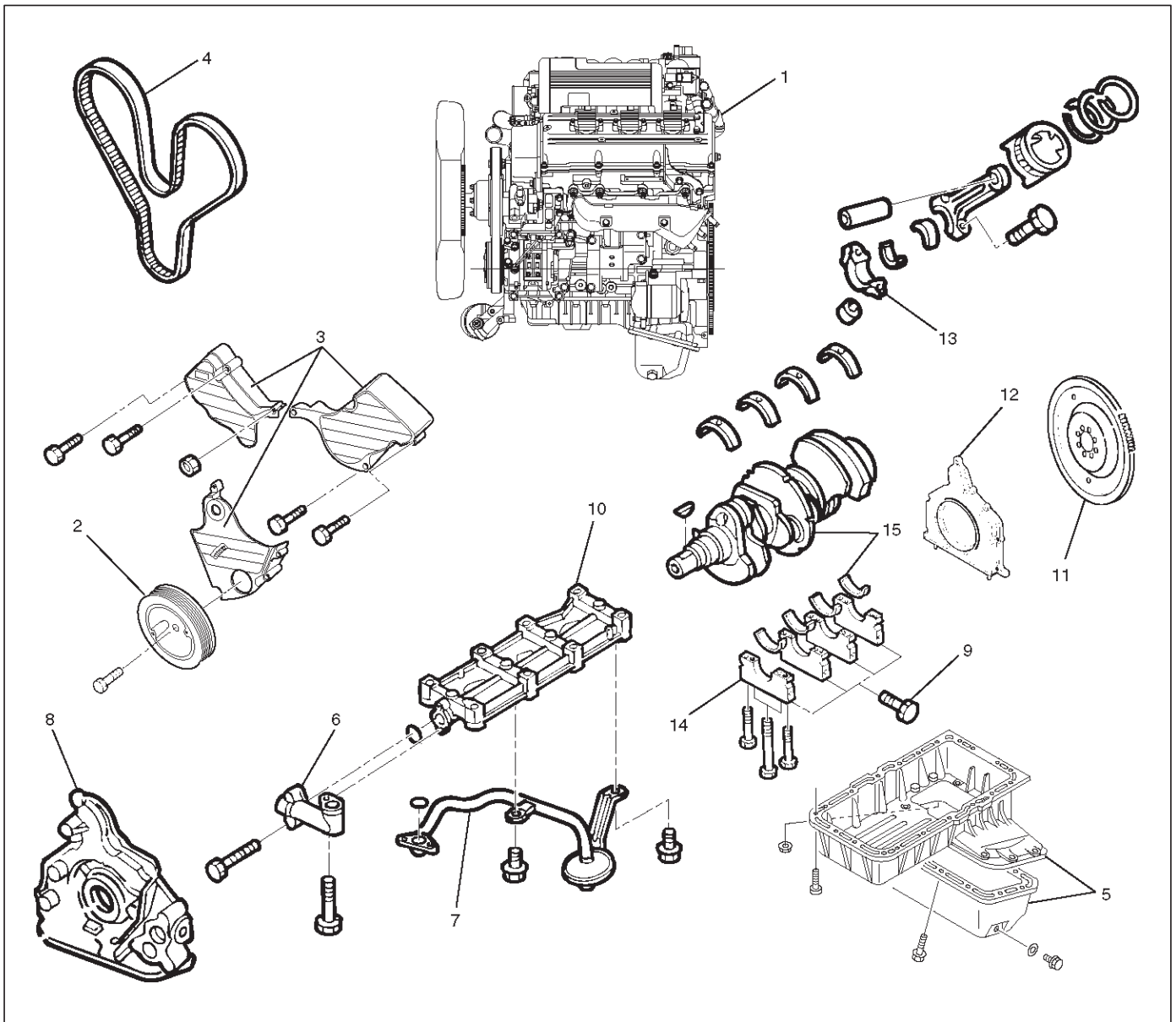
- Refer to installation procedure for Oil Pan and Crankcase in this manual.

6. Install cylinder head assembly.

- Refer to installation procedure for Cylinder Head in this manual.

Crankshaft and Main Bearings

Removal



F06RW010

Legend

- | | |
|----------------------------|----------------------------------|
| (1) Engine Assembly | (8) Oil Pump Assembly |
| (2) Crankshaft Pulley | (9) Cylinder Body Side Bolt |
| (3) Timing Belt Cover | (10) Oil Gallery |
| (4) Timing Belt | (11) Flywheel |
| (5) Crankcase with Oil Pan | (12) Rear Oil Seal Retainer |
| (6) Oil Pipe | (13) Connecting Rod Cap |
| (7) Oil Strainer | (14) Crankshaft Main Bearing Cap |
| | (15) Crankshaft and Main Bearing |

1. Remove engine assembly.

- Refer to removal procedure for Engine Assembly in this manual.

2. Remove timing belt.

- Refer to removal procedure for Timing Belt in this manual.

3. Remove oil pan and crankcase.

- Refer to removal procedure for Oil Pan and Crankcase in this manual.

4. Remove oil pipe with O-ring.

5. Remove oil strainer assembly with O-ring.

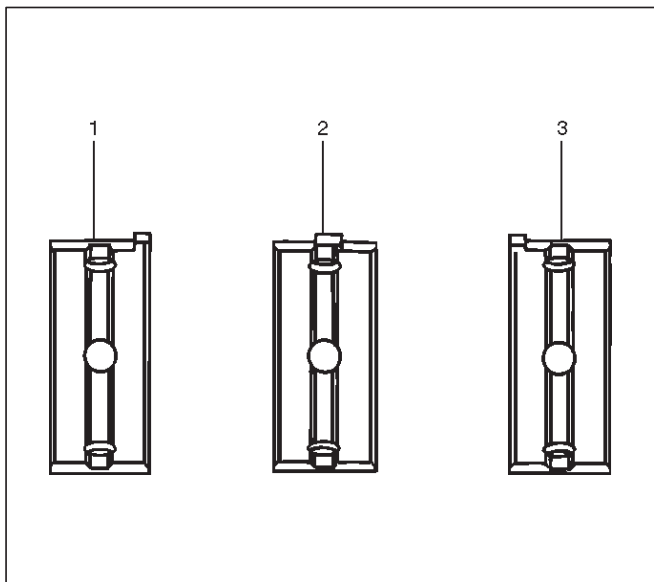
6. Remove oil pump assembly.
 - Refer to removal procedure for Oil Pump in this manual.
7. Remove cylinder body side bolts.
8. Remove oil gallery.
9. Remove flywheel.
10. Remove rear oil seal retainer.
 - Refer to removal procedure for Rear Oil Seal in this manual.
11. Remove connecting rod caps.
12. Remove crankshaft main bearing caps.
13. Remove crankshaft and main bearings.

Installation

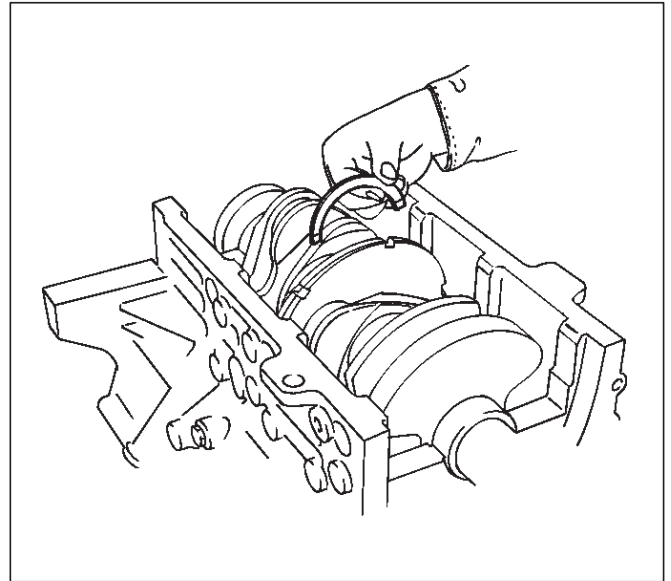
1. Install crankshaft and main bearings.
 - Install main bearing in the cylinder block and main bearing cap respectively.
 - Apply new engine oil to upper and lower main bearings.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Make sure that main bearings are in correct position.
- Install crankshaft with care.
- Apply engine oil to the thrust washer.
- Install thrust washer on No.3 journal.
- Oil grooves in thrust washer must face the crankshaft.



015RS012



015RS013

2. Install crankshaft main bearing caps.
 - Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Install bearing caps in the order of numbers, starting with cylinder block front side.
- Tighten main bearing fixing bolts to the specified torque.

Torque : 39 N·m (4.0 Kg·m/29 lb ft)

- After tightening the bolts, make sure that the crankshaft rotates smoothly.

3. Install connecting rod caps.

- The cap number must be same as connecting rod number.
- Apply engine oil to the thread and seating surface of each nut.
- Tighten nuts to the specified torque.

Torque : 54 N·m (5.5 Kg·m/40 lb ft)

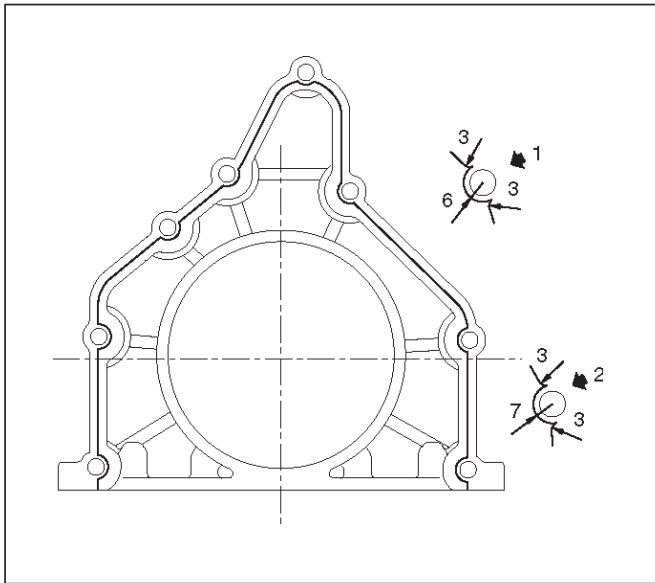
- After tightening the nuts, make sure that the crankshaft rotates smoothly.

4. Install rear oil seal retainer.

- Remove oil on cylinder block and retainer fitting surface.
- Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.

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- The oil seal retainer must be installed within 5 minutes after sealant application before the sealant hardens.



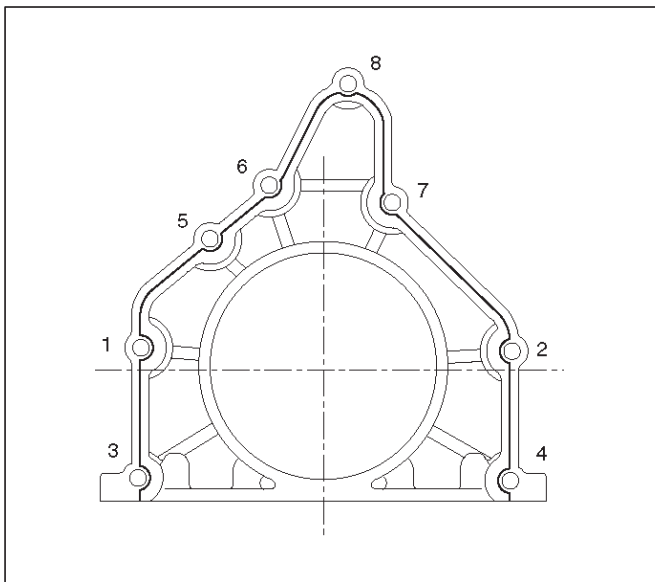
015RW002

Legend

- (1) Around Bolt Holes
- (2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque : 18 N-m (1.8 Kg-m/13 lb ft)



015RW001

5. Install flywheel.

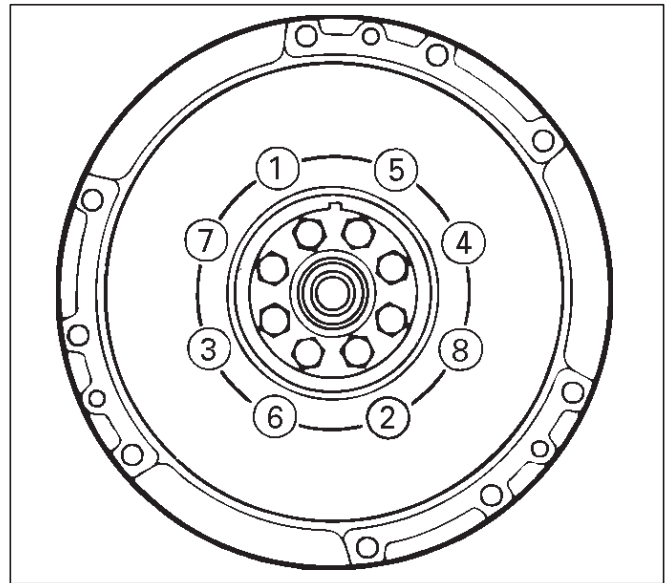
- Clean tapped holes in the crankshaft.
- Remove oil on crankshaft and flywheel fitting surface.

NOTE:

- Do not reuse the bolts.
- Do not apply oil or thread lock to the bolts.

- Tighten fixing bolts to the specified torque.

Torque : 54 N-m (5.5 Kg-m/40 lb ft)



015RS018

6. Install oil gallery.

- Clean contact surface of oil gallery and main bearing cap.
Apply engine oil to oil gallery fixing bolts and tighten the bolts in two steps, in the order shown in illustration.

Torque :

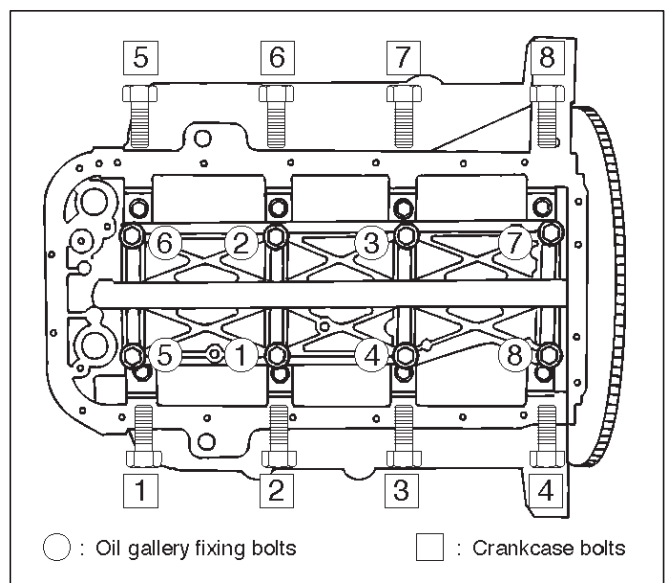
1st step : 29 N-m (3.0 Kg-m/21 lb ft)

2nd step : 55°-65°

- 7. Install cylinder body side bolts and tighten bolts in order to the specified torque.

Torque : 39 N-m (4.0 Kg-m/29 lb ft)

NOTE: Do not apply the oil to the bolts.



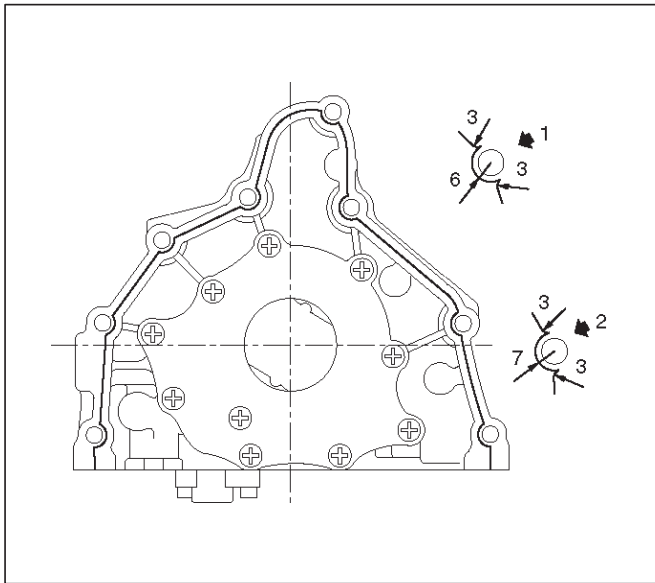
012RS007

8. Install oil pump assembly.

- Remove oil on cylinder block and oil pump mounting surface.

- Apply sealant (TB1207B or equivalent) to the oil pump mounting surface.
- The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.
- Apply engine oil to oil seal lip.
- Install oil pump in the cylinder block and tighten fixing bolts to the specified torque.

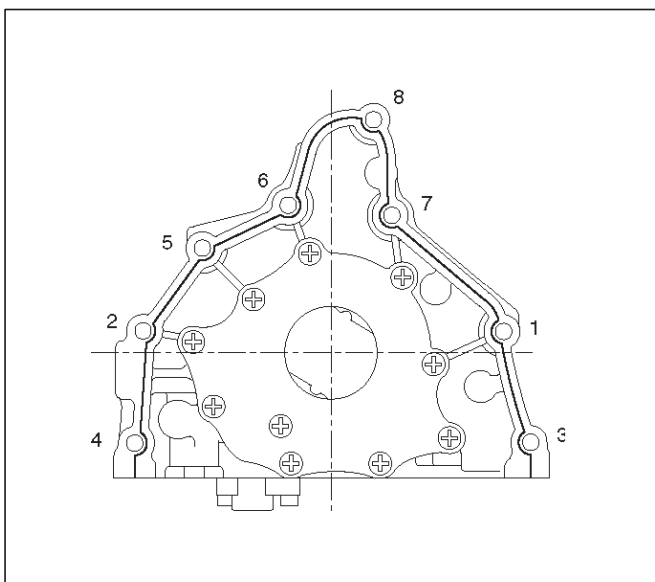
Torque : 25 N·m (2.5 Kg·m/18 lb ft)



051RW002

Legend

- (1) Around Bolt Holes
- (2) Around Dowel Pin



051RW001

9. Install oil strainer with O-ring, tighten to the specified torque.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)

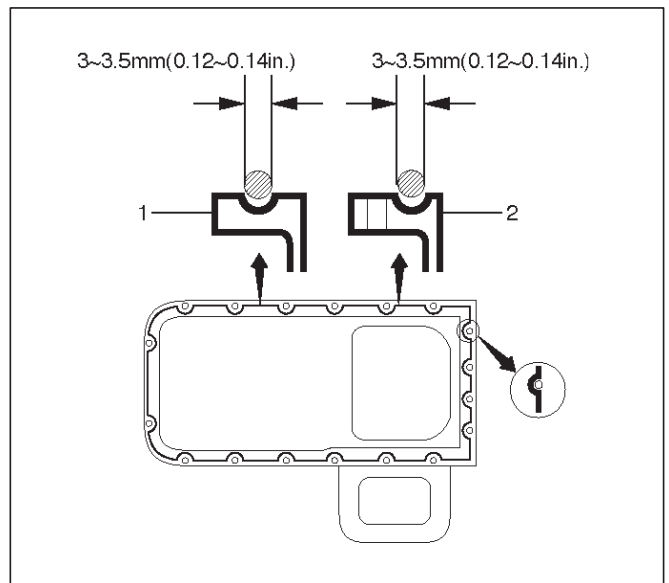
10. Install oil pipe with O-ring, tighten fixing bolts to the specified torque.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)

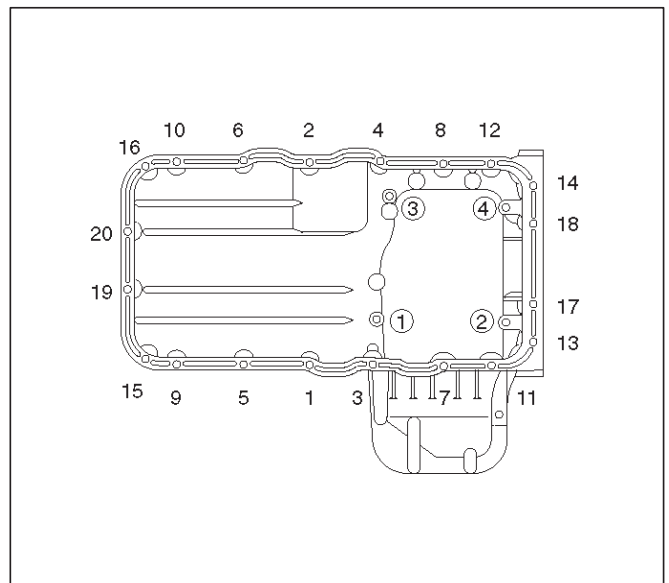
11. Install crankcase.

- Remove oil on crankcase mounting surface and dry the surface.
- Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
- The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.
- Tighten fixing bolts to the specified torque.

Torque : 10 N·m (1.0 Kg·m/89 lb in)



013RW010



013RW004

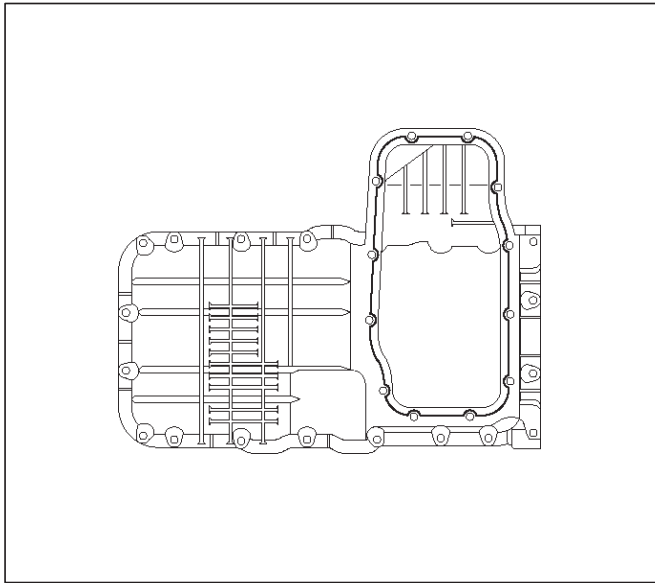
12. Install oil pan

- Remove oil on oil pan mounting surface and dry the surface.
- Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the oil pan mounting surface. The bead must be continuous.
- The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

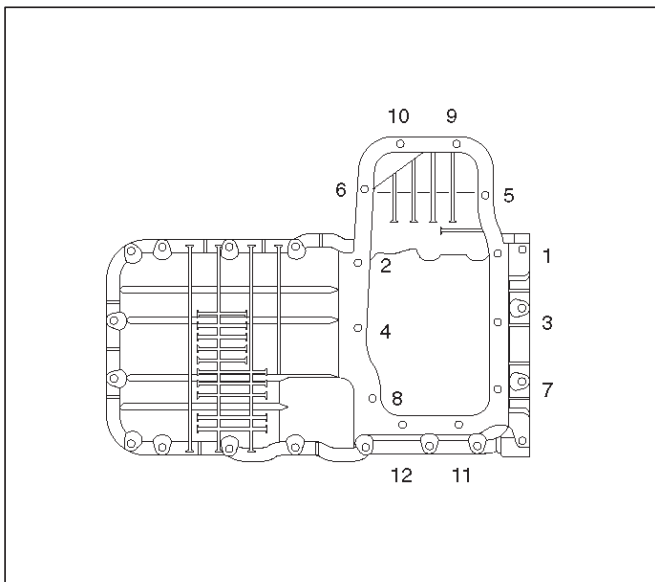
6A-46 ENGINE MECHANICAL

- Tighten fixing bolts to the specified torque.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)



013RW003



013RW002

13. Install timing belt.

- Refer to installation procedure for Timing Belt in this manual.

14. Install engine assembly.

- Refer to installation procedure for Engine in this manual.

Rear Oil Seal

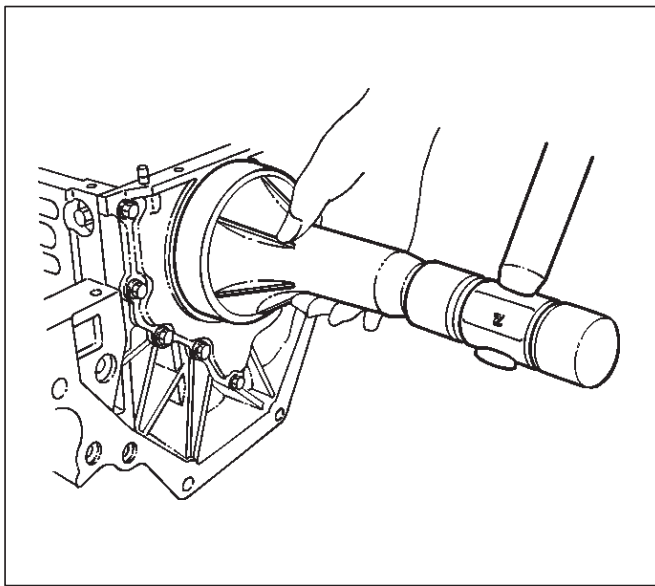
Removal

1. Remove transmission assembly.
 - Refer to removal procedure for Transmission section in this manual.
2. Remove flywheel.
3. Remove rear oil seal using a seal remover.

NOTE: Take care not to damage the crankshaft or oil seal retainer when removing oil seal.

Installation

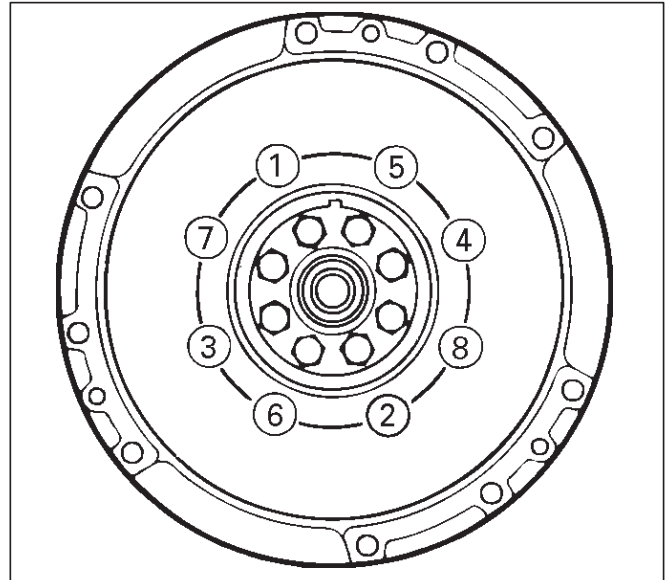
1. Apply engine oil to oil seal lip and install oil seal using 5-8840-2286-0.



2. Install flywheel.
 - Clean tapped holes in the crankshaft.
 - Remove oil on the crankshaft and flywheel mounting surface.
 - Tighten fixing bolts to the specified torque.

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

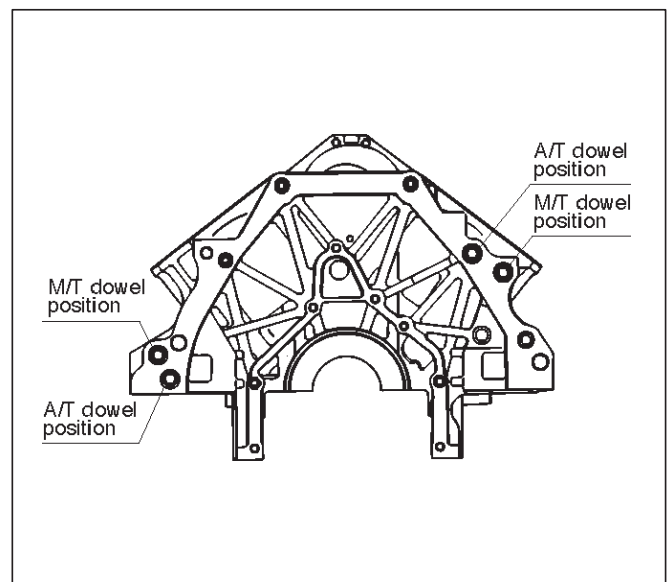
Torque : 54 N·m (5.5 Kg·m/40 lb ft)



3. Install transmission.
 - See Transmission section in this manual.

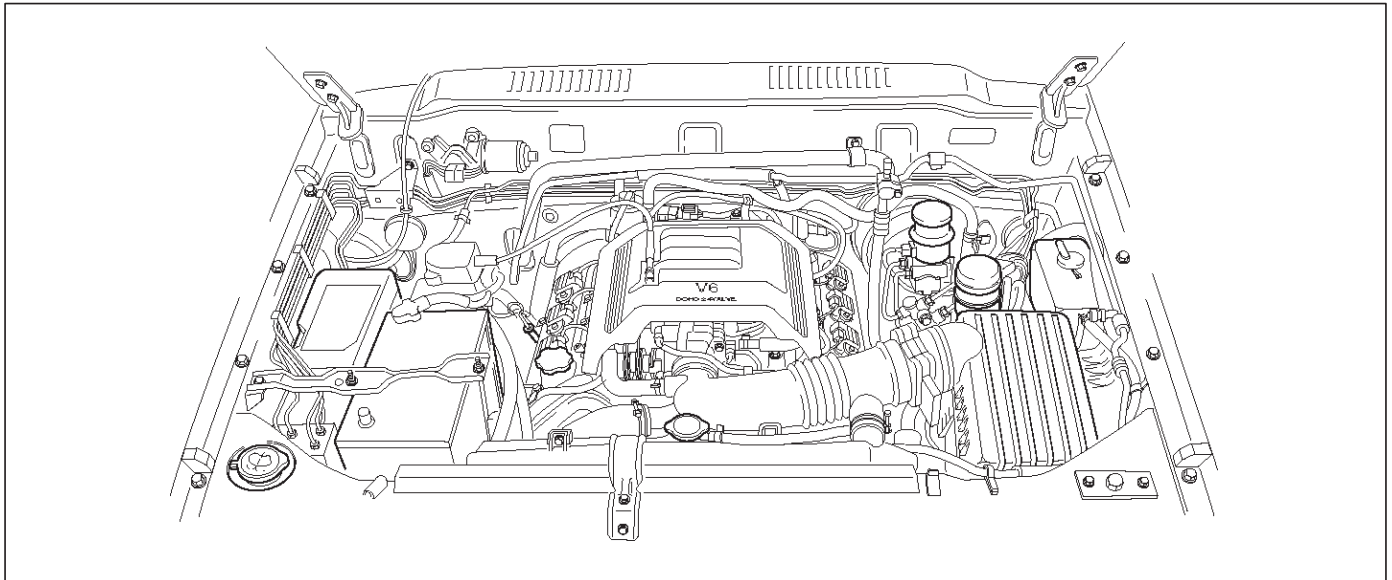
CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side. Take care that dowel positions are different between the manual transmission and the automatic transmission.

Otherwise, the transmission may be damaged.



Engine Assembly

Removal



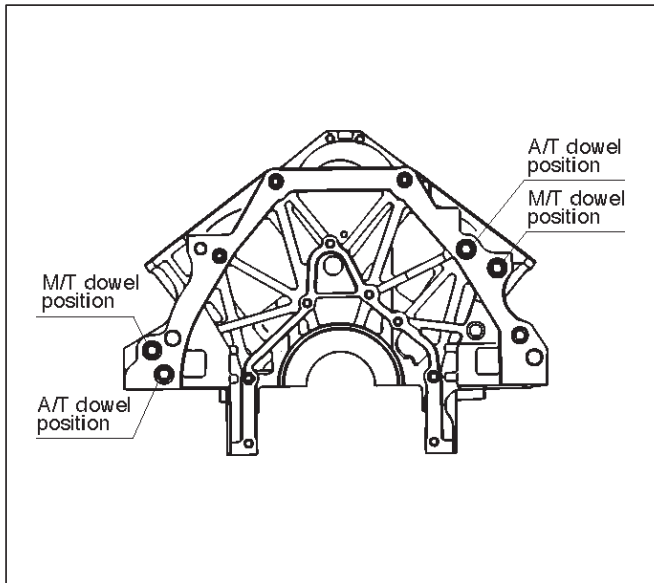
035RW027

1. Disconnect battery ground and positive cable.
 2. Remove battery.
 3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
 4. Remove engine hood.
 5. Drain radiator coolant.
 6. Disconnect accelerator cable and automatic cruise control cable from throttle valve on common chamber.
 7. Disconnect air duct with air cleaner cover.
 8. Remove air cleaner assembly.
 9. Disconnect canister vacuum hose.
 10. Disconnect vacuum booster hose.
 11. Disconnect three engine harness connectors.
 12. Disconnect harness connector to transmission (left front side of engine compartment), disconnect shift on the fly harness connector from front side of front axle and remove transmission harness bracket from engine left side.
 13. Disconnect ground cable between engine and frame.
 14. Disconnect bonding cable connector on the back of right dash panel.
 15. Disconnect bonding cable terminal on the left bank.
 16. Disconnect starter harness connector from starter.
 17. Disconnect generator harness connector from generator.
 18. Disconnect coolant reserve tank hose from radiator.
 19. Remove radiator upper and lower hoses.
 20. Remove upper fan shroud.
 21. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
 22. Move drive belt tensioner to loose side using wrench then remove drive belt.
 23. Remove power steering pump fixing bolts, then power steering pump. Place the power steering pump along with piping on the body side.
 24. Remove air conditioning compressor fixing bolts from bracket and place the compressor along with piping on the body side.
 25. Remove O2 sensor harness connectors from exhaust front pipe.
 26. Remove three exhaust pipe fixing nuts from each bank.
 27. Remove two exhaust pipe fixing nuts from each exhaust pipe, then move exhaust pipe to rear side of vehicle.
 28. Remove flywheel dust covers.
 29. Disconnect two heater hoses from engine.
 30. Disconnect fuel hoses from right side of transmission.
- CAUTION: Plug fuel pipes on engine side and fuel hoses from fuel tank.**
31. Remove transmission assembly. Refer to Transmission section in this manual.
 32. Support the engine by engine hoist.
 33. Remove two left side engine mount fixing bolts from engine mount on chassis side.
 34. Remove two right side engine mount fixing bolts from engine mount on chassis side.
 35. Remove engine assembly.

Installation

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side. Take care that dowel positions are different between the manual transmission and the automatic transmission.

If the engine is assembled in the condition that the dowels have not been mounted in the specified positions, the transmission may be damaged the transmission.



012RS009

1. Install engine assembly. Tighten engine mount fixing bolts to frame to the specified torque.

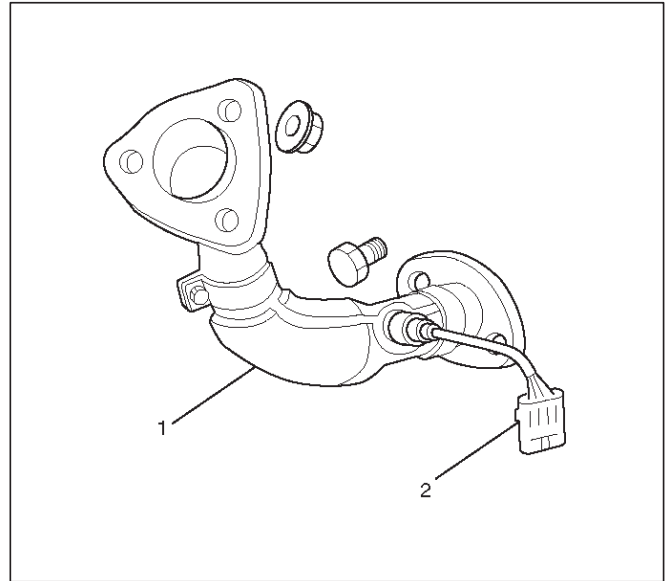
Torque: 41 N·m (4.2 Kg·m/30 lb ft)

2. Reconnect fuel hose to fuel pipe on engine.
3. Install transmission assembly. Refer to Transmission section in this manual.
4. Reconnect two heater hoses to engine.
5. Install flywheel dust covers.
6. Install exhaust pipe and temporarily tighten two (each bank) rear exhaust flange nuts then tighten three stud nuts (each bank) between exhaust manifold and exhaust pipe, finally tighten rear side nuts to the specified torque.

Torque:

Nuts: 43 N·m (4.4 Kg·m/32 lb ft)

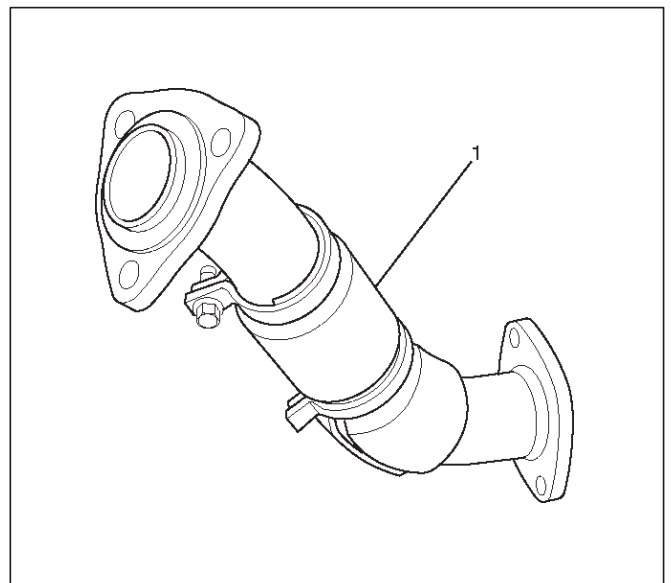
Stud nuts: 67 N·m (6.8 Kg·m/49 lb ft)



150RW061

Legend

- (1) Exhaust Front Pipe RH
- (2) O2 Sensor (for IGM)



150RW062

Legend

- (1) Exhaust Front Pipe LH

7. Reconnect O2 sensor connector.
8. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (2.2 Kg·m/16 lb ft) for fan pulley and fan bracket.

Torque : 10 N·m (1.0 Kg·m/88.5 lb in) for fan and clutch assembly.

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9. Install air conditioner compressor to engine and tighten to the specified torque.

Torque :

M8 bolts : 22 N·m (2.2 Kg·m/16 lb ft)

M10 bolts : 43 N·m (4.4 Kg·m/32 lb ft)

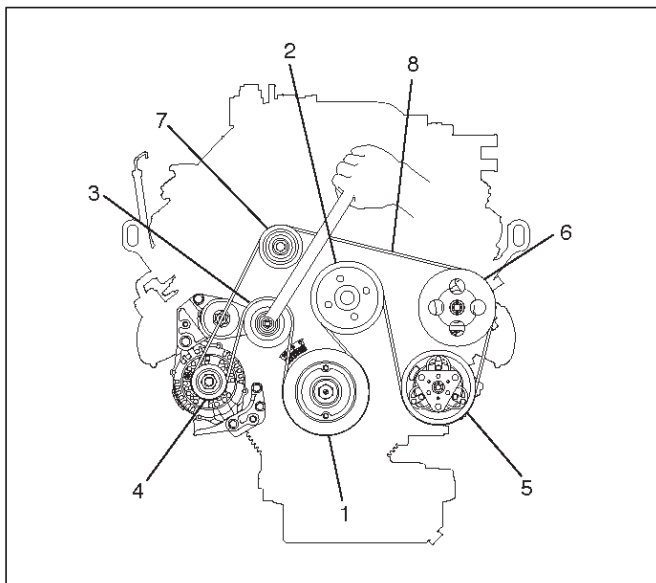
10. Install power steering pump, tighten fixing bolt to the specified torque.

Torque :

M8 bolts : 22N·m (2.2 Kg·m/16 lb ft)

M10 bolts : 46 N·m (4.7 Kg·m/34 lb ft)

11. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



850RW001

Legend

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

12. Install upper fan shroud.

13. Reconnect radiator upper and lower hoses.

14. Reconnect coolant reserve tank hose to radiator.

15. Reconnect generator harness connector.

16. Reconnect starter harness connector.

17. Reconnect bonding cable terminal on left bank

18. Reconnect bonding cable terminal on the back of right dash panel.

19. Reconnect ground cable between engine and chassis.

20. Reconnect harness connector to transmission and install transmission harness bracket on engine left side.

21. Reconnect three engine harness connectors.

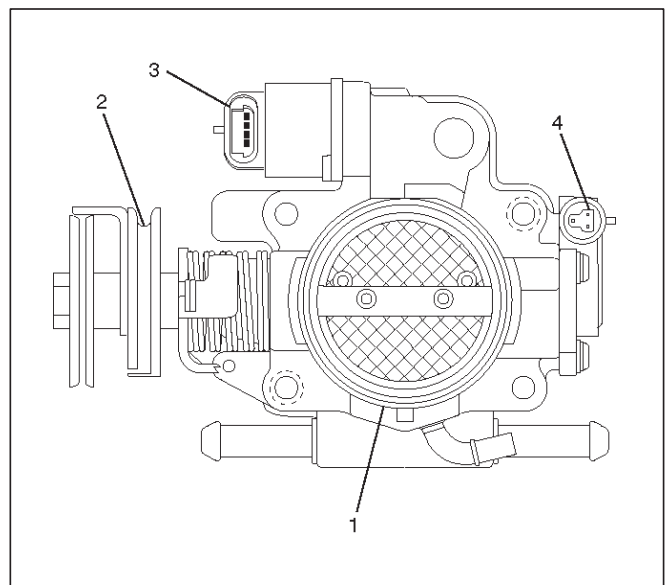
22. Reconnect vacuum booster hose.

23. Reconnect canister vacuum hose.

24. Install air cleaner assembly.

25. Reconnect air duct.

26. Reconnect accelerator cable and automatic cruise control cable to throttle valve on common chamber.



035RW007

Legend

- (1) Throttle Valve Assembly
- (2) Throttle Lever
- (3) Idle Air Control Valve
- (4) Throttle Position Sensor

27. Install engine hood to the original position.

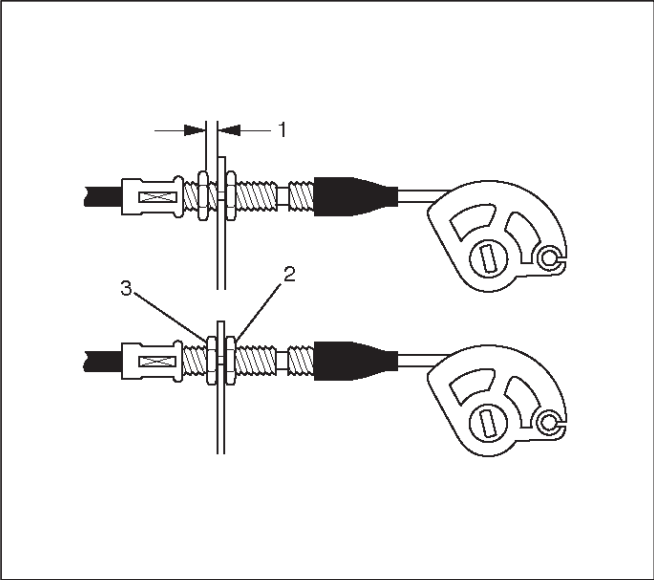
- Refer to installation procedure for Body section in this manual.

Accelerator pedal cable adjustment

- 1. Loosen adjusting nut and lock nut.
- 2. Pull outer cable while fully closing the throttle valve.
- 3. Tighten adjusting nut and lock nut temporarily.
- 4. Loosen adjusting nut by three turns and tighten lock nut.

Then, manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

If it does not reach the stopper screw, repeat from step 1.



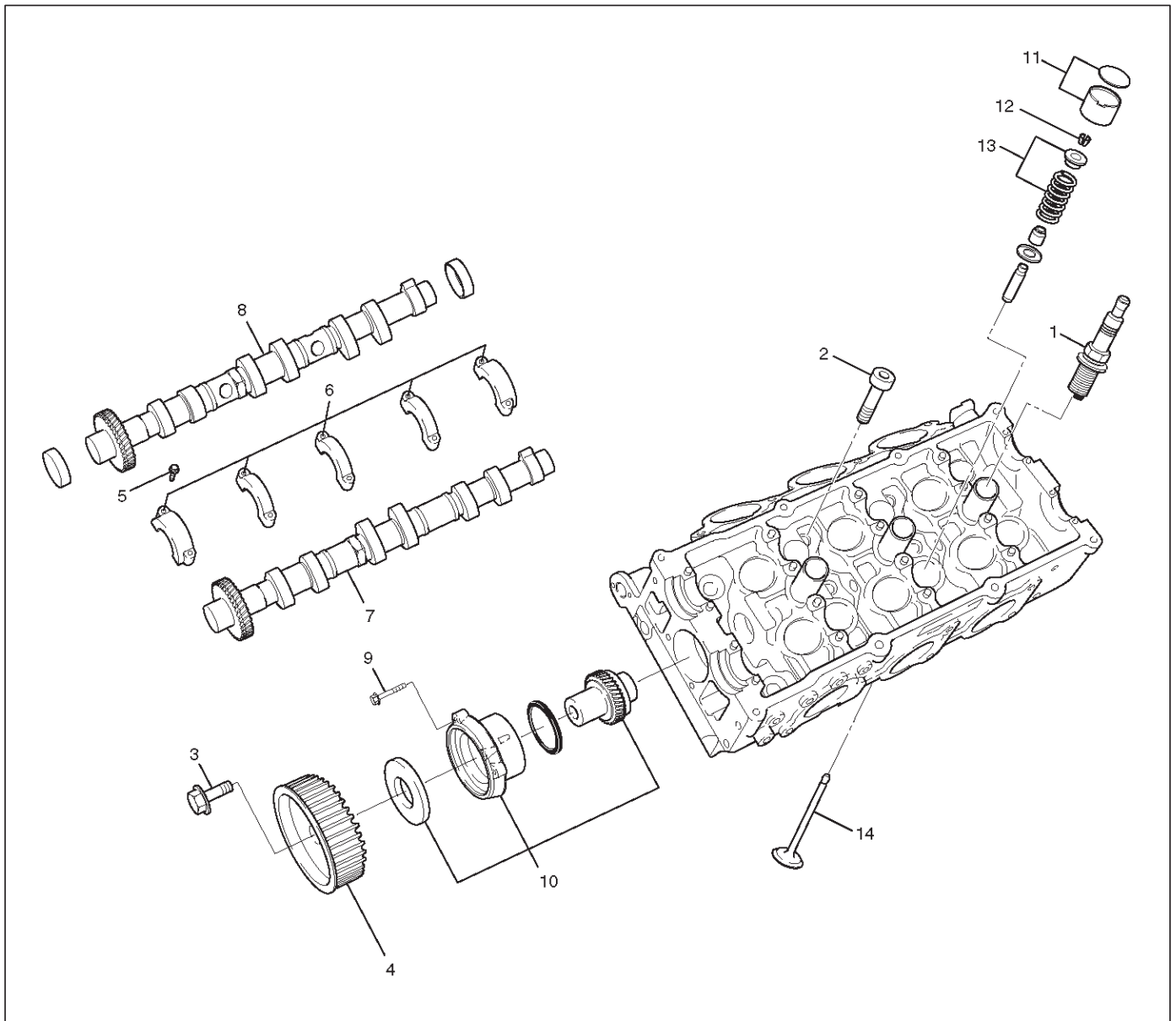
130RW004

Legend

- (1) Clearance
- (2) Lock Nut
- (3) Adjusting Nut

Cylinder Head

Cylinder Head and Associated Parts



011RW008

Legend

- | | |
|--|---|
| (1) Spark Plug | (8) Camshaft Intake |
| (2) Cylinder Head Bolt | (9) Retainer Fixing Bolt |
| (3) Camshaft Drive Gear Pulley Fixing Bolt | (10) Retainer Assembly |
| (4) Camshaft Drive Gear Pulley | (11) Tappet with Shim |
| (5) Camshaft Bracket Fixing Bolt | (12) Split Collar |
| (6) Camshaft Bracket | (13) Valve Spring and Spring Upper Seat |
| (7) Camshaft Exhaust | (14) Valve |

Disassembly

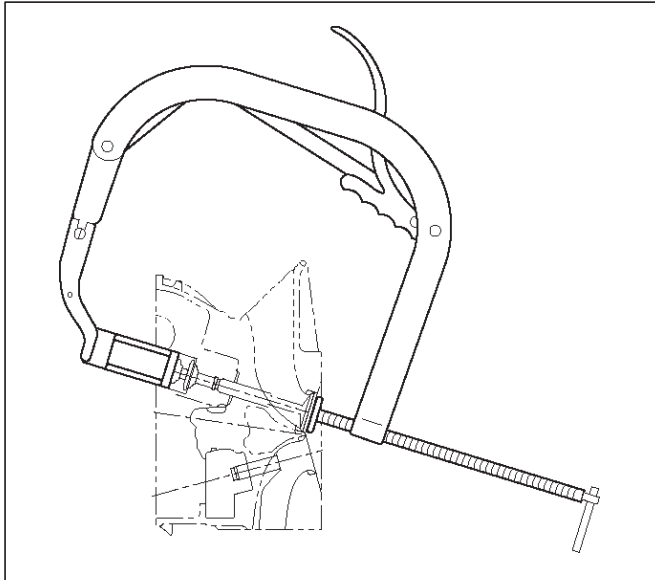
NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.

- Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

1. Remove camshaft drive gear pulley fixing bolt (3), then pulley (4).

2. Remove camshaft bracket fixing bolt (5), camshaft bracket (6), then camshaft exhaust (7), and intake side (8).
3. Remove tappet with shim (11).
4. Use the 5-8840-2446-0 valve spring compressor and 5-8840-2547-0 valve spring compressor adapter to remove the split collar (12), valve spring with upper seat (13) and valve (14).



014RW042

5. Remove spark plug (1).

CAUTION: Do not remove the spark plugs when the head and plugs are hot. Clean dirt and debris from spark plug recess areas before removal.

Clean

Cylinder head

Carefully remove all varnish, soot and carbon from the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

Inspection and Repair

1. Cylinder head gasket and mating surfaces for leaks, corrosion and blow-by. If the gasket has failed, determine the cause.
 - Insufficient torque on head bolts.
 - Improper installation
 - Loose or warped cylinder head
 - Missing dowel pins
 - Warped case surface
2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.

3. Cylinder head deck for corrosion, sand particles in head and porosity.

CAUTION:

- Do not attempt to weld the cylinder head. Replace it.
 - Do not reuse cylinder head bolts.
4. Cylinder head deck, common chamber and exhaust manifold mating surfaces for flatness. These surfaces may be reconditioned by milling. If the surfaces are "out of flat" by more than specification, the surface should be ground to within specifications. Replace the head if it requires machining beyond the repairable limit.

Head surface and manifold surface

Standard: 0.05 mm (0.002 in) or less

Warpage limit: 0.2 mm (0.0079 in)

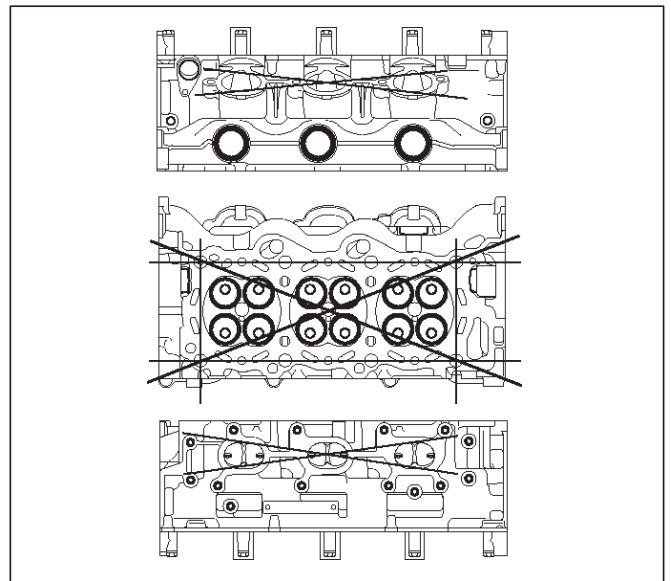
Maximum Repairable limit: 0.2 mm (0.0079 in)

Head height

Standard height : 133.2 mm (5.2441 in)

Warpage limit : 0.2 mm (0.0079 in)

Maximum Repairable limit : 133.0 mm (5.2362 in)



011RW019

5. Water jacket sealing plugs seating surfaces.

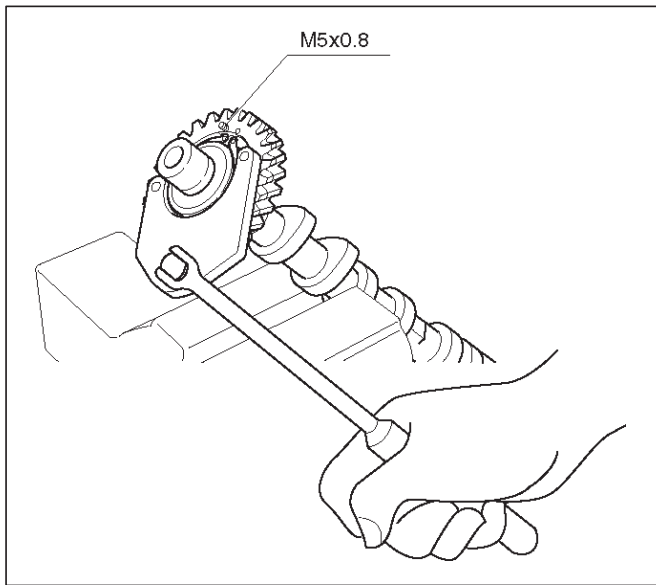
Reassembly

1. Install Spark plug and tighten all the spark plugs to specified torque.

Torque: 18 N-m (1.8 Kg-m/13 lb ft)
2. Tighten sub gear setting bolt.
 1. Use 5-8840-2443-0 gear spring lever to turn sub gear to right direction until the M5 bolt aligns with the hole between camshaft driven gear and sub gear.

6A-54 ENGINE MECHANICAL

- Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving .



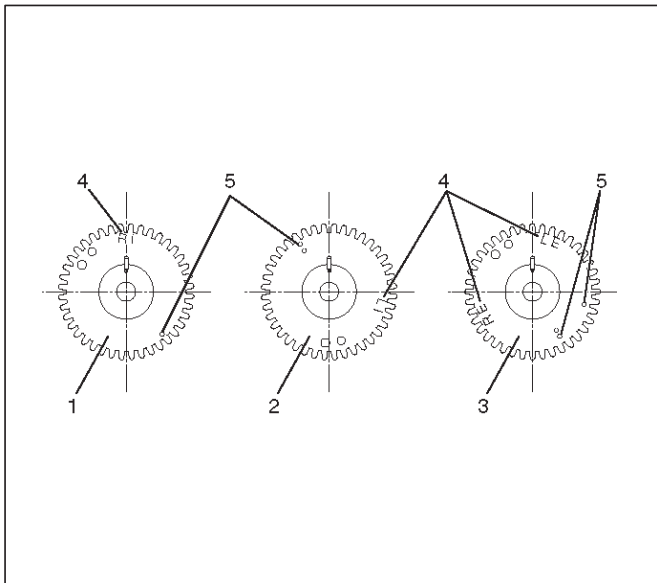
014RW025

- Install camshaft drive gear assembly and tighten three bolts to the specified torque.

Torque: 10 N·m (1.0 Kg·m/89 lb in)

- Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.

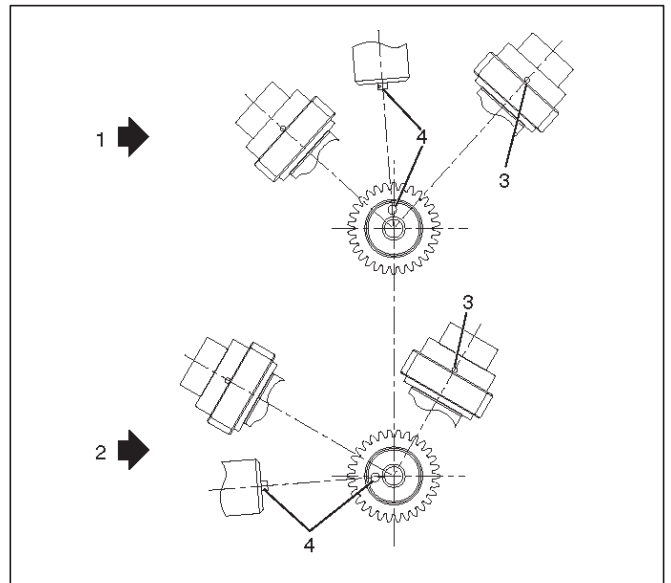
- Apply engine oil to camshaft journal and bearing surface of camshaft bracket.
- Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

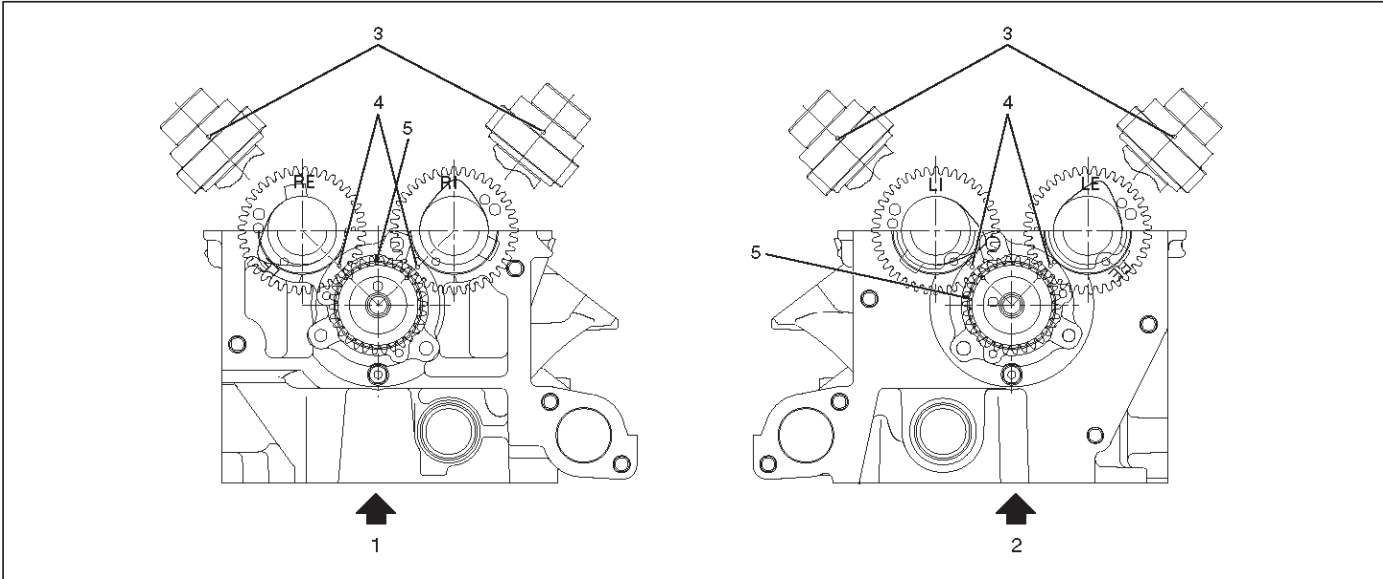
- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discrimination Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



014RW023

Legend

- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin



014RW024

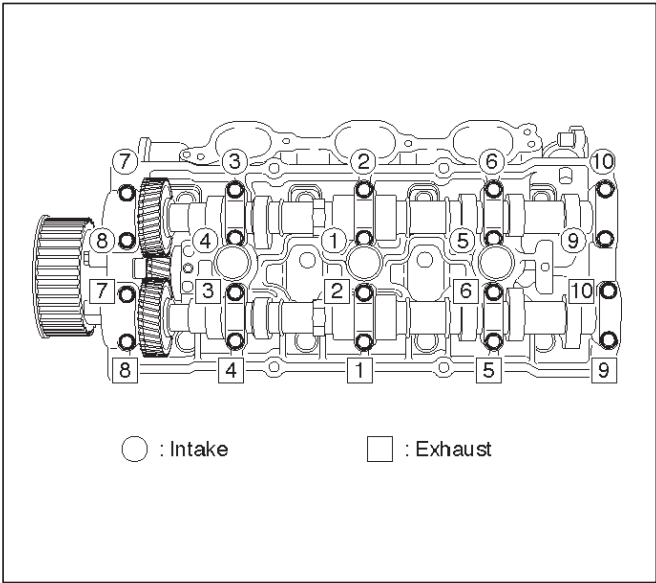
Legend

- (1) Right Bank
- (2) Left Bank

- (3) Alignment Mark on Camshaft Drive Gear
- (4) Alignment Mark on Camshaft
- (5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (1.0 Kg·m/89 lb in)



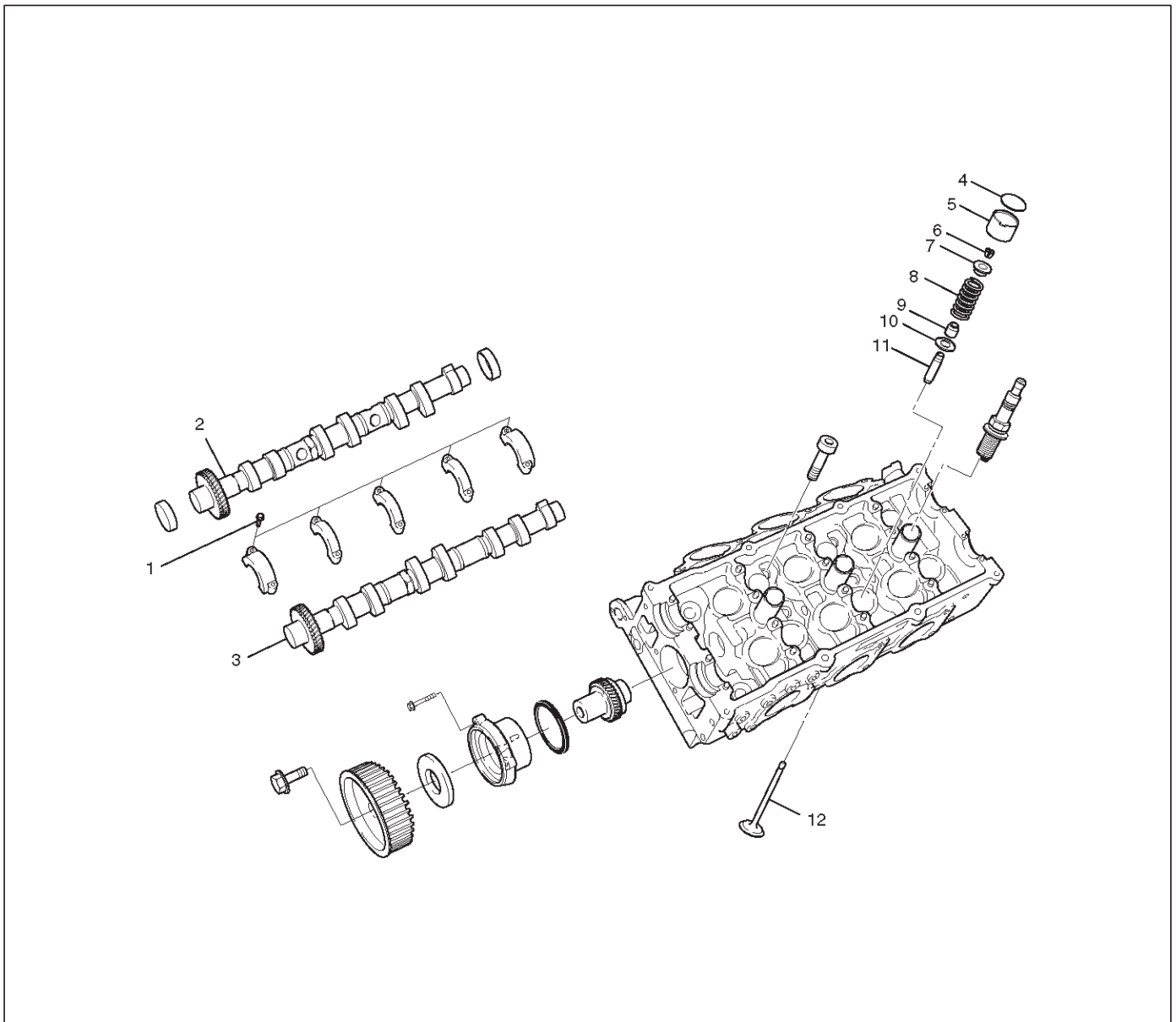
014RW031

5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

Torque: 98 N·m (10.0 Kg·m/72 lb ft)

Valve Spring, Oil Controller, Valve, Valve Guide

Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts



014RW039

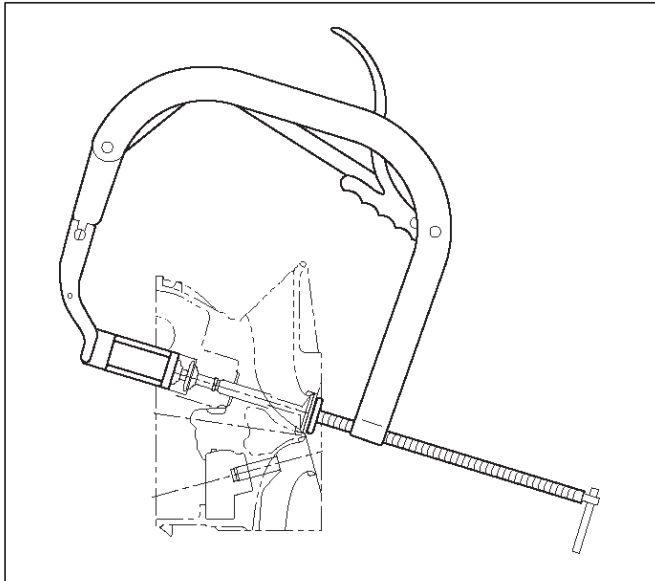
Legend

- | | |
|-----------------------------------|------------------------|
| (1) Camshaft Bracket Fixing Bolts | (7) Spring Upper Seat |
| (2) Camshaft Assembly Inlet | (8) Valve Spring |
| (3) Camshaft Assembly Exhaust | (9) Oil Controller |
| (4) Shim | (10) Spring Lower Seat |
| (5) Tappet | (11) Valve Guide |
| (6) Split Collar | (12) Valve |

Disassembly

1. Remove camshaft bracket fixing bolts (1).
2. Remove camshaft assembly (intake).
3. Remove camshaft assembly (Exhaust side).
4. Remove shim (4) and tappet (5).

- Use 5-8840-2446-0 valve spring compressor and 5-8840-2547-0 valve spring compressor adapter to remove split collar.



014RW042

- Remove valve spring.
- Remove valve.
- Remove oil controller and spring lower seat.
- Remove the valve guide using the 5-8840-2442-0 valve guide replacer.

Inspection and Repair

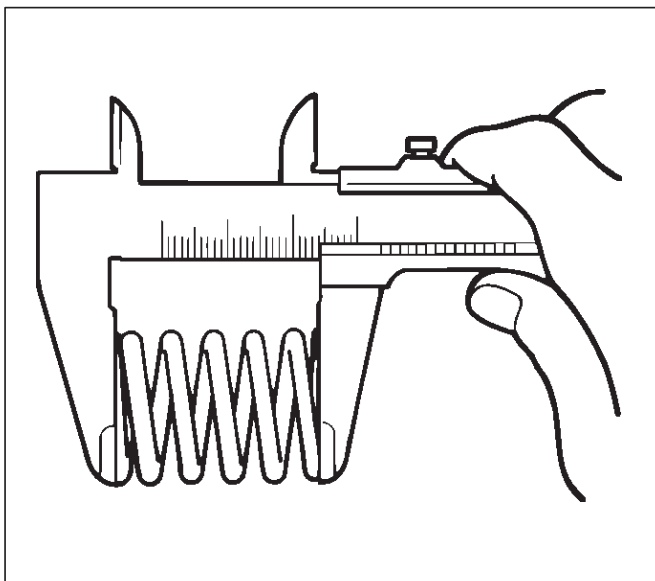
Valve Spring

CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

- Measure the free height of the springs. The springs must be replaced if the free height is below the specified limit.

Standard : 44.6 mm (1.7559 in)

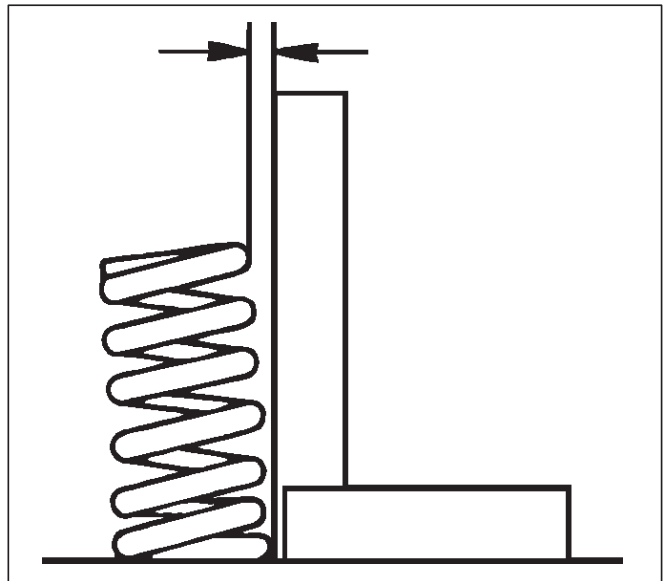
Limit : 43.6 mm (1.7165 in)



014RS004

- Measure the valve spring squareness with a steel square and replace the valve springs if the measured value exceeds the specified limit.

Limit : 2 mm (0.0787 in)



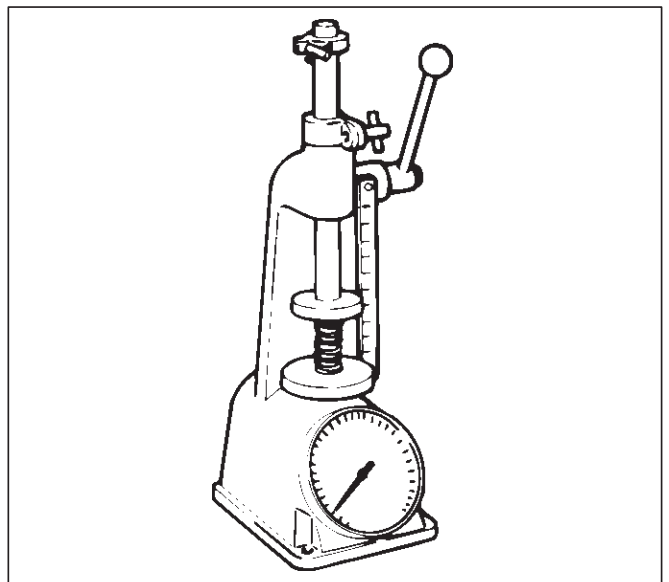
014RS005

- Using a spring tester to compress the springs to the installed height, measure the compressed spring tension, and replace the springs if the measured tension is below the specified limit.

At installed height: 35.0 mm (1.38 in)

Standard: 196 N (44 lb)

Limit: Less than 181 N (41 lb)



014RS006

Valve Guide

CAUTION: Take care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratches or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

6A-58 ENGINE MECHANICAL

1. Measure the valve stem diameter with a micrometer. If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

Diameter of Valve Stem

Intake

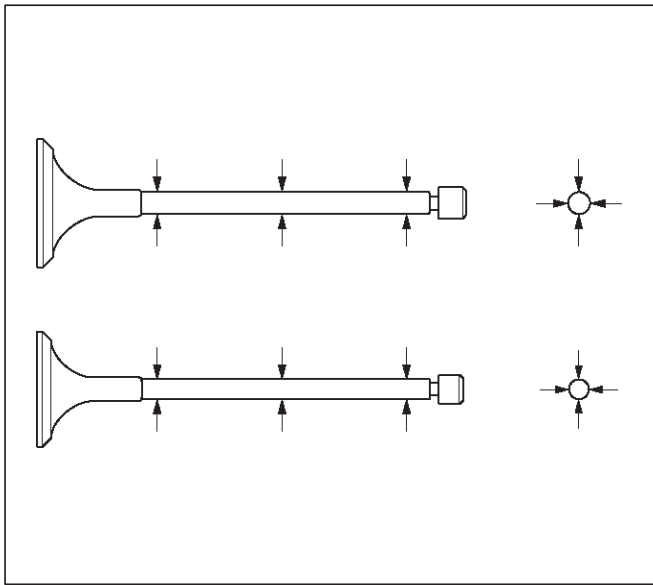
Standard : 5.977 mm–5.959 mm
(0.2353 in–0.2346 in)

Limit : 5.90 mm (0.2323 in)

Exhaust

Standard : 5.952 mm–5.970 mm
(0.2343 in–0.2350 in)

Limit : 5.90 mm (0.2323 in)



2. Measure the inside diameter of the valve guide with a micrometer. Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the value exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Inside Diameter of the Valve Guide

Inlet clearance

Standard : 0.023 mm–0.056 mm
(0.0009 in–0.0002 in)

Limit : 0.20 mm (0.00787 in)

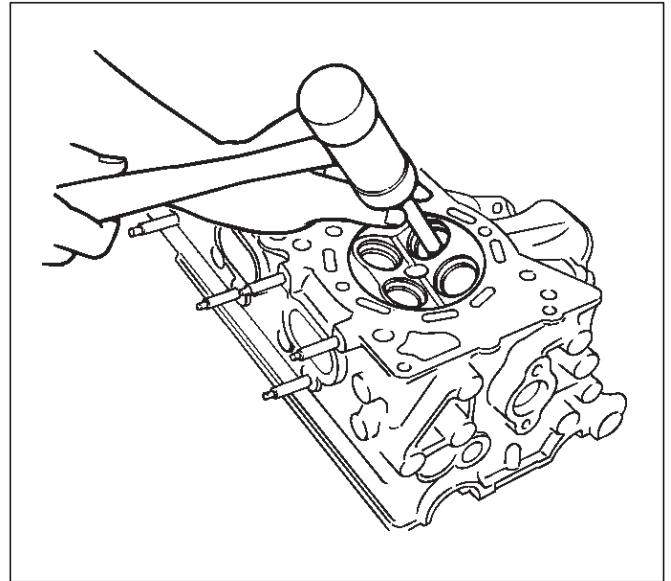
Exhaust clearance

Standard : 0.030 mm–0.063 mm
(0.0012 in–0.0025 in)

Limit : 0.20 mm (0.00787 in)

Valve Guide Replacement

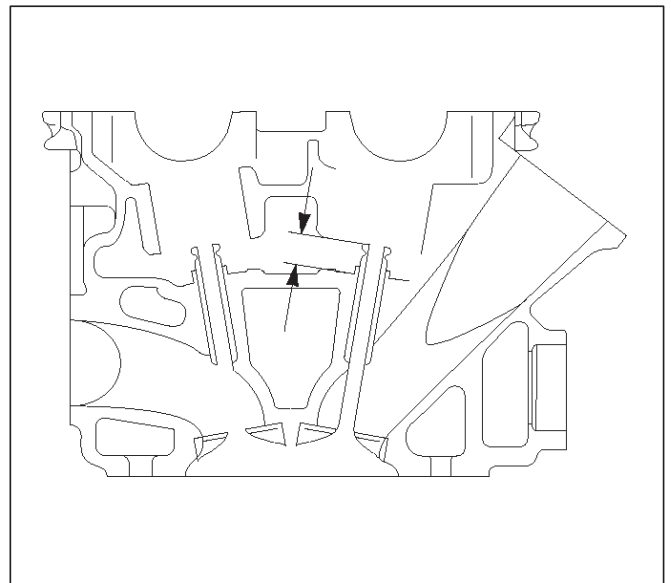
1. Using Valve guide replacer: 5-8840-2442-0, drive out the valve guide from the combustion chamber side.



2. Apply engine oil to the outside of the valve guide. Using valve guide replacer 5-8840-2442-0, drive in a new valve guide from the camshaft side, and check the valve guide height.

Valve guide upper end height: 13.0 mm (0.5118 in)

(Measured from the cylinder head upper face)



3. Check the clearance. If the clearance is less than the specified value, ream the inside diameter of valve guide. Using a sharp 6 mm reamer, ream the valve guide to obtain the specified clearance.

Valve Seat

1. Measure the protrusion of the valve stem when a new valve is installed in the cylinder head. If the protrusion of the valve stem exceeds the limit, replace the valve seat insert or the cylinder head assembly.

Protrusion of valve stem

Intake

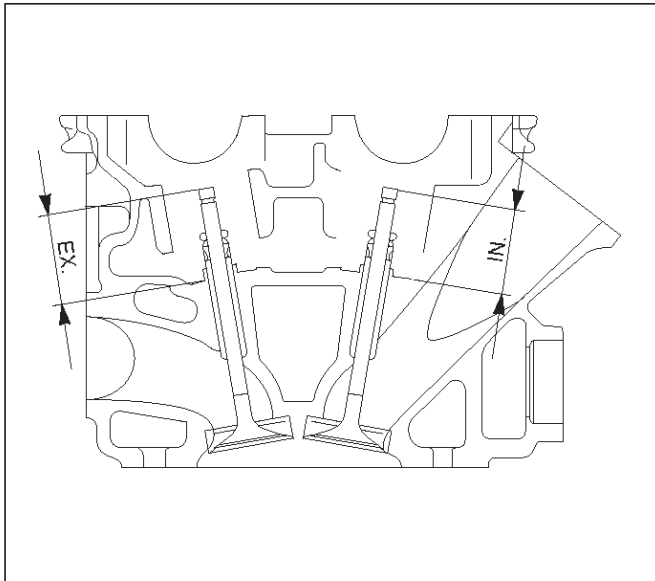
Standard: 39.32 mm (1.5480 in)

Limit: 39.47 mm (1.5539 in)

Exhaust

Standard: 39.30 mm (1.5472 in)

Limit: 39.45 mm (1.5531 in)



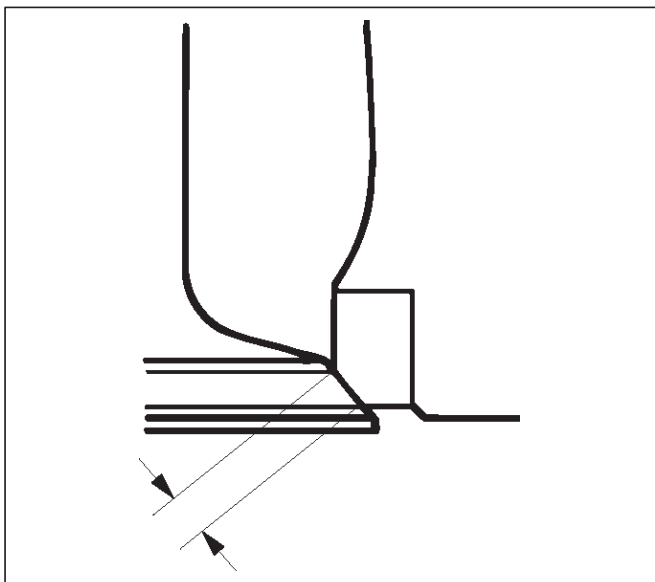
014RW047

2. Measure the valve seat contact width. Make the necessary corrections if the seat contact surface is damaged or rough or if the contact width wear exceeds the limit.

Valve seat contact width

Standard: 1.1 mm (0.0433 in)

Limit: 1.7 mm (0.0669 in)



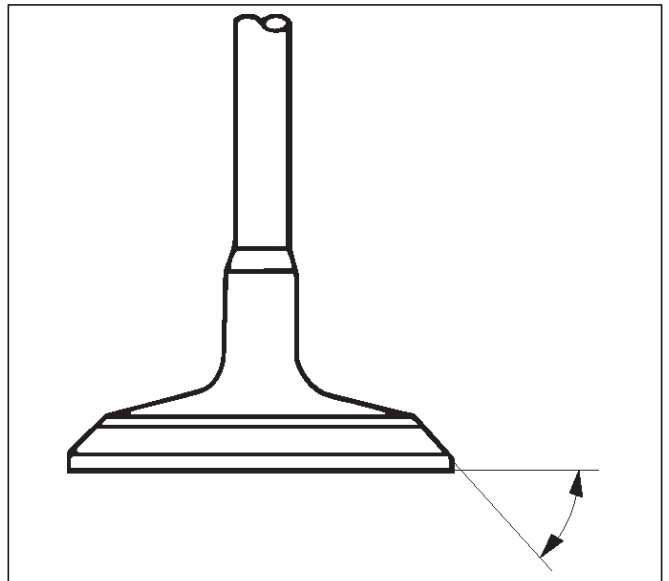
014RS011

Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.

2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Valve contact surface angle: 45°

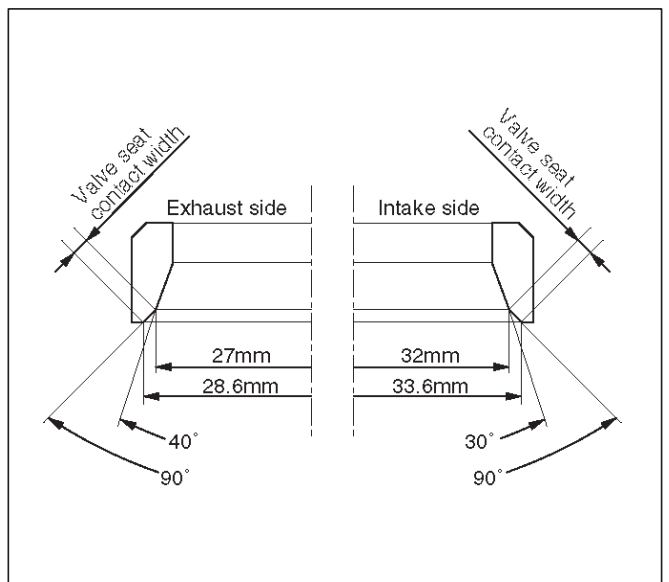


014RS012

Valve Seat Insert Correction

1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

Valve seat angle degree: 90°

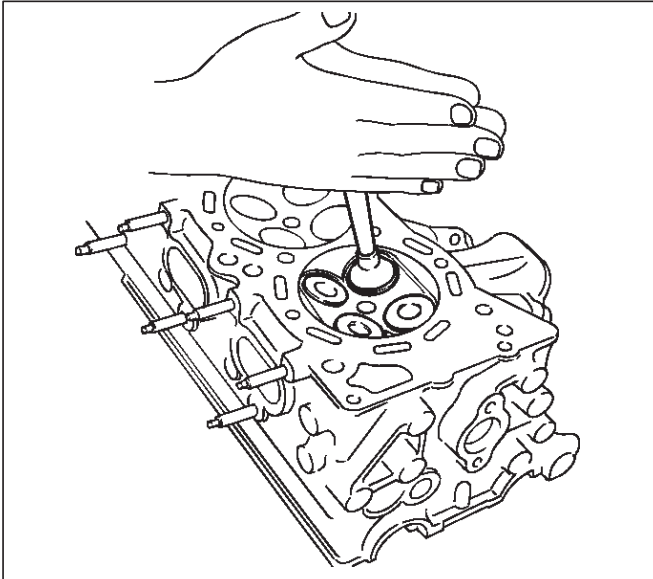


014RW059

3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while lapping it to fit the valve seat insert.

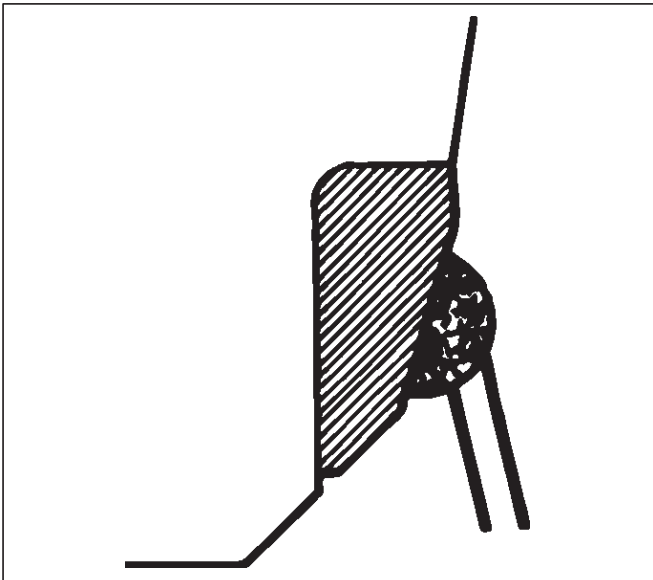
6A-60 ENGINE MECHANICAL

6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.



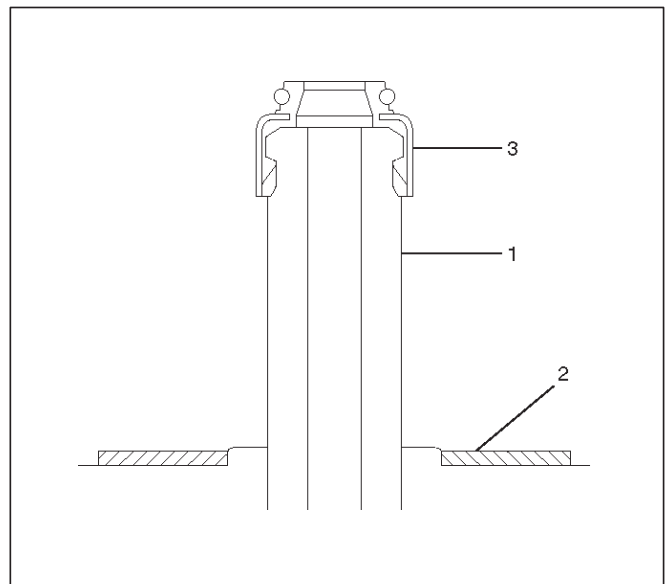
4. Carefully clean the valve seat press-fit section on the cylinder head side.
5. Heat the press-fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press-fit section into the valve seat horizontally.

**Standard fitting interference: 0.14 mm–0.09 mm
(0.0055 in–0.0035 in)**

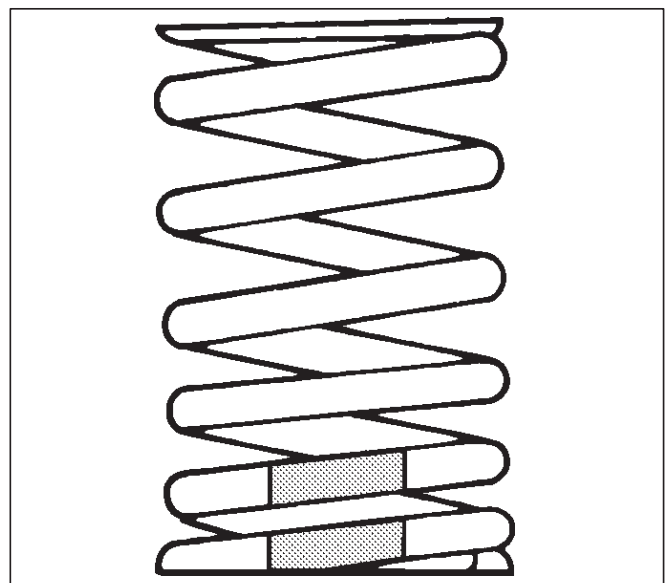
7. After insertion, use a seat grinder to grind finish the seating face. Carefully note the seating angle, the contact width, and the depression.
8. Lap the valve and the seat.

Reassembly

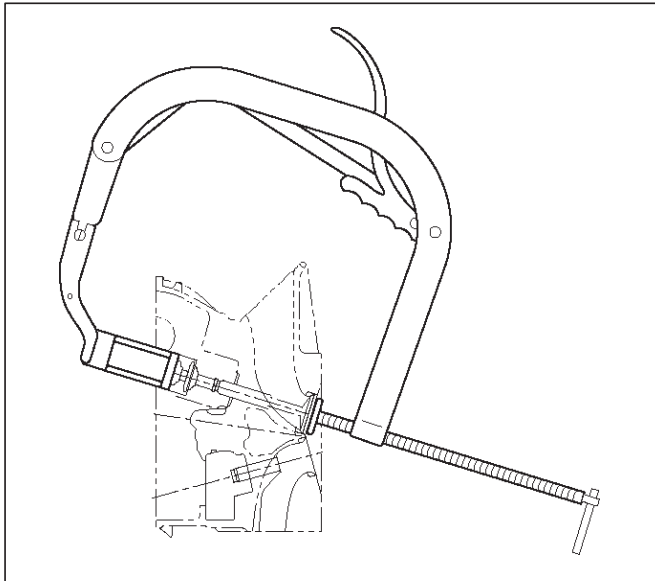
1. Install valve guide (1) to cylinder head. Apply engine oil to the outside of the valve guide. Using valve guide replacer 5-8840-2442-0, drive in a new valve guide from the camshaft side.
2. Install oil controller (3) and spring lower seat (2). Using oil controller replacer 5-8840-0623-0, drive in a new oil controller.



3. Install valve to valve guide. Before install valve guide apply engine oil to the outside of the valve stem.
4. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat. The painted area of the valve spring should be facing downward.



5. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using the 5-8840-2446-0 valve spring compressor and 5-8840-2547-0 valve spring compressor adapter to install the split collars.



014RW042

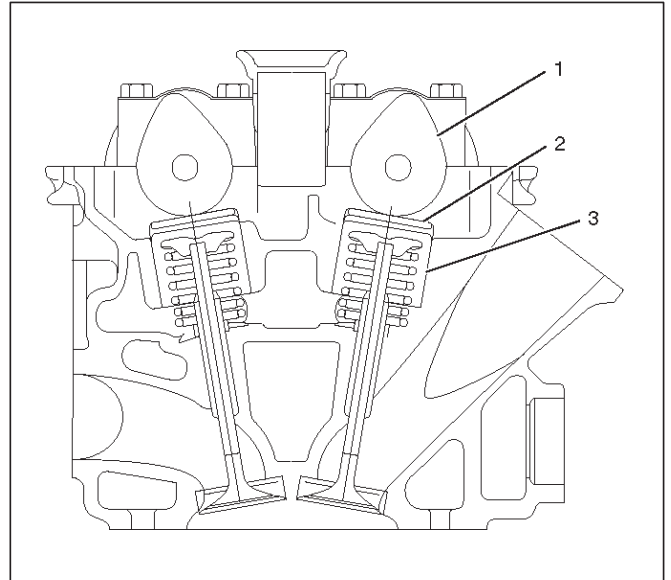
6. Install tappet with shim.

7. Install camshaft assembly.

- Refer to installation procedure for Camshaft in this manual.

Valve Clearance Adjustments

NOTE: To adjust valve clearance, apply engine oil to the cam as well as to the adjusting shim (2) with the cylinder head built on the cylinder block, give a few turns to the camshaft by means of timing pulley tightening bolt, and measure valve clearance when the nose of cam is just opposite to maximum cam lift (1) as shown in illustration below.



014RW081

Legend

- (1) Cam
- (2) Shim
- (3) Tappet

Valve Clearance Standard Value (cold)

Intake: 0.23 mm–0.33 mm
(0.0091 in–0.0130 in)

Exhaust: 0.25 mm–0.35 mm
(0.0098 in–0.0138 in)

Selection of Adjusting Shim

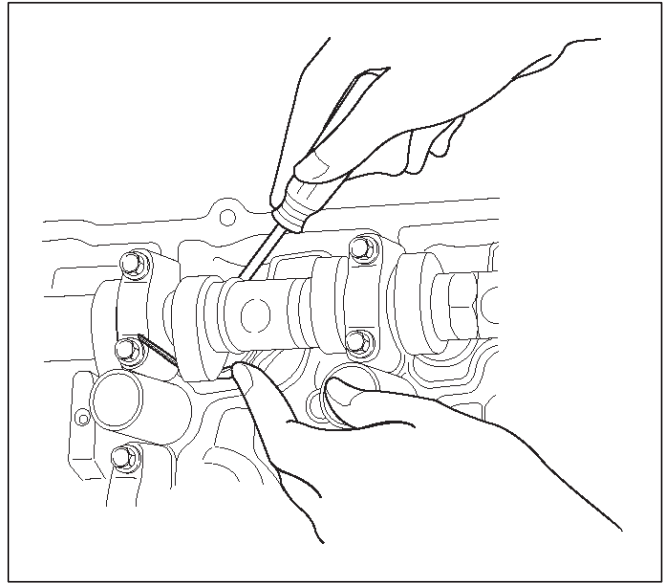
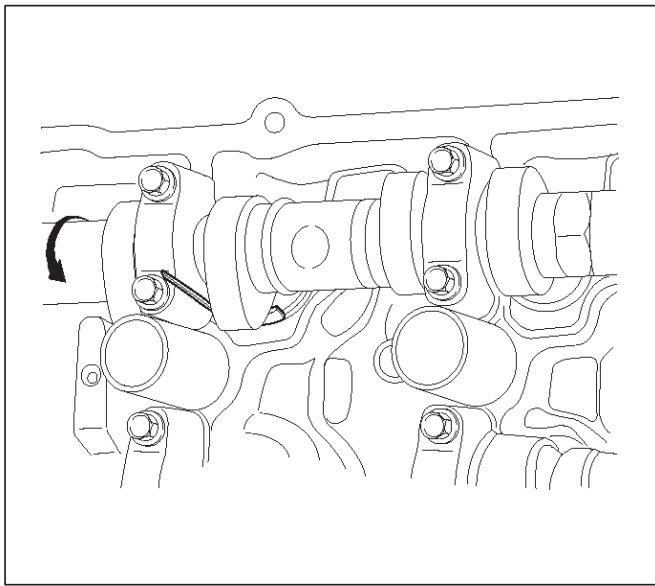
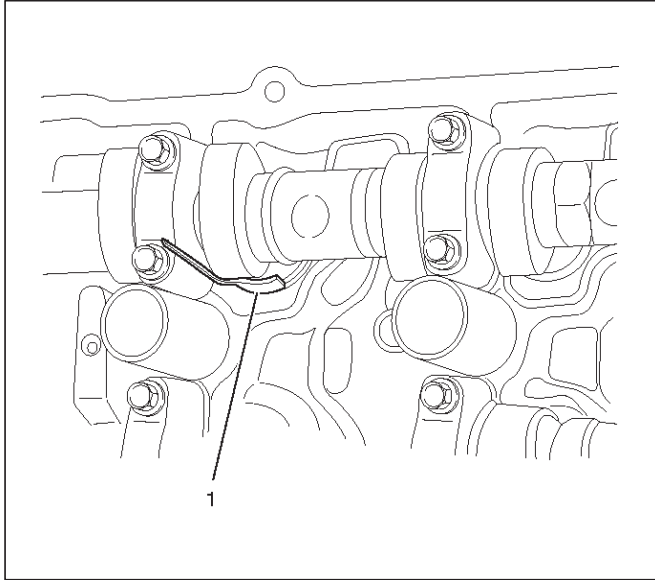
Shim to be selected = (Thickness of removed shim) + (Valve clearance measurement – Standard valve)

Based on the above formula, the best suited shim should be selected from 41 sorts of shim (differently thick at 0.02mm (0.0008 in) intervals from 2.40mm (0.0945 in) through 3.2mm (0.1260 in) thick). Install the shim and check valve clearance.

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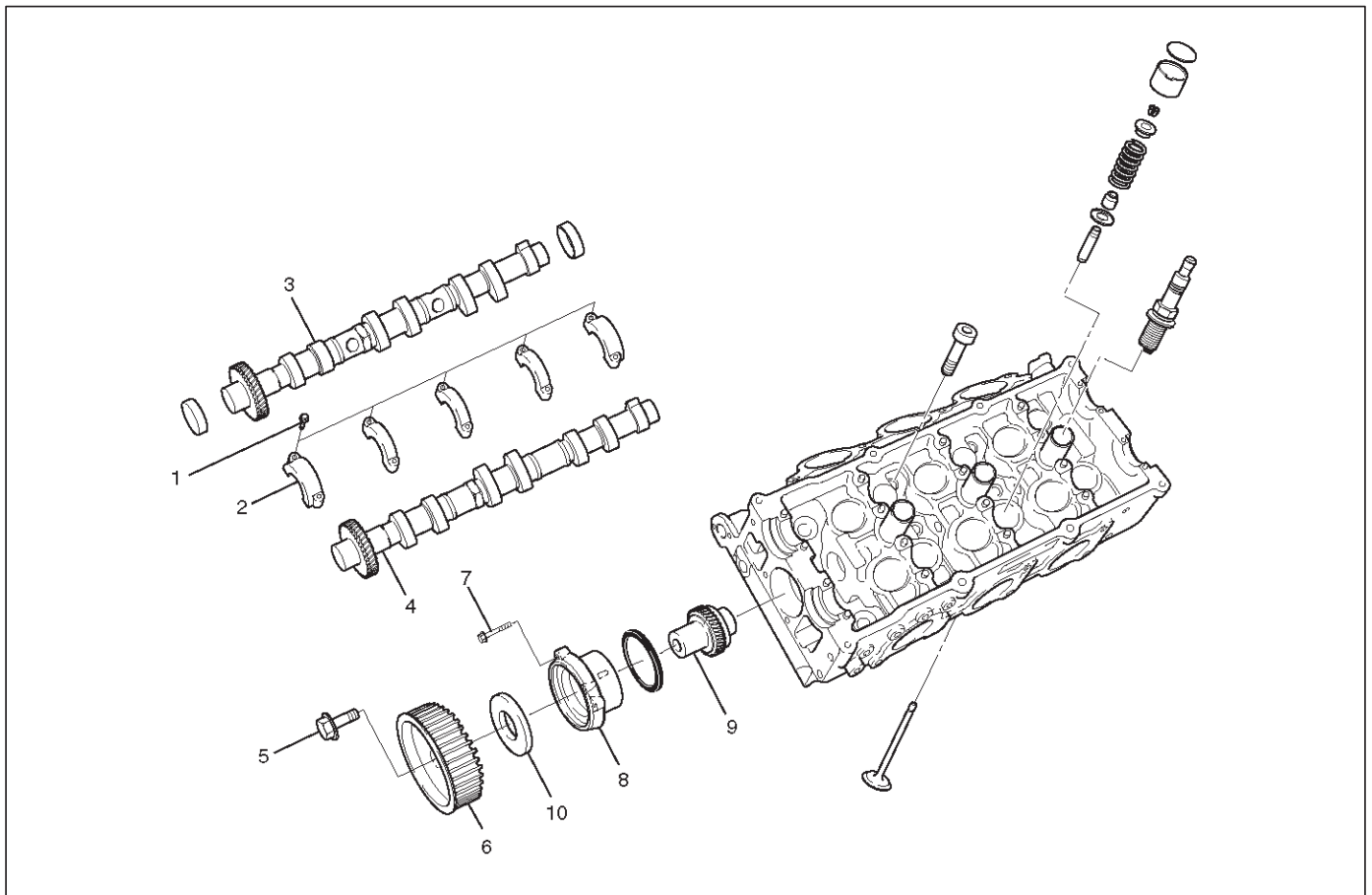
Replacement of Shim

Let the cam push down the edge of tappet by using 5-8840-2444-0 valve clearance adjusting tool and push out the shim with a flat blade screw driver as shown in illustrations below.



Camshaft

Camshaft and Associated Parts



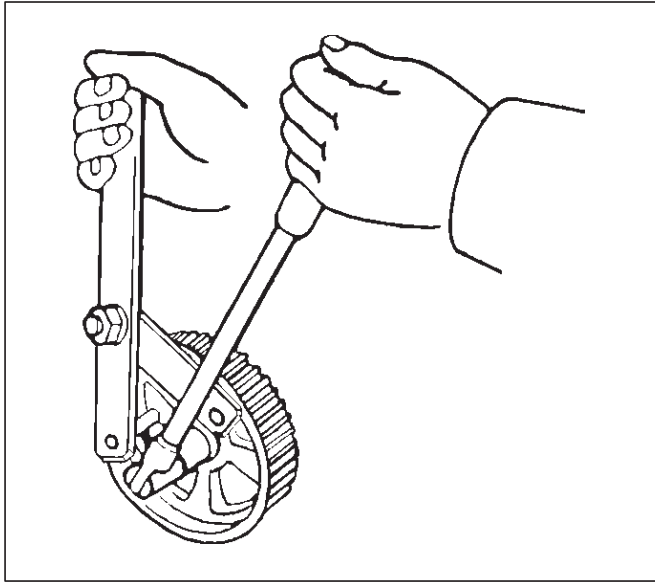
014RW040

Legend

- | | |
|----------------------------------|--------------------------------|
| (1) Camshaft Bracket Fixing Bolt | (6) Camshaft Drive Gear Pulley |
| (2) Camshaft Bracket | (7) Retainer Fixing Bolt |
| (3) Camshaft Assembly Intake | (8) Retainer |
| (4) Camshaft Assembly Exhaust | (9) Camshaft Drive Gear |
| (5) Pulley Fixing Bolt | (10) Oil Seal |

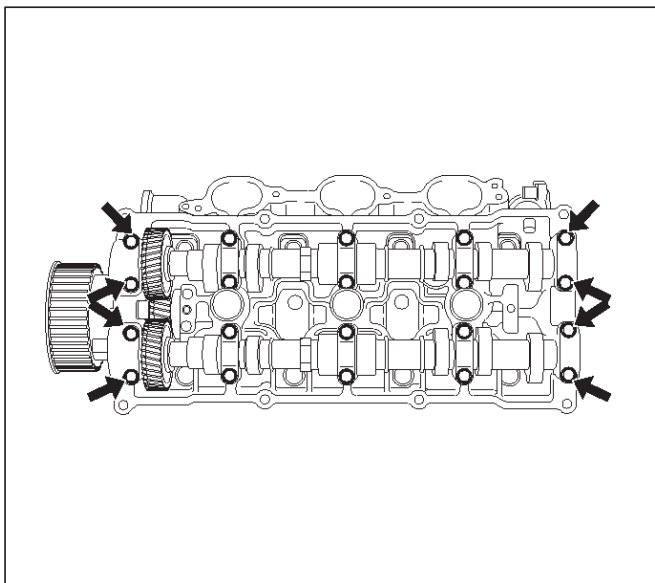
Disassembly

1. Remove fixing bolt (5) for camshaft drive gear pulley using the 5-8840-2447-0 universal holder.



014RW060

2. Remove twenty fixing bolts from inlet and exhaust camshaft bracket on one side bank, then camshaft brackets (2).



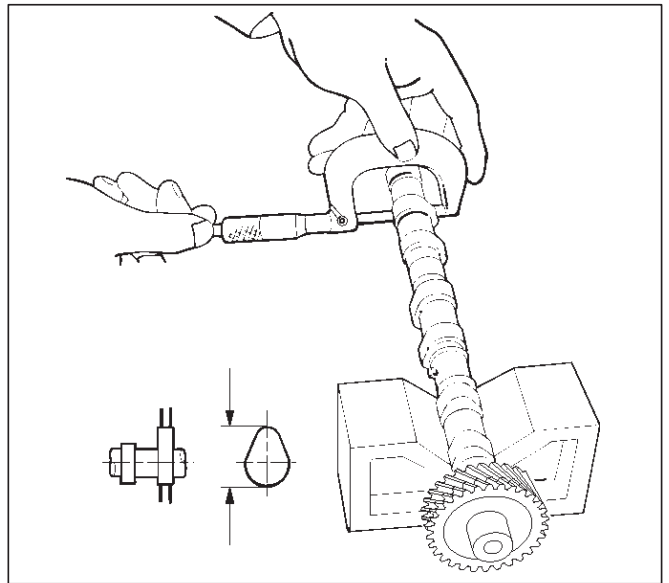
014RW027

3. Remove camshaft assembly (3), (4).
4. Remove three fixing bolts (7) from camshaft drive gear retainer (8), then camshaft drive gear assembly.

Inspection and Repair

1. Use a micrometer to measure the cam lobe height and uneven wear. Replace the camshaft if either the lobe height or the uneven wear exceeds the specified limit.

Lobe height : 44.709 mm (1.7602 in)
Uneven wear : 0.05 mm (0.0020 in)



014RW045

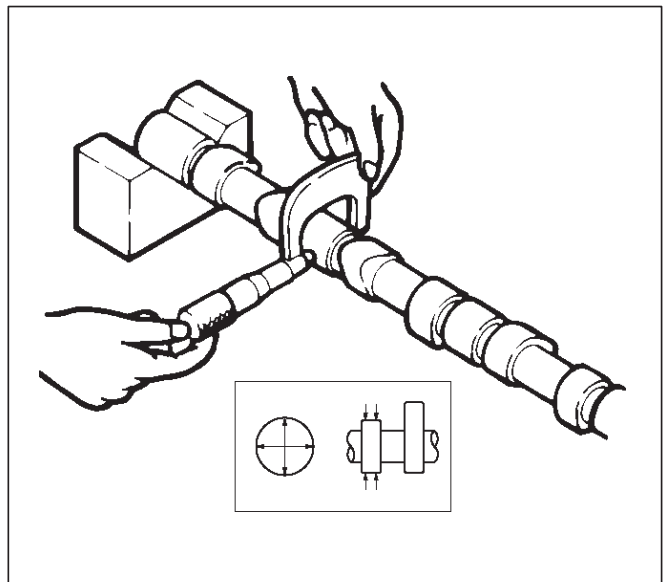
2. Use a micrometer to measure the diameter and the uneven wear of the camshaft journals. Replace the camshaft if the diameter or the uneven wear exceeds the specified limit.

Journal Diameter

Standard : 25.972 mm–25.993 mm
(1.0225 in–1.0233 in)

Limit : 25.8 mm (1.0157 in)

Uneven wear : 0.05 mm (0.0020 in)

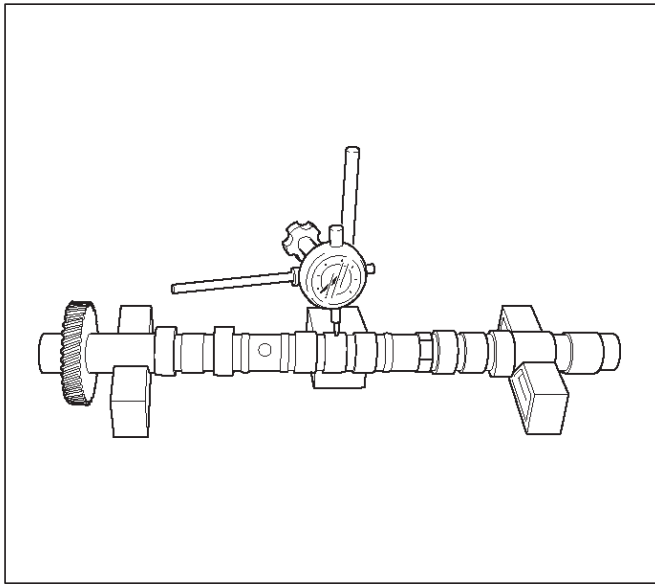


014RS023

3. Place the camshaft on V-blocks. Slowly rotate the camshaft and measure the runout with a dial indicator. Replace the camshaft if the runout exceeds the specified limit.

Runout

Limit : 0.1 mm (0.0039 in)



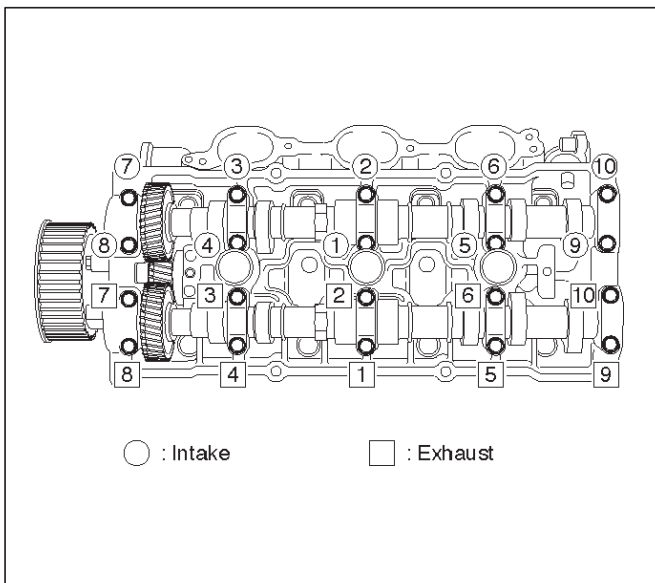
014RW044

4. Measure the camshaft journal oil clearance.

1. Measure the camshaft bracket housing inside diameter.

NOTE: Tighten camshaft bracket (2) to specified torque before measuring the camshaft bracket inside diameter.

Torque : 10 N-m (1.0 Kg-m/89 lb in)



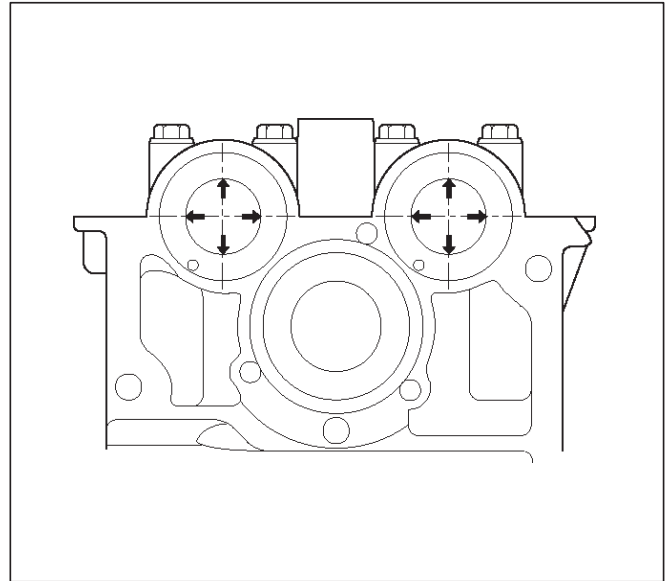
014RW031

2. Subtract the camshaft outside diameter from the camshaft bracket housing inside diameter.

Oil Clearance

**Standard : 0.027 mm–0.078 mm
(0.0011 in–0.0031 in)**

Limit : 0.11 mm (0.0043 in)

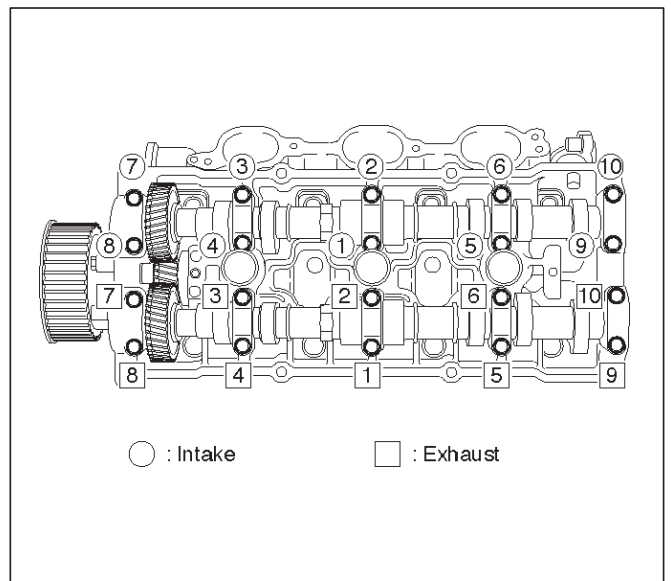


014RW037

5. Replace the cylinder head and/or camshaft if the measured oil clearance exceeds the specified limit.

1. Carefully clean the camshaft journal, the camshaft bracket, and the cylinder head.
2. Install camshaft assembly and camshaft brackets (2), tighten twenty bolts (1) on one side bank to the specified torque.

Torque: 10 N-m (1.0 Kg-m/89 lb in)



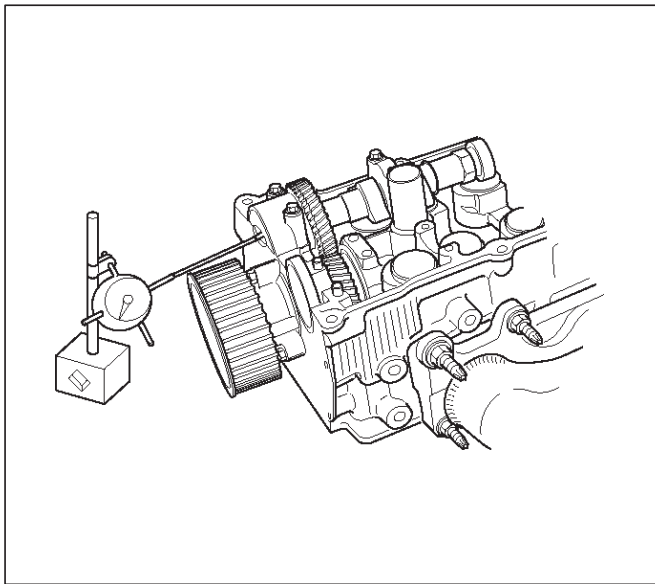
014RW031

3. Measure the camshaft thrust clearance with a dial indicator. Replace the camshaft and/or the cylinder head if the camshaft thrust clearance exceeds the specified limit.

Camshaft thrust Clearance

**Standard : 0.03 mm–0.08 mm
(0.0012 in.–0.0031 in.)**

Limit : 0.12 mm (0.0047 mm)



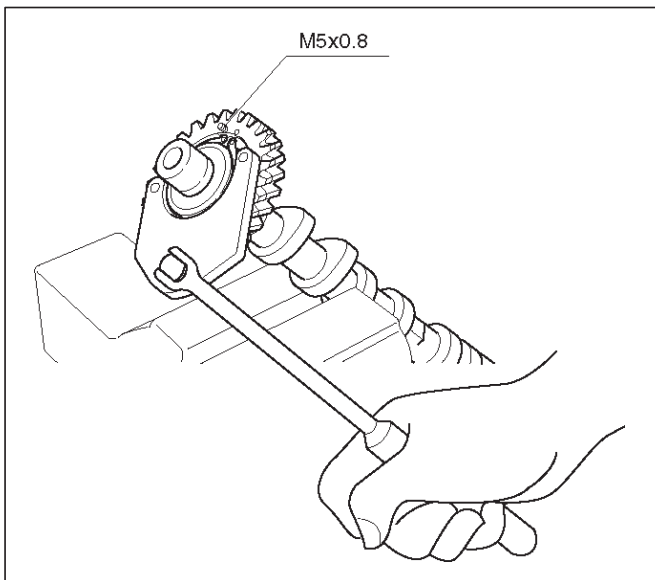
014RW035

Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

Torque: 10 N·m (1.0 Kg·m/89 lb in)

2. Tighten sub gear setting bolt.
 1. Use 5-8840-2443-0 to turn sub gear to right direction until the M5 bolt hole aligns between camshaft driven gear and sub gear.
 2. Tighten M5 bolt suitable torque for prevent moving the sub gear.

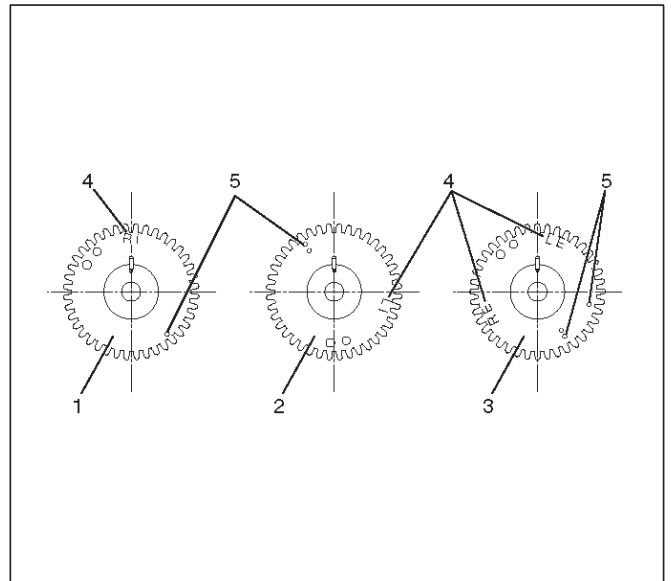


014RW041

3. Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.

1. Apply engine oil to camshaft journal and bearing surface of camshaft bracket.

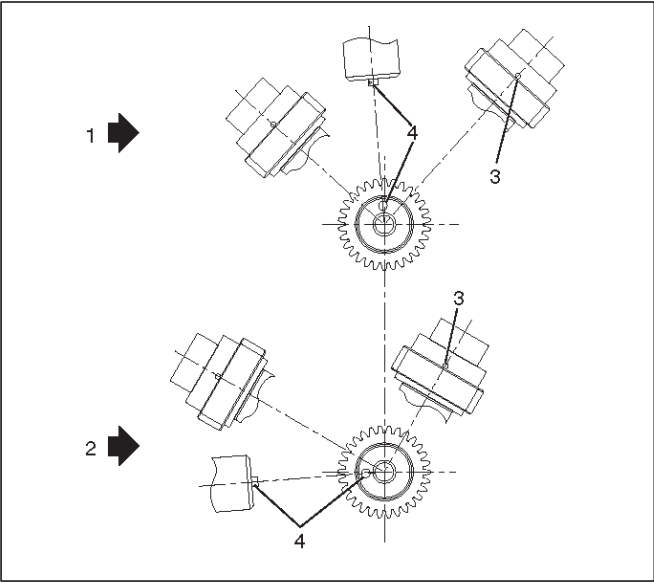
2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

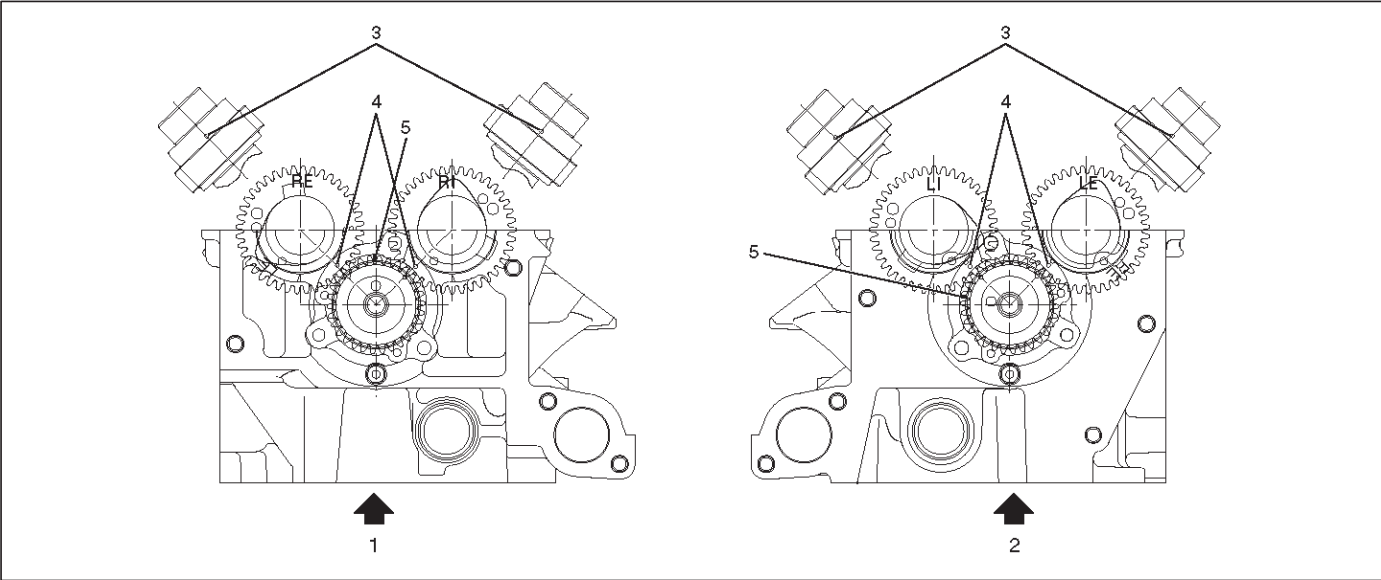
- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discerning Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



014RW023

Legend

- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin



014RW024

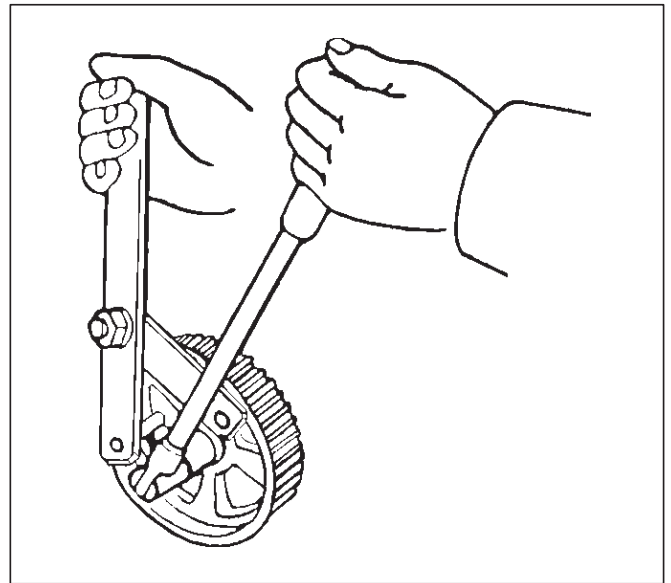
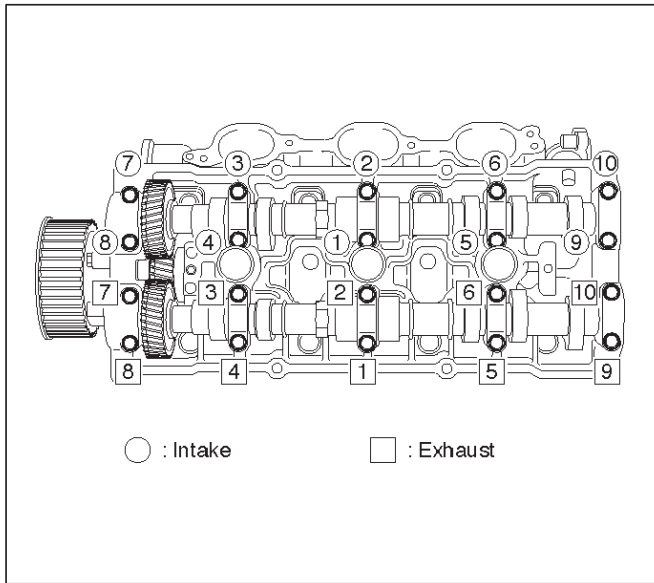
Legend

- (1) Right Bank
- (2) Left Bank
- (3) Alignment Mark on Camshaft Drive Gear
- (4) Alignment Mark on Camshaft
- (5) Alignment Mark on Retainer

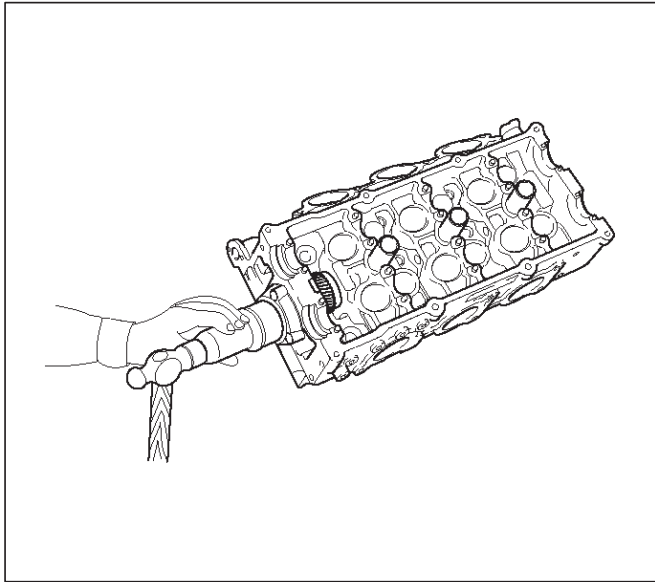
3. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (1.0 Kg·m/89 lb in)

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4. If the oil seal requires replacement, use the 5-8840-2445-0 to install the oil seal.

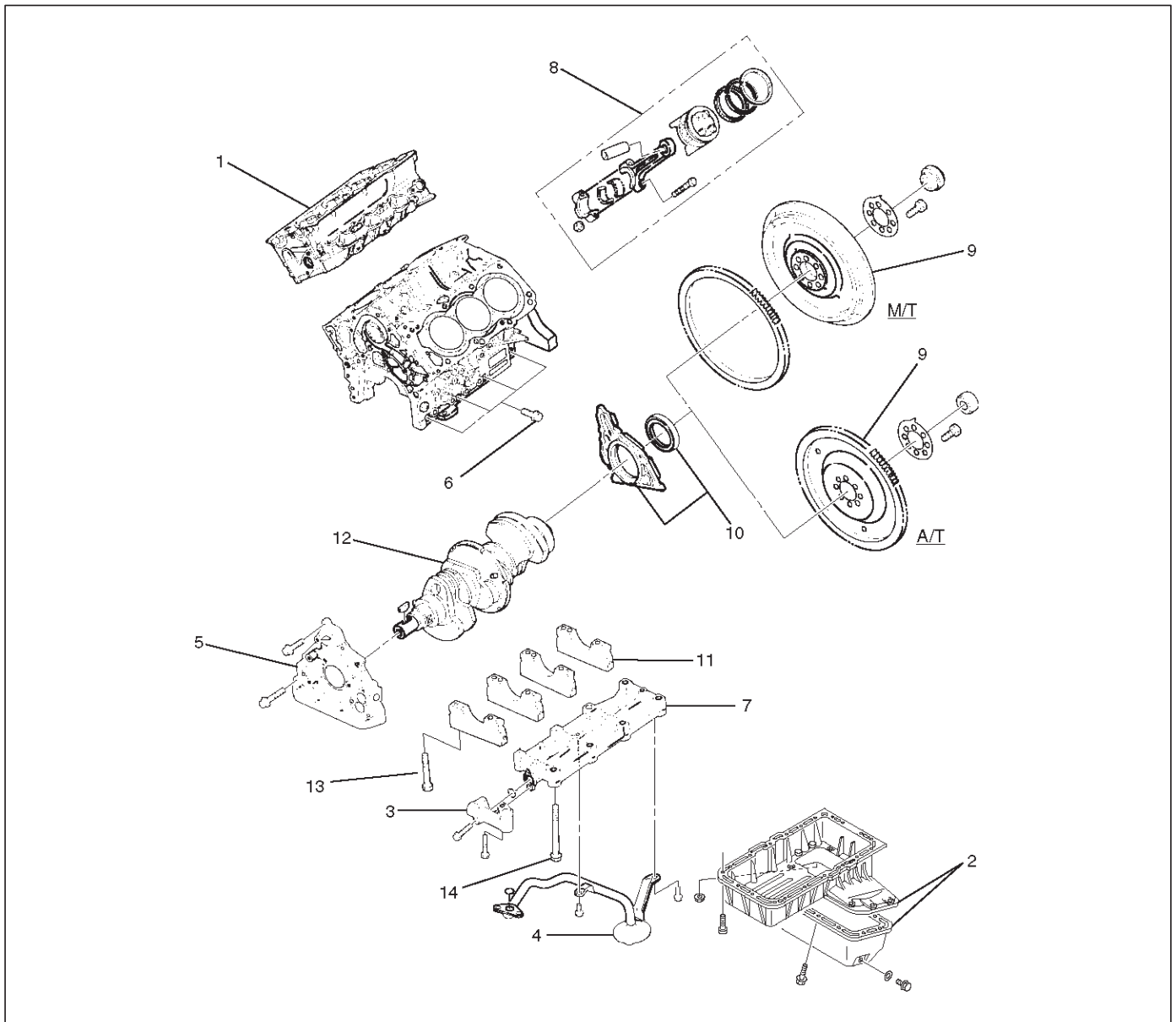


5. Tighten bolt for camshaft drive gear pulley to the specified torque using the 5-8840-2447-0 universal holder.

Torque: 98 N·m (10.0 Kg·m/72 lb ft)

Crankshaft

Crankshaft and Associated Parts



013RW009

Legend

- | | |
|-------------------------------|--|
| (1) Cylinder Head Assembly | (8) Piston and Connecting Rod Assembly |
| (2) Crankcase with Oil Pan | (9) Flywheel |
| (3) Oil Pipe and O-Ring | (10) Rear Oil Seal Retainer and Oil Seal |
| (4) Oil Strainer and O-Ring | (11) Main Bearing Cap |
| (5) Oil Pump Assembly | (12) Crankshaft |
| (6) Cylinder Block Side Bolts | (13) Main Bearing Cap Fixing Bolts |
| (7) Oil Gallery | (14) Oil Gallery Fixing Bolts |

Disassembly

1. Remove cylinder head assembly (1). Refer to "Cylinder Head" in this manual.
2. Remove crankcase with oil pan (2). Refer to "Oil Pan and Crankcase" in this manual.

CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.

3. Remove oil pipe and O-ring (3).
4. Remove oil strainer and O-ring (4).
5. Remove oil pump assembly (5).
6. Remove crankcase side bolts (6).

6A-70 ENGINE MECHANICAL

7. Remove oil gallery (7).
8. Remove piston and connecting rod assembly (8). Refer to "Piston, Piston Ring and Connecting Rod" in this manual.
9. Remove flywheel (9).
10. Remove rear oil seal retainer (10).
11. Remove main bearing cap (11).
12. Remove crankshaft (12).

Inspection and Repair

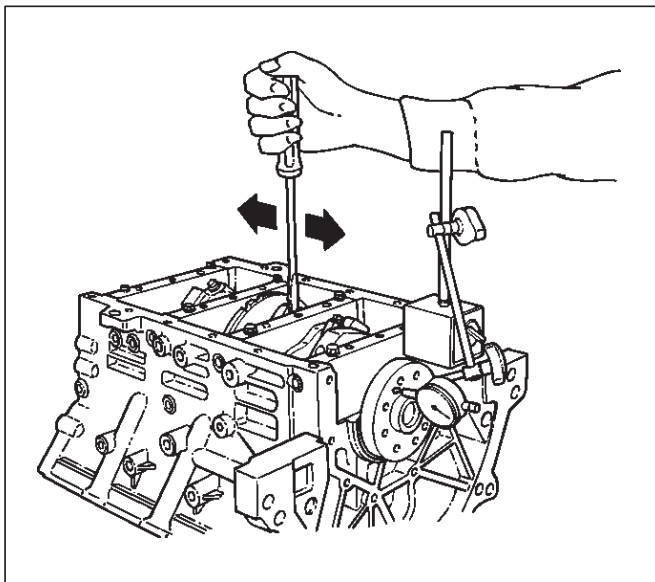
1. Crankshaft

Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

Thrust Clearance

**Standard : 0.06 mm–0.24 mm
(0.0024 in–0.0094 in)**

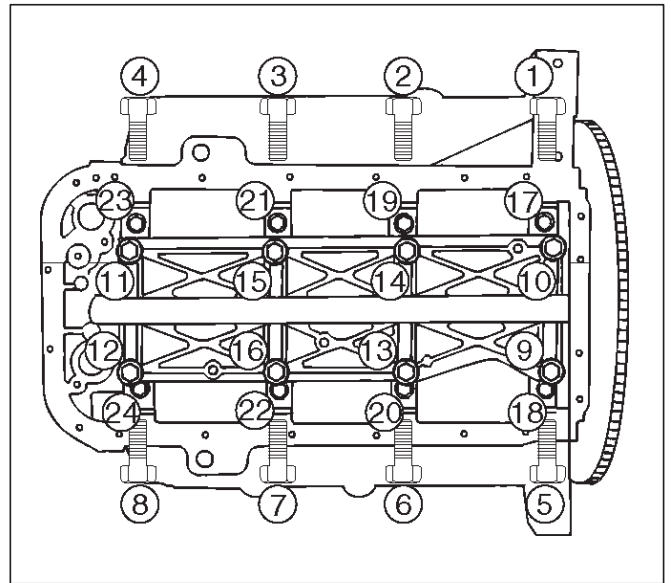
Limit : 0.30 mm (0.0118 in)



015RS003

Main Bearing Clearance

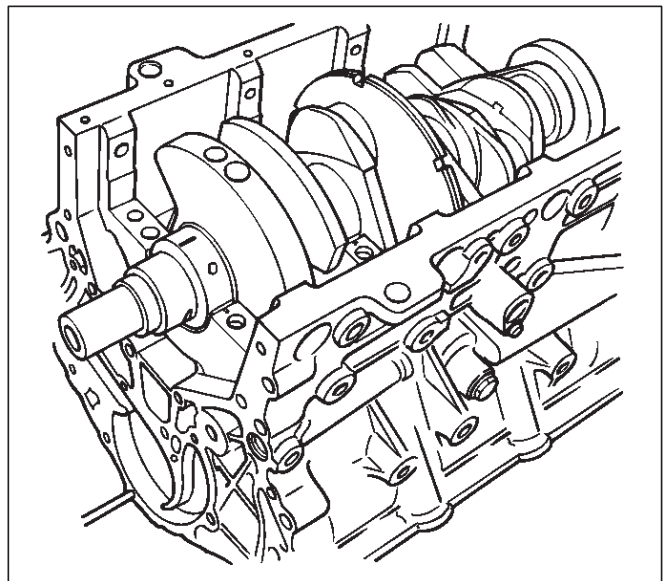
1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts in the sequence shown in the illustration. Arrange the removed main bearing caps in the cylinder number order. Remove the main bearings.



015RS004

3. Remove the crankshaft. Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear. The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions. Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.

NOTE: Do not set the plastigage on the oil hole.



015RS005

9. Install main bearing caps, oil gallery and crank case bolts in the order shown, and tighten each bolt to the specified torque.

NOTE: Do not apply engine oil to the crank case side bolts.

Main bearing cap bolts.

Torque: 39 N·m (4.0 Kg·m/29 lb ft)

Oil gallery fixing bolts.

Torque:

1st step: 29 N·m (3.0 Kg·m/21 lb ft)

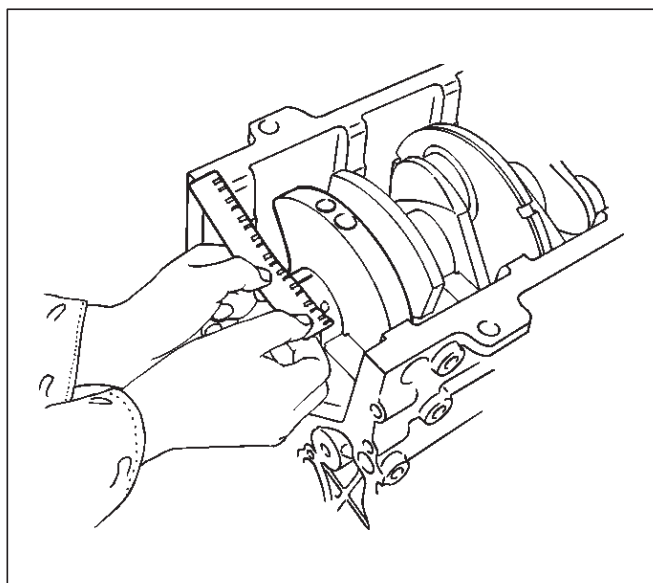
2nd step 55° ~ 65°

Crank case side bolts

Torque : 39 N·m (4.0 Kg·m/29 lb ft)

NOTE: Do not allow the crankshaft to rotate.

Limit : 0.08 mm (0.0031 in)



015RS008

12. Clean the plastigage from the bearings and the crankshaft.

Remove the crankshaft and the bearings.

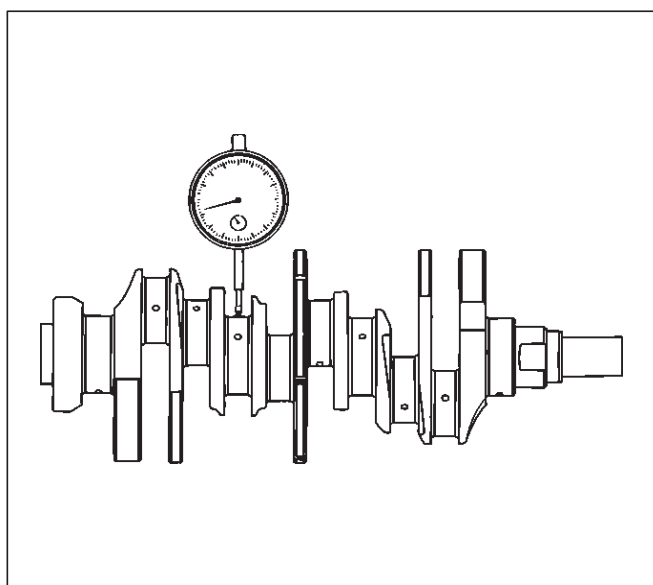
Crankshaft (12) Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

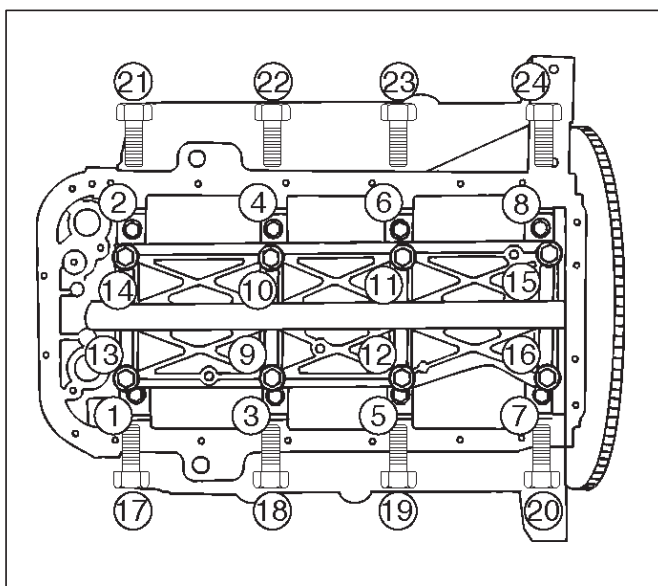
Inspection and Repair

1. Carefully set the crankshaft on the V-blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

Runout : 0.04 mm (0.0016 in)

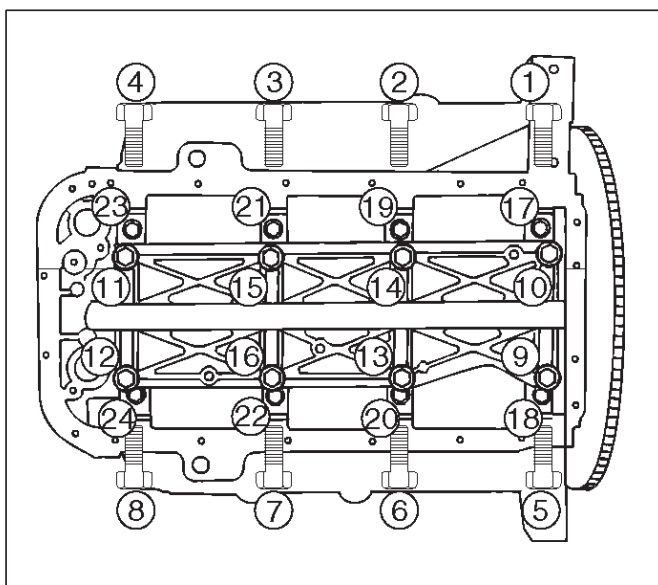


015RS007



015RS006

10. Remove the main bearing caps in the sequence shown in the illustration.



015RS004

11. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

**Standard : 0.019 mm-0.043 mm
(0.0007 in-0.0017 in)**

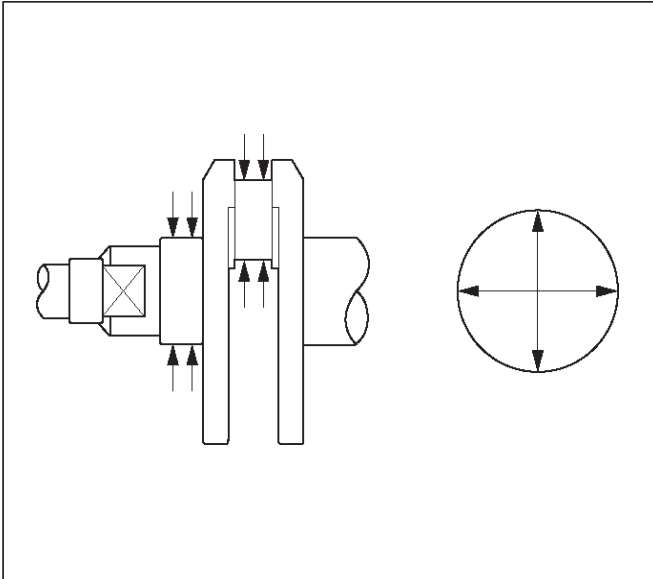
6A-72 ENGINE MECHANICAL

2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

**Main journal diameter : 63.918 mm–63.933 mm
(2.5165 in–2.5170 in)**

**Crank pin diameter : 53.922 mm–53.937 mm
(2.1229 in.–2.1235 in.)**

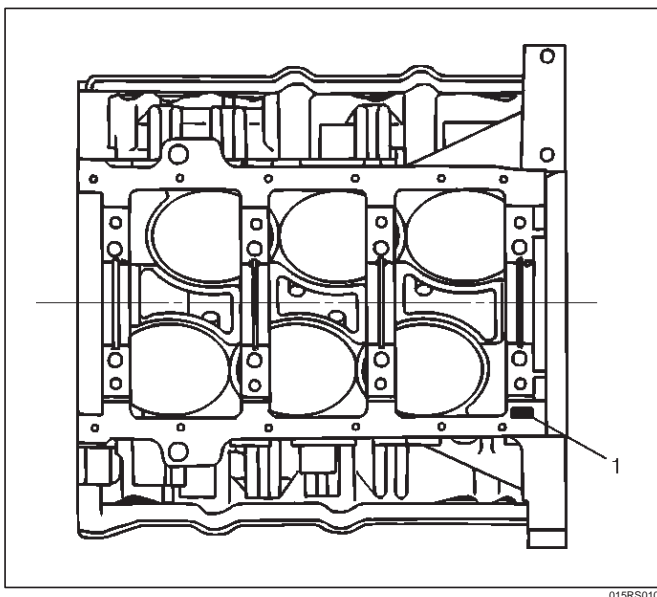
Uneven wear limit : 0.005 mm (0.0002 in)



Crankshaft Bearing Selection

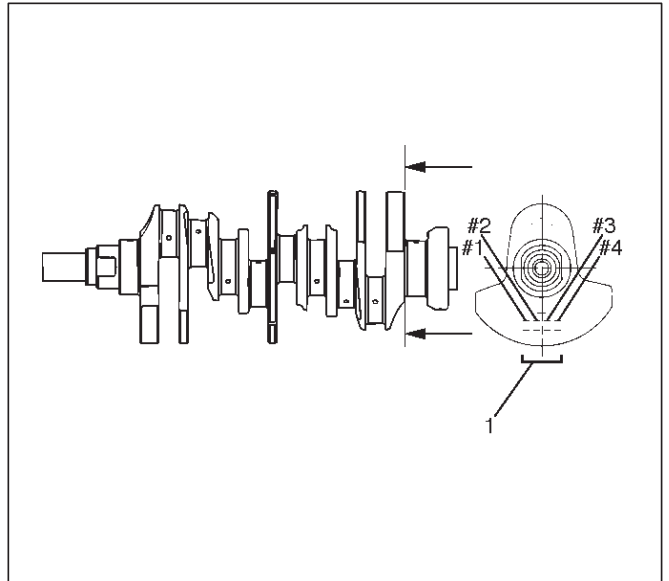
When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings, paying close attention to the cylinder block journal hole.

1. Diameter size mark (1) and the crankshaft journal.

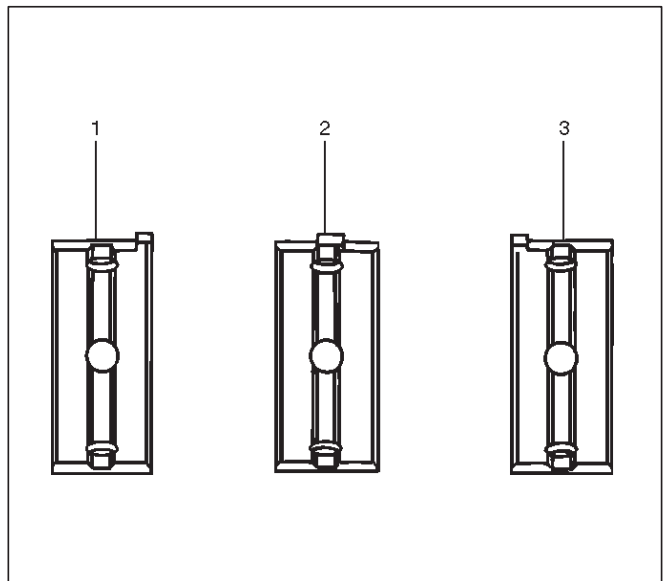


2. Diameter size mark (1).

The diameter size marks are stamped on the No.1 crankshaft balancer as shown in the illustration.



NOTE: Take care to ensure the bearings are positioned correctly.



Legend

- (1) Number 1 and 4 main bearing upper and lower
- (2) Number 2 and 3 main bearing upper
- (3) Number 2 and 3 main bearing lower

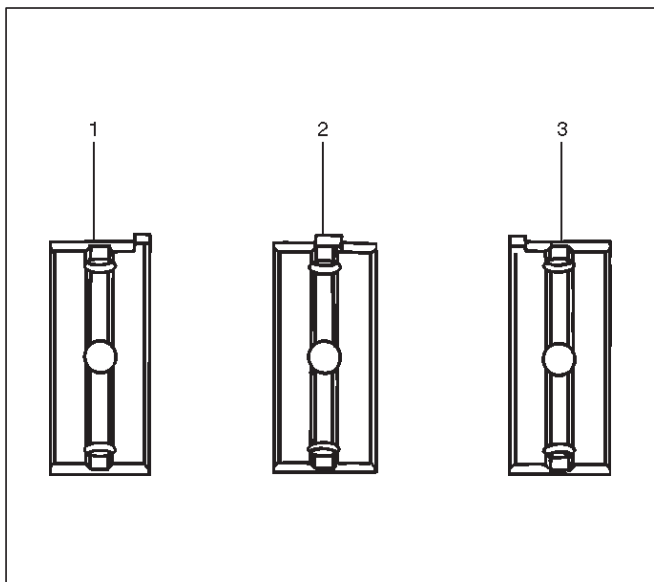
1 Size Mark	Main Bearing Bore Diameter	Crank Shaft Main Journal Diameter	2 Size Mark	Crank Shaft Bearing Size Mark (Upper Side)	Crank Shaft Bearing Size Mark (Lower Side)	Oil Clearance (Reference)
1	68.994-69.000 (2.7163-2.7165)	63.918-63.925 (2.5165-2.5167)	2	Blue	Blue	0.030-0.049 (0.0012-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Brown	Brown	0.028-0.047 (0.0011-0.0019)
2	68.987-68.993 (2.7160-2.7163)	63.918-63.925 (2.5165-2.5167)	2			Green
		63.926-63.933 (2.5168-2.5170)	1	0.027-0.046 (0.0011-0.0018)		
3	68.980-68.986 (2.7157-2.7160)	63.918-63.925 (2.5165-2.5167)	2	Yellow	Yellow	0.028-0.047 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1			0.026-0.045 (0.0010-0.0018)

Reassembly

1. Crankshaft (12)

- Install the main bearings to the cylinder block and the main bearing caps.
- Be sure that they are positioned correctly.
- Apply new engine oil to the upper and lower main bearing faces.

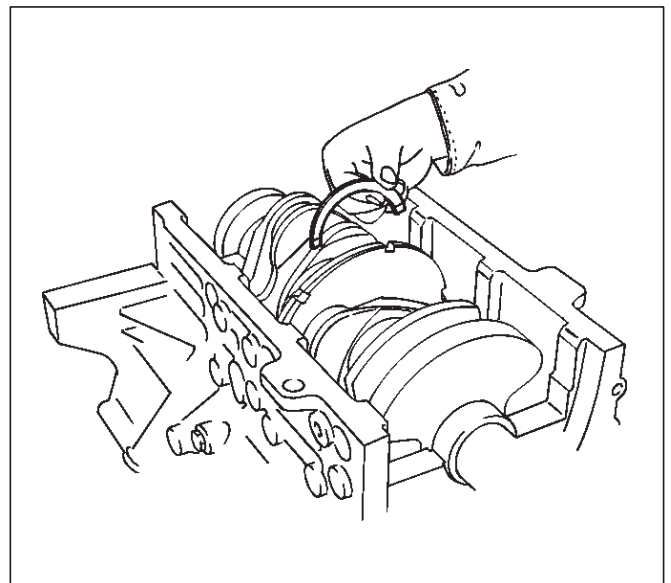
NOTE: Do not apply engine oil to the main bearing back faces.



015RS012

- Carefully mount the crankshaft.

- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.

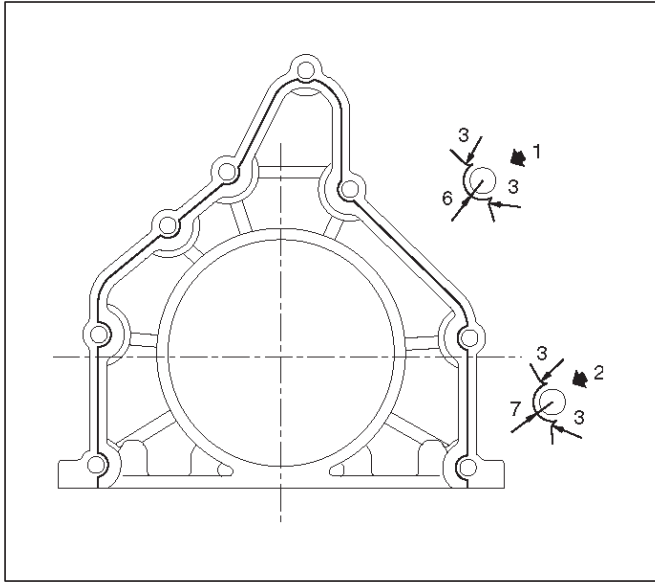


015RS013

2. Rear oil seal (10)

- Remove the oil from the cylinder block and the retainer mounting surface.
- Apply sealant (TB-1207B or equivalent) to the retainer mounting surface, following the pattern shown in the illustration.

The retainer must be installed within 5 minutes after sealant application before the sealant hardens.



015RW002

Legend

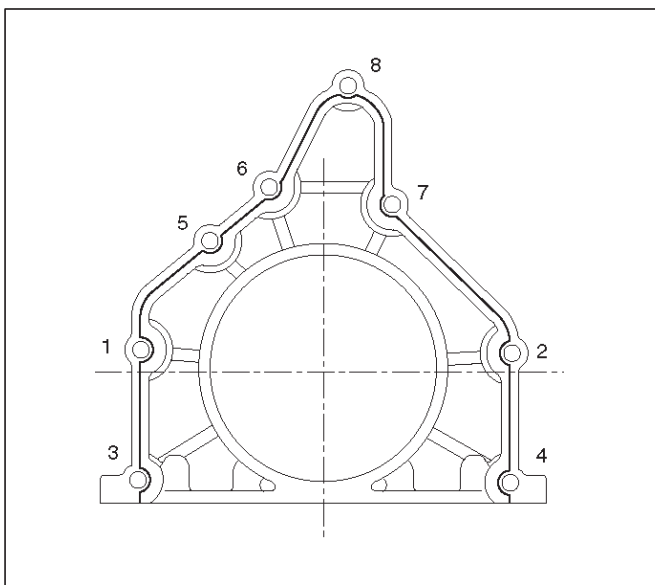
- (1) Around Bolt Holes
- (2) Around Dowel Pin

- Apply engine oil to the oil seal lip.
- Align the cylinder block dowel pin holes with the rear retainer dowel pins.
- Tighten the rear retainer fixing bolts. New bolts should be used when installing rear retainer.

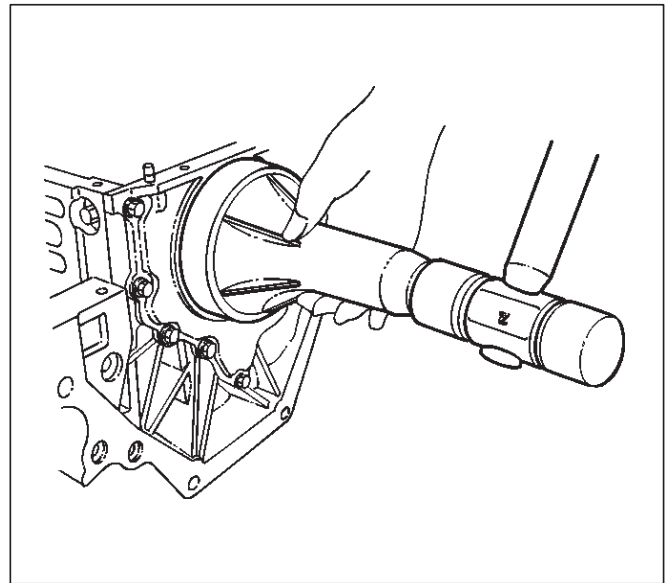
Torque: 18 N-m (1.8 Kg-m/13 lb ft)

NOTE: Be very careful not to disengage the oil seal garter spring during installation of the rear retainer.

If the seal was removed from retainer for replacement, apply engine oil to the oil seal lip and install the oil seal using 5-8840-2286-0 oil seal installer.



015RW001



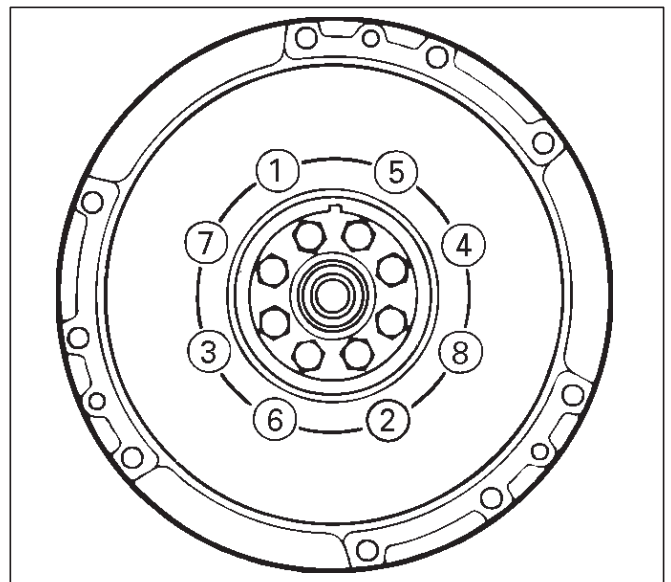
015RS017

3. Flywheel (9)

1. Thoroughly clean and remove the oil from the threads of crankshaft.
2. Remove the oil from the crankshaft and flywheel mounting faces.
3. Mount the flywheel on the crankshaft and then install the washer.
4. Hold the crankshaft to prevent from rotating then install the bolts in the order shown to the specified torque.

Torque: 54 N-m (5.5 Kg-m/40 lb ft)

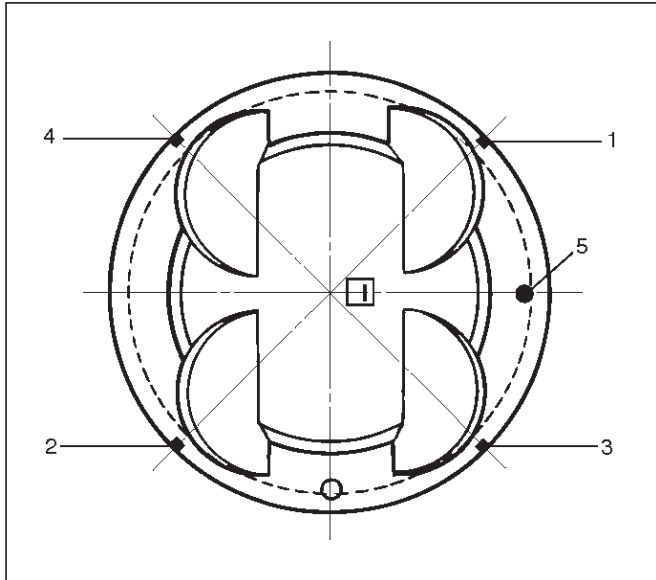
NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS018

4. Piston and connecting rod assembly (8)

- Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.



015RS019

Legend

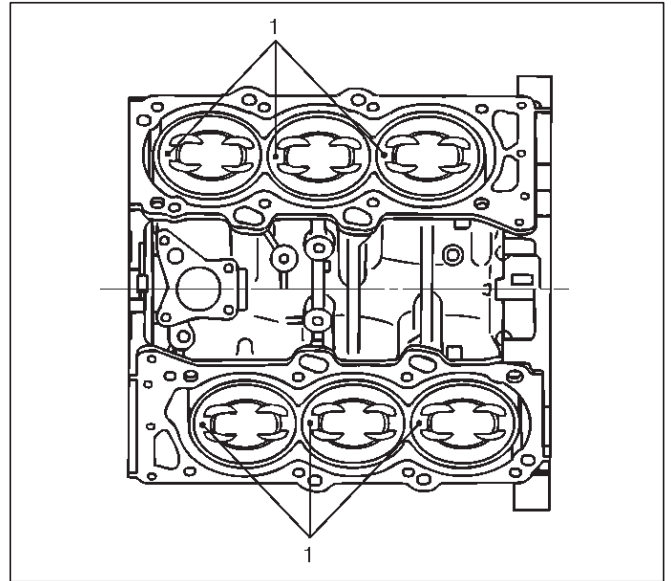
- (1) No.1 Compression Ring
- (2) No.2 Compression Ring
- (3) Oil Ring Side Rail Upper
- (4) Oil Ring Side Rail Lower
- (5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
- Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
- Apply engine oil to the threads and seating faces of the nuts.
- Tighten the nuts.

Torque: 54 N·m (5.5 Kg·m/40 lb ft)

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces.

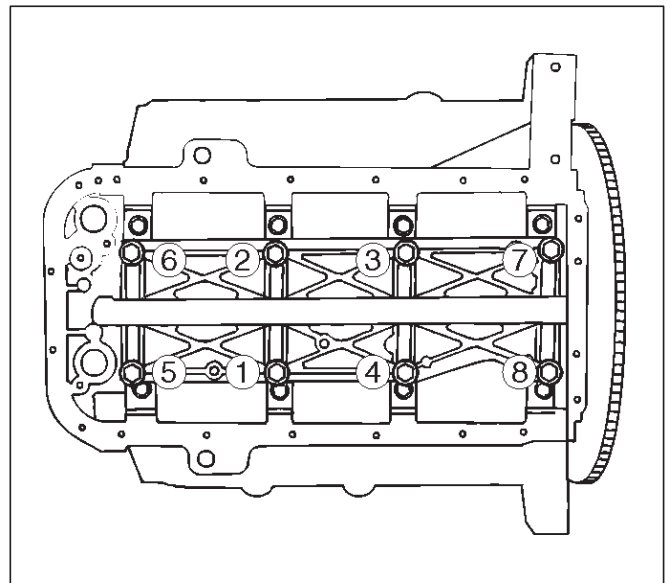


015RS020

- 5. Install oil gallery (7) and tighten the bolts in 2 steps, in the order shown.

1st step: 29 N·m (3.0 Kg·m/22 lb ft)

2nd step: 55° ~ 65°



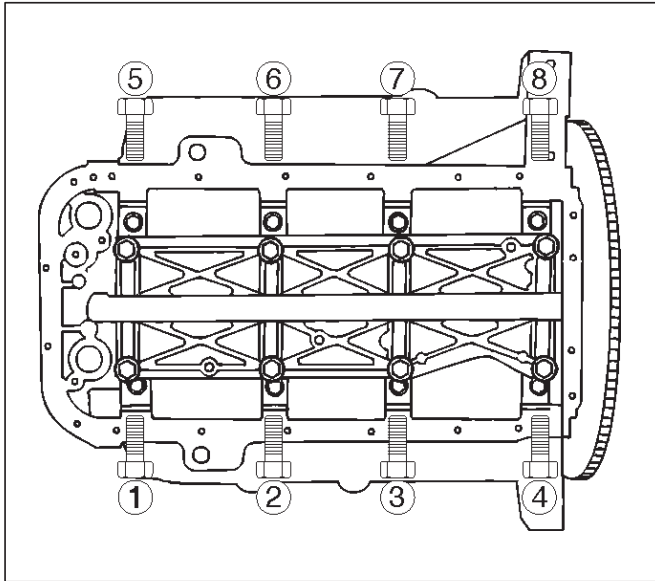
051RS009

- 6. Cylinder block side bolts (6)

- Tighten all the bolts to the specified torque in the order shown.

NOTE: Do not apply engine oil to the crank case side bolts.

Torque: 39 N·m (4.0 Kg·m/29 lb ft)



012RS001

7. Install oil pump assembly (5), refer to “Oil pump” in this manual.

8. Install oil strainer and O-ring (4).

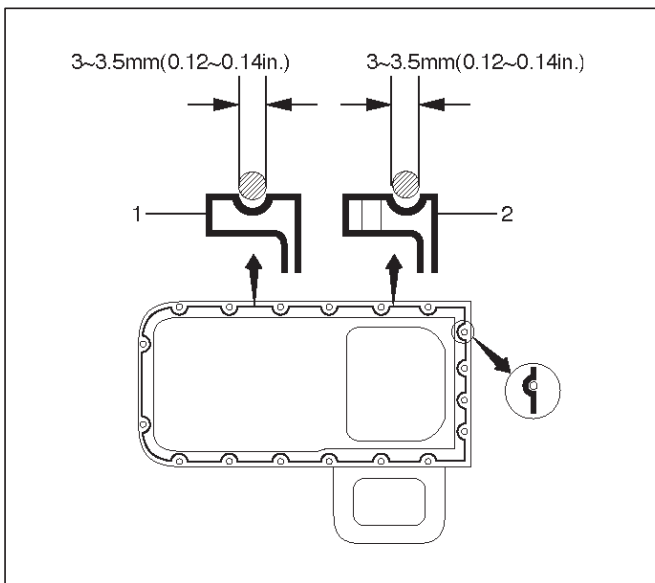
9. Install oil pipe and O-ring (3) and tighten the bolts.

Torque: 25 N·m (2.5 Kg·m/18 lb ft)

10. Install crankcase with oil pan (2).

1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
2. Apply a correct width bead of sealant (TB—1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
3. The crankcase assembly must be installed within 5 minutes after sealant application to prevent premature hardening of the sealant.
4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (1.0 Kg·m/89 lb in)



013RW010

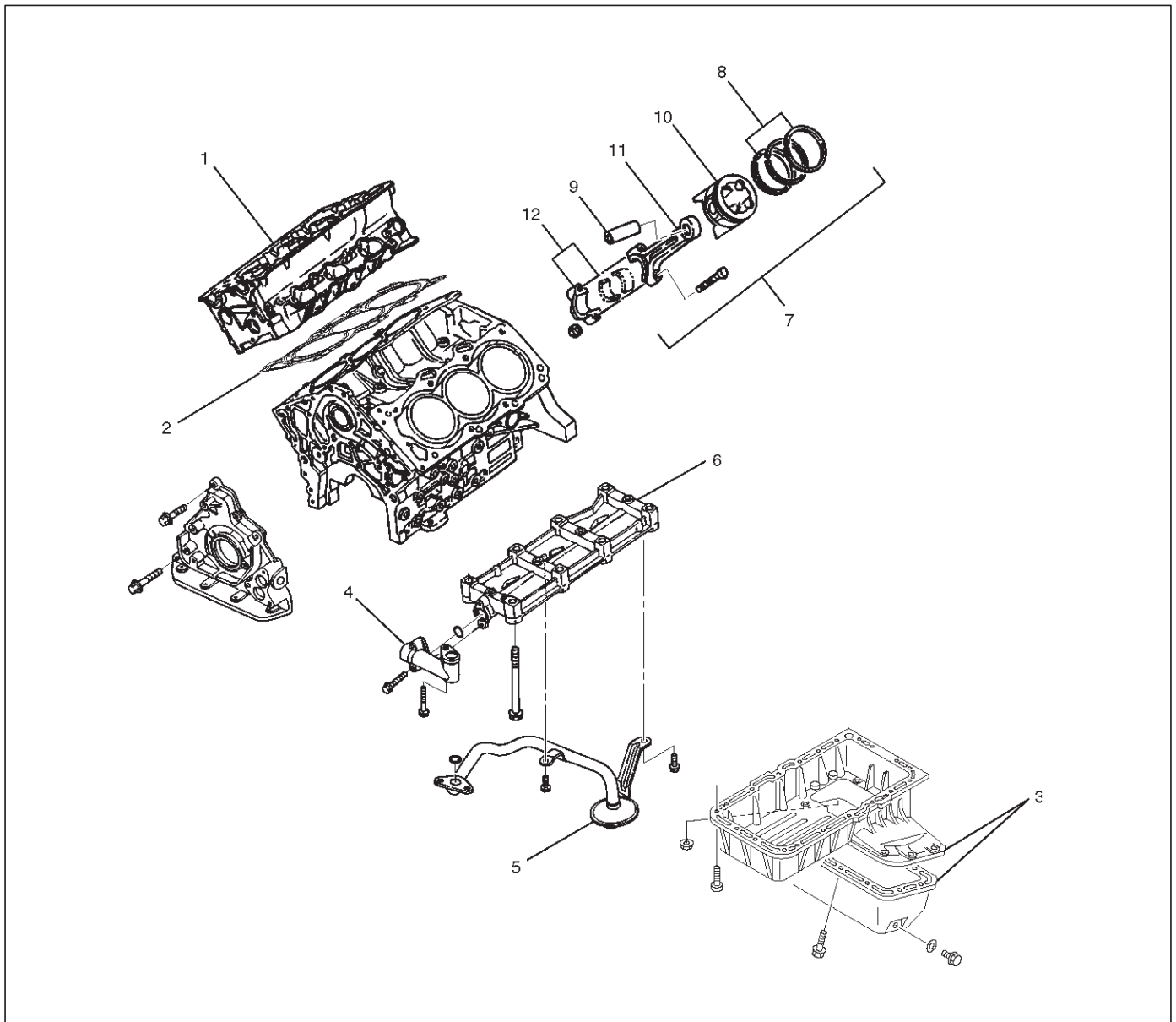
Legend

- (1) Portion Between Bolt Holes
- (2) Bolt Hole Portion

11. Install cylinder head assembly, refer to “Cylinder head” in this manual.

Piston and Connecting Rod

Piston, Connecting Rod and Associate Parts



Legend

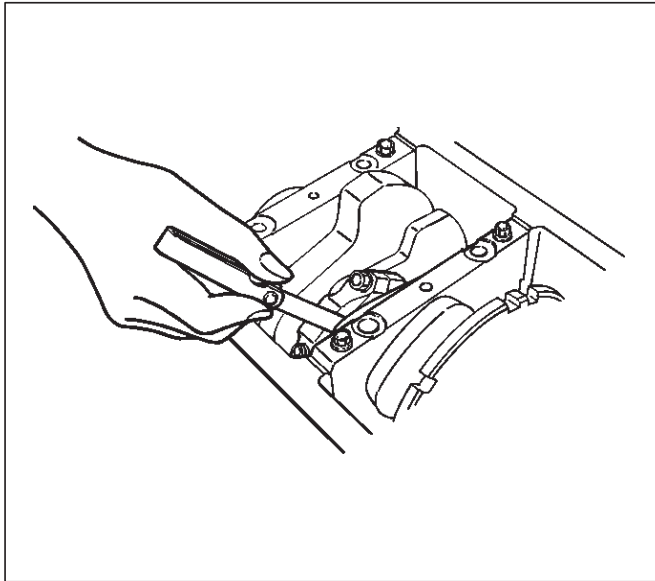
- | | |
|-----------------------------|--|
| (1) Cylinder Head Assembly | (7) Piston and Connecting Rod Assembly |
| (2) Cylinder Head Gasket | (8) Piston Ring |
| (3) Crankcase with Oil Pan | (9) Piston Pin |
| (4) Oil Pipe and O-Ring | (10) Piston |
| (5) Oil Strainer and O-Ring | (11) Connecting Rod |
| (6) Oil Gallery | (12) Connecting Rod Cap |

Disassembly

1. Remove cylinder head assembly (1). Refer to "Cylinder Head Removal" in this manual.
2. Remove cylinder head gasket (2).
3. Remove crankcase with oil pan (3). Refer to "Oil Pan and Crankcase" in this manual.
4. Remove oil pipe and O-ring (4).

5. Remove oil strainer and O-ring (5).
6. Remove oil gallery (6).
7. Remove connecting rod cap with connecting rod lower bearing (12).
8. Remove piston and connecting rod assembly (7).

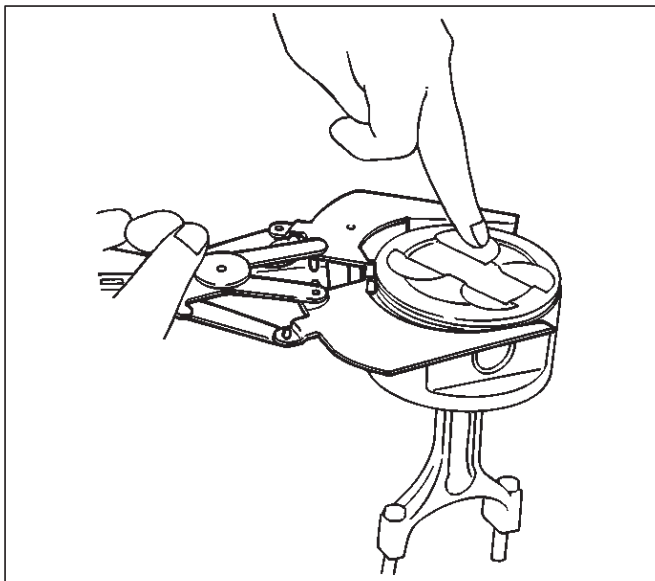
NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.



015RS031

- Remove any ridge or carbon build up from the top end of the cylinder.

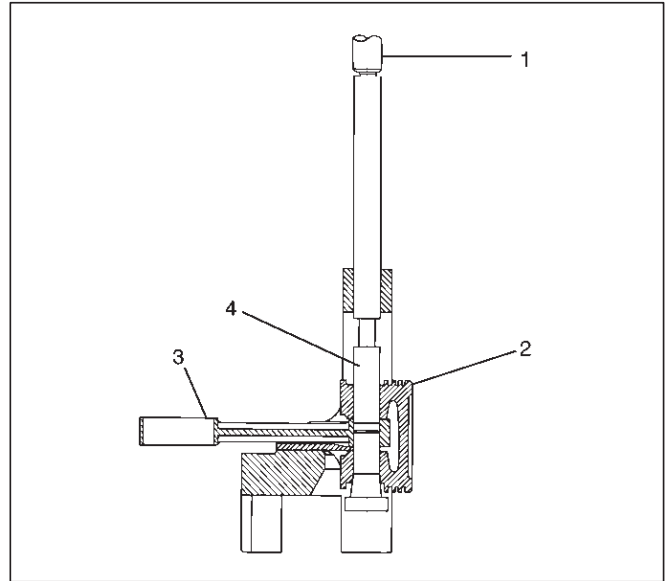
9. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.



015RS022

10. Remove the piston pin (9) using 5-8840-0551-0 piston pin service set and piston support with a press.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions. Heating the connecting rod will permit easy removal of the piston pin.



015RX001

Legend

- (1) Press Ram
- (2) Piston
- (3) Connecting Rod
- (4) Piston Pin

- 11. Piston (10)
- 12. Connecting rod (11)

Inspection and Repair

Pistons (10)

Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

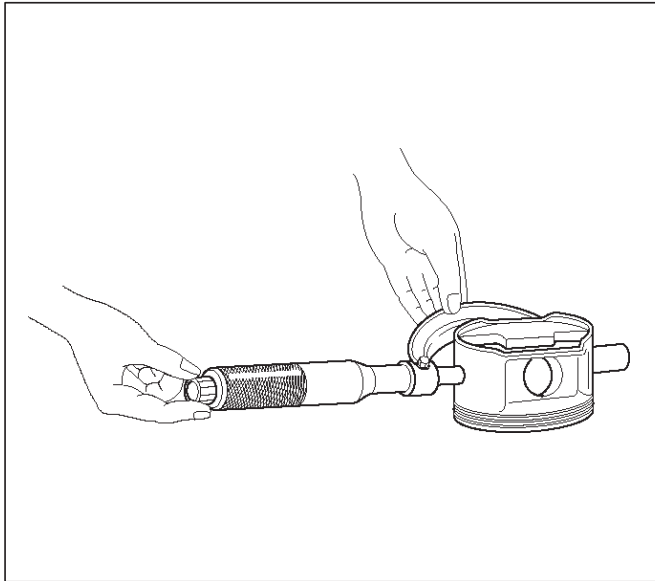
NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

Piston Diameter

1. Measure the piston outside diameter with micrometer at the piston grading position and a right angle to the piston pin.

Piston grading position (from piston head)

Piston grading position : 43.0 mm (1.6929 in)



015RV014

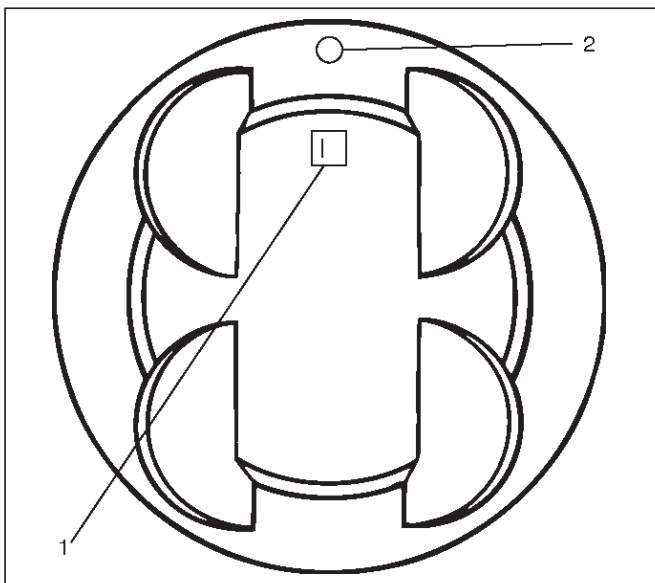
The size mark (1) for piston outside diameter is represented as shown in illustration below.

Outside Diameter

**Size Mark A : 93.360 mm–93.370 mm
(3.6756 in–3.6760 in)**

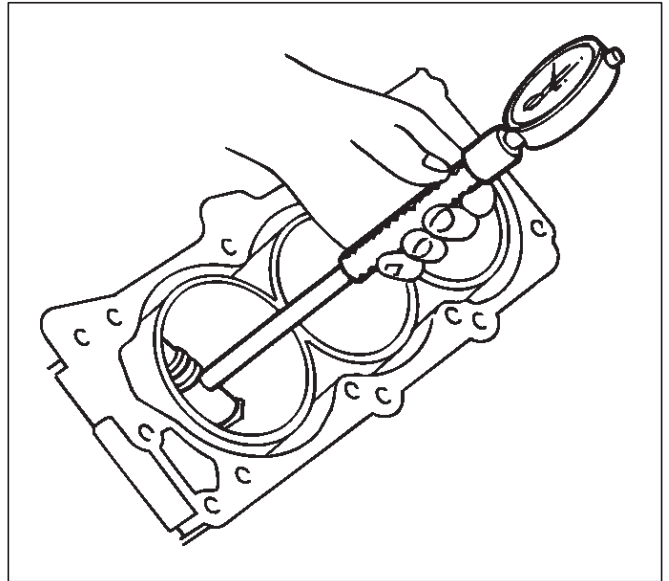
**Size Mark B : 93.371 mm–93.380 mm
(3.6760 in–3.6764 in)**

**Size Mark C : 93.381 mm–93.390 mm
(3.6764 in–3.6768 in)**



015RS025

Measure the cylinder bore inside diameter (refer to “Cylinder Block” in this manual).



012RS002

Piston Rings (8)

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement

- Insert the piston ring into the bore.
- Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
- Measure the ring end gap.

Compression Ring

1st ring

**Standard: 0.300 mm–0.400 mm
(0.0118 in–0.0157 in)**

Limit: 1.0 mm (0.0394 in)

2nd ring

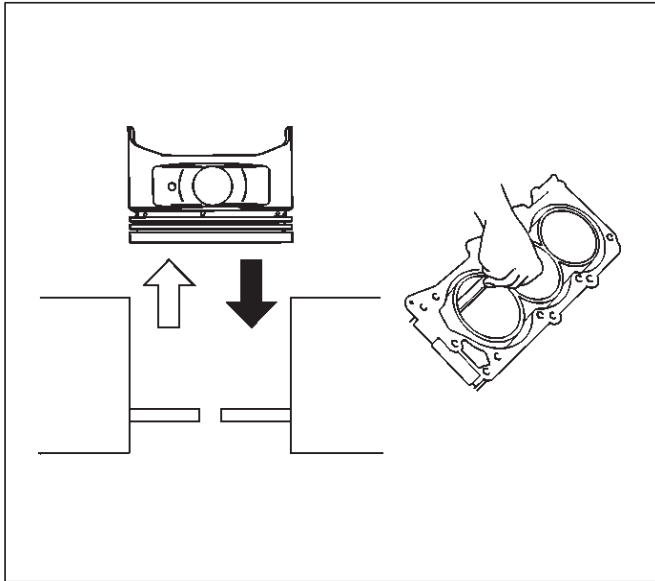
**Standard: 0.450 mm–0.600 mm
(0.0177 in–0.0236 in)**

Limit: 1.2 mm (0.0472 in)

Oil ring

**Standard: 0.150 mm–0.450 mm
(0.0059 in–0.0177 in)**

Limit: 1.05 mm (0.0413 in)

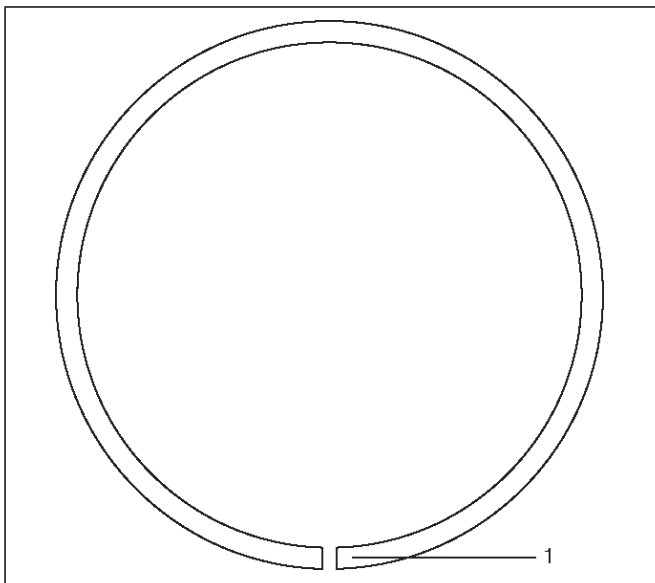


015RS026

- Positioning mark (1) is painted as shown in the illustration.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring



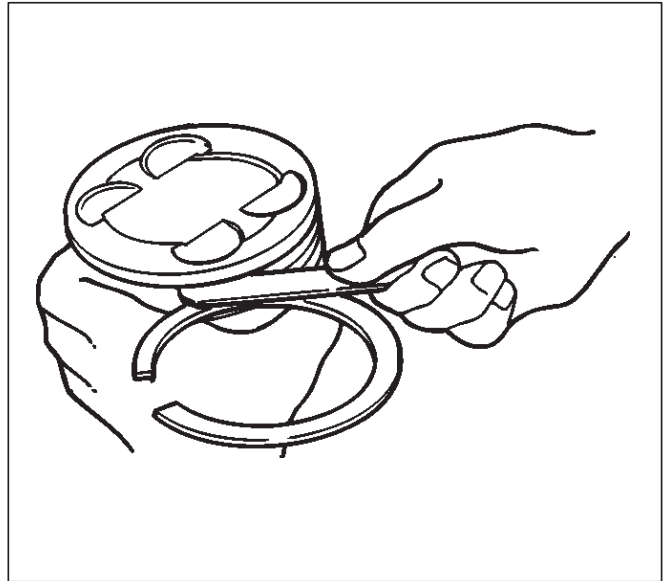
015RS027

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

Compression Ring Clearance

**Standard : 0.016 mm–0.038 mm
(0.0006 in.–0.0015 in)**

Limit : 0.15mm (0.0059 in)



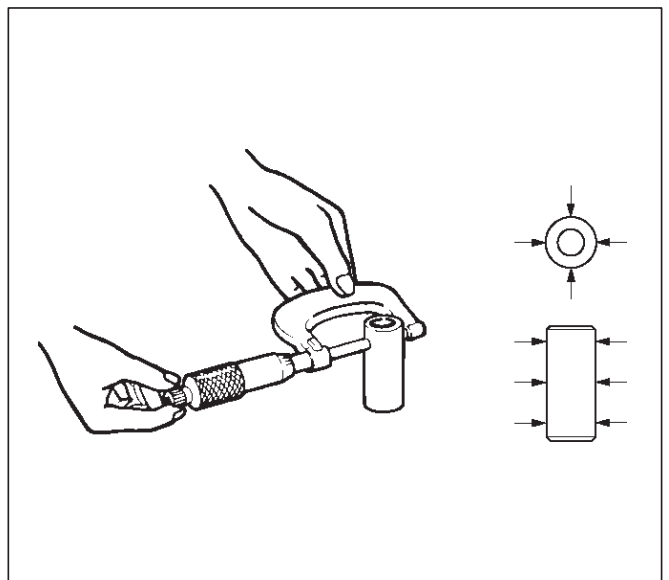
015RS028

Piston Pin (9)

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

Standard : 0.023 mm–0.038 mm (0.0009 in–0.0015 in)



015RS029

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

Clearance

**Standard : 0.010 mm–0.017 mm
(0.0004 in.–0.0007 in)**

Limit : 0.040 mm (0.0016 in)

Connecting Rods (11)

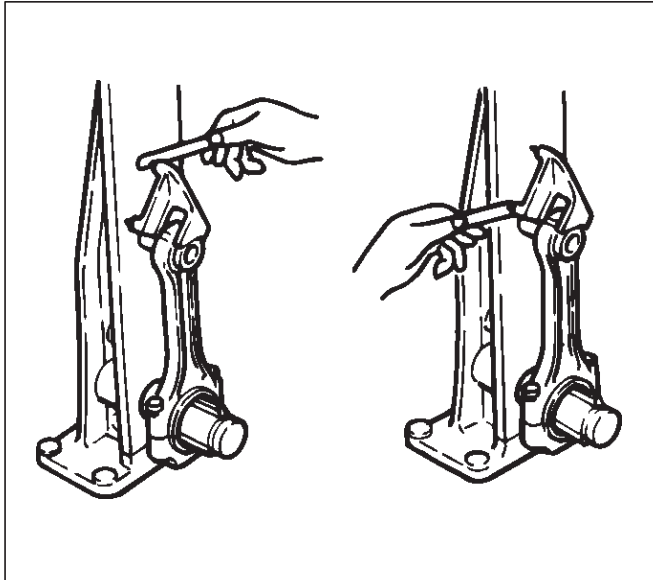
1. Check the connecting rod alignment. If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

Bend per 100 mm (3.937 in)

Limit: 0.15 (0.0059)

Twist per 100 mm (3.937 in)

Limit: 0.20 (0.0078)



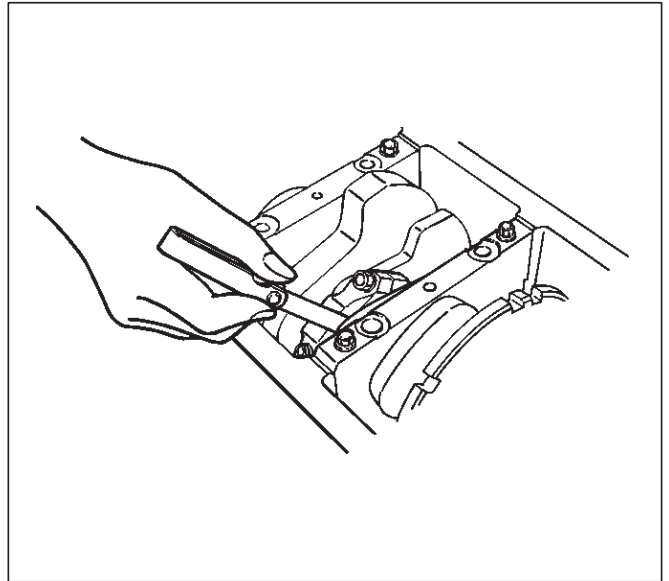
015RS030

2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the large end of the connecting rod. If the clearance exceeds the specified limit, the connecting rod must be replaced.

Standard : 0.16 mm–0.35 mm

(0.0063 in.–0.0138 in)

Limit : 0.40 mm (0.0157 in)



015RS031

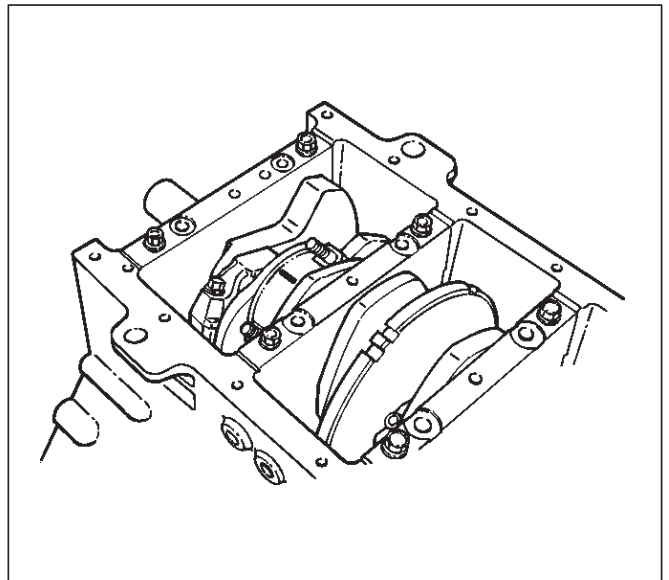
3. Measure the oil clearance between the connecting rod and the crankshaft.

1. Remove the connecting rod cap nuts and the rod caps (12).

Arrange the removed rod caps in the cylinder number order.

2. Clean the rod bearings and the crankshaft pins.

3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.



015RS032

6A-82 ENGINE MECHANICAL

- Reinstall the rod caps (12) to their original positions.
Tighten the rod cap nuts.

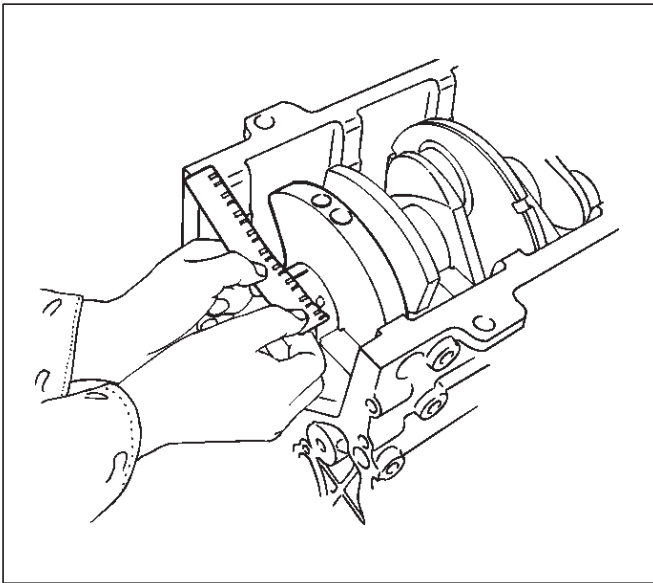
Torque: 54 N·m (5.5 Kg·m/40 lb ft)

NOTE: Do not allow the crankshaft to rotate.

- Remove the rod caps.
- Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

**Standard : 0.019 mm–0.043 mm
(0.0007 in–0.0017 in)**

Limit : 0.08 mm (0.003 in)



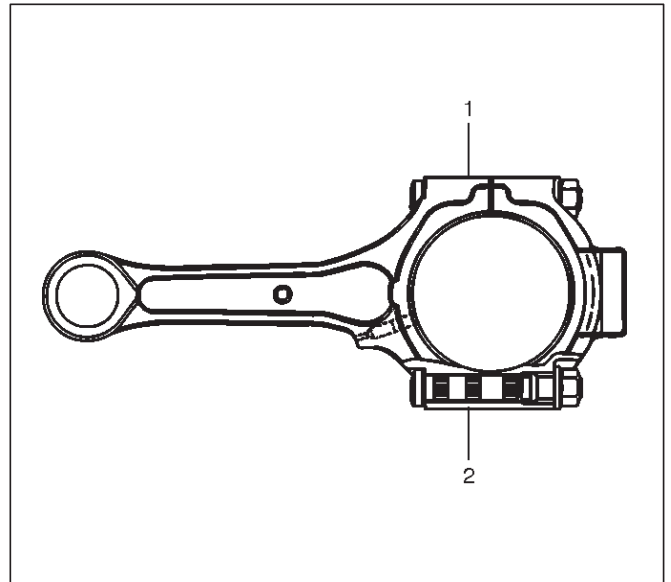
015RS008

- Clean the plastigage from the bearings and the crankshaft pins.

Con-rod Bearing Selection

Select and install the new connecting rod bearings, paying close attention to the connecting rod big end diameter size mark (1).

NOTE: Take care not to confuse the alignment mark (2) and the size mark (1) during the installation procedure.



015RS034

1 Size Mark	Big end Bore Diameter	Crankshaft Pin Diameter	Connecting Rod Bearing Thickness (Reference)	Color of Size Mark	Oil Clearance (Reference)
A	56.994-57.000 (2.2439-2.2441)	53.922-53.937 (2.1229-2.1235)	1.512-1.516 (0.0595-0.0597)	Yellow	0.025-0.054 (0.0010-0.0021)
B	56.988-56.994 (2.2436-2.2439)		1.508-1.512 (0.0594-0.0595)	Green	0.027-0.056 (0.0011-0.0022)
C	56.982-56.988 (2.2434-2.2436)		1.504-1.508 (0.0592-0.0594)	Pink	0.029-0.058 (0.0011-0.0023)

Reassembly

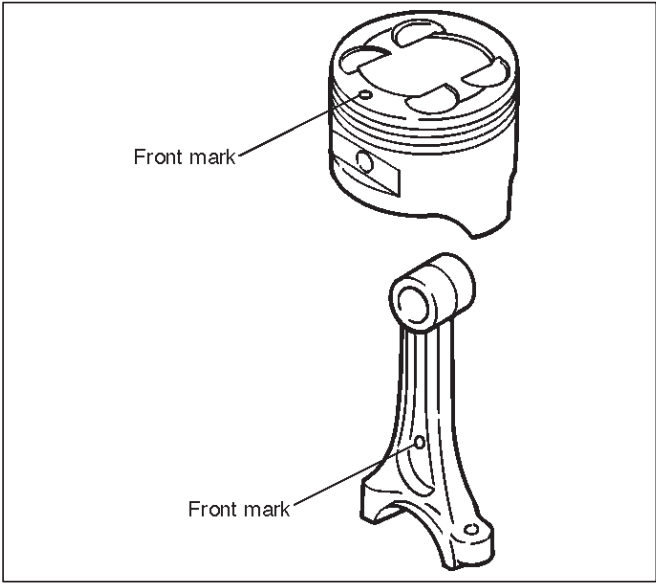
- Install connecting rod
- Install piston

- Install piston pin

- Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

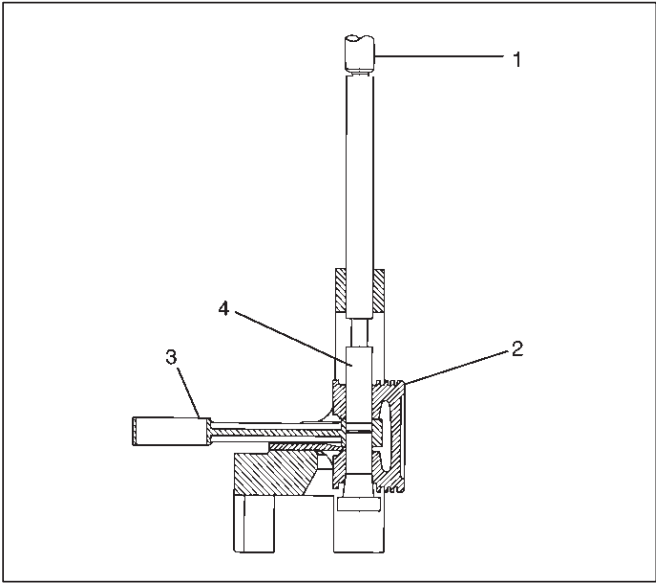
NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

- Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.



- With 5-8840-0551-0 Piston pin service set and a press, press fit the piston pin.

NOTE: Heat the connecting rod small end to a suitable temperature to ensure smooth installation.

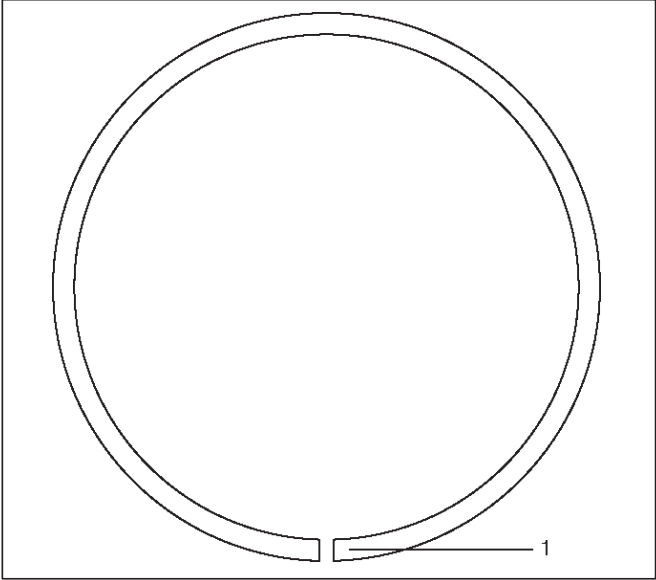


Legend

- (1) Press Ram
- (2) Piston
- (3) Connecting Rod
- (4) Piston Pin

- 4. Install piston ring with the piston ring expander. The compression ring must be set with the T mark (1) facing up.

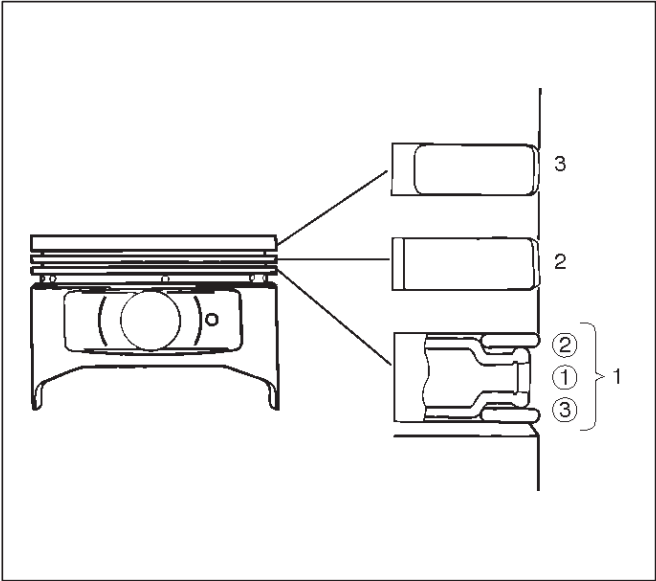
Marked T : No.1 Compression ring
Marked T2 : No.2 Compression ring



- Install piston rings in the following sequence.
 1. Oil ring
 1. Expander ring
 2. Upper side rail
 3. Lower side rail
 2. 2nd compression ring
 3. 1st compression ring
- The compression rings must be set with the T or T2 mark facing up.

Marked T : No.1 Compression ring
Marked T2 : No.2 Compression ring

- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.



- 5. Install piston and connecting rod assembly.
 - Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.

6A-84 ENGINE MECHANICAL

- Tighten the connecting rod cap nuts

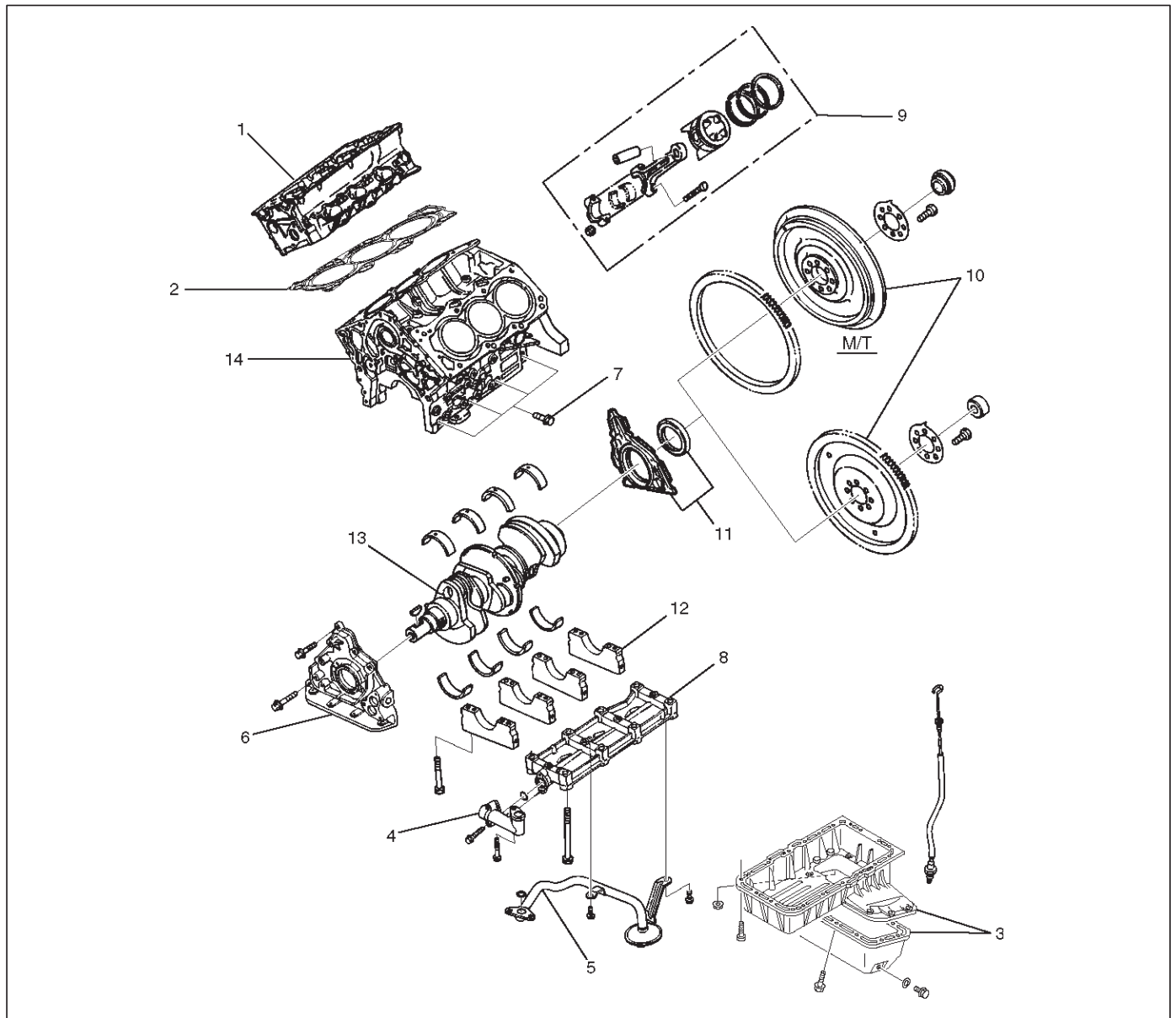
Torque : 54 N·m (5.5 Kg·m/40 lb ft)

NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to "Crankshaft and main bearing" in this manual.
7. Oil strainer and O-ring.
8. Oil pipe and O-ring.
9. Install crankcase with oil pan, refer to "Oil pan and Crankcase" in this manual.
10. Install cylinder head gasket.
11. Install Cylinder head assembly.
 - Refer to "Cylinder head" in this manual.

Cylinder Block

Cylinder Block and Associated Parts



012RW010

Legend

- | | |
|-------------------------------|--|
| (1) Cylinder Head Assembly | (8) Oil Gallery |
| (2) Cylinder Head Gasket | (9) Piston and Connecting Rod Assembly |
| (3) Crankcase with Oil Pan | (10) Flywheel |
| (4) Oil Pipe and O-Ring | (11) Rear Oil Seal Retainer Assembly |
| (5) Oil Strainer and O-Ring | (12) Main Bearing Cap |
| (6) Oil Pump Assembly | (13) Crankshaft |
| (7) Cylinder Block Side Bolts | (14) Cylinder Block |

Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove crankcase with oil pan.
4. Remove oil pipe and O-ring.
5. Remove oil strainer and O-ring.
6. Remove oil pump assembly.
7. Remove crankcase side bolts.
8. Remove oil gallery.
9. Remove piston and connecting rod assembly.
10. Remove flywheel.

11. Remove rear oil seal retainer assembly.
12. Remove main bearing cap.
13. Remove crankshaft.
14. Remove cylinder block.

Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

Flatness

1. Using a straight-edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

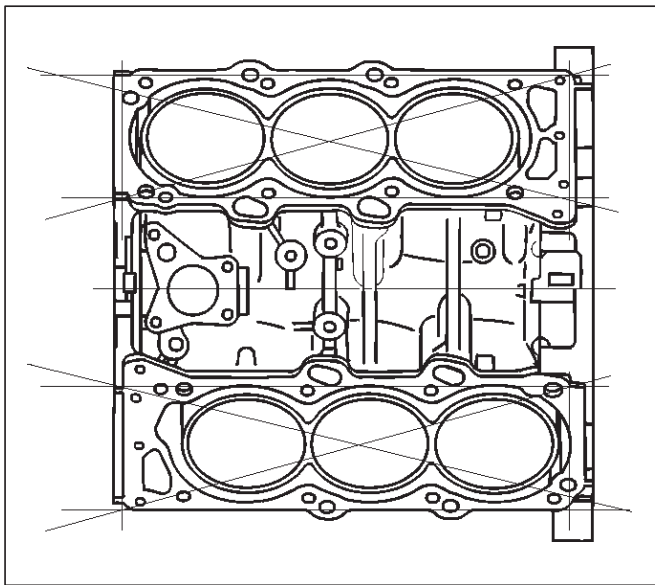
CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

Warpage

Limit : 0.15 mm (0.0059 in)

Maximum repairable limit: 0.15 mm (0.0059 in)



012RS004

Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

Cylinder Bore Inside Diameter

Limit : 93.530 (3.6823)

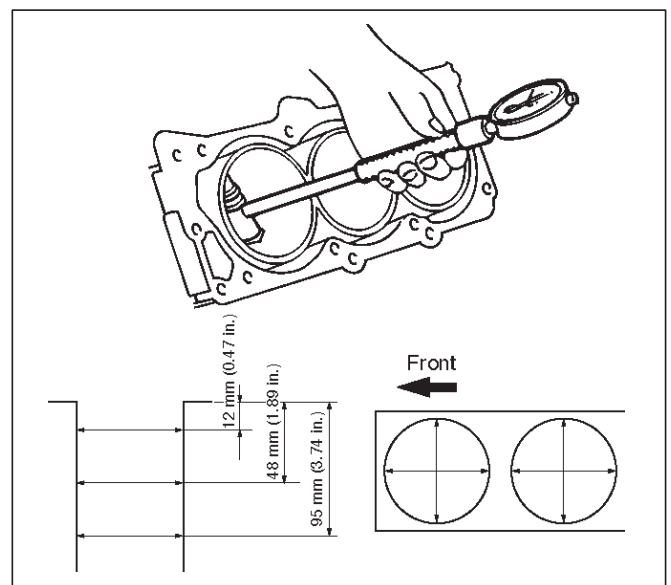
If the measurement exceed the specified limit, the cylinder block must be replaced.

Diameter

**Grade A : 93.400 mm–93.410 mm
(3.6772 in–3.6776 in)**

**Grade B : 93.411 mm–93.420 mm
(3.6776 in–3.6779 in)**

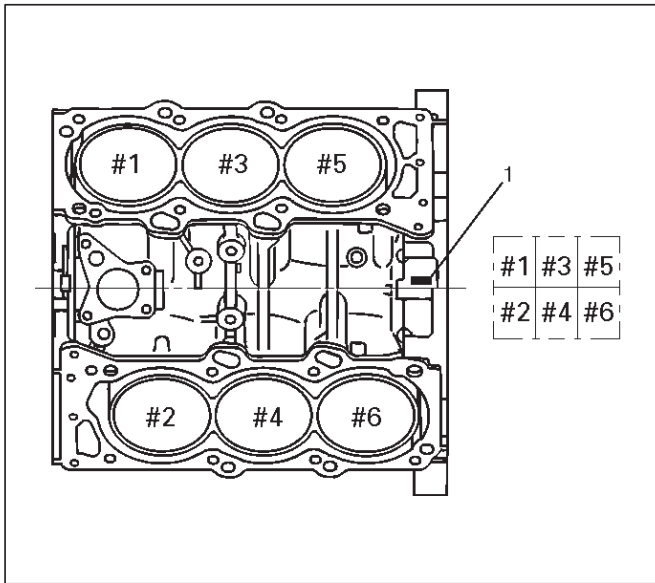
**Grade C : 93.421 mm–93.430 mm
(3.6780 in–3.6783 in)**



012RS005

NOTE: For information on piston diameter, please refer to the section "Inspection of the Piston and Connecting Rod Assembly" in this manual.

- The "Grade" mark (1) is stamped at the position illustrated.

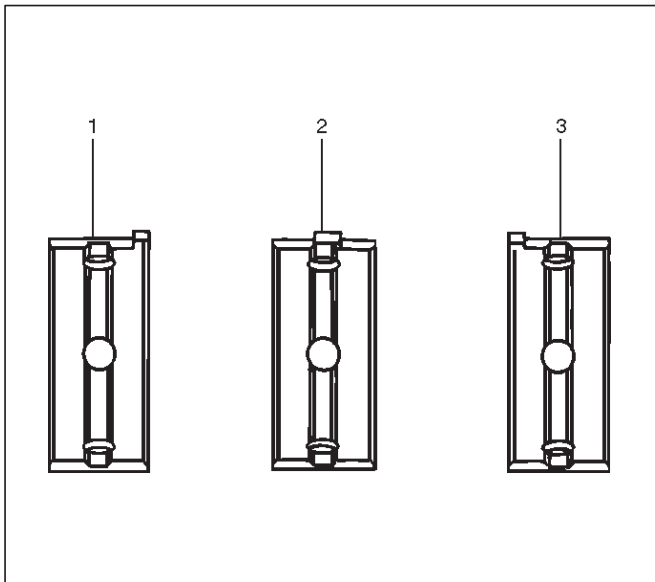


012RS006

Reassembly

1. Install cylinder block.
2. Install crankshaft.
 - Install the main bearings to the cylinder block and the main bearing caps.
 - Be sure that they are positioned correctly.
 - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the bearing back faces.



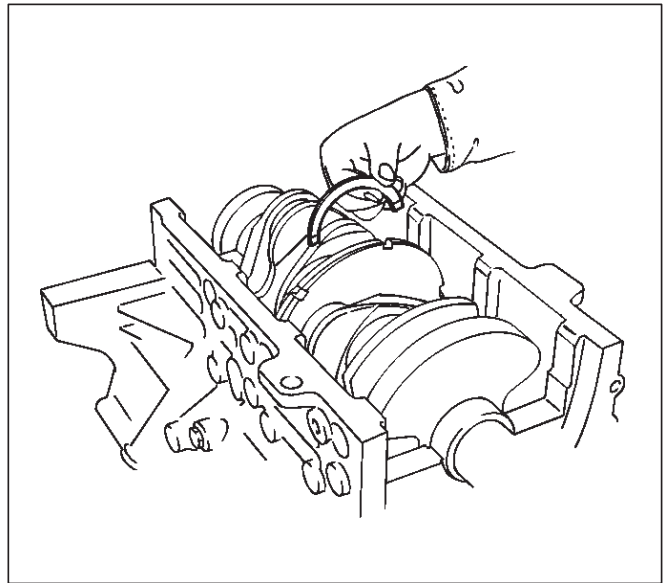
015RS012

Legend

- (1) Number 1 and 4 main bearing upper and lower.
- (2) Number 2 and 3 main bearing upper.
- (3) Number 2 and 3 main bearing lower.

- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.

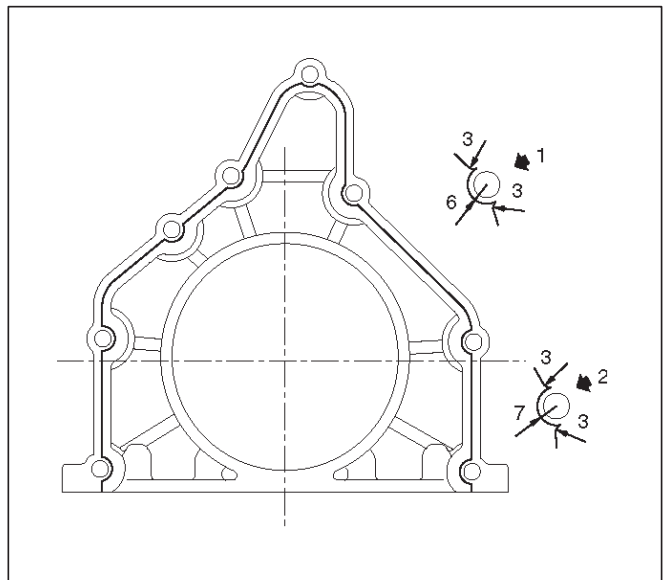
- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.



015RS013

3. Install rear oil seal retainer.

- Remove oil on cylinder block and retainer fitting surface.
- Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
- The oil seal retainer must be installed within 5 minutes after sealant application before the sealant hardens.



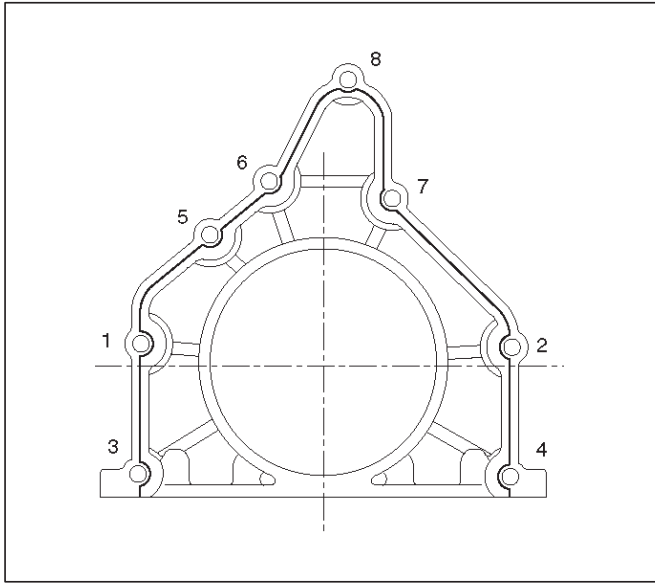
015RW002

Legend

- (1) Around Bolt Holes
- (2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque: 25 N·m (2.5 Kg·m/18.4 lb ft)



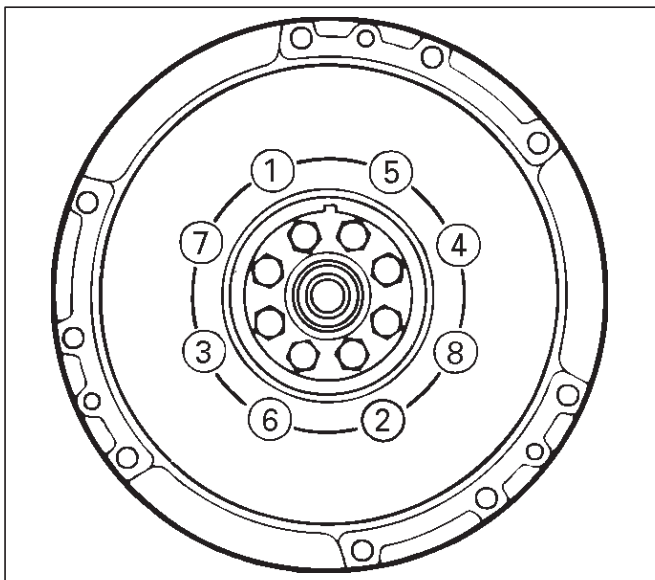
015RW001

4. Install flywheel

1. Thoroughly clean and remove the oil from the threads of crankshaft.
2. Remove the oil from the crankshaft and flywheel mounting faces.
3. Mount the flywheel on the crankshaft and then install the washer.
4. Holding the crankshaft stationary, tighten the flywheel bolts in the order shown.

Torque: 54 N·m (5.5 Kg·m/40 lb ft)

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.



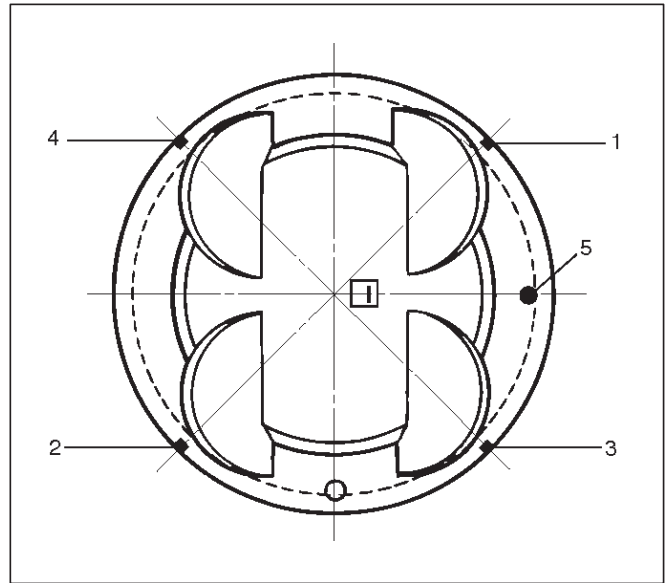
015RS018

5. Install piston and connecting rod assembly.

- Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

- Check to see that the piston ring end gaps are correctly positioned.

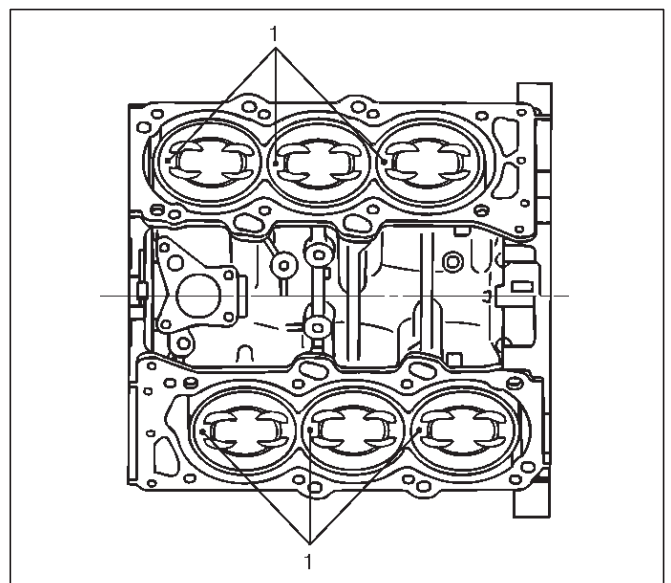


015RS019

Legend

- (1) No.1 Compression Ring
- (2) No.2 Compression Ring
- (3) Oil Ring Side Rail Upper
- (4) Oil Ring Side Rail Lower
- (5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks (1) must be facing the front of the engine.

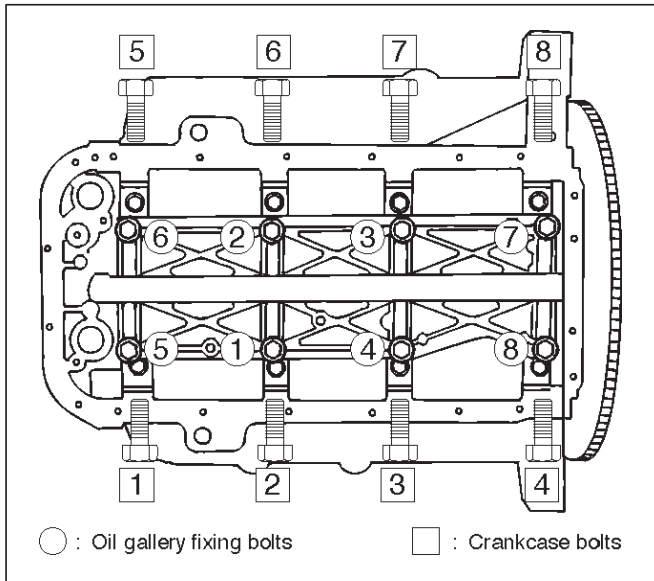


015RS020

6. Install oil gallery and tighten the bolts in 2 steps in the order shown.

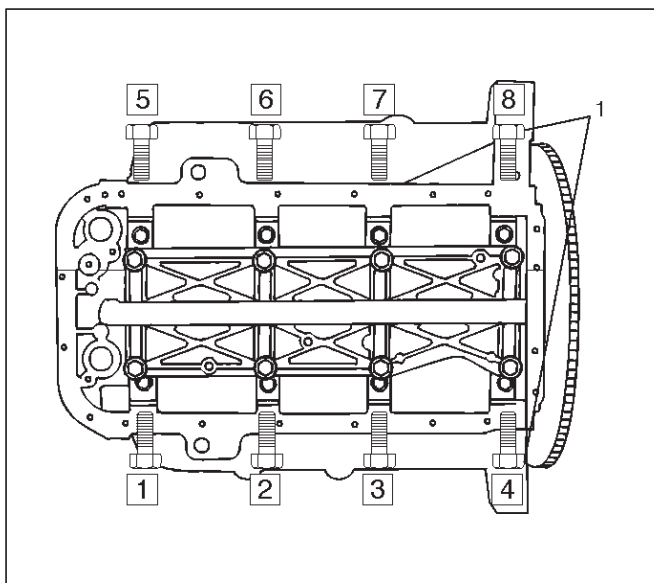
1st step : 29 N·m (3.0 Kg·m/22 lb ft)

2nd step : 55° ~ 65°



7. Install cylinder block side bolts (1) and tighten crankcase bolts in sequence shown in the illustration.

Torque : 39 N·m (4.0 Kg·m/29 lb ft)



8. Install oil pump assembly. Refer to "Oil Pump" in this manual.

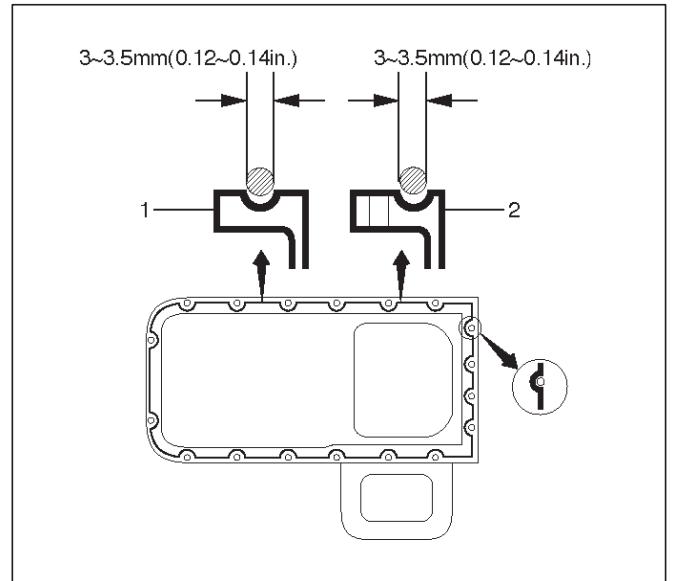
9. Install oil strainer and O-ring.

10. Install oil pipe and O-ring.

11. Install crankcase with oil pan.

1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
2. Apply a correct width bead of sealant (TB- 1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
3. The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (1.0 Kg·m/89 lb in)



Legend

- (1) Portion Between Both Holes
- (2) Bolt Hole Portions

12. Install cylinder head gasket.

13. Install cylinder head assembly. Refer to "Cylinder Head" in this manual.

Main Data and Specification

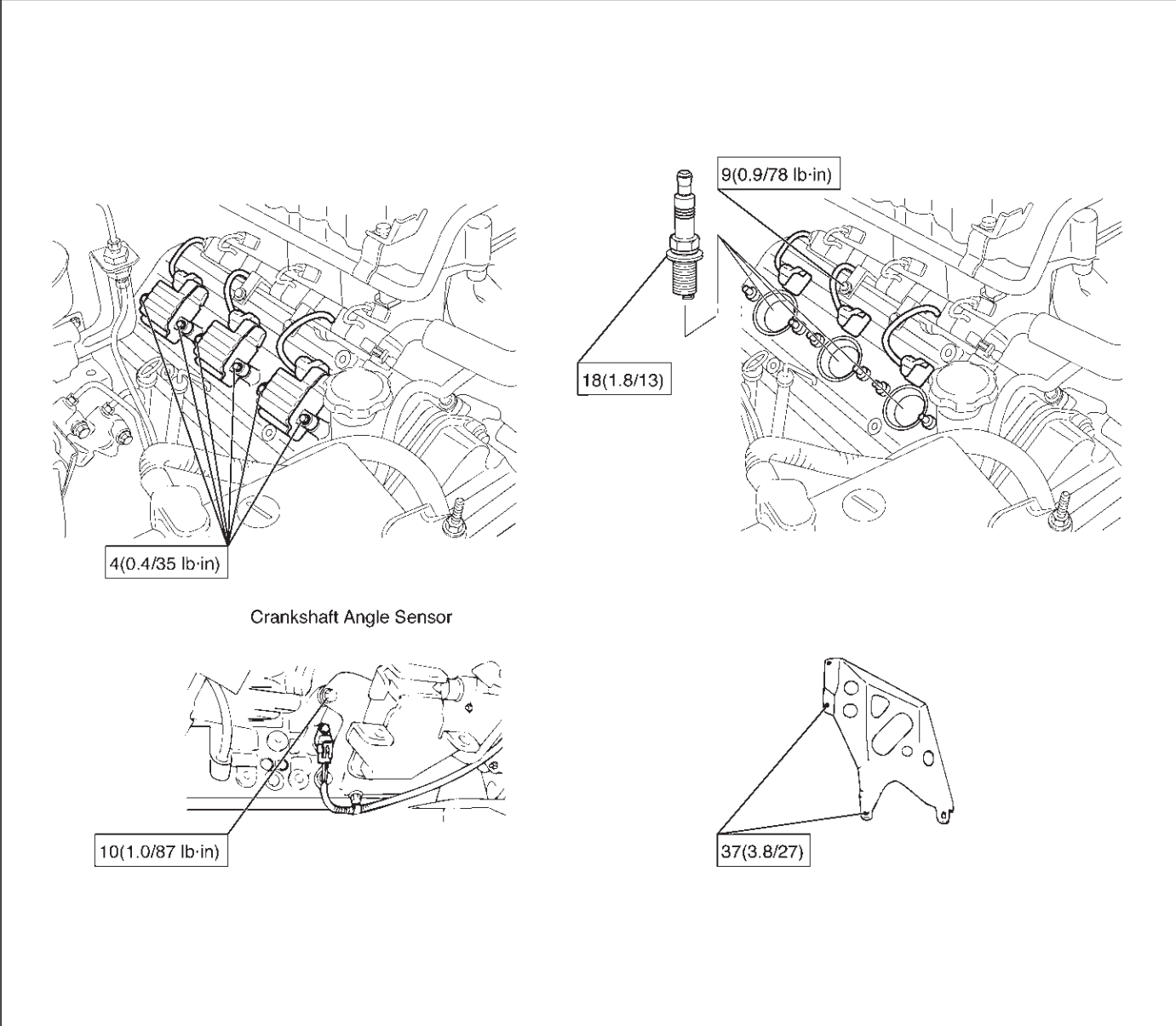
General Specification

Item	Specifications	
	6VD1	6VE1
Engine type, number of cylinders and arrangement	Water cooled, four cycle V6	
Form of combustion chamber	Pent roof type	
Valve mechanism	4-Cams, 4-Valves, DOHC Gear & Belt Drive	
Cylinder liner type	Casted in cylinder drive	
Total piston displacement	3165 cc	3494 cc
Cylinder bore x stroke	93.4mm x 77.0mm (3.6772 in x 3.0315 in)	93.4mm x 85.0mm (3.6772 in x 3.3465 in)
Compression ratio	9.1 : 1	
Compression pressure at 300rpm	14.0 Kg/cm ²	
Engine idling speed rpm	Non adjustable (750)	
Valve clearance	Intake: 0.28 mm (0.11 in)	
	Exhaust: 0.30mm (0.12in)	
Oil capacity	5.3 liters	
Ignition timing	Non adjustable 16° BTDC at idle rpm)	Non adjustable (20° BTDC at idle rpm)
Spark plug	K16PR-P11, PK16PR11, RC10PYP4	
Plug gap	1.0 mm-1.1 mm(0.0394 in – 0.0433 in)	

Torque Specifications

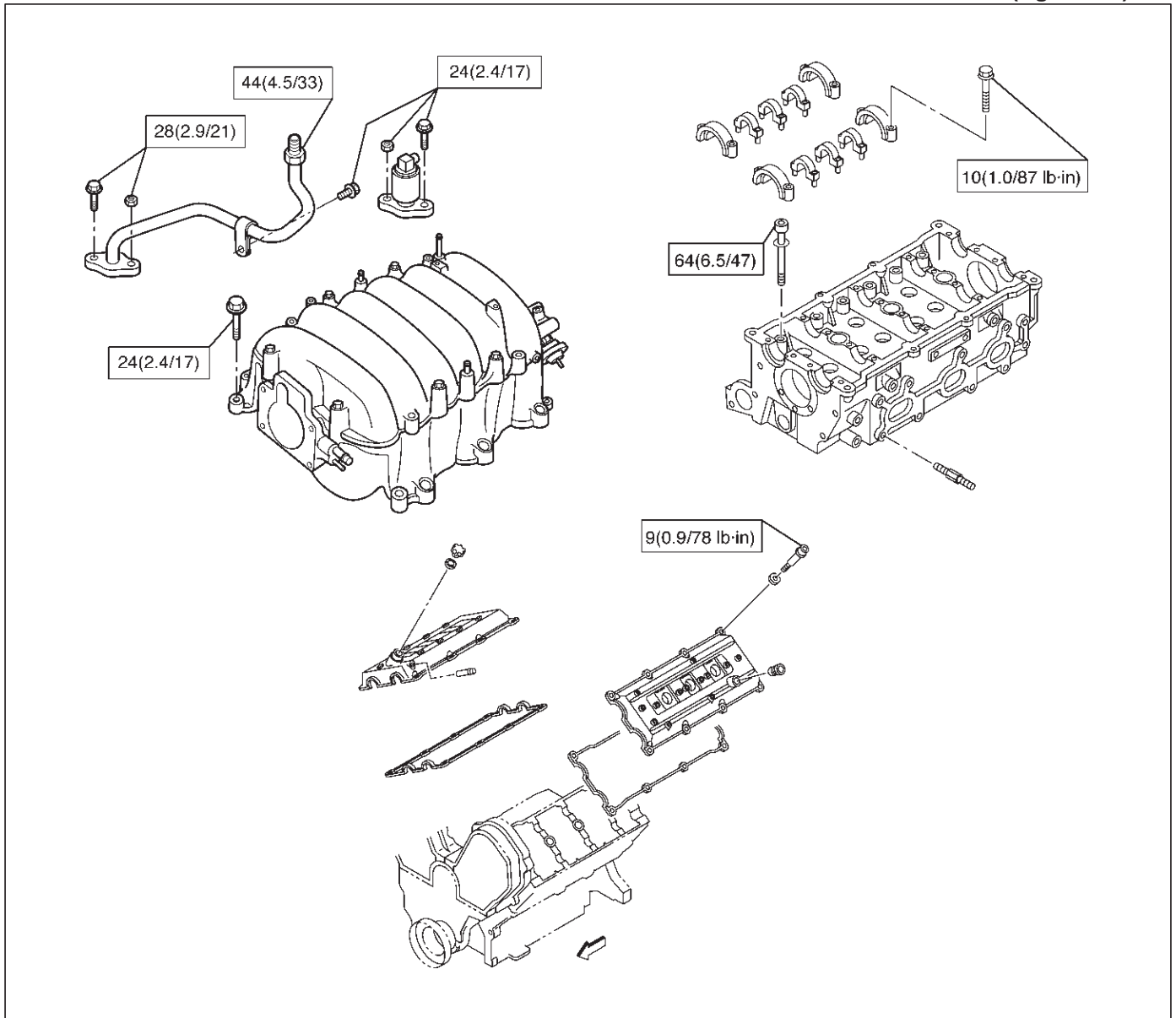
Ignition coil, Spark plug, Crankshaft angle sensor and Under cover

N-m (Kg-m/lb ft)



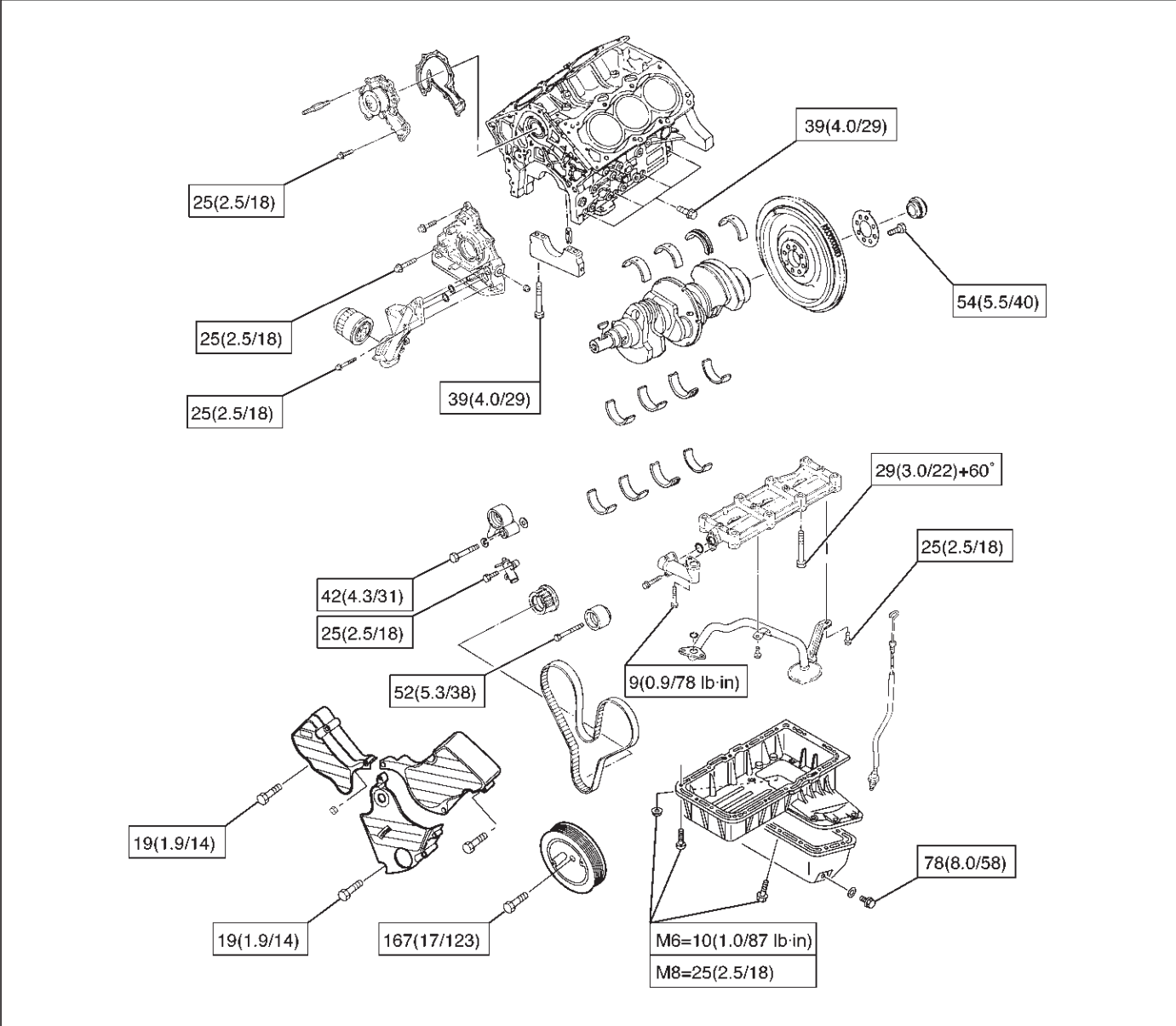
6A-92 ENGINE MECHANICAL

Cylinder head cover, Cylinder head, Camshaft bracket, Common chamber, EGR valve and EGR pipe
N-m (Kg-m/lb ft)



Crankshaft main bearing, Flywheel, Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer and Water pump

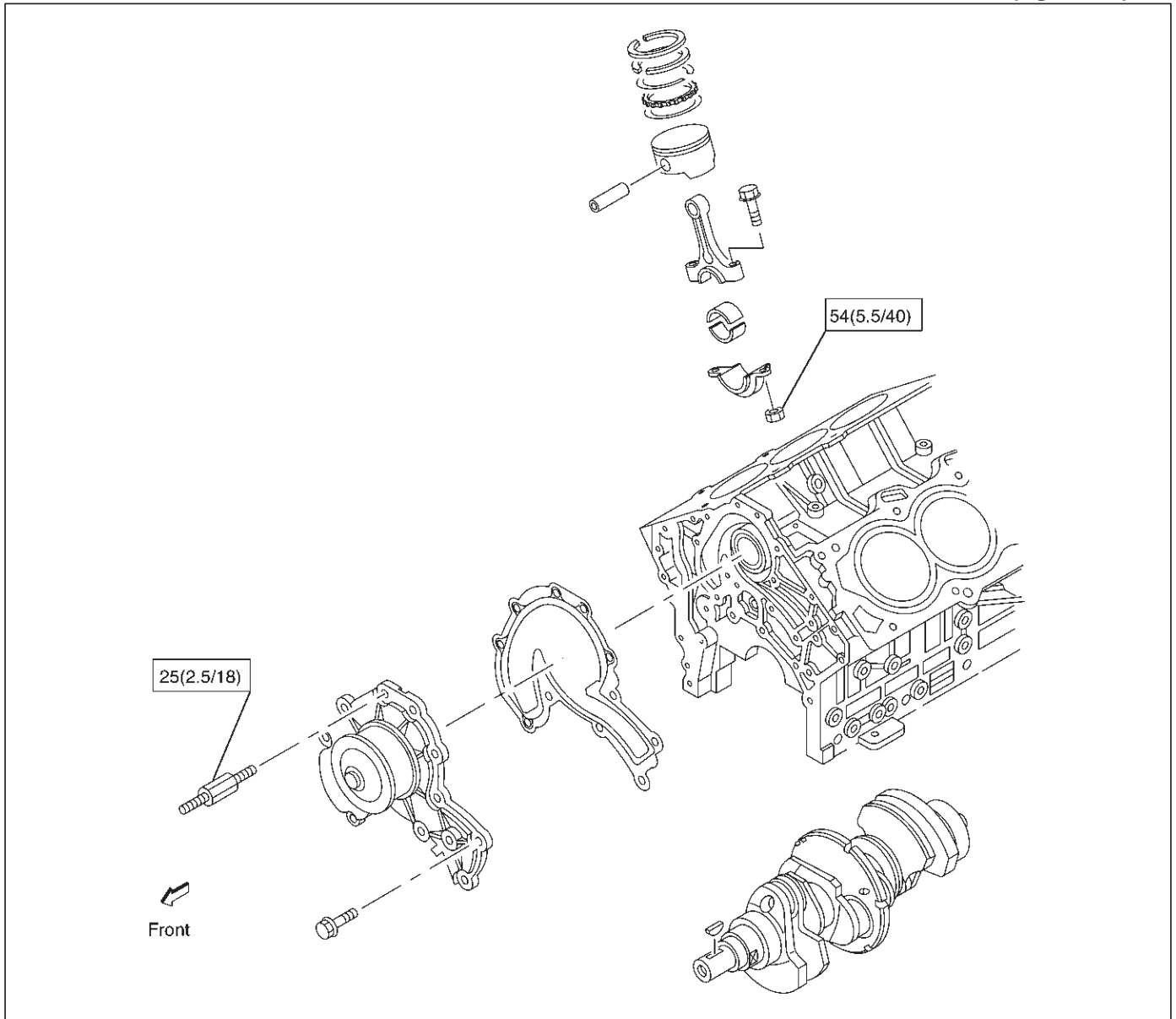
N-m (Kg-m/lb ft)



6A-94 ENGINE MECHANICAL

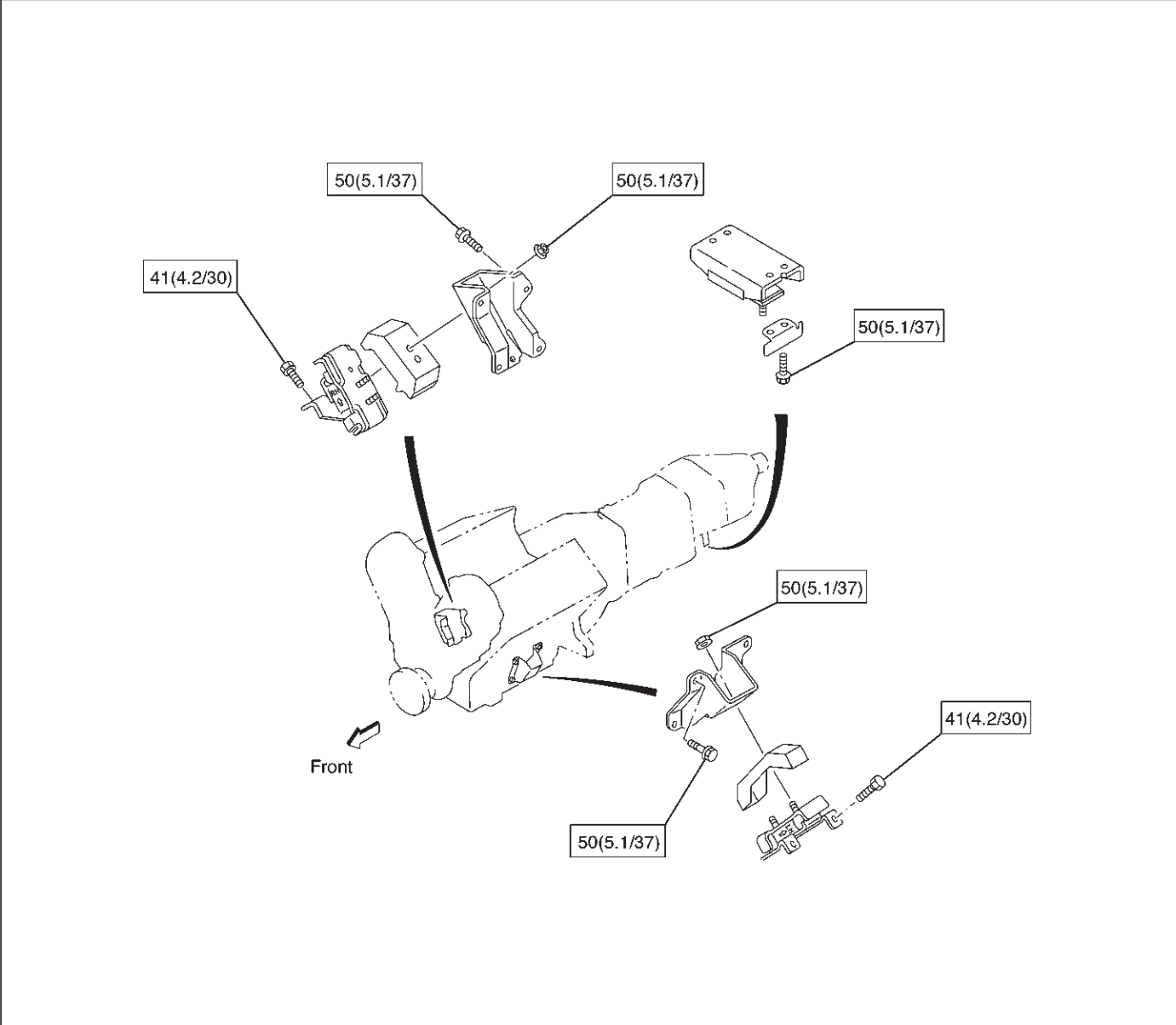
Connecting rod and Water pump

N-m (Kg-m/lb ft)



Engine mount

N-m (Kg-m/lb ft)



Special Tool

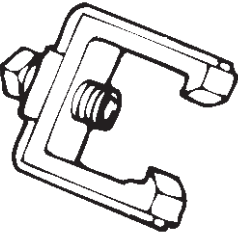
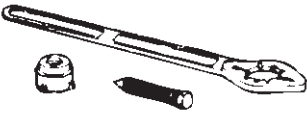
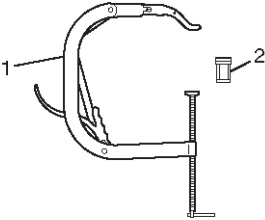
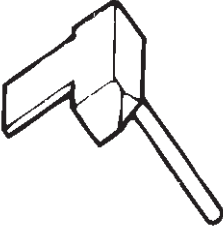
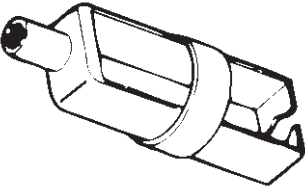
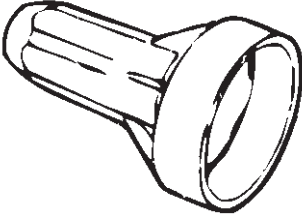
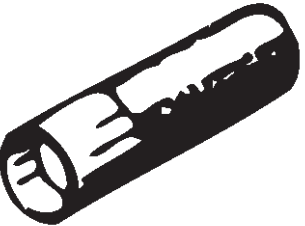
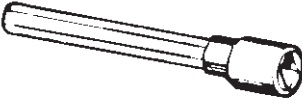
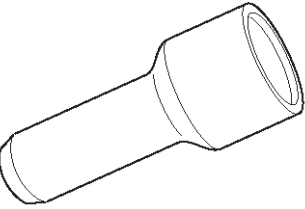
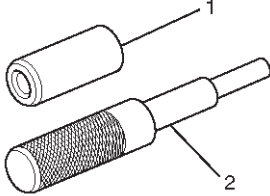
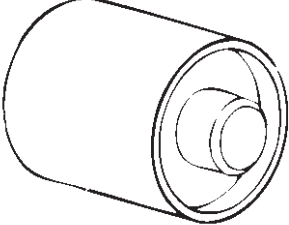
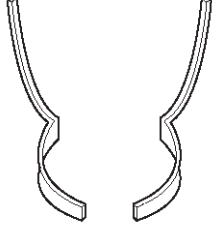
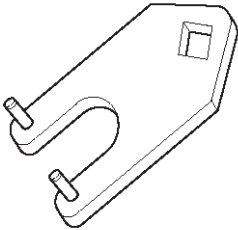
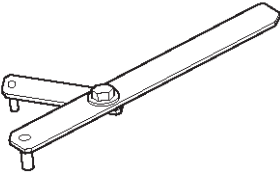
ILLUSTRATION	TOOL NO. TOOL NAME	ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RT033</p>	<p>5-8840-0011-0 (J-21687-02) Remover; tie rod end</p>	 <p>901RT041</p>	<p>5-8840-0133-0 (J-8614-01) Holder; Crankshaft</p>
 <p>F06RW002</p>	<p>5-8840-2441-0 Set Number of Valve Compressor 5-8840-2446-0 (J-8062) Compressor; Valve Spring (1) 5-8840-2547-0 (J-42898) Adapter; Compressor Valve Spring (2)</p>	 <p>901RT042</p>	<p>5-8840-2153-0 (J-37228) Seal cutter</p>
 <p>901RT036</p>	<p>5-8840-0623-0 (J-37281) Remover; Oil controller</p>	 <p>901RT043</p>	<p>5-8840-2286-0 (J-39201) Installer; Real oil seal</p>
 <p>901RT037</p>	<p>5-8840-0624-0 (J-38537) Installer; Oil controller</p>	 <p>901RT046</p>	<p>9-8511-4209-0 (J-24239-1) Cylinder head bolt wrench</p>
 <p>901RW171</p>	<p>5-8840-2445-0 (J-42985) Installer; Camshaft oil seal</p>	 <p>901RW182</p>	<p>5-8840-2442-0 (J-42899) Replacer; Valve guide (set) (1,2) 5-8840-2548-0 (J-42687) Installer; Valve guide (1) 5-8840-2549-0 (J-37985-1) Remover; Valve guide (2)</p>
 <p>901RT040</p>	<p>5-8840-2545-0 (J-39206) Installer; Pilot bearing</p>	 <p>901RW109</p>	<p>5-8840-2444-0 (J-42689) Adjusting Tool: Valve clearance</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW110</p>	<p>5-8840-2443-0 (J-42686) Lever; Gear spring</p>
 <p>901RW115</p>	<p>5-8840-2447-0 (J-43041) Holder; Universal</p>

ENGINE

ENGINE COOLING

CONTENTS

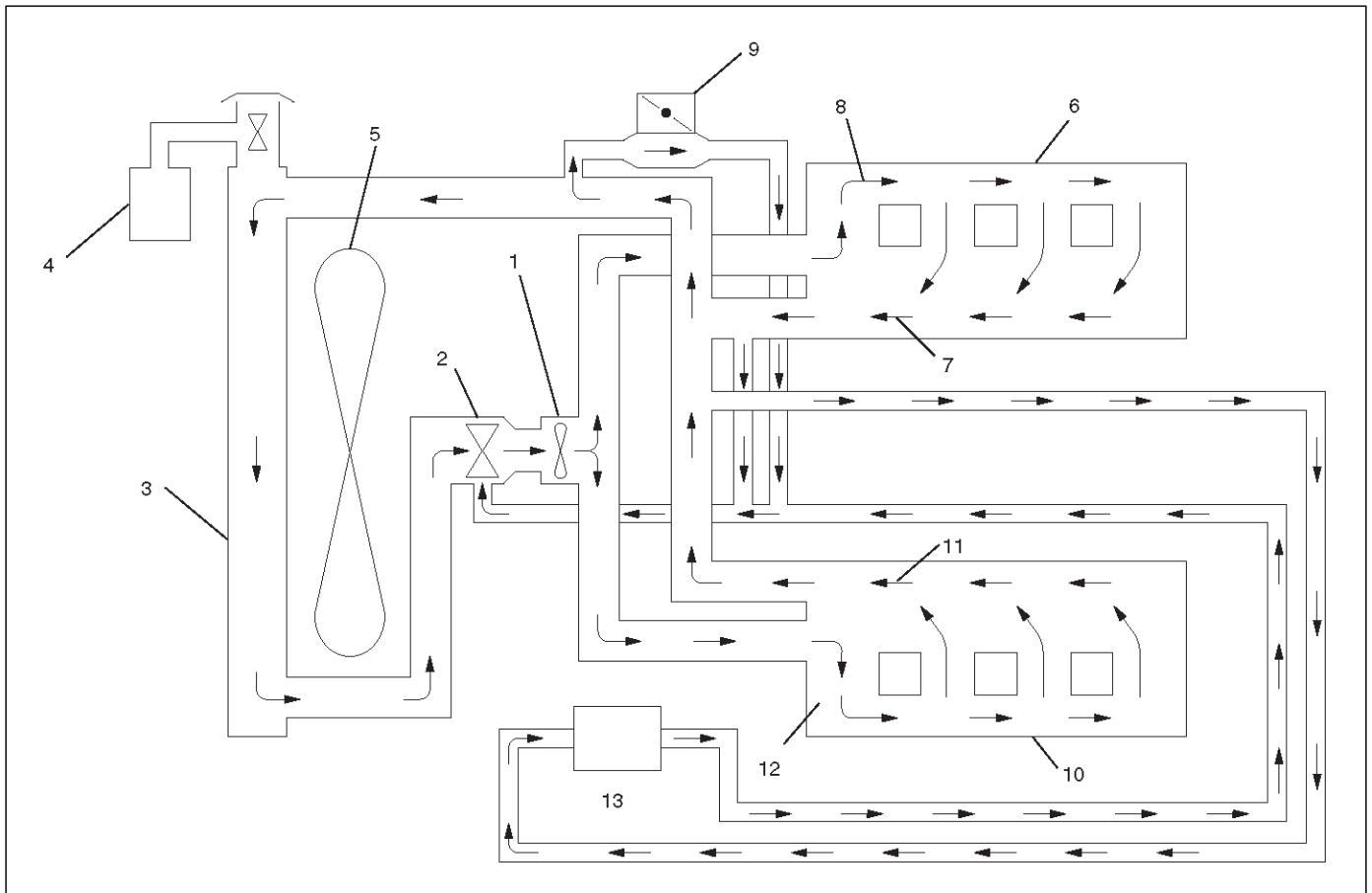
Service Precaution	6B-1	Installation	6B-8
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Service Precaution

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

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

General Description



030RW001

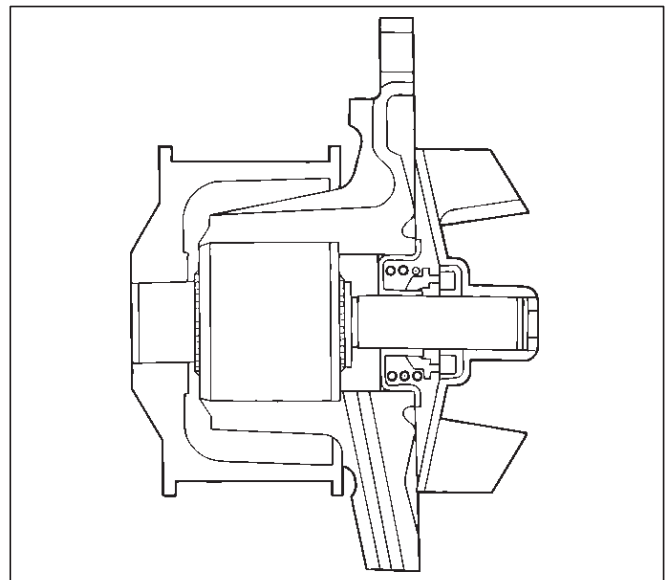
Legend

- | | |
|--------------------|---------------------|
| (1) Water Pump | (7) Cylinder Head |
| (2) Thermostat | (8) Right Bank |
| (3) Radiator | (9) Throttle Body |
| (4) Reserve Tank | (10) Cylinder Block |
| (5) Cooling Fan | (11) Cylinder Head |
| (6) Cylinder Block | (12) Left Bank |
| | (13) Heater |

The cooling system is a pressurized Engine Coolant (EC) forced circulation type which consists of a water pump, thermostat cooling fan, radiator and other components. The automatic transmission fluid is cooled by the EC in radiator.

Water Pump

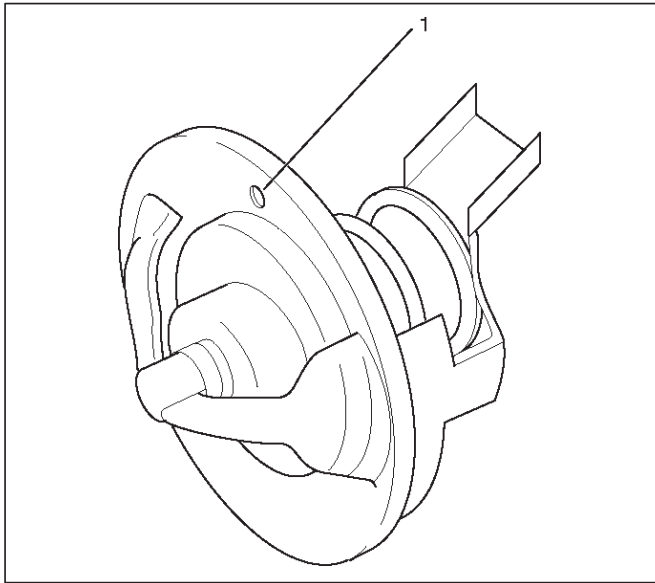
The EC pump is a centrifugal impeller type and is driven by a timing belt.



030RS001

Thermostat

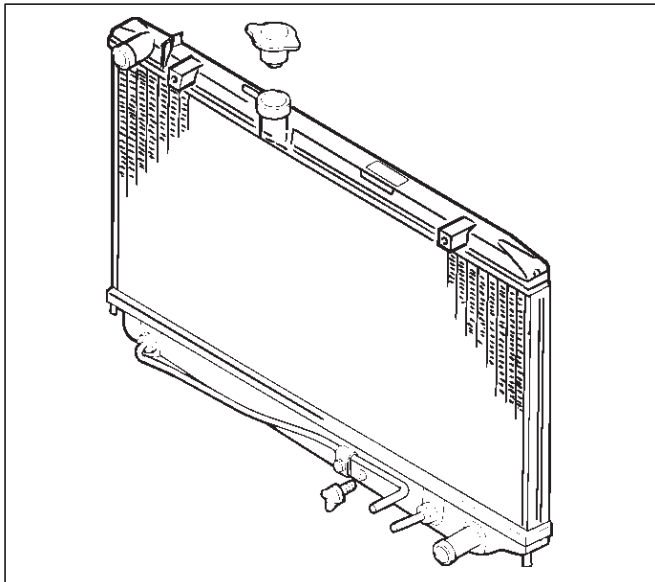
The thermostat is a wax pellet type with a air hole(1) and is installed in the thermostat housing.



031RW002

Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of the coolant, the radiator is fitted with a cap in which the valve is operated at 88.2 ~ 117.6 kPa (12.8 ~ 17.0 psi) pressure. (No oil cooler provided for M/T)



110RS001

Anti Freeze Solution

- Relation between the mixing ratio and freezing temperature of the EC varies with the ratio of anti-freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.
- Calculating mixing ratio

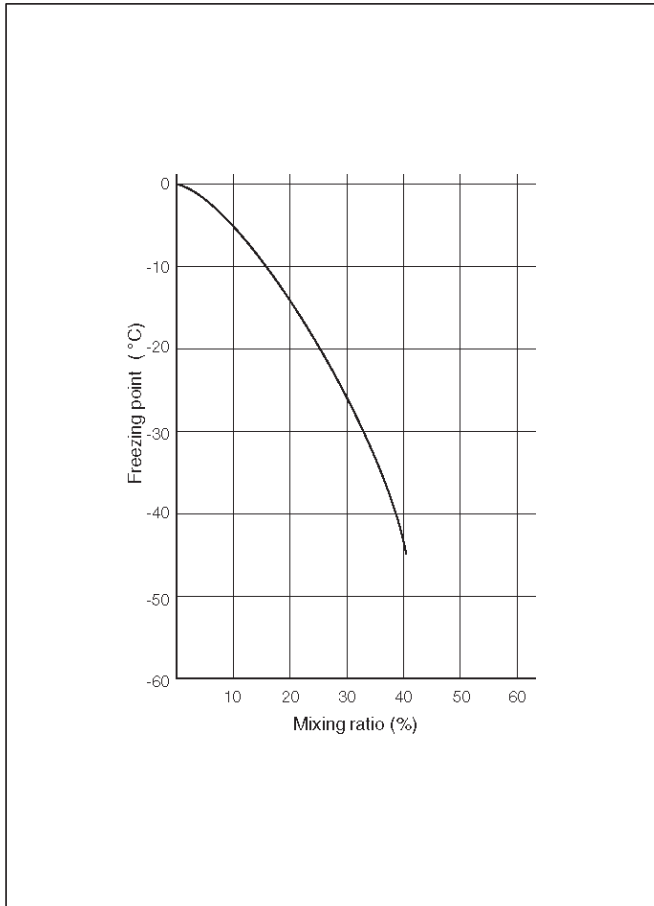
$$\text{Mixing ratio} = \frac{\text{Anti freeze solution (Lit/gal.)}}{\text{Anti freeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

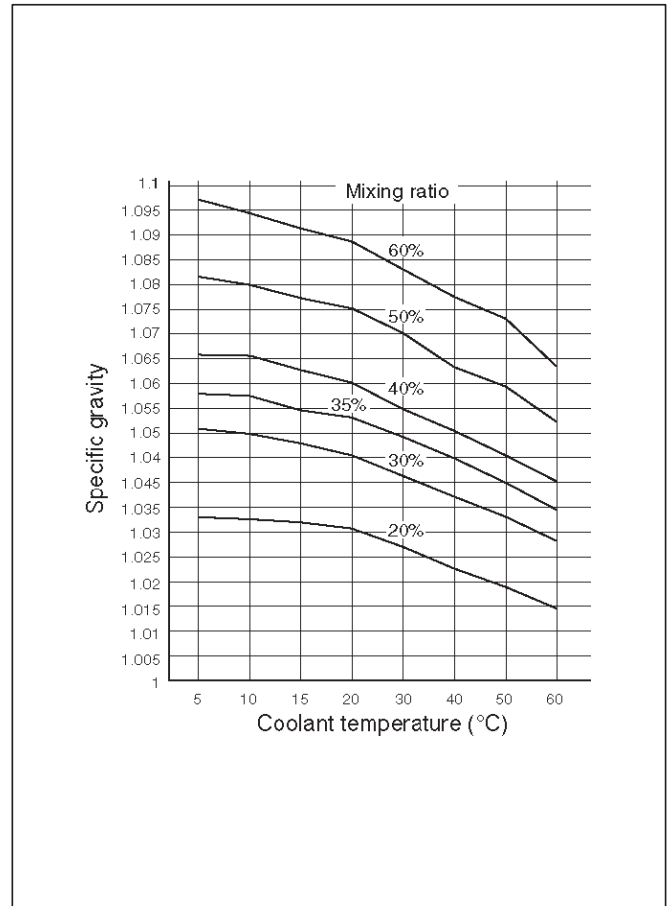
6B-4 ENGINE COOLING

NOTE: Antifreeze solution + Water = Total cooling system capacity.

- Total Cooling System Capacity
- M/T 8.8Lit (2.32Us gal)
- A/T 8.4Lit (2.22Us gal)



B06RW002



B06RW003

- Mixing ratio

Check the specific gravity of engine coolant in the cooling system temperature ranges from 0°C to 50°C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.

NOTE:

1. Even in the areas where the atmospheric temperature is higher than 0°C, be sure not to use antifreeze solution at a mixing ratio lower than 20% so that the inside of the engine may not be corroded.
2. If antifreeze solution is used at a mixing ratio higher than 60%, the specific heat of the coolant falls and the engine may be overheated. Moreover, antifreeze performance drop and the coolant may be frozen. The density of the solution must be adjusted as occasion calls.

Antifreeze solution lower than 20% may not have sufficient anticorrosive performance, and therefore, please never fail to adjust as occasion demands within the range of 20% to 60%.

Diagnosis

Engine Cooling Trouble

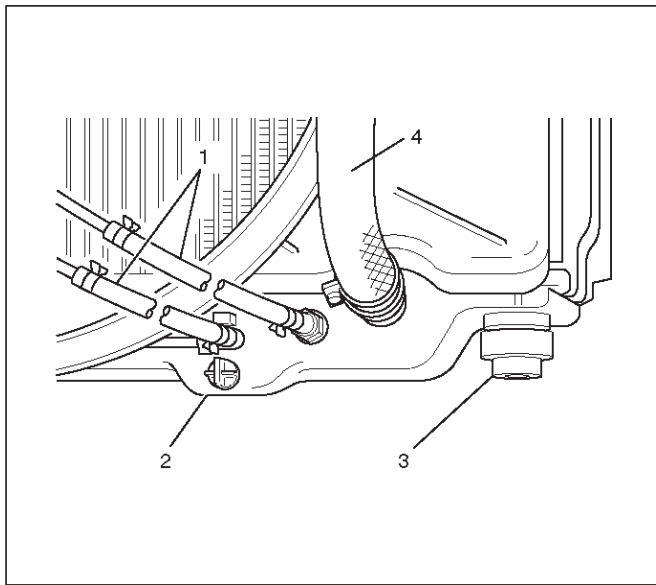
Condition	Possible cause	Correction
Engine overheating	Low Engine Coolant level	Replenish
	Incorrect fan installed	Replace
	Thermo meter unit faulty	Replace
	Faulty thermostat	Replace
	Faulty Engine Coolant temperature sensor	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Faulty Throttle Position sensor	Replace throttle valve assembly
	Open or shorted Throttle Position sensor circuit	Repair or replace
Damaged cylinder head gasket	Replace	
Engine overcooling	Faulty thermostat	Replace
Engine slow to warm-up	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the "MIN" and "MAX" lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the "MAX" line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.

Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug (2) at the bottom of the radiator.



2. Remove the radiator cap.

WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.

3. Disconnect all hoses from the EC reserve tank.
Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.
Fill the EC reserve tank to "MAX" line when the engine is cold.
6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to "P" (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.

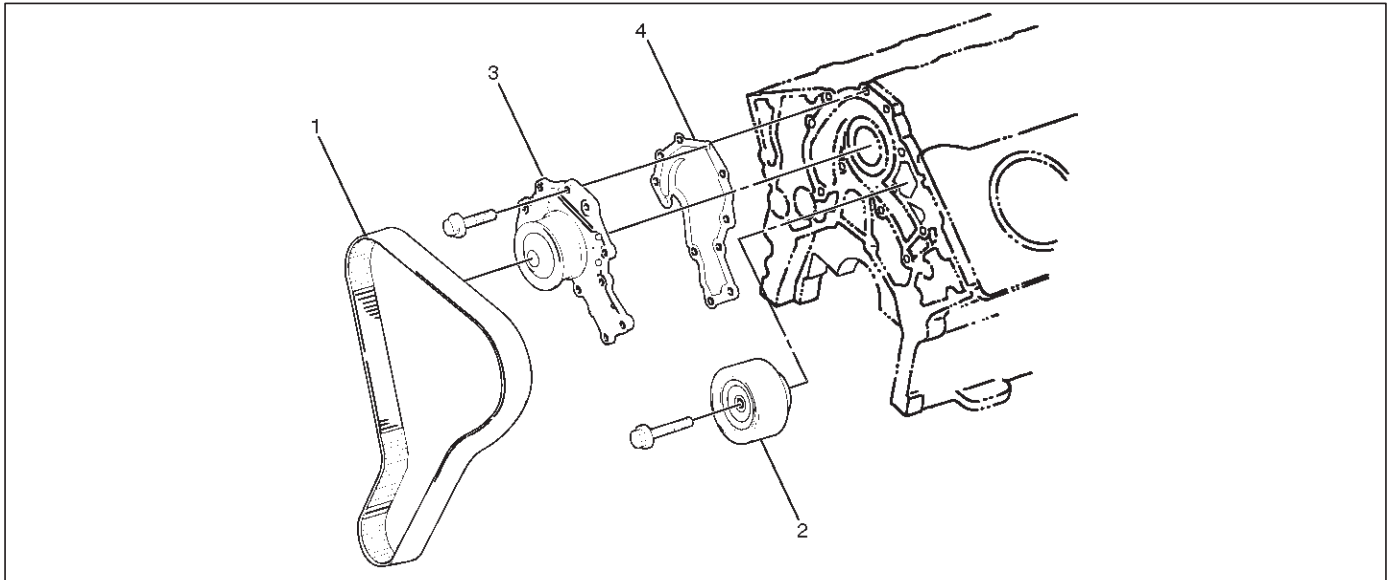
9. After the engine has cooled, replenish with EC up to the "MAX" line of the reserve tank.

10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).

11. If the running water sound is heard, repeat steps 8 to 10.

Water Pump

Water Pump and Associated Parts



030RS002

Legend

- (1) Timing Belt
- (2) Idle Pulley

- (3) Water Pump Assembly
- (4) Gasket

Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt. Refer to "Timing Belt" in this manual.
5. Remove Idle pulley.
6. Remove water pump assembly.
7. Remove gasket.

2. Install water pump assembly and tighten bolts to the specified torque.

Torque: 25 N·m (2.5 Kg·m/18 lb ft)

• Tightening order

The tightening order are in the illustrate.

NOTE: To prevent the oil leakage, apply the LOCTITE 262 or an equivalent, to the arrow marked fixing bolt thread.

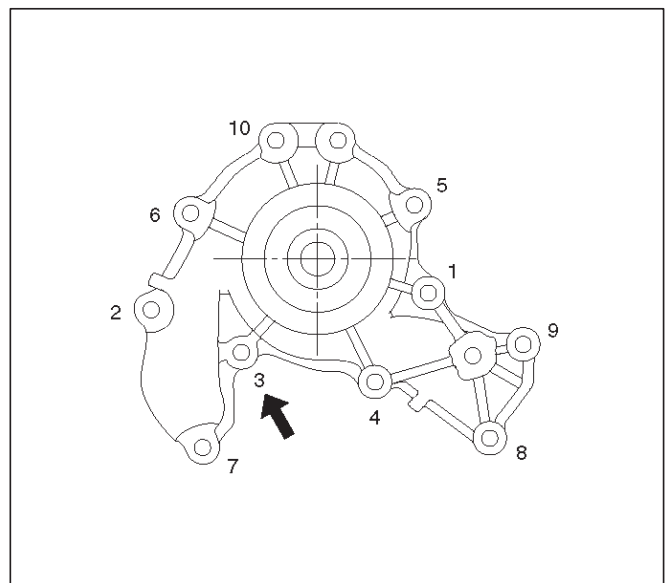
Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced:

- Crack in the water pump body
- EC leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller.

Installation

1. Install gasket, clean the mating surface of gasket before installation.



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6B-8 ENGINE COOLING

3. Idle pulley

- Install idle pulley and tighten bolt to the specified torque.

Torque: 52 N-m (5.3 Kg-m/38 lb ft)

4. Timing belt

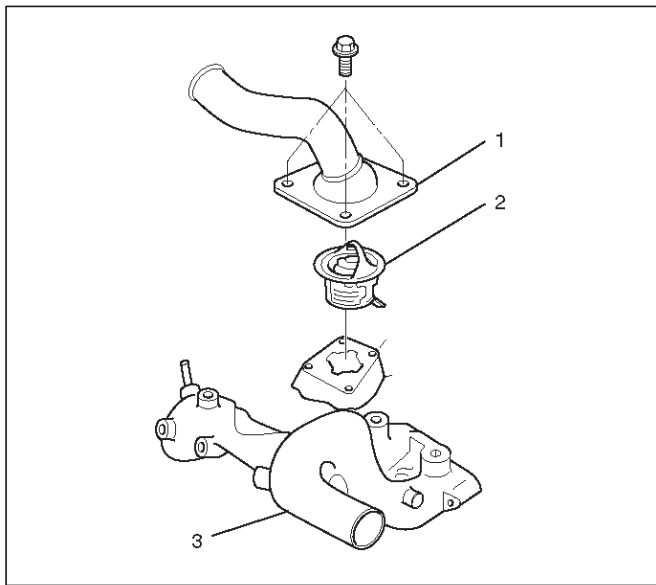
- Install timing belt. Refer to timing belt installation step in "Timing Belt" in this manual.

5. Connect radiator inlet hose and replenish EC.

6. Connect battery ground cable.

Thermostat

Thermostat and Associated Parts



031RW001

Legend

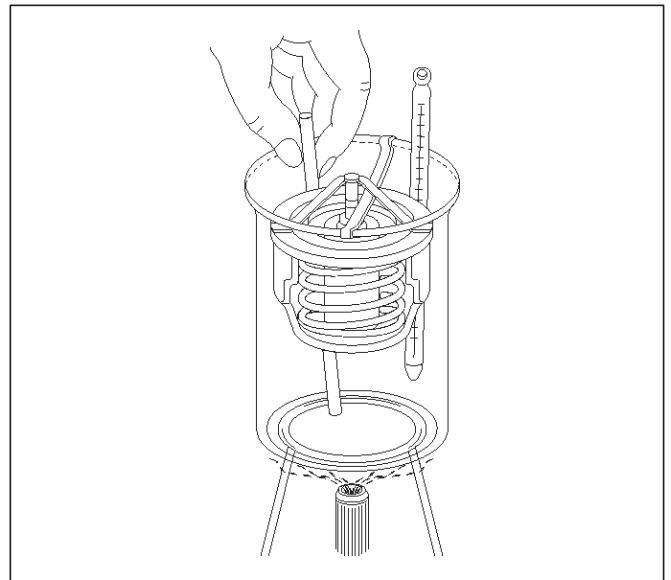
- (1) Thermostat Housing
- (2) Thermostat
- (3) Outlet Pipe

Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.
5. Remove thermostat(2).

Inspection

Suspend the thermostat in a water-filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat. Gradually increase the water temperature. Stir the water so that the entire water is same temperature.



031RS003

Confirm the temperature when the valve first begins to open.

**Valve opening temperature 74.5C ~ 78.5°C
(166.1°F ~ 173.3°F)**

Confirm the temperature when the valve is fully opened.

**Valve full open temperature and lift More than
8.5mm (0.33 in) at 90°C (194°F)**

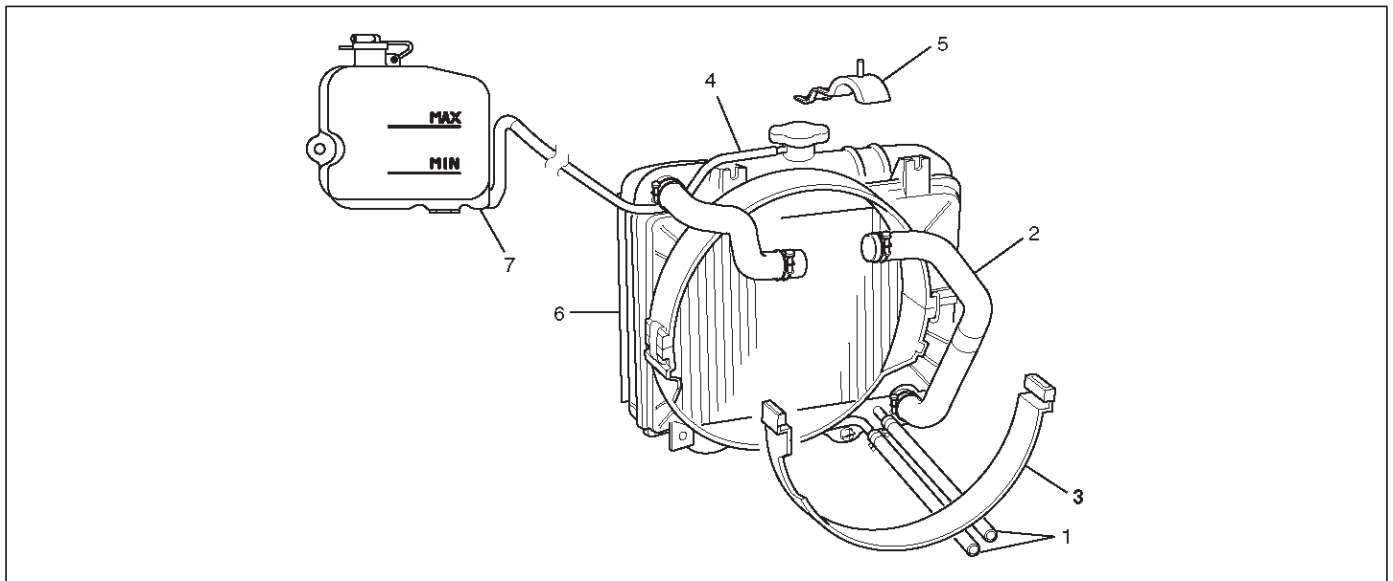
Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

Installation

1. Install thermostat into the outlet pipe(4) making sure that the air hole is in the up position.
2. Install thermostat housing and tighten bolts to the specified torque.
Torque: 25 N-m (2.5 Kg-m/18 lb ft)
3. Install rubber hose.
4. Replenish engine coolant (EC).
5. Start engine and check for EC leakage.

Radiator

Radiator and Associated Parts



110RW003

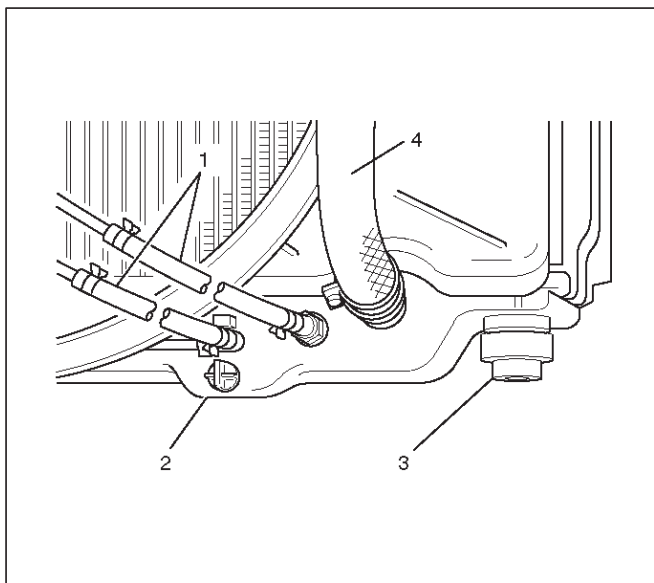
Legend

- | | |
|--|-----------------------|
| (1) Oil Cooler Hose For Automatic Transmission | (4) Reserve Tank Hose |
| (2) Radiator Hose | (5) Bracket |
| (3) Fan Guide, Lower | (6) Radiator Assembly |
| | (7) Reserve Tank |

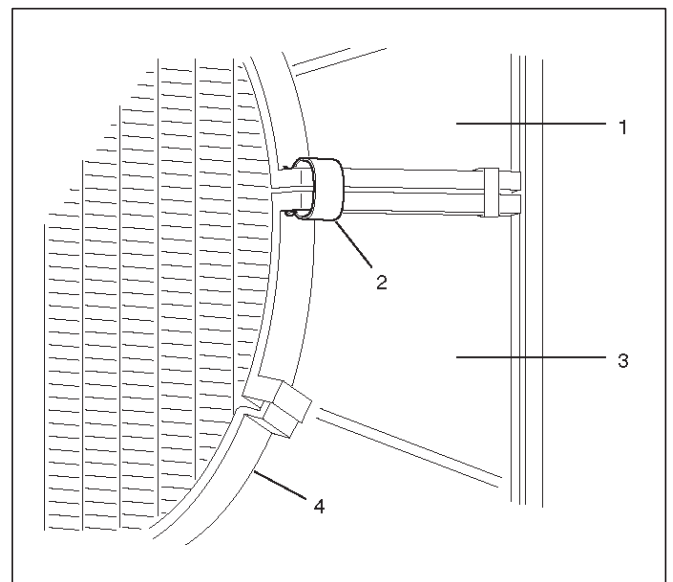
Removal

1. Disconnect battery ground cable.
2. Loosen a drain plug(2) to drain EC.
3. Disconnect oil cooler hose(1) on automatic transmission (A/T).
4. Disconnect radiator inlet hose and outlet hose from the engine.

5. Remove fan guide(1), clips(3) on both sides and the bottom lock, then remove lower fan guide(3) with fan shroud(4).



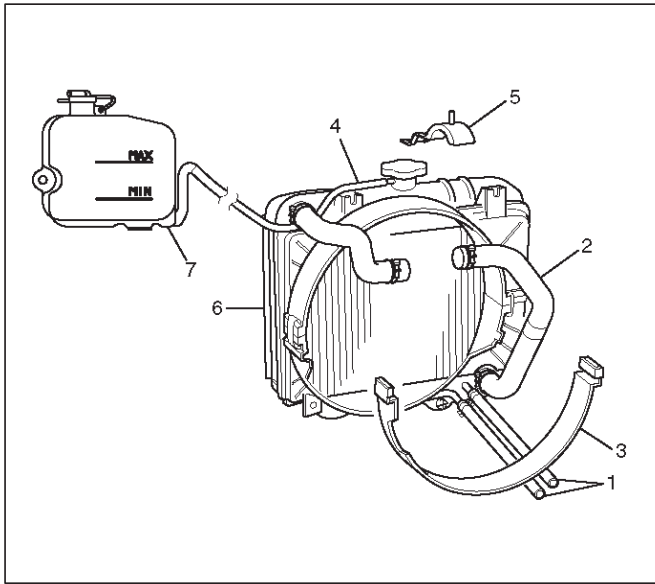
110RW002



110RW001

6B-10 ENGINE COOLING

6. Disconnect the reserve tank hose(4) from radiator.
7. Remove bracket(5).



110RW004

8. Lift up and remove the radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
9. Remove rubber cushions on both sides at the bottom.

Inspection

Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester. Replace the cap if the valve opening pressure is outside the standard range.

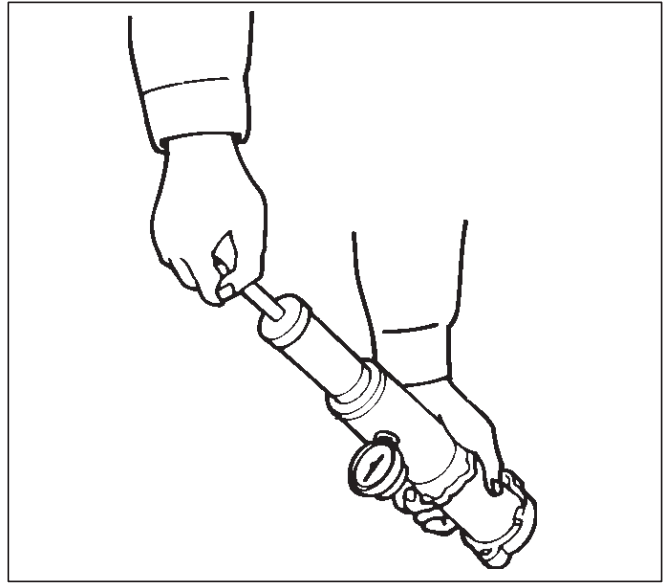
**Valve opening pressure kPa (psi) 88.3 ~ 117.7
(12.8 ~17.1)**

Cap tester: 5-8840-0277-0

Adapter: 5-8840-2603-0

Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

**Valve opening vacuum kPa (psi) 1.96 ~ 4.91
(0.28 ~ 0.71)**



110RS006

Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

Flushing the Radiator

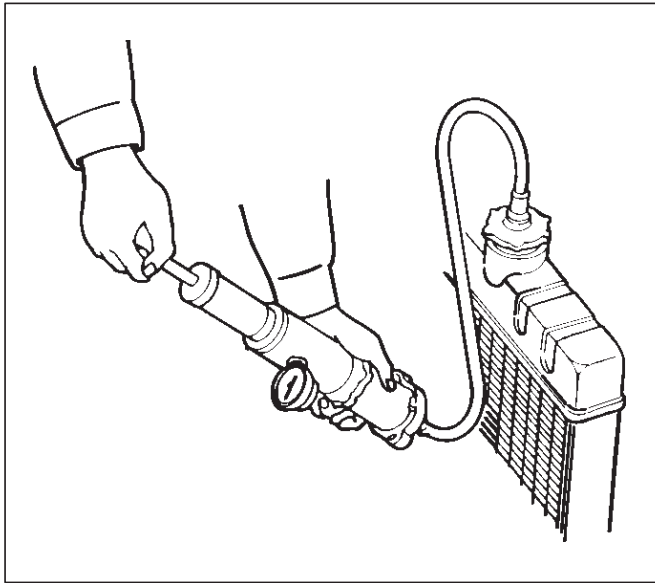
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all signs of scale and rust.

Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 196 kPa (28.5 psi) with a cap tester:

- Leakage from the radiator
- Leakage from the coolant pump
- Leakage from the water hoses
- Check the rubber hoses for swelling.

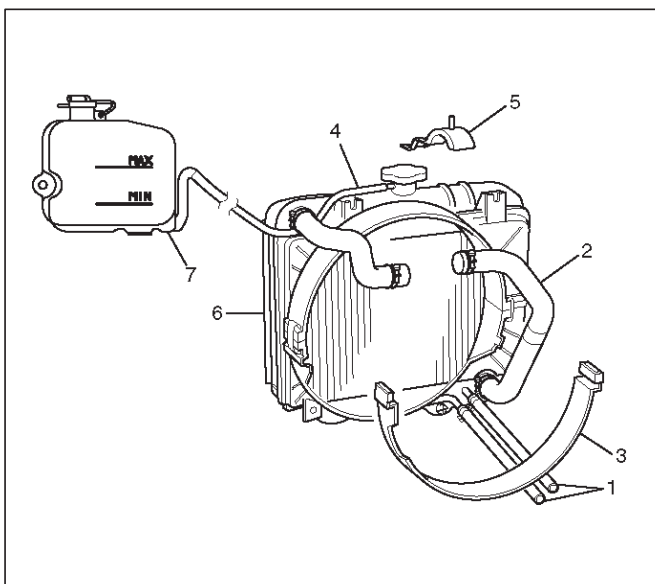
Cap tester: 5-8840-0277-0
 Adapter: 5-8840-2603-0



110RS005

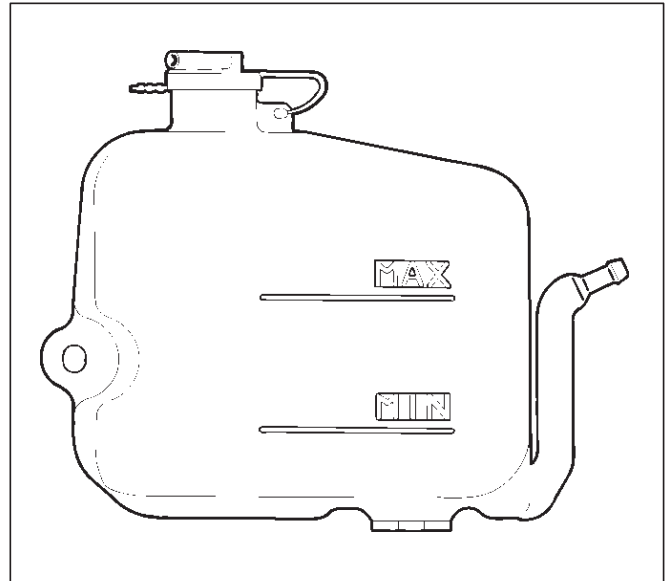
Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Install bracket (6) and support the radiator upper tank with the bracket (5) and secure the radiator.
4. Connect reserve tank hose (4).
5. Install lower fan guide (3).
6. Connect radiator inlet hose and outlet hose to the engine.
7. Connect oil cooler hose (1) to automatic transmission.



110RW004

8. Connect battery ground cable.
9. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.



111RS001

Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.

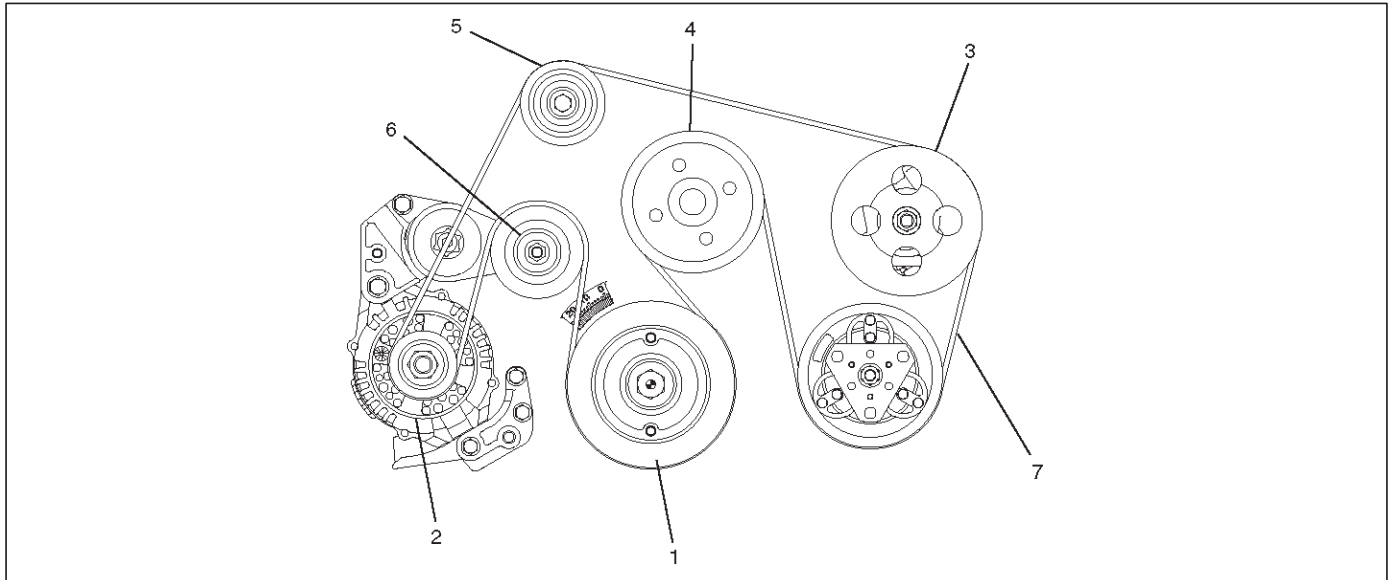
1. Make sure that the engine is cool.
2. Open radiator cap pour coolant up to filler neck.
3. Pour coolant into reservoir tank up to "MAX" line.
4. Tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.

WARNING: WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

5. After tightening radiator cap, warm up the engine at about 2000 rpm. Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
6. Check to see the thermostat has opened through the needle position of water thermometer, conduct a 5-minute idling again and stop the engine.
7. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the cooling system and reservoir tank hose for leakage.
8. Pour coolant into reservoir tank up to "MAX" line.

Drive Belt and Cooling Fan

Drive Belt and Associated Parts



015RW005

Legend

- | | |
|-------------------------|---------------------------------------|
| (1) Crankshaft Pulley | (4) Water Pump and Cooling Fan Pulley |
| (2) Generator | (5) Idle Pulley |
| (3) Power Steering Pump | (6) Tension Pulley |
| | (7) Drive Belt |

The drive belt adjustment is not required as automatic drive belt tensioner is equipped.

Inspection

Check drive belt for wear or damage, and replace with a new one as necessary.

Installation

Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (2.2 Kg·m/16 lb ft) for fan pulley and fan bracket.

Torque : 10 N·m (1.0 Kg·m/88.5 lb in) for fan and clutch assembly.

NOTE: Fan belts for 6VE1 Gasoline Engine mounted on 98MY (UX) have been brought into one. As a result, the rotating direction of a fan belt is opposite to the direction of cooling fan for 92 to 97MY 6VD1 with no interchangeability.

Therefore, incorrect installation of a fan may cause the air for cooling to flow in the opposite direction, this resulting in the poor performance of the air-conditioner and a rise temperature in engine cooling water.

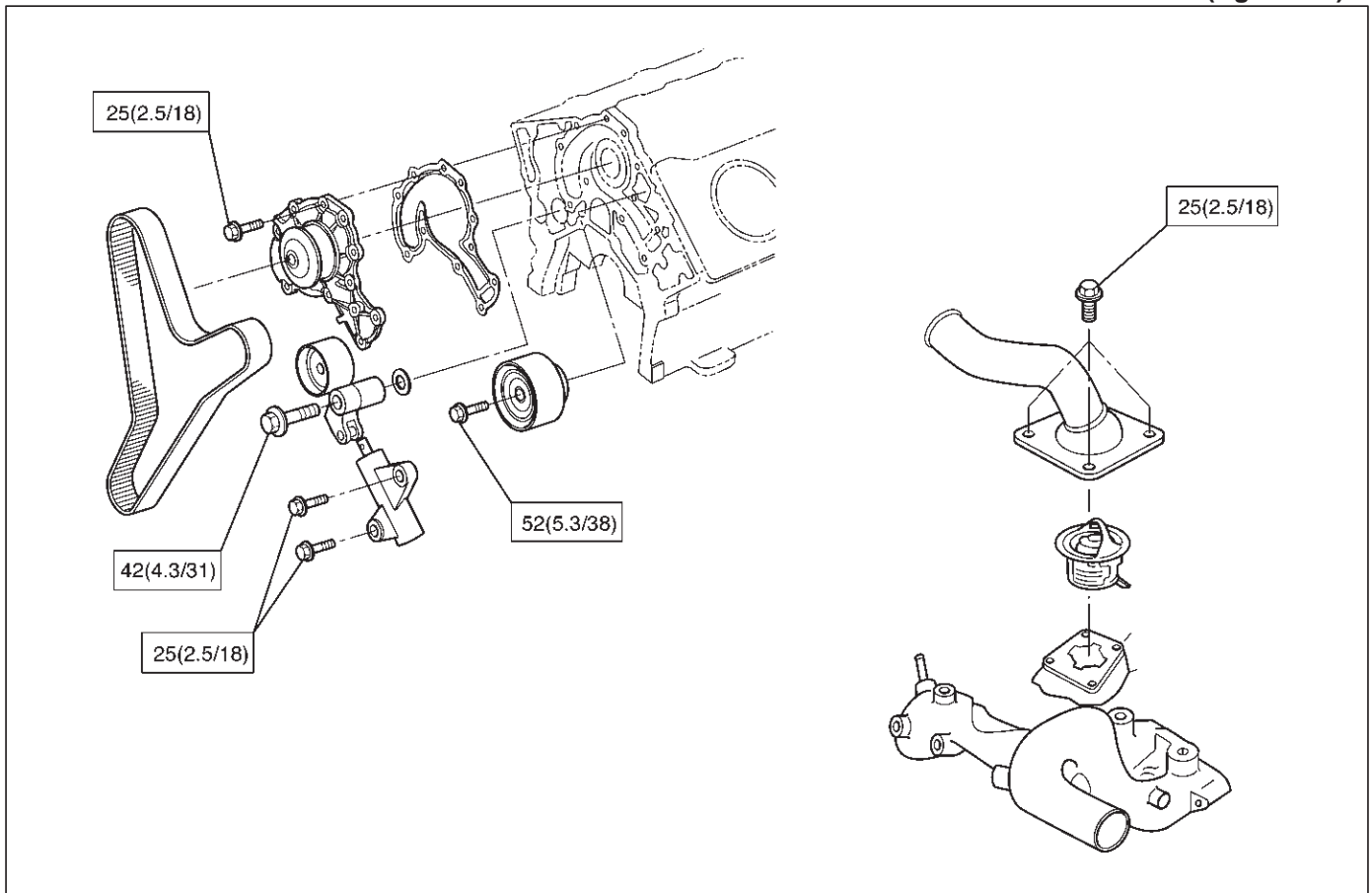
Main Data and Specifications

General Specifications

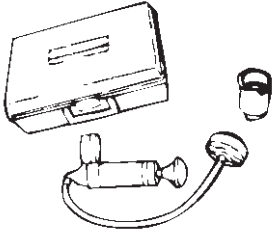
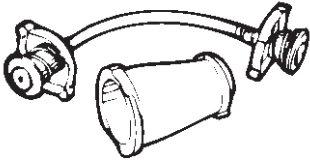
	M/T	A/T
Cooling system	Engine coolant forced circulation	
Radiator	(1 tube in row) Tube type corrugated (2 tube in row)	
Heat radiation capacity	68,000 kcal/h	77,000 kcal/h
Heat radiation area	9.445m ² (0.878ft ²)	11.21m ² (1.04ft ²)
Radiator front area	0.302m ² (0.028ft ²)	
Radiator dry weight	39N (8.8lb)	44N (9.9lb)
Radiator cap valve opening pressure	93.3 ~ 122.7kpa (13.5 ~ 17.8psi)	
Engine coolant capacity	2.5lit (2.6U.S q.t.)	2.4lit (2.5U.S q.t.)
Engine coolant pump	Centrifugal impeller type	
Delivery	300 (317) or more	
Pump speed	5000 ± 50 rpm	
Thermostat	Wax pellet type with air hole	
Valve opening temperature	74.5 ~ 78.5°C (166.1 ~ 173.3°F)	
Engine coolant total capacity	10.4lit (11.0U.S qt)	10.5lit (11.1U.S qt)

Torque Specifications

N·m (Kg·m/lb ft)



Special Tool

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW072</p>	<p>5-8840-0277-0 (J-24460-01) Tester; radiator cap</p>
 <p>901RW073</p>	<p>5-8840-2603-0 (J-33984-A) Adapter; radiator cap</p>

ENGINE

ENGINE FUEL

CONTENTS

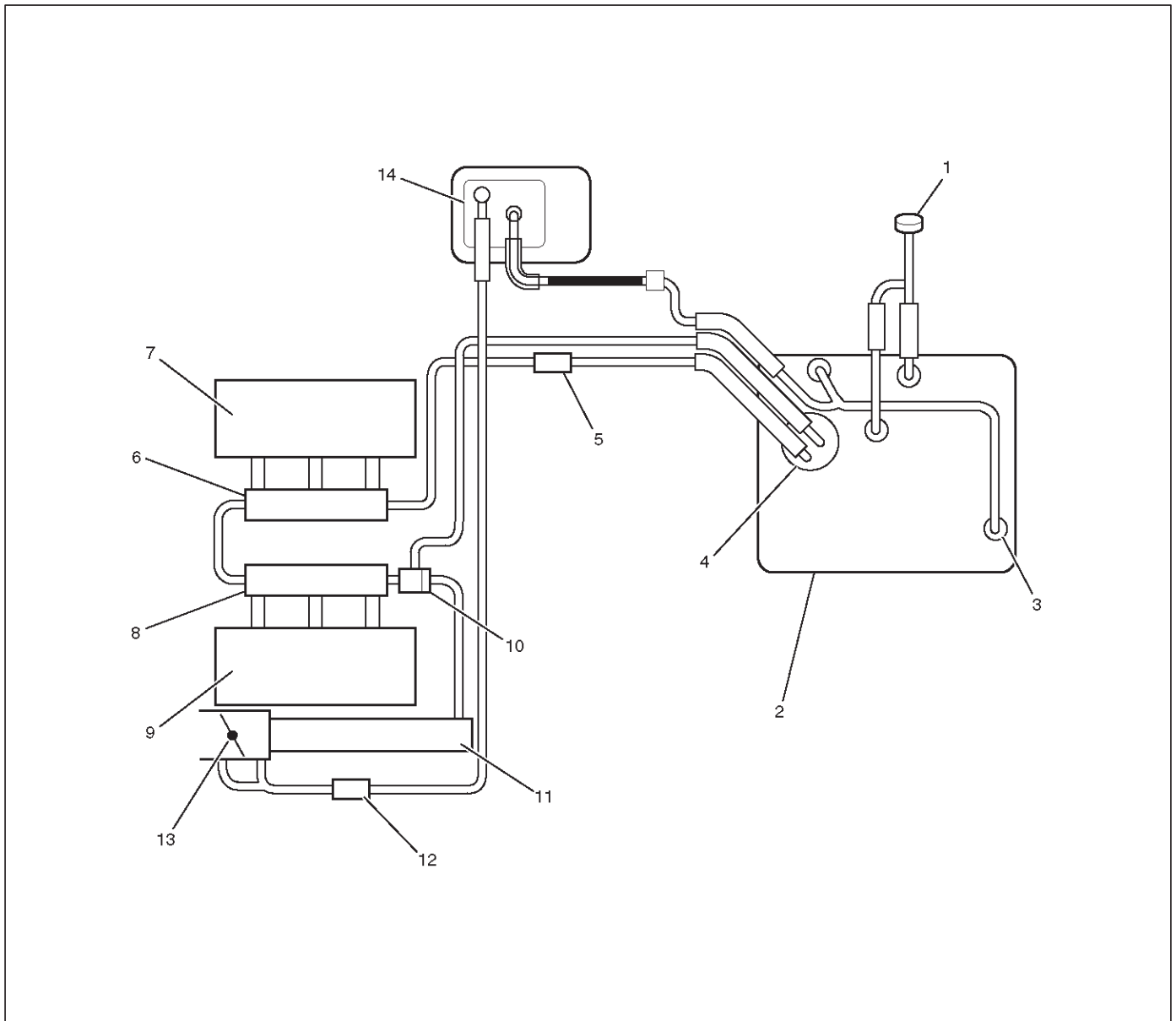
Service Precaution	6C-1	Fuel Tank and Associated Parts	6C-7
General Description	6C-2	Removal	6C-7
Fuel Metering	6C-3	Installation	6C-8
Fuel Filter	6C-4	Fuel Tube / Quick – Connect Fittings	6C-8
Fuel Filter and Associated Parts	6C-4	Precautions	6C-8
Removal	6C-4	Cautions During Work	6C-8
Inspection	6C-4	Removal	6C-8
Installation	6C-5	Reuse of Quick–Connector	6C-10
Inspection	6C-5	Assembling Advice	6C-10
In–Tank Fuel Filter	6C-5	Fuel Gauge Unit	6C-11
Fuel Pump Flow Test	6C-5	Fuel Gauge Unit and Associated Parts ...	6C-11
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Fuel Pump Relay	6C-7	Inspection	6C-12
General Description	6C-7	Main Data and Specifications	6C-12
Fuel Tank	6C-7		

Service Precaution

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

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

General Description



140RW030

Legend

- | | |
|---------------------|----------------------------------|
| (1) Fuel Filler Cap | (8) Fuel Rail Left |
| (2) Fuel Tank | (9) Left Bank |
| (3) Rollover Valve | (10) Fuel Pressure Control Valve |
| (4) Fuel Pump | (11) Common Chamber |
| (5) Fuel Filter | (12) Duty Solenoid Valve |
| (6) Fuel Rail Right | (13) Throttle Valve |
| (7) Right Bank | (14) Canister |

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect "O" rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.

- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.

Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All cars are equipped with an Evaporative Emission Control System. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere.

Fuel Metering

The Engine Control Module (ECM) is in complete control of this fuel delivery system during normal driving conditions.

The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.

This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the ECM.

With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the ECM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to effect an appropriate air/fuel ratio.

The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The ECM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.

Two interchangeable "O" rings are used on the injector that must be replaced when the injectors are removed.

The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.

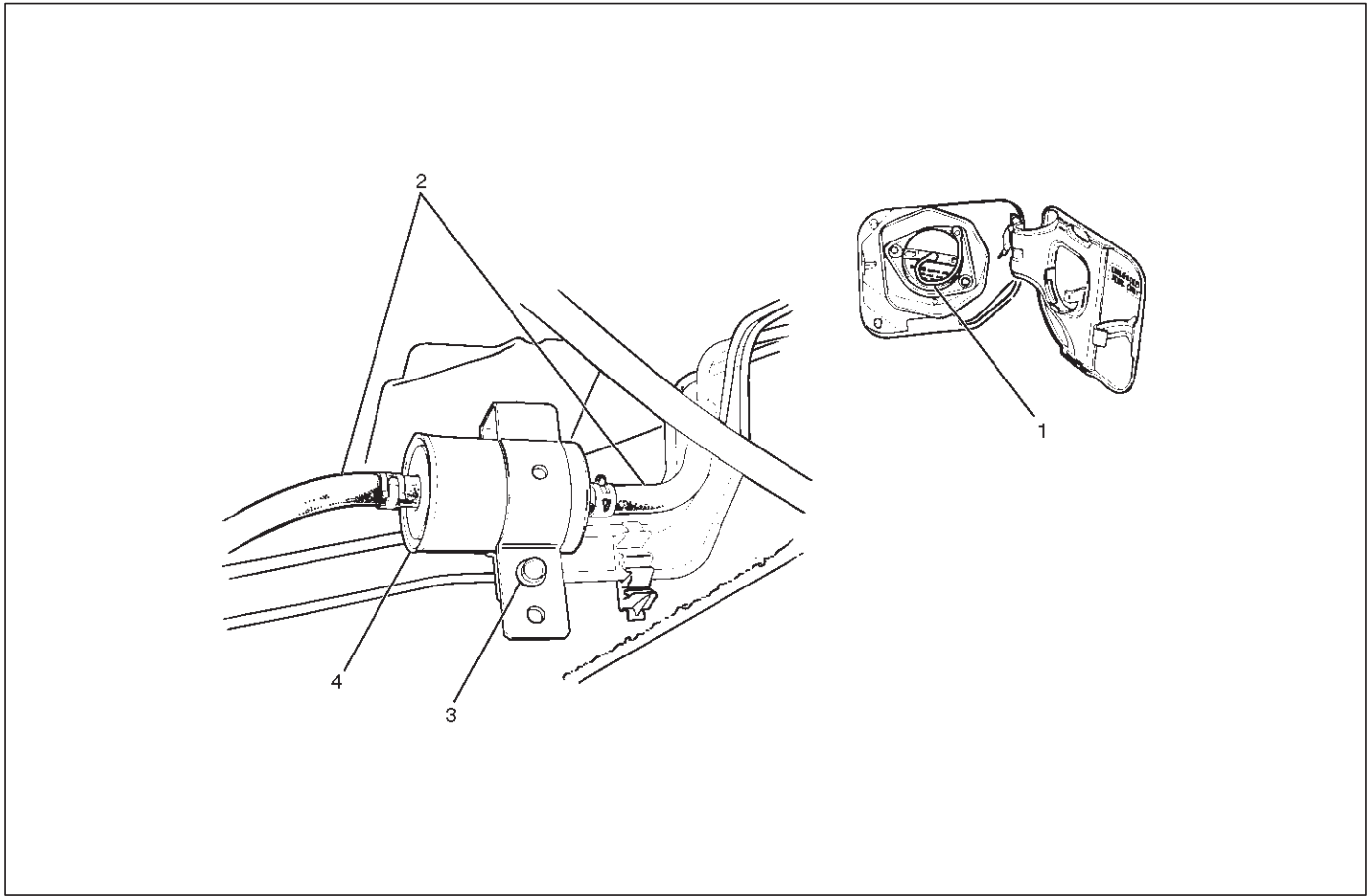
Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.

The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.

See Section "Driveability and Emission" for more information and diagnosis.

Fuel Filter

Fuel Filter and Associated Parts



041RW014

Legend

- | | |
|---------------------|-----------------------------|
| (1) Fuel Filler Cap | (3) Fuel Filter Fixing Bolt |
| (2) Fuel Hose | (4) Fuel Filter |

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

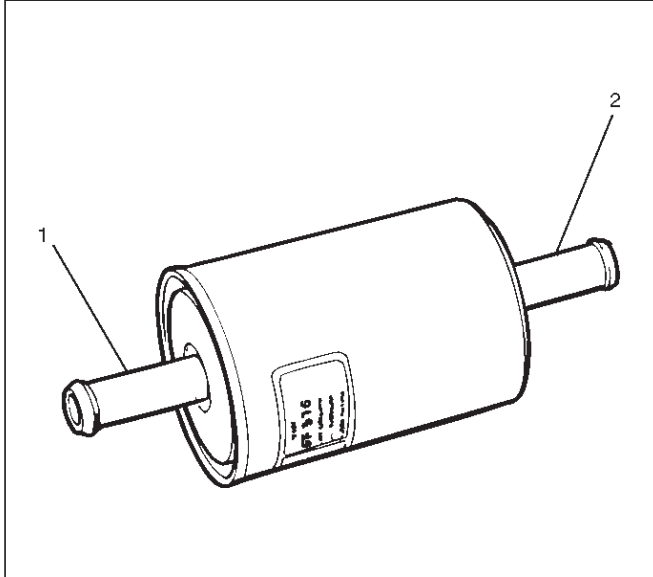
1. Disconnect battery ground cable.
2. Remove Fuel filler cap(1).
3. Disconnect fuel hoses(2) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt(3).
 - Remove the fuel filter fixing bolt(3) on fuel filter holder.
5. Remove fuel filter(4).

Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check the drain of receive rubber and if it is clogged with dust, clean it up with air.

Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.
3. Connect fuel hoses on engine side(1) and fuel tank side(2).



4. Install fuel filler cap
5. Connect the battery ground cable.

041RW001

Inspection

After installation, start engine and check for fuel leakage.

In-Tank Fuel Filter

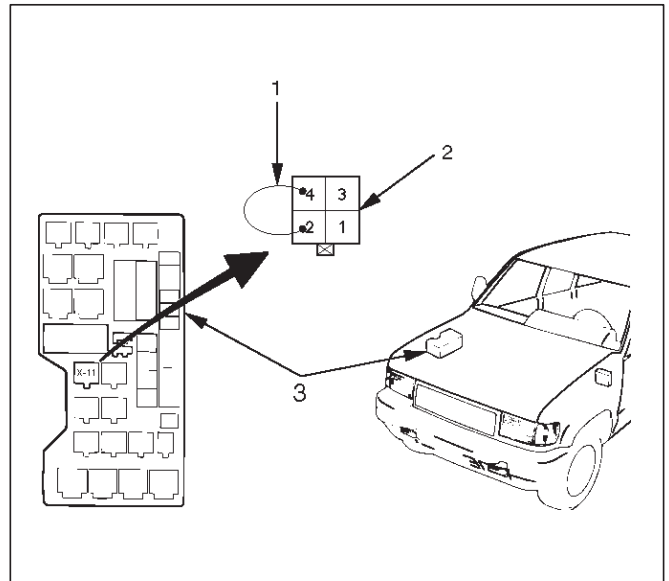
The filter is located on the lower end of fuel pickup tube in the fuel tank. It prevents dirt from entering the fuel pipe and also stops water unless the filter is completely submerged in the water. It is a self cleaning type, not requiring scheduled maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stoppage. In such a case, the tank must be cleaned thoroughly.

Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks:

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, check pipes and hoses for squashing or clogging.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.

4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.



140RW002

CAUTION: Never generate sparks when connecting a jumper wire.

Delivery	Delivery
15 seconds	0.38 liters minimum

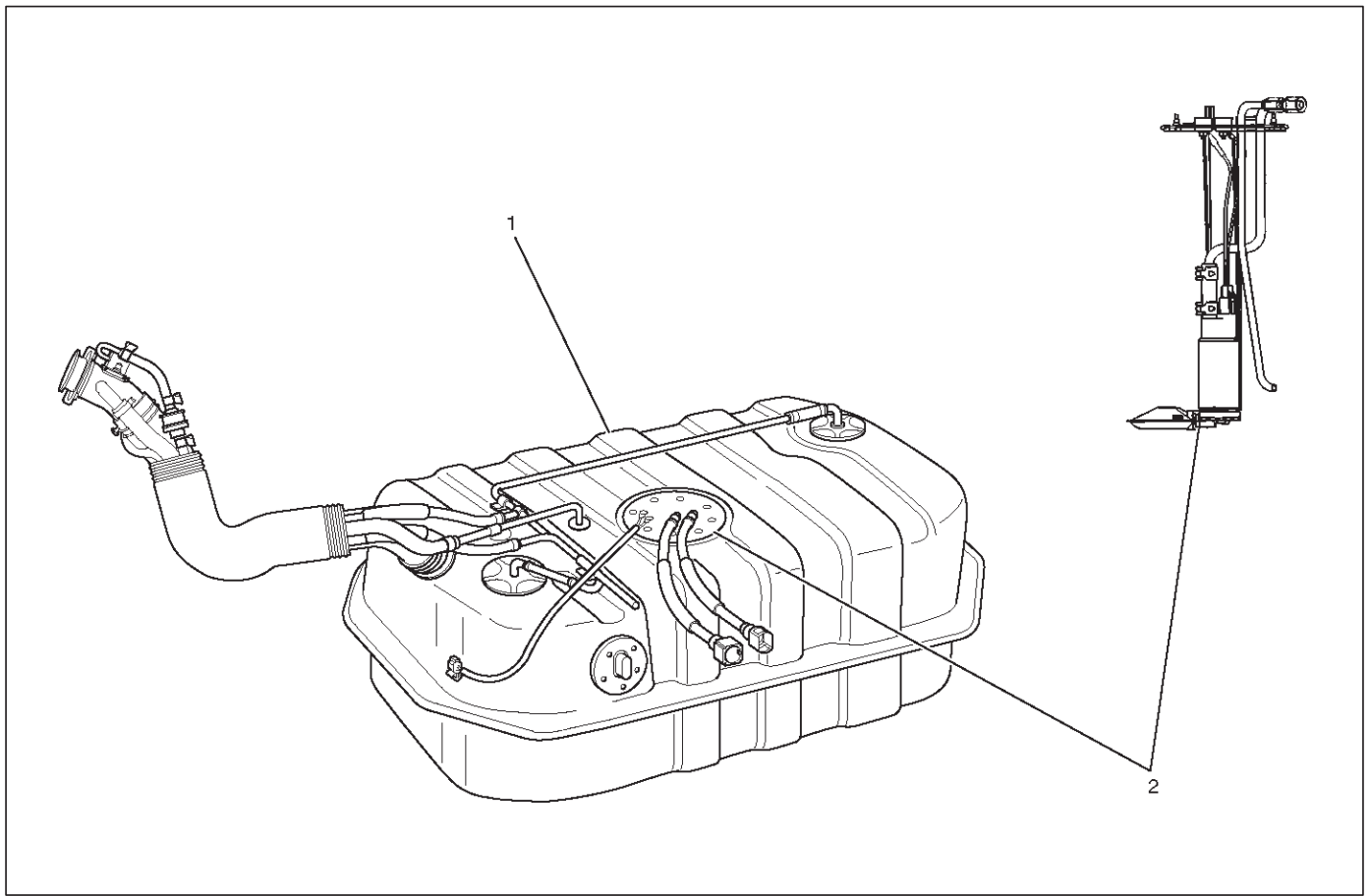
If the measure value is out of standard, conduct the pressure test.

Pressure test

For the pressure test to the fuel system, see Section 6E "Fuel Control System".

Fuel Pump

Fuel Pump and Associated Parts



035RW047

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
Tighten drain plug to the specified torque after draining fuel.

Torque: 20 N·m (2.0 Kg·m/14 lb ft) — M8

4. Remove fuel tank assembly(1). Refer to “Fuel Tank Removal” in this section.
5. Remove fuel pump (FP) assembly(2) fixing screws and remove the FP assembly.

NOTE: After removing FP, cover fuel tank to prevent any dust entering.

Installation

1. Install FP assembly(2).
2. Install fuel tank assembly(1). Refer to “Fuel Tank Installation”.
3. Fill the tank with fuel and tighten fuel filler cap.
4. Connect battery ground cable.

Fuel Pump Relay

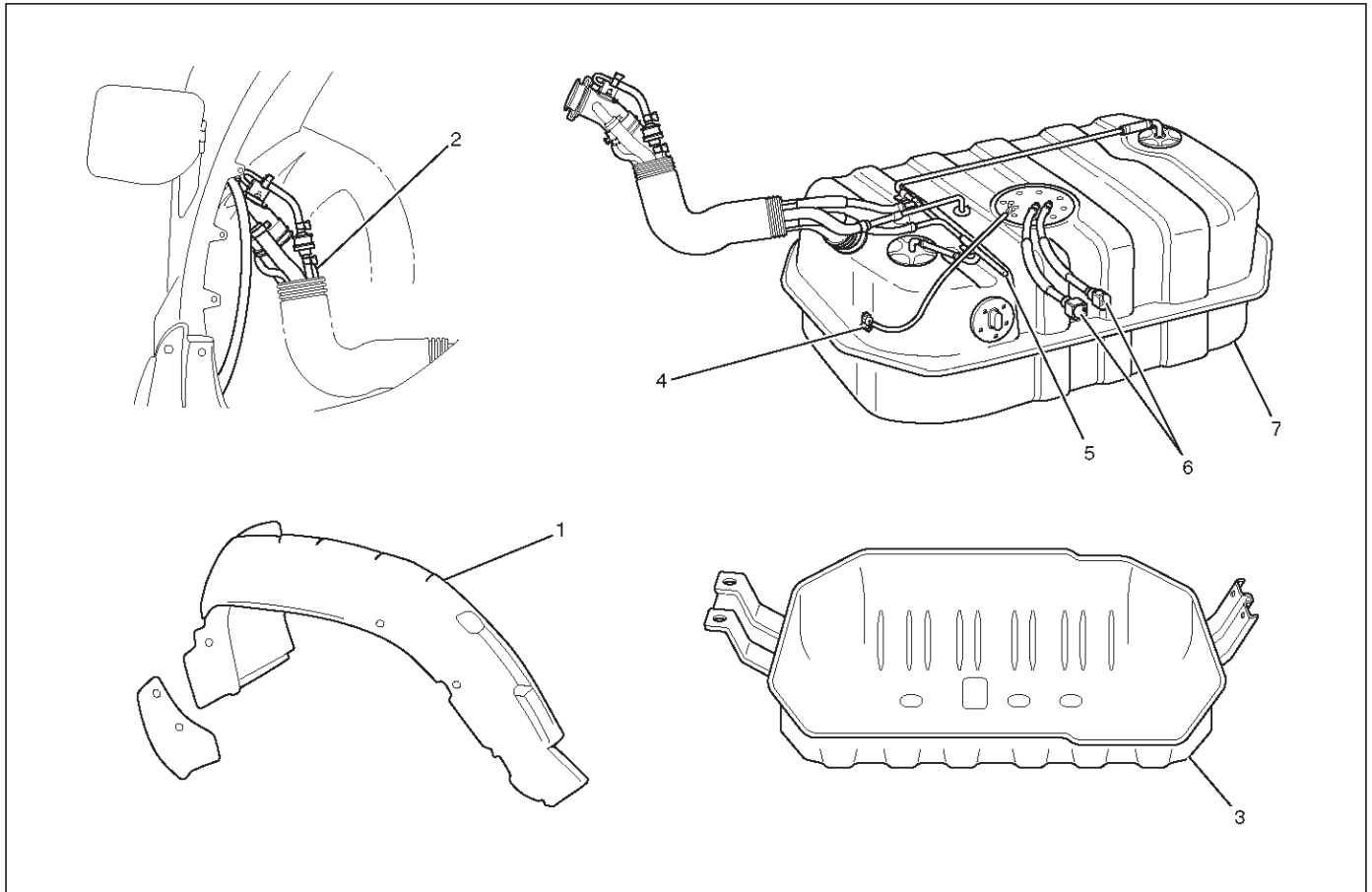
General Description

In order to control the FP operation, the FP relay is provided. When the starter switch is turned to "ON" position, the FP relay operates the FP for 2 seconds.

When it is turned to "START" position, the Power Train Control Module (PCM) receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FP to feed fuel.

Fuel Tank

Fuel Tank and Associated Parts



Legend

- | | |
|---|--|
| (1) Fender Liner | (4) Fuel Tank Wiring Connector |
| (2) Fuel Filler Hose and Air Breather Hose and Evapo Hose | (5) Evapo Fuel Hose |
| (3) Undercover | (6) Fuel Feed Tube and Fuel Return Tube/Quick-Connect Fittings |
| | (7) Fuel Tank |

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.

3. Drain fuel.

Tighten drain plug to the specified torque after draining fuel.

Torque: 20 N·m (2.0 Kg·m/14 lb ft) — M8

4. Remove fender liner (1) of wheel well on rear right side.
5. Fuel filler hose, air breather hose and evapo hose (2).
6. Remove undercover fixing bolts on both sides and remove under cover(3).

6C-8 ENGINE FUEL

7. Disconnect two fuel tank wiring connectors(4) on front right side of tank.
8. Disconnect evapo fuel hose(5).
9. Disconnect fuel feed tube and fuel return tube(6).

NOTE: Handling of the fuel tube, be sure to refer "Fuel Tube/Quick-Connect Fittings" in this section.

10. Remove fuel tank fixing bolts on both sides and remove fuel tank(7).

Installation

1. Install fuel tank(7).
 - Place a flange on right side of tank on the bracket.

- Install a flange on left side on the bracket from the bottom, and tighten bolts to the specified torque.

Torque: 36 N-m (3.7 Kg-m/27 lb ft)

2. Connect fuel feed tube and fuel return tube(6).
3. Connect evapo fuel hose(5).
4. Connect fuel tank wiring connector(4).
5. Install undercover(3).
6. Connect fuel filler hose, air breather hose and evapo hose(2).
7. Install fender liner(1).
 - Mount fender liner to the wheel well.
 - Fill the tank with fuel and tighten fuel filler cap.
 - Connect battery ground cable.

Fuel Tube / Quick – Connect Fittings

Precautions

- Lighting of Fires Prohibited.
- Keep flames away from your work area to prevent the inflammable from catching fire.
- Disconnect the battery negative cable to prevent shorting during work.
- When welding or conducting other heat-generating work on other parts, be sure to provide pretreatment to protect the piping system from thermal damage or spattering.

Cautions During Work

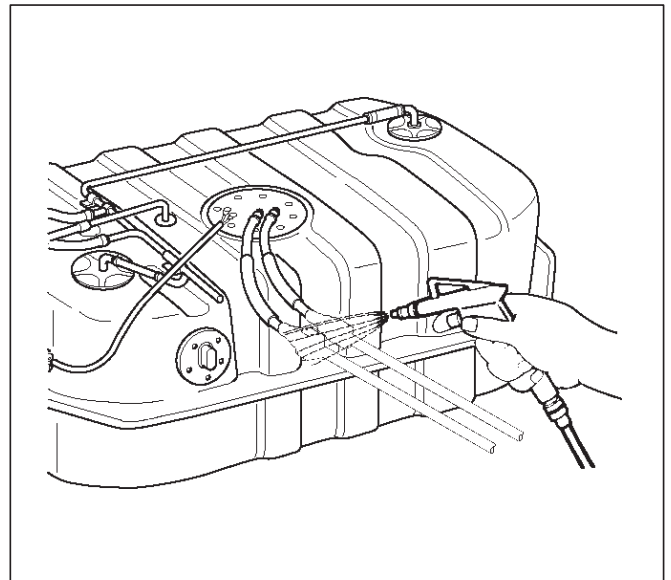
Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electrolyte.

The piping wet with battery electrolyte cannot be used. Be careful not to give a bending or twisting force to the piping during the work. If deformed, replace with a new piping.

Removal

1. Open the fuel cap to relieve the fuel pressure in the tank.

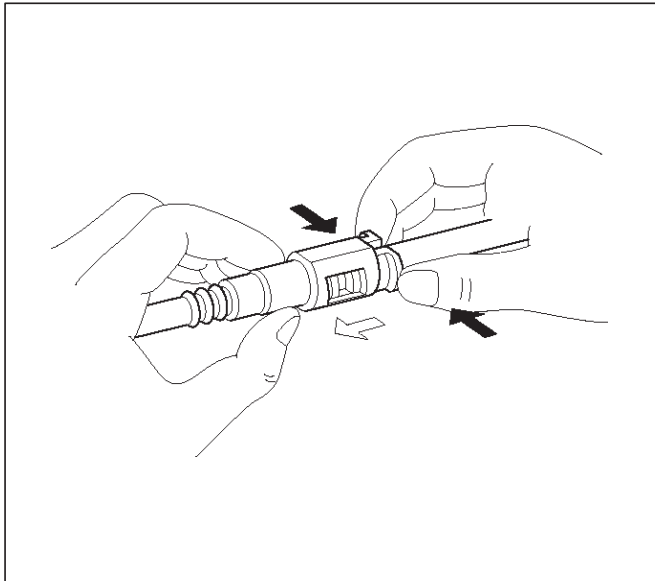
If the fuel quick-connect fittings are dusty, clean with an air blower, etc. and then remove it.



As some pressure may remain in the piping, cover the connector with a cloth, etc. to prevent the splashing of fuel in the first disconnection of the piping.

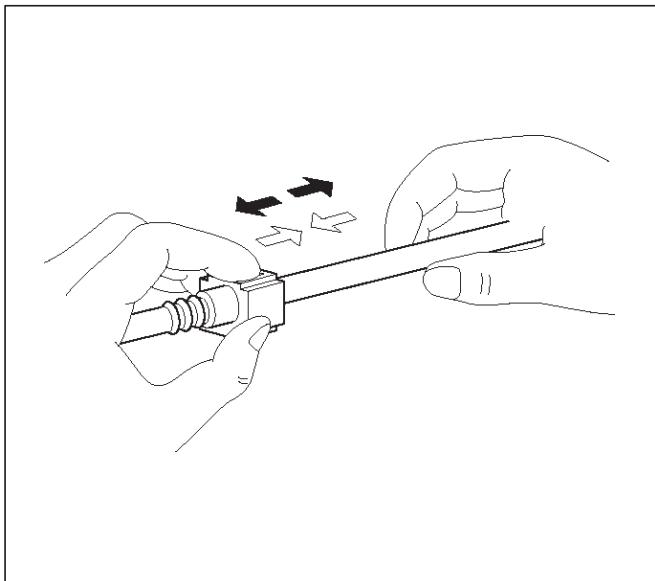
141RW016

2. For removal of the delivery pipe (feeding fuel to the engine), hold the connector in one hand, and hold the retainer tab with the other hand and pull out the connector, as illustrated. The pipe can be removed with the retainer attached.



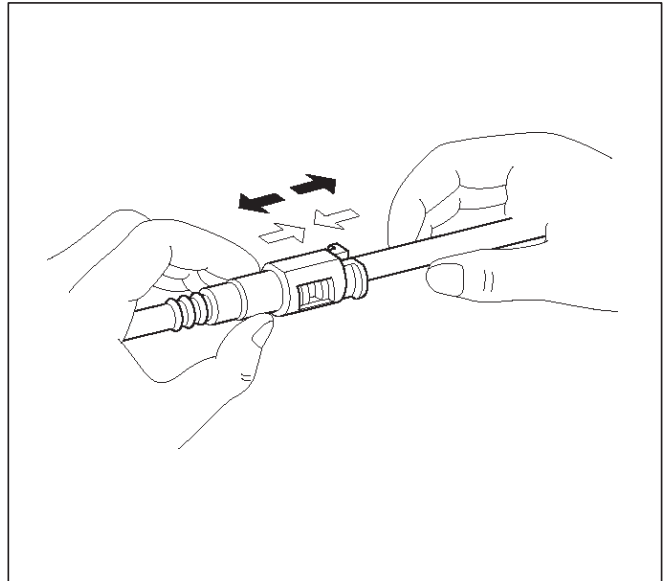
141RW019

3. For removal of the return pipe (returning fuel to the tank), hold the pipe in one hand, and pull out the connector with the other hand while pressing the square relieve button of the retainer, as illustrated.



141RW020

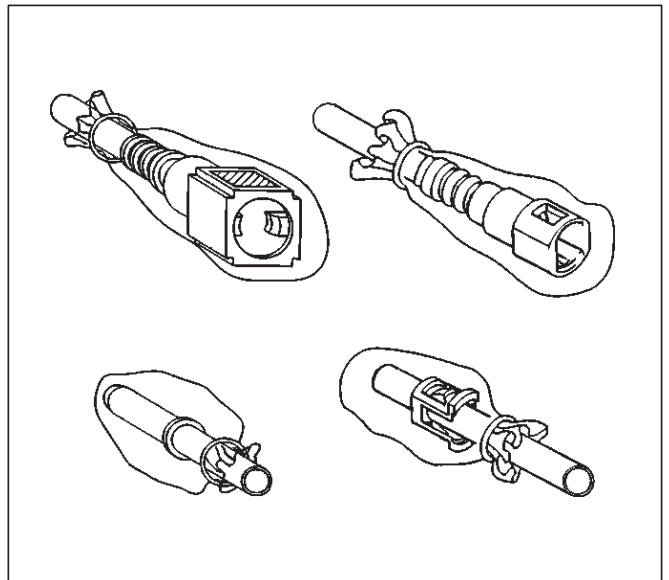
NOTE: This work should be done by hands. Do not use any tools. Should the pipe can hardly be removed from the connector, use a lubricant (light oil) and/or push and pull the connector longitudinally until the pipe is removed.



141RW021

When reusing the delivery pipe retainer, reuse without removing the retainer from the pipe. If the retainer is damaged or deformed, however, replace with a new retainer.

Cover the connectors removed with a plastic bag, etc. to prevent the entry of dust or rain water.



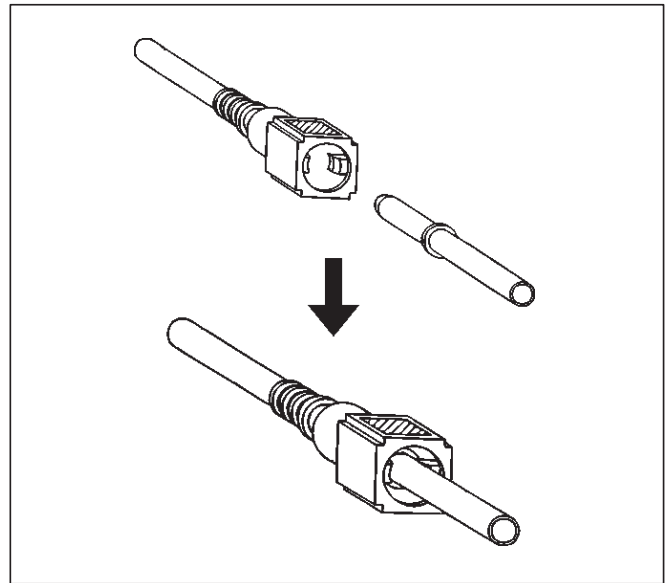
141RW022

Reuse of Quick-Connector

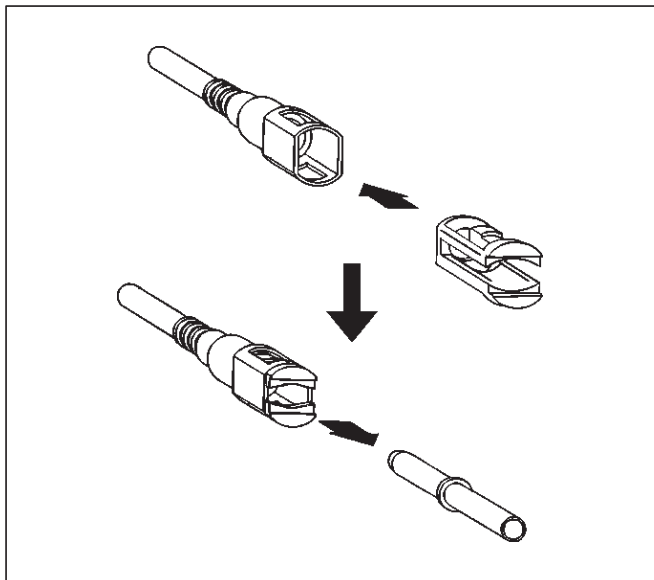
(Delivery Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud and dust from the pipe and make sure that the end including spool is free of defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- If the retainer removed according to the removal step above is attached to the pipe, clean and insert it straight into the quick-connector till it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.

NOTE: The retainer, once removed from the pipe, cannot be reused. Just replace with a new retainer. Insert the new retainer into the connector side until it clicks, and connect the pipe as inserting it into the retainer until it clicks.



141RW017



141RW018

(Return Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud or dust from the pipe and make sure that the end including spool is free from defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- After cleaning the pipe, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.

Assembling Advice

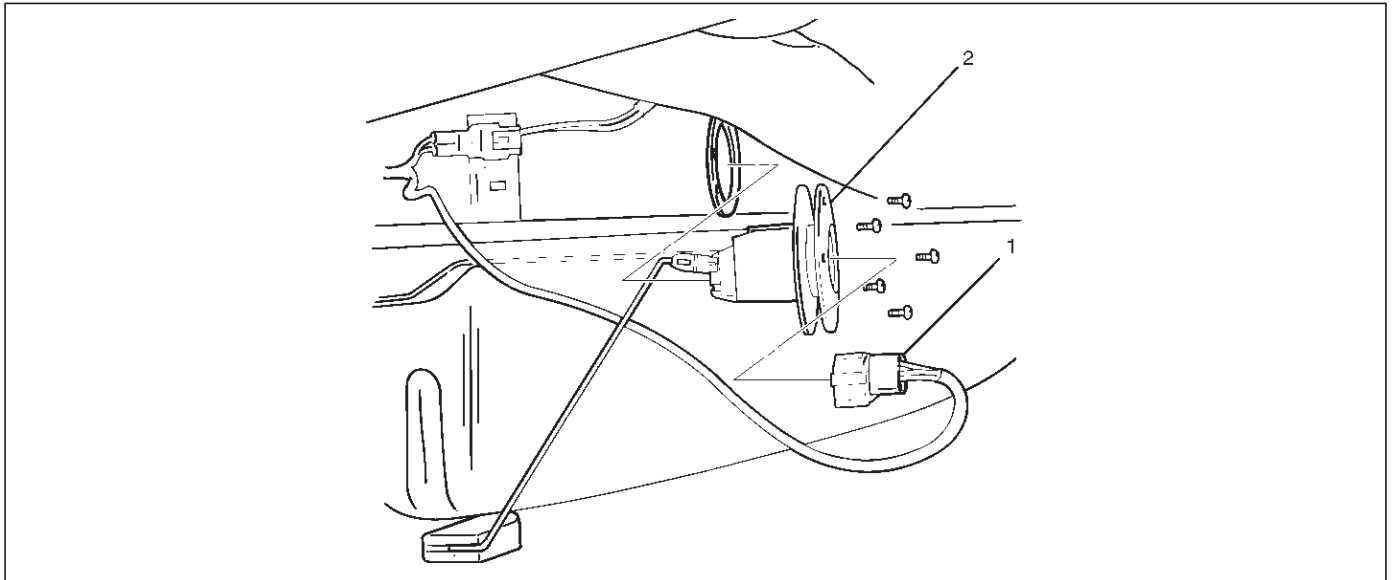
Application of engine oil or light oil to the pipe facilitates connecting work. The work should be started immediately after lubrication, since dust may stick to the pipe surface to cause poor sealability if a long time passes after lubrication.

Test/Inspection After Assembling

1. Reconnect the battery negative cable.
2. Turn the ignition key to the "ON" position and check pump startup sound. As the pump is actuated to raise fuel pressure, check and see fuel leak from the piping system.
3. Make sure of no fuel leakage by conducting the above fuel leak check a few times.
4. Start the engine and make sure of stable idling speed and normal vehicle run. The entry of dust during the work may sometimes affect the fuel injection system.

Fuel Gauge Unit

Fuel Gauge Unit and Associated Parts



140RS004

Legend

- (1) Wiring Connector
- (2) Fuel Gauge Unit

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
Tighten drain plug to the specified torque after draining fuel.

Torque: 20 N·m (2.0 Kg·m/14 lb ft) — M8

4. Wiring connector
 - Disconnect wiring connector(1) from the unit.
5. Fuel gauge unit
 - Remove the fixing screws, then the fuel gauge unit(2).

NOTE: After removing fuel gauge unit, cover fuel tank to prevent any dust entering

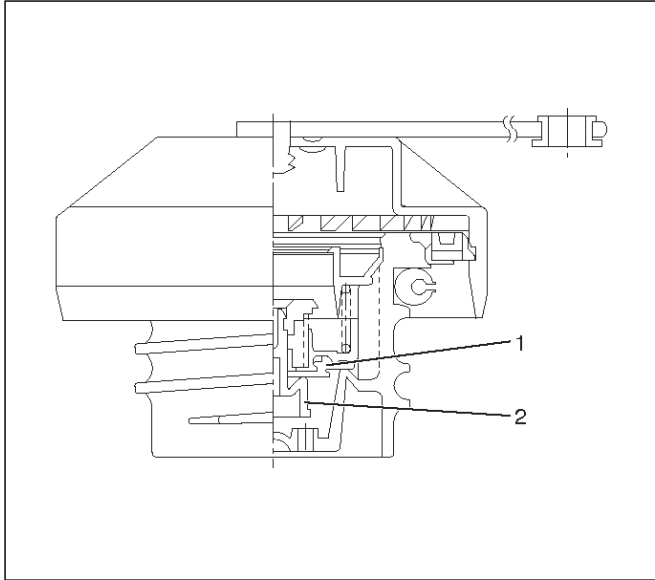
Installation

1. Fuel gauge unit(2).
2. Wiring connector(1).
 - Connect the wiring connector to the fuel gauge unit.
 - Fill the tank with fuel and tighten fuel filler cap.
 - Connect battery ground cable.

Fuel Filler Cap

General Description

Fuel filler cap includes vacuum valve and pressure valve. In case any high vacuum and any high pressure happen in tank, each valve works to adjust the pressure to prevent the tank from being damaged.



140RW021

Legend

- (1) Vacuum Valve
- (2) Pressure Valve

Inspection

Check the seal ring in the filler cap for presence of any abnormality and for seal condition. Replace the filler cap, if abnormal.

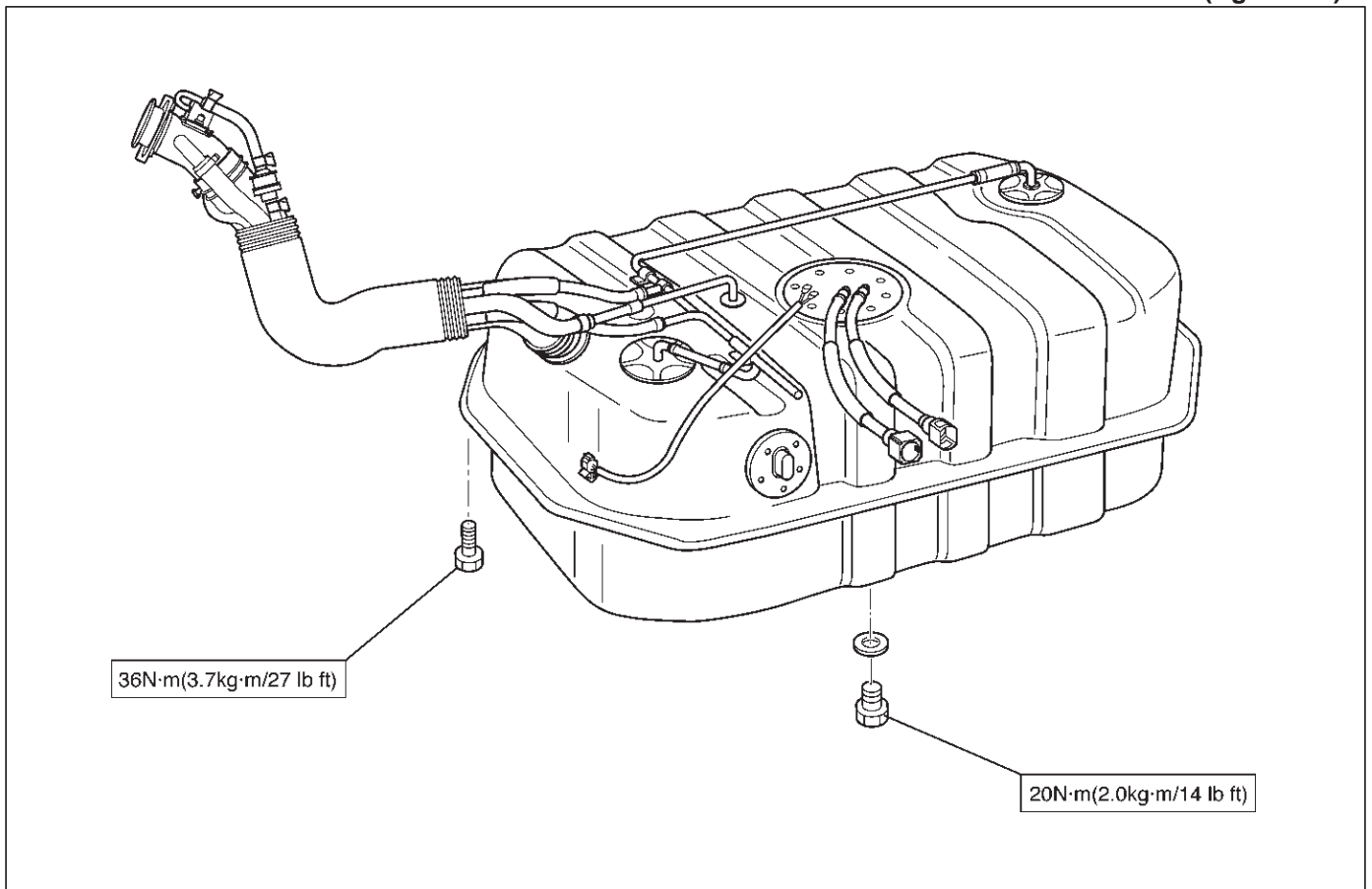
CAUTION: The fuel filler cap valves have characteristics.

A defective valve, no valve at all or a valve with the wrong characteristics will do a lot of harm to engine operating characteristics; be sure to use the same fuel filler cap as installed in this vehicle.

Main Data and Specifications

Torque Specification

N·m (Kg·m/lb ft)



ENGINE

ENGINE ELECTRICAL

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Battery	6D1-2	Battery Removal	6D1-4
General Description	6D1-2	Battery Installation	6D1-4
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Battery Charging	6D1-3		

Service Precaution

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

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Battery

General Description

There are six battery fluid caps on top of the battery. These are covered by a paper label.

The battery is completely sealed except for the six small vent holes on the side. These vent holes permit the escape of small amounts of gas generated by the battery. This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an extensive charge. (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.

Replace the battery if obvious physical damage is discovered during inspection.

Check for any other physical damage and correct it as necessary.

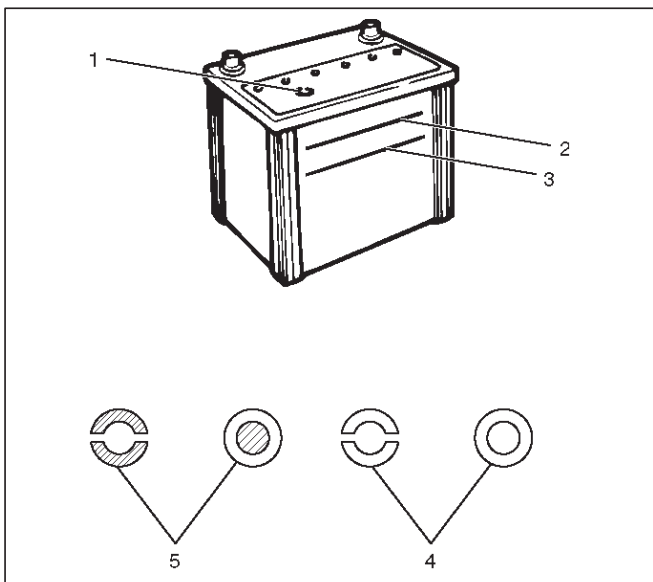
2. Hydrometer Check

There is a built-in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.

Before trying to read the hydrometer, carefully clean the upper battery surface.

If your work area is poorly lit, additional light may be necessary to read the hydrometer.

- a. BLUE RING OR DOT VISIBLE(5) – Go to Step 4.
- b. BLUE RING OR DOT NOT VISIBLE(4) – Go to Step 3.

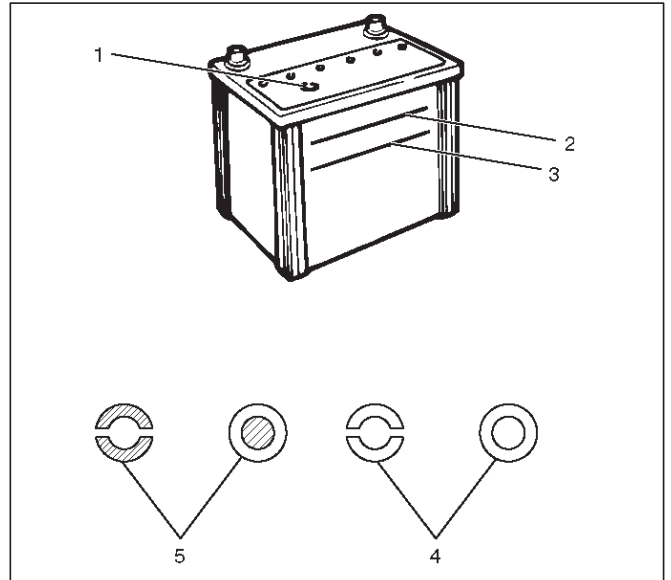


061RW001

3. Fluid Level Check

The fluid level should be between the upper level line(2) and lower level line(3) on side of battery.

- a. CORRECT FLUID LEVEL – Charge the battery.
- b. BELOW LOWER LEVEL – Replace battery.



061RW001

4. Voltage Check

1. Put voltmeter test leads to battery terminals.
 - a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 5.
 - b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section). Fast charge battery for 30 minutes at amperage rate no higher than specified value. Take voltage and amperage readings after charge.
 - a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
 - b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10–15 hours. Then go to Step 5.
 - c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 5.
 - d. VOLTAGE BELOW 12V – Replace Battery.

5. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section). Read voltage after 15 seconds, then remove load.

- a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.
- b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
°F	°C	V
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	-1	9.1
20	-7	8.9
10	-12	8.7
0	-18	8.5

The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.

Battery Charging

Observe the following safety precautions when charging the battery:

- Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
- Pay close attention to the battery during charging procedure.
Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
- In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
- Battery temperature can have a great effect on battery charging capacity.
- The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.
Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting with an Auxiliary (Booster) Battery

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

- Serious personal injury, particularly to your eyes.
- Property damage from a battery explosion, battery acid, or an electrical fire.
- Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of reach of young children.

Jump Starting Procedure

- Set the vehicle parking brake.
If the vehicle is equipped with an automatic transmission, place the selector level in the "PARK" position.
If the vehicle is equipped with a manual transmission, place the shift lever in the "NEUTRAL" position.
Turn "OFF" the ignition.
Turn "OFF" all lights and any other accessory requiring electrical power.
- Look at the built-in hydrometer.
If the indication area of the built-in hydrometer is completely clear, do not try to jump start.
- Attach the end of one jumper cable to the positive terminal of the booster battery.
Attach the other end of the same cable to the positive terminal of the discharged battery.
Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.
Be sure that the booster battery has a 12 volt rating.

6D1-4 ENGINE ELECTRICAL

4. Attach one end of the remaining cable to the negative terminal of the booster battery.

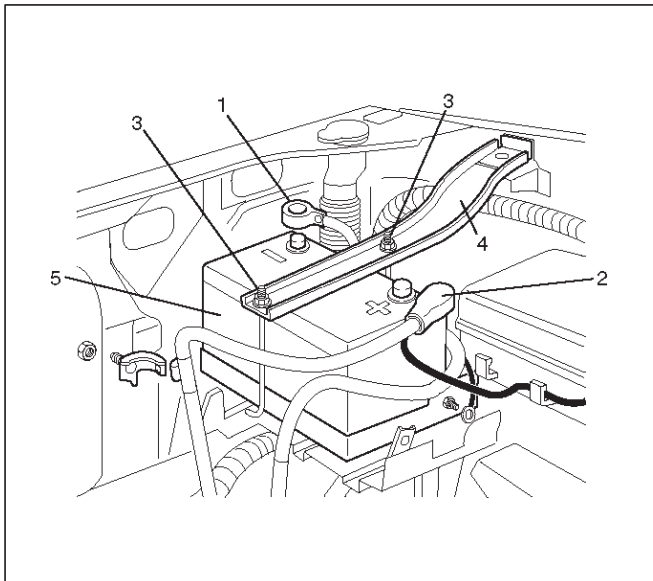
Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.

The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.
Make sure that all unnecessary electrical accessories have been turned "OFF".
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in reverse order.
Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Battery Removal



061RS002

1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).

Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Install retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

Main Data and Specifications**General Specifications**

Model (JIS)	95D31R-MF	80D26R-MF	75D26R-MF
Voltage (V)	12	12	12
Cold Cranking Performance (Amp)	622	582	490
Reserve Capacity (Min)	159	133	123
Load Test (Amp)	310	290	245
Fast Charge Maximum Amperage (Amp)	20	20	20
BCI Group No.	27	24	24

MEMO

ENGINE

IGNITION SYSTEM

CONTENTS

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General Description	6D2-2	Inspection and Repair	6D2-4
Diagnosis	6D2-2	Installation	6D2-4
Ignition Coil	6D2-3	Crankshaft Angle Sensor	6D2-5
Removal	6D2-3	Removal	6D2-5
Inspection and Repair	6D2-3	Installation	6D2-5
Installation	6D2-3	Main Data and Specifications	6D2-6
Spark Plug	6D2-4		

Service Precaution

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

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

6D2-2 IGNITION SYSTEM

General Description

Ignition is done by the electronic ignition (EI) that directly fires the spark plugs from ignition coils through spark plug wires without using a distributor. A pair of ignition coils for the cylinders having different phases by 360° (No.1 and No.4, No.2 and No.5, No.3 and No.6) are fired simultaneously.

Since the cylinder on exhaust stroke requires less energy to fire its ignition plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke. After additional 360° rotation, respective cylinder strokes are reversed.

The EI consists of six ignition coils, ignition control module, crank angle sensor, powertrain control module (PCM) and other components.

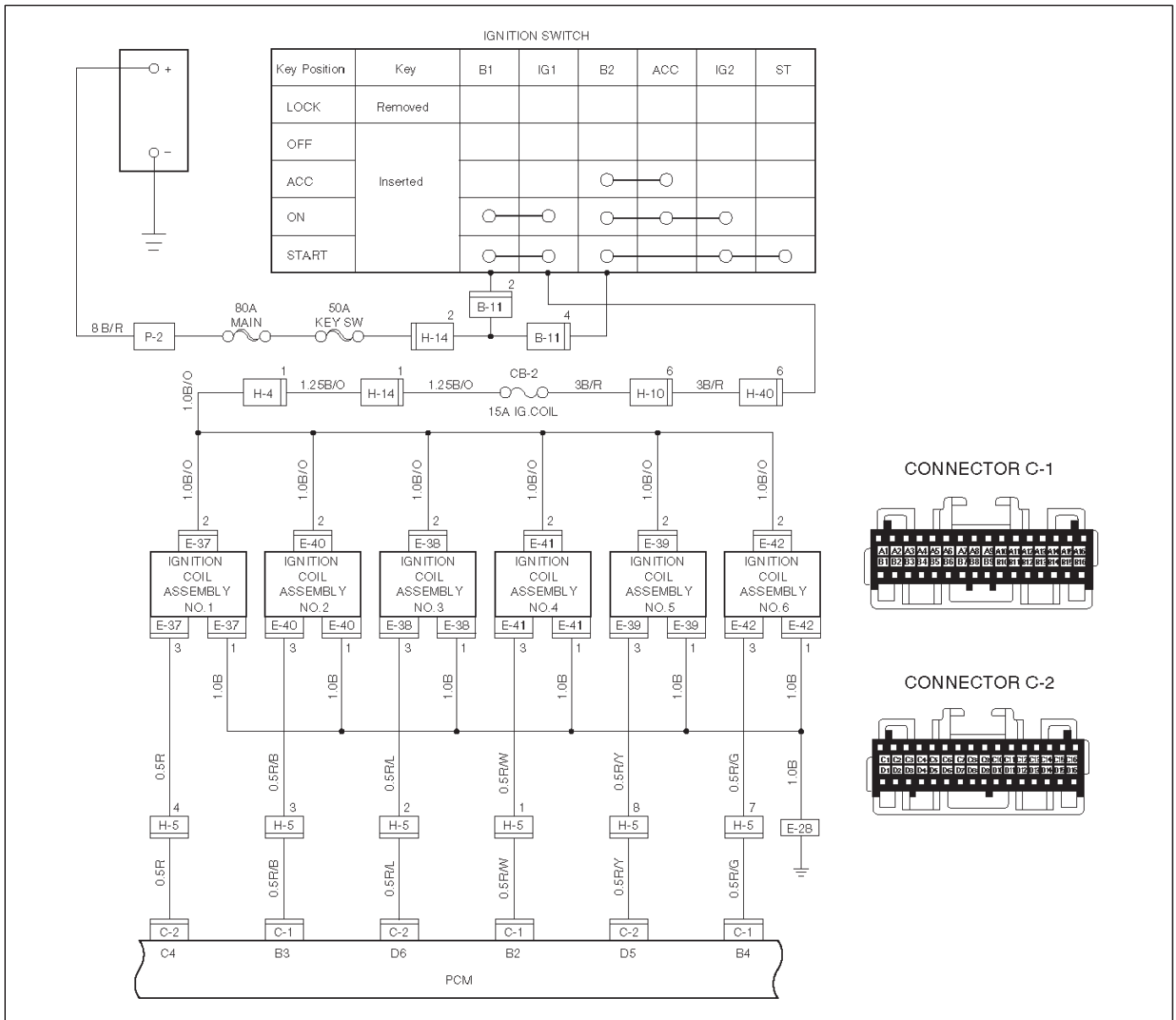
The ignition coils are connected with the PCM by means of a 32 pin connector.

The ignition control module turns on/off the primary circuit of ignition coils, and also it controls the ignition timing at the engine speed below 538 rpm.

A notch in the timing disc on the crankshaft activates the crank angle sensor which then sends information such as firing order and starting timing of each ignition coil to the PCM.

Further, the EI employs ignition control (IC) to control similar to a distributor system.

By receiving signals such as crank position, engine speed, water temperature and Manifold Absolute Pressure (MAP), the PCM controls the ignition timing.



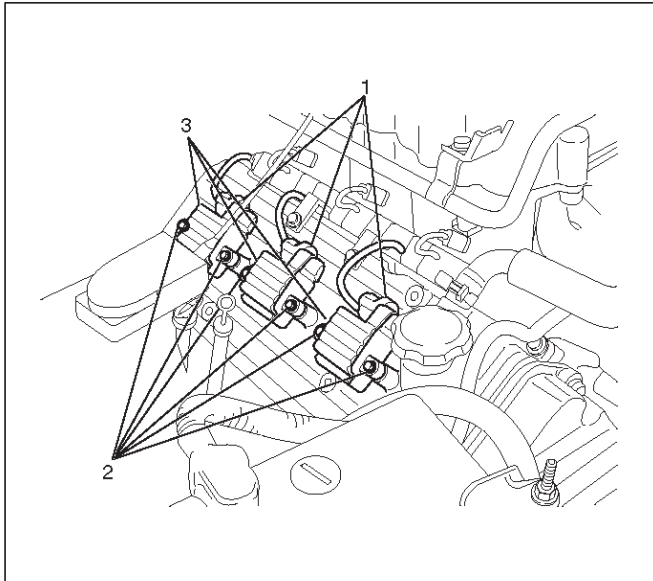
Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

Ignition Coil

Removal

1. Disconnect battery ground cable.
2. Ignition coil connector and ignition coil.
 - Disconnect three connector from ignition coil.
 - Remove harness bracket bolt on cylinder head cover.
 - Remove fixing bolts on ignition coil.



Legend

- (1) Ignition Coil Connector
- (2) Bolt
- (3) Ignition Coil Assembly

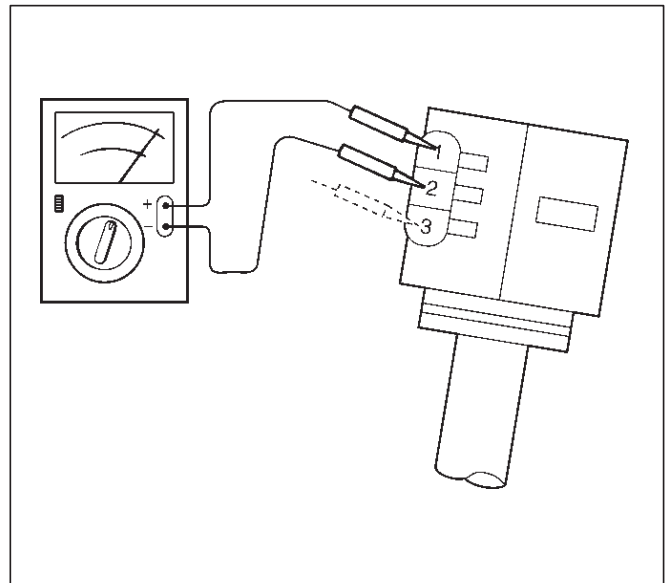
Inspection and Repair

Check the ignition coil assembly for insulation. Check terminals for corrosion or damage, and replace as necessary.

Measuring resistance of ignition coil assembly.

Terminal No.	Limit
1 to 2	Without 0 ohm or infinity maximum ohm.
1 to 3	Same as above
2 to 3	Same as above

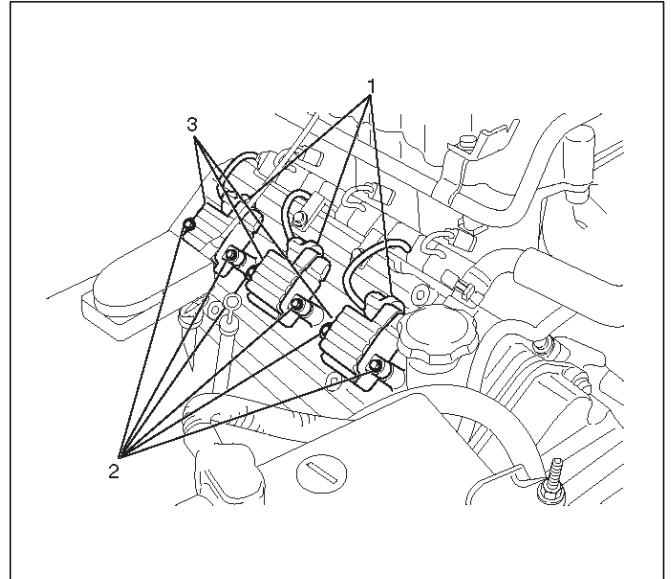
Measure resistance of ignition coil assembly, and replace the ignition coil assembly if its value exceeds the standard.



Installation

1. Install the ignition coil assembly (3).
Connect ignition coil connector (1) and ignition coil (3), then tighten bolt (2) to the specified torque.

Torque: 4 N·m (0.4 Kg·m/35 lb in)



2. Connect battery ground cable.

Spark Plug

Removal

1. Remove spark plugs.

Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- Check electrode and insulator for presence of cracks, and replace if any.
- Check electrode for wear, and replace if necessary.
- Check gasket for damage, and replace if necessary.
- Measure insulation resistance with an ohmmeter, and replace if faulty.
- Adjust spark plug gap to 1.0 mm (0.04 in) ~ 1.1 mm (0.043 in).
- Check fuel and electrical systems if spark plug is extremely dirty.
- Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

Possible causes:

- Too rich mixture
- Presence of oil in combustion chamber
- Incorrectly adjusted spark plug gap

Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

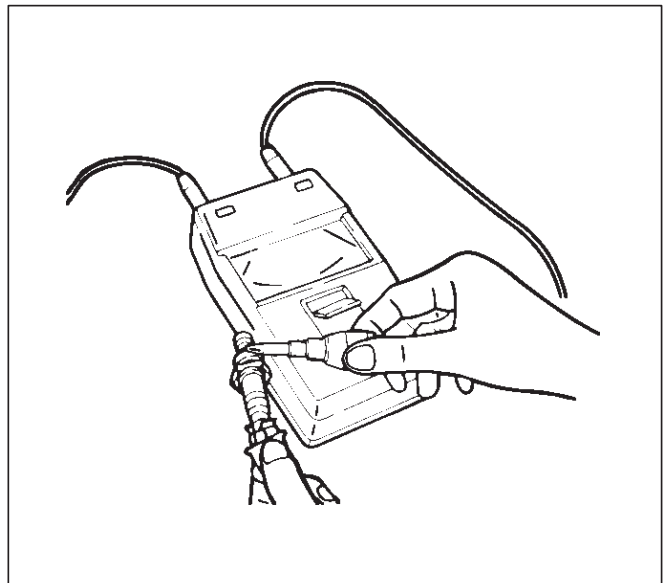
Possible causes:

- Too lean mixture
- Improper heat value

Measuring Insulation Resistance

- Measure insulation resistance using a 500 volt megaohm meter.
- Replace spark plugs if measured value is out of standard.

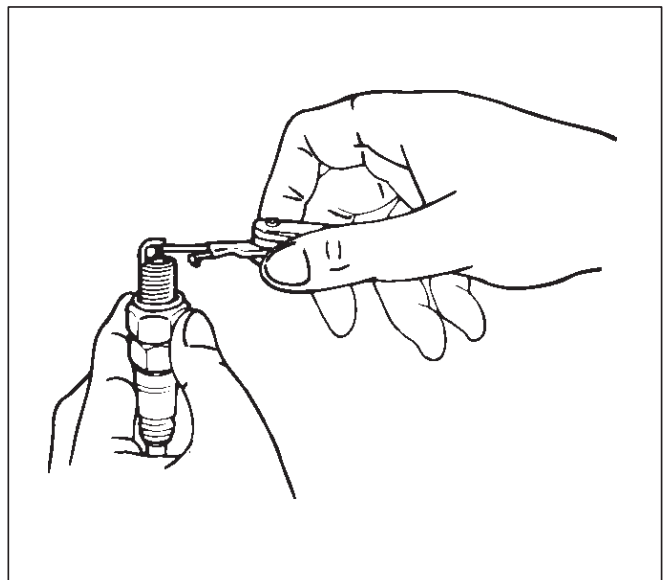
Insulation resistance: 50 M Ω or more



011RS010

Cleaning Spark Plugs

- Clean spark plugs with a spark plug cleaner.
- Raise the ground electrode to an angle of 45 to 60 degrees. If electrode is wet, dry it before cleaning.
- After spark plug is thoroughly cleaned, check insulator for presence of cracks.
- Clean threads and metal body with a wire brush.
- File the electrode tip if electrode is extremely worn.
- Bend the ground electrode to adjust the spark plug gap.



011RS011

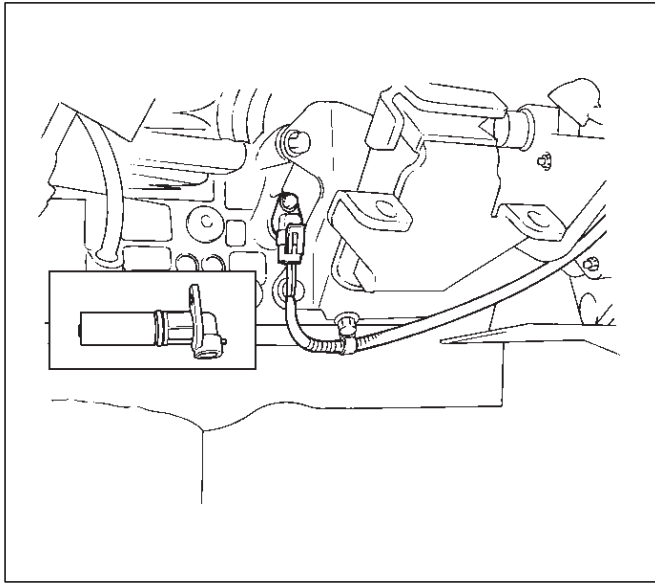
Installation

1. Spark plugs
 - Tighten spark plugs to the specified torque.
- Torque: 18 N·m (1.8 Kg·m/13 lb ft)**

Crankshaft Angle Sensor

Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft angle sensor.
3. Remove crankshaft angle sensor from cylinder block.



012RS008

Installation

1. Install crankshaft angle sensor into the cylinder block.
Before installation, apply small amount of engine oil to the O-ring.

Torque: 10 N·m (1.0 Kg·m/89 lb in)

2. Reconnect wiring connector to crankshaft angle sensor.

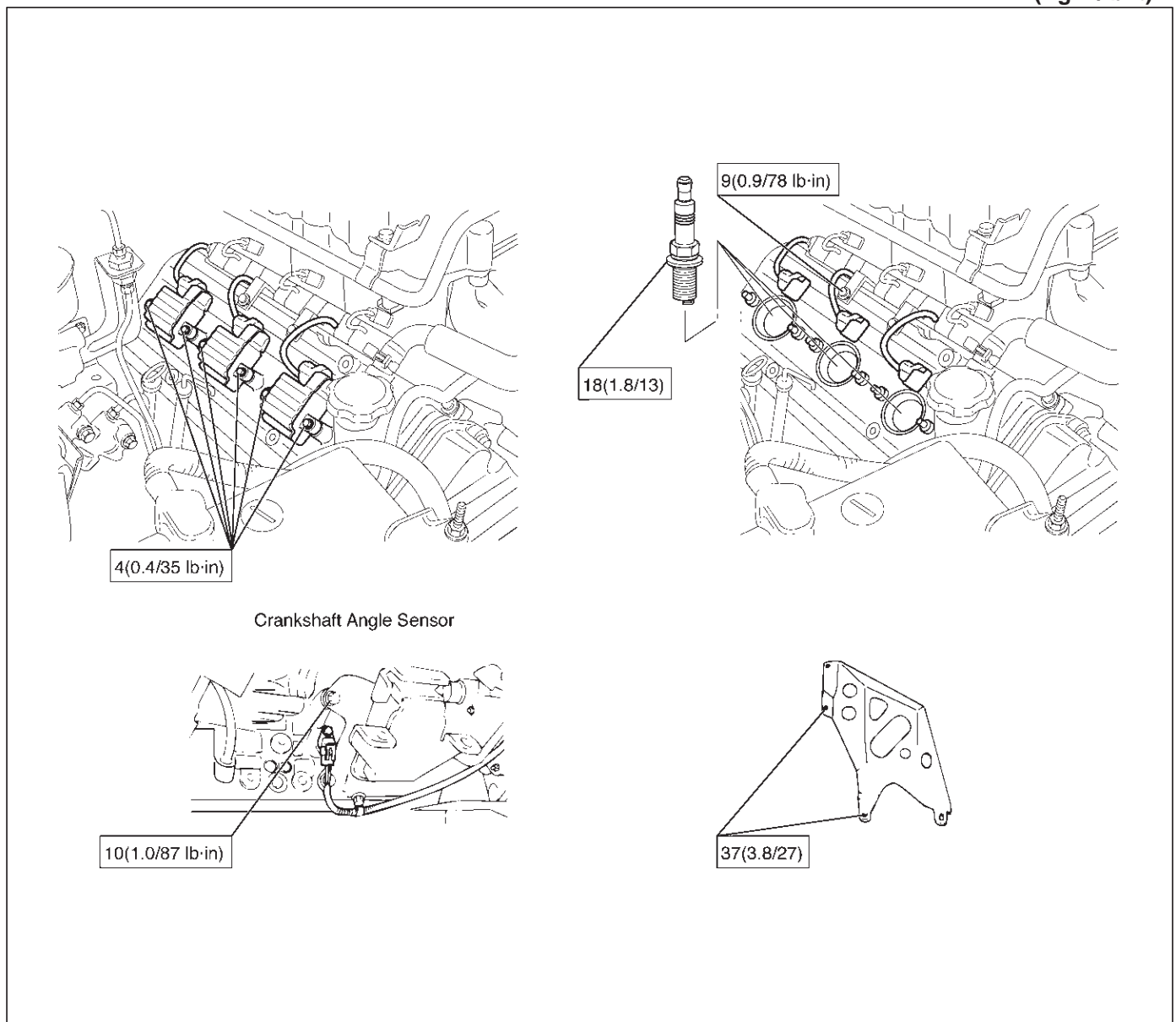
Main Data and Specifications

General Specifications

Ignition System	
Ignition Form	Electronic Ignition System (EI system) with Crankshaft angle Sensor
Spark Plug	
Type	K16PR-P11 RC10PYP4 PK16PR11
Plug gap	1.0 mm (0.04 in) – 1.1 mm (0.043 in)
Torque	18 N·m (1.8 Kg·m/13 lb ft)

Torque Specifications

N·m (Kg·m/lb ft)



ENGINE

STARTING AND CHARGING SYSTEM

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General Description	6D3-2	Generator	6D3-19
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Starter	6D3-5	Inspection	6D3-19
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Service Precaution

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Starting System

General Description

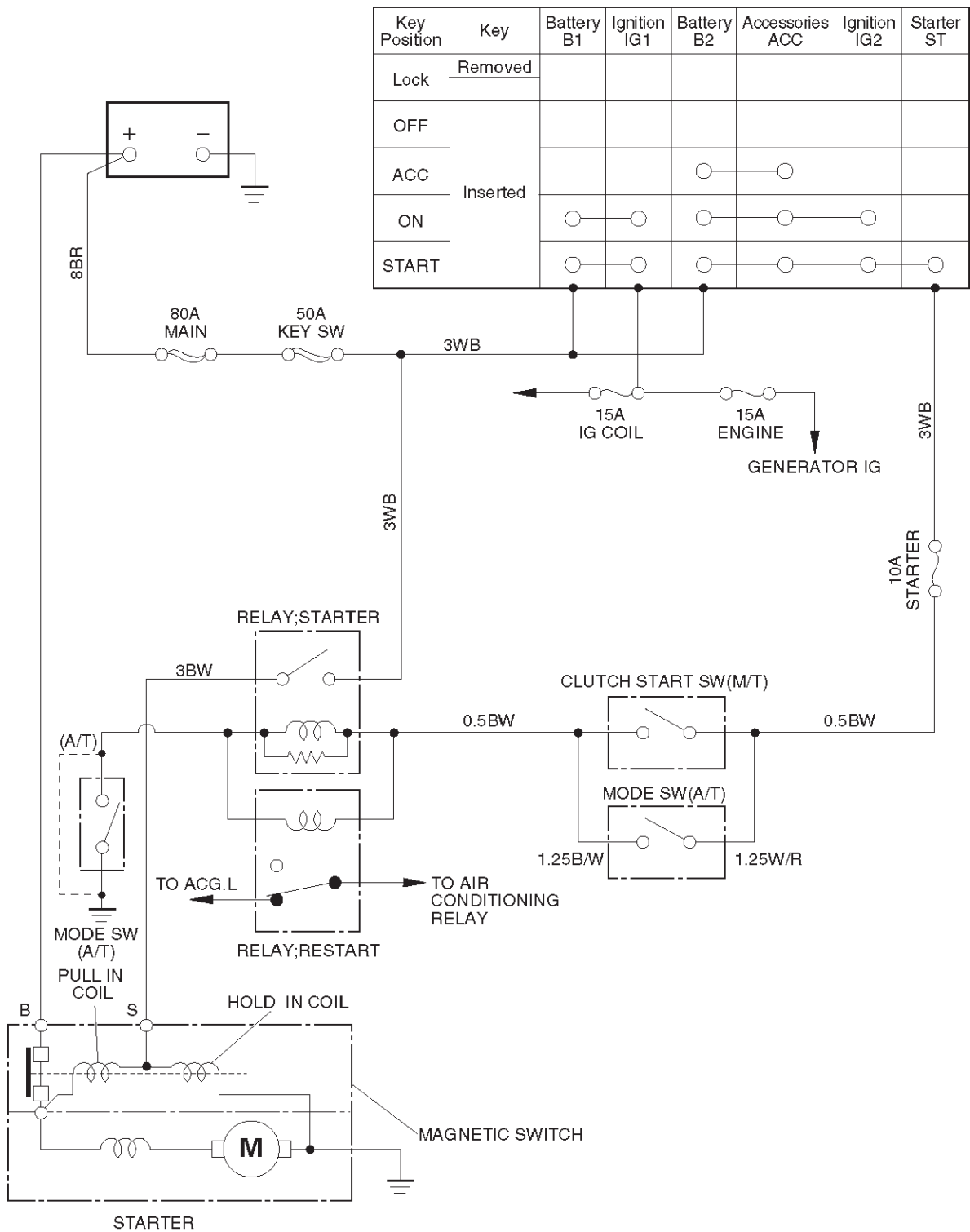
Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.



6D3-4 STARTING AND CHARGING SYSTEM

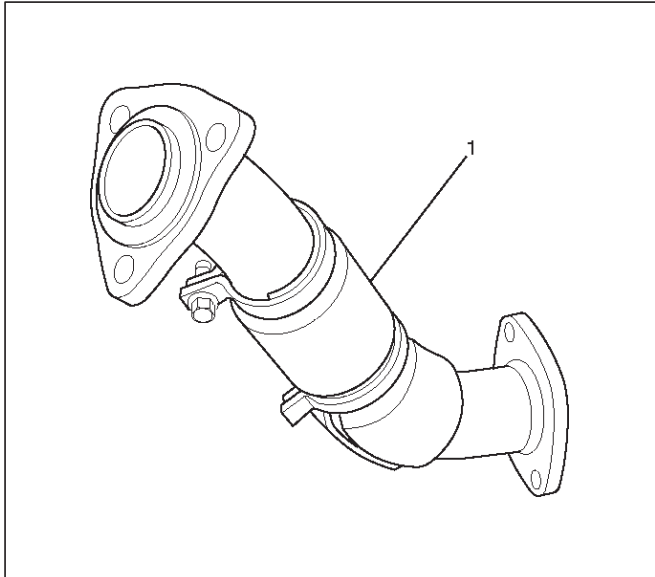
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter failure	Repair or replace starter

Starter

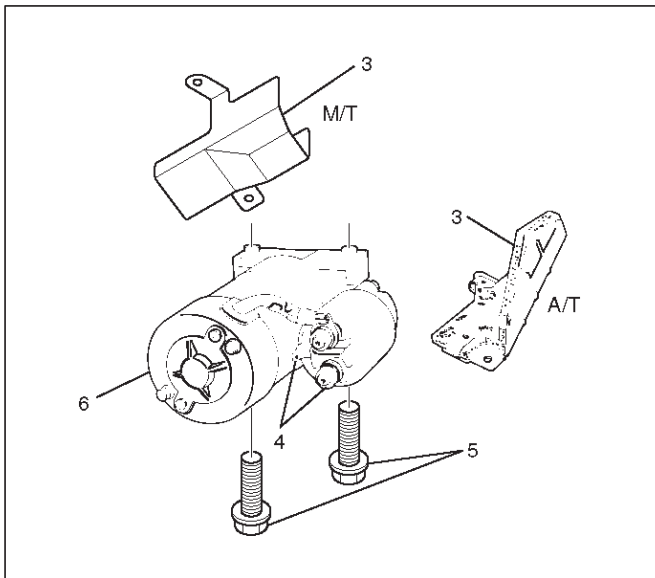
Removal

1. Battery ground cable.
2. Remove exhaust front left pipe(1).



150RW062

3. Remove heat protector(3).
4. Disconnect starter wiring connector from terminals "B" and "S"(4).
5. Remove starter assembly mounting bolts on inside and outside(5).
6. Remove starter assembly toward the bottom of engine(6).



065RW027

Installation

1. Install starter assembly(6).

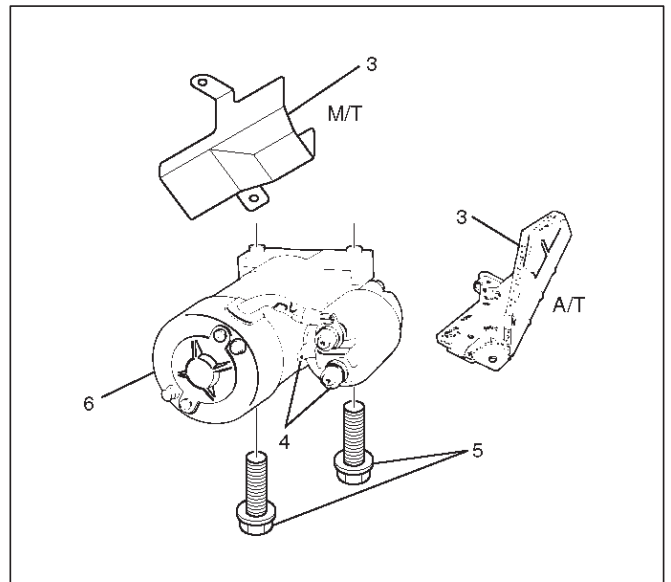
2. Install mounting bolts and tighten bolts to specified torque(5).

Torque: 40 N-m (4.1 Kg-m/30 lb ft)

3. Reconnect the connectors to terminals "B" and "S" and tighten Terminals "B" to specified torque.

Torque: 9 N-m (0.9 Kg-m/80 lb in)

4. Install heat protector(3).



065RW027

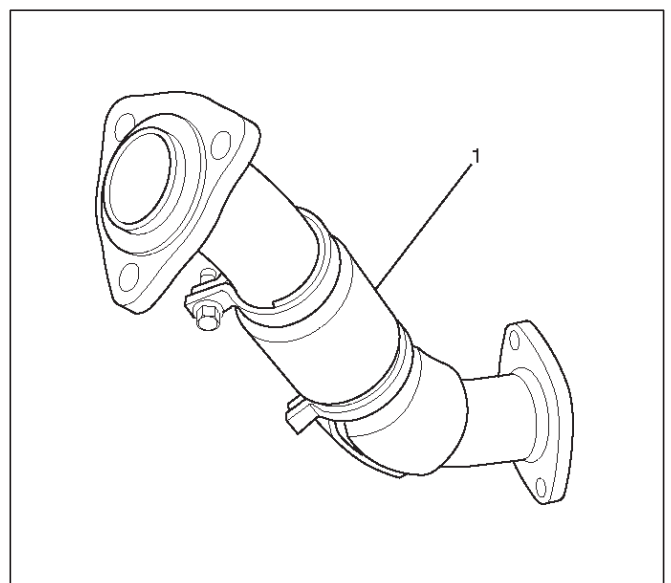
5. Install exhaust front left pipe and tighten bolts and nuts to specified torque(2).

Stud Nuts

Torque: 67 N-m (6.8 Kg-m/49 lb ft)

Nuts

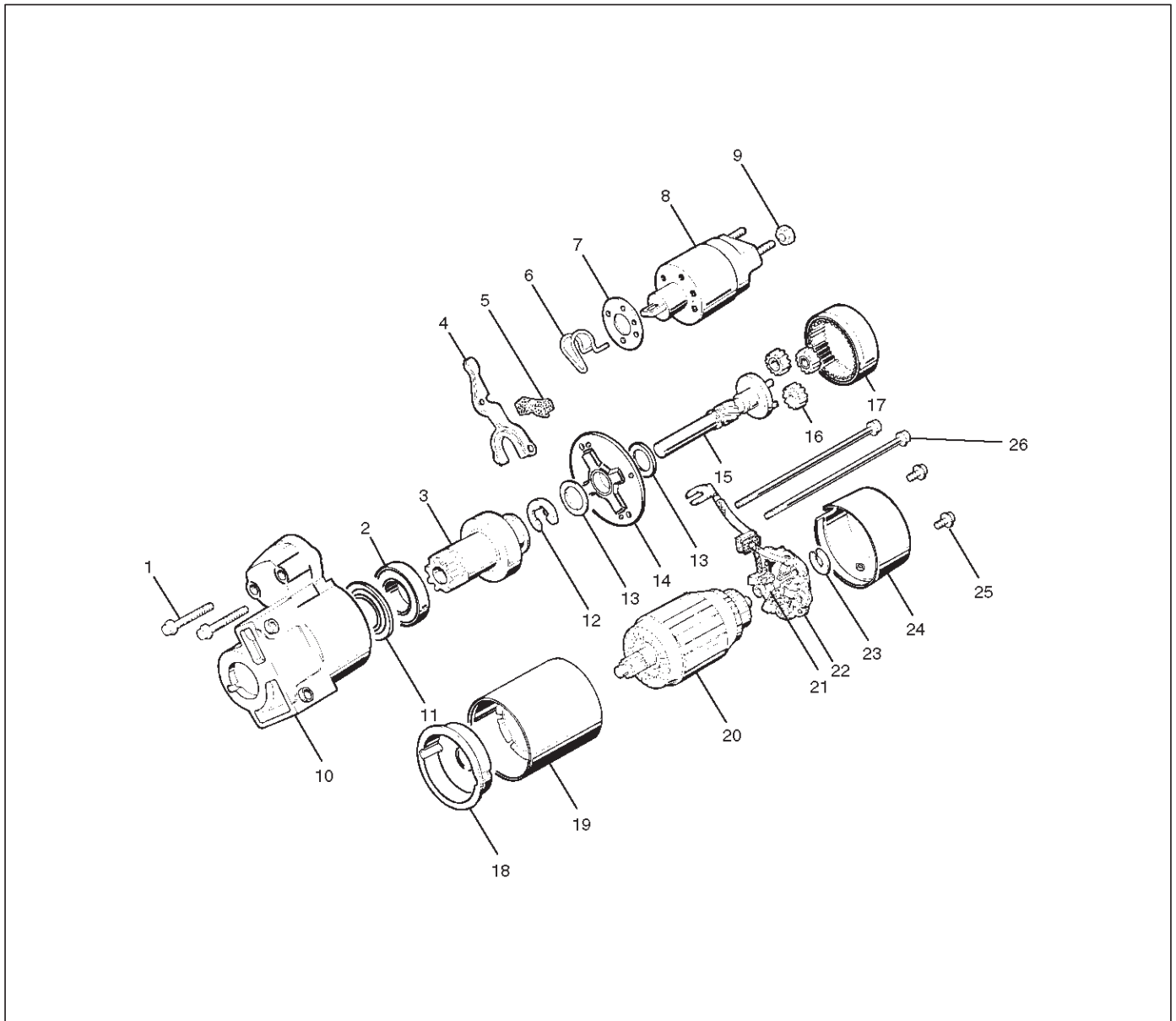
Torque: 43 N-m (4.4 Kg-m/32 lb ft)



150RW062

6. Reconnect the battery ground cable.

Disassembled View



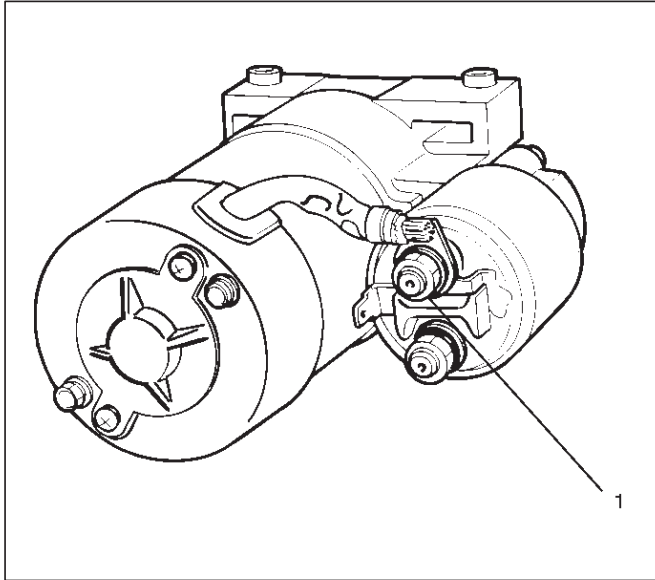
065RW002

Legend

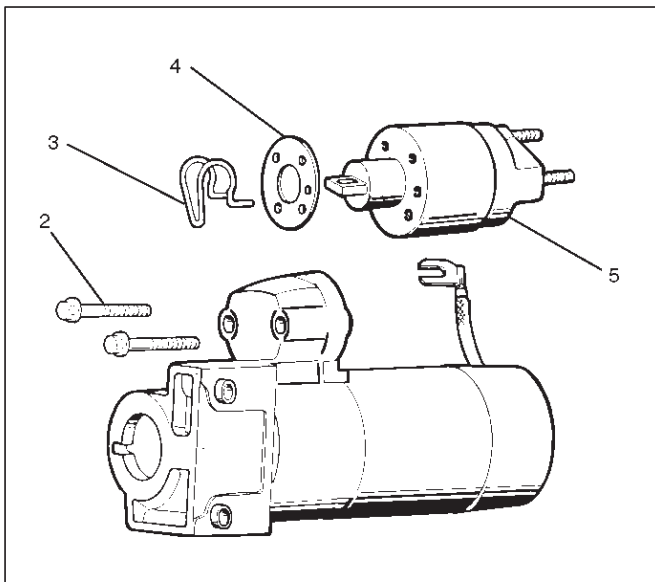
- | | |
|------------------------|---------------------------|
| (1) Bolt (2 pcs) | (14) Center Bracket |
| (2) Ball Bearing | (15) Pinion Shaft |
| (3) Pinion | (16) Planet Gear (3) |
| (4) Shift Lever | (17) Internal Gear |
| (5) Dust Cover | (18) Center Bracket (A) |
| (6) Torsion Spring | (19) Yoke Assembly |
| (7) Dust Cover | (20) Armature |
| (8) Magnetic Switch | (21) Brush |
| (9) Nut | (22) Brush Holder |
| (10) Gear Case | (23) Thrust Washer |
| (11) Bearing Cover | (24) Rear Cover |
| (12) E-Ring | (25) Screw (2 pcs) |
| (13) Thrust Washer (2) | (26) Through Bolt (2 pcs) |

Disassembly

1. Loosen the nut(1) on terminal "M" of magnetic switch and disconnect the connector cable.
2. Remove bolt (2 pcs) (2).

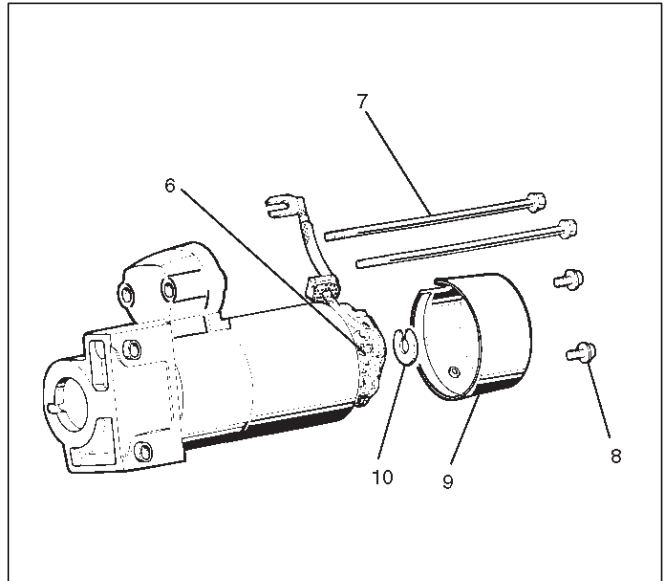


3. Remove magnetic switch(5).
4. Remove dust cover(4).
5. Remove torsion spring bolts, then the magnetic switch assembly.
6. Remove torsion spring(3) from magnetic switch assembly(5).

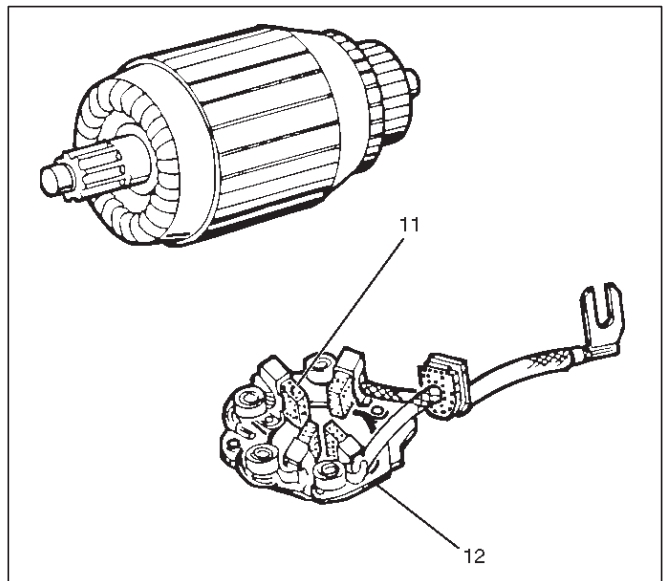


7. Remove screw (2 pcs) (8).
8. Remove through bolt (2 pcs) (7).

9. Remove screws and through bolts, then the rear cover(9) then remove thrust washer(10).
10. Remove brush holder(6).



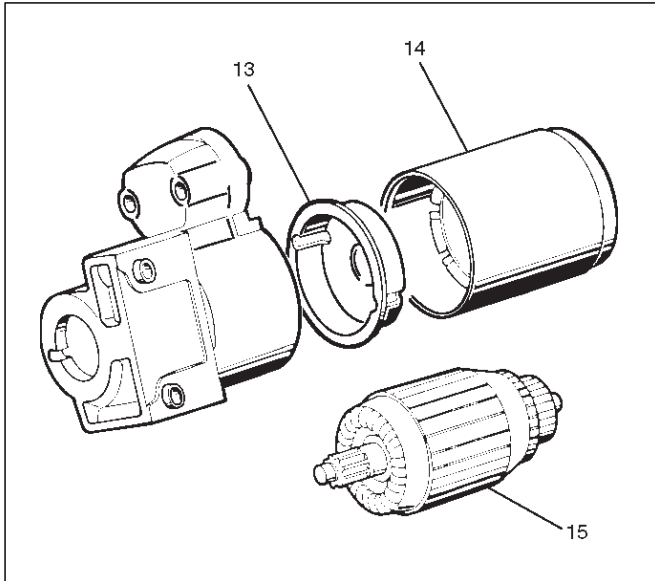
11. Raise a brush spring to detach brushes (4 pcs) from the commutator face and pull off the brush holder(12) and brush(11).



12. Remove yoke assembly(14).
13. Remove armature(15).
14. Pull off the yoke assembly, then remove armature, washer and center bracket.(A) (13).

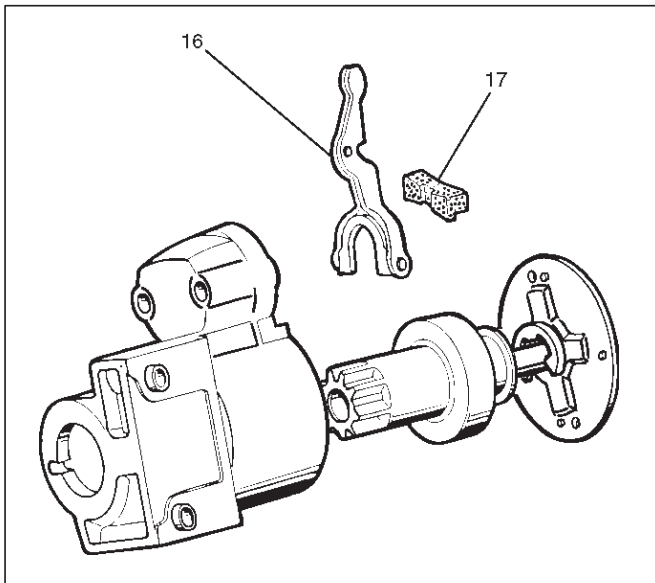
6D3-8 STARTING AND CHARGING SYSTEM

NOTE: In disassembling the yoke assembly, hold the armature and pull off slowly the yoke assembly. Because of strong magnetic force, avoid placing a metallic part near armature.



15. Remove dust cover(17).

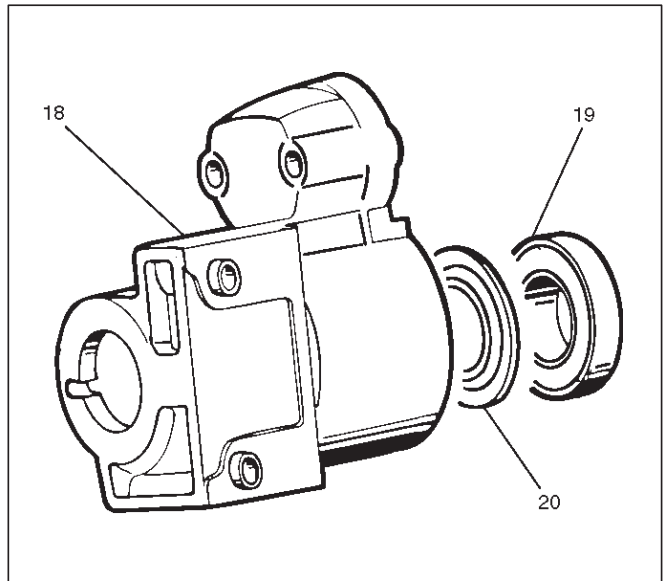
16. Remove a dust cover and shift lever(16) from the gear case.



17. Remove ball bearing(19).

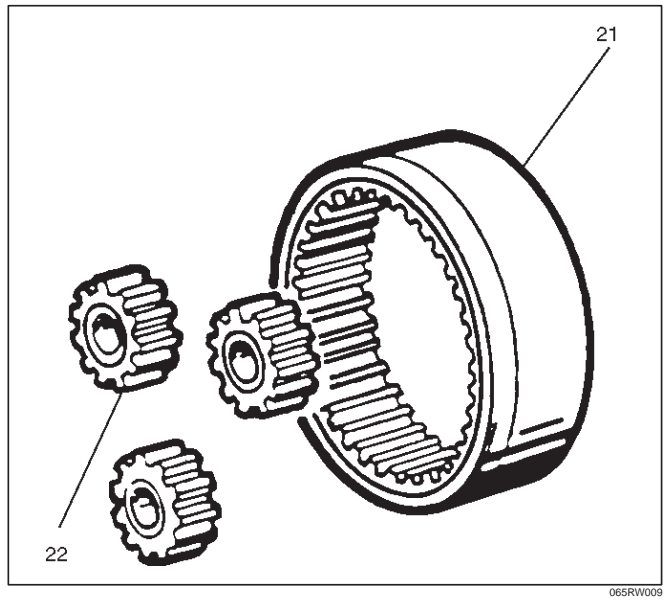
18. Remove bearing cover(20).

19. Remove a ball bearing and bearing cover from the gear case(18).

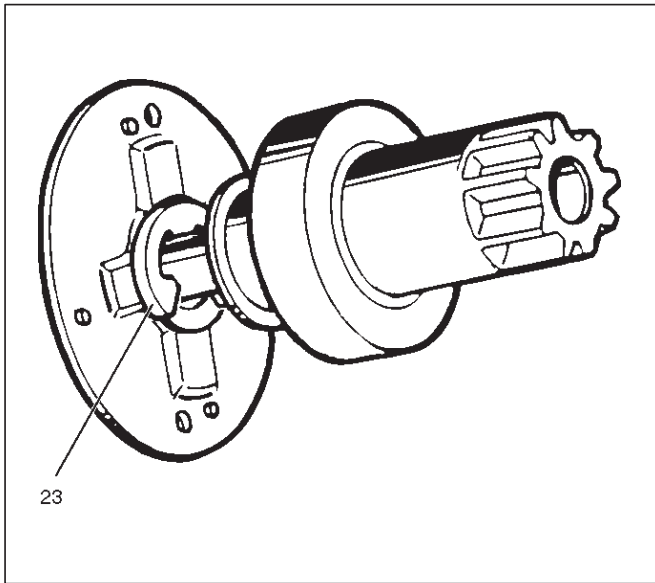


20. Internal gear(21).

21. Remove internal gear and planet gear(3) (22).



22. Remove an E-ring(23) from the pinion shaft using a flat blade screwdriver.

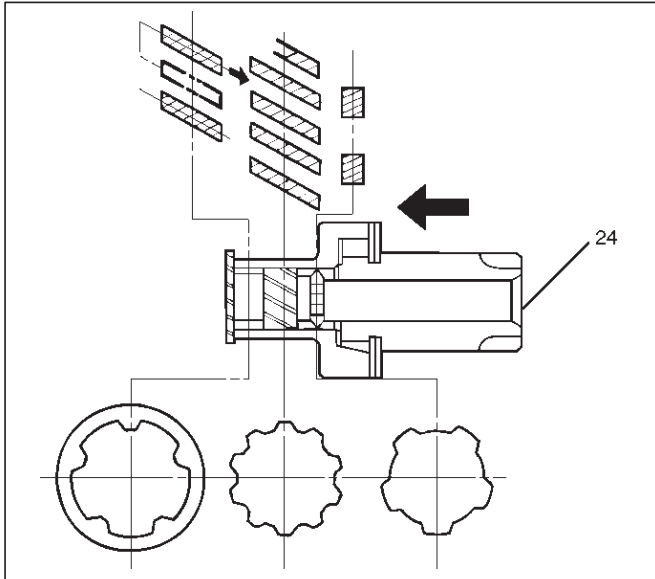


23. Holding the pinion shaft, push pinion toward the center bracket, and turn the pinion clockwise or counterclockwise by one tooth of spline, then pull off the pinion.

24. Remove thrust washer(24).

25. Remove center bracket

26. Remove pinion shaft.



Inspection and Repair

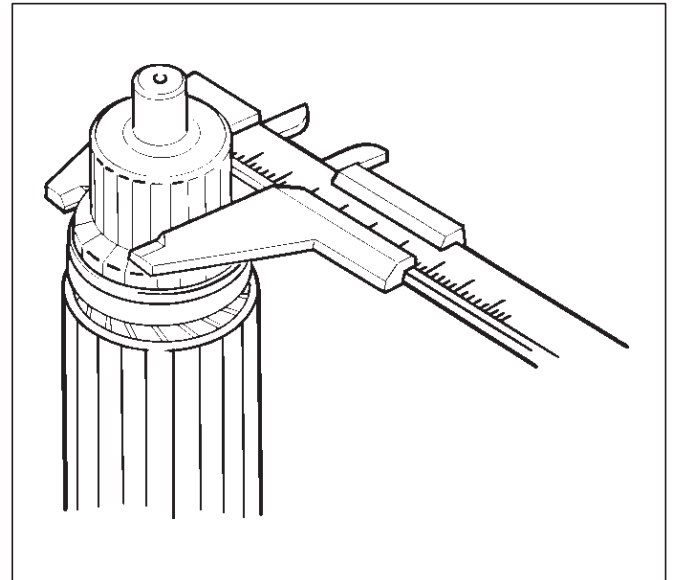
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

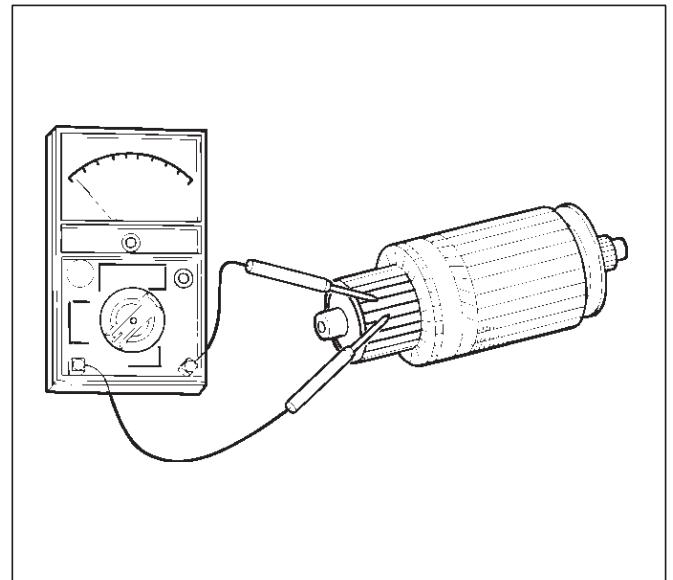
Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

Standard: 33.0 mm (1.30 in)

Limit: 32.0 mm (1.26 in)

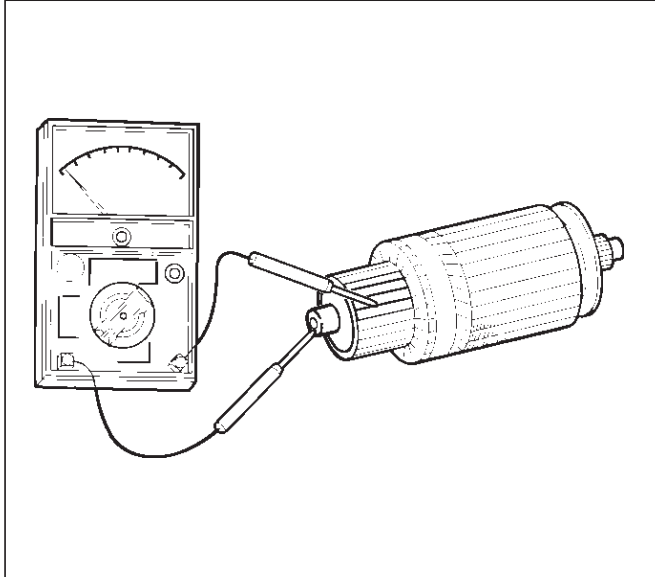


Check for continuity between commutator and segment. Replace commutator if there is no continuity (i.e., disconnected).



6D3-10 STARTING AND CHARGING SYSTEM

Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

Measure runout of armature core and commutator with a dial gauge. Repair or replace, if it exceeds the limit.

Armature

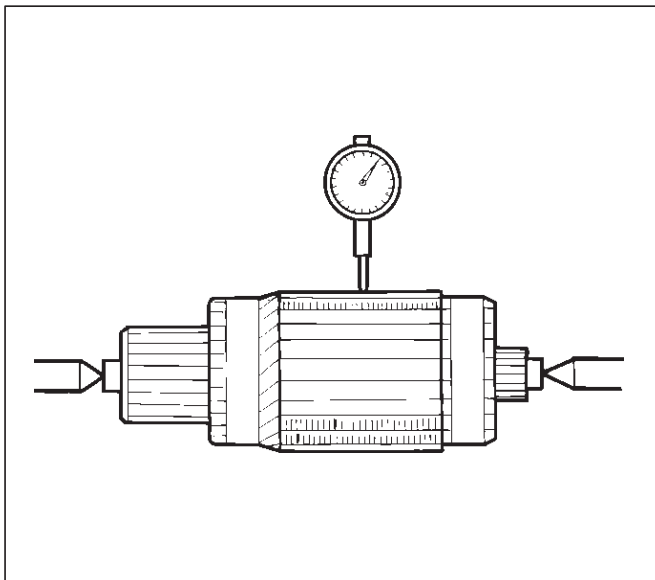
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)

Commutator

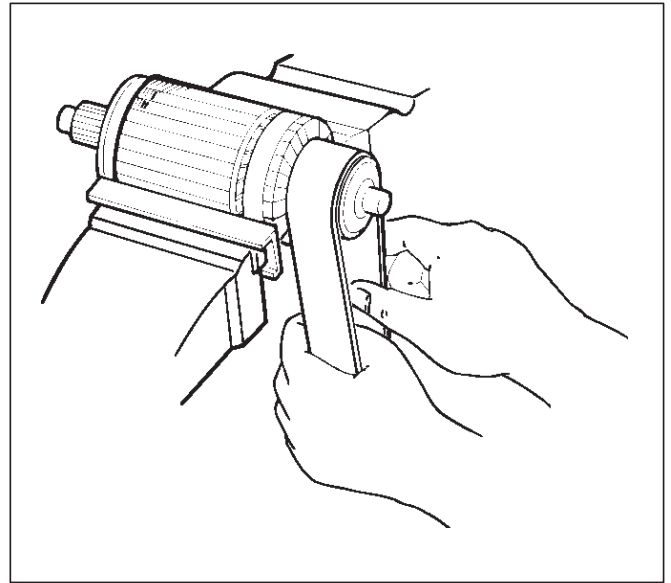
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)



065RS017

Polish the commutator surface with sandpaper #500 to #600 if it is rough.

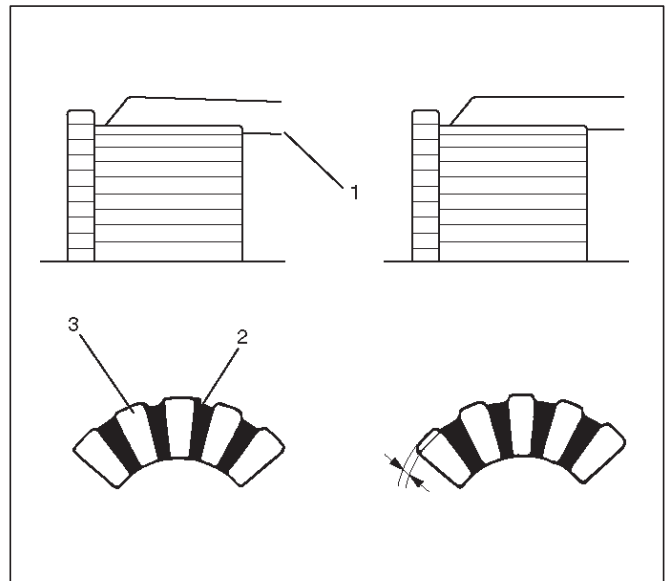


065RW012

Measure the depth of insulator in commutator. Repair, if it is below the limit.

Standard: 0.05 mm to 0.8 mm (0.02 in to 0.03 in)

Limit: 0.2 mm (0.008 in)



065RW013

Legend

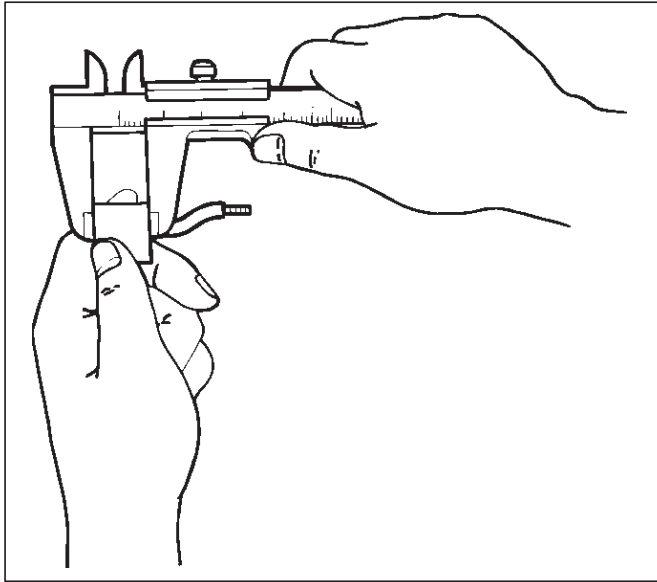
- (1) Steel Saw
- (2) Insulator
- (3) Commutator Segments

Brush

Measure the length of brush.
 Replace with a new one, if it is below the limit.

Standard: 16 mm (0.63 in)

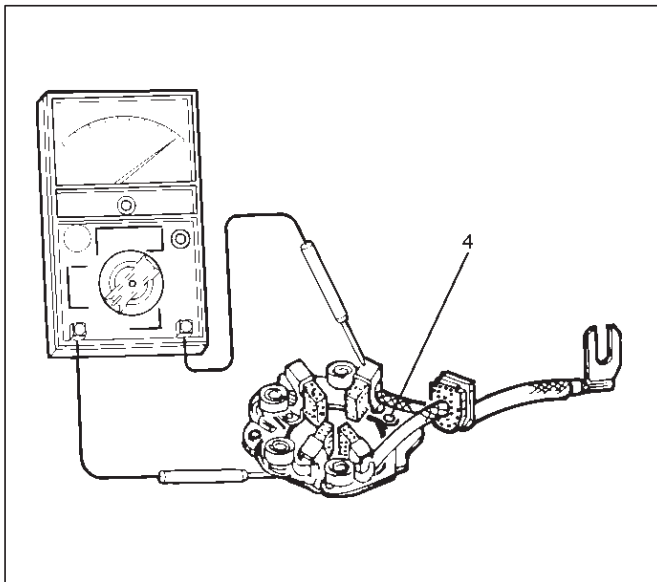
Limit: 11 mm (0.43 in)



065RW014

Brush Holder

Check for continuity between brush holder (+) (4) and base (-). Replace, if there is continuity (i.e., insulation is broken).

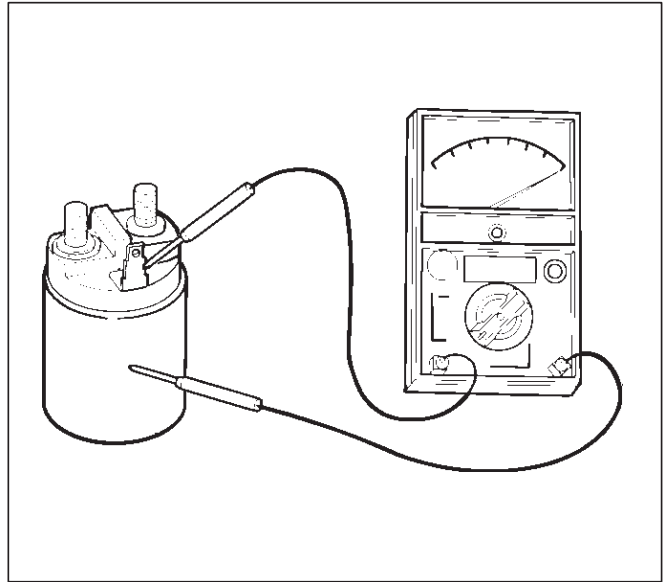


065RW015

Magnetic Switch

Check for continuity of shunt coil between terminals S and M.

Replace, if there is no continuity (i.e., coil is disconnected).

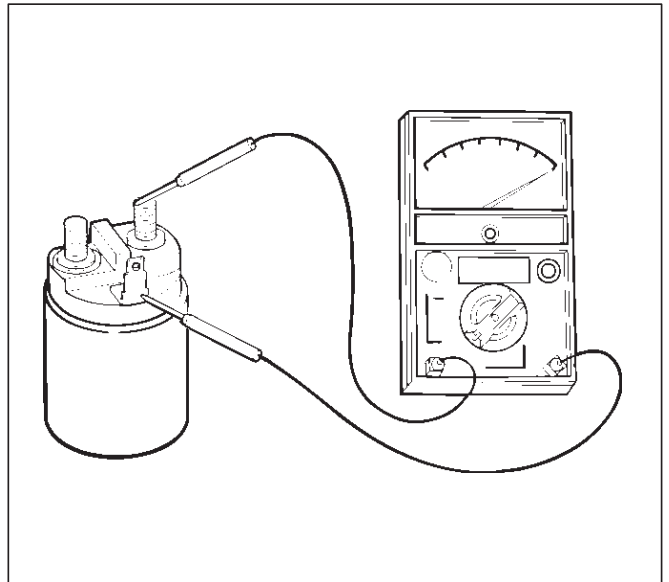


065RW016

Continuity of Series Coil

Check for continuity between terminals S and M.

Replace, if there is no continuity (i.e., coil is disconnected).

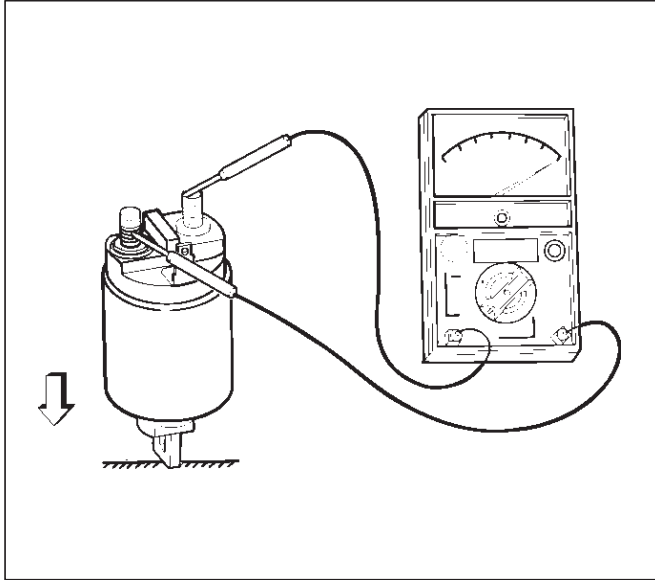


065RW017

6D3-12 STARTING AND CHARGING SYSTEM

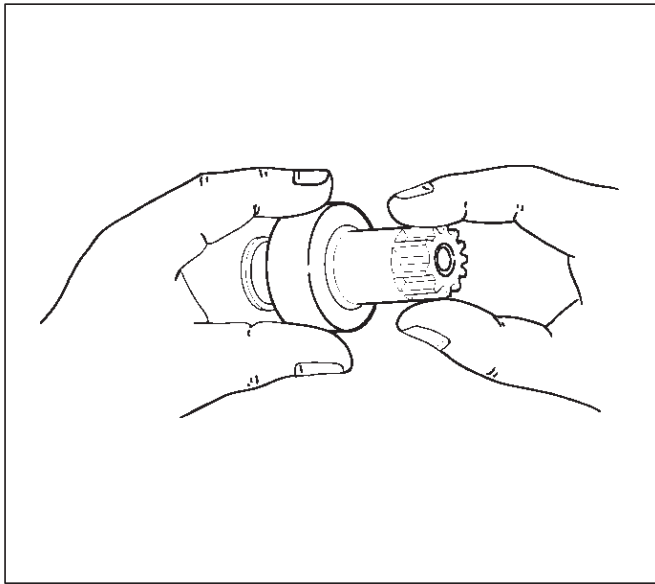
Continuity of Contacts

With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



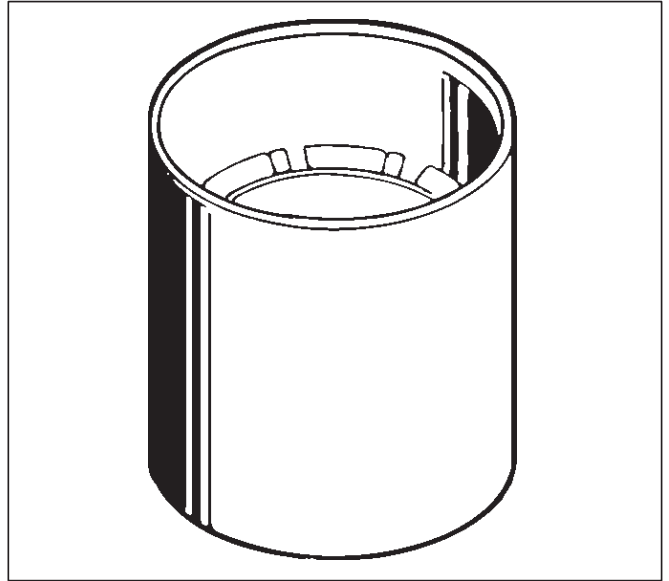
Pinion

Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated in reverse. If not, replace the pinion.



Yoke Assembly

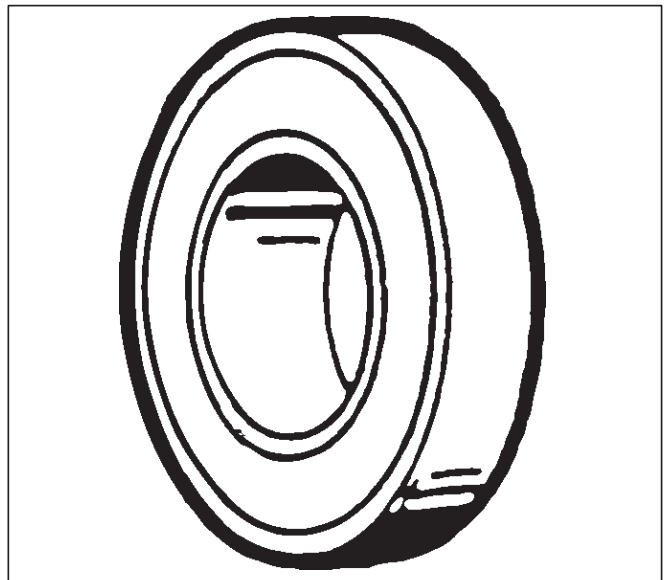
Check a magnet inside the yoke.
Replace the yoke assembly if it is broken.



Ball Bearing

Clamp the inner race of the ball bearing with your finger, and check for sticking or play when rotating the outer race.

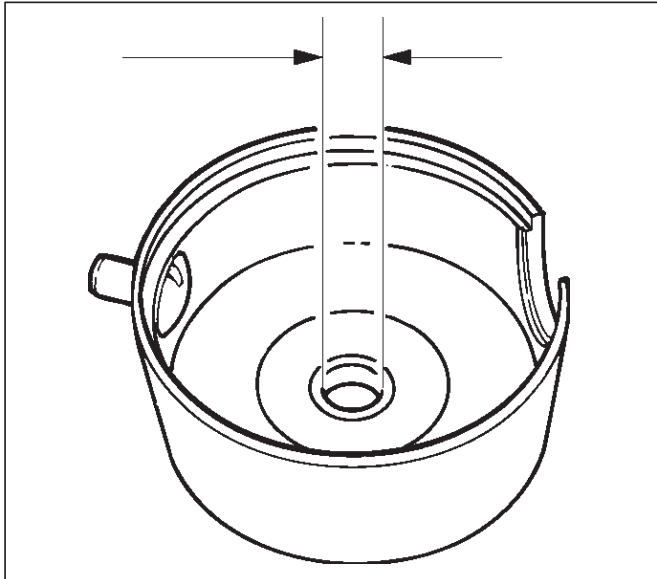
Replace, if abnormality is found.



Measure inner diameter of bushing in the rear cover, and replace if it exceeds the limit.

Standard: 12.50 mm to 12.527 mm (0.492 in to 0.4932 in)

Limit: 12.60 mm (0.4961 in)

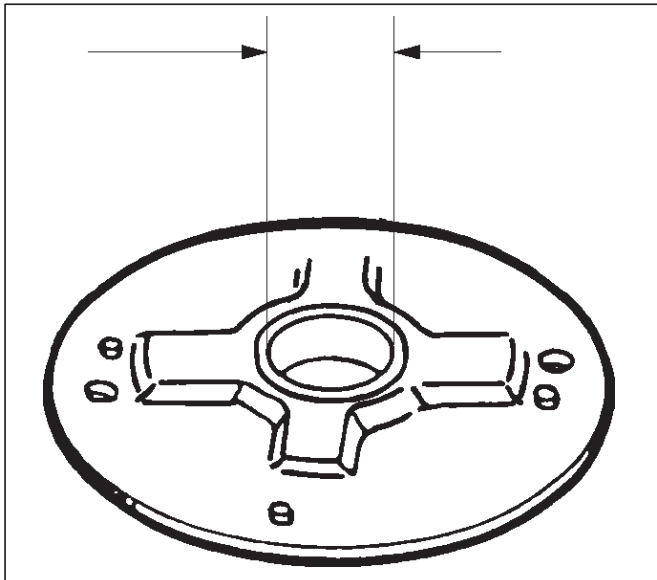


065RS028

Measure inner diameter of bushing in the center bracket (P), and replace if it exceeds the limit.

Standard: 18.01 mm to 18.127 mm (0.7091 in to 0.7137 in)

Limit: 18.15 mm (0.7146 in)



065RS029

Reassembly

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

Grease application places

- Bushing in rear cover and center bracket
- Gears in reduction gear
- Shift lever operating portion
- Sliding portion of pinion
- Plunger sliding portion of magnetic switch

Reassembling Yoke Assembly

Before reassembly, make sure that no metallic parts attach to the yoke assembly. Because of strong magnetic force, hold the yoke assembly and insert it slowly into the armature.

Torque

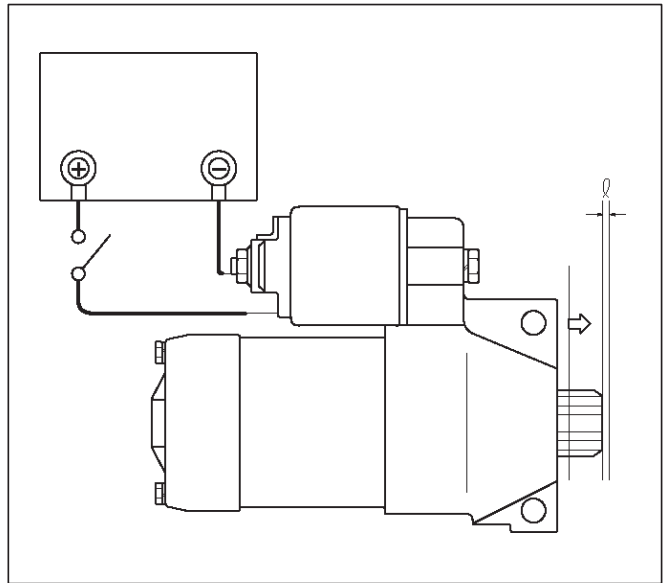
Torque for each part (See Torque Specifications in this section)

Pinion Jump-out Dimension

Connect the “+” cable of battery to terminal S and the “-” cable to terminal M. Turn the switch on, and measure pinion travel dimension in thrust direction from the jump-out position.

In measuring the dimension, pull the pinion out a little in the arrow direction.

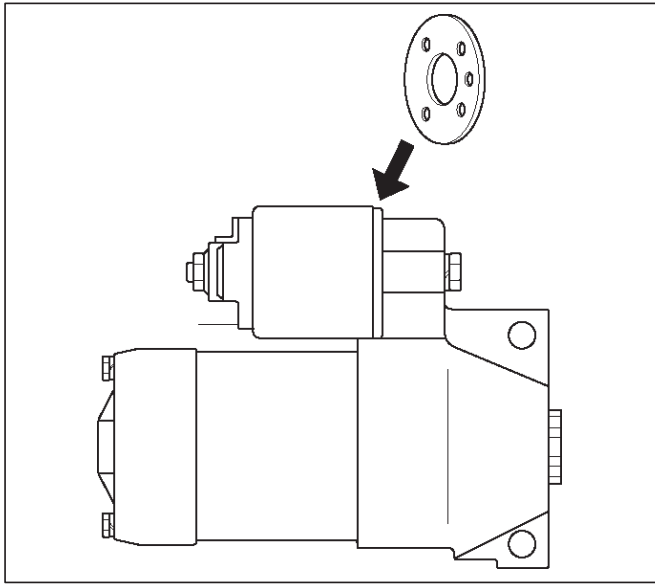
Dimension(L): 0.05 mm to 1.5 mm (0.002 in to 0.06 in)



065RS030

6D3-14 STARTING AND CHARGING SYSTEM

If the measured value is out of standard, insert dust cover, or disassemble and adjust.



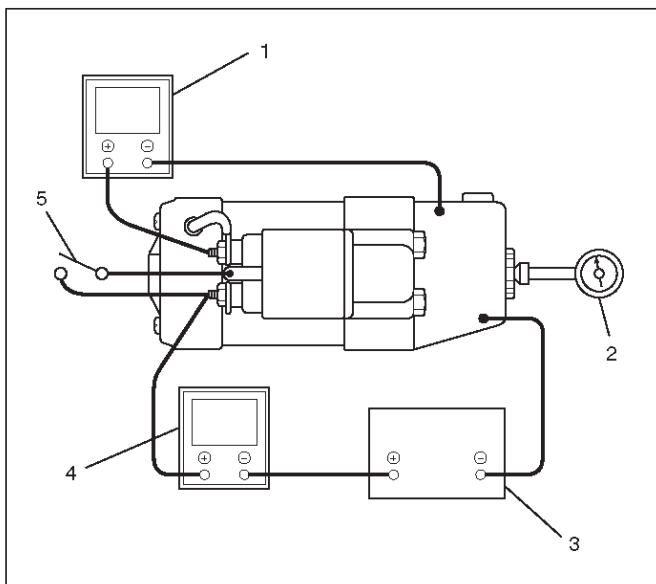
065RW019

Characteristic Test

For easily confirming the characteristics, conduct the no load test as follows:

Rating as short as 30 seconds requires rapid testing.

Fix the starter on the test bench, and wire as shown in illustration. When the switch is closed, the current flows and the starter runs under no load. At this time, measure current, voltage and speed to check if they satisfy the standard.



065RW020

Legend

- (1) Volt Meter
- (2) Tachometer
- (3) Battery
- (4) Ammeter
- (5) Switch

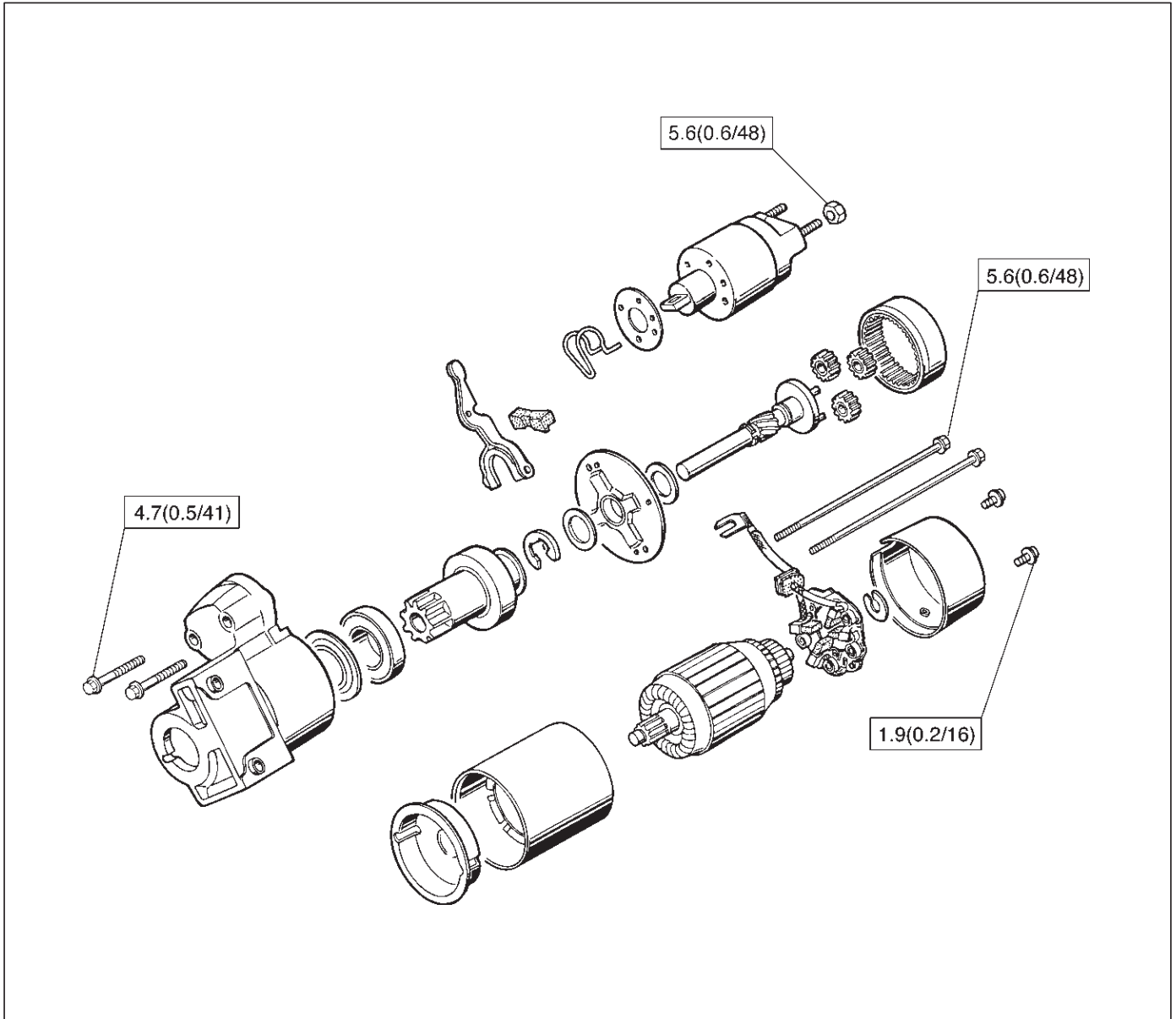
Main Data and Specifications**General Specifications**

Model	HITACHI GD002350
Rating	
Voltage	12 V
Output	1.4 Kw
Time	30 sec
Number of teeth of pinion	9
Rotating direction(as viewed from pinion)	Clockwise
Weight(approx.)	34 N
No load characteristics	
Voltage /Current	11V/90A or less
Speed	2700rpm or more
Load characteristics	
Voltage/current	8.4V/250A
Torque	7.3N·m(64lb·in.) or more
Speed	1200rpm or more
Locking characteristics	
Voltage/current	3V/750A or less
Torque	19N·m(14lb·in) or more

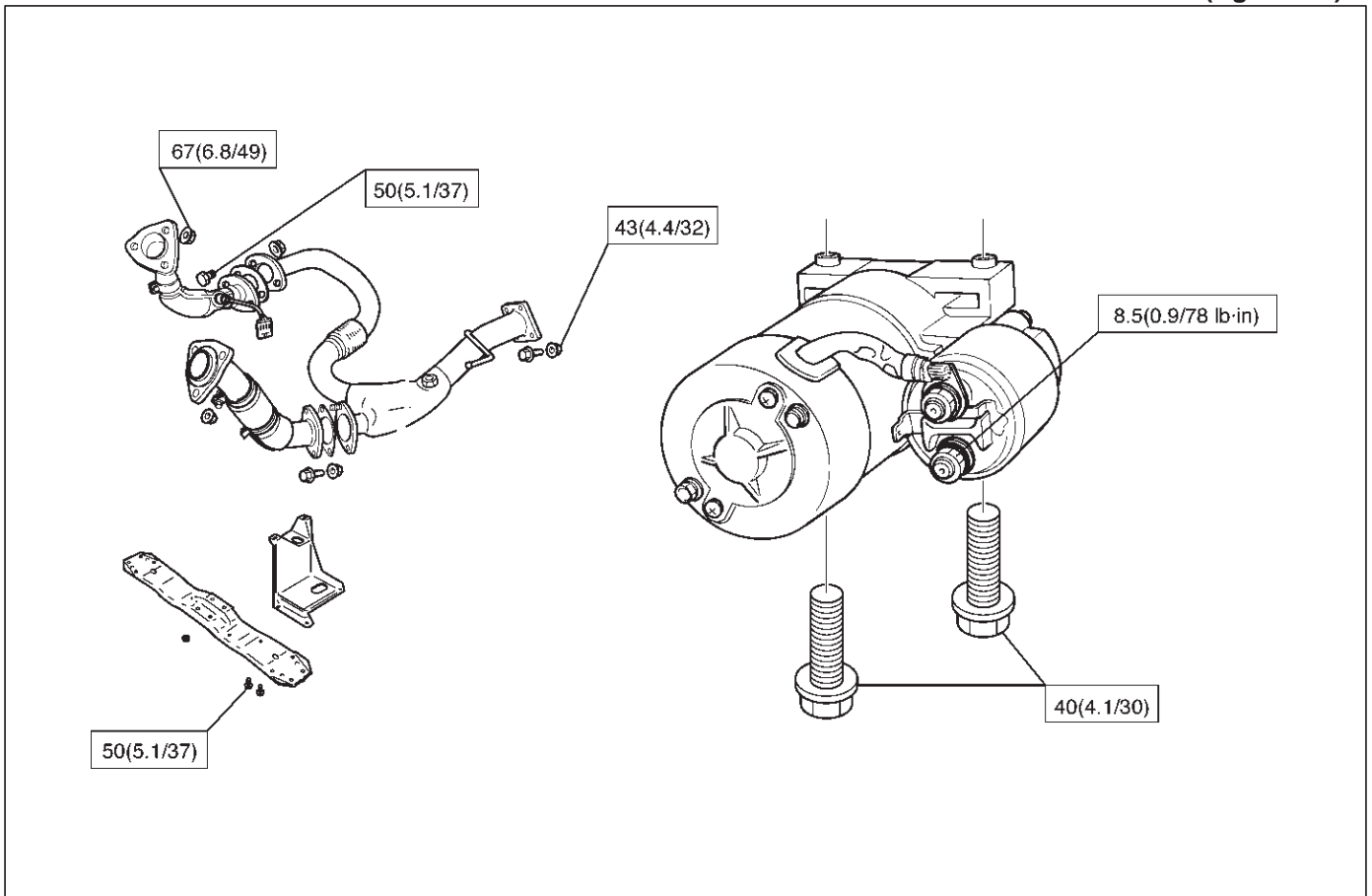
6D3-16 STARTING AND CHARGING SYSTEM

Torque Specifications

N-m (Kg-m/lb ft)



N·m (Kg·m/lb ft)



Charging System

General Description

The IC integral regulator charging system and its main components are connected as shown in the illustration.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

The generator does not require particular maintenance such as voltage adjustment.

The rectifier connected to the stator coil has eight diodes to transform AC voltage into DC voltage.

This DC voltage is connected to the output terminal of generator.

General On-Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally if the lamp goes off when the engine starts.

If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:

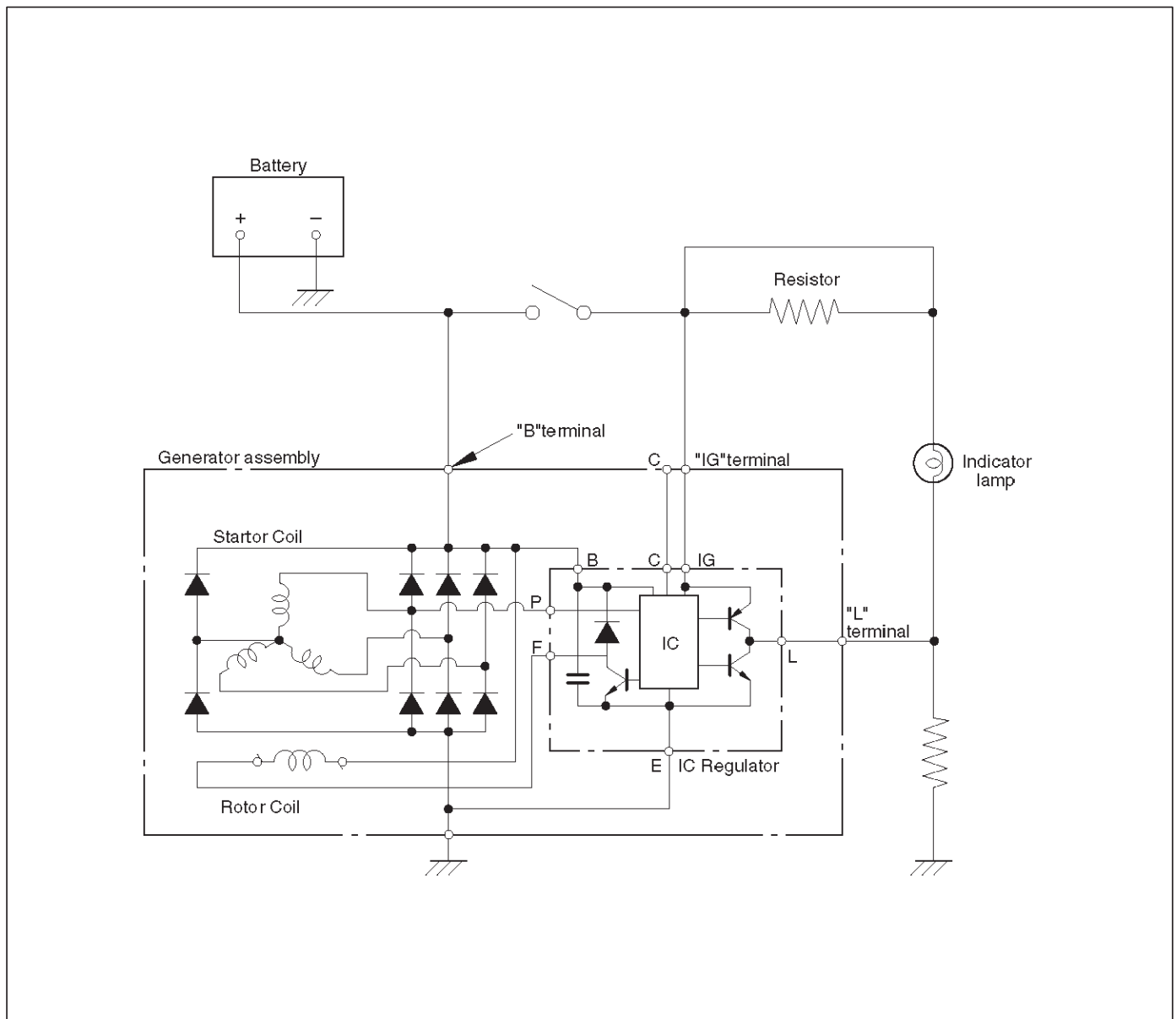
1. Check visually the belt and wiring connector.
2. With the engine stopped, turn the stator switch to "ON" position and observe the warning lamp.

If lamp does not come on:

Disconnect wiring connector from generator, and ground the terminal "L" on connector side.

If lamp comes on:

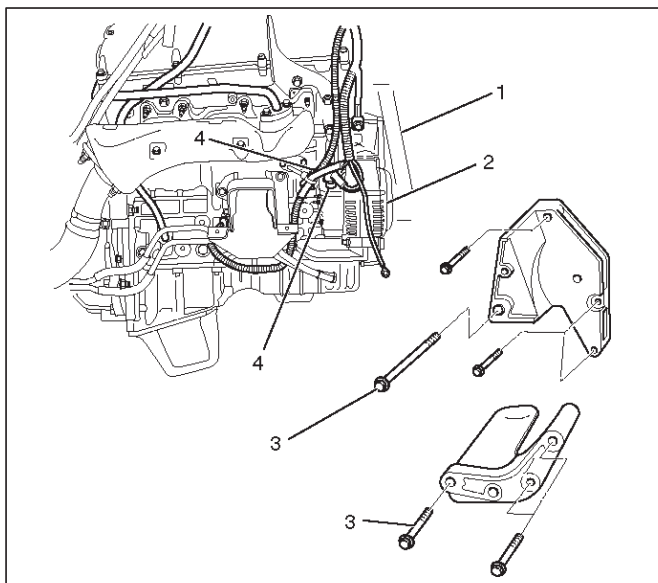
Repair or replace the generator.



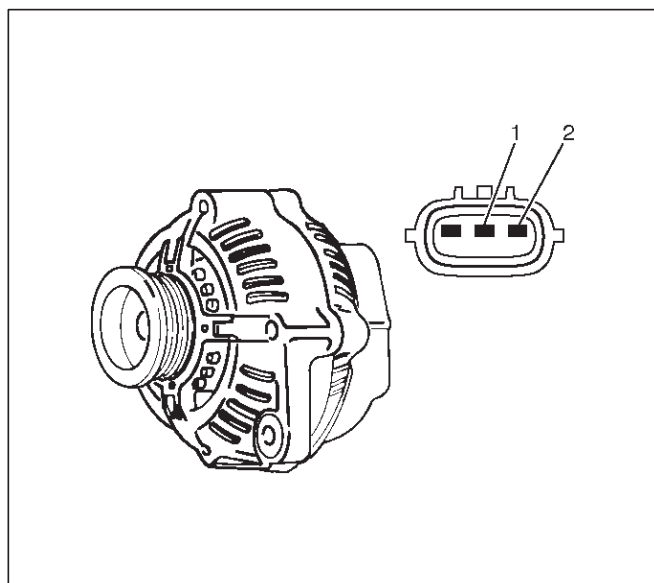
Generator

Removal

1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal "B" and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



060RW002



066RW001

If voltage is not present, the line between battery and connector is disconnected and so requires repair.

3. Reconnect the wiring connector to the generator, run the engine at middle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., head lights). At this time, the voltage must not be less than 13V.

Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to "ON" and connect a voltmeter between connector terminal L (2) and ground or between terminal IG (1) and ground.

Installation

1. Install generator assembly to the position to be installed.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

Torque:

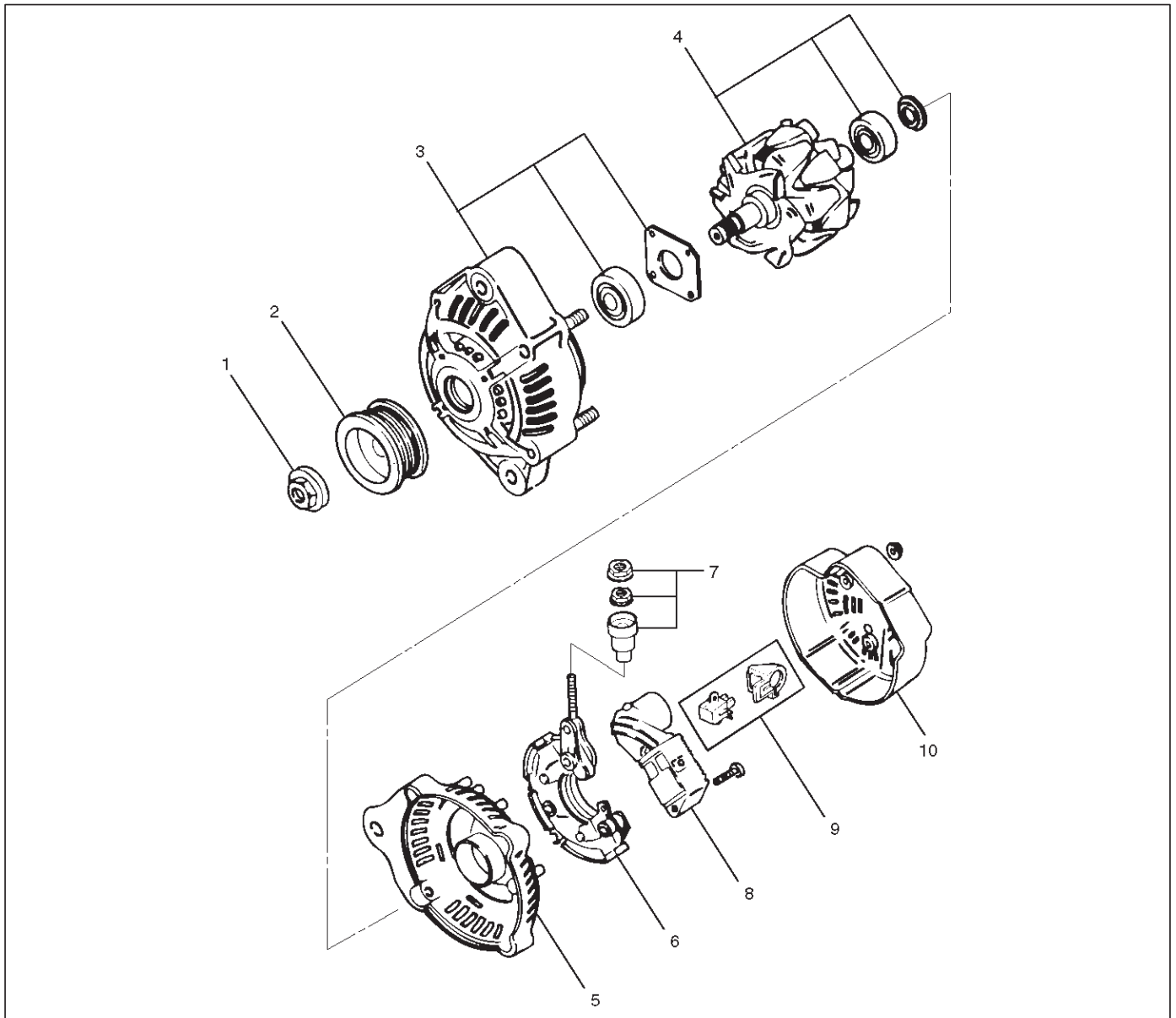
M10 bolt: 41 N·m (4.2 Kg·m/30 lb ft)

M8 bolt: 21 N·m (2.1 Kg·m/15 lb ft)

3. Connect wiring harness connector and direct terminal "B".
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

6D3-20 STARTING AND CHARGING SYSTEM

Disassembled View

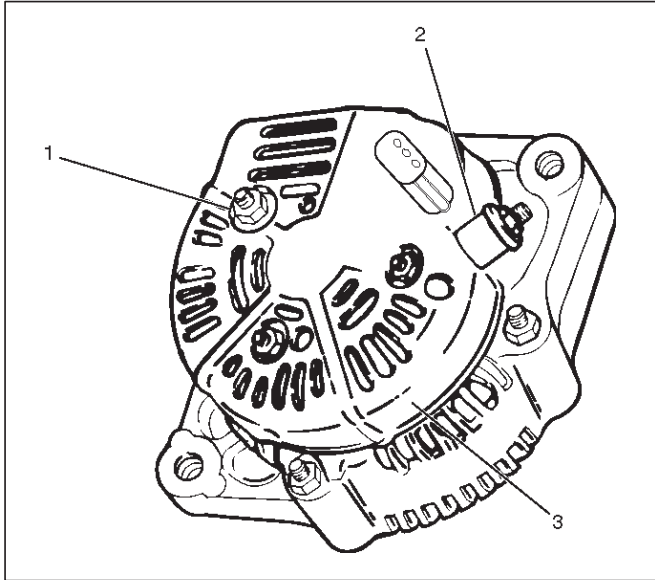


Legend

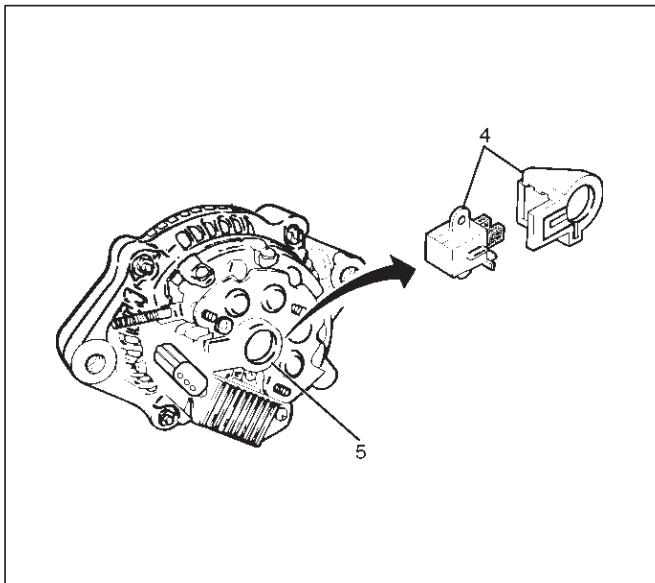
- | | |
|--------------------------|--------------------------------|
| (1) Pulley Nut | (6) Rectifier |
| (2) Pulley | (7) Terminal Insulator and Nut |
| (3) Front Cover Assembly | (8) Regulator Assembly |
| (4) Rotor Assembly | (9) Brush Holder Assembly |
| (5) Rear End Cover | (10) Rear Cover |

Disassembly

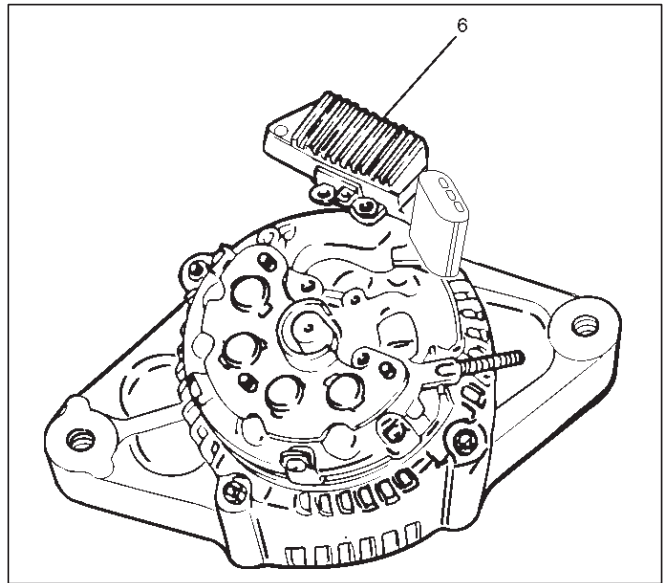
1. Terminal insulator and nut(2).
2. Remove three nuts(1) on the rear cover and a nut on terminal B and insulator, then remove the rear cover(3).



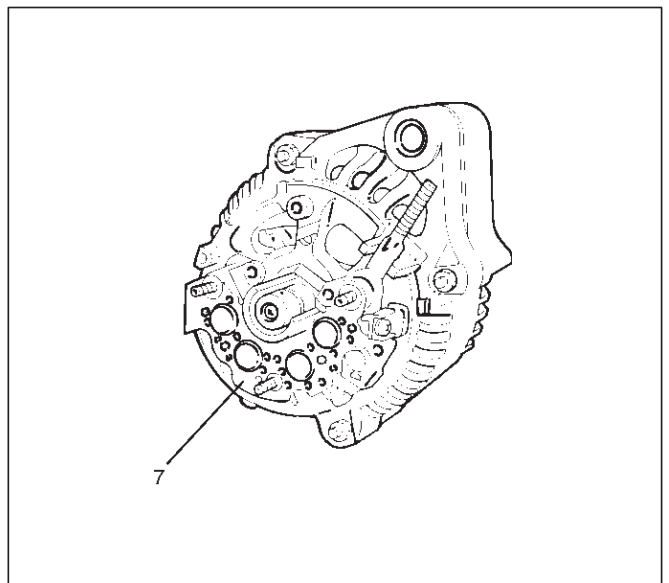
3. Remove two screws that fix the brush holder(5) and rectifier, then remove the brush holder assembly(4).



4. Remove three screws on the IC regulator, then the IC regulator assembly(6).

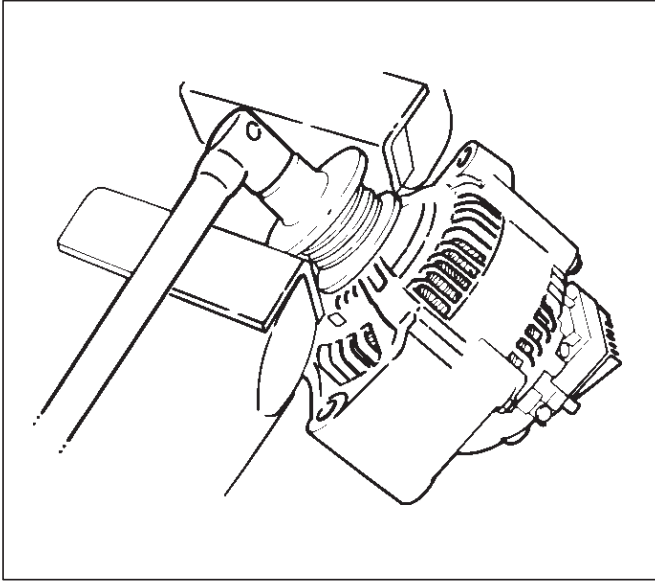


5. Remove four screws that fix rectifier(7) and stator lead wires.



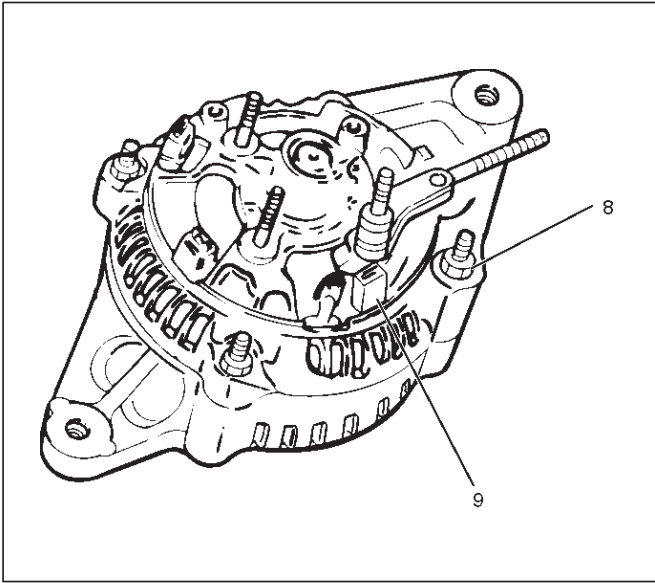
6D3-22 STARTING AND CHARGING SYSTEM

6. Secure the pulley directly in the vise between two copper plates, and remove the nut and pulley.



066RS010

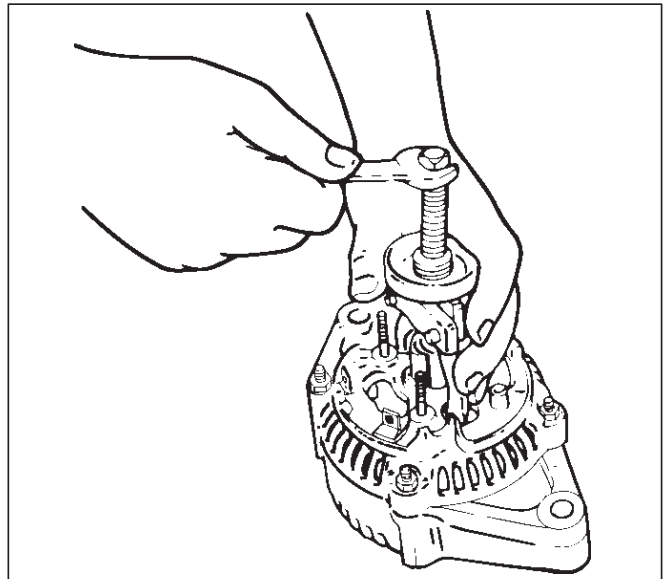
7. Remove four nuts(8) that secure the front cover assembly and rear end cover, and an insulator(9).



066RW005

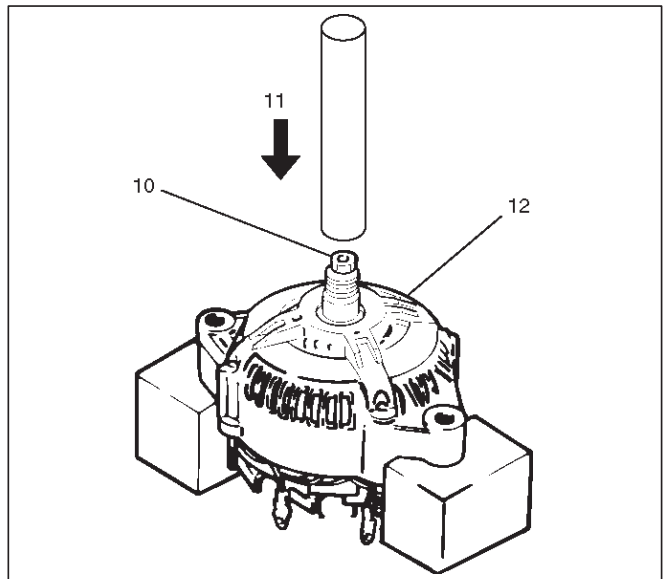
8. Use the puller to remove the rear end cover.

9. Rotor assembly



066RS012

10. Pull the rotor assembly(10) off the front cover assembly(12) using a bench press(11).



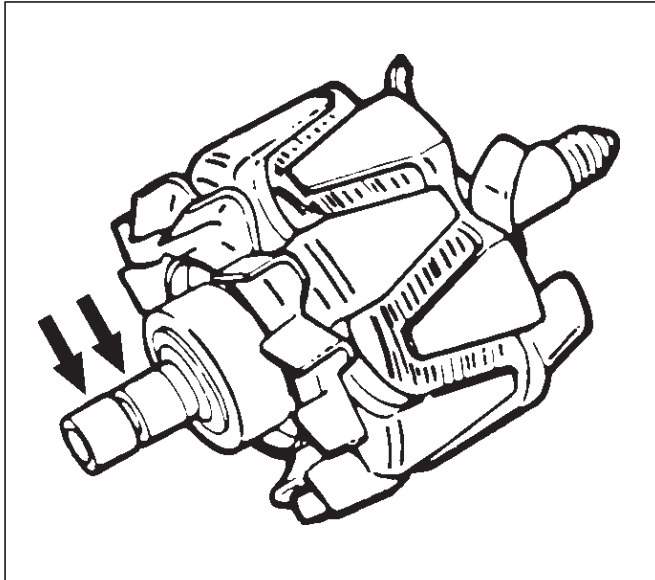
066RW006

Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

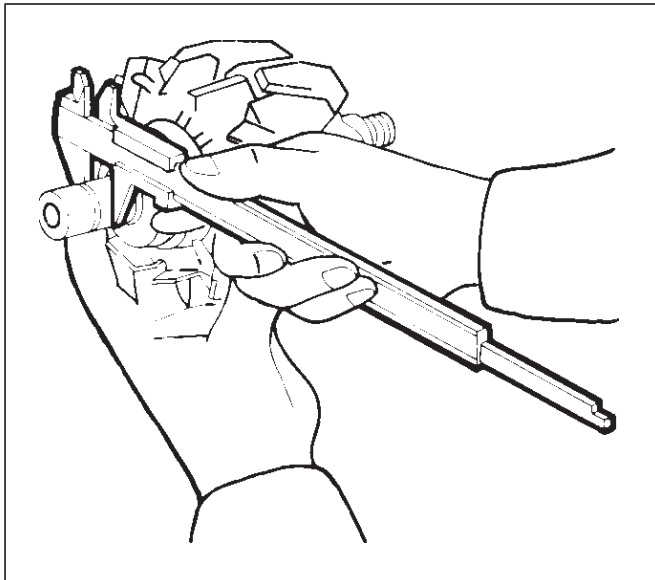
Rotor Assembly

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500—600 sandpaper.



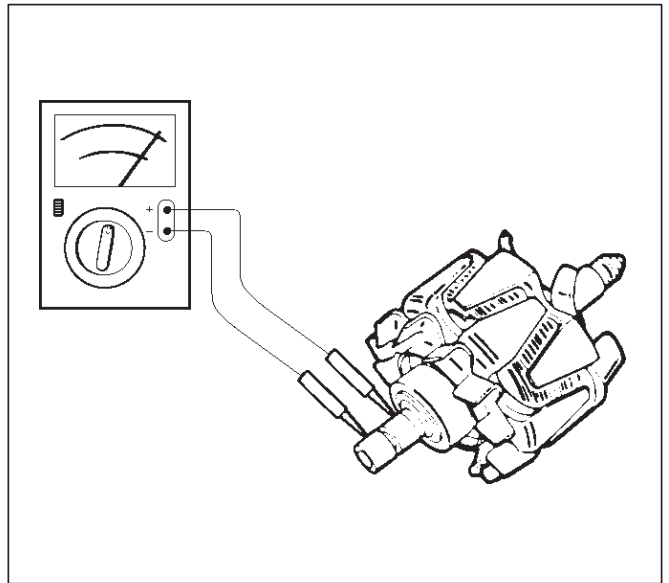
066RS014

2. Measure the slip ring diameter, and replace if it exceeds the limit.



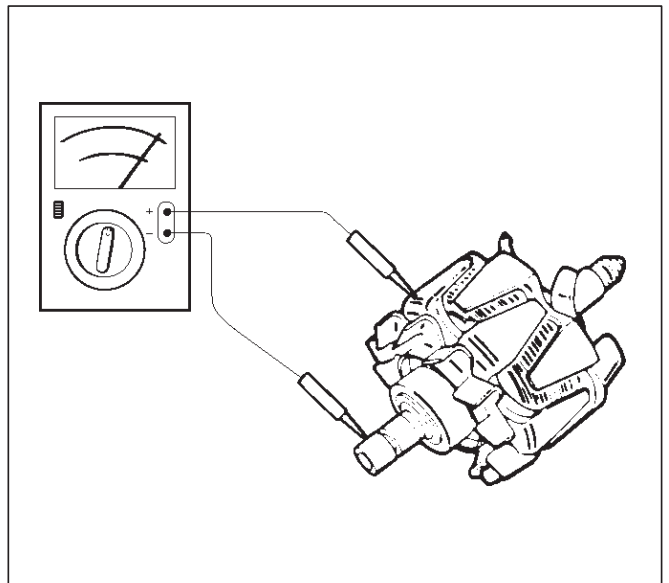
066RS015

3. Check resistance between slip rings, and replace if there is no continuity.



066RS016

4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.

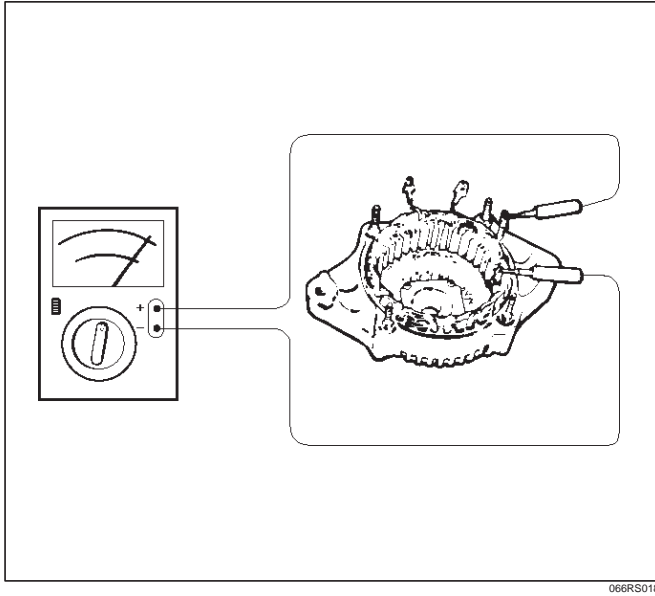


066RS017

6D3-24 STARTING AND CHARGING SYSTEM

Stator Coil

1. Measure resistance between respective phases.
2. Measure insulation resistance between stator coil and core with a mega-ohmmeter.
If less than standard, replace the coil.

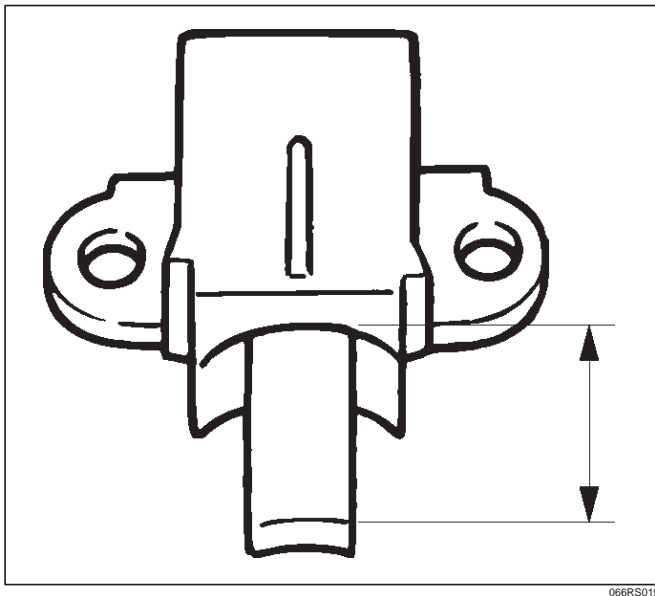


Brush

Measure the brush length.
If more than limit, replace the brush.

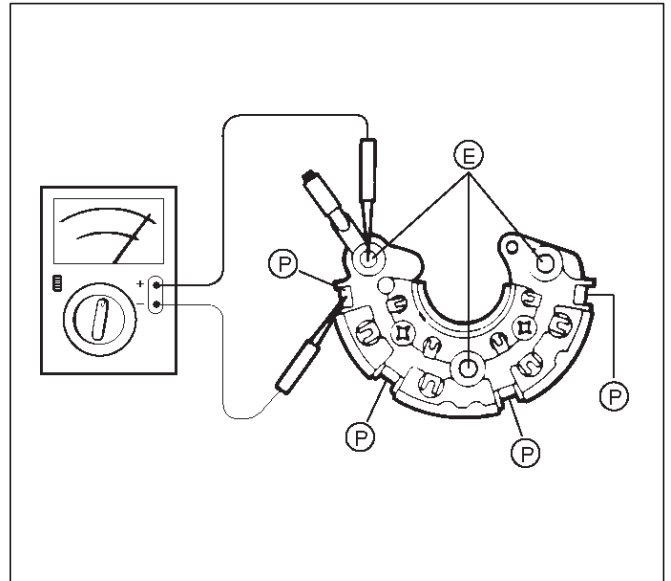
Standard: 10.0mm (0.4134 in)

Limit: 8.4mm (0.3307 in)



Rectifier Assembly

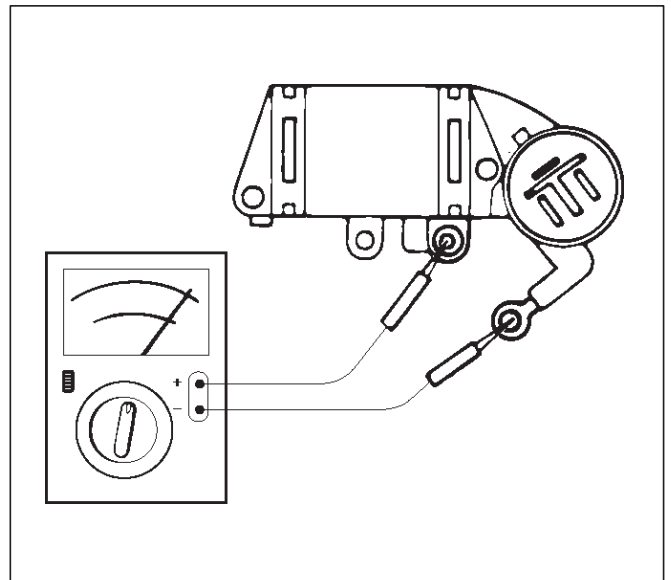
Check for continuity across "P" and "E" in the $\times 100W$ range of multimeter.



Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the rectifier assembly.

IC Regulator Assembly

Check for continuity across "B" and "F" in the $\times 100W$ range of multimeter.

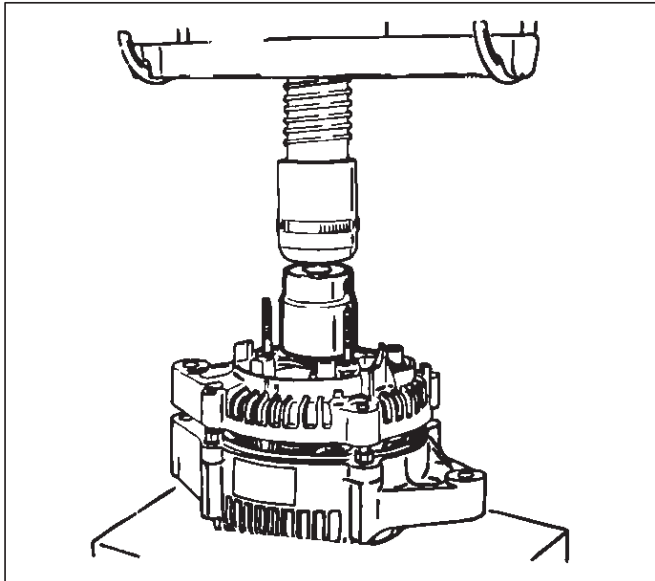


Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the IC regulator assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

- Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.

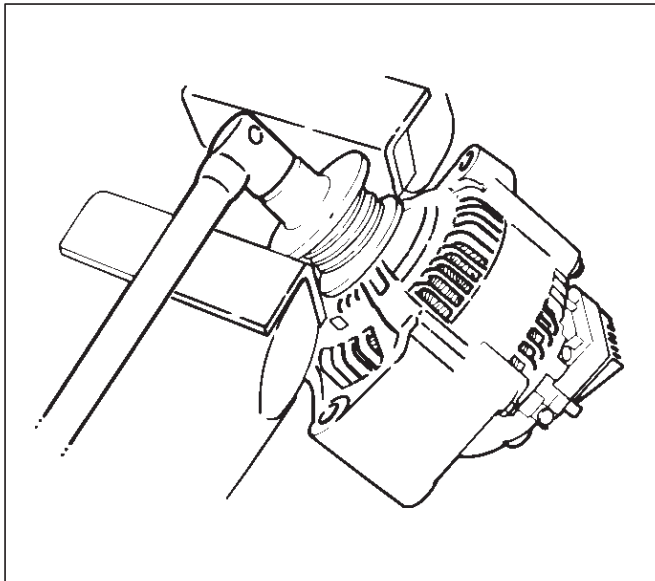


066RS022

- Install pulley on the rotor.

Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

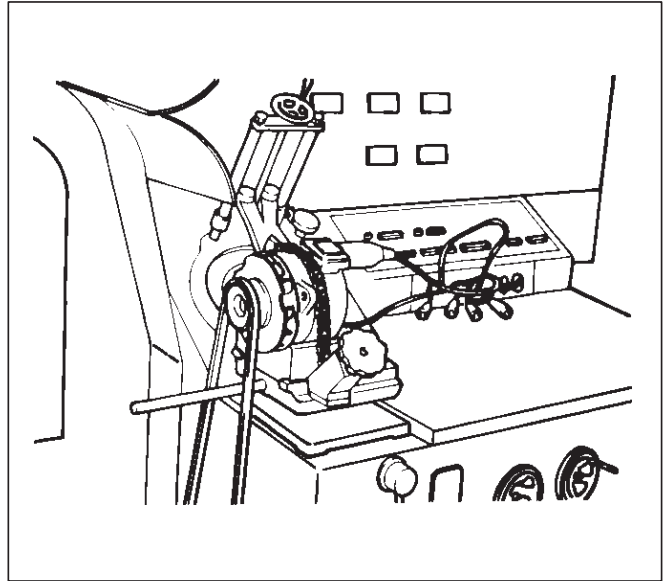
Torque: 111 N-m (11.3 Kg-m/82 lb ft)



066RS010

Bench Test

Conduct a bench test of the generator.

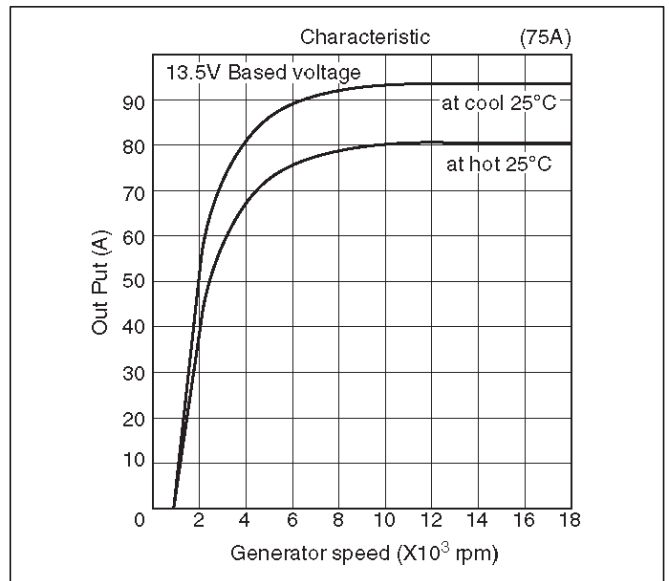


066RS023

Preparation

Remove generator from the vehicle (see "Generator removal").

- Secure generator to the bench test equipment and connect wires.
Terminal "IG" for energization
Terminal "L" for neutral (warning lamp)
Terminal "B" for output
- Conduct the generator characteristic test.
Characteristics of generator are shown in illustration.
Repair or replace the generator if its outputs are abnormal.



B06RW001

6D3-26 STARTING AND CHARGING SYSTEM

Main Data and Specifications

General Specifications

Parts Number (Nippon denso)	102211—5030
Model	ACHD04
Rated voltage	12 V
Rated output	75 A
Rotating direction (As viewed from pulley)	Clockwise
Pulley effective diameter	50 mm (1.97 in)
Weight	44 N (33 lb)

ENGINE

ENGINE DRIVEABILITY AND EMISSIONS

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6E-2 ENGINE DRIVEABILITY AND EMISSIONS

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6E-4 ENGINE DRIVEABILITY AND EMISSIONS

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Specifications

Tightening Specifications

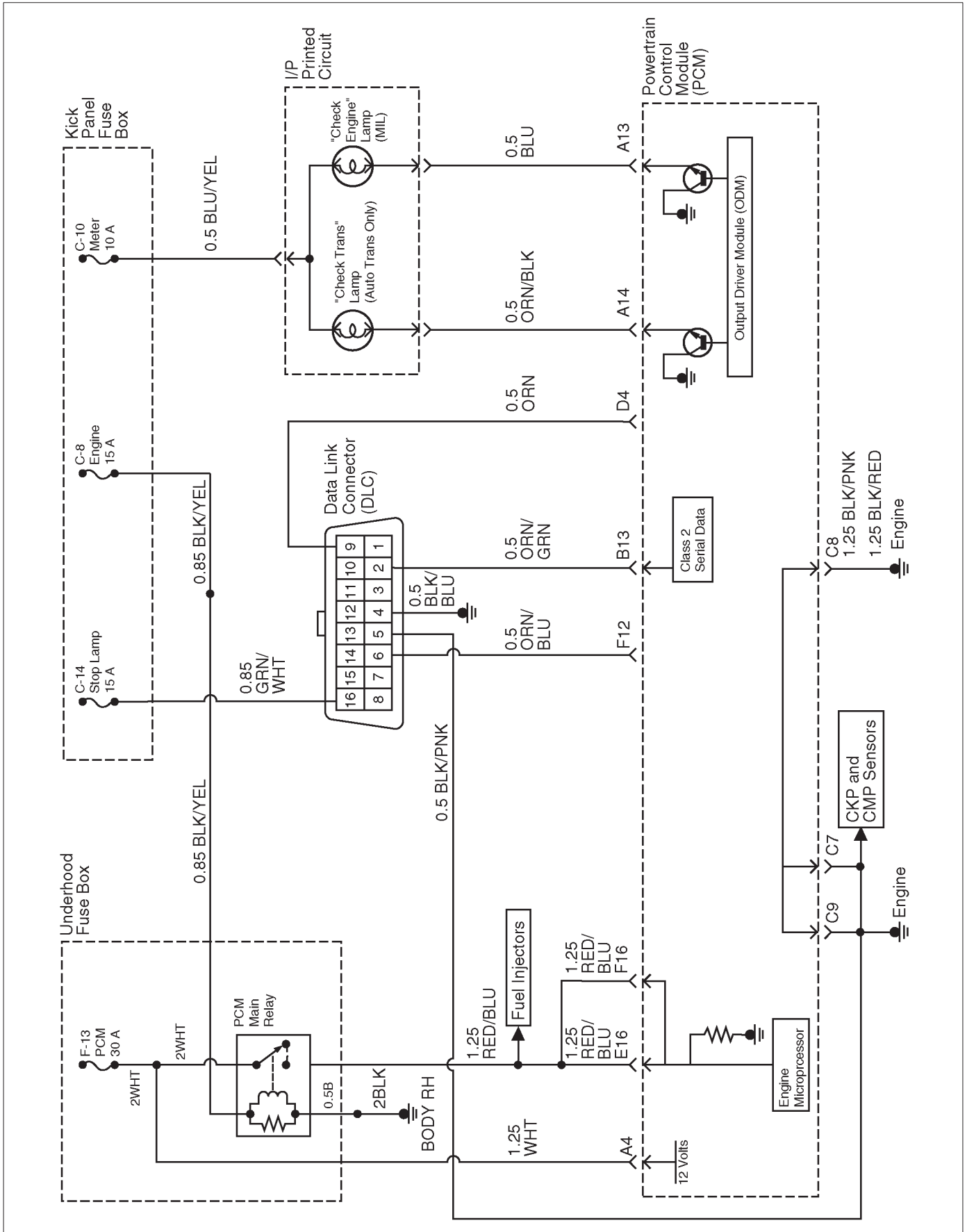
Application	N-m	Lb Ft.	Lb In.
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Crankshaft Position Sensor Mounting Bolt	10	—	87
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Lower Intake Manifold to Engine Block Nuts	25	18	—
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VSS Retaining Bolt	13	—	120

Vehicle Type Specifications

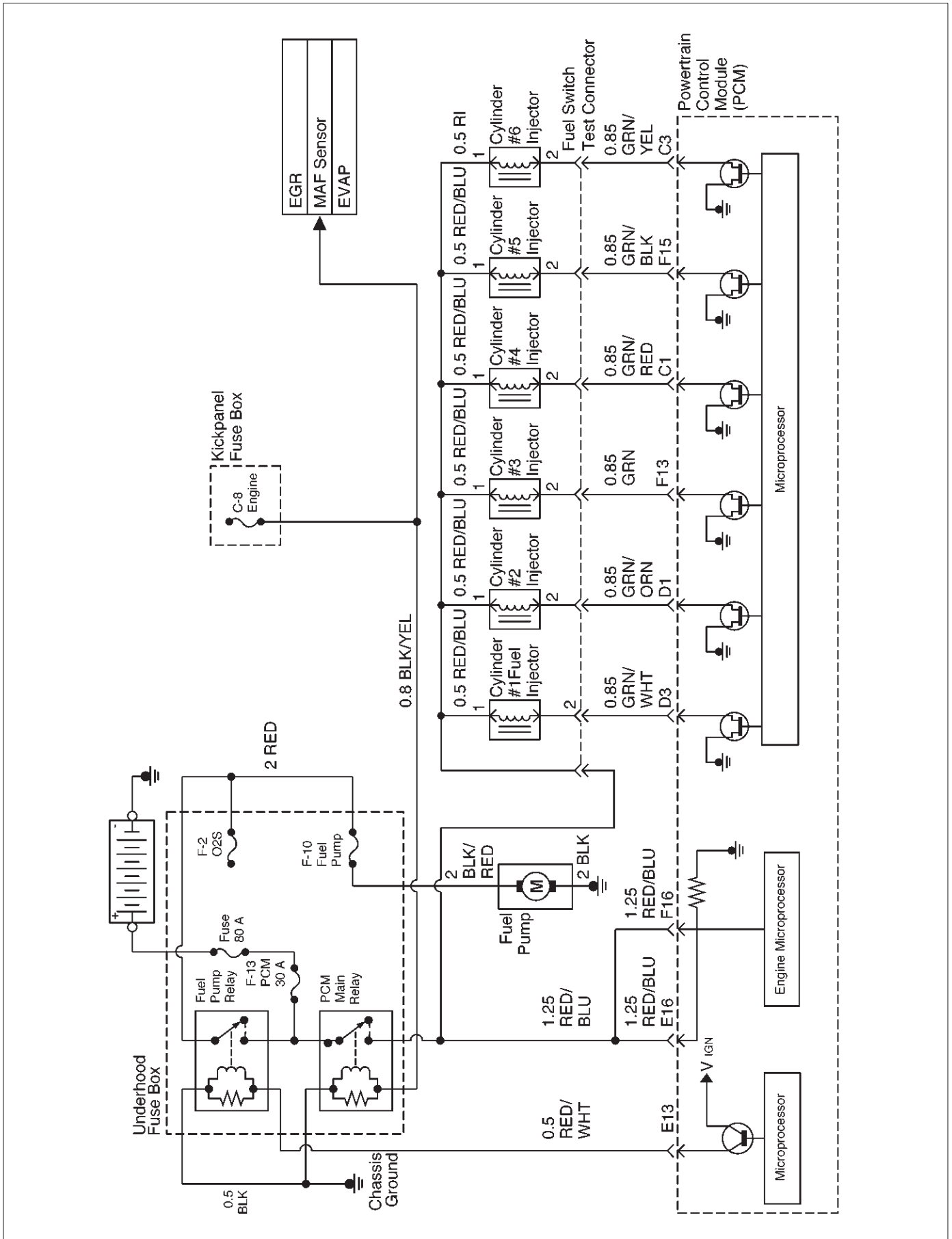
EC		AUSTRALIA		THAILAND SOUTH-EA ST-ASIA LATIN AMERICA		GULF CONTRIES SAUDI CHINA		SOU TH AFRI CA	EXPORT		Specifications			
UBS		UBS		UBS		UBS		UBS	UBS		OBD	O ₂ SEN SOR	CAT A	EGR
MT	AT	MT	AT	MT	AT	MT	AT	MT	MT	AT				
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Diagrams and Schematics

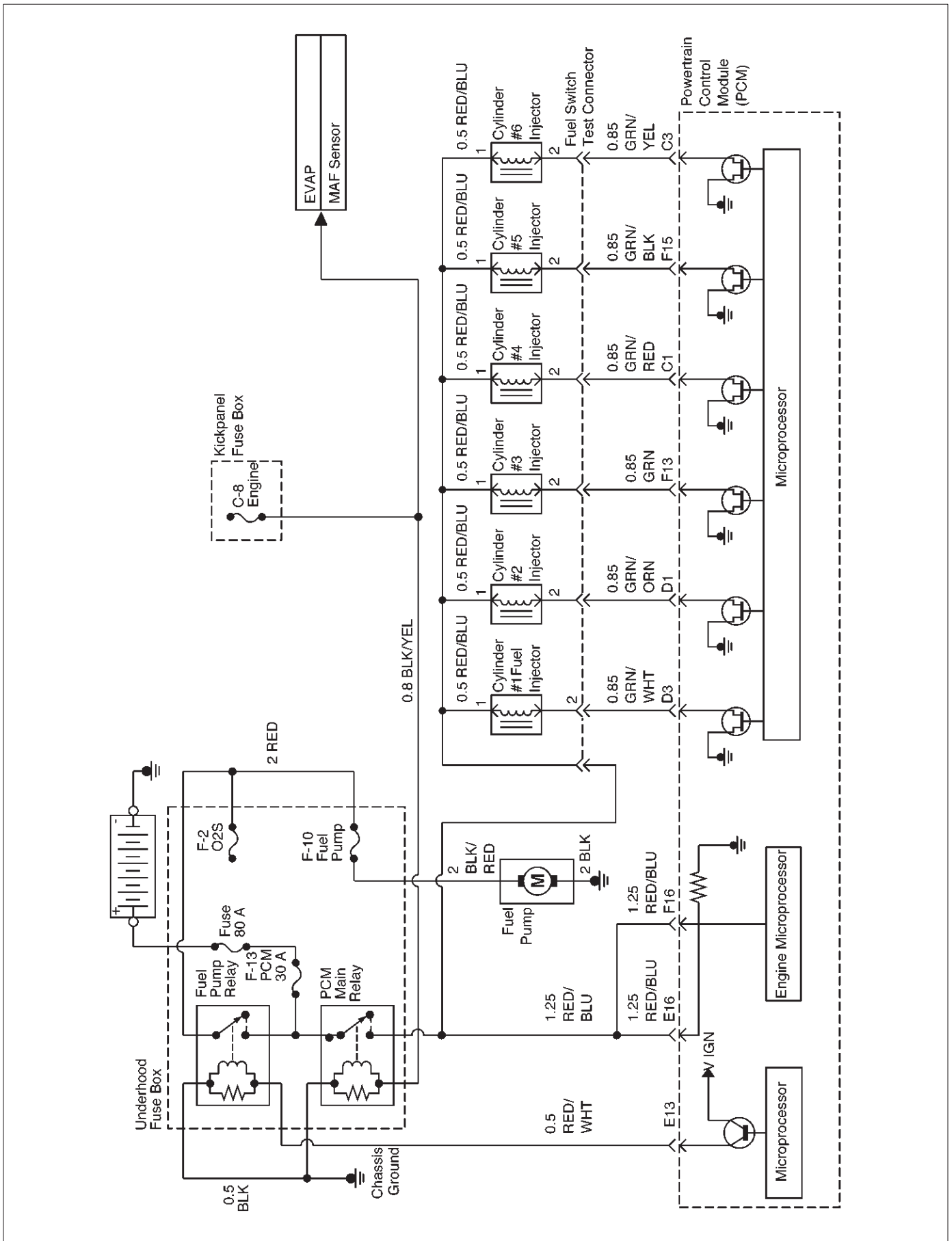
PCM Wiring Diagram (1 of 11)



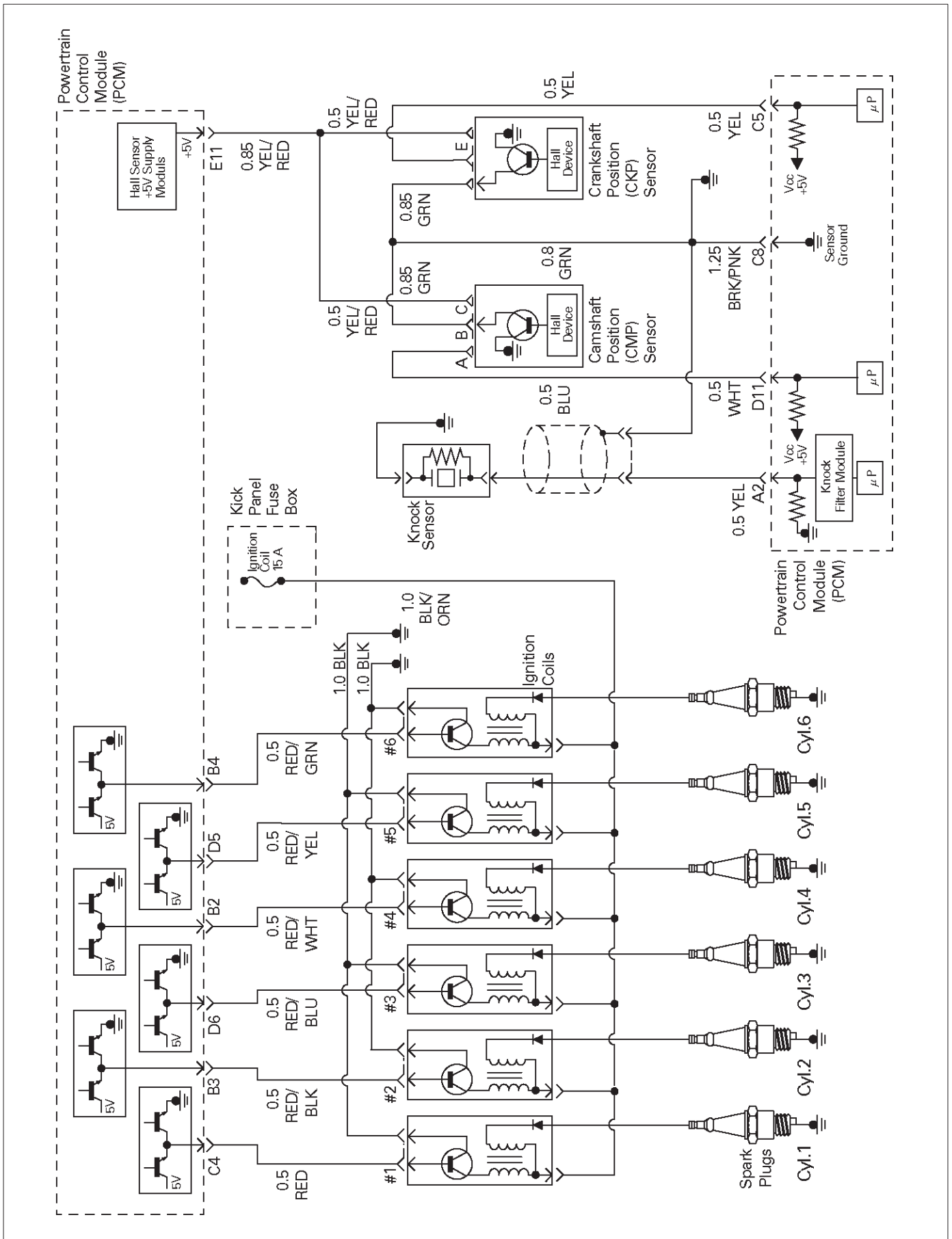
PCM Wiring Diagram (2 of 11) For EC, THAILAND, SOUTH EAST ASIA, LATIN AMERICA, GULF, SAUDI, CHINA.



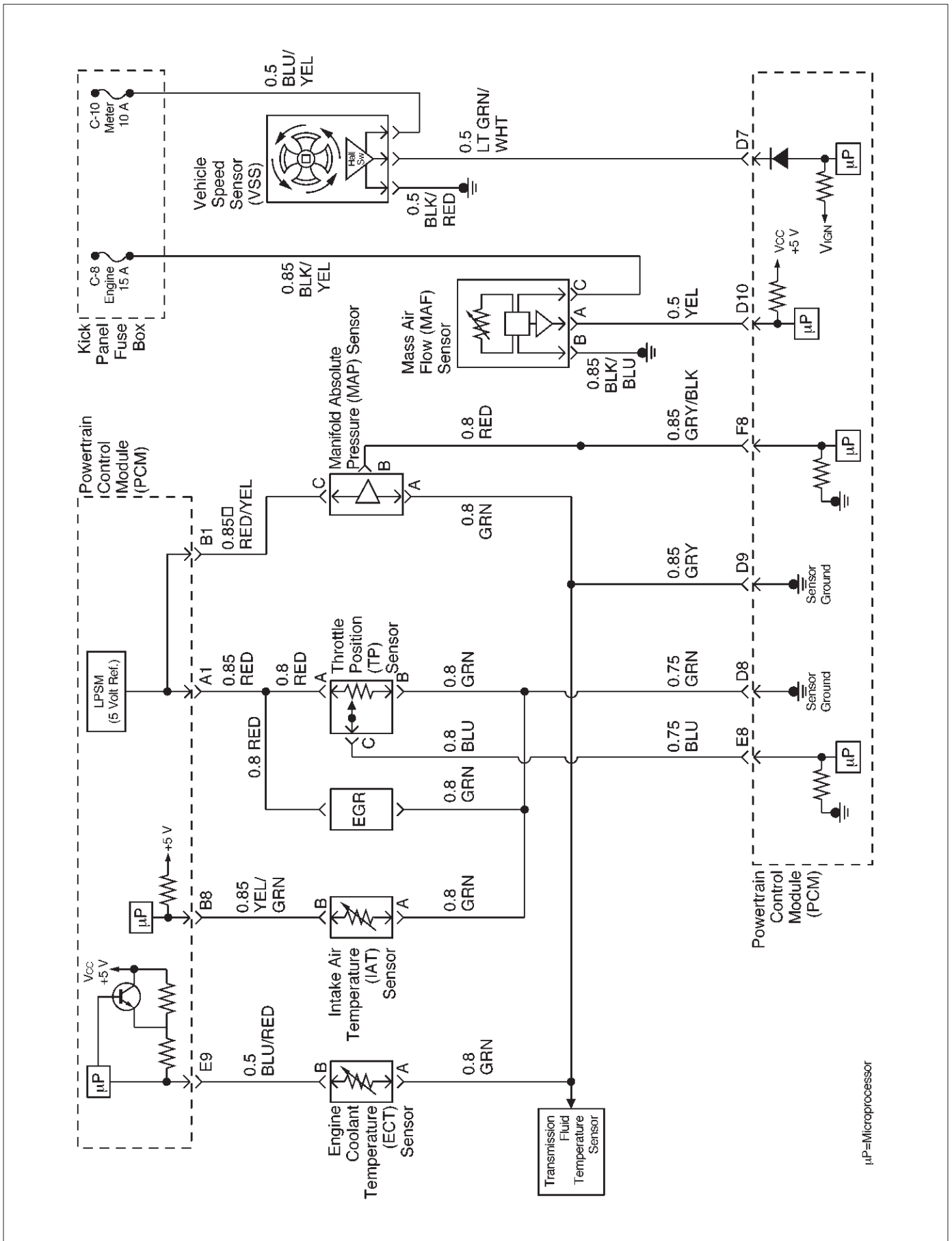
PCM Wiring Diagram (3 of 11) For SOUTH AFRICA and EXP.



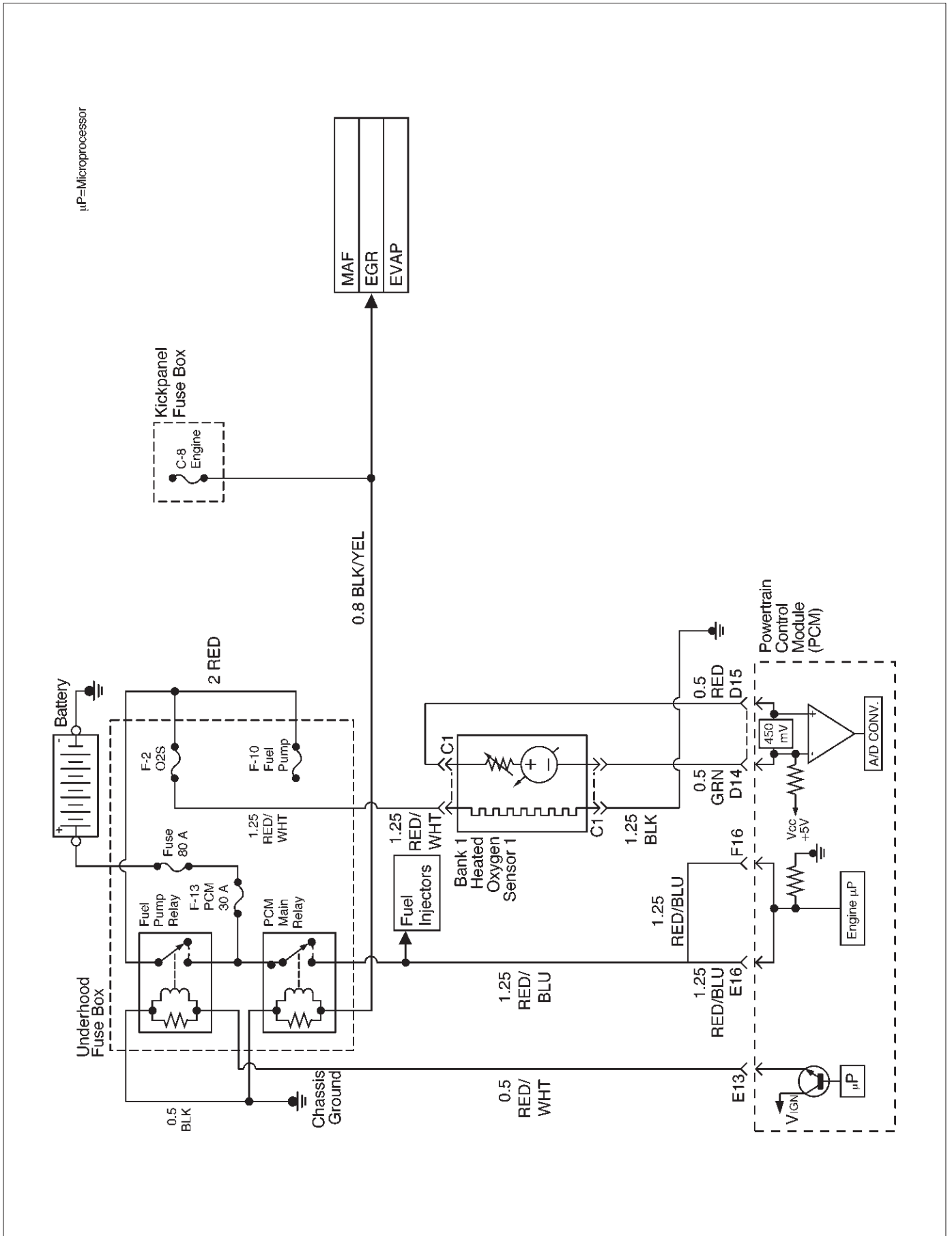
PCM Wiring Diagram (4 of 11)



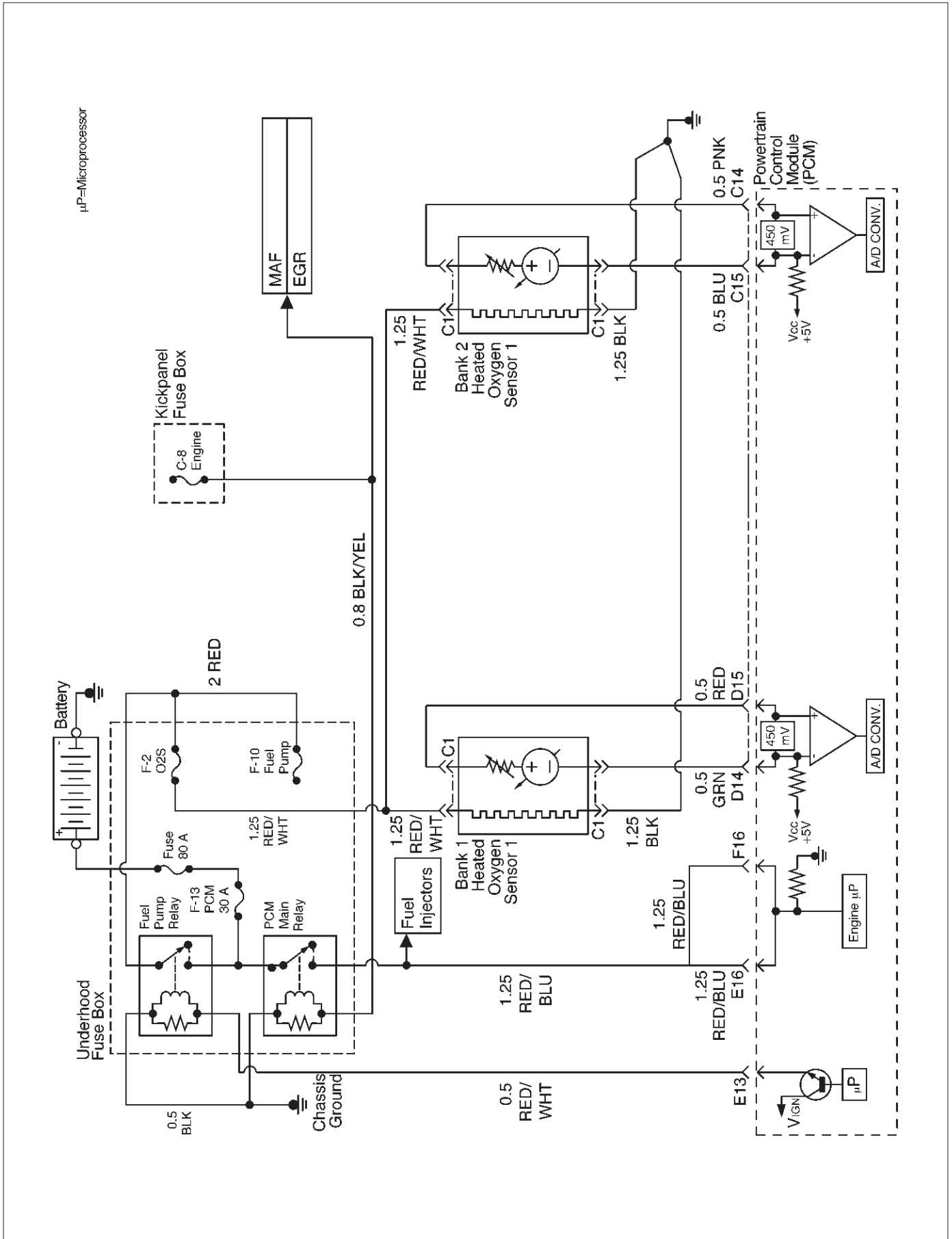
PCM Wiring Diagram (5 of 11)



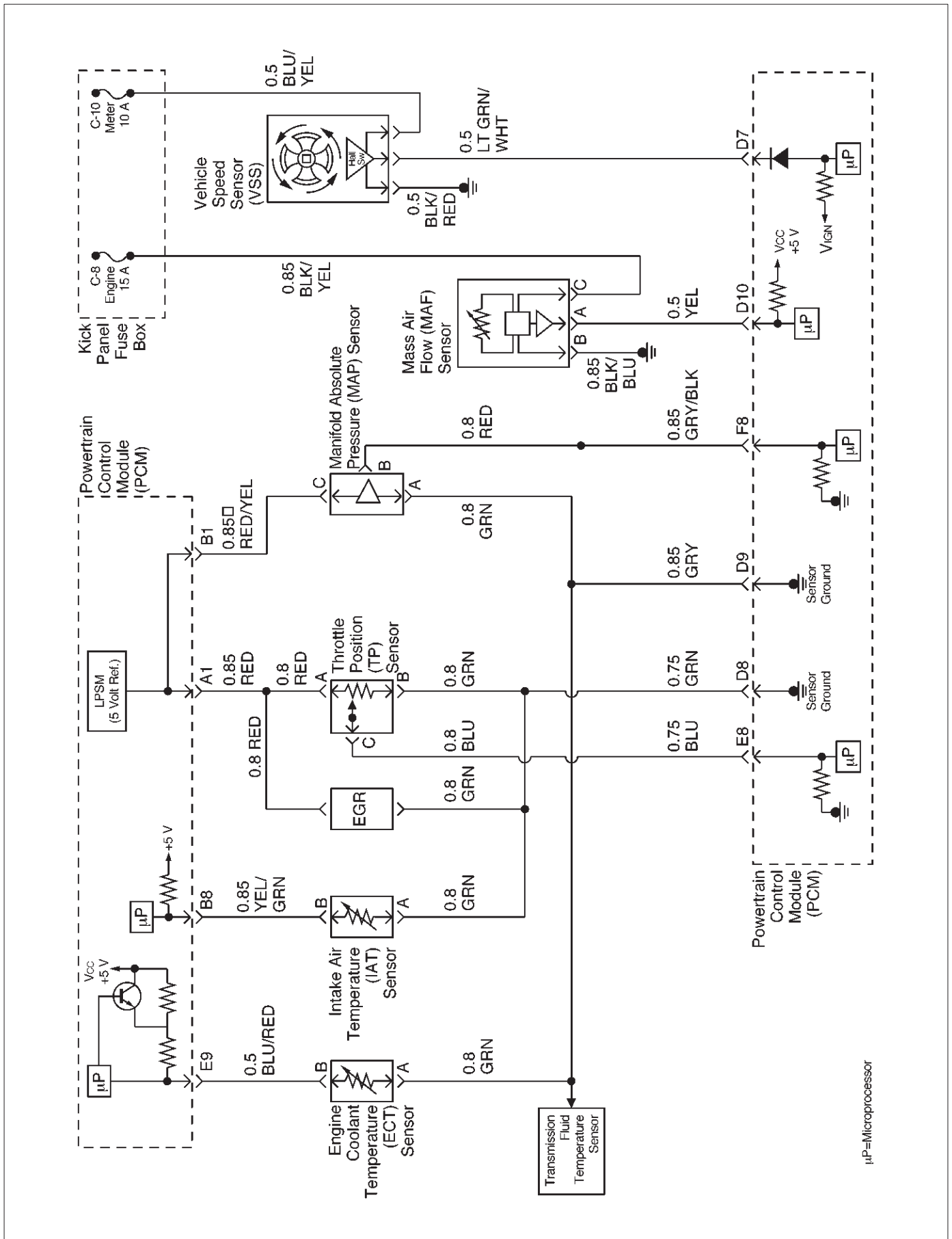
PCM Wiring Diagram (6 of 11) For AUSTRALIA, THAILAND, SOUTH EAST ASIA, LATIN AMERICA, GULF, SAUDI, LATIN AMERICA.



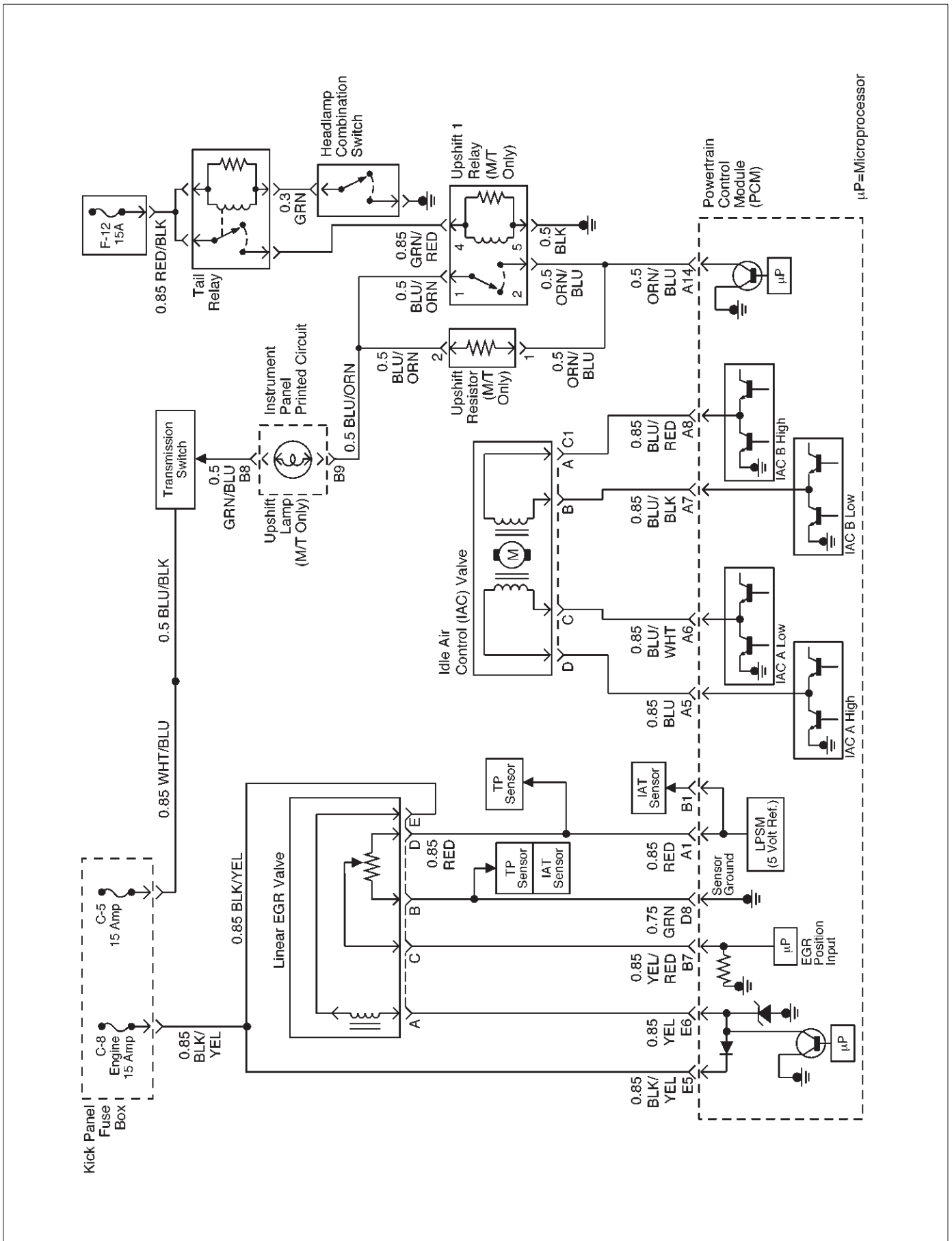
PCM Wiring Diagram (7 of 11) For EC.



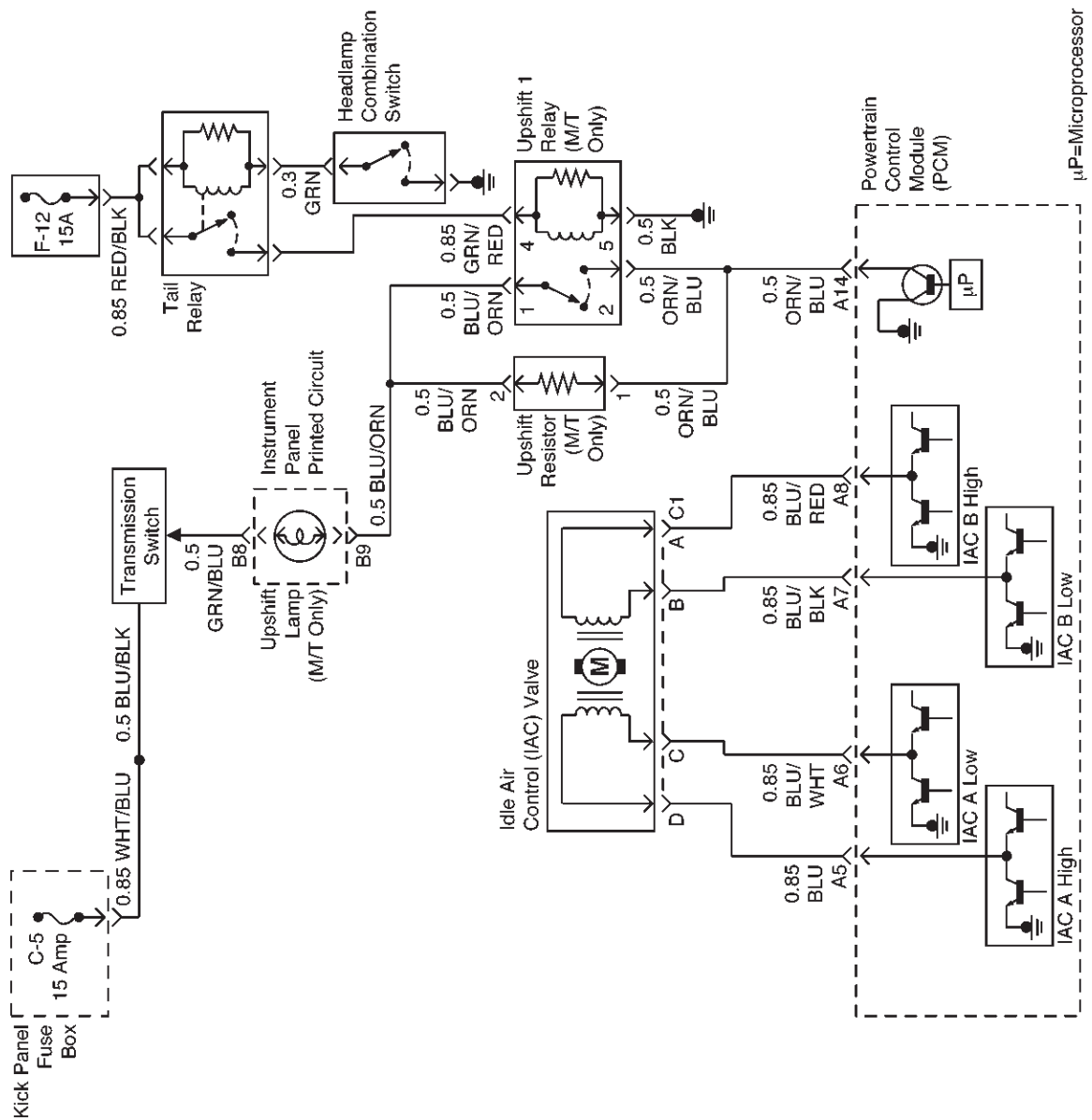
PCM Wiring Diagram (8 of 11) For EXPORT and SOUTH AFRICA.



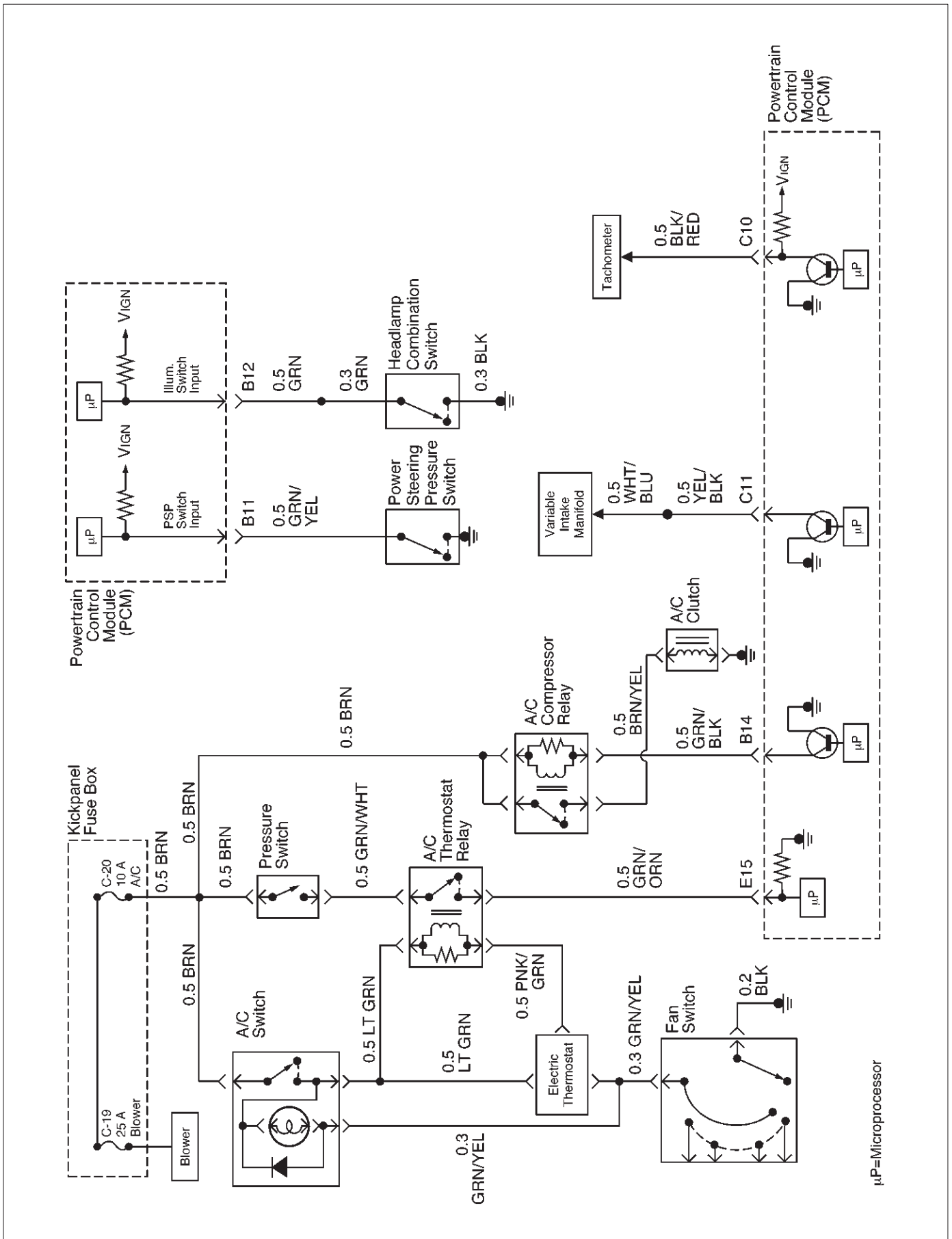
PCM Wiring Diagram (9 of 11) Except EXP and SOUTH AFRICA



PCM Wiring Diagram (10 of 11) For EXPORT and SOUTH AFRICA

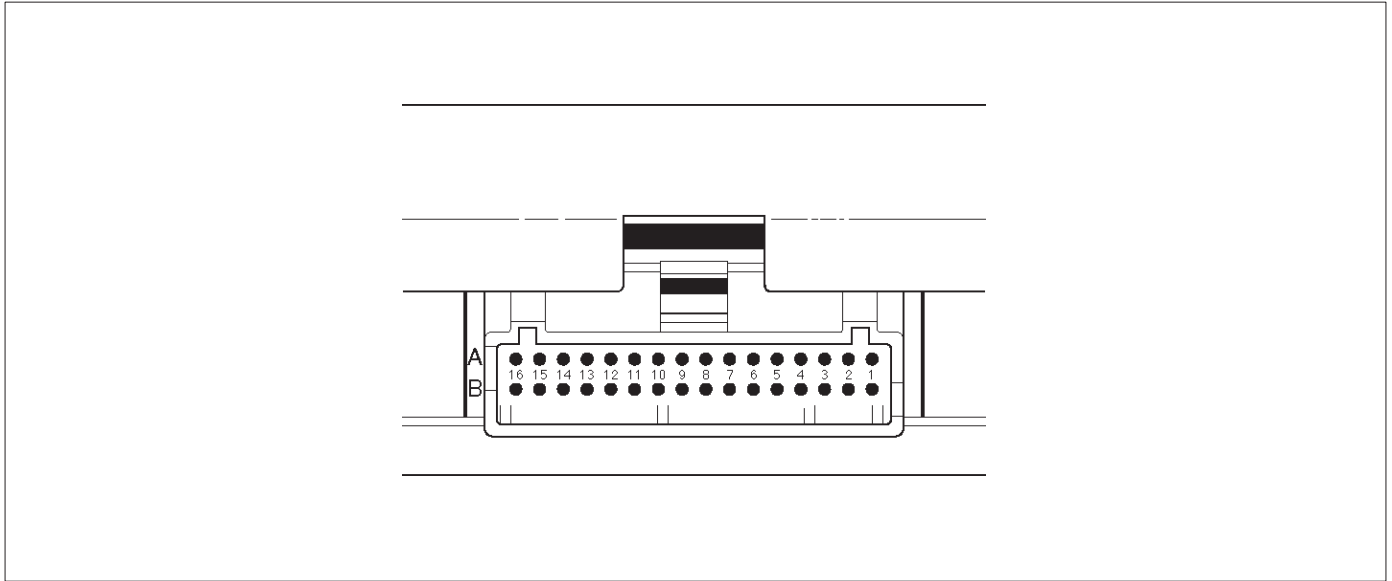


PCM Wiring Diagram (11 of 11)



PCM Pinouts

PCM Pinout Table, 32-Way Red Connector – Row “A”



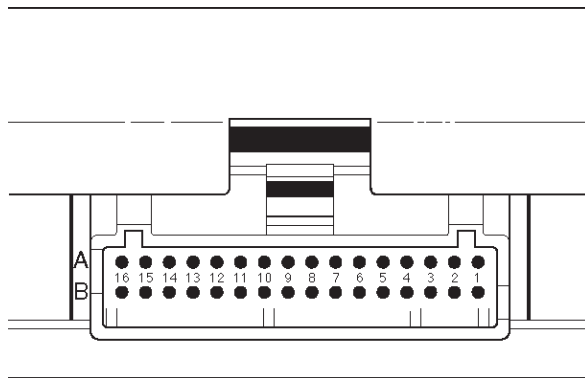
TS23344

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
A1	5 Volt Reference “A”	RED	5.0 V	5.0 V	Appropriate Sensor
A2	Knock Sensor	YEL	0.0 V DC 2mV AC	0.0 V DC 18mV AC (at idle)	General Description and Operation, Knock Sensor
A3	Not Used	—	—	—	—
A4	Battery Feed	WHT	B+	B+	Chassis Electrical
A5	Idle Air Control (IAC) “A” High	BLU	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A6	IAC “A” Low	BLU/WHT	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A7	IAC “B” Low	BLU/BLK	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A8	IAC “B” High	BLU/RED	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A9	Automatic Transmission Fluid (ATF) Lamp	ORN/BLU	B+	B+	Automatic Transmission (4L30E)
A10	Winter Lamp	PNK/GRN	B+	B+	Automatic Transmission (4L30E)
A11	Power Lamp	GRY/WHT	B+	B+	Automatic Transmission (4L30E)
A12	Antilock Brake System (ABS)	GRY	B+	B+	Antilock Brake System
A13	Malfunction Indicator (Check Engine or MIL) Lamp	BLU	0.0 V	B+	Chassis Electrical
A14	“Check Transmission” Lamp Driver (AT) Up Shift Lamp Driver (MT)	ORN/BLK ORN/BLU	B+	B+	Chassis Electrical

6E-18 ENGINE DRIVEABILITY AND EMISSIONS

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
A15	EVAP	RED/BLU	B+	5.0 V	—
A16	Band Apply (AT) Air Pump (MT)	BRN/YEL	B+	B+	Automatic Transmission (4L30E)

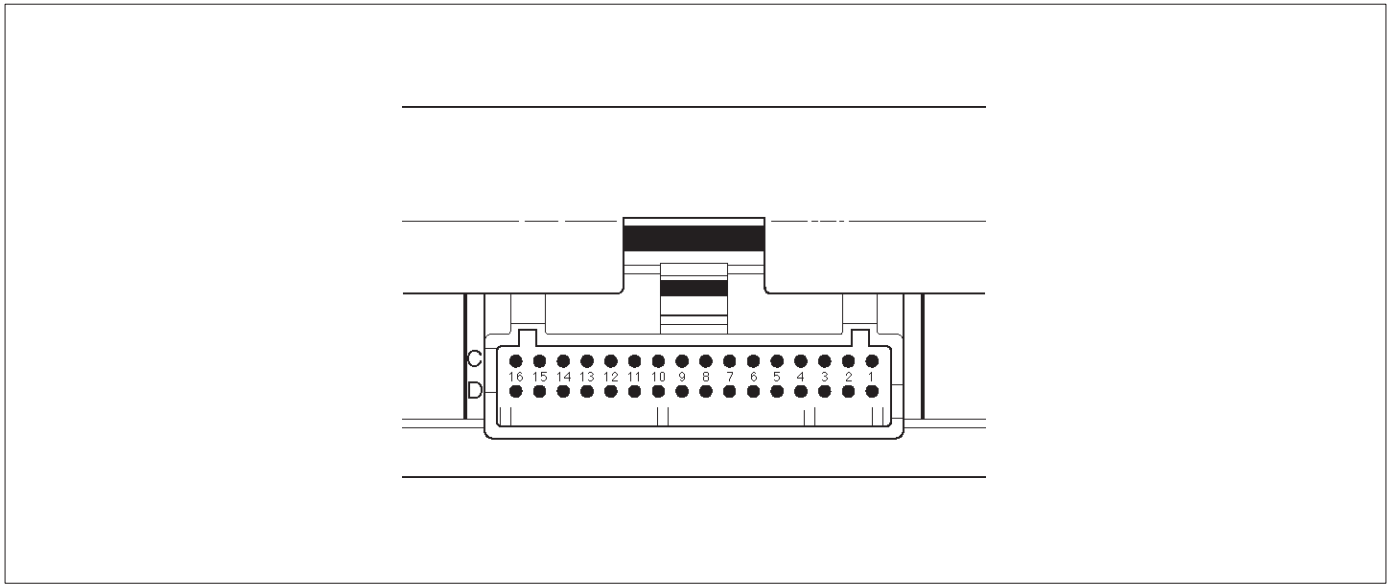
PCM Pinout Table, 32-Way Red Connector – Row “B”



TS23344

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
B1	5 Volt Reference “B”	RED/YEL	5.0 V	5.0 V	Appropriate Sensor
B2	Ignition coil	RED/WHT	0.0 V	0.1 V	General Description and Operation
B3	Ignition coil	RED/BLK	0.0 V	0.1 V	General Description and Operation
B4	Ignition coil	RED/GRN	0.0 V	0.1 V	General Description and Operation
B5	Not Used	—	—	—	—
B6	Not Used	—	—	—	—
B7	Exhaust Gas Recirculation (EGR)	YEL/RED	0.6 V	0.6 V	General Description and Operation, Linear EGR Control
B8	Intake Air Temperature (IAT) Sensor	YEL/GRN	0.5-4.9 V (depends on temperature)	0.5-4.9 V (depends on temperature)	General Description and Operation, IAT
B9	Not Used	—	—	—	—
B10	Not Used	—	—	—	—
B11	Power Steering Pressure (PSP) Switch	GRN/YEL	B+	B+	General Description and Operation, PSP
B12	Illuminated Switch	GRN	B+	B+	Chassis Electrical
B13	Class 2 Data	ORN/GRN	0.0 V	0.0 V	Diagnosis, Class 2 Serial Data
B14	A/C Clutch	GRN/BLK	B+ (A/C OFF)	B+ (A/C OFF)	General Description and Operation, A/C Clutch Circuit Operation
B15	ECM to ECU Communication	Violet	0.0 V	0.1 V	—
B16	Not Used	—	—	—	—

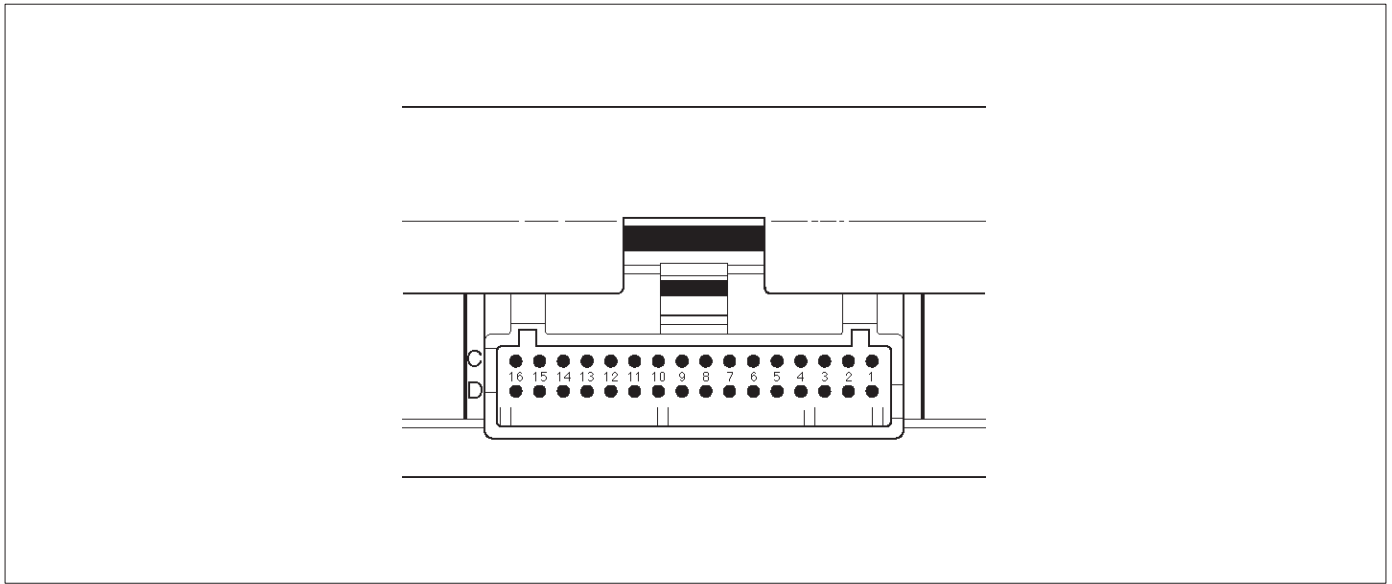
PCM Pinout Table, 32-Way White Connector – Row “C” (For EC)



TS23345

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
C1	Injector Cylinder #4	GRN/RED	B+	B+	General Description and Operation, Fuel Injector
C2	Shift “B” Solenoid	BRN/BLK	0.0 V	0.0 V	Automatic Transmission (4L30E)
C3	Injector Cylinder #6	GRN/YEL	B+	B+	General Description and Operation, Fuel Injector
C4	Ignition Control (IC) Cylinder #1	RED	0.0 V	0.1 V	General Description and Operation, Fuel Injector
C5	Crankshaft Position Sensor, “A” Circuit	YEL	0.3 V to 5 V	2.2 V	General Description and Operation, Crankshaft Position Sensor
C6	Not Used	—	—	—	—
C7	PCM Ground	YEL	0.0 V	0.0 V	Chassis Electrical
C8	PCM Ground	BLK/PNK	0.0 V	0.0 V	Chassis Electrical
C9	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C10	Tachometer	BLK/RED	8.8 V	10.0 V (at idle)	Chassis Electrical
C11	Variable Intake Manifold	YEL/BLK	0.0 V	B+ (rpm 3600 over)	Manual Transmission
C12	Alternator Control Gain	WHT/BLU	10.5 V	B+	Chassis Electrical
C13	Fuel PWM	BLU/PNK	B+	B+	—
C14	Bank 2 HO2S 1 High	PNK	0.4 V	0.1-0.9 V	General Description and Operation, Fuel HO2S 1
C15	Bank 2 HO2S 1 Low	BLU	0.0 V	0.1 V	General Description and Operation, Fuel HO2S 1
C16	Not Used	—	—	—	—

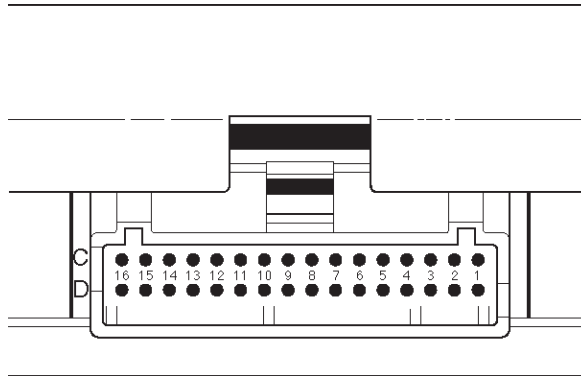
PCM Pinout Table, 32-Way White Connector – Row “C” (For except EC)



TS23345

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
C1	Injector Cylinder #4	GRN/RED	B+	B+	General Description and Operation, Fuel Injector
C2	Shift “B” Solenoid	BRN/BLK	0.0 V	0.0 V	Automatic Transmission (4L30E)
C3	Injector Cylinder #6	GRN/YEL	B+	B+	General Description and Operation, Fuel Injector
C4	Ignition Control (IC) Cylinder #1	RED	0.0 V	0.1 V	General Description and Operation, Fuel Injector
C5	Crankshaft Position Sensor, “A” Circuit	YEL	0.3 V to 5 V	2.2 V	General Description and Operation, Crankshaft Position Sensor
C6	Not Used	—	—	—	—
C7	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C8	PCM Ground	BLK/PNK	0.0 V	0.0 V	Chassis Electrical
C9	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C10	Tachometer	BLK/RED	8.8 V	10.0 V (at idle)	Chassis Electrical
C11	Variable Intake Manifold	YEL/BLK	0.0 V	B+ (rpm 3600 over)	Manual Transmission
C12	Not Used	—	—	—	—
C13	Not Used	—	—	—	—
C14	Not Used	—	—	—	—
C15	Not Used	—	—	—	—
C16	Not Used	—	—	—	—

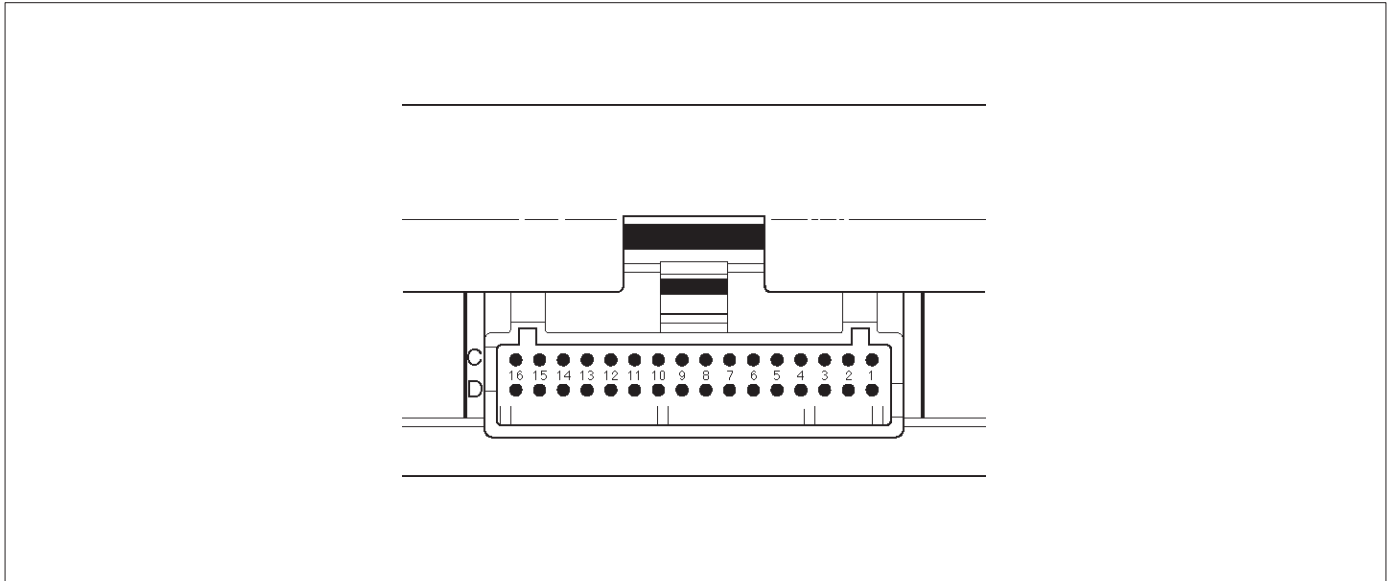
**PCM Pinout Table, 32-Way White Connector – Row “D”
(For except EXPORT and SOUTH AFRICA)**



TS23345

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
D1	Injector Cylinder #2	GRN/ORN	B+	B+	General Description and Operation, Fuel Injector
D2	Torque Converter Clutch (TCC)	BRN/BLU	0.0 V	0.0 V	On-Vehicle Service, Torque Converter Clutch
D3	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation, Fuel Injector
D4	Serial Data (8192)	ORN	5.0 V	5.0 V	Chassis Electrical
D5	Ignition Control, Cylinder #5	RED/YEL	0.0 V	0.1 V	General Description and Operation, Ignition Coil
D6	Ignition Control, Cylinder #3	RED/BLUE	0.0 V	0.0 V	General Description and Operation, Ignition Coil
D7	VSS Input / IMOB Response	WHT/BLK	0.0 V	0.1 V (at rest)	Chassis Electrical
D8	Sensor Ground 5V Reference A Return	GRN	0.0 V	0.0 V	Appropriate Sensor
D9	Sensor Ground 5 V Reference B Return	GRY	0.0 V	0.0 V	Appropriate Sensor
D10	Mass Air Flow (MAF)	YEL	4.9 V	4.2 V	General Description, Mass Air Flow Sensor
D11	Camshaft Position Sensor	WHT	5.0 V or less than 1.0 V	4.6 V	General Description and Operation, Camshaft Position Sensor
D12	Not Used	—	—	—	—
D13	Not Used	—	—	—	—
D14	Bank 1 HO2S 1 Low	GRN	0.0 V	0.1 V	General Description and Operation, Fuel HO2S 1
D15	Bank 1 HO2S 1 Signal	RED	0.4 V	0.1-0.9 V	General Description and Operation, Fuel HO2S 1
D16	Not Used	—	—	—	—

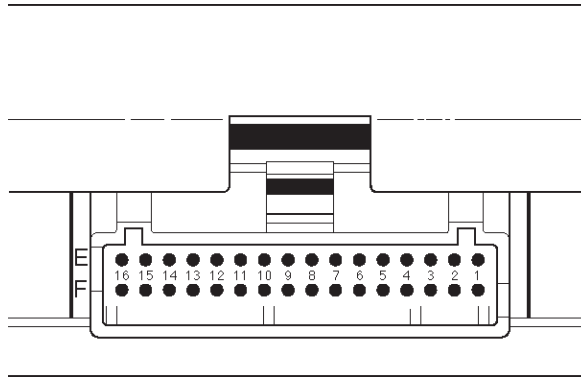
**PCM Pinout Table, 32-Way White Connector – Row “D”
(For EXPORT and SOUTH AFRICA)**



TS23345

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
D1	Injector Cylinder #2	GRN/ORN	B+	B+	General Description and Operation, Fuel Injector
D2	Torque Converter Clutch (TCC)	BRN/BLU	0.0 V	0.0 V	On-Vehicle Service, Torque Converter Clutch
D3	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation, Fuel Injector
D4	Serial Data (8192)	ORN	5.0 V	5.0 V	Chassis Electrical
D5	Ignition Control, Cylinder #5	RED/YEL	0.0 V	0.1 V	General Description and Operation, Ignition Coil
D6	Ignition Control, Cylinder #3	RED/BLUE	0.0 V	0.0 V	General Description and Operation, Ignition Coil
D7	VSS Input / IMOB Response	LIGHT GRN/WHT	0.0 V	0.1 V (at rest)	Chassis Electrical
D8	Sensor Ground 5V Reference A Return	GRN	0.0 V	0.0 V	Appropriate Sensor
D9	Sensor Ground 5 V Reference B Return	GRY	0.0 V	0.0 V	Appropriate Sensor
D10	Mass Air Flow (MAF)	YEL	4.9 V	4.2 V	General Description, Mass Air Flow Sensor
D11	Camshaft Position Sensor	WHT	5.0 V or less than 1.0 V	4.6 V	General Description and Operation, Camshaft Position Sensor
D12	Not Used	—	—	—	—
D13	Not Used	—	—	—	—
D14	Not Used	—	—	—	—
D15	Not Used	—	—	—	—
D16	Not Used	—	—	—	—

**PCM Pinout Table, 32-Way Blue Connector – Row “E”
(For except EXPORT and SOUTH AFRICA)**



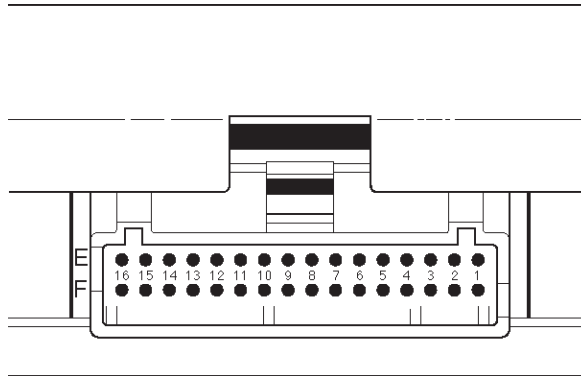
TS23346

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
E1	Transmission Output Shaft Sensor (TOSS) High	RED	0.0 V	0.1 V	Automatic Transmission (4L30E)
E2	Transmission Output Shaft Sensor (TOSS) Low	WHT	0.0 V	0.0 V	Automatic Transmission (4L30E)
E3	Pressure Control Solenoid Low	PPL/RED	0.0 V	1.1 V	Automatic Transmission (4L30E)
E4	Pressure Control Solenoid High	PPL/WHT	0.0 V	4.9 V	Automatic Transmission (4L30E)
E5	Exhaust Gas Recirculation (EGR) Control High	BLK/YEL	B+	B+	General Description and Operation, EGR Control
E6	Exhaust Gas Recirculation (EGR) Control Low	YEL	B+	B+	General Description and Operation, EGR Control
E7	Transmission Range Signal “B”	BLU/YEL	0.0 V	0.0 V	Automatic Transmission (4L30E)
E8	Throttle Position (TP) Sensor	BLU	0.5-0.8 V	0.5-0.8 V (at idle)	General Description and Operation, Throttle Position Sensor
E9	Engine Coolant Temperature (ECT) Sensor	BLU/RED	0.5-4.9 V (depends on temperature)	0.5-4.9 V (depends on temperature)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
E10	Not Used	—	—	—	—
E11	Crankshaft Position (CKP) Sensor +5 Volt Reference	YEL/RED	5.0 V or less than 1.0 V	5.0 V	General Description and Operation, Crankshaft Position Sensor
E12	Transmission Range Signal “A”	BLU/WHT	B+	B+	Automatic Transmission (4L30E)
E13	Fuel Pump (FP) Relay	RED/WHT	0.0 V	B+	On-Vehicle Service, Fuel Pump Relay
E14	Shift High (BAND APPLY)	BRN/WHT	B+	B+	Automatic Transmission (4L30E)

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PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
E15	A/C Request	GRN/ORN	0.0 V	0.0 V	Electric Cooling Fans
E16	Ignition Feed (1 of 2 F16)	RED/BLU	B+	B+	—

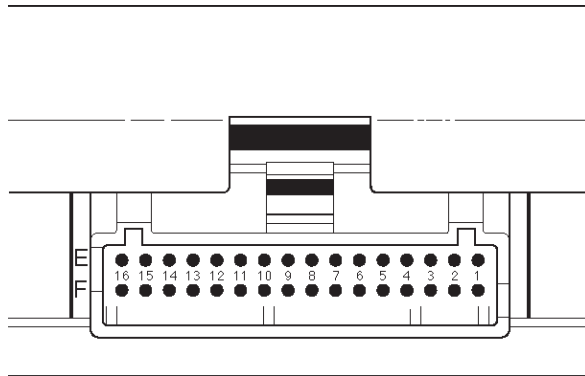
**PCM Pinout Table, 32-Way Blue Connector – Row “E”
(For EXPORT and SOUTH AFRICA)**



TS23346

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
E1	Transmission Output Shaft Sensor (TOSS) High	RED	0.0 V	0.1 V	Automatic Transmission (4L30E)
E2	Transmission Output Shaft Sensor (TOSS) Low	WHT	0.0 V	0.0 V	Automatic Transmission (4L30E)
E3	Pressure Control Solenoid Low	PPL/RED	0.0 V	1.1 V	Automatic Transmission (4L30E)
E4	Pressure Control Solenoid High	PPL/WHT	0.0 V	4.9 V	Automatic Transmission (4L30E)
E5	Not Used	—	—	—	—
E6	Not Used	—	—	—	—
E7	Transmission Range Signal “B”	BLU/YEL	0.0 V	0.0 V	Automatic Transmission (4L30E)
E8	Throttle Position (TP) Sensor	BLU	0.5-0.8 V	0.5-0.8 V (at idle)	General Description and Operation, Throttle Position Sensor
E9	Engine Coolant Temperature (ECT) Sensor	BLU/RED	0.5-4.9 V (depends on temperature)	0.5-4.9 V (depends on temperature)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
E10	Not Used	—	—	—	—
E11	Crankshaft Position (CKP) Sensor +5 Volt Reference	YEL/RED	5.0 V or less than 1.0 V	5.0 V	General Description and Operation, Crankshaft Position Sensor
E12	Transmission Range Signal “A”	BLU/WHT	B+	B+	Automatic Transmission (4L30E)
E13	Fuel Pump (FP) Relay	RED/WHT	0.0 V	B+	On-Vehicle Service, Fuel Pump Relay
E14	Shift High (BAND APPLY)	BRN/WHT	B+	B+	Automatic Transmission (4L30E)
E15	A/C Request	GRN/ORN	0.0 V	0.0 V	Electric Cooling Fans
E16	Ignition Feed (1 of 2 F16)	RED/BLU	B+	B+	—

PCM Pinout Table, 32-Way Blue Connector – Row “F”

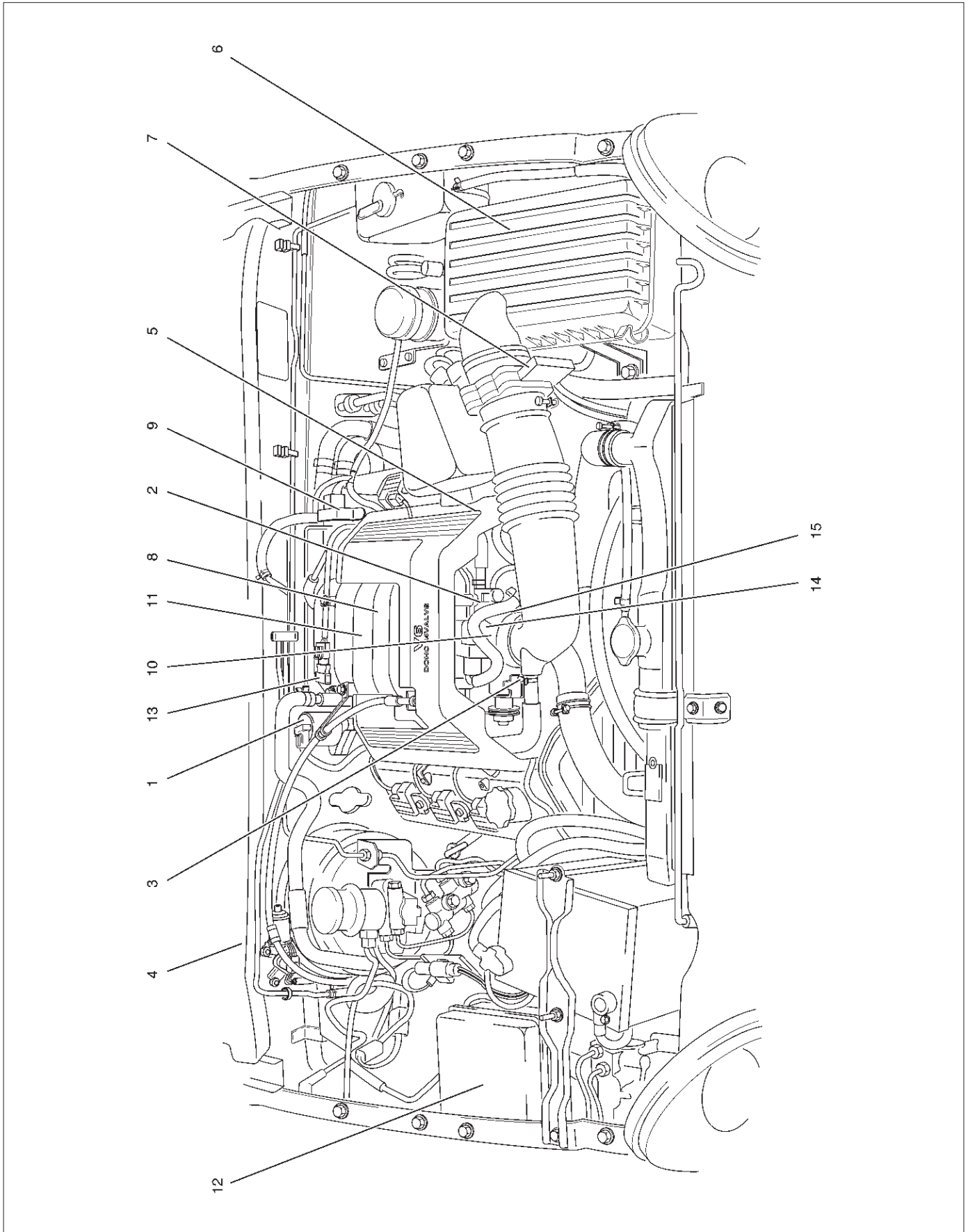


TS23346

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F1	Not Used	—	—	—	—
F2	Transmission Range Signal “C”	BLU/BLK	0.0 V	0.0 V	Automatic Transmission (4L30E)
F3	Transmission Range Signal “P”	YEL/GRN	B+	0.0 V	Automatic transmission (4L30E)
F4	Brake Switch	GRN/YEL	0.0 V	0.0 V	Automatic transmission (4L30E)
F5	Power Switch	PPL/RED	B+	B+	Automatic Transmission (4L30E)
F6	Winter Switch	PPL/GRN	B+	B+	Automatic Transmission (4L30E)
F7	Transmission Fluid Temperature	RED/BLK	0.5-4.9 V (depends on temperature)	0.5-4.9 V (depends on temperature)	Automatic Transmission (4L30E)
F8	Manifold Absolute Pressure (MAP)	GRY/BLK	3.5-4.9 V (depends on altitude and barometric pressure)	0.6-1.3 V	General Description and Operation, Manifold Absolute Pressure
F9	Not Used	—	—	—	—
F10	Cruise Control	GRY/BLU	B+	B+	Automatic transmission (4L30E)
F11	Kickdown Switch	LT BLU	B+	B+	Automatic Transmission (4L30E)
F12	DIAG	ORN/BLU	B+	B+	—
F13	Injector “C” Cylinder #3	GRN	B+	B+	General Description and Operation, Fuel Injector
F14	Shift “A” Solenoid	BRN/RED	B+	B+	Automatic Transmission (4L30E)
F15	Injector Cylinder #5	GRN/BLK	B+	B+	General Description and Operation, Fuel Injector
F16	Ignition Feed (1 of 2 E16)	RED/BLU	B+	B+	—

Component Locators

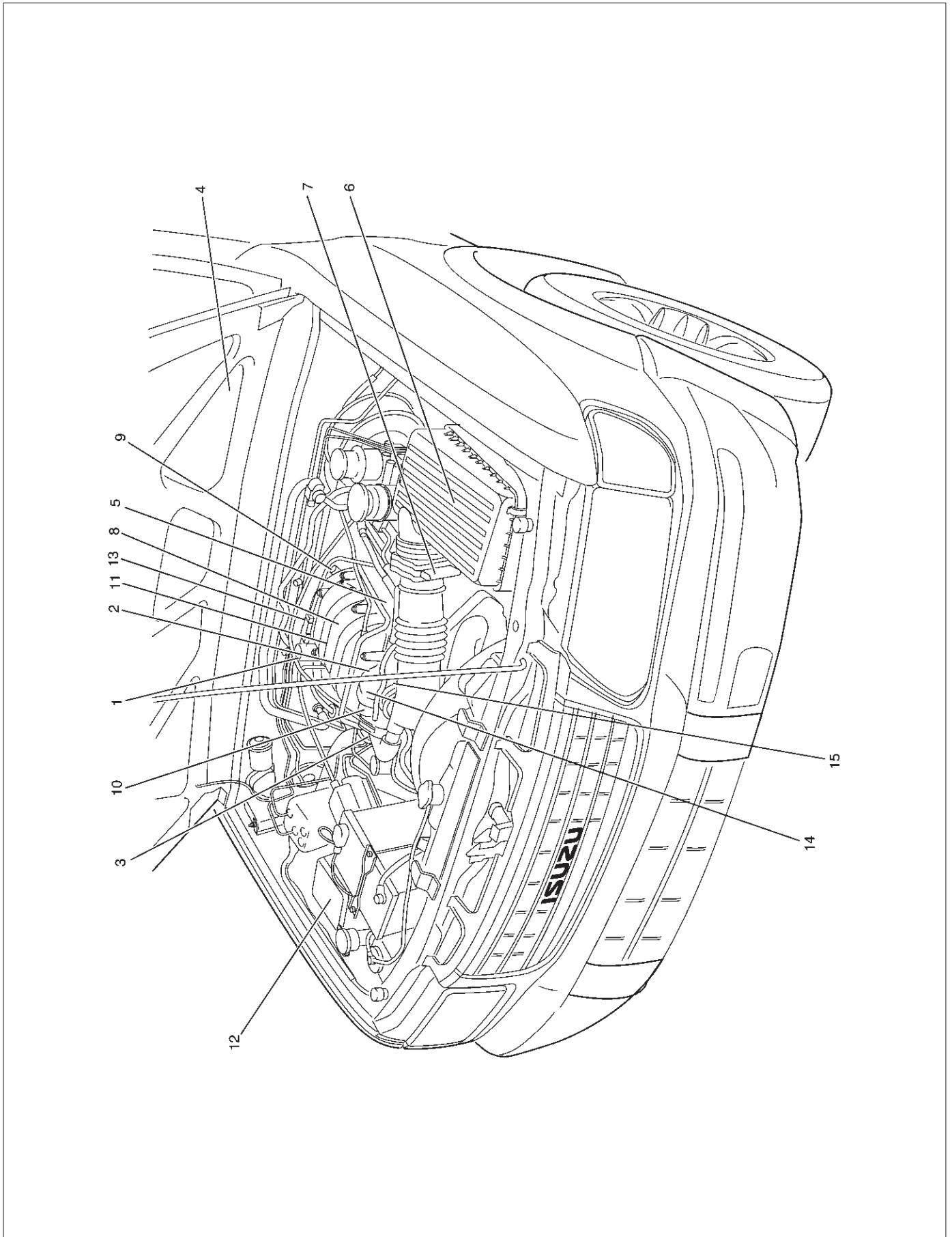
Engine Component Locator (This illustration is based on RHD model.)



Engine Component Locator Table

Number	Name	Location
1	Linear Exhaust Gas Recirculation (EGR) Valve	Rear right side of the engine
2	Throttle Position (TP) Sensor	On the rear of the throttle body
3	Intake Air Temperature (IAT) Sensor	On the intake air duct near the throttle body
4	Check Engine (MIL) Light	On the instrument panel beneath the tachometer
5	Positive Crankcase Ventilation (PCV) Valve	On the left of the cylinder head cover
6	Air Cleaner	Left front of the engine bay
7	Mass Air Flow (MAF) Sensor	Attached to the air filter box
8	Camshaft Position (CMP) Sensor	On the rear right side at the left of the cylinder head cover
9	Fuel Pressure Regulator	Rear right side of the engine
10	Idle Air Control (IAC) Valve	On the left of the throttle body
11	Upper Intake Manifold	Top of the engine
12	Fuse/Relay Box	Along the inside of the right fender
13	Manifold Absolute Pressure (MAP) Sensor	Bolted to the top of the upper intake manifold
14	Throttle Body	Between the intake air duct and the upper intake manifold
15	Engine Coolant Temperature Sensor	On the coolant crossover pipe at the front of the engine, near the throttle body

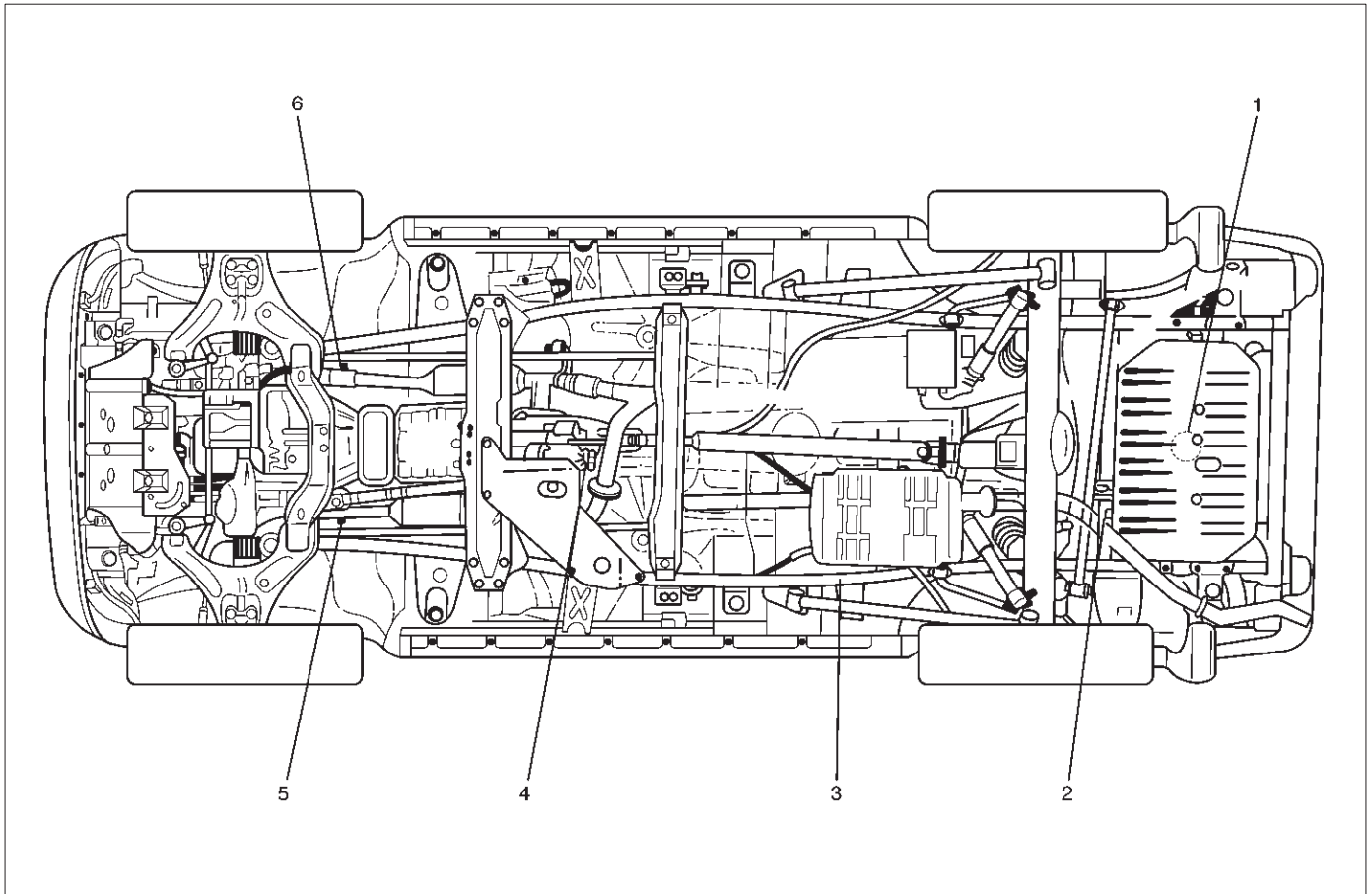
Engine Component Locator (This illustration is based on LHD model.)



Engine Component Locator Table

Number	Name	Location
1	Linear Exhaust Gas Recirculation (EGR) Valve	Rear right side of the engine
2	Throttle Position (TP) Sensor	On the rear of the throttle body
3	Intake Air Temperature (IAT) Sensor	On the intake air duct near the throttle body
4	Check Engine (MIL) Light	On the instrument panel beneath the tachometer
5	Positive Crankcase Ventilation (PCV) Valve	On the left of the cylinder head cover
6	Air Cleaner	Left front of the engine bay
7	Mass Air Flow (MAF) Sensor	Attached to the air filter box
8	Camshaft Position (CMP) Sensor	On the rear right side at the left of the cylinder head cover
9	Fuel Pressure Regulator	Rear right side of the engine
10	Idle Air Control (IAC) Valve	On the left of the throttle body
11	Upper Intake Manifold	Top of the engine
12	Fuse/Relay Box	Along the inside of the right fender
13	Manifold Absolute Pressure (MAP) Sensor	Bolted to the top of the upper intake manifold
14	Throttle Body	Between the intake air duct and the upper intake manifold
15	Engine Coolant Temperature Sensor	On the coolant crossover pipe at the front of the engine, near the throttle body

Undercarriage Component Locator



F00RW040

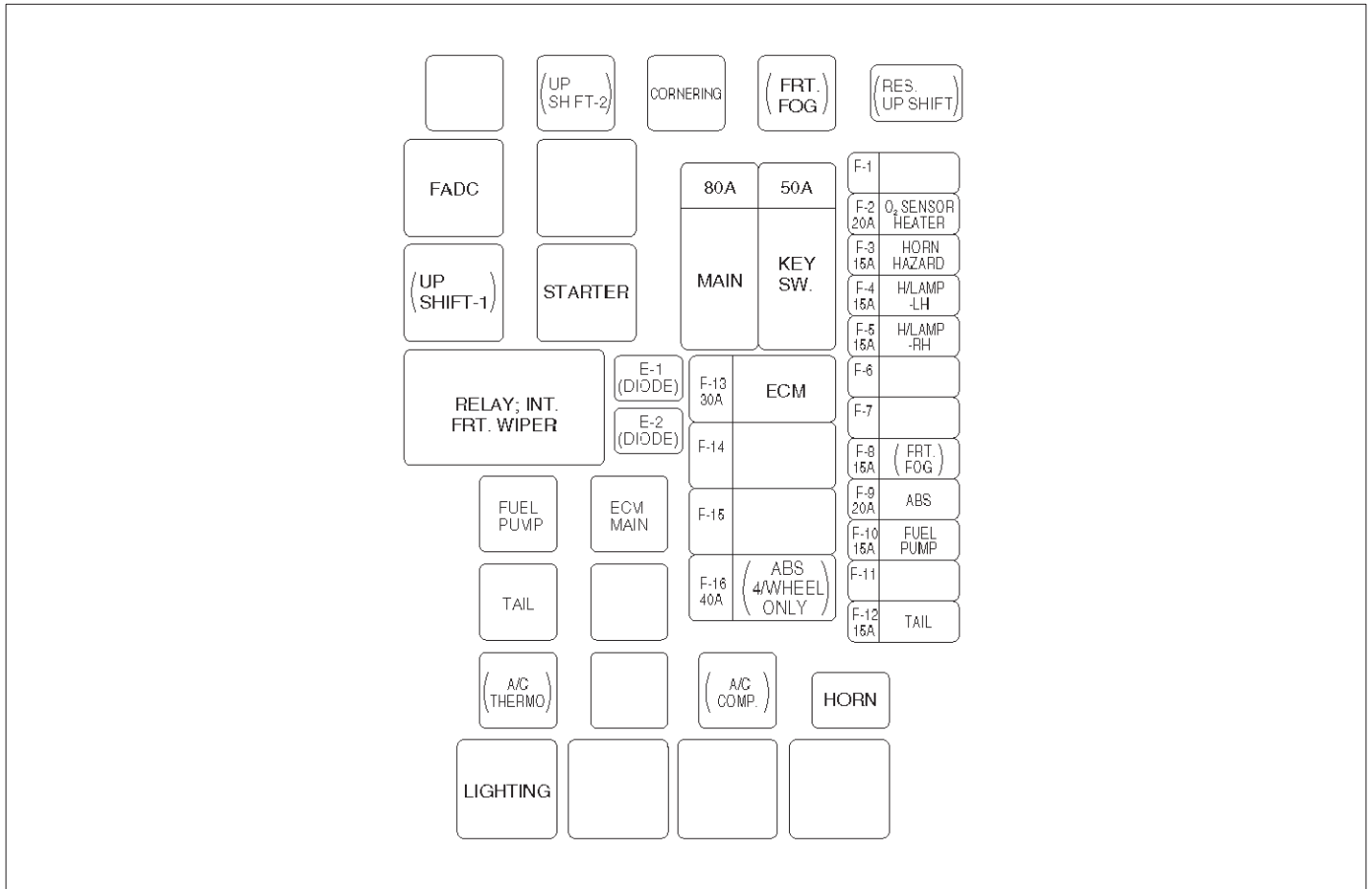
Undercarriage Component Locator Table (Automatic Transmission)

Number	Name	Location
1	Fuel Pump Assembly	Installed in the top of the fuel tank
2	Fuel Gauge Unit	Installed in the front edge of the fuel tank, on the right side
3	Fuel Filter	Located along the inside of the right frame rail, ahead of the rear axle
4	Vehicle Speed Sensor (VSS)	2WD: Protrudes from the transmission housing, just ahead of the propeller shaft. 4WD: Protrudes from the rear output shaft housing of the transfer case.
5	Heated Oxygen Sensor (Bank 1, HO2S 1)	Threaded into the exhaust pipe ahead of the right-hand catalytic converter
6	Heated Oxygen Sensor (Bank 2, HO2S 1)	Threaded into the exhaust pipe ahead the left-hand catalytic converter

Undercarriage Component Locator Table (Manual Transmission)

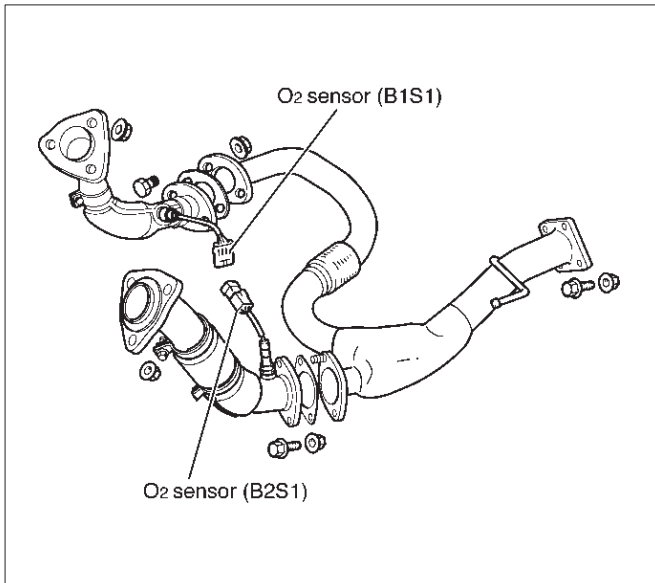
Number	Name	Location
1	Fuel Pump Assembly	Installed in the top of the fuel tank
2	Fuel Gauge Unit	Installed in the front edge of the right frame rail, ahead of the rear axle
3	Fuel Filter	Located along the inside of the right frame rail, ahead of the rear axle
4	Vehicle Speed Sensor (VSS)	2WD: Protrudes from the transmission housing, just ahead of the propeller shaft. 4WD: Protrudes from the rear output shaft housing of the transfer case.
5	Heated Oxygen Sensor (Bank 1, HO2S 1)	Threaded into the exhaust pipe ahead of the right-hand catalytic converter
6	Heated Oxygen Sensor (Bank 2, HO2S 1)	Threaded into the exhaust pipe ahead of the left-hand catalytic converter

Fuse and Relay Panel (Underhood Electrical Center)



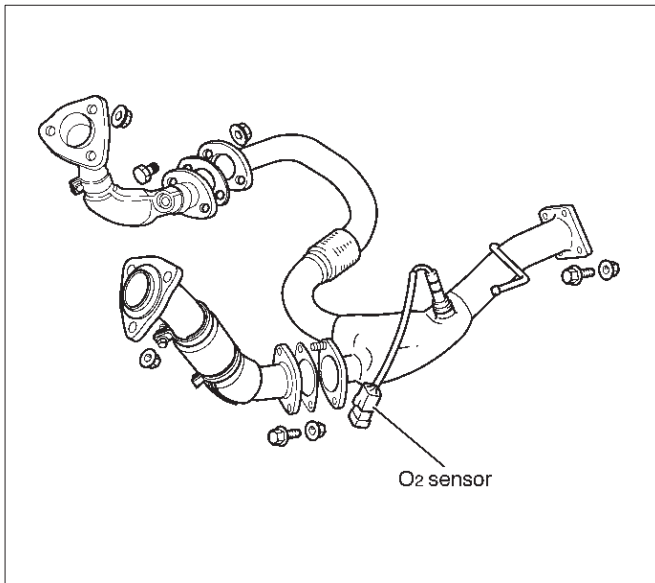
Sensors and Miscellaneous Component Locators

- For EC.

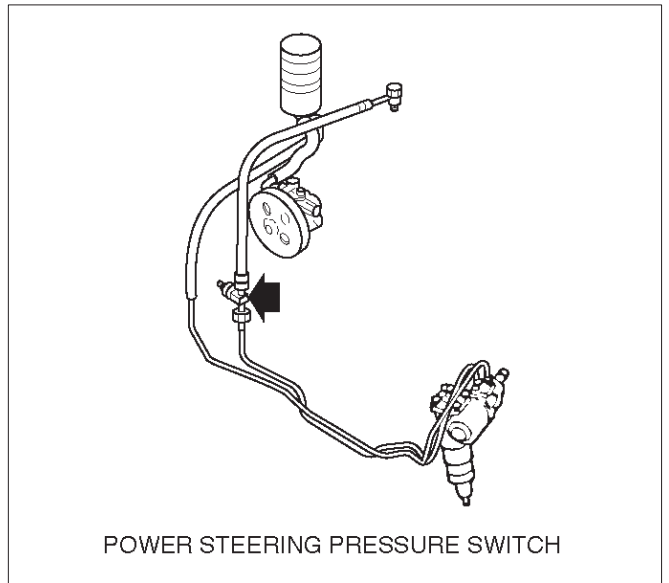


060RW194

- For AUSTRALIA, THAILAND, SOUTH EAST ASIA, LATIN AMERICA, GULF, SAUDI, CHINA.

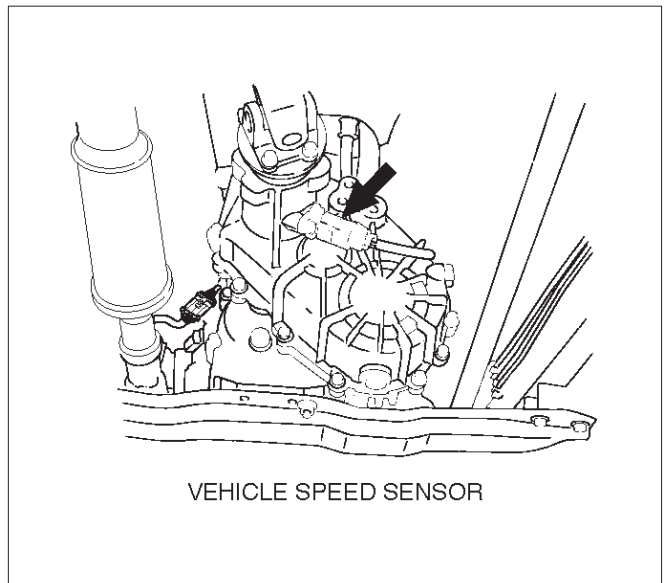


150RW101



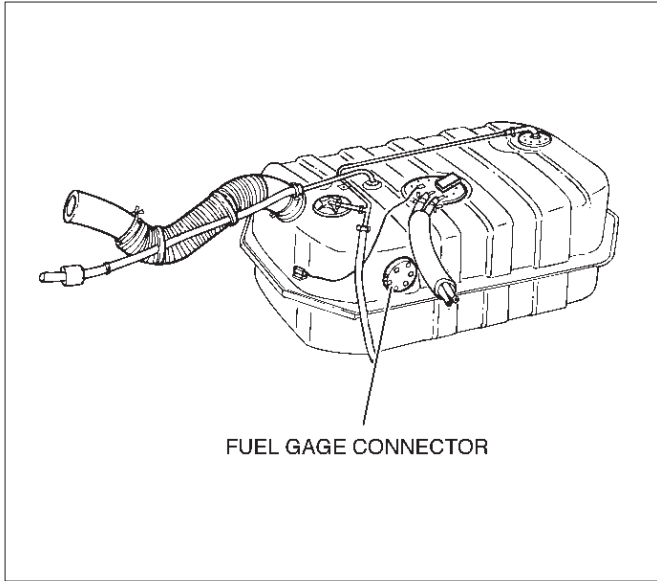
POWER STEERING PRESSURE SWITCH

T321066

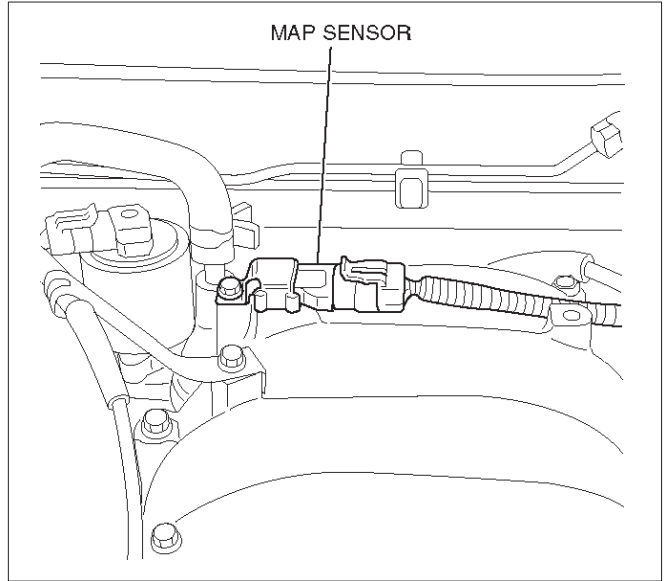


VEHICLE SPEED SENSOR

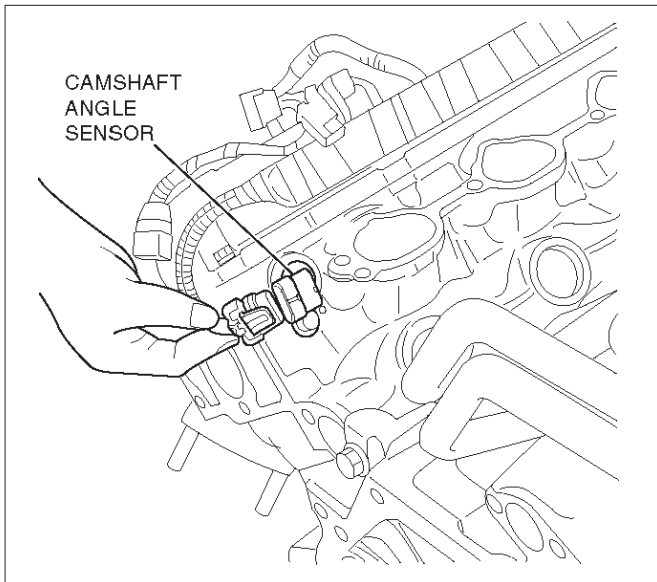
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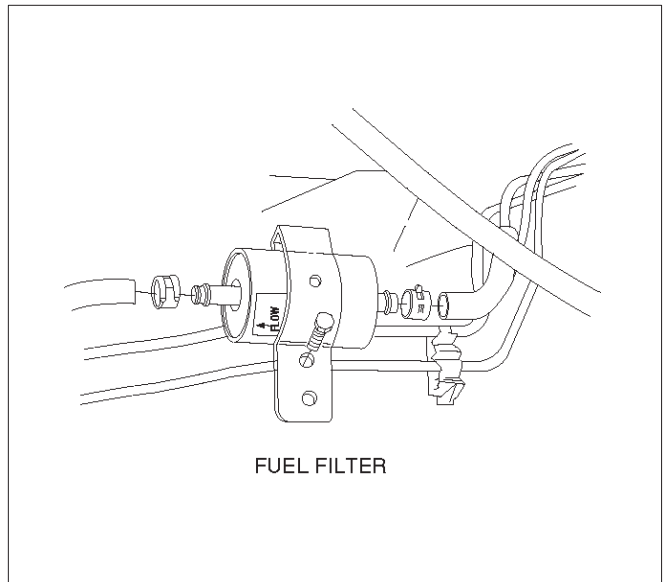
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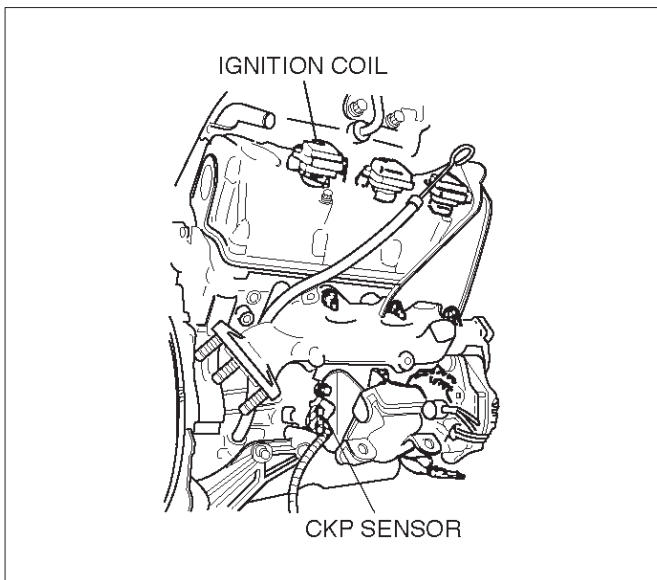
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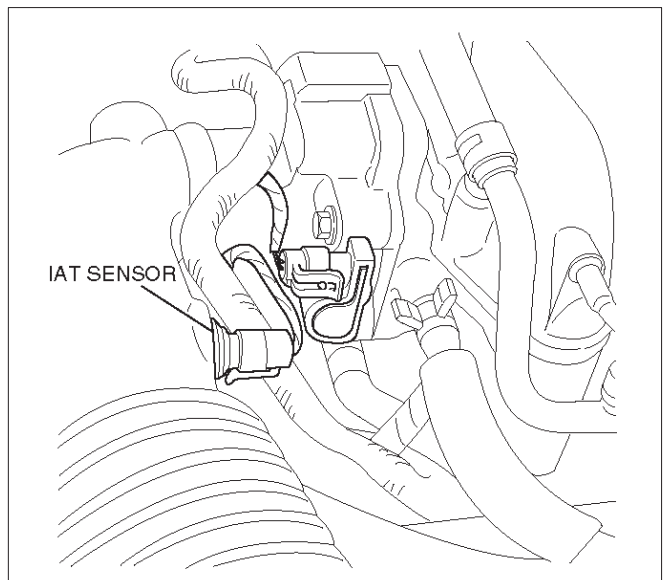
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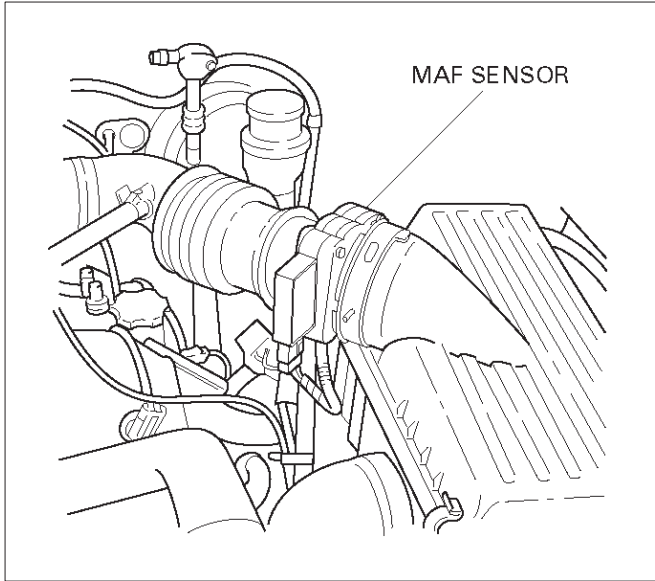
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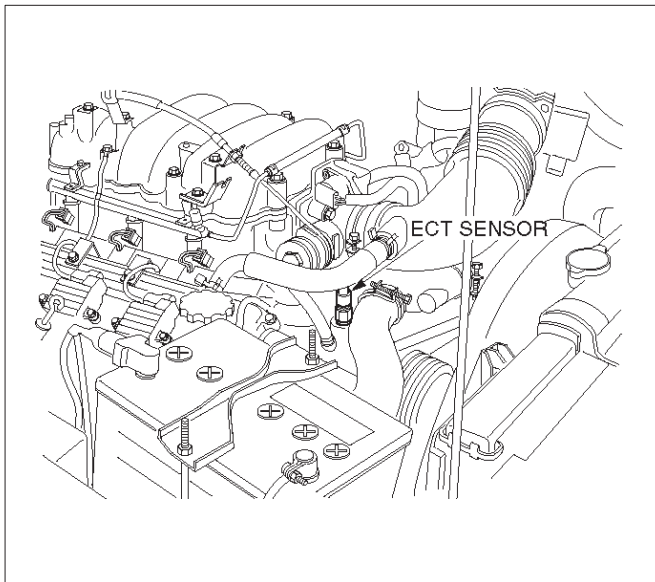
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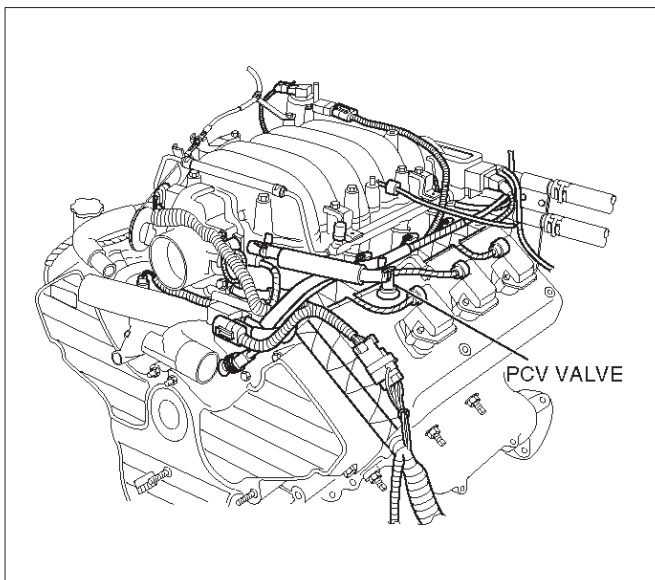
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060RW007



028RW001

Diagnosis

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
 - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
 - Conduct a thorough visual inspection.
 - Review the service history.
 - Detect unusual sounds or odors.
 - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
 - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
 - "System checks" contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Call technical assistance for similar cases where repair history may be available. Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze frame data.
2. Evaluate the symptoms and the conditions described by the customer.

3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Tech 2s, such as the Tech II and the 5-8840-0285-0 (Fluke model 87 DVOM), have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint.

When the Complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in *Intermittents*, or could be normal.

2. Repair and verify.

After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL("Check Engine" lamp) has been requested).
2. Clear the DTC(S).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

OBD Serviceability Issues

The list of non-vehicle faults that could affect the performance of the OBD system has been compiled. These non-vehicle faults vary from environmental conditions to the quality of fuel used.

The illumination of the MIL ("Check Engine" lamp) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Using fuel with the wrong octane rating for your vehicle may cause driveability problems. Many of the major fuel companies advertise that using "premium" gasoline will improve the performance of your vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel's ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non-OEM Parts

All of the OBD diagnostics have been calibrated to run with OEM parts. Something as simple as a high-performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL ("Check Engine" lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL ("Check Engine" lamp) to turn on.

Aftermarket electronics, such as cellular phones, stereos, and anti-theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL ("Check Engine" lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain-soaked, it can temporarily cause engine misfire and turn on the MIL ("Check Engine" lamp).

Poor Vehicle Maintenance

The sensitivity of OBD diagnostics will cause the MIL ("Check Engine" lamp) to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD. Poor vehicle maintenance can not be classified as a "non-vehicle fault", but with the sensitivity of OBD diagnostics, vehicle maintenance schedules must be more closely followed.

Related System Faults

Many of the OBD system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Maintenance Schedule

Refer to the *Maintenance Schedule*.

Visual / Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for punches, cuts, disconnects, and correct routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Serial Data Communications

Class II Serial Data Communications

This vehicle utilizes the "Class II" communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Tech 2 manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other Tech 2 will appear the same, with some exceptions. Some Tech 2s will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. For more information on this system of coding, refer to *Decimal/Binary/Hexadecimal Conversions*. On this vehicle Tech 2 displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

On-Board Diagnostic (OBD)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage. Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Knock Sensor (KS)
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable. Output components to be monitored include, but are not limited to, the following circuits:

- Idle Air Control (IAC) Motor
- Electronic Transmission controls
- A/C relays
- Cooling fan relay
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70°C (160°F) and rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Frame Data* for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

Common OBD Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required".

The enable criteria for each diagnostic is listed on the first page of the DTC description under the heading "Conditions for Setting the DTC". Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAF/MAP
- barometric pressure
- IAT
- TP
- fuel trim
- TCC enabled
- A/C on

Trip

Technically, a trip is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostic are run when the vehicle is at operating temperature, some when the vehicle first start up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is idle; some diagnostics function with the TCC disables. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enables criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as following:

- Commanding the MIL ("Check Engine" lamp) on and off
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non-emission related Service Lamp (future)
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic

The Diagnostic Executive records DTCs and turns on the MIL when emission-related faults occur. It can also turn off the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) ("Check Engine" lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("Check Engine" lamp). However, OBD requires that the it illuminate under a strict set of guide lines.

Basically, the MIL is turned on when the PCM detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissionsrelated faults.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after *three consecutive* trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned off, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm-up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur with 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL ("Check Engine" lamp) is on the instrument panel and has the following function:

- It informs the driver that a fault affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come "ON" with the key "ON" and the engine not running. When the engine is started, the MIL will turn "OFF."
- When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On-Board Diagnostic (OBD II) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
 - Emissions related
 - Requests illumination of the MIL of the first trip with a fail
 - Stores a History DTC on the first trip with a fail
 - Stores a Freeze Frame (if empty)
 - Stores a Fail Record
 - Updates the Fail Record each time the diagnostic test fails
- Type B
 - Emissions related
 - "Armed" after one (1) trip with a fail
 - "Disarmed" after one (1) trip with a pass
 - Requests illumination of the MIL on the *second consecutive trip* with a fail
 - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
 - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)

- Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
- Updates the Fail Record each time the diagnostic test fails
- Type C (if the vehicle is so equipped)
 - Non-Emissions related
 - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
 - Stores a History DTC on the *first trip* with a fail
 - *Does not* store a Freeze Frame
 - Stores Fail Record when test fails
 - Updates the Fail Record each time the diagnostic test fails
- Type D (*Type D* non-emissions related are not utilized on certain vehicle applications).
 - Non-Emissions related
 - Dose not request illumination of any lamp
 - Stores a History DTC on the *first trip* with a fail
 - *Does not* store a Freeze Frame
 - Stores Fail Record when test fails
 - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Storing and Erasing Freeze Frame Data and Failure Records

The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate
- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

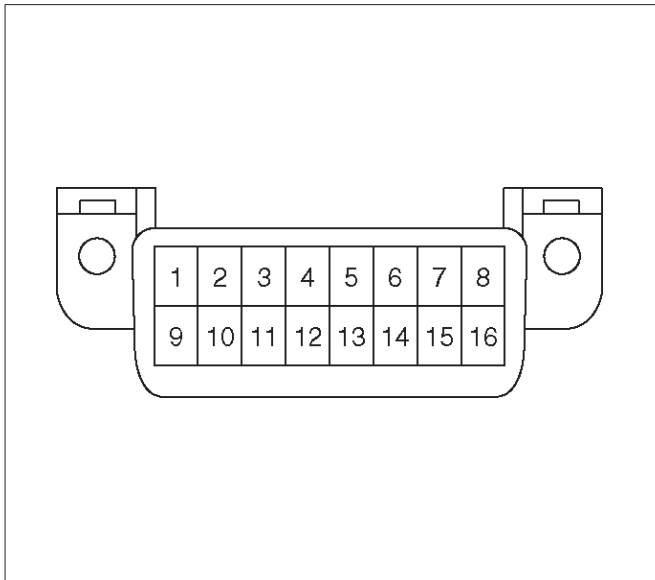
In the case of an “intermittent” fault, the MIL (“Check Engine” lamp) may illuminate and then (after three trips) go “OFF”. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the “Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub-system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). The DLC is used to connect to Tech 2. Some common uses of Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.



TS24064

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using A Tech 2

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Tech 2. When reading DTC(s), follow instructions supplied by Tech 2 manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the “warm-up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Tech 2 “clear DTCs”. When clearing DTCs follow instructions supplied by the tool manufacturer.

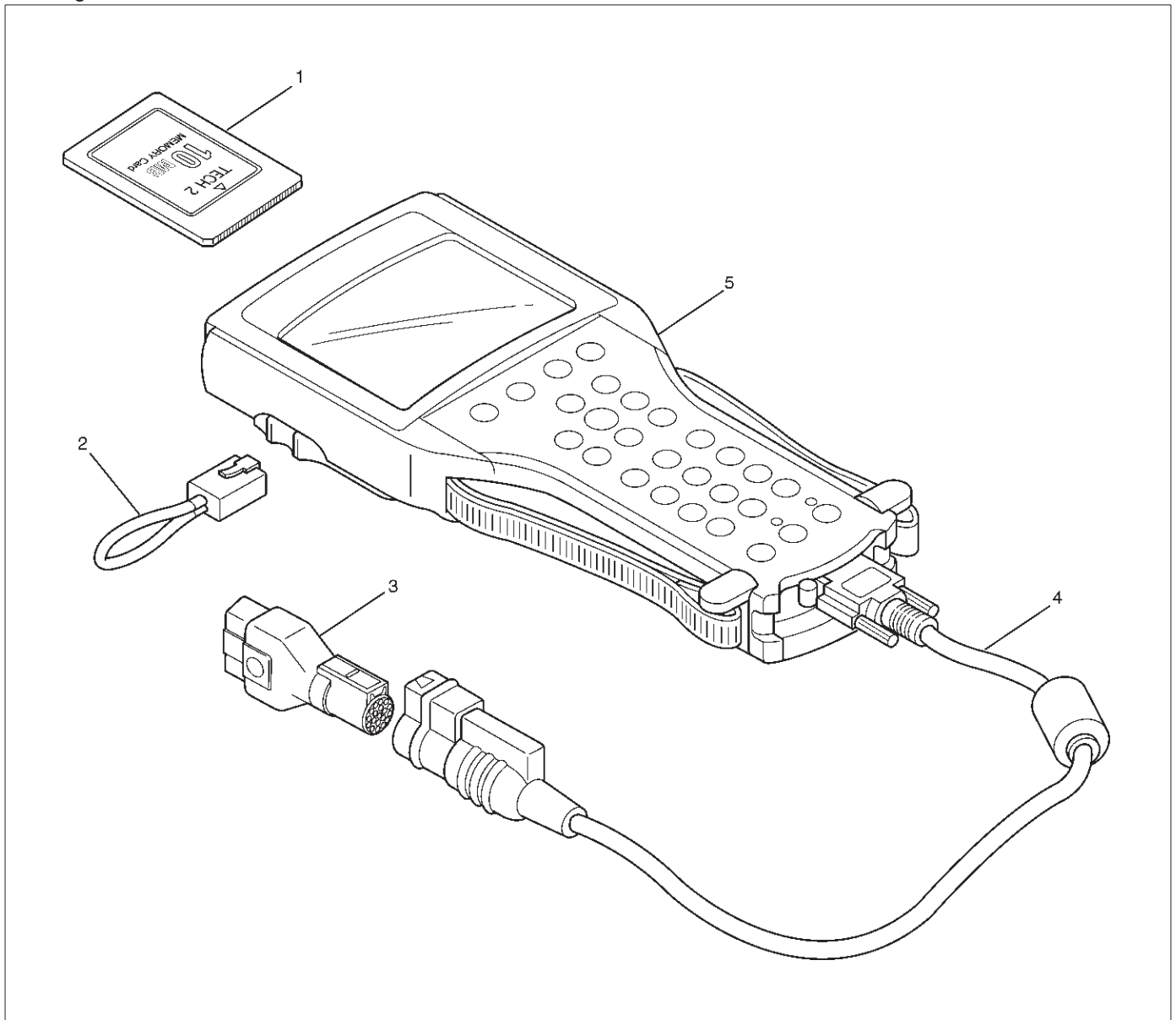
When Tech 2 is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

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

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 Tech 2 user guide.



901RW180

Legend

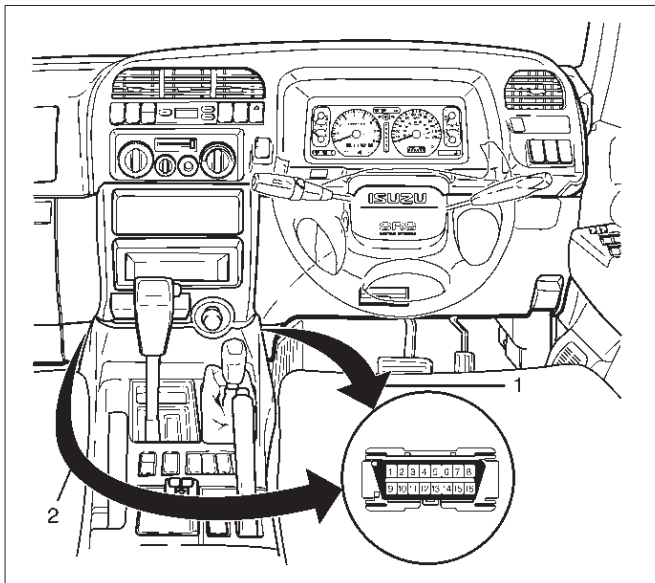
- (1) PCMCIA Card
- (2) RS 232 Loop Back Connector
- (3) SAE 16/19 Adaptor
- (4) DLC Cable
- (5) Tech-2

Tech 2 Features

1. Tech 2 is 12 volt system. Do not apply 24 volt.
2. After connect and/or install Tech 2 body, Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector, connect them to the vehicle DLC.
3. After power off to the Tech 2, remove and reinstall the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu to press EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press "F1: Clear DTC Info".

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
 2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
 3. Connect the DLC cable to the Tech 2 (5)
 4. Make sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.
 1. For RHD model: Right front side in the console box.
 2. For LHD model: Left front side in the console box.



060RW220

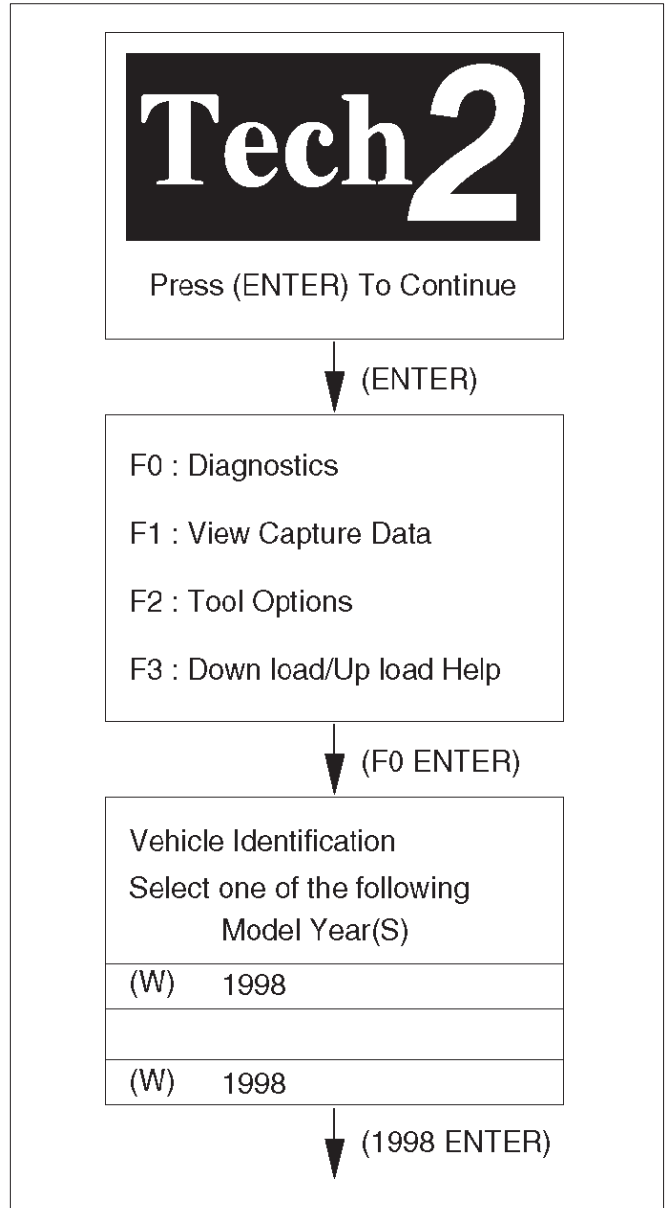
6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.



060RW009

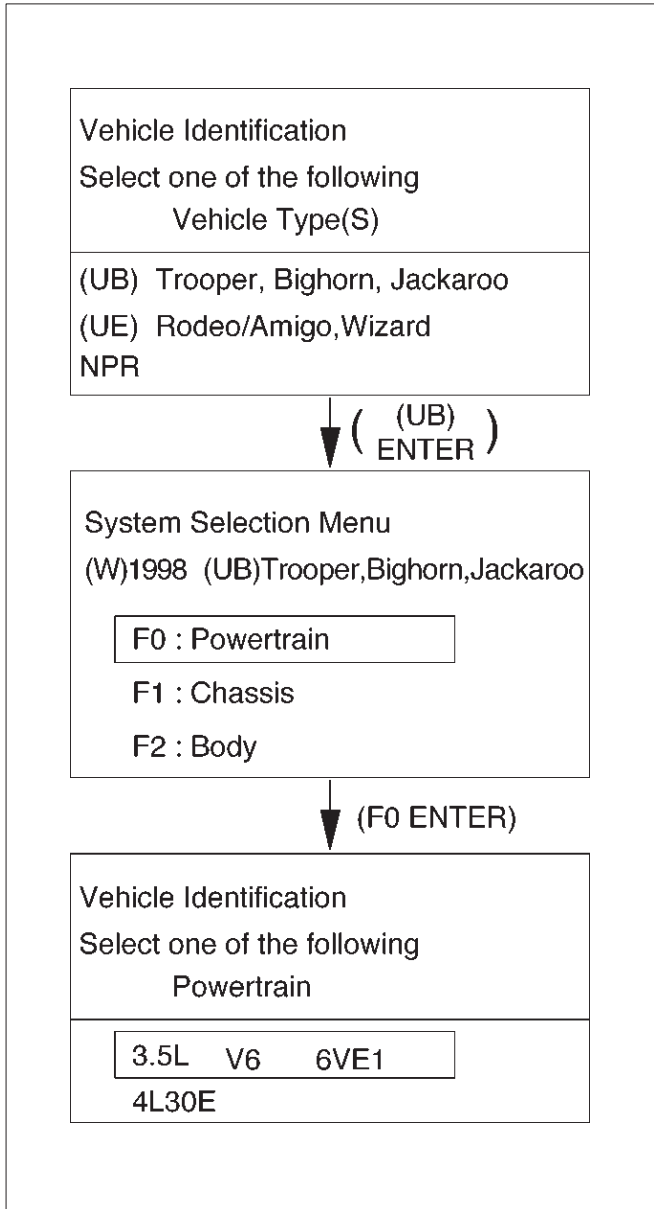
Operating Procedure (For Example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below. (Ver. 5.471)



060RW014

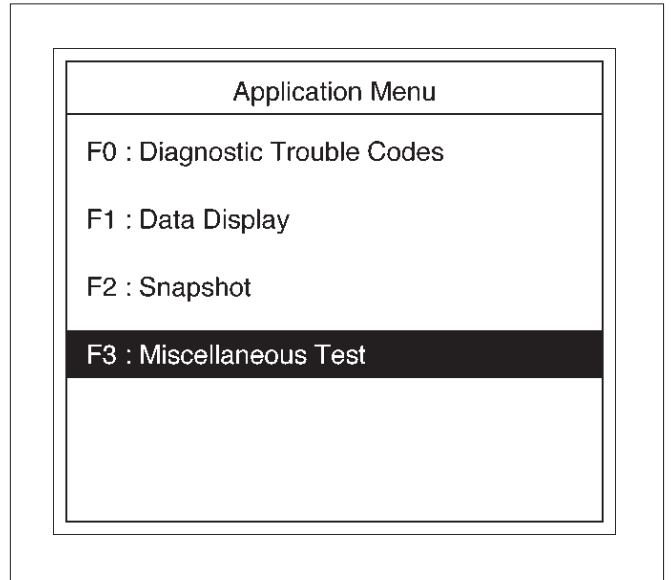
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.



060RW218

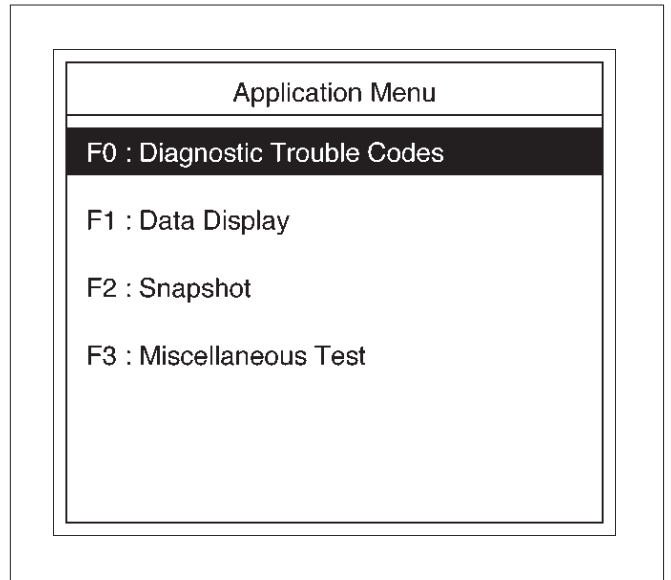
Menu

- The following table shows, which functions are used the available equipment versions.



060RW228

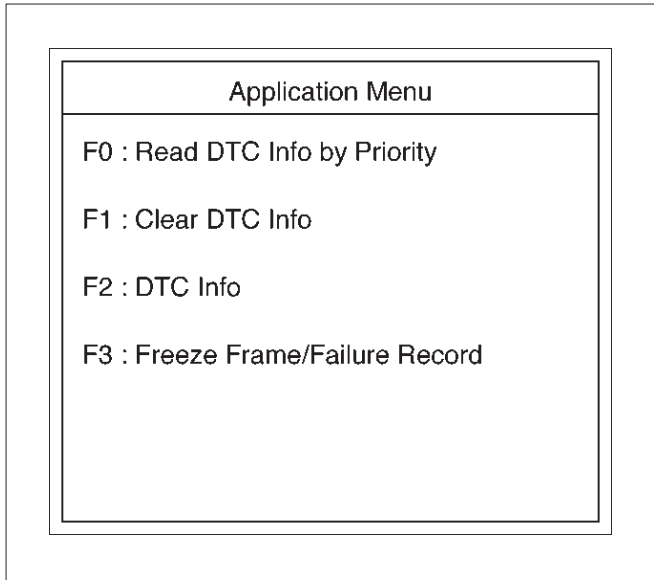
DTC Modes



060RW229

On OBD passenger cars there are five options available in Tech 2 DTC mode to display the enhanced information available. A description of the new modes, DTC Info follows. After selecting DTC, the following menu appears:

- DTC Info
- Freeze Frame
- Fail Records (not all applications)
- Clear Info

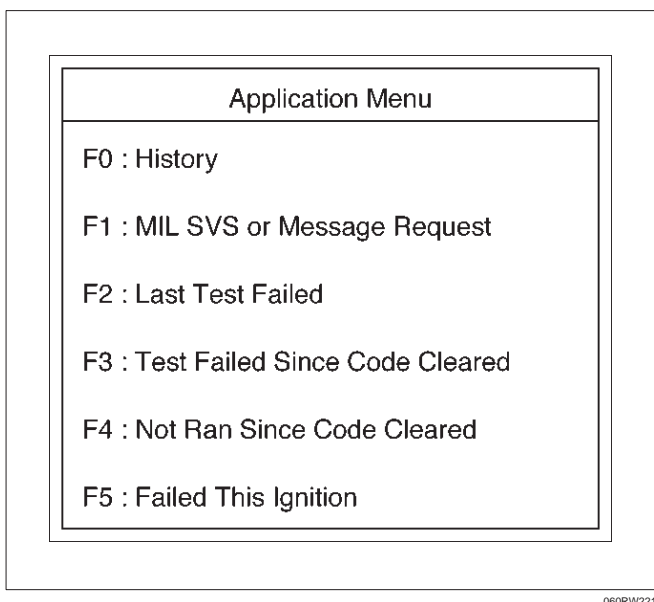


The following is a brief description of each of the sub menus in DTC Info and Specific DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are seven choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.

To get a complete description of any status, press the "Enter" key before pressing the desired F-key. For example, pressing "Enter" then an F-key will display a definition of the abbreviated Tech 2 status.



DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will not display Type B DTCs that have not requested the MIL ("Check Engine" lamp). It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test ran. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Requested

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Clear

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Clear

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Injector Balance Test

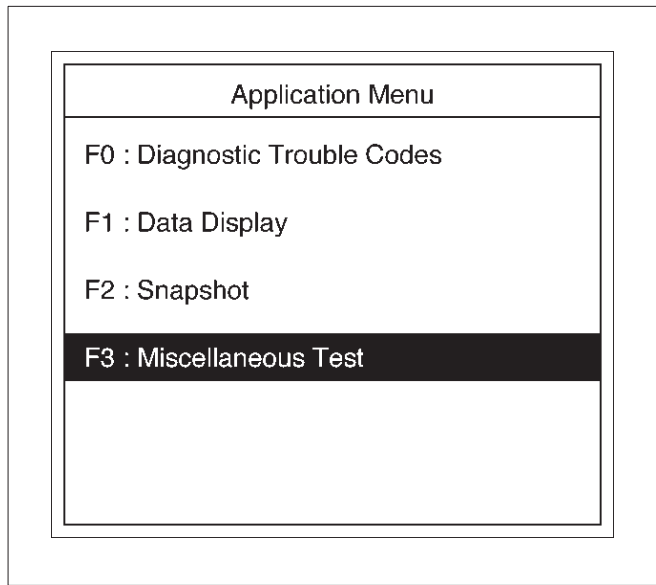
This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-6.

Tech 2 must be used for this test.

Test Procedure:

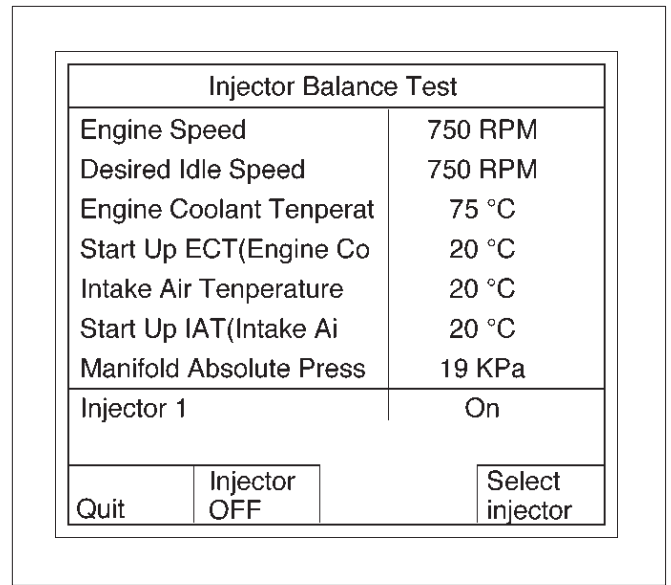
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

3. Select F3: Miscellaneous Test in the Application Menu.



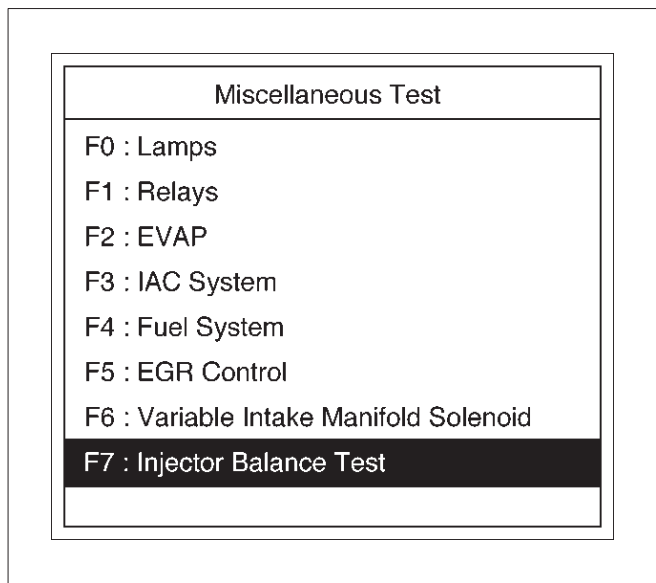
060RW228

5. Select injector number and push "injector off" of soft key.



060RW230

4. Select F7: Injector Balance Test in the Miscellaneous Test.



060RX006

6. Make sure of engine speed change.
7. In the engine speed whose change has been confirmed, the injector electric circuit can be regard as normal.

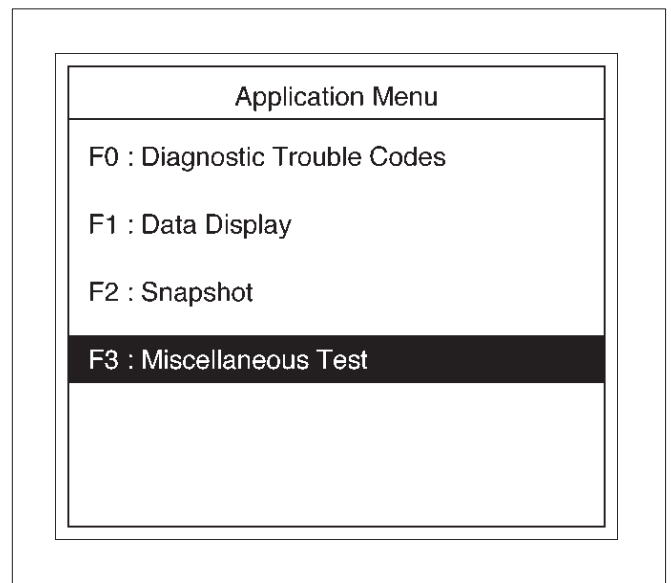
As for the engine speed whose change has not been confirmed, the injector electric circuit or the injector proper is faulty.

EGR Control Test

This test is conducted check EGR valve for its working. Tech 2 must be used for this test.

Test Procedure:

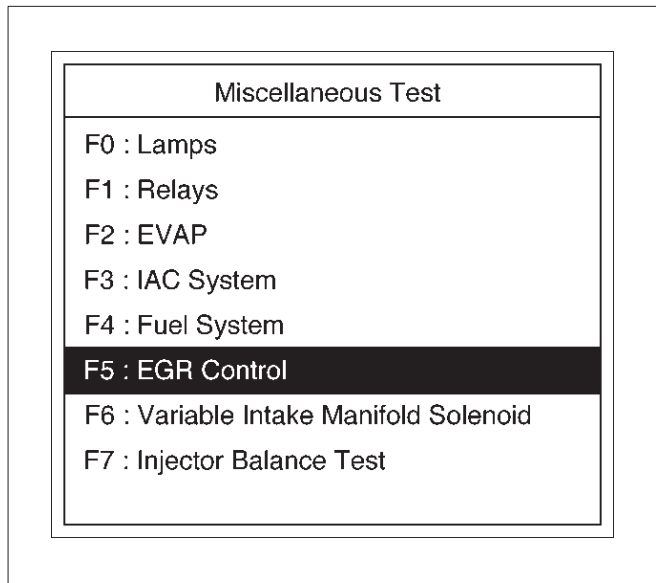
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



060RW228

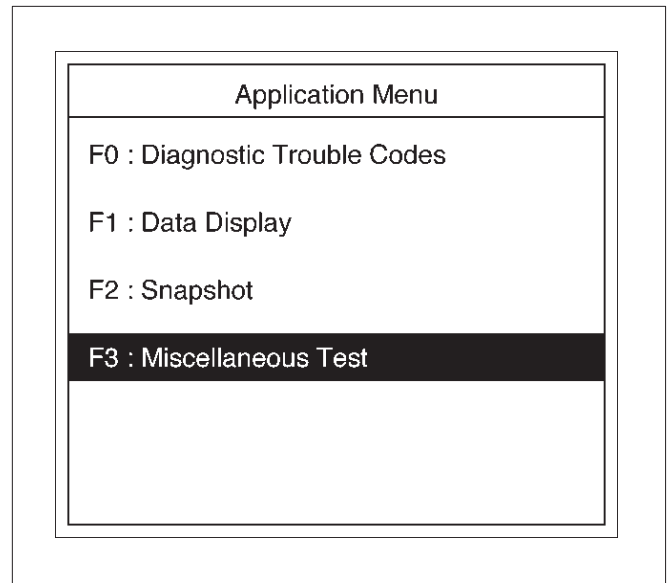
6E-48 ENGINE DRIVEABILITY AND EMISSIONS

4. Select F5: EGR Control Test in the Miscellaneous Test.



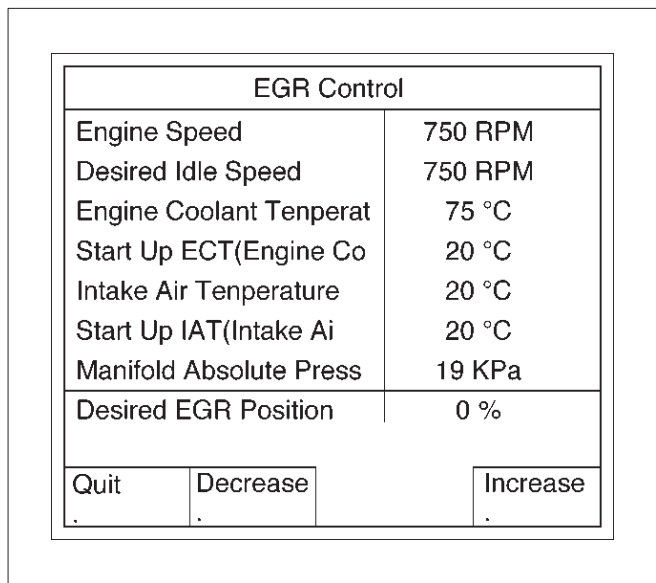
060RX008

3. Select F3: Miscellaneous Test in the Application Menu.



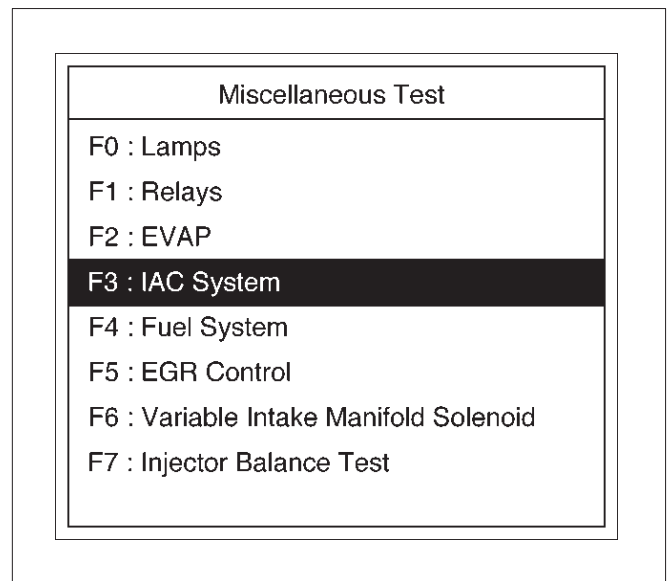
060RW228

5. Instruct EGR Valve to check a data list.



060RW234

4. Select F3: IAC System Test in the Miscellaneous Test.



060RX007

6. If change in the data list shows a normal valve.

Idle Air Control System Test

This test is conducted check IAC system for its working. Tech 2 must be used for this test.

Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

5. Select F1: IAC Control Test.

Application Menu	
F0 : RPM Control	
F1 : IAC Control	
F2 : IAC Reset	

060RW235

● F0: RPM Control

RPM Control	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Tenperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Temperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Desired Idle Speed	750 RPM
Quit	Decrease Increase

060RW232

6. Instruct IAC system to check a data list.

IAC Control	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Tenperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Temperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Idle Air Control	21 Steps
Quit	Decrease Increase

060RW233

● F2: IAC Reset

IAC Reset	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Tenperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Temperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Idle Air Control	21 Steps
Quit	Reset IAC

060RW231

7. If change in the data list shows a normal IAC.

Primary System-Based Diagnostic

Primary System-Based Diagnostic

There are primary system-based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are diagnosed for the following conditions:

- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to *On-Vehicle Service, Heated Oxygen Sensors*.

Fuel Control Heated Oxygen Sensor

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in closed loop to adjust fuel injector pulse width. While in closed loop, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors (Bank 1 HO2S 1 and Bank2 HO2S 1) to become active. Oxygen sensor heaters are required to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Fuel Trim System Monitor Diagnostic Operation

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

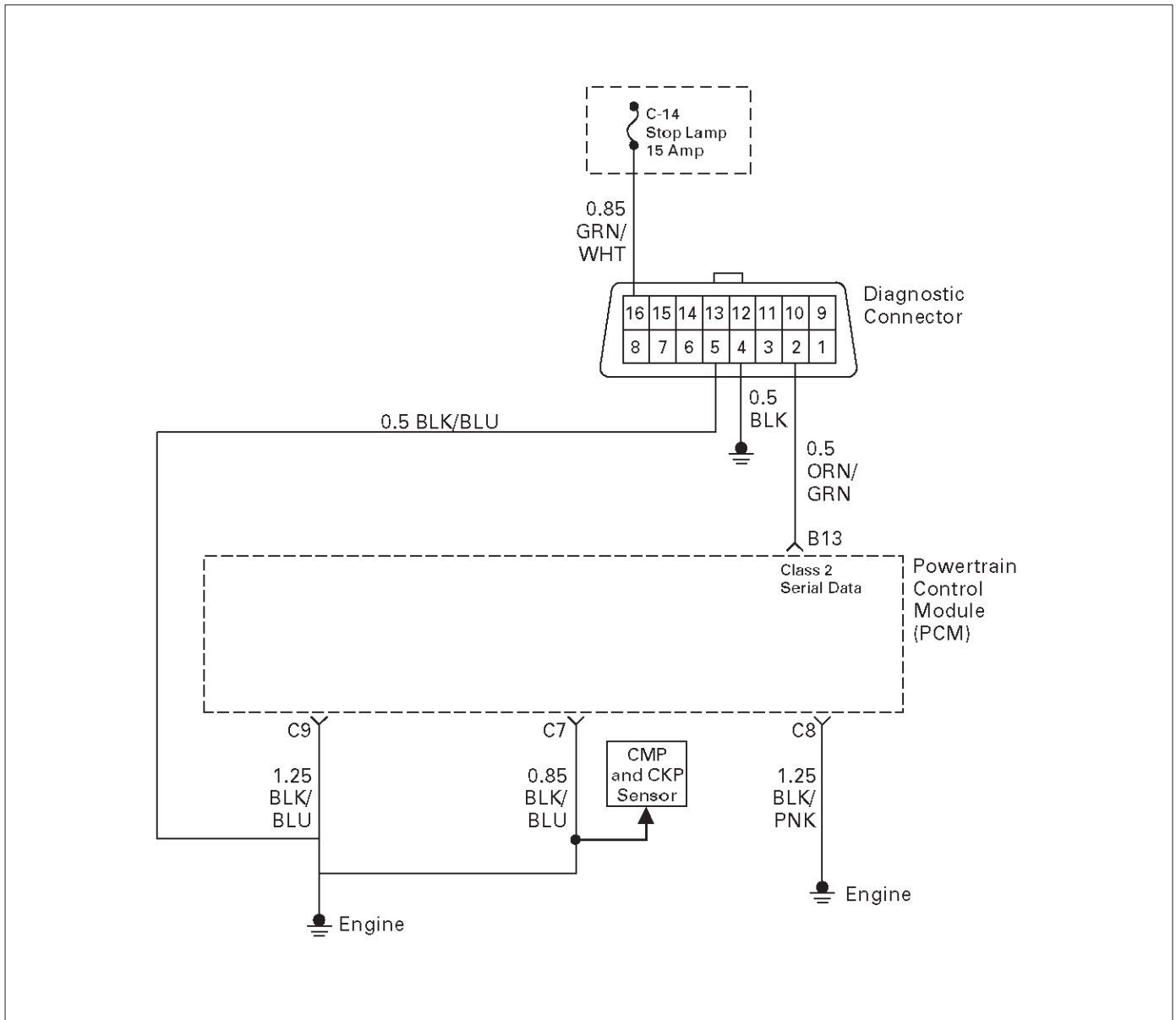
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use a Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use a Tech 2 to observe fuel trim counts while the problem is occurring.

On-Board Diagnostic (OBD) System Check



TS321119

Circuit Description

The on-board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on-board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The MIL ("Check Engine" lamp) should be "ON" steady with the ignition "ON"/engine "OFF." If not, Chart A-1 should be used to isolate the malfunction.
2. Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.
3. This test ensures that the PCM is capable of controlling the MIL ("Check Engine" lamp) and the MIL ("Check Engine" lamp) driver circuit is not shorted to ground.
4. If the engine will not start, the *Cranks But Will Not Run* chart should be used to diagnose the condition.
7. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

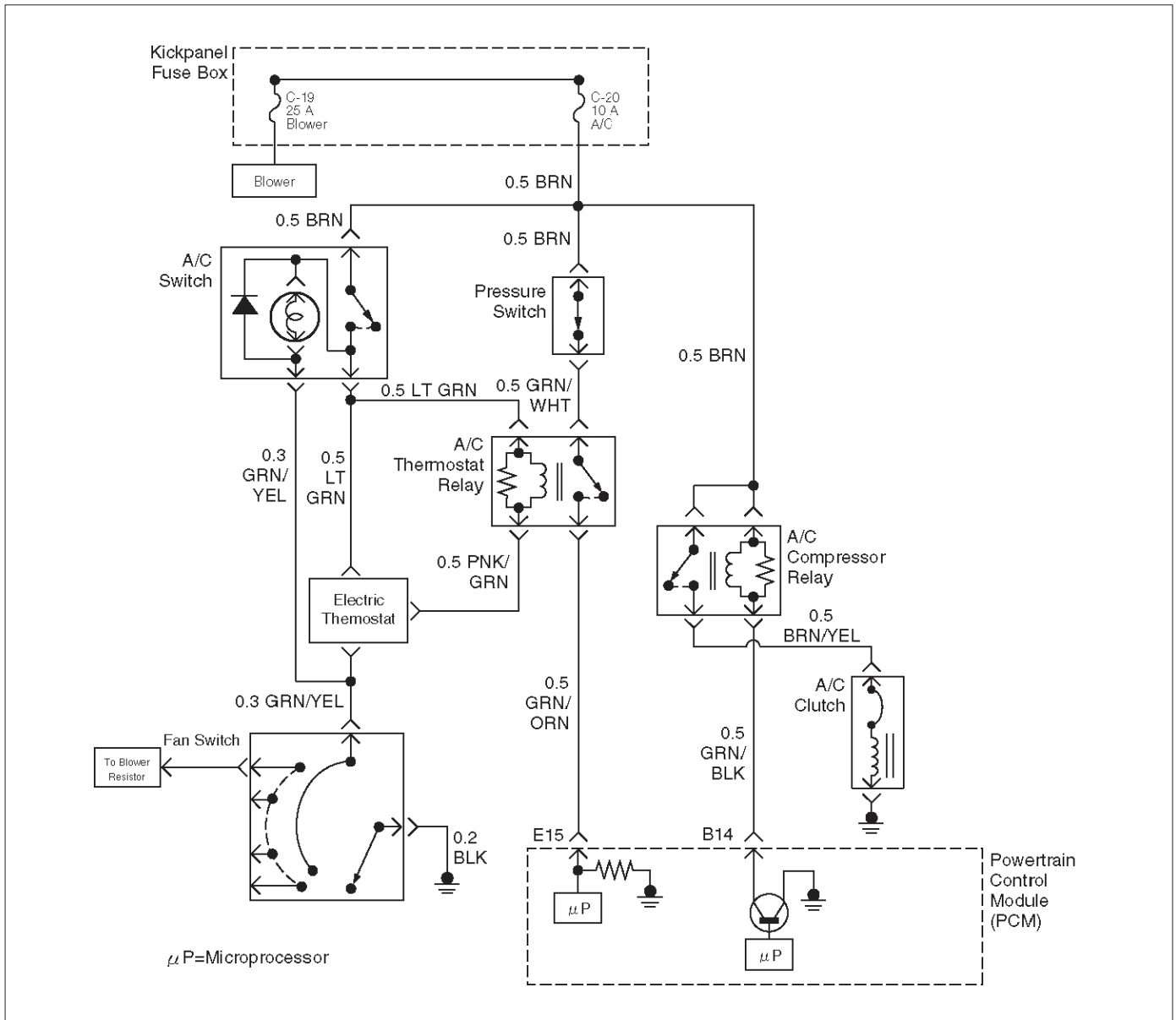
6E-52 ENGINE DRIVEABILITY AND EMISSIONS

10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. *Refer to UBS 98 model year Immobilizer Workshop Manual.*

On-Board Diagnostic (OBD) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "ON," engine "OFF." 2. Observe the malfunction indicator lamp (MIL or "Check Engine" lamp). Is the MIL ("Check Engine" lamp) "ON?"	—	Go to Step 2	Go to No MIL ("Check Engine" lamp)
2	1. Ignition "OFF." 2. Install a Tech 2. 3. Ignition "ON." 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to Step 3	Go to Step 8
3	1. Using the Tech 2 output tests function, select MIL ("Check Engine" lamp) dash lamp control and command the MIL ("Check Engine" lamp) "OFF." 2. Observe the MIL ("Check Engine" lamp). Did the MIL ("Check Engine" lamp) turn "OFF?"	—	Go to Step 4	Go to MIL ("Check Engine" lamp) On Steady
4	Attempt to start the engine. Did the engine start and continue to run?	—	Go to Step 5	Go to Cranks But Will Not Run
5	Select "Display DTCs" with the Tech 2. Are any DTCs stored?	—	Go to Step 6	Go to Step 7
6	Are two or more of the following DTCs stored? P0107, P0108, P0113, P0118, P0122, P0123, P0712.?	—	Go to "Multiple PCM Information Sensor DTCs Set"	Go to applicable DTC table
7	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Refer to Typical scan data value	Refer to indicated Component System Checks
8	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," engine "OFF." 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. 4. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 2	Go to Step 9
9	Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to Step 2	Go to Step 10
10	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>Powertrain Control Module (PCM) in On-Vehicle Service</i> . Is the action complete?	—	Go to Step 2	—

A/C Clutch Control Circuit Diagnosis



Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerant charge, a 12-volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily canceled during system operation by the electronic thermostat in the evaporator case. The electronic thermostat may intermittently remove the control circuit ground for the A/C thermostat relay to prevent the evaporator from forming ice. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, voltage is supplied to the compressor clutch coil. The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125 °C (257 °F).
- The intake air temperature (IAT) is less than 5 °C (41 °F).
- The power steering pressure switch signals a cramped position.

Diagnostic Aids

To diagnose an the intermittent fault, check for the following conditions:

- Poor connection at the PCM—Inspect connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness—Inspect the wiring harness for damage. If the harness appears to OK, observe the A/C clutch while moving connectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent fault.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commanded the A/C clutch “ON.” The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

Test Description

IMPORTANT: Do not engage the A/C compressor clutch with the engine running if an A/C mode is not selected at the A/C control switch.

The numbers below refer to the step numbers on the Diagnostic Chart:

3. This a test determine is the problem is with the refrigerant system. If the switch is open, A/C pressure gauges will be used to determine if the pressure switch is faulty or if the system is partially discharged or empty.
4. Although the normal complaint will be the A/C clutch failing to engage, it is possible for a short circuit to cause the clutch to run when A/C has not been selected. This step is a test for that condition.
7. There is an extremely low probability that both relays will fail at the same time, so the substitution process is one way to check the A/C Thermostat relay. Use a known good relay to do a substitution check.
9. The blower system furnishes a ground for the A/C control circuit, and it also shares a power source through the Heater and A/C Relay. The blower must be “ON” in order to test the A/C system.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other DTCs stored?	—	Go to the other DTC chart(s) first	Go to Step 3
3	1. Disconnect the electrical connector at the pressure switch located on the receiver/drier. 2. Use an ohmmeter to check continuity across the pressure switch. Is the pressure switch open?	—	Go to Air Conditioning to diagnose the cause of the open pressure switch	Go to Step 4
4	IMPORTANT: Before continuing with the diagnosis, the following conditions must be met: <ul style="list-style-type: none"> • The intake air temperature must be greater than 15°C. (60°F). • The engine coolant temperature must be less than 119°C (246°F). 1. A/C “OFF.” 2. Start the engine and idle for 1 minute. 3. Observe the A/C compressor. Is the A/C compressor clutch engaged even though A/C has not been requested?	—	Go to Step 45	Go to Step 5
5	1. Idle the engine. 2. A/C “ON”. 3. Blower “ON”. 4. Observe the A/C compressor. Is the A/C compressor magnetic clutch engaged?	—	Refer to Diagnostic Aids	Go to Step 6

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Engine idling. 2. A/C "ON". 3. Blower "ON". 4. Observe the "A/C Request" display on the Tech 2. Does the tool "A/C Request" display indicate "Yes?"	—	Go to <i>Step 34</i>	Go to <i>Step 7</i>
7	Temporarily substitute the A/C compressor relay in place of the A/C thermostat relay, then repeat Step 5. Did the "A/C Request" display indicate "Yes?"	—	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	Replace the original A/C thermostat relay. Is the action complete?	—	Verify repair	—
9	Does the blower operate?	—	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	Repair the blower. Is the action complete?	—	Verify repair	—
11	Check for a faulty 10a A/C fuse in the underdash fuse panel. Was the 10A fuse OK?	—	Go to <i>Step 13</i>	Go to <i>Step 12</i>
12	Check for short circuit and make repairs if necessary. Replace the 10A A/C fuse. Is the action complete?	—	Verify repair	—
13	1. Ignition "ON." 2. Use a DVM to check voltage at the positive A/C switch wire (BRN). Was voltage equal to the specified value?	+B	Go to <i>Step 15</i>	Go to <i>Step 14</i>
14	Repair the open wire (BRN) between the A/C switch and the A/C fuse. Is the action complete?	—	Verify repair	—
15	1. Remove the glove box to gain access to the A/C thermostat. 2. Disconnect the thermostat connector. 3. Attach a fused jumper between ground and the PNK/GRN wire at the thermostat. 4. A/C "ON." 5. Blower "ON." Does A/C request indicate "YES" on the Tech 2?	—	Go to <i>Step 16</i>	Go to <i>Step 23</i>
16	1. Ignition "ON." 2. Use a DVM to check voltage at the electronic A/C thermostat. Was voltage equal to the specified value?	+B	Go to <i>Step 20</i>	Go to <i>Step 17</i>
17	Check for an open (LT GRN) between the thermostat and the A/C switch. Was the wire open?	—	Go to <i>Step 18</i>	Go to <i>Step 19</i>
18	Repair the open wire (LT GRN) between the thermostat and the A/C switch. Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
19	Replace the A/C switch. Is the action complete?	—	Verify repair	—
20	Use an ohmmeter to check continuity between the electronic A/C thermostat and the blower switch. Was there an open circuit?	—	Go to Step 21	Go to Step 22
21	Repair the open wire (GRN/YEL) between the thermostat and the blower switch. Is the action complete?	—	Verify repair	—
22	Replace the electronic A/C thermostat. Is the an action complete?	—	Verify repair	—
23	Check for an open circuit between A/C thermostat relay and PCM A/C request terminal (E-15). Was there an open circuit?	—	Go to Step 24	Go to Step 25
24	Repair the open circuit between the PCM and A/C thermostat relay. Is the action complete?	—	Verify repair	—
25	Check for an open circuit between the A/C switch (LT GRN) and the A/C thermostat relay (LT GRN). Was there an open circuit?	—	Go to Step 26	Go to Step 27
26	Repair the open circuit between the A/C switch and the A/C thermostat relay. Is the action complete?	—	Verify repair	—
27	1. Ignition "ON." 2. Use a DVM to check voltage at the A/C pressure switch (BRN). Was voltage equal to the specified value?	+B	Go to Step 29	Go to Step 28
28	Repair the open circuit between the 10A A/C fuse and the pressure switch. Is the action complete?	—	Verify repair	—
29	Use an ohmmeter to check continuity between the pressure switch (GRN/WHT) and the A/C thermostat relay (GRN/WHT). Was the circuit open?	—	Go to Step 30	Go to Step 31
30	Repair the open circuit between the pressure switch and the A/C thermostat relay. Is the action complete?	—	Verify repair	—
31	Check for damaged pin or terminal at E-15 of the PCM. Was a damaged pin or terminal found?	—	Go to Step 32	Go to Step 33
32	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
33	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
34	1. Remove the A/C compressor relay. 2. Ignition "ON." 3. Use a DVM to check voltage at both of the BRN wires at the A/C compressor relay socket. Is the voltage equal to the specified value?	+B	Go to <i>Step 36</i>	Go to <i>Step 35</i>
35	Repair the faulty BRN wire between the A/C fuse and the A/C compressor relay . Is the action complete?	—	Verify repair	—
36	1. A/C compressor relay removed. 2. Engine idling. 3. A/C "ON." 4. Blower "ON." 5. Use a DVM to measure voltage between the GRN/BLK wire at the A/C compressor relay socket and battery±. Did the DVM indicate the specified value?	+B	Go to <i>Step 40</i>	Go to <i>Step 37</i>
37	Check for an open GRN/BLK wire between PCM terminal B-14 and the A/C compressor relay. Was the wire open?	—	Go to <i>Step 38</i>	Go to <i>Step 39</i>
38	Repair the open GRN/BLK wire between the PCM and the A/C compressor relay. Is the action complete?	—	Verify repair	—
39	Check for a damaged pin or terminal at B-14 of the PCM. Was a damaged pin or a terminal found?	—	Go to <i>Step 32</i>	Go to <i>Step 33</i>
40	1. A/C compressor relay removed. 2. Connect a fused jumper at the A/C compressor relay socket between either BRN wire and the BRN/YEL wire. 3. Engine idling. 4. A/C "ON." 5. Blower "ON." Did the compressor magnetic clutch engage?	—	Go to <i>Step 41</i>	Go to <i>Step 42</i>
41	Repair the A/C compressor relay. Is the action complete?	—	Verify repair	—
42	Check for an open circuit between the A/C compressor relay and the A/C clutch. Was an open circuit found?	—	Go to <i>Step 43</i>	Go to <i>Step 44</i>
43	Repair the open circuit between the compressor Clutch and the A/C compressor relay. Is the action complete?	—	Verify repair	—
44	Service the compressor clutch or replace the compressor due to a faulty internal overheat switch. Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
45	1. Remove the A/C compressor relay. 2. Idle the engine. Is the compressor clutch still engaged when A/C is not selected?	—	Go to <i>Step 46</i>	Go to <i>Step 47</i>
46	Repair the short to voltage between the A/C clutch and A/C compressor relay. Is the action complete?	—	Verify repair	—
47	1. Reinstall the A/C compressor relay. 2. Remove the A/C thermostat relay. 3. Engine idling. Is the compressor clutch still engaged when A/C is not selected?	—	Go to <i>Step 48</i>	Go to <i>Step 50</i>
48	Use a DVM to check for a short to ground between the A/C compressor relay and B-14 of the PCM. Was a short detected?	—	Go to <i>Step 49</i>	Go to <i>Step 33</i>
49	Repair the short to ground between the PCM and A/C compressor relay. Is the action complete?	—	Verify repair	—
50	Repair the short to ground between the A/C thermostat relay and the electronic thermostat. Is the action complete?	—	Verify repair	—

Electronic Ignition System Diagnosis

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is the ignition system or the fuel system. If DTC P0341, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis. If a misfire is being experienced with no DTC set, refer to the *Symptoms* section for diagnosis.

Fuel Metering System Check

Some failures of the fuel metering system will result in an “Engine Cranks But Will Not Run” symptom. If this condition exists, refer to the *Cranks But Will Not Run* chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.

Refer to *Fuel System Electrical Test* for the fuel system wiring schematic.

If there is a fuel delivery problem, refer to *Fuel System Diagnosis*, which diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the fuel trim values are greater than +23%, refer to *DTC P0131, DTC P0151, DTC P0171, and DTC 1171* for items which can cause a lean HO2S signal.

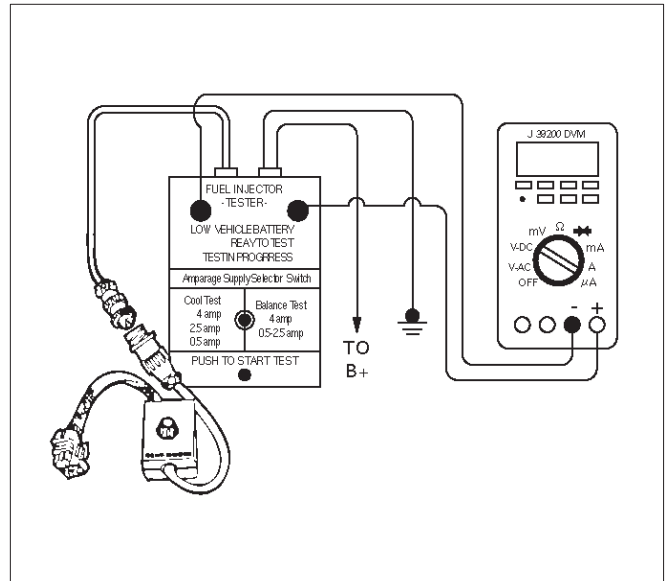
Idle Air Control (IAC) Valve

The Tech 2 displays the IAC pintle position in counts. A count of “0” indicates the PCM is commanding the IAC pintle to be driven all the way into a fully-seated position. This is usually caused by a large vacuum leak. The higher the number of counts, the more air is being commanded to bypass the throttle blade. Refer to IAC System Check in order to diagnose the IAC system. Refer to *Rough, Unstable, or Incorrect Idle, Stalling in Symptoms* for other possible causes of idle problems.

Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to *Fuel Systems Diagnosis*.

Fuel Injector Coil Test Procedure and Fuel Injector Balance Test Procedure



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the 5-8840-0378-0 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch “OFF,” open the valve on the fuel pressure gauge.

3. Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10°C-35°C (50°F-95°F)
11.8 – 12.6	5.7 – 6.6

- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.

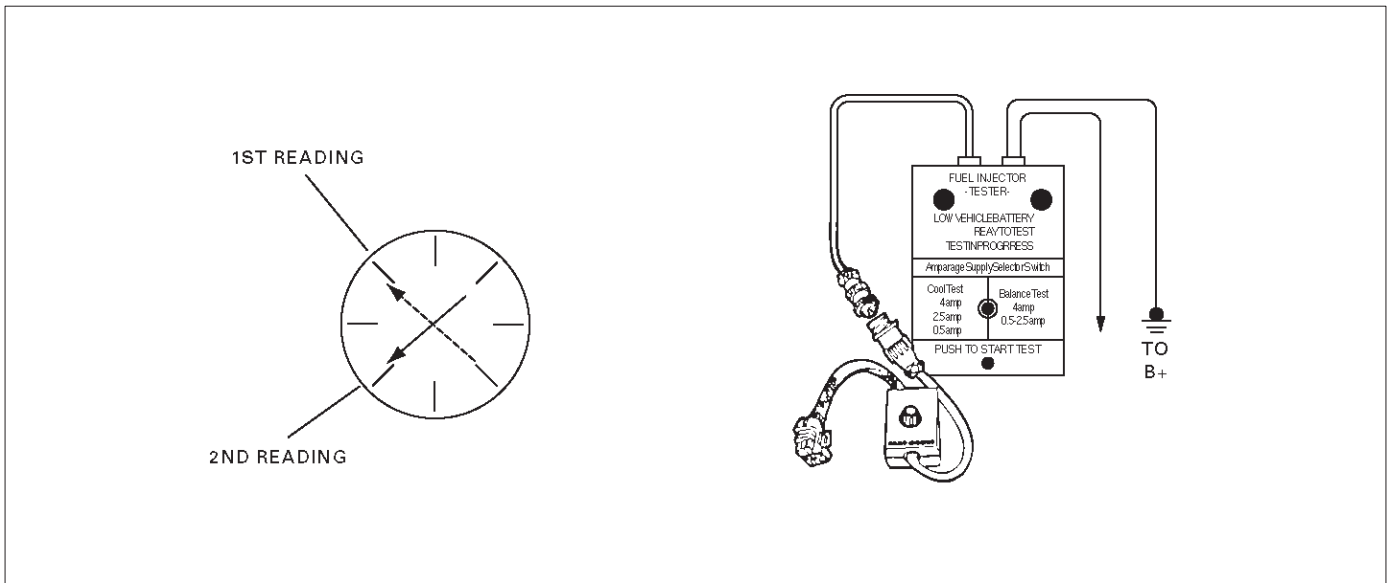
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35°C/10°C (95°F/50°F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volts

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool-down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to "Hot Soak" fuel boiling.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)



R262001

CYLINDER	1	2	3	4	5	6
1st Reading (1)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
2nd Reading (2)	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)	131 kPa (19 psi)	130 kPa (19 psi)
Amount of Drop (1st Reading-2nd Reading)	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)	165 kPa (24 psi)	166 kPa (24 psi)
Av.drop = 166 kPa/24 psi ± 10 kPa/1.5 psi = 156 - 176 kPa or 22.5 - 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)	OK	OK

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Turn the engine "OFF."</p> <p>NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure.</p> <p>2. Relieve the fuel pressure. Refer to <i>Test Description Number 2</i>.</p> <p>3. Connect the 5-8840-2638-0 Fuel Injector Tester to B+ and ground, and to the 5-8840-2619-0 Injector Switch Box.</p> <p>4. Connect the injector switch box to the grey fuel injector harness connector located on the front of the EVAP canister bracket.</p> <p>5. Set the amperage supply selector switch on the fuel injector tester to the "Coil Test" 0.5 amp position.</p> <p>6. Connect the leads from the 5-8840-0285-0 Digital Voltmeter (DVM) to the injector tester. Refer to the illustrations associated with the test description.</p> <p>7. Set the DVM to the tenths scale (0.0).</p> <p>8. Observe the engine coolant temperature.</p> <p>Is the engine coolant temperature within the specified values?</p>	10°C (50°F) to 35°C (95°F)	Go to Step 3	Go to Step 5
3	<p>1. Set injector switch box injector #1.</p> <p>2. Press the "Push to Start Test" button on the fuel injector tester.</p> <p>3. Observe the voltage reading on the DVM.</p> <p>IMPORTANT: The voltage reading may rise during the test.</p> <p>4. Record the lowest voltage observed after the first second of the test.</p> <p>5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4.</p> <p>Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?</p>	5.7-6.6 V	Go to Step 4	Go to Step 7
4	<p>Replace the faulty fuel injector(s). Refer to <i>Fuel Injector</i>.</p> <p>Is the action complete?</p>	—	Go to Step 7	—

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	<ol style="list-style-type: none"> 1. Set injector switch box injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. <p>IMPORTANT: The voltage reading may rise during the test.</p> <ol style="list-style-type: none"> 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. <p>Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?</p>	9.5 V	Go to Step 4	Go to Step 6
6	<ol style="list-style-type: none"> 1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. <p>For any injector, is the subtracted Value in step 2 greater than the specified value?</p>	0.6 V	Go to Step 4	Go to Step 7
7	<p>CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.</p> <ol style="list-style-type: none"> 1. Connect the 5-8840-0378-0 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the scan tool. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. <p>Is the fuel pressure within the specified values?</p>	296-376 kPa (43-55 psi)	Go to Step 8	Go to Fuel System Diagnosis
8	<p>Turn the fuel pump "OFF."</p> <p>Does the fuel pressure remain constant?</p>	—	Go to Step 9	Go to Fuel System Diagnosis

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
9	<ol style="list-style-type: none"> 1. Connect the 5-8840-2638-0 Fuel Injector Tester and 5-8840-2619-0 Injector Switch Box the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the scan tool turn the fuel pump "ON" then "OFF" in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the "Push to Start Test" button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. <p>Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?</p>	10 kPa (1.5 psi)	Go to Step 10	Go to <i>OBD System Check</i>
10	<p>Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 11.</p> <p>NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding.</p> <p>Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?</p>	10 kPa (1.5 psi)	Go to Step 11	Go to <i>Symptoms</i>
11	<p>Replace the faulty fuel injector(s). Refer to <i>Fuel Injector</i>.</p> <p>Is the action complete?</p>	—	Verify repair	—

Knock Sensor Diagnosis

The Tech 2 has two data displays available for diagnosing the knock sensor (KS) system. The two displays are described as follows:

- “Knock Retard” indicates the number of degrees that the spark timing is being retarded due to a knock condition.
- “KS Noise Channel” indicates the current voltage level being monitored on the noise channel.

DTCs P0325 and P0327 are designed to diagnose the KS module, the knock sensor, and the related wiring. The problems encountered with the KS system should set a DTC. However, if no DTC was set but the KS system is suspect because of a detonation complaint, refer to *Detonation/Spark Knock in Symptoms*.

Powertrain Control Module (PCM) Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition “OFF” and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all component and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned “ON” and “OFF” by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

Multiple PCM Information Sensor DTCs Set

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions. The PCM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors. The PCM applies 5 volts through a pull-up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5-volt supply and the resistor:

- The engine coolant temperature (ETC) sensor
 - The intake air temperature (IAT) sensor
 - The transmission fluid temperature (TFT) sensor
- The PCM provides the following sensors with a 5-volt reference and a sensor ground signal:

- The exhaust gas recirculating (EGR) pintle position sensor
- The throttle position (TP) sensor
- The manifold absolute pressure (MAP) sensor

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

IMPORTANT: Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0108
- P0113
- P0118
- P0123
- P0560
- P0712
- P0406

IMPORTANT: If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0108
- P0113
- P0118
- P0123
- P0712
- P0406

A short to ground in the 5-volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0107
- P0122

In the 5-volt reference circuit A, between the PCM and the splice, will cause one or more of the following DTCs to be set:

- P0122

In the 5-volt reference circuit B, between the PCM and the splice, will cause one or more of the following DTCs to be set:

- P0107

Check for the following conditions:

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- **Poor connection at PCM.** Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and a poor terminal-to-wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor's displayed value on the Tech 2 with the ignition "ON" and the engine "OFF" while you move the connectors and the wiring harnesses related to the following sensors:
 - IAT
 - ECT
 - TP
 - MAP
 - EGR
 - TFT

Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Turn the ignition "OFF," disconnect the PCM. 2. Turn the ignition "ON," check the 5 volt reference A circuit for the following conditions: <ul style="list-style-type: none"> ● A poor connection at the PCM. ● An open between the PCM connector and the splice. ● A short to ground. ● A short to voltage. Is there an open or short?	—	Go to Step 3	Go to Step 4
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: <ul style="list-style-type: none"> ● A poor connection at the PCM or the affected sensors. ● An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to Step 5	Go to Step 6
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to Step 7	Go to Step 12
7	Measure the voltage between the MAP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to Step 8	Go to Step 15
8	Measure the voltage between the TP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to Step 9	Go to Step 16
9	Measure the voltage between the IAT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to Step 10	Go to Step 17
10	Measure the voltage between the ECT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to Step 11	Go to Step 18

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Disconnect the EGR valve. 2. Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to <i>Step 13</i>	Go to <i>Step 18</i>
12	Measure the voltage between the TFT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to <i>Step 20</i>	Go to <i>Step 19</i>
13	Replace the EGR valve. Is the action complete?	—	Verify repair	—
14	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to voltage in the TP sensor signal circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to voltage in the IAT sensor signal circuit. Is the action complete?	—	Verify repair	—
17	Locate and repair the short to voltage in the ECT sensor signal circuit. Is the action complete?	—	Verify repair	—
18	Locate and repair the short to voltage in the EGR pintle position sensor signal circuit. Is the action complete?	—	Verify repair	—
19	Locate and repair the short to voltage in the TFT sensor signal circuit. Is the action complete?	—	Verify repair	—
20	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Go to <i>OBD System Check</i>	—

Exhaust Gas Recirculation (EGR) Diagnosis (For except EXPORT and SOUTH AFRICA)

Pintle position error diagnosis is covered by DTC P0402, P0404, P1404, P0405, P0406. If EGR diagnostic trouble codes P0402, P0404, P1404, P0405, P0406 are encountered, refer to the DTC charts.

Engine Tech 2 Data Definitions and Ranges

A/C CLUTCH — Tech 2 Displays ON or OFF —

Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostic.

A/C REQUEST — Tech 2 Displays YES or NO —

Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO — Tech 2 Range 0.0-25.5 —

Air/fuel ratio indicates the PCM commanded value. In closed loop, the air/fuel ratio should normally be displayed around "14.2-14.7." A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

BAROMETRIC PRESSURE — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —

The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around "61-104" depending on altitude and barometric pressure.

CHECK TRANS LAMP — AUTO TRANSMISSION —

Indicates the need to check for a DTC with the Tech 2 when the lamp is flashing 0.2 seconds ON and 0.2 seconds OFF.

CMP ACT. COUNTER — Cam Position Activity DECEL FUEL MODE — Tech 2 Display ACTIVE or INACTIVE —

"ACTIVE" displayed indicates that the PCM has detected conditions appropriate to operate in deceleration fuel mode. The PCM will command the deceleration fuel mode when it detects a closed throttle position while the vehicle is traveling over 20 mph. While in the deceleration fuel mode, fuel is delivered by entering open loop and decreasing the injector pulse width.

DESIRED EGR POS. — Tech 2 Range 0%-100% —

Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE — Tech 2 Range 0-3187 RPM —

The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT — (Engine Coolant Temperature) Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE — Tech 2 Range 0%-100% —

Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK — Tech 2 Range 0.00-5.00 Volts —

Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

ENGINE LOAD — Tech 2 Range 0%-100% —

Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME — Tech 2 Range 00:00:00-99:99:99 Hrs:Min:Sec —

Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED — Range 0-9999 RPM —

Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

FUEL PUMP — Tech 2 Displays ON or OFF —

Indicates the PCM commanded state of the fuel pump relay driver circuit.

FUEL TRIM CELL — Tech 2 Range 0-21 —

The fuel trim cell is dependent upon engine speed and MAF sensor readings. A plot of RPM vs. MAF is divided into 22 cells. Fuel trim cell indicates which cell is currently active.

FUEL TRIM LEARN — Tech 2 Displays NO or YES —

When conditions are appropriate for enabling long term fuel trim corrections, fuel trim learn will display "YES." This indicates that the long term fuel trim is responding to the short term fuel trim. If the fuel trim learn displays "NO," then long term fuel trim will not respond to changes in short term fuel trim.

HO2S BANK 1, SEN. 1 — Tech 2 Range 0-1132 mV —

Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK2, SEN. 1—Tech 2 Range 0-1132 mV—

Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 1, SEN. 1—Tech 2 Displays NOT READY or READY—

Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S BANK 2, SEN. 1 — Tech 2 Displays NOT READY or READY —

Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1/BANK 2 SEN. 1 — Tech 2 Range 00:00:00-99:99:99 HRS:MIN:SEC —

Indicates warm-up time for each HO2S. The HO2S warm-up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm-up will the display "00:00:00".

IAC POSITION — Tech 2 Range 0-255 Counts —

Displays the commanded position of the idle air control pintle in counts. A larger number of counts means that more air is being commanded through the idle air passage. Idle air control should respond fairly quickly to changes in engine load to maintain desired idle RPM.

IAT (INTAKE AIR TEMPERATURE) — Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 — Tech 2 Range 0-25.5 Volts —

This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1/INJ. PULSE BANK 2 — Tech 2 Range 0-1000 msec. —

Indicates the amount of time the PCM is commanding each injector "ON" during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

KS NOISE CHANNEL (Knock Sensor) —

Indicates the output from the KS noise channel. There is always some electrical noise in an engine compartment and to avoid mistaking this as engine knock, the output from the knock sensor is compared to the output from the noise channel. A knock condition is not set unless the knock sensor output is greater than the noise channel output.

LONG TERM FUEL TRIM BANK 1/BANK 2 —

The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

LOOP STATUS — Tech 2 Displays OPEN or CLOSED —

"CLOSED" indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In "OPEN" the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAF — Tech 2 Range 0.0-512 gm/s —

MAF (mass air flow) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAP — Tech 2 Range 10-105 kPa (0.00-4.97 Volts) —

The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL — Tech 2 Displays ON or OFF —

Indicates the PCM commanded state of the malfunction indicator lamp.

POWER ENRICHMENT — Tech 2 Displays ACTIVE or INACTIVE —

"ACTIVE" displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in power enrichment mode, the PCM will increase the amount of fuel delivered by entering open loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

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SPARK — Tech 2 Range -64° to 64° —

Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START-UP ECT — Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

START-UP IAT — Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

TP — Tech 2 Range 0%-100% —

TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display "0%" at idle and "100%" at wide open throttle.

TP SENSOR — Tech 2 Range 0.00-5.00 Volts —

The voltage being monitored by the PCM on the TP sensor signal circuit.

CATALYST PROTECTION MODE — Tech 2 Displays YES or NO —

"YES" displayed indicates that the PCM has detected conditions appropriate to operate in TWC protection mode. The PCM will decrease the air/fuel ratio to a value that depends on mass air flow (higher mass air flow = lower air/fuel ratio).

UPSHIFT LAMP (MANUAL TRANSMISSION)

VEHICLE SPEED — Tech 2 Range 0-255 km/h (0-155 mph) —

The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER — Tech 2 Displays Cylinder Number —

This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessories off, brake not applied and air conditioning off.

Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

3.2/3.5L V-6 Engine

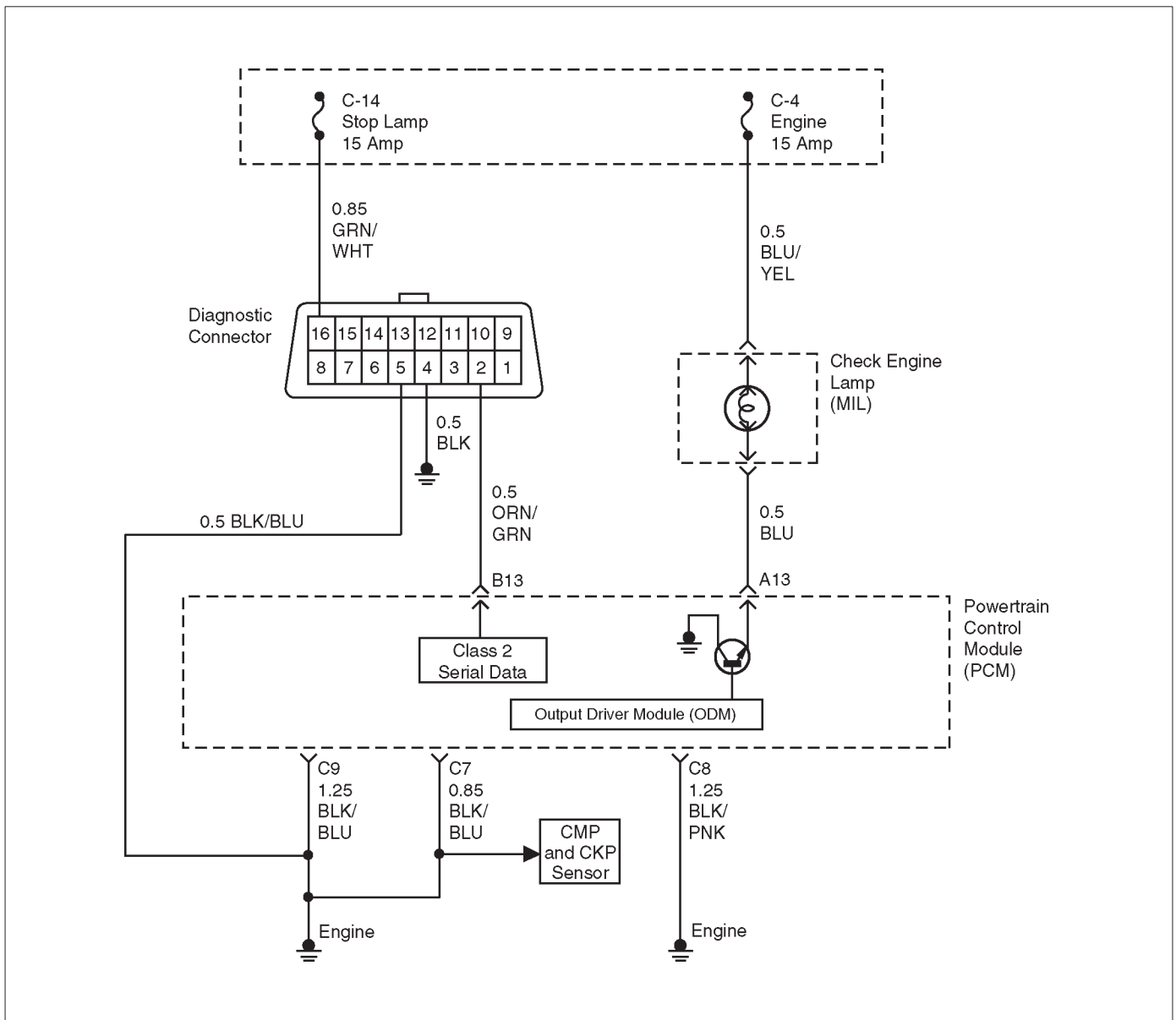
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
A/C Clutch	Engine	On/Off	Off	Off	General Description and Operation, A/C Clutch Circuit Operation
A/C Request	Engine	Yes/No	No	No	General Description and Operation, A/C Request Signal
Air/Fuel Ratio	Engine	Ratio: _ to 1	14.7	14.7	General Description and Operation, Fuel System Metering Purpose
Barometric Pressure	Engine	kPa	61-104 (depends on altitude and barometric)	61-104 (depends on altitude and barometric)	General Description and Operation
CMP Act. Counter (Cam Position Activity)	Engine	Counts	0-255, always increasing	0-255, always increasing	DTC P0341 and P0342
Decel Fuel Mode	Engine	Active/Inactive	Inactive	Inactive	General Description and Operation, Deceleration Mode
Desired EGR Position	Engine	Percent	0%	0%	General Description and Operation, EGR Pintle Position Sensor
Desired Idle	Engine	RPM	750	—	General Description and Operation, Idle Air Control (IAC) Valve
ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	80-100°C (176-212°F)	80-100°C (176-212°F)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
EGR Closed Valve Pintle Position	Engine	Steps	20-40	20-40	General Description and Operation, EGR Pintle Position Sensor
EGR Duty Cycle	Engine	Percent	0%	0%	General Description and Operation, Linear EGR Operation and Results of Incorrect Operation
EGR Feedback	Engine	Volts	0.45-0.80	0.45-0.80	—
EGR Normalized	Engine	Percent	0%	0%	—
Engine Load	Engine	Percent	2.0% - 5.5%	8.0% - 16.0%	General Description and Operation, Mass Air Flow (MAF) Sensor
Time From Start	Engine	Sec	Varies. Resets at each engine start.	Varies. Resets at each engine start.	—
Engine Speed	Engine	RPM	Within -50 to +100 of "Desired Idle"	Actual engine speed	DTCs: P1508, P1509
Fuel Pump	Engine	On/Off	On	On	Engine Fuel
HO2S Bank 1 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950, always changing quickly	General Description and Operation, Fuel control HO2S

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Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
HO2S Bank 2 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Control HO2S
HO2S Bank 1 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S; DTC: P0135
HO2S Bank 2 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	0-100°C, depends on underhood	0-80°C, depends on underhood	General Description and Operation, Intake Air Temperature (IAT) Sensor
Ignition Voltage	Engine	Volts	12.8-14.1	12.8-14.1	General Description and Operation, Electronic Ignition System
Inj. Pulse Bank 1	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Inj. Pulse Bank 2	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
KS Noise Channel (Knock Sensor)	Engine	Volts	0.10-0.40	0.50-1.75	General Description and Operation, Knock Sensor Purpose and Operation; DTCs: P0352, P0327
Loop Status	Engine	Open/Closed	Closed	Closed	General Description and Operation, Fuel Metering System; DTCs: P0125-P0155
MAF (Mass Air Flow)	Engine	Grams per second	2.85-6.65	9.5-16.5	General Description and Operation, MAF; DTCs: P101, P0102, P0103
MAP kPa (Manifold Absolute Pressure)	Engine	Kilopascals	—	—	General Description and Operation, Manifold Absolute Pressure (MAP) Sensor; DTCs: P0106, P0107, P0108
MIL	Engine	On/Off	Off	Off	On-Board Diagnostic System Check
Power Enrichment	Engine	Inactive/Active	Inactive	Inactive	General Description and Operation, Acceleration Mode
Spark (Advance)	Engine	Degrees Before Top Dead Center	15-22	34-44	General Description and Operation, Electronic Ignition System

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Start-Up ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	Depends on engine coolant temperature at time of start-up	Depends on engine coolant temperature at time of start-up	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
Start-Up IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	Depends on intake air temperature at time of start-up	Depends on intake air temperature at time of start-up	General Description and Operation, Intake Air Temperature (IAT) Sensor
TP (Throttle Position)	Engine	Percent	0	—	General Description and Operation, Throttle Position (TP) Sensor; DTCs: P0121, P0122,P0123
TP Sensor (Throttle Position)	Engine	Volts	0.50-0.82	0.60-1.00	General Description and Operation, Throttle Position (TP) Sensor; DTCs: P0121, P0122,P0123
Catalyst Protection Mode	Engine	No/Yes	No	No	General Description, Fuel Metering, catalytic Converter Protection Mode
Vehicle Speed	Engine	MPH / km/h	0	0	4L30-E Automatic Transmission Diagnosis
EVAP Purge Solenoid	Engine	Percent	65	99	General Description
VIM Solenoid	Engine	On/Off	On	On	General Description
Security Wait Time	Engine	Active/Inactive	Inactive	Inactive	—

No Malfunction Indicator Lamp (MIL)



D06RW0006

Circuit Description

The "Check Engine" lamp (MIL) should always be illuminated and steady with the ignition "ON" and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL "ON" by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.

- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A "No MIL" condition accompanied by a no-start condition suggests a faulty PCM ignition feed or battery feed circuit.
9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to *PCM Terminal End View* for terminal locations of the PCM ground circuits.
12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as "good" simply by honking the horn. Replace the horn relay after completing this step.

17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *UBS 98 model year Immobilizer Workshop Manual*.

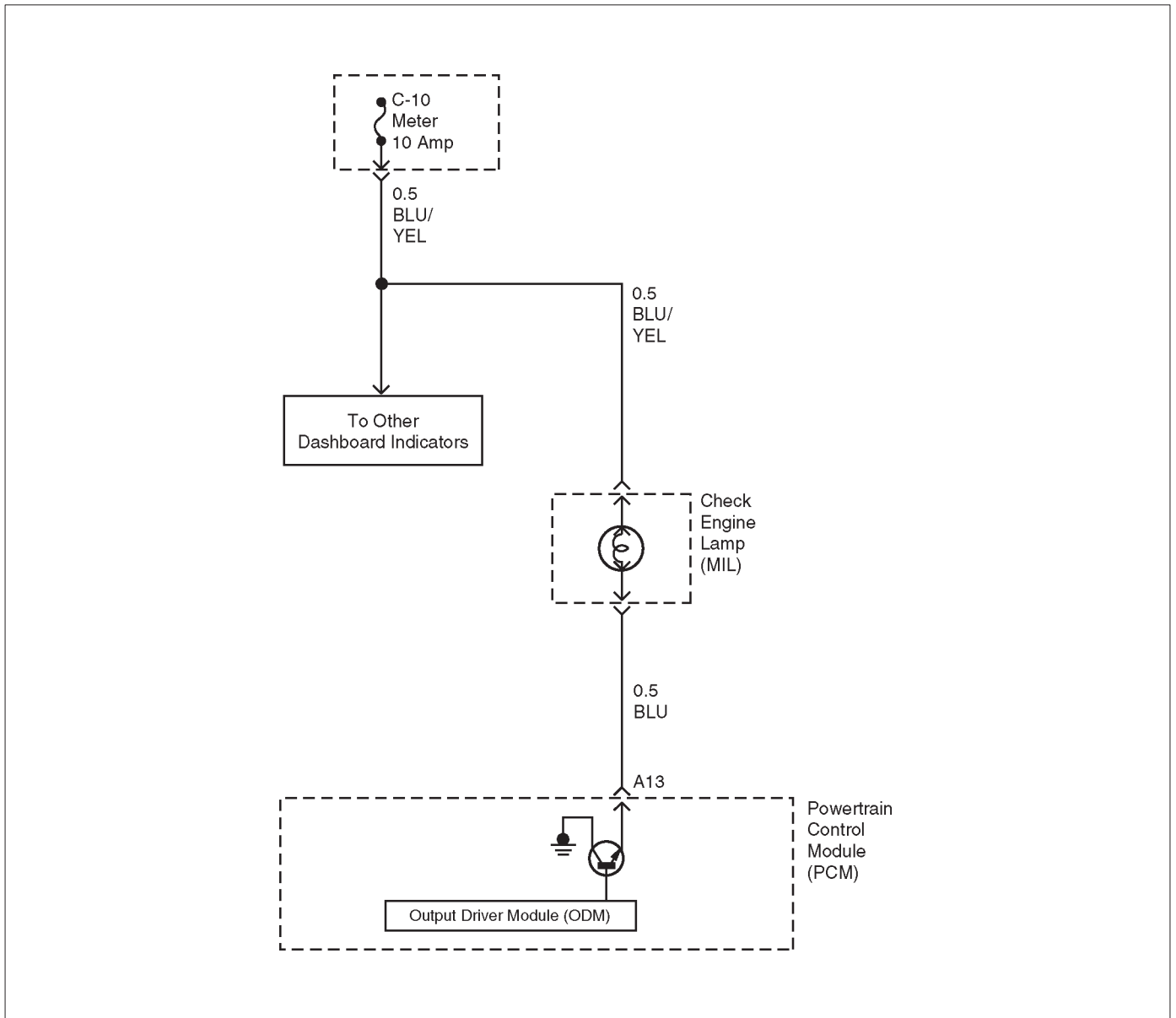
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to Step 6
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to Step 4	Go to Step 16
4	Ignition "ON," probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light "ON?"	—	Go to Step 5	Go to Step 13
5	1. Ignition "OFF." 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition "ON." Is the MIL "ON?"	—	Go to Step 10	Go to Step 11
6	Check the PCM ignition feed and battery feed fuses (15 A engine fuse and 15 A PCM fuse). Are both fuses OK?	—	Go to Step 7	Go to Step 15
7	1. Ignition "OFF." 2. Disconnect the PCM. 3. Ignition "ON." 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light "ON?"	—	Go to Step 8	Go to Step 12
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light "ON?"	—	Go to Step 9	Go to Step 14
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to Step 17
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to Step 18
12	Substitute a known "good" relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to Step 13
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>PCM</i> in <i>ON-Vehicle Service</i> for procedures. Is the action complete?	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to <i>Instrument Panel</i> in <i>Electrical Diagnosis</i>

Malfunction Indicator Lamp (MIL) "ON" Steady



D06RW0007

Circuit description

The malfunction indicator lamp (MIL) should always be illuminated and steady with ignition "ON" and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL "ON" by grounding the MIL driver circuit. The MIL should not remain "ON" with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

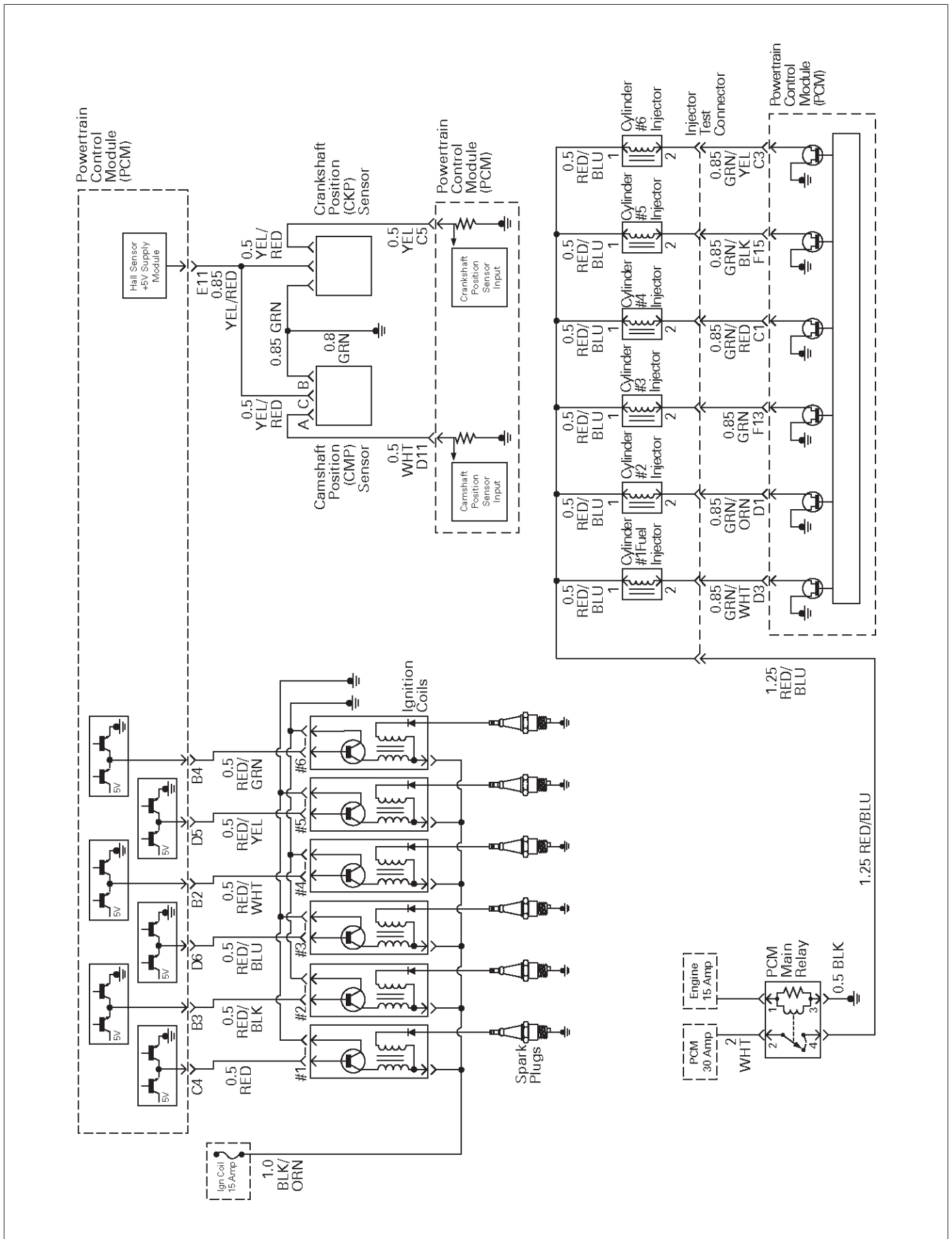
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain "ON" when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *UBS 98 model year Immobilizer Workshop Manual*.

Malfunction Indicator Lamp (MIL) "ON" Steady

Step	Action	Value(s)	Yes	No
1	Was the "On-Board diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "OFF," disconnect PCM. 2. Ignition "ON," observe the MIL (Service Engine Soon lamp). Is the MIL "ON?"	—	Go to Step 3	Go to Step 5
3	1. Ignition "OFF," disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to <i>OBD System Check</i>	Go to Step 4
4	Replace the instrument panel cluster. Is the action complete?	—	Go to <i>OBD System Check</i>	—
5	1. Ignition "OFF," reconnect the PCM. 2. Using Tech 2, select "Output Miscellaneous Test" and command the MIL "OFF." Did the MIL turn "OFF?"	—	Go to <i>OBD System Check</i>	Go to Step 6
6	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Go to <i>OBD System Check</i>	—

Engine Cranks But Will Not Run



Circuit Description

The electronic Ignition system uses a coil-at-plug method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver inside the ignition coil, which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICM opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left "OFF" during the next six 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting period, a camshaft position (CMP) signal pulse will have been received by the PCM. The CMP signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start-up, the PCM will begin sequential fuel delivery with a 1-in-6 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty engine coolant temperature sensor – Using Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10°C of intake air temperature. If not, replace the ECT sensor.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

5. An obvious cause of low fuel pressure would be an empty fuel tank.
6. The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
7. A blinking test light verifies that the PCM is monitoring the 58X crankshaft reference signal and is capable of activating the injectors. If there is an open or shorted driver circuit, DTCs 201-206 should be set.
19. By using a spark tester, each ignition coil's ability to produce 25,000 volts is verified.
25. If there is an open or shorted driver circuit, DTCs 201-206 should be set. All six injector driver circuits can be checked at one time without removing the intake manifold if a 5-8840-2636-0 test light is available. This is the alternative procedure:
 - With the ignition "OFF," disconnect the gray connector located at the rear of the air filter, attached to a bracket on the purge canister.
 - Connect test light 5-8840-2636-0 to the connector. Do any of the light constantly illuminate or fail to blink when the engine is cranked? If so, repair the short or open circuit, or replace the PCM if indicated.

This procedure only tests the driver circuit as far as the test connection, so step 31 is added to test the circuit all the way to the injector.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Check the 15 A ignition coil fuse, the 15 A engine fuse, and the 30 A PCM fuse. Was a fuse blown?	—	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—
4	1. Ignition "OFF," install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. (Use a shop cloth to absorb any fuel leakage while making the connection.) 2. Ignition "ON," observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady?	285-376 kPa (43-55 psi)	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	Is any fuel pressure indicated?	—	Go to <i>Fuel System Electrical Test</i>	Go to <i>Fuel System Diagnosis</i>
6	Install an injector switch box to the injector test connector, and attempt to operate the injector. Did the fuel pressure drop when the injector is operated?	—	Go to <i>Step 7</i>	Go to <i>Step 12</i>
7	Install an injector test light at the #2 cylinder injector harness connector. Does the light blink when the engine is cranked?	—	Go to <i>Step 8</i>	Go to <i>Step 18</i>
8	1. Ignition "ON." 2. While the coil connectors are disconnected, touch each coil connector's ignition feed terminal with a grounded test light (the ignition feed wire is black with orange tracer). Did the test light illuminate?	—	Go to <i>Step 10</i>	Go to <i>Step 9</i>
9	Repair the open ignition feed circuit. Is the action complete?	—	Verify repair	—
10	While the coil connectors are disconnected, touch each connector's secondary ground terminal with a test light to B+. (The ground wires are black.) Did the test light illuminate at each coil connector?	—	Go to <i>Step 12</i>	Go to <i>Step 11</i>
11	Repair the open secondary ground circuit. Is the action complete?	—	Verify repair	—
12	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to <i>Step 13</i>

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
13	<p>1. Remove any ignition coil and install a spark tester at the spark plug end of the coil.</p> <p>2. Observe the tester while the engine is cranking.</p> <p>Was a crisp, blue spark observed? Only one or two sparks followed by no result is considered the same as "No Spark."</p>	—	Go to <i>Step 15</i>	Go to <i>Step 14</i>
14	<p>Replace the ignition coil, and return to Step 13 to test the remaining coils.</p> <p>Is the action complete?</p>	—	Verify repair	—
15	<p>Repeat Step 13 for each coil. Remove only one coil at a time, and reinstall each coil on its spark plug after testing, but do not refasten coils with screws at this time.</p> <p>After all coils have passed the spark test, does the engine start?</p>	—	Refasten all coils with their screws	Go to <i>Step 16</i>
16	<p>1. Remove the spark plugs from all cylinders.</p> <p>2. Visually inspect the spark plug electrodes.</p> <p>3. Replace any spark plugs with loose or missing electrodes or cracked insulators.</p> <p>Did your inspection reveal any spark plugs exhibiting excessive fouling?</p>	—	Correct the fouling condition	Go to <i>Step 17</i>
17	<p>Refer to <i>Engine Mechanical Diagnosis</i> to diagnose the following conditions:</p> <ul style="list-style-type: none"> ● Faulty or incorrect camshaft drive belts ● Leaking or sticky valves or rings ● Excessive valve deposits ● Loose or worn rocker arms ● Weak valve springs ● Incorrect valve timing ● Leaking head gasket <p>Is the action complete?</p>	—	Verify repair	Go to <i>Step 19</i>
18	<p>Observe the "Engine Speed" data display on the scan tool while cranking the engine.</p> <p>Is the engine RPM indicated? (If the scan tool is normally powered from the cigarette lighter socket, and if the scan tool display goes blank while cranking the engine, it will be necessary to power the scan tool directly from the vehicle battery.)</p>	—	Go to <i>Step 19</i>	Go to <i>Step 28</i>
19	<p>1. Disconnect the 7-pin gray connector at the rear of the air filter beneath the point where the air duct attaches to the MAF sensor.</p> <p>2. Ignition "ON."</p> <p>3. Using a test light connected to ground, probe the ignition terminal at the PCM (female) side of the 7-pin connector.</p> <p>Is the test light "ON?"</p>	—	Go to <i>Step 20</i>	Go to <i>Step 26</i>

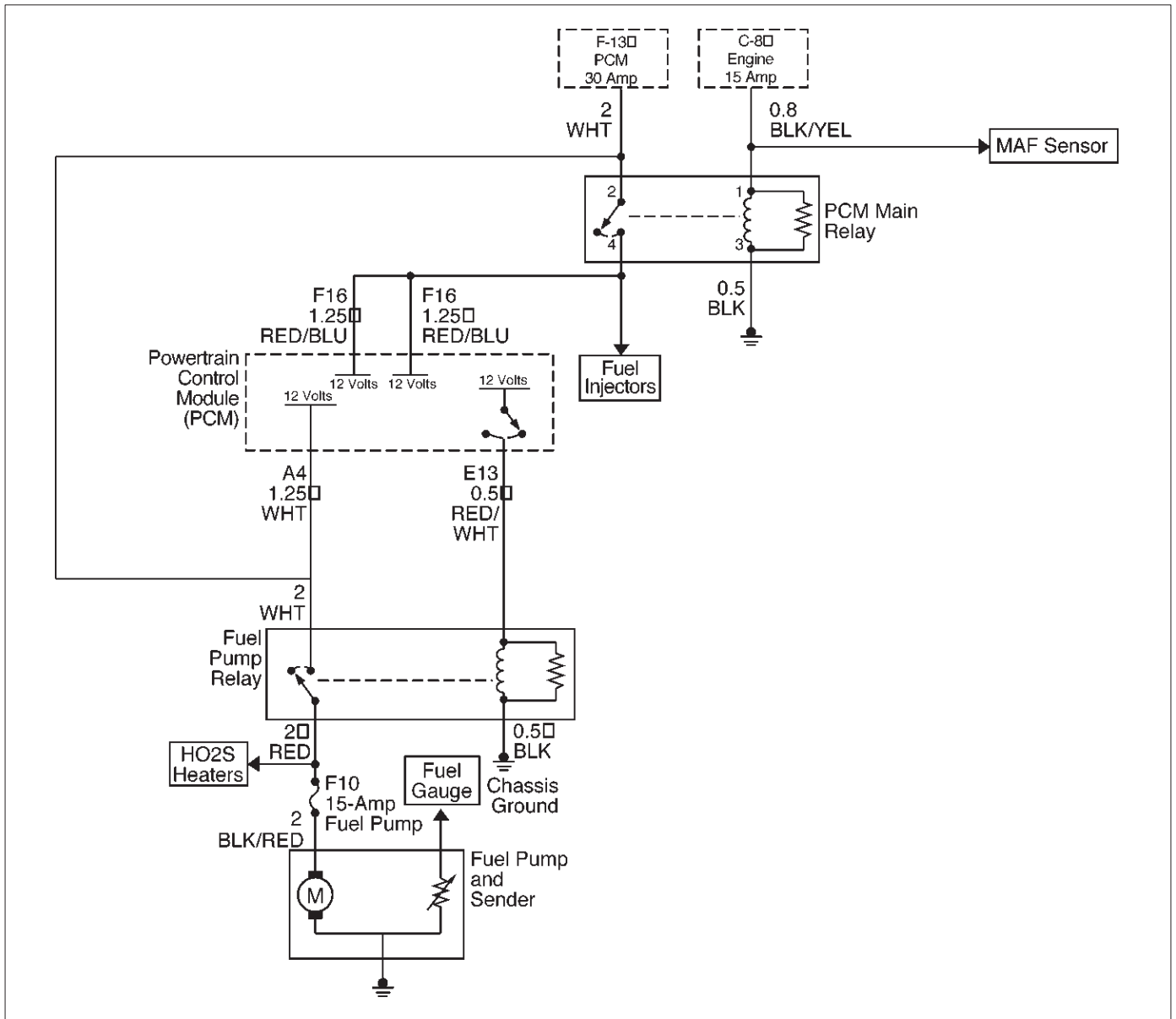
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
20	<ol style="list-style-type: none"> 1. At the PCM (female) side of the connector, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector. 2. Ignition "ON." 3. Observe the test light, and repeat the test for each injector driver circuit. <p>Did the test light stay on when checking any of the 6 injector driver circuits?</p>	—	Go to <i>Step 21</i>	Go to <i>Step 23</i>
21	<ol style="list-style-type: none"> 1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," observe the test light. <p>Is the test light "ON?"</p>	—	Go to <i>Step 22</i>	Go to <i>Step 27</i>
22	<p>Locate and repair the short to ground in the injector driver circuit.</p> <p>Is the action complete?</p>	—	Verify repair	—
23	<ol style="list-style-type: none"> 1. Using the same test location as in step 20, connect a test light between the ignition terminal and one of the driver circuits. 2. Crank the engine and observe the test light. 3. Repeat for each injector driver circuit. <p>Did the light blink during the test for each circuit?</p>	—	Go to <i>Step 25</i>	Go to <i>Step 24</i>
24	<p>Check for an open injector driver circuit.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 27</i>
25	<ol style="list-style-type: none"> 1. At the injector (male) side of the gray connector, connect an ohmmeter between the ignition pin and one of the driver circuit pins. 2. Check for continuity in the circuit. 3. Repeat for each injector circuit. The readings should be approximately equal to the specified value for injector resistance. <p>Was a problem found?</p>	12.5 ohms	Verify repair	Go to <i>Step 8</i>
26	<p>Repair the ignition feed circuit.</p> <p>Is the action complete?</p>	—	Verify repair	—
27	<p>Replace the PCM.</p> <p>IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i>.</p> <p>Is the action complete?</p>	—	Verify repair	—
28	<ol style="list-style-type: none"> 1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition "ON." 3. With a test light to ground, probe the harness ignition feed terminal. <p>Did the light illuminate?</p>	—	Go to <i>Step 30</i>	Go to <i>Step 29</i>
29	<p>Check the ignition feed wire between the sensor and the PCM for a short to ground or open circuit.</p> <p>Is the action complete?</p>	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
30	1. Ignition "ON." 2. At the CKP harness connector, connect a test light between the ignition and ground terminals. Did the light illuminate?	—	Go to <i>Step 32</i>	Go to <i>Step 31</i>
31	Check the sensor ground circuit for an open or short to voltage. Is the action complete?	—	Verify repair	—
32	Check the signal circuit between the sensor and the PCM for a short to ground, short to voltage, or an open. Was a problem found?	—	Verify repair	Go to <i>Step 33</i>
33	Replace the CKP sensor. Is the action complete?	—	Verify repair	Go to <i>Step 27</i>

Fuel System Electrical Test



D06RW101

Circuit Description

When the ignition switch is first turned "ON," the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain "ON" as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned "ON" or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition "ON," the fuel pump can be turned "ON" by using a command by Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the "Fuel System Pressure Test" chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.
- A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the disconnect is completed.

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge 5-8840-0378-0 to the fuel feed line located in front of and above the right side valve train cover .
3. Reinstall the fuel pump relay.

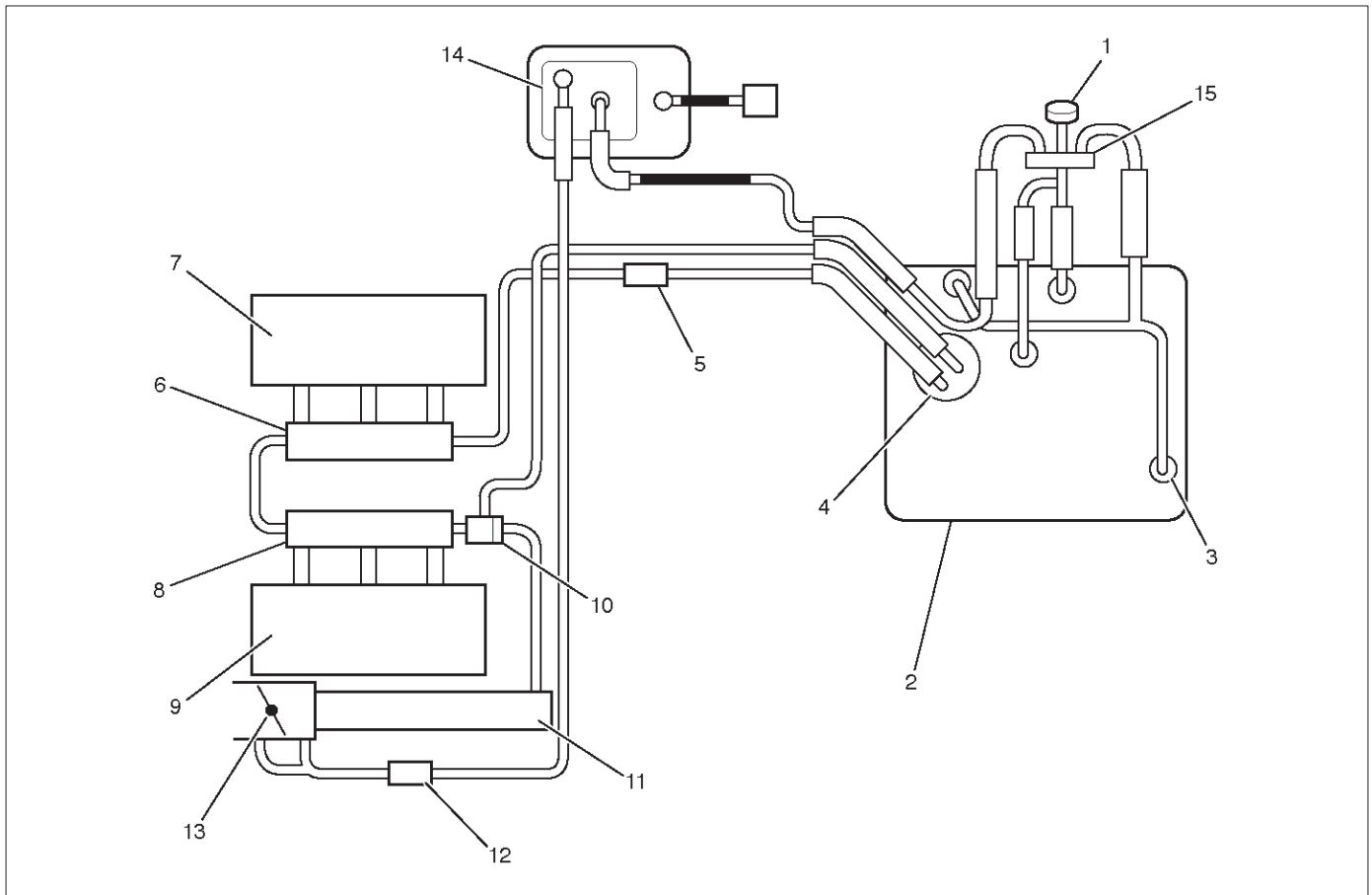
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Read the "Caution" above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Use Tech 2 to command the fuel pump "ON." Is there an immediate pressure build-up which indicates the pump is running?	—	Go to Step 3	Go to Step 4
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump "ON" with Tech 2. Did the pump turn "OFF" after 2 seconds?	—	Test completed	Go to Step 12
4	1. Ignition "OFF." 2. Remove the fuel pump relay. 3. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to Step 6	Go to Step 5
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull-in coil. 2. Ignition "ON." Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 12	Go to Step 7
7	1. With a test light connected to battery (-), probe the fuel pump relay connector at the wire which runs from the relay pull-in coil to the PCM. 2. Ignition "ON." Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 8	Go to Step 9
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	—	Verify repair	Go to Step 10
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	—	Verify repair	Go to Step 11
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump "ON" with Tech 2. Did the light illuminate for 2 seconds?	—	Go to Step 15	Go to Step 13
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump "ON" with Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded "ON?"	—	Go to Step 17	Go to Step 14
14	1. Re-connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	—	Verify repair	—
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump "ON" with Tech 2. Did the test light illuminate for 2 seconds?	—	Go to Step 18	Go to Step 16
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	—	Verify repair	—
17	1. Re-connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	—	Verify repair	—
18	Replace the fuel pump. Is the action complete?	—	Verify repair	—

Fuel System Diagnosis



140RW020

Legend

- | | |
|-----------------------------------|----------------------------------|
| (1) Fuel Filler Cap | (8) Fuel Rail Left |
| (2) Fuel Tank | (9) Left Bank |
| (3) Rollover Valve | (10) Fuel Pressure Control Valve |
| (4) Fuel Pump and Sender Assembly | (11) Common Chamber |
| (5) Fuel Filter | (12) Duty Solenoid Valve |
| (6) Fuel Rail Right | (13) Throttle Valve |
| (7) Right Bank | (14) Canister |
| | (15) Evapo Shut Off Valve |

Circuit Description

When the ignition switch is turned "ON," the powertrain control module (PCM) will turn "ON" the in-tank fuel pump. The in-tank fuel pump will remain "ON" as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in-tank fuel pump "OFF" 2 seconds after the ignition switch is turned "ON" or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir. The in-tank fuel pump supplies fuel through an in-line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch "ON" and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
 - The fuel pump check valve.
 - The fuel pump flex line.

- The valve or valve seat within the fuel pressure regulator.
 - The fuel injector(s).
4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may cause a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech II Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the "Fuel Cut-Off Mode."

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine "OFF."

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
- Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to *Fuel Rail Assembly* in *On-Vehicle Service*.
 - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.
21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging, and misfiring.
22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump "ON" with Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the disconnect is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge 5-8840-0378-0 to the fuel feed line located in front of and above the right side valve train cover.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Turn the ignition "OFF." 2. Turn the air conditioning system "OFF." 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition "ON." NOTE: The fuel pump will run for approximately 2 seconds. Use Tech 2 to command the fuel pump "ON". 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to Step 3	Go to Step 17
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 4	Go to Step 12
4	1. When the vehicle is at normal operation temperature, turn the ignition "ON" to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21-105 kPa (3-15 psi)	Go to Step 5	Go to Step 9
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to Step 6	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: <ul style="list-style-type: none"> ● The in-pipe fuel filter. ● The fuel feed line. Was a restriction found?	—	Verify repair	Go to Step 7
7	Remove the fuel tank and visually and physically inspect the following items: <ul style="list-style-type: none"> ● The fuel pump strainer for a restriction. ● The fuel line for a leak. ● Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to Step 8
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21-105 kPa (3-15 psi)	Go to Step 10	Go to Step 11

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 13	Go to Step 15
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to Step 14
14	Remove the fuel tank and inspect for leaky hose or in-tank fuel line. Was a problem found?	—	Verify repair	Go to Step 8
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 11	Go to Step 16
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to Step 18	Go to Step 21
18	1. Relieve the fuel pressure. Refer to the <i>Fuel Pressure Relief</i> . 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to Step 19	Go to Step 20
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to Step 11
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to Step 22	Go to Step 23

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
22	<p>1. Command the fuel pump "ON" with Tech 2.</p> <p>2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed.</p> <p>CAUTION: Do not let the fuel pressure exceed the second specified value.</p> <p>Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?</p>	<p>376 kPa (55 psi)</p> <p>414 kPa (60 psi)</p>	Go to <i>Step 11</i>	Go to <i>Step 7</i>
23	<p>1. Command the fuel pump "ON" with Tech 2.</p> <p>2. Remove the fuel filler cap and listen for the sound of the fuel pump running.</p> <p>3. Turn the pump off.</p> <p>Was the fuel pump running?</p>	—	Go to <i>Step 7</i>	Go to <i>Fuel System Electrical Test Chart</i>

Idle Air Control (IAC) System Check

Circuit Description

The powertrain control module (PCM) controls engine idle speed with the idle air control (IAC) valve. To increase idle speed, the PCM retracts the IAC valve pintle away from its seat, allowing more air to bypass the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing by pass air flow. Tech 2 will read the PCM commands to the IAC valve in counts. Higher counts indicate more air bypass (higher idle). Lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC Tech 2 counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non-IAC system problem:

- Vacuum leak (high idle) – If idle is too high, stop the engine. Fully extend (low) IAC with the Tech 2. Start the engine. If idle speed is above 800 RPM, locate and correct the vacuum leak, including the PCV system. Check for binding of the throttle blade or linkage.
- Lean heated oxygen sensor signal (high air/fuel ratio) – The idle speed may be too high or too low. Engine speed may vary up and down, and disconnecting the IAC valve does not help. Diagnostic trouble codes P0131, P0151, P0171, or P0174 may be set. Tech 2 oxygen (O₂) voltage will be less than 100 mV (0.1 V). Check for low regulated fuel pressure, water in fuel, or a restricted injector.
- Rich heated oxygen sensor signal (low air/fuel ratio) – The idle speed will be too low. Tech 2 IAC counts will usually be above 80. The system is obviously rich and may exhibit black smoke in the exhaust.
Tech 2 O₂ voltage will be fixed at about 750 mV (0.75 V). Check for high fuel pressure, or a leaking or sticking injector. A silicon-contaminated heated oxygen sensor will show an O₂ voltage slow to respond on Tech 2.

- Throttle body – Remove the IAC valve and inspect the bore for foreign material.
- IAC valve electrical connections – IAC valve connections should be carefully checked for proper contact.
- PCV valve – An incorrect or faulty PCV valve may result in an incorrect idle speed. Refer to *Diagnosis, Rough Idle, Stalling*. If intermittent poor driveability or idle symptoms are resolved by disconnecting the IAC, carefully recheck the connections and valve terminal resistance, or replace the IAC.

Test Description

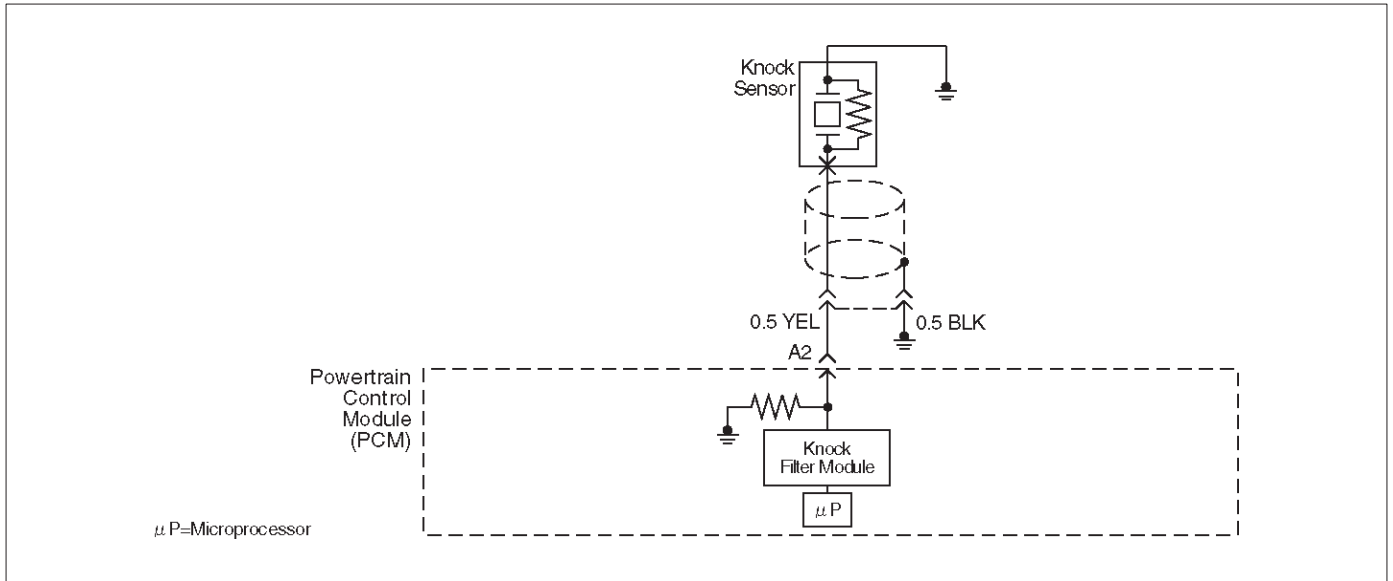
Number(s) below refer to the step number(s) on the Diagnostic Chart.

1. The Tech 2 is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be resettled when removed from the throttle body.
2. This step checks the quality of the IAC movement in step 1. Between 700 revolutions per minute (RPM) and about 1500 RPM, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 RPM), it may take many flashes to extend the IAC valve before engine speed will begin to drop. This is normal on certain engines. Fully extending the IAC may cause engine stall. This may be normal.

Idle Air Control (IAC) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "OFF." 2. Connect the Tech 2. 3. Set the parking brake. 4. Block the wheels. 5. Turn the air conditioning "OFF." 6. Idle the engine in Park (A/T) or Neutral (M/T). 7. Operate the IAC test. 8. The engine speed should decrease and increase as the IAC is cycled. Does the RPM change?	—	Go to <i>Step 2</i>	Go to <i>Step 3</i>
2	RPM should change smoothly. Does the RPM change within the range specified?	700-1500 RPM	—	Go to <i>Step 3</i>
3	Check the IAC passages. Are the IAC passages OK?	—	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Clear any obstruction from the IAC passages. Is the action complete?	—	Verify repair	—
5	Replace the IAC. Refer to <i>On-Vehicle Service, Idle Air Control Valve</i> . Is the action complete?	—	Verify repair	—

Knock Sensor (KS) System Check (Engine Knock, Poor Performance, or Poor Economy)



Circuit Description

The knock sensor (KS) sends an AC voltage signal to the powertrain control module (PCM). As the KS detects engine knock, the signal to the PCM changes in amplitude and frequency. The PCM retards timing if the engine speed is over 900 RPM.

Diagnostic Aids

If the KS system checks OK, but detonation is the complaint, refer to *Diagnosis, Detonation/Spark Knock*.

Test Description

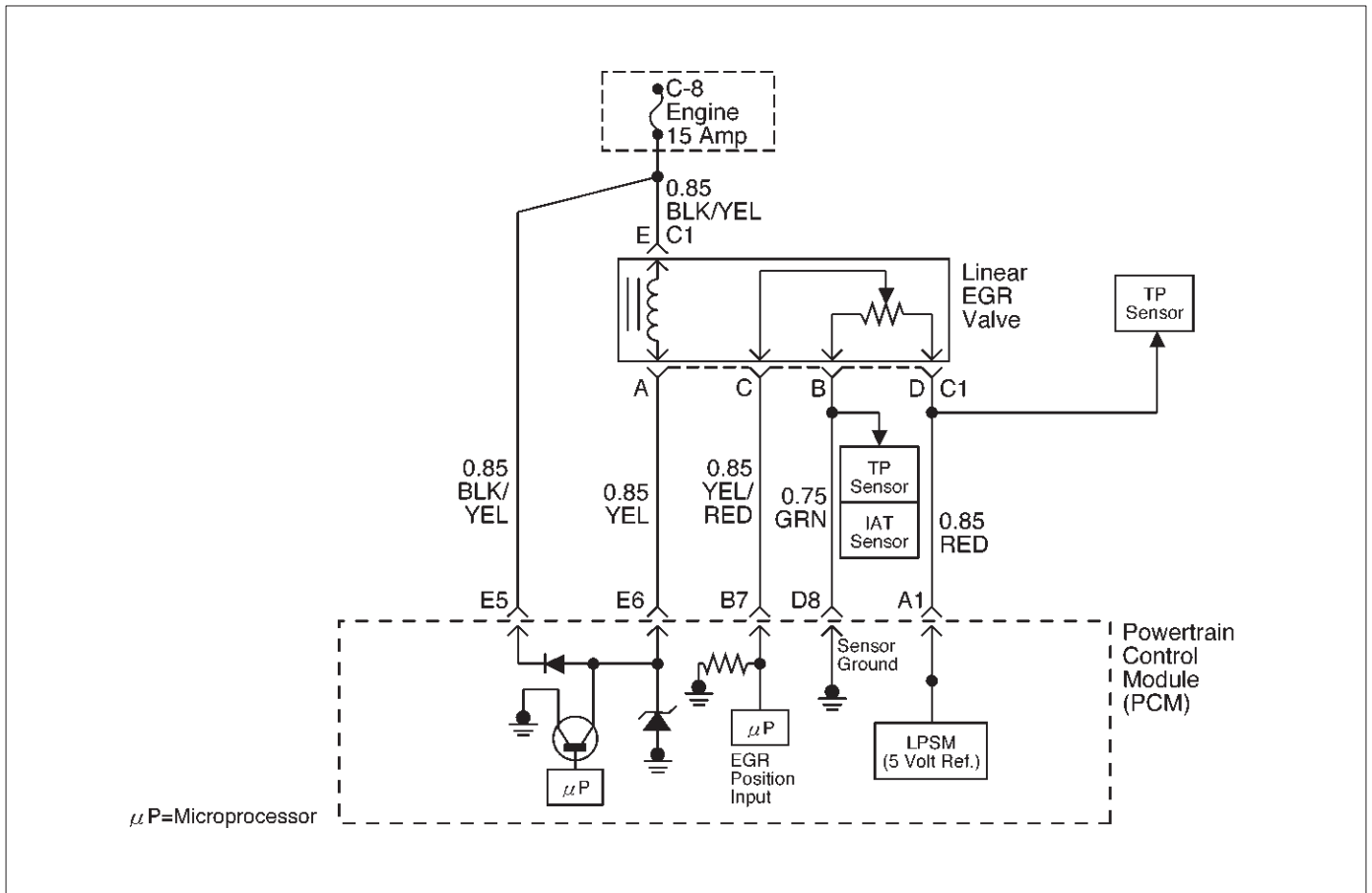
The numbers below refer to the step numbers on the Diagnostic Chart.

9. The change in signal speed depends on how hard the tapping is done. Normally there is about 1.5 to 10 mV at PCM pin A2 with the engine off. Loud tapping should be able to make the reading jump to 20-25 mV AC.

Knock Sensor (KS) System Check (Engine Knock, Poor Performance, or Poor Economy)

Step	Action	Value(s)	Yes	No
1	Is DTC P0325 or P0327 set?	—	Go to <i>DTC P0325 or DTC P0327</i>	Go to <i>Step 2</i>
2	Run the engine at 1500 RPM. Is there an internal engine knock?	—	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Repair the mechanical problem. Is the action complete?	—	Verify repair	—
4	1. Install Tech 2. 2. Turn the ignition "ON." 3. Cycle through the list until "Knock Retard" is displayed. Is knock retard at the specified value?	0°	Go to <i>Step 6</i>	Go to <i>Step 7</i>
5	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—
6	1. Start the engine. 2. Monitor the knock retard display on Tech 2 while changing the throttle setting to place different loads on the engine. Is knock retard at the specified value? (Turn the ignition "OFF.")	0°	Go to <i>Step 9</i>	Go to <i>Step 7</i>
7	1. At the rear of the engine, behind the rear fuel injector on the lift side, disconnect the 2-wire knock sensor harness connector. 2. Attach the positive lead of DVM to B+. 3. On the main harness side of the connector, use the negative lead of the DVM to probe the connector pin that is connected to the black wire. Does the DVM indicate the specified value? (Reconnect the knock sensor harness.)	B+	Go to <i>Step 9</i>	Go to <i>Step 8</i>
8	Repair the open black wire ground for the shield which prevents stray electromagnetic pulses from affecting the knock signal. Is the action complete?	—	Verify repair	—
9	1. Reconnect the wire harness. 2. Set a DVM to AC voltage. 3. With the DVM, backprobe the PCM connector at A2. 4. Tap the engine lift bracket with a socket extension. Did the DVM show an increase in AC voltage while tapping on the lift bracket?	—	System OK	Go to <i>Step 10</i>
10	Replace the knock sensor. Is the action complete?	—	Verify repair	—

Exhaust Gas Recirculation (EGR) System Check



Circuit Description

A properly operation exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio. Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NO_x) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

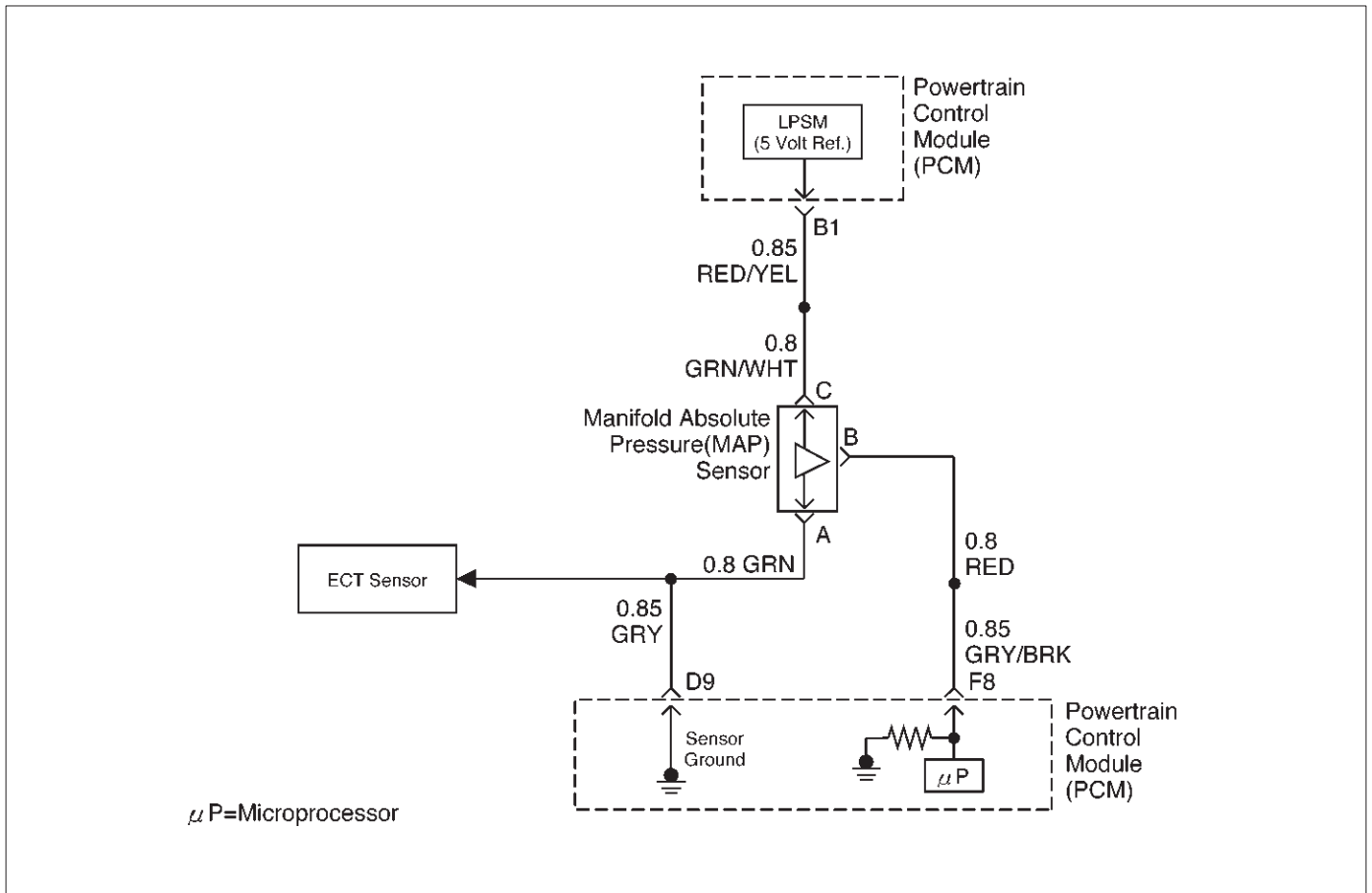
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NO_x. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause a rough idle. Also, an EGR mounted incorrectly (rotated 180°) could cause rough idle. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to *Manifold Absolute Pressure Output Check*.

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve Loose?	—	Go to <i>Step 2</i>	Go to <i>Step 3</i>
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm. 3. Using Tech 2, command EGR "50% ON." Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to <i>Step 4</i>
4	1. Engine "OFF." 2. Ignition "ON." 3. Using a test light to ground, check the EGR harness between the EGR valve and the ignition feed. Does the test light illuminate?	—	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to <i>Step 6</i>
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to <i>Step 8</i>
8	1. Ground the EGR valve metal case to battery (-). 2. Using Tech 2, command EGR "ON" and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to <i>Step 9</i>	Go to <i>DTC P1406 chart</i>
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to <i>Step 10</i>	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

Manifold Absolute Pressure (MAP) Output Check



D06RW102

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5-volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1-2 volts at idle. Higher pressure (high voltage) output voltage will be about 4-4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to used the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Applying 34 kPa (10 Hg) vacuum to the MAP sensor should cause the voltage to be 1.5-2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction, Be sure that no other vacuum devices are connected to the MAP hose.

IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition "OFF" and leave it "OFF" for 15 seconds. 2. Ignition "ON." Don't crank engine. 3. Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1-4. Is the voltage reading the same +/-0.40 volt?	—	Go to <i>Step 2</i>	Go to <i>Step 5</i>
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 Hg) of vacuum and note the voltage change. Is the voltage change 1.5-2.1 volts less than Step 1?	—	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	No trouble found. Check the sensor cover for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Repair the material to block. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	Replace the sensor. Refer to <i>On-Vehicle Service, MAP Sensor</i> . Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

PCM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

- A - Emission related P-code, check engine light on as soon as a failure detected.
- B - Emission related P-code, check engine light on if a failure detected in two consecutive trips.
- C - Non emission related P-code, check engine light on if a failure detected in one trip.
- D - Non emission related P-code, no check engine light, but P-code will be set if a failure detected.
- X - Do not check.

6E-102 ENGINE DRIVEABILITY AND EMISSIONS

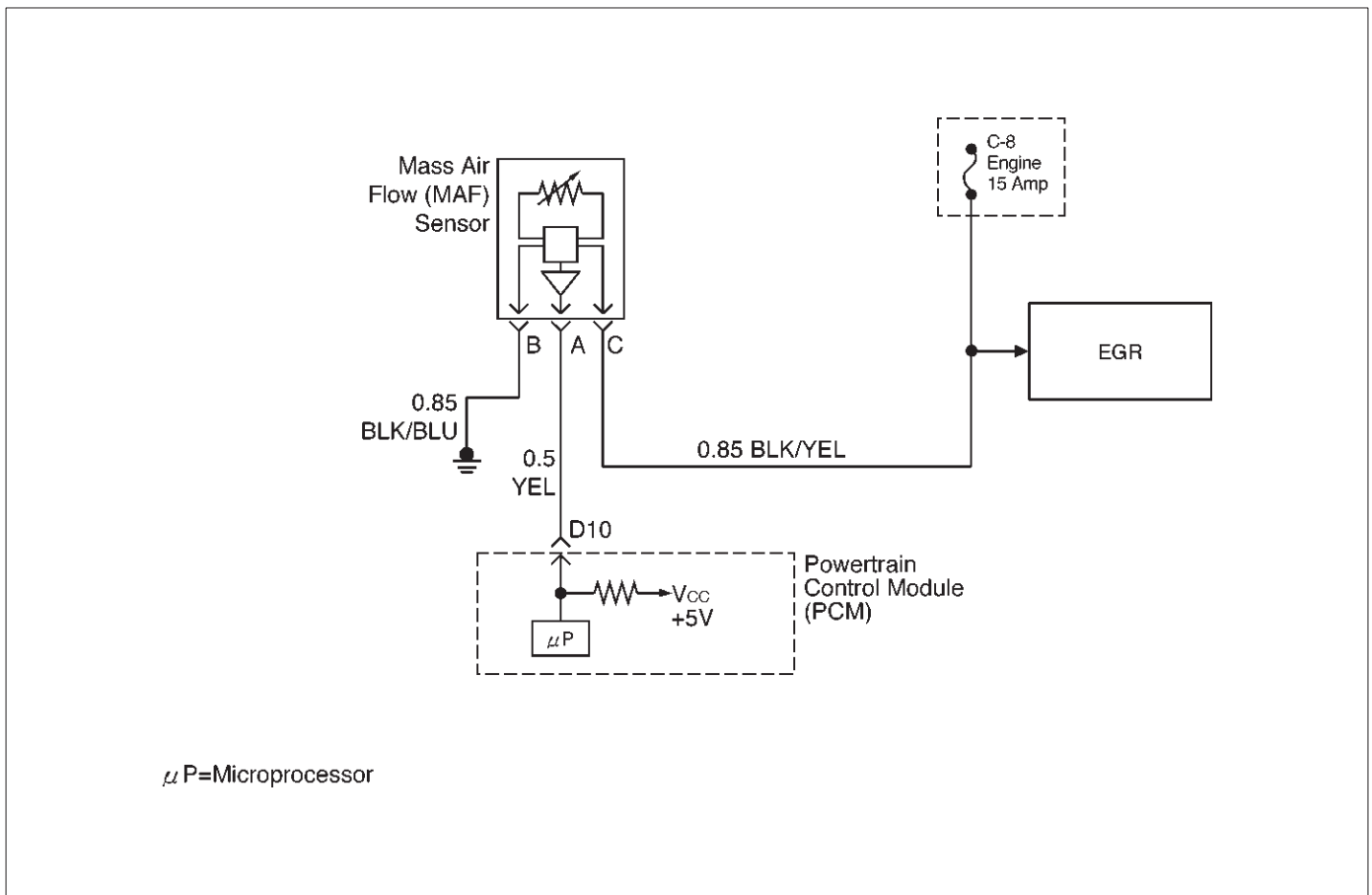
PCM Diagnostic Trouble Codes

DTC	Description	Countries		G. EXP A/T	G. EXP M/T	EC A/T	EC A/T	EC M/T	EC M/T	AUST A/T	AUST M/T
		w/o immobi	w/o immobi	w/immobi	w/o immobi	w/immobi	w/o immobi	w/immobi	w/o immobi	w/immobi	w/immobi
P0101	MAF system performance	B	B	B	B	B	B	B	B	B	B
P0102	MAF sensor circuit low frequency	A	A	A	A	A	A	A	A	A	A
P0103	MAF sensor circuit high frequency	A	A	A	A	A	A	A	A	A	A
P0107	MAP sensor circuit low voltage	A	A	A	A	A	A	A	A	A	A
P0108	MAP sensor circuit high voltage	A	A	A	A	A	A	A	A	A	A
P0112	ITA sensor circuit low voltage	A	A	A	A	A	A	A	A	A	A
P0113	ITA sensor circuit high voltage	A	A	A	A	A	A	A	A	A	A
P0117	ETC sensor circuit low voltage	A	A	A	A	A	A	A	A	A	A
P0118	ETC sensor circuit high voltage	A	A	A	A	A	A	A	A	A	A
P0121	TP system performance	A	A	A	A	A	A	A	A	A	A
P0122	TP sensor circuit low voltage	A	A	A	A	A	A	A	A	A	A
P0123	TP sensor circuit high voltage	A	A	A	A	A	A	A	A	A	A
P0131	HO2S circuit low voltage bank 1 sensor 1	X	X	A	A	A	A	A	A	A	A
P0132	HO2S circuit high voltage bank 1 sensor 1	X	X	A	A	A	A	A	A	A	A
P0134	HO2S circuit insufficient activity bank 1 sensor 1	X	X	X	X	X	X	X	X	A	A
P0151	HO2S circuit low voltage bank 2 sensor 1	X	X	A	A	A	A	A	A	X	X
P0152	HO2S circuit high voltage bank 2 sensor 1	X	X	A	A	A	A	A	A	X	X
P0171	Fuel trim system lean bank 1	X	X	B	B	B	B	B	B	B	B
P0172	Fuel trim system rich bank 1	X	X	B	B	B	B	B	B	B	B
P0174	Fuel trim system lean bank 2	X	X	B	B	B	B	B	B	X	X
P0175	Fuel trim system rich bank 2	X	X	B	B	B	B	B	B	X	X
P0201	Injector 1 control circuit	A	A	A	A	A	A	A	A	A	A
P0202	Injector 2 control circuit	A	A	A	A	A	A	A	A	A	A
P0203	Injector 3 control circuit	A	A	A	A	A	A	A	A	A	A
P0204	Injector 4 control circuit	A	A	A	A	A	A	A	A	A	A
P0205	Injector 5 control circuit	A	A	A	A	A	A	A	A	A	A
P0206	Injector 6 control circuit	A	A	A	A	A	A	A	A	A	A
P0218	T overtemp	D	X	D	D	X	X	X	X	D	X
P0325	KS sensor circuit	B	B	B	B	B	B	B	B	B	B
P0327	KS sensor circuit	B	B	B	B	B	B	B	B	B	B
P0336	58X reference signal circuit	B	B	B	B	B	B	B	B	B	B
P0337	CKP sensor circuit low frequency	B	B	B	B	B	B	B	B	B	B
P0341	CMP sensor circuit performance	B	B	B	B	B	B	B	B	B	B
P0342	CMP sensor circuit low	B	B	B	B	B	B	B	B	B	B
P0351	Injector 1 control circuit	A	A	A	A	A	A	A	A	A	A
P0352	Injector 2 control circuit	A	A	A	A	A	A	A	A	A	A
P0353	Injector 3 control circuit	A	A	A	A	A	A	A	A	A	A
P0354	Injector 4 control circuit	A	A	A	A	A	A	A	A	A	A
P0355	Injector 5 control circuit	A	A	A	A	A	A	A	A	A	A
P0356	Injector 6 control circuit	A	A	A	A	A	A	A	A	A	A
P0402	EGR pintle crank error	X	X	B	B	B	B	B	B	A	A
P0404	EGR open stuck	X	X	B	B	B	B	B	B	A	A
P0405	EGR low voltage	X	X	A	A	A	A	A	A	A	A
P0406	EGR high voltage	X	X	A	A	A	A	A	A	A	A
P0502	VSS circuit low input	B	B	B	B	B	B	B	B	B	B
P0560	T voltage	C	X	C	C	X	X	X	X	C	X
P0562	System voltage low	D	D	D	D	D	D	D	D	D	D
P0563	System voltage high	B	B	B	B	B	B	B	B	B	B
P0601	PCM memory	A	A	A	A	A	A	A	A	A	A
P0705	T range circuit	D	X	D	D	X	X	X	X	D	X
P0706	T range rat	D	X	D	D	X	X	X	X	D	X
P0712	T temp LO	D	X	D	D	X	X	X	X	D	X
P0713	T temp HI	D	X	D	D	X	X	X	X	D	X
P0719	T switch B LO	D	X	D	D	X	X	X	X	D	X
P0722	T shaft speed no signal	C	X	C	C	X	X	X	X	C	X
P0723	T shaft speed rat	C	X	C	C	X	X	X	X	C	X
P0730	T gear ratio	C	X	C	C	X	X	X	X	C	X
P0748	press solenoid circuit	C	X	C	C	X	X	X	X	C	X
P0753	T solenoid A circuit	C	X	C	C	X	X	X	X	C	X
P0758	T solenoid B circuit	C	X	C	C	X	X	X	X	C	X
P1127	CO ADJUST ERROR	A	A	X	X	X	X	X	X	X	X
P1154	HO2S circuit transition time ratio bank 2 sensor 1	X	X	A	A	A	A	A	A	X	X
P1171	Fuel system lean during acceleration	X	X	A	A	A	A	A	A	A	A
P1380	ABS rough road ABS system fault	X	X	X	X	X	X	X	X	A	A
P1404	EGR closed stuck	X	X	B	B	B	B	B	B	A	A
P1508	IAC system low RPM	B	B	B	B	B	B	B	B	B	B
P1509	IAC system high RPM	B	B	B	B	B	B	B	B	B	B
P1618	Serial peripheral interface(SPI)	C	X	C	C	X	X	X	X	C	X
P1625	PCM unexpected reset	D	D	D	D	D	D	D	D	D	D
P1626	immobi no response	X	X	D	X	D	X	X	X	D	D
P1631	immobi incorrect response	X	X	D	X	D	X	X	X	D	D
P1640	Driver 1 input high voltage	D	D	D	D	D	D	D	D	D	D
P1648	immobi wrong key	X	X	D	X	D	X	X	X	D	D
P1649	immobi no key	X	X	D	X	D	X	X	X	D	D
P1790	T ROM checksum	C	X	C	C	X	X	X	X	C	X
P1792	EEPROM checksum	C	X	C	C	X	X	X	X	C	X
P1835	T kick down switch	D	X	D	D	X	X	X	X	D	X
P1850	brake band solenoid	D	X	D	D	X	X	X	X	D	X
P1860	TCC PWM circuit	D	X	D	D	X	X	X	X	D	X

PCM Diagnostic Trouble Codes (Cont'd)

DTC	Description	Countries		LAO A/T	LAO M/T	S.A. M/T	SAUD/CHINA	SAUD/CHINA
				w/o immobi	w/o immobi	w/ommobi	A/T w/o immobi	M/T w/o immobi
P0101	MAF system performance			B	B	B	B	B
P0102	MAF sensor circuit low frequency			A	A	A	A	A
P0103	MAF sensor circuit high frequency			A	A	A	A	A
P0107	MAP sensor circuit low voltage			A	A	A	A	A
P0108	MAP sensor circuit high voltage			A	A	A	A	A
P0112	ITA sensor circuit low voltage			A	A	A	A	A
P0113	ITA sensor circuit high voltage			A	A	A	A	A
P0117	ETC sensor circuit low voltage			A	A	A	A	A
P0118	ETC sensor circuit high voltage			A	A	A	A	A
P0121	TP system performance			A	A	A	A	A
P0122	TP sensor circuit low voltage			A	A	A	A	A
P0123	TP sensor circuit high voltage			A	A	A	A	A
P0131	HO2S circuit low voltage bank 1 sensor 1			A	A	X	A	A
P0132	HO2S circuit high voltage bank 1 sensor 1			A	A	X	A	A
P0134	HO2S circuit insufficient activity bank 1 sensor 1			A	A	X	X	X
P0151	HO2S circuit low voltage bank 2 sensor 1			X	X	X	A	A
P0152	HO2S circuit high voltage bank 2 sensor 1			X	X	X	A	A
P0171	Fuel trim system lean bank 1			B	B	X	B	B
P0172	Fuel trim system rich bank 1			B	B	X	B	B
P0174	Fuel trim system lean bank 2			X	X	X	B	B
P0175	Fuel trim system rich bank 2			X	X	X	B	B
P0201	Injector 1 control circuit			A	A	A	A	A
P0202	Injector 2 control circuit			A	A	A	A	A
P0203	Injector 3 control circuit			A	A	A	A	A
P0204	Injector 4 control circuit			A	A	A	A	A
P0205	Injector 5 control circuit			A	A	A	A	A
P0206	Injector 6 control circuit			A	A	A	A	A
P0218	T overtemp			D	X	X	D	X
P0325	KS sensor circuit			B	B	B	B	B
P0327	KS sensor circuit			B	B	B	B	B
P0336	58X reference signal circuit			B	B	B	B	B
P0337	CKP sensor circuit low frequency			B	B	B	B	B
P0341	CMP sensor circuit performance			B	B	B	B	B
P0342	CMP sensor circuit low			B	B	B	B	B
P0351	Injector 1 control circuit			A	A	A	A	A
P0352	Injector 2 control circuit			A	A	A	A	A
P0353	Injector 3 control circuit			A	A	A	A	A
P0354	Injector 4 control circuit			A	A	A	A	A
P0355	Injector 5 control circuit			A	A	A	A	A
P0356	Injector 6 control circuit			A	A	A	A	A
P0402	EGR pintle crank error			A	A	X	B	B
P0404	EGR open stuck			A	A	X	B	B
P0405	EGR low voltage			A	A	X	A	A
P0406	EGR high voltage			A	A	X	A	A
P0502	VSS circuit low input			B	B	B	B	B
P0560	T voltage			C	X	X	C	X
P0562	System voltage low			D	D	D	D	D
P0563	System voltage high			B	B	B	B	B
P0601	PCM memory			A	A	A	A	A
P0705	T range circuit			D	X	X	D	X
P0706	T range rat			D	X	X	D	X
P0712	T temp LO			D	X	X	D	X
P0713	T temp HI			D	X	X	D	X
P0719	T switch B LO			D	X	X	D	X
P0722	T shaft speed no signal			C	X	X	C	X
P0723	T shaft speed rat			C	X	X	C	X
P0730	T gear ratio			C	X	X	C	X
P0748	press solenoid circuit			C	X	X	C	X
P0753	T solenoid A circuit			C	X	X	C	X
P0758	T solenoid B circuit			C	X	X	C	X
P1127	CO ADJUST ERROR			X	X	A	X	X
P1154	HO2S circuit transition time ratio bank 2 sensor 1			X	X	X	A	A
P1171	Fuel system lean during acceleration			A	A	X	A	A
P1380	ABS rough road ABS system fault			A	A	X	X	X
P1404	EGR closed stuck			A	A	X	B	B
P1508	IAC system low RPM			B	B	B	B	B
P1509	IAC system high RPM			B	B	B	B	B
P1618	Serial peripheral interface(SPI)			C	X	X	C	X
P1625	PCM unexpected reset			D	D	D	D	D
P1626	immobi no response			X	X	D	X	X
P1631	immobi incorrect response			X	X	D	X	X
P1640	Driver 1 input high voltage			D	D	D	D	D
P1648	immobi wrong key			X	X	D	X	X
P1649	immobi no key			X	X	D	X	X
P1790	T ROM checksum			C	X	X	C	X
P1792	EEPROM checksum			C	X	X	C	X
P1835	T kick down switch			D	X	X	D	X
P1850	brake band solenoid			D	X	X	D	X
P1860	TCC PWM circuit			D	X	X	D	X

Diagnostic Trouble Code (DTC) P0101 MAF System Performance



D06RW103

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on throttle position and engine RPM.

Conditions for Setting the DTC

- The engine is running.
- No TP sensor or MAP sensor DTCs are set.
- The throttle is steady, TP angle doesn't change by more than 1%.
- System voltage is between 11.5 volts and 16 volts.
- Calculated air flow is between 25 g/second and 40 g/second.
- Above conditions present for at least 1 second.
- MAF signal frequency indicates an airflow significantly higher or lower than a predicted value based on throttle position and engine RPM for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0101 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
 - Mis-routed harness.
 - Rubbed through wire insulation.
 - Broken wire inside the insulation.
- Refer to Intermittents under service category Symptoms. Any un-metered air may cause this DTC to set. Check for the following:
- The duct work at the MAF sensor for leaks.
 - An engine vacuum leak.
 - The PCV system for vacuum leaks.
 - An incorrect PCV valve.

- The engine oil dip stick not fully seated.
- The engine oil fill cap loose or missing.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- The MAF system performance or “rationality” diagnostic uses the MAP sensor signal along with other input to calculate an expected airflow rate that is then compared to the actual measured airflow from the MAF sensor. The first few steps of this table verify that the MAP sensor is working properly.
- Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or Failure Records data can be useful in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same Freeze Frame conditions (RPM, load, vehicle speed , temperature, etc.) that were noted. This will isolate when the DTC failed.

For any test that requires back probing the PCM or component harness connectors, use the Connector Test Adapter Kit J 35616-A. Using this kit will prevent any damage to the harness connector terminals.

- Any un-metered air may cause this DTC to set. Check the PVC system for vacuum leaks. Also inspect the dip stick for being pulled out. Check the oil fill cap for being loose.
- Verifies the signal circuit from the MAF sensor electrical connector to the PCM.
- Verifies whether a ground and B+ circuit is available.
- Checks a signal circuit for an open.
- Checks for a signal circuit shorted to B+.

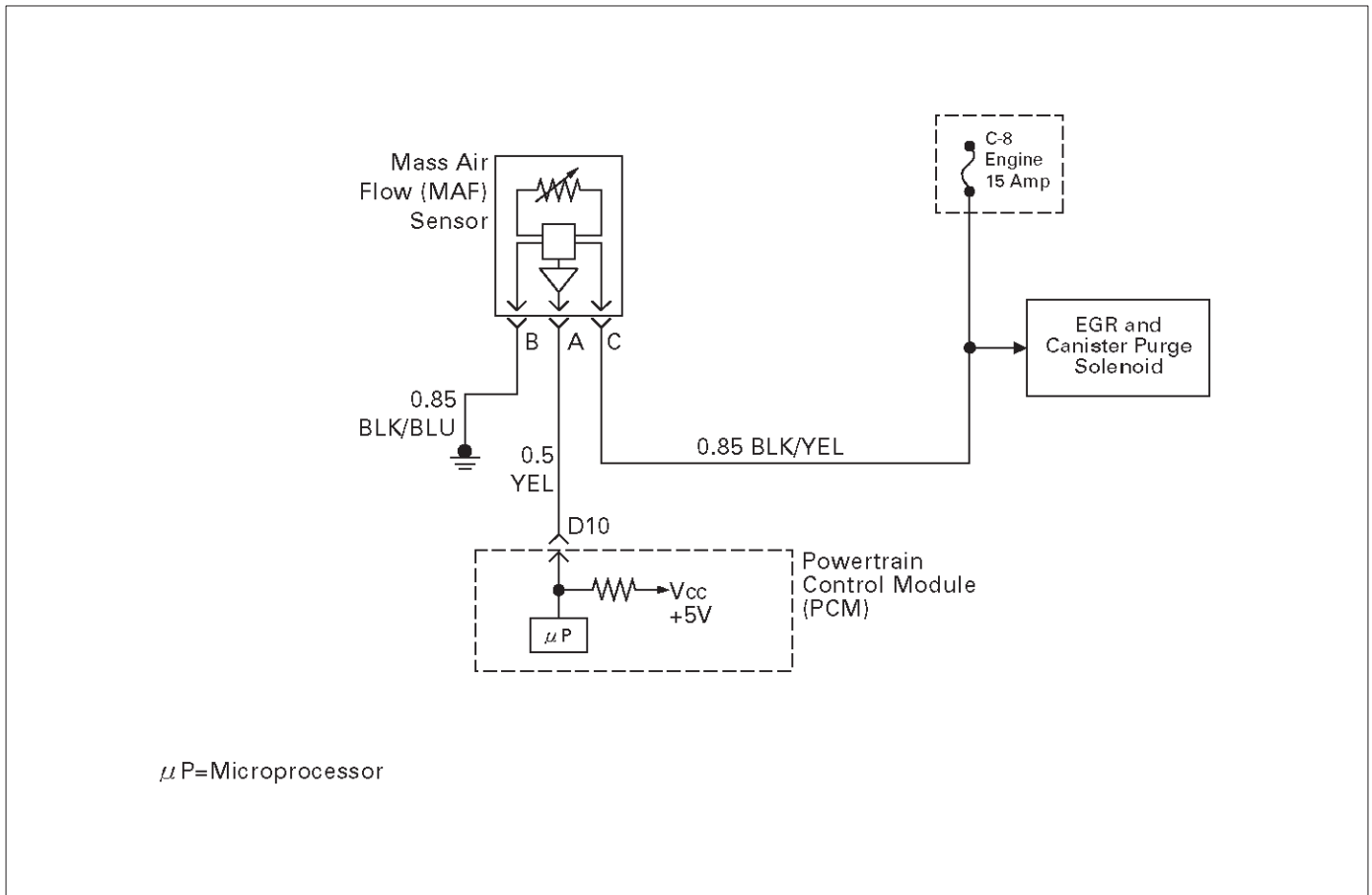
DTC P0101 – MAF System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Using a Tech 2, select “MAP” from the Engine 1 Data List. Is the value displayed greater than the value shown?	85 kPa	Go to Step 3	Go to Step 13
3	1. Remove the MAP sensor from the intake manifold but leave the electrical harness connected. 2. Connect a hand operated vacuum pump to the MAP sensor. 3. Observe the MAP display while slowly applying vacuum up to 20” Hg as indicated on the pump gauge. Each 1” of vacuum applied should result in a 3 to 4 kPa drop in the MAP sensor value on the Tech 2 and the value should change smoothly with each increase in vacuum. Did the MAP value change smoothly through the entire range of the test without any erratic readings?	—	Go to Step 13	Go to Step 4
4	With 20” Hg vacuum applied to the MAP sensor, is the MAF sensor reading the same or less than the value shown?	34 kPa	Go to Step 5	Go to Step 13
5	Disconnect the vacuum source from the MAP sensor. Does the MAP sensor reading return to its original value?	—	Go to Step 6	Go to Step 13

DTC P0101 – MAF System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
6	<ol style="list-style-type: none"> Ignition "ON," engine "OFF." Review the Freeze Frame and/or Failure Records data for this DTC and note parameters. Ignition "OFF" for 15 seconds. Start the engine and operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame /Failure Records possible. (Special operating conditions that need to be met before the PCM will run this diagnostic (where applicable) are listed in "Conditions for Setting the DTC"). Using the Tech 2, select "DTC," then enter the DTC number which was set. <p>Does the Tech 2 indicate that this diagnostic failed this ignition?</p>	—	Go to Step 7	Refer to Diagnostic Aids
7	<ol style="list-style-type: none"> Check for the following conditions: <ul style="list-style-type: none"> Objects blocking the MAF sensor inlet screen; Intake manifold vacuum leaks; Vacuum leaks at throttle body; Vacuum leaks EGR valve flange and pipes. Crankcase ventilation valve faulty, missing, or incorrectly installed. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to Step 8
8	<ol style="list-style-type: none"> Ignition "OFF." Disconnect the MAF sensor connector. Ignition "ON," engine "OFF." Using DVM 5-8840-0285-0, measure voltage between the MAF sensor signal circuit and chassis ground. <p>Is the voltage near the specified value?</p>	5 V	Go to Step 9	Go to Step 10
9	<p>Connect a test light (5-8840-0607-0) between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector.</p> <p>Is the test light "ON?"</p>	—	Go to Step 13	Go to Step 12
10	<p>Is the voltage less than the specified value?</p>	4.5 V	Go to Step 13	Go to Step 11
11	<ol style="list-style-type: none"> Ignition "OFF," disconnect the PCM. Ignition "ON," engine "OFF." Measure voltage between the MAF signal circuit and ground. <p>Does the voltage measure near the specified value?</p>	0 V	Go to Step 13	Go to Step 12
12	<p>Connect a test light (5-8840-0607-0) between the MAF sensor ignition feed circuit and chassis ground.</p> <p>Is the test light "ON?"</p>	—	Go to Step 13	Go to Step 7
13	<ol style="list-style-type: none"> Check for a poor connection at the MAF sensor. If a poor connection is found, replace faulty terminal(s). Refer to <i>Repair Procedures in Electrical Diagnosis (8A Cell 5)</i>. <p>Was a poor connection found?</p>	—	Verify repair	Solved

Diagnostic Trouble Code (DTC) P0102 MAF Sensor Circuit Low Frequency



T321122

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 2500 Hz at idle to around 1900 Hz at maximum engine load. DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for greater than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is below 1000 Hz for a total of 50-percent of the last 1000 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0102 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
 - Misrouted harness – Inspect the MAF sensor harness to ensure that it is not routed too close to high voltage wires.
 - Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
 - Plugged intake air duct or filter element – A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3-6 g/second at idle to 100 g/second or greater at the time of the 1-2 shift. If not, check for a restriction.
- If DTC P0102 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

6E-108 ENGINE DRIVEABILITY AND EMISSIONS

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.

4. A voltage reading of less than 4 or over 5 volts at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.

5. This verifies that ignition feed voltage and a good ground are available at the MAF sensor.

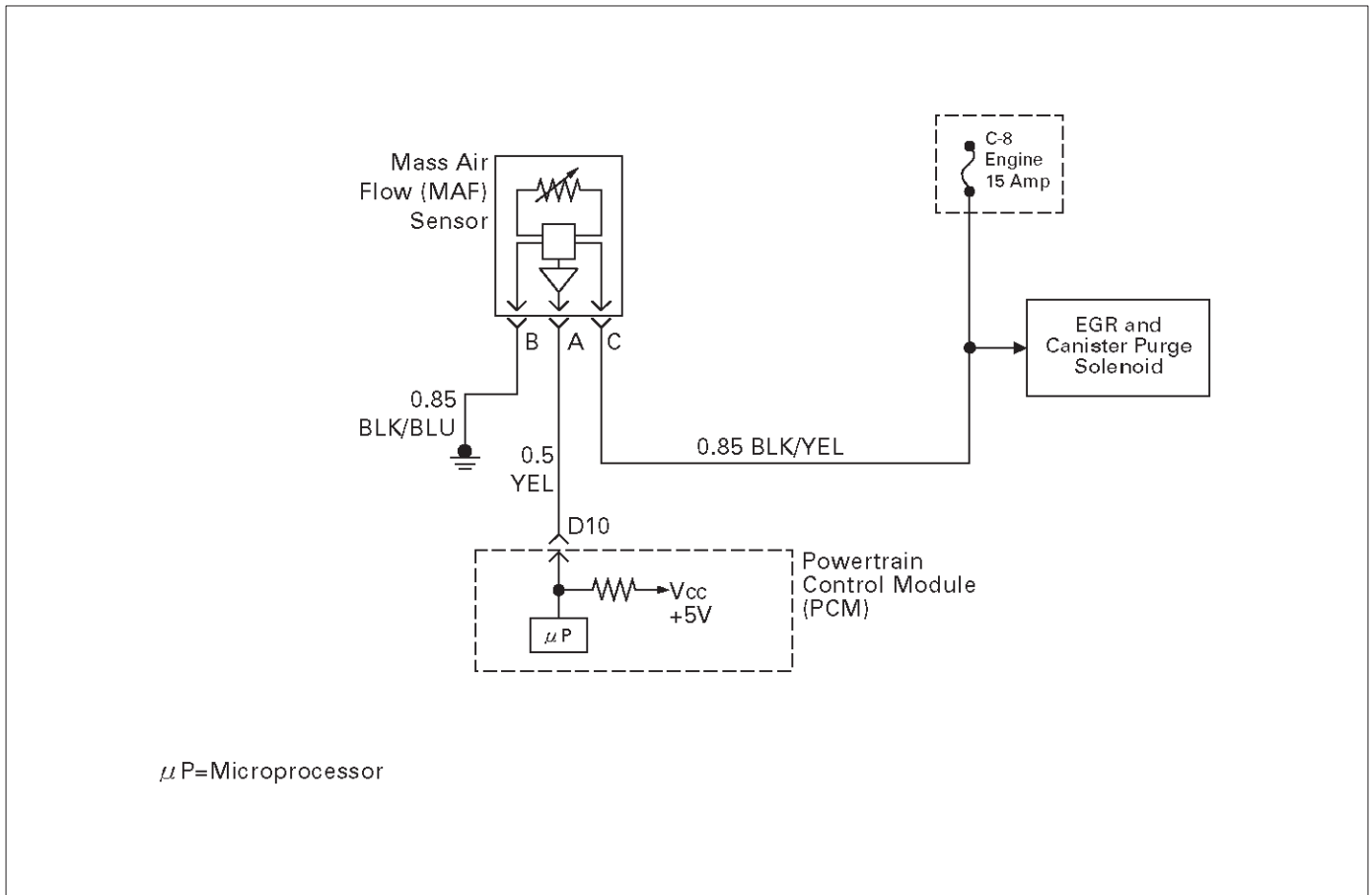
DTC P0102 – MAF Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	3 g/Sec	Go to Step 4	Go to Step 5
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0102. Does the Tech 2 indicate DTC P0102 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine "OFF." 4. Using a DVM, measure voltage between the MAF sensor signal circuit and battery ground. Is the voltage near the specified value?	5 V	Go to Step 5	Go to Step 8
5	Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector. Is the test light "ON?"	—	Go to Step 13	Go to Step 6
6	Connect a test light between the MAF sensor ignition feed circuit and battery ground. Is the test light "ON?"	—	Go to Step 12	Go to Step 7
7	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, replace the faulty terminal(s). Was a poor connection found?	—	Verify repair	Go to Step 11
8	1. Ignition "OFF." 2. Disconnect the MAF sensor. 3. Disconnect the PCM connector for the MAF signal circuit. 4. Ignition "ON," engine "OFF." 5. With the DVM, measure the voltage between the MAF signal terminal at the PCM and battery ground. Is the voltage under the specified value?	4 V	Go to Step 9	Go to Step 10

DTC P0102 – MAF Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition "OFF." 2. Disconnect the PCM white connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit for a short to 5 volts. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF." 2. Disconnect the PCM white connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF ground circuit. Is the action complete?	—	Verify repair	Go to Step 13
11	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
12	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
13	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to Step 14
14	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0103 MAF Sensor Circuit High Frequency



Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 2500 Hz at idle to around 9000 Hz at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is above 10,000 Hz (10.0 kHz) for a total of 50 percent of the last 200 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.

- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for clearing the MIL/DTC

- DTC P0103 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

If DTC P0103 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

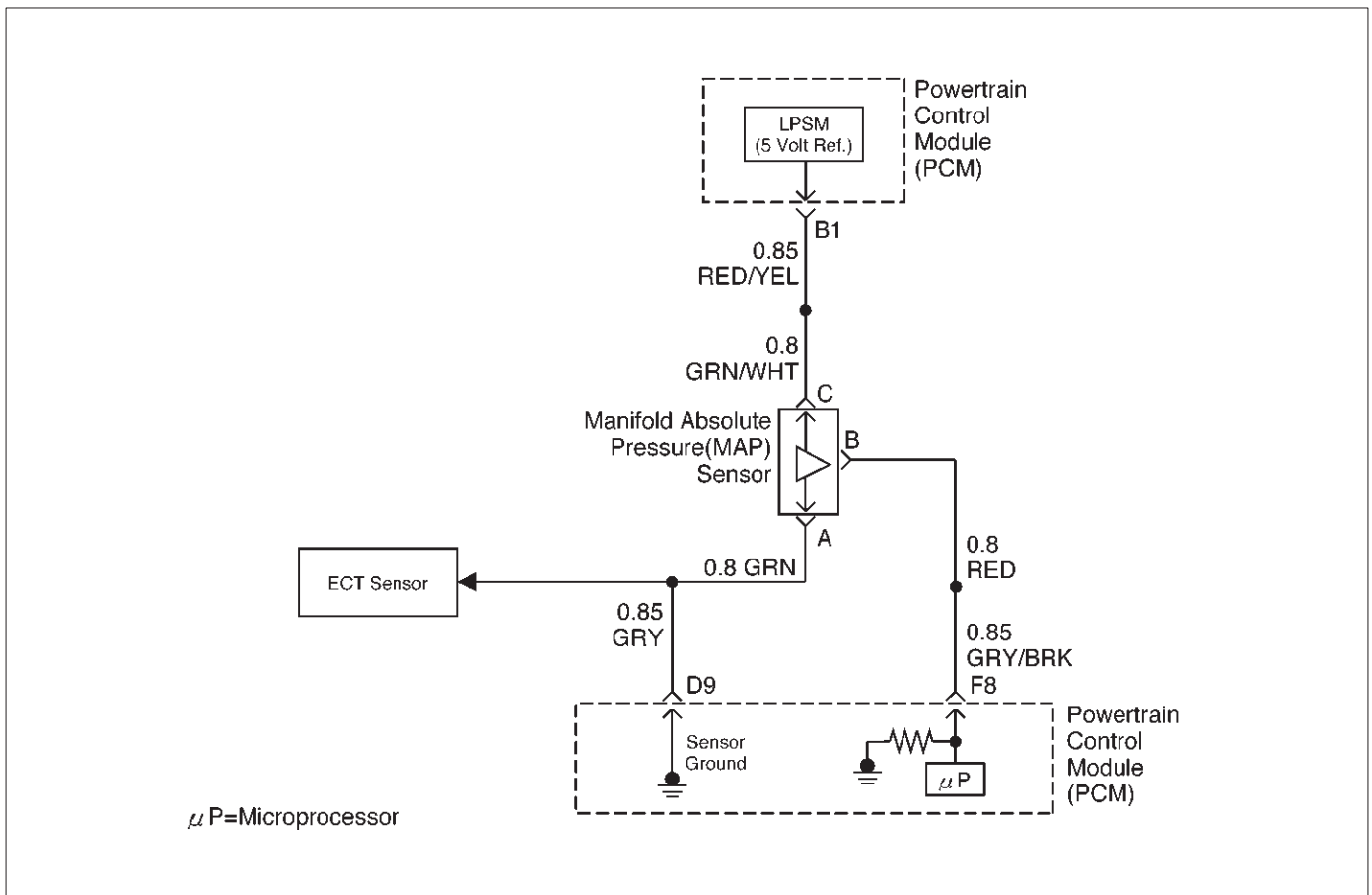
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.
4. A frequency reading with the MAF sensor connector disconnected indicates an electromagnetic interference (EMI) related fault.

DTC P0103 – MAF Sensor Circuit High Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0103. Does the Tech 2 indicate DTC P0103 failed this ignition?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is "MAF Frequency" above the specified value?	219 g/Sec	Go to <i>Step 4</i>	Go to <i>Step 7</i>
4	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0.0 g/Sec	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to <i>Step 8</i>
6	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	1. With the engine idling, monitor "MAF Frequency" display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate "MAF Frequency" above the specified value?	219 g/Sec	Go to <i>Step 5</i>	Go to <i>Step 8</i>
8	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0107 MAP Sensor Circuit Low Voltage



D06RW102

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure at or below 11 kPa for a total of approximately 10 seconds over a 16-second period.
- Ignition voltage more than 11 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0107 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check for intermittent codes.
- The MAP sensor shares a 5 Volt reference with the Rough Road Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Rough Road Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors

and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault. If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in

determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

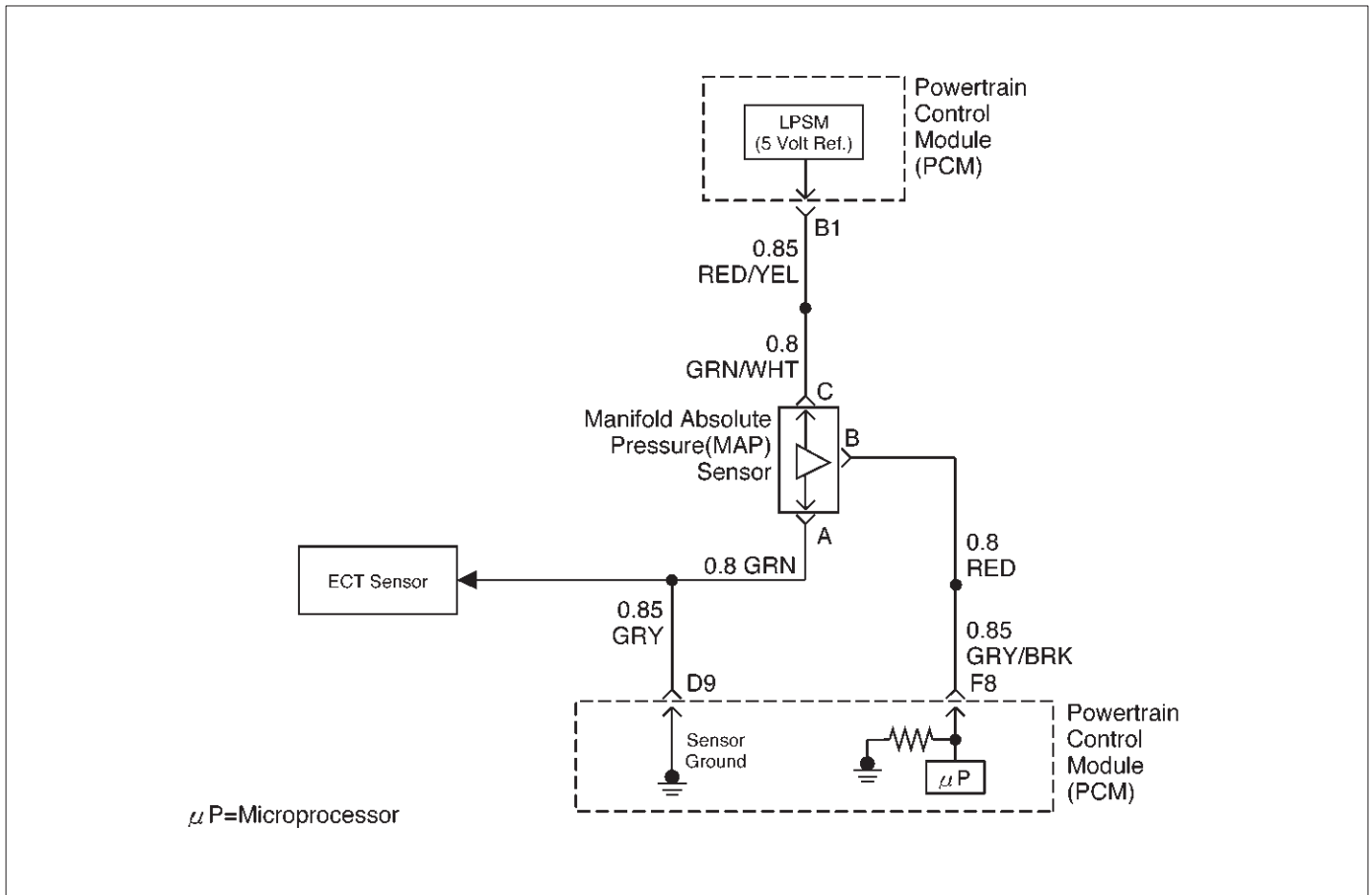
DTC P0107 – MAP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	11 kPa at sea level	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "Specific DTC" info for DTC P0107. Does the Tech 2 indicate DTC P0107 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference "A" circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition "ON." 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	5 V 104 kPa	Go to Step 10	Go to Step 5
5	1. Disconnect the jumper. 2. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value.	5 V 104 kPa	Go to Step 6	Go to Step 8
6	1. Ignition "OFF." 2. Disconnect the PCM and check the 5 volt reference "A" circuit for an open or short to ground. 3. If the 5 volt reference "A" circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference "A" circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference "A" circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9

DTC P0107 – MAP Sensor Circuit Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0108 MAP Sensor Circuit High Voltage



D06RW102

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running for more than 10 seconds.
- Throttle position is below 3% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 10 seconds over a 16-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.

- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0108 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1108 Diagnostic Chart may isolate the cause of the fault.

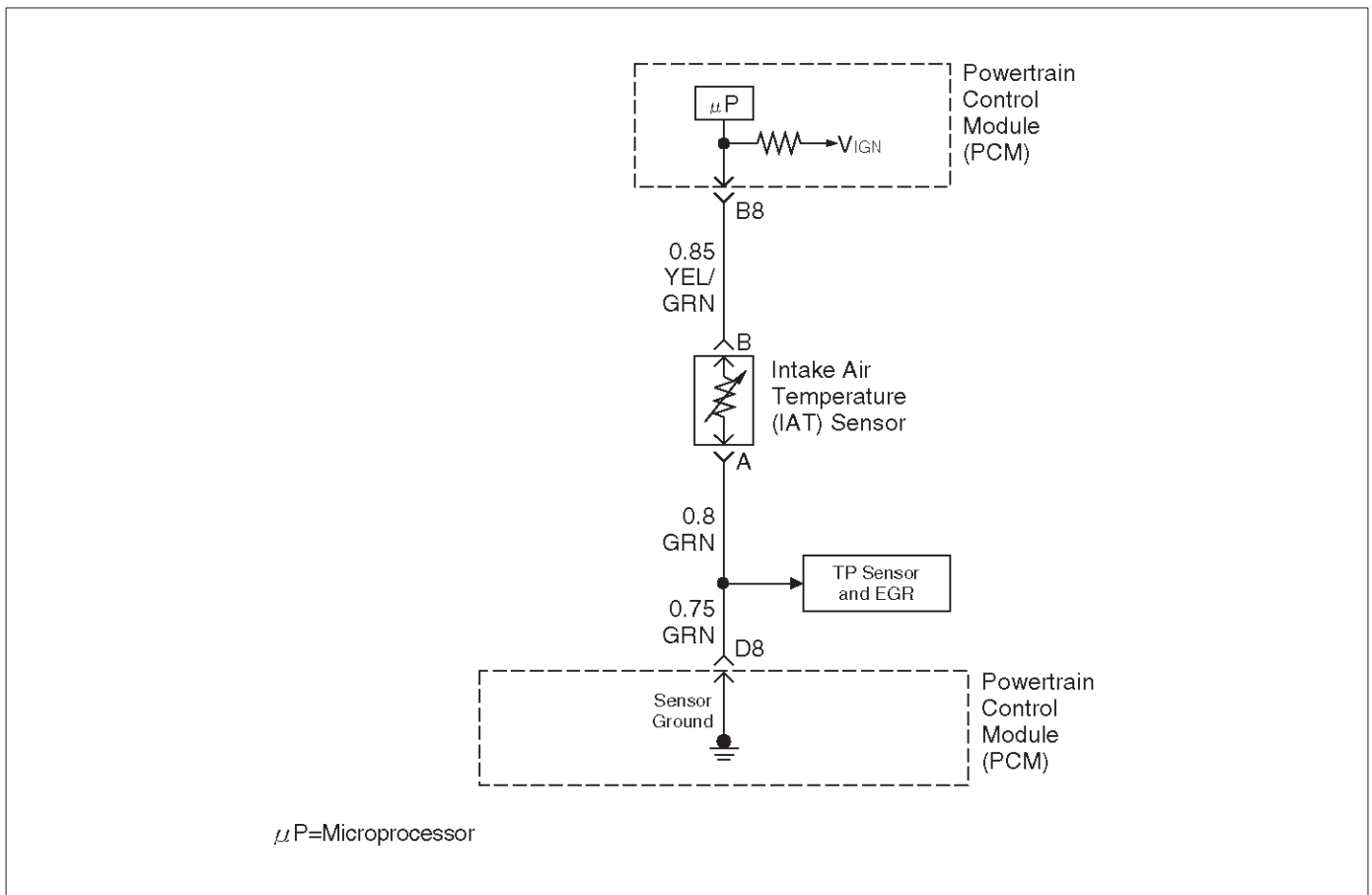
DTC P0108 – MAP Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to <i>Symptoms</i> section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	90 kPa	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "Specific DTC" info for DTC P0108. Does the Tech 2 indicate DTC P0108 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Ignition "ON." 4. Note the MAP sensor voltage displayed on the Tech 2. Is the MAP sensor voltage at the specified value?	0.0 V 11 kPa	Go to Step 5	Go to Step 6
5	Probe the sensor ground circuit with a test light to B+. Is the test light "ON?"	—	Go to Step 7	Go to Step 9
6	1. Check the MAP signal circuit for a short to voltage or a short to the 5 volt reference "A" circuit. 2. If the MAP sensor signal circuit is shorted, repair circuit as necessary. Was the MAP sensor signal circuit shorted?	—	Verify repair	Go to Step 11
7	1. Check for a poor sensor ground terminal connection at the MAP sensor electrical connector. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to Step 8
8	Check for a plugged or leaking vacuum supply to the MAP sensor. Is the vacuum supply plugged or leaking?	—	Verify repair	Go to Step 12
9	1. Check for a poor sensor ground terminal connection at the PCM. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to Step 10
10	1. Check the continuity of the MAP sensor ground circuit. 2. If the MAP sensor ground circuit measures over 5 ohms, repair open or poor connection. Was a condition found and corrected?	—	Verify repair	Go to Step 11

DTC P0108 – MAP Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify Repair	—
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0112 IAT Sensor Circuit Low Voltage



D06RW026

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. DTC P0112 will set when the PCM detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 30 mph (48 km/h) .
- IAT signal voltage indicates and intake air temperature greater than 148°C (298°F) (about 5 volts) for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0112 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-bout terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
 - Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.
- If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

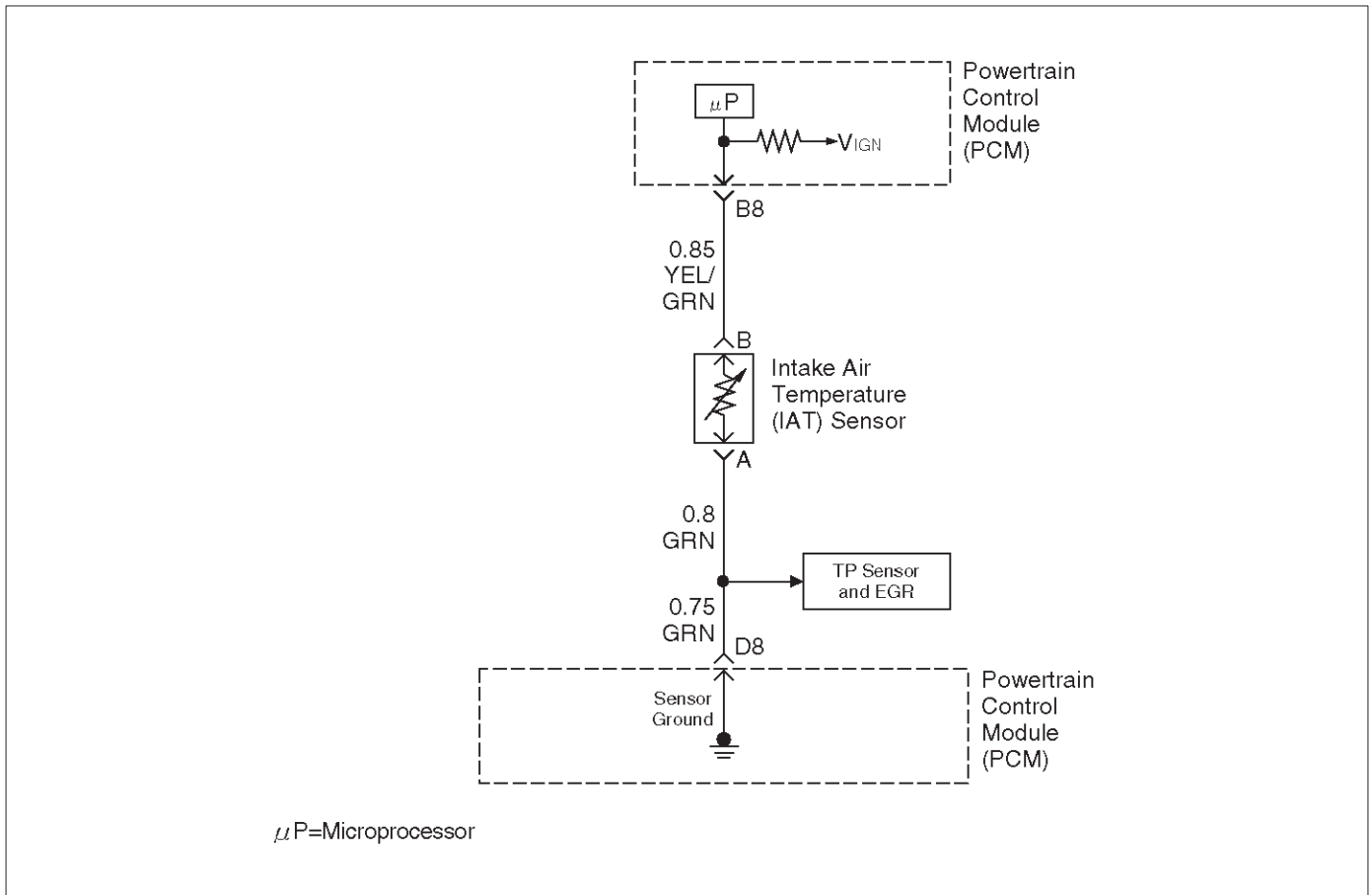
Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

DTC P0112-IAT Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148°C (283°F)	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Ignition "ON," engine "OFF." Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the "Specific DTC" info for DTC P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Ignition "ON." 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	-38°C (-36°F)	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Ignition "OFF." 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify repair	Go to <i>Step 7</i>
6	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0113 IAT Sensor Circuit High Voltage



D06RW026

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 20 mph (32 km/h).
- ECT signal temperature is above 60°C (140°F).
- Mass air flow is less than 20 g/second.
- IAT signal voltage indicates an intake air temperature less than -39°C (-38°F) for total of 12.5 seconds over a 25-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0113 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The IAT sensor shares a ground with the EGR position sensor and the TP sensor. Check the ground if these DTC's are set.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

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3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

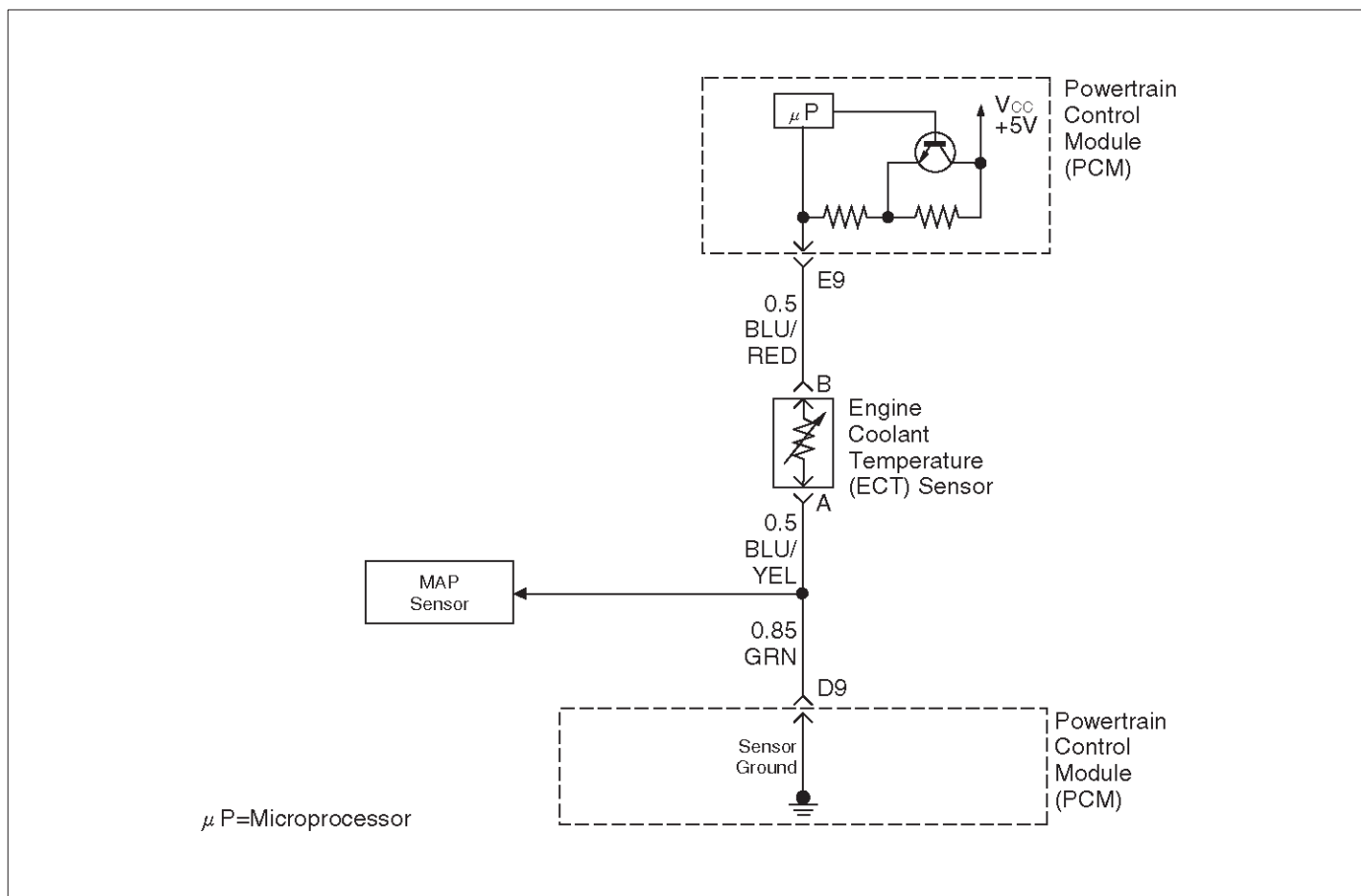
DTC P0113 –IAT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Ignition "ON," engine "OFF." Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" below the specified value?	-38°C (-36°F)	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "Specific DTC" info for DTC P0113. Does the Tech 2 indicate DTC P0113 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition "ON." 5. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to <i>Step 7</i>	Go to <i>Step 8</i>

DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 10</i>
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to <i>Step 9</i>
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to <i>Step 9</i>
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0117 ECT Sensor Circuit Low Voltage



060RY00304

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the rear of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than one minute.
- The ECT sensor signal indicates an engine coolant temperature greater than 150°C (302°F) (about 0.10 V) for a total of 50 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0117 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

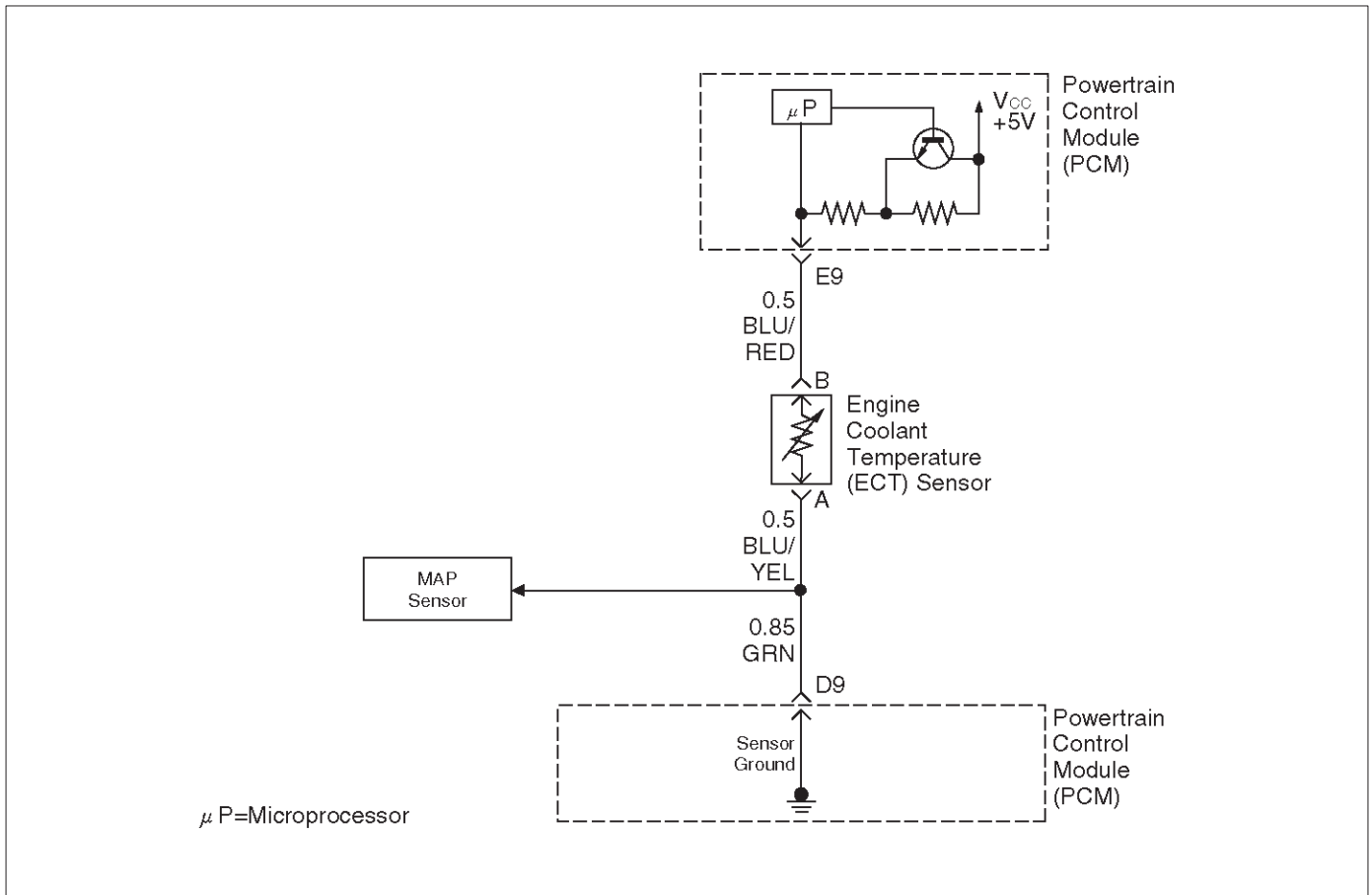
Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

DTC P0117 – ECT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "Specific DTC" info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	-39°C (-38°F)	Go to Step 6	Go to Step 5
5	1. Ignition "OFF." 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted, repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0118 ECT Sensor Circuit High Voltage



060RY00304

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the rear of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than 1.5 minutes.
- The ECT sensor signal indicates an engine coolant temperature of -39°C (-38°F) or less (about 5 volts) for a total of 50 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0118 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

The ECT shares a ground with the Transmission Fluid Temperature sensor, the Rough Road sensor, and the MAP sensor.

Check the ground if these DTCs are also set.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

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Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

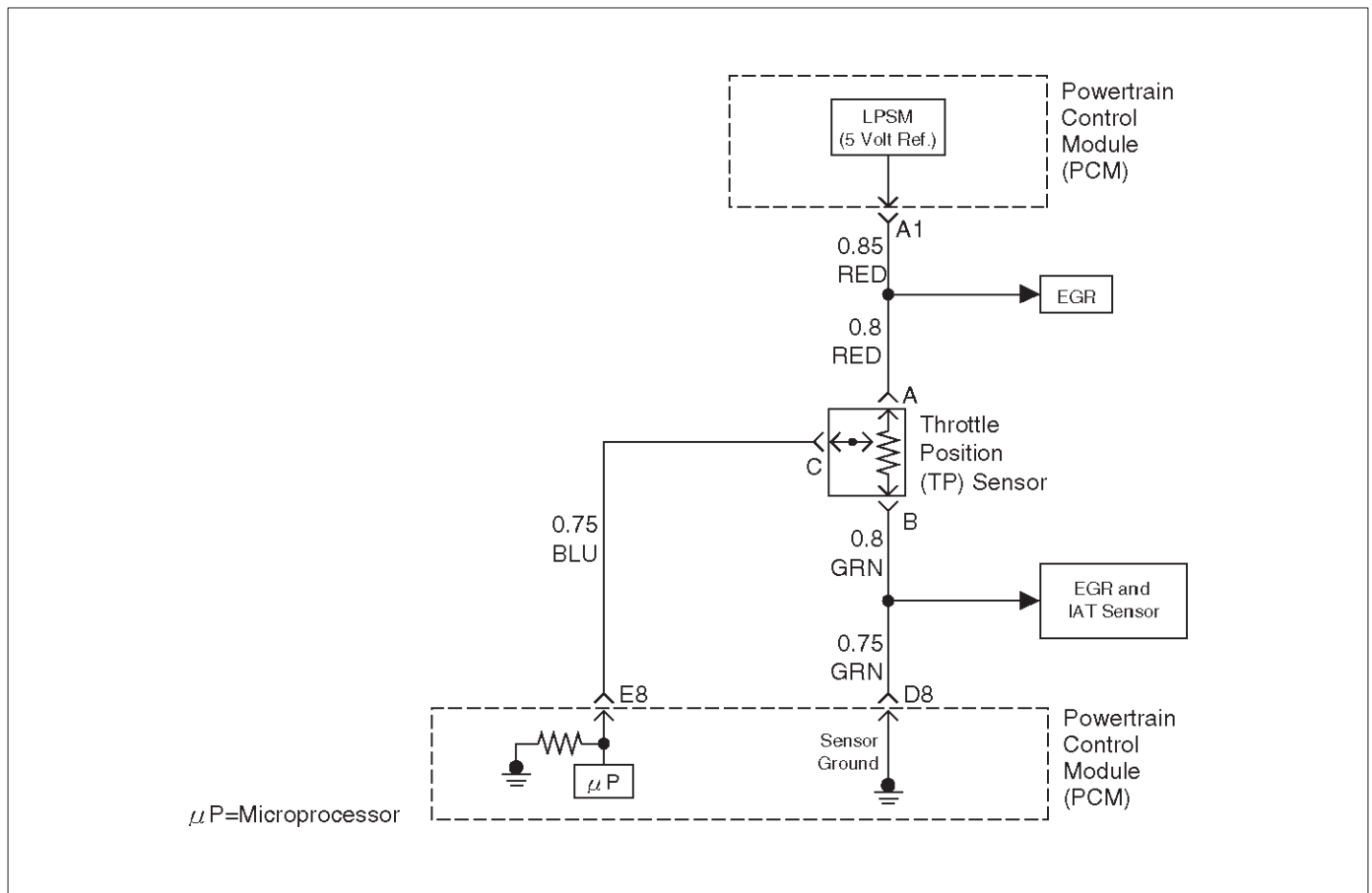
DTC P0118 – ECT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	-39°C (-38°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "Specific DTC" info for DTC P0118. Does the Tech 2 indicate DTC P0118 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140°C (284°F)	Go to Step 6	Go to Step 5
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140°C (284°F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10

DTC P0118 – ECT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to <i>Step 9</i>
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to <i>Step 9</i>
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0121 TP System Performance



D06RW028

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from about 0.6 volts at closed throttle to about 4.5 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and many of the PCM-controlled outputs. The PCM monitors throttle position and compares actual throttle position from the TP sensor to a predicted TP value calculated from engine speed. If the PCM detects an out-of-range condition, DTC P0121 will set.

Conditions for Setting the DTC

- The engine is running.
- No MAP DTCs, or P0121, P0122, P0123 are set.
- MAP reading is below 55 kPa.
- Throttle is steady, throttle angle is changing less than 1%.
- Predicted throttle angle is not close to actual throttle angle.
- Above conditions are present for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on mass air flow and RPM.

Conditions for Clearing the MIL/DTC

- DTC P0121 can be cleared by using the Tech 2 "Clear info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Skewed MAP signal or faulty Map sensor – An incorrect MAP signal may cause the PCM to incorrectly calculate the predicted TP sensor value during high engine load situations. Check for an unusually low MAP reading. This condition can cause DTC P0121 to be set.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0121 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

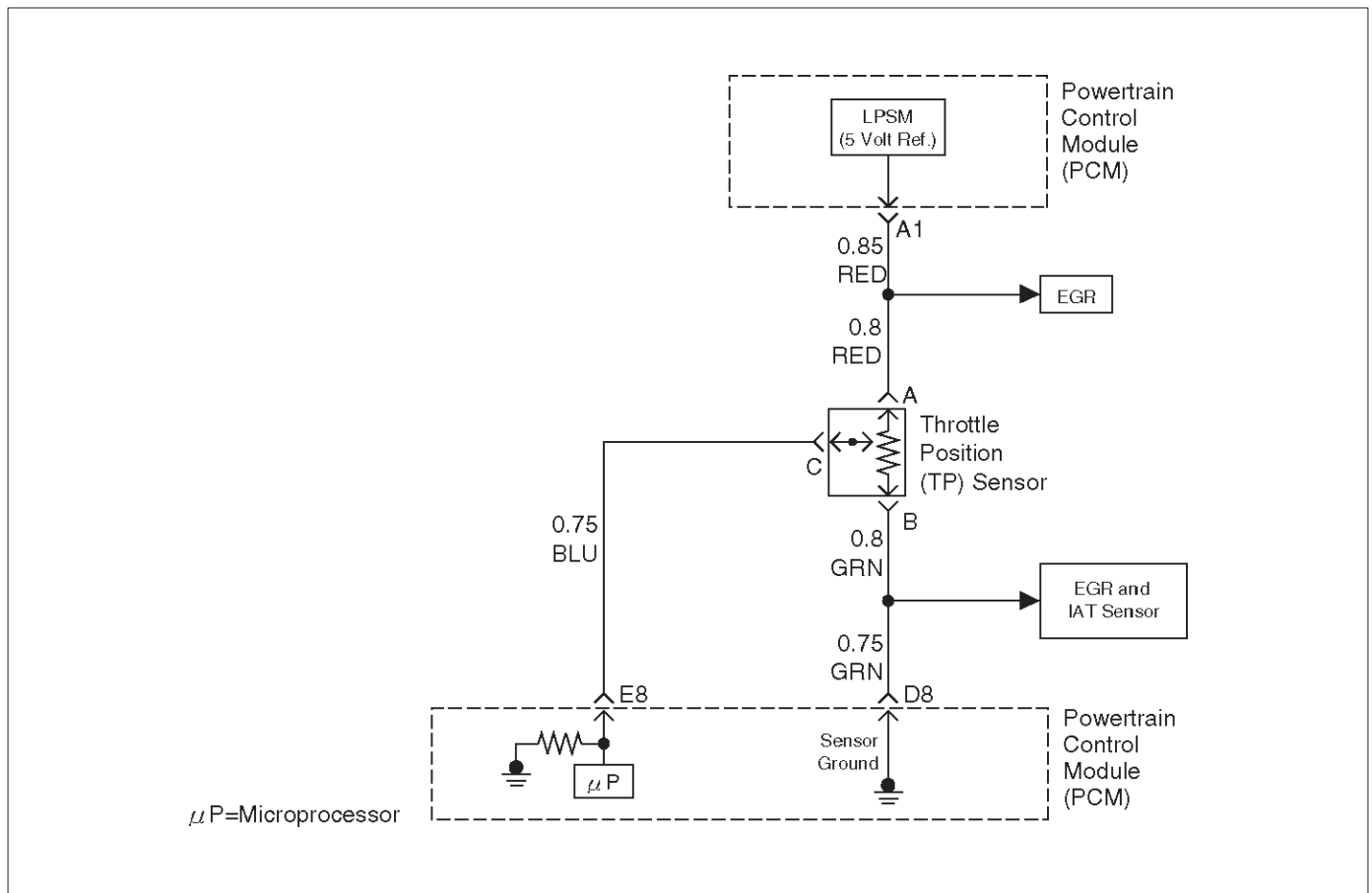
DTC P0121 –TP System Performance

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65 kPa	Go to Step 3	Go to Step 6
3	1. Disconnected the MAP sensor. 2. Connect a test light between the 5 volt reference "A" circuit and the MAP signal circuit at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65 kPa	Go to Step 5	Go to Step 4
4	1. Check the MAP signal circuit between the PCM and the MAP sensor for an open, short to ground, or short to the MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to Step 12
5	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
6	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle = 0% Wide open throttle = 100%	Refer to <i>Diagnostic Aids</i>	Go to Step 7
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0 V	Go to Step 8	Go to Step 9
8	1. Connect a test light between the 5 volt reference "A" circuit and the TP sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading at the specified value?	5 V	Go to Step 11	Go to Step 10
9	Check the following items: 1. TP signal circuit for a short to voltage. 2. TP sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to Step 12

DTC P0121 –TP System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items: 1. TP signal circuit or 5 volt reference "A" circuit for a poor connection. 2. TP signal circuit or 5 volt reference "A" circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0122 TP Sensor Circuit Low Voltage



D06RW028

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from below 0.6 volts at closed throttle to about 4.5 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and many of the PCM-controlled outputs.

Conditions for Setting the DTC

- The ignition is "ON."
- TP sensor signal voltage is less than 0.22 volt for a total of 0.78 second over a 1.5-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on mass air flow and RPM.

Conditions for Clearing the MIL/DTC

- DTC P0122 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check intermittent codes.
- The TP sensor shares a 5 Volt reference with the EGR position sensor. Check the 5 Volt reference if these DTCs are also set.
- The TP sensor shares a ground with the IAT sensor, the EGR position sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If DTC P0122 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

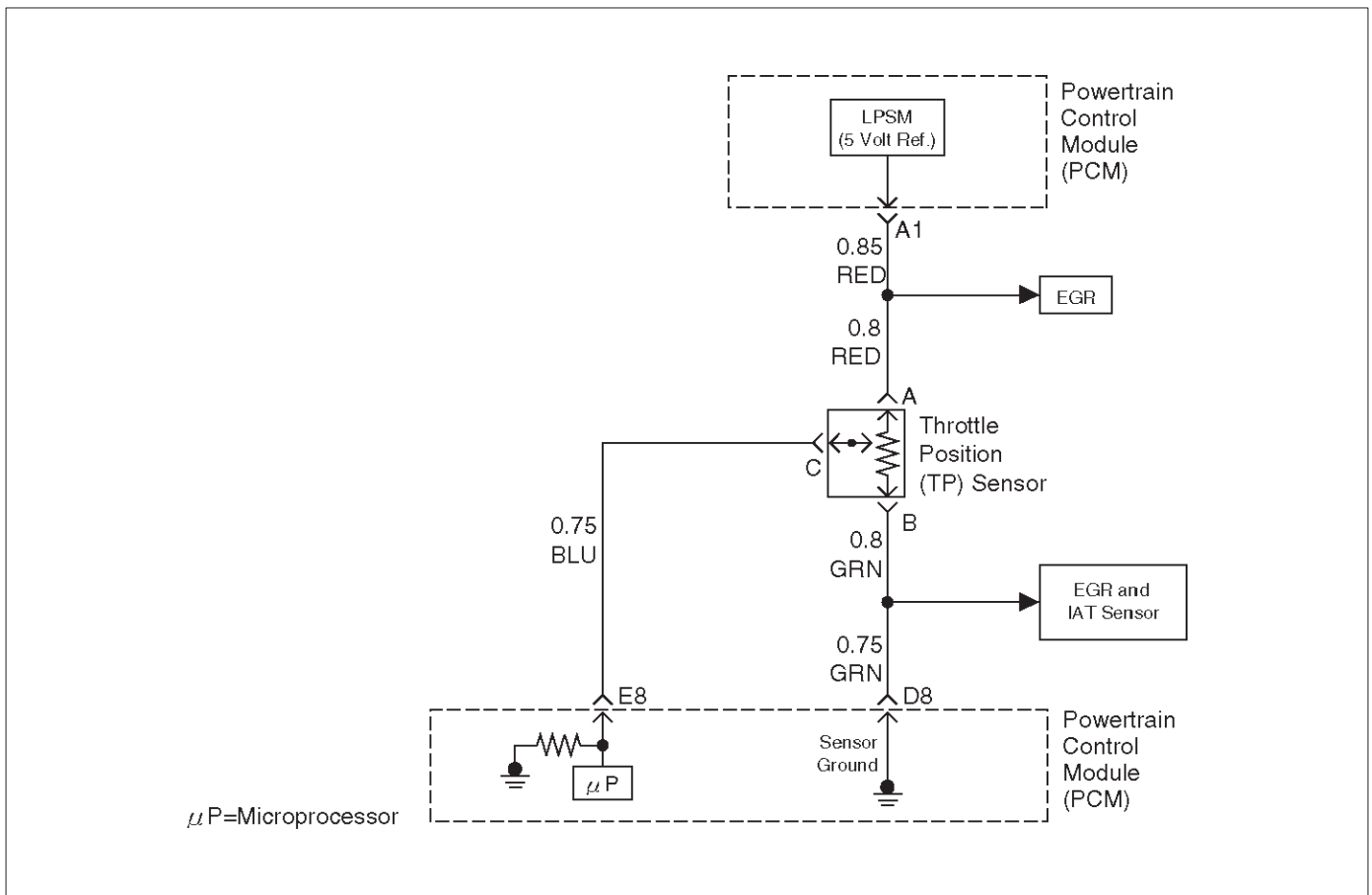
DTC P0122 –TP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the "TP Sensor" display on the Tech 2. Is the "TP Sensor" below the specified value?	0.22 V	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0122. Does the Tech 2 indicate DTC P0122 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the TP sensor electrical connector. 3. Jumper the 5 volt reference "A" circuit and the TP signal together at the TP sensor harness connector. 4. Ignition "ON." Observe the "TP Sensor" display on the Tech 2. Is the "TP Sensor" at the specified value?	5 V	Go to Step 10	Go to Step 5
5	1. Disconnect jumper. 2. Connect a test light between B+ and the TP sensor signal circuit at the TP sensor harness connector. Observe the "TP Sensor" display on the Tech 2. Is the "TP Sensor" at the specified value?	5 V	Go to Step 6	Go to Step 8
6	1. Ignition "OFF." 2. Disconnect the PCM and check the 5 volt reference "A" circuit for an open or short to ground. 3. If the 5 volt reference "A" circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference "A" circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference "A" circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the TP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the TP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the TP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9
9	Check the TP sensor signal circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12

DTC P0122 –TP Sensor Circuit Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the TP sensor signal circuit for a poor connection at the TP sensor and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 11</i>
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0123 TP Sensor Circuit High Voltage



D06RW028

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from about 0.6 volts at closed throttle to about 4.5 volts at wide open throttle (WOT). The TP signal is one of the most important inputs used by the powertrain control module (PCM) for fuel control and many of the PCM-controlled outputs.

Conditions for Setting the DTC

- The ignition is "ON."
- TP sensor signal voltage is greater than 4.88 volts for a total of 0.78 second over a 1.5-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on mass air flow and RPM.

Conditions for Clearing the MIL/DTC

- DTC P0123 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check intermittent codes.
 - The TP sensor shares a 5 Volt reference with the EGR position sensor. Check the 5 Volt reference if these DTCs are also set.
 - The TP sensor shares a ground with the IAT sensor and the EGR position sensor. Check the ground if these other DTCs are also set.
 - Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
 - Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.
 - Faulty TP sensor – With the ignition key "ON," engine "OFF," observe the TP sensor display on the Tech 2 while slowly depressing the accelerator to wide open throttle. If a voltage over 4.88 volts is seen at any point in normal accelerator travel, replace the TP sensor.
- If DTC P0123 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number (s) below refer to the step number(s) on the Diagnostic Chart.

7. Components that share the TP sensor 5 volt reference "A" circuit include the following device:

- EGR valve

Disconnect the component while observing the TP sensor display on the Tech 2. If the reading changes drastically when this component is

disconnected, replace the component that affected the reading.

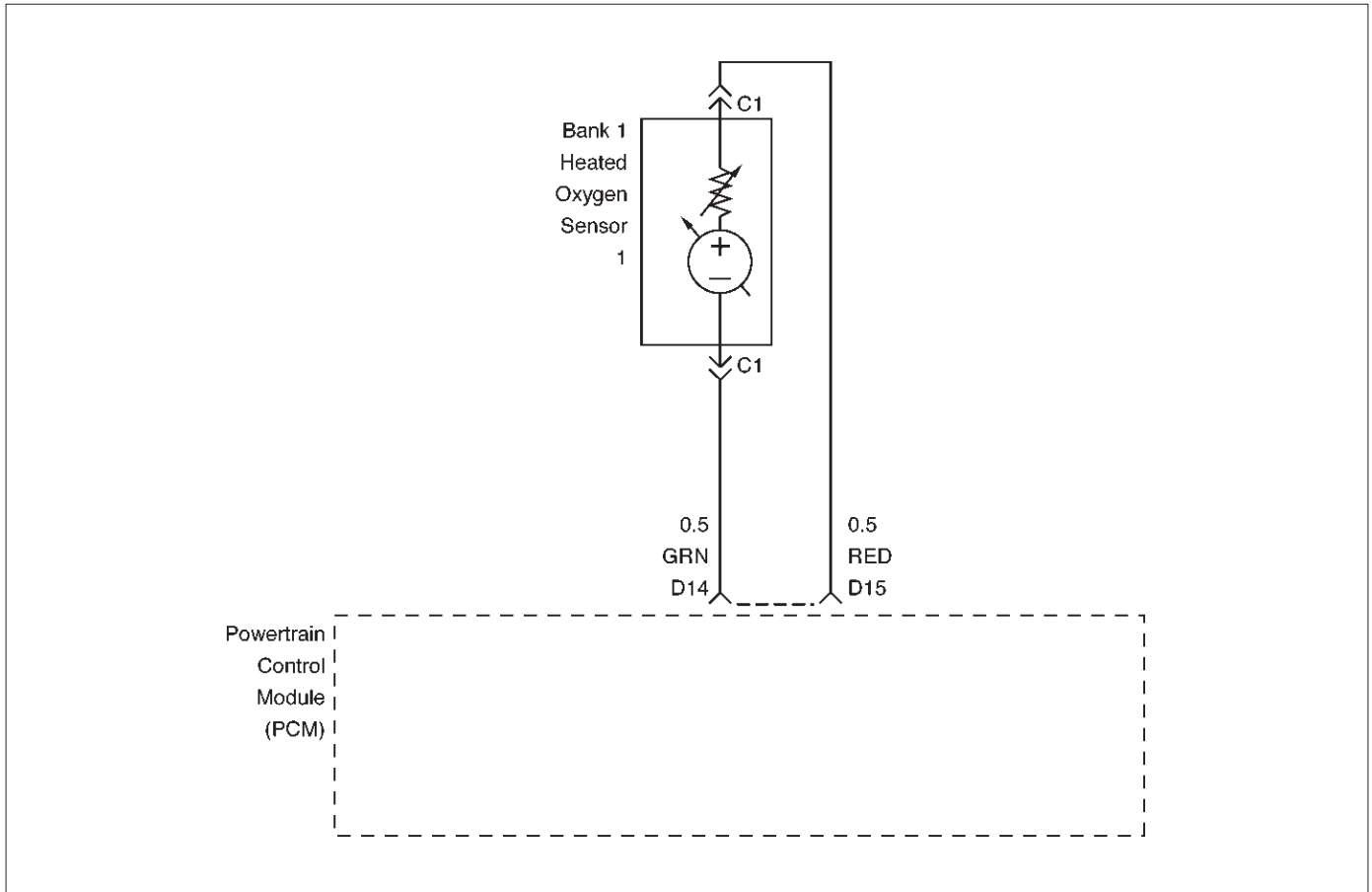
DTC P0123 – TP Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the "TP Sensor" display on the Tech 2. Is the "TP Sensor" above the specified value?	4.88 V	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "Specific DTC" info for DTC P0123. Does the Tech 2 indicate DTC P0123 failed.	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the TP sensor electrical connector. 2. Observe the "TP Sensor" display on the Tech 2. Is the "TP Sensor" near the specified value?	0 V	Go to Step 5	Go to Step 6
5	Probe the sensor ground circuit at the TP sensor harness connector with a test light connected to B+. Is the test light "ON?"	—	Go to Step 7	Go to Step 10
6	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," engine "OFF." 3. Check for a short to voltage on the TP sensor signal circuit. 4. If the TP sensor signal circuit is shorted, repair it as necessary. Was the TP sensor signal circuit shorted?	—	Verify repair	Go to Step 12
7	1. Ignition "ON." 2. Monitor the "TP Sensor" Tech 2 display while disconnecting each of the components that share the 5 volt reference "A" circuit (one at a time). 3. If the "TP Sensor" Tech 2 display changes, replace the component that caused the display to change when disconnected. Does disconnecting any of these components cause the "TP Sensor" display to change?	—	Verify repair	Go to Step 8
8	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," engine "OFF." 3. Check for a short to B+ on the 5 volt reference "A" circuit. 4. If the 5 volt reference "A" circuit is shorted, repair it as necessary. Was the 5 volt reference "A" circuit shorted?	—	Verify repair	Go to Step 9
9	Check for poor electrical connections at the TP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 11

DTC P0123 – TP Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition "OFF." 2. Disconnect the PCM, and check for an open sensor ground circuit to the TP sensor. 3. If a problem is found, repair it as necessary. Was the sensor ground circuit to the TP sensor open?	—	Verify repair	Go to <i>Step 12</i>
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1



060RW236

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0131 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Vehicle is operating in “closed loop.”
- Engine coolant temperature is above 60°C (140°F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- DTC P0131 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0131 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform “Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the

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HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.

- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to step numbers on the diagnostic chart.

3. DTC P0131 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

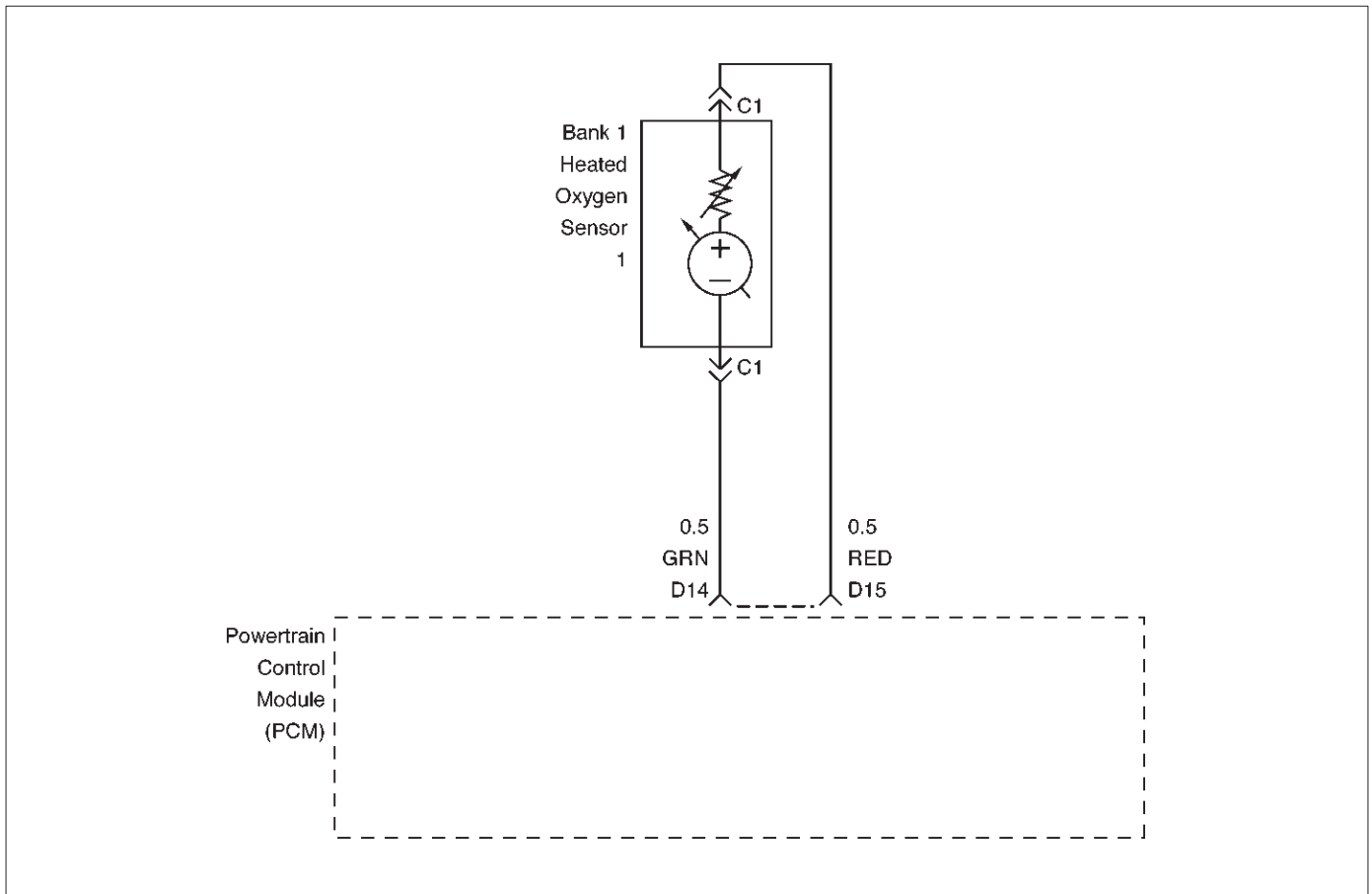
DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	22 mV	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF," review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Specific DTC" info for DTC P0131 until the DTC P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Turn the ignition "OFF." 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to Step 5	Go to Step 6
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Turn the ignition "OFF," HO2S 1 and PCM disconnected. 2. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—

DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to <i>Diagnostic Aids</i>	Go to <i>Step 9</i>
9	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0132 HO2S Circuit High Voltage Bank 1 Sensor 1



060RW236

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0132 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60°C (140°F)
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during “deceleration fuel cutoff mode” operation for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- DTC P0132 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0132 may be set. Refer to *Fuel System Diagnosis*.
- Perform “Injector Balance Test” – Refer to *Fuel System Diagnosis*.
- MAF sensor – The system can go rich if MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.

- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) –If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit or Faulty HO2S—A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle by monitoring the HO2S voltage with a Tech 2. If the

HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal conditions.

- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0132 failing during “deceleration fuel cutoff mode” operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

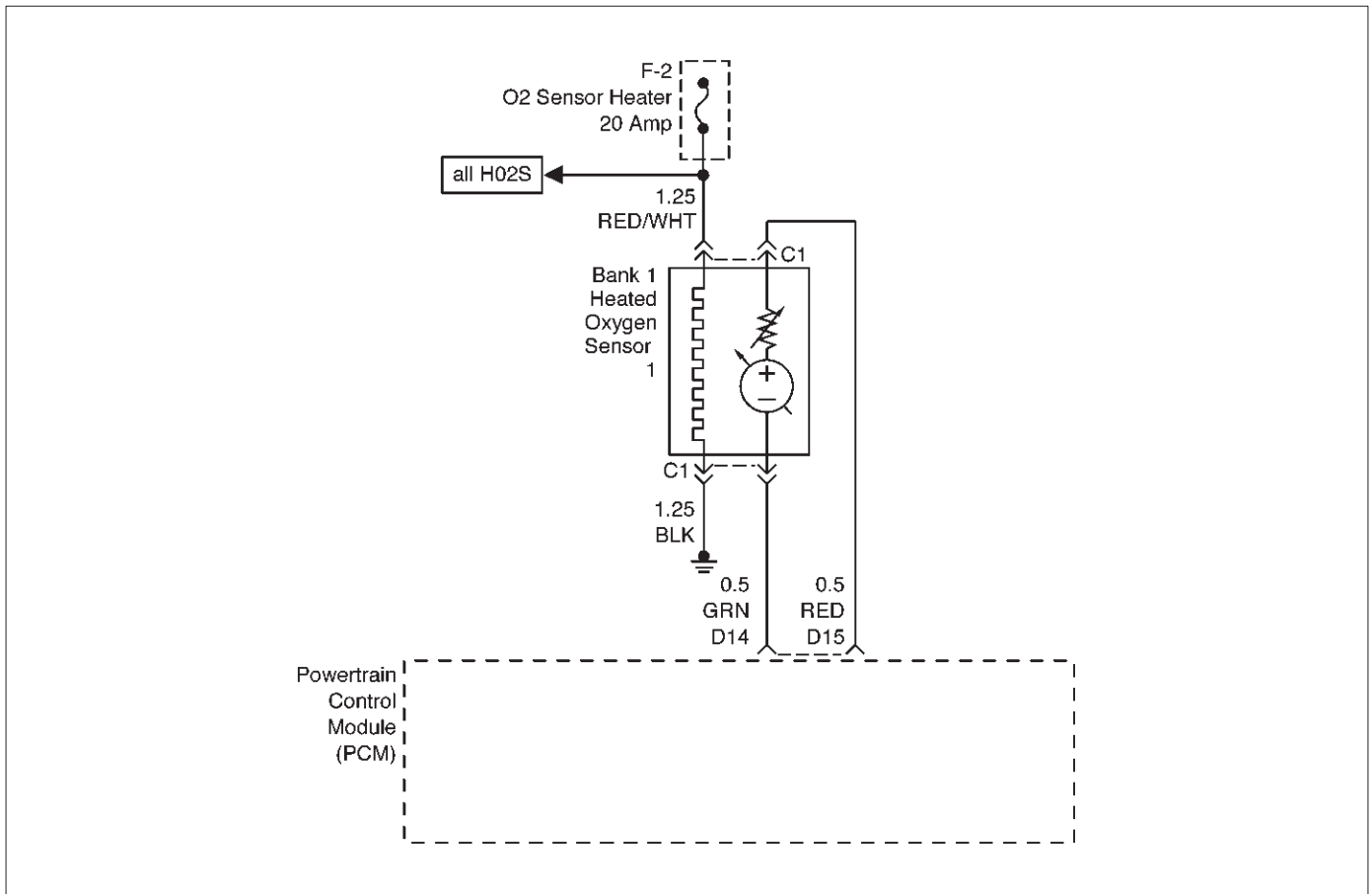
DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to Step 4	Go to Step 3
3	1. Ignition “ON,” review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Specific DTC” info for DTC P0132 until the DTC P0132 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0132 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition “OFF.” 2. Disconnect Bank 1 HO2S 1. 3. Ignition “ON.” 4. At HO2S Bank 1 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine "OFF." 2. At Bank 1 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to <i>Diagnostic Aids</i>	Go to <i>Step 8</i>
8	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1



060RW237

Circuit Description

- The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0134 will be set, indicating an open sensor signal or sensor low circuit.
- Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active.
- Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.

- Oxygen sensor heater has been determined to be functioning properly.
- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Take When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- DTC P0134 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition “ON,” engine “OFF,” after a cool down period, the HO2S 1 voltage displayed on Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV

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indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.

- Intermittent test – With the Ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- If the DTC P0134 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

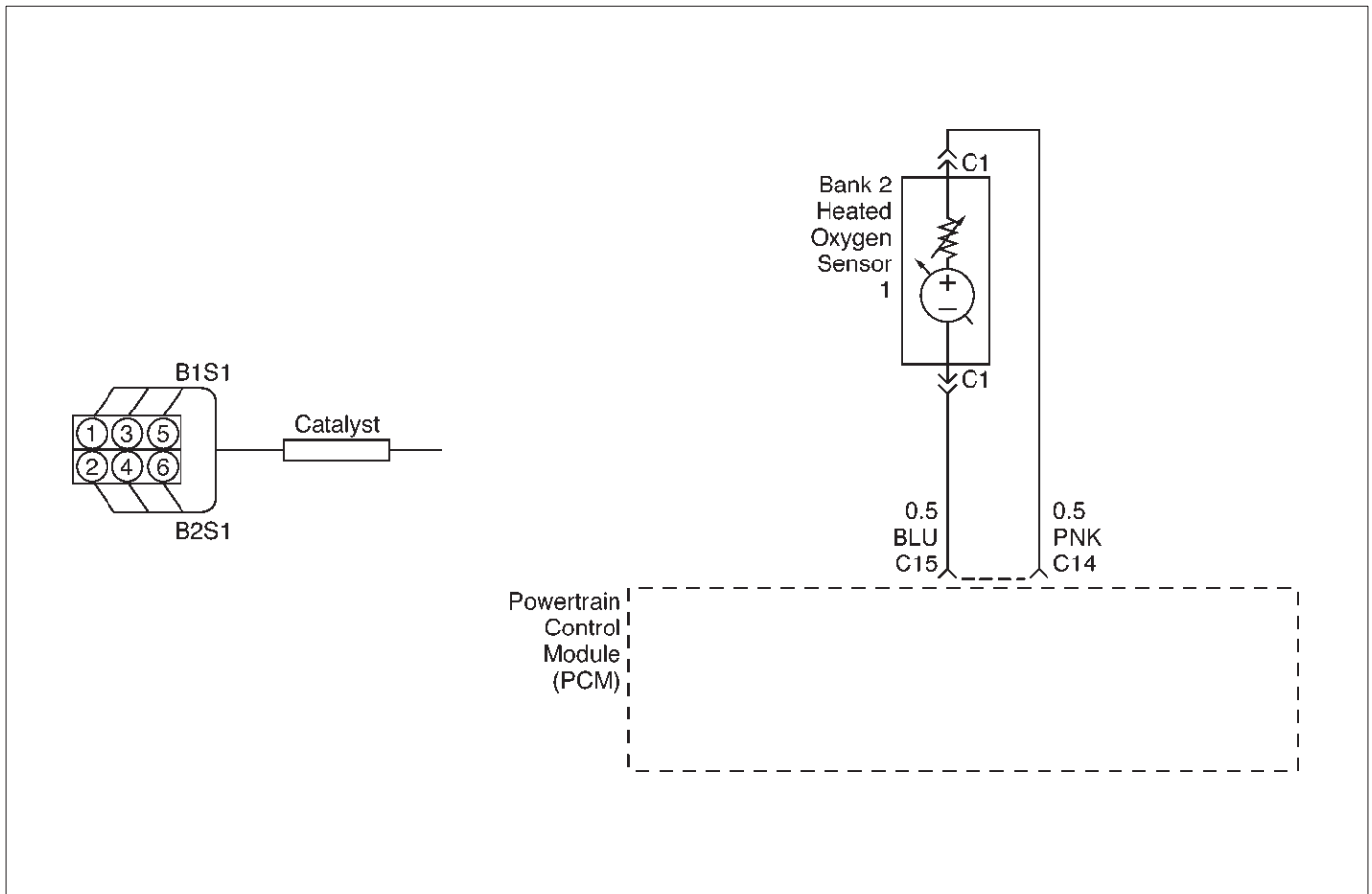
DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Install Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to Step 3	Go to Step 4
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor “Specific DTC” info for DTC P0134 until the DTC P0134 test runs. 4. Note the test result. Does Tech 2 indicate DTC P0134 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to Step 5
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 6
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	1. Ignition “OFF.” 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to Step 8

DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to <i>Step 9</i>
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage in the specified range?	0-10 mV	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1



Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0151 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 2 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- DTC P0151 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0151 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test."
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for

exhaust leaks that may cause a false lean condition to be indicated.

- MAF sensor –The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0151 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0151 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicate.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

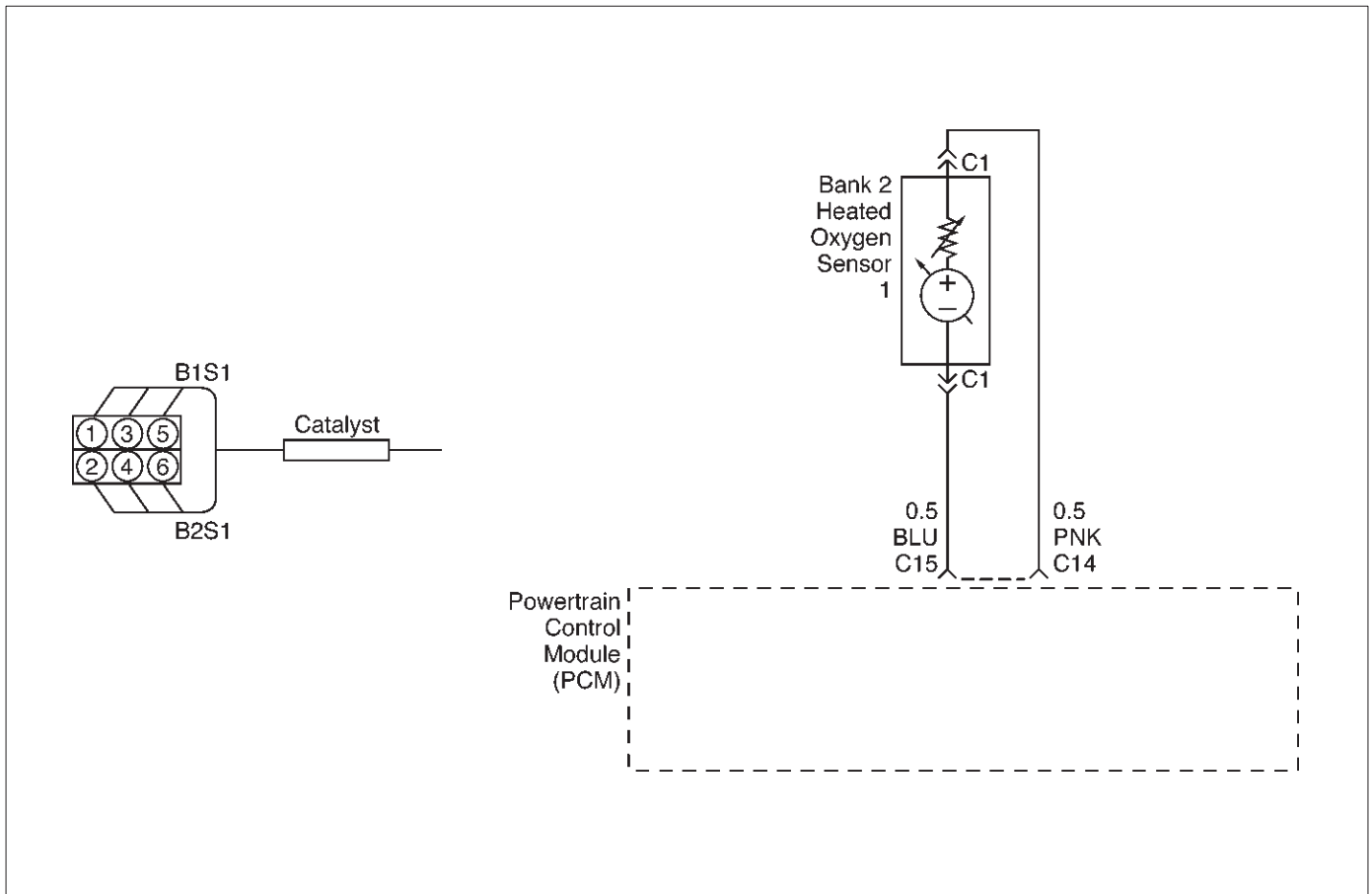
DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Install Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain below the specified value?	22 mV	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF," review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor "Specific DTC" info for DTC P0151 until the DTC P0151 test runs. 4. Note test result. Does Tech 2 indicate DTC P0151 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Turn ignition "OFF." 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 1 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 1 signal circuits shorted?	—	Go to Step 5	Go to Step 6
5	Repair the Bank 2 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "OFF." 2. Leave the PCM and HO2S 1 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—

DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON." Does Tech 2 indicate Bank 2 HO2S 1 voltage near the specified value?	425-475 mV	Refer to <i>Diagnostic Aids</i>	Go to <i>Step 9</i>
9	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0152 HO2S Circuit HIGH Voltage Bank 2 Sensor 1



Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing the injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0152 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- The engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio between 14.5 and 14.8.
- Throttle angle between 3% and 19%.
- Bank 2 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 2 HO2S 1 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- DTC P0152 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0152 may be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) system – Check the canister for fuel saturation. If the canister is full of fuel, check EVAP control system components and hoses. Refer to *Evaporative Emission (EVAP) Control System*.

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- MAF sensor – The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if rich condition is corrected. If so, replace MAF sensor.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S)– If the HO2S is internally shorted, the HO2S voltage displayed on Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can cause a high HO2S voltage to be indicated. This condition is indicated by powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S– A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode.

An HO2S which is faulty and not allowing a full voltage switch between the rich and lean thresholds can also cause the condition. Operate the vehicle while monitoring the HO2S voltage with Tech 2. If the HO2S is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal connections.

- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0152 failing during deceleration fuel cutoff mode operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0152 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

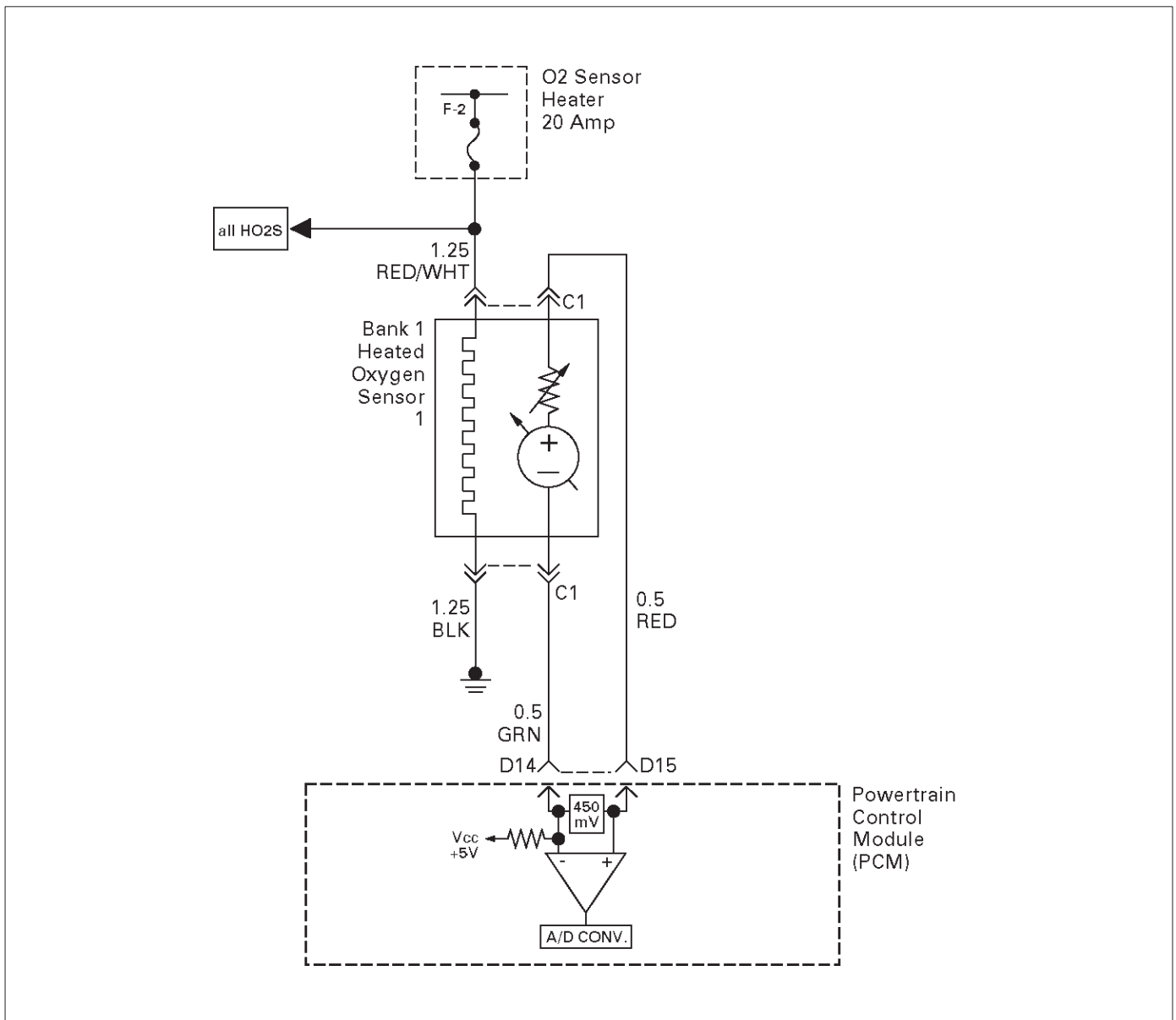
DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Install Tech 2. 2. Engine is at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-off mode)	Go to Step 4	Go to Step 3
3	1. Ignition “ON.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using Tech 2, monitor “Specific DTC” info for DTC P0152 until the DTC P0152 test runs. 5. Note the test result. Does Tech 2 indicate DTC P0152 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition “OFF.” 2. Disconnect Bank 2 HO2S 1. 3. Ignition “ON.” 4. At HO2S Bank 2 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine "OFF." 2. At Bank 2 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using Tech 2, monitor Bank 2 HO2S 1 voltage. Is Bank 2 HO2S 1 voltage below the specified value?	10 mV	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage between the specified values?	425-475 mV	Refer to <i>Diagnostic Aids</i>	Go to <i>Step 8</i>
8	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0171 Fuel Trim System Lean Bank 1



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop,” the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set DTC P0171.

The PCM's maximum authority to control long term fuel trim allows a range between -15% (automatic transmission) or -12% (manual transmission) and $+20\%$. The PCM monitors fuel trim under various engine

speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TP sensor DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between -40°C (-40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.

- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0171 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.
4. If the DTC P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

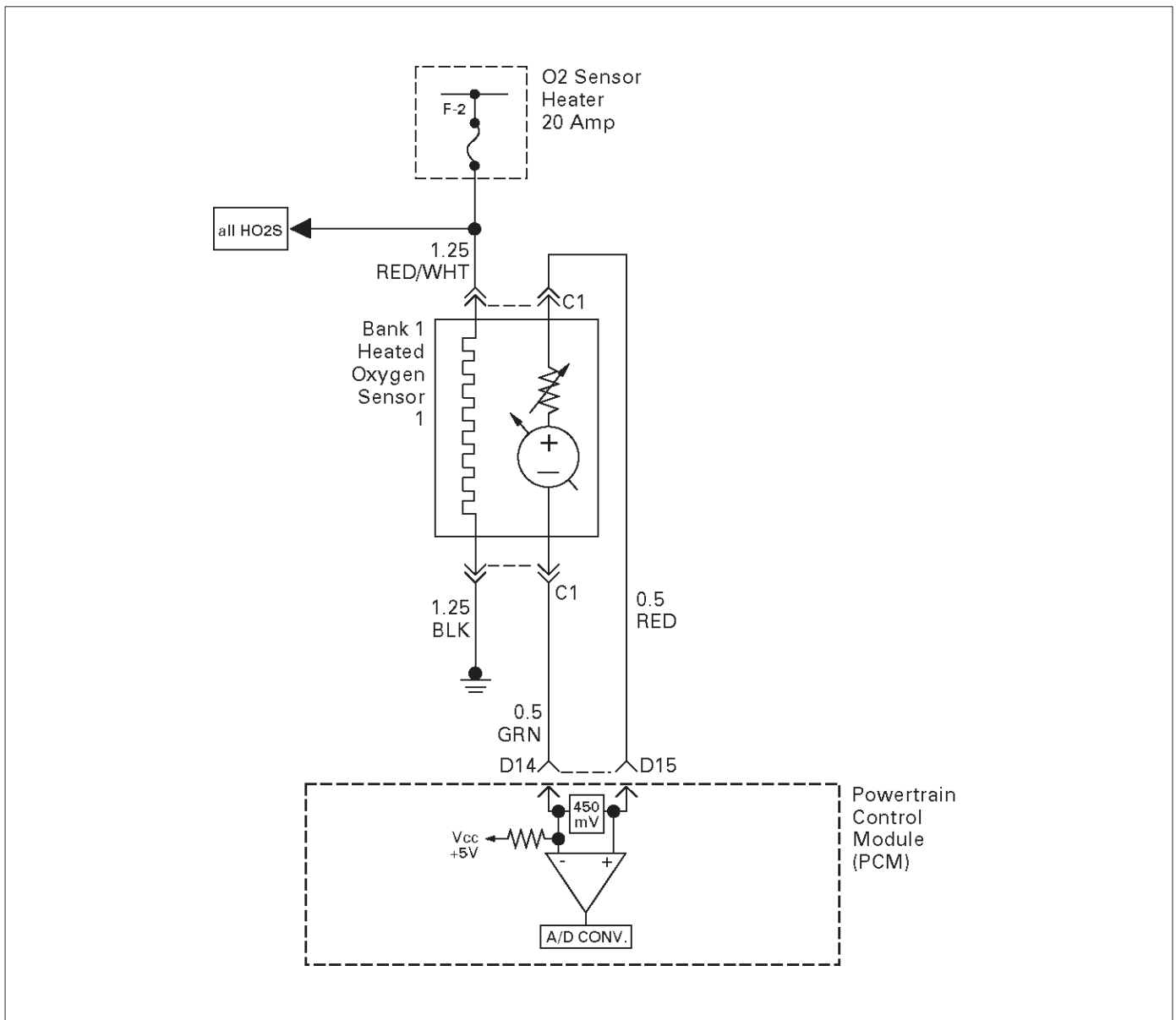
DTC P0171 – Fuel Trim System Lean Bank 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Are any DTCs set other than P0171 and P0174?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to <i>Step 3</i>
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe the “BANK 1 L.T. FUEL TRIM” display on the Tech 2. Is the displayed value greater than the specified value?	L.T. Fuel Trim: +20%	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “Specific DTC” info for DTC P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0171 test runs and note the test result. Does the Tech 2 indicate DTC P0171 failed this ignition?	—	Go to <i>Step 5</i>	The lean condition is not present. If a driveability symptom still exists, refer to <i>Symptoms</i> section.
5	Was DTC P0174 also set?	—	Go to <i>Step 6</i>	Go to <i>Step 15</i>
6	Visually and physically inspect the vacuum hoses for disconnects, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to <i>Step 7</i>
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to <i>Crankcase Ventilation System</i>). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to <i>Step 8</i>
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to <i>Step 9</i>
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to <i>Step 11</i>

DTC P0171 – Fuel Trim System Lean Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the fuel for excessive water, alcohol, or other contaminants (see <i>Diagnosis in Engine Fuel</i> for the procedure) and correct the contaminated fuel condition if present (see <i>Engine Fuel</i>). Was the fuel contaminated?	—	Verify repair	Go to Step 12
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 13
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in “closed loop” while monitoring the “BANK 1 S.T. FUEL TRIM” displayed on the Tech 2. Does “BANK 1 S.T. FUEL TRIM” value decrease to near the specified value?	0%	Go to Step 19	Go to Step 14
14	Perform the procedure in the “Fuel System Pressure Test” and repair fuel system problem if necessary. Did Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to Step 15
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 16
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 17
17	Perform the “Injector Balance Test,” and correct any problem found (refer to <i>Fuel Metering System</i>). Did Injector Balance Test isolate a problem?	—	Verify repair	Go to Step 18
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to <i>Diagnostic Aids</i>
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0172 Fuel Trim System Rich Bank 1



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop,” the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensors (HO2S) 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set DTC P0172.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12 (manual transmission) and +20%.

The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following was set: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TPS DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between –40°C (–40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.

- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop.”

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0172 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

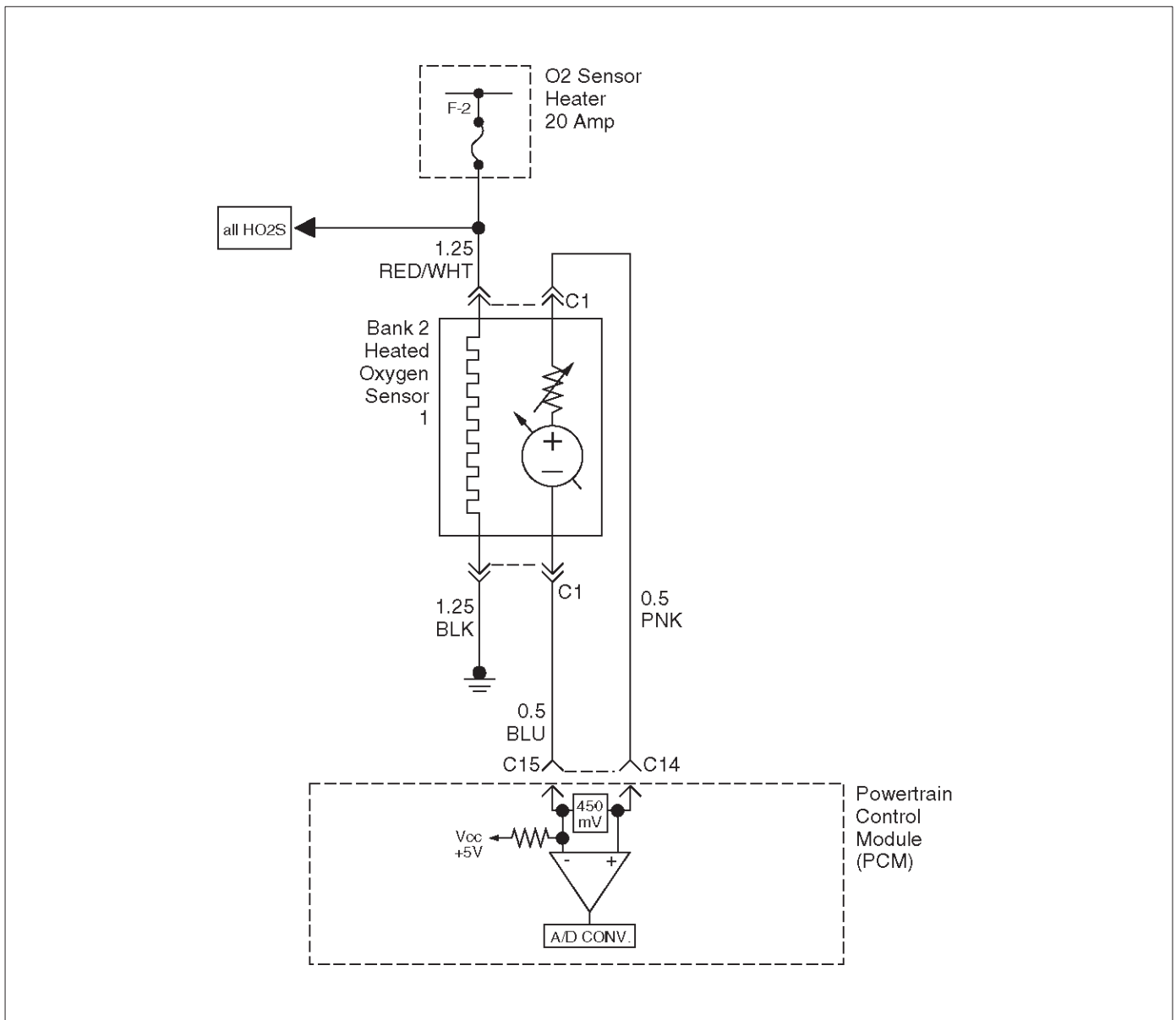
DTC P0172 – Fuel Trim System Rich Bank 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to Step 3
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe “B1 Long Term Fuel Trim” display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to Step 5	Go to Step 4
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0172 test runs and note test result. Does the Tech 2 indicate DTC P0172 failed this ignition?	—	Go to Step 5	The rich condition is not present. If a driveability symptom still exists, refer to <i>Symptoms</i> .
5	Is DTC P0175 also set?	—	Go to Step 6	Go to Step 15
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to Step 7
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 8
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to Step 9
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to Step 10	Go to Step 11
10	1. Ignition “OFF.” 2. Physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 11

DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to <i>Fuel Metering System</i>). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to Step 12
12	Ignition "ON," engine "OFF," monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 0% Maximum 100%	Go to Step 13	Go to Step 18
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S. T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to Step 19	Go to Step 14
14	1. Perform "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to <i>Engine Fuel or Fuel Metering System</i>). Did the Fuel System Pressure Test isolate a problem requiring repair?	—	Verify repair	Go to Step 16
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—
16	1. Perform the "Injector Balance Test." 2. If Injector Balance Test isolates a problem, repair as necessary (refer to <i>Fuel Metering System</i>). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to Step 17
17	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery white deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to Diagnostic Aids
18	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0174 Fuel Trim System Lean Bank 2



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 2, the PCM will set DTC P0174.

The PCM's maximum authority to control long term fuel trim allows a range between -15% (automatic transmission) or -12% (manual transmission) and +20%. The PCM monitors fuel trim under various engine

speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TP sensor, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between -40°C (-40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.

- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0174 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the

Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.
4. If the DTC P0174 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

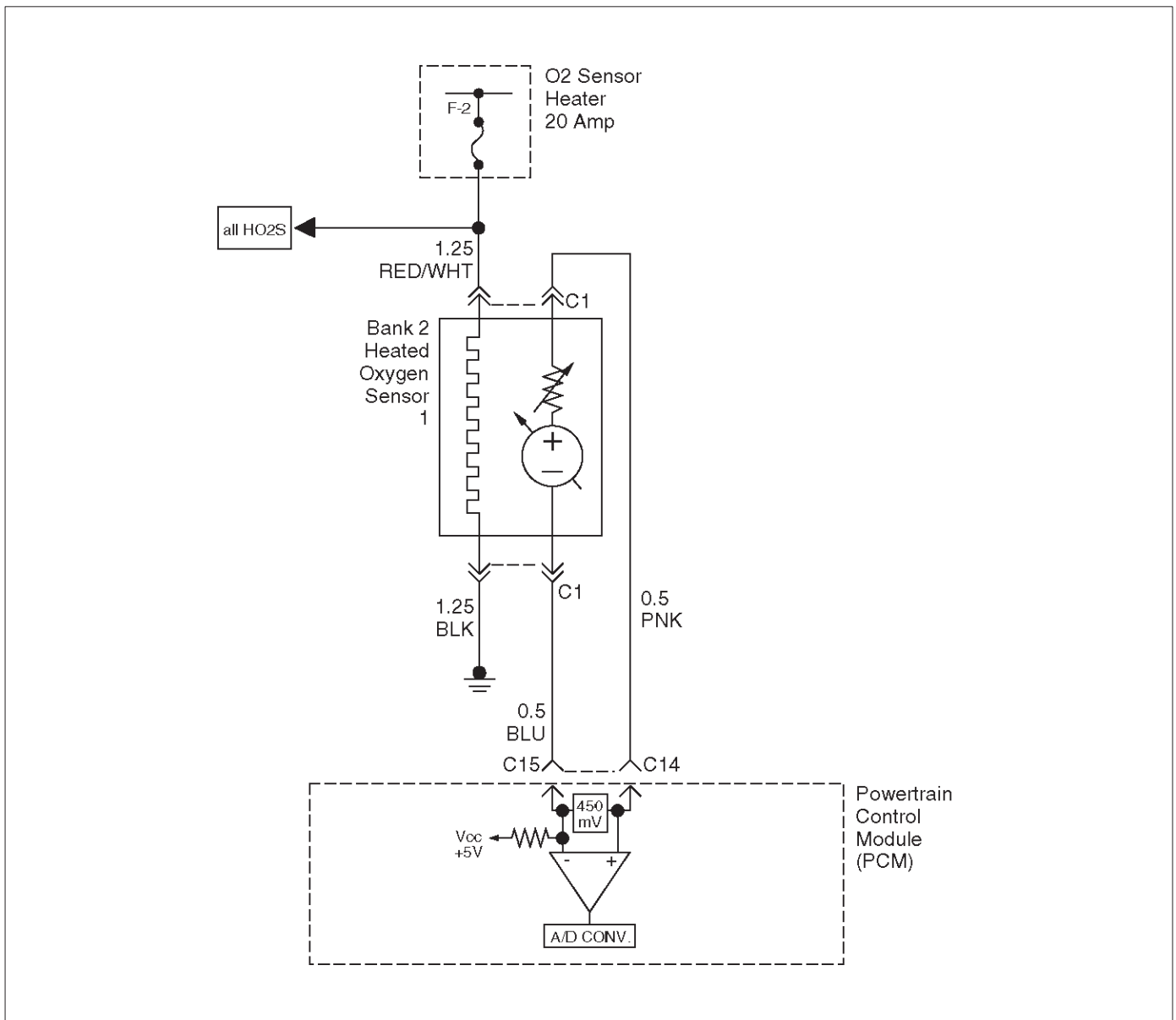
DTC P0174 – Fuel Trim System Lean Bank 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Are any DTCs set other than P0174 and P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to <i>Step 3</i>
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe the “BANK 2 L.T. FUEL TRIM” display on the Tech 2. Is the displayed values greater than the specified values?	L.T. Fuel Trim: +20%	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	1. Review and record Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0174 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0174 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0174 failed this ignition?	—	Go to <i>Step 5</i>	The lean condition is not present. If a driveability symptom still exists, refer to <i>Symptoms</i> section.
5	Was DTC P0171 also set?	—	Go to <i>Step 6</i>	Go to <i>Step 15</i>
6	Visually and physically inspect the vacuum hoses for disconnects, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to <i>Step 7</i>
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to <i>Crankcase Ventilation System</i>). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to <i>Step 8</i>
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to <i>Step 9</i>
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to <i>Step 10</i>	Go to <i>Step 11</i>

DTC P0174 – Fuel Trim System Lean Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 11
11	Check the fuel for excessive water, alcohol, or other contaminants (see <i>Diagnosis in Engine Fuel</i> for procedure) and correct the contaminated fuel condition is present (see <i>Engine Fuel</i>). Was the fuel contaminated?	—	Verify repair	Go to Step 12
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 13
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in “closed loop” while monitoring the “BANK 1 S.T. FUEL TRIM” displayed on the Tech 2. Does the “BANK 1 S.T. FUEL TRIM” value decrease to near the specified value?	0%	Go to Step 19	Go to Step 14
14	Perform the procedure in the “Fuel System Pressure Test” and repair fuel system problem if necessary. Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to Step 15
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 16
16	Visually and physically inspect the Bank 2 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 17
17	Perform the “Injector Balance Test,” and correct any problem found (refer to <i>Fuel Metering System</i>). Did the Injector Balance Test isolate a problem?	—	Verify repair	Go to Step 18
18	1. Visually and physically inspect the Bank 2 HO2S 1 to ensure that it is installed securely and that the Bank 2 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to Diagnostic Aids
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0175 Fuel Trim System Rich Bank 2



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 2, the PCM will set DTC P0175.

The PCM's maximum authority to control long term fuel trim allows a range between -15% (automatic transmission) or -12% (manual transmission) and +20%. The PCM's maximum authority to control short term fuel

trim allows a range between -11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TPS, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between -40°C (-40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.

- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop.”

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0175 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed -out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records Vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0175 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

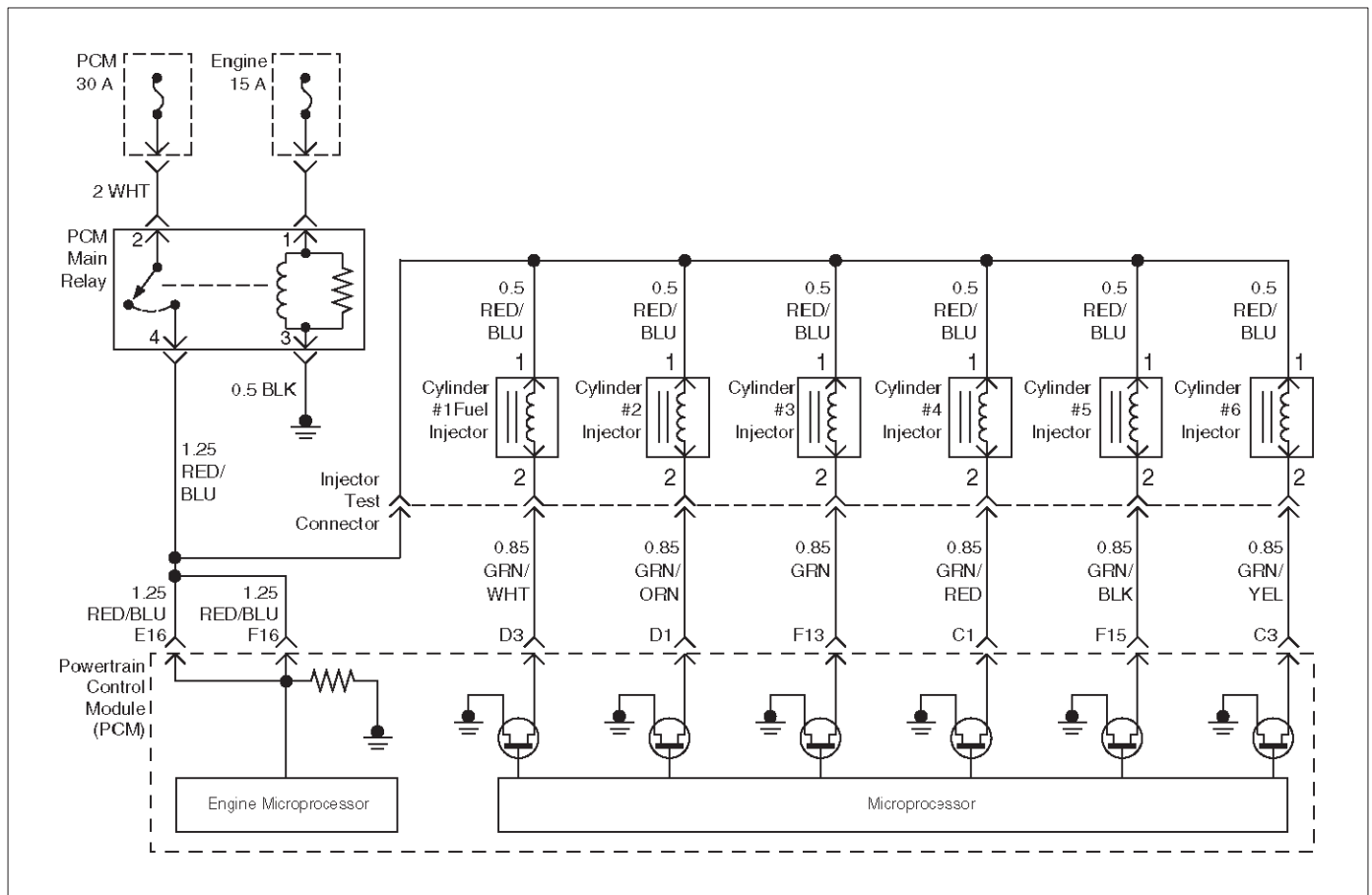
DTC P0175 – Fuel Trim System Rich Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to <i>Step 3</i>
3	1. Start the engine and operate the vehicle in "closed loop." 2. Observe the "BANK 2 L.T. FUEL TRIM" display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: -15% (auto. trans.) OR -12% (man. trans.)	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0175 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0175 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0175 failed this ignition?	—	Go to <i>Step 5</i>	The rich condition is not present. If a driveability symptom still exists, refer to <i>Symptoms</i> .
5	Was DTC P0172 also set?	—	Go to <i>Step 6</i>	Go to <i>Step 15</i>
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to <i>Step 7</i>
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to <i>Step 8</i>
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to <i>Step 9</i>
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	1. Turn the ignition off and physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 2. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to <i>Step 11</i>

DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
11	<ol style="list-style-type: none"> 1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to <i>Fuel Metering System</i>). <p>Did the fuel pressure regulator require replacement?</p>	—	Verify repair	Go to Step 12
12	<ol style="list-style-type: none"> 1. Ignition "ON," engine "OFF." 2. Monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. <p>Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?</p>	Minimum 0% Maximum 100%	Go to Step 13	Go to Step 18
13	<ol style="list-style-type: none"> 1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S.T. FUEL TRIM" display on the Tech 2. <p>Did both values change to near the specified value?</p>	0%	Go to Step 19	Go to Step 14
14	<ol style="list-style-type: none"> 1. Perform the "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to <i>Engine Fuel</i> or <i>Fuel Metering System</i>). <p>Did the Fuel System Pressure Test isolate a condition requiring repair?</p>	—	Verify repair	Go to Step 16
15	<p>Replace the PCM.</p> <p>IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i>.</p> <p>Is the action complete?</p>	—	Verify repair	—
16	<ol style="list-style-type: none"> 1. Perform the "Injector Balance Test." 2. If the Injector Balance Test isolates a problem, repair as necessary (refer to <i>Fuel Metering System</i>). <p>Did the Injector Balance Test isolate a problem requiring repair?</p>	—	Verify repair	Go to Step 17
17	<ol style="list-style-type: none"> 1. Remove and visually/physically inspect the Bank 2 HO2S 1 for silicon contamination. This will be indicated by a powdery white deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 2 HO2S 1, replace the contaminated sensor. <p>Did the sensor require replacement?</p>	—	Verify repair	Refer to Diagnostic Aids
18	<ol style="list-style-type: none"> 1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. <p>Is the action complete?</p>	—	Verify repair	—
19	<p>Replace the MAF sensor.</p> <p>Is the action complete?</p>	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0201 Injector 1 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0201 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

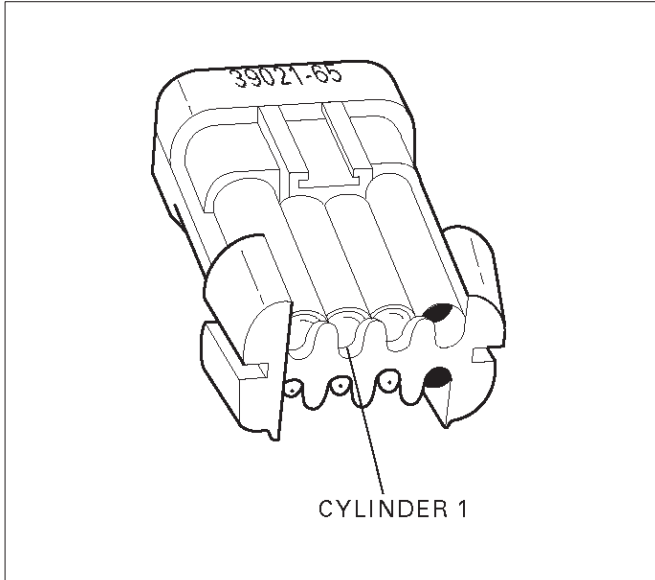
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 1 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14δ .
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

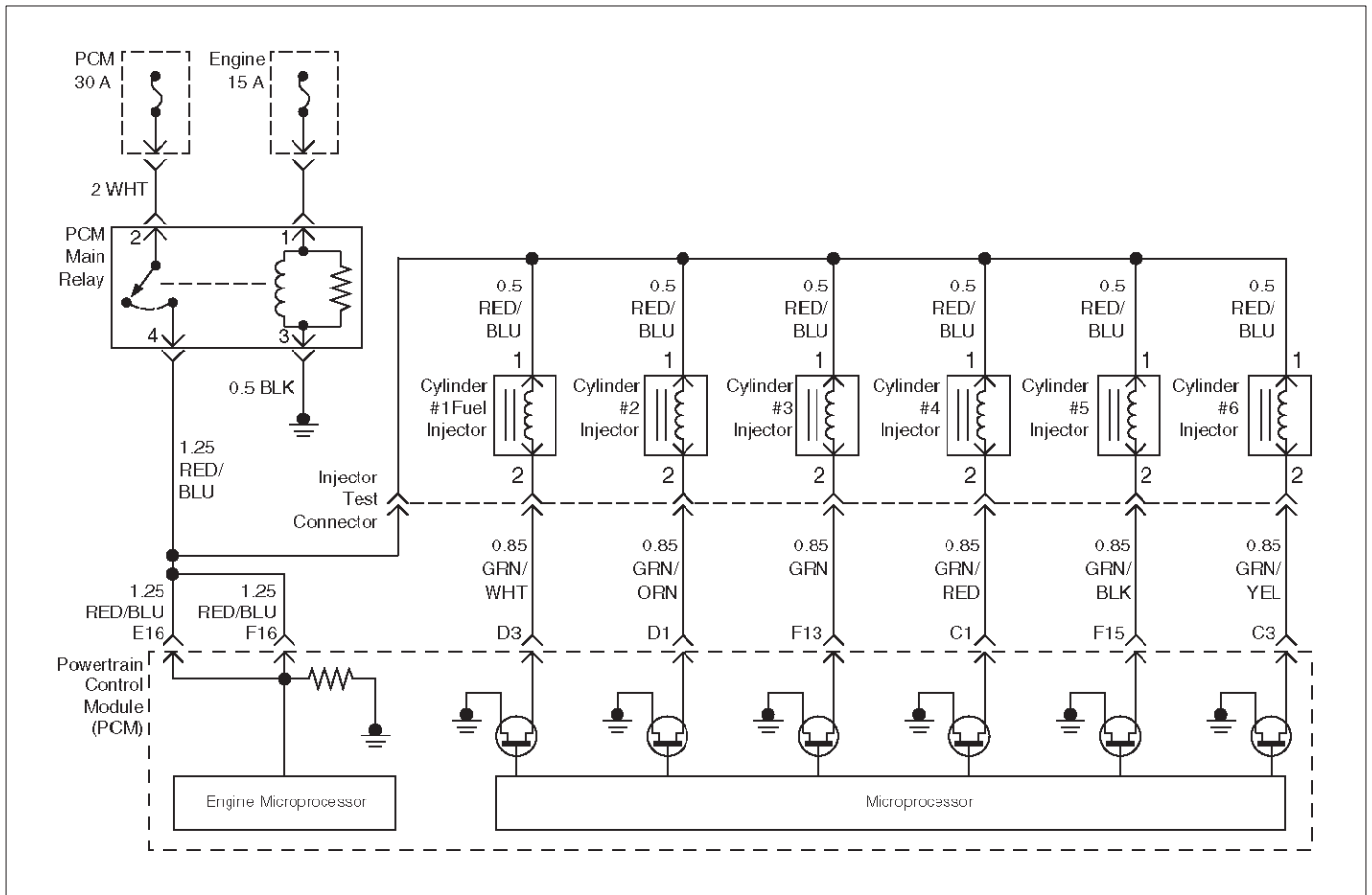
DTC P0201 – Injector 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector connector. 3. Install an injector test light 5-8840-2636-0 on the injector test connector. 4. Crank the engine and note the light. Does the injector test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 1 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0201 – Injector 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 1 (green with white tracer). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/white wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0202 Injector 2 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0202 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

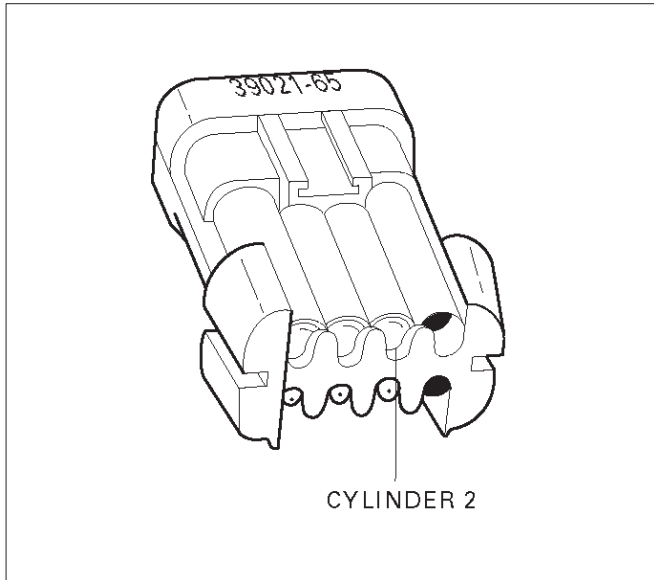
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 2 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

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If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14δ .

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

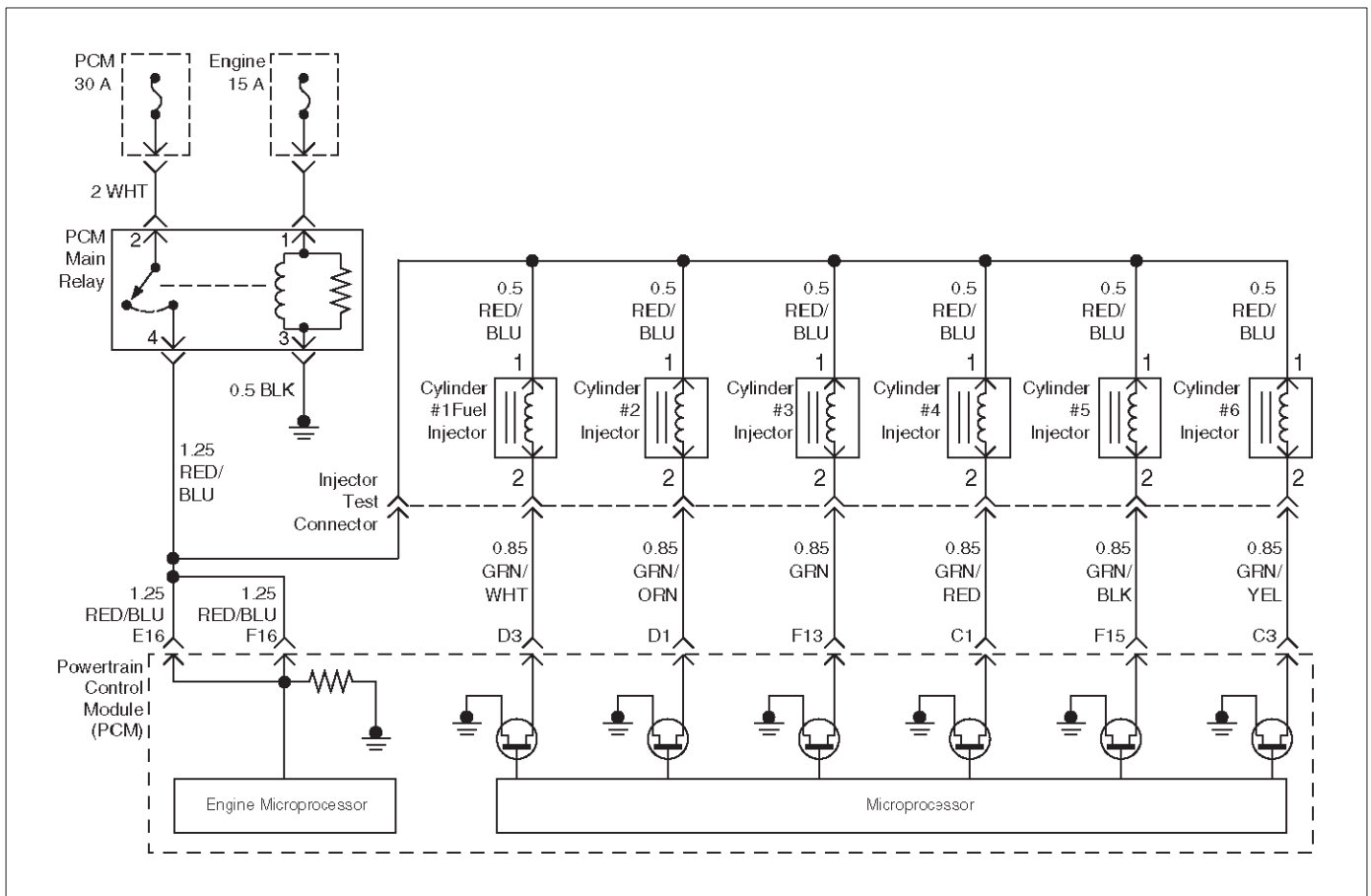
DTC P0202 – Injector 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light 5-8840-2636-0 on injector connector. 4. Crank the engine and note the light. Does the cylinder 2 test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 2 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0202 – Injector 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 2 (green with orange tracer). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/orange wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0203 Injector 3 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0203 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

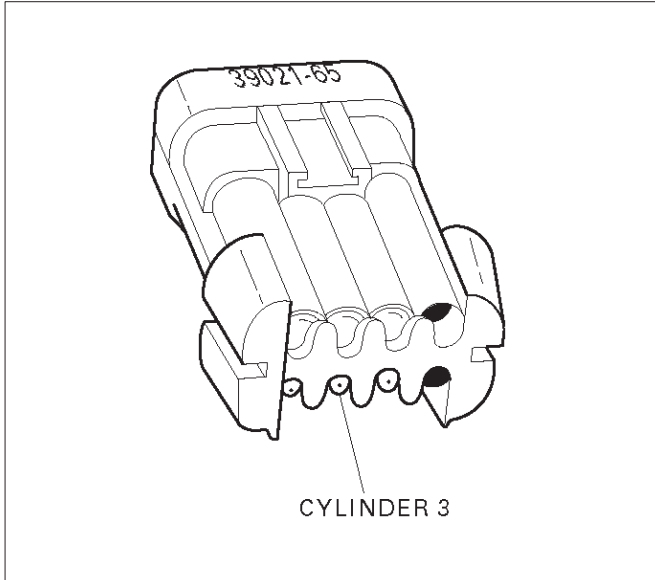
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 3 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14δ .
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

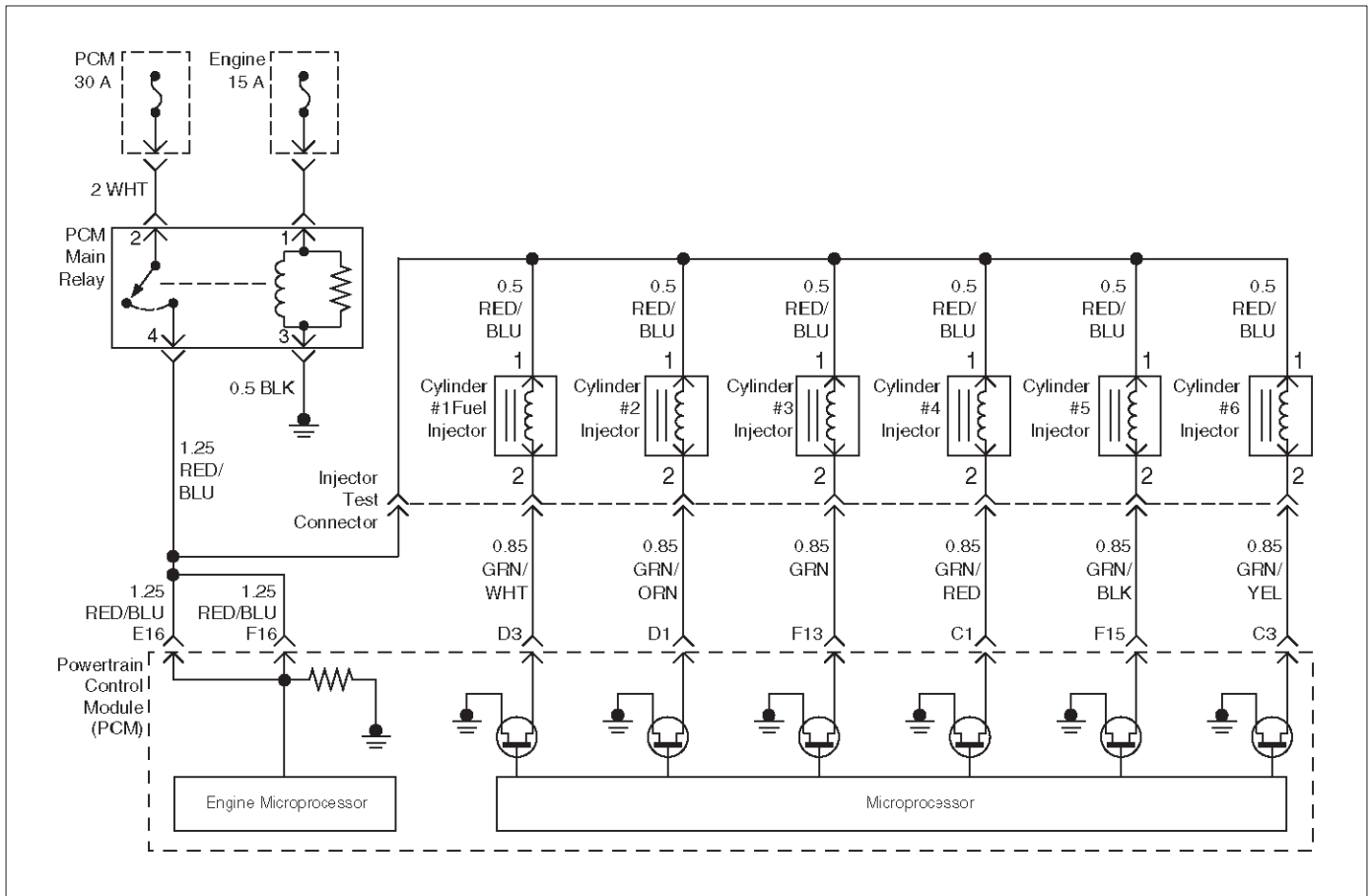
DTC P0203 – Injector 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector test connector . 3. Install an injector test light 5-8840-2636-0 on injector connector. 4. Crank the engine and note the light. Does the cylinder 3 test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 3 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0203 – Injector 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 3 (green). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0204 Injector 4 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0204 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

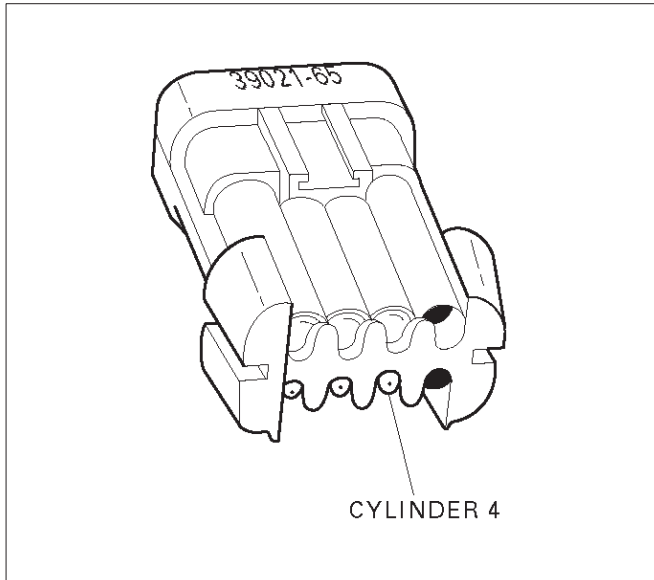
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 4 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

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If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321057

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14 δ .
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

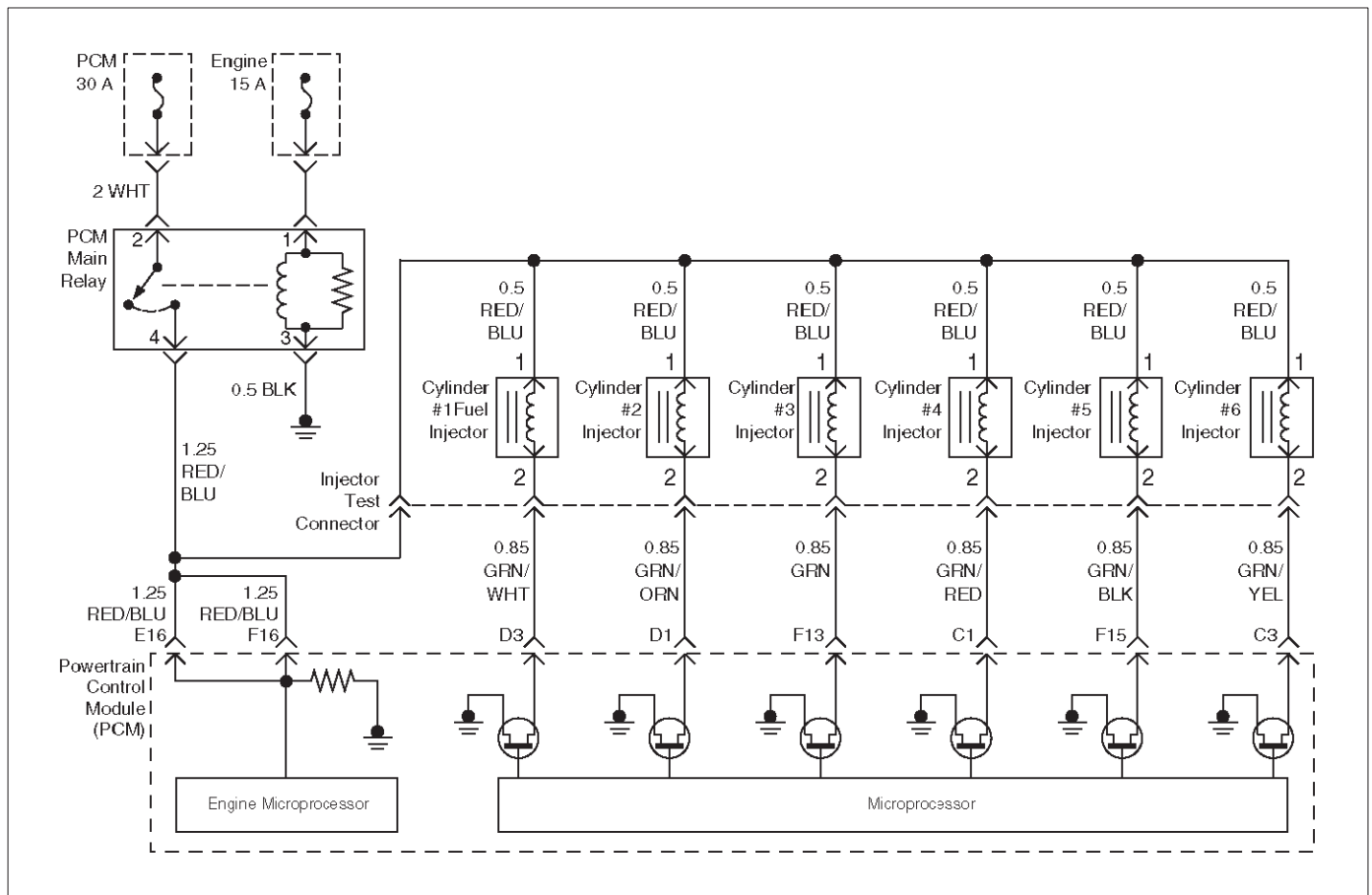
DTC P0204 – Injector 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light 5-8840-2636-0 on injector connector. 4. Crank the engine and note the light. Does the cylinder 4 test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 4 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0204 – Injector 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 4 (green/red). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/red wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0205 Injector 5 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0205 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0205 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

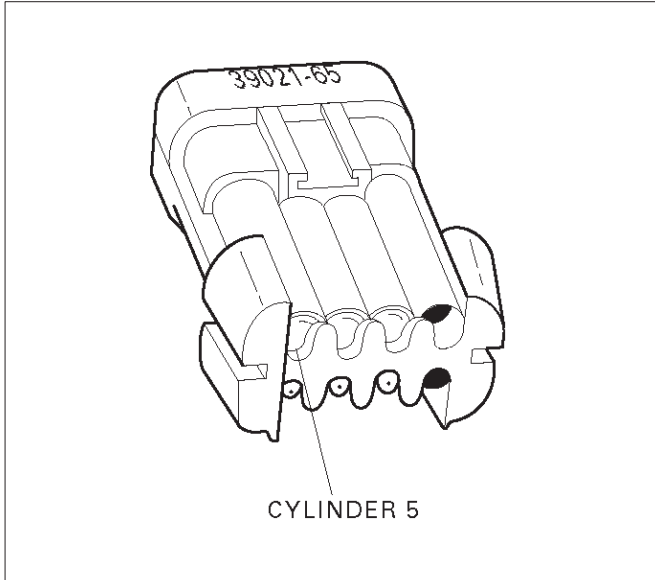
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0205 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 5 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321058

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14δ .
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

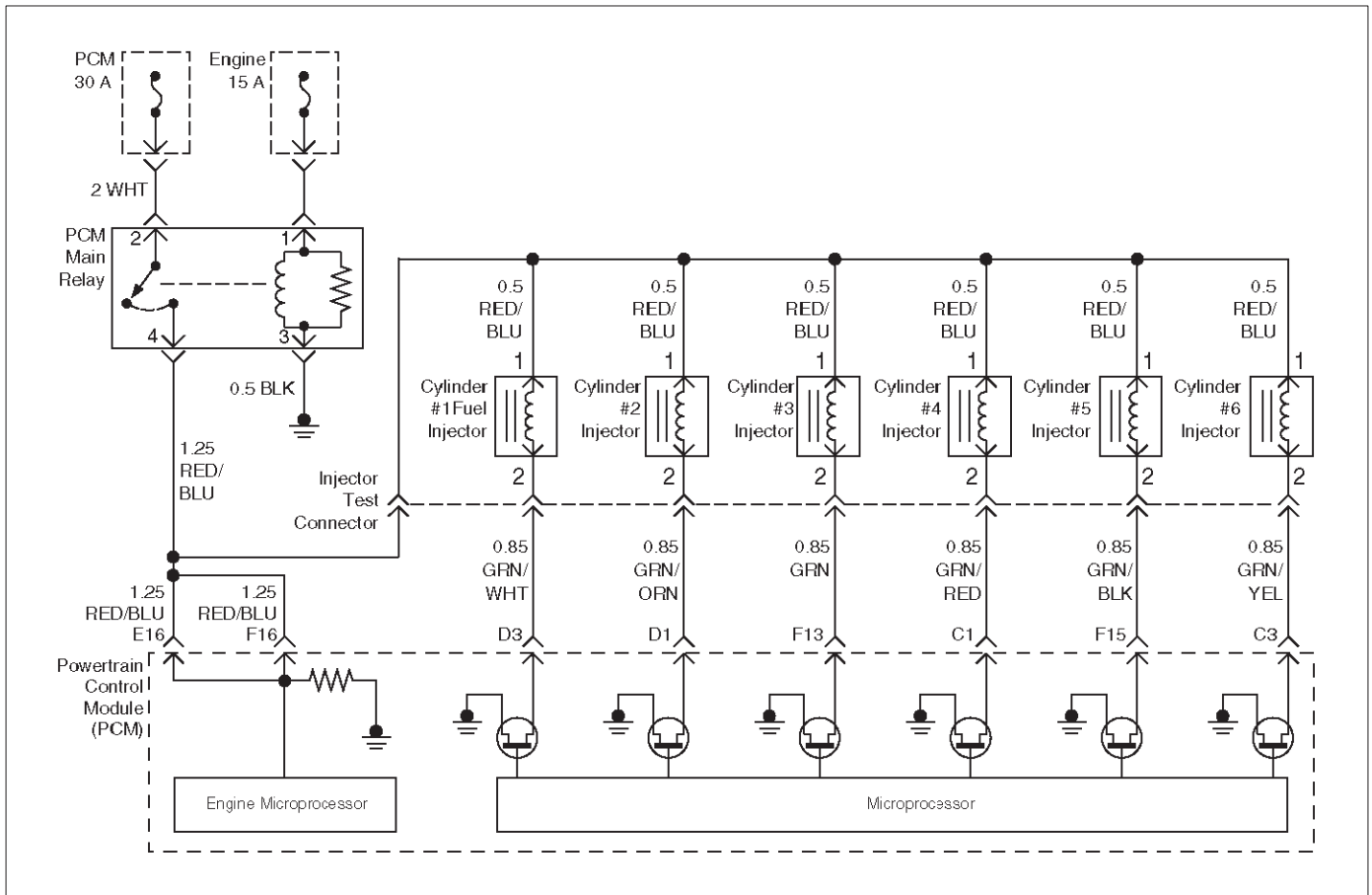
DTC P0205 – Injector 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0205 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0205 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light 5-8840-2636-0 on injector connector. 4. Crank the engine and note the light. Does the cylinder 5 test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 5 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0205 – Injector 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 5 (green with black tracer). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/black wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0206 Injector 6 Control Circuit



D06RW034

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0206 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0206 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

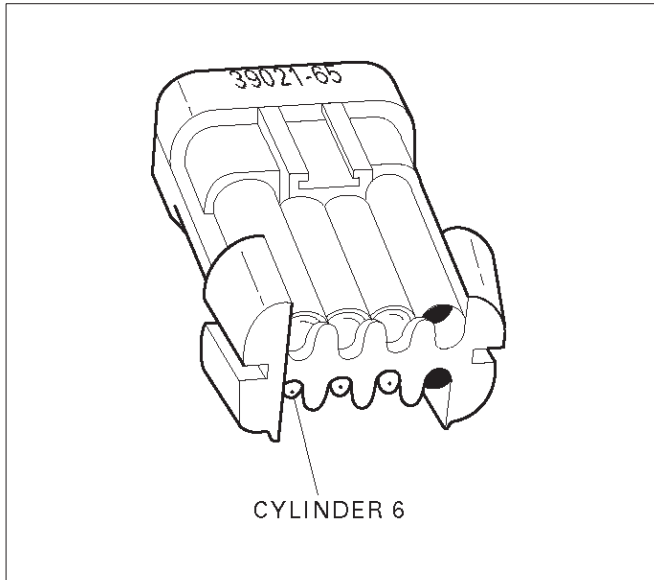
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0206 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. On the Trooper, the special 7-way gray connector is located at the front of the charcoal canister. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 6 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

6E-186 ENGINE DRIVEABILITY AND EMISSIONS

If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321059

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14δ .
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

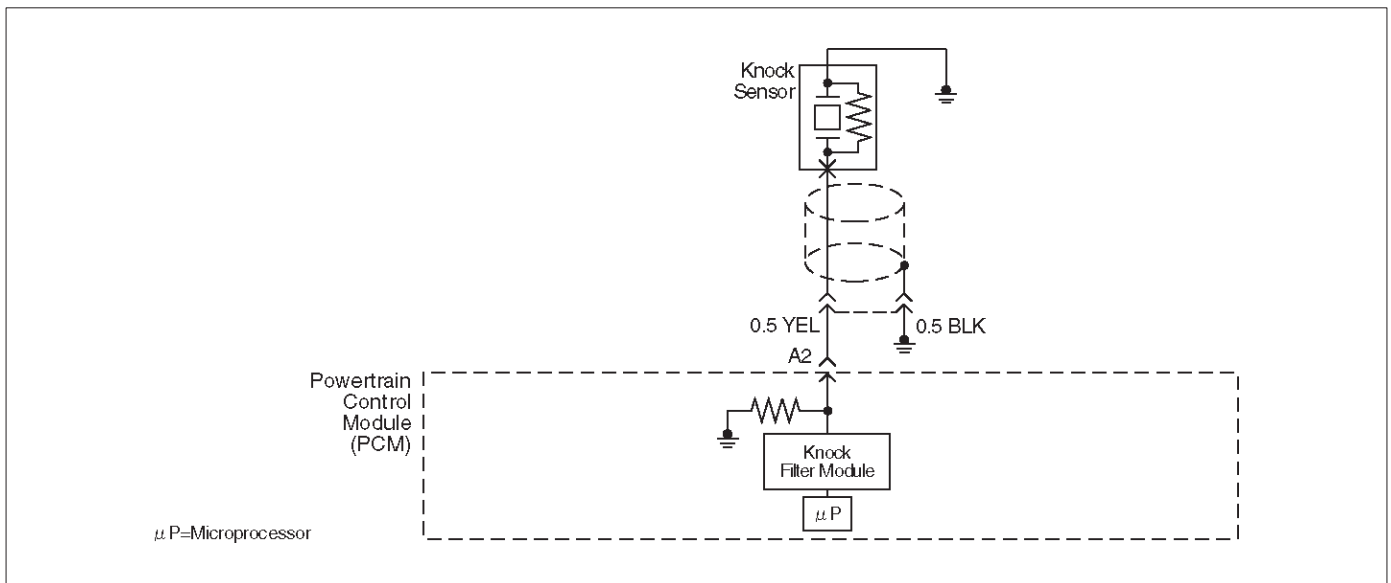
DTC P0206 – Injector 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0206 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0206 reset?	—	Go to Step 5	Go to <i>Diagnostic Aids</i>
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light 5-8840-2636-0 on injector connector. 4. Crank the engine and note the light. Does the cylinder 6 test light blink?	—	Go to <i>Fuel Injector Coil Test Procedure</i>	Go to Step 6
6	Note whether the injector test light for cylinder 6 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to Step 7	Go to Step 9

DTC P0206 – Injector 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to <i>Step 8</i>	Go to <i>Step 15</i>
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to <i>OBD System Check</i>	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 6 (green with yellow tracer). Does the ohmmeter indicate continuity?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
10	Repair the open injector harness wire or open injector Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/yellow wire for a short to voltage. Was there a short to voltage?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0325 KS Module Circuit



D06RW035

Circuit Description

The knock sensor is used to detect engine detonation, allowing the powertrain control module (PCM) to retard ignition control (IC) spark timing based on the knock sensor (KS) signal being received. The knock sensor produces an AC signal so that under a no knock condition the signal on the KS circuit measures about 0.007 V AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The PCM contains a non-replaceable knock filter module called a signal-to-noise enhancement filter (SNEF) module. This filter module in the PCM determines whether knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the PCM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the PCM determines that an abnormally low noise channel voltage level is being experienced, a DTC P0325 will set.

Conditions for Setting the DTC

- Engine has been running for at least 30 seconds.
- The PCM determines that its internal signal from its knock filter module indicates a continuous knocking condition for more than 10 seconds.

Action Taken When the DTC Sets

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

- The PCM will use a "substitute" default spark retard value of 6 degrees to minimize knock during conditions when knock is likely to occur.

Conditions for Clearing the MIL/DTC

- DTC P0325 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the knock sensor and PCM connectors for backed-out terminals, broken locks, and improperly formed or damaged terminals.
- Misrouted harness – Inspect the knock sensor harness to ensure that it is not routed too close to high voltage wires such as spark plug leads.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

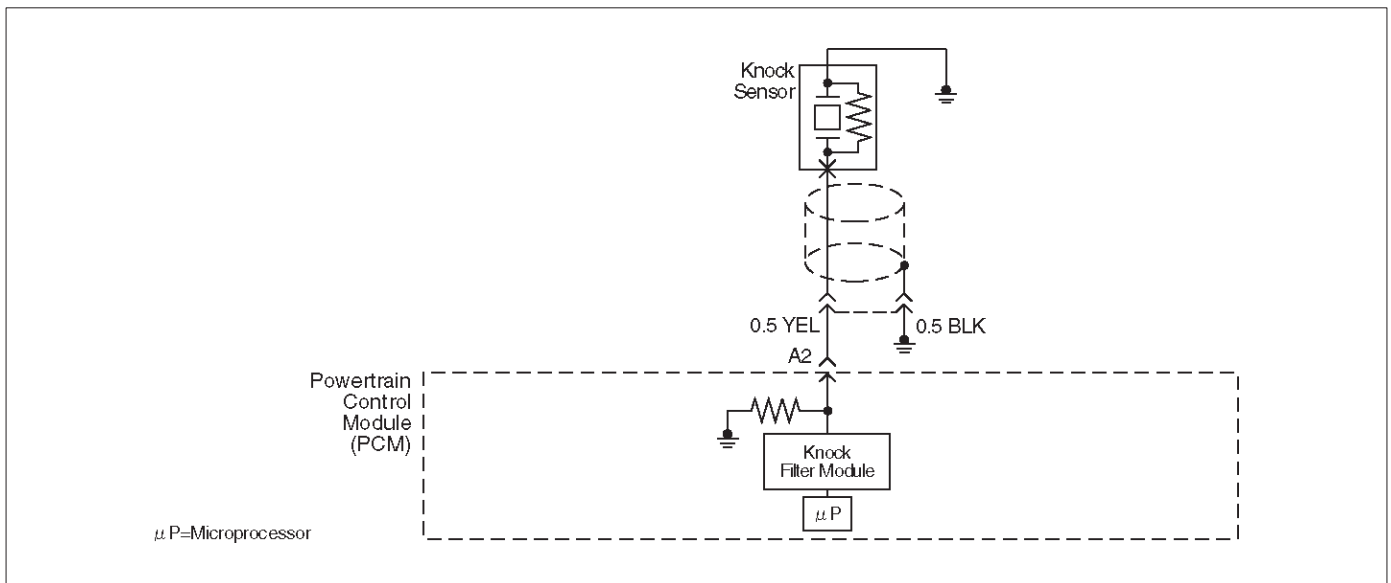
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

DTC P0325 – KS Module Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>IMPORTANT: If an engine knock can be heard, repair the engine mechanical problem before proceeding with this diagnostic.</p> <ol style="list-style-type: none"> Operate the vehicle within parameters specified under criteria included in "Conditions for Setting the DTC." Using Tech 2, monitor "Specific DTC" info for DTC P0325 until the DTC P0325 test runs. Note the test result. Does Tech 2 indicate DTC P0325 failed this ignition?	—	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> Ignition "ON," engine "OFF." Review and record Tech 2 Failure Records data for DTC P0325. Operate the vehicle within Failure Records conditions. Using Tech 2, monitor "Specific DTC" info for DTC P0325 until the DTC P0325 test runs. Does Tech 2 indicate DTC P0325 test failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	Replace the PCM. <p>IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i>.</p> Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0327 KS Sensor Circuit



Circuit Description

The powertrain control module (PCM) uses the knock sensor to detect engine detonation, allowing the PCM to retard ignition control (IC) spark timing based on the knock sensor (KS) signal being received. The knock sensor produces an AC signal so that under a no knock condition the signal on the KS circuit measures about 0.007 V AC. The signal amplitude and frequency are dependent upon the amount of knock being experienced. The PCM monitors the KS signal and can diagnose the KS sensor and circuitry.

Conditions for Setting the DTC

- Engine running for at least 10 seconds.
- The TP sensor is greater than 5%.
- The ECT sensor is greater than 60°C (140°F).
- Engine speed is between 2000 and 4000 RPM.
- The knock sensor signal voltage is less than 0.20 volts, or greater than 4.8 volts.
- All conditions are present for more than 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a calculated spark retard value to minimize knock during conditions when knock is likely to occur. The calculated value will vary based on engine speed and load.

Conditions for Clearing the MIL/DTC

- DTC P0327 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.
4. The knock sensor is attached to a short jumper harness, so it can be tested without removing the intake manifold. A 2-wire connector for the knock sensor is accessible behind the left rear fuel injector.

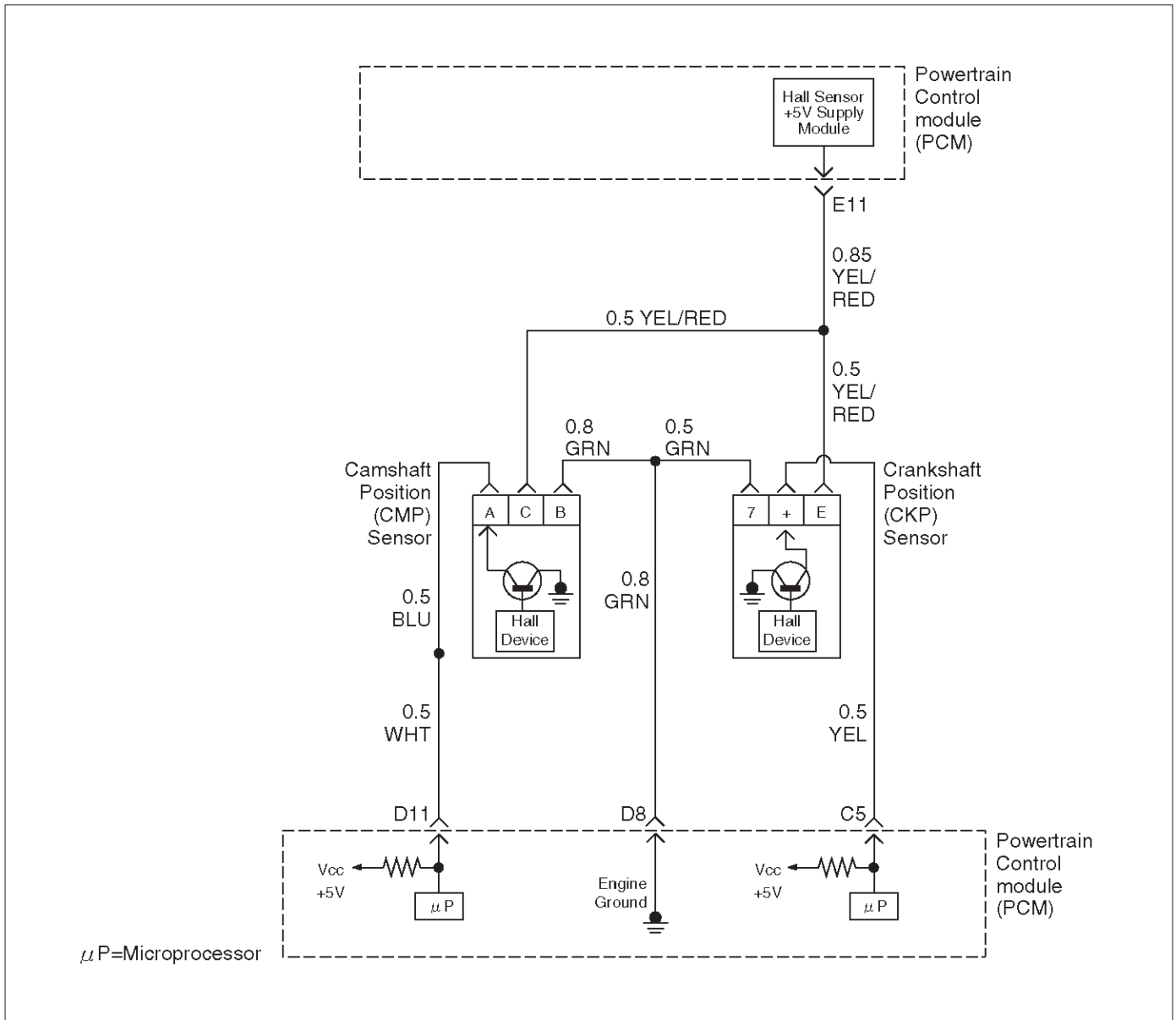
DTC P0327 – KS Sensor Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	IMPORTANT: If an engine knock can be heard, repair the engine mechanical problem before proceeding with this diagnostic. 1. Operate the engine within the conditions specified in diagnostic support "Conditions for Setting the DTC." 2. Using Tech 2, monitor "Specific DTC" info for DTC P0327 until the DTC P0327 test runs. 3. Note the test result. Does Tech 2 indicate DTC P0327 failed this ignition?	—	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions. 4. Using Tech 2, monitor "Specific DTC" info for DTC P0327 until the DTC P0327 test runs. 5. Note the test result. Does Tech 2 indicate DTC P0327 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Check for a damaged terminal at the knock sensor connector. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	Using a test light to battery +, check the black/blue wire (PCM side) to verify that the shield connection is good. Did the test light illuminate?	—	Go to Step 7	Go to Step 6
6	Repair the open shield ground. Is the action complete?	—	Verify repair	—
7	1. Ignition "OFF," disconnect the PCM. 2. Check the KS signal circuit for a poor terminal connection at the PCM. 3. If a problem is found, replace the faulty terminal. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Ignition "OFF," PCM disconnected. 2. Check the KS signal circuit between the PCM and the knock sensor connector for an open, a short to voltage, or a short to ground. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Ignition "OFF," PCM disconnected. 2. Knock sensor connected. 3. Measure the resistance of the knock sensor by connecting the DVM between the PCM connector and the engine block. Is the resistance of each knock sensor near the specified value?	100K ohms	Go to Step 10	Go to Step 11

DTC P0327 – KS Sensor Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition "OFF," PCM disconnected. 2. Connect the DVM to monitor AC voltage between the PCM connector and engine ground. 3. Tap on the engine lift bracket with a socket extension while observing the signal indicated on the DVM. Is any signal indicated on the DVM while tapping on the engine lift bracket?	—	Go to <i>Step 12</i>	Go to <i>Step 11</i>
11	Replace the knock sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0336 58X Reference Signal Circuit



Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM receives an incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0336 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection - Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

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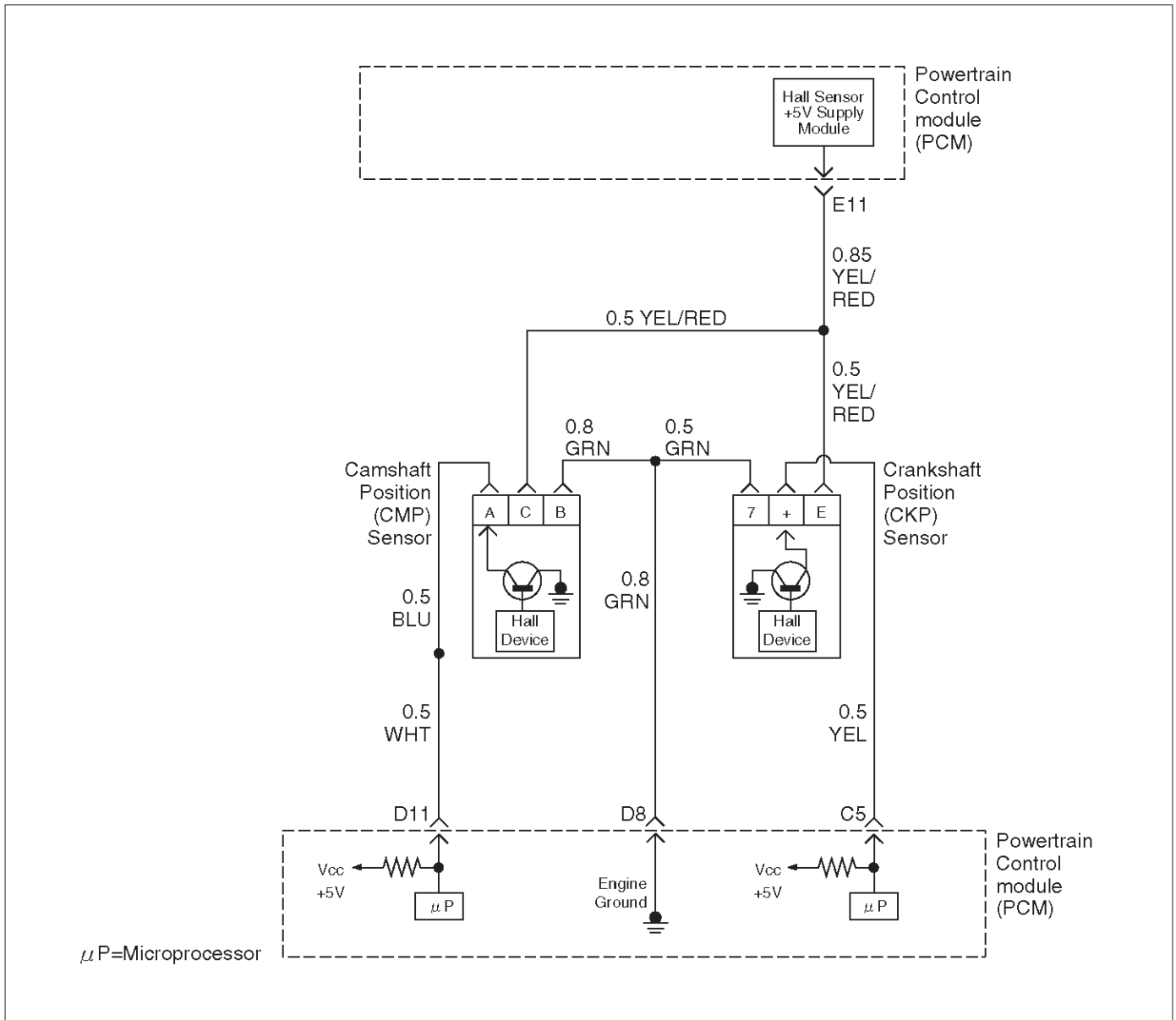
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the ICM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Reference Signal Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to " <i>Engine Cranks But Will Not Run</i> " chart
3	1. Review and record Failure Records information. 2. Clear DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0336 set?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 8	Go to Step 6
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	Replace the CKP sensor. Use caution to avoid any hot oil that may drip out. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 9
9	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98 model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0337 CKP Sensor Circuit Low Frequency



Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM does not receive pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- No camshaft position (CMP) sensor DTCs are set.
- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 8 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0337 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

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- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the ICM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

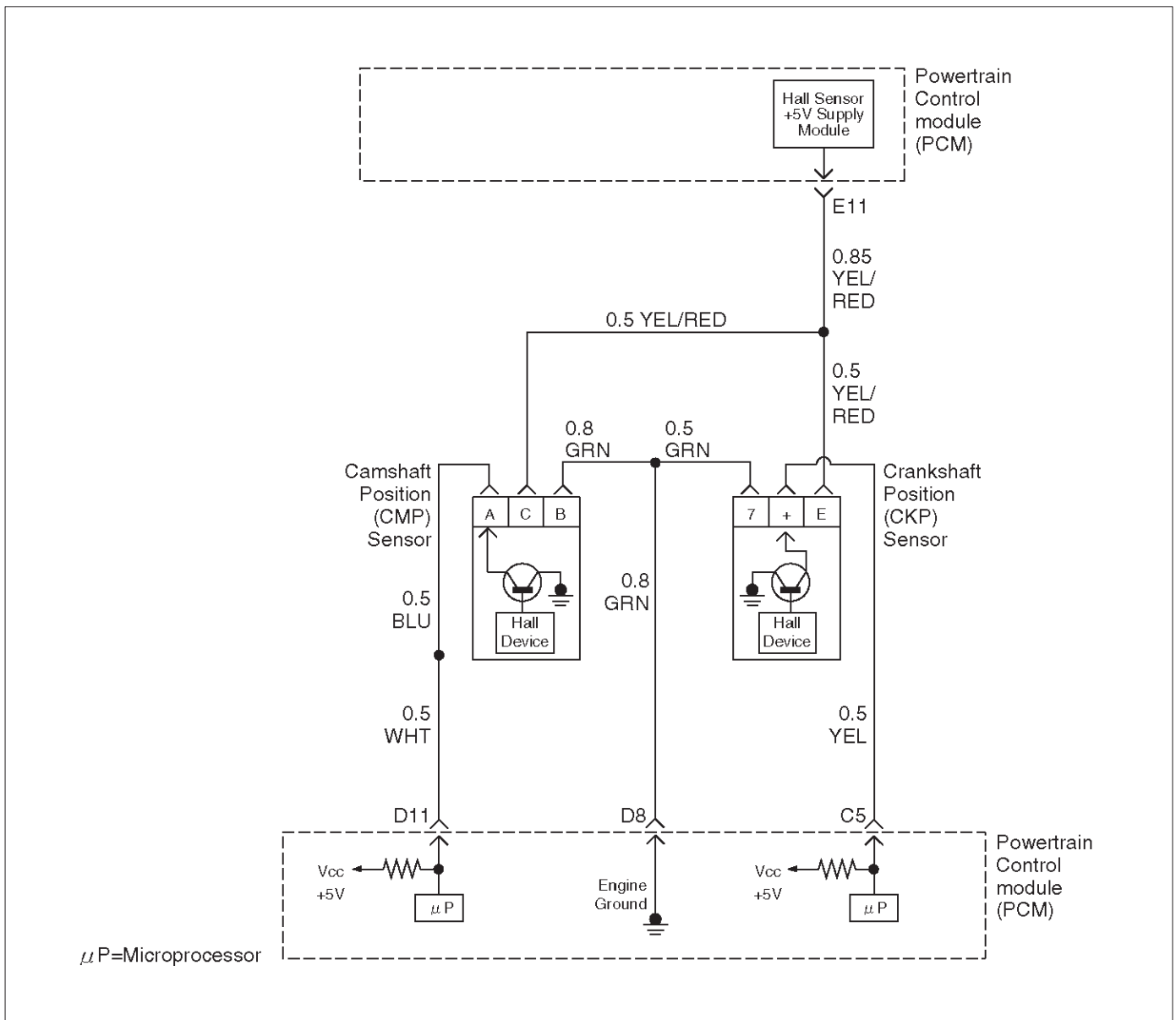
DTC P0337 – CKP Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to <i>Chart 3</i>
3	1. Review and record Failure Records information. 2. Clear DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0337 set?	—	Go to Step 4	Refer to <i>Diagnostic Aid</i>
4	1. Disconnect the CKP sensor. 2. Ignition "ON." 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 4-6 volts and ground available at the sensor?	—	Go to Step 7	Go to Step 5
5	1. Ignition "ON." 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to Step 6	Go to Step 11
6	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
7	1. Ignition "OFF." 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 11	Go to Step 9
9	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
10	Replace the CKP sensor. Use caution and avoid hot oil that may drip out. Is the action complete?	—	Verify repair	—

DTC P0337 – CKP Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 12</i>
12	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0341 CMP Sensor Circuit Performance



D06RW032

Circuit Description

The CMP signal is produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The powertrain control module (PCM) uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM receives an incorrect number of pulses on the CMP reference circuit, DTC P0341 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running (1X CMP reference pulses are being received).
- The CMP sensor signal is not detected at the correct interval every 6 cylinders.
- Above condition fails for 100 occurrences within 200 test samples.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate the injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0341 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and

wiring harnesses related to the ICM and the CMP sensor. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

12. Determines whether the fault is being caused by a missing camshaft magnet or a faulty sensor. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

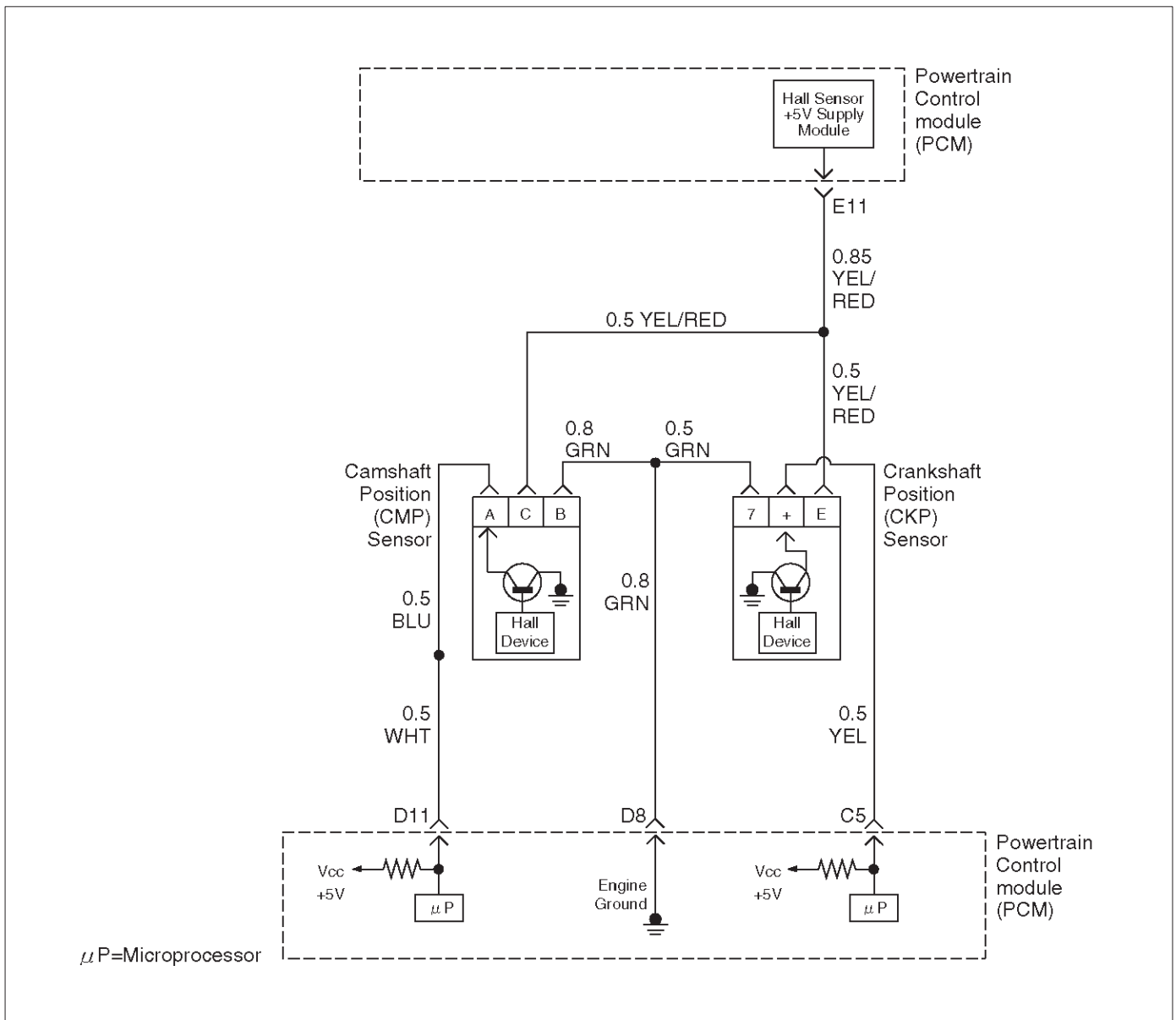
DTC P0341 – CMP Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using Tech 2, monitor "Specific DTC" info for DTC P0341 until the DTC P0341 test runs. 5. Note the test result. Does Tech 2 indicate DTC P0341 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the CMP sensor. 2. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to Step 4	Go to Step 5
4	Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to Step 11	Go to Step 8
5	If the voltage measured in step 3 was less than 4-6 volts, proceed directly to step 6 without completing this step. If the voltage in step 3 was greater than 4-6 V, repair the short to voltage in the CMP feed circuit. Is the action complete?	—	Verify repair	—
6	1. Check for poor connections at the camshaft position sensor. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition "OFF," disconnect the PCM and the CMP sensor. 2. Check the following circuits for an open between the ignition coil and the CMP sensor: <ul style="list-style-type: none"> ● The sensor feed circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
8	1. Ignition "OFF," disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuits: <ul style="list-style-type: none"> ● The CMP sensor signal circuit for an open or a short to voltage. ● The CMP sensor input signal circuit for a short to ground. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for a short or open in the sensor ground circuit. Was a problem found?	—	Verify repair	Go to Step 10

DTC P0341 – CMP Sensor Circuit Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	Backprobe the PCM connector with a DVM to monitor voltage on the camshaft position input signal circuit while cranking the engine with the sensor connected. (Use rubber band, tape, or an assistant to keep the DVM lead in contact with the sensor terminal during this test.) Does the voltage toggle between the specified values?	4-0 V	Go to <i>Step 15</i>	Go to <i>Step 12</i>
12	1. Remove the CMP sensor from the engine front cover (leave the sensor wiring connected). 2. Place a magnet on the CMP sensor. (If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test.) Does the DVM display a voltage near the specified value?	0 V	Go to <i>Step 13</i>	Go to <i>Step 14</i>
13	Replace the faulty or missing camshaft position sensor magnet. Is the action complete?	—	Verify repair	—
14	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
15	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0342 CMP Sensor Circuit Low



D06RW032

Circuit Description

The CMP signal produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The hall type CMP sensor and the CKP sensor share 5 V and ground connections at the powertrain control module (PCM). The third wire at the sensor is a signal circuit to the PCM. The PCM uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM does not receive pulses on the CMP reference circuit, DTC P0342 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running.
- The CMP sensor signal is not received by the PCM once every 6 cylinders.
- The above condition occurs for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0342 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter

connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the ICM and the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.
14. Determines whether the fault is being caused by a missing camshaft magnet or a faulty PCM. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

DTC P0342 – CMP Sensor Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using Tech 2, monitor “Specific DTC” information for DTC P0342 until the DTC P0342 test runs. 5. Note test result. Does Tech 2 indicate DTC P0342 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Ignition “ON.” 2. Disconnect the CMP sensor. 3. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to Step 7	Go to Step 4
4	1. Ignition “OFF,” disconnect the PCM and the CMP sensor. 2. Check for poor connections at the camshaft position sensor. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check the following circuits between the PCM and the CMP sensor: <ul style="list-style-type: none"> • The sensor feed circuit. Open or short to ground? • The sensor ground circuit. Open or short to voltage? 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—

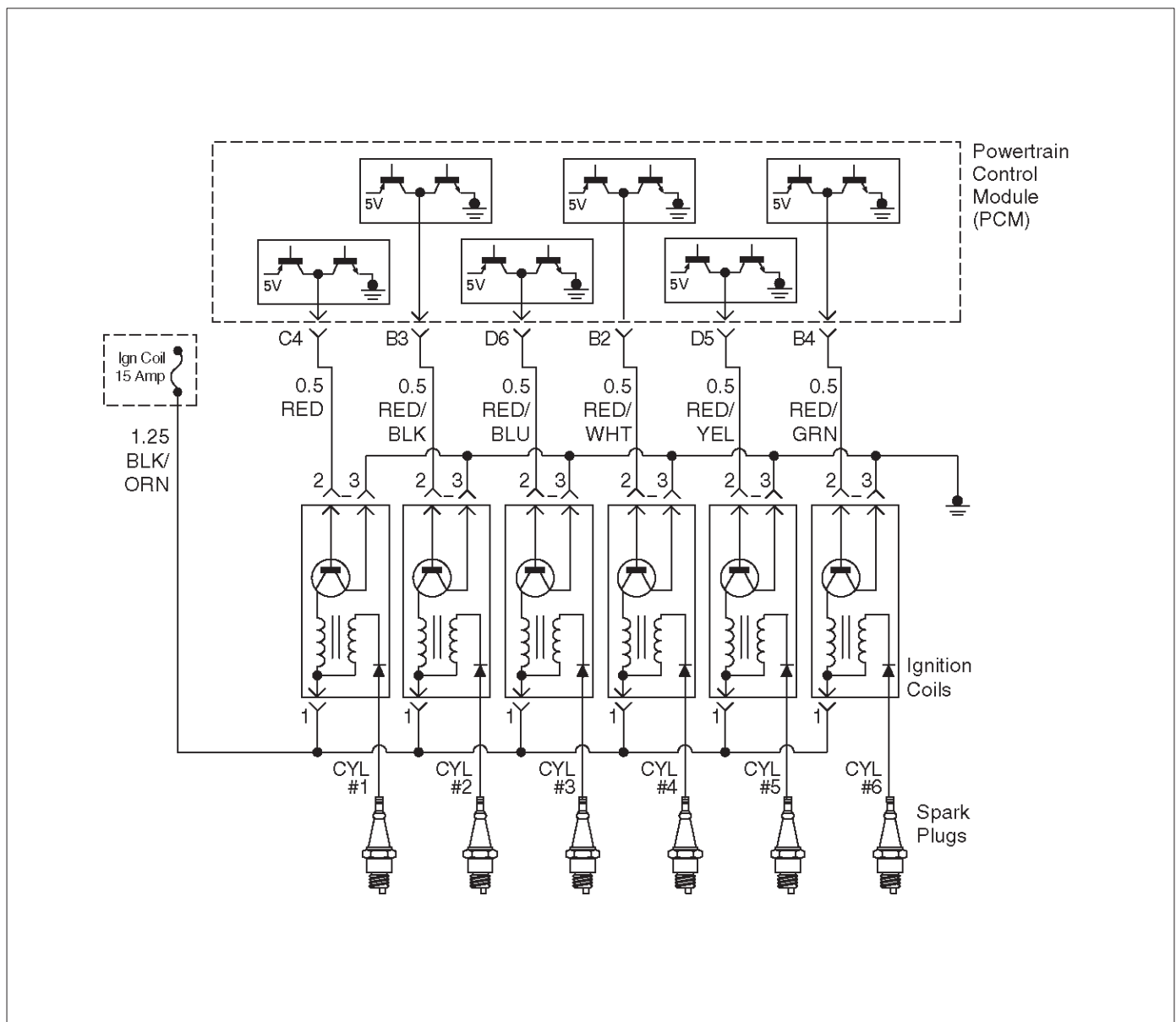
DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "ON," engine "OFF." 2. Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	1. Turn the ignition "OFF." 2. Disconnect the PCM and connect a DVM to monitor voltage on the camshaft position signal circuit at the PCM connector. 3. Ignition "ON." 4. Monitor the voltage display on the DVM while repeatedly touching the CMP sensor signal circuit at the CMP sensor connector with a test light to ground. Does the DVM voltage display switch between 0 and approximately 5 volts when the test light is touched to the CMP sensor signal circuit?	—	Go to <i>Step 12</i>	Go to <i>Step 9</i>
9	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit at the PCM connector with a test light to B+. 5. If the test light is "ON," locate and repair the short to ground in the camshaft position input signal circuit. Was either circuit shorted to ground?	—	Verify repair	Go to <i>Step 10</i>
10	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit with a test light to ground. 5. If the test light is "ON," locate and repair the short to voltage in the camshaft position input signal circuit. Was the test light "ON"?	—	Verify repair	Go to <i>Step 11</i>
11	1. Ignition "OFF," disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuit: <ul style="list-style-type: none"> • The CMP sensor signal circuit for an open. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	—
12	1. Ignition "ON." 2. Remove the CMP sensor from the engine front cover (leave the sensor wiring connected). 3. Place a magnet on the CMP sensor. If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test. Does the DVM display a voltage near the specified value?	0 V	Go to <i>Step 14</i>	Go to <i>Step 13</i>
13	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—

DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Reinstall the CMP sensor to the engine front cover. 2. Observe the DVM connected to monitor voltage on the camshaft position signal circuit while cranking the engine. Does the voltage toggle between the specified values?	4-0 V	Go to <i>Step 15</i>	Go to <i>Step 16</i>
15	Replace the PCM. NOTE: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—
16	Replace faulty or missing camshaft magnet. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0351 Ignition 1 Control Circuit



D06RW072

Circuit Description

The powertrain control module's (PCM) control circuit 1 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 1 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 1, it will set a DTC P0351.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0351 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe Tech 2 display related to DTC P0351 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

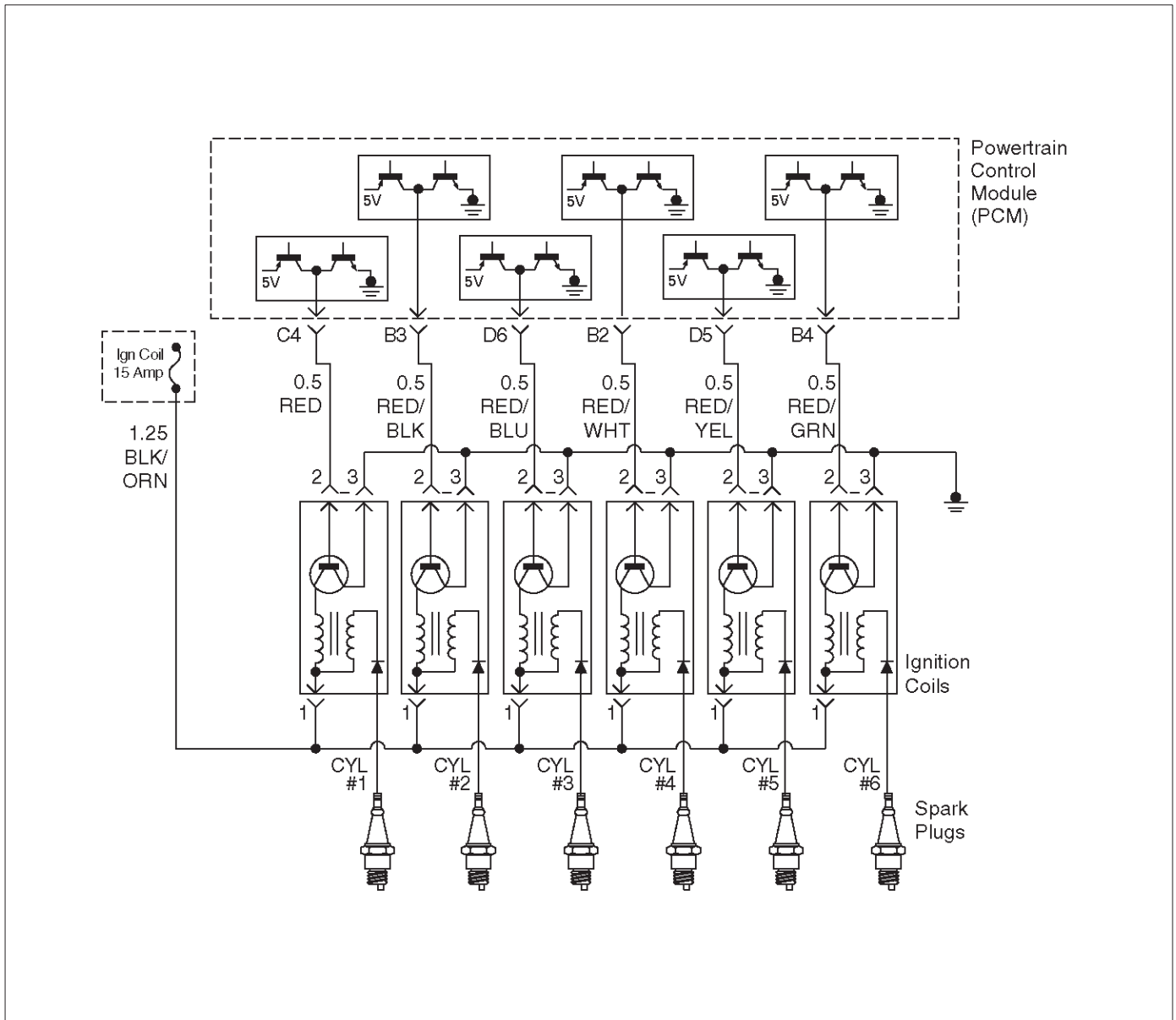
DTC P0351 – Ignition 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use Tech 2 to monitor the “Specific DTC” information for DTC P0351 until the DTC P0351 test runs. 5. Note the test result. Does Tech 2 indicate DTC P0351 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 1 at the PCM with a DVM. Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition “OFF.” 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 1 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 1 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 1 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0351 – Ignition 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0352 Ignition 2 Control Circuit



Circuit Description

The powertrain control module's (PCM) control circuit 2 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 2 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 2, it will set a DTC P0352.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58 X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0352 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

6E-210 ENGINE DRIVEABILITY AND EMISSIONS

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0352 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

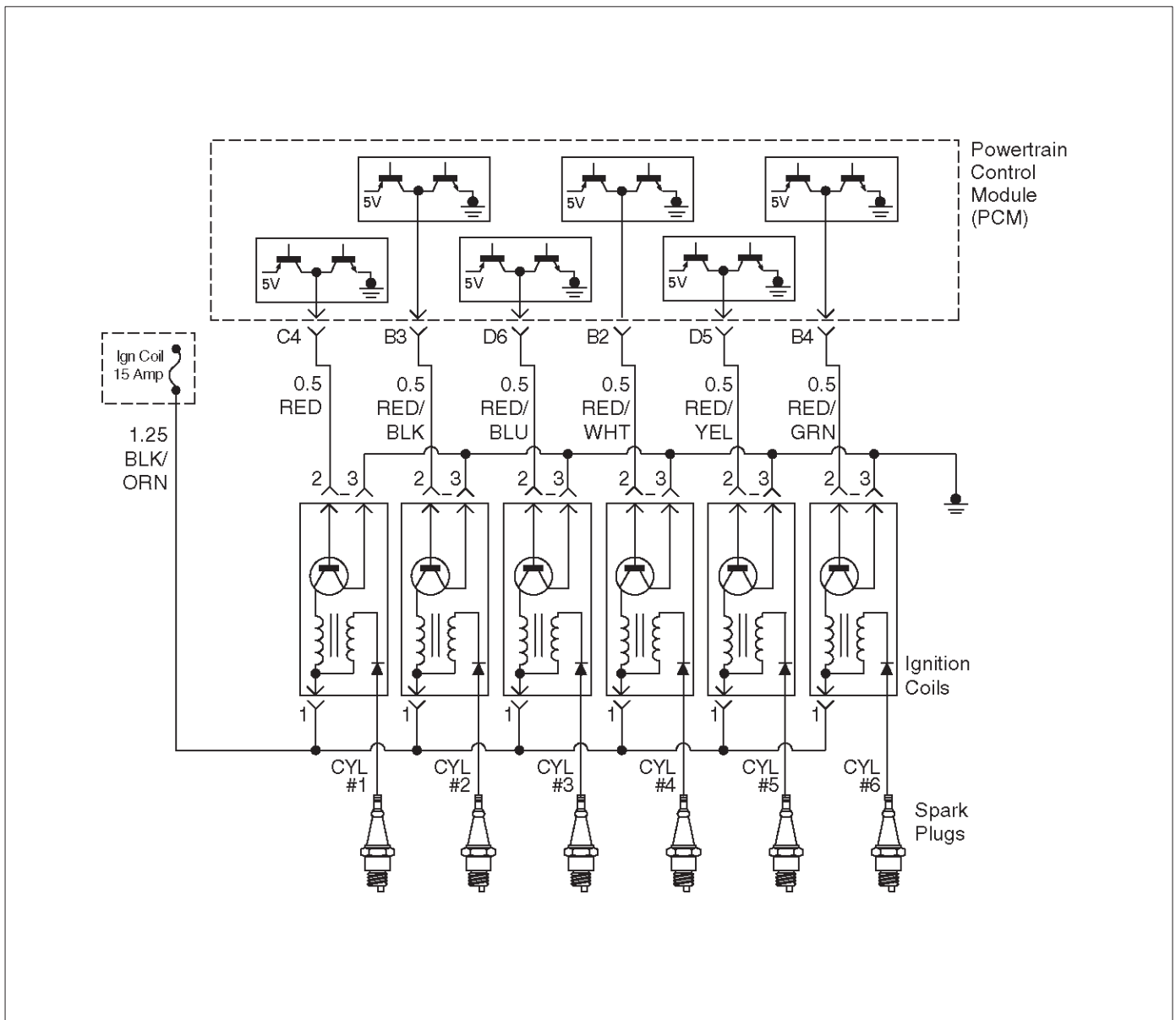
DTC P0352 – Ignition 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "Specific DTC" information for DTC P0352 until the DTC P0352 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0352 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 2 at the PCM with a DVM . Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition "OFF." 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 2 voltage at the ignition coil connector while cranking the engine connector. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 2 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 2 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0352 – Ignition 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0353 Ignition 3 Control Circuit



Circuit Description

The powertrain control module's (PCM) control circuit 3 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 3 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 3, it will set a DTC P0353.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0353 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0353 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

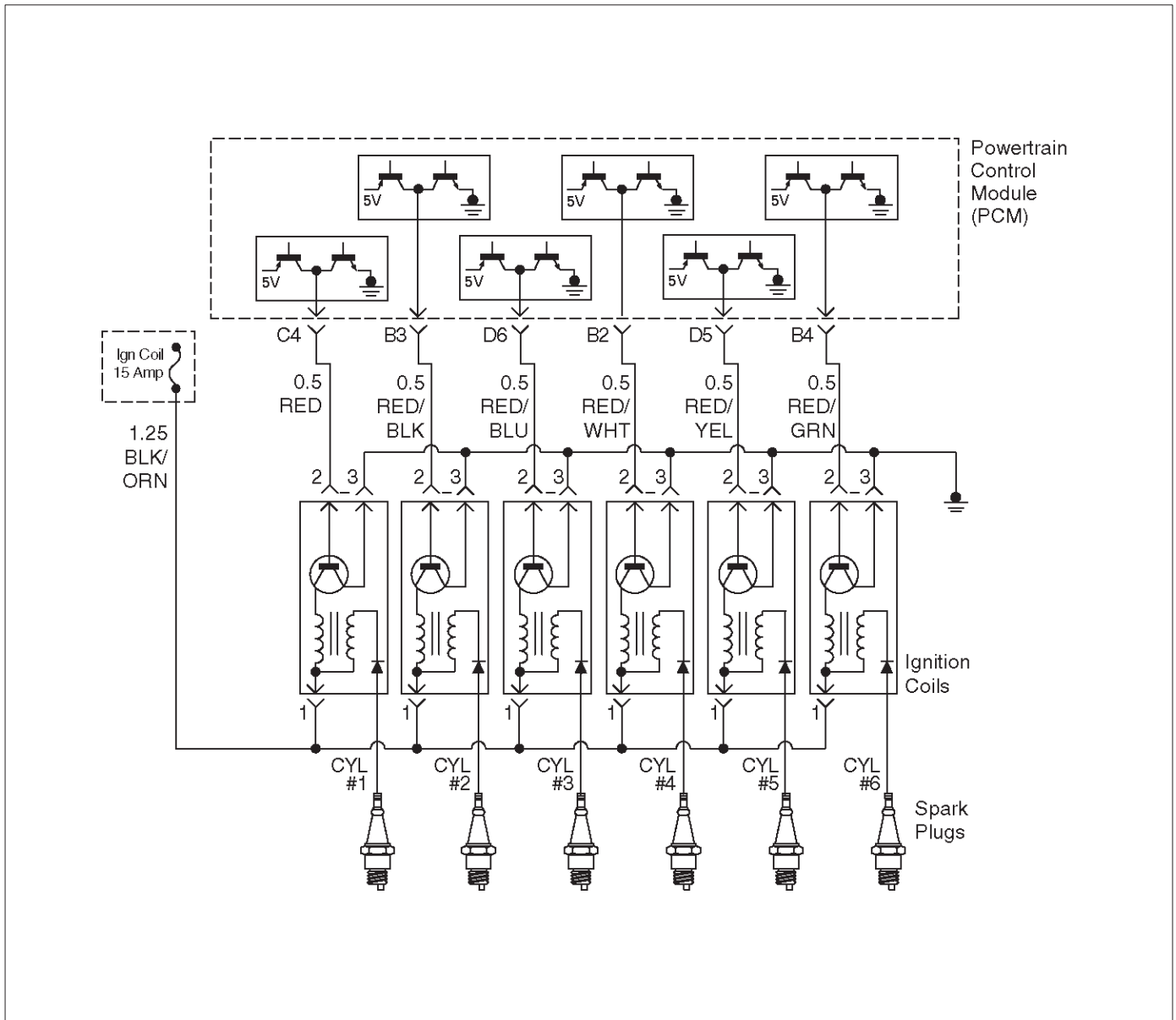
DTC P0353 – Ignition 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "Specific DTC" information for DTC P0353 until the DTC P0353 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0353 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 3 at the PCM with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition "OFF." 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 3 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 3 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 3 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0353 – Ignition 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0354 Ignition 4 Control Circuit



Circuit Description

The powertrain control module's (PCM) control circuit 4 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 4 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 4, it will set a DTC P0354.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0354 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

6E-216 ENGINE DRIVEABILITY AND EMISSIONS

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0354 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

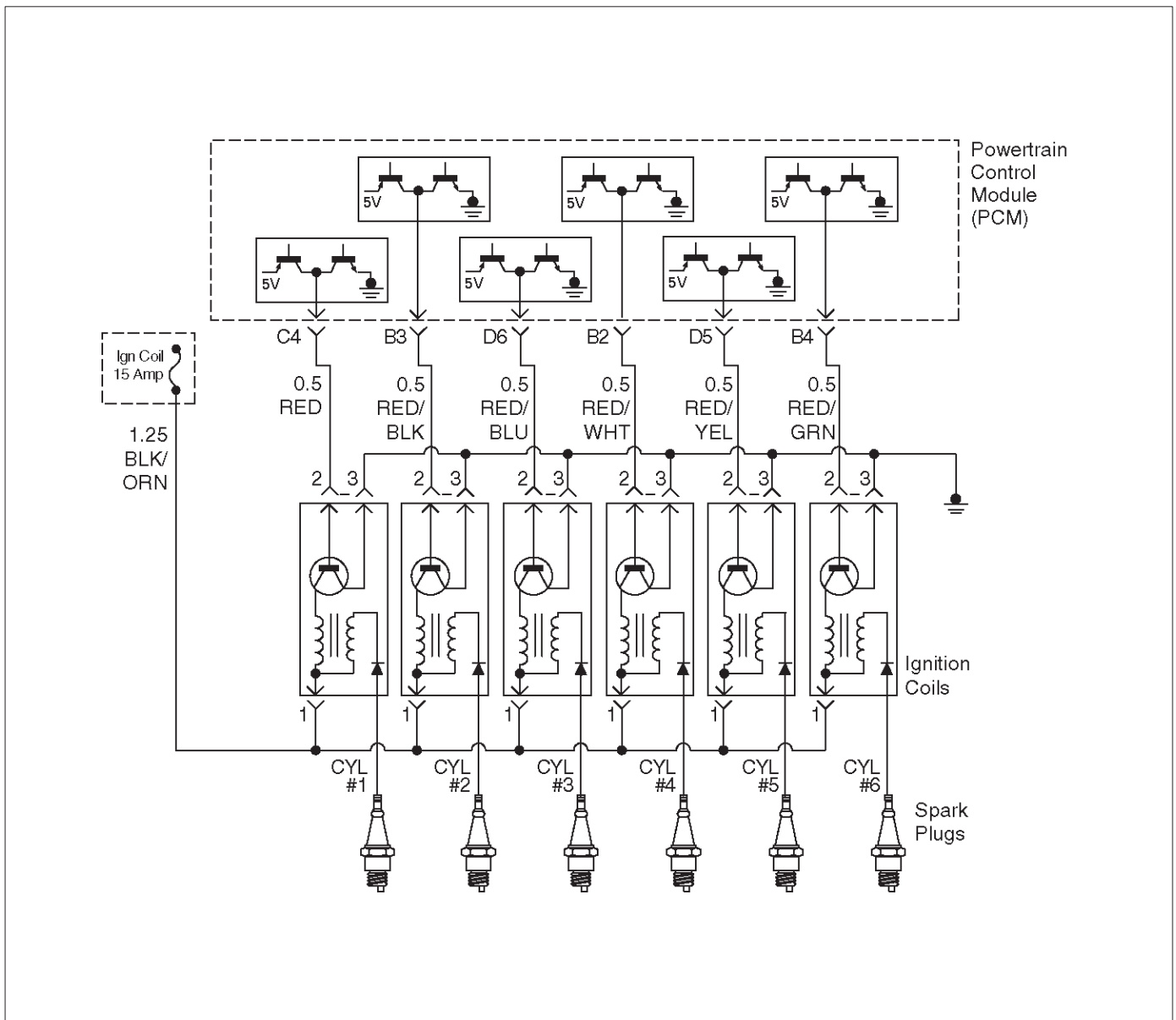
DTC P0354 – Ignition 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “Specific DTC” information for DTC P0354 until the DTC P0354 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0354 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 4 at the PCM with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition “OFF.” 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 4 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 4 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 4 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0354 – Ignition 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open in ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0355 Ignition 5 Control Circuit



Circuit Description

The powertrain control module's (PCM) control circuit 5 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 5 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 5, it will set a DTC P0355.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0355 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0355 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

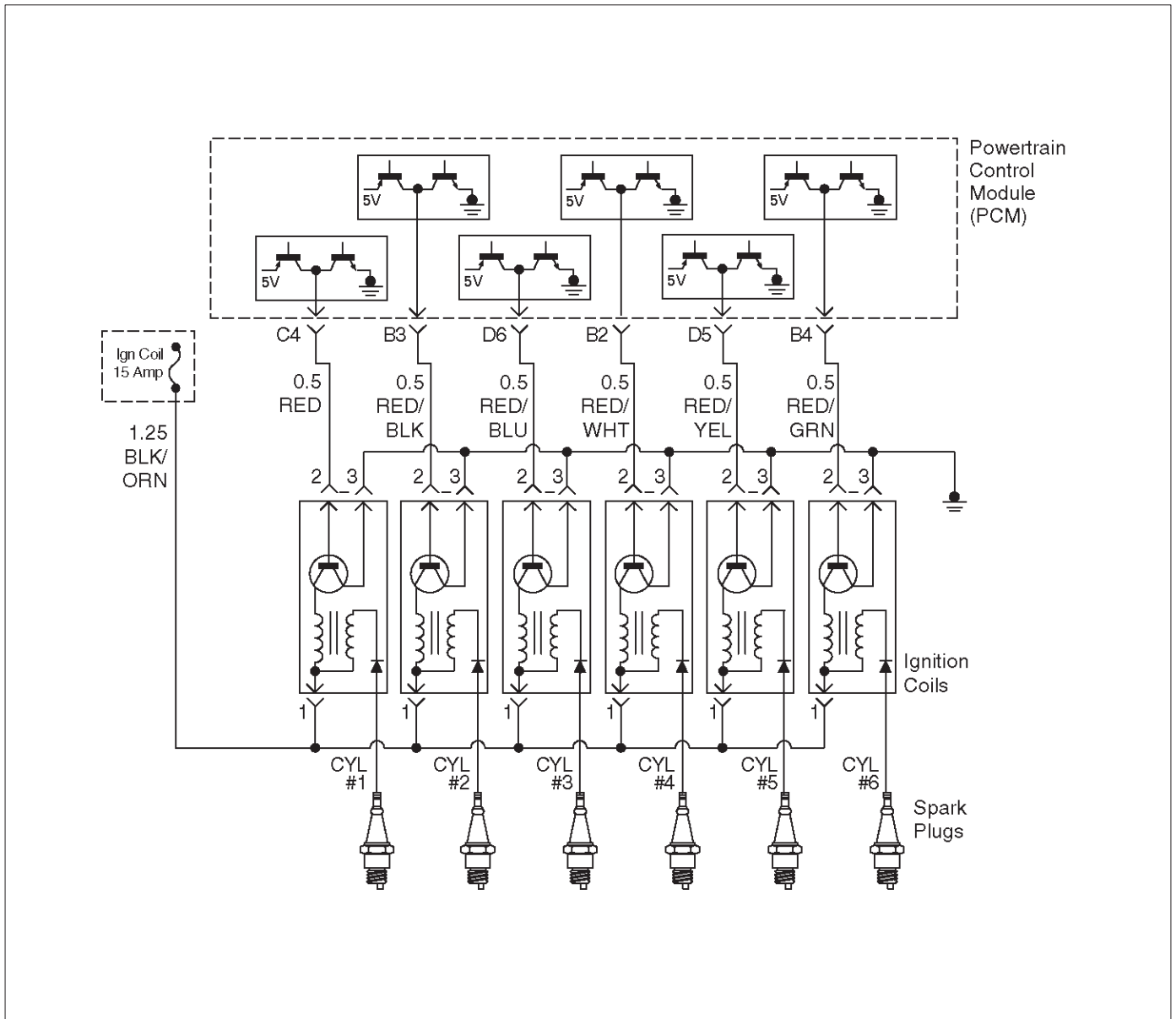
DTC P0355 – Ignition 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "Specific DTC" information for DTC P0355 until the DTC P0355 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0355 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 5 at the PCM with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition "OFF." 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 5 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 5 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 5 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0355 – Ignition 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0356 Ignition 6 Control Circuit



Circuit Description

The powertrain control module's (PCM) control circuit 6 provides a zero-volt or a 5-volt output signal to the ignition coil. The normal voltage on the circuit is zero volts. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the number 6 ignition coil. When the PCM shuts off the 5 volts to the ignition coil, the ignition coil turns "OFF." This causes the ignition coil primary magnetic field to collapse, producing a voltage in the secondary coil which fires the spark plug.

The circuit between the PCM and ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem on ignition control circuit 6, it will set a DTC P0356.

Conditions for Setting the DTC

- The ignition is "ON."
- The engine is turning, determined by the 58X crankshaft position input signal.

- The output voltage is not equal to 5 volts when output is "ON."
- The output voltage is not equal to 0 volts when output is "OFF."
- Twenty test failures occur within 40 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0356 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

6E-222 ENGINE DRIVEABILITY AND EMISSIONS

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0356 while moving the

connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

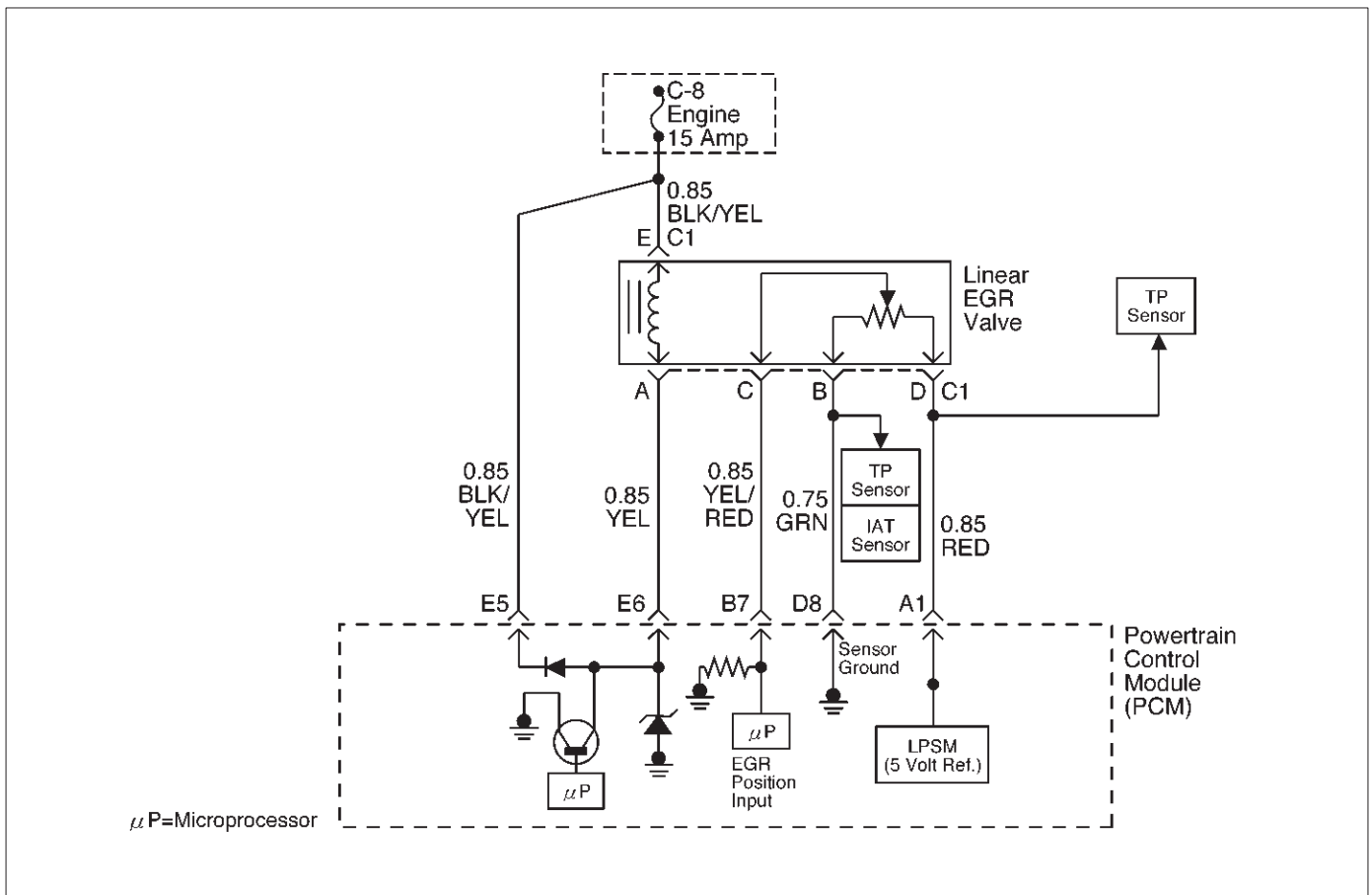
DTC P0356 – Ignition 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “Specific DTC” information for DTC P0356 until the DTC P0356 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0356 failed this ignition cycle?	—	Go to Step 3	Go to <i>Diagnostic Aids</i>
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to Step 4
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 6 at the PCM with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to Step 6	Go to Step 9
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the PCM for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to Step 7	Go to Step 13
7	1. Ignition “OFF.” 2. Disconnect the 3-pin and 5-pin connectors at the ignition coil. 3. Check ignition control circuit 6 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to Step 8	Go to Step 11
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 6 for short to ground. Was a problem found?	—	Verify repair	Go to Step 10
10	Check ignition control circuit 6 for short to voltage. Was a problem found?	—	Verify repair	Go to Step 13

DTC P0356 – Ignition 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0402 EGR Pintle Crank Error



D06RW106

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is stuck open. If the PCM detects a pintle position signal indicates more than 21.5% and more than for 625 msec during cranking, the PCM will set DTC P0402.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C
- At Engine revolution less than 600 RPM, EGR pintle position indicates more than 21.5% and more than for 625 msec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0402 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

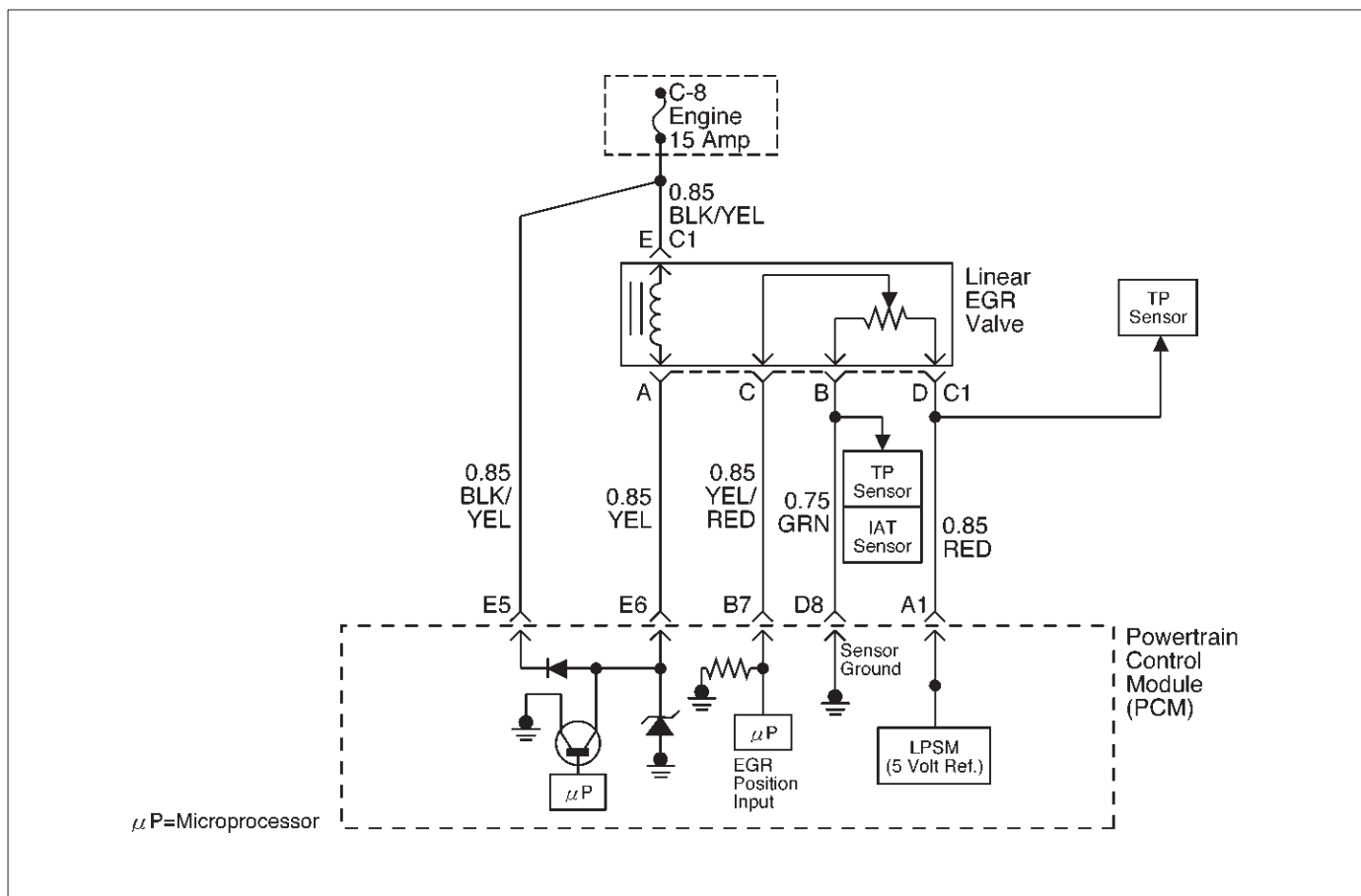
- Foreign material on EGR valve between pintle and seat may cause EGR stuck open. Inspect foreign material in EGR valve.
- Excessive carbon deposit may cause unsmooth operation of EGR valve shaft. Inspect carbon deposit and clean up inside of carbon deposit.
- Poor connection or damaged harness—inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the "Restricted Exhaust System Check".

DTC P0402 – EGR Pintle Crank Open Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor "Specific DTC" info for DTC P0402 until the DTC P0402 test runs. Note the result. Does Tech 2 indicates DTC P0402 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to Step 4	Go to Step 5
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any foreign material between seat and pintle. Was any foreign material in EGR valve?	—	Go to Step 6	Go to Step 7
6	1. Remove EGR valve foreign material from EGR valve and clean up inside. 2. Visually inspect damage of pintle and seat, which leakage may occur. Was there any severe damage which affects function?	—	Go to Step 7	Verify repair Go to Step 8
7	1. Reconnect. 2. Ignition "OFF". 3. Install Tech 2. 4. Run the engine at idle. 5. On Tech-II, select special function for EGR. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to Step 8
8	Replace the EGR valve. Does DTC P0402 still fail "DTC" test on Tech 2?	—	Go to Step 9	Verify repair
9	Replace the EGR valve. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0404 EGR Open Stuck



D06RW106

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is different from commanded position. If the PCM detects a pintle position signal indicates more than 15 points different between current and commanded and more than 15 seconds, the PCM will set DTC P0404.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desired EGR position is more than 0.
- The difference between desired EGR and current EGR is less than 3%.
- Difference EGR pintle position between current and commanded position becomes more than 15% and last more than 15 seconds, and this condition meets three times in a trip. Then it trigger, the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected after consecutive 2nd trip in which the fault is detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0404 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

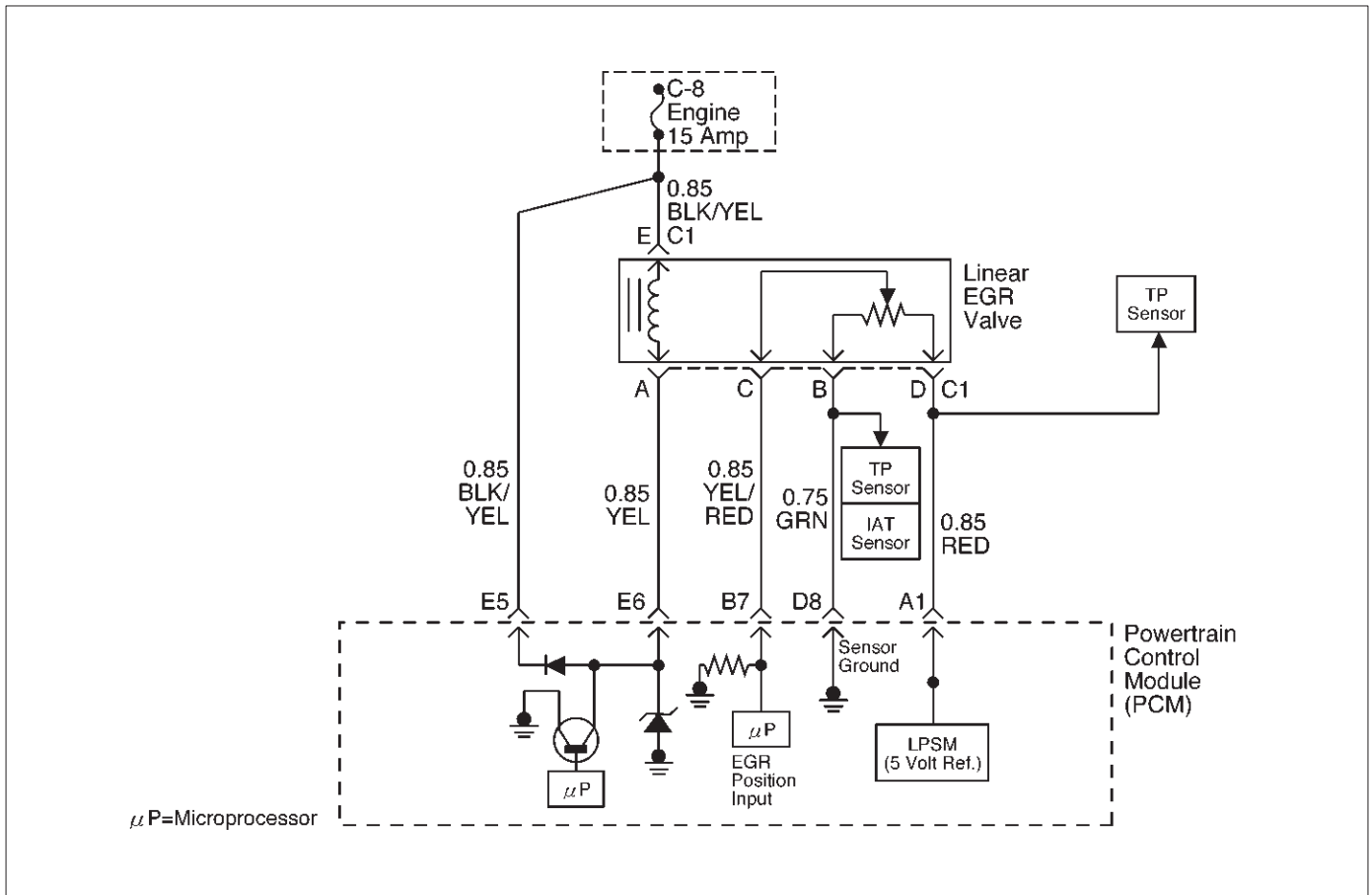
Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft may cause EGR stuck open or unsmooth operation. Those carbon deposit may occur by unusual port operation. Clean up carbon may make smooth function of EGR valve.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

DTC P0404 – EGR Open Stuck

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor "Specific DTC" info for DTC P0404 until the DTC P0404 test runs. Note the result. Does Tech 2 indicates DTC P0404 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to Step 4	Go to Step 5
4	Repair the damaged pin or terminal.	—	Verify repair	Is the action complete?
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft. Was excessive carbon deposit On EGR valve shaft?	—	Go to Step 6	Go to Step 7
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Visually inspect damage of pintle and seat whether there is bent, leakage may occur. Was there any severe damage which affects function?	—	Go to Step 8	Verify repair Go to Step 7
7	1. Reconnect. 2. Ignition "OFF". 3. Install Tech 2. 4. Run the engine at idle. 5. On Tech 2, select F3:Misc. Test; F2:EGR. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to Step 8
8	Replace the EGR valve. Does DTC P0404 still fail "DTC" test on Tech 2?	—	Go to Step 9	Verify repair
9	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0405 EGR Low Voltage



D06RW106

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates less than 0.1 V and last more than 10 seconds, then the PCM will set DTC P0405.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position output voltage is less than 0.1 volt and last more than 10 sec. Action taken when the DTC sets.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0405 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

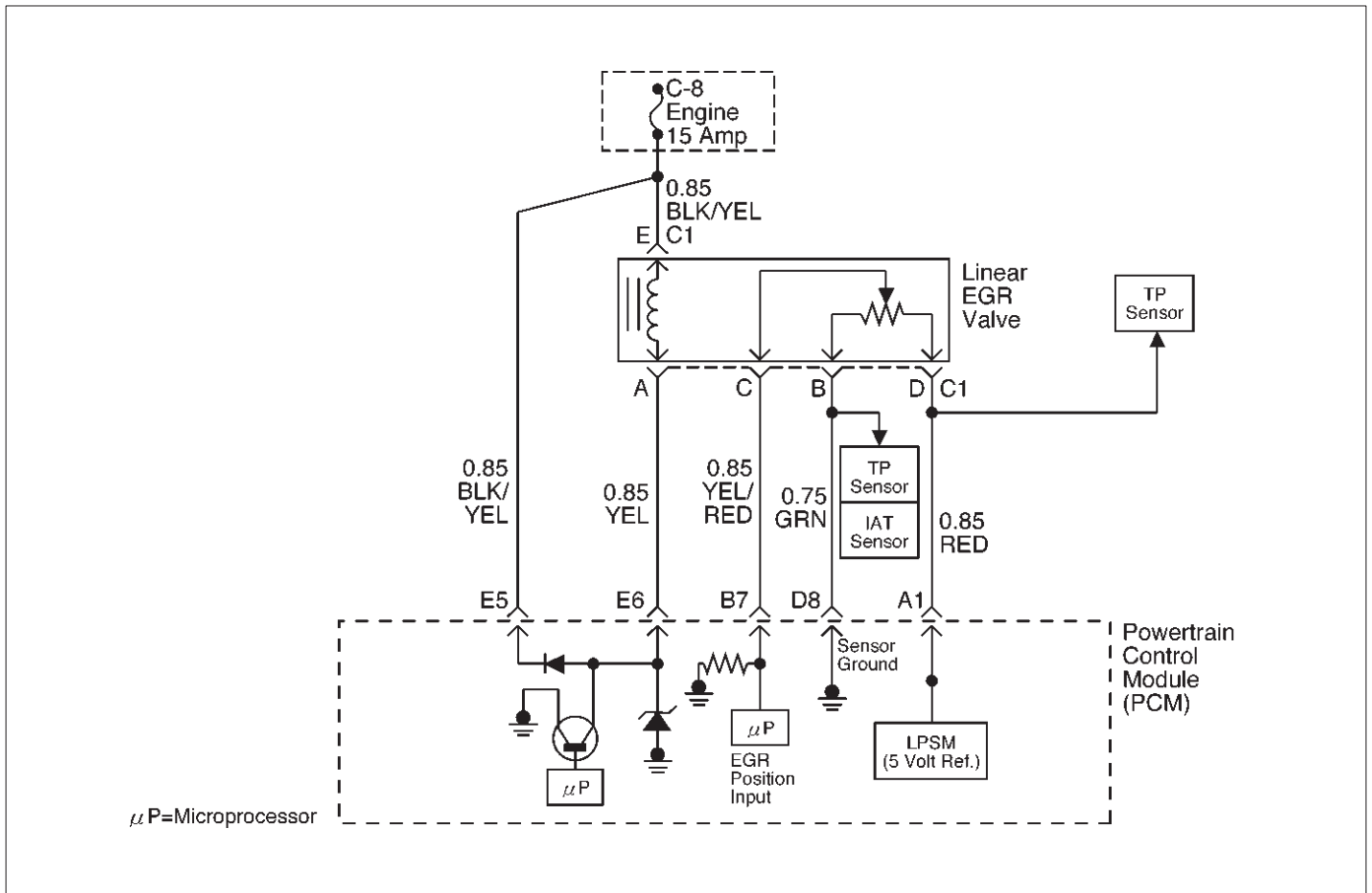
DTC P0405 – EGR Low Volt

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor "DTC" info for DTC P0405 until the DTC P0405 test runs. Note the result. Does Tech 2 indicates DTC P0405 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to Step 4	Go to Step 5
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (RED) and ground (B). Did the DVM indicate the specified value?	4–6 V	Go to Step 6	Go to Step 7
6	1. Disconnect the EGR harness connector. 2. Measure resistance between terminal B and D. Was resistance in range?	5–5.5 K Ω	Go to Step 10	Go to Step 17
7	1. Ignition "ON". 2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to Step 8	Go to Step 9
8	Repair the open 5 volt reference circuit. Is the action complete?	—	Verify repair	—
9	Repair the damaged sensor ground wire. Is the action complete?	—	Verify repair	—
10	1. Disconnect the EGR harness 2. Use an ohmmeter to measure between the pintle position pin and the sensor ground pin on the EGR valve. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the ohmmeter reading approximately equal to the specified value?	1 to 1.25 K Ω	Go to Step 11	Go to Step 17
11	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at EGR valve pintle position pin and sensor ground pin. Was voltage in range?	Less than 0.1 V	Go to Step 17	Go to Step 12

DTC P0405 – EGR Low Volt (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at PCM sensor ground pin and pintle position pin. Was voltage in range?	Less than 0.1 V	Go to <i>Step 13</i>	Go to <i>Step 18</i>
13	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Check short circuit between EGR pintle position circuit and EGR ground circuit. Was any short circuit?	—	Go to <i>Step 14</i>	Go to <i>Step 18</i>
14	Locate and repair the short to ground in the pintle position circuit Is the action complete?	—	Verify repair	—
15	1. Ignition "OFF". 2. Disconnect the PCM. 3. Ignition "ON". 4. Measure the voltage between the EGR pintle position circuit and ground. Is the measured voltage near the specified value?	Less than 0.1 V	Go to <i>Step 17</i>	Go to <i>Step 16</i>
16	Check for a short circuit between other wires and the pintle position circuit Was any short circuit?	—	Repair short circuit Verify repair	Go to <i>Step 17</i>
17	Replace the EGR valve. Does DTC P1404 still fail "specific DTC test on Tech 2"?	—	Go to <i>Step 18</i>	Verify repair
18	Examine the PCM pin and terminal connection. Was there a damaged terminal?	—	Go to <i>Step 4</i>	Go to <i>Step 19</i>
19	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0406 EGR High Voltage



D06RW106

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates more than 4.8 V and last more than 10 seconds, then the PCM will set DTC P0406.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position output voltage is more than 4.8 volt and last more than 10 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0404 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

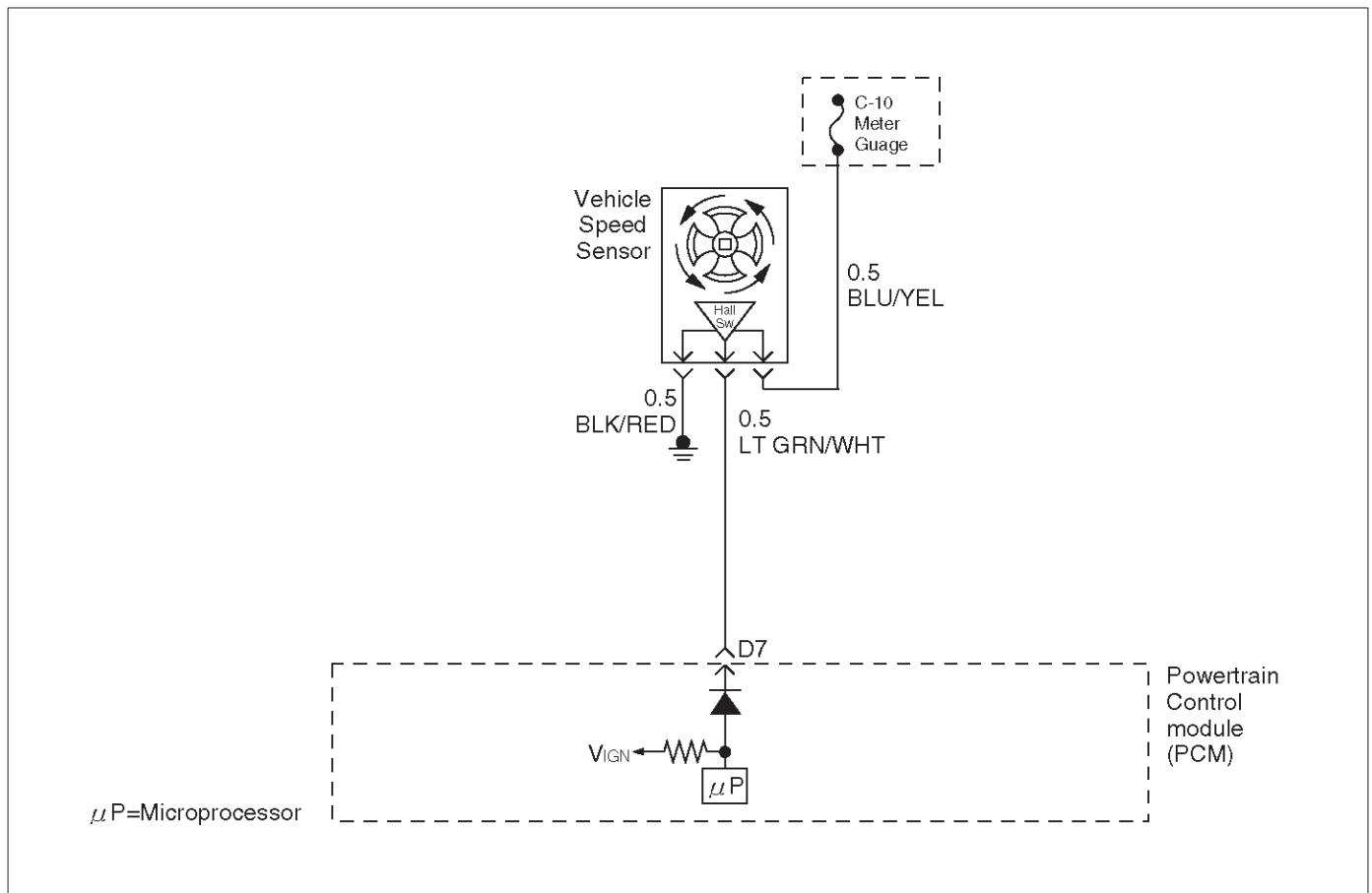
DTC P0406 – EGR High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using Tech 2, monitor "DTC" info for DTC P0406 until the DTC P0406 test runs. Note the result. Does Tech 2 indicates DTC P0406 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to Step 4	Go to Step 5
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	Is the action complete?
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (RED). Did the DVM indicate the specified value?	4–6 V	Go to Step 8	Go to Step 6
6	1. Ignition "ON". 2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to Step 7	Go to Step 16
7	Repair the open 5 volt reference circuit Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF" 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between D (5 V reference) and B (Sensor Ground) at EGR sensor terminals. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was there measured resistance in range?	5 to 5 K δ	Go to Step 9	Go to Step 15
9	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between B and C at EGR sensor terminal. Was there open circuit?	—	Go to Step 15	Go to Step 10
10	1. Ignition "OFF". 2. Disconnect the EGR harness at PCM connector. 3. Use a DVM to check for shorted wire between A1 and B7. Was there shorted wire?	—	Go to Step 14	Go to Step 11

DTC P0406 – EGR High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition "ON". 2. Use a DVM to backprobe at terminal C of EGR valve for voltage. Was measured voltage more than 4.8 V?	more than 4.8 V	Go to <i>Step 12</i>	Go to <i>Step 12</i>
12	1. Ignition "ON". 2. Stay the EGR harness connected. 3. Check voltage by backproving at PCM B7 terminal. Was voltage more than 4.8 V?	4.8 V	Go to <i>Step 16</i>	Go to <i>Step 13</i>
13	1. Locate short circuit at EGR harness between RED to RED or GREEN, RED to YEL. 2. Replace EGR harness. Is the action complete?	—	Verify repair	—
14	Replace EGR harness. Is the action complete?	—	Verify repair	—
15	Replace the EGR valve. Does DTC P1404 still fail "specific DTC test on Tech 2"?	—	Go to <i>Step 16</i>	Verify repair
16	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0502 VSS Circuit Low Input



D06RW019

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit that interacts with the magnetic field created by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

Conditions for Setting the DTC

- Engine is running.
- Engine coolant temperature is above 60°C (140°F).
- Engine speed is between 1800 RPM and 2500 RPM.
- Throttle angle is between 10% and 40%.
- Engine load is greater than 50 kPa.
- MAP sensor indicates greater than 50 kPa manifold pressure.
- PCM detects no VSS signal for 12.5 seconds over a period of 25 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0502 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connects to the engine harness. Power and ground are applied by jumpers to the VSS through the connectors which are located just in front of the air cleaner assembly. The VSS signal is monitored with a DVM as the rear driveshaft turns. The wheels can be turned to rotate the driveshaft, or in 2-wheels-drive vehicles the driveshaft can be turned directly.
- The speedometer-to-PCM VSS signal wire is spliced to a wire leading to the cruise control module. If a short to ground or voltage is indicated between the PCM and speedometer, it could be on the cruise control circuit if the vehicle is equipped with cruise control.

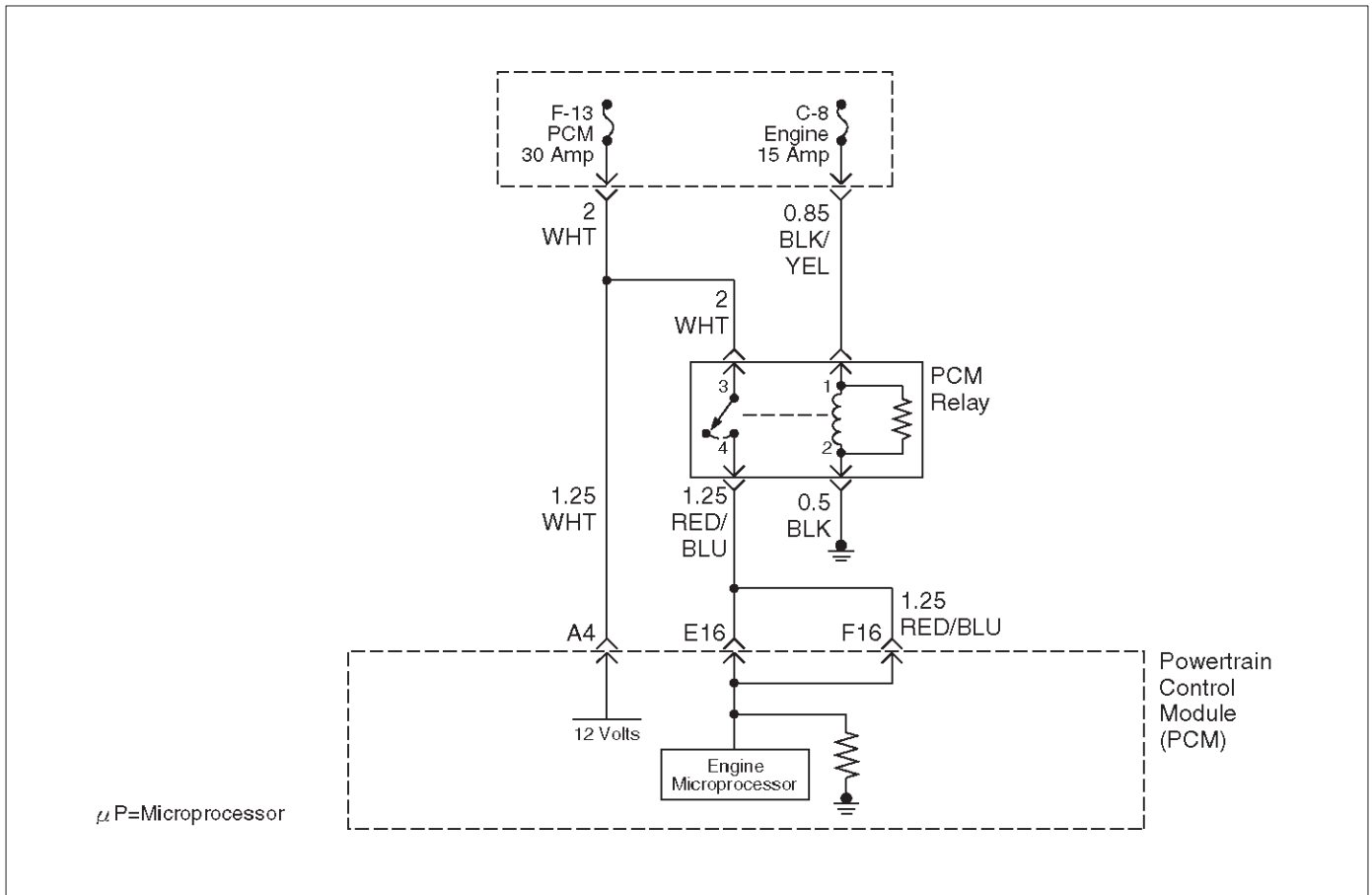
DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Does the speedometer work?	—	Go to <i>Step 10</i>	Go to <i>Step 3</i>
3	1. Disconnect the VSS connector. 2. Ignition "ON." 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Repair the sensor ground. Is the action complete?	—	Verify repair	—
5	1. Ignition "ON," sensor disconnected. 2. Using a DVM, measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	Repair the open or short to ground which may have blown the meter fuse. Is the action complete?	—	Verify repair	—
7	1. Ignition "ON," VSS disconnected. 2. Using a DVM, measure at the VSS connector between ground and the wire from the speedometer. Was the measurement near the specified value?	7.5-8 V	Go to <i>Step 9</i>	Go to <i>Step 8</i>
8	Check for an open or short circuit between the speedometer and the VSS. Was an open or short circuit located?	—	Verify repair	Go to <i>Step 9</i>
9	Replace the speedometer. Is the action complete?	—	Verify repair	—

DTC P0502 – VSS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	<ol style="list-style-type: none"> 1. Ignition "OFF." 2. Disconnect the MAF sensor and remove the air cleaner assembly and filter element to gain access to the 16-way black connector located immediately to the rear of the left front headlamp. The connector attaches the VSS wires from the transmission harness to the left-side engine harness. 3. Disconnect the black 16-way connector. 4. Select a terminal adapter from kit J 35616 that can be used with a jumper to supply B+ to the blue wire with a yellow tracer (transmission side of the connector). 5. Use another terminal adapter to attach a voltmeter to the light-green wire with a white tracer (next to the wire in the previous step.) 6. Disconnect the blue connector next to the black 16-way connector, and locate the black/red tracer wire at one corner of the blue connector. The black/red wire is the VSS ground. Use a terminal adapter to attach a jumper to ground to the black/red VSS ground wire at the transmission side of the blue connector. 7. Raise the rear wheels off the ground with transmission in neutral. <p>Does the DVM toggle back and forth between 0.6 V and 10 V as the wheels (and driveshaft) are rotated?</p>	—	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	<p>Replace the VSS.</p> <p>Is the action complete?</p>	—	Verify repair	—
12	<p>Check for an open or short between the PCM and the speedometer.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 13</i>
13	<p>Replace the PCM.</p> <p>IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i>.</p> <p>Is the action complete?</p>	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0562 System Voltage Low



D06RW020

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage DTC will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition "ON."
- System voltage is below 11.5 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0562 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0562 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0562 – System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Using a Tech 2, measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to Step 3	Charge battery, then go to Step 3
3	1. Using a Tech 2. 2. Select "Ignition Volts" on the Tech 2. 3. Start the engine and raise the engine speed to the specified value. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	2000 RPM 12.8-14.1 V	Go to Step 4	Go to <i>Starting/Charging</i>
4	1. Ignition "OFF." 2. Disconnect the PCM connector at the PCM. 3. Using a DVM, measure the battery voltage at the PCM connector A-4. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition "OFF," engine "OFF."	Go to Step 5
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to Step 6
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0563 System Voltage High

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Conditions for Setting the DTC

- Ignition "ON."
- System voltage is above 16 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).

- The PCM will store as Failure Records only conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0563 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0563 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0563 – System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the "ON-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Using a Tech 2, measure the battery voltage at the battery. Is the battery voltage less than the specified value?	11.5 V	Go to Step 3	Go to Step 4
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage less than the specified value?	11.5 V	Replace battery	Go to Step 4
4	1. Turn "OFF" all the accessories. 2. Install a Tech 2. 3. Select the ignition voltage parameter on the Tech 2. 4. Start the engine and raise the engine RPM to the specified value. Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3?	2000 RPM	Go to <i>Starting/Charging</i>	Go to Step 5
5	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98 model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0601 PCM Memory

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read-only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. Unlike the PROM used in past applications, the EEPROM is not replaceable.

Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).

- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- DTC P0601 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

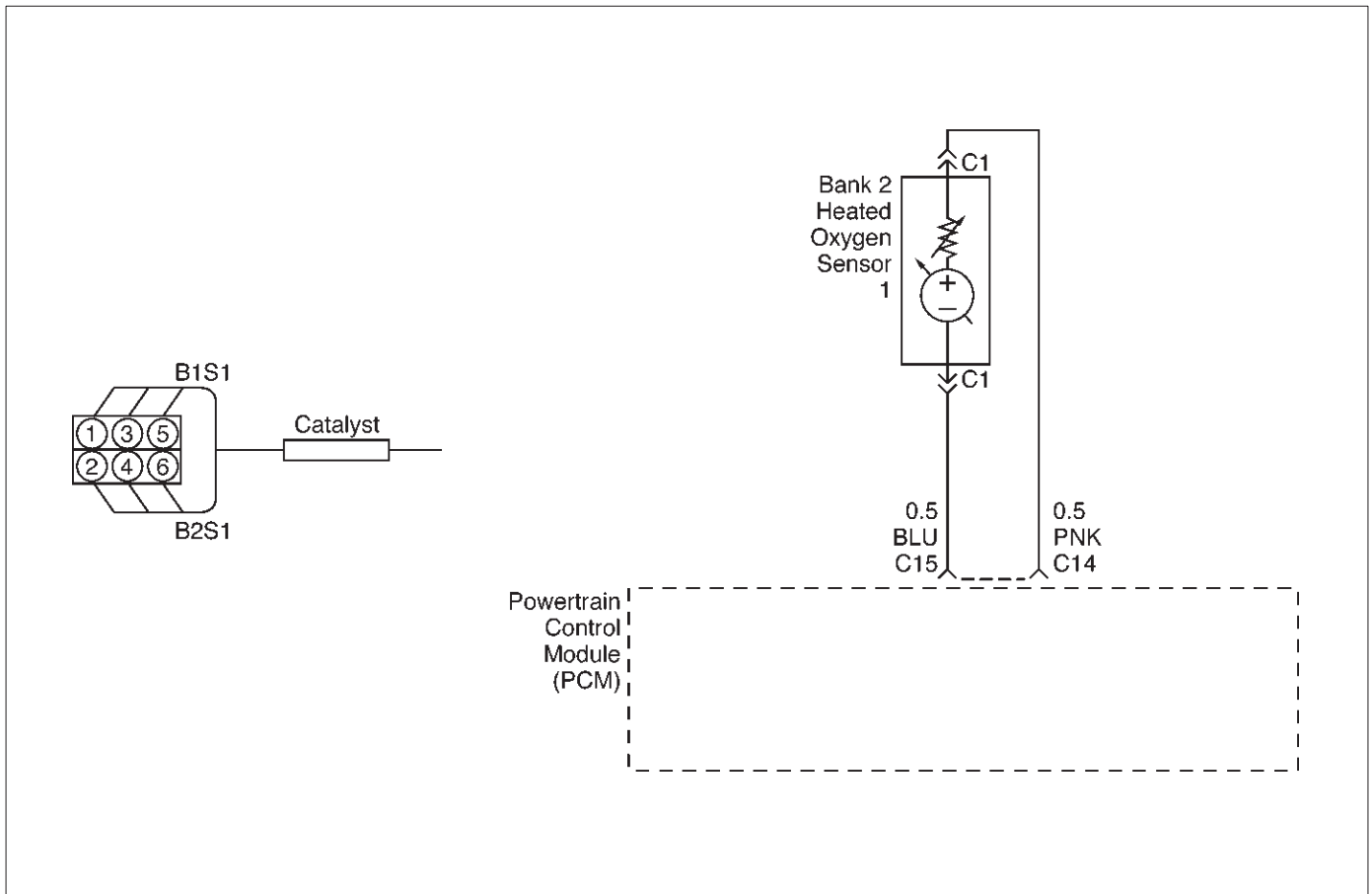
Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement.

DTC P0601 – PCM Memory

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1



Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During the monitor period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1154 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 50°C (122°F) for automatic transmission; 75°C (167°F) for manual transmission.
- The engine is operating in “closed loop.”
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.

- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 2 HO2S 1 transition ratio between lean to rich and rich to lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- “Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1154 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A multifunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1154 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1154 continues to set, replace the Bank 2 HO2S 1. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

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the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.

8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	IMPORTANT: If any other DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 3. Using a Tech 2, monitor "Specific DTC" info for DTC P1154 until the DTC P1154 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	Did Tech 2 also indicate P1133, and/or P1134 test failed?	—	Go to Step 17	Go to Step 4
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to Step 5	Go to Step 6
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to Step 2	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to Step 7	Go to Step 8
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to Step 2	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to Step 9	Go to Step 10
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to Step 2	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to Step 11	Go to Step 12
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to Step 2	—

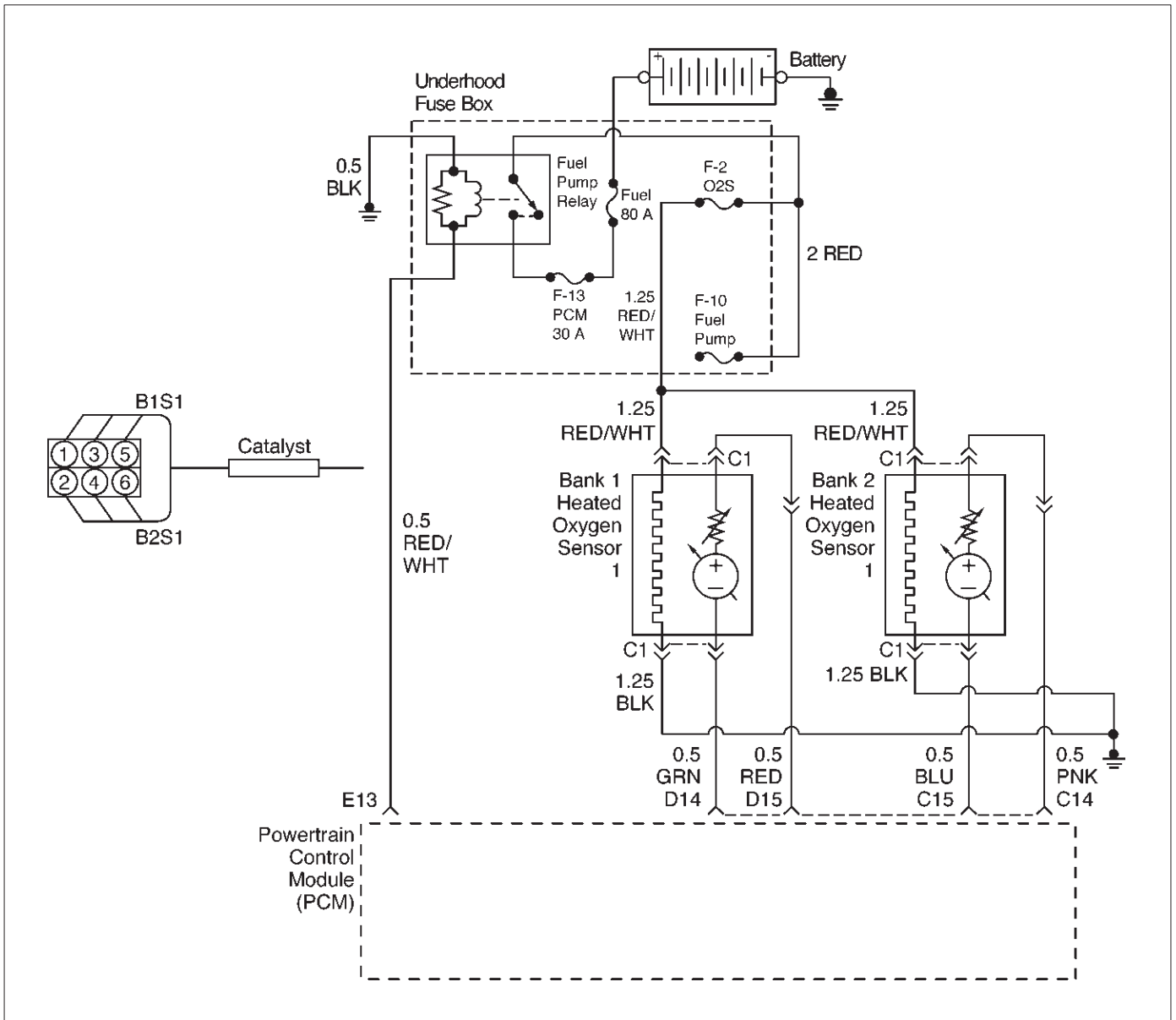
DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to <i>Step 13</i>	Go to <i>Step 14</i>
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to <i>Step 2</i>	—
14	Visually/physically inspect the following items: <ul style="list-style-type: none"> • Ensure that the Bank 2 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 2 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to <i>Step 18</i>	Go to <i>Step 15</i>
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to <i>Step 16</i>	Go to <i>Step 19</i>
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the scan too indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to <i>Step 21</i>	Go to <i>Step 22</i>
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. <ul style="list-style-type: none"> • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to <i>Step 20</i>
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1171 Fuel System Lean During Acceleration



Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during "closed loop" operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a "rich" condition (high oxygen sensor voltage). If this "rich" exhaust is not detected at this time, a DTC P1171 will set. A plugged fuel filter, restricted fuel line, restricted in-tank filter or defective fuel pump can prevent adequate amounts of fuel from being supplied during power enrichment mode.

Conditions for Setting the DTC

- No related DTCs.

- Engine is operating in "closed loop power enrichment" mode for 3 seconds.
- Engine coolant temperature is above 60°C (140°F).
- While in "power enrichment" mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1171 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

- A restricted fuel filter or fuel line, restricted in-tank filter, or a defective fuel pump may supply adequate

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amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.

- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. It is possible to measure a satisfactory fuel pressure at idle even though the pressure may drop at high flow requirements. It may be necessary to watch fuel pressure at high engine load.
- Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing gauge. Ignition "ON," pump pressure should be 280-320 kPa.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Are any component-related DTCs set?	—	Go to component DTC charts	Go to Step 3
3	1. Check the vehicle's fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle's fuel tank if the tank is almost empty. Was fuel added to the vehicle's fuel tank?	—	Go to Step 4	Go to Step 5
4	1. Place the transmission in park. 2. Using Tech 2, observe HO2S 1 voltage while running warm engine 75°C-95°C (167°F-203°F) at 1200 RPM. 3. HO2S 1 voltage should vary within the specified range. 4. Quickly open the throttle halfway for a few seconds. Did the voltage suddenly rise toward the high end of the specified range?	100-900 mV	Go to Chart A-7	Go to Step 5
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280-325 kPa (41-46 psi)	Go to OBD System Check	Go to Step 6
6	Check for restricted fuel lines or restricted in-line filter. Was a problem found?	—	Verify repair	Go to Step 7

DTC P1171 – Fuel System Lean During Acceleration (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second specified value?	414 kPa (60 psi) 325 kPa (46 psi)	Go to <i>Diagnostic Aids</i>	Go to <i>Step 8</i>
8	Check for: <ul style="list-style-type: none"> ● Faulty fuel pump ● Restricted fuel pump strainer (sock) ● Incorrect fuel pump ● Incorrect fuel being used ● Hot fuel Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1380 ABS Rough Road ABS System Fault

Circuit Description

The powertrain control module (PCM) monitors ABS fault signal. When PCM receives fault signal, PCM will set DTC P1380.

Conditions for Setting the DTC

- Vehicle speed is more than 5 mph.
- Load is less than 99%.
- Engine revolution is less than 6250 rpm.
- PCM receives ABS fault signals from ABS unit.
- Ignition on.
- Misfire DTCs exist.
- 100 test failures within 120 test samples.

Action Taken When the DTC Sets

- The PCM will store DTC 1380 only, no MIL turn on.

Conditions for Clearing the MIL/DTC

- A history DTC P1380 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC 1380 can be cleared by using Tech-2 or disconnecting the PCM battery feed.

Diagnostic Aids

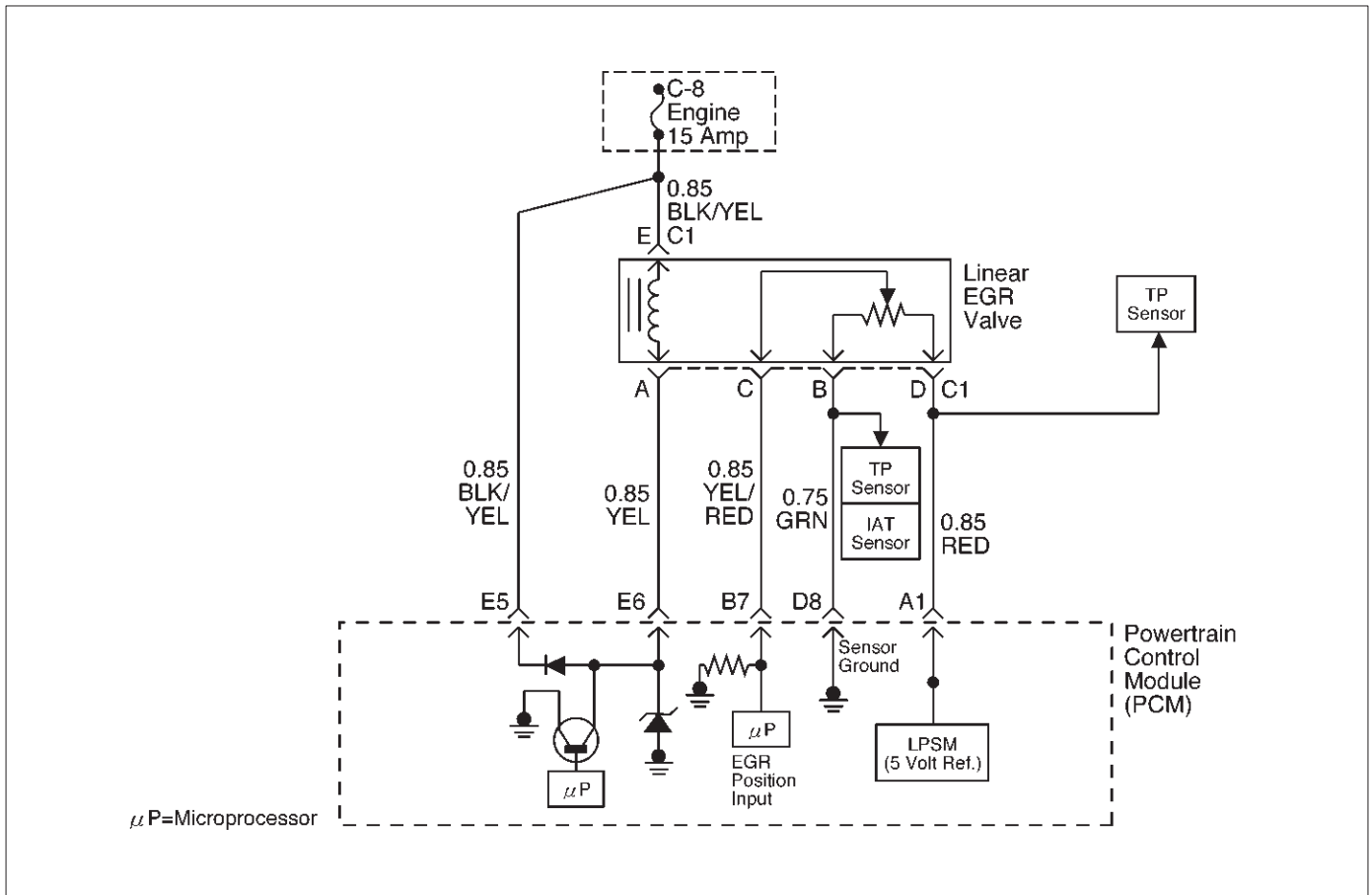
Check for the following conditions:

- PCM and ABS communication line short circuit to other line may cause faulty signal. Inspect communication line.
- Follow ABS ECU diagnosis procedure, refer to ABS procedure page.

DTC P1380 – ABS Rough Road ABS System Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Specific DTC" info for DTC P1380 and Misfire DTCs until the DTC P1380 and Misfire DTCs test runs. Note the result. Does the Tech 2 indicates DTC P1380 and Misfire DTCs failed this ignition?	—	Refer to ABS diagnosis After inspect ABS, unit repeat <i>Step 2</i> Still problem exists, go to <i>Step 3</i>	Clear DTC by Tech 2
3	Check short circuit among communication line of PCM/ABS and others. Was short circuit?	—	Repair wiring Verify repair	Go to <i>Step 4</i>
4	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1404 EGR Closed Stuck



D06RW106

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if current pintle zero position is different from the learned zero position. If the PCM detects a pintle position signal indicates more than 30 % different between current zero position and the learned zero position and more than 5 seconds, and this condition meet 3 times during trip, then the PCM will set DTC P1404.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desire EGR position is 0.
- Difference EGR pintle position between current and the learned zero is more than 30 % last more than 5 seconds, and meet three time to the above condition during a trip. Then it trigger the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after consecutive 2nd trip in which the fault is detected.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1404 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

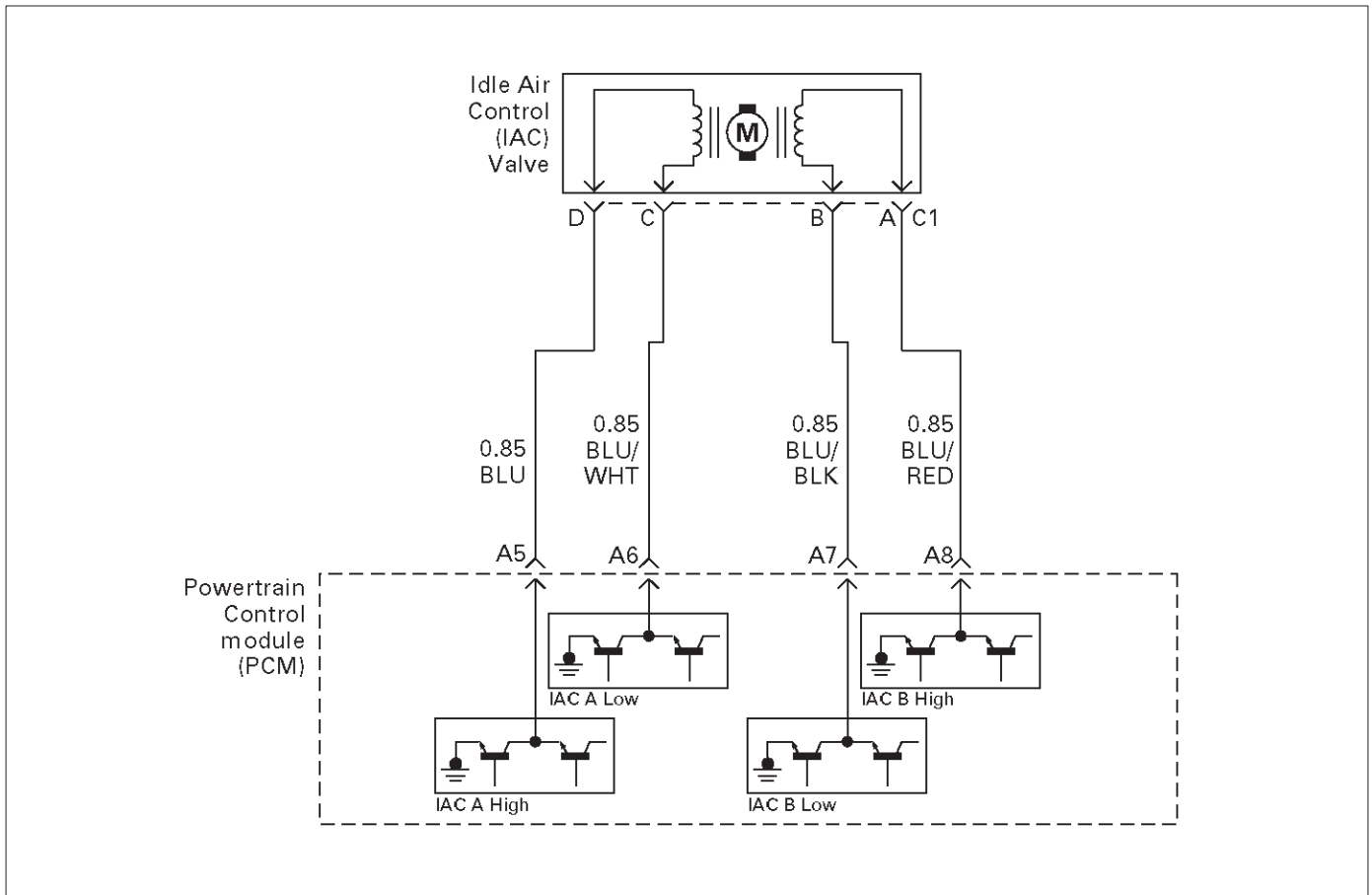
- Excessive carbon deposit on EGR valve shaft or/and foreign material may cause no return to EGR valve fully seated. Those carbon deposit may occur by unusual port operation. Remove foreign material or/and excessive carbon deposit on EGR valve shaft may make return to EGR valve fully seated.
- Poor connection or damaged harness – Inspect the wiring harness for damage. Same as P1406 description

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1404 – EGR Closed Stuck

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC inf. for DTC P1404 until the DTC P1404 test runs. Note the result. Does the Tech 2 indicates DTC P1404 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to Step 4	Go to Step 5
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft. 3. Inspect any foreign material inside of EGR valve. Was excessive carbon deposit on EGR valve shaft or/and foreign material in EGR valve ?	—	Go to Step 6	Go to Step 7
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Remove foreign material from EGR valve. 3. Visually inspect damage of pintle and seat whether there is bent, leakage may occur. Was there any severe damage which affects function?	3–6 ohms	Go to Step 8	Verify repair Go to Step 7
7	1. Reconnect. 2. Ignition "OFF". 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select F3:Misc. Test F5:EGR. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to Step 8
8	1. Reset the learned zero EGR valve position. 2. Repeat step 7. Did EGR work properly?	—	Verify repair	Go to Step 9
9	Replace the EGR valve. Replace the EGR valve. Does DTC P1404 still fail "specific DTC" test on the Tech 2?	—	Go to Step 10	Verify repair
10	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1508 IAC System Low RPM



T321115

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi-directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, DTC P1508 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of these DTCs are set: TP sensor, VSS, ECT, EGR, fuel system, MAF, MAP, IAT, canister purge, injector control or ignition control.
- Barometric pressure is above 75 kPa.
- Engine coolant temperature (ECT) is above 50°C (120°F).
- Engine speed is more than 100-200 RPM lower than desired idle, based upon coolant temperature.
- The engine has been running for at least 125 seconds.
- Vehicle speed is less than 1 mph.
- Canister purge duty cycle is above 10%.
- Ignition voltage is between 9.5 volts and 16.7 volts.

- The throttle is closed.
- Engine speed is lower than desired idle.
- All of the above conditions are met for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1508 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring for damage.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC

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passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate.

- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or a disconnected brake booster hose.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

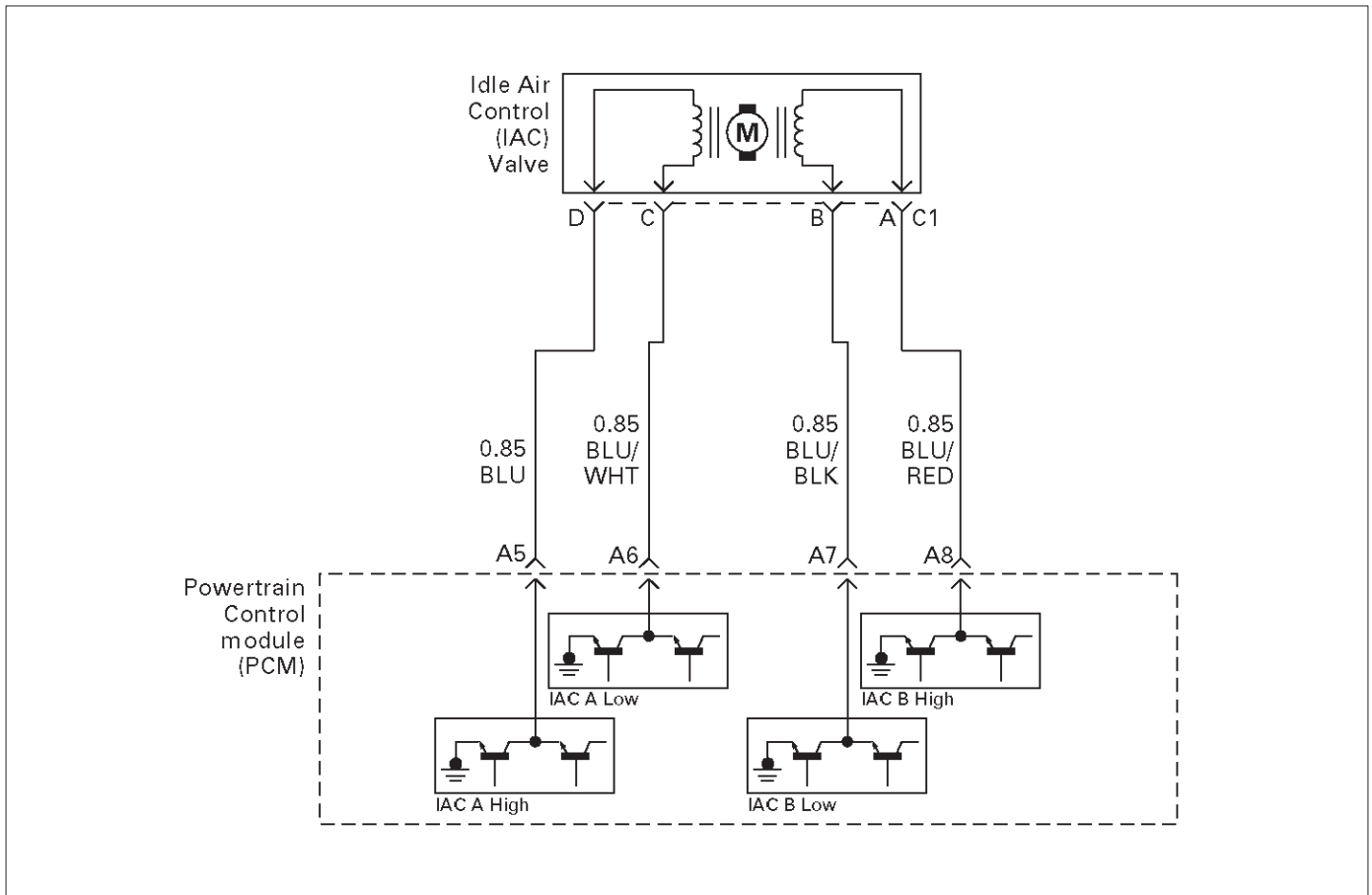
DTC P1508 – IAC System Low RPM

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<ol style="list-style-type: none"> 1. Start the engine. 2. Turn all accessories "OFF"(A/C, rear defroster, etc). 3. Using a Tech 2, command RPM up to 1500, down to 500, and the up to 1500 while monitoring the "Engine Speed" on the Tech 2. <p>NOTE: This Tech 2 command may cause the engine to "cut out" when RPM goes above 1500. If this occurs, the "cutting out" will stop when the Tech 2 command for the test is discontinued, or if the Tech 2 command is changed to less than 1500 RPM.</p> <p>Does the "Engine Speed" remain within the specified value of the "Desired Idle" for each RPM command?</p>	± 50 RPM	No trouble found. Go to <i>Diagnostic Aids</i>	Go to <i>Step 3</i>
3	<ol style="list-style-type: none"> 1. Disconnect the IAC. 2. Install IAC Node Light 5-8840-2312-0 or equivalent. 3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the node light. <p>NOTE: This Tech 2 command may cause the engine to "cut out" when RPM goes above 1500. If this occurs, the "cutting out" will stop when the Tech 2 command for the test is discontinued, or if the Tech 2 command is changed to less than 1500 RPM.</p> <p>Does each node light cycle red and green (never "OFF")?</p>	—	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	<ol style="list-style-type: none"> 1. Check the following circuits for an open, short to voltage, short ground, or poor connections at the PCM: <ul style="list-style-type: none"> • IAC "A" Low. • IAC "A" High. • IAC "B" Low. • IAC "B" High. 2. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>

DTC P1508 – IAC System Low RPM (Cont'd)

Step	Action	Value(s)	Yes	No
5	Visually/physically inspect for following conditions: <ul style="list-style-type: none"> ● Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body. Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. Do any of the above require a repair?	—	Refer to appropriate section for on-vehicle service	Go to <i>Step 6</i>
6	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the IAC valve. Is the action complete?	—	Verify repair	—
8	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1509 IAC System High RPM



T321115

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi-directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detect a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, DTC P1509 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of these DTCs are set: TP sensor, VSS, ECT, EGR, fuel system, MAF, MAP, IAT, canister purge, injector control or ignition control.
- Barometric pressure is above 75 kPa.
- Engine coolant temperature is above 50°C (120°F).
- Engine speed is more than 100-200 RPM lower than desired idle, based upon coolant temperature.
- The engine has been running for at least 125 seconds.
- Vehicle speed is less than 1 mph.
- Canister purge duty cycle is above 10%.
- Ignition voltage is between 9.5 volts and 16.7 volts.
- Engine speed is lower than desired idle.

- All of the above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1509 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring for damage.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at the EGR valve and the EGR pipe to the intake manifold, leaks at the throttle body, faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.

- Throttle body – Check for sticking throttle plate. Also inspect the IAC passage for deposits or objects which keep the IAC pintle from fully extending.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1509 – IAC System High RPM

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Start the engine.</p> <p>2. Turn all accessories “OFF” (A/C, rear defroster, etc.).</p> <p>3. Using a Tech 2, command RPM up to 1500, down to 500, and then up to 1500 while monitoring “Engine Speed” on the Tech 2.</p> <p>NOTE: This Tech 2 command may cause the engine to “cut out” when RPM goes above 1500. If this occurs, the “cutting out” will stop when the Tech 2 command for the test is discontinued, or if the Tech 2 command is changed to less than 1500 RPM.</p> <p>Does the “Engine Speed” remain within the specified value of “Desired Idle” for each RPM command?</p>	± 50 RPM	No trouble found. Go to <i>Diagnostic Aids</i>	Go to Step 3
3	<p>1. Disconnect the IAC.</p> <p>2. Install IAC Node Light 5-8840-2312-0 or equivalent.</p> <p>3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the node light.</p> <p>NOTE: This Tech 2 command may cause the engine to “cut out” when RPM goes above 1500. If this occurs, the “cutting out” will stop when the Tech 2 command for the test is discontinued, or if the Tech 2 command is changed to less than 1500 RPM.</p> <p>Does each node light cycle red and green (never “OFF”)?</p>	—	Go to Step 5	Go to Step 4
4	<p>1. Check the following circuits for an open, short to voltage, short ground, or poor connections at the PCM:</p> <ul style="list-style-type: none"> ● IAC “A” Low ● IAC “A” High ● IAC “B” Low ● IAC “B” High <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 8
5	<p>Visually/physically inspect for following conditions:</p> <ul style="list-style-type: none"> ● Vacuum leaks. ● Throttle plate or throttle shaft for binding. ● Accelerator and cruise control cables for being misadjusted or for binding. ● Faulty, missing, or incorrectly installed PCV valve. <p>Do any of the above require a repair?</p>	—	Refer to appropriate section for on-vehicle service	Go to Step 6

DTC P1509 – IAC System High RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the IAC valve. Is the action complete?	—	Verify repair	—
8	Replace the PCM. IMPORTANT: The replacement PCM must be programmed, Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1618 Serial Peripheral Interface (SPI) PCM Interprocessor Communication Error

Circuit Description

The serial peripheral interface (SPI) communication is used internally by the PCM to send messages between the engine processor and the automatic transmission processor. Included in each message sent between the two-processors is a checksum of the message. Both the engine processor and automatic transmission processor will compare this check sum value with the calculated value. If the checksums don't match, the processor will view the new data as being corrupted and ignore the values. The processor will then use the previous message. The receiving processor will then send a message to the sending processor informing it that it's last message was corrupted.

Conditions for Setting the DTC

- Battery voltage is above 9.0 V for 2 seconds.
- The PCM detects an internal program fault (check sum of data communications error).

- Check sum fault present for 3 out 6 seconds.
- No TCM resets for 2 seconds.

Action Taken When the DTC Sets

- The PCM will flash the "Check Trans" lamp the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The automatic transmission will operate in the "safety mode" to protect the mechanical parts of the transmission. Shift quality and/or gear changes may not be normal.

Conditions for Clearing the MIL/DTC

- DTC P1618 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

DTC P1618 – Serial Peripheral Interface (SPI) PCM Interprocessor Communication Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Is the EEPROM calibration the latest version available?	—	Go to Step 4	Go to Step 3
3	Reprogram the PCM with the latest available calibrations. Does DTC 1618 re-appear when the <i>OBD System Check</i> is repeated?	—	Go to Step 4	Repair completed
4	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only records code DTC P1625.

Conditions for Setting the DTC

- Clock or COP reset.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- DTC P1625 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- P1625 alone stored does not need diagnosis. Clear DTC code.

Diagnostic Trouble Code (DTC) P1640 Driver-1-Input High Voltage

Circuit Description

Output driver modules (ODMs) are used by the powertrain control module (PCM) to turn "ON" many of the current-driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding "ON."

Unlike the Quad Driver Modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

Since A/C is an option, No A/C will cause the air conditioning clutch relay output to always fault. If a fault is seen on the air conditioning clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

Conditions for Setting the DTC

- Ignition "ON."
- Engine running.
- No DTC 1618.
- Ignition voltage is above 13.2 volts for 4 seconds.
- Output voltage does not equal ignition voltage when output is "OFF" or output voltage is not less than 1 volt when output is "ON."
- Above conditions occur for at least 1 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- DTC P1640 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: Instrument cluster harness, canister purge solenoid, A/C clutch relay. An open ignition feed circuit at any of these components will cause DTC P1640 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The following PCM pins are controlled by output driver modules (ODMs):

- A13 – "Check Engine Lamp"
- A14 – SVS ("Check Trans")
- B14 – A/C Clutch

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

6. The Tech 2 Driver Module Status indicates the PCM pin that is affected.
11. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself-lamp, purge, solenoid, or A/C compressor relay.
13. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 4, a short to ground would be between the affected component and the PCM.

DTC P1640 – Driver-1-Input High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Install the Tech 2. 3. Review and record Tech 2 Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Use the Tech 2 to indicate DTC P1640. Does the Tech 2 indicate DTC P1640?	—	Go to Step 3	—
3	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to Step 4	Go to Step 5
4	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
5	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to Step 6	Go to Step 7
6	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
7	Were either of the lamp circuits for "Check Engine" or "Check Trans." indicated as faulty by the Tech 2?	—	Go to Step 8	Go to Step 14
8	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition "ON." 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to Step 16	Go to Step 9
9	1. Ignition "ON." 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to Step 11	Go to Step 10
10	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
11	1. Ignition "OFF." 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to Step 12	Go to Step 13
12	Repair the short to ground between the affected component and is PCM driver terminal. Is the action complete?	—	Verify repair	—

DTC P1640 – Driver-1-Input High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—
14	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to <i>Step 16</i>	Go to <i>Step 15</i>
15	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to <i>Step 11</i>	Go to <i>Step 10</i>
16	Replace the PCM. IMPORTANT: The replacement PCM must be programmed. Refer to <i>UBS 98model year Immobilizer Workshop Manual</i> . Is the action complete?	—	Verify repair	—

Symptom Diagnosis

Preliminary Checks

Before using this section, perform the “On-Board Diagnostic (OBD) System Check” and verify all of the following items:

- The powertrain control module (PCM) and malfunction indicator lamp (MIL) (Service Engine Soon lamp) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the “Vehicle Emission Control Information” label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Ignition wires for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

Intermittents

IMPORTANT: An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use Tech 2 to help detect intermittent conditions. Tech 2s have several features that can be used to locate an

intermittent condition. Use the following feature to find intermittent faults:

- Using Tech 2’s “Freeze Frame” buffer or “Failure Records” buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Service Engine Soon lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned “OFF.” If not, the PCM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (Service Engine Soon lamp) with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing at ignition wires or plugs.
- MIL (Service Engine Soon lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Route ignition coil wiring away from the ignition coils. Check all wires from the PCM to the ignition coil for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *PCM Connector Symptom* tables.

Hard Start Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search.</p> <p>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect Tech 2. With the ignition "ON" and the engine not running, compare engine coolant temperature to intake air temperature.</p> <p>Are ECT and IAT within the specified value of each other?</p>	$\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$)	Go to <i>Step 8</i>	Go to <i>Step 5</i>
5	<p>1. Using Tech 2, display the engine coolant temperature and note the value.</p> <p>2. Check the resistance of the engine coolant temperature sensor.</p> <p>3. Refer to <i>Engine Coolant Temperature Sensor Temperature vs. Resistance</i> chart on <i>DTC P0118 Diagnostic Support</i> for resistance specifications.</p> <p>Is the resistance value near the resistance for the temperature noted?</p>	—	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	<p>Replace the ECT sensor.</p> <p>Is the action complete?</p>	—	Verify repair	—
7	<p>Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground.</p> <p>Is the action complete?</p>	—	Verify repair	—
8	<p>1. Check for a faulty, plugged, or incorrectly installed PCV valve.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Check for water- or alcohol-contaminated fuel.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Perform the procedure in <i>Fuel System Pressure Test</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>
11	<p>1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electric Ignition System</i> for procedure.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 12</i>

Hard Start Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	<p>1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i>.</p> <p>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 13</i>
13	<p>1. Check for a loose ignition coil ground. Refer to <i>Electronic Ignition System</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 14</i>
14	<p>1. Remove the ignition coils and check the ignition coils for cracks or carbon tracking.</p> <p>2. If a problem is found, replace affected coil(s) as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 15</i>
15	<p>1. Check IAC operation. Perform the procedure in the <i>DTC P0506, Step 6</i> diagnostic table.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 16</i>
16	<p>1. Check for the following engine mechanical problems (refer to <i>Engine Mechanical</i>):</p> <ul style="list-style-type: none"> ● Low compression ● Leaking cylinder head gaskets ● Worn or incorrect camshaft ● Camshaft drive belt slipped or stripped <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 17</i>
17	<p>1. Review all diagnostic procedures within this table.</p> <p>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Surges and/or Chuggles Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner's manual. Inform the customer how the TCC and the A/C clutch operate.</p> <p>Is the customer experiencing a normal condition?</p>	—	System OK	Go to <i>Step 5</i>
5	<p>1. Check the the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to <i>Powertrain Control Module (PCM) and Sensors</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<p>1. Check the fuel pressure. Refer to <i>Fuel System Pressure Test</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>Monitor the long term fuel trim on Tech 2.</p> <p>Is the long term fuel trim significantly in the negative range (rich condition)?</p>	—	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	<p>1. Check items that can cause the engine to run rich. Refer to <i>Diagnostic Aids in DTC P0172 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to <i>Step 10</i>	Verify repair
9	<p>1. Check items that can cause the engine to run lean. Refer to <i>Diagnostic Aids in DTC P0171</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to <i>Step 10</i>	Verify repair

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electric Ignition System</i> for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	1. Check for a loose ignition coil ground. Refer to <i>Electric Ignition System</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
12	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 13</i>
13	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i> . NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 14</i>
14	1. Check the injector connections. 2. If any of the injector connectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 15</i>
15	1. Check PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in <i>Electrical Diagnosis</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 16</i>
16	1. Check MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to <i>Electrical Diagnosis</i> for wiring repair procedures. Was a problem found?	—	Verify repair	Go to <i>Step 17</i>
17	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 18</i>

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
18	1. Check the exhaust system for possible restriction: <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. ● Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to <i>Restricted Exhaust System Check</i>. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 19</i>
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lack of Power, Sluggish or Spongy Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Remove and check the air filter element for dirt or restrictions. Refer to <i>Air Intake System</i> in <i>ON-Vehicle Service</i>. 2. Replace the air filter element if necessary.</p> <p>Was a repair required?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Check for low fuel pressure. Refer to <i>Fuel System Pressure Test</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<p>1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Using Tech 2, monitor the knock sensor (KS) system for excessive spark retard activity. Refer to <i>Knock Sensor (KS) System</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electronic Ignition System</i> for procedure. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i>.</p> <p>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>

Lack of Power, Sluggish or Spongy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	<p>1. Check the PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in <i>Electrical Diagnosis</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 12</i>
12	<p>1. Check the exhaust system for possible restriction:</p> <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. ● Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to <i>Restricted Exhaust System Check</i>. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 13</i>
13	<p>1. Check the torque converter clutch (TCC) for proper operation. Refer to <i>4L30-E Transmission Diagnosis</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 14</i>
14	<p>1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to <i>Engine Mechanical</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 15</i>
15	<p>1. Review all diagnostic procedures within this table.</p> <p>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Detonation/Spark Knock Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to Step 3
3	<p>Was a visual/physical check performed?</p>	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	<p>If Tech 2 readings are normal (refer to <i>Typical Scan Values</i>) and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87 and re-evaluate the vehicle performance.</p> <p>Is detonation present?</p>	—	Go to Step 5	Verify repair
5	<p>1. Check the transmission range switch circuit. Use Tech 2 and be sure Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to <i>4L30-E Automatic Transmission Diagnosis</i>).</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 6
6	<p>1. Check TCC operation. Refer to <i>4L30-E Transmission Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 7
7	<p>1. Check for obvious overheating problems:</p> <ul style="list-style-type: none"> ● Low engine coolant. ● Restricted air flow to radiator, or restricted water flow through radiator. ● Correct coolant solution should be a 50/50 mix of approved antifreeze/coolant and water. Refer to <i>Engine Cooling</i>. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 8
8	<p>1. Check fuel pressure. Refer to Chart Fuel System Pressure Test. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 9
9	<p>1. Check items that can cause an engine to run lean (long term fuel trim significantly in the positive range). For a lean condition, refer to <i>Diagnostic Aids in DTC P0171 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 10

Detonation/Spark Knock Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Spark plugs for proper heat range. Refer to <i>General Information</i> . 2. If incorrect spark plugs are installed, replace spark plugs as necessary. Did any spark plugs require replacement?	—	Verify repair	Go to <i>Step 11</i>
11	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re-evaluate vehicle performance. Is detonation still present?	—	Go to <i>Step 12</i>	Verify repair
12	1. Check for an engine mechanical problem. Perform a cylinder compression check. Refer to <i>Engine Mechanical</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 13</i>
13	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Rough, Unstable, or Incorrect Idle, Stalling Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Go to <i>Step 13</i>	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Check the PCM grounds for cleanliness, tightness and proper routing. Refer to the PCM wiring diagrams in <i>Electrical Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>Observe the long term fuel trim on Tech 2.</p> <p>Is the long term fuel trim significantly in the negative range (rich condition)?</p>	—	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	<p>1. Check items that can cause the engine to run rich. Refer to <i>Diagnostic Aids in DTC P0172 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
7	<p>Is the long term fuel trim significantly in the positive range (lean condition)?</p>	—	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	<p>1. Check items that can cause the engine to run lean. Refer to <i>Diagnostic Aids in DTC P0171 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Check for incorrect idle speed. Ensure that the following conditions are present:</p> <ul style="list-style-type: none"> ● The engine is fully warm. ● The accessories are "OFF." <p>2. Using Tech 2, monitor the IAC position.</p> <p>Is the IAC position within the specified values?</p>	Between 10 and 50 counts	Go to <i>Step 11</i>	Go to <i>Step 10</i>

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	<p>1. Visually/physically inspect for the following conditions:</p> <ul style="list-style-type: none"> ● Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body. Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. ● Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or a disconnected brake booster hose. <p>2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 8
11	<p>Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 12
12	<p>1. Perform the "Injector Coil/Balance Test" in <i>Fuel Metering System</i>. 2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 13
13	<p>1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to <i>Fuel Metering System</i>. 3. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 14
14	<p>1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electronic Ignition System</i> for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 15
15	<p>1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i>. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 16
16	<p>1. Check for a loose ignition coil ground. Refer to <i>Electrical Ignition System</i>. 2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to Step 17

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 18</i>
18	Using Tech 2, monitor the throttle position (TP) angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to <i>Step 19</i>	Refer to <i>DTC P0123</i> for further diagnosis
19	1. Check the positive crankcase ventilation (PCV) valve for proper operation. Refer to <i>Crankcase Ventilation System</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 20</i>
20	1. Check the transmission range switch circuit. Use Tech 2 and be sure Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to <i>4L30-E Automatic Transmission Diagnosis</i>). Was a problem found?	—	Verify repair	Go to <i>Step 21</i>
21	1. Check for the following engine mechanical items. Refer to <i>Engine Mechanical</i> for diagnosis procedures: <ul style="list-style-type: none"> ● EGR valve mounted backward. Compare with a known-good vehicle. ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Worn rocker arms ● Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 22</i>
22	1. Check for faulty motor mounts. Refer to <i>Engine Mechanical</i> for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 23</i>
23	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Poor Fuel Economy Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Non-standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.)</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to Step 3
3	<p>Was a visual/physical check performed?</p>	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	<p>Check owner's driving habits.</p> <ul style="list-style-type: none"> ● Is the A/C "ON" full time (defroster mode "ON")? ● Are tires at the correct pressure? ● Are excessively heavy loads being carried? ● Is acceleration too much, too often? <p>Was a problem found?</p>	—	Go to Step 5	Go to Step 6
5	<p>Review the items in Step 4 with the customer and advise as necessary.</p> <p>Is the action complete?</p>	—	System OK	—
6	<p>1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 7
7	<p>1. Remove and check the air filter element for dirt or for restrictions. Refer to <i>Air Intake System</i>. 2. Replace the air filter element if necessary.</p> <p>Was a repair required?</p>	—	Verify repair	Go to Step 8
8	<p>1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Spark Plug Replacement</i>.</p> <p>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 9
9	<p>1. Check for low engine coolant level. Refer to <i>Engine Cooling</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 10

Poor Fuel Economy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for an incorrect or faulty engine thermostat. Refer to <i>Engine Cooling</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 11
11	1. Check for low engine compression. Refer to <i>Engine Mechanical</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 12
12	1. Check the TCC operation. Refer to <i>4L30-E Transmission Diagnosis</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 13
13	1. Check the exhaust system for possible restriction: <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. ● Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to <i>Restricted Exhaust System Check</i>. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 14
14	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on Tech 2?	—	Go to Step 16	Go to Step 15
15	Diagnose and repair an inaccurate speedometer condition as necessary. Refer to <i>Vehicle Speed Sensor</i> in <i>Electrical Diagnosis</i> . Was a problem found?	—	Verify repair	—
16	1. Check the air intake system and the crankcase for air leaks. Refer to <i>Air Intake System</i> and <i>Crankcase Ventilation System</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 17
17	1. Review all diagnostic procedures within this table. 2. When all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 18
18	Perform the procedure in <i>Fuel System Pressure Test</i> . Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

Excessive Exhaust Emissions or Odors Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions.)</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Go to Step 12	Go to Step 3
3	<p>Was a thorough visual/physical check performed?</p>	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	<p>1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc. 2. If a problem is found, repair as necessary.</p> <p>Were any vacuum leaks located?</p>	—	Go to Step 12	Go to Step 5
5	<p>1. Check the fuel cap for proper installation. 2. Secure the fuel cap if necessary.</p> <p>Was the fuel cap installed properly?</p>	—	Go to Step 6	Go to Step 12
6	<p>1. Check the fuel pressure. Perform the procedure in <i>Fuel System Pressure Test</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to Step 12	Go to Step 7
7	<p>1. Check for a faulty, plugged, or incorrectly installed crankcase ventilation valve; also check the crankcase ventilation system for plugging. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to Step 12	Go to Step 8
8	<p>1. Check the injector connections. 2. If any of the injectors are connected to an incorrect cylinder, correct as necessary.</p> <p>Was a problem found?</p>	—	Go to Step 12	Go to Step 9
9	<p>1. Perform the "Injector Coil/Balance Test" in <i>Fuel Metering System</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to Step 12	Go to Step 10
10	<p>1. Refer to <i>Engine Cooling</i> for cooling system diagnosis. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Go to Step 12	Go to Step 11
11	<p>1. Remove excessive carbon buildup with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test.</p> <p>Does the vehicle pass the test?</p>	—	System OK	Go to Step 13
12	<p>Perform the exhaust emission test.</p> <p>Does the vehicle pass the test?</p>	—	System OK	Go to Step 13

Excessive Exhaust Emissions or Odors Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
13	Does the exhaust emission test indicate excessive CO and HC levels or is long term fuel trim significantly in the negative range (rich condition)?	—	Go to <i>Step 14</i>	Go to <i>Step 15</i>
14	1. Check items that can cause the engine to run rich. Refer to <i>Diagnostic Aids in DTC P0172 Diagnostic Support</i> . Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to <i>Step 16</i>
15	1. Check items that can cause the engine to run lean. Refer to <i>Diagnostic Aids in DTC P0171 Diagnostic Support</i> . Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to <i>Step 16</i>
16	1. Check the EGR system. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to <i>Step 12</i>	Go to <i>Step 17</i>
17	1. Check for an engine mechanical problem. Perform a cylinder compression check (refer to <i>Engine Mechanical</i>). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to <i>Step 12</i>	Go to <i>Step 18</i>
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Dieseling, Run-On Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine continues to run after key is turned "OFF," but runs very rough. If engine runs smooth, check ignition switch and adjustment.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Check for a short between B+ and any of the ignition feed circuits. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Backfire Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Check for proper ignition voltage coil output with spark tester 5-8840-0383-0. Refer to <i>Electric Ignition System</i> for procedure. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i>.</p> <p>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. Refer to <i>DTC P0172</i> to determine the cause of a rich condition or <i>Engine Mechanical</i> for an oil fouling condition.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<p>1. Visually/physically inspect the ignition coils for cracks. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Check for an intermittent ignition system malfunction:</p> <ul style="list-style-type: none"> ● Intermittent CKP 58X signal. ● Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check the fuel pressure. Refer to <i>Fuel System Pressure Test</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>

Backfire Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	<p>1. Check for the following engine mechanical conditions. Refer to <i>Engine Mechanical</i> for diagnosis procedures:</p> <ul style="list-style-type: none"> ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing <p>2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Check the intake and exhaust manifold(s) for casting flash. Refer to <i>Engine Mechanical</i>.</p> <p>2. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>
11	<p>1. Review all diagnostic procedures within this table.</p> <p>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. <p>3. If a problem is found, repair as necessary. Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Cuts Out, Misses Symptom

Step	Action	Value(s)	Yes	No
1	DEFINITION: Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to Step 13	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual/Physical Check
4	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in <i>Electrical Diagnosis</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	Observe the long term fuel trim on Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to Step 6	Go to Step 7
6	1. Check items that can cause the engine to run rich. Refer to <i>Diagnostic Aids in DTC P0172 Diagnostic Support</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
7	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to Step 8	Go to Step 9
8	1. Check items that can cause the engine to run lean. Refer to <i>Diagnostic Aids in DTC P0171 Diagnostic Support</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check for incorrect idle speed. Ensure that the following conditions are present: <ul style="list-style-type: none"> • The engine is fully warm. • The accessories are "off." 2. Using Tech 2, monitor the IAC position. Is the IAC position within the specified values?	Between 5 and 50 counts	Go to Step 11	Go to Step 10

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	<p>1. Visually/physically inspect for the following conditions:</p> <ul style="list-style-type: none"> ● Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body. Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. ● Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 8
11	<p>Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 12
12	<p>1. Perform the "Injector Coil/Balance Test" in <i>Fuel Metering System</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 13
13	<p>1. Check for fuel in the pressure regulator vacuum hose.</p> <p>2. If fuel is present, replace the fuel pressure regulator assembly. Refer to <i>Fuel Metering System</i>.</p> <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 14
14	<p>1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electronic Ignition System</i> for the procedure.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 15
15	<p>1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i>.</p> <p>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 16
16	<p>1. Check for a loose ignition coil ground. Refer to <i>Electronic Ignition System</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 17

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 18</i>
18	Using Tech 2, monitor the TP angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to <i>Step 19</i>	Refer to <i>DTC P0123</i> for further diagnosis
19	1. Check the PCV valve for proper operation. Refer to <i>Crankcase Ventilation System</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 20</i>
20	1. Check the transmission range switch circuit. Use Tech 2 and be sure Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to <i>4L30-E Automatic Transmission Diagnosis</i>). Was a problem found?	—	Verify repair	Go to <i>Step 21</i>
21	1. Check the following engine mechanical items. Refer to <i>Engine Mechanical</i> for diagnosis procedures: <ul style="list-style-type: none"> ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Worn rocker arms ● Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 22</i>
22	1. Check for faulty motor mounts. Refer to <i>Engine Mechanical</i> for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 23</i>
23	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Hesitation, Sag, Stumble Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to Step 3
3	<p>Was a visual/physical check performed?</p>	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	<p>1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to <i>Powertrain Control Module (PCM) and Sensors</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 5
5	<p>1. Check the fuel pressure. Refer to <i>Fuel System Pressure Test</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 6
6	<p>Observe the TP angle display on Tech 2 while slowly increasing throttle pedal.</p> <p>Does the TP angle display steadily increase from 0% at closed throttle to 100% at WOT?</p>	—	Go to Step 7	Go to Step 18
7	<p>Monitor the long term fuel trim on Tech 2.</p> <p>Is the long term fuel trim significantly in the negative range (rich condition)?</p>	—	Go to Step 8	Go to Step 9
8	<p>1. Check items that can cause the engine to run rich. Refer to <i>Diagnostic Aids in DTC P0172 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 10
9	<p>1. Check items that can cause the engine to run lean. Refer to <i>Diagnostic Aids in DTC P0171 Diagnostic Support</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 10

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to <i>Electronic Ignition System</i> for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	1. Check for a loose ignition coil ground. Refer to <i>Electronic Ignition System</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
12	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 13</i>
13	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to <i>Electronic Ignition System</i> . NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 14</i>
14	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in <i>Electrical Diagnosis</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 15</i>
15	1. Check the MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to <i>Electrical Diagnosis</i> for wiring repair procedures. Was a problem found?	—	Verify repair	Go to <i>Step 16</i>
16	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 17</i>

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance
18	Replace the TP sensor. Is the action complete?	—	Verify repair	—

Default Matrix Table

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with Tech 2. MIL is "ON" in diagnostics. Engine does not start and run.	Ignition System Check
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	<ol style="list-style-type: none"> 1. On-board Diagnostic (OBD) system check. 2. Careful visual/physical inspections. 	Chassis Electrical
Hard Starts	<ol style="list-style-type: none"> 1. OBD system check. 2. Sensors (ECT, MAP, MAF, TP) ; MAP output chart. 3. Fuel system electrical test, fuel system diagnosis. 4. Ignition system. 5. IAC system check. 	Engine Mechanical, Ignition System Check, Exhaust System Diagnosis
Surges and/or Chuggles	<ol style="list-style-type: none"> 1. OBD system check. 2. Heated oxygen sensors. 3. Fuel system diagnosis. 4. Ignition system. 	Calibration ID "Broadcast Code"/Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis, 4L30-E System Test

Symptoms	Initial Diagnosis	Default Section(s)
Lack of Power, Sluggish or Spongy	<ol style="list-style-type: none"> 1. OBD system check. 2. Fuel system diagnosis. 3. Ignition system. 4. Knock sensor. 5. EGR operation. 6. EGR system check. 	Refer to <i>Exhaust System</i> in <i>Engine Exhaust</i> , TCC Operation, Calibration ID/Service Bulletins
Detonation/Spark Knock	<ol style="list-style-type: none"> 1. OBD system check. 2. Transmission range switch. 3. EGR operation. 4. EGR system check. 5. TCC operation. 6. Fuel system diagnosis. 7. Ignition system. 8. Knock sensor. 	TCC operation, Cooling System, Ignition System Check, Calibration ID/Service Bulletins
Hesitation, Sag, Stumble	<ol style="list-style-type: none"> 1. OBD system check. 2. TP. 3. MAP output check. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. Ignition system. 	EGR Operation, EGR System Check, Generator Output Voltage (refer to <i>Chassis Electrical</i>), Calibration ID/Service Bulletins, Ignition System Check
Cuts Out, Misses	<ol style="list-style-type: none"> 1. OBD system check. 2. Cylinder balance test. 	Ignition System Check
Rough, Unstable, or Incorrect Idle, Stalling	<ol style="list-style-type: none"> 1. OBD system check. 2. Fuel injector and fuel injector balance test. 3. Ignition system. 4. IAC operation. 5. EGR operation. 	MAP Output Check, Throttle Linkage, IAC System Check, EGR System Check, A/C Clutch Control Circuit Diagnosis, Crankcase Ventilation System, Calibration ID/Service Bulletins, Generator Output Voltage (refer to <i>Chassis Electrical</i>), Exhaust Diagnosis
Poor Fuel Economy	<ol style="list-style-type: none"> 1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system. 	TCC Operation, Exhaust System (refer to <i>Engine Exhaust</i>)
Engine Cranks But Will Not Run	<ol style="list-style-type: none"> 1. OBD system check. 	Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector and Fuel Injector Balance Test.
Excessive Exhaust Emissions or Odors	<ol style="list-style-type: none"> 1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. Crankcase ventilation system. 7. Ignition system. 8. MAP output check. 	EGR System Check, Exhaust Diagnosis, Calibration ID/Service Bulletins
Dieseling, Run-On	<ol style="list-style-type: none"> 1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 	—

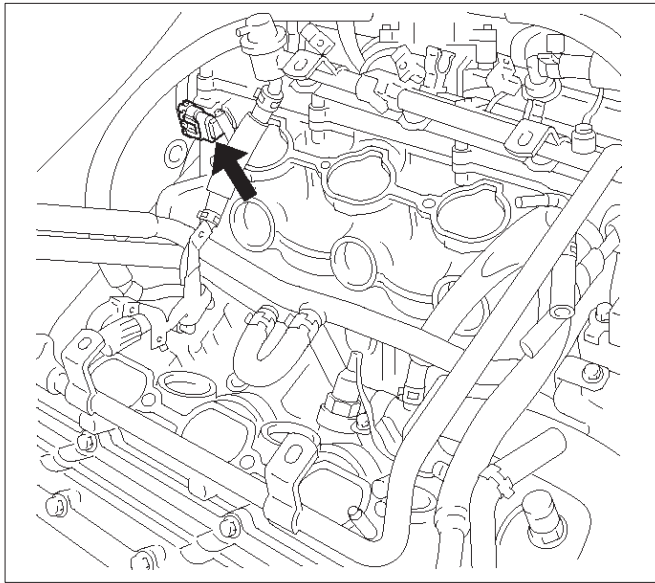
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Symptoms	Initial Diagnosis	Default Section(s)
Backfire	<ol style="list-style-type: none">1. OBD system check.2. Ignition system.3. Fuel system diagnosis.4. Fuel injector and fuel injector balance test.5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check
Catalyst Monitor	<ol style="list-style-type: none">1. OBD system check.2. Careful visual/physical inspection.3. Heated oxygen sensors.	Exhaust System
Fuel Trim	<ol style="list-style-type: none">1. OBD system check.2. Careful visual/physical inspection.3. Fuel system diagnosis.4. Heated oxygen sensors, MAF sensors.	Exhaust System Intake Air System
Evaporative Emissions	<ol style="list-style-type: none">1. OBD system check.2. Careful visual/physical inspection.3. Fuel system diagnosis.	—
Heated Oxygen Sensors	<ol style="list-style-type: none">1. OBD system check.2. Careful visual/physical inspection.	Exhaust System

Camshaft Position (CMP) Sensor

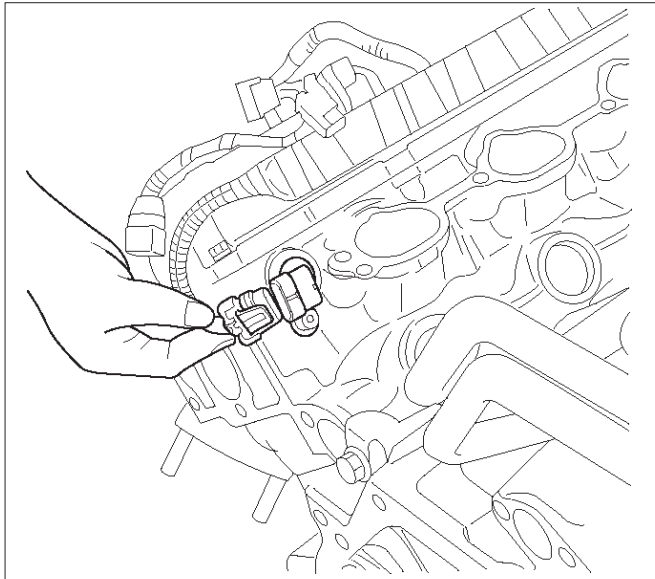
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the common chamber assembly.
Refer to Common Chamber in Engine Mechanical.



014RW120

4. Disconnect the electrical connector to the CMP sensor.



014RV053

5. Remove the CMP retaining bolt from the side of left cylinder head.
6. Remove the CMP sensor from the cylinder head.

Inspection Procedure

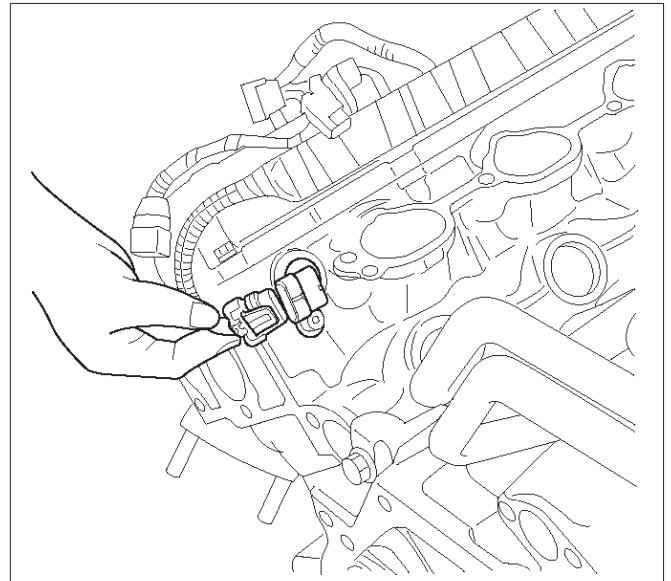
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CMP sensor in the cylinder head.
2. Install the CMP sensor retaining bolt.

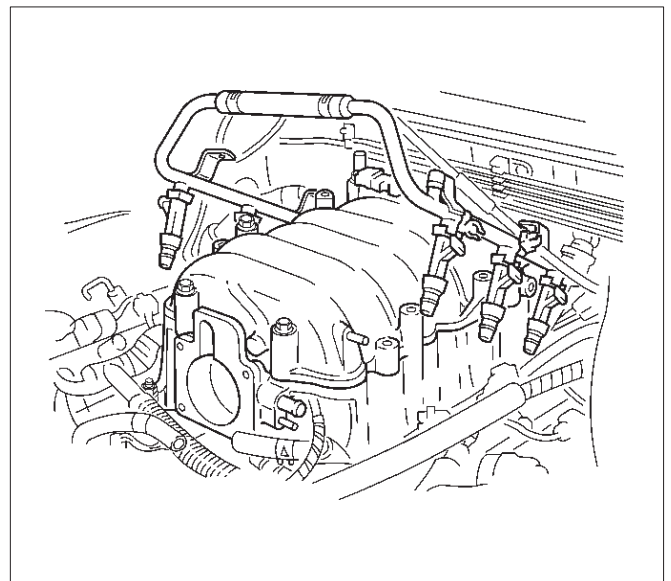
Tighten

- Tighten the retaining screw to 9 N·m (78 lb in.).
3. Connect the electrical connector to the CMP sensor.



014RV053

4. Install the common chamber assembly.
Refer to Common Chamber in Engine Mechanical.



014RW106

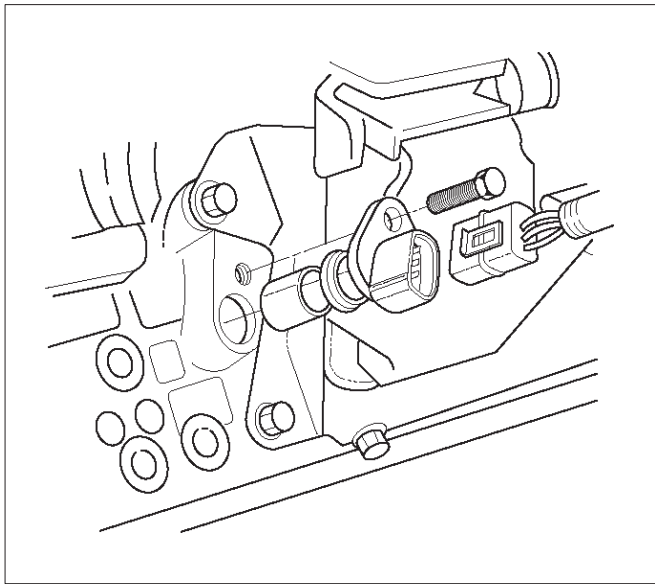
5. Install the engine cover.
6. Connect the negative battery cable.

Crankshaft Position (CKP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CKP sensor.
3. Remove one bolt and the CKP sensor from the right side of the engine block, just behind the mount.

NOTE: Use caution to avoid any hot oil that might drip out.



TS22909

Inspection Procedure

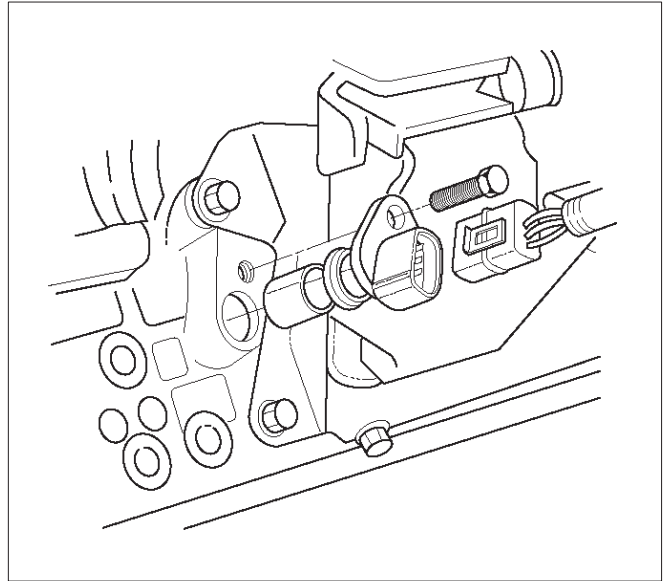
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

Tighten

- Tighten the mounting bolt to 9 N·m (78 lb in.).



TS22909

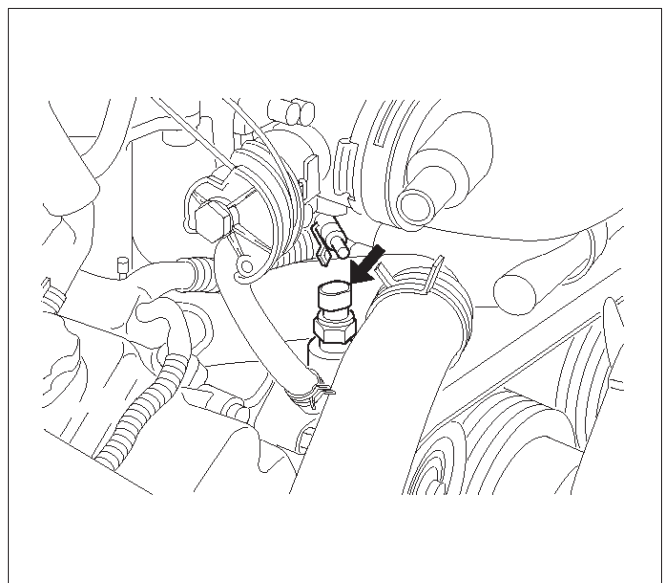
3. Connect the electrical connector to the CKP sensor.
4. Connect the negative battery cable.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

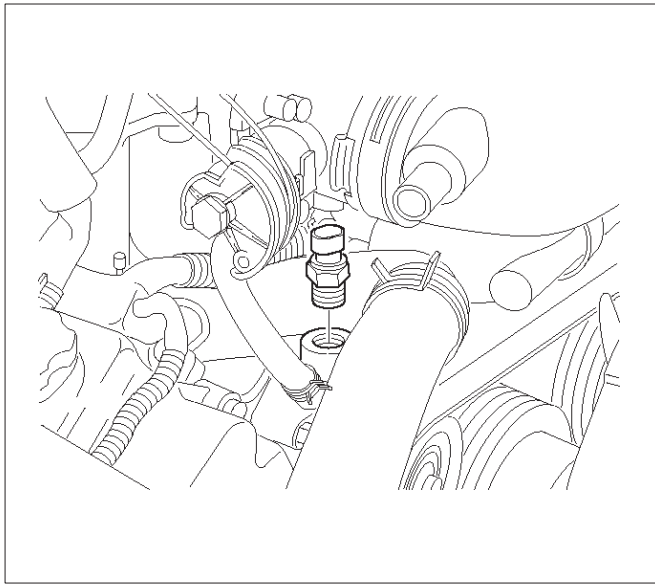
NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System in Engine Cooling*.
3. Disconnect the electrical connector.



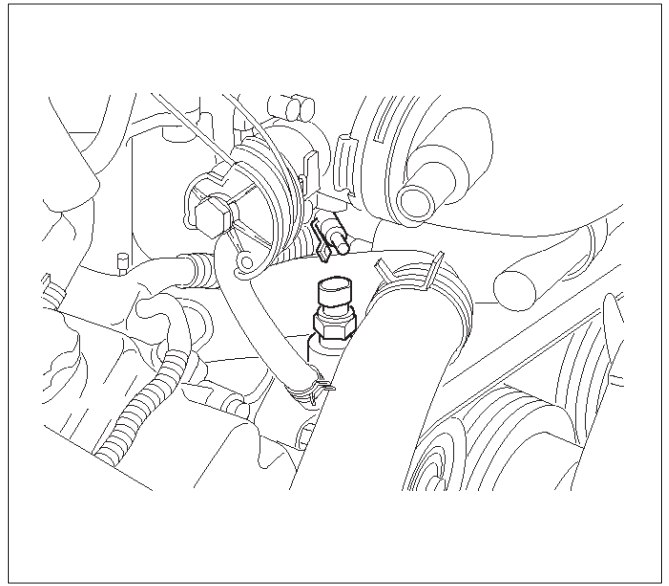
014RW127

4. Remove the ECT sensor from the coolant crossover.



014RW086

3. Connect the electrical connector.



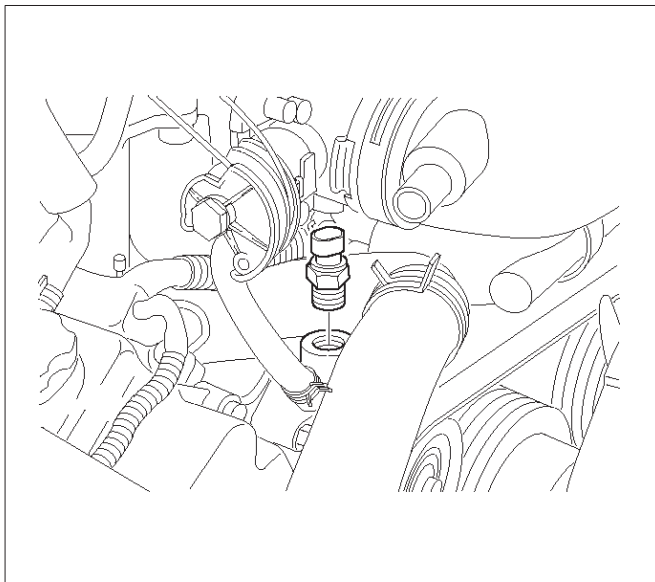
014RW085

Installation Procedure

1. Apply sealer or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the coolant crossover.

Tighten

- Tighten the ECT sensor to 30 N·m (22 lb ft.).



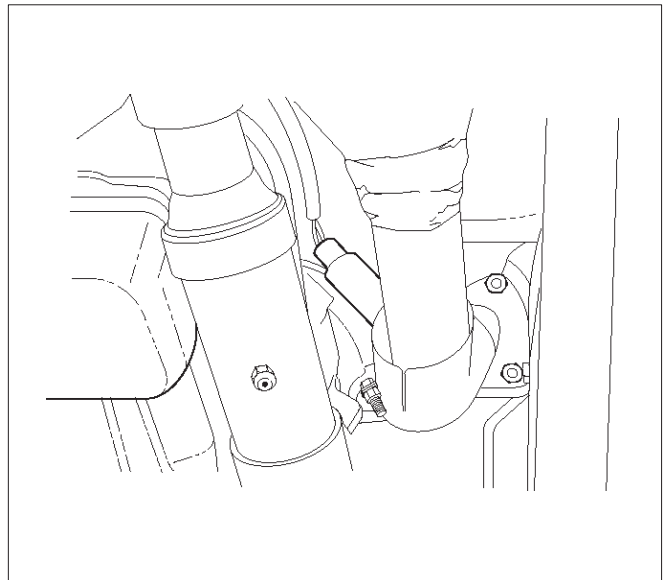
014RW086

4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System in Engine Cooling*.
5. Connect the negative battery cable.

Heated Oxygen Sensor (HO2S)

Removal Procedure

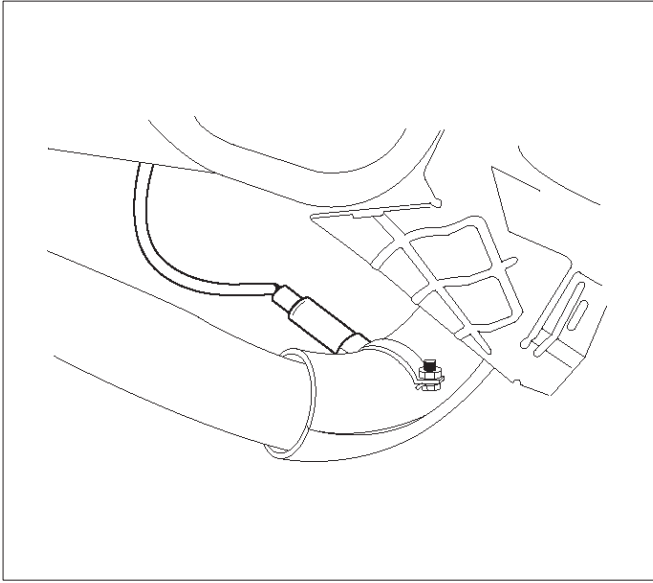
1. Disconnect the negative battery cable.
2. Locate the oxygen sensors.
 - Bank 1 sensor 1 is mounted on the right-hand front exhaust pipe.



TS22912

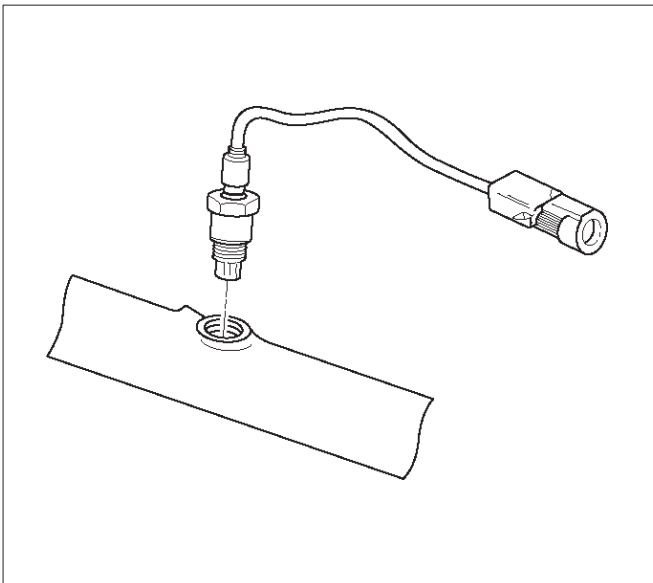
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- Bank 2 sensor 1 is mounted on the exhaust pipe ahead of the catalytic converter.



TS22914

3. Disconnect the pigtail from the wiring harness.

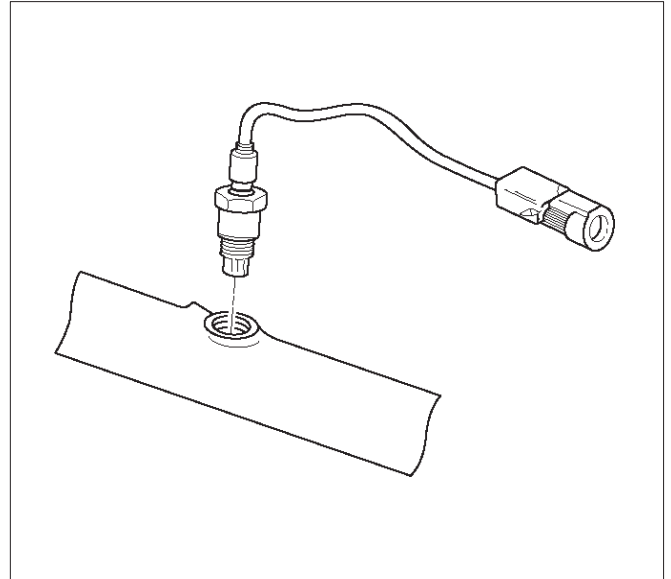


TS23739

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

NOTE: Do not use a torch to remove an HO2S unless the sensor is being replaced. Using a torch could damage the sensor.

4. Remove the sensor from the exhaust pipe.
 - Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48°C (120°F).

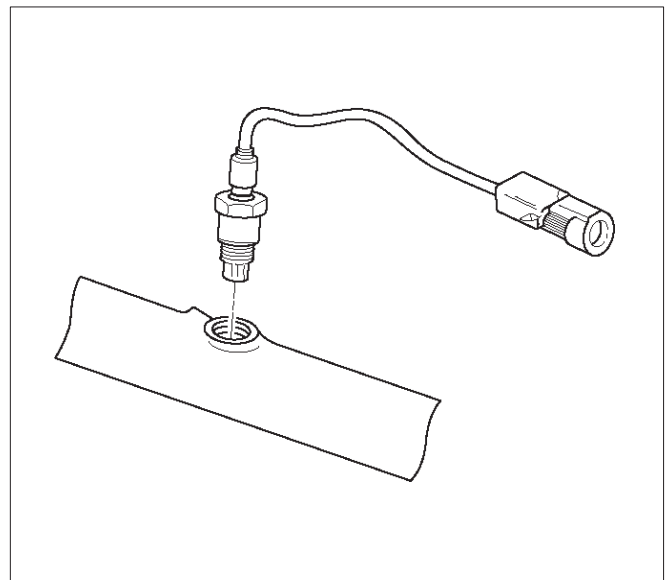


TS23739

Inspection Procedure

All two sensors are identical. Inspect each in the same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion, and bare wires or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, or other contaminations.



TS23739

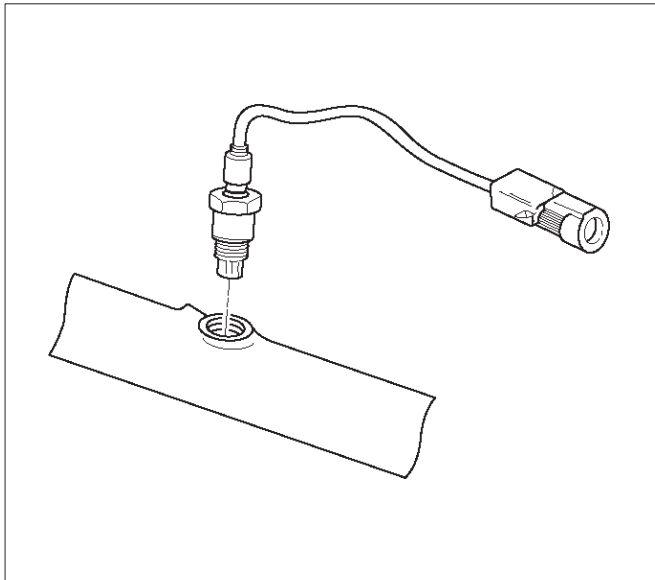
Installation Procedure

IMPORTANT:

- A special anti-seize compound, P/N 5613695, is used on the HO₂S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with engine heat, but the glass beads will remain, making the sensor easier to remove.
 - New or service sensors will already have the compound applied to the threads. If a sensor is removed and is to be reinstalled for any reason, the threads must have anti-seize compound applied.
1. Apply anti-seize compound or the equivalent to the threads of the oxygen sensor, if necessary.
 2. Install the oxygen sensor on the exhaust pipe in its original position.

Tighten

- Tighten the oxygen sensor to 55 N·m (40 lb in.).



TS23739

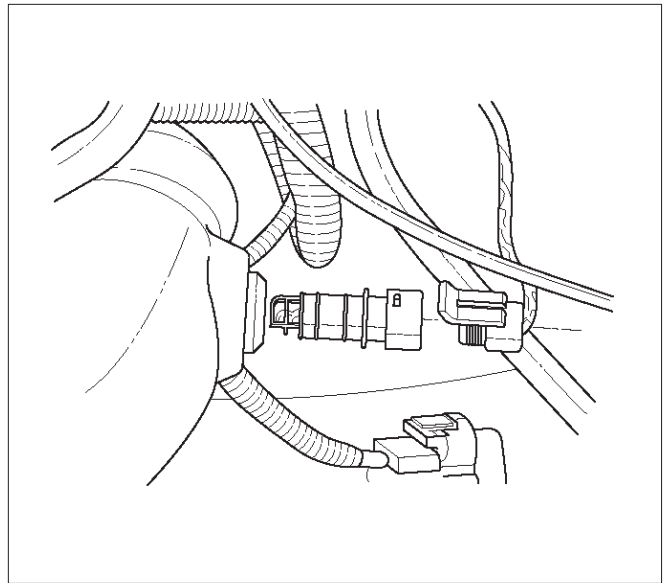
3. Connect the pigtail to the wiring harness.
4. Connect the negative battery cable.

Intake Air Temperature (IAT) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover
3. The IAT sensor is located in the intake air duct, behind the throttle body.

4. Disconnect the electrical connector from the IAT sensor.

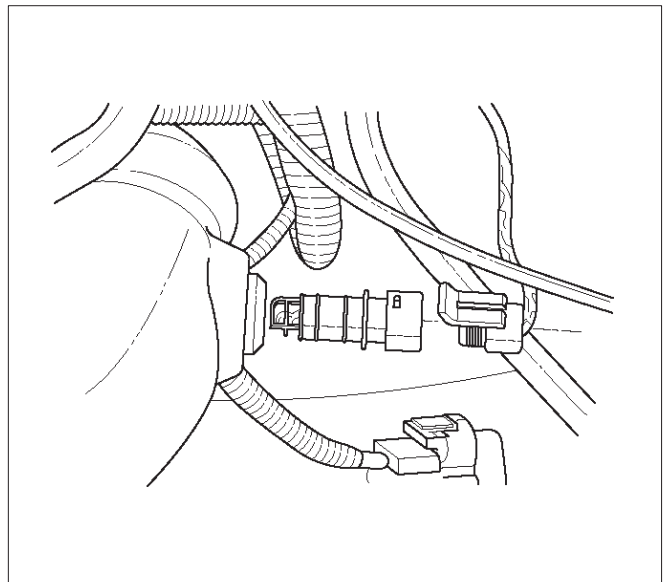


TS23741

5. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.

Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.
2. Correct the IAT electrical connector.



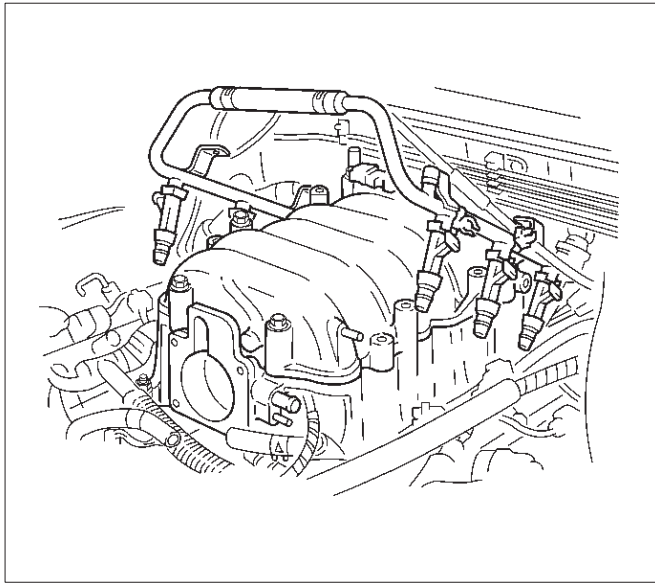
TS23741

3. Install the engine cover.
4. Connect the negative battery cable.

Knock Sensor (KS)

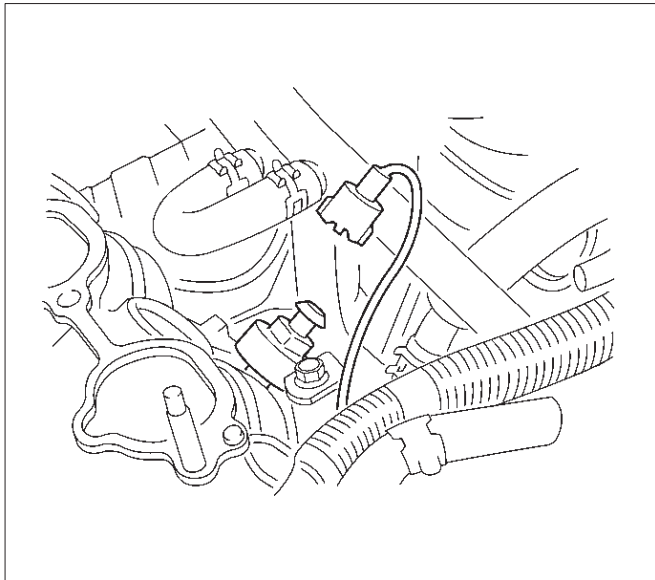
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Draining and Filling the Cooling System* in *Engine Cooling*.
3. Remove the engine cover.
4. Remove the common chamber assembly.
Refer to Common Chamber in *Engine Mechanical*.



014RW106

5. Disconnect the electrical connector from the knock sensor.



014RW103

6. Unscrew the knock sensor from the engine block.

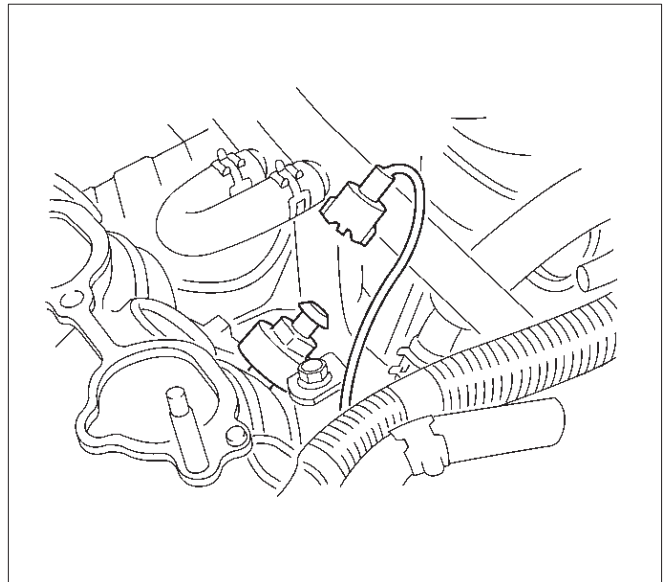
Installation Procedure

NOTE: Do not apply thread sealant to the sensor threads. The sensor is coated at the factory and applying additional sealant will affect the sensor's ability to detect detonation.

1. Screw the knock sensor into the engine block.

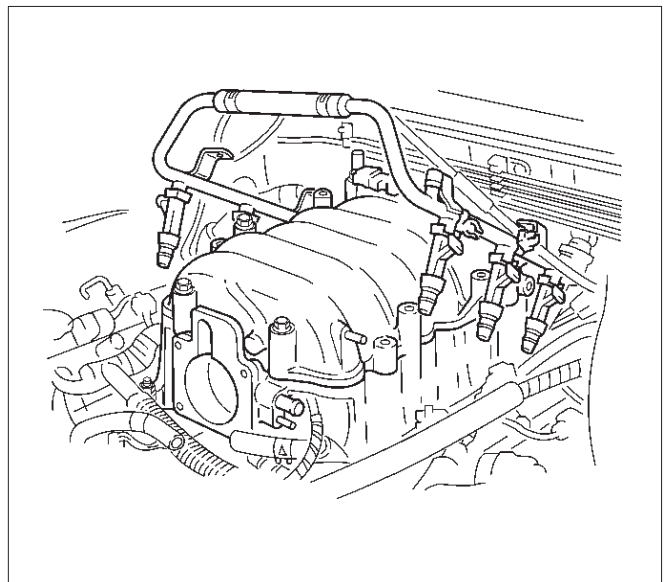
Tighten

- Tighten the knock sensor to 20 N·m (177 lb in.).



014RW103

2. Connect the electrical connector to the knock sensor.
3. Install the common chamber assembly.
Refer to Common Chamber in *Engine Mechanical*.



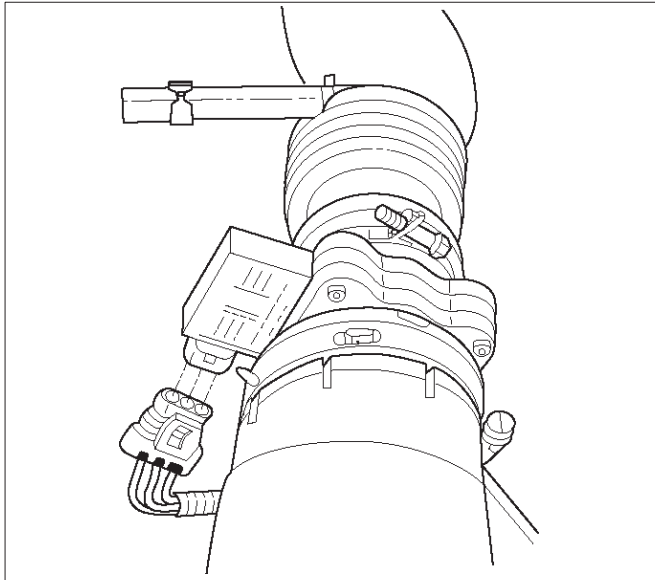
014RW106

4. Install the engine cover.
5. Fill the cooling system.
Refer to *Draining and Filling the Cooling System* in *Engine Cooling*.
6. Connect the negative battery cable.

Mass Air Flow (MAF) Sensor

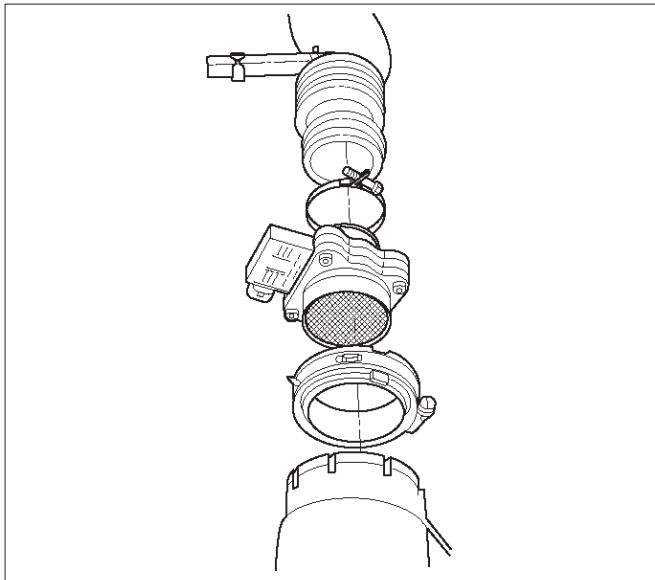
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAF sensor.



TS23740

3. Loosen the clamps which secure the intake air duct and the air cleaner to the MAF sensor.
4. Remove the intake air duct from the MAF sensor.
5. Remove the MAF sensor from the air cleaner.

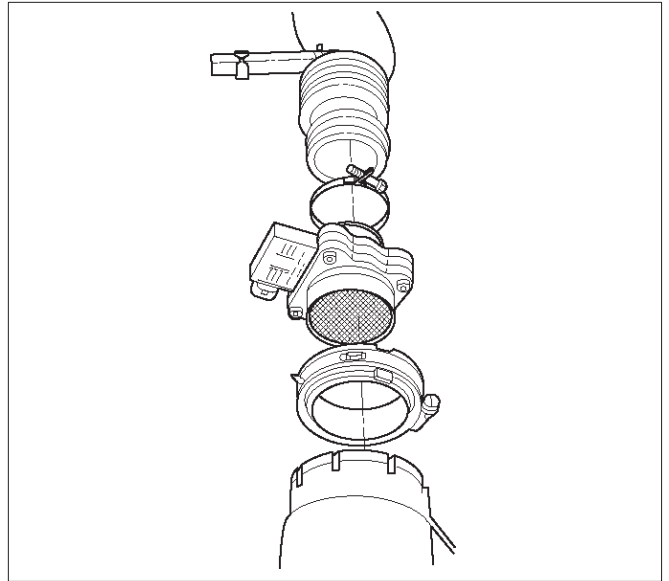


TS23781

Installation Procedure

1. Install the MAF sensor on the air cleaner with the clamp.

2. Install the intake air duct and the clamp on the MAF sensor.



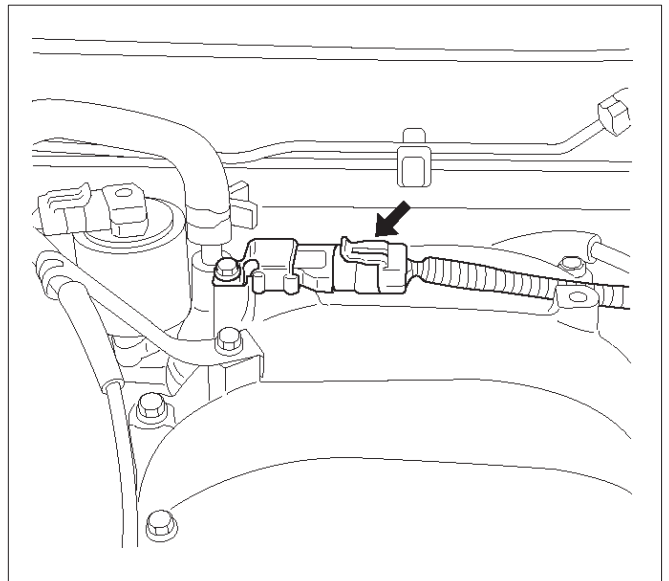
TS23781

3. Tighten the clamps to secure the MAF sensor to the intake air duct and the air cleaner.
4. Connect the MAF electrical connector.
5. Connect the negative battery cable.

Manifold Absolute Pressure (MAP) Sensor

Removal Procedure

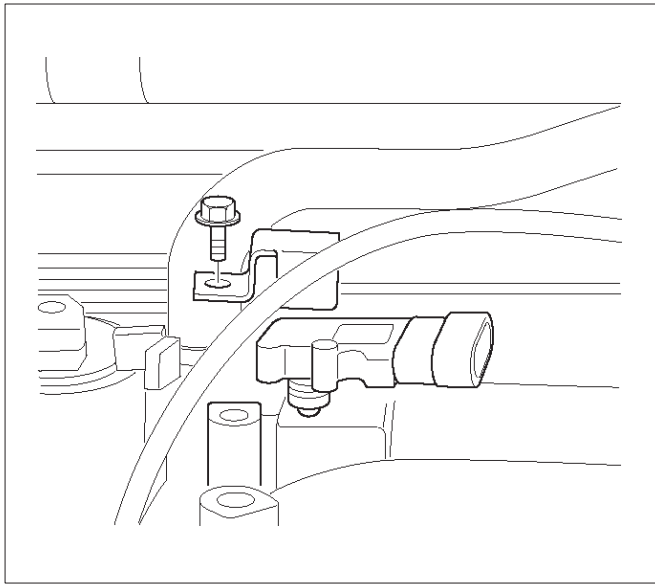
1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP sensor.



055RW005

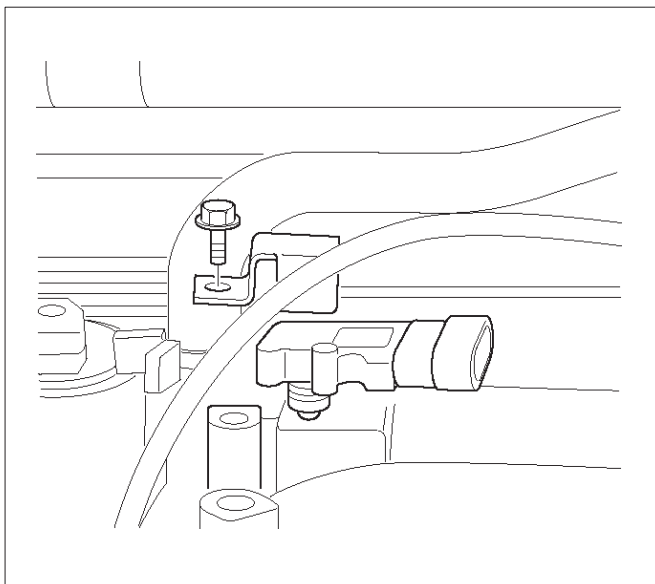
3. Remove the bolt securing the MAP sensor to the mounting bracket on the common chamber.

4. Remove the MAP sensor from the mounting bracket.

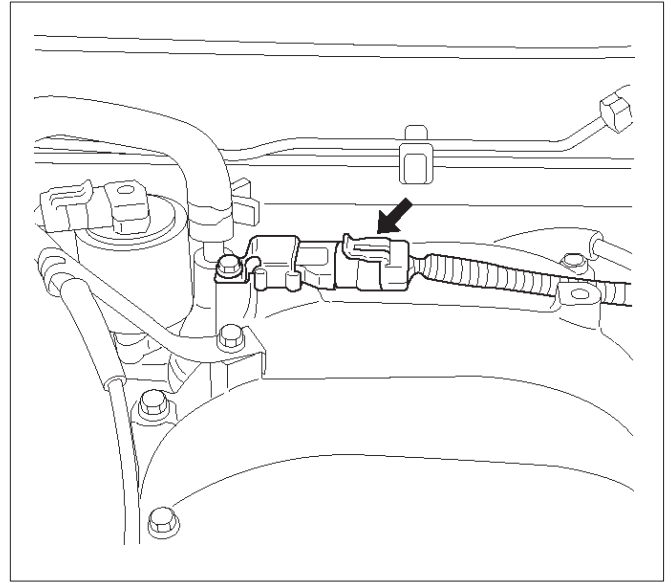


Installation Procedure

1. Install the MAP sensor in the mounting bracket.



2. Install the mounting bracket retaining bolt on the common chamber.
3. Connect the MAP electrical connector.



4. Connect the negative battery cable.

Malfunction Indicator Lamp (MIL)

Removal and Installation Procedure

Refer to Warning light bulb, indicator light valve, illumination light bulb, A/T indicator light bulb in Meter and Gauge.

Powertrain Control Module (PCM)

Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.

Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause

damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal PCM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the PCM (for example: battery cable, PCM pigtail, PCM fuse, jumper cables, etc.).

IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on the metal PCM cover.

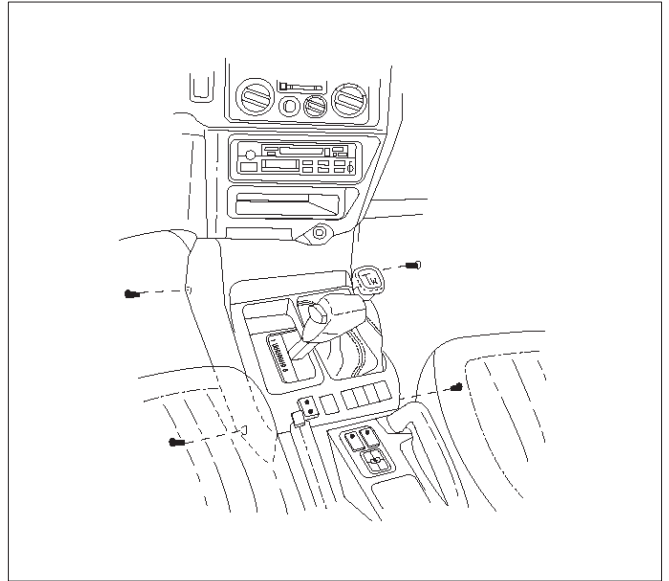
IMPORTANT: The ignition should always be in the "OFF" position in order to install or remove the PCM connectors.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to ensure it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

The service PCM EEPROM will not be programmed. DTC P0601 indicates the check sum error.

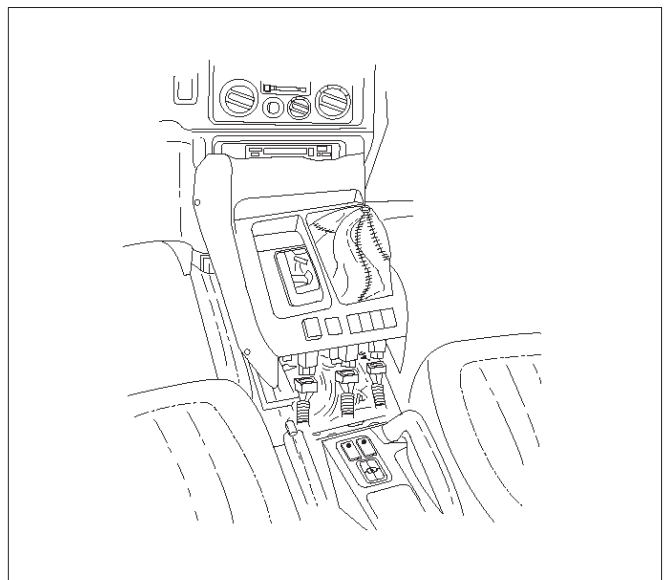
Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove the front console assembly.
 1. Remove the four screws.



TS23755

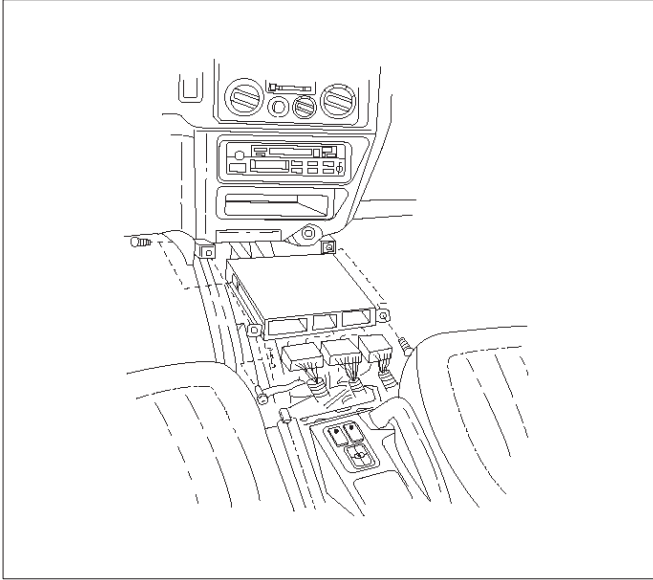
2. Remove the transfer shift lever knob by unscrewing the knob.
3. Move the transmission gear selector out of the park position.
4. Lift up sharply on the back edge of the assembly.
5. Disconnect the seat heater switch connectors (if equipped).
6. Disconnect the POWER and WINTER switch connectors.
7. Lift out the front console assembly.



TS23756

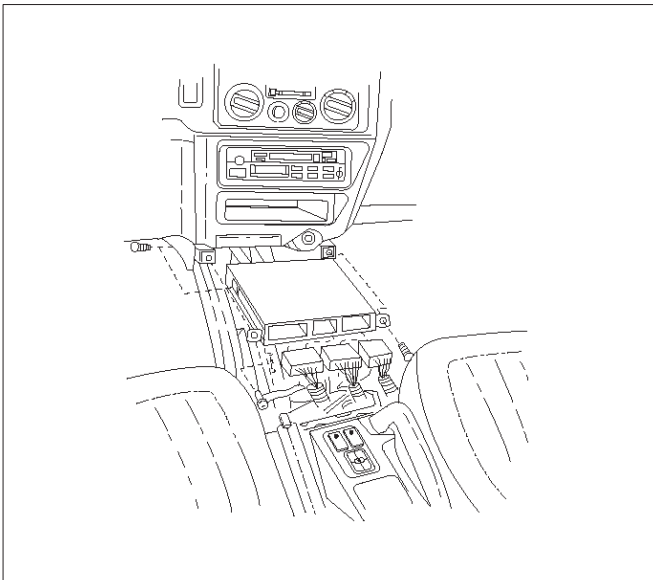
6E-300 ENGINE DRIVEABILITY AND EMISSIONS

4. Disconnect the red, white, and blue electrical connectors at the PCM.
5. Remove the two screws in the front of the PCM.
6. Remove the one screw at the left rear of the PCM.
7. Pull the PCM straight out from the dashboard.



Installation Procedure

1. Insert the PCM into the dashboard.
 - Line up the holes in front for the mounting screws.
2. Install the PCM with two screws in the front and one screw at the left rear.
3. Plug the red, white, and blue connectors into the appropriate sockets.



EEPROM

General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control powertrain operation.

EEPROM Programming

1. Step-up – Ensure that the following conditions have been met:
 - The battery is fully charged.
 - The ignition is “ON.”
 - The Vehicle Interface Module cable connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user’s instructions.
3. If the PCM fails to program, Refer to *UBS 98 model year Immobilizer Workshop Manual*.

Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

Power Steering Pressure (PSP) Switch

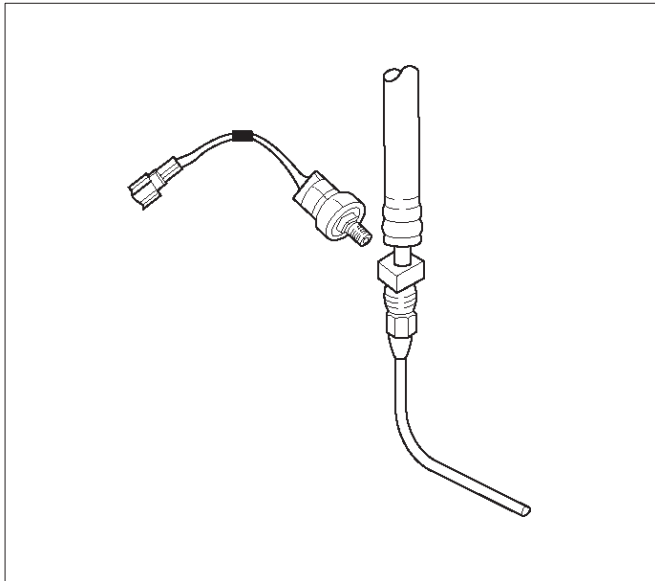
General Description

The Power Steering Pressure (PSP) switch closes when the hydraulic pressure reaches 3920 ± 690 kPa (570 ± 100 psi). This causes the PCM to actuate the idle air control valve in order to prevent the additional load from slowing down the engine. The switch opens when the hydraulic pressure drops to 2970 ± 560 kPa (430 ± 80 psi).

Removal Procedure

1. Disconnect the PSP switch pigtail from the wiring harness.
 - The pigtail is permanently attached to the switch. Do not attempt to remove the wires from the sensor.
 - Have a container ready to catch the power steering fluid that leaks out of the line when the switch is removed.

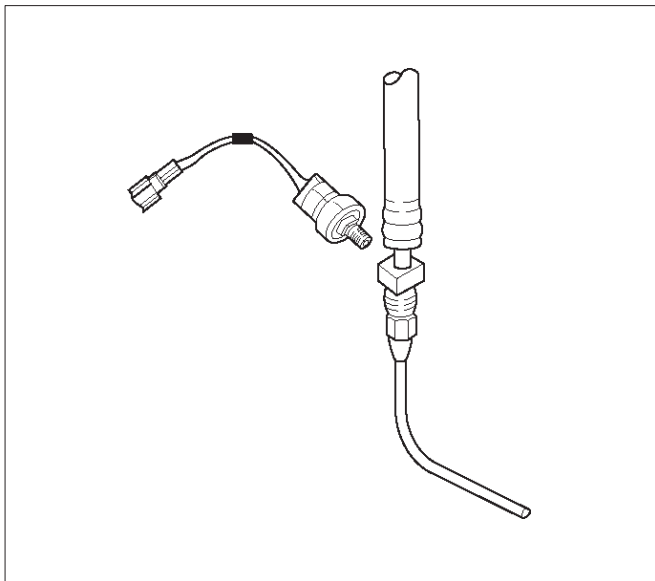
2. Remove the PSP switch from the power steering line.
 - Plug the line to prevent excessive loss of fluid and possible contamination of the power steering system.



TS23760

Installation Procedure

1. Install the PSP switch in the power steering line.



TS23760

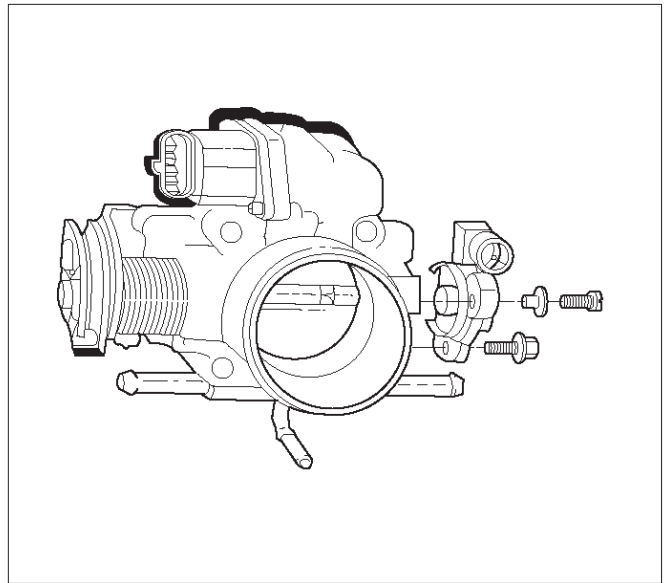
2. Connect the PSP switch pigtail to the wiring harness.
3. Check the power steering fluid level. Refer to *Power Steering*.
4. Start the engine. Watch the PSP switch for signs of fluid leakage.

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.

3. Remove the bolts and the TP sensor from the throttle body.



TS23747

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

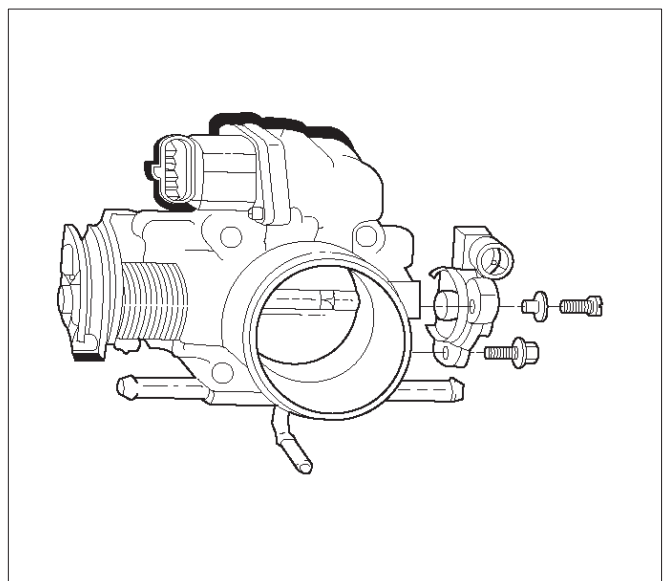
Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

- The voltage should be under 0.85 volt.
- If the reading is greater than 0.85 volt, check the throttle shaft to see if it is binding. Check that the throttle cable is properly adjusted, also. Refer to *Throttle Cable Adjustment*.
- If the throttle shaft is not binding and the throttle cable is properly adjusted, install a new TP sensor.

Installation Procedure

1. Install the TP sensor on the throttle body with the bolts.



TS23747

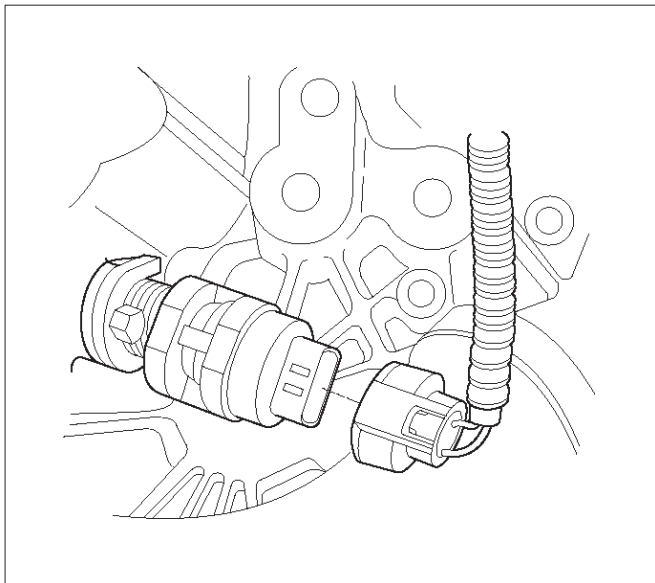
2. Connect the TP electrical connector.
3. Install the negative battery cable.

Vehicle Speed Sensor (VSS)

Removal Procedure

CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.

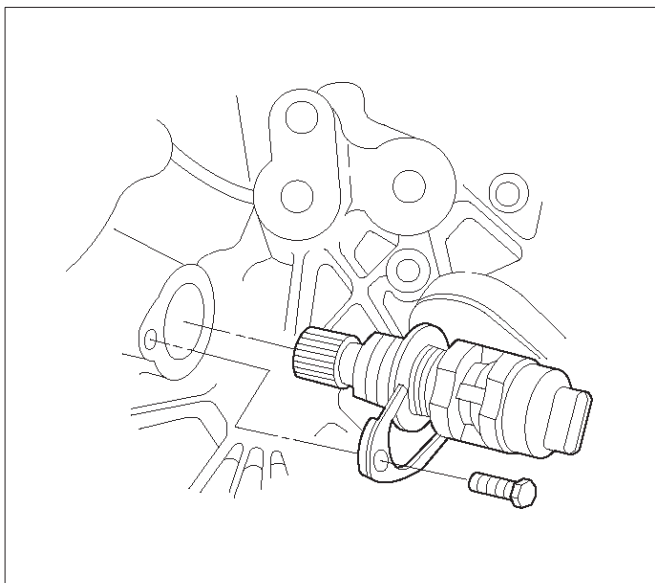
1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.



TS23748

3. Remove the bolt and the clamp securing the VSS in place.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case.



TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

Inspection Procedure

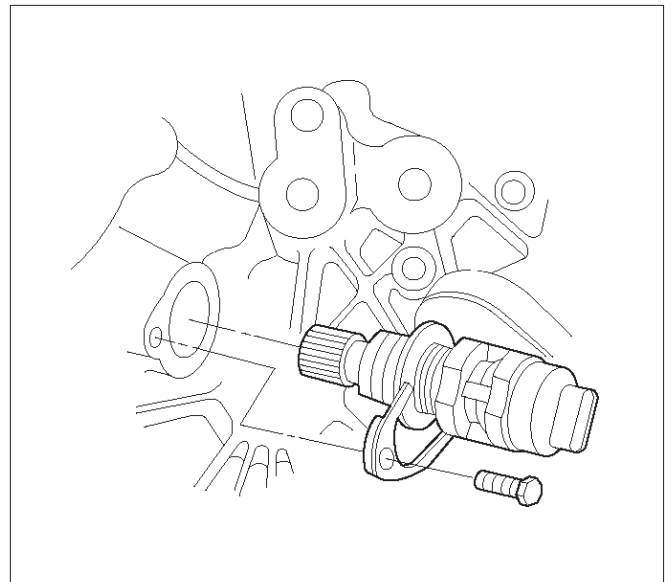
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

Installation Procedure

1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

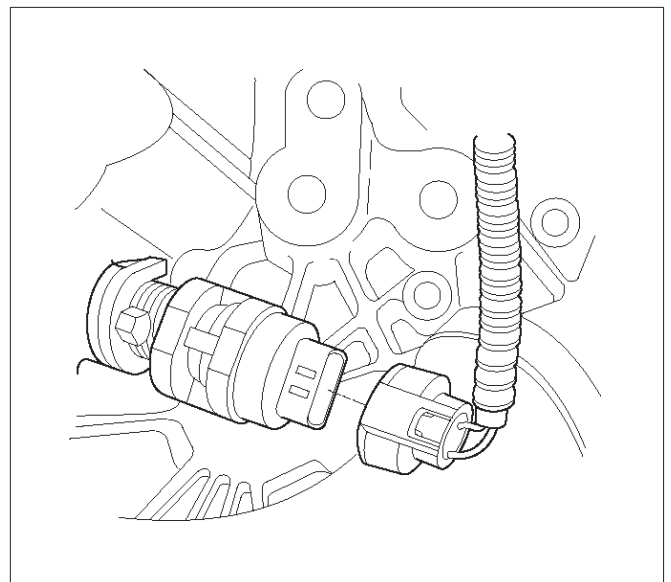
Tighten

- Tighten the bolt to 16 N·m (12 lb ft.).



TS23780

3. Connect the VSS electrical connector.



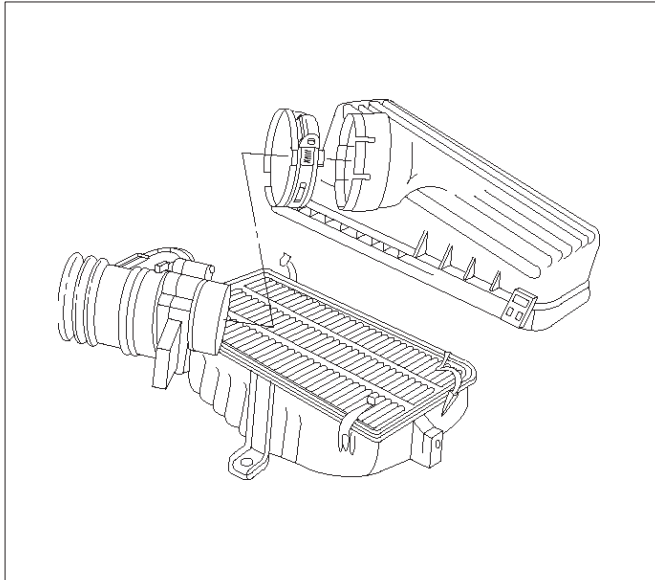
TS23748

4. Check the transfer case oil level. Add fluid if necessary.
5. Connect the negative battery cable.

Air Cleaner/Air Filter

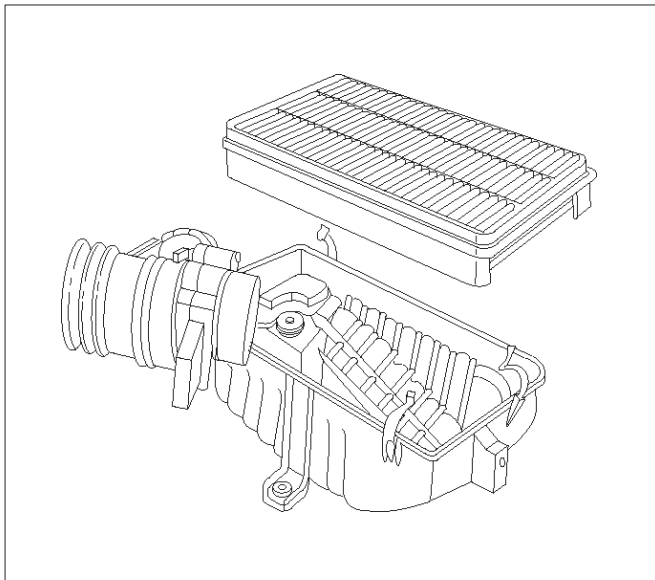
Removal Procedure

1. Loosen the clamp between the air cleaner lid and the mass air flow sensor.
2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.



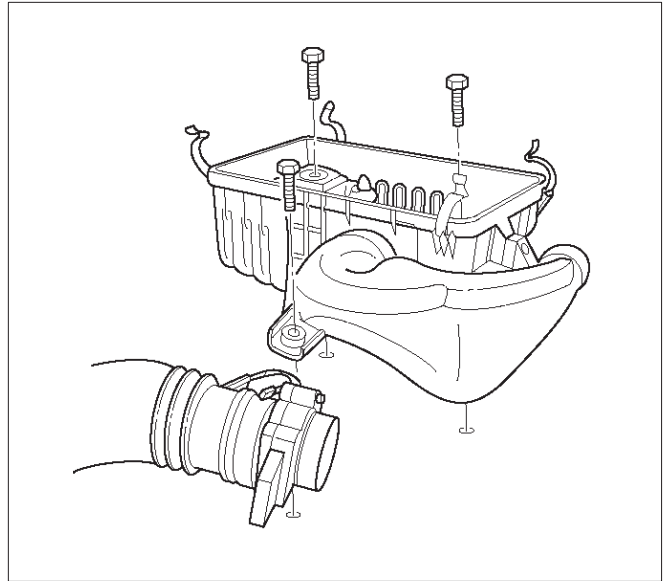
TS23973

4. Remove the air filter element.



TS23794

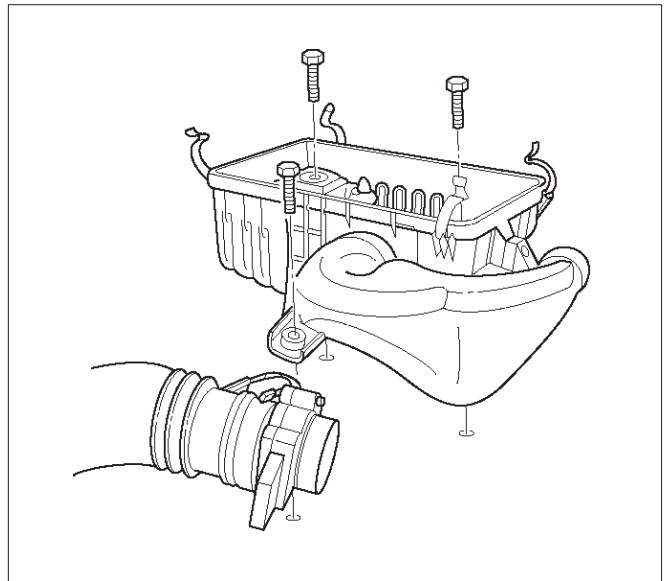
5. Remove the retaining bolts and the air cleaner housing from the vehicle.



130RT002

Installation Procedure

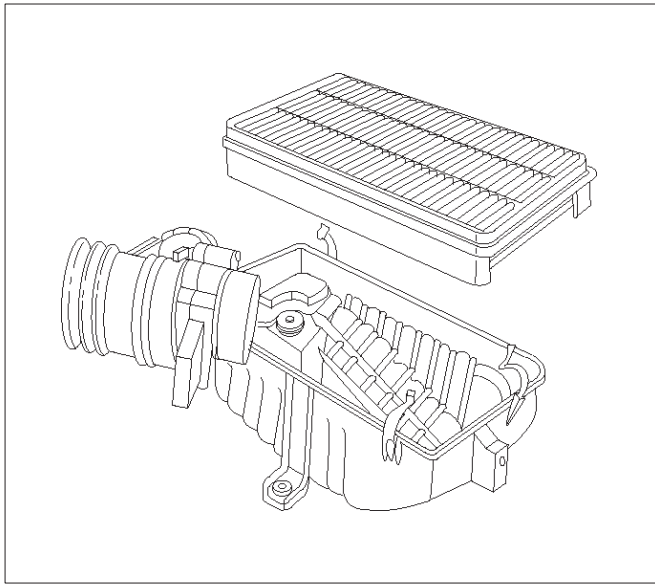
1. Install the air cleaner housing in the vehicle with the retaining bolts.



130RT002

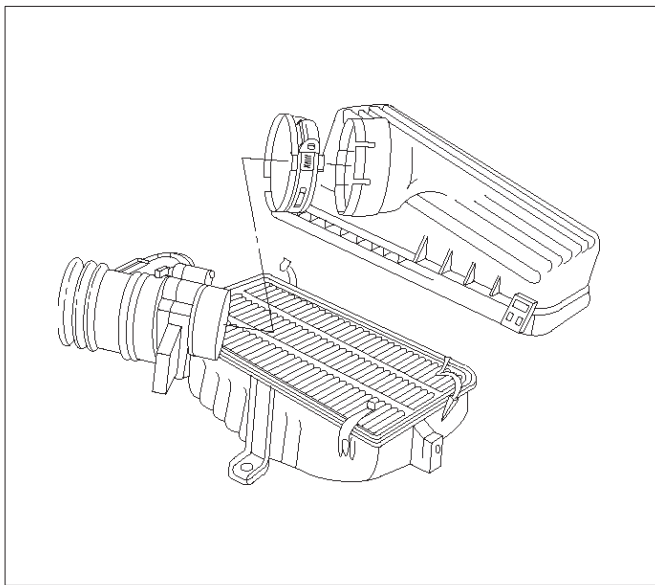
6E-304 ENGINE DRIVEABILITY AND EMISSIONS

2. Install the air filter element in the air cleaner housing.



TS23794

3. Install the air cleaner lid on the MAF sensor and the air cleaner housing.



TS23973

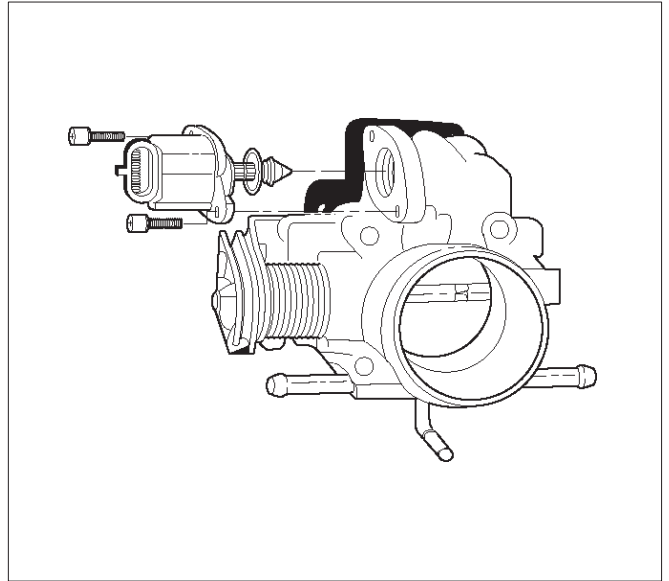
4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

Idle Air Control (IAC) Valve

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the IAC electrical connector.
3. Remove the bolts and the IAC valve from the throttle body.

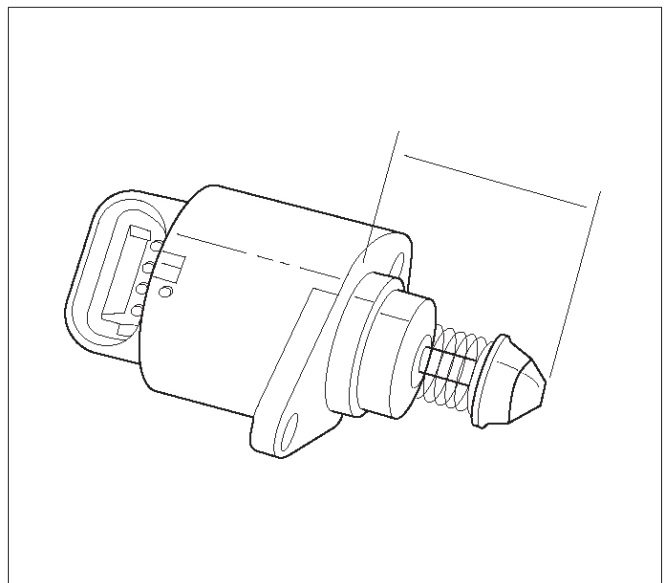
NOTE: Do not clean the IAC valve by soaking it in solvent. The valve will be damaged as a result.



TS23745

Cleaning, Inspection, and Measurement Procedure

- Clean the IAC valve O-ring sealing surface, pintle valve seat and air passage.
 - Use carburetor cleaner and a parts cleaning brush to remove carbon deposits. Do not use a cleaner that contains methyl ethyl ketone. This is an extremely strong solvent and not necessary for this type of deposit.
 - Shiny spots on the pintle are normal and do not indicate misalignment or a bent pintle shaft.
 - If the air passage has heavy deposits, remove the throttle body for complete cleaning.



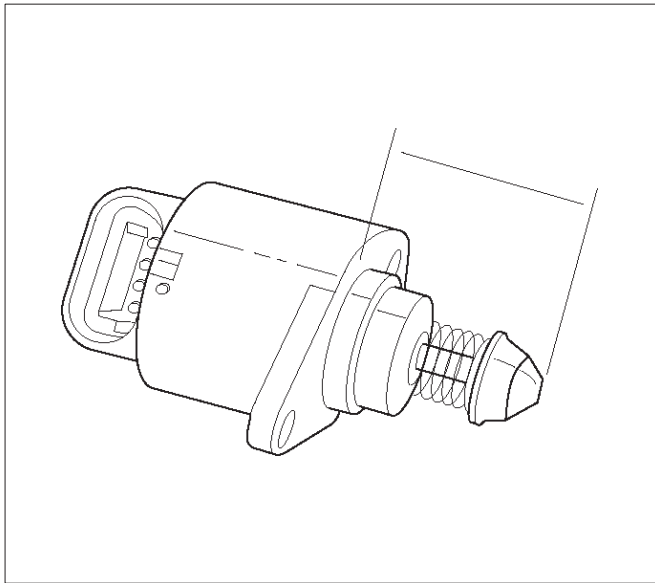
TS23746

- Inspect the IAC valve O-ring for cuts, cracks, or distortion. Replace the O-ring if damaged.

- In order to install a new IAC valve, measure the distance between the tip of the pintle and the mounting flange. If that measurement is 28 mm (1.1 in.) or less, the valve needs no adjustment. If the measurement is greater than 28 mm (1.1 in.), apply finger pressure and retract the valve. The force required to retract the pintle on a new valve will not damage the valve, shaft, or pintle.

NOTE: Do not push or pull on the IAC valve pintle on IAC valves that have been in service. The force required to move the pintle may damage it.

IMPORTANT: Use an identical replacement part in order to replace a valve. IAC valve pintle shape and diameter are designed for the specific application.



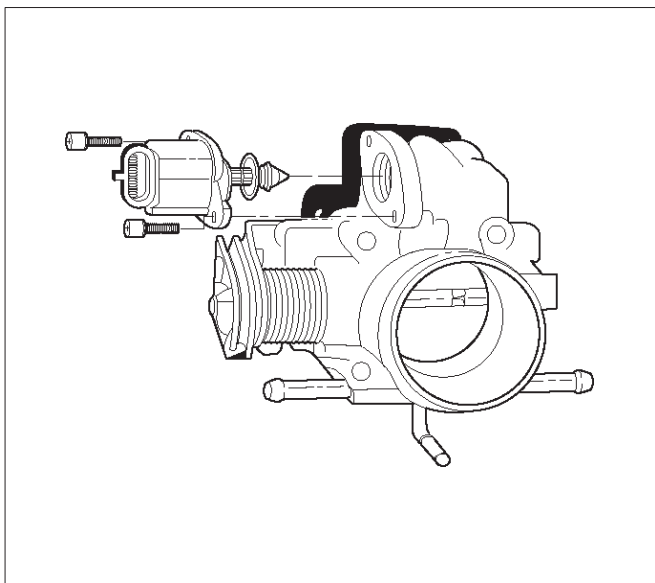
TS23746

Installation Procedure

1. Install the IAC valve on the throttle body with the bolts.

Tighten

- Tighten the bolts to 1 N·m (9 lb in.).



TS23745

2. Connect the IAC valve electrical connector.
3. Install the negative battery cable.

Common Chamber

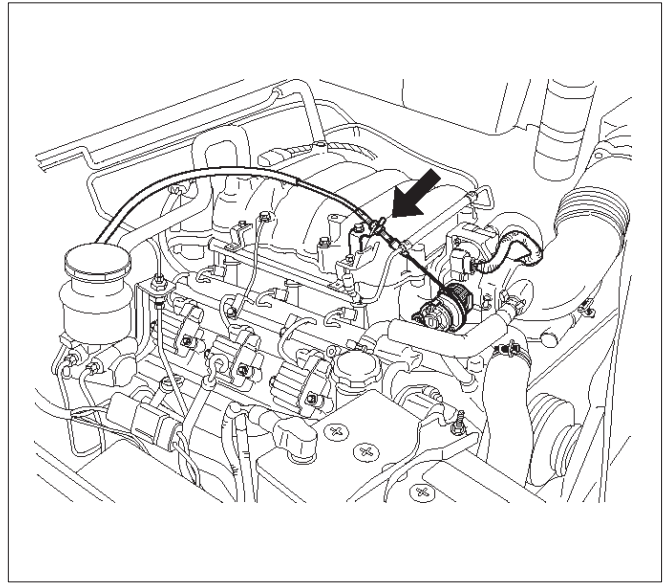
Removal and Installation Procedure

Refer to Common Chamber in Engine Mechanical.

Accelerator Cable Assembly

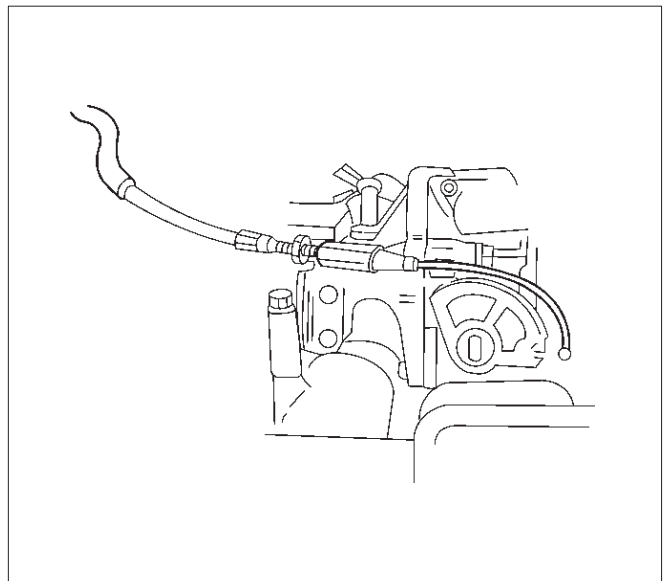
Removal Procedure

1. Remove the engine cover.
2. Loosen the adjusting nut on the cable bracket mounting on the common chamber.



101RW005

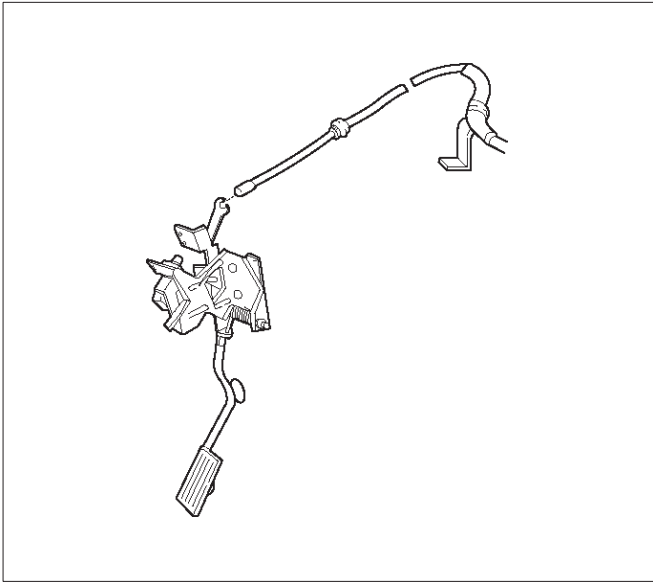
3. Remove the accelerator control cable (on the throttle valve end).



101RW006

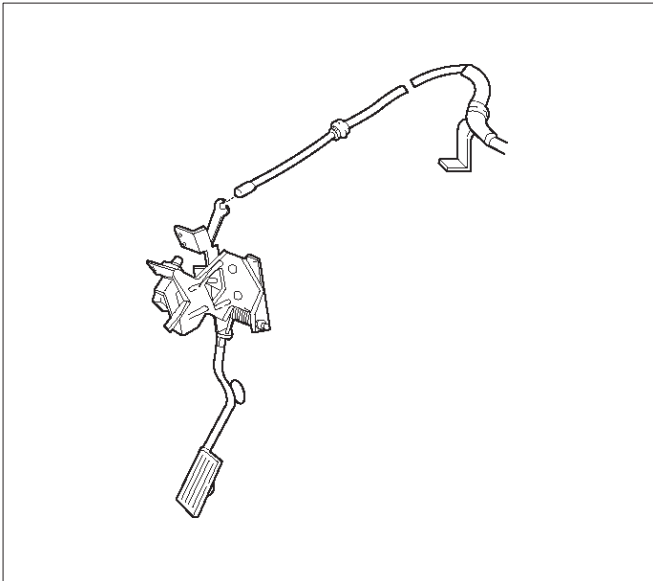
6E-306 ENGINE DRIVEABILITY AND EMISSIONS

4. Remove the accelerator control cable (on the accelerator pedal end).



TS23982

5. Remove the grommet.
6. Remove the accelerator control cable.



TS23983

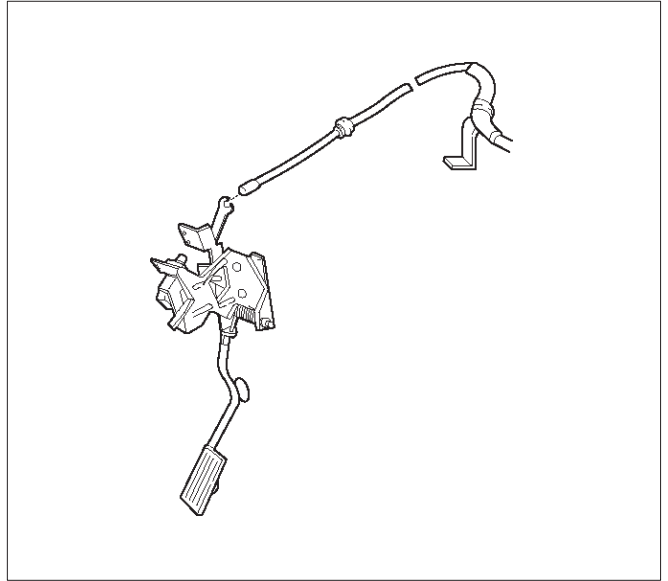
Inspection Procedure

Check the following items, and replace the control cable if any abnormality is found:

- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

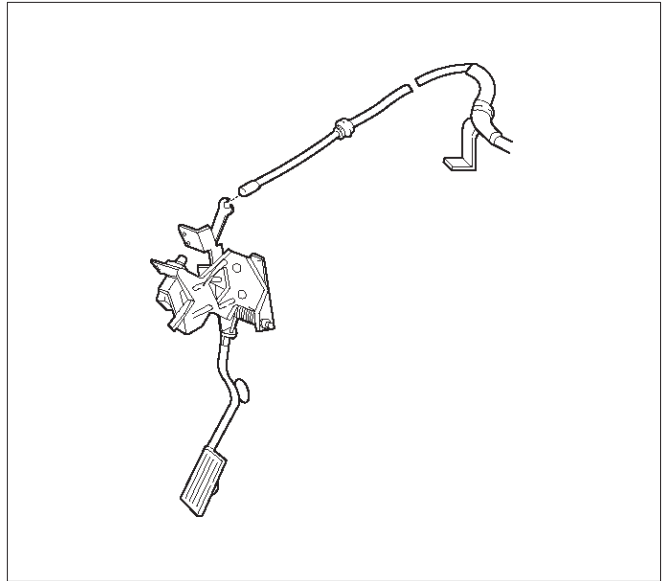
Installation Procedure

1. Install the accelerator control cable.



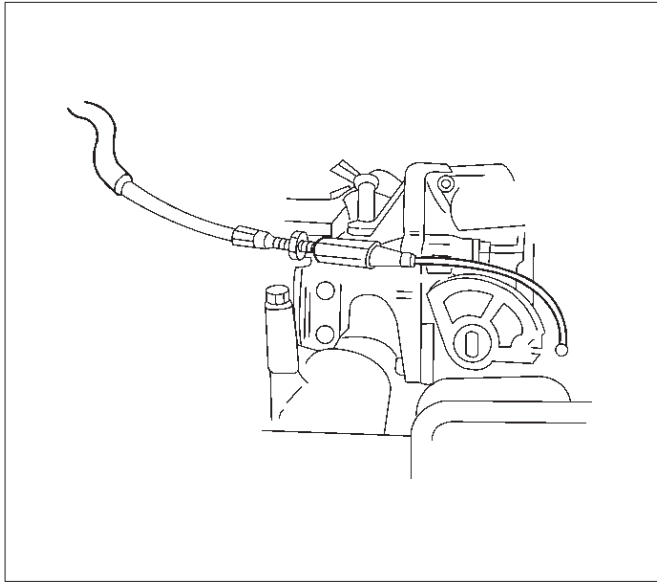
TS23983

2. Install the grommet.
3. Install the accelerator control cable (on the accelerator pedal end).



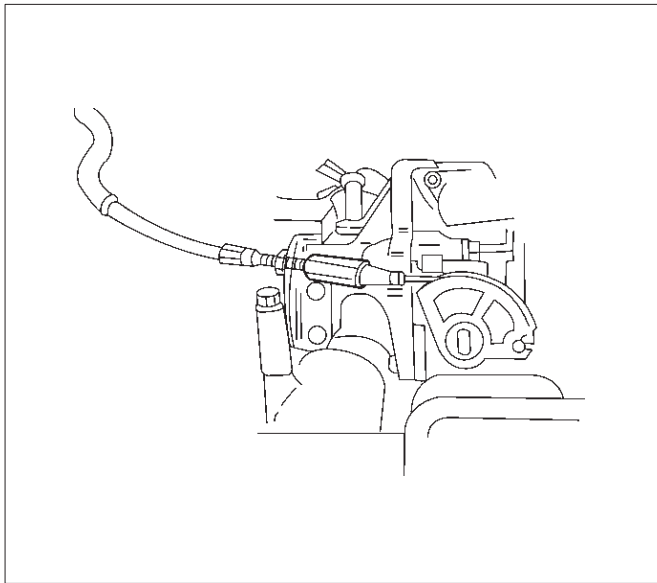
TS23982

4. Install the accelerator control cable (on the throttle valve end).



101RW006

5. Install the adjusting nut.

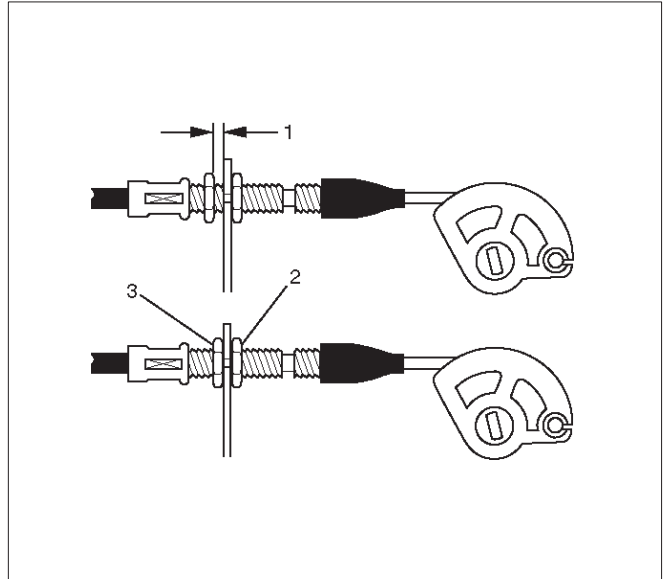


101RW007

6. Adjust the accelerator cable at the throttle body. Refer to *Accelerator Cable Adjustment*.
7. Install the engine cover.

Adjustment Procedure

1. Loosen the adjusting nut and lock nut.
2. Pull outer cable closing fully the throttle valve.
3. Tighten adjusting nut and lock nut temporarily.

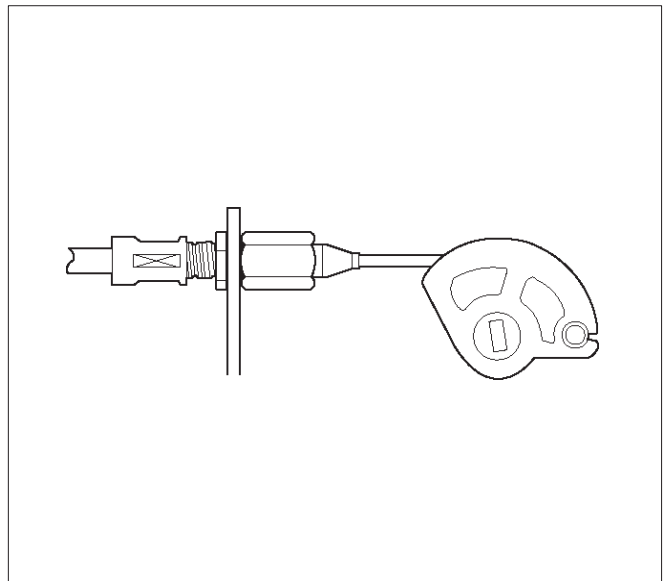


035RW004

4. Loosen adjusting nut by three turns and tighten lock nut. Then, manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

IMPORTANT: The valve lever must return up to the stopper screw. If the valve lever does not reach the stopper screw, repeat the procedure again from step 1.

5. If it does not reach the stopper screw, repeat from step 1.

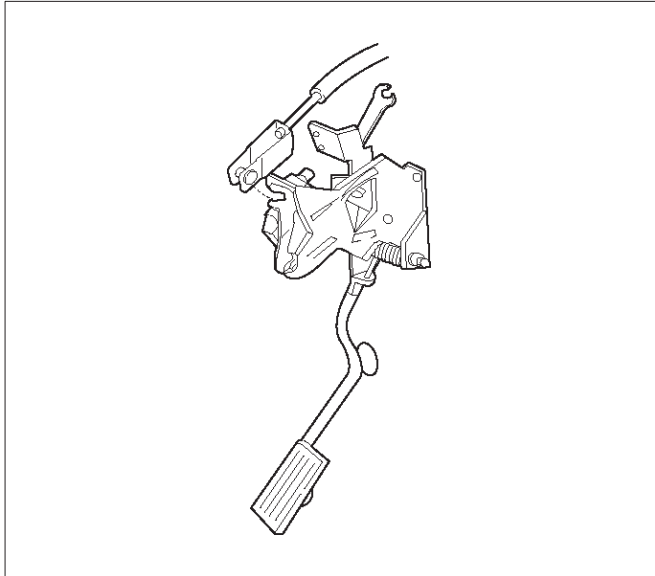


TS23782

Accelerator Pedal Replacement

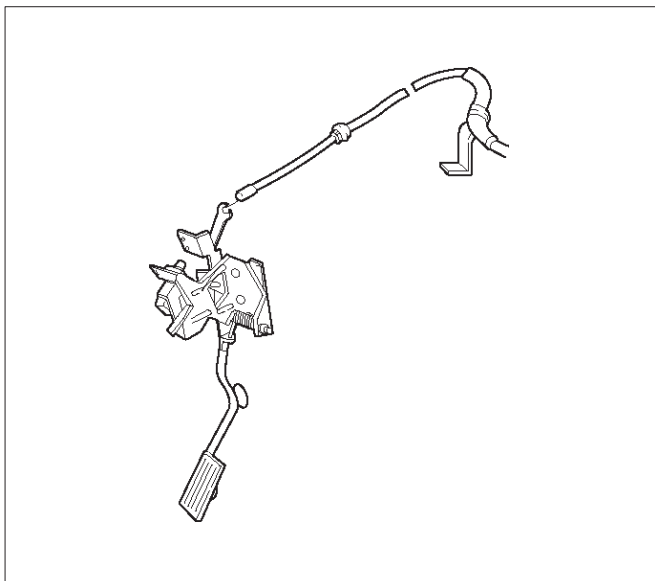
Removal Procedure

1. Disconnect the cruise control cable from the accelerator pedal assembly.



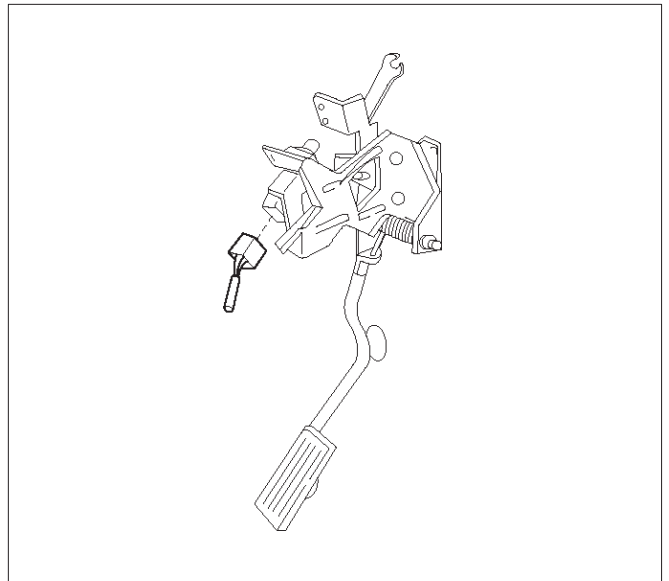
TS24053

2. Disconnect the accelerator pedal control cable from the accelerator pedal assembly.



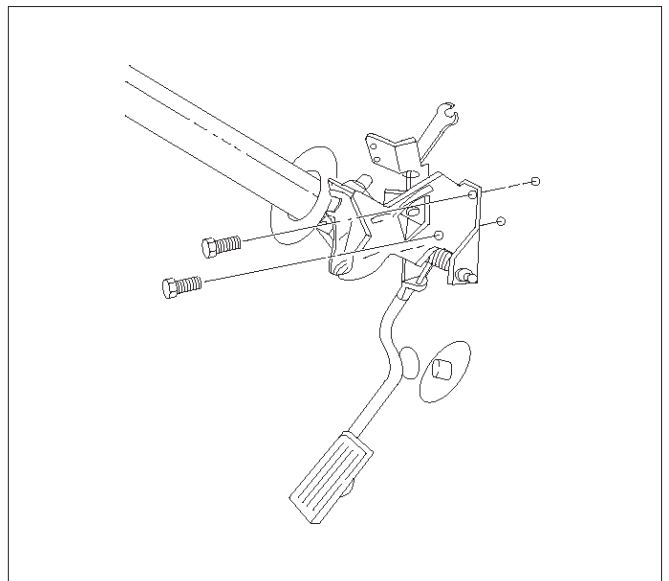
TS24054

3. Disconnect the wiring harness from the kick-down switch.



TS24038

4. Remove the two screws from the accelerator pedal assembly.

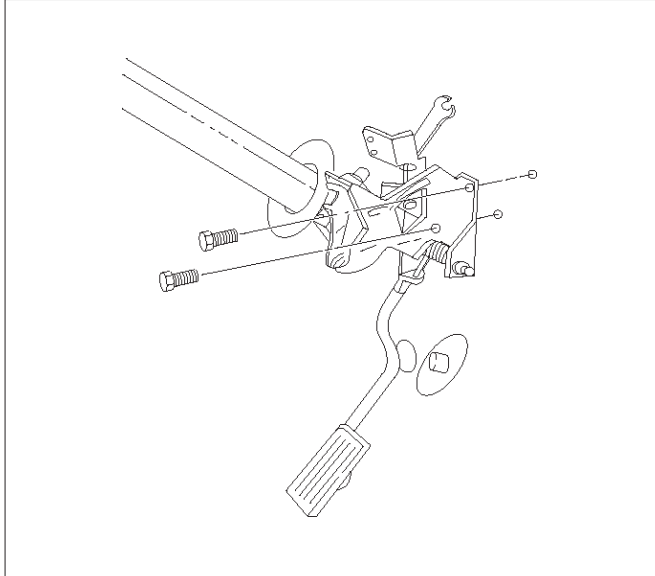


TS24055

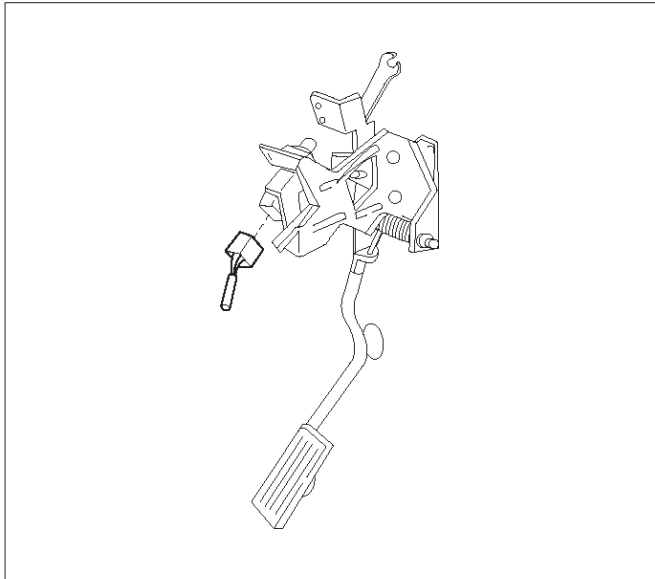
5. Remove the accelerator pedal assembly from the bulkhead.

Installation Procedure

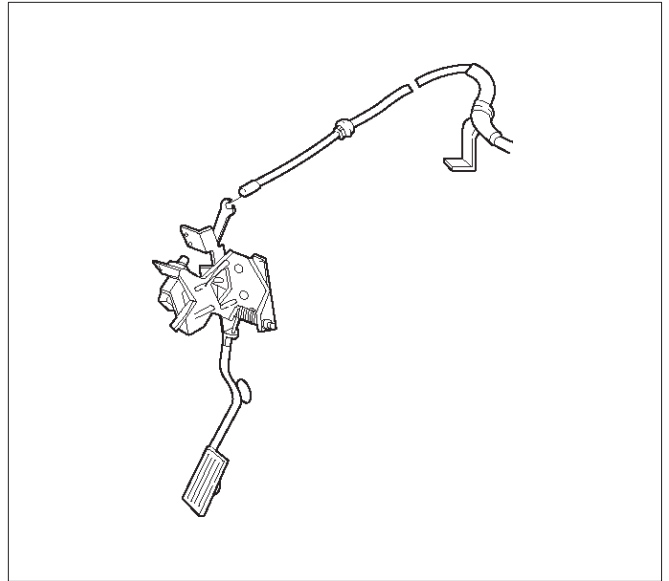
1. Install the accelerator pedal assembly on the bulkhead.
2. Install the two screws to the accelerator pedal assembly.



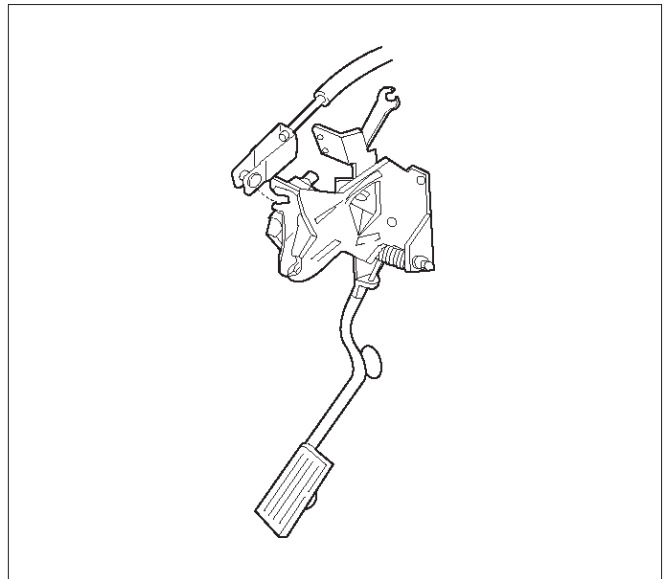
3. Connect the wiring harness to the kick-down switch.



4. Connect the accelerator pedal control cable to the accelerator pedal assembly.

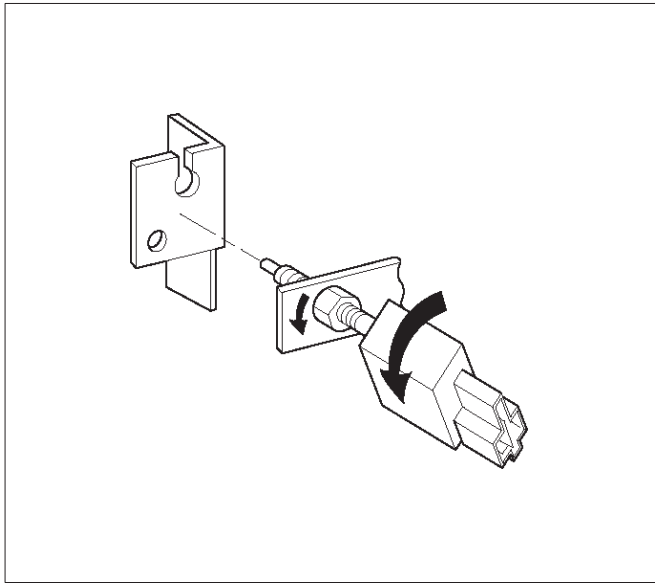


5. Connect the cruise control cable to the accelerator pedal assembly.



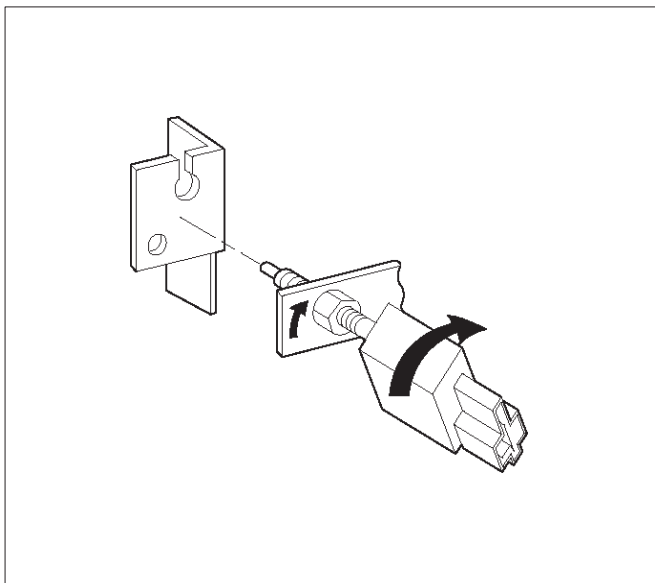
Pedal Stroke Adjustment Procedure

1. Loosen the jam nut and rotate the kick-down switch counterclockwise.



TS24039

2. Fully depress the pedal and hold it by hand. Rotate the switch clockwise until the switch clicks.
3. Rotate the switch 1/2 turn further and lock it in this position by tightening the jam nut.



TS24040

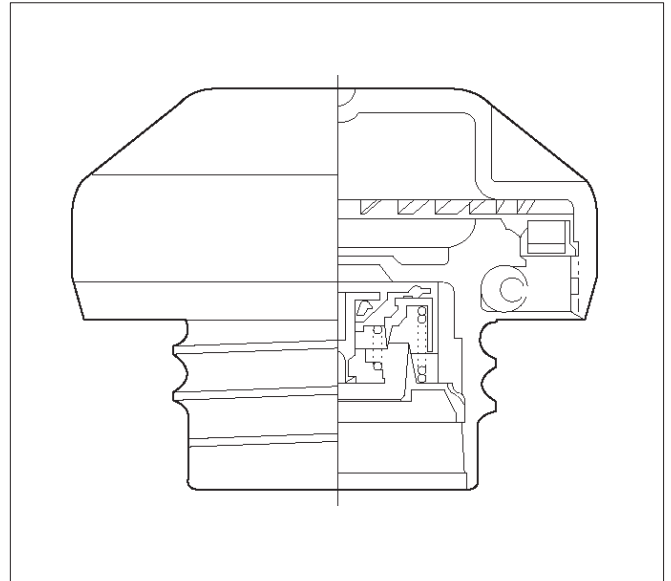
4. Step on the accelerator pedal and make sure there is a clicking sound at the full-stroke position.

Fuel Filter Cap

General Description

The fuel filter cap includes a vacuum valve and a pressure valve.

If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank at the EGR valve.



TS23767

Inspection Procedure

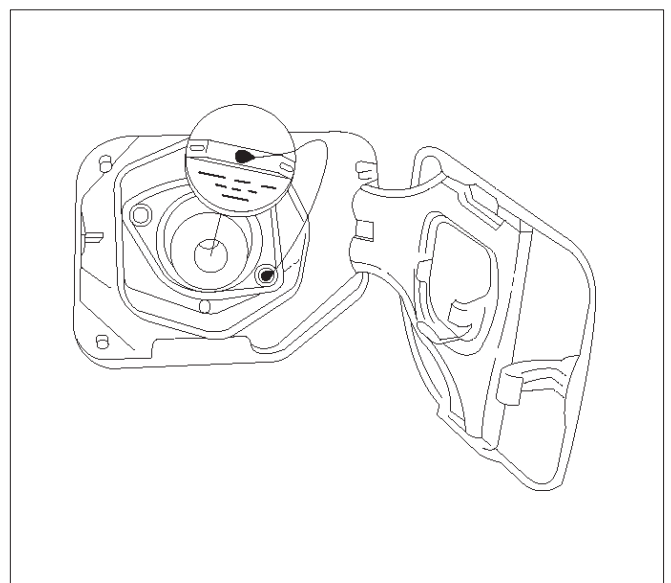
NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

Fuel Filter

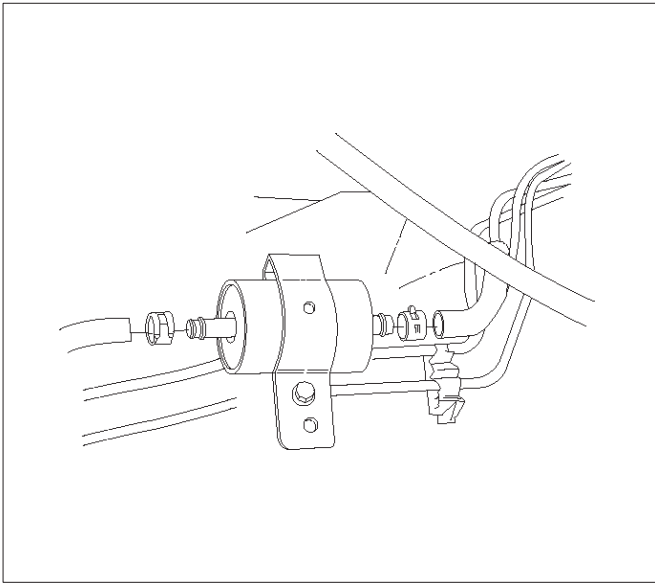
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



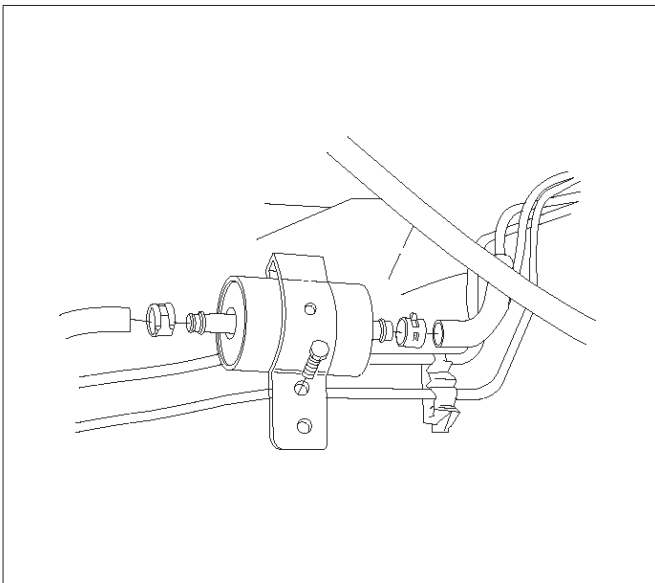
041RW005

3. Disconnect the fuel line from the fuel filter on the engine side.
4. Disconnect the fuel line from the fuel filter on the fuel tank side.



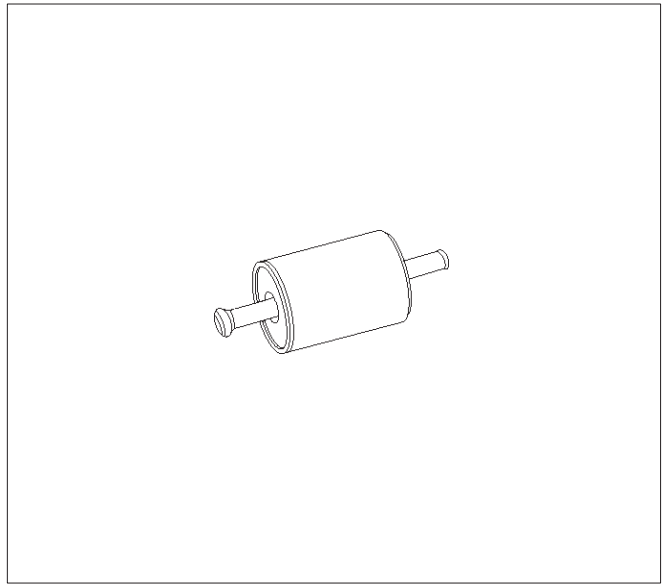
041RW006

5. Remove the bolt on the fuel filter holder.



041RW007

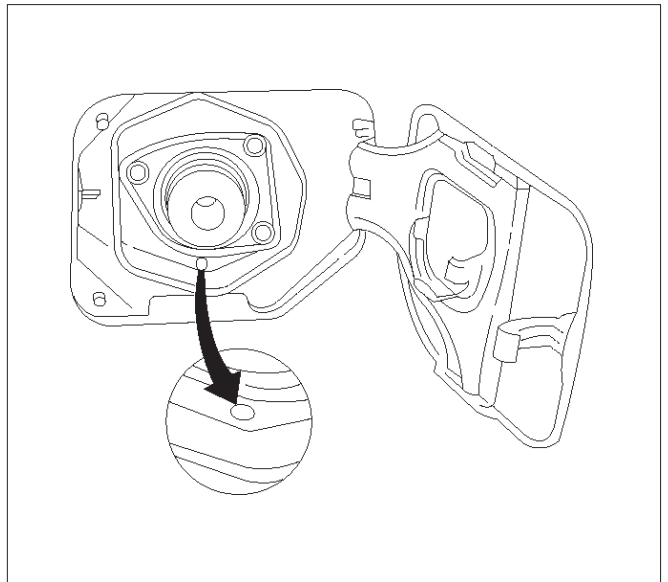
6. Remove the fuel filter.



041RW008

Inspection Procedure

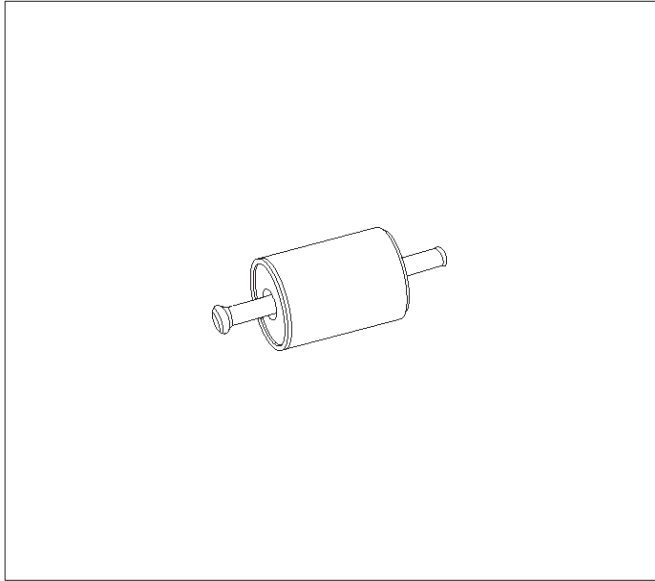
1. Replace the fuel filter when the following occur:
 - Fuel leaks from the fuel filter body.
 - The fuel filter body is damaged.
 - The fuel filter is clogged with dirt or sediment.
2. If the drain hole is clogged, clean the drain.



041RW009

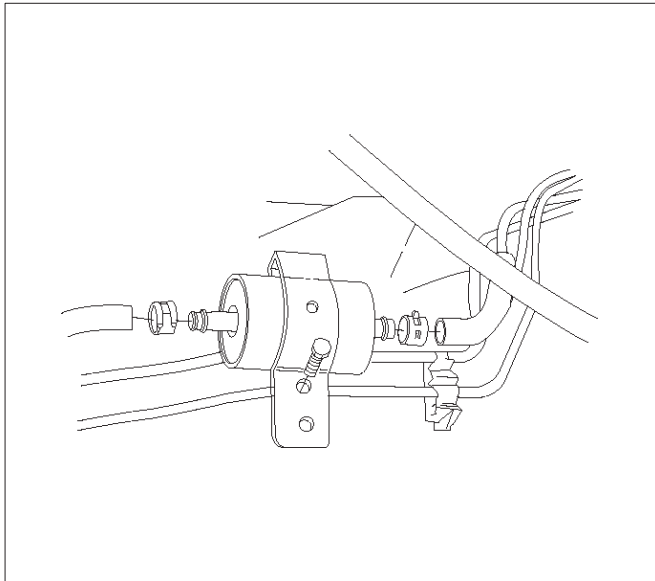
Installation Procedure

1. Install the fuel filter in the correct direction.



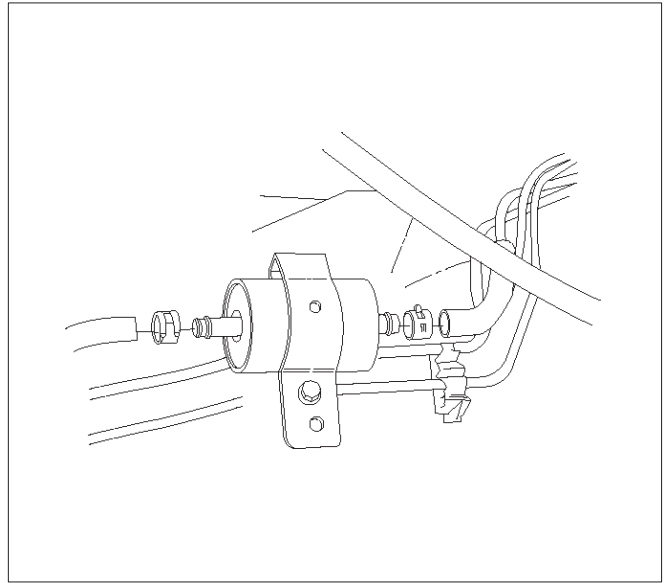
041RW008

2. Install the bolt on the fuel filter holder.



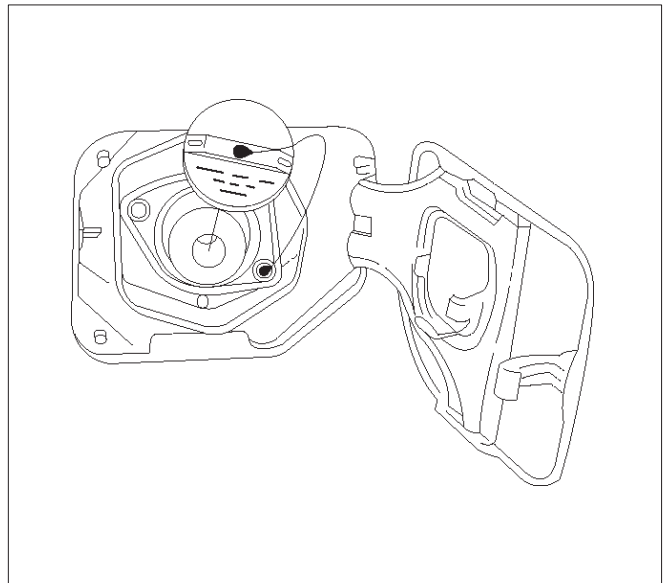
041RW007

3. Connect the fuel line on the engine side.
4. Connect the fuel line on the fuel tank side.



041RW006

5. Install the fuel filler cap.



041RW005

6. Connect the negative battery cable.

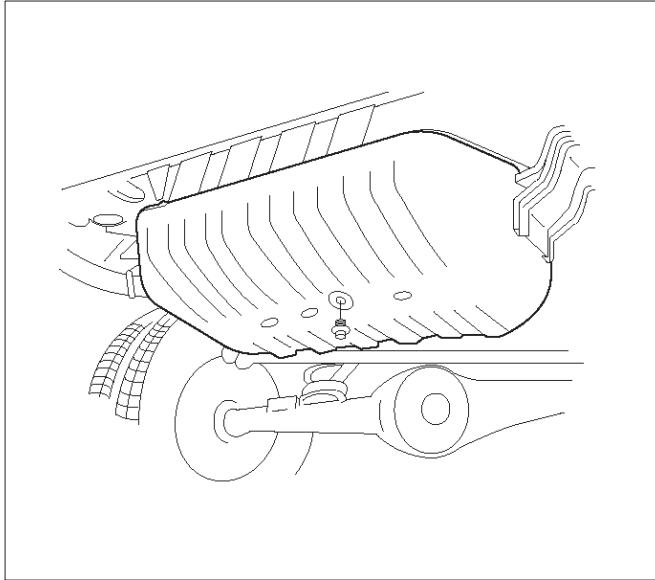
Fuel Gauge Unit

Removal Procedure

1. Disconnect the negative battery cable.
2. Loosen the fuel filler cap.
3. Drain the fuel from the tank.

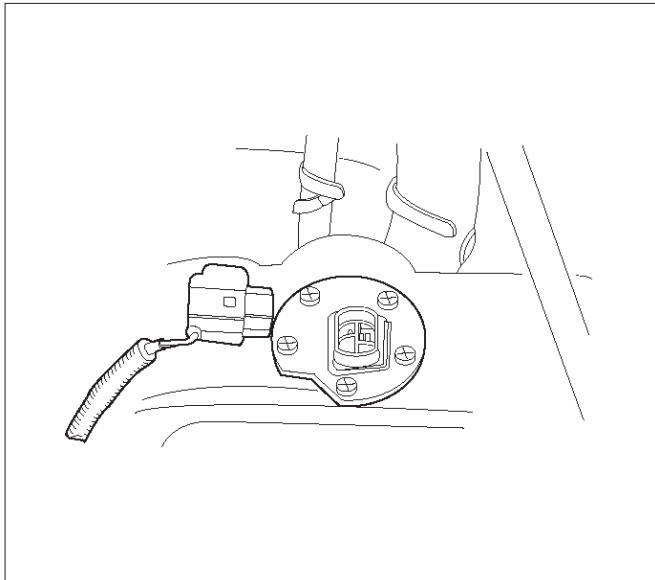
Tighten

- Tighten the drain plug to 20 N-m (14 lb ft.).



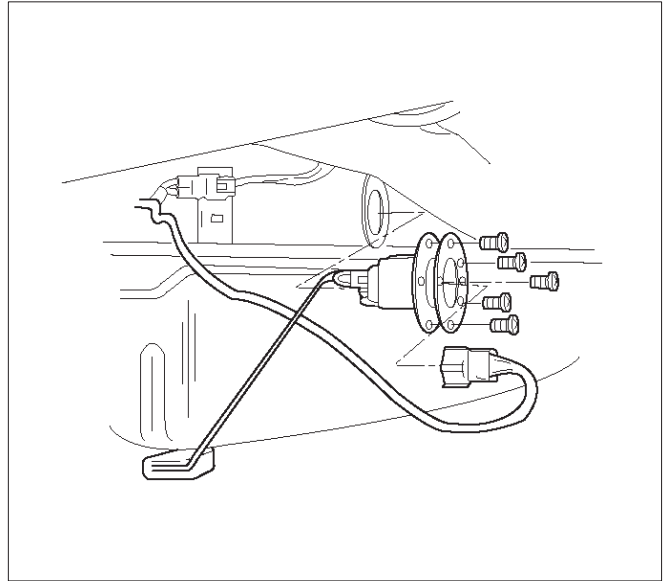
TS22907

4. Disconnect the wiring connector from the fuel gauge unit.



TS23771

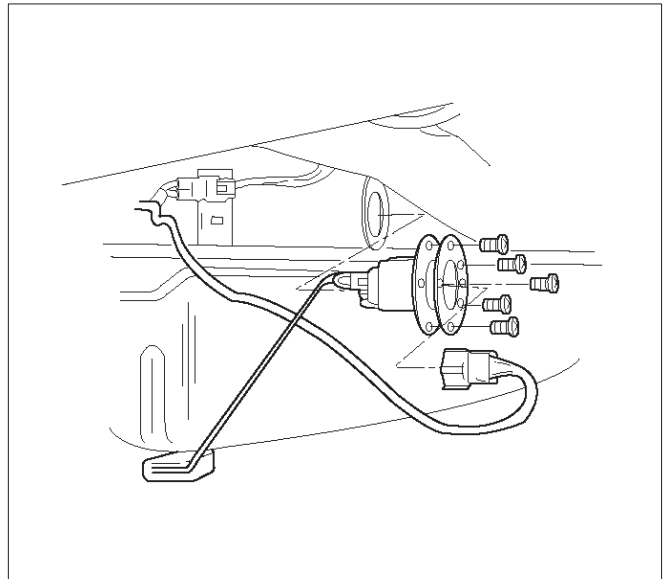
5. Remove the fuel gauge unit retaining screws.
6. Remove the fuel gauge unit.
 - Cover or plug the fuel tank to prevent dust, dirt, or debris from entering the tank.



TS22911

Installation Procedure

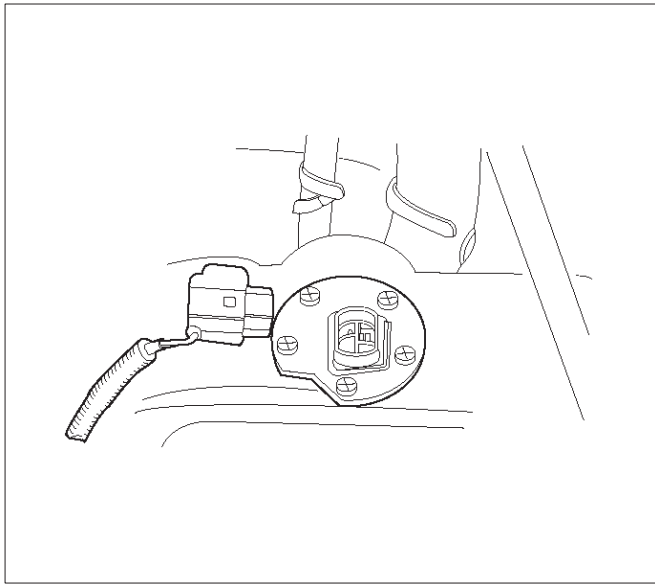
1. Install the fuel gauge unit.
2. Install the fuel gauge unit retaining screws.



TS22911

6E-314 ENGINE DRIVEABILITY AND EMISSIONS

3. Connect the wiring connector to the fuel gauge unit.



TS23771

4. Fill the fuel tank with fuel.
 - Tighten the fuel filler cap.
 - Check for leaks at the fuel gauge unit gasket.
5. Connect the negative battery cable.

Fuel Injectors

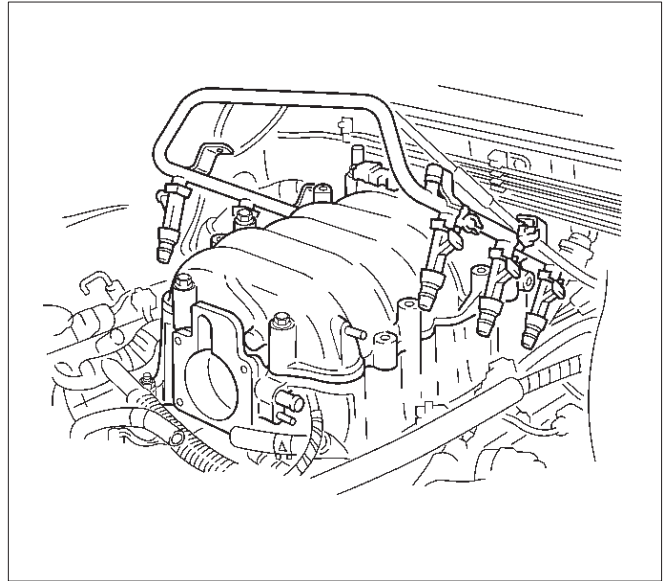
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and the filter if necessary.

NOTE: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

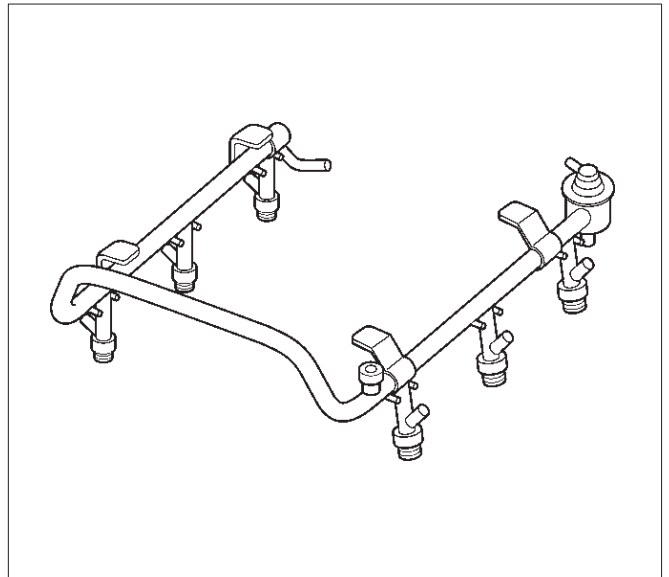
IMPORTANT: Fuel injectors are serviced as a complete assembly only.

1. Disconnect the negative battery cable.
2. Remove the upper intake manifold. Refer to *Common Chamber in Engine Mechanical*.
3. Remove the fuel rail. Refer to *Fuel Rail*.



014RW164

4. Remove the injector retainer clip.



055RW009

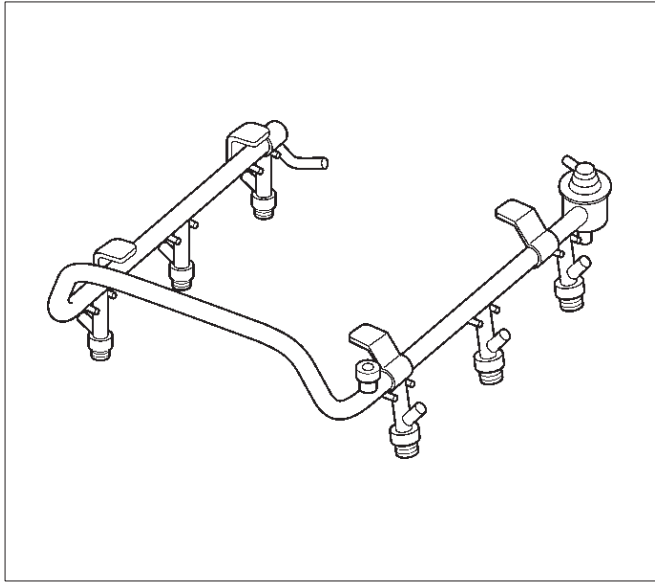
5. Remove the fuel injector assembly.
6. Remove the O-ring from the fuel injector.
7. Remove the O-ring backup from the fuel injector.

Inspection Procedure

1. Inspect the O-rings for cracks or leaks.
2. Replace worn or damaged O-rings.
3. Lubricate the new O-rings with engine oil before installation.

Installation Procedure

1. Install the O-ring backup on the fuel injector.
2. Install the new O-ring on the fuel injector.
3. Install the fuel injector on the fuel rail.



055RW009

4. Use new fuel injector retainer clips to retain the fuel injector to the fuel rail.
5. Coat the end of the fuel injector with engine oil.
6. Install the fuel rail. Refer to *Fuel Rail*.



014RW164

7. Install the upper intake manifold. Refer to *Common Chamber in Engine Mechanical*.
8. Install the engine cover.
9. Connect the negative battery cable.

Fuel Pressure Regulator

Removal Procedure

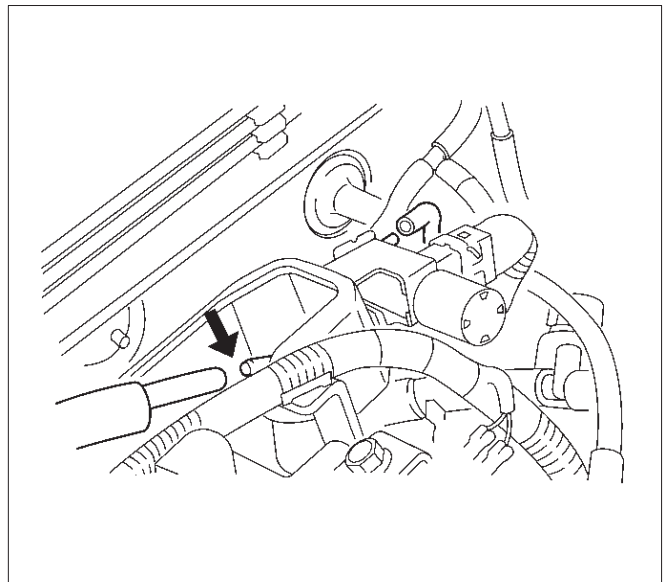
CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before disconnecting the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

NOTE: Compressed air must never be used to test or clean a fuel pressure regulator, as damage to the fuel pressure regulator may result.

NOTE: To prevent damage to the fuel pressure regulator, do not immerse the pressure regulator in solvent.

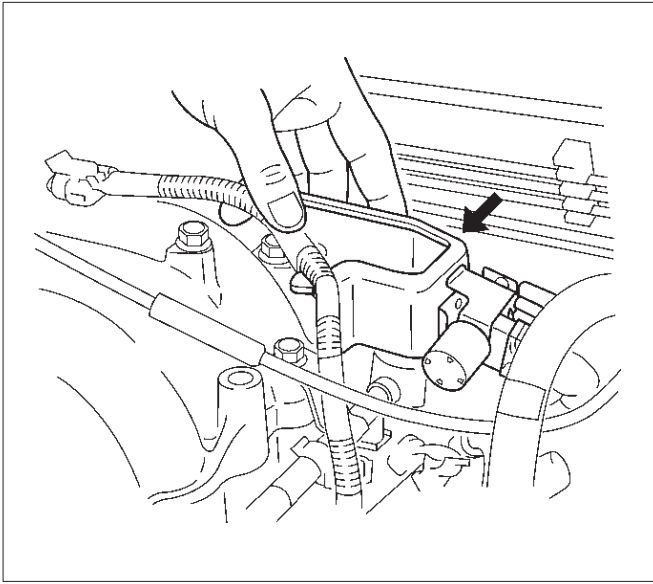
1. Depressurize the fuel system. Refer to *Fuel Pressure Relief Procedure*.
2. Disconnect the negative battery cable.
3. Remove the fuel pump relay. Refer to *Fuel Pump Relay*.
4. Remove the pressure regulator hose from the fuel pressure regulator.



014RW110

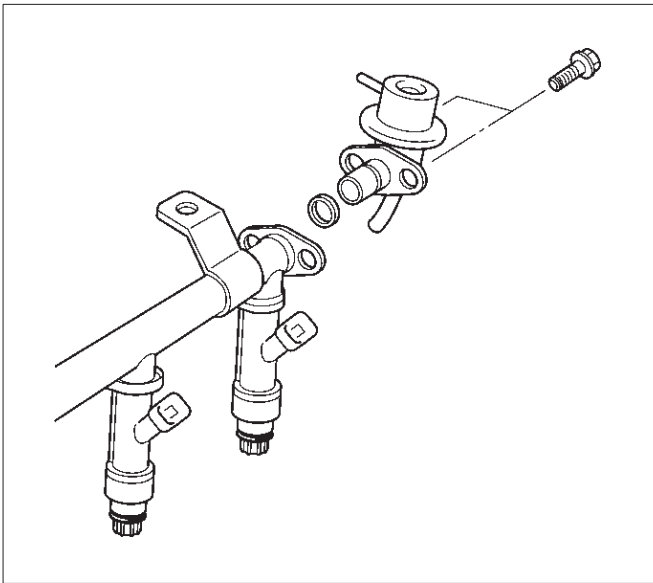
6E-316 ENGINE DRIVEABILITY AND EMISSIONS

5. Remove the two bolts from the protector that secures the common chamber.



014RW109

6. Remove the fuel pressure regulator attaching screw.

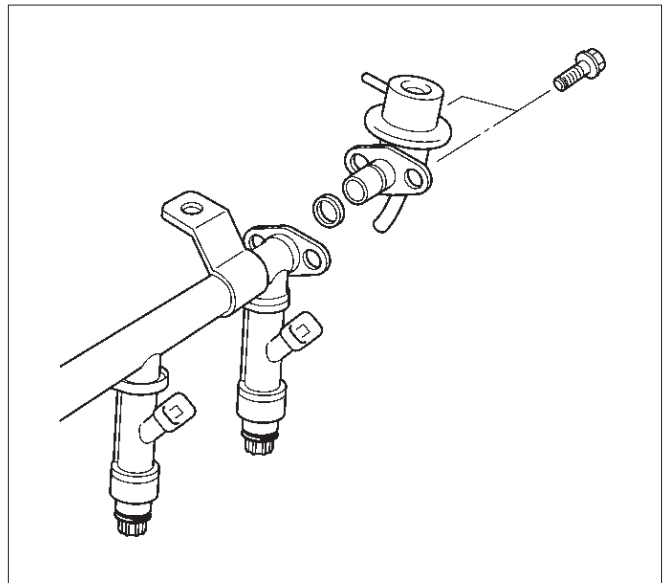


F06RW043

7. Remove the fuel pressure regulator from the fuel rail.

Disassembly Procedure

1. Remove the O-ring from the fuel pressure regulator.
2. Loosen the swivel nut.
3. Remove the fuel return line from the fuel pressure regulator.
4. Remove the O-ring from the fuel return line.
 - The O-ring may be left inside the fuel pressure regulator instead of on the fuel return line.



F06RW043

Assembly Procedure

1. Install a new O-ring on the fuel return line.
2. Install the fuel return line on the fuel pressure regulator.

NOTE: Do not over-tighten the swivel nut on the fuel pressure regulator. The fuel pressure regulator can be damaged and fuel may leak if the swivel nut is over-tightened.

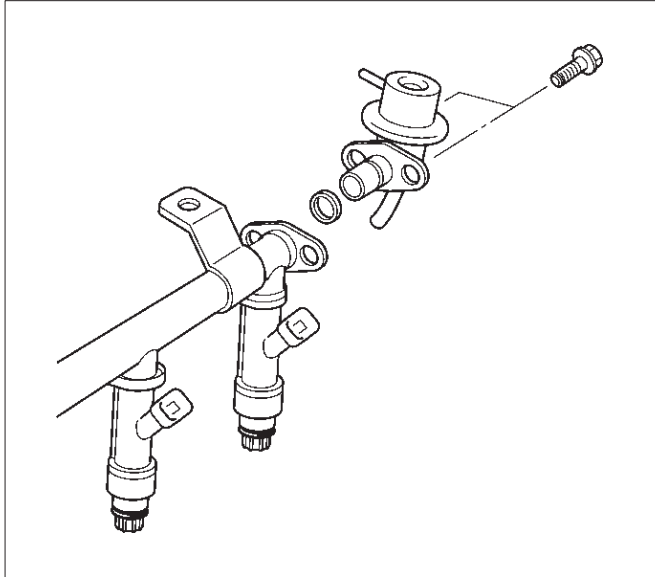
3. Tighten the swivel nut.
4. Install a new O-ring on the fuel pressure regulator.

Installation Procedure

1. Install the fuel pressure regulator attaching screw.

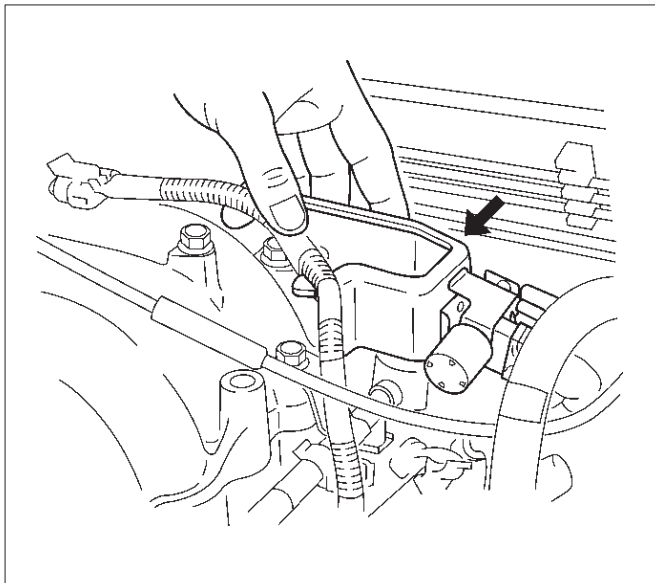
Tighten

- Tighten the fuel pressure regulator attaching screw to 3 N·m (26 lb in.).



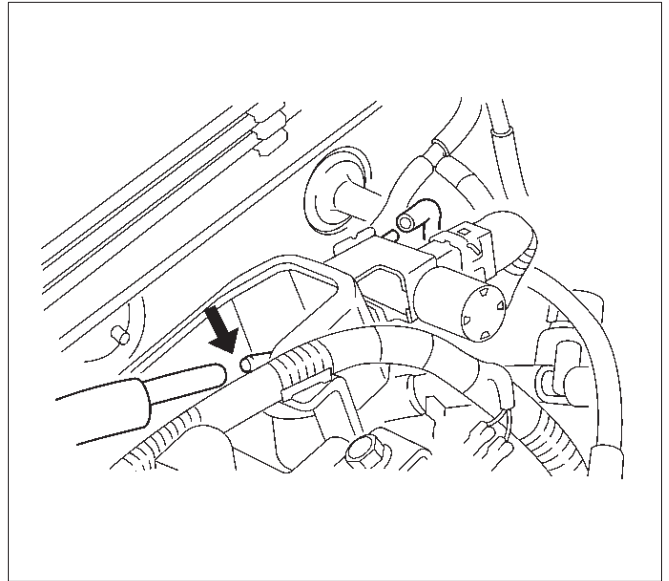
F06RW043

2. Install the fuel pressure regulator on the fuel rail.
3. Install the two bolts to the protector that secures the common chamber.



014RW109

4. Install the pressure regulator hose to the fuel pressure regulator.



014RW110

5. Install the fuel pump relay. Refer to *Fuel Pump Relay*.
6. Connect the negative battery cable.
7. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel lines.

Fuel Metering System

Fuel Pressure Relief Procedure

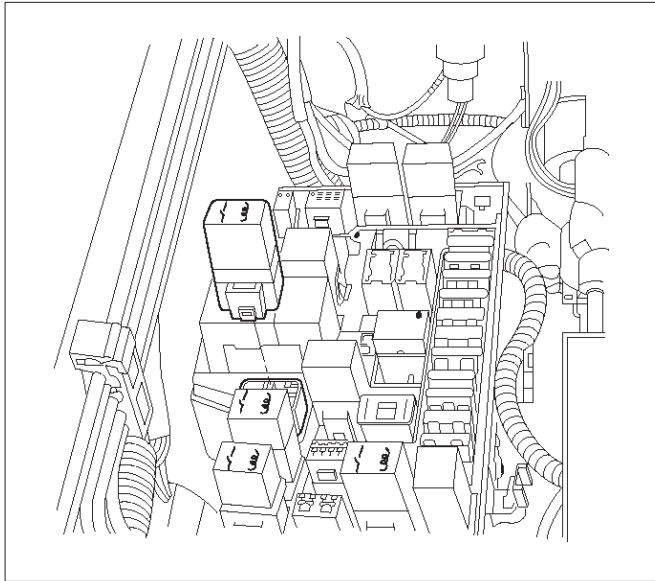
CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before you disconnect the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel cap.

6E-318 ENGINE DRIVEABILITY AND EMISSIONS

2. Remove the fuel pump relay from the underhood relay box. Refer to *Fuel Pump Relay*.



TS23976R

3. Start the engine and allow it to stall.
4. Crank the engine for 30 seconds.
5. Disconnect the negative battery cable.

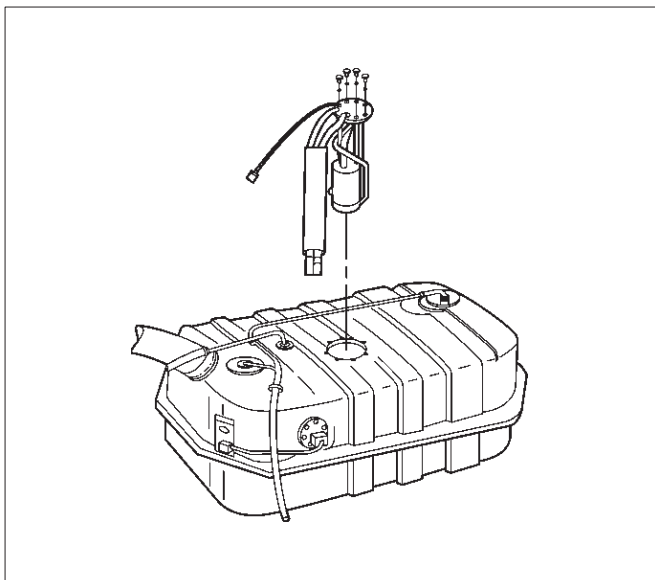
Fuel Pump Assembly

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain all the fuel from the tank.
3. Install and tighten the drain plug.

Tighten

- Tighten the drain plug to 20 N-m (14 lb ft.).
4. Remove the fuel tank. Refer to *Fuel Tank*.
 5. Remove the retaining screws from the fuel tank.
 6. Remove the fuel pump assembly from the fuel tank.
 - Cover the fuel pump opening in order to prevent dust, dirt, or debris from entering the fuel tank.



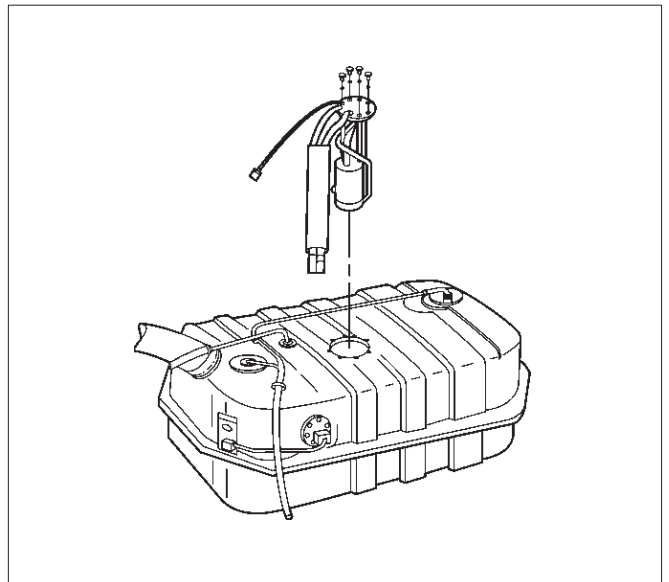
TS23795

Inspection Procedure

1. Inspect the fuel pump gasket for tears, cracks, stretching, or rotting. If any of these conditions are found, replace the fuel pump gasket.
2. Inspect the in-tank fuel filter for tears or evidence of dirt, debris, or water in the fuel. If any of these conditions are found, replace the in-tank fuel filter.

Installation Procedure

1. Install the fuel pump assembly.
2. Install the fuel pump assembly retaining screws.
3. Install the fuel tank assembly. Refer to *Fuel Tank*.
4. Fill the tank with fuel.
5. Tighten the fuel filler cap.
6. Connect the negative battery cable.

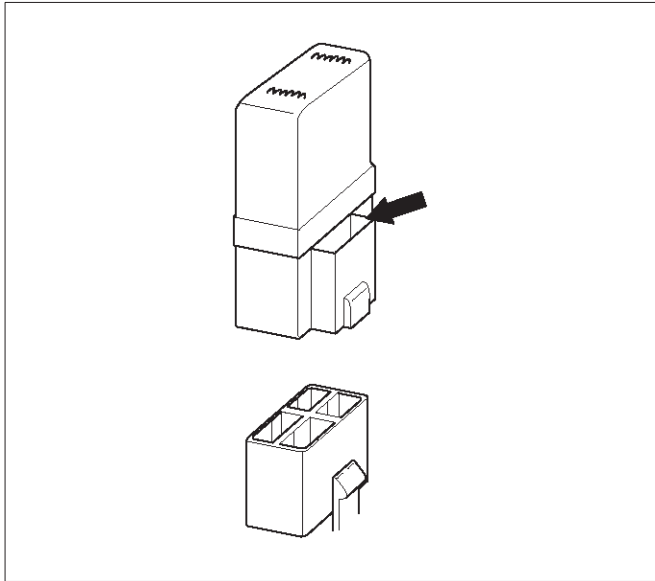


TS23795

Fuel Pump Relay

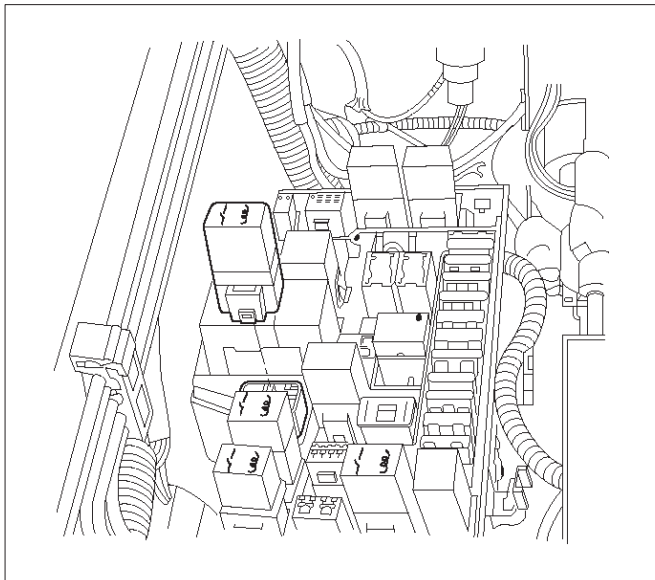
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
 - The screwdriver blade will release the catch inside.



T321092

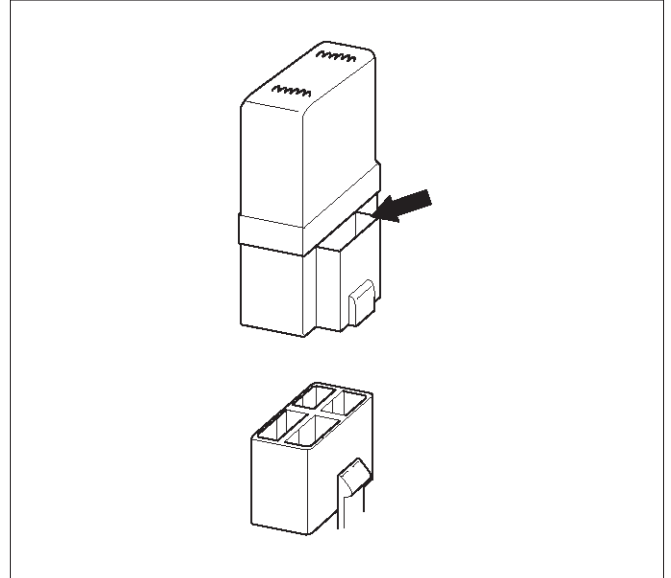
4. Pull the relay straight up and out of the fuse and relay box.



TS23976R

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
 - An audible "click" will be heard.



T321092

3. Install the fuse and relay box cover.

Fuel Rail Assembly

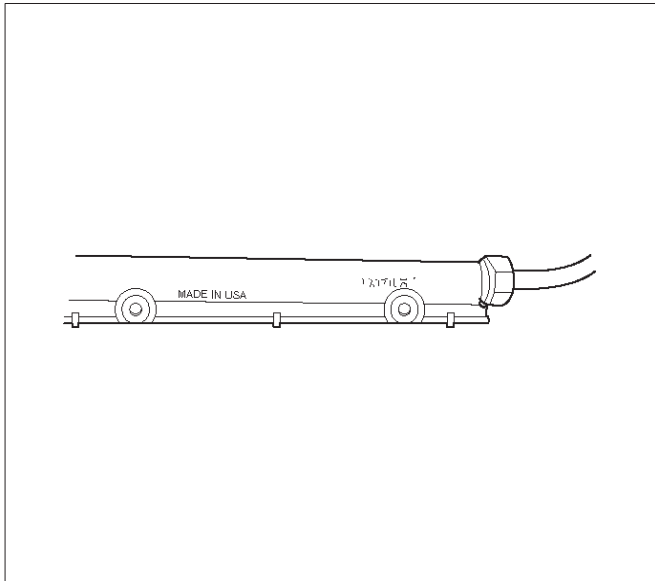
Removal Procedure

NOTE:

- Do not attempt to remove the fuel inlet fitting on the fuel rail. It is staked in place. Removing the fuel inlet fitting will result in damage to the fuel rail or the internal O-ring seal.
- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminals and the injector spray tips.
- Fittings should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passages.

6E-320 ENGINE DRIVEABILITY AND EMISSIONS

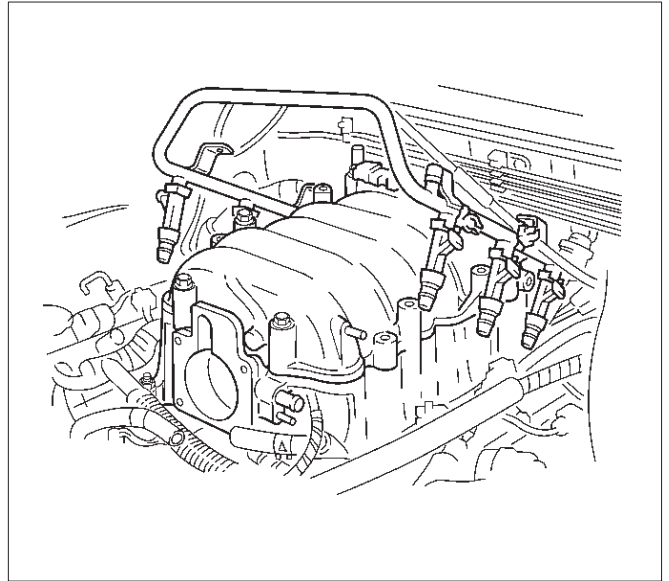
IMPORTANT: An eight-digit identification number is stamped on the side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.



TS24022

Before removal, the fuel rail assembly may be cleaned with a spray type engine cleaner. Follow the spray package instructions. Do not immerse the fuel rails in liquid cleaning solvent.

1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure in this Section.
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Disconnect the accelerator pedal cable from throttle body and cable bracket.
5. Disconnect the connectors from manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Disconnect the vacuum hose on canister VSV and positive crankcase ventilation hose.
7. Remove the common chamber. Refer to the common chamber in Engine Mechanical.
 1. Lift up carefully on the fuel injectors. Do not separate the fuel injectors from the fuel rail.
 2. If an injector becomes separated from the fuel rail, the injector O-ring seals and the retainer clip must be replaced.
 3. Drain residual fuel into an approved container.

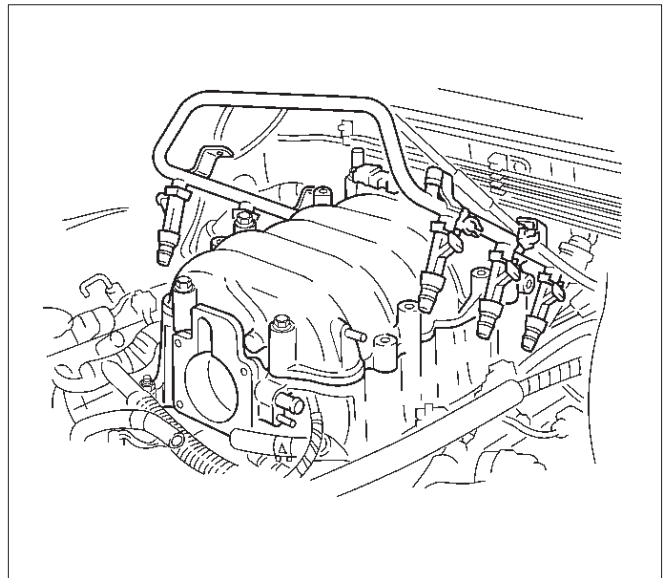


014RW164

8. If removal of the fuel pressure regulator is necessary, refer to *Fuel Pressure Regulator*.
9. If removal of the fuel injectors is necessary, refer to *Fuel Injectors*.

Installation Procedure

1. If the fuel injectors were removed, install them. Refer to *Fuel Injectors*.
2. If the fuel pressure regulator was removed, install it. Refer to *Fuel Pressure Regulator*.
3. Install the common chamber. Refer to common chamber in engine Mechanical.



014RW164

4. Connect the vacuum hose on Canister VSV and positive crankcase ventilation hose.
5. Connect the connectors to manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Connect the accelerator pedal cable to throttle body and cable bracket.
7. Install the engine cover.
8. Connect the negative battery cable.
9. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel rail and in the injectors.

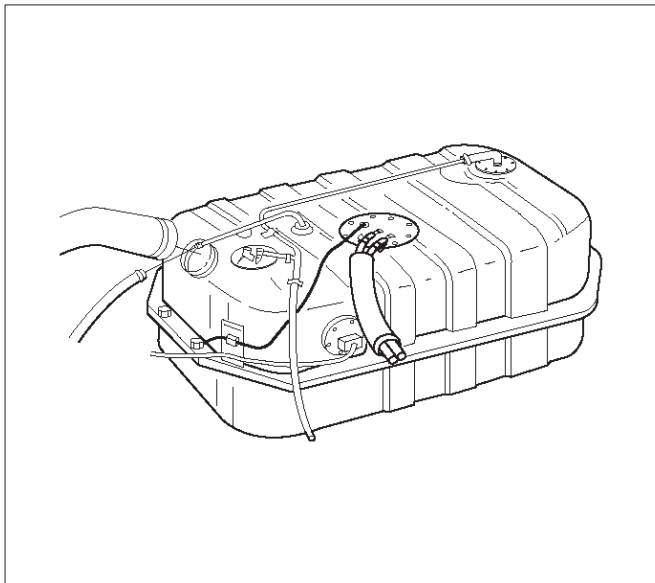
Fuel Tank

Removal Procedure

1. Disconnect the negative battery cable.
2. Loosen the fuel filler cap.
3. Drain the fuel from the tank into an approved container.
4. Install and tighten the drain plug.

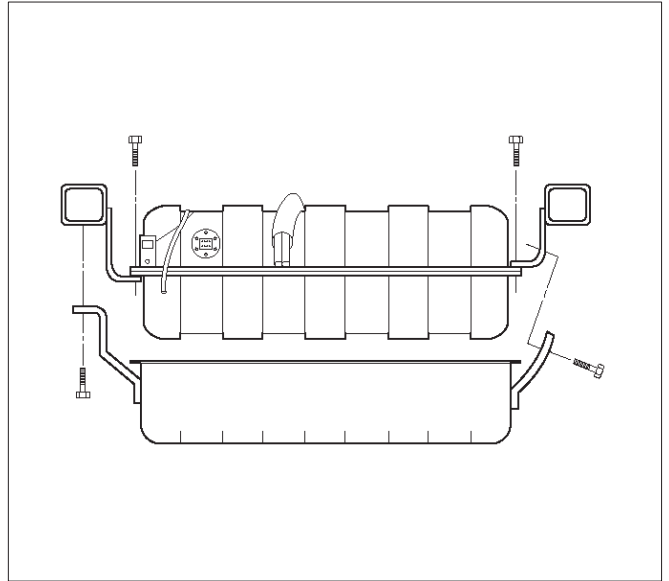
Tighten

- Tighten the drain plug to 20 N·m (14 lb ft.).
5. Disconnect the fuel filler hose at the fuel tank.
 6. Disconnect the air breather hose at the fuel tank.



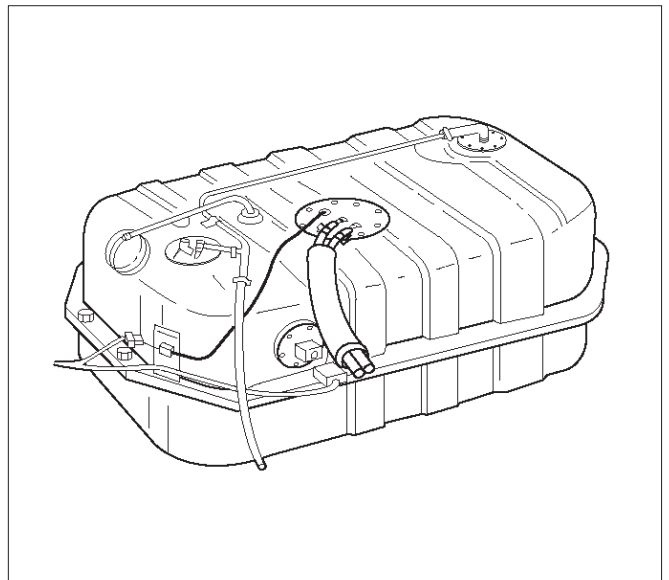
TS23796

7. Remove the undercover retaining bolts.
8. Remove the undercover.



TS23797

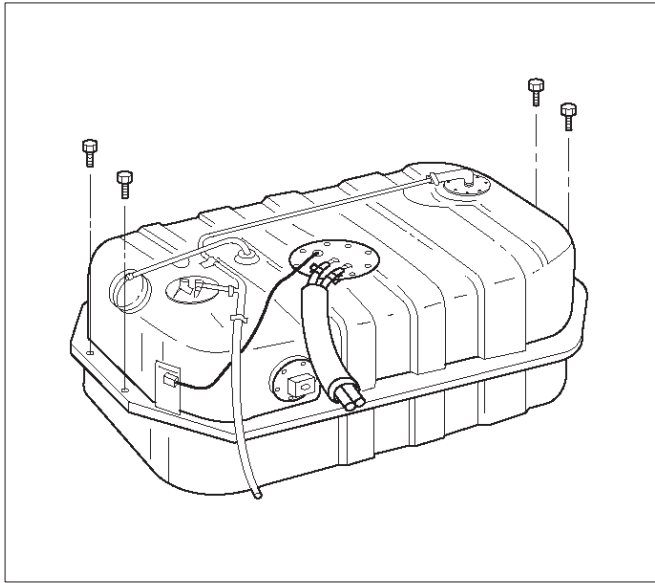
9. Disconnect the wiring connector to the fuel pump.
10. Disconnect the wiring connector to the fuel gauge unit.
11. Remove the fuel gauge unit connector from the bracket.
12. Disconnect the EVAP vapor hose.
13. Disconnect the fuel supply hose.
14. Disconnect the fuel return hose.
 - Plug the hoses to prevent dust from entering the hoses.



TS23769

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15. Remove the fuel tank retaining bolts on both sides.
16. Remove the fuel tank.



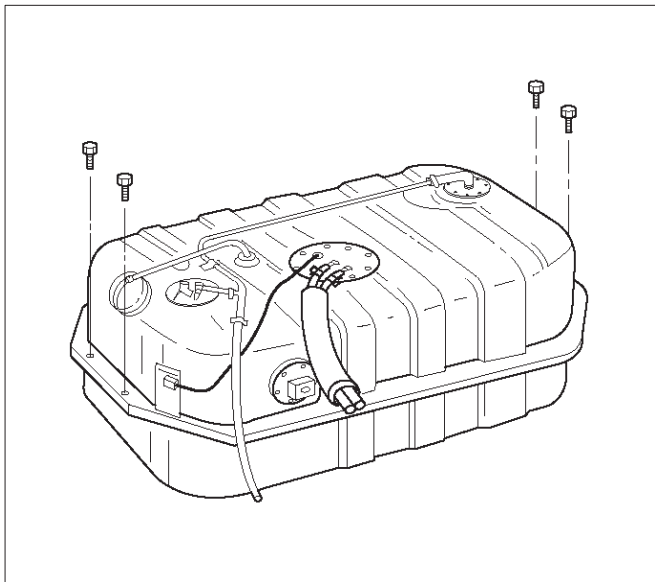
TS23770

Installation Procedure

1. Install the fuel tank.
 - Place the flanges on the left and right side of the tank on the bracket.
2. Install the fuel tank retaining bolts.

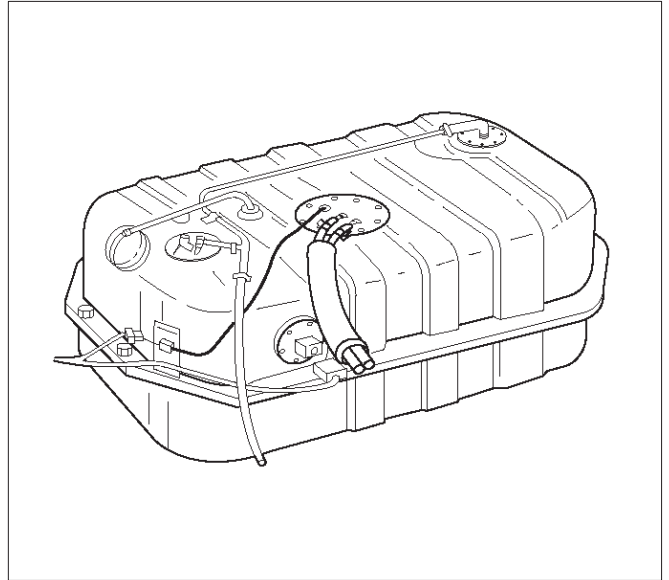
Tighten

- Tighten the fuel tank retaining bolts to 36 N·m (27 lb ft.).



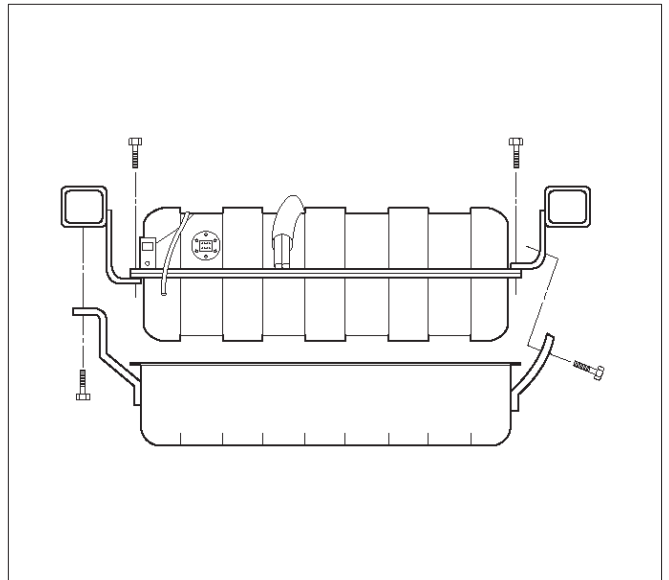
TS23770

3. Connect the fuel return hose.
4. Connect the fuel supply hose.
5. Connect the EVAP vapor hose.
6. Connect the wiring connector for the fuel gauge unit.
7. Connect the fuel gauge wiring connector to the bracket.
8. Connect the wiring connector for the fuel pump.



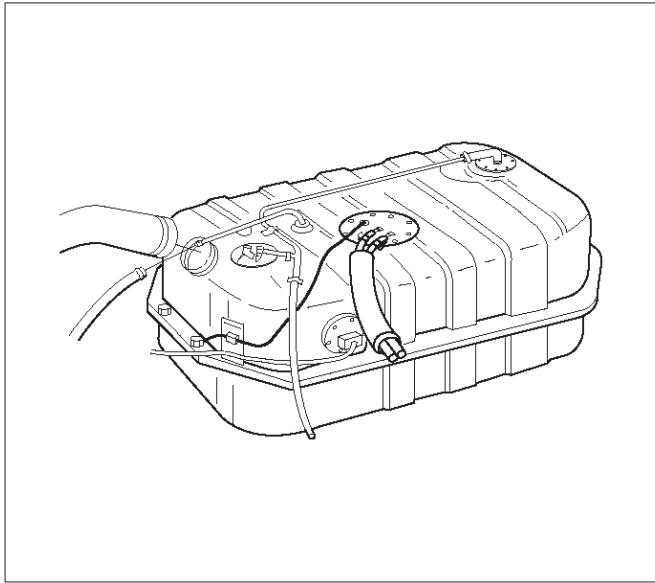
TS23769

9. Install the undercover.
10. Secure the undercover with the retaining bolts.



TS23797

11. Connect the fuel filler fuse at the tank.
12. Connect the air breather hose at the tank.



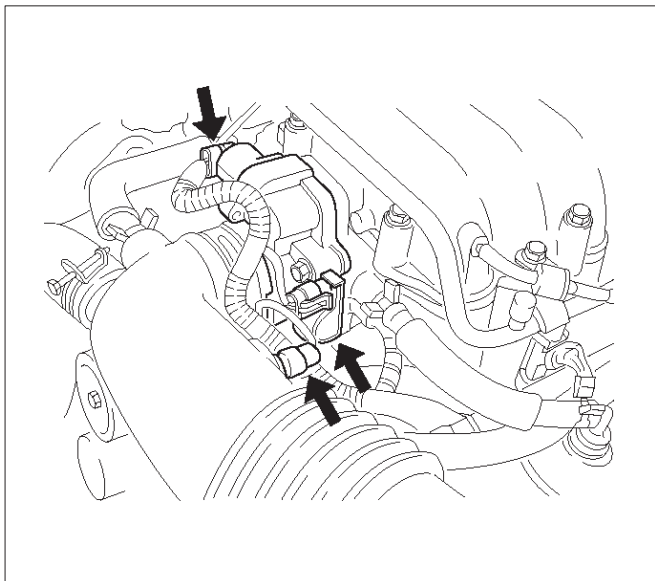
TS23796

13. Fill the fuel tank with fuel.
14. Tighten the fuel filler cap.
15. Connect the negative battery cable.

Throttle Body (TB)

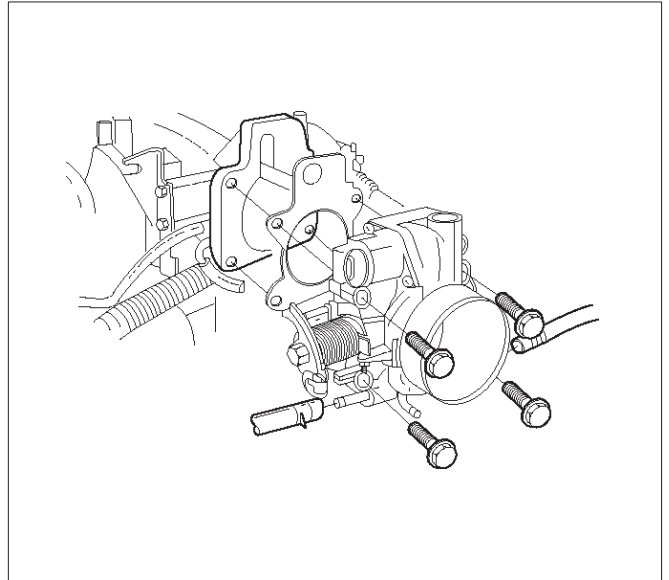
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Cooling System*.
3. Remove the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System*.
4. Disconnect the electrical connectors:
 - Throttle position (TP) sensor.
 - Idle air control (IAC) solenoid.
 - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor*.



035RW023

5. Disconnect the vacuum hose below the air horn.
6. Remove the intake air duct clamp.
7. Disconnect the intake air duct.
8. Disconnect the coolant lines from the throttle body.
9. Remove the bolts from the common chamber.
10. Remove the throttle body from the common chamber.
11. Remove the gasket from the upper intake manifold.



035RW024

12. Remove the IAC. Refer to *Idle Air Control (IAC) Solenoid*.
13. Remove the TP sensor. Refer to *Throttle Position (TP) Sensor*.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

- If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
- Do not leave any scratches in the aluminum casting.

Installation Procedure

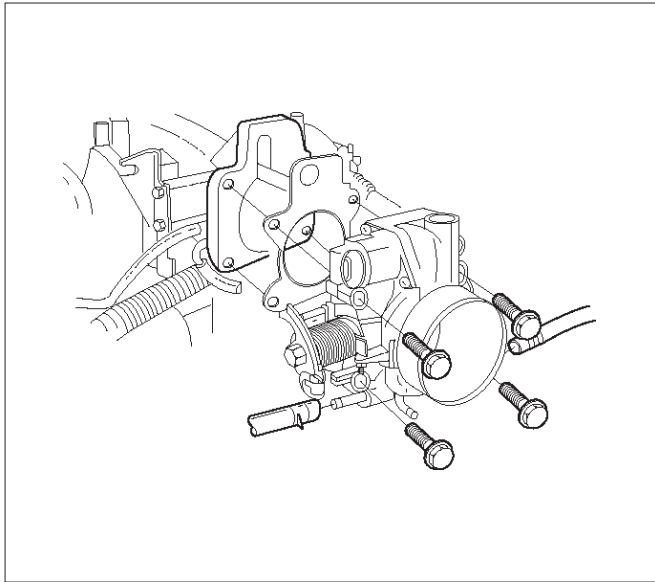
1. Install the TP sensor. Refer to *Throttle Position (TP) Sensor*.
2. Install the IAC. Refer to *Idle Air Control (IAC) Solenoid*.
3. Install the gasket on the common chamber.
4. Install the throttle body on the common chamber.

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- Secure the gasket and the throttle body with the four bolts.
 - The vacuum lines must be properly routed under the throttle body before tightening the mounting bolts.

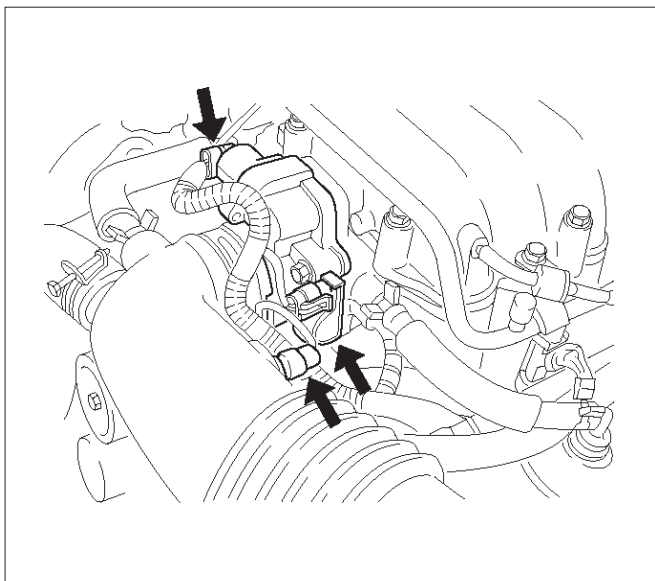
Tighten

- Tighten the throttle body mounting bolts to 24 N·m (17 lb ft.).



035RW024

- Install the coolant lines.
- Connect all the vacuum lines.
- Install the intake air duct.
- Tighten the intake air duct clamp.
- Connect all the electrical connectors:
 - Throttle position (TP) sensor.
 - Idle air control (IAC) solenoid.
 - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor*.



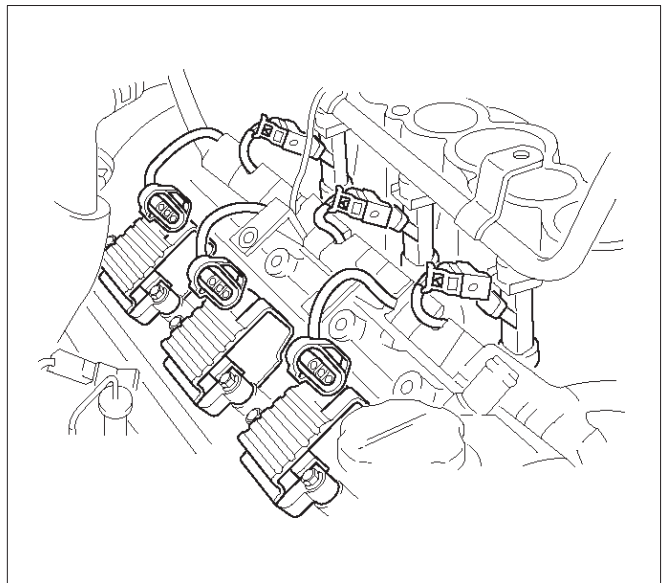
035RW023

- Install the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System*.
- Fill the cooling system. Refer to *Cooling System*.
- Install the negative battery cable.

Electronic Ignition System

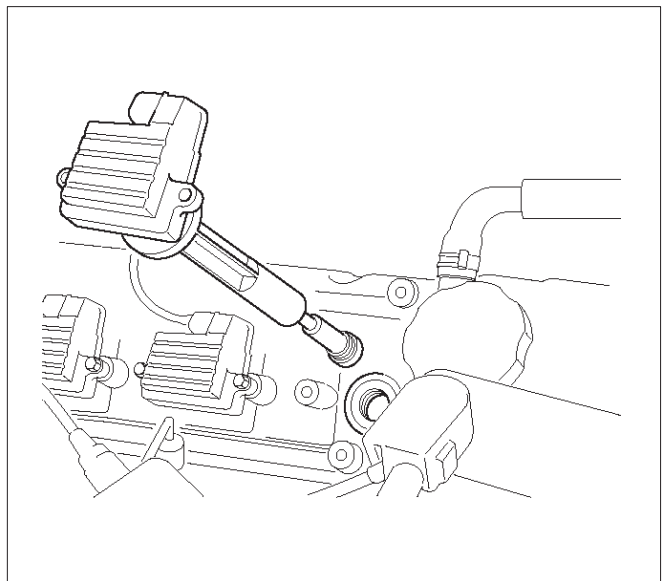
Removal Procedure

- Disconnect the negative battery cable.
- Disconnect the electrical connector at the ignition coil.
- Remove the two screws that secure the ignition coil to the rocker cover.



014RW108

- Remove the ignition coil and the spark plug boot from the spark plug.
 - Twist the ignition coil while pulling it straight up.



014RW091

- Use the spark plug socket in order to remove the spark plug from the engine.

Spark Plug Gap Check

- Check the gap of all spark plugs before installation.
- Use a round wire feeler gauge to ensure an accurate check.
- Plugs installed with the wrong gap can cause poor engine performance and excessive emissions.

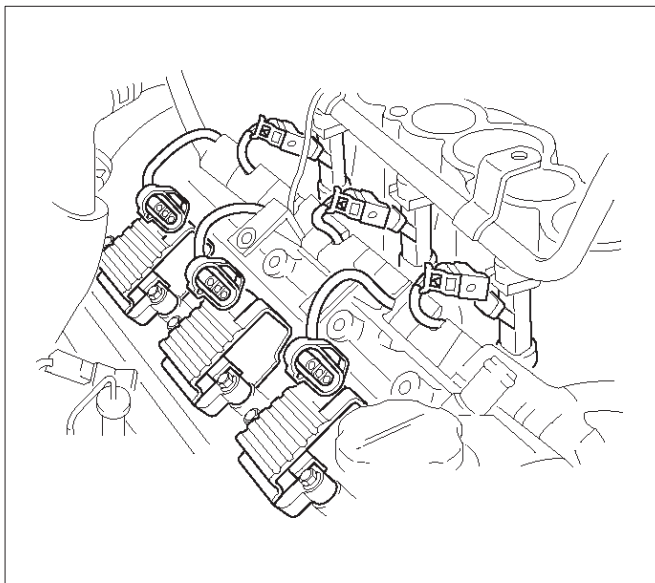
Installation Procedure

NOTE: The plug must thread smoothly into the cylinder head and be fully seated. Use a thread chaser if necessary to clean the threads in the cylinder head. Cross-threading or failure to fully seat the spark plug can cause plug overheating, exhaust blow-by gas, or thread damage. Do not overtighten the spark plugs. Over tightening can cause aluminum threads to strip.

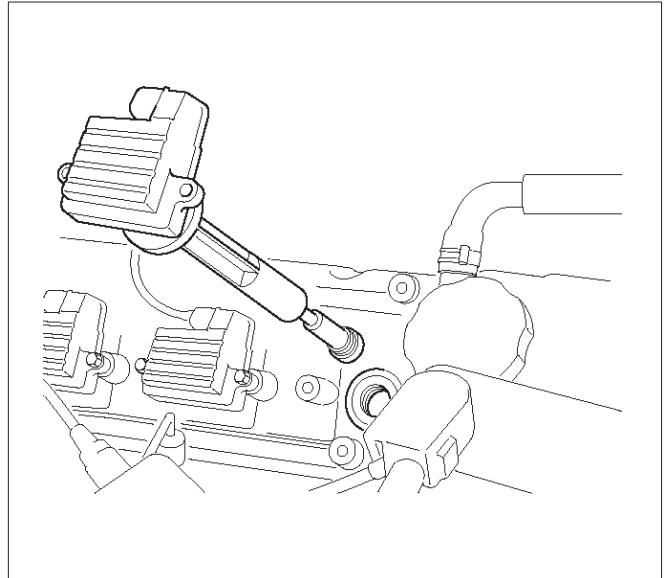
1. Install the spark plug in the engine. Use the appropriate spark plug socket.

Tighten

- Tighten the spark plug to 18 N·m (13 lb ft.).
2. Install the ignition coil and spark plug boot over the spark plug.



3. Secure the ignition coil to the rocker cover with two screws.



4. Connect the electrical connector at the ignition coil.
5. Connect the negative battery cable.

Catalytic Converter

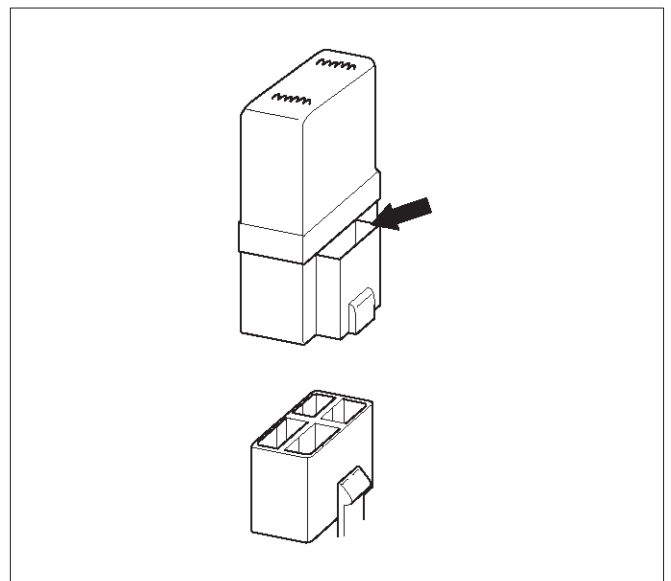
Removal and Installation Procedure

Refer to *Engine Exhaust in Engine*.

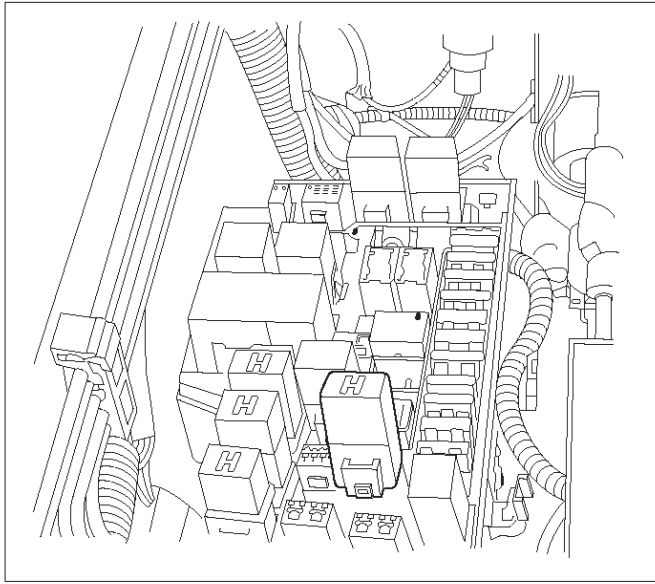
Air Conditioning Relay

Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
 - The screwdriver blade will release the catch inside.



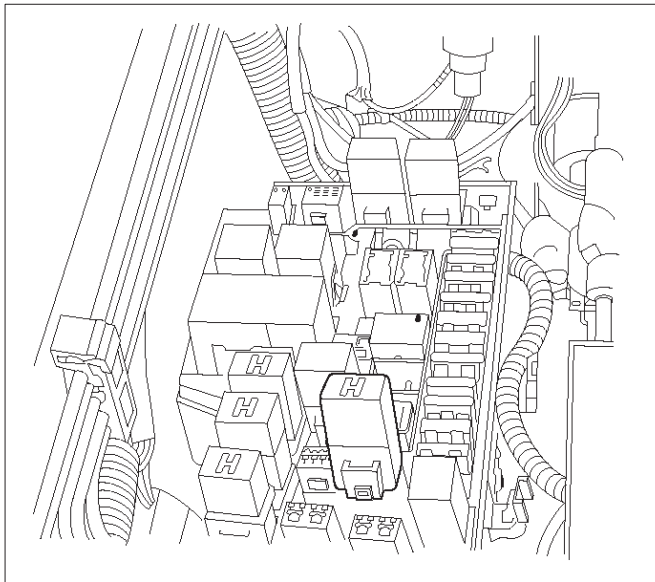
4. Pull the relay straight up and out of the fuse and relay box.



TS23986

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
 - An audible “click” will be heard.
3. Install the fuse and relay box cover.



TS23986

EVAP Canister Hoses

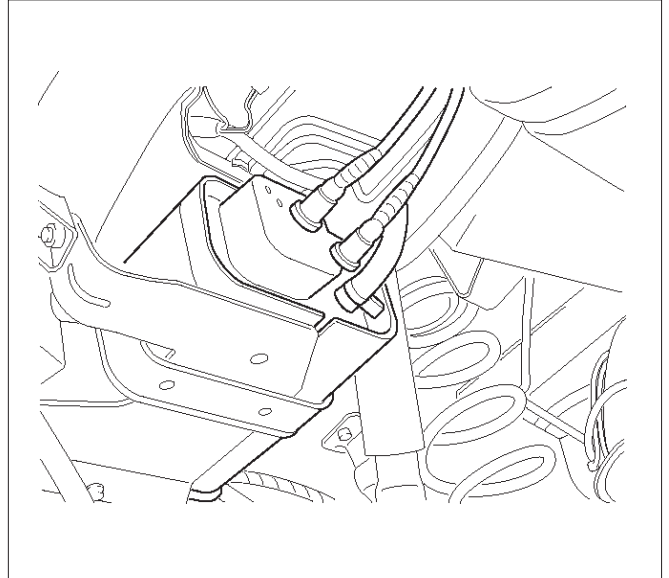
Service Information

To view the routing of the EVAP canister hoses, refer to *Vehicle Emission Control Information in Diagnosis*. Use 6148M or equivalent when you replace the EVAP canister hoses.

EVAP Canister

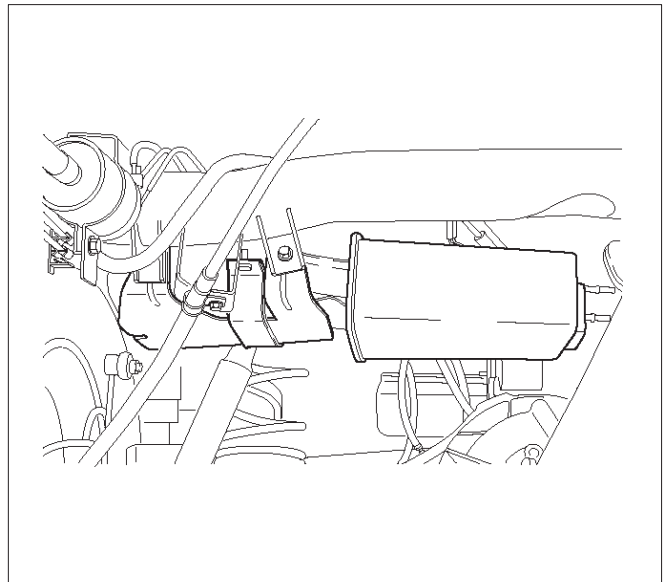
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the three hoses from the EVAP canister.



014RW145

3. Remove the retaining two bolts on the mounting bracket and slide the canister out of mounting bracket.



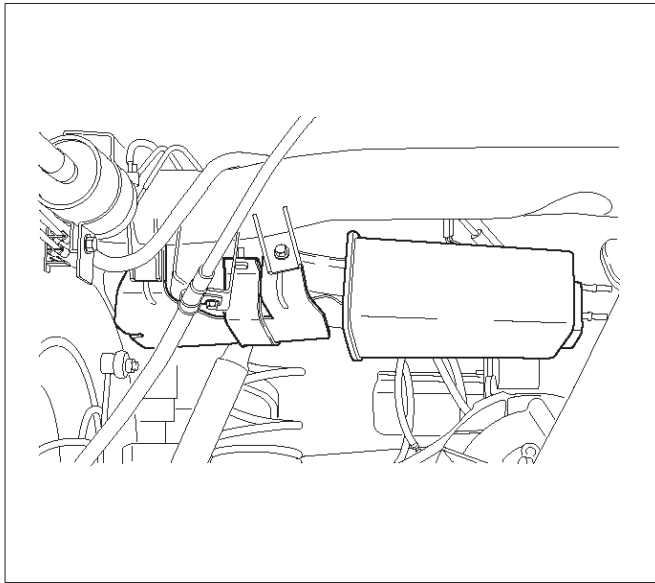
014RW146

Inspection Procedure

1. Inspect the hoses for cracks and leaks.
2. Inspect the canister for a damaged case.

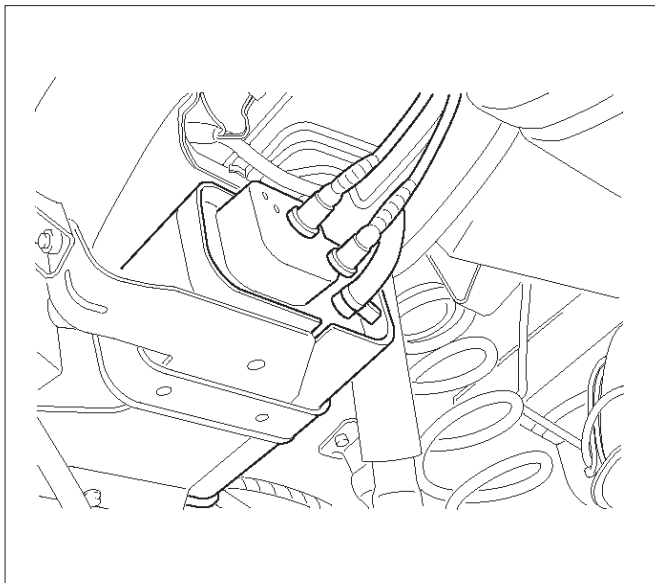
Installation Procedure

1. Slide the canister into mounting bracket and install the mounting bracket two bolts.



014RW146

2. Connect the three hoses to the EVAP canister.



014RW145

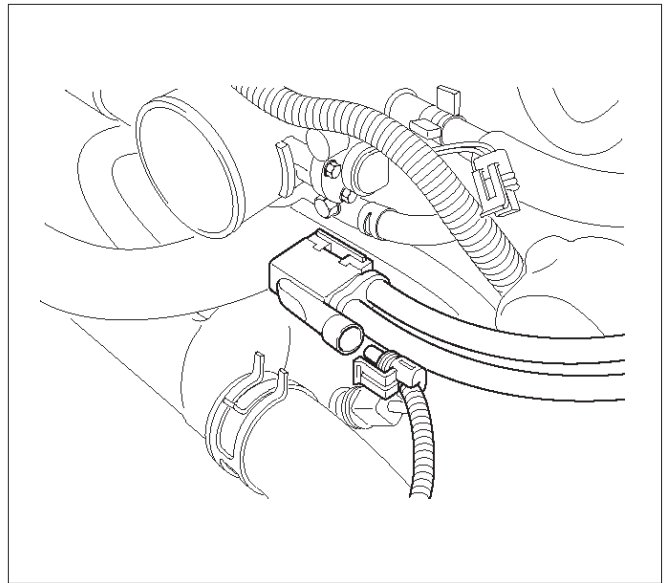
3. Disconnect the negative battery cable.

EVAP Canister Purge Solenoid

Removal Procedure

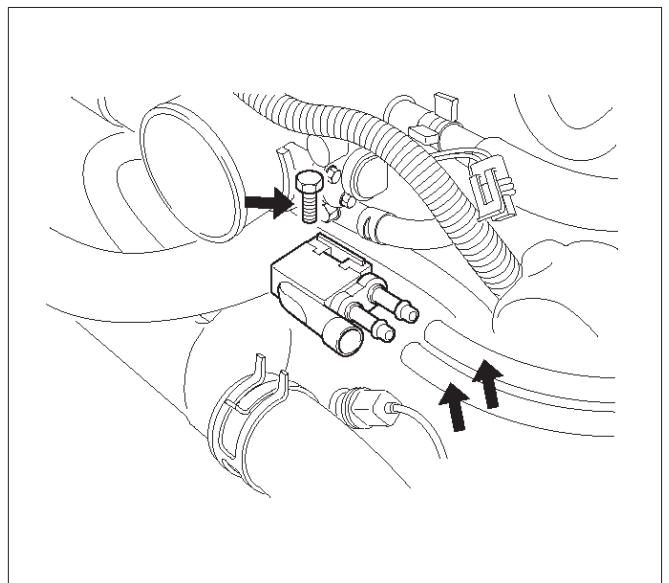
1. Disconnect the electrical connector from the EVAP canister purge solenoid.

2. Disconnect the vacuum hoses from the EVAP canister purge solenoid.



014RW136

3. Remove the EVAP canister purge solenoid retaining bolt from the upper intake manifold.
4. Remove the EVAP canister purge solenoid.



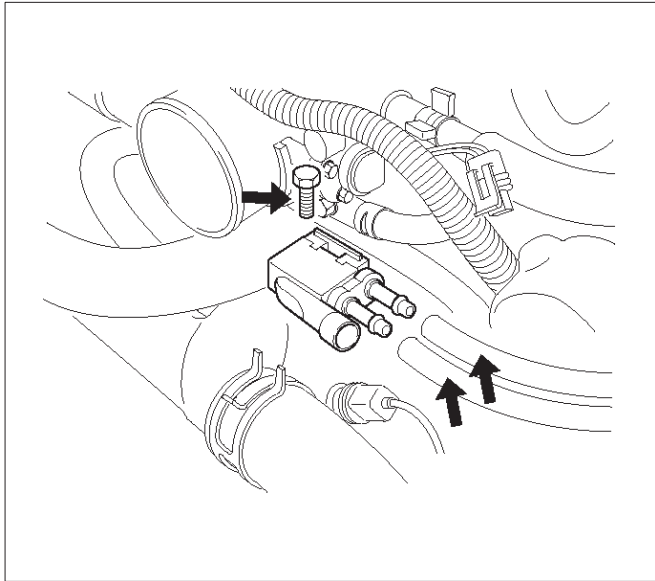
014RW137

Installation Procedure

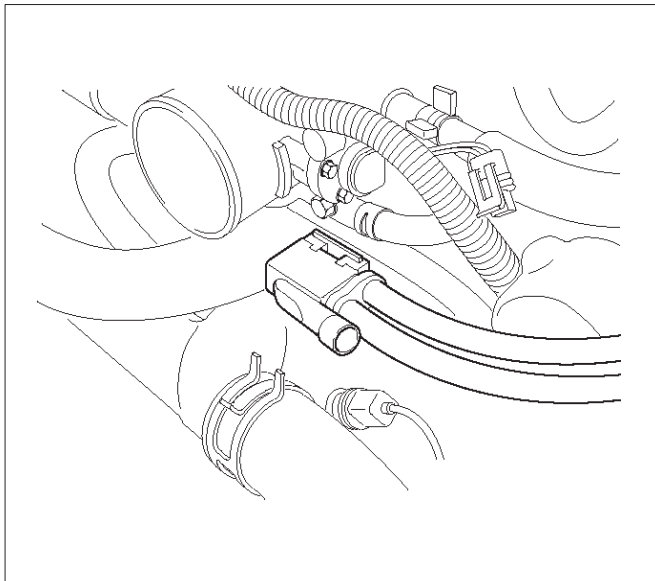
1. Install the EVAP canister purge solenoid on the upper intake manifold.
2. Install the EVAP canister purge solenoid retaining bolt.

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3. Connect the vacuum hoses to the EVAP canister purge solenoid.



4. Connect the electrical connector to the EVAP canister purge solenoid.



Fuel Tank Vent Valve

Removal and Installation Procedure

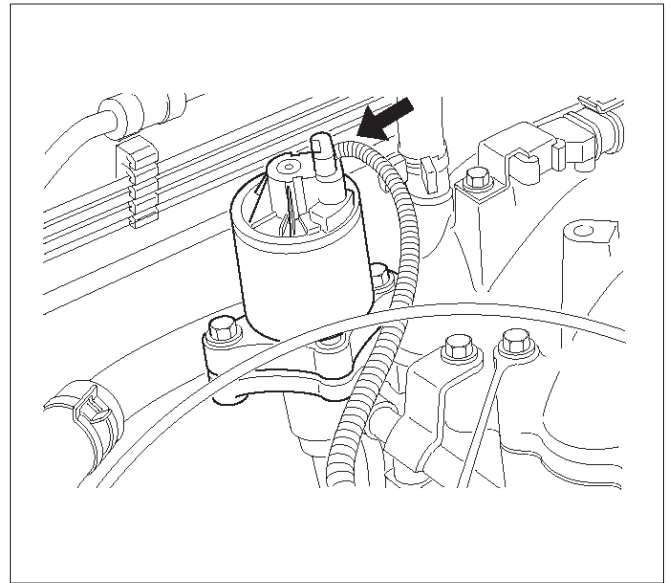
Refer to *Fuel Pump*

Linear Exhaust Gas Recirculation (EGR) Valve

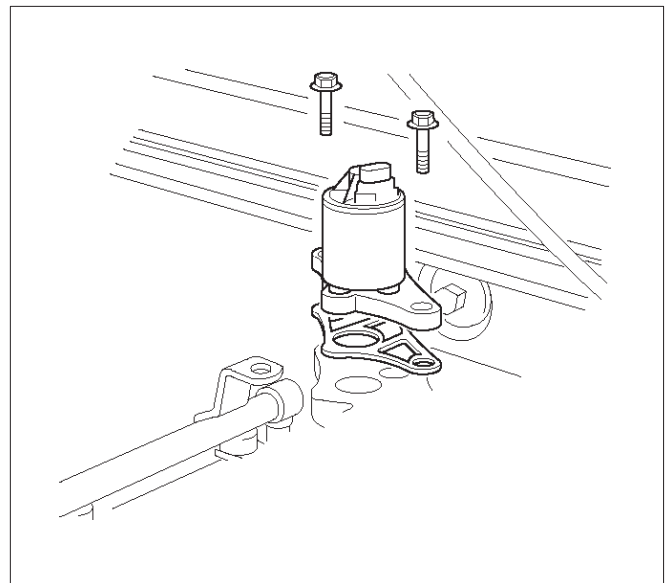
Removal Procedure

1. Disconnect the negative battery cable.

2. Disconnect the electrical connector at the EGR valve.



3. Remove the bolt and the nut from the upper intake manifold.

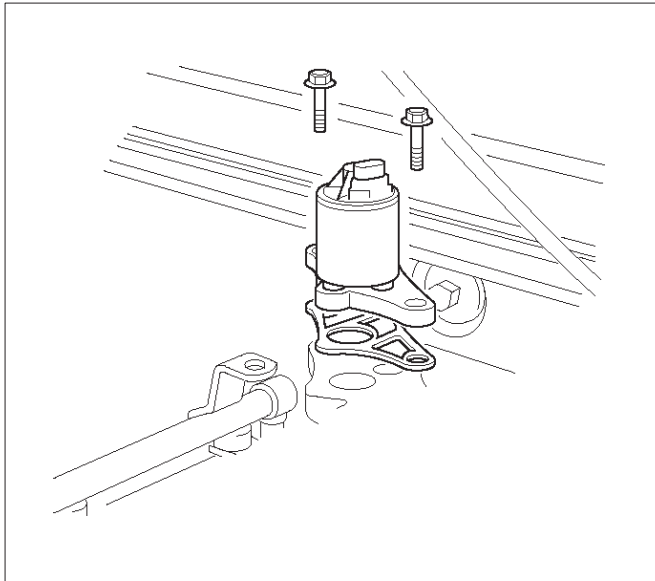


4. Remove the EGR valve from the upper intake manifold.
5. Remove the gasket from the upper intake manifold.

Installation Procedure

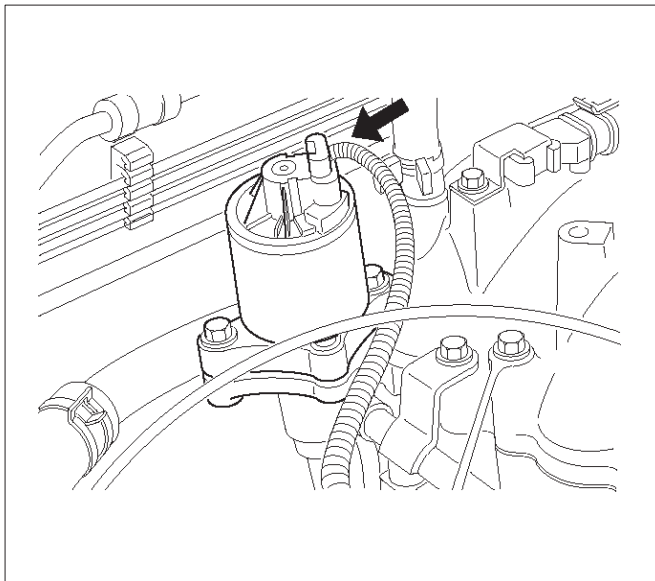
1. Install the gasket on the upper intake manifold.
2. Install the EGR valve on the upper intake manifold.
3. Secure the EGR valve and the gasket with the bolt and the nut.

NOTE: It is possible to install the EGR valve rotated 180° from the correct position. Make sure that the base of the valve is placed so that it aligns with the mounting flange.



014RW098

4. Connect the electrical connector at the EGR valve.



014RW139

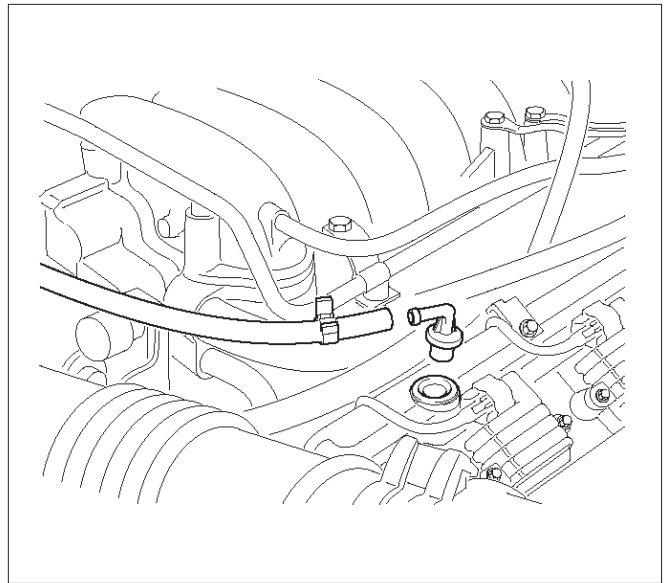
5. Connect the negative battery cable.

Positive Crankcase Ventilation (PCV) Valve

Removal Procedure

1. Remove the vacuum hose at the PCV valve.
 - Slide the clamp back to release the hose.

2. Pull the PCV valve from the rubber grommet in the right valve cover.



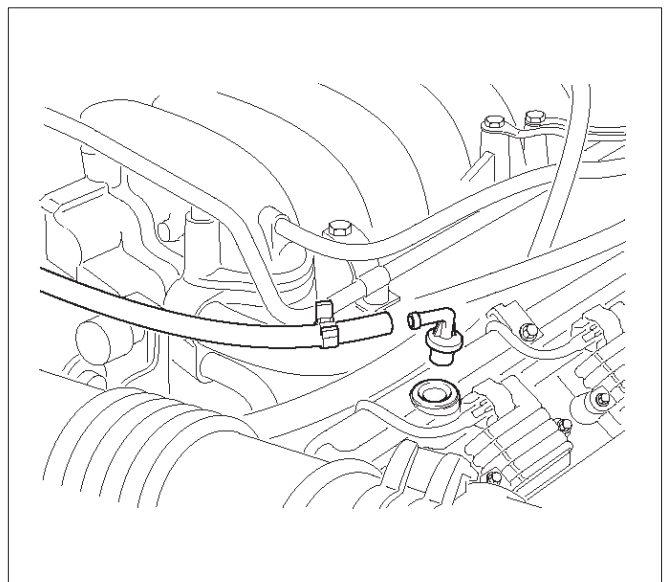
014RW097

Inspection Procedure

1. Shake the valve and listen for the rattle of the needle inside the valve.
2. If the valve does not rattle, replace the valve.

Installation Procedure

1. Push the PCV valve into the rubber grommet in the left valve cover.
2. Install the vacuum hose on the PCV valve and secure the vacuum hose with the clamp.



014RW097

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.

Replace wire harnesses with the proper part number replacement.

Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.

The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* for all wire harness repair procedures.

Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.

Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.

Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

PCM Connectors and Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

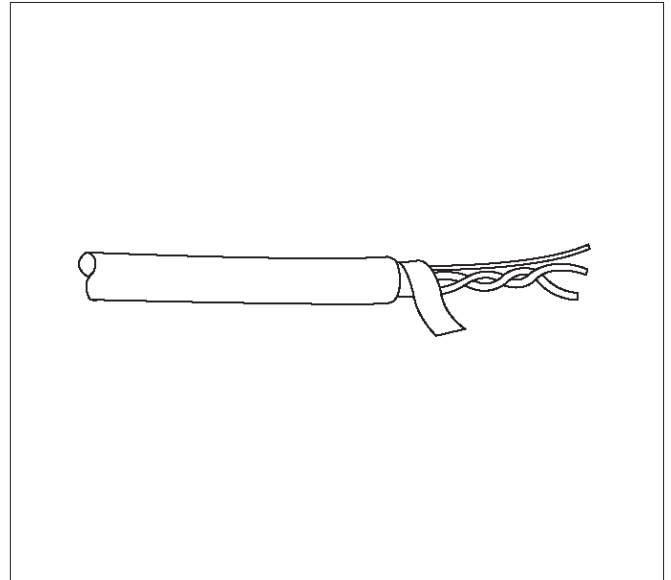
Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulled into position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

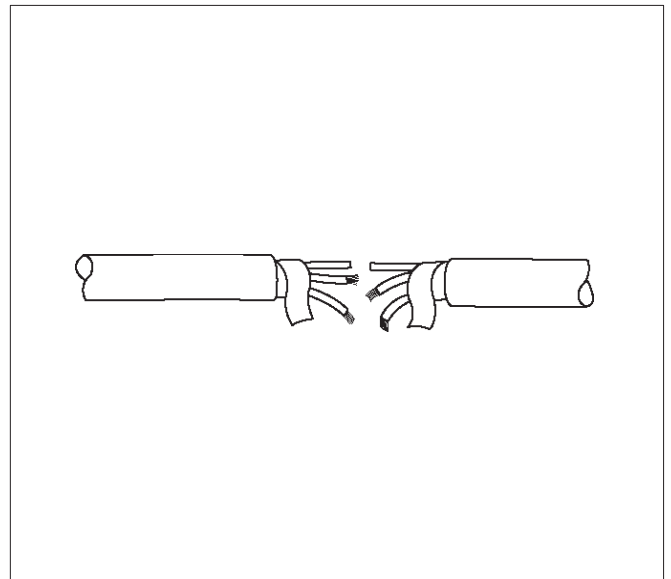
Wire Harness Repair: Twisted Shielded Cable

Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.

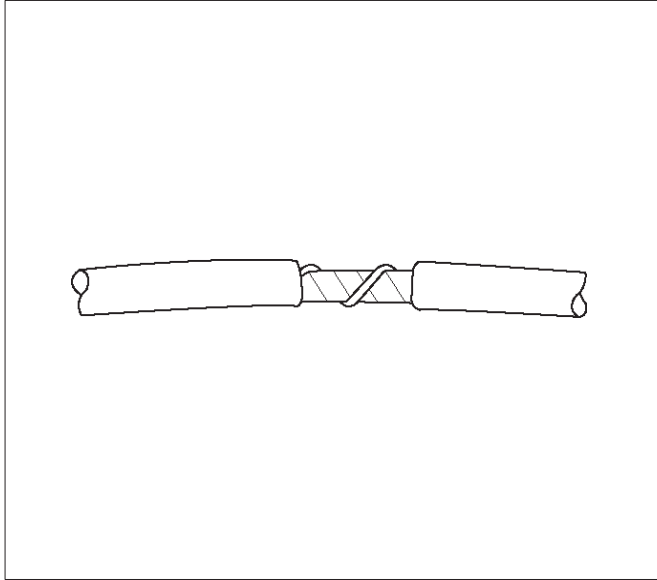


3. Untwist the conductors.
4. Strip the insulation as necessary.



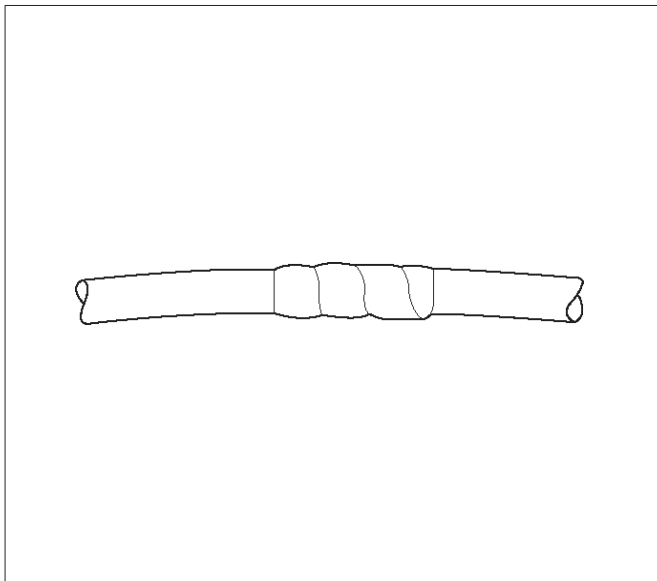
Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



049

4. Tape over the whole bundle to secure.

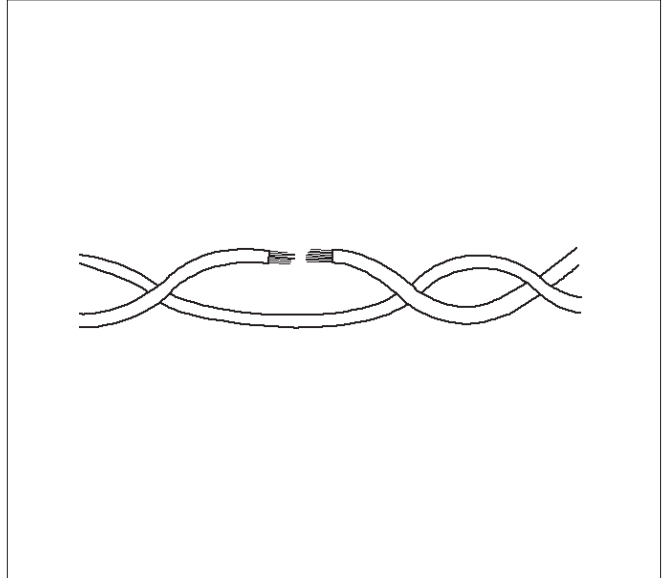


050

Twisted Leads

Removal Procedure

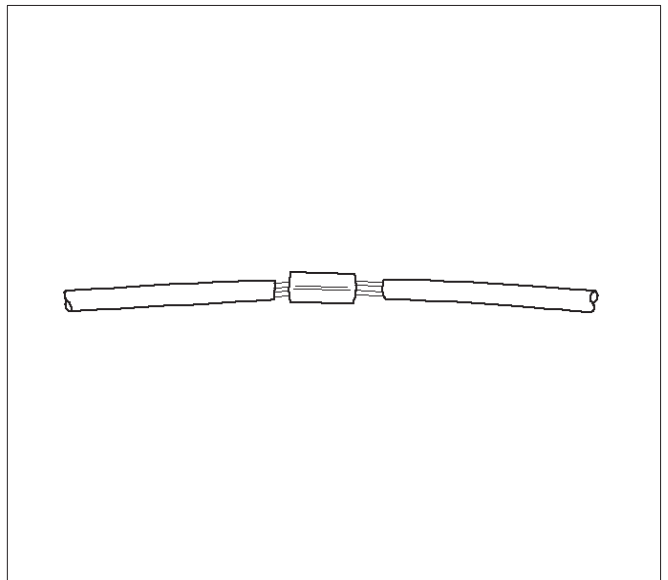
1. Locate the damaged wire.
2. Remove the insulation as required.



051

Installation Procedure

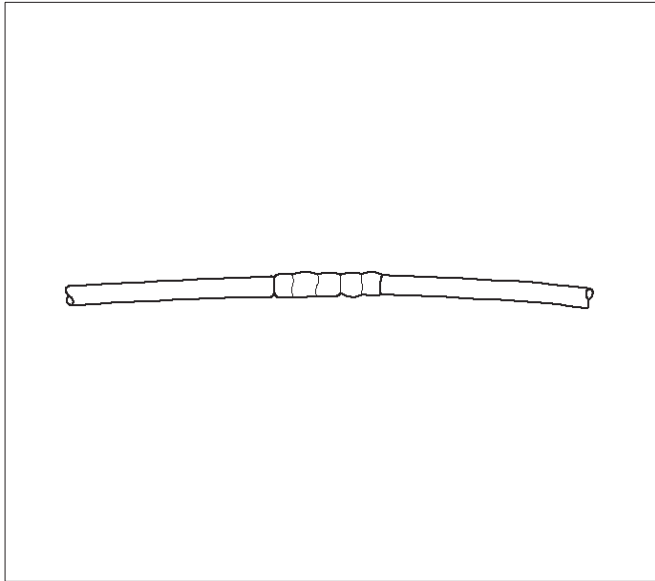
1. Use splice clips and rosin core solder in order to splice the two wires together.



052

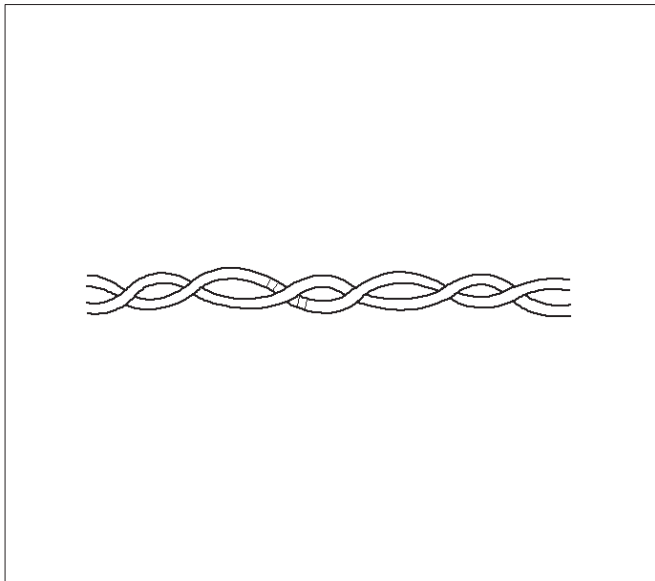
6E-332 ENGINE DRIVEABILITY AND EMISSIONS

2. Cover the splice with tape in order to insulate it from the other wires.



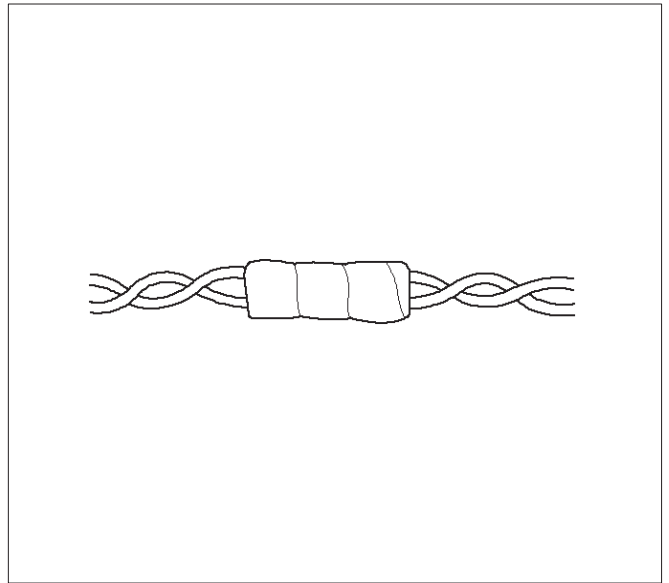
053

3. Twist the wires as they were before starting this procedure.



054

4. Tape the wires with electrical tape. Hold in place.



055

Weather-Pack Connector

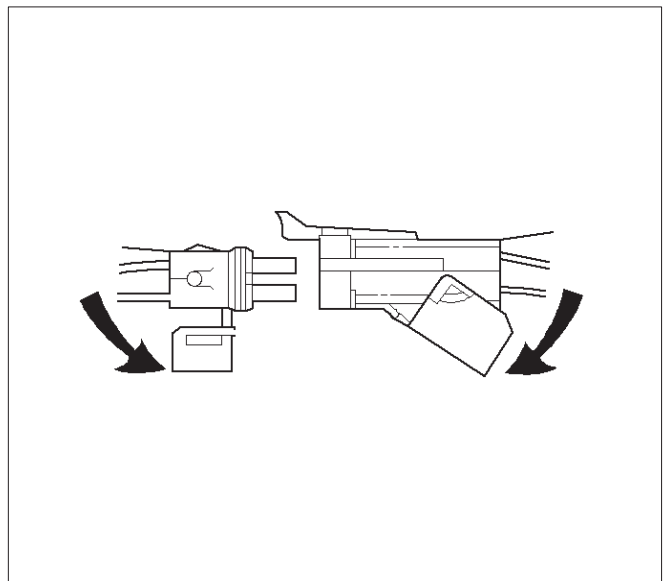
Tools Required

J 28742-A Weather-Pack II Terminal Remover

Removal Procedure

A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could from oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

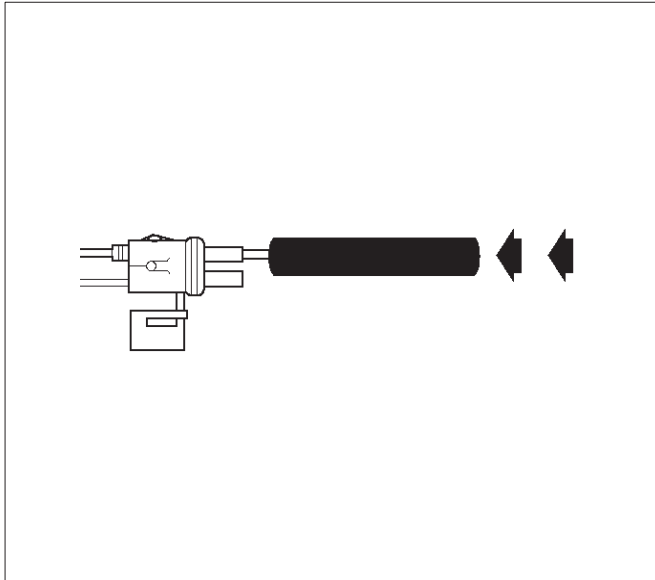
1. Open the secondary lock hinge on the connector.



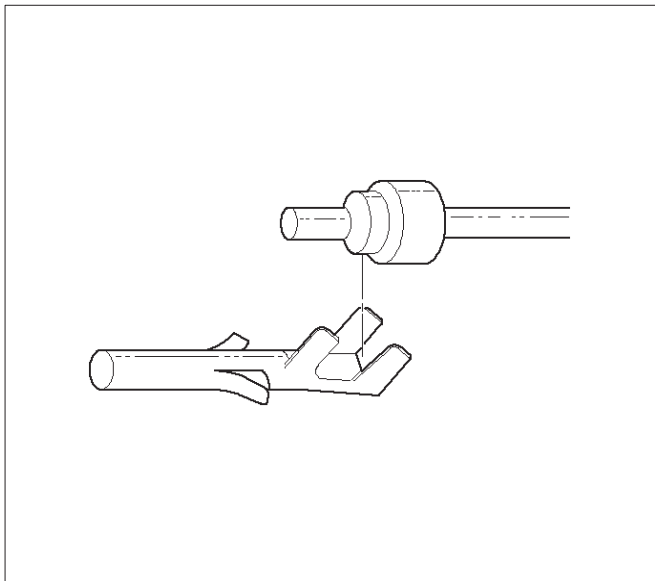
070

2. Use tool J 28742-A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742-A to release.

NOTE: Do not use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



3. Cut the wire immediately behind the cable seal.



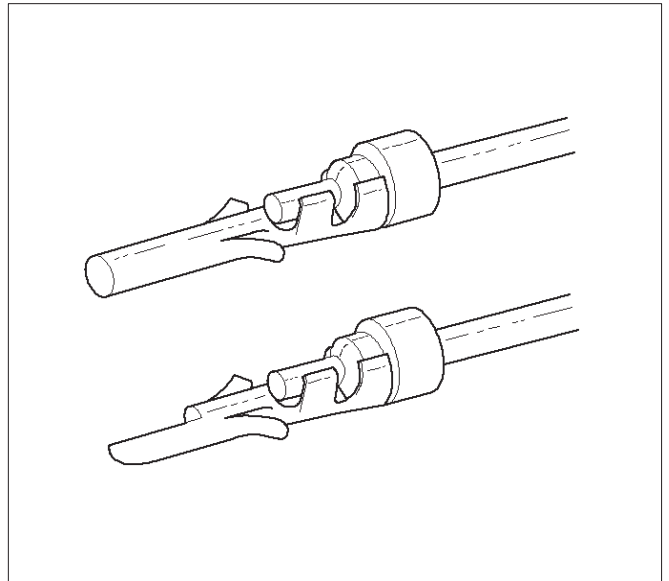
Installation Procedure

Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

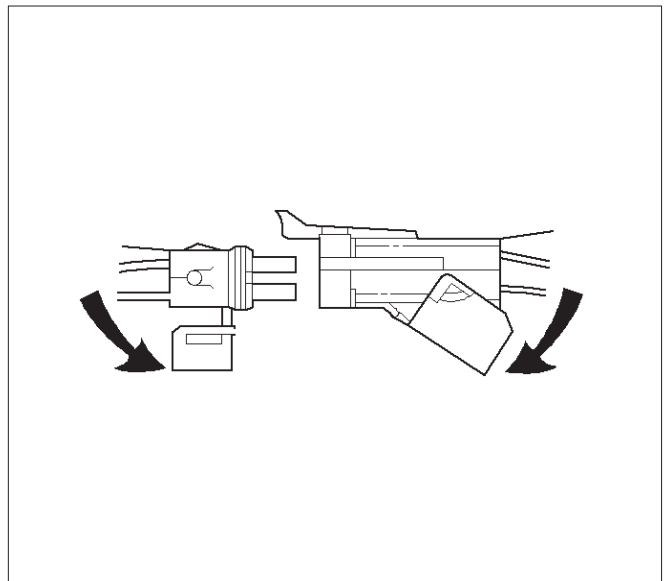
Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.

2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2") of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



5. Push the terminal and the connector to engage the locking tangs.



6. Close the secondary locking hinge.

Com-Pack III

General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or equivalent. These will damage the terminals.

Metri-Pack

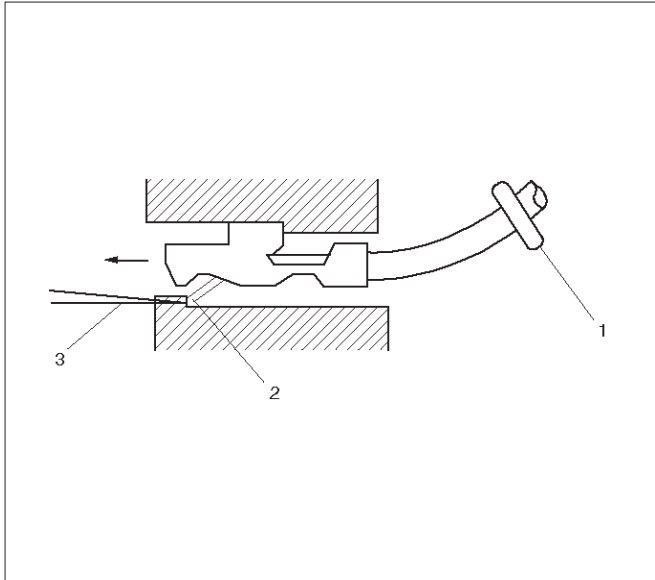
Tools Required

J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).



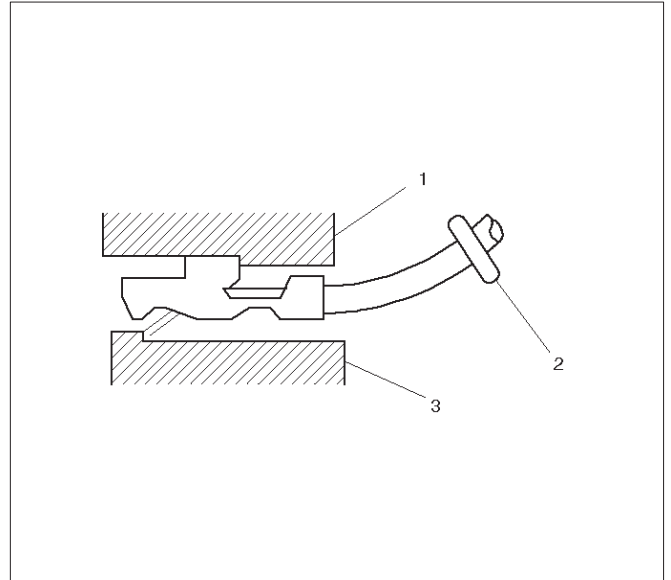
060

3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

Installation Procedure

Metri-Pack terminals are also referred to as "pull-to-seat" terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.



061

3. Then the terminal is pulled back into the connector to seat it in place.

General Description

General Description (PCM and Sensors)

58X Reference PCM Input

The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

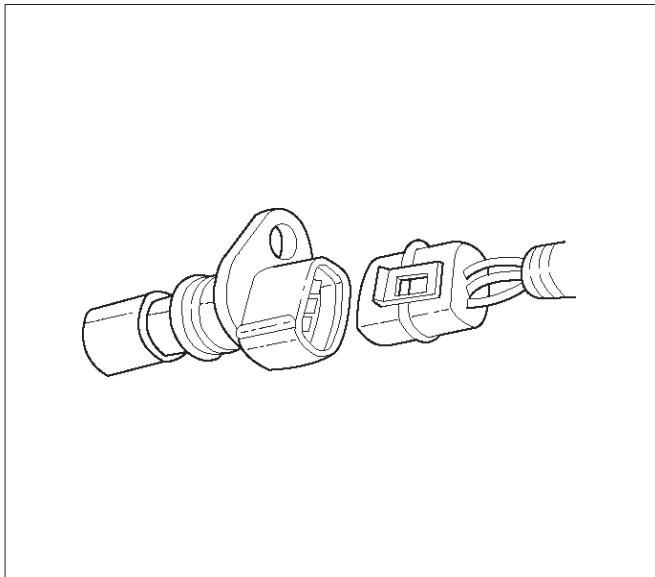
This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning "ON" the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

Refer to *A/C Clutch Circuit Diagnosis* for A/C wiring diagrams and diagnosis for the A/C electrical system.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position.

Refer to *Electronic Ignition System* for additional information.

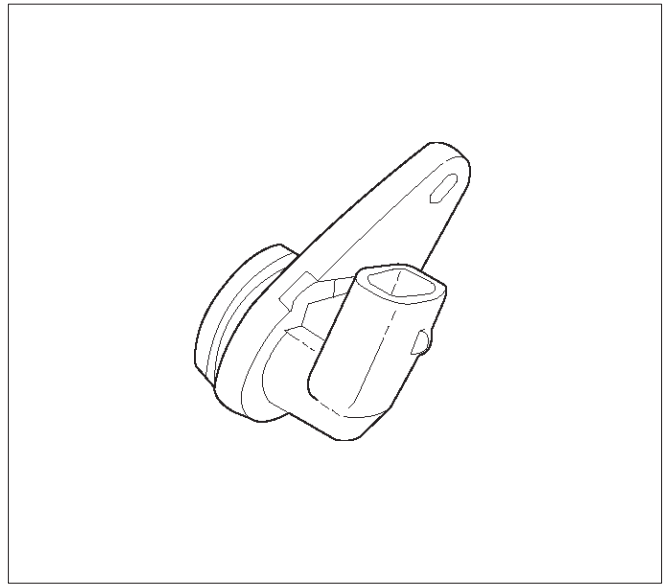


Camshaft Position (CMP) Sensor and Signal

The camshaft position (CMP) sensor sends a CMP signal to the PCM. The PCM uses this signal as a "sync pulse" to

trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1-in-6 chance of the injector sequence being correct.

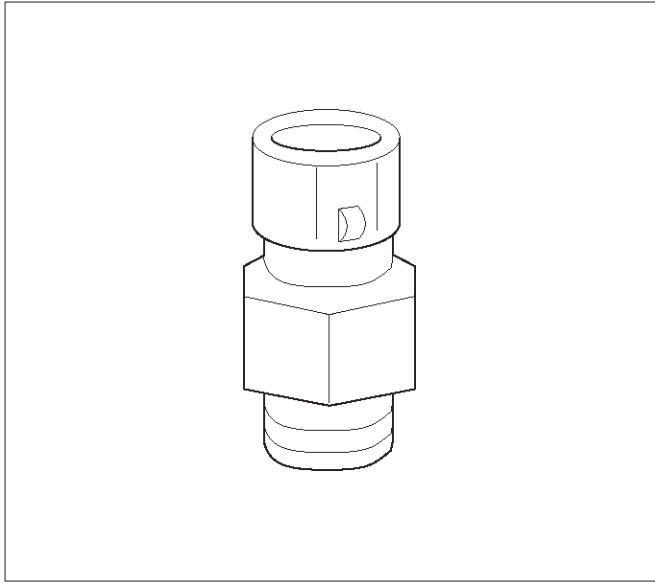
Refer to *DTC P0341* for further information.



Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at -40°C (-40°F). High temperature causes a low resistance of 70 ohms at 130°C (266°F). The PCM supplies a 5-volt signal to the ECT sensor through resistors in the PCM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.

Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85°C (185°F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0177 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



Electrically Erasable Programmable Read Only Memory (EEPROM)

The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.

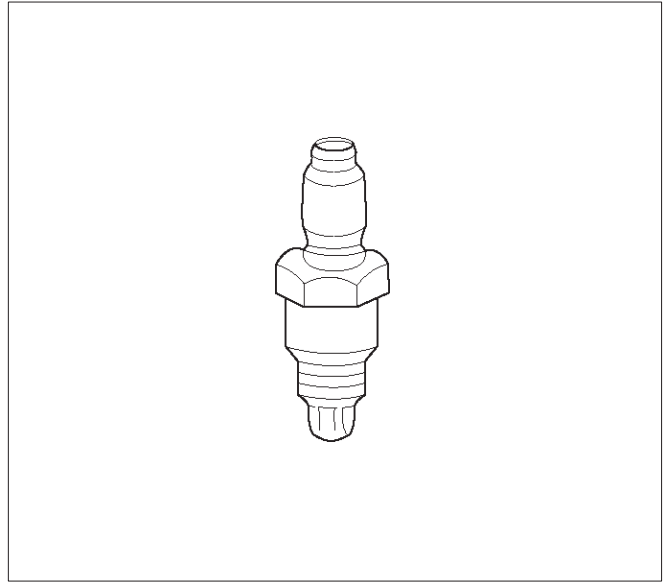
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensors

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust stream where they can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

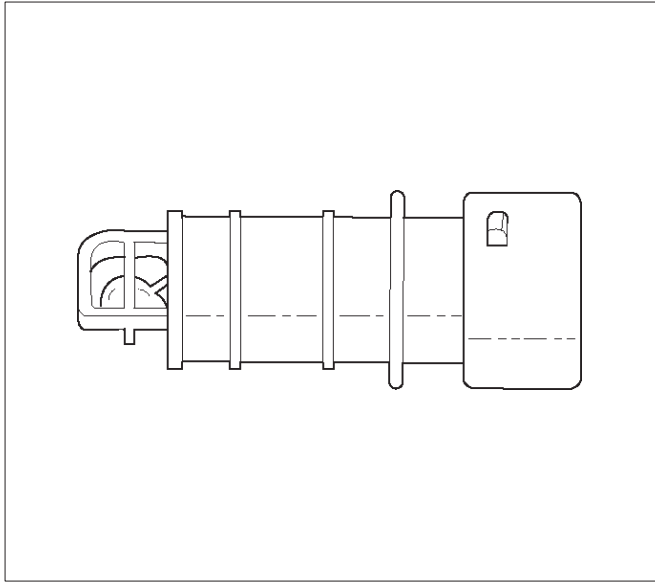
An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and Tech 2 will display a constant voltage between 400-500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. Faults in the Bank 2 HO2S 1 signal circuit will cause DTC 0154 (open circuit), DTC P0151 (grounded circuit), or DTC P0152 (signal voltage high) to set.



Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of 100,000 ohms at -40°C (-40°F). High temperature causes low resistance of 70 ohms at 130°C (266°F). The PCM supplies a 5-volt signal to the sensor through a resistor in the PCM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.



0018

Knock Sensor

Insufficient gasoline octane levels may cause detonation in some engines. Detonation is an uncontrolled explosion (burn) in the combustion chamber. This uncontrolled explosion results from a flame front opposite that of the normal flame front produced by the spark plug. The rattling sound normally associated with detonation is the result of two or more opposing pressures (flame fronts) colliding within the combustion chamber. Light detonation is sometimes considered normal, but heavy detonation could result in engine damage.

A knock sensor system is used to control detonation. This system is designed to retard spark timing up to 20 degrees to reduce detonation in the engine. This allows the engine to use maximum spark advance to improve driveability and fuel economy.

The knock sensor system has two major components:

- The knock sensor (KS) module.
- The knock sensor.

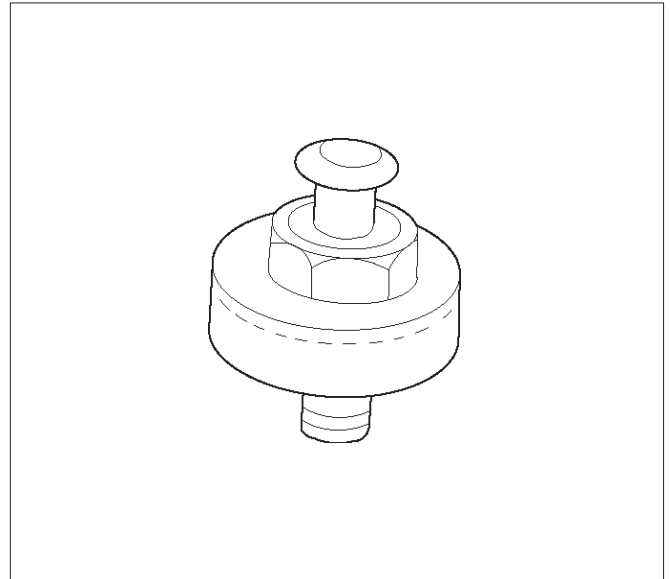
The knock sensor, mounted in the engine block near the cylinders, detects abnormal vibration in the engine. The sensor produces an AC output signal of about 10 millivolts. The signal amplitude and frequency are dependent on the amount of knock being experienced. The signal voltage increases with the severity of the knock. This signal voltage is input to the PCM. The PCM then retards the ignition control (IC) spark timing based on the KS signal being received.

The PCM determines whether knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the PCM to reject any false knock signal by indicating the amount of normal engine mechanical noise present. Normal engine noise varies depending on the engine speed and load. If the voltage level on the KS noise channel circuit is below the range considered normal, DTC P0327 will set, indicating a fault in the KS

circuit or the knock sensor. If the PCM determines that an abnormal minimum or maximum noise level is being experienced, DTC P0325 will set.

The PCM contains a knock sensor (KS) module. The KS module contains the circuitry which allows the PCM to utilize the KS signal and diagnose the KS sensor and the KS circuitry. If the KS module is missing or faulty, a continuous knock condition will be indicated, and the PCM will set DTC P0325.

Although it is a plug-in device, the KS module is not replaceable. If the KS module is faulty, the entire PCM must be replaced.



0009

Linear Exhaust Gas Recirculation (EGR) Control

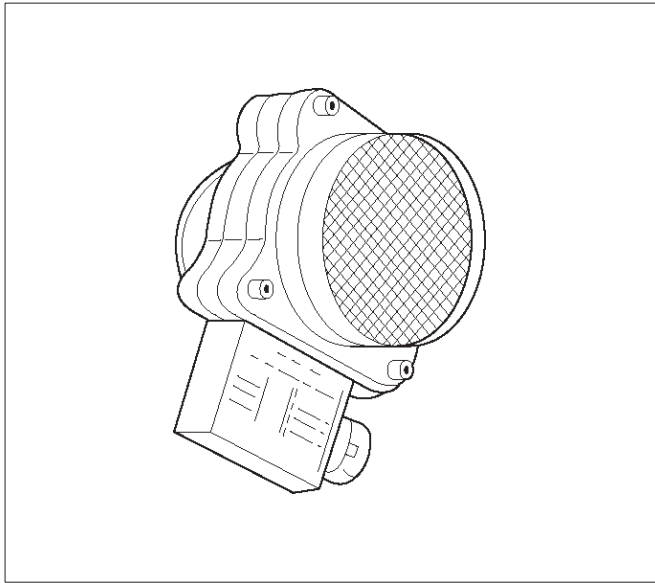
The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the difference between the volume and the quantity of air that enters the engine. "Volume" means the size of the space to be filled. "Quantity" means the number of air molecules that will fit into the space. This information is important to the PCM because heavier, denser air will hold more fuel than lighter, thinner air. The PCM adjusts the air/fuel ratio as needed depending on the MAF value. Tech 2 reads the MAF value and displays it in terms of grams per second (gm/s). At idle, Tech 2 should read between 4-7 gm/s on a fully warmed up engine. Values should change quickly on acceleration. Values should remain stable at any given

RPM. A failure in the MAF sensor or circuit will set DTC P0101, DTC P0102, or DTC P0103.



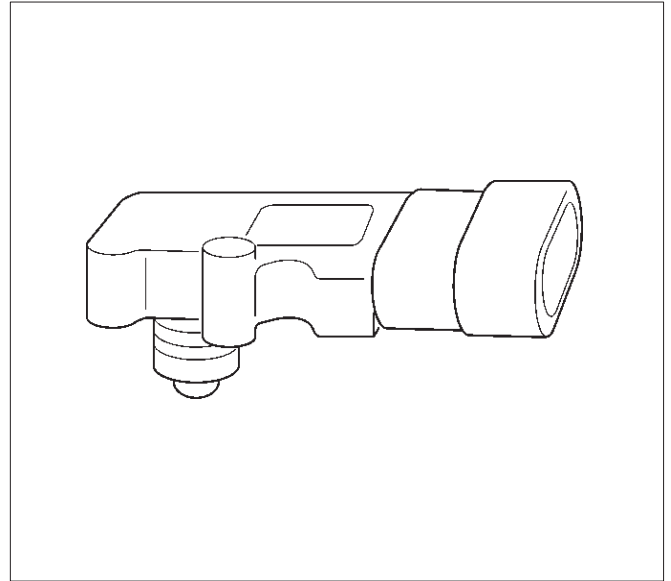
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to *DTC P0401*.
- Engine vacuum level for other diagnostics.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107 or DTC P1106, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.



Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

- Fuel metering system.
- Transmission shifting (automatic transmission only).
- Ignition timing.
- On-board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Service Engine Soon lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

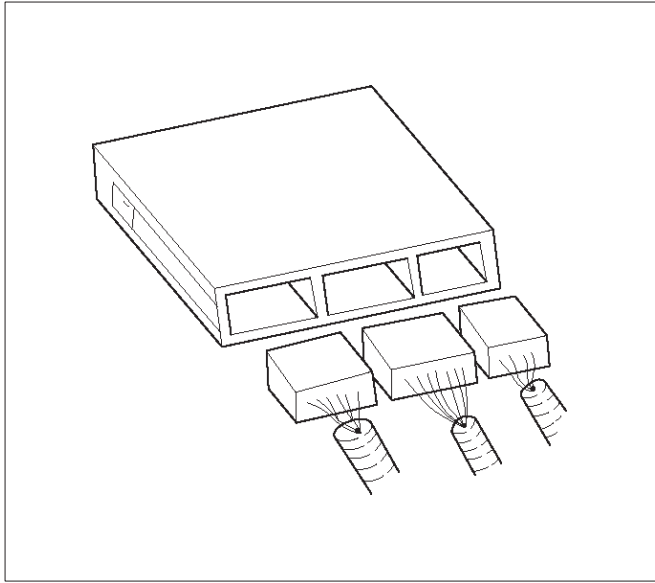
This engine uses 2 different control modules:

- IPCM-6KT for automatic transmission-equipped vehicles.
- ISFI-6 for manual transmission-equipped vehicles.

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement. The PCM controls output circuits such as the injectors, IAC, cooling fan relays, etc., by controlling the ground or the power feed circuit through transistors of following device.

- Output Driver Module (ODM)



PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- Knock sensor
- Automatic transmission shift functions
- Cruise control
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the PCM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned "ON." These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

PCM Input/Outputs

Inputs – Operating Conditions Read

- Air Conditioning "ON" or "OFF"

- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Mass Air Flow
- Engine Knock
- Camshaft Position

Outputs – Systems Controlled

- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Control
- Idle Air Control
- Electric Fuel Pump
- Air Conditioning
- Diagnostics
 - Malfunction Indicator Lamp (Service Engine Soon lamp)
 - Data Link Connector (DLC)
 - Data Output
- Transmission Control Module
- Alternator Gain Control

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested Tech-2. The PCM should remain connected to the PCM or to a recommended breakout box.

Reprogramming The PCM

The Trooper allow reprogramming of the PCM without removing it from the vehicle. This provides a flexible and cost-effective method of making changes in software calibrations.

The service programming system (SPS) will not allow incorrect software programming or incorrect calibration changes.

Refer to the UBS 98model year Immobilizer Workshop Manual.

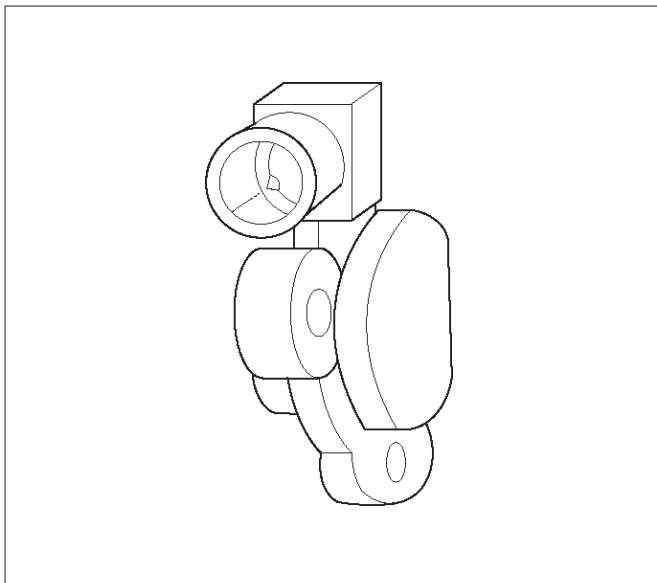
Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of

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the TP sensor is low. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be above 4 volts.

The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving. A hard failure in the TP sensor 5-volt reference or signal circuits will set a DTC P0123. A hard failure with the TP sensor ground circuit may set DTC P0123. Once a DTC is set, the PCM will use an artificial default value based on engine RPM and mass air flow for the throttle position, and some vehicle performance will return. A high idle may result when DTC P0123 is set. The PCM can also detect a shifted TP sensor. The PCM monitors throttle position and compares the actual TP sensor reading to a predicted TP value calculated from engine speed. If the PCM detects an out-of-range condition, DTC P0121 will be set.



Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is a thermistor which changes its resistance based on the temperature of the transmission fluid. For a complete description of the TFT sensor, refer to *4L30-E Automatic Transmission Diagnosis*.

A failure in the TFT sensor or associated wiring will cause DTC P0712 or DTC P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value and the transmission will operate normally.

Transmission Range Switch

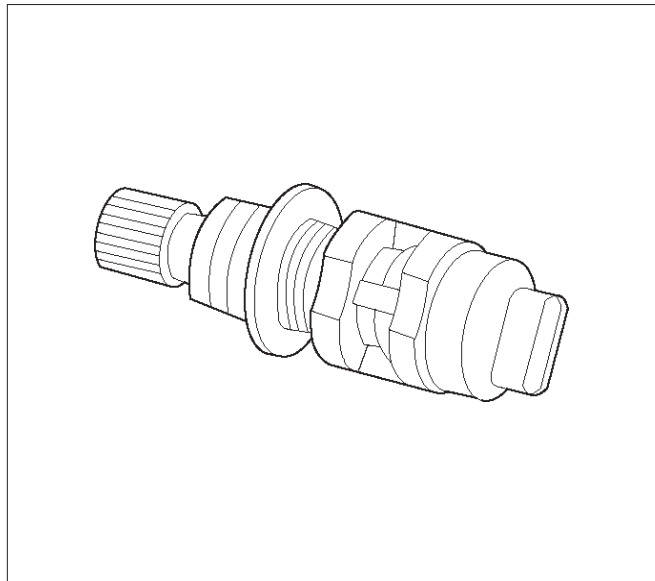
IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR and IAC valve operation.

For more information on the transmission on the transmission range switch, refer to *4L30-E Automatic Transmission*.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a pulsing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the cruise control, speedometer, and the TCC and shift solenoids in the transmission. For more information on the TCC and shift solenoids, refer to *4L30-E Automatic Transmission*.



Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After

this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.



TS23793

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not touch the knock sensor module component leads.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Upshift Lamp

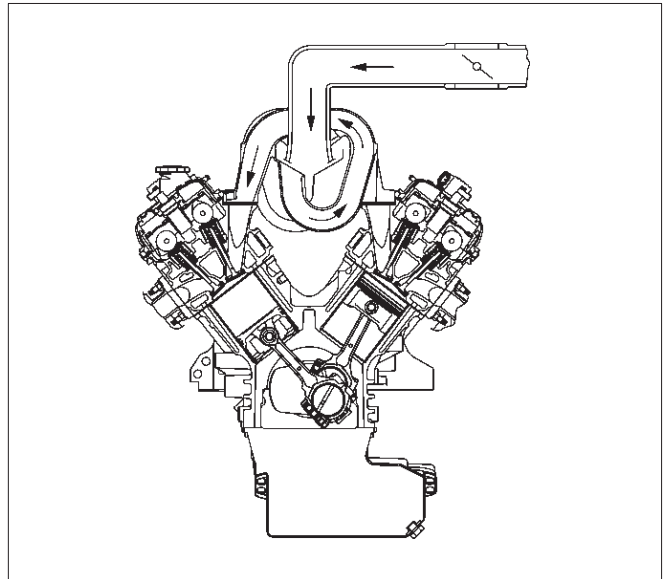
Refer to *Manual Transmission*.

General Description (Air Induction)

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by the following steps:

1. Through the throttle body.
2. Into the common chamber.
3. Through the cylinder head intake ports.
4. Into the cylinders.



055RV010

General Description (Fuel Metering)

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Accelerator Controls

The accelerator control system is a cable-type system with specific linkage adjustments.

Refer to *Cable Adjustment*.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.
- Ignition dwell time.

CMP Signal

The PCM uses this signal to determine the position of the number 1 piston during its power stroke, allowing the

PCM to calculate true sequential multiport fuel injection (SFI). Loss of this signal will set a DTC P0341. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode as long as the fault is present, with a 1-in-6 chance of being correct.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de-energizes the fuel injectors. The PCM holds the fuel injectors de-energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors "ON" and "OFF," allowing fuel into the cylinders.

Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increase above 6400 RPM. The fuel injectors are turned back on when engine speed decreases below 6150 RPM.

Fuel Cutoff Mode

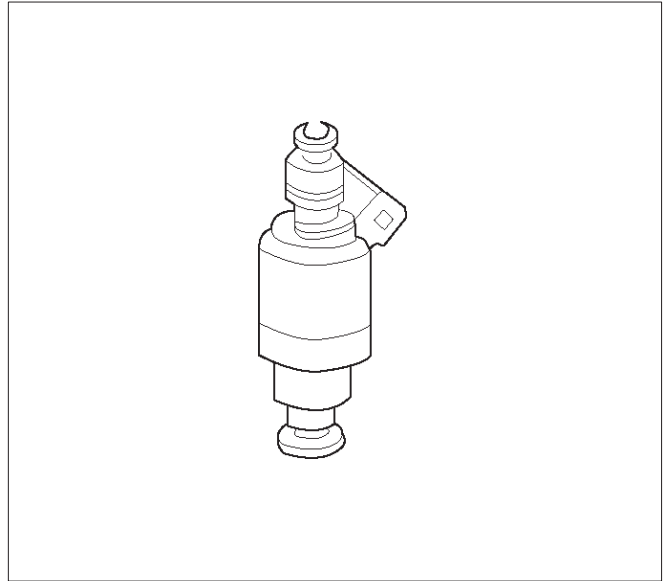
No fuel is delivered by the fuel injectors when the ignition is "OFF." This prevents engine run-on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid-operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.
- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.
- The idle air control (IAC) valve.
- The fuel pump.
- The fuel pump relay.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to *Section 6C* for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that fuel injector is "ON." The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the

constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "closed loop" system. The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called "modes." All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm-operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separate.

If the pressure is too low, poor performance and a DTC P0131, DTC P0151, DTC P0171 or DTC P1171 will be the result. If the pressure is too high, excessive odor and/or a DTC P0132, DTC P0152, DTC P0172 or DTC P0175 will be the result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.



0011

Fuel Pump Electrical Circuit

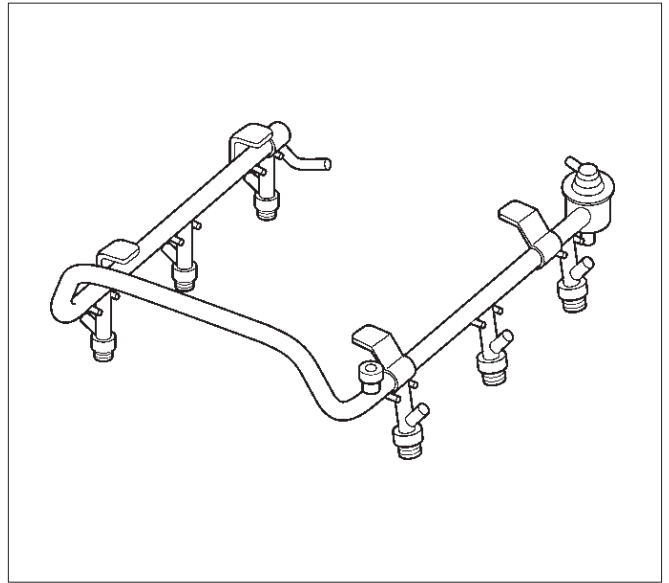
When the key is first turned "ON," the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58 X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in-tank fuel pump.

An inoperative fuel pump will cause a "no-start" condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains

a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



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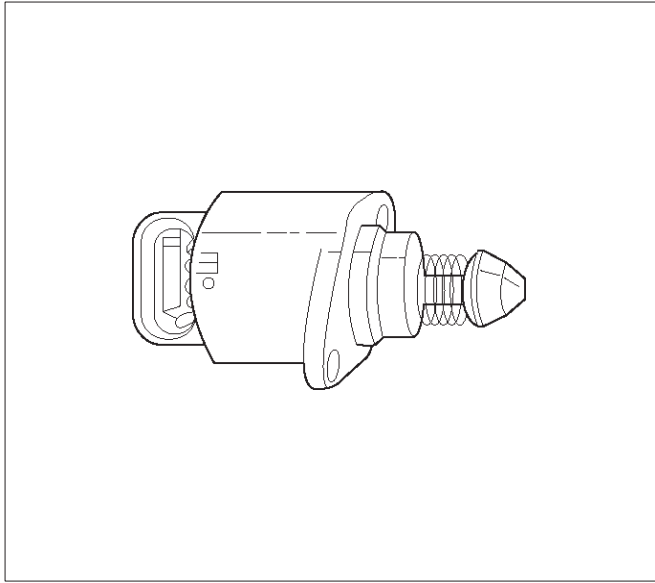
Idle Air Control (IAC) Valve

The purpose of the idle air control (IAC) valve is to control engine idle speed, while preventing stalls due to changes in engine load. The IAC valve, mounted in the throttle body, controls bypass air around the throttle plate. By moving the conical valve (pintle) in (to decrease air flow) or out (to increase air flow), a controlled amount of air can move around the throttle plate. If the RPM is too low, the PCM will retract the IAC pintle, resulting in more air moving past the throttle plate to increase the RPM. If the RPM is too high, the PCM will extend the IAC pintle, allowing less air to move past the throttle plate, decreasing the RPM.

The IAC pintle valve moves in small steps called counts. During idle, the proper position of the IAC pintle is calculated by the PCM based on battery voltage, coolant temperature, engine load, and engine RPM. If the RPM drops below a specified value, and the throttle plate is closed, the PCM senses a near-stall condition. The PCM will then calculate a new IAC pintle valve position to prevent stalls.

If the IAC valve is disconnected and reconnected with the engine running, the idle RPM will be wrong. In this case, the IAC must be reset. The IAC resets when the key is cycled "ON" then "OFF." When servicing the IAC, it should only be disconnected or connected with the ignition "OFF."

The position of the IAC pintle valve affects engine start-up and the idle characteristics of the vehicle. If the IAC pintle is fully open, too much air will be allowed into the manifold. This results in high idle speed, along with possible hard starting and a lean air/fuel ratio. DTC P0507 or DTC P1509 may set. If the IAC pintle is stuck closed, too little air will be allowed in the manifold. This results in a low idle speed, along with possible hard starting and a rich air/fuel ratio. DTC P0506 or DTC P1508 may set. If the IAC pintle is stuck part-way open, the idle may be high or low and will not respond to changes in the engine load.



0006

Run Mode

The run mode has the following two conditions:

- Open loop
- Closed loop

When the engine is first started the system is in “open loop” operation. In “open loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in “open loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start-up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters “closed loop” operation. In “closed loop,” the PCM calculates the air/fuel ratio (injector on-time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

Starting Mode

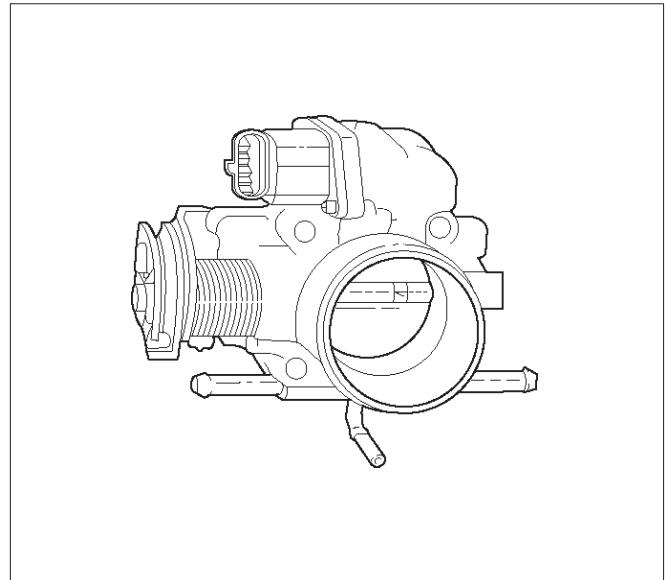
When the ignition is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor and IAC valve are also mounted on the throttle body. Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components.

Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.

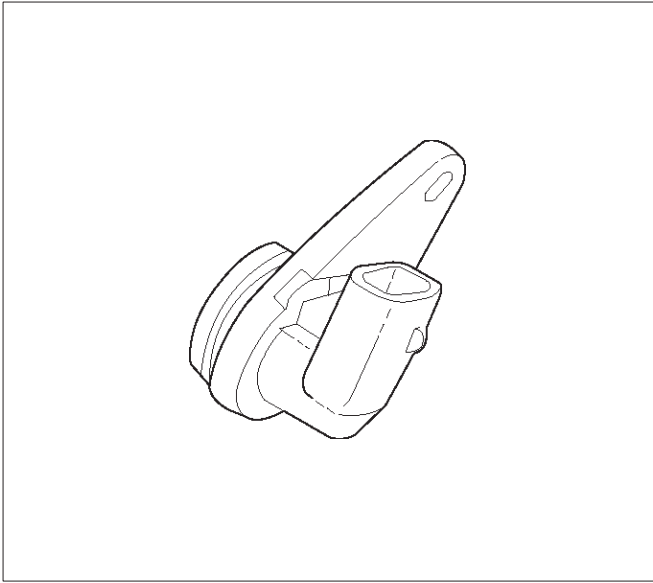


0019

General Description (Electronic Ignition System)

Camshaft Position (CMP) Sensor

As the camshaft sprocket turns, a magnet in the sprocket activates the Hall-effect switch in the CMP sensor. When the Hall-effect switch is activated, it grounds the signal line to the PCM, pulling the camshaft position sensor signal circuit's applied voltage low. This is a CMP signal. The CMP signal is created as piston #1 is approximately 25° after top dead center on the power stroke. If the correct CMP signal is not received by the PCM, DTC P0341 will be set.



0014

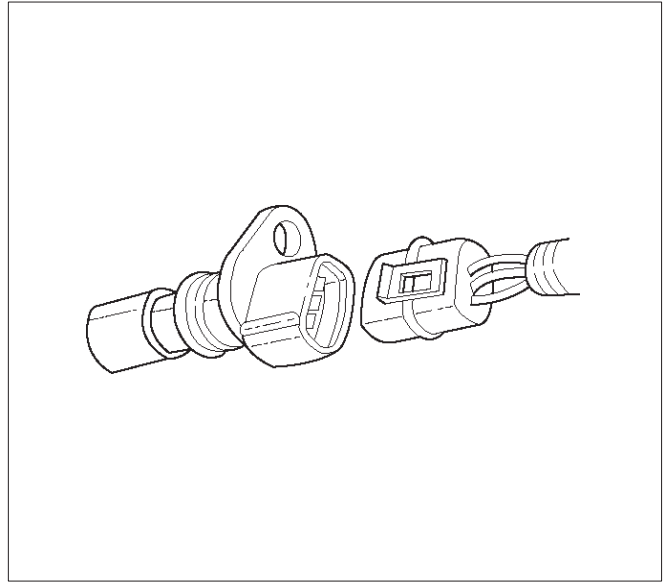
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. Refer to *Electronic Ignition System* for additional information.

Electronic Ignition

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

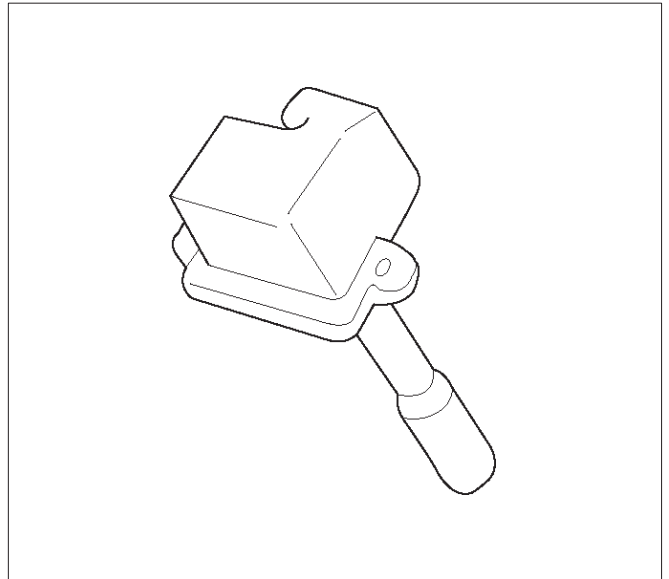
- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.



0013

Ignition Coils

A separate coil-at-plug module is located at each spark plug. The coil-at-plug module is attached to the engine with two screws. It is installed directly to the spark plug by an electrical contact inside a rubber boot. A three-way connector provides 12-volt primary supply from the 15-amp ignition fuse, a ground-switching trigger line from the PCM, and a ground.



0001

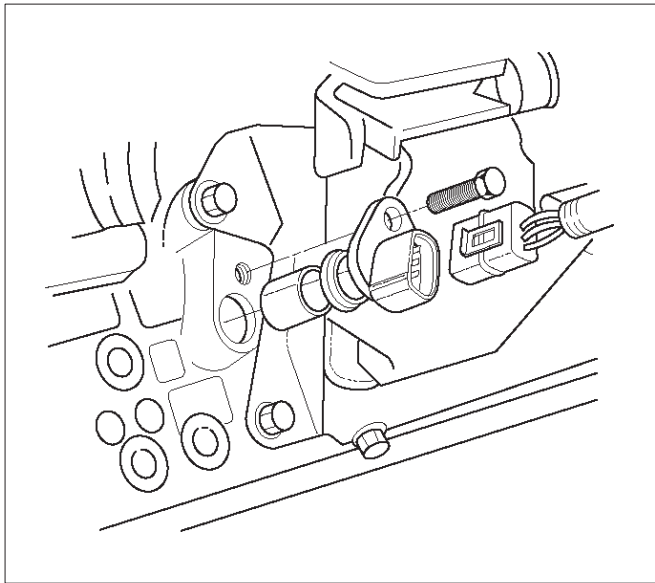
Ignition Control

The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell. The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

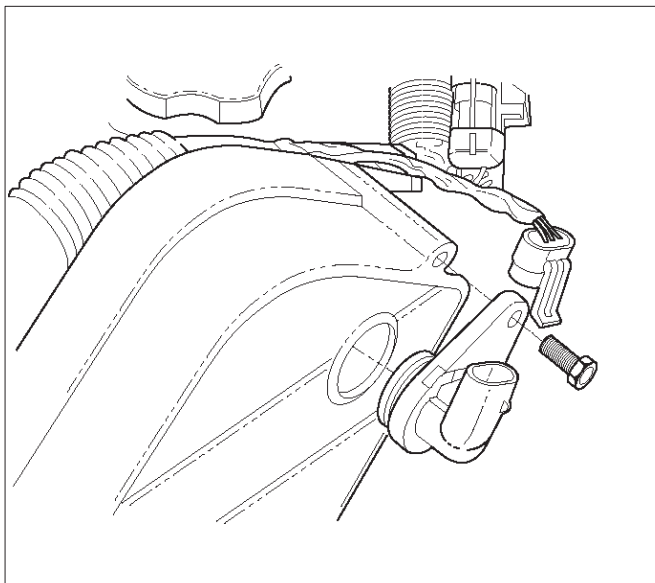
- Engine speed.

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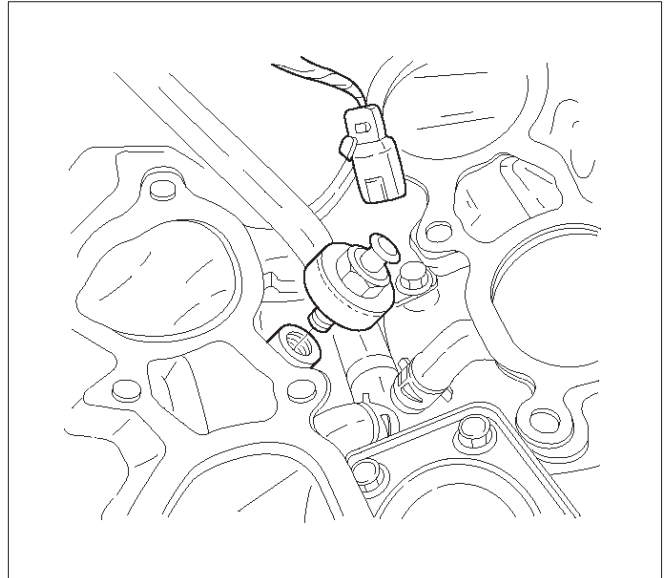
- Crankshaft position (58X reference).
- Camshaft position (CMP) sensor.
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Knock signal (knock sensor).
- Park/Neutral position (PRNDL input).
- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.
- The crankshaft position (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.



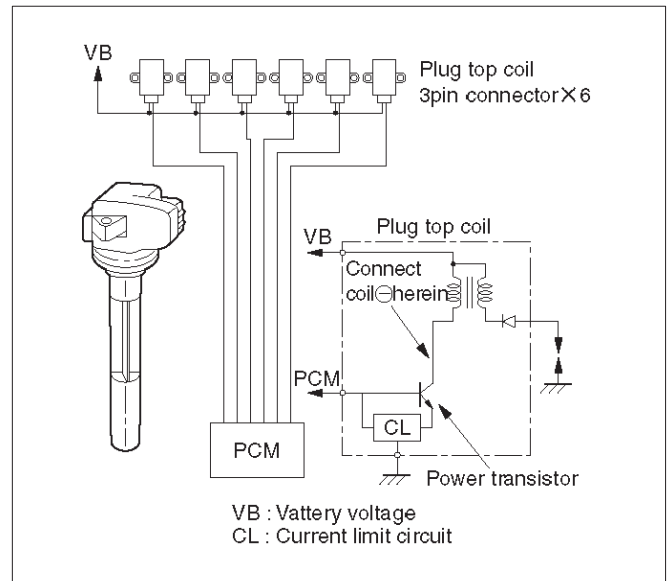
- The camshaft position (CMP) sensor sends a signal related to the position of the camshaft.



- The knock sensor tells the PCM if there is any problem with pre-ignition or detonation. This information allows the PCM to retard timing, if necessary.

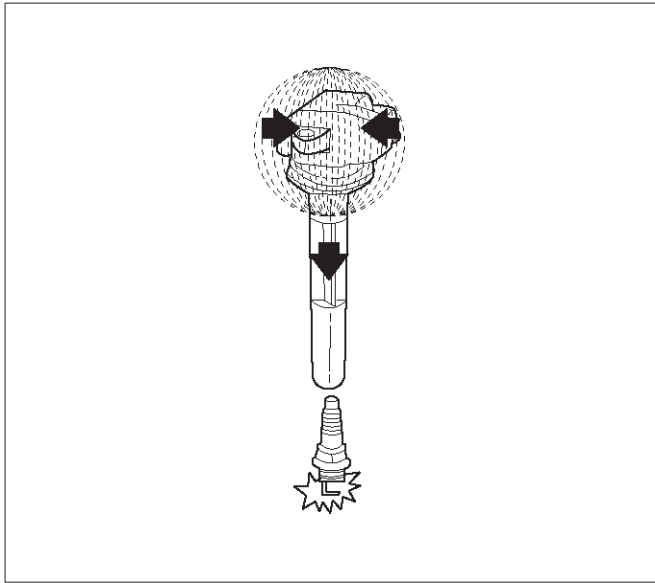


Based on these sensor signals and engine load information, the PCM sends 5V to each ignition coil.



The PCM applies 5V signal voltage to the ignition coil requiring ignition. This signal sets on the power transistor of the ignition coil to establish a grounding circuit for the primary coil, applying battery voltage to the primary coil. At the ignition timing, the PCM stops sending the 5V signal voltage. Under this condition the power transistor of the ignition coil is set off to cut the battery voltage to the primary coil, thereby causing a magnetic field generated in the primary coil to collapse. On this moment a line of magnetic force flows to the secondary coil, and when this magnetic line crosses the coil, high voltage induced by

the secondary ignition circuit to flow through the spark plug to the ground.



TS24047

Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5-volt output signal to the ignition control (IC) module. Each spark plug has its own primary and secondary coil module ("coil-at-plug") located at the spark plug itself. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil-at-plug module. This energizes the primary coil and creates a magnetic field in the coil-at-plug module. When the PCM shuts off the 5-volt signal to the ignition control module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture. The circuit between the PCM and the ignition coil is monitored for open circuits, shorts to voltage, and shorts to ground. If the PCM detects one of these events, it will set one of the following DTCs:

- P0351: Ignition coil Fault on Cylinder #1
- P0352: Ignition coil Fault on Cylinder #2
- P0353: Ignition coil Fault on Cylinder #3
- P0354: Ignition coil Fault on Cylinder #4
- P0355: Ignition coil Fault on Cylinder #5
- P0356: Ignition coil Fault on Cylinder #6

Knock Sensor (KS) PCM Input

The knock sensor (KS) system is comprised of a knock sensor and the PCM. The PCM monitors the KS signals to determine when engine detonation occurs. When a knock sensor detects detonation, the PCM retards the spark timing to reduce detonation. Timing may also be retarded because of excessive mechanical engine or transmission noise.

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide

optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Mass air flow (MAF) sensor.
- PRNDL input from transmission range switch.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS) .
- Crankshaft position (CKP) sensor.

Spark Plug

Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequently fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to *Maintenance and Lubrication*.

Normal spark plug operation will result in brown to grayish-tan deposits appearing on the insulator portion of the spark plug. A small amount of red-brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by-products of fuels and lubricating oils with additives. Some electrode wear will also occur. Engines which are not running properly are often referred to as "misfiring." This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as "pre-ignition."

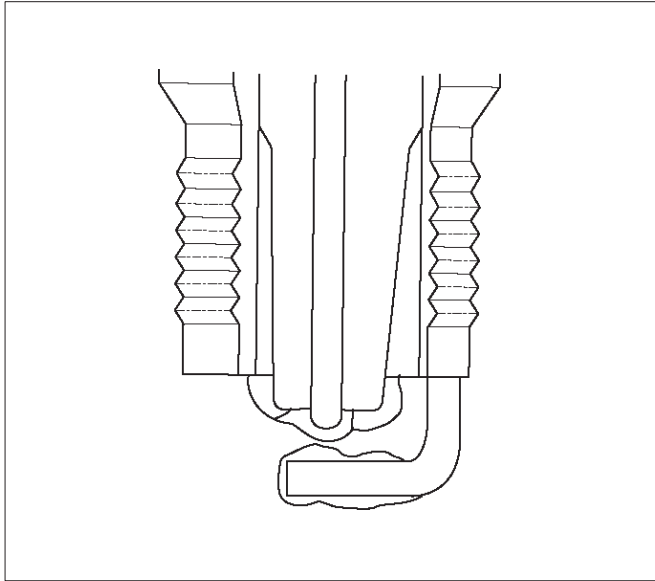
Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause. Refer to DTC P0172.

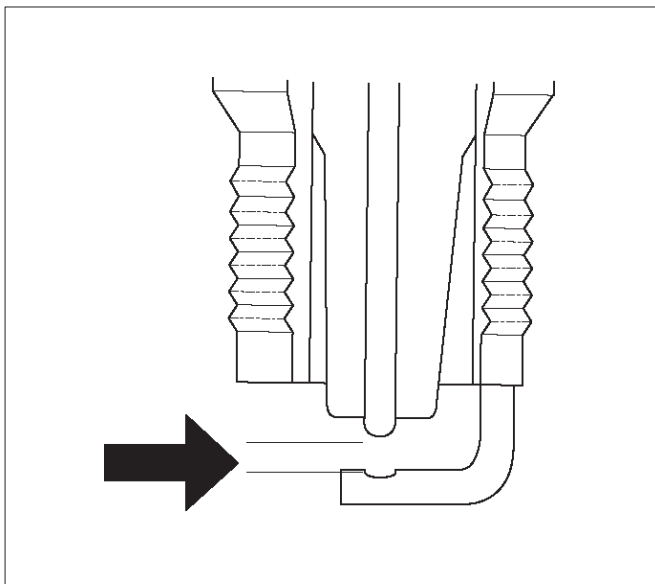
Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break-in of new or newly overhauled engines. Deposit fouling of the spark plug occurs when the normal red-brown, yellow or white deposits of combustion by-products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating

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oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.

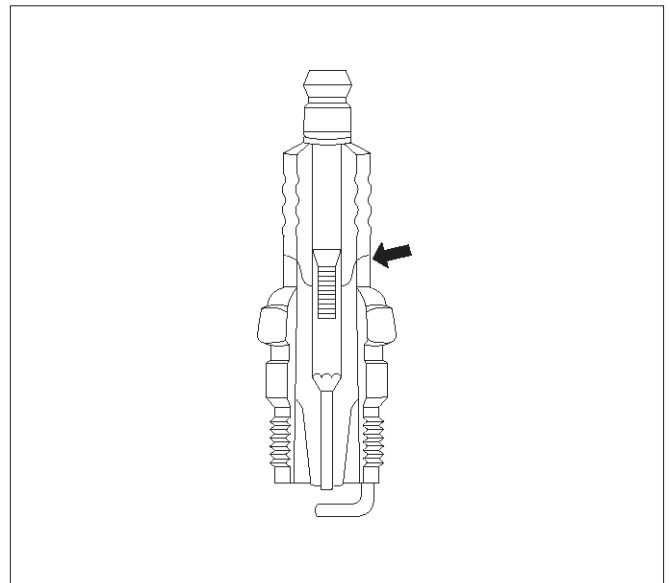


Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A check of the gap size and comparison to the gap specified for the vehicle in *Maintenance and Lubrication* will tell if the gap is too wide. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.

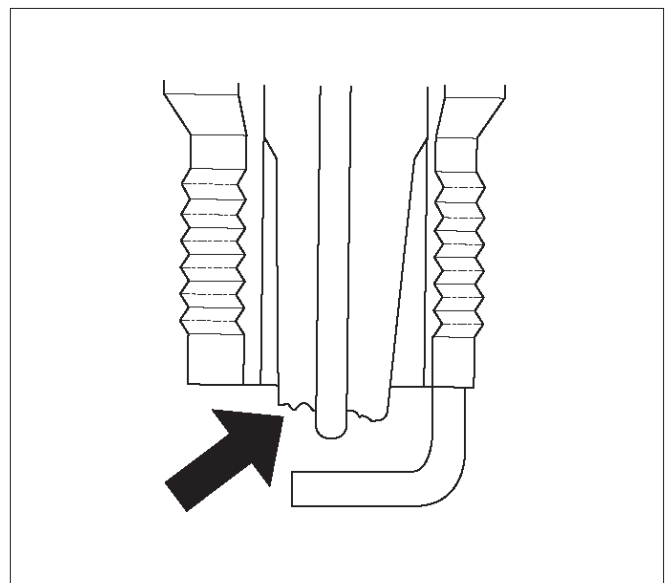


Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can

keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact between the seats. In extreme cases, exhaust blow-by and damage beyond simple gap wear may occur. Cracked or broken insulators may be the result of improper installation, damage during spark plug re-gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.



A broken or cracked lower insulator tip (around the center electrode) may result from damage during re-gapping or from "heat shock" (spark plug suddenly operating too hot).



- Damage during re-gapping can happen if the gapping tool is pushed against the center electrode or the insulator around it, causing the insulator to crack. When re-gapping a spark plug, make the adjustment by bending only the ground side terminal, keeping the tool clear of other parts.
- "Heat shock" breakage in the lower insulator tip generally occurs during several engine operating conditions (high speeds or heavy loading) and may be caused by over-advanced timing or low grade fuels. Heat shock refers to a rapid increase in the tip temperature that causes the insulator material to crack.

Spark plugs with less than the recommended amount of service can sometimes be cleaned and re-gapped, then returned to service. However, if there is any doubt about the serviceability of a spark plug, replace it. Spark plugs with cracked or broken insulators should always be replaced.

A/C Clutch Diagnosis

A/C Clutch Circuit Operation

A 12-volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.

The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The throttle is greater than 90%.
- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119°C (246°F).
- The IAT is less than 5°C (41°F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improves idle quality during compressor clutch engagement.
- It improves wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

- The A/C control head.
- The A/C refrigerant pressure switches.
- The A/C compressor clutch.
- The A/C compressor clutch relay.

- The PCM.

A/C Request Signal

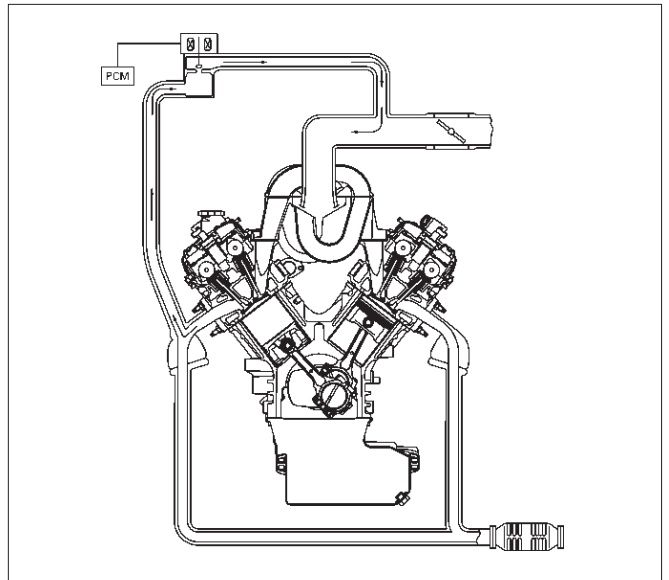
This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

Refer to *A/C Clutch Circuit Diagnosis* for A/C wiring diagrams and diagnosis for A/C electrical system.

General Description (Exhaust Gas Recirculation (EGR) System)

EGR Purpose

The exhaust gas recirculation (EGR) system is used to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.



057RW002

Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Linear EGR Valve Operation and Results of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust

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to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with Tech 2 as "Actual EGR Pos." "Actual EGR Pos." should always be near the commanded EGR position ("Desired EGR Pos."). If a problem with the EGR system will not allow the PCM to control the pintle position properly, DTC P1406 will set. The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTCs P0401 and/or P1406 are set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

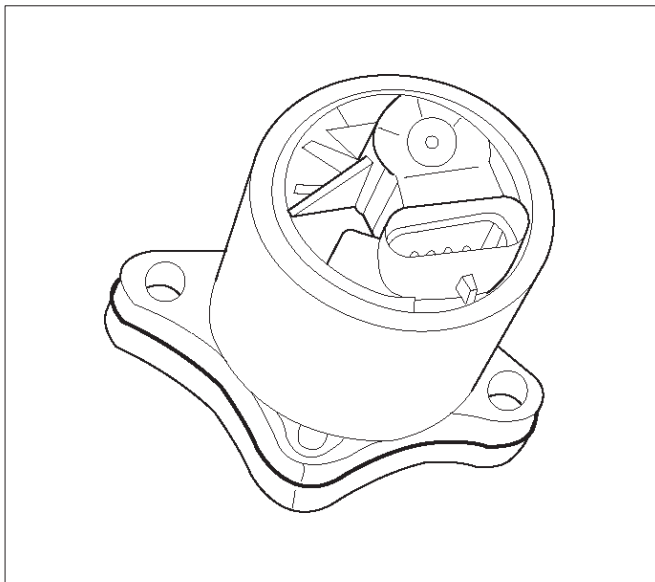
- Warm engine operation.
- Above-idle speed.

Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR flow test).
- Poor fuel economy.



0017

EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1406.

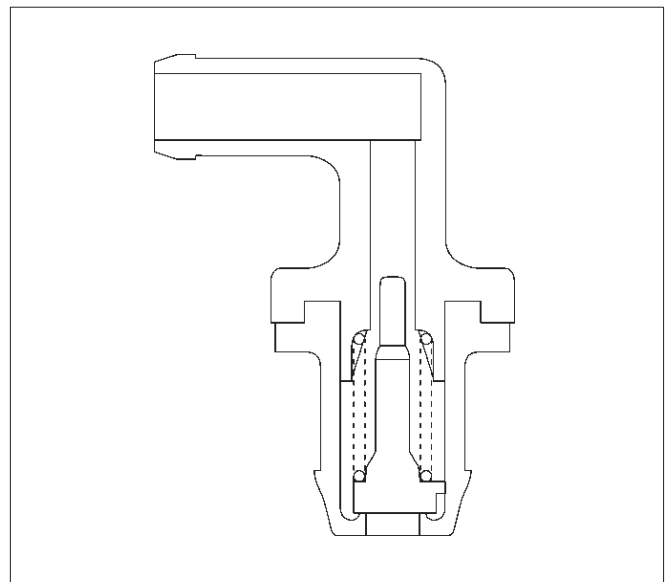
General Description (Positive Crankcase Ventilation (PCV) System)

Crankcase Ventilation System Purpose

The crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow-by gases. This mixture is then passed through the positive crankcase ventilation (PCV) valve into the common chamber.

Crankcase Ventilation System Operation

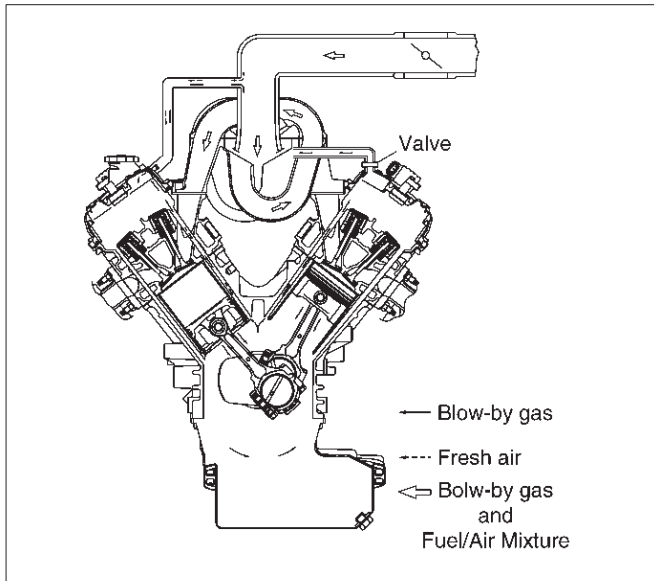
The primary control is through the positive crankcase ventilation (PCV) valve. The PCV valve meters the flow at a rate that depends on the intake vacuum. The PCV valve restricts the flow when the inlet vacuum is highest. In addition, the PCV valve can seal the common chamber off in case of sudden high pressure in the crankcase.



028RV002

While the engine is running, exhaust fumes and small amounts of the fuel/air mixture escape past the piston

rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



During normal, part-throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

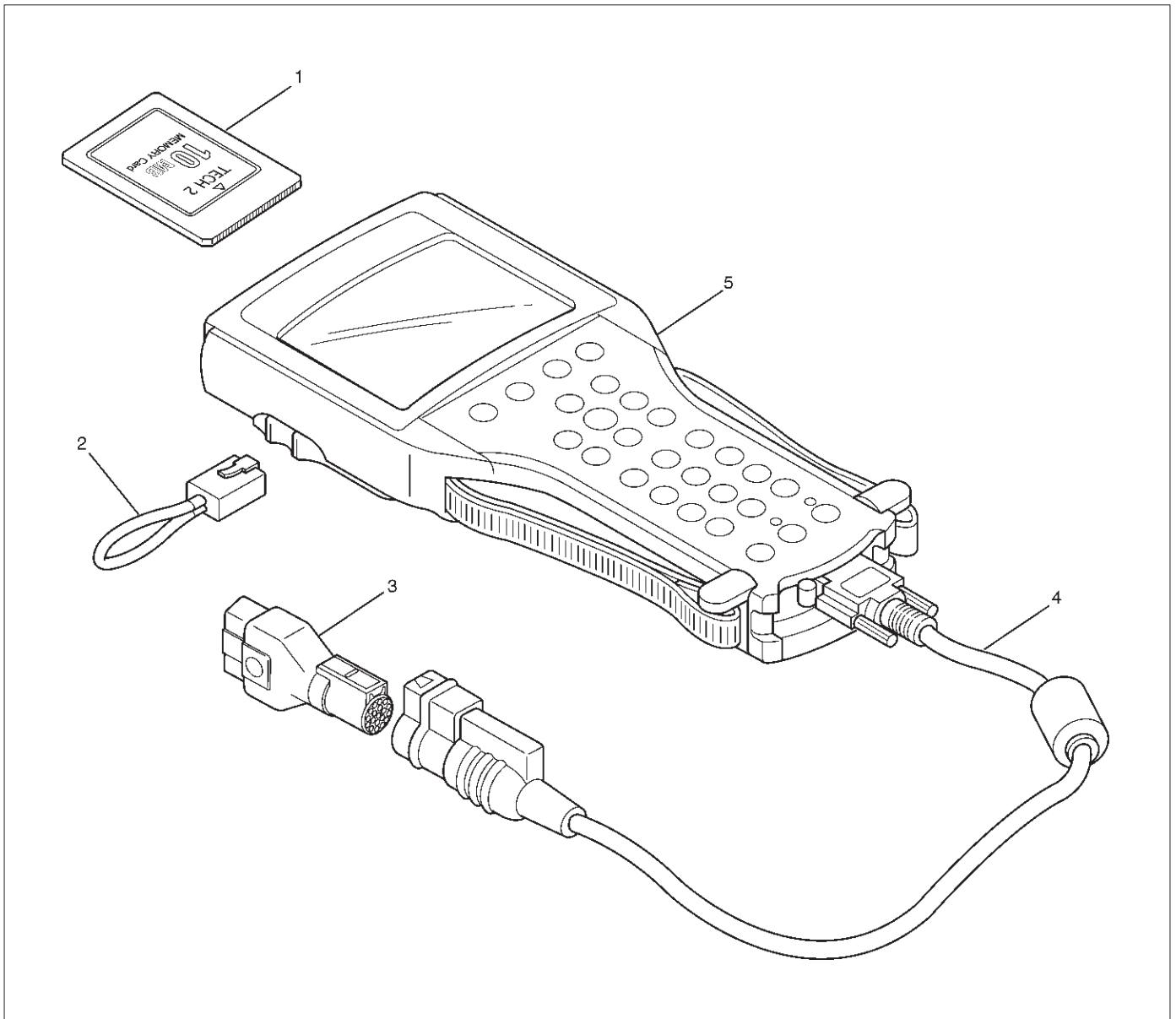
A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling of slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

Special Tools



Legend

- (1) PCMCIA Card
- (2) RS232 Loop Back Connector

- (3) SAE 16/19 Adapter
- (4) DLC Cable
- (5) TECH-2

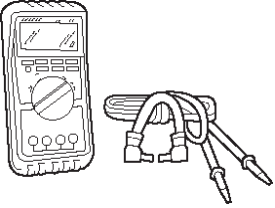
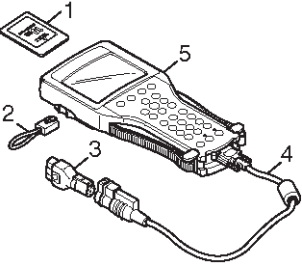
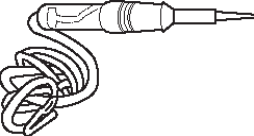

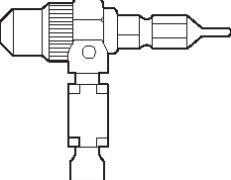
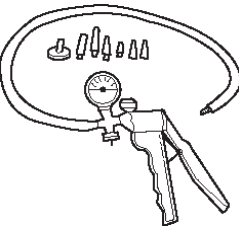
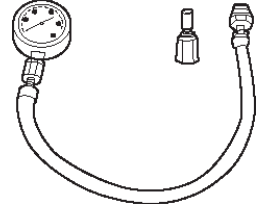
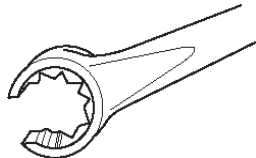
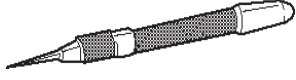

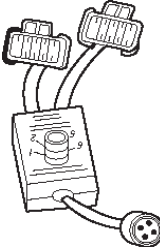
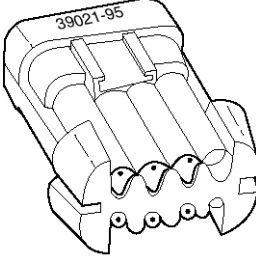
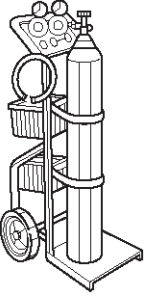
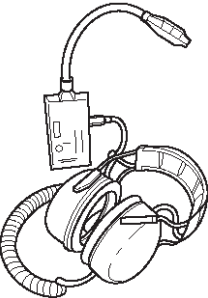
ILLUSTRATION	TOOL NO. TOOL NAME
	<p>5-8840-0285-0 (J 39200) High Impedance Multimeter (Digital Voltmeter – DVM)</p>
	<p>(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH-2</p>
	<p>5-8840-0607-0 (J 34142-B) Unpowered Test Light</p>
	<p>5-8840-0385-0 (J 35616-A/BT-8637) Connector Test Adapter Kit</p>
	<p>5-8840-0383-0 (J 26792/BT-7220-1) Spark Tester</p>
	<p>5-8840-0279-0 (J 23738-A) Vacuum Pump with Gauge common tool</p>

ILLUSTRATION	TOOL NO. TOOL NAME
	<p>BT-8515 Exhaust Back Pressure Tester or common tool</p>
	<p>5-8840-2640-0 (J 39194-B) Heated Oxygen Sensor Wrench</p>
	<p>5-8840-0632-0 (J 35689-A) Terminal Remover</p>
	<p>5-8840-0388-0 (J 28742-A) Weather Pack II Terminal Remover</p>
	<p>5-8840-2635-0 (J 39021-90) Injector Switch Box</p>
	<p>5-8840-2636-0 (J 39021-65) Injector Test Light</p>

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ILLUSTRATION	TOOL NO. TOOL NAME
	5-8840-2607-0 (J 41413) EVAP Pressure/Purge Diagnostic Station
	5-8840-2608-0 (J 41416) Ultrasonic Leak Detector

1. 5-8840-2607-0 (J-41413)EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. 5-8840-2608-0 (J-41416) Ultrasonic Leak Detector is a microprocessor-based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the 5-8840-2607-0 (J-41413) EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the 5-8840-2608-0 (J-41416). The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

ENGINE

ENGINE EXHAUST

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Removal	6F-5	Installation	6F-7
Installation	6F-5	Main Data and Specifications	6F-8

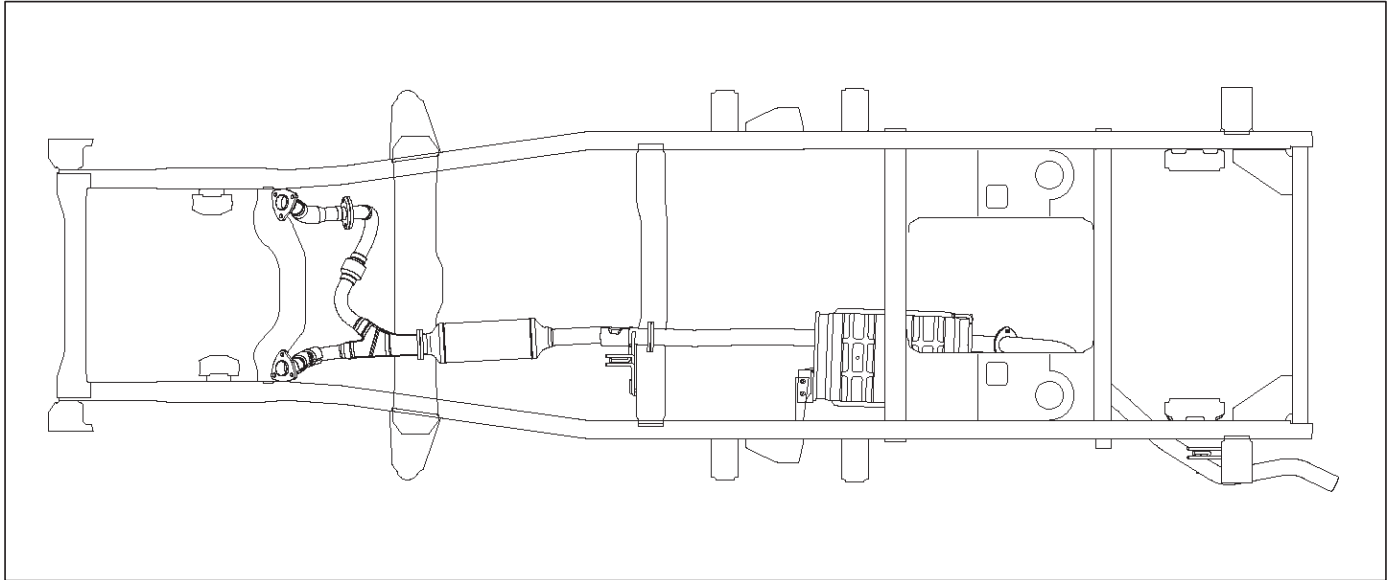
Service Precaution

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

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

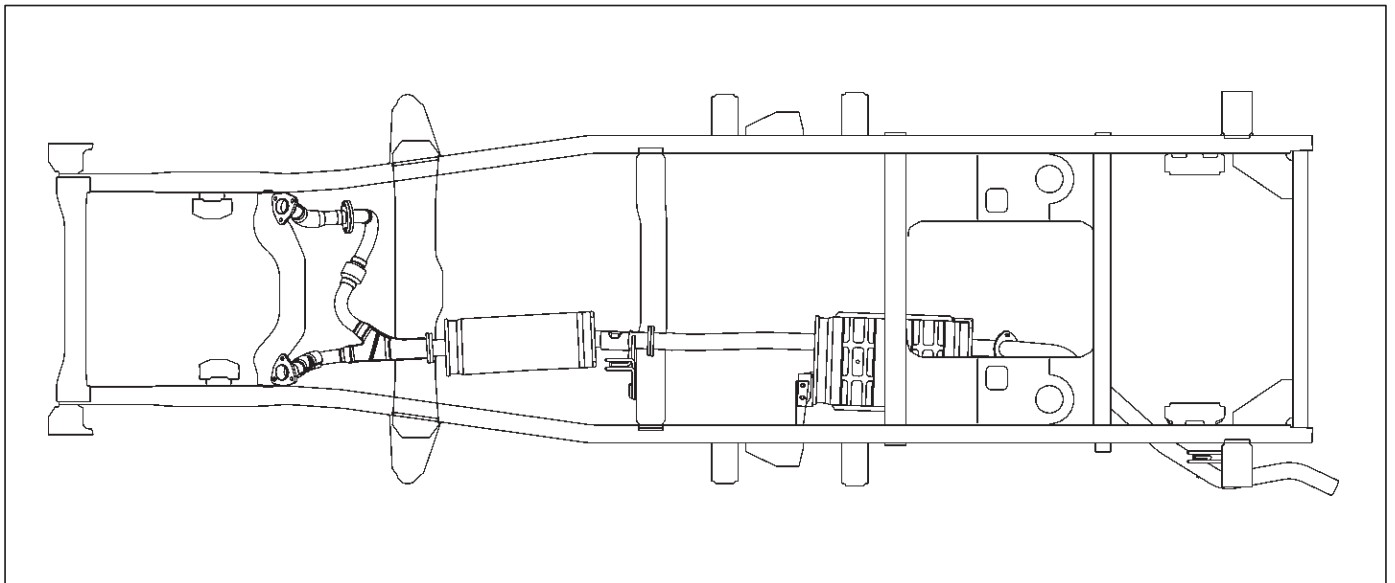
General Description

General export with three way catalytic converter model

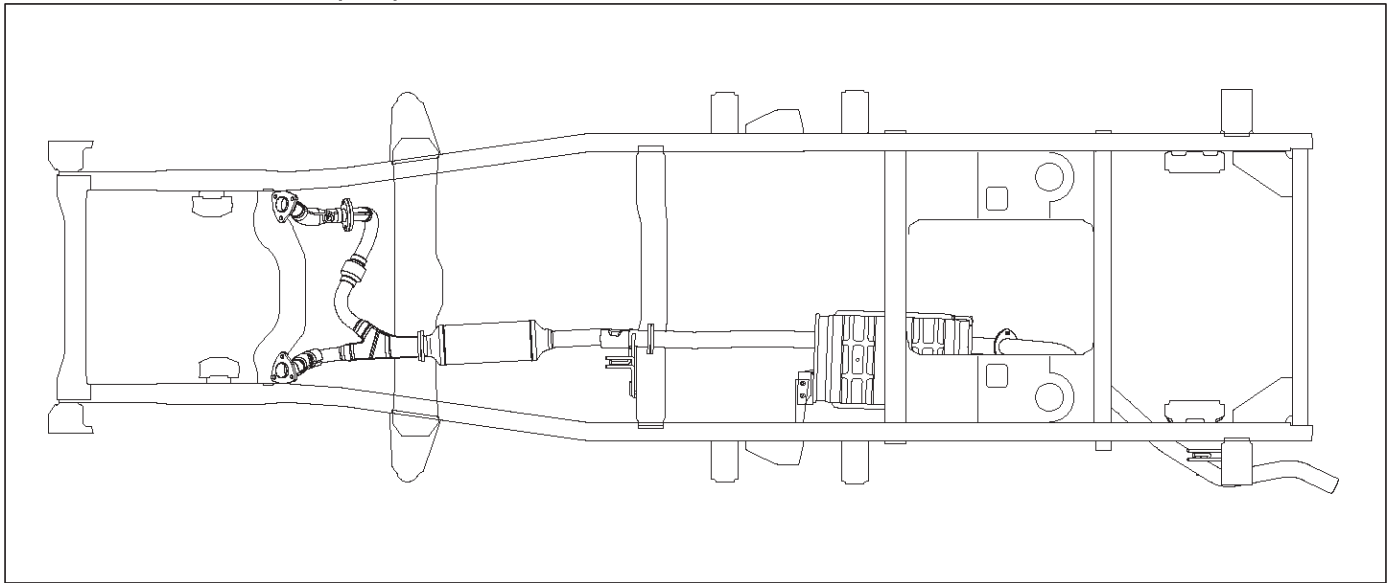


150RW060

General export with out three way catalytic converter model



150RW059

For Isuzu General Motors (IGM)

150RW058

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

CAUTION: The catalytic converter requires the use of unleaded fuel only.

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Types:

Three way (Reduction/Oxidation) catalyst

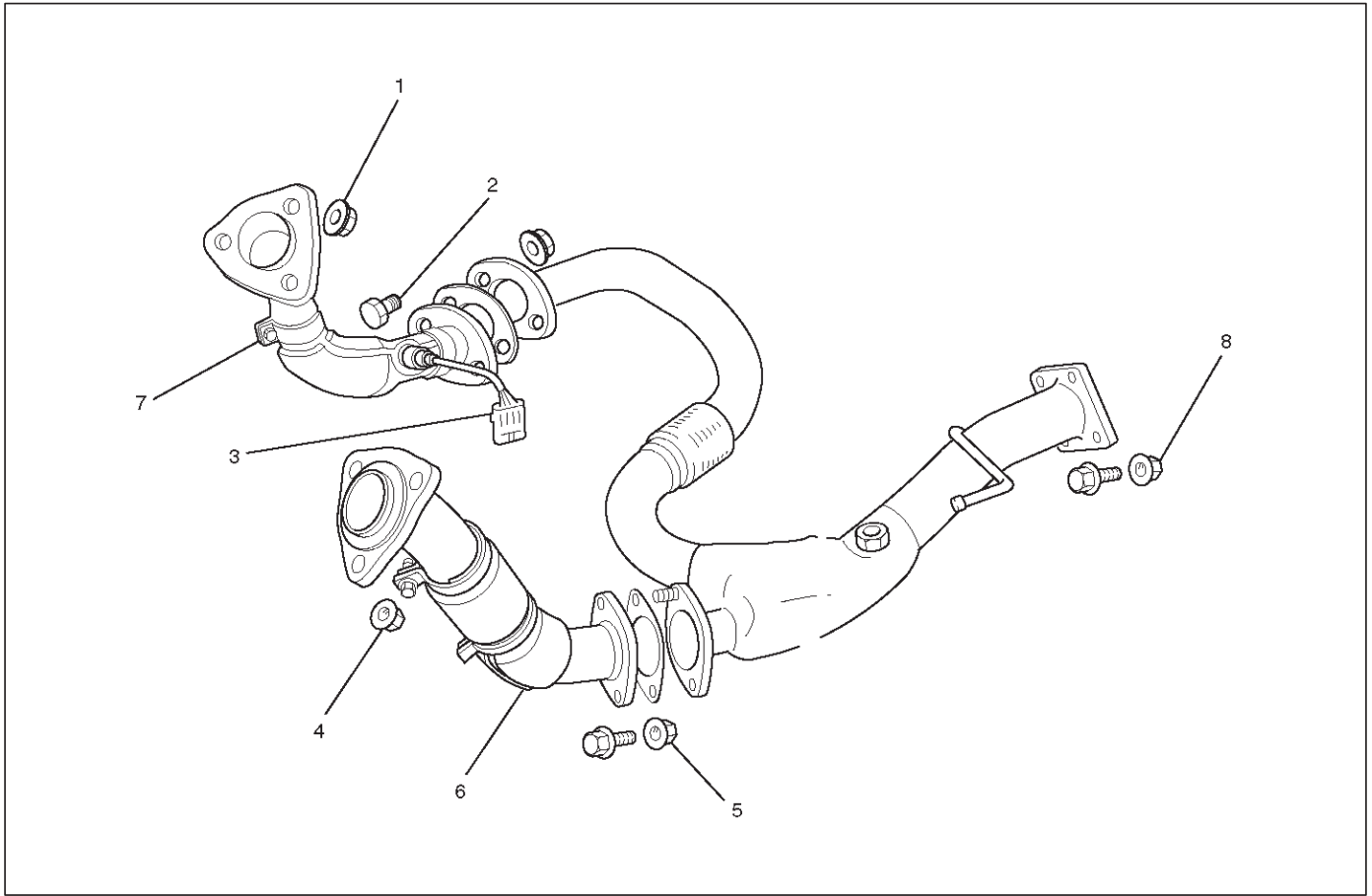
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NO_x) as well as hydrocarbons (HC) and carbon monoxide (Co).

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

Front Exhaust Pipe

Front Exhaust Pipe and Associated Parts



150RW063

Legend

- | | |
|---|--|
| (1) Front Exhaust Pipe RH Fixing Nuts | (5) Front Exhaust Pipe LH Fixing Bolts and Nuts |
| (2) Front Exhaust Pipe RH Fixing Bolts and Nuts | (6) Front Exhaust Pipe LH |
| (3) O2 Sensor Terminal Connector (for IGM) | (7) Front Exhaust Pipe RH |
| (4) Front Exhaust Pipe LH Fixing Nuts | (8) Three way Exhaust Pipe Fixing Bolts and Nuts |

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Disconnect O2 sensor harness connector (3).
4. Remove front exhaust pipe fixing nuts and three way Exhaust Pipe Fixing Bolts and Nuts (2)(5)(8).
5. Remove front exhaust pipe fixing three stud nuts from exhaust manifold (1)(4).
6. Remove front exhaust pipe (6)(7).

Installation

1. Install front exhaust pipe (6)(7) and tighten three stud nuts (1)(4) and nuts (2)(5)(8) to the specified torque.

Torque

Stud Nuts : 67 N·m (6.8 Kg·m/49 lb ft)

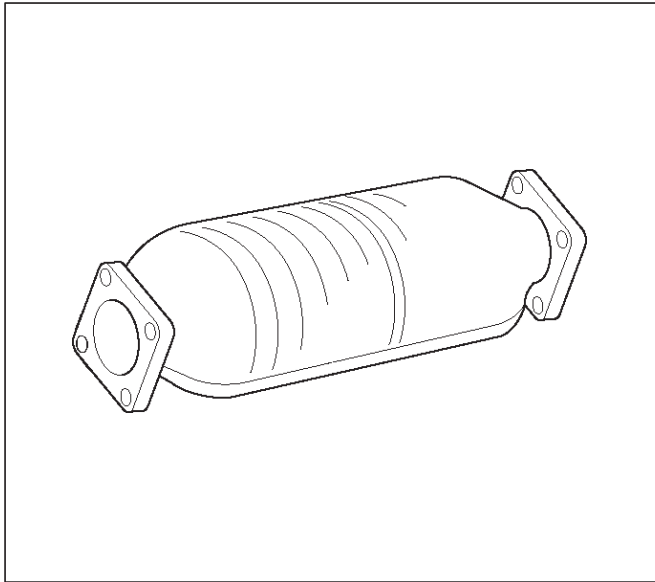
Nuts : 43 N·m (4.3 Kg·m/32 lb ft)

2. Reconnect O2 sensor harness connector (3).

Three Way Catalytic Converter

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove three way exhaust pipe fixing bolts and nuts.



150RW065

Installation

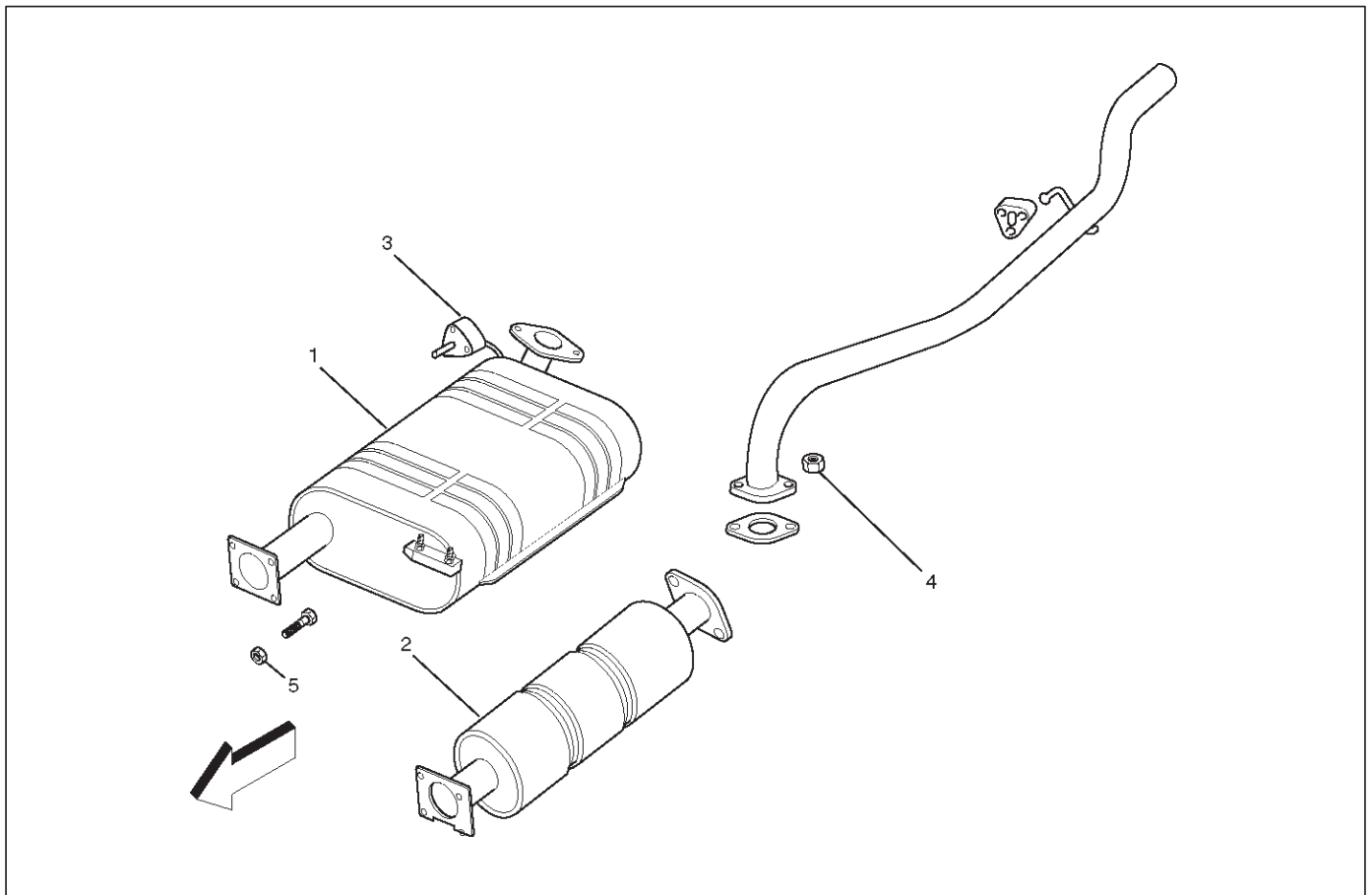
1. Install three way catalytic converter between three way exhaust pipe and silencer.
2. Tighten nuts to the specified torque.

Torque

Nuts : 43 N·m (4.4 Kg·m/32 lb ft)

Exhaust Silencer

Exhaust Silencer and Associated Parts



E06RW031

Legend

- | | |
|----------------------|-----------------------------------|
| (1) Exhaust Silencer | (3) Mounting Rubber |
| (2) Exhaust Silencer | (4) Exhaust Silencer Fixing Nuts |
| | (5) Exhaust Silencer Fixing Bolts |

Removal

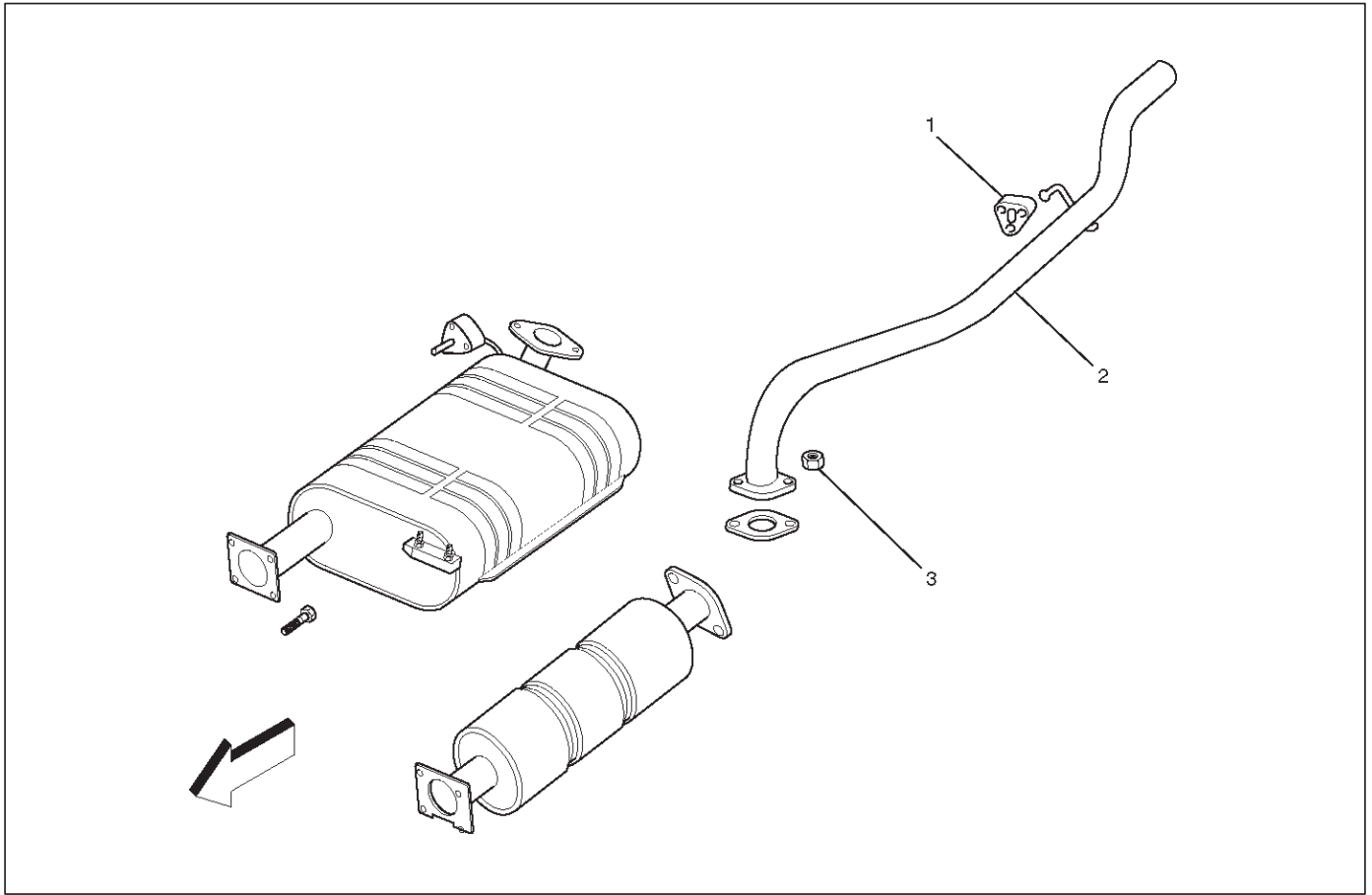
1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove exhaust silencer fixing nuts (4) then disconnect rear exhaust pipe from exhaust silencer.
4. Remove exhaust silencer fixing nuts (5) then disconnect exhaust silencer from three way exhaust pipe.
5. Remove exhaust silencer mounting nuts from chassis side then remove exhaust silencer (1)(2).

Installation

1. Install the exhaust silencer (1)(2) chassis side and tighten nuts to the specified torque.
Nuts: 16 N·m (1.6 Kg·m/12 lb ft)
2. Install the exhaust silencer and tighten nuts (5) on front exhaust pipe to specified torque.
Nuts: 43 N·m (4.4 Kg·m/32 lb ft)
3. Install the rear exhaust pipe and tighten fixing nuts on exhaust silencer to specified torque.
Nuts: 43 N·m (4.4 Kg·m/32 lb ft)

Rear Exhaust pipe

Rear Exhaust pipe and Associated Parts



E06RW033

Legend

(1) Mounting Rubber

(2) Rear Exhaust Pipe

(3) Rear Exhaust Pipe Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove rear exhaust pipe fixing nuts (3), then disconnect rear exhaust pipe from exhaust silencer.
4. Remove mounting rubber (1).
5. Remove rear exhaust pipe (2).

Installation

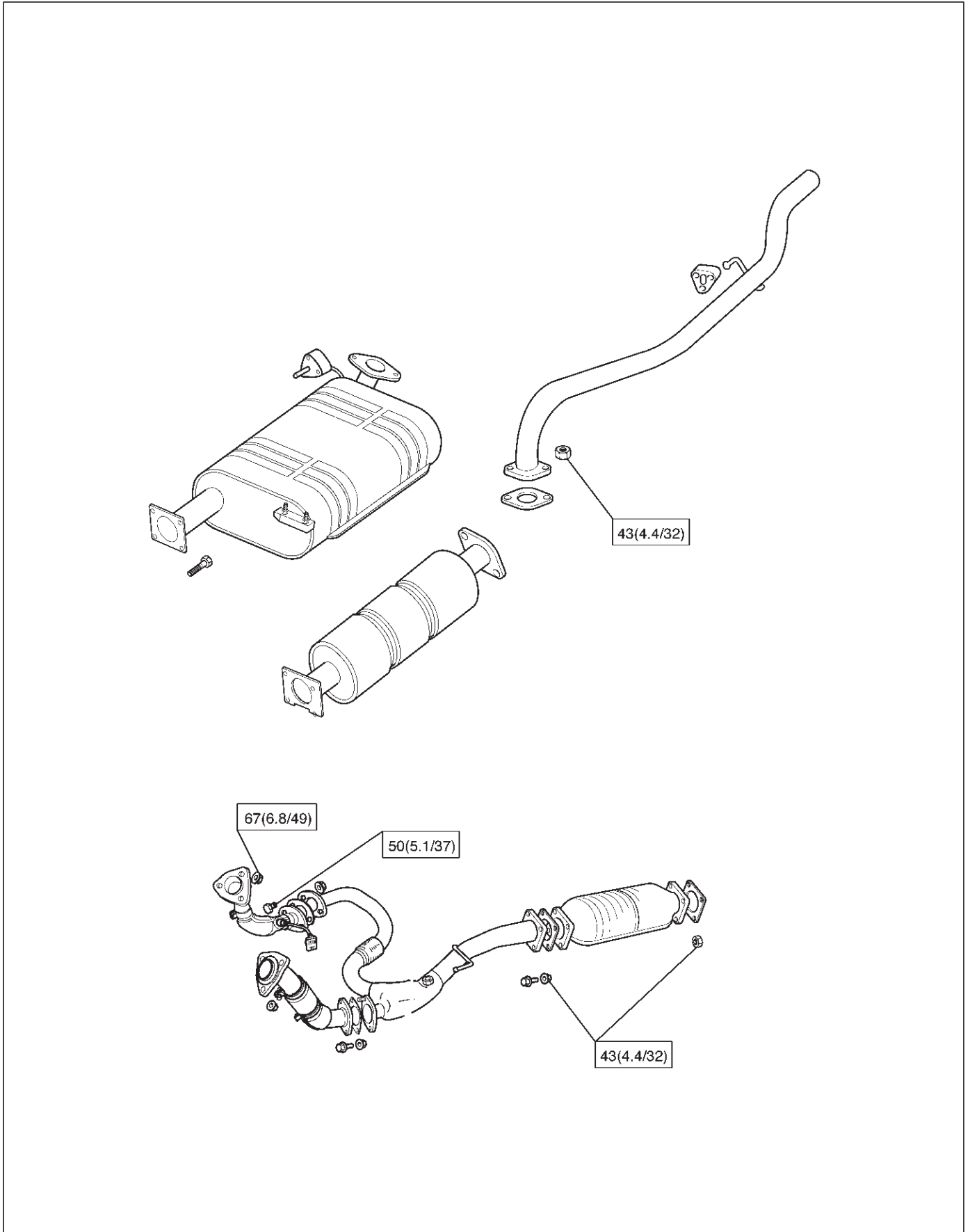
1. Install the mounting rubber (1).
2. Install the exhaust pipe (2) and tighten two nuts (3) on exhaust silencer to specified torque.

Nuts: 43 N·m (4.4 Kg·m/32 lb ft)

Main Data and Specifications

Torque Specifications

N·m (Kg·m/lb ft)



ENGINE

ENGINE LUBRICATION

CONTENTS

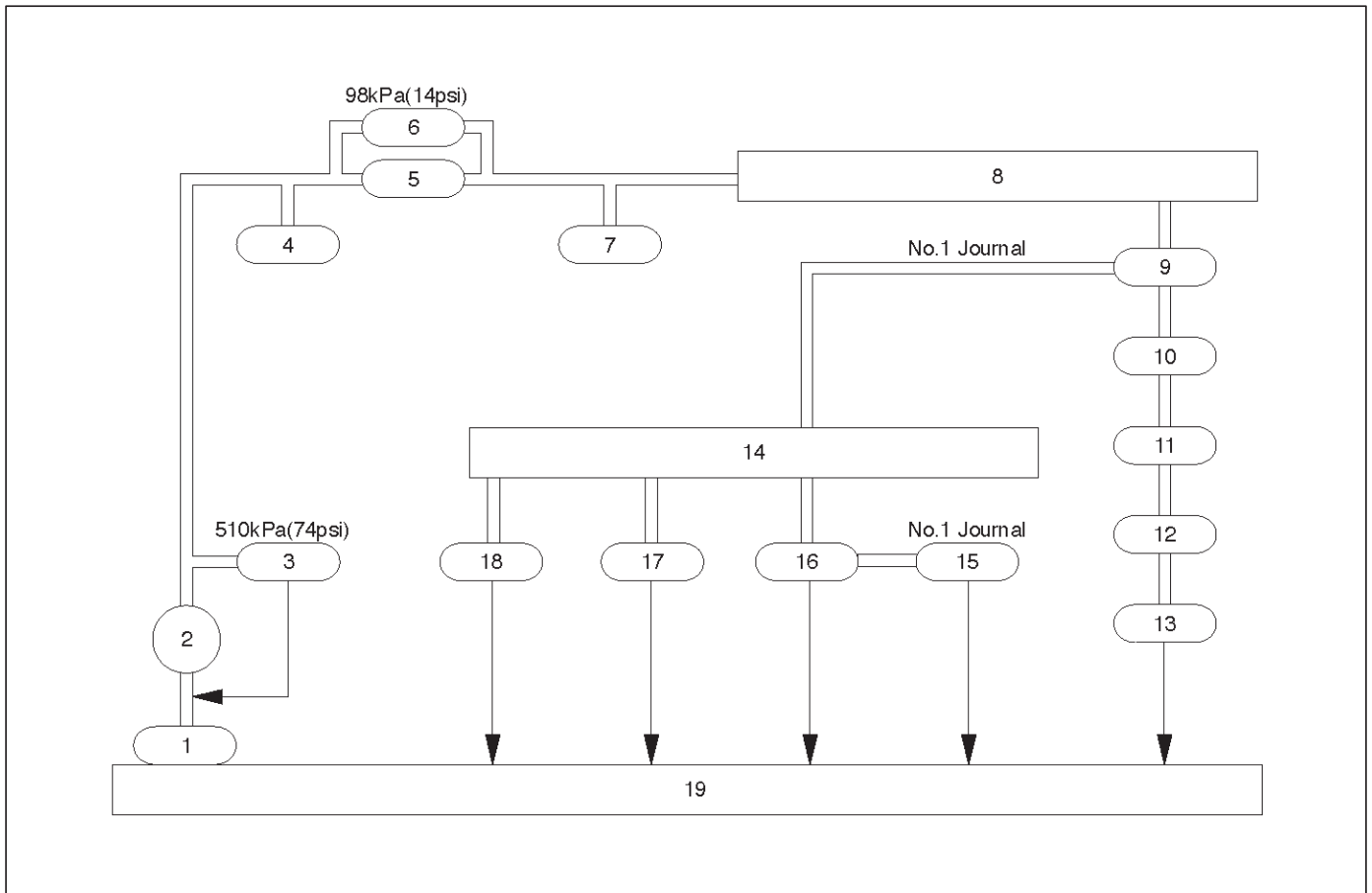
Service Precaution	6G-1	Removal	6G-10
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Oil Pump and Associated Parts	6G-3	Installation	6G-12
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Service Precaution

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

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

General Description



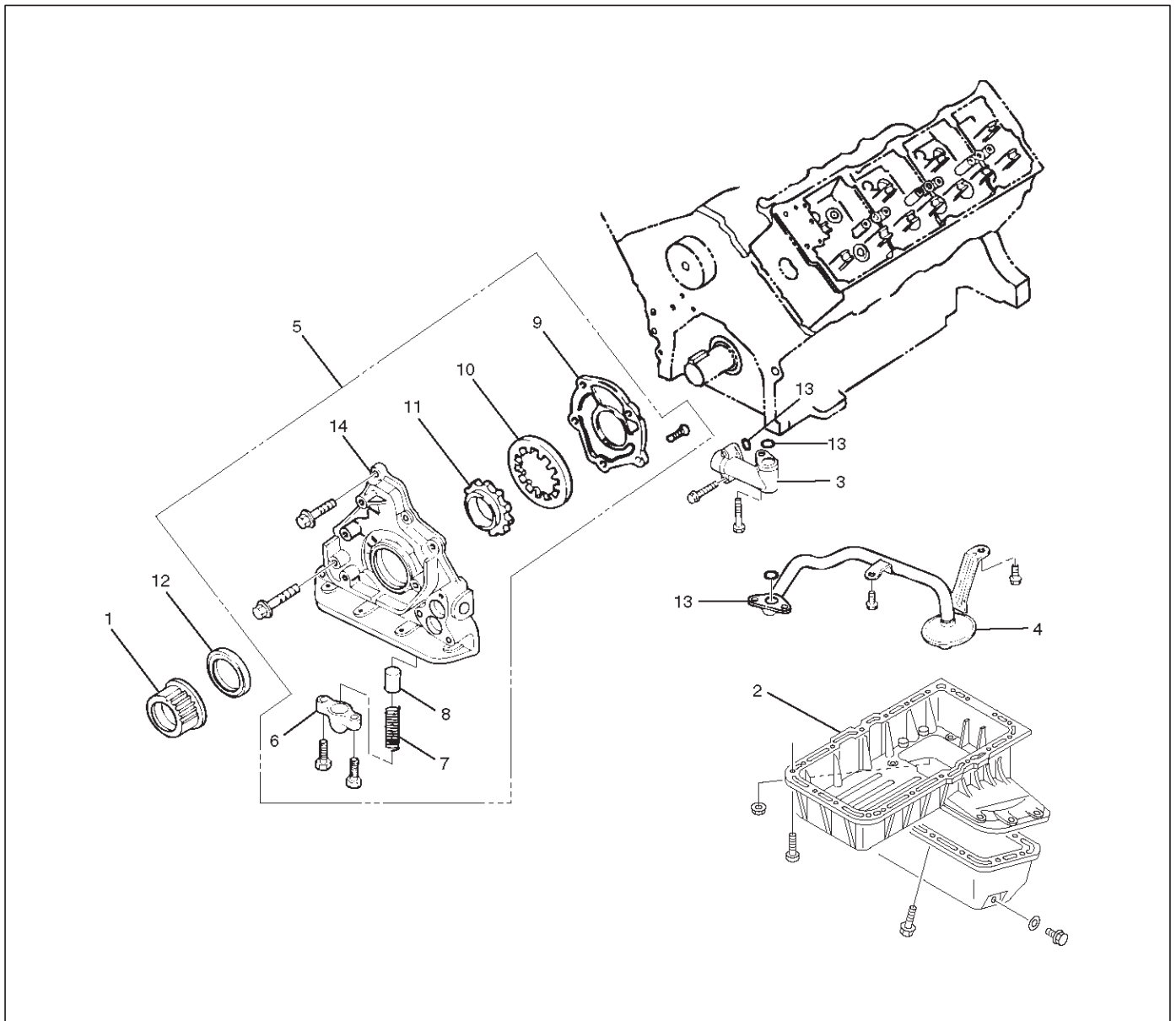
C06RW002

Legend

- | | |
|-------------------------|---|
| (1) Oil Strainer | (10) Crankshaft |
| (2) Oil Pump | (11) Connecting Rod Bearing |
| (3) Relief Valve | (12) Connecting Rod |
| (4) Oil Pressure Switch | (13) Piston |
| (5) Oil Filter | (14) Oil Gallery; Cylinder Head |
| (6) Safety Valve | (15) Camshaft |
| (7) Oil Pressure Unit | (16) Camshaft Journal |
| (8) Oil Gallery | (17) Front Journal; Camshaft Drive Gear |
| (9) Crankshaft Bearing | (18) Rear Journal; Camshaft Drive Gear |
| | (19) Oil Pan |

Oil Pump

Oil Pump and Associated Parts



051RW005

Legend

- | | |
|------------------------------|--------------------|
| (1) Crankshaft Timing Pulley | (8) Relief Valve |
| (2) Crankcase with Oil Pan | (9) Oil Pump Cover |
| (3) Oil Pipe | (10) Driven Gear |
| (4) Oil Strainer | (11) Drive Gear |
| (5) Oil Pump Assembly | (12) Oil Seal |
| (6) Plug | (13) O-ring |
| (7) Spring | (14) Oil Pump Body |

Oil Pump and Associated Parts

1. Remove crankshaft timing pulley.
2. Remove crankcase with oil pan.
3. Remove oil pipe.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove plug.
7. Remove spring.
8. Remove relief valve.
9. Remove oil pump cover.
10. Remove driven gear.

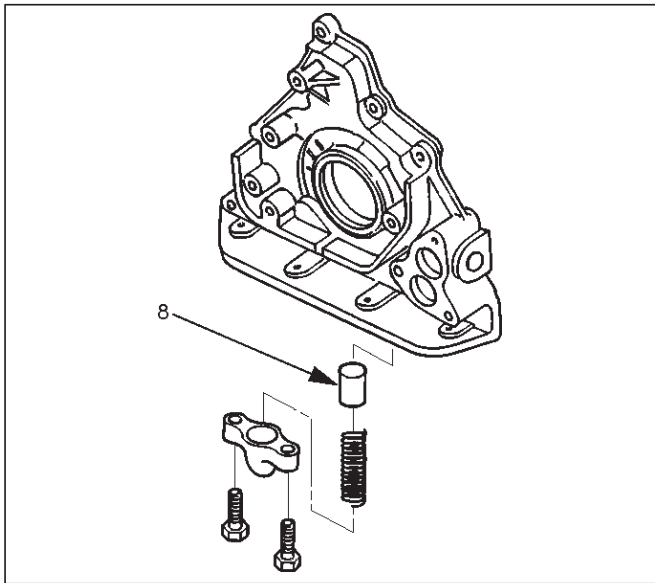
11. Remove drive gear.
12. Remove oil seal.
13. Remove O-ring.

Inspection and Repair

CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found during inspection.

Relief Valve (8)

- Check to see that the relief valve slides freely.
- The oil pump must be replaced if the relief valve does not slide freely.
- Replace the spring and/or the oil pump assembly (5) if the spring is damaged or badly worn.



Body (14) and Gears (10, 11)

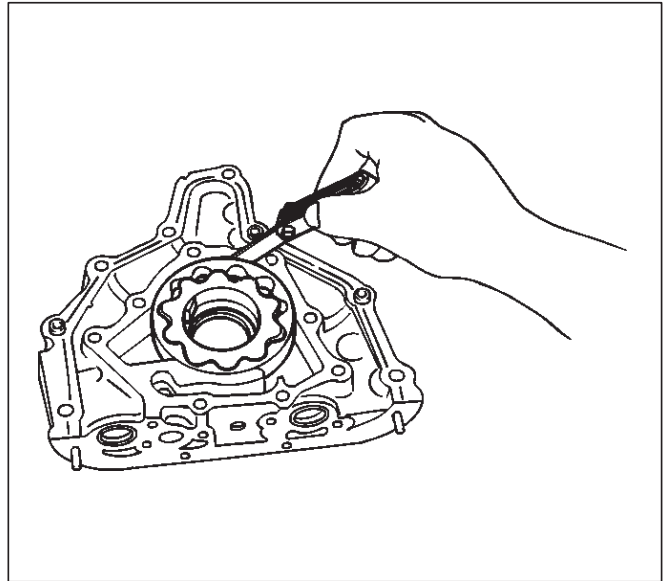
The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

- Badly worn or damaged driven gear (10).
- Badly worn drive gear (11) driving face.
- Badly scratched or scored body sliding face (14) or driven gear (10).
- Badly worn or damaged gear teeth.

Measure the clearance between the body and the driven gear with a feeler gauge.

Standard : 0.10 mm–0.18 mm
(0.0039 in.–0.0070 in)

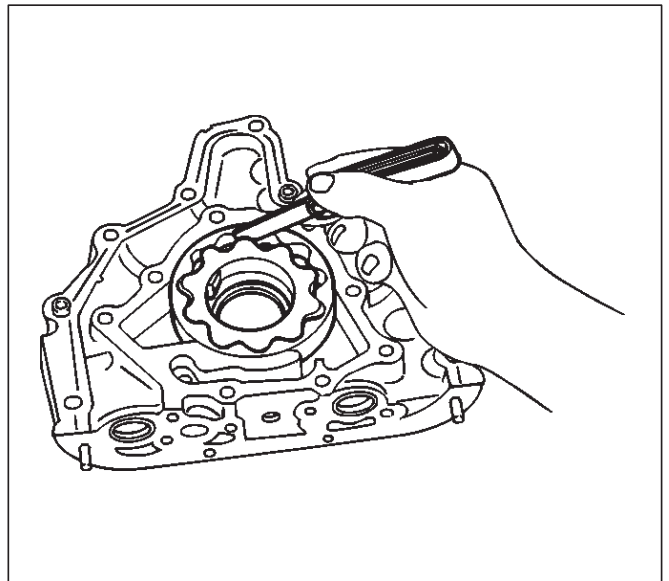
Limit : 0.20mm (0.0079 in)



- Measure the clearance between the drive gear and driven gear with a feeler gauge.

Standard : 0.11 mm–0.24 mm
(0.0043 in–0.0094 in)

Limit : 0.35mm (0.0138 in)

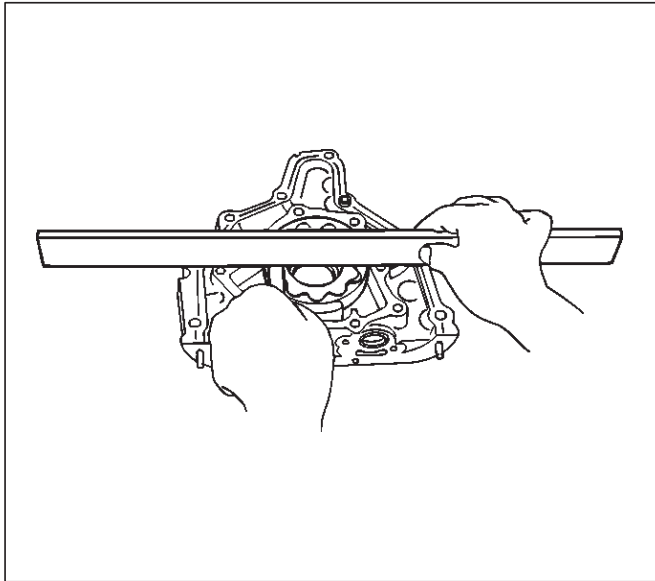


- Measure the side clearance with a precision straight edge and a feeler gauge.

Clearance

Standard : 0.03 mm–0.09 mm
(0.0011 in–0.0035 in)

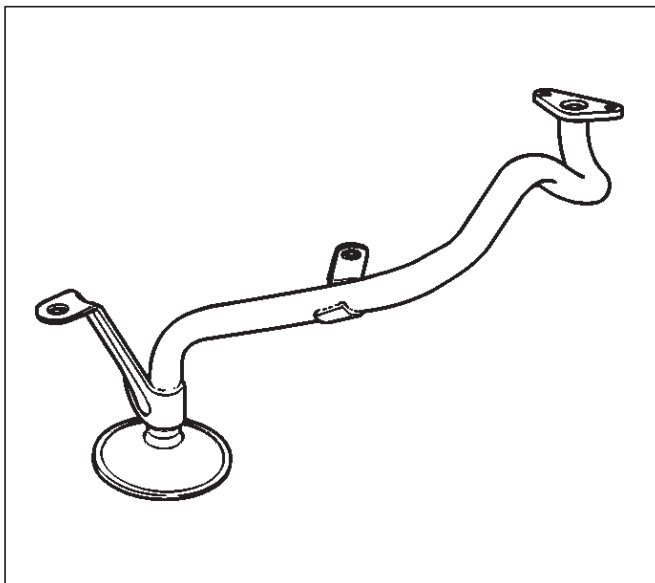
Limit : 0.15mm (0.0059 in)



051RS005

Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.



051RS006

Reassembly

1. Install drive gear (11).
2. Install driven gear (10).
3. Install oil pump cover (9) and first, loosely tighten all of the attaching screws. Next, tighten the attaching screws to the specified torque.

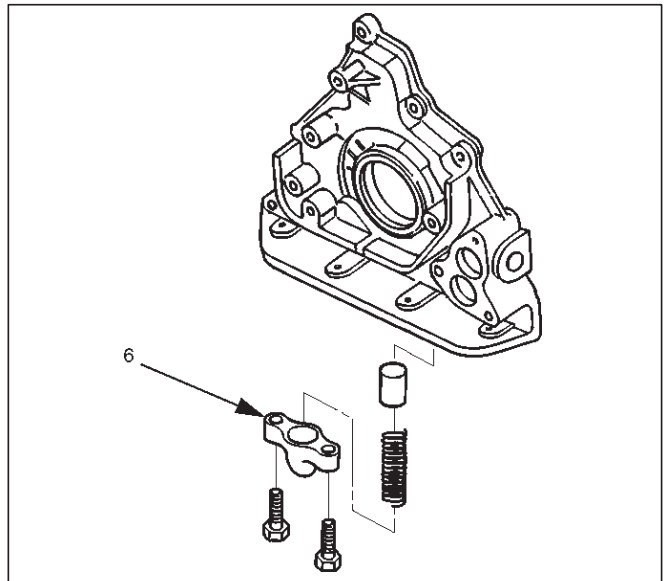
Torque : 10 N·m (1.0 Kg·m/89 lb in)

After installation, check that the gear rotates smoothly.

4. Install relief valve (8) and apply engine oil to the relief valve and spring (7).
5. Install spring (7).

6. Install the plug (6).

Torque : 8 N·m (0.8 Kg·m/69 lb in)



051RS007

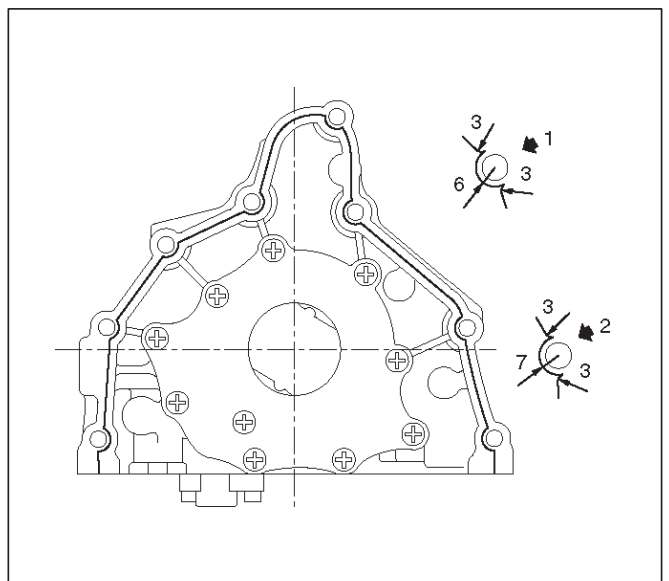
7. Install oil pump assembly (5).

- Carefully remove any oil from the cylinder body and the pump. Apply sealant (TB-1207B or equivalent) to the pump fitting face as shown in illustration. Take care that sealant is not applied to oil port surfaces. The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.

CAUTION: Do not apply an excessive amount of sealant to the contact surface. Applying too much sealant will overflow the contact surfaces. This could cause serious damage to the engine.

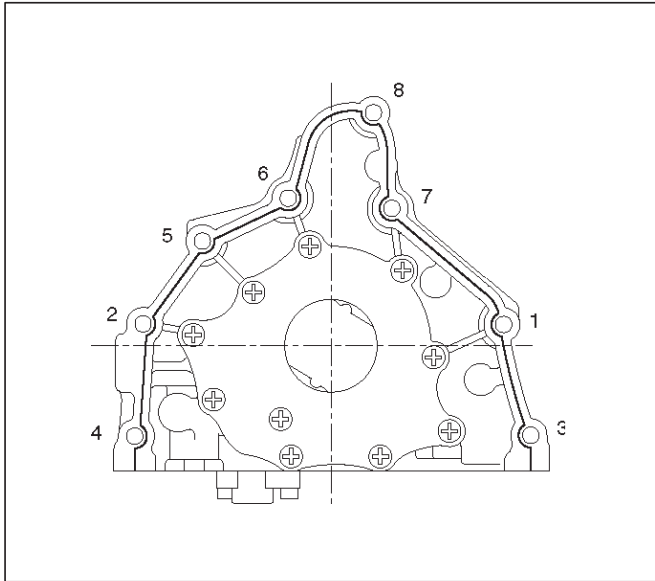
- Attach oil pump assembly to cylinder body.
- Tighten the oil pump fixing bolts.

Torque : 25 N·m (2.5 Kg·m/18 lb-ft)



051RW002

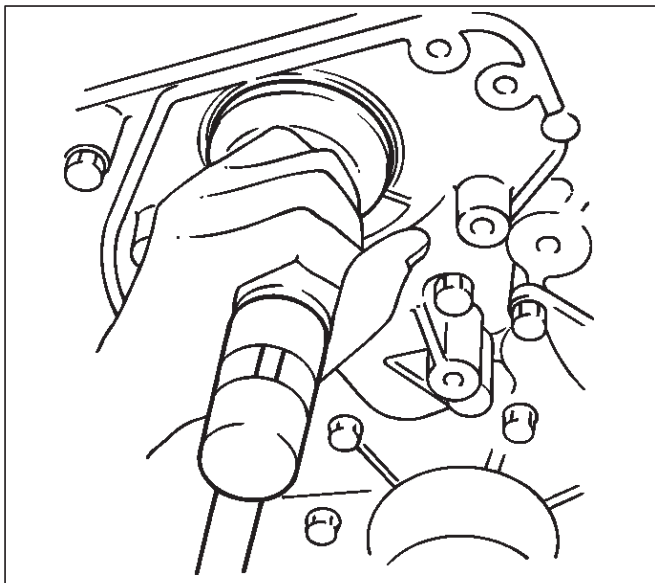
6G-6 ENGINE LUBRICATION



Legend

- (1) Around Bolt Holes
- (2) Around Dowel Pin

8. Install the new oil seal (12). Apply engine oil to the oil seal lip before installation then use 5-8840-2287-0 oil seal Installer, install oil seal.



9. Install oil strainer (4) with O-ring (13).

Torque: 25 N-m (2.5 Kg-m/18 lb ft)

10. Install oil pipe (3) with O-ring (13).

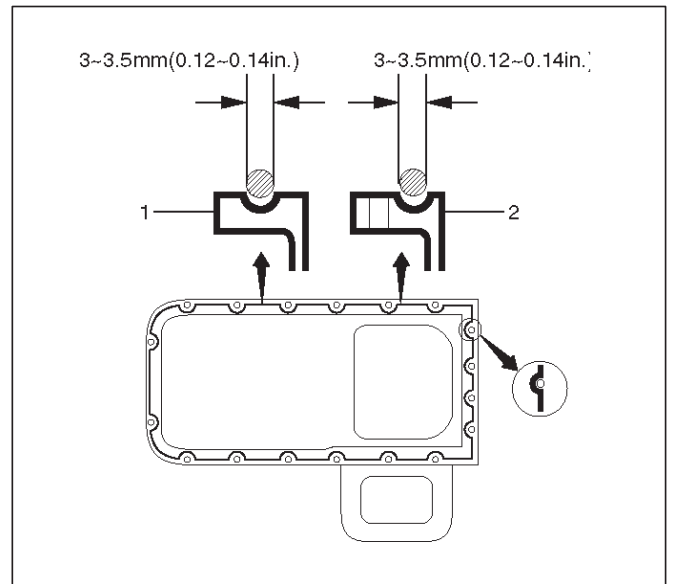
Torque: 25 N-m (2.5 Kg-m/18 lb ft)

11. Install crankcase with oil pan (2).

- Remove oil on crankcase mounting surface and dry the surface.
- Apply a proper 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
- The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.

- Tighten fixing bolts to the specified torque.

Torque : 10 N-m (1.0 Kg-m/89 lb in)

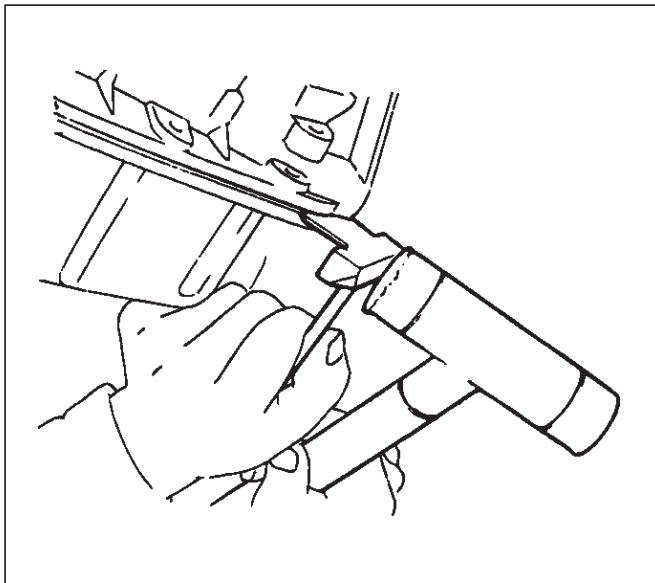


12. Install crankshaft timing pulley.

Oil Pan and Crankcase

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Lift vehicle by supporting the frame.
4. Remove front wheels.
5. Remove oil level dipstick from level gauge tube.
6. Remove stone guard.
7. Remove radiator under fan shroud.
8. Remove suspension cross member fixing bolts, 2 pcs each per side and remove suspension cross member.
9. Remove pitman arm and relay lever assembly, using the 5-8840-2005-0 remover, remove pitman arm from the steering unit and remove four fixing bolts for relay lever assembly.
10. Remove axle housing assembly four fixing bolts from housing isolator side and mounting bolts from wheel side. At this time support the axle with a garage jack and remove axle housing assembly.
11. Remove oil pan fixing bolts.
12. Remove oil pan, using 5-8840-2153-0 sealer cutter, remove oil pan.

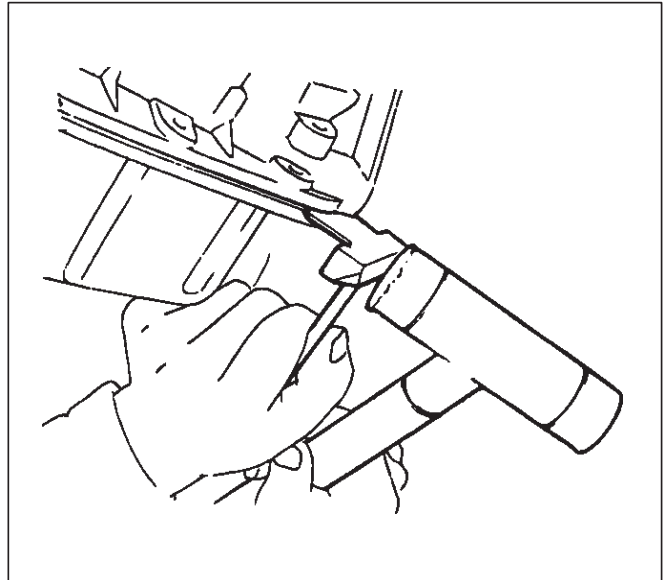


013RS003

13. Remove crankcase fixing bolts.
14. Remove crankcase, using 5-8840-2153-0 sealer cutter, remove crankcase.

NOTE: Do not deform or damage the flange of oil pan and crankcase.

Replace the oil pan and/or crankcase if deformed or damaged.



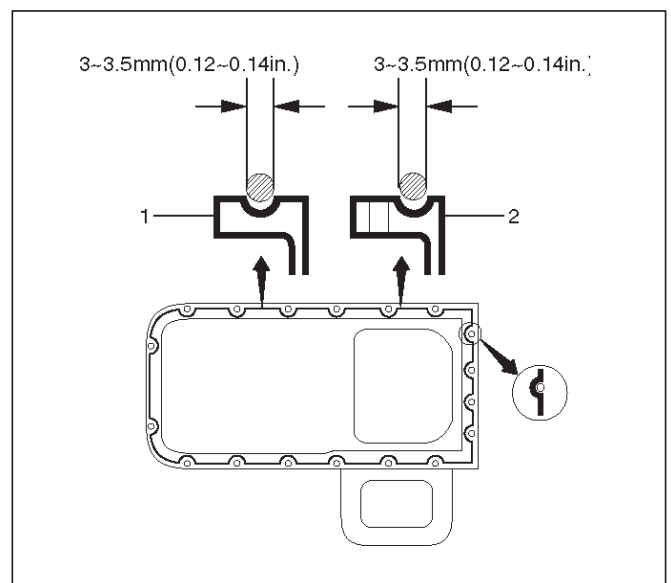
013RS003

Installation

1. Install crankcase.
 1. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
 2. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of crankcase.

Sealant beat must be continuous.

 - The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.

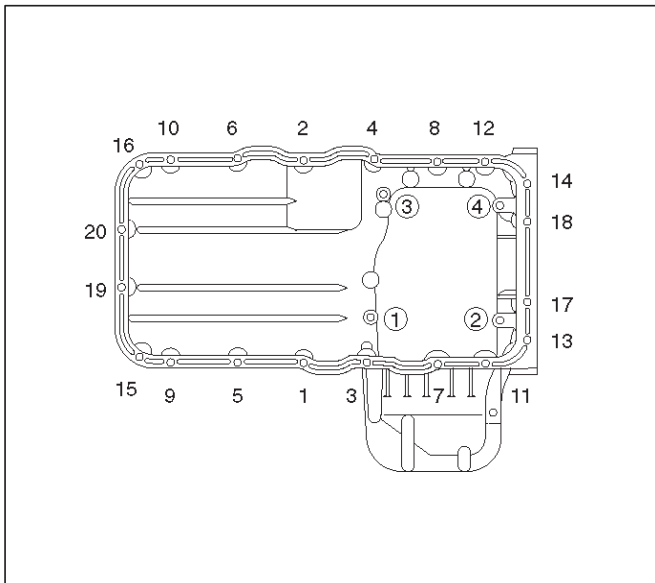


013RW010

6G-8 ENGINE LUBRICATION

3. Install crankcase, tighten crankcase fixing bolts to the specified torque.

Torque : 10 N-m (1.0 Kg-m/89 lb in)



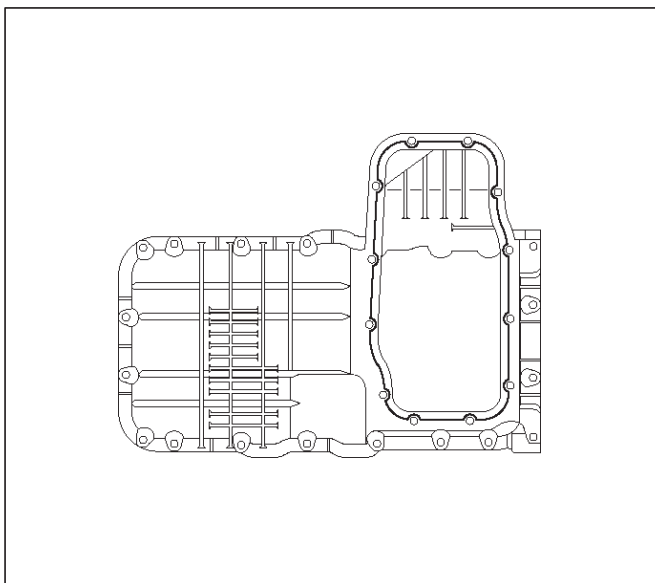
013RW004

2. Install oil pan

1. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
2. Properly apply a 4.5 mm (07 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of oil pan.

Sealant beat must be continuous.

- The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.



013RW003

3. Install oil pan, tighten oil pan fixing bolts to the specified torque.

Torque : 25 N-m (2.5 Kg-m/18 lb ft)

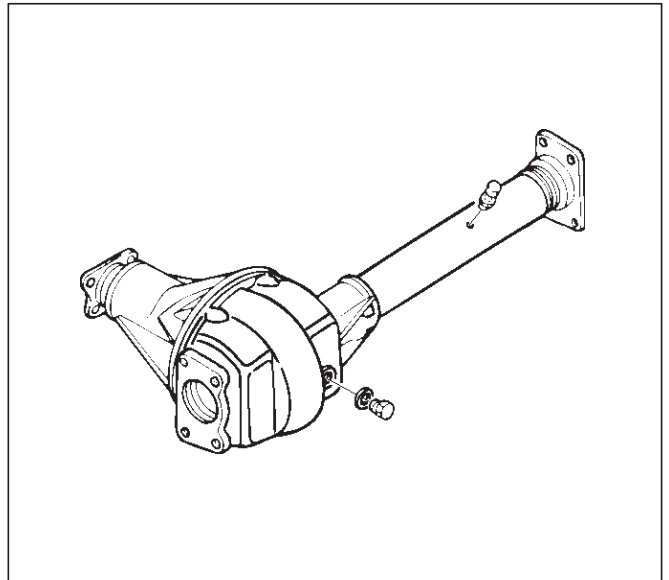
3. Install axle housing assembly and tighten fixing bolts to the specified torque.

Axle case bolts

Torque : 82 N-m (8.4 Kg-m/60 lb ft)

Mounting bolts

Torque : 152 N-m (15.5 Kg-m/112 lb ft)



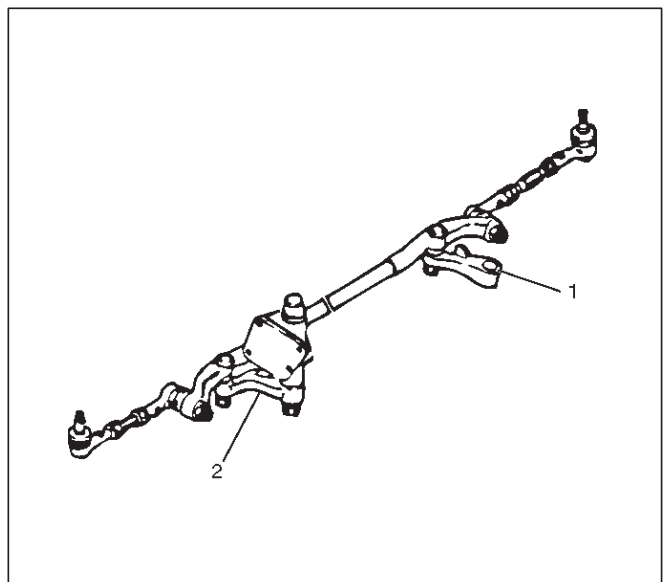
013RW005

4. Install relay lever assembly and tighten fixing bolts.

Torque: 44 N-m (4.5 Kg-m/32 lb ft)

5. Engage teeth of pitman arm and steering unit, and tighten nut to the specified torque.

Torque : 216 N-m (22.0 Kg-m/159 lb ft)



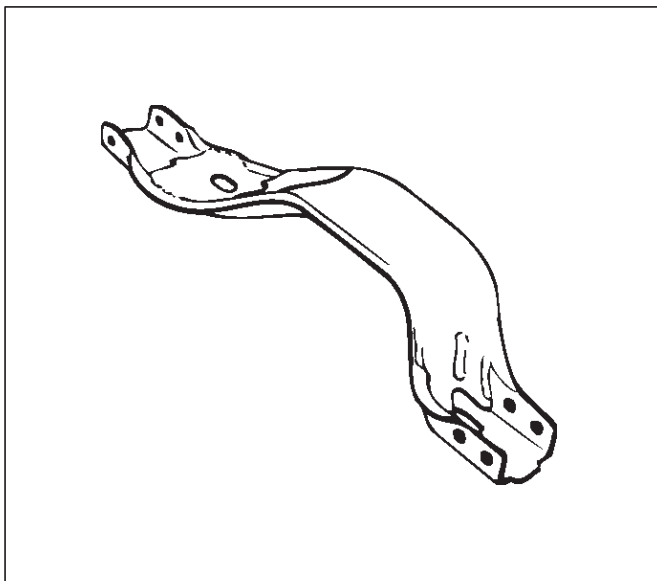
013RW006

Legend

- (1) Pitman Arm
- (2) Relay Lever

6. Install suspension cross member and tighten fixing bolts to the specified torque.

Torque : 78 N·m (8.0 Kg·m/58 lb ft)



013RW007

7. Install radiator under fan shroud.
8. Install stone guard.
9. Install engine oil level dipstick.
10. Fill engine oil until full level on engine oil gauge dipstick.

Oil Pump

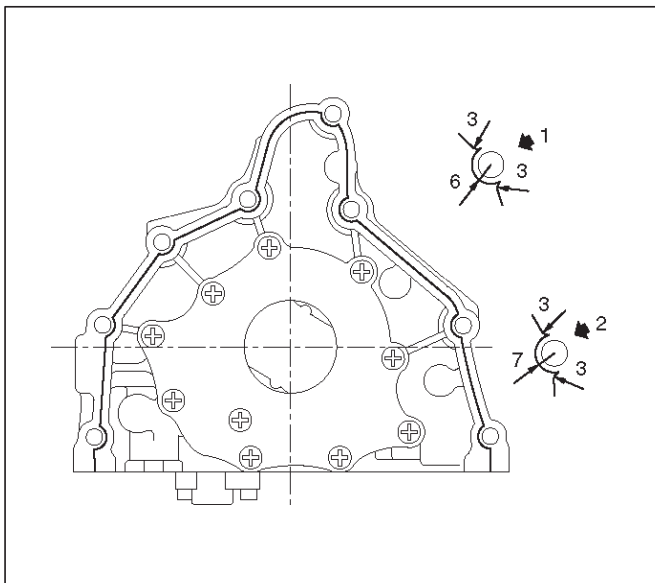
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankcase assembly.
 - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove crankshaft pulley.
 - Refer to removal procedure for Crankshaft Pulley in this manual.
5. Remove timing belt.
 - Refer to removal procedure for Timing Belt in this manual.
6. Remove timing pulley from crankshaft.
7. Remove four fixing bolts from oil filter assembly.
8. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.
9. Remove three bolts from oil pipe and O-ring.
10. Remove eight oil pump fixing bolts, then oil pump assembly.
11. Remove sealant from mounting surface of oil pump assembly, cylinder block and take care not to damage mounting surfaces of oil pump and cylinder block.

Installation

1. Install oil pump assembly
 - Apply sealant (TB-1207B or equivalent) to the oil pump mounting surfaces as shown in the illustration.
 - The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.

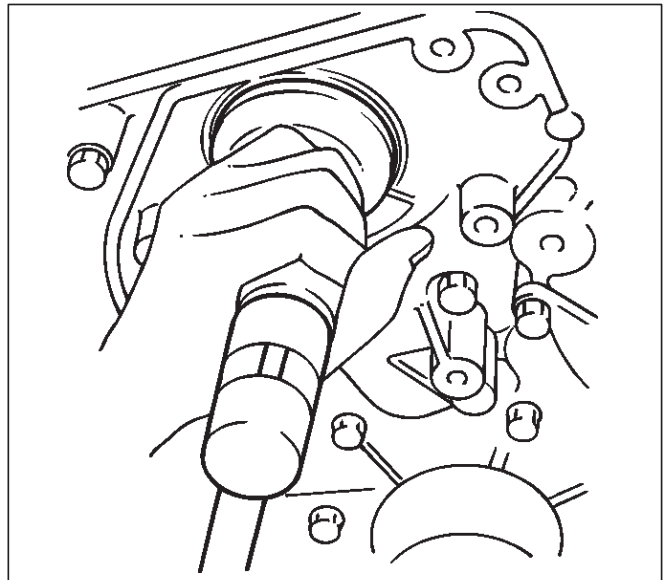
NOTE: Do not apply sealant to the oil ports.



051RW002

- Use 5-8840-2287-0 installer when installing new oil seal.
- Apply engine oil to oil seal lip.
- Install oil pump assembly to the cylinder block.

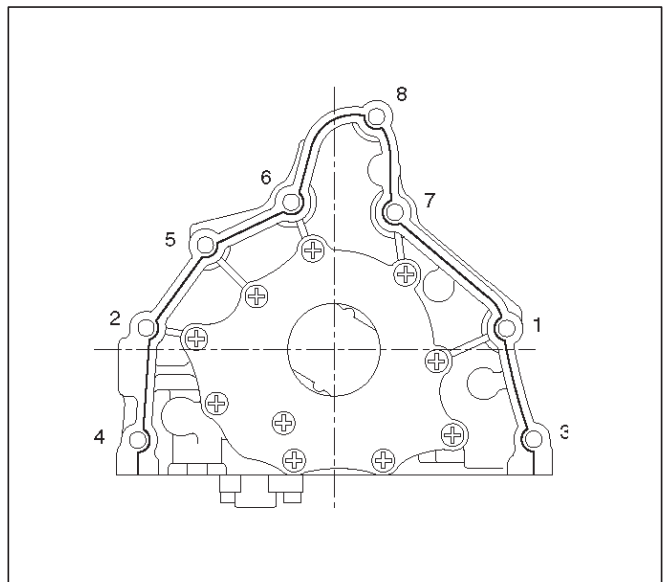
NOTE: Do not damage oil seal during installation of oil pump assembly.



015RS001

- Tighten fixing bolts to the specified torque.

Torque : 25 N-m (2.5 Kg-m/18 lb ft)



051RW001

2. Install oil pipe with O-ring, tighten fixing bolt to the specified torque.

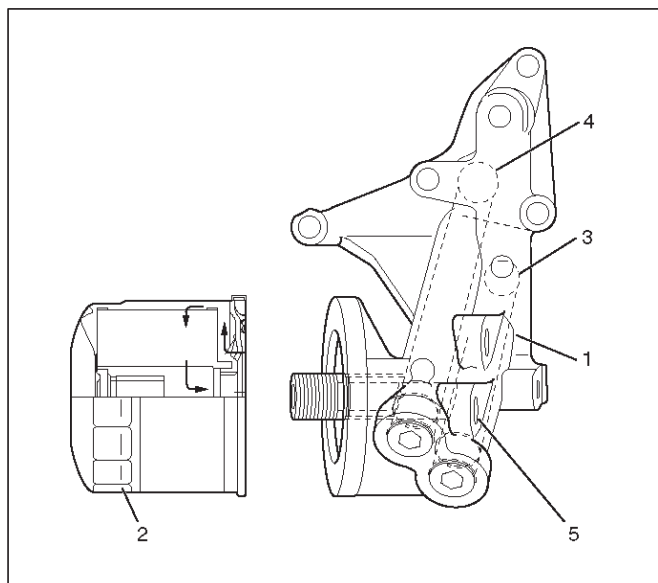
Torque : 10 N-m (1.0 Kg-m/89 lb in)

3. Install oil strainer with O-ring, tighten fixing bolt to the specified torque.

Torque : 25 N-m (2.5 Kg-m/18 lb ft)

4. Install oil filter assembly and tighten bolts to the specified torque.

Torque : 25 N·m (2.5 Kg·m/18 lb ft)



Legend

- (1) Oil Pump
- (2) Oil Filter
- (3) Oil Gallery
- (4) From Oil Filter
- (5) To Oil Filter

5. Install timing pulley on crankshaft.

Install timing belt.

- Refer to installation procedure for Timing Belt in this manual.

6. Install crankshaft pulley.

- Refer to install procedure for Crankshaft Pulley in this manual.

7. Install crankcase assembly.

- Refer to installation procedure for Oil Pan and Crankcase in this manual.

8. Refill engine oil until full level on engine oil dipstick.

Oil Pump Oil Seal

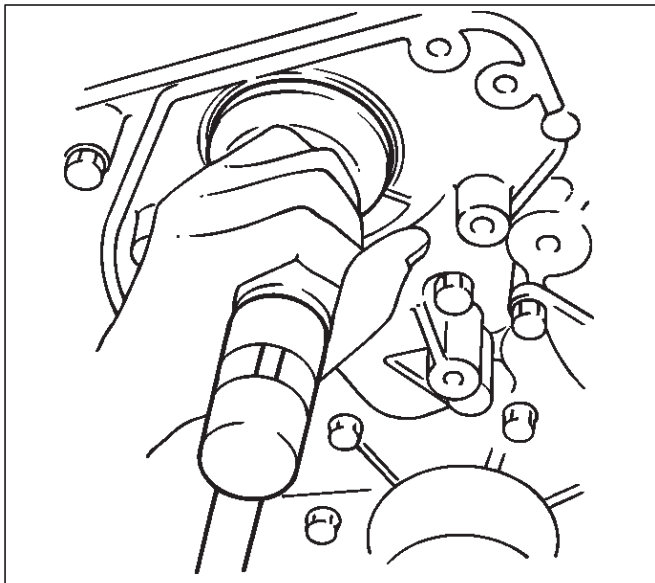
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankshaft pulley.
 - Refer to removal procedure for Crankshaft Pulley in this manual.
4. Remove timing belt.
 - Refer to removal procedure for Timing Belt in this manual.
5. Remove timing pulley from crankshaft.
6. Remove oil pump oil seal using a sealer puller.

NOTE: Take care not to damage sealing surfaces of oil pump and crankshaft when removing oil seal.

Installation

1. Install oil pump oil seal, apply engine oil to oil seal lip, then install oil seal using 5-8840-2287-0 installer.



2. Install timing pulley to crankshaft.
3. Install timing belt.
 - Refer to installation procedure for Timing Belt in this manual.
4. Install crankshaft pulley.
 - Refer to installation procedure for Crankshaft Pulley in this manual.
5. Refill engine oil until full level.

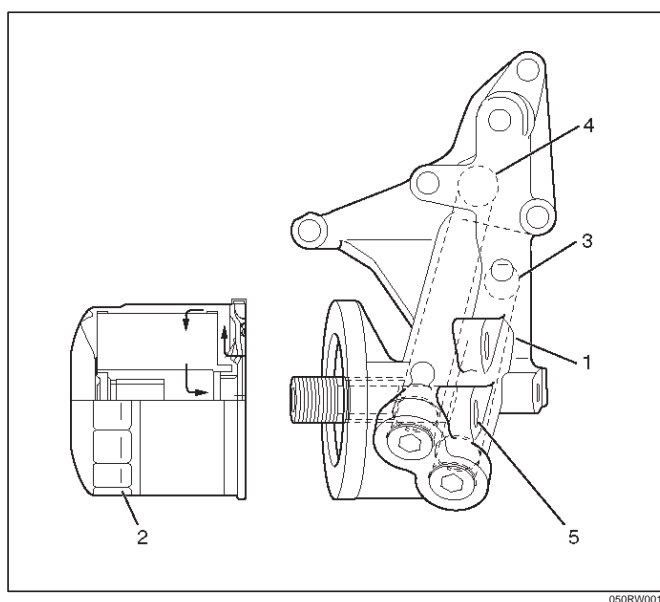
Oil Filter

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove oil filter using 5-8840-0203-0 filter wrench.

Installation

1. Clean filter fitting surface and apply small amount of engine oil to sealing surface.
2. Install oil filter cartridge by hand until it comes in contact with sealing surface then rotate additional 2/3 turn to tighten using 5-8840-0203-0 filter wrench.



Legend

- (1) Oil Pump
- (2) Oil Filter
- (3) Oil Gallery
- (4) From Filter
- (5) To Filter

3. Fill engine oil until full level on dipstick.
4. Reconnect battery ground cable.

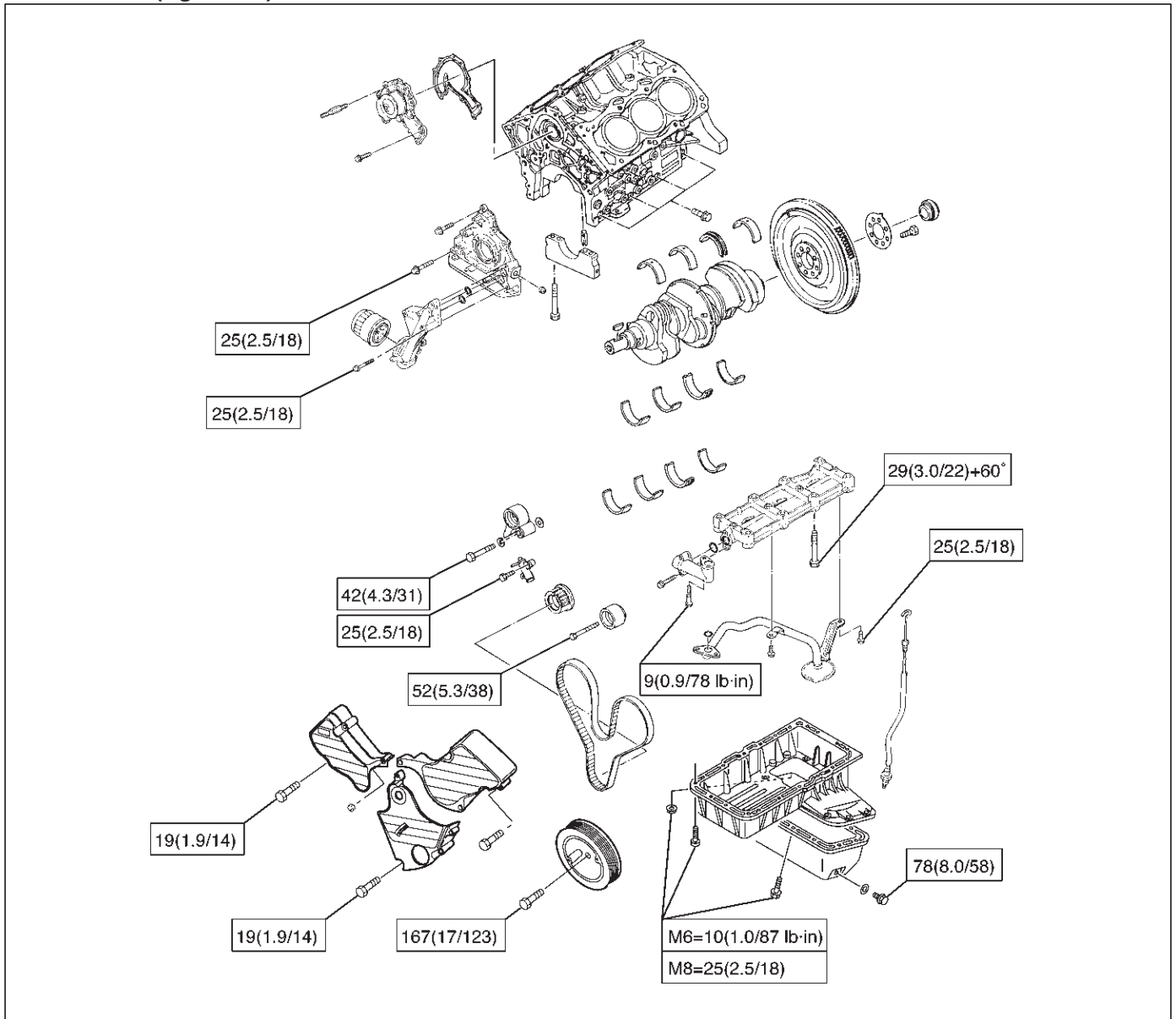
Main Data and Specification

General Specification

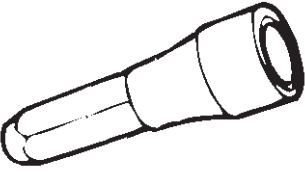
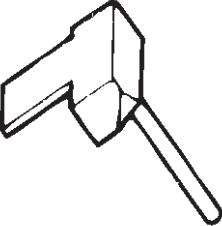

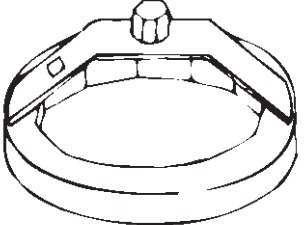
Item	Specifications	
	6VD1	6VE1
Oil capacity	5.3 liters	

Torque Specifications

Crankcase, Oil pan, Timing belt tensioner, Timing pulley, timing belt cover, Oil pump, Oil gallery, Oil strainer N·m (Kg·m/lb·ft)



Special Tool

ILLUSTRATION	TOOL NO. TOOL NAME
 901RT044	5-8840-2287-0 (J-39202) Installer; Oil pump oil seal
 901RT042	5-8840-2153-0 (J-37228) Seal cutter
 901RT038	5-8840-2005-0 (J-29107) Universal pitman arm puller
 901RT034	5-8840-0203-0 (J-36390) Wrench; Oil filter

ENGINE

ENGINE SPEED CONTROL SYSTEM

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Service Precaution	6H-1	Accelerator Pedal	6H-3
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Inspection	6H-2	Installation	6H-3
Installation	6H-2	Adjustment	6H-3
Adjustment	6H-2		

Service Precaution

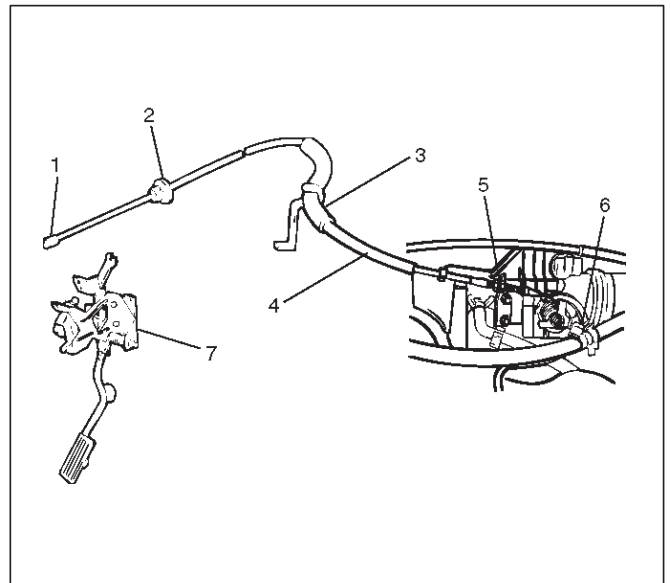
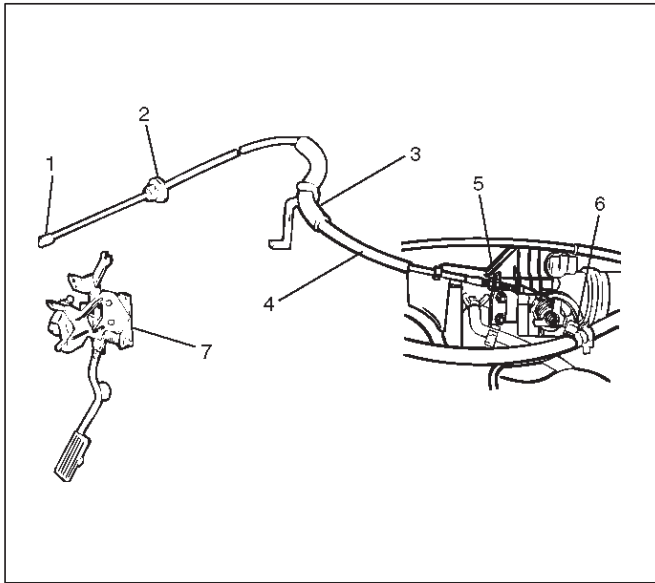
WARNING: IF SO EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM (SRS), REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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Accelerator Pedal Control Cable

Removal

1. Loosen the adjusting nut(5) on the cable bracket mounted on the common chamber.
2. Remove cable clip(3).
3. Disconnect accelerator pedal (AP) control cable(6). (on throttle valve side)
4. Disconnect AP control cable(1). (on AP pedal(7) side)
5. Remove molding cap(2).
6. Remove AP control cable(4).



Adjustment

1. Loosen adjusting nut and lock nut.
2. Pull outer cable while closing fully the throttle valve.
3. Tighten adjusting nut and lock nut temporarily.
4. Loosen adjusting nut by three turns and tighten lock nut.

Then, manually operating the throttle valve, make sure that the valve lever returns up to the stopper screw.

If it does not reach the stopper screw, repeat from step 1.

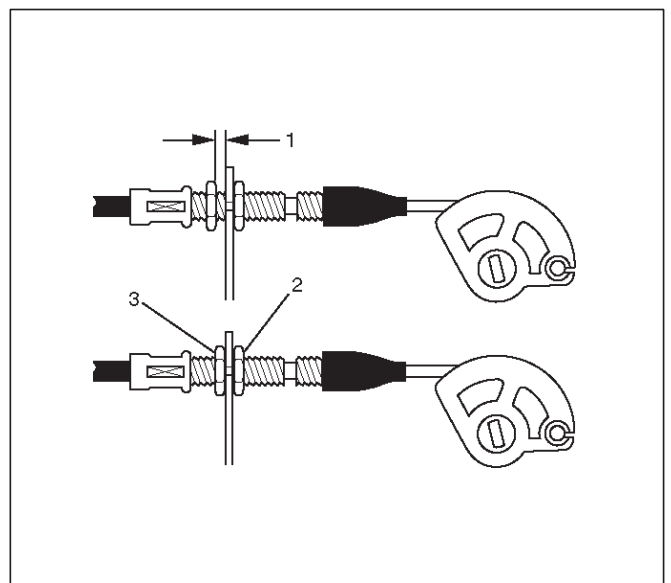
Inspection

Check the following items, and replace the control cable if any abnormality is found:

- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

Installation

1. Install AP control cable(4).
2. Install molding cap(2).
3. Connect AP control cable(1). (on AP side)
4. Connect AP control cable(6). (on throttle valve side)
5. Install cable clip(3).
6. Install adjusting nut(5).

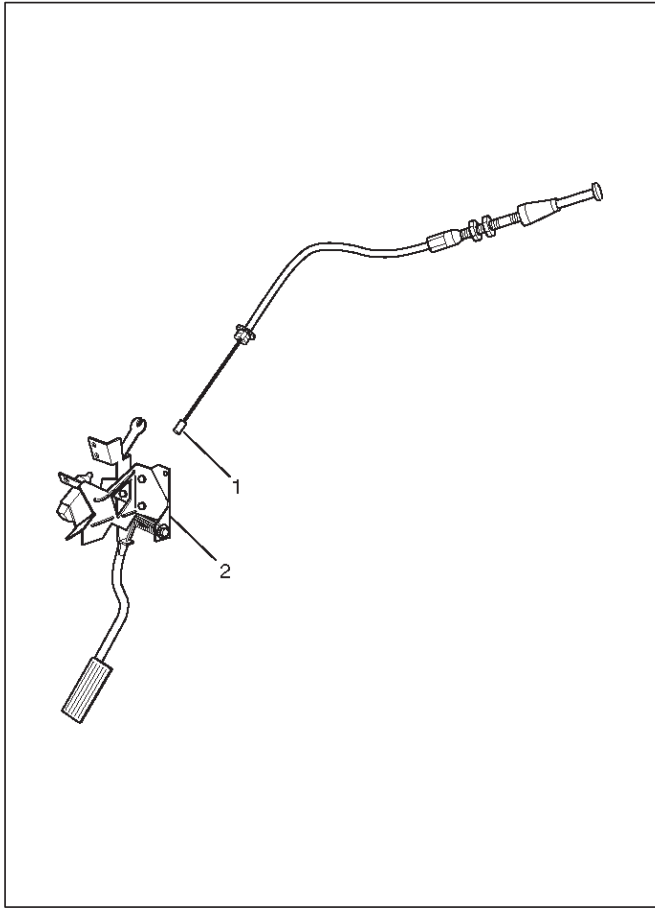


Legend

- (1) Clearance
- (2) Lock Nut
- (3) Adjusting Nut

Accelerator Pedal

Accelerator Pedal and Associated Parts



035RW028

Legend

- (1) Accelerator Pedal Control Cable
- (2) Accelerator Pedal Assembly

Adjustment

Manual Transmission:

- Rotate counterclockwise to loosen the lock nut and screw the stopper bolt in sufficiently.
- Fully depress the pedal and hold it there with your hand. Next, rotate the stopper bolt until it hits the stopper of pedal bracket. Then, lock the stopper bolt there.

Automatic Transmission:

- Rotate counterclockwise to loosen the kickdown switch sufficiently.
- Fully depress the pedal and hold it there with your hand. Rotate the switch clockwise and then rotate further by 1/2 turn from the position where the switch clicks. Lock the switch there.
- Step on the accelerator pedal and make sure that you can hear a clicking sound at the full stroke position.

Removal

1. Accelerator Pedal control cable(1).
2. Accelerator Pedal assembly(2).

Installation

1. Accelerator pedal assembly(2).
2. Accelerator pedal control cable(1).

MEMO

ENGINE

INDUCTION

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Installation	6J-2

Service Precaution

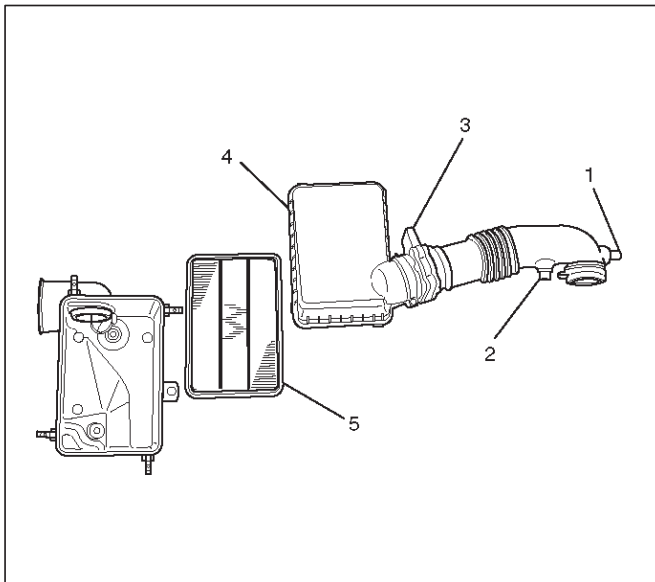
WARNING: IF SO EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM (SRS), REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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

Air Cleaner Element

Removal

1. Remove positive ventilation hose from connector(1).
2. Remove intake air temperature sensor(2).
3. Remove air flow sensor(3).
4. Remove air cleaner duct cover(4).
5. Remove air cleaner element(5).

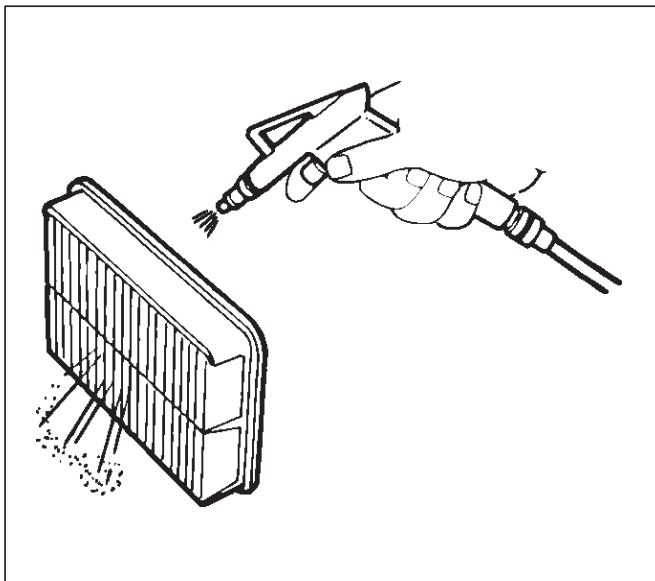


Inspection

Check the air cleaner element for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

Cleaning Method

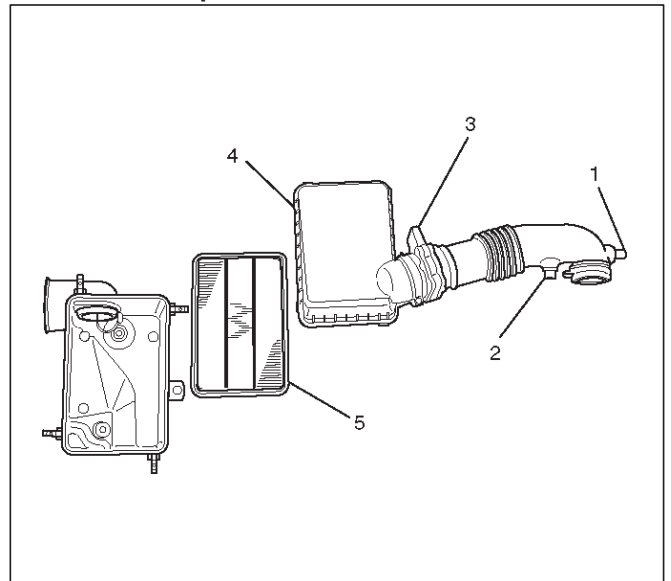
Tap the air cleaner element gently so as not to damage the paper element, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.



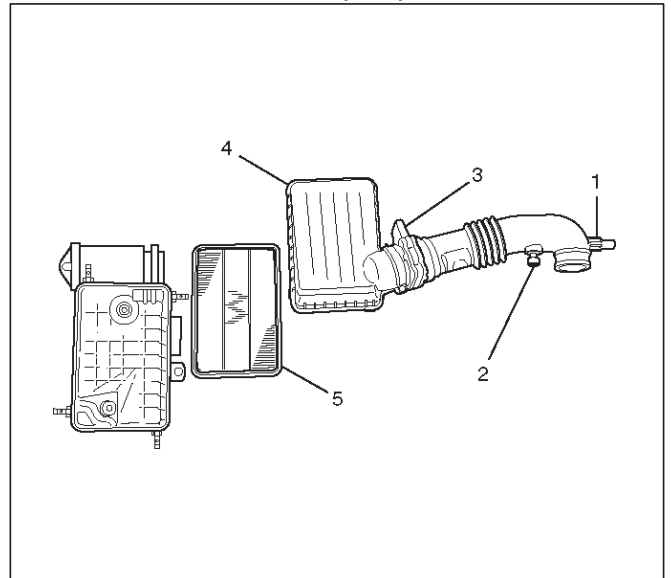
Installation

1. Install air cleaner element(5).
2. Attach the air cleaner duct cover (4) to the body completely, then clamp it with the clip.
3. Install mass air flow sensor(3).
4. Install air temperature sensor(2).
5. Connect positive crankcase ventilation hose to connector(1).

For General Export Model



For Isuzu General Motors (IGM) Model



SECTION 00
SERVICE INFORMATION

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TROUBLESHOOTING

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1. HARD STARTING

1. STARTER MOTOR INOPERATIVE		
Checkpoint	Possible cause	Correction
Battery	Loose battery cable terminal Poor connections due to rusting	Clean and/or retighten the battery cable terminal
	Battery discharged or weak	Recharge or replace the battery
	Fan belt loose or broken	Adjust or replace the fan belt
Fusible link	Fusible link shorted	Replace the fusible link
Starter switch	Defective starter switch or starter relay	Replace the starter switch or the starter relay
Starter motor	Defective magnetic switch or starter relay	Repair or replace the magnetic switch
	Defective starter motor	Repair or replace the starter motor
2. STARTER MOTOR OPERATES BUT ENGINE DOES NOT TURN OVER		
Battery	Loose battery cable terminal Poor connections due to rusting	Clean and/or retighten the battery cable terminal
	Battery discharged or weak	Recharge or replace the battery
	Fan belt loose or broken	Adjust or replace the fan belt
Starter motor	Defective pinion gear	Replace the pinion gear
	Defective magnetic switch	Repair or replace the magnetic switch
	Brush wear, Weak brush spring	Replace the brush and/or the brush spring
Engine	Piston, crank bearing seizure, or other damage	Repair or replace the related parts

3. ENGINE TURNS OVER BUT DOES NOT START		
Checkpoint	Possible cause	Correction
Engine stop mechanism	Defective fuel cut solenoid valve	Replace the fuel cut solenoid valve
FUEL IS NOT BEING DELIVERED TO THE INJECTION PUMP		
Fuel	Fuel tank is empty	Fill the fuel tank
Fuel piping	Clogged or damaged fuel lines. Loose fuel line connection	Repair or replace the fuel lines Retighten the fuel line connection
Fuel filter	Fuel filter overflow valve does not close	Repair or replace the fuel filter overflow valve
	Clogged fuel filter element	Replace the fuel filter element or the filter cartridge
Fuel system	Air in the fuel system	Bleed the air from the fuel system
Fuel feed pump	Defective feed pump	Repair or replace the feed pump
FUEL IS BEING DELIVERED TO THE INJECTION PUMP		
Fuel	Use of the wrong fuel	Use the correct fuel
	Water particles in the fuel	Charge the fuel
Fuel system	Air in the injection pump	Bleed the air from the fuel system
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Injection pump	Defective fuel injection nozzle resulting in the fuel drippage after fuel injection	Replace the delivery valve
	Defective injection pump control rack operation	Repair or replace the injection pump control rack
	Injection pump plunger worn or stuck	Replace the injection pump plunger assembly
	Injection pump drive shaft seizure or other damage	Replace the injection drive shaft
	Injection pump governor spring seizure	Replace the injection pump governor spring

4. QUICK-ON START SYSTEM (QOS III)**PREPARATION**

1. Disconnect the thermostitch connector.
2. Determine whether or not the glow plugs are receiving power.
 - a) Make sure that the starter switch is "OFF"
 - b) Connect a voltmeter between one of the glow plugs and the cylinder wall.
 - c) Move the starter switch to the "ON" position.
The voltmeter needle will show the source voltage (12V) if the glow plugs are receiving power.
If the voltmeter needle does not move, the glow plugs are not receiving power.
3. Perform the troubleshooting procedure.

Glow plug indicator light does not turn on.	<ol style="list-style-type: none"> 1. Defective Fusible link wire 2. Broken indicator light fuse 3. Defective indicator light bulb 	Replace the fusible link wire Replace the indicator light fuse Replace the indicator light bulb
Preheating system does not work	<ol style="list-style-type: none"> 1. Defective Fusible link wire shorted 2. Defective glow plug relay connector 3. Defective glow plug connector 4. Defective quick-on start timer connector 	Replace the fusible link wire Replace or Repair glow plug relay connector Replace or Repair glow plug connector Replace or Repair quick-on start timer connector
Preheating time to long or to short	<ol style="list-style-type: none"> 1. Defective thermo sensor include defective wiring harness 2. Defective glow plug 3. Defective timer unit 	Replace thermo sensor or repair wiring harness. Replace glow plug Replace timer unit

2. UNSTABLE IDLING

Checkpoint	Possible cause	Correction
Idling system	Idling improperly adjusted	Adjust the idling
Fast idling speed control device	Defective fast idling speed control device	Repair or replace the fast idling speed control device
Accelerator control system	Accelerator control system improperly adjusted	Adjust the accelerator control system

00 – 6 SERVICE INFORMATION

Checkpoint	Possible cause	Correction
Fuel system	Fuel system leakage or blockage	Repair or replace the fuel system
	Air in the fuel system	Bleed the air from the fuel system
	Water particles in the fuel system	Change the fuel
Fuel filter	Clogged fuel filter element	Replace the fuel filter element or the fuel filter cartridge
Fuel feed pump	Defective fuel feed pump	Repair or replace the fuel feed pump
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Injection pump	Defective delivery valve resulting in fuel drippage after fuel injection	Replace the delivery valve
	Injection timing improperly adjusted	Adjust the injection timing
	Insufficient injection volume	Adjust the injection volume
	Defective idle spring	Replace the idle spring
	Defective governor lever operation	Repair or replace the governor lever
	Regulator valve improperly adjustment	Adjust or replace the regulator valve
	Broken plunger spring	Replace the plunger spring
	Worn plunger	Replace the plunger assembly
	Worn cam disc	Replace the cam disc
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Compression pressure	Blown out cylinder head gasket. Worn cylinder liner. Piston ring sticking between the valve and the valve seat	Replace the related parts

3. INSUFFICIENT POWER

Checkpoint	Possible cause	Correction
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Fuel	Water particle in the fuel	Replace fuel
Fuel filter	Clogged fuel filter element	Replace the fuel filter element or the fuel filter cartridge
Fuel feed pump	Defective fuel feed pump	Repair or replace the fuel feed pump
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection pipes	Fuel injection pipes damaged or obstructed	Replace the fuel injection pipes
Injection pump	Defective regulating valve	Repair or replace the regulating valve
	Defective delivery valve	Replace the delivery valve
	Defective timer	Repair or replace the timer
	Worn cam disk	Replace the cam disk
	Improper control lever operation	Adjust or replace the control lever
	Defective injection timing	Adjust the injection timing Repair or replace the injection pump timer
	Weak governor spring	Replace the governor spring
	Worn plunger	Replace the plunger assembly
	Worn cam disk	Replace the cam disk

00 – 8 SERVICE INFORMATION

Checkpoint	Possible cause	Correction
Turbocharger	Booster compensator pipe broken or cracked	Replace the booster compensator pipe
	Exhaust gas leakage from the exhaust system Air leakage from the intake system	Repair or replace the related parts
	Defective waste gate	Repair or replace the waste gate
	Defective turbocharger assembly	Replace the turbocharger assembly
Compression pressure	Blown out cylinder head gasket. Worn cylinder liner. Piston ring sticking between the valve and valve seat	Replace the related parts
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Valve spring	Valve spring weak or broken	Replace the valve spring
Exhaust system	Exhaust pipe clogged	Clean the exhaust pipe
Full load adjusting screw seal	Open and improperly set adjusting screw seal	Adjust and reseal the adjusting screw

4. EXCESSIVE FUEL CONSUMPTION

Checkpoint	Possible cause	Correction
Fuel system	Fuel leakage	Repair or replace the fuel system related parts
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Idling speed	Poorly adjusted idling speed	Adjust the idling speed
Injection nozzle	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection timing	Fuel injection timing improperly	Adjust the fuel injection timing
Injection pump	Defective Delivery valve resulting is fuel drippage after fuel injection	Replace the delivery valve
Turbocharger	Air leakage from the turbocharger intake side	Repair the turbocharger intake side
	Defective turbocharger assembly	Replace the turbocharger assembly
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Compression pressure	Blown out cylinder head gasket. Worn cylinder liner. Piston ring sticking between the valve and valve seat	Replace the related parts
Valve spring	Valve spring weak or broken	Replace the valve spring

5. EXCESSIVE OIL CONSUMPTION

Checkpoint	Possible cause	Correction
Engine oil	Engine oil unsuitable Too mauch engine oil	Replace the engine oil Correct the engine oil level
Oil seal and gasket	Oil leakage from the oilseal and/or the gasket	Replace the oil seal and/or the gasket
Air breather	Clogged air breather	Clean the air breather
Intake and exhaust valve	Worn valve stems and valve guides	Replace the intake and exhaust valves and the valve springs

6. OVERHEATING

Checkpoint	Possible cause	Correction
Cooling water	Insufficient cooling water	Replace the cooling water
Fan clutch	Oil leakage from the fan clutch	Replace the fan clutch
Fan belt	Fan belt loose or cracked causing slippage	Replace the fan belt
Radiator	Defective radiator cap or clogged radiator core	Replace the radiator cap or clean the radiator core
Water pump	Defective water pump	Repair or replace the water pump
Cylinder head and cylinder body sealing cap	Defective searing cap resulting in water leakage	Replace the sealing cap
Thermostat	Defective thermostat	Replace the thermostat
Cooling system	Cooling system clogged by foreign material	Clean the foreign material from the cooling system
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing

7. WHITE EXHAUST SMOKE

Checkpoint	Possible cause	Correction
Fuel	Water particles in the fuel	Replace the fuel
Fuel injection timing	Delayed fuel injection timing	Adjust the fuel injection timing
Compression pressure	Blown out cylinder head gasket. Worn cylinder liner. Piston ring sticking between the valve and valve seat	Replace the related parts
Turbocharger	Defective turbocharger	Replace the turbocharger
Inlet and exhaust valves Valves seals	Defective valve seales. Worn valves stems and valve guides	Replace the valve seales, the valves, and the valve guides

8. DARK EXHAUST SMOKE

Checkpoint	Possible cause	Correction
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Injection nozzle	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing
Injection pump	Defective Delivery valve resulting is fuel drippage after fuel injection	Replace the delivery valve
	Excessive injection volume	Adjust the injection volume

9. OIL PRESSURE DOES NOT RISE

Checkpoint	Possible cause	Correction
Engine oil	Improper viscosity engine oil. Insufficient engine oil	Replace the engine oil Correct the engine oil volume
Oil pressure gauge or unit Oil pressure indicator light	Defective oil pressure gauge or unit Defective indicator light	Repair or replace the oil pressure gauge or unit Replace the indicator light
Oil filter	Clogged oil filter element	Replace the oil filter element or the oil filter cartridge
Relief valve and by-pass valve	Relief valve sticking and/or weak by-pass valve spring	Replace the relief valve and/or the by-pass valve spring
Oil pump	Clogged oil pump strainer	Clean the oil pump strainer
	Worn oil pump related parts	Replace the oil pump related parts
Rocker arm shaft	Worn rocker arm bushing	Replace the rocker arm bushing
Camshaft	Worn camshaft and camshaft bearing	Replace the camshaft and the camshaft bearing
Crankshaft and bearings	Worn crankshaft and bearings	Replace the crankshaft and/or the bearings

10. ABNORMAL ENGINE NOISE

1. ENGINE KNOCKING

Check to see that the engine has been thoroughly warmed up before beginning the troubleshooting procedure.

Checkpoint	Possible cause	Correction
Fuel	Fuel unsuitable	Replace the fuel
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing
Injection nozzle	Improper injection nozzle starting pressure and spray condition	Adjust or replace the injection nozzle
Compression pressure	Blown out head gasket Broken piston ring	Replace the head gasket or the piston ring

2. GAS LEAKAGE NOISE

Exhaust pipes	Loosely connected exhaust pipes. Broken exhaust pipes	Tighten the exhaust pipe connections Replace the exhaust pipes
Injection nozzles and/or glow plugs	Loose injection nozzles and/or glow plugs	Replace the washers Tighten the injection nozzles and/or the glow plugs
Exhaust manifold	Loosely connected exhaust manifold and/or glow plugs	Tighten the exhaust manifold connections
Cylinder head gasket	Damaged cylinder head gasket	Replace the cylinder head gasket

3. CONTINUOUS NOISE

Fan belt	Loose fan belt	Readjust the fan belt tension
Cooling fan	Loose coling fan	Retighten the cooling fan
Water pump bearing	Worn or damaged water pump bearing	Replace the water pump bearing
Alternator or vacuum pump	Defective alternator or vacuum pump	Repair or replace the alternator or the vacuum pump
Valve clearance	Clearance improperly adjust	Adjust the valve clearance

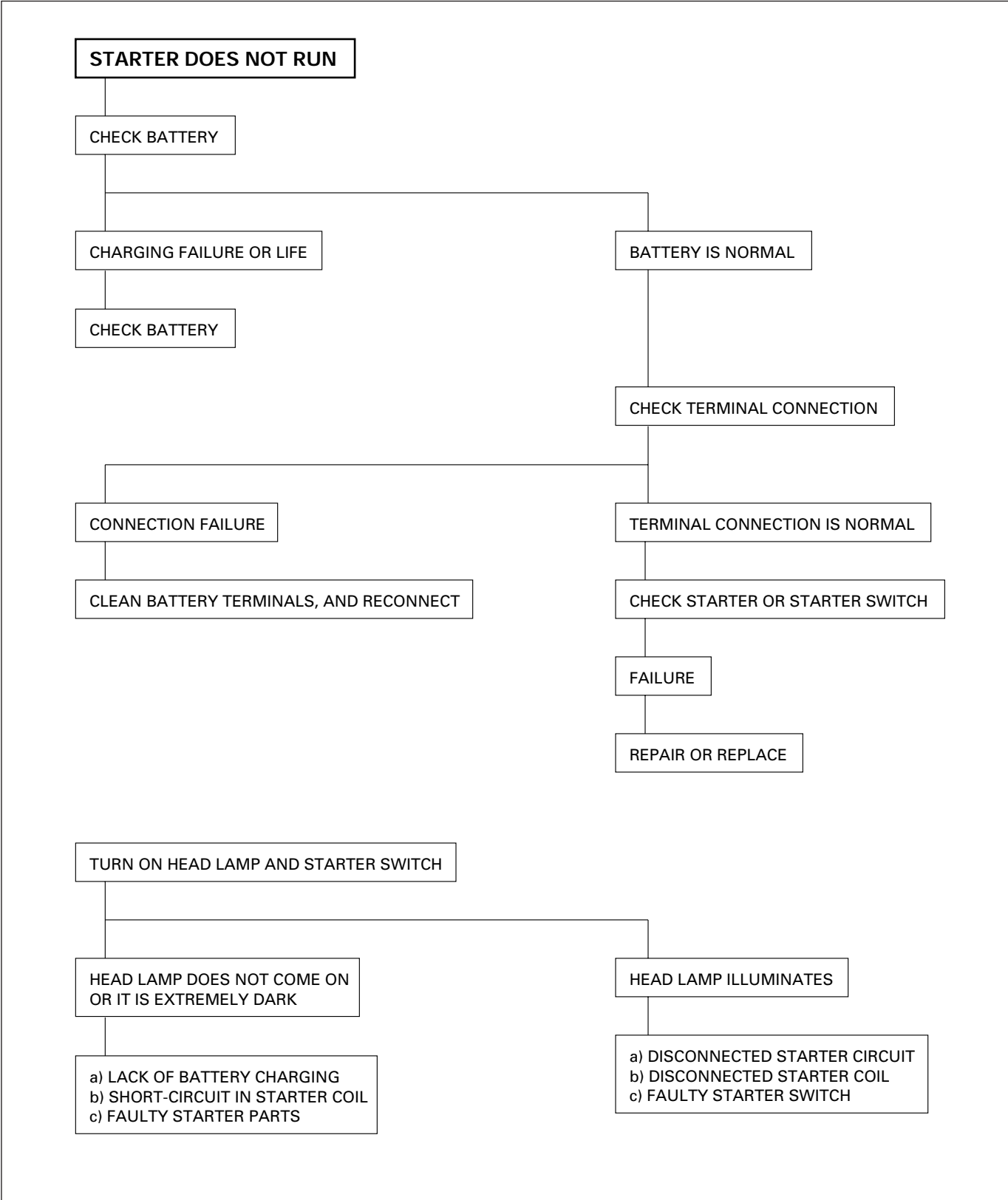
4. SLAPPING NOISE		
Checkpoint	Possible cause	Correction
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Rocker arm	Damaged rocker arm	Replace the rocker arm
Flywheel	Loose flywheel bolts	Retighten the flywheel bolts
Crankshaft and thrust bearings	Worn or damaged crankshaft and/or thrust bearings	Replace the crankshaft and/or the thrust bearings
Crankshaft and connecting rod bearings	Worn or damaged crankshaft and/or connecting rod bearings	Replace the crankshaft and/or the connecting rod bearings
Connecting rod bushing and piston pin	Worn or damaged connecting rod bushing and piston pin	Replace the connecting rod bushing and/or the piston pin
Piston and cylinder liner	Worn or damaged piston and cylinder liner. Foreign material in the cylinder.	Replace the piston and the cylinder liner.

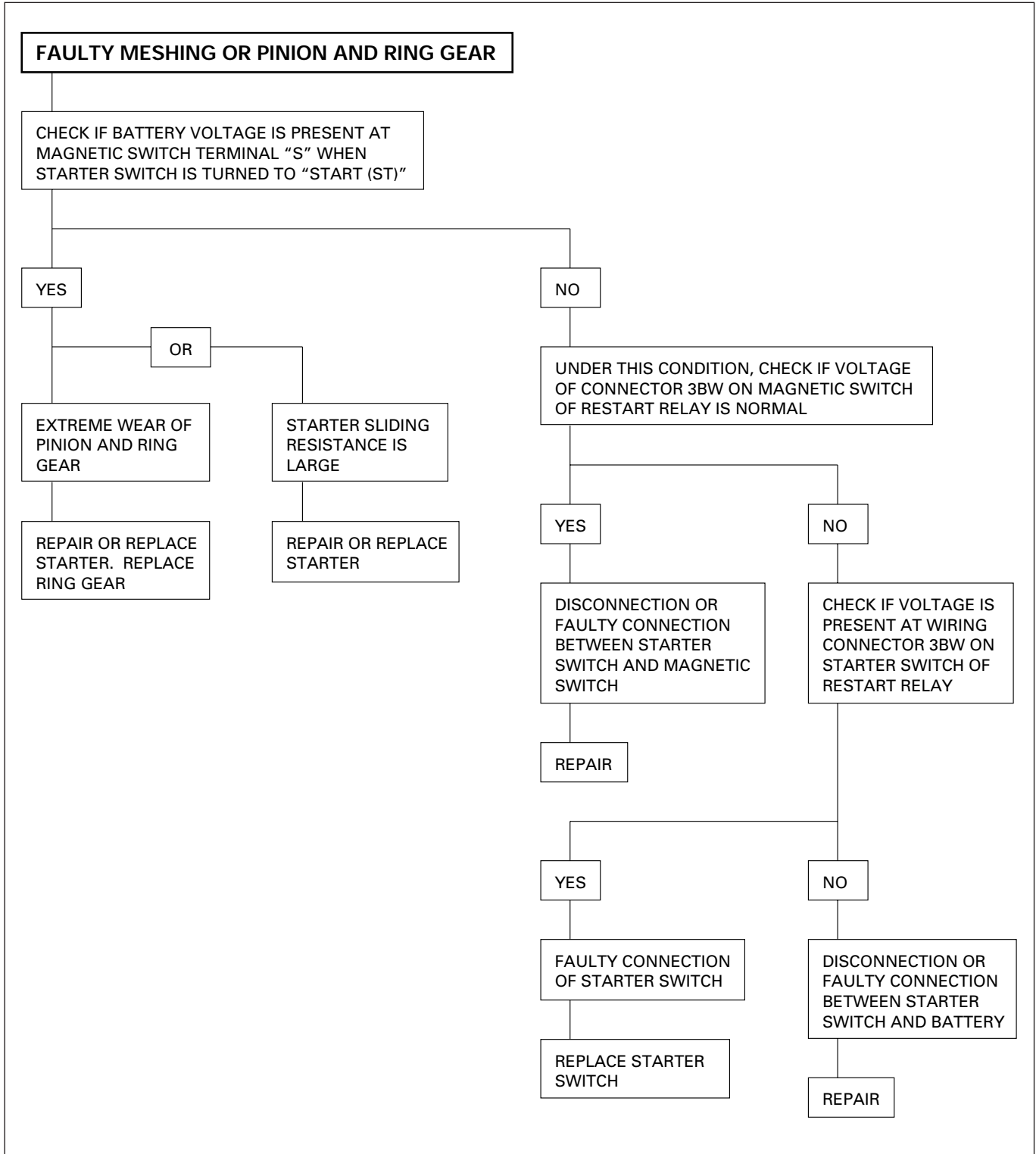
ENGINE COOLING TROUBLE

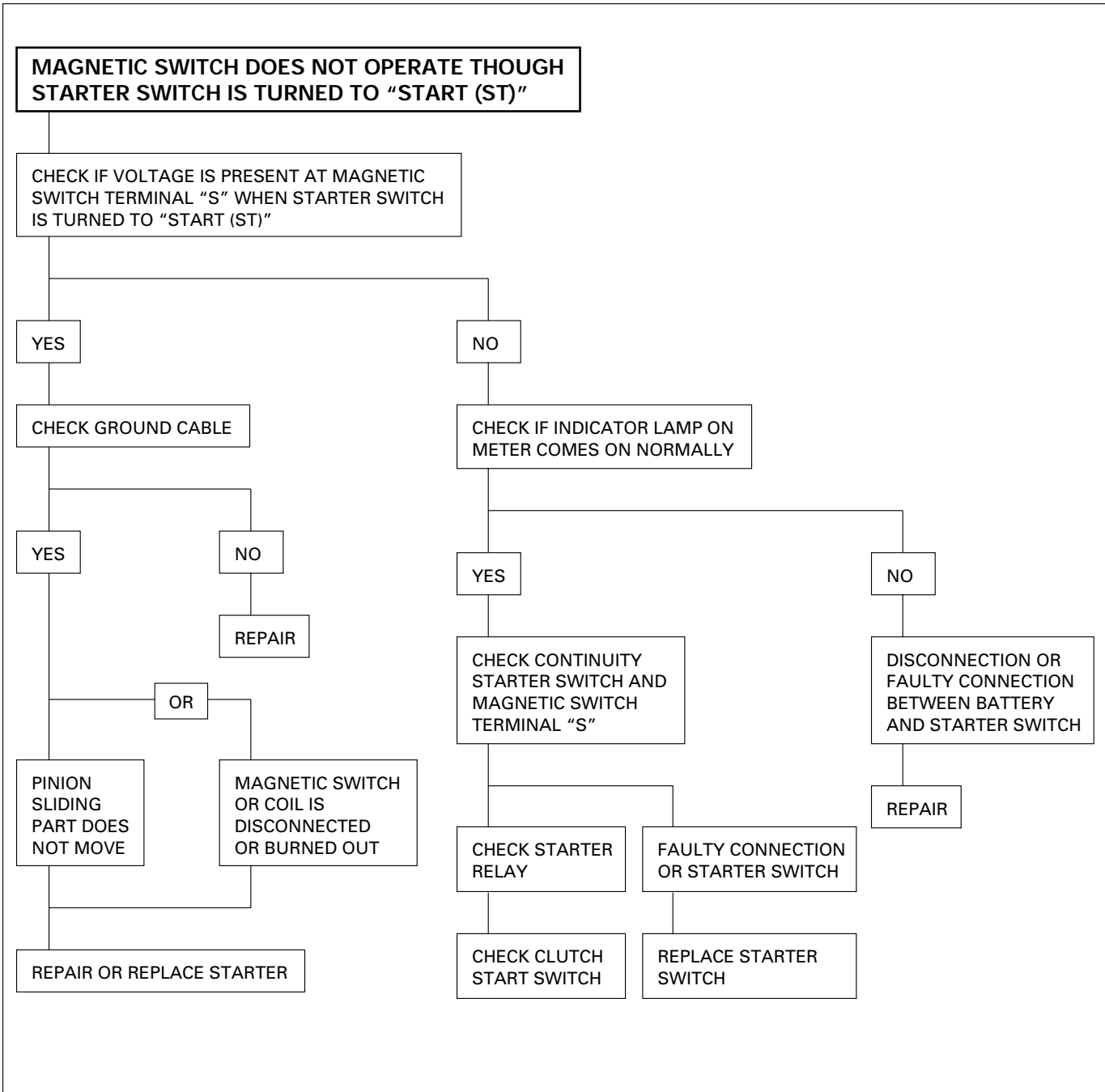
Condition	Possible cause	Correction
Engine overheating	Low coolant level	Replenish
	Thermo unit faulty	Replace
	Faulty thermostat	Replace
	Faulty coolant unit	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil Replenish
	Damaged cylinder head gasket	Replace
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Loose fan belt	Adjust
	Excessive fuel injected	Adjust
	Improper injection timing	Adjust
Injection timing improper	Adjust	
Engine overcooling	Faulty thermostat	Replace
Too long engine warm-up time	Faulty thermostat	Replace
	Thermo unit faulty	Replace

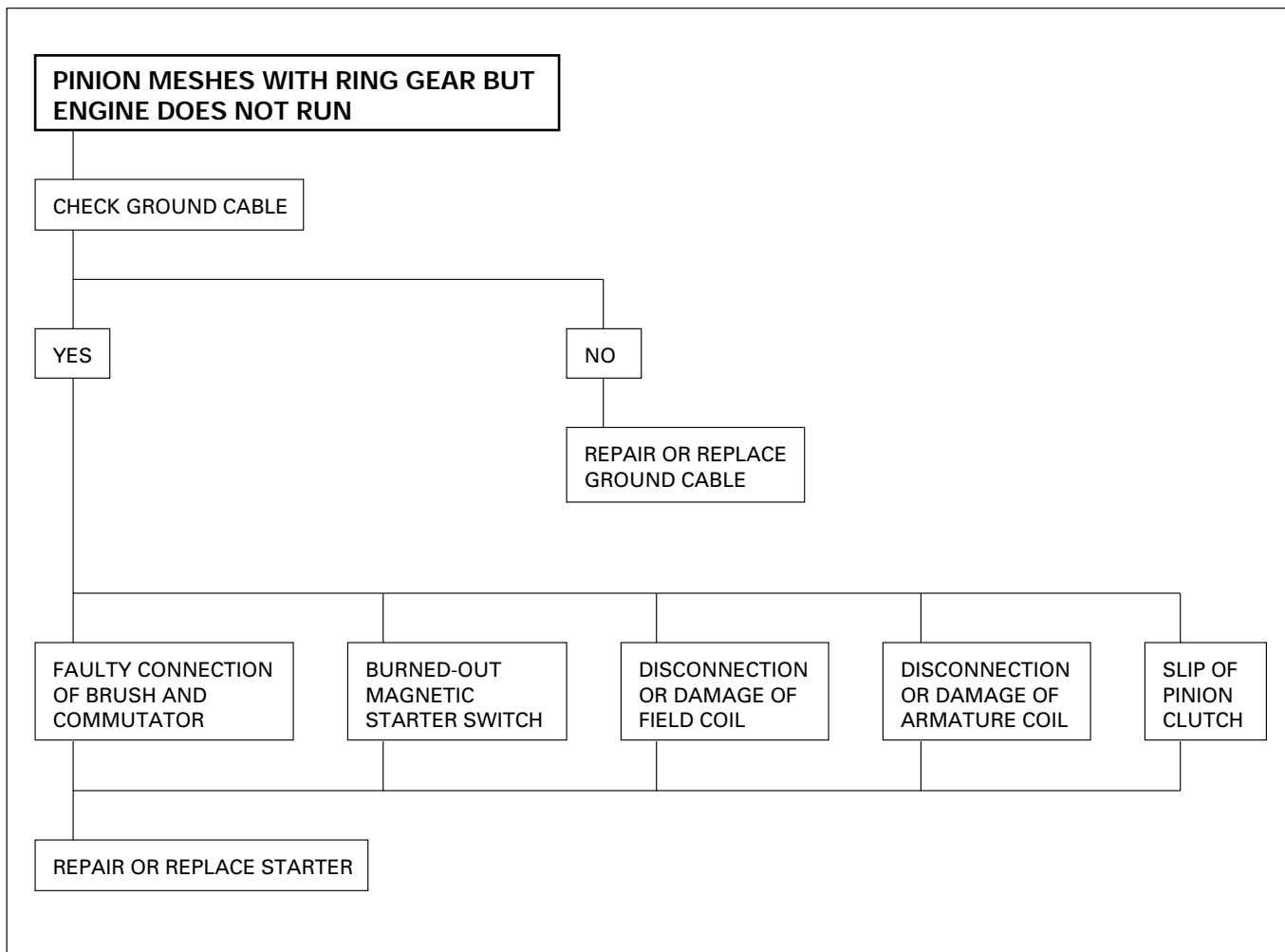
ENGINE ELECTRICAL

Check if the battery is normal, then perform the following diagnosis.









STARTER DOES NOT STOP THOUGH STARTER SWITCH IS RETURNED TO "ON"

DISCONNECTED STARTER SWITCH WIRING CONNECTOR, AND CHECK STARTER SWITCH OPERATION.

KEY POSITION	BATTERY B1	IGNITION IG1	BATTERY B2	ACCESSORIES ACC	IGNITION IG2	STARTER ST
LOCK						
OFF						
ACC			●	●		
ON	●	●	●	●	●	
START	●	●	●		●	●

THERE MUST BE NO CONTINUITY EXCEPT ABOVE LINES

YES

NO

MAGNETIC SWITCH CONTACTS ARE FUSED AND NOT MOVED, OR A RETURN SPRING IS BROKEN OR DETERIORATED

REPLACE STARTER SWITCH

REPLACE MAGNETIC SWITCH

MAIN DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine type	Diesel, four cycle water cooled inline	
Camshaft type	Overhead valve	
Cylinder line-type	Dry type	
Number of cylinders	4	
Bore x stroke	(mm)	95.4 x 107
Total piston displacement	(cc)	3,059
Compression ratio	(to 1)	20.0
Engine weight (dry)	N (kg/lb)	2353 (240/529)(4JG2-NA) 2597 (265/584)(4JG2-T)
Engine idling speed (Reference)	RPM	750 (4JG2-NA) 720 (4JG2-T)
Compression pressure	kpa (kg/cm ² /psi)-rpm	2940 (30/426)-200
Firing order		1-3-4-2
Injection timing		1°A.T.D.C (4JG2-NA) T.D.C. (4JG2-T)
VALVE SYSTEM		
Intake valves	open at:	B.T.D.C. 24°
	close at:	A.B.D.C. 55°
Exhaust valve	open at:	B.B.D.C. 54°
	close at:	A.T.D.C. 26°
Valve clearance at	cold	mm (in)
	intake:	0.40 (0.016)
	exhaust:	0.40 (0.016)
Oil filter	Full flow and bypass combined type	
Oil capacity (Original factory fill or rebuilt engine)	7.1 liters (6.3 US quarts)	
Oil capacity (Service change)		
with filter change	6.0 liters (6.3 US quarts)	
without filter change	5.0 liters (5.3 US quarts)	
Oil cooler	Water cooled type	
Inter cooler	Air cooled type	
Turbocharger		
Control method	Wastegate control	
Lubrication method	Pressurized control	
Cooling method	Coolant cooled	

Engine Cooling

Cooling system	Coolant forced circulation	
Radiator	(2 tube in row) Tube type corrugated	
Heat radiation capacity	J/h (kcal/h)	318 x 10 ⁶ (76000)
Heat radiation area	m ² (ft ²)	15.63 (1.454)
Front area	m ² (ft ²)	0.309 (2.029)
Dry weight	N(Kg/lb)	83 (8.5/18.7)
Radiator cap		
Valve opening pressure	kPa(Kg/cm ² psi)	88.2~117.6 (0.899~1.199/12.78~17.05)
Coolant capacity	lit (Imp.qt./US qt.)	2.8 (2.46/2.96)
Coolant pump	Centrifugal impeller type	
Pulley ratio	1.2	
Coolant total capacity	lit (Imp.qt./US qt.)	8.6 (7.57/9.09)

Starting System

Model	HITACHI S14-03	DENSO ADR4G1
Rating		
Voltage	V	12
Output	kw	2.2
Time	sec	30
Number of tooth of pinion		9
Rotating direction (as viewed from pinion)	Clockwise	
Weight (approx.)	N (kg/lb)	59 (6.0/13.2)
No-load characteristics		
Voltage/current	V/A	11/160 or less
Speed	rpm	3900 or more
Load characteristics		
Voltage/current	V/A	10.85/300
Torque	N•m (kg•m/lb•ft)	7.4 (0.75/5.4) or more
Speed	rpm	2000 or more
Locking characteristics		
Voltage/current	V/A	3/1300 or less
Torque	N•m (kg•m/lb•ft)	26 (2.7/20) or more

Charging System

Model (HITACHI)		LR150 – 446	LR180 – 501B
Rated voltage	V	12	12
Rated output	A	50	80
Rotating direction (As viewed from pulled)		Clockwise	Clockwise
Pulley effective diameter	mm(in)	80 (3.15)	80 (3.15)
Weight (with pump)	N(Kg/lb)	65(6.6 /14.6)	76(7.8 /17.2)

SERVICE STANDARD

Engine Mechanical

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Cylinder Head	Cylinder head deck, and exhaust manifold mating surface for flatness	0.05 (0.0020) or less	0.2 (0.0079)	Cannot be reground
	Cylinder head height	92.0 (3.6220)	—	
	Hot plug depression	—	0.02 (0.0008)	
	Hot plug installation pressure	44000-54000N (4500–5500 kg/9923–12128 lbs)	—	
Valve Spring	Free height	48.0 (1.8898)	47.10 (1.8543)	At installed height 38.9 (1.5)
	Squareness	—	1.7 (0.0669)	
	Spring tension N (lb)	294 (30/66.1)	257.9 (26.3/57.9)	
Valve and Valve Guide	Diameter of Valve stem	IN	7.946–7.961 (0.3128–0.3134)	7.880 (0.3102)
		EX	7.921–7.936 (0.3118–0.3124)	7.850 (0.3091)
	Valve and valve guide clearance	IN	0.039–0.071 (0.0015–0.0028)	0.200 (0.0079)
		EX	0.064–0.096 (0.0025–0.0038)	0.250 (0.0098)
	Valve guide upper end height (Measured from the Cylinder head upper face)		13.0 (0.5118)	—
	Valve guide margin		1.1 (0.0433)	1.6 (0.0630)
	Valve thickness	IN	1.34 (0.0528)	1.1 (0.0433)
		EX	1.38 (0.0543)	1.1 (0.0433)
	Valve seat contact surface angle		45°	—
	Valve seat contact width	IN	1.7 (0.0669)	2.2 (0.0866)
EX		2.0 (0.0787)	2.5 (0.0984)	
Push rod	Curvature	—	0.3 (0.0118)	

00 – 24 SERVICE INFORMATION

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Camshaft	End play	0.08 (0.0031)	0.2 (0.0079)	
	Cam height	42.02 (1.6543)	41.65 (1.6398)	
	Journal diameter	49.945-49.975 (1.9663-1.9675)	49.60 (1.9528)	
	Run-out	0.02 (0.0008) or less	0.10 (0.0039)	
	Camshaft bearing inside diameter	50.000–50.030 (1.9685–1.9697)	50.08 (1.9716)	
	Camshaft bearing clearance	0.025-0.085 (0.0010-0.0033)	0.12 (0.0047)	
Tappet	Outside diameter	12.97-12.99 (0.5106-0.5114)	12.95 (0.5098)	
	Clearance between tappet and cylinder body	0.03 (0.0012)	0.10 (0.0039)	
Rocker arm Assembly	Rocker arm shaft outside diameter	18.98-19.00 (0.7472-0.7480)	18.90 (0.7441)	
	Rocker arm inside diameter	19.01-19.03 (0.7484-0.7492)	19.10 (0.7520)	
	Clearance between rocker arm and rocker arm shaft	0.01-0.05 (0.00039-0.00197)	0.20 (0.00787)	
	Rocker arm shaft runout	—	0.30 (0.0118)	
Oil pump	Oil clearance Body and gear	0.14 (0.0055)	0.20 (0.0079)	
	Body cover and gear	0.06 (0.0024)	0.15 (0.0059)	
Crankshaft	Thrust clearance	0.10 (0.0039)	0.30 (0.0118)	
	Main bearing clearance (Between main bearing and Crankshaft)	0.031-0.063 (0.0012-0.0025)	0.11 (0.0043)	Cannot be reground
	Crankshaft runout	0.05 (0.0020) or less	0.08 (0.0031)	
	Main journal diameter	69.917-69.932 (2.7526-2.7532)	69.91 (2.7524)	Uneven wear limit 0.05 (0.002)
	Crank pin diameter	52.915-52.930 (2.0833-2.0839)	52.90 (2.0827)	Uneven wear limit 0.08 (0.0031)

mm (in)

Parts	Items	Service standard	Service limit	Remarks	
Piston, Piston pin, Piston ring and Connecting rod	Piston diameter	95.365-95.404 (3.7545-3.7561)	—		
	Piston Clearance (Between piston and Cylinder liner)	0.047-0.065 (0.0019-0.0026)	—		
	Piston ring gap	1st/2nd	0.20-0.35 (0.0079-0.0138)	1.5 (0.0591)	
		Oil	0.10-0.30 (0.0039-0.0118)	1.5 (0.0591)	
	Piston ring clearance	1st/2nd	0.05-0.09 (0.0020-0.0035)	0.15 (0.0059)	
		Oil	0.03-0.07 (0.0012-0.0028)	0.15 (0.0059)	
	Piston pin outside diameter		33.995-34.000 (1.3384-1.3386)	33.970 (1.3374)	
	Clearance between connecting rod and piston pin		0.008-0.020 (0.0003-0.0008)	0.05 (0.0020)	
	Clearance between piston and piston pin		0.002-0.015 (0.00008-0.0006)	0.04 (0.0016)	
	Connecting rod alignment	Bend	0.08(0.0031) or less	0.20 (0.0079)	Per 100 (3.937)
		Twist	0.05(0.0020) or less	0.15 (0.0059)	Per 100 (3.937)
	Connecting rod thrust clearance		0.230 (0.0091)	0.35 (0.0138)	
Clearance between crank pin and connecting rod		0.029-0.083 (0.0011-0.0033)	0.100 (0.0039)		
Cylinder Block	Warpage (Upper surface of the cylinder block)	—	0.20 (0.0079)		
	Cylinder bore diameter	97.001-97.040 (3.8189-3.8205)			

00 – 26 SERVICE INFORMATION

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Cylinder Block (cont' d)	Cylinder liner projection	0.0-0.1 (0.00-0.0039)		
	Cylinder liner outside diameter	97.011-97.050 (3.8193-3.8209)		

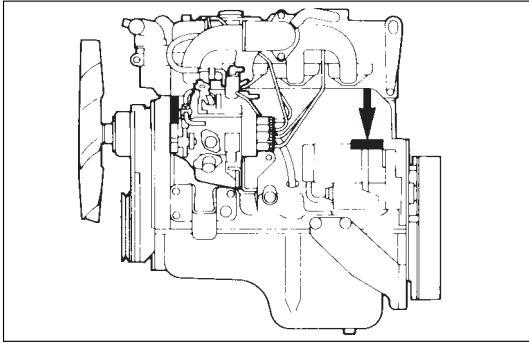
Engine Cooling

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Thermostat	Valve opening temperature	82°C (180°F)		
	Valve full open temperature and lift	More than 10 (0.39) at 95°C (203°F)		
Radiator cap	Valve opening pressure	88.2 ~ 117.6kpa (0.899 ~ 1.199kg/cm ² / 12.8 ~ 17.0psi)		
Drive belt	Tension (Slackness) AC generator & fan pulley drive belt	New belt 8-12 (0.31-0.47) Used belt 8-12 (0.31-0.47)		
	A/C Compressor drive belt	New belt 7-10 (0.28-0.39) Used belt 5-8 (0.2-0.31)		
	P/S pump drive belt	New belt 13-16 (0.51-0.63) Used belt 13-16 (0.51-0.63)		

SERVICING

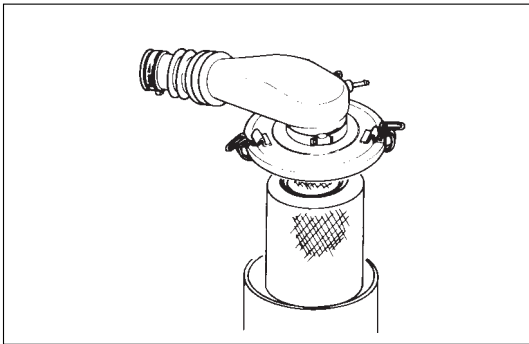
Servicing refers to general maintenance procedures to be performed by qualified service personnel.



MODEL IDENTIFICATION

Engine Serial Number

The engine number is stamped on the front left hand side of the cylinder body.



AIR CLEANER

Oil Wetted (Viscous) Type Paper Element (Australia only)

The air cleaner has an oil wetted paper element. No servicing is required until the replacement interval is reached. Never attempt to clean the element, no matter how dirty it may appear. The element is designed to provide normal filtering efficiency until it becomes due for replacement. Refer to the Item "Service and Maintenance" in the Owner's and Driver's Manual for general service information.

Dry Type Paper Element

Element cleaning procedures will vary according to the condition of the element.



Dust Fouled Element

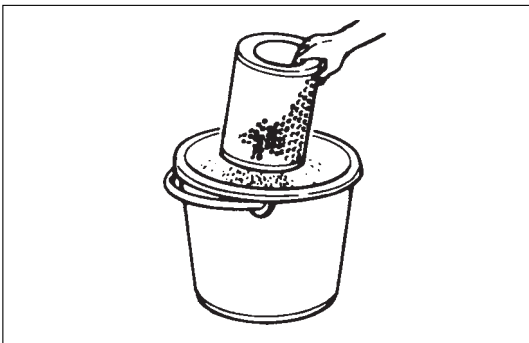
Rotate the element with your hand while applying compressed air to the inside of the element. This will blow the dust free.

Compressed air pressure	Kpa (Kg/cm ² / Psi)
	392 - 490 (4-5/57-71)



CAUTION

Do not bang the element against another object in an attempt to clean it. Damage to the element will result.

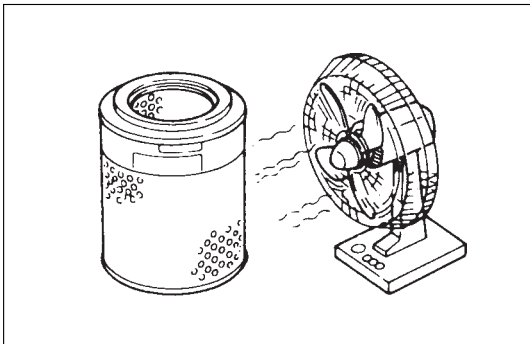


Carbon and Dust Fouled Element

1. Prepare a cleaning solution of Isuzu Genuine Element Cleaner (Donaldson D1400) diluted with water.
2. Submerge the element in the solution for twenty minutes.



3. Remove the element from the solution and rinse it well with running water.
Water pressure must not exceed 274 Kpa (2.8 kg/cm²/40 Psi)



4. Dry the element in a well ventilated area.
An electric fan will hasten drying.

NOTE:

Do not use compressed air or an open flame to dry the element quickly. Damage to the element will result. It will usually take two or three days for the element to dry completely. Therefore, it is a good idea to have a spare on hand to use in the interim.

LUBRICATING SYSTEM

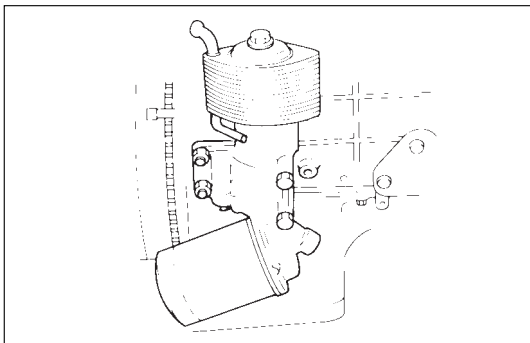
Main Oil Filter (Cartridge Type Paper Element)

Replacement Procedure

1. Loosen the drain plug to drain the engine oil.
2. Wait a few minutes and then retighten the drain plug.
3. Loosen the used oil filter by turning it counterclockwise with the filter wrench.
4. Clean the oil cooler fitting face.
This will allow the new oil filter to seat properly.
5. Apply a light coat of engine oil to the O-ring.
6. Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
7. Use the filter wrench to turn in the filter an additional 1 and 1/4 turns.



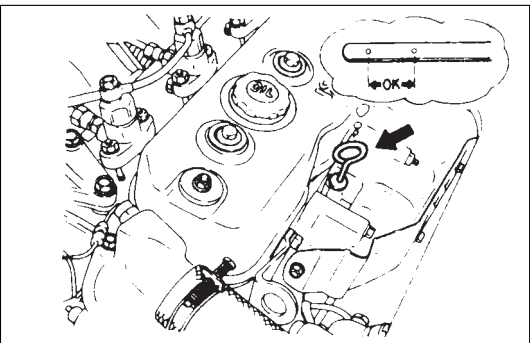
Filter Wrench: 5-8840-0200-0

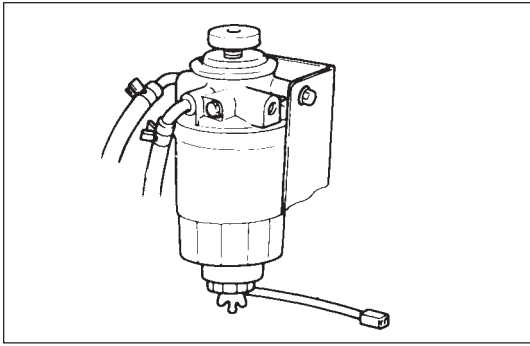


8. Check the engine oil level and replenish to the specified level if required.

Replenishment Engine Oil	lit(lmp qt / US qt)
	0.7 (0.62/0.74)

9. Start the engine and check for oil leakage from the main oil filter.





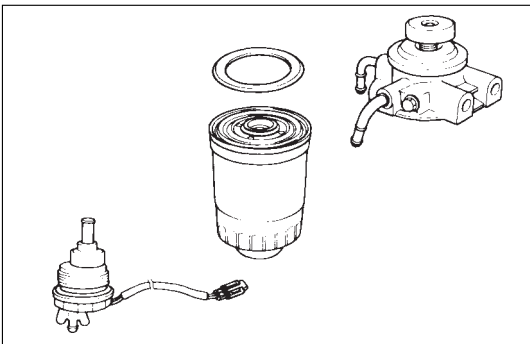
FUEL SYSTEM

Fuel Filter

Replacement Procedure



1. Loosen the used fuel filter by turning it counterclockwise with the filter wrench.
Filter Wrench: 5-8840-0253-0 (J-22700)
2. Remove the level sensor from the filter by turning it counterclockwise with a wrench.

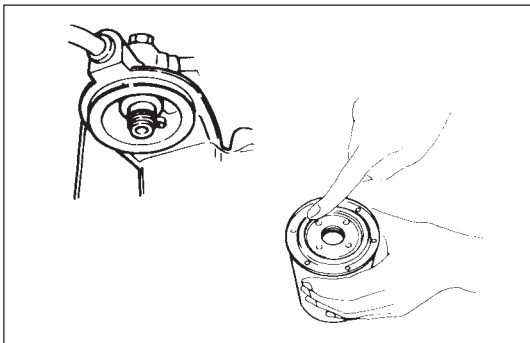


3. Install the level sensor to the new fuel filter with a wrench.

Level Sensor Torque N·m (Kg·m/lb·ft)

13 (1.3/9)

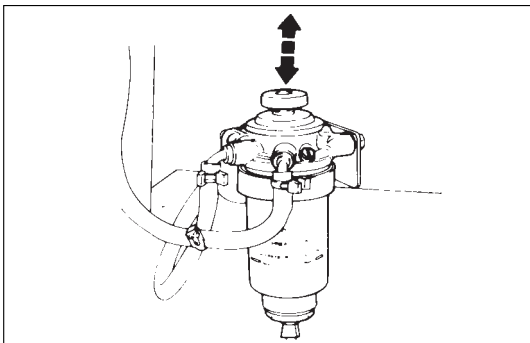
4. Clean the filter cover fitting faces.
This will allow the new fuel filter to seat properly.



5. Apply a light coat of engine oil to the O-ring.
6. Turn in the fuel filter until the sealing face comes in contact with the O-ring.



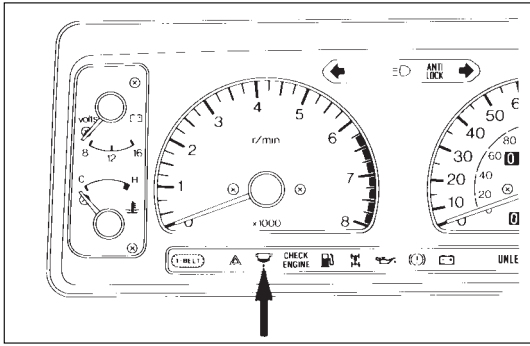
7. Turn in the fuel filter an additional 2/3 of a turn with a filter wrench.
Filter Wrench: 5-8840-0253-0 (J-22700)



8. Loosen the bleeder plug on the injection pump overflow valve.
9. Operate the priming pump until fuel begins to flow from the fuel filter.
10. Retighten the bleeder plug.
11. Operate the priming pump several times and check for fuel leakage.

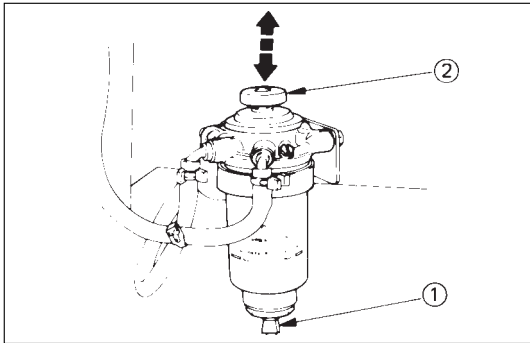
NOTE:

The use of an ISUZU genuine fuel filter is strongly recommended.



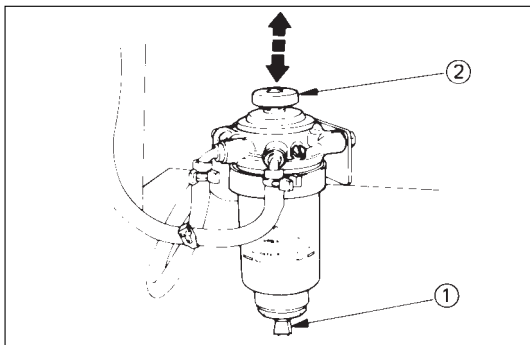
Fuel Filter Water Draining Procedure

The indicator light will come on when the water level in the water separator exceeds the specified level. Drain the water and foreign material from the water separator with the following procedure.



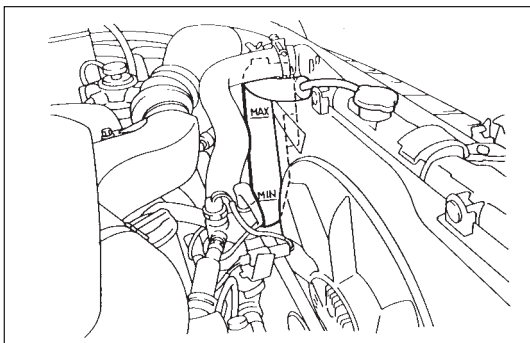
1. Find a safe place to park the vehicle.
2. Open the engine hood and place a container (Approximately 0.2 liter capacity) at the end of the vinyl hose beneath the drain plug on the separator.
3. Loosen the drain plug by turning it counterclockwise (Approximately 5 turns) and operate the priming pump up and down about 10 times until water is drained approximately 0.1 liter.
4. After draining, securely tighten the drain plug by turning it clockwise and operate the priming pump manually up and down several times.
5. After starting the engine, check to see that there is no fuel leak from the drain plug. Also check to see that the fuel filter water indicator light has turned off.

If water separator requires frequent draining, have the fuel tank drained for removal of water at your Isuzu Dealer.



Air Bleeding

1. Loosen the bleeder screw on the injection pump overflow valve.
2. Operate the priming pump until fuel mixed with foam flows from the bleeder screw.
3. Tighten the bleeder screw.
4. Operate the priming pump several times and check for fuel leakage.



COOLING SYSTEM

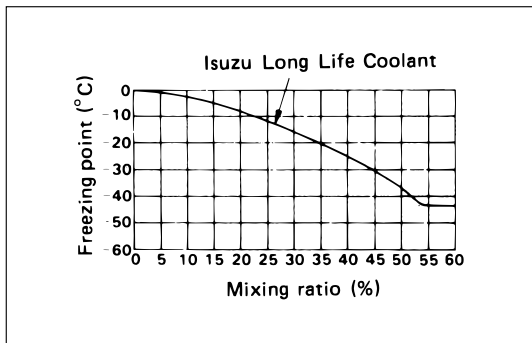
Coolant Level

Check the coolant level and replenish the radiator reserve tank as necessary.

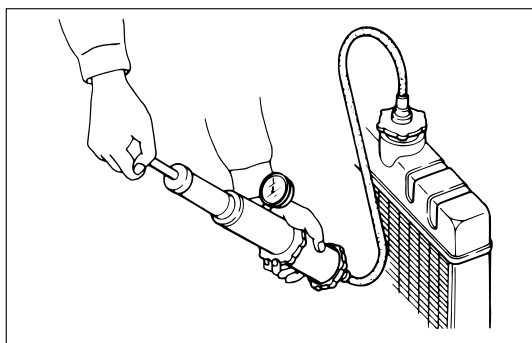
If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.

NOTE:

Do not overfill the reserve tank.



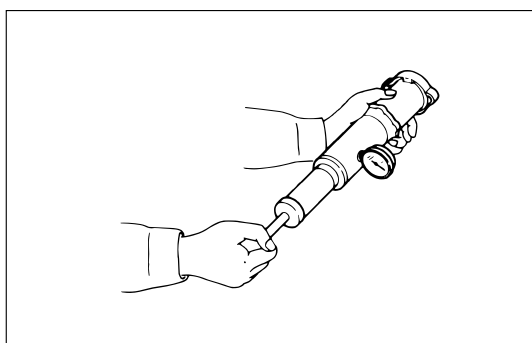
Remove the radiator filler cap only when absolutely necessary.
 Always check the coolant level when the engine is cold.
 Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.



Cooling System Inspection

Install a radiator filler cap tester to the radiator. Apply testing pressure to the cooling system to check for leakage. The testing pressure must not exceed the specified pressure.

Testing Pressure	Kpa (Kg/cm ² / Psi)
	196 (2/28.45)

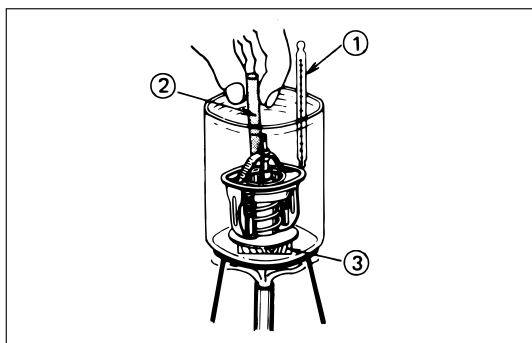


Radiator Cap Inspection

The radiator filler cap is designed to maintain coolant pressure in the cooling system at 1.05 kg/cm² (15 psi/103 kPa). Check the radiator filler cap with a radiator filler cap tester. The radiator filler cap must be replaced if it fails to hold the specified pressure during the test procedure.

Radiator Filler Cap Pressure	Kpa (Kg/cm ² / Psi)
Pressure Valve	93.3 – 122.7 (0.95 – 1.25/13.5 – 17.8)

Negative Valve (Reference)	Kpa (Kg/cm ² / Psi)
	1.0 – 3.9 (0.01 – 0.04/0.14 – 0.57)



Thermostat Operating Test

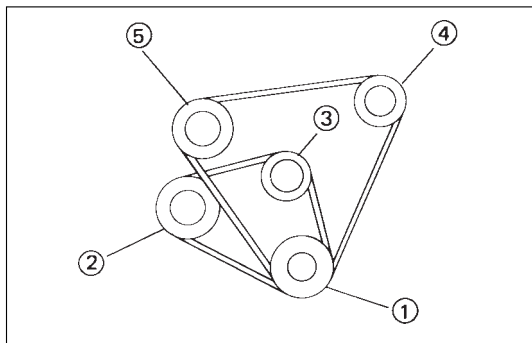
1. Completely submerge the thermostat in water.
2. Heat the water.
 Stir the water constantly to avoid direct heat being applied to the thermostat.
3. Check the thermostat initial opening temperature.

Thermostat Initial Opening Temperature	°C(°F)
	82 (180)

4. Check the thermostat full opening temperature.

Thermostat Full Opening Temperature	°C(°F)
	90 (194)

Valve Lift at Fully Open Position	mm(in)
	10 (0.39)



Drive Belt Adjustment

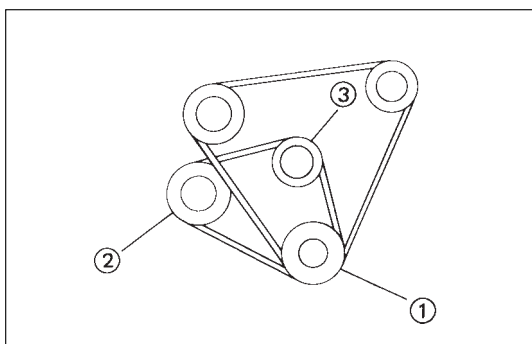
Check the drive belt tension.

Depress the drive belt mid-portion with a 98N (10kg/22 lb) force.

Drive Belt Deflection	mm(in)
	10 (0.39)

Check the drive belt for cracking and other damage.

- ① Crankshaft damper pulley.
- ② Alternator pulley
- ③ Cooling fan pulley
- ④ Oil pump pulley or idler pulley
- ⑤ Compressor pulley or idler pulley

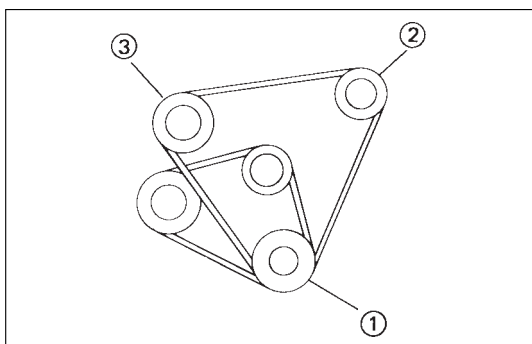


Cooling Fan Pulley Drive Belt

Fan belt tension is adjusted by moving the alternator.

Depress the drive belt mid-portion with a 98N (10Kg/22lb) force.

- ① Crankshaft damper pulley
- ② Alternator pulley
- ③ Cooling fan pulley



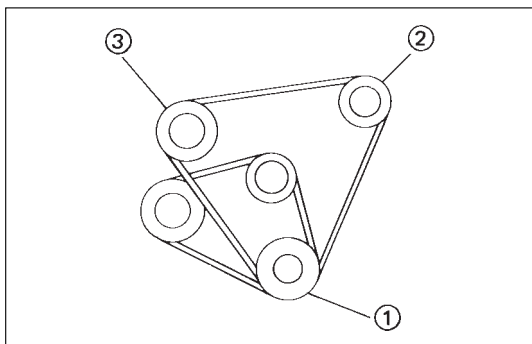
Compressor Pulley Drive Belt

Move the idler pulley as required to adjust the compressor drive belt tension.

If the vehicle is equipped with power steering, move the oil pump as required.

Depress the drive belt mid-portion with a 98N (10Kg/22lb) force.

- ① Crankshaft damper pulley
- ② Oil pump pulley or idler pulley
- ③ Compressor pulley



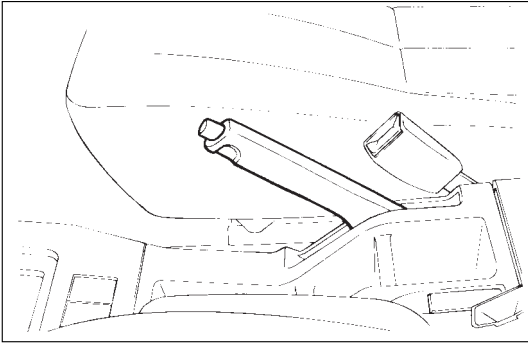
Power Steering Oil Pump Pulley Drive Belt

Move the oil pump as required to adjust the oil pump drive belt tension.

On air conditioner equipped models, both drive belts pulley must always be replaced as a set.

Depress the drive mid-portion with a 98N (10kg/22 lb) force.

- ① Crankshaft damper pulley
- ② Oil pump pulley
- ③ Compressor pulley or idler pulley

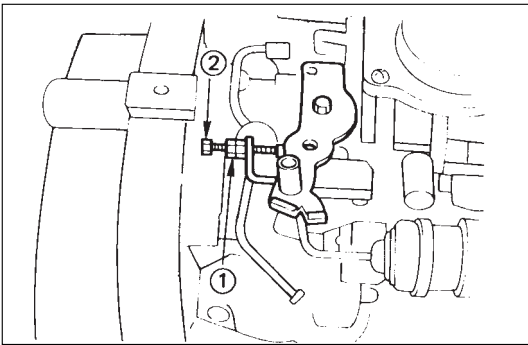


ENGINE CONTROL

Idling Speed Adjustment

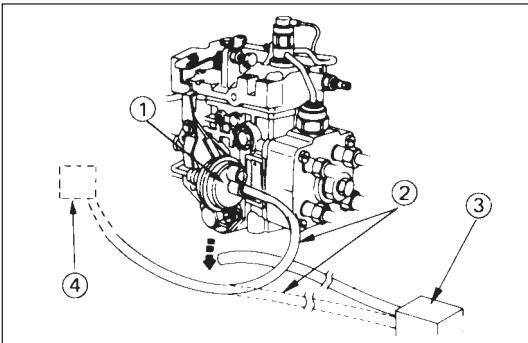
1. Set the vehicle parking brake and choke the drive wheels.
2. Place the transmission in neutral.
3. Start the engine and allow it to warm up.
4. Disconnect the engine control cable from the control lever.
5. Set a tachometer to the engine.
6. Check the engine idling speed.
If the engine idling speed is outside the specified range, it must be adjusted.

Engine Idling Speed	rpm
750 (4JG2-NA)/720 (4JG2-T)	



Idling Speed Adjustment

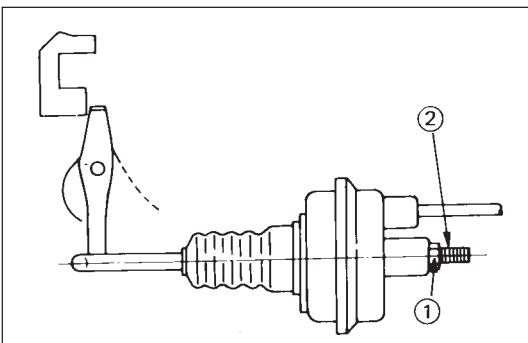
1. Loosen the idling set screw lock nut (1) on the injection pump idling set bolt.
2. Adjust the idling speed to the specified range by turning the idling set bolt (2).
3. Lock the idling set bolt with the idling set screw lock nut.
4. Check that the idling control cable is tight (free of slack).
If required, remove the slack from the cable.



Fast Idling Speed Inspection

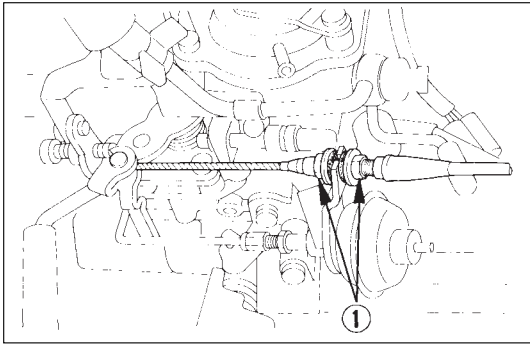
1. Set tachometer to the engine.
2. Disconnect the vacuum hose from the fast idle actuator (1) on the injection pump.
3. Disconnect the other vacuum hose (2) from the vacuum switching valve (3) and connect it to the fast idle actuator (1).
The vacuum line will now be connected directly from the vacuum pump (4) to the fast idle actuator.
4. Check the engine fast idling speed.
If the engine idling speed is outside the specified range, it must be adjusted.

Fast Idling Speed	rpm
850 – 950	



Fast Idling Speed Adjustment

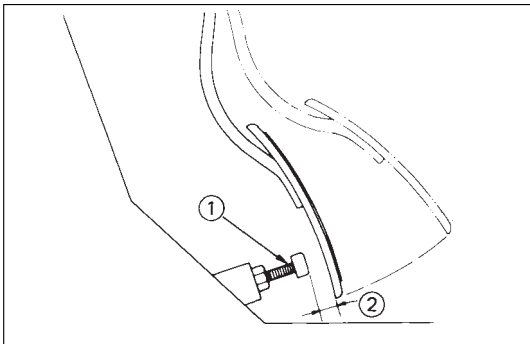
1. Loosen the fast idle actuator lock nut (1).
2. Adjust the fast idling speed by turning the adjusting screw (2).
3. Tighten the lock nut (1).
4. Connect the vacuum hose to the fast idle actuator.
5. Connect the other vacuum hose to the vacuum switching valve.



Accelerator Control

Accelerator Control Cable Adjustment

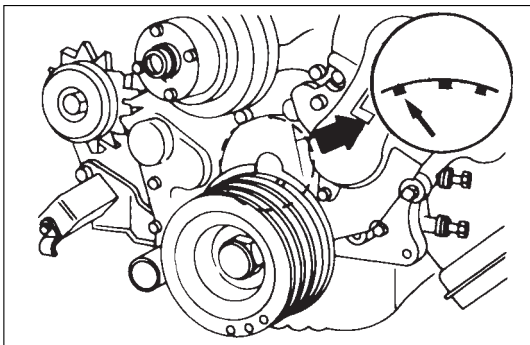
1. Loosen the accelerator cable clamp bolt ① .
2. Check that the idling control knob on the instrument panel is in the engine idling position.
3. Hold the accelerator lever ② in the fully closed position and stretch the control cable ③ in the direction indicated by the arrow to remove any slack.



Accelerator Pedal Adjustment

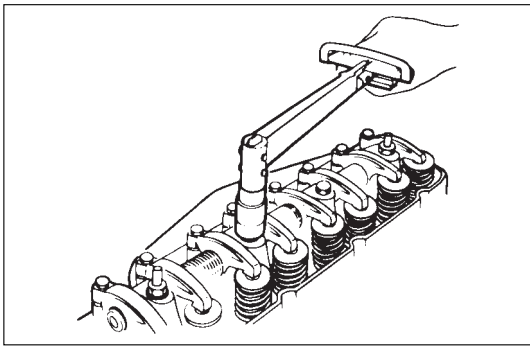
1. Depress the accelerator pedal and hold it.
2. Use the stopper bolt ① to adjust the clearance between the stopper bolt end and the accelerator pedal lower face ② .

Accelerator and Stopper Bolt Clearance	mm(in)
	2 - 5 (0.08 - 0.20)



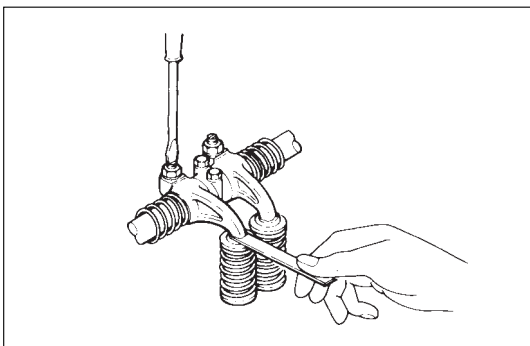
VALVE CLEARANCE ADJUSTMENT

1. Bring the piston in either the No. 1 cylinder or the No. 4 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft damper pulley TDC line is aligned with the timing pointer.

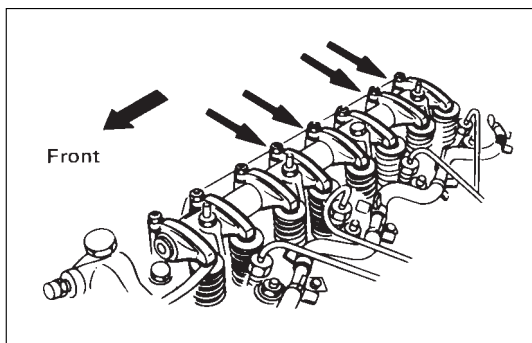
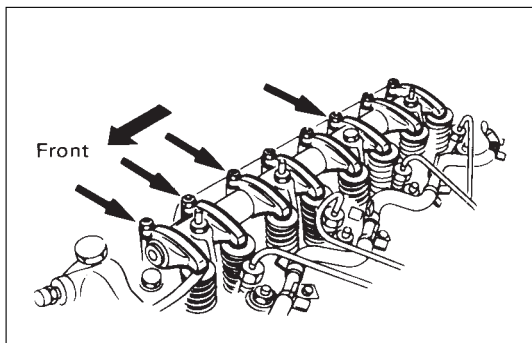


2. Check the rocker arm shaft bracket nuts for looseness. Tighten any loose rocker arm shaft bracket nuts before adjusting the valve clearance.

Rocker Arm Shaft Bracket Nut Torque	N·m(Kg·m/lb·ft)
	54 (5.5/40)



3. Check for play in the No. 1 intake and exhaust valve push rods.
If the No. 1 cylinder intake and exhaust valve push rods have play, the No. 1 piston is at TDC on the compression stroke.
If the No.1 cylinder intake and exhaust valve push rods are depressed, the No. 4 piston is at TDC on the compression stroke.




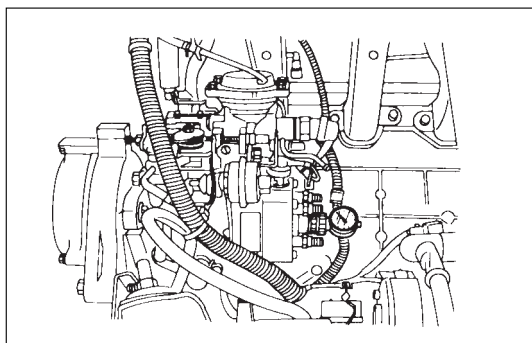
Adjust the No. 1 or the No. 4 cylinder valve clearances while their respective cylinders are at TDC on the compression stroke.

Valve Clearance (At Cold)	mm(in)
0.4 (0.016)	

4. Loosen each valve clearance adjusting screw as shown in the illustration.
5. Insert a feeler gauge of the appropriate thickness between the rocker arm and the valve stem end.
6. Turn the valve clearance adjusting screw until a slight drag can be felt on the feeler gauge.
7. Tighten the lock nut securely.
8. Rotate the crankshaft 360°.
9. Realign the crankshaft damper pulley TDC notched line with the timing pointer.
10. Adjust the clearances for the remaining valves as shown in the illustration.

INJECTION TIMING ADJUSTMENT

1. Set the No. 1 cylinder to Top Dead Center.
 2. Remove injector pump distributor head plug.
 3. Cancel Wax CSD with the handle of a screw driver.
 4. Fit a dial gauge and set lift to 1 mm.
 5. Set crankshaft damper pulley Top Dead Center mark about 45° before Top Dead Center from the pointer.
 6. Set dial gauge in the "O" position.
-  Measuring device : 5-8840-0145-0
7. Turn the crankshaft a little rightwise and leftwise and see if the pointer is stable in the "O" position.
 8. Turn the crankshaft in the normal direction and read the measuring device's indication at TDC (4JG2-T) or 1° ATDC (4JG2-NA).

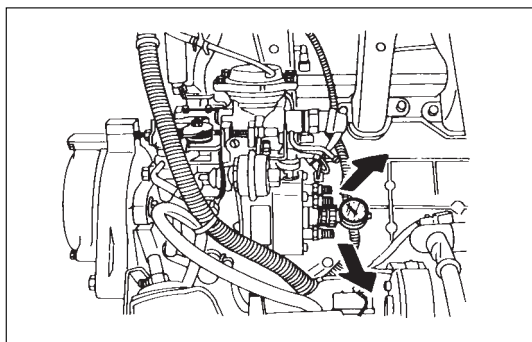


Starting Timing	mm(in)
0.5 (0.02)	

9. If the injection timing is outside the specified range, continue with the following steps.
10. Loosen the injection pump fixing nuts and bracket bolts.
11. Adjust the injection pump setting angle.
 - If injection timing will be advanced, move the injection pump toward the engine.
 - If injection timing will be retarded, move the injection pump away from the engine.

Tighten the pump fixing nut, adjust bolt and pump distributor head plug to the specified torque.

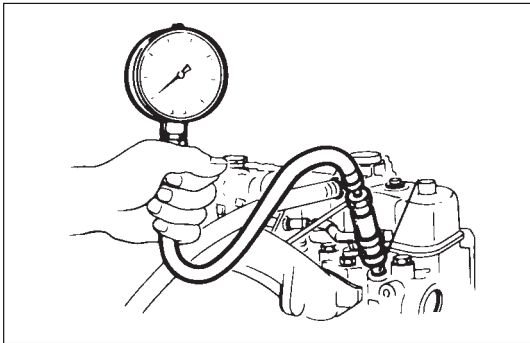
Pump Fixing Bolt	N·m(Kg·m/lb·ft)
19(1.9/13)	



Adjust Bolt	N·m(Kg·m/lb·ft)
40(4.1/30)	
Injection Pump Distributor Head Plug	N·m(Kg·m/lb·ft)
17 (1.7/12)	

CAUTION

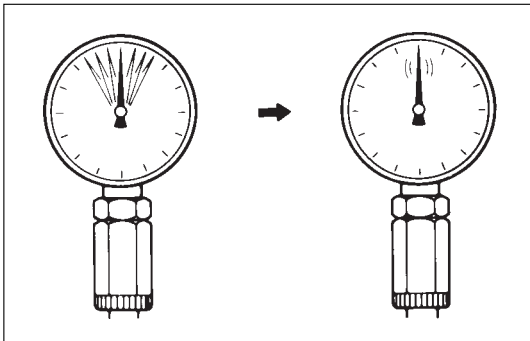
- When installing the distributor head plug, be sure to use new copper washer.



COMPRESSION PRESSURE MEASUREMENT

1. Start the engine and allow it to idle until the coolant temperature reaches 70 – 80°C (158 – 176°F).
2. Remove the following parts.
 - * Glow plugs
 - * Fuel cut solenoid connector
 - * QOS (Quick-On Start System) fusible link wire at the connector.
3. Set the adapter and compression gauge to the No. 1 cylinder glow plug hole.

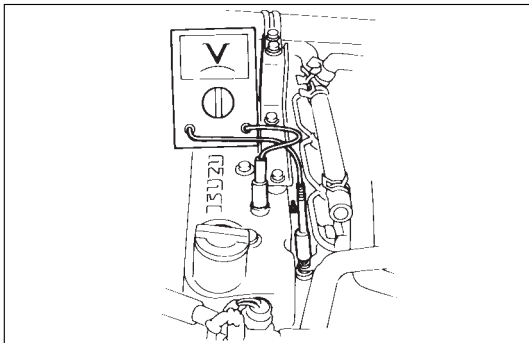
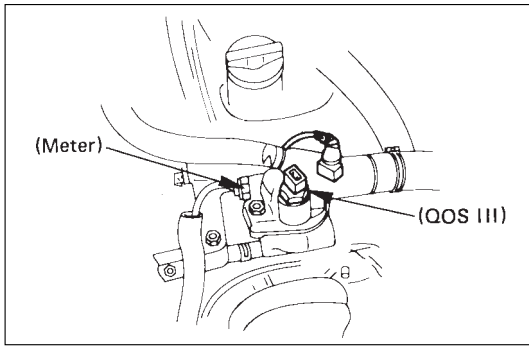
Compression Gauge
(with Adapter): 5-8840-2675-0
Adapter: 5-8531-7002-0



4. Turn the engine over with the starter motor and take the compression gauge reading.

Compression Pressure at 200 rpm		Kpa (Kg/cm ² / Psi)
Standard	Limit	
2940 (30/426)	2157 (22/313)	

5. Repeat the procedure (Steps 3 and 4) for the remaining cylinders.
If the measured value is less than the specified limit, refer to "Troubleshooting" in this Manual.



QUICK-ON START III SYSTEM

Quick-On Start System Inspection Procedure

1. Disconnect the thermo-sensor connection on the thermostat outlet pipe.
2. Turn the starter switch to the "ON" position. If the Quick-On Start III System is operating properly, the glow relay will make a clicking sound within seven seconds after the starter switch is turned on.
3. Measure the glow plug terminal voltage with a circuit tester immediately after turning the starter switch to the "ON" position.

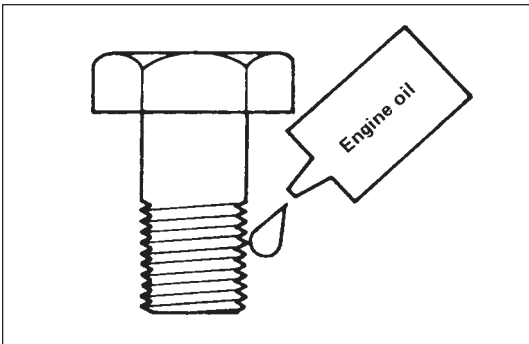
Glow Plug Terminal Voltage	V
	8 – 9

NOTE:

Electrical power to the quick-on start system will be cut after the starter has remained in the "ON" position for ten seconds.

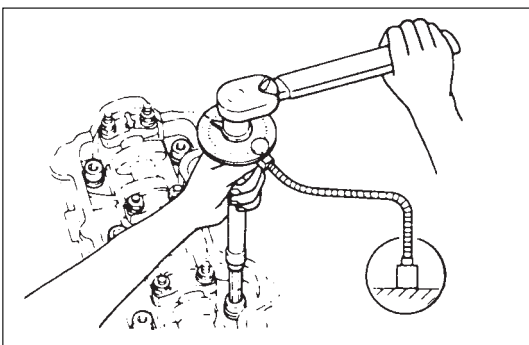
Turn the starter switch to the "OFF" position and back to the "ON" position.

This will reset the Quick-On Start III System.



Nut and Bolt Angular Tightening Method (Using The Special Tool)

1. Carefully wash the nuts and bolts to remove all oil and grease.
2. Apply engine oil to the threads and setting faces of the nuts and bolts.
3. Use a torque wrench to tighten the nuts and bolts to the specified torque (snug torque).

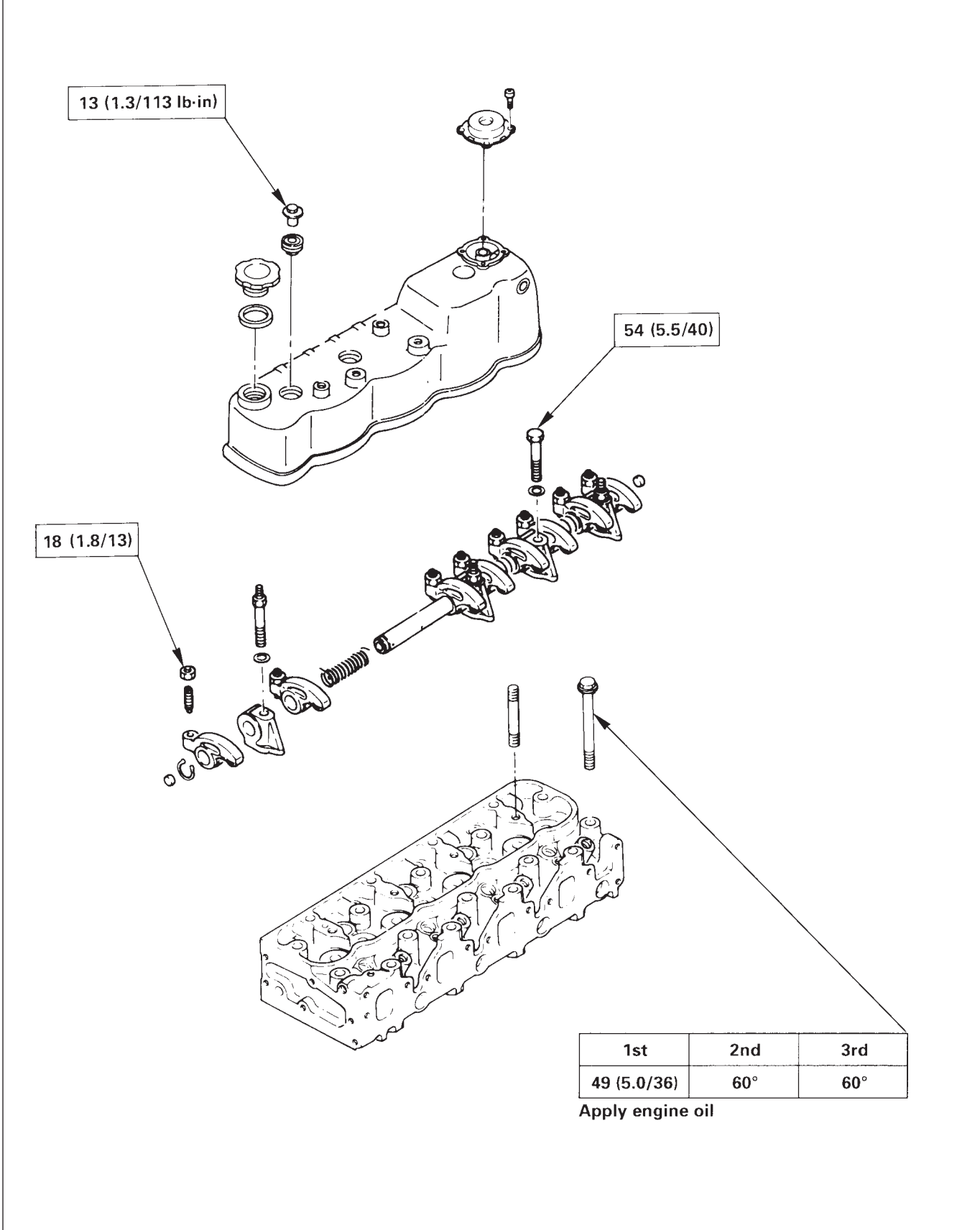


4. Attach the angle gauge to the socket wrench. Angle Gauge: 5-88400-266-0
5. Attach a magnet to some part to hold the angle gauge stationary.
6. Tighten the nuts and bolts to the specified angle, noting the angle gauge indication.

FIXING TORQUE

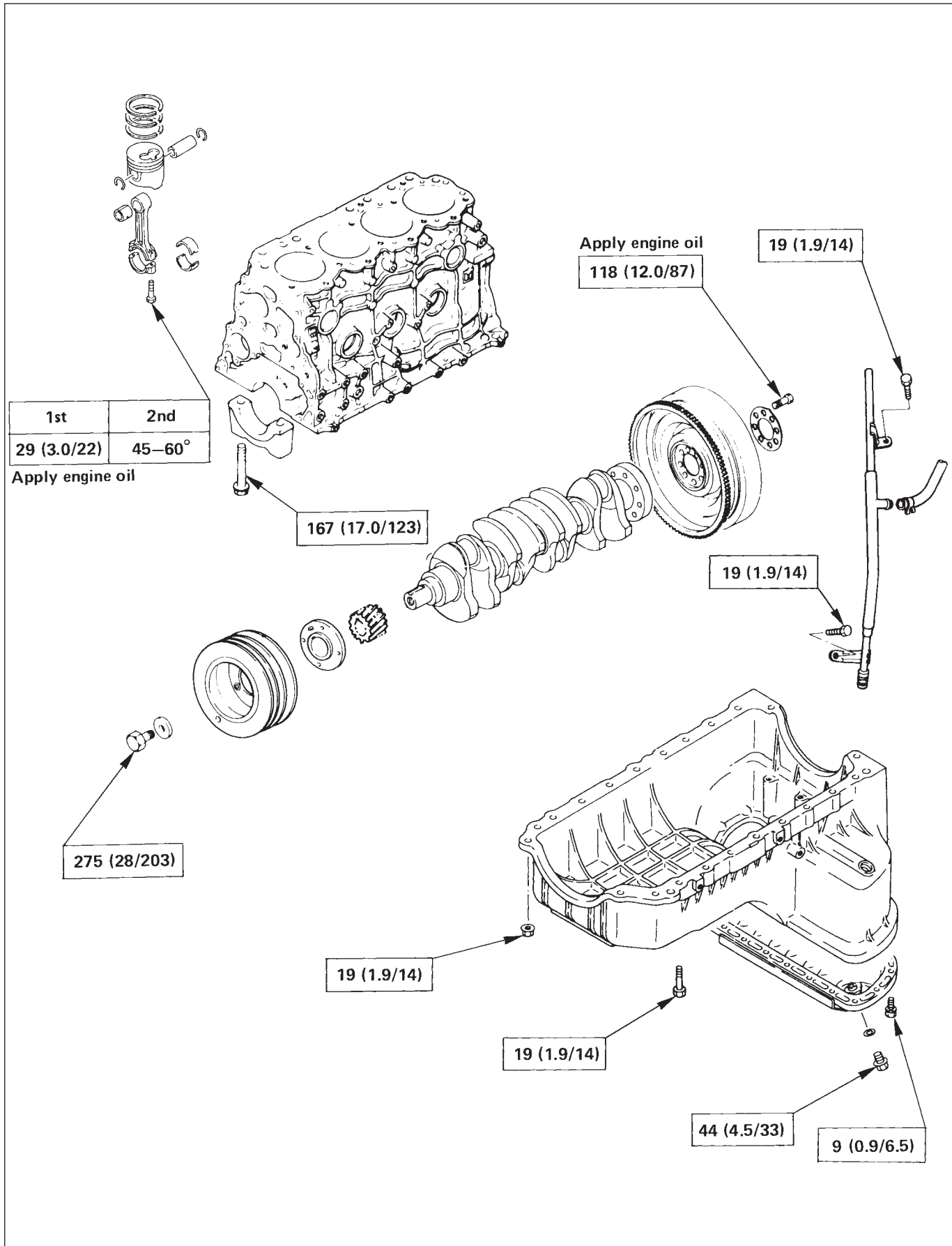
CYLINDER HEAD COVER, CYLINDER HEAD ROCKER, SHAFT BRAKER

N·m (Kg·m/lb·ft)



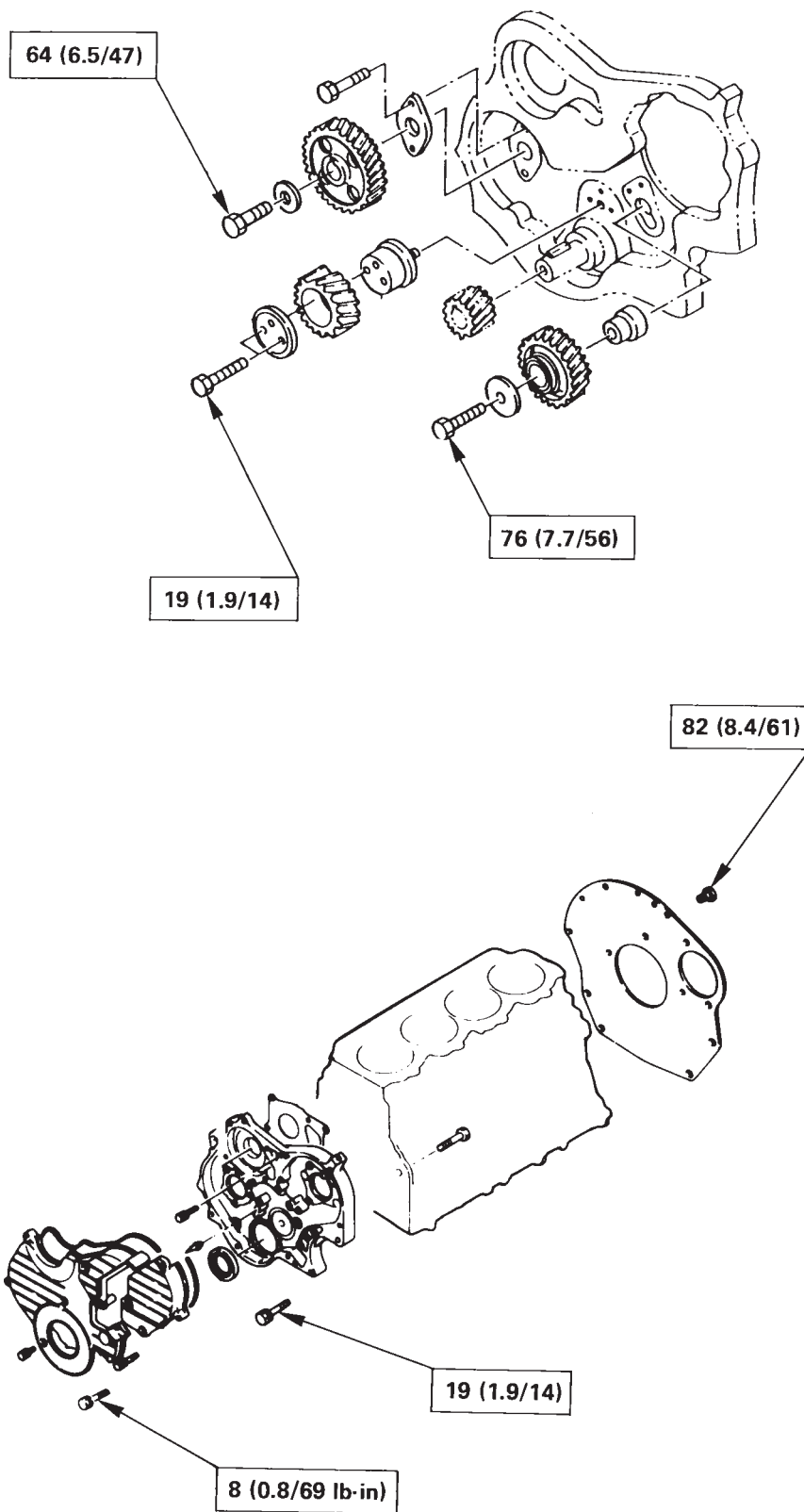
Crankshaft Bearing Cap, Connecting Rod Bearing Cap, Crankshaft Damper Pulley, Flywheel, Crank Case

N·m (Kg·m/lb·ft)



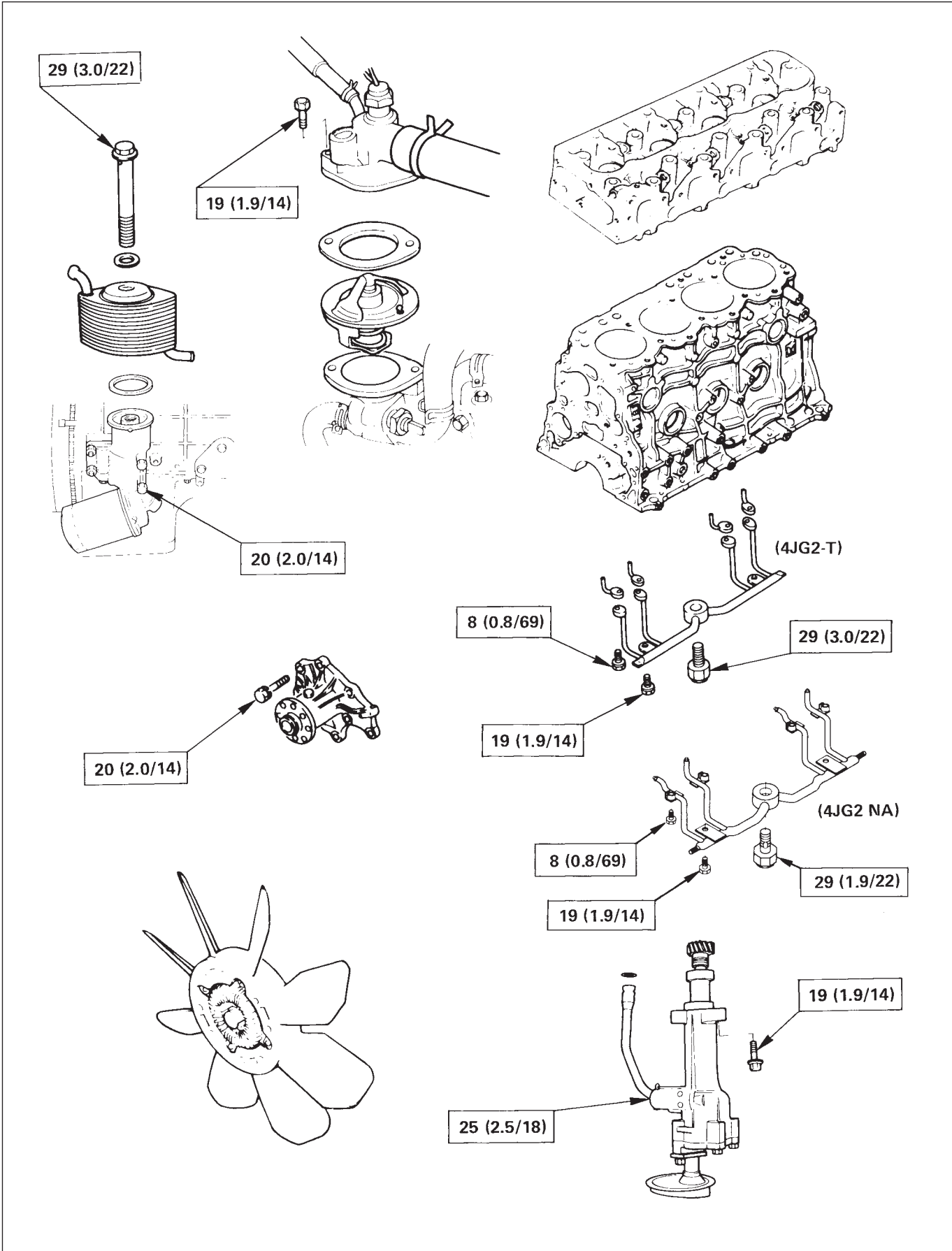
Gear Case, Timing Gear, Camshaft

N·m (Kg·m/lb·ft)



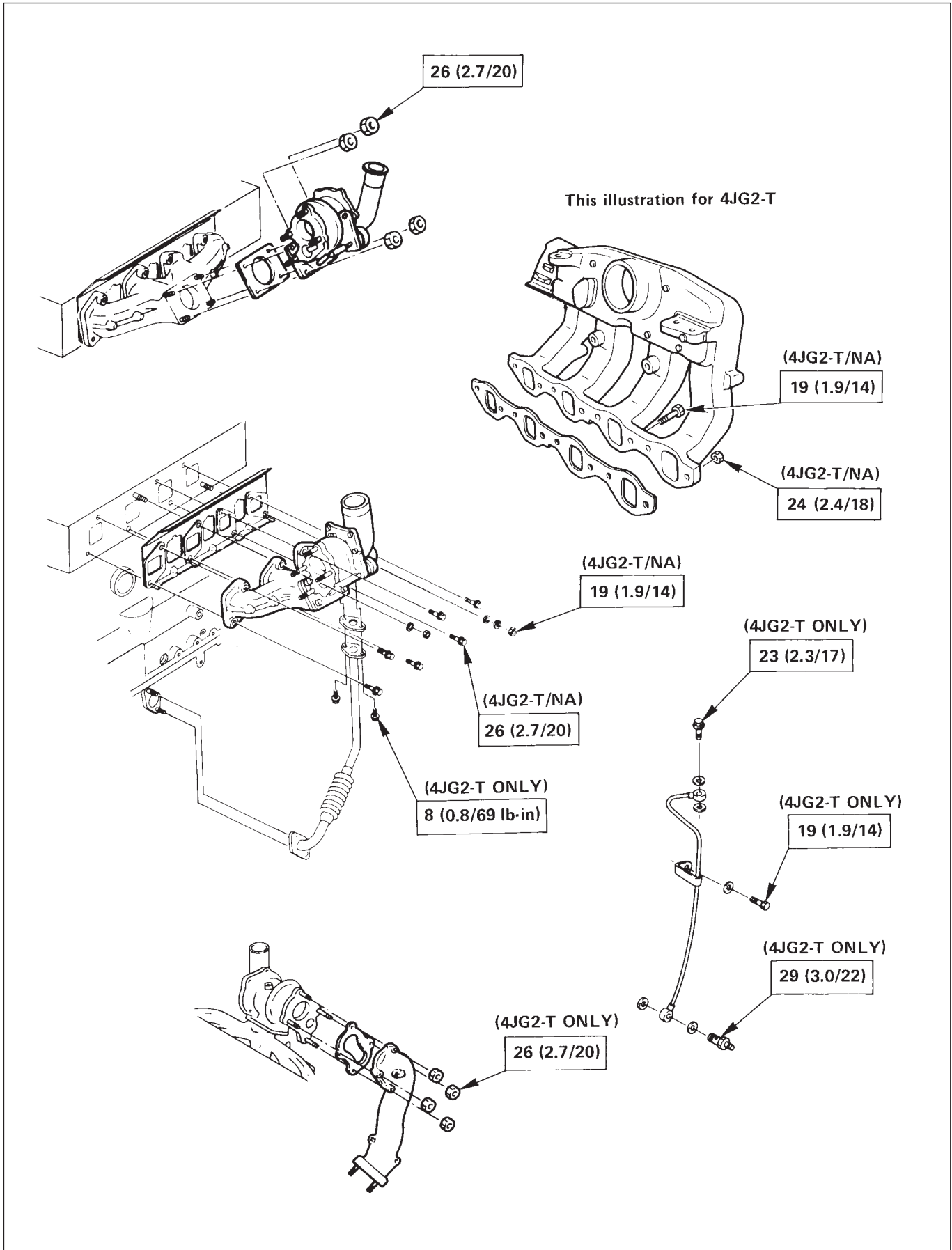
Cooling System and Lubrication System

N·m (Kg·m/lb·ft)



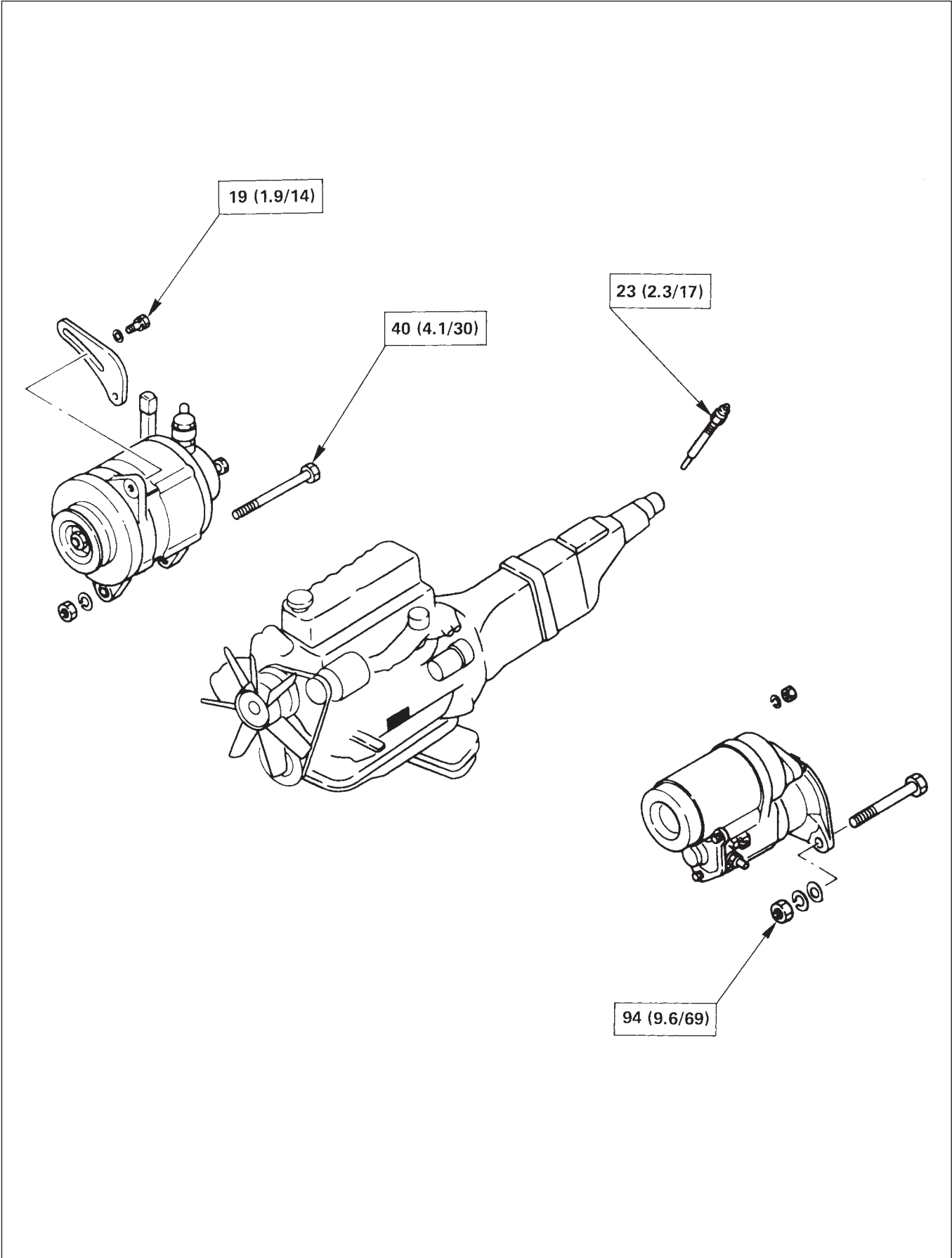
Intake Manifold, Exhaust Manifold, Turbo Charger

N·m (Kg·m/lb·ft)



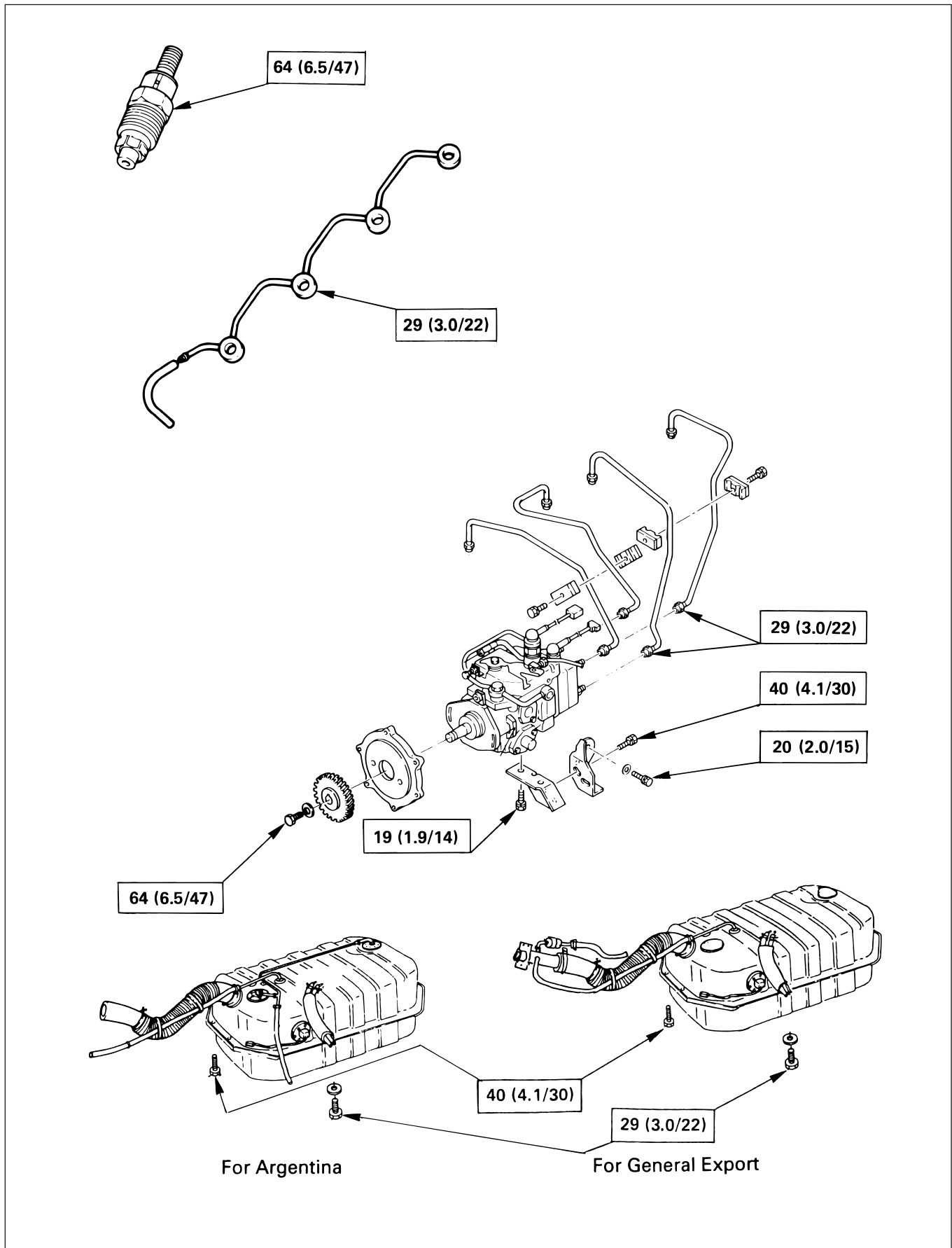
Engine Electricals

N·m (Kg·m/lb·ft)



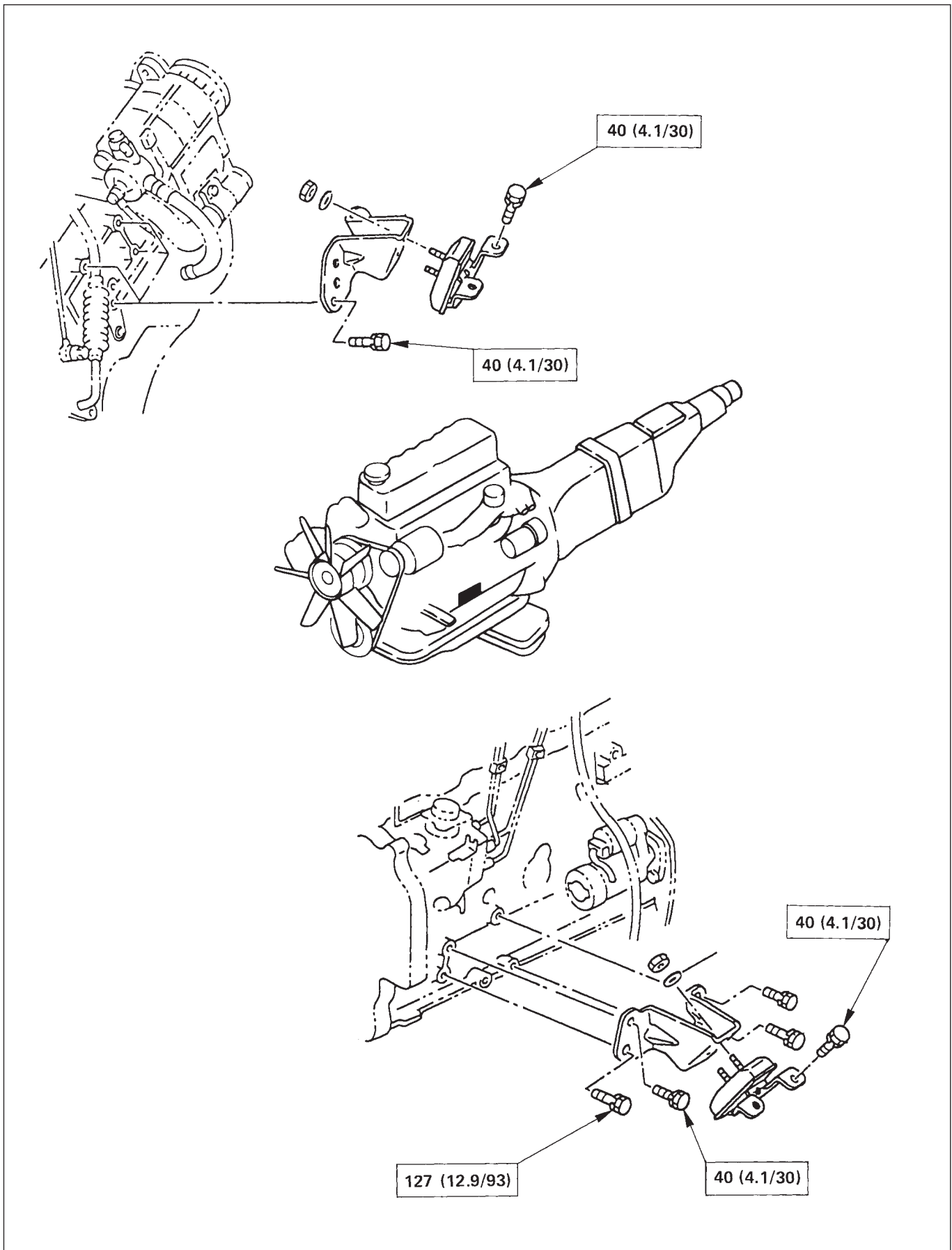
Engine Fuel

N·m (Kg·m/lb·ft)



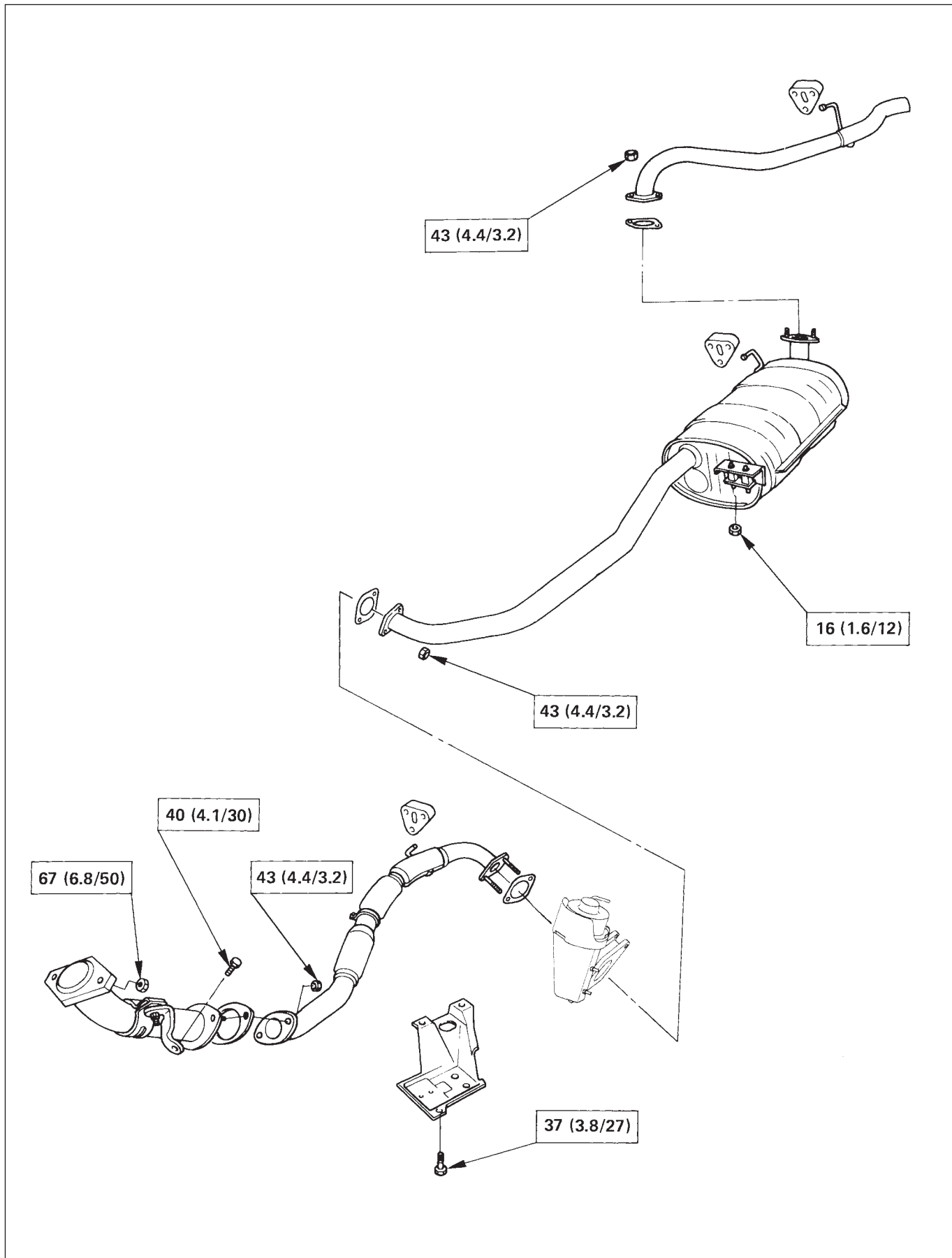
Engine Mount Bracket

N·m (Kg·m/lb·ft)

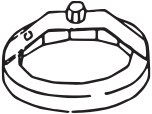
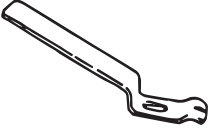






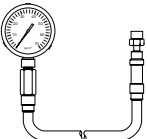
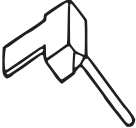
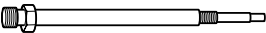


Exhaust System







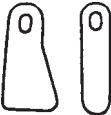




N·m (Kg·m/lb·ft)



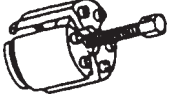

SPECIAL TOOLS

ILLUSTRATION	TOOL NO.	TOOL NAME
	5-8840-0200-0	Oil Filter Wrench
	9-8523-1423-0 (J-29760)	Valve Spring Compressor
	5-8840-2033-0	Valve Stem Oil Seal Installer
	5-8840-9018-0	Piston Ring Compressor
	9-8523-1212-0	Valve Guide Replacer
	5-8840-2313-0	Cylinder Liner Installer
	5-8840-2304-0	Cylinder Liner Remover Ankle
	9-8523-1169-0	Cylinder Liner Remover
	5-8840-2675-0	Compression Gauge
	5-8840-2153-0	Seal Cutter
	5-8531-7002-0	Gauge Adapter

SPECIAL TOOLS (CONT.1)

ILLUSTRATION	TOOL NO.	TOOL NAME
	5-8840-0145-0	Measuring Device
	5-8522-0024-0	Crankshaft Timing Gear Installer
	5-8840-0266-0	Angle Gauge
	5-8840-9016-0	Injection Nozzle Tester
	5-8840-2038-0	Bearing Replacer
	5-8840-2061-0	Crankshaft Front Oil Seal Installer
	5-8840-2032-0	Engine Hanger
	5-8840-0259-0	Nozzle Holder Wrench
	5-8840-0253-0 (J-22700)	Fuel Filter Wrench
	5-8840-2360-0	Crankshaft Rear Oil Seal Remover
	5-8840-2359-0	Crankshaft Rear Oil Seal Installer

SPECIAL TOOLS (CONT.2)

ILLUSTRATION	TOOL NO.	TOOL NAME
	5-8840-2362-0	Crankshaft Front Oil Seal Remover
	5-8840-0133-0	Holder

MEMO

A series of horizontal dotted lines for writing.

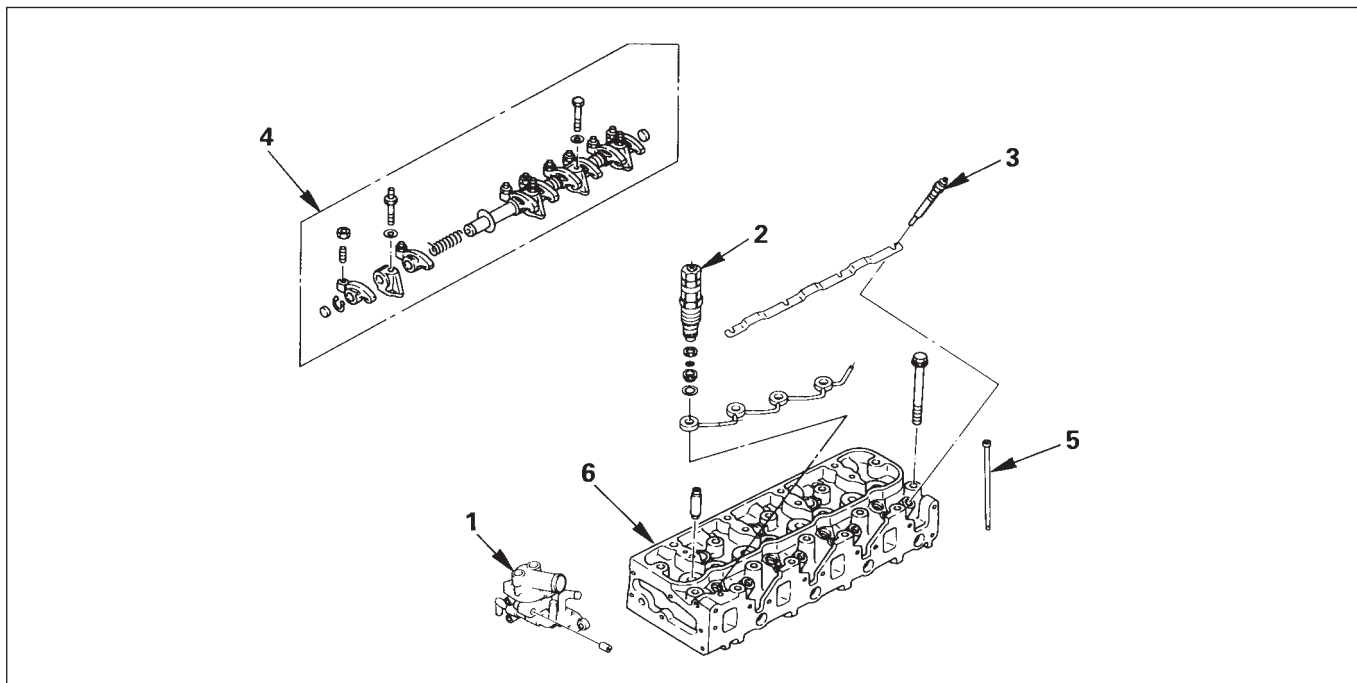
SECTION 6A

ENGINE MECHANICAL

CONTENTS

	PAGE
Cylinder Head	6A- 2
Valve Springs, Valve Stem Oil Seal, Valve, Valve Guide, Push rod	6A- 7
Camshaft, Tappet	6A-14
Rocker Arm Assembly	6A-19
Oil pump	6A-21
Crankshaft	6A-25
Piston and Connecting Rod	6A-34
Cylinder Block	6A-42

CYLINDER HEAD

**NOTE:**

- During disassembly, be sure that the valve train components are kept together and identified so that they can be re-installed in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, make a compression test and note the results.

**DISASSEMBLY**

1. Thermostat Housing Assembly
2. Injection Nozzle Holder
3. Glow Plug and Glow Plug Connector
4. Rocker Arm Shaft and Rocker Arm
5. Push Rod
6. Cylinder Head
 - Refer to Section 6A2 "Cylinder Head"

**CLEAN**

- Cylinder head bolts
 - Cylinder head
- Carefully remove all varnish, soot and carbon to the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

- Cylinder head gasket and mating surfaces for leaks, corrosion and blow-by. If the gasket has failed, determine the cause;
 - Improper installation
 - Loose or warped cylinder head
 - Insufficient torque on head bolts
 - Warped case surface
- 1. Cylinder head bolts for damaged threads or stretching and damaged heads caused by improper use of tools.



CAUTION:

Suspected bolts must be replaced.

2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.



CAUTION:

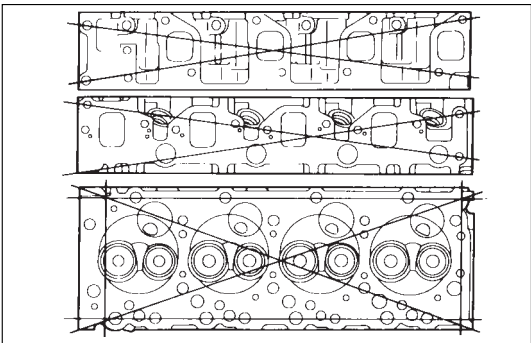
Do not attempt to weld the cylinder head. Replace it.

4. Cylinder head deck, intake and exhaust manifold mating surfaces for flatness.

These surfaces may be re-conditioned by milling. If the surfaces are “out of flat” by more than specification, the surface should be grinded to within specifications. If more than limit of specification, it should be replaced.

mm (in)

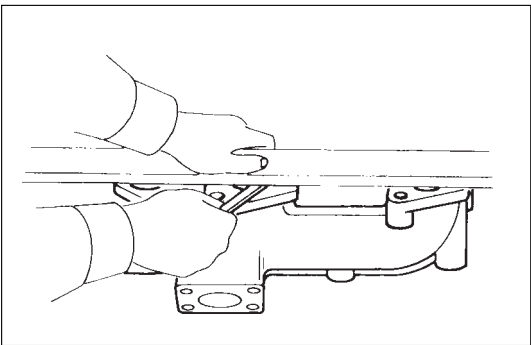
	Standard	Limit
Cylinder Head Lower Face Warpage	0.05 (0.0020) or less	0.20 (0.0079)
Cylinder Head Height	92 (3.6220)	–

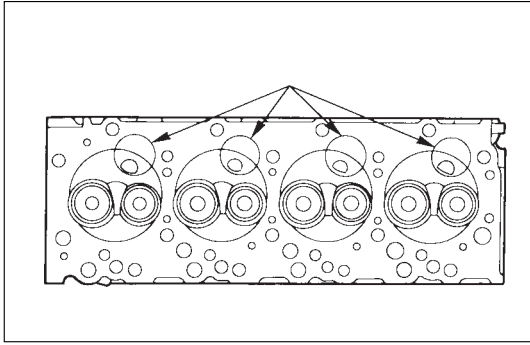


5. Water jacket sealing plugs seating surfaces.
6. Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage. Regrind the exhaust manifold cylinder head fitting surfaces if the measured values are between the specified limit and the standard. If the measured values exceed the specified limit, the manifold must be replaced.

Exhaust Manifold Warpage mm(in)

Standard	Limit
0.05 (0.0020) or less	0.20 (0.0079)

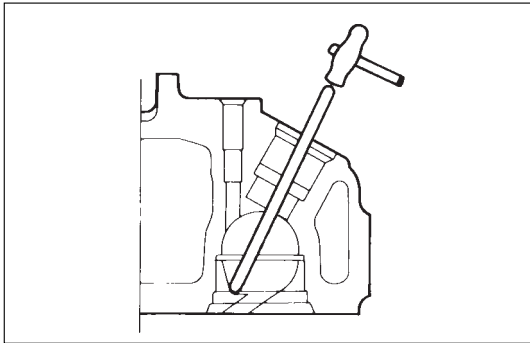




Hot plug depression

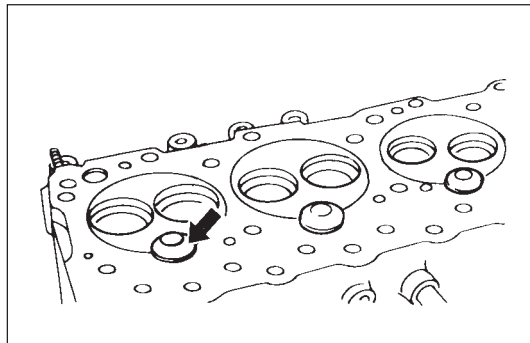
1. Clean the cylinder head lower side, taking care not to damage the hot plug surfaces.
2. Use a straight edge and feeler gauge to measure hot plug depression in a straight line from the No.1 hot plug to the No.4 hot plug.
If the measured value exceeds the limit, the hot plugs must be replaced.

Depression Limit	mm(in)
0.02 (0.0008)	



Hot plug removal

1. Insert a 3.0 - 5.0 (0.12 - 0.20 in.) diameter bar into the nozzle holder fitting hole until it makes contact with the hot plug.
2. Lightly tap the bar with a hammer to drive the hot plug free.
If the measured value exceeds the limit, the hot plugs must be replaced.



Combustion chamber inspection

1. Remove the carbon adhering to the inside of the combustion chamber. Take care not to damage the hot plug fitting positions.
2. Inspect the inside of the combustion chamber, the hot plug hole, and the hot plug machined faces for cracking and other damage.
If cracking or damage is present, the cylinder head must be replaced.

Note:

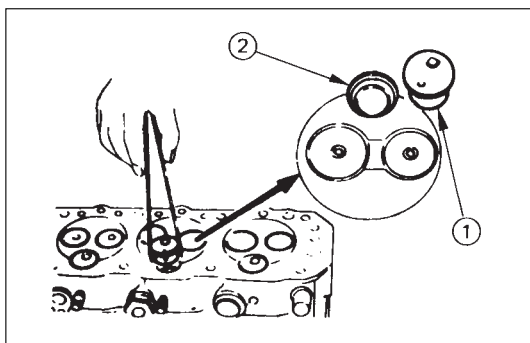
Be absolutely certain that there are no scratches or protuberance on the combustion chamber surfaces which will be in contact with the hot plug after it is installed. These flaws will prevent the hot plug from seating correctly.

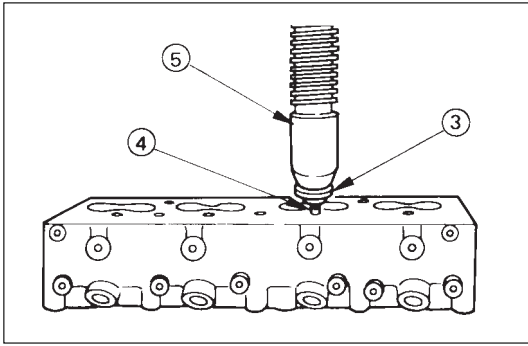
Hot plug inspection

Inspect the hot plugs for excessive wear and other damage. Replace the hot plugs if either of these conditions are discovered.

Hot plug installation

1. Align the hot plug knock ball ① with the cylinder head groove ② and tap it temporarily into position with a plastic hammer.





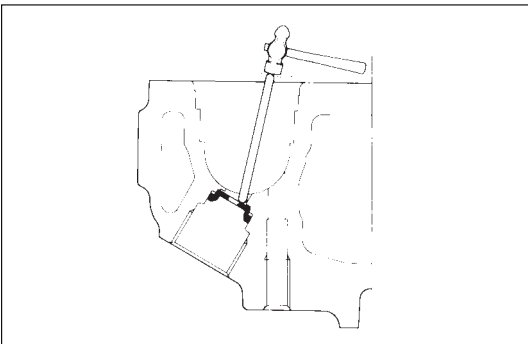
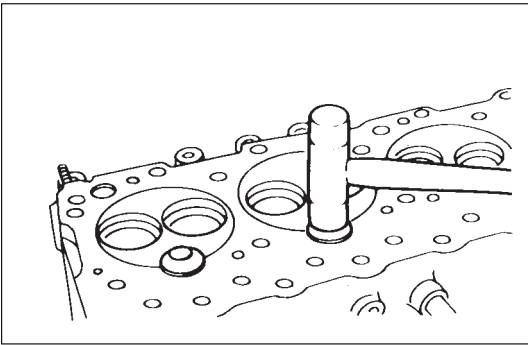
2. Place an appropriate metal plate ③ thick over the hot plug upper surface ④ .
3. Use a press ⑤ to exert a pressure of 44000-54000N(4500 – 5500 kg) (9923 – 12128 lbs.) on the metal plate covering the hot plug upper surface. This will drive the hot plug into position.
4. Lightly tap the hot plug heads to make sure that they are firmly seated.
5. Repeat the procedure Steps 1-4 for the remaining hot plugs.

⚠ CAUTION:

Do not apply pressure greater than that specified. Damage to the cylinder head will result.

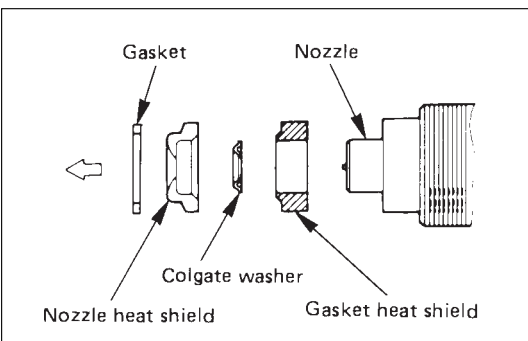
6. Use a surface grinder to grind off any hot plug surface protuberances.
The hot plug surfaces must be perfectly flush with the cylinder head.
7. After grinding, make sure that the hot plug surfaces are completely free of protuberances.
The hot plug surfaces must also be free of depressions.

Once again, lightly tap the hot plug heads to make sure that they are firmly seated.



Heat shield removal

After removing the hot plugs, use a hammer ① and a brass bar ② to lightly tap the lower side of the heat shield ③ and drive it free.



Heat shield installation

Install the heat shield washer and the heat shield to the cylinder head from the nozzle holder installation hole side. Lightly tap the flange into place with a brass bar. The heat shield flange side must be facing up.

NOTE:

Always install a new heat shield. Never reuse the old heat shield.



REASSEMBLY

6. Cylinder Head

- Refer to Section 6A2 "Cylinder head"

5. Push Rod



4. Rocker Arm Shaft and Rocker Arm

- Tighten rocker arm shaft fixing bolts

N·m (Kg·m/lb·ft)

54 (5.5/40)



3. Glow Plug and Glow Plug Connector

- Tighten glow plugs.

N·m (Kg·m/lb·ft)

23 (2.3/17)

2. Injection Nozzle Holder

- Refer to Section 6C2 "Injection nozzle".

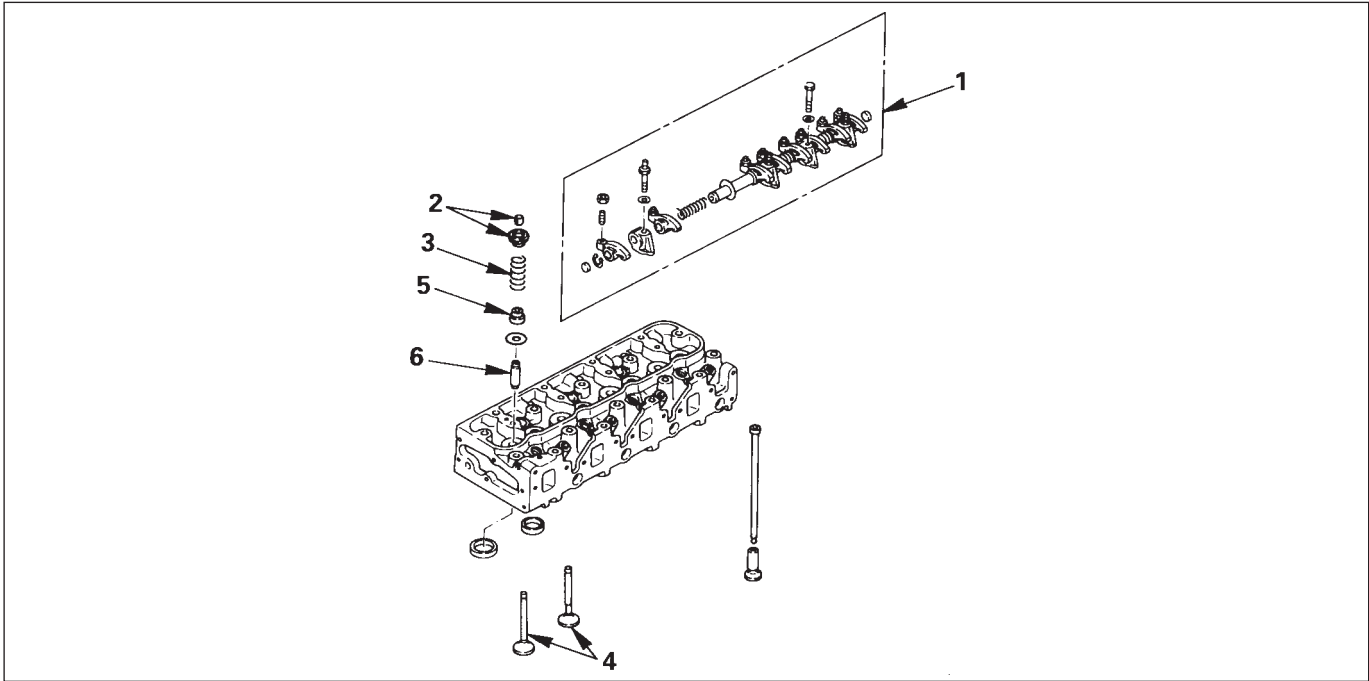
1. Thermostat Housing Assembly

- Tighten thermostat housing assembly fixing bolt

N·m (Kg·m/lb·ft)

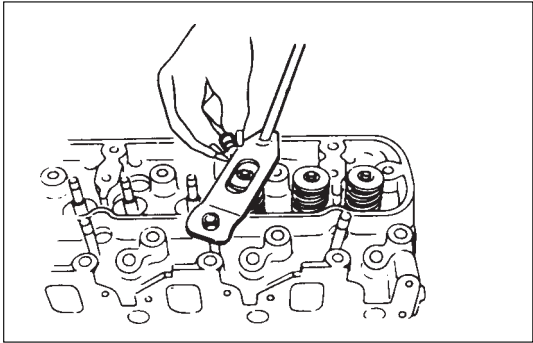
19 (1.9/14)

VALVE SPRING, VALVE STEM OIL SEAL, VALVE, VALVE GUIDE, PUSH ROD

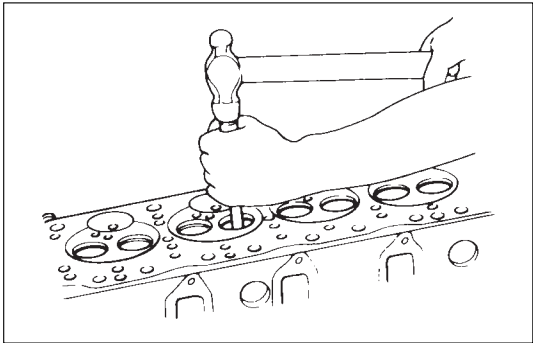


DISASSEMBLY

- 1 Rocker Arm Assembly
- 2 Split Collar
Using special Tool, compress valve spring
Valve spring compressor: 9-8523-1423-0(J-29760)
- 3 Valve Spring
- 4 Valve
- 5 Valve Stem Oil Seal

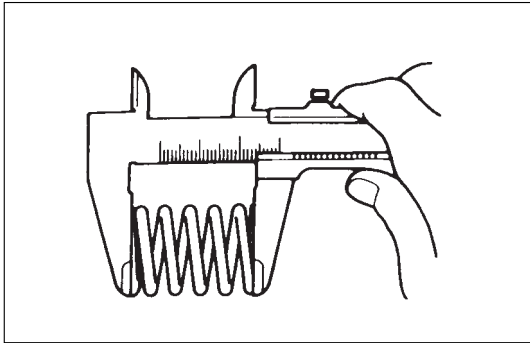


- 6. Valve Guide
Valve Guide Replacer: 9-8523-1212-0



 **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



 **Valve spring CAUTION:**

Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

1. Free height

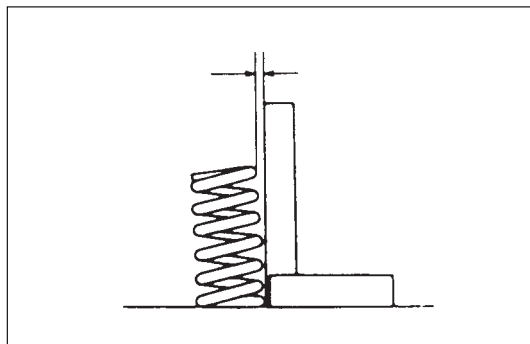
- Measure the free height of the springs. The springs must be replaced if the height is below the specified limit.

mm(in)	
Standard	Limit
48.0 (1.8898)	47.100 (1.8543)

2. Squareness

- Measure the valve spring squareness with a steel square.
- Replace the valve springs if the measured value exceeds the specified limit.

Limit	mm(in)
1.7 (0.0669)	

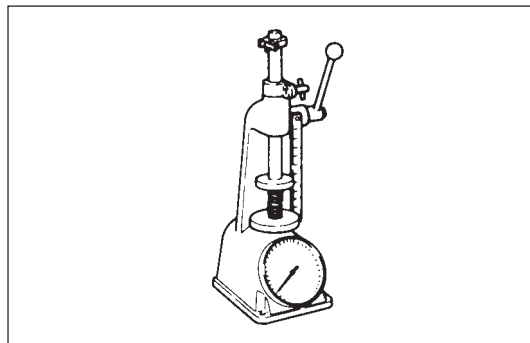


3. Spring tension

- Use a spring tester to compress the springs to the installed height. Measure the compressed spring tension.

Replace the springs if the measured tension is below the specified limit.

N(Kg/lb)		
At installed height 38.9mm (1.5in)	Standard	Limit
		294.0 (30/66.1)

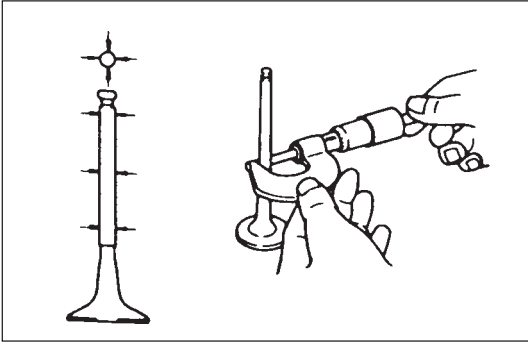


Valve Guide

 **CAUTION:**

Taking care not to damage the valve seat contact surface, when removing carbon adhering to the valve head.

Carefully inspect the valve stem for scratching or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.



1. Valve Guide Clearance

- Measure the valve stem diameter with a micrometer.
If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

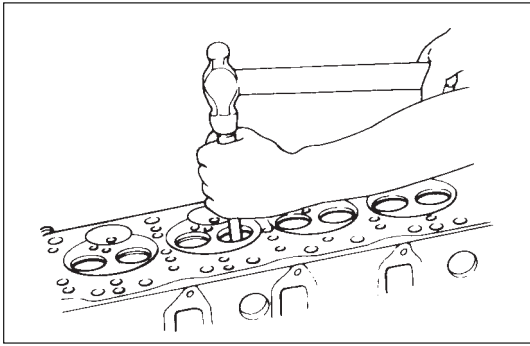
mm(in)

		Standard	Limit
Diameter of Valve stem	Inlet	7.946 – 7.961 (0.3128 – 0.3134)	7.880 (0.3102)
	Exhaust	7.921 – 7.936 (0.3118 – 0.3124)	7.850 (0.3091)

- Measure the inside diameter of the valve guide with a micrometer.
- Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the valve exceeds of the valve guide. If the valve exceeds the specified limit, the valve and the valve guide must be replaced as a set.

mm(in)

		Standard	Limit
Inlet clearance		0.039 – 0.071 (0.0015 – 0.0028)	0.200 (0.0079)
Exhaust clearance		0.064 – 0.096 (0.0025 – 0.0038)	0.250 (0.0098)



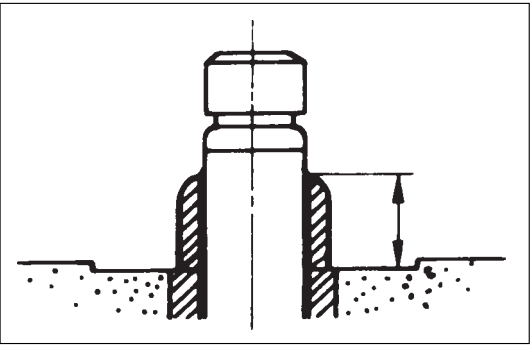
Valve Guide Replacement



- Using special tool, drive out the valve guide from the combustion chamber side.



Valve guide replacer: 9-8523-1212-0



- Apply engine oil to the outside of the valve guide. Using special tool, drive in a new valve guide from cylinder head upper face side, and check the valve guide height.



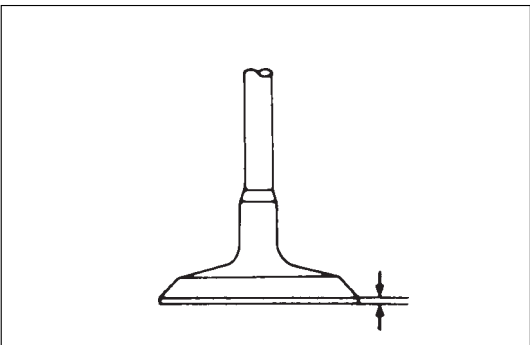
Valve guide replacer: 9-8523-1212-0

Height mm(in)

13 (0.5118)

NOTE:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

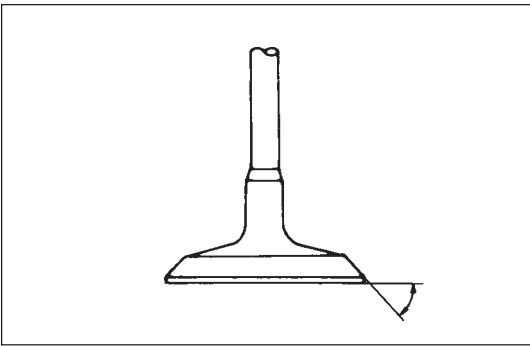


Valve Thickness

- Measure the valve thickness.
- If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

mm(in)

	Standard	Limit
Inlet	1.34 (0.0528)	1.1 (0.0433)
Exhaust	1.38 (0.0543)	1.1 (0.0433)

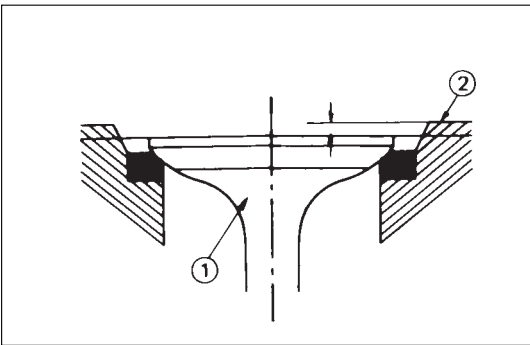


Contact surface angle on valve seat on valve

- Measure contact surface angle on valve seat.
- If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Standard Degree

45

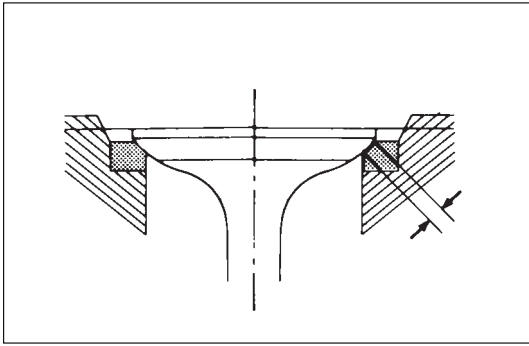


Valve Depression

- Install the valve ① to the cylinder head ②.
- Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface. If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Valve Depression mm(in)

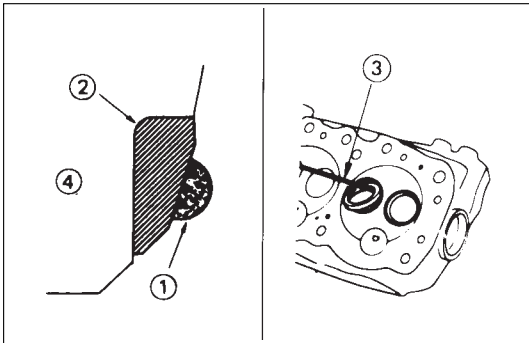
Standard	Limit
1.1 (0.0433)	1.6 (0.0630)



Valve Contact Width

1. Check the valve contact faces for roughness and unevenness. Make smooth the valve contact surfaces.
2. Measure the valve contact width.
If the measured value exceeds the specified limit, the valve seat insert must be replaced.

	mm(in)	
	Standard	Limit
Inlet	1.7 (0.0669)	2.2 (0.0866)
Exhaust	2.0 (0.0787)	2.5 (0.0984)

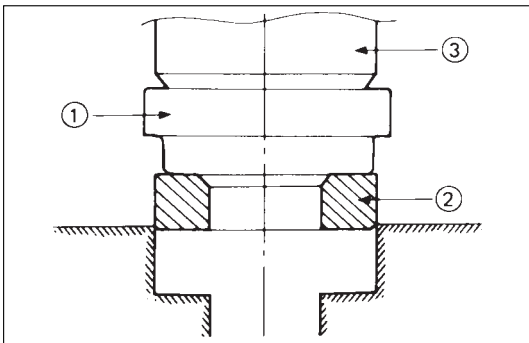


Valve Seat Insert Replacement



Valve Seat Insert Removal

1. Arc weld the entire inside circumference ① of the valve seat insert ②.
2. Allow the valve seat insert to cool for a few minutes. This will invite contraction and make removal of the valve seat insert easier.
3. Use a screwdriver ③ to pry the valve seat insert free. Take care not to damage the cylinder head \checkmark .
4. Carefully remove carbon and other foreign material from the cylinder head insert bore.



Valve Seat Insert Installation

1. Carefully place the attachment ① (having a smaller outside diameter than the valve seat insert) on the valve seat insert ②.

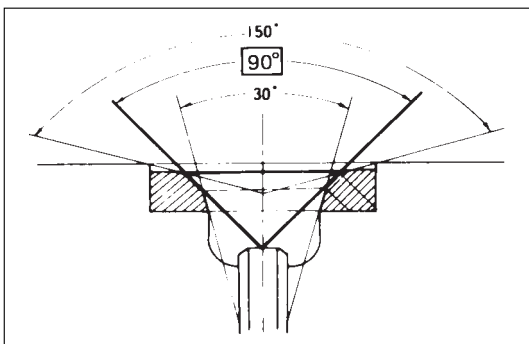
Note:

The smooth side of the attachment must contact the valve seat insert.

2. Use a bench press ③ to gradually apply pressure to the attachment and press the valve seat insert into place.

Note:

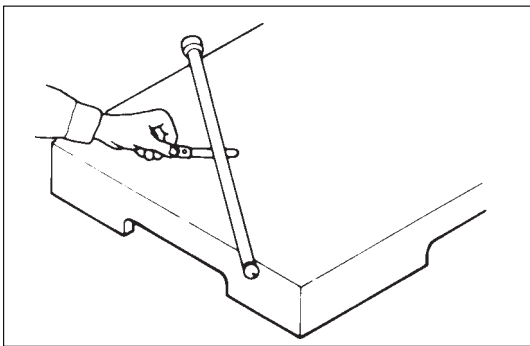
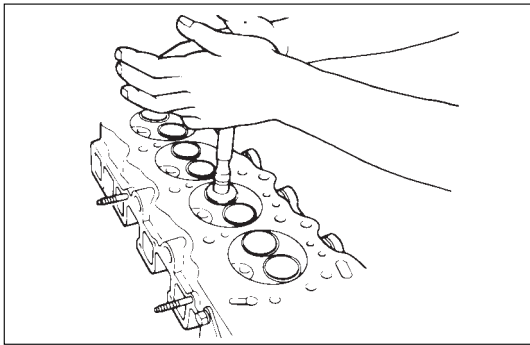
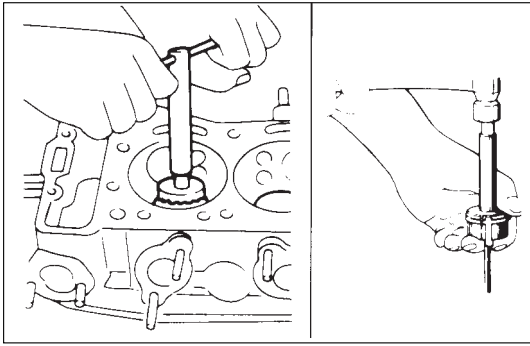
Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.



Valve Seat Insert Correction

1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value.

Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.



Valve Seat Angle	degree
45	

NOTE:

Use an adjustable valve cutter pilot.
Do not allow the valve cutter pilot to wobble inside the valve guide.

3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while tapping it to fit the valve seat insert.
6. Check that the valve contract width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.

Push Rod Curvature

1. Lay the push rod on a surface plate.
2. Roll the push rod along the surface plate and measure the push rod curvature with a thickness gauge.

If the measure value exceeds the specified limit, the push rod must be replaced.

Push Rod Curvature Limit	mm(in)
0.3 (0.0118)	

3. Visually inspect both ends of the push rod for excessive wear and damage. The push rod must be replaced if these conditions are discovered during inspection.



REASSEMBLY

6. Valve Guide

- Apply engine oil to the outside of the valve guide.
Using special tool, drive in a new valve guide from the cmashft side.



Valve guide replacer: 9-8523-1212-0

5. Valve Stem Oil Seal

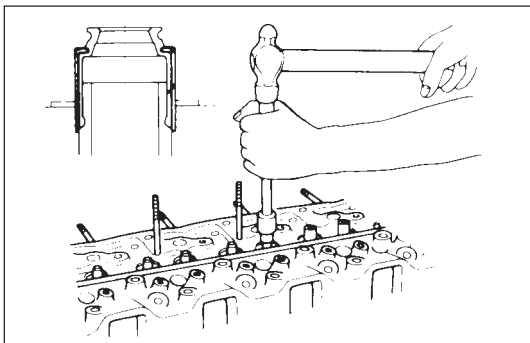
- Using special tool, drive in a new oil seal
Oil special tool, drive in anew oil seal

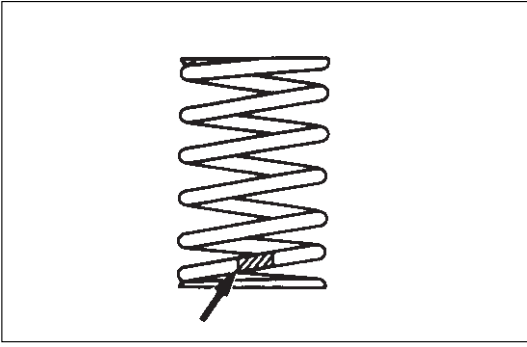


Oil seal installer: 5-8840-2033-0

4. Valve

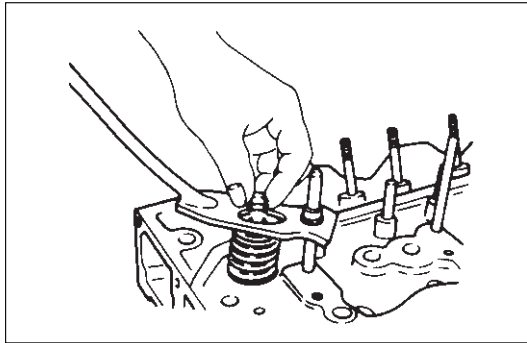
- Apply engine oil to the outside of the valve stem.





3. Valve Spring

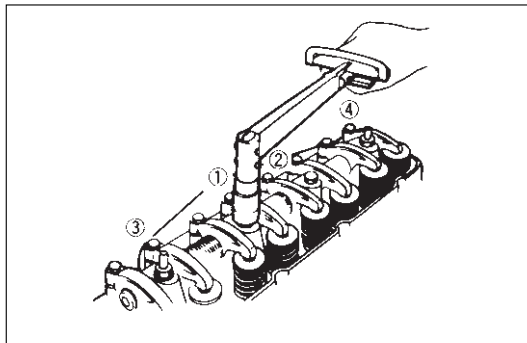
- Attach the valve seat to the upper spring seat. The painted area of the valve spring should be facing downward.



2. Split Collar

- Use a spring compressor to push the valve spring into position.
- Install the spring seat split collar.
- Set the split collar by tapping lightly around the head of the collar with a rubber hammer.

Valve spring compressor: 9-8523-1423-0 (J-29760)

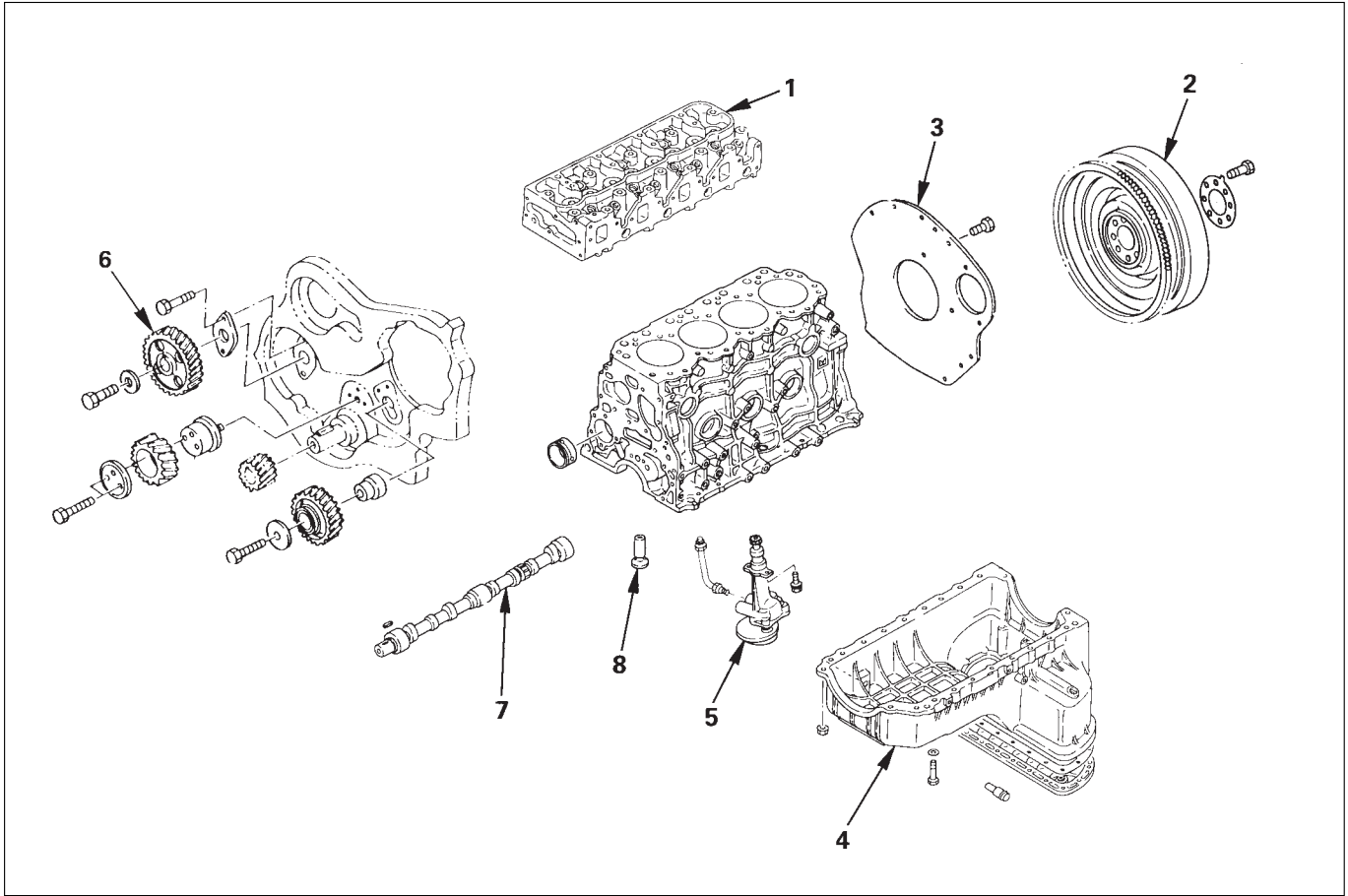


1. Rocker Arm Assembly

N·m(Kg·m/lb·ft)

54 (5.5/40)

CAMSHAFT, TAPPET



DISASSEMBLY

1. Cylinder Head Assembly
2. Flywheel
3. Cylinder Block rear Plate
4. Crankcase Assembly
5. Oil Pump Assembly

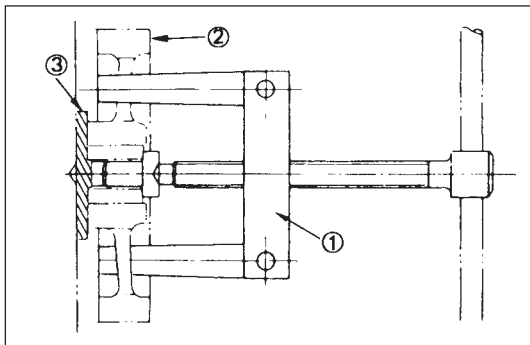
6. Camshaft Timing Gear

- Install the stopper bolt ① to the timing pulley to prevent it from turning.
- Use the timing pulley puller ② to remove the pulley.



Camshaft Timing Pulley Puller: 5-8840-0086-0

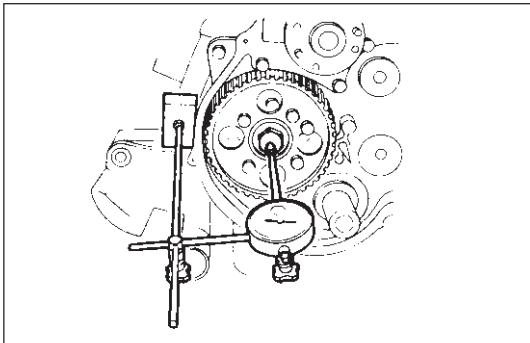
7. Camshaft Thrust Plate



8. Camshaft
9. Tappet

INSPECTION AND REPAIR

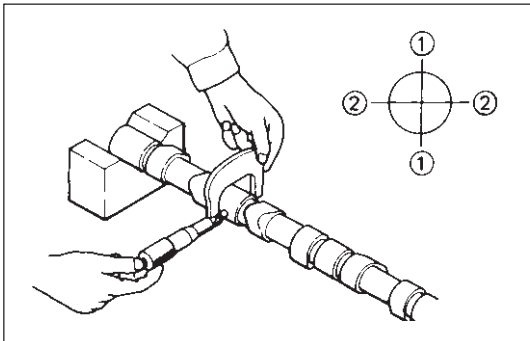
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



1. Measure the Camshaft Thrust Clearance.

- Use a dial indicator to measure the camshaft end play. This must be done before removing the camshaft gear. If the camshaft end play exceeds the specified limit, the thrust plate must be replaced.

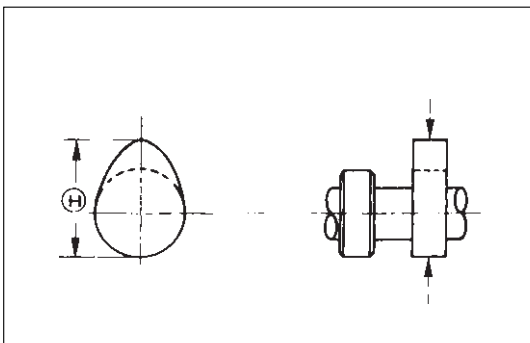
Camshaft End Play		mm(in)
Standard	Limit	
0.08 (0.0031)	0.2 (0.0079)	



2. Camshaft Journal Diameter

- Use a micrometer to measure each camshaft journal diameter in two directions (① and ②). If the measured value is less than the specified limit, the camshaft must be replaced.

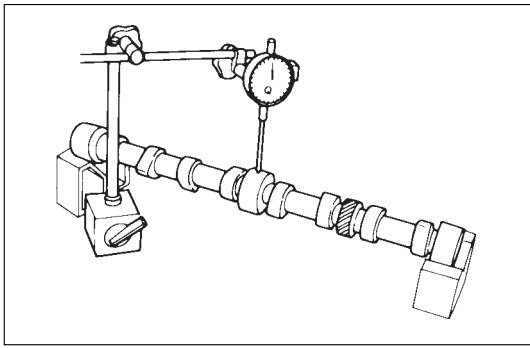
Journal Diameter		mm(in)
Standard	Limit	
49.945-49.975 (1.9663-1.9675)	49.60 (1.9528)	



3. Cam Height

- Measure the cam height (H) with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

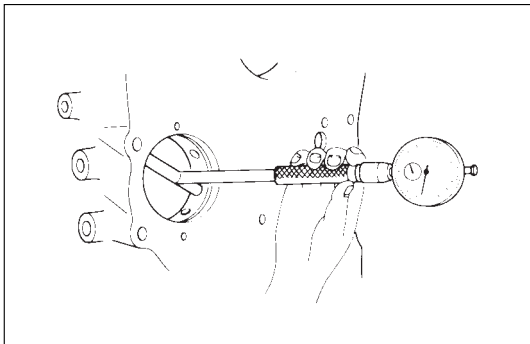
Cam Height		mm(in)
Standard	Limit	
42.02 (1.6543)	41.65 (1.6398)	



4. Camshaft Run-Out

- Mount the camshaft on V-blocks.
- Measure the run-out with a dial indicator. If the measured value exceeds the specified limit, the camshaft must be replaced.

Run-Out		mm(in)
Standard	Limit	
0.02 (0.0008) or less	0.10 (0.0039)	



5. Camshaft and Camshaft Bearing Clearance

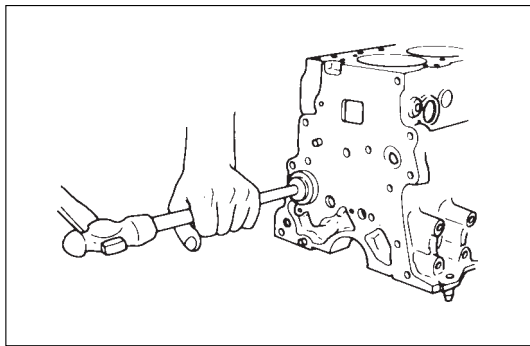
- Use an inside dial indicator to measure the camshaft bearing inside diameter.

Camshaft Bearing Inside Diameter		mm(in)
Standard	Limit	
50.00 – 50.03 (1.9685 – 1.9697)	50.08 (1.9716)	

Camshaft Bearing Clearance		mm(in)
Standard	Limit	
0.025 – 0.085 (0.0010 – 0.0033)	0.12 (0.0047)	

- If the clearance between the camshaft bearing inside diameter and the journal exceeds the specified limit, the camshaft bearing must be replaced.

Camshaft Bearing Replacement

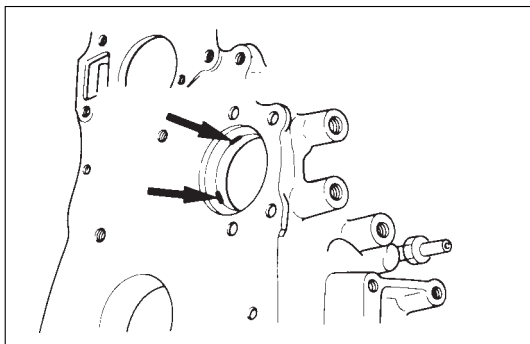


Camshaft Bearing Removal



1. Remove the cylinder body plug plate.
2. Use the bearing replacer to remove the camshaft bearing.

Bearing Replacer: 5-8840-2038-0

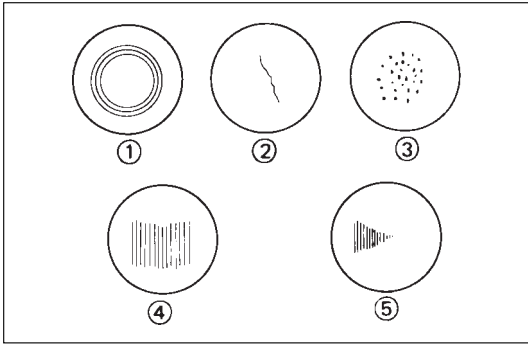


Camshaft Bearing Installation



1. Align the bearing oil holes with the cylinder body oil holes.
2. Use the replacer to install the camshaft bearing.

Bearing Replacer: 5-8840-2038-0



TAPPET

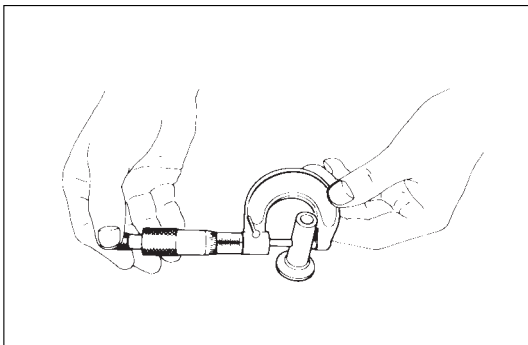
Visually inspect the tappet camshaft contact surfaces for pitting, cracking, and other abnormal conditions. The tappet must be replaced if any of these conditions are present.

Refer to the illustration at the left.

- ① Normal contact
- ② Cracking
- ③ Pitting
- ④ Irregular contact
- ⑤ Irregular contact

NOTE:

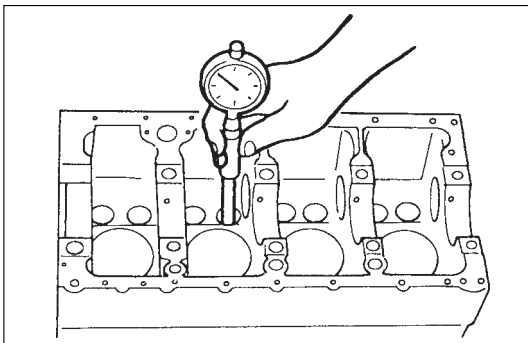
The tappet surfaces are spherical. Do not attempt to grind them with an oil stone or similar tool in an effort to repair the tappet. If the tappet is damaged, it must be replaced.



Tappet Outside Diameter

1. Measure the tappet outside diameter with a micrometer. If the measured value is less than the specified limit, the tappet must be replaced.

Tappet Outside Diameter		mm(in)
Standard	Limit	
12.97 – 12.99 (0.5106 – 0.5114)	12.95 (0.5098)	



2. Measure the inside diameter tappet on the cylinder block and calculate the clearance. If the clearance exceeds the limit, replace tappet or/ and cylinder block.

Clearance Between Tappet and Cylinder Body		mm(in)
Standard	Limit	
0.03 (0.0012)	0.10 (0.0039)	

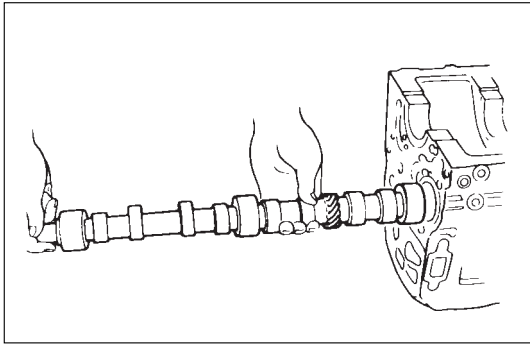
REASSEMBLY

9. Tappet

- 1) Apply a coat of engine oil to the tappet and the cylinder body tappet insert holes.
- 2) Locate the position mark applied at disassembly (if the tappet is to be reused).

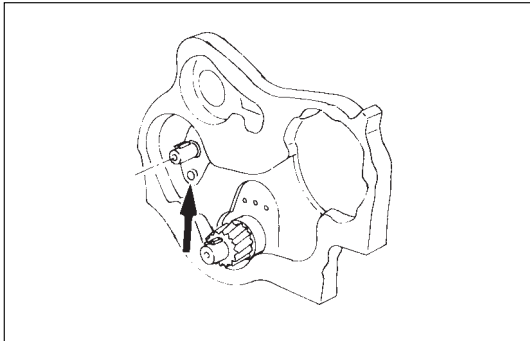
NOTE:

The tappet must be installed before the camshaft.



8. Camshaft

- 1) Apply a coat of engine oil to the camshaft and the camshaft bearings.
Install the camshaft to the cylinder body.
Take care not to damage the camshaft bearings.

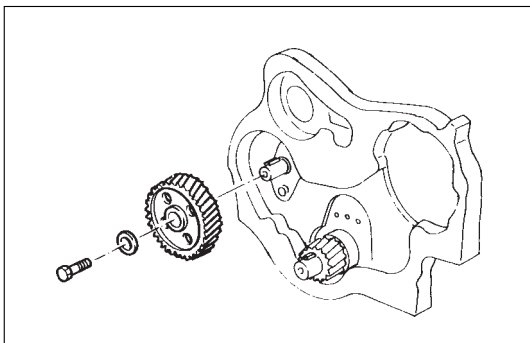


7. Camshaft Thrust Plate

Install the thrust plate to the cylinder body and tighten the thrust plate bolts to specified torque.

N·m(Kg·m/lb·ft)

18 (1.8/13)



6. Camshaft Timing Gear

- 1) Install the camshaft timing gear to the camshaft.
The timing gear mark ("Y - Y") must be facing outward.
- 2) Tighten the timing gear to the specified torque.

N·m(Kg·m/lb·ft)

64 (6.5/47)

5. Oil Pump Assembly

- Refer to Section 6A2 "Oil Pump Installation".

4. Crankcase Assembly

- Refer to Section 6A2 "Crankcase".

3. Cylinder Block Rear Plate

- Tighten cylinder block rear plate fixing bolts to the specified torque.

N·m(kg·m/lb·ft)

82 (8.4/61)

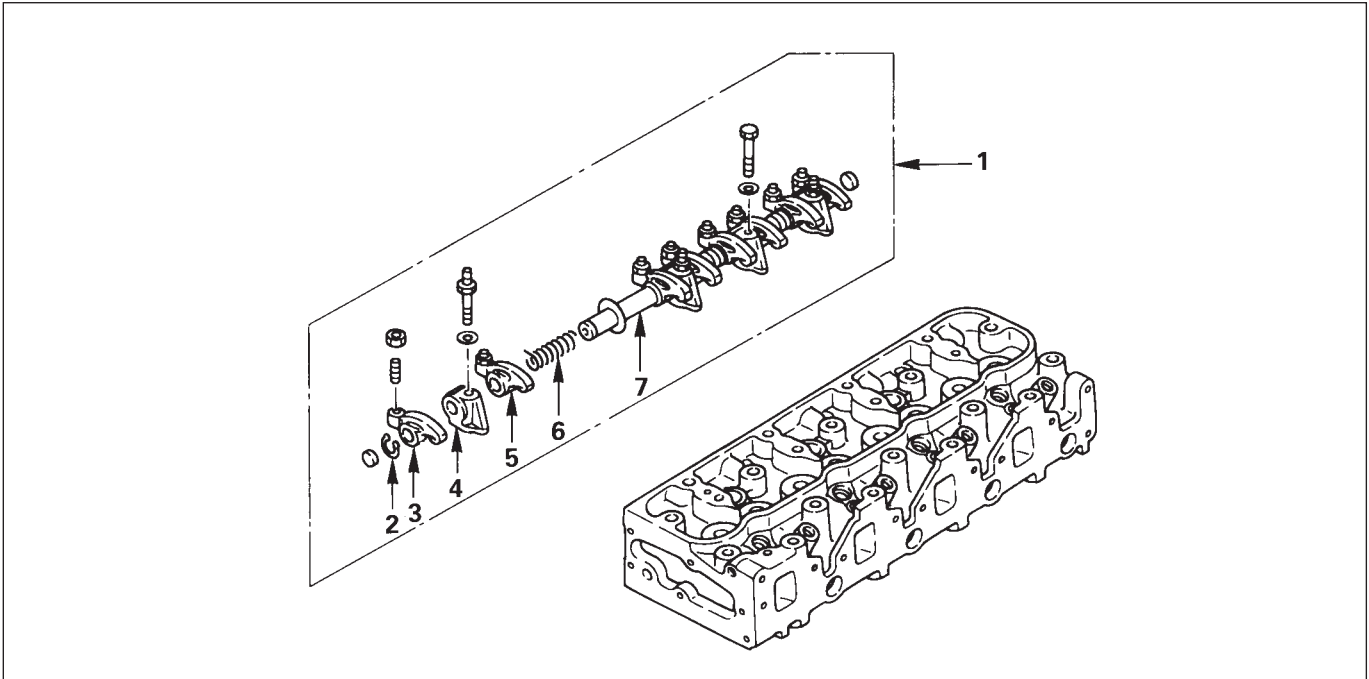
2. Flywheel

- Refer to Section 6A2 "Crankshaft Installation".

1. Cylinder Head Assembly

- Refer to Section 6A2 "Cylinder Head Installation".

ROCKER ARM ASSEMBLY



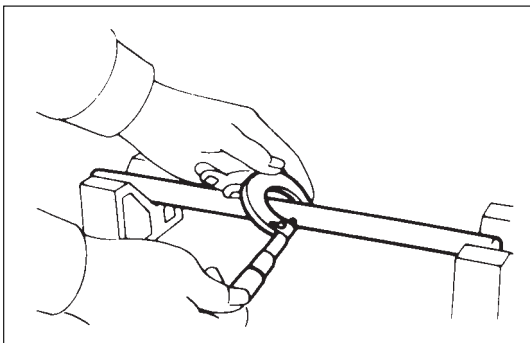
DISASSEMBLY

1. Rocker Arm Shaft Assembly
2. Rocker Arm Shaft Snap Ring
3. Rocker Arm
4. Rocker Arm Shaft Bracket
5. Rocker Arm
6. Rocker Arm Shaft Spring
7. Rocker Arm Shaft



INSPECTION AND REPAIR

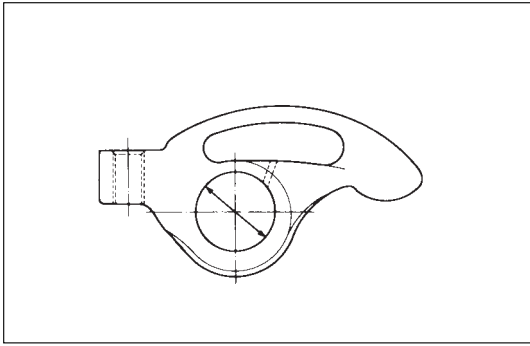
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



Use a micrometer to measure the rocker shaft outside diameter at the point where the rocker arm moves on the rocker shaft.

Replace the rocker shaft if the diameter exceeds the specified limit.

Rocker Arm Shaft Outside Diameter		mm(in)
Standard	Limit	
18.98 – 19.00 (0.7472 – 0.7480)	18.9 (0.7441)	



Oil Clearance

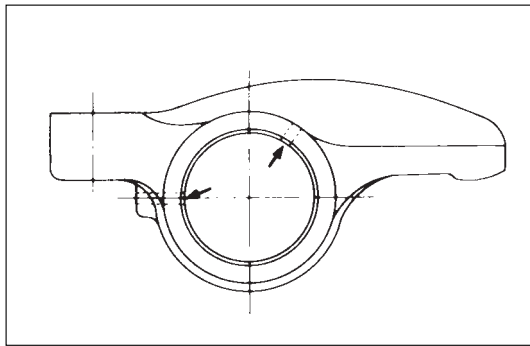
1. Use either a vernier caliper or a dial indicator to measure the rocker arm inside diameter.

Rocker Arm Inside Diameter		mm(in)
Standard	Limit	
19.01 – 19.03 (0.7484 – 0.7492)	19.100 (0.7520)	

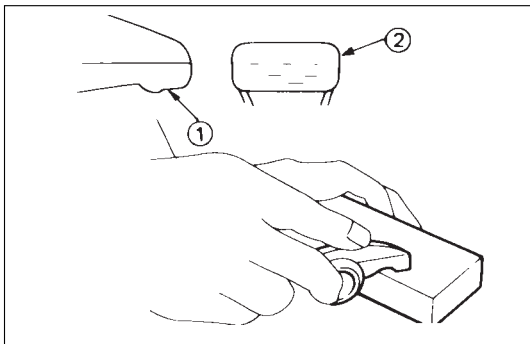
2. Measure the rocker arm shaft outside diameter. If the measured value exceeds the specified limit, replace either the rocker arm or the rocker arm shaft.

Clearance Between Rocker Arm and Rocker Arm Shaft

Clearance Between Rocker Arm and Rocker Arm Shaft		mm(in)
Standard	Limit	
0.01 – 0.05 (0.0004 – 0.0019)	0.20 (0.0079)	

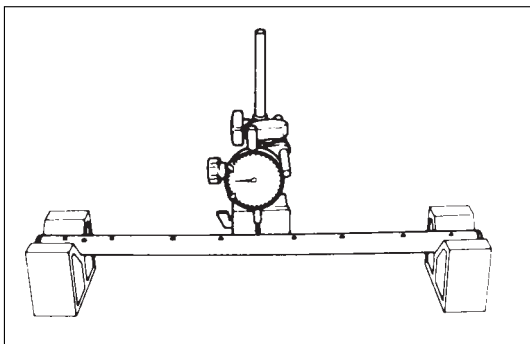


3. Check that the rocker arm oil port is free of obstructions. If necessary, use compressed air to clean the rocker arm oil port.



Rocker Arm Correction

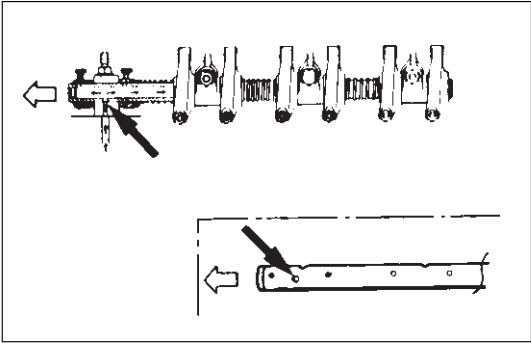
Inspect the rocker arm valve stem contact surface for step wear ① and scoring ②. If the contact surfaces have light step wear or scoring, they may be honed with an oil stone. If the step wear or scoring is severe, the rocker arm must be replaced.



Rocker Arm Shaft Run-Out

1. Place the rocker arm shaft on a V-block.
2. Use a dial indicator to measure the rocker arm shaft central portion run-out. If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition. If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Run-Out		mm(in)
Limit	0.3 (0.0118)	



REASSEMBLY

7. Rocker Arm Shaft

- Apply a light coat of engine oil to the rocker arm shafts.
- Position the rocker arm shaft with the large oil hole (4φ) facing the front of the engine.
- Install the rocker shaft together with the rocker arm, the rocker arm shaft bracket, and the spring.

6. Rocker Arm Shaft Spring

5. Rocker Arm

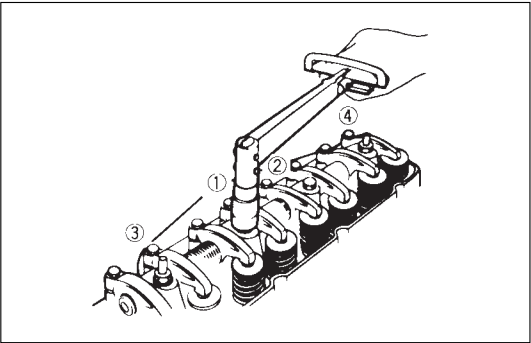
4. Rocker Arm Shaft Bracket

3. Rocker Arm

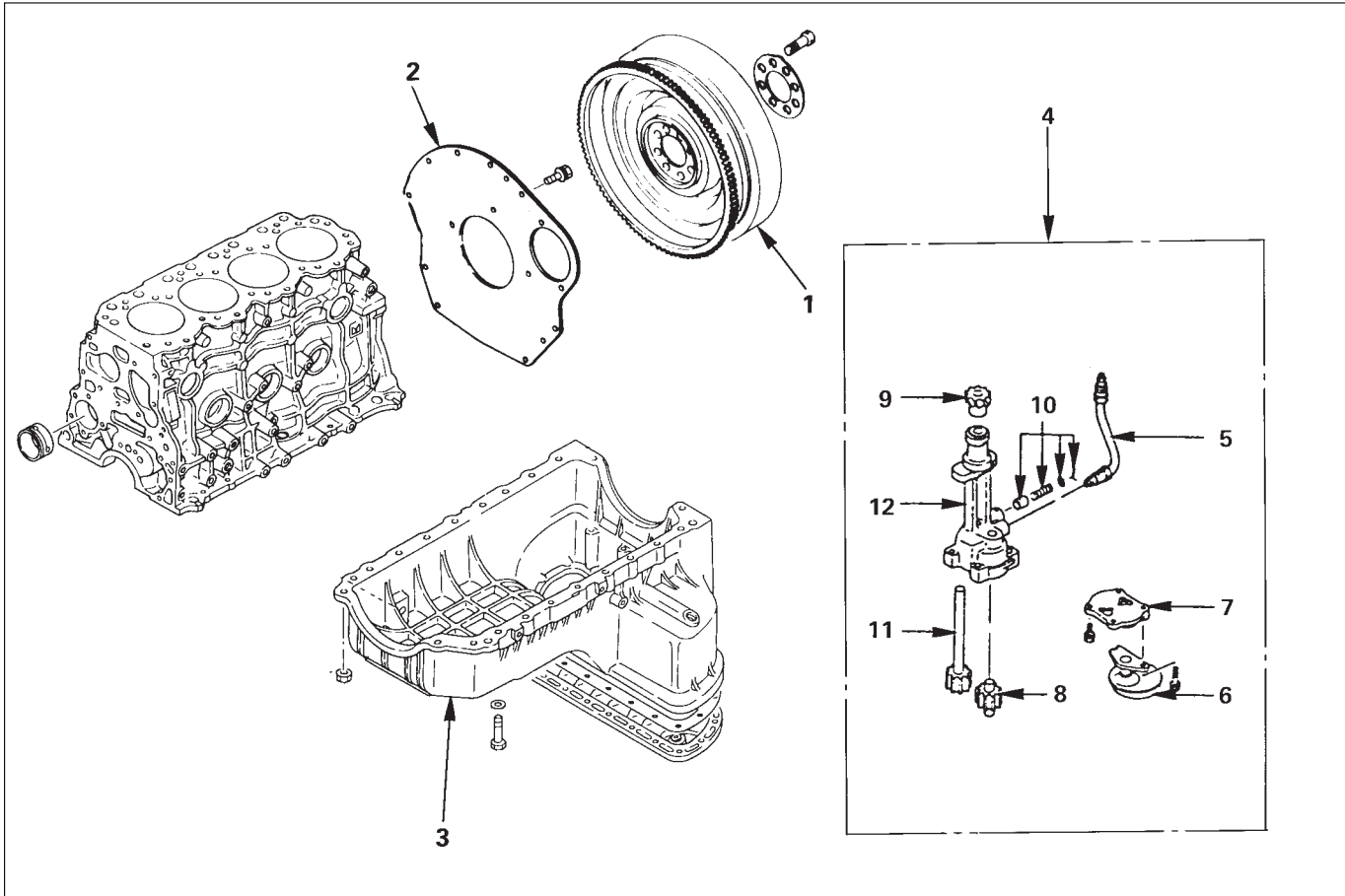
2. Rocker Arm Shaft Snap Ring

1. Rocker Arm Shaft Assembly

- Install the rocker arm shaft assembly in cylinder head.
- Tighten the rocker arm shaft fixing bolts to the specified torque.



OIL PUMP





DISASSEMBLY

1. Flywheel
2. Cylinder Block Rear Plate
3. Crankcase Assembly
 - Refer to section 6A2 "Crankcase".
4. Oil Pump Assembly
5. Oil Pipe
6. Strainer Assembly
7. Pump Cover
8. Driven Gear
9. Pinion Gear
10. Relief Valve
11. Drive Shaft
12. Oil Pump Body



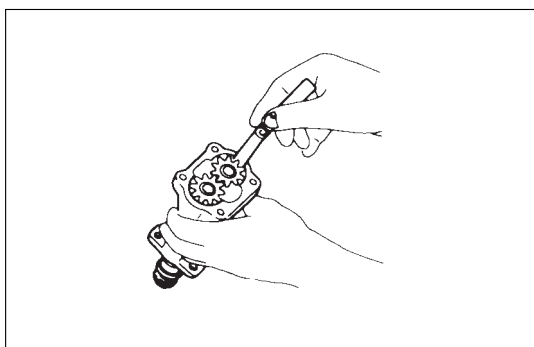
INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part placements if excessive wear or damage is discovered during inspection.

Body and gears

The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

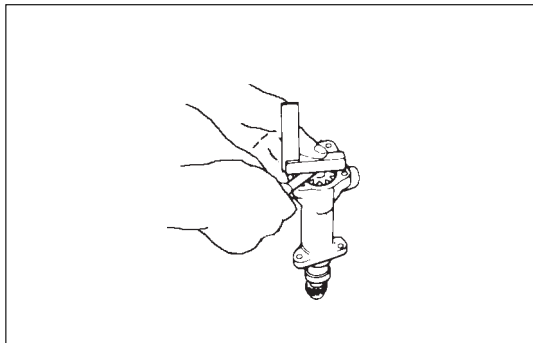
- Badly worn or damaged driven gear guide.
- Badly worn or damaged gear teeth.



Gear Teeth and Body Inner Wall Clearance

- Use a feeler gauge to measure the clearance between the gear teeth and the body inner wall.
- If the clearance between the gear teeth and the body inner wall exceeds the specified limit, either the gear or the body must be replaced.

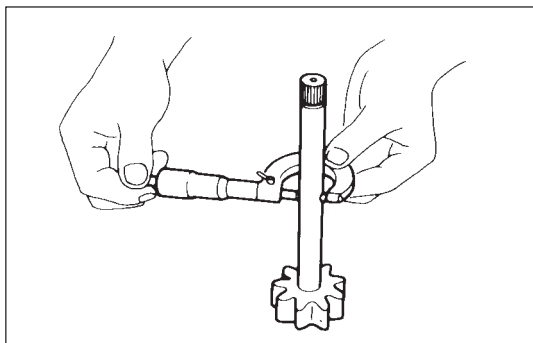
Gear Teeth and Body Internal Wall Clearance		mm(in)
Standard	Limit	
0.14 (0.0055)	0.20 (0.0079)	



⚙️ Gear and Body Clearance

- Use a feeler gauge to measure the clearance between the body and the gear.
- If the clearance between the gear and the body exceeds the specified limit, the body must be replaced.

Gear and Body Clearance		mm(in)
Standard	Limit	
0.06 (0.0024)	0.15 (0.0059)	



⚙️ Drive Shaft and Oil Pump Body Clearance

- Use a micrometer to measure the drive shaft outside diameter.
- Use an inside dial indicator to measure the pump body inside diameter.
- If the clearance between the drive shaft and the oil pump body exceeds the specified limit, the oil pump assembly must be replaced.

Drive Shaft and Oil Pump Body Clearance		mm(in)
Standard	Limit	
0.04 (0.0016)	0.20 (0.0079)	

⚙️ REASSEMBLY

12. Oil Pump Body

11. Drive Shaft

10. Relief Valve

9. Pinion Gear

8. Driven Gear

7. Pump Cover

6. Strainer Assembly

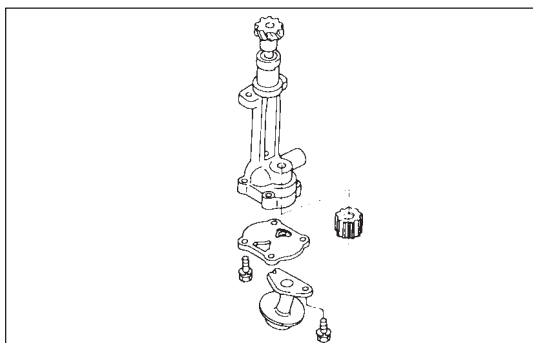
- Install the strainer assembly and tighten the strainer assembly fixing bolts.

N·m(kg·m/lb·ft)



16 (1.6/12)

5. Oil Pipe



4. Oil Pump Assembly

- Apply molybdenum mixed engine oil to drive gear of camshaft and driven gear of oil pump.
- Tighten the oil pump fixing bolt to the specified torque

N·m(kg·m/lb·ft)



19 (1.9/14)

3. Crankcase Assembly

- Refer to Section 6A2 "Crankcase".

2. Cylinder Block Rear Plate

- Align the rear plate with the cylinder body knock pins. Tighten the rear plate to the specified torque.

N·m(kg·m/lb·ft)

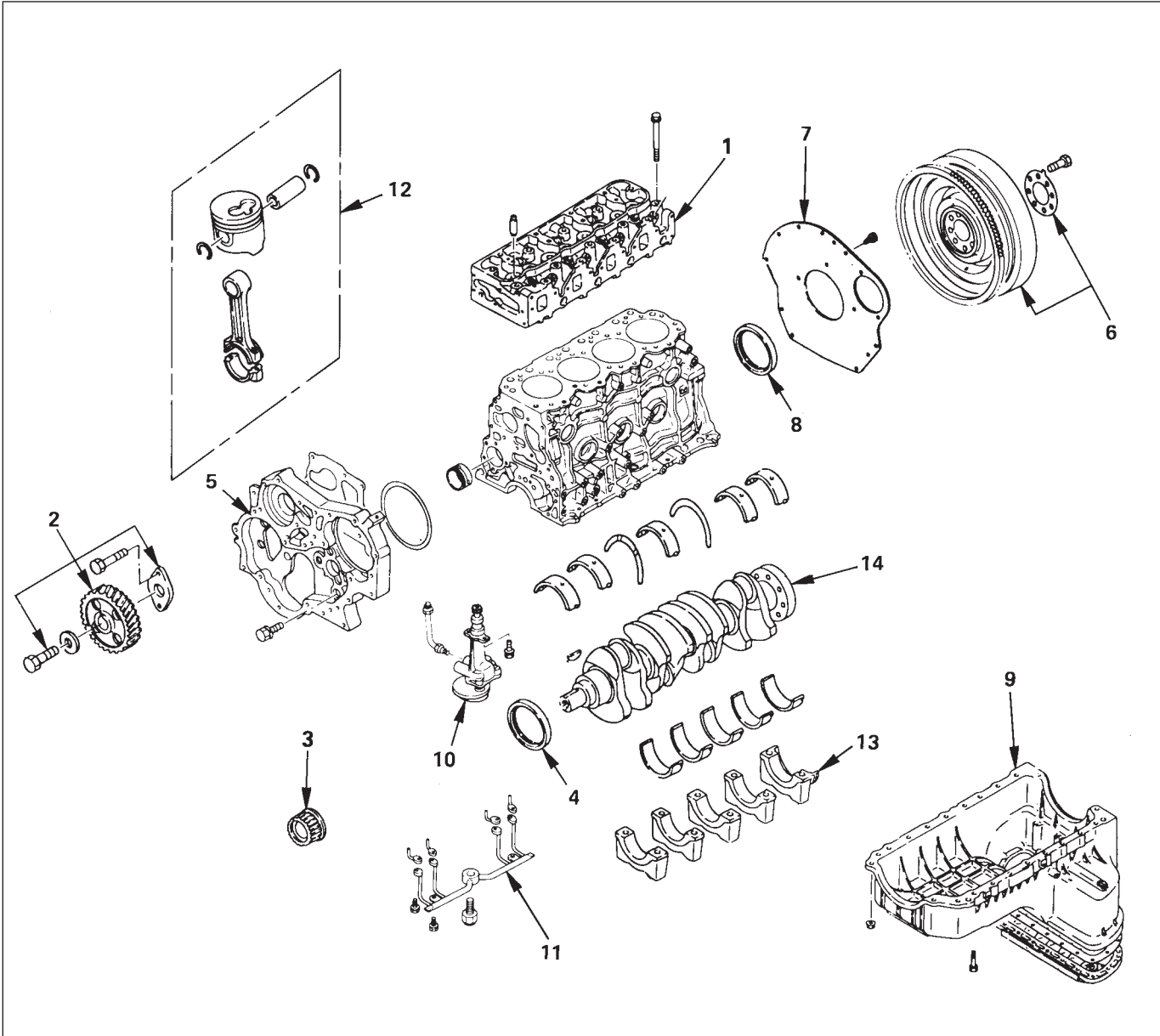


82 (8.4/61)

1. Flywheel

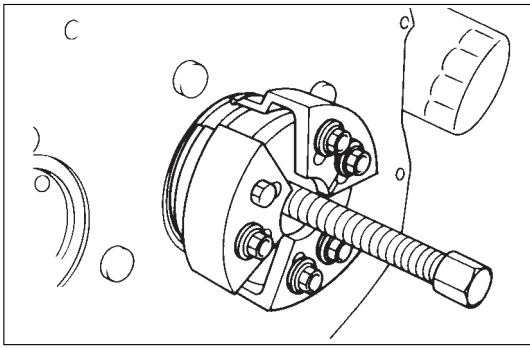
- Refer to Section 6A2 "Crankshaft and Main Bearing".

CRANKSHAFT



DISASSEMBLY

1. **Cylinder Head**
 - Refer to "Cylinder head" in Section 6A2.
2. **Camshaft Timing Gear**
 - Refer to "Camshaft" in Section 6A2.
3. **Crankshaft Timing Gear**
4. **Crankshaft Front Oil Seal**
5. **Timing Gear Case**
6. **Flywheel**
7. **Cylinder Block Rear Plate**



8. Crankshaft Rear Oil Seal

- With the oil seal pushed in deep, install the special tool as shown in the illustration and remove the oil seal.



Oil Seal Remover : 5-8840-2362-0

9. Crankcase Assembly

- Refer to “Crankcase” in Section 6A2.

10. Oil Pump Assembly

11. Piston Cooling Oil Pipe

12. Piston and Connecting Rod Assembly

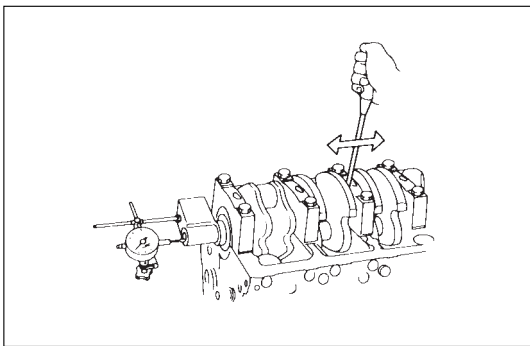
13. Main Bearing Cap

14. Crankshaft



INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



1. Crankshaft

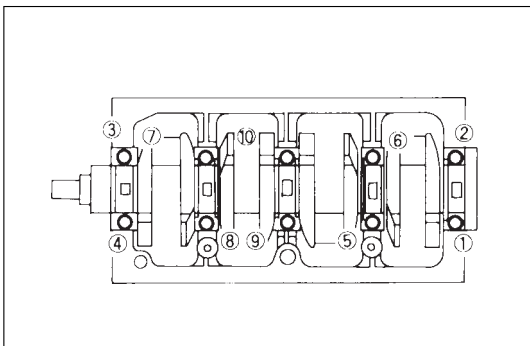
Thrust clearance

Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance.

If the thrust clearance exceeds the specified limit, replace the thrust bearing as a set.

mm(in)

Standard	Limit
0.10 (0.0039)	0.30 (0.0118)



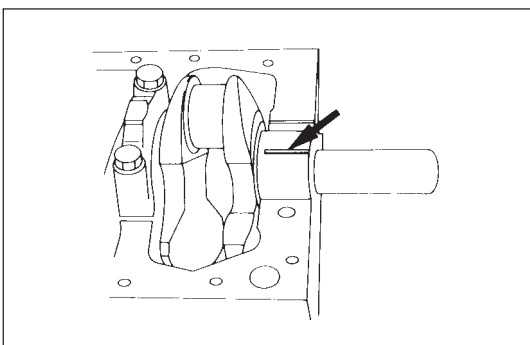
2. Main bearing clearance

- 1) Remove the main bearing caps in the sequence shown in the illustration
Arrange the removed main bearing caps in the cylinder number order.
- 2) Remove the crankshaft. Remove the main bearings.
- 3) Clean the upper and lower bearings as well as the crankshaft main journal.
- 4) Check the bearings for damage or excessive wear. The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
- 5) Set the upper bearings and the thrust washers to their original positions. Carefully install the crankshaft.
- 6) Set the lower bearings to the bearing cap original position.
- 7) Apply plastigage to the crankshaft journal unit as shown in the illustration.
- 8) Install the main bearing caps. Apply engine oil to the bolt threads and the seats. Tighten the bolts to the specified torque.

N·m(kg·m/lb·ft)

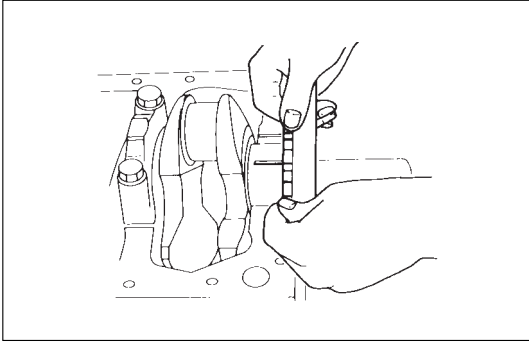


167 (17/123)



NOTE:

Do not allow the crankshaft to rotate.



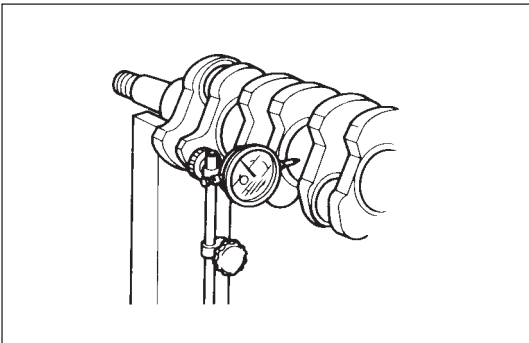
- 9) Remove the main bearing caps.
- 10) Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.
- 11) Clean the plastigage from the bearings and the crankshaft.

Remove the crankshaft and the bearings. mm(in.)

Standard	Limit
0.031 – 0.063 (0.0012 – 0.0025)	0.11 (0.0043)

3. Run-out

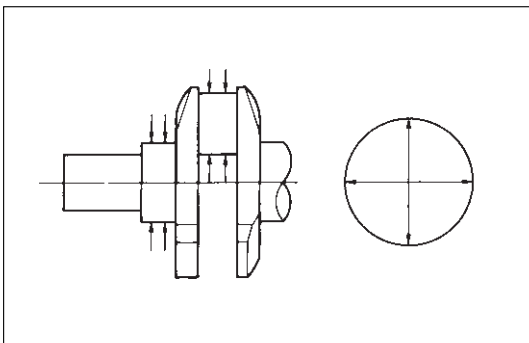
- 1) Carefully set the crankshaft on the V-blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.



Run-Out mm(in)

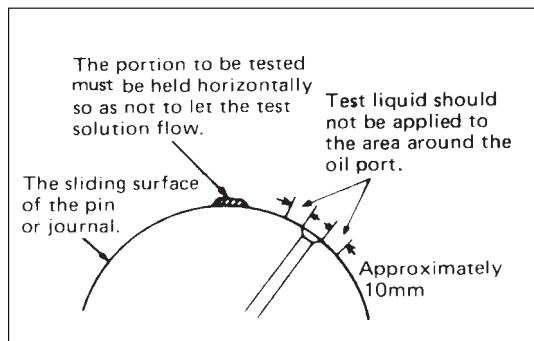
Standard	Limit
0.05 (0.0020) or less	0.08 (0.0031)

Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.



mm(in)

	Standard	Limit	Uneven wear limit
Main journal diameter	69.917-69.932 (2.7526-2.7532)	69.91 (2.7524)	0.05 (0.0020) or less
Crank pin diameter	52.915-52.930 (2.0833-2.0839)	52.90 (2.0843)	0.08 (0.0031)



Crankshaft inspection

Inspect the surface of the crankshaft journals and crank pins for excessive wear and damage.
 Inspect the oil seal fitting surfaces for excessive wear and damage.
 Inspect the oil ports for obstructions.



Crankshaft tuffriding inspection

The portion to be tested must be held horizontally so as not to let the test solution flow.
 Test liquid should not be applied to the area around the oil port.
 The sliding surface of the pin or journal.
 Approximately 10mm

NOTE:

To increase crankshaft strength, Tuffride Method (Soft nitriding) has been applied. Because of this, it is not possible to regrind the crankshaft surfaces.

1. Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of oil the surfaces to be inspected.
2. Prepare a 5 - 10% solution of ammonium cupric chloride (dissolved in distilled water).
3. Use a syringe to apply the solution to the surface to be inspected.
 Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

NOTE:

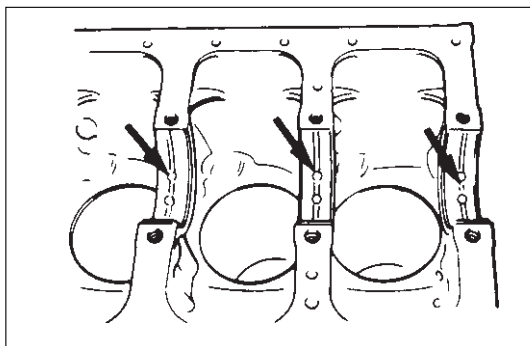
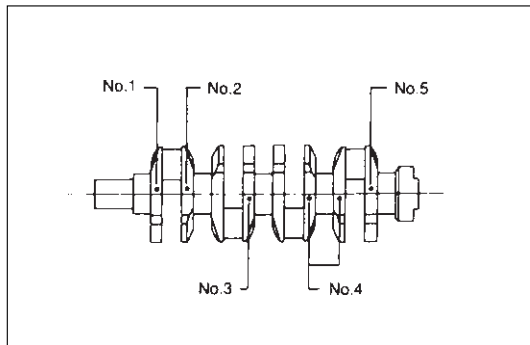
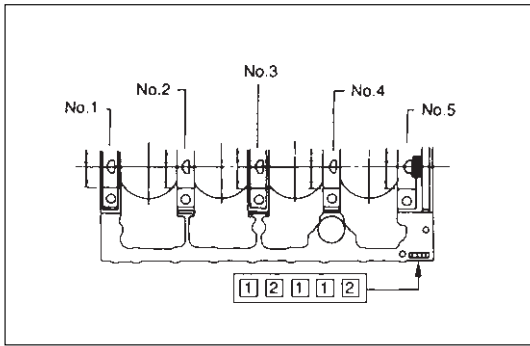
Do not allow the solution to come in contact with the oil ports and their surrounding area.

Testing

1. Wait for thirty to forty seconds.
 If there is no discoloration after thirty or forty seconds, the crankshaft is usable.
 If discoloration appears (the surface being tested will become the color copper), the crankshaft must be replaced.
2. Steam clean the crankshaft surface immediately after completing the test.

NOTE:

The ammonium cupric chloride solution is highly corrosive. Because of this, it is imperative that the surfaces being tested be cleaned immediately after completing the test.



Crankshaft Bearing Selection

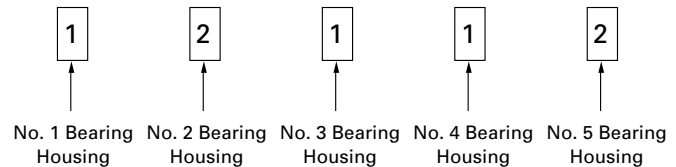
When installing new crankshaft bearings or replacing old bearings, refer to the selection table below.

Select and install the new crankshaft bearings, paying close attention to the cylinder body journal hole 1 diameter size mark and the crankshaft journal 2 diameter size mark.

Crankshaft Bearing Housing Grade Mark Position

Crankshaft bearing housing grade marks **1** or **2** are stamped on the rear right hand side of the cylinder body.

Example:



Crankshaft Journal Grade Mark Position

The crankshaft journal grade marks (1 or -) are stamped on each crankshaft journal web.

The crankshaft journal and bearing clearance must be the same for each position after installation of the crankshaft and the crankshaft bearings.

Note:

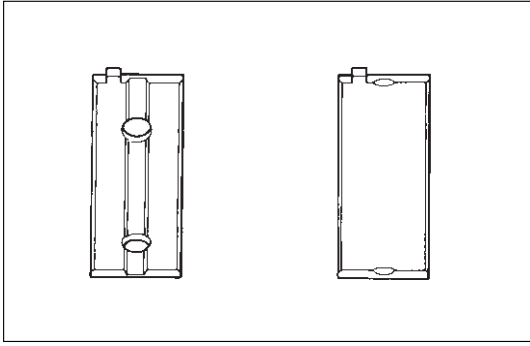
The crankshaft journal mark No. 4 is stamped on crankshaft No. 4 journal web front side or rear side.

NOTE:

Although all upper journal bearings (cylinder body side) have oil grooves and holes, all lower bearings (bearing cap side) have no groove and hole.

Play close attention to the distinction during the installation procedure.

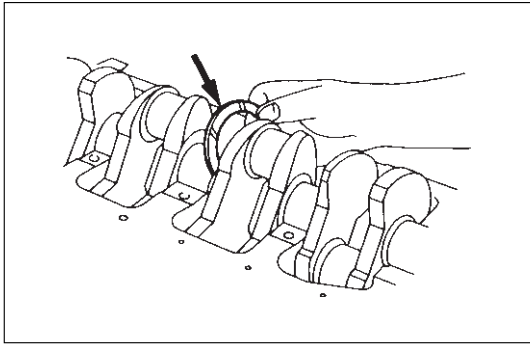
Main Bearing Bore Diameter mm(in.)		Crankshaft Main Journal Diameter mm(in.)		Crankshaft Bearing Grade Mark	Oil Clearance mm (in.)
Size Mark	Inside Diameter	Grade Mark	Outside Diameter		
1	73.987 ~ 74.000 (2.9129 ~ 2.9134)	1 or -	69.927 ~ 69.932 (2.7530 ~ 2.7532)	Black	0.035 ~ 0.061 (0.0014 ~ 0.0024)
		2 or --	69.922 ~ 69.927 (2.7528 ~ 2.7530)	Blue	0.032 ~ 0.058 (0.0013 ~ 0.0023)
		3 or ---	69.917 ~ 69.922 (2.7526 ~ 2.7528)		0.037 ~ 0.063 (0.0015 ~ 0.0025)
2	73.975 ~ 73.987 (2.9124 ~ 2.9129)	1 or -	69.927 ~ 69.932 (2.7530 ~ 2.7532)	Green	0.031 ~ 0.056 (0.0012 ~ 0.0022)
		2 or --	69.922 ~ 69.927 (2.7528 ~ 2.7530)		0.036 ~ 0.048 (0.0014 ~ 0.0019)
		3 or ---	69.917 ~ 69.922 (2.7526 ~ 2.7528)	Black	0.033 ~ 0.058 (0.0013 ~ 0.0023)



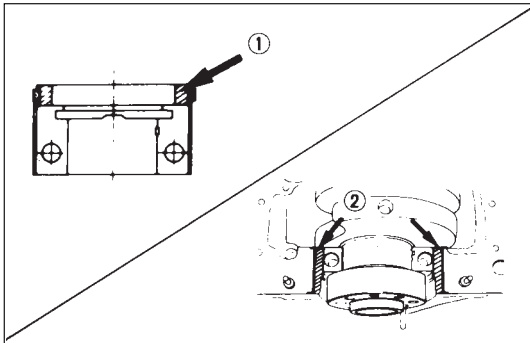
REASSEMBLY

14. Crankshaft

- Install the main bearings to the cylinder body and the main bearing caps.
- Be sure that they are positioned correctly.
- Apply new engine oil to the upper and lower main bearing faces.
- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.



- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.

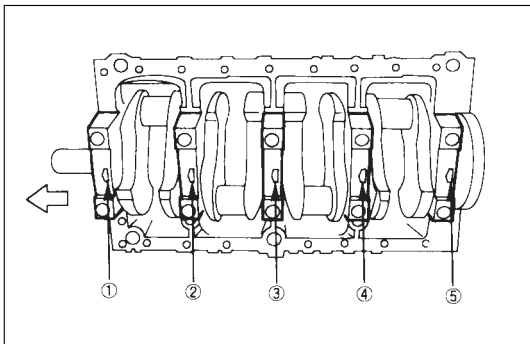


13. Main Bearing Cap

- Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap ① as shown in the illustration.
- Install the arch gasket ② to the No. 5 bearing cap. Use your fingers to push the arch gasket into the bearing cap groove.

NOTE

Take care not to scratch the arch gasket outer surface.

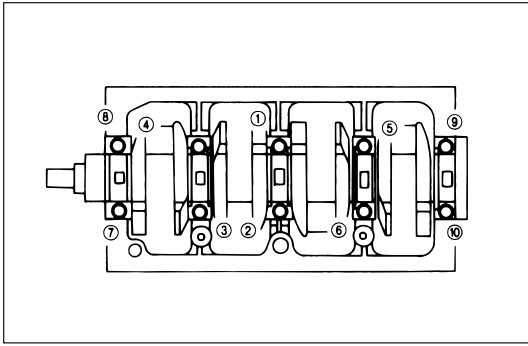


- Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap cylinder body fitting surfaces at points ③ and ④ shown in the illustration.

NOTE:

Be sure that the bearing cap fitting surface is completely free of oil before applying the liquid gasket.

Do not allow the liquid gasket to obstruct the cylinder thread holes and bearings.



- Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.
- Apply engine oil to the crankshaft bearing cap bolts.
- Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

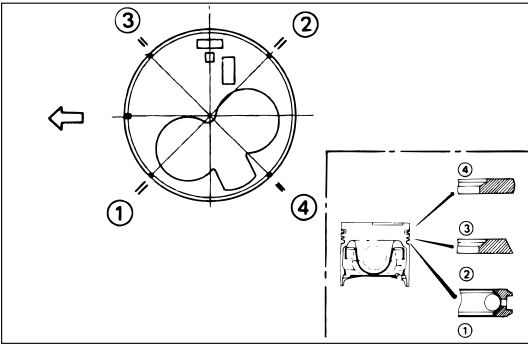
N·m(kg·m/lb·ft)

167 (17.0/123)



NOTE:

Check to see that the crankshaft turns smoothly by rotating it manually.



12. Piston and Connecting Rod Assembly

- Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins and each piston ring and piston. Check to see that the piston ring end gaps are correctly positioned.



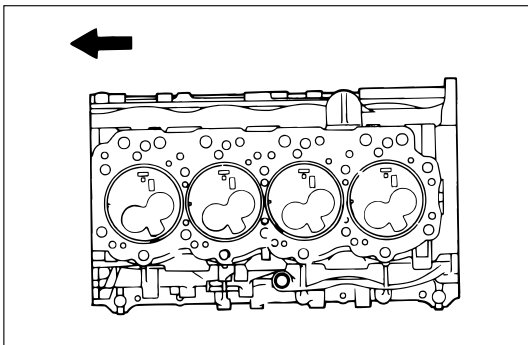
- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. Piston ring compressor: 5-8840-9018-0 The front marks must be facing the front of the engine.
- Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
- Apply engine oil to the threads and seating faces of the nuts.
- Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.



N·m (kg·m/lb·ft)

1st step	2nd step
29 (3.0/22)	45° ~ 60°

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.



11. Piston Cooling Oil Pipe

- Tighten the bolt and oiling jet plug to the specified torque

N·m (kg·m/lb·ft)

M6	8 (0.8/6)
M8	19 (1.9/14)



Oiling Jet Plug

N·m(kg·m/lb·ft)

29 (3.0/22)



10. Oil Pump Assembly

- 1) Prepare a solution of 80% engine oil and 20% molybdenum disulfide.
- 2) Apply an ample coat of the solution to the teeth of the oil pump pinion.
- 3) Install the oil pump and tighten the bolts to the specified torque.



N·m(kg·m/lb·ft)



19 (1.9/14)

NOTE:

Take care not to damage the O-rings when tightening the oil pipe bolts.

9. Crankcase Assembly

- Refer to "Crankcase" Section 6A2

8. Crankshaft Rear Oil Seal

- 1) Tighten the adapter to the crankshaft rear and section with 2 bolts.
- 2) Insert the oil seal into the peripheral section of the adapter,
- 3) Insert the sleeve into the adapter section, and 1) tighten it with a bolt (M12 x 1.75L = 70) until the adapter section hits the sleeve.
- 4) Remove the adapter and the sleeve.
- 5) With the seal pressed in, check the dimension of the oil seal section.

Standard Dimension = 12.5 ± 0.3 mm

Oil Seal Installer: 5-8840-2359-0

7. Cylinder Block Rear Plate

Align the rear plate with the cylinder body knock pins. Tighten the rear plate to the specified torque.

N·m(kg·m/lb·ft)



82 (8.4/61)

6. Flywheel

- 1) Thoroughly clean and remove the oil from the threads of crankshaft.
- 2) Mount the flywheel on the crankshaft and then install the washer.
- 3) Align the flywheel with the crankshaft dowel pin.
- 4) Tighten the flywheel bolts to the specified torque in the numerical order shown in the illustration.

N·m(kg·m/lb·ft)



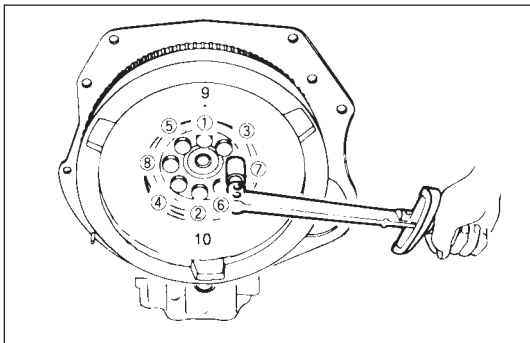
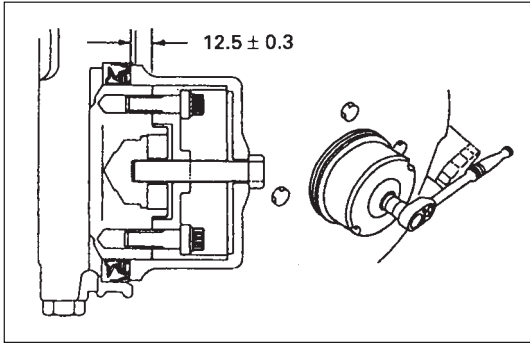
118 (12.0/87)

5. Timing Gear Case

- 1) Install the timing gear case to the cylinder body.

NOTE:

Take care not to twist the front oil seal.

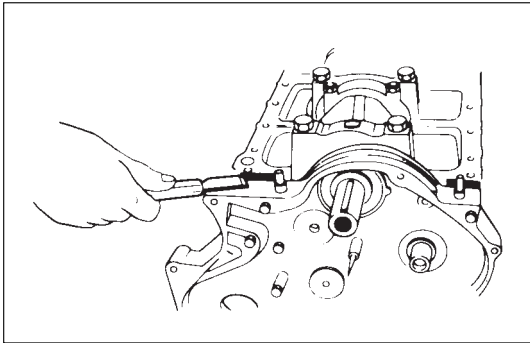


- 2) Tighten the timing gear case bolt together with the timing gear case gasket to the specified torque.

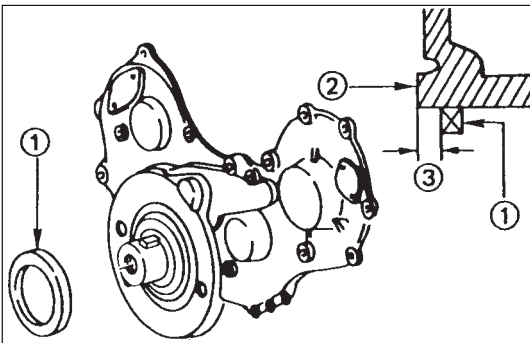
N·m(kg·m/lb·ft)



19 (1.9/14)



- 3) Cut away the gasket protruding above the fitting surfaces (as shown in the illustration).



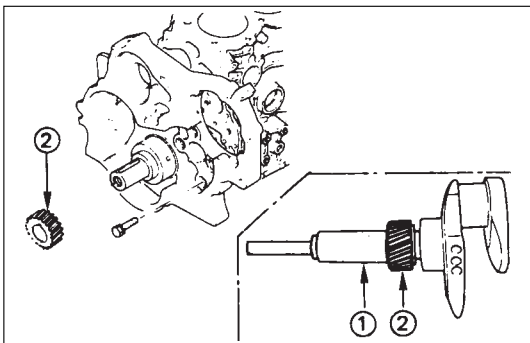
4. Crankshaft Front Oil Seal

- Use the installer to install the front oil seal (1) to the gear case cover (2).

Oil Seal Installer: 5-8840-2061-0

Note the oil seal installation depth (3) shown in the illustration.

Depth (3) = 1 mm (0.0394 in.)



3. Crankshaft Timing Gear

Use the crankshaft timing gear installer (1) to install the timing gear (2).

The crankshaft timing mark ("X - X") must be facing outward.

Crankshaft Timing Gear Installer: 5-8522-0024-0



2. Camshaft Timing Gear

- Tighten the fixing bolt to the specified torque.

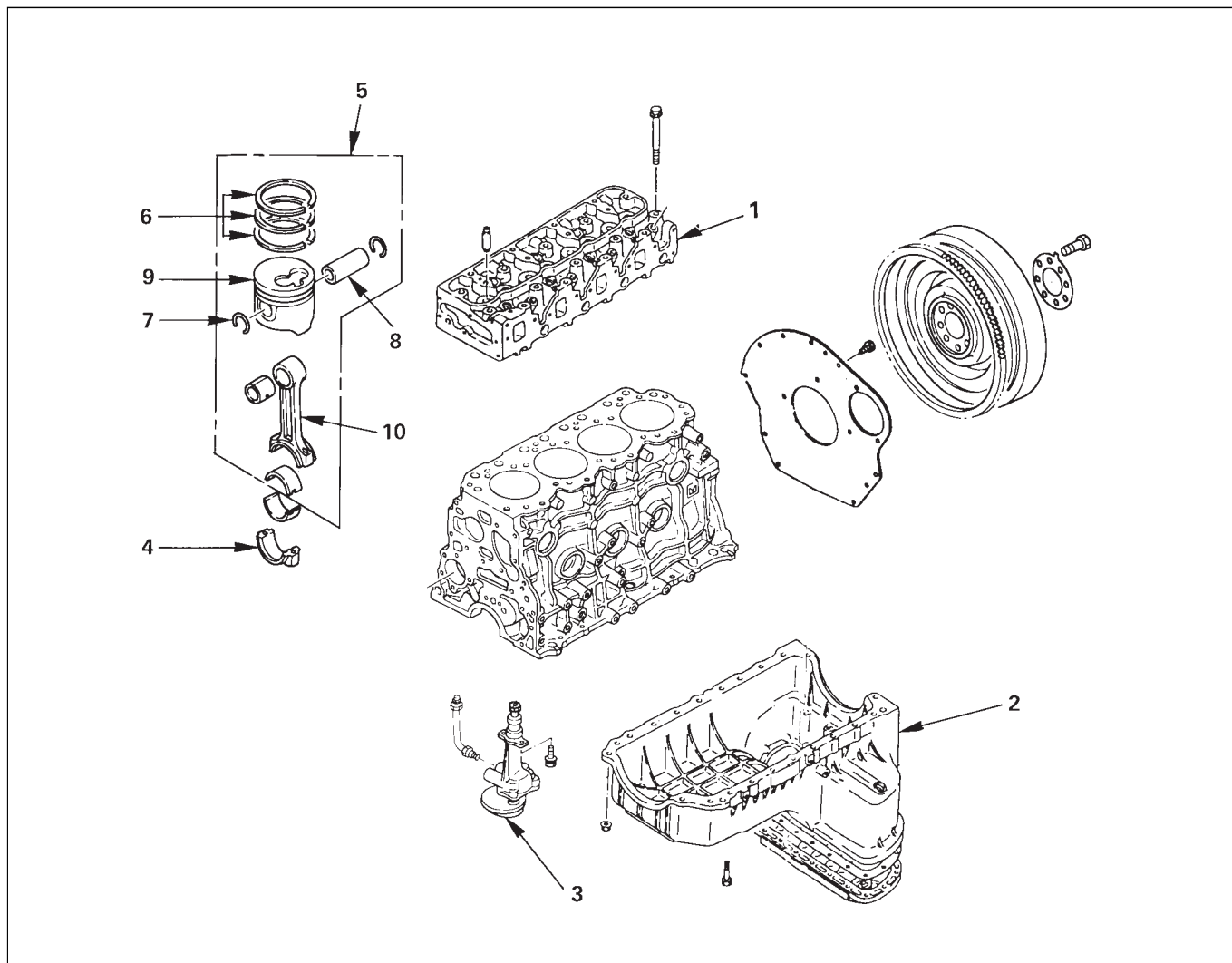
N·m(kg·m/lb·ft)

64 (6.5/47)

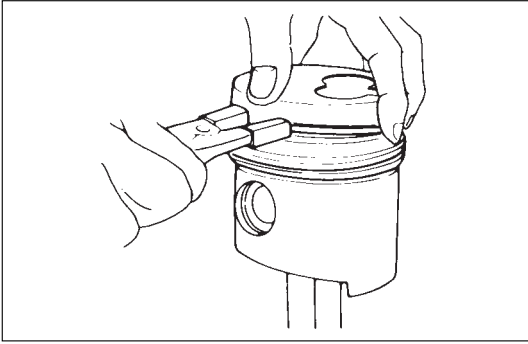
1. Cylinder Head

- Refer to "Cylinder head" in Section 6A2.

PISTON AND CONNECTING ROD

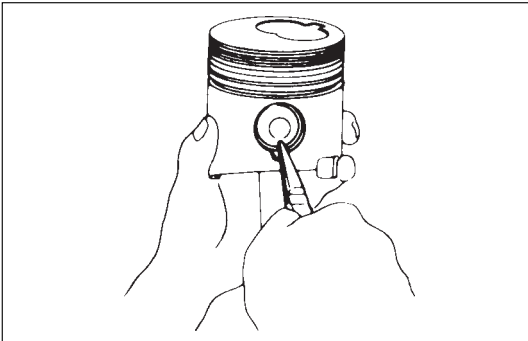
**DISASSEMBLY**

1. **Cylinder Head Assembly**
 - Refer to "Cylinder head" in Section 6A2.
2. **Crankcase Assembly**
 - Refer to "Crankcase" in Section 6A2
3. **Oil Pump Assembly**
4. **Connecting Rod Bearing Cap**
5. **Piston and Connecting Rod**
 - Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod



6. Piston Ring

Remove the piston rings with a piston ring expander. Arrange the removed piston rings in the cylinder number order.



7. Piston Pin Snap Ring

- Use a pair of pliers to remove the piston pin snap rings

8. Piston Pin

NOTE:

Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions.

9. Piston

10. Connecting Rod



INSPECTION AND REPAIR

PISTON AND PISTON RING

Pistons

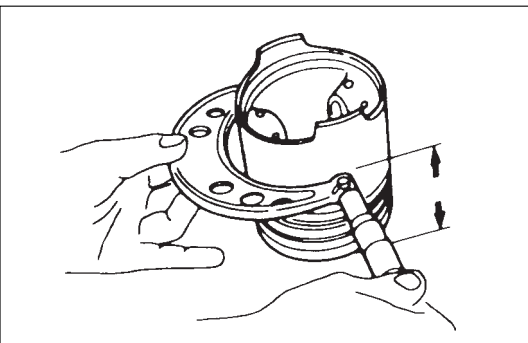
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE:

Never use a wire brush to clean the pistons. Damage will result.

Visually check each piston for cracking, scoring, and other signs of excessive wear.

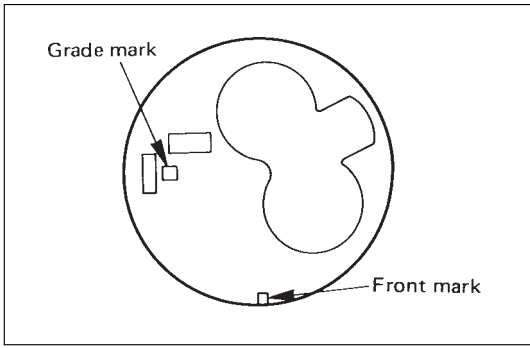
If any of the above conditions are present, the piston must be replaced.



Piston Diameter

- Measure the piston outside diameter with micrometer at the piston grading position.

Piston Grading Position	mm(in)
	71.00 (2.7974)



Piston Outside Diameter

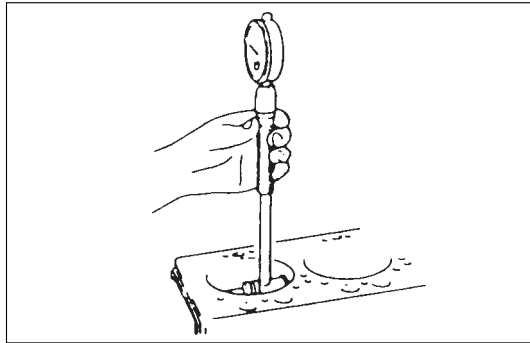
Following are installed piston grade from factory. mm (in)

Grade Mark	Outside Diameter
A	95.365 – 95.374 (3.7545 – 3.7549)
B	95.375 – 95.384 (3.7549 – 3.7553)
C	95.385 – 95.394 (3.7553 – 3.7557)
D	95.395 – 95.404 (3.7557 – 3.7561)

Method of selection grade for piston service part.

mm (in)

Factory Grade	Service Part Grade	Outside Diameter
A and B	AX	95.369 – 95.384 (3.7547 – 3.7553)
C and D	CX	95.385 – 95.400 (3.7553 – 3.7559)



Cylinder Liner Bore Diameter

Following are installed cylinder liner bore grade from factory. mm (in)

Grade Mark	Inside Diameter
A	95.425 – 95.440 (3.7569 – 3.7575)
B	95.441 – 95.450 (3.7575 – 3.7579)
C	95.451 – 95.460 (3.7579 – 3.7583)
D	95.461 – 95.475 (3.7583 – 3.7589)

Method of selection grade for cylinder liner service part.

mm (in)

Factory Grade	Service Part Grade	Outside Diameter
A and B	AX	95.435 – 95.450 (3.7573 – 3.7579)
C and D	CX	95.451 – 95.466 (3.7579 – 3.7585)

The grading position for piston outside diameter is represented by the Grade mark as shown in Figure.

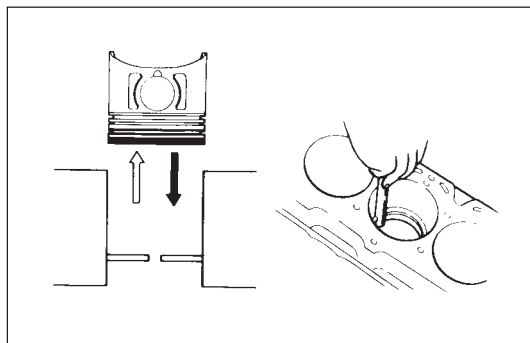
Measure the cylinder bore inside diameter (refer to "Inspection of the Cylinder Block" in this Section).

If the piston clearance does not conform to the specified valve, the pistons and/or cylinder liners must be replaced.

Piston Clearance

mm(in)

0.051 – 0.066 (0.0020 – 0.0026)

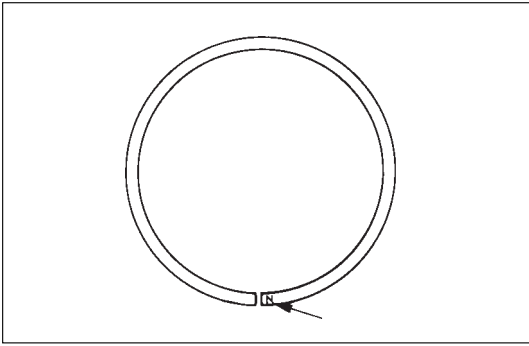


Piston rings

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

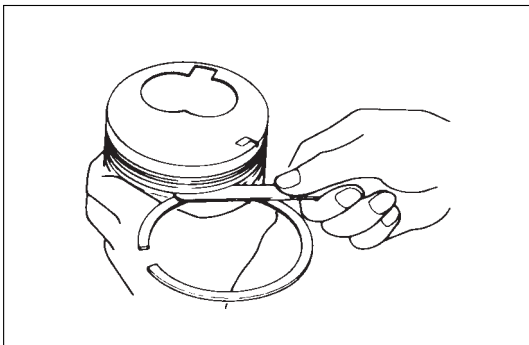
1. Ring end gap measurement

- Insert the piston ring into the bore.



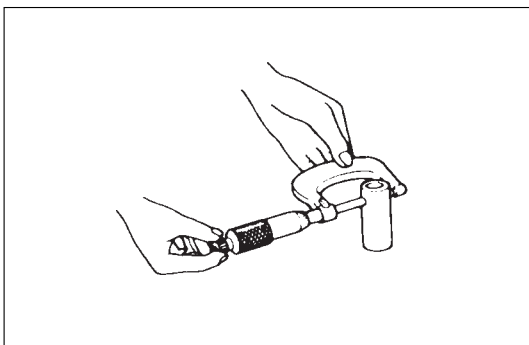
- Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
- Measure the ring end gap.

		mm(in)	
		Standard	Limit
Compression ring	1st/2nd	0.20-0.35 (0.0079-0.0138)	1.5 (0.0591)
	Oil ring	0.10-0.30 (0.0039-0.0118)	



2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove/piston ring clearance exceeds the specified limit, the piston must be replaced.

		mm(in)	
		Standard	Limit
Compression ring	Top	0.05-0.09 (0.0020-0.0035)	0.15 (0.0059)
	2nd	0.05-0.09 (0.0020-0.0035)	
Oil ring		0.03-0.07 (0.0012-0.0028)	

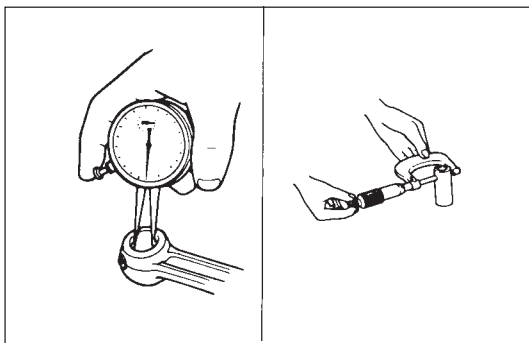


Piston pin

Visually inspect the piston pin for cracks, flaws, and other damage and replace if necessary.

1. Use a micrometer to measure the piston pin outside diameter in both directions at three different positions. If the measurement exceed the specified limit, the piston pin must be replaced.

		mm (in)	
		Standard	Limit
Piston pin outside diameter		33.995-34.000 (1.3384-1.3386)	33.970 (1.3374)



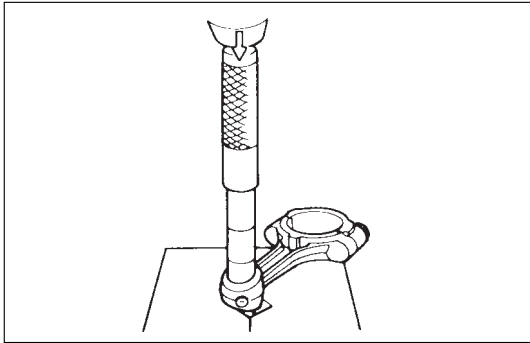
2. Measure the inside diameter of the connecting rod small end. If the clearance between the small end and pin does not conform to the specified value, the connecting rod or bushing and pin must be replaced.

		mm (in)	
		Standard	Limit
Clearance		0.008 ~ 0.020 (0.0003 ~ 0.0008)	0.05 (0.0020)

- Insert the piston pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston and the piston pin must be replaced.

mm (in)

	Standard	Limit
Clearance	0.002 ~ 0.015 (0.00008 ~ 0.0006)	0.04 (0.0016)



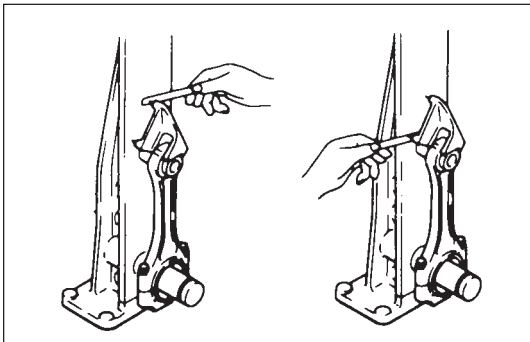
Bushing replacement

Removal: Use a suitable bar and bench press or hammer.

Installation: Use a suitable bar and bench press.

NOTE:

Align the bushing with the connecting rod oil port.
After installing a new bushing, finish the bushing bore with a pin hole grinder.

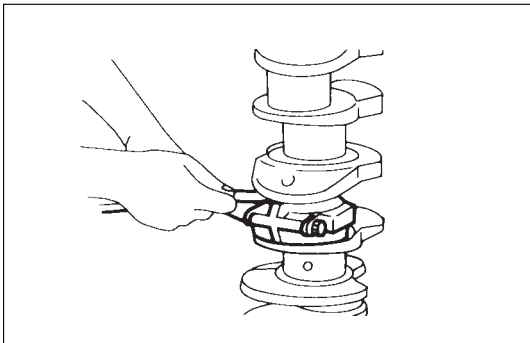


Connecting rods

- Check the connecting rod alignment with a connecting rod aligner. If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

mm (in)

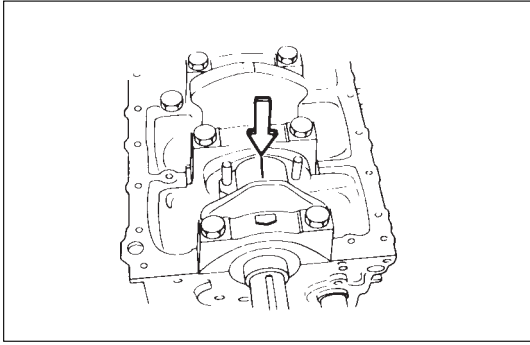
	Standard	Limit
Bend per 100 (3.937)	0.08 (0.0031) or less	0.20 (0.0079)
Twist per 100 (3.937)	0.05 (0.0020) or less	0.15 (0.0059)



- Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the big end of the connecting rod. If the clearance exceeds the specified limit, the connecting rod must be replaced.

mm (in)

Standard	Limit
0.230 (0.0091)	0.350 (0.0138)



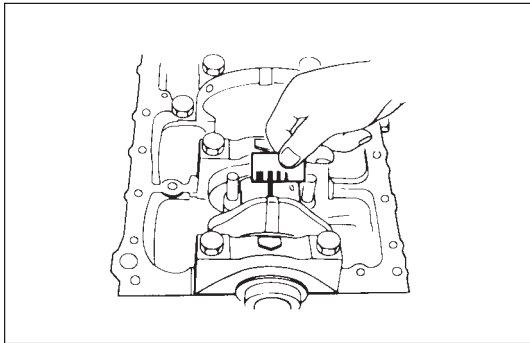
3. Measure the oil clearance between the connecting rod and the crankshaft by:
 - 1) Remove the connecting rod cap nuts and the rod caps.
Arrange the removed rod caps in the cylinder number order.
 - 2) Clean the rod bearings and the crankshaft pins.
 - 3) Carefully check the rod bearings.
If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions.
Apply plastigage to the crank pin.
 - 4) Reinstall the rod caps to their original positions.
 - 5) Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.



N·m (kg·m/lb·ft)	
1st step	2nd step
29 (3.0/22)	45° ~ 60°

NOTE:

Do not allow the crankshaft to rotate.



- 6) Remove the rod caps.
- 7) Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearings as a set.
- 8) Clean the plastigage from the bearings and the crankshaft pins.

mm (in)	
Standard	Limit
0.029 (0.0011) – 0.083 (0.0033)	0.100 (0.0039)



REASSEMBLY

10. Connecting Rod

9. Piston

8. Piston Pin

- Apply a coat of engine oil to the piston pin and the piston pin hole.

7. Piston Pin Snap Ring

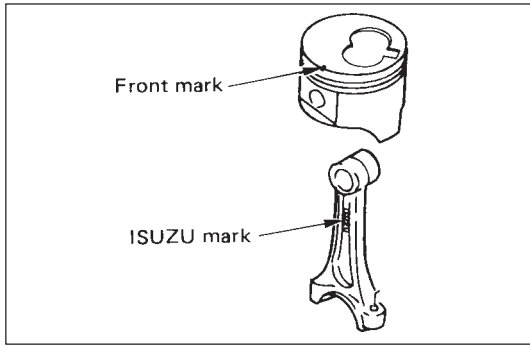


- Apply a thin coat of engine oil to the piston pin.
Try to insert the piston pin into the piston pin hole with normal finger pressure.
Weigh each piston and connecting rod assembly. Select piston and connecting rod combinations so that the weight variation of the different assemblies is held within the specified limits.

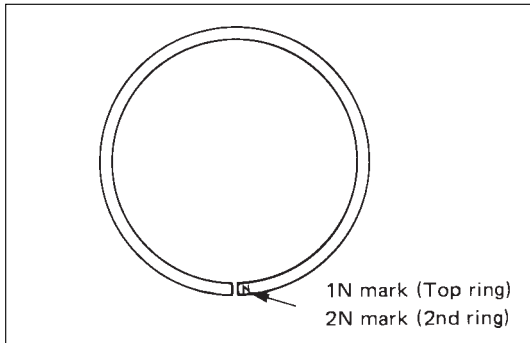
g (oz)	
Variance in weight after assembly	Less than 3 (0.1058)

NOTE:

When changing piston/connecting rod combinations, do not change the piston/piston pin combination.

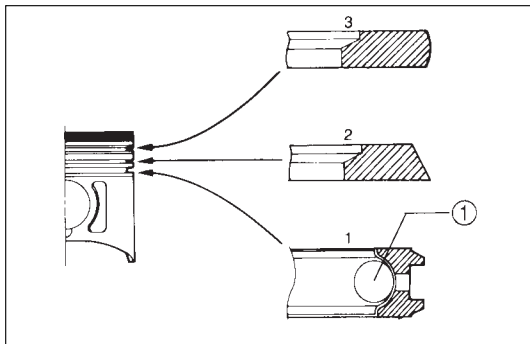


- Attach the piston to the connecting rod with the piston front mark and the connecting rod ISUZU mark on the same side.



6. Piston Ring

- Install the piston rings with the piston ring expander. The compression ring must be set with the 1N, 2N mark facing up.
- Discrimination mark is painted as shown in the illustration.



- Install piston rings in the following sequence.

1) Oil ring

- ① Expander ring

2) 2nd compression ring

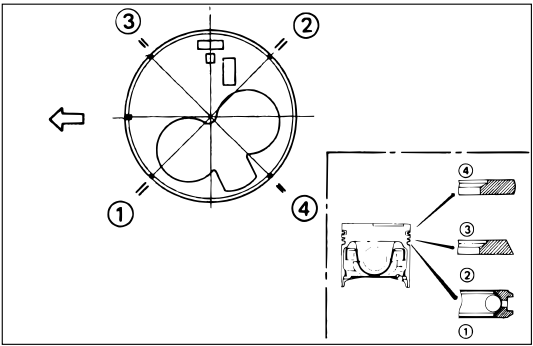
3) 1st compression ring

- The compression ring must be set with the 1N or 2N mark facing up.
- 1st compression ring: N
- 2nd compression ring: 2N
- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.
- Insert the bearings into the connecting rods and caps.

Apply new engine oil to the bearing faces.

Cap side bearings have no oil hole.

Conn rod side bearing's oil hole should be aligned with oil hole on the conn rod.



5. Piston and Connecting Rod

- Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.
- Check to see that the piston ring end gaps are correctly positioned.
- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks must be facing the front of the engine.

4. Connecting Rod Bearing Cap



- Apply engine oil to screw and seat of bearing cap bolts and nuts.
- Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.

N·m (kg·m/lb·ft)	
1st step	2nd step
29 (3.0/22)	45° ~ 60°

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

3. Oil Pump Assembly

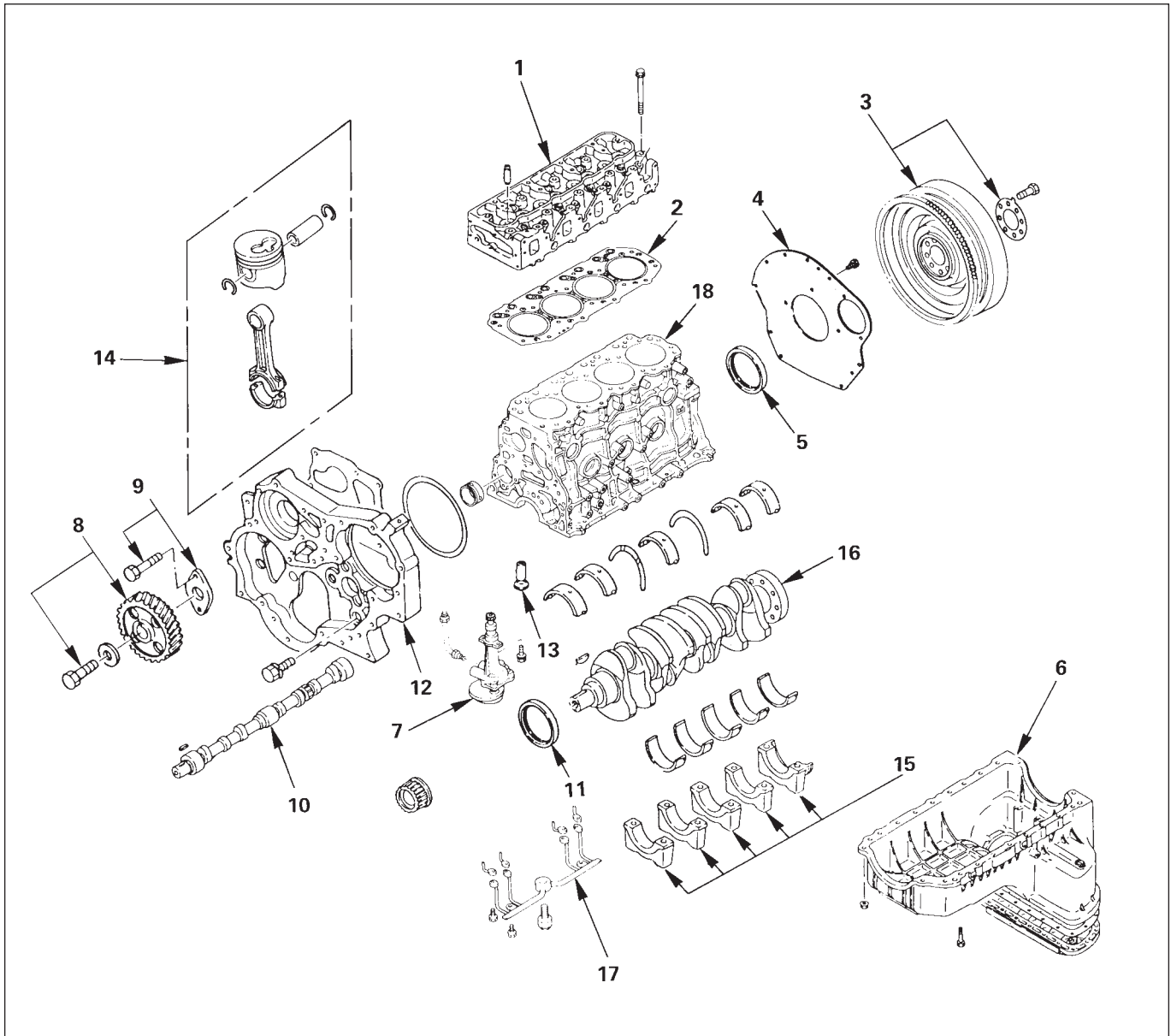
2. Crankcase Assembly

- Refer to "Crankcase" in Section 6A2.

1. Cylinder Head Assembly

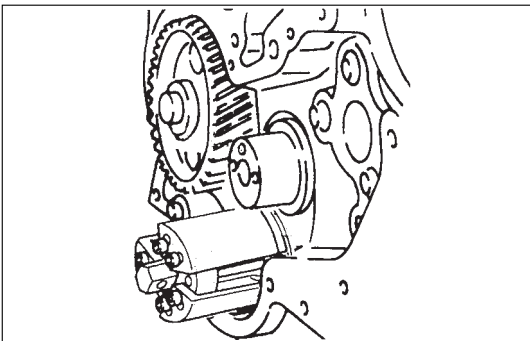
- Refer to "Cylinder head" in Section 6A2.

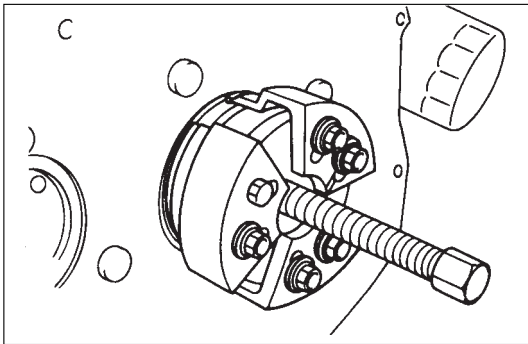
CYLINDER BLOCK



DISASSEMBLY

1. **Cylinder Head Assembly**
 - Refer to "Cylinder head" in Section 6A2.
2. **Cylinder Head Gasket**
3. **Flywheel**
4. **Cylinder Block Rear Plate**
5. **Crankshaft Rear Oil Seal**
 - With the oil seal pushed in deep, install the special tool as shown in the illustration and remove the oil seal.
- Oil Seal Remover : 5-8840-2362-0
6. **Crankcase Assembly**
 - Refer to "Crankcase" in Section 6A2
7. **Oil Pump Assembly**





8. Camshaft Timing Gear
 9. Camshaft Thrust Plate
 10. Camshaft
 11. Crankshaft Front Oil Seal
 - With the oil seal pushed in deep, install the special tool as shown in the illustration and remove the oil seal.
- Oil Seal Remover : 5-8840-2362-0
12. Timing Gear Case
 13. Tappet
 14. Piston Assembly
 15. Main Bearing Cap Assembly
 16. Crankshaft
 17. Piston Cooling Oil Pipe
 18. Cylinder Block

INSPECTION REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

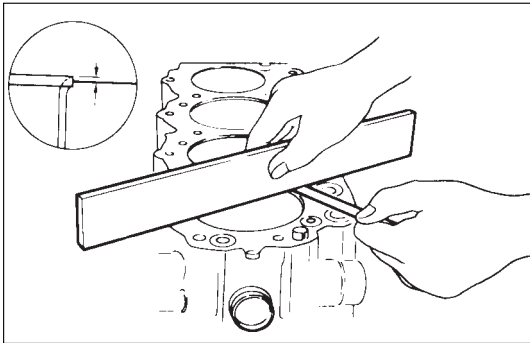
1. Remove the gasket and any other material adhering to the upper surface of the cylinder block.



Be very careful not to allow any material to accidentally drop into the cylinder block.

Be very careful not to scratch the cylinder block.

2. Carefully remove the oil pump, Rear Oil Seal retainer, and oil pan installation surface seal.
3. Wipe the cylinder block clean.

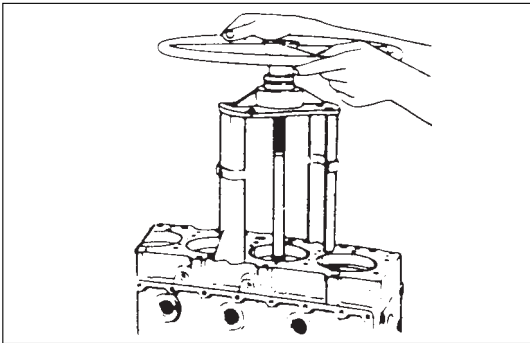


Cylinder Liner Projection Inspection

1. Hold a straight edge ① along the top edge of the cylinder liner to be measured.
2. Use a feeler gauge ② to measure each cylinder liner projection.

The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 mm (0.0012 in).

Standard	mm(in.)
0.0 – 0.1 (0.0000 – 0.0039)	



Flatness

1. Remove the cylinder body dowel.
2. Set the cylinder liner remover to the cylinder liner.
3. Check that the remover shaft ankle is firmly gripping the cylinder liner bottom edge.
4. Slowly turn the remover shaft handle counterclockwise to pull the cylinder liner free.



Cylinder Liner Remover Ankle: 5-8840-2304-0

Cylinder Liner Remover: 9-8523-1169-0

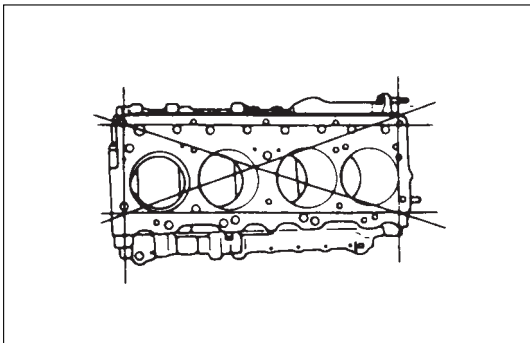
NOTE:

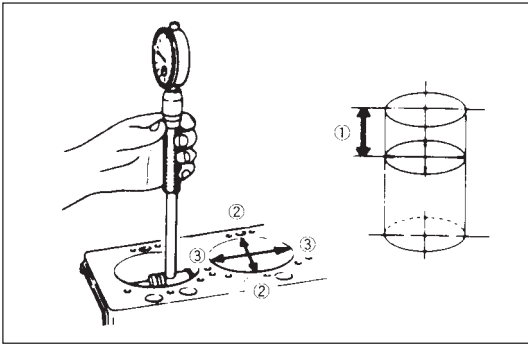
Take care not to damage the cylinder body upper during the cylinder liner removal procedure.

5. Use a straight edge ① and a feeler gauge ② to measure the four sides and the two diagonals of the cylinder body upper face.

If the measured values exceed the limit, the cylinder body must be replaced.

Limit	mm(in.)
0.20 (0.0079)	





Cylinder Liner Bore Measurement

Use a cylinder indicator to measure the cylinder liner bore at measuring point ① in the thrust ② – ② and axial ③ – ③ directions of the crankshaft.

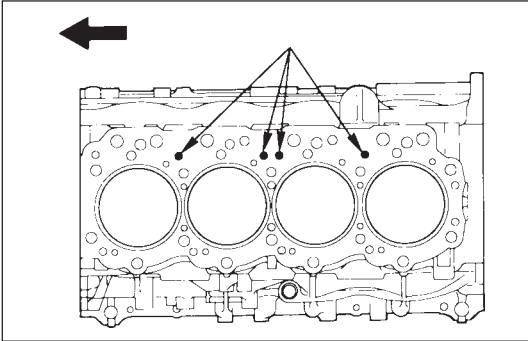
Measuring Point ① 20mm (0.79 in)

If the measured value exceeds the specified limit, the cylinder liner must be replaced.

NOTE:

The inside of the dry type cylinder liner is chrome plated. It cannot be rebored or honed.

If the inside of the cylinder liner is scored or scorched, the cylinder liner must be replaced.



Cylinder Liner Grade Selection

Measure the cylinder body inside diameter and select the appropriate cylinder liner grade.

Standard Fitting Interference mm (in.)

0.001 – 0.019 (0.0004 – 0.0007)

If the cylinder liner fitting interference is too small, engine cooling efficiency will be adversely effected.

If the cylinder liner fitting interference is too large, it will be difficult to insert the cylinder liner into the cylinder body.

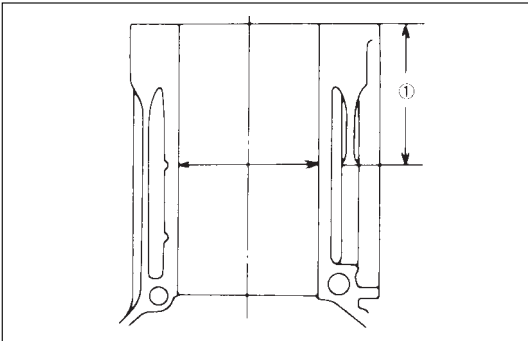
NOTE:

There are two methods by which liners can be selected.

Method I

The cylinder block deck has been marked during production to indicate the correct liner sizes. The liner grade (i.e. 1, 2, 3, 4) is indicated in permanent ink.

In the case of a questionable liner marking use the next method for correct liner selection.

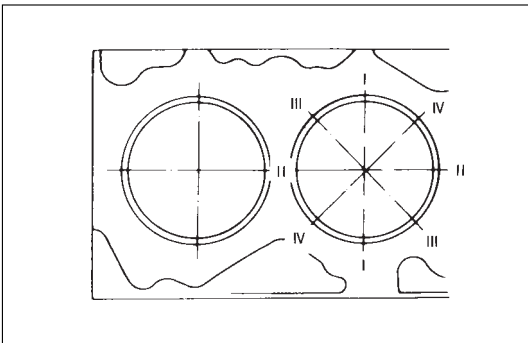


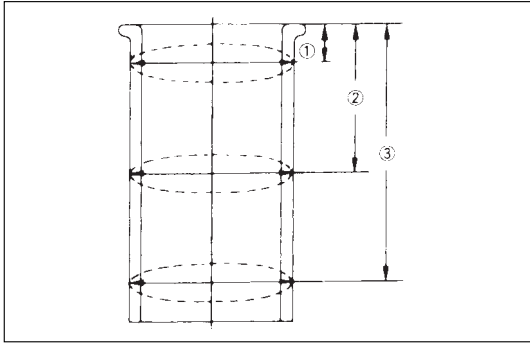
Method II

Cylinder Body Bore Measurement

1) Take measurements at measuring point (A) across positions ① – ①, ② – ②, ③ – ③, and ④ – ④.

Measuring Point (A) 98 mm (3.86 in).

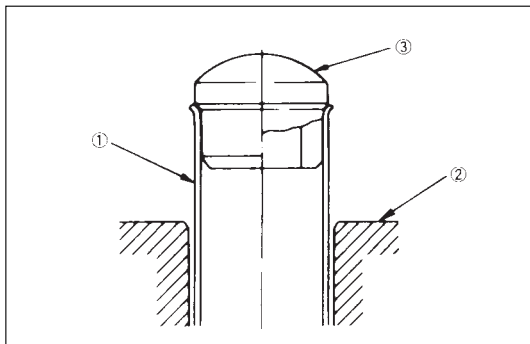




- 2) Calculate the average value of the four measurements to determine the correct cylinder grade.
- 3) Consult the following table with the resultant diameter for the correct liner application.

mm (in.)

Liner Grade	Cylinder bore diameter average	Liner outside diameter
1	97.001-97.010 (3.8189-3.8193)	97.011-97.020 (3.8193-3.8197)
2	97.011-97.020 (3.8193-3.8197)	97.021-97.030 (3.8197-3.8201)
3	97.021-97.030 (3.8197-3.8201)	97.031-97.040 (3.8201-3.8205)
4	97.031-97.040 (3.8201-3.8205)	97.041-97.050 (3.8205-3.8209)



Cylinder Liner Installation

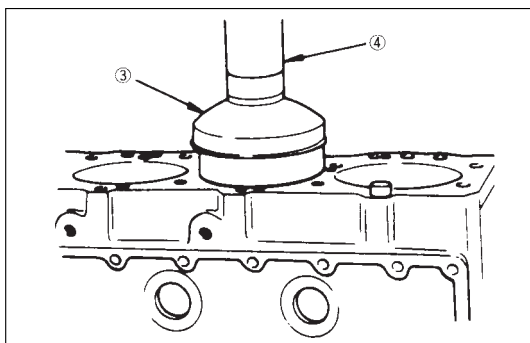
1. Cylinder Liner Installation Using The Special Tool.
 - 1) Use new kerosene or diesel oil to thoroughly clean the cylinder liners and horse.
 - 2) Use compressed air to blow-dry the cylinder liner and bore surfaces.



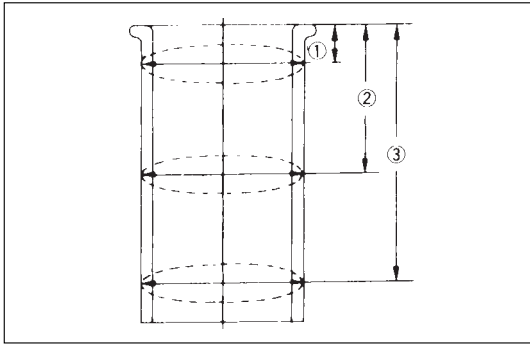
Cylinder Liner Installer : 5-8840-2313-0

NOTE:

All foreign material must be carefully removed from the cylinder liner and the cylinder bore before installation.



- 3) Insert the cylinder liner ① into the cylinder body ② from the top of the cylinder body.



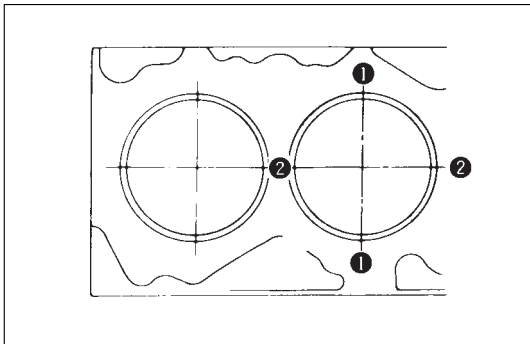
- 4) Set the cylinder liner installer ③ to the top of the cylinder liner.
Position the cylinder body so that the installer center is directly beneath the bench press shaft center ④.



Cylinder Liner Installer: 5-8840-2313-0

NOTE:

Check that the cylinder liner is set perpendicular to the bench press and that there is no wobble.



- 5) Use the bench press to apply a seating force of 4,900 N (500kg/1,102.5 lb) to the cylinder liner.
- 6) Apply a force of 24,500 N (2,500 kg /5,512.5 lb) to fully seat the cylinder liner.
- 7) After installing the cylinder liner, measure the cylinder liner projection.
- 8) After installing the cylinder liner, measure the cylinder liner projection.
Refer to "Cylinder Liner Projection Inspection" in this Section
Measure the cylinder liner bore inside diameter and select the appropriate piston grade.

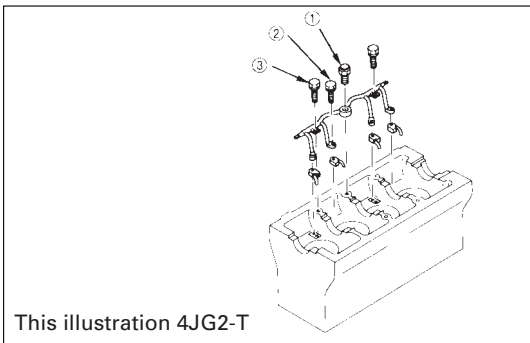


REASSEMBLY

18. Cylinder Block

17. Piston Cooling Oil Pipe

- 1) Fix the oil jet pipes with knock pins on the cylinder block.
- 2) Install the oil pipe for piston cooling in the cylinder block, tightening a relief valve ① and four joint bolts ② to the specified torque.

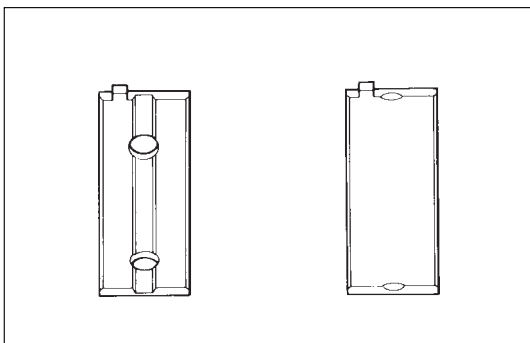


Oil pipe fixing bolts	N-m (kg·m/lb·ft)
M8	19 (1.9/14)
M6	8 (0.8/69 lb·in.)
Relief valve fixing bolt	N-m (kg·m/lb·ft)
	29 (3.0/22)



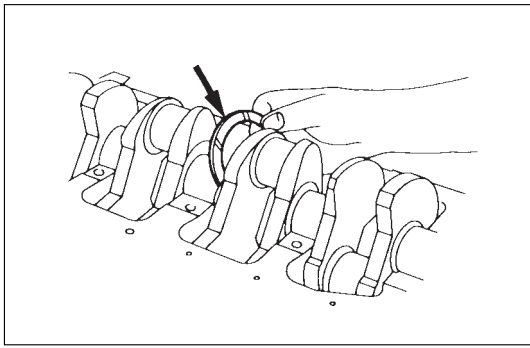
CAUTION:

After installed the piston assembly. Check and see that there is appropriate clearance between pistons and oil jet pipes by rotating crankshaft slowly.

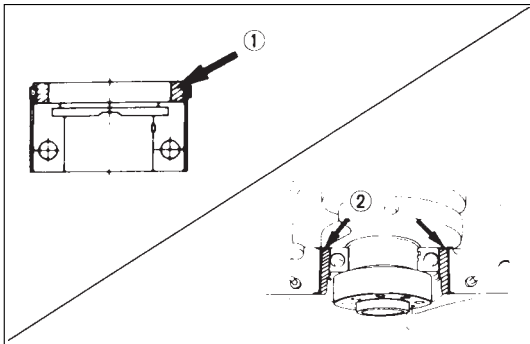


16. Crankshaft

- Install the main bearings to the cylinder body and the main bearing caps.
- Be sure that they are positioned correctly.
- Apply new engine oil to the upper and lower main bearing faces
- Carefully mount the crankshaft.



- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.

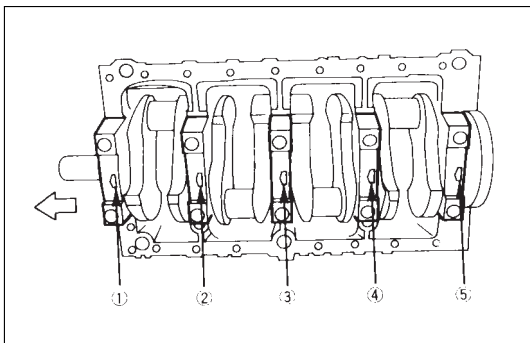


15. Main Bearing Cap Assembly

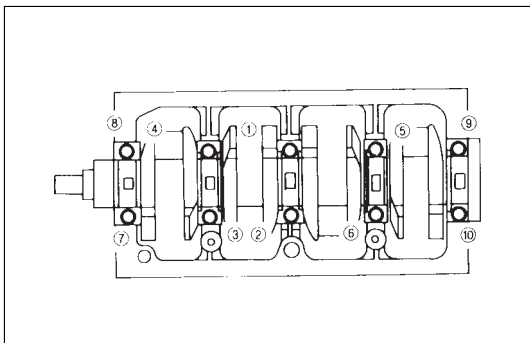
- Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap cylinder body fitting surfaces at points ① and ② shown in the illustration.

NOTE:

Be sure that the bearing cap fitting surface is completely free of oil before applying the liquid gasket. Do not allow the liquid gasket to obstruct the cylinder thread holes and bearings.



- Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.
- Apply engine oil to the crankshaft bearing cap bolts.



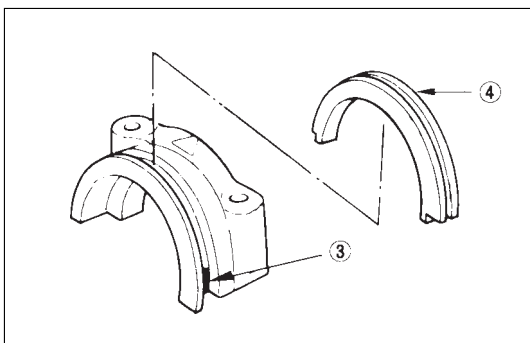
- Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.



N·m (kg·m/lb·ft)
167 (17.0/123)

NOTE:

Check to see that the crankshaft turns smoothly by rotating it manually.



- Apply the recommended liquid packing or its equivalent to the No. 5 crankshaft bearing cap ③ as shown in the illustration. Install the arch packing ④ to the No. 5 bearing cap.

NOTE:

Take care to install the arch packing in the groove of bearing cap correctly. Take care not to scratch the arch packing outer surface.

14. Piston Assembly

- Refer to "Piston and connecting rod" in this Section.

13. Tappet

12. Timing Gear Case

- 1) Install the timing gear case to the cylinder body.

NOTE:

Take care not to twist the front oil seal.

- 2) Tighten the timing gear case bolt together with the timing gear case gasket to the specified torque.

N·m (kg·m/lb·ft)



19 (1.9/14)

- 3) Cut away the gasket protruding above the fitting surfaces (as shown in the illustration).

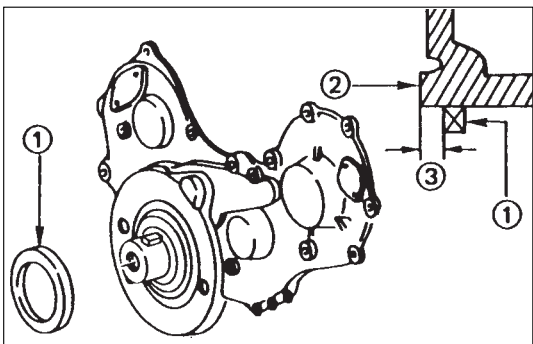
11. Crankshaft Front Oil Seal

- Use the installer to install the front oil seal ① to the gear case cover ②.

Oil Seal Installer: 5-8840-2061-0

Note the oil seal installation depth ③ shown in the illustration.

Depth ③ = 1 mm (0.039 in.)



10. Camshaft

- Refer to 'Camshaft, Tappet' in Section 6A.

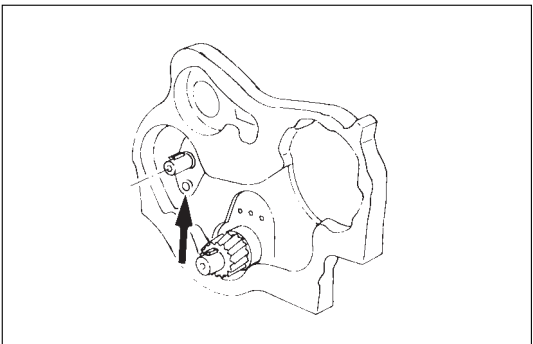
9. Camshaft Thrust Plate

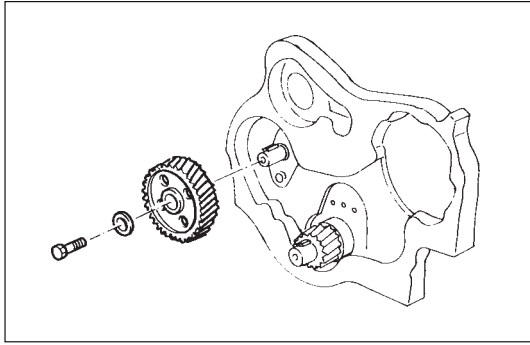
- Install the thrust plate to the cylinder body and tighten the thrust plate bolts to specified torque.

N·m (kg·m/lb·ft)



18 (1.8/13)





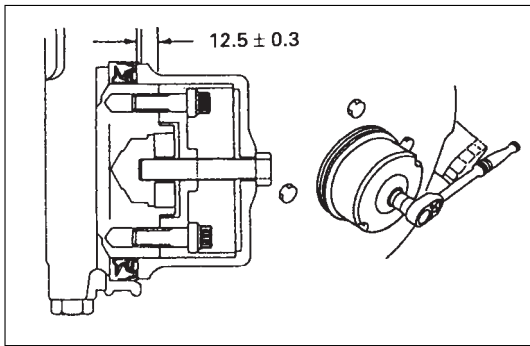
8. Camshaft Timing Gear

- 1) Install the camshaft timing gear to the camshaft. The timing gear mark ("Y - Y") must be facing outward.
- 2) Tighten the timing gear to the specified torque.

N·m (kg·m/lb·ft)



64 (6.5/47)



7. Oil Pump Assembly

- Refer to 'Oil pump' in Section 6A2.

6. Crankcase Assembly

- Refer to 'Crankcase' in Section 6A2.

5. Crankshaft Rear Oil Seal

- 1) Tighten the adapter to the crankshaft rear and section with 2 bolts.
- 2) Insert the oil seal into the peripheral section of the adapter,
- 3) Insert the sleeve into the adapter section, and 1) tighten it with a bolt (M12 x 1.75L = 70) until the adapter section hits the sleeve.
- 4) Remove the adapter and the sleeve.
- 5) With the seal pressed in, check the dimension of the oil seal section.

Standard Dimension = 12.5 ± 0.3 mm

Oil Seal Installer: 5-8840-2359-0



4. Cylinder Block Rear Plate

- Tighten the cylinder block rear plate fixing bolt to the specified torque

N·m (kg·m/lb·ft)



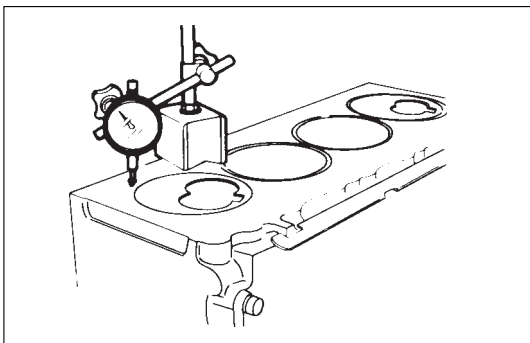
82 (8.4/61)

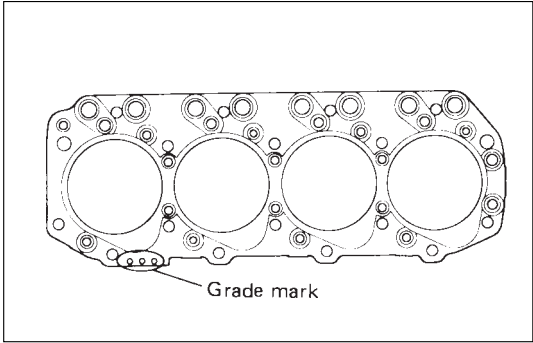
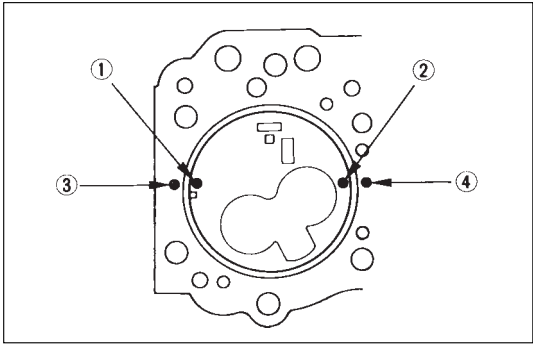
3. Flywheel

- Refer to 'Crankshaft' in Section 6A.

2. Cylinder Head Gasket

1. Carefully remove carbon deposits and gasket residue from the piston top face and the cylinder body upper surface.





2. Use a dial indicator to measure the piston head projection at measuring points ① and ③ on the piston head and measuring points ② and ④ on the cylinder body.
Do this for each cylinder.
3. Note the highest measured value.
This will determine the cylinder head gasket thickness.

Piston Head Projection	mm (in)
0.658 ~ 0.814 (0.0259 ~ 0.0320)	

Piston head projection must be within the range shown in the above table.

4. Select a cylinder head gasket of the appropriate thickness.
The difference between the highest measured piston head projection and the lowest measured piston head projection must not exceed mm (in).
mm (in)

Grade mark	Average piston projection	Gasket thickness (Reference)
A	0.658-0.712 (0.0259-0.0281)	1.60 (0.0630)
B	0.713-0.758 (0.0281-0.0299)	1.65 (0.0650)
C	0.759-0.813 (0.0299-0.0320)	1.70 (0.0670)

1. **Cylinder Head Assembly**
 - Refer to Section 6A2 'Cylinder head'

MEMO

A series of horizontal dotted lines for writing.

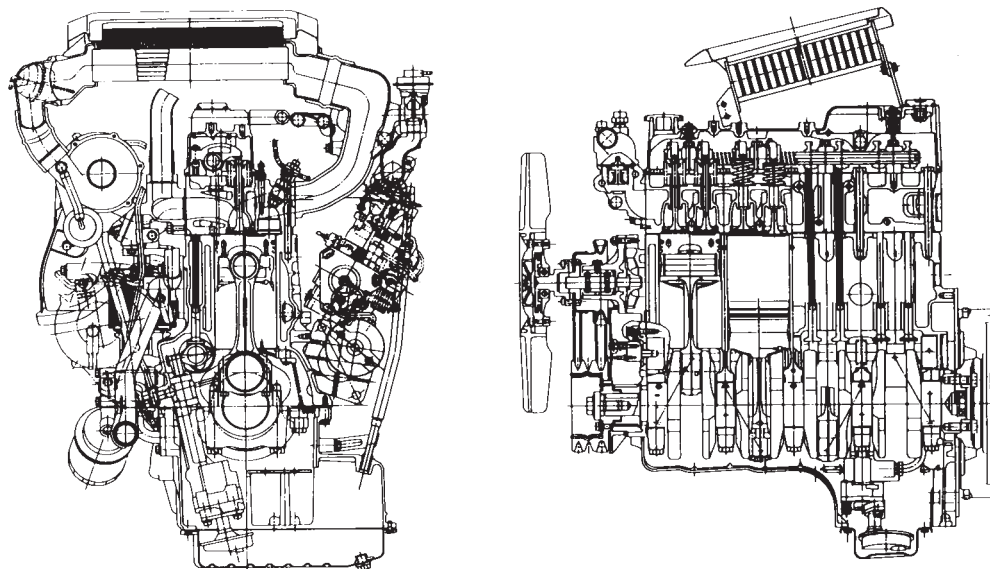
SECTION 6A2

4JG2-NA/4JG2-TURBO ENGINE

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GENERAL DESCRIPTION



This illustration for 4JG2-T

RECARD Comet V Type swirl combustion chamber which provides superior driving performance, fuel economy and silent combustion over a wide range of driving conditions, is applied.

The cylinder head gasket is of laminated steel sheets.

Three grades of the gasket according to the measured piston head projection from the cylinder block are provided to give the engine a minimum compression ration fluctuation.

The cylinder head fixing blots, flywheel bolts and connecting rod fixing bolts are tightened by the angular Tightening Method.

The chrome plated steel dry type (Chromard) cylinder liners provide the highest durability.

Auto-thermatic pistons having steel struts with 0.7 mm offset from the piston pin center line, ate applied to reduce thermal expansion and resulting engine noise when the engine is cold.

The crankshaft bearings and connecting rod bearings are of aluminum having a high bearing surface.

These bearing are especially sensitive to foreign material such as metal scraps. So, it is very important that the oil ports and other related surfaces are kept clean and free of foreign material.

Crank shaft bearing selection for optimum bearing and journal clearance is applied to reduce vibration and noise.

As tufftriding (Nitriding treatment) is applied to increase crankshaft strength, crankpins and journals should not be reground.

An oiling jet device for piston cooling is provided in the lubricating oil circuit from cylinder block oil gallery via a check valve.

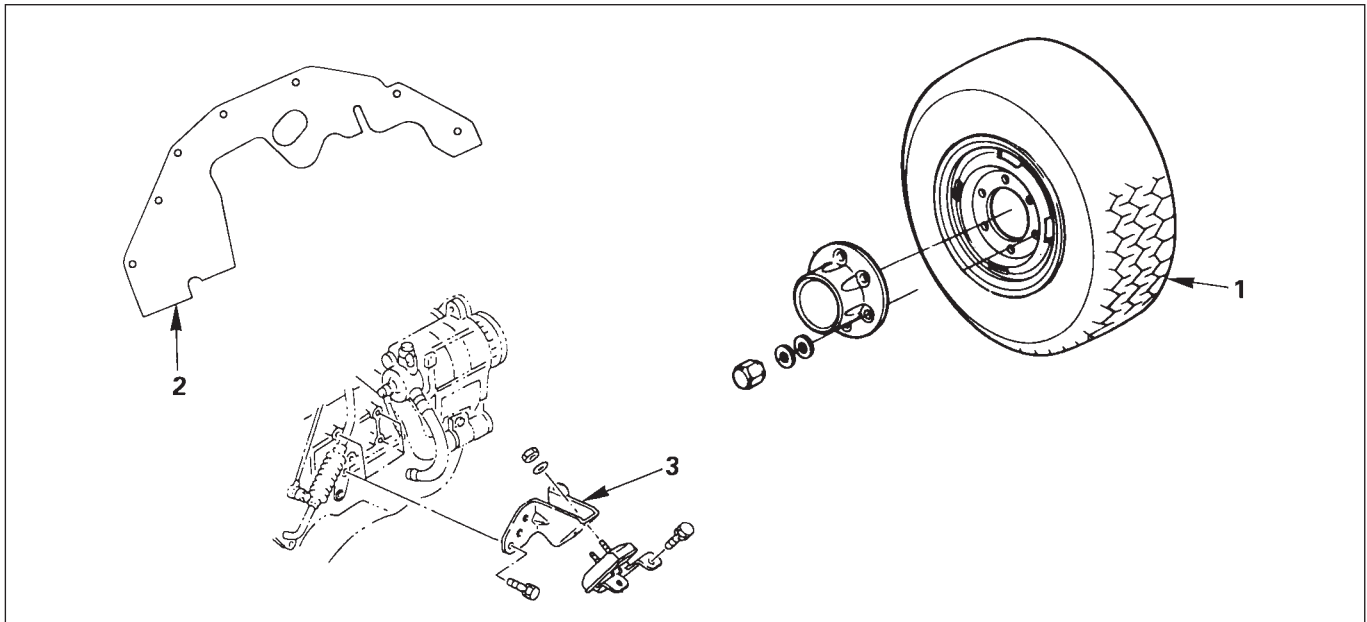
Take care not to damage any oiling jet when removing and installing piston and connecting assembly.

The DFI (Double Formation Injection) Pintaux Type injection nozzle having a sub-injection hole is applied. This nozzle contributes to substantially minimize the diesel knocking sound noticeable in the cold engine idling operation.

Install the injection nozzle, directing the sub-injection hole to the specified direction.


QOS III preheating system which features a quick-on glow plug with thermometer control of the glowing time and the afterglow time function, is applied.

ENGINE MOUNT (RH)



 **REMOVAL**
Preparation:

- Battery ground cable
- Support engine
- Support vehicle

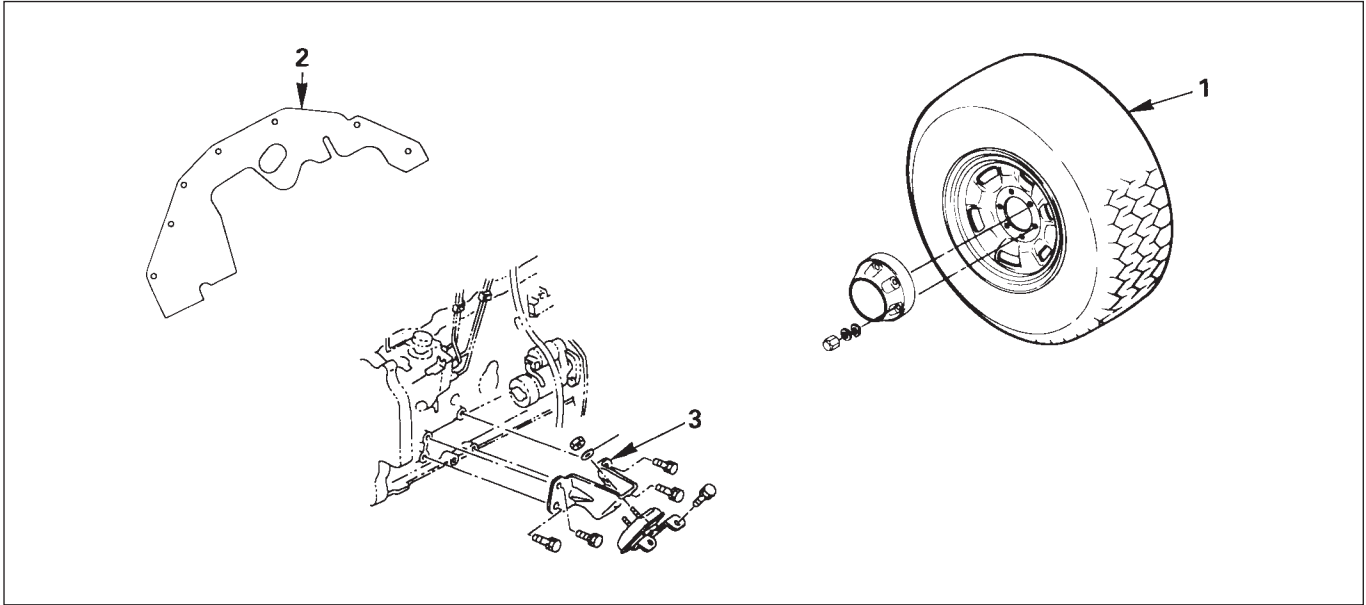
1. **Front Tire**
2. **Dust Cover**
3. **Engine Mount**
 - Remove fixing bolts from cylinder body and chassis frame.

 **INSTALLATION**
3. **Engine Mount**Cylinder body side N·m(kg·m/lb·ft)
 40 (4.1/30)
Chassis frame side N·m(kg·m/lb·ft)
 40 (4.1/30)

- Tighten the fixing bolts to the specified torque

2. **Dust Cover**1. **Front Tire**N·m(kg·m/lb·ft)
 118 (12.0/87)

ENGINE MOUNT (LH)



REMOVAL

Preparation:

- Disconnect battery ground cable
- Support engine
- Support vehicle

1. **Front Tire**
2. **Dust Cover**
3. **Engine Mount**
 - Remove fixing bolts from cylinder body and chassis frame.



INSTALLATION

3. **Engine Mount**
 - Tighten the fixing bolts to the specified torque

Cylinder body side N·m(kg·m/lb·ft)



40 (4.1/30)

Chassis frame side N·m(kg·m/lb·ft)



40 (4.1/30)

Chassis frame side N·m(kg·m/lb·ft)



41 (4.2/30)

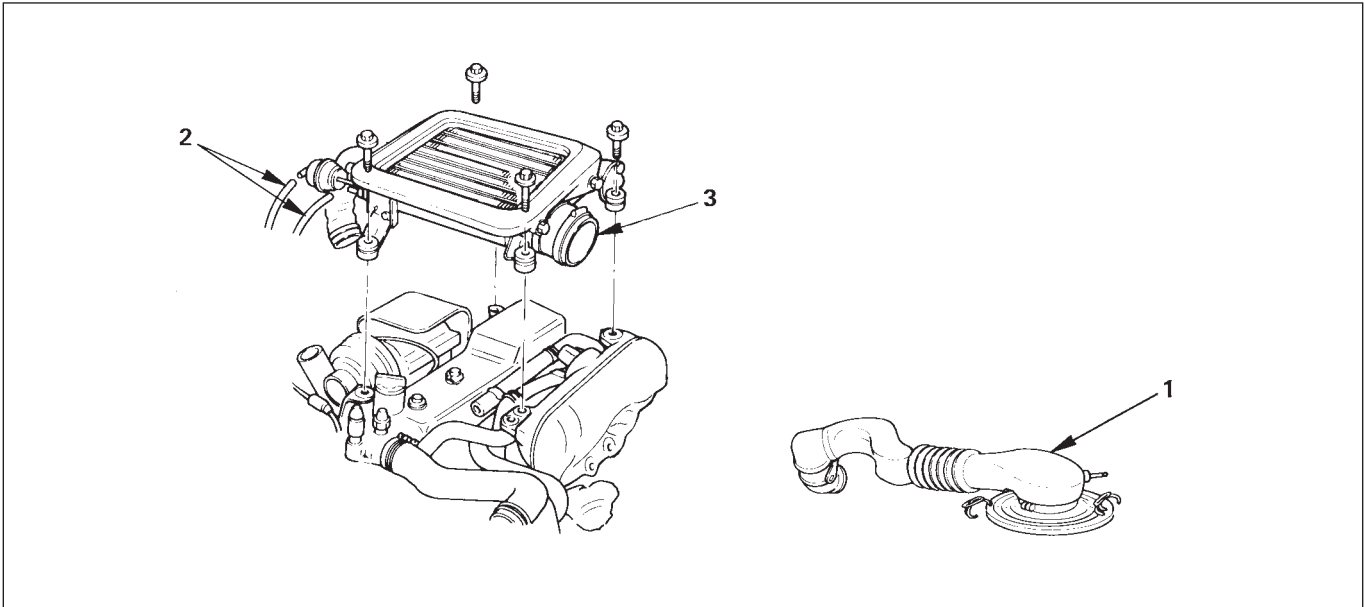
2. **Dust Cover**

1. **Front Tire**
 - Tighten the fire fixing nuts to specified torque



118 (12.0/87)

INTERCOOLER (4JG2-T only)



↔ REMOVAL

Preparation:

- Disconnect battery ground cable

1. Air Cleaner Cover & Air Duct

- Remove bolts from intercooler.

2. Vacuum Hose

3. Intercooler Assembly

- Disconnect outlet hose from intake manifold.
- Remove bolts from engine side brackets.

↔ INSTALLATION

3. Intercooler

- Connect outlet hose to intake manifold.
- Install intercooler and tighten fixing bolts to the specified torque.

N·m (Kg·m/lb·ft)

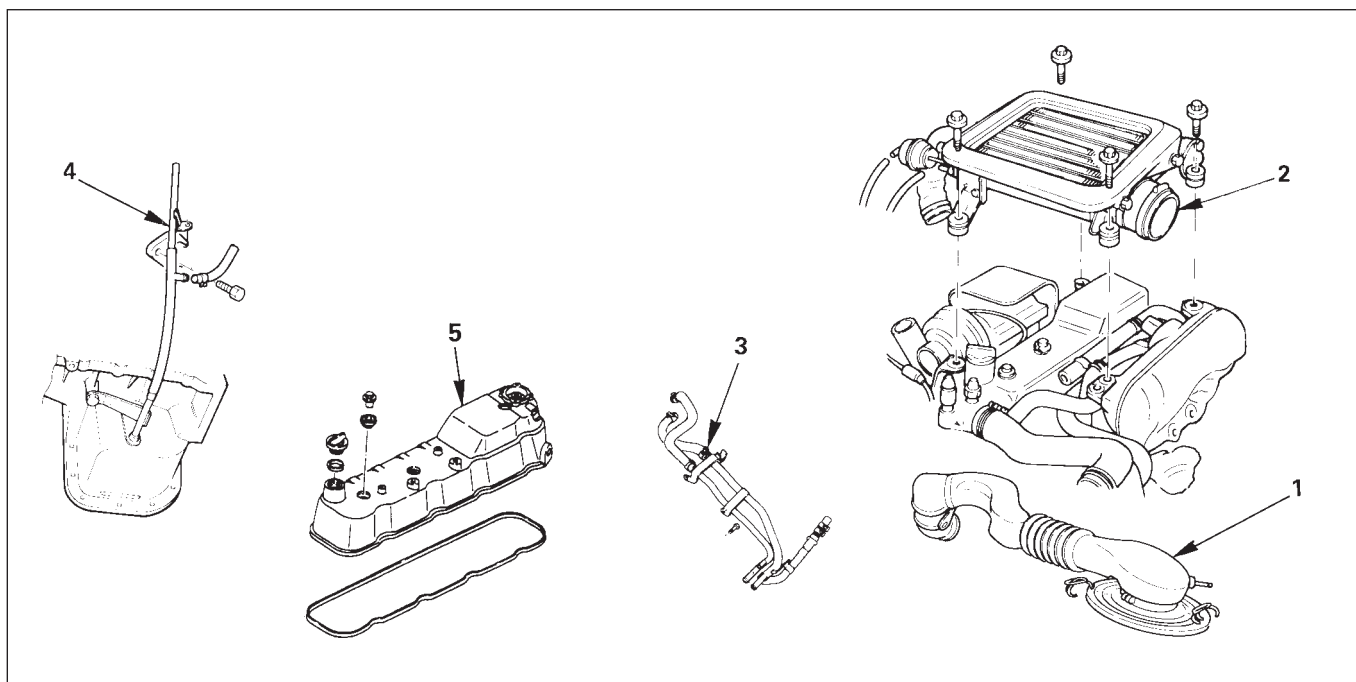


19 (2.0/14)

2. Vacuum Hose

1. Air Cleaner Cover & Air Duct

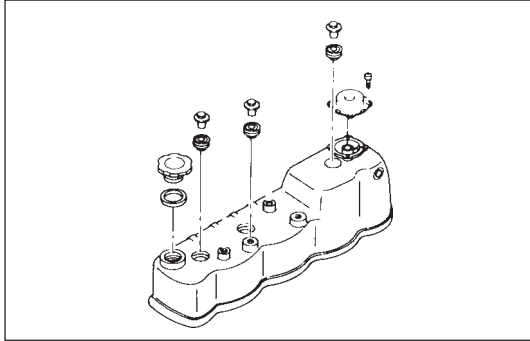
CYLINDER HEAD COVER

**REMOVAL****Preparation:**

- Disconnect battery ground cable.
- 1. Air Cleaner Cover & Air Duct (4JG2-T only)**
 - Disconnect two air hose.
 - Release clips and bands and remove air cleaner cover.
 - 2. Intercooler Assembly (4JG2-T only)**
 - (Refer to intercooler removal steps in this section)
 - 3. Heater and Oil Cooler Pipe Fixing Bolts**
 - Remove fixing bolts from.
 - 4. Oil Level Gauge Tube**
 - 5. Cylinder head cover**



INSTALLATION



5. Cylinder Head Cover

- Apply engine oil to the rocker arms and the valve springs.
- Install the cylinder head cover gasket to the cylinder head cover.
- The gasket must be perfectly smooth with no loose areas.
- Tighten the cylinder head cover nuts to the specified torque in the numerical order.

N·m(Kg·m/lb·in)

13 (1.3/113 lb·in)



4. Oil Level Gauge Tube

Bolt

N·m(Kg·m/lb·ft)

19 (1.9/14)

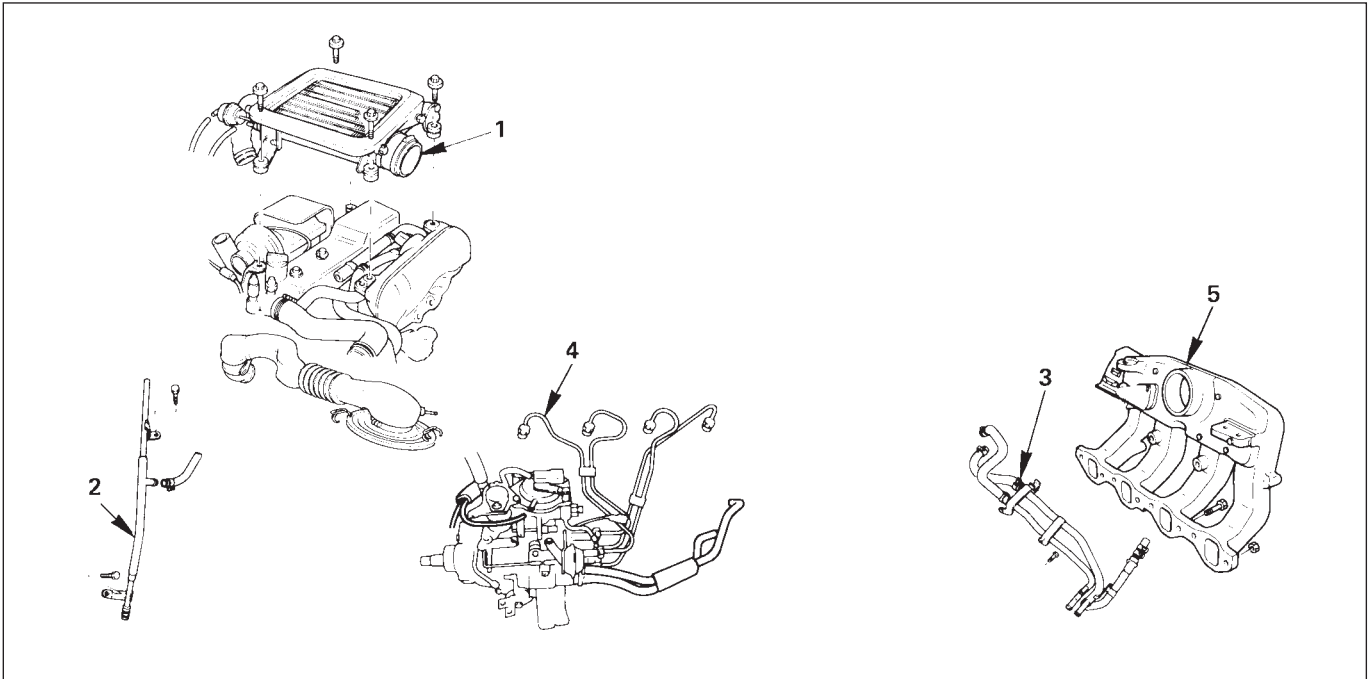
3. Heater and Oil Cooler Pipe Fixing Bolts

2. Intercooler Assembly (4JG2-T Only)

- (Refer to intercooler installation steps in this section.)

1. Air Cleaner Cover & Air Duct

INLET MANIFOLD



↔ REMOVAL

1. Intercooler (4JG2-T only)
2. Oil Level Gauge Tube (4JG2-T only)
3. Heater and Oil Cooler Pipe Fixing Bolts.
 - Remove fixing bolts from inlet manifold.
4. Injection Pipes
5. Inlet Manifold

↔ INSTALLATION

5. Inlet Manifold



- Tighten the fixing bolts and nuts to the specified

Bolt N·m(Kg·m/lb·ft)

19 (1.9/14)

Nut

N·m(Kg·m/lb·ft)

24(2.4/18)

4. Injection Pipes

- Tighten the sleeve nut to the specified torque

N·m(Kg·m/lb·ft)



29 (3.0/22)

3. Heater and Oil Cooler Pipe Fixing Bolts

- Tighten fixing bolts to the specified torque

N·m(Kg·m/lb·ft)

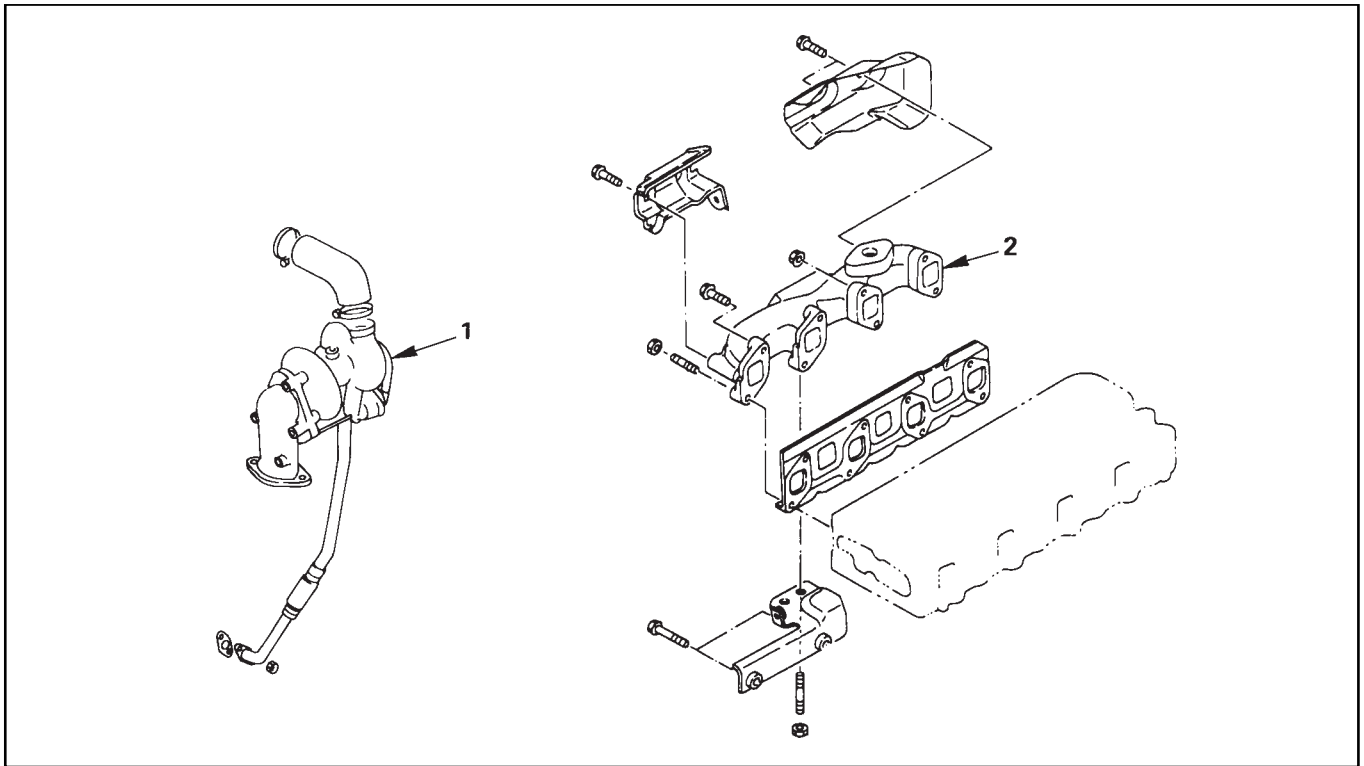


19 (1.9/14)

2. Oil Level Gauge Tube (4JG2-T only)**1. Inter Cooler (4JG2-T only)**

- Refer to “Inter cooler installation” steps in this section.

EXHAUST MANIFOLD



REMOVAL

1. Turbocharger (4JG2-T only)
 - Refer to the “Turbocharger” removal in this section.
2. Exhaust Manifold



INSTALLATION

2. Exhaust Manifold
 - Tighten the fixing nuts and bolts to the specified torque.

Nut	N·m(Kg·m/lb·ft)
-----	-----------------

19 (1.9/14)



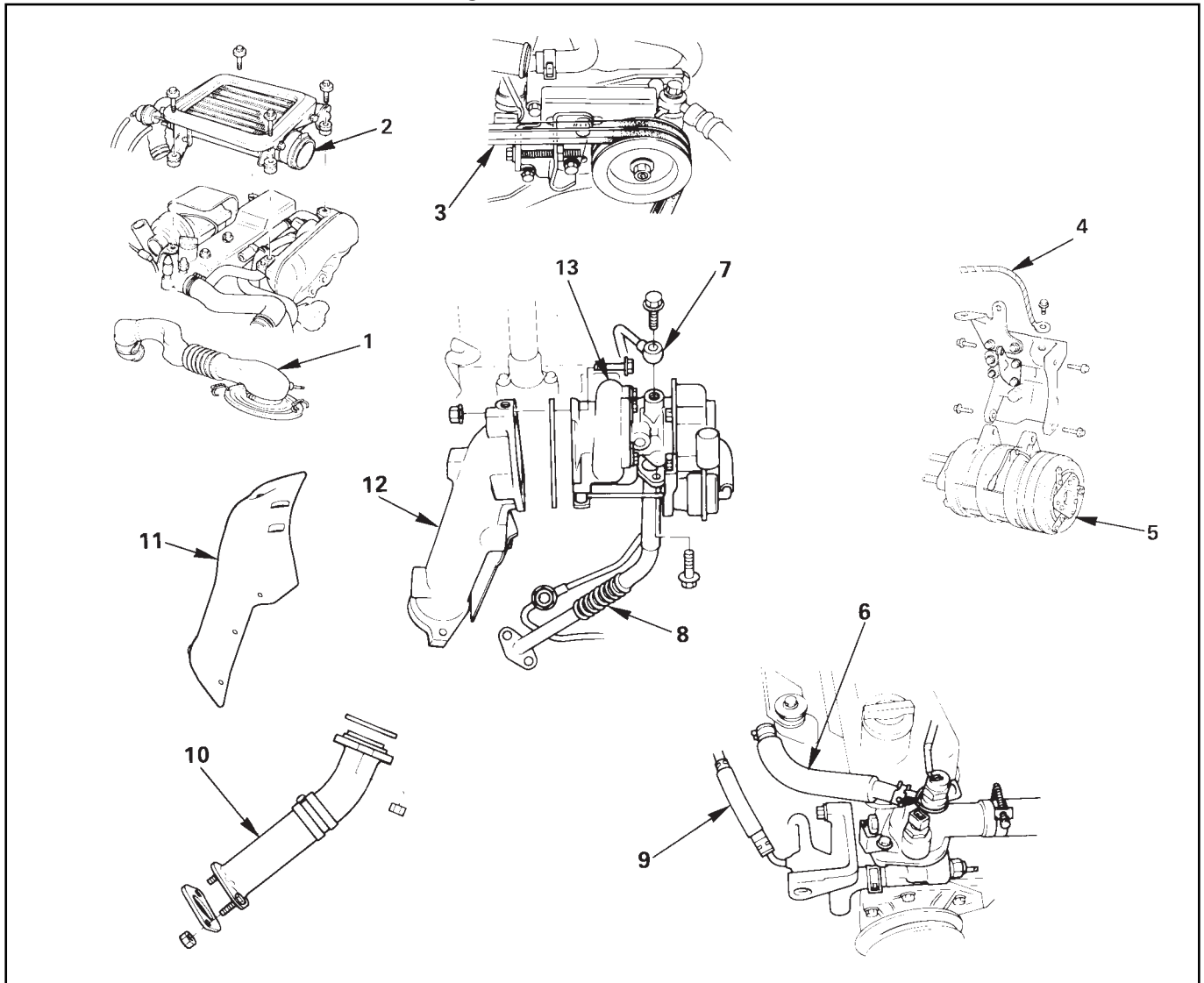
Bolt	N·m(Kg·m/lb·ft)
------	-----------------

26 (2.7/20)



1. Turbocharger (4JG2-T only)
 - Refer to the “Turbocharger” installation in this section.

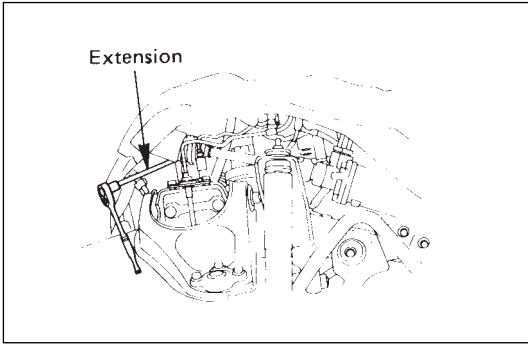
TURBOCHARGER (4JG2-T only)



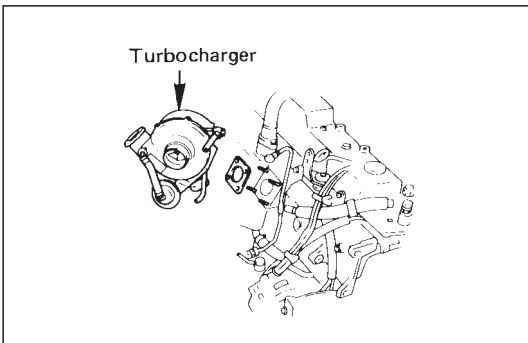
↔ REMOVAL

Preparation

- Space stand and remove right front tire
 - Remove battery
 - Drain coolant
1. **Air Cleaner Cover & Air Duct**
 - Disconnect connecting rubbers and stay fixing bolts.
 2. **Intercooler Assembly (4JG2-T Only)**
 - Refer to intercooler removal steps in this section.
 3. **Power Steering (P/S) Pump Drive Belts**
 - Loosen P/S pump fixing bolts and adjusting bolt and remove two drive belt.
 4. **Engine Ground Cable**

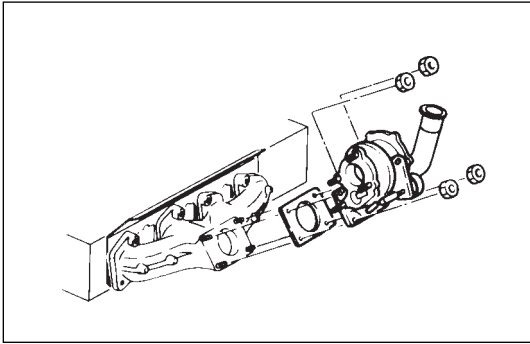


5. **Air Conditioner (A/C) Compressor Assembly**
 - Remove A/C compressor fixing bolt (rear under side of compressor) by using a long extension bar at under side of wheel arch.
 - Disconnect magnetic clutch harness connector.
 - Removal fixing bolts (upper and front lower sides of compressor) and set A/C compressor asm with pipelines on battery cable.
6. **Water Inlet Pipe: Turbo (4JG2-T Only)**
7. **Oil Feed Pipe: Turbo (4JG2-T Only)**
 - Remove joint bolt from turbo charger.
 - Plug up oil port of turbocharger to prevent entrance of foreign material.
8. **Oil Return Pipe: Turbo (4JG2-T Only)**
 - Disconnect oil return pipe flange from turbocharger.
9. **Water Outlet Pipe: Turbo (4JG2-T Only)**
10. **Exh. Pipe: Ft (4JG2-T Only)**
11. **Heat Protector (4JG2-T Only)**
12. **Exh. Adapter (4JG2-T Only)**
13. **Turbocharger Assembly (4JG2-T Only)**
 - Remove turbocharger asm from exhaust manifold.





INSTALLATION



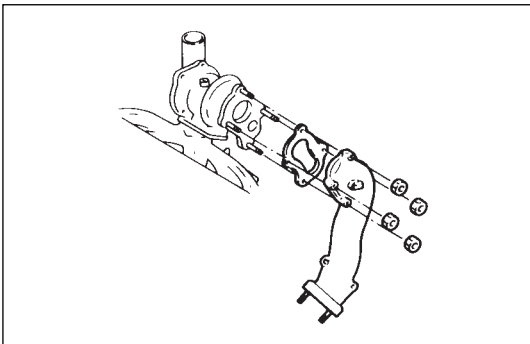
13. Turbocharger Assembly (4JG2-T Only)

- Install the turbocharger asm with gasket in exh. manifold and tighten fixing nuts to the specified torque.

N·m(Kg·m/lb·ft)



26 (2.7/20)



12. Exh. Adapter (4JG2-T Only)

- Install exh. adapter and tighten bolts to the specified torque.

N·m(Kg·m/lb·ft)



26 (2.7/20)

11. Heat Protector (4JG2-T Only)

10. Exh. Pipe: Ft

- Install exh. pipe and tighten bolts to the specified torque.

N·m(Kg·m/lb·ft)



67 (6.8/49)

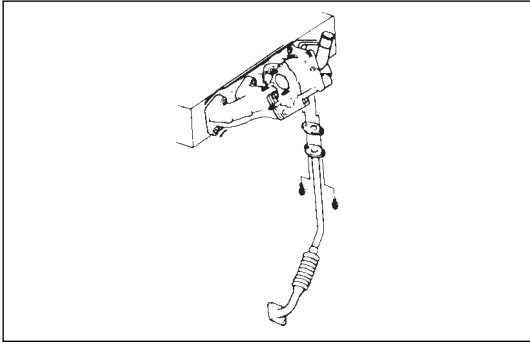
9. Water Outlet Pipe: Turbo (4JG2-T Only)

- Install water outlet pipe with new gasket to the specified torque.

N·m(Kg·m/lb·ft)



8(0.8/6)



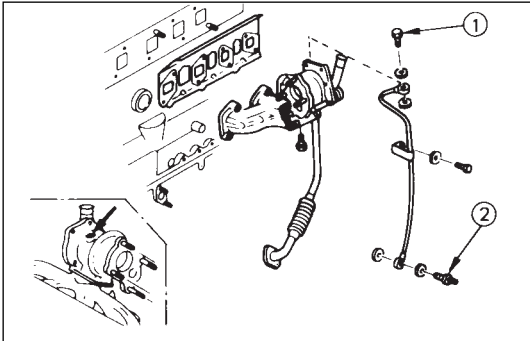
8. Oil Return Pipe: Turbo (4JG2-T Only)

- Install oil return pipe with new gasket in turbocharger and tighten joint bolt to the specified torque.

N·m(Kg·m/lb·ft)



8(0.8/6)



7. Oil Feed Pipe: Turbo (4JG2-T Only)

- Apply about 100 cc engine oil to oil feed hose of turbocharger housing before installing oil feed pipe.
- Lubricate turbocharger securely by rotating turbine shaft by hand.
- Install oil feed pipe with new gasket and tighten joint bolt to the specified torque.

N·m(Kg·m/lb·ft)



① 23 (2.3/17) ② 29 (3.0/22)

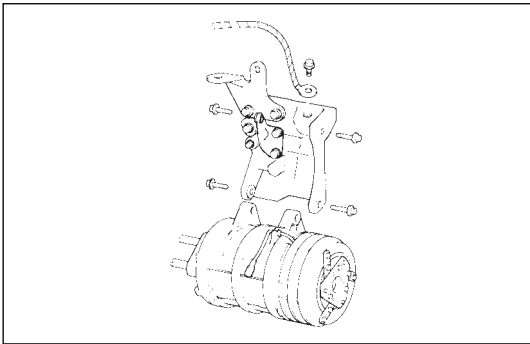
6. Water Inlet Pipe: Turbo (4JG2-T Only)

- Install water inlet pipe with new gasket and tighten joint bolt to the specified torque.

N·m(Kg·m/lb·ft)



8(0.8/6)



5. A/C Compressor Assembly

- Tighten temporarily fixing bolts (front upper and lower sides of compressor)
- Tighten fixing bolt (rear under side of compressor) to the specified torque by using along extension bar and torque wrench at under side of wheel arch.
- Tighten fixing bolts (front upper and lower side of compressor) to the specified torque.

N·m(Kg·m/lb·ft)



37 (3.8/27)

4. Engine Ground Cable

3. P/S Pump Drive Belts

- Install drive belts, adjust belt tension by adjusting bolt and tighten locking bolt to the specified torque.
- Refer to drive belt adjustment steps in section 6B.

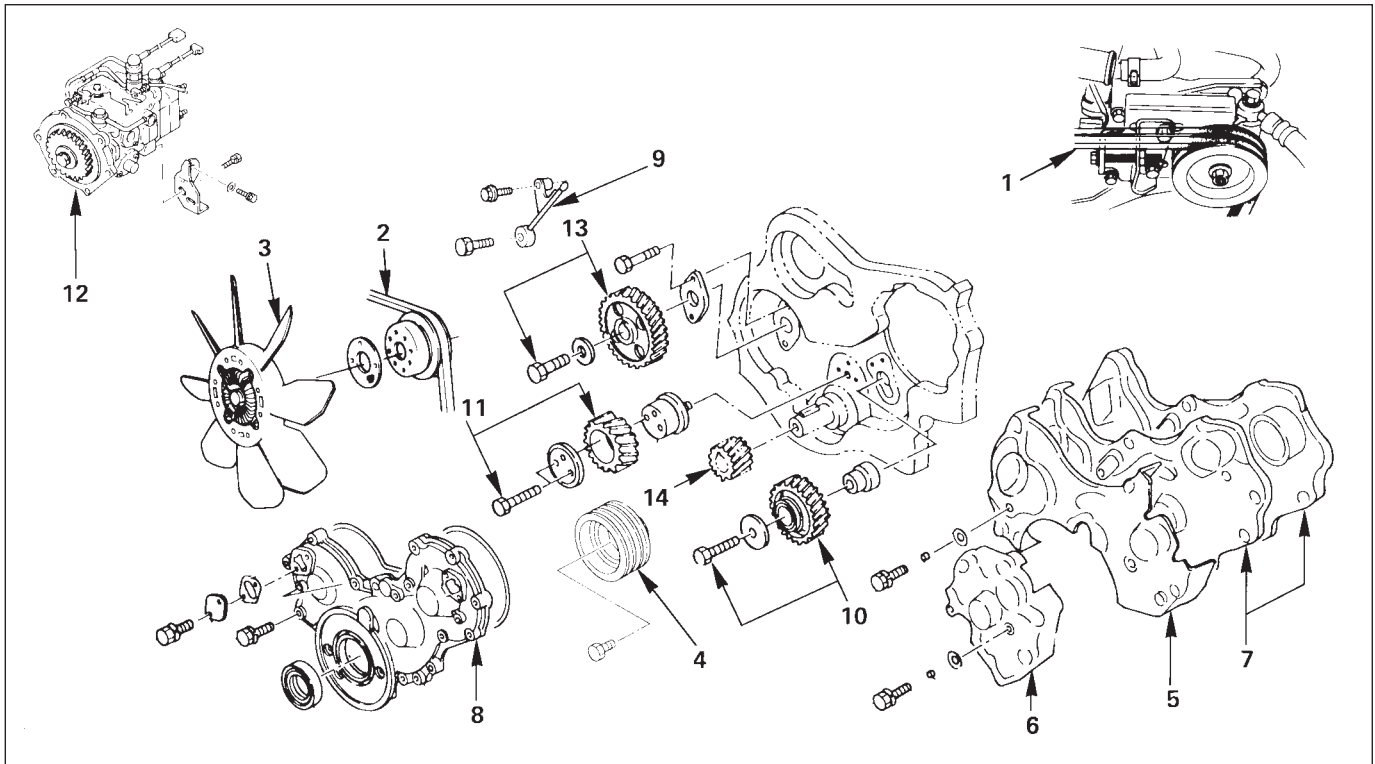
2. Intercooler Assembly (4JG2-T Only)

- Refer to intercooler installation steps in this section.

1. Air Cleaner Cover & Air Duct (4JG2-T Only)

- Connect inlet and outlet connecting hoses and tighten stay fixing bolts.
- Install right front tire.
- Fill coolant
- Install battery and connect battery cables.

TIMING GEAR

**REMOVAL****Preparation:**

- Disconnect battery ground cable.
- Drain coolant.

1. P/S Pump Drive Belt

- Loosen P/S pump mounting bolt and adjust bolt, and remove the drive belt.

2. AC Generator Drive Belt

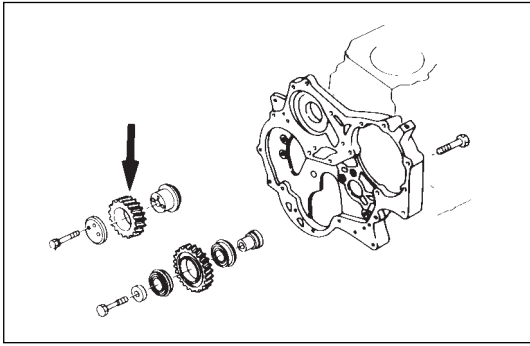
- Loosen AC Generator mounting bolt (under side) and adjust plate lock bolt, and remove the drive belt.

3. Cooling Fan Assembly

- Remove clamp nut, and remove cooling fan asm, distant pipe, and fan pulley.

4. Crankshaft Damper Pulley**5. Upper Noise Shield Cover****6. Lower Noise Shield Cover****7. Noise Cover Spacer.****8. Timing Gear Case Cover****9. Oil Pipe****10. Idler Gear "B" and Shaft**

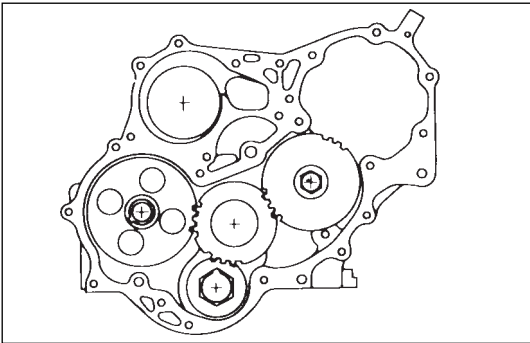
- 1) Measure the camshaft timing gear backlash and the crankshaft timing gear backlash before removing the idler gear.



- 2) Measure the idler gear end play before removing the idler gear.

NOTE:

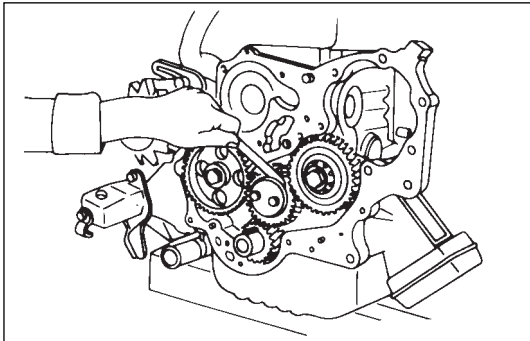
Refer to the following items for details on the backlash and end play measurement procedures.



Timing Gear Backlash Measurement

- 1) Set a dial indicator to the timing gear to be measured. Hold both the gear to be checked and the adjoining gear stationary.
- 2) Move the gear to be checked as far as possible to both the right and the left. Take the dial indicator reading. If the measured value exceeds the specified limit, the timing gear must be replaced.

Timing Gear Backlash		mm (in)
Standard	Limit	
0.10-0.17 (0.0039-0.0067)	0.30 (0.012)	

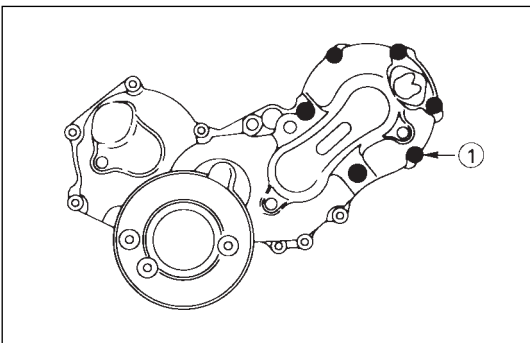


Idler Gear "A" End Play Measurement

Insert a feeler gauge between the idler gear and the thrust collar to measure the gap and determine the idler gear end play.

If the measured value exceeds the specified limit, the thrust collar must be replaced.

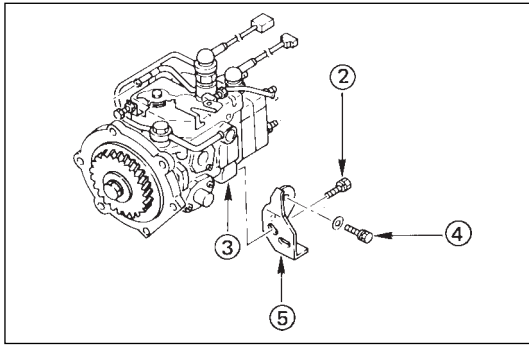
Idler Gear End Play		mm (in)
Standard	Limit	
0.07 (0.0028)	0.2 (0.0079)	



11. Idle Gear

12. Injection Pump

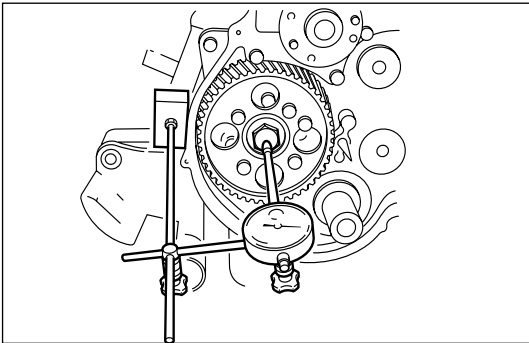
- 1) Remove the six injection pump bracket bolts ① from the timing gear case.



- 2) Remove the injection pump rear bracket bolts ② from the injection pump bracket ③.
- 3) Remove the injection pump rear bracket bolts ④ and the bracket ⑤ from the cylinder body.
- 4) Pull the injection pump along with the injection pump timing gear free toward the rear of the engine.

NOTE:

Plug the injection pump delivery holder ports with the shipping caps (or the equivalent) to prevent the entry of foreign material.

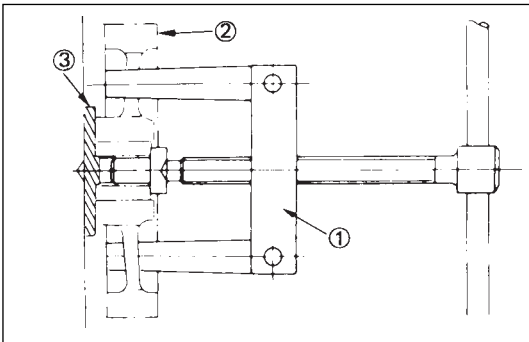


13. Camshaft Timing Gear

- 1) Use a dial indicator to measure the camshaft end play.
This must be done before removing the camshaft gear.
If the camshaft end play exceeds the specified limit, the thrust plate must be replaced.

Camshaft End Play mm (in)

Standard	Limit
0.050-0.114 (0.0020-0.0044)	0.2 (0.008)



- 2) Remove the camshaft timing gear bolt from the camshaft.

NOTE:

Hold the camshaft stationaly to prevent the camshaft from turning.

- 3) Use the universal puller ① to pull out the camshaft timing gear ②.
- 4) Remove the thrust plate ③.

14. Crank Shaft Gear

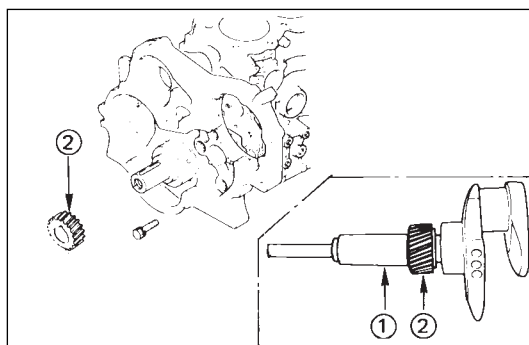


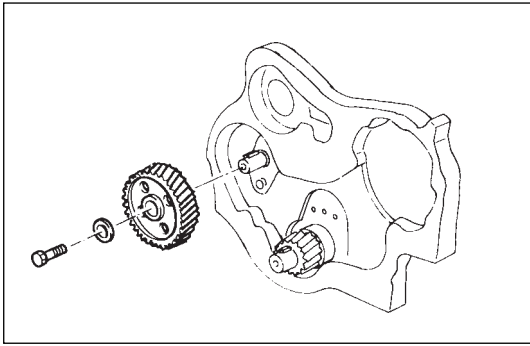
INSTALLATION

14. Crank Shaft Gear

- 1) Install the crankshaft gear.
- 2) Use the crankshaft gear installer ① to install the crankshaft gear ②.
The crankshaft gear timing mark ("X - X") must be facing outward.

Crankshaft Gear Installer : 9-8522-0020-0



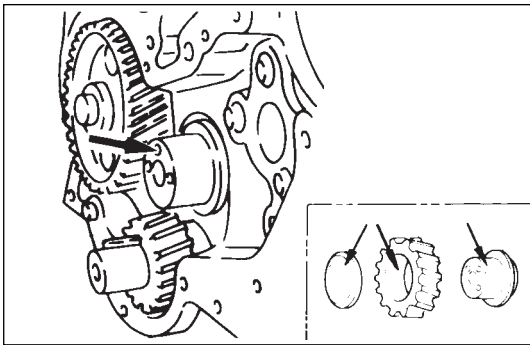


13. Crankshaft Timing Gear

- 1) Install the camshaft timing gear to the camshaft. The timing gear mark ("Y - Y") must be facing outward.
- 2) Tighten the timing gear to the specified toeque.

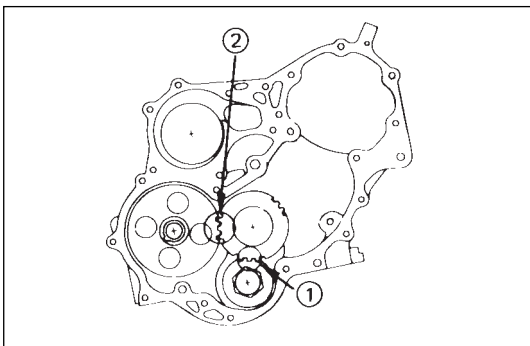
N·m(Kg·m/lb·ft)

64 (6.5/47)



11. Idle Gear

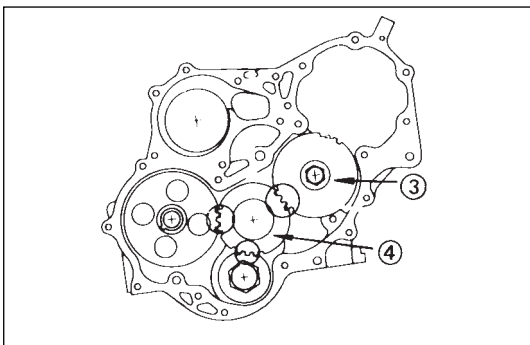
- 1) Apply engine oil to the idler gear and the idler gear shaft. The idler gear shaft oil hole must be facing up.
- 2) Position the idler gear setting marks "X" and "Y" so that they are facing the front of the engine.



- 3) Align the idler gear "X" setting mark with the crankshaft timing gear ① "X - X" setting mark.
- 4) Align the idler gear "Y" setting mark with the camshaft timing gear ② "Y - Y" setting mark.
- 5) Install the thrust collar and bolts to the cylinder body through the shaft. The thrust collar oil hole must be facing up, and the thrust collar chamfered must be outward.
- 6) Tighten the idler gear bolt to the specified torque.

N·m(Kg·m/lb·ft)

19 (1.9/14)

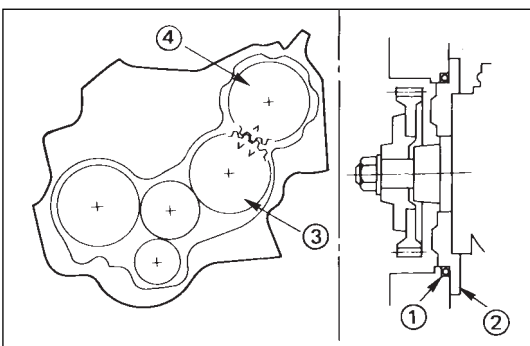


10. Idler Gear "B" and Shaft

- 1) Apply engine oil to the idler gear and the idler gear shaft.
- 2) Align the idler gear "B" ③ "Z" setting mark with the idler gear "A" ④ "Z - Z" setting mark.
- 3) Tighten the idler gear bolt to the specified torque.

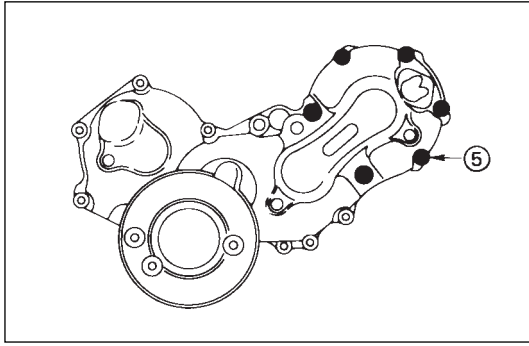
N·m(Kg·m/lb·ft)

76 (7.7/56)

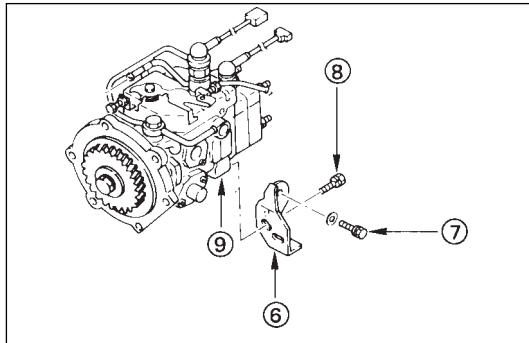


12. Injection Pump

- 1) Install the O-ring ① to the injection pump flange ②.
- 2) Install the injection pump to the timing gear case. Align the idler gear "B" ③ "V - V" mark with the injection pump timing gear ④ "V" mark.



- 3) Temporarily tighten the six injection pump nuts ⑤. The injection pump nuts will be finally tightened after the injection pump rear bracket bolts.



- 4) Install the injection pump rear bracket ⑥ and the rear bracket bolts ⑦ to the cylinder body.
 5) Install the rear bracket bolts ⑧ to the injection pump bracket ⑨. Do not tighten the bolts. The rear bracket bolts ⑦ and ⑧ will be finally tightened to the specified torque after the injection pump nuts.

- 6) Tighten the injection pump bracket bolts ⑦ to the specified torque.

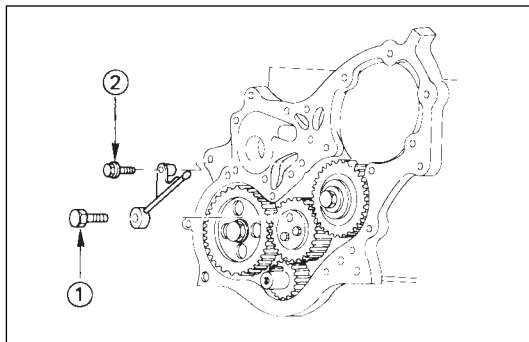
N·m(Kg·m/lb·ft)

206(21/152)

- 7) Tighten the injection pump bracket bolts ⑧ to the specified torque.

N·m(Kg·m/lb·ft)

206(21/152)

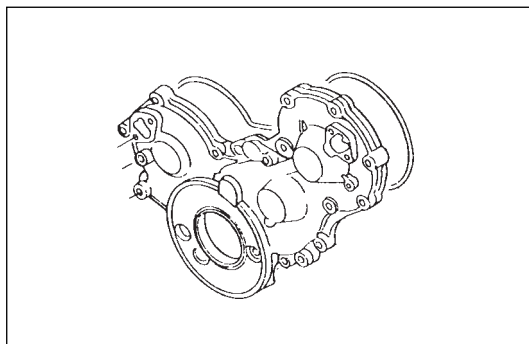


9. Timing Gear Oil Pipe

- 1) Install the oil pipe to the timing gear case and idler gear "A".
 2) Tighten the oil pipe eye bolt ① and bolt ② to the specified torque.

N·m(Kg·m/lb·ft)

13 (1.3/9)



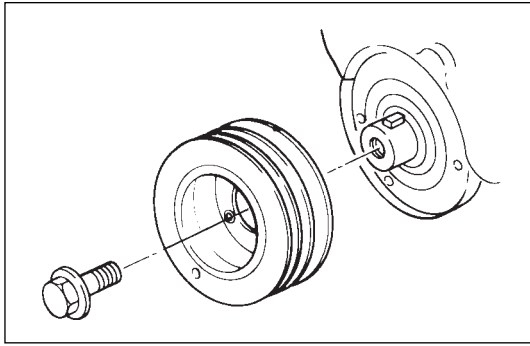
8. Timing Gear Case Cover

- 1) Align the gear case with the timing gear case knock pin and then install the timing gear case cover.
 2) Tighten the gear case cover bolts to the specified torque.

7. Noise Cover Spacer

6. Lower Noise Shield Cover

5. Upper Noise Shield Cover



4. Cranshaft Damper Pulley

Tighten the crankshaft damper pulley bolt to the specified torque.

NOTE:

Hold the flywheel ring gear stationary to prevent the crankshaft from turning when tightening the damper pulley.



N·m(Kg·m/lb·ft)
206(21/152)

3. Cooling Fan Assembly

- Mount fan pulley, distance piece, and cooling fan asm (in this order) on the water pump, and tighten to the specified torque.



N·m(Kg·m/lb·ft)
206(21/152)

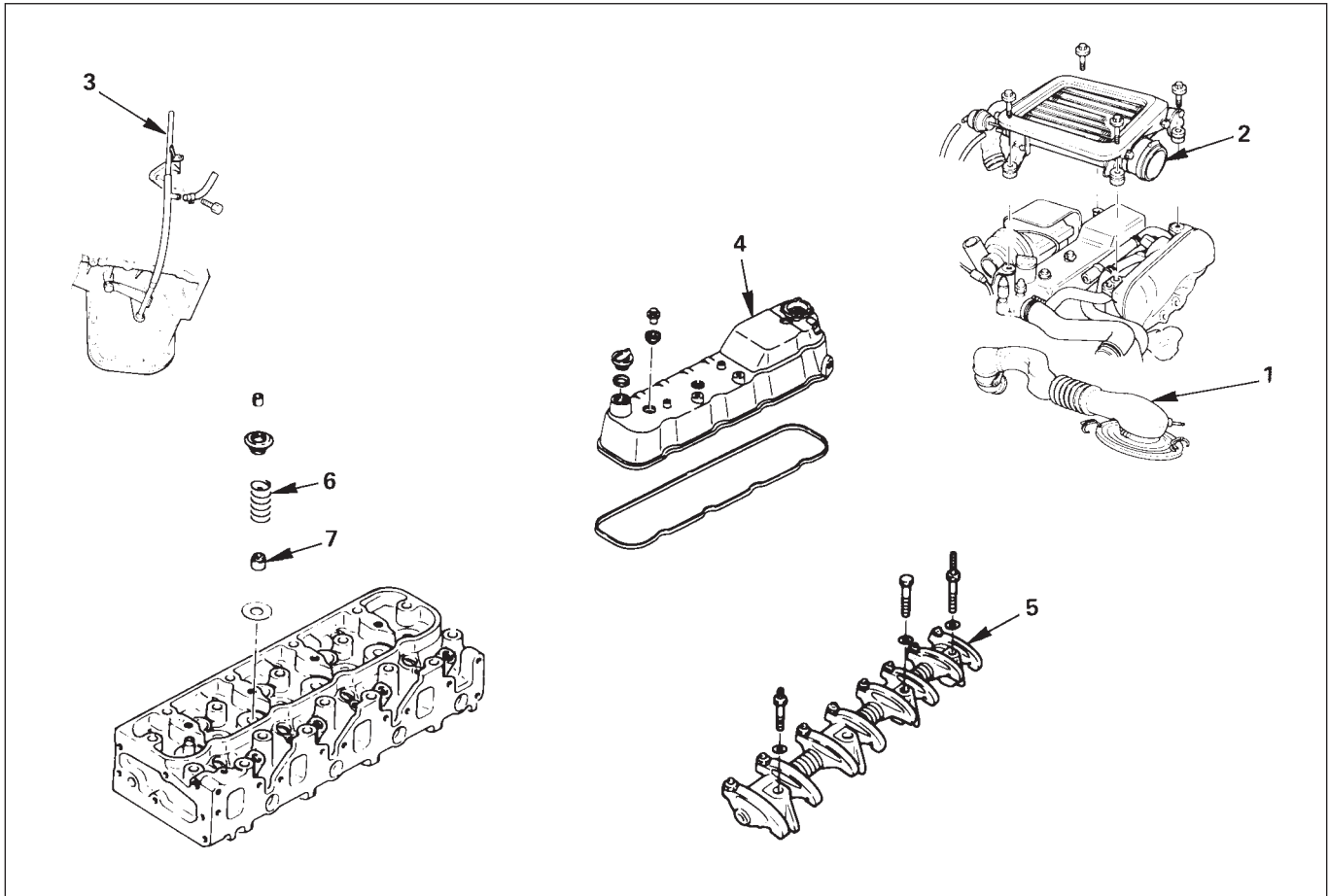
2. AC Generator Drive Belt

- Install AC Generator drive belt and adjust belt tension.
- Refer to Drive Belt Adjustment in section 6B.

1. P/S Pump Drive Belt

- Install P.S pump drive belt and adjust belt tension.
- Refer to Drive Belt Adjustment in section 6B.

VALVE STEM OIL SEAL & VALVE SPRING



↔ REMOVAL

Preparation

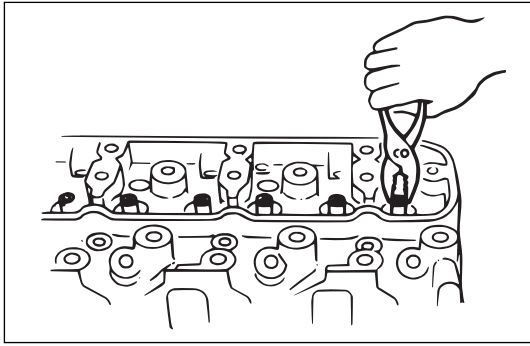
- Disconnect battery ground cable.
1. **Air cleaner Cover & Air Duct (4JG2-T Only)**
 - Disconnect air hoses.
 - Release clips and bands and remove air cleaner cover.
 2. **Intercooler Assembly (4JG2-T Only)**
 - (Refer to intercooler removal steps in this section)
 3. **Oil Level Gauge Tube**
 4. **Cylinder Head Cover**
 5. **Rocker Arm Shaft Assembly**
 - Loosen bolts and nuts of rocker arm shaft
 - Bracket by turns and removal rocker
 - Shaft asm.
 6. **Valve Spring**
 - Apply compressed air to cylinder from the glow plug hole hold the valve in place.
 - Using special tool, compress valve spring and removal split collar.



Valve spring compressor: 9-8523-1423-0 (J-29760)

⚠ CAUTION

- Put removed valve springs in the order of cylinder number.

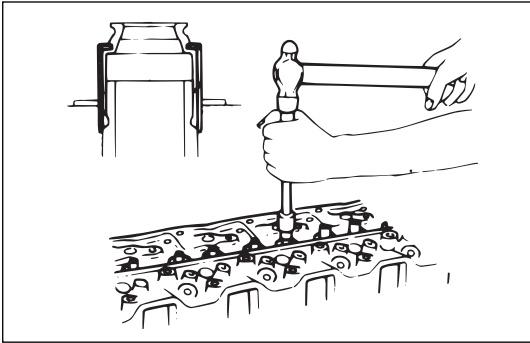


7. Valve Stem Oil Seal

- Removal oil seal by pliers.

⚠ CAUTION

- Removed oil controller should not be reused.



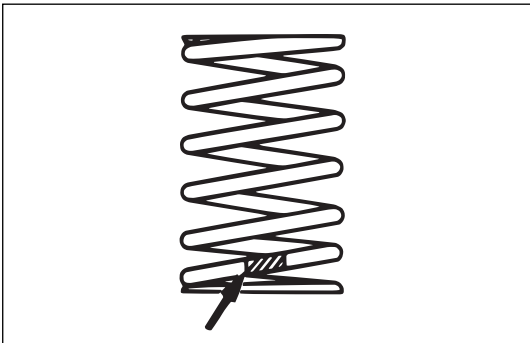
↔ INSTALLATION

7. Valve Stem Oil Seal

- Install new oil seal to valve guide.
- Guide using special tool.
Special tool: 5-8840-2033-0

6. Valve Spring

- Attach the valve spring to the upper spring seat.

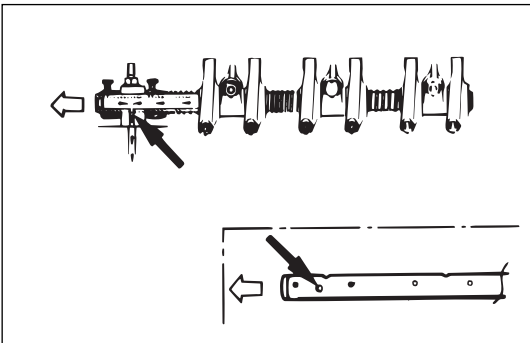


⚠ CAUTION

- The painted area of the valve spring should be facing toward.
- Apply compressed air to cylinder from the glow plug hole to hold the valve in place.
- Install split collar by special tool.



Valve spring compressor: 9-8523-1423-0 (J-29760)



5. Rocker Arm Shaft Assembly

- Install rocker arm shaft with a larger oil hole (ø4) to the front of engine.
- Align fixing bolt with not of rocker arm shaft and tighten fixing bolt to the specified torque.

N·m(Kg·m/lb·ft)



54 (5.5/40)

4. Cylinder Head Cover

- Install cylinder head cover and tighten bolt to the specified torque.

N·m(Kg·m/lb·in)



13 (1.3/113)

3. Oil Level Gauge Guide Tube

- Tighten guide tube to the specified torque.

N·m(Kg·m/lb·ft)



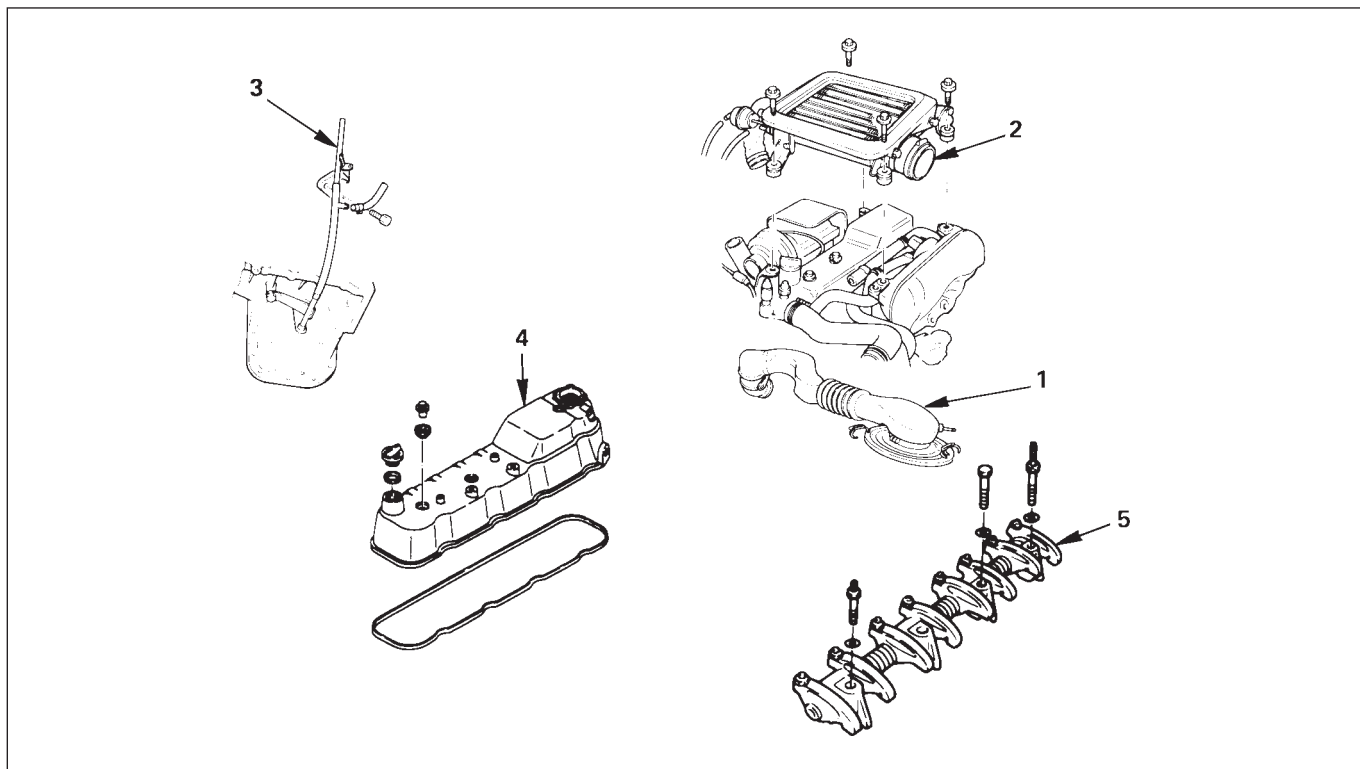
19 (1.9/14)

2. Intercooler Assembly (4JG2-T Only)

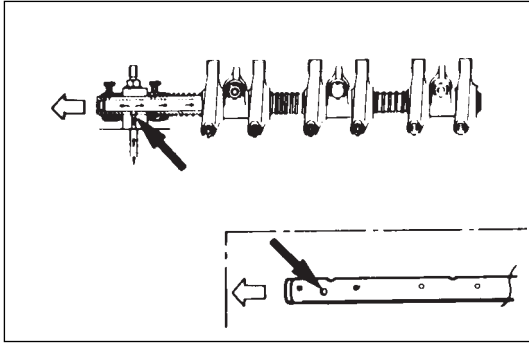
- Refer to intercooler installation steps in this section.

1. Air Cleaner Cover & Air Duct (4JG2-T Only)

ROCKER ARM SHAFT ASSEMBLY

**REMOVAL****Preparation**

- Disconnect battery ground cable.
1. **Air Cleaner Cover & Air Duct (4JG2-T Only)**
 - Disconnect air hoses.
 - Release clips and bands and remove air cleaner cover.
 2. **Intercooler Assembly (4JG2-T Only)**
 - Refer to intercooler removal steps in this section.
 3. **Oil Level Gauge Tube**
 4. **Cylinder Head Cover**
 5. **Rocker Arm Shaft Assembly**
 - Loosen bolts and nuts of rocker arm shaft bracket by turns and remove rocker shaft asm.



INSTALLATION

5. Rocker Arm Shaft Assembly

- Install rocker arm shaft with larger oil hole ($\phi 4$) to the front of engine.
- Align fixing bolt with not of rocker arm shaft and tighten fixing bolts to the specified torque.

N·m (kg·m/lb·ft)

54 (5.5/40)



- Adjust valve clearance refreshing to section valve clearance adjustment.

4. Cylinder Head Cover

- Install cylinder head cover and tighten bolts to the specified torque.

N·m (kg·m/lb·in)

13 (1.3/113)



3. Oil Level Gauge Guide Tube

- Tighten guide tube to the specified torque.

N·m (kg·m/lb·ft)

19 (1.9/14)

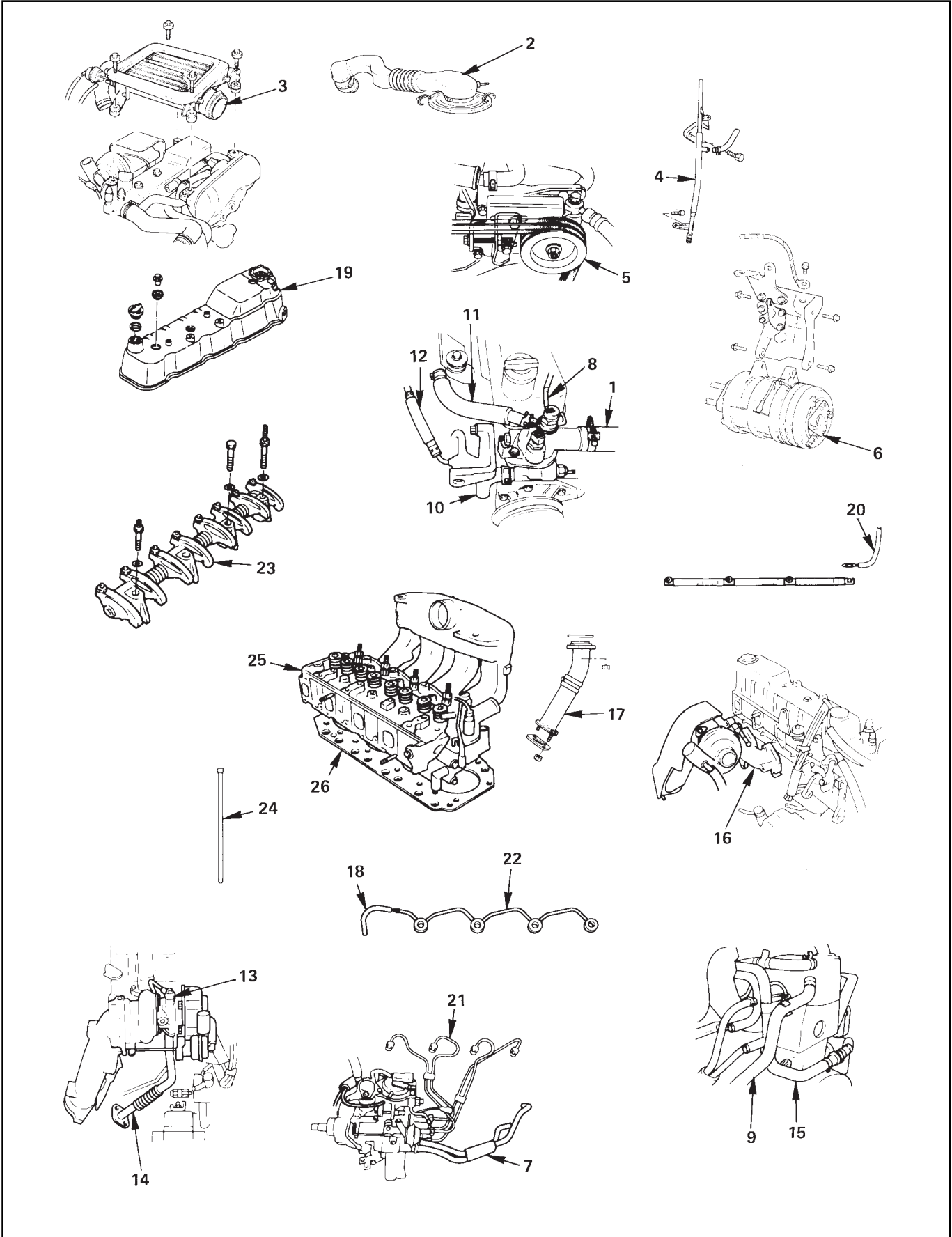


2. Intercooler Assembly (4JG2-T Only)

- Refer to intercooler installation steps in this section.

1. Air Cleaner Cover & Air Duct (4JG2-T Only)

CYLINDER HEAD





REMOVAL

Preparation

- Remove battery. (two batteries for cold area)
- Disconnect window washer hose, and remove engine hood.
- Drain coolant.
- Space stand and front right tire.

1. Radiator Hose : Upper

- Disconnect upper radiator hose from engine side.

2. Air Cleaner Cover & Air Duct

3. Intercooler Assembly (4JG2-T Only)

- (Refer to intercooler removal steps in this section)

4. Oil Level Gauge Guide Tube

5. P/S Pump

- Loosen P/S pump fixing bolts and adjusting bolt and remove two drive belts.
- Remove two fixing bolts (front side). A fixing nut (rear side) and support P/S pump asm with oil hoses by tying to body side.

6. A/C Compressor Assembly

- Remove A/C compressor fixing bolt (rear under side of compressor) by using a long extension bar at under side of wheel arch.
- Disconnect magnetic clutch harness connector.
- Remove fixing bolts (upper and front lower side of compressor) and set A/C compressor asm with pipe line on battery carrier.

7. Water Hose; CSD

- Disconnect CSD water hoses from heater hose side.

8. Engine Harness

- Disconnect five harness connectors from units on thermostat housing.

9. Heater Hose: Rear Side

- Disconnect heater hose from heater pipe.

10. Water Bypass Hose

- Disconnect water bypass hose from water pump.

11. Water Inlet Hose: Turbo (4JG2-T Only)

- Disconnect from water outlet pipe of engine.

12. Water Outlet Hose: Turbo (4JG2-T Only)

- Disconnect from water inlet pipe of engine.

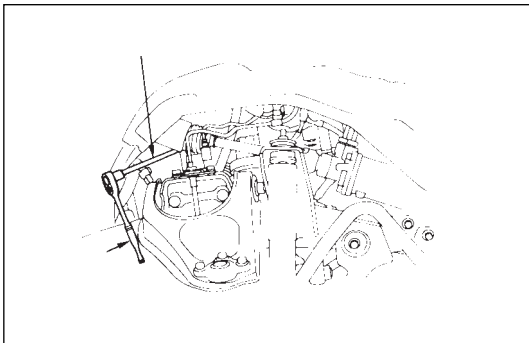
13. Oil Feed Pipe: Turbo (4JG2-T Only)

- Remove two joint bolts (from turbocharger and cylinder block) and oil feed pipe.

14. Oil Return Pipe Fixing Nut (4JG2-T Only)

- Remove oil return pipe fixing nut from cylinder block.

15. Oil Cooler Hose



16. Exh. Manifold; W/turbo (4JG2-T Only)

- Remove exh. manifold bracket fixing bolt from exh. manifold.
- Remove exh. manifold fixing bolts and nuts from cylinder head.
- After pulling out exh. manifold a little, remove oil return pipe flange from stud bolt and remove exh. manifold w/turbo.

17. Front Exhaust Pipe

18. Fuel Leak Off Hose

19. Cylinder Head Cover

20. Glow Plug Harness

21. Injection Pipe

- Loosen sleeve nuts on injection pump side.
- Disconnect sleeve nuts on injection pipe.

22. Fuel Leak Off Pipe

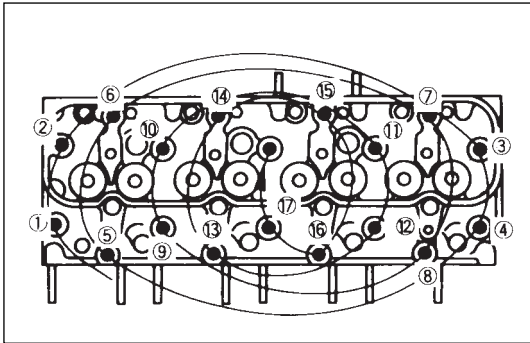
23. Rocker Arm Shaft Assembly

24. Push Rod

25. Cylinder Head W/inlet Manifold

- Disconnect cylinder head bolts in sequence shown in Figure.

26. Cylinder Head Gasket



INSTALLATION

26. Cylinder Head Gasket

- Determine cylinder head gasket grade by measuring projection of piston head.
- Install dowel in cylinder block.
- Install cylinder head gasket with top mark up.

25. Cylinder Head W/intake Manifold

- Clean up cylinder head lower surface and cylinder body upper surface.
- Install cylinder head as softly.
- Apply engine oil to screw and seat of cylinder head bolts.
- Tighten cylinder head bolts in following sequence.

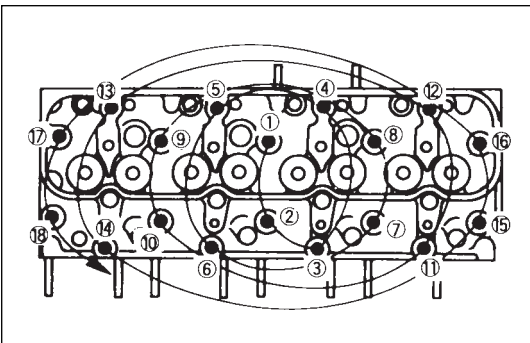
N·m (kg·m/lb·ft)

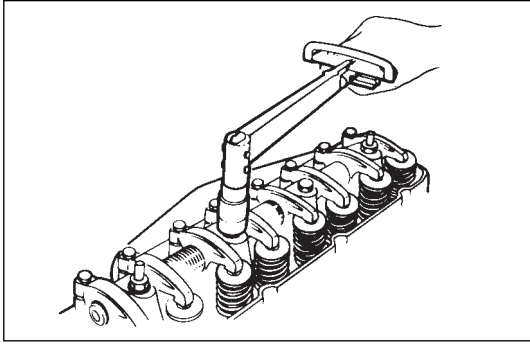
1st Step	2nd Step	3rd Step
49 (5.0/36)	60°	60°



24. Push Rod

- Inspect curvature, excessive wear and damage. (Refer to push rod inspection)





23. Rocker Arm Shaft Assembly

- Loosen all adjusting screws.
- Align fixing bolts to not of rocker arm shaft and tighten them to the specified torque.

N·m (kg·m/lb·ft)



54 (5.5/40)

- Valve clearance adjustment.
- Refer to valve clearance adjustment steps in section 00.

22. Fuel Leak Off Pipe

- Install fuel leak off pipe with new copper gasket and tighten joint bolts to the specified torque.

N·m (kg·m/lb·ft)



29 (3.0/22)

21. Injection Pipe

- Install injection pipes and sleeve nuts securely and tighten them to the specified torque.

N·m (kg·m/lb·ft)



29 (3.0/22)

20. Glow Plug Harness

19. Cylinder Head Cover

- Apply engine oil to the rocker arms and the valve spring.
- Install the cylinder head cover gasket to the cylinder head cover.
- Tighten the cylinder head cover nuts to the specified torque in the numerical order shown in the illustration.

N·m (kg·m/lb·in)



13 (1.3/113)

18. Fuel Leak Off Hose

17. Front Exh. Pipe

- Install front exhaust pipe and tighten fixing bolts to the specified torque.

N·m (kg·m/lb·ft)



19 (1.9/14)

16. Exh. Manifold W/turbo (4JG2-T Only)

- Install manifold gasket in cylinder head.
- Insert exh. manifold into studs on cylinder head a little.
- Under this condition, insert oil return pipe frange into studs on crankcase.
- Tighten exh. manifold fixing bolts and nut to specified torque.

N·m (kg·m/lb·ft)



26 (2.7/20)

15. Oil Cooler Hose

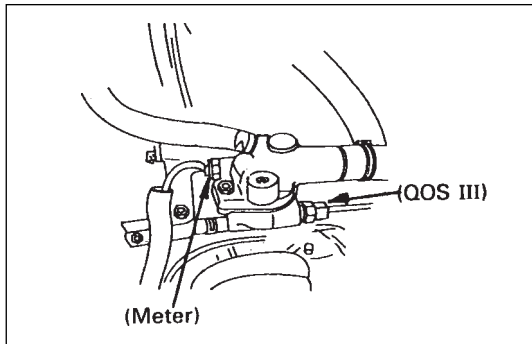
14. Oil Return Pipe: Turbo (4JG2-T Only)

- Tighten joint bolt to the specified torque.

N·m (kg·m/lb·in)



8 (0.8/69)



13. Oil Feed Pipe: Turbo (4JG2-T Only)

- Tighten joint bolts (cylinder block and turbo charger side) to the specified torque.

N·m (kg·m/lb·ft)



23 (23/17)

12. Water Outlet Hose: Turbo (4JG2-T Only)

- Connect to water inlet pipe of engine.

11. Water Inlet Hose: Turbo (4JG2-T Only)

- Connect to water outlet pipe.

10. Water Bypass Hose

- Water bypass hose connect to water inlet pipe.

9. Heater Hose

- Connect to heater pipe.

8. Engine Harness

- Connect five harness connectors to units on thermostat housing.

7. Water Hose: CSD

6. A/C Compressor

- Tighten temporarily fixing bolts (upper and front lower sides of compressor.)
- Tighten fixing bolt (rear under side of compressor) to the specified torque by using a long extension bar and torque wrench at under side of wheel arch.
- Tighten fixing bolts (front upper and lower sides of compressor) to the specified torque.

N·m (kg·m/lb·ft)



37 (3.8/27)

5. P/S Pump Drive Belt

- Install drive belts adjust belt tension by adjusting bolt and tighten locking bolt to the specified torque.

N·m (kg·m/lb·ft)



40 (4.1/30)

- Refer to "Drive Belt Adjustment" in section 6B.

4. Oil Level Gauge Guide Tube

- Tighten guide tube to the specified torque.

N·m (kg·m/lb·ft)



19 (1.9/14)

3. Intercooler Assembly (4JG2-T Only)

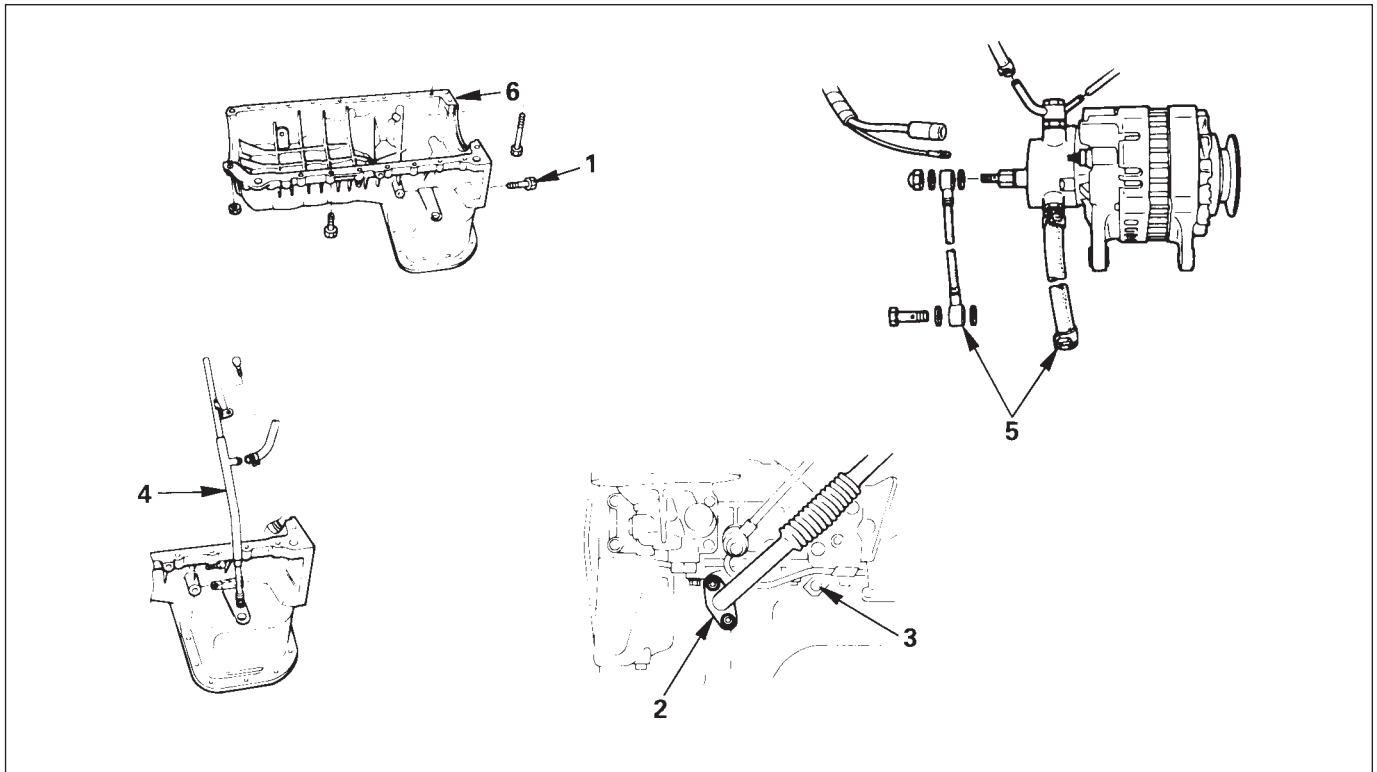
- Refer to "Drive Belt Adjustment" in section 6B.

2. Intake Air Duct (4JG2-T Only)

1. Radiator Hose Upper

- Connect to water outlet pipe.

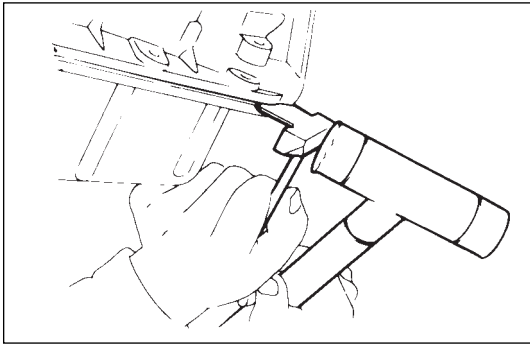
CRANKCASE

**REMOVAL****Preparation**

- Disconnect battery ground cable.
- Lift up car.
- Drain engine oil.

**NOTE**

- Install drain plug with new gasket.
- 1. Transmission Housing Bolt**
 - Remove six fixing bolts from under side of housing.
 - 2. Oil Return Pipe: Turbo (4JG2 -T only)**
 - Remove return pipe fixing nuts and set return pipe frange from stud on crankcase.
 - 3. Oil Pipe Clip Bolt: Vaccum Pump**
 - 4. Oil Level Gauge Guide Tube**
 - Remove two guide tube stay fixing bolts.
 - Disconnect blow by hose and remove oil level gauge guide tube.



5. Vacuum Hose

6. Crankcase

- Remove crankcase fixing bolts two fixing bolts for rear oil seal arch parts on crankcase could be removed extension universal joint box wrench.
- Remove crankcase by using crankcase seal cutter to shear sealant off and remove crankcase. Oil seal cutter: 5-8840-2153-0



NOTE

- Don't pry crankcase or you may distort sealing surface.
- Distorted or damaged crankcase should not be used.



INSTALLATION

6. Crankcase

- Completely remove all residual sealant, lubricant and moisture from the sealing surface of crankcase and cylinder block.
- Apply a correct width bead of sealant (TB-1207C or its equivalent) to contact surface of crankcase there must be no gaps in the bead.
- Install crankcase with cylinder-block, and tighten fixing bolts to the specified torque.

N·m (kg·m/lb·ft)

19 (1.9/14)



5. Vacuum Hose

4. Oil Level Gauge Guide Tube

- Install guide tube to the specified torque.

N·m (kg·m/lb·ft)

19 (1.9/14)



- Connect blow by hose to guide tube.

3. Oil Pipe Clip Bolts: Vacuum Pump

- Tighten oil pipe clip fixing bolts to the specified torque.

N·m (kg·m/lb·ft)

19 (1.9/14)



2. Oil Return Pipe: Turbo.

- Tighten fixing nuts to crankcase to the specified torque.

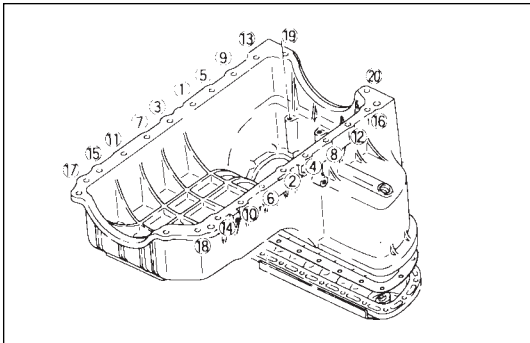
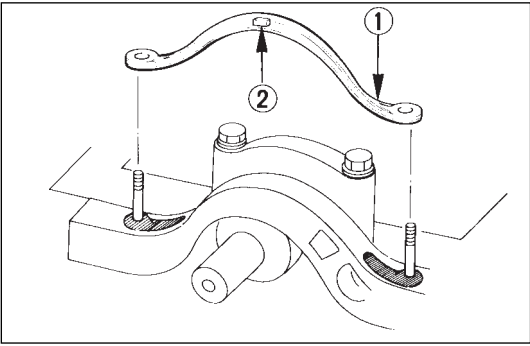
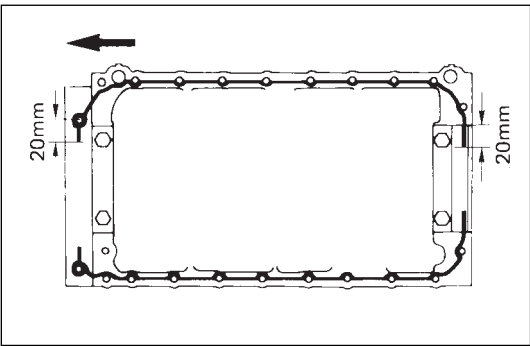
N·m (kg·m/lb·in)

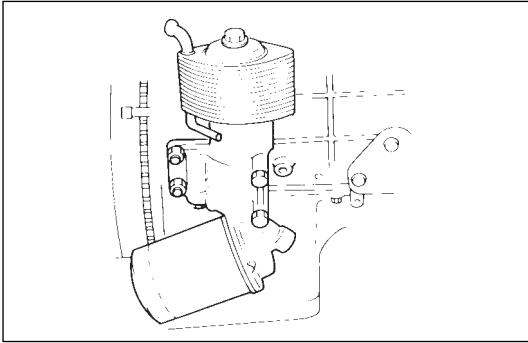
8 (0.8/69)



1. Transmission Housing Bolts

- Pour engine oil into engine.
- Install battery ground cable.
- Start the engine and check for oil leakage from crankcase.





OIL FILTER CARTRIDGE



REMOVAL

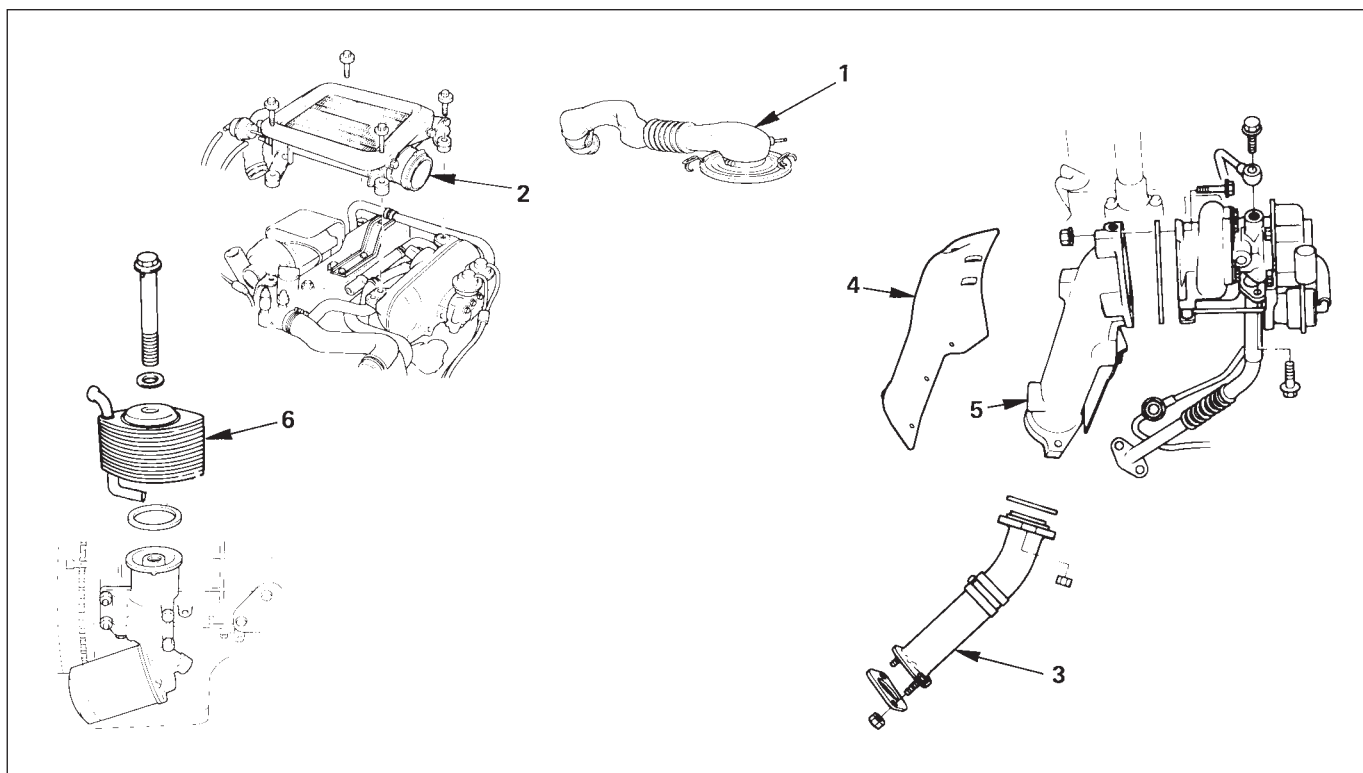
- Place a receptacle beneath the oil filter to contain the drained oil.
- Remove the oil filter cartridge using filter wrench.
Filter wrench: 5-8840-0200-0



INSTALLATION

- Lightly oil the o-ring of oil filter cartridge.
- Turn in the new oil filter cartridge by hand until the sealing face is fitted against the o-ring.
- Use the filter wrench to turn in the oil filter and additional one and 1-1/8 turns.
- Start the engine and check for oil leakage from oil filter.

OIL COOLER

**REMOVAL****Preparation**

- Disconnect battery ground cable
- Drain coolant

1. Air Cleaner Cover & Air Duct**2. Intercooler Assembly (4JG2-T Only)**

- Refer to intercooler removal steps in this section

3. Front Exh. Pipe

- Disconnect front exhaust pipe from engine side and intermediate pipe.

4. Heat Protector (4JG2-T Only)**5. Exh. Adapter (4JG2-T Only)****6. Oil Cooler**

- Disconnect water inlet and outlet hose.
- Remove fixing bolts and oil cooler.
- Put rag to beneath side of oil cooler to prevent oil leaking.

**INSTALLATION****6. Oil Cooler**

- Tighten oil cooler fixing bolt to the specified torque and connect water hose.

N·m(Kg·m/lb·ft)



29 (3.0/22)

5. Exh. Adapter (4JG2-T Only)

- Install exhaust duct with gasket and tighten fixing bolts to the specified torque.

N·m(Kg·m/lb·ft)



26 (2.7/20)

4. Heat Protector (4JG2-T Only)**3. Front Exh. Pipe**

- Install front exhaust pipe and tighten fixing bolts to the specified torque.

Exh Dust Side N·m(Kg·m/lb·ft)



67 (6.8/49)

Intermediate pipe side N·m(Kg·m/lb·ft)

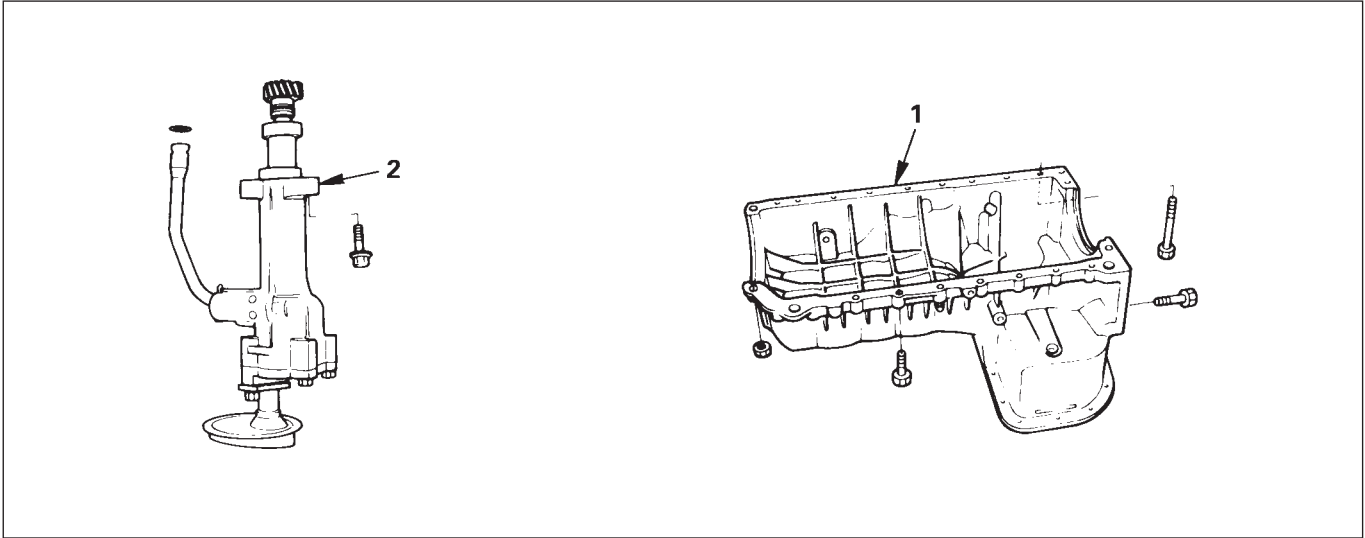
43 (4.4/32)

2. Intercooler Assembly (4JG2-T Only)

- Refer to intercooler installation steps in section.
- Pour coolant into radiator.
- Install battery ground cable.
- Start engine and check for oil and water leakage carefully.

1. Air Cleaner Cover & Air Duct

OIL PUMP ASSEMBLY



REMOVAL

Preparation

- Disconnect battery ground cable.
- Lift up car.
- Drain engine oil.

NOTE

- Install drain plug with new washer.
1. **Crankcase**
 - Refer to crankcase removal steps in this section
 2. **Oil Pump Assembly**
 - Remove oil pump asm from cylinder block.

INSTALLATION



- Prepare a solution of 80% engine oil and 20% molybdenum disulfide.
- Apply and ample coat of the solution to the teeth of the oil pump pinion.

2. Oil Pump Assembly

- Apply engine oil to oil pipe o-ring and insert the o-ring in o-ring hold on cylinder block.
- Install oil pump asm with oil pipe in cylinder block and tighten fixing bolts to the specified torque.

N·m(Kg·m/lb·ft)



19 (1.9/14)

- Tighten sleeve nut to the specified torque.

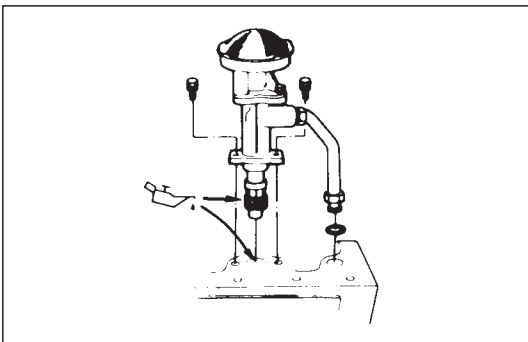
N·m(Kg·m/lb·ft)



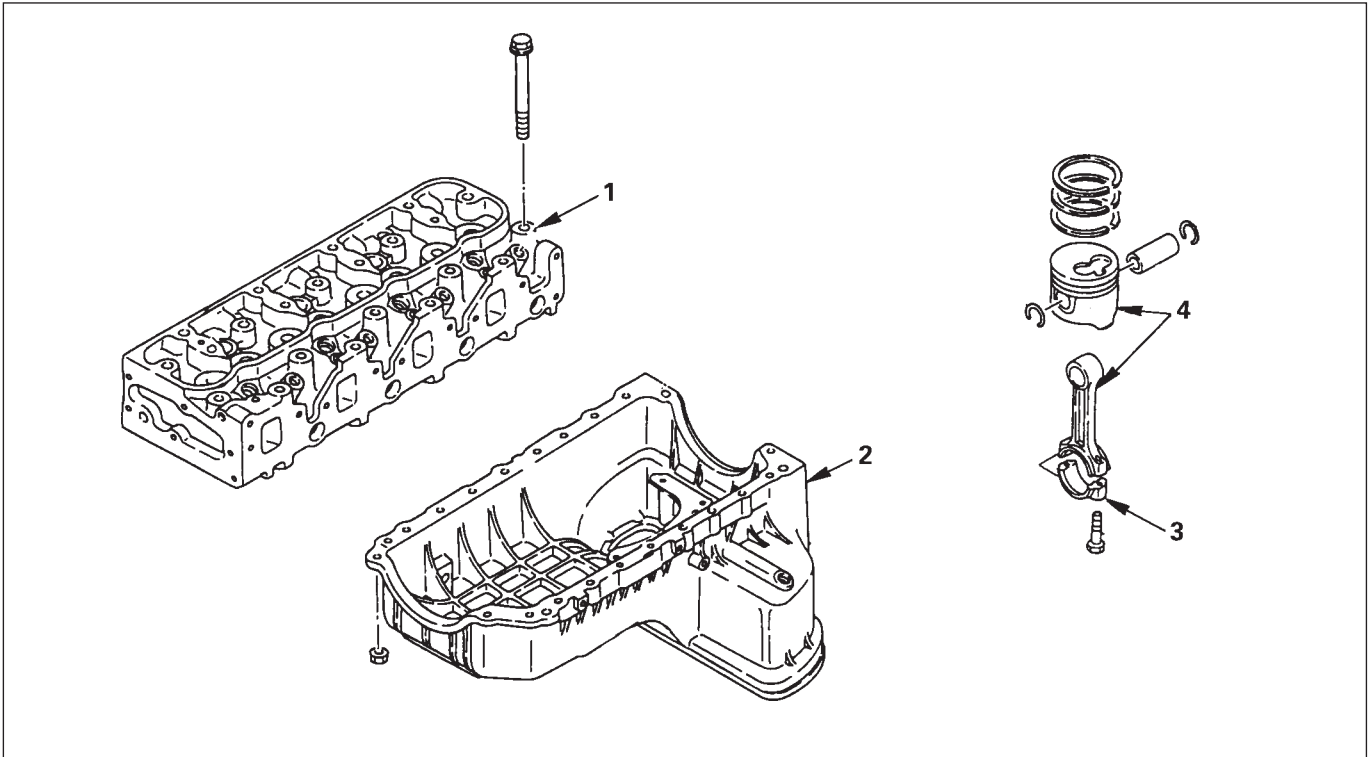
25 (2.5/18)

1. Crankcase

- Refer to crankcase installation steps in this section



PISTON, PISTON RING AND CONNECTING ROD

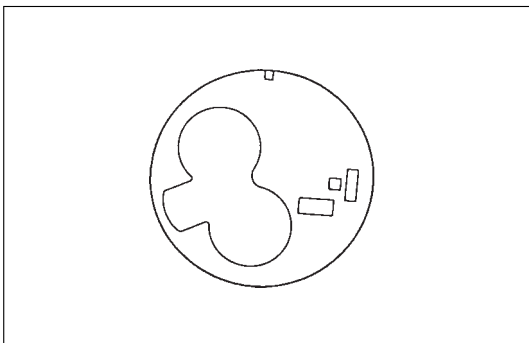


↔ REMOVAL

1. **Cylinder Head**
 - Refer to "Cylinder Head" removal in this section.
2. **Crankcase**
 - Refer to "Crankcase" in this section.
3. **Connecting Rod Bearing Cap**
 - Before removing the bearing cap, remove carbon on the top of cylinder bore.
4. **Piston, Piston Rings and Connecting Rod**
 - Push piston and connecting rod out from the top of cylinder bore.

↔ INSTALLATION

4. **Piston, Piston Rings and Connecting Rod**
 - Apply engine oil to cylinder bore, connecting rod bearings and crank pins.
 - In installing the piston, its front mark must face the engine front side.
3. **Connecting Rod Bearing Cap**
 - The bearing cap number must be same as connecting rod number.
 - Apply engine oil to the thread and sealing surface of each nuts.
 - Tighten nuts to the specified torque.



N·m(Kg·m/lb·ft)



1st step 29 (3.0/22)	2nd step 45° – 60°
----------------------	--------------------

- After tightening the nuts, make sure that the crankshaft rotates smoothly.

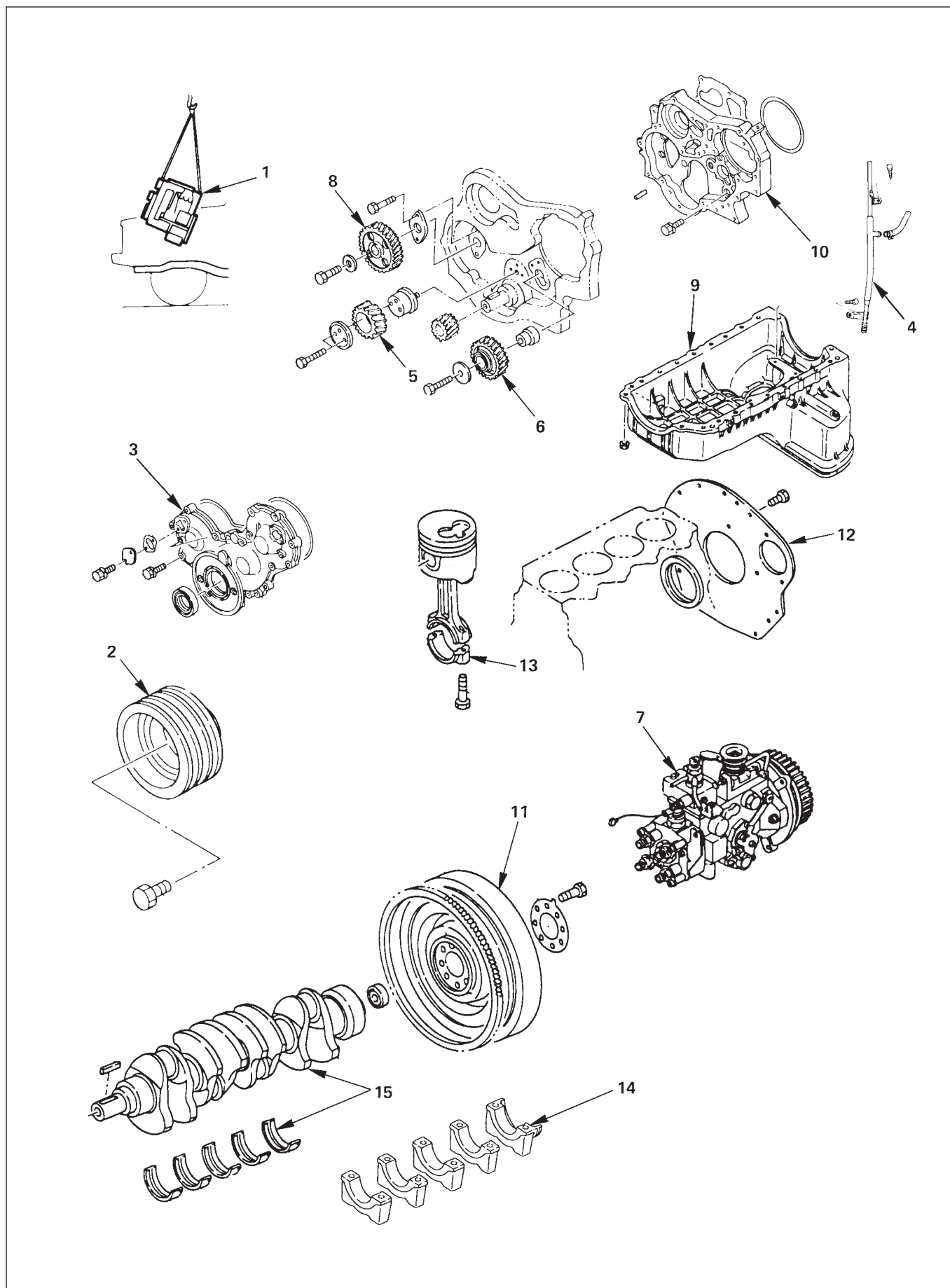
2. Crankcase

- Refer to “Crankcase” in this section.

1. Cylinder Head

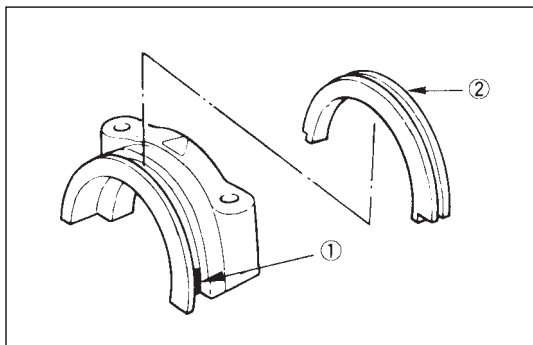
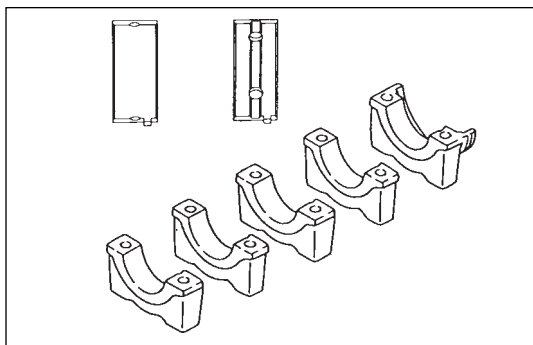
- Refer to “Cylinder Head” installation in this section.



CRANKSHAFT AND MAIN BEARING



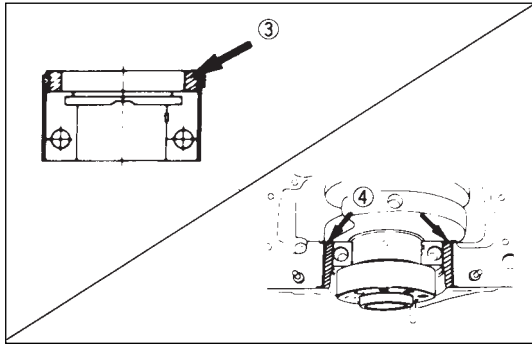
**REMOVAL**

1. **Engine Assembly**
 - Refer to "Engine Assembly" removal in this section.
2. **Crankshaft Damper Pulley**
3. **Timing Gear Case Cover**
4. **Oil Level Gauge and Guide Tube**
5. **Idler Gear "B" and Shaft**
6. **Idler Gear**
7. **Injection Pump**
8. **Camshaft Timing Gear**
9. **Crankcase**
10. **Gear Case**
11. **Flywheel**
12. **Rear Plate**
13. **Connecting Rod Caps**
14. **Crankshaft Main Bearing Caps**
15. **Crankshaft and Main Bearings**

**INSTALLATION**

15. **Crankshaft and Main Bearings**
 - Install main bearings in the cylinder body and main bearing cap respectively.
 - Apply new engine oil to upper and lower main bearings.
 - Make sure that main bearing are in correct position.
- 
 - Install crankshaft with care.
 - Apply engine oil to the thrust washer.
 - Install thrust washer on No. 3 journal. Oil grooves in thrust washer must face the crankshaft.
- 
14. **Crankshaft Main Bearing Caps**
 - Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.
 - Install bearing caps in the order of numbers, starting with cylinder body front side.
 - Tighten main bearing fixing bolts to the specified torque.

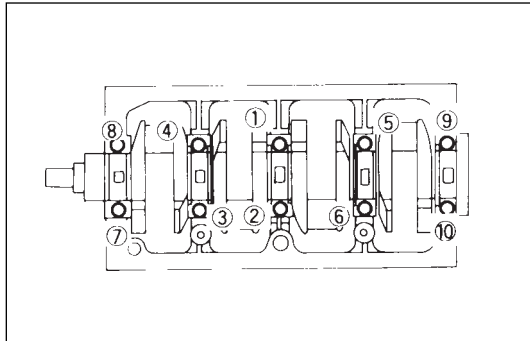




N·m(Kg·m/lb·ft)

167 (17.0/123)

- After tightening the bolts, make sure that the crankshaft rotates smoothly.



13. Connecting Rod Caps

- The cap number must be same as connecting rod number.
- Apply engine oil to the thread and sealing surface of each nut.
- Tighten nuts to the specified torque.

N·m(Kg·m/lb·ft)

1st step 29 (3.0/22)	2nd step 45° – 60°
----------------------	--------------------

- After tightening the nuts, make sure that the crankshaft rotates smoothly.

12. Rear Plate

- Tighten bolts to the specified torque.

N·m(Kg·m/lb·ft)



82 (80/61)

11. Flywheel

- Tighten bolts to the specified torque.

N·m(Kg·m/lb·ft)



118 (12.0/87)

10. Gear Case

- Tighten fixing bolts to the specified torque.

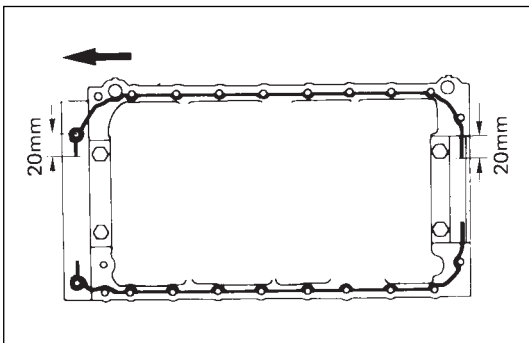
N·m(Kg·m/lb·ft)



19 (1.9/14)

9. Crankcase

- Remove oil from oil pan mounting surface, and dry the surface.
- Apply a proper wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
- Crankcase must be installed within 5 minutes after sealant application.
- Tighten fixing bolts and nuts to the specified torque.

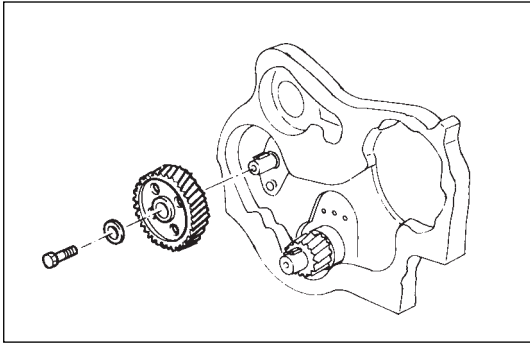


Bolts

N·m(Kg·m/lb·ft)



19 (1.9/14)



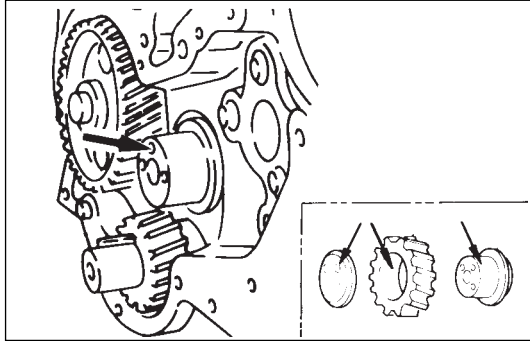
Nuts	N·m(Kg·m/lb·ft)
	24 (2.4/18)

8. Camshaft Timing Gear

- 1) Install the camshaft timing gear to the camshaft. The timing gear mark ("Y - Y") must be facing outward.
- 2) Tighten the timing gear to the specified torque.

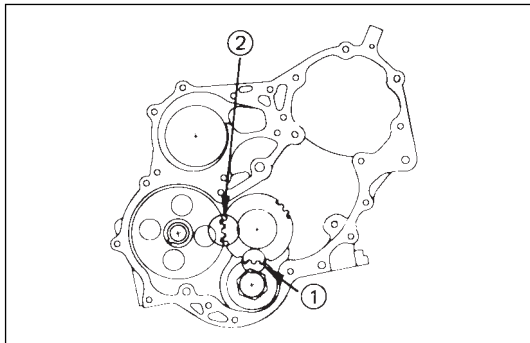


	N·m(Kg·m/lb·ft)
	64 (6.5/47)



6. Idler Gear

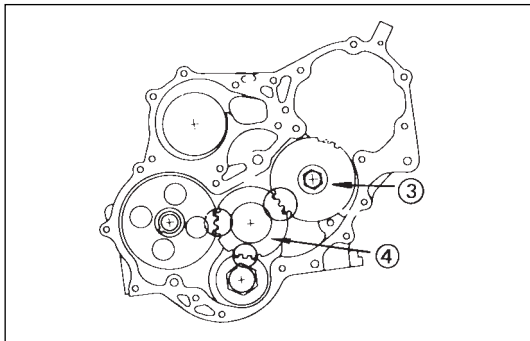
- 1) Apply engine oil to the idler gear and the idler gear shaft. The idler gear shaft oil hole must be facing up.
- 2) Position the idler gear setting marks "X" and "Y" so that they are facing the front of the engine.



- 3) Align the idler gear "X" setting mark with the crankshaft timing gear ① "X - X" setting mark.
- 4) Align the idler gear "Y" setting mark with the camshaft timing gear ② "Y - Y" setting mark.
- 5) Install the thrust collar and bolts to the cylinder body through the shaft. The thrust collar oil hole must be facing up, and the thrust collar chamfered must be outward.
- 6) Tighten the idler gear bolt to the specified torque.



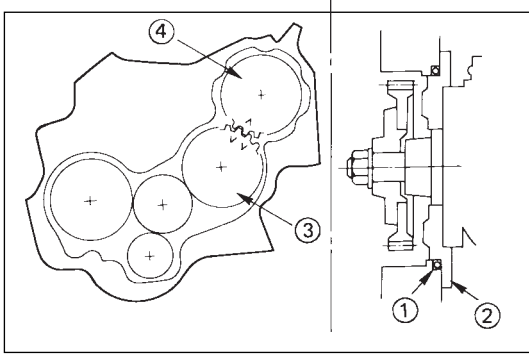
	N·m(Kg·m/lb·ft)
	19 (1.9/14)



5. Idler Gear "B" and Shaft

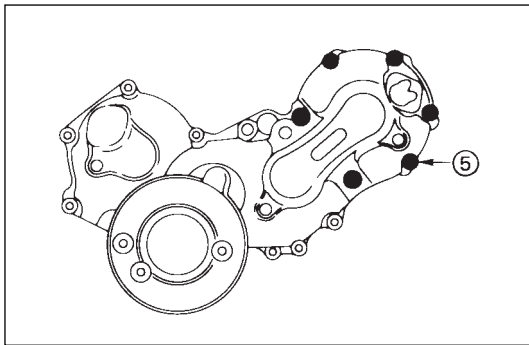
- 1) Apply engine oil to the idler gear and the idler gear shaft.
- 2) Align the idler gear "B" ③ "Z" setting mark with the idler gear "A" ④ "Z - Z" setting mark.
- 3) Tighten the idler gear bolt to the specified torque.

	N·m(Kg·m/lb·ft)
	76 (7.7/56)

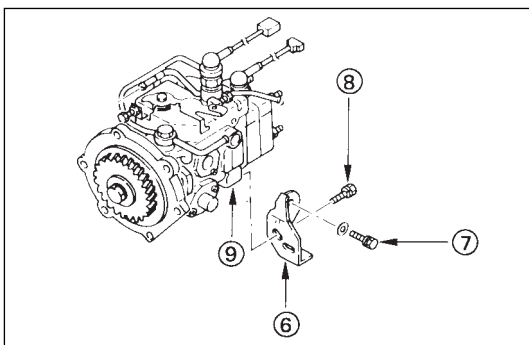


7. Injection Pump

- 1) Install the O-ring ① to the injection pump flange ②.
- 2) Install the injection pump to the timing gear case. Align the idler gear "B" ③ "V - V" mark with the injection pump timing gear ④ "V" mark.



- 3) Temporarily tighten the six injection pump nuts ⑤. The injection pump nuts will be finally tightened after the injection pump rear bracket bolts.



- 4) Install the injection pump rear bracket ⑥ and the rear bracket bolts ⑦ to the cylinder body.
- 5) Install the rear bracket bolts ⑧ to the injection pump bracket ⑨. Do not tighten the bolts. The rear bracket bolts ⑦ and ⑧ will be finally tightened to the specified torque after the injection pump nuts.

- 6) Tighten the infection pump bracket bolts ⑦ to the specified torque.



N·m(Kg·m/lb·ft)

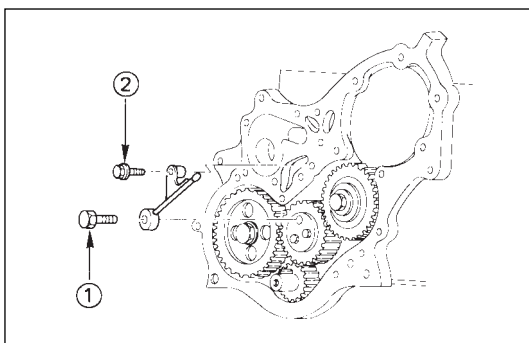
20 (2.0/15)

- 7) Tighten the injection pump bracket bolts ⑧ to the specified torque.



N·m(Kg·m/lb·ft)

40 (4.1/30)



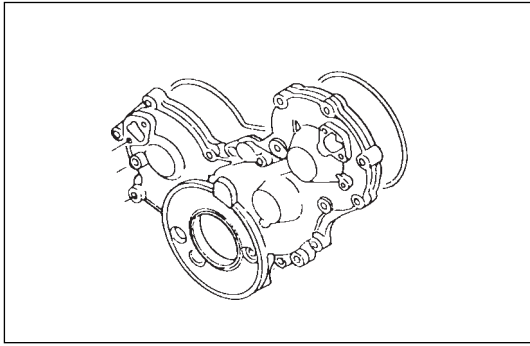
4. Timing Gear Oil Pipe

- 1) Install the oil pipe to the timing gear case and idler gear "A".
- 2) Tighten the oil pipe eye bolt ① and bolt ② to the specified torque.



N·m(Kg·m/lb·ft)

13 (1.3/9)

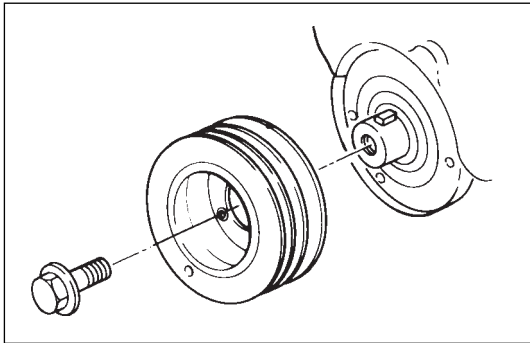


3. Timing Gear Case Cover

- 1) Align the gear case with the timing gear case knock pin and then install the timing gear case cover.
- 2) Tighten the gear case cover bolts to the specified torque.

N·m(Kg·m/lb·in)

8 (0.8/69)



2. Crankshaft Damper Pulley

Tighten the crankshaft damper pulley bolt to the specified torque.

NOTE:

Hold the flywheel ring gear stationary to prevent the crankshaft from turning when tightening the damper pulley.

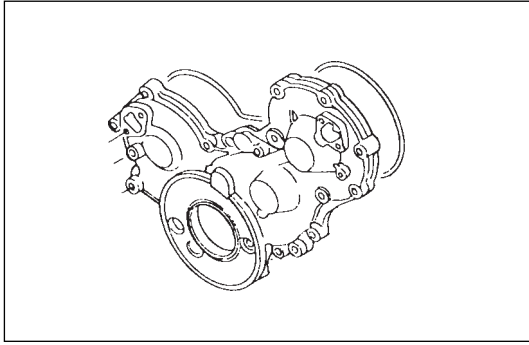
N·m(Kg·m/lb·ft)

206 (21.0/152)



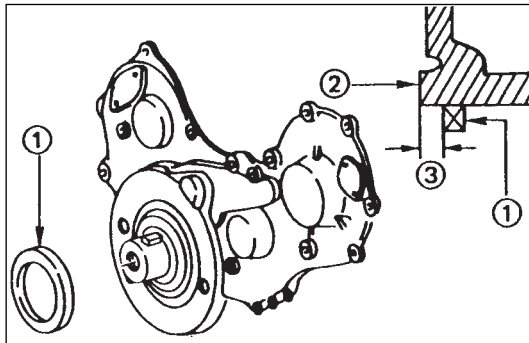
1. Engine Assembly

FRONT OIL SEAL



REMOVAL

1. Crankshaft Damper Pulley
2. Timing Gear Case Cover Assembly
3. Front Oil Seal
 - Remove crankshaft front oil seal using suitable size box wrench for push the oil seal from inside of timing gear case cover.



INSTALLATION

3. Front Oil Seal
 - Use the installer to install the front oil seal (1) to the gear case cover (2).

Oil Seal Installer: 5-8840-2061-0

Note the oil seal installation depth (3) shown in the illustration.

Depth (3) = 1 mm (0.039 in).
2. Timing Gear Case Cover Assembly
 - 1) Align the timing gear case cover with the timing gear case dowel pin then install the timing gear case cover.
 - 2) Tighten the timing gear case cover bolts to the specified torque.

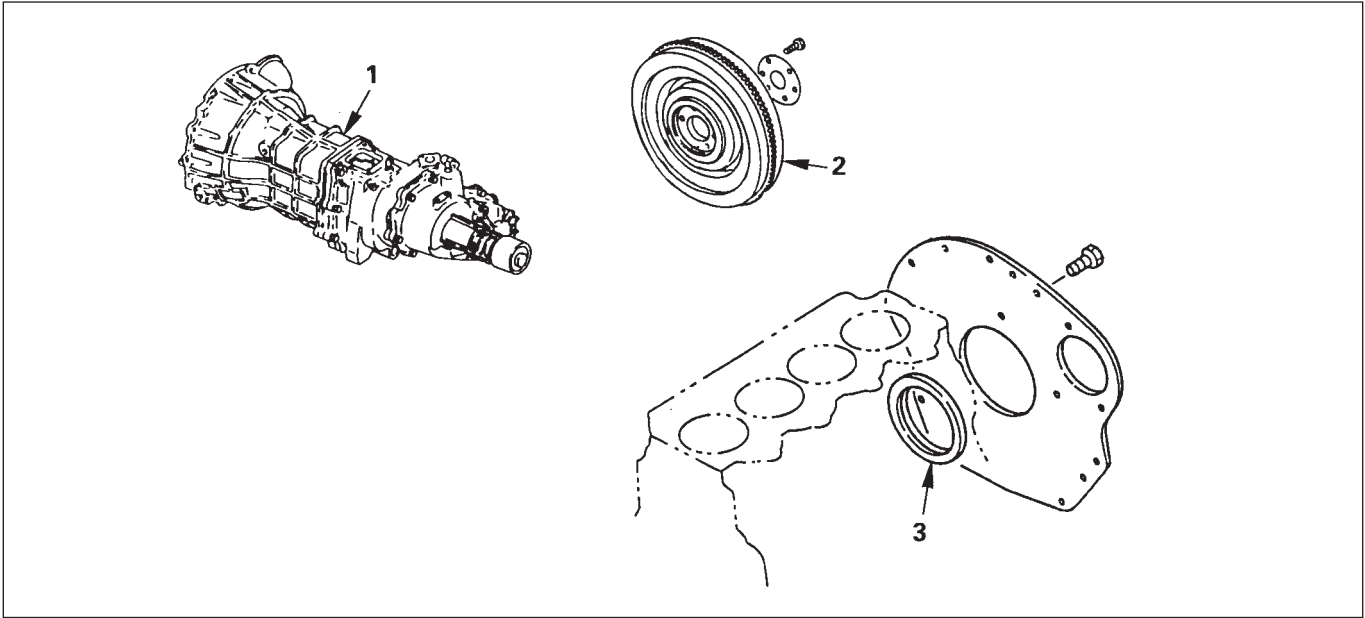


N·m(Kg·m/lb·in)

8 (0.8/69)

1. Crankshaft Damper Pulley

REAR OIL SEAL



REMOVAL

1. Transmission Assembly

- Refer to "Transmission" removal in section 7.

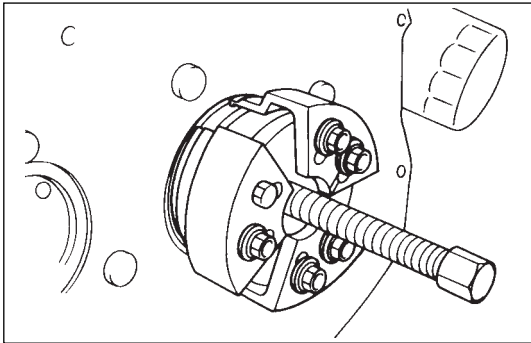
2. Flywheel

3. Rear Oil Seal

- With the oil seal pushed in deep, install the special tool as shown in the illustration and remove the oil seal.



Oil Seal Remover : 5-8840-2362-0



INSTALLATION

3. Rear Oil Seal

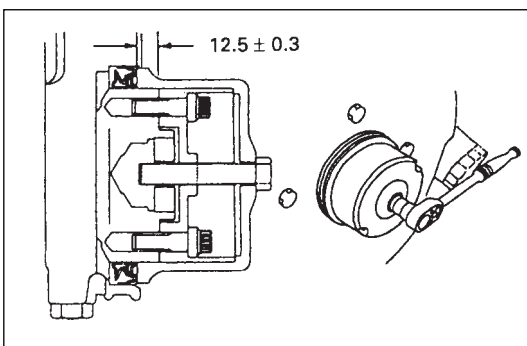
8. Crankshaft Rear Oil Seal

- 1) Tighten the adapter to the crankshaft rear and section with 2 bolts.
- 2) Insert the oil seal into the peripheral section of the adapter,
- 3) Insert the sleeve into the adapter section, and 1) tighten it with a bolt (M12 x 1.75L = 70) until the adapter section hits the sleeve.
- 4) Remove the adapter and the sleeve.
- 5) With the seal pressed in, check the dimension of the oil seal section.

Standard Dimension = 12.5 ± 0.3 mm



Oil Seal Installer: 5-8840-2359-0



2. Flywheel

- Tighten bolts to the specified torque.

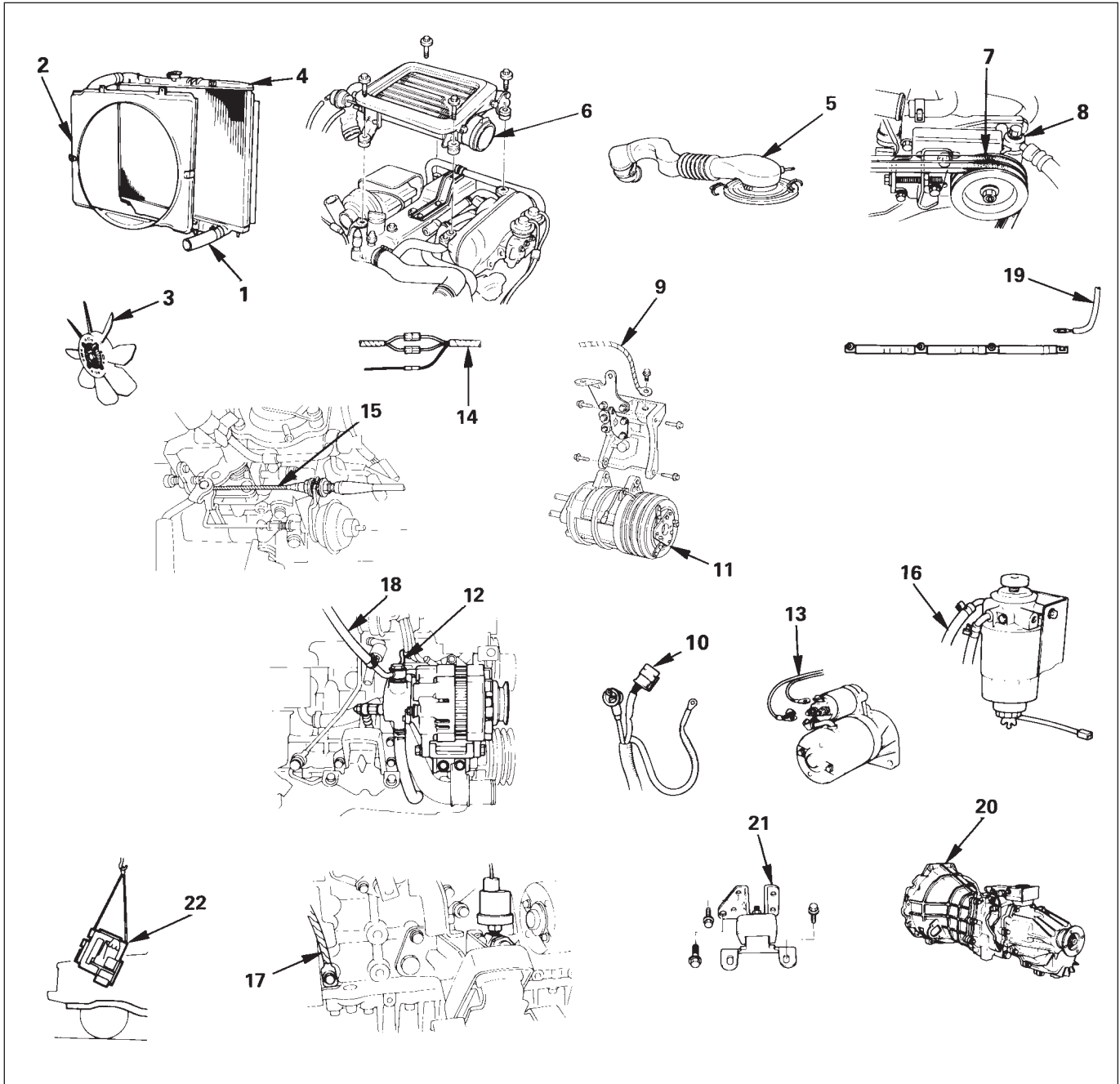
N·m(Kg·m/lb·ft)

118 (12.0/87)

1. Transmission Assembly

- Refer to “Transmission” installation in section 7.

ENGINE ASSEMBLY



REMOVAL

Preparation

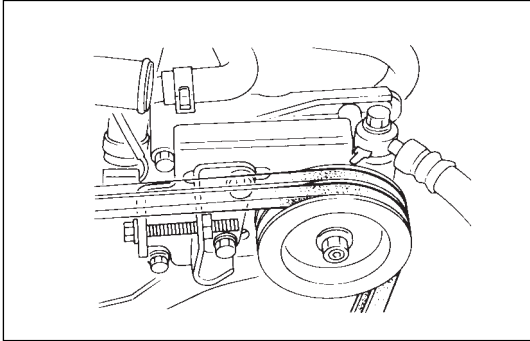
- Space stands and removal front tires.
- Removal battery. (two batteries for cold area)
- Drain coolant.
- Disconnect window washer hose and remove engine hood.

1. Radiator Hose

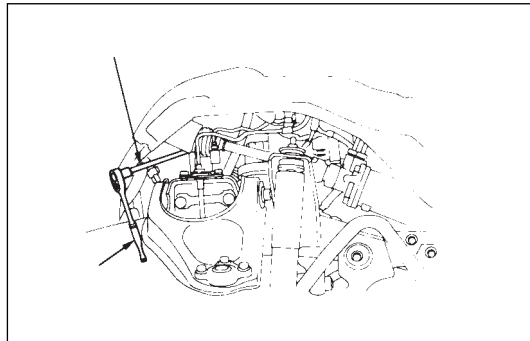
- Disconnect upper and lower hoses from engine side.

2. Fan Shroud

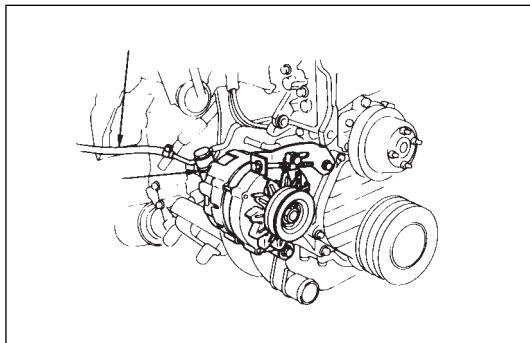
- Disengage clips and remove upper and lower fan shrouds.



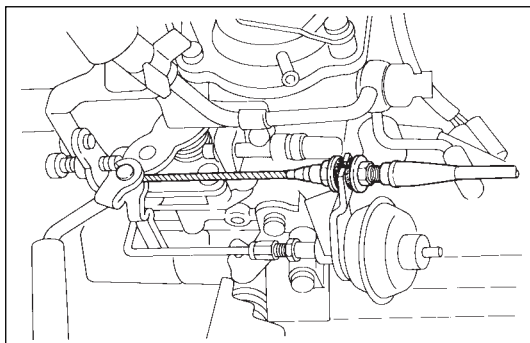
3. **Cooling Fan Assembly**
 - Remove cooling fan asm fixing nuts, cooling fan asm, fan pulley and center.
4. **Radiator Assembly**
 - Remove bracket and radiator asm.
5. **Air Cleaner Cover & Air Duct**
6. **Intercooler Assembly (4JG2 -T only)**
 - (Refer to Intercooler removal steps in this section)
7. **P/S Pump Drive Belts**
 - Loosen P/S pump fixing bolts and adjusting bolt and remove two drive belts.
8. **P/S Pump Assembly**
 - Remove two fixing bolts (front side), a fixing nut (rear side) and support P/S pump asm with oil hoses by tying to body side.



9. **Engine Ground Cable**
 - Disconnect ground cable from A/C compressor bracket.
10. **AC Generator Harness**
 - Disconnect B terminal and harness connector from AC generator.
11. **A/C Compressor Assembly**
 - Remove A/C compressor fixing bolt (rear under side of compressor) by using a long extension bar at under side of wheel arch.
 - Disconnect magnetic clutch harness connector.
 - Remove fixing bolts (upper and front lower side of compressor) and set A/C compressor asm with pipe lines on battery carrier.



12. **Vacuum Hose: Vacuum Pump**
 - Disconnect vacuum hose from vacuum pump.
13. **Starter Harness**
 - Disconnect B terminal and put cable harness close to chassis side.
 - Disconnect S terminal connector.
14. **Engine Harness.**
 - Disconnect engine harness close to engine side.

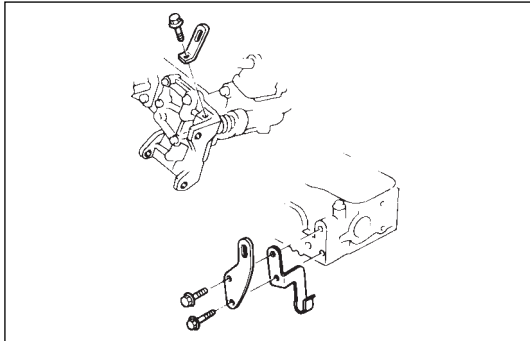


15. **Accelerator Cable**
 - Loosen locking nut at bracket and disconnect accelerator cable from injection pump control lever.
16. **Fuel Hoses**
 - Disconnect fuel hoses from injection pump side and take care not to spill fuel and enter dust.
17. **Engine Ground Cable**
 - Disconnect ground cable from left rear side of timing gear case.

18. Vacuum Hose : Vacuum Tank

- Disconnect vacuum hose from vacuum pump side.

19. Glow Plug Harness



20. Transmission Assembly

- Install special tools (engine hangers) in front right and left rear sides of cylinder head.
- Front right side; use the ground cable fixing bolt on A/C compressor bracket.
- Left rear side; fix hanger together with oil cooler hose clip.
Engine hanger: 5-8840-2032-0
- Lift engine carefully by using hoist.

21. Engine Mounting

- Remove fixing bolts (both left and right side) using extension bar and box wrench at under side of wheel arches.

22. Engine Assembly

- Install special tools (engine hangers) in left rear and front right sides of cylinder head.
- Lift engine carefully by using hoist.
- Lift front part of engine higher than rear part of it.
- Take out engine asm taking care not to damage full pipes, brake pipes and etc.



INSTALLATION

22. Engine Assembly

- Position engine mountings by using hoist.

21. Engine Mounting

- After all fixing bolts (left: two bolts, rights: two bolts) were inserted to every holes, and engine asm and tighten fixing bolts to the specified torque.

N·m(Kg·m/lb·ft)

40 (4.1/30)

20. Transmission Assembly

- Refer to transmission installation steps in section 7.

19. Glow Plug Harness

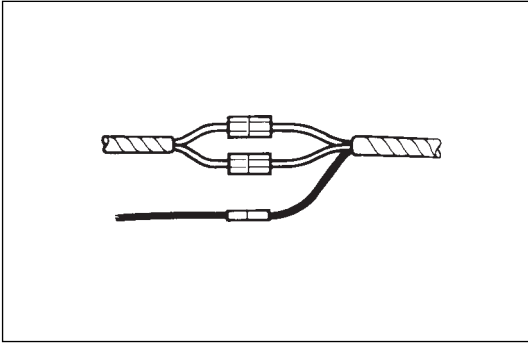
18 Vacuum Hose: Vacuum Tank

17. Engine Ground Cable

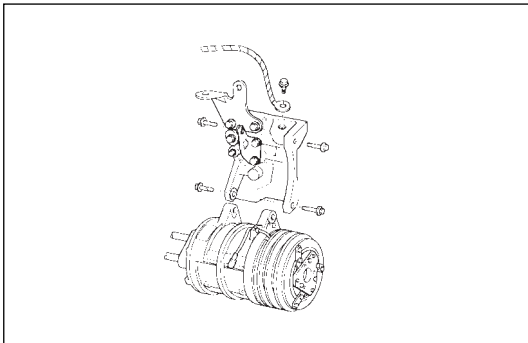
16. Fuel Hose

15. Accelerator Cable

- Refer to accelerator cable installation steps in section 6C.



- 14. Engine Harness.
- 13. Starter Harness
- 12. Vacuum Hose: Vacuum Pump

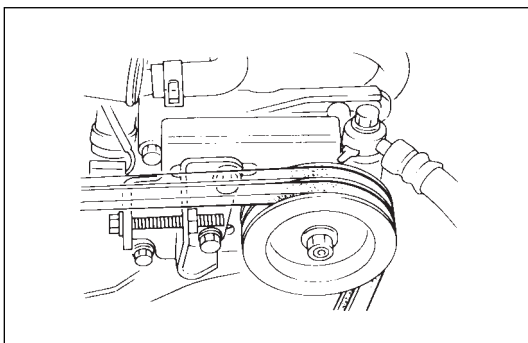
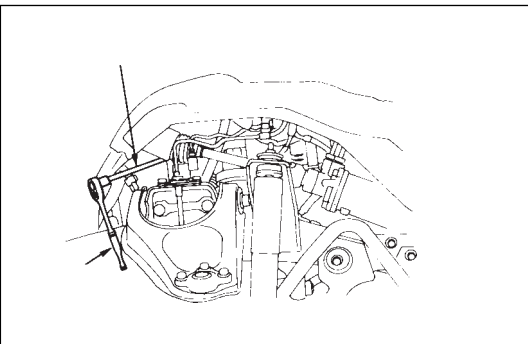


11. A/C Compressor Assembly

- Tighten temporarily fixing bolts (upper and front lower sides of compressor).
- Tighten fixing bolt (rear under side of compressor) to the specified torque by using along extension bar and torque wrench at under side of wheel arch.
- Tighten fixing bolts (front upper and lower sides of compressor) to the specified torque.

N·m(Kg·m/lb·ft)

40 (4.1/30)



- 10. **A.C. Generator Harness**
- 9. **Engine Ground Cable**
 - Attached ground cable to A/C compressor bracket.
- 8. **P/S Pump Assembly**
 - Install P/S pump asm in engine and tighten temporarily fixing nut.
- 7. **P/S Pump Drive Belt**
 - Install drive belts adjust belt tension by adjusting bolt and tighten locking bolt to the specified torque.
 - Refer to “Drive Belt Adjustment” in section 6B.

N·m(Kg·m/lb·ft)



40 (4.1/30)

- 6. **Intercooler Assembly (4JG2-T Only)**
 - Refer to intercooler installation steps in this section.
- 5. **Air Cleaner Cover & Duct**
- 4. **Radiator Assembly**
 - Install cushion rubber in under left and right part of radiator and position radiator.
 - Fix radiator by bracket.
- 3. **Cooling Fan Assembly**
 - Install cooling fan asm and tighten fixing bolts to the specified torque.

N·m(Kg·m/lb·in)



8 (0.8/69)

- 2. **Fan Shroud**
- 1. **Radiator Hose**
 - Connect upper and lower hose to engine side.
 - Pour coolant in to radiator.
 - Install battery.
 - Connect window washer hose.

SECTION 6B

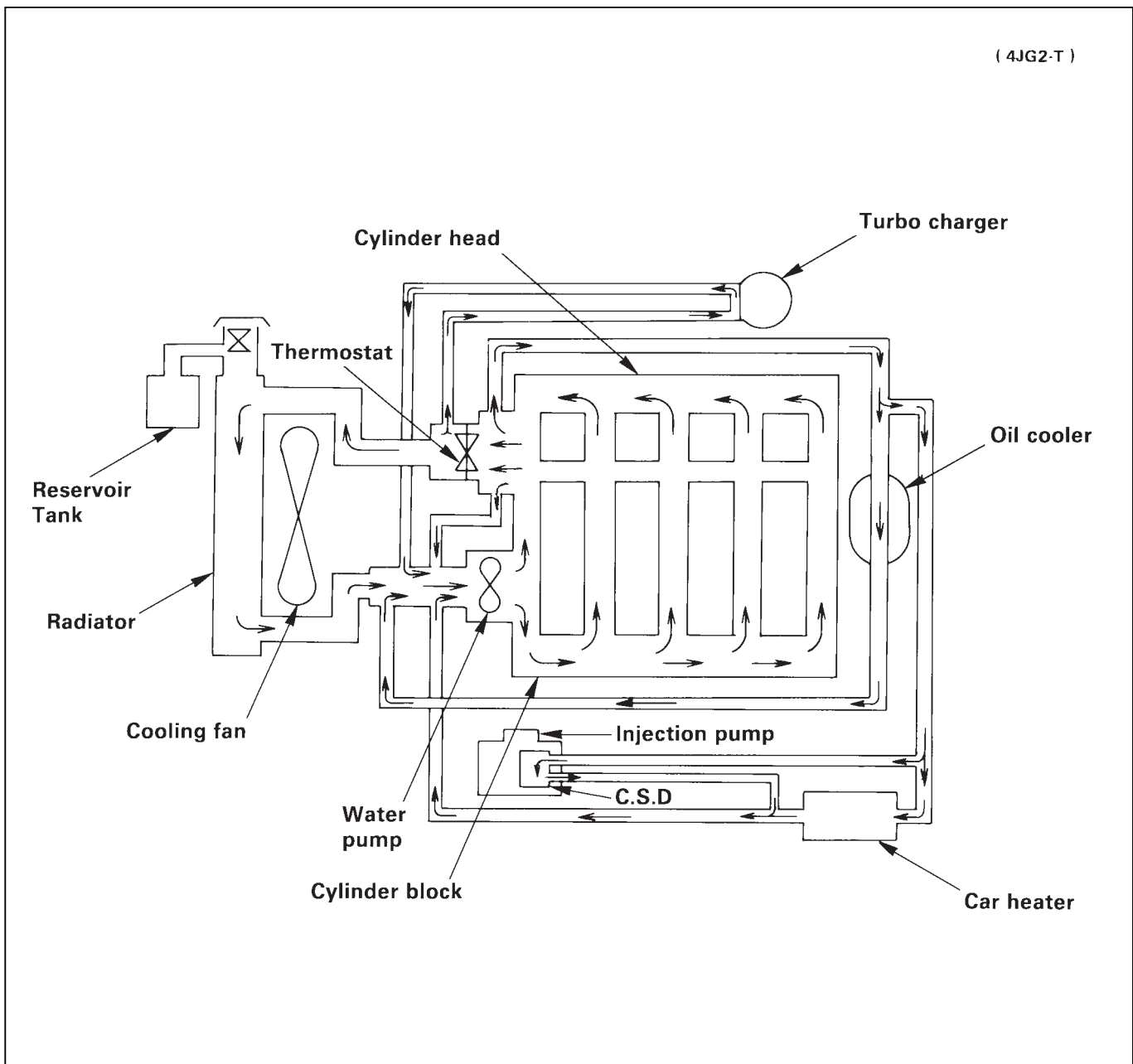
ENGINE COOLING

CONTENTS

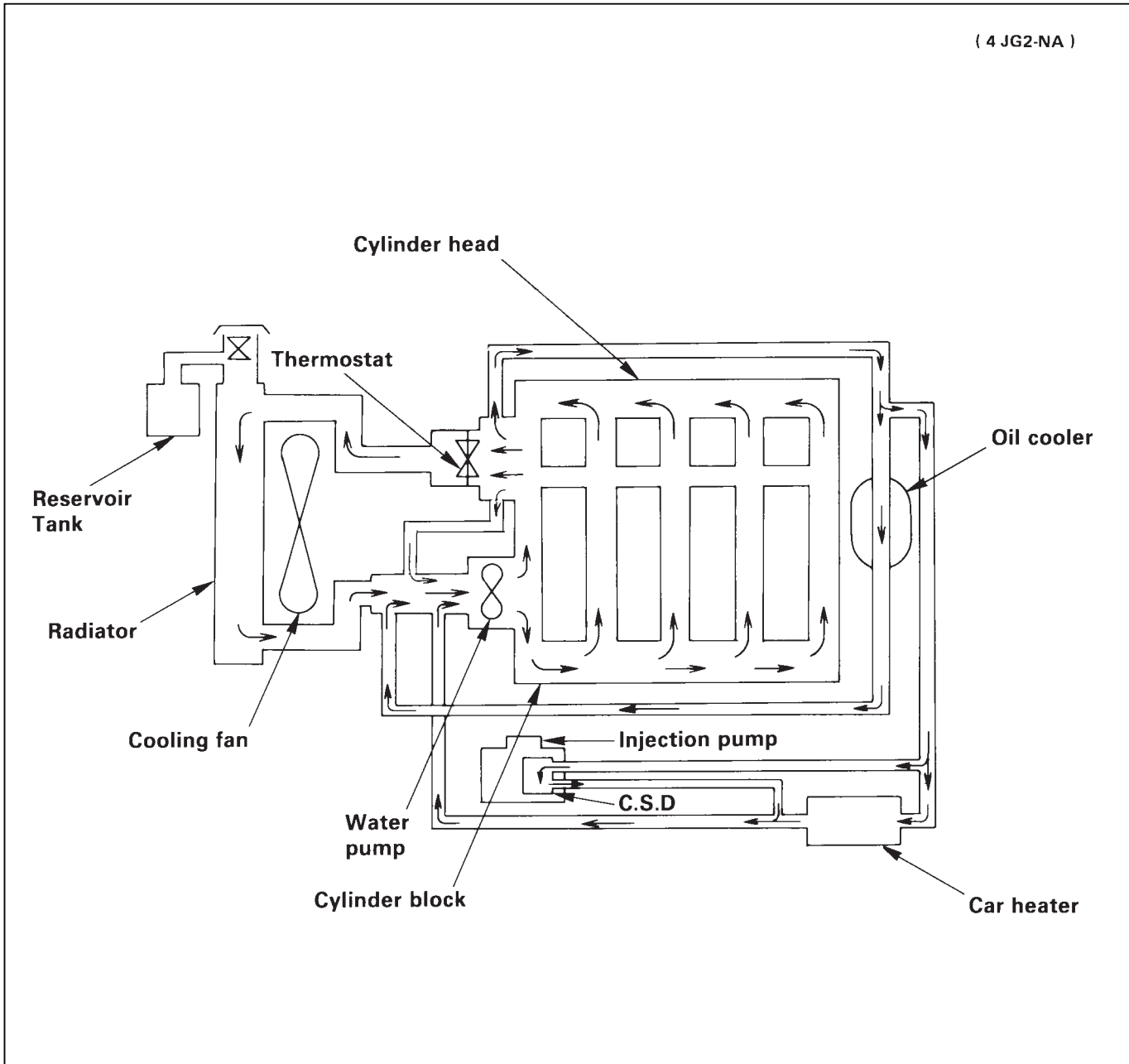
	PAGE
General Description	6B- 1
On-Vehicle Service	6B- 5
Water Pump	6B- 5
Thermostat	6B- 7
Radiator	6B- 9
Drive Belt Adjustment	6B-15

GENERAL DESCRIPTION

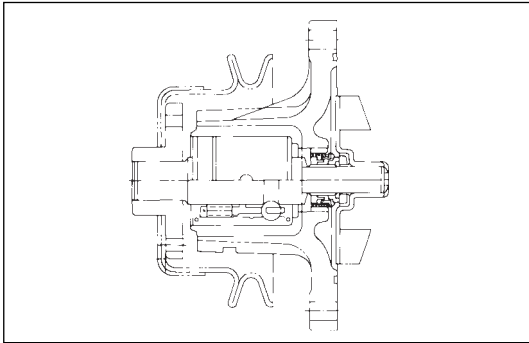
(4JG2-T)



(4 JG2-NA)

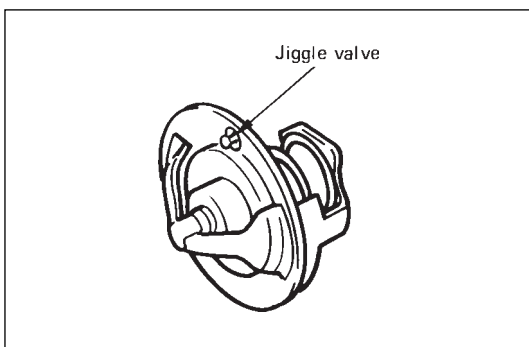


The cooling system is a pressurized coolant forced circulation type which consists of water pump, thermostat cooling fan, radiator and other components. The circulating coolant cools the lubricating oil in the oil filter and turbocharger.



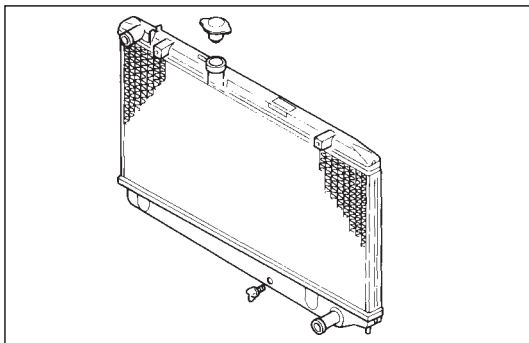
WATER PUMP

The coolant pump is a centrifugal impeller type and is driven by V type drive belt.



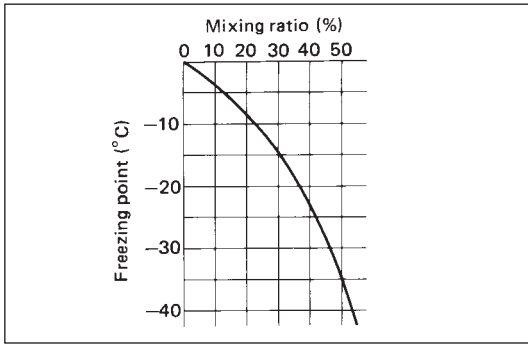
THERMOSTAT

The thermostat is a wax pellet type with a jiggle valve and is installed in the thermostat housing.



RADIATOR

The radiator is a tube type with corrugated fins. In order to raise the boiling point of coolant, the radiator is fitted with a cap in which the valve is operated under the pressure.



ANTI-FREEZE SOLUTION

- Relation between Mixing ratio and Freezing point
Freezing temperature of the engine coolant varies with the ratio of anti-freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.
- Calculation of mixing ratio

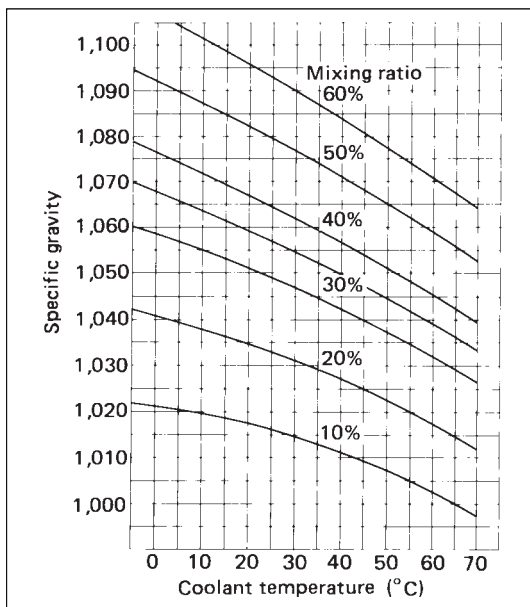
Mixing ratio

$$= \frac{\text{Anti-freeze solution (Lit/qt.)}}{\text{Anti-freeze solution (Lit/qt.)} + \text{Water (Lit/qt.)}}$$

Note: Anti-freeze solution + Water = 8.6 lit
Total cooling system capacity.

In case of 6.8 lit total cooling system capacity

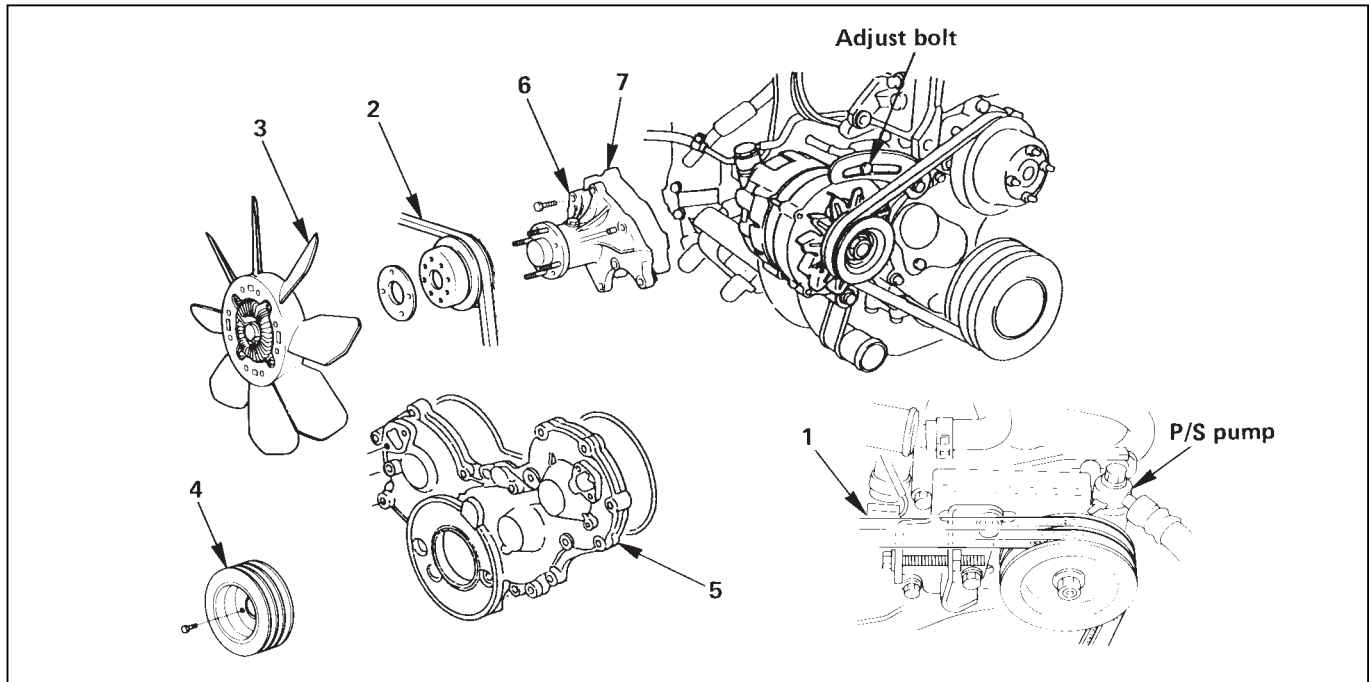
Mixing ratio (%)	Anti-freeze solution: lit. (imp. qt./U.S. qt)	Water: lit. (imp.qt/U.S. qt)
0	0 0	6.8 (5.98/7.19)
5	0.3 (0.26/0.32)	6.5 (5.71/6.87)
10	0.7 (0.62/0.74)	6.0 (5.28/6.34)
15	1.0 (0.88/0.93)	5.8 (5.1/6.13)
20	1.4 (1.23/1.48)	5.4 (4.75/5.7)
25	1.7 (1.50/1.80)	5.1 (4.49/5.39)
30	2.0 (1.76/1.86)	4.8 (4.22/5.04)
35	2.4 (2.11/2.23)	4.4 (3.87/4.65)
40	2.7 (2.38/2.85)	4.1 (3.6/4.33)
45	3.1 (2.72/2.87)	3.7 (3.26/3.91)
50	3.4 (2.99/3.60)	3.4 (2.99/3.59)



- Mixing ratio
Check the specific gravity of engine coolant in the cooling system in temperature ranges from 0° C to 50° C using a suction type hydrometer, then determine the density of the coolant by referring to the table at left.

ON-VEHICLE SERVICE

WATER PUMP



REMOVAL

Preparation

- Drain coolant.

1. P/S pump Drive Belts

- Loosen P/S pump mounting bolt, loosen adjust bolts and remove the drive belts.

2. AC Generator Drive Belt

- Loosen AC Generator mounting bolt (bottom side), adjust plate lock bolt, and remove the drive belt.

3. Cooling Fan Assembly

- Remove lock nut and take out cooling fan assembly, distance piece, and fan pulley.

4. Crankshaft Damper Pulley.

5. Gear Case Cover.

6. Water Pump Assembly

7. O-ring



INSPECTION

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced.

- Cracks in the coolant pump body
- Coolant leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller

**INSTALLATION****7. O-ring**

- Set O-ring in water pump body groove.

6. Water Pump Assembly

- Install water pump assembly, and tighten to specified torque.

N·m (Kg·m/lb·ft)



20(2.0/14)

5. Gear Case Cover

- Install gear case cover, and tighten to specified torque.

N·m (Kg·m/lb·in)



8(0.8/69)

4. Crankshaft Damper Pulley

- Install crankshaft damper pulley, and tighten to specified torque.

N·m (Kg·m/lb·ft)



19(1.9/14)

3. Cooling Fan Assembly

- Install fan pulley, distance piece, and cooling fan assembly in this order on water pump, and tighten to specified torque.

N·m (Kg·m/lb·in)



8(0.8/69)

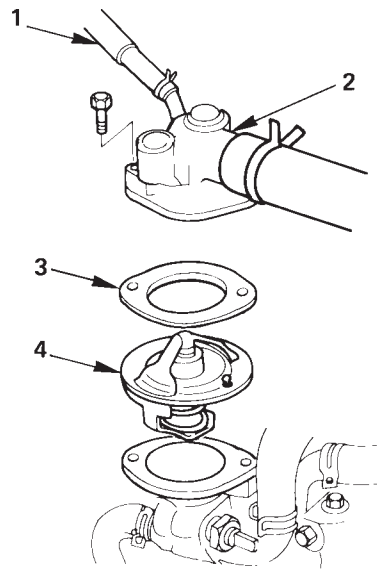
2. AC Generator Drive Belt

- Install AC Generator drive belt and adjust belt tension.
- (Refer to Drive Belt Adjustment in this Section).

1. P/S Pump Drive Belts

- Install P/S pump drive belts and adjust belt tension.
- (Refer to Drive Belt Adjustment in this Section).

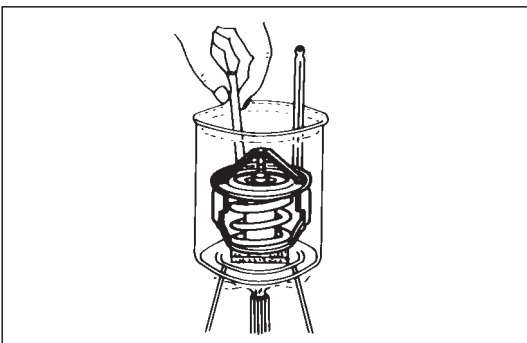
THERMOSTAT

**REMOVAL****Preparation**

- Disconnect battery ground cable.
- Drain coolant from the radiator and engine.

1. Water Hose; Turbocharger (4JG2-T Only)**2. Outlet Pipe**

- Remove mounting bolt and remove outlet pipe together with radiator hose.

3. Gasket**4. Thermostat****INSPECTION**

Submerge the thermostat assembly in the water. Place wooden blocks on the bottom of the water container.

Not to directly heat the thermostat.

Gradually increase the water temperature. Stir the water so that the entire water is same temperature.

- Make sure that primary valve begins to open at the specified temperature.

Valve Opening Temperature

°C (°F)

82 (180)

- Make sure that secondary valve opens fully at the specified temperature.

Valve Full Open Temperature	°C (°F)
<hr/>	
95 (203)	
<hr/>	

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.



INSTALLATION

4. Thermostat
3. Gasket
2. Outlet Pipe

- Connect outlet pipe and tighten bolts to the specified torque.

N·m (Kgm/lb·ft)

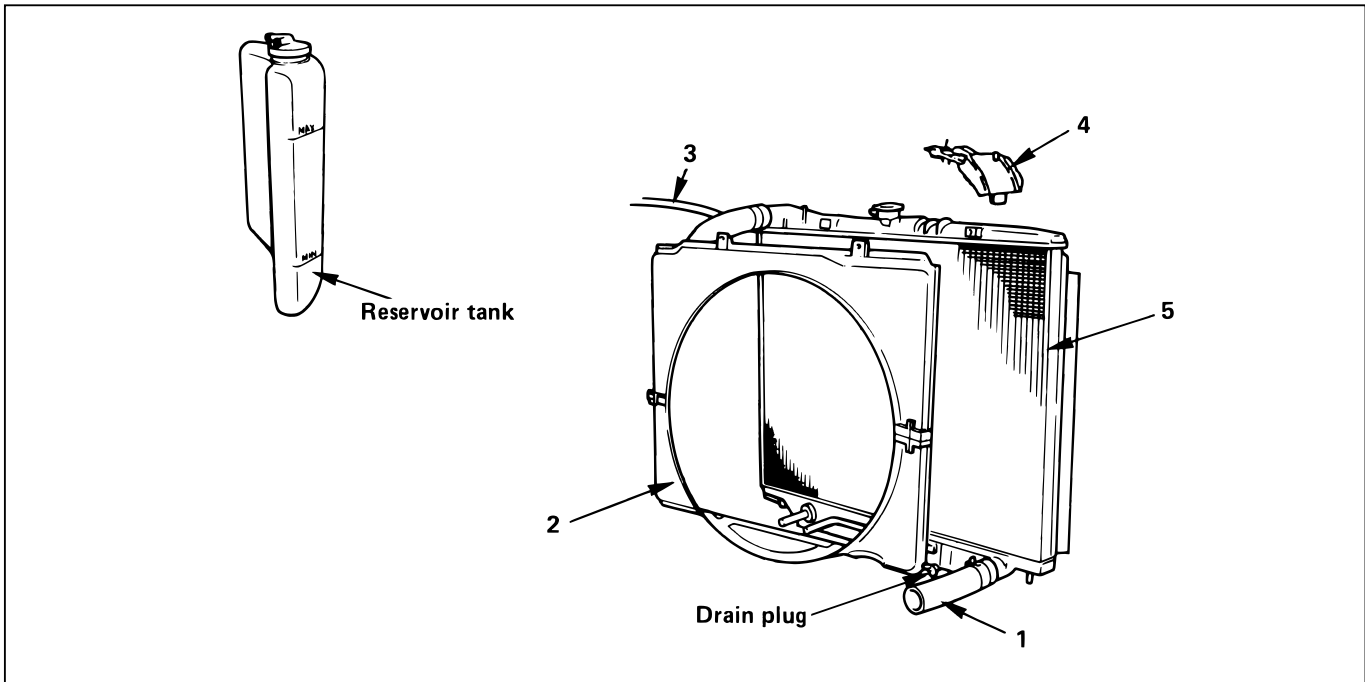


19(1.9/14)

1. Water Hose: Turbocharger (4JG2-T Only)

- Install battery ground cable.
- Pour coolant,
- Start the engine and check coolant leakage.

RADIATOR



REMOVAL

Preparation

- Disconnect battery ground cable.
- Loosen drain plug to drain coolant.

1. Radiator Hose

- Disconnect lower hose and upper hose from the engine.

2. Fan Guide Lower

- Remove clips on both sides and the bottom lock.

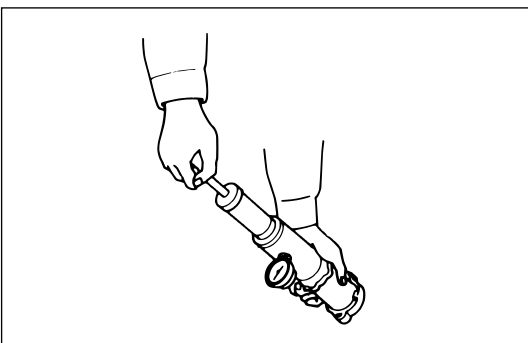
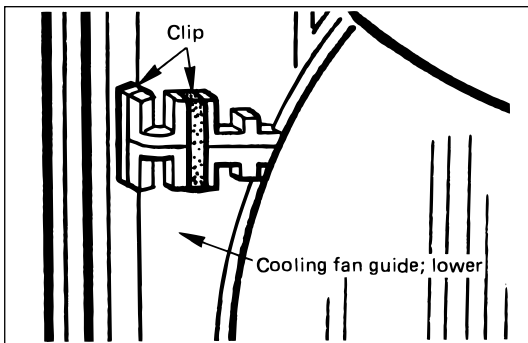
3. Reservoir Tank Hose

- Disconnect the hose from radiator.

4. Bracket

5. Radiator Assembly

- Remove upward the radiator assembly with hose, taking care not to damage the radiator core by fan blade.
- Remove cushion rubbers on both sides of the bottom.



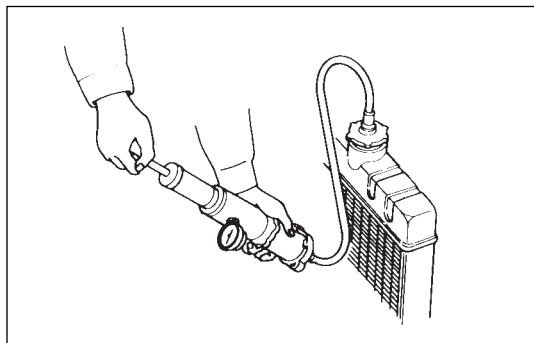
INSPECTION

Radiator Cap

- Measure the valve opening pressure with the radiator cap tester. Replace the radiator cap if it exceeds the standard.

Valve opening pressure	kPa(Kg/cm ² / psi)
93.3 – 122.7 (0.95 – 1.25/13.5 – 17.8)	

Check the condition of negative pressure valve in the center of valve seat side of the cap. If the valve seat does not move smoothly due to rust or dust, clean or replace the radiator cap.



Radiator Core

- Deformed radiator fins could reduce radiation effects, resulting in overheat. Straighten the fins. In such a case, take care not to damage the fin roots.
- Remove dust and other foreign materials.

Flushing the Radiator

- Wash the inside of radiator and the coolant passage with water and neutral detergent. Remove all scales and rust.

Checking for Coolant Leakage

- Check the cooling system for leakage with the radiator cap tester by applying 196.0kPa (28.4 psi) air pressure from filler neck to inside the radiator.



INSTALLATION

5. Radiator Assembly

- Install cushion rubbers on both sides of radiator bottom.
- Install radiator assembly with hose, taking care not to damage the radiator core by a fan blade.

4. Bracket

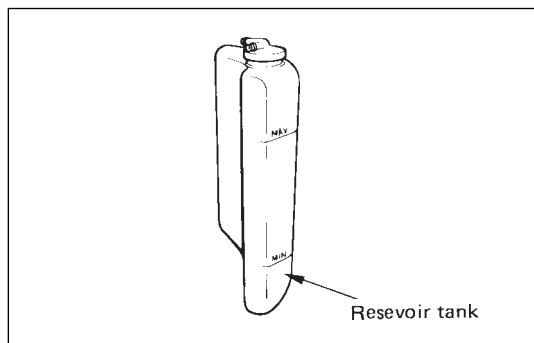
- Support the radiator upper tank with the bracket and fix the radiator.

3. Reserve Tank Hose

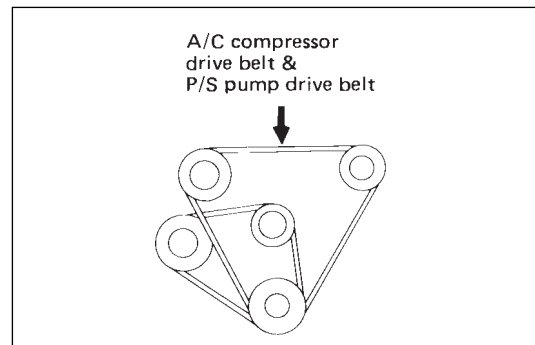
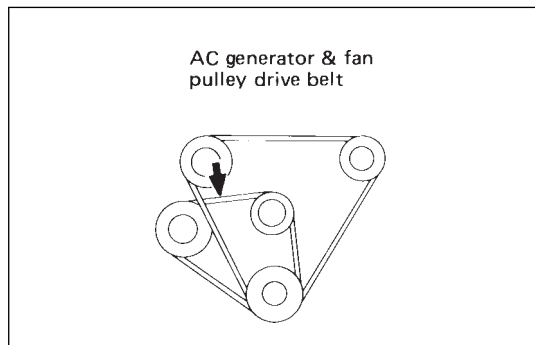
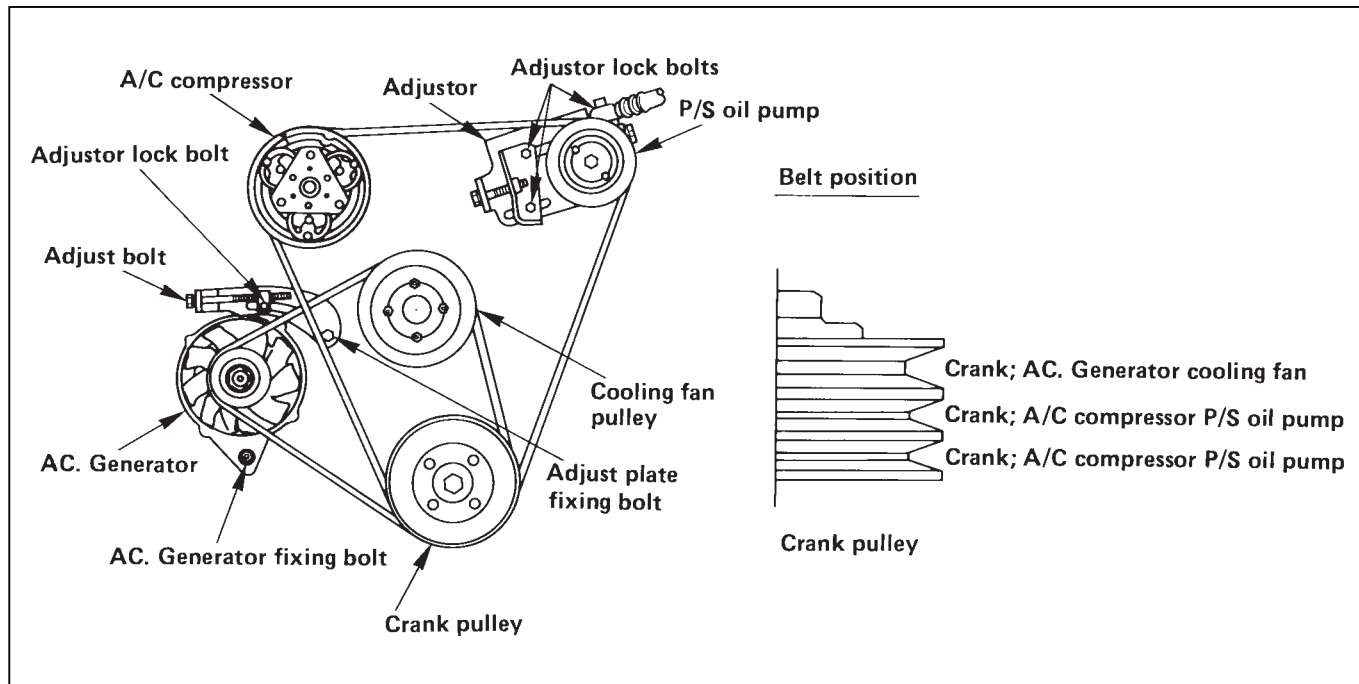
2. Fan Guide, Lower

1. Radiator Hose

- Connect inlet hose and outlet hose to the engine.
- Connect battery ground cable.
- Pour coolant
- Pour coolant up to filler neck of radiator, and up to MAX mark of reserve tank.
- Start engine to warm up, and check for coolant level. Replenish coolant if it does not reach the radiator filler neck, and tighten the cap completely.



DRIVE BELT ADJUSTMENT



INSPECTION

Check drive belts for wear or damage, and replace with new ones as necessary. Check belts for tension, and adjust as necessary.

- Check drive belts tension
- Push the middle of belts with a force of 98 N (10 kg/22 lb) and check each bolt for deflection.
- Standard deflection

mm (in)

	Initial tension	Tension at readjustment
AC generator & fan pulley drive belt	8~12 (0.31~0.47)	
A/C compressor drive belt	7~12 (0.28~0.39)	5~8 (0.20~0.31)
P/S pump drive belt	13~16 (0.51~0.63)	



TENSION ADJUSTMENT

P/S oil pump and A/C compressor pulley belt.

- With P/S pump lock bolt loose, adjust belt tension with adjust belt.

Cooling fan pulley belt

- With AC Generator mounting and lock bolts loose, adjust belt tension with adjuster's adjust bolt.



Torque Standard	N·m(Kg·m/lb·ft)
AC generator fixing bolt	40 (4.1/30)
Adjust plate fixing bolt	24 (2.4/17)
Adjust plate lock bolt	19 (1.9/14)
P/S oil pump adjustor lock bolt	37 (3.8/27)

SECTION 6C

FUEL SYSTEM

CONTENTS

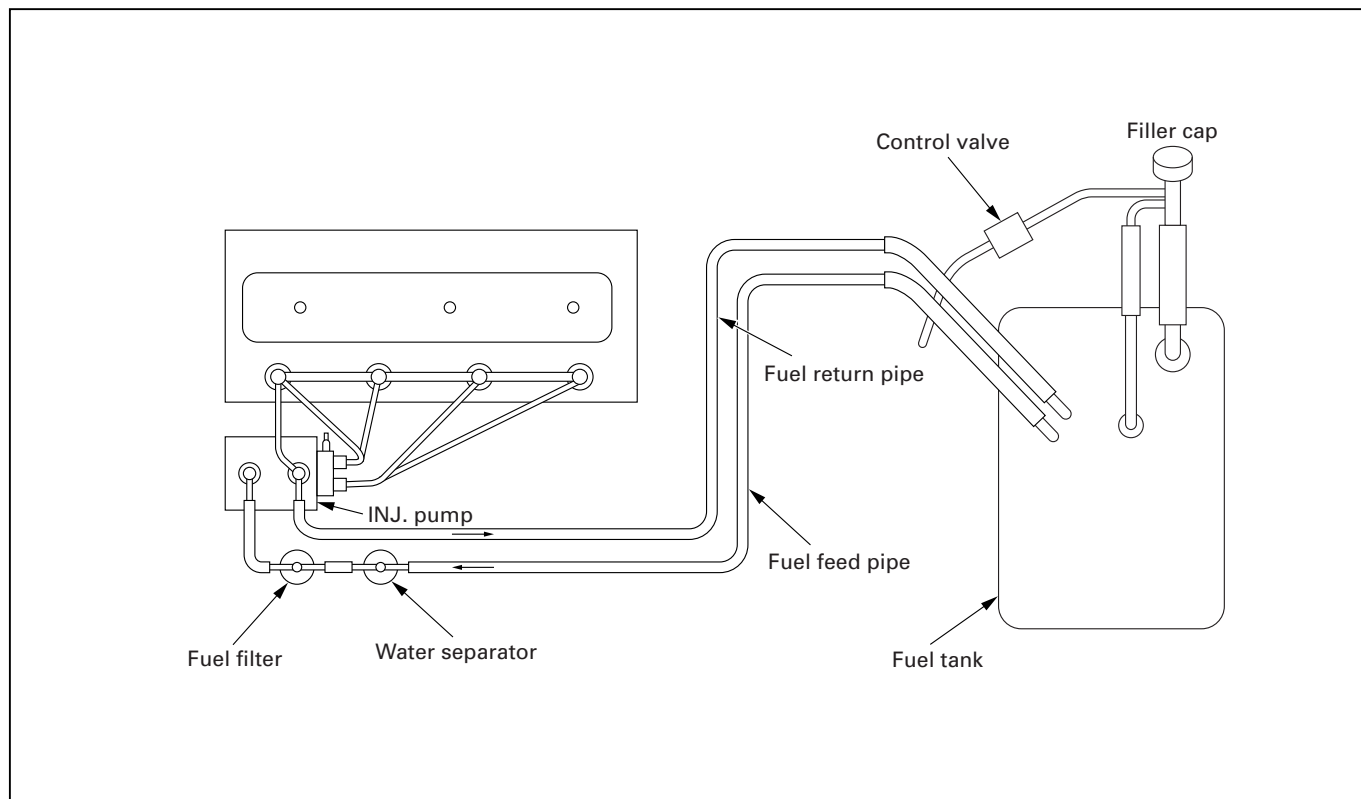
	PAGE
General Description	6C- 1
On-Vehicle Service	6C- 7
Fuel Filter Assembly	6C- 7
Fuel Filter Cartridge	6C- 8
Injection nozzle	6C- 9
Injection Pump Assembly	6C-14
Fuel Tank	6C-18
Fuel Gauge Unit	6C-19
Fuel Filler Cap	6C-20
Accelerator Control	6C-21
Accelerator Control Cable	6C-21
Accelerator Pedal	6C-23
Air Cleaner	6C-24

GENERAL DESCRIPTION

When working on the fuel system, there are several things to keep in mind:

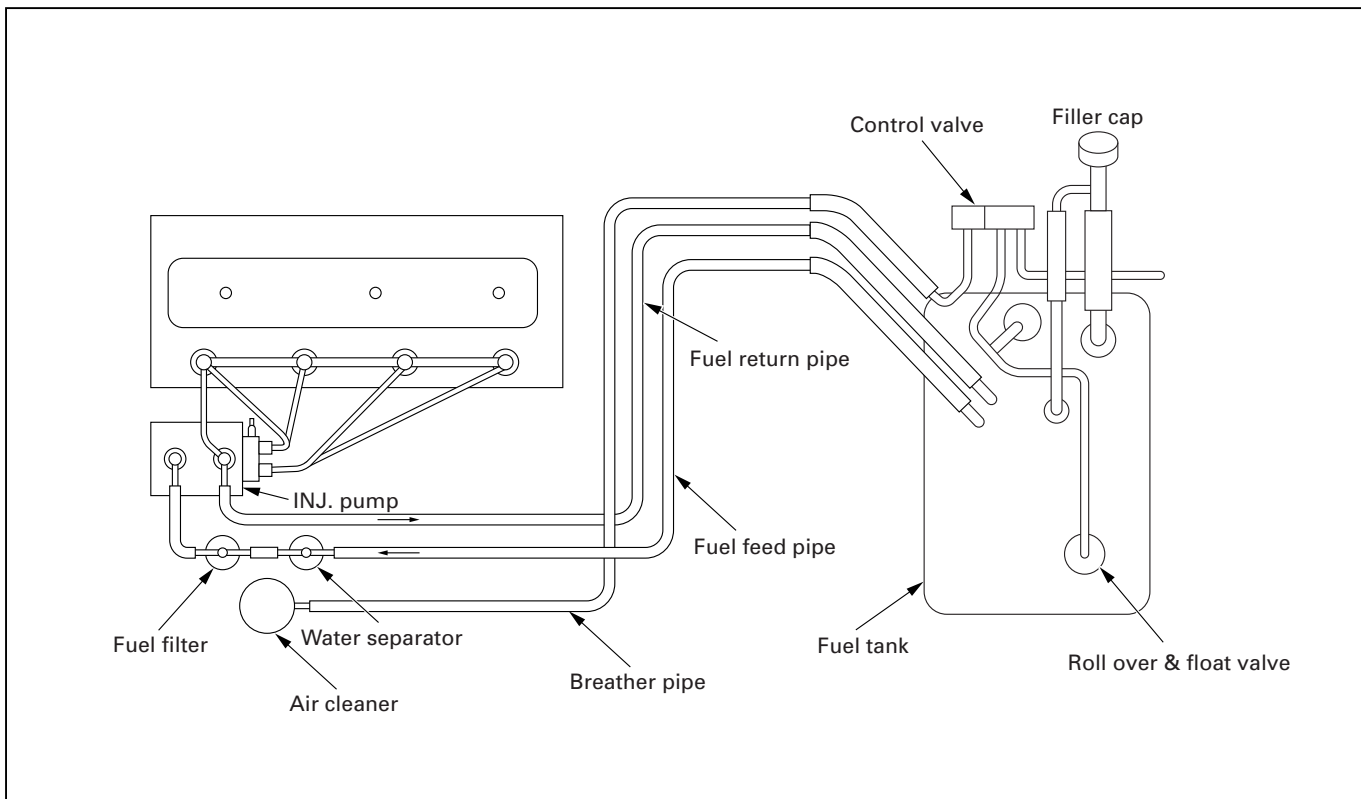
- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
 - Always keep a dry chemical (Class B) fire extinguisher near the work area.
 - Replace all pipes with the same pipe and fittings that were removed.
Clean and inspect "O" rings. Replace where required.
 - Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.

General Export



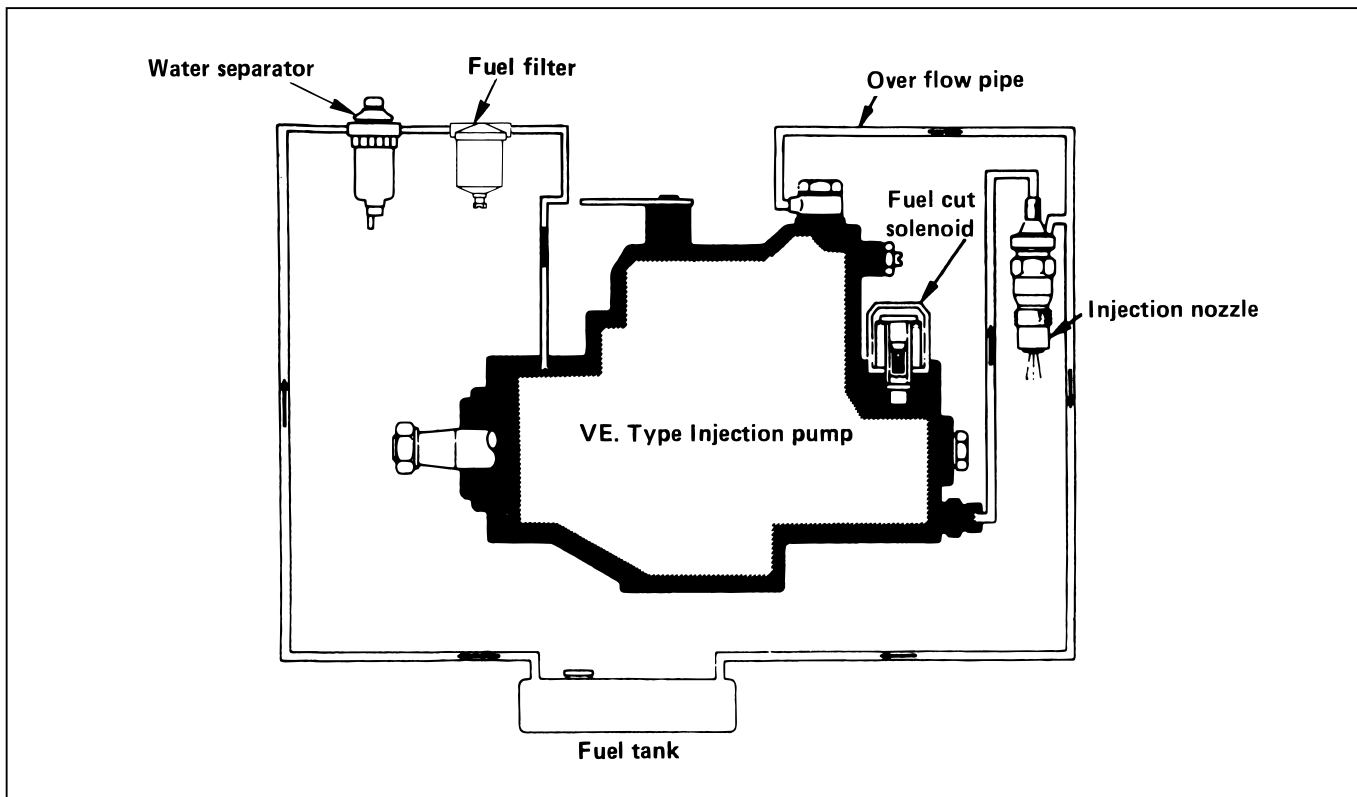
140RX024

Argentina

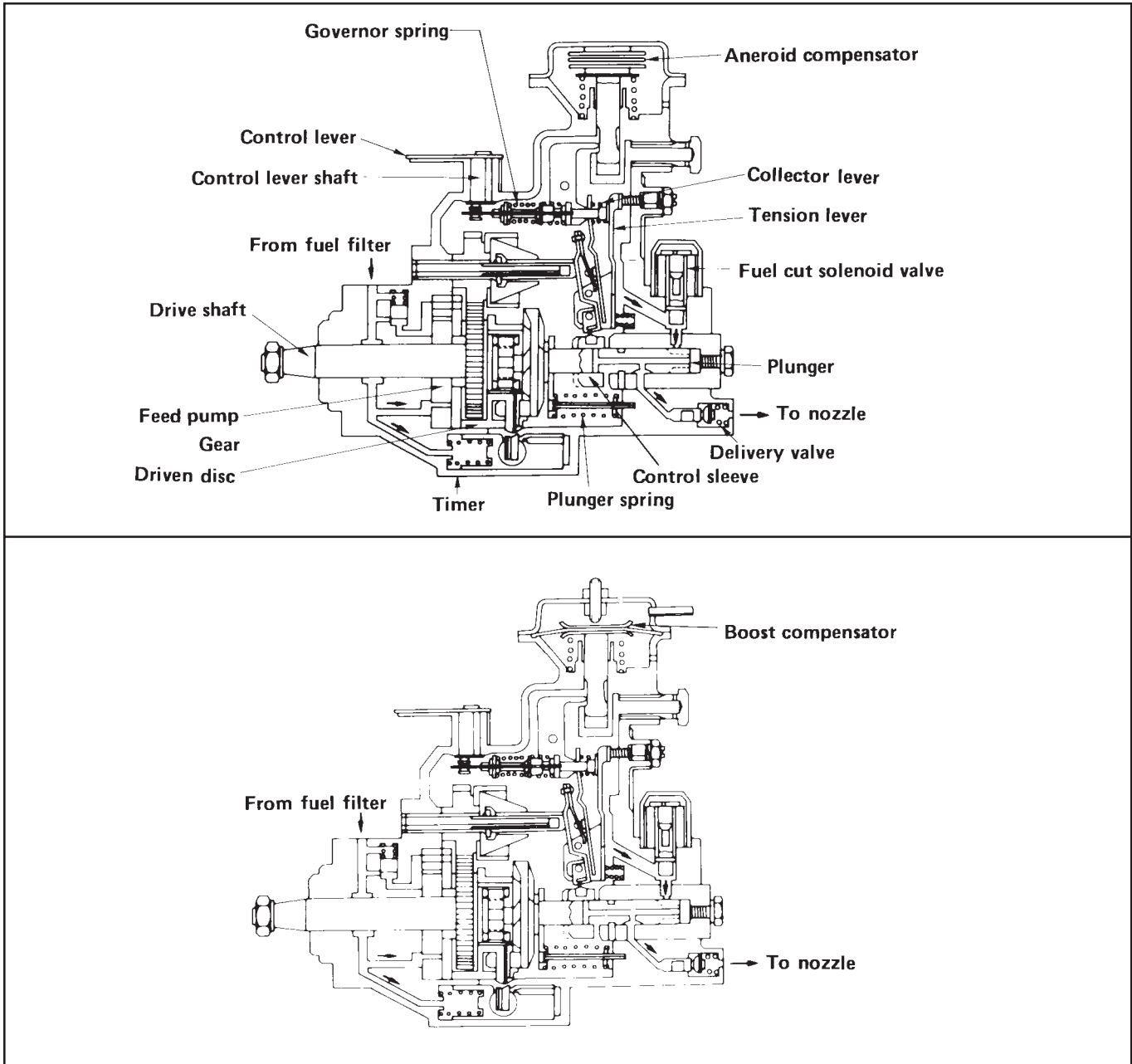


140RX025

Fuel Flow Chart



INJECTION PUMP



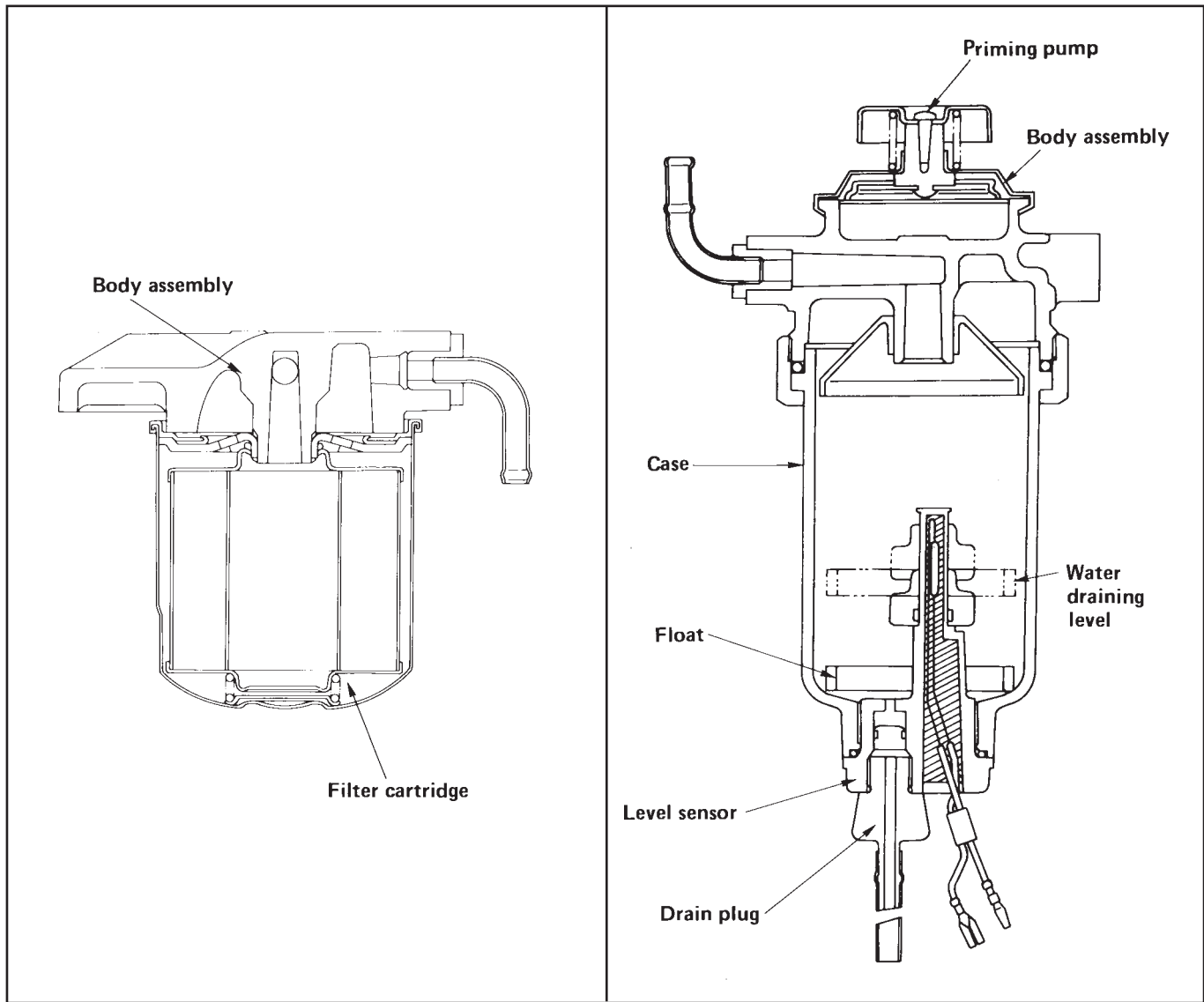
A Bosch Distributor Type Injection Pump is used. A single reciprocating/revolving plunger delivers the fuel uniformly to the injection nozzles, regardless of the number of cylinders.

The governor, the injection timer, and the feed pump are all contained in the injection pump housing. The injection pump is compact, light weight, and provides reliable high-speed operation.

An aneroid compensator is available as an option for vehicles to be operated at high altitudes. It adjusts the fuel and air mixing ratio.

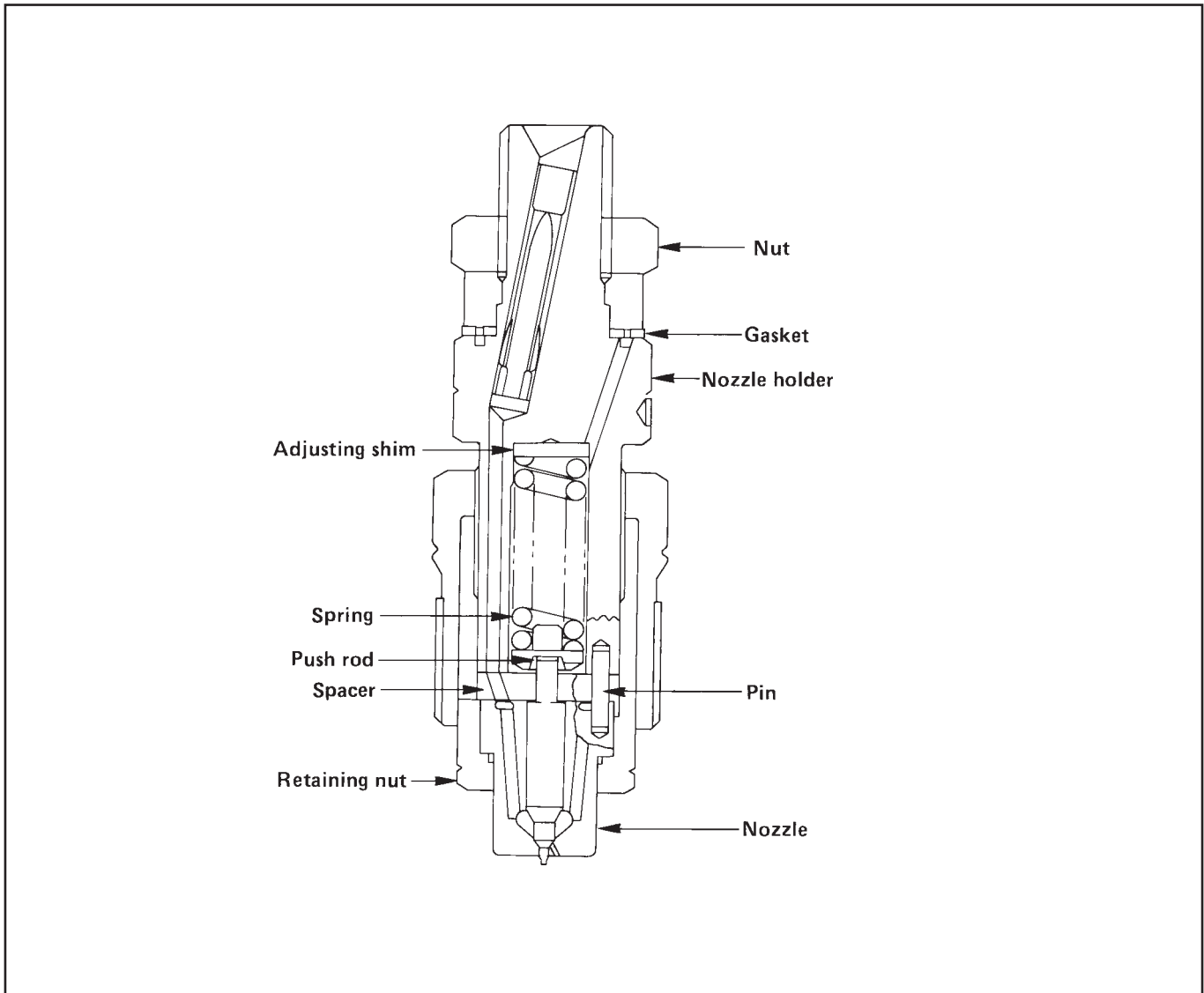
A boost compensator is installed on turbocharger equipped vehicles.

FUEL FILTER AND WATER SEPARATOR



A cartridge type fuel filter and a water separator are used along with the VE type injection pump. As the inside of the injection pump is lubricated by the fuel which it is pumping, the fuel must be perfectly clean. The fuel filter and the water separator remove water particles and other foreign material from the fuel before it reaches the injection pump. The water separator has an internal float. When the float reaches the specified level, a warning light comes on to remind you to drain the water from the water separator. A diaphragm type priming pump is installed at the top of the water separator. It is used during the water draining and the air bleeding procedures.

INJECTION NOZZLE

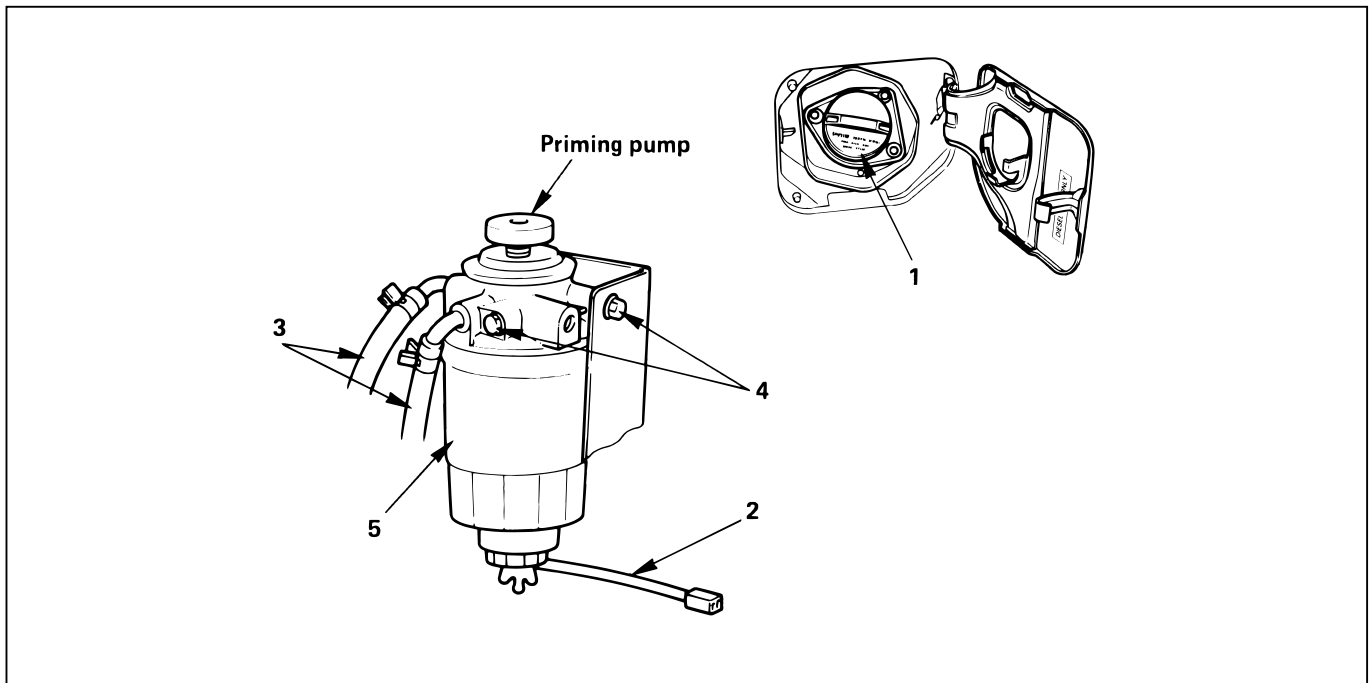


The injection nozzle sprays pressurized fuel from the injection pump through the injection nozzle orifices and into the combustion chamber.

4J series engines with the DFI (Double Formation Injection) Pintaux Type fuel injection nozzle having a sub-injection hole is used. This injection nozzle contributes to substantially minimize the diesel knocking sound noticeable in the cold engine idling operation.

ON-VEHICLE SERVICE

FUEL FILTER ASSEMBLY



REMOVAL

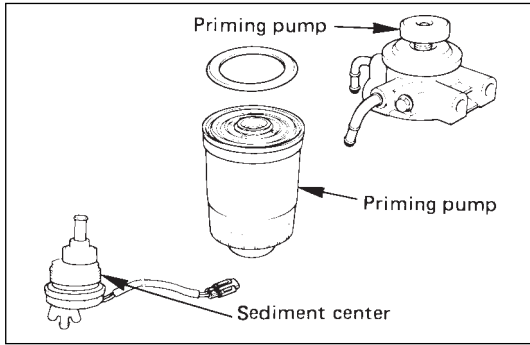
Preparation: Disconnect battery ground cable.

1. **Fuel Filler Cap**
2. **Lead Switch Harness Connector**
3. **Fuel Hose**
 - Disconnect fuel hose from filter body.
 - Plug the hose ends to prevent fuel spillage.
4. **Remove the Bolt on Fuel Filter Bracket.**
5. **Fuel Filter Assembly**



INSTALLATION

5. **Fuel Filter Assembly**
 - Install the filter
4. **Tighten the Fuel Filter Bracket Fixing Bolt.**
3. **Fuel Hose**
 - Connect hoses to filter body.
2. **Lead Switch Harness Connector**
1. **Fuel Filler Cap**
 - Connect the battery ground cable.
 - Feed fuel to the injection pump by means of the priming, and bleed the fuel system.



FUEL FILTER CARTRIDGE



DISASSEMBLY

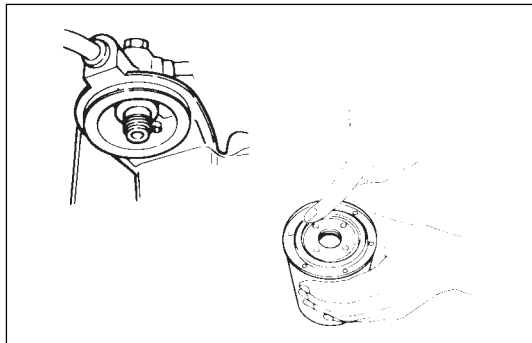
- Drain fuel completely from the fuel filter.
- Protect the filter body with cloth and lightly grip with a vise.
- Remove sedimentor center.
- Remove the cartridge using a filter wrench.
Filter wrench: 5-8840-0253-0(J-22700)



REASSEMBLY



- Install the sedimentor center.
Clean the cartridge mounting surface of filter body so that the cartridge can be securely.
Apply engine oil thinly to new cartridge o-ring.
- To facilitate bleeding, fill the new cartridge with light oil.
- Tighten the cartridge until o-ring comes in contact with the sealing, taking care not to spill the light oil.
- Retighten 1/3~2/3 using a filter wrench.
Filter wrench: 5-8840-0253-0(J-22700)

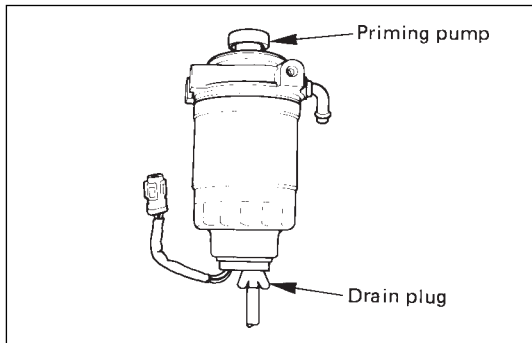


Bleeding

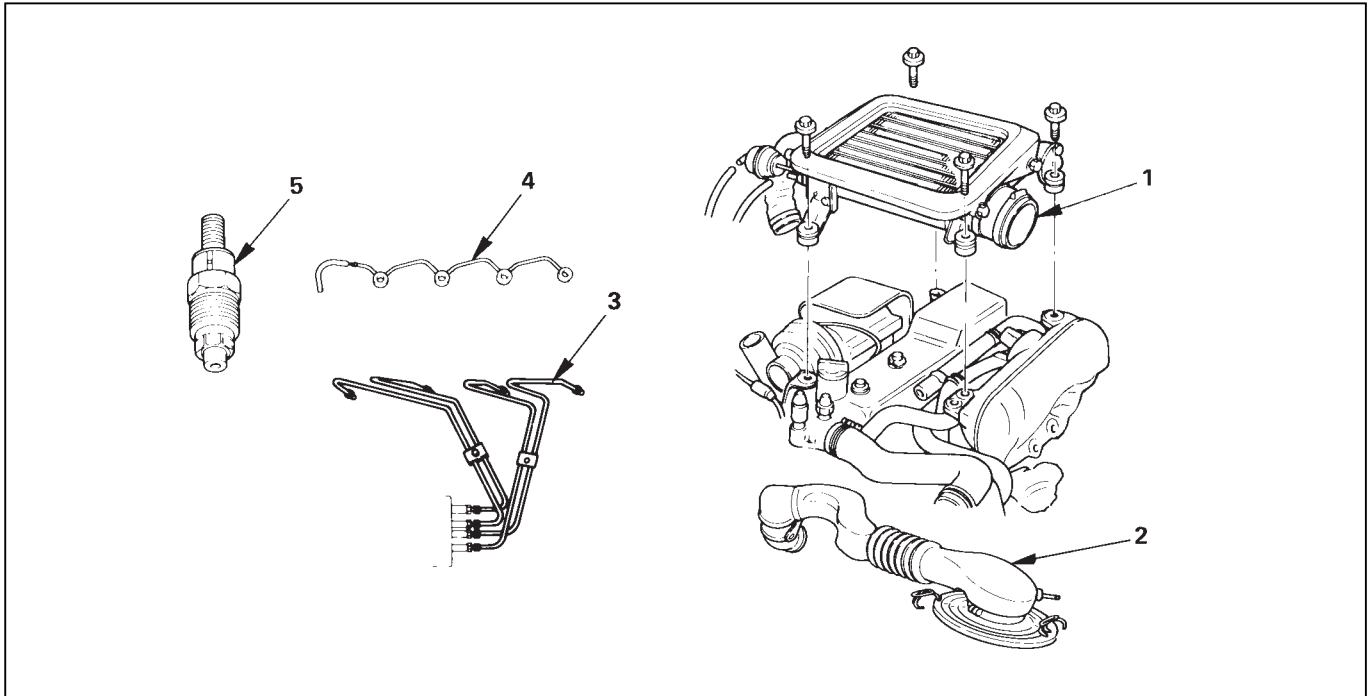
- Operate priming pump to send the air in the fuel system to the injection pump.
- Loosen injection pump bleeding plug, and operate the priming pump until no bubble is made.
- Tighten the bleeding plug.
- Start the engine, and if it is not started in 10 seconds or less, repeat the bleeding steps.
- Make sure of no fuel leakage, and tighten the priming pump.

Draining

- When the water in the sedimentor reaches the specified volume, warning light is actuated. In this case, follow the draining steps below.
- Set a vinyl hose over the drain plug.
- Loosen the drain plug.
- To drain the water, operate the priming pump several times.
- After draining, tighten the drain plug.
- Operate the priming pump several times to check for fuel leakage.
- Check and see the warning light is off.



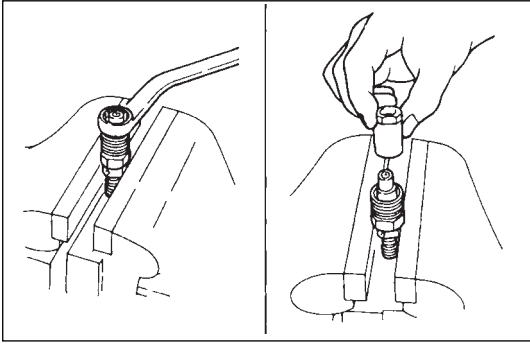
INJECTION NOZZLE

**REMOVAL****Preparation:**

- Disconnect battery ground cable.
1. **Intercooler Assembly (4JG2-T Only)**
 - (Refer to intercooler removal steps in section 6A2)
 2. **Air Cleaner Cover & Air Duct**
 3. **Injection Pipe**
 - Release injection pipe clip.
 - Loosen the flare nut on the injection pump side.
 - Loosen the flare nut on the injection nozzle side, disconnect and put aside the pipe.
 4. **Leak Off Pipe**
 5. **Injection Nozzle**

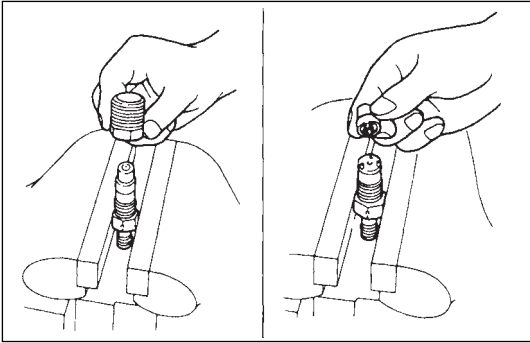
**INSPECTION**

- Set the nozzle in a nozzle tester.
Check there is no fuel leak in the nozzle seal when a fuel pressure of 14710 kpa (150kg/cm²/2133 psi) is applied.
If there is leak, replace.



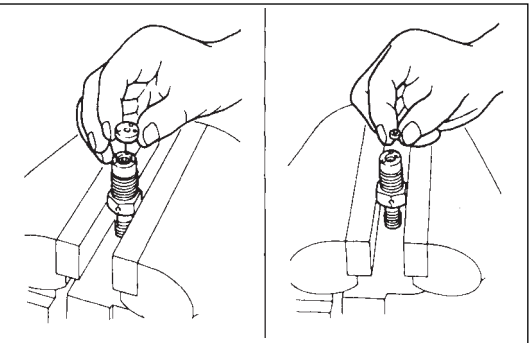
DISASSEMBLY

- Grip nozzle holder with a vise, loosen retaining nut and disassemble.
- Loosen holder nut and remove the nozzle.



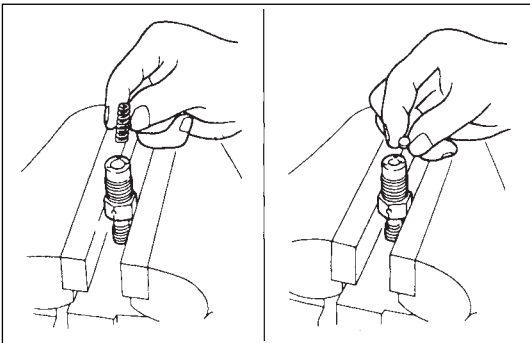
CAUTION

- Be careful not to damage the needle valve.
- Remove spacer, positioning pin, and push rod.
- Remove spring and adjusting shim.



CAUTION

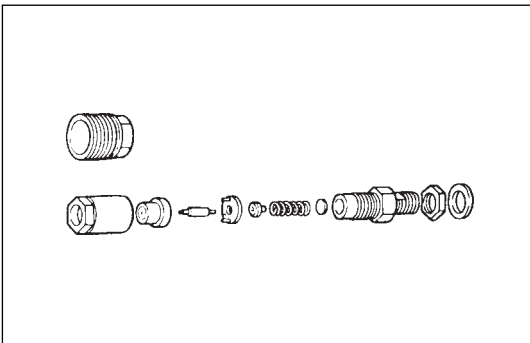
- Wash all the parts removed and arrange them on a cylinder basis, care should be taken not to miss any parts.
- Soak the nozzle assembly in a parts receptacle filled with light oil.
- Care should be taken not to miss shim, if used.

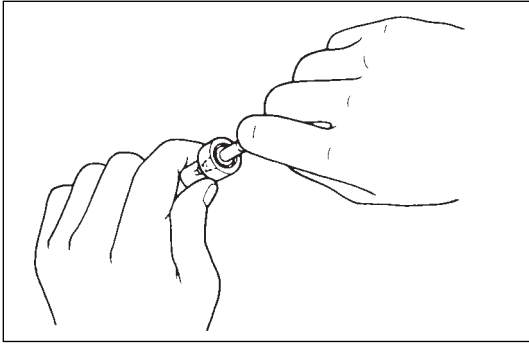


INSPECTION

Nozzle

- Soak the nozzle removed in clean light oil, wash nozzle body and needle valve separately, and check and see that the needle valve slide smoothly in the nozzle body.



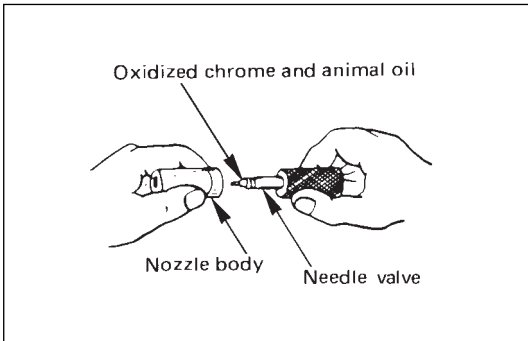


⚠ CAUTION

- If the needle valve does not slide smoothly repair or replace with a new nozzle assembly.

Nozzle lapping procedure

- Apply thinly a compound (Chrome oxide kneaded with an animal oil) to the seat of needle valve and lap.

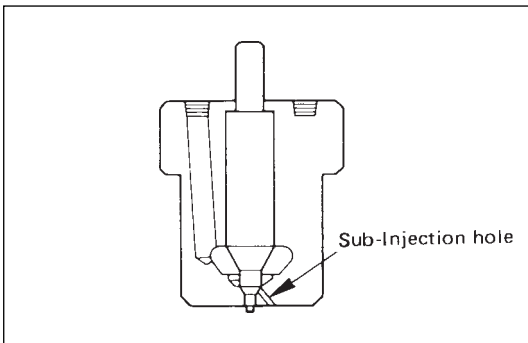


⚠ CAUTION

- Excess compound may cause worn needle valve, and be sure to wash out the compound after lapping.

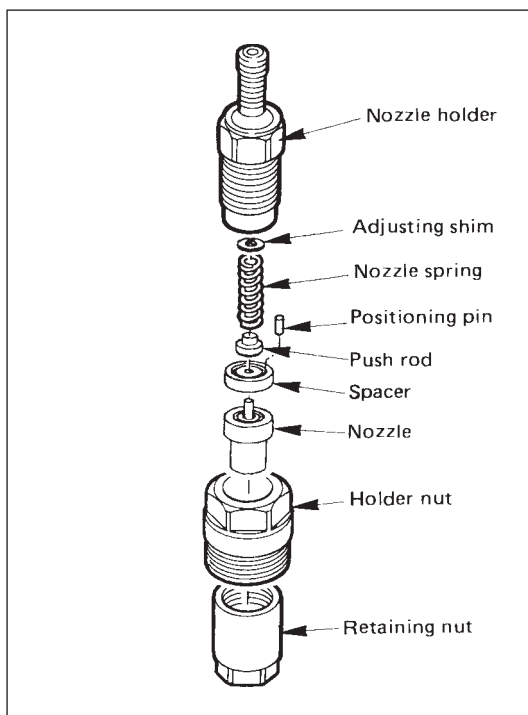
Nozzle body & needle

- Check nozzle body end for seizure. If significantly seized, replace as a nozzle assembly basis. Also replace as a nozzle assembly basis, if needle valve end is deformed or seized.



⚠ CAUTION

- If either nozzle body or needle valve is faulty, replace with a new nozzle assembly.
- DFI's sub hole is very small, care should be taken not to allow foreign matter to get in.



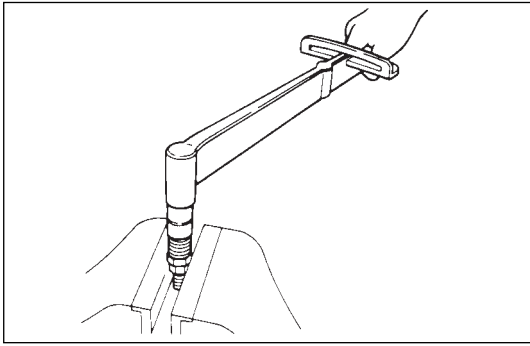
REASSEMBLY

To reassemble, follow the removal steps in the reverse order, noting the following point.



CAUTION

- Be careful to fit spacer because positioning pins are set off.



- Install retaining nut and tighten nut to the specified torque.

N·m (Kg·m/lb·ff)



39 (4/35)

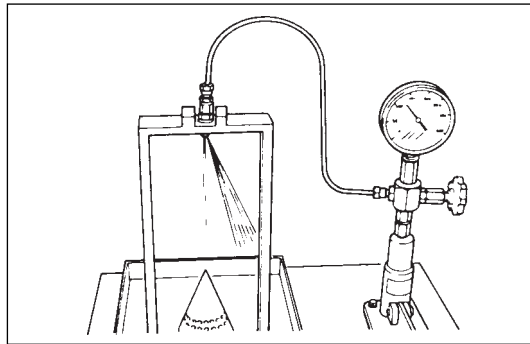


ADJUSTMENT OF INJECTION STARTING PRESSURE

- Set nozzle holder asm on a nozzle tester.
- Apply hydraulic pressure by operating tester handle, and make sure fuel can be injected under the following pressure.

Kpa (Kg/cm²/Psi)

14710 (150/2133)



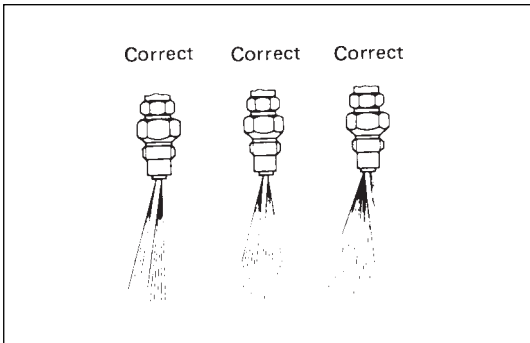
CAUTION

- If not injected under the specified pressure, adjust with adjusting shim.

Ref.

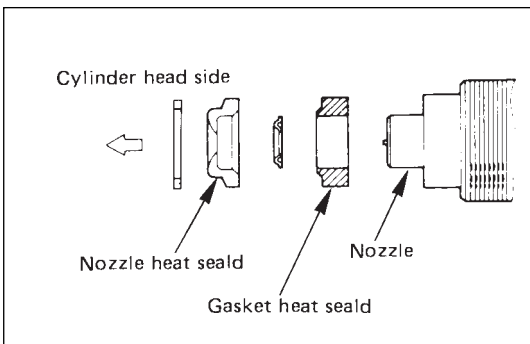
Types are available in the 1.0 – 1.75 mm (0.039 – 0.069 in) thickness range (on a 0.01 mm (0.0004 in) basis).

- Unless extremely deformed spray in seen, there is no problem.



CAUTION

- In case of DFI test results are O.K. if the sub-hole inject fuel in spray.



INSTALLATION

DFI should be positioned correctly and then installed in the cylinder head, because the sub-hole must be set in the specified direction.

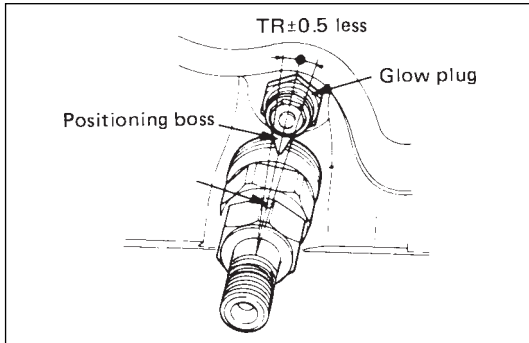


CAUTION

- Nozzle and assembling should be as illustrated.
- Use new heat shield and new corrugated washer.

5. Injection Nozzle

- Lightly tighten the holder nut to such extent that the nozzle holder can turn one word and one word.
- Set positioning confirmation drilled hole (ø2) within a nozzle turning angle of ± 5° against the cylinder head-side positioning boss.



- Apply a wrench as illustrated, and tighten the holder nut to the specified torque using a special tool.

N·m (Kg·m/lb.ft)



64 (6.5/47)

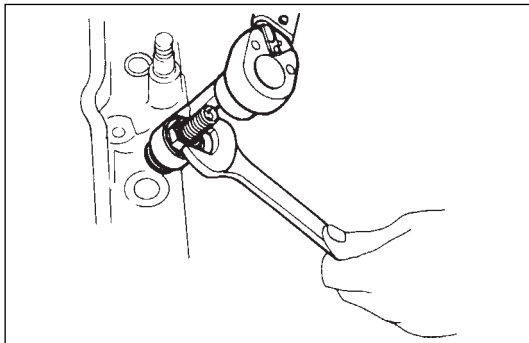


wrench: nozzle holder 5-8840-0259-0



CAUTION

- After tightening the holder nut, make sure that the drilled hole makes $\pm 5^\circ$ or smaller with the cylinder head-side positioning boss.
- When mounting leak off pipe, injection nozzle and pipe, clean then with air so that dust may not enter.



4. Leak Off Pipe

- Mount using a new copper waker

3. Injection Pipe

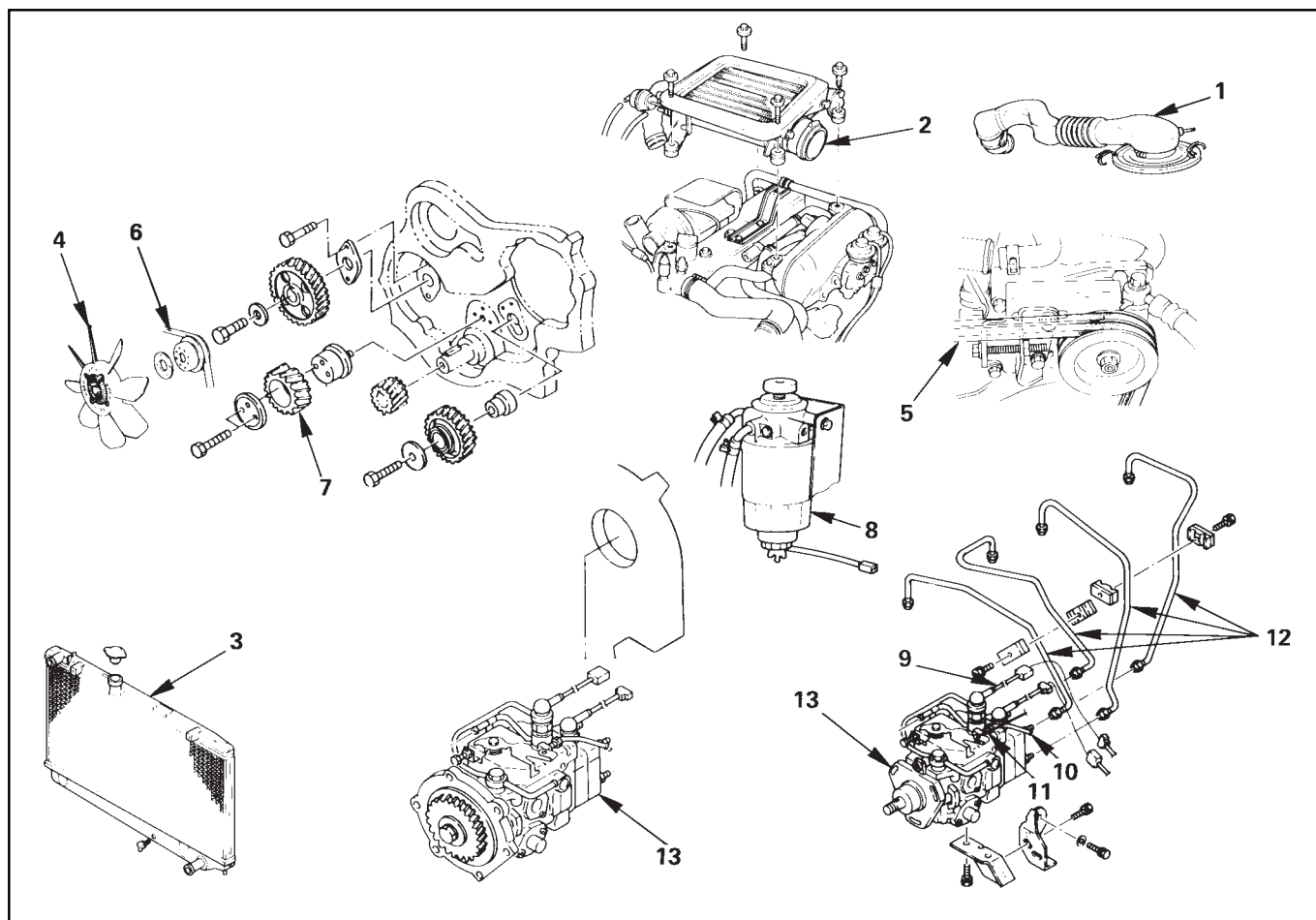
- Connect injection pipe to nozzle holder.
- Tighten the injection pump side.
- Fit pipe clip in specified position.

2. Air Cleaner Cover & Air duct

1. Intercooler Assembly

- Refer to "Intercooler" installation in section 6A2.

INJECTION PUMP ASSEMBLY



Removal Steps

1. Air cleaner cover & air duct
2. Intercooler assembly
3. Radiator assembly
4. Cooling fan assembly
5. P/S pump drive belt
6. AC generator drive belt

7. Timing gear
8. Fuel filter assembly
9. Injection pump harness
10. Fuel hose and CSD hose
11. Injection pump Control cable
12. Injection pipe
13. Injection pump assembly

Installation Steps

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

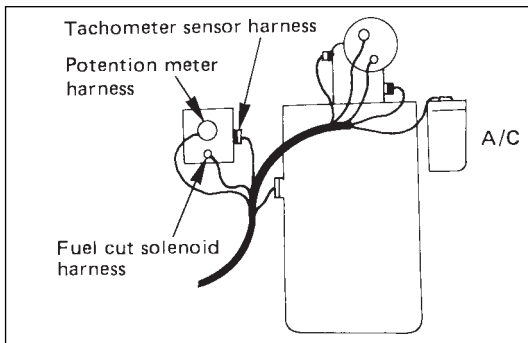


REMOVAL

Preparation:

- Disconnect battery ground cable.
- Drain coolant.

- 1. Air Cleaner Cover & Air Duct**
- 2. Intercooler Assembly (4JG2-T ONLY)**
 - Refer to Intercooler Assembly removal.
- 3. Radiator Assembly**
 - Disconnect upper and lower hoses on the engine side.
- 4. Cooling Fan Assembly**
 - Remove cooling fan asm and remove fan pulley and spacer.
- 5. P/S Pump Drive Belt**
 - Loosen P/S pump lock bolt and adjust bolt remove two drive belts.
- 6. AC Generator Drive Belt**
 - Loosen AC generator mounting bolt (under side) and adjust, bolt and remove drive belt.
- 7. Timing Gear**
 - Refer to Timing Gear Removal
 - Remove the loosened nut and fixing bolt and remove the timing gear.
- 8. Fuel Filter Assembly**
- 9. Injection Pump Harness**
 - Remove tachometer sensor, throttle sensor, and fuel cut solenoid, harness.
- 10. Fuel Hose & CSD Hose**
 - Disconnect inlet hose and outlet hose and keep hose end up to prevent fuel from coming out.
 - Disconnect CSD hose.
- 11. Injection Pump Control Cable**
- 12. Injection Pipe**
 - Release pipe clip.
 - Remove the flare nut on the pump side.
 - Remove the flare nut on the injection nozzle side, and remove the injection pipe.

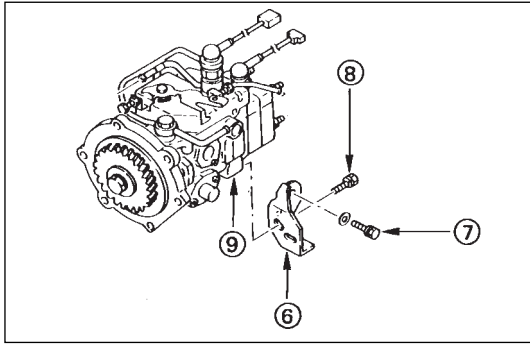


CAUTION

- Be sure to plug the injection nozzle holder and delivery holder to prevent the entry of foreign matter.

13. Injection Pump Assembly

- Remove pump mounting nut
- Loosen injection pump rear bracket adjuster lock bolt.
- Remove the mounting bolt on the engine side, and pull out the pump behind the engine.



INSTALLATION

13. Injection Pump Assembly

- Tighten the injection pump bracket bolts ⑦ to the specified torque..

N·m (Kg·m/lb·ft)



20 (2.0/15)

- Tighten the injection pump bracket bolts ⑧ to the specified torque..

N·m (Kg·m/lb·ft)



40 (4.1/30)

12. Injection Pipe

- Connect the pump side and nozzle side of the pipe, and tighten securely.
- Install clip where it was.

11. Injection Pump Control Cable

- See adjustment of accelerator control cable.

10. Fuel Hose & CSD Hose

9. Injection Pump Harness

- Mount engine harness and connect it to switches.

8. Fuel Filter Assembly

7. Timing Gear

- Refer to Timing Gear in Section 6A2.

6. AC Generator Drive Belt

- Mount AC Generator drive belt and adjust belt tension.
- See drive belt adjustment in section 6B.

5. P/S Pump Drive Belt

- Mount P/S pump drive belt and adjust belt tension.
- See drive belt adjustment in section 6B.

4. Cooling Fan Assembly

- Mount fan pulley, distance piece, and cooling fan asm (in this order) on the water pump, and tighten to the specified torque.

N·m (Kg·m/lb·in)



8 (0.8/69)

3. Radiator Assembly

2. Intercooler Assembly (4JG2-T ONLY)

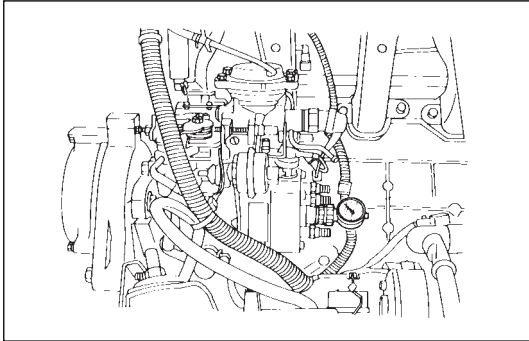
- See installation of intercooler.
- Pour coolant.
- Connect battery ground cable.

1. Air Cleaner Cover & Air Duct



INJECTION TIMING ADJUSTMENT

- Set No.1 cylinder to top dead center.
- Remove injection pump distributor head plug.
- Cancel wax CSD with the handle of a driver.
- Fit a dial gauge and set lift to 2 mm(0.0787 in).



Measuring device: 5-8840-0145-0

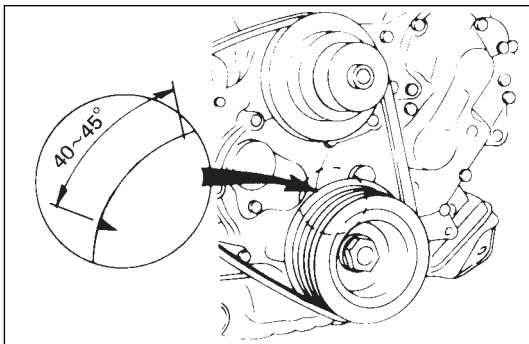
- Set crankshaft damper pulley top dead center mark about 45° before top dead center from the pointer.
- Set dial gauge in the "0" position.
- Turn the crankshaft a little rightwise and leftwise and see if the pointer is stable in the "0" position.
- Turn the crankshaft in the normal direction and read the measuring device's indication at TDC (4JG2-T) and ATDC 1° (4JG2-NA)

mm(in)



Standard	0.5 (0.0197)
----------	--------------

- If it reads abnormal, loosen injection pump fixing nut and pump bracket adjust bolt, make adjustment by changing the pump mounting angle, and tighten the nut and bolt to the specified torque where the dial indicates the specified valve.



Pump fixing nut	N·m (Kg·m/lb·ft)
	19 (1.9/13)



Adjust bolt	N·m (Kg·m/lb·ft)
	40 (4.1/30)

- Remove the measuring device and tighten the distributor head plug to the specified torque.

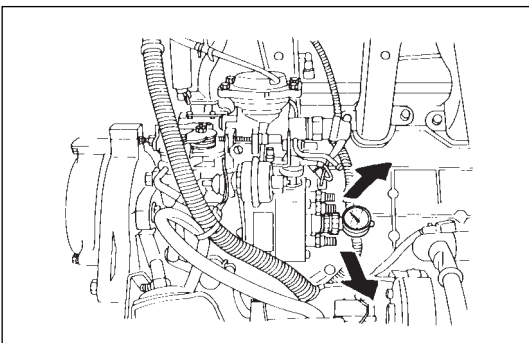


	N·m (Kg·m/lb·ft)
	17 (1.7/12)

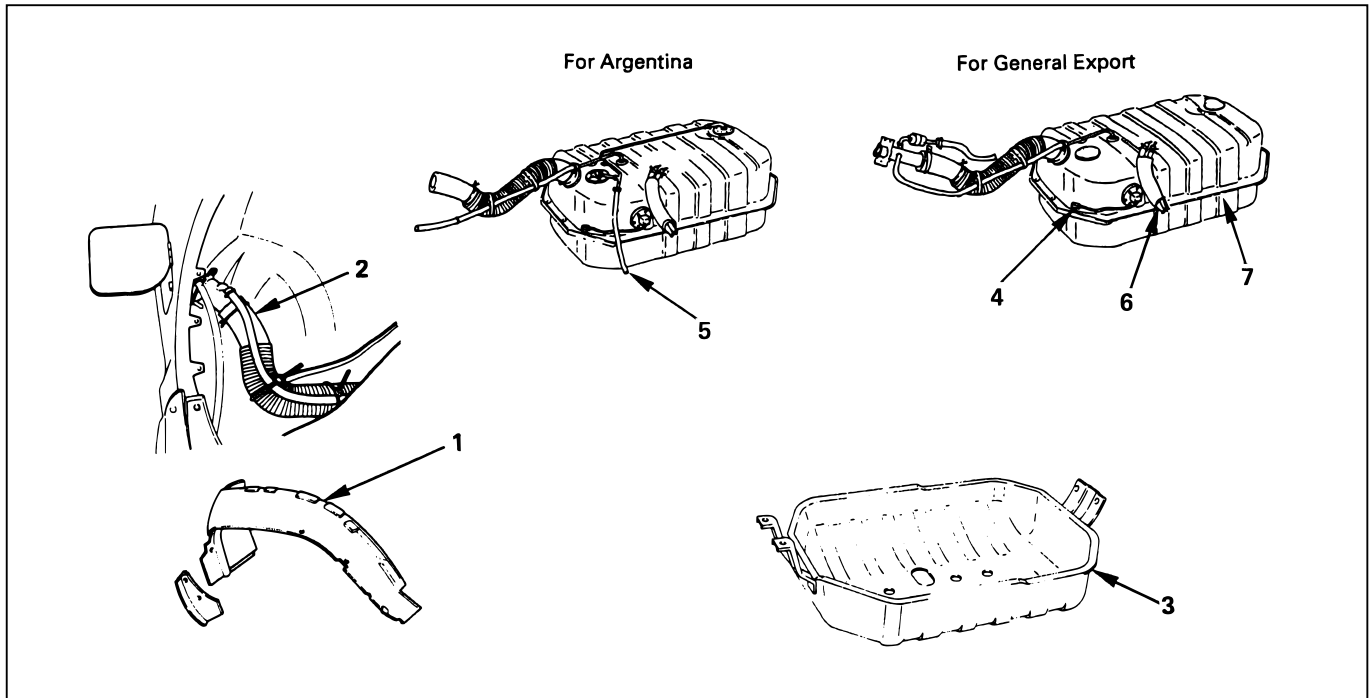


CAUTION

- When installing the distributor head plug, be sure to use new copper washer.
- Connect injection pipe.
- Fit pipe clip where specified.



FUEL TANK

**Removal Steps**

1. Inner liner
2. Fuel filler hose and breather hose
3. Under cover

4. Fuel tank wiring connector

5. Evapo fuel hose
6. Fuel hose and fuel return hose
7. Fuel tank

Installation Steps

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

**REMOVAL****Preparation:**

- Disconnect battery ground cable.
- Loosen fuel filler cap.
- Drain fuel.
- Tighten drain plug to the specified torque after draining fuel.

N·m (Kg·m/lb·ft)

20 (2.0/14)

1. Inner Liner

- Remove inner liner of wheel arch on rear right side.

2. Fuel Filler Hose and Air Breather Hose**3. Under Cover**

- Remove undercover fixing bolts on both sides.

4. Fuel Tank Wiring Connector

- Disconnect two connectors on front right side of tank.

5. Evapo Fuel Hose**6. Fuel Hose and Fuel Return Hose****7. Fuel Tank**

- Remove fuel tank fixing bolts on both sides.

INSTALLATION

7. Fuel Tank

- Place a flange on right side of tank on the bracket.
- Install a flange on left side on the bracket from the bottom, and tighten bolts to the specified torque.

N·m (Kg·m/lb·ft)



36 (3.7/27)

6. Fuel Hose and Fuel Return Hose

5. Evapo Fuel Hose

4. Fuel Tank Wiring Connector

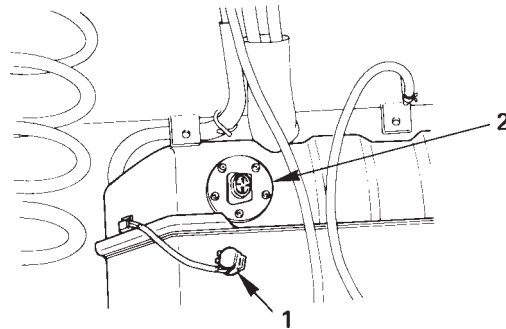
3. Under Cover

2. Fuel Filler Hose and Air Breather Hose

1. Inner Liner

- Mount inner liner on the wheel arch.
- Fill the tank with fuel and tighten fuel filler cap.
- Connect battery ground cable.

FUEL GAUGE UNIT



Removal Steps

1. Wiring connector
2. Fuel gauge unit

Installation Steps

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



REMOVAL

Preparation:

- Disconnect battery ground cable.
- Loosen fuel filler cap.
- Drain fuel.
- Tighten drain plug to the specified torque after draining fuel.

N·m (Kg·m/lb·ft)

20 (2.0/14)

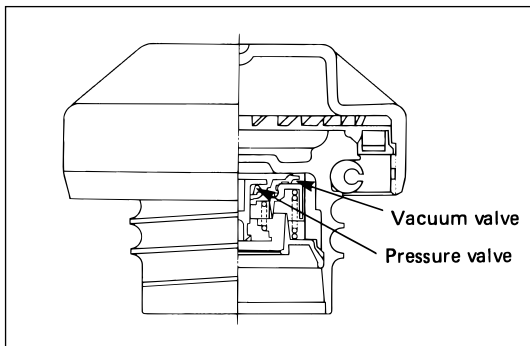
1. **Wiring Connector**
 - Drain fuel
2. **Fuel Gauge Unit**
 - Remove the fixing screws, then the fuel gauge unit.



INSTALLATION

2. **Fuel Gauge Unit**
1. **Wiring Connector**
 - Connect the wiring connector to the fuel gage unit.
 - Fill the tank with fuel and tighten fuel filler cap.
 - Connect battery ground cable.

FUEL FILLER CAP



The fuel filler cap contains a vacuum valve. If a negative pressure develops in the fuel tank, the external valve of fuel filler cap opens to allow the fresh air to flow into the fuel tank through the vacuum valve.

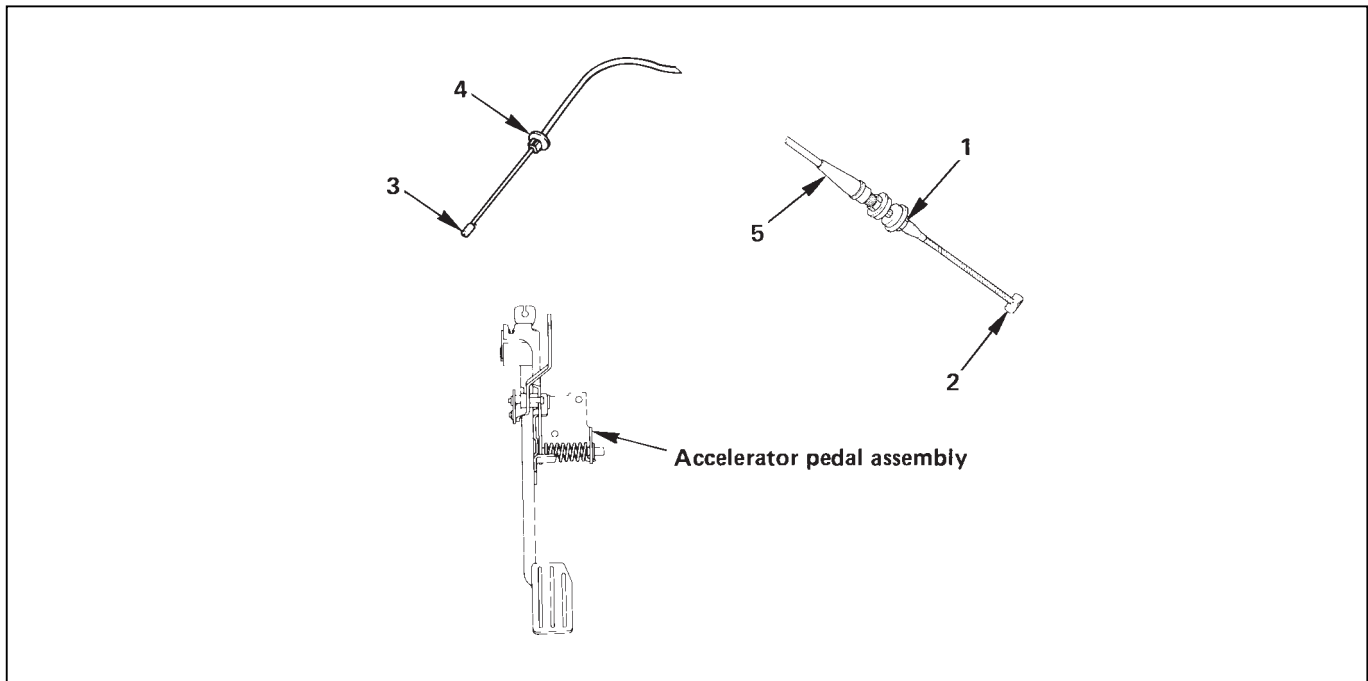


INSPECTION

Check the seal ring in the filler cap for presence of any abnormality and for seal condition. Replace the filler cap, if abnormal.

ACCELERATOR CONTROL

ACCELERATOR CONTROL CABLE



Removal Steps

1. Adjusting nut
2. Accelerator control cable (Injection pump side)

3. Accelerator control cable (Accelerator pedal side)
4. Grommet
5. Accelerator control cable

Installation Steps

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



REMOVAL

1. **Adjusting Nut**
 - Loosen the adjust nut on the cable bracket mounted on the injection pump.
2. **Accelerator Control Cable (on injection pump side)**
3. **Accelerator Control Cable (on accelerator pedal side)**
4. **Grommet**
5. **Accelerator Control Cable**



INSPECTION

Check the following items, and replace the control cable if any abnormality is found.

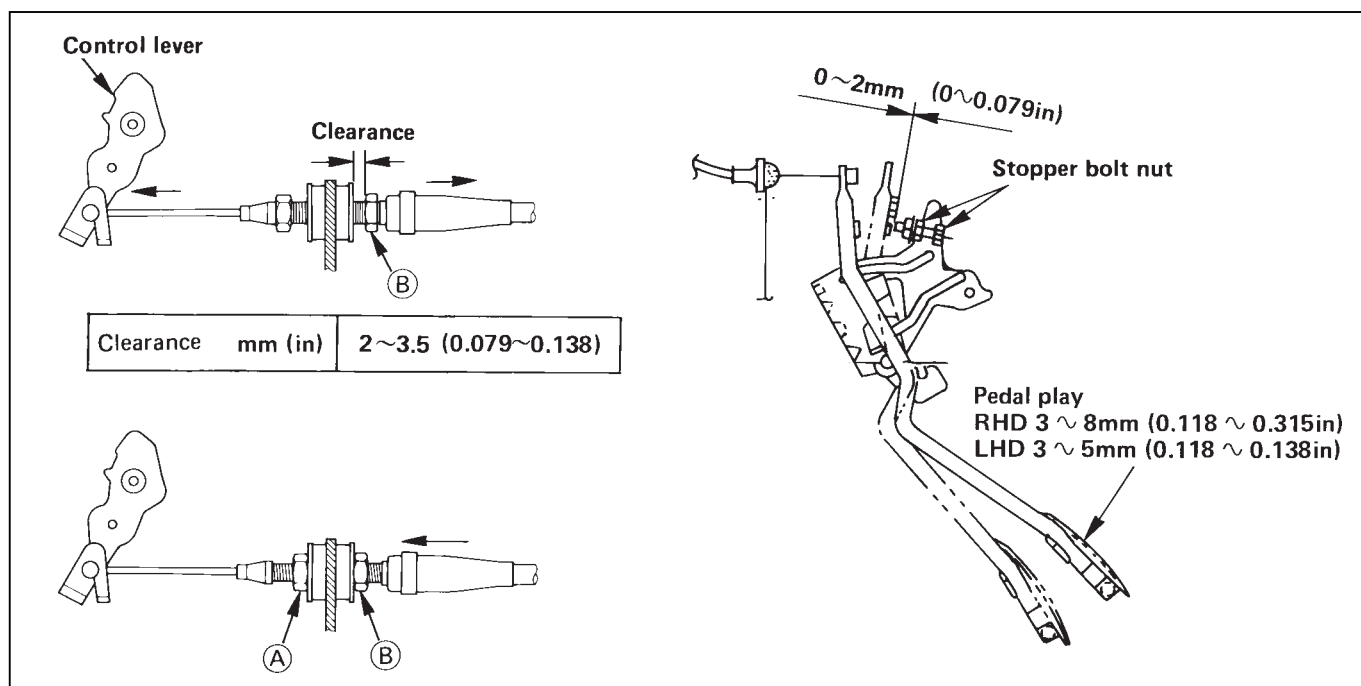
- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

INSTALLATION

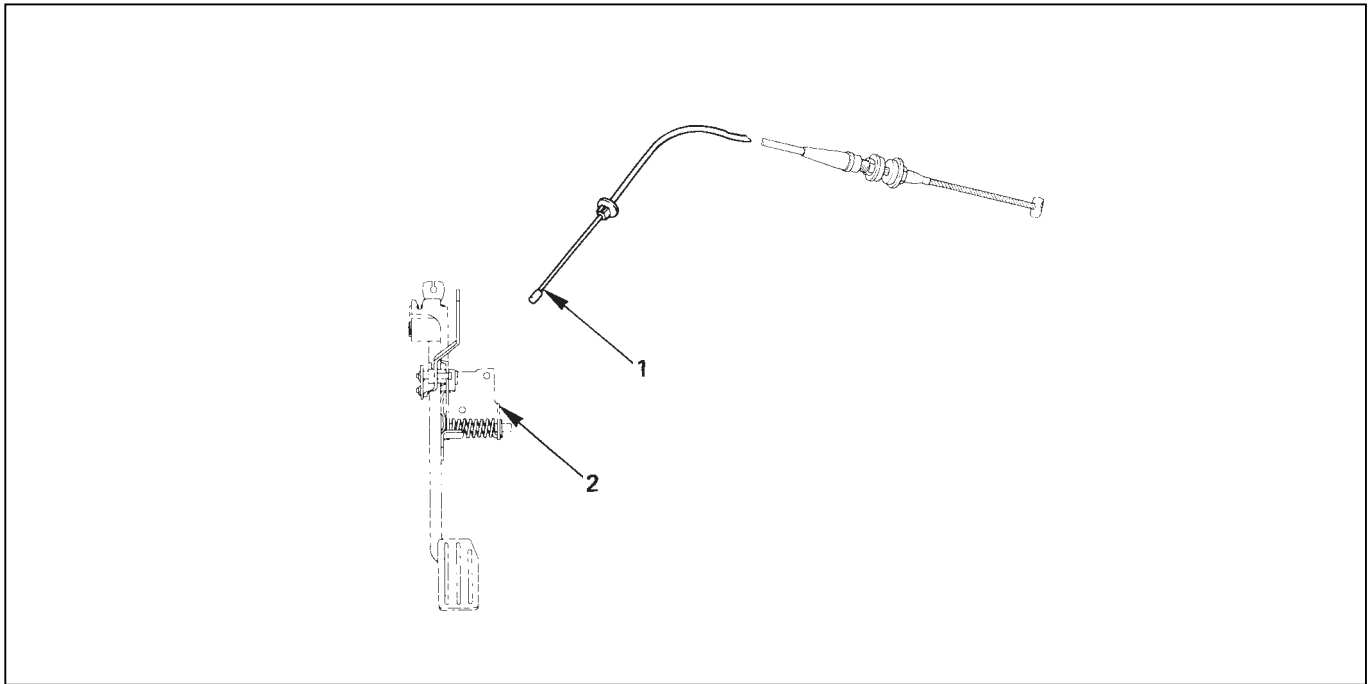
5. Adjusting Nut
4. Accelerator Control Cable (on injection pump side)
3. Accelerator Control Cable (on accelerator pedal side)
2. Grommet
1. Accelerator Control Cable

Adjustment of Accelerator Control Cable

1. Loosen the lock nut.
2. Lock the throttle valve fully closed, and pull the outer cable. Then, adjust the nut B so that the clearance between nut B and bracket is as shown in figure.
3. Push the nut B against the bracket and tighten nut A to lock the cable.



ACCELERATOR PEDAL



Removal Steps

1. Accelerator control cable
2. Accelerator pedal assembly

Installation Steps

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



REMOVAL

1. Accelerator Control Cable
2. Accelerator Pedal Assembly



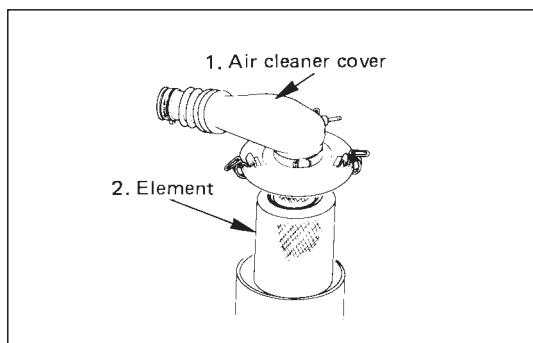
INSTALLATION

2. Accelerator Pedal Assembly
1. Accelerator Control Cable

Adjustment of Pedal Stroke Manual Transmission

- Turn counterclockwise and loosen the stopper bolts sufficiently.
- Step on the pedal fully and hold it with your hand. Next turn the stopper bolt until it comes into contact with the stopper of pedal bracket. Then, lock the stopper bolt in that position.

AIR CLEANER



REMOVAL

- Disconnect the hose coming.

1. **Air Cleaner Cover**
 - Disconnect air hose.
2. **Element**



INSPECTION

Check the element for damage or clogging by dust. Replace if it is damaged, or clean if it is clogged.

Cleaning Method

Top the element carefully not to damage the paper filter, or clean the element by blowing with compressed air of about 49kPa (0.5 kg/cm²/71 psi) from the clean side if it is extremely dirty.



INSTALLATION

2. **Element**
1. **Air Cleaner Cover**
 - Set the cover to the body completely, then clamp it with the clip.

SECTION 6D

ENGINE ELECTRICAL

CONTENTS

Battery.....	Section 6D1
Starting System	Section 6D2
Charging System.....	Section 6D3
QOS-III Preheating System.....	Section 6D6

SECTION 6D1

BATTERY

CONTENTS

General Description	6D1-1	Jump Starting	6D1-3
Diagnosis	6D1-1	Removal and Installation of Battery	6D1-4
On-Vehicle Service.....	6D1-3		
Battery Charging.....	6D1-3		

GENERAL DESCRIPTION

There are six battery fluid caps at the top of the battery. These are covered by a paper label.

The battery is completely sealed except for the six small vent holes at the side. These vent holes permit the escape of small amounts of gas generated by the battery.

This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an excessive charge.
(A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self-discharge than a conventional type battery.

DIAGNOSIS**1. VISUAL INSPECTION**

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.

Replace the battery if obvious physical damage is discovered during inspection.

Check for any other physical damage and correct it as necessary. If not, proceed to Step 2.

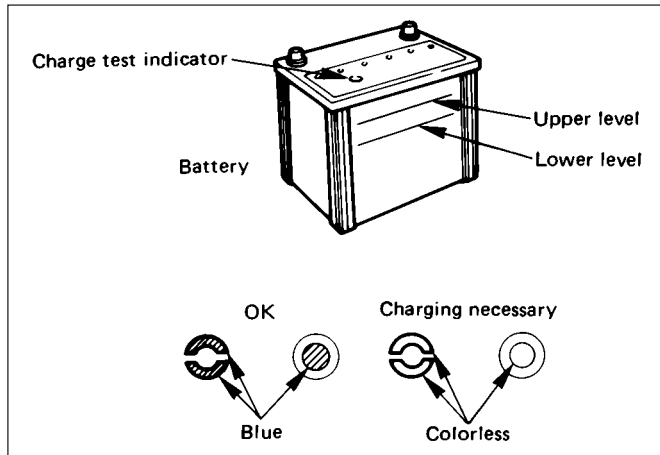
2. HYDROMETER CHECK

There is a built-in hydrometer (Charge test indicator) at the top of the battery. It is designed to be used during diagnostic procedures.

Before trying to read the hydrometer, carefully clean the upper battery surface.

If your work area is poorly lit, additional light may be necessary to read the hydrometer.

- a. BLUE RING OR DOT VISIBLE – Go to Step 4.
- b. BLUE RING OR DOT NOT VISIBLE – Go to Step 3.



3. FLUID LEVEL CHECK

The fluid level should be between the upper level line and lower level line on side of the battery.

- a. CORRECT FLUID LEVEL - Charge the battery.
- b. BELOW LOWER LEVEL - Replace battery.

4. VOLTAGE CHECK

- (1) Put voltmeter test leads to battery terminals.
 - a. VOLTAGE IS 12.4V OR ABOVE - Go to Step 5.
 - b. VOLTAGE IS UNDER 12.4V - Go to procedure (2) below.
- (2) Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
 Fast charge battery for 30 minutes at amperage rate no higher than specified value.
 Take voltage and amperage readings after charge.
 - a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE - Replace battery.
 - b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE - Drop charging voltage to 15V and charge for 10 - 15 hours. Then go to Step 5.
 - c. VOLTAGE IS BETWEEN 12V AND 16V - Continue charging at the same rate for an additional 3-1/2 hours. Then go to Step 5.
 - d. VOLTAGE IS BELOW 12V - Replace battery.

5. LOAD TEST

- (1) Connect a voltmeter and a battery load tester across the battery terminals.
- (2) Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
- (3) Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section). Read voltage after 15 seconds, then remove load.
 - a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN FOLLOWING TABLE - The battery is good and should be returned to service.
 - b. VOLTAGE IS LESS THAN MINIMUM LISTED - Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
°F	°C	
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	-1	9.1
20	-7	8.9
10	-12	8.7
0	-18	8.5

The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.

ON-VEHICLE SERVICE

BATTERY CHARGING

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during the charging procedure.
Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick-charged or slow-charged in the same manner as other batteries.
Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

JUMP STARTING

JUMP STARTING WITH AN AUXILIARY (BOOSTER) BATTERY

CAUTION:

Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.
Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING:

Failure to carefully follow the jump starting procedure could result in the following:

1. Serious personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of the reach of young children.

JUMP STARTING PROCEDURE

1. Set the vehicle parking brake.
If the vehicle is equipped with an automatic transmission, place the selector lever in the "PARK" position.
If the vehicle is equipped with a manual transmission place the shift lever in the "NEUTRAL" position.
Turn "OFF" the ignition.
Turn "OFF" all lights and any other accessory requiring electrical power.
2. Look at the built-in hydrometer.
If the indication area of the built-in hydrometer is completely clear, do not try to jump start.
3. Attach the end of one jumper cable to the positive terminal of the booster battery.
Attach the other end of the same cable to the positive terminal of the discharged battery.
Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.
Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.
Attach the other end of the same cable to a solid engine ground (such as the A/C compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.
This ground connection must be at least 450 mm (18 in) from the battery of the vehicle whose battery is being charged.

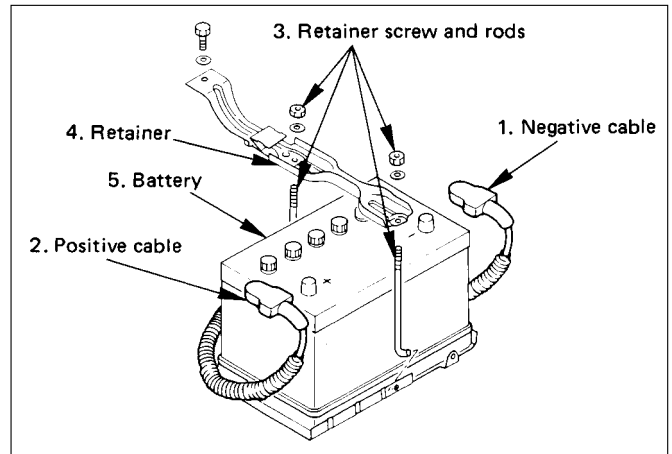


WARNING:

Never attach the end of the jumper cable directly to the negative terminal of the dead battery.

5. Start the engine of the vehicle with the good battery.
Make sure that all unnecessary electrical accessories have been turned "OFF".
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in the reverse order.
Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

REMOVAL AND INSTALLATION OF THE BATTERY



↔ REMOVAL

1. Negative cable
2. Positive cable
3. Retainer screw and rods
4. Retainer
5. Battery

→← INSTALLATION

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

1. Make sure that the rod is hooked on the body side.

SECTION 6D2

STARTING SYSTEM

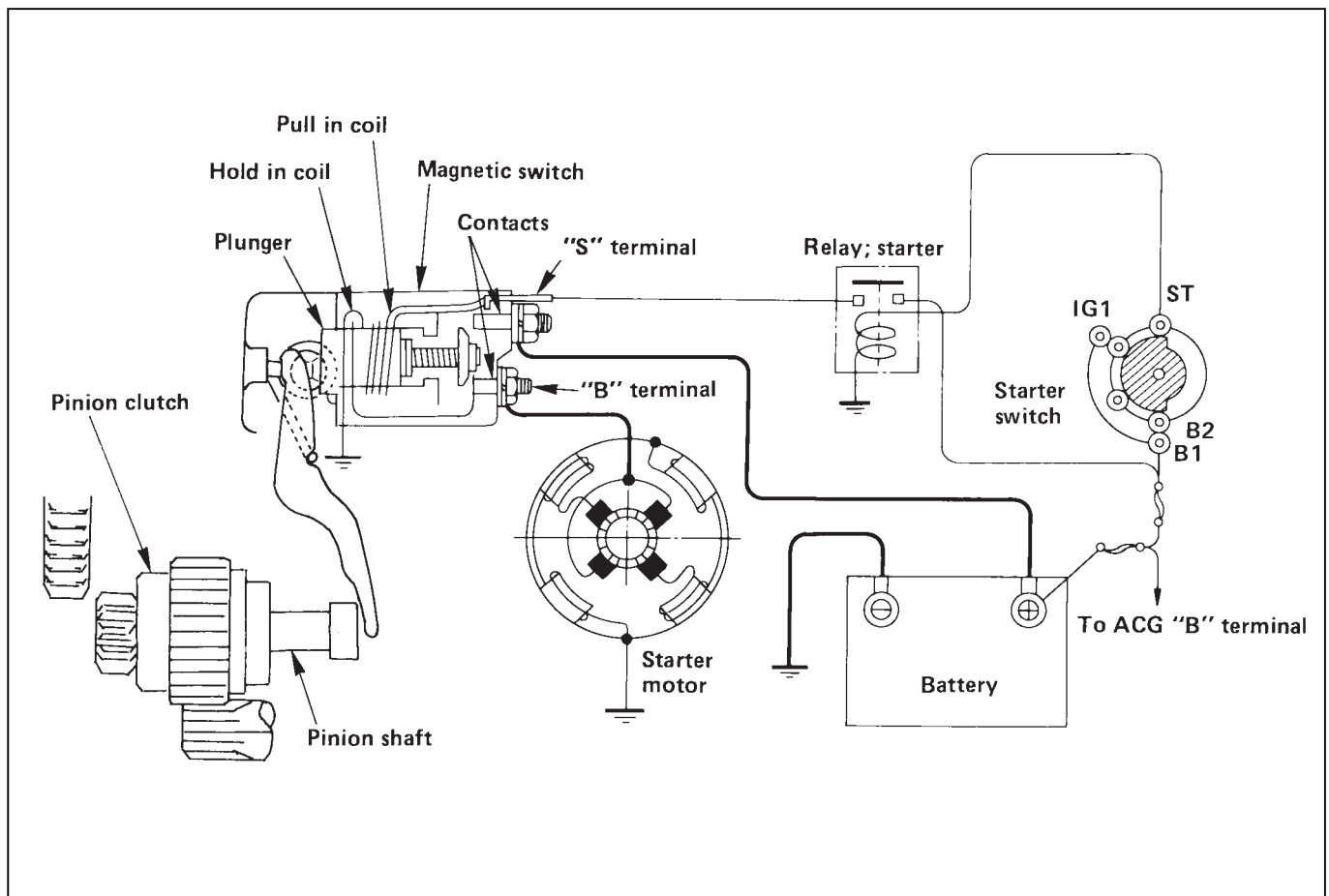
CONTENTS

	PAGE
General Description	6D2- 1
On-Vehicle Service	6D2- 3
Unit Repair	6D2- 5

GENERAL DESCRIPTION

STARTING CIRCUIT

The cranking system consists of a battery, starter, starter switch, starter relay, etc. and these main components are connected as shown in Figure. For details of the starting circuit.

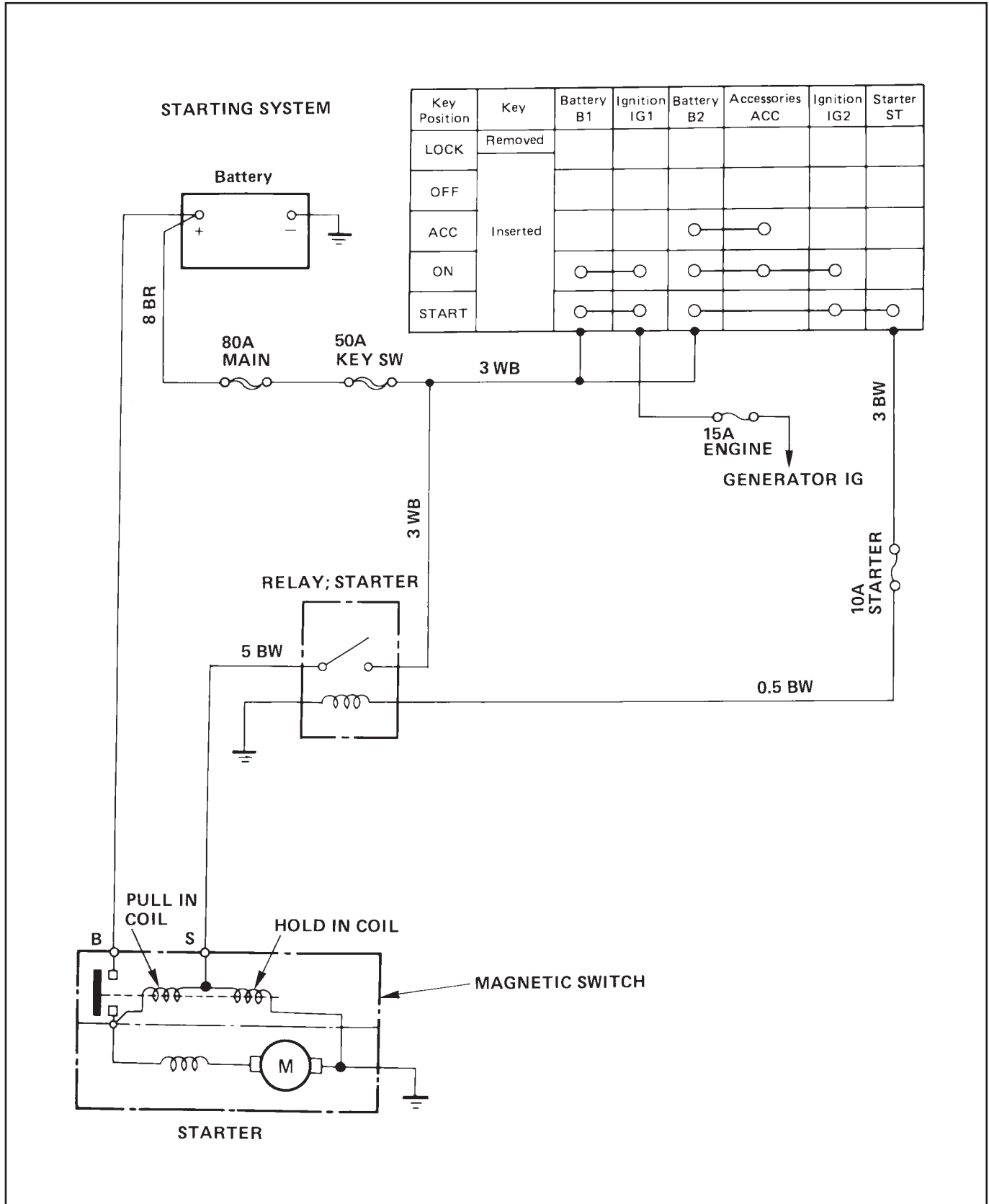


STARTER

The starting system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with ring gear. Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off,

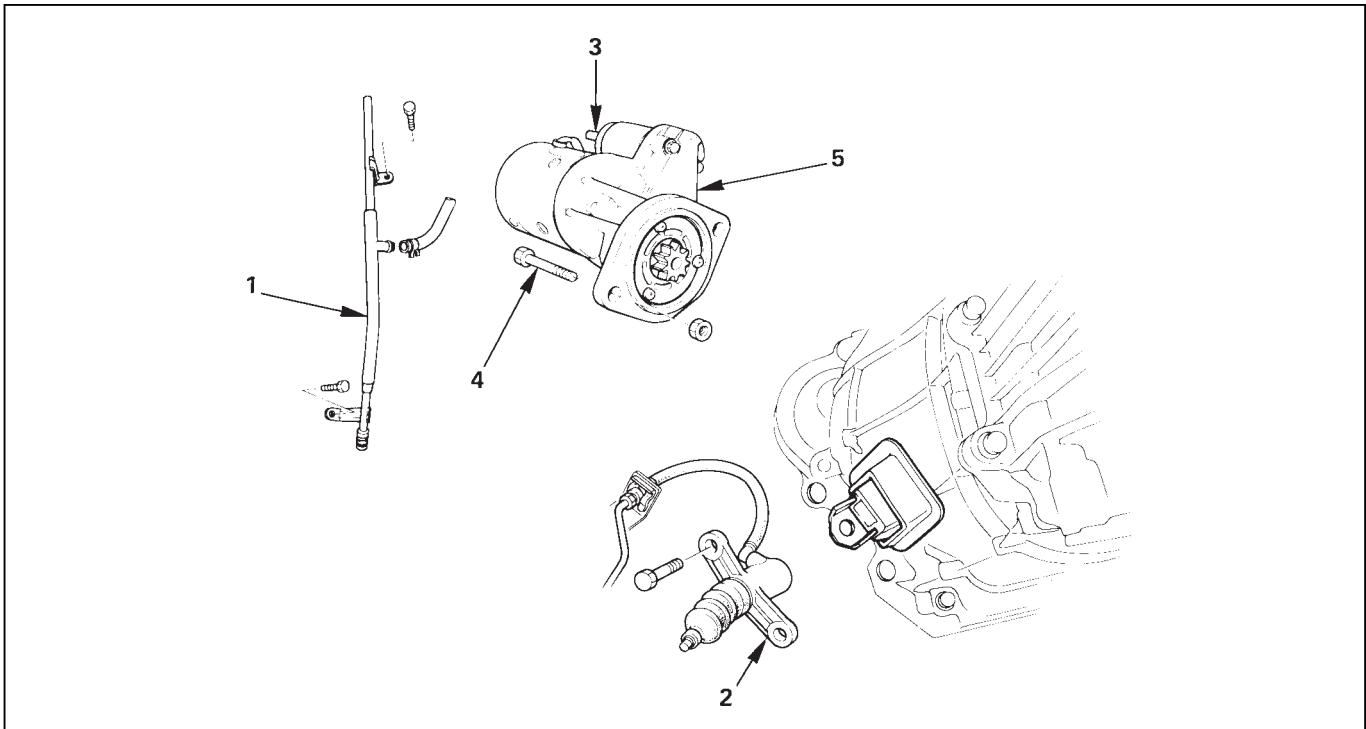
the plunger returns, the pinion is disengaged from ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.

STARTING CIRCUIT



ON-VEHICLE SERVICE

STARTER



REMOVAL

Preparation

- Battery ground cable (both batteries)

1. Oil Level Gauge and Guide

- Remove the guide and plug the hole on the oil pan.

2. Clutch Slave Cylinder

- Remove the slave cylinder and wire it to the frame.

3. Starter Wiring Connector

- Disconnect the connector from terminals "B" and "S".

4. Mounting

5. Starter Assembly



INSTALLATION

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

5. Starter Assembly

- Tighten the fixing bolt and nut to the specified torque

N·m (Kg·m/lb·ft)



94 (9.6/69)

4. Mounting

3. Starter Wiring Connector

- Reconnect the connectors to terminals “B” and “S”.

2. Clutch Slave Cylinder

- Tighten the fixing bolt and nut to the specified torque

N·m (Kg·m/lb·ft)

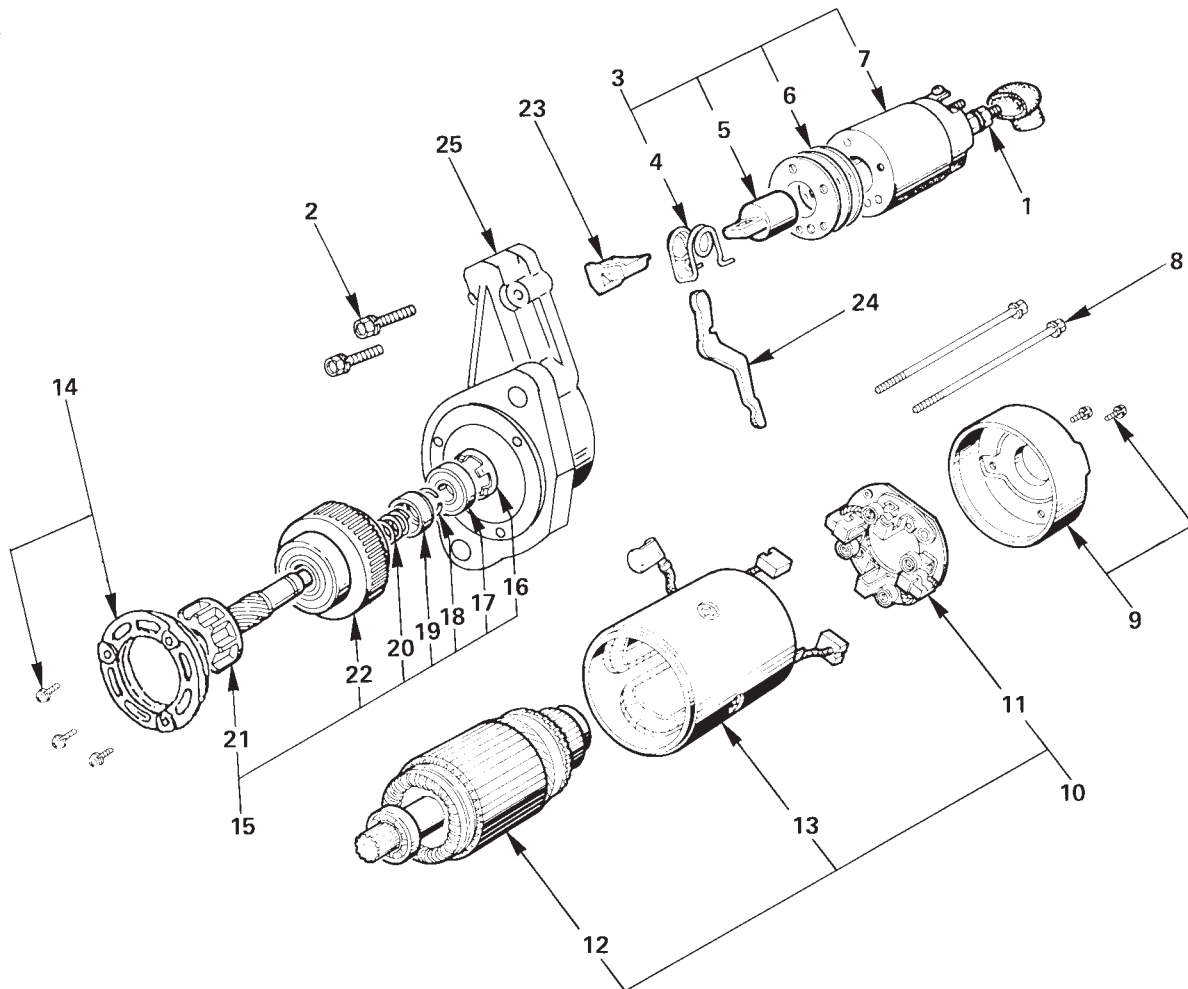


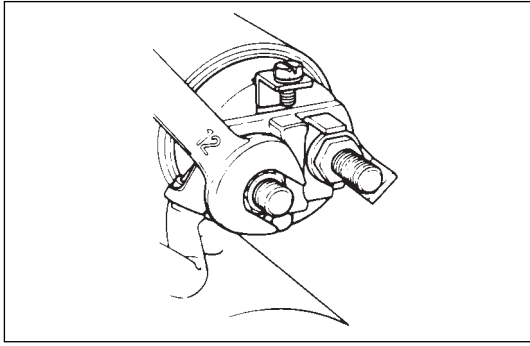
78 (8.0/58)

1. Oil Level Gauge and Guide

- Connect the battery ground cable.

UNIT REPAIR





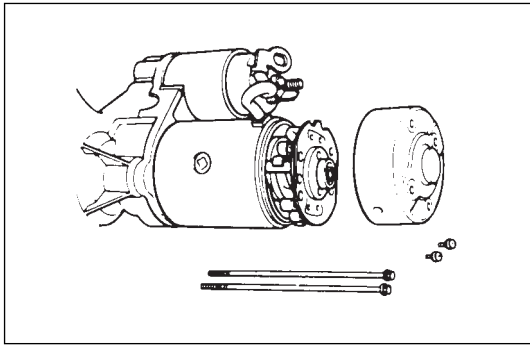
DISASSEMBLY

1. Lead Wire Nut

- Loosen the nut on terminal "M" of magnetic switch and disconnect the connector cable.

2. Bolt (2 pcs)

3. Magnetic Switch Assembly



4. Torsion Spring

- Remove torsion spring from magnetic switch assembly.

5. Plunger

6. Shim

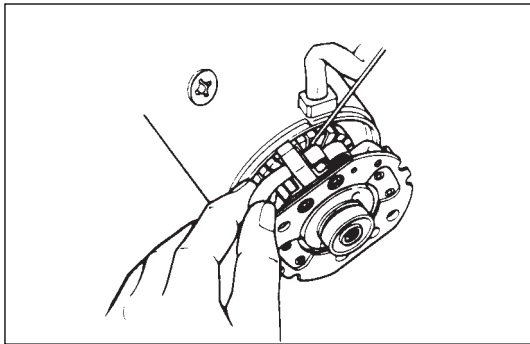
7. Magnetic Switch

8. Through Bolt

9. Rear Cover

- Remove the through bolts, then remove the rear cover.

10. Motor Assembly



11. Brush Holder

- Raise a brush spring to detach the negative side of the brushes (2 pcs) from the commutator face and remove the positive side of brushes (2pcs) from the positive side of brushes (2pcs) from the brush holder.

12. Armature

13. Yoke Assembly

14. Bearing Retainer

15. Pinion Assembly

16. Bearing Holder

17. Bearing

18. Pinion Stopper Clip

- Remove the stopper clip using a screw driver or equivalent.

19. Pinion Stopper

20. Return Spring

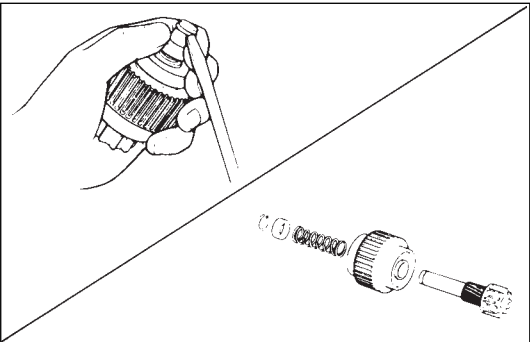
21. Pinion Shaft

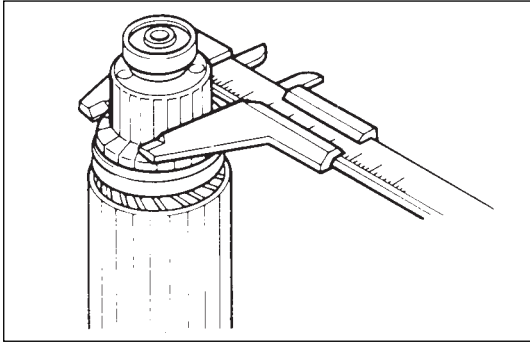
22. Clutch

23. Dust Cover

24. Shift Lever

25. Gear Case





INSPECTION AND REPAIR

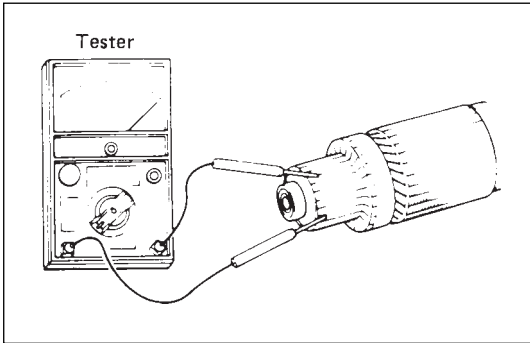
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

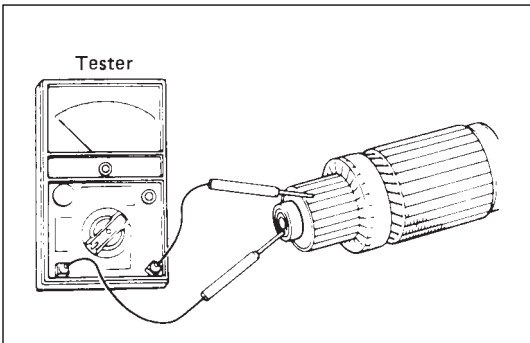
- Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

mm (in)

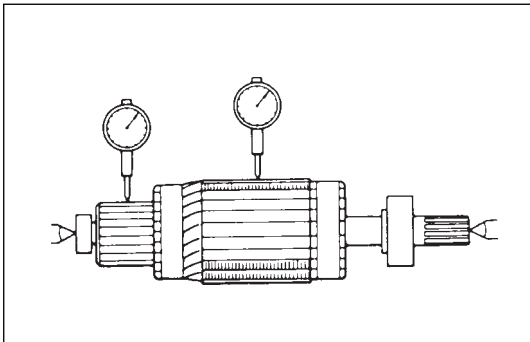
Standard	Limit
38.0(1.50)	36.5(1.44)



- Check for continuity between commutator and segments. Replace commutator if there is no continuity (i.e., disconnected).



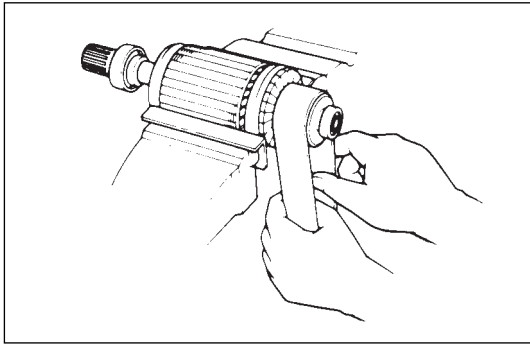
- Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



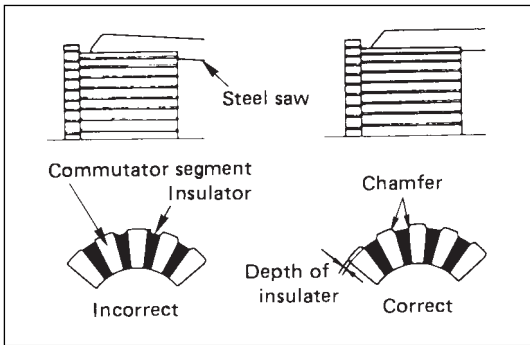
- Measure runout of armature core and commutator with a dial gage. Repair or replace, if it exceeds the limit.

mm(in)

Name	Standard	Limit
Armature	0.05 (0.002) Max.	0.1 (0.004)
Conmutator	0.05 (0.002) Max.	0.1 (0.004)

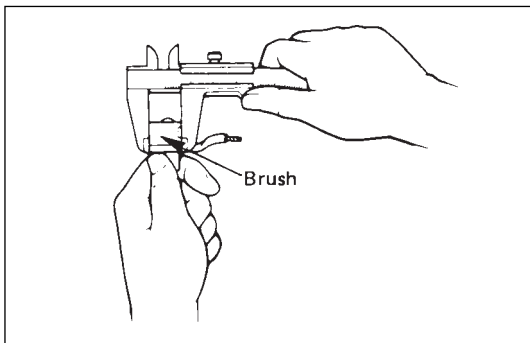


- Polish the commutator surface with sand paper #500 to #600 if it is rough.



- Measure the depth of insulator in commutator. Repair, if it is below the limit.

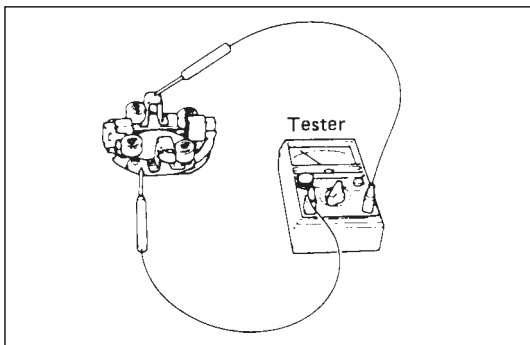
mm(in)	
Standard	Limit
0.5 ~ 0.8 (0.02 ~ 0.03)	0.2 (0.008)



Brush

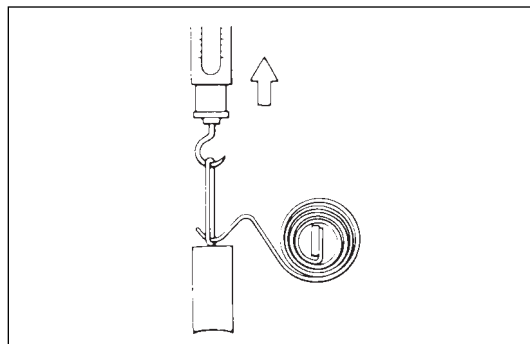
- Measure the length of brush. Replace with a new one, if it is below the limit.

mm(in)	
Standard	Limit
18.0 (0.71)	11.0 (0.43)



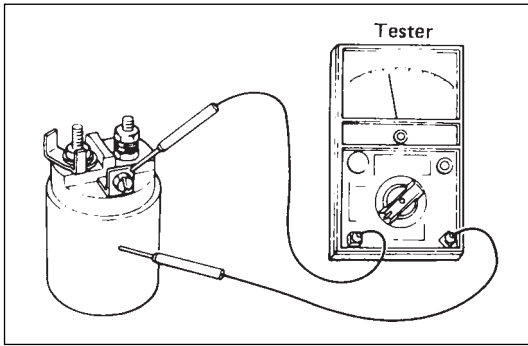
Brush holder

- Check for continuity between brush holder (+) and base (-). Replace, if there is continuity (i.e., insulation is broken).



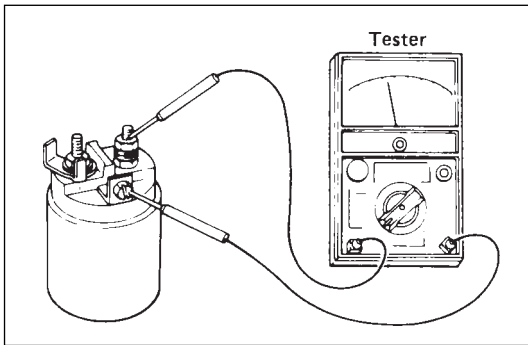
- Inspect the brush springs for wear, damage or other abnormal conditions.

N (Kg/lb)	
Standard	
28-35 (2.9-3.6/6.4-7.9)	

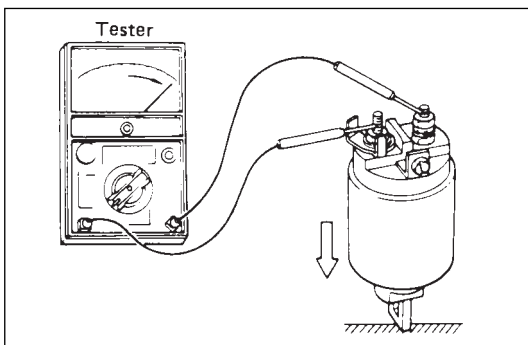


Magnetic switch

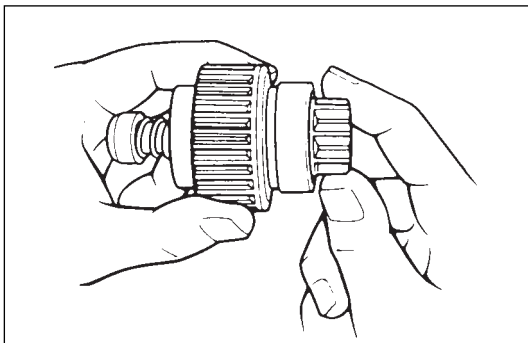
- Continuity of shunt coil
Check for continuity between terminals S and coil case.
Replace, if there is no continuity (i.e., coil is disconnected).



- Continuity of series coil
Check for continuity between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



- Continuity of contacts
With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



Pinion

- Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated reversely. If not, replace the pinion.

Yoke assembly

- Check a magnet inside the yoke.
Replace the yoke assembly if it is broken.



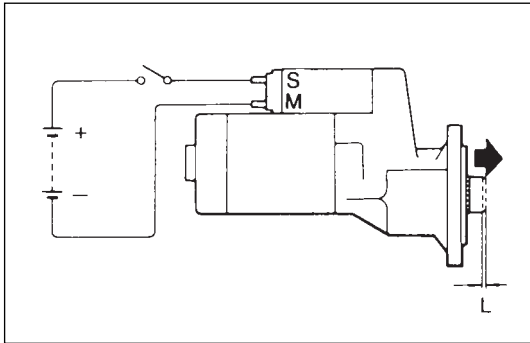
REASSEMBLY

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



Grease application places

- Gears in reduction gear
- Shift lever operating portion
- Sliding portion of pinion
- Plunger sliding portion of magnetic switch



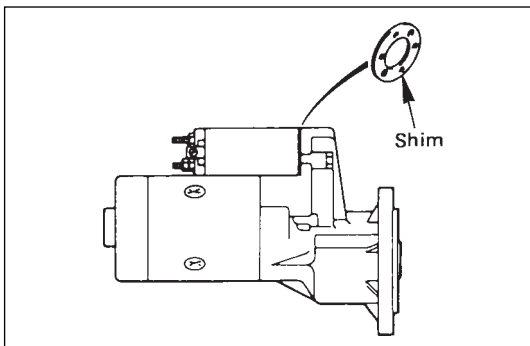
Pinion jump-out dimension

- Connect the (+) cable of battery to terminal S and the (-) cable to terminal M. Turn the switch on, and measure pinion travel dimension "L" in thrust direction from the jump-out position.

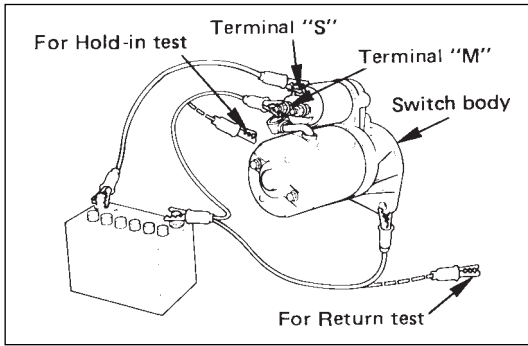


In measuring the dimension, pull the pinion out a little in the arrow direction.

mm (in)	
Dimension	Standard
L	0.3 - 1.5 (0.01 - 0.06)



If the measured value is out of standard, adjust the of shims.



MAGNETIC SWITCH

Pull-out test

Connect the magnetic switch to the battery as shown. The negative side to the "M" terminal and the magnetic switch body (housing); the positive side to the "S" terminal. If the pinion has been ejected, the pull-in coil is satisfactory

Hold-in test

1. Next disconnect the "M" terminal.
2. The pinion should remain the ejected position

Return test

When the switch body is disconnected, the pinion should return quickly

MEMO

A series of horizontal dotted lines for writing.

SECTION 6D3
CHARGING SYSTEM
CONTENTS

	PAGE
General Description	6D3-1
Diagnosis	6D3-4
Unit Repair	6D3-5

GENERAL DESCRIPTION

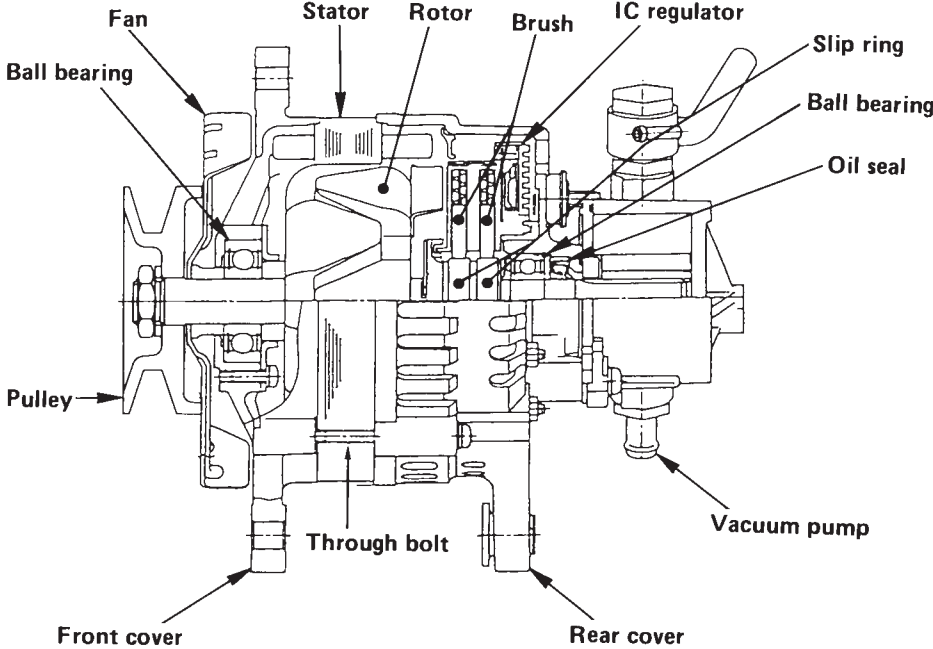
The charging system is the IC integral regulator charging system and its main components are connected as shown in Figure.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

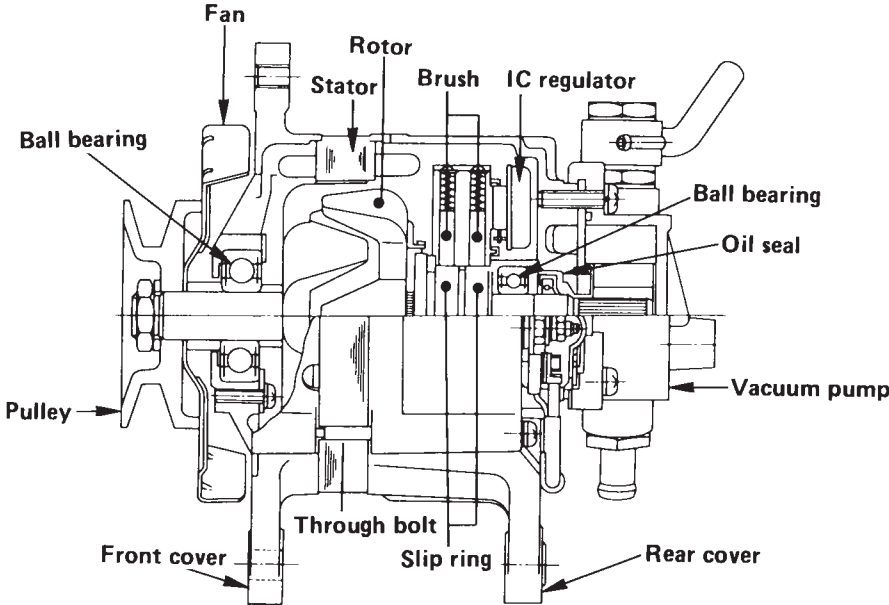
The generator does not require particular maintenance such as voltage adjustment. The rectifier connected to the stator coil has nine diodes to transform A.C. voltage into D.C. voltage. This D.C. voltage is connected to the output terminal of generator.

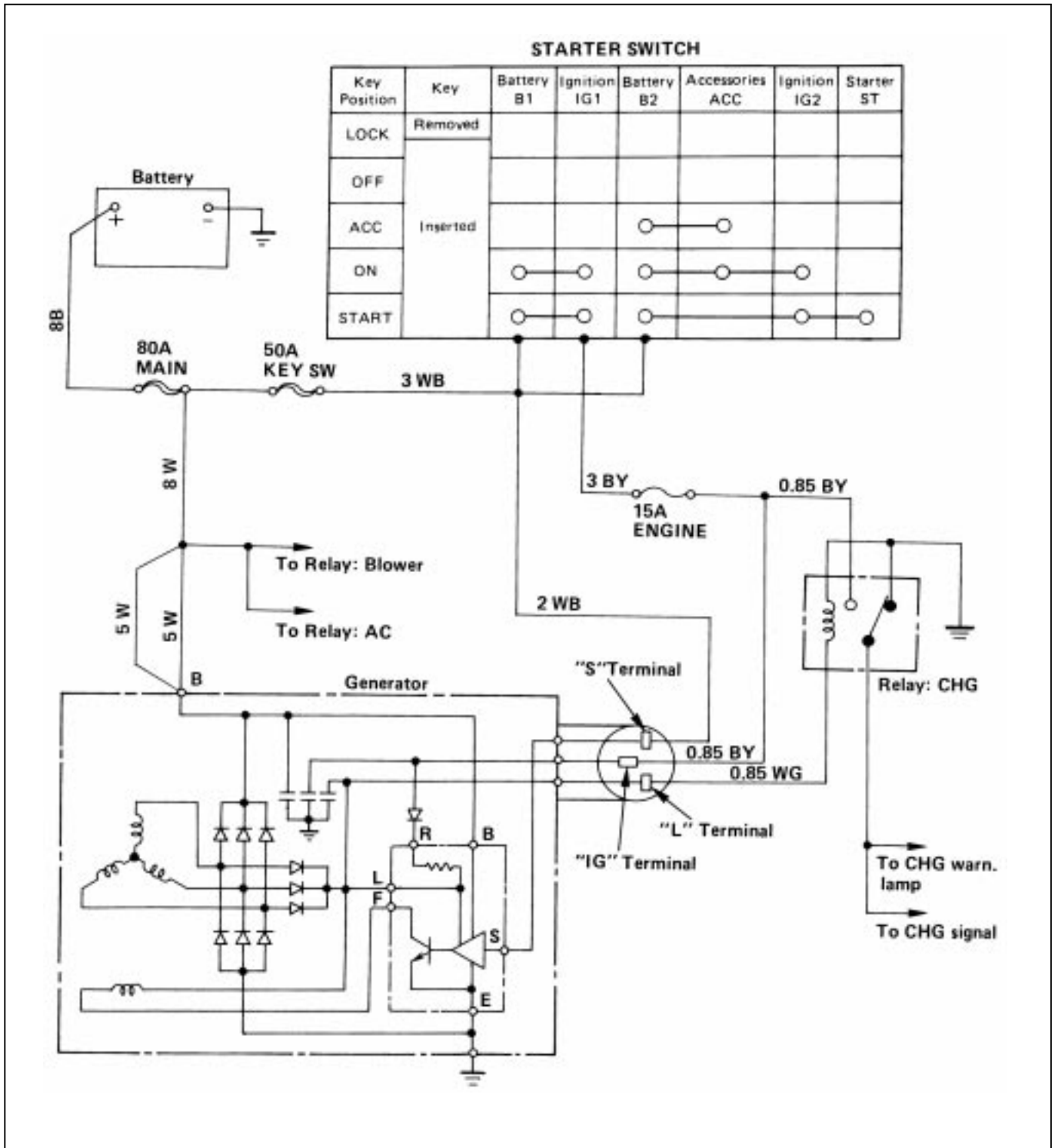
Generator

50A



80A

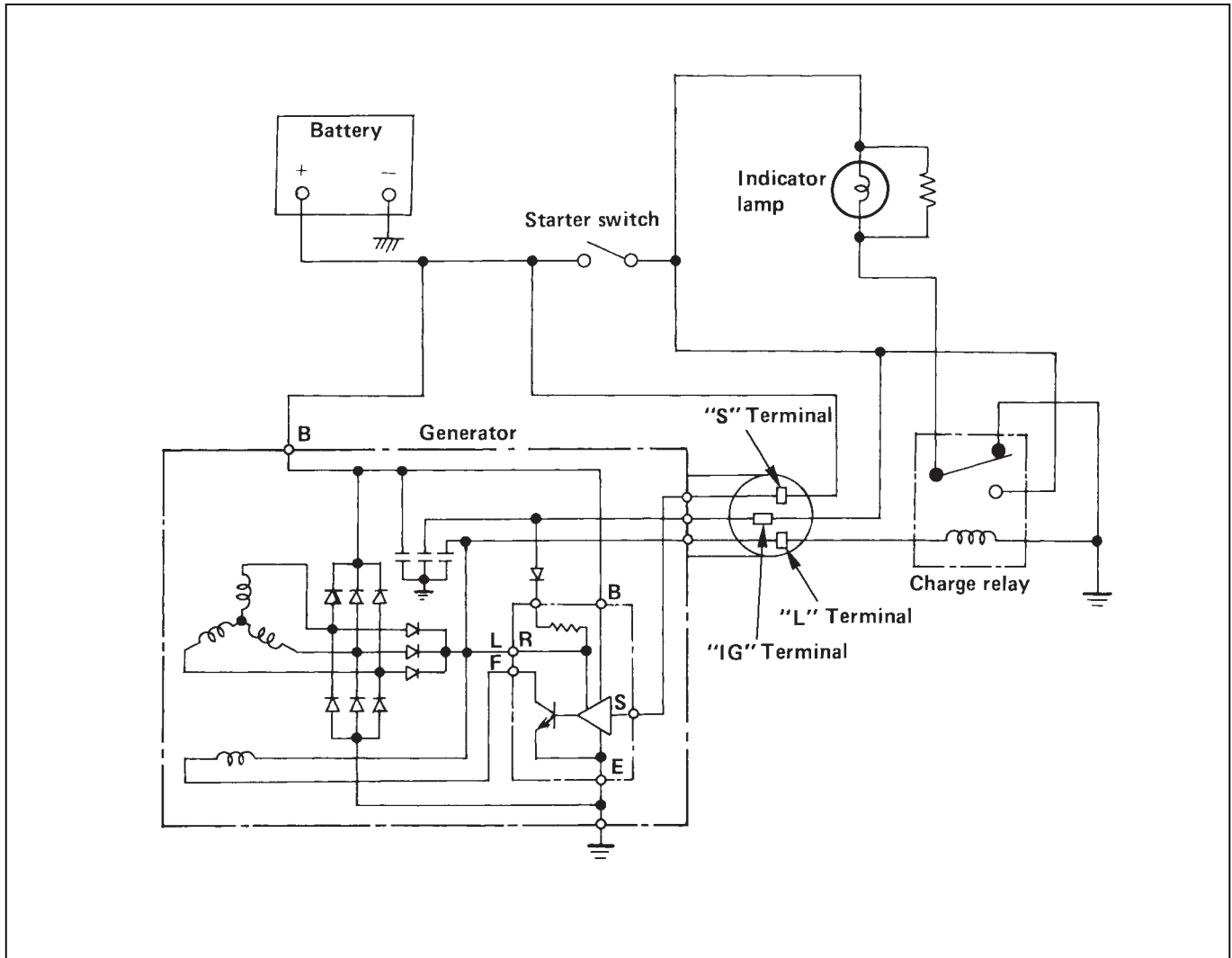




DIAGNOSIS

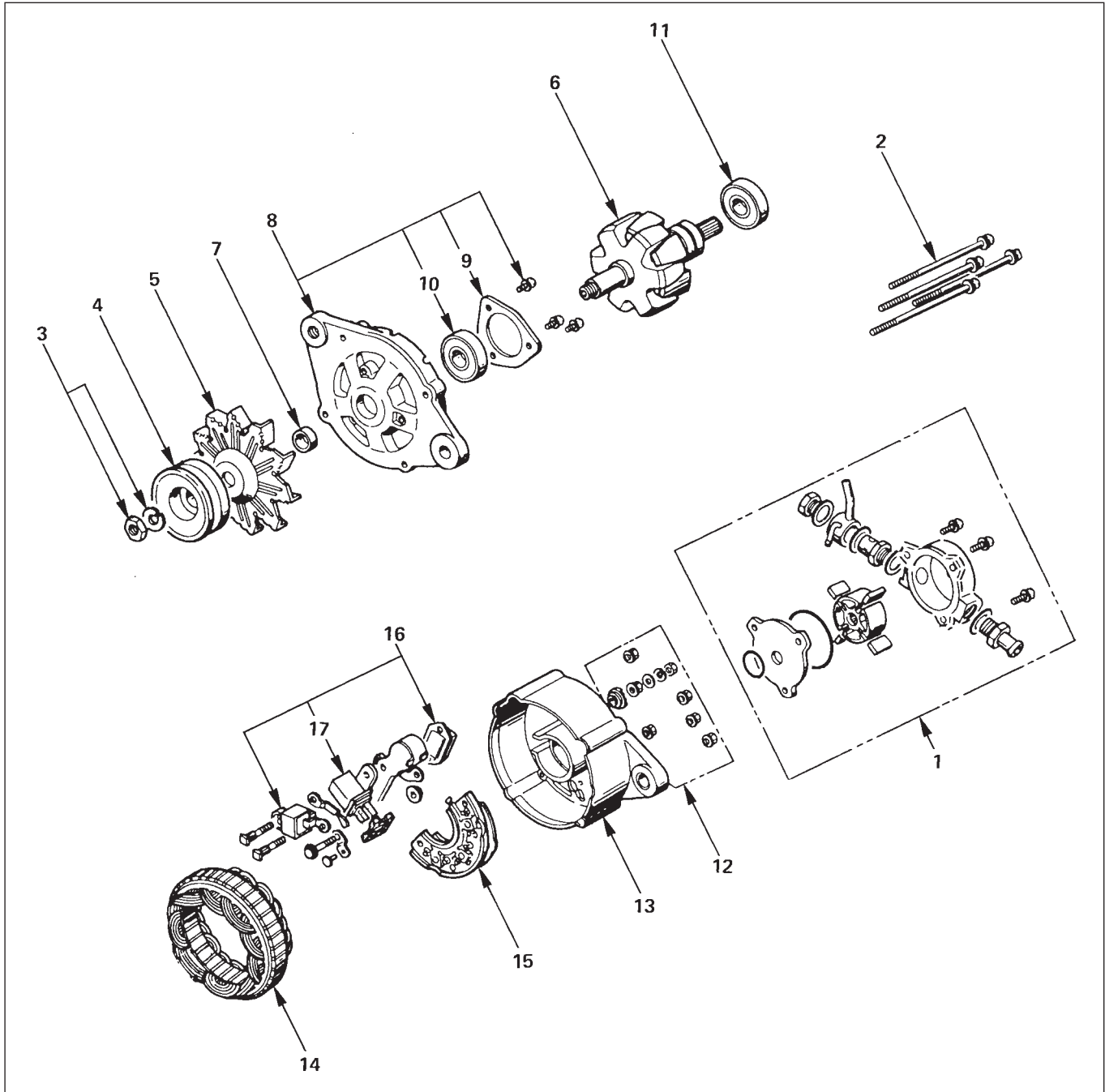
GENERAL ON-VEHICLE INSPECTION

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally if the lamp goes off when the engine starts. If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:



1. Check visually the belt and wiring connector.
2. With the engine in stop status, turn the starter switch to "ON" position and observe the warning lamp.
 - If lamp does not come on:
Disconnect wiring connector from generator, an ground the terminal "L" on connector side.
 - If lamp comes on:
Repair or replace the generator.

UNIT REPAIR

**Disassembly Steps**

1. Vacuum pump
2. Through bolt
3. Pulley nut
4. Pulley
5. Fan
6. Rotor
7. Spacer
8. Front cover assembly
9. Bearing retainer
10. Front bearing

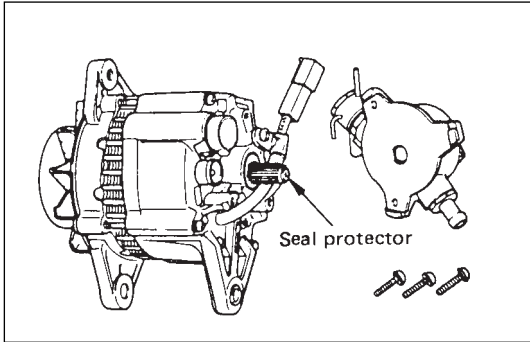
11. Rear bearing
12. Terminal bolt and nut
13. Rear cover
14. Stator
15. Diode
16. IC regulator assembly
17. Brush holder

Reassembly Steps

To reassemble, follow the disassembly steps in the reverse order.



DISASSEMBLY



1. Vacuum Pump

- Drain fluid from discharged port.
- Remove the vacuum pump fixing bolts. Hold the center plate and remove the vacuum pump horizontally in direction in line with the rotor shaft.

2. Through Bolt

3. Pulley Nut

- Cover the vice with copper plates, clamp the rotor with vice, and remove the nut.

4. Pulley

5. Fan

6. Rotor

7. Spacer

8. Front Cover Assembly

9. Bearing Retainer

10. Front Bearing

11. Rear Bearing

12. Terminal Bolt and Nut

13. Rear Cover

- Remove the nuts fixing the B terminal and diode holder.

Separate the stator and rear cover.

Note the position of insulation washers to ensure reassembly into original position.

14. Stator

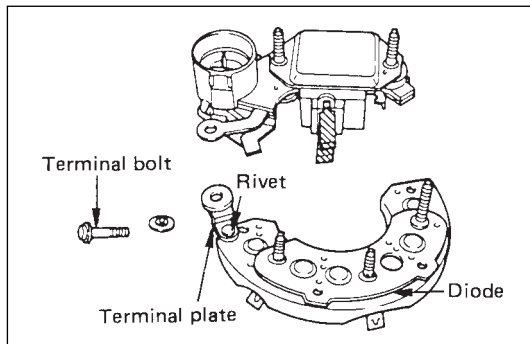
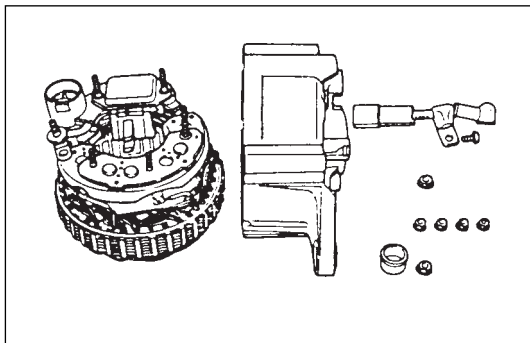
15. Diode

- Separate the diodes from the stator by melting away solder on stator coil and diode.

When melting solder, hold the lead wire with longnose pliers to prevent heat from being transferred to the diodes.

16. IC Regulator

- Separate the IC regulator from the diode by melting away solder on IC regulator holder plate and removing the nut.



17. Brush Holder Assembly

- Remove the serrated bolts and melt away solder on IC regulator.
- Do not remove the serrated bolts unless the replacement of brush or condenser.

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



INSPECTION AND REPAIR

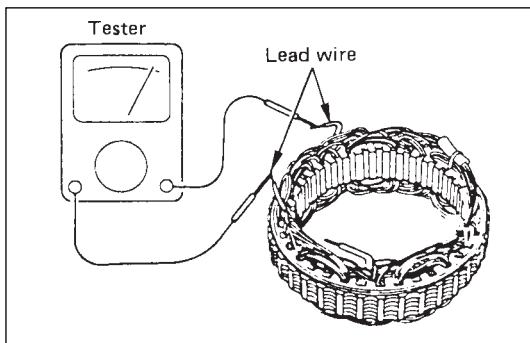
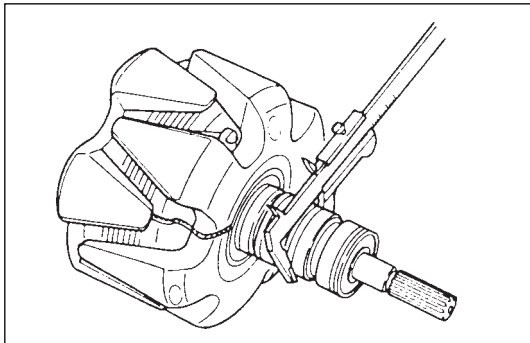
Repair or replace necessary parts if extreme wear or damage is found during inspection.

ROTOR ASSEMBLY

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500-600 sandpaper.
2. Measure the slip ring diameter, and replace if it exceeds the limit.

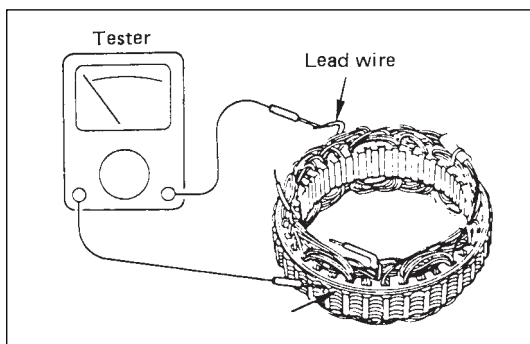
mm (in)	
Standard	Limit
34.6(1.36)	33.6(1.32)

3. Check for continuity between slip rings, and replace if there is no continuity.
4. Check for continuity between slip ring and rotor core or slip ring and rotor shaft.
In case of continuity, replace the rotor assembly.

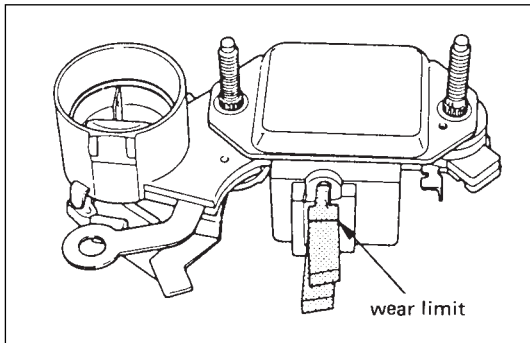
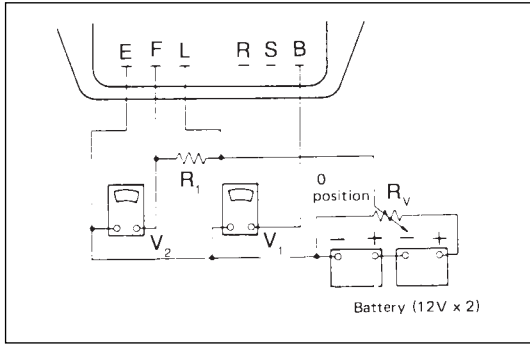
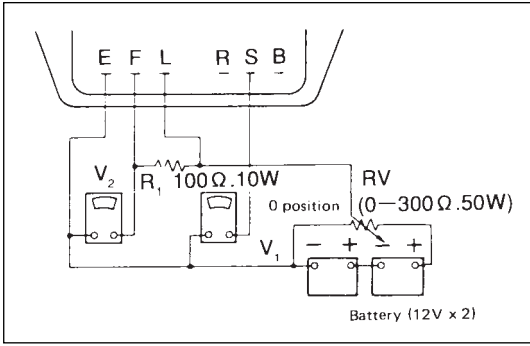


STATOR COIL

1. Check for continuity between respective phases.
In case of no continuity, replace the stator.



2. Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.



DIODE

1. Check for continuity across the terminal (example: across BAT and U). If a continuity exists, the diode is in satisfactory condition. If no continuity exists the diode is defective.
 2. Make a test with the polarities reversed. If no continuity exists, the diode is in satisfactory condition. If a continuity exists at any point, the diode is defective and should be replaced.
- Auxiliary diodes are not provided with the terminal and continuity test should be made across the terminals of the conventional diodes.

Across terminals	BAT (Positive side (+) diodes)	
	Tester pin	Negative side
U.V.W. Positive side		No continuity
U.V.W. Negative side	Continuity	

Across terminals	BAT (Positive side (+) diodes)	
	Tester pin	Negative side
U.V.W. Positive side		No continuity
U.V.W. Negative side	Continuity	

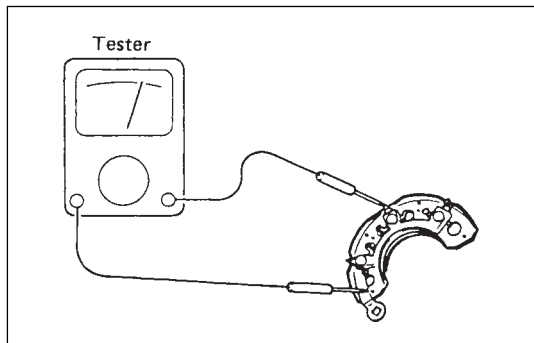
BRUSH

Measure length of brushes.

Brush length (L) mm(in)

Standard	Limit
20(0.7)	6 (0.24)

Brushes are provided with a line which indicates the limit of usage.



IC REGULATOR

Measuring instruments is necessary. Take the following measurements with the instruments connected as shown in the illustration.

- (V1) Voltage at BAT1 V

Standard	10 - 13
----------	---------

- (V2) Voltage across F-E V

Standard	Limit
2 or less	2 or more

- Take measurement with 'S' terminal disconnected.
- (V3) Measure the voltage at BAT1 - BAT2. V

Standard	20 - 26
----------	---------

- Measurement the voltage across the E-F while varying resistance gradually from zero using variable resistor. Then check that voltage increases from 2V to 10 - 13. If increase in voltage is interrupted at any point, replace the regulator.
- (V4) Measure the voltage across the intermediate tap on variable resistor and 'E' terminal without actuating the variable resistor. V

Standard voltage at 20°C (68°F)	14.0 - 14.6
---------------------------------	-------------

If measured value deviates from the standard, replace the regulator.

Check the following with the instrument connected as illustrated.

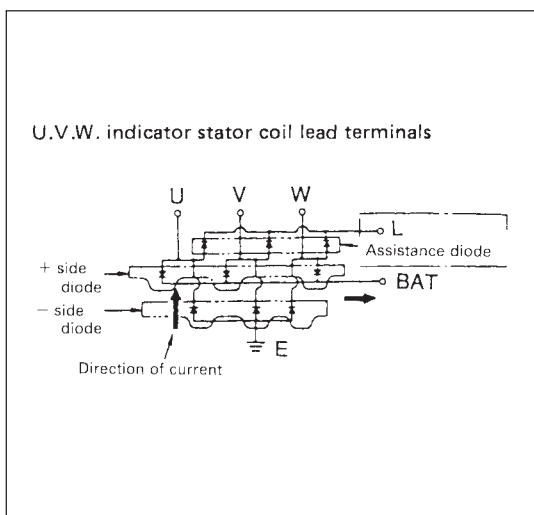
Measure the voltage across the terminals B and E by gradually increasing voltage with variable resistor RV. Check to see if voltage increases from lower than 2V to range from 10 to 13 volts.

If the voltage does not vary, the regulator is defective and should be replaced.

Check the voltage across the intermediate tap of the variable resistor and terminal E without actuating the variable resistor. V

Standard voltage at 20°C (68°F)	14.5 - 16.6
---------------------------------	-------------

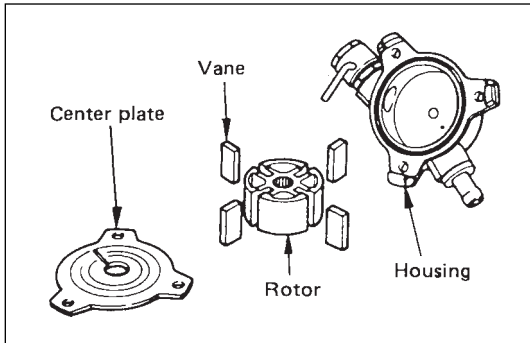
If measured voltage deviates from the standard value, replace the regulator.



VACUUM PUMP

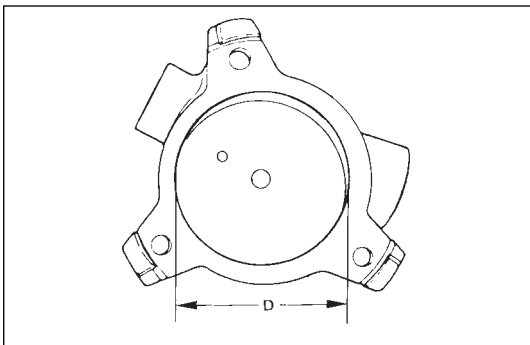
Visual check

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



Disassembly of Vacuum pump

- For the center plate, rotor and vane in the mentioned.



Housing

- Measure the inside diameter of housing and place if it exceed the standard.

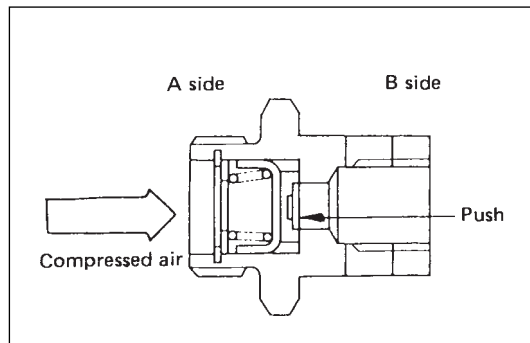
	mm (in)
Standard	60.0 – 60.1 (2.362 – 2.366)

Vane



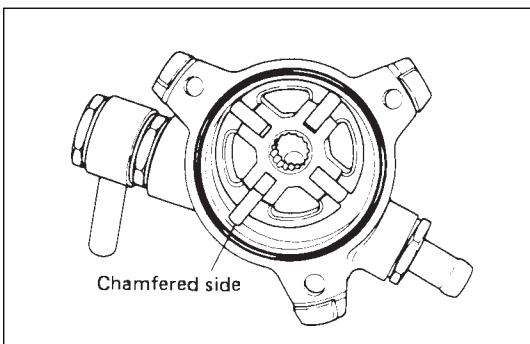
Measure the length of vanes

	mm (in)
Standard	14.2– 15.2(0.559–0.598)



Check valve

- Apply a light pressure onto the "B" side of valve with a screw driver and check that valve operates smoothly.
- Apply compressed air onto "A" side of valve and check if there is air leak.

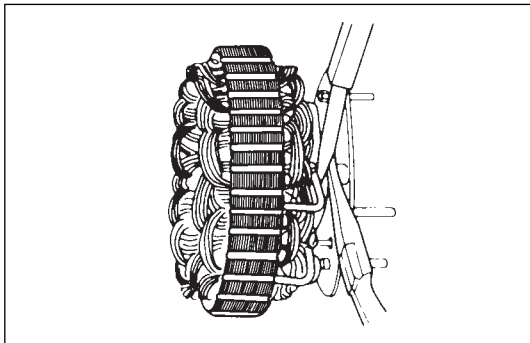
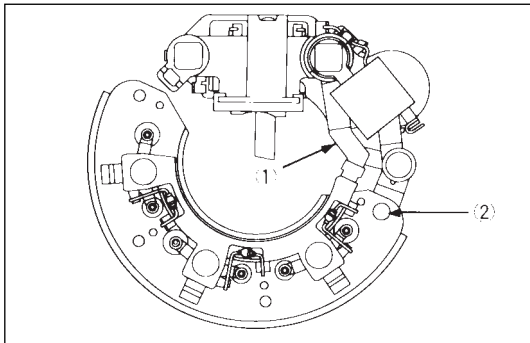
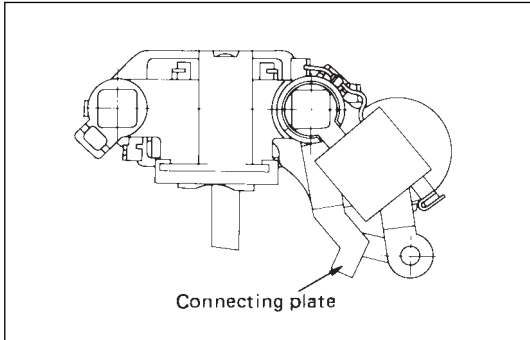
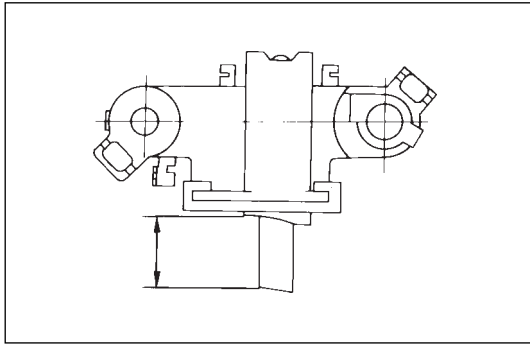


Reassembly of vacuum pump

- Position the rotor, with the serrated boss turned up, on the center plate and housing.
Align the holes in center plate and rotor.
- Install vanes into slits in rotor.
The vanes should be installed with chamfered side turned outward.
- Install the O-ring and center plate



REASSEMBLY



17. Brush Holder

16. IC Regulator Assembly

- Hold the brush in the holder as shown in the illustration and solder the lead wire.
- Put the IC regulator on the brush holder and press the bolt.
Bushing and connecting plate must be installed when pressing the bolt.

15. Diode

- Connect the terminals by fixing the rivet at ① and soldering the terminal at ②.

14. Stator

- When connecting stator coil leads and diode leads using solder, use long-nose pliers and finish the work as quickly as possible to prevent the heat from being transferred to the diodes.

13. Rear Cover

12. Terminal Bolt and Nut

11. Rear Bearing

10. Front Bearing

9. Bearing Retainer

8. Front Cover Assembly

7. Spacer

6. Rotor

5. Fan

4. Pulley

3. Pulley Nut

- Cover vice with copper plates, clamp the rotor with the vice, and tighten nut to the specified torque.

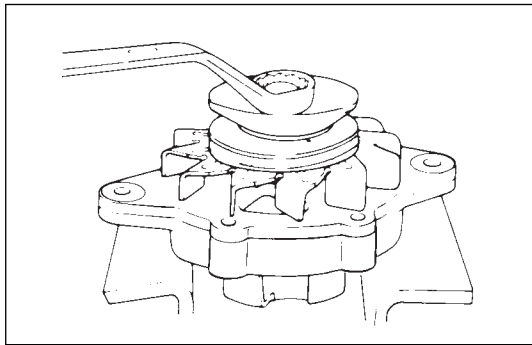
2. Through Bolt

- Place guide bar through the holes in front cover and rear cover flange for alignment, then install the through bolts.

1. Vacuum Pump

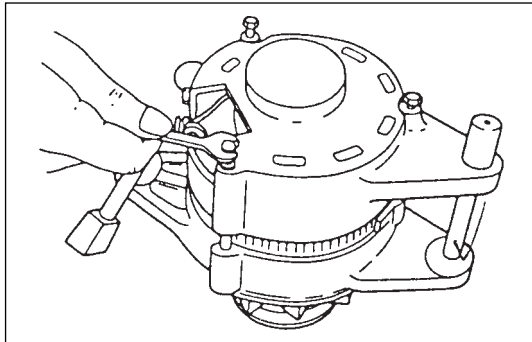
- Install and mount the housing to the generator using 3 bolts.
- Pour engine oil (5 cc or so) in through the filler port, then check that generator pulley can be turned smoothly with hand.

6D3 - 12 CHARGING SYSTEM



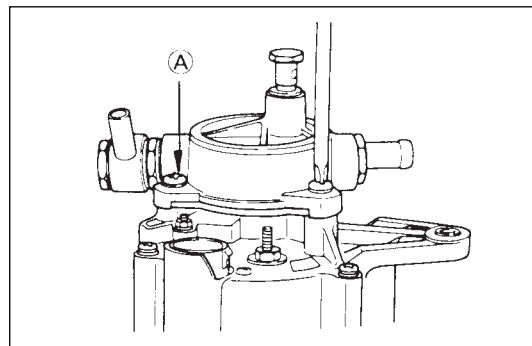
N·m (Kg·m/lb·ft)

52 (5.3 / 38)



N·m (Kg·m/lb·in)

7 (0.7 / 61)



N·m (Kg·m/lb·in)

7 (0.7 / 61)

SECTION 6D6

QOSIII PREHEATING SYSTEM

CONTENTS

	PAGE
General Description	6D6- 1
System Diagram	6D6- 2

GENERAL DESCRIPTION

QOS III preheating system features a quick-on glow plug with thermometer control of the glowing time and the afterglow time function.

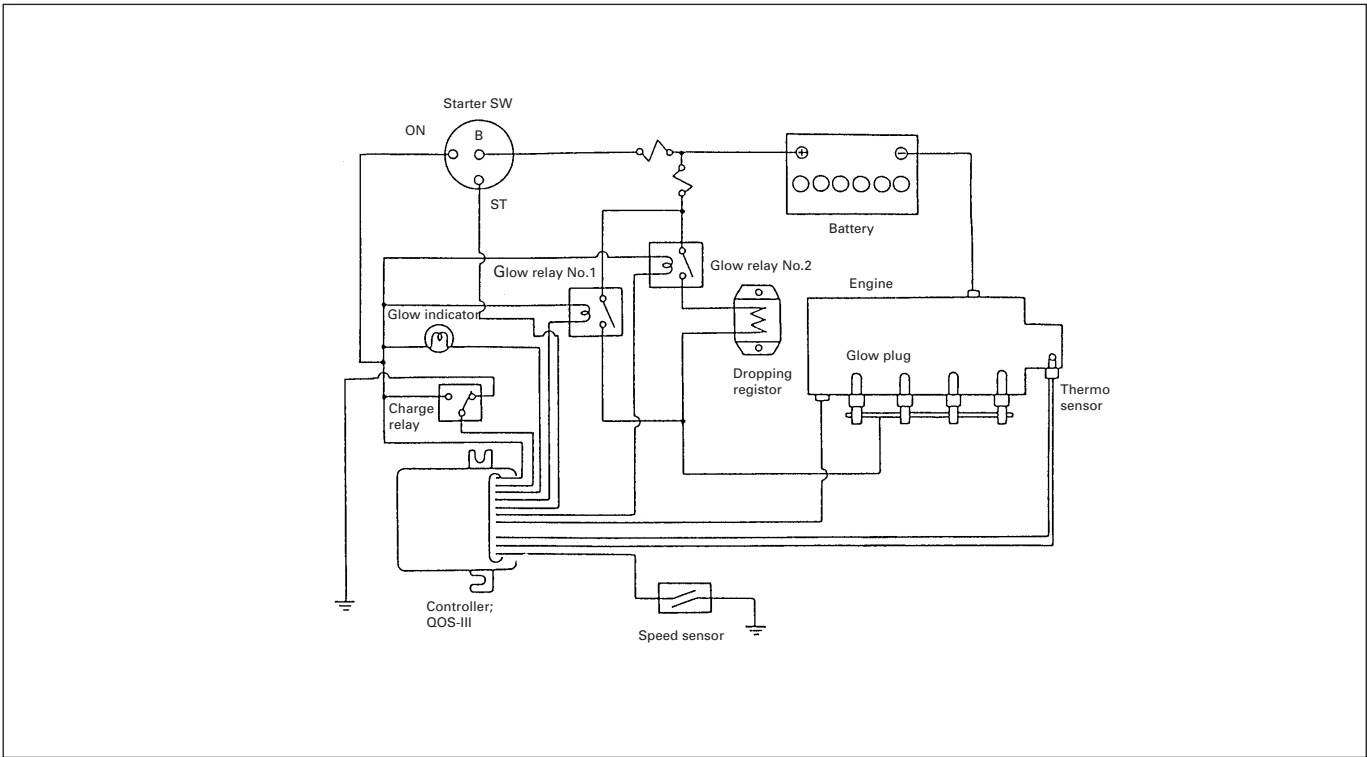
The system consists of a controller, indicator lamp, thermosensor, vehicle speed sensor, dropping resistor, relay (2 pcs), and temperature self-control type glow plug (4 pcs).

With the employment of the thermosensor, the glow time changes according to the engine coolant temperature, thus allowing optimum starting conditions to be obtained.

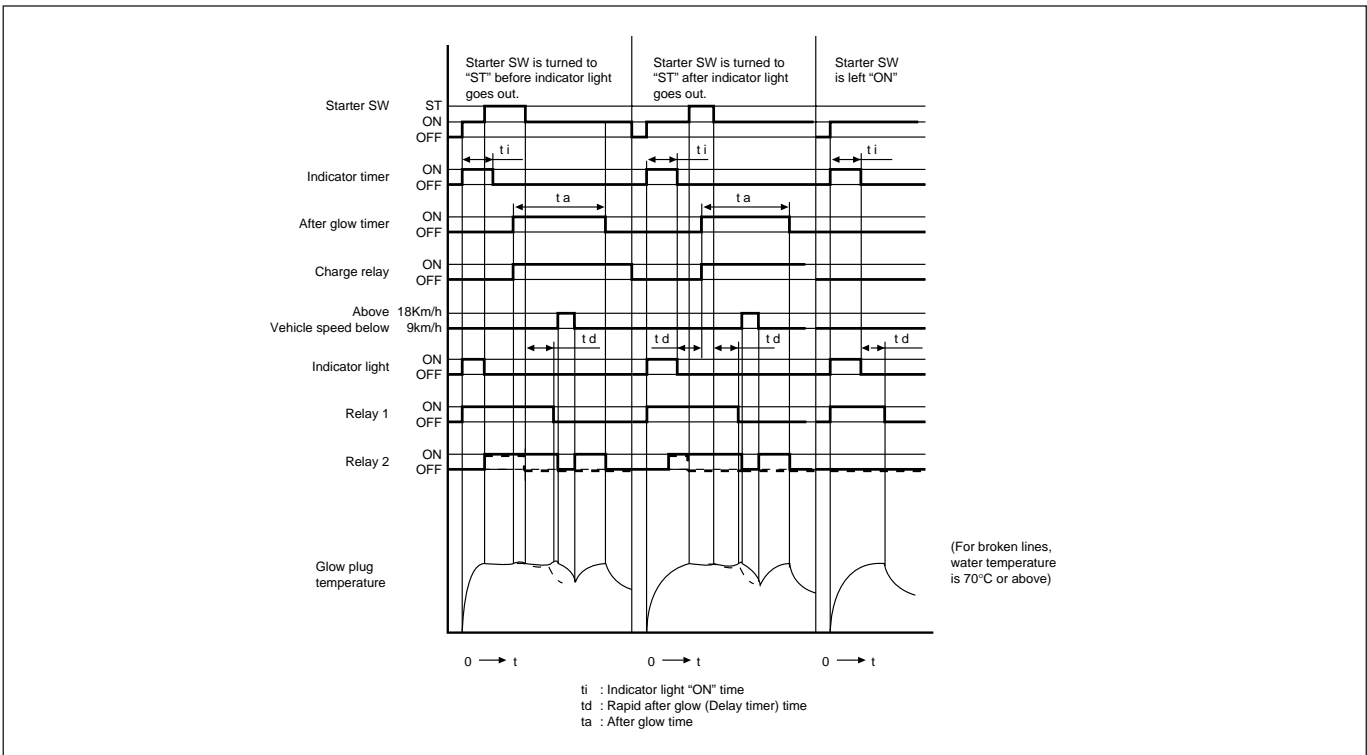
The afterglow time function is controlled by thermosensor, vehicle speed sensor, and the engine runstall sensor (charge relay).

SYSTEM DIAGRAM

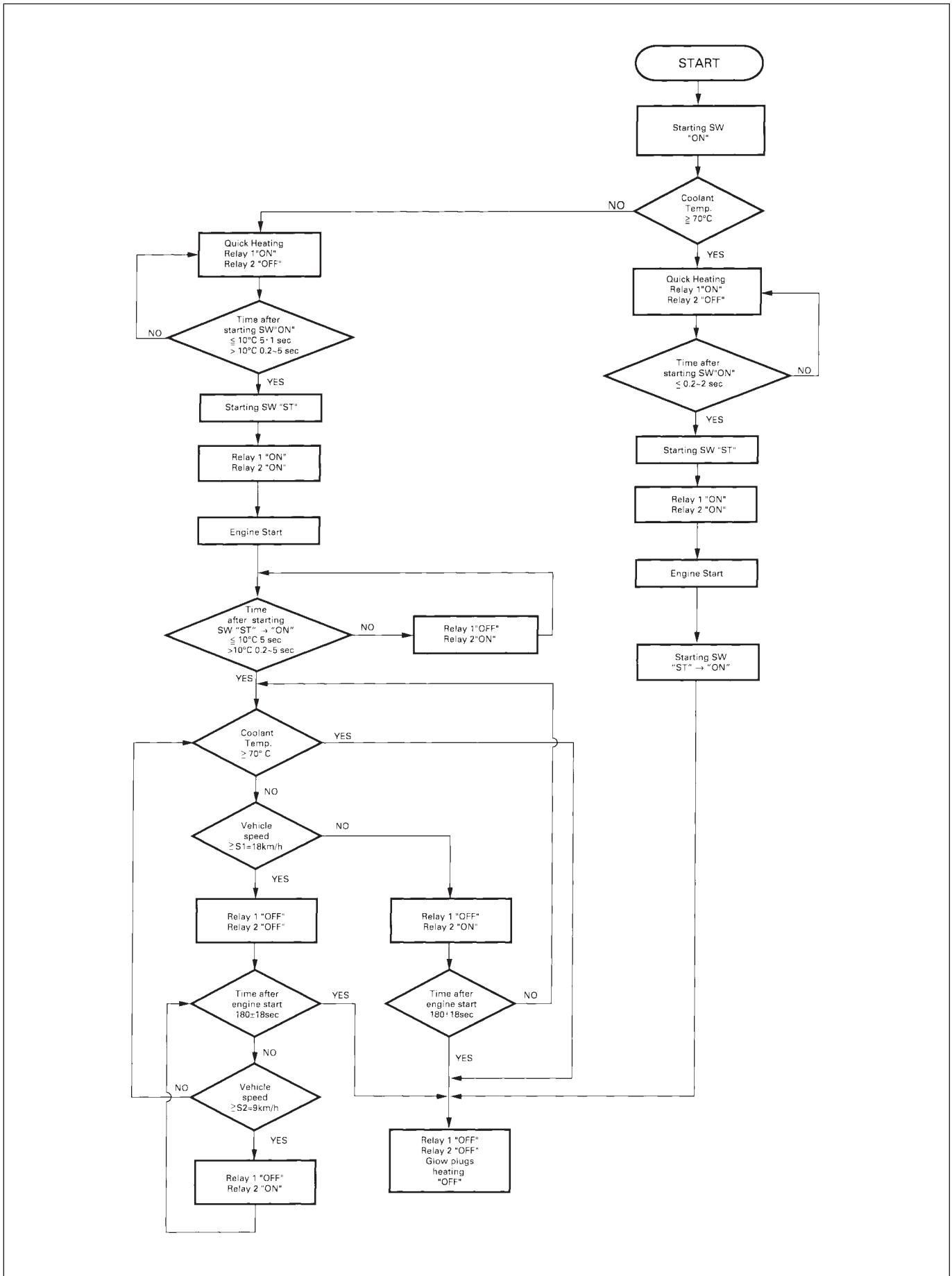
WIRING DIAGRAM



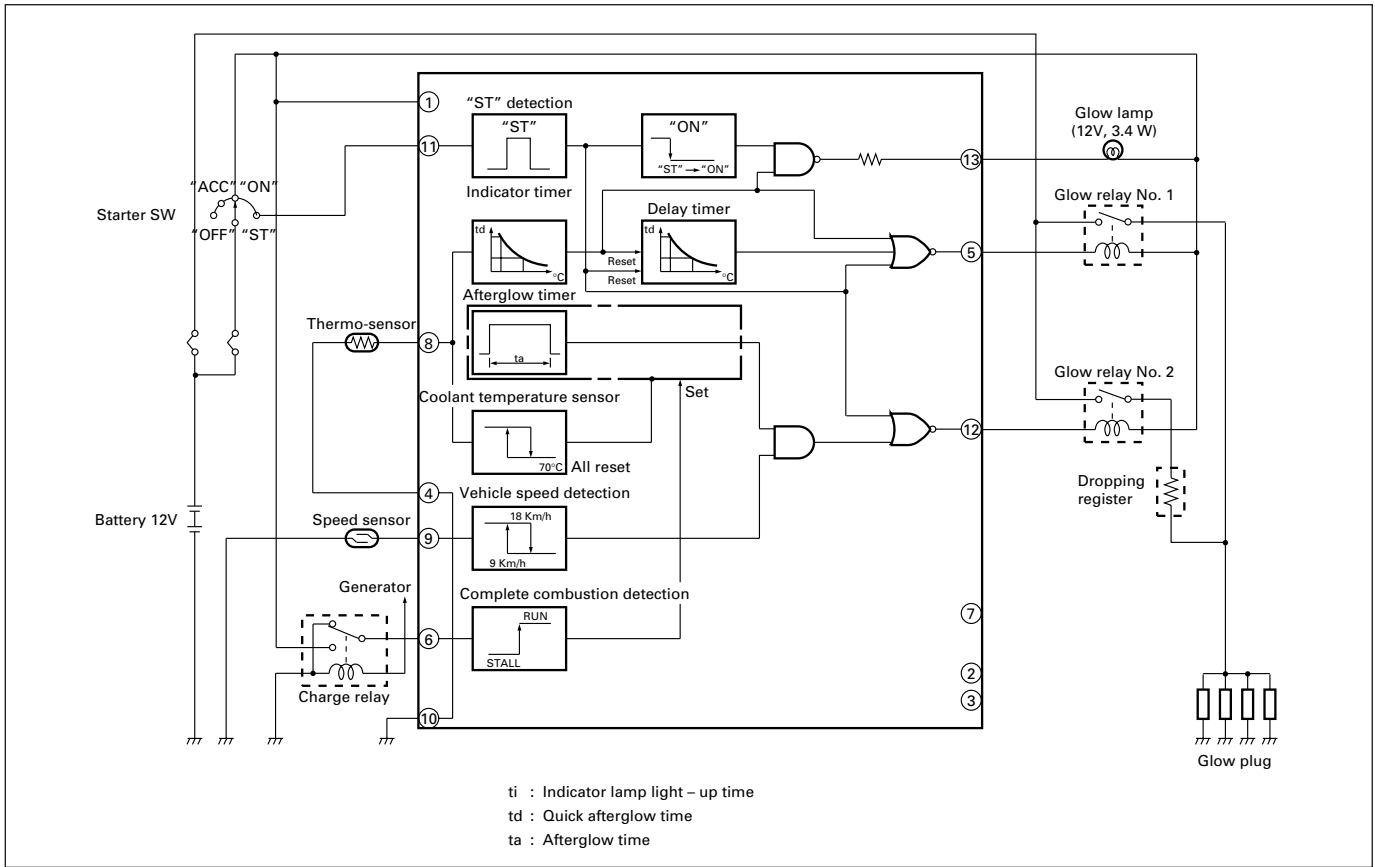
QOS III Timing Chart

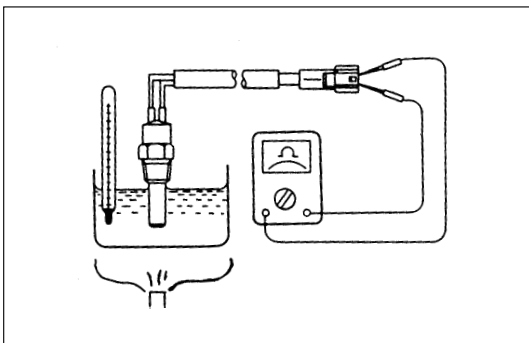
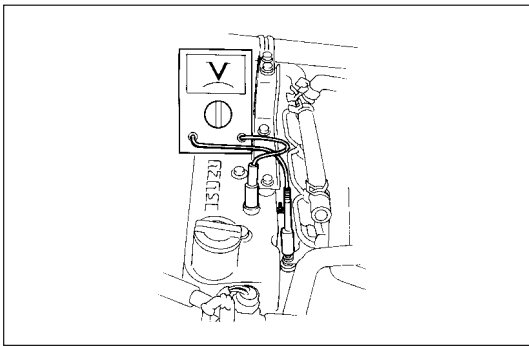
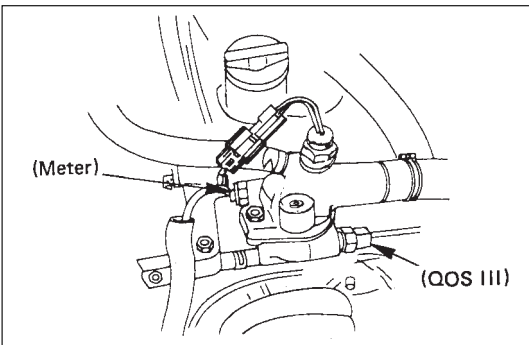
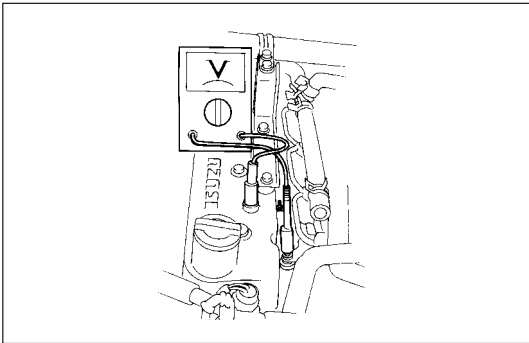
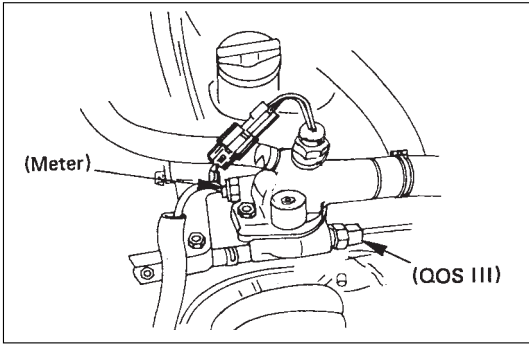


QOS III FLOW CHART



QOS III BLOCK CHART





Inspection on QOSIII System Operation

I Inspection on Quick Heating Operation

1. Disconnect thermo-sensor connection on the thermostat housing.
2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following items with starter switch set to ON position (but do not start the engine).
 - 1) The glow indicator shall light for about 5 sec.
 - 2) The circuit tester shall indicate power supply voltage for 9 ~ 13 sec.
 If above specifications are not satisfied, inspect wire harness, glow relay and thermo-sensor. If satisfied, inspect glow plug.

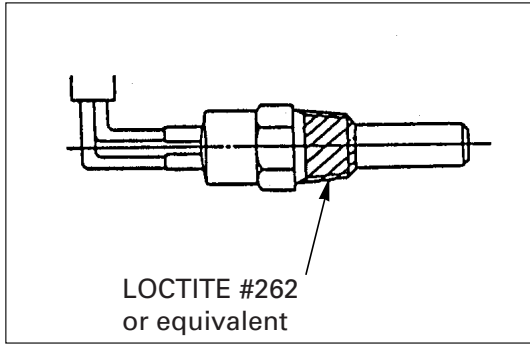
II Inspection on Afterglow Operation

1. Disconnect thermo-sensor connection on the thermostat housing.
2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following item with start the engine.
 - 1) The circuit tester shall indicate about 7 volts after 360 seconds of engine start.
 - If above specifications are not satisfied, inspect battery voltage, engine earth, wiring harness, glow plug, dropping resistor, relay No. 2 read switch and charge relay.

THERMO SENSOR

Measure the resistance depending on the water temperature as shown in the left figure. (Measuring range: -10°C ~ 50°C)

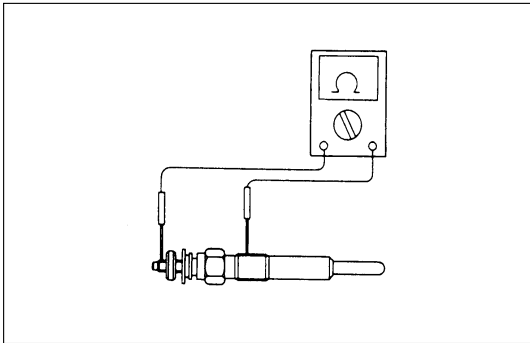
Temperature	Current (mA)	Resistance (K Ω)
20 \pm 1	1.0	2.0 ~ 3.0
50 \pm 1	1.0	0.6 ~ 1.0



When installing the thermo sensor, apply sealant (Loctite #262 or equivalent) to arrowed portion in the left figure to prevent water leakage.



Torque	N·m (Kg·m/lb·in)
8 (0.8/69)	



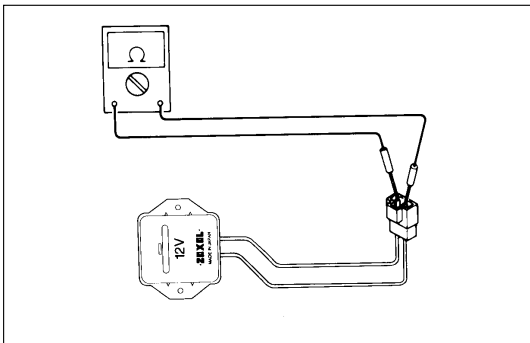
GLOW PLUG

Inspect the resistance



Resistance at normal temperature	Ω
0.8 ~ 1.0	

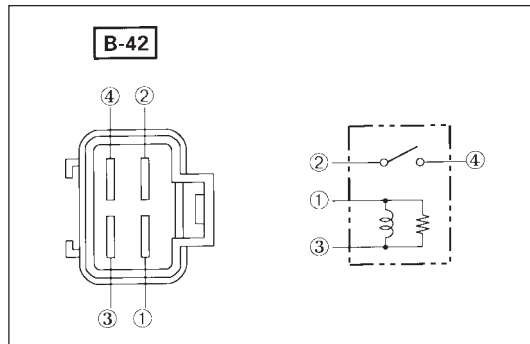
Torque	N·m (Kg·m/lb·ft)
23 (2.3/17)	



DROPPING RESISTOR

Inspect the resistance

Resistance of normal ambient temperature	m Ω
224 ~ 236	



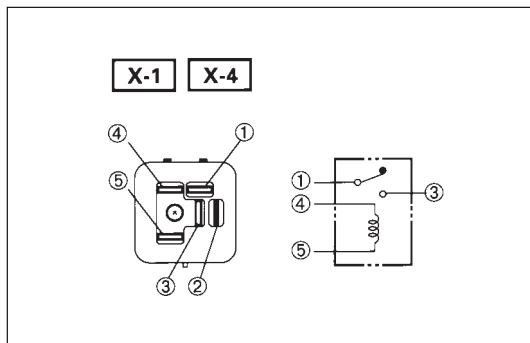
GLOW PLUG RELAY

Inspect the continuity

② - ④	No Continuity
① - ③	Continuity

If apply the battery voltage to terminal between ① - ③

② - ④	Continuity
-------	------------



CHARGE RELAY

Inspect the continuity

① - ②	Continuity
① - ③	No Continuity
④ - ⑤	Continuity

If apply the battery voltage to terminal between ④ - ⑤

① - ②	No Continuity
① - ③	Continuity

SECTION 6F

ENGINE EXHAUST

CAUTION:

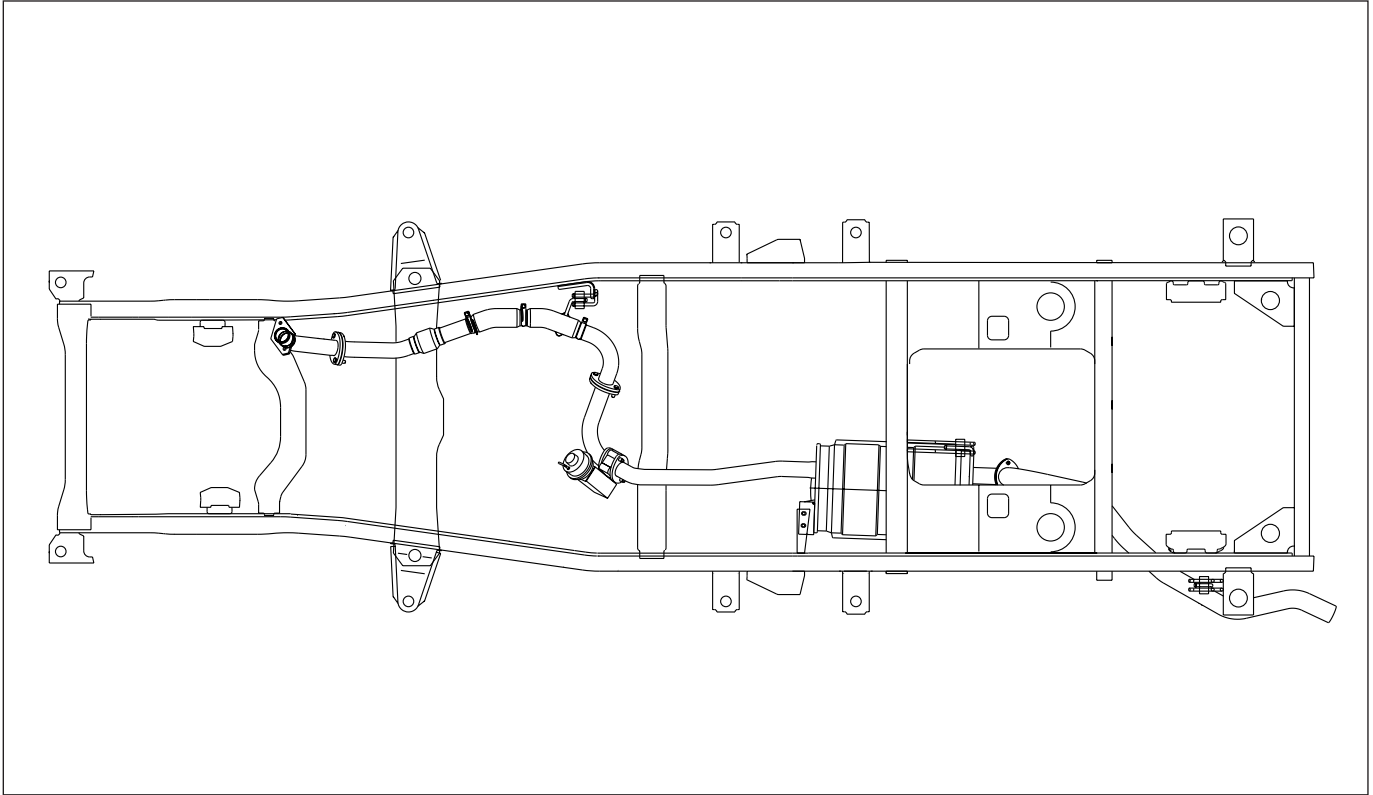
Exhaust system components must have enough clearance from the underbody to prevent

overheating of the floor pan and possible damage to the passenger compartment, insulation and trim materials.

CONTENTS

	PAGE
General Description	6F-2
Hangers	6F-2
Gasket	6F-2
On-Vehicle Service	6F-3
Front Exhaust Pipe	6F-3
Center Exhaust Pipe	6F-5
Exhaust Silencer	6F-7
Rear Exhaust Pipe	6F-9

GENERAL DESCRIPTION



150RV013

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating of the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

HANGERS

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

GASKET

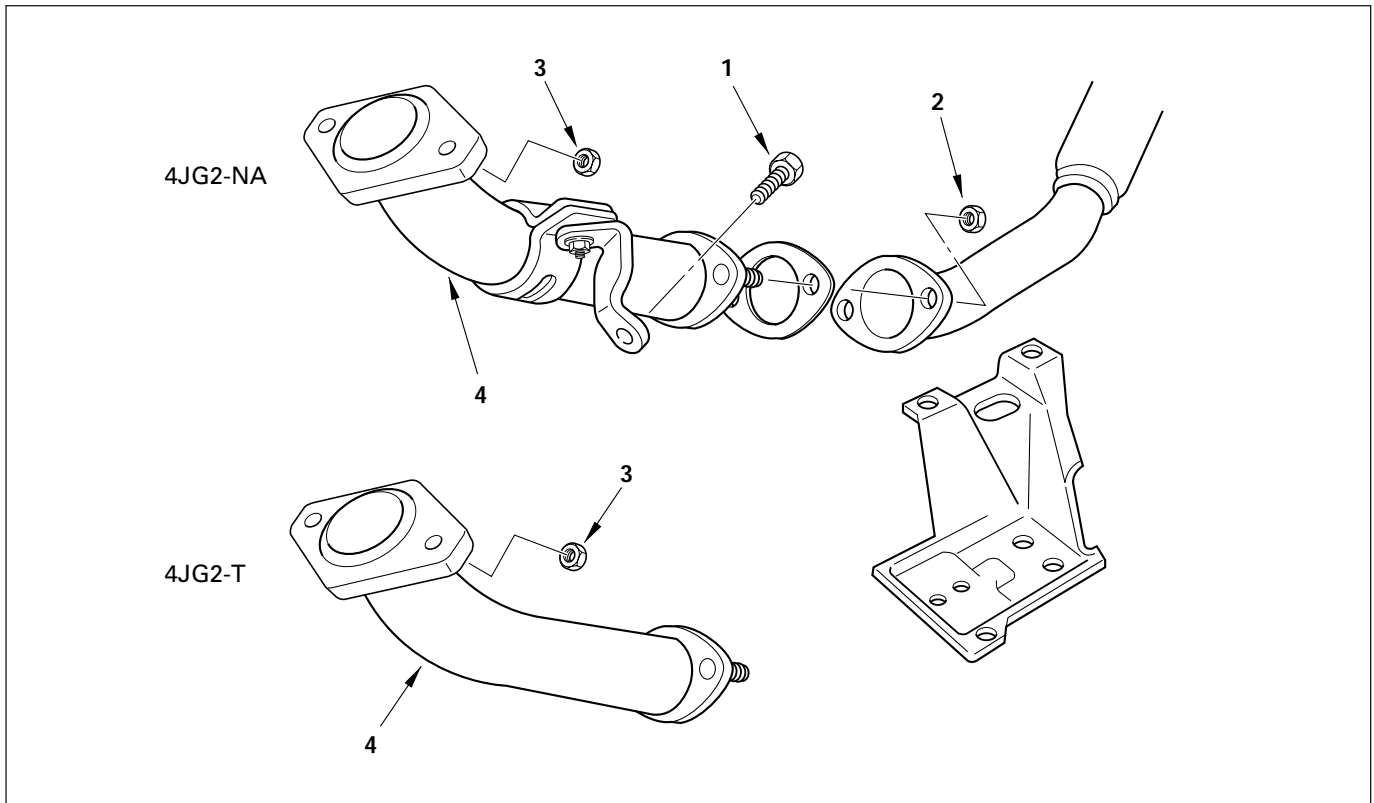
The gasket must be replaced whenever a new exhaust pipe, muffler or exhaust throttle is installed.

ON-VEHICLE SERVICE

Rattles and noise vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all bolts or nuts loose until all parts are properly aligned; then tighten, working from front to rear.

1. Check connections for looseness or damage, especially for exhaust gas leakage.
2. Check clamps and rubbers for weakness, cracks or damage.
3. If any part of the converter heat shield is damaged or dented to the extent that it contacts the catalyst, repair or replace.
4. Check for dents or damage and for any holes or cracks caused by corrosion.

FRONT EXHAUST PIPE



150RV009



REMOVAL

Preparation:

- Disconnect battery negative cable.
- Raise the vehicle and support with suitable safety stands.

1. **Front exhaust pipe mounting bracket fixing bolt**



2. Front exhaust pipe fixing nuts

- Remove two bolts fixed from front pipe and center pipe A.

3. Exhaust manifold fixing nuts

- Remove two fixing nuts from exhaust manifold and front pipe.

4. Front exhaust pipe



INSTALLATION

4. Front exhaust pipe

3. Exhaust manifold fixing nuts

- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



67 (6.8/49)

2. Front exhaust pipe fixing nuts

- Tighten the fixing nuts to the specified torque

N·m (Kg·m/lb·ft)



43 (4.4/32)

1. Front exhaust pipe mounting bracket fixing bolt

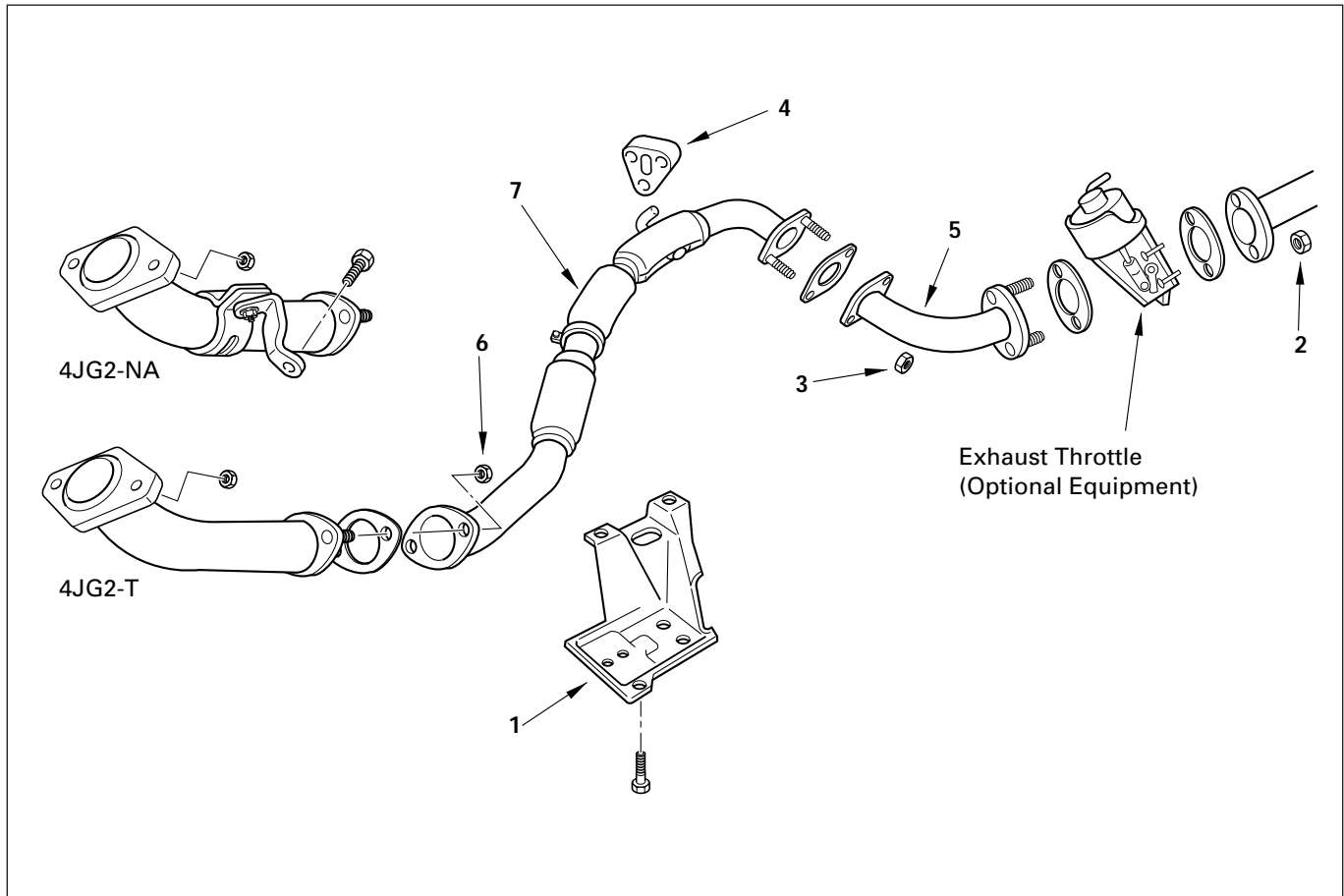
- Tighten the fixing nuts to the specified torque

N·m (Kg·m/lb·ft)



40 (4.1/30)

CENTER EXHAUST PIPE



150RV011

**REMOVAL****Preparation:**

- Disconnect battery negative cable.
- Raise the vehicle and support with suitable safety stands.

- 1. Exhaust pipe protector**
- 2. Exhaust silencer fixing nuts**
- 3. Center exhaust pipe fixing nuts**
 - Remove two fixing nuts from center pipe A and B.
- 4. Mounting rubber**
 - Pull out a mounting rod clamped to the center pipe from mounting rubber.
- 5. Center exhaust pipe B**
- 6. Front exhaust pipe fixing nuts**
 - Remove two fixing nuts from front pipe and center pipe A.
- 7. Center exhaust pipe A**



INSTALLATION

7. Center exhaust pipe A

6. Front exhaust pipe fixing nuts

- Tighten the fixing nuts to the specified torque

N·m (Kg·m/lb·ft)



43 (4.4/32)

5. Center exhaust pipe B

4. Mounting rubber

3. Center exhaust pipe fixing nuts

- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



43 (4.4/32)

2. Exhaust silencer fixing nuts

- Tighten the fixing bolts to the specified torque.

N·m (Kg·m/lb·ft)



40 (4.1/30)

1. Exhaust pipe protector

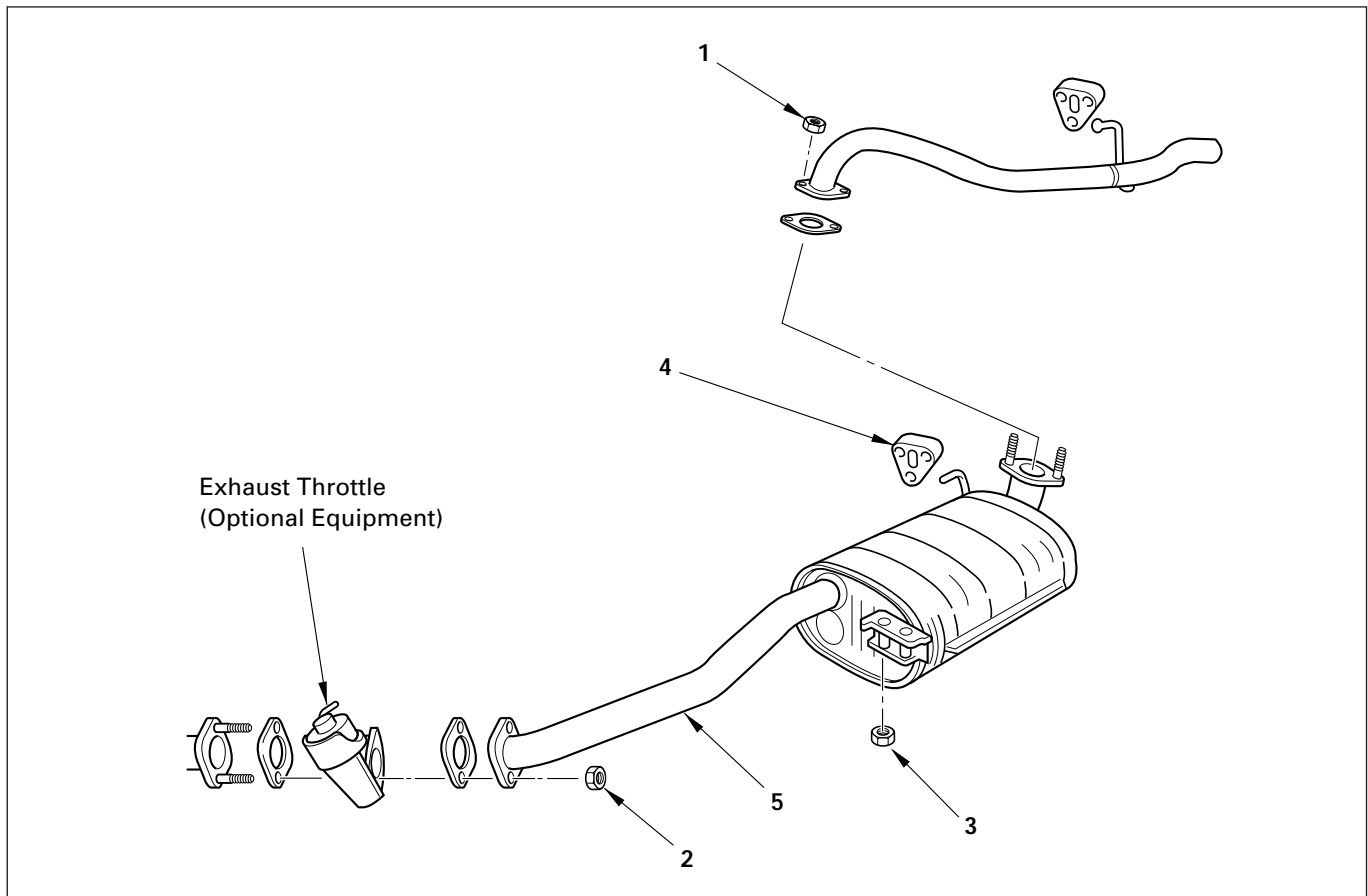
- Tighten the fixing bolts to the specified torque.

N·m (Kg·m/lb·ft)



37 (3.8/27)

EXHAUST SILENCER



150RV010

**REMOVAL****Preparation:**

- Disconnect battery negative cable.
- Raise the vehicle and support with suitable safety stands.

1. **Rear exhaust pipe fixing nuts**
2. **Exhaust silencer fixing nuts**
3. **Exhaust silencer fixing nuts**
4. **Mounting rubber**
5. **Exhaust silencer**



INSTALLATION

5. Exhaust silencer

4. Mounting rubber

3. Exhaust silencer fixing nuts

- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



16 (1.6/12)

2. Exhaust silencer fixing nuts

- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



43 (4.4/32)

1. Rear exhaust pipe fixing nuts

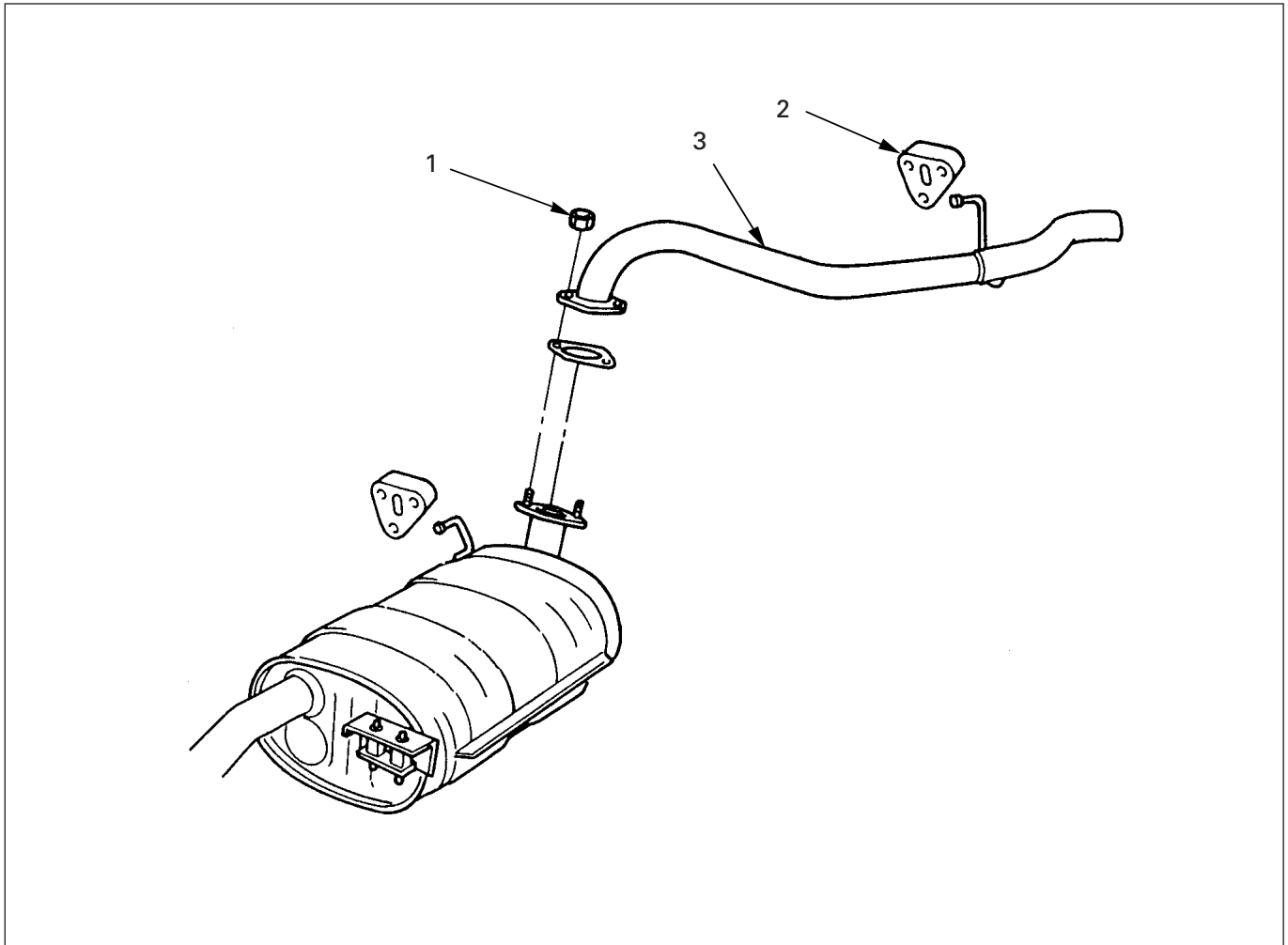
- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



43 (4.4/32)

REAR EXHAUST PIPE



↔ REMOVAL

Preparation:

- Disconnect battery negative cable.
- Raise the vehicle and support with suitable safety stands.

1. Rear exhaust pipe fixing nuts

- Remove two nuts from muffler and rear exhaust pipe.

2. Mounting rubber

- Disconnect front side mounting rubber of rear pipe.

3. Rear exhaust pipe

↔ INSTALLATION

3. Rear Exhaust pipe

2. Mounting rubber

1. Rear exhaust pipe fixing nuts

- Tighten the fixing nuts to the specified torque.

N·m (Kg·m/lb·ft)



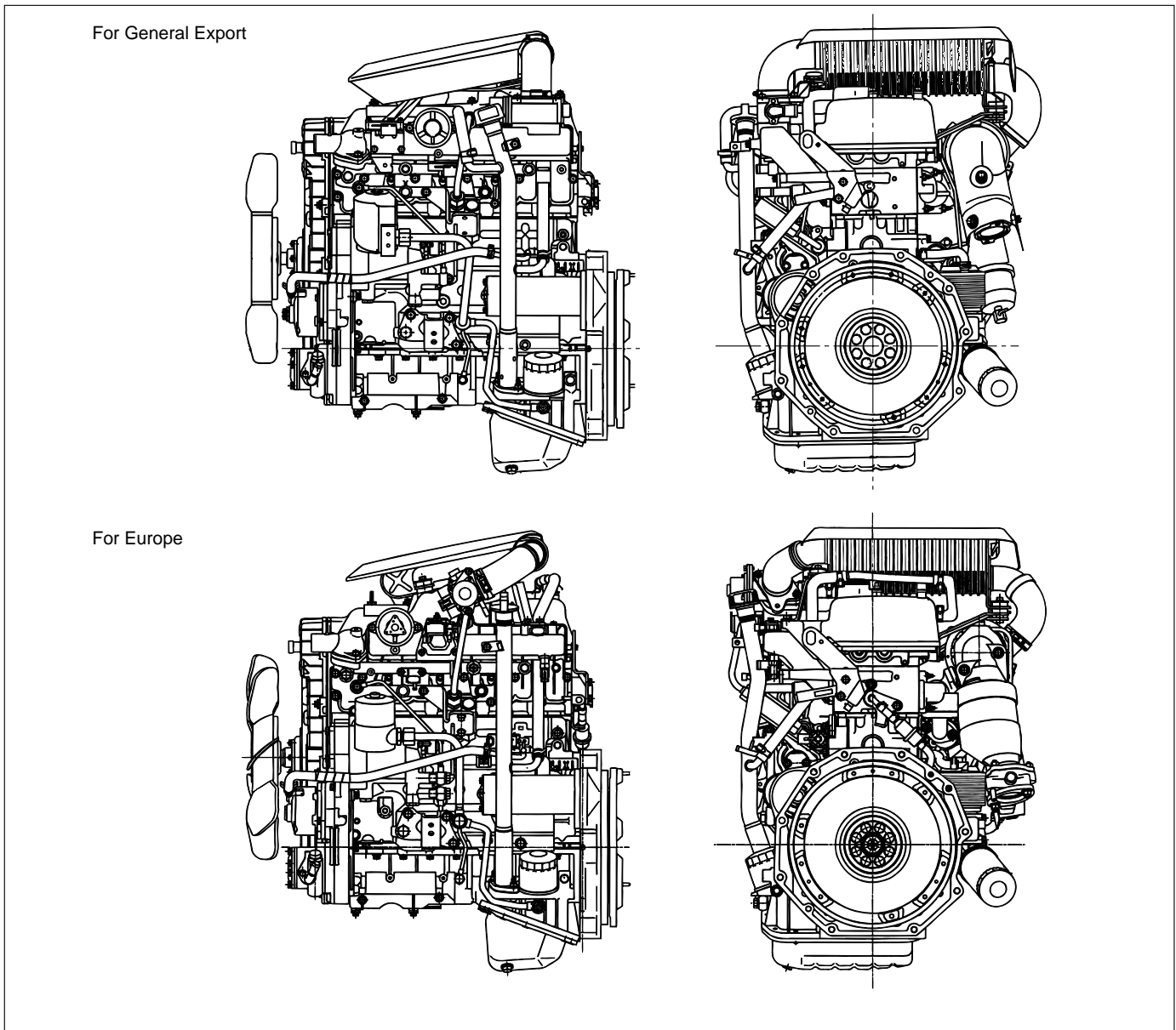
43 (4.4/32)

ENGINE

ENGINE MECHANICAL CONTENTS

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Service Information	6A-3	Cylinder Head Gasket	6A-43
Service Standard	6A-6	Camshaft	6A-47
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Tightening Torque	6A-14	Valve Stem Seal, Valve Spring and Adjuster . .	6A-60
Special Tools	6A-25	Valve Clearance Adjustment	6A-67
Engine Assembly	6A-28	Oil Rail and Injector	6A-69
Engine Mount (RH)	6A-30	Crank Case	6A-72
Engine Mount (LH)	6A-31	Crankshaft	6A-74
Intercooler	6A-32	Piston and Connecting Rod	6A-84
Cylinder Head Cover	6A-33	Cylinder Block	6A-92
Intake Manifold	6A-35	Oil Pump Assembly	6A-98
Exhaust Manifold	6A-36	Oil Filter Cartridge	6A-99
Turbocharger	6A-38	Oil Cooler	6A-99

GENERAL DESCRIPTION



F06R200004

Cylinder Head Gasket

The cylinder head gasket is laminated steel sheets. Three grades of the gasket according to the measured piston head projection from the cylinder block are provided to give the engine a minimum compression ratio fluctuation.

Tightening Method for Special Bolt

The cylinder head fixing bolts, flywheel bolts and connecting rod cap fixing bolts are tightened by the angular Tightening Method.

Piston

Auto-thermatic pistons having steel struts with a 0.4 mm offset from the piston pin center line, are applied to reduce thermal expansion and resulting engine noise when the engine is cold.

Bearings

The crankshaft bearings and connecting rod bearings are of aluminum having a high bearing surface. These bearings are especially sensitive to foreign material such as metal scraps. So, it is very important that the oil ports and other related surfaces are kept clean and free of foreign material. Crankshaft bearings are selected for optimum bearing and journal clearance which reduces vibration and noise.

Crankshaft

As tufftriding (Nitriding treatment) is applied to increase crankshaft strength, crankpins and journals should not be reground.

Piston Cooling

An oiling jet device for piston cooling is provided in the lubricating oil circuit from the cylinder block oil gallery via a check valve.
Take care not to damage any oiling jet when removing and installing piston and connecting assembly.

Fuel Injection System

The injection system is oil rail type.

Quick On Start 4 System

QOS4 preheating system which features a quick-on glow plug with thermometer control of the glowing time and the afterglow time function, is applied.

SERVICE INFORMATION

MAIN DATA AND SPECIFICATION

Engine type		Diesel, four cycle water cooled inline
Camshaft type		DOHC
Number of cylinders		4
Bore x stroke	(mm)	95.4 x 104.9
Total piston displacement	(cc)	2999
Compression ratio	(to 1)	19.0
Engine weight (dry)	N (kg/lb)	For Europe : 18.5 2492 (254/560) (A/T) For Europe : 2422 (247/545) (A/T) 2649 (270/593) (M/T) For Europe : 2697 (275/606) (M/T)
Engine idling speed (Reference)	RPM	720
Compression pressure	kpa (kg/cm ² /psi)-rpm	3040 (31/441)-200
Firing order		1-3-4-2
VALVE SYSTEM		
Intake valves	open at:	B.T.D.C. 3°
	close at:	A.B.D.C. 57.6°
Exhaust valves	open at:	B.B.D.C. 56.5°
	close at:	A.T.D.C. 5°
Valve clearance (at cold)	mm (in)	
	intake:	0.15 (0.006)
	exhaust:	0.25 (0.01)
Oil filter		Full flow and bypass combined type
Oil capacity (Original factory fill or rebuilt engine)		9.0 liters (7.9 US quarts)
Oil capacity (Service change)		
with filter change		6.0 liters (6.3 US quarts)
without filter change		5.0 liters (5.3 US quarts)
Oil cooler		Water cooled type
Inter cooler		Air cooled type
Turbocharger method		
Control method		Wastegate control
Lubrication		Pressurized control
Cooling method		Coolant cooled

Engine Cooling

Cooling system		Coolant forced circulation
Radiator		(2 tube in row) Tube type corrugated
Heat radiation capacity	J/h (kcal/h)	318 x 10 ⁶ (76000)
Heat radiation area	m ² (ft ²)	15.63 (1.454)
Front area	m ² (ft ²)	0.309 (2.029)
Dry weight	N (kg/lb)	83 (8.5/18.7)
Radiator cap		
Valve opening pressure	kPa (kg/cm ² / psi)	93.3 – 122.7 (0.95 – 1.25/13.5 – 17.8)
Coolant capacity	lit (Imp.qt./US qt.)	M/T 2.5 (2.2/2.6) A/T 2.4 (2.1/2.5)
Coolant pump		Centrifugal impeller type
Pulley ratio	(to 1)	1.2
Coolant total capacity	lit (Imp.qt./US qt.)	9.3 (8.2/9.8)

Starting System

Model		HITACHI S14-0
Rating		
Voltage	V	12
Output	kW	2.8
Time	sec	30
Number of teeth of pinion		9
Rotating direction (as viewed from pinion)		Clockwise
Weight (approx.)	N(kg/lb)	49 (5.0/11)
No-load characteristics		
Voltage/current	V/A	11/160 or less
Speed	rpm	4000 or more
Load characteristics		
Voltage/current	V/A	8.76/300
Torque	N·m(kg·m/lb·ft)	7.4 (0.75/5.4) or more
Speed	rpm	1700 or more
Locking characteristics		
Voltage/current	V/A	2.5/1100 or less
Torque	N·m(kg·m/lb·ft)	18.6 (1.9/14) or more

Charging System

Model (HITACHI)		LR190-750B	LR1100 – 731
Rated voltage	V	12	
Rated output	A	90	100
Rotation direction (As viewed from pulled)		Clockwise	
Pulley effective diameter	mm (in)	69 (2.72)	
Weight	N (kg/lb)	52 (5.3/11.7)	

SERVICE STANDARD

Engine

mm (in)

Parts	Items		Service standard	Service limit	Remarks
Cylinder Head	Cylinder head lower surface for flatness		0.075 (0.0030) or less	0.50 (0.0197)	Cannot be reground
	Cylinder head height		95.0 (3.740)	—	
Valve Spring	Free height		45.7 (1.8)	44.8 (1.765)	
	Squareness		—	1.6 (0.063)	
	Spring tension (when assembled)	N(lb)	241 (54.2)	210 (47.22)	
Valve and Valve guide	Diameter of Valve stem	IN	6.959 – 6.977 (0.27 – 0.272)	6.92 (0.270)	
		EX	6.692 – 6.970 (0.271 – 0.272)	6.90 (0.269)	
	Valve and valve guide clearance	IN	0.023 – 0.056 (0.0009 – 0.0022)	0.19 (0.0074)	
		EX	0.03 – 0.063 (0.0011 – 0.0024)	0.20 (0.0079)	
	Valve guide upper end height (Measured from the Cylinder head upper face)		8.0 (0.312)	—	
	Valve guide margin		1.1 (0.0433)	1.6 (0.0630)	
	Valve thickness	IN	1.2 (0.0472)	1.1 (0.0433)	
		EX	1.2 (0.0472)	1.1 (0.0433)	
	Valve seat contact surface angle		45°	—	
	Valve seat contact width	IN	2.1 (0.0827)	2.6 (0.1024)	
EX		2.1 (0.0827)	2.6 (0.1024)		
Camshaft	End play		0.08 (0.00314)	2.0 (0.00797)	
	Cam lobe height	IN	46.67 (1.8374)	46.57 (1.8335)	
		EX	46.77 (1.8413)	46.67 (1.8374)	
	Journal diameter		29.939 – 29.960 (1.167 – 1.168)	29.84 (1.1748)	
	Runout		0.02 (0.0008) or less	0.10 (0.0039)	
	Camshaft oil clearance		0.40 – 0.082 (0.0016 – 0.0032)	0.12 (0.0047)	

mm (in)

Parts	Items	Service standard	Service limit	Remarks	
Tappet	Outside diameter	32.977 – 32.990 (1.2983 – 1.2988)	32.950 (1.2972)		
	Oil clearance	0.01 – 0.039 (0.0004 – 0.0015)	0.10 (0.0039)		
Crankshaft	Thrust clearance	0.04 – 0.20 (0.0016 – 0.0079)	0.30 (0.00118)		
	Main bearing oil clearance	0.037 – 0.068 (0.0015 – 0.0027)	0.11 (0.0043)		
	Crankshaft runout	0.05 (0.0020) or less	0.08 (0.0031)		
	Main journal diameter	69.917 – 69.932 (2.7526 – 2.7532)	69.91 (2.7524)	Uneven wear limit 0.05 (0.002)	
	Crank pin diameter	52.915 – 52.930 (2.0933 – 2.0839)	52.90 (2.0827)	Uneven wear limit 0.08 (0.0031)	
Piston, Piston pin, Piston ring and Connecting rod	Piston diameter	95.32 – 95.349 (3.7527 – 3.7539)	—		
	Piston clearance	0.11 – 0.92 (0.0043 – 0.0362)	—		
	Piston ring gap	1st	0.25 – 0.40 (0.0098 – 0.0157)	1.5 (0.0590)	
		2nd	0.20 – 0.35 (0.0079 – 0.0138)	1.5 (0.0590)	
		Oil	0.10 – 0.30 (0.0039 – 0.0118)	1.5 (0.0590)	
	Piston ring clearance	1st/2nd	0.05 – 0.09 (0.0020 – 0.0035)	0.15 (0.0059)	
		Oil	0.03 – 0.07 (0.00118 – 0.00276)	0.15 (0.0059)	
	Piston pin diameter	30.995 – 31.000 (1.203 – 1.205)	30.97 (1.2078)		
	Piston pin clearance (Between connecting rod and piston pin)	0.008 – 0.020 (0.0003 – 0.00079)	0.05 (0.0020)		
	Piston pin clearance (Between piston and piston pin)	0.005 – 0.018 (0.0002 – 0.0007)	0.04 (0.0016)		
	Connecting rod alignment	Bend	0.08 (0.031) or less	0.20 (0.00787)	Per 100 (3.94) Per 100 (3.94)
		Twist	0.05 (0.0020) or less	0.15 (0.0059)	
	Connecting rod thrust clearance		0.230 (0.0091)	0.35 (0.0138)	
Oil clearance (Between crank pin and Connecting rod)		0.022 – 0.042 (0.0009 – 0.0017)	0.0060 (0.0024)		

6A – 8 ENGINE MECHANICAL

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Cylinder Block	Warpage (Upper surface of the cylinder block)	—	0.20 (0.0079)	
	Cylinder bore diameter	95.421 – 95.450 (3.7567 – 3.7579)		

Engine Cooling

mm (in)

Parts	Items	Service standard	Service limit	Remarks
Thermostat	Valve opening temperature	83 – 87°C (181 – 189°F)		
	Valve full open temperature and lift	More than 9.5 (0.374) at 100°C (212°F)		
Radiator cap	Valve opening pressure	88.2 – 117.6 kPa (12.8 – 17.0 psi)		

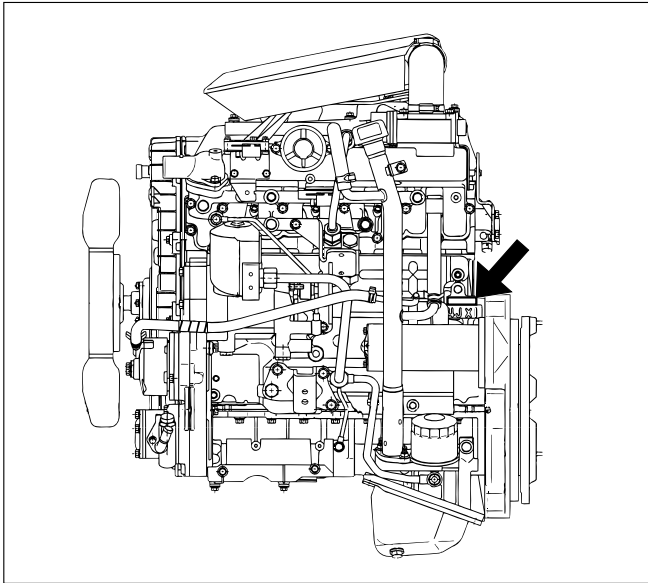
SERVICING

Servicing refers to general maintenance procedures to be performed by qualified service personnel.

MODEL IDENTIFICATION

Engine Serial Number

The engine number is stamped on the rear left hand side of the cylinder body.



012RW115

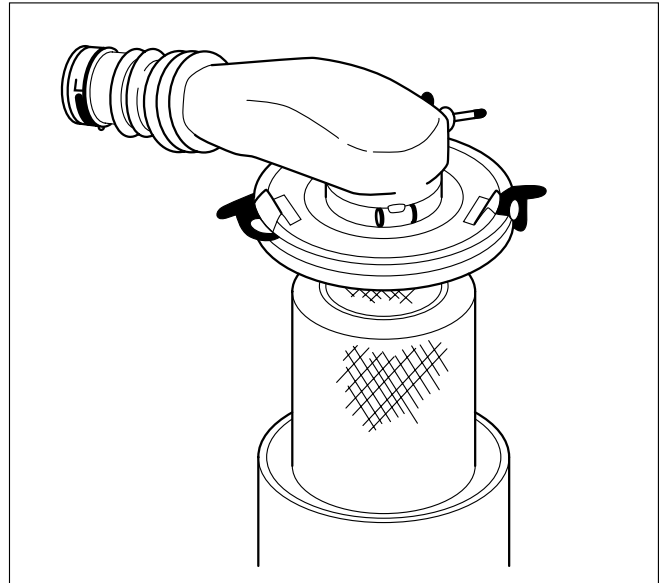
AIR CLEANER

Oil Wetted (Viscous) Type Paper Element.

The air cleaner has an oil wetted paper element. No servicing is required until the replacement interval is reached.

Never attempt to clean the element, no matter how dirty it may appear. The element is designed to provide normal filtering efficiency until it becomes due for replacement.

Refer to the Item "Service and Maintenance" in the Owner's and Driver's Manual for general service information.



012RW062

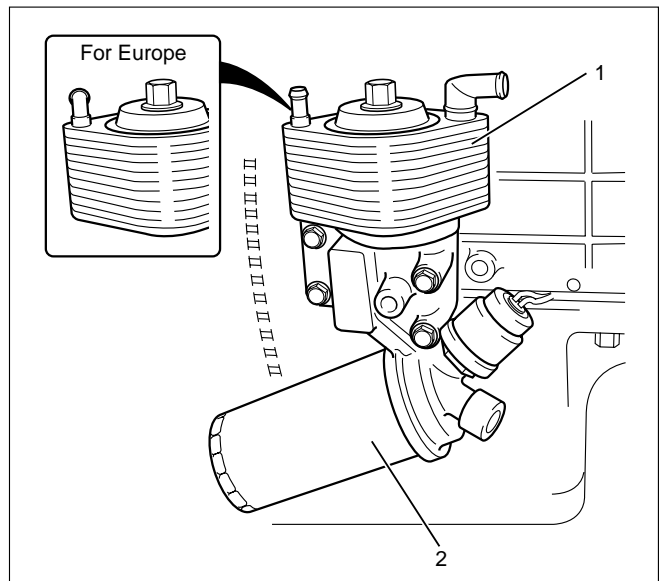
LUBRICATING SYSTEM

Main Oil Filter (Cartridge Type Paper Element)

Replacement Procedure

1. Loosen the drain plug to drain the engine oil.
2. Wait a few minutes and then retighten the drain plug.
3. Loosen the used oil filter (2) by turning it counter-clockwise with the filter wrench.
4. Clean the oil filter gasket fitting face.
This will allow the new oil filter to seat properly.
5. Apply a light coat of engine oil to the O-ring.
6. Turn the new oil filter until the filter O-ring is fitted against the sealing face.
7. Use the filter wrench to turn the filter additional one and 1/4 turns.

Filter Wrench: 5-5540-0203-0



050R20001

6A – 10 ENGINE MECHANICAL

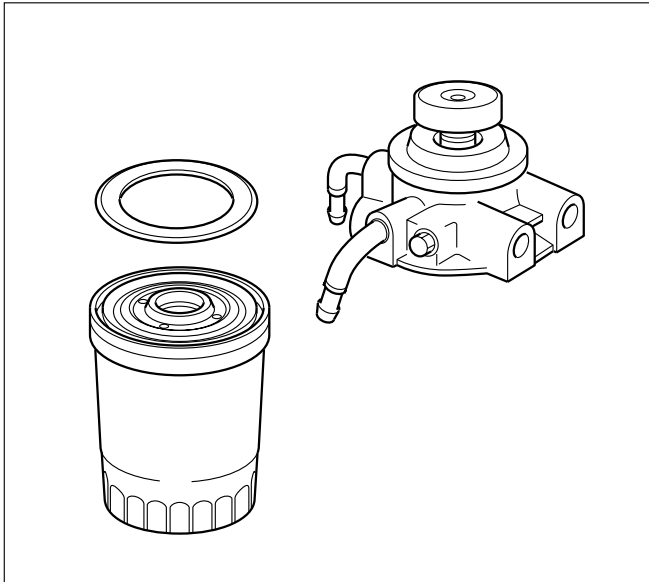
8. Check the engine oil level and replenish to the specified level if required.
9. Start the engine and check for oil leakage from the main oil filter.

FUEL SYSTEM

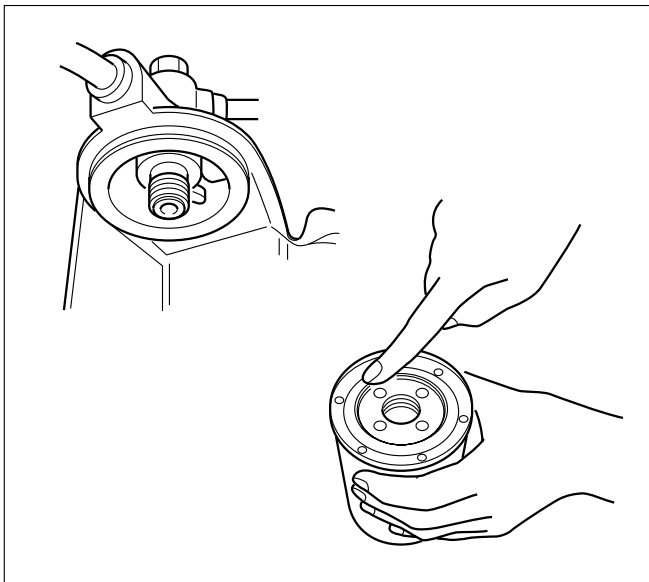
Fuel filter

Replacement Procedure

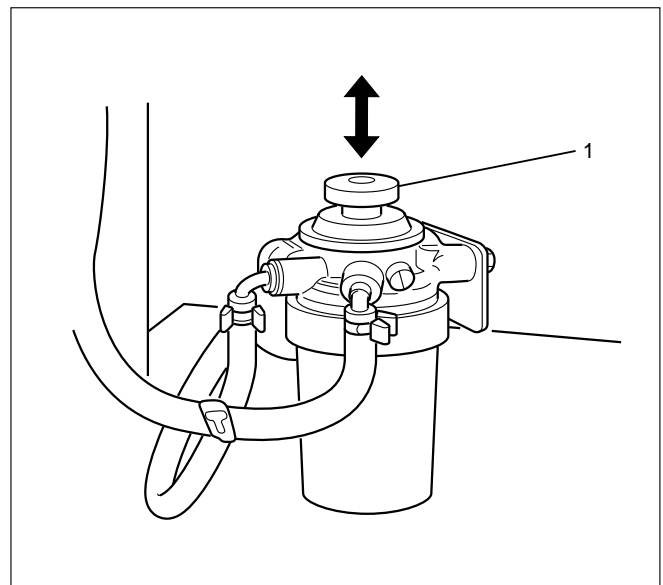
1. Loosen the used fuel filter by turning it counterclockwise with the filter wrench.
Filter Wrench : 5-8840-0203-0



2. Clean the filter cover fitting faces.
This will allow the new fuel filter to seat properly.



3. Apply a light coat of engine oil to the O-ring.
4. Turn the fuel filter until the sealing face comes in contact with the O-ring.
5. Turn the fuel filter with a filter wrench 2/3 of a turn until sealed.
Filter Wrench: 5-8840-0203-0



Legend

- (1) Priming pump

6. Operate the priming pump until the air is discharged completely from fuel system.

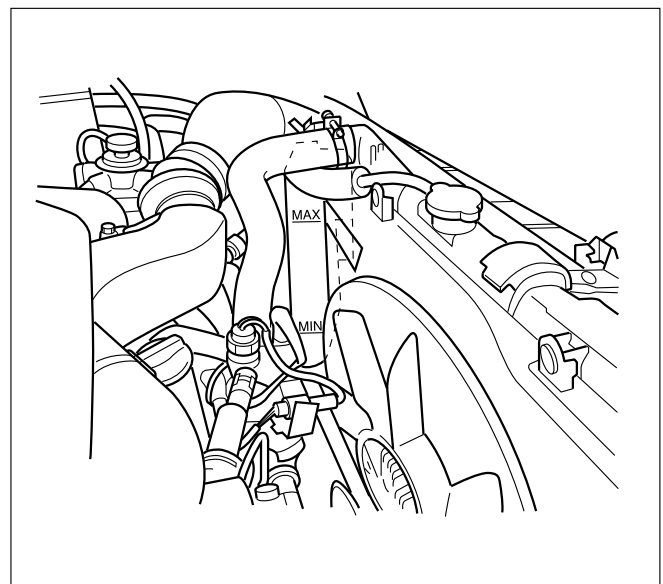
NOTE: The use of an Isuzu genuine fuel filter is strongly recommended.

COOLING SYSTEM

Coolant Level

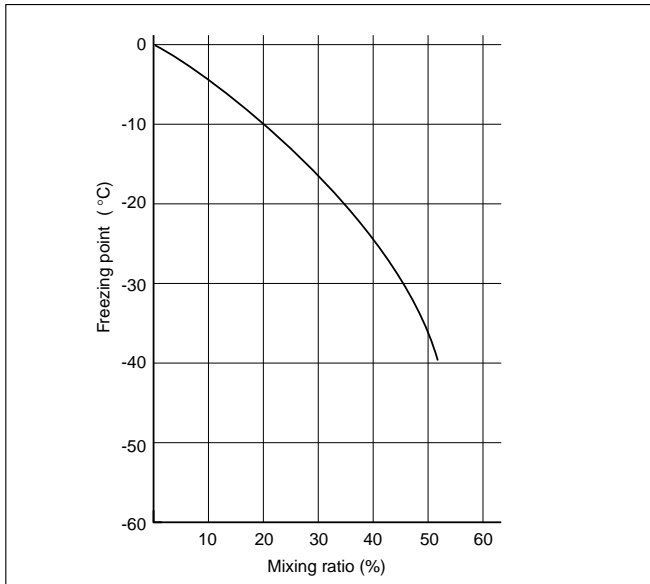
Check the coolant level and replenish the radiator reserve tank as necessary.

If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.



NOTE: Do not overfill the reserve tank.

Remove the radiator filler cap only when absolutely necessary. Always check the coolant level when the engine is cold. Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.

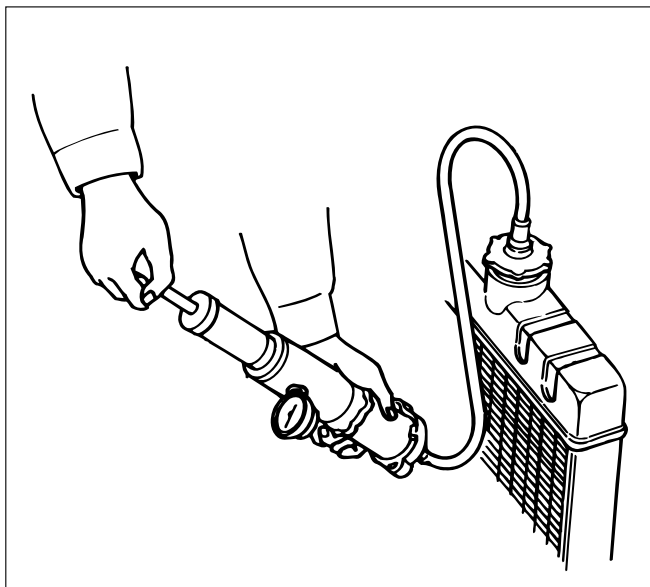


111RW002

Cooling System Inspection

Install a radiator filler cap tester to the radiator. Apply testing pressure to the cooling system to check for leakage. The testing pressure must not exceed the specified pressure.

Testing Pressure: 196 kPa (2 kg/cm²/28.45 psi)



110RS005

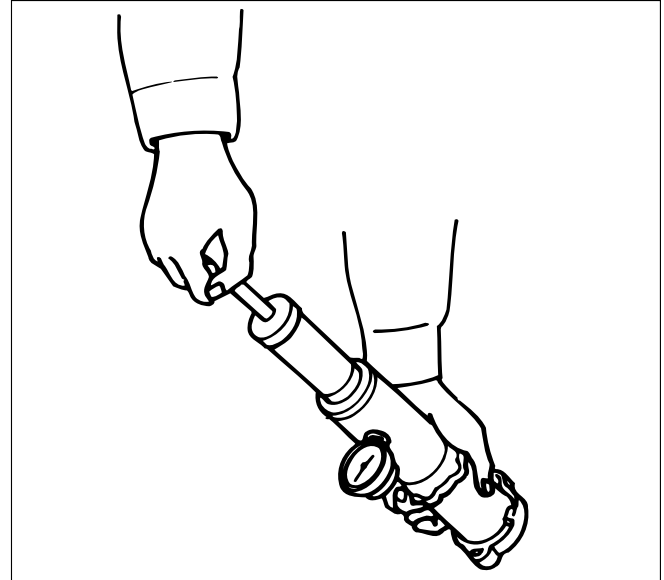
Radiator Cap Inspection

The radiator filler cap is designed to maintain coolant pressure in the cooling system at 103 kPa (1.05 kg/cm²/15 psi). Check the radiator filler cap with a radiator filler cap tester.

The radiator filler cap must be replaced if it fails to hold the specified pressure during the test procedure.

Radiator Filler Cap Pressure Valve: 88.2 – 117.6 kPa (0.899 – 1.199 kg/cm²/12.8 – 17.1 psi)

Negative Valve (Reference): 1.0 – 3.9 kPa (0.01 – 0.04 kg/cm²/0.14 – 0.57 psi)



110RS006

Thermostat Operating Test

1. Completely submerge the thermostat in water.
2. Heat the water.
Stir the water constantly to avoid direct heat being applied to the thermostat.

3. Check the thermostat initial opening temperature.

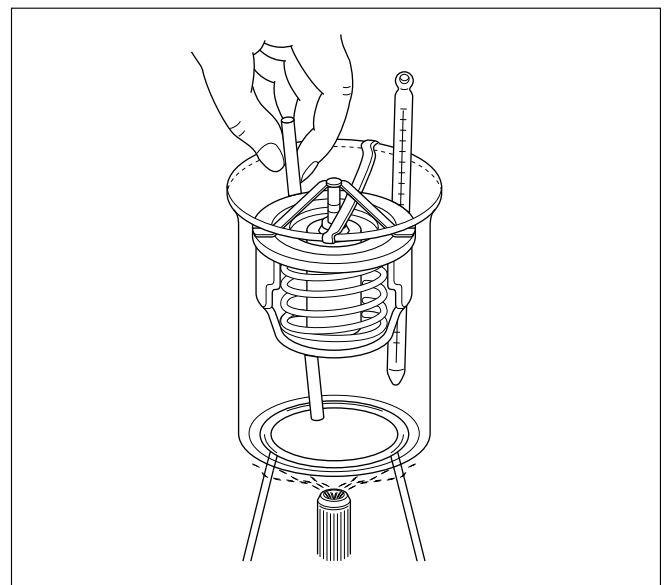
Thermostat Initial Opening Temperature:

83 – 87°C (181 – 189°F)

4. Check the thermostat full opening temperature.

Thermostat Full Opening Temperature:

100°C (212°F)



031RS003

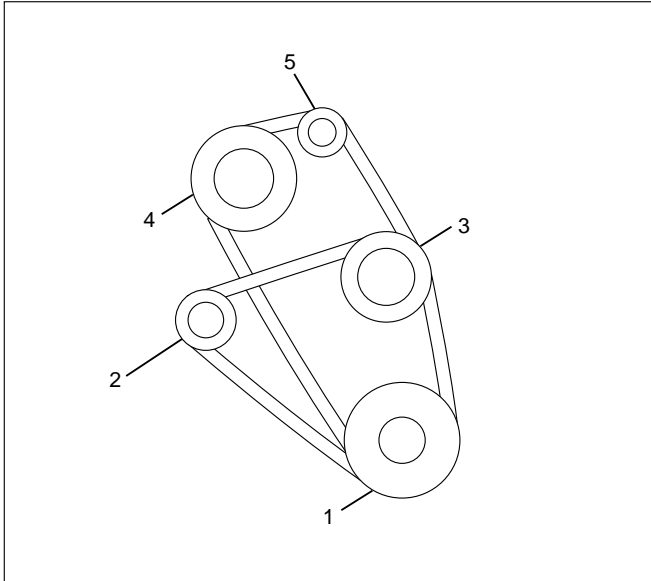
Valve Lift at Fully Open Position: 9.5 mm (0.374 in)

Drive Belt Adjustment

Check the drive belt tension
Depress the drive belt mid-portion with a 98 N (10 kg/ 22 lb) force.

Drive Belt Deflection: 10 mm (0.39 in)

Check the drive belt for cracking and other damage.



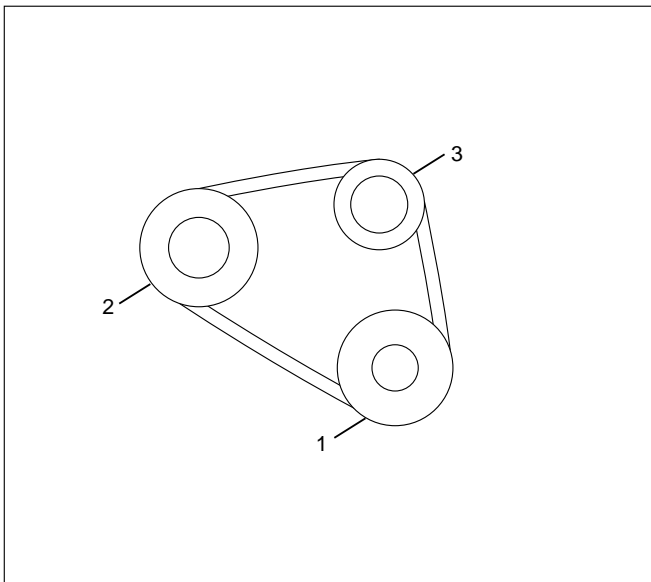
012RW110

Legend

- (1) Crankshaft pulley
- (2) Generator pulley
- (3) Cooling fan pulley
- (4) A/C compressor pulley
- (5) Belt tensioner pulley

Cooling Fan Pulley Drive Belt

Fan belt tension is adjusted by moving the generator.
Depress the drive belt mid-portion with a 98 N (10 kg/ 22 lb) force.



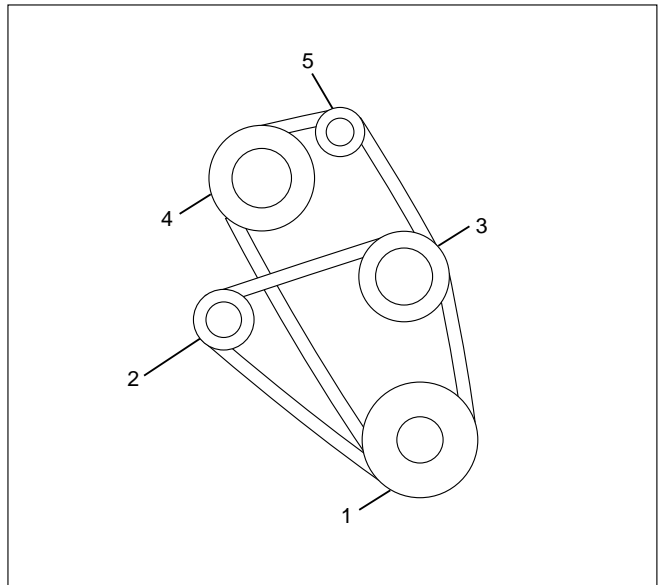
012RW084

Legend

- (1) Crankshaft pulley
- (2) Generator pulley
- (3) Cooling fan pulley

Compressor Pulley Drive Belt

Move the tensioner pulley as required to adjust the compressor drive belt tension.
Depress the drive belt mid-portion with a 98 N (10 kg/ 22 lb) force.



012RW110

Legend

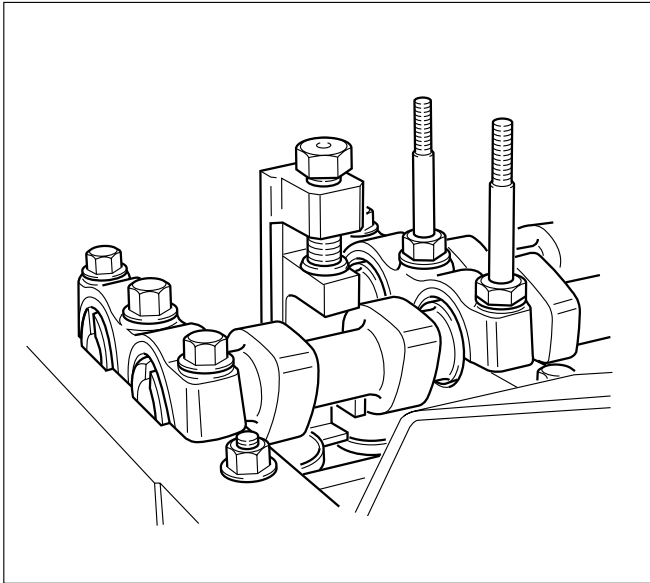
- (1) Crankshaft pulley
- (2) Generator pulley
- (3) Cooling fan pulley
- (4) A/C compressor pulley
- (5) Belt tensioner pulley

VALVE CLEARANCE ADJUSTMENT

1. Install 2.80 mm valve adjuster (shim) first when reassembling the engine.
Thickness mark faces down.
2. Measure the valve clearance after installing cam carrier assy with camshafts.
3. Change the adjuster using a special tool when the clearance is out of tolerance.
Valve Clearance Adjusting Tool: 5-8840-2590-0

VALVE CLEARANCE (When cold condition)

Inlet	0.15 ± 0.05 mm
Exh	0.25 ± 0.05 mm



014RW150

COMPRESSION PRESSURE MEASUREMENT

1. Start the engine and allow it to idle until the coolant temperature reaches 70 – 80°C (158 – 176°F).
2. Remove the following parts.
 - Glow plugs
 - Fuel cut solenoid connector
 - QOS (Quick-On Start System) fuse in the fuse box.
3. Set the adapter and compression gauge to the No. 1 cylinder glow plug hole.
Compression Gauge
(with Adapter): 5-8840-2008-0
4. Turn the engine over with the starter motor and take the compression gauge reading.

Compression Pressure at 200 rpm

Standard: 3040 kPa (31 kg/cm²/441 psi)

Limit: 2160 kPa (22 kg/cm²/313 psi)

5. Repeat the procedure (Steps 3 and 4) for the remaining cylinders.

QUICK-ON START 4 SYSTEM

Quick-On Start System Inspection Procedure

1. Disconnect the ECT-sensor connection around the thermostat outlet pipe.
2. Turn the starter switch to the "ON" position.
If the Quick-On Start 4 System is operating properly, the glow relay will make a clicking sound within seven seconds after the starter switch is turned on.
3. Measure the glow plug terminal voltage with a circuit tester immediately after turning the starter switch to the "ON" position.

Glow Plug Terminal Voltage: approx. 12V

NOTE: Electrical power to the quick-on start system will be cut after the starter has remained in the "ON" position for twenty seconds.

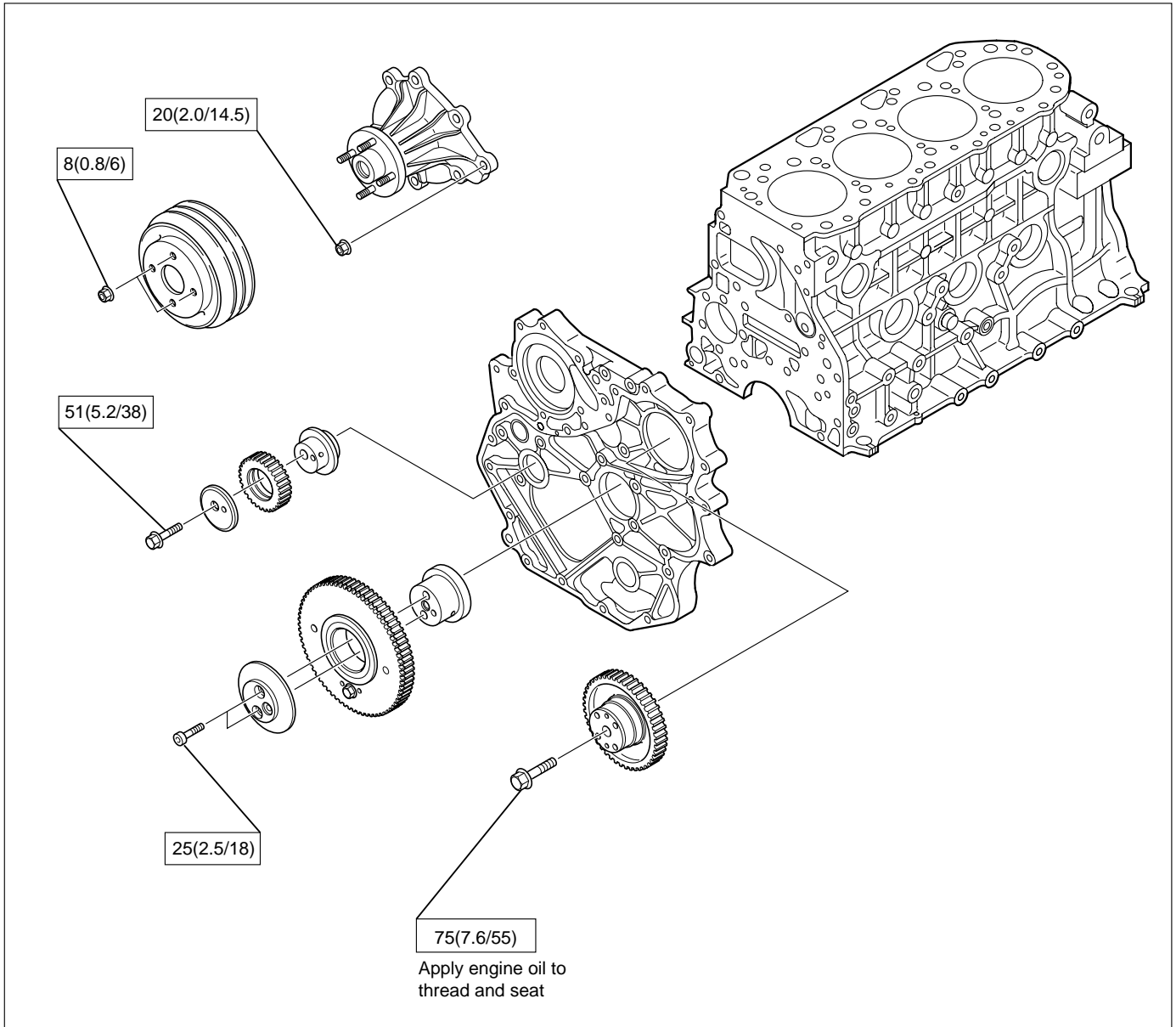
Turn the starter switch to the "OFF" position and back to the "ON" position.

This will reset the Quick-On Start 4 System.

TIGHTENING TORQUE

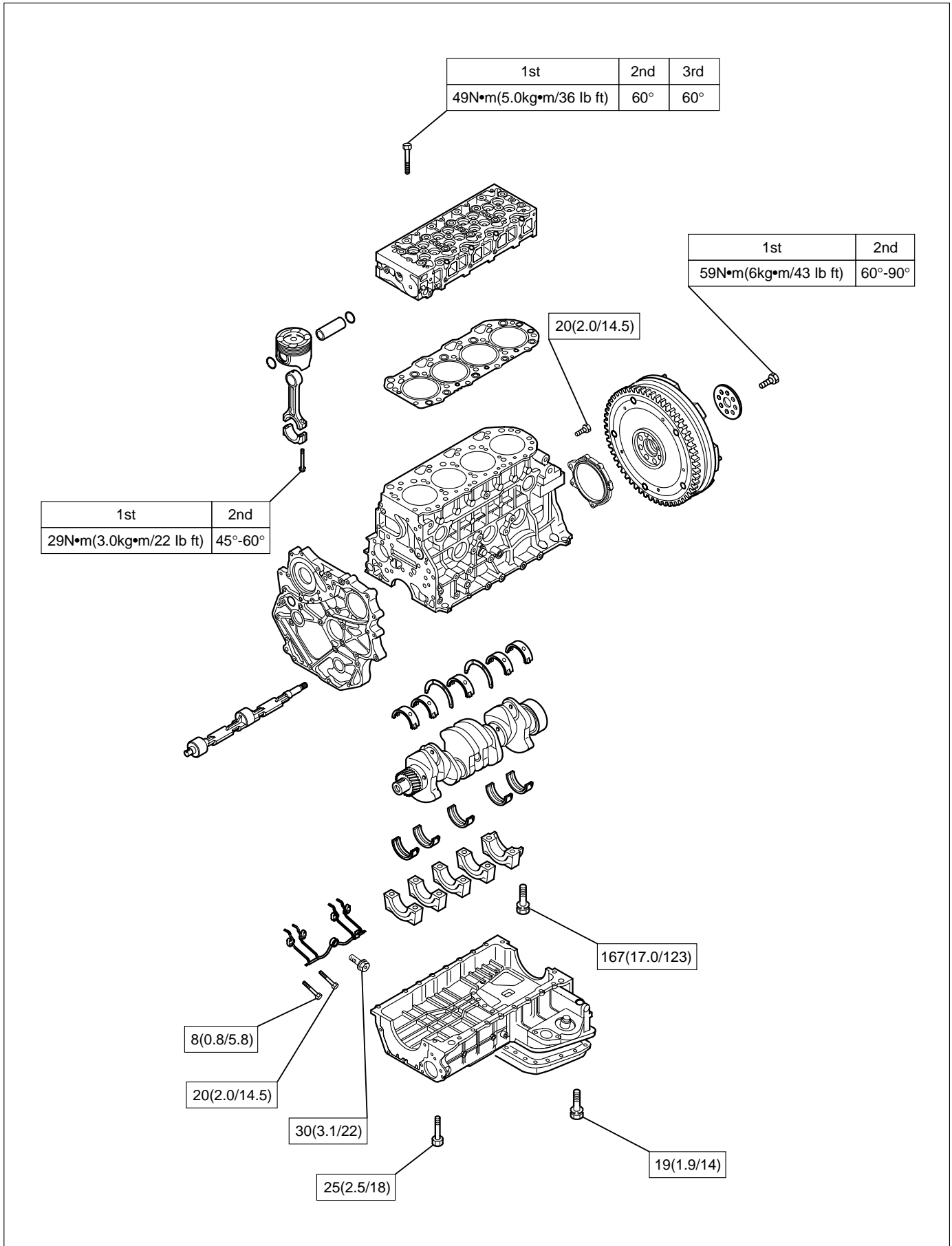
Timing Gear Case, Timing Gear

N·m (kg·m/lb·ft)



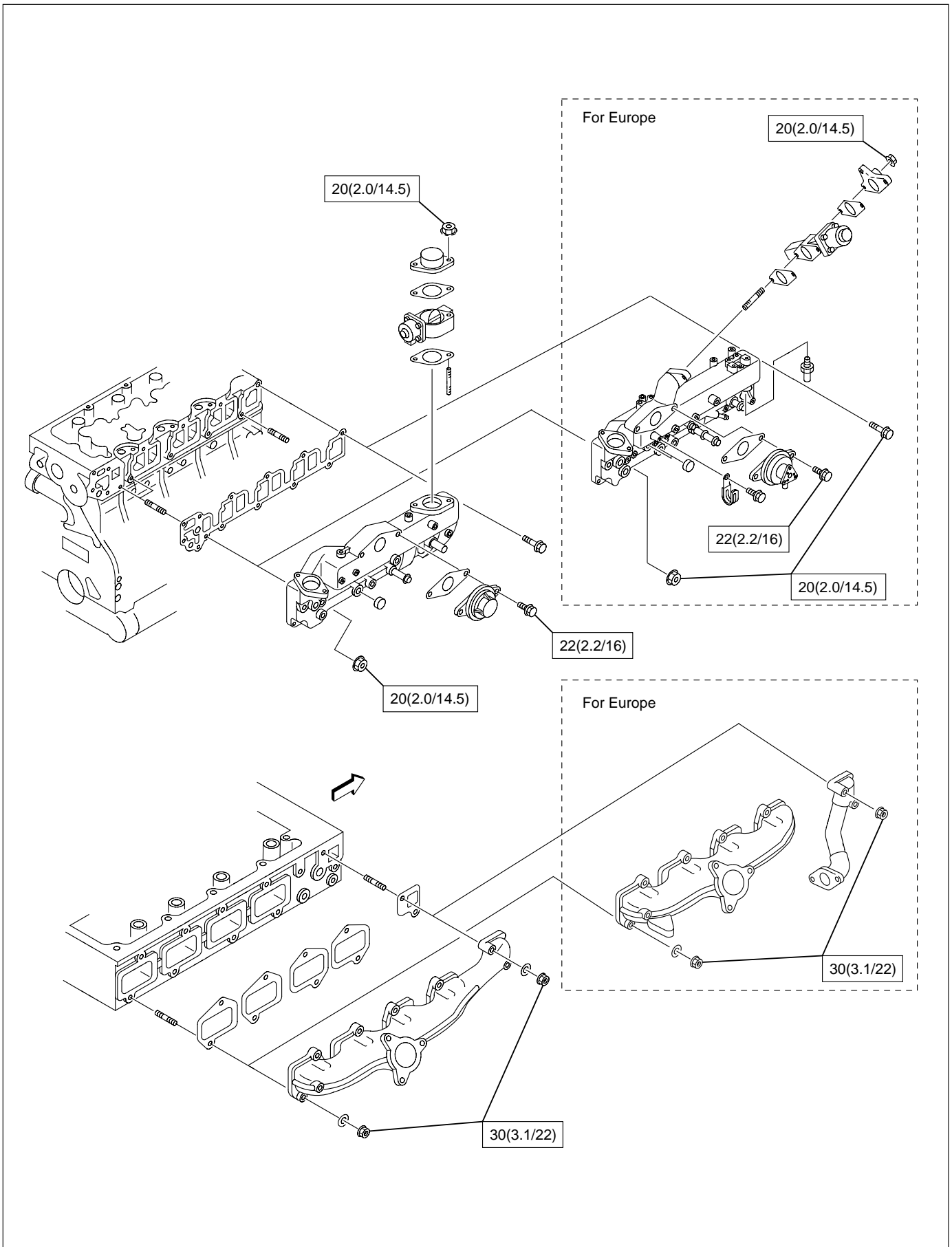
Cylinder Head, Flywheel, Crank Case, Oil Pan

N·m (kg·m/lb·ft)



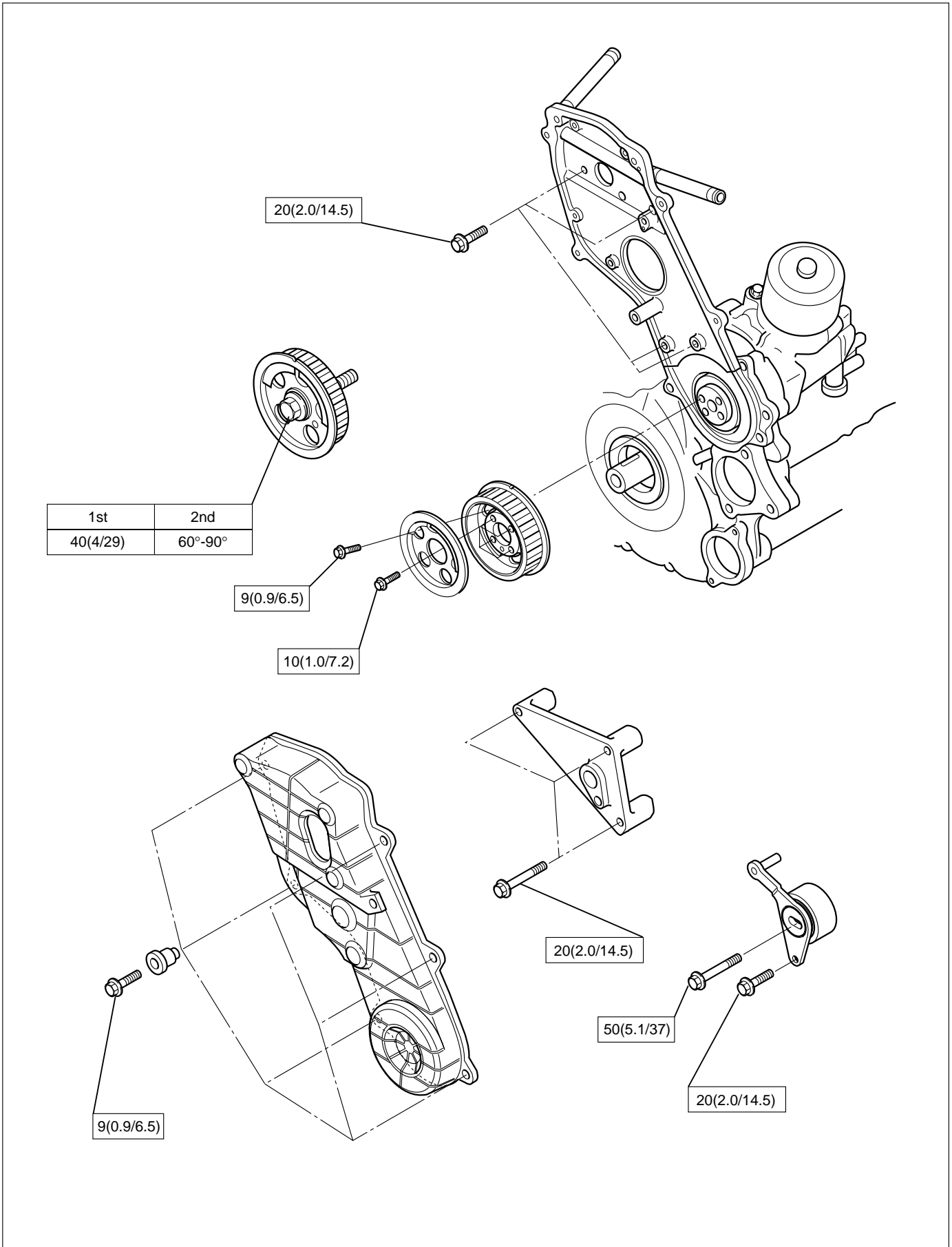
Intake / Exhaust Manifold

N·m (kg·m/lb·ft)



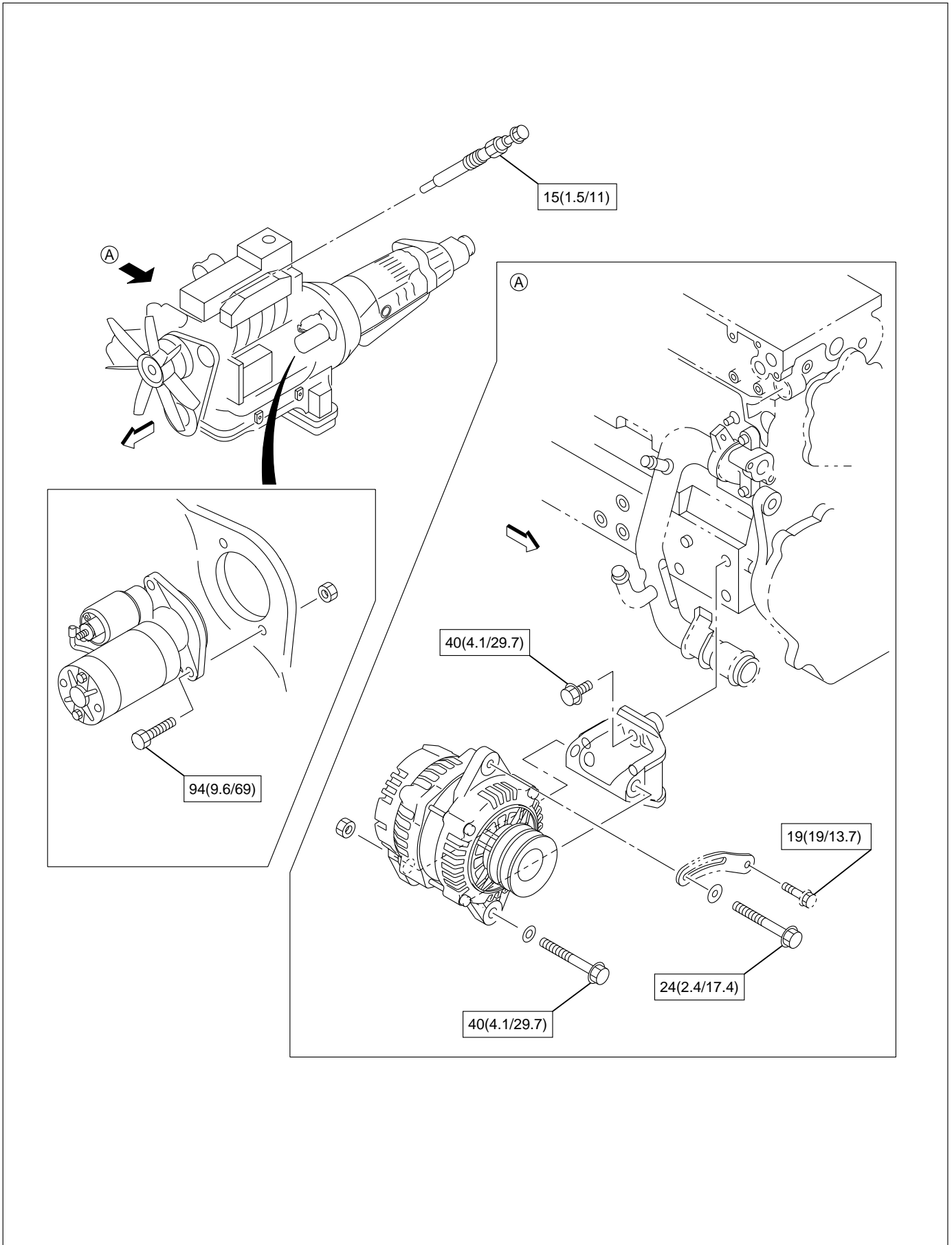
Timing Pulley

N·m (kg·m/lb·ft)



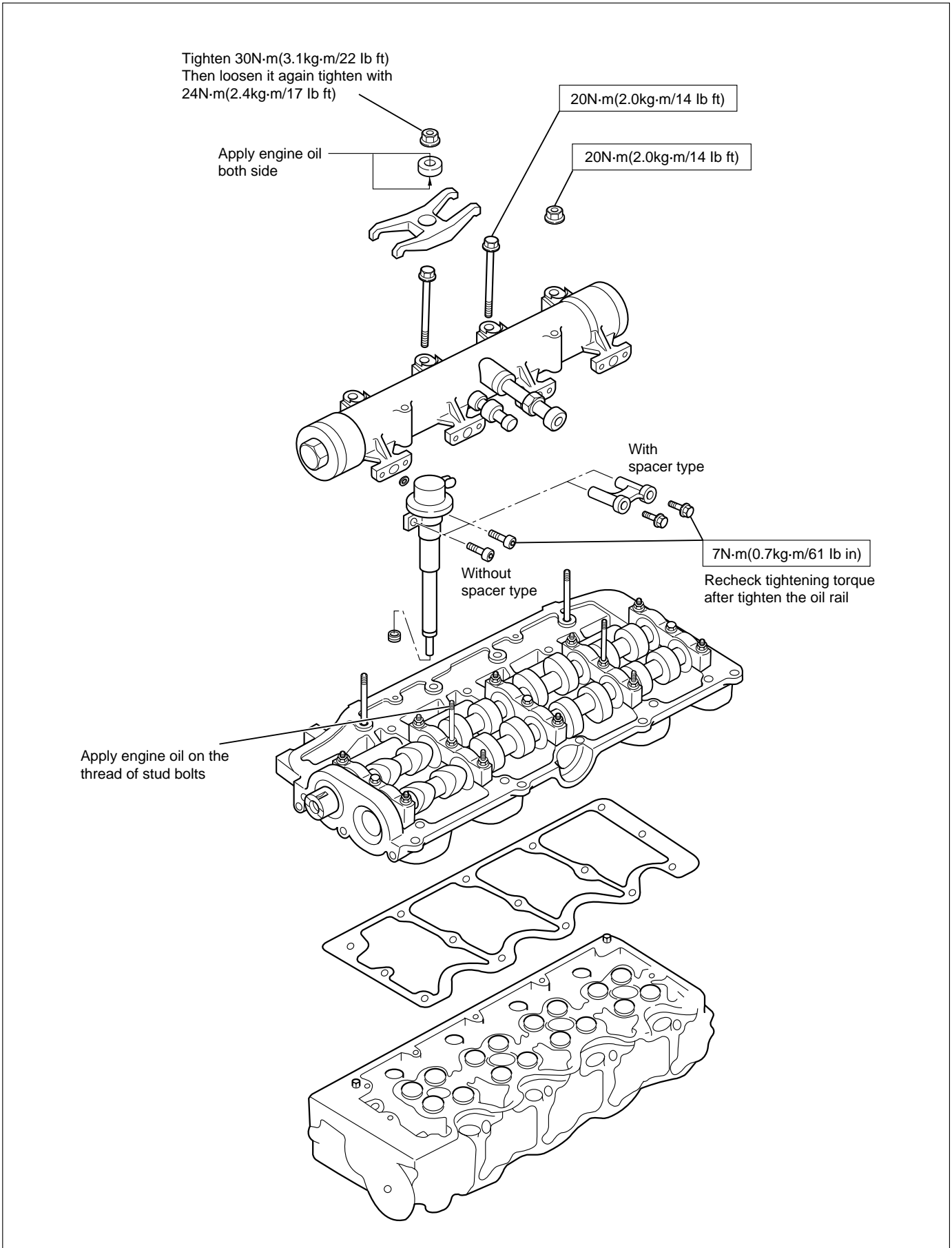
Engine Electricals

N·m (kg·m/lb·ft)



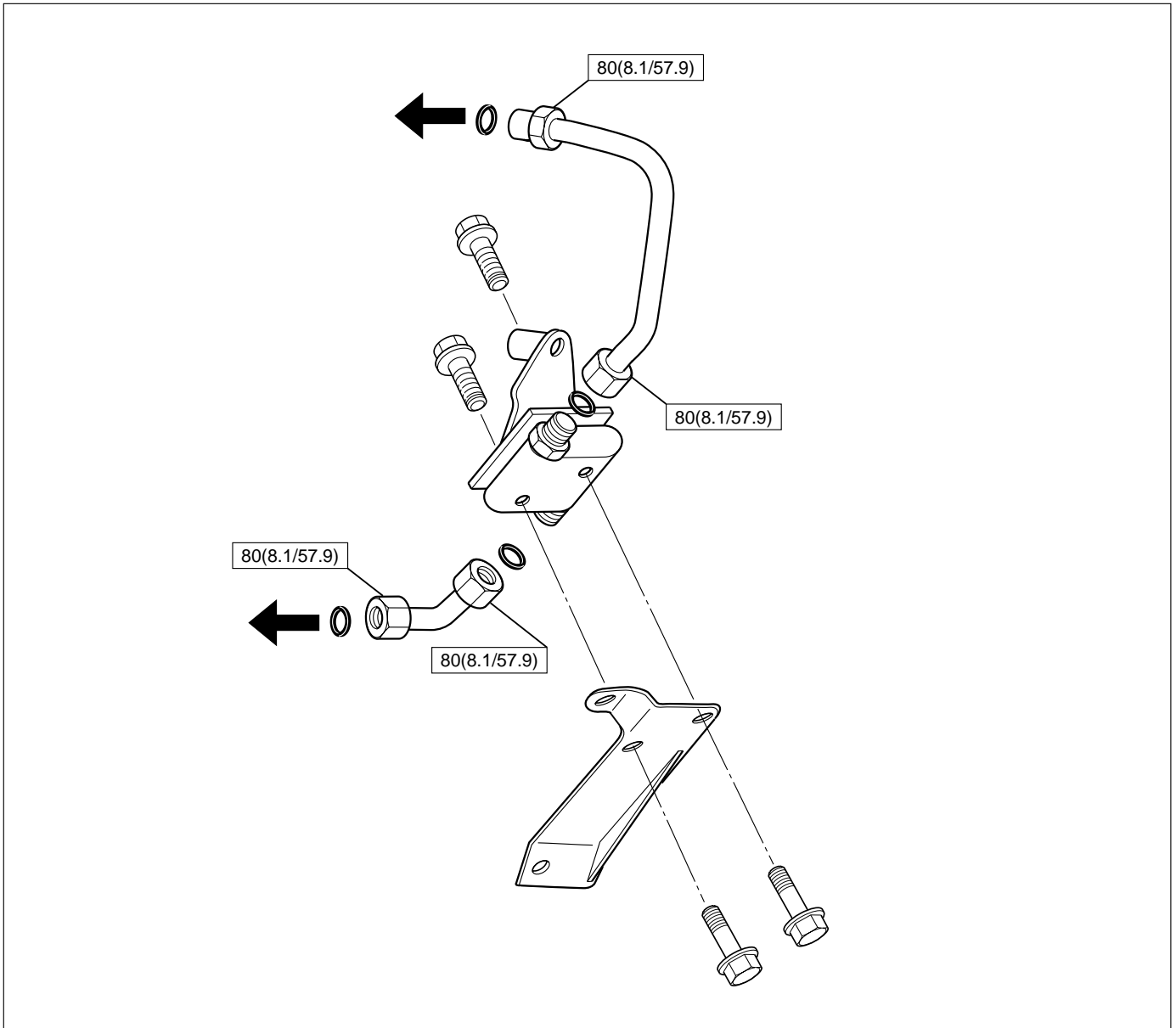
Injector

N·m (kg·m/lb·ft)



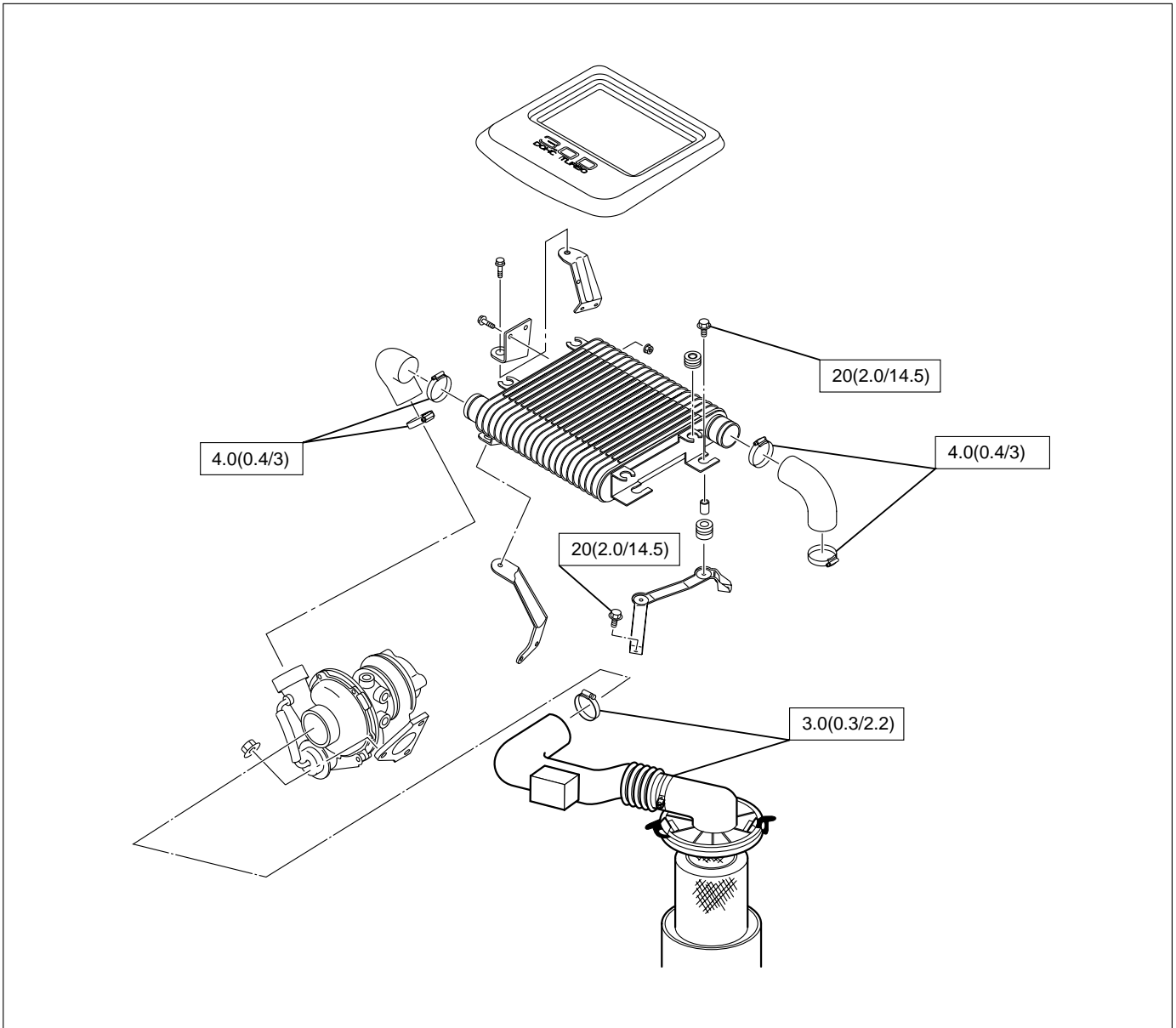
High Pressure Oil Pipe

N·m (kg·m/lb·ft)



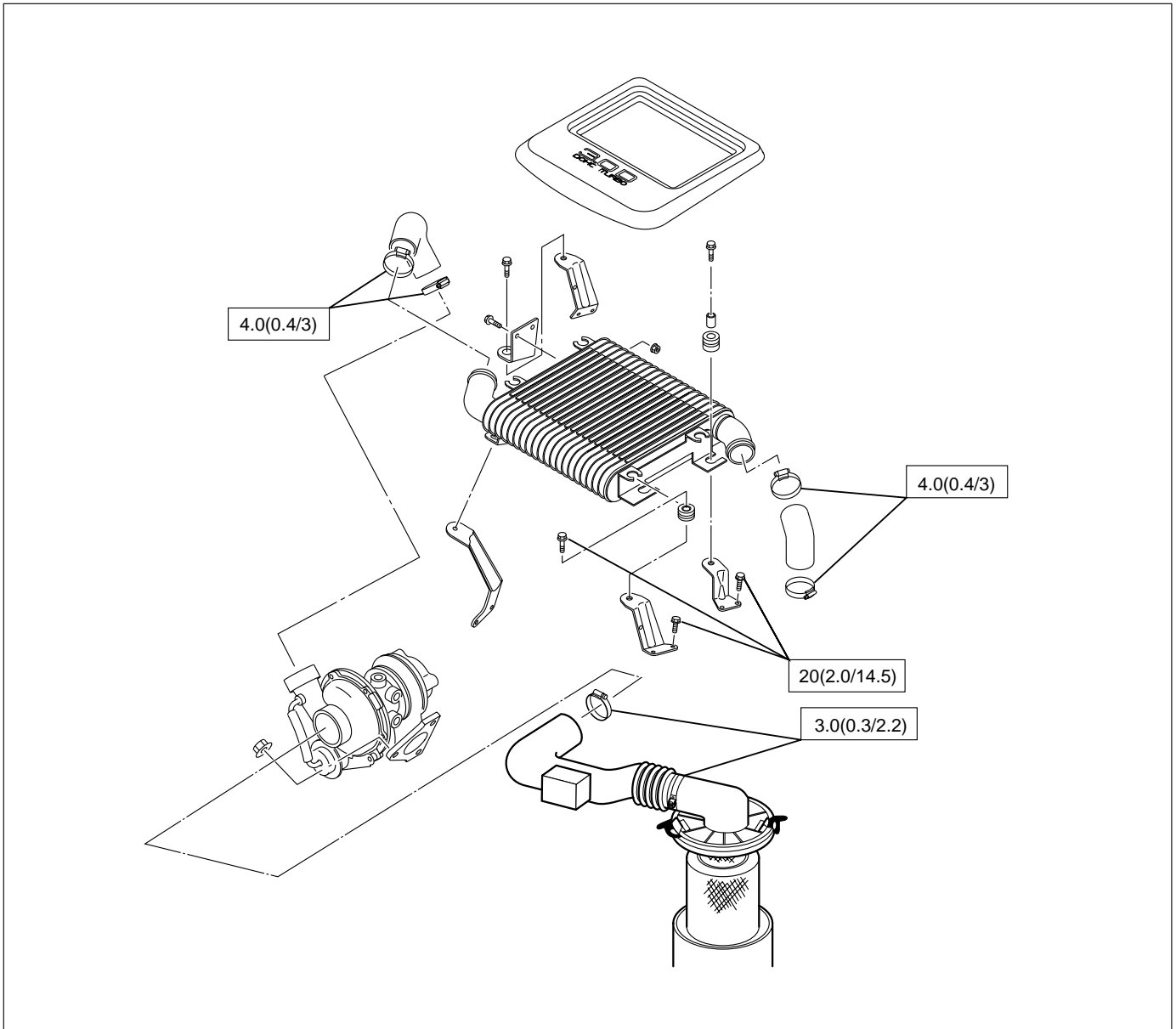
Air Duct and Intercooler (For General Export)

N·m (kg·m/lb·ft)



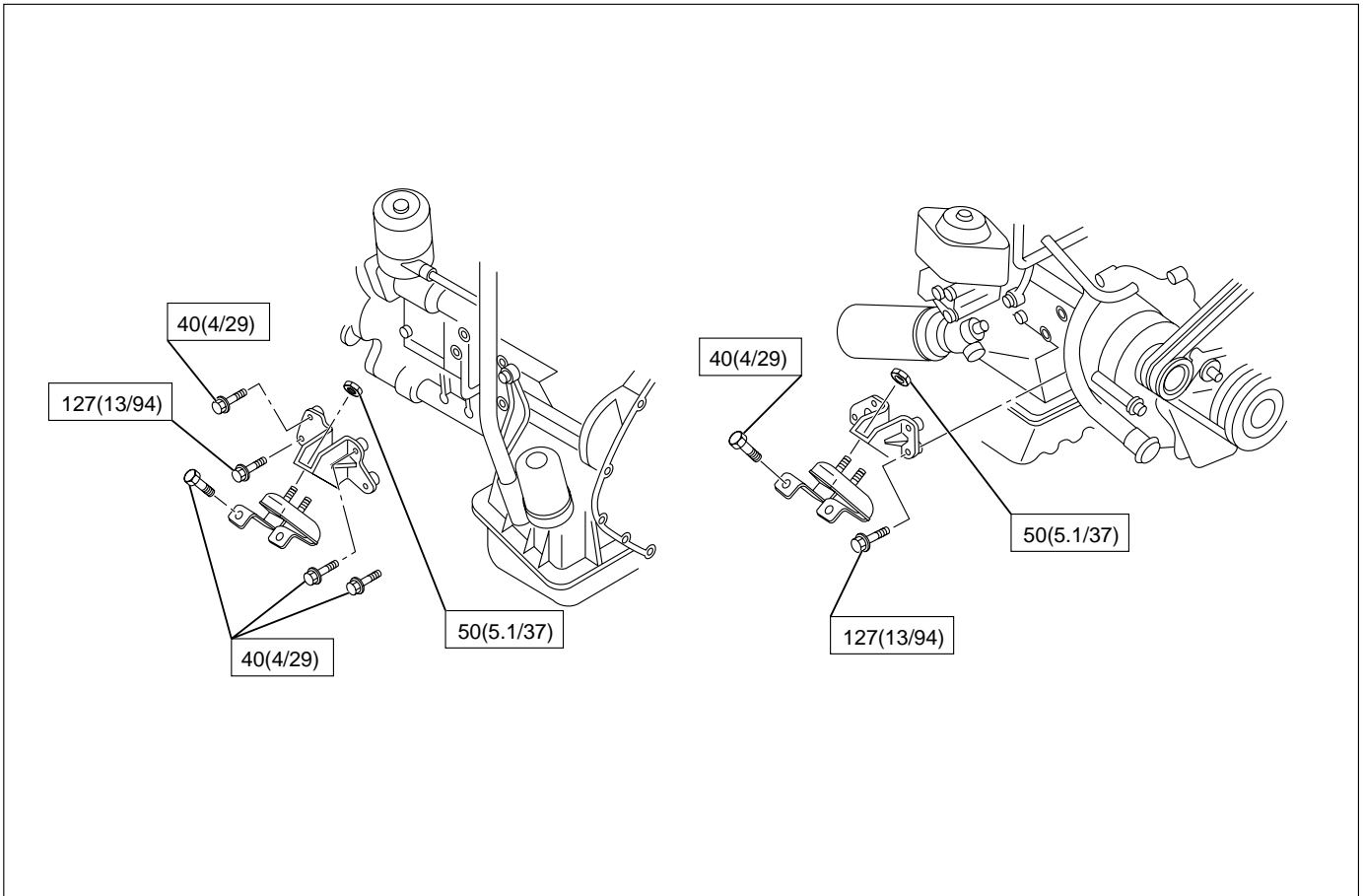
Air Duct and Intercooler (For Europe)

N·m (kg·m/lb·ft)



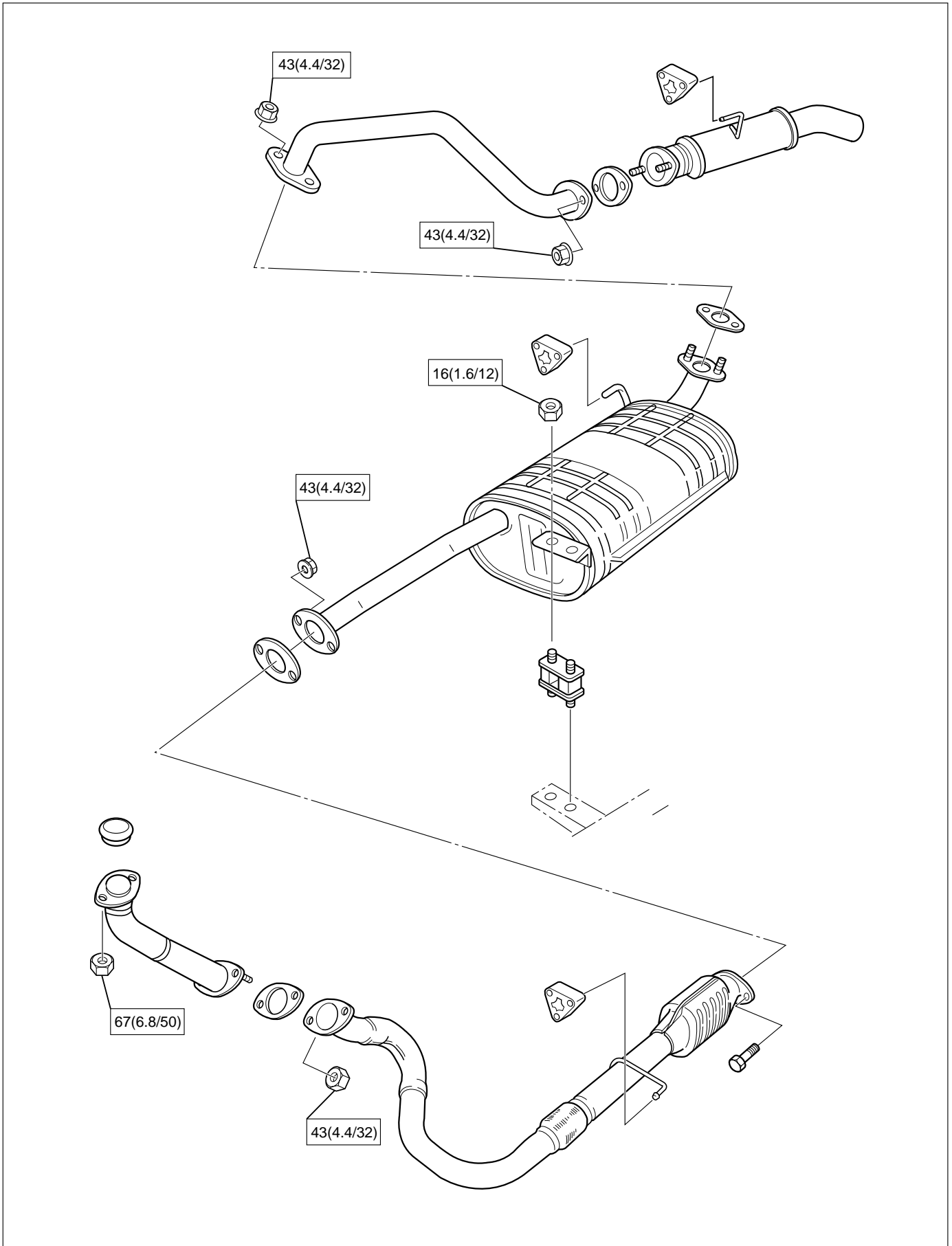
Engine Mount Bracket

N·m (kg·m/lb·ft)

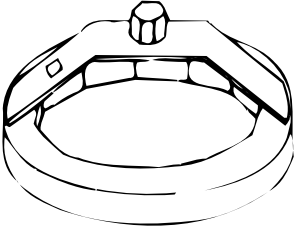
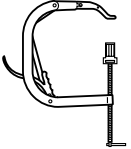
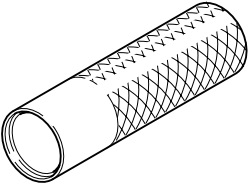

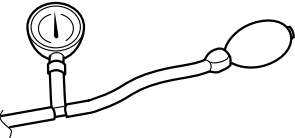
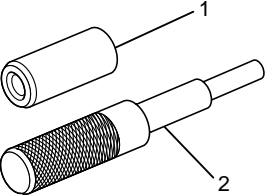


Exhaust System

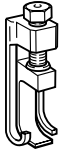
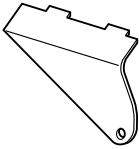
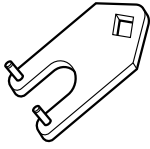
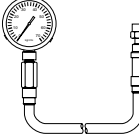
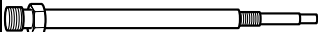
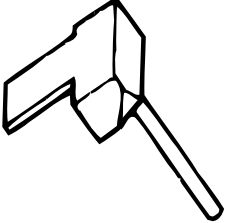
N·m (kg·m/lb·ft)



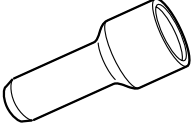




SPECIAL TOOLS

Illustration	Tool No.	Tool Name
 <p style="text-align: right; font-size: small;">901RT034</p>	5-8840-0203-0	Filter Wrench
 <p style="text-align: right; font-size: small;">F06RV038</p>	5-8840-2441-0	Valve Spring Compressor
 <p style="text-align: right; font-size: small;">5884020330</p>	5-8840-2033-0	Stem Seal Installer
 <p style="text-align: right; font-size: small;">901LX017</p>	5-8840-9018-0	Piston Ring Compressor
 <p style="text-align: right; font-size: small;">901RX00001</p>	5-8840-0075-0	Turbocharger Pressure Gauge
 <p style="text-align: right; font-size: small;">901RW182</p>	9-8523-1212-0	Valve Guide Replacer

SPECIAL TOOLS

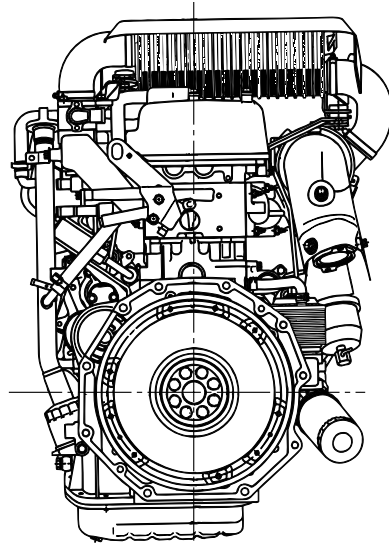
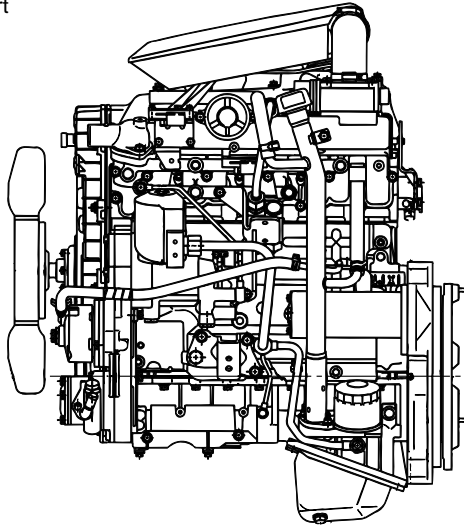
Illustration	Tool No.	Tool Name
 <p style="text-align: right; font-size: small;">F06RW057</p>	5-8840-2590-0	Valve Clearance Adjusting Tool
 <p style="text-align: right; font-size: small;">F06RW056</p>	5-8840-2592-0	Camshaft Stopper
 <p style="text-align: right; font-size: small;">F06RV037</p>	5-8840-2591-0	Camshaft Gear Tool
 <p style="text-align: right; font-size: small;">901LX057</p>	5-8840-2675-0	Compression Gauge
 <p style="text-align: right; font-size: small;">901LX056</p>	5-8531-7002-0	Adapter: Compression Gauge
 <p style="text-align: right; font-size: small;">901RT042</p>	5-8840-2153-0	Seal Cutter

SPECIAL TOOLS

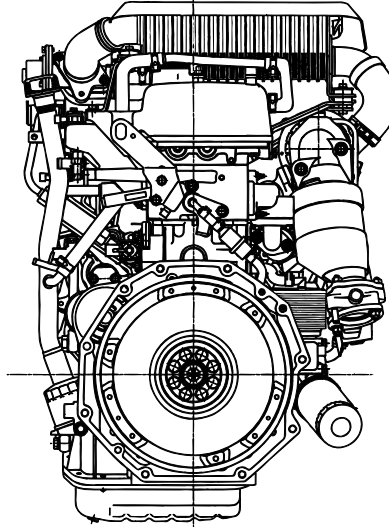
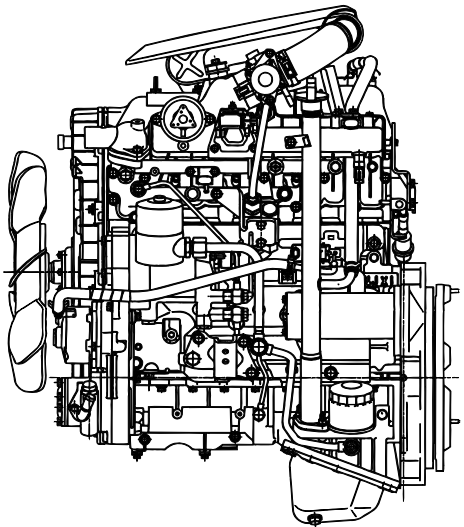
Illustration	Tool No.	Tool Name
 <small>901RV061</small>	9-8522-0021-0	Crankshaft Gear Installer
 <small>901LX030</small>	5-8840-0266-0	Angle Gauge
 <small>901LX040</small>	5-8840-2360-0	Rear Oil Seal Remover
 <small>901LX025</small>	5-8840-2359-0	Rear Oil Seal Installer
 <small>901LX039</small>	5-8840-2061-0	Front Oil Seal Installer

ENGINE ASSEMBLY

For General Export



For Europe



F06R200004

REMOVAL

1. Remove battery.
2. Drain engine coolant
3. Disconnect window washer hose and remove engine hood.
4. Radiator Hose
 - 1) Disconnect upper and lower hoses from engine side.
5. Fan Shroud
 - 1) Disengage clips and remove upper and lower fan shrouds.
6. Cooling Fan Assembly
 - 1) Remove cooling fan assembly fixing nuts, cooling fan assembly.
7. Radiator Assembly
 - 1) Remove bracket and radiator assembly.
8. Air Cleaner Cover & Air Duct
9. Intercooler Assembly
 - 1) Refer to "Intercooler" in this manual.
10. Engine Ground Cable
 - 1) Disconnect ground cable from A/C compressor bracket.
11. AC Generator Harness
 - 1) Disconnect B terminal and harness connector from AC generator.
12. A/C Compressor Assembly
 - 1) Disconnect magnetic clutch harness connector.
 - 2) Remove A/C compressor fixing bolt (rear under side of compressor).
 - 3) Remove fixing bolts (upper and front lower side of compressor) and set A/C compressor assembly with pipe lines on battery carrier.

- 13 Vacuum Hose
 - 1) Disconnect vacuum hose from vacuum pump.
14. Starter Harness
 - 1) Disconnect B terminal and put cable harness close to chassis side.
 - 2) Disconnect S terminal connector.
15. Engine Harness
 - 1) Disconnect engine harness close to engine side.
16. Fuel Pipe
 - 1) Remove fuel pipe from fuel pump and take care not to spill fuel and let dust enter.
17. Engine Ground Cable
 - 1) Disconnect ground cable from left rear side of timing gear case.
18. Vacuum Hose: Vacuum Tank

Disconnect vacuum hose from vacuum pump side.
19. Glow Plug Harness
20. Transmission Assembly
 - 1) Set transmission support tool under the transmission.
 - 2) Remove transmission rear mount.
 - 3) Remove transmission fixing bolt from rear of engine assembly except two bolts.
 - 4) Carefully hang up engine assembly with a hoist.
 - 5) Remove remaining two transmission fixing bolts.
 - 6) Remove transmission assembly.
 - 7) Remove heater hose.
 - 8) Disconnect wire harness connector for shift on the fly.
 - 9) Remove vacuum hose.
21. Prepare Engine Stand
22. Engine Assembly
 - 1) Remove engine mount fixing bolts.
 - 2) Carefully hang up the engine assembly.
 - 3) Take out the engine assembly making sure not to damage the brake oil pipe and other pipe etc.

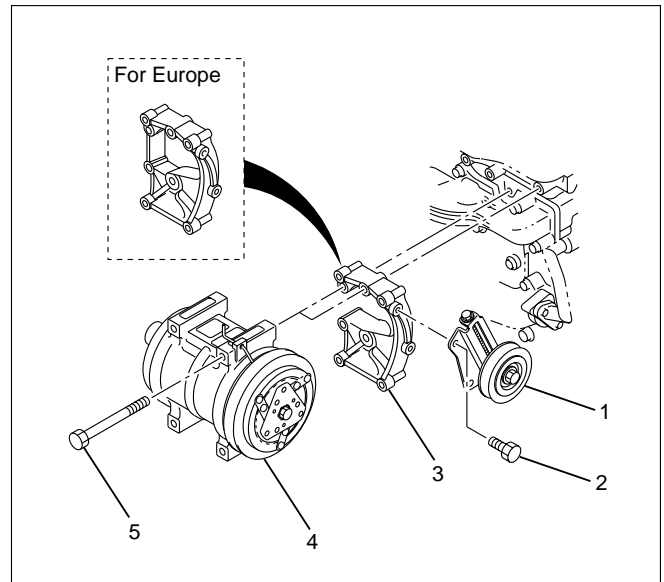
INSTALLATION

1. Engine assembly
 - 1) Install engine in mounting position by using hoist.
2. Transmission Assembly
 - 1) Refer to transmission installation steps in section 7.
3. Engine Mounting
 - 1) After all fixing bolts (left: two bolts, rights: two bolts) were inserted in every hole, tighten fixing bolts to the specified torque.

Torque: 40 N·m (4 kg·m/29 lb·ft)
4. Glow Plug Harness
5. Vacuum Hose
 - 1) Connect Vacuum Hose to Vacuum Pump
6. Engine Ground Cable
7. Fuel Pipe
 - 1) Install fuel pipe to fuel pump.
8. Engine Harness
9. Starter Harness
10. A/C Compressor Assembly
 - 1) Tighten temporarily the fixing bolts (upper and front lower sides of compressor.)

- 2) Tighten fixing bolt (rear under side of compressor) to the specified torque.
- 3) Tighten fixing bolts (front upper and lower sides of compressor) to the specified torque.

Torque: 40 N·m (4 kg·m/29 lb·ft)



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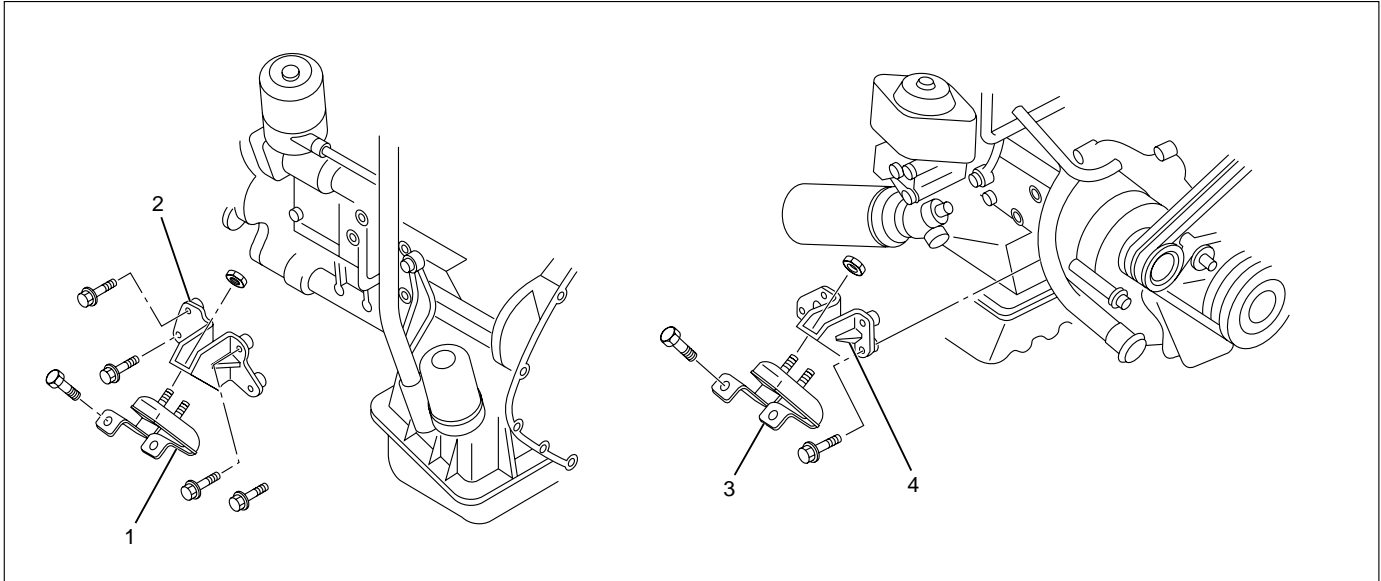
Legend

- (1) Tensioner
- (2) Bolt
- (3) Bracket
- (4) A/C compressor
- (5) Bolt

11. A.C Generator Harness
12. Engine Ground Cable
 - 1) Tighten ground cable to A/C compressor bracket.
13. Air Cleaner cover & Duct
14. Intercooler Assembly
 - 1) Refer to "Intercooler" in this manual.
15. Radiator Assembly
 - 1) Install rubber cushion in under left and right part of radiator and position radiator.
 - 2) Fix radiator with bracket.
16. Cooling Fan Assembly
 - 1) Install cooling fan assembly and tighten fixing bolts to the specified torque.

Torque: 8 N·m (0.8 kg·m/5.8 lb ft)
17. Fan Shroud
18. Radiator Hose
 - 1) Connect upper and lower hose to engine side.
 - 2) Pour coolant into radiator.
19. Install battery.
20. Connect window washer hose and install engine hood.

ENGINE MOUNT (RH)



022RW018

Legend

- (1) Rubber Engine Mount (LH)
- (2) Engine Mounting Bracket (LH)
- (3) Rubber Engine Mount (RH)
- (4) Engine Mounting Bracket (RH)

REMOVAL

1. Disconnect battery ground cable
2. Hang the engine assembly.
3. Rubber engine mount.
 - 1) Remove bolts from chassis frame bracket.
 - 2) Remove nuts from rubber engine mount and engine mounting bracket.
4. Remove bolt which is fixed between engine and mounting bracket then remove the engine mounting bracket.

INSTALLATION

- Tighten the fixing bolts to the specified torque.

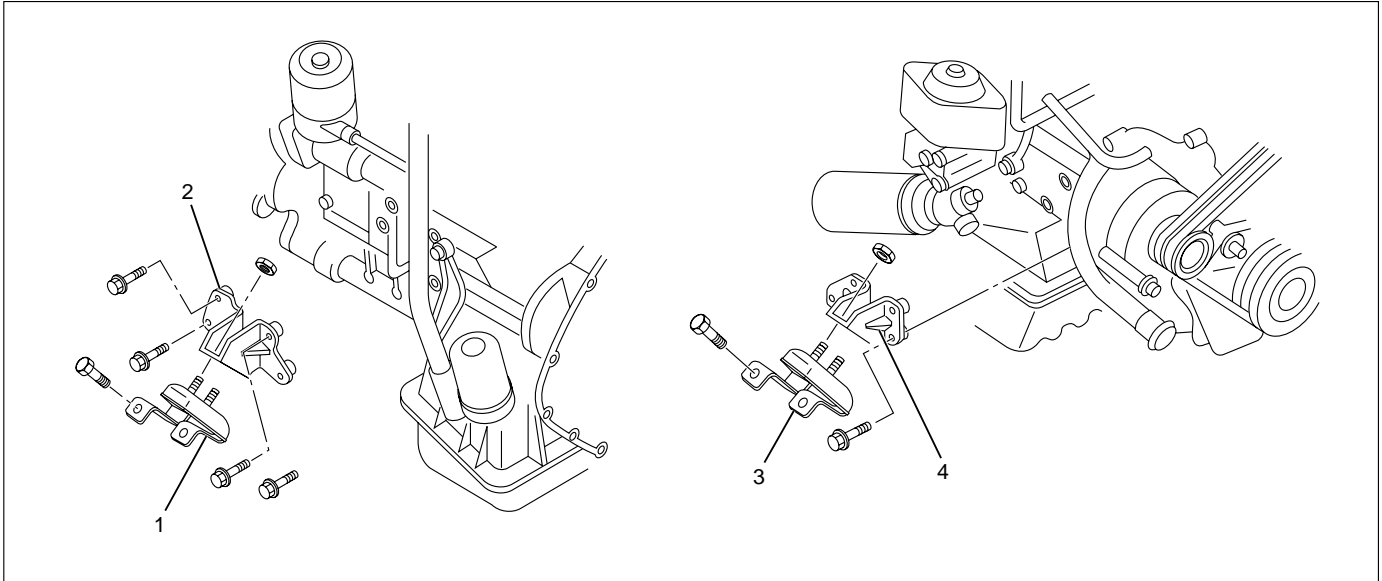
1. Engine mounting bracket to cylinder block.

Torque : 40 N·m (4 kg·m/29 lb ft) (for M10)
127 N·m (13 kg·m/94 lb ft) (for M14)

2. Rubber engine mount to chassis frame and engine mounting bracket.

Torque :40 N·m (4 kg·m/29 lb ft)

ENGINE MOUNT (LH)



022RW018

Legend

- (1) Rubber Engine Mount (LH)
- (2) Engine Mounting Bracket (LH)
- (3) Rubber Engine Mount (RH)
- (4) Engine Mounting Bracket (RH)

REMOVAL

1. Disconnect battery ground cable
2. Hang the engine assembly.
3. Rubber engine mount.
 - 1) Remove bolts from chassis frame bracket.
 - 2) Remove nuts from rubber engine mount and engine mounting bracket.
4. Remove bolt which is fixed between engine and mounting bracket then remove the engine mounting bracket.

INSTALLATION

- Tighten the fixing bolts to the specified torque.

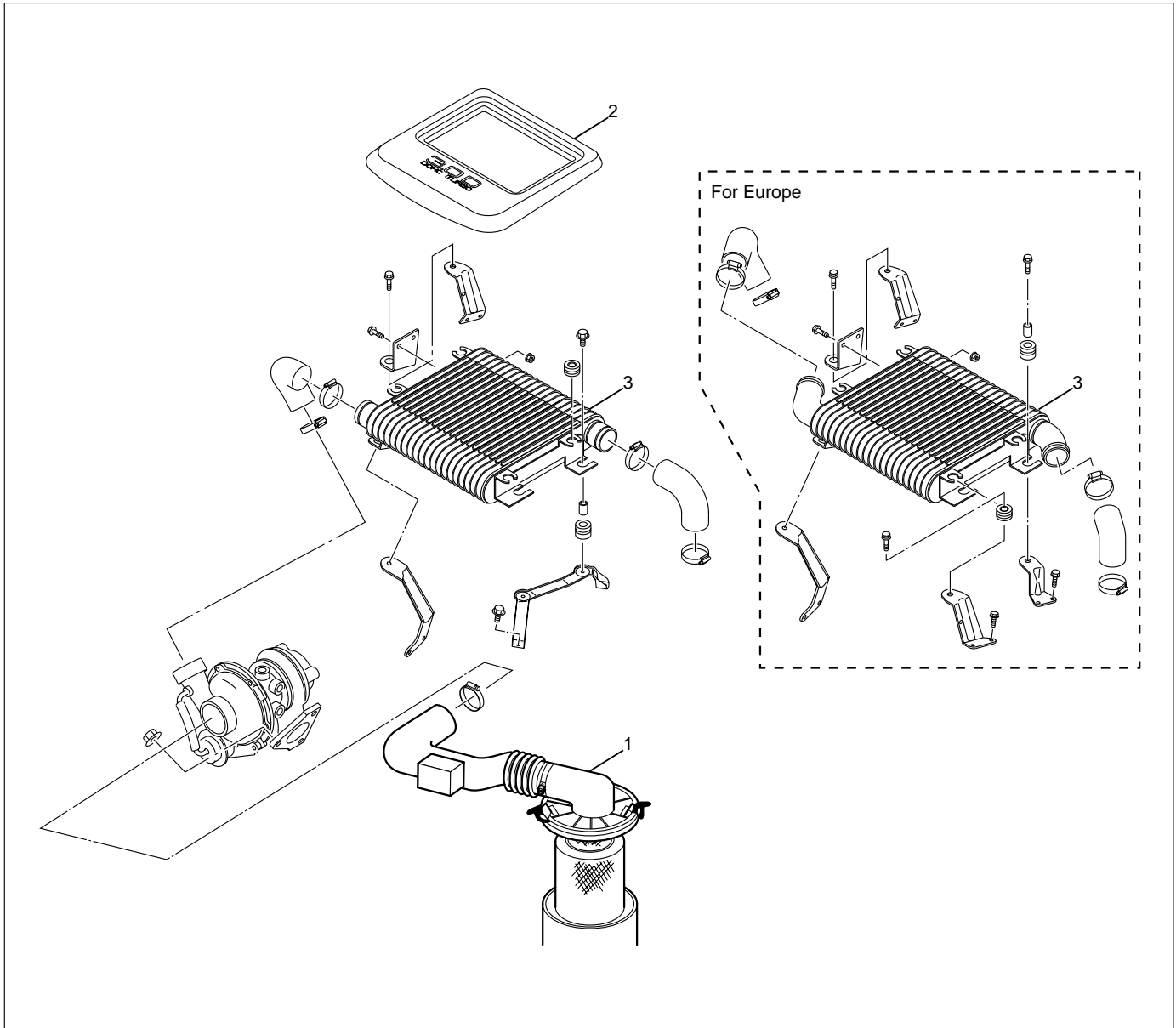
1. Engine mounting bracket to cylinder block.

Torque : 40 N·m (4 kg·m/29 lb ft) (for M10)
127 N·m (13 kg·m/94 lb ft) (for M14)

2. Rubber engine mount to chassis frame and engine mounting bracket.

Torque :40 N·m (4 kg·m/29 lb ft)

INTERCOOLER



135R200003

Legend

- | | |
|----------------------------------|--------------------------|
| (1) Air Cleaner Cover & Air Duct | (2) Intercooler Cover |
| | (3) Intercooler Assembly |

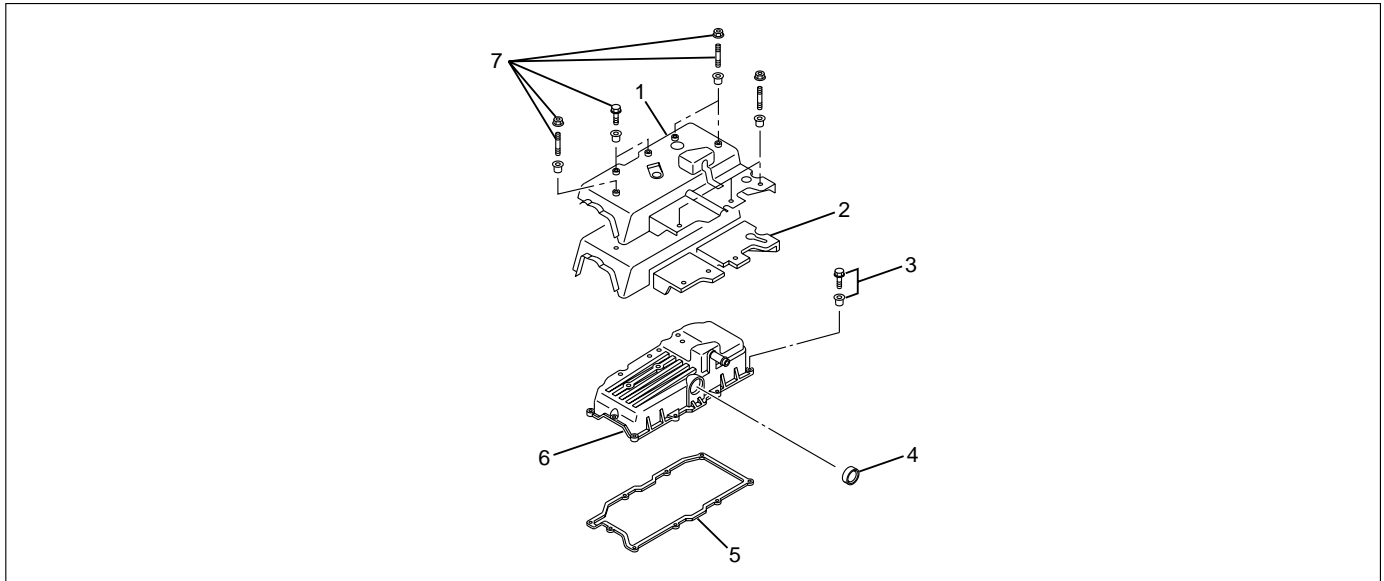
REMOVAL

1. Disconnect the battery ground cable.
2. Remove air cleaner cover and air duct.
3. Remove intercooler cover.
4. Remove intercooler assembly.
 - 1) Remove rubber hose from between intercooler outlet and intake manifold inlet.
 - 2) Remove rubber hose from between turbocharger outlet and intercooler inlet.
 - 3) Remove intercooler assembly fixing bolts from the bracket, remove intercooler assembly.

INSTALLATION

1. Intercooler assembly
 - 1) Connect outlet hose to intake manifold.
Torque : 4 N-m (0.4 kg-m/3 lb ft)
 - 2) Connect inlet hose from turbocharger to intercooler.
Torque : 4 N-m (0.4 kg-m/3 lb ft)
 - 3) Install intercooler and tighten fixing bolts to the specified torque.
Torque : 20 N-m (2.0 kg-m/14.5 lb ft)
2. Install intercooler cover.
3. Install air cleaner cover and air duct.
4. Connect the battery ground cable.

CYLINDER HEAD COVER



010R200006

Legend

- | | |
|---------------------------|-------------------------|
| (1) Noise Insulator Cover | (4) Oil Seal |
| (2) Insulator | (5) Gasket |
| (3) Bolt | (6) Cylinder Head Cover |
| | (7) Bolt |

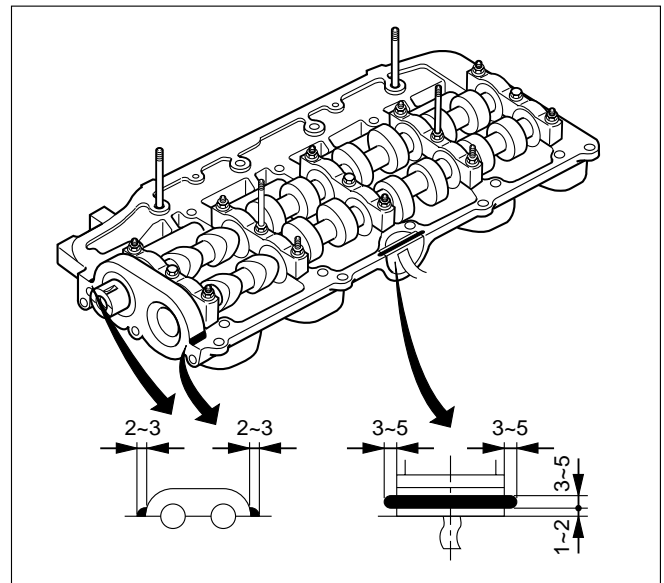
REMOVAL

1. Disconnect battery ground cable.
2. Remove clip, remove air cleaner cover and air duct.
3. Remove intercooler assembly.
Refer to "Intercooler" in this manual.
4. Remove PCV hose.
5. Remove bolts which fix noise insulator cover then remove noise insulator cover and insulator.
6. Remove high pressure oil pipe at cylinder head side.

Take care when removing the injector oil pipe, because sometimes, during removal, your hand can be injured by the remaining high pressure oil.

INSTALLATION

1. Cylinder head cover.
 - 1) Install the cylinder head cover gasket to cylinder head cover.
 - 2) The gasket must be set perfectly with no loose areas.
 - 3) Apply liquid gasket (TB1207B or equivalent) to the rubber seal of the camshaft end, injector harness gasket area and No. 1 camshaft bracket.



012RW119

- 4) Tighten cylinder head cover fixing bolts to the specified torque.

Torque : 9 N·m (0.9 kg·m/6.5 lb ft)

2. Fill with about 300 cc of engine oil from the high pressure oil pipe installation port of the oil rail using an oil rail filler. If assembled without filling the oil rail with oil, the time for starting the engine will be longer.
3. Install the high pressure oil pipe immediately and tighten the sleeve nut to the specified torque.

Torque : 80 N·m (8.1 kg·m/57.9 lb ft)

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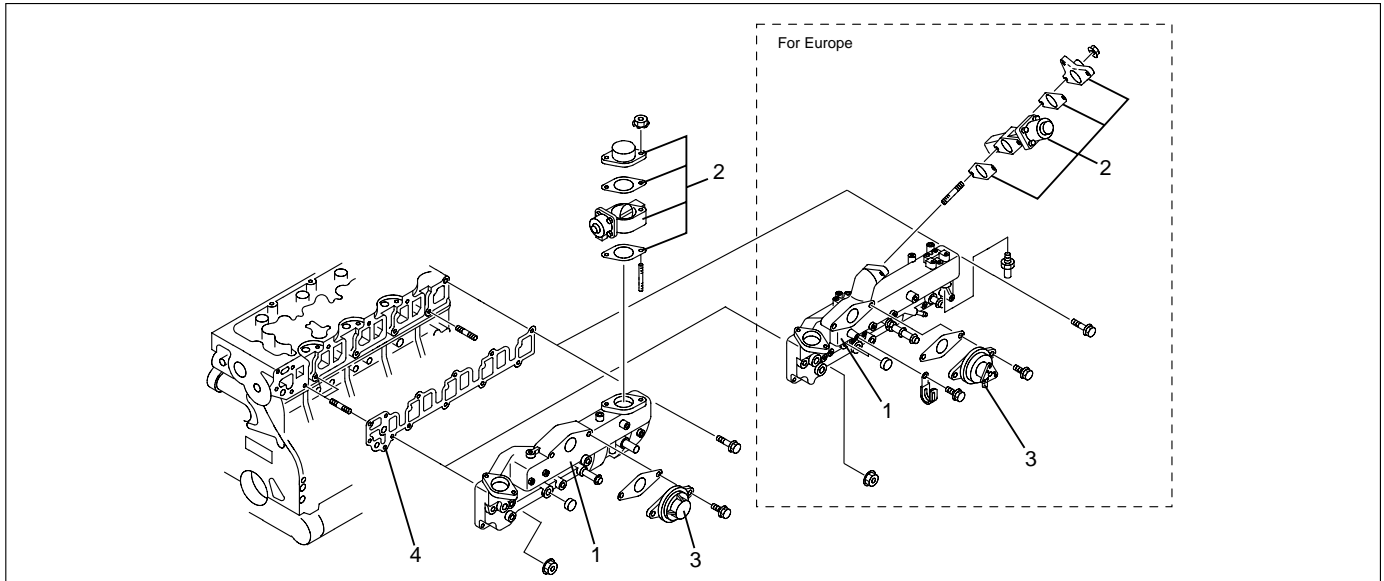
NOTE: Do not scratch the oil seal on the cylinder head during installation of the high pressure oil pipe.

4. Install the noise insulator and its cover on the cylinder head cover.

NOTE: Do not catch the injector harness with the noise insulator cover.

5. Connect the PCV hose.
6. Install the intercooler assembly.
Refer to "Intercooler" in this manual.
7. Install air cleaner cover and air duct.
8. Connect battery ground cable.

INTAKE MANIFOLD



025R200005

Legend

- (1) Intake Manifold
- (2) Throttle Valve Assembly
- (3) EGR Valve
- (4) Gasket

REMOVAL

1. Drain engine coolant and disconnect water hose from thermostat hosing.
2. Remove intercooler assembly
Refer to "Intercooler" in this manual.
3. Remove bracket bolt of oil level gauge guide tube.
4. Remove PCV Hose.
5. Remove hoses from EGR, EGR vacuum sensor and inlet/outlet of heater.
6. Disconnect harness connector from MAP sensor, EGR vacuum sensor, ETC sensor, water temperature unit, IAT sensor and EVRV.
7. Remove high pressure oil pipe.
8. Remove the two way valve.
9. Remove fuel pipe from between intake manifold and high pressure oil pump.
10. Remove fixing bolts and nuts on the intake manifold, then remove the intake manifold assembly.

INSTALLATION

1. Install the intake manifold, tighten bolts and nuts to the specified torque.

Torque : 20 N-m (2.0 kg-m/14.5 lb ft) for bolt and nut

2. Install the fuel pipe and tighten to the specified torque.

Torque :

M16 bolt (apply engine oil) 4 N-m (0.4 kg-m/2.9 lb ft)

Cap nut (M10) 13N-m (1.3 kg-m/9.4 lb ft)

Fuel pipe (M10 apply engine oil) 14 N-m (1.4 kg-m/10 lb ft)

3. Install two way valve.

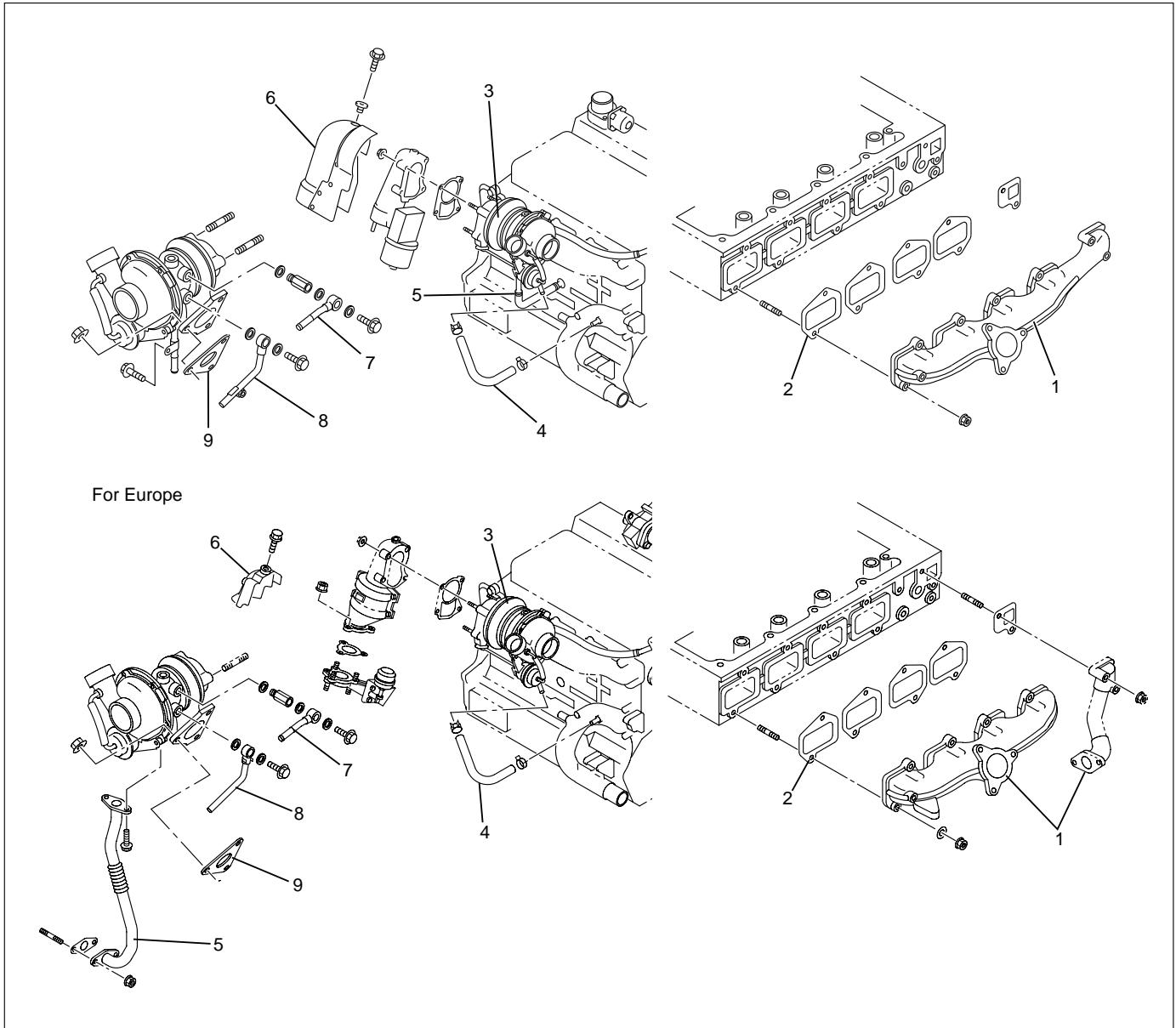
Torque : 20 N-m (2.0 kg-m/14.5 lb ft)

4. Fill with about 300 cc of engine oil from the high pressure oil pipe installation port of the oil rail using an oil filler. If assembled without filling the oil rail with oil, the time for starting the engine will be longer.
5. Install the high pressure oil pipe immediately and tighten the sleeve nut to the specified torque.

Torque : 80 N-m (8 kg-m/57.9 lb ft)

6. Reconnect harness connector to MAP sensor, EGR vacuum sensor, ETC sensor, Water temperature unit, IAT sensor and EVRV.
7. Connect the hoses to EGR valve, EGR vacuum sensor, and water inlet/outlet pipe for heater.
8. Connect PCV hose.
9. Install the oil level gauge guide tube and tighten bracket bolt.
10. Install the intercooler assembly.
Refer to "Intercooler" in this manual.
11. Connect the hose to the thermostat housing and fill with engine coolant.

EXHAUST MANIFOLD



025R200004

Legend

- | | |
|---------------------------|--------------------|
| (1) Exhaust Manifold | (5) Water Hose |
| (2) Gasket | (6) Heat Protector |
| (3) Turbocharger Assembly | (7) Oil Pipe |
| (4) Water Hose | (8) Oil Pipe |
| | (9) Gasket |

REMOVAL

1. Remove the hose from both turbocharger outlet and intake manifold inlet side, then remove intercooler assembly.
2. Loosen belt tensioner, remove A/C compressor assembly.
3. Remove heat protector from turbocharger.
4. Remove water hoses and oil pipes from turbocharger.
5. Remove turbocharger assembly from exhaust manifold.
6. Remove exhaust manifold fixing nuts, then remove exhaust manifold.

RINSTALLATION

1. Install gasket on the exhaust manifold and tighten to the specified torque.

Torque : 30 N·m (3.1 kg·m/22 lb ft)

2. Install turbocharger on the exhaust manifold.

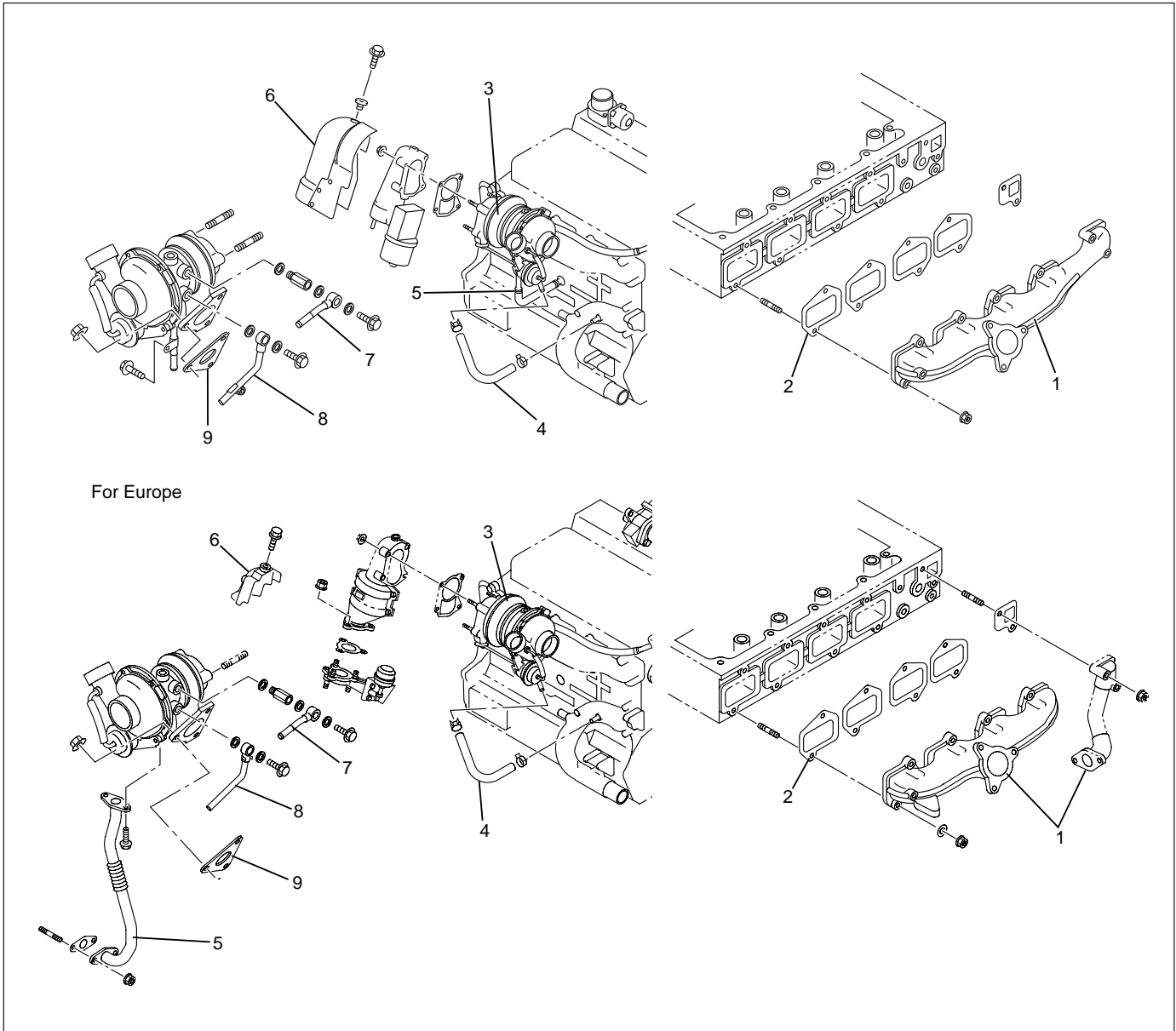
Torque : 27 N·m (2.8 kg·m/20.2 lb ft)

3. Install water hoses and oil pipes.
4. Install heat protector to turbocharger.

Torque : 9 N·m (0.9 kg·m/6.5 lb ft)

5. Install A/C compressor assembly and readjust belt tensioner.
6. Install the intercooler assembly in the normal position.
Connect both hoses to turbocharger and intake manifold.

TURBOCHARGER



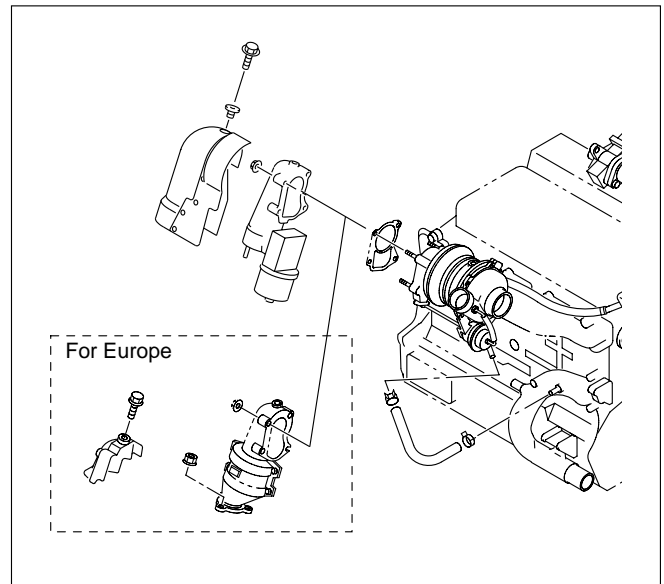
025R200004

Legend

- | | |
|---------------------------|--------------------|
| (1) Exhaust Manifold | (5) Water Hose |
| (2) Gasket | (6) Heat Protector |
| (3) Turbocharger Assembly | (7) Oil Pipe |
| (4) Water Hose | (8) Oil Pipe |
| | (9) Gasket |

REMOVAL

1. Remove battery.
2. Drain engine coolant.
3. Remove air cleaner cover with air duct.
4. Remove intercooler assembly.
Refer to "Intercooler" in this manual.
5. Remove water pipe for turbocharger inlet.
6. Remove oil pipe for turbocharger.
 - 1) Remove eye bolt from turbocharger.
 - 2) Plug oil port on the turbocharger to prevent entry of foreign materials.
7. Remove oil drain pipe from turbocharger.
8. Remove water outlet pipe.
9. Remove heat protector.
10. Remove exhaust adaptor.
11. Remove turbocharger assembly from exhaust manifold.

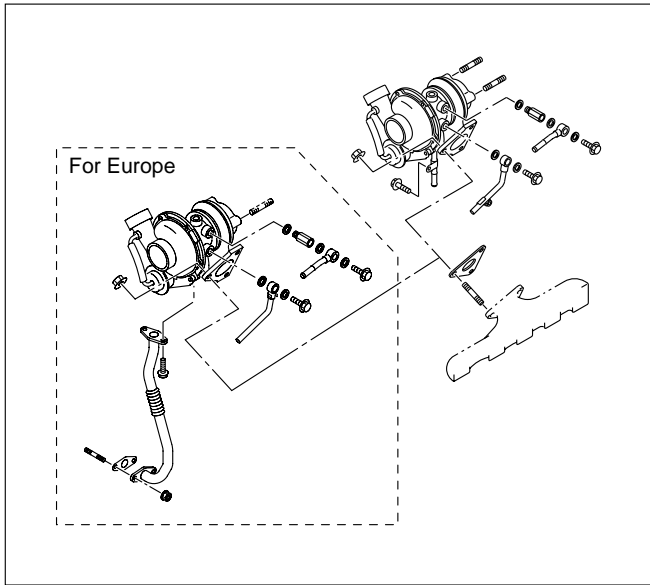


025R200006

INSTALLATION

1. Install turbocharger assembly to exhaust manifold, tighten to the specified torque.

Torque : 27 N·m (2.8 kg·m/20.2 lb ft)



025R200007

2. Install exhaust adaptor.

Torque : 27 N·m (2.8 kg·m/20.2 lb ft)

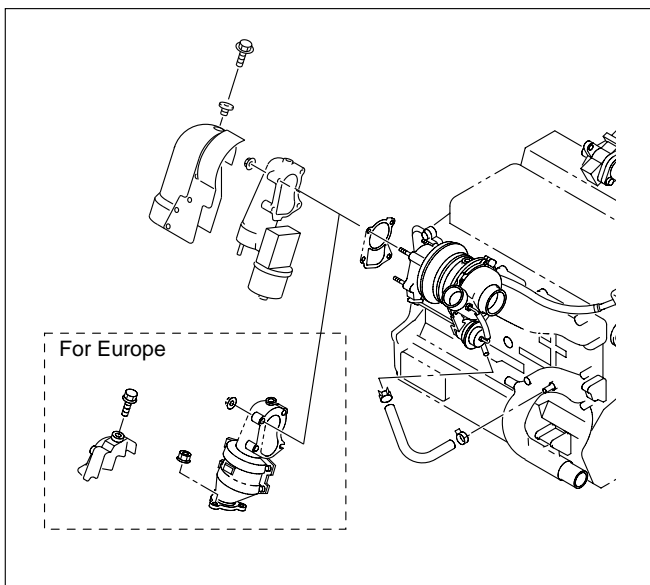
3. Install heat protector.

4. Install water outlet pipe with gasket.

Torque : 9 N·m (0.9 kg·m/6.5 lb ft)

5. Install turbocharger oil drain pipe.

Torque : 9 N·m (0.9 kg·m/6.5 lb ft)



025R200006

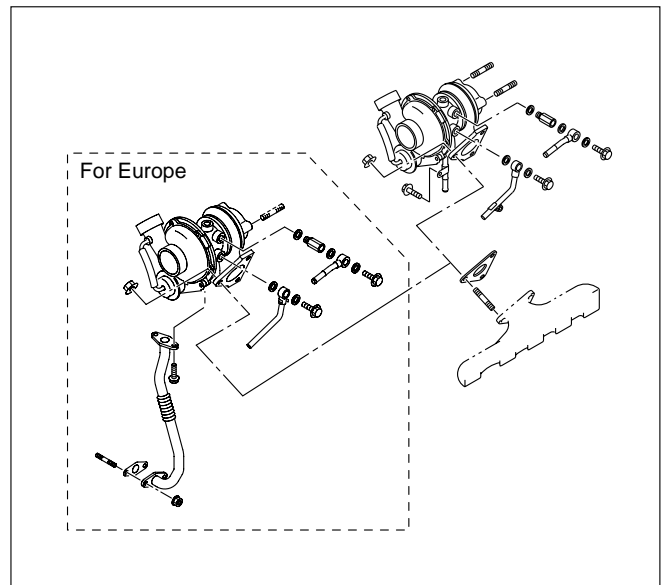
6. Install oil supply pipe to turbocharger.

- 1) Fill with 100 cc engine oil at the turbocharger oil supply hole before installing the oil pipe.

- 2) Turn the turbocharger by hand to lubricate turbocharger shaft.

- 3) Install oil supply pipe with new gasket to the turbocharger and tighten oil supply pipe bolts to the specified torque.

**Torque : 22 N·m (2.2 kg·m/15.9 lb ft) for M10
54 N·m (5.5 kg·m/39.8 lb ft) for M14**



025R200007

7. Install water inlet pipe with new gasket, tighten to the specified torque.

Torque : 9 N·m (0.9 kg·m/6.5 lb ft)

8. Install intercooler assembly.

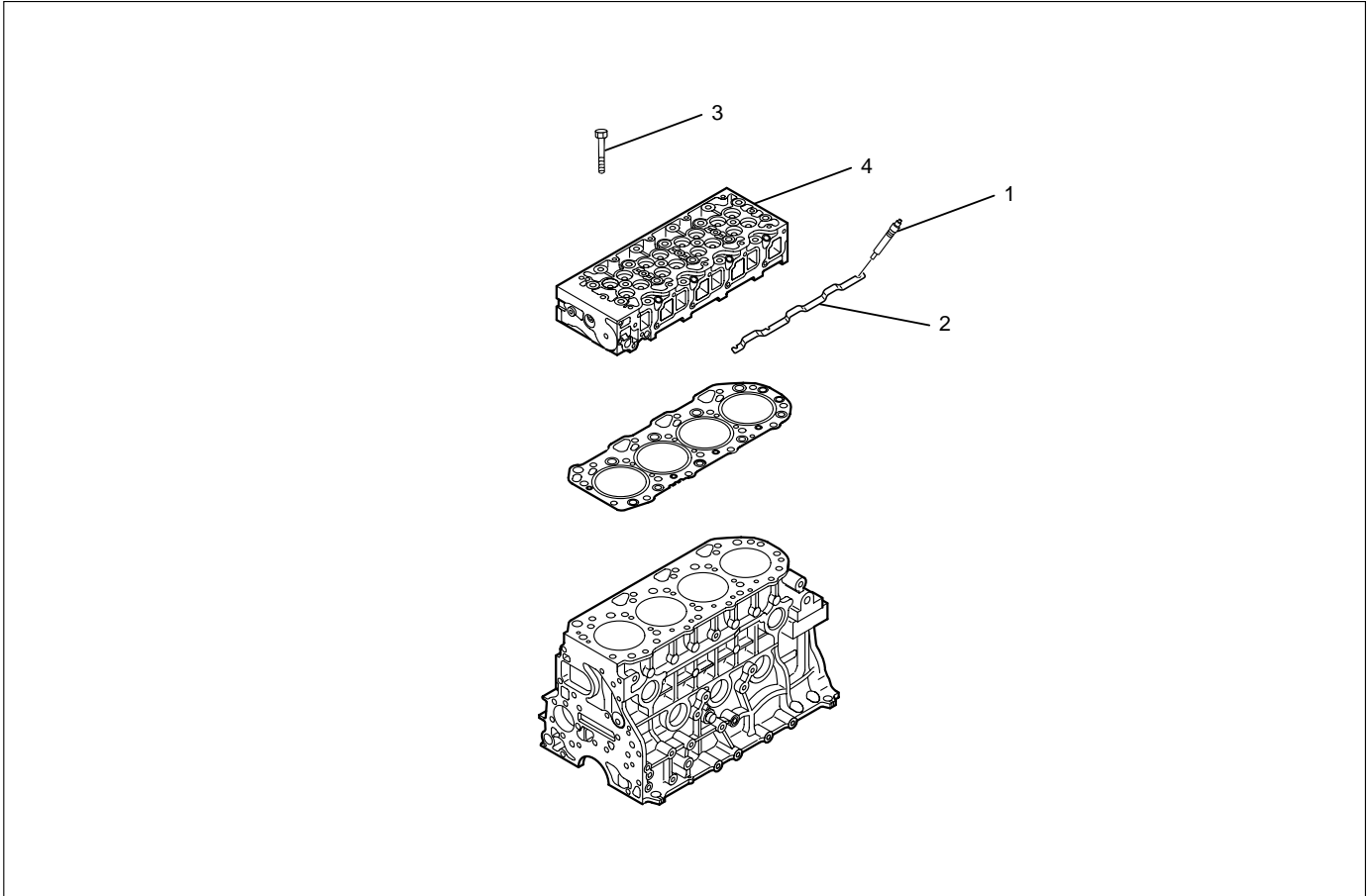
Refer to "Intercooler" in this manual.

9. Install air cleaner cover with air duct, connect both side hoses.

10. Fill with engine coolant.

11. Install the battery and connect battery cables.

CYLINDER HEAD



012RW096

Legend

- (1) Glow Plug
- (2) Plate
- (3) Cylinder Head Bolt
- (4) Cylinder Head

NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be re-installed in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, do a compression test and note the results.

DISASSEMBLY

1. Injector Assy
2. Glow Plug and Glow Plug Connector
3. Cylinder Head Assembly
 - Refer to "Cylinder Head Gasket"

CLEAN

- Cylinder head
Carefully remove all varnish, soot and carbon on the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Cylinder head gasket and mating surfaces for leaks, corrosion and blow-by. If the gasket has failed, determine the cause;
 - Improper installation
 - Loosen or warped cylinder head
 - Insufficient torque on head bolts
 - Warped cylinder block surface

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2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.

CAUTION: Do not attempt to weld the cylinder head. Replace it.

4. Cylinder head lower surface for flatness.
Use a straight edge and a feeler gauge to measure the cylinder head lower surface warpage.
If the measured values exceed the specified limit, the cylinder head must be replaced.

Cylinder Head Lower Face Warpage:

Standard: 0.075 mm (0.0029 in) or less

Limit: 0.2 mm (0.0079 in)

Cylinder Head Height:

Standard: 95 mm (3.740 in)

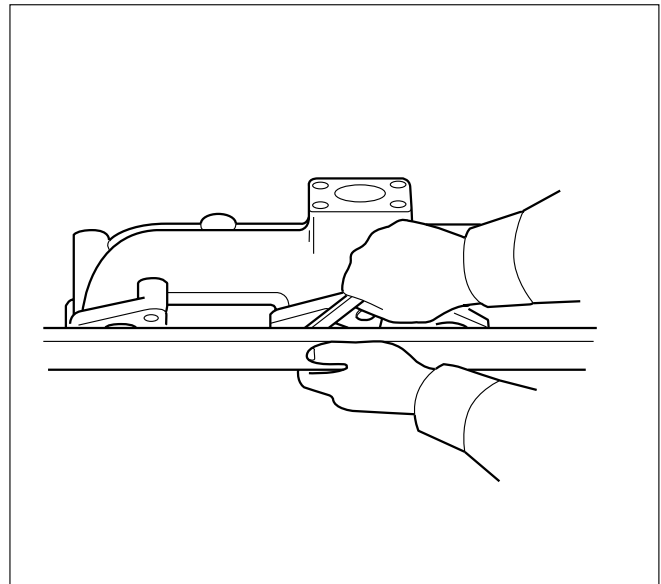
5. Water jacket sealing plugs seating surfaces.
6. Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.
If the measured values exceed the specified limit, the manifold must be replaced.

Exhaust Manifold Warpage:

Standard: 0.05 mm (0.0020 in) or less

Limit: 0.20 mm (0.0079 in)

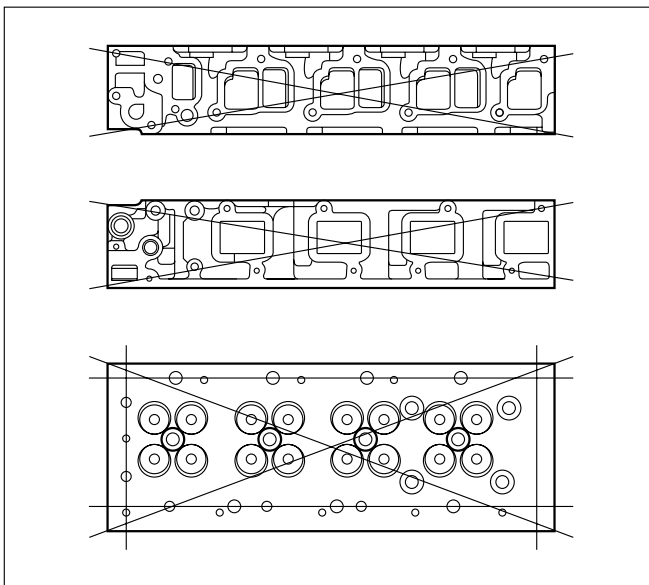
CAUTION: Do not attempt to weld the cylinder head. Replace it.



012RW053

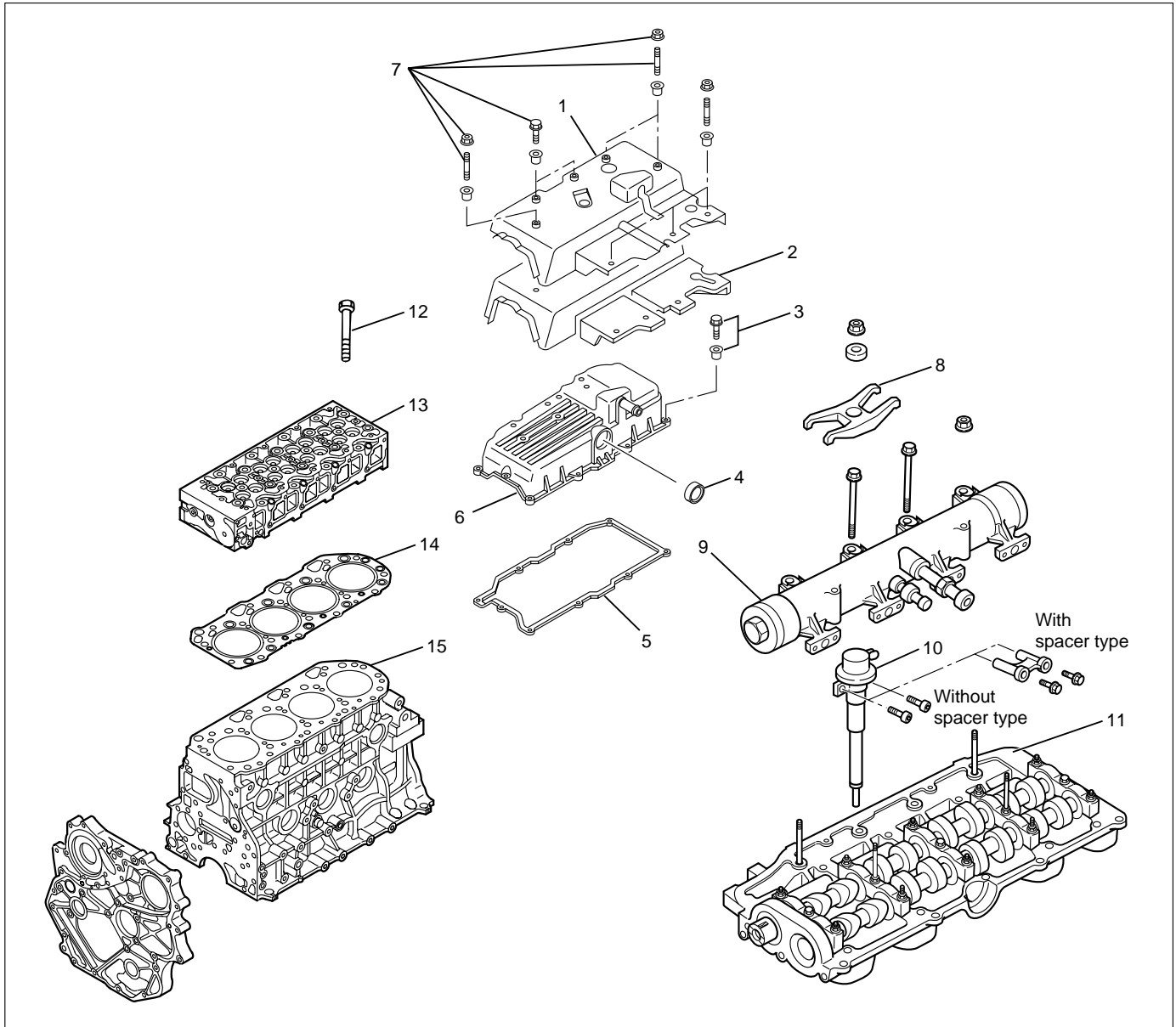
REASSEMBLY

1. Cylinder Head
 - Refer to "Cylinder Head Gasket".
 2. Glow Plug and Glow Plug Connector
 - Tighten glow plugs.
- Torque: 15 N·m (1.5 kg·m/11 lb ft)**



011RW006

CYLINDER HEAD GASKET



011R200002

Legend

- | | |
|---|-----------------------------|
| (1) Cylinder Head Noise Insulator Cover | (9) Oil Rail |
| (2) Insulator | (10) Injector Assembly |
| (3) Bolt and Gasket | (11) Camshaft Carrier |
| (4) Oil Seal | (12) Cylinder Head Bolt |
| (5) Gasket | (13) Cylinder Head Assembly |
| (6) Cylinder Head Cover | (14) Cylinder Head Gasket |
| (7) Bolt, Stud and Rubber Mounting | (15) Cylinder Block |
| (8) Injector Clamp | |

REMOVAL

1. Disconnect battery ground cable.
2. Drain engine coolant.
3. Remove air cleaner and air duct.
4. Remove intercooler assembly.
Refer to "Intercooler" in this manual.
5. Remove oil level gauge guide assembly.
6. Remove PCV hose.
7. Remove EGR vacuum hose.
8. Disconnect harness connector around the cylinder head.
9. Remove A/C compressor assembly.
10. Remove A/C compressor bracket.
11. Remove generator assembly and take out fan belt.
12. Remove heat protector and remove valve assembly.
13. Remove water hose and oil pipe from turbocharger.
14. Remove turbocharger assembly.
15. Remove water hose between thermostat and radiator.
16. Remove cylinder head noise insulator cover.

NOTE: Do not make damage to the harness.

17. Remove high pressure pipe.
18. Remove timing belt cover.
19. Remove CMP sensor bracket.
20. Remove timing belt tensioner and remove timing belt.
21. Remove camshaft pulley.
22. Remove front plate.
23. Remove water pipe between cylinder head and water pump.
24. Remove fuel pipe between fuel pump and intake manifold.
25. Remove fuel return pipe.
26. Remove intake manifold assembly.
27. Disconnect glow plug wiring and remove glow plug.
28. Remove cylinder head cover.
29. Drain oil from oil rail.
30. Disconnect injector harness connector.
31. Disconnect harness connector from oil pressure sensor and oil temperature sensor on the oil rail.
32. Disconnect injector harness assembly.
33. Remove injector clamp.
34. Remove injector spacer (If equipped.).
35. Remove injector assembly.
36. Remove oil rail assembly.
37. Remove camshaft carrier.
38. Remove cylinder head assembly.
39. Remove cylinder head gasket.

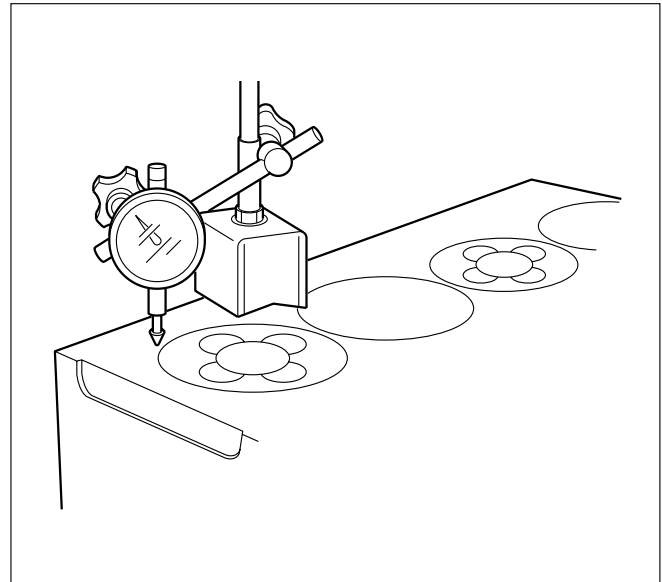
INSTALLATION

1. Install cylinder head gasket with top mark up.

NOTE: Determine cylinder head gasket grade by measuring projection of piston head.

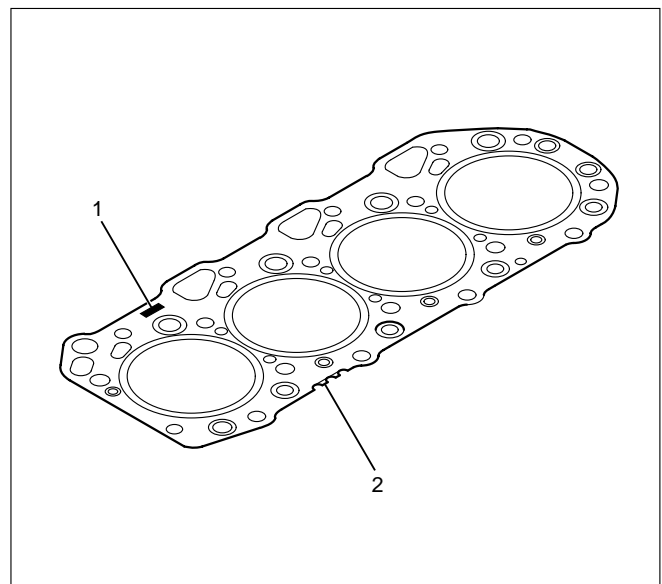
2. Selection cylinder head gasket.

- 1) Measure the piston head projection by dial gauge.



012RW073

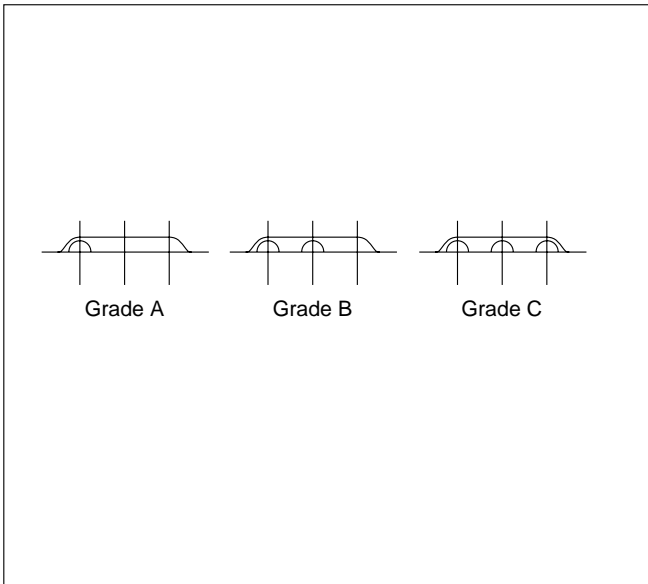
- 2) Measure the projection of piston head at the nearest possible point to the cylinder bore.
- 3) Obtain the largest measurement from among all cylinders.
- 4) Determine cylinder head gasket grade by maximum value of measuring projection of piston head.



011RW043

Legend

- (1) Top Mark
- (2) Grade Mark



011RW042

Cylinder head gasket and piston projection mm

Grade	Piston projection	Gasket thickness
A	more 0.333 to less 0.383	1.35
B	more 0.383 to less 0.433	1.40
C	more 0.433 to less 0.483	1.45

CAUTION:

- The projection of each piston should be 0.333 mm or more and less than 0.483 mm.
 - Maximum difference in projection between pistons should be less than 0.1 mm.
 - If the piston projection is without standard, reassemble the engine all over again.
3. Install cylinder head assembly, tighten bolts by angular tightening method.

Torque:

1st step; 49 N-m (4.9 kg-m/35.4 lb ft)

2nd step; 60°

3rd step; 60°

CAUTION: The cylinder head bolts cannot be reused.

4. Install camshaft carrier assembly.
Refer to "Camshaft" in this manual.
5. Install oil rail and injector assembly.
Refer to "Oil rail and injector" in this manual.
6. Install injector harness to connect harness connector.

Note: Apply liquid gasket (TB 1207B or equivalent) to the rubber seal of the camshaft end, injector harness gasket area and No. 1 camshaft bracket. Refer to the Cylinder head cover.

7. Install cylinder head cover.

Torque: 9 N-m (0.9 kg-m/6.5 lb ft)

8. Install glow plug to tighten specified torque.

Torque: 15 N-m (1.5 kg-m/11 lb ft) and connect

glow plug harness.

9. Install intake manifold.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

10. Install fuel return pipe.
11. Install fuel pipe in between fuel pump and intake manifold.
12. Install water pipe in between cylinder head and water pump.
Tighten flange bolt to the specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

13. Install front plate.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

14. Install camshaft pulley, tighten with angular tightening method.

1st step 40 N-m (4.0 kg-m/29 lb ft)

2nd step 60°

NOTE: Apply engine oil to camshaft pulley bolt.

15. Align timing mark oil pump pulley and camshaft pulley to front plate then put the timing belt and tighten tensioner bolt.

**Torque: 20 N-m (2.0 kg-m/14.5 lb ft) for M8
50 N-m (5.1 kg-m/37 lb ft)**

16. Install CMP sensor bracket.
17. Install timing belt cover.

Torque: 9 N-m (0.9 kg-m/6.5 lb ft)

18. Fill with about 300 cc of engine oil from the high pressure oil pipe installing port of oil rail using an oil filler.

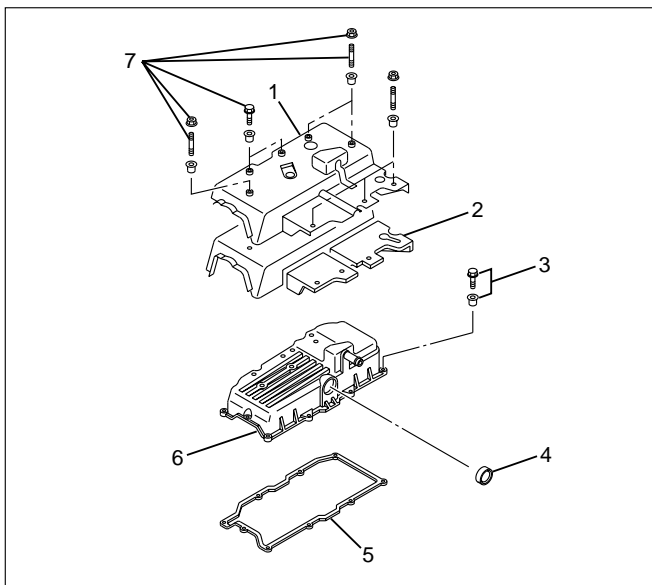
If assembled without filling the oil rail with oil, the time for engine start will be longer.

19. Immediately install high pressure oil pipe to tighten with specified torque.

Torque: 80 N-m (8 kg-m/57.9 lb ft)

20. Install cylinder head noise insulator cover.

Torque: 9 N-m (0.9 kg-m/6.5 lb ft)

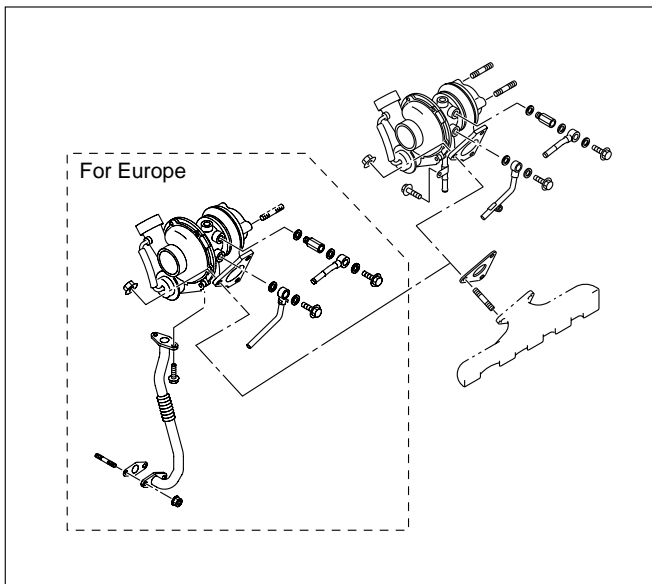


010R200006

Legend

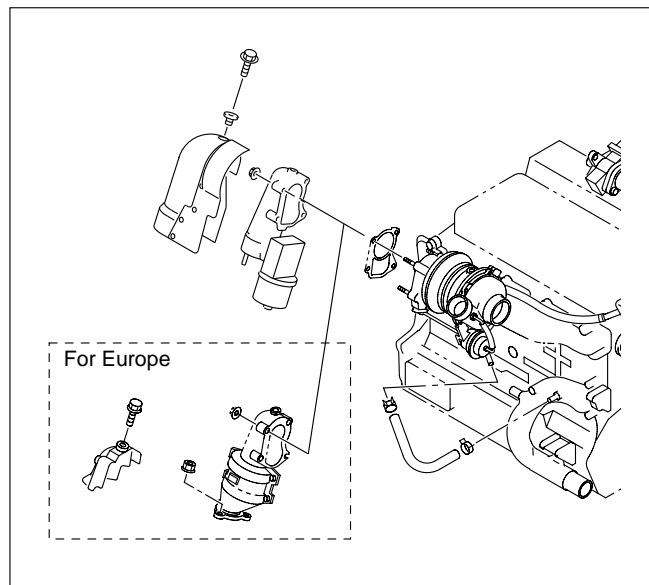
- (1) Cylinder Head Noise Insulator Cover
- (2) Insulator
- (3) Bolt
- (4) Oil Seal
- (5) Gasket
- (6) Cylinder Head Cover
- (7) Bolt, Stud and Rubber Mounting

- 21. Install water hose between thermostat and radiator.
- 22. Install turbocharger assembly to exhaust manifold.
- Torque: 27 N-m (2.8 kg-m/20.2 lb ft)**
- 23. Install water hose and oil pipe for turbocharger.



025R200007

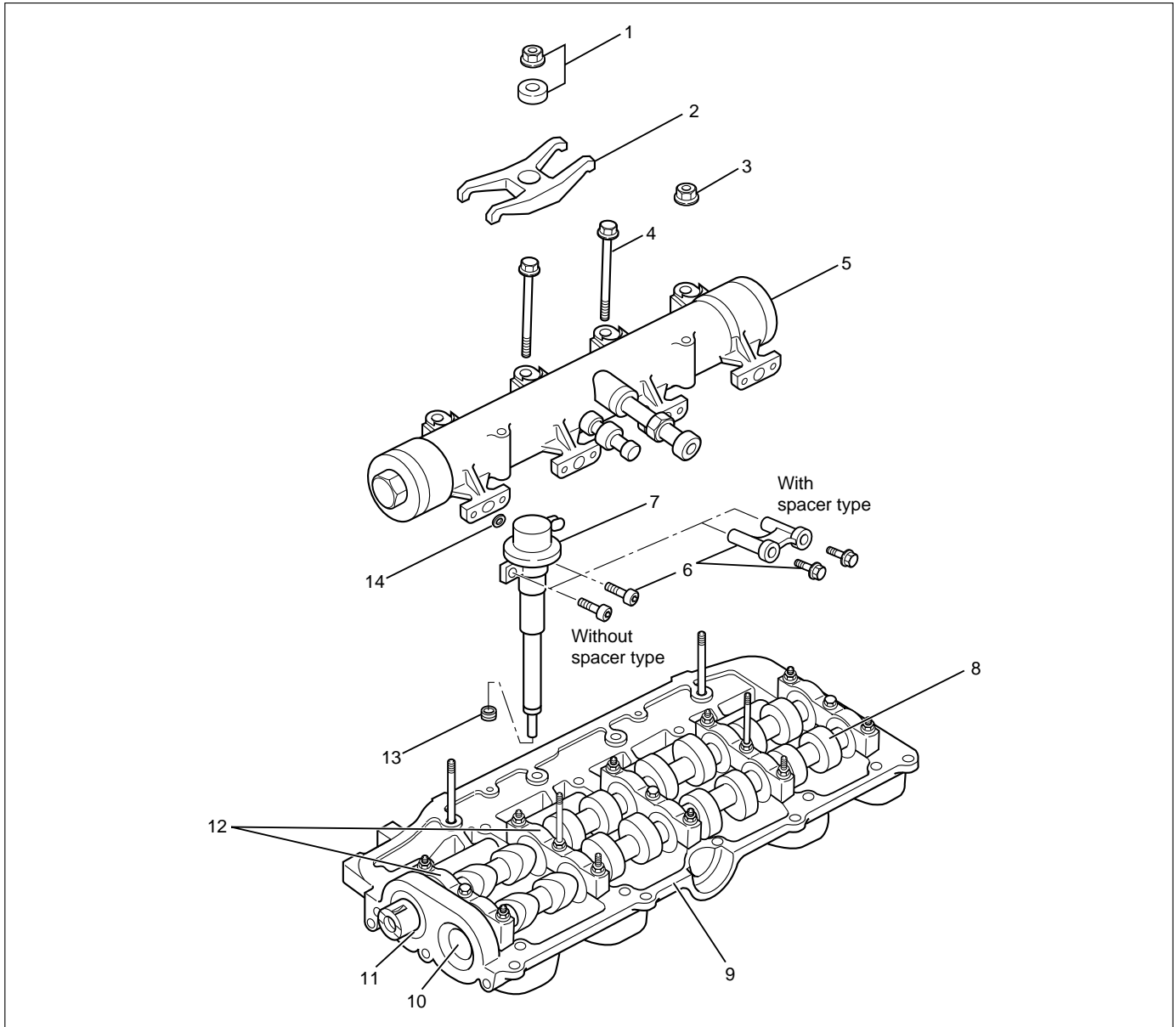
- 24. Install exhaust valve assembly and heat protector.
- Torque: 27 N-m (2.8 kg-m/20.2 lb ft) for valve**
- Torque: 9 N-m (0.9 kg-m/6.5 lb ft) for heat protector**



025R200006

- 25. Install generator assembly.
- Torque: 40 N-m (4.0 kg-m/29 lb ft) for ACG bracket**
- Torque: 40 N-m (4.0 kg-m/29 lb ft) between ACG and bracket**
- Torque: 20 N-m (2.0 kg-m/14.5 lb ft) between ACG and adjuster plate**
- 26. Fix the A/C compressor bracket and install A/C compressor.
- Torque: 47 N-m (4.7 kg-m/34 lb ft) for A/C bracket**
- Torque: 20 N-m (2.0 kg-m/14.5 lb ft) for belt tensioner**
- 27. Reconnect harness connector around cylinder head.
- 28. Connect EGR vacuum hose.
- 29. Install oil level gauge guide assembly.
- Tighten nuts lower portion and tighten bolt.
- Torque: 20 N-m (2.0 kg-m/14.5 lb ft)**
- 30. Install intercooler assembly.
- Refer to "Intercooler" in this manual.
- 31. Install air duct between air cleaner and turbocharger.
- 32. Fill engine coolant.
- 33. Reconnect battery.

CAMSHAFT



012R200004

Legend

- | | |
|-----------------------------------|-----------------------|
| (1) Nut and Washer | (8) Camshaft |
| (2) Injector Clamp | (9) Camshaft Carrier |
| (3) Nut | (10) Plug |
| (4) Bolt | (11) Oil Seal |
| (5) Oil Rail Assembly | (12) Camshaft Bracket |
| (6) Spacer (If equipped) and Bolt | (13) Gasket |
| (7) Injector Assembly | (14) Gasket |

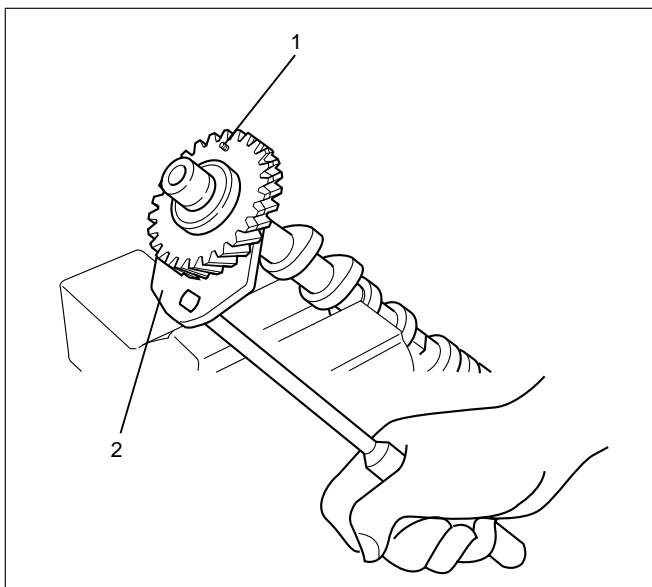
DISASSEMBLY

1. Injector clamp
2. Injector assembly
3. Oil rail assembly
4. Camshaft bracket
5. Camshaft
6. Oil seal
7. Plug

NOTE: Before starting disassembly above, drain oil from oil rail to prevent oil from entering the cylinder.

REASSEMBLY

1. Camshaft
 - 1) Before reassembling the camshaft to the camshaft carrier, align the holes between the main gear and the sub gear on the intake side of the camshaft gear with a special tool.
 - 2) Set lock pin to gear holes from sub gear side.
- Camshaft Gear Tool: 5-8840-2591-0

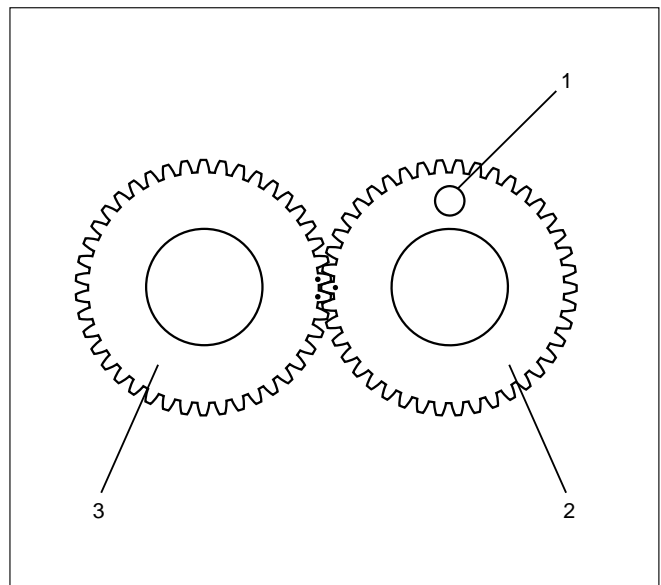


014RW183

Legend

- (1) Locking pin
- (2) Special tool

- 3) Apply engine oil to the camshaft gear tooth.
- 4) Apply engine oil to the journal on the camshaft carrier.
- 5) Align the timing mark on the intake and exhaust camshaft gear and put on the camshaft carrier.



014RW184

Legend

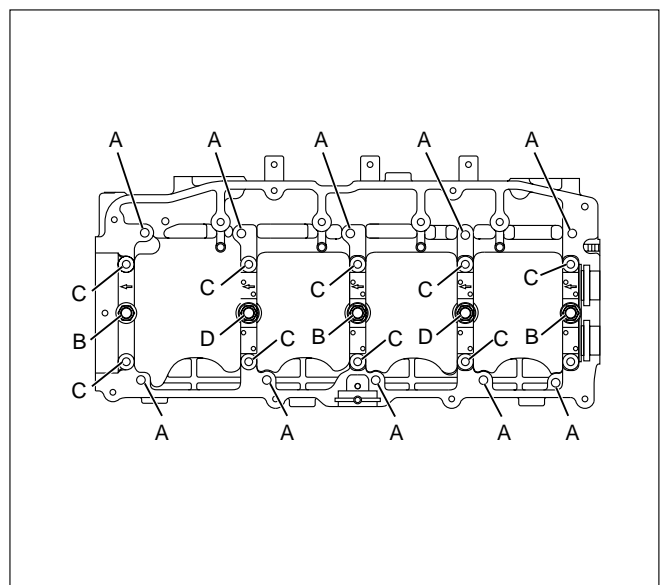
- (1) Locking pin
- (2) Intake side camshaft gear
- (3) Exhaust side camshaft gear

- 6) Apply liquid gasket (TB1207B or equivalent) to No. 1 camshaft bracket matching surface.
- 7) Set No. 1 to No. 5 camshaft bracket on camshaft carrier.
- 8) Temporarily tighten bracket bolts B and C.

Temporal Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

- 9) Put gasket on the cylinder head.
- 10) Install camshaft carrier onto the cylinder head and tighten bolts to specified torque.

Torque: A; 22 N-m (2.2 kg-m/15.9 lb ft)
B; 38 N-m (3.9 kg-m/28.2 lb ft)
C; 22 N-m (2.2 kg-m/15.9 lb ft)
D; 38 N-m (3.9 kg-m/28.2 lb ft)



011RW035

- Remove locking pin.

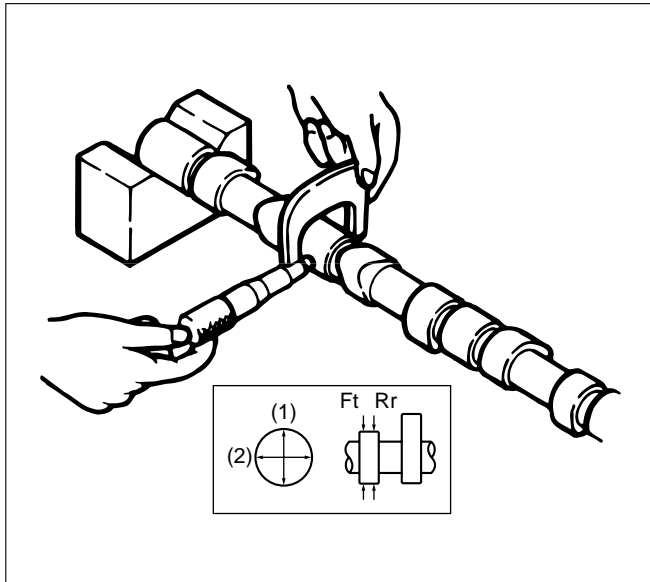
INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Camshaft Journal diameter

- 1) Use a micrometer to measure each camshaft journal diameter in two directions (1) and (2). If the measured value is less than the specified limit, the camshaft must be replaced.

Standard: 29.939 – 29.96 mm (1.1787 – 1.1795 in)
Limit: 29.84 mm (1.17 in)



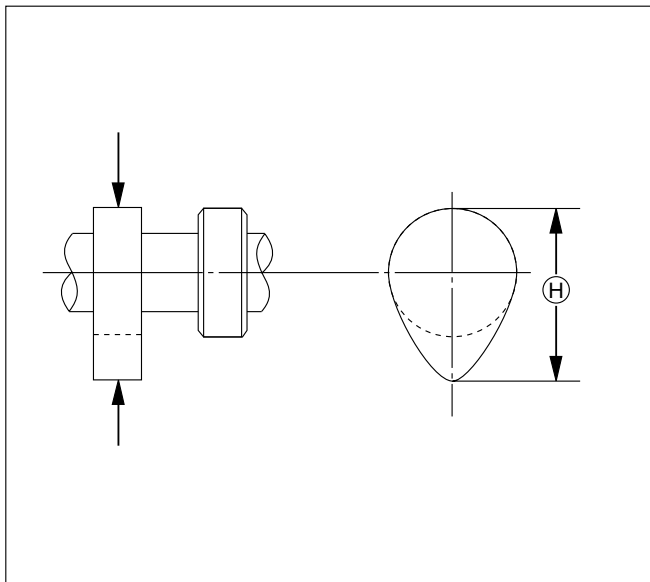
014RW179

2. Cam Height

- 1) Measure the cam height (H) with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Standard: IN 46.62 mm (1.8354 in)
EX 46.72 mm (1.8394 in)

Limit: IN 46.57 mm (1.8335 in)
EX 46.67 mm (1.8374 in)

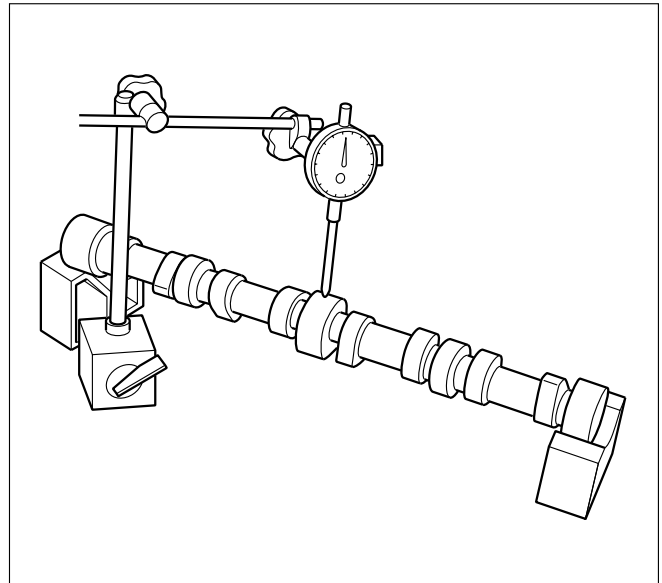


012RW059

3. Cam Run-Out

- 1) Mount the camshaft on V-blocks.
- 2) Measure the cam height (H) with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Standard: 0.02 mm (0.0008 in) or less
Limit: 0.10 mm (0.0039 in)

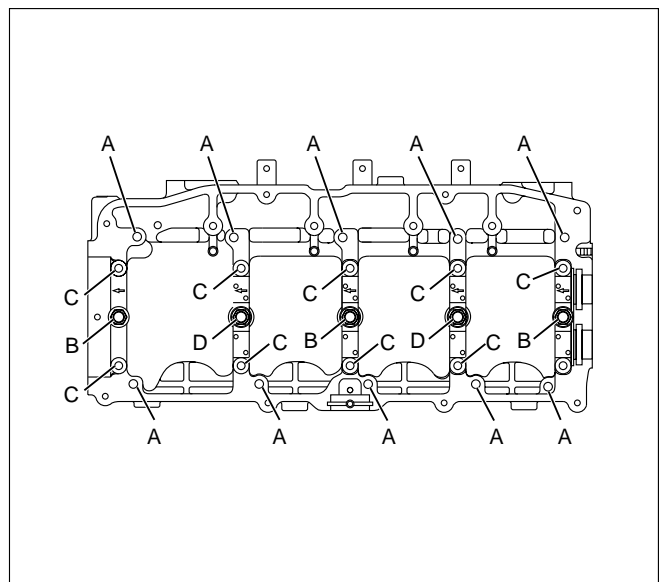


014RW171

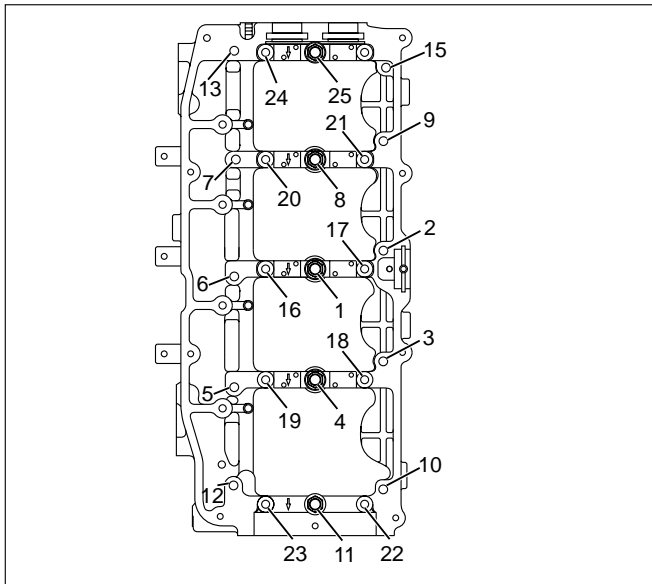
4. Camshaft oil clearance

- 1) Clean the camshaft, camshaft bracket and camshaft carrier.
- 2) Put camshaft carrier on the cylinder head.
- 3) Put camshaft on the camshaft carrier.
- 4) Put plastigauge on the camshaft journal.
- 5) Install camshaft bracket to original position and tighten bolts to specified torque in the numerical order shown in the illustration.

Torque: A; 22 N·m (2.2 kg·m/15.9 lb ft)
B; 38 N·m (3.9 kg·m/28.2 lb ft)
C; 22 N·m (2.2 kg·m/15.9 lb ft)
D; 38 N·m (3.9 kg·m/28.2 lb ft)



110RW035



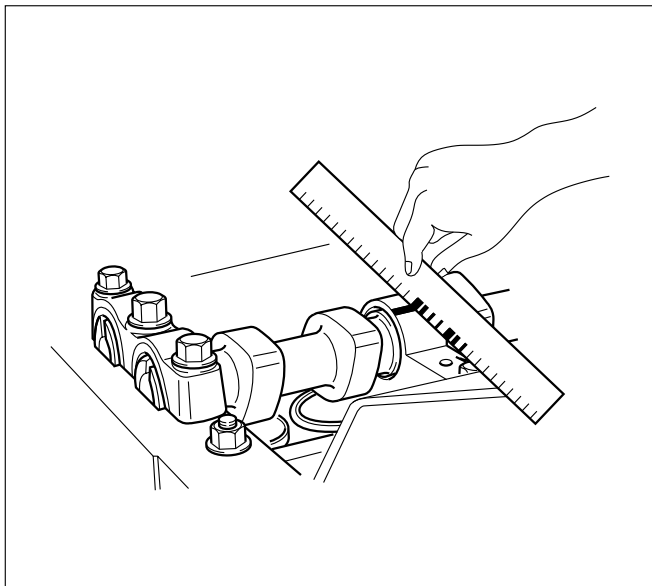
011RW041

NOTE: Do not allow the camshaft to rotate.

- 6) Remove the camshaft bracket and measure the plastigauge width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the camshaft carrier and/or camshaft.

Oil clearance.

Standard: 0.040 – 0.082 mm (0.0016 – 0.0032 in)
Limit: 0.12 mm (0.0047 in)

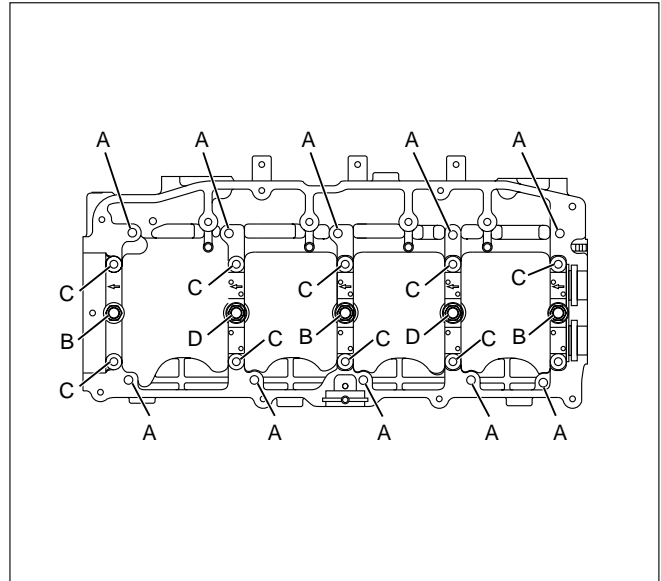


014RW185

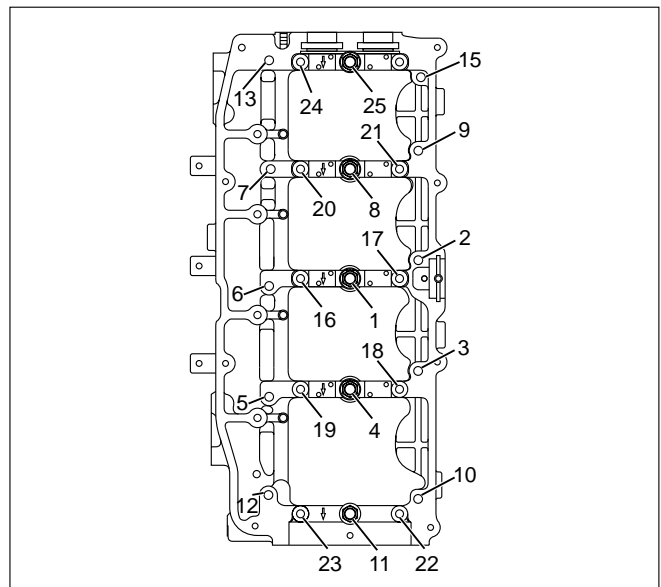
- 7) Clean the plastigauge from the camshaft bracket and camshaft carrier.
5. Camshaft thrust clearance.
 - 1) Clean the camshaft, camshaft bracket and camshaft carrier.
 - 2) Put camshaft carrier on the cylinder head.
 - 3) Put camshaft on the camshaft carrier.
 - 4) Put plastigauge on the camshaft journal.

- 5) Install camshaft bracket to original position and tighten bolts to specified torque in the numerical order shown in the illustration.

Torque: A; 22 N·m (2.2 kg·m/15.9 lb ft)
B; 38 N·m (3.9 kg·m/28.2 lb ft)
C; 22 N·m (2.2 kg·m/15.9 lb ft)
D; 38 N·m (3.9 kg·m/28.2 lb ft)



011RW035

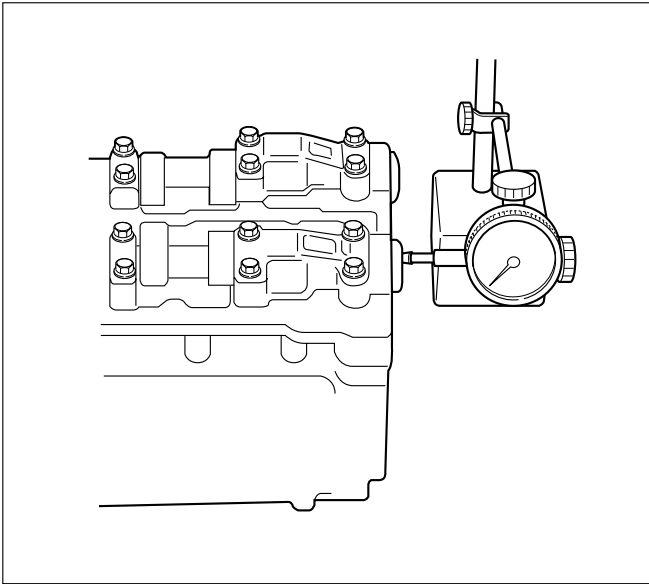


011RW041

- 6) Use a dial indicator to measure the camshaft thrust clearance. If the camshaft thrust clearance exceeds the specified limit, replace the camshaft carrier and/or camshaft.

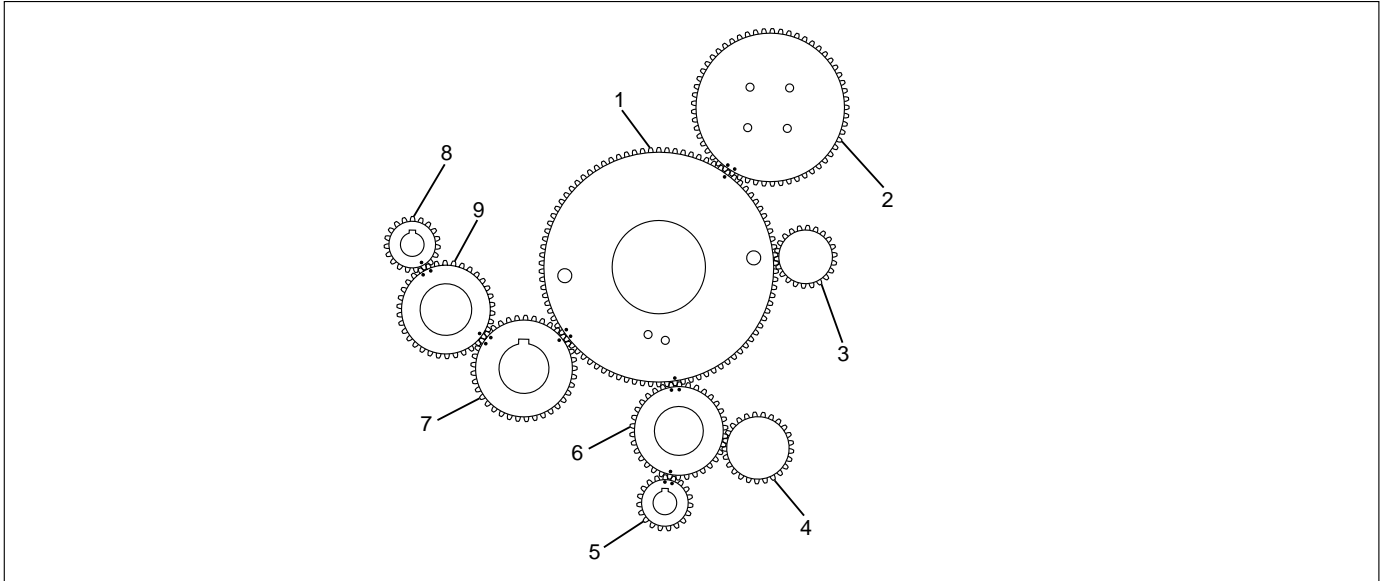
Camshaft thrust clearance

Standard: 0.1 mm (0.0002 in)
Limit: 0.2 mm (0.0078 in)



014RW001

TIMING GEAR



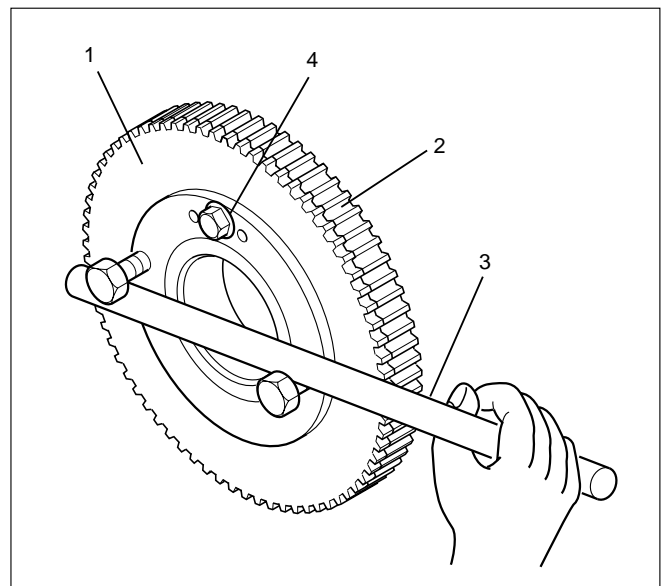
020RW028

Legend

- | | |
|---------------------------------|---------------------|
| (1) Idle Gear A | (5) Balance Gear LH |
| (2) High Pressure Oil Pump Gear | (6) Idle Gear C |
| (3) Vacuum Pump Gear | (7) Crankshaft Gear |
| (4) Power Steering Pump Gear | (8) Balance Gear RH |
| | (9) Idle Gear B |

REMOVAL

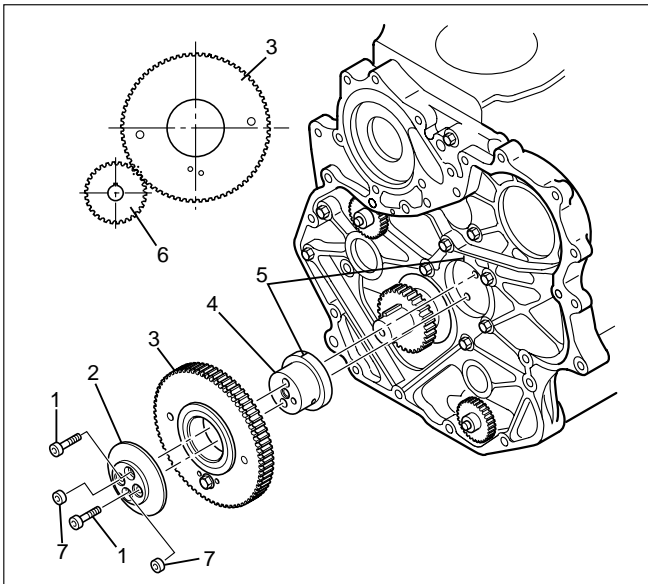
1. Loosen fixing bolt for generator and remove generator assembly.
2. Remove fixing nuts, then remove cooling fan assembly and fan pulley.
3. Remove crankshaft damper pulley.
4. Belt cover
 - 1) Disconnect harness connector of CMP (camshaft position) sensor.
 - 2) Remove CMP sensor.
 - 3) Remove belt cover.
5. Loosen belt tensioner to remove timing belt.
6. Remove camshaft pulley.
7. Remove high pressure oil pump pulley.
8. Remove front plate.
9. Remove vacuum pump.
10. Remove power steering pump.
11. Remove gear cover assembly.
12. Idle gear A.
 - 1) Set two bolts to sub gear of idle gear A and turn it to align the tooth of idle gear A then lock them by bolt as show in the illustration.
 - 2) Remove idle gear A fixing bolts.
 - 3) Remove idle gear A.



014RW177

Legend

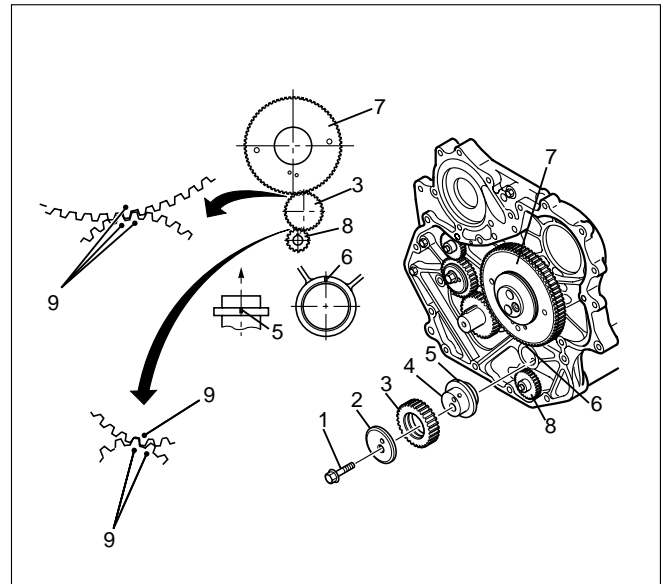
- | |
|------------------|
| (1) Sub-Gear |
| (2) Main Gear |
| (3) Bar |
| (4) Locking Bolt |



014R20007

Legend

- (1) Bolt
- (2) Retainer
- (3) Idle Gear A
- (4) Idle Gear A Shaft
- (5) Align Mark
- (6) Crankshaft Gear
- (7) O-Ring



014RW175

Legend

- (1) Bolt
- (2) Retainer
- (3) Idle Gear C
- (4) Idle Gear C Shaft
- (5) Align Mark
- (6) Align Mark
- (7) Idle Gear A
- (8) Balance Shaft Gear LH
- (9) Timing Mark

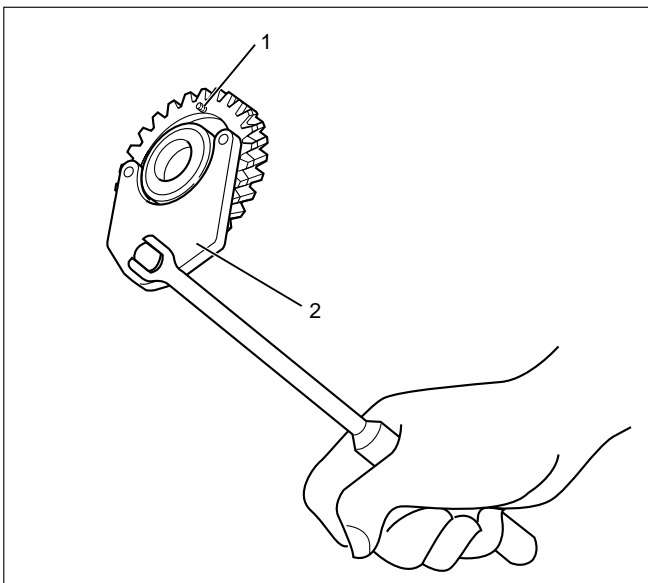
13. Idle gear C

- 1) Use the special tool on idle gear C, turning the sub gear to align the teeth, then set lock pin.
- 2) Remove idle gear C fixing bolt then remove the idle gear C with flange.

Camshaft Gear Tool : 5-8840-2591-0

14. Idle gear B

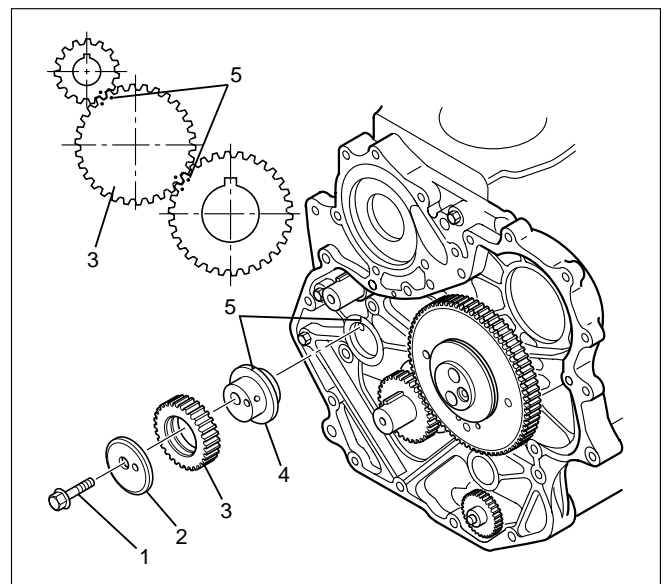
- 1) Loosen idle gear B fixing bolt to remove idle gear B with flange.



014RW181

Legend

- (1) Lock pin
- (2) Camshaft Gear Tool



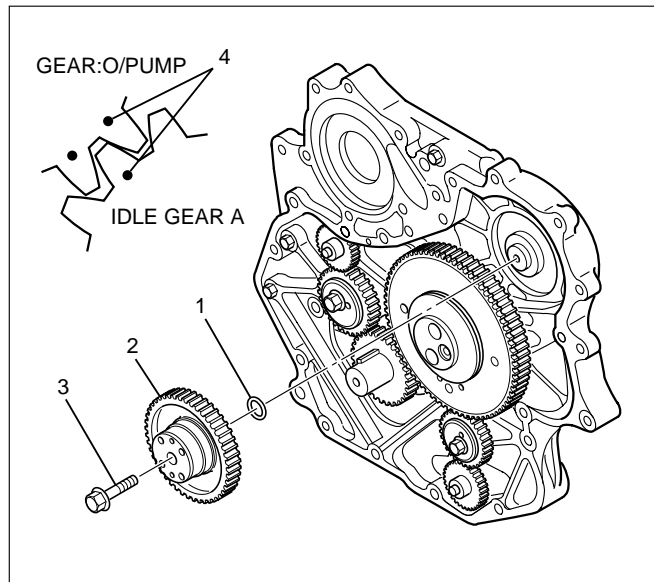
014R20008

Legend

- (1) Bolt
- (2) Retainer
- (3) Idle Gear B
- (4) Idle Gear B Shaft
- (5) Align Mark

15. High pressure oil pump

- 1) Remove oil pump gear fixing bolt then remove oil pump.



040RW005

Legend

- (1) O-Ring
- (2) High Pressure Oil Pump Gear
- (3) Bolt
- (4) Timing Mark

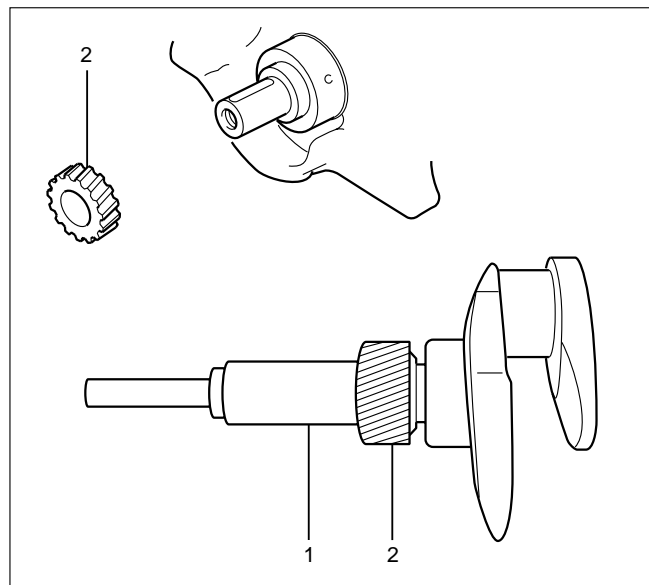
16. Remove balance shaft gear LH. and RH.

17. Remove crankshaft gear.

INSTALLATION

1. Crankshaft gear

- 1) Force key into the crankshaft and insert crankshaft gear with the crankshaft gear key groove set on the key.



012RW066

Legend

- (1) Crankshaft Gear Installer
- (2) Crankshaft Gear

2. Balance shaft gear

- 1) Install the balance shaft gear RH to balance shaft, tighten center bolt to the specified torque.

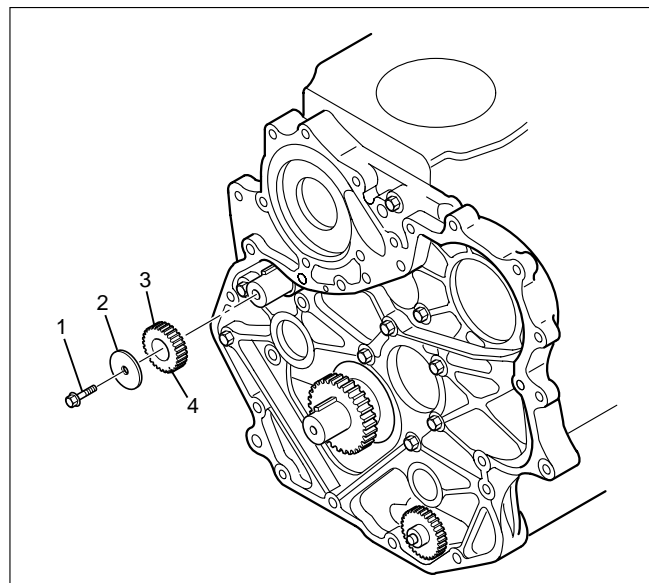
Torque : 32 N-m (3.2 kg-m/23 lb ft)

- 2) Install thrust plate for balance shaft LH before installing the balance shaft gear LH.

Torque : 25 N-m (2.5 kg-m/18 lb ft)

- 3) Install balance shaft gear LH to balance shaft, tighten center bolt to the specified torque.

Torque : 32 N-m (3.2 kg-m/23 lb ft)



014RW173

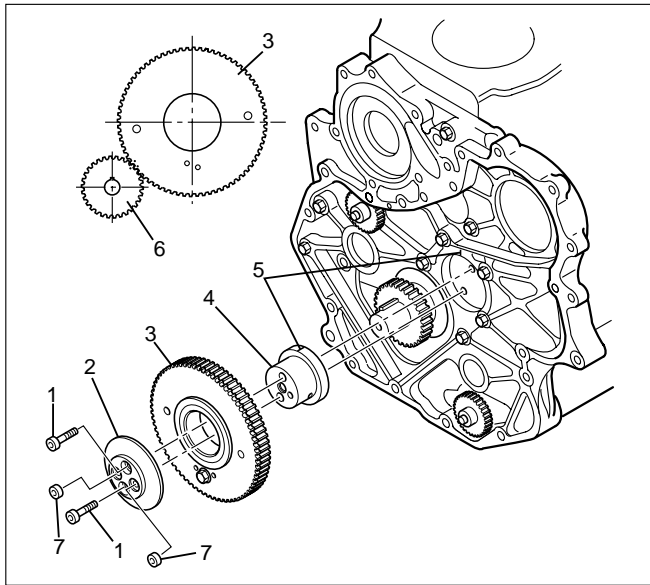
Legend

- (1) Center Bolt
- (2) Plate
- (3) Balance Shaft Gear RH
- (4) Timing Mark

3. Idle gear A

- 1) Insert idle gear A shaft to align alignment mark between idle gear A shaft and timing gear case.
- 2) Apply engine oil to the shaft surface.
- 3) Install the idle gear A to align the timing mark with the crankshaft gear.
- 4) Install the flange, tighten bolts to the specified torque.

Torque: 25 N-m (2.5 kg-m/18 lb ft)



014R200007

Legend

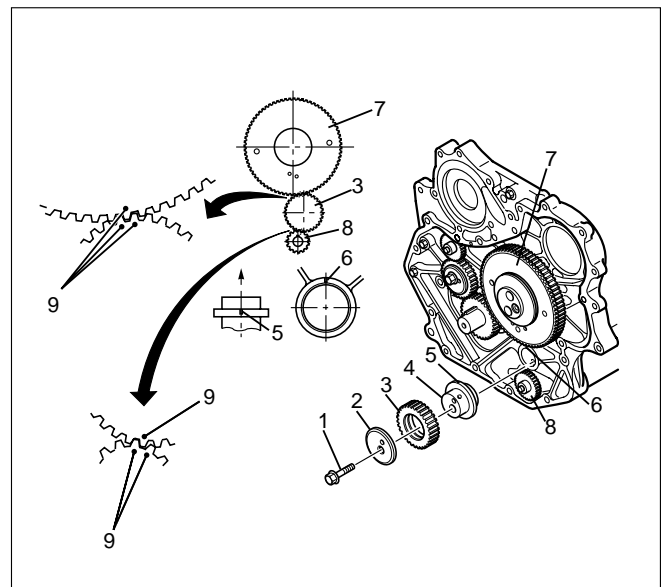
- (1) Bolt
- (2) Retainer
- (3) Idle Gear A
- (4) Idle Gear A Shaft
- (5) Align Mark
- (6) Crankshaft Gear
- (7) O-Ring

NOTE: Conform not difference timing marks between each others.

4. Idle gear C

- 1) Insert idle gear C shaft to align alignment mark between idle gear C shaft and timing gear case.
- 2) Apply engine oil to the shaft surface.
- 3) Align timing mark on idle gear C with balance shaft gear LH and idle gear A timing marks, then insert idle gear C.
- 4) Set position of idle gear C flange with a dowel pin, tighten bolt to the specified torque.

Torque: 25 N-m (2.5 kg-m/18 lb ft)



014RW175

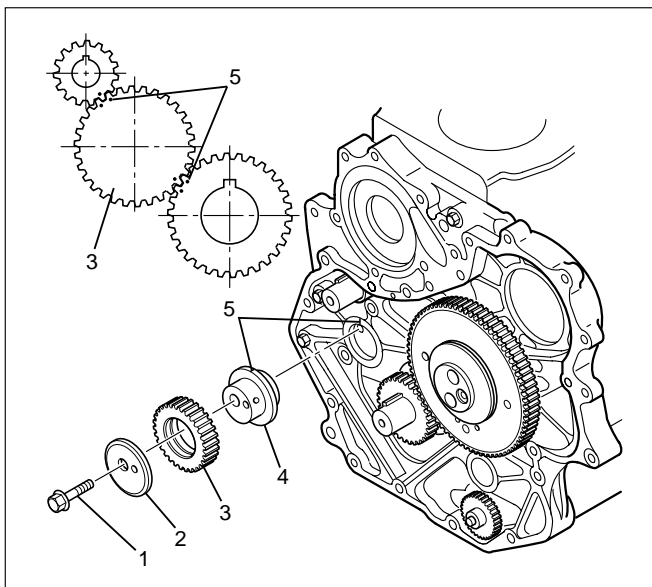
Legend

- (1) Bolt
- (2) Retainer
- (3) Idle Gear C
- (4) Idle Gear C Shaft
- (5) Align Mark
- (6) Align Mark
- (7) Idle Gear A
- (8) Balance Shaft Gear LH
- (9) Timing Mark

5. Idle gear B

- 1) Insert idle gear B shaft to align alignment mark between idle gear B shaft and timing gear case.
- 2) Apply engine oil to the shaft surface.
- 3) Align timing mark on idle gear B with balance shaft gear RH and crankshaft gear timing marks, then insert idle gear B.
- 4) Install flange and tighten the bolt to the specified torque.

Torque: 51 N-m (5.2 kg-m/38 lb ft)



Legend

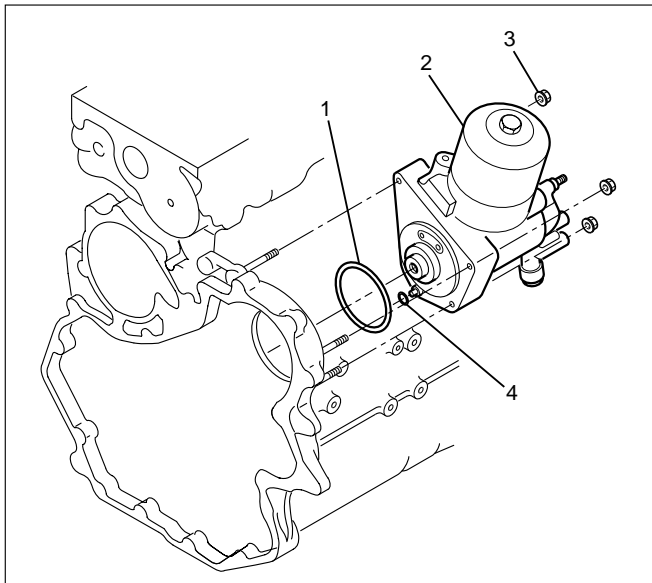
- (1) Bolt
- (2) Retainer
- (3) Idle Gear B
- (4) Idle Gear B Shaft
- (5) Align Mark

6. High pressure oil pump

- 1) Install O-ring on the high pressure oil pump.
- 2) Install the high pressure oil pump to the timing gear case, tighten the nut to the specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

NOTE: Be sure to set O-ring completely.



Legend

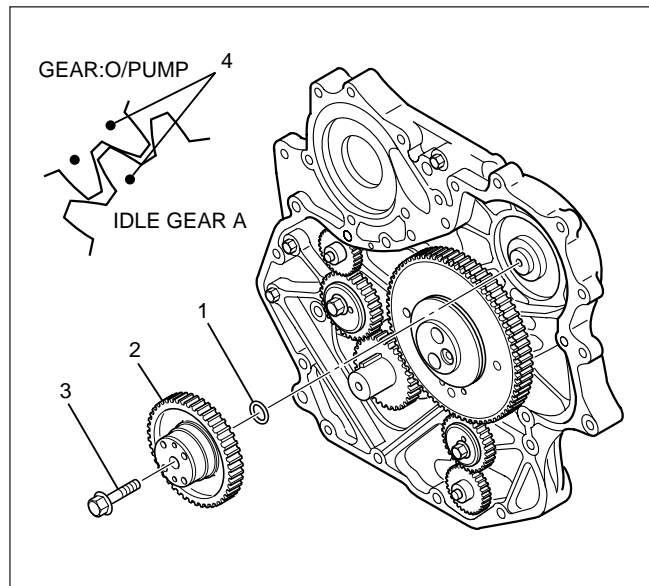
- (1) O-ring (large)
- (2) High pressure oil pump
- (3) Nut
- (4) O-ring (small)

7. High pressure oil pump

- 1) Install O-ring on the oil pump shaft with grease and install the gear with the idle gear A timing mark set at the oil pump gear timing mark.
- 2) Tighten center bolt to the specified torque.

Torque: 75 N-m (7.6 kg-m / 55 lb ft)

NOTE: Be sure to align timing marks with each other.



Legend

- (1) O-ring
- (2) High Pressure Oil Pump Gear
- (3) Center Bolt
- (4) Timing Mark

8. Remove lock from idle gear.

- 1) Remove lock bolt from idle gear A and remove lock pin from idle gear C.

9. Timing gear case assembly

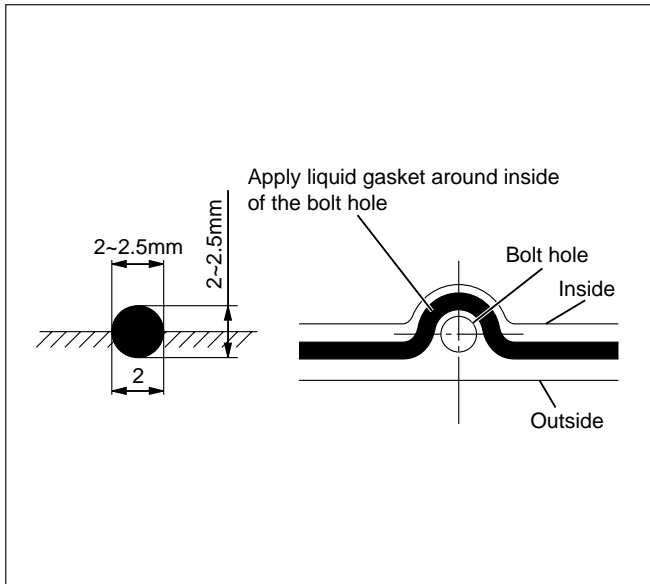
- 1) Clean fixing surface of timing gear case.
- 2) Install the gasket on the idle gear rear side end.
- 3) Apply liquid gasket to the timing gear case fitting surface.

NOTE: Be sure to apply liquid gasket evenly.

- 4) Install timing gear case and tighten bolts to the specified torque.

Torque: 20 N-m (2.0 kg-m / 14.5 lb ft)

NOTE: Must install within 5 minutes after applying liquid gasket.



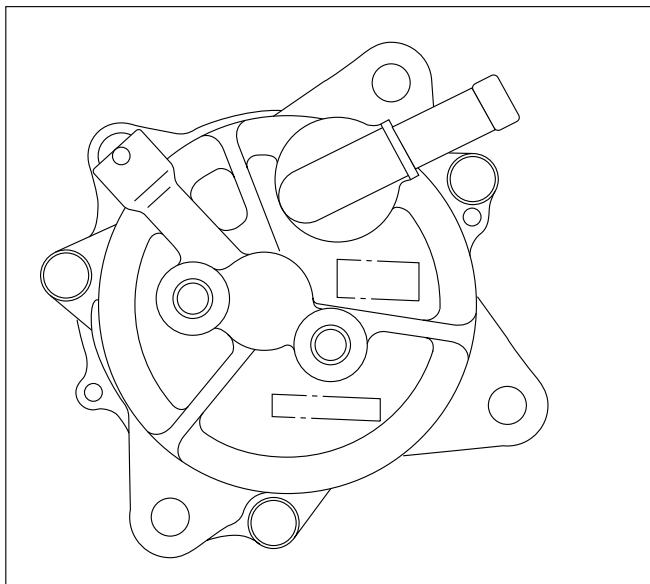
F06HX00001

10. Vacuum pump

- 1) Install vacuum pump and tighten bolts to specified torque.

Torque: 25 N-m (2.5 kg-m / 18 lb ft)

- 2) Install noise insulator cover.

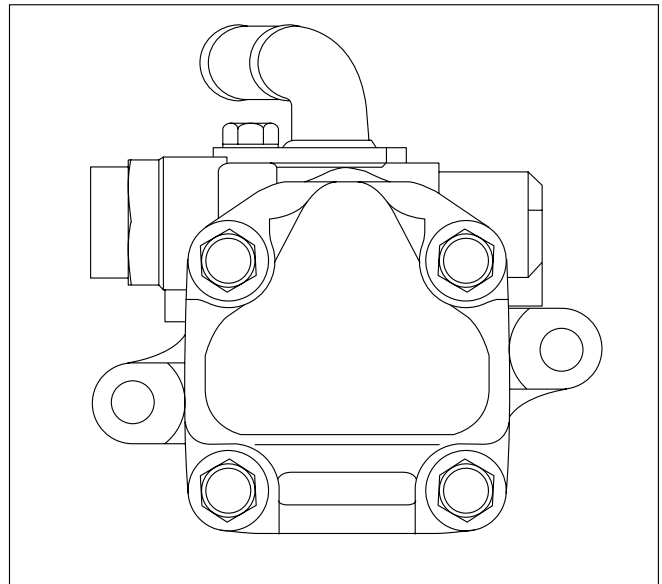


052RW001

11. Power steering pump (P/S)

- 1) Install P/S pump.

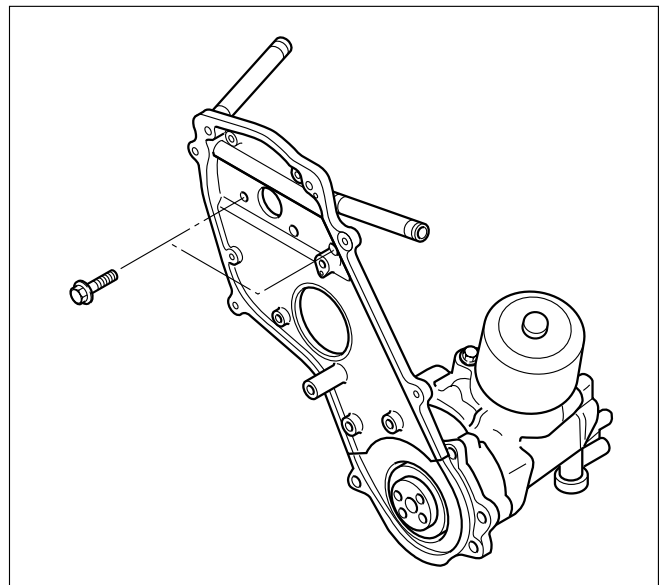
Torque: 25 N-m (2.5 kg-m / 18 lb ft)



430RW017

12. Install front plate.

Torque: 20 N-m (2.0 kg-m / 14.5 lb ft)

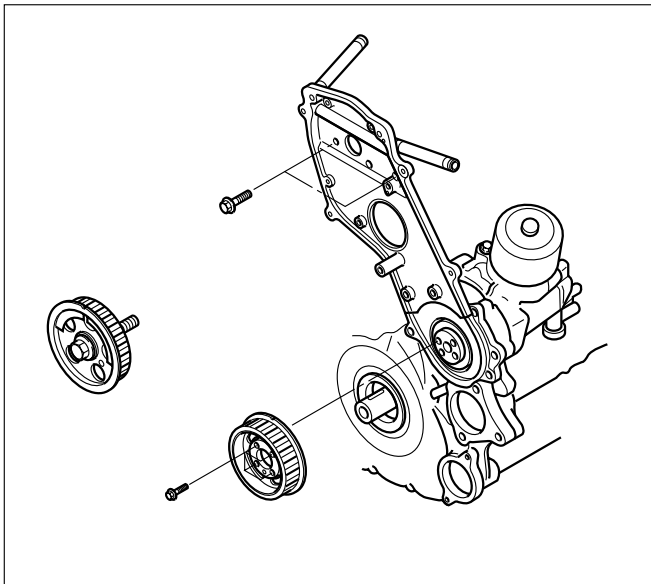


012RW035

13. High pressure oil pump pulley.

- 1) Install oil pump pulley and tighten to specified torque.

Torque: 10 N-m (1.0 kg-m / 7.2 lb ft)

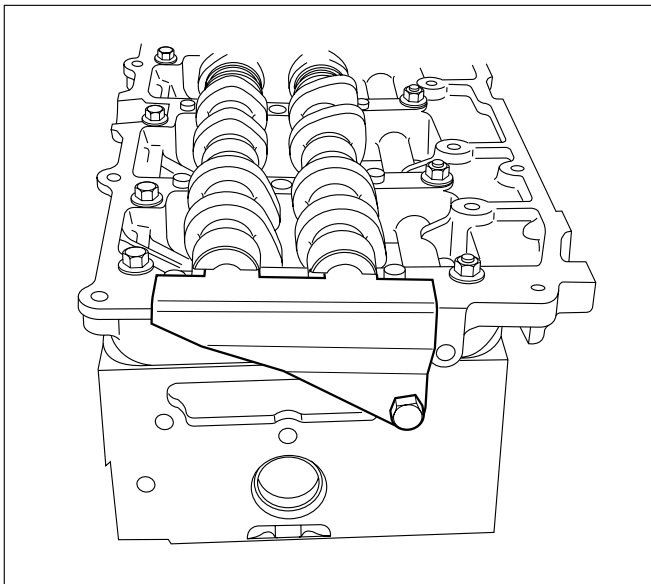


012RW036

14. Camshaft pulley

- 1) Align TDC mark with crankshaft pulley and gear case cover.
- 2) Set camshaft stopper on the end of intake and exhaust camshaft.

Camshaft Stopper: 5-8840-2592-0



012RW099

- 3) Install key to camshaft and install camshaft pulley.
- 4) Apply engine oil to camshaft pulley fixing bolt and tighten bolt with angular tightening method.

First step: 40 N·m (4.0 kg·m / 29 lb ft)

Second step: 60° to 90°

15. Timing belt

- 1) Install tensioner and tighten the bolt temporarily.
- 2) Align timing mark with camshaft pulley timing mark and timing gear case timing mark.
- 3) Set No.1 cylinder TDC position.

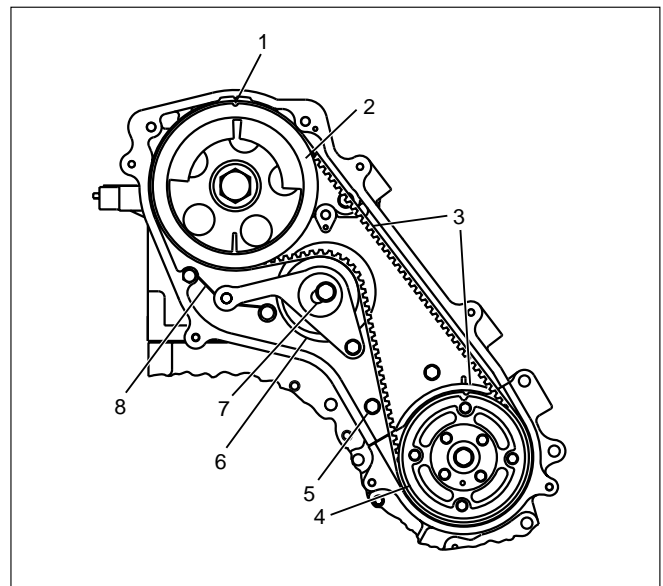
- 4) Install the timing belt in the following order camshaft pulley, oil pump pulley, tensioner.

NOTE:

- 1) It is recommended for easy installation that the belt be secured with a double clip after it is installed to each pulley.
- 2) The "ISUZU" mark should be read from the front of the engine when installing the timing belt.
- 5) Install the belt tensioner.
- 6) Conform not phase difference each pulley.
- 7) Tension the timing belt with two turns of the crankshaft.
- 8) Tighten the tensioner bolt in order A to B to the specified torque.

Torque: Bolt A 5 N·m (0.5 kg·m/3.6 lb ft)

Bolt B 2 N·m (0.2 kg·m/1.4 lb ft)



F06RW055

Legend

- (1) Align Mark
- (2) Camshaft Pulley
- (3) Timing Belt
- (4) Oil Pump Pulley
- (5) Bolt B
- (6) Tensioner Assy
- (7) Tensioner Bolt A
- (8) Tensioner Spring

16. CMP sensor bracket

- 1) Install CMP sensor bracket and tighten bolt to the specified torque.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

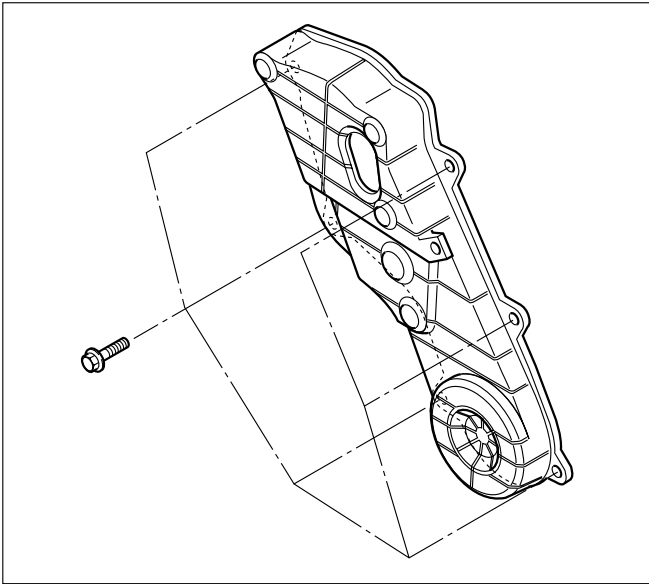
17. Timing belt cover

- 1) Install timing belt cover and tighten bolt to the specified torque.

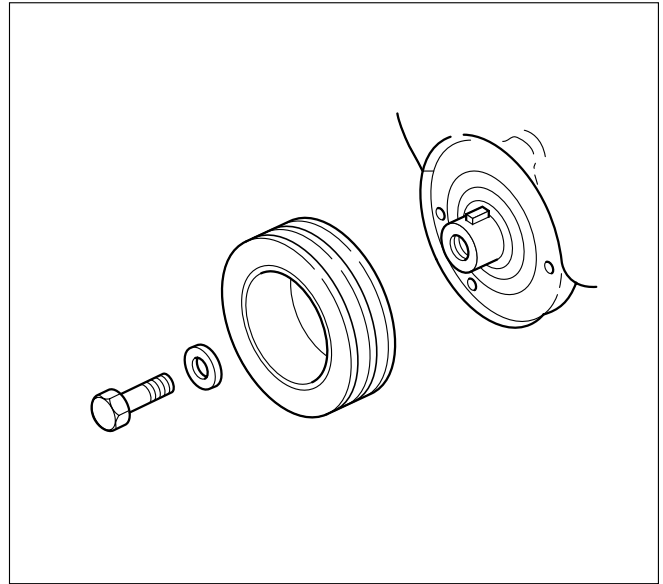
Torque: 9 N·m (0.9 kg·m / 6.5 lb ft)

- 2) Tighten CMP sensor to the specified torque.

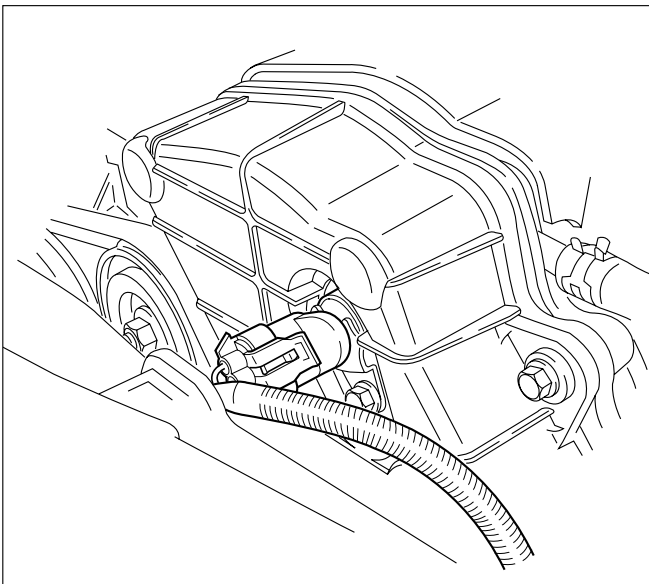
Torque: 9 N·m (0.9 kg·m / 6.5 lb ft)



012RW039



012RW032



014RW163

18. Crankshaft damper pulley

- 1) Insert damper pulley with the crankshaft key groove set on the key.
- 2) Tighten damper pulley bolt to the specified torque.

Torque: 220 N·m (22 kg·m / 159 lb ft)

19. Cooling fan Assembly

- 1) Install the cooling fan assembly to the fan pulley, tighten the nuts to the specified torque.

Torque: 8 N·m (0.8 kg·m / 5.8 lb ft)

20. AC generator drive belt.

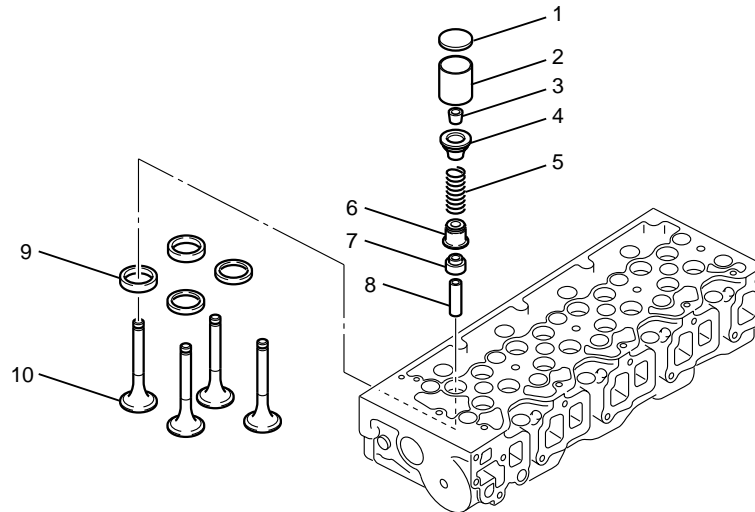
- 1) Temporarily tighten generator fixing bolts and belt tensioner adjustment plate.
- 2) Tension the generator drive belt then tighten the generator fixing bolt.

Torque: 40 N·m (4.0 kg·m / 29 lb ft)

- 3) Tighten the belt tensioner adjustment plate bolt.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

VALVE STEM SEAL, VALVE SPRING AND ADJUSTER



011RW031

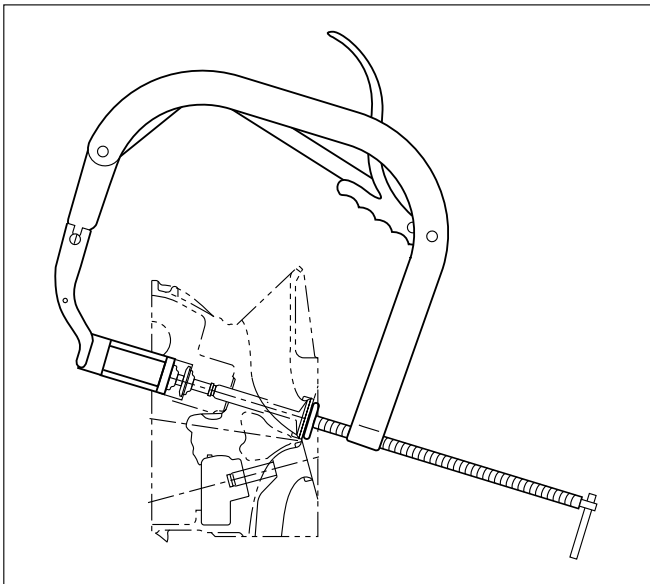
Legend

- | | |
|-----------------------|-----------------------|
| (1) Adjuster | (6) Spring Seat Lower |
| (2) Tappet | (7) Valve Stem Seal |
| (3) Split Collar | (8) Valve Guide |
| (4) Spring Seat Upper | (9) Valve Seat |
| (5) Valve Spring | (10) Valve |

REMOVAL

1. Disconnect battery ground cable.
 2. Drain engine coolant.
 3. Remove the air duct from between air cleaner and turbocharger.
 4. Remove intercooler assembly.
Refer to "Intercooler" in this manual.
 5. Remove oil level gauge guide assembly.
 6. Disconnect PCV hose.
 7. Disconnect EGR vacuum hose.
 8. Disconnect harness connectors around the cylinder head such as the injector, CMP sensor, MAP sensor, EGR sensor, EVRV, IAT sensor, A/C compressor, TP stepping motor, TP sensor and fuel temperature sensor etc.
 9. Remove A/C compressor assembly.
 10. Remove A/C compressor bracket.
 11. Remove generator assembly and take out drive belt.
 12. Remove heat protector, remove exhaust valve assembly.
 13. Remove water cooling hose and lubrication pipe for turbocharger.
 14. Remove turbocharger assembly.
 15. Remove hose between thermostat and radiator.
 16. Remove noise insulator cover of cylinder head.
- NOTE: Do not damage injector harness.
17. Remove high pressure oil pipe.
 18. Remove timing belt cover.
 19. Remove CMP sensor bracket.
 20. Remove timing belt tensioner then remove timing belt.
 21. Remove camshaft pulley.
 22. Remove front plate.
 23. Remove engine coolant pipe between cylinder head and water pump.

24. Remove fuel pipe between fuel pump and intake manifold.
25. Remove fuel return pipe from rear of cylinder head.
26. Remove intake manifold assembly.
27. Disconnect glow plug harness and remove glow plug.
28. Remove cylinder head cover.
29. Remove injector harness connector.
30. Disconnect harness connector from oil pressure sensor and oil temperature sensor on the oil rail.
31. Remove injector harness assembly.
32. Remove injector clamp.
33. Remove injector is fixed bolts.
34. Remove injector assembly.
35. Remove oil rail.
36. Remove camshaft carrier assembly with camshaft.
37. Remove cylinder head assembly.
38. Disassemble valve spring according to the following method.
 - 1) Use valve spring compressor then remove split collars.
 - 2) Valve spring compressor: 5-8840-2441-0



014rw042

NOTE: Put removed valve spring in order of cylinder number.

39. Valve stem seal.
 - 1) Use a screwdriver or pliers to remove valve stem seal.

NOTE: Do not reuse removed valve stem seal.

INSPECTION AND REPAIR

Make the necessary adjustments, repairs and part replacements if excessive wear or damage is discovered during inspection.

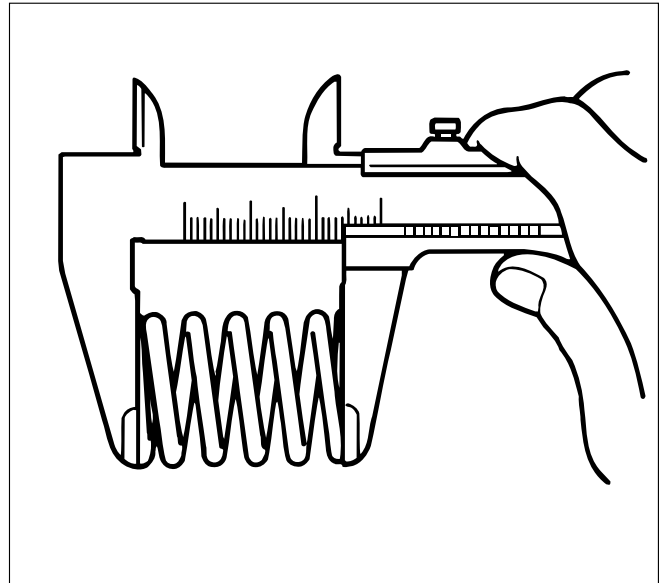
Valve spring

CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

1. Free height
 - 1) Measure the free height of the springs. The springs must be replaced if the height is below the specified limit.

Standard: 45.85 mm (1.8051in)

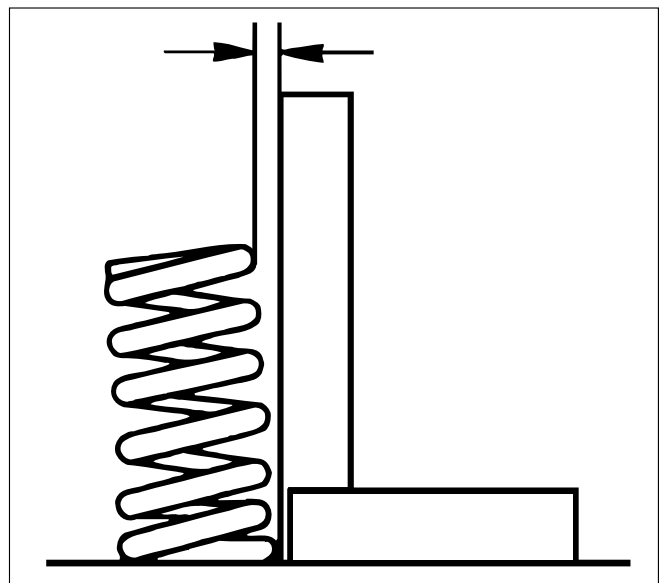
Limit: 43.9 mm (1.7283 in)



014rs004

2. Squareness
 - 1) Measure the valve spring squareness with a steel square.
 - 2) Replace the valve springs if the measured value exceeds the specified limit.

Limit: 1.6 mm (0.063 in)

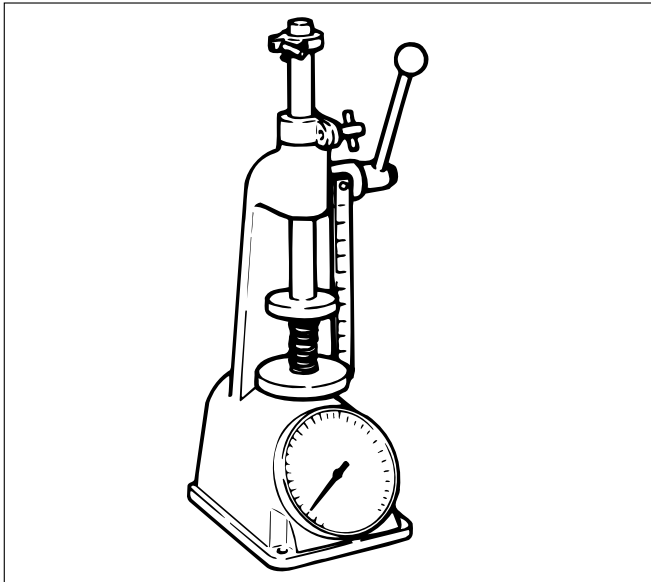


014rs005

3. Spring tension

- 1) Use a spring tester to compress the springs to the installed height. Measure the compressed spring tension.
- 2) Replace the springs if the measured tension is below the specified limit.

Standard: 236.0 N (24 kg/53 lb)
Limit: 205.0 N (21 kg/46 lb)



014RS006

Valve Guide

CAUTION: Taking care not to damage the valve seat contact surface, when removing carbon adhering to the valve head.

Carefully inspect the valve stem for scratching or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

1. Valve Guide Clearance

- 1) Measure the valve stem diameter with a micrometer.

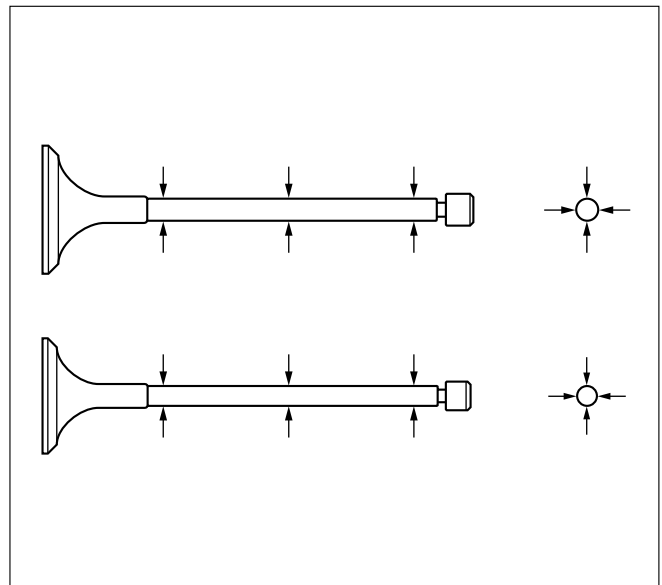
If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

Diameter of Valve stem:Inlet

Standard: 6.959 – 6.977 mm (0.2740 – 0.2747 in)
Limit: 6.92 mm (0.2724 in)

Diameter of Valve stem:Exhaust

Standard: 6.952 – 6.97 mm (0.2737 – 0.2744 in)
Limit: 6.90 mm (0.2717 in)



014RS007

- 2) Measure the inside diameter of the valve guide with a micrometer.
- 3) Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide.

If the valve exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Inlet clearance

Standard: 0.023 – 0.053 mm (0.0009 – 0.0021 in)
Limit: 0.19 mm (0.0075 in)

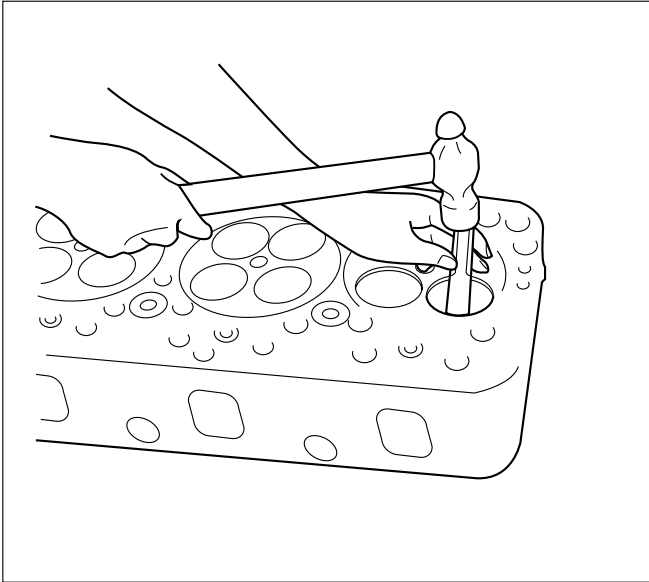
Exhaust clearance

Standard: 0.03 – 0.063 mm (0.0012 – 0.0025 in)
Limit: 0.20 mm (0.0079 in)

Valve Guide Replacement

- Using the special tool, drive out the valve guide from the combustion chamber side.

Valve guide replacer: 9-8523-1212-0

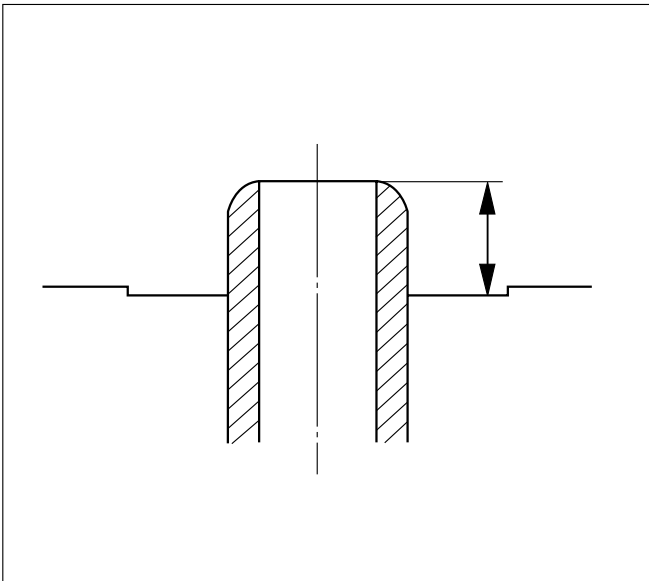


011RW001

- Apply engine oil to the outside of the valve guide. Using the special tool, drive in a new valve guide from cylinder head upper face side, and check the valve guide height.

Valve guide replacer: 9-8523-1212-0

Height: 8.0 mm (0.315 in)



012RW052

NOTE: If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

Valve Thickness

- Measure the valve thickness.
- If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

Inlet

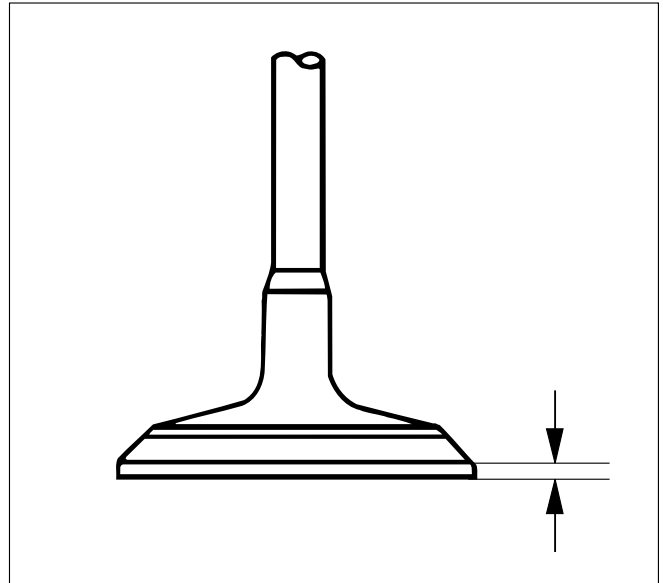
Standard: 1.2 mm (0.0472 in)

Limit: 1.1 mm (0.0433 in)

Exhaust

Standard: 1.2 mm (0.0472 in)

Limit: 1.1 mm (0.0433 in)

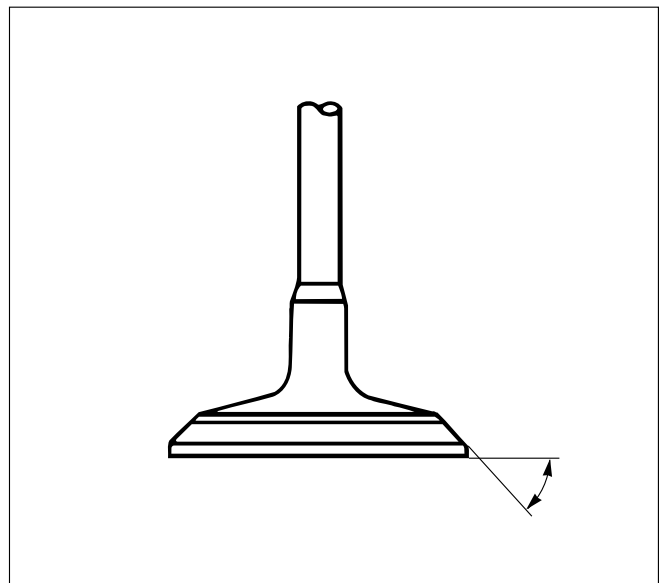


012RW060

Contact surface angle on valve seat on valve

- Measure contact surface angle on valve seat.
- If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Standard: 68°



014RW018

Valve Depression

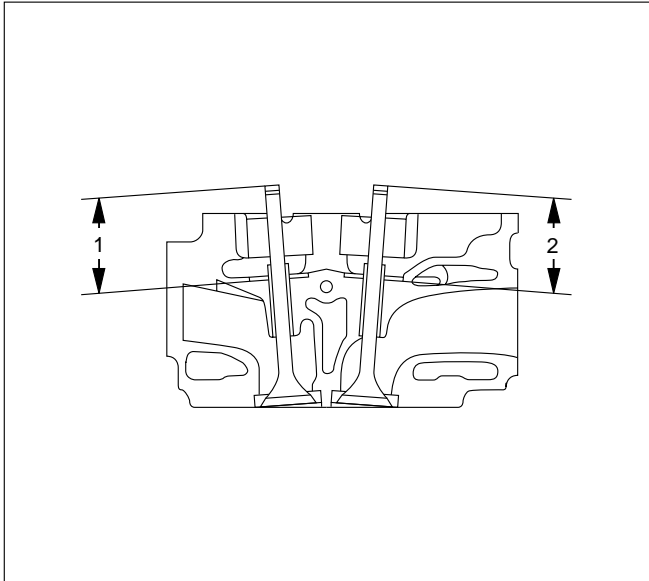
1. Measure the valve stem height from the upper surface of the cylinder head as shown in the illustration.

Standard:

Intake side 35.59 mm (1.4012 in)
Exhaust side 35.49 mm (1.3972 in)

Limit:

Intake side 35.74 mm (1.4071 in)
Exhaust side 35.64 mm (1.4031 in)



011RW044

Legend

- (1) Intake Side
- (2) Exhaust Side

Valve Contact Width

1. Check the valve contact faces for roughness and unevenness. Make the valve contact surfaces smooth.
2. Measure the valve contact width.
If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Inlet

Standard: 2.1 mm (0.0827 in)

Limit: 2.6 mm (0.1024 in)

Exhaust

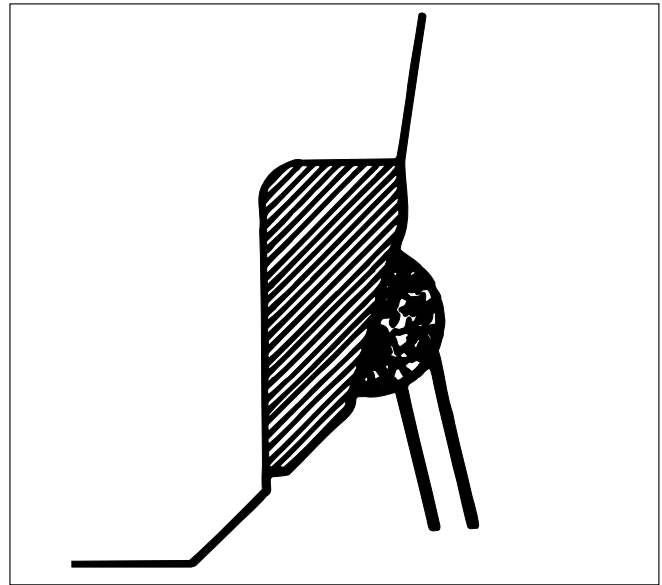
Standard: 2.0 mm (0.0787 in)

Limit: 2.5 mm (0.0984 in)

Valve Seat Insert Replacement

Valve Seat Insert Removal

1. Arc weld the entire inside circumference of the valve seat insert.

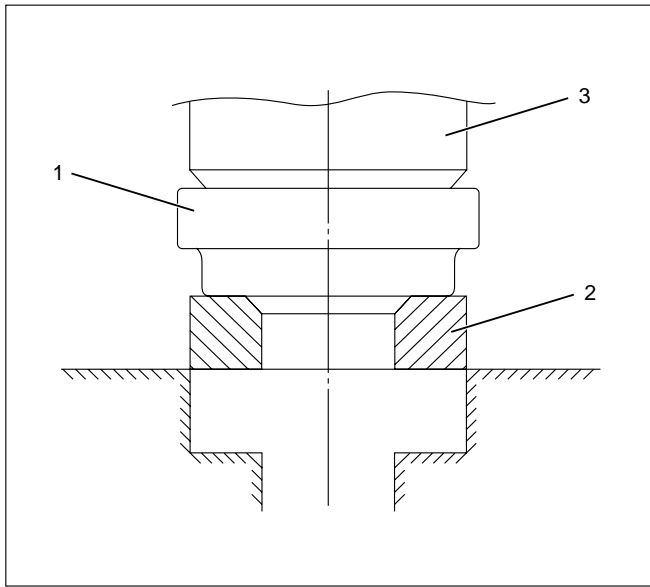


014RS015

2. Allow the valve seat insert to cool for a few minutes. This will invite contraction and make removal of the valve seat insert easier.
3. Use a screwdriver to pry the valve seat insert free. Take care not to damage the cylinder head.
4. Carefully remove carbon and other foreign material from the cylinder head insert bore.

Valve Seat Insert Installation

1. Carefully place the attachment (1) (having a smaller outside diameter than the valve seat insert) on the valve seat insert (2).



012RW055

Legend

- (1) Attachment
- (2) Valve Seat Insert
- (3) Bench Press

NOTE: The smooth side of the attachment must contact the valve seat insert.

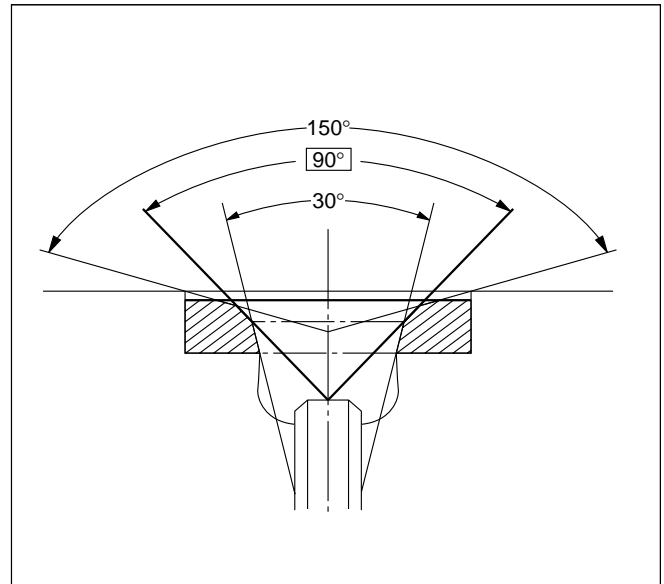
2. Use a bench press (3) to gradually apply pressure to the attachment and press the valve seat insert into place.

Note: Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.

Valve Seat Insert Correction

1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter (15°, 45° and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

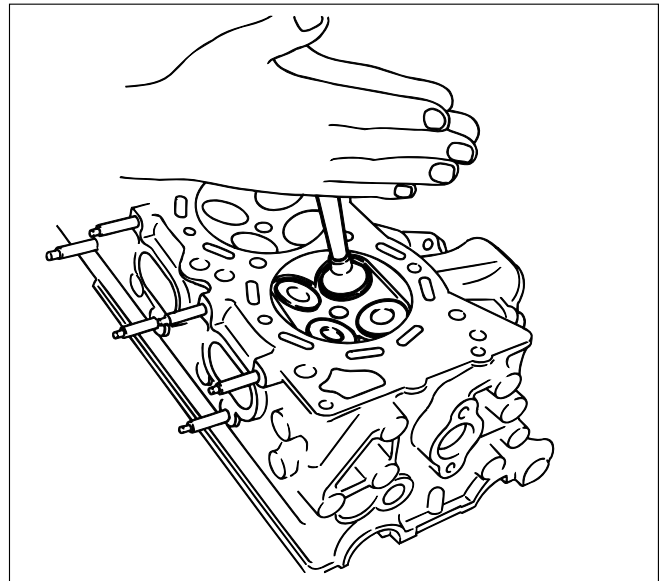
Valve Seat Angle: 45°



012RW056

NOTE: Use an adjustable valve cutter pilot. Do not allow the valve cutter pilot to wobble inside the valve guide.

3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while tapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



014RS014

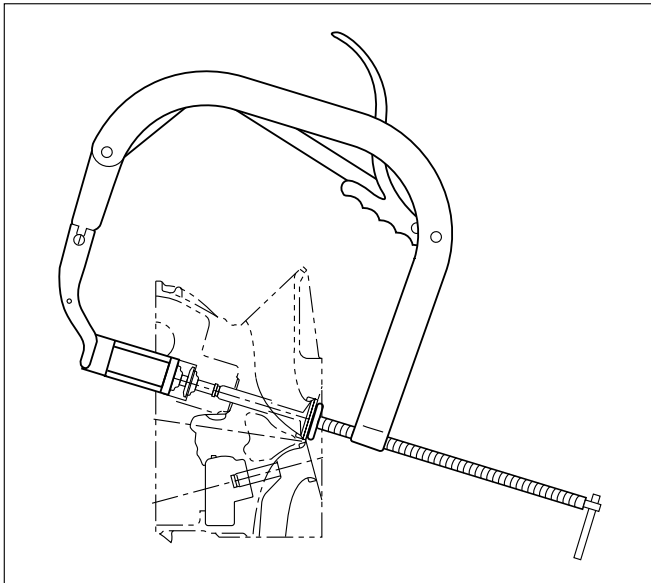
INSTALLATION

1. Valve stem seal
 - 1) Use the special tool to install the stem seal to the valve guide.

Stem Seal Installer: 5-8840-2033-0
2. Valve spring.
 - 1) Install the lower valve seat spring, valve spring, then the upper valve spring seat.
 - 2) Use valve spring compressor to compress the spring then install the split collar.

Valve spring compressor: 5-8840-2441-0

NOTE: Make sure the split collar installs completely.



014RW042

3. Install cylinder head assembly.
Refer to "Cylinder Head" in this manual.
4. Install the camshaft carrier with camshaft.
Refer to "Camshaft" in this manual.
5. Install oil rail assembly.
Refer to "Oil rail and injector" in this manual.
6. Install injector assembly.
Refer to "Oil rail and injector" in this manual.
7. Install the injector harness assembly.
Refer to "Injector" in this manual.
8. Reconnect harness connector to oil pressure sensor and oil temperature sensor on the oil rail.
9. Reconnect Injector harness connector to injector.
Refer to "Injector" in this manual.
10. Install cylinder head cover with gasket.
Refer to "Cylinder Head Cover" in this manual.
11. Install glow plug with specified torque.
Torque: 15 N-m (1.5 kg-m / 10.8 lb ft)
12. Install the intake manifold assembly.
Refer to "Intake Manifold" in this manual.
13. Install the fuel pipe.

14. Install the water pipe between the cylinder head and water pump.

Torque: 20 N-m (2.0 k-m / 14.5 lb ft)

15. Install the front plate.
16. Install the camshaft pulley.
Refer to "Timing Gear" in this manual.
17. Install timing belt and set the tensioner.
Refer to "Timing Belt" in this manual.
18. Install CMP sensor bracket.

Torque: 20 N-m (2.0 kg-m / 14.5 lb ft)

19. Install timing belt cover.

Torque: 9 N-m (0.9 kg-m / 6.5 lb ft)

20. Fill the oil rail with engine oil then immediately install the high pressure oil pipe with the specified torque.

Torque: 80 N-m (8.1 kg-m / 57.9 lb ft)

21. Install the noise insulator cover.
22. Reconnect hose between thermostat and radiator.
23. Install turbocharger assembly.
Refer to "Turbocharger" in this manual.
24. Install water hose and oil pipe for turbocharger.
Refer to "Turbocharger" in this manual.
25. Install the valve assembly and install heat protector.
26. Install generator and set the fan belts.
27. Install A/C compressor bracket, compressor assembly and set drive belt.
28. Reconnect harness connector around cylinder head.
29. Reconnect vacuum hose to EGR valve.
30. Reconnect PCV hose.
31. Install oil level gauge guide assembly.
32. Install intercooler assembly.
Refer to "Intercooler" in this manual.
33. Install the air duct assembly.
34. Fill engine coolant.
35. Connect battery ground cable.

VALVE CLEARANCE ADJUSTMENT

NOTE:

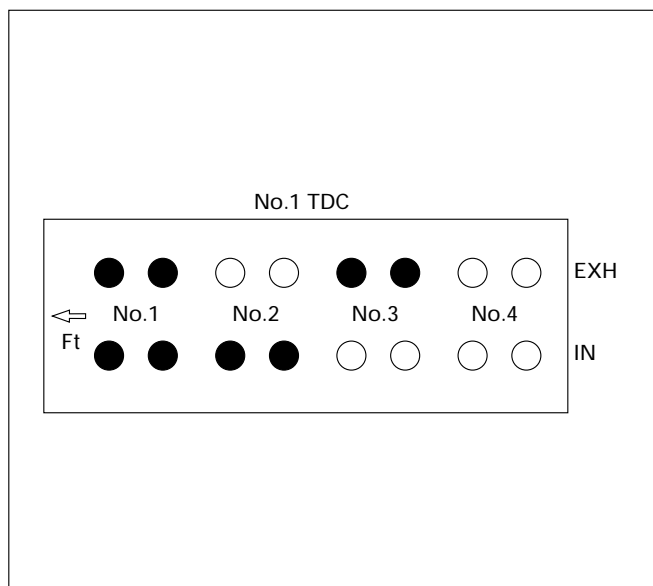
1. Valve clearance should be inspected and adjusted while the engine is cool.
2. The tightening of the camshaft bearing cap and camshaft carrier assembly should be checked before inspecting and adjusting valve clearance.

INSPECTION

1. Remove cylinder head noise insulator cover and cylinder head cover.
Refer to "Cylinder Head" in this manual.
2. Disconnect all harness connectors of the injector and remove harness assembly.
3. Drain oil from oil rail assembly.
4. Remove injector clamp nuts and fixing bolts to take out injector assembly.
5. Loosen oil rail bolts, remove oil rail assembly.
6. Set cylinder No.1 to the TDC at the compression stroke. Make sure that there is play in cylinder No.1 tappets on inlet and exhaust sides and that there is no play in cylinder No.4 tappets.
7. Measure valve clearance at No.1 TDC (Refer to the black circles indicated in the illustration).

Standard Valve clearance:

Intake valve: 0.15 mm (0.0059 in) ± 0.05 mm (0.0020 in)
Exhaust valve: 0.25 mm (0.0098 in) ± 0.05 mm (0.0020 in)

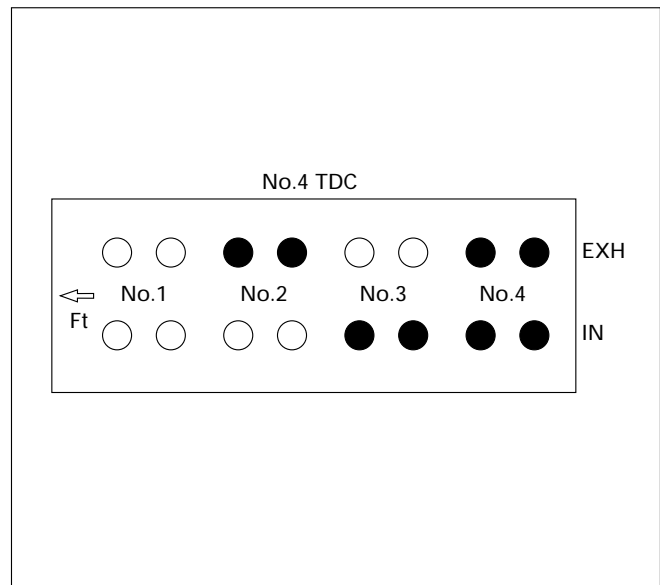


011RW045

8. Turn the crankshaft one turn to set No.4 cylinder TDC at the compression stroke.
9. Measure valve clearance at No.4 TDC (Refer to the black circles indicated in the illustration).

Standard Valve clearance:

Intake valve: 0.15 mm (0.0059 in) ± 0.05 mm (0.0020 in)
Exhaust valve: 0.25 mm (0.0098 in) ± 0.05 mm (0.0020 in)



011RW046

10. If measured value is outside standard value, readjust the valve clearance.

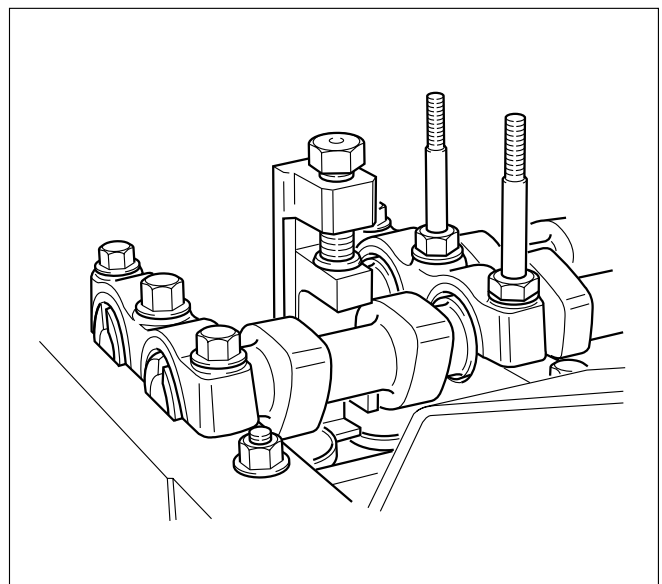
ADJUSTMENT

For valve clearance adjustment, follow the procedure given below.

1. Set cylinder No.1 or No.4 to the TDC at the compression stroke.
Set the valve clearance adjusting tool on the tappet requiring adjustment.
After making sure of the correct setting of the special tool, depress the tappet by turning the bolt.
Valve Clearance Adjusting Tool: 5-8840-2590-0

NOTE: Before depressing the tappet, set the tappet notch in the direction where adjuster can be easily taken out.

2. Take out the adjuster using a small screw driver and finger magnet.



014RW150

3. Determine the thickness of the adjuster as follows.
 - 1) Measure the thickness of the removed adjuster with a micrometer.
 - 2) Calculate the thickness of a new adjuster.

Calculation

TA: Thickness of new adjuster

M: Valve clearance measurement.

TO: Thickness of the removed adjuster

For intake side: $TA=TO+(M-0.15)$ mm

For exhaust side: $TA=TO+(M-0.25)$ mm

Select a new adjuster whose thickness is as close to the estimated value as possible.

4. Install oil rail and tighten it temporarily.
5. Install injector assembly.

NOTE:

- 1) Do not forget to insert the O-ring between injector and oil rail.
- 2) Install the injector to the same position as before removal.
6. Install the injector fixing bolts and temporarily tighten.
7. Install the injector clamp and tighten temporarily.
8. Tighten injector fixing bolts to the specified torque.

Torque: 6.5 N·m (0.7 kg·m / 5.1 lb ft)

9. Tighten injector clamp nut to the specified torque with special method.

Torque: loosen one turn and tighten again to specified torque.

Torque: 25 N·m (2.4 kg·m / 17.4 lb ft)

10. Tighten oil rail to the specified torque.

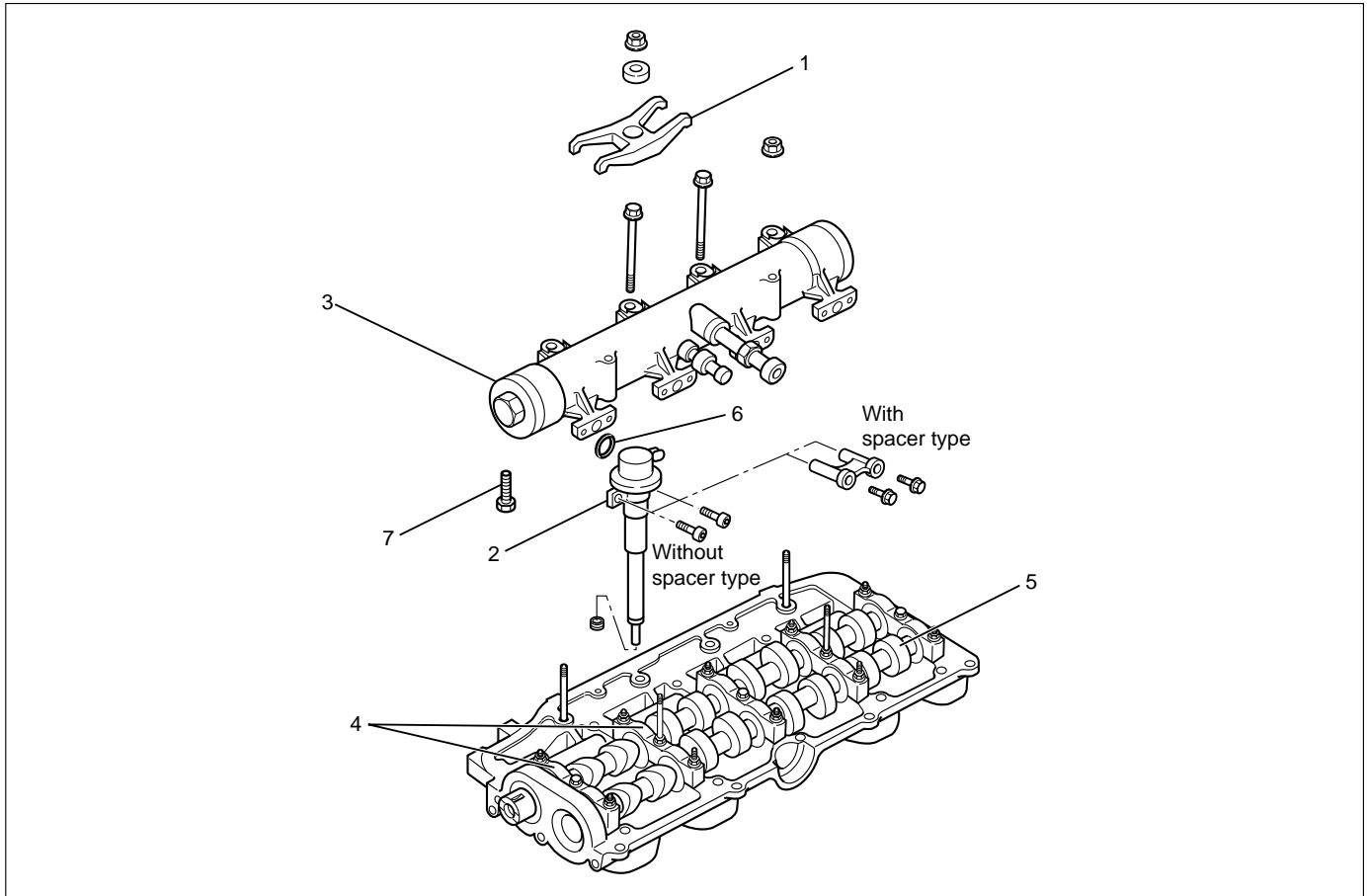
Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

11. Install injector harness and reconnect connector.
12. Install cylinder head cover.
Refer to "Cylinder Head" in this manual.
13. Fill with about 300cc of engine oil at the high pressure oil pipe installation port on the oil rail using an oil filler.
If assembled without filling the oil rail with oil, the time for engine starting will be longer.
14. Immediately install high pressure oil pipe to tighten with specified torque.

Torque: 80 N·m (8.1 kg·m / 57.9 lb ft)

15. Install cylinder head noise insulator cover.
Refer to "Cylinder Head" in this manual.

OIL RAIL AND INJECTOR



012R200005

Legend

- (1) Injector Clamp
- (2) Injector Assembly
- (3) Oil Rail Assembly

- (4) Camshaft Bracket
- (5) Camshaft
- (6) O-Ring
- (7) Drain Plug

REMOVAL

Prior to removal, be sure to confirm and record the group code of the injector installed using Tech2.

1. Disconnect battery ground cable.
2. Remove air cleaner cover and air duct.
3. Remove intercooler.
Refer to "Intercooler" in this manual.
4. Remove PCV hose and pipe.
5. Remove cylinder head noise insulator cover.
6. Remove high pressure oil pipe.

CAUTION:

- 1) **Sleeve nut should be loosened with cloth tied around it to prevent oil from spurting due to the remaining pressure.**
- 2) **The high pressure pipe should be disconnected with a cloth tied around the intake manifold glow plug to prevent oil from flowing out of the oil rail.**

7. Loosen eye bolt of fuel pipe at fuel pump side.

NOTE: Cloth should be put around the loosened eye bolt to prevent fuel from flowing out.

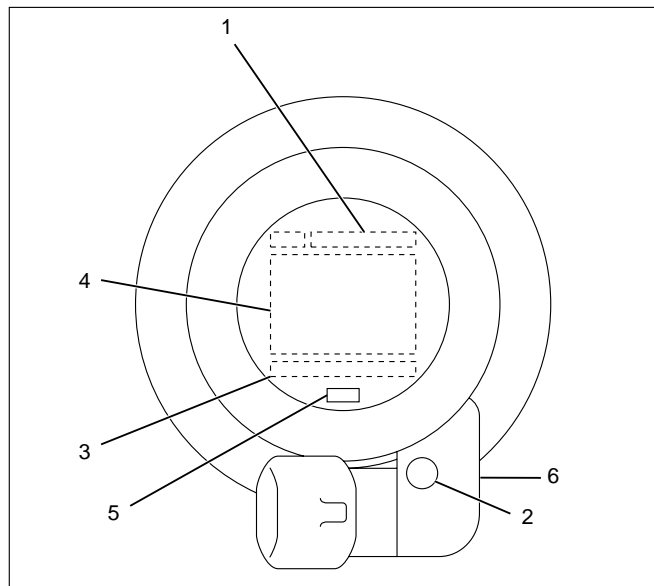
8. Remove fuel return hose at chassis side.
9. Remove PCV hose to cylinder head cover.
10. Remove cylinder head cover.
11. Drain the oil from oil rail assembly.
12. Record the identification marking of injector for each cylinder which is indicated on the upper portion of injector.

There are nine kinds of identification marking available, one alphabet letter and one numeral letter.

In case three kinds of markings are given, one alphabet letter (sometimes printed) and one numeral letter, top priority is given to the one alphabet letter and one numeral letter.

(For example)
 If you find identification marking “A”, “RA” and “2” on the injector, you can use injector grade “A”. (The “RA” is sometimes printed, but can be ignored)

Grade	Identification Marking	
	One Alphabet Letter	One Numeral Letter
A	A	1
	A	2
	A	3
B	B	1
	B	2
	B	3
C	C	1
	C	2
	C	3



055RW021-1

Legend

- (1) Part Number
- (2) Two Alphabet Letter
- (3) Serial Number
- (4) Bar Code
- (5) One Alphabet Letter
- (6) One Numeral Letter

- 13. Remove harness connector from each injector.
- 14. Loosen nuts and bolts for oil rail.
- 15. Remove injector fixing bolts.
- 16. Remove injector clamp.
- 17. Remove injector assembly.

NOTE: Do not drop O-ring

INSTALLATION

- 1. Install oil rail, tighten temporarily
- 2. Install injector assembly.

NOTE: Do not forget to install O-ring between injector and oil rail.

- 3. Install injector fixing bolts, tighten temporarily.
- 4. Install injector clamp, tighten nut temporarily.
- 5. Tighten injector bolts to the specified torque.

Torque: 6.5 N-m (0.7 kg-m / 5.1 lb ft)

- 6. Tighten injector clamp nut to the specified torque with special method.

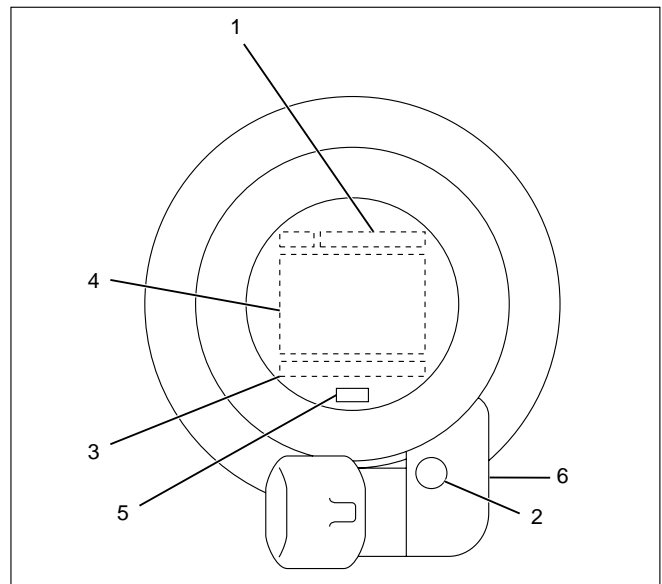
Torque: 30 N-m (3.1 kg-m / 22 lb ft) then loose a time again tighten as following torque.

Torque: 25 N-m (2.4 kg-m / 17.4 lb ft)

- 7. Tighten oil rail to the specified torque.

Torque: 20 N-m (2.0 kg-m / 14.5 lb ft)

- 8. Install injector harness assembly, reconnect harness connector to injector.
- 9. Record the identification marking of injector for each cylinder that is indicated on the upper portion of injector.



055RW021-1

Legend

- (1) Part Number
- (2) Two Alphabet Letter
- (3) Serial Number
- (4) Bar Code
- (5) One Alphabet Letter
- (6) One Numeral Letter

- 10. Install cylinder head assembly.
 Refer to “Cylinder Head” in this manual.
- 11. Fill with about 300cc of engine oil from the high pressure oil pipe at the high pressure oil pipe installation port on the oil rail using an oil filler.
 If assembled without filling the oil rail with oil, the time for engine starting will be longer.

12. Immediately install high pressure oil pipe and tighten to specified torque.

Torque: 80 N·m (8.1 kg·m / 57.9 lb ft)

13. Install cylinder head noise insulator cover.
Refer to "Cylinder Head" in this manual.

14. Install intercooler assembly.
Refer to "Intercooler" in this manual.

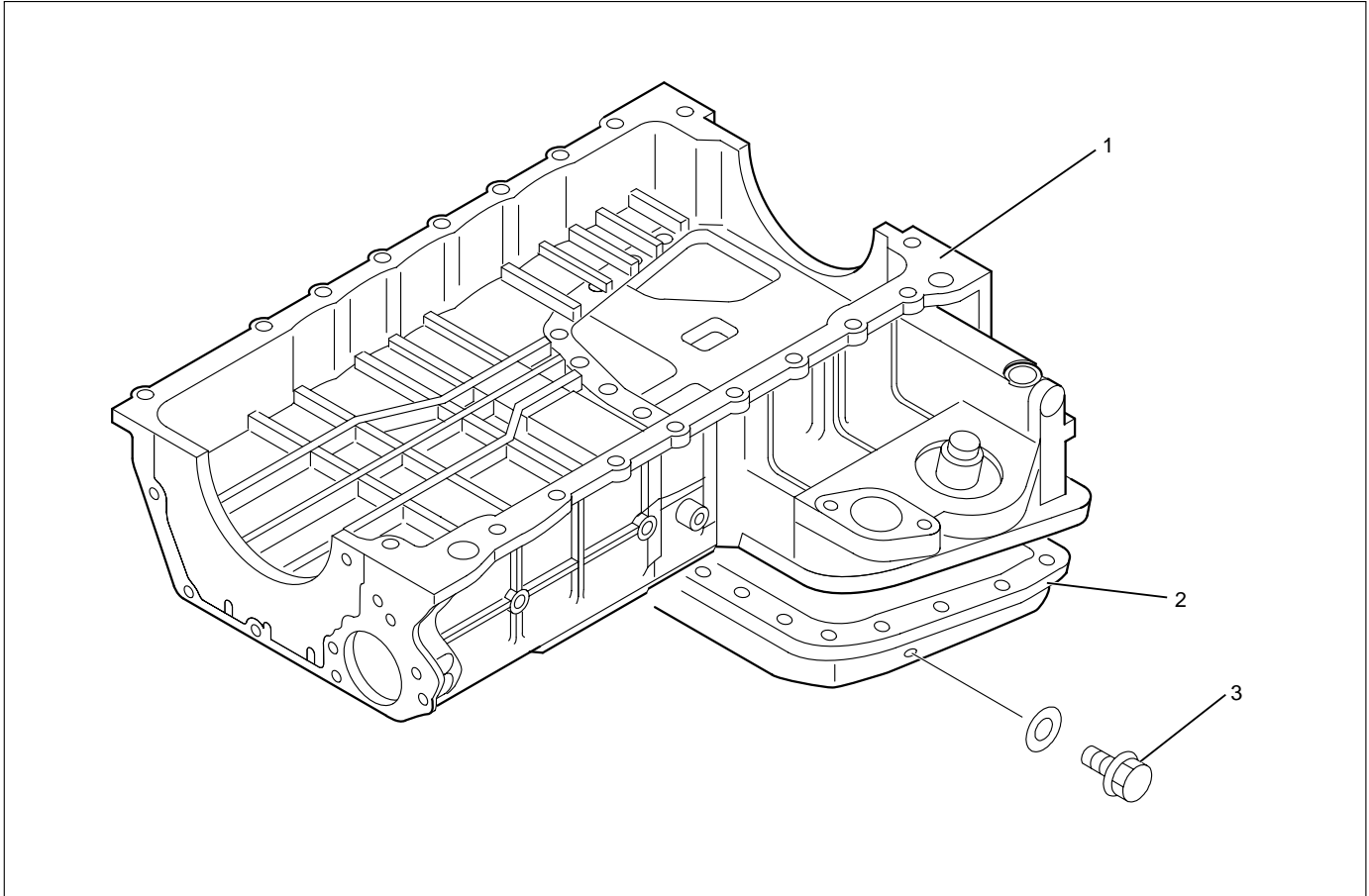
15. Install air cleaner cover and air duct.

16. Use TECH2 to rewrite injector data to ECM.
For rewriting method refer to section "Data Programming in Case of ECM Change" of 6E 4JX1 engine driveability and emissions in this manual.

NOTE:

- 1) On completion of servicing, bleed air from the engine inside fuel passage by means of the priming pump. (The priming pump should be operated more times than in the case of conventional engines.)
- 2) As air is in the oil rail, it takes more time to start the engine. Rough idling may occur while the air is being bled completely after starting the engine, but it does not indicate trouble.
The air will be bled and normal engine status will be reached while the vehicle is driven for about 5 km or engine is operated for about 5 minutes at 1500 to 2000 rpm.
- 3) The injector spare part will be provided for group number B1, B2 and B3 only.

CRANK CASE



012RW029

Legend

- (1) Crank Case
- (2) Oil Pan
- (3) Drain Plug

REMOVAL

1. Drain engine oil.
2. Remove transmission assembly.
3. Remove crankshaft damper pulley.
4. Remove timing belt cover, timing belt, pulley and front plate.
5. Remove timing gear case cover.
6. Remove timing gears.

NOTE: Do not forget to set lock bolt for idle gear A and lock pin for idle gear C.

7. Remove timing gear case.
8. Remove oil level gauge guide assembly.
9. Remove flywheel assembly.

CAUTION:

- 1) The flywheel heavy; be careful not to drop it.
- 2) Be careful no to let it slip because the hexagon of the bolt is thin.

10. Remove rear plate (for A/T) or flywheel housing (for MT).
11. Remove retainer.

NOTE:

- 1) Be careful not to damage the oil seal; it can be reused.
- 2) Inspect installation portion for distortion and flow on the slinger; also inspect for flow on the oil seal lip.
- 3) If there is some flow oil seal/slinger, replace a set.

12. Remove bolts from thrust plate of balance shaft LH then remove balance shaft.
13. Loosen crank case fixing bolts.
14. Use seal cutter to take off the liquid gasket.
Seal cutter: 5-8840-2153-0
15. Remove crank case assembly.

CAUTION:

Do not give shock to crank case for prevention take off applied vibration insulation material on the crank case.

INSTALLATION

1. Install relief valve (if it was removed).

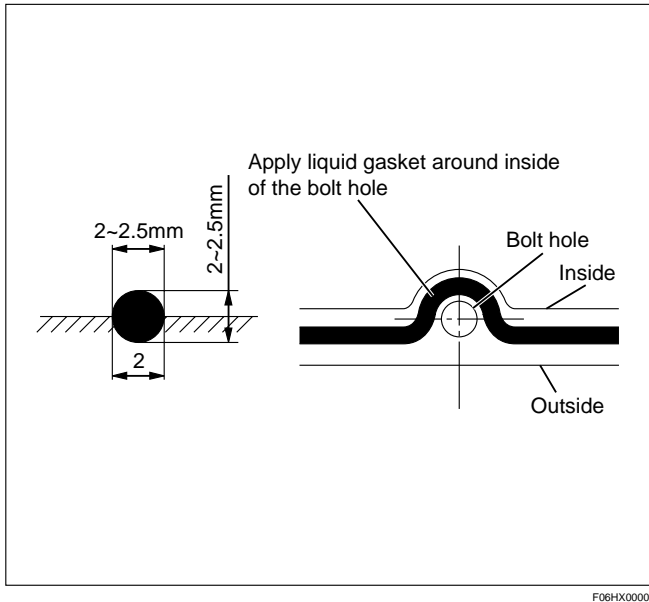
Torque: 30 N-m (3.1 kg-m / 22 lb ft)

2. Insert O-ring to strainer, install strainer and tighten to specified torque.

Torque: 20 N-m (2.0 kg-m / 14.5 lb ft)

3. Apply liquid gasket (TB1207B or equivalent) to surface of oil pan and tighten bolt to the specified torque.

Torque: 19 N-m (1.9 kg-m / 13.7 lb ft)



4. Apply engine oil to the balance shaft and insert it into crank case.

NOTE:

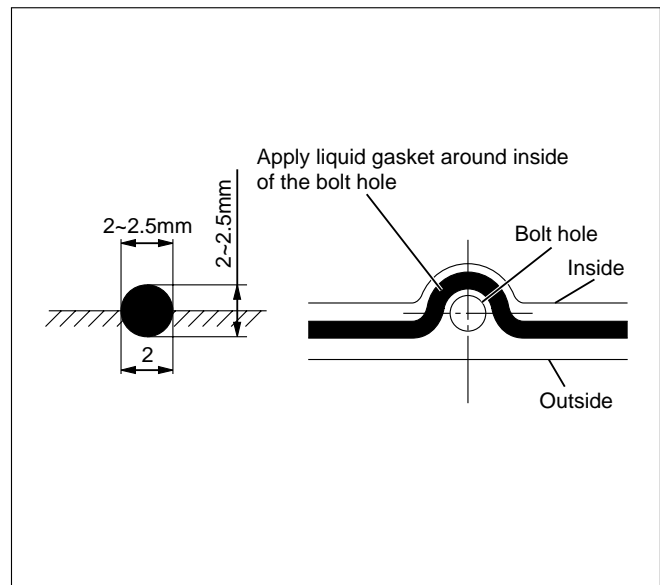
- Do not damage bearing when inserting the balance shaft.
 - Make sure it rotates smoothly.
5. Tighten thrust plate of balance shaft LH.

Torque: 25 N-m (2.5 kg-m / 18 lb ft)

6. Set O-ring port of oil gallery on the cylinder block.
7. Apply liquid gasket (TB1207C or equivalent) to crankcase fixing surface then tighten bolts to the specified torque.

Torque: 25 N-m (2.5 kg-m / 18 lb ft)

NOTE: Make sure there is no oil, dust or scratches on the surface coated with liquid gasket and mount within five minutes of gasket application.



8. Install retainer with oil seal.
9. Install rear plate (A/T) or flywheel housing (MT), tighten bolt to the specified torque.

Torque: 97 N-m 9.9 kg-m / 72 lb ft)

10. Install flywheel assembly with applied engine oil to the bolt, tighten the bolt using angular tightening method.

1st step: 59 N-m (6.0 kg-m / 43 lb ft)

2nd step: 60° to 90°

11. Install oil level gauge guide assembly.
12. Install timing gear case.

Torque: 20 N-m (2.5 kg-m / 14.5 lb ft)

13. Install timing gears
Refer to "Timing Gear" in this manual.
14. Remove lock bolt from idle gear A and remove lock pin from idle gear C.
15. Install timing gear case cover.

Torque: 20 N-m (2.5 kg-m / 14.5 lb ft)

16. Install oil pump pulley.

Torque: 10 N-m (1.0 kg-m / 7.2 lb ft)

17. Install camshaft pulley tighten bolt with angular tightening method.

Torque:

1st step: 40 N-m (4.0 kg-m / 29 lb ft)

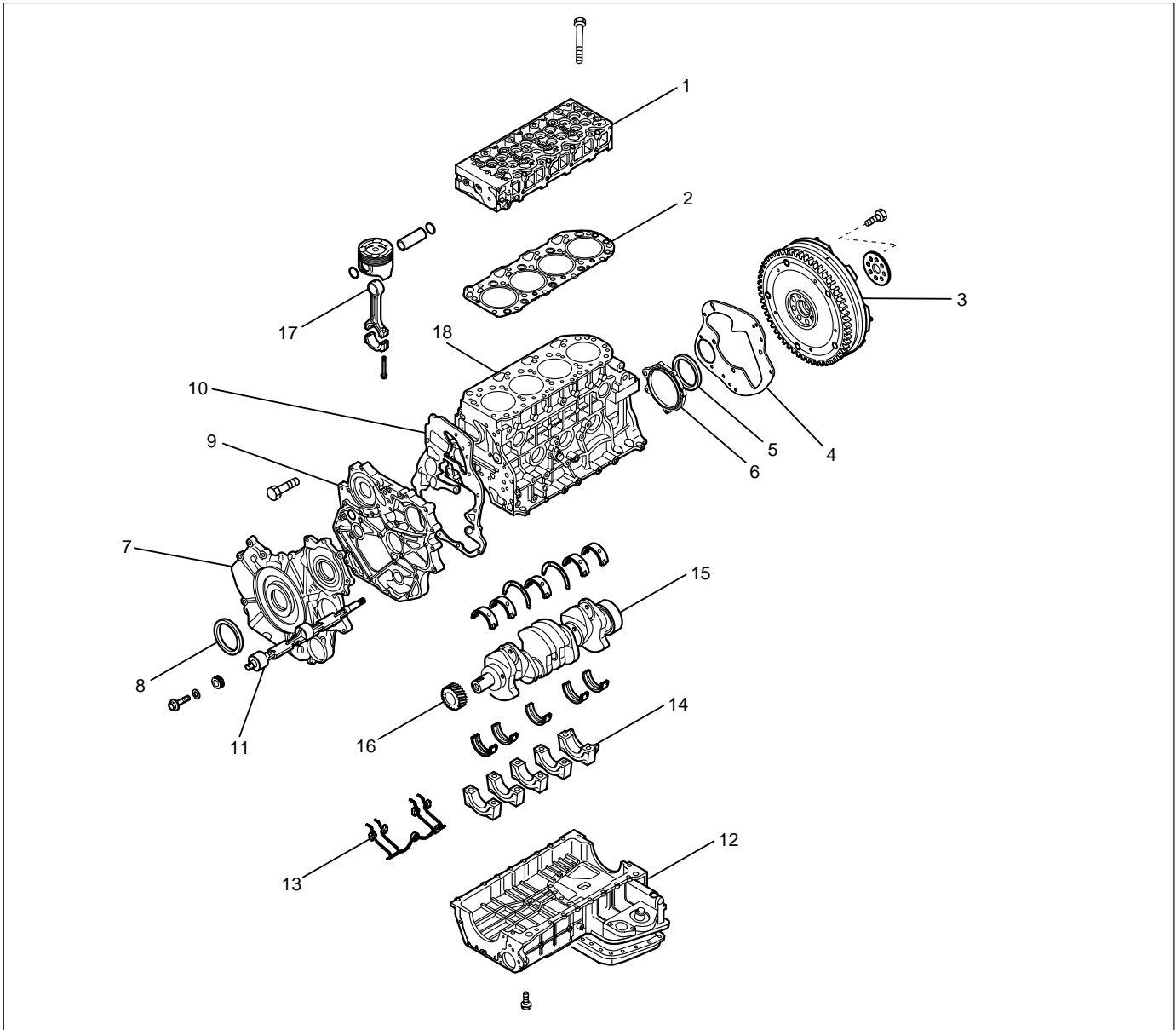
2nd step: 75°

18. Install timing belt and belt tensioner.
Refer to "Timing Gear" in this manual.
19. Install crankshaft damper pulley.

Torque: 220 N-m (22 kg-m / 159 lb ft)

20. Fill engine oil.

CRANKSHAFT



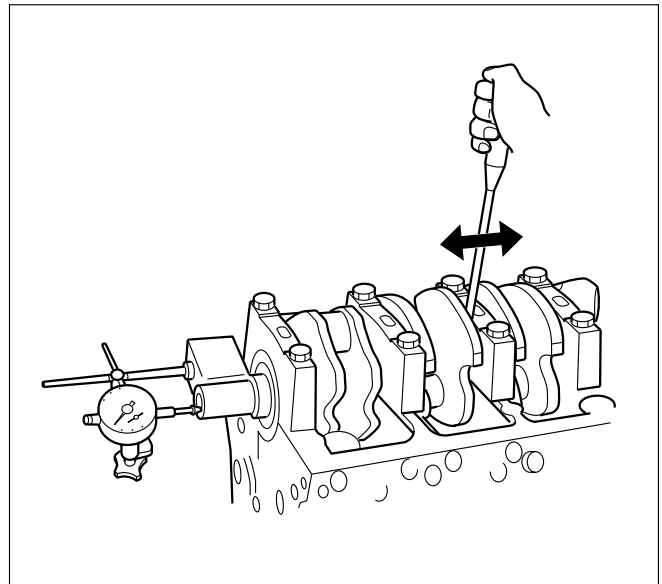
012RW023

Legend

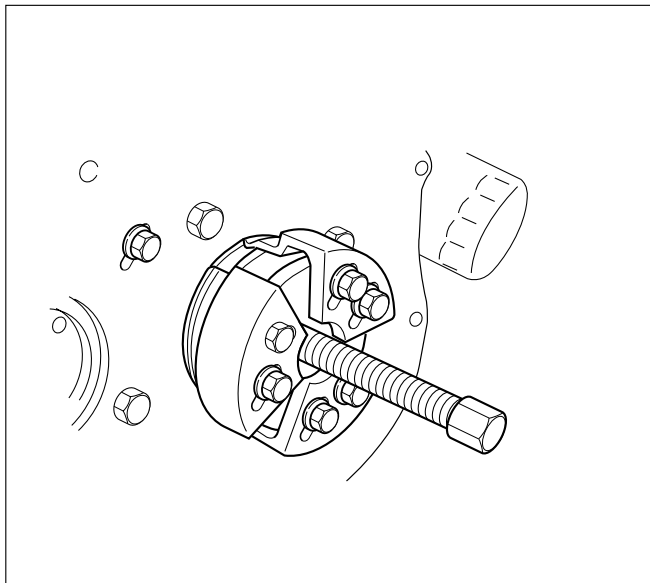
- | | |
|---|---|
| (1) Cylinder Head | (9) Timing Gear Case |
| (2) Cylinder Head Gasket | (10) Gasket |
| (3) Flywheel | (11) Balance Shaft |
| (4) Cylinder Block Rear Plate (for A/T) or Flywheel Housing (for M/T) | (12) Crank Case |
| (5) Crankshaft Rear Oil Seal | (13) Piston Cooling Oil Pipe |
| (6) Retainer | (14) Main Bearing Cap |
| (7) Timing Gear Case | (15) Crankshaft |
| (8) Crankshaft Front Oil Seal | (16) Crankshaft Timing Gear |
| | (17) Piston and Connecting Rod Assembly |
| | (18) Cylinder Block |

DISASSEMBLY

1. Cylinder Head
 - 1) Refer to "Cylinder head" in this manual.
2. Crankshaft Front Oil Seal
 - 1) Use a plastic hammer and a screwdriver to tap around the oil seal to free it from the gear case cover.
Take care not to damage the oil seal fitting surfaces.
3. Crankshaft Timing Gear
4. Timing Gear Case
5. Flywheel
6. Cylinder Block Rear Plate
7. Crankshaft Rear Oil Seal
 - 1) Use special tool to remove the crankshaft rear oil seal.
Oil Seal Remover: 5-8840-2360-0



012RW063



015LV002

8. Crank Case
9. Piston Cooling Oil Pipe
10. Piston and Connecting Rod Assembly
11. Main Bearing Cap Assembly
12. Crankshaft

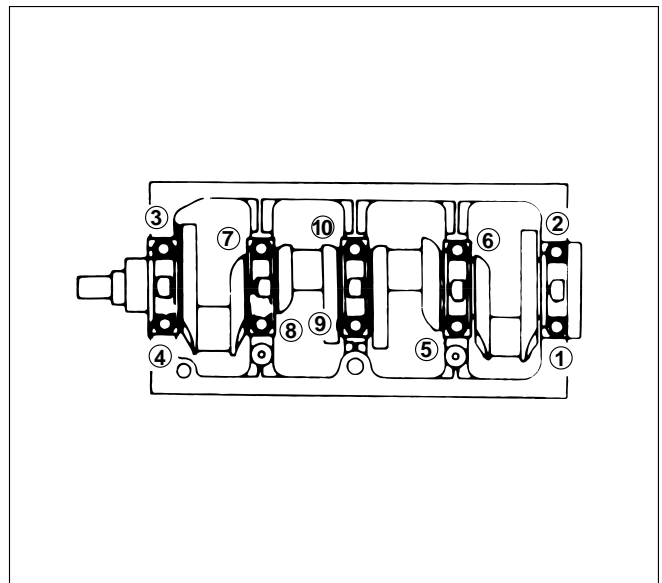
INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Crankshaft Thrust clearance
 - Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance.
If the thrust clearance exceeds the specified limit, replace the thrust bearing as a set.

Standard : 0.04 – 0.20 mm (0.0016 – 0.0079 in)
Limit: 0.30 mm (0.0118 in)

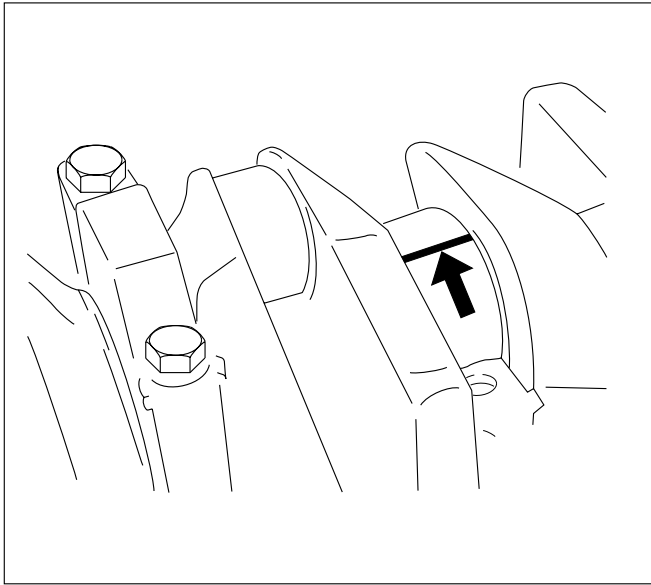
2. Main bearing clearance
 - 1) Remove the main bearing caps in the sequence shown in the illustration.
Arrange the removed main bearing caps in the cylinder number order.



012RW026

- 2) Remove the crankshaft. Remove the main bearings.
- 3) Clean the upper and lower bearings as well as the crankshaft main journal.
- 4) Check the bearings for damage or excessive wear.
The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
- 5) Set the upper bearings and the thrust washers to their original positions. Carefully install the crankshaft.
- 6) Set the lower bearings to the bearing cap original position.

- 7) Apply plastigage to the crankshaft journal unit as shown in the illustration.



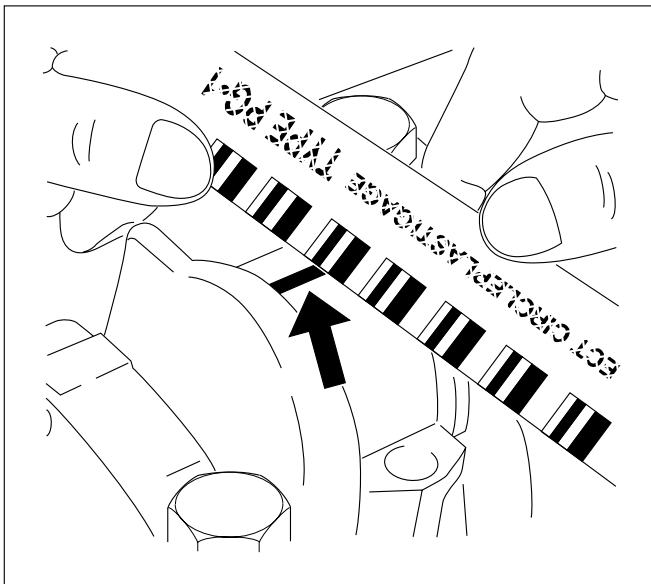
014RW055

- 8) Install the main bearing caps. Apply engine oil to the bolt threads and the seats. Tighten the bolts to the specified torque.

Torque: 167 N·m (17 kg·m/123 lb ft)

NOTE: Do not allow the crankshaft to rotate.

- 9) Remove the main bearing caps.
- 10) Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.



014RW077

- 11) Clean the plastigage from the bearings and the crankshaft.

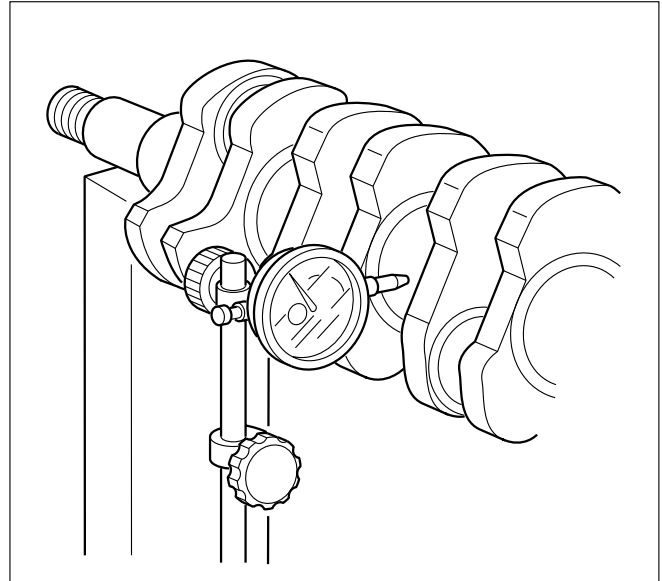
Remove the crankshaft and the bearings.

Standard: 0.031 – 0.063 mm (0.0012 – 0.0025 in)
Limit: 0.11 mm (0.0043 in)

3. Run-out

- 1) Carefully set the crankshaft on the V-blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

Standard: 0.05 mm (0.0020 in) or less
Limit: 0.08 mm (0.0031 in)



012RW068

Measure the diameter and the uneven wear of main journal and crank pin.

If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

Main journal diameter

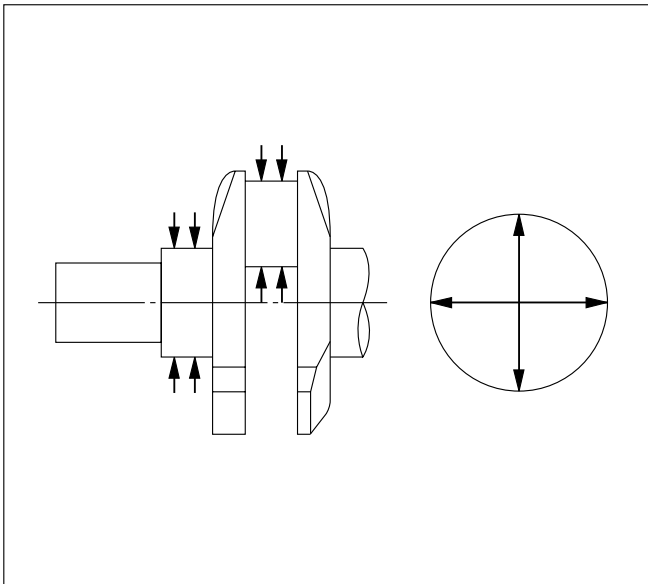
Standard: 69.917 – 69.932 mm (2.7526 – 2.7532 in)
Limit: 69.91 mm (2.7524 in)

Crank pin diameter

Standard: 52.915 – 52.930 mm (2.0833 – 2.0839 in)
Limit: 52.90 mm (2.0827 in)

Uneven wear limit

Standard: 0.05 mm (0.0020 in) or less
Limit: 0.08 mm (0.0031 in)



012RW045

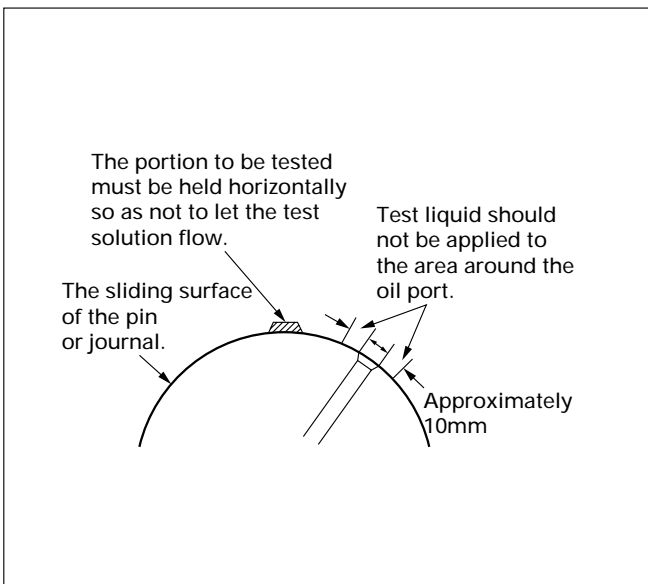
Crankshaft inspection

Inspect the surface of the crankshaft journals and crank pins for excessive wear and damage.
 Inspect the oil seal fitting surfaces for excessive wear and damage.
 Inspect the oil ports for obstructions.

Crankshaft tufftriding inspection

1. Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of on the surfaces to be inspected.
2. Prepare a 5 – 10% solution of ammonium cupric chloride (dissolved in distilled water).
3. Use a syringe to apply the solution to the surface to be inspected.
 Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

NOTE: Do not allow the solution to come in contact with the oil ports and their surrounding area (Approximately 10 mm).



F06MV020

Judgment

1. Wait for thirty or forty seconds.
 If there is no discoloration after thirty or forty seconds, the crankshaft is usable.
 If discoloration appears (the surface being tested will become the color of copper), the crankshaft must be replaced.
2. Steam clean the crankshaft surface immediately after completing the test.

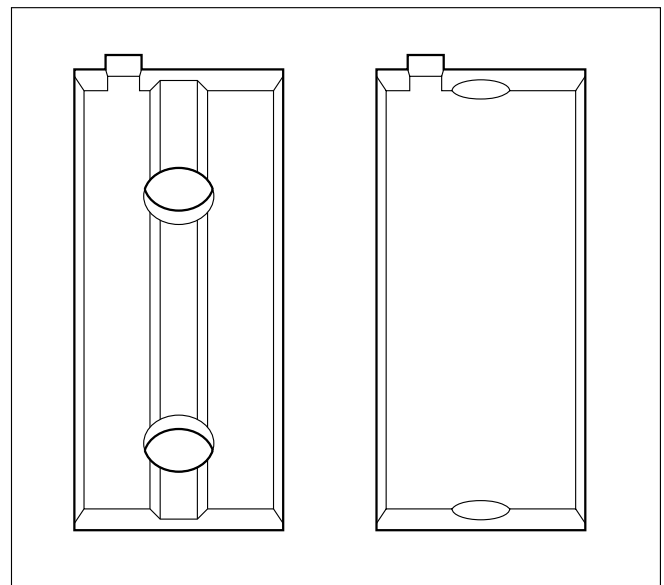
NOTE: The ammonium cupric chloride solution is highly corrosive. Because of this, it is imperative that the surfaces being tested be cleaned immediately after completing the test.

CRANKSHAFT BEARING SECTION

When installing new crankshaft bearings, refer to the selection table below.

Select and install the new crankshaft bearings, paying close attention to the cylinder body journal hole diameter grade mark and the crankshaft journal diameter grade mark.

NOTE: Although all upper journal bearings (cylinder body side) have oil grooves and holes, all lower bearings (bearing cap side) have no groove and hole. Play close attention to the distinction during the installation procedure.

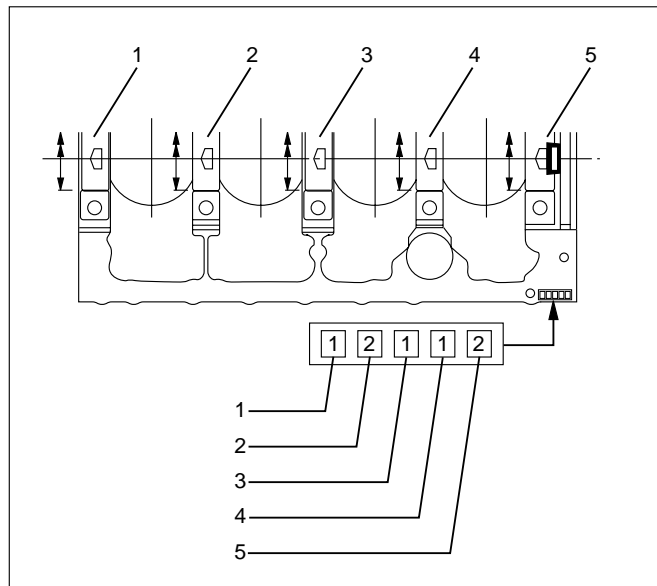
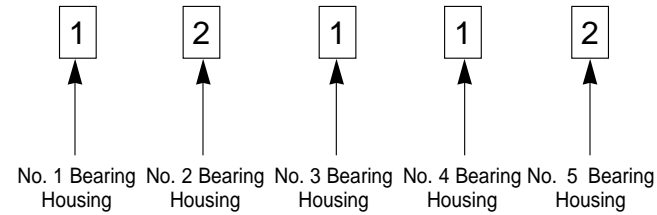


012RW038

Crankshaft Bearing Bore Grade Mark Position

Crankshaft bearing bore grade marks **1** or **2** are stamped on the rear right hand side of the cylinder body.

Example:

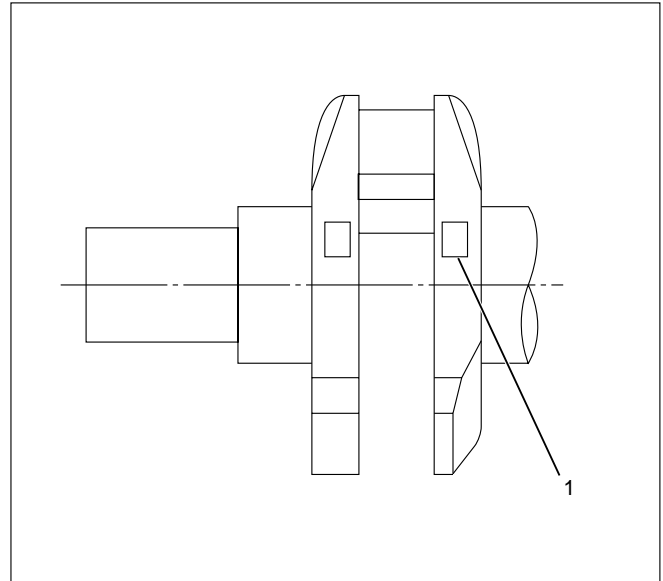


Legend

- (1) No. 1 Main bearing bore grade
- (2) No. 2 Main bearing bore grade
- (3) No. 3 Main bearing bore grade
- (4) No. 4 Main bearing bore grade
- (5) No. 5 Main bearing bore grade

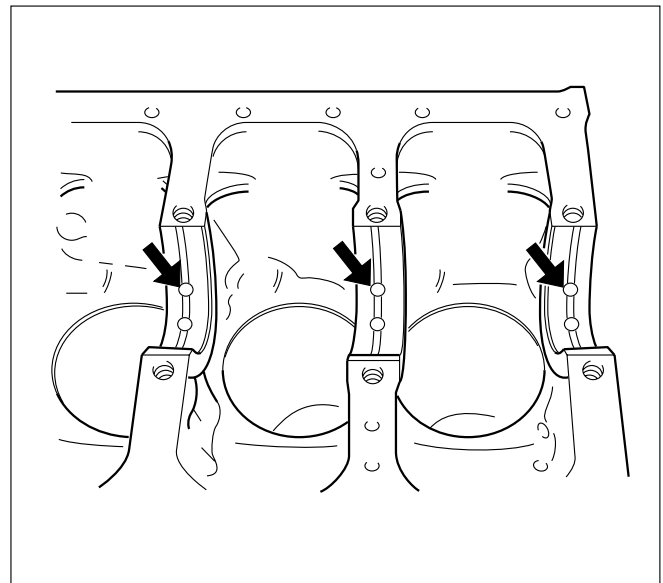
Crankshaft Journal Grade Mark Position

The crankshaft journal grade marks (1 or -) are stamped on each crankshaft journal wave. The crankshaft journal and bearing clearance must be the same for each position after installation of the crankshaft and the crankshaft bearings.



Legend

- (1) Crankshaft journal outside diameter grade



Main Bearing Bore Diameter mm(in)		Crankshaft Main Journal Diameter mm(in)		Crankshaft Bearing	Oil Clearance mm(in)
Grade	Inside Diameter	Grade	Outside Diameter		
1	73.992 – 74.000 (2.9131 – 2.9134)	1 or -	69.927 – 69.932 (2.7530 – 2.7532)	4	0.045 – 0.061 (0.0018 – 0.0024)
		2 or - -	69.922 – 69.927 (2.7528 – 2.7530)	4	0.050 – 0.066 (0.0020 – 0.0026)
		3 or - - -	69.917 – 69.922 (2.7526 – 2.7528)	5	0.052 – 0.068 (0.0020 – 0.0027)
2	73.983 – 73.992 (2.9127 – 2.9131)	1 or -	69.927 – 69.932 (2.7530 – 2.7532)	2	0.042 – 0.059 (0.0017 – 0.0023)
		2 or - -	69.922 – 69.927 (2.7528 – 2.7530)	3	0.044 – 0.061 (0.0017 – 0.0024)
		3 or - - -	69.917 – 69.922 (2.7526 – 2.7528)	4	0.046 – 0.063 (0.0018 – 0.0025)
3	73.975 – 73.983 (2.9124 – 2.9127)	1 or -	69.927 – 69.932 (2.7530 – 2.7532)	1	0.037 – 0.053 (0.0015 – 0.0021)
		2 or - -	69.922 – 69.927 (2.7528 – 2.7530)	2	0.039 – 0.055 (0.0015 – 0.0022)
		3 or - - -	69.917 – 69.922 (2.7526 – 2.7528)	2	0.044 – 0.060 (0.0017 – 0.0024)

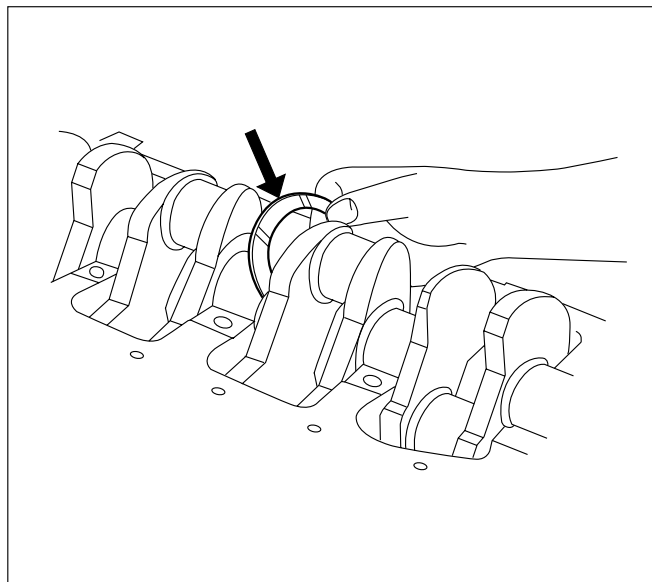
REASSEMBLY

1. Crankshaft

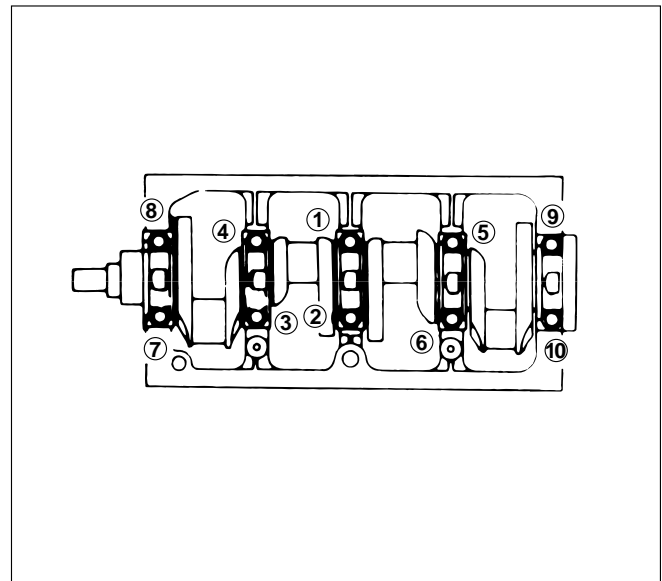
- 1) Install the main bearings to the cylinder body and the main bearing caps.
- 2) Be sure that they are positioned correctly.
- 3) Apply new engine oil to the upper and lower main bearing faces.
- 4) Carefully mount the crankshaft.
- 5) Apply engine oil to the thrust washer.
- 6) Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.

- 7) Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.
- 8) Apply engine oil to the crankshaft bearing cap bolts.
- 9) Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

Torque: 167 N·m (17.0 kg·m/123 lb ft)



012RW047

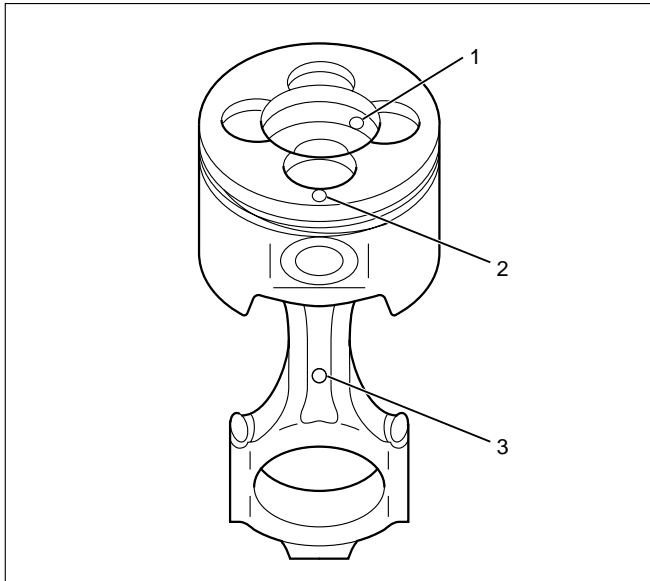


012RW027

NOTE: Check to see that the crankshaft turns smoothly by rotating it manually.

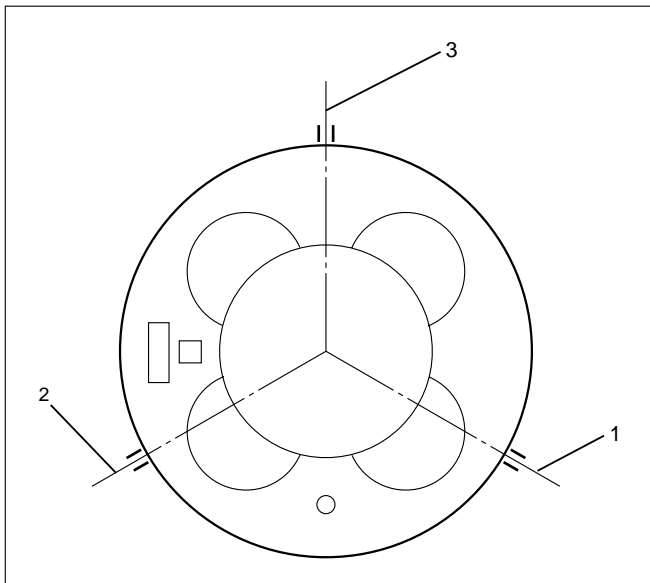
3. Piston and Connecting Rod Assembly

- 1) Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins and each piston ring and piston.
- 2) Align the front mark (2) of piston and front mark (3) of connecting rod then assemble them.



015RW051

- 3) The N mark of the piston ring is faced toward the top, check to see that the piston ring end gap is correctly positioned.



015RW083

Legend

- (1) 1st piston ring end gap
- (2) 2nd piston ring end gap
- (3) Oil ring end gap

- 4) Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
Piston Ring Compressor: 5-8840-9018-0
- 5) Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
- 6) Apply engine oil to the threads and seating faces of the nuts.
- 7) Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.

1st step: 29 N·m (3.0 kg·m/22 lb ft)

2nd step: 45°– 60°

After tightening the cap nuts, check to see that the crankshaft rotates smoothly

4. Piston Cooling Oil Pipe

If the piston cooling oil pipe is forcibly assembled, the end of the oil jet may bend. It could make it impossible to supply oil to the piston cooling holes, which will sometimes cause piston seizure.

Sufficient care should be taken to pipe assembly work.

- 1) Tighten the bolt and oil jet plug to the specified torque.

Torque:

M6: 8 N·m (0.8 kg·m/6 lb ft)

M8: 20 N·m (2.0 kg·m/14.5 lb ft)

Oiling Jet Plug: 30 N·m (3.1 kg·m/22 lb ft)

5. Crank case

- 1) Refer to “Crank case” in this manual.

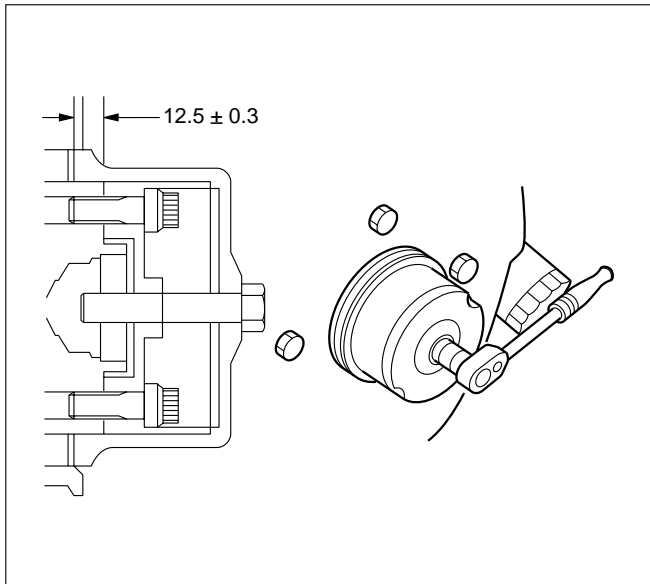
6. Apply liquid gasket (TB-1207C or equivalent) to retainer then install it to rear end of cylinder block within 5 minutes.

7. Crankshaft Rear Oil Seal

- 1) Tighten the adapter to the crankshaft rear and section with 2 bolts.
- 2) Insert the oil seal into the peripheral section of the adapter.
- 3) Insert the sleeve into the adapter and tighten it with a bolt (M12 x 1.75L = 70) until the adapter hits the sleeve.
- 4) Remove the adapter and the sleeve.
- 5) Check the dimension of the oil seal setting from rear end of crankshaft.

Standard Dimension = 12.5 ± 0.3 mm

Oil Seal Installer: 5-8840-2359-0



012RW067

8. Cylinder Block Rear Plate (A/T)

Align the rear plate with the cylinder block dowel pins.

Tighten the rear plate to the specified torque.

Torque: 97 N·m (9.9 kg·m/72 lb ft)

9. Flywheel housing (M/T)

Align the flywheel housing with the cylinder block dowel pins.

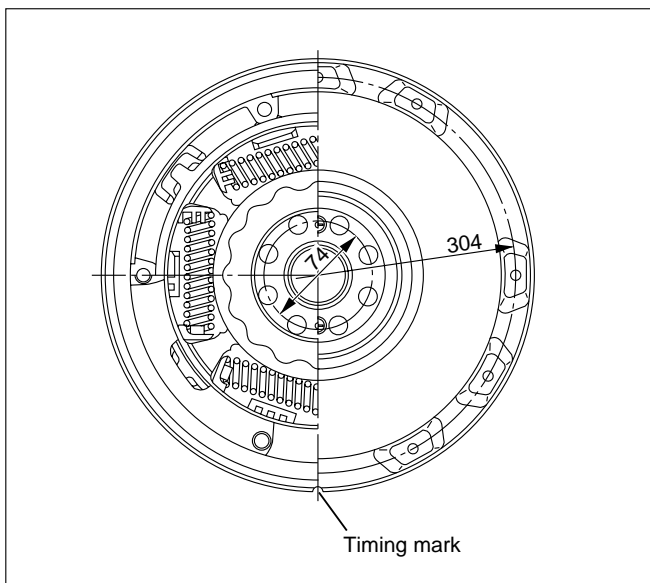
Tighten the bolt to the specified torque.

Torque: 97 N·m (9.9 kg·m/72 lb ft)

10. Flywheel

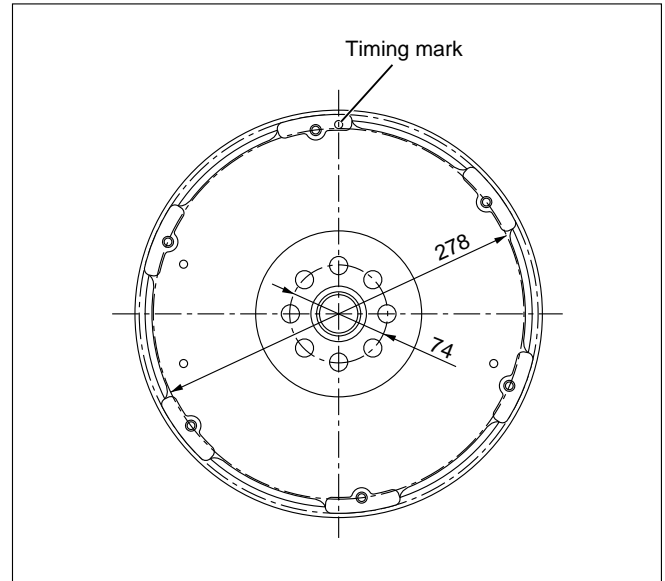
- 1) Thoroughly clean and remove the oil from the threads of crankshaft and flywheel fixing surface.
- 2) Mount the flywheel on the crankshaft and then install the washer.
- 3) Align the timing mark, cut out on the flywheel is at lowest position for M/T model and identification hole on the boss is highest position for A/T model when cylinder No. 1 is at the TDC.

For M/T Model



015RW120

For A/T model

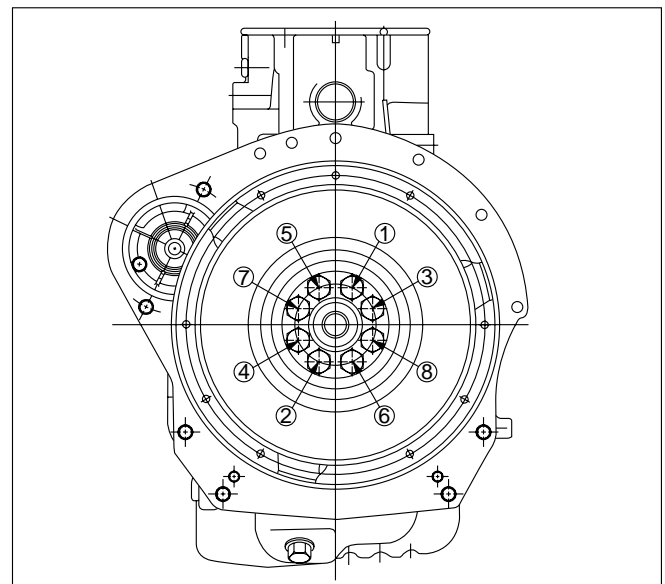


015RW121

- 4) Tighten the flywheel bolts in 2 steps using angular tightening method.

Torque: 1st step 60 N·m (6.1 kg·m/44 lb ft)

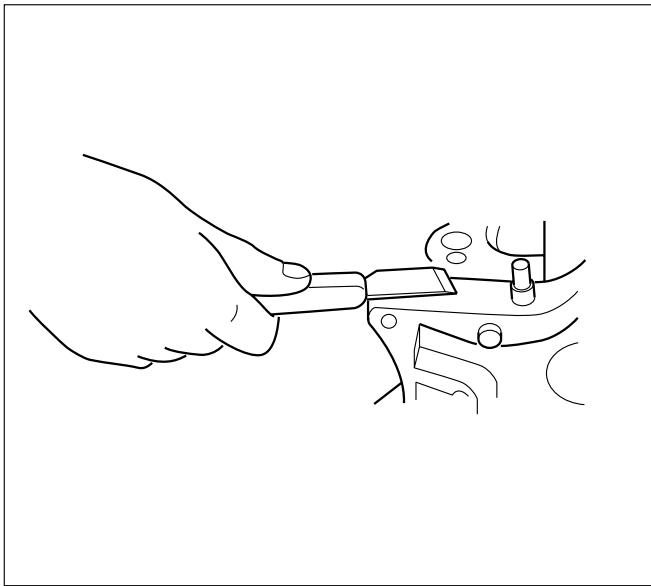
Torque: 2nd step 60° – 90°



201RW021

11. Timing Gear Case

- 1) Cut away the gasket protruding between the cylinder block and the crank case fitting surfaces (as shown in the illustration).



012RW064

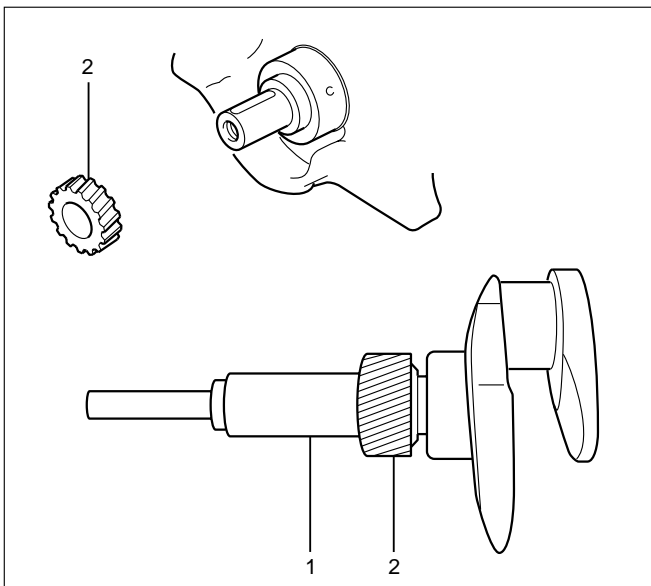
- 2) Apply liquid gasket (TB1207B or equivalent) between the cylinder block and the crankcase fitting surfaces.
- 3) Install the timing gear case to the cylinder body.
- 4) Tighten the timing gear case bolt together with the timing gear case gasket to the specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb-ft)

12. Crankshaft Gear

- 1) Set key to crankshaft key groove.
- 2) The timing mark on the crankshaft gear must be facing outward.
- 3) Use the crankshaft gear installer to install the crankshaft gear.

Crankshaft installer: 9-8522-0021-0



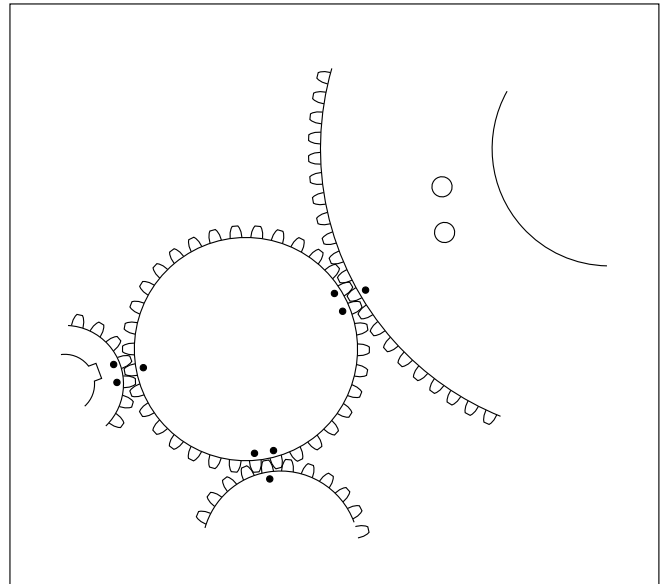
012RW066

Legend

- (1) Crankshaft Gear Installer
- (2) Crankshaft Gear

13. Installation of the Timing Gear

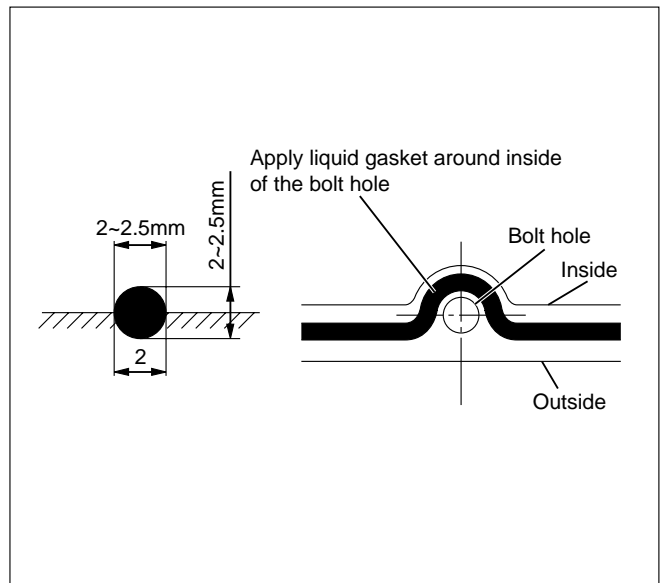
- 1) Align teeth on the scissors gear and lock them before install timing gear.
- 2) Align timing marks on each timing gear and assemble them.
- 3) Refer to timing gear detail in this manual.



012RW024

14. Timing Gear Case Cover

- 1) Remove lock bolt from idle gear A and remove lock pin from idle gear C.
- 2) Install oil pump gear oil seal before assembling timing gear case cover.
- 3) Clean fitting surface and apply liquid gasket (TB1207C or equivalent) to fitting surface.



F06HX00001

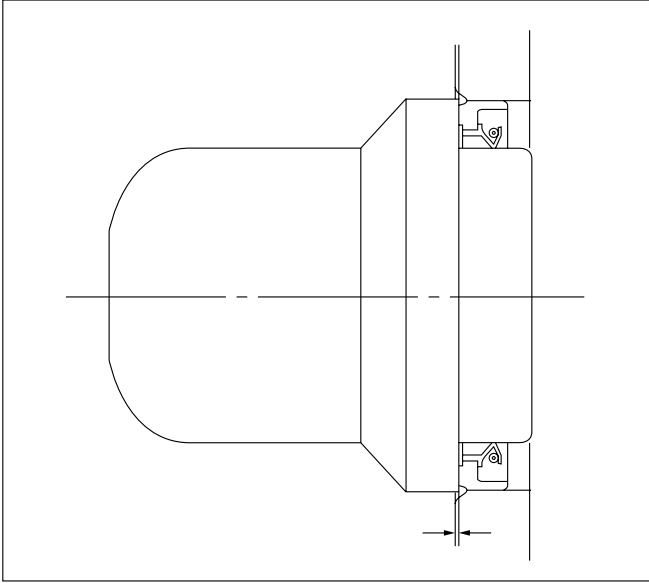
- 4) Tighten bolts to specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

15. Crankshaft Front Oil Seal

- 1) Set oil seal with special tool.
 - 2) Install front oil seal to timing gear case cover.
- Crankshaft Front Oil Seal Installer: 5-8840-2061-0
- 3) Remove special tool and check oil seal position from front surface of timing gear case.

Oil Seal Position: 0.5 – 2.5 mm (0.0197 – 0.0984 in)

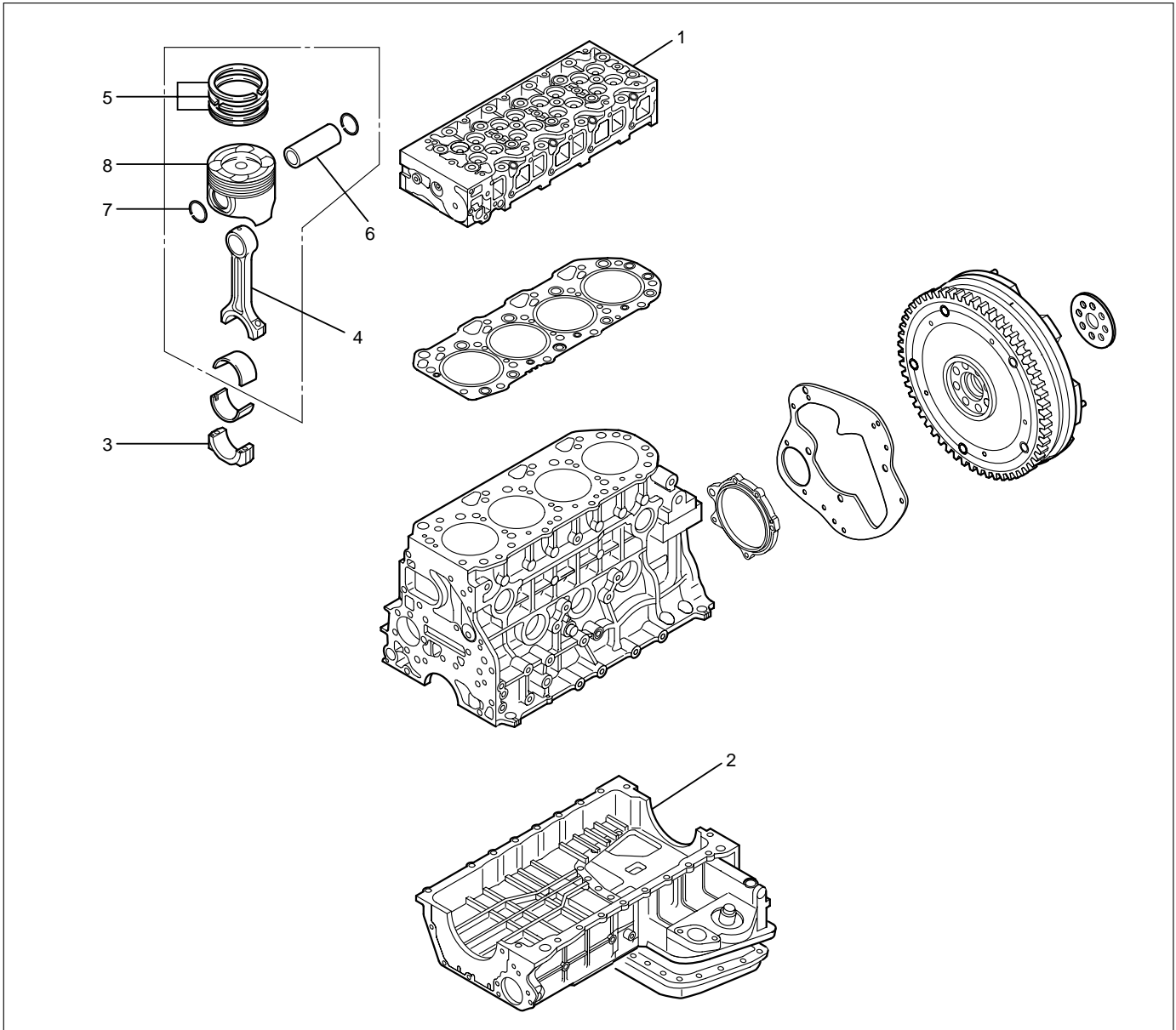


015RW074

16. Cylinder Head

- 1) Refer to "Cylinder head" in this manual.

PISTON AND CONNECTING ROD



012RW061

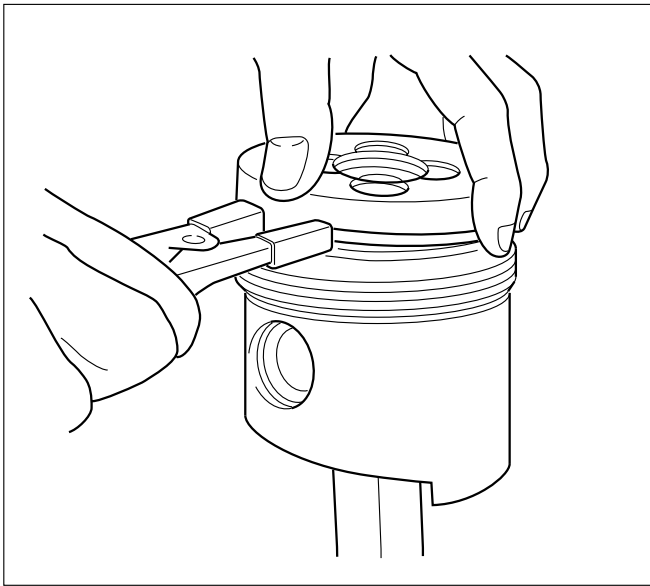
Legend

- | | |
|--------------------------------|--------------------------|
| (1) Cylinder Head Assembly | (4) Connecting Rod |
| (2) Crank Case | (5) Piston Ring |
| (3) Connecting Rod Bearing Cap | (6) Piston Pin |
| | (7) Piston Pin Snap Ring |
| | (8) Piston |

DISASSEMBLY

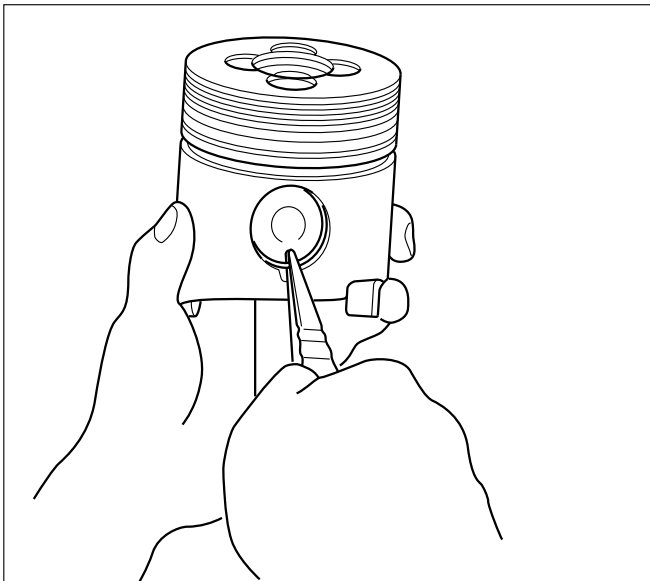
1. Cylinder Head Assembly
 - 1) Refer to “Cylinder head” in this manual.
2. Crank Case Assembly
 - 1) Refer to “Crank Case” in this manual.
3. Connecting Rod Bearing Cap
4. Piston and Connecting Rod
 - 1) Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod.
5. Piston Ring

Remove the piston rings with a piston ring expander.
Arrange the removed piston rings in the cylinder number order.



015RW082

6. Piston Pin Snap Ring
 - 1) Use a pair of pliers to remove the piston pin snap rings.



015RW077

7. Piston Pin
 - 1) Remove piston pin from piston assembly.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions.

8. Piston
9. Connecting Rod

INSPECTION AND REPAIR

PISTON AND PISTON RING

Pistons

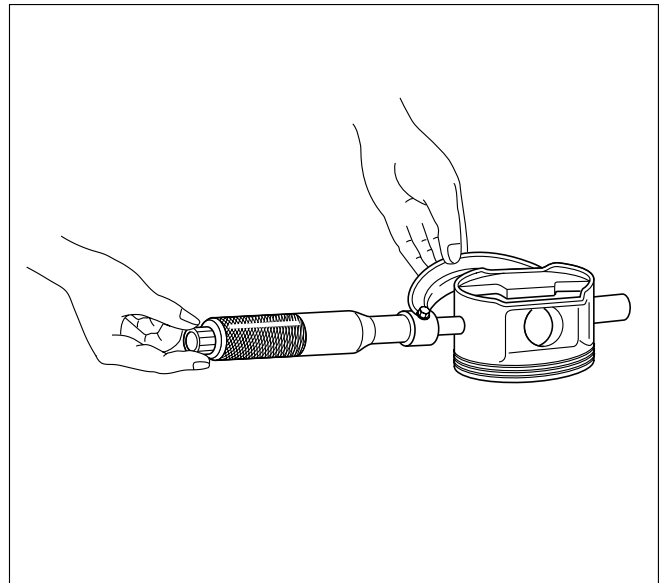
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are present, the piston must be replaced.

Piston Diameter

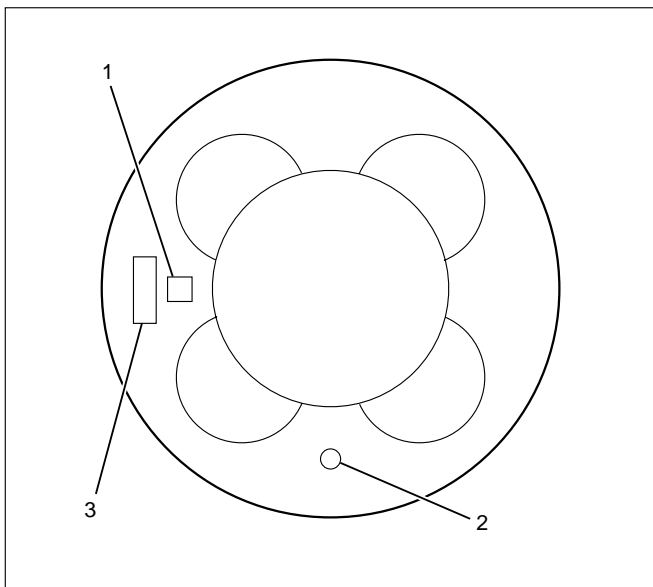
1. Measure the piston outside diameter with micrometer at the piston grading position.

Piston Grading Position: 69.75 mm (2.7461 in) from piston head



015LV014

Piston Outside Diameter		mm(in)
Grade Mark	Outside Diameter	
A	95.320 – 95.329 (3.7527 – 3.7531)	
B	95.330 – 95.339 (3.7531 – 3.7535)	
C	95.340 – 95.349 (3.7535 – 3.7539)	



015RW080

Legend

- (1) Piston Grade
- (2) Piston Front Mark
- (3) Part Number

The grade for piston outside diameter is stamped on the piston head.

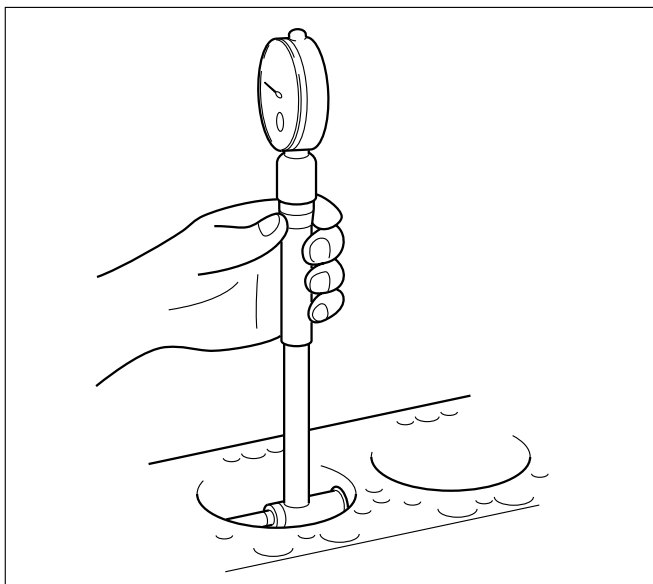
Measure the cylinder bore diameter at measuring points.

If the piston clearance does not conform to the specified value, the pistons must be replaced.

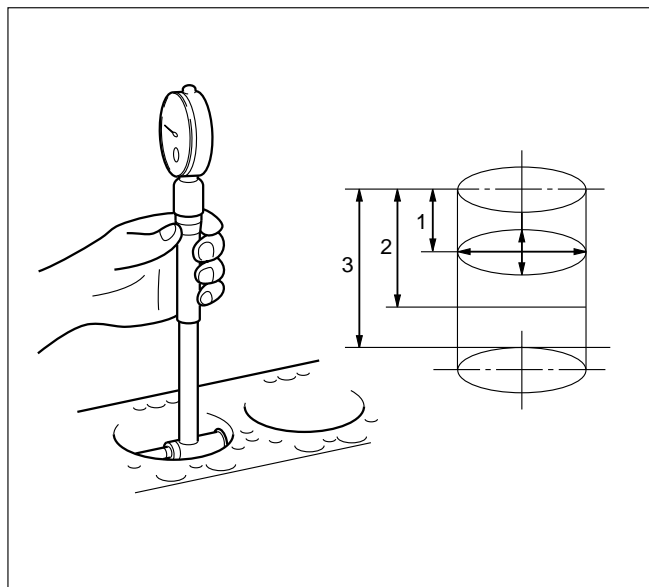
Piston Clearance:

0.092 – 0.110 mm (0.0036 – 0.0043 in)

Cylinder Bore Diameter		mm(in)
Grade Mark	Cylinder Bore Diameter	
A	95.421 – 95.430 (3.7567 – 3.7571)	
B	95.431 – 95.440 (3.7571 – 3.7575)	
C	95.441 – 95.450 (3.7575 – 3.7579)	



012RW071



012RW117

Legend

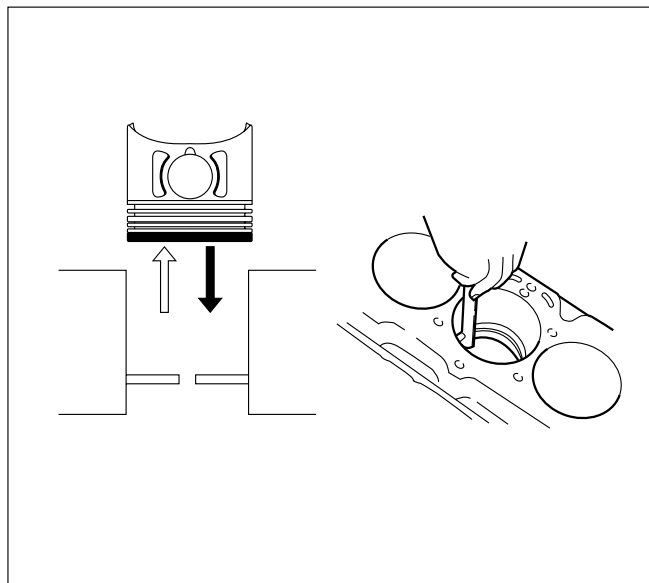
- Measuring point 1 = 20 mm
- 2 = 90 mm
- 3 = 160 mm

Piston rings

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement

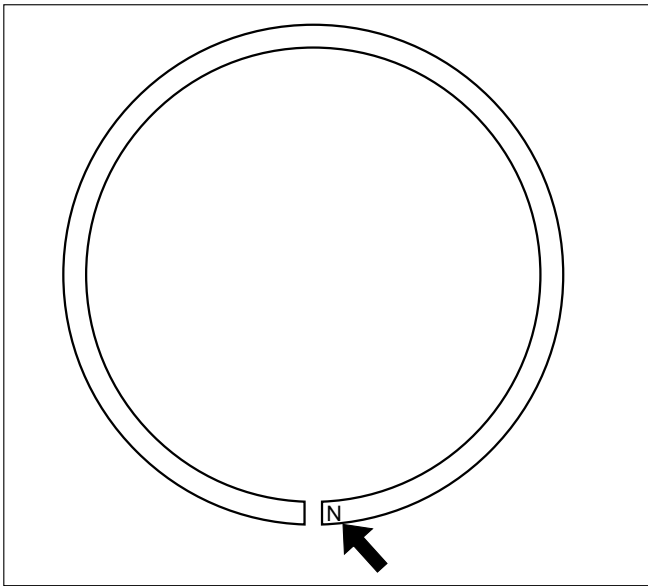
- 1) Insert the piston ring into the cylinder bore.



012RW051

- 2) Push the ring by the piston, at the right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
- 3) Measure the ring end gap.

NOTE: The piston ring is stamped with a discerning mark on the upper face of piston ring.



012RW037

Discerning Mark

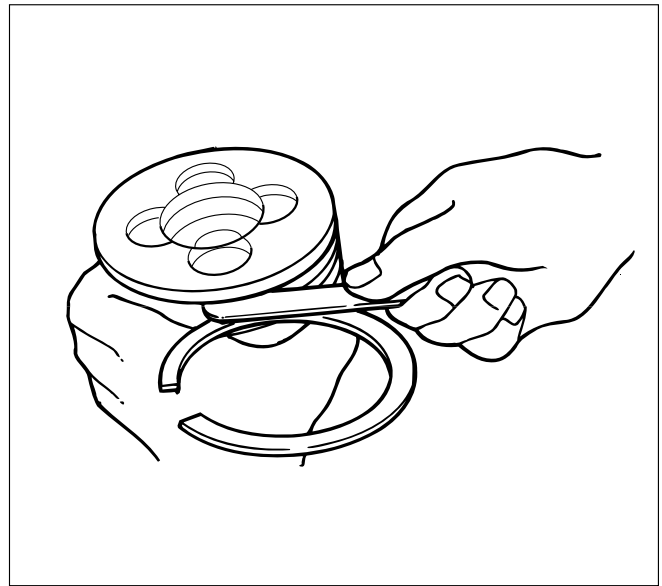
Piston Ring	Discerning Mark
1st compression ring	1N
2nd compression ring	2N

Ring End Gap mm(in)

Piston Ring	Standard Gap	Limit
1st compression ring	0.25 – 0.40 (0.0098 – 0.0157)	1.5 (0.0590)
2nd compression ring	0.20 – 0.35 (0.0079 – 0.0138)	
Oil ring	0.10 – 0.30 (0.0039 – 0.0118)	

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove/piston ring clearance exceeds the specified limit, the piston and/or piston rings must be replaced.

		mm(in)	
		Standard	Limit
Compression ring	1st	0.05 – 0.09 (0.0020 – 0.0035)	0.15 (0.0059)
	2nd	0.05 – 0.09 (0.0020 – 0.0035)	
Oil ring		0.03 – 0.07 (0.0012 – 0.0028)	



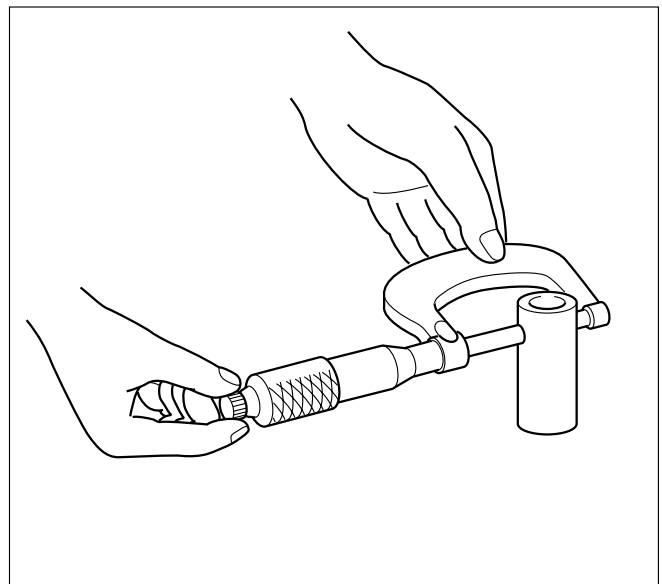
015RW076

Piston pin

Visually inspect the piston pin for cracks, flaws, and other damage and replace if necessary.

1. Use a micrometer to measure the piston pin outside diameter in both directions at three different positions. If the measurement exceeds the specified limit, the piston pin must be replaced.

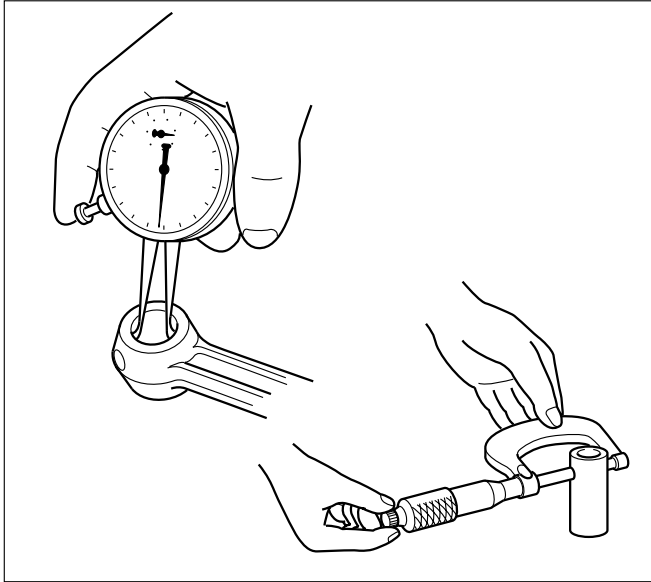
Standard: 30.995 – 31.000 mm (1.2212 – 1.2214 in)
Limit: 30.97 mm (1.2202 in)



012RW082

- Measure the inside diameter of the connecting rod small end. If the clearance between the small end and pin does not conform to the specified value, the connecting rod or bushing and pin must be replaced.

Standard: 0.008 – 0.020 mm (0.0003 – 0.0008 in)
Limit: 0.05 mm (0.0020 in)



012RW074

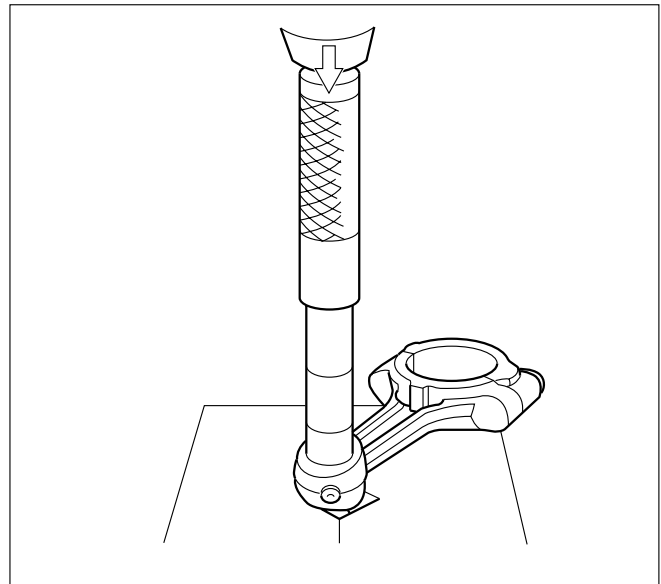
- Insert the piston pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston and the piston pin must be replaced.

Standard: 0.005 – 0.018 mm (0.0002 – 0.0007 in)
Limit: 0.04 mm (0.0016 in)

Bushing replacement

Removal: Use a suitable bar and bench press or hammer

Installation: Align the bushing with a connecting rod oil port. After installing a new bushing, finish the bushing bore with a pin hole grinder.



012RW123

Connecting rods

- Check the connecting rod alignment with a connecting rod aligner.

If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

Bend per 100 mm (3.937 in)

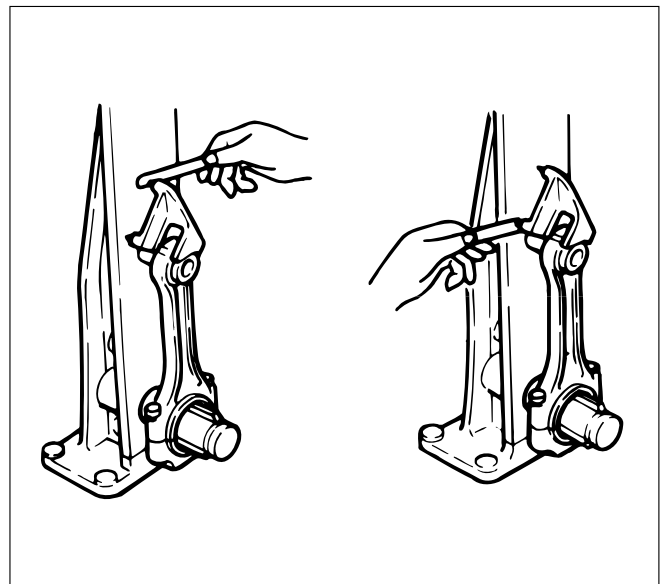
Standard: 0.08 mm (0.0031 in) or less

Limit: 0.20 mm (0.0079 in)

Twist per 100 mm (3.937 in)

Standard: 0.05 mm (0.0020 in) or less

Limit: 0.15 mm (0.0059 in)



012RW001

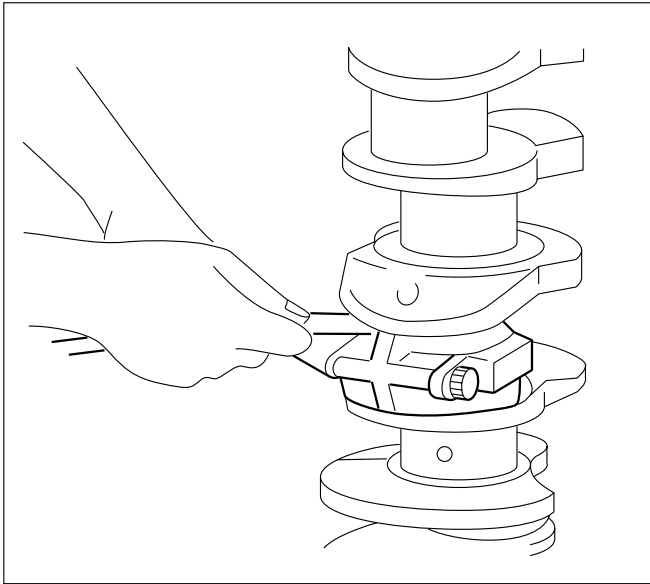
- Measure the connecting rod thrust clearance.

Use a feeler gauge to measure the thrust clearance at the big end of the connecting rod.

If the clearance exceeds the specified limit, the connecting rod must be replaced.

Standard: 0.230 mm (0.0091 in)

Limit: 0.350 mm (0.0138 in)



012RW075

3. Measure the oil clearance between the connecting rod and the crankshaft.

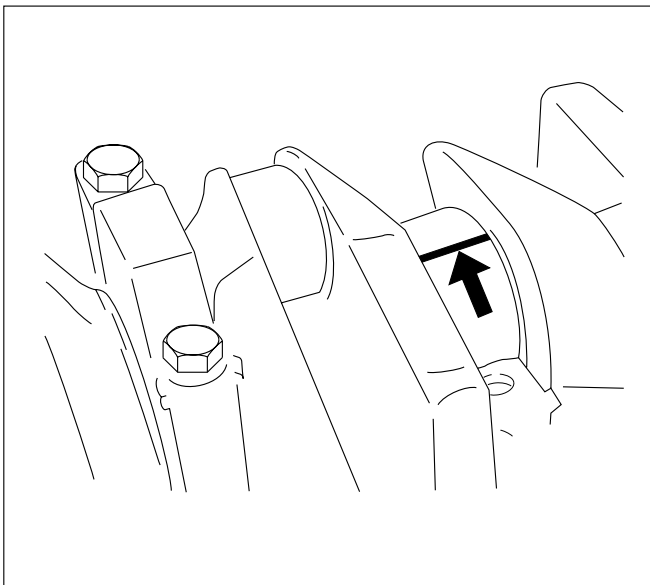
- 1) Remove the connecting rod cap nuts and the rod caps.

Arrange the removed rod caps in the cylinder number order.

- 2) Clean the rod bearings and the crankshaft pins.
- 3) Carefully check the rod bearings.

If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions.

Apply plastigage to the crank pin.



014RW055

- 4) Reinstall the rod caps to their original positions.
- 5) Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.

1st step: 29 N·m (3.0 kg·m/22 lb ft)

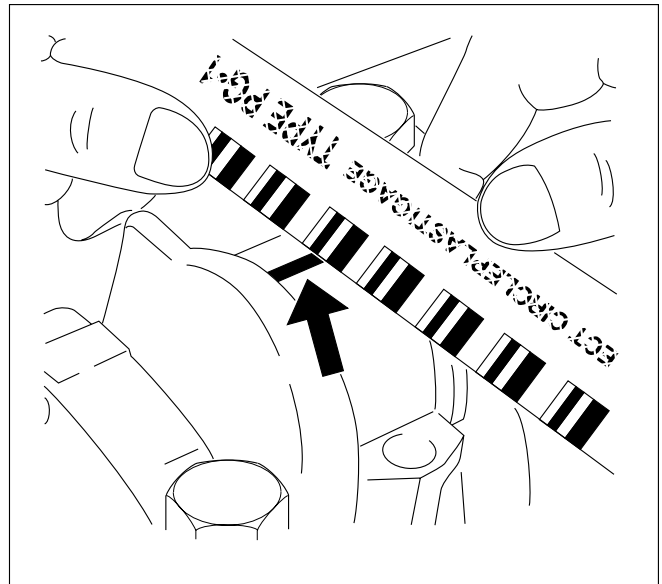
2nd step: 45°– 60°

NOTE: Do not allow the crankshaft to rotate

- 6) Remove the rod caps.
- 7) Measure the smallest width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearings as a set.
- 8) Clean the plastigage from the bearings and the crankshaft pins

Standard: 0.022 – 0.042 mm (0.0009 – 0.0017 in)

Limit: 0.100 mm (0.0039 in)



014RW077

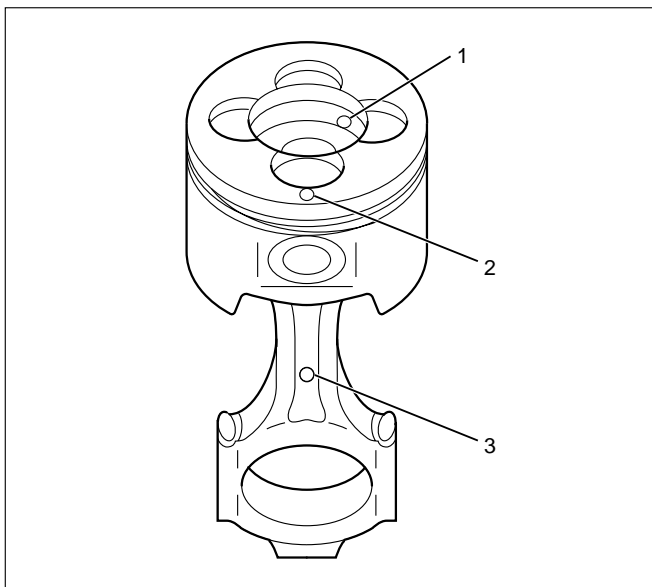
REASSEMBLY

1. Connecting Rod
2. Piston
3. Piston Pin
 - 1) Apply a coat of engine oil to the piston pin and the piston pin hole.
4. Piston Pin Snap Ring
 - 1) Try to insert the piston pin into the piston pin hole with normal finger pressure.
 - 2) Weight each piston and connecting rod assembly.
 - 3) Select piston and connecting rod combinations so that the weight variation of the different four assemblies is held within the specified limits.

Variance in weight after assembly: Less than 3g (0.1058 oz)

NOTE: When changing piston/connecting rod combinations, do not change the piston/piston pin combination.

- 4) Attach the piston to the connecting rod with the piston front mark (2) and the connecting rod front mark (3) on the same side.



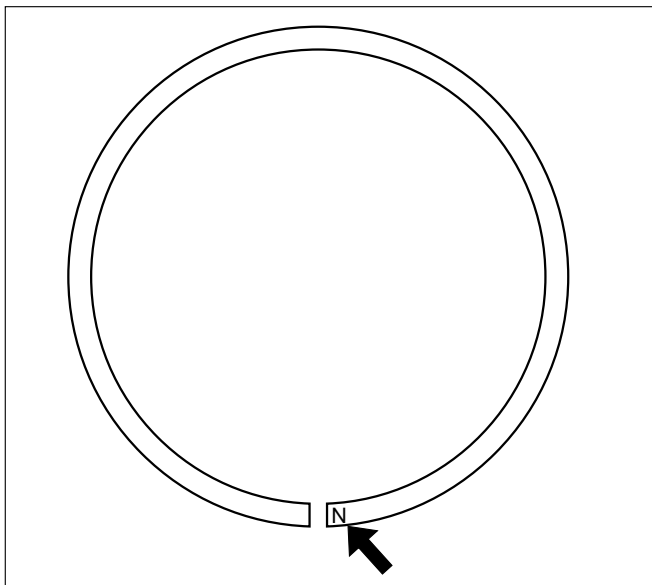
015RW051

5. Piston Ring

- 1) Install the piston rings with the piston ring expander.
The compression ring must be set with the 1N, 2N mark facing up.
- 2) Discerning mark is stamped as shown in the illustration (1).

Marked 1N: 1st compression ring

Marked 2N: 2nd compression ring

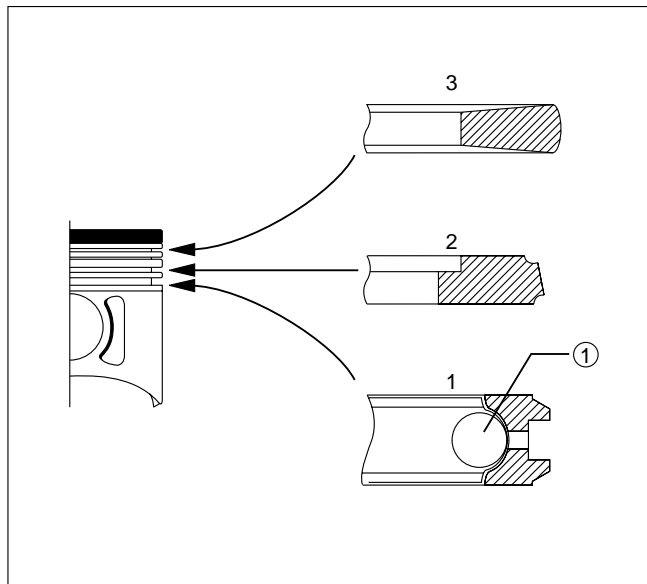


012RW037

- 3) Install piston rings in the following sequence.
 - 1) Oil ring
 - (1) After installing the expander ring then assemble the oil ring.
 - 2) 2nd compression ring

3) 1st compression ring

- 1) The compression ring must be set with the 1N or 2N mark facing up.
- 2) 1st compression ring: 1N
- 3) 2nd compression ring: 2N
- 4) After installation, apply engine oil to the entire circumference of the piston rings.
Check to see that all the rings rotate smoothly.



012RW058

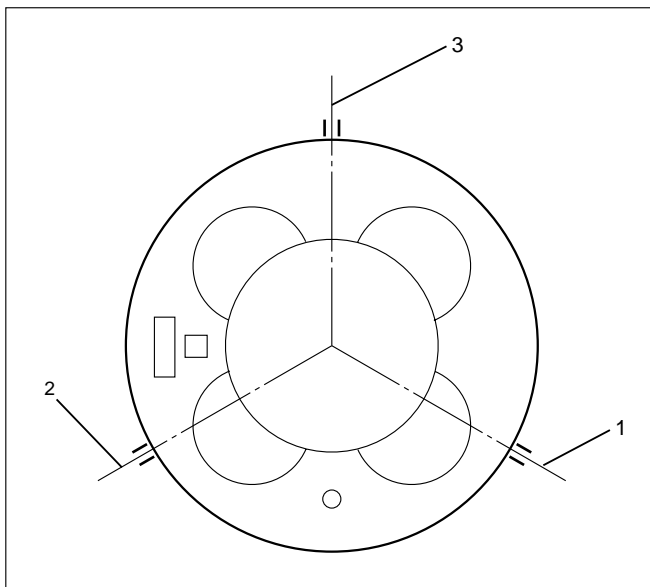
5) Insert the bearings into the connecting rods and caps.

Apply new engine oil to the bearing faces.
Cap side bearings have no oil hole.

Connecting rod side bearing's oil hole should be aligned with oil hole on the connecting rod.

6. Piston and Connecting Rod

- 1) Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.
- 2) Check to see that the piston ring end gaps are correctly positioned.



015RW083

Legend

- (1) 1st compressor ring gap
- (2) 2nd compressor ring gap
- (3) Oil ring gap

- 3) Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- 4) The front marks must be facing the front of the engine.

Piston Ring Compressor : 5-8840-9018-0

7. Connecting Rod Bearing Cap

- 1) Apply engine oil to thread and seat of bearing cap bolts.
- 2) Tighten the cap bolts in 2 steps, using angular tightening method as shown in the following specifications.

1st step: 29 N·m (3.0 kg·m/22 lb ft)

2nd step: 45°– 60°

After tightening the cap bolts, check to see that the crankshaft rotates smoothly.

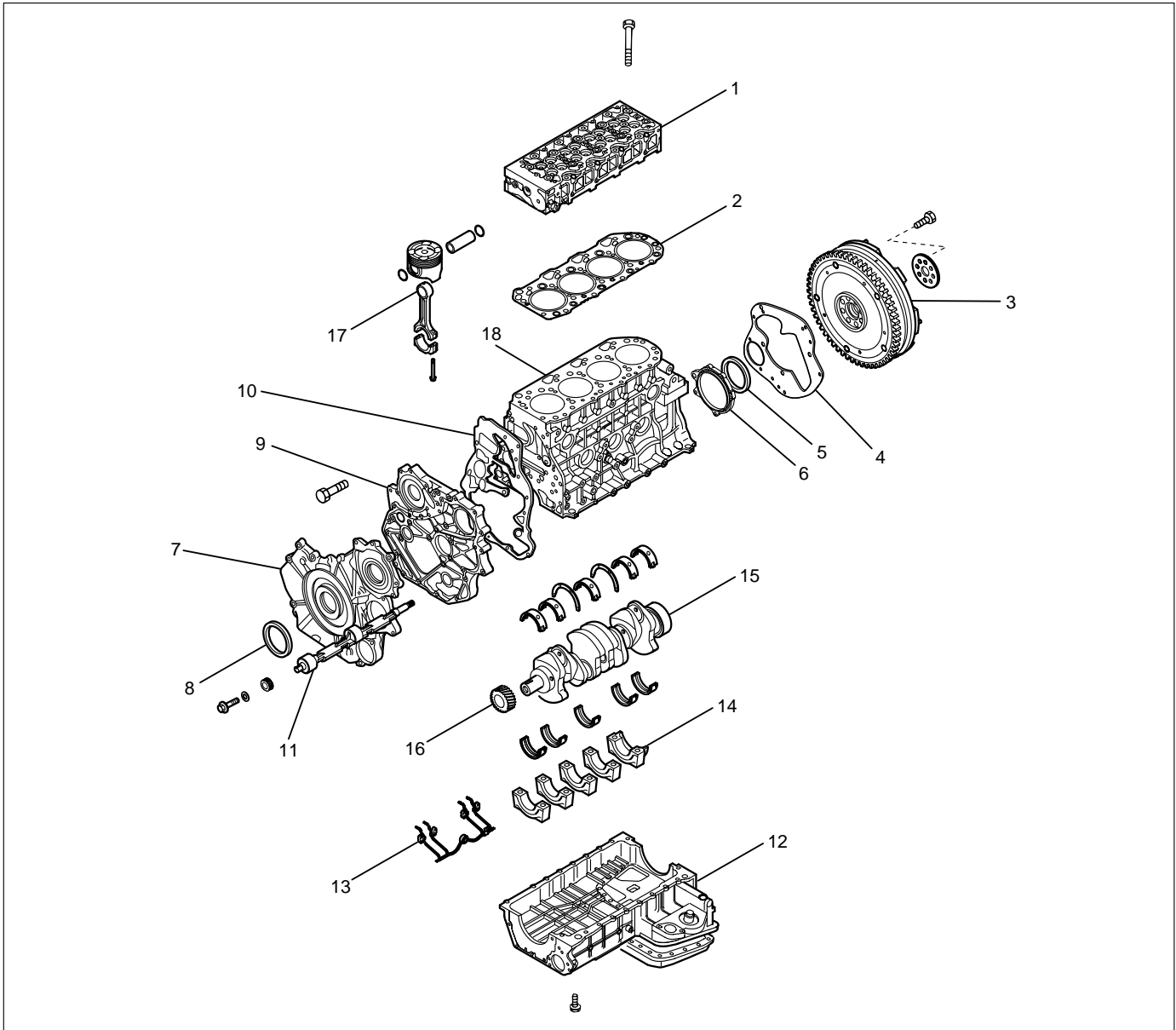
8. Crank Case Assembly

- 1) Refer to "Crank Case" in this manual.

9. Cylinder Head Assembly

- 1) Refer to "Cylinder head" in this manual.

CYLINDER BLOCK



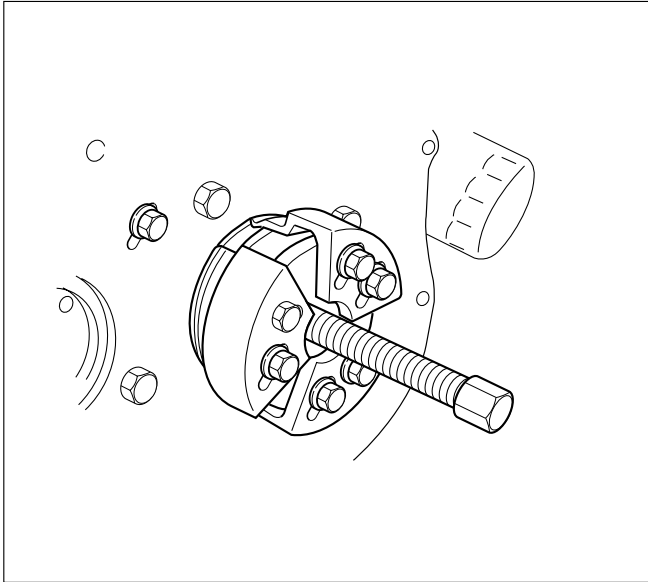
012RW023

Legend

- | | |
|---|---|
| (1) Cylinder Head | (9) Timing Gear Case |
| (2) Cylinder Head Gasket | (10) Gasket |
| (3) Flywheel | (11) Balance Shaft |
| (4) Cylinder Block Rear Plate (A/T)
Flywheel Housing (M/T) | (12) Crank Case |
| (5) Crankshaft Rear Oil Seal | (13) Piston Cooling Oil Pipe |
| (6) Retainer | (14) Main Bearing Cap |
| (7) Timing Gear Case Cover | (15) Crankshaft |
| (8) Crankshaft Front Oil Seal | (16) Crankshaft Timing Gear |
| | (17) Piston and Connecting Rod Assembly |
| | (18) Cylinder Block |

DISASSEMBLY

1. Cylinder Head Assembly
Refer to "Cylinder Head" in this manual.
2. Cylinder Head Gasket.
3. Flywheel
4. Cylinder Block Rear Plate (A/T), or Flywheel housing (M/T).
5. Crankshaft Rear Oil Seal.
Install the special tool as shown in the illustration and remove the oil seal.
Oil Seal Remover: 5-8840-2360-0



015RV002

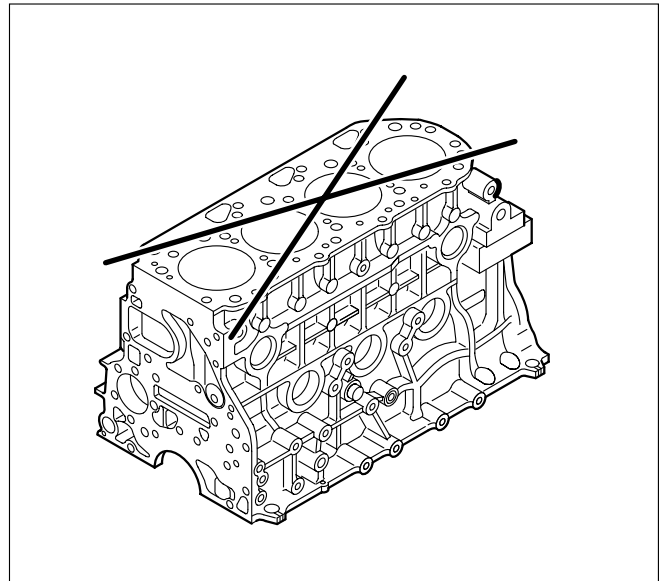
6. Retainer
7. Timing Gear Case Cover
8. Crankshaft Front Oil Seal
 - 1) Use a plastic hammer and a screwdriver to tap around the oil seal to free it from the gear case cover.
9. Timing Gears
Refer to "Timing Gear" in this manual.
10. Timing gear case
11. Gasket
12. Balance shaft right
13. Crank case assembly
14. Piston cooling oil pipe
15. Piston assembly
16. Main bearing cap
17. Crankshaft assembly
18. Cylinder block side cover right and left
19. Cylinder block

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block.
Be very careful not to allow any material to accidentally drop into the cylinder block.
Be very careful not to scratch the cylinder block.
2. Carefully remove liquid gasket, which was used when assembled, from gear case, rear oil seal retainer and crank case.
3. Wipe the cylinder block clean and visually check it.
4. Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder block upper face.
If the measured values exceed the limit, the cylinder block must be replaced.

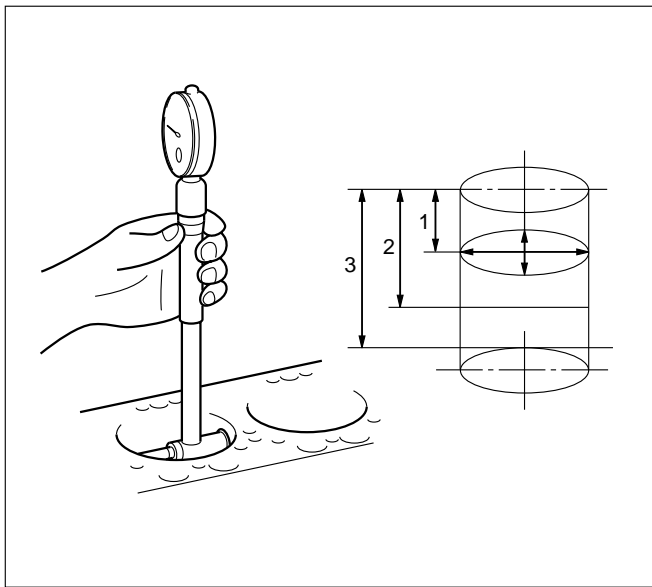
Limit: 0.20 mm (0.0079 in)



012RW122

Cylinder Bore Measurement

1. Use a cylinder gauge to measure the cylinder bore measuring direction for thrust and radial at measuring points.



012RW117

Legend

- Measuring Point 1; 20 mm
 2; 90 mm
 3; 160 mm

2. Select the right piston grade by the averaged cylinder bore measurement (maximum and minimum value eliminated).

Cylinder bore diameter mm(in)

Grade mark	Standard
A	95.421 – 95.430 (3.7567 – 3.7571)
B	95.431 – 95.440 (3.7571 – 3.7575)
C	95.441 – 95.450 (3.7575 – 3.7579)

3. If measured values exceed the limit, replace or adjust the cylinder block honing or boring.

Limit 95.950 mm (3.7776 in)

4. Boring of the cylinder bore is allowed until it is 0.5 mm (0.0197 in) diameter and oversized piston is available as a service part.

Boring Cylinder Block

1. Use an oversized piston on the basis of above mentioned cylinder using the largest inside diameter.
2. Measure the piston outside diameter at right angles with piston pin at a piston grade measuring point 69.75 mm (2.7461 in) from piston top surface and calculate a inside diameter for cylinder boring.

3. Calculation of cylinder bore boring.

$D + C - H$ (mm)

D; Outside diameter piston (mm)

C; Clearance between Cylinder bore and piston
 0.092 – 0.110 mm (0.0036 – 0.0043 in)

H; Honing allowance

Less than 0.03 mm (0.0012 in)

The oversize pistons are available three grades.

4. Honing the cylinder bore after boring.
5. Measure cylinder bore after honing.

Difference between each cylinder bore

Less than 0.02 mm (0.0008 in)

Cylinder bore and piston grade (After boring) mm(in)

Grade Mark	Outside Diameter	Bore Diameter
	95.820 – 95.829 (3.7724 – 3.7728)	95.921 – 95.930 (3.7764 – 3.7768)
95.830 – 95.839 (3.7728 – 3.7732)	95.931 – 95.940 (3.7768 – 3.7772)	
95.840 – 95.849 (3.7732 – 3.7736)	95.941 – 95.950 (3.7772 – 3.7776)	

REASSEMBLY

1. Cylinder Block
2. Piston Cooling Oil Pipe
 - 1) Fix the cooling jet pipes with knock pins on the cylinder block.
 - 2) Install the oil pipe for piston cooling in the cylinder block, tightening a relief valve (1) and four joint bolts (2) to the specified torque.

If oil jet pipe is forcibly assembled, the end of oil jet may bend. It could make it impossible to supply oil to the piston cooling hole, sometimes causing piston seizure.

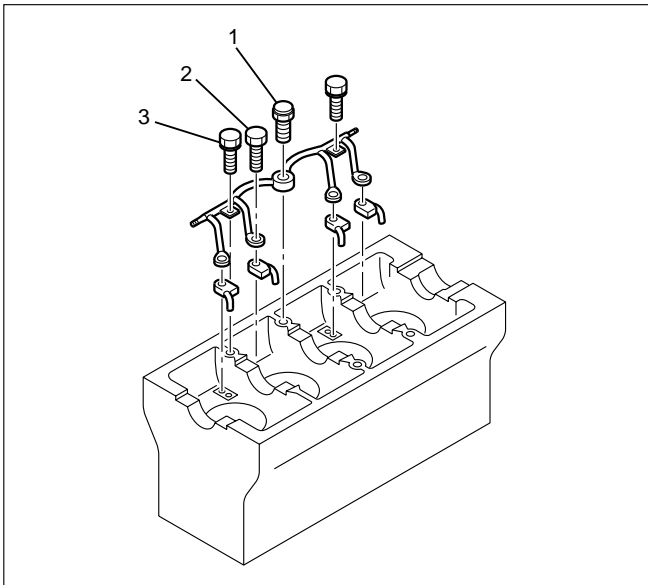
Sufficient care should be taken to pipe assembly work.

Oil pipe fixing bolts

M8: 20 N·m (2.0 kg·m/14 lb ft)

M6: 8 N·m (0.8 kg·m/69 lb in)

Relief valve fixing bolts : 30 N·m (3.1 kg·m/22 lb ft)

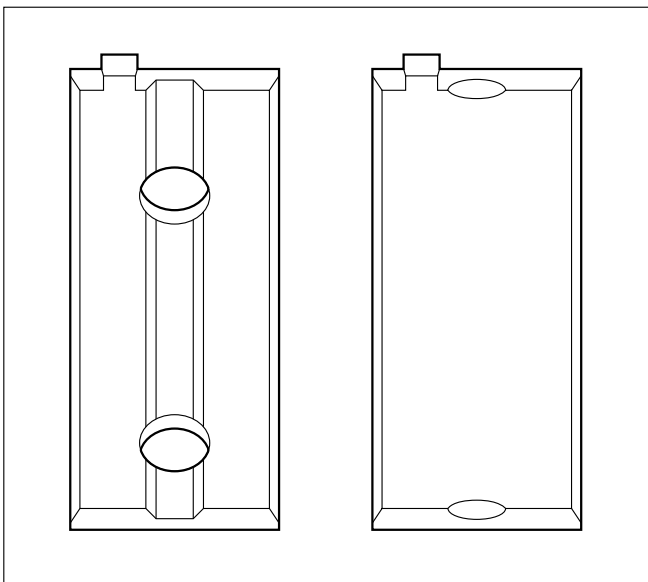


012RW076

CAUTION: After installing the piston assembly, check and see that there is appropriate clearance between pistons and oil jet pipes by rotating crankshaft slowly.

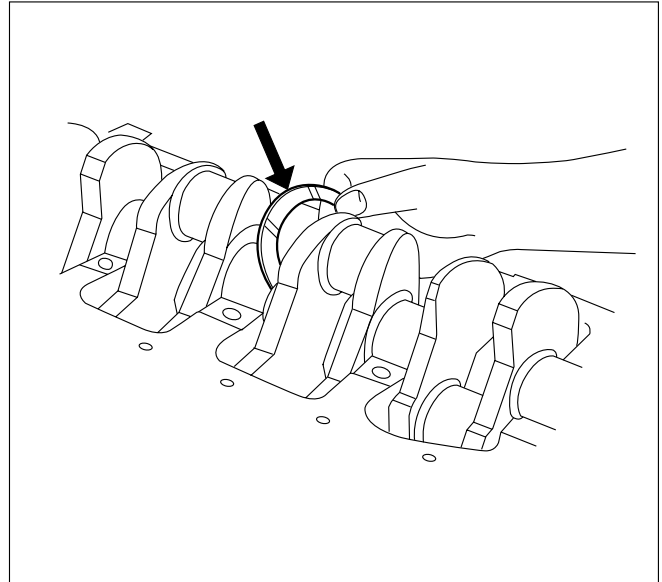
3. Crankshaft

- 1) Install the main bearings to the cylinder body and the main bearing caps.
- 2) Be sure that they are positioned correctly.
- 3) Apply new engine oil to the upper and lower main bearing faces.
- 4) Carefully mount the crankshaft.



012RW038

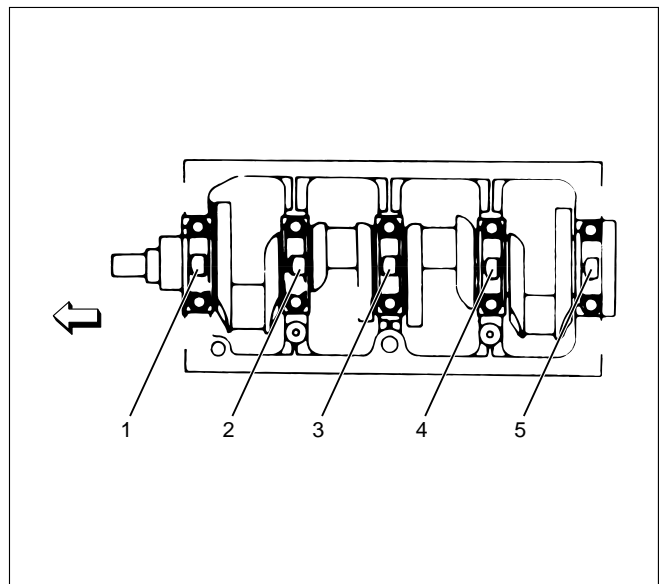
- 5) Apply engine oil to the thrust washer.
- 6) Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.



012RW047

4. Main Bearing Cap Assembly

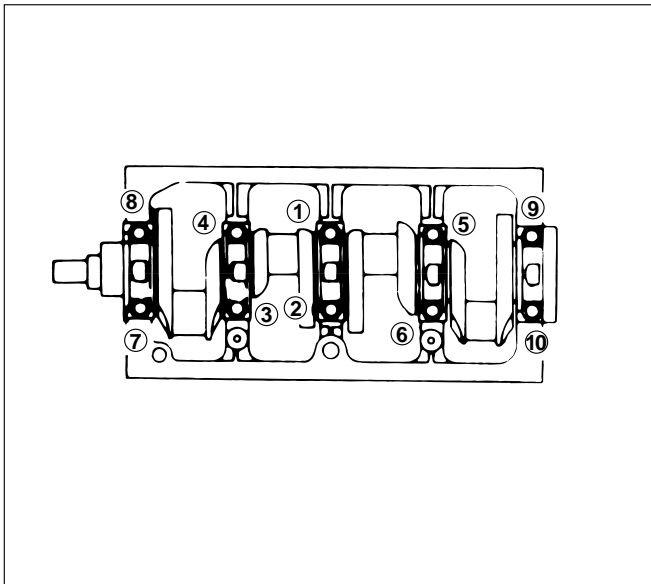
- 1) Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.



012RW025

- 2) Apply engine oil to the crankshaft bearing cap bolts.
- 3) Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

Torque: 167 N·m (17.0 kg·m/123 lb ft)



012RW027

NOTE: Check to see that the crankshaft turns smoothly by rotating it manually.

4. Piston Assembly

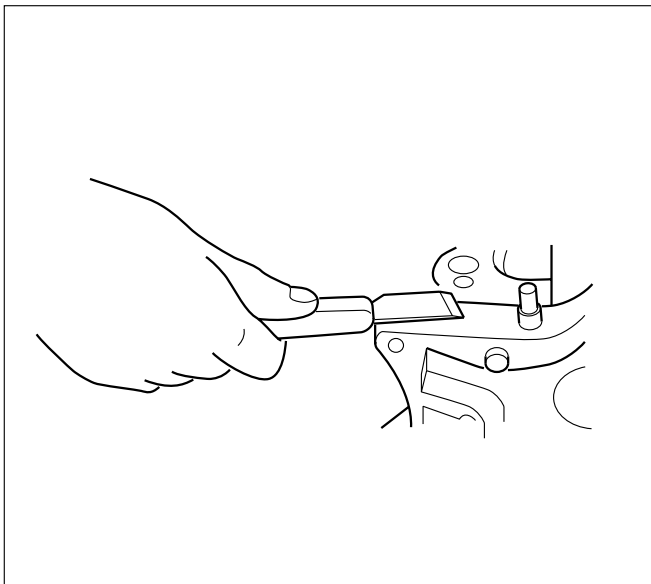
1) Refer to "Piston and connecting rod" in this manual.

5. Cylinder Block Side Cover Right and Left

6. Balance Shaft Right and Left

7. Timing Gear Case

1) Cut out the liquid gasket forced out from between the contact surface of cylinder block and crankshaft.



012RW064

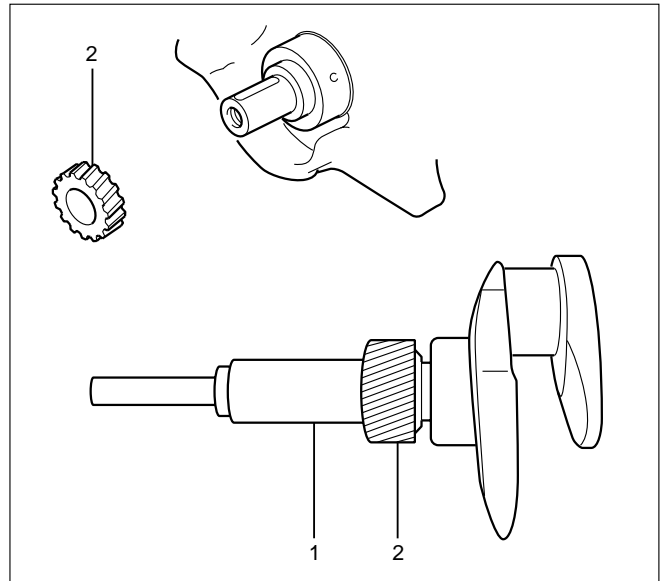
2) Apply liquid gasket (TB1207B or equivalent) to the fitting surface of the cylinder block and crankcase.

3) Install timing gear case with gasket to cylinder block and tighten to specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

8. Crankshaft Gear

Force key into crankshaft and force in crankshaft gear along the key groove using a special tool (1) with the crank gear (2) timing mark facing outside.



012RW066

9. Install timing gear align the timing mark on each timing gear.

For alignment of timing marks refer to "Timing Gear" in this manual.

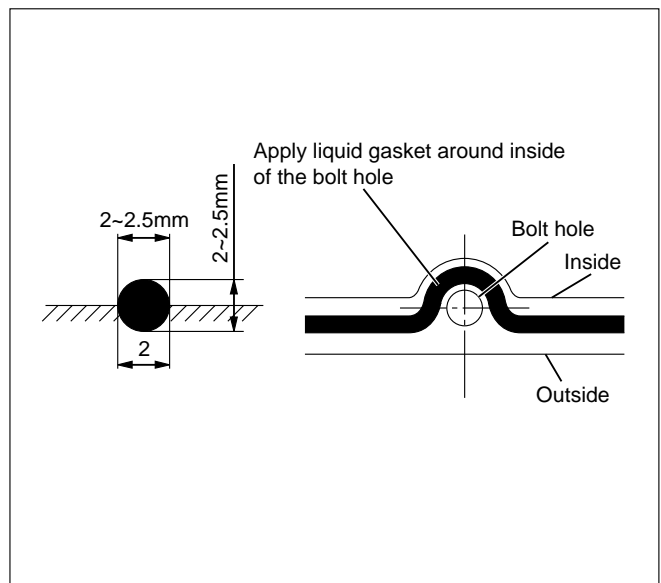
NOTE: Remove the locking bolt or pin from idle gear A and idle gear C.

10. Assembling the gear case cover.

1) Install the oil seal on the oil pump assembly before installing the gear case cover.

2) Apply liquid gasket to timing gear case.

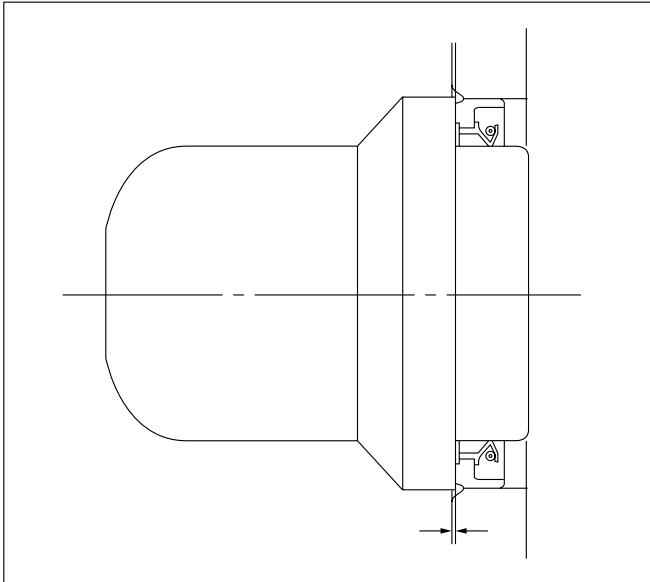
NOTE: Be sure to apply liquid gasket evenly.



F06HX00001

11. Use the special tool to install the crankshaft front oil seal to timing gear case.

Front Oil Seal Installer: 5-8840-2061-0



015RW074

- 1) Check fit-of the oil seal and gear case cover at the front end.

Standard: 0.5 – 2.5 mm (0.0197 – 0.0984 in)

NOTE: Apply engine oil to oil seal lip before installation of the seal.

12. Install the oil pan assembly to original position and tighten to specified torque.

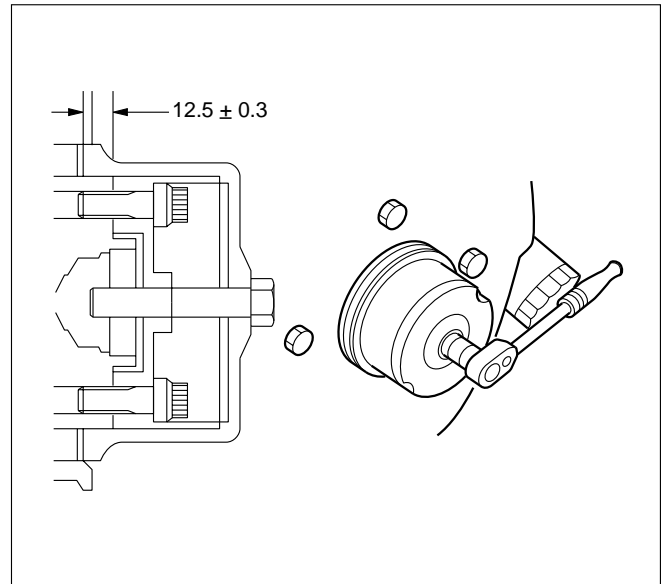
Torque: 22 N·m (2.2 kg·m/15.9 lb ft)

13. Crankshaft Rear Oil Seal

- 1) Tighten the adapter to the crankshaft rear end with 2 bolts.
- 2) Insert the oil seal into the adapter.
- 3) Insert the sleeve into the adapter and tighten it with a bolt (M12 x 1.75L = 70) until the adapter hits the sleeve.
- 4) Remove the adapter and the sleeve.
- 5) With the seal pressed in, check the dimension of the oil seal outside end and crankshaft end.

Standard Dimension = 12.5 ± 0.3 mm

Oil Seal Installer: 5-8840-2359-0



012RW067

14. Cylinder Block Rear Plate (A/T Model)

- 1) Tighten the cylinder block rear plate fixing bolts to the specified torque.

Torque: 97 N·m (9.9 kg·m/72 lb ft)

15. Flywheel Housing (M/T Model)

- 1) Install flywheel housing aligned with the dowel pin on the cylinder block.
- 2) Tighten the flywheel housing fixing bolts to the specified torque.

Torque: 97 N·m (9.9 kg·m/72 lb ft)

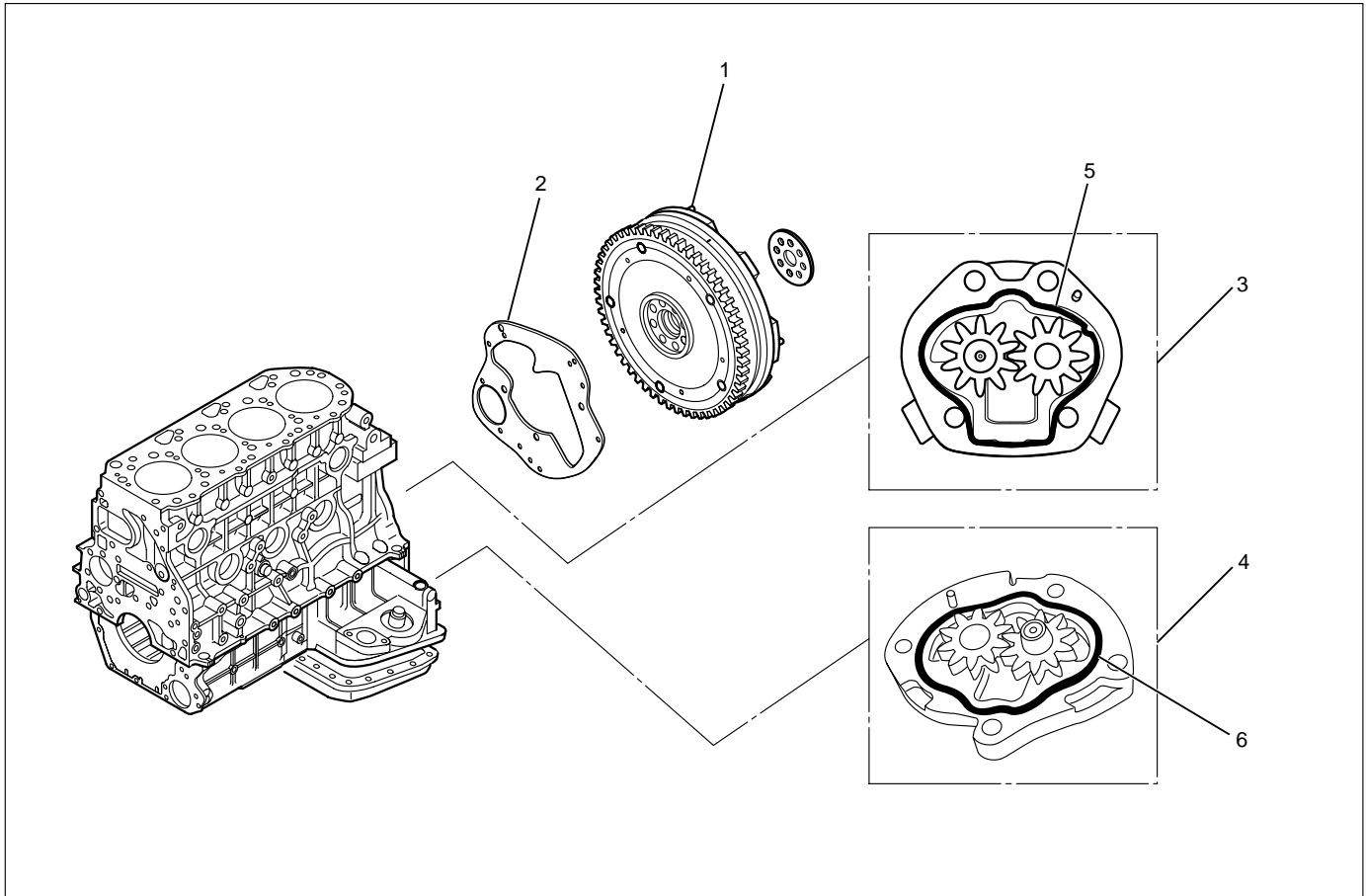
16. Flywheel

- 1) Refer to "Crankshaft" in this manual.

17. Cylinder Head Assembly

- 1) Refer to "Cylinder Head" in this manual.

OIL PUMP ASSEMBLY



012RW097

Legend

- (1) Flywheel
- (2) Rear Plate (A/T)
- (3) First Oil Pump Assembly

- (4) Second Oil Pump Assembly
- (5) O-Ring (For first oil pump)
- (6) O-Ring (For second oil pump)

REMOVAL

1. Disconnect battery ground cable
2. Lift up car
3. Drain engine oil

NOTE: Install drain plug with new gasket.

4. Flywheel
5. Rear Plate (A/T) or Flywheel Housing (M/T)
6. First Oil Pump Assembly and Second Oil Pump Assembly
 - 1) Remove oil pump assembly from cylinder block and crankcase.

INSTALLATION

1. First oil pump assembly
 - 1) Set O-ring to oil pump.
 - 2) Install oil pump drive gear to the rear end of the balance shaft RH.
 - 3) Apply engine oil to pump gear, install pump gear to rear end of cylinder block with specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

2. Second oil pump assembly
 - 1) Set O-ring to oil pump.
 - 2) Install oil pump drive gear to the rear end of the balance shaft LH.
 - 3) Apply engine oil to pump gear, install pump gear to rear end of crank case with specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

3. Install rear plate (A/T) or flywheel housing (M/T)

Torque: 97 N-m (9.9 kg-m/72 lb ft)

4. Install flywheel
 - 1) Apply engine oil to bolt and tighten with angular tightening method.

First step: 59 N-m (6.0 kg-m/43 lb ft)

Second step: 60° to 90°

OIL FILTER CARTRIDGE

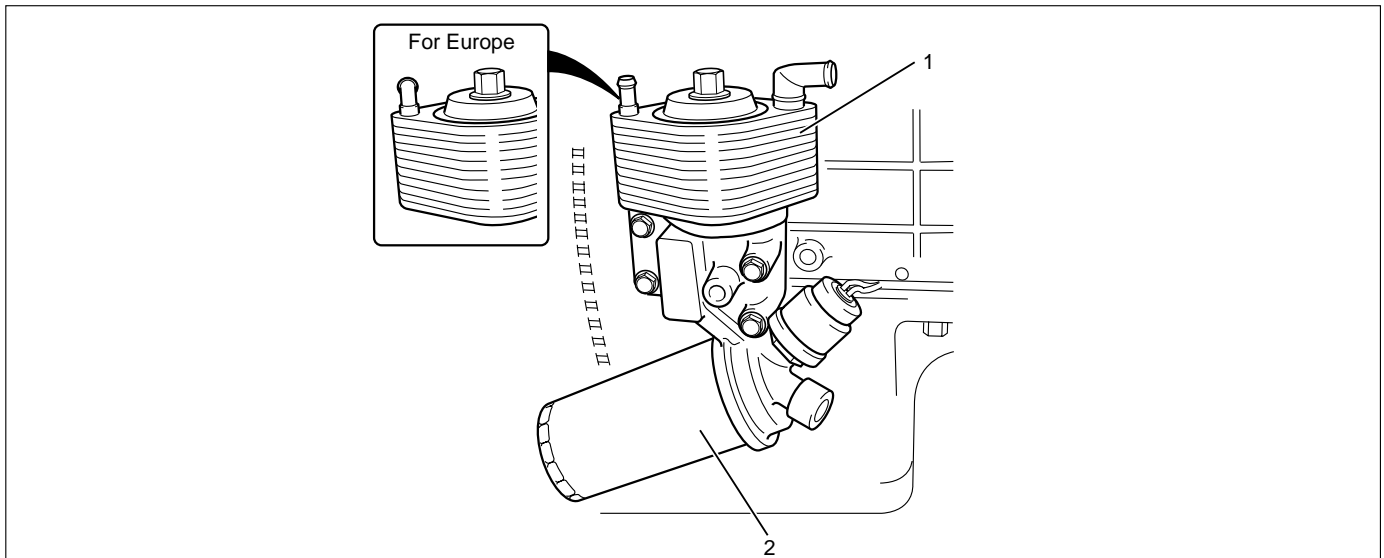
REMOVAL

1. Place a receptacle beneath the oil filter to contain the drained oil.
2. Remove the oil filter cartridge using filter wrench.
Filter wrench : 5-8840-0203-0

INSTALLATION

1. Lightly apply oil to the O-ring of oil filter cartridge.
2. Turn the new oil filter cartridge by hand until the sealing face is fitted against the O-ring.
3. Use the filter wrench to turn the oil filter an additional one and 1/8 turns.
4. Start the engine and check for oil leakage from oil filter.

OIL COOLER



050R200001

Legend

- (1) Oil Cooler Assembly
- (2) Oil Filter Cartridge

REMOVAL

1. Disconnect battery ground cable
2. Drain engine coolant
3. Remove front exhaust pipe
4. Remove heat protector
5. Remove exhaust valve assembly
6. Oil cooler assembly
 - 1) Remove water hoses from inlet and outlet pipe.
 - 2) Put rag beneath side of oil cooler to prevent oil leaking.
 - 3) Remove fixing bolts and oil cooler assembly.

INSTALLATION

1. Oil Cooler
 - 1) Tighten oil cooler fixing bolt to the specified torque and connect water hose.

Torque: 29 N·m (3.0 kg·m/22 lb ft)

2. Exh. Valve Assembly
 - 1) Install exhaust valve assembly with gasket and tighten fixing bolts to the specified torque.

Torque: 27 N·m (2.7 kg·m/20 lb ft)

3. Heat Protector
4. Front Exhaust Pipe
 - 1) Install front exhaust pipe and tighten fixing bolts to the specified torque.

Exh. Valve Side: 67 N·m (6.8 kg·m/50 lb ft)

Intermediate Pipe Side: 43 N·m (4.4 kg·m/32 lb ft)

5. Fill engine coolant.
6. Connect battery ground cable.
7. Start engine and check for oil and water leakage carefully.

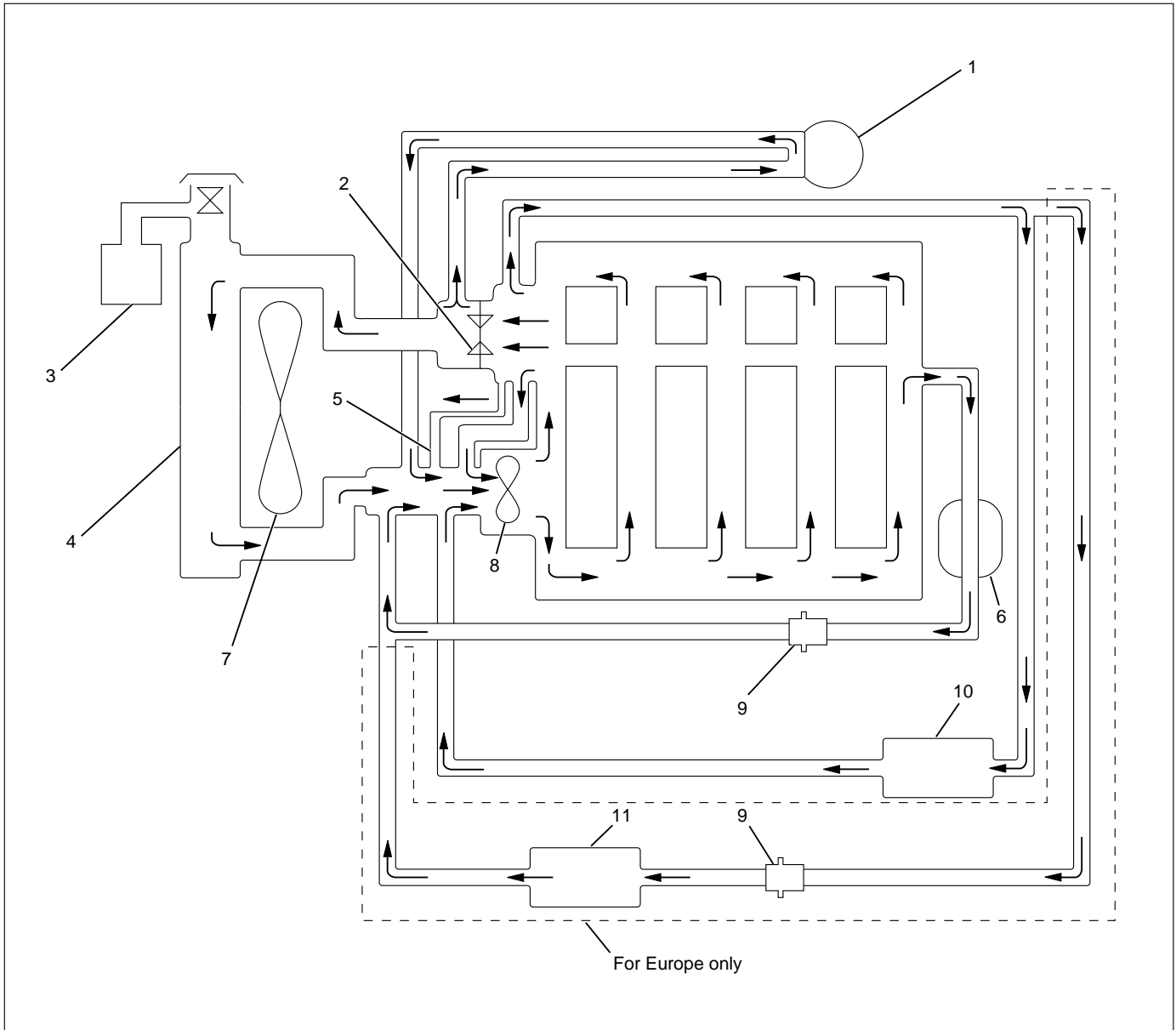
ENGINE COOLING

CONTENTS

General Description	6B-2	Thermostat	6B-7
On-Vehicle Service	6B-6	Radiator	6B-9
Water Pump	6B-6	Drive Belt Adjustment	6B-11

GENERAL DESCRIPTION

COOLANT FLOW



032R200001

Legend

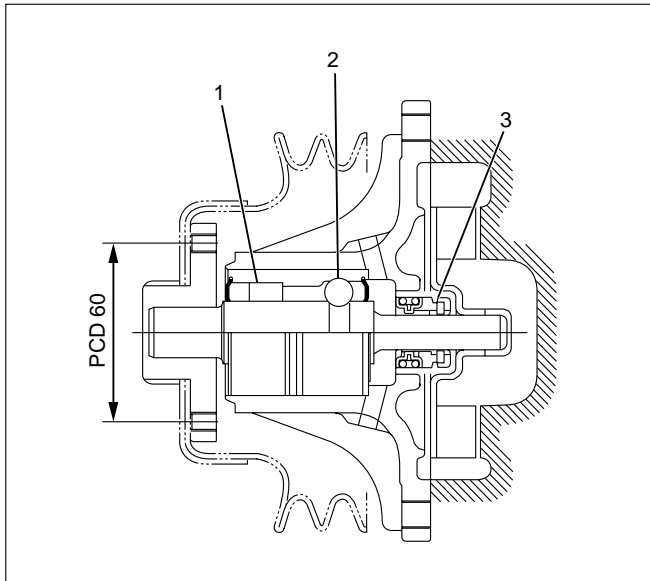
- | | |
|--------------------|------------------|
| (1) Turbocharger | (6) Oil Cooler |
| (2) Thermostat | (7) Cooling fan |
| (3) Reservoir Tank | (8) Water Pump |
| (4) Radiator | (9) Thermo Valve |
| (5) Bypass | (10) Car Heater |
| | (11) EGR Cooler |

The cooling system is a pressurized coolant forced circulation type which consists of water pump, thermostat, cooling fan, radiator and other components.

The circulating coolant cools the lubricating oil in the oil cooler and turbocharger.

WATER PUMP

The coolant pump is a centrifugal impeller type and is driven by V type drive belt.



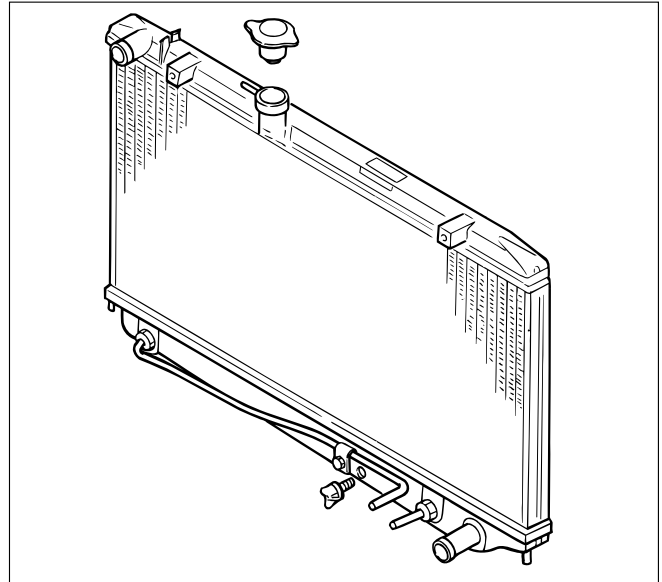
A06RW024

Legend

- (1) Roller Bearing
- (2) Ball Bearing
- (3) Seal Unit

RADIATOR

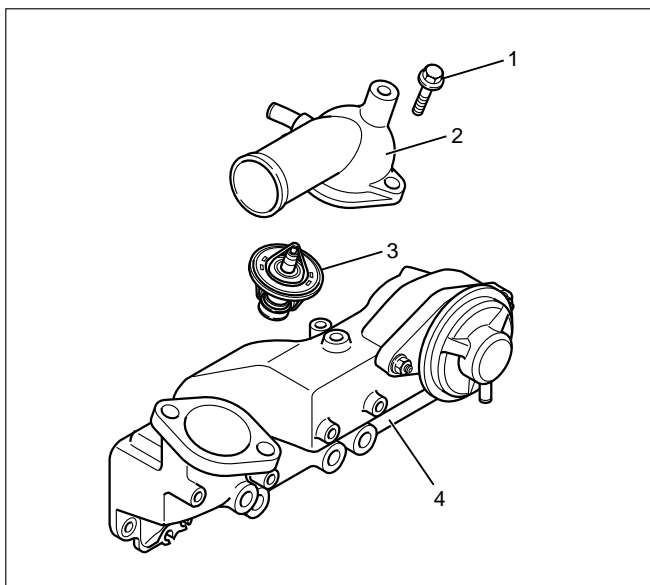
The radiator is a tube type with corrugated fins. In order to raise the boiling point of coolant, the radiator is fitted with a cap in which the valve is operated under the pressure.



110RS001

THERMOSTAT

The thermostat is a wax pellet type with a jiggle valve and is installed in the thermostat housing.



032RW002

Legend

- (1) Bolt
- (2) Thermostat Housing
- (3) Thermostat
- (4) Intake Manifold

ANTI-FREEZE SOLUTION

- Relation between Mixing ratio and Freezing point
Freezing temperature of the engine coolant varies with the ratio of anti-freeze solution in water.
Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

- Calculation of mixing ratio

Mixing ratio (%)

$$= \frac{\text{Anti-freeze solution (Lit/qt.)}}{\text{Anti-freeze solution (Lit/qt.)} + \text{Water (Lit/qt.)}} \times 100$$

For example

In case total coolant capacity = 10 l

It is necessary to mix about 35% anti-freeze solution at ambient temperature minus 20°C.

Capacity of anti-freeze solution:

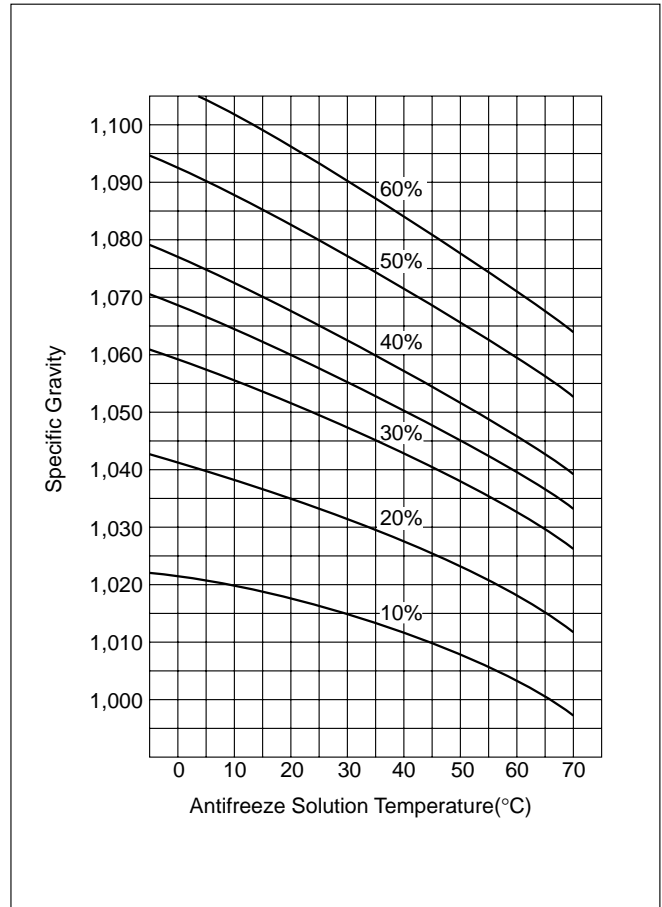
$$\frac{35}{100} \times 10 = 3.5 \text{ l}$$

Water capacity: 10 l – 3.5 l = 6.5 l

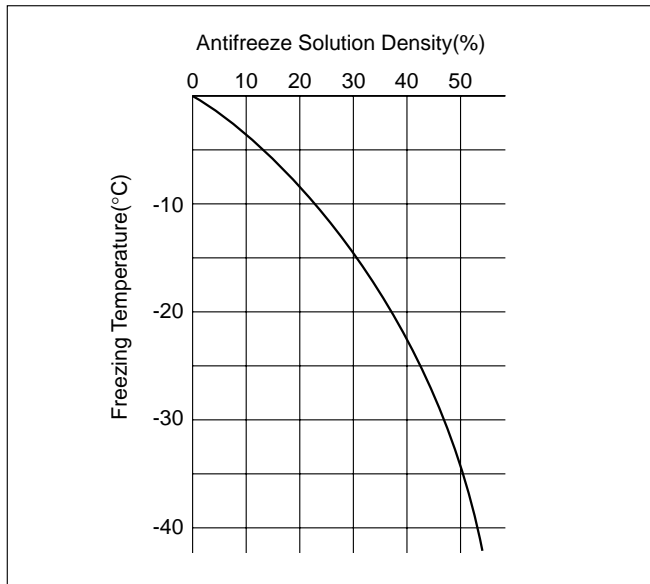
Therefore, you prepare the water 6.5 l and anti-freeze solution 3.5 l, then mix them to get total 10 l coolant.

- Mixing ratio

Check the specific gravity of engine coolant in the cooling system in temperature ranges from 0° C to 50° C using a suction type hydrometer, then determine the density of the coolant by referring to the table at below.



B06RW017



B06RW018

ENGINE COOLANT CHANGE PROCEDURE

1. To change engine coolant, make sure that the engine is cool.

WARNING:

When the coolant is heated to a high temperature, be sure not to loosen or remove the radiator cap. Otherwise you might get scalded by hot vapor or boiling water. To open the radiator cap, put a piece of thick cloth on the cap and loosen the cap slowly to reduce the pressure once the coolant has become cooler.

2. Open radiator cap and drain the cooling system by loosening the drain valve on the radiator and on the cylinder body.

NOTE: For best results it is suggested that the engine cooling system be flushed at least once a year. It is advisable to flush the interior of the cooling system including the radiator before using anti-freeze (ethylene-glycol based).

Replace damaged rubber hoses as the engine anti-freeze coolant is liable to leak out even minor cracks. Isuzu recommends using Isuzu genuine anti-freeze (ethylene-glycol based) or equivalent, for the cooling system and not add any inhibitors or additives.

CAUTION:

A failure to correctly fill the engine cooling system in changing or topping off coolant may sometimes cause the coolant to overflow from the filler neck even before the engine and radiator are completely full.

If the engine runs under this condition, shortage of coolant may possibly result in engine overheating. To avoid such trouble, the following precautions should be taken in filling the system.

3. To refill engine coolant, pour coolant up to filler neck using a filling hose which is smaller in outside diameter than the filler neck. Otherwise air between the filler neck and the filling hose will block entry, preventing the system from completely filling up.
4. Keep a filling rate of 9 liter/min. or less. Filling over this maximum rate may force air inside the engine and radiator.
And also, the coolant overflow will increase, making it difficult to determine whether or not the system is completely full.
5. After filling the system full, pull out the filling hose and check to see if air trapped in the system is dislodged and the coolant level goes down. Should the coolant level go down, repeat topping-off until there is no more drop in the coolant level.
6. Directly after filling the radiator, fill the reservoir to the maximum level.
7. Install and tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.

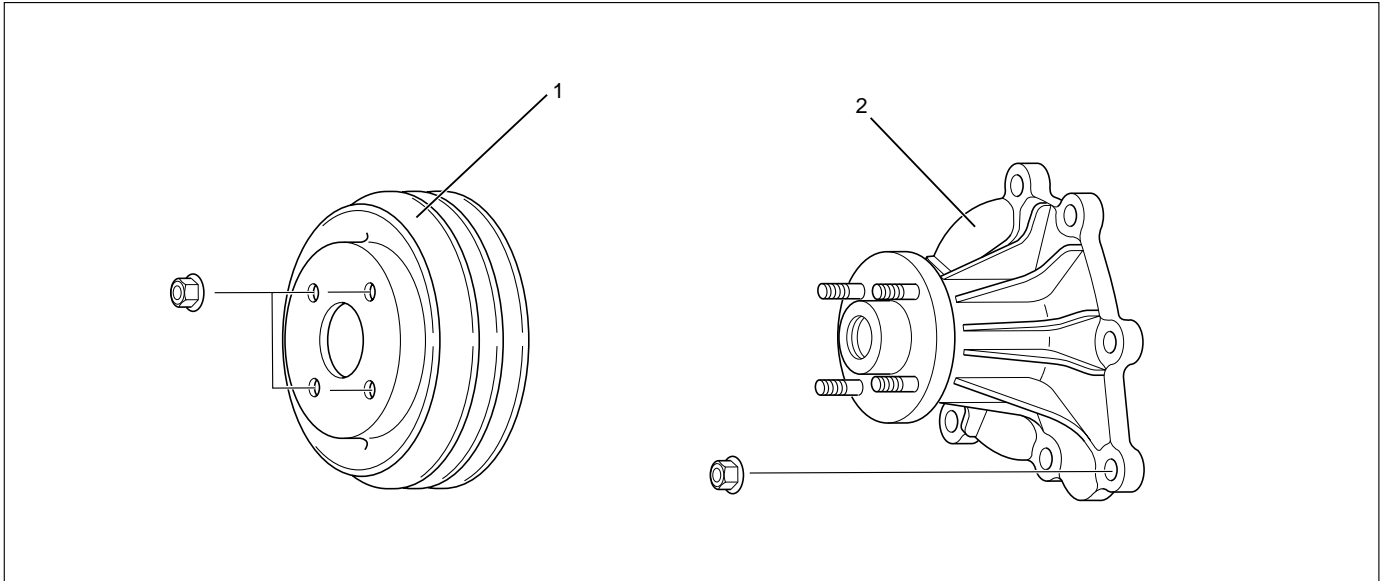
WARNING:

When the coolant is heated to a high temperature, be sure not to loosen or remove the radiator cap. Otherwise you might get scalded by hot vapor or boiling water. To open the radiator cap, put a piece of thick cloth on the cap and loosen the cap slowly to reduce the pressure once the coolant has become cooler.

8. After tightening radiator cap, warm up the engine at about 2,000 rpm.
Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
9. Check to see the thermostat has opened by the needle position of a water thermometer, conduct a 5-minute idle again and stop the engine.
10. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant be found, check the coolant system and reservoir tank hose for leakage.
11. Fill the coolant into the reservoir tank up to "MAX" line.

ON-VEHICLE SERVICE

WATER PUMP



030RW009

Legend

- (1) Fan Pulley
- (2) Water Pump Assembly

REMOVAL

1. Drain coolant.
2. AC Generator Drive Belt
 - 1) Loosen AC Generator mounting bolt, adjust plate lock bolt, and remove the drive belt.
3. Cooling Fan Assembly
 - 1) Remove lock nut and take out cooling fan assembly with cooling fan clutch.
4. Water Pump Assembly

INSPECTION

Make necessary repair and parts replacement if excessive wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced.

- 1) Cracks in the water pump body
- 2) Coolant leakage from the seal unit
- 3) Excessive play in radial direction or abnormal noise
- 4) Excessive play in thrust direction
 - Limit : 0.2mm (0.008in) or less
- 5) Cracks or corrosion in the impeller

INSTALLATION

1. Gasket
 - 1) Set gasket to gear case.
2. Water Pump Assembly
 - 1) Install water pump assembly, and tighten to specified torque.

Torque: 20 N-m (2.0 kg-m/14.5 lb ft)

3. Cooling Fan Assembly

- 1) Install cooling fan assembly, and tighten to specified torque.

Torque: 8 N-m (0.8 kg-m/5.8 lb ft)

4. AC Generator Drive Belt

- 1) Install AC Generator drive belt and adjust belt tension.

Torque: 40 N-m (4.1 kg-m/29.7 lb ft)

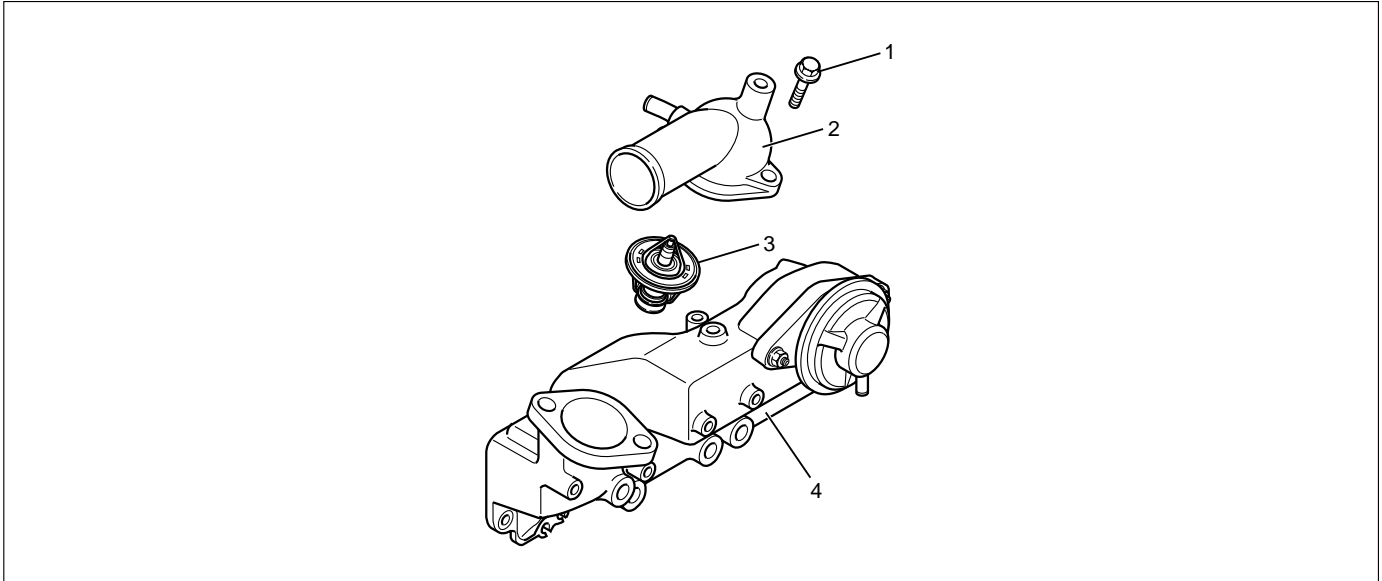
For ACG to bracket

20 N-m (2.0 kg-m/14.5 lb ft)

For ACG to adjust plate

5. Fill coolant to specified capacity.

THERMOSTAT



035RW002

Legend

- (1) Bolt
- (2) Thermostat Housing
- (3) Thermostat
- (4) Intake Manifold

REMOVAL

1. Disconnect battery ground cable.
2. Drain coolant from the radiator and engine.
3. Thermostat housing
 - 1) Remove mounting bolt and remove thermostat housing together with radiator hose.
4. Gasket
5. Thermostat

INSPECTION

Make necessary repair and parts replacement if excessive wear or damage is found during inspection. Submerge the thermostat assembly in the water. Place wooden blocks on the bottom of the water container.

Do not heat the thermostat directly.

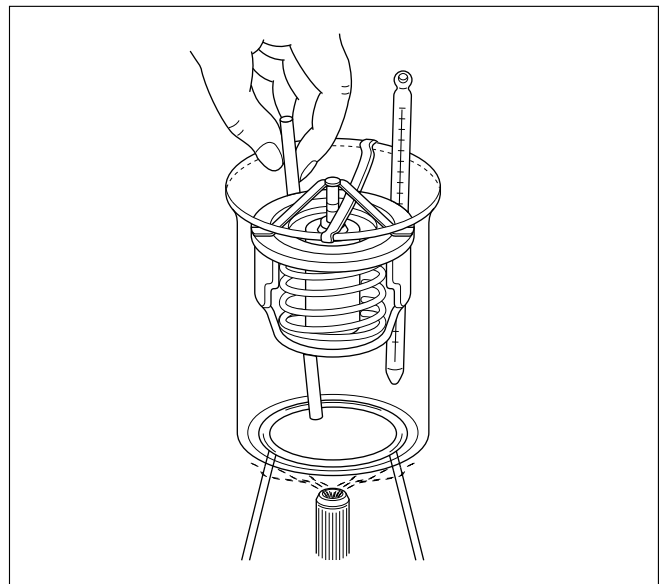
Gradually increase the water temperature. Stir the water so that the entire water is the same temperature.

- 1) Make sure that valve begins to open at the specified temperature.

Valve Opening Temperature: 85°C (185°F)

- 2) Make sure that valve opens fully at the specified temperature.

Valve Full Open Temperature: 100°C (212°F)



031RS003

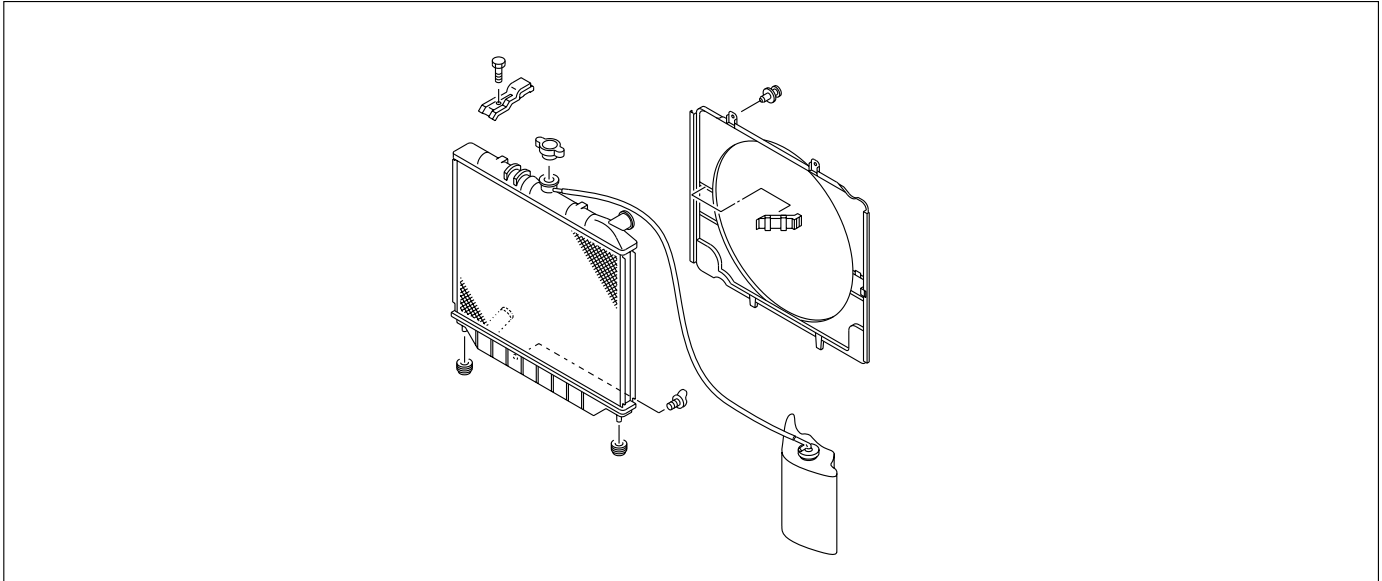
INSTALLATION

1. Thermostat
 - 1) The jiggle valve of the thermostat must face the cylinder head side.
2. Gasket
3. Install thermostat housing and tighten bolt to the specified torque.

Torque: 20 N·m (2.0 kg·m/14.5 lb ft)

4. Reconnect water hose
 - 1) Fill coolant to full level.
 - 2) Reconnect battery ground cable.
5. Start the engine check for coolant leakage.

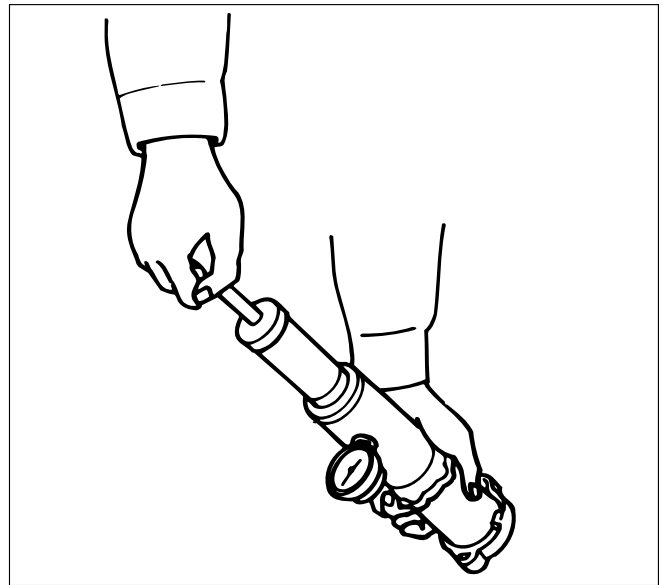
RADIATOR



110RW017

REMOVAL

1. Disconnect battery ground cable
2. Loosen drain plug to drain coolant.
3. Radiator Hose
 - 1) Disconnect lower hose and upper hose from the engine.
4. Fan Guide
 - 1) Remove clips on both sides and the bottom lock.
5. Reservoir Tank Hose
 - 1) Disconnect the hose from radiator.
6. Bracket
7. Radiator Assembly
 - 1) Remove the radiator assembly upward by the hoses taking care not to damage the radiator core by the fan blade.
 - 2) Remove rubber cushions on both sides of the bottom.



110RS006

INSPECTION

Radiator Cap

- 1) Measure the valve opening pressure with the radiator cap tester. Replace the radiator cap if it exceeds the standard.

Valve opening pressure: 93.2 – 122.7 kPa
(0.95 – 1.25 kg/cm² /
13.5 – 17.8 psi)

Check the condition of the negative pressure valve in the center of the valve seat side of the cap. If the valve seat does not move smoothly due to rust or dust, clean and replace the radiator cap.

Radiator Core

- 1) Deformed radiator fins could reduce radiation effects, resulting in overheating. Straighten the fins. In such a case, take care not to damage the fin roots.
- 2) Remove dust and other foreign materials.

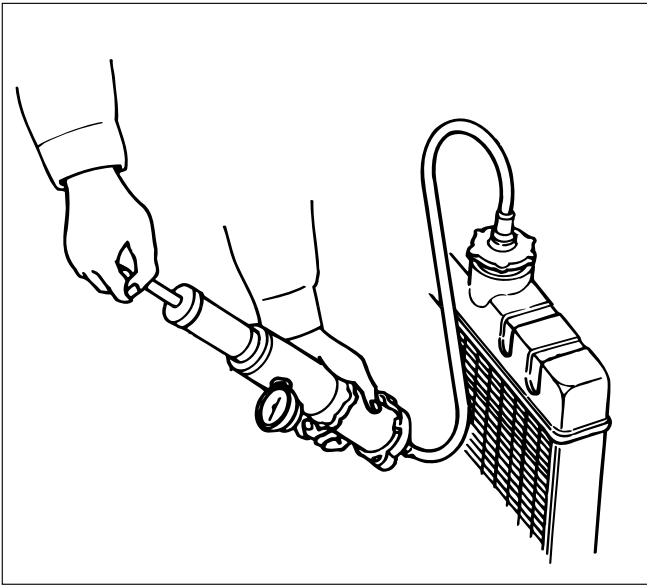
Flushing the Radiator

- 1) Wash the inside of radiator and the coolant passage with water and a neutral detergent. Remove all scales and rust.

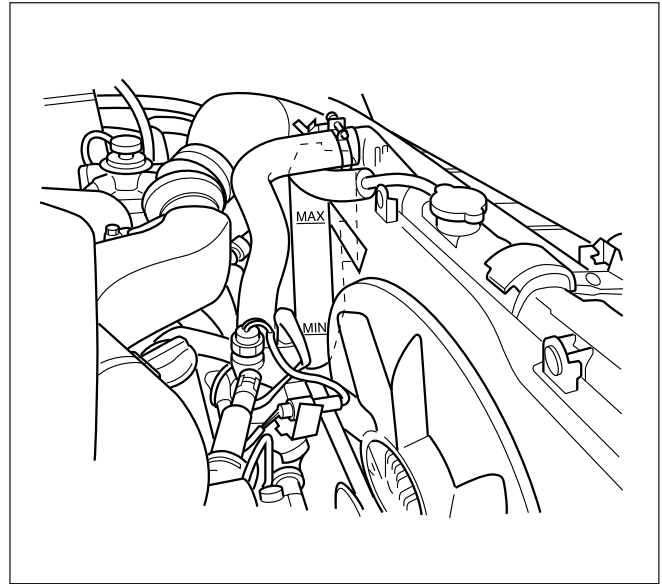
6B – 10 ENGINE COOLING

Checking for Coolant Leakage

- 1) Check the cooling system for leakage with the radiator cap tester by applying 196.0 kPa (28.4 psi) air pressure from filler neck to inside the radiator.



110RS005

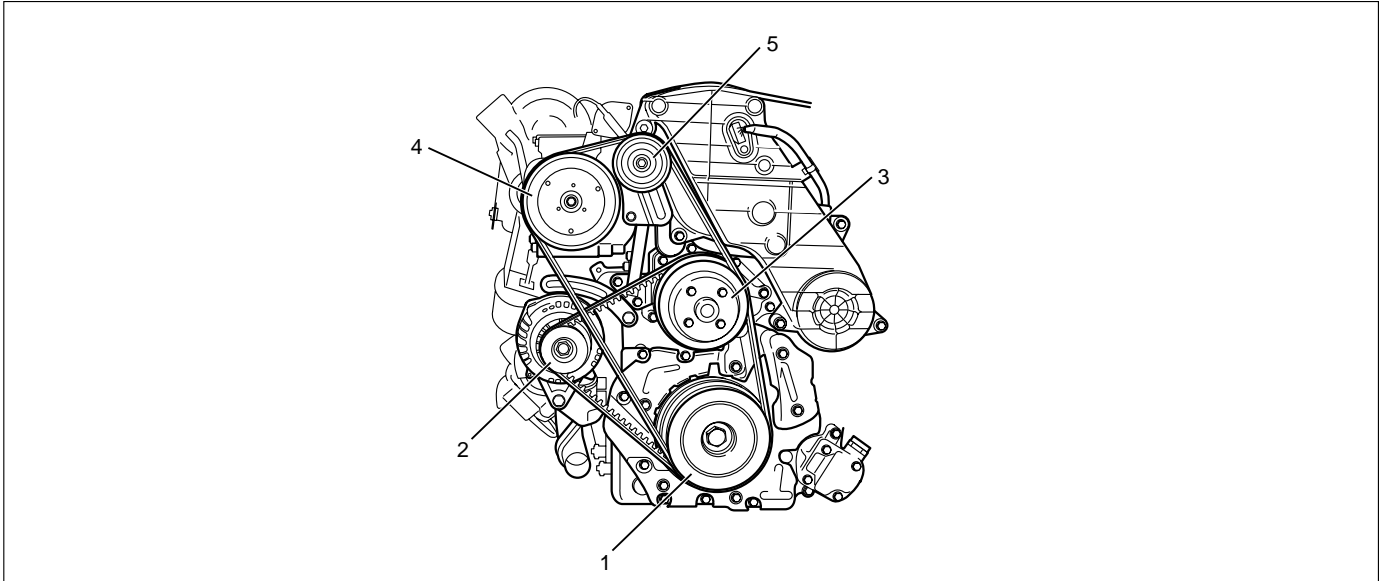


012RW080

INSTALLATION

1. Radiator Assembly
 - 1) Install rubber cushions on both sides of radiator bottom.
 - 2) Install radiator assembly with hose, taking care not to damage the radiator core by a fan blade.
2. Bracket
 - 1) Support the radiator upper tank with the bracket and fix the radiator.
3. Reserve Tank Hose
4. Fan Guide, Lower
5. Radiator Hose
 - 1) Connect inlet hose and outlet hose to the engine.
 - 2) Connect battery ground cable.
 - 3) Pour coolant up to filler neck of radiator, and up to MAX mark of reserve tank.
 - 4) Start engine to warm up, and check for coolant level. Replenish coolant if it does not reach the radiator filler neck, and tighten the cap completely.

DRIVE BELT ADJUSTMENT



012RW085

Legend

- (1) Crankshaft Pulley
- (2) A.C. Generator
- (3) Cooling Fan Pulley
- (4) A/C Compressor
- (5) Belt Tensioner Pulley

INSPECTION

Check drive belts for wear or damage, and replace with new ones as necessary. Check belts for tension, and adjust as necessary.

- 1) Check drive belt tension.
- 2) Push the middle of belt with a force of 98 N (10 kg/22 lb) and check each belt for deflection.

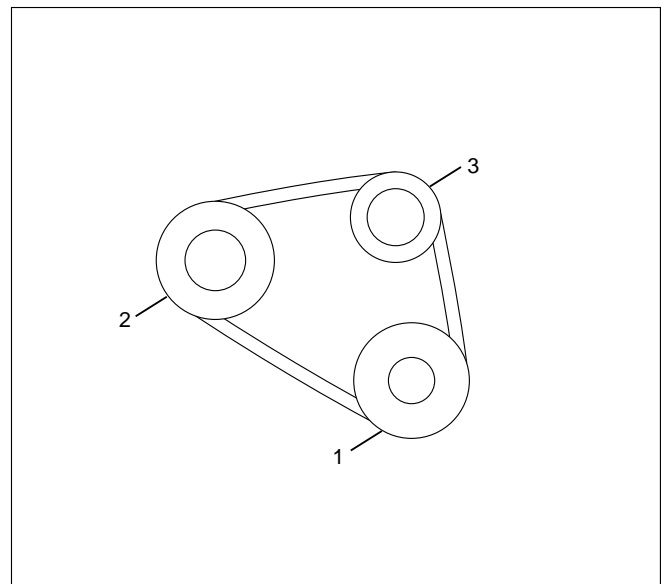
Standard deflection:

For A.C. generator & fan pulley drive belt
 Initial tension : 8 – 12 mm (0.31 – 0.47 in)
 Tension at readjustment : Same as above.

For A/C compressor drive belt
 Initial tension : 7 – 10 mm (0.28 – 0.38 in)
 Tension at readjustment : 5 – 8 mm (0.20 – 0.31 in)

TENSION ADJUSTMENT

- 1) Loosen AC generator mounting bolt to move AC generator, adjust belt tension and tighten to the specified torque.



012RW084

Legend

- (1) Crankshaft Pulley
- (2) A.C. Generator Pulley
- (3) Cooling Fan Pulley

6B – 12 ENGINE COOLING

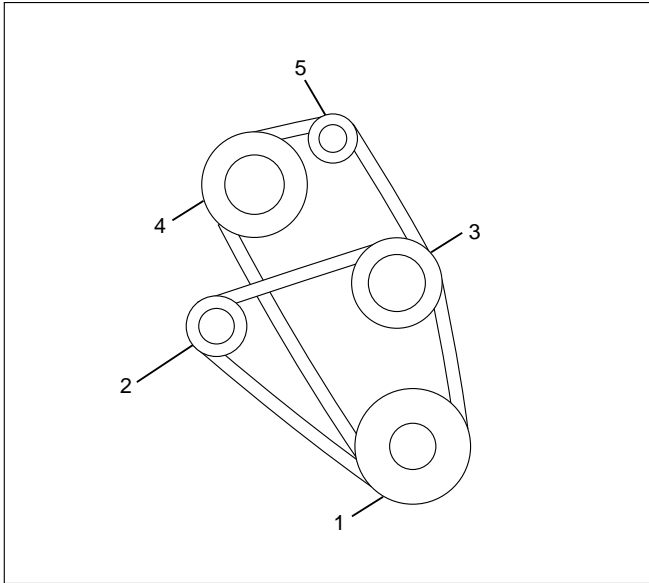
Torque:

For A.C. Generator fixing bolt
40 N·m (4.1 kg·m/29.7 lb ft)

For Adjusting plate fixing bolt
24 N·m (2.4 kg·m/17.4 lb ft)

For Adjusting plate lock bolt
19 N·m (1.9 kg·m/13.7 lb ft)

- 2) Adjust the A/C compressor drive belt by tightening the belt tensioner bolt.



012RW110

Legend

- (1) Crankshaft Pulley
 - (2) A.C. Generator Pulley
 - (3) Cooling Fan Pulley
 - (4) A/C Compressor Pulley
 - (5) Belt Tensioner Pulley
-

ENGINE FUEL CONTENTS

General Description	6C-1	High Pressure Oil Pump	6C-15
On-Vehicle Service	6C-7	Fuel Tank	6C-20
Fuel Filter Assembly	6C-7	Fuel Gauge Unit	6C-21
Fuel Filter Cartridge	6C-7	Fuel Filler Cap	6C-21
Injector	6C-9		
Fuel Pump Pipe	6C-13		

GENERAL DESCRIPTION

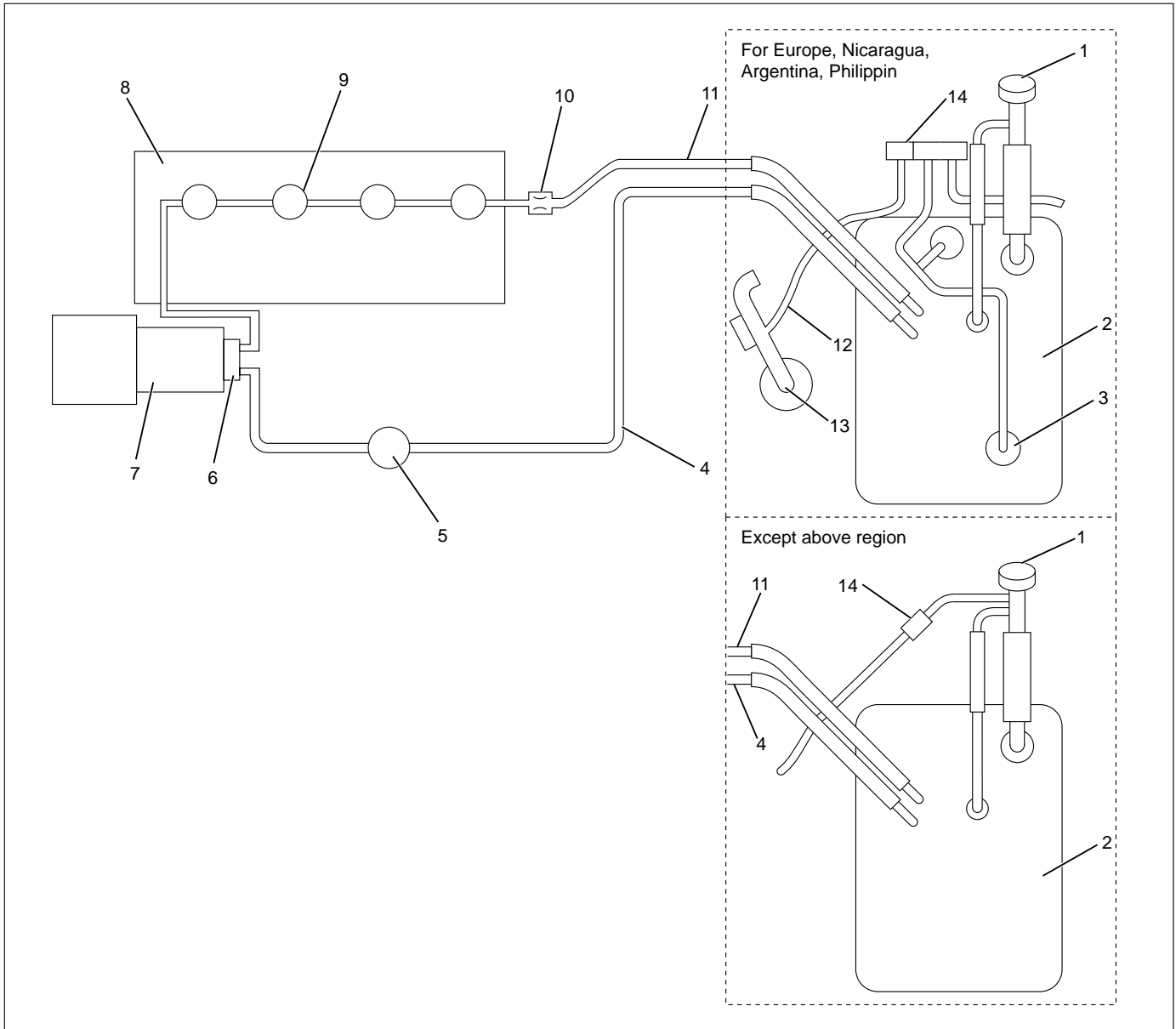
To realize the compatibility between low exhaust emission and high engine output, an HEUI (Hydraulically actuated Electronically controlled Unit Injector) system, has been introduced. This system is comprised of a hydraulic system, fuel system, and electronic control system, using a high-pressure oil pump in place of the conventional fuel injection pump. The oil pressurized by means of this pump and by signals from the ECM (Electronic Control Module) actuates the fuel injector provided for each cylinder. Inside of the fuel injector, fuel pressure is increased due to the high-pressure oil. The ECM detects the driving state of the vehicle, forms, signals sent by engine and other part sensors, which determines the optimum fuel injection amount and timing, thus controlling the fuel injectors. Thus high engine output, good fuel economy, and low exhaust emission are realized.

When working on the fuel system, there are several things to keep in mind:

- 1) Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- 2) Always keep a dry chemical (Class B) fire extinguisher near the work area.
- 3) Replace all pipes with the same pipe and fittings that were removed.
Clean and inspect "O" rings. Replace where required.
- 4) Always relieve the line pressure before servicing any fuel system components.
- 5) Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- 6) After maintenance work, push priming pump and send enough fuel to the fuel system before starting the engine.

NOTE: In comparison with the conventional engine, the capacity of fuel passage in the 4JX1 engine is larger. It takes the priming pump more time to fill the engine with fuel.

FUEL FLOW

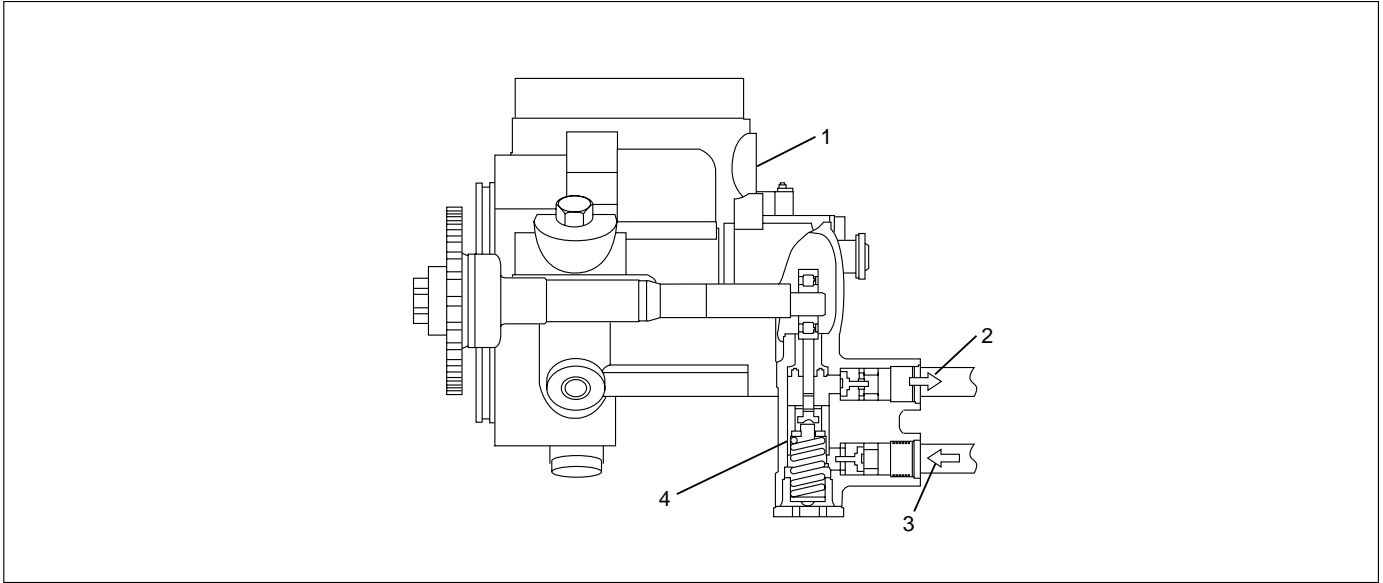


040R200001

Legend

- | | |
|-----------------------------------|---------------------------------------|
| (1) Fuel Filler Cap | (8) Cylinder Head |
| (2) Fuel Tank | (9) Injector |
| (3) Rollover Valve | (10) Orifice |
| (4) Fuel Supply Pipe | (11) Fuel Return Pipe |
| (5) Fuel Filter with Priming Pump | (12) Fuel Tank Pressure Release Hose |
| (6) Fuel Pump | (13) Intake Air Duct |
| (7) High Pressure Oil Pump | (14) Fuel Tank Pressure Control Valve |

FUEL PUMP



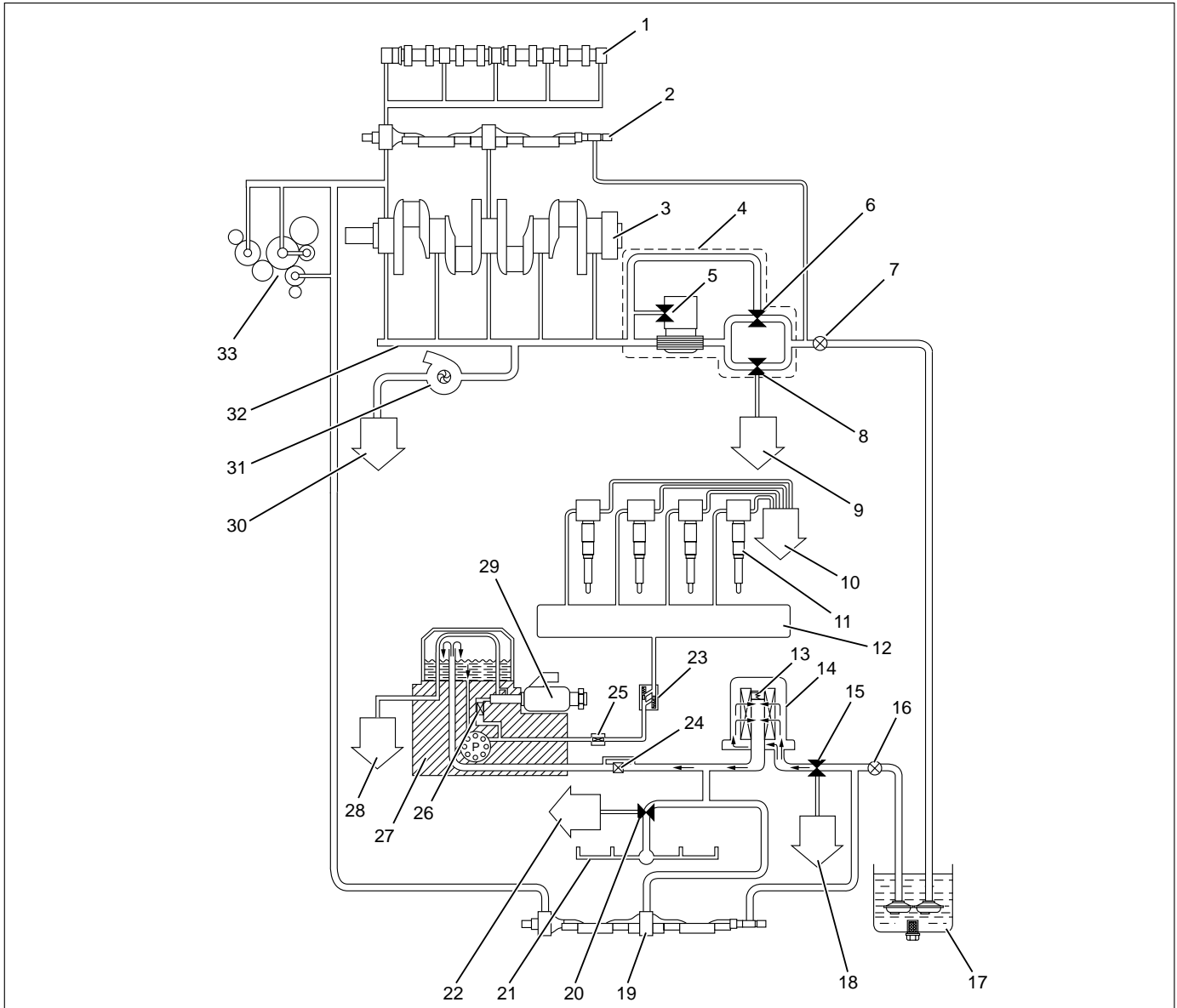
140RW041

Legend

- (1) High Pressure Oil Pump
- (2) To Injector

- (3) From Fuel Tank
- (4) Fuel Pump

HIGH PRESSURE OIL PUMP, OIL FLOW

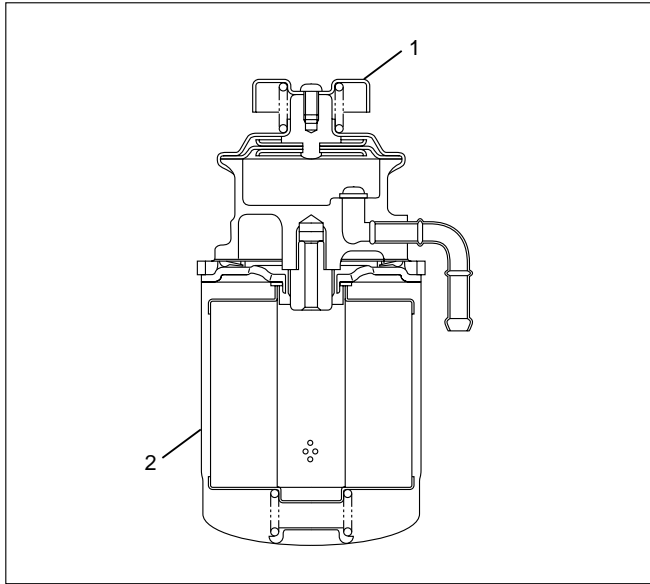


040RW018

Legend

- | | |
|---|---|
| (1) Camshaft | (17) Oil Pan |
| (2) Balance Shaft | (18) To Oil Pan |
| (3) Crankshaft | (19) Balance Shaft |
| (4) Oil Cooler and Oil Filter Assembly | (20) Cooling Jet Relief Valve 245 Kpa (2.5 kg/cm ² / 36 Psi) |
| (5) Oil Filter Relief Valve 98 Kpa (1 kg/cm ² /14.2 Psi) | (21) Cooling Jet |
| (6) Oil Cooler Relief Valve 245 Kpa (2.5 kg/cm ² / 36 Psi) | (22) To Oil Pan |
| (7) First Oil Pump | (23) Two Way Check Valve |
| (8) Main Oil Relief Valve 588 Kpa (6 kg/cm ² / 85 Psi) | (24) Nipple Filter |
| (9) To Oil Pan | (25) Edge Filter |
| (10) To Oil Pan | (26) Edge Filter |
| (11) Injector | (27) High Pressure Oil Pump Assembly |
| (12) Oil Rail | (28) To Oil Pan |
| (13) Sub Oil Filter Relief Valve 98 Kpa (1 kg/cm ² / 14.2 Psi) | (29) Pressure Control Valve |
| (14) Sub Oil Filter | (30) To Oil Pan |
| (15) Relief Valve 588 Kpa (6 kg/cm ² / 85 Psi) | (31) Turbocharger |
| (16) Second Oil Pump | (32) Oil Gallery |
| | (33) Timing Gear Train |

FUEL FILTER



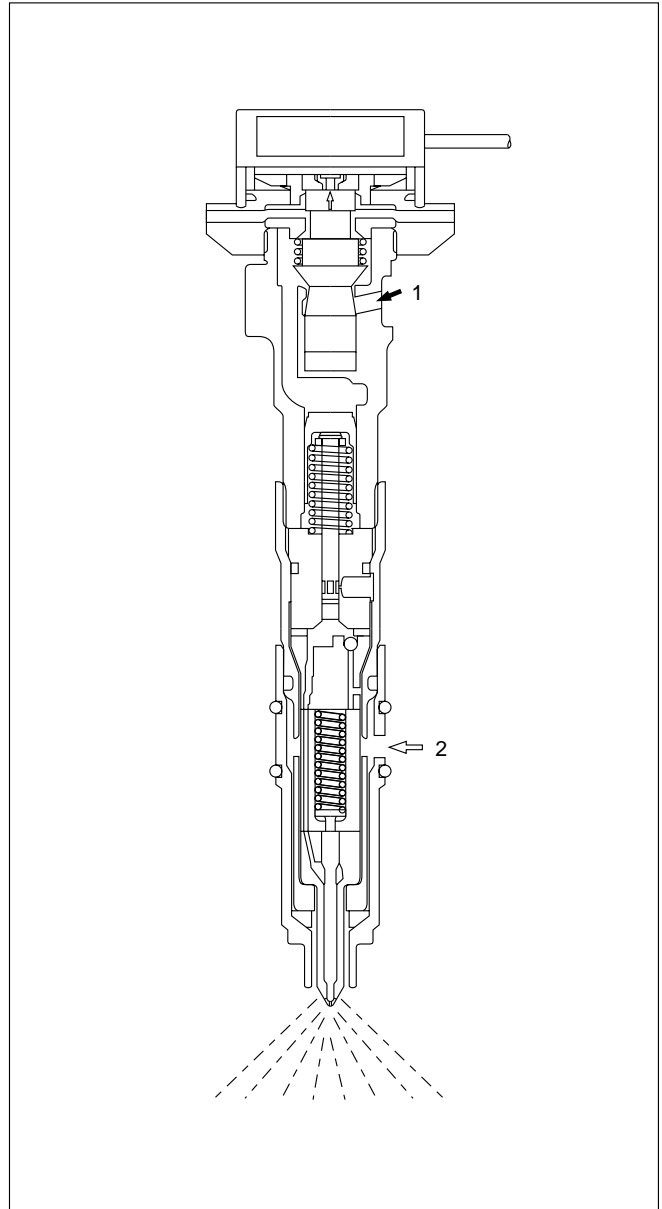
041RW017

Legend

- (1) Priming Pump
- (2) Fuel Filter Cartridge

A cartridge type fuel filter is used along with the piston type fuel pump on the high pressure oil pump. The fuel filter removes foreign material from the fuel before it reaches the fuel pump. A diaphragm type priming pump is installed at the top of the fuel filter. It is used during the air bleeding procedures.

INJECTOR ASSEMBLY



055RW018

Legend

- (1) Oil Passage
- (2) Fuel Passage

1. Construction of Fuel Injector

The fuel injector is comprised of the solenoid section, hydraulic line, and fuel line. Fuel injection is controlled by the continuity time signal and continuity start timing signal sent by the ECM (Electronic Control Module) to the solenoid.

2. Working of Fuel Injector

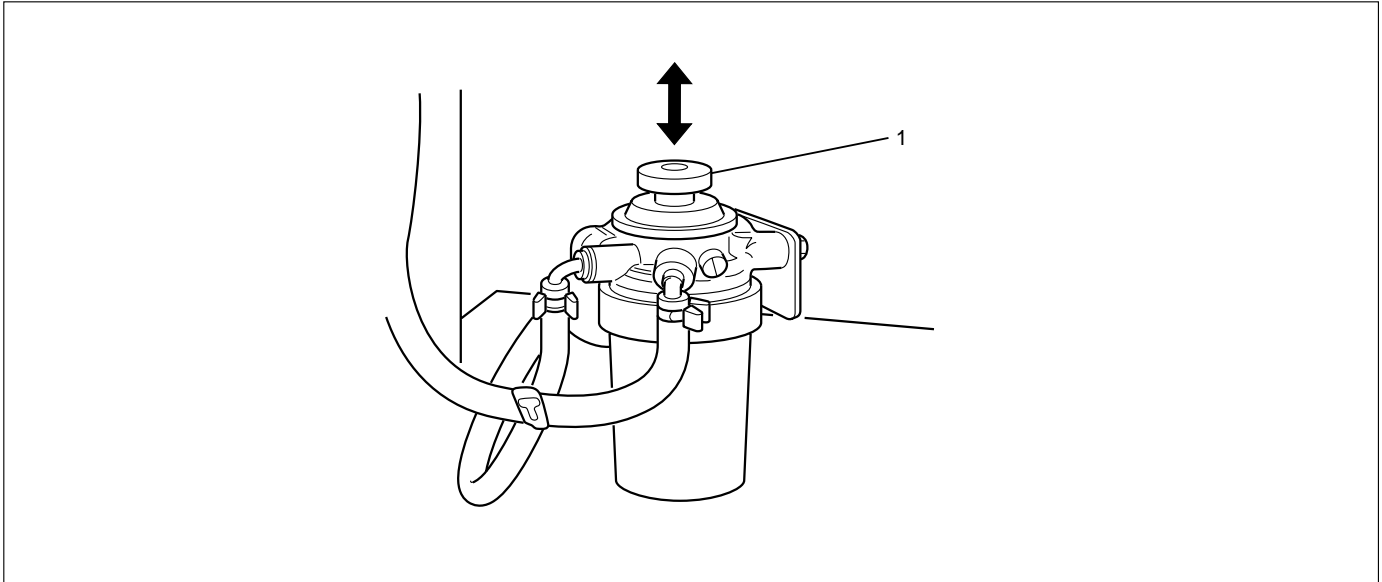
- 1) The ECM detects the working of the engine from its input signals, such as engine speed, accelerator throttle opening, and engine coolant temperature, sending the optimal signals to the solenoid.

6C – 6 ENGINE FUEL

- 2) With the current carried to the solenoid, a poppet valve is opened by means of an armature to let high-pressure engine oil into the injector.
- 3) Under the oil pressure, the piston and plunger are depressed to compress the fuel. The pressure of the compressed fuel is increased over the pressure of high-pressure engine oil by the ratio (about 7 : 1) of piston top to plunger bottom.
- 4) The injection nozzle end needle is lifted under the increased pressure of the fuel for fuel injection.
- 5) With current stopped from the ECM, the poppet valve is closed which holds up the high-pressure engine oil and lets the oil used to compress fuel out of the injector through its drain hole.

ON-VEHICLE SERVICE

FUEL FILTER ASSEMBLY



012RW111

Legend

- (1) Priming Pump

REMOVAL

1. Disconnect battery ground cable.
2. Fuel Filler cap
3. Fuel Hose
 - 1) Disconnect fuel hose from filter body.
Plug the hose ends to prevent fuel spillage.
4. Remove the Bolt on Fuel Filter Bracket
5. Remove Fuel Filter Assembly

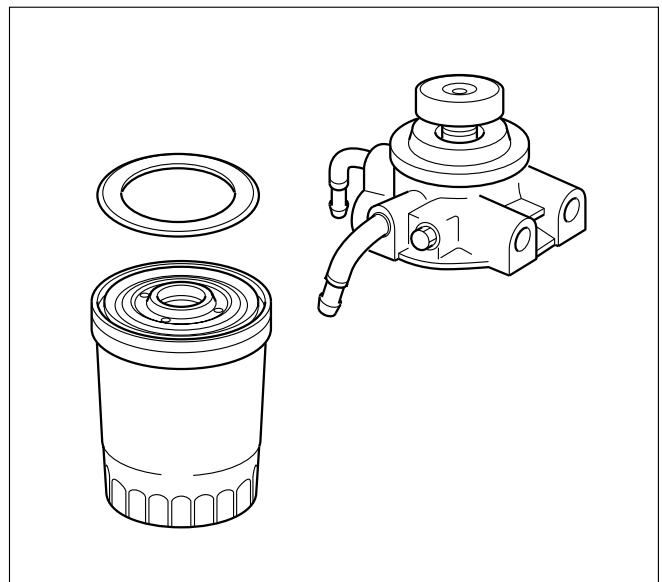
INSTALLATION

1. Install the fuel filter assembly
2. Tighten the Fuel Filter Bracket Fixing Bolt
3. Fuel Hose
 - 1) Connect hoses to filter body.
4. Fuel Filler Cap
 - 1) Connect the battery ground cable.
 - 2) Feed fuel to the fuel pump by priming, and bleed the air from fuel system.

FUEL FILTER CARTRIDGE

DISASSEMBLY

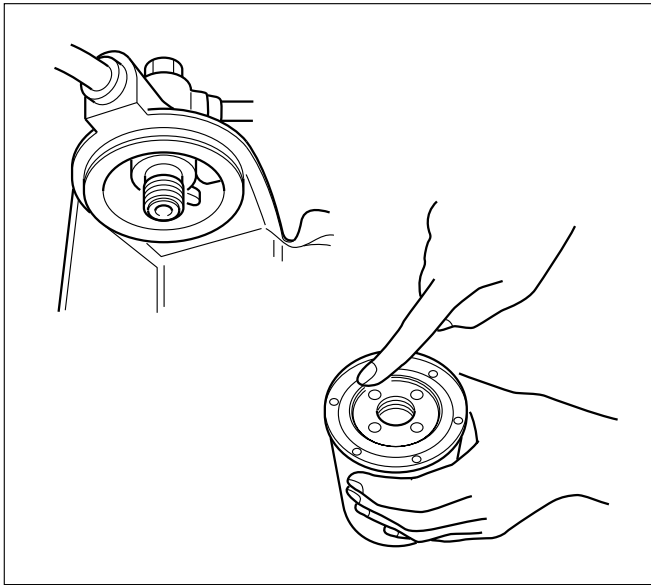
1. Drain fuel completely from the fuel filter.
2. Protect the filter body with cloth and lightly grip with a vise.
3. Remove the cartridge using a filter wrench.
Filter wrench: 5-8840-0203-0



012RW112

REASSEMBLY

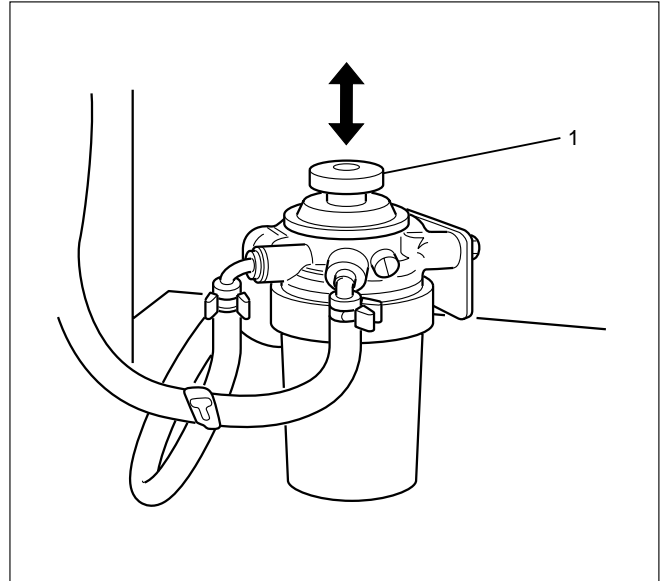
1. Clean the cartridge mounting surface of the filter body so that the cartridge can be secured.
Apply engine oil thinly to new cartridge O-ring.
2. To facilitate bleeding, fill the new cartridge with light oil.
3. Tighten the cartridge until O-ring comes in contact with the seal, taking care not to spill the light oil.
4. Retighten 1/3 – 2/3 using a filter wrench.
Filter wrench: 5-8840-0203-0



012RW078

Bleeding

1. Loosen air bleeding plug.
2. Operate priming pump to bleed the air in the fuel line.
3. Operate the priming pump until the fuel is overflow from air bleeding plug.
4. Tighten the air bleeding plug.
5. Start the engine, and if it is not started in 10 seconds or less, repeat the bleeding steps.
6. Make sure of no fuel leakage, and tighten the priming pump.



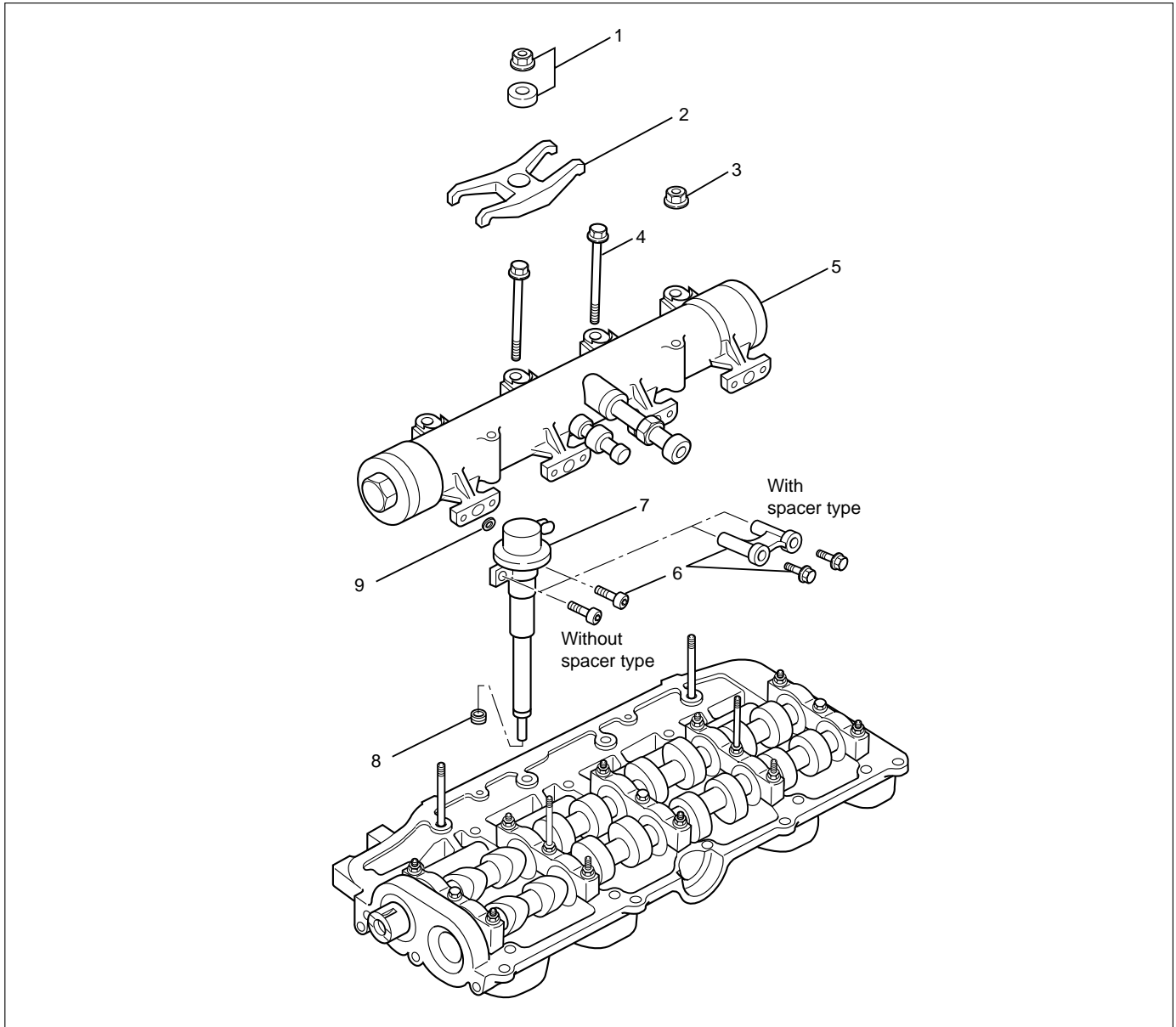
012RW111

Legend

- (1) Priming Pump

NOTE: In comparison with the conventional engine, the capacity of fuel passage in the 4JX1 engine is larger. It takes the priming pump more time to fill the engine with fuel.

INJECTOR



012R200006

Legend

- | | |
|-----------------------------------|------------|
| (1) Nut and Washer | (8) Gasket |
| (2) Injector Clamp | (9) O-Ring |
| (3) Nut | |
| (4) Bolt | |
| (5) Oil Rail Assembly | |
| (6) Spacer (If equipped) and Bolt | |
| (7) Injector Assembly | |

REMOVAL

Prior to removal, be sure to confirm and record the group code of the injector installed using Tech2.

1. Disconnect battery ground cable.
2. Remove air cleaner cover and air duct.
3. Remove intercooler.
Refer to "Intercooler" in this manual.
4. Remove PCV hose and pipe.
5. Remove cylinder head noise insulator cover.
6. Remove high pressure oil pipe.

CAUTION:

- 1) **Sleeve nut should be loosened with cloth tied around to prevent oil from spurting due to the remaining pressure.**
- 2) **High oil pressure pipe should be disconnected with cloth tied around the intake manifold glow plug to prevent oil from flowing out of the oil rail.**
7. Loosen eye bolt of fuel pipe at fuel pump side.

NOTE: Cloth should be put around the loosened eye bolt to prevent fuel from flowing out.

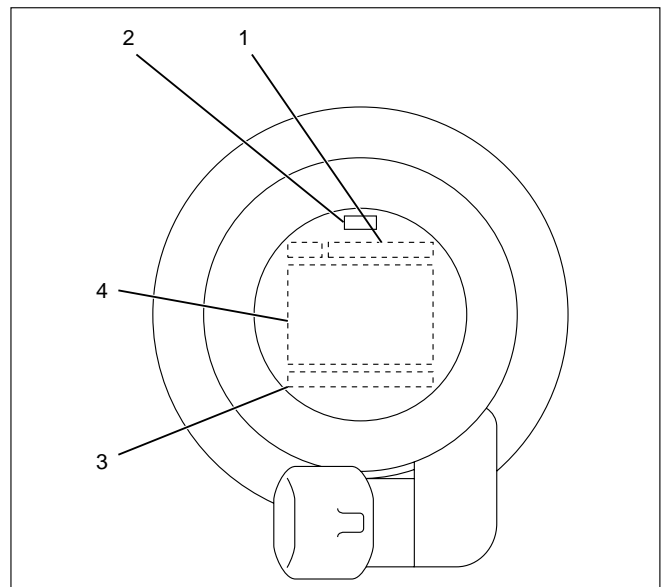
8. Remove fuel return hose at chassis side.
9. Remove PCV hose to cylinder head cover.
10. Remove cylinder head cover.
11. Drain the oil from oil rail assembly.

NOTE: Do not drop O-ring

12. Record the grade code of injector for each cylinder that is indicated on the upper portion of injector.
There are nine kinds of grade code available, one alphabet letter and one numeral letter.

Grade code

Category number
A – 1
A – 2
A – 3
B – 1
B – 2
B – 3
C – 1
C – 2
C – 3



065RW0001

Legend

- (1) Part Number
- (2) Category Number (Grade code)
- (3) Serial Number
- (4) Bar Code

13. Remove harness connector from each injector.
14. Loosen nuts and bolts for oil rail.
15. Remove injector fixing bolts.
16. Remove injector clamp.
17. Remove injector assembly.

INSTALLATION

1. Install oil rail, tighten temporarily
2. Install injector assembly.

NOTE:

- 1) Do not forget to install O-ring between injector and oil rail.
- 2) Use new O-ring
- 3) Clean O-ring groove and fitting surface of parts.
- 4) Apply engine oil to O-ring.
3. Install injector fixing bolts, tighten temporarily.
4. Install injector clamp, tighten nut temporarily.
5. Tighten injector fixing bolts to the specified torque.

Torque: 6.5 N·m (0.7 kg·m / 5.1 lb ft)

6. Tighten injector clamp nut to the specified torque with special method.

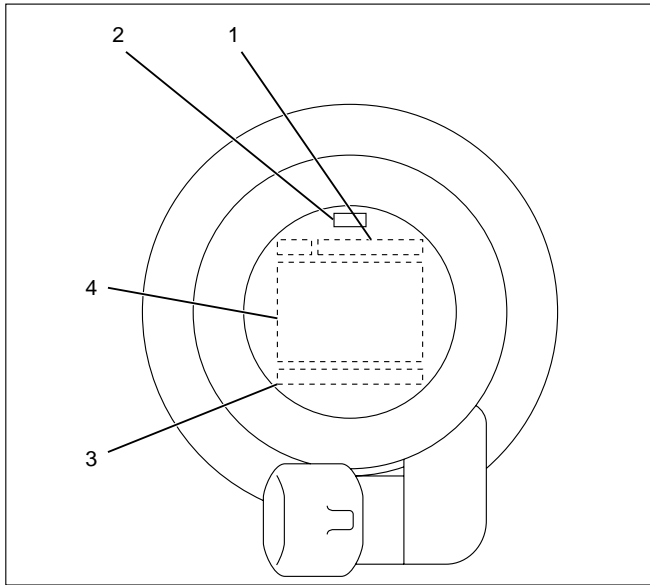
Torque: 30 N·m (3.1 kg·m / 22.4 lb ft) then loosen a time again tighten as following torque.

Torque: 25 N·m (2.4 kg·m / 17.4 lb ft)

7. Tighten oil rail to the specified torque.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

8. Install injector harness assembly, reconnect harness connector to injector.
9. Record the identification marking of injector for each cylinder that is indicated on the upper portion of injector.



055RW00001

Legend

- (1) Part Number
- (2) Category Number (Grade code)
- (3) Serial Number
- (4) Bar Code

10. Install cylinder head assembly. Refer to "Cylinder Head" in this manual.
11. Fill with about 300cc of engine oil from the high pressure oil pipe installation port of the oil rail using an oil filler. If assembled without filling the oil rail with oil, the time for engine starting will be longer.
12. Immediately install high pressure oil pipe and tighten to specified torque.

Torque: 80 N·m (8.1 kg·m / 57.9 lb ft)

13. Install cylinder head noise insulator cover. Refer to "Cylinder Head" in this manual.
14. Install intercooler assembly. Refer to "Intercooler" in this manual.
15. Install air cleaner cover and air duct.
16. Use TECH2 to rewrite injector data to ECM. For rewriting method refer to section "Data Programming in Case of ECM Change" of section 6E 4JX1 engine driveability and emissions in this manual.

NOTE:

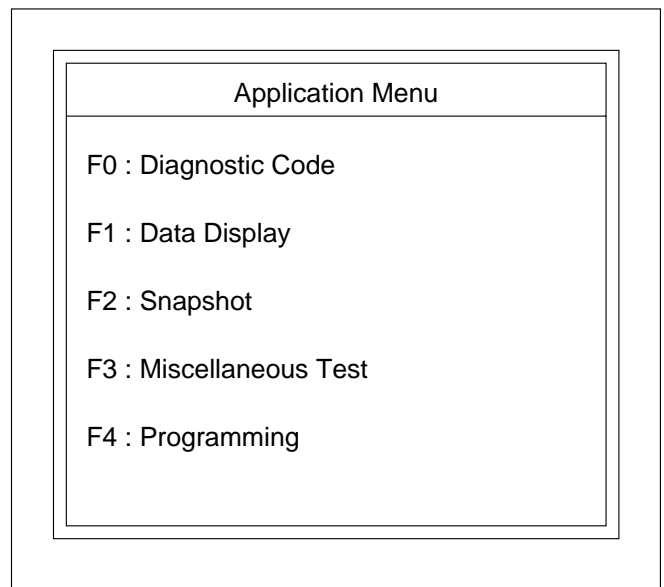
- 1) On completion of servicing, bleed air from the engine inside fuel passage by means of the priming pump. (The priming pump should be operated more times than in the case of conventional engines.)
- 2) As air is in the oil rail, it takes more time to start the engine. Rough idling may occur while the air is being bled completely after engine start, but it does not indicate trouble. The air will be bled and normal engine status will be reached while the vehicle is driven for about 5 km or engine is operated for about 5 minutes at 1500 to 2000 rpm.
- 3) The injector spare part will be provided for group number B1, B2 and B3 only.

Injector Grade code Programming (Injector Change)

In case of an injector change, the injector grade code (category number) must be programmed by Tech-2.

Programming Procedure

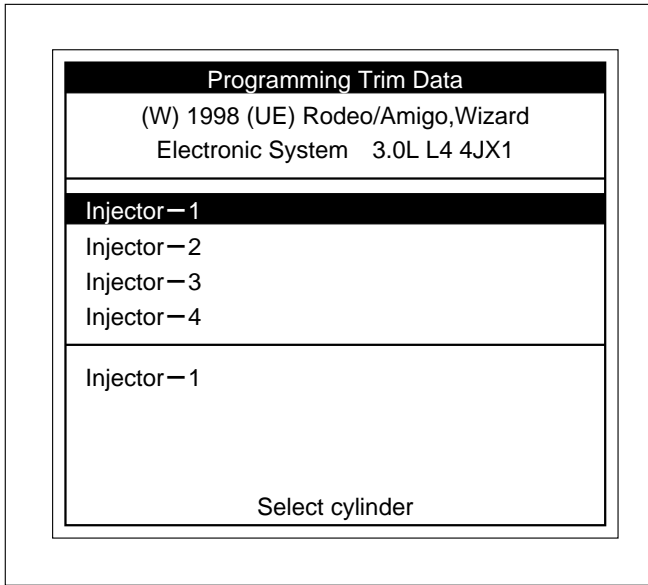
1. Connect the Tech-2 to the vehicle DLC.
2. Turn the starter switch to the "ON" position.
3. Select the "Diagnosis" from the Main menu.
4. Select the "Programming" from the Application menu.



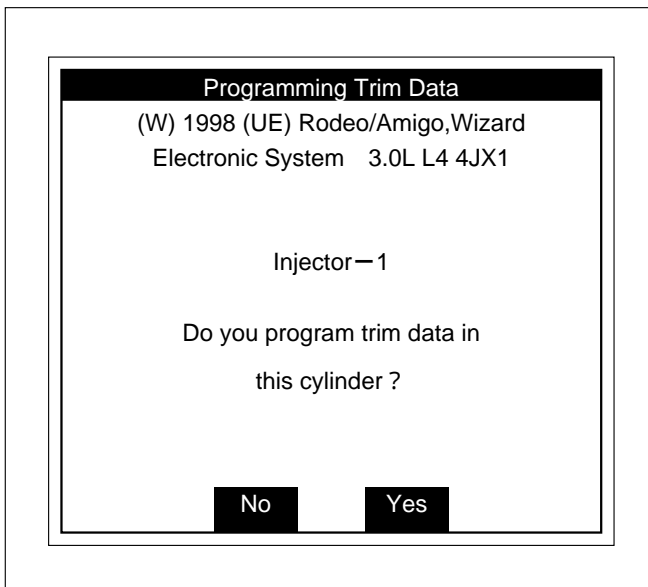
035RW00002

6C – 12 ENGINE FUEL

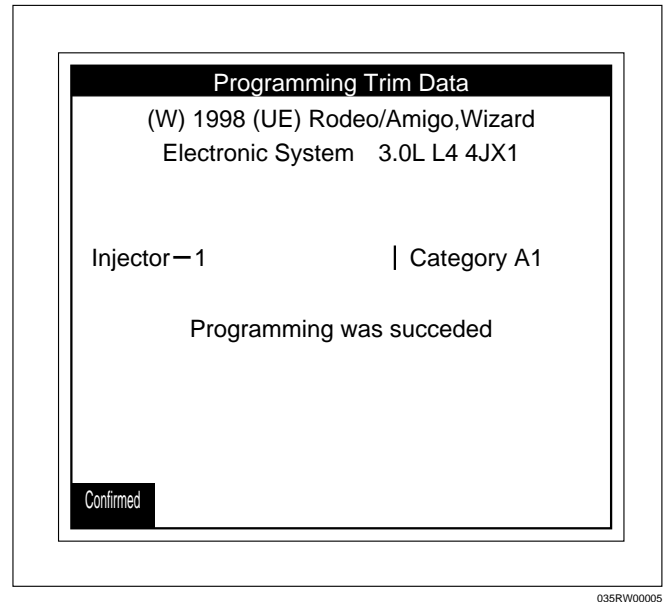
5. Select “Programming Trim Date” from Programming menu.
6. Select the injector change from Programming Trim Date menu.
7. Select the cylinder number which changed injector.



8. Appoint and select the grade code (Category number) of injector.

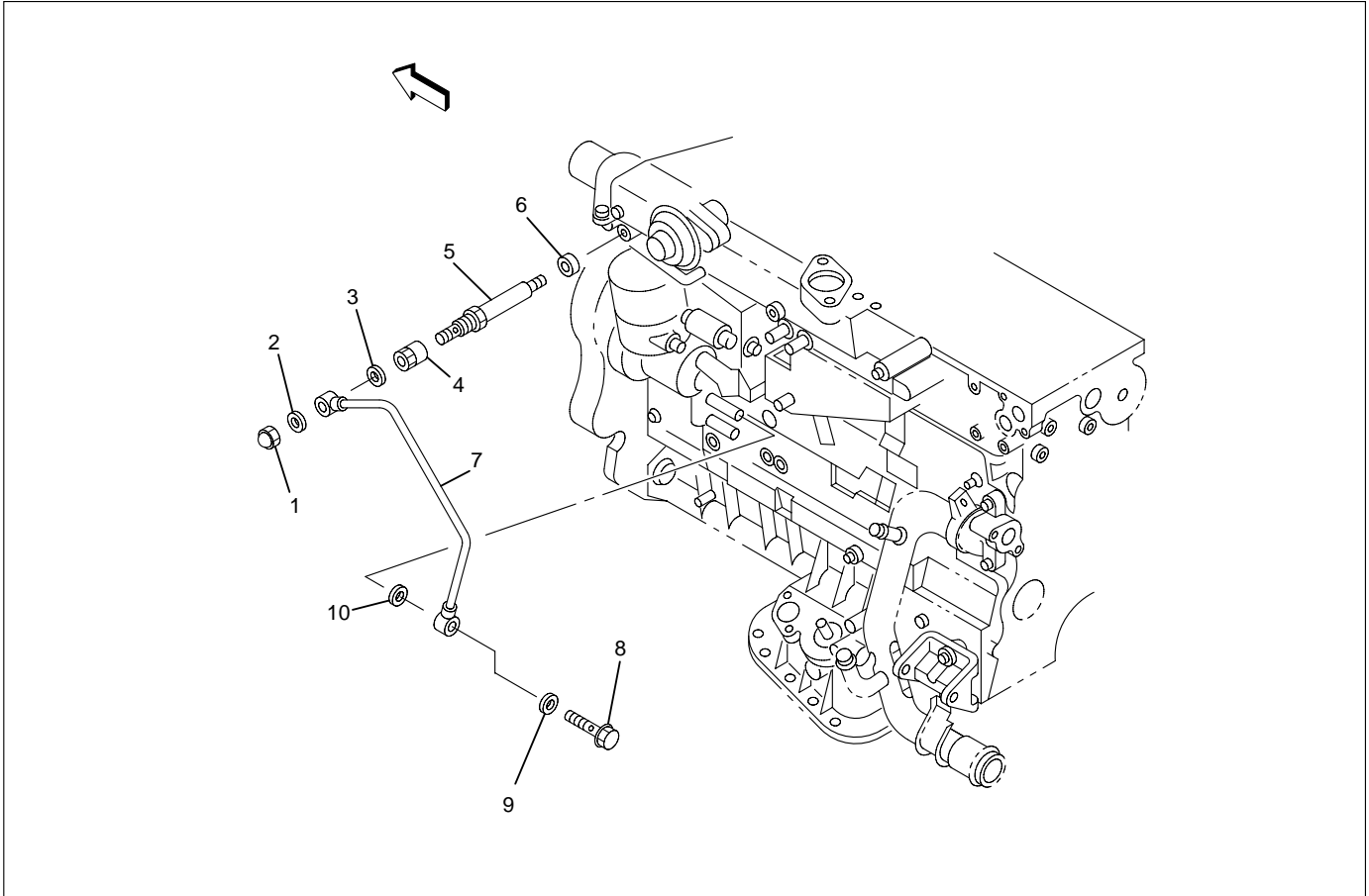


9. Confirm the completion of injector programming.



Note; The injector grade code (category number) is indicated on the new (service part) injector.

FUEL PUMP PIPE



040R200002

Legend

- | | |
|--------------|--------------------|
| (1) Cap Nut | (6) Gasket |
| (2) Gasket | (7) Fuel Pump Pipe |
| (3) Gasket | (8) Eye Bolt |
| (4) Pipe Nut | (9) Gasket |
| (5) Adapter | (10) Gasket |

REMOVAL

1. Remove eye bolt.
2. Remove cap nut.

NOTE: The eye bolt and cap nut should be disconnected with cloth tied around them to prevent flowing out of fuel.

3. Remove fuel pump pipe.
4. Remove pipe nut.
5. Remove adapter.

INSTALLATION

1. Apply engine oil to the thread, then install adapter with new gasket.

Torque : 16 N·m (1.6 kg·m/12 lb ft)

NOTE: Be careful not to enter the foreign material.

2. Apply engine oil to the thread, then install pipe nut.

Torque : 10 N·m (1.0 kg·m/87 lb ft)

NOTE: Do not apply oil to cap nut side.

3. Install fuel pump pipe, new gaskets and cap nut to adapter temporarily. Do not tighten the cap nut.
4. Install eye bolt with new gasket then tighten to specified torque.

Torque : 29 N·m (3.0 kg·m/22 lb ft)

6C – 14 ENGINE FUEL

NOTE:

- 1) Do not apply oil to the eye bolt.
- 2) Do not bend the fuel pump pipe.

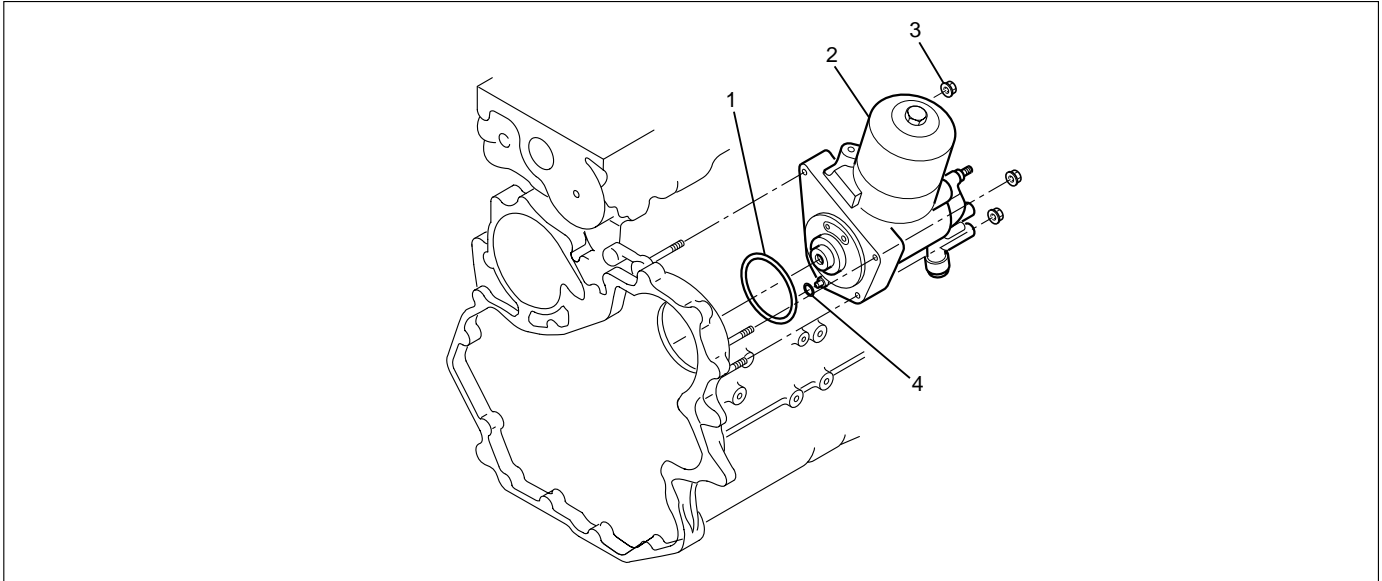
5. Tighten cap nut to specified torque.

Torque : 13 N·m (1.3 kg·m/113 lb ft)

NOTE: Do not apply oil to the cap nut.

6. Start the engine, check that the fuel leakage is not found.

HIGH PRESSURE OIL PUMP



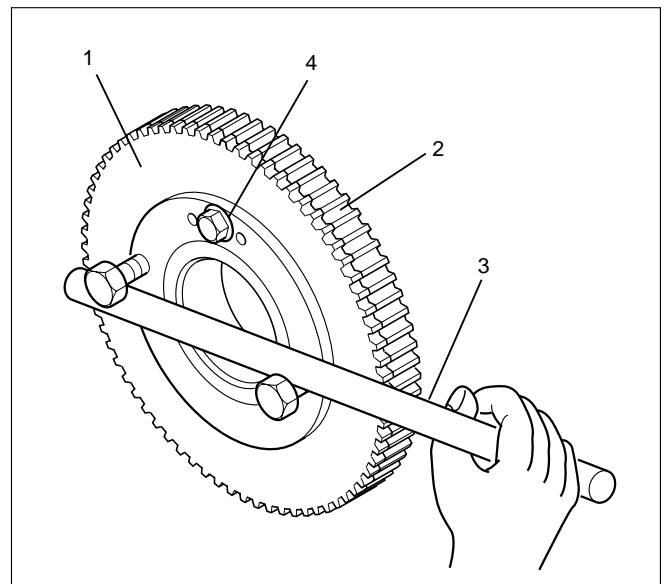
040RW007

Legend

- (1) O-Ring
- (2) High Pressure Oil Pump Assembly
- (3) Nut
- (4) O-Ring

REMOVAL

1. Disconnect battery ground cable.
2. Remove air cleaner cover and air duct
3. Intercooler assembly
Refer to "Intercooler" in this manual.
4. Remove high pressure oil pipe
5. Timing belt cover
Disconnect CMP sensor cable.
Remove CMP sensor bracket.
6. Tensioner
7. Timing Belt
8. Remove high pressure oil pump timing pulley
9. Remove crankshaft damper pulley
10. Remove timing gear case cover
11. Remove idle gear A
Before removing idle gear A, set two bolts to the sub gear of idle gear A and turn it to align the teeth of idle gear A main gear.
Then lock them by bolts as shown in the illustration.



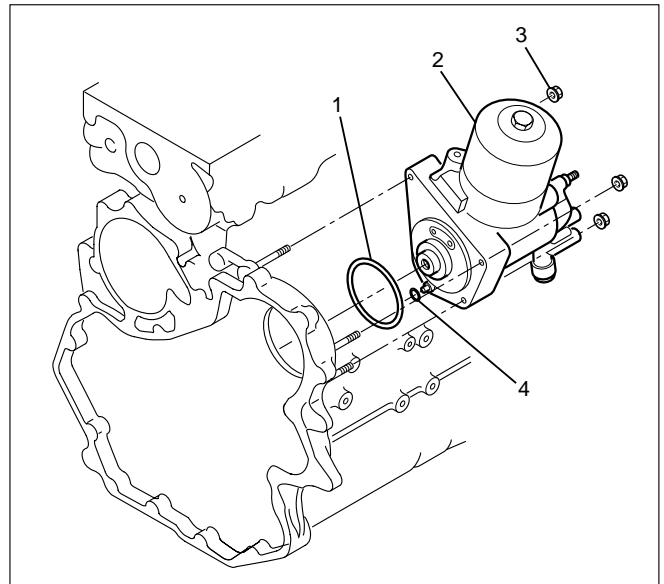
014RW177

Legend

- (1) Idle gear A sub gear
- (2) Idle gear A main gear
- (3) Bar
- (4) Lock bolt

6C – 16 ENGINE FUEL

12. Remove high pressure oil pump
13. Remove high pressure oil pump assembly



040RW007

Legend

- (1) O-ring
 - (2) High pressure oil pump
 - (3) Nut
 - (4) O-ring
-

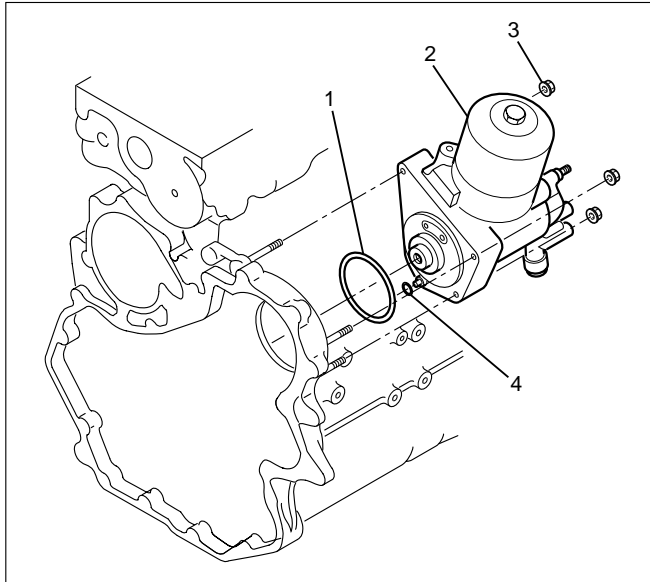
INSPECTION AND REPAIR

The high pressure oil pump is made precisely, therefore, disassembly is not recommended.

INSTALLATION

1. Set O-ring to high pressure oil pump assembly.
Install the pump assembly into the rear of timing gear case.
Tighten nut to specified torque.

Torque: 20 N·m (2.0 kg·m/14.5 lb ft)



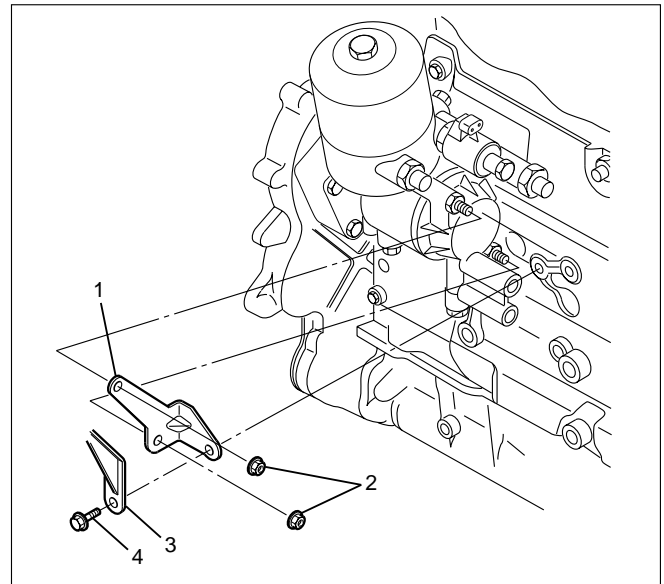
040RW007

Legend

- (1) O-ring
- (2) High Pressure Oil Pump Assembly
- (3) Nuts
- (4) O-ring

2. Tighten high pressure oil pump assembly bracket together with two way valve bracket.

Torque: 27 N·m (2.8 kg·m/20.2 lb ft)



040RW006

Legend

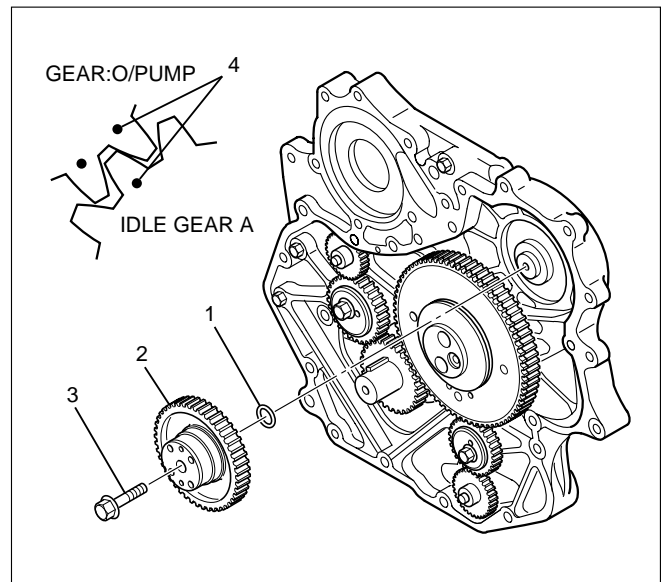
- (1) High Pressure Oil Pump Assembly
- (2) Nut
- (3) Two Way Valve Bracket
- (4) Bolt

3. Install the pump gear to align timing mark with idle gear A.

Tighten high pressure pump gear fixing bolt to the specified torque.

Apply engine oil to thread and seat of bolt.

Torque: 75 N·m (7.6 kg·m/55 lb ft)



040RW005

Legend

- (1) O-ring
- (2) Pump Gear
- (3) Bolt
- (4) Timing Mark

6C – 18 ENGINE FUEL

4. Remove lock bolt of idle gear A.
5. Install timing gear case cover.
Refer to "Timing gear" in this manual.
6. Install front plate.

Torque: 20 N·m (2.0 kg·m/14.5 lb ft)

7. Install timing pulley of high pressure oil pump.

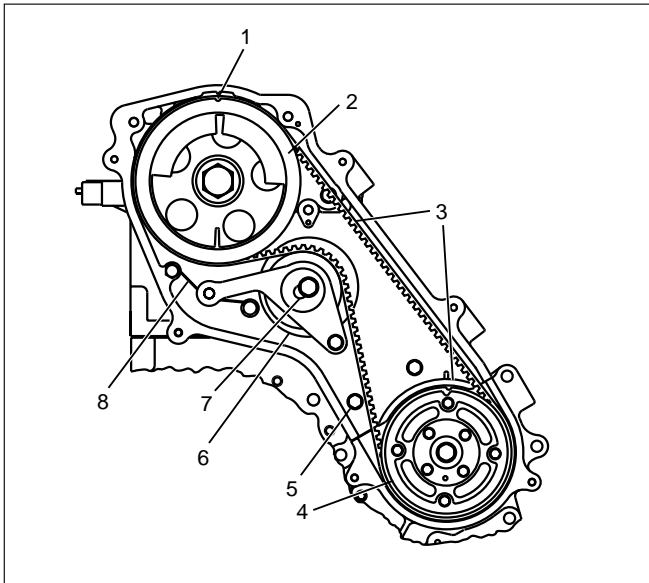
Torque: 10 N·m (1.0 kg·m/7.2 lb ft)

8. Install timing belt and tighten timing belt tensioner assembly.
Refer to "Cylinder head" in this manual.

14. Install the crankshaft damper pulley with specified torque.

Torque: 220 N·m (22 kg·m/159 lb ft)

15. Install the intercooler assembly.
Refer to "Intercooler" in this manual.
16. Install air cleaner cover and air duct.



F06RW055

Legend

- (1) Align Mark
- (2) Camshaft Pulley
- (3) Timing Belt
- (4) High Pressure Oil Pump Pulley
- (5) Bolt
- (6) Tensioner Assembly
- (7) Tensioner Bolt
- (8) Tensioner Spring

9. Install CMP sensor bracket.

Torque: 20 N·m (2.0 kg·m/14.5 lb ft)

10. Connect CMP sensor cable.
11. Install timing belt cover.

Torque: 9 N·m (0.9 kg·m/6.5 lb ft)

12. Fill with about 300 cc of engine oil from the high pressure oil pipe installation port of the oil rail using an oil filler.

If assembled without filling the oil rail with oil, the time for engine starting will be longer.

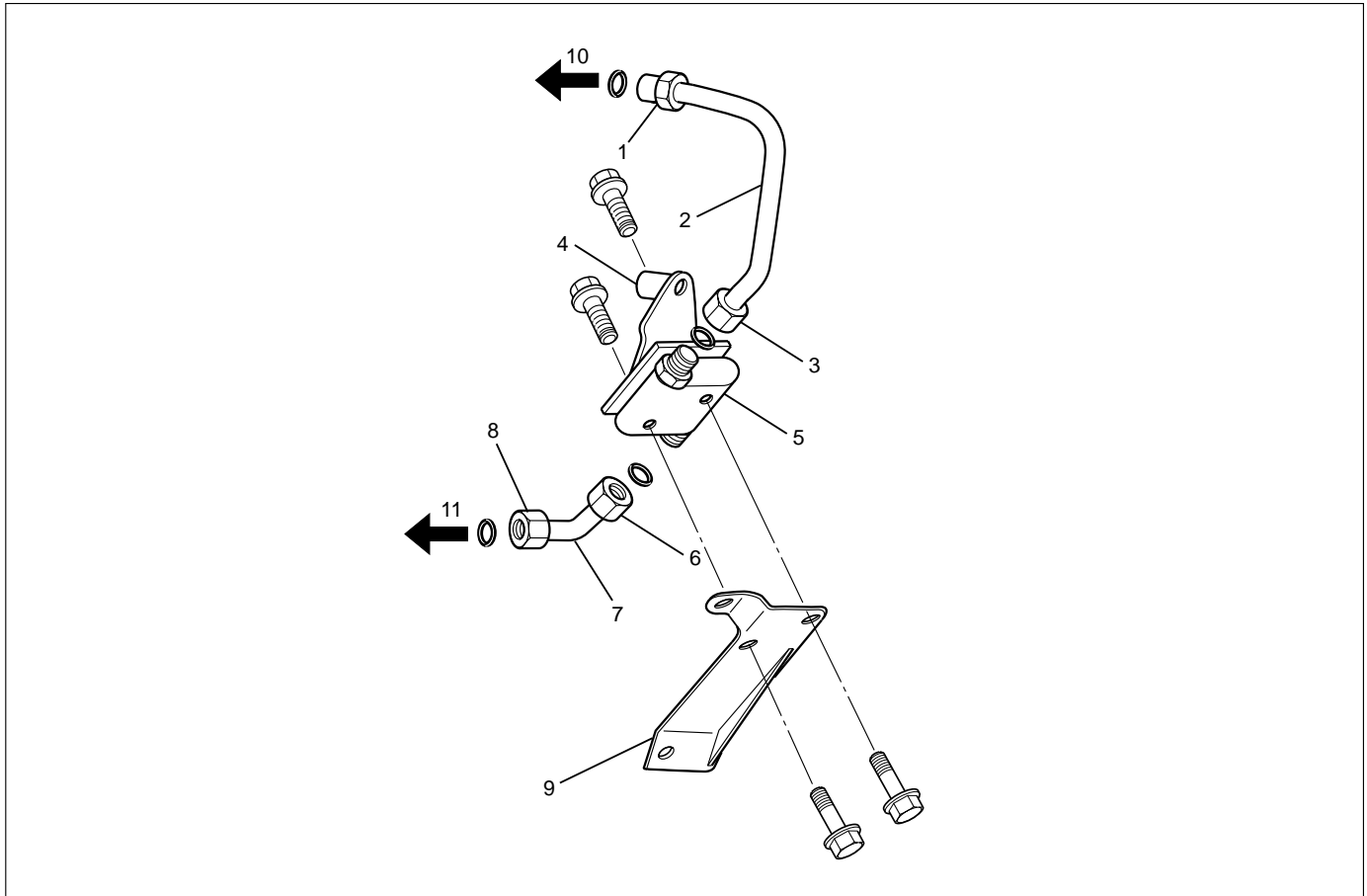
13. Immediately install high pressure oil pipe and tighten to specified torque.

NOTE:

- 1) Use new O-ring.
- 2) Clean O-ring groove and fitting surface of parts.
- 3) Apply engine oil to O-ring.

Torque: 80 N·m (8.1 kg·m/57.9 lb ft)

HIGH PRESSURE OIL PIPE INSTALLATION



052R200001

Legend

- | | |
|-------------------|--------------------------------|
| (1) Union Nut F | (7) Pipe A |
| (2) Pipe B | (8) Union Nut C |
| (3) Union Nut E | (9) Lower Bracket |
| (4) Upper Bracket | (10) To Oil Rail |
| (5) Two Way Valve | (11) To High Pressure Oil Pump |
| (6) Union Nut D | |

1. Install upper bracket to two way valve, tighten them temporarily.
2. Install pipe A to two way valve, tighten pipe A temporarily with union nut D.
3. Install two way valve assembly to cylinder block, tighten with union nut C temporarily.
4. Install pipe B to two way valve, tighten union nut E and union nut F temporarily.
5. Tighten upper bracket to specified torque.

Torque : 20 N·m (2.0 kg·m/14.5 lb ft)

6. Tighten union nut in the following order, union nut C, D, F, and E to the specified torque.

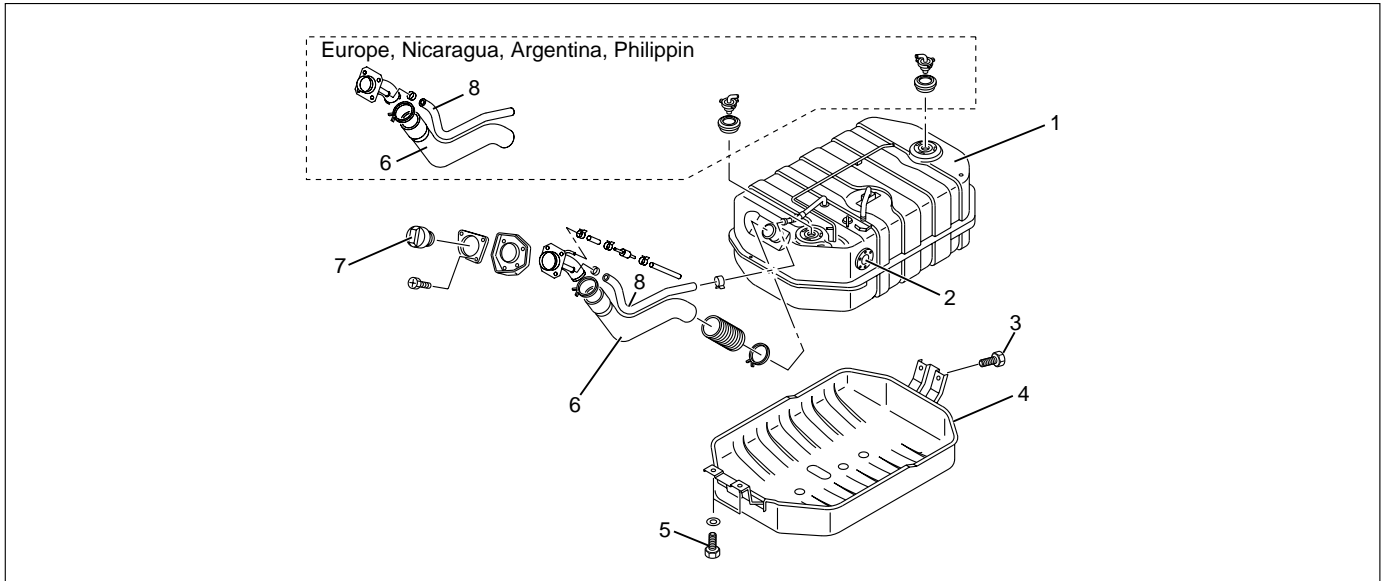
Torque : 80 N·m (8.1 kg·m/57.9 lb ft)

7. Tighten lower bracket to the specified torque.

Torque : 20 N·m (2.0 kg·m/14.5 lb ft)

NOTE: Wash inside pipe, inside union nut and O-ring seal surface to remove engine oil and foreign materials.

FUEL TANK



140R200032

Legend

- | | |
|------------------------|----------------------|
| (1) Fuel Tank Assembly | (4) Under Cover |
| (2) Gauge Unit | (5) Bolt |
| (3) Bolt | (6) Fuel Filler Hose |
| | (7) Fuel Filler Cap |
| | (8) Breather Hose |

REMOVAL

1. Disconnect battery ground cable.
2. Remove fuel filler cap.
3. Drain fuel.
After drain the fuel tighten the drain plug with specified torque.

Torque : 20 N·m (2.0 kg·m/14 lb ft)

4. Remove fuel filler hose and let air pull off hose.
5. Remove breather hose.
6. Remove fuel feed hose and fuel return hose.
7. Disconnect harness connector from fuel gauge unit.
8. Remove under cover.
9. Remove fuel tank assembly.

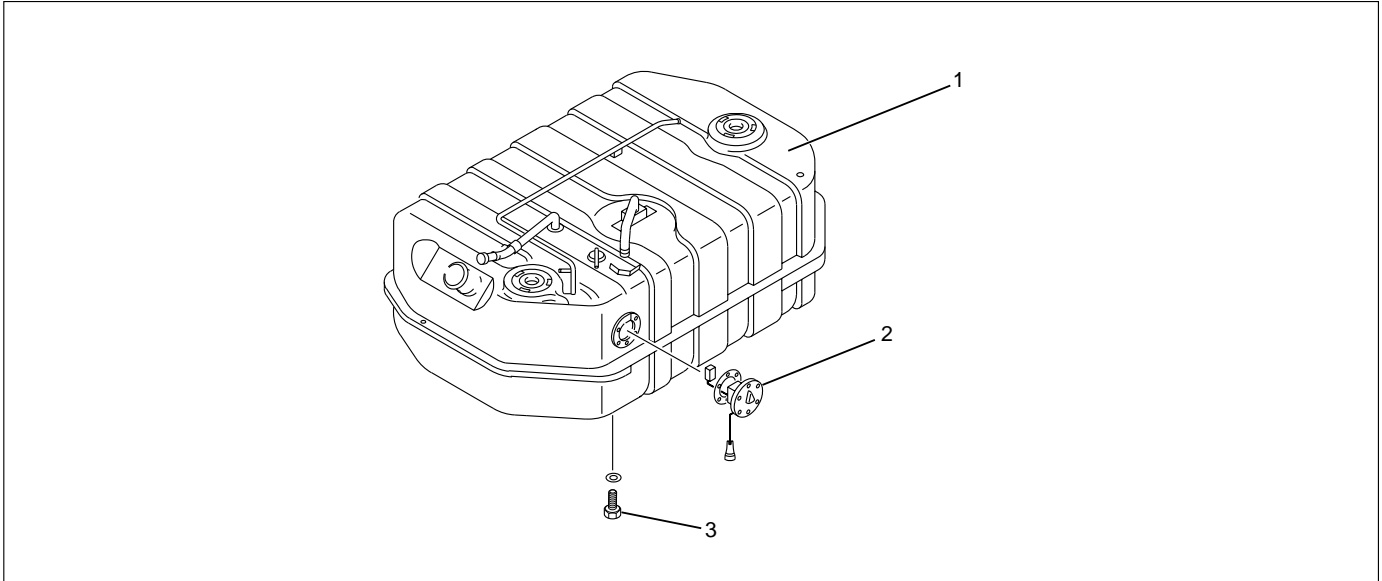
INSTALLATION

1. Fuel tank assembly.
 - 1) Place a flange on right side of tank on the bracket.
 - 2) Install a flange to left side of the bracket from the bottom, and tighten bolts to the specified torque.

Torque : 36 N·m (3.7 kg·m/26.8 lb ft)

2. Install fuel hose and fuel return hose.
3. Install the breather hose.
4. Reconnect harness connector to fuel gauge unit.
5. Install under cover.
6. Install fuel filler hose and let air pull off hose.
7. Fill fuel tank with fuel and tighten filler cap.
8. Reconnect battery ground cable.

FUEL GAUGE UNIT



140R20033

Legend

- (1) Fuel Tank Assembly
- (2) Fuel Gauge Unit
- (3) Drain Plug

REMOVAL

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
After drain the fuel tighten the drain plug with specified torque.

Torque : 20 N·m (2.0 kg·m/14 lb ft)

4. Disconnect harness connector from fuel gauge unit.
5. Fuel Gauge Unit
 - 1) Remove the fixing screws, then the fuel gauge unit.

INSTALLATION

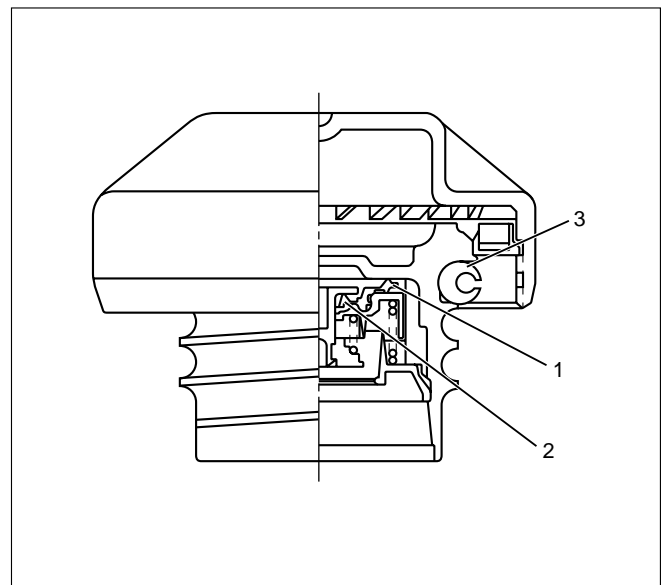
1. Fuel Gauge Unit
2. Connect the harness connector to the fuel gage unit.
3. Fill the tank with fuel and tighten fuel filler cap.
4. Connect battery ground cable.

FUEL FILLER CAP

The fuel filler cap contains a vacuum valve. If a negative pressure develops in the fuel tank, the external valve of the fuel filler cap opens to allow the fresh air to flow into the fuel tank through the vacuum valve.

INSPECTION

Check the seal ring in the filler cap for presence of any abnormality and for seal condition.
Replace the filler cap, if abnormal.



060R200247

Legend

- (1) Vacuum Valve
- (2) Pressure Valve
- (3) Seal Ring

MEMO

A series of horizontal dotted lines for writing.

ENGINE ELECTRICAL

CONTENTS

Battery	6D-1	Charging System	6D-15
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BATTERY

GENERAL DESCRIPTION

There are six battery fluid caps at the top of the battery. These are covered by a paper label.

The battery is completely sealed except for the six small vent holes at the side. These vent holes permit the escape of small amounts of gas generated by the battery.

This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an excessive charge. (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self-discharge than a conventional type battery.

DIAGNOSIS

1. VISUAL INSPECTION (Step 1)

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.

Replace the battery if obvious physical damage is discovered during inspection.

Check for any other physical damage and correct it as necessary. If not, proceed to Step 2.

2. HYDROMETER CHECK (Step 2)

There is a built-in hydrometer (Charge test indicator) at the top of the battery. It is designed to be used during diagnostic procedures.

Before trying to read the hydrometer, carefully clean the upper battery surface.

If your work area is poorly lit, additional light may be necessary to read the hydrometer.

- a. BLUE RING OR DOT VISIBLE – Go to Step 4.
- b. BLUE RING OR DOT NOT VISIBLE – Go to Step 3.

3. FLUID LEVEL CHECK (Step 3)

The fluid level should be between the upper level line and lower level line on side of the battery.

- a. CORRECT FLUID LEVEL – Charge the battery.
- b. BELOW LOWER LEVEL – Replace battery.

4. VOLTAGE CHECK (Step 4)

- (1) Put voltmeter test leads to battery terminals.
 - a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 5.
 - b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
- (2) Determine fast charge amperage from specification. (See Main Data and Specifications in this section.)

Fast charge battery for 30 minutes at amperage rate no higher than specified value.

Take voltage and amperage readings after charge.

 - a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.

6D – 2 ENGINE ELECTRICAL

b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours.

Then go to Step 5.

c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3-1/2 hours. Then go to Step 5.

d. VOLTAGE IS BELOW 12V – Replace battery.

5. LOAD TEST (Step 5)

(1) Connect a voltmeter and a battery load tester across the battery terminals.

(2) Apply 300 ampere load for 15 seconds to remove surface charge from the battery.

Remove load.

(3) Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).

Read voltage after 15 seconds, then remove load.

a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN FOLLOWING TABLE – The battery is good and should be returned to service.

b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
°F	°C	
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	-1	9.1
20	-7	8.9
10	-12	8.7
0	-18	8.5

The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.

ON-VEHICLE SERVICE

BATTERY CHARGING

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during the charging procedure.

Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.

Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.

3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick-charged or slow-charged in the same manner as other batteries.

Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

JUMP STARTING

JUMP STARTING WITH AN AUXILIARY (BOOSTER) BATTERY

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: Failure to carefully follow the jump starting procedure could result in the following:

1. Serious personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode. Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water. Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of the reach of young children.

JUMP STARTING PROCEDURE

1. Set the vehicle parking brake.

If the vehicle is equipped with an automatic transmission, place the selector lever in the "PARK" position.

If the vehicle is equipped with a manual transmission place the shift lever in the "NEUTRAL" position.

Turn "OFF" the ignition.

Turn "OFF" all lights and any other accessory requiring electrical power.

2. Look at the built-in hydrometer.

If the indication area of the built-in hydrometer is completely clear, do not try to jump start.

3. Attach the end of one jumper cable to the positive terminal of the booster battery.

Attach the other end of the same cable to the positive terminal of the discharged battery.

Do not allow the vehicles to touch each other.

This will cause a ground connection, effectively neutralizing the charging procedure.

Be sure that the booster battery has a 12 volt rating.

4. Attach one end of the remaining cable to the negative terminal of the booster battery.

Attach the other end of the same cable to a solid engine ground (such as the A/C compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.

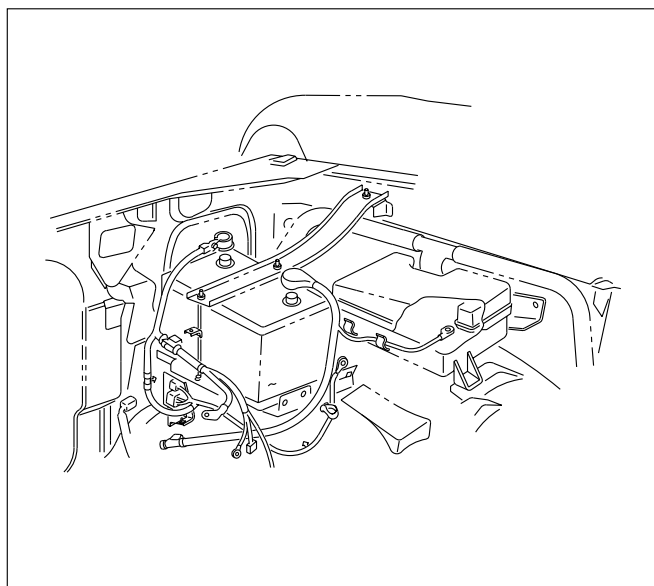
This ground connection must be at least 450 mm (18 in) from the battery of the vehicle whose battery is being charged.

WARNING: Never attach the end of the jumper cable directly to the negative terminal of the dead battery.

5. Start the engine of the vehicle with the good battery. Make sure that all unnecessary electrical accessories have been turned "OFF".
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in the reverse order.

Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

REMOVAL AND INSTALLATION OF THE BATTERY



065RW029

REMOVAL

1. Negative cable
2. Positive cable
3. Retainer screw and rods
4. Retainer
5. Battery

INSTALLATION

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

1. Make sure that the rod is hooked on the body side.

MAIN DATA AND SPECIFICATIONS

Model (JIS)	80D26R-MF	75D26R-MF
Voltage (V)	12	12
Cold-Cranking Performance (Amp)	582	490
Reserve Capacity (Min)	133	123
Load Test (Amp)	300	300
Fast Charge Maximum Amperage (Amp)	6.5	6.5

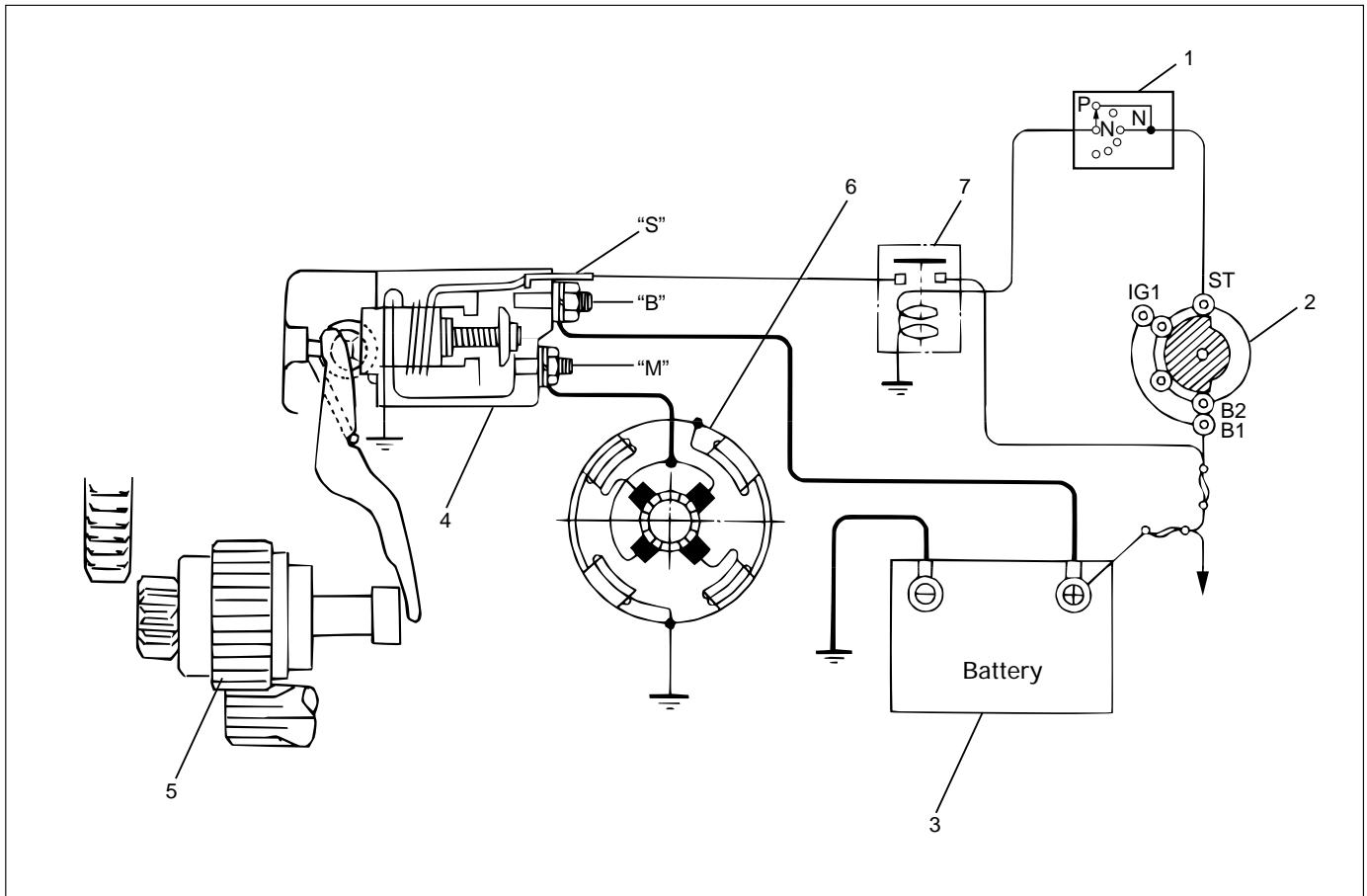
STARTING SYSTEM

GENERAL DESCRIPTION

STARTING CIRCUIT

The cranking system consists of a battery, starter,

starter switch, starter relay, etc. and these main components are connected as shown in the illustration.



065RW039

Legend

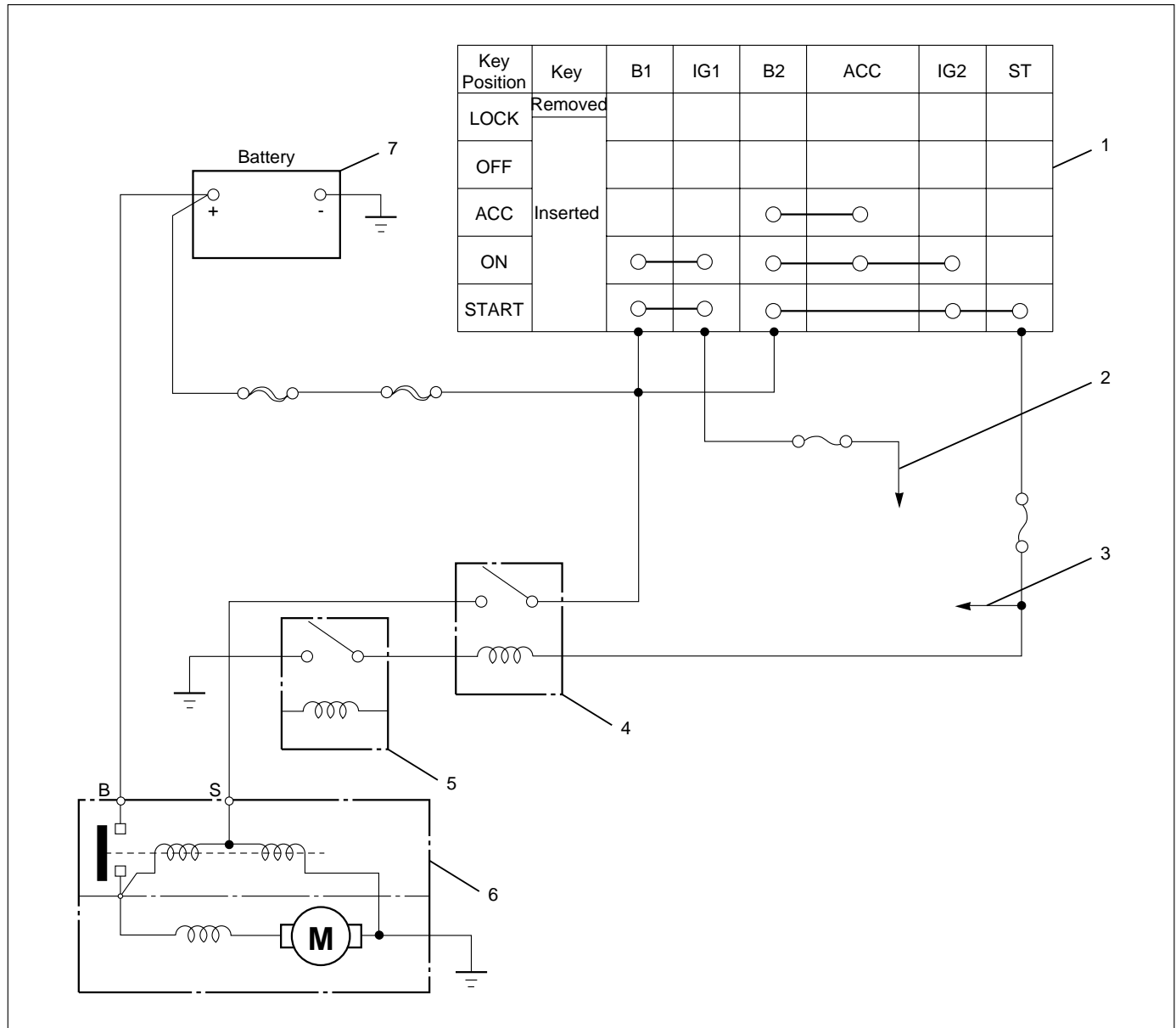
- | | |
|----------------------|---------------------|
| (1) Inhibitor Switch | (4) Magnetic Switch |
| (2) Starter Switch | (5) Pinion Clutch |
| (3) Battery | (6) Starter Motor |
| | (7) Starter Relay |

STARTER

The starting system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of the magnetic switch are closed, and the armature rotates. At the same time, the plunger is activated, and the pinion is pushed forward by the shift lever to mesh with ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.

RELATION BETWEEN STARTER SWITCH AND STARTER

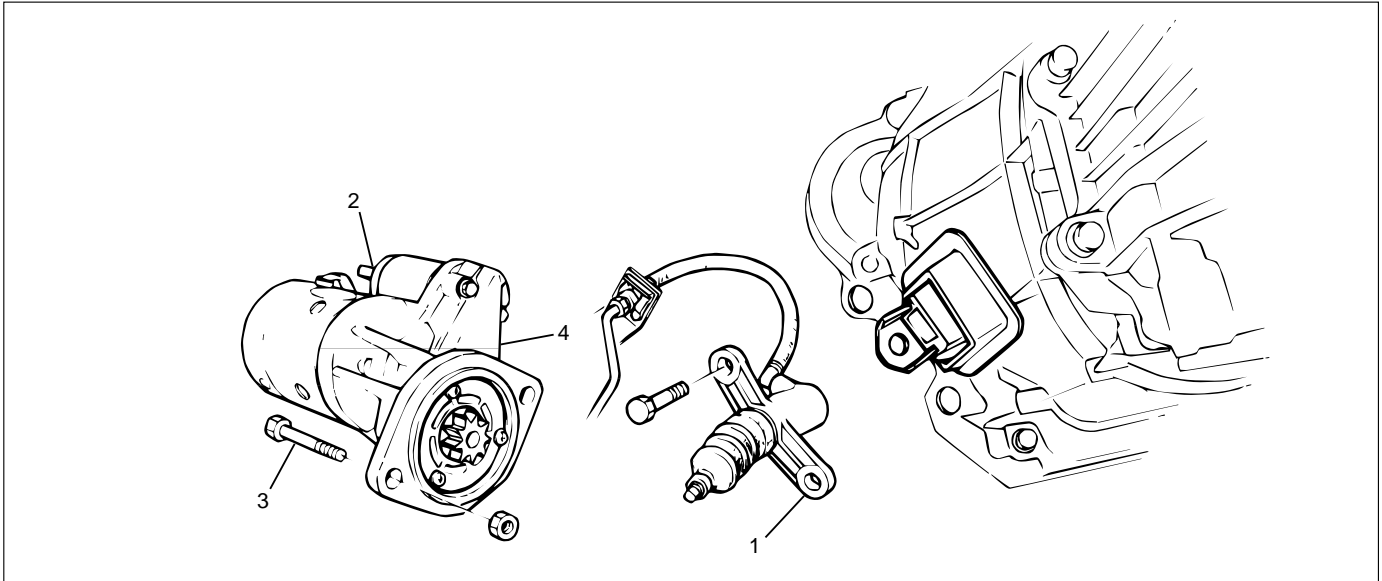


Legend

- (1) Starter Switch
- (2) To Generator
- (3) To QOS4 Control
- (4) Starter Relay
- (5) Immobilizer Relay (for Europe)
- (6) Magnetic Switch
- (7) Battery

ON-VEHICLE SERVICE

STARTER



065RW00003

Legend

- (1) Clutch Slave Cylinder
- (2) Magnetic Switch

- (3) Bolt
- (4) Starter Assembly

REMOVAL

- 1 Battery ground cable
- 2 Remove the slave cylinder and bind with wire it to the frame.
- 3 Disconnect the connector from terminals "B" and "S".
4. Remove mounting bolts
5. Remove starter assembly

INSTALLATION

1. Install starter assembly, tighten the fixing bolt and nut to the specified torque.

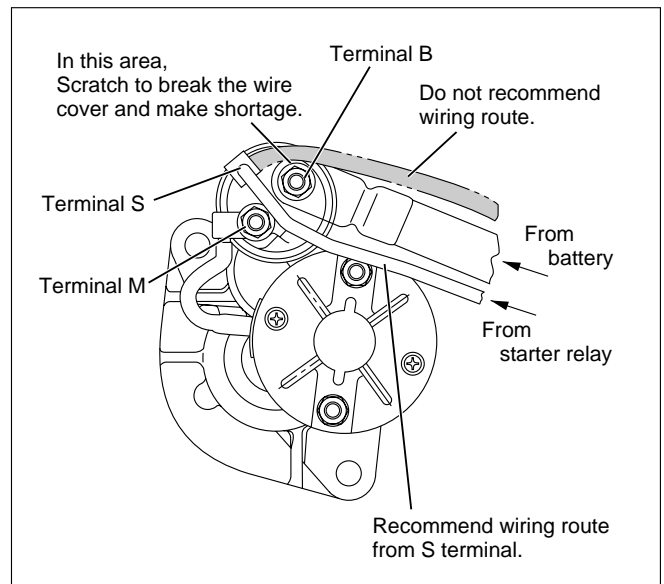
Torque: 94 N-m (9.6 kg-m/69 lb ft)

2. Reconnect the starter terminals.

CAUTION: When installing the starter motor wiring, do not allow the S-circuit wiring to obstruct the B-circuit terminal.

Install the wiring exactly as shown on the attached illustration.

If S-circuit wiring obstructs the B-circuit terminal, harness cover breakage and short circuiting may occur.

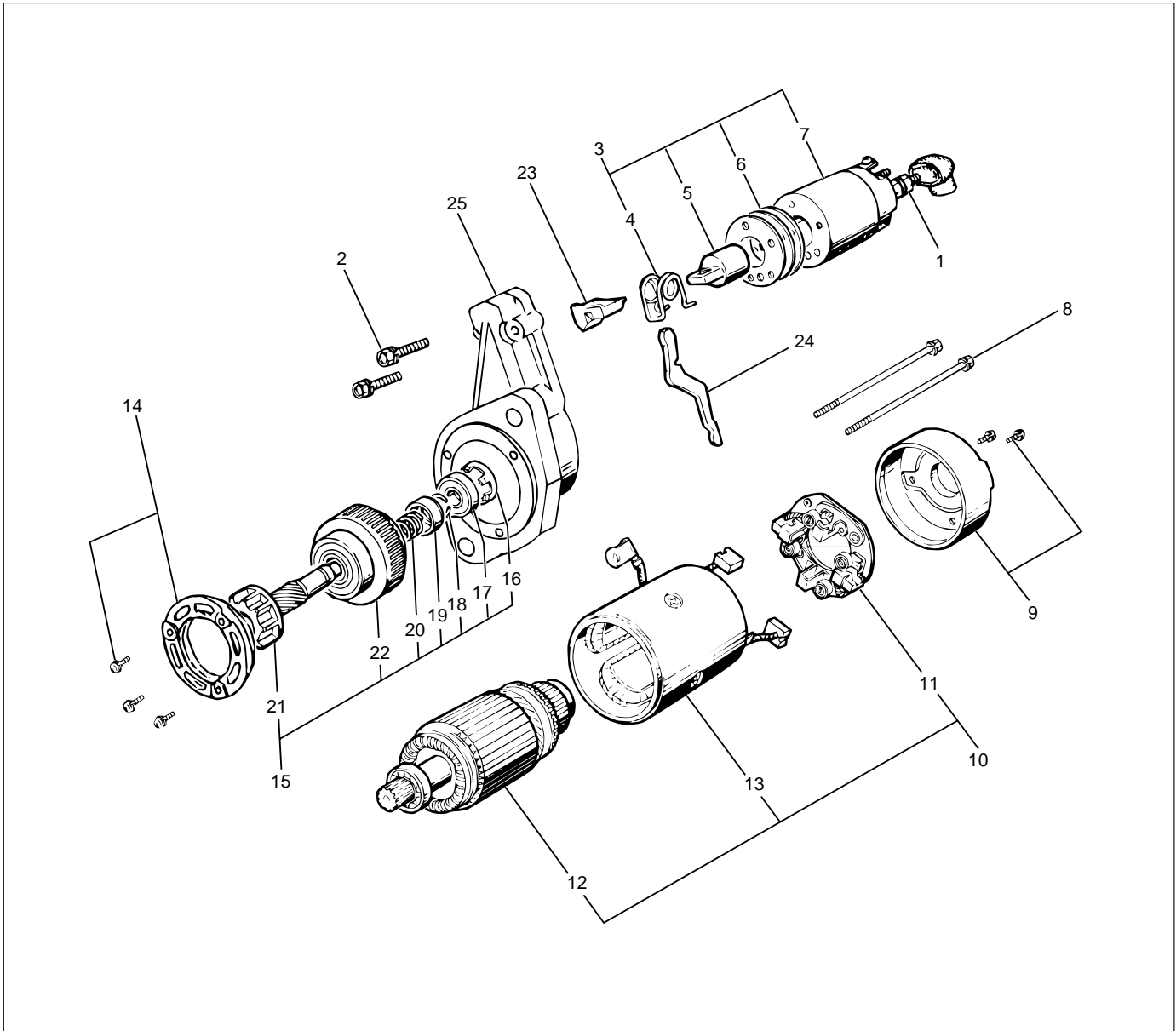


065RW00002

- 2-1. Install the wire harness from the battery to the terminal "B" with tightening torque 8.6 N-m (0.88 kg-m/6.4 lb-ft).
- 2-2. Cover the terminal "B" together with wire harness.
- 2-3. Connect the wire harness from starter relay to the terminal "S".
3. Install the clutch slave cylinder, tighten the fixing bolt and nut to the specified torque.

Torque: 78 N-m (8.0 kg-m/58 lb-ft)

UNIT REPAIR



065RW040

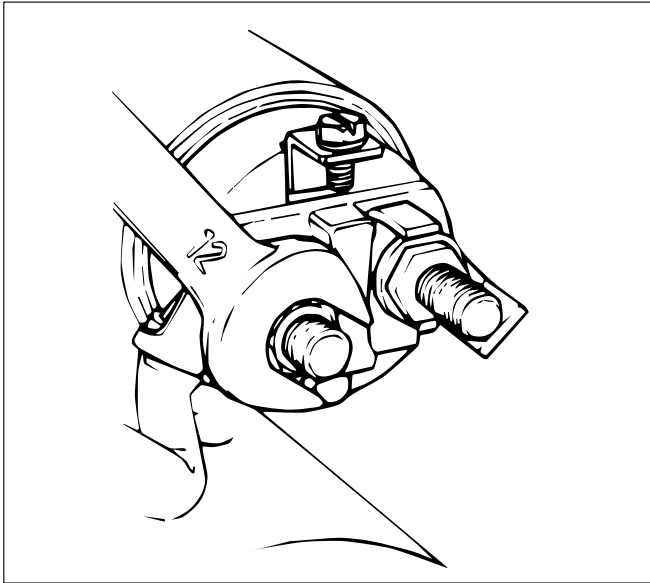
Legend

- | | |
|---------------------|-----------------------|
| (1) Terminal | (13) Yoke Assembly |
| (2) Bolt | (14) Bearing Retainer |
| (3) Magnetic Switch | (15) Pinion Assembly |
| (4) Torsion Spring | (16) Bearing Holder |
| (5) Plunger | (17) Bearing |
| (6) Shim | (18) Clip |
| (7) Magnetic Switch | (19) Stopper |
| (8) Through Bolt | (20) Spring |
| (9) Rear Cover | (21) Pinion Shaft |
| (10) Motor Assembly | (22) Clutch |
| (11) Brush Holder | (23) Dust Cover |
| (12) Armature | (24) Shift Lever |
| | (25) Gear Case |

DISASSEMBLY

1. Terminal Nut

- 1) Loosen the nut on terminal "M" of magnetic switch and disconnect the connector cable.



2. Bolt (2 pcs)

3. Magnetic Switch Assembly

4. Torsion Spring

- 1) Remove torsion spring from magnetic switch assembly.

5. Plunger

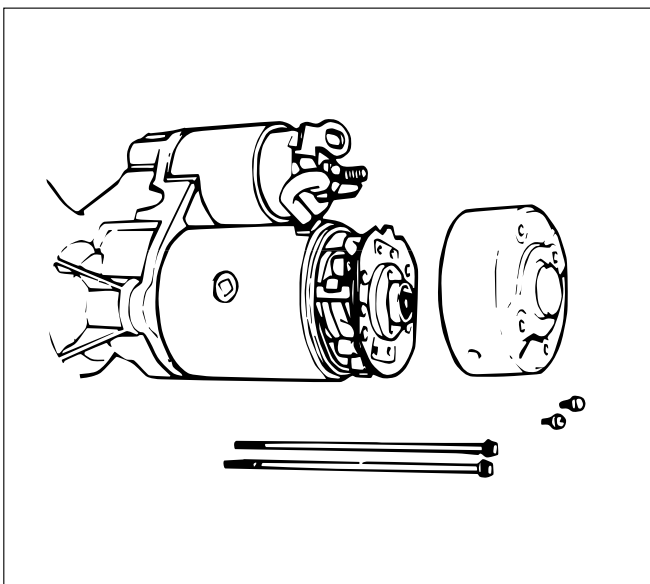
6. Shim

7. Magnetic Switch

8. Through Bolt

9. Rear Cover

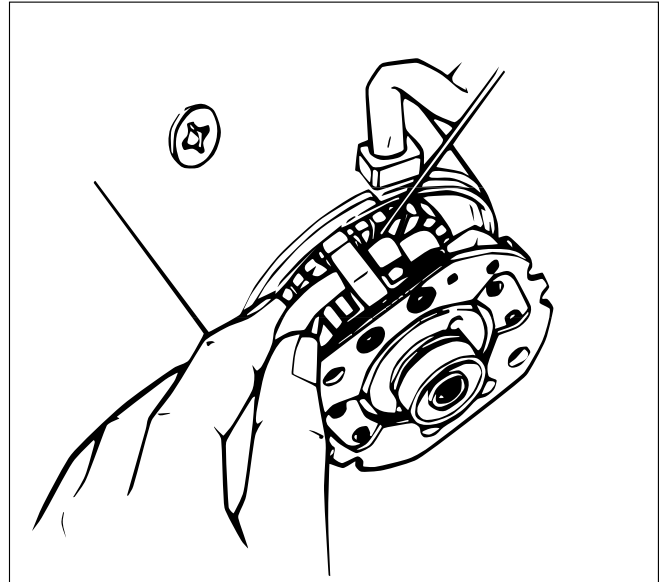
- 1) Remove the through bolts, then remove the rear cover.



10. Motor Assembly

11. Brush Holder

- 1) Raise a brush spring to detach the negative side of the brushes (2 pcs) from the commutator face and remove the positive side of brushes (2 pcs) from the positive side of brushes (2 pcs) from the brush holder.



12. Armature

13. Yoke Assembly

14. Bearing Retainer

15. Pinion Assembly

16. Bearing Holder

17. Bearing

18. Pinion Stopper Clip

- 1) Remove the stopper clip using a screw driver of equivalent size.

19. Pinion Stopper

20. Return Spring

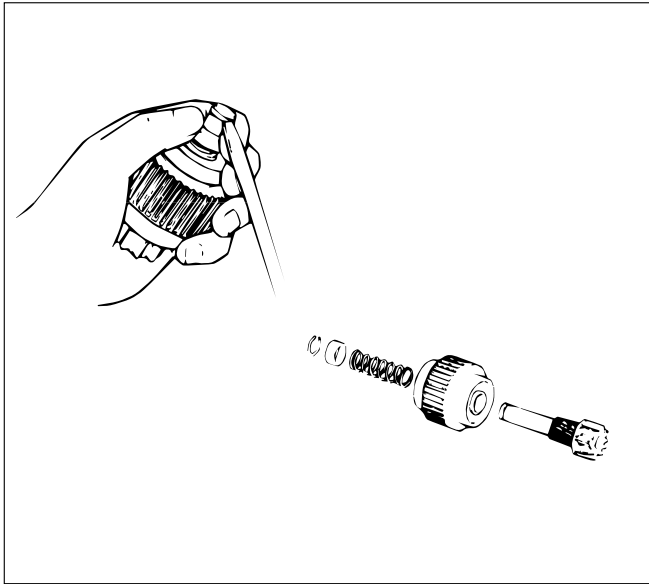
21. Pinion Shaft

22. Clutch

23. Dust Cover

24. Shift Lever

25. Gear Case



065RW041

INSPECTION AND REPAIR

Repair or replace necessary parts if extreme wear or damage is found during inspection.

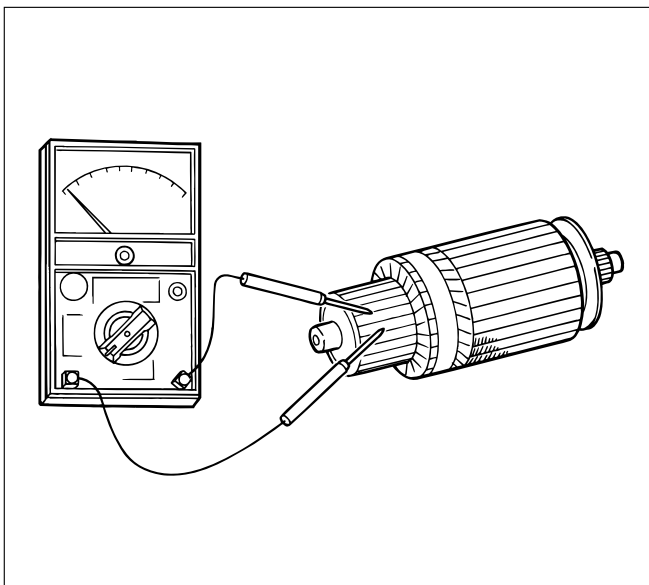
Armature

- 1) Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

Standard: 38.0 mm (1.50 in)

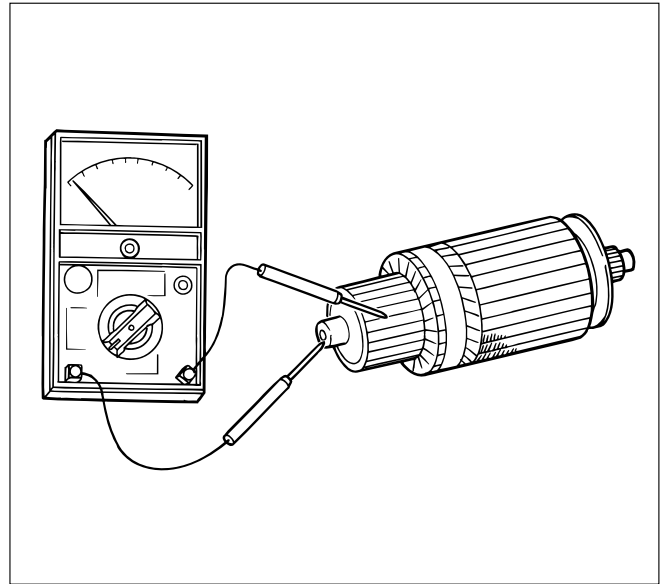
Limit: 36.5 mm (1.44 in)

- 2) Check for continuity between commutator and segments. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

- 3) Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

- 4) Measure runout of armature core and commutator with a dial gage. Repair or replace, if it exceeds the limit.

Armature

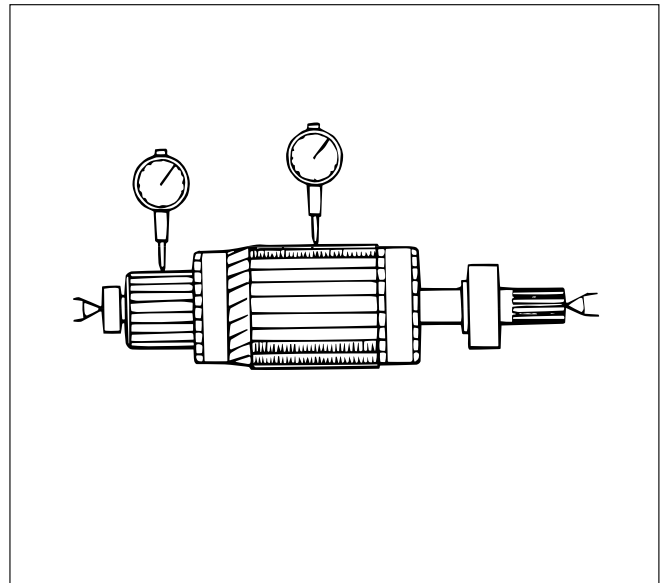
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.1 mm (0.004 in)

Commutator

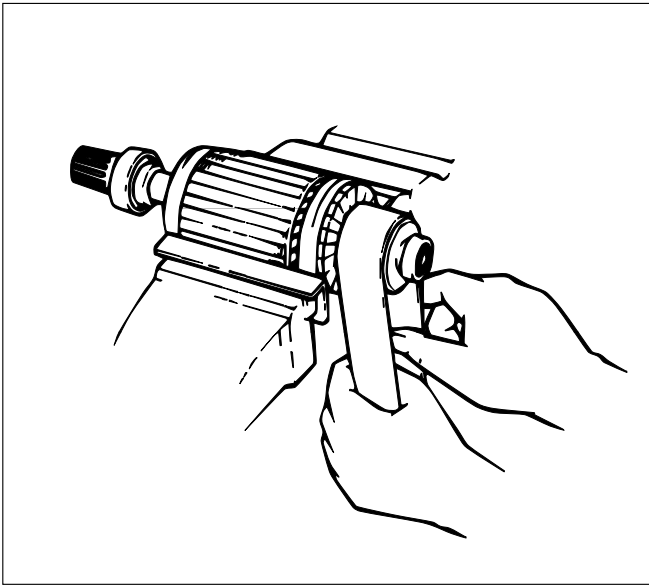
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.1 mm (0.004 in)



045RW045

- 5) Polish the commutator surface with sand paper #500 to #600 if it is rough.

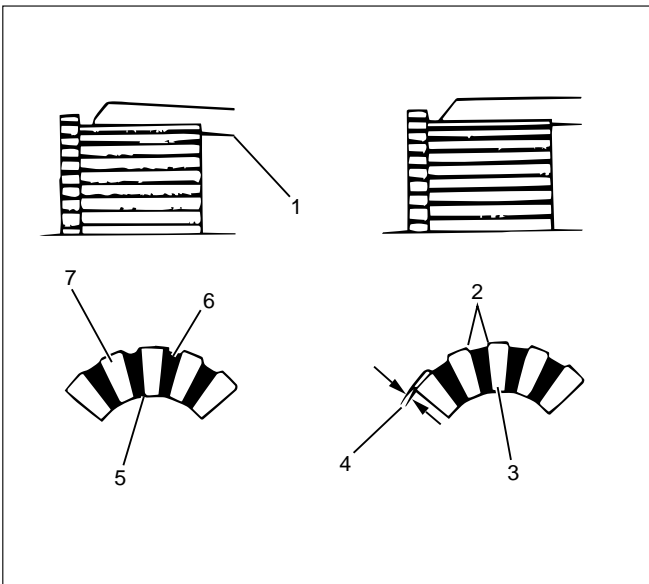


065RW105

- 6) Measure the depth of insulator in commutator. Repair, if it is below the limit.

Standard: 0.5 – 0.8 mm (0.02 – 0.03 in)

Limit: 0.2 mm (0.008 in)



065RW102

Legend

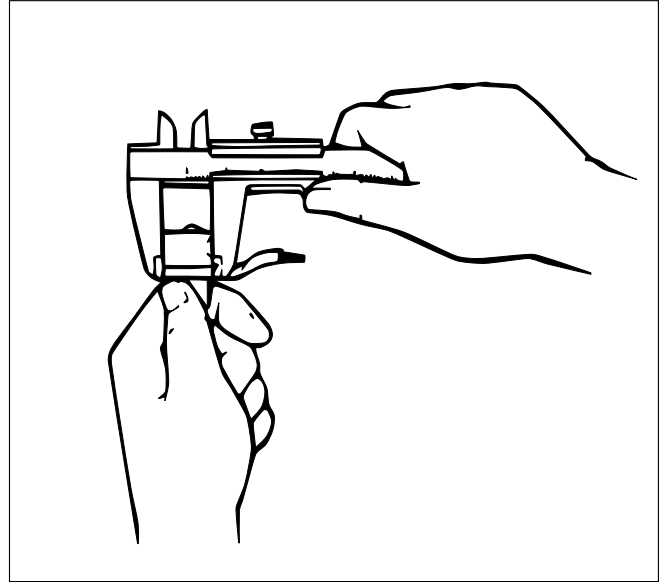
- (1) Steel Saw
- (2) Chamfer
- (3) Correct Condition
- (4) Depth of Insulator
- (5) Incorrect Condition
- (6) Insulator
- (7) Commutator Segment

Brush

- 1) Measure the length of brush.
Replace with a new one, if it is below the limit.

Standard: 18.0 mm (0.71 in)

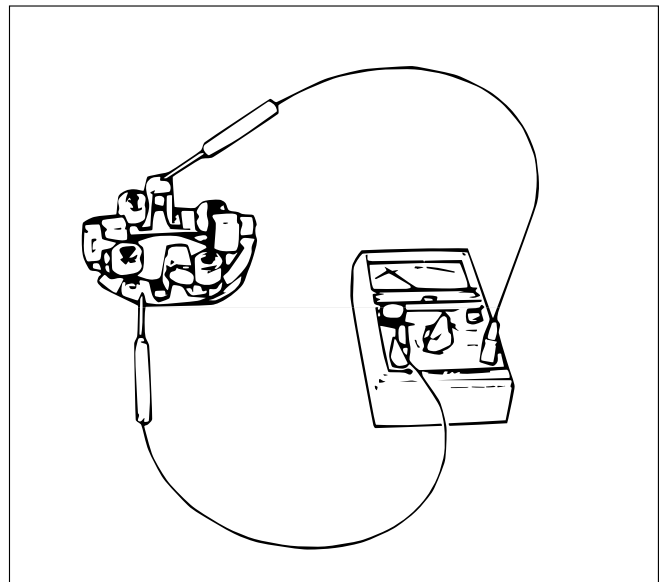
Limit: 11.0 mm (0.43 in)



065RW103

Brush holder

- 1) Check for continuity between brush holder (+) and base (-). Replace, if there is continuity (i.e., insulation is broken).

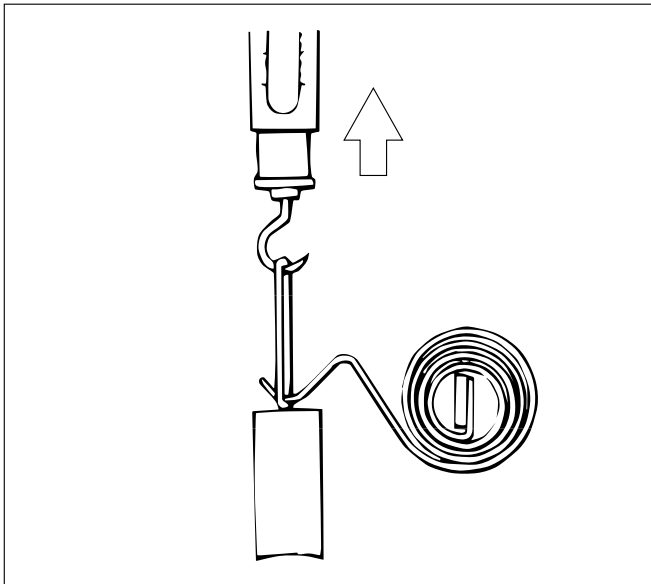


065RW104

6D – 12 ENGINE ELECTRICAL

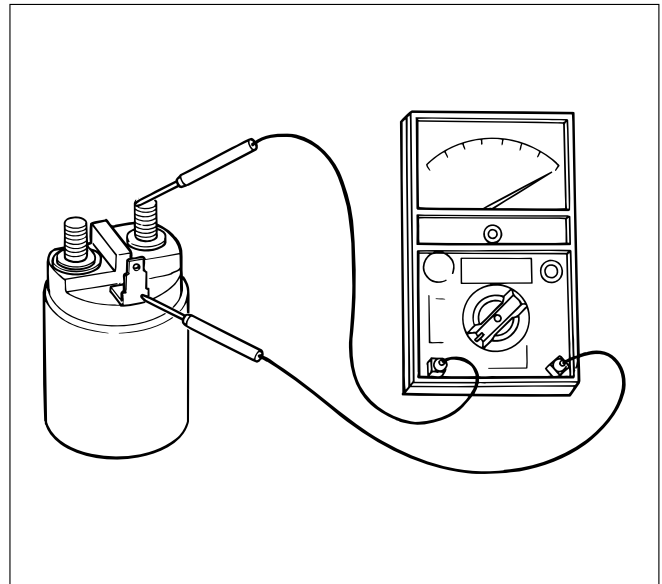
- 2) Inspect the brush springs for wear, damage or other abnormal conditions.

Standard: 28 – 35 N (2.9 – 3.6 kg/6.4 – 7.9 lb)



065RW052

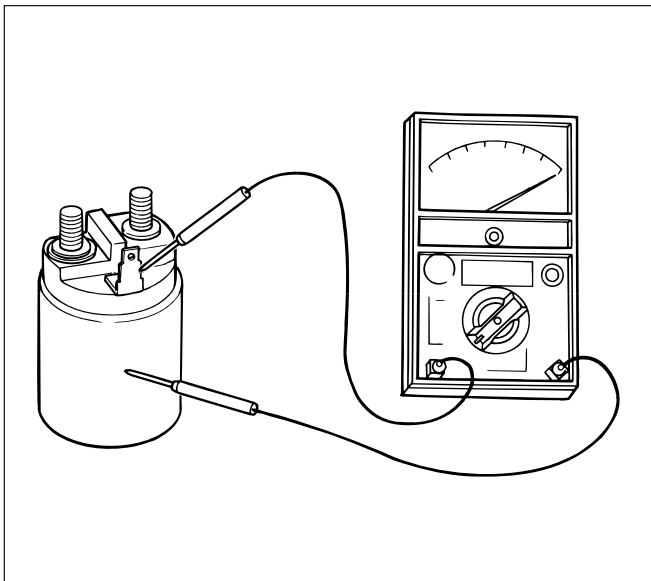
- 2) Continuity of series coil
Check for continuity between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW017

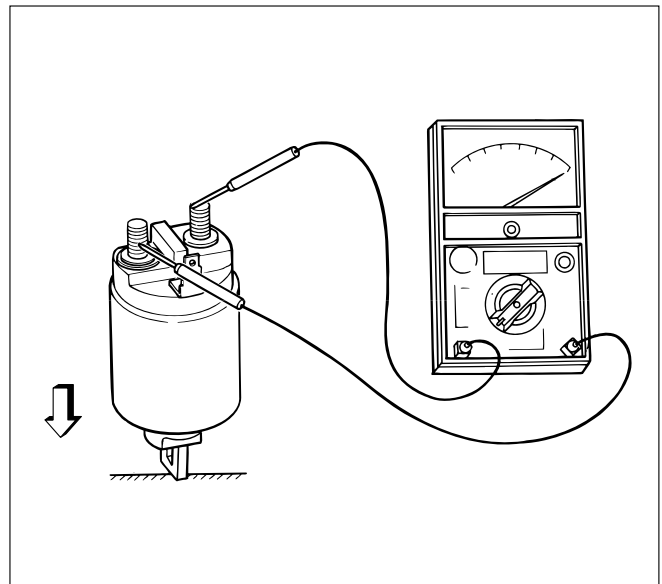
Magnetic switch

- 1) Continuity of shunt coil
Check for continuity between terminals S and coil case.
Replace, if there is not continuity (i.e., coil is disconnected.)



065RW016

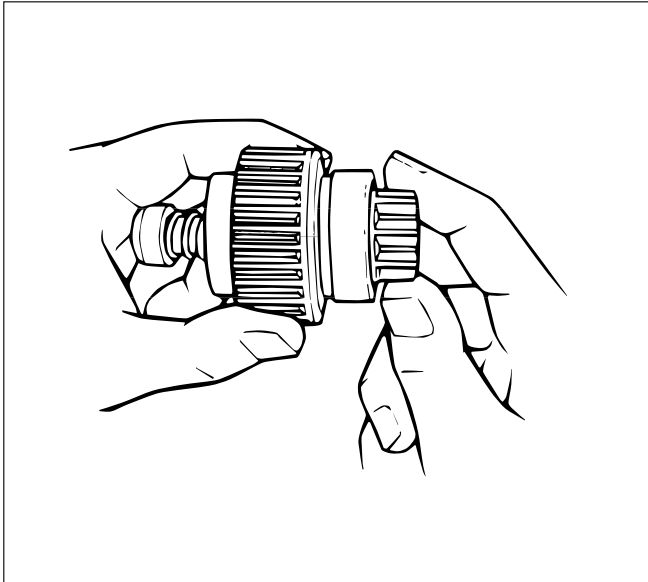
- 3) Continuity of contacts
With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



065RW018

Pinion

- 1) Check by hand to see if the pinion rotates smoothly in the dirve direction, or if it is locked when it is rotated reversely.
If not, replace the pinion.



065RW048

Yoke assembly

- 1) Check the magnet inside the yoke.
Replace the yoke assembly if it is broken.

REASSEMBLY

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

Grease application places

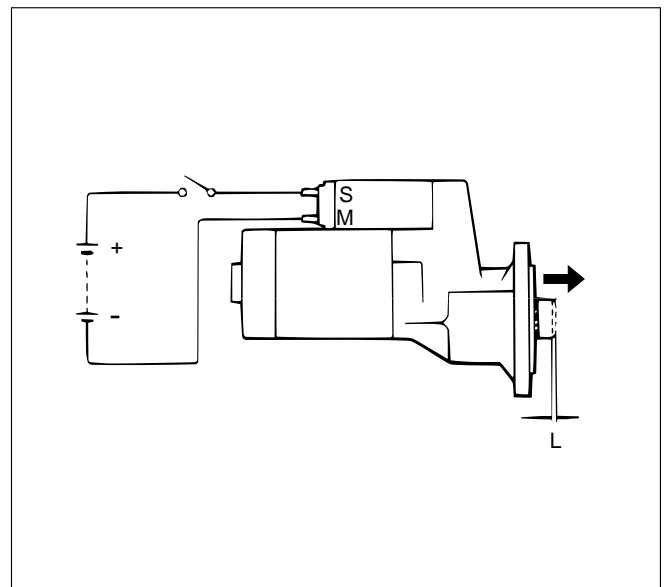
- 1) Gears in reduction gear
- 2) Shift lever operating portion
- 3) Sliding potion of pinion
- 4) Plunger sliding portion of magnetic switch

Pinion jump-out dimension

- 1) Connect the (+) cable of battery to terminal S and the (-) cable to terminal M. Turn the switch on, and measure pinion travel dimension "L" in thrust direction from the jump-out position.

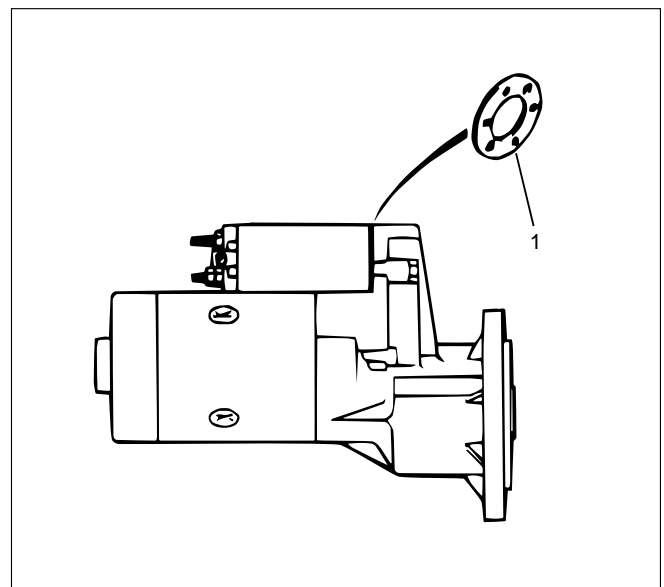
In measuring the dimension, pull the pinion out a little in the arrow direction.

Dimension L: 0.3 – 1.5 mm (0.01 – 0.06 in)



065RW054

If the measured value is out of standard, adjust the of shims.



065RW053

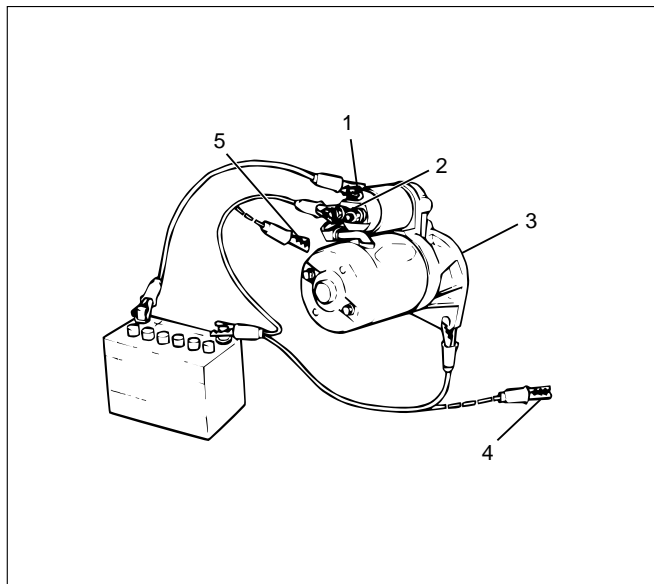
Legend

(1) Shim

MAGNETIC SWITCH

Pull-out test

Connect the magnetic switch to the battery as shown. The negative side to the “M” terminal and the magnetic switch body (housing); the positive side to the “S” terminal. If the pinion has been ejected, the pull-in coil is satisfactory.



06SRW055

Legend

- (1) Terminal “S”
- (2) Terminal “M”
- (3) Starter
- (4) For Return Test
- (5) For Hold-In Test

Hold-in test

1. Next disconnect the “M” terminal.
2. The pinion should remain in the ejected position.

Return test

When the switch body is disconnected, the pinion should return quickly.

CHARGING SYSTEM

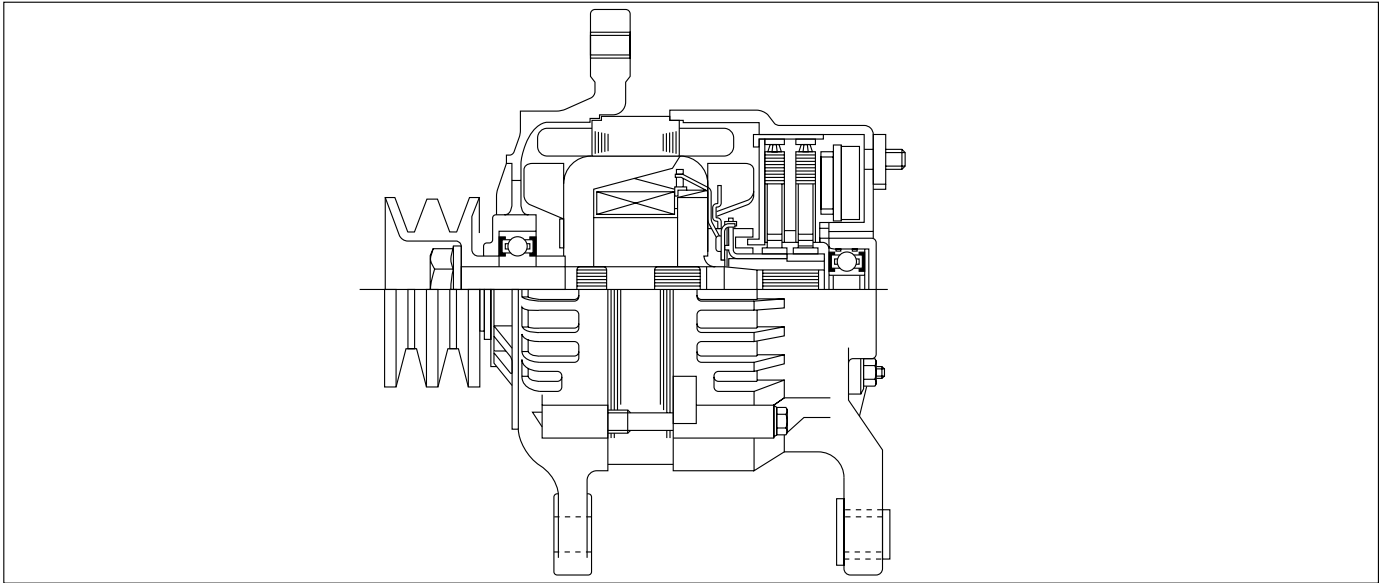
GENERAL DESCRIPTION

The charging system is the IC integral regulator charging system and its main components are connected as shown in Figure.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

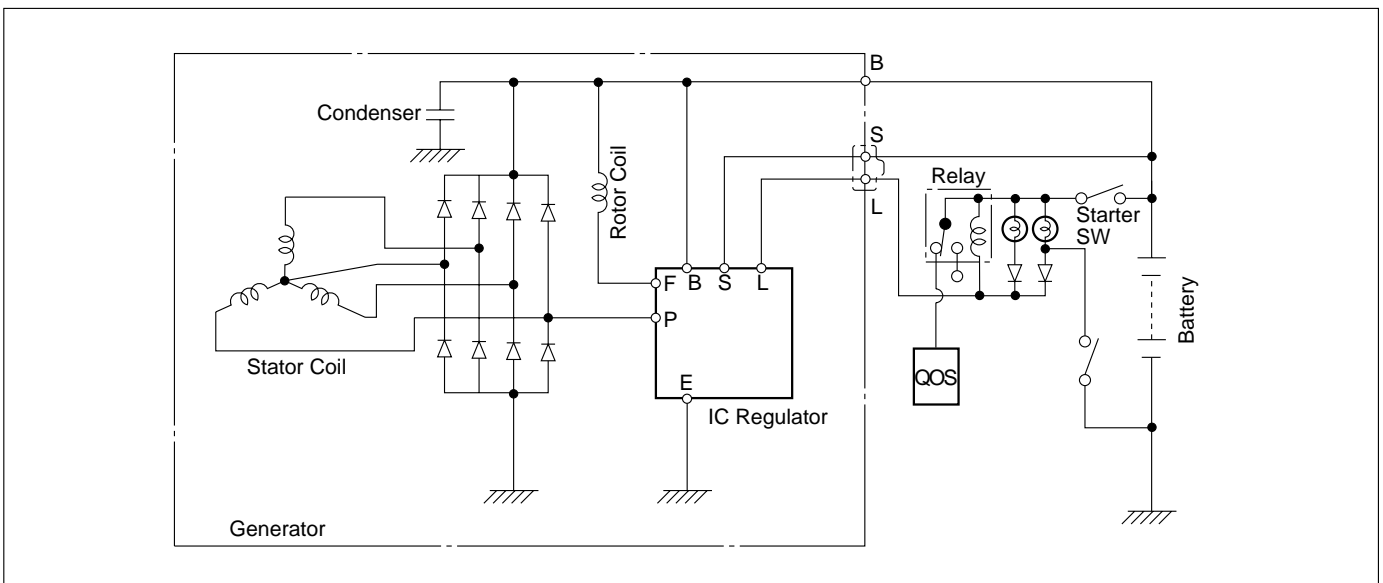
The generator does not require particular maintenance such as voltage adjustment. The rectifier connected to the stator coil has nine diodes to transform A.C. voltage into D.C. voltage. This D.C. voltage is connected to the output terminal of generator.

GENERATOR



A06RW001

CHARGING CIRCUIT



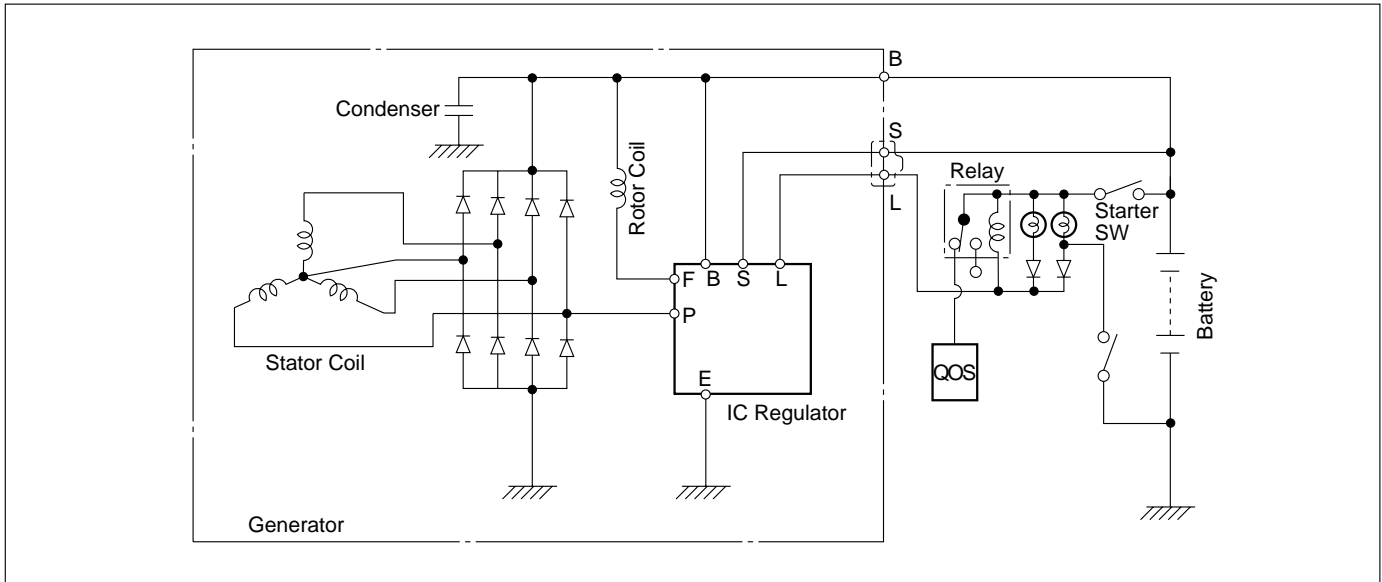
065R200028

DIAGNOSIS

GENERAL ON-VEHICLE INSPECTION

The operating condition of the charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally

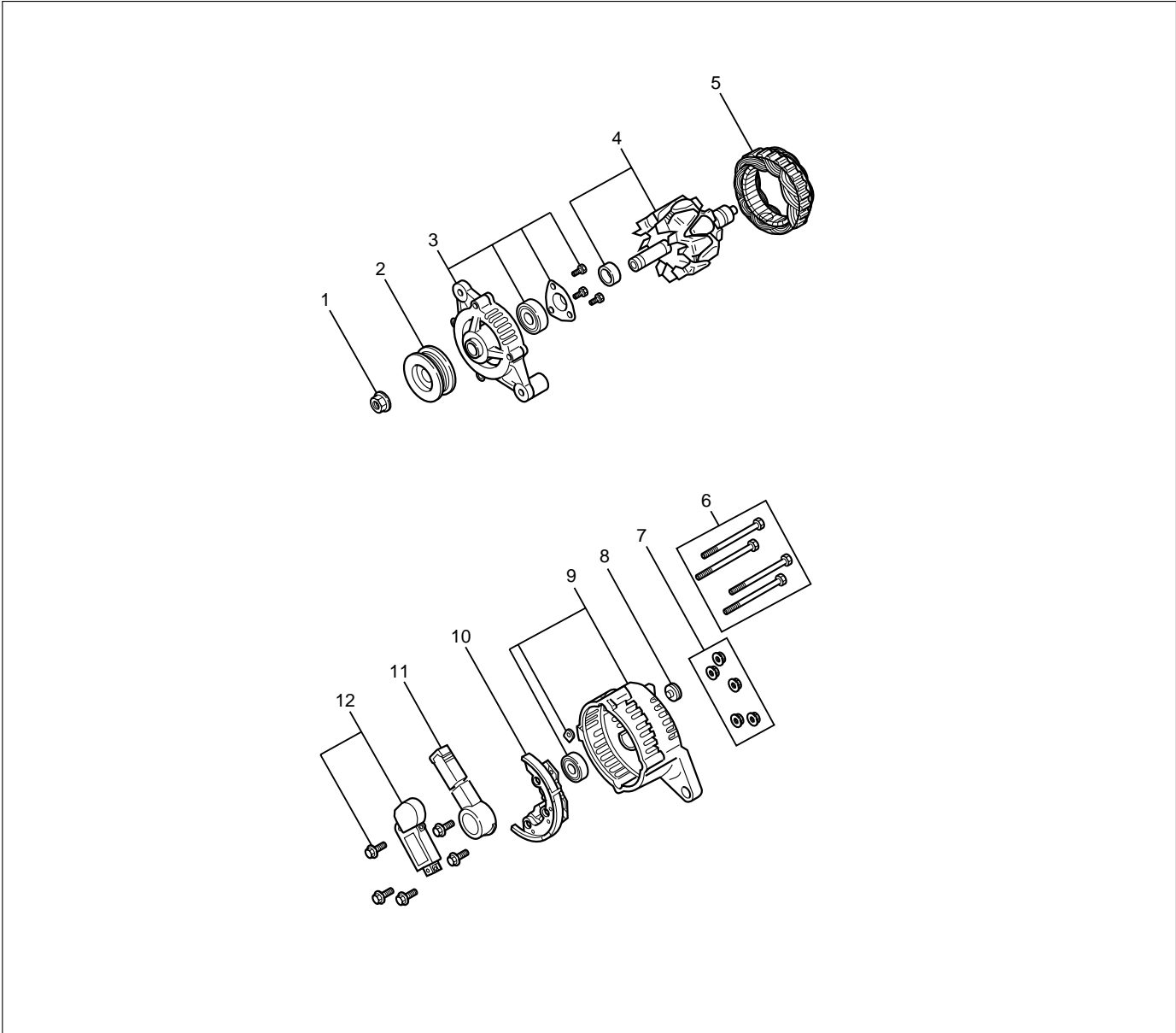
if the lamp goes off when the engine starts. If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:



065R200028

1. Check visually the belt and wiring connector.
2. With the engine in stop status, turn the starter switch to "ON" position and observe the warning lamp.
 - 1) If lamp does not come on:
Disconnect wiring connector from generator, and ground terminal "L" on connector side.
 - 2) If lamp comes on:
Repair or replace the generator.

UNIT REPAIR



066RW022

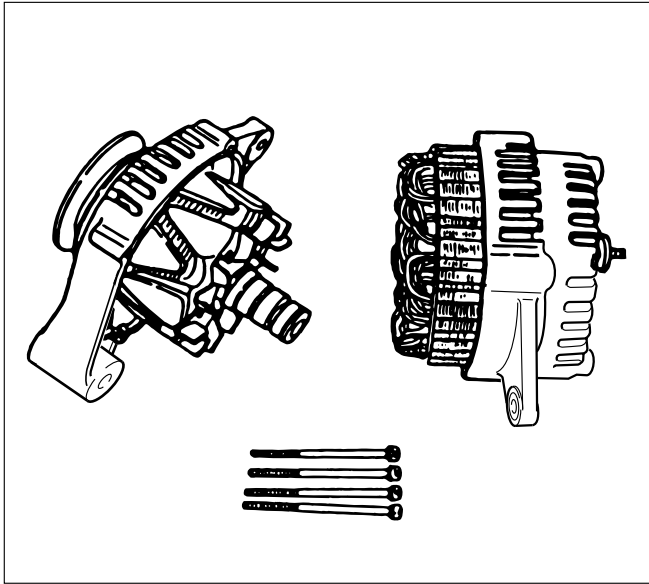
Legend

- (1) Pulley Nut
- (2) Pulley
- (3) Front Cover Assembly
- (4) Rotor Assembly
- (5) Stator Assembly
- (6) Through Bolt
- (7) Nut
- (8) Terminal Insulator Plate
- (9) Rear Cover Assembly
- (10) Diode
- (11) Brush Holder
- (12) Regulator Assembly

DISASSEMBLY

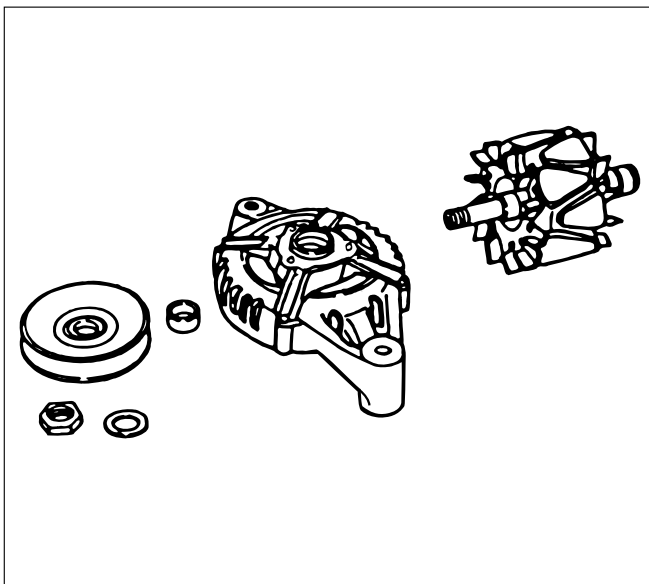
1. Remove the through bolt.
Insert the tip of a pry bar into the gaps between the front cover and the stator core.
Pry apart and separate the front cover, rotor, the rear cover and stator.

NOTE: Take care not to scratch or otherwise damage the stator coil with pry bar.



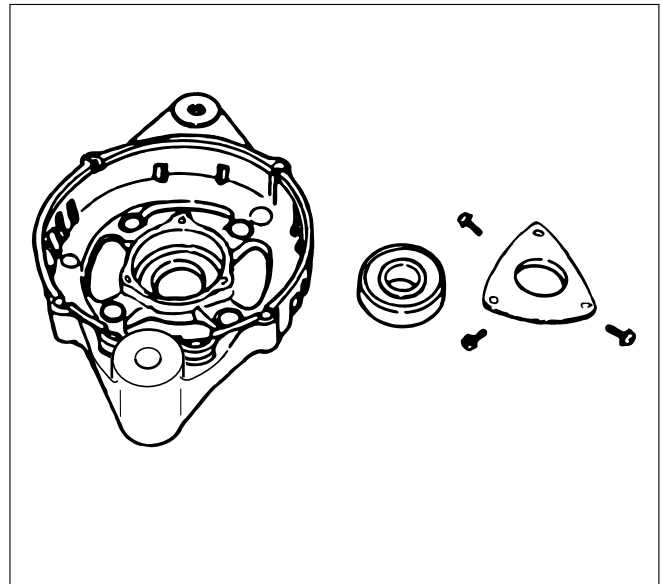
F06RT021

2. Clamp the rotor in a vise and then remove the nut and pulley.
3. Remove the rotor assembly from front cover.



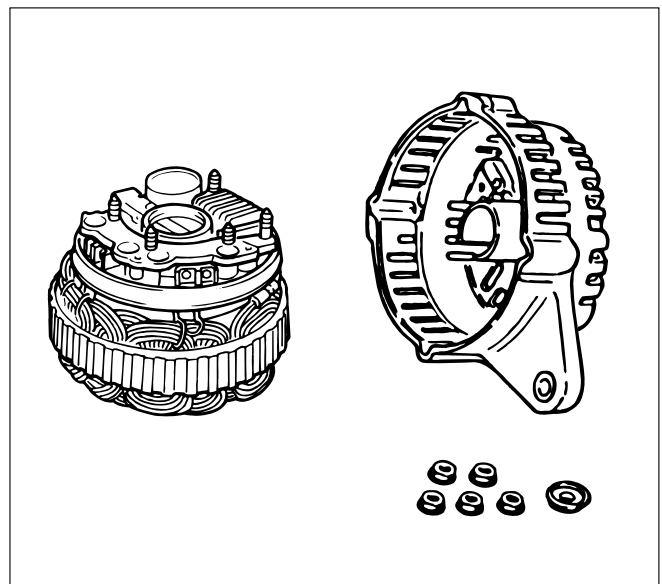
F06RT022

4. Remove screws with bearing retainer from front cover and remove bearing.



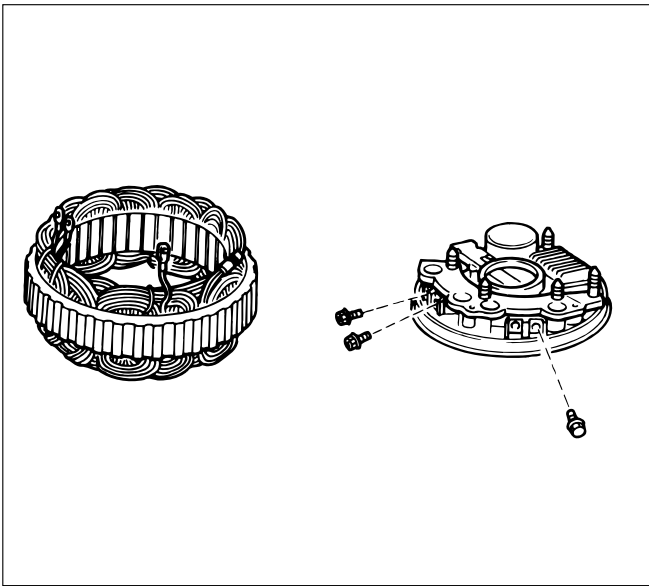
F06RT023

5. Remove the mounting nuts holding the "B" terminal, the diode, and the brush holder.
6. Separate the rear cover from the stator.



F06RT024

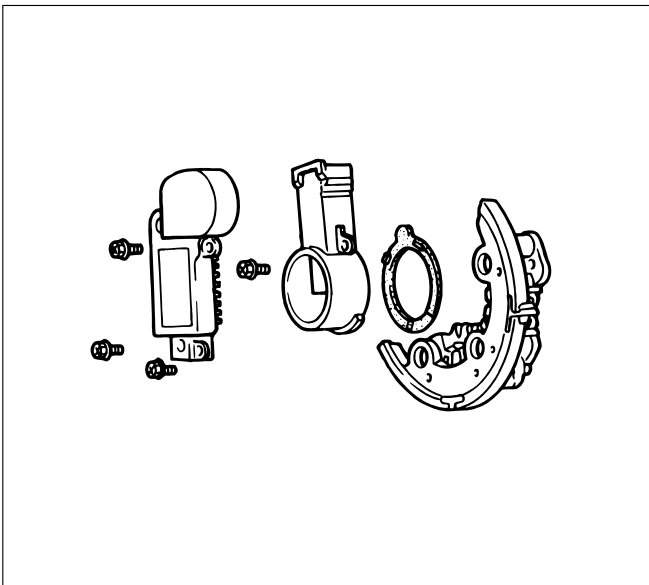
- Remove bolts which secure stator terminal to rectifier terminal, and remove stator.



066RS030

- Remove Bolts which secure regulator, rectifier and brush-holder, and separate these parts.

NOTE: Do not apply a shock or load to regulator, rectifier and brush holder.



066RW025

INSPECTION AND REPAIR

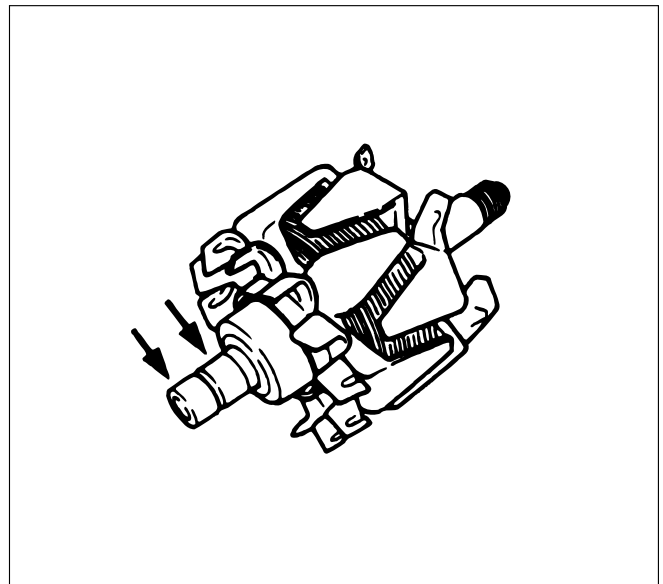
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Rotor Assembly

- Check the face of the slip rings for contamination and roughness. If found to be scored, dress with a fine sandpaper (#500 – 600). If found to be contaminated, clean with a cloth saturated with alcohol.
- Measure the outside diameter of the slip rings.

Standard: 27 mm (1.06 in)

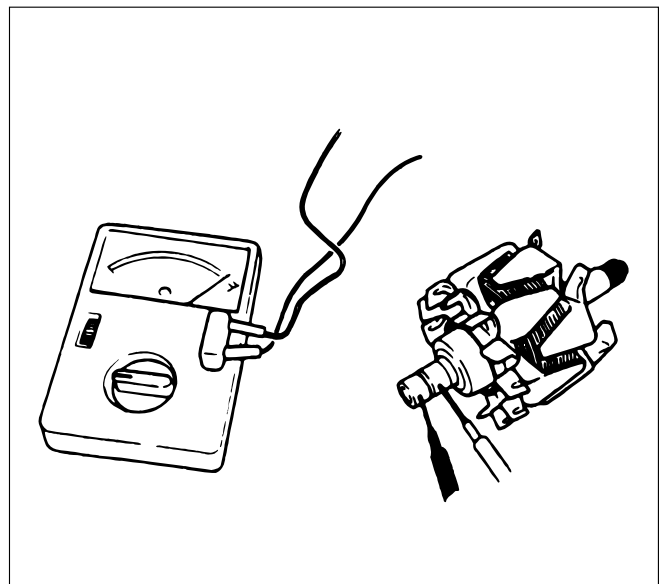
Limit: 26 mm (1.02 in)



066RS032

- Check resistance between slip rings, and replace if there is no continuity.

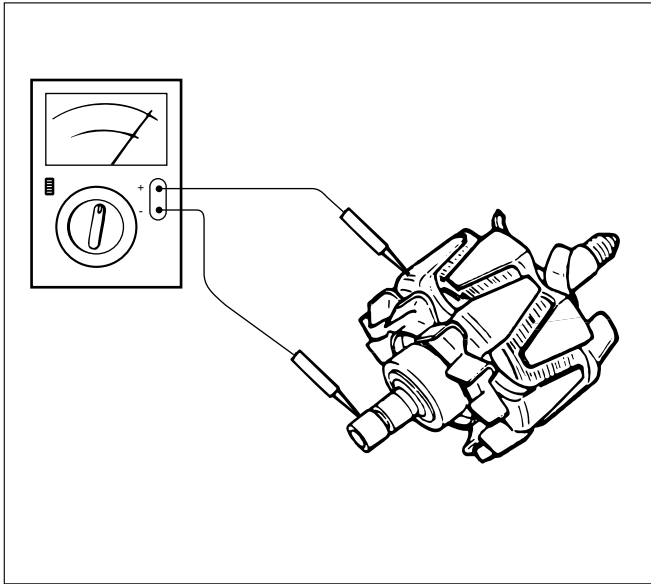
Standard: 3.75 Ω or less



066RS033

6D – 20 ENGINE ELECTRICAL

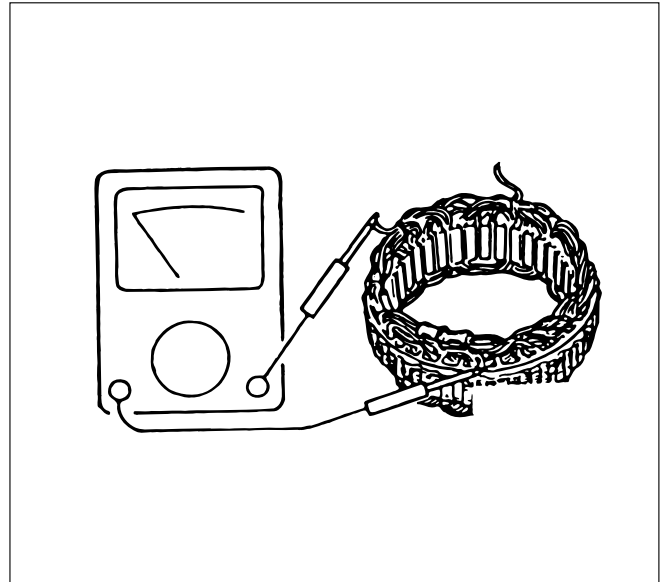
4. Check for continuity between slip ring and rotor core.
In case of continuity, replace the rotor assembly.



066RS017

2. Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.

Standard: More than 1M Ω

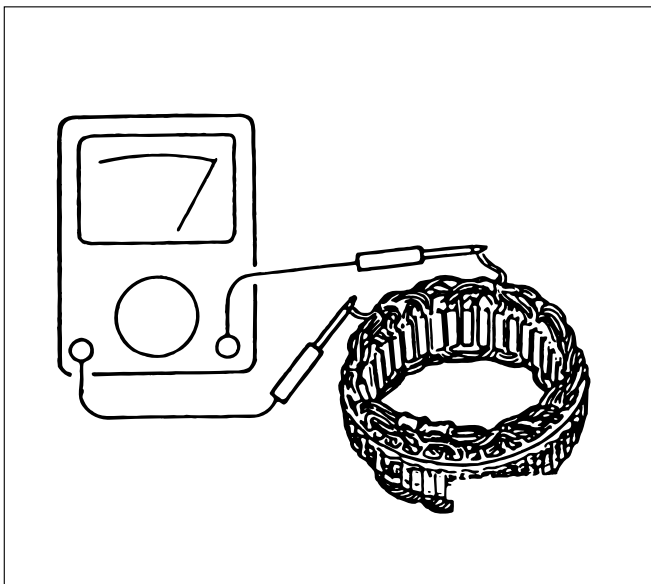


066RS035

Stator Coil

1. Check for continuity across the stator coils. If no continuity exists, replace the coils.
Resistance value at 20°C

Standard: Approx 0.07 Ω



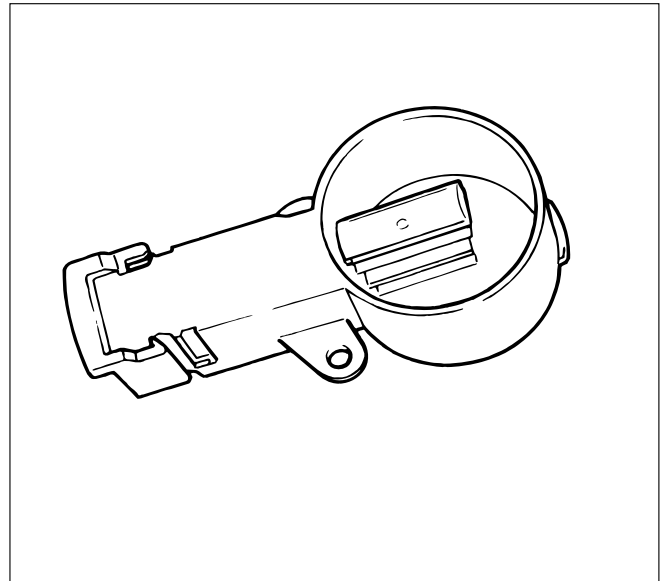
066RS034

Brush

Measure the brush length.
If more than limit, replace the brush.

Standard: 18.0 mm (0.709 in)

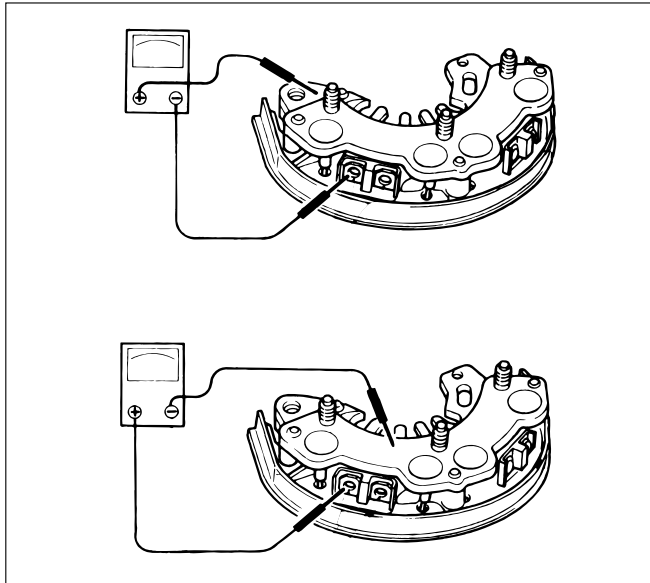
Limit: 5.5 mm (0.217 in)



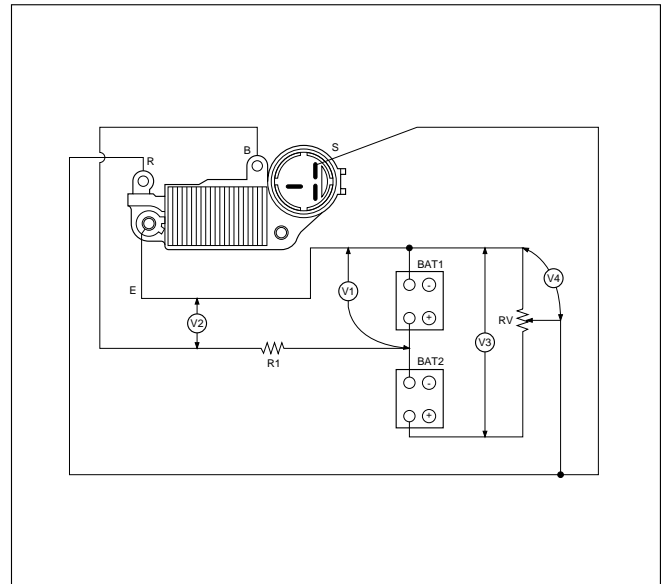
066RW024

Rectifier Assembly

1. Measure the resistance between each diode terminal and aluminum diode fin in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
2. If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.



066RS036



066RW029

Reassembly

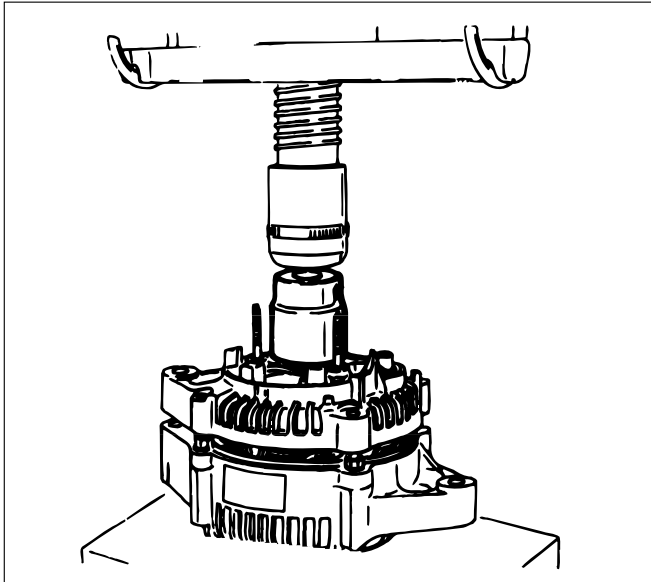
To reassemble, follow the disassembly steps in the reverse order, noting the following points:

NOTE:

- 1) Never make battery connections with polarities reversed, or battery will be shorted via the diodes. This will cause damage to the diodes.
 - 2) Do not connect generator B terminal to ground; it is connected directly to the battery. This cable will burn if it is connected to ground.
 - 3) Make sure to disconnect the positive (+) terminal of the battery when quick-charging battery. Diodes may be damaged due to abnormal pulse voltage generated by the quick charger.
 - 4) When reassembling the front section to rear section, insert a stiff wire into hole in the rear face of the rear cover from the outboard side to support the brush in raised position, then insert the front section to which rotor is assembled.
 - 5) Reassemble parts carefully to be sure they fit into their original position, paying attention to the insulated portions.
 - 6) Wipe insulating tubes, washers and plates clean and install them in position carefully to avoid getting oil or grease on them.
- a. Measuring equipment specifications
1. Fixed resistor (R1) : 10 Ohms / 3W
 2. Variable resistor (Rv) : 0 – 300 Ohms / 12W
 3. Batteries (BAT1, BAT2) : 12V (2 Batteries)
 4. DC voltmeter : 0 – 50V / 0.5 steps (4 Check points)
- b. Measuring procedure
1. Measure the voltage “V1” across the first battery (BAT1). If the reading is between 10 and 13 volts, the battery is normal.
 2. Measure the voltage “V3” across both the batteries (BAT1, BAT2). If the reading is between 20 and 26 volts, the batteries are normal.
 3. Gradually increase the resistance of the variable resistor from zero. Measure the voltage “V2” (the voltage across the F and E terminals).
Check to see that the voltage across “V1” changes at this time. If there is no change, the voltage regulator is faulty and must be replaced.
 4. Measure the voltage at “V4” (the voltage across the variable resistor center tap and terminal E with the variable resistor resistance held constant). The measure voltage should be within the specified (14.4 ± 0.3 volts) limits. If it is not, the regulator must be replaced.

6D – 22 ENGINE ELECTRICAL

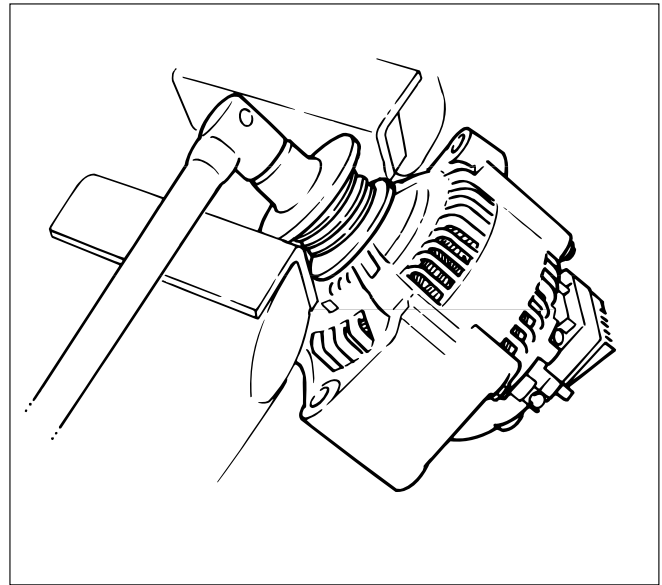
- Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.



066RS022

- Install pulley on the rotor.
Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

Torque: 111 N·m (82 lb ft)



066RS010

MAIN DATA AND SPECIFICATIONS

General Specifications

	Model	LR190-750B	LR-1100-731
Battery voltage	V		12
Rated output	A	90	100
Direction of rotation (as viewed from pulley side)		Clockwise	
Rated rotation speed	rpm		5,000
Maximum speed	rpm		18,000

QOS4 PREHEATING SYSTEM

GENERAL DESCRIPTION

QOS4 preheating system features a quick-on glow plug with thermometer control of the glowing time and the afterglow time function.

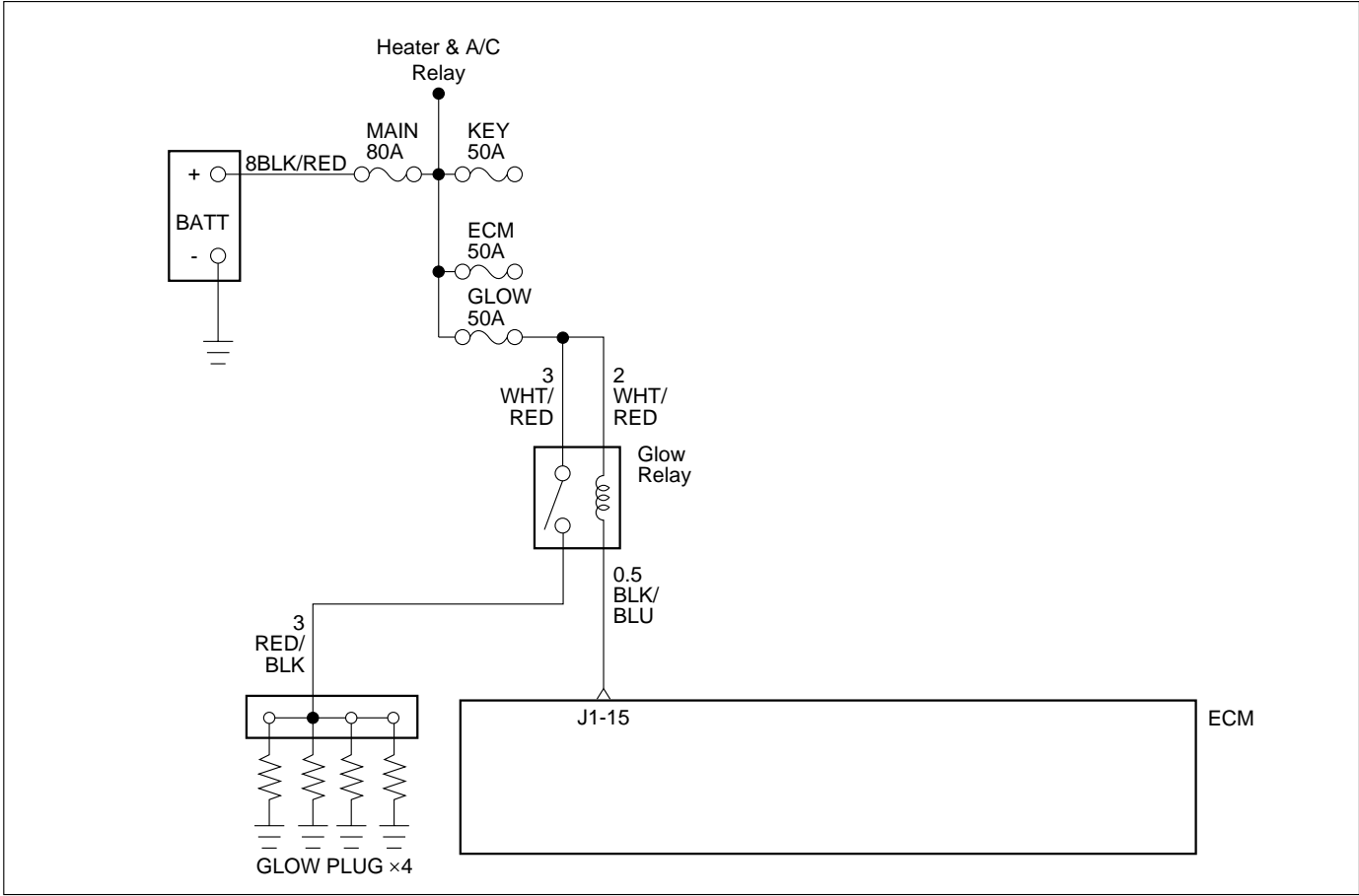
The system consists of the ECM, indicator lamp, ECT sensor, vehicle speed sensor, relay and temperature self-control type glow plugs.

With the employment of the ECT sensor, the glow time changes according to the engine coolant temperature, thus allowing optimum starting conditions to be obtained.

The after glow time function is controlled by ECM.

NOTE:
Refer to DTC P0380 and P0381 of 6E section.

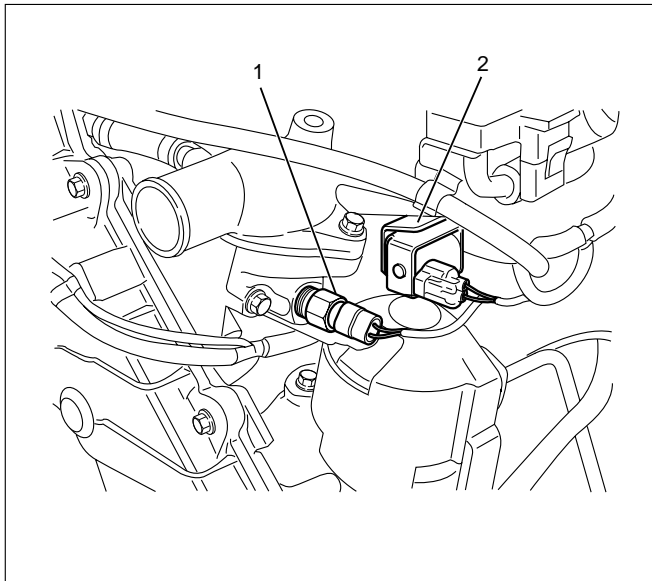
SYSTEM DIAGRAM



INSPECTION ON QOS4 SYSTEM OPERATION

1 Inspection on Quick Heating Operation

1. Disconnect ECT-sensor connection on the thermostat housing



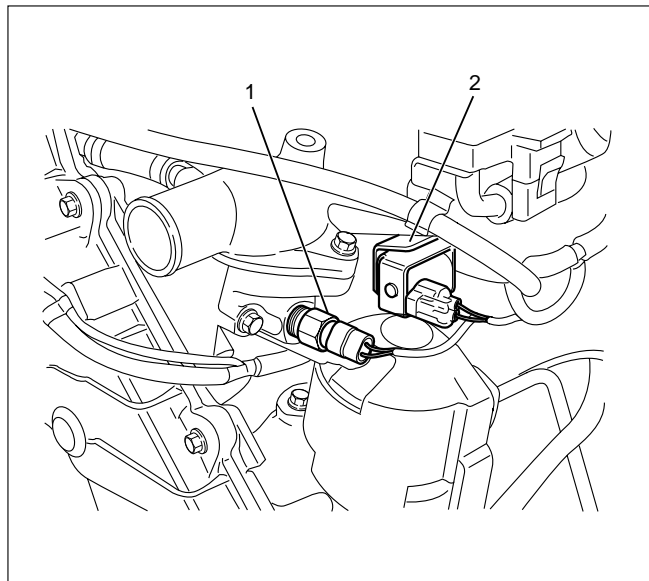
060RW166

Legend

- (1) ECT Sensor
- (2) EVRV

2 Inspection on Afterglow Operation

1. Disconnect ECT-sensor connection on the thermostat housing



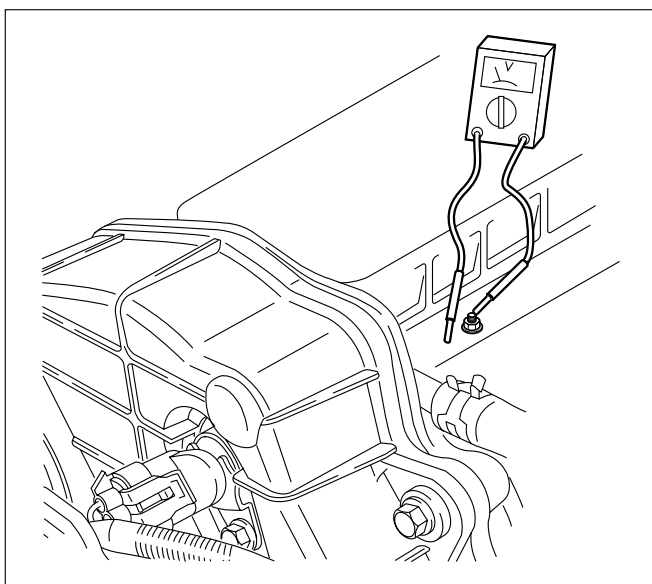
060RW166

Legend

- (1) ECT Sensor
- (2) EVRV

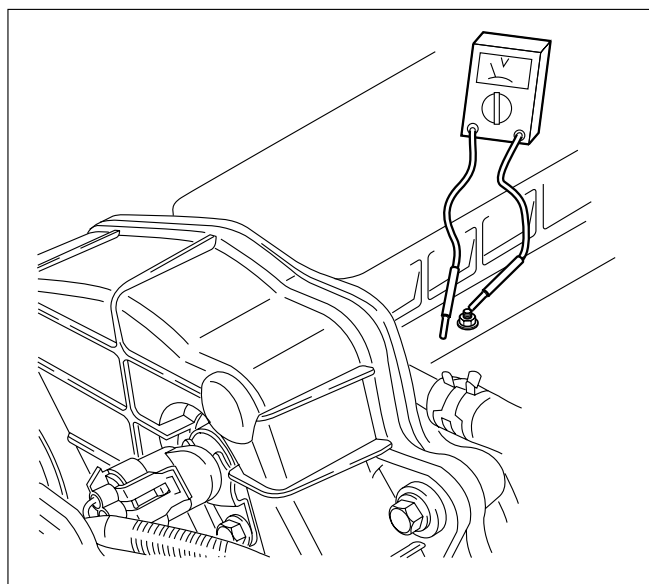
2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following items with starter switch set to ON position (but do not start the engine).
 - 1) The glow indicator shall light for about 5 sec.
 - 2) The circuit tester shall indicate power supply voltage for 180 sec.

If above specifications are not satisfied, inspect wire harness, glow relay and ECT-sensor. If satisfied, inspect glow plug.



065RW035

2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following item with the engine started.
 - 1) The circuit tester shall indicate about 12 volts after 180 seconds of engine start.
 - If above specifications are not satisfied, inspect battery voltage, engine earth, wiring harness, glow plug, and ECM.

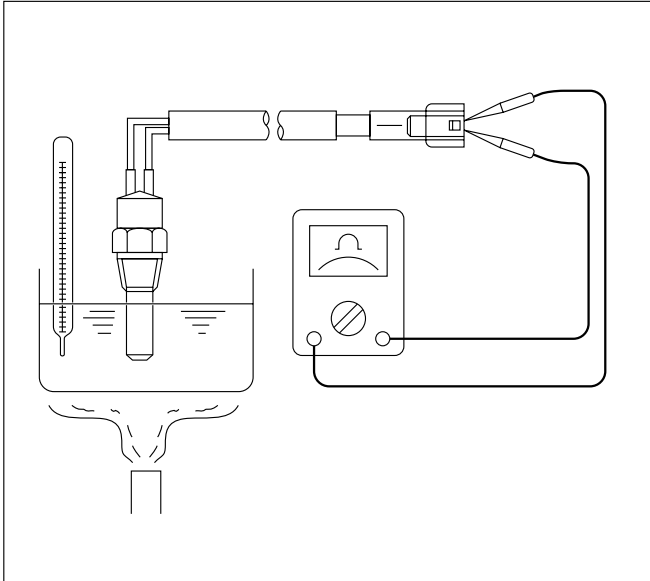


065RW035

ECT SENSOR

Measure the resistance depending on the water temperature.

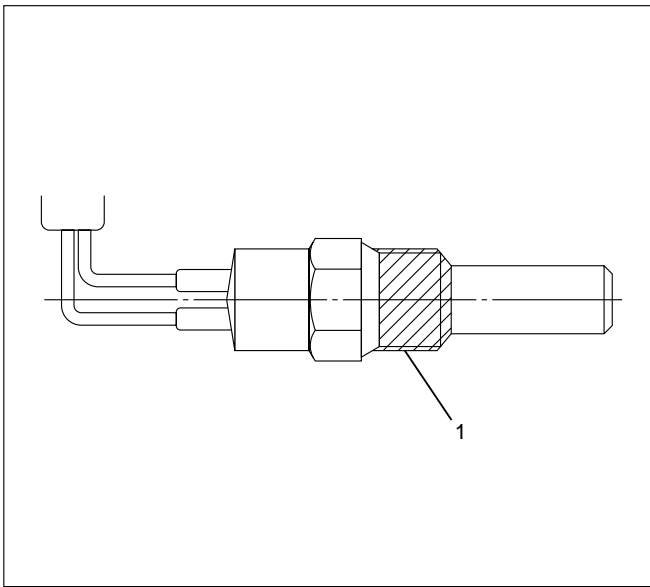
Temperature (°C)	Current (mA)	Resistance (kΩ)
20 ± 1	1.0	2.0 – 3.0
50 ± 1	1.0	0.6 – 1.0



065RW058

When installing the ECT sensor, apply sealant (Loctite #262 or equivalent) to prevent water leakage.

Torque: 8 N·m (0.8 kg·m/69 lb in)



065RW060

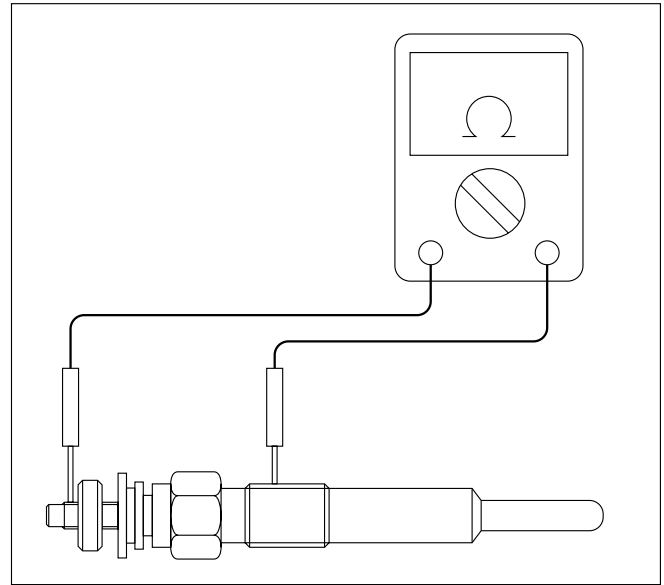
Legend
(1) Sealing Material

GLOW PLUG

Inspect the resistance

Resistance at normal temperature: 0.8 – 1.0 Ω

Torque: 23 N·m (2.3 kg·m/17 lb·ft)



065RW061

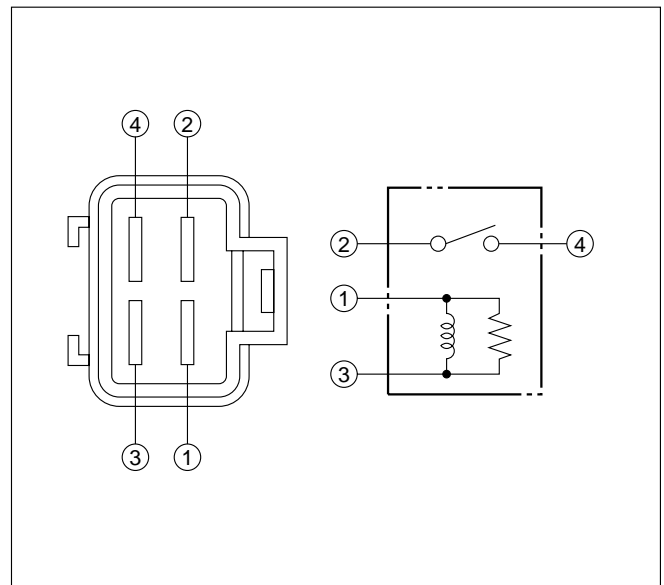
GLOW PLUG RELAY

Inspect the continuity

(2) – (4)	No Continuity
(1) – (3)	Continuity

If battery voltage is applied to the terminal between (1) – (3)

(2) – (4)	Continuity
-----------	------------



065RW037

MEMO

A series of horizontal dotted lines for writing.

4JX1-TC 3.0L ENGINE DRIVEABILITY AND EMISSIONS

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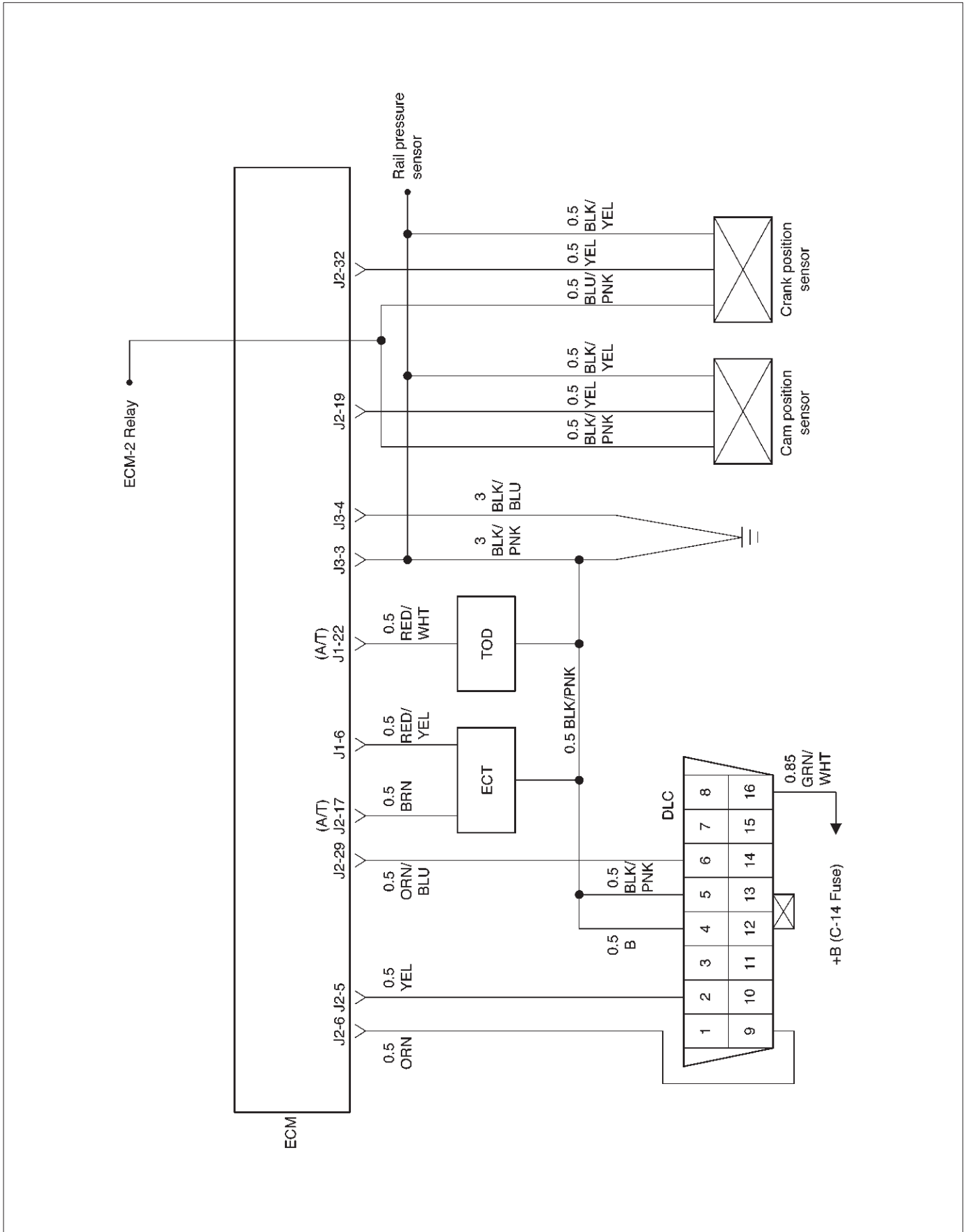
Specification

Tightening Specifications

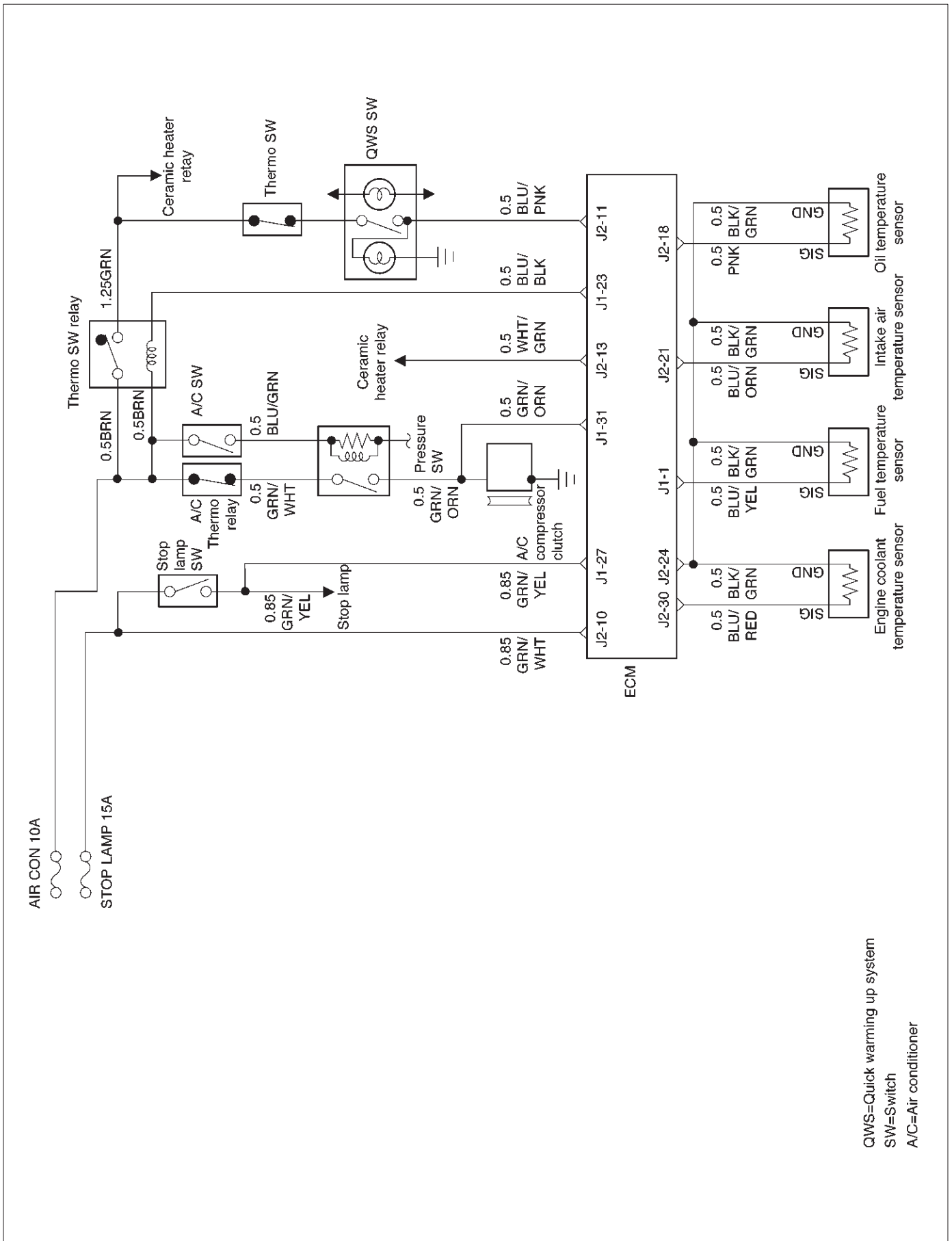
Application	N-m	Kg-m	Lb Ft.	Lb In.
Camshaft Position Sensor Retaining Screw	9	0.9	—	78
Crankshaft Position Sensor Mounting Bolt	9	0.9	—	78
Engine Coolant Temperature Sensor	19	1.9	14	—
Throttle Body Mounting Nuts	20	2.0	14	—
VSS Retaining Bolt	16	1.6	12	—
MAP Sensor Screw	4	0.4	—	35
EGR VSV Bolts	8	0.8	—	69
Fuel Temp Sensor	19	1.9	14	—
Oil Temp Sensor Bolt	19	1.9	14	—
Rail Pressure Sensor Bolt	20	2.0	14	—

Diagrams and Schematics

ECM Wiring Diagram (1 of 6)

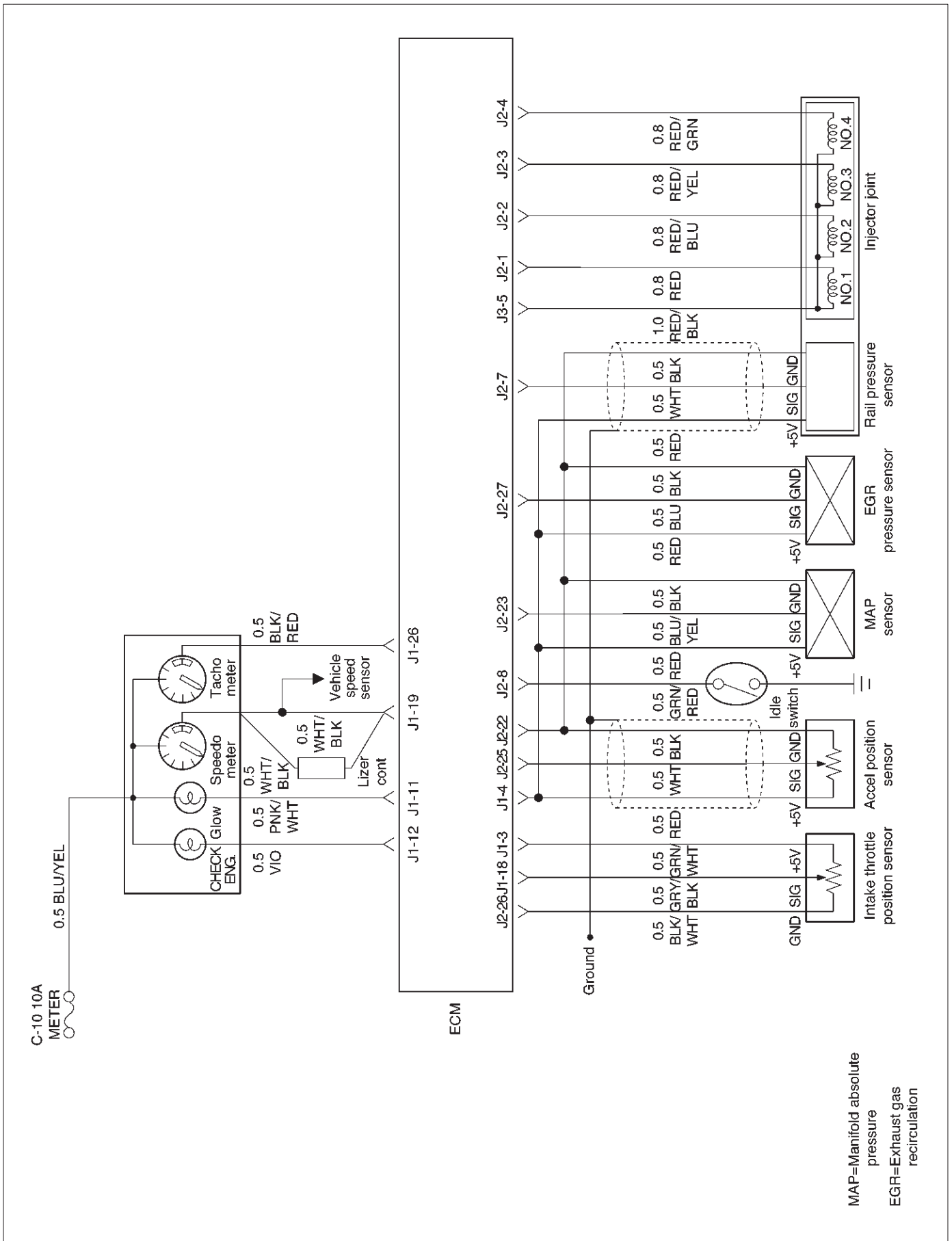


ECM Wiring Diagram (2 of 6)

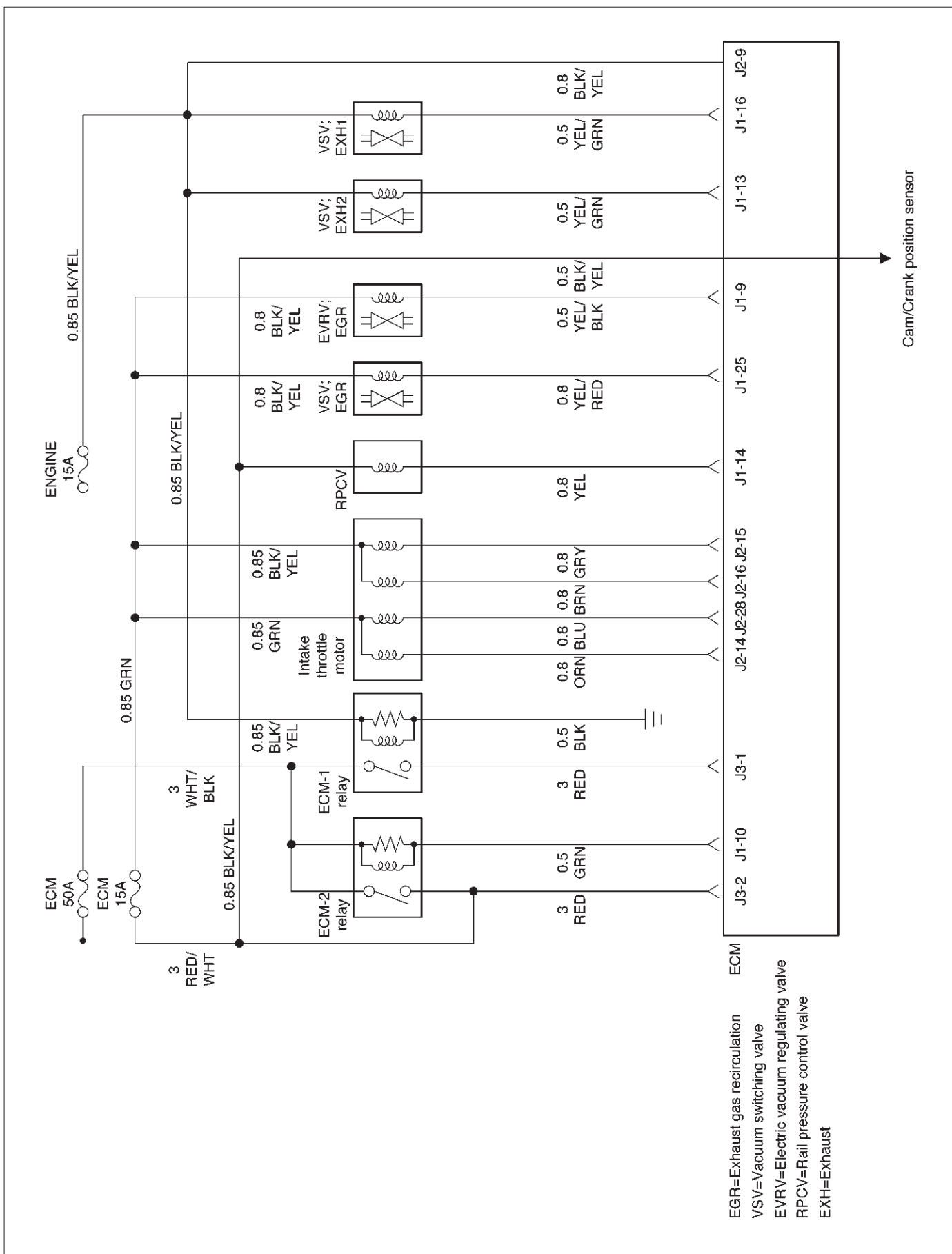


QWS=Quick warming up system
 SW=Switch
 A/C=Air conditioner

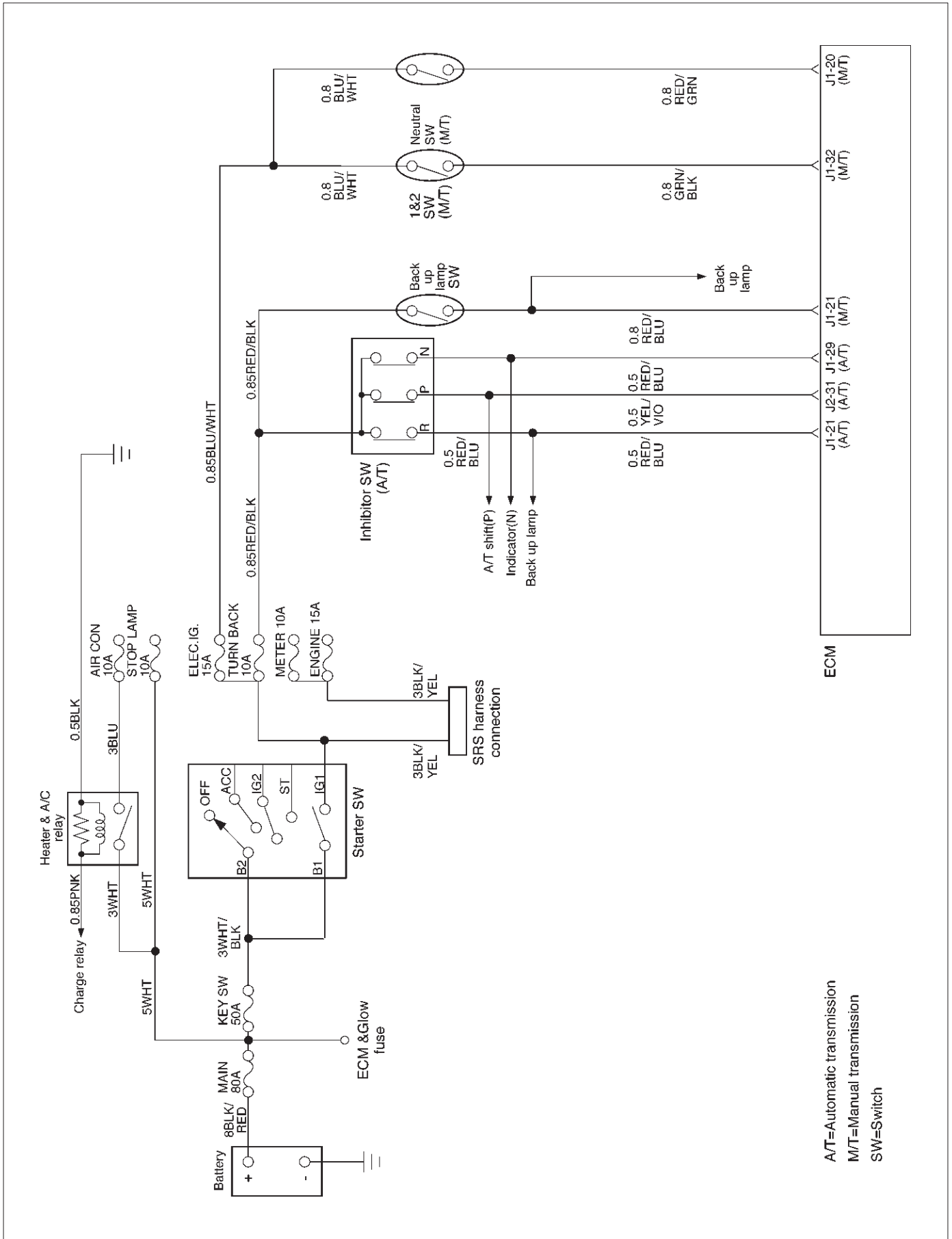
ECM Wiring Diagram (3 of 6)



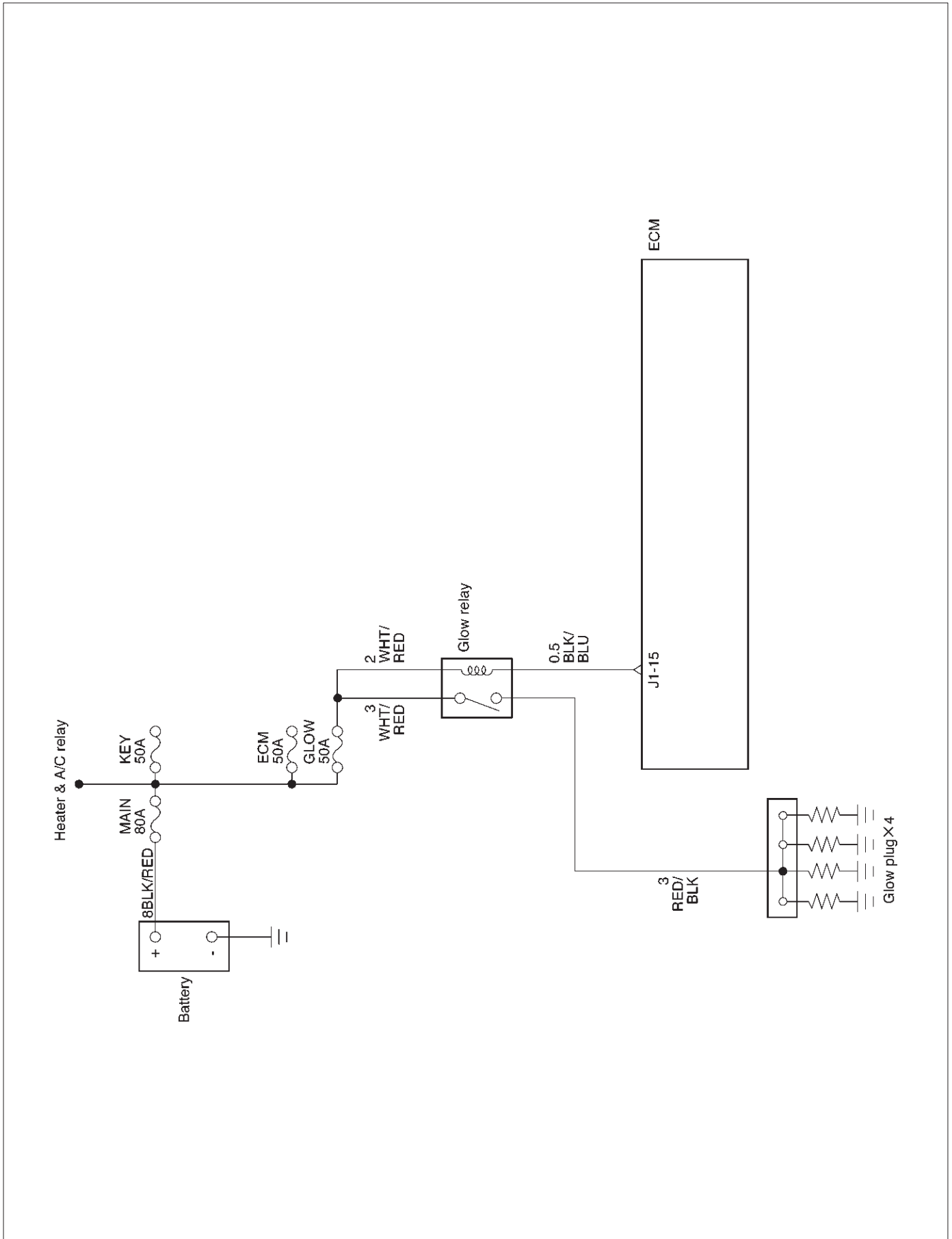
ECM Wiring Diagram (4 of 6)



ECM Wiring Diagram (5 of 6)

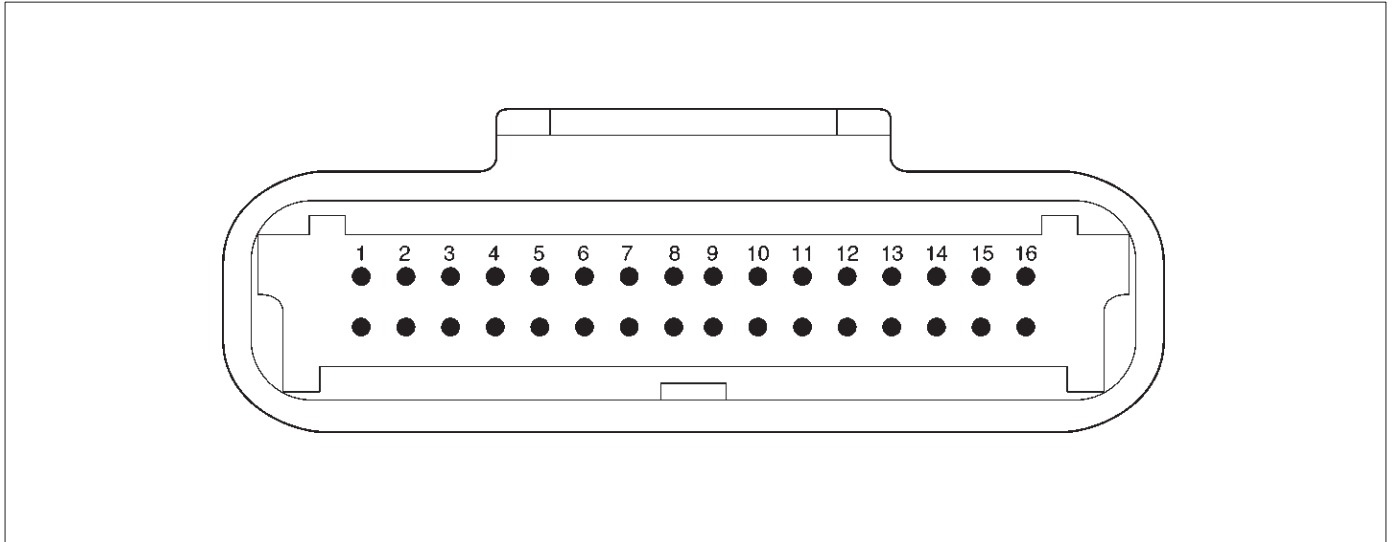


ECM Wiring Diagram (6 of 6)



ECM Pinouts

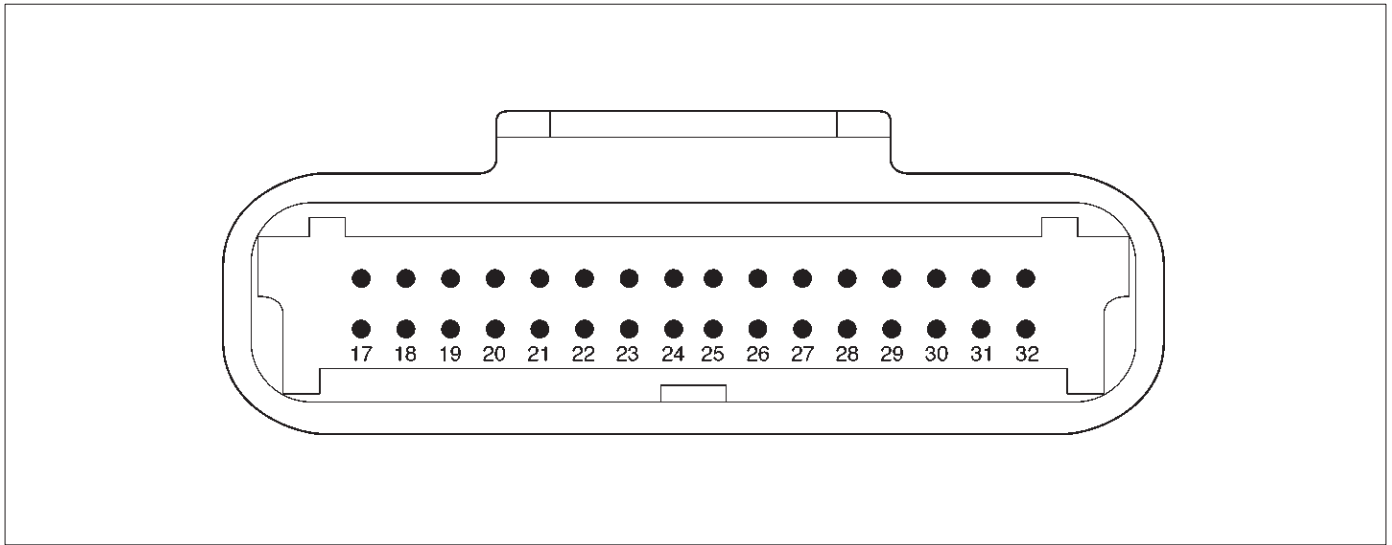
ECM Pinout Table, 32-Way Connector – J1 RED – Upper



060RW138

J1 – RED	
PIN	SIGNAL
1	FUEL TEMPERATURE
2	SPARE ANALOG 1
3	+5VB1
4	+5VB2
5	SPARE ANALOG 3
6	ACCEL POS OUT 1
7	NOT USED
8	SPARE OUT 2 (TCC)
9	EVRV (EGR)
10	IGN RELAY
11	GLOW PLUG LAMP
12	DIAGNOSTIC LAMP
13	VSV (EXHAUST #2)
14	RAIL PRESS CNTRL VALVE
15	GLOW PLUG RELAY
16	VSV (EXHAUST #1)

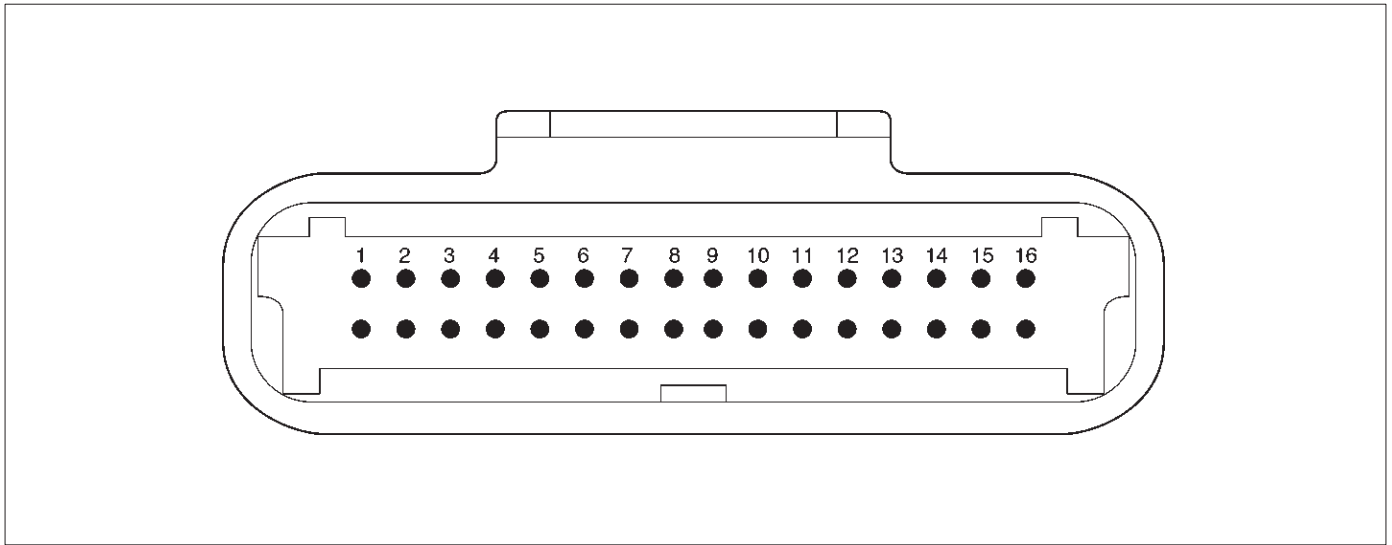
ECM Pinout Table, 32-Way Connector – J1 RED – Lower



060RW137

J1 – RED	
PIN	SIGNAL
17	SPARE ANALOG 4
18	INTAKE SM POSITION
19	VEHICLE SPEED
20	MT NEUTRAL
21	REVERSE SW
22	ACCEL POS OUT 2
23	THERMO SW RELAY
24	SPARE OUT 3 (TURBO)
25	VSV (EGR)
26	TACHOMETER 1
27	BRAKE SW 1
28	NOT USED (BRAKE 2)
29	A/T NEUTRAL SW
30	NO CONNECTION
31	AC REQUEST SW
32	AT SOLENOID

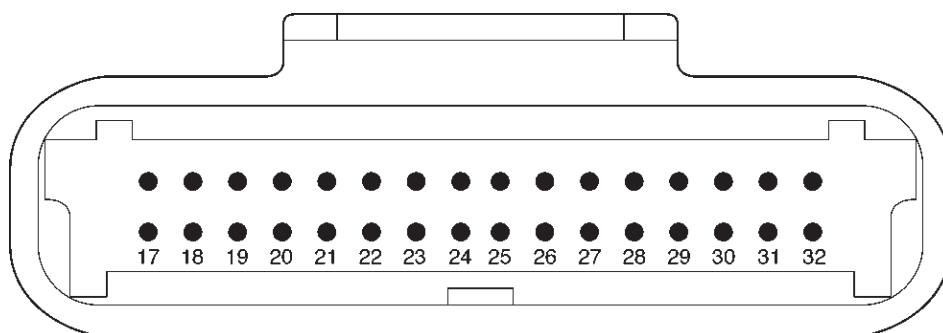
ECM Pinout Table, 32-Way Connector – J2 BLUE – Upper



060RW138

J2 – BLUE	
PIN	SIGNAL
1	INJECTOR A RTN
2	INJECTOR B RTN
3	INJECTOR C RTN
4	INJECTOR D RTN
5	CLASS 2
6	SDATA
7	RAIL OIL PRESSURE
8	IDLE SW
9	IGN SW
10	BATTERY
11	QUICK WARM REQ. SW
12	PARTIAL IDLE SW
13	CERAMIC HTR REQUEST SW
14	INTAKE SW S2B
15	INTAKE SW S1T
16	INTAKE SW S1B

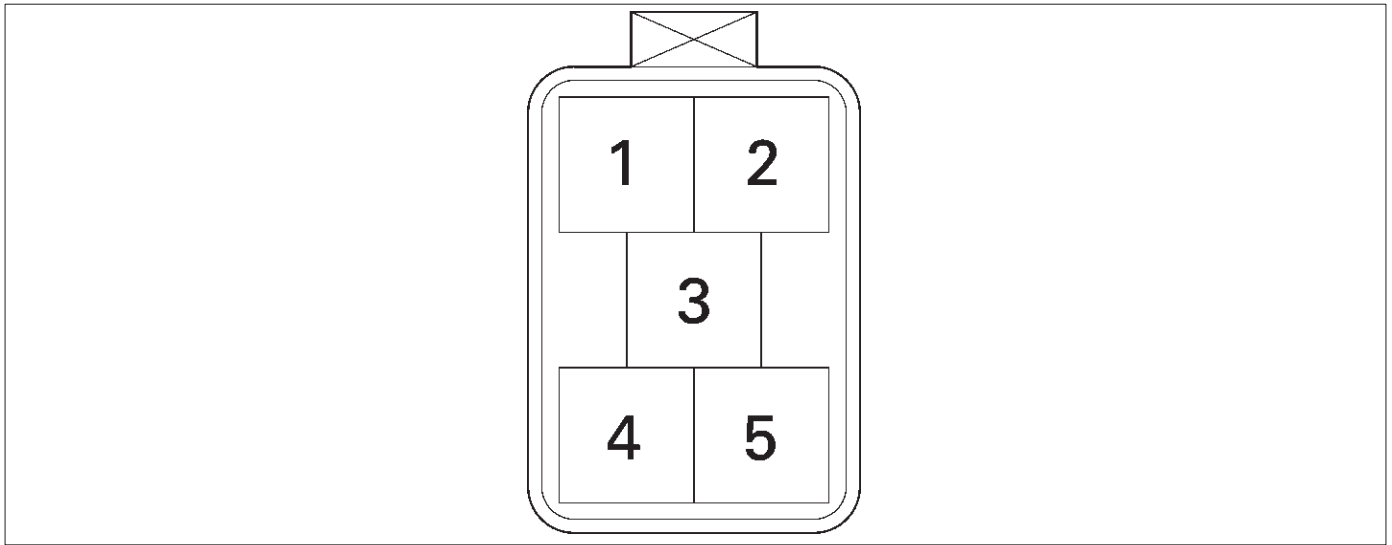
ECM Pinout Table, 32-Way Connector – J2 BLUE – Lower



060RW137

J2 – BLUE	
PIN	SIGNAL
17	COOLANT TEMP OUT
18	OIL TEMPERATURE
19	TDC/CAM
20	SPARE ANALOG 2
21	INTAKE AIR TEMPERATURE
22	+5VRTN2
23	BOOST/INLET PRESSURE
24	+5VRTN3
25	ACCELERATOR POSITION
26	+5VRTN1
27	EGR VACUUM PRESSURE
28	INTAKE SM S2T
29	DIAGNOSTIC REQUEST SW
30	COOLANT TEMPERATURE
31	A/T PARK SW
32	CRANKSHAFT

ECM Pinout Table, 5-Way Connector – J3

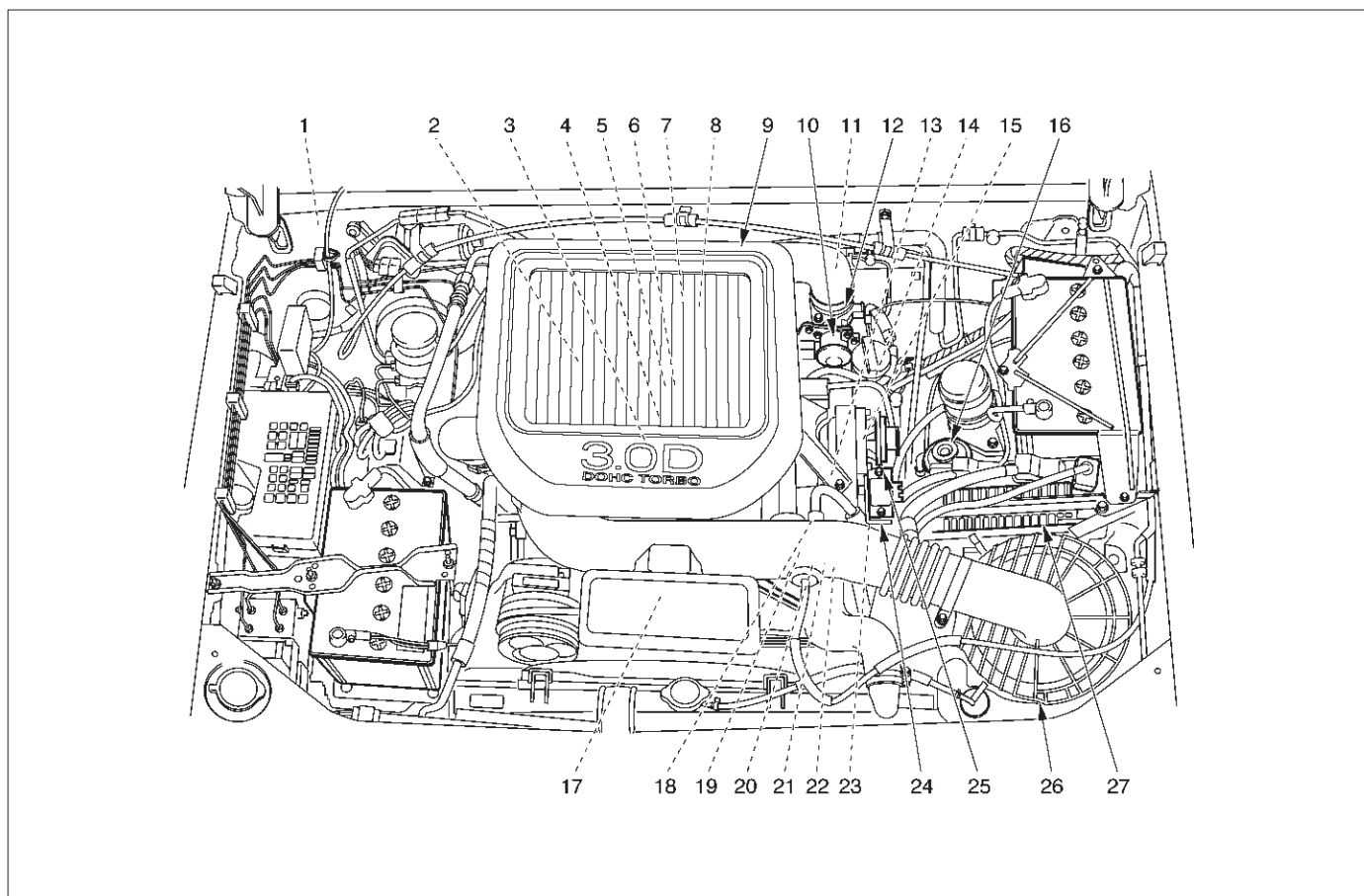


060RW139

J3	
PIN	SIGNAL
1	IGNITION
2	IGNITION
3	PWR GND
4	PWR GND
5	INJECTOR H1

Component Locator

Engine Component Locator Table



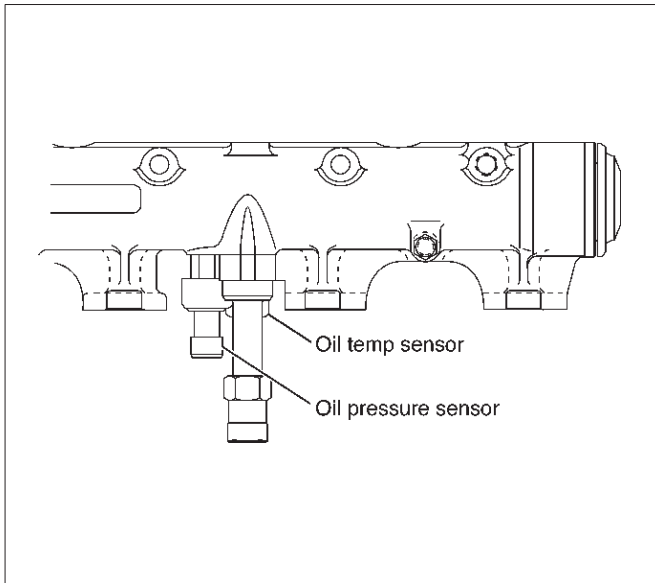
F06RW051

Number	Name	Location
1	AP (Accelerator Pedal Position) Sensor	AP Bracket
2	CKP (Crankshaft Position) Sensor	Inside the right front flywheel Housing
3	Oil Rail	Mounted on the camshaft carrier
4	Oil (Rail) Pressure Sensor	Mounted on the Oil Rail
5	OT (Oil Temperature) Sensor	Mounted on the Oil Rail
6	Fuel Injector	In the Cylinder Head Cover
7	Fuel Return Orifice	Inside the Cylinder Head
8	FT (Fuel Temperature) Sensor	Fuel Return Adaptor
9	Intercooler	On the Cylinder Head Cover
10	Intake Throttle Motor	Behind the Intake Manifold
11	Intake Throttle	Behind the Intake Manifold
12	2 Way Check Valve	Below the Intake Manifold
13	VSV (Vacuum Switching Valve)	At the left Cylinder Body
14	EGR Pressure Sensor	Below the Intake Manifold
15	Fuel Filter	At the left Engine Room
16	CMP (Camshaft Position) Sensor	On the forward of Timing Gear Case
17	IAT (Intake Air Temperature) Sensor	Below the Intake Manifold
18	ECT (Engine Coolant Temperature)	Thermostat Housing
19	High Pressure Oil Pump	On the back Timing Gear Case

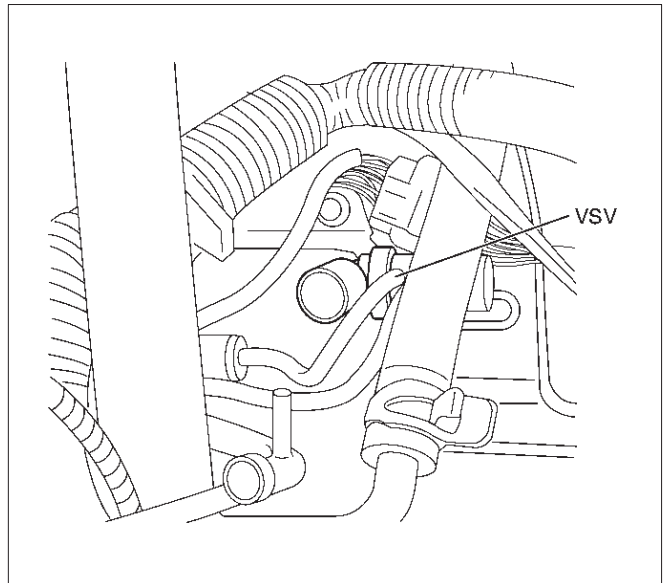
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Number	Name	Location
20	Rail Pressure Control Valve	In the High Pressure Oil Pump
21	Fuel Pump	In the High Pressure Oil Pump
22	EVRV	On the Intake Manifold
23	MAP (Manifold Absolute Pressure) Sensor	On the Intake Manifold
24	EGR Valve	On the Intake Manifold
25	Air Cleaner	At the left Engine Room
26	ECM	Behind the Air Cleaner

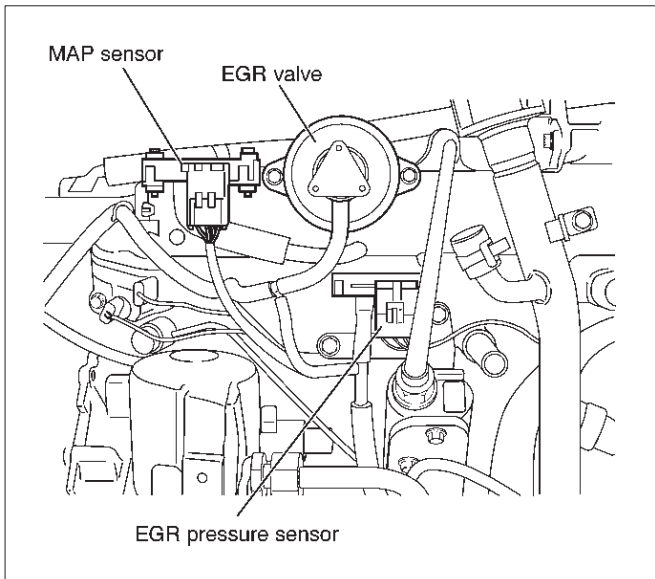
Sensors and Miscellaneous Component Locators



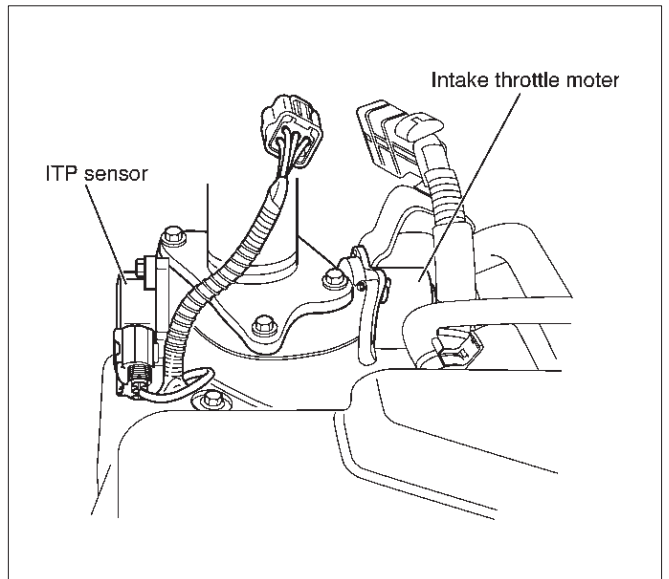
035RW115



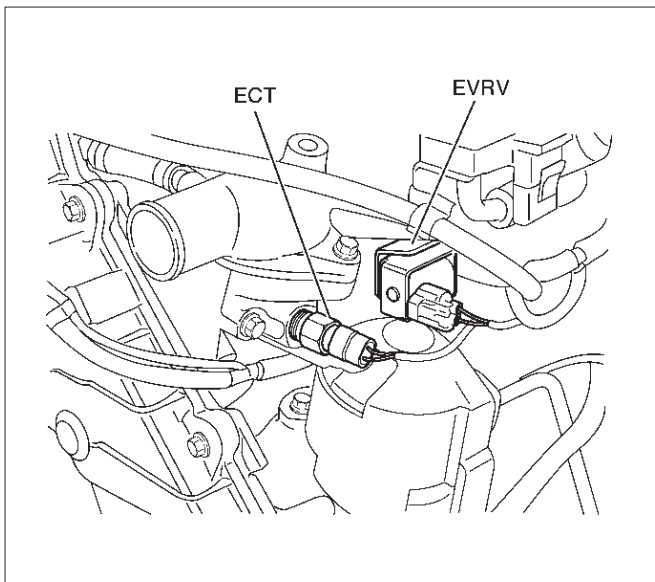
035RW118



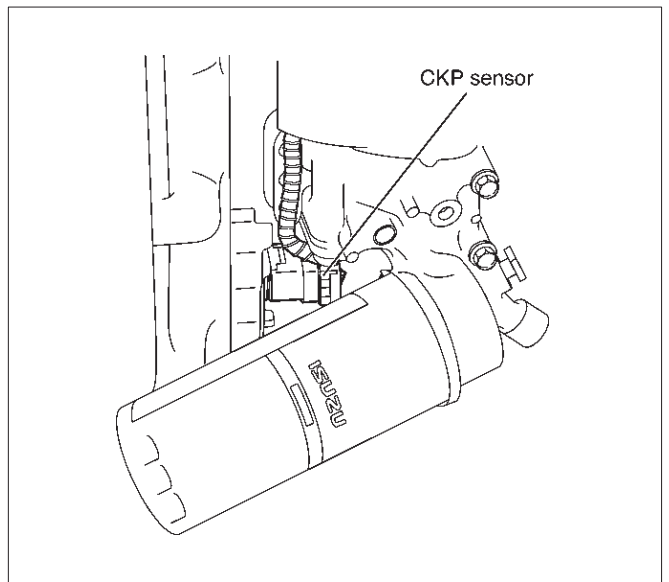
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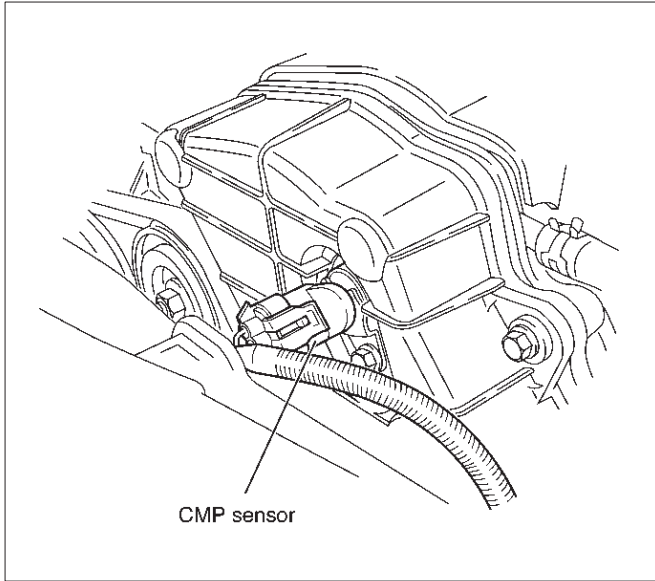
035RW119



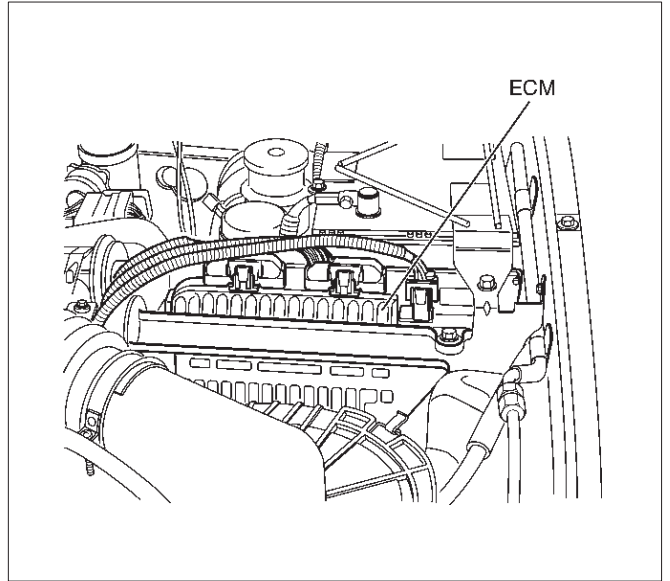
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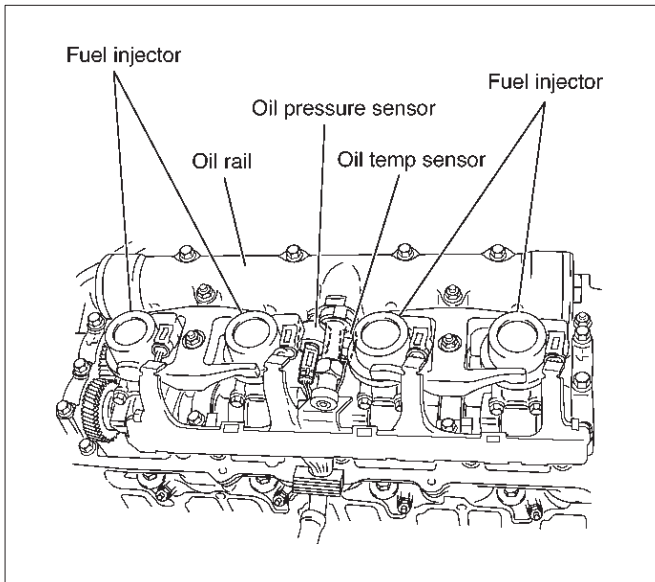
035RW120



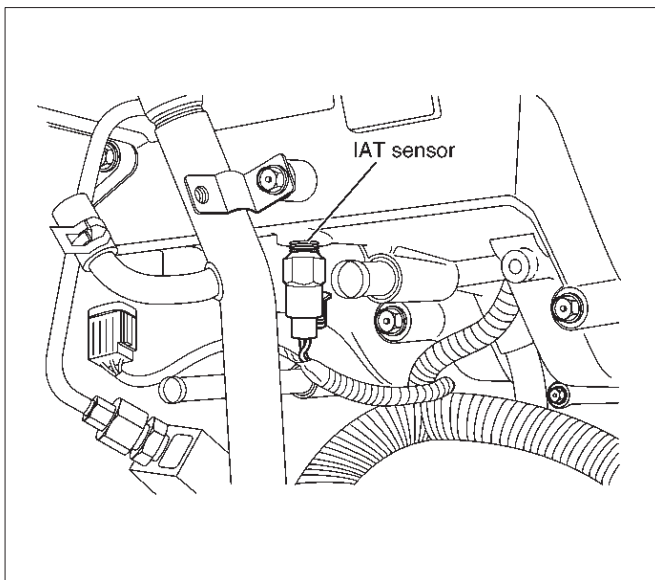
035RW121



035RW107



035RW122



035RW116

Abbreviations Charts

List of abbreviations which may be used in this section.

Abbreviations	Term	Abbreviations	Term
A/C	Air Conditioner	BLK	Black
A/T	Automatic Transmission	BLU	Blue
ACC	Accessory	BRN	Brown
AP	Accel Position	GRN	Green
ASM	Assembly	GRY	Gray
CKP	Crank Position	LT BLU	Light Blue
CMP	Cam Position	LT GRN	Light Green
DLC	Data Link Connector	ORN	Orange
DTC	Diagnosis Trouble Code	PNK	Pink
DVM	Digital Volt Meter	RED	Red
ECM	Engine Control Module	VIO	Violet
ECT	Engine Coolant Temperature	WHT	White
EGR	Exhaust Gas Recirculation	YEL	Yellow
EVRV	Electric Vacuum Regulating Valve		
EXH	Exhaust		
FT	Fuel Temperature		
IAT	Intake Air Temperature		
IG	Ignition		
ITP	Intake Throttle Position		
M/T	Manual Transmission		
MAP	Manifold Absolute Pressure		
MIL	Mulfunction Indicator Lamp		
OBD	On-Board Diagnostic		
OT	Oil Temperature		
QOS	Quick on Start System		
QWS	Quick Warming-Up System		
RP	Rail Pressure		
RPCV	Rail Pressure Control Valve		
SRS	Supplemental Restraint System		
ST	Start		
SW	Switch		
TEMP	Temperature		
TOD	Torque on Demand		
VSS	Vehicle Speed Sensor		
VSV	Vacuum Switching Valve		
HEUI	Hydraulically Actuated Electronically Controlled Unit Injector		

Diagnosis

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
 - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
 - Conduct a thorough visual inspection.
 - Review the service history.
 - Detect unusual sounds or odors.
 - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
 - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
 - "System checks" contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Call technical assistance for similar cases where repair history may be available. Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze frame data.

2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most scan tools, such as the Tech 2 and the DVM, have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint.
 - When the complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in *Intermittents*, or could be normal.
2. Repair and verify.
 - After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
 - Conditions noted by the customer.
 - If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for the MIL ("Check Engine" lamp) has been requested).
2. Clear the DTC(s).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

Serviceability Issues

Non-OEM Parts

All of the OBD diagnostics have been calibrated to run with OEM parts. Accordingly, if commercially sold sensor or switch is installed, it makes a wrong diagnosis and turn on the MIL (“Check Engine” lamp).

Aftermarket electronics, such as cellular phones, stereos, and anti-theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL (“Check Engine” lamp).

Poor Vehicle Maintenance

The sensitivity of OBD diagnostics will cause the MIL (“Check Engine” lamp) to turn on if the vehicle is not maintained properly. Restricted oil filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD. Poor vehicle maintenance can not be classified as a “non-vehicle fault”, but with the sensitivity of OBD diagnostics, vehicle maintenance schedules must be more closely followed.

Related System Faults

Many of the OBD system diagnostics will not run if the ECM detects a fault on a related system or component.

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for punches, cuts, disconnects, and correct routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Serial Data Communications

Class II Serial Data Communications

This vehicle utilizes the “Class II” communication system. Each bit of information can have one of two lengths: long

or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait.

On this vehicle the Tech 2 displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

On-Board Diagnostic (OBD)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to operate engine properly.

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable. Accel Position (AP) sensor that indicates high throttle position at low engine loads or MAP voltage. Input components may include, but are not limited to the following sensors:

- Intake Air Temperature (IAT) Sensor
- Crankshaft Position (CKP) Sensor
- Intake throttle Position (ITP) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Camshaft Position (CMP) Sensor
- Manifold absolute Pressure (MAP) Sensor
- Accel Position Sensor
- Fuel Temp Sensor
- Rail Pressure Sensor
- Oil Temp Sensor
- EGR Pressure Sensor
- Vehicle Speed Sensor

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable.

Output components to be monitored include, but are not limited to, the following circuit:

- EGR VSV
- EGR EVRV
- Electronic Transmission controls
- Injector
- Intake throttle
- Glow plug
- MIL control

Refer to ECM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70°C (160°F) and rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Frame Data* for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

Common OBD Terms**Diagnostic**

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- EGR
- engine speed
- vehicle speed
- ECT

- MAP
- VSV
- IAT
- ITP
- AP
- FT (Fuel Temp)
- RP (Rail Pressure)
- OT (Oil Temp)
- EGR EVRV
- Idle SW
- Brake SW

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as follows:

- Commanding the MIL ("Check Engine" lamp) on and off
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Current status information on each diagnostic

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) ("Check Engine" lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with "Check Engine" lamp.

Basically, the MIL is turned on when the ECM detects a DTC that will impact the vehicle emissions.

- When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On-Board Diagnostic (OBD) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Characteristic of Code

- Non-Emissions related
- Does not request illumination of any lamp
- Stores a History DTC on the *first trip* with a fail
- Stores Fail Record when test fails
- Updates the Fail Record each time the diagnostic test fails

Storing and Erasing Freeze Frame Data and Failure Records

The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

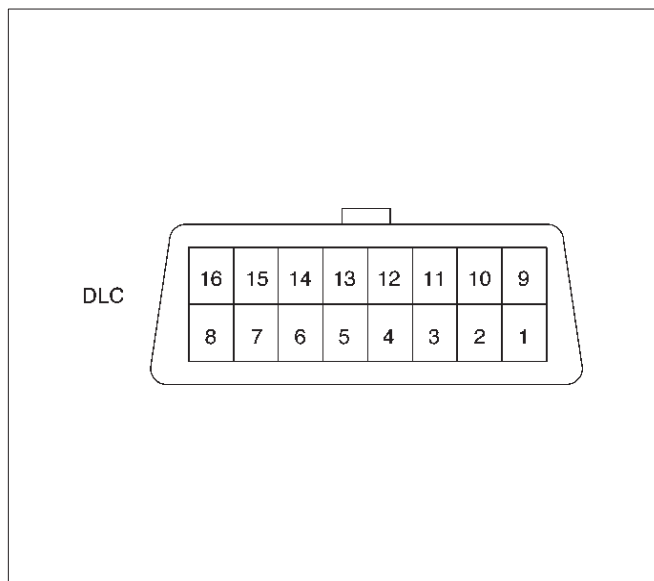
Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- Intake Throttle Position
- MAP
- Injector Base Pulse Width
- Loop Status

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). It is located at behind the lower front instrument panel. The DLC is used to connect to a Tech 2. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.



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Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed.
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

Reading Flash Diagnostic Trouble Codes

The provision for communicating with the Engine Control Module (ECM) is the Data Link Connector (DLC). The DLC is located in the front console box. It is used in the assembly plant to receive information in checking that the engine is operating properly before it leaves the plant.

The diagnostic trouble code(s) (DTCs) stored in the ECM's memory can be read either through a hand-held diagnostic scanner plugged into the DLC or by counting the number of flashes of the "Check Engine" Malfunction Indicator Lamp (MIL) when the diagnostic test terminal of the DLC is grounded. The DLC terminal "6" (diagnostic request) is pulled "Low" (grounded) by jumpering to DLC terminal "4", which is a ground wire.

This will signal the ECM that you want to "flash" DTC(s), if any are present. Once terminals "4" and "6" have been connected, the ignition switch must be moved to the "ON" position, with the engine not running.

The "Check Engine" MIL will indicate a DTC three times if a DTC is present. If more than one DTC has been stored

in the ECM's memory, the DTC(s) will be output from the lowest to the highest, with each DTC being displayed three times. The DTC display will continue as long as the DLC is shorted.

Reading Diagnostic Trouble Codes Using a TECH 2

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Tech 2. When reading DTC(s), follow instructions supplied by Tech 2 manufacturer. For the 1998 model year, Isuzu dealer service departments will continue to use Tech 2.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

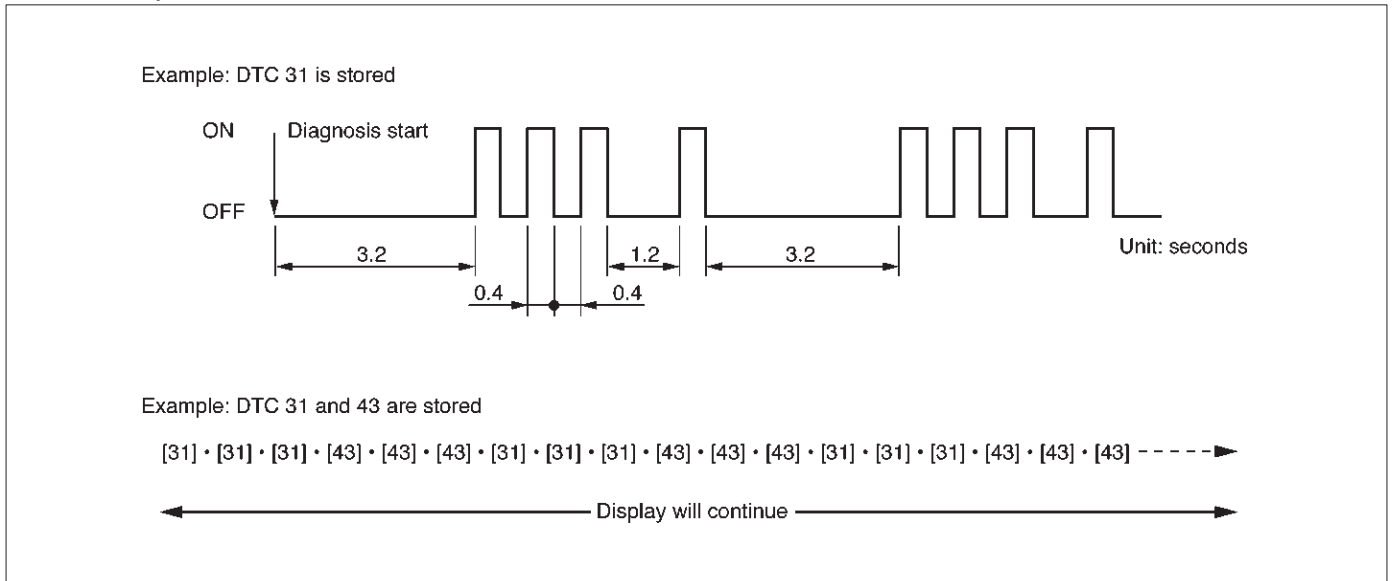
If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the "warm-up" cycles with no further faults detected, the DTC will automatically be cleared from the ECM memory.

To clear Diagnostic Trouble Codes (DTCs), use the Tech 2 "clear DTCs" or "clear information" function. When clearing DTCs follow instructions supplied by the Tech 2 manufacturer.

When a Tech 2 is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

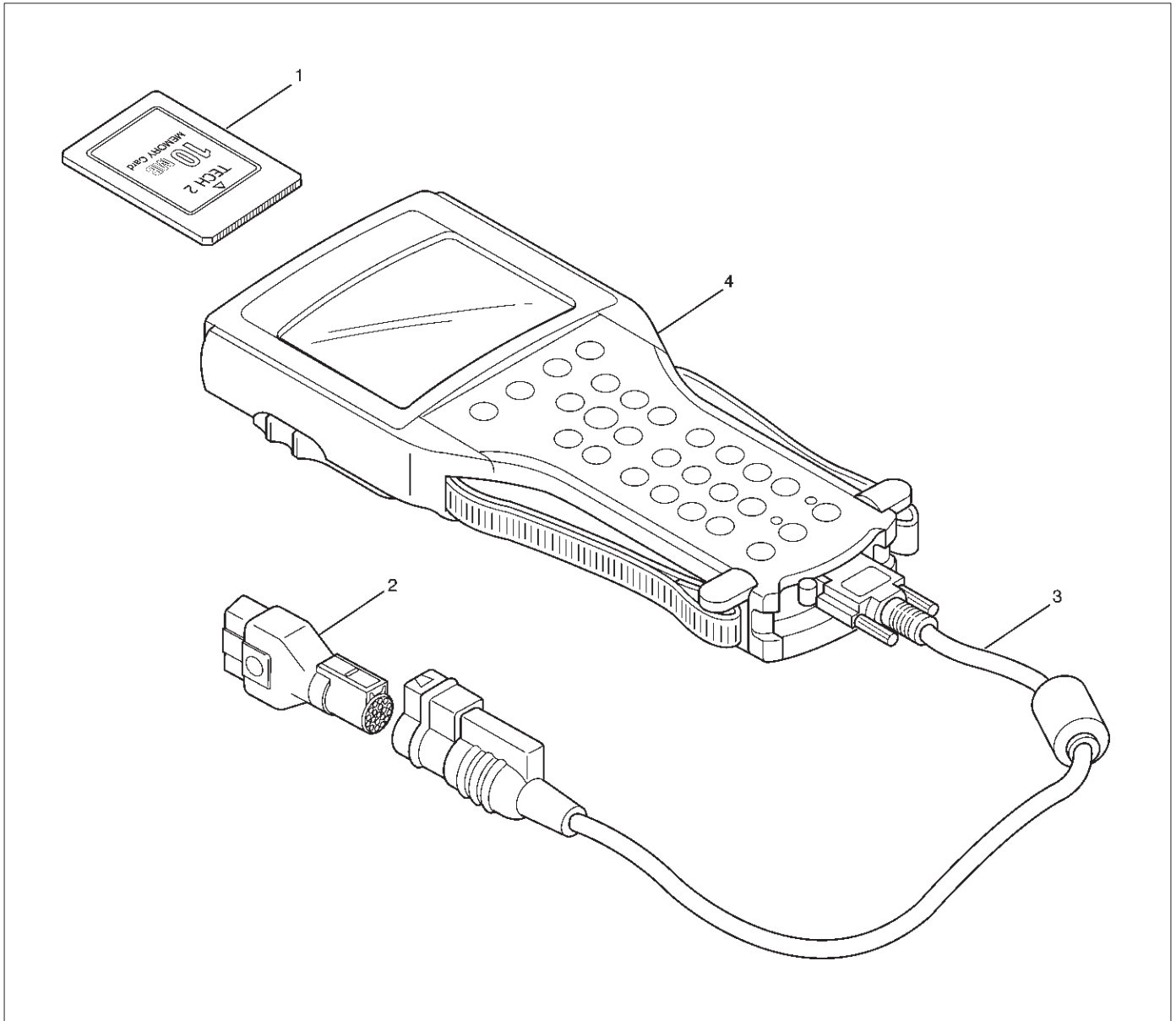
NOTE: To prevent system damage, the ignition key must be "OFF" when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery ECM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).



Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 user guide.



Legend

- (1) PCMCIA Card
- (2) SAE 16/19 Adaptor

- (3) DLC Cable
- (4) Tech-2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
 2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
 3. Connect the DLC cable to the Tech 2 (5)
 4. Make sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.
 6. The vehicle ignition turns on.
 7. Verify the Tech 2 power up display.

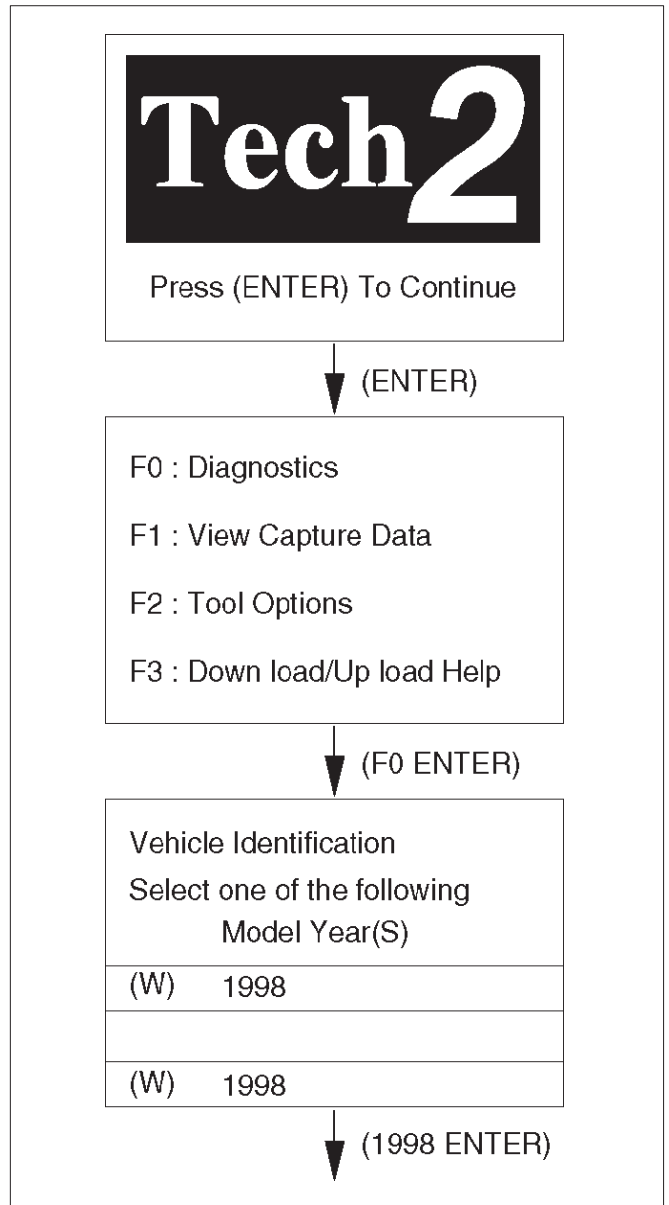


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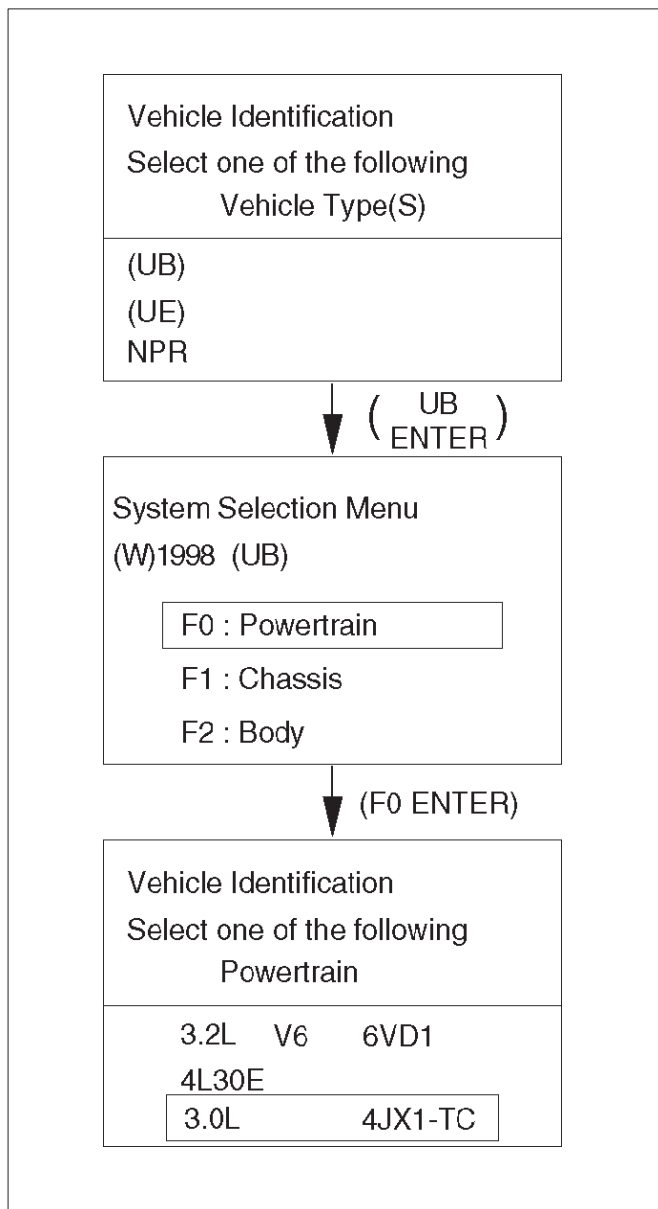
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



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Menu

- The following table shows, which functions are used the available equipment versions.

F0: Diagnostic Trouble Codes
F0: Read DTC Info Ordered By Priority
F1: Read DTC Info As Stored By ECU
F2: Clear DTC Information
F3: Freeze Frame / Failure Records
F1: Data Display
F2: Snapshot
F3: Actuator Tests
F0: Checklight
F1: Glow Time Lamp
F2: EGR Switching Valve
F3: Exhaust Switching Valve 1
F4: Exhaust Switching Valve 2
F4: Miscellaneous Tests
F0: Throttle Motor Control
F1: Rail Pressure Control
F2: EGR Regulating Valve Control
F3: Rail Pressure Control Valve
F4: Injector Balance Test
F5: Programming
F0: Injector Calibration
(F1: Rail Pressure Calibration)

DTC Modes

There are three options available in the Tech 2 DTC mode to display the enhanced information available. A description of the new modes, DTC Info, follows. After selecting DTC, the following menu appears:

- DTC Info
- Clear Info
- Read DTC Info Ordered By Priority

The following is a brief description of each of the sub menus in DTC Info. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the ECM's history memory. It will not display Type B DTCs that have not requested the MIL ("Check Engine" lamp). It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

MIL SVC or Message Requested

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared.

Injector Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1 – 4. Tech-2 must be used for this test.

Test Procedure:

1. Connect Tech-2 to the vehicle DLC.
2. Set Ignition Switch to the "ON" position.
3. Select Control Test.
4. Select Injector Test.
5. Send instructions to each injector(Switch on), making sure of injector working noise.

NOTE: If injector working noise (Clink) can hardly be confirmed, remove the engine head cover noise insulation.

Refer to Section 6A.

6. In the injector whose working noise has been confirmed, its electric circuit can be regarded as normal.

As for the injector whose working noise has not been confirmed, its electric circuit or the injector proper is faulty.

EGR Valve Test

This test is conducted to check EGR valve for its working. This test needs Tech-2.

Test Procedure

1. Connect Tech-2 to vehicle DLC.
2. Switch on the engine.
3. Select "DIAGNOSIS" from the main menu.
4. Select Miscellaneous Test.
5. Select EGR Valve.
6. Instruct EGR Valve to check a data list.
7. If change in the data list shows a normal valve, the working of EGR Valve can be judged to be normal.

Rail Pressure Control Valve Test

This test is conducted to check RPC valve for its working. This test needs Tech-2.

Test Procedure

1. Connect Tech-2 to vehicle DLC.
2. Switch on the engine.
3. Select "DIAGNOSIS" from the main menu.
4. Select Miscellaneous Test.
5. Select Rail Pressure Control Valve.
6. Instruct RPC Valve to check a data list.
7. If change in the data list shows a normal valve, the working of RPC Valve can be judged to be normal.

Injector Balance Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-4, when the engine is idling.

This test needs Tech-2.

Test Procedure

1. Connect Tech-2 to vehicle DLC.
2. The engine is running at idling condition.
3. Select "DIAGNOSIS" from the main menu.
4. Select Miscellaneous Test.
5. Select the injector Balance Test.
6. Send instructions to each injector(Switch On), making sure change of the engine vibration.
7. In the injector whose change of the vibration has been confirmed, it's electric circuit can be regarded as normal.

Data Programming in Case of ECM Change

When replacing ECM, it is necessary to confirm and record the group sign of injector beforehand. For this confirmation.

Tech–2 must be used. After ECM change, the recorded group sign should be programmed. Oil pressure sensor data also should be programmed.

- Group Sign Confirmation Procedure
 - 1 Connect Tech–2 to vehicle DLC.
 - 2 Turn Ignition Switch to the “ON” position.
 - 3 Select “DIAGNOSIS” from the main menu.
 - 4 Select programming.
 - 5 Select Read/store Trim Data.
 - 6 Confirm and record the group sign of injector.
- ECM Change
- Programming Procedure for Injector Group Sign
 - 1 Connect Tech–2 to vehicle DLC.
 - 2 Turn Ignition Switch to the “ON” position.
 - 3 Select “DIAGNOSIS” from the main menu.
 - 4 Select programming.
 - 5 Select ECM change.
 - 6 Select cylinder.
 - 7 Program Injector Group Sign.
 - 8 Confirm the completion of Injector programming.
- Programming Procedure for Oil Pressure Sensor
 - 1 Connect Tech–2 to vehicle DLC.
 - 2 Turn Ignition Switch to the “ON” position.
 - 3 Select “DIAGNOSIS” from the main menu.
 - 4 Select programming.

Rail Pressure Sensor Programming

Rail pressure sensor replacement must be programmed. This programming needs Tech–2.

Programing Procedure

1. Connect Tech–2 to vehicle DLC.
2. Turn Ignition Switch to the “ON” position.
3. Select “DIAGNOSIS” from the main menu.
4. Select Programming.
5. Select Oil Pressure Sensor change.
6. Execute Oil Pressure Sensor Program.
7. Confirm the completion of Oil Pressure Sensor Program.

Injector Group Sign Programming (Injector Change)

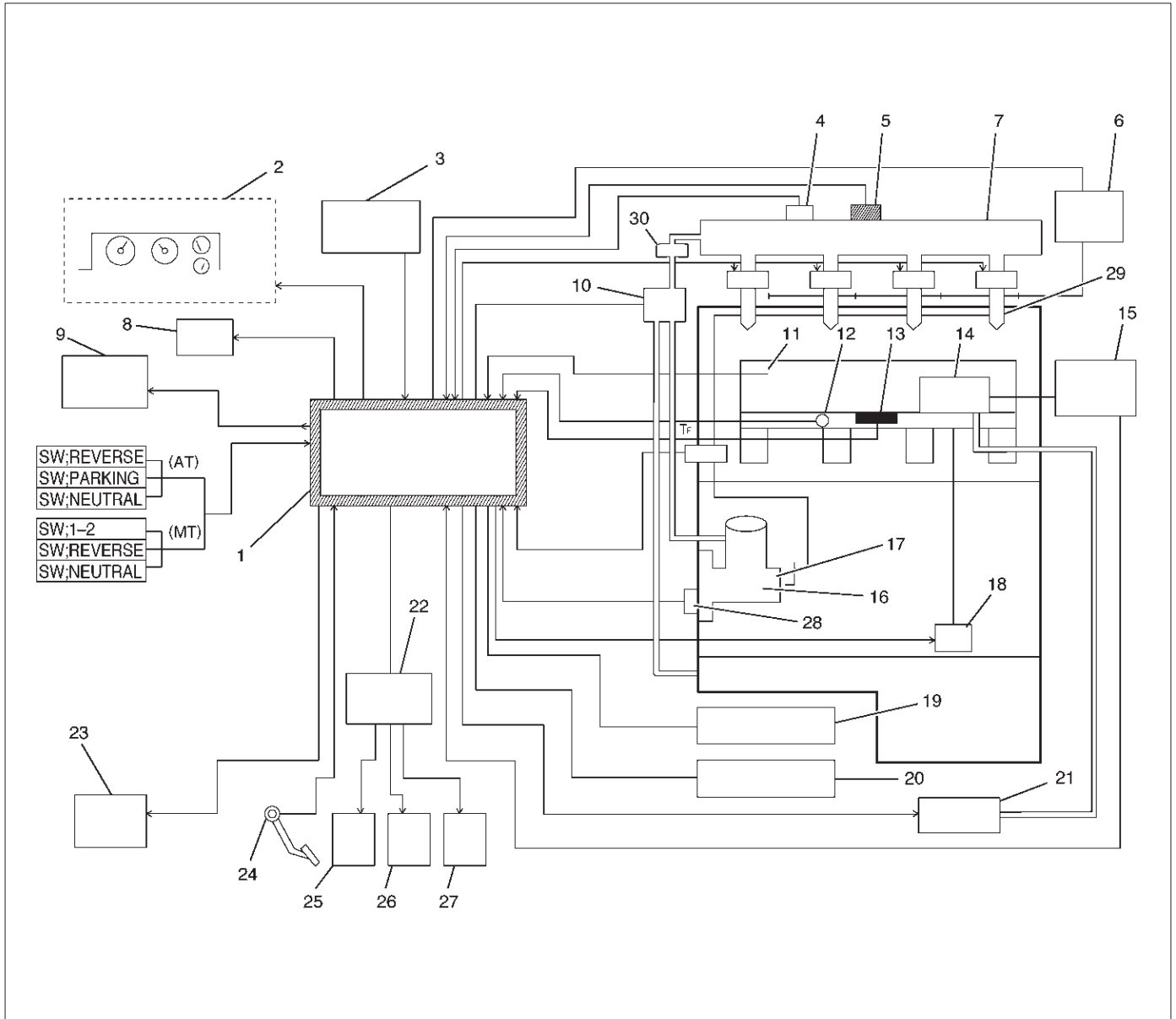
In case of Injector change, injector group sign must be programmed.

This programming needs Tech–2.

Programing Procedure

1. Connect Tech–2 to vehicle DLC.
2. Turn Ignition Switch to the “ON” position.
3. Select “DIAGNOSIS” from the main menu.
4. Select Programming.
5. Select Injector change.
6. Select the cylinder changed.
7. Appoint and select Injector Group Sign.
8. Confirm the completion of Injector programming.

Fuel Injection System



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Legend

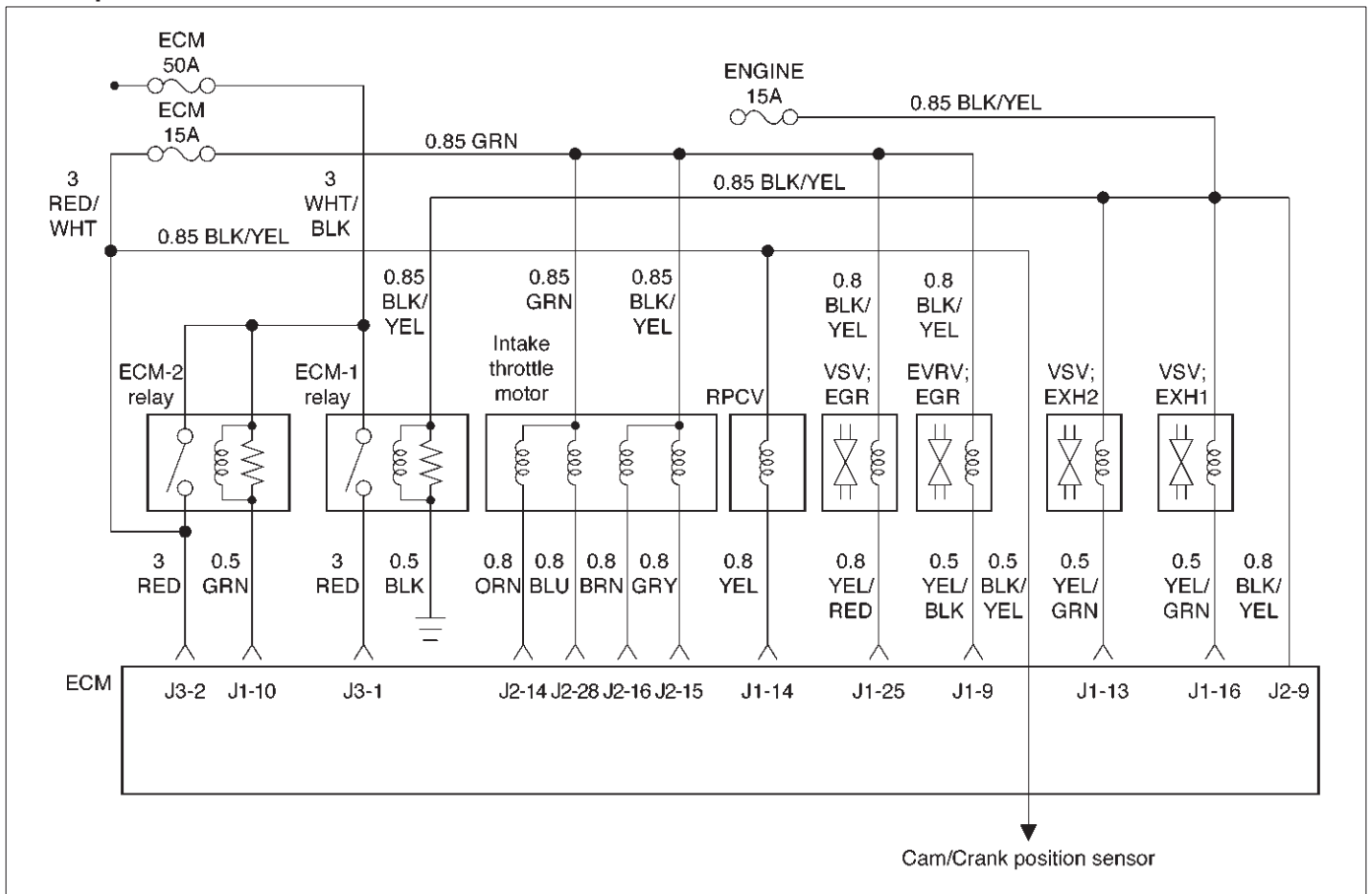
- | | |
|---------------------------------|-------------------------------|
| (1) ECM | (16) High Pressure Oil Pump |
| (2) Meter Panel | (17) Fuel Pump |
| (3) Battery | (18) VSV |
| (4) Oil Temp Sensor | (19) EXH Throttle VSV1 |
| (5) Rail Pressure Sensor | (20) EXH Throttle VSV2 |
| (6) Glow Relay | (21) EVRV |
| (7) Oil Rail | (22) Engine Harness Connector |
| (8) Tech-2 | (23) QWS Relay |
| (9) A/C Comp Relay | (24) APS |
| (10) RPCV | (25) T.O.D |
| (11) Intake Air Temp Sensor | (26) ECT |
| (12) Engine Coolant Temp Sensor | (27) OBD |
| (13) MAP Sensor | (28) TDC |
| (14) EGR Valve | (29) Injector |
| (15) EGR Pressure Sensor | (30) Edge Filter |

Guid to the System

- Fuel Injection system is an HEUI (Hydraulically Actuated, Electronically Controlled, Unit, Injector) type. In this type of injector system, the oil pressurized by means of High Pressure Oil Pump (16) is fed through Rail Pressure Control Valve (10) and Oil Rail (7) to Injector (29) from which fuel is injected under this oil pressure. For diagnosis, therefore, the Rail Pressure as well as the Electric Circuit must be inspected.

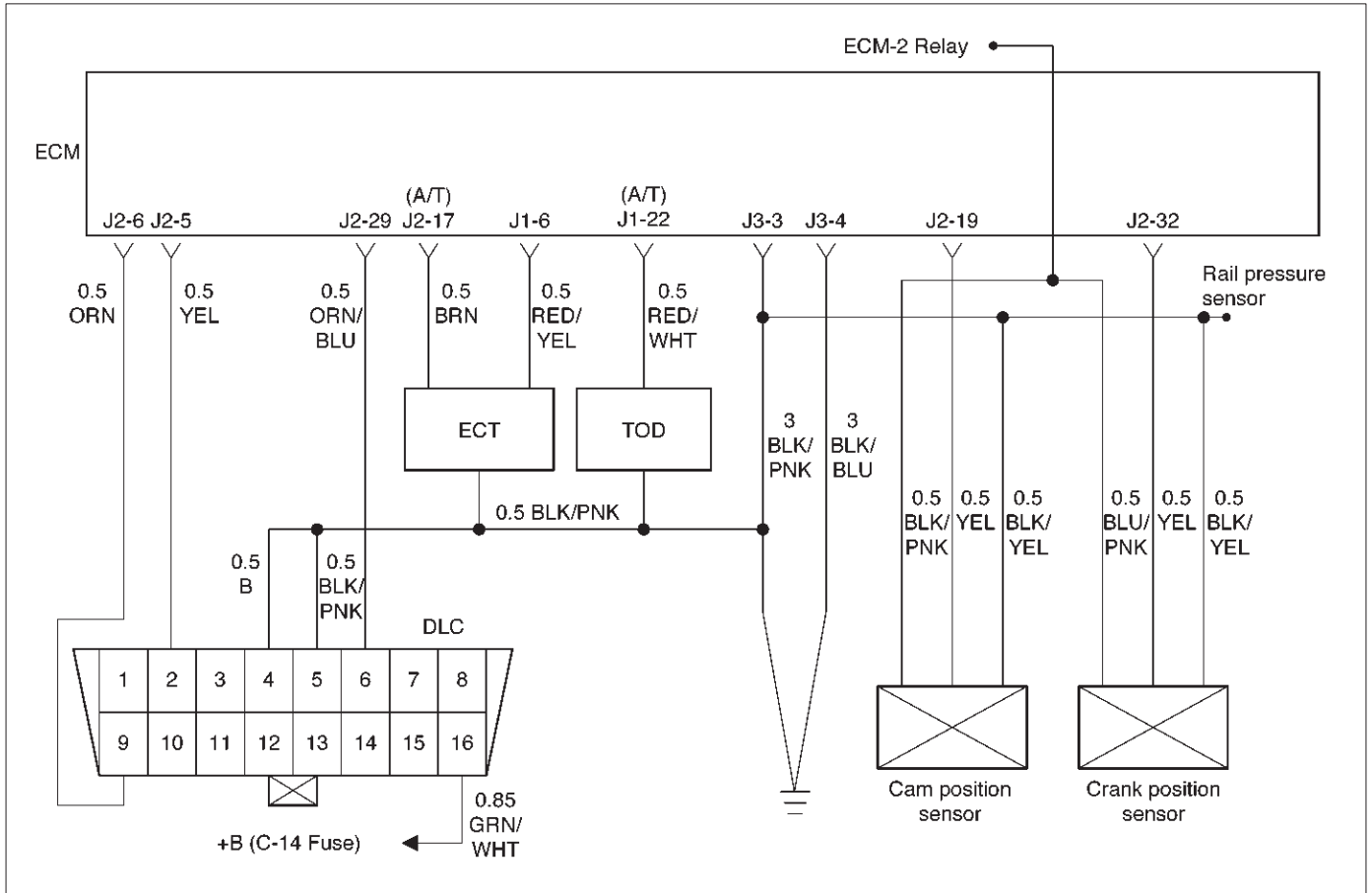
On-Board Diagnostic (OBD) System Check

A Group



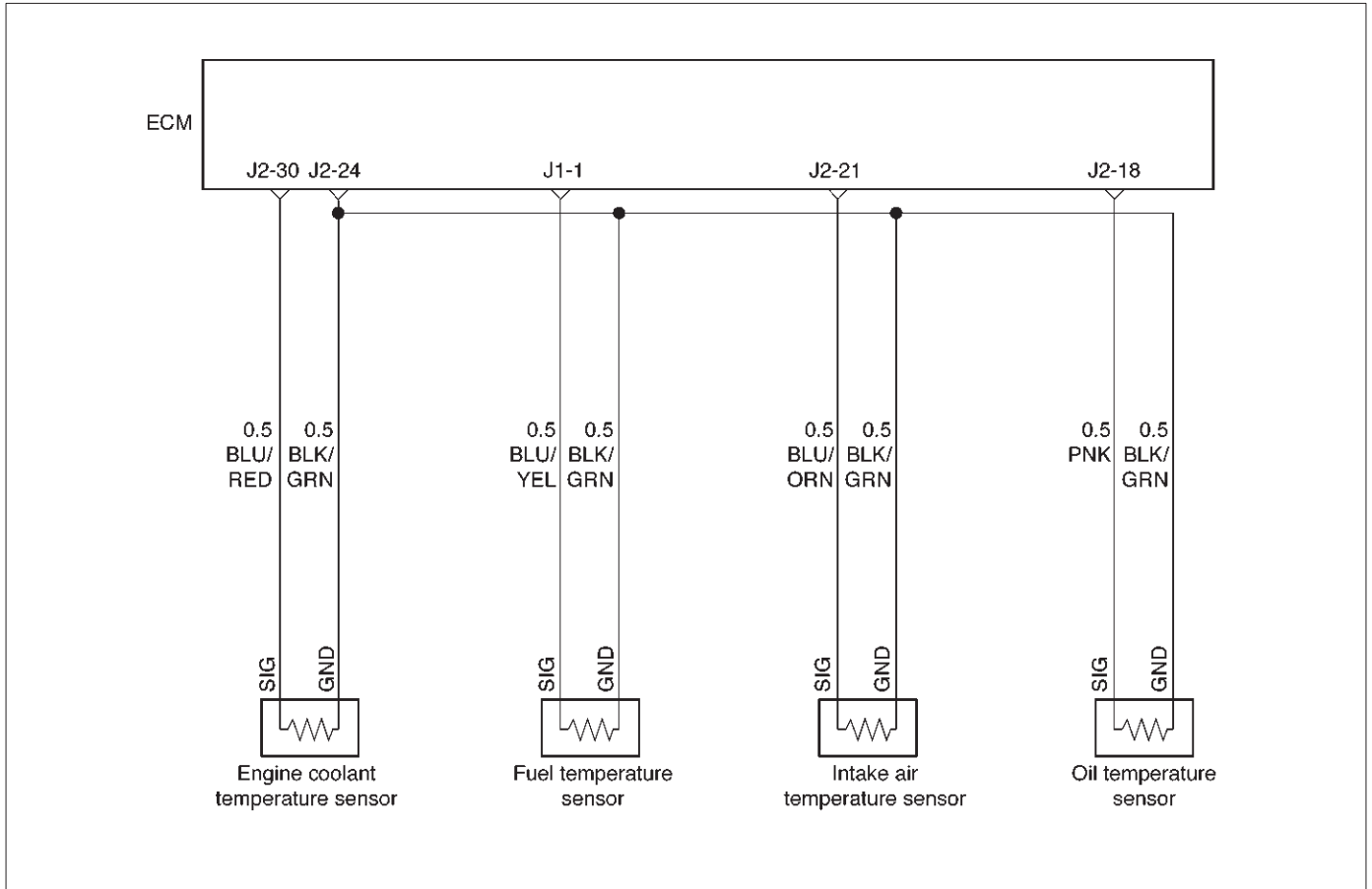
6E-36 4JX1-TC ENGINE DRIVEABILITY AND EMISSIONS

B Group



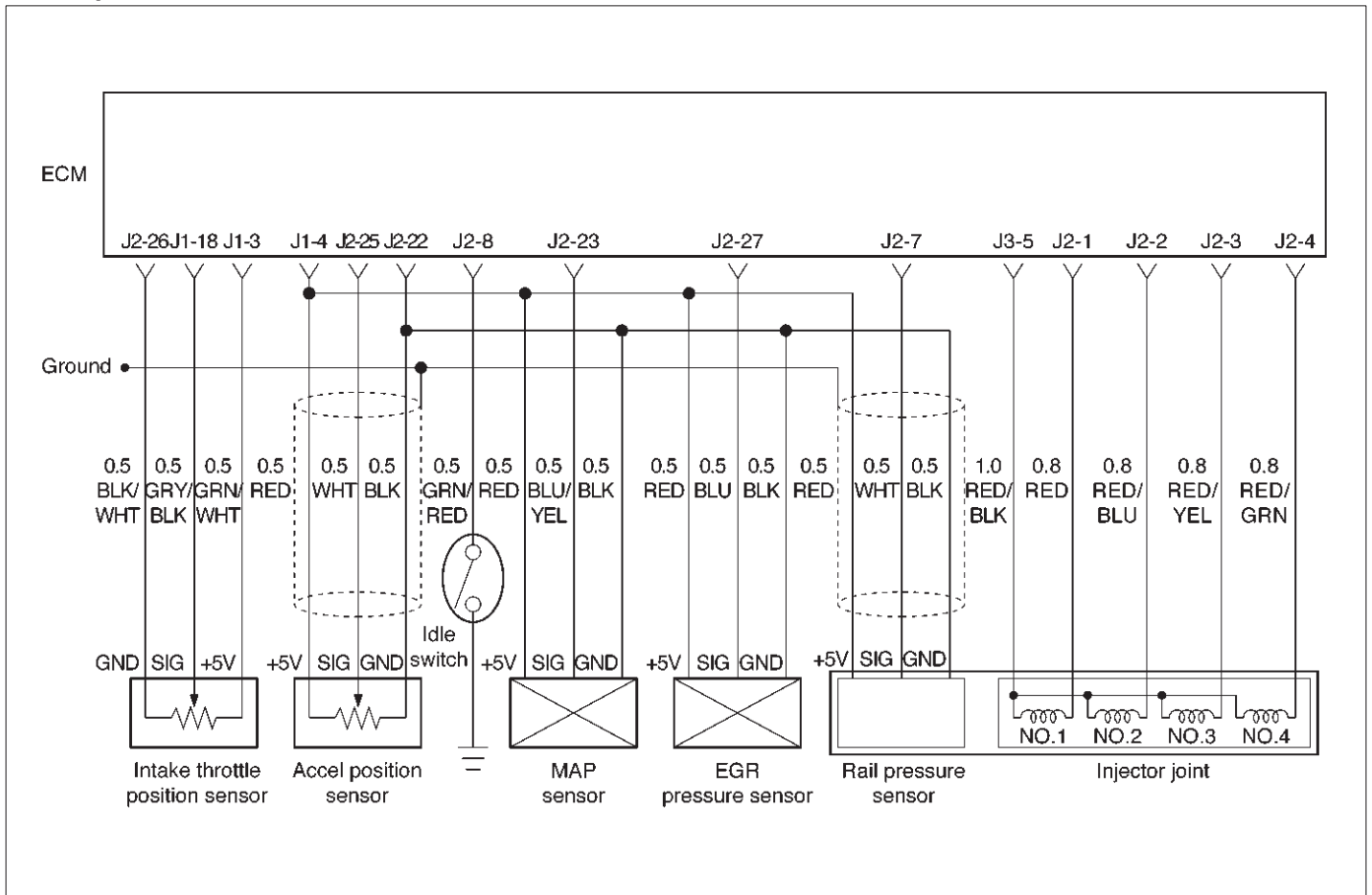
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C Group



060RW129

D Group



060RW134

Circuit Description

The on-board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the ECM and engine grounds for cleanliness and tightness.

The on-board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the ECM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The MIL ("Check Engine" lamp) should be "ON" steady with the ignition "ON"/engine "OFF." If not, Chart A-1 should be used to isolate the malfunction.
2. Checks the Class 2 data circuit and ensures that the ECM is able to transmit serial data.
3. This test ensures that the ECM is capable of controlling the MIL ("Check Engine" lamp) and the MIL ("Check Engine" lamp) driver circuit is not shorted to ground.
4. If the engine will not start, the *Cranks But Will Not Run* chart should be used to diagnose the condition.
7. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.
9. When the ECM is replaced, the characteristic data of injector and rail pressure sensor should be inputted.

On- Board Diagnostic (OBD) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "ON," engine "OFF." 2. Observe the malfunction indicator lamp (MIL or "Check Engine" lamp). Is the MIL ("Check Engine" lamp) "ON?"	—	Go to Step 2	Go to No MIL ("Check Engine" lamp)
2	1. Ignition "OFF." 2. Install a Tech 2. 3. Ignition "ON." 4. Attempt to display ECM engine data with the Tech 2. Does the Tech 2 display ECM data?	—	Go to Step 3	Go to Step 8
3	1. Using the Tech 2 output tests function, select MIL ("Check Engine" lamp) dash lamp control and command the MIL ("Check Engine" lamp) "OFF." 2. Observe the MIL ("Check Engine" lamp). Did the MIL ("Check Engine" lamp) turn "OFF?"	—	Go to Step 4	Go to MIL ("Check Engine" lamp) On Steady
4	Attempt to start the engine. Did the engine start and continue to run?	—	Go to Step 5	Go to Cranks But Will Not Run
5	Select "Display DTCs" with the Tech 2. Are any DTCs stored?	—	Go to Step 6	Go to Step 7
6	Are two or more of the following DTCs stored? A Group; P0337, P0342, P1193, P1404, P1405, P1488 B Group; P0337, P0342 C Group; P0112, P0117, P0182, P0197 D Group; P0107, P0405, P1194, P1485	—	Go to Chart, "Multiple ECM Information Sensor DTCs Set"	Go to applicable DTC table
7	Compare ECM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to Step 8	Refer to indicated Component System Checks
8	1. Ignition "OFF," disconnect the ECM. 2. Ignition "ON," engine "OFF." 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. 4. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 2	Go to Step 9
9	Check the Tech 2 on other vehicle. Was Tech 2 abnormal?	—	Go to Step 11	Go to Step 10
10	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Go to Step 2	—
11	Repair the Tech 2 or prepare another Tech 2. Is the action complete?	—	Go to Step 2	—

Engine Control Module ECM Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the ECM memory. Diagnostic trouble codes can also be cleared by turning the ignition “OFF” and disconnecting the battery power from the ECM for 30 seconds. Turning off the ignition and disconnecting the battery power from the ECM will cause all diagnostic information in the ECM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the ECM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the ECM connections or the ECM is the cause of a problem, and the ECM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the ECM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all components and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned “ON” and “OFF” by the ECM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the ECM but will cause the solenoid or relay to be inoperative.

Multiple ECM Information Sensor DTCs Set

Circuit Description

The Engine Control Module ECM monitors various sensors to determine the engine operating conditions. The ECM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The ECM provides a sensor ground to all of the sensors. The ECM applies 5 volts through a pull-up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5-volt supply and the resistor:

- The fuel temperature (FT) sensor
- The engine coolant temperature (ECT) sensor
- The Intake air temperature (IAT) sensor

The ECM provides the following sensors with a 5-volt reference and a sensor ground signal:

- The Intake throttle position sensor
- The manifold absolute pressure sensor
- The rail pressure sensor
- The accelerator position sensor
- The oil temperature sensor

- The camshaft position sensor
- The crankshaft position sensor
- The EGR pressure sensor

The ECM monitors the signals from these sensors in order to determine their operating status.

Diagnostic Aids

IMPORTANT: Be sure to inspect ECM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0337
- P0342
- P1193
- P1404
- P1405
- P1488

IMPORTANT: If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the ECM and the splice will cause one or more of the following DTCs to be set:

- P0337
- P0342
- P0117

A short to ground in the 5-volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0112
- P0117
- P0182
- P0197

An open in the 5-volt reference circuit A, between the ECM and the splice will cause one or more of the following DTCs to be set:

- P0107
- P0405
- P1194
- P0122

An open in the 5-volt reference circuit B, between the ECM and the splice will cause one or more of the following DTCs to be set:

- P1485

Check for the following conditions:

- **Poor connection at ECM.** Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and a poor terminal-to-wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor’s displayed value on the Tech 2 with the ignition “ON” and the engine “OFF” while you move the connectors and the wiring harnesses related to the following sensors:
 - ECT Sensor

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- MAP Sensor
- CMP Sensor
- CKP Sensor
- EGR Pressure Sensor
- EGR VSV
- RPCV
- IAT Sensor
- Intake Throttle Motor
- Fuel Temperature Sensor
- Oil Temperature Sensor
- Rail Pressure Sensor

Multiple ECM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Turn the ignition "OFF," disconnect the ECM. 2. Turn the ignition "ON," check the 5 volt reference D circuit for the following conditions: <ul style="list-style-type: none"> ● D poor connection at the ECM. ● An open between the ECM connector and the splice. ● D short to ground. ● D short to voltage. Is there an open or short?	—	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: <ul style="list-style-type: none"> ● A poor connection at the ECM or the affected sensors. ● An open between the ECM connector and the affected sensors. Is there an open or a poor connection?	—	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	Go to <i>Step 6</i>
6	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Go to <i>OBD System Check</i>	—

EGR (Exhaust Gas Recirculation) Diagnosis

- A diagnosis of the EGR system is covered by DTC P1403.
- EGR VSV circuit diagnosis is covered by DTC P1404.
- EGR pressure sensor diagnosis is covered by DTC P405 and/or P406.
- EGR EVRV circuit diagnosis is covered by DTC P1405. Refer to the DTC charts.

Tech 2 Data Definitions and Ranges

A/C CLUTCH—Tech 2 Displays ON or OFF—

Indicates whether the A/C has commanded the A/C clutch ON.

MAP kPa — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —

The manifold absolute pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The manifold absolute pressure is used to compensate for altitude differences and is normally displayed around “61-104” depending on altitude and manifold absolute pressure.

CMP ACT. COUNTER —Cam Position

DESIRED IDLE — Tech 2 Range 0-3187 RPM —

The idle speed that the ECM is commanding. The ECM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT — (Engine Coolant Temperature) Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the ECM. The ECM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the ECM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

ENGINE RUN TIME — Tech 2 Range

00:00:00-99:99:99 Hrs:Min:Sec —

Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED — Range 0-9999 RPM —

Engine speed is computed by the ECM from the 57X reference input. It should remain close to desired idle under various engine loads with engine idling.

Air Intake Valve meter POSITION — Tech 2 Range 0-100 % —

IAT (INTAKE AIR TEMPERATURE)— Tech 2 Range -40°C to 151°C (-40°F to 304°F) —

The ECM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the ECM to adjust fuel delivery and spark timing according to incoming air density.

MAP — Tech 2 Range 10-105 kPa (0.00-4.97 Volts)—

The manifold absolute pressure (MAP) sensor measures the change in the boost pressure.

MIL — Tech 2 Displays ON or OFF —

Indicates the ECM commanded state of the malfunction indicator lamp.

AP — Tech 2 Range 0%-100% —

AP (Accelerator position) angle is computed by the ECM from the AP sensor voltage. AP angle should display “0%” at idle and “100%” at wide open throttle.

AP SENSOR — Tech 2 Range 0.00-5.00 Volts —

The voltage being monitored by the ECM on the AP sensor signal circuit.

VEHICLE SPEED—Tech 2 Range 0-255 km/h (0-155 mph)—

The vehicle speed sensor signal is converted into km/h and mph for display.

Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the ECM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

Test Conditions

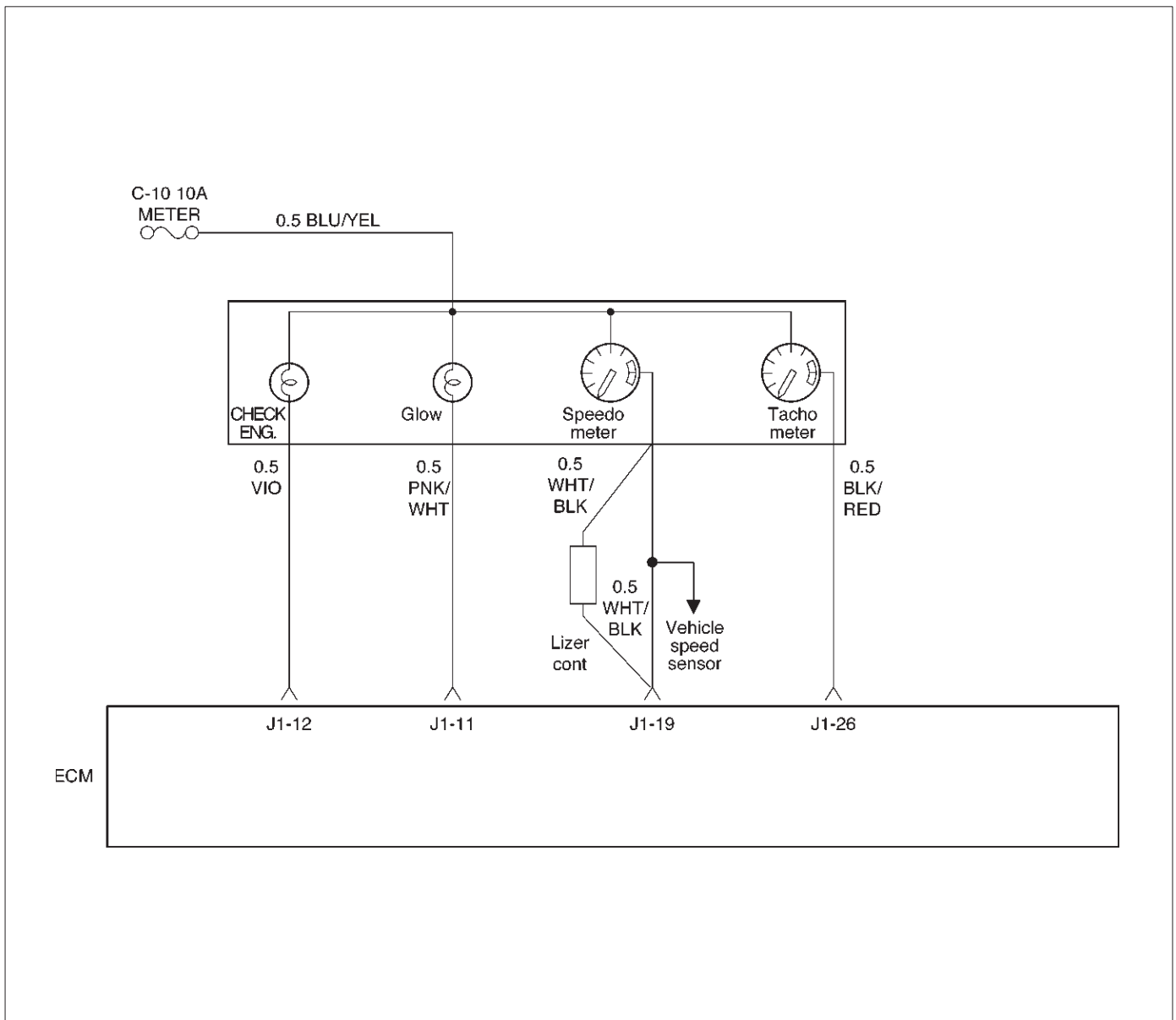
Engine running, lower radiator hose hot, transmission in park or neutral, accessories off, brake not applied and air conditioning off.

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4JX1-TC Engine (Automatic and Manual Transmission)

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Battery Voltage	Engine	Volts	12.5 ~ 14.5	13 ~ 15	General Description
Ignition Status	Engine	On/Off	On	On	General Description
Ignition Relay ²	Engine	On/Off	On	On	General Description
Idle Switch	Engine	Inactive/ Active	—	—	DTC P0510, P1510
Manifold Absolute Pressure	Engine	KPa	96 ~ 106	110 ~ 150	General Description DTC P0107, P0108
Rail Oil Pressure	Engine	MPa	3.5 ~ 5	4.5 ~ 10	General Description DTC P0192, P0193
Desired Rail Oil Pressure	Engine	MPa	4 ~ 5	5 ~ 9	General Description DTC P0192, P0193
Fuel Temperature	Engine	°C (°F)	75 ~ 85	75 ~ 85	DTC P0182, P0183
Quick Warming Switch	Engine	On/Off	Off	Off	DTC P0380
Thermo Relay	Engine	On/Off	—	—	DTC P1655
Actual EGR Pressure	Engine	KPa	58 ~ 60	M/T 63 ~ 66 A/T 95 ~ 105	DTC P0405, P0406
Barometric Pressure	Engine	KPa	98 ~ 102	98 ~ 102	General Description
Relative EGR Pressure	Engine	KPa	-38 ~ -45	M/T -34 ~ -37 A/T 0	General Description
Desired EGR Pressure	Engine	KPa	-43 ~ -40	M/T 36 A/T 0	General Description
Brake Switch	Engine	Inactive/ Active	—	—	DTC P1588
Gear	Engine	—	—	—	—
Vehicle Speed	Engine	Km/h	0	0	Transmission Diagnosis
Rail Pressure Control Valve	Engine	%	17 ~ 22	18 ~ 27	DTC P1193
EGR Status	Engine	Disable/ Enable	Enable	M/T Enable A/T Disable	General Description
EGR Switching Valve	Engine	On/Off	—	—	General Description
Throttle Motor Position Sensor	Engine	Volts	3.1 ~ 3.9	0.2 ~ 0.9	DTC P1485, P1486, P1487
Throttle Motor Position	Engine	Steps	0 ~ 1.0	0 ~ 1.0	DTC P1488
Delivered Fuel Quantity	Engine	mm ³ /st	6 ~ 10	6 ~ 12	General Description
Injector Status	Engine	Disable/ Enable	Enable	Enable	DTC P0201, P0202, P0203, P0204, General Description
Injector Pulse Width	Engine	ms	0.9 ~ 1.25	0.7 ~ 1.1	General Description
Injector Start Offset	Engine	°CA	—	—	General Description

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Exhaust VSV1	Engine	On/Off	Off	Off	DTC P0475
Exhaust VSV2	Engine	On/Off	Off	Off	DTC P1475
Deceleration Fuel Cut Off	Engine	Inactive/Active	—	—	General Description
Glow Time Lamp	Engine	On/Off	Off	Off	DTC P0381
Glow Time Relay	Engine	On/Off	Off	Off	DTC P0380
Diagnostic Request	Engine	Inactive 12V/ Active 0V	—	—	General Description
A/C Clutch	Engine	On/Off	Off	Off	General Description
Desired Idle	Engine	RPM	720	—	General Description
ECT (Engine Coolant Temp)	Engine	°C (°F)	80 ~ 90	80 ~ 90	General Description ECT
Engine Speed	Engine	RPM	720	2500	DTC P0219
MAT (Intake Air Temp)	Engine	°C (°F)	65 ~ 80	65 ~ 80	DTC P0112, P0113
MAP KPa (Manifold Absolute Pressure)	Engine	Kilopascals	—	—	General Description DTC P0107, P0108
MIL	Engine	On/Off	Off	Off	General Description
AP (Accel Position)	Engine	Percent	0	8 ~ 14	DTC P0121, P0122, P0123
AP (Accel Position)	Engine	Volts	0.25 ~ 0.45	0.8 ~ 1.0	DTC P0121, P0122, P0123
Rail Oil Temperature	Engine	°C (°F)	—	—	DTC P0197, P0198
Desired Throttle Motor Position	Engine	Steps	—	—	—
Learned Idle Fuel Quantity	Engine	mm 3/st	—	—	—

No Malfunction Indicator Lamp (MIL)



Circuit Description

The "Check Engine" lamp (MIL) should always be illuminated and steady with the ignition "ON" and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The Engine Control Module ECM turns the MIL "ON" by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the ECM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.

- If the engine cranks but will not run, check for an open ECM ignition or battery feed, or a poor ECM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- A "No MIL" condition accompanied by a no-start condition suggests a faulty ECM ignition or battery feed circuit.
- Using a test light connected to B+, probe each of the ECM ground terminals to ensure that a good ground is present. Refer to *ECM Terminal End View* for terminal locations of the ECM ground circuits.
- In this step, temporarily substitute a known good relay for the ECM relay. The horn relay is nearby, and it can be verified as "good" simply by honking the horn. Replace the horn relay after completing this step.

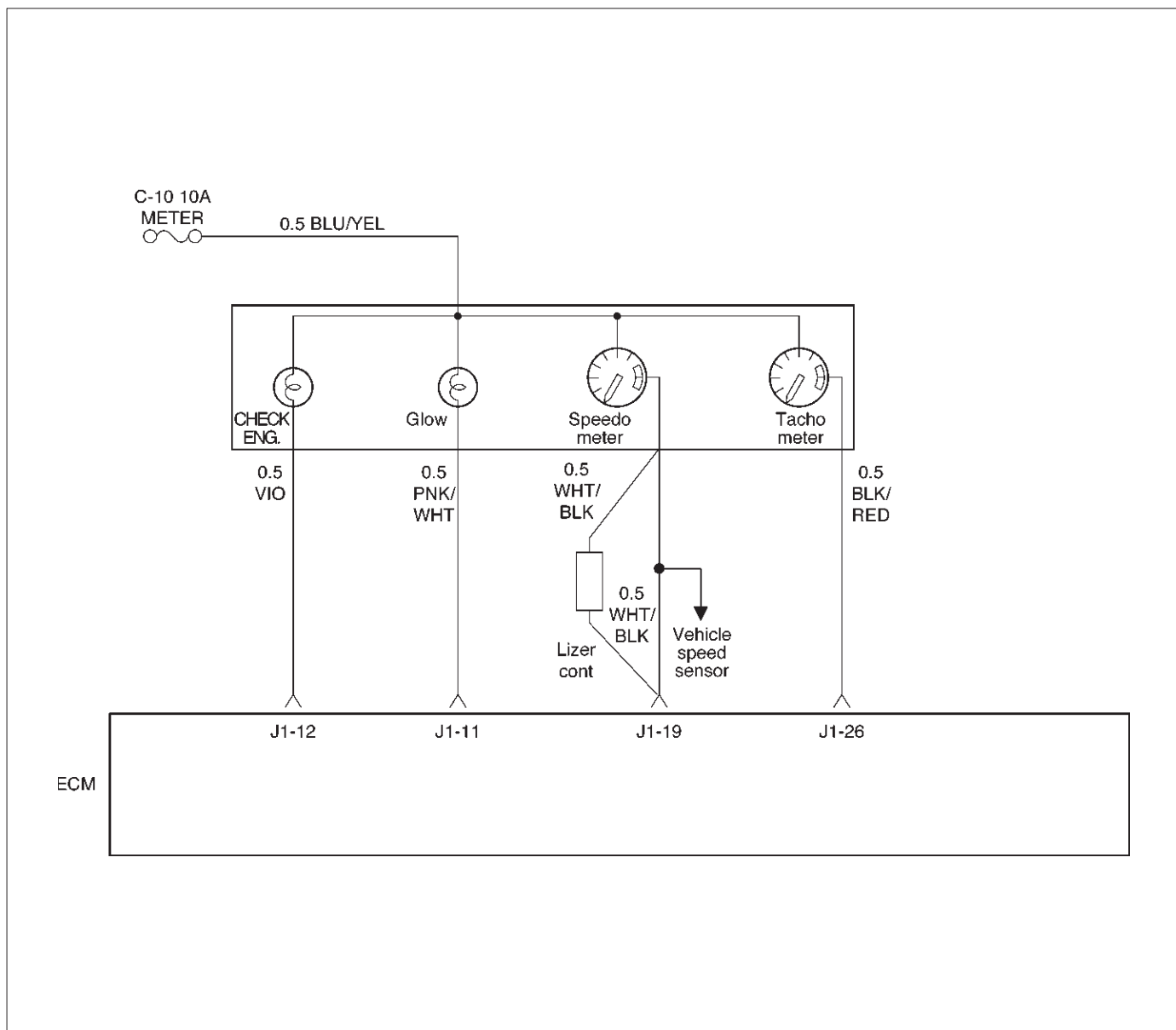
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to Step 6
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to Step 4	Go to Step 16
4	Ignition "ON," probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light "ON?"	—	Go to Step 5	Go to Step 13
5	1. Ignition "OFF." 2. Disconnect the ECM. 3. Jumper the MIL driver circuit at the ECM connector to ground. 4. Ignition "ON." Is the MIL "ON?"	—	Go to Step 10	Go to Step 11
6	Check the ECM ignition feed and battery feed fuses (15 A engine fuse and 15 A ECM fuse). Are both fuses OK?	—	Go to Step 7	Go to Step 15
7	1. Ignition "OFF." 2. Disconnect the ECM. 3. Ignition "ON." 4. Probe the ignition feed circuit at the ECM harness connector with a test light to ground. Is the test light "ON?"	—	Go to Step 8	Go to Step 12
8	Probe the battery feed circuit at the ECM harness connector with a test light to ground. Is the test light "ON?"	—	Go to Step 9	Go to Step 14
9	Check for a faulty ECM ground connection. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for damaged terminals at the ECM. Was a problem found?	—	Verify repair	Go to Step 17
11	Check for an open MIL driver circuit between the ECM and the MIL. Was a problem found?	—	Verify repair	Go to Step 18
12	Substitute a known "good" relay for the ECM main relay. Was the malfunction fixed?	—	Verify repair	Go to Step 13
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open ECM battery feed circuit. Is the action complete?	—	Verify repair	—

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Locate and repair the short to ground in the ECM ignition feed circuit or ECM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	<i>Go to Instrument Panel in Electrical Diagnosis</i>

Malfunction Indicator Lamp (MIL) "ON" Steady



Circuit description

The "Check Engine" lamp (MIL) should always be illuminated and steady with ignition "ON" and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The Engine Control Module ECM turns the MIL "ON" by grounding the MIL driver circuit.

The MIL should not remain "ON" with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain "ON" when the ECM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.

Malfunction Indicator Lamp (MIL) "ON" Steady

Step	Action	Value(s)	Yes	No
1	Was the "On-Board diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "OFF," disconnect ECM. 2. Ignition "ON," observe the MIL (CHECK ENGINE lamp). Is the MIL "ON?"	—	Go to <i>Step 3</i>	Go to <i>Step 5</i>
3	1. Ignition "OFF," disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the ECM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to <i>OBD System Check</i>	Go to <i>Step 4</i>
4	Replace the instrument panel cluster. Is the action complete?	—	Go to <i>OBD System Check</i>	—
5	1. Ignition "OFF," reconnect the ECM. 2. Ignition "ON," reprogram the ECM. Refer to <i>On-Vehicle Service</i> in <i>Engine Control Module and Sensor</i> for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL "OFF." Did the MIL turn "OFF?"	—	Go to <i>OBD System Check</i>	Go to <i>Step 6</i>
6	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Go to <i>OBD System Check</i>	—

Engine Cranks But Will Not Run

Circuit Description

In this type of injector system, the Engine Control Module (ECM) triggers the correct driver inside the injector, which then triggers the correct injector based on the 57X signal received from the crankshaft position sensor (CKP).

During crank, the ECM monitors the CKP 57X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 57X signal has been processed by the ECM, it will command all four injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left "OFF" during the next four 57X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting period, a camshaft position (CMP) signal pulse will have been received by the ECM. The CMP signal allows the ECM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start-up, the ECM will begin sequential fuel delivery with a 1-in-4 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation or a wire

broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty engine coolant temperature sensor – Using a Tech 2, compare engine coolant temperature with manifold air temperature on a completely cool engine.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- An obvious cause of low fuel pressure would be an empty fuel tank.
- The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
- If there is an open or shorted driver circuit, DTCs 0201-0204 should be set.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check the 15 A injector fuse, the 15 A engine device fuse, and the 15A ECM fuse. Was a fuse blown?	—	Go to Step 3	Go to Step 4
3	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—
4	Is fuel tank empty?	—	Fill the fuel tank	Go to Step 5
5	Is the right fuel using?	—	Go to Step 6	Replace the fuel
6	Is the right engine oil using?	—	Go to Step 7	Replace the engine oil
7	Using the Tech–2. Is DTC P0192 or P0193 set? (Check rail pressure system)	—	Go to <i>DTC P0192 or DTC P0193</i>	Go to Step 8
8	Using the Tech–2. Is DTC P0201 – P0204 set? (Check inject circuit fault)	—	Go to <i>DTC P0201 – P0204</i>	Go to Step 9
9	Using the Tech–2. Is DTC P1657 set? (Check ECM Main relay)	—	Go to <i>DTC P1657</i>	Go to Step 10

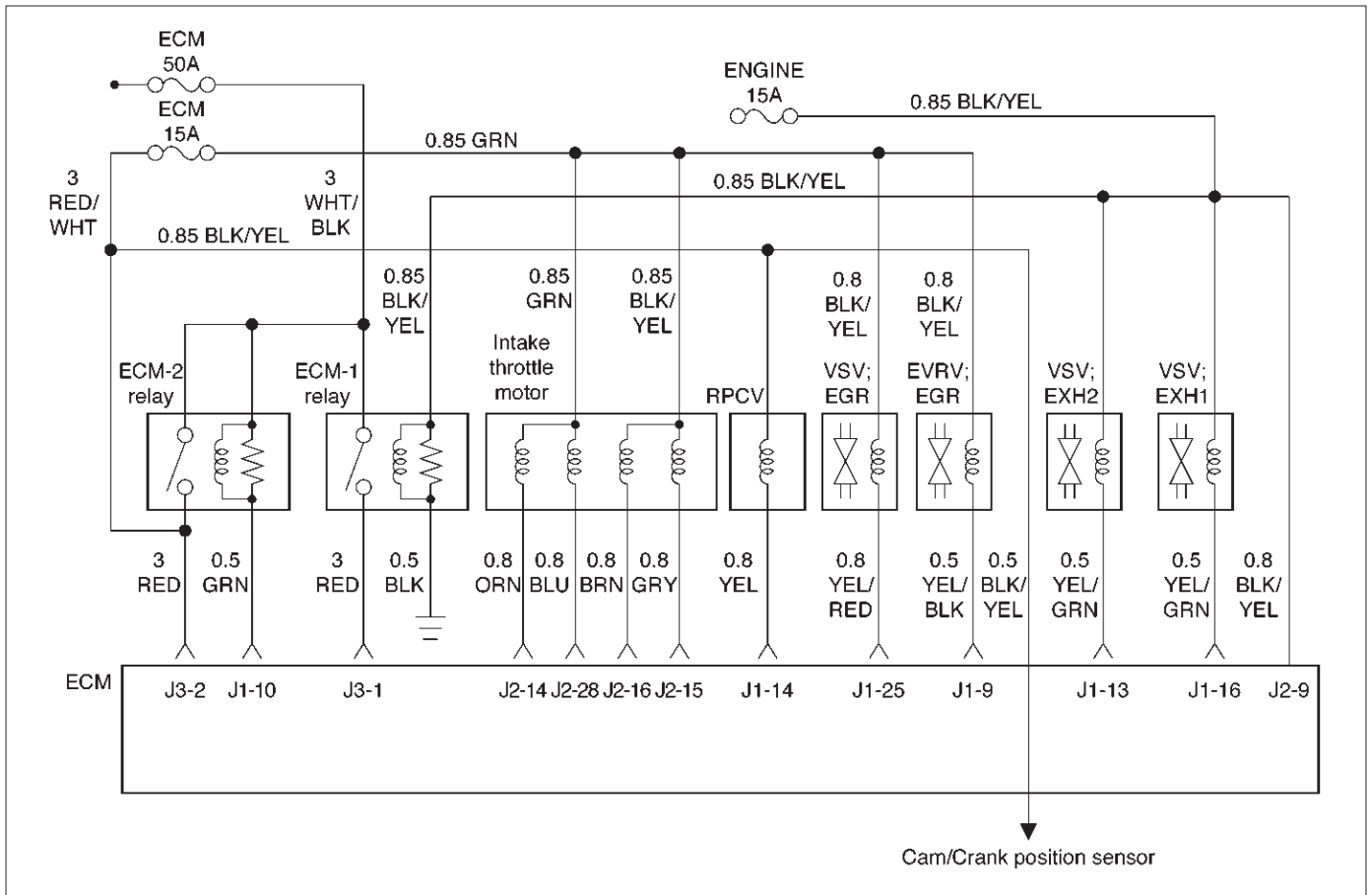
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
10	Refer to <i>Engine Mechanical Diagnosis</i> to diagnose the following conditions: <ul style="list-style-type: none"> ● Faulty camshaft drive belts ● Leaking or sticky valves or rings ● Excessive valve deposits ● Weak valve springs ● Incorrect valve timing ● Leaking head gasket Is the action complete?	—	Verify repair	Go to <i>Step 11</i>
11	Observe the "Engine Speed" data display on the Tech 2 while cranking the engine. Is the engine RPM indicated? (If the Tech 2 is normally powered from the cigarette lighter socket, and if the Tech 2 display goes blank while cranking the engine, it will be necessary to power the Tech 2 directly from the vehicle battery.)	—	Go to <i>Step 12</i>	Go to <i>Step 17</i>
12	1. At the ECM (female) side of the connector mentioned in step, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector. 2. Ignition "ON." 3. Observe the test light, and repeat the test for each injector driver circuit by oscilloscope. Did the test light stay on when checking any of the 4 injector driver circuits?	—	Go to <i>Step 13</i>	Go to <i>Step 15</i>
13	1. Ignition "OFF," disconnect the ECM. 2. Ignition "ON," observe the test light. Is the test light "ON?"	—	Go to <i>Step 14</i>	Go to <i>Step 16</i>
14	Locate and repair the short to ground in the injector driver circuit. Is the action complete?	—	Verify repair	—
15	Check for an open injector driver circuit. Was a problem found?	—	Verify repair	Go to <i>Step 16</i>
16	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
17	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition "ON." 3. With a test light to ground, probe the harness ignition feed terminal. Did the light illuminate?	—	Go to <i>Step 19</i>	Go to <i>Step 18</i>
18	Check the ignition feed wire between the sensor and the ECM for a short to ground or open circuit. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Ignition "ON." 2. At the CKP harness connector, connect a test light between the ignition and ground terminals. Did the light illuminate?	—	Go to <i>Step 21</i>	Go to <i>Step 20</i>
20	Check the sensor ground circuit for an open or short to voltage. Is the action complete?	—	Verify repair	—
21	Check the signal circuit between the sensor and the ECM for a short to ground, short to voltage, or an open. Was a problem found?	—	Verify repair	Go to <i>Step 22</i>
22	Replace the CKP sensor. Is the action complete?	—	Verify repair	Go to <i>Step 16</i>

Exhaust Gas Recirculation (EGR) System Check



060RW135

Circuit Description

Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NO_x) in the exhaust gas. Lower combustion temperatures also prevent detonation.

Diagnostic Aids

The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NO_x. An EGR pintle constantly in the open position would cause a rough idle.

System Check

Step	Action	Value(s)	Yes	No
1	Move the valve up and down to check the slide resistance. Is the slide resistance large?	—	Go to <i>Step 8</i>	Go to <i>Step 2</i>
2	1. Set the transmission at "Park" or "Neutral". 2. Put the engine in warming-up operation by idling. (The engine temperature should be 80°C or more) 3. Disconnect the vacuum hose from the EGR valve. 4. Apply a vacuum of 250 mmHg to the EGR valve by the vacuum pump (mighty pack). Does the vibration due to engine operation become larger?	—	Go to <i>Step 3</i>	Go to <i>Step 9</i>
3	1. Check if there is not any damage on the vacuum hose from the vacuum pump to the EGR valve. 2. Install the vacuum pump (mighty pack) to the EGR valve. Does the vacuum became 250 mmHg or more at that time?	250 mmHg or more	Go to <i>Step 4</i>	Go to <i>Step 8</i>
4	Install the EGR valve and the vacuum hose formally and increase the engine revolution speed to 3000 rpm. Can both EGR valve 1 and EGR valve 2 be opened and closed?	—	The system is normal	Go to <i>Step 5</i>
5	Measure the resistance of the VSV: EGR coil. Is the resistance value in the range of 30 δ to 50 δ ?	30 ~ 50 δ	Go to <i>Step 6</i>	Go to <i>Step 10</i>
6	Measure the resistance of the EVRV: EGR coil. Is the resistance value in the range of 10 δ to 13 δ ?	10 ~ 13 δ	Go to <i>Step 7</i>	Go to <i>Step 11</i>
7	Was the harness open or poor connection?	—	Go to <i>Step 12</i>	Go to <i>Step 13</i>
8	Replace the EGR valve ASM. Is the action complete?	—	Verify repair	—
9	Clean or replace the EGR valve ASM. Is the action complete?	—	Verify repair	—
10	Replace the EGR VSV. Is the action complete?	—	Verify repair	—
11	Replace the EGR EVSV. Is the action complete?	—	Verify repair	—
12	Repair the harness. Is the action complete?	—	Verify repair	—
13	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

ECM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported a Tech 2 and to flash.If any DTCs not listed

here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

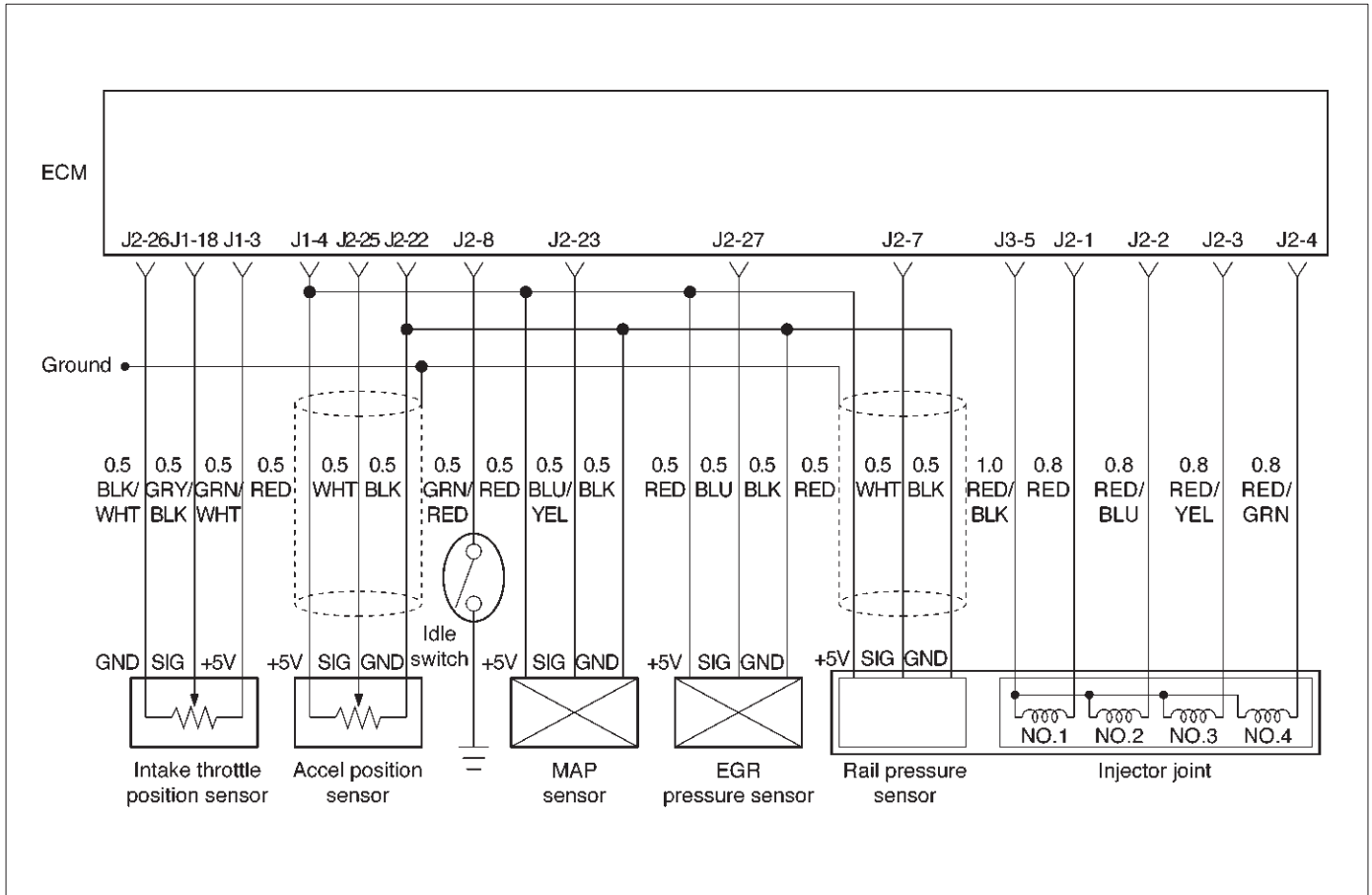
ECM Diagnostic Trouble Codes

DTC using a Tech 2	Flash DTC	Description	MIL
P0107	34	MAP Sensor Low Voltage	ON
P0108	34	MAP Sensor High Voltage	ON
P0112	23	Intake Air temp Sensor Low Voltage	ON
P0113	23	Intake Air temp Sensor High Voltage	ON
P0117	14	Engine Coolant Temp Sensor Low Voltage	ON
P0118	14	Engine Coolant Temp Sensor High Voltage	ON
P0121	33	Accel Position Sensor Rationality	ON
P0122	21	Accel Position Sensor Low Voltage	ON
P0123	21	Accel Position Sensor High Voltage	ON
P0182	15	Fuel Temp Sensor Low Voltage	ON
P0183	15	Fuel Temp Sensor High Voltage	ON
P0192	63	Rail Pressure Sensor Low Voltage	ON
P0193	63	Rail Pressure Sensor High Voltage	ON
P1193	64	RPCV Circuit Open/Short	—
P1194	61	Rail Pressure System Low Voltage	ON
P1195	61	Rail Pressure System High Voltage	ON
P1196	62	Rail Pressure System High Warning	ON
P0197	16	Oil Temp sensor Low Voltage	ON
P0198	16	Oil Temp sensor High Voltage	ON
P0201	51	Injector #1 Circuit Fault	ON
P0202	52	Injector #2 Circuit Fault	ON
P0203	53	Injector #3 Circuit Fault	ON
P0204	54	Injector #4 Circuit Fault	ON
P0217	22	High Coolant Temp Warning	ON
P1217	36	High Oil Temp Warning	ON
P0219	11	Engine Over Speed Warning	ON
P0336	43	Crank Position Sensor Out of Syncro	ON
P0337	43	Crank Position Sensor No Signal	ON
P0341	41	Cam Position Sensor Out of Syncro	ON
P0342	41	Cam Position Sensor No Signal	ON
P0380	66	Glow Relay Circuit Open/Short	—
P0381	67	Glow Lamp Circuit Open/Short	—
P1403	32	EGR EVRV Fault	—
P1404	31	EGR VSV Circuit	—
P0405	26	EGR Pressure Sensor Low Voltage	ON
P1405	37	EGR EVRV Circuit Open/Short	—
P0406	26	EGR Pressure Sensor High Voltage	ON

4JX1-TC ENGINE DRIVEABILITY AND EMISSIONS 6E-55

DTC using a Tech 2	Flash DTC	Description	MIL
P0475	71	EXH #1 VSV Circuit Open/Short	—
P1475	71	EXH #2 VSV Circuit Open/Short	—
P1485	74	Intake Throttle Position Sensor Low Voltage	ON
P1486	74	Intake Throttle Position Sensor High Voltage	ON
P1487	73	Intake Throttle System Circuit Open/Short	ON
P1488	72	Intake Throttle Motor Control Circuit Signal Gap	—
P0502	24	Vehicle Speed Sensor No Signal	ON
P0510	75	Idle SW Malfunction, Open Circuit	ON
P1510	75	Idle SW Malfunction, Short Circuit	ON
P0562	35	System Voltage Too Low	ON
P1562	35	System Voltage Too Low at Cranking	ON
P1587	25	Brake SW Malfunction [B]	—
P1588	25	Brake SW Malfunction [A]	ON
P0601	55	ECM Checksum Error	ON
P1626	56	Immobilizer No Signal	ON
P1631	56	Immobilizer Wrong Signal	ON
P1648	56	No Security Code Entered	ON
P1649	56	Immobilizer Function not Programmed	ON
P0650	77	Check Engine Lamp Circuit Open/Short	—
P0654	27	Techometer Circuit Open/Short	—
P1655	17	Thermo Relay Circuit Open/Short	—
P1657	76	ECM Main Relay Circuit Open/Short	—
P1589	47	TransMission SW Circuit Open/Short	—

Diagnostic Trouble Code (DTC) P0107 (Flash DTC 34) MAP Sensor Circuit Low Voltage



060RW134

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The ECM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the ECM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0107 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

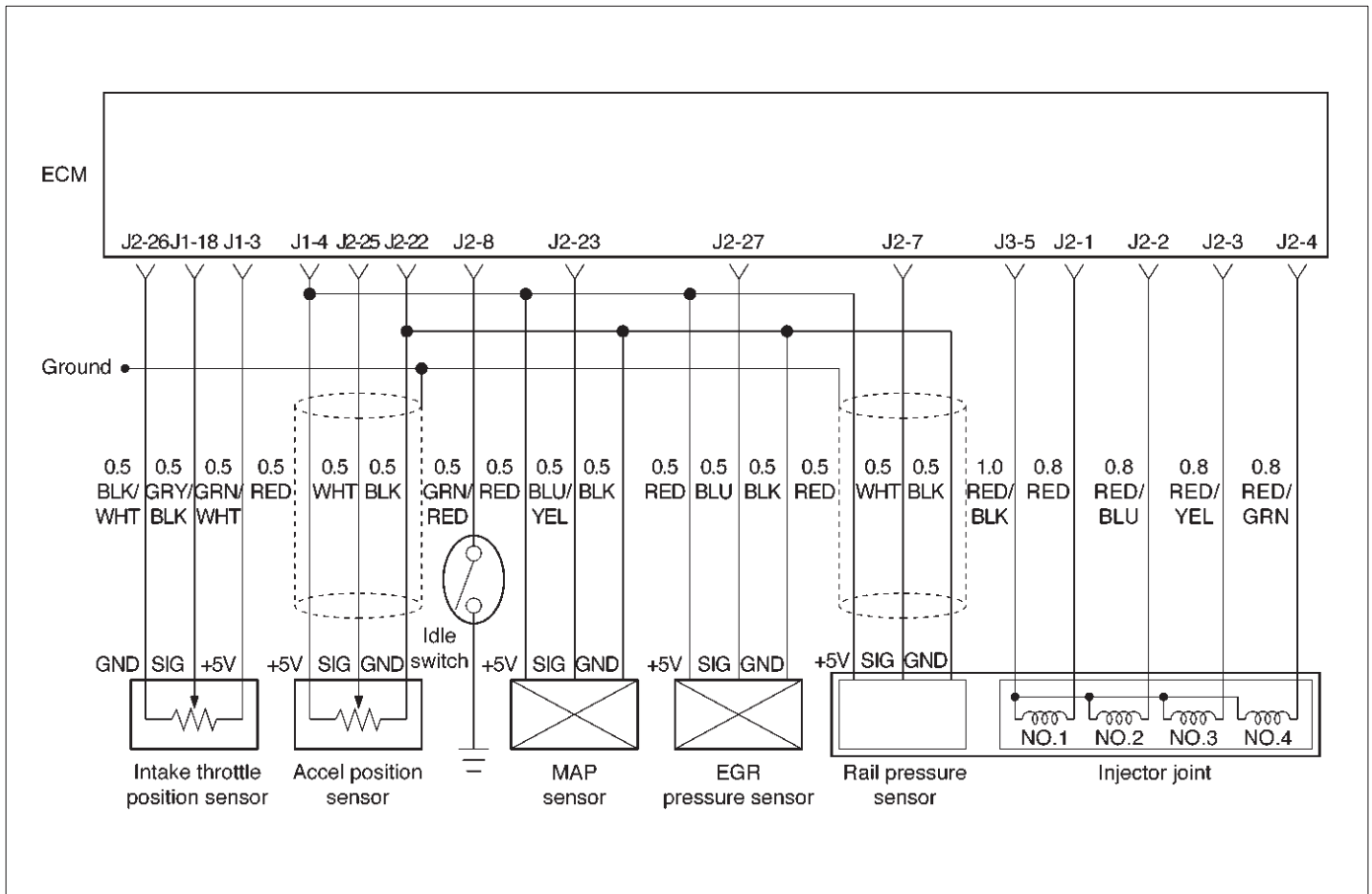
- Turn on the ignition switch and stop the engine. At this time, the boost pressure will be equal to the atmospheric pressure and the signal voltage will increase.
- Check for intermittent codes.
- The MAP sensor shares a ground with the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

DTC P0107 – MAP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Put the engine into an idling status. Is the MAP voltage value displayed on the Tech 2 below the specified value?	0.25 V	Go to Step 3	Refer to <i>Diagnostic Aids and Symptom Diagnosis</i>
3	1. Turn off the ignition switch. 2. Remove the sensor connector connection. 3. Jumper between harness pins "red" and "blue" wires. 4. Turn on the ignition switch "ON". Is the MAP voltage reading above the specified value?	4 V	Go to Step 5	Go to Step 4
4	1. Turn off the ignition switch. 2. Remove the jumper wire. 3. Connect the relay & solenoid checker (5-8840-0386-0) to the battery voltage, then check the MAP signal circuit (blue wire). 4. Turn on the ignition switch. Is the value displayed on the Tech 2 above the specified value?	4 V	Go to Step 6	Go to Step 7
5	Check the terminal connection at the MAP sensor and repair or replace terminal if necessary. Is the action complete?	—	Verify repair	—
6	Repair the 5V power circuit (red) harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
7	Repair the signal circuit (blue) harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0108 (Flash DTC 34) MAP Sensor Circuit High Voltage



060RW134

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The ECM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the ECM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0108 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

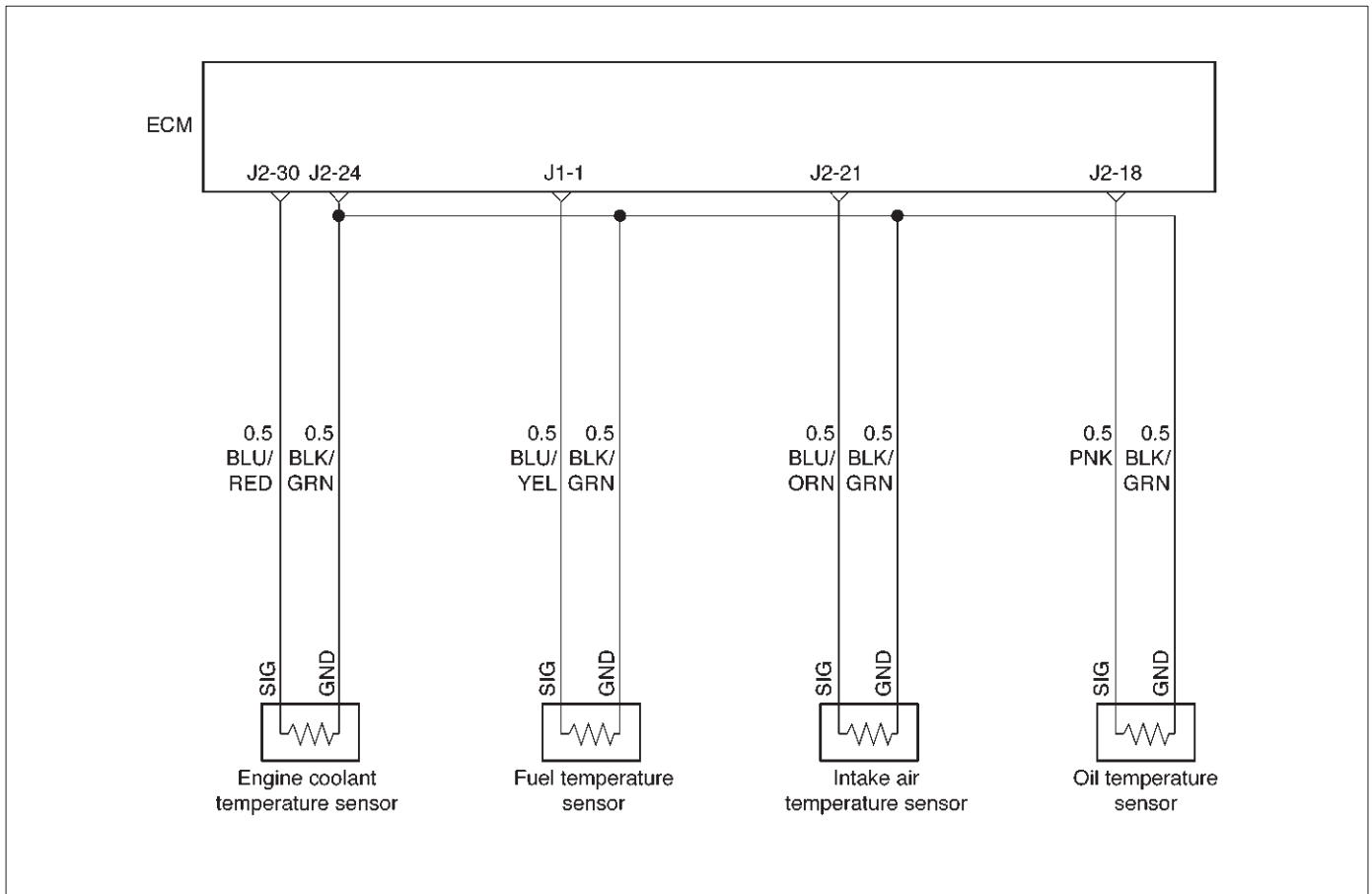
- Turn on the ignition switch and stop the engine. At this time, the boost pressure will be equal to the atmospheric pressure and the signal voltage will increase.
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Put the engine into an idling status. Is the MAP voltage value displayed on the Tech 2 above the specified value?	4 V	Go to Step 3	Go to Step 4
3	1. Turn off the ignition switch. 2. Remove the sensor connector connection. 3. Turn on the ignition switch "ON". Is the MAP voltage value displayed on the Tech 2 below the specified value?	1 V	Go to Step 5	Go to Step 6
4	Is the MAP voltage value displayed on the Tech 2 below the specified value?	1 V	Refer to <i>Chart P0107</i>	Refer to <i>Diagnostic Aids and Symptom Diagnosis</i>
5	Connect the relay and solenoid checker (5-8840-0386-0) to the battery voltage, then check the sensor grounding circuit. Does the checker lamp come on?	—	Go to Step 7	Go to Step 8
6	A voltage short circuit occurs in the MAP signal circuit or this circuit is shorted with the 5V power circuit. Repair the harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
7	Replace the MAP sensor hose or the MAP sensor. Is the action complete?	—	Verify repair	—
8	Repair the harness for open ground circuit. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0112 (Flash DTC 23) IAT Sensor Circuit Low Voltage



060RW129

Circuit Description

The Intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The Engine Control Module ECM applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the ECM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the ECM to monitor a lower voltage. DTC P0112 will set when the ECM detects an excessively low signal voltage on the Intake air temperature sensor signal circuit.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0112 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault. If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a “shifted” sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

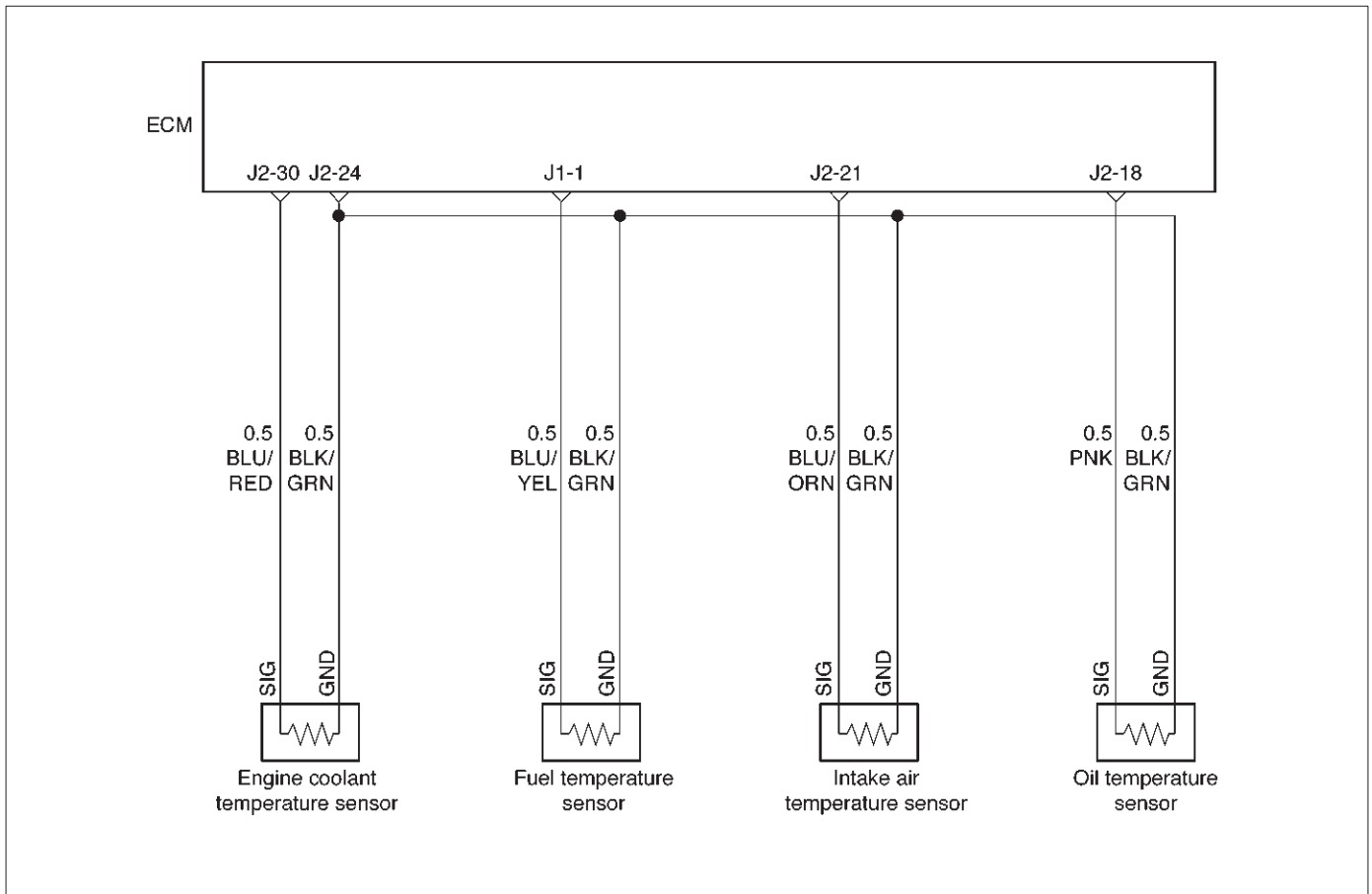
Intake Air Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
25	77	2796
15	59	4450
5	41	7280

DTC P0112 – IAT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148°C (283°F)	Go to Step 4	Go to Step 3
3	1. Ignition “ON,” engine “OFF.” Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “DTC” info for DTC P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Ignition “OFF.” 2. Disconnect the IAT sensor electrical connector. 3. Ignition “ON.” 4. Observe the manifold air temperature on the Tech 2. Is the manifold air temperature below the specified value?	–38°C (–36°F)	Go to Step 6	Go to Step 5
5	1. Ignition “OFF.” 2. Disconnect the ECM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0113 (Flash DTC 23) IAT Sensor Circuit High Voltage



060RW129

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The Engine Control Module ECM applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the ECM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the ECM to monitor a lower voltage. DTC P0113 will set when the ECM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0113 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault. If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the MAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the MAT sensor. If the MAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Manifold Air Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
25	77	2796
15	59	4450
5	41	7280

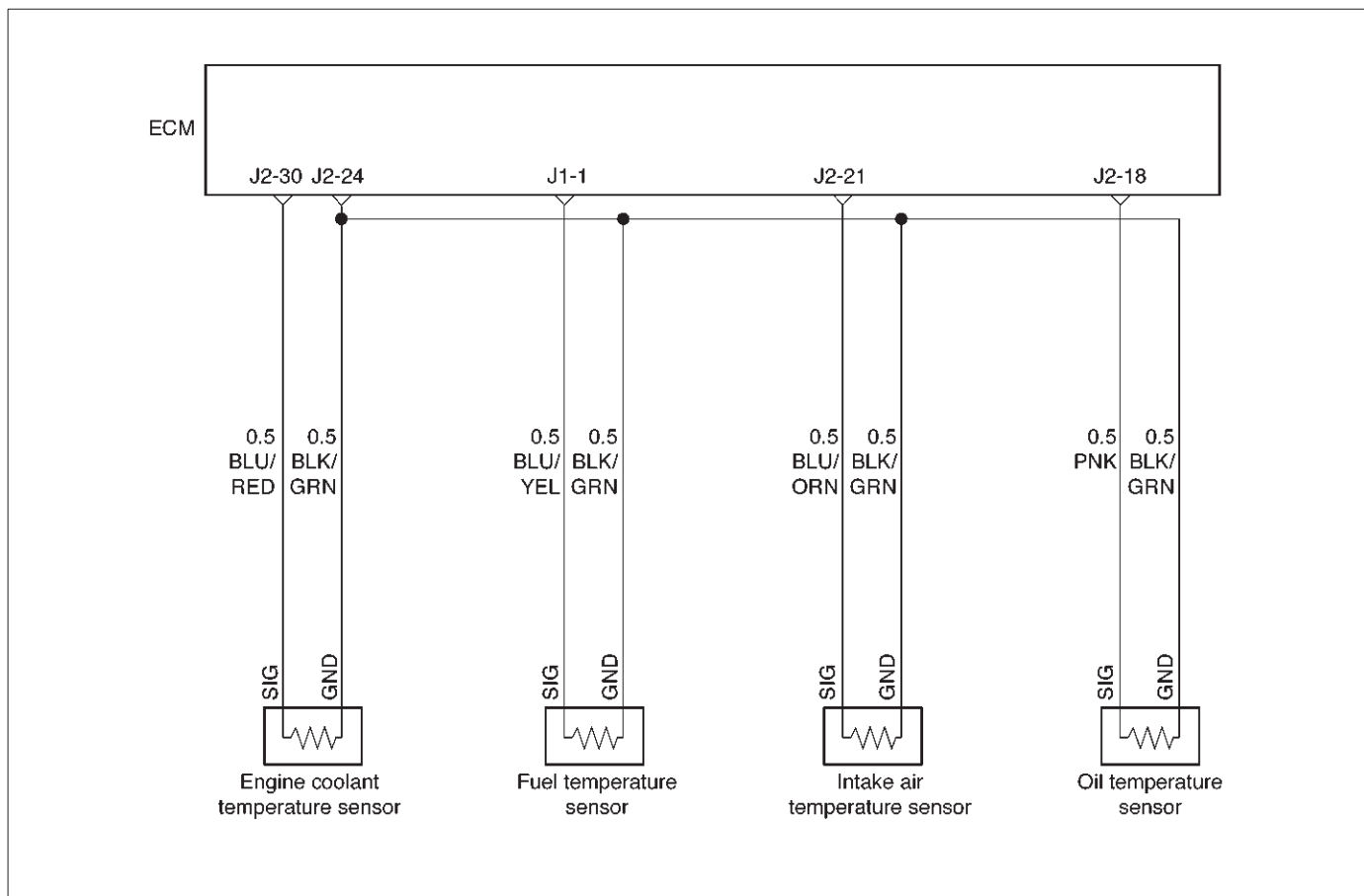
DTC P0113 –IAT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Ignition "ON," engine "OFF." Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" below the specified value?	–38°C (–36°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0113. Does the Tech 2 indicate DTC P0113 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition "ON." 5. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to Step 6	Go to Step 5
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
7	1. Ignition "OFF." 2. Disconnect the ECM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to Step 9

DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Disconnect the ECM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to <i>Step 9</i>
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the ECM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
11	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0117 (Flash DTC 14) ECT Sensor Low Voltage



060RW129

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the rear of the engine. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0117 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

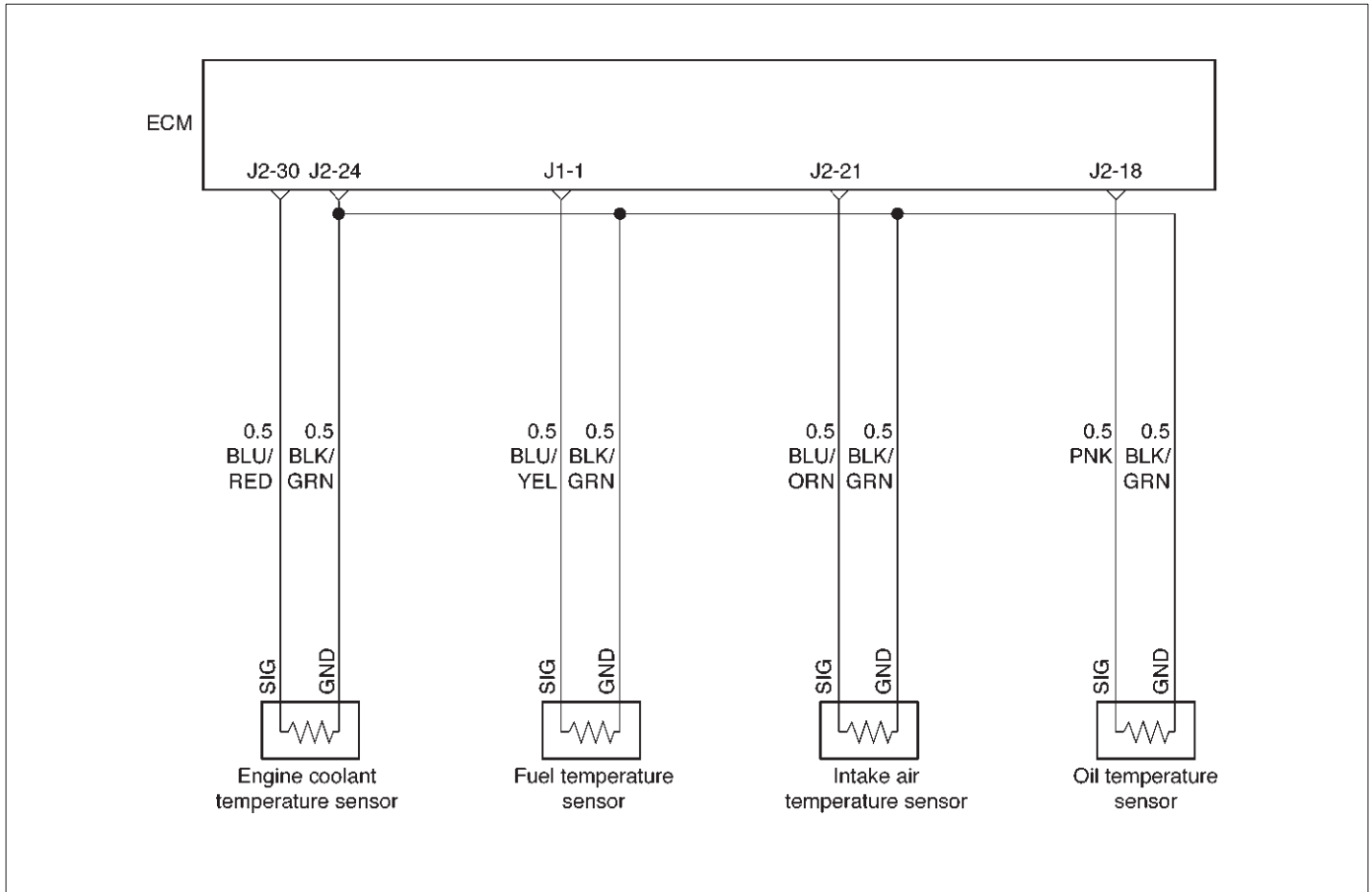
Engine Coolant Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
25	77	2796
15	59	4450

DTC P0117 – ECT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” at the specified value?	-39°C (-38°F)	Go to Step 6	Go to Step 5
5	1. Ignition “OFF.” 2. Disconnect the ECM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted. repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0118 (Flash DTC 14) ECT Sensor High Voltage



060RW129

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the rear of the engine. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0118 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
80	176	332
25	77	2796
15	59	4450

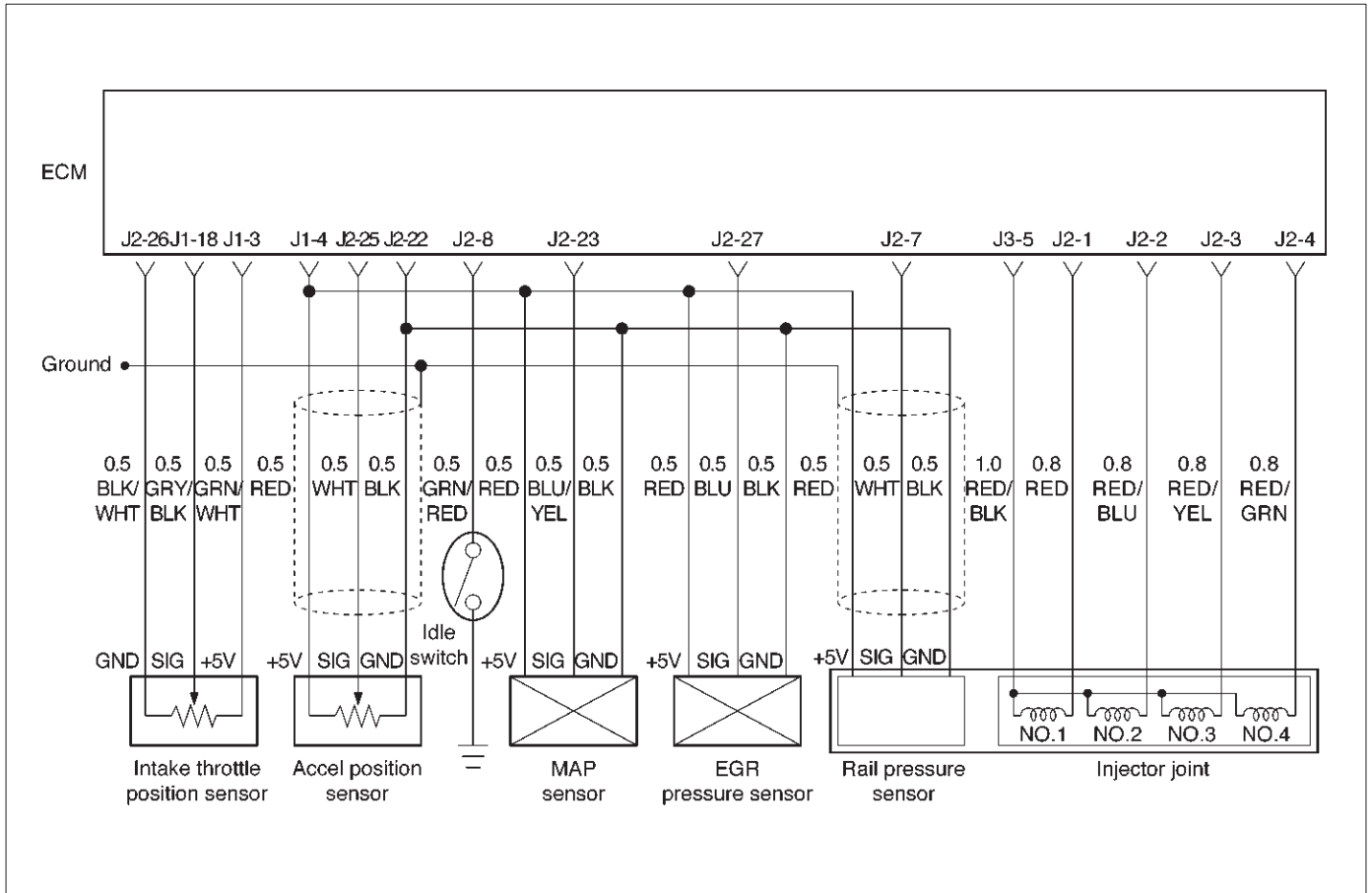
DTC P0118 – ECT Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	-39°C (-38°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0118. Does the Tech 2 indicate DTC P0118 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140°C (284°F)	Go to Step 6	Go to Step 5
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140°C (284°F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
7	1. Ignition "OFF." 2. Disconnect the ECM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to Step 9

DTC P0118 – ECT Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Disconnect the ECM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to <i>Step 9</i>
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the ECM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0121 (Flash DTC 33) AP Sensor Rationality



060RW134

Circuit Description

The accel position (AP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The AP signal is one of the most important inputs used by the Engine Control Module ECM for fuel volume control and many of the ECM-controlled outputs. If the ECM detects an out-of-range condition, DTC P0121 will set.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) after fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0121 can be cleared by using the Tech 2 "Clear info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

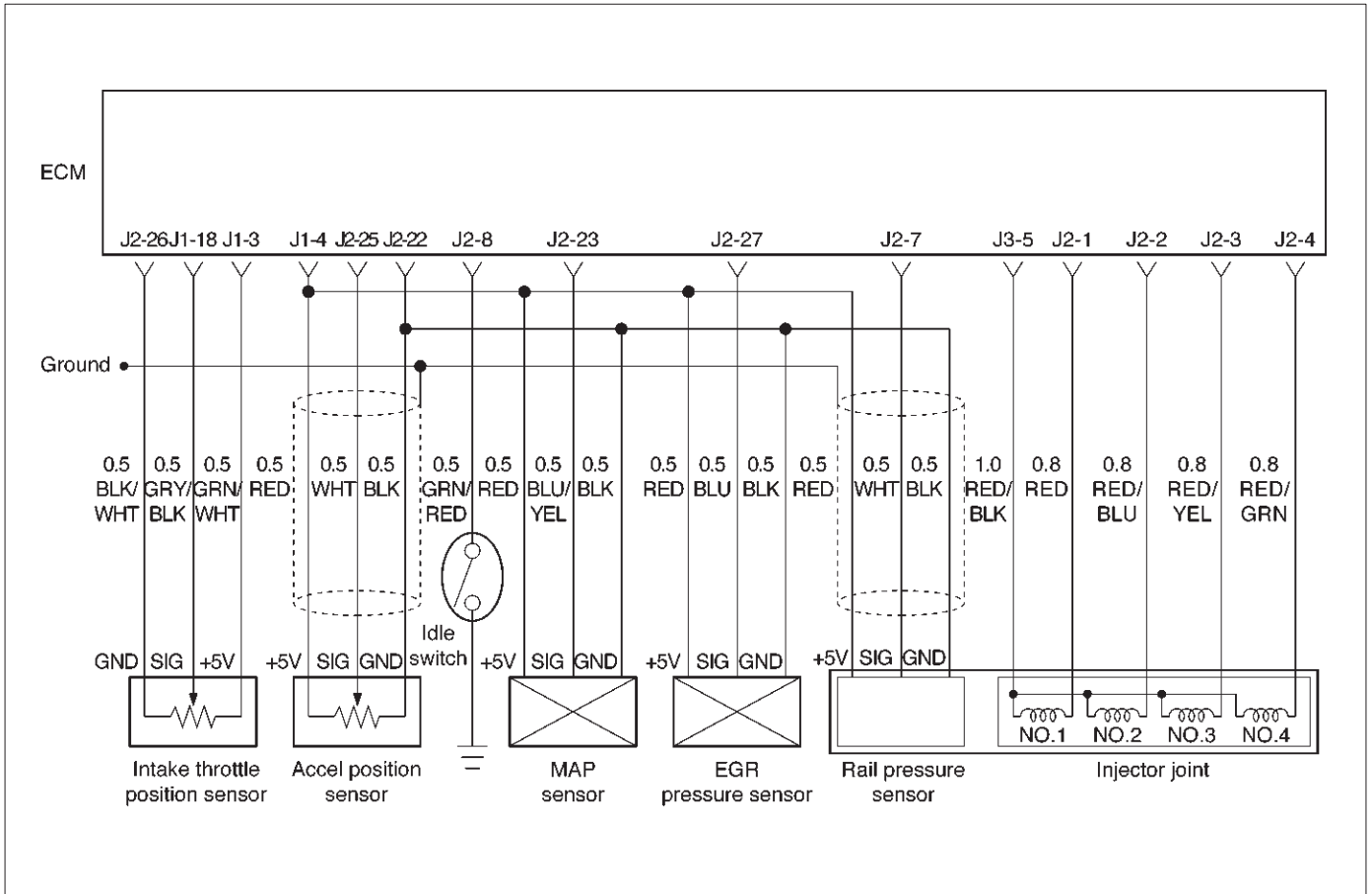
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks improperly formed or damaged terminals, and poor terminal-to-wire connection.
 - Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.
- If DTC P0121 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P0121 –AP Sensor Rationality

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check the Idle SW. Was the Idle SW circuit open or damage?	—	Replace the Idle SW circuit	Go to Step 3
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle = 0% Wide open throttle = 100%	Refer to <i>Diagnostic Aids</i>	Go to Step 4
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0 V	Go to Step 5	Go to Step 6
5	1. Connect a test light between the 5 volt reference "J2" circuit and the AP sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading at the specified value?	5 V	Go to Step 8	Go to Step 7
6	Check the following items: 1. AP signal circuit for a short to voltage. 2. AP sensor ground circuit for high resistance between the ECM and the AP sensor. 3. AP sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to Step 9
7	Check the following items: 1. AP signal circuit or 5 volt reference "J2" circuit for a poor connection. 2. AP signal circuit or 5 volt reference "J2" circuit for high resistance between the ECM and the AP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to Step 9
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0122 (Flash DTC 21) AP Sensor Low Voltage



Circuit Description

The accelerator position (AP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

The AP signal is used by the Engine Control Module ECM for fuel volume control and many of the ECM-controlled outputs.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0122 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If DTC P0122 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P0122 –AP Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Check the AP sensor signal circuit. Was the AP sensor signal circuit open or damage?	—	Replace the APS circuit	Go to Step 3

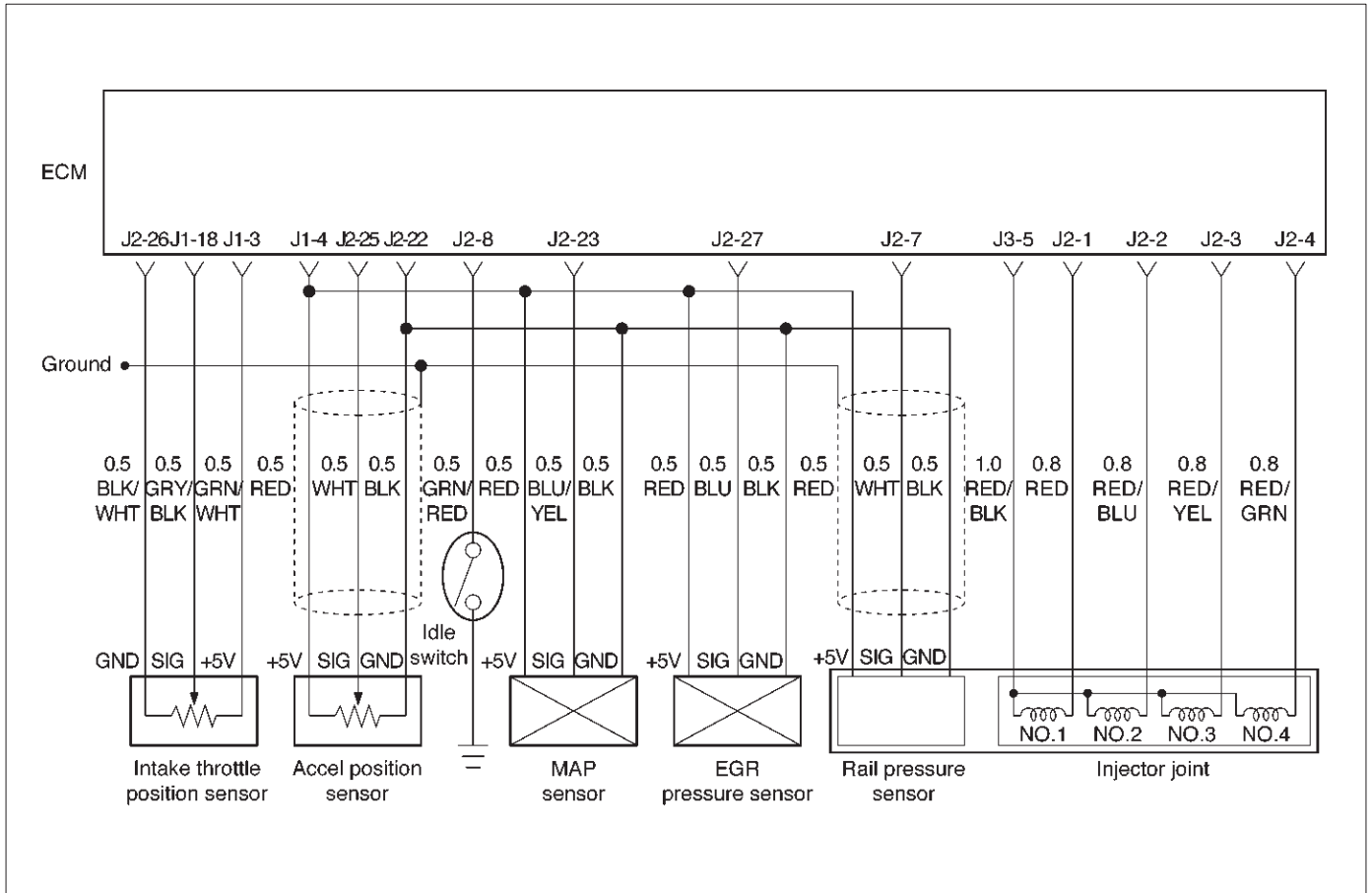
DTC P0122 –AP Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the "AP Sensor" display on the Tech 2. Is the "AP Sensor" below the specified value?	0.1 V	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0122. Does the Tech 2 indicate DTC P0122 failed?	—	Go to <i>Step 5</i>	Refer to <i>Diagnostic Aids</i>
5	1. Ignition "OFF." 2. Disconnect the AP sensor electrical connector. 3. Jumper the 5 volt reference "J2" circuit and the AP signal together at the AP sensor harness connector. 4. Ignition "ON." Observe the "AP Sensor" display on the Tech 2. Is the "AP Sensor" at the specified value?	5 V	Go to <i>Step 11</i>	Go to <i>Step 6</i>
6	1. Disconnect jumper. 2. Connect a test light between B+ and the AP sensor signal circuit at the AP sensor harness connector. Observe the "AP Sensor" display on the Tech 2. Is the "AP Sensor" at the specified value?	5 V	Go to <i>Step 7</i>	Go to <i>Step 9</i>
7	1. Ignition "OFF." 2. Disconnect the ECM and check the 5 volt reference "A" circuit for an open or short to ground. 3. If the 5 volt reference "J2" circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference "J2" circuit open or shorted to ground?	—	Verify repair	Go to <i>Step 8</i>
8	Check the 5 volt reference "J2" circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 13</i>
9	1. Ignition "OFF." 2. Disconnect the ECM, and check the AP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the AP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the AP signal circuit open or shorted to ground?	—	Verify repair	Go to <i>Step 10</i>
10	Check the AP sensor signal circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 13</i>
11	Check the AP sensor signal circuit for a poor connection at the AP sensor and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 12</i>

DTC P0122 –AP Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the AP sensor. Is the action complete?	—	Verify repair	—
13	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0123 (Flash DTC 21) AP Sensor High Voltage



Circuit Description

The accelerator position (AP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

The TP signal is one of the most important inputs used by the Engine Control Module ECM for fuel volume control and many of the ECM-controlled outputs.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0123 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.
- Faulty AP sensor – With the ignition key "ON," engine "OFF," observe the AP sensor display on the Tech 2 while slowly depressing the accelerator to wide open throttle. If a voltage over 4.88 volts is seen at any point in normal accelerator travel, replace the AP sensor.

If DTC P0123 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number (s) below refer to the step number(s) on the Diagnostic Chart.

8. Components that share the AP sensor 5 volt reference "A" circuit include the following device:

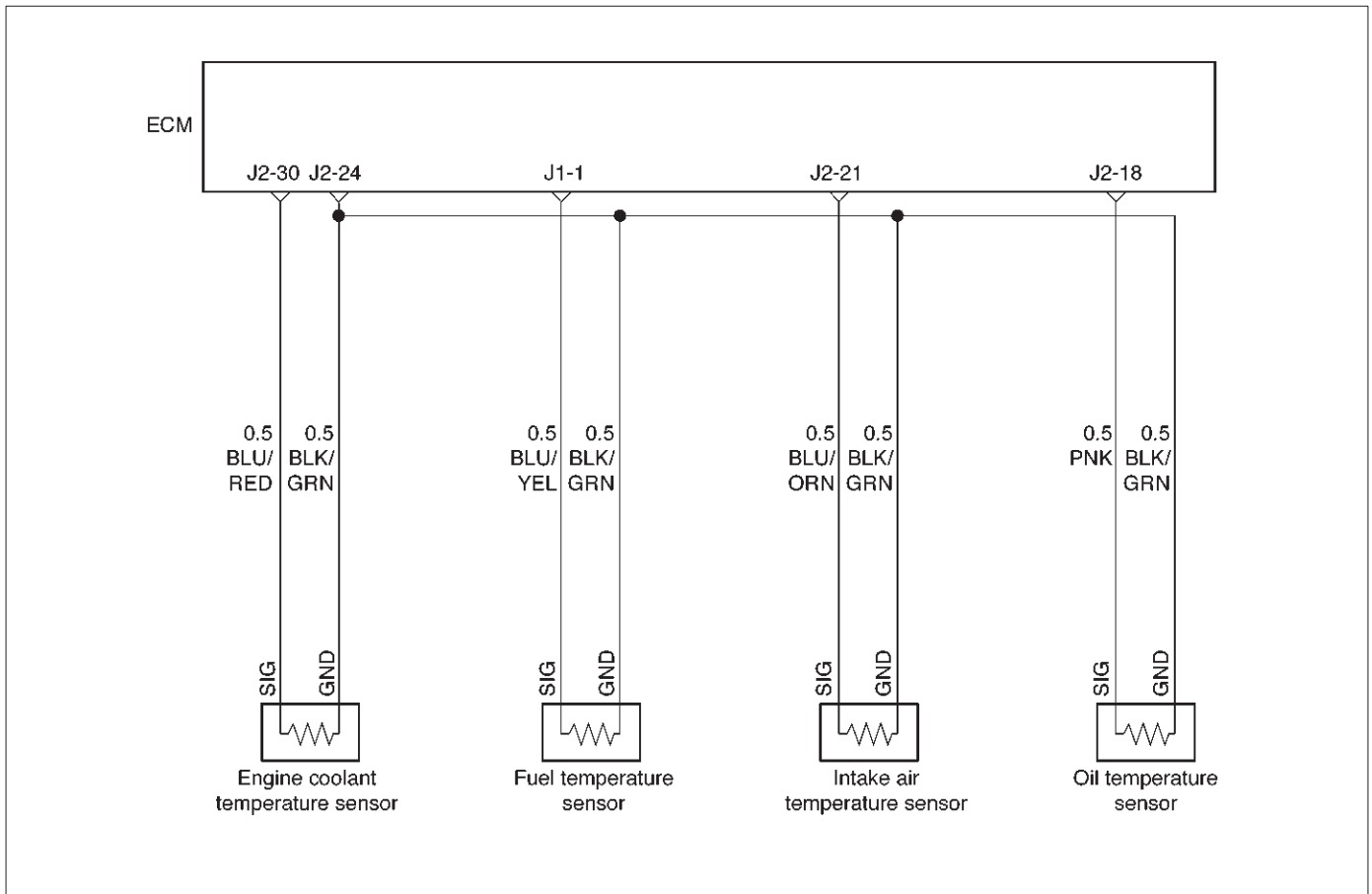
DTC P0123 – AP Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check the AP sensor signal circuit. Was the AP sensor signal circuit open or damage?	—	Replace the APS circuit	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the "AP Sensor" display on the Tech 2. Is the "AP Sensor" above the specified value?	4.5 V	Go to Step 5	Go to Step 4
4	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0123. Does the Tech 2 indicate DTC P0123 failed.	—	Go to Step 5	Refer to <i>Diagnostic Aids</i>
5	1. Disconnect the AP sensor electrical connector. 2. Observe the "AP Sensor" display on the Tech 2. Is the "AP Sensor" near the specified value?	0 V	Go to Step 6	Go to Step 7
6	Probe the sensor ground circuit at the AP sensor harness connector with a test light connected to B+. Is the test light "ON?"	—	Go to Step 8	Go to Step 11
7	1. Ignition "OFF," disconnect the ECM. 2. Ignition "ON," engine "OFF." 3. Check for a short to voltage on the AP sensor signal circuit. 4. If the AP sensor signal circuit is shorted, repair it as necessary. Was the AP sensor signal circuit shorted?	—	Verify repair	Go to Step 13
8	1. Ignition "ON." 2. Monitor the "AP Sensor" Tech 2 display while disconnecting each of the components that share the 5 volt reference "J2" circuit (one at a time). 3. If the "AP Sensor" Tech 2 display changes, replace the component that caused the display to change when disconnected. Does disconnecting any of these components cause the "AP Sensor" display to change?	—	Verify repair	Go to Step 9
9	1. Ignition "OFF," disconnect the ECM. 2. Ignition "ON," engine "OFF." 3. Check for a short to B+ on the 5 volt reference "A" circuit. 4. If the 5 volt reference "J2" circuit is shorted, repair it as necessary. Was the 5 volt reference "J2" circuit shorted?	—	Verify repair	Go to Step 10
10	Check for poor electrical connections at the AP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 12

DTC P0123 – AP Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition "OFF." 2. Disconnect the ECM, and check for an open sensor ground circuit to the AP sensor. 3. If a problem is found, repair it as necessary. Was the sensor ground circuit to the AP sensor open?	—	Verify repair	Go to <i>Step 13</i>
12	Replace the AP sensor. Is the action complete?	—	Verify repair	—
13	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0182 (Flash DTC 15) FT Sensor Low Voltage



060RW129

Circuit Description

The fuel temperature (FT) sensor is a thermistor mounted on a coolant crossover pipe at the rear of the engine. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the FT signal circuit. When the fuel is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the fuel warms, the sensor resistance becomes lower, and the FT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0182 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the FT display on the Tech 2 while moving connectors and wiring harnesses related to the FT sensor. A change in the FT display will indicate the location of the fault. If DTC P0182 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

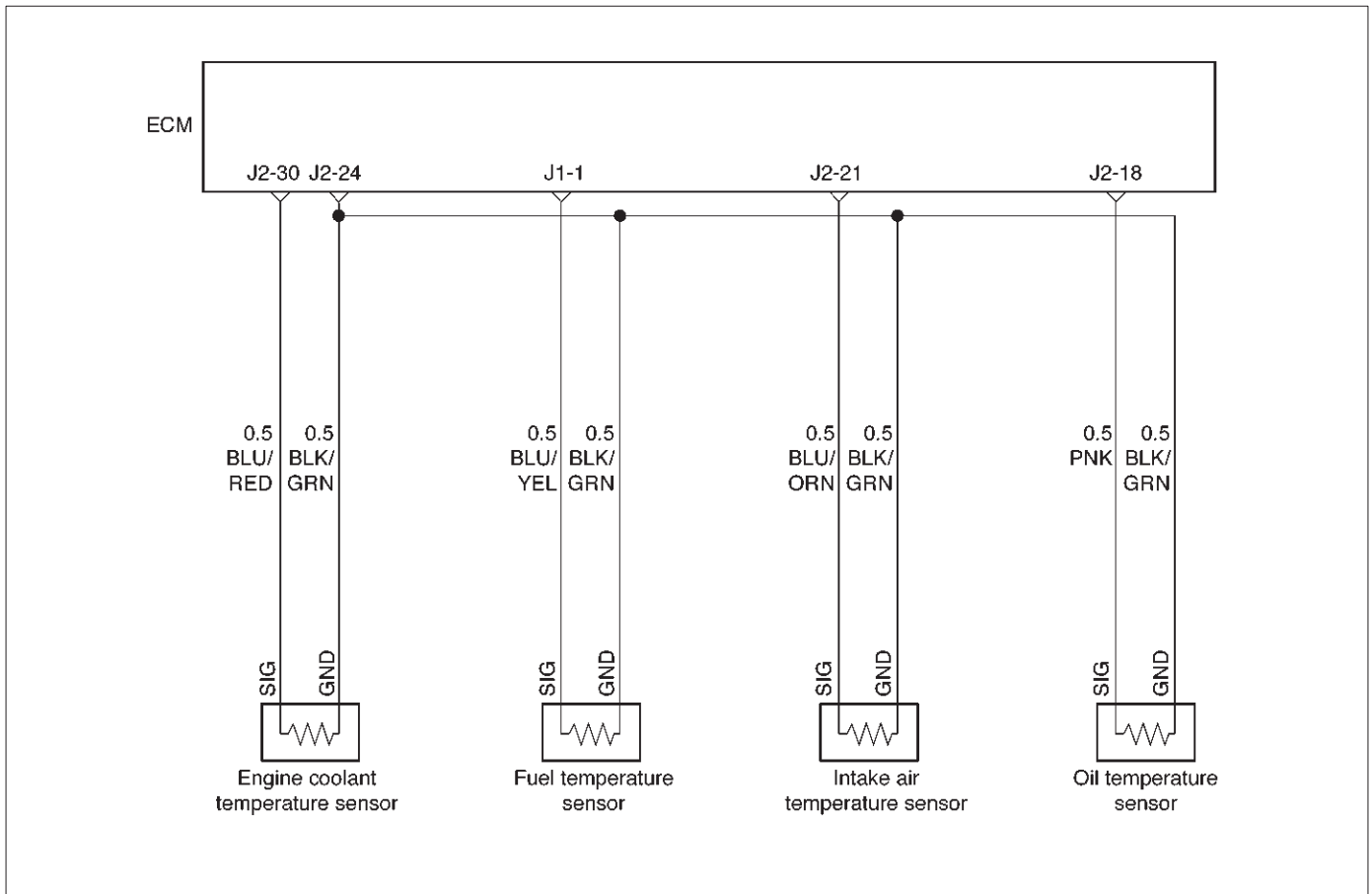
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

DTC P0182 – FT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Fuel Temp" display on the Tech 2. Is the "Fuel Temp" below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0182. Does the Tech 2 indicate DTC P0182 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the FT sensor electrical connector. 2. Observe the "Fuel Temp" display on the Tech 2. Is the "Fuel Temp" at the specified value?	-39°C (-38°F)	Go to Step 6	Go to Step 5
5	1. Ignition "OFF." 2. Disconnect the ECM and check the FT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the FT signal circuit is shorted, repair it as necessary. Was the FT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the FT sensor. Is the action complete?	—	Verify repair	—
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0183 (Flash DTC 15) FT Sensor High Voltage



060RW129

Circuit Description

The fuel temperature (FT) sensor is a thermistor mounted in on a coolant crossover pipe at the rear of the engine. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the FT signal circuit. When the fuel is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the fuel warms, the sensor resistance becomes less, and the FT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0183 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the FT display on the Tech 2 while moving connectors and wiring harnesses related to the FT sensor. A change in the FT display will indicate the location of the fault. If DTC P0182 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

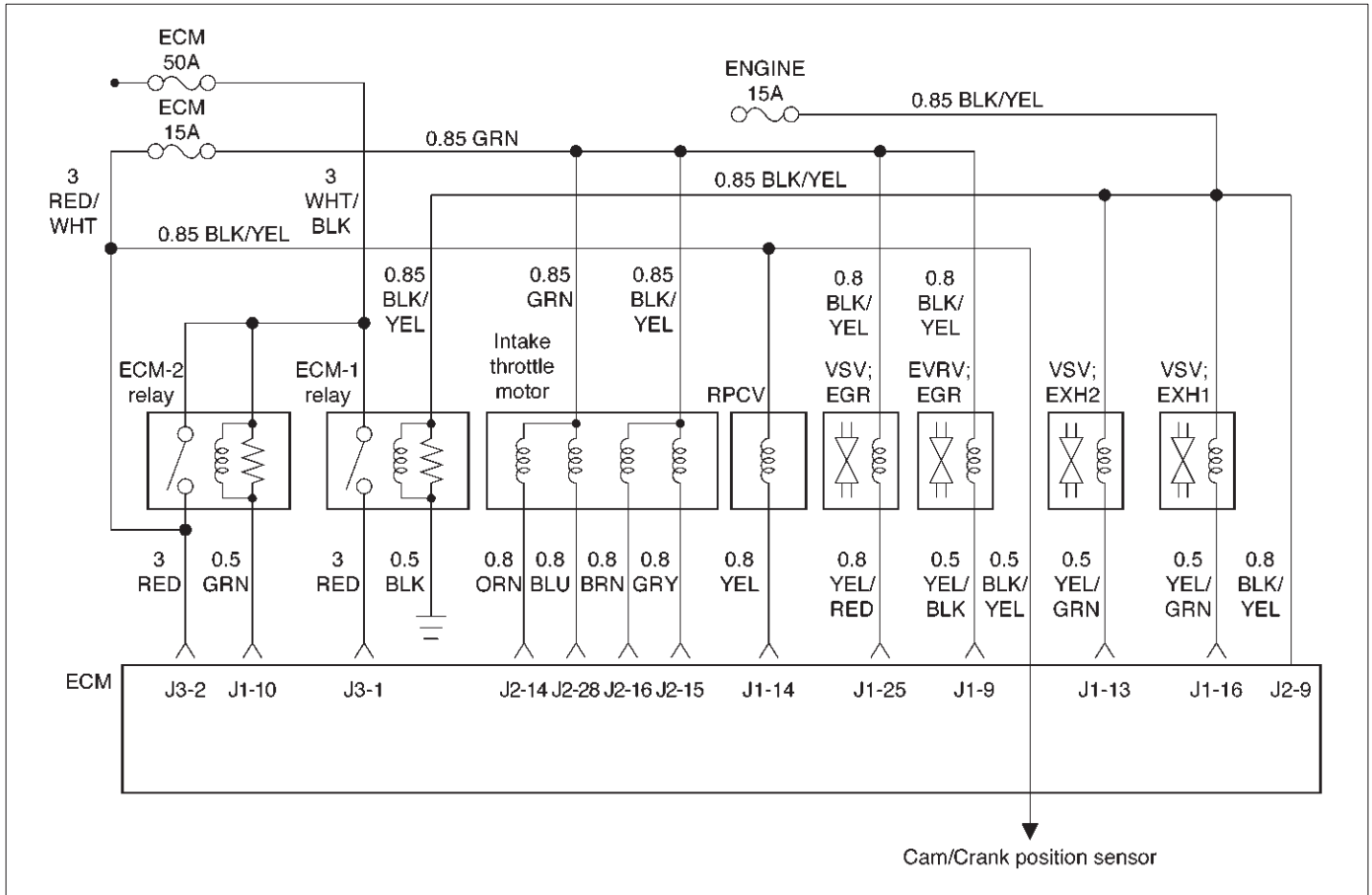
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

DTC P0183 – FT Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. Observe the “Fuel Temp” display on the Tech 2. Is the “Fuel Temp” below the specified value?	–39 °C (–38 °F)	Go to Step 4	Go to Step 3
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the “ DTC” info for DTC P0183. Does the Tech 2 indicate DTC P0183 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the FT sensor electrical connector. 2. Jumper the FT signal circuit and the sensor ground circuit together at the FT sensor harness connector. 3. Observe the “Fuel Temp” display on the Tech 2. Is the “Fuel Temp” at the specified value?	140 °C (284 °F)	Go to Step 6	Go to Step 5
5	1. Jumper the FT signal circuit at the FT sensor harness connector to chassis ground. 2. Observe the “Fuel Temp” display on the Tech 2. Is the “Fuel Temp” at the specified value?	140 °C (284 °F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the FT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
7	1. Ignition “OFF.” 2. Disconnect the ECM, and check the FT sensor ground circuit for an open. 3. If the FT sensor ground circuit is open, repair it as necessary. Was the FT sensor ground circuit open?	—	Verify repair	Go to Step 9
8	1. Ignition “OFF.” 2. Disconnect the ECM, and check the FT signal circuit for an open. 3. If the FT sensor signal circuit is open, repair it as necessary. Was the FT signal circuit open?	—	Verify repair	Go to Step 9
9	Check for a poor sensor ground or FT signal circuit terminal connection at the ECM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to Step 11
10	Replace the FT sensor. Is the action complete?	—	Verify repair	—
11	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0192 (Flash DTC 63) Rail Pressure Sensor Low Voltage



060RW135

Circuit Description

The rail pressure (RP) sensor responds to changes in oil manifold pressure.

The ECM monitors the RP signals for voltages outside the normal range of the RP sensor. If the ECM detects a RP signal voltage that is excessively low, DTC P0192 will be set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0192 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

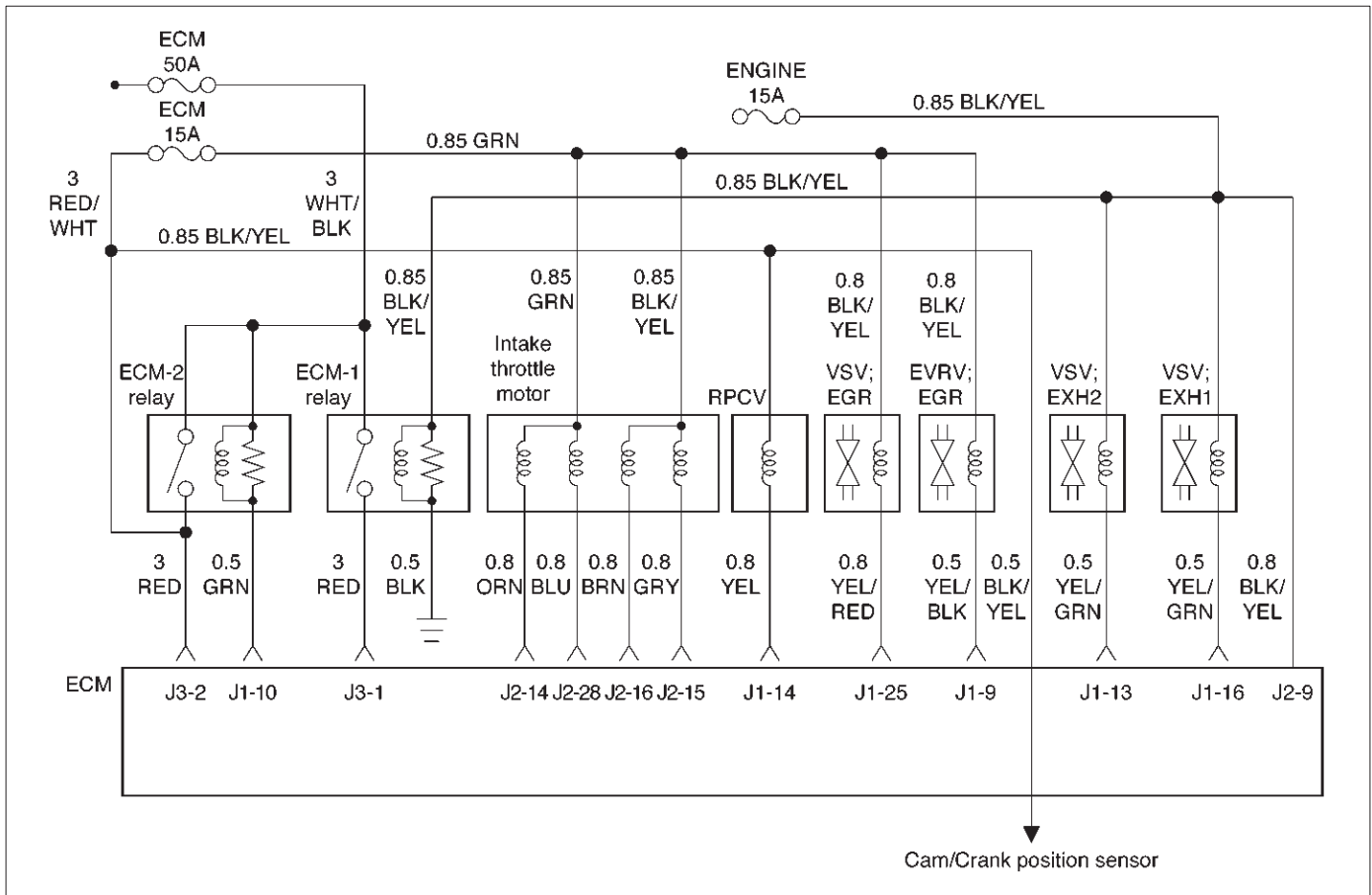
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the RP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0192 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0192 Diagnostic Chart may isolate the cause of the fault.

DTC P0192 – RP Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0192. Does the Tech 2 indicate DTC P0192 failed?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	Check the RP sensor signal circuit. Was the RP sensor signal circuit open or damage?	—	Replace the RP circuit.	Go to Step 4
4	1. Ignition "OFF." 2. Disconnect the ECM and check the 5 volt reference "J1" circuit for an open or short to ground. 3. If the 5 volt reference "J1" circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference "J1" circuit open or shorted to ground?	—	Verify repair	Go to Step 5
5	Check the 5 volt reference "J1" circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 6
6	1. Ignition "OFF." 2. Disconnect the ECM, and check the RP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the RP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the RP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the RP sensor signal circuit for a poor connection at the ECM and the RP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 8
8	Replace the RP sensor (Refer to the RP sensor programming). Is the action complete?	—	Verify repair	Go to Step 9
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0193 (Flash DTC 63) Rail Pressure Sensor High Voltage



060RW135

Circuit Description

The rail pressure (RP) sensor responds to changes in oil manifold pressure.

The ECM monitors the RP signals for voltages outside the normal range of the RP sensor. If the ECM detects a RP signal voltage that is excessively high, DTC P0193 will be set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0193 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

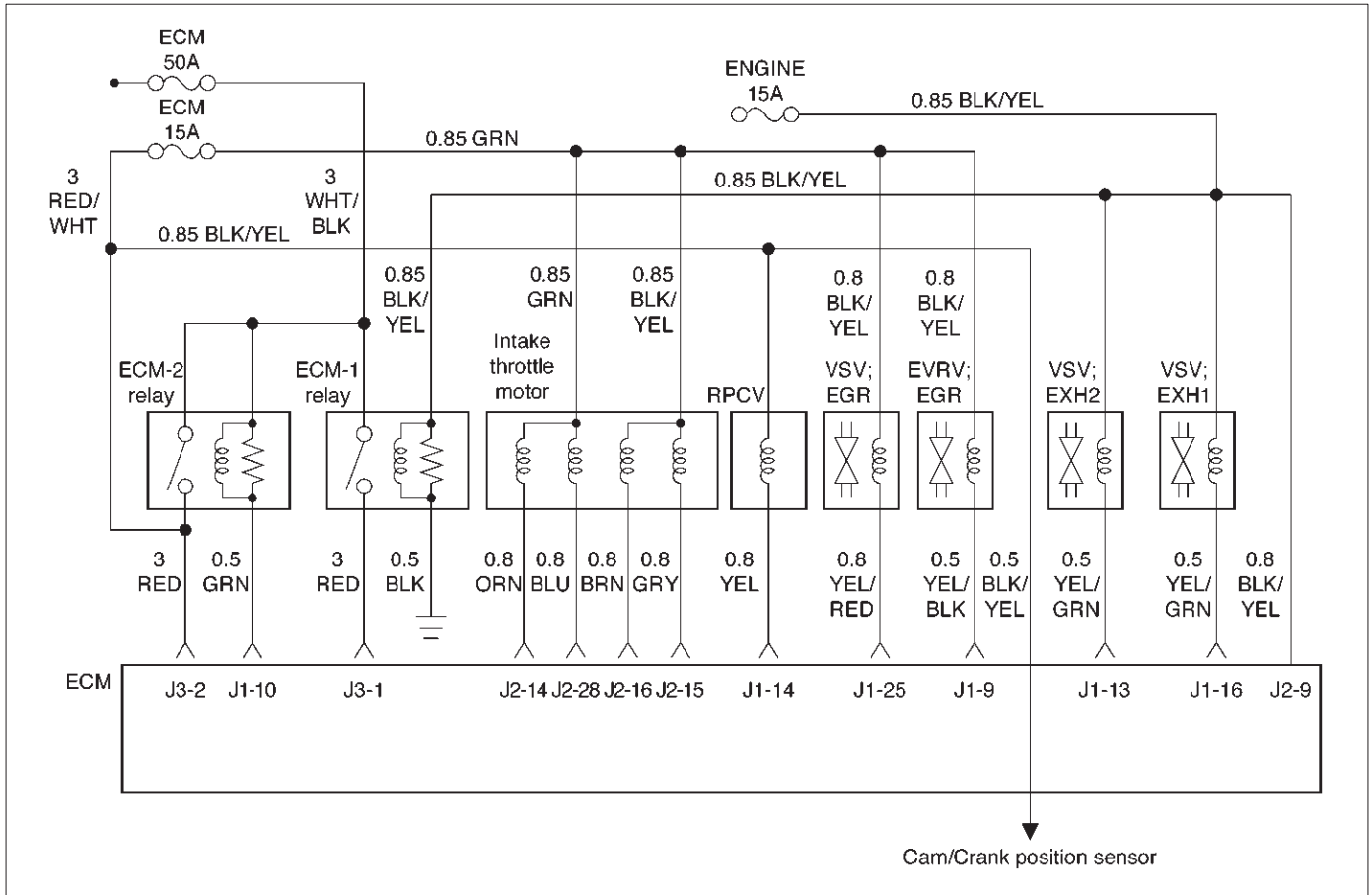
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the RP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0193 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0193 Diagnostic Chart may isolate the cause of the fault.

DTC P0193 – RP Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0108. Does the Tech 2 indicate DTC P0108 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	Check the RP sensor signal circuit. Was the RP sensor signal circuit open or damage?	—	Replace the RP circuit	Go to Step 4
4	Probe the sensor ground circuit with a test light to B+. Is the test light "ON?"	—	Go to Step 5	Go to Step 7
5	1. Check the RP signal circuit for a short to voltage or a short to the 5 volt reference "J1" circuit. 2. If the RP sensor signal circuit is shorted, repair circuit as necessary. Was the RP sensor signal circuit shorted?	—	Verify repair	Go to Step 6
6	1. Check for a poor sensor ground terminal connection at the RP sensor electrical connector. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to Step 7
7	1. Check for a poor sensor ground terminal connection at the ECM. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to Step 8
8	1. Check the continuity of the RP sensor ground circuit. 2. If the RP sensor ground circuit measures over 5 ohms, repair open or poor connection. Was a condition found and corrected?	—	Verify repair	Go to Step 9
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify Repair	—

Diagnostic Trouble Code (DTC) P1193 (Flash DTC 64) RPCV Circuit Open/Short



060RW135

Circuit Description

The rail pressure control valve (RPCV) is built in the high pressure oil circuit. RPCV is an important device which is used to control oil pressure in the HEUI system. The circuit receives current through Engine 15A fuse from the battery, current flowing in the order of RPCV.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1193 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

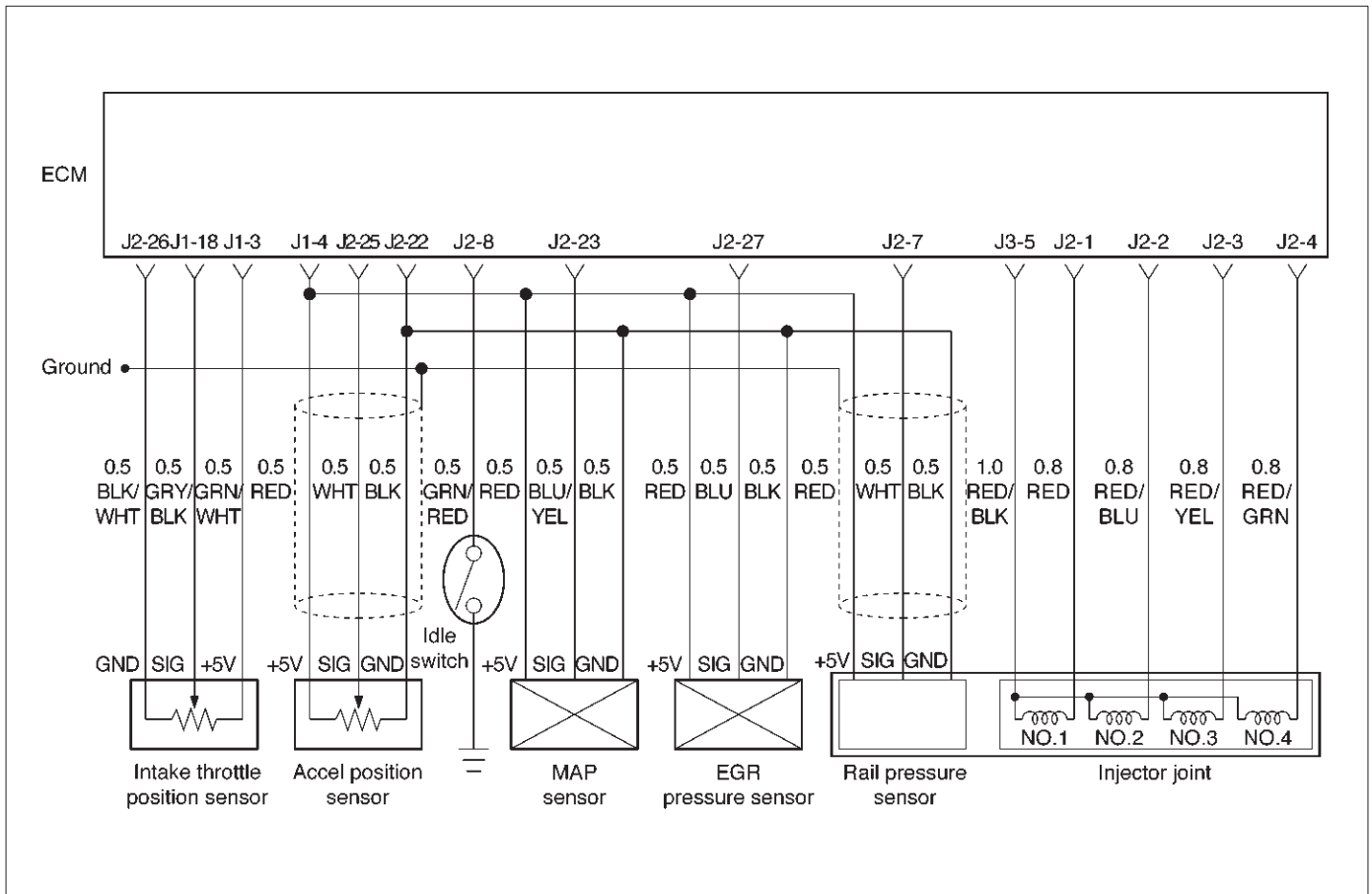
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the RPCV display on the Tech 2 while moving connectors and wiring harnesses related to the RPCV. A change in the RPCV display will indicate the location of the fault.

If DTC P1193 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

DTC P1193 – RPCV Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "ON." 2. Observe the "Rail Oil Pressure" display on the Tech 2. Is the "Rail Oil Pressure" below the specified value?	3.5 ~ 5 Mpa	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	Replace the RPCV. Is the action complete?	—	Go to <i>Step 2</i>	—
4	1. Engine "On". 2. Using the Tech 2, operate "RPCV". 3. Check the combustion noise. Was the combustion noise change?	—	—	Go to <i>Step 5</i>
5	Check the RPCV circuit. (Fuse 15A to J1-14) Was the RPCV circuit damaged?	—	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	Repair the RPCV circuit. Is the action complete?	—	Verify repair	—
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to <i>Step 8</i>
8	Replace the high pressure oil pump. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1194 (Flash DTC 61) Rail Pressure System Low Voltage



060RW134

Circuit Description

The rail pressure (RP) sensor responds to changes in oil rail pressure.

The ECM monitors the RP signals for voltages outside the normal range of the RP sensor. If the ECM detects a RP signal voltage that is excessively low, DTC P1194 will be set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1194 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

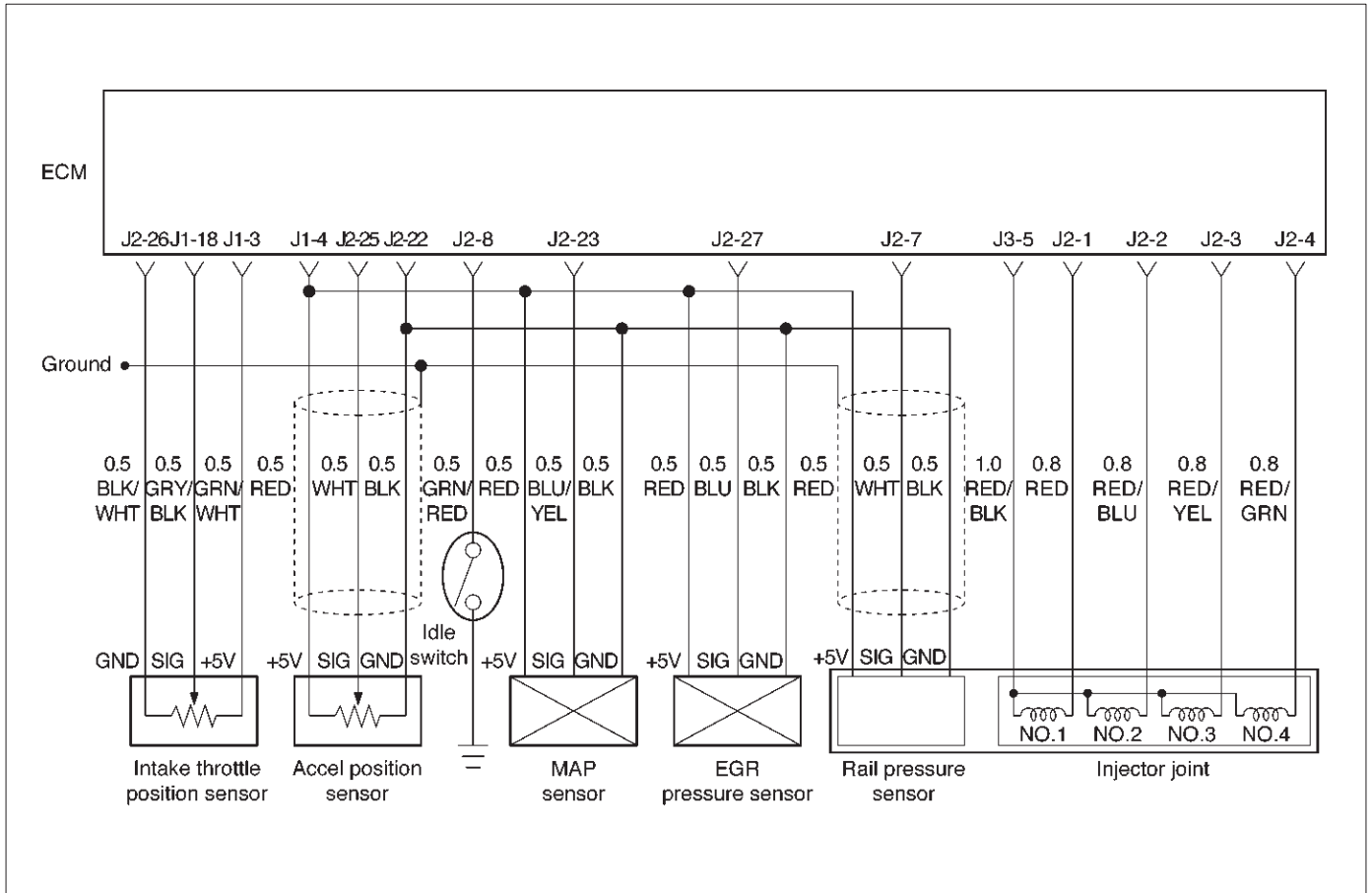
- Check for intermittent codes.
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P1194 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1194 Diagnostic Chart may isolate the cause of the fault.

DTC P1194 – RP System Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Engine is running. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1194. Does the Tech 2 indicate DTC P1194 failed?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	Connect a test light between B+ and the RP sensor signal circuit at the RP sensor harness connector. Is the RP value near the specified value.	5 V	Go to <i>Step 4</i>	Go to <i>Step 6</i>
4	1. Ignition “OFF.” 2. Disconnect the ECM and check the 5 volt reference “J2” circuit for an open or short to ground. 3. If the 5 volt reference “J2” circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference “J2” circuit open or shorted to ground?	—	Verify repair	Go to <i>Step 5</i>
5	Check the 5 volt reference “J2” circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 6</i>
6	1. Ignition “OFF.” 2. Disconnect the ECM, and check the RP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the RP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the RP signal circuit open or shorted to ground?	—	Verify repair	Go to <i>Step 7</i>
7	Check the RP sensor signal circuit for a poor connection at the ECM and the RP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 8</i>
8	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to <i>Step 9</i>
9	Check the 2 way valve. Was the 2 way valve damage?	—	Replace the 2 way valve	Go to <i>Step 10</i>
10	Replace the RPCV. Is the action complete?	—	Verify repair	Go to <i>Step 11</i>
11	Replace the RP sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1195 (Flash DTC 61) Rail Pressure System High Voltage



060RW134

Circuit Description

The rail pressure (RP) sensor responds to changes in oil rail pressure.

The ECM monitors the RP signals for voltages outside the normal range of the RP sensor. If the ECM detects a RP signal voltage that is excessively low, DTC P1195 will be set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1195 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

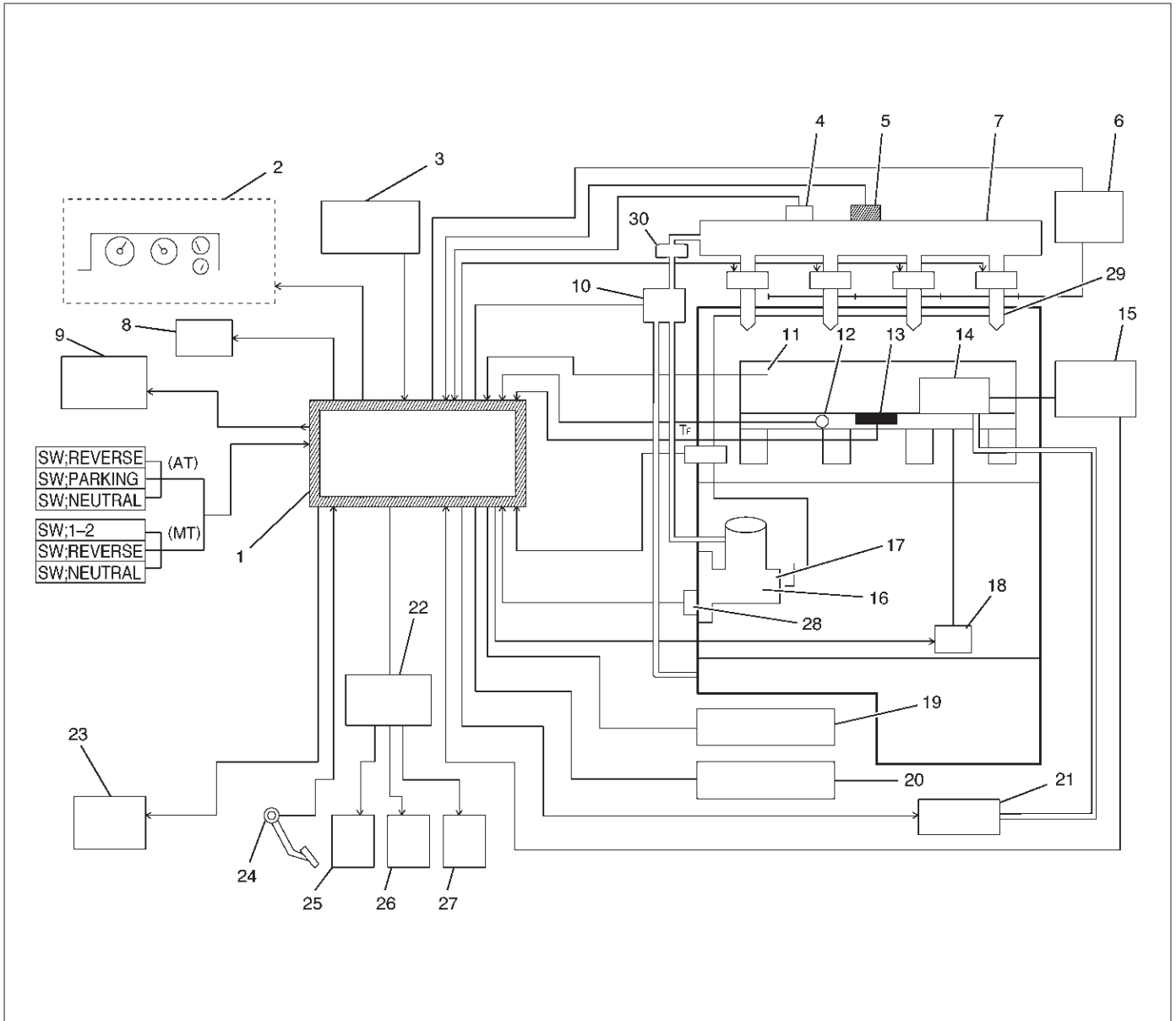
- Check for intermittent codes.
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P1195 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1195 Diagnostic Chart may isolate the cause of the fault.

DTC P1195 – RP System High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Engine is running. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1195. Does the Tech 2 indicate DTC P1195 failed?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	Connect a test light between B+ and the RP sensor signal circuit at the RP sensor harness connector. Is the RP value near the specified value.	0 V	Go to Step 4	Go to Step 6
4	1. Ignition "OFF." 2. Disconnect the ECM and check the ground circuit for an open. Was the ground circuit open?	—	Verify repair	Go to Step 5
5	Check the ground circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 6
6	Check the RP sensor signal circuit for a poor connection at the ECM and the RP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to Step 8
8	Check the 2 way valve. Was the 2 way valve damage?	—	Replace the 2 way valve	Go to Step 9
9	Replace the RPCV. Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the RP sensor. Is the action complete?	—	Verify repair	—

**Diagnostic Trouble Code (DTC) P1196 (Flash DTC 62)
Rail Pressure System High Warning**



060RW178

Legend

- | | |
|---------------------------------|-------------------------------|
| (1) ECM | (16) High Pressure Oil Pump |
| (2) Meter Panel | (17) Fuel Pump |
| (3) Battery | (18) VSV |
| (4) Oil Temp Sensor | (19) EXH Throttle VSV1 |
| (5) Rail Pressure Sensor | (20) EXH Throttle VSV2 |
| (6) Glow Relay | (21) EVRV |
| (7) Oil Rail | (22) Engine Harness Connector |
| (8) Tech-2 | (23) QWS Relay |
| (9) A/C Comp Relay | (24) AP Sensor |
| (10) RPCV | (25) T.O.D |
| (11) Intake Air Temp Sensor | (26) ECT |
| (12) Engine Coolant Temp Sensor | (27) OBD |
| (13) MAP Sensor | (28) TDC |
| (14) EGR Valve | (29) Injector |
| (15) EGR Pressure Sensor | (30) Edge Filter |

Circuit Description

The rail pressure control valve (RPCV) is built in the high pressure oil circuit.

RPCV is an important device which is used to control oil pressure in the HEUI system.

The circuit receives current through Engine 15A fuse from the battery, current flowing in the order of RPCV.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1196 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Rail Pressure Control display on the Tech 2 while moving connectors and wiring harnesses related to the Rail Pressure Control. A change in the Rail Pressure Control display will indicate the location of the fault.

If DTC P1196 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

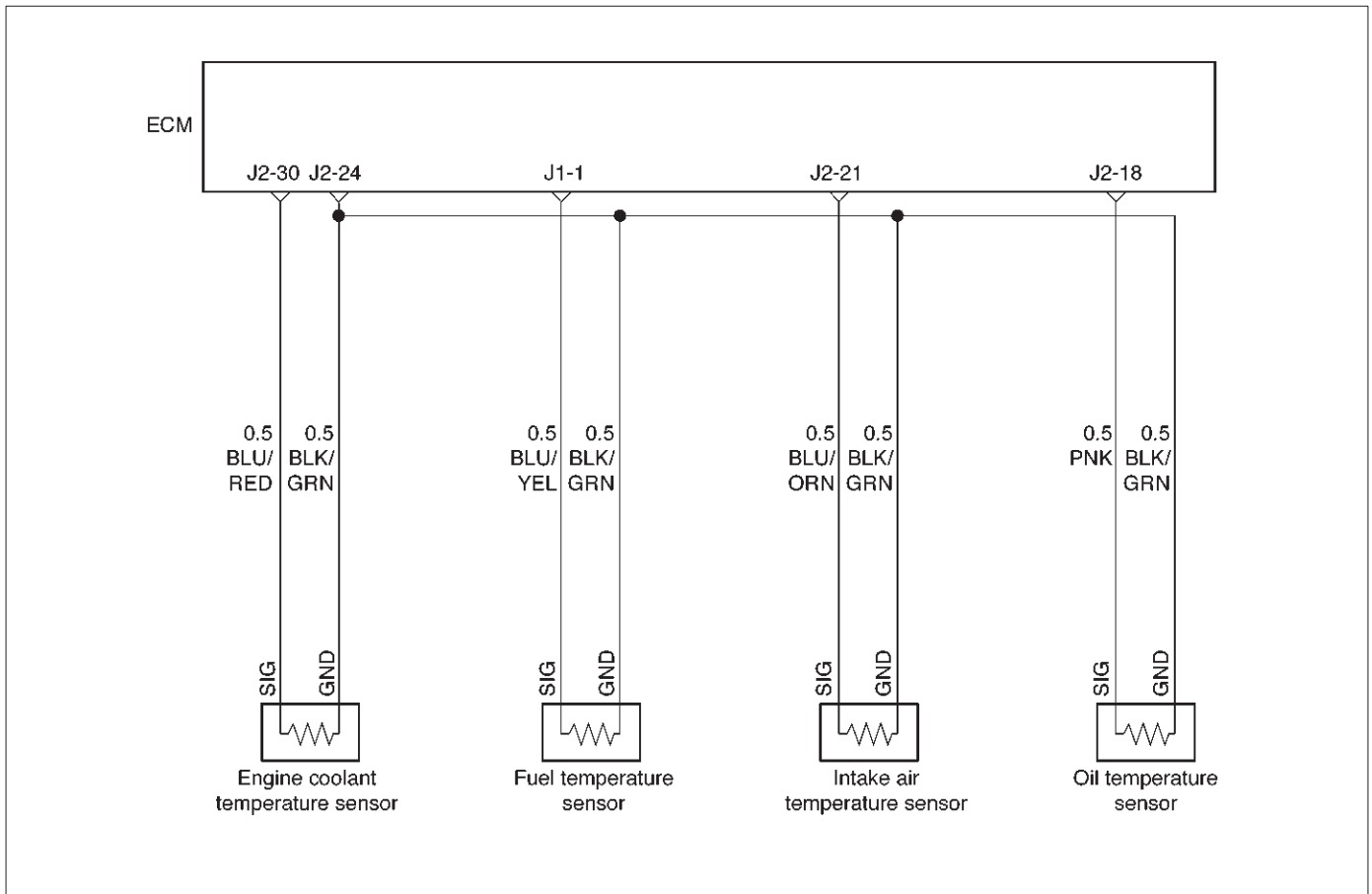
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

DTC P1196 – RP System High Warning

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Engine is running. 2. Observe the “Rail Pressure Control” display on the Tech 2. Is the action correct?	—	Go to Step 4	Go to Step 3
3	Replace the RPCV. Is the action complete?	—	Verify repair	Go to Step 4
4	1. Engine is running. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1196. Does the Tech 2 indicate DTC P1196 failed this ignition?	—	Go to Step 5	—
5	1. Check the 2 way valve. 2. Observe the “RP Control” display on the Tech 2. Is the action correct?	—	Go to Step 4	Go to Step 6
6	Replace the 2 way valve. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0197 (Flash DTC 16) Oil Temp Sensor Low Voltage



060RW129

Circuit Description

The engine oil temperature (OT) sensor is a thermistor mounted in the oil rail. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine oil is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine oil warms, the sensor resistance becomes lower, and the OT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0197 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the OT display on the Tech 2 while moving connectors and wiring harnesses related to the OT sensor. A change in the OT display will indicate the location of the fault. If DTC P0197 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

- 2. Verifies that the fault is present.
- 3. If DTC P0197 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the OT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the OT sensor. If the OT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

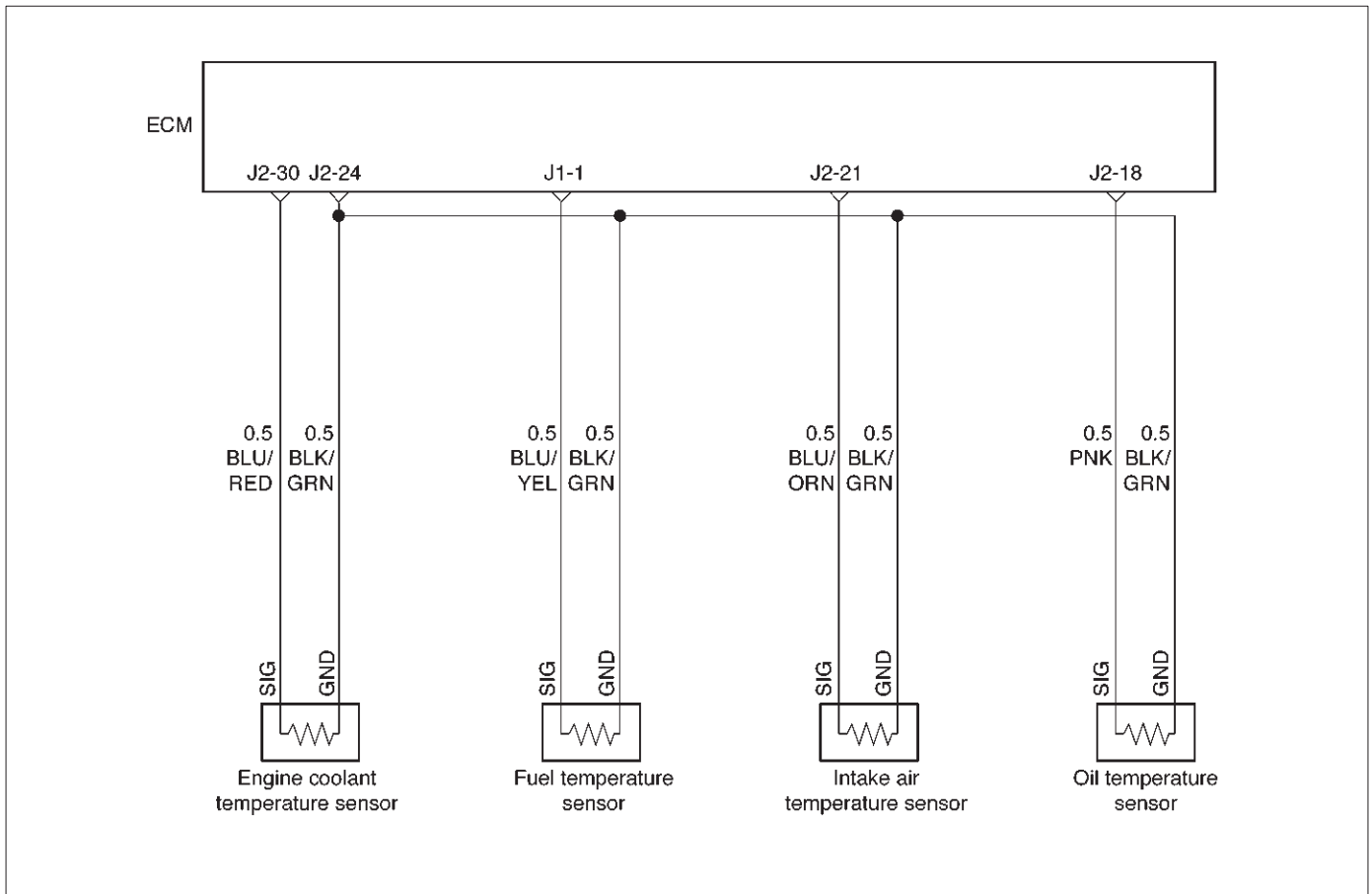
Engine Oil Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
80	176	332
25	77	2796
15	59	4450

DTC P0197 – OT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Oil Temp" display on the Tech 2. Is the "Eng Oil Temp" below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0197. Does the Tech 2 indicate DTC P0197 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the OT sensor electrical connector. 2. Observe the "Eng Oil Temp" display on the Tech 2. Is the "Eng Oil Temp" at the specified value?	–39°C (–38°F)	Go to Step 6	Go to Step 5
5	1. Ignition "OFF." 2. Disconnect the ECM and check the OT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the OT signal circuit is shorted, repair it as necessary. Was the OT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the OT sensor. Is the action complete?	—	Verify repair	—
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0198 (Flash DTC 16) Oil Temp Sensor High Voltage



060RW129

Circuit Description

The engine oil temperature (OT) sensor is a thermistor mounted in the oil rail. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine oil is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine oil warms, the sensor resistance becomes lower, and the OT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0198 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the OT display on the Tech 2 while moving connectors and wiring harnesses related to the OT sensor. A change in the OT display will indicate the location of the fault. If DTC P0198 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0198 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the OT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the OT sensor. If the OT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Oil Temperature Sensor

°C	°F	Ohms
Temperature vs. Resistance Values (approximate)		
80	176	332
25	77	2796
15	59	4450

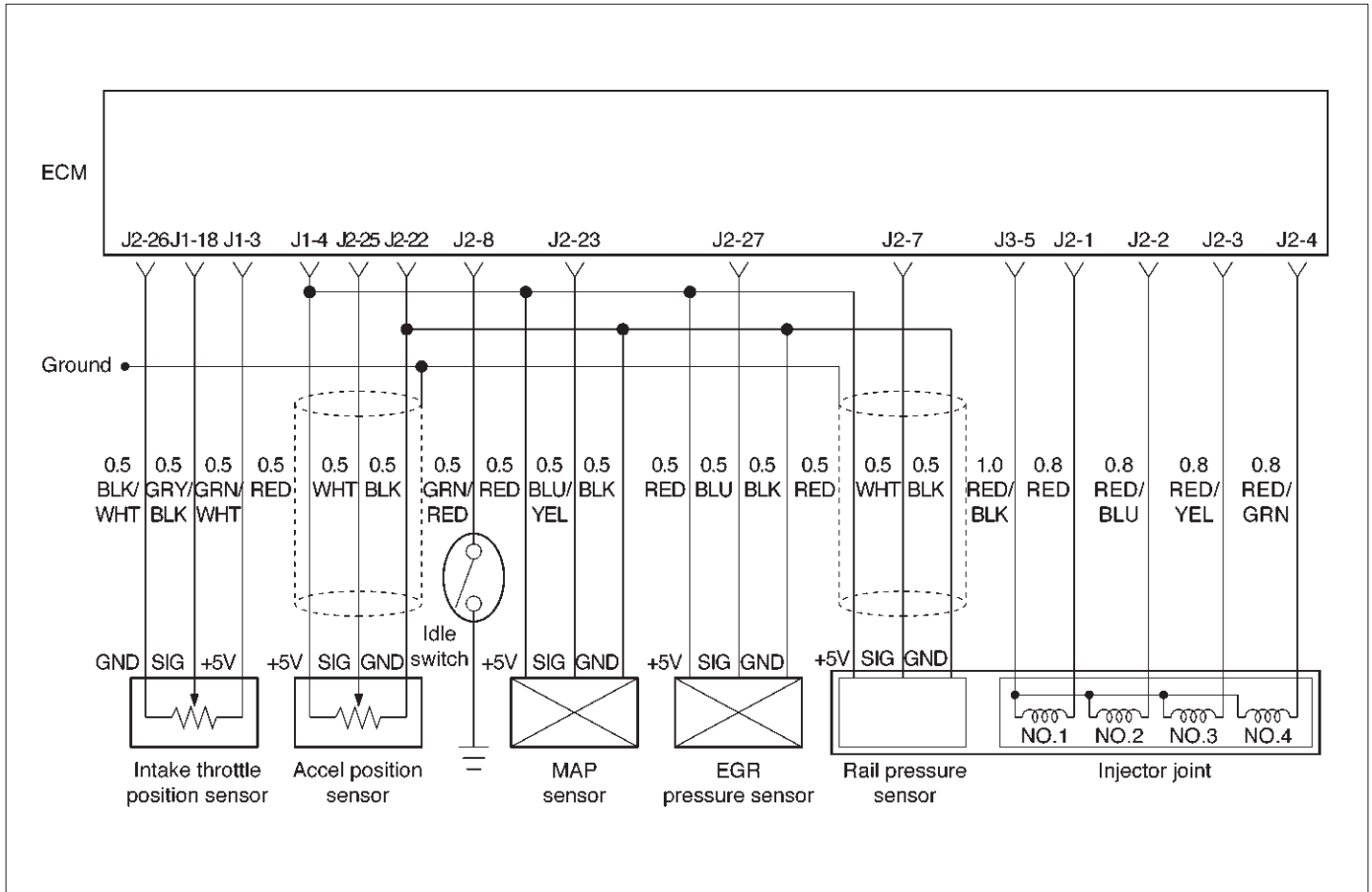
DTC P0198 – OT Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Oil Temp" display on the Tech 2. Is the "Eng Oil Temp" below the specified value?	–39°C (–38°F)	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the " DTC" info for DTC P0198. Does the Tech 2 indicate DTC P0198 failed?	—	Refer to <i>Test Description</i>	Refer to <i>Diagnostic Aids</i>
4	1. Disconnect the OT sensor electrical connector. 2. Jumper the OT signal circuit and the sensor ground circuit together at the OT sensor harness connector. 3. Observe the "Eng Oil Temp" display on the Tech 2. Is the "Eng Oil Temp" at the specified value?	140°C (284°F)	Go to <i>Step 6</i>	Go to <i>Step 5</i>
5	1. Jumper the OT signal circuit at the OT sensor harness connector to chassis ground. 2. Observe the "Eng Oil Temp" display on the Tech 2. Is the "Eng Oil Temp" at the specified value?	140°C (284°F)	Go to <i>Step 7</i>	Go to <i>Step 8</i>
6	Check for poor connections at the OT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 10</i>
7	1. Ignition "OFF." 2. Disconnect the ECM, and check the OT sensor ground circuit for an open. 3. If the OT sensor ground circuit is open, repair it as necessary. Was the OT sensor ground circuit open?	—	Verify repair	Go to <i>Step 9</i>

DTC P0198 – OT Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Disconnect the OT, and check the OT signal circuit for an open. 3. If the OT sensor signal circuit is open, repair it as necessary. Was the OT signal circuit open?	—	Verify repair	Go to <i>Step 9</i>
9	Check for a poor sensor ground or OT signal circuit terminal connection at the ECM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to <i>Step 11</i>
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0201 (Flash DTC 51) Injector # 1 Circuit Fault



Circuit Description

The Engine Control Module ECM has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0201 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.

Injector Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-4. Tech-2 must be used for this test.

Test Procedure:

1. Connect Tech-2 to the vehicle DLC.
2. Set Ignition Switch to the "ON" position.
3. Select Control Test.
4. Select Injector Test.
5. Send instructions to each injector (Switch on), making sure of injector working noise.

NOTE: If injector working noise (Clink) can hardly be confirmed, remove the engine head cover noise insulation.

Refer to Section 6A.

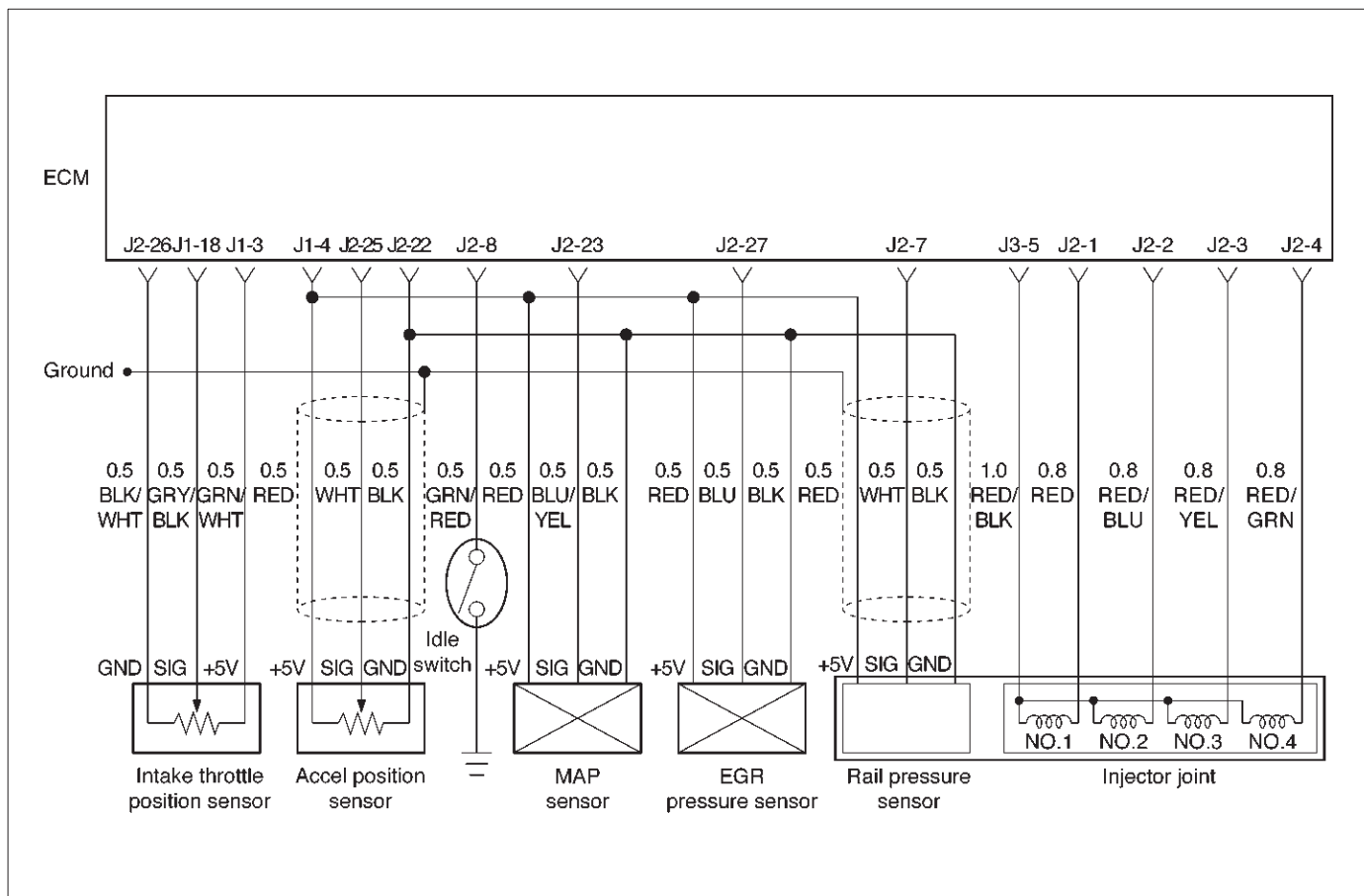
6. In the injector whose working noise has been confirmed, its electric circuit can be regarded as normal.

As for the injector whose working noise has not been confirmed, its electric circuit or the injector proper is faulty.

DTC P0201 – Injector # 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to Step 5	—
5	Check the Injector test. Does the working noise confirm?	—	Go to Step 6	Go to Step 7
6	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Verify repair	Go to Step 7
7	Check for an open circuit between the injector connector and the ECM. Was there an open circuit?	—	Go to Step 8	Go to Step 9
8	Repair the open circuit. Is the action complete?	—	Verify repair	—
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the Injector (Refer to the Injector Group Sign Programming). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0202 (Flash DTC 52) Injector # 2 Circuit Fault



Circuit Description

The Engine Control Module ECM has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0202 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.

Injector Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-4. Tech-2 must be used for this test.

Test Procedure:

1. Connect Tech-2 to the vehicle DLC.
2. Set Ignition Switch to the "ON" position.
3. Select Control Test.
4. Select Injector Test.
5. Send instructions to each injector (Switch on), making sure of injector working noise.

NOTE: If injector working noise (Clink) can hardly be confirmed, remove the engine head cover noise insulation.

Refer to Section 6A.

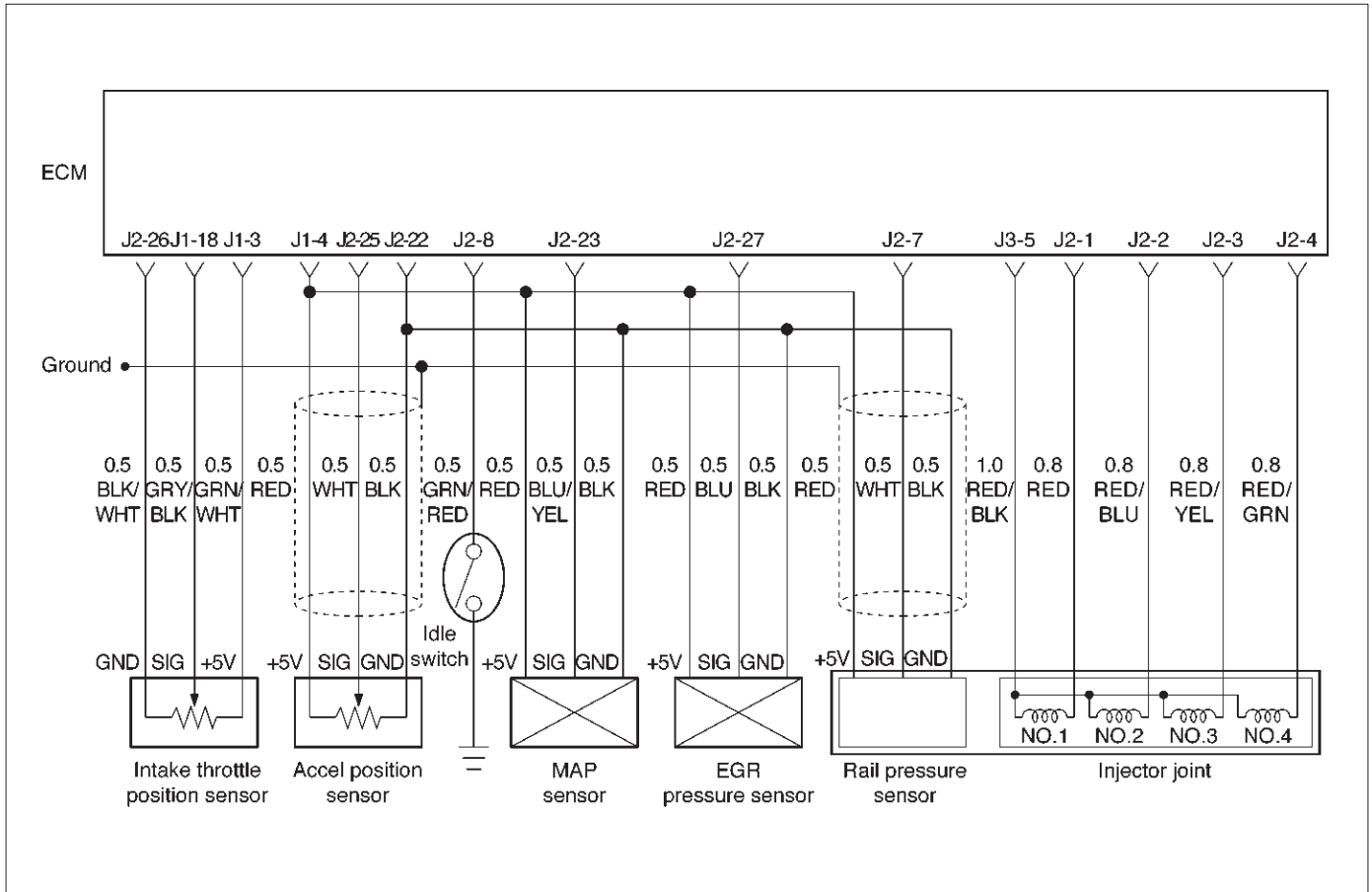
6. In the injector whose working noise has been confirmed, its electric circuit can be regarded as normal.

As for the injector whose working noise has not been confirmed, its electric circuit or the injector proper is faulty.

DTC P0202 – Injector # 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to Step 5	—
5	Check the Injector test. Does the working noise confirm?	—	Go to Step 6	Go to Step 7
6	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Verify repair	Go to Step 7
7	Check for an open circuit between the injector connector and the ECM. Was there an open circuit?	—	Go to Step 8	Go to Step 9
8	Repair the open circuit. Is the action complete?	—	Verify repair	—
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the Injector (Refer to the Injector Group Sign Programming). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0203 (Flash DTC 52) Injector # 3 Circuit Fault



Circuit Description

The Engine Control Module ECM has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0203 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.

Injector Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-4. Tech-2 must be used for this test.

Test Procedure:

1. Connect Tech-2 to the vehicle DLC.
2. Set Ignition Switch to the "ON" position.
3. Select Control Test.
4. Select Injector Test.
5. Send instructions to each injector (Switch on), making sure of injector working noise.

NOTE: If injector working noise (Clink) can hardly be confirmed, remove the engine head cover noise insulation.

Refer to Section 6A.

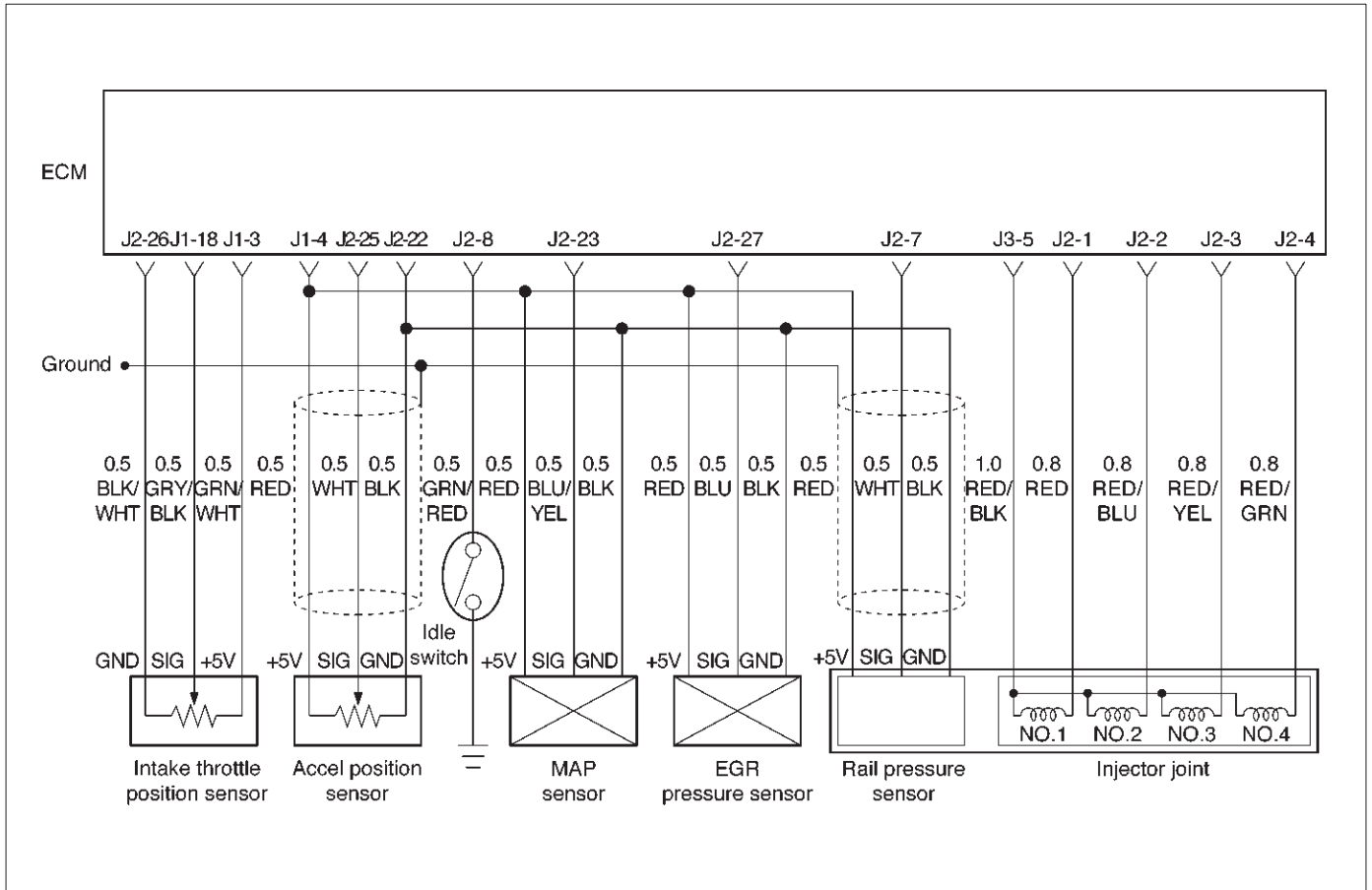
6. In the injector whose working noise has been confirmed, its electric circuit can be regarded as normal.

As for the injector whose working noise has not been confirmed, its electric circuit or the injector proper is faulty.

DTC P0203 – Injector # 3 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to Step 5	—
5	Check the Injector test. Does the working noise confirm?	—	Go to Step 6	Go to Step 7
6	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Verify repair	Go to Step 7
7	Check for an open circuit between the injector connector and the ECM. Was there an open circuit?	—	Go to Step 8	Go to Step 9
8	Repair the open circuit. Is the action complete?	—	Verify repair	—
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the Injector (Refer to the Injector Group Sign Programming). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0204 (Flash DTC 54) Injector # 4 Circuit Fault



Circuit Description

The Engine Control Module ECM has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0204 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.

Injector Test

This test is conducted to make it sure that appropriate electric signals are being sent to injectors Nos. 1-4. Tech-2 must be used for this test.

Test Procedure:

1. Connect Tech-2 to the vehicle DLC.
2. Set Ignition Switch to the "ON" position.
3. Select Control Test.
4. Select Injector Test.
5. Send instructions to each injector (Switch on), making sure of injector working noise.

NOTE: If injector working noise (Clink) can hardly be confirmed, remove the engine head cover noise insulation.

Refer to Section 6A.

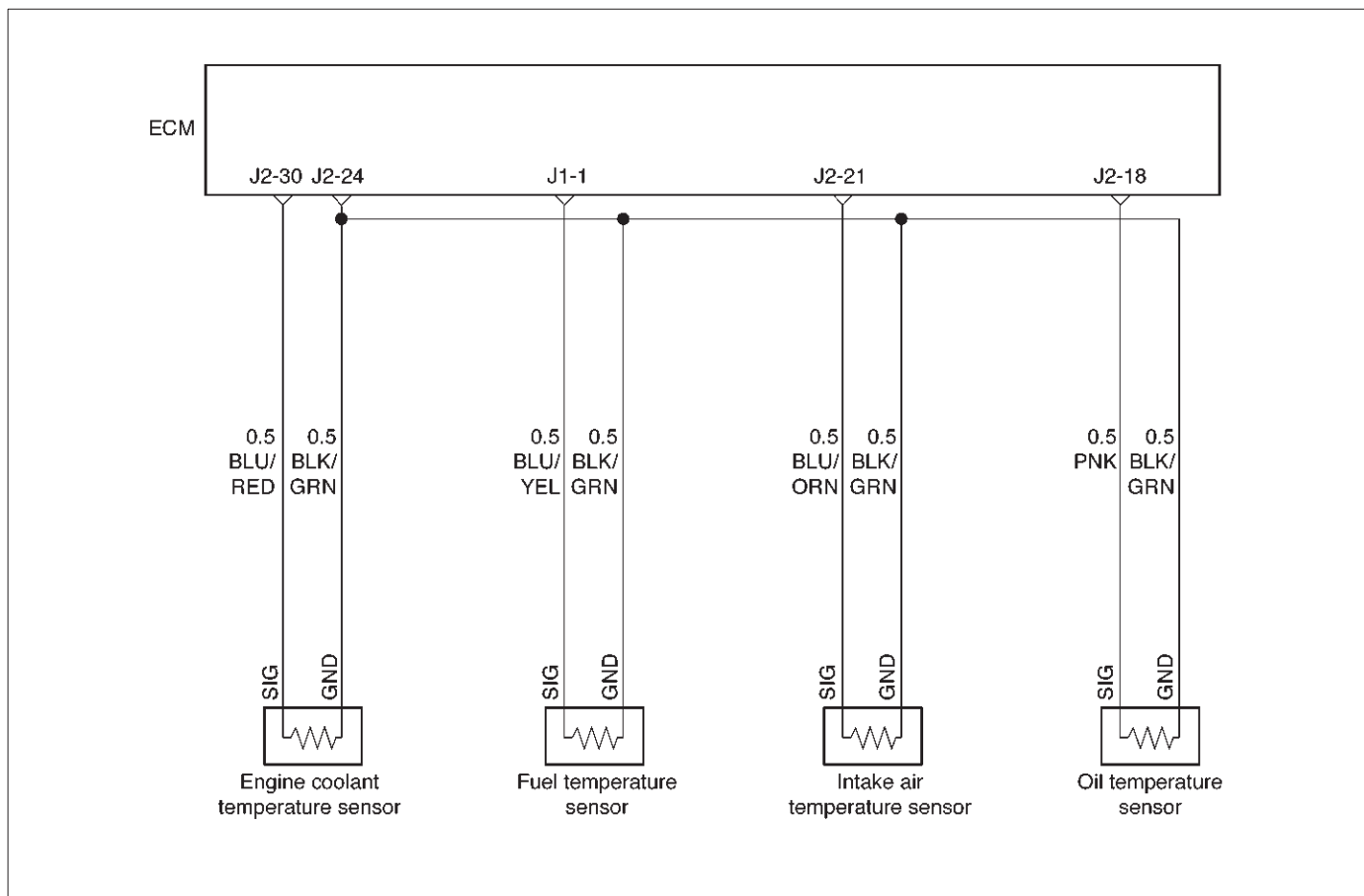
6. In the injector whose working noise has been confirmed, its electric circuit can be regarded as normal.

As for the injector whose working noise has not been confirmed, its electric circuit or the injector proper is faulty.

DTC P0204 – Injector #4 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Will the engine start?	—	Go to Step 3	Go to <i>Engine Cranks But Will Not Run</i> chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to Step 5	—
5	Check the Injector test. Does the working noise confirm?	—	Go to Step 6	Go to Step 7
6	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Verify repair	Go to Step 7
7	Check for an open circuit between the injector connector and the ECM. Was there an open circuit?	—	Go to Step 8	Go to Step 9
8	Repair the open circuit. Is the action complete?	—	Verify repair	—
9	Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the Injector (Refer to the Injector Group Sign Programming). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0217 (Flash DTC 22) High Coolant Temp Warning



060RW129

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the rear of the engine. The Engine Control Module ECM applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0217 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0217 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently.

Test Description

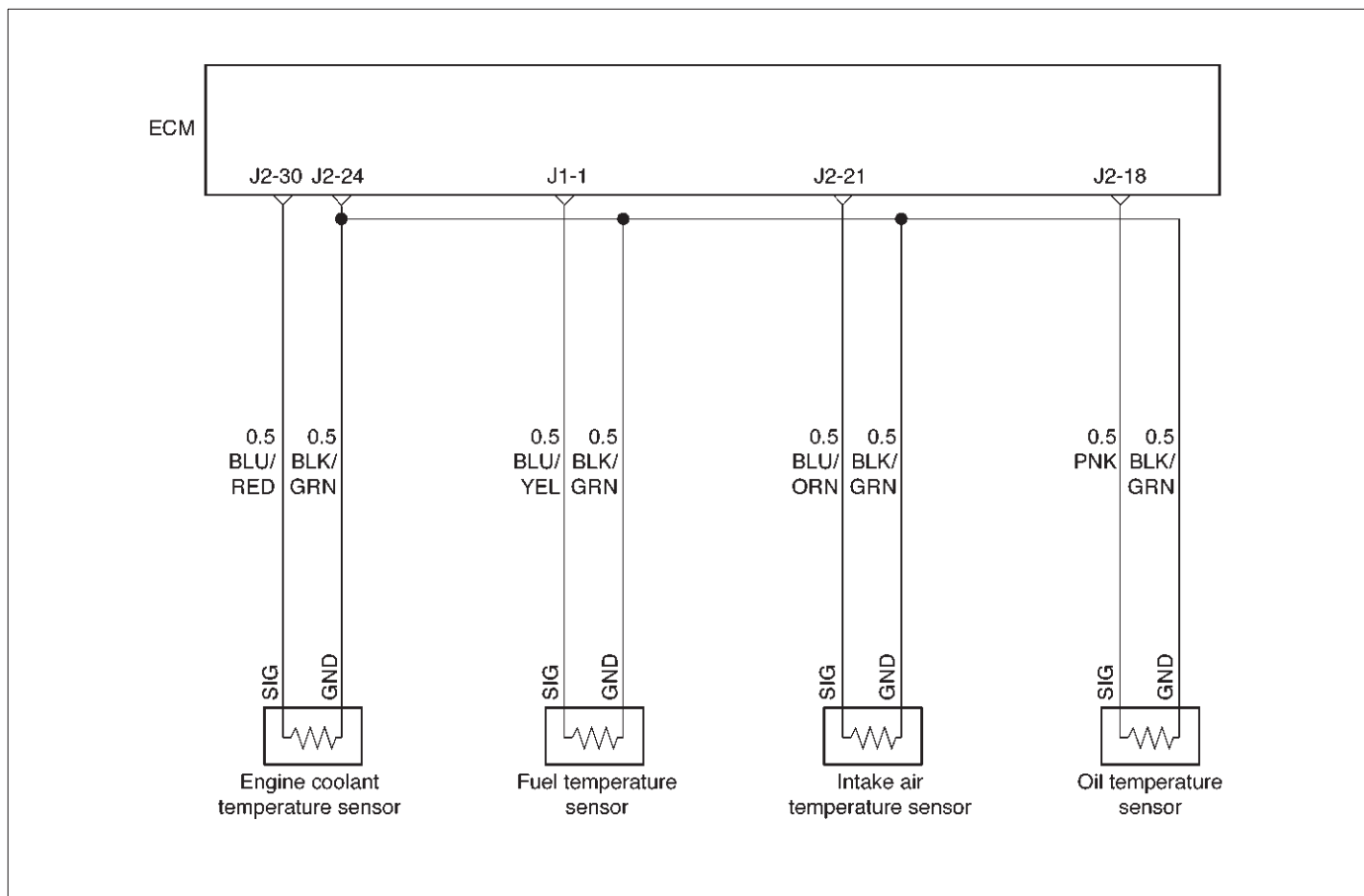
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

DTC P0217 – High Coolant Temp Warning

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	110°C	Go to Step 6	Go to Step 3
3	Check the engine coolant quantity Was the engine coolant appropriate quantity?	—	Go to Step 6	Go to Step 4
4	Check a leak from EC circuit. Was the EC leaked from EC circuit?	—	Go to Step 5	Go to Step 6
5	Repair the EC circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0217. Does the Tech 2 indicate DTC P0217 failed this ignition?	—	Go to Step 7	—
7	1. Ignition "OFF". 2. Check the Thermostat. 3. If the Thermostat is damaged, repair it as necessary. Was the Thermostat damaged?	—	Go to Step 8	Go to Step 9
8	Replace the Thermostat. Is the action complete?	—	Verify repair	—
9	1. Check the Radiator. 2. If the Radiator is damaged, repair it as necessary. Was the Radiator damaged?	—	Go to Step 10	Go to Step 11
10	Repair the Radiator. Is the action complete?	—	Verify repair	—
11	1. Check the EC circuit in the Engine. 2. Observe the "Eng Data List" display on the Tech 2. 3. If the EC circuit in the Engine is damaged, repair it as necessary. Was the EC circuit damaged?	Refer to Data List	Go to Step 12	Go to Step 6
12	Repair the EC circuit. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1217 (Flash DTC 36) High Oil Temp Warning



060RW129

Circuit Description

The engine oil temperature (OT) sensor is a thermistor mounted on a oil manifold. The Engine Control Module (ECM) applies a voltage (about 5 volts) through a pull-up resistor to the OT signal circuit. When the engine oil is cold, the sensor (thermistor) resistance is high, therefore the ECM will measure a high signal voltage. As the engine oil warms, the sensor resistance becomes lower, and the OT signal voltage measured at the ECM drops.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1217 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

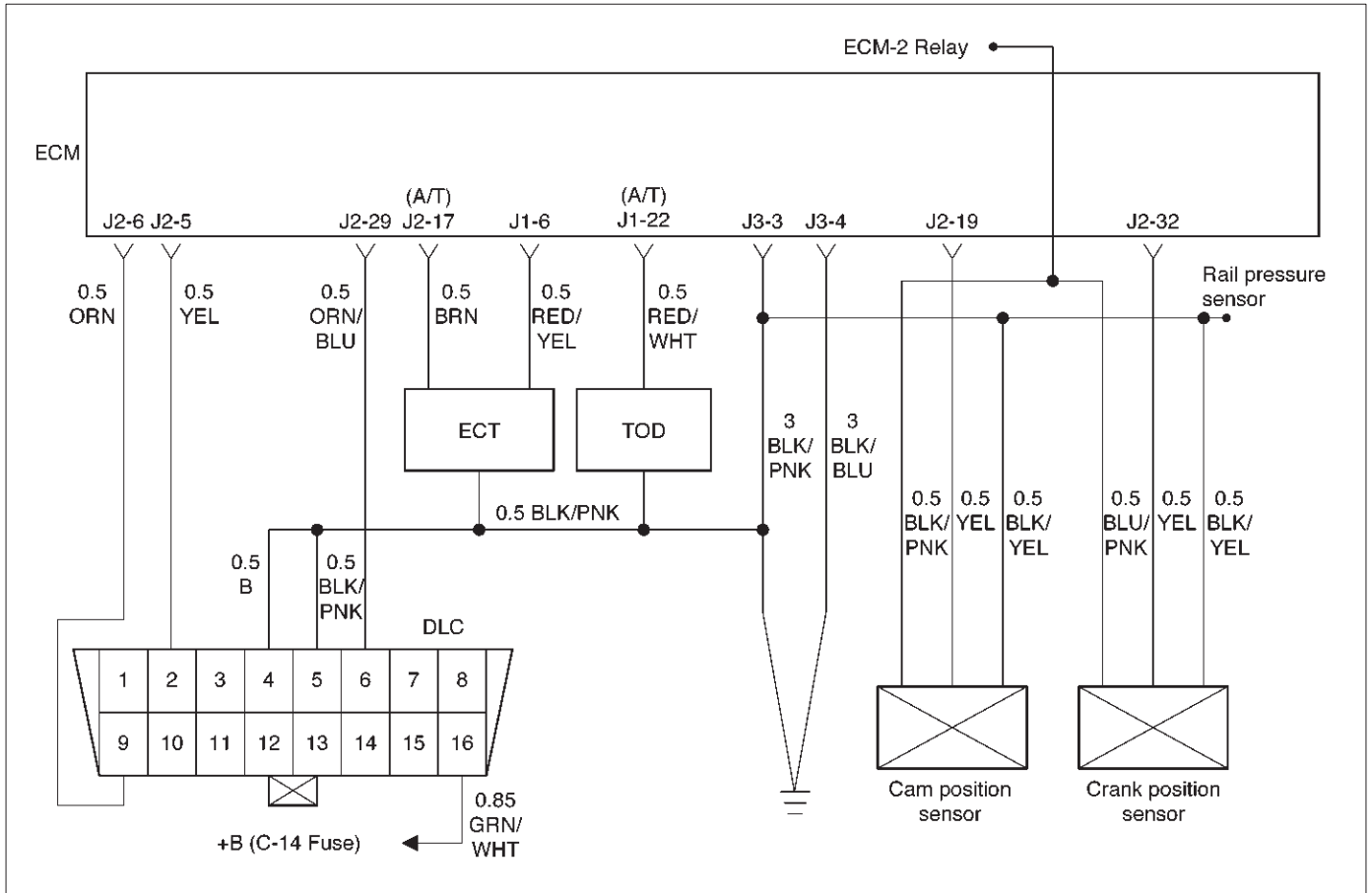
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- High Oil Temperature Warning may sometimes be given due to High Coolant Temp Warning. On this occasion, recognize DTC P0217 and give priority to High Coolant Temp Warning.

DTC P1217 – High Oil Temp Warning

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Using a Tech 2, monitor "DTC" info for DTC P0217. Does the Tech 2 indicate DTC P0217 failed this ignition?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1217. Does the Tech 2 indicate DTC P1217 failed this ignition?	—	Go to Step 5	Refer to <i>Diagnostic Aids</i>
5	1. Measure the engine oil quantity by oil level gage. 2. If the engine oil is shortage, fill up it as necessary. Was the engine oil is shortaged?	—	Verify repair	Go to Step 6
6	Replace the oil temp sensor. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the oil cooler. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0219 (Flash DTC 11) Engine Over Speed Warning



060RW133

Circuit Description

The CKP reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, CKP crankshaft reference pulses will be produced. The Engine Control Module ECM uses the CKP reference signal to calculate engine RPM and crankshaft position.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0219 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for:

- Poor connection – Inspect the CKP harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged X57 – Inspect the X57 for damage.

DTC P0219 – Engine Over Speed Warning

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check the responsibility. Was the driver responsibility?	—	Go to Step 3	Go to <i>Chart 4</i>

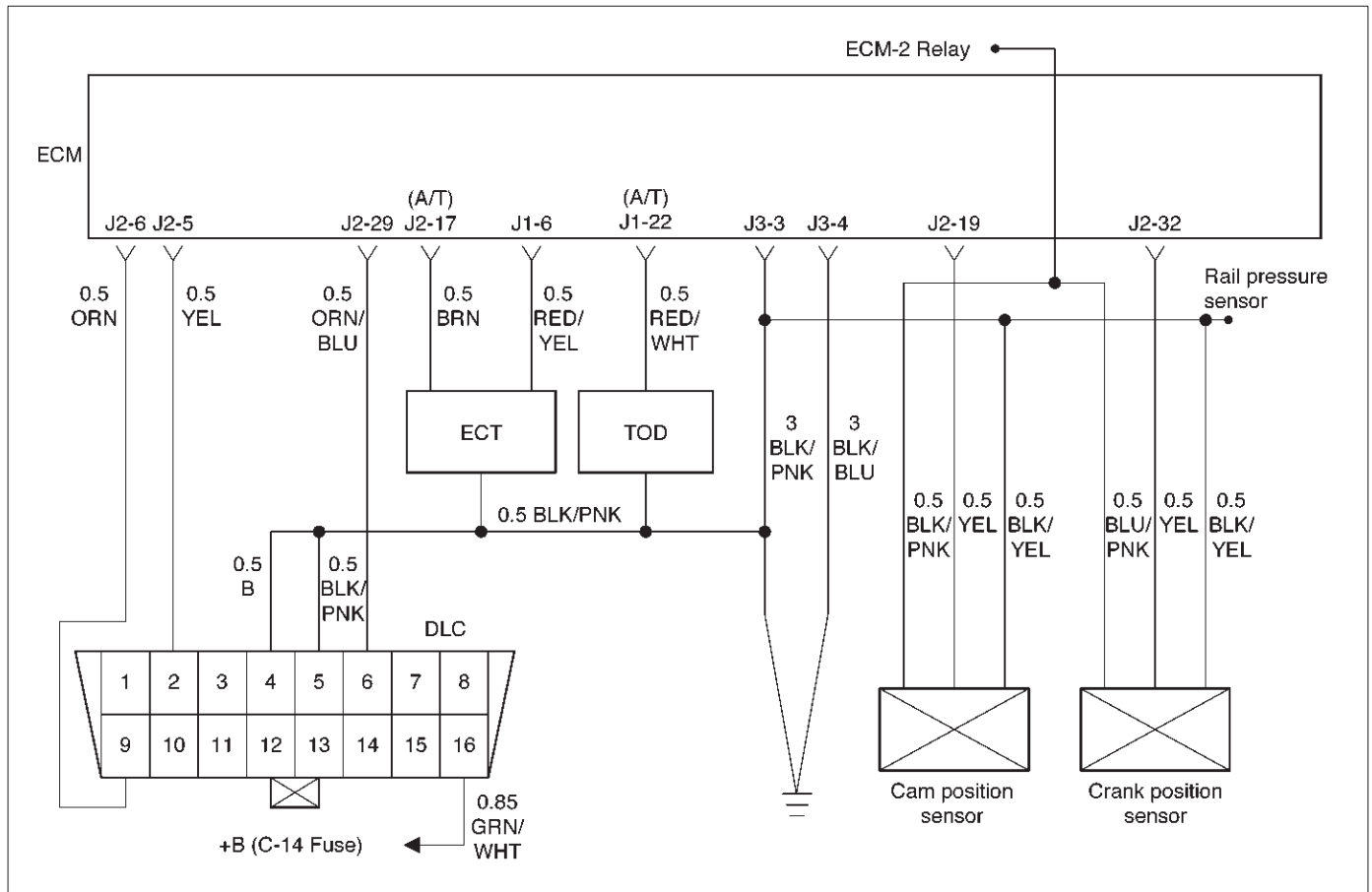
DTC P0219 – Engine Over Speed Warning (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Review and record Failure Records information. 2. Clear DTC P0219. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0219 set?	—	Go to <i>Step 4</i>	—
4	Observe the AP value displayed on the Tech 2. Is the AP value near the specified value?	(Idling 720 r.p.m) 0 %	Go to <i>Step 3</i>	Go to <i>Step 5</i>
5	Observe the Engine speed displayed on the Tech 2. Is the Engine speed near the specified value?	(Idling) 720 r.p.m	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	1. Check the CKP sensor. 2. Ignition "ON." 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (ECM side). Are 4-6 volts and ground available at the sensor?	—	Go to <i>Step 9</i>	Go to <i>Step 7</i>
7	1. Ignition "ON." 2. With a DVM, backprobe the ECM connector 5 V reference and ground connections. Are 5 V reference and ground available at the ECM?	—	Go to <i>Step 8</i>	Go to <i>Step 13</i>
8	Check 5 V reference or ground between the CKP sensor and ECM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the ECM and CKP sensor. 3. Check for an open or a short to ground in the CKP reference circuit between the CKP sensor connector and the ECM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 10</i>
10	1. Reconnect the ECM and CKP sensor. 2. Connect a DVM to measure voltage on the CKP reference circuit at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to <i>Step 13</i>	Go to <i>Step 11</i>
11	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 12</i>
12	Replace the CKP sensor. Is the action complete?	—	Verify repair	—
13	Check the connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 14</i>

DTC P0219 – Engine Over Speed Warning (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the X57 signal plate. Is the X57 signal plate damage?	—	Go to <i>Step 15</i>	Go to <i>Step 3</i>
15	Replace the X57 signal plate. Is the action complete?	—	Verify repair	Go to <i>Step 2</i>

Diagnostic Trouble Code (DTC) P0336 (Flash DTC 43) CKP (Crank Position) Sensor Out of Synchro



060RW133

Circuit Description

The CKP reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, crankshaft pulses will be produced. The Engine Control Module ECM uses the CKP reference signal to calculate engine RPM and crankshaft position. If the ECM receives an incorrect number of pulses on the CKP reference circuit, DTC P0336 will set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0336 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

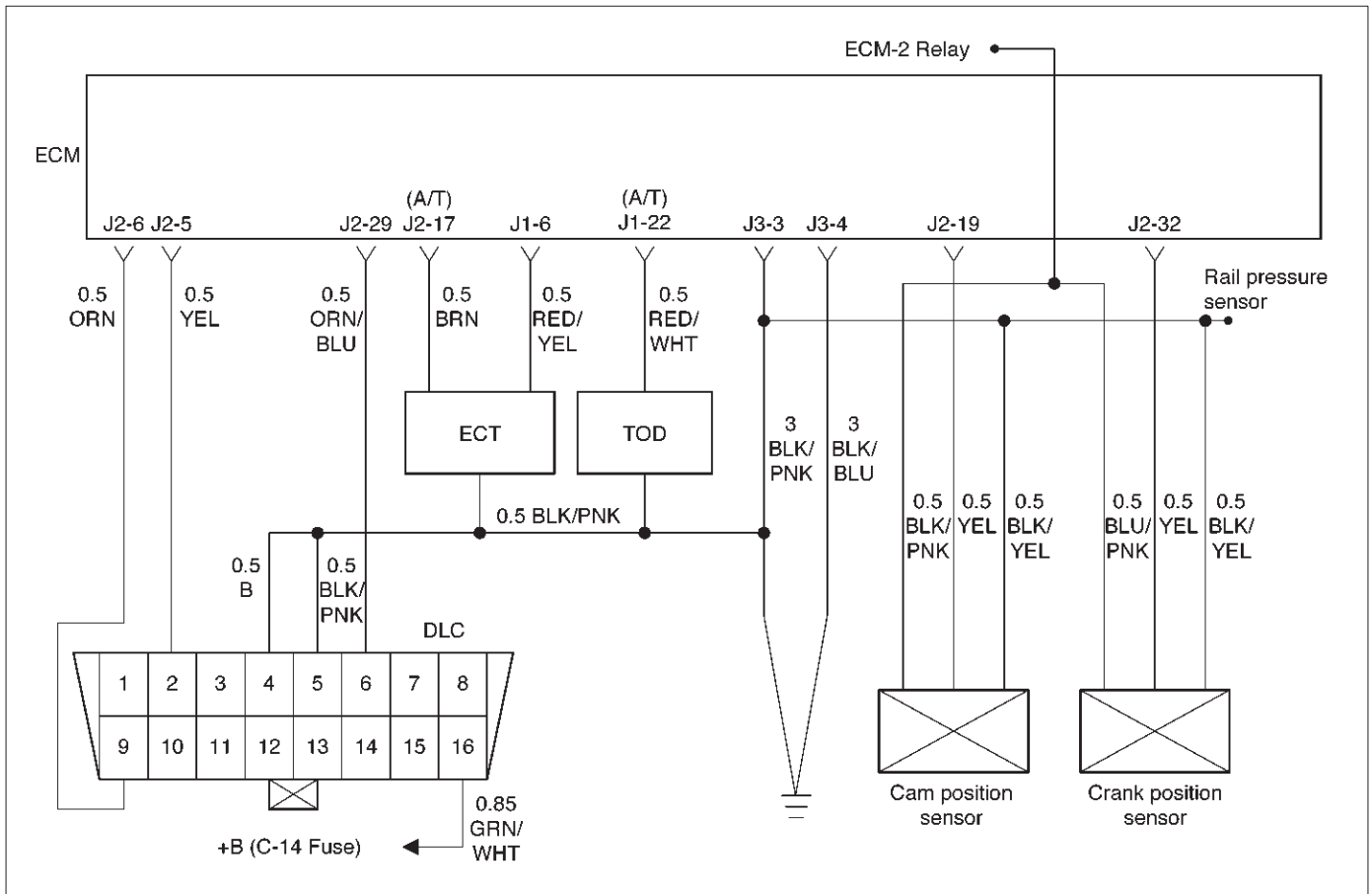
- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on and observe a voltmeter connected to the CKP reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – CKP Sensor Out of Synchro

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to “ <i>Engine Cranks But Will Not Run</i> ” chart
3	1. Review and record Failure Records information. 2. Clear DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0336 set?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the ECM and CKP sensor. 2. Check for an open or a short to ground in the CKP reference circuit between the CKP sensor connector and the ECM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Reconnect the ECM and CKP sensor. 2. Connect a DVM to measure voltage on the CKP reference circuit at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 8	Go to Step 6
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	Replace the CKP sensor. Is the action complete?	—	Verify repair	Go to Step 8
8	Check connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 9
9	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0337 (Flash DTC 43) CKP (Crank Position) Sensor No Signal



060RW133

Circuit Description

The CKP reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, CKP crankshaft reference pulses will be produced. The Engine Control Module ECM uses the CKP reference signal to calculate engine RPM and crankshaft position. If the ECM does not receive pulses on the CKP reference circuit, DTC P0337 will set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0337 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on and observe a voltmeter connected to the CKP reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ICM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

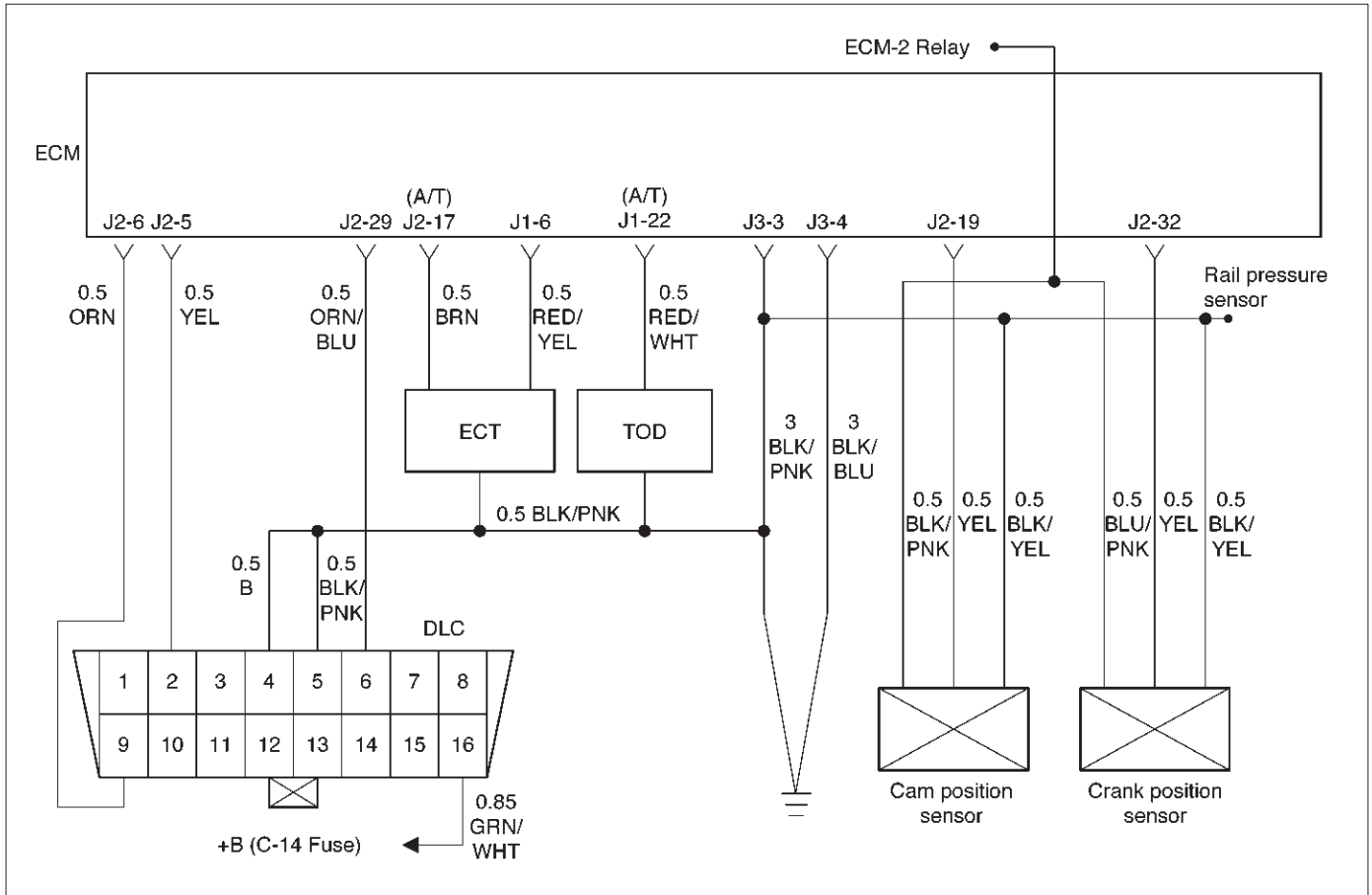
DTC P0337 – CKP Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to <i>Chart 3</i>
3	1. Review and record Failure Records information. 2. Clear DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0337 set?	—	Go to Step 4	Refer to <i>Diagnostic Aid</i>
4	1. Disconnect the CKP sensor. 2. Ignition “ON.” 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (ECM side). Are 4-6 volts and ground available at the sensor?	—	Go to Step 7	Go to Step 5
5	1. Ignition “ON.” 2. With a DVM, backprobe the ECM connector 5 V reference and ground connections. Are 5 V reference and ground available at the ECM?	—	Go to Step 6	Go to Step 11
6	Check 5 V reference or ground between the CKP sensor and ECM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
7	1. Ignition “OFF.” 2. Disconnect the ECM and CKP sensor. 3. Check for an open or a short to ground in the CKP reference circuit between the CKP sensor connector and the ECM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Reconnect the ECM and CKP sensor. 2. Connect a DVM to measure voltage on the CKP reference circuit at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 11	Go to Step 9
9	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
10	Replace the CKP sensor. Use caution and avoid hot oil that may drip out. Is the action complete?	—	Verify repair	—

DTC P0337 – CKP Sensor No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 12</i>
12	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0341 (Flash DTC 41) CMP (Cam Position) Sensor Out of Synchro



Circuit Description

The CMP signal is produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The Engine Control Module ECM uses the CMP signal pulses to initiate sequential fuel injection. If the ECM receives an incorrect number of pulses on the CMP reference circuit, DTC P0341 will set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0341 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection — Inspect the ECM harness and connectors for improper mating, broken locks,

improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness — Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ICM and the CMP sensor. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.
12. Determines whether the fault is being caused by a missing camshaft magnet or a faulty sensor. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

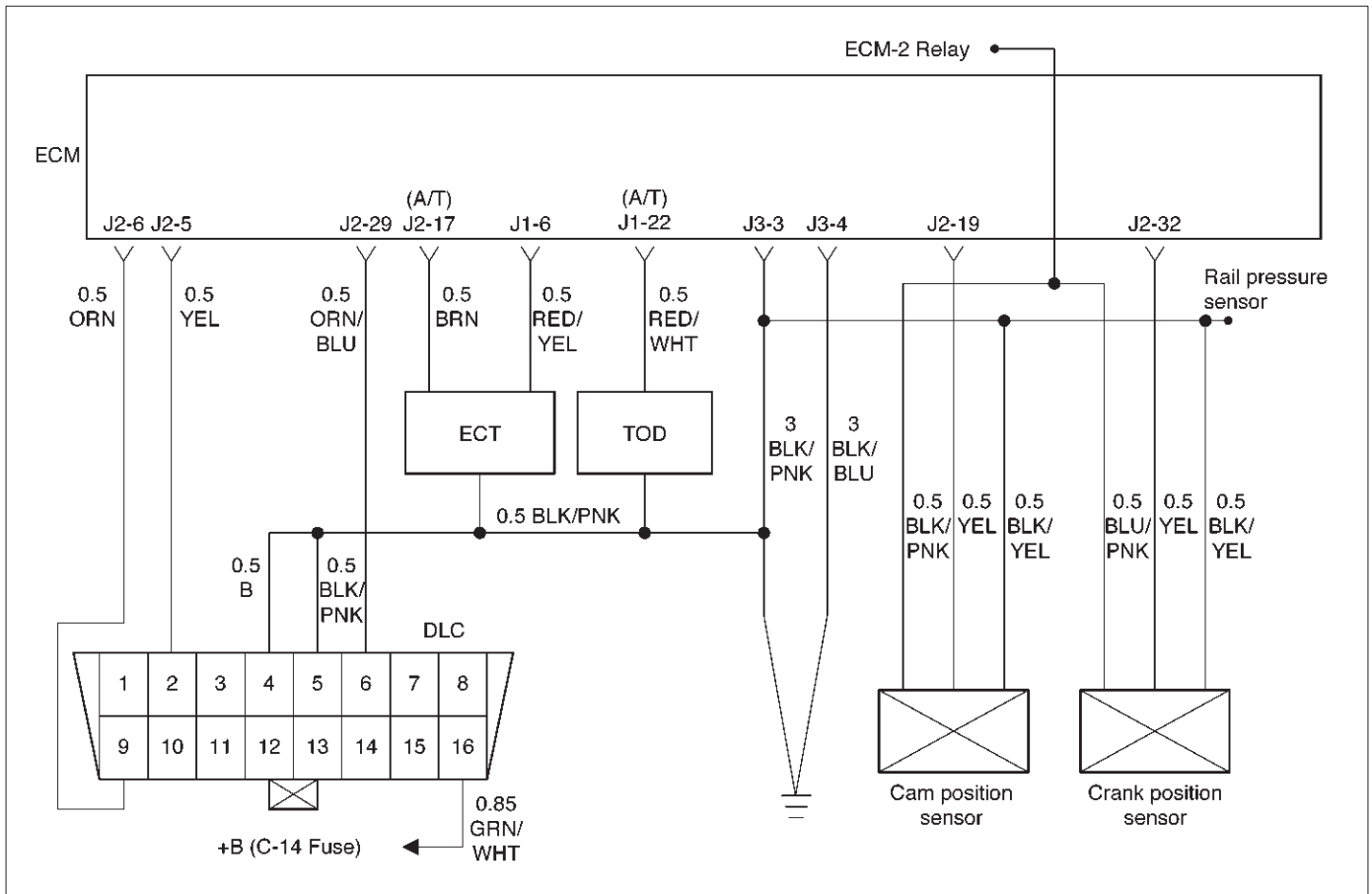
DTC P0341 —CMP Sensor Out of Synchro

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0341 until the DTC P0341 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0341 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Disconnect the CMP sensor. 2. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to Step 4	Go to Step 5
4	Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to Step 11	Go to Step 8
5	If the voltage measured in step 3 was less than 4-6 volts, proceed directly to step 6 without completing this step. If the voltage in step 3 was greater than 4-6 V, repair the short to voltage in the CMP feed circuit. Is the action complete?	—	Verify repair	—
6	1. Check for poor connections at the camshaft position sensor. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition "OFF," disconnect the ECM and the CMP sensor. 2. Check the following circuits for an open between the ignition control module and the CMP sensor: • The sensor feed circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
8	1. Ignition "OFF," disconnect the ECM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuits: • The CMP sensor signal circuit for an open or a short to voltage. • The CMP sensor input signal circuit for a short to ground. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for a short or open in the sensor ground circuit. Was a problem found?	—	Verify repair	Go to Step 10

DTC P0341 —CMP Sensor Out of Synchro (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for poor connections at the ECM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	Backprobe the ECM connector with a DVM to monitor voltage on the camshaft position input signal circuit while cranking the engine with the sensor connected. (Use rubber band, tape, or an assistant to keep the DVM lead in contact with the sensor terminal during this test.) Does the voltage toggle between the specified values?	4-0 V	Go to <i>Step 15</i>	Go to <i>Step 12</i>
12	1. Remove the CMP sensor from the engine front cover (leave the sensor wiring connected). 2. Place a magnet on the CMP sensor. (If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test.) Does the DVM display a voltage near the specified value?	0 V	Go to <i>Step 13</i>	Go to <i>Step 14</i>
13	Replace the faulty or missing camshaft position sensor magnet. Is the action complete?	—	Verify repair	—
14	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
15	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0342 (Flash DTC 41) CMP (Cam Position) Sensor No Signal



Circuit Description

The CMP signal produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) synchro pulses are also being received. The hall type CMP sensor and the CKP sensor share 5 V and ground connections at the Engine Control Module ECM. The third wire at the sensor is a signal circuit to the ECM. The ECM uses the CMP signal pulses to initiate sequential fuel injection. If the ECM does not receive pulses on the CMP reference circuit, DTC P0342 will set.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0342 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ICM and the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.
14. Determines whether the fault is being caused by a missing camshaft magnet or a faulty ECM. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

DTC P0342 —CMP Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<ol style="list-style-type: none"> Ignition “ON.” Review and record Tech 2 Failure Records data. Operate the vehicle within Failure Records conditions as noted. Using a Tech 2, monitor “Specific DTC” information for DTC P0342 until the DTC P0342 test runs. Note test result. Does the Tech 2 indicate DTC P0342 failed this ignition?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	<ol style="list-style-type: none"> Ignition “ON.” Disconnect the CMP sensor. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to <i>Step 7</i>	Go to <i>Step 4</i>
4	<ol style="list-style-type: none"> Ignition “OFF,” disconnect the ECM and the CMP sensor. Check for poor connections at the camshaft position sensor. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 5</i>
5	<ol style="list-style-type: none"> Check for poor connections at the ECM. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 6</i>
6	<ol style="list-style-type: none"> Check the following circuits between the ECM and the CMP sensor: <ul style="list-style-type: none"> The sensor feed circuit. Open or short to ground? The sensor ground circuit. Open or short to voltage? If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—
7	<ol style="list-style-type: none"> Ignition “ON,” engine “OFF.” Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to <i>Step 8</i>	Go to <i>Step 9</i>

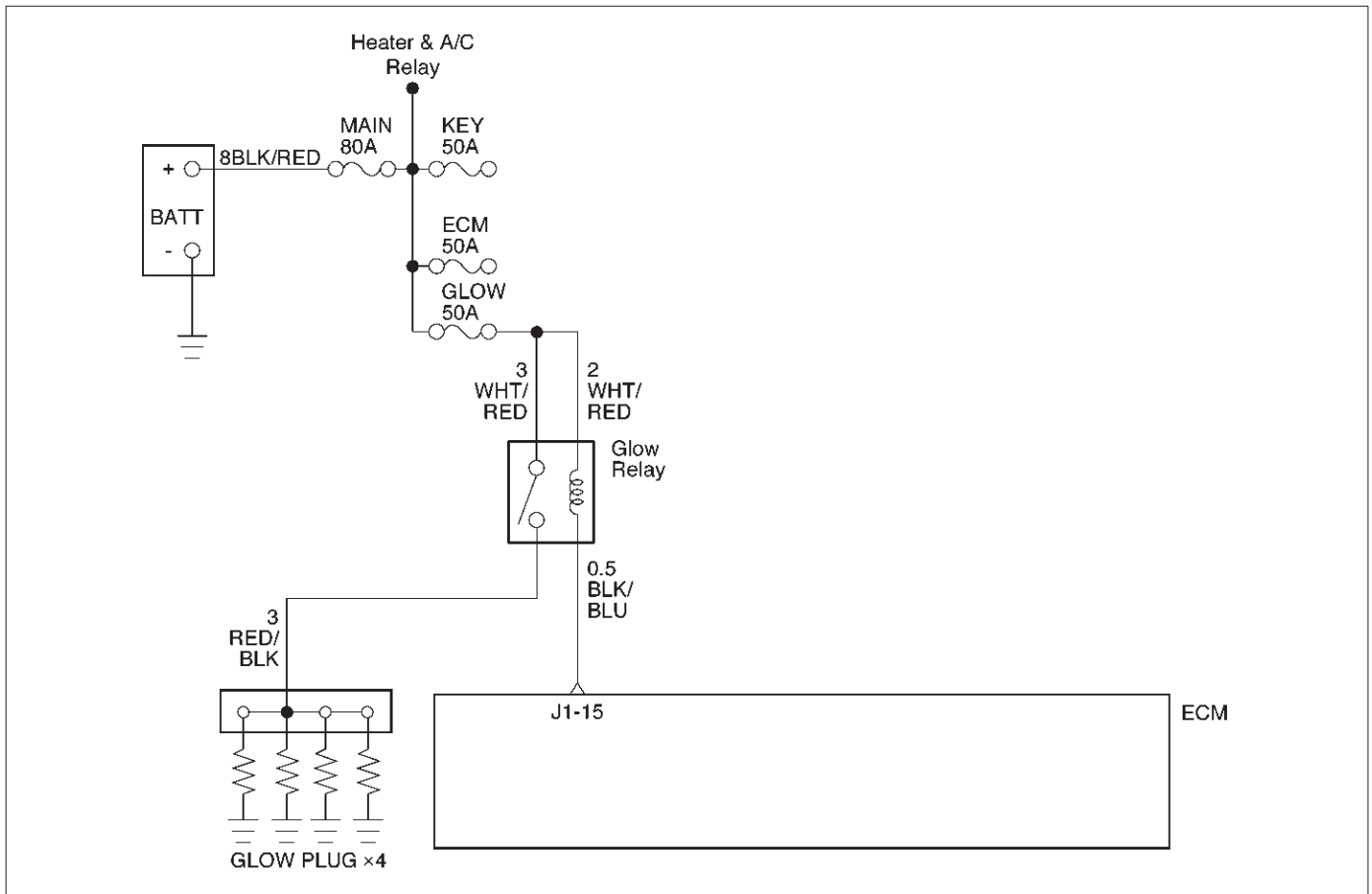
DTC P0342 —CMP Sensor No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
8	<ol style="list-style-type: none"> 1. Turn the ignition "OFF." 2. Disconnect the ECM and connect a DVM to monitor voltage on the camshaft position signal circuit at the ECM connector. 3. Ignition "ON." 4. Monitor the voltage display on the DVM while repeatedly touching the CMP sensor signal circuit at the CMP sensor connector with a test light to ground. <p>Does the DVM voltage display switch between 0 and approximately 5 volts when the test light is touched to the CMP sensor signal circuit?</p>	—	Go to Step 12	Go to Step 9
9	<ol style="list-style-type: none"> 1. Ignition "OFF." 2. Leave the ECM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit at the ECM connector with a test light to B+. 5. If the test light is "ON," locate and repair the short to ground in the camshaft position input signal circuit. <p>Was either circuit shorted to ground?</p>	—	Verify repair	Go to Step 10
10	<ol style="list-style-type: none"> 1. Ignition "OFF." 2. Leave the ECM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit with a test light to ground. 5. If the test light is "ON," locate and repair the short to voltage in the camshaft position input signal circuit. <p>Was the test light "ON"?</p>	—	Verify repair	Go to Step 11
11	<ol style="list-style-type: none"> 1. Ignition "OFF," disconnect the ECM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuit: <ul style="list-style-type: none"> • The CMP sensor signal circuit for an open. 3. If a problem is found, repair it as necessary. <p>Was a problem found?</p>	—	Verify repair	—
12	<ol style="list-style-type: none"> 1. Ignition "ON." 2. Remove the CMP sensor from the engine front cover (leave the sensor wiring connected). 3. Place a magnet on the CMP sensor. If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test. <p>Does the DVM display a voltage near the specified value?</p>	0 V	Go to Step 14	Go to Step 13
13	<p>Replace the camshaft position sensor.</p> <p>Is the action complete?</p>	—	Verify repair	—
14	<ol style="list-style-type: none"> 1. Reinstall the CMP sensor to the engine front cover. 2. Observe the DVM connected to monitor voltage on the camshaft position signal circuit while cranking the engine. <p>Does the voltage toggle between the specified values?</p>	4-0 V	Go to Step 15	Go to Step 16

DTC P0342 —CMP Sensor No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
15	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
16	Replace faulty or missing camshaft magnet. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0380 (Flash DTC 66) Glow Relay Circuit Open/Short



060RW132

Circuit Description

Glow relay circuit receives current through Glow 50A fuse from the battery. Glow relay is circuited to Glow plug.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0380 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

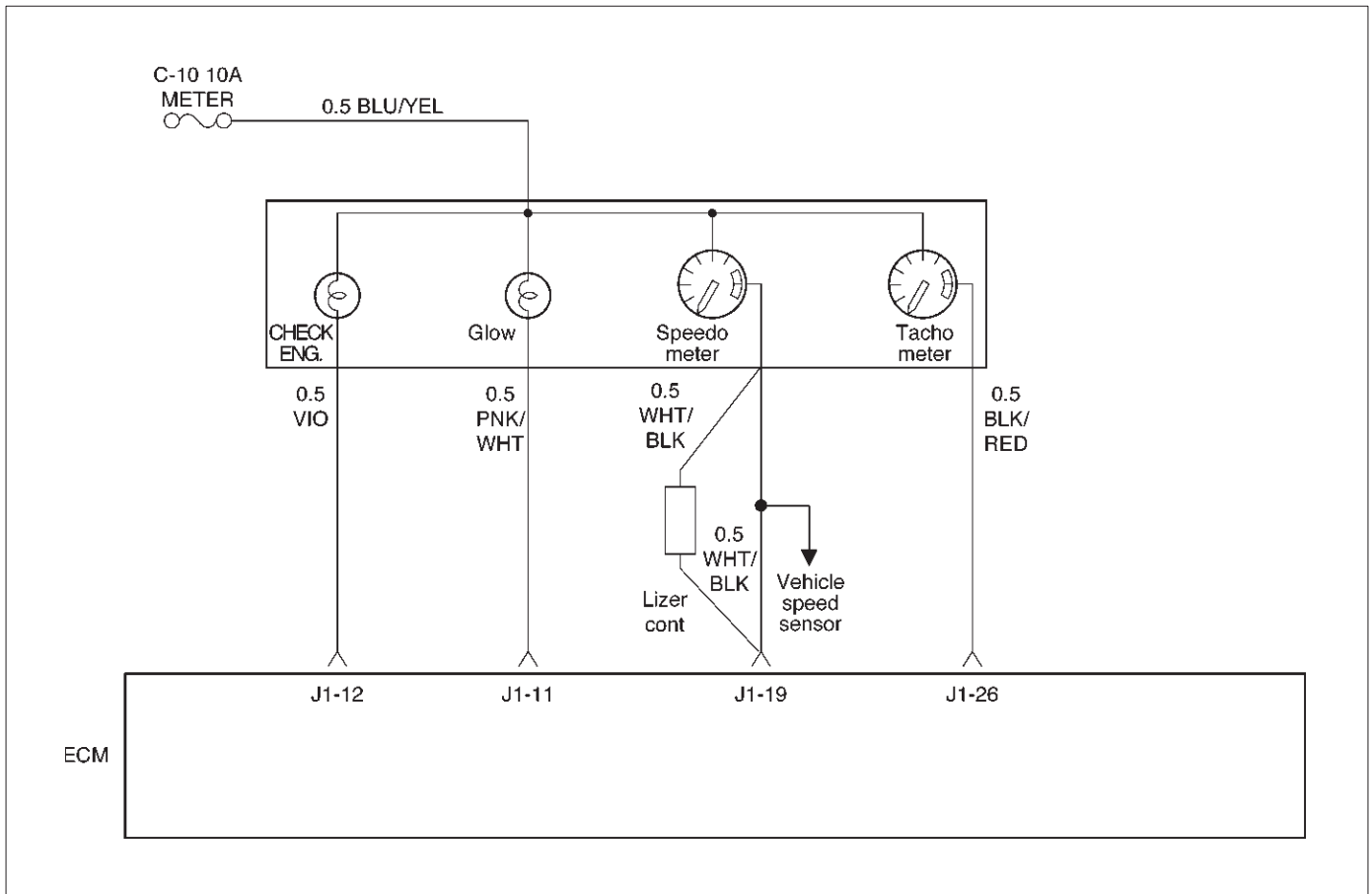
An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P0380 – Glow Relay Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Attempt to start the engine. Does the engine start?	—	Go to <i>Step 3</i>	Go to <i>Chart 3</i>
3	1. Review and record Failure Records information. 2. Clear DTC P0380. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0380 set?	—	Go to <i>Step 4</i>	Refer to <i>Diagnostic Aid</i>
4	Check the glow fuse 50A. Is the glow fuse 50A damage?	—	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Replace the glow fuse 50A. Is the action complete?	—	Verify repair	Go to <i>Step 6</i>
6	1. Ignition “OFF.” 2. Check for an open or a short to ground in the Glow relay circuit between the Glow relay connector and the ECM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	Check the connections at the Glow relay and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 8</i>
8	Replace the Glow relay. Is the action complete?	—	Verify repair	Go to <i>Step 9</i>
9	Check the connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 10</i>
10	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0381 (Flash DTC 67) Glow Lamp Circuit Open/Short



060RW136

Circuit Description

Glow Lamp Circuit receives current through Meter 10A fuse, Glow lamp being circuited to ECM.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0381 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

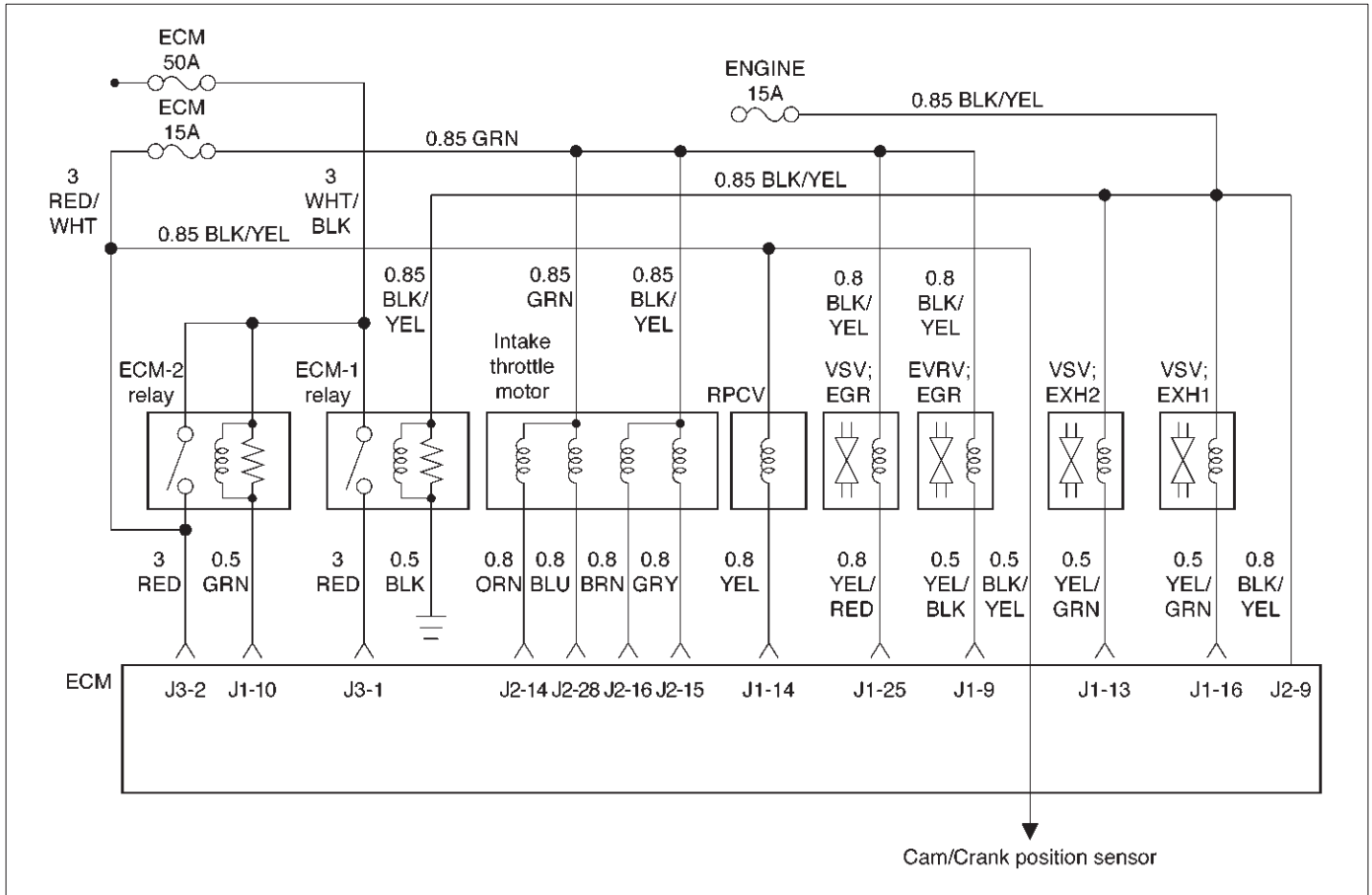
An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P0381 – Glow Lamp Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Review and record Failure Records information. 2. Clear DTC P0381. 3. Observe DTCs. Is DTC P0381 set?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aid</i>
3	1. Ignition "OFF." 2. Remove the Meter assembly. 3. Check for an open or a short to ground in the Glow Lamp circuit. 4. If a problem is found, repair as necessary. (On electric bulb of the Glow Lamp, The Glow Lamp harness circuit) Was a problem found?	—	Refer to the Meter in Electric section 8	Go to <i>Step 4</i>
4	Check the connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 5</i>
5	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1403 (Flash DTC 32) EGR EVRV Fault



060RW135

Circuit Description

EGR EVRV Circuit has a common power source in parallel with EGR, VSV, RPCV, and Intake Throttle Motor. This may cause multiple DTCs. On such occasion, refer to "Multiple ECM Information sensor DTCs Set".

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged EVRV – Inspect the wiring harness for damage.
- Ensure EVRV is correctly mounted. See *On-Vehicle Service*.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

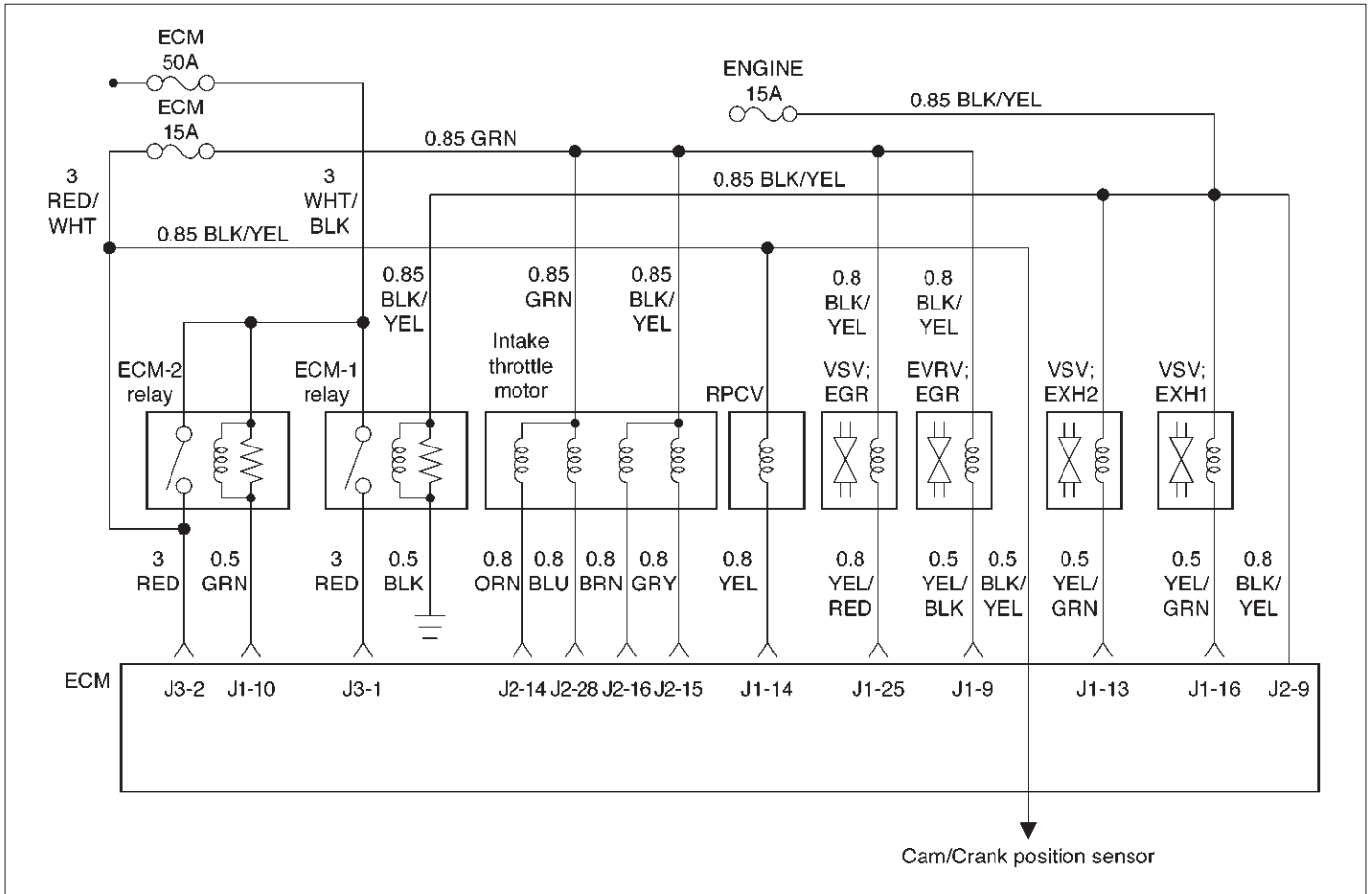
Number(s) below refer to the step number(s) on the Diagnostic Chart

3. A malfunctioning MAP sensor can set an EGR DTC. The MAP sensor could send a constant signal which is not low enough to set a low MAP DTC. The constant signal from the MAP sensor also may not be high enough to set a high MAP DTC. This step verifies that the MAP sensor is responding.

DTC P1403 – EGR EVRV Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Check the EVRV circuit. Was the EVRV circuit damage?	—	Replace the EVRV circuit	Go to <i>Step 3</i>
3	1. Start the engine. 2. Monitor the MAP signal with a scan tool while idling. 3. While idling, jab the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the scan tool show an immediate large change?	—	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
5	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to <i>Step 8</i>	Go to <i>Step 6</i>
6	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem is found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to <i>Step 8</i>	Go to <i>Step 7</i>
7	1. Inspect the EGR passages for a blockage caused by excessive deposits or other damage. 2. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to <i>Step 8</i>	Refer to <i>Diagnostic Aids</i>
8	1. Review and record the scan tool Failure Records data. 2. Clear DTC and monitor the scan tool System Info Screen while operating the vehicle as specified in “Diagnostic Aids.” 3. Using a scan tool, monitor “DTC” info for DTC P1403 until the DTC P1403 test runs. 4. Note the test result. Does the scan tool indicate DTC P1403 failed this ignition?	—	Go to the last step completed in this diagnostic chart	Repair complete

Diagnostic Trouble Code (DTC) P1404 (Flash DTC 31) EGR VSV Circuit



060RW135

Circuit Description

The Engine control module (ECM) monitors the EGR valve input to ensure that the valve responds properly to commands from the ECM, and to detect a fault if VSV is stuck open. When the VSV is fixing at closed and opening the ECM will set DTC P1404.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged VSV—inspect the wiring harness for damage.

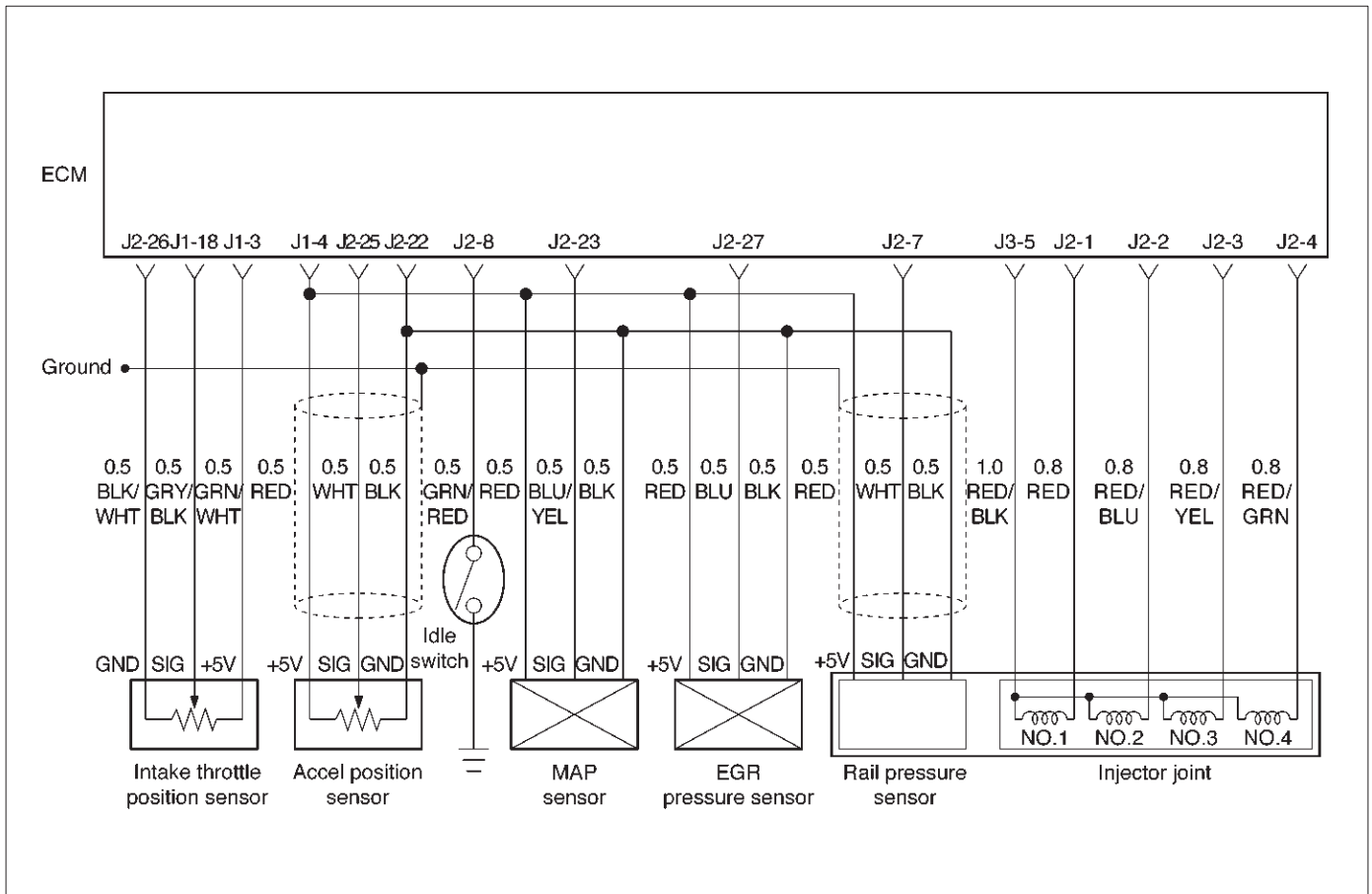
DTC P1404 – EGR VSV Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON", engine "OFF", review and record scan tool Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a scan tool, monitor "Specific DTC" info for DTC P1404 until the DTC P1404 test runs. Note the result. Does the scan tool indicates DTC P1404 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>

DTC P1404 – EGR VSV Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
3	Check the VSV circuit. Was the VSV circuit open or damage?	—	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Repair the opened VSV circuit or VSV. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0405 (Flash DTC 26) EGR Pressure Sensor Low Voltage



060RW134

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage.

Conditions for Clearing the MIL/DTC

- DTC P0405 can be cleared by using the scan tool "Clear Info" function or by disconnecting the ECM battery feed.

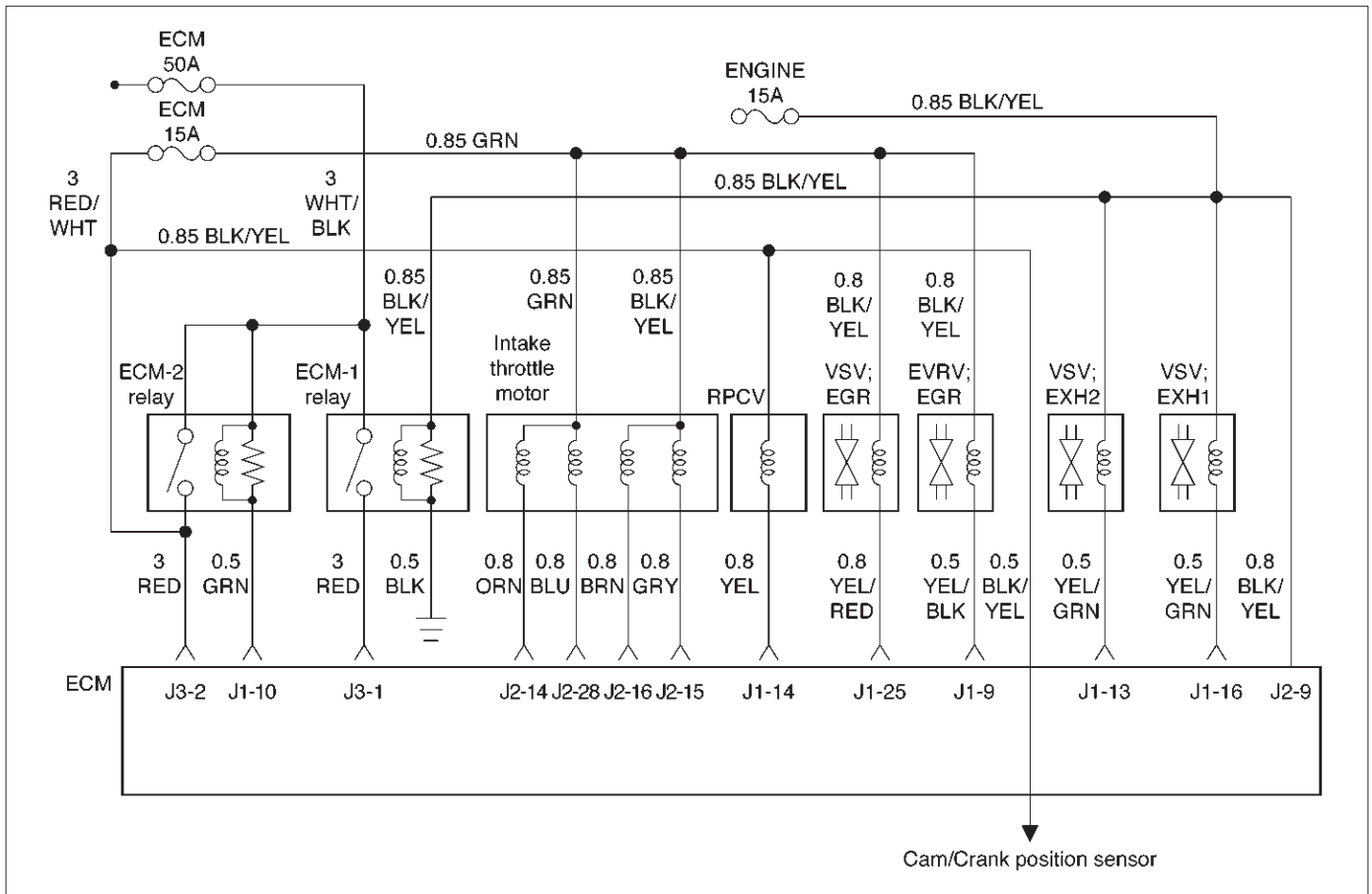
DTC P0405 – EGR Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Put the engine into an idling status. Is the EGR pressure sensor voltage value displayed on the Tech 2 below the specified value?	0.25 V	Go to Step 3	Refer to <i>Diagnostic Aids and Symptom Diagnosis</i>

DTC P0405 – EGR Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn off the ignition switch. 2. Remove the sensor connector connection. 3. Jumper between harness pins "red" and "blue" wires. 4. Turn on the ignition switch "ON". Is the EGR pressure sensor voltage reading above the specified value?	4 V	Go to <i>Step 5</i>	Go to <i>Step 4</i>
4	1. Turn off the ignition switch. 2. Remove the jumper wire. 3. Connect the relay & solenoid checker (5-8840-0386-0) to the battery voltage, then check the EGR pressure sensor signal circuit (blue wire). 4. Turn on the ignition switch. Is the value displayed on the Tech 2 above the specified value?	4 V	Go to <i>Step 6</i>	Go to <i>Step 7</i>
5	Check the terminal connection at the EGR pressure sensor and repair or replace terminal if necessary. Is the action complete?	—	Verify repair	—
6	Repair the 5V power circuit (red) harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
7	Repair the signal circuit (blue) harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1405 (Flash DTC 37) EGR EVRV Circuit Open/Short



060RW135

Circuit Description

EGR EVRV Circuit has a common power source in parallel with EGR, VSV, RPCV, and Intake Throttle Motor. This may cause multiple DTCs. On such occasion, refer to “Multiple ECM Information Sensor DTCs Set”.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1405 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the ECM battery feed.

Diagnostic Aids

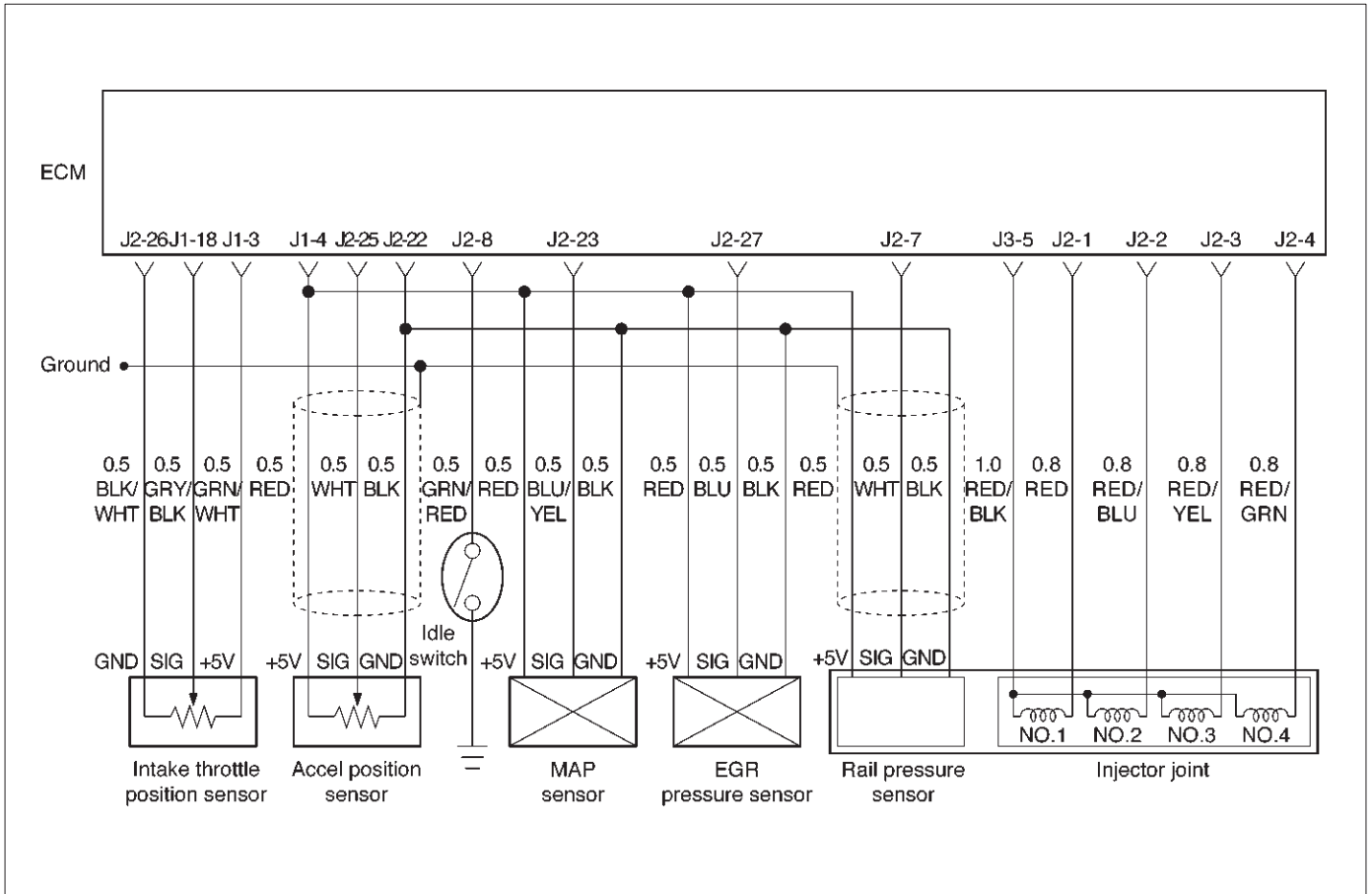
An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P1405 – EGR EVRV Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Review and record Failure Records information. 2. Clear DTC P1405. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P1405 set?	—	Go to Step 3	Refer to <i>Diagnostic Aid</i>
3	1. Ignition "OFF." 2. Disconnect the EVRV. 3. Check for an open or a short to ground in the EVRV circuit between the EVRV connector and the ECM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 4
4	Check the connections at the EVRV and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 5
5	Check the connections at the ECM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 6
6	Replace the EVRV. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0406 (Flash DTC 26) EGR Pressure Sensor High Voltage



060RW134

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage.

Conditions for Clearing the MIL/DTC

- DTC P0404 can be cleared by using the scan tool “Clear Info” function or by disconnecting the ECM battery feed.

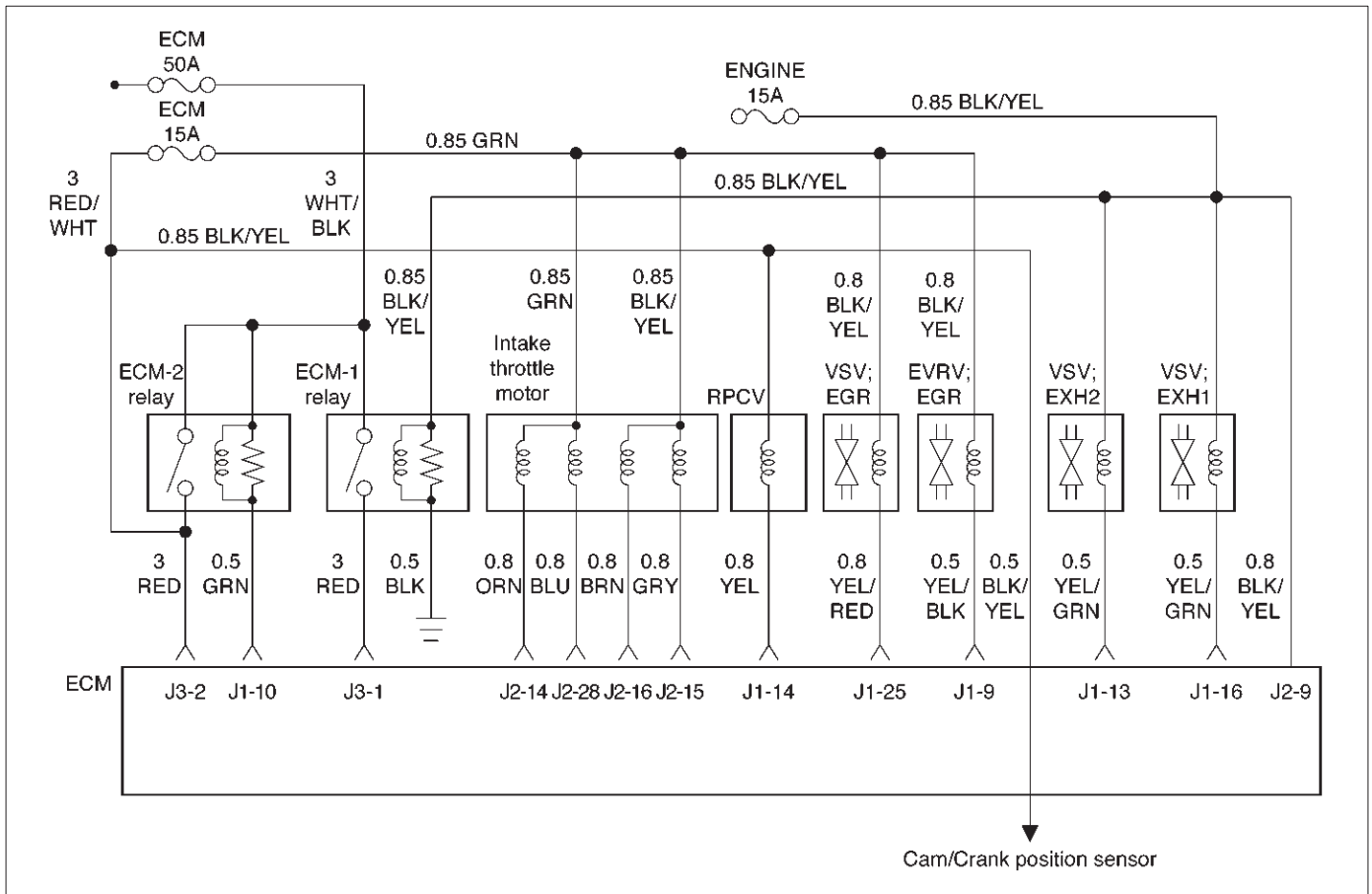
DTC P0406 – EGR Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Put the engine into an idling status. Is the EGR pressure sensor voltage value displayed on the Tech 2 above the specified value?	4 V	Go to Step 3	Go to Step 4
3	1. Turn off the ignition switch. 2. Remove the sensor connector connection. 3. Turn on the ignition switch “ON”. Is the EGR pressure sensor voltage value displayed on the Tech 2 below the specified value?	1 V	Go to Step 5	Go to Step 6

DTC P0406 – EGR Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
4	Is the EGR pressure sensor voltage value displayed on the Tech 2 below the specified value?	1 V	Refer to <i>Chart P0107</i>	Refer to <i>Diagnostic Aids and Symptom Diagnosis</i>
5	Connect the relay and solenoid checker (5-8840-0386-0) to the battery voltage, then check the sensor grounding circuit. Does the checker lamp come on?	—	Go to <i>Step 7</i>	Go to <i>Step 8</i>
6	A voltage short circuit occurs in the MAP signal circuit or this circuit is shorted with the 5V power circuit. Repair the harness or Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—
7	Replace the EGR pressure sensor hose or the EGR pressure sensor. Is the action complete?	—	Verify repair	—
8	Repair the harness for open ground circuit. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0475 (Flash DTC 71) EXH #1 VSV Circuit



060RW135

Circuit Description

EXH. #1, #2 VSV Circuit receives current through Engine 15A fuse, #1 and #2 being connected in parallel.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0475 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

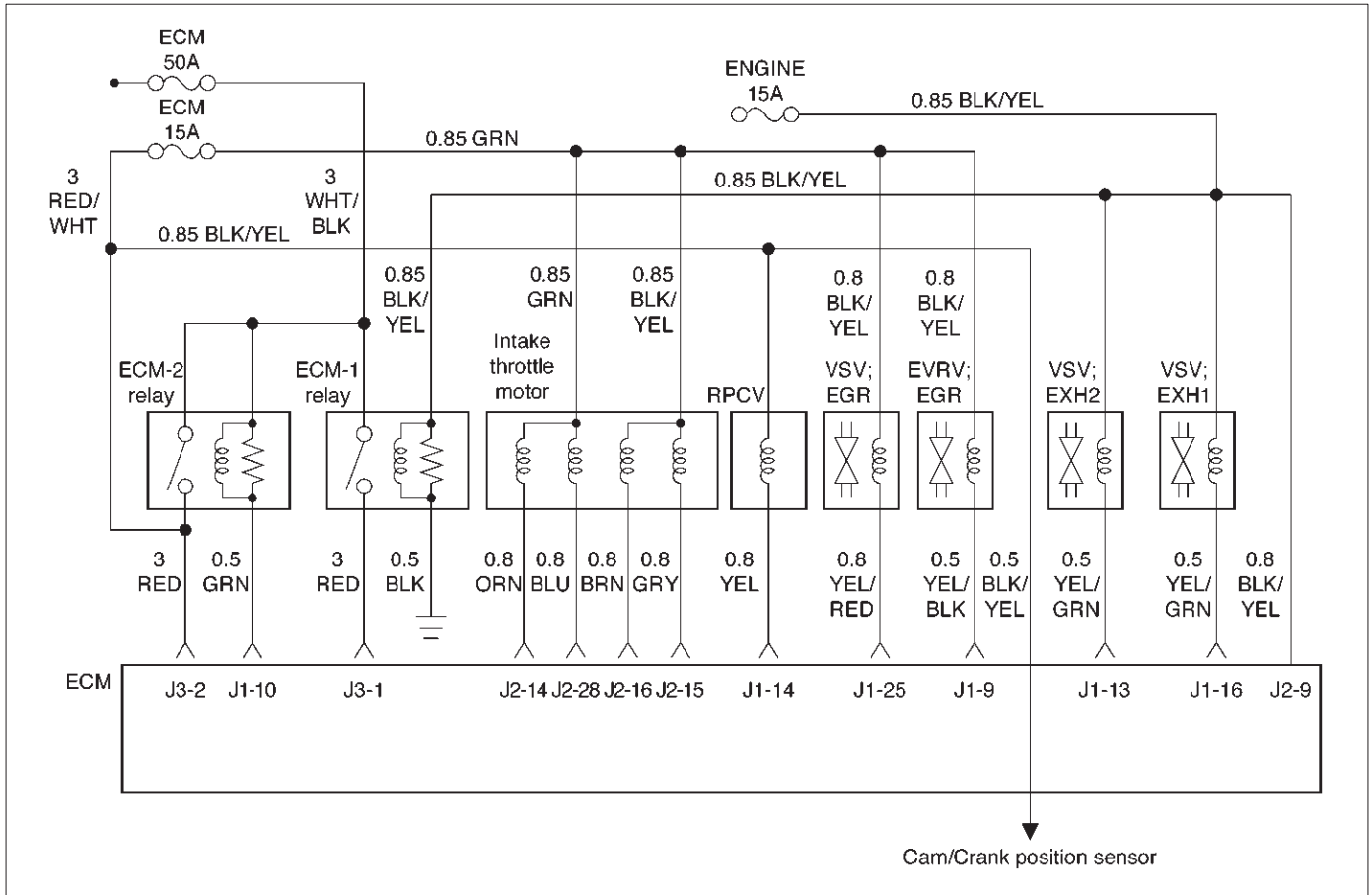
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P0475 – EXH #1 VSV Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “ DTC” info for DTC P0475. Does the Tech 2 indicate DTC P0475 failed this ignition?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	1. Ignition “OFF.” 2. Disconnect the EXH #1 VSV connectors. 3. Check the EXH #1 VSV circuit for a short to ground. Is the EXH #1 VSV circuit shorted to ground?	—	Verify repair	Go to <i>Step 4</i>
4	Replace the EXH #1 VSV. Is the action complete?	—	Verify repair	Go to <i>Step 5</i>
5	1. Ignition “ON,” engine “OFF.” Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “ DTC” info for DTC P0475. Does the Tech 2 indicate DTC P0475 failed this ignition?	—	Go to <i>Step 6</i>	—
6	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1475 (Flash DTC 71) EXH #2 VSV Circuit Open/Short



060RW135

Circuit Description

EXH. #1, #2 VSV Circuit receives current through Engine 15A fuse, #1 and #2 being connected in parallel.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1475 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

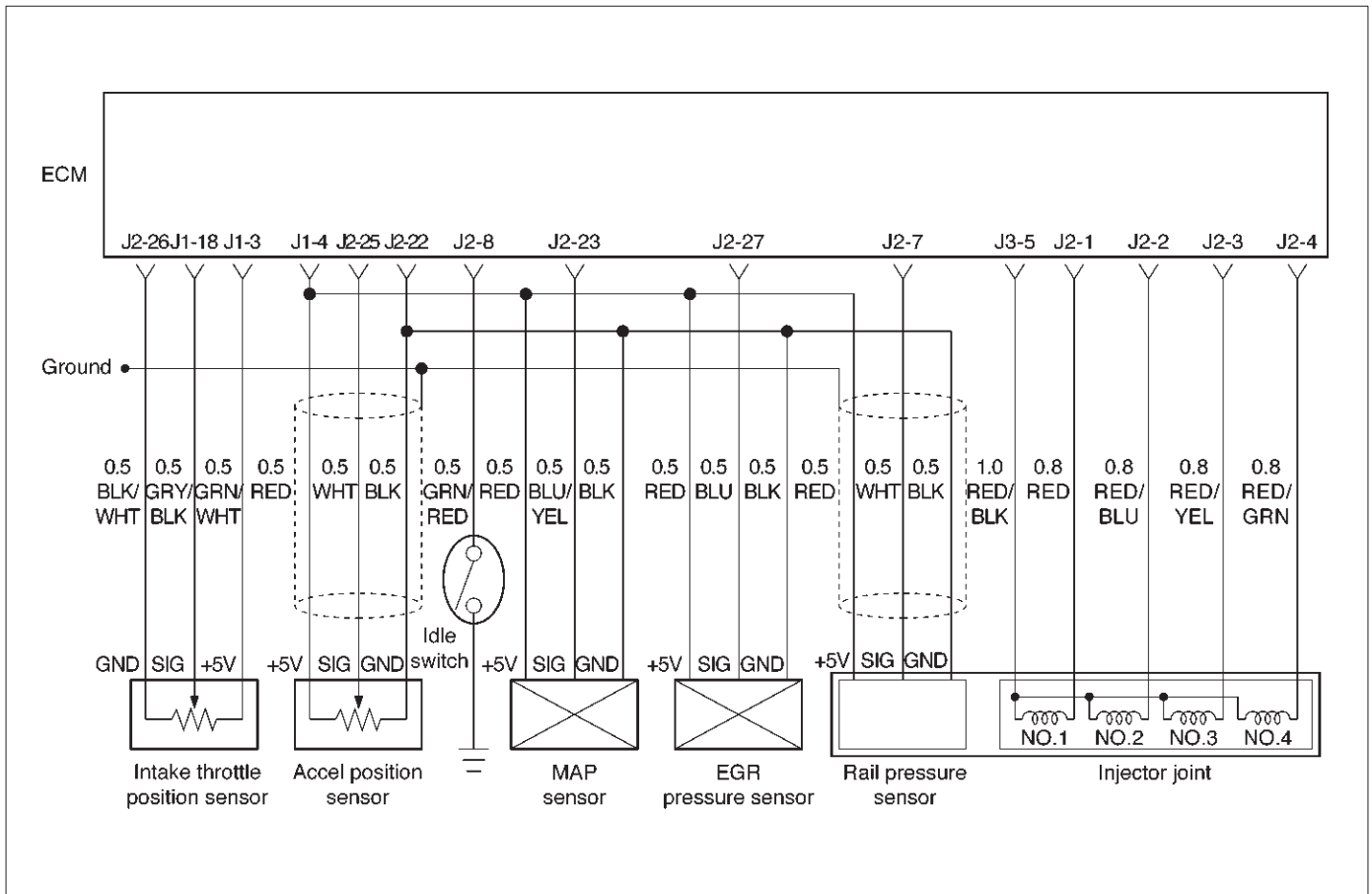
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P1475 – EXH #2 VSV Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “ DTC” info for DTC P1475. Does the Tech 2 indicate DTC P1475 failed this ignition?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	1. Ignition “OFF.” 2. Disconnect the EXH #2 connectors. 3. Check the EXH #2 circuit for a short to ground. Is the EXH #2 circuit shorted to ground?	—	Verify repair	Go to Step 4
4	Replace the EXH #2 VSV. Is the action complete?	—	Verify repair	Go to Step 5
5	1. Ignition “ON,” engine “OFF.” Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “ DTC” info for DTC P1475. Does the Tech 2 indicate DTC P1475 failed this ignition?	—	Go to Step 6	—
6	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1485 (Flash DTC 74) ITP (Intake Throttle Position) Sensor Low Voltage



060RW134

Circuit Description

The intake throttle position (ITP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1485 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the ITP sensor. A change in the display will indicate the location of the fault.

If DTC P1485 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

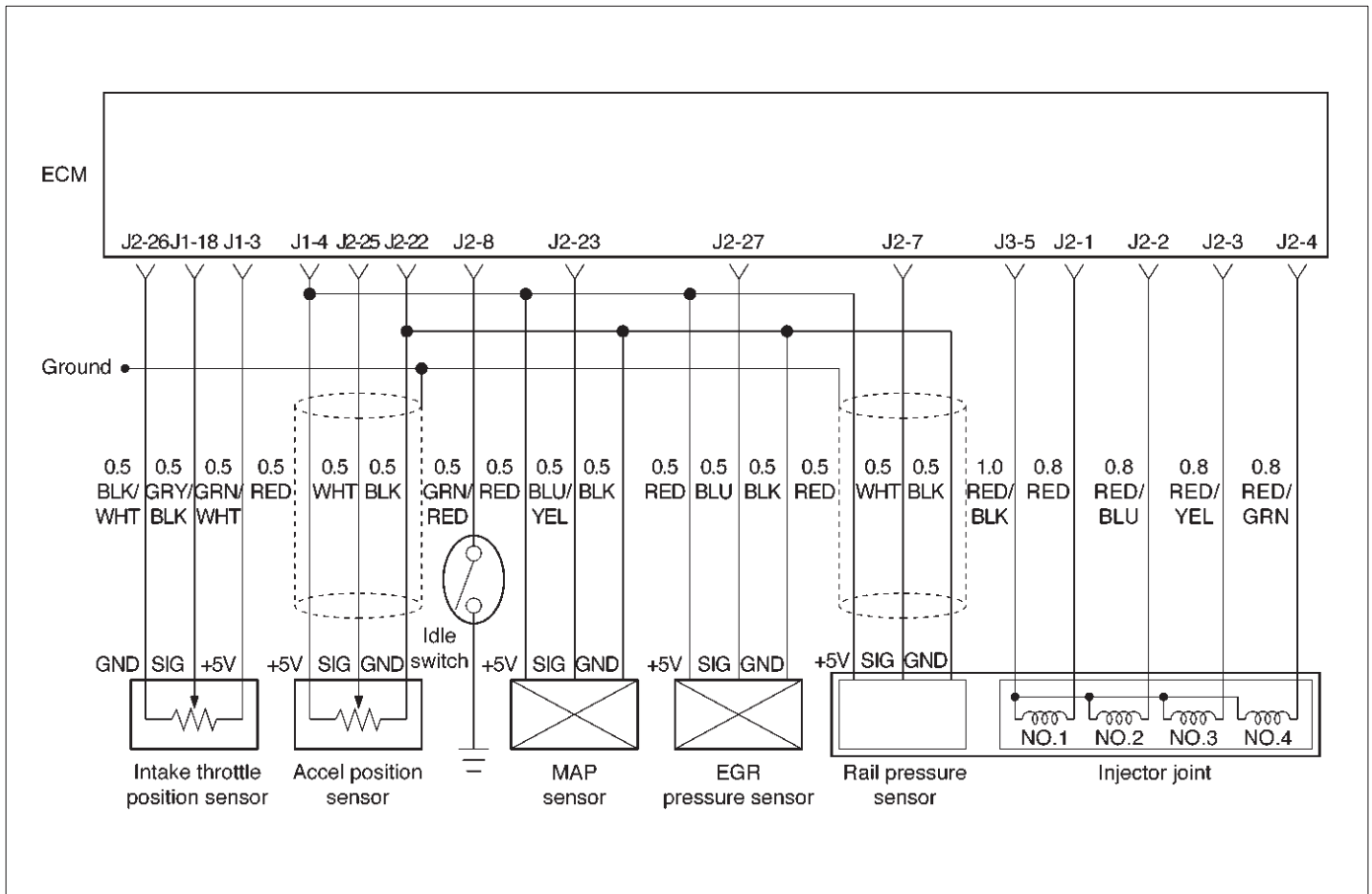
DTC P1485 –ITP Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed by the hand, observe the "ITP Sensor" display on the Tech 2. Is the "ITP Sensor" below the specified value?	0.22 V	Go to Step 4	Go to Step 3

DTC P1485 –ITP Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1485. Does the Tech 2 indicate DTC P1485 failed?	—	Go to Step 4	Refer to Diagnostic Aids
4	Check the ITP sensor signal circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 5
5	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2 monitor the "Specific DTC" info for DTC P1485. Does the Tech 2 indicate DTC P1485 failed?	—	Go to Step 6	Refer to Diagnostic Aids
6	Replace the intake throttle. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1486 (Flash DTC 74) ITP (Intake Throttle Position) Sensor High Voltage



060RW134

Circuit Description

The intake throttle position (ITP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1486 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

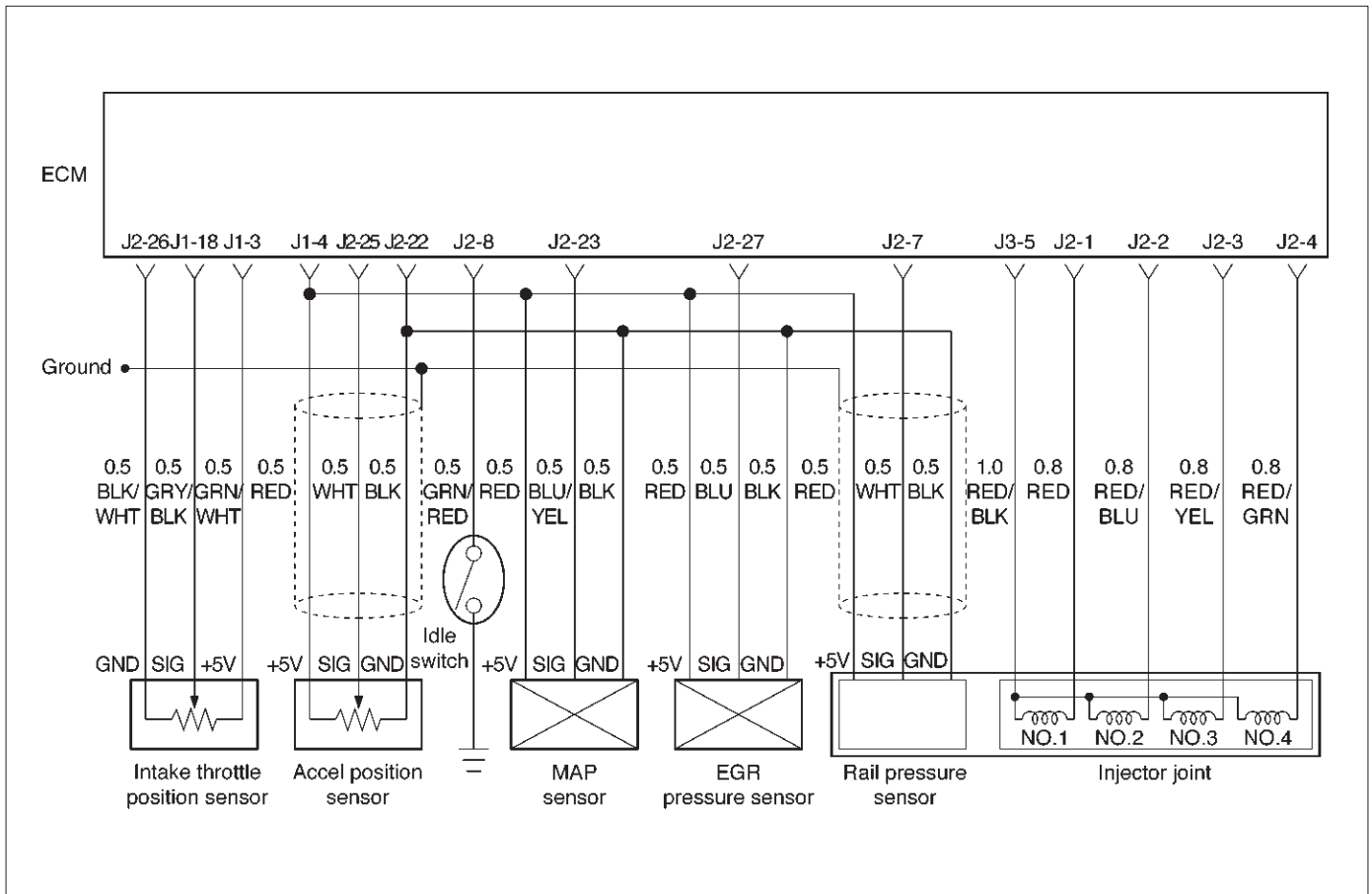
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ITP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.
- Faulty TP sensor – With the ignition key "ON," engine "OFF," observe the TP sensor display on the Tech 2 while slowly depressing the accelerator to wide open throttle.

If DTC P1486 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1486 – ITP Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed by the hand, observe the "ITP Sensor" display on the Tech 2. Is the "ITP Sensor" above the specified value?	4.88 V	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1486. Does the Tech 2 indicate DTC P1486 failed.	—	Go to <i>Step 4</i>	Refer to <i>Diagnostic Aids</i>
4	Check for poor electrical connections at the ITP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to <i>Step 5</i>
5	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2 monitor the "DTC" info for DTC P1486. Does the Tech 2 indicate DTC P1486 failed.	—	Go to <i>Step 6</i>	Refer to <i>Diagnostic Aids</i>
6	Replace the intake throttle. Is the action complete?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1487 (Flash DTC 73) Intake Throttle System Circuit Open/Start



060RW134

Circuit Description

The intake throttle position (ITP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1487 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

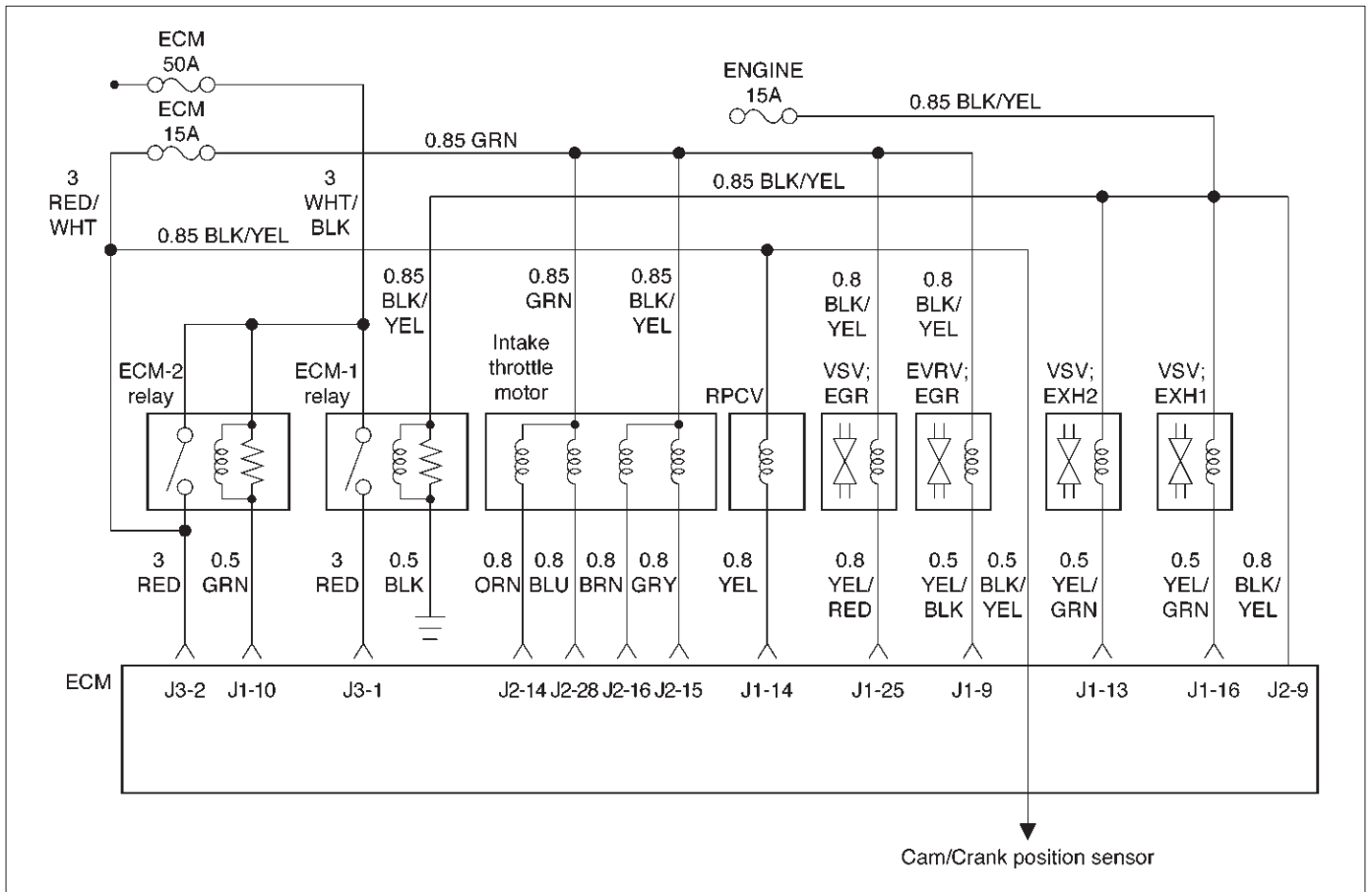
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the ITP sensor. A change in the display will indicate the location of the fault.

If DTC P1487 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1487 – Intake Throttle System Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1487. Does the Tech 2 indicate DTC P1487 failed?	—	Go to Step 3	Refer to <i>Diagnostic Aids</i>
3	Check the ITP circuit for a poor connection at the ECM and ITP and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 4
4	1. Ignition "ON," engine "OFF." 2. Operate the throttle by the hand. Is the action complete?	—	Verify repair	Go to Step 5
5	Replace the ITP Assembly. Is the action complete?	—	Verify repair	Go to Step 6
6	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1488 (Flash DTC 72) Intake Throttle Motor Control Circuit Signal Gap



060RW135

Circuit Description

The Intake throttle position (ITP) sensor circuit provides a voltage signal that changes relative to throttle blade angle.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1488 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

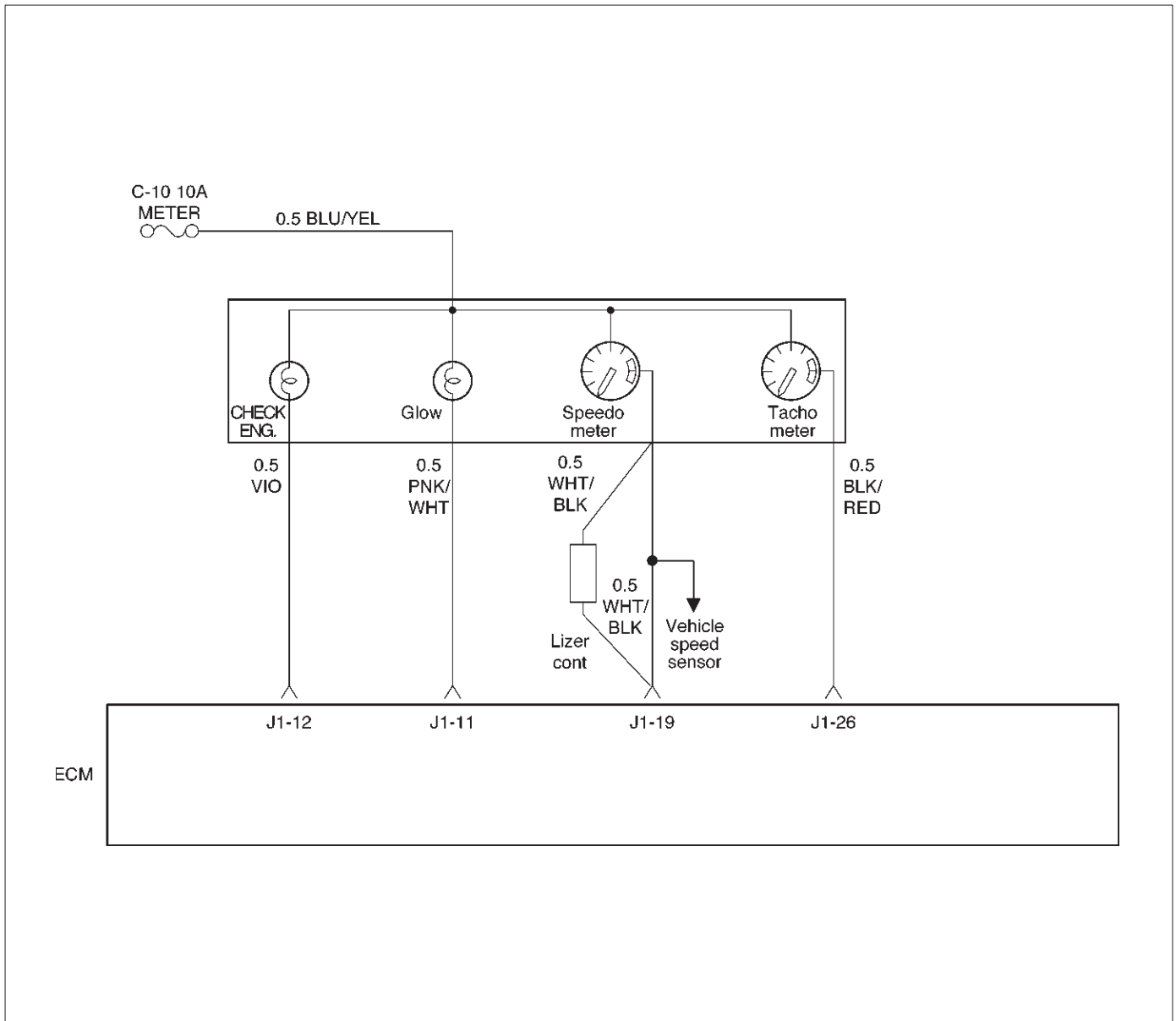
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the ITP sensor. A change in the display will indicate the location of the fault.

If DTC P1488 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1488 – Intake Throttle Motor Control Circuit Signal Gap

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition “ON,” engine “OFF.” 2. With the throttle closed, observe the “ITP Sensor” display on the Tech 2. Is the “ITP Sensor” below the specified value?	0.22 V	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the “Specific DTC” info for DTC P1488. Does the Tech 2 indicate DTC P1488 failed?	—	Go to <i>Step 4</i>	Refer to <i>Diagnostic Aids</i>
4	Check the ITP circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 5</i>
5	Check the Intake throttle motor circuit for a poor connection and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 6</i>
6	Check the ITP Assembly for a poor connection at the TP sensor and fasten the ITP Assembly if necessary. Did the ITP Assembly require repair?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0502 (Flash DTC 24) VSS (Vehicle Speed Sensor) No Signal



060RW136

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit that interacts with the magnetic field created by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the engine control module (ECM) on the reference circuit. The ECM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0502 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

10. To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connected to the engine harness. The green 16-way connector is adjacent to a blue 16-way connector, and it can be easily accessed by removing the air cleaner assembly. The green 16-way connector is separated, and battery voltage is applied to the VSS through the yellow wire at one corner of the connector. The VSS output can be monitored with a DVM connected to the blue wire with a black tracer. The two wires are next to each other in the 16-way connector. The test connections are made on the transmission side of the connector, the side that is not clipped to the body sheetmetal.

11. The speedometer-to-ECM VSS signal wire is spliced to a wire leading to the cruise control module. If a short to ground or voltage is found between the ECM and speedometer, it could be located between the splice and the cruise control module.

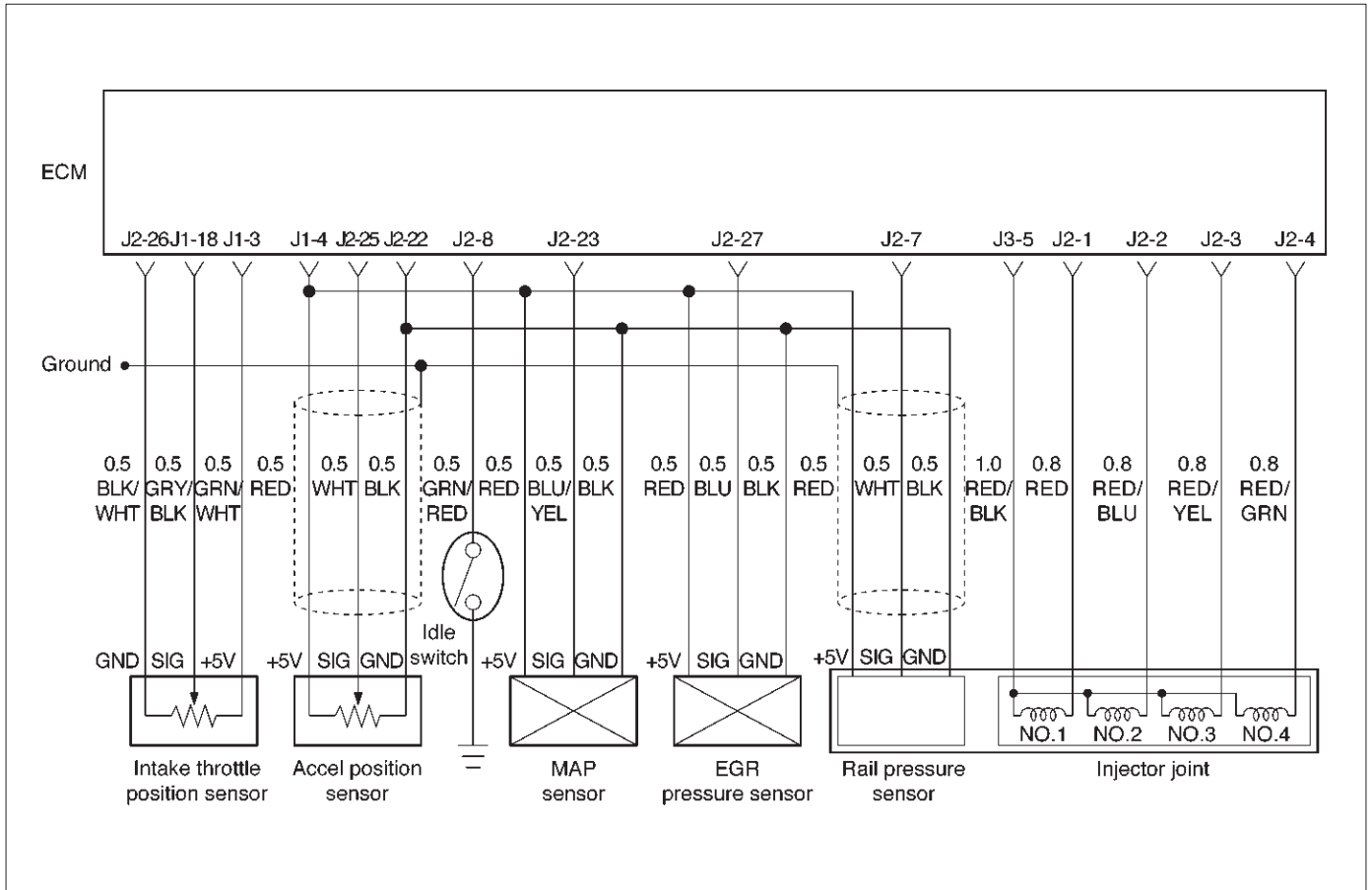
DTC P0502 –VSS No Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Does the speedometer work?	—	Go to Step 10	Go to Step 3
3	1. Disconnect the VSS connector. 2. Ignition “ON.” 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to Step 5	Go to Step 4
4	Repair the sensor ground. Is the action complete?	—	Verify repair	—
5	1. Ignition “ON,” sensor disconnected. 2. Using a DVM, measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to Step 7	Go to Step 6
6	Repair the open or short to ground which may have blown the meter fuse. Is the action complete?	—	Verify repair	—
7	1. Ignition “ON,” VSS disconnected. 2. Using a DVM, measure at the VSS connector between ground and the blue/black wire from the speedometer. Was the measurement near the specified value?	7.5-8 V	Go to Step 9	Go to Step 8
8	Check for an open or short circuit between the speedometer and the VSS. Was an open or short circuit located?	—	Verify repair	Go to Step 9
9	Replace the VSS. Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the speedometer. Is the action complete?	—	Verify repair	Go to Step 11

DTC P0502 –VSS No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open or short between the ECM and the speedometer. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
12	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

**Diagnostic Trouble Code (DTC) P0510 (Flash DTC 75)
Idle SW Malfunction, Open Circuit**



060RW134

Circuit Description

The idle switch signal is used by the Engine Control Module ECM for fuel control.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0510 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

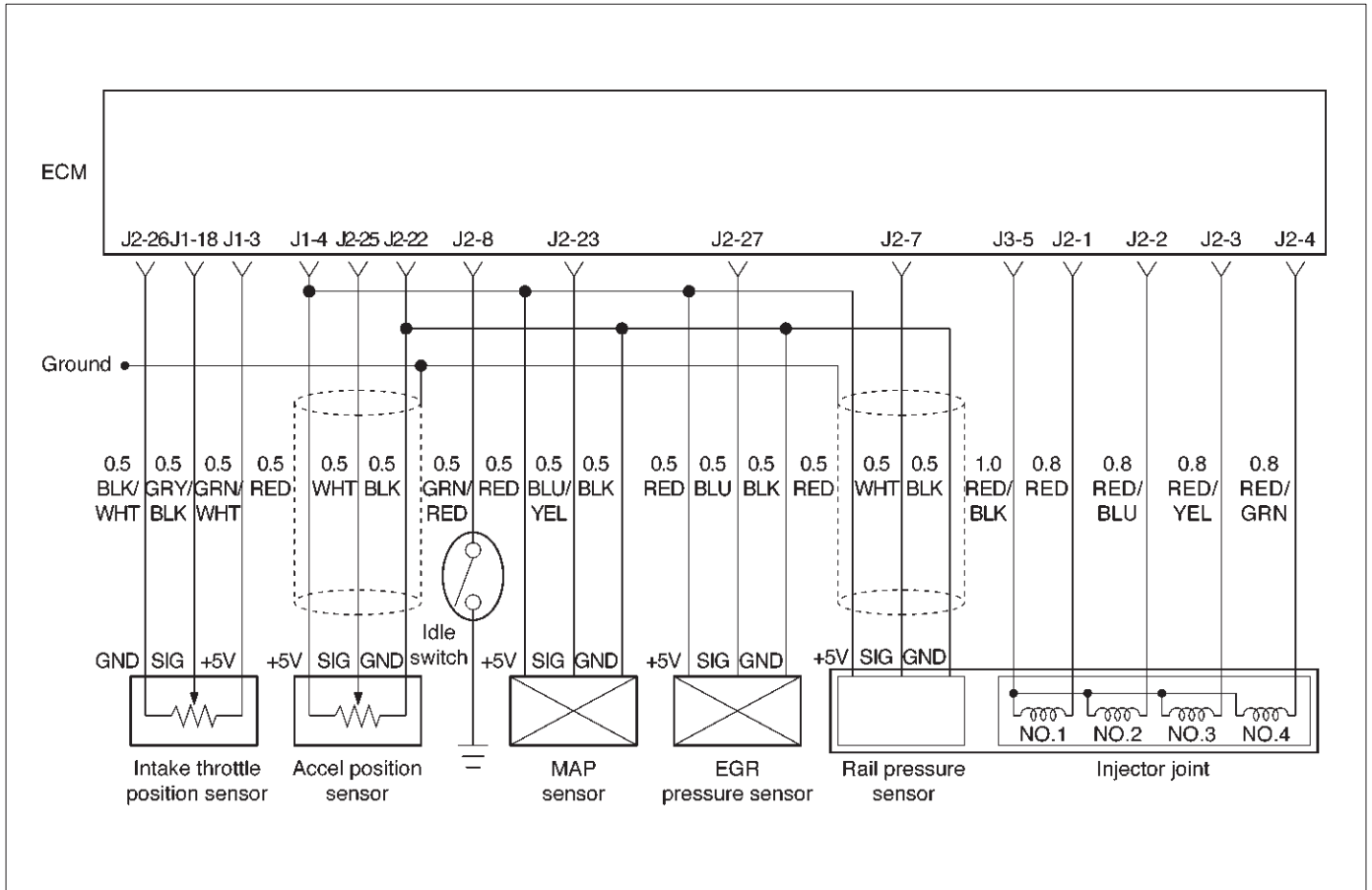
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Idle SW display on the Tech 2 while moving connectors and wiring harnesses related to the Idle SW.

If DTC P0510 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P0510 – Idle SW Malfunction, Open Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0510. Does the Tech 2 indicate DTC P0510 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
3	Check the Idle SW circuit for a poor connection and repair the terminal if necessary. Did the terminal require repair?	—	Verify repair	Go to Step 4
4	1. Ignition "ON." 2. Operate the accel pedal, and check the data list "ON OFF" on the Tech 2. Is the data list correct?	—	Verify repair	Go to Step 5
5	Replace the Idle SW. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1510 (Flash DTC 75) Idle SW Malfunction Short Circuit



060RW134

Circuit Description

The idle switch signal is used by the Engine Control Module ECM for fuel control.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1510 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Idle SW display on the Tech 2 while moving connectors and wiring harnesses related to the Idle SW.

If DTC P0122 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1510 – Idle SW Malfunction, Short Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1510. Does the Tech 2 indicate DTC P1510 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
3	Check the Idle SW circuit for a poor connection and repair the terminal if necessary. Did the terminal require repair?	—	Verify repair	Go to Step 4
4	1. Ignition "ON." 2. Operate the accel pedal, and check the data list "ON OFF" on the Tech 2. Is the data list correct?	—	Verify repair	Go to Step 5
5	Replace the Idle SW. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0562 (Flash DTC 35) System Voltage Too Low

Circuit Description

The engine control module (ECM) monitors the system voltage on the ignition feed terminals to the ECM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Action Taken When the DTC Sets

- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store as Failure Records only conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- DTC P0563 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or defective accessory.

DTC P0562 – System Voltage Too Low

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to Step 3	Charge battery, then go to Step 3
3	1. Install a Tech 2. 2. Select "Ignition Volts" on the Tech 2. 3. Start the engine and raise the engine speed to the specified value. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	2000 RPM 12.8-14.1 V	Go to Step 4	Go to <i>Starting/Charging</i>
4	1. Ignition "OFF." 2. Disconnect the ECM connector at the ECM. 3. Using a DVM, measure the battery voltage at the ECM connector. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition "OFF," engine "OFF."	Go to Step 5
5	1. Check for faulty connections at the ECM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to Step 6
6	Check for an open battery feed circuit to the ECM. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1562 (Flash DTC 35) System Voltage Too Low at Cranking

Circuit Description

The engine control module (ECM) monitors the system voltage on the ignition feed terminals to the ECM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) at the first time of the fault is detected.

Conditions for Clearing the MIL/DTC

- DTC P0563 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

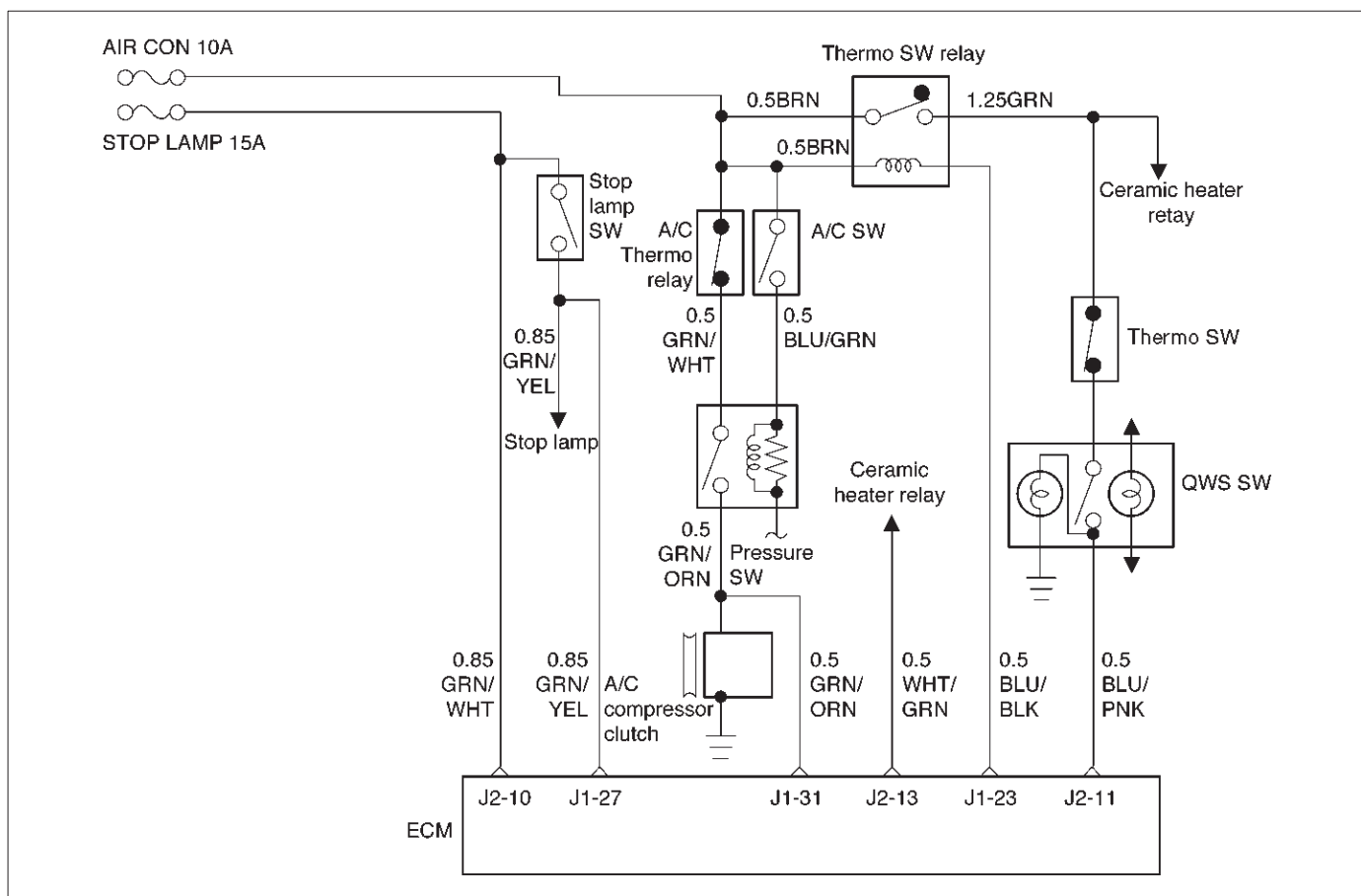
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or defective accessory.

DTC P1562 – System Voltage Too Low at Cranking

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage less than the specified value?	11.5 V	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage less than the specified value?	11.5 V	Replace battery	Go to <i>Step 4</i>
4	1. Turn "OFF" all the accessories. 2. Install a Tech 2. 3. Select the ignition voltage parameter on the Tech 2. 4. Start the engine and raise the engine RPM to the specified value. Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3?	2000 RPM	Go to <i>Starting/Charging</i>	Go to <i>Step 5</i>
5	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1587 (Flash DTC 25) Brake SW Malfunction



060RW130

Circuit Description

Brake Stop Lamp SW Circuit receives through Stop Lamp 10A fuse from the battery.

Action Taken When the DTC Sets

- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1587 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

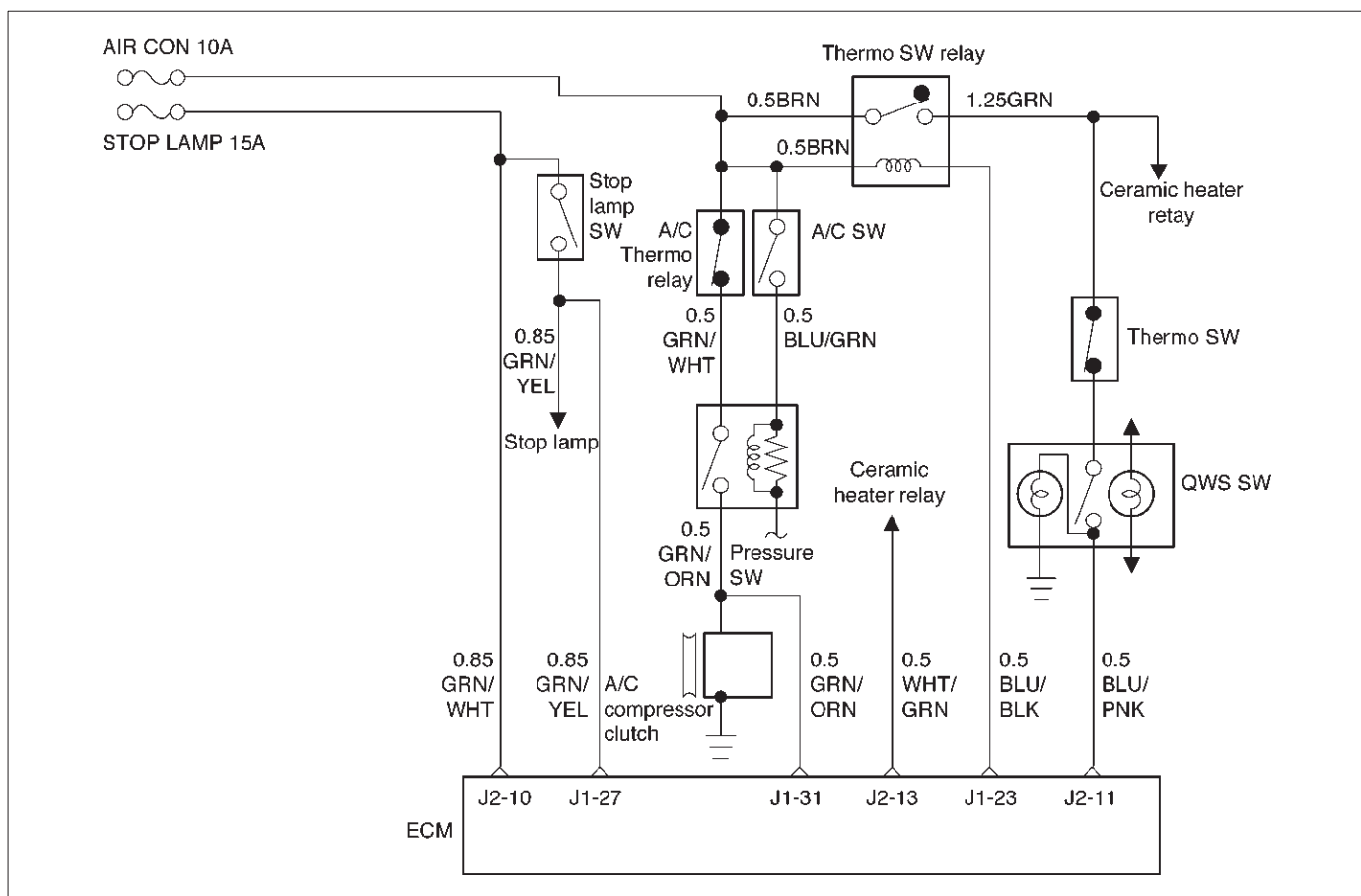
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Brake SW display on the Tech 2 while moving connectors and wiring harnesses related to the Brake SW. A change in the display will indicate the location of the fault.

If DTC P1587 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1587 – Brake SW Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1587. Does the Tech 2 indicate DTC P1587 failed?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	Check the Brake SW circuit for a poor connection and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 4</i>
4	Replace the Brake SW. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1588 (Flash DTC 25) Brake SW Malfunction



060RW130

Circuit Description

Brake Stop Lamp SW Circuit receives through Stop Lamp 10A fuse from the battery.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1588 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Brake SW display on the Tech 2 while moving connectors and wiring harnesses related to the Brake SW. A change in the display will indicate the location of the fault.

If DTC P1588 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1588 – Brake SW Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1588. Does the Tech 2 indicate DTC P1588 failed?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	Check the Brake SW circuit for a poor connection and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 4</i>
4	Replace the Brake SW. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0601 (Flash DTC 55) ECM Checksum Error

Action Taken When the DTC Sets

- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- DTC P0601 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

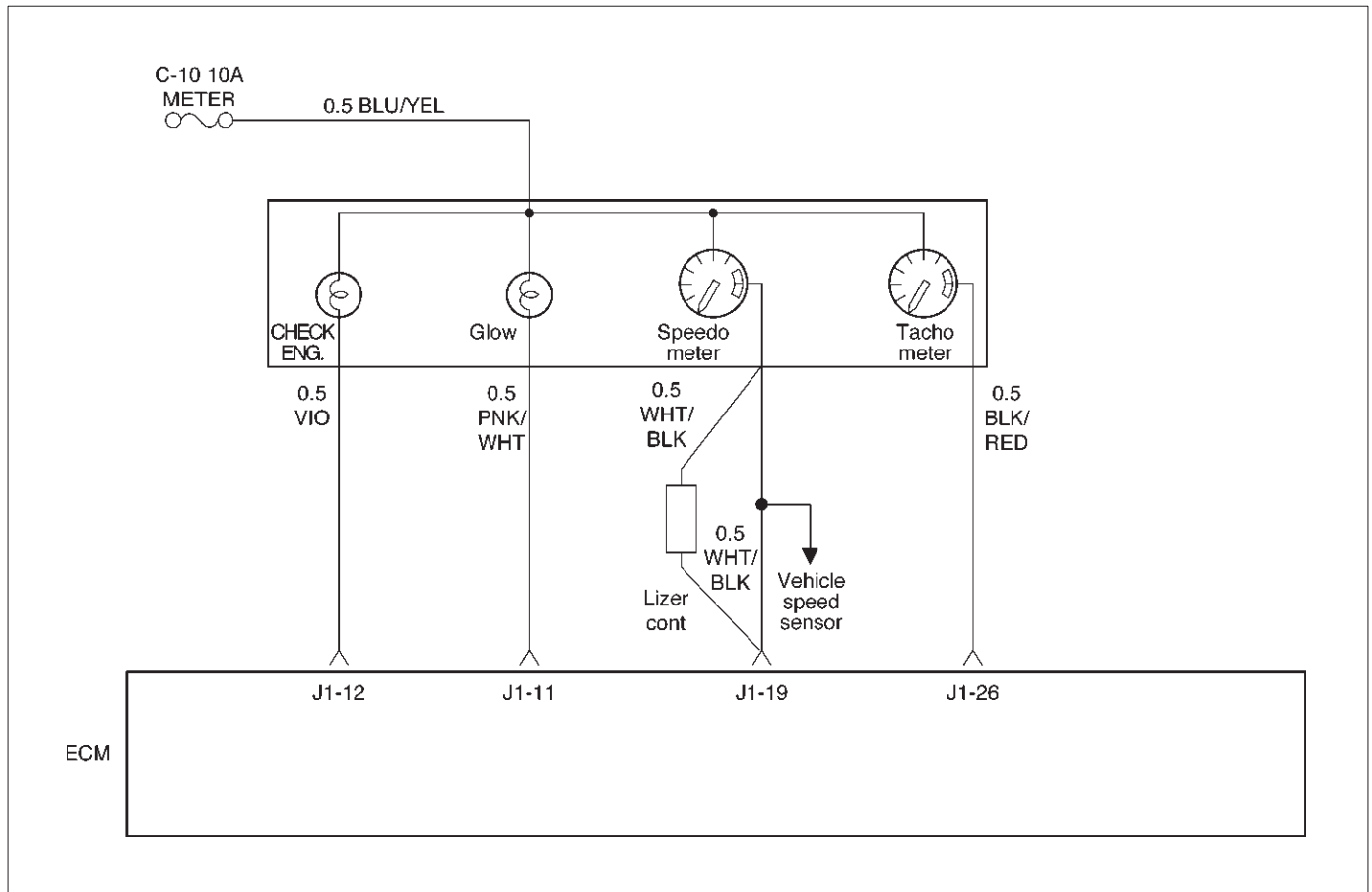
Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the ECM was programmed. The only possible repair is ECM replacement. Remember to program the replacement ECM with the correct software and calibration for the vehicle.

DTC P0601 – ECM Checksum Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0650 (Flash DTC 77) Check Engine Lamp Circuit Open/Short



060RW136

Circuit Description

The check engine lamp circuit receives through Meter 10A fuse the battery, current flowing in the order of Meter and check engine lamp.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0650 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

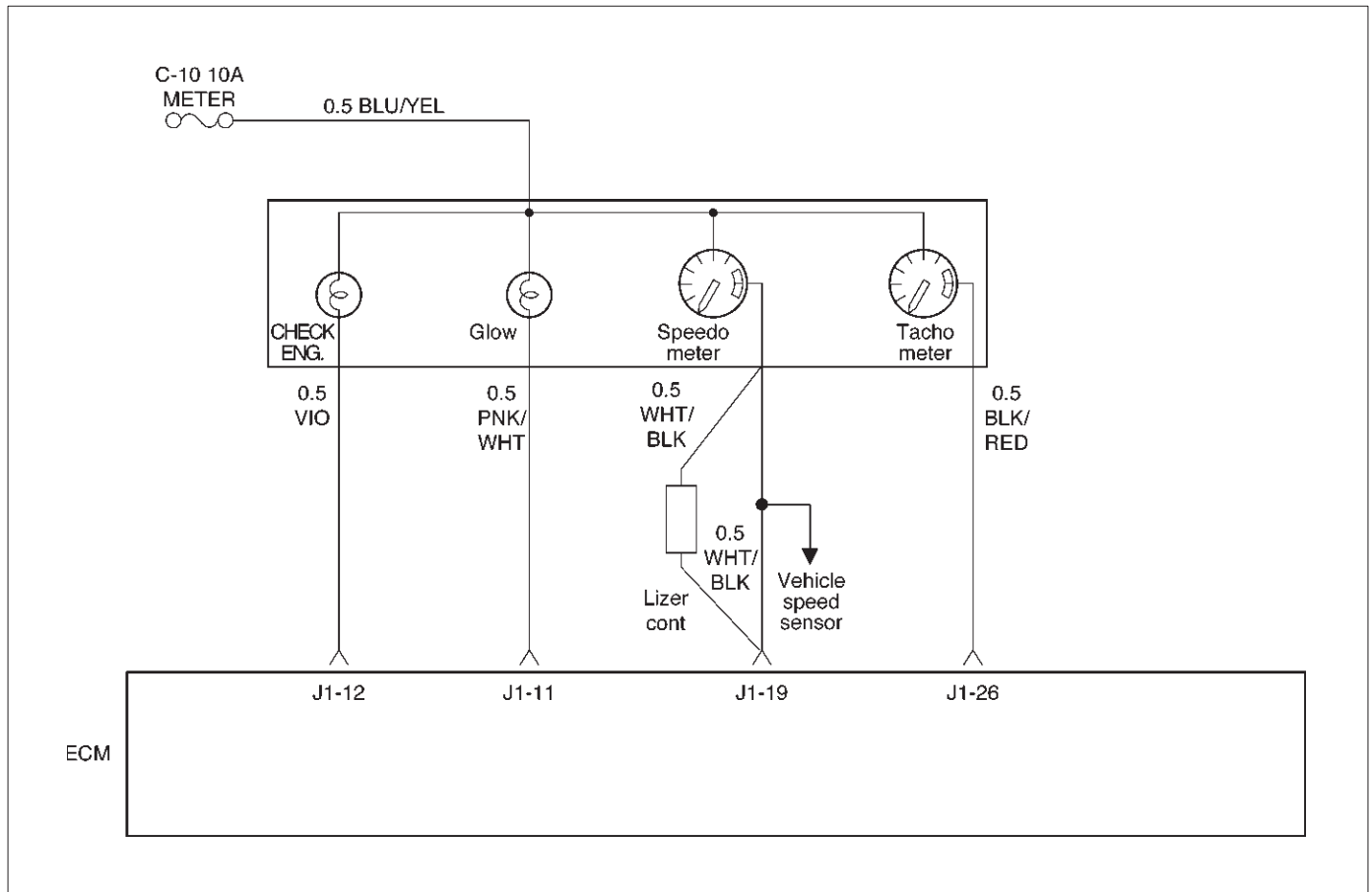
- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the lamp test display on the Tech 2 while moving connectors and wiring harnesses related to the check engine lamp. A change in the display will indicate the location of the fault.

If the Tech 2 indicate DTCs P0650 and P0381, check the meter circuit necessarily.

DTC P0650 – Check Engine Lamp Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Lamp Test" display on the Tech 2. Is the "Lamp Test" operating?	—	Refer to <i>Diagnostic Aids</i>	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0650. 5. If the Tech 2 indicate DTCs P0650 and P0381, check the meter circuit necessarily. Does the Tech 2 indicate DTC P0650 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	Check the Check Engine Lamp circuit for a poor connection at the Meter and replace the bulb if necessary. Did the bulb require replacement?	—	Verify repair	Go to Step 5
5	Using the Tech 2. Does the Tech 2 indicate DTC P0650 failed?	—	Go to Step 6	—
6	Check the Meter circuit for a poor connection. Did the Meter require repair?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0654 (Flash DTC 27) Tachometer Circuit Open/Short



060RW136

Circuit Description

The Tach Meter circuit receives through Meter 10A fuse from the battery, current flowing in the order of Meter and the Tach Meter.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0650 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

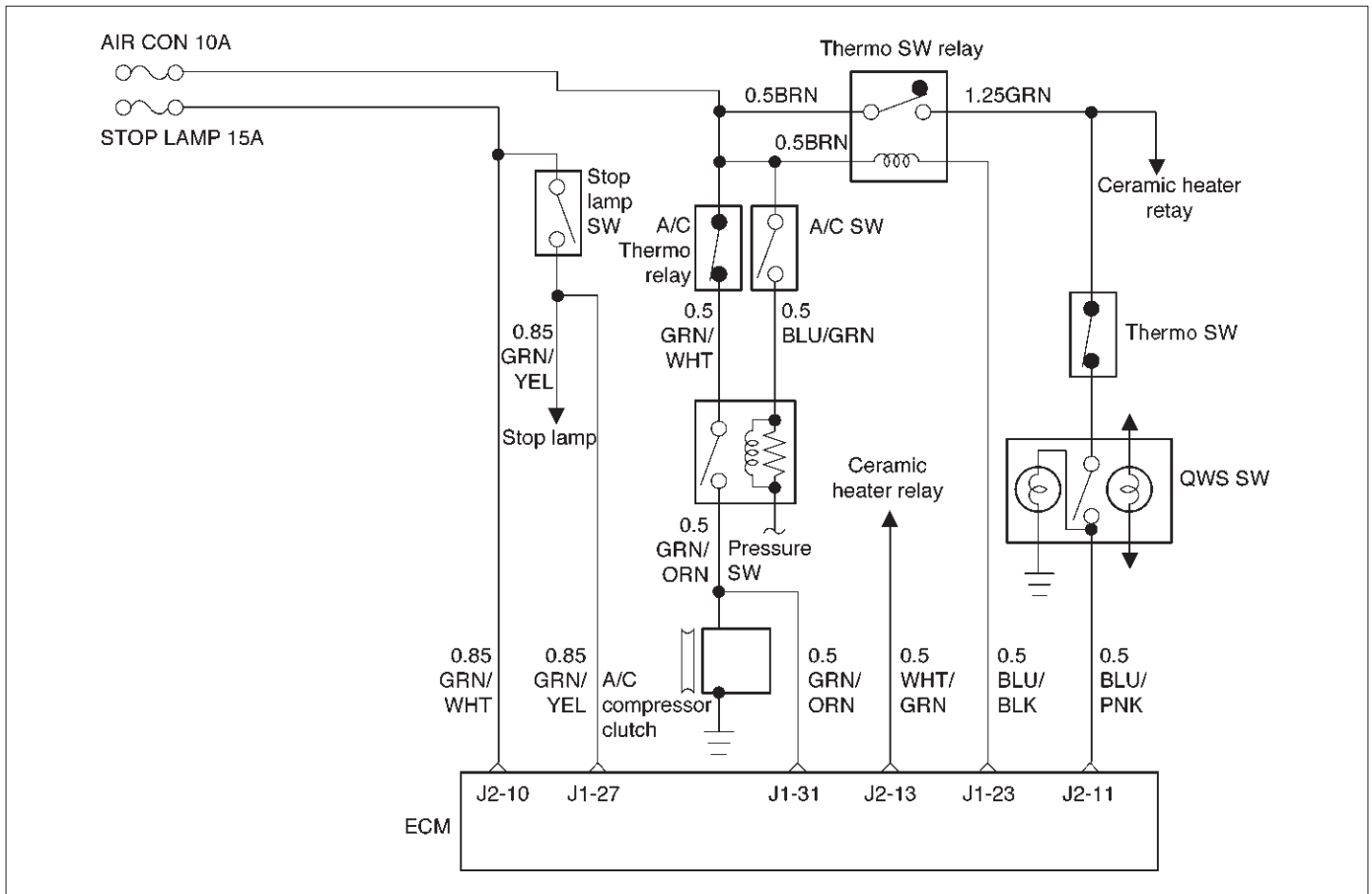
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- If the Tech 2 indicat DTCs 0654, P0650 and P0381, Check the meter circuit necessarily.

DTC P0654 – Tachometer Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P654. Does the Tech 2 indicate DTC P0654 failed?	—	Go to <i>Step 3</i>	Refer to <i>Diagnostic Aids</i>
3	Check the Tach meter circuit for a poor connection at the Meter and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 4</i>
4	Using the Tech 2. Does the Tech 2 indicate DTC P0654 failed?	—	Verify repair	Go to <i>Step 5</i>
5	Check the Tach Meter circuit for a poor connection. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 6</i>
6	Replace the tachometer. Is the action complete?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1655 (Flash DTC 17) Thermo Relay Circuit Open/Short



060RW130

Circuit Description

The thermo relay circuit receives current through air con 10A fuse from the battery, current flowing in the order of the thermo relay and thermo SW.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1655 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

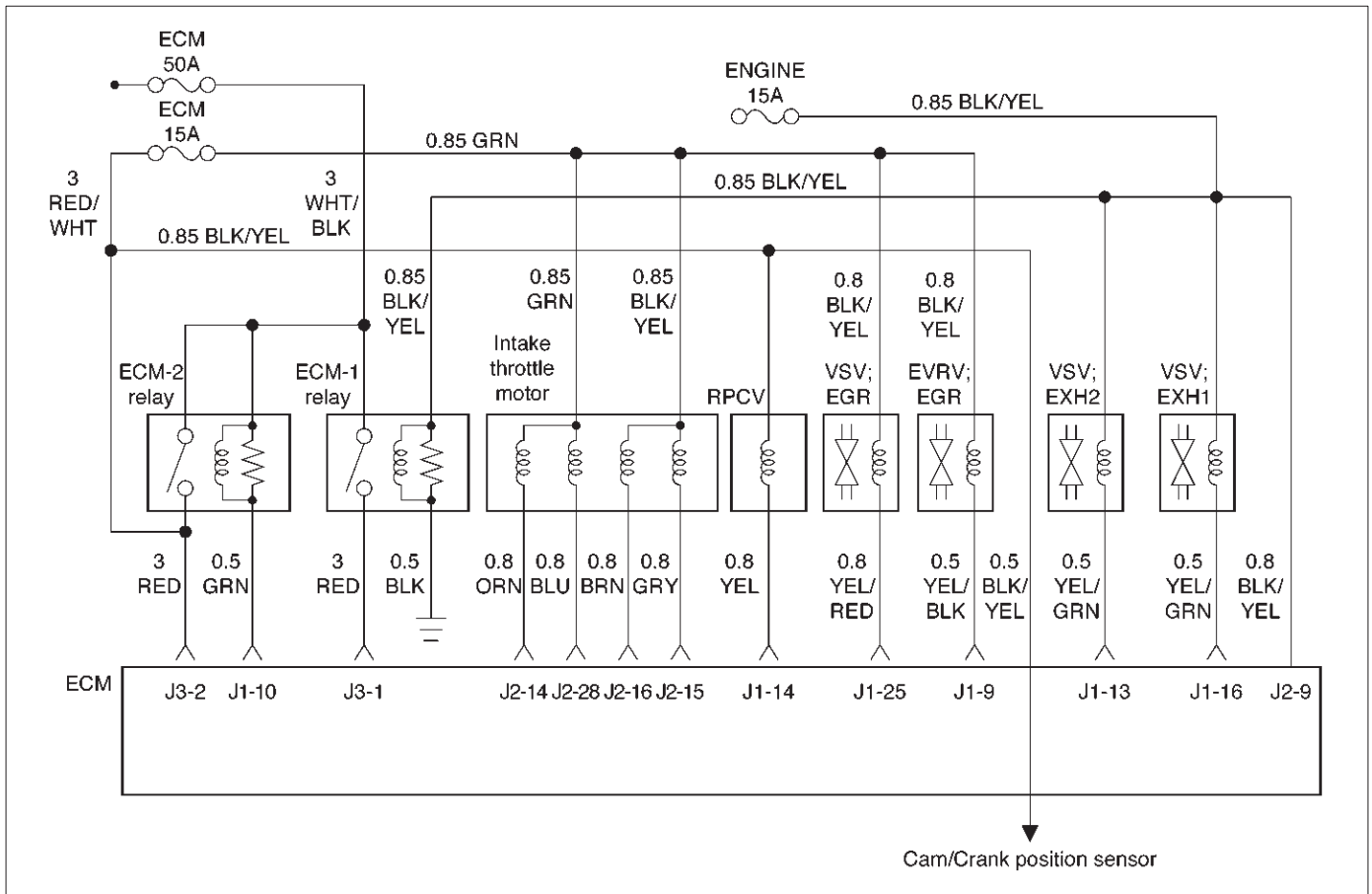
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P1655 – Thermo Relay Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Ignition "ON," engine "OFF." 2. Observe the "Batteri Voltage" display on the Tech 2. Is the "Batteri Voltage" below the specified value?	11 V	Go to Step 4	Go to Step 3
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "Specific DTC" info for DTC P1655. Does the Tech 2 indicate DTC P1655 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	Check the Thermo Relay circuit for a poor connection and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 5
5	Check the Thermo Relay for damage. Did the Thermo Relay require replacement?	—	Verify repair	Go to Step 6
6	Check the Thermo Relay circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 7
7	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1657 (Flash DTC 76) ECM Main Relay Circuit Open/Short



060RW135

Circuit Description

The ECM main relay circuit receives current through ECM 50A fuse from the battery, current flowing in the order of the ECM main relay and ECM.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1657 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the ECM battery feed.

Diagnostic Aids

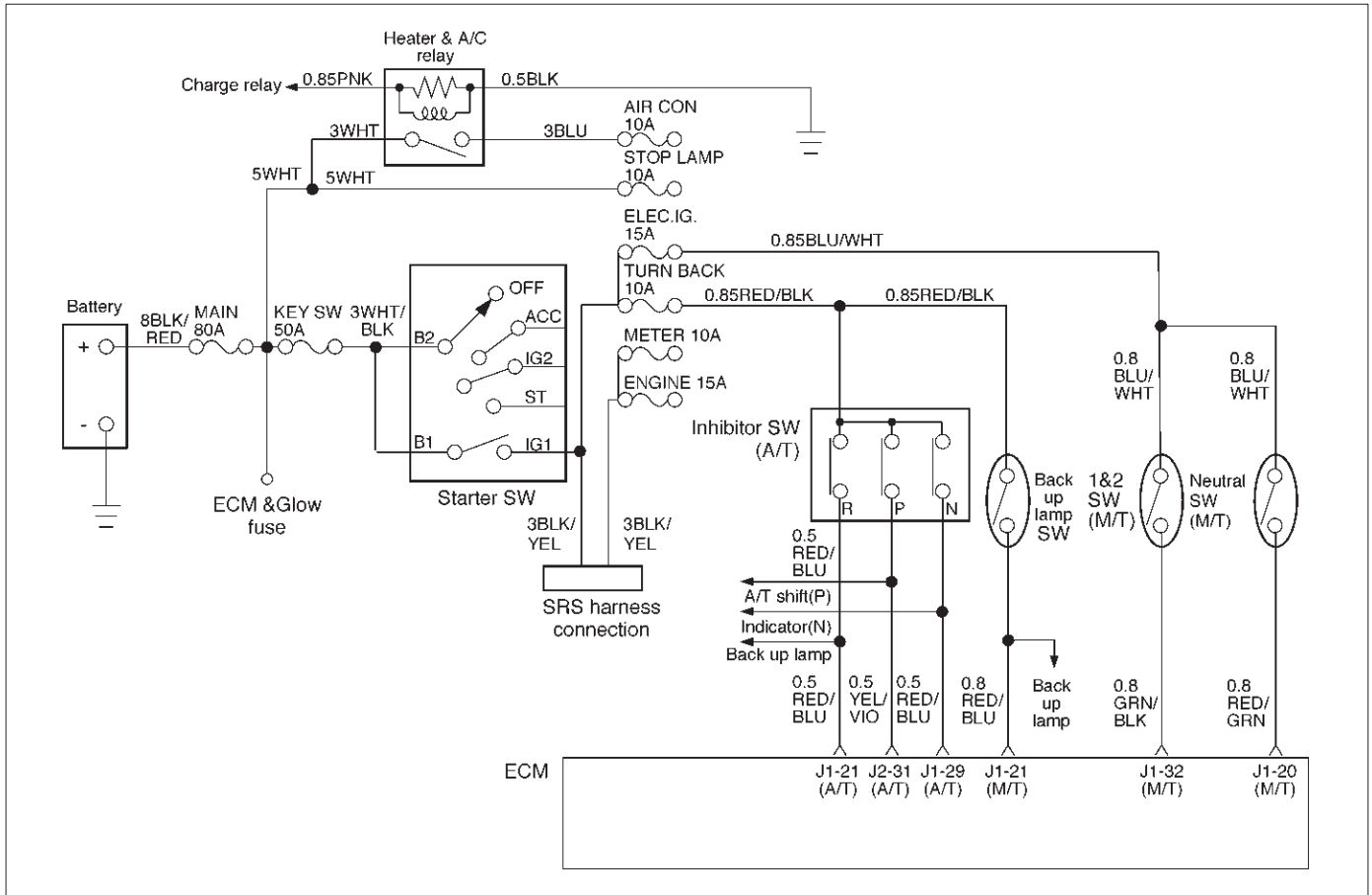
Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.

DTC P1657 – ECM Main Relay Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Check the Fuse 50A-ECM and 15A-Eng. 2. If the Fuse is open, replace it as necessary. Was the Fuse open?	—	Verify repair	Go to Step 3
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the “DTC” info for DTC P1657. Does the Tech 2 indicate DTC P1657 failed?	—	Go to Step 4	Refer to <i>Diagnostic Aids</i>
4	Check the ECM Main Relay circuit between the Fuse and the ECM Main Relay for a poor connection and repair the terminal if necessary. Did the terminal require repair?	—	Verify repair	Go to Step 5
5	Check the ECM Main Relay for a damage and Replace the ECM (Refer to the Data Programming in Case of ECM change) Main Relay if necessary. Did the ECM Main Relay require replacement?	—	Verify repair	Go to Step 6
6	Check the ECM Main Relay circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 7
7	Check the ECM Main Relay Ground circuit for a poor connection and repair the terminal if necessary. Did the terminal require repair?	—	Verify repair	Go to Step 8
8	Check the ECM Main Relay power circuit for a poor connection and repair the terminal if necessary. Did the terminal require repair?	—	Verify repair	Go to Step 9
9	Replace the ECM (Refer to the Data Programming in Case of ECM change) Main Relay. Is the action complete?	—	Verify repair	Go to Step 10
10	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1589 (Flash DTC 47) Transmission SW Circuit Open/Short



060RW131

Circuit Description

The transmission SW circuit receives current through ELEC IG 10A fuse from the battery, current flowing in the order of the transmission SW and ECM.

Action Taken When the DTC Sets

- The ECM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P1589 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If DTC P1589 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

DTC P1589 – Transmission Circuit Open/Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check the Fuse 10A for an open circuit and replace the Fuse if necessary. Did the Fuse require replacement?	—	Verify repair	Go to Step 3

DTC P1589 – Transmission Circuit Open/Short (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P1589. Does the Tech 2 indicate DTC P1589 failed?	—	Go to <i>Step 4</i> (A/T) Go to <i>Step 6</i> (M/T)	Refer to <i>Diagnostic Aids</i>
4	Check the Indicator Lamp correct indicated for a correct indication on the Meter. (A/T only) Did the Indicator Lamp correct indicated?	—	Go to <i>Step 5</i>	Go to <i>Step 8</i>
5	Check the Trans Mission SW signal circuit for a poor connection at the ECM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 8</i>
6	Check the Trans Mission SW circuit for a poor connection at the Trans Mission SW and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to <i>Step 7</i>
7	Replace the Trans Mission SW. Is the action complete?	—	Verify repair	Go to <i>Step 8</i>
8	Replace the ECM (Refer to the Data Programming in Case of ECM change). Is the action complete?	—	Verify repair	—

Symptom Diagnosis

Preliminary Checks

Before using this section, perform the “On-Board Diagnostic (OBD) System Check” and verify all of the following items:

- The powertrain control module (ECM) and malfunction indicator lamp (MIL) (CHECK ENGINE lamp) are operating correctly.
- There are no DTC(s) stored.
- Tech-2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- ECM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the “Vehicle Emission Control Information” label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Injector wires for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

Intermittents

IMPORTANT: An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a Digital Multimeter (5-8840-0285-0) connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a scan tool to help detect intermittent conditions. The scan tools have several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Tech-2 “Freeze Frame” buffer or “Failure Records” buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (CHECK ENGINE lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned “OFF.” If not, the ECM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (CHECK ENGINE lamp) with no stored DTC may be caused by the following:

- MIL (CHECK ENGINE lamp) wire to ECM shorted to ground.
- Poor ECM grounds. Refer to the ECM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *ECM Connector Symptom* tables.

Hard Start Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls.</p> <p>Was the “On-Board Diagnostic (OBD) System Check” performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search.</p> <p>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect the scan tool. With the ignition “ON” and the engine not running, compare engine coolant temperature to manifold air temperature.</p> <p>Are ECT and MAT within the specified value of each other?</p>	$\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$)	Go to <i>Step 8</i>	Go to <i>Step 5</i>
5	<p>1. Using Tech–2, display the engine coolant temperature and note the value.</p> <p>2. Check the resistance of the engine coolant temperature sensor.</p> <p>3. Refer to <i>Engine Coolant Temperature Sensor Temperature vs. Resistance</i> chart on <i>DTC P0118 Diagnostic Support</i> for resistance specifications.</p> <p>Is the resistance value near the resistance for the temperature noted?</p>	—	Go to <i>Step 7</i>	Go to <i>Step 6</i>
6	<p>Replace the ECT sensor.</p> <p>Is the action complete?</p>	—	Verify repair	—
7	<p>Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground.</p> <p>Is the action complete?</p>	—	Verify repair	—
8	<p>1. Injector Test Operate the each injector by Tech 2 with the ignition “ON” and check if the working noise confirm.</p> <p>2. If a problem is found, check the harness or replace the injector.</p> <p>Is the action complete?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>Check the oil rail pressure by Tech 2 at the cranking.</p> <p>Is the pressure near the specified value?</p>	Less than 3 MPa	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	<p>Check the oil leakage on the high oil pressure line. If the oil leakage is found, repair as necessary.</p> <p>Was the oil leakage found?</p>	—	Verify repair	Go to <i>Step 11</i>
11	<p>1. Check for water-or alcohol-contaminated fuel.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 12</i>

Hard Start Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Check the battery voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 13</i>
13	1. Check for the following engine mechanical problems (Refer to <i>Engine Mechanical</i>): <ul style="list-style-type: none"> ● Low compression ● Leaking cylinder head gaskets ● Worn or incorrect camshaft ● Camshaft drive belt slipped or stripped 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 14</i>
14	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech-2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Surges and/or Chuggles Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.</p> <p>Was the “On-Board Diagnostic (OBD) System Check” performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner’s manual. Inform the customer how the TCC and the A/C clutch operate.</p> <p>Is the customer experiencing a normal condition?</p>	—	System OK	Go to <i>Step 5</i>
5	<p>1. Check the priming pump. Refer to <i>Fuel System</i>. 2. If a problem is found, operate the priming pump.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<p>1. Injector Test Operate the each injector by Tech 2 with the ignition “ON” and check if the working noise confirm.</p> <p>2. If a problem is found, check the harness and repair as necessary.</p> <p>Is the action complete?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Check ECM grounds for the cleanliness, tightness and proper locations. Refer to the ECM wiring diagrams in <i>Electrical Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check AP sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to <i>Electrical Diagnosis</i> for wiring repair procedures.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the “Vehicle Emission Control Information” label. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the exhaust system for possible restriction: <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. ● Check for a possible plugged catalytic converter by checking the exhaust system back pressure. Refer to <i>Restricted Exhaust System Check</i>. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lack of Power, Sluggish or Spongy Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way.</p> <p>Was the “On-Board Diagnostic (OBD) System Check” performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Remove and check the air filter element for dirt or restrictions. Refer to <i>Air Intake System</i> in <i>On-Vehicle Service</i>. 2. Replace the air filter element if necessary.</p> <p>Was a repair required?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Check AP sensor system. Refer to <i>AP sensor diagnostic</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<p>1. Check for water-or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Using a Tech 2, Injector test. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check the ECM grounds for the cleanliness, tightness and proper locations. Refer to the ECM wiring diagrams in <i>Electrical Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Check the exhaust system for possible restriction:</p> <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. ● Check for a possible plugged catalytic converter by checking the exhaust system back pressure. Refer to <i>Restricted Exhaust System Check</i>. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Check the torque converter clutch (TCC) for proper operation. Refer to <i>Transmission Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>

Lack of Power, Sluggish or Spongy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to <i>Engine Mechanical</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
12	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Rough, Unstable, or Incorrect Idle, Stalling Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to Step 2	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Go to Step 6	Go to Step 3
3	<p>Was a visual/physical check performed?</p>	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	<p>1. Check the ECM grounds for cleanliness, tightness and proper routing. Refer to the ECM wiring diagrams in <i>Electrical Diagnosis</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 5
5	<p>1. Check for incorrect idle speed. Ensure that the following conditions are present:</p> <ul style="list-style-type: none"> • The engine is fully warm. • The accessories are "OFF." <p>2. Using a Tech 2, monitor the AP position.</p> <p>Is the AP position within the specified values?</p>	0%	Go to Step 10	Go to Step 9
6	<p>1. Visually/physically inspect for the following conditions:</p> <ul style="list-style-type: none"> • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 7
7	<p>1. Injector Test Operate the each injector by Tech 2 with the ignition "ON" and check if the working noise confirm.</p> <p>2. If a problem is found, check the harness or replace the injector.</p> <p>Is the action complete?</p>	—	Verify repair	Go to Step 8
8	<p>1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive.</p> <p>2. If a problem is found, diagnose and repair the transmission range switch as necessary (Refer to <i>Automatic Transmission Diagnosis</i>).</p> <p>Was a problem found?</p>	—	Verify repair	Go to Step 9

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Check for the following engine mechanical items. Refer to <i>Engine Mechanical</i> for diagnosis procedures: <ul style="list-style-type: none"> ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Valves clearance ● Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 10</i>
10	1. Check for faulty engine mounts. Refer to <i>Engine Mechanical</i> for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 11</i>
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Poor Fuel Economy Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Larger than standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.)</p> <p>Was the “On-Board Diagnostic (OBD) System Check” performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>Check owner’s driving habits.</p> <ul style="list-style-type: none"> ● Is the A/C “ON” full time (defroster mode “ON”)? ● Are tires at the correct pressure? ● Are excessively heavy loads being carried? ● Is acceleration too much, too often? ● Is engine oil correct? <p>Was a problem found?</p>	—	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	<p>Review the items in Step 4 with the customer and advise as necessary.</p> <p>Is the action complete?</p>	—	System OK	—
6	<p>1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the “Vehicle Emission Control Information” label. 2. If a problem is found, repair as necessary.</p> <p>Was a repair required?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Remove and check the air filter element for dirt or for restrictions. Refer to <i>Air Intake System</i>. 2. Replace the air filter element if necessary.</p> <p>Was a repair required?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check for low engine coolant level. Refer to <i>Engine Cooling</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Check for an incorrect or faulty engine thermostat. Refer to <i>Engine Cooling</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Check for low engine compression. Refer to <i>Engine Mechanical</i>. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>

Poor Fuel Economy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	<p>1. Check the TCC operation. Refer to <i>Transmission Diagnosis</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 12</i>
12	<p>1. Check the exhaust system for possible restriction:</p> <ul style="list-style-type: none"> ● Inspect the exhaust system for damaged or collapsed pipes. ● Inspect the muffler for heat distress or possible internal failure. <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 13</i>
13	<p>Check for proper calibration of the speedometer.</p> <p>Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?</p>	—	Go to <i>Step 15</i>	Go to <i>Step 14</i>
14	<p>Diagnose and repair an inaccurate speedometer condition as necessary. Refer to <i>Vehicle Speed Sensor</i> in <i>Electrical Diagnosis</i>.</p> <p>Was a problem found?</p>	—	Verify repair	—
15	<p>1. Check the air intake system and the crankcase for air leaks. Refer to <i>Air Intake System</i> and <i>Crankcase Ventilation System</i>.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 16</i>
16	<p>1. Review all diagnostic procedures within this table.</p> <p>2. When all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All connections within a suspected circuit and/or system. <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 17</i>
17	<p>Perform the procedure in <i>Injector Test</i>.</p> <p>Was the fuel pressure normal?</p>	—	Contact Technical Assistance	Verify repair

Excessive Exhaust Emissions or Odors Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Vehicle fails an emission test. Vehicle has excessive “rotten egg” smell. (Excessive odors do not necessarily indicate excessive emissions.)</p> <p>Was the “On-Board Diagnostic (OBD) System Check” performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a thorough visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc. 2. If a problem is found, repair as necessary.</p> <p>Were any vacuum leaks located?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Check the fuel cap for proper installation. 2. Secure the fuel cap if necessary.</p> <p>Was the fuel cap installed properly?</p>	—	Go to <i>Step 6</i>	Verify repair
6	<p>1. Injector Test Operate the each injector by Tech 2 with the ignition “ON” and check if the working noise confirm.</p> <p>2. If a problem is found, check the harness or replace the injector.</p> <p>Is the action complete?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<p>1. Refer to <i>Engine Cooling</i> for cooling system diagnosis. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<p>1. Check for an engine mechanical problem. Perform a cylinder compression check (Refer to <i>Engine Mechanical</i>).</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<p>1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system. <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Dieseling, Run-On Symptom

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: Engine continues to run after key is turned "OFF," but runs very rough. If engine runs smooth, check ignition switch and adjustment.</p> <p>Was the "On-Board Diagnostic (OBD) System Check" performed?</p>	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	<p>1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.</p> <p>Was a bulletin found that addresses the symptom?</p>	—	Verify repair	Go to <i>Step 3</i>
3	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 4</i>	Go to <i>Visual/Physical Check</i>
4	<p>1. Check for a short between B+ and any of the ignition feed circuits. 2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<p>1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Cuts Out, Symptom

Step	Action	Value(s)	Yes	No
1	DEFINITION: Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to Step 7	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual/Physical Check
4	1. Check the ECM grounds for clearness, tightness and proper routing. Refer to the ECM wiring diagrams in <i>Electrical Diagnosis</i> . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check for incorrect idle speed. Ensure that the following conditions are present: <ul style="list-style-type: none"> ● The engine is fully warm. ● The accessories are "off." 2. Using a Tech 2, monitor the AP position. Is the AP position within the specified values?	0%	Go to Step 6	Go to Step 7
6	1. Visually/physically inspect for the following conditions: <ul style="list-style-type: none"> ● Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Check the Throttle body. ● Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty VSV or brake booster hose disconnected . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	Using a Tech 2, monitor the AP angle with the engine idling. Is the AP angle at the specified value and steady?	0%	Go to Step 8	Refer to DTC P0123 for further diagnosis
8	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary. Was a problem found?	—	Verify repair	Go to Step 9

Cuts Out, Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	<p>1. Injector Test Operate the each injector by Tech 2 with the ignition "ON" and check if the working noise confirm.</p> <p>2. If a problem is found, check the harness or replace the injector.</p> <p>Is the action complete?</p>	—	Verify repair	Go to <i>Step 10</i>
10	<p>1. Check the following engine mechanical items. Refer to <i>Engine Mechanical</i> for diagnosis procedures:</p> <ul style="list-style-type: none"> ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Broken valve springs <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 11</i>
11	<p>1. Check for faulty motor mounts. Refer to <i>Engine Mechanical</i> for inspection of mounts.</p> <p>2. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 12</i>
12	<p>1. Review all diagnostic procedures within this table.</p> <p>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:</p> <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system <p>3. If a problem is found, repair as necessary.</p> <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Starter Motor Doesn't Rotate

Step	Action	Value(s)	Yes	No
1	<p>DEFINITION: As starter motor doesn't rotate, engine is not cranked.</p> <ol style="list-style-type: none"> 1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. <p>Was the bulletin found?</p>	—	Verify repair	Go to <i>Step 2</i>
2	<p>Was a visual/physical check performed?</p>	—	Go to <i>Step 3</i>	Go to <i>Visual/Physical Check</i>
3	<ol style="list-style-type: none"> 1. Check battery cord terminal for looseness & poor contact due to corrosion. 2. Check battery voltage. 3. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 4</i>
4	<ol style="list-style-type: none"> 1. Check fan belt for looseness & damage. 2. If a problem is found, adjust or replace as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 5</i>
5	<ol style="list-style-type: none"> 1. Check fuse bull link for disconnection & short. 2. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 6</i>
6	<ol style="list-style-type: none"> 1. Check generator for mount & damage (Refer to <i>Engine Mechanical</i>). 2. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 7</i>
7	<ol style="list-style-type: none"> 1. Check starter SW and starter relay for looseness and damage. 2. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 8</i>
8	<ol style="list-style-type: none"> 1. Check starter motor for mount and damage. (Refer to <i>Engine Mechanical</i>) 2. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Go to <i>Step 9</i>
9	<ol style="list-style-type: none"> 1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. <p>Was a problem found?</p>	—	Verify repair	Contact Technical Assistance

Starting Difficulty In Case Fuel Doesn't Come to Injector

Step	Action	Value(s)	Yes	No
1	DEFINITION: Engine is cranked, but not started for a long time. Steps soon. Was OBD System check performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Perform a bulletin research. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to <i>Visual/Physical Check</i>
4	Check fuel shortage. If short, replenish. Was fuel short?	—	Verify replenish	Go to Step 5
5	1. Check fuel pipeline for leak. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check fuel pipeline & filter for deformation & clogging. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check fuel pump for damage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	Check the Injector test by Tech 2. Does the working noise confirm?	—	Go to Step 11	Go to Step 9
9	1. Check the injector connector for damage. 2. Check the injector harness for damage. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 10
10	Replace the injector. (Refer to the <i>injector group sign programming</i>) Is the action complete?	—	Verify repair	—
11	1. Indicate RPCV Data List by Tech 2 to check operation. Perform RPCV test. 2. If a problem is found, replace RP sensor or RPCV as necessary. Was a problem found?	—	Verify repair	Go to Step 12

Starting Difficulty In Case Fuel Doesn't Come to Injector (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lubrication System Trouble

Step	Action	Value(s)	Yes	No
1	DEFINITION: In road tests oil pressure doesn't rise, or oil is foul to excess. Was OBD System check performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	1. Perform a bulletin research. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found?	—	Verify repair	Go to Step 3
3	1. Check if a correct engine oil is used. 2. If a problem is found, change engine oil. Was a problem found?	—	Verify repair	Go to Step 4
4	1. Check the oil pressure meter for damage. 2. Check the oil unit harness and connector for damage. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check oil pipe connections for leakage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check oil filter for clogging. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check valve clearance. 2. If a problem is found, adjust as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Check camshaft bearing for wear. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check crankshaft & connecting rod bearings for wear. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 10
10	1. Check oil pump for damage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 11

Lubrication System Trouble (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Check cylinder head & cam carrier gaskets for damage. 2. If a problem is found, repair or replace as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 12</i>
12	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

QOS System Doesn't Work

Step	Action	Value(s)	Yes	No
1	Was OBD System check performed?	—	Go to Step 2	Go to <i>OBD System Check</i>
2	Check glowplug indicator light. If bulb is broken, replace. Was a problem found?	—	Verify repair	Go to Step 3
3	1. Connect a circuit tester between glowplug & engine ground. 2. With ignition on and engine off, check if the glow indicator and circuit tester indicate power voltage for 9 to 13 sec. If not indicated, repair terminal & wire harness. Was repair needed?	—	Verify repair	Go to Step 4
4	1. Connect a circuit tester between glowplug and engine ground. 2. With engine on, check if voltage continues for 180 sec. If not, inspect and repair glow relay. Was repair needed?	—	Verify repair	Go to Step 5
5	1. Remove the glowplug, and if damaged, replace. 2. Check glowplug resistance. Was resistance as specified?	0.8 – 1 Ω	Go to Step 7	Go to Step 6
6	Replace glowplug. Was measure completed?	—	Verify repair	Go to Step 7
7	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Much Black Smoke in Exhaust Gas

Step	Action	Value(s)	Yes	No
1	DEFINITION: In road tests, much black smoke is mixed. Was OBD System check performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Perform a bulletin research. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found?	—	Verify repair	Go to <i>Step 3</i>
3	1. Check if a correct fuel is used. 2. If a problem is found, change fuel. Was a problem found?	—	Verify repair	Go to <i>Step 4</i>
4	1. Check air cleaner element for clogging. 2. If a problem is found, repair or replace as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 5</i>
5	1. Connect Tech 2 to the vehicle. 2. Monitor data list to check injector function. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 6</i>
6	1. Connect Tech 2 to the vehicle. 2. Monitor RPCV test to check rpcv function. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	1. Check valve clearance. 2. If a problem is found, adjust as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 8</i>
8	1. Review all diagnostic procedures in this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical check ● Tech 2 data list ● Freeze Frame data ● All electrical connections in suspected circuits & systems 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Excess Engine Oil Consumption

Step	Action	Value(s)	Yes	No
1	DEFINITION: Oil consumption measured in road tests is higher than expected. Was OBD System check performed?	—	Go to <i>Step 2</i>	Go to <i>OBD System Check</i>
2	1. Perform a bulletin research. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found?	—	Verify repair	Go to <i>Step 3</i>
3	1. Check if a correct engine oil is used. 2. If a problem is found, change engine oil. Was a problem found?	—	Verify repair	Go to <i>Step 4</i>
4	1. Check oil pipe connections for leakage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 5</i>
5	1. Check oil seals and gaskets for leakage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 6</i>
6	1. Connect Tech 2 to the vehicle. 2. Perform RPCV test to check its function. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 7</i>
7	1. Check piston ring for damage & groove wear. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 8</i>
8	1. Check valve stem, valve guide and oil controller for wear. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 9</i>
9	1. Check camshaft carrier & cylinder head gaskets for blow-by. 2. If a problem is found, repair or replace as necessary. Was a problem found?	—	Verify repair	Go to <i>Step 10</i>
10	1. Review all the diagnostic procedures in this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: <ul style="list-style-type: none"> ● Visual/physical check ● Tech 2 data list ● Freeze Frame data ● All electrical connections in suspected circuits & systems 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Default Matrix Table

the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is "ON" in diagnostics. Engine does not start and run.	HEUI System Check
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no ECM codes set. Customer complains of vibration.	—
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no ECM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission
ECM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Chassis Electrical
ECM Power and Ground Check	On-Board Diagnostic (OBD) System Check. ECM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no ECM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	<ol style="list-style-type: none"> 1. On-board diagnostic (OBD) system check. 2. Careful visual/physical inspections. 	Chassis Electrical
Hard Starts	<ol style="list-style-type: none"> 1. OBD system check. 2. Sensors (ECT, MAP, EGR, AP) ; output chart. 3. Fuel system electrical test, fuel system diagnosis. 4. Injector system. 	Engine Mechanical, Injector System Check, Exhaust System Diagnosis
Surges and/or Chuggles	<ol style="list-style-type: none"> 1. OBD system check. 2. Fuel system diagnosis. 3. Injector system. 	Calibration ID "Broadcast" /Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis
Lack of Power, Sluggish or Spongy	<ol style="list-style-type: none"> 1. OBD system check. 2. Fuel system diagnosis. 3. Injector system. 	Refer to <i>Exhaust System</i> in <i>Engine Exhaust</i> , TCC Operation, Calibration ID/Service Bulletins

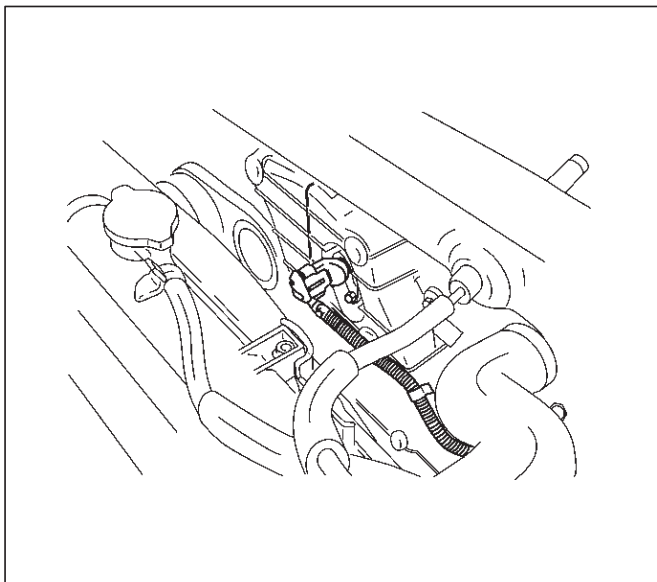
6E-200 4JX1-TC ENGINE DRIVEABILITY AND EMISSIONS

Symptoms	Initial Diagnosis	Default Section(s)
Hesitation, Sag, Stumble	<ol style="list-style-type: none"> 1. OBD system check. 2. AP. 3. MAP output check. 4. Fuel system diagnosis. 5. Injector system. 	Generator Output Voltage (refer to <i>Chassis Electrical</i>), Calibration ID/Service Bulletins, Ignition System Check
Rough, Unstable, or Incorrect Idle, Stalling	<ol style="list-style-type: none"> 1. OBD system check. 2. Fuel injector test. 	MAP Output Check, Throttle Linkage, A/C Clutch Control Circuit Diagnosis, Calibration ID/Service Bulletins, Generator Output Voltage (refer to <i>Chassis Electrical</i>), Exhaust Diagnosis
Poor Fuel Economy	<ol style="list-style-type: none"> 1. OBD system check. 2. Careful visual/physical inspection. 3. Injector system. 4. Cooling system. 	TCC Operation, Exhaust System (refer to <i>Engine Exhaust</i>)
Engine Cranks But Will Not Run	<ol style="list-style-type: none"> 1. OBD system check. 	Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector Test.
Excessive Exhaust Emissions or Odors	<ol style="list-style-type: none"> 1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector test. 6. Injector system. 7. MAP output check. 	Exhaust Diagnosis, Calibration ID/Service Bulletins
Dieseling, Run-On	<ol style="list-style-type: none"> 1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 	—

On-Vehicle Service Camshaft Position (CMP) Sensor

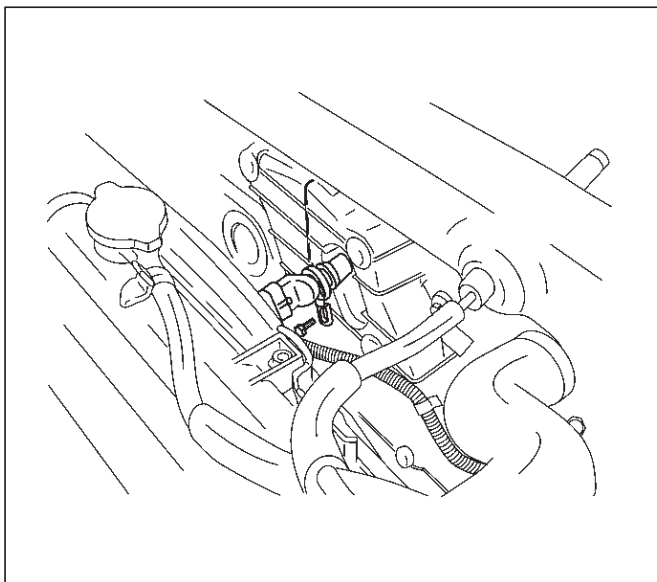
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CMP sensor.



035RW071

3. Remove the CMP sensor retaining bolt from the cylinder head cover.



035RW075

Inspection Procedure

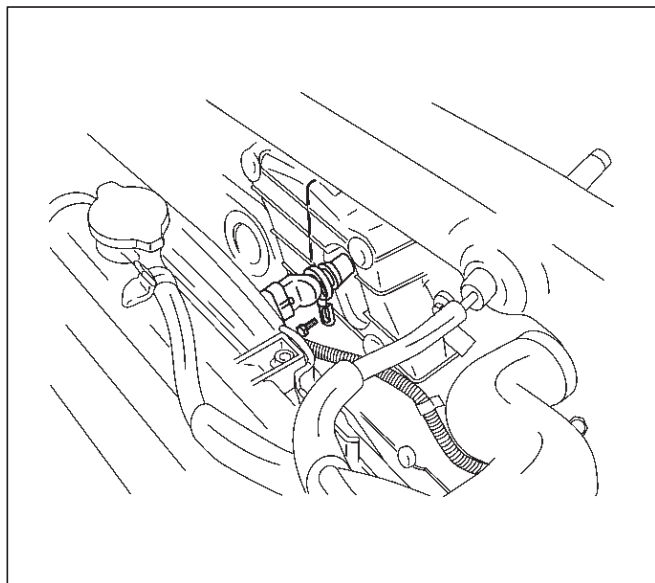
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CMP sensor in the cylinder head cover.
2. Install the CMP sensor retaining bolt.

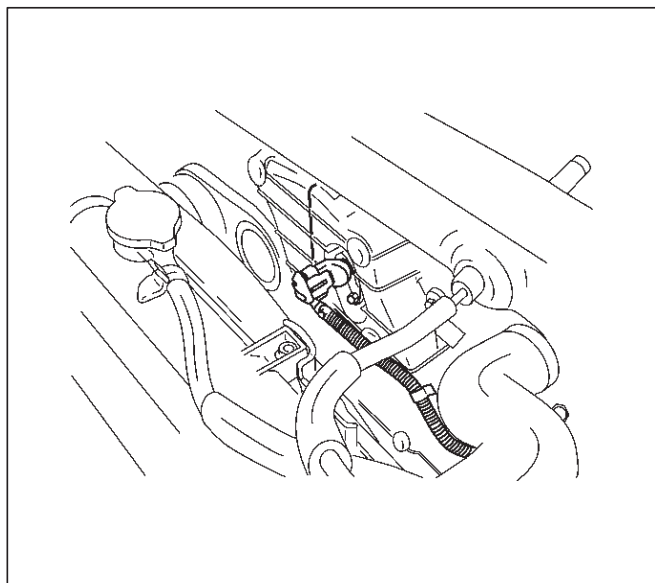
Tighten

- Tighten the retaining bolt to 9 N·m (78 lb in.).



035RW075

3. Connect the electrical connector to the CMP sensor.



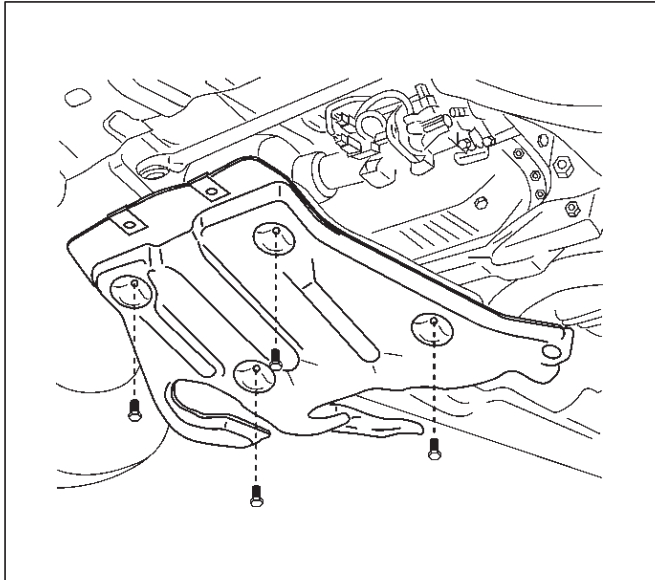
035RW071

4. Connect the negative battery cable.

Crankshaft Position (CKP) Sensor

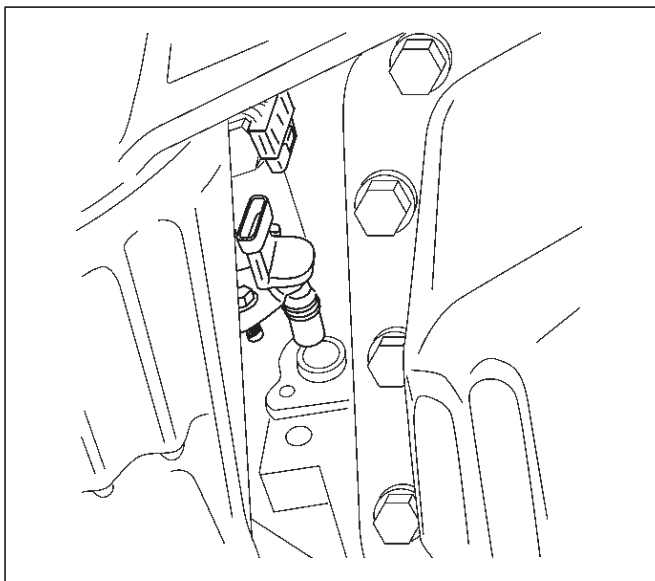
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the under cover.



3. Disconnect the electrical connector to the CKP sensor.
4. Remove one bolt and the CKP sensor from the left side of the engine block.

NOTE: Use caution to avoid any hot oil that might drip out.



Inspection Procedure

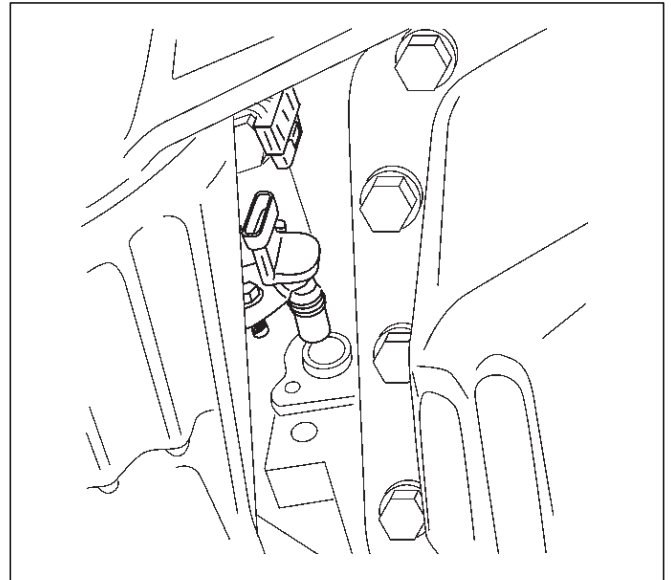
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

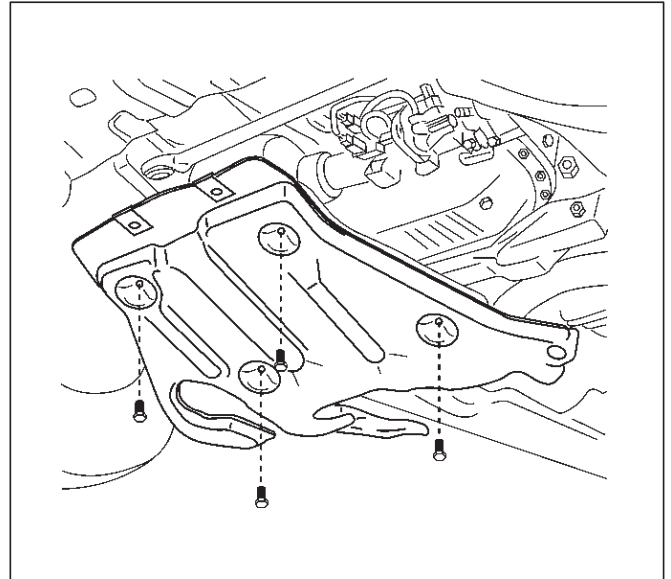
1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

Tighten

- Tighten the mounting bolt to 9 N-m (78 lb in.).



3. Connect the electrical connector to the CKP sensor.
4. Install the under cover.



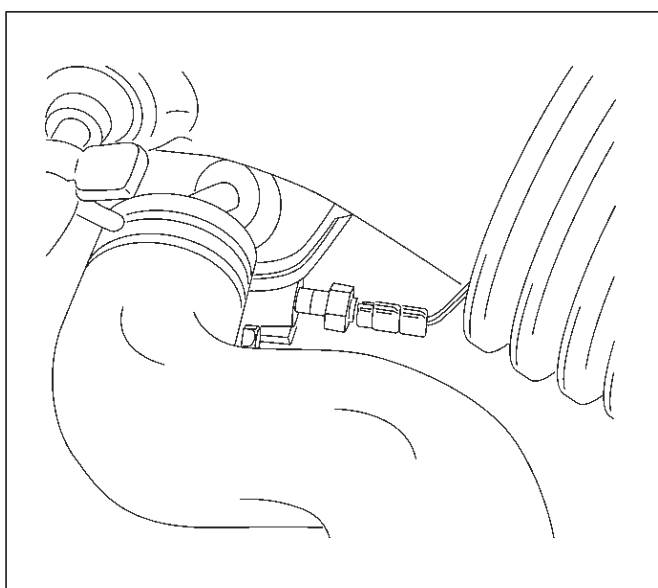
5. Connect the negative battery cable.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling*.
3. Disconnect the electrical connector.
4. Remove the ECT sensor from the front side of the intake manifold.

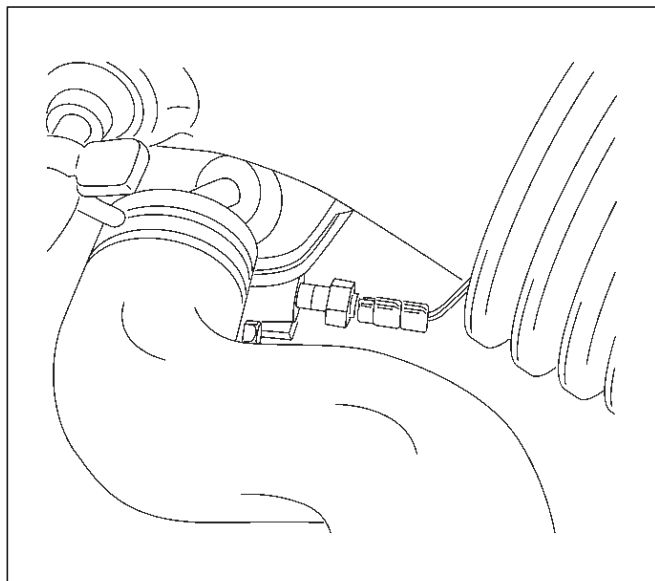


Installation Procedure

1. Apply sealer (LOCTITE 262) or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the front side of the intake manifold.

Tighten

- Tighten the ECT sensor to 19 N·m (14 lb ft.).
3. Connect the electrical connector.

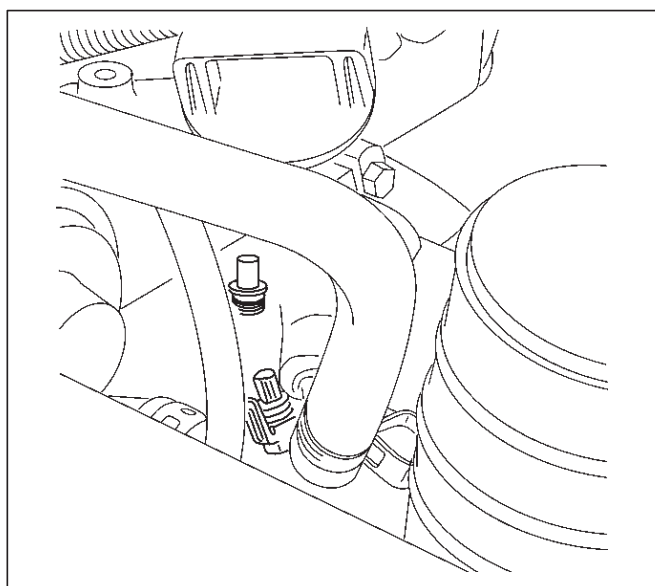


4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling*.
5. Connect the negative battery cable.

Intake Air Temperature (IAT) Sensor

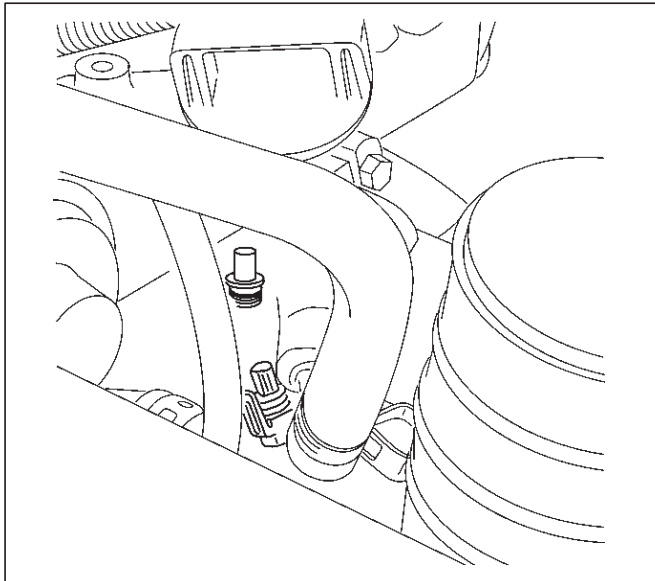
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the IAT sensor.
3. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.



Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.



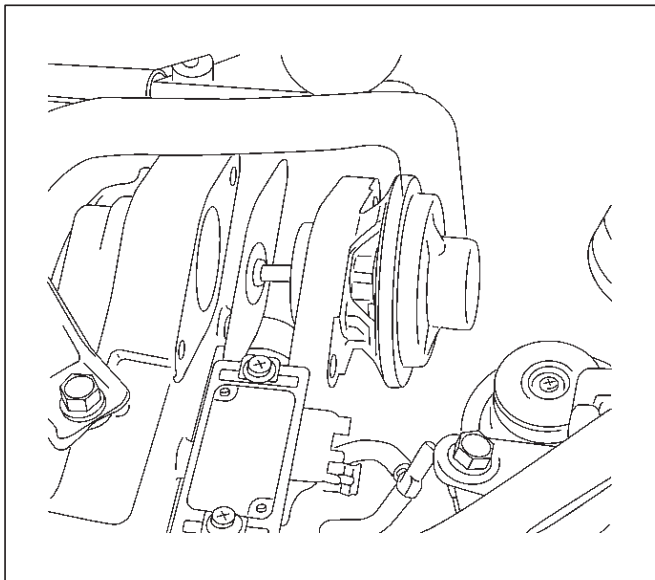
035RW056

2. Connect the IAT electrical connector.
3. Connect the negative battery cable.

Manifold Absolute Pressure (MAP) Sensor

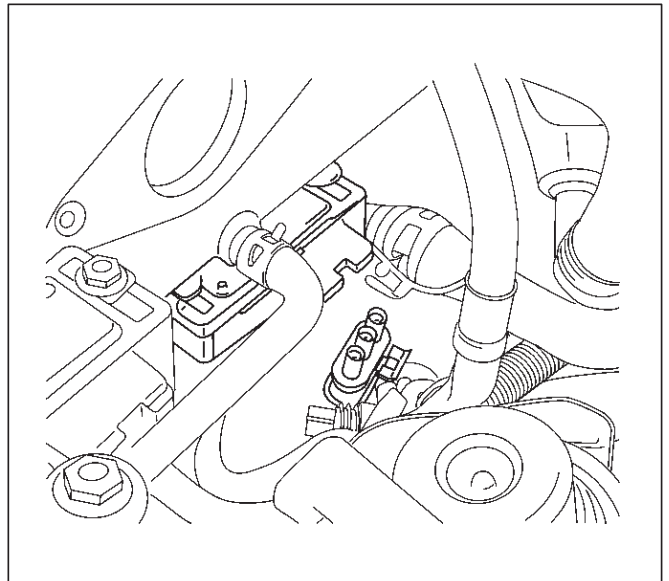
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the EGR valve.



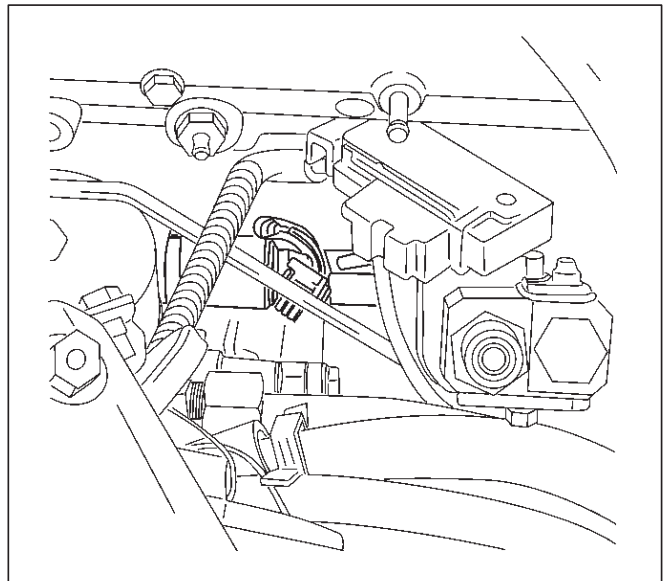
035RW054

3. Disconnect the MAP sensor connector from the MAP sensor.



035RW053

4. Remove the bolts and the MAP sensor from the intake manifold.

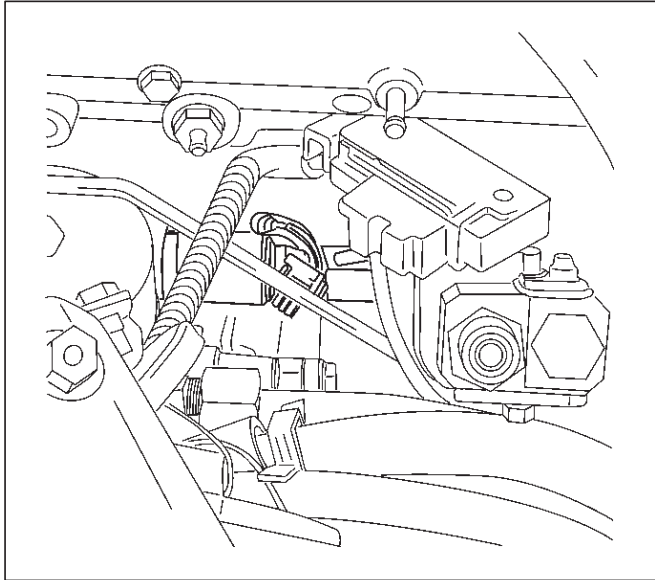


035RW057

Installation Procedure

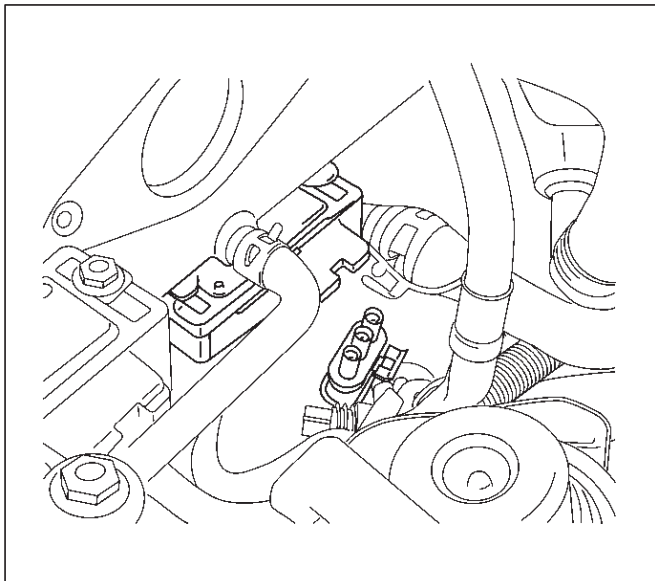
1. Install the MAP sensor and bolts on the intake manifold.

Torque: 4 N·m (35 lb in)



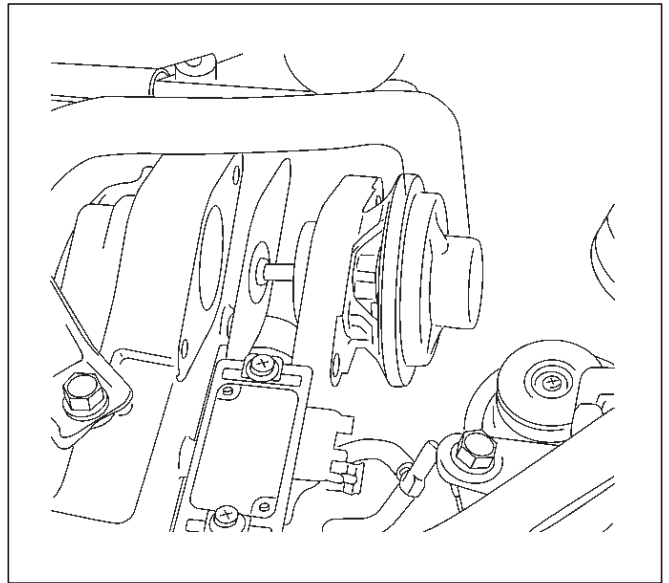
035RW057

2. Connect the MAP sensor connector.



035RW063

3. Connect the EGR valve.



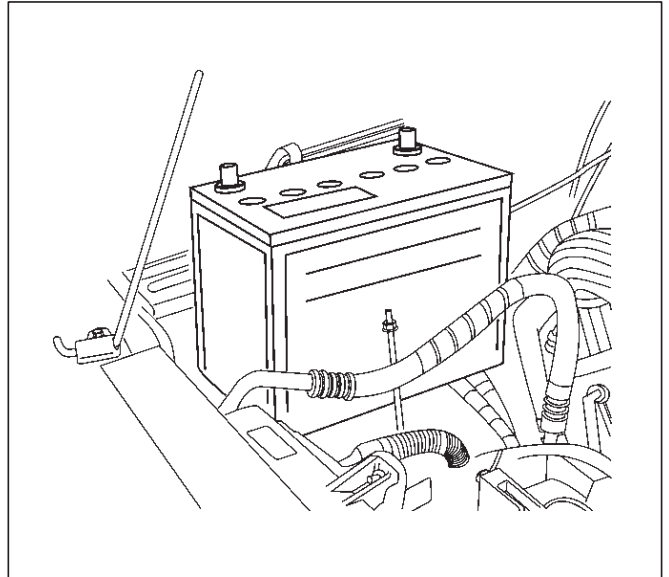
035RW054

4. Connect the negative battery cable.

Oil Temperature (OT) Sensor

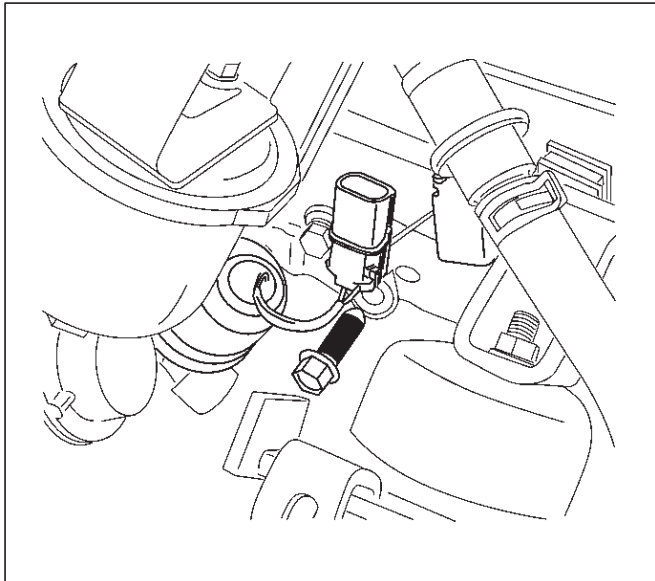
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the battery.



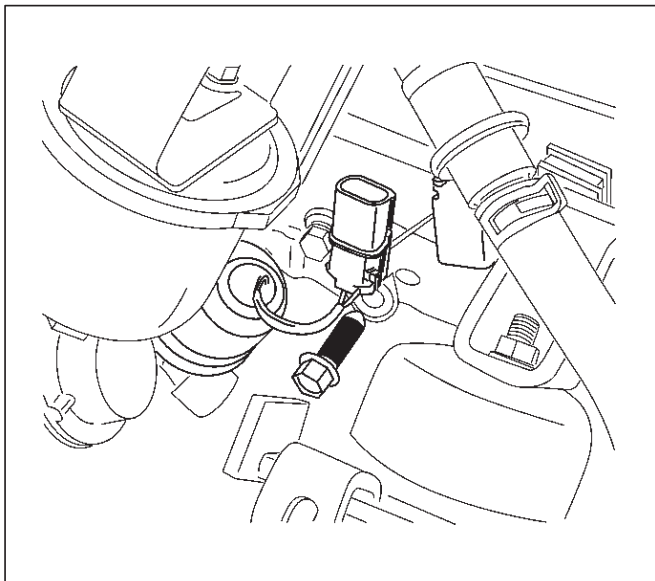
035RW095

3. Disconnect the electrical connector from the OT sensor.
4. Remove the OT sensor.

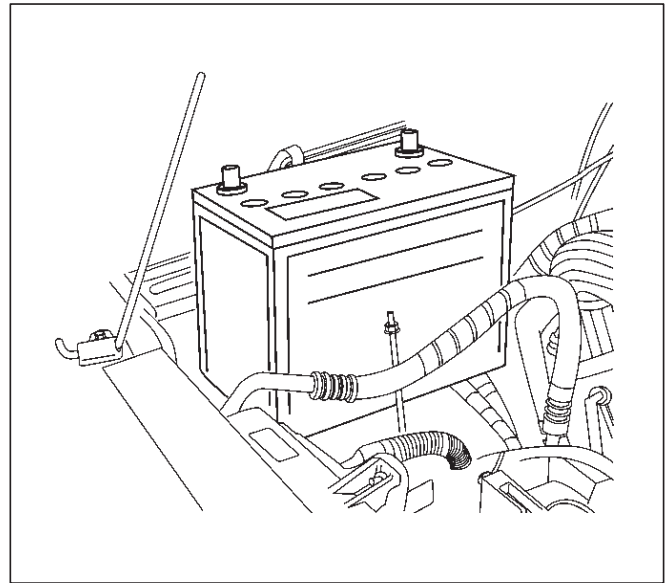


Installation Procedure

1. Install the OT sensor.



2. Connect the OT sensor electrical connector.
3. Install the battery.



4. Connect the negative battery cable.

Malfunction Indicator Lamp (MIL)

Removal and Installation Procedure

Refer to Meter in Electrical section.

Engine Control Module (ECM)

Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the ECM, do not touch the connector pins or soldered components on the circuit board.

When replacing the ECM to prevent possible electro damage, follow these guidelines:

Before removing the ECM, disconnect the negative battery cable.

Before install the ECM, install the negative battery cable.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.

Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause

damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal ECM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the ECM (for example: battery cable, ECM pigtail, ECM fuse, jumper cables, etc.).

IMPORTANT: When replacing the production ECM with a service ECM, it is important to transfer the broadcast code and production ECM number to the service ECM label. This will allow positive identification of ECM parts throughout the service life of the vehicle. Do not record this information on the metal ECM cover.

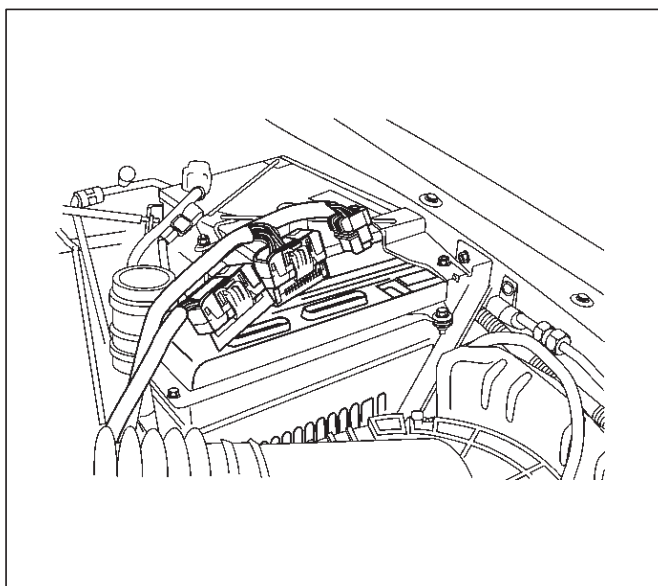
IMPORTANT: The ignition should always be in the "OFF" position in order to install or remove the ECM connectors.

Service of the ECM should normally consist of either replacement of the ECM. If the diagnostic procedures call for the ECM to be replaced, the ECM should be checked first to ensure it is the correct part. If it is, remove the faulty ECM and install the new service ECM.

DTC P0601 indicates the check sum error.

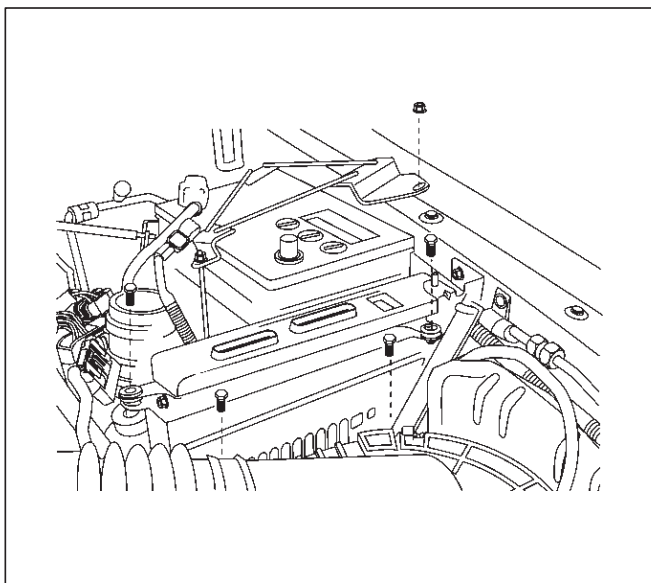
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ECM connector.



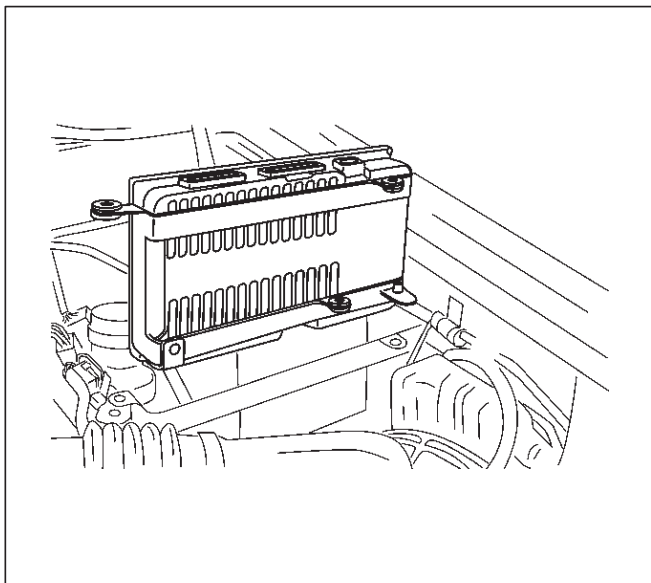
035RW093

3. Remove the bolts ECM bracket and battery bracket.



035RW094

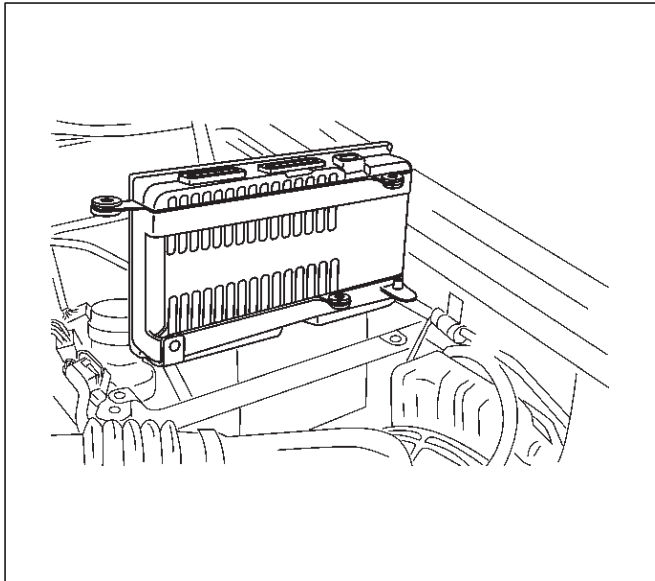
4. Remove the ECM.



035RW092

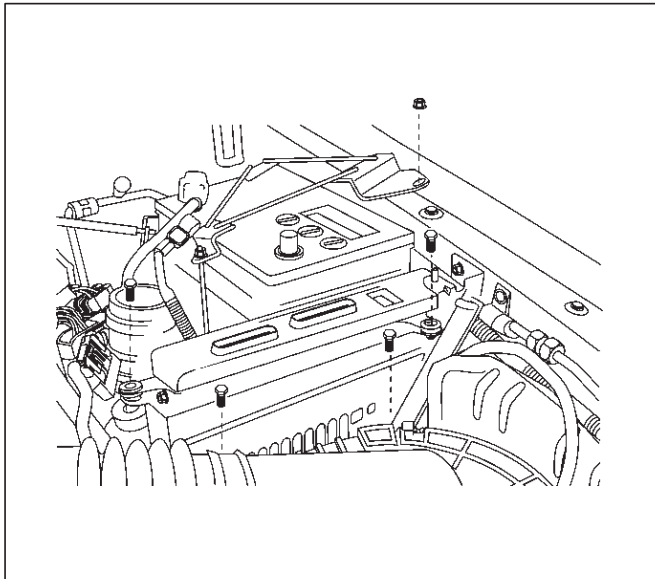
Installation Procedure

1. Install the ECM.



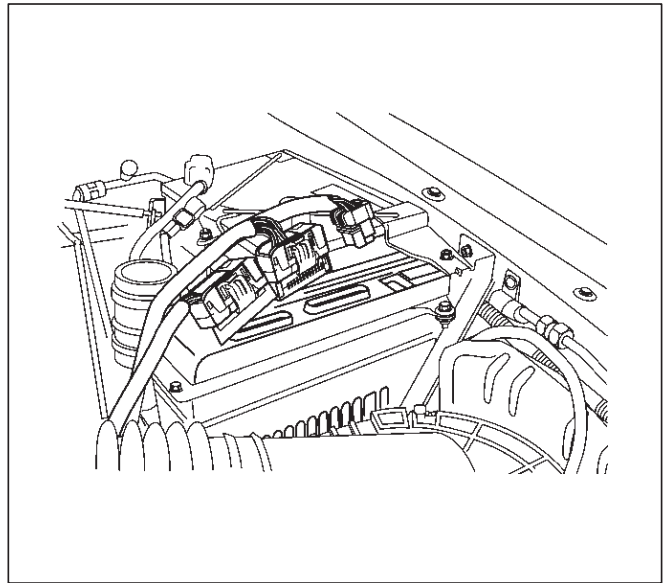
035RW092

2. Install the bolts, ECM bracket and battery bracket.



035RW094

3. Connect the ECM connector.



035RW093

4. Connect the negative battery cable.
If the ECM is replaced, the new ECM will need to be programmed.

EEPROM

General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the ECM. The EEPROM contains program and calibration information that the ECM needs to control powertrain operation.

Functional Check

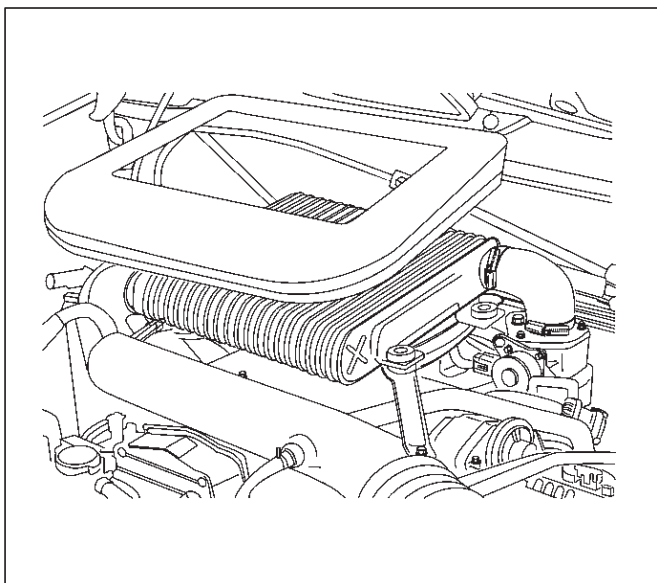
1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

Intake Throttle Position (ITP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.

2. Remove the cover of the intercooler.



035RW051

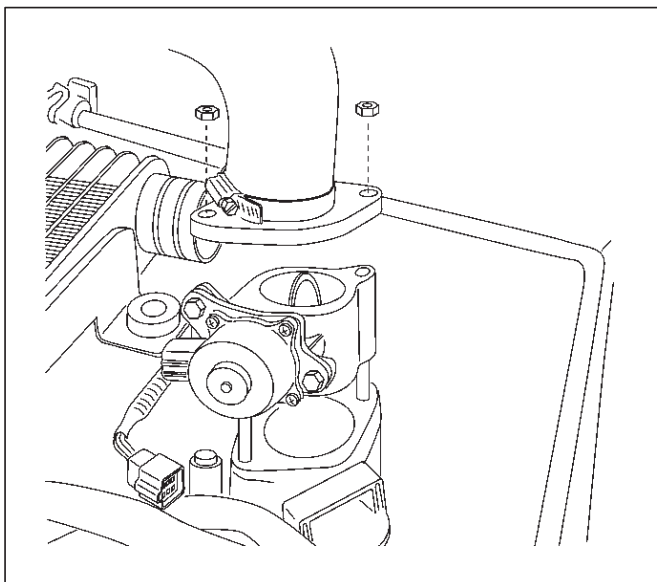
3. Remove the bolts and the left side bracket to the intercooler.

4. Remove the air duct with bracket from the intercooler.

5. Remove the throttle body from the intake manifold.

6. Disconnect the ITP sensor electrical connector and throttle motor control connector.

7. Remove the bolts and the ITP sensor from the throttle body.



035RW086

NOTE: Do not clean the ITP sensor by soaking it in solvent. The sensor will be damaged as a result.

Function Check

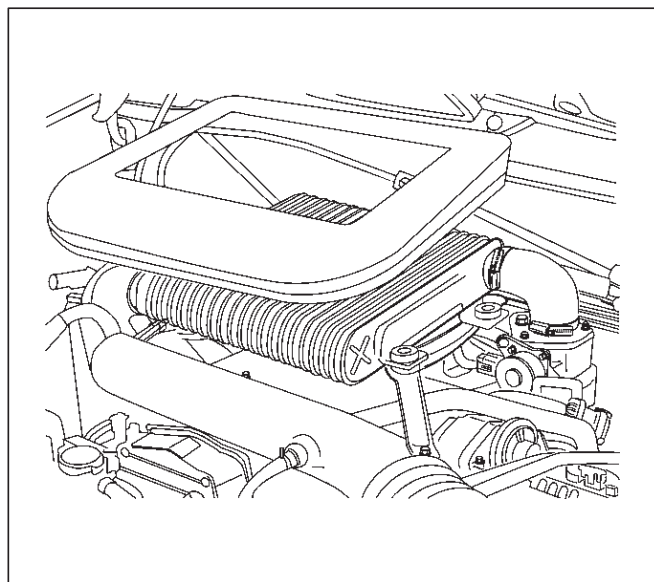
Use a Tech 2 to check the ITP sensor output voltage at closed throttle.

- The voltage should be under 0.85 volt.
- If the reading is greater than 0.85 volt, check the throttle shaft to see if it is binding.

- If the throttle shaft is not binding and the throttle cable is properly adjusted, install a new ITP sensor.

Installation Procedure

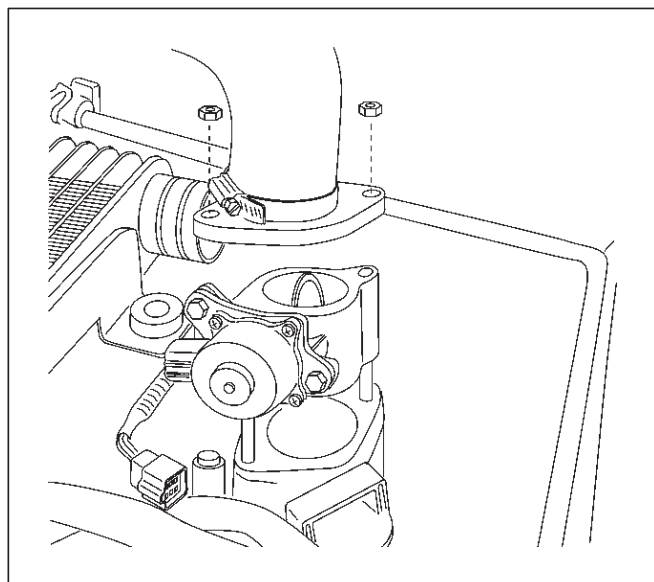
1. Install the ITP sensor on the throttle body with the bolts.



035RW051

2. Install the throttle body to the intake manifold and the air duct with bracket between throttle body and intercooler.

Torque: 20 N·m (14 lb ft)



035RW086

3. Connect the ITP sensor electrical connector and throttle motor control connector.

4. Install the bracket to the intercooler.

5. Install the cover of intercooler.

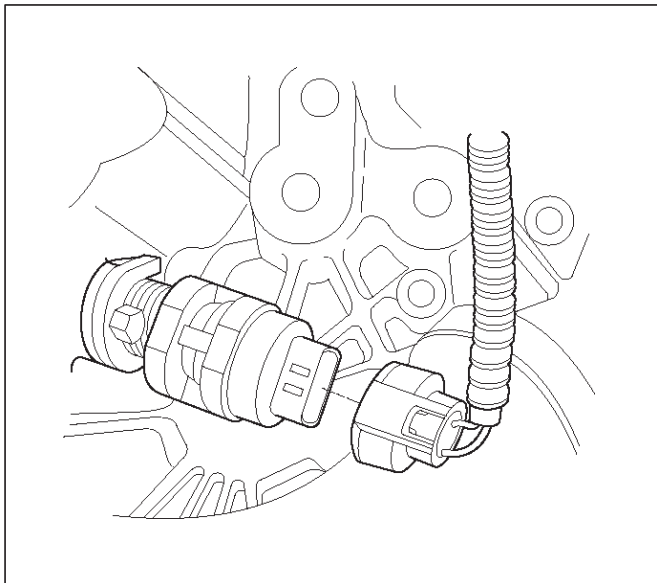
6. Install the negative battery cable.

Vehicle Speed Sensor (VSS)

Removal Procedure

CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.

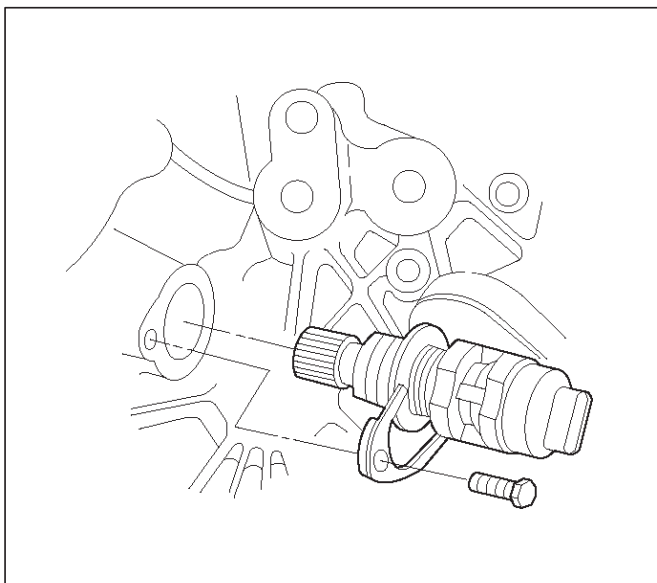
1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.



TS23748

3. Remove the bolt and the clamp securing the VSS in place.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case.



TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

Inspection Procedure

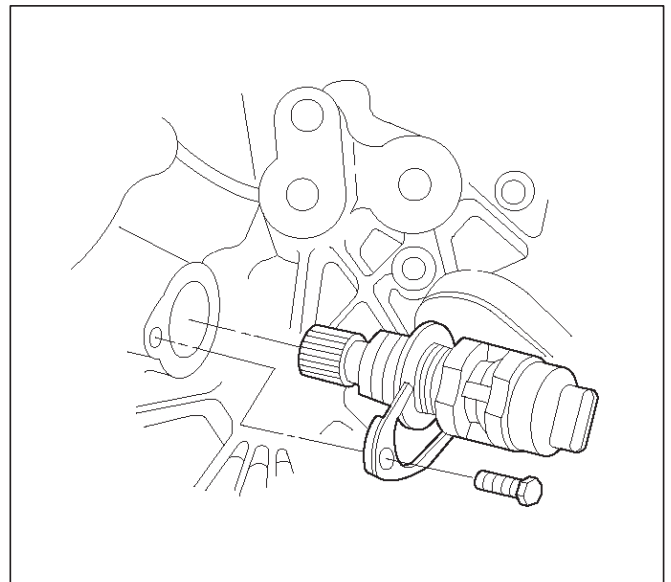
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

Installation Procedure

1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

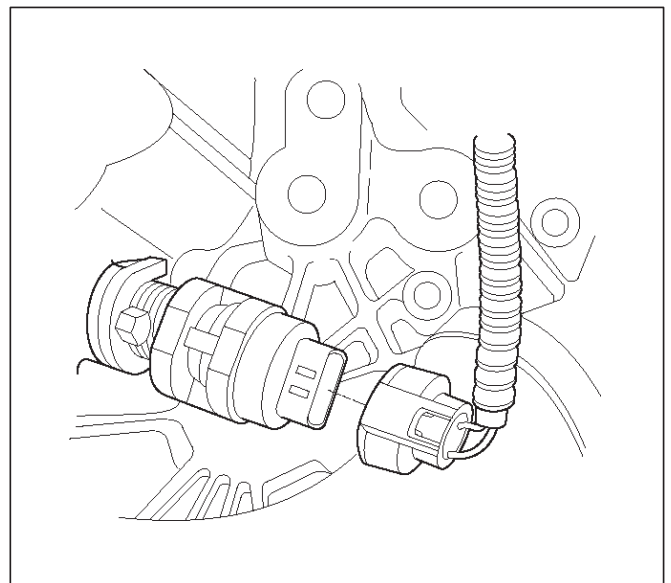
Tighten

- Tighten the bolt to 16 N-m (12 lb ft.).



TS23780

3. Connect the VSS electrical connector.



TS23748

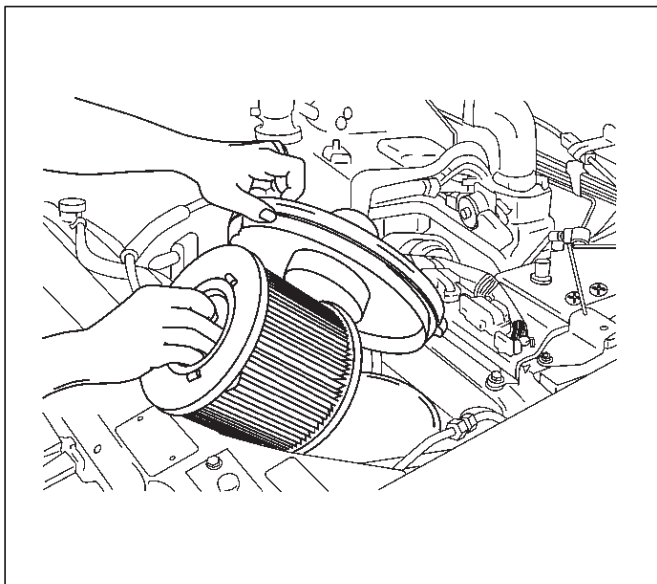
4. Check the transfer case oil level. Add fluid if necessary.

5. Connect the negative battery cable.

Air Cleaner/Air Filter

Removal Procedure

1. Loosen the clamp between the air cleaner lid and the duct.
2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.
4. Remove the air filter element.

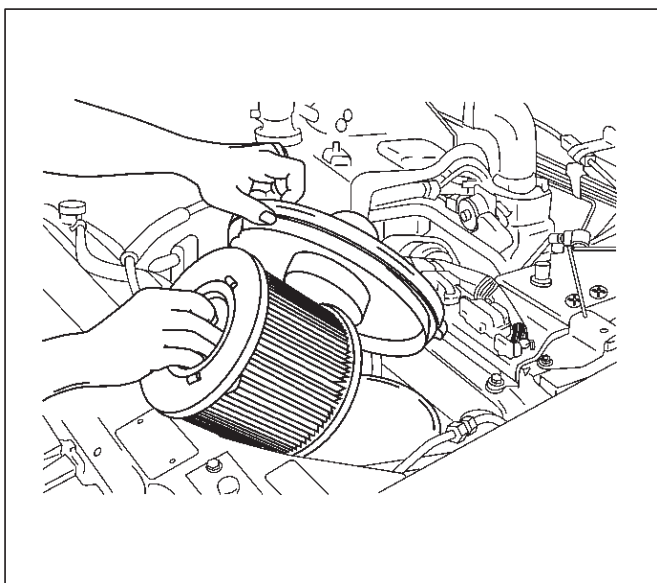


035RW074

5. Remove the retaining bolts and the air cleaner housing from the vehicle.

Installation Procedure

1. Install the air cleaner housing in the vehicle with the retaining bolts.
2. Install the air filter element in the air cleaner housing.



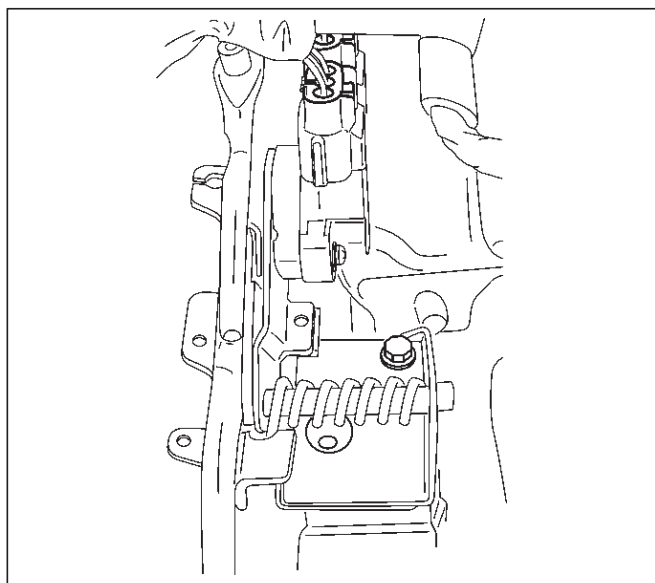
035RW074

3. Install the air cleaner lid on the air duct and the air cleaner housing.
4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

Accel Position (AP) Sensor

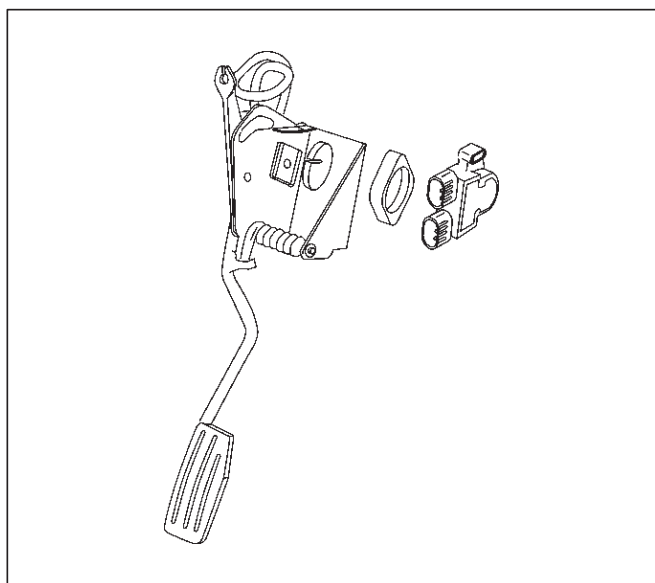
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the AP sensor.
3. Remove the bolts and the accelerator pedal assembly from the bulkhead.



035RW060

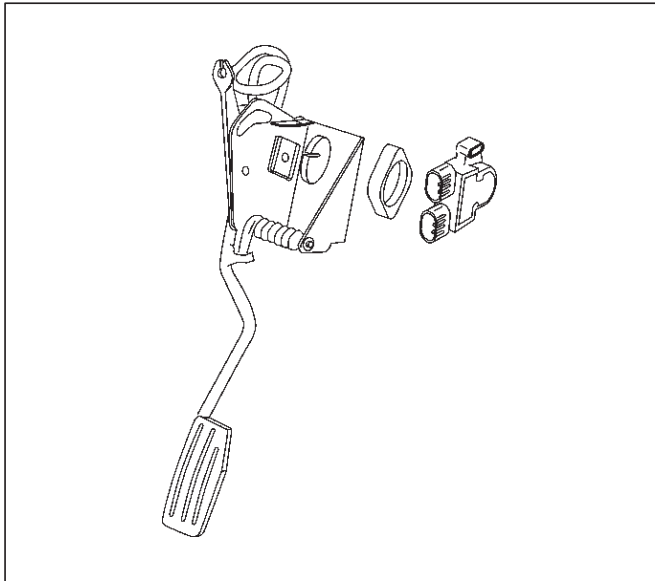
4. Remove the bolts and AP sensor from the accelerator pedal assembly.



035RW066

Installation Procedure

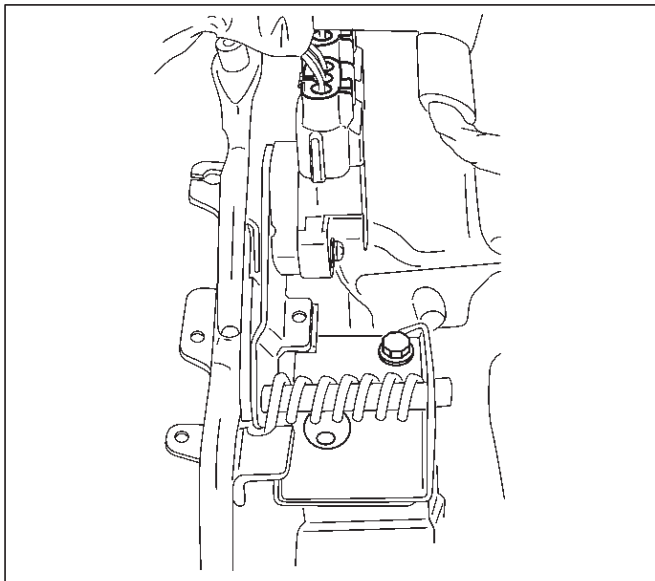
1. Install the AP sensor to the accelerator pedal assembly.



035RW066

2. Install the accelerator pedal assembly to the bulkhead.

3. Connect the electrical connector to the AP sensor.



035RW060

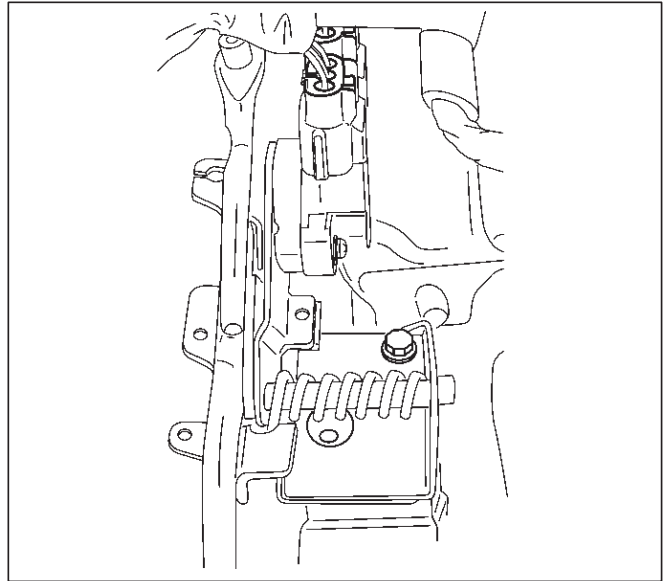
4. Connect the negative battery cable.

Accelerator Pedal Replacement

Removal Procedure

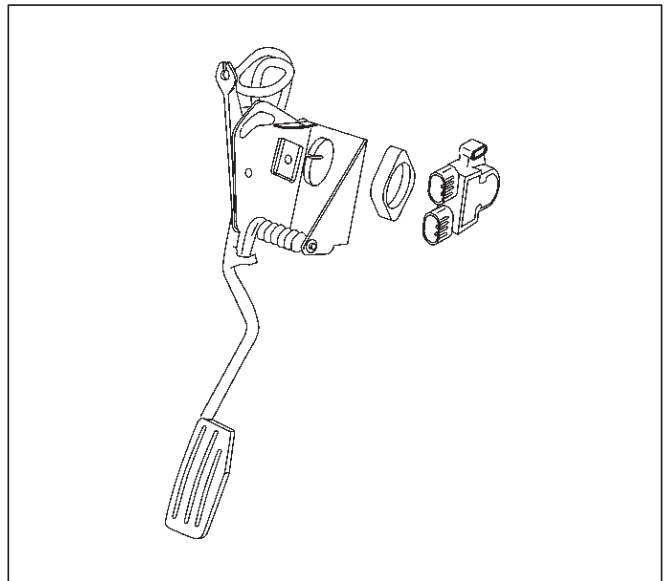
1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the AP sensor.

3. Remove the bolts and the accelerator pedal assembly from the bulkhead.



035RW066

4. Remove the bolts and AP sensor from the accelerator pedal assembly.

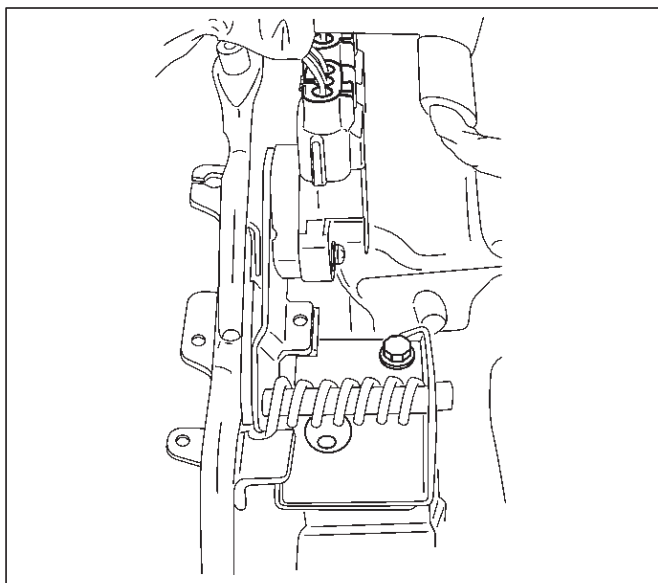


035RW066

Installation Procedure

1. Install the AP sensor to the accelerator pedal assembly.
2. Install the accelerator pedal assembly to the bulkhead.

3. Connect the electrical connector to the AP sensor.



035RW060

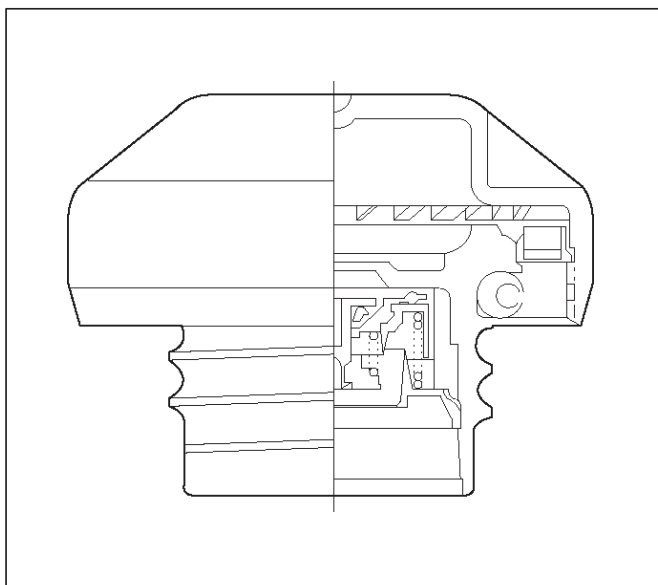
4. Connect the negative battery cable.

Fuel Filter Cap

General Description

The fuel filler cap includes a vacuum valve and a pressure valve.

If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank at the EGR valve.



TS23767

Inspection Procedure

NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

Fuel Filter

Removal and Installation Procedure

Refer to the Engine fuel in the 4JX1 Engine section.

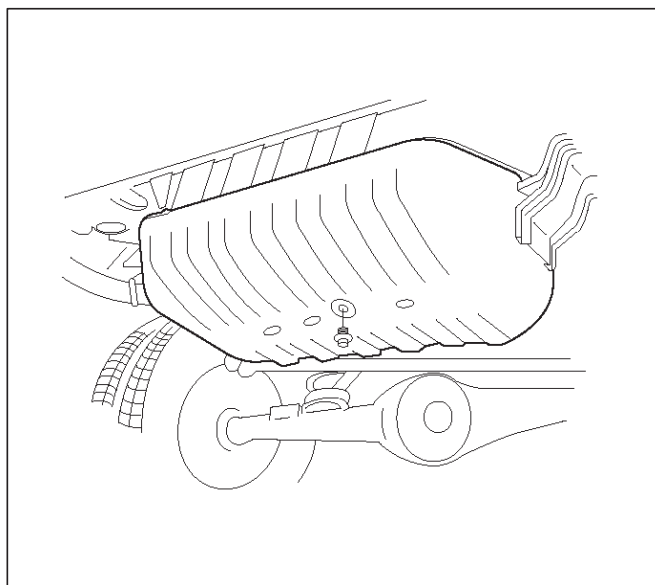
Fuel Gauge Unit

Removal Procedure

1. Disconnect the negative battery cable.
2. Loosen the fuel filler cap.
3. Drain the fuel from the tank.

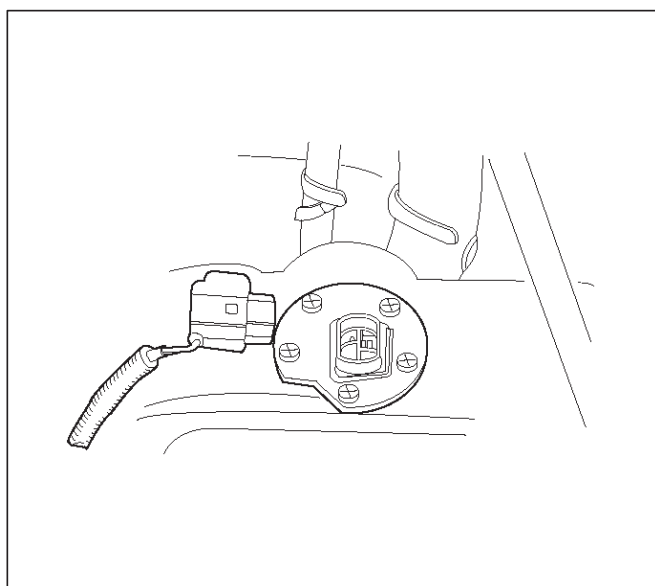
Tighten

- Tighten the drain plug to 20 N·m (14 lb ft.).



TS22907

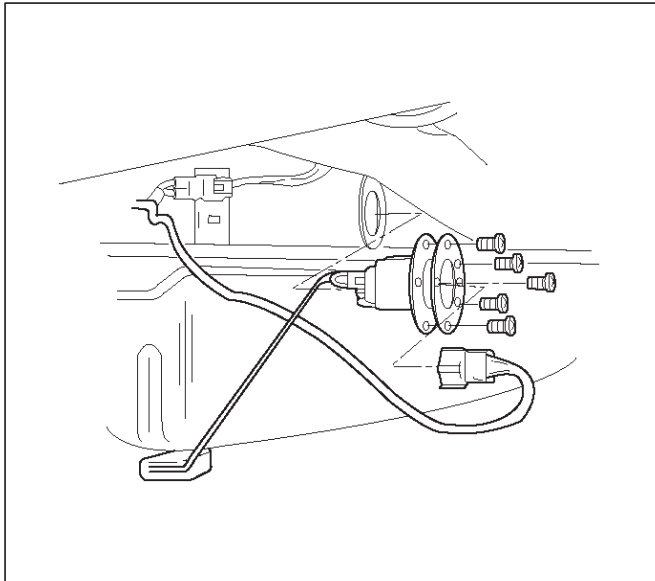
4. Disconnect the wiring connector from the fuel gauge unit.



TS23771

5. Remove the fuel gauge unit retaining screws.

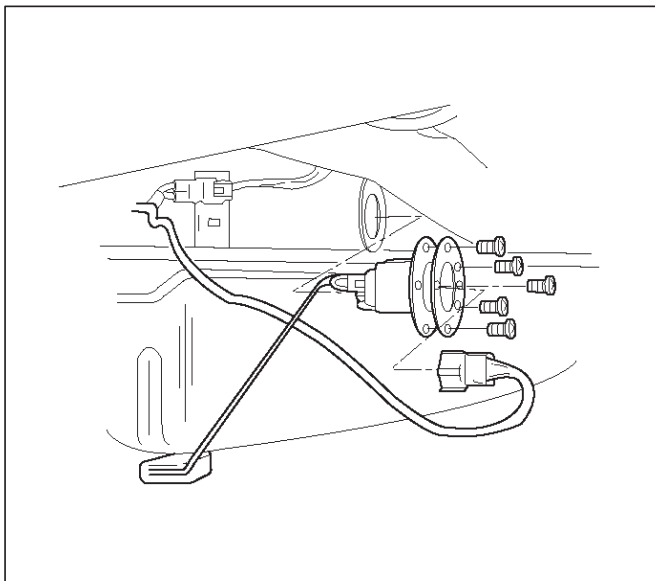
6. Remove the fuel gauge unit.
 - Cover or plug the fuel tank to prevent dust, dirt, or debris from entering the tank.



TS22911

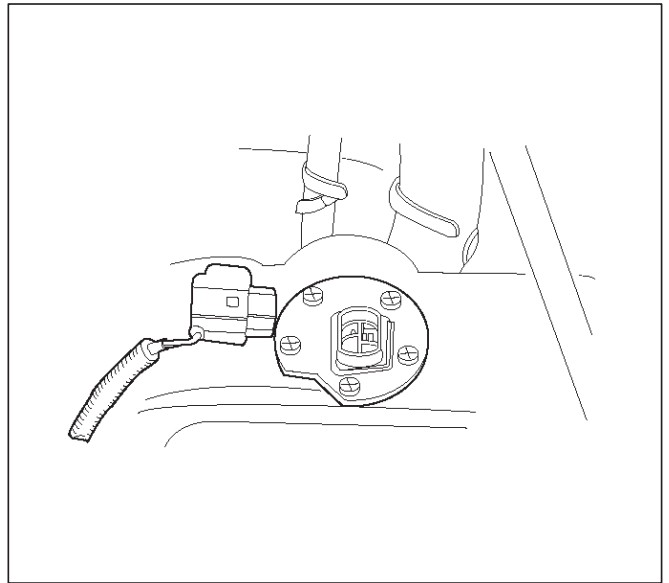
Installation Procedure

1. Install the fuel gauge unit.
2. Install the fuel gauge unit retaining screws.



TS22911

3. Connect the wiring connector to the fuel gauge unit.



TS23771

4. Fill the fuel tank with fuel.
 - Tighten the fuel filler cap.
 - Check for leaks at the fuel gauge unit gasket.
5. Connect the negative battery cable.

Fuel Injectors

Removal and Installation Procedure

Refer to Engine Fuel in 4JX1 Engine Section.

Fuel Temperature Sensor

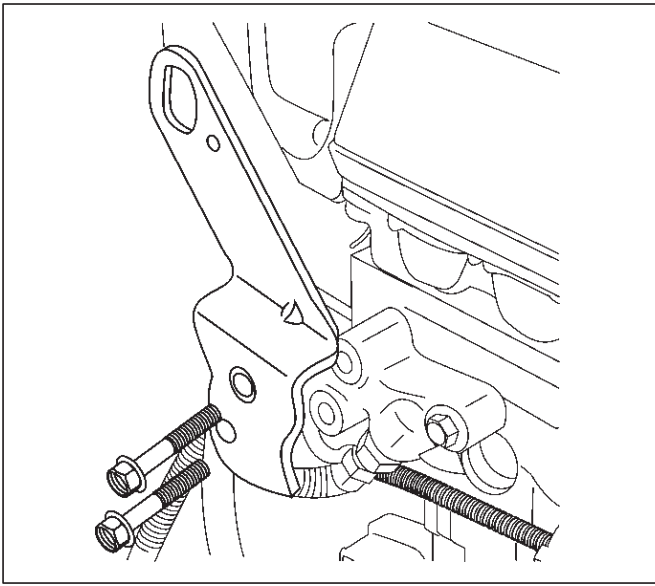
Removal Procedure

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

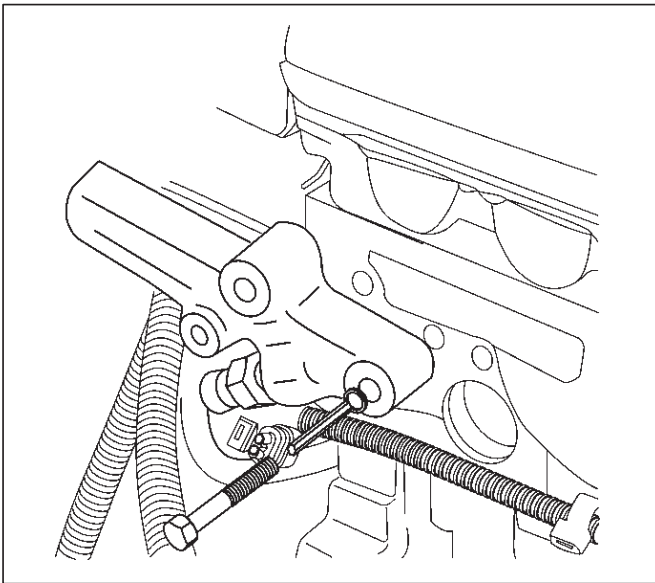
CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before disconnecting the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Disconnect the negative battery cable.
2. Remove the intercooler assembly.
3. Remove the cylinder head. Refer to engine mechanical section.

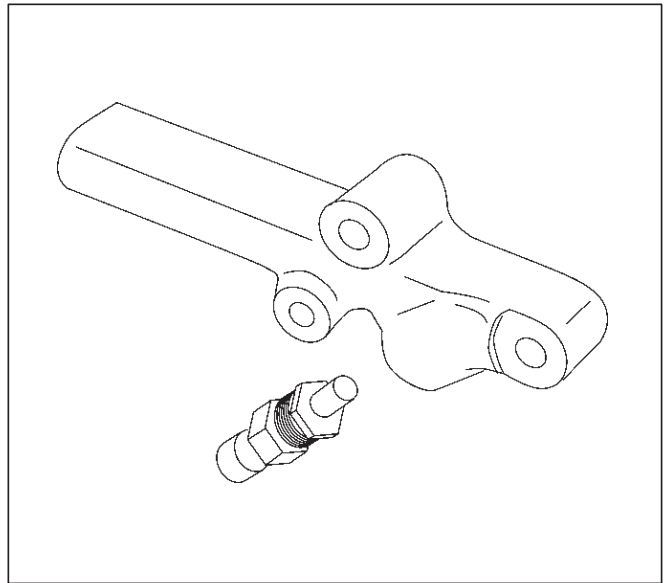
4. Remove the rear side engine hanger.



5. Remove the fuel return adapter.

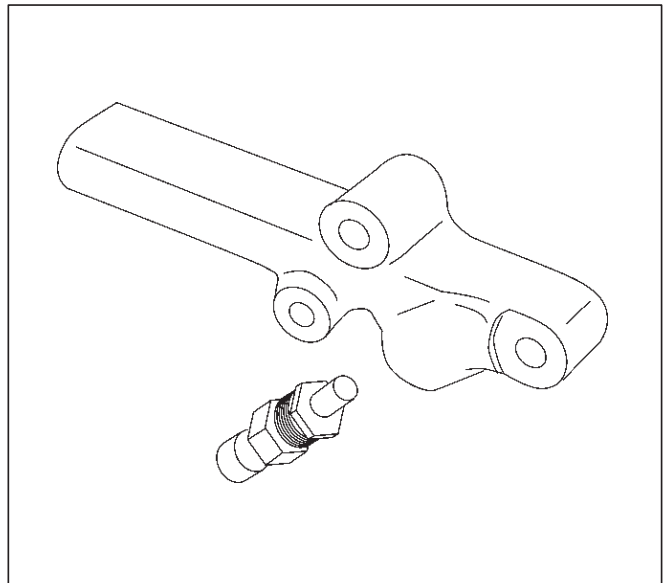


6. Remove the fuel pressure sensor from the fuel return adapter.

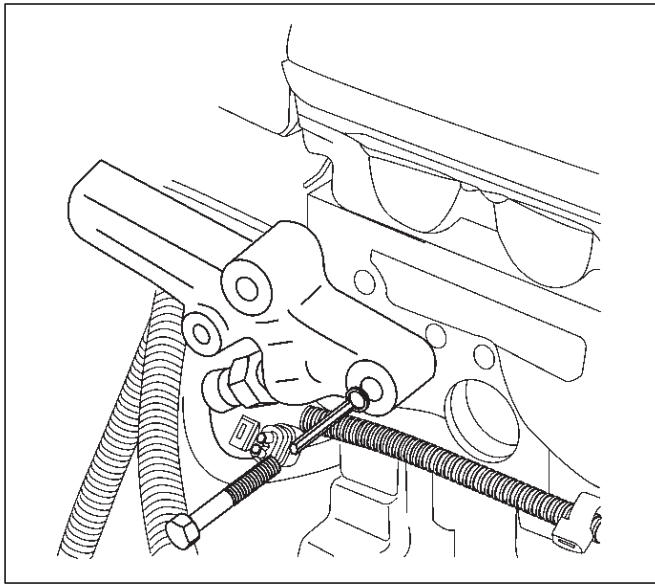


Installation Procedure

1. Install the fuel pressure sensor in the fuel return adapter.

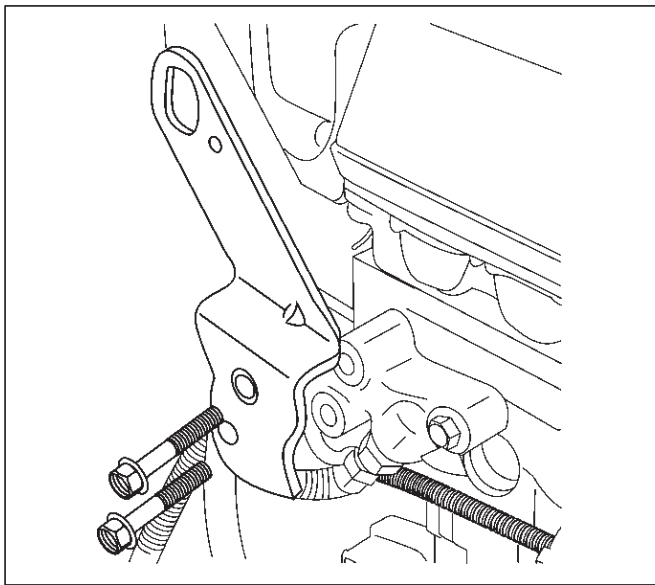


2. Install the fuel return adapter.



3. Install the rear side engine hanger. Tighten the rear side engine hanger fixing bolts to specified torque.

Torque: 19 N-m (14 lb ft)



4. Install the cylinder head. Refer to engine mechanical section.

5. Install the intercooler assembly.

6. Connect the negative battery cable.

Rail Pressure (RP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air cleaner cover and air duct.
3. Remove the intercooler assembly.
4. Remove the injector oil pipe.
5. Remove the intake throttle valve.
6. Remove the cylinder head cover noise insulation.
7. Remove the cylinder head cover.
8. Remove the RP sensor.

Installation Procedure

- Refer to the *RP Sensor Programming*.

1. Install the RP sensor.
2. Install the cylinder head cover.
3. Install the cylinder head cover noise insulation.
4. Install the intake throttle valve.
5. Install the injector oil pipe.
6. Install the intercooler assembly and tighten intercooler assembly fixing bolts to specified torque.

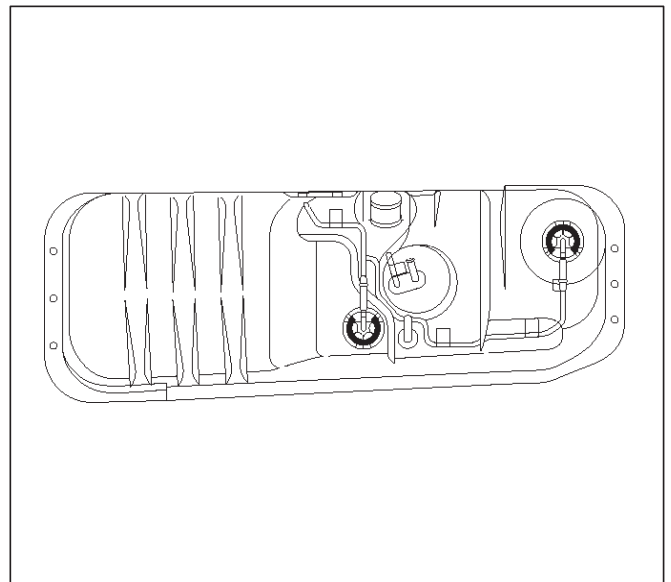
Torque: 20 N-m (14 lb ft)

7. Install the air cleaner cover and air duct.
8. Connect the negative battery cable.

Fuel Tank

Removal Procedure

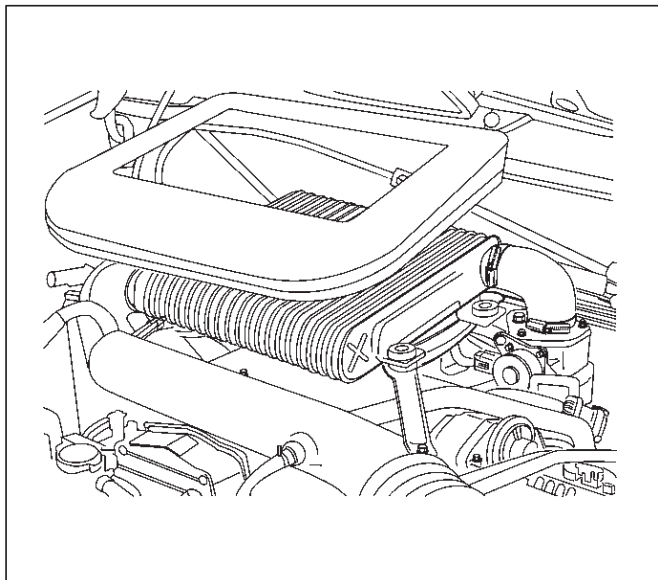
Refer to *Engine Fuel* in 4JX1 Engine section.



Throttle Body (TB)

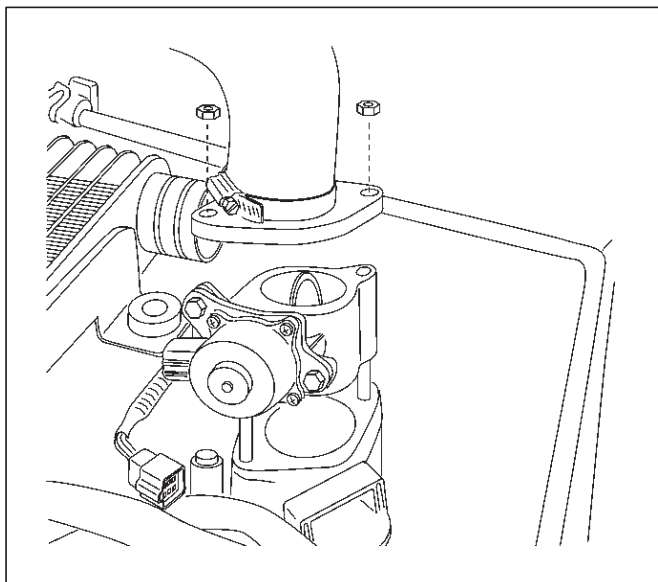
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the cover of the intercooler.



035RW051

3. Remove the bolts and the left side bracket to the intercooler.
4. Remove the air duct with bracket from the intercooler.



035RW086

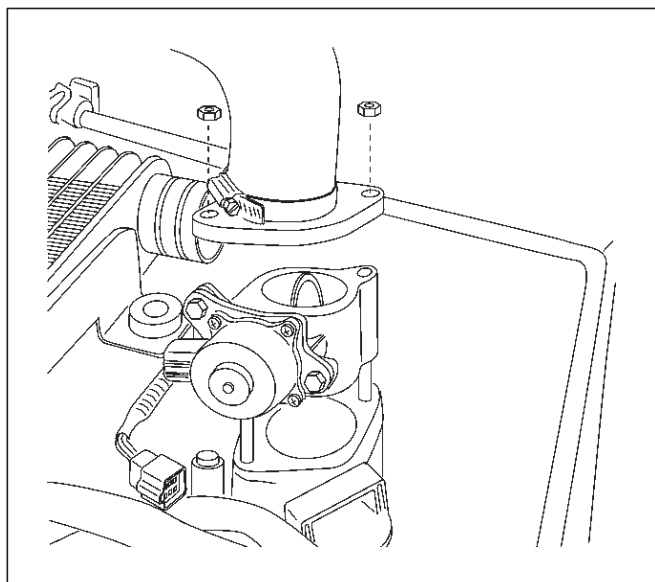
5. Remove the throttle body assembly from the intake manifold.
6. Disconnect the ITP sensor electrical connector.

Installation Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

- If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
 - Do not leave any scratches in the aluminum casting.
1. Install the throttle body assembly to the intake manifold and the air duct with bracket between throttle body and intercooler.

Torque: 20 N-m (14 lb ft)



035RW086

2. Connect the ITP sensor electrical connector and throttle motor control connector.
3. Install the bracket to the intercooler.
4. Install the cover of intercooler.
5. Connect the negative battery cable.

Air Conditioning (A/C) Relay

Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Pull the relay straight up and out of the fuse and relay box.

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
 - An audible "click" will be heard.
3. Install the fuse and relay box cover.

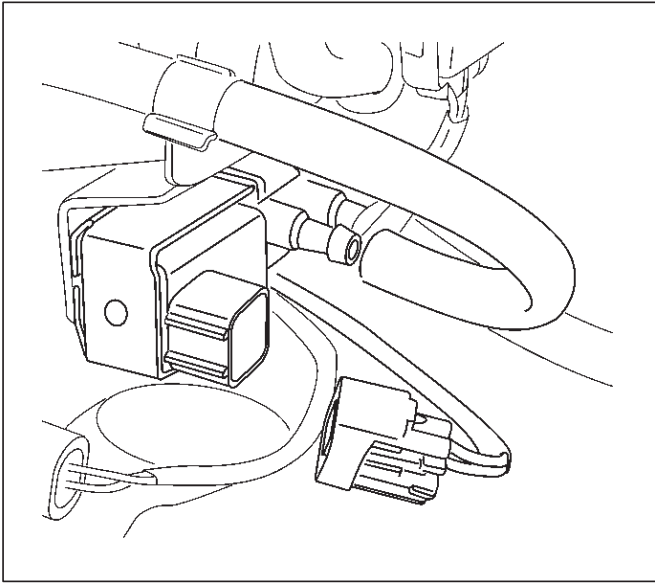
Exhaust Gas Recirculation (EGR) Vacuum Switch Valve (VSV)

Removal Procedure

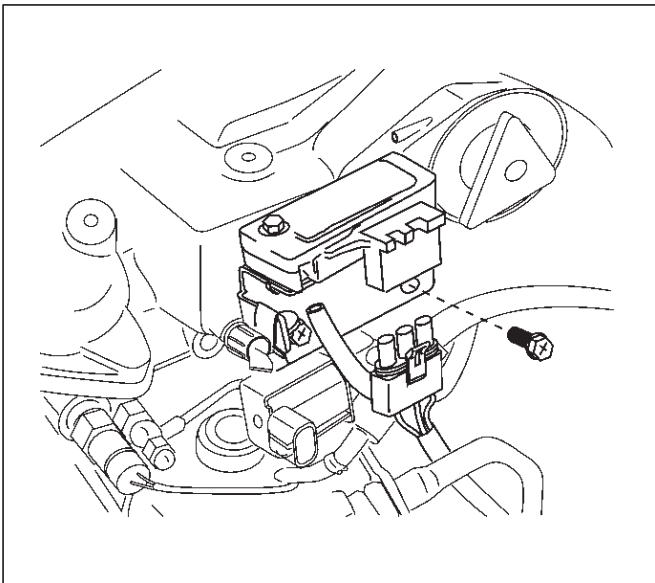
1. Disconnect the negative battery cable.

6E-218 4JX1-TC ENGINE DRIVEABILITY AND EMISSIONS

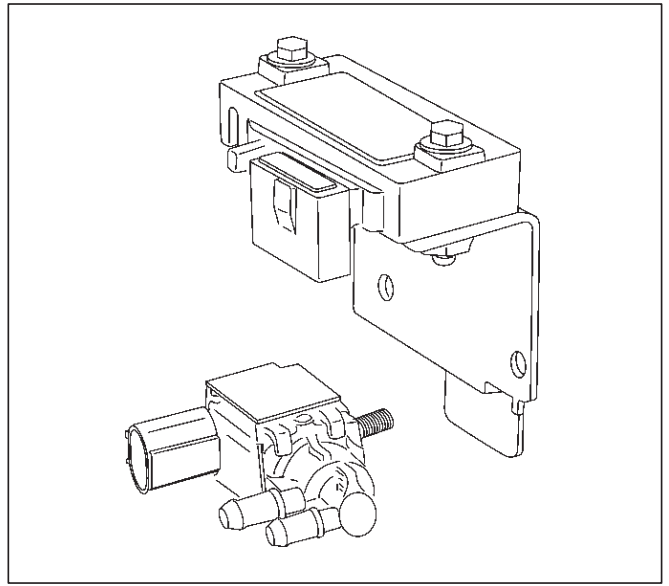
2. Disconnect the EGR VSV connector and vacuum hose from the EGR VSV.



3. Remove the MAP sensor assembly and EGR VSV.



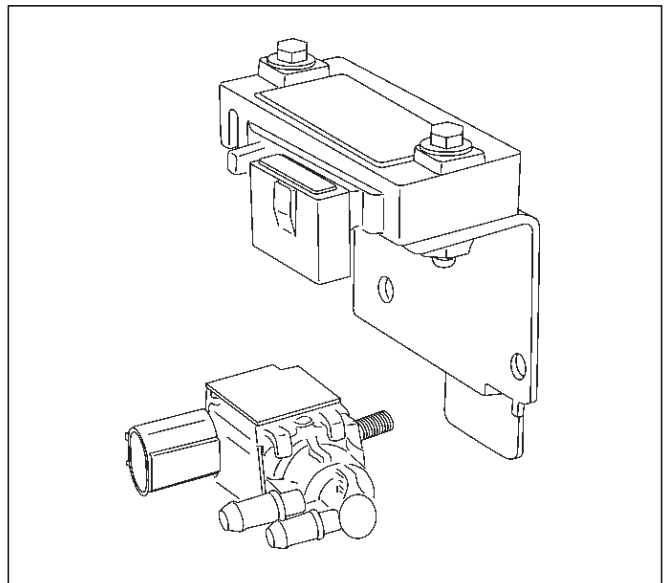
4. Remove the EGR VSV from the MAP sensor bracket.



Installation Procedure

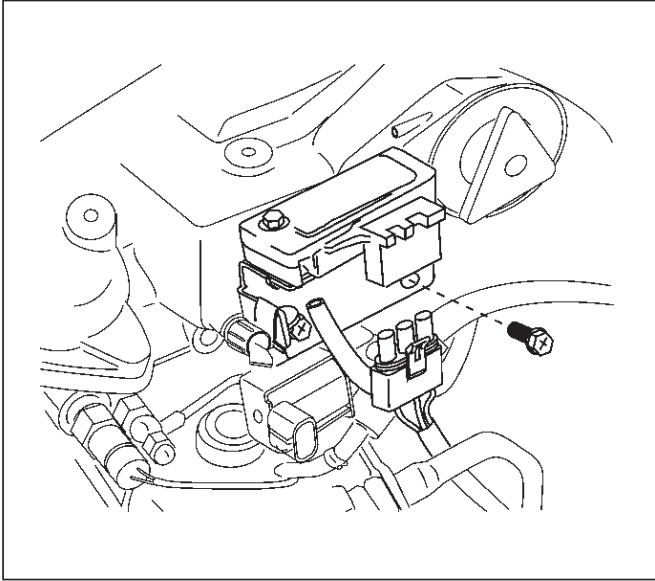
1. Install the EGR VSV and tighten nut to specified torque.

Torque: 8 N·m (69 lb in)



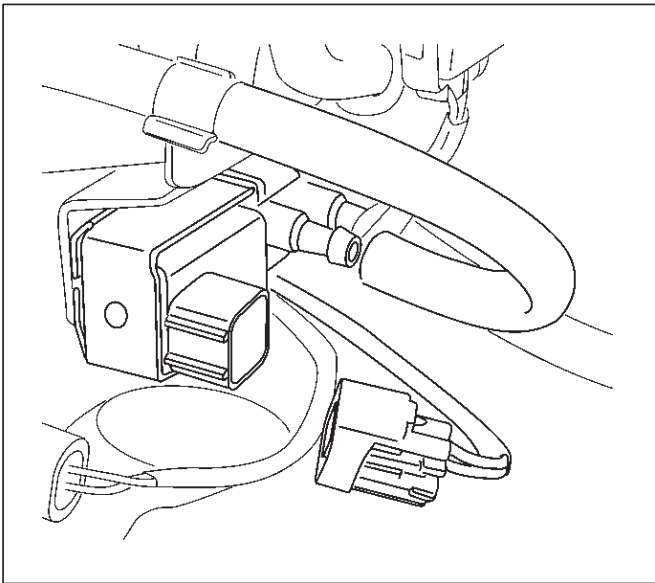
2. Install the MAP sensor assembly and EGR VSV and tighten MAP sensor bracket fixing bolts specified torque.

Torque: 9 N·m (78 lb in)



035RW067

3. Connect the EGR VSV connector and vacuum hose in the EGR VSV.



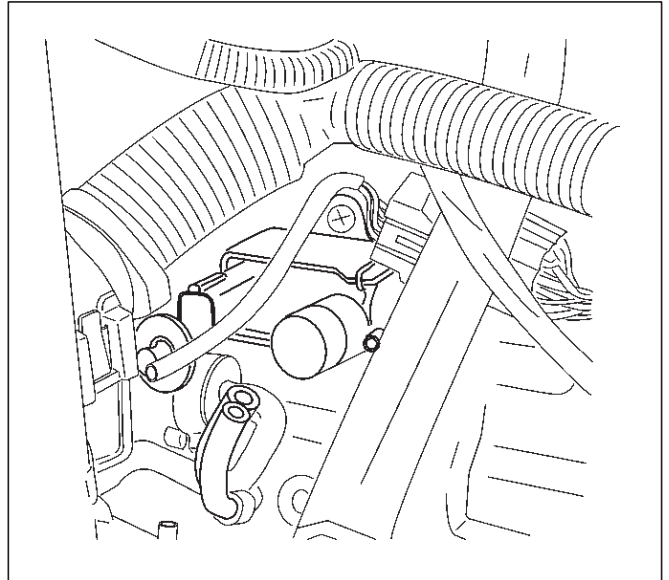
035RW063

4. Connect the negative battery cable.

Electronic Vacuum Regulating Valve (EVRV)

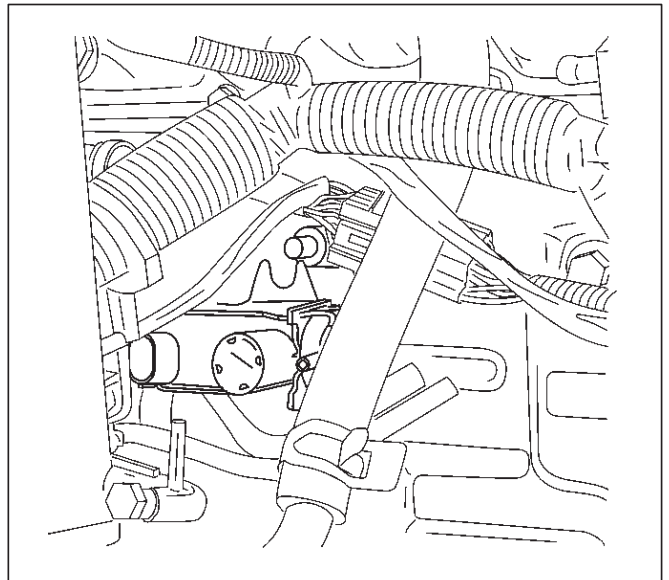
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the EVRV hose and the EVRV connector.



035RW065

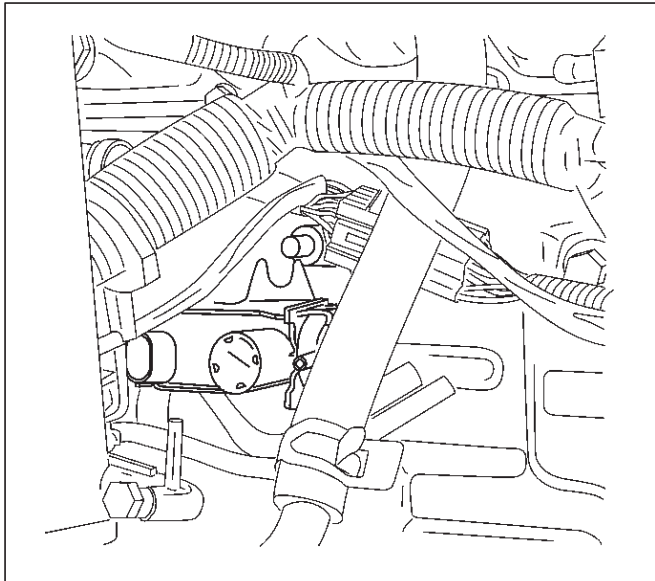
3. Remove the EVRV.



035RW064

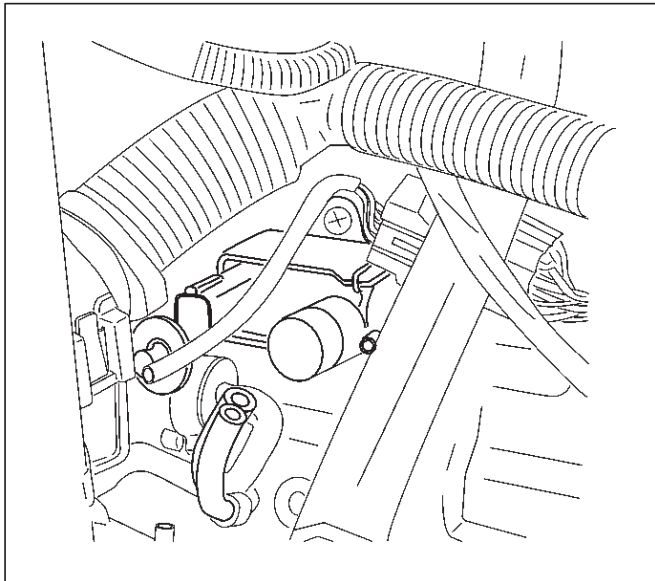
Installation Procedure

1. Install the EVRV.



035RW064

2. Connect the EVRV hose and the EVRV connector.



035RW065

3. Connect the negative battery cable.

Wiring and Connectors

Wiring Harness Service

The ECM harness electrically connects the ECM to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment. Replace wire harnesses with the proper part number replacement.

Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.

The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* for all wire harness repair procedures.

Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.

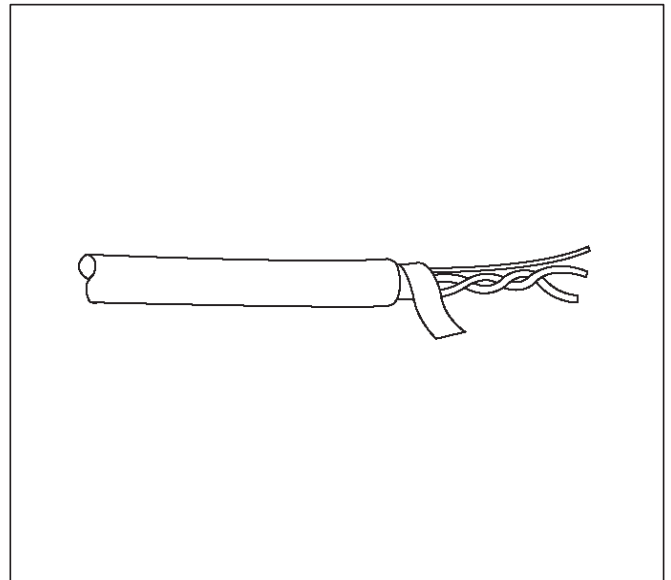
Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.

Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

Wire Harness Repair: Twisted Shielded Cable

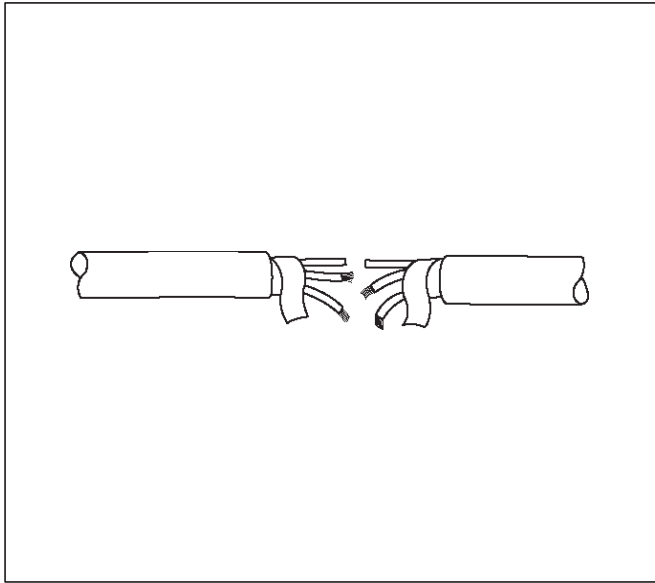
Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.

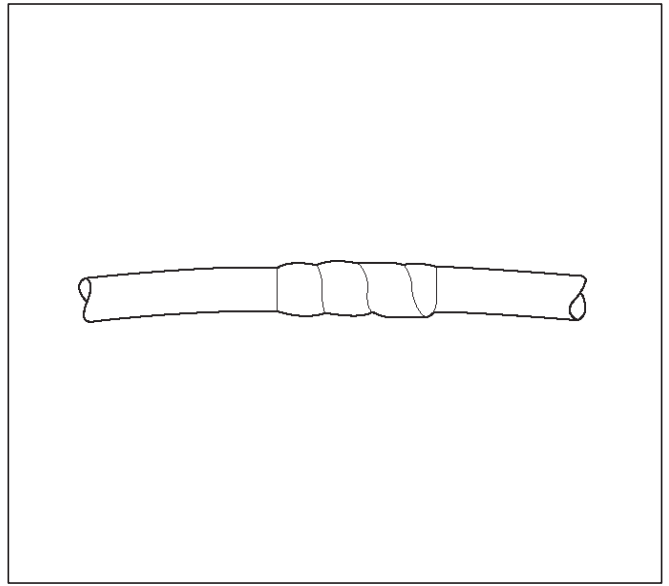


047

3. Untwist the conductors.
4. Strip the insulation as necessary.



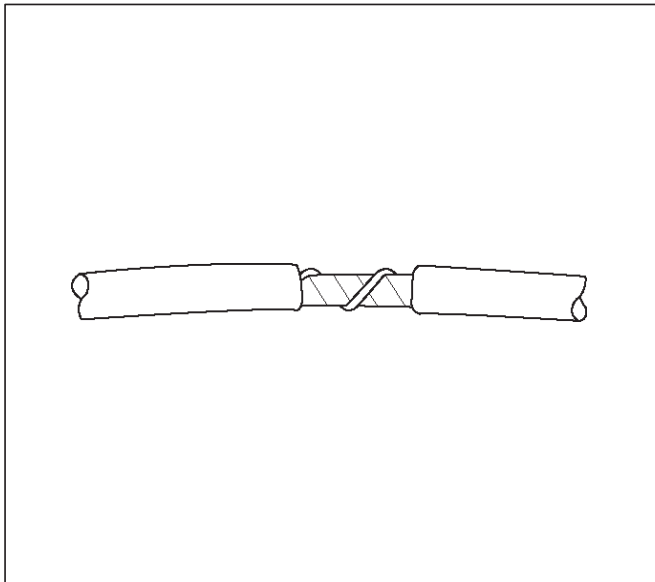
4. Tape over the whole bundle to secure.



Twisted Leads

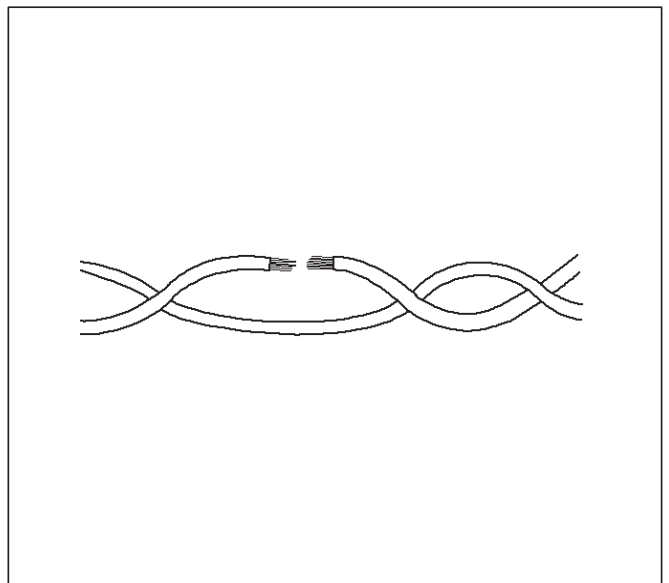
Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



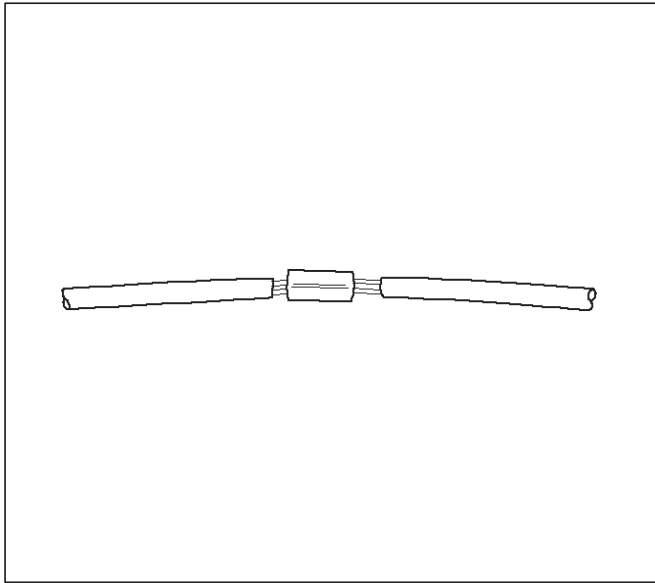
Removal Procedure

1. Locate the damaged wire.
2. Remove the insulation as required.

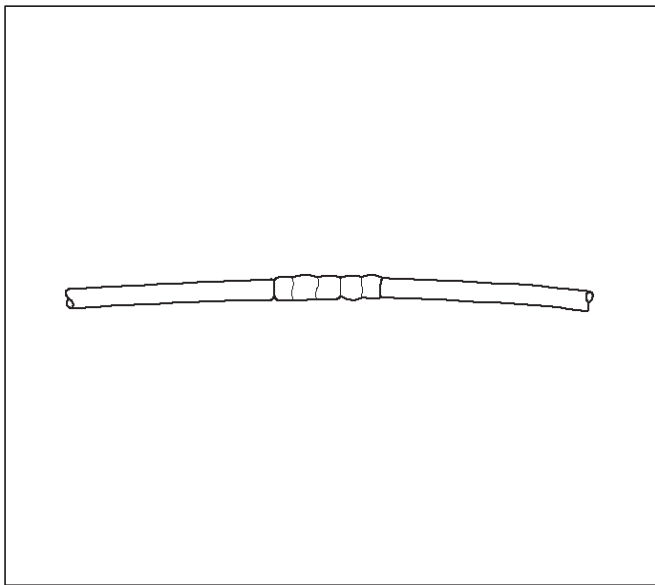


Installation Procedure

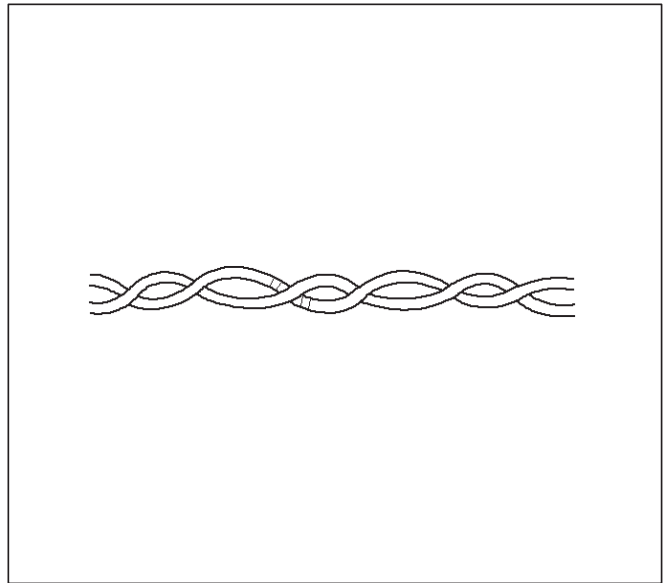
1. Use splice clips and rosin core solder in order to splice the two wires together.



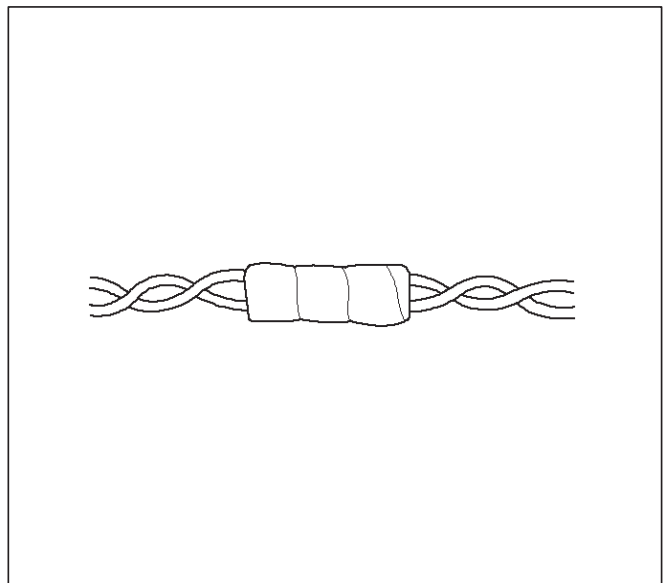
2. Cover the splice with tape in order to insulate it from the other wires.



3. Twist the wires as they were before starting this procedure.



4. Tape the wires with electrical tape. Hold in place.



Weather-Pack Connector

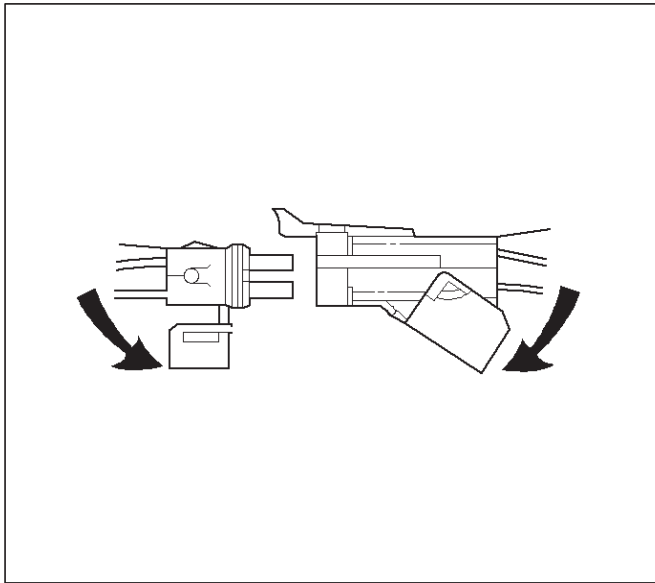
Tools Required

5-8840-0388-0 Weather-Pack II Terminal Remover

Removal Procedure

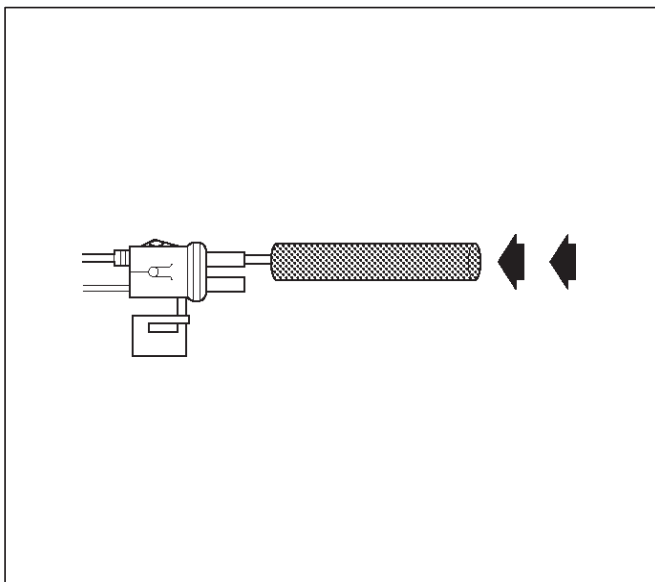
A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could lead to oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

1. Open the secondary lock hinge on the connector.

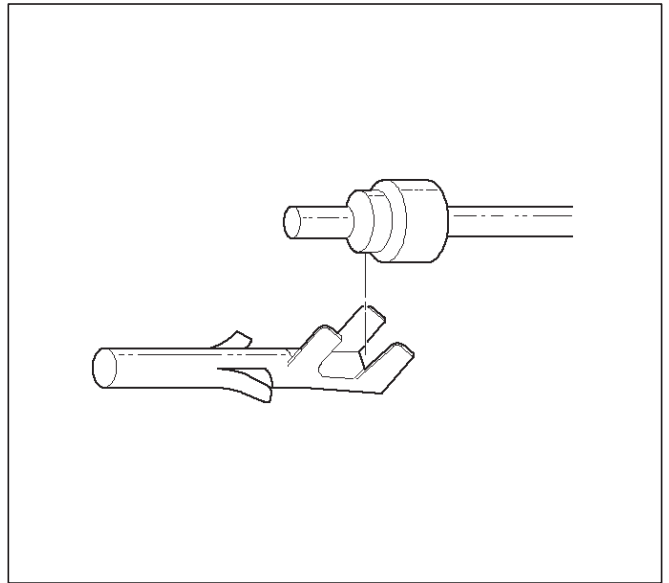


2. Use tool 5-8840-0388-0 or the equivalent to remove the pin and the sleeve terminals. Push on 5-8840-0388-0 to release.

NOTE: Do not use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



3. Cut the wire immediately behind the cable seal.

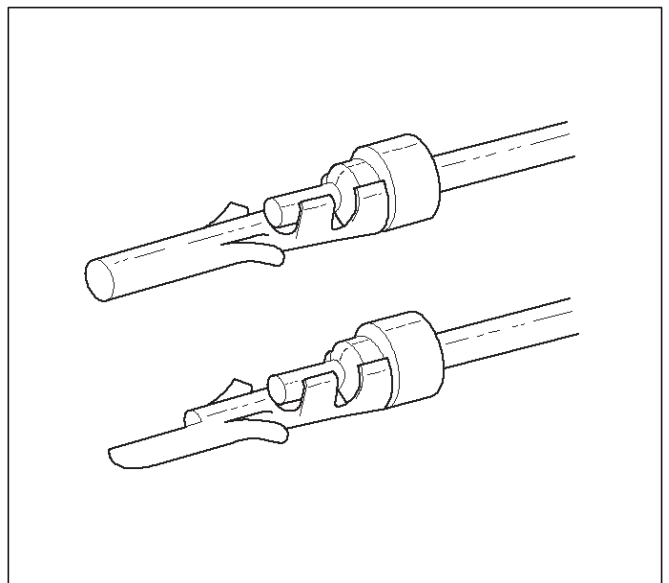


Installation Procedure

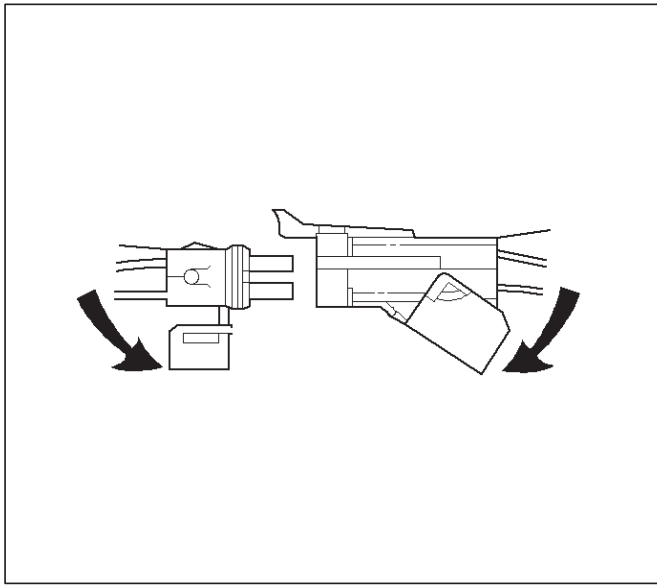
Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2") of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



5. Push the terminal and the connector to engage the locking tangs.



6. Close the secondary locking hinge.

Com-Pack III

General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool 5-8840-0388-0 or equivalent. These will damage the terminals.

Metri-Pack

Tools Required

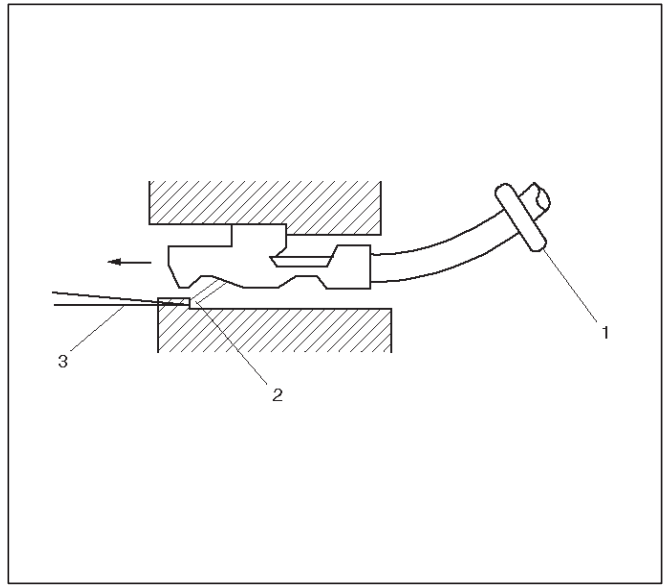
5-8840-0632-0 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.

2. Insert the 5-8840-0632-0 tool or equivalent (3) in order to release the terminal locking tang (2).

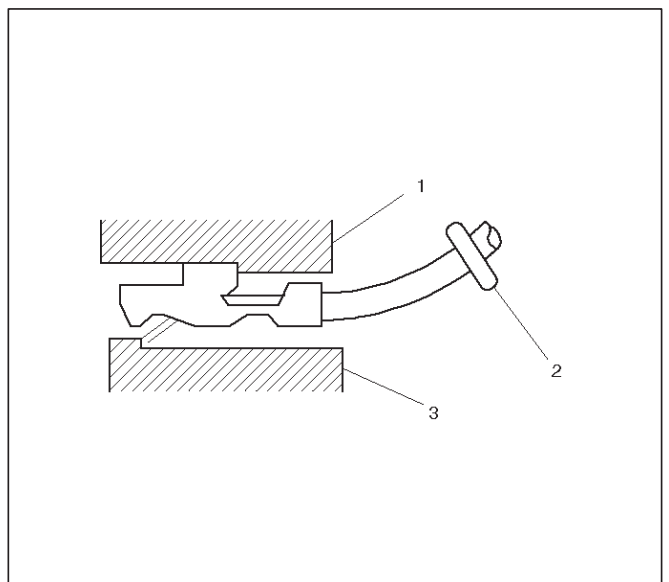


3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

Installation Procedure

Metri-Pack terminals are also referred to as "pull-to-seat" terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.



3. Then the terminal is pulled back into the connector to seat it in place.

General Description (ECM and Sensors)

57X Reference ECM Input

The engine control module (ECM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The ECM also uses the pulses on this circuit to initiate injector pulses. If the ECM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 57X reference signal.

A/C Request Signal

This signal tells the ECM when the A/C mode is selected at the A/C control head.

Refer to *A/C Clutch Circuit Diagnosis* for A/C wiring diagrams and diagnosis for the A/C electrical system.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the engine control module (ECM) to calculate the ignition sequence. The CKP sensor initiates the 57X reference pulses which the ECM uses to calculate RPM and crankshaft position.

Refer to *Electronic Ignition System* for additional information.

Camshaft Position (CMP) Sensor and Signal

The camshaft position (CMP) sensor sends a CMP signal to the ECM. The ECM uses this signal as a “cylinder distinction” to trigger the injectors in the power order. If the ECM detects an incorrect CMP signal while the engine is running, DTC P0341 will set, and the ECM triggers the injectors in the power order.

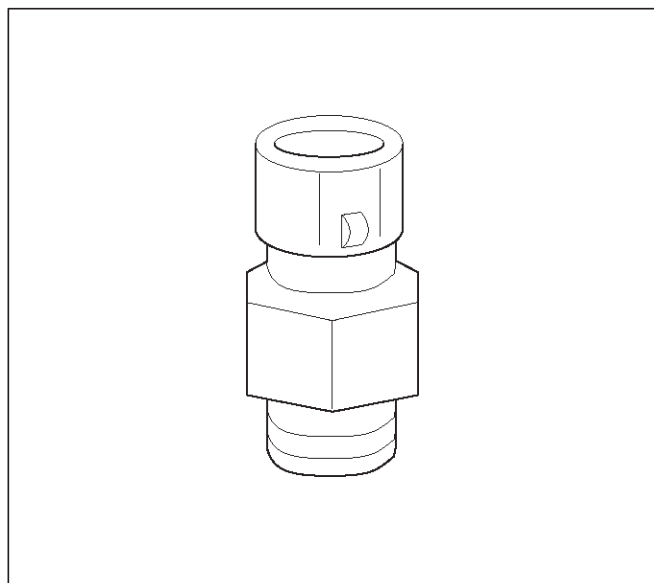
Refer to *DTC P0341*.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at -40°C (-40°F). High temperature causes a low resistance of 70 ohms at 130°C (266°F). The ECM supplies a 5-volt signal to the ECT sensor through resistors in the ECM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the ECM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the ECM controls.

The Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85°C (185°F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant

temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0117 or DTC P0118.



0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

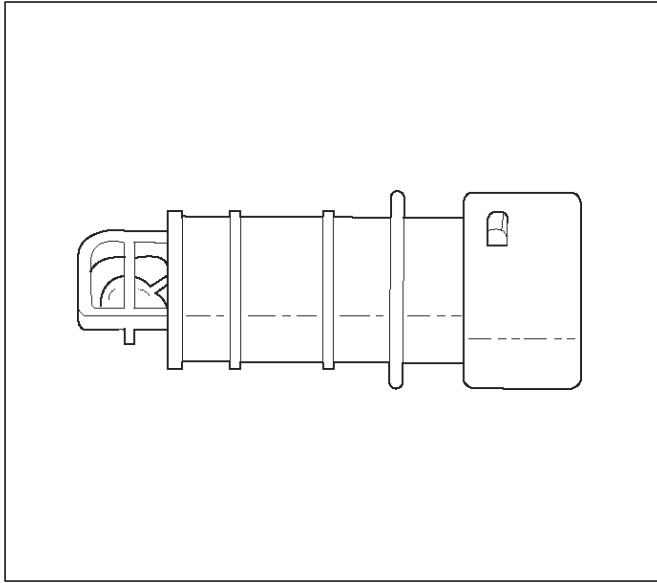
The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the ECM. The EEPROM contains the program and the calibration information that the ECM needs to control powertrain operation.

Unlike the PROM used in past applications, the EEPROM is not replaceable. If the ECM is replaced, the new ECM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the ECM.

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of 100,000 ohms at -40°C (-40°F). High temperature causes low resistance of 70 ohms at 130°C (266°F). The ECM supplies a 5-volt signal to the sensor through a resistor in the ECM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the ECM calculates the incoming air temperature.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.



Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the ECM varies from below 2 volts at idle (high vacuum) to above 4 volts.

The MAP sensor is used to determine the following:

- Boost pressure for injector control.
- Barometric pressure (BARO).

If the ECM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107 or DTC P1106, respectively. The ECM can detect a shifted MAP sensor. The ECM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the ECM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

Engine Control Module (ECM)

The engine control module (ECM) is located in the engine room.

The ECM constantly observes the information from various sensors. The ECM controls the systems that affect vehicle performance. The ECM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Service Engine Soon lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

ECM Function

The ECM supplies 5, 12 and 110 volts to power various sensors or switches. The power is supplied through resistances in the ECM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. The ECM controls output circuits such as the

injectors, glow relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)

ECM Components

The ECM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The ECM monitors numerous engine and vehicle functions via electronic sensors such as the crankshaft position (CKP) sensor, and vehicle speed sensor (VSS). The ECM also controls certain engine operations through the following:

- Fuel injector control
- Rail pressure control

ECM Voltage Description

The ECM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the ECM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter to assure accurate voltage readings.

The input/output devices in the ECM include analog-to-digital converters, signal buffers, counters, and special drivers. The ECM controls most components with electronic switches which complete a ground circuit when turned "ON." These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

ECM Input/Outputs

Inputs – Operating Conditions Read

- Air Conditioning "ON" or "OFF"
- Engine Coolant Temperature
- Crankshaft Position
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Intake Throttle Position
- Vehicle Speed
- Fuel Temperature
- Oil Temperature
- Intake Air Temperature
- EGR boost pressure
- Oil rail pressure
- Camshaft Position
- Accelerator position

Outputs – Systems Controlled

- Exhaust Gas Recirculation (EGR)
- Injector Control
- QWS

- QOS
- Diagnostics
 - Malfunction Indicator Lamp (Service Engine Soon lamp)
 - Data Link Connector (DLC)
 - Data Output

ECM Service Precautions

The ECM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the ECM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter. The ECM should remain connected to the ECM or to a recommended breakout box.

Intake Throttle Position (ITP) Sensor

ITP sensor is a potentiometer type and installed to the intake throttle valve body. A voltage of 5V is applied constantly from ECM to ITP sensor thereby to determine by change in voltage the opening of the intake throttle valve during warming up.

Transmission Range Switch

IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the ECM which position is selected by the transmission selector lever.

For more information on the transmission on the transmission range switch, refer to *Automatic Transmission*.

Accelerator Position Sensor (AP)

AP sensor is a potentiometer type and installed to accelerator pedal bracket. A voltage of 5V constantly applied from ECM to the sensor thereby to determine the accelerator pedaling angle by change in voltage. Further, this sensor is provided with an accelerator switch, which is set off only when the accelerator pedal is stepped on.

Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as

portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the ECM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.



TS23793

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the ECM connector pins or soldered components on the ECM circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

General Description (Air Induction)

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by the following steps:

1. Through the throttle body.
2. Into the intake manifold.
3. Through the cylinder head intake ports.
4. Into the cylinders.

General Description (Fuel Metering)

Deceleration Mode

The ECM reduces the amount of fuel injected when it detects a decrease in the Accelerator position.

Fuel Injector

Fuel injector comprises the solenoid, hydraulic line, and fuel line. Fuel injection is controlled by the continuity time signal and continuity start timing signal from ECM to the solenoid.

ECM determines the running conditions of engine by input signals such as engine speed, Accelerator throttle valve opening, and engine coolant temperature, thereby to send the solenoid the best suited signal to the engine status. When current is carried to the solenoid, the armature opens the poppet valve to allow high pressure oil to run into the injector. Under the pressure of the oil, the piston and plunger are depressed to compress the fuel in the combustion chamber of the plunger. Specifically, the pressure of the fuel compressed is increased by a piston top/plunger bottom area ratio over the pressure of high pressure oil, thereby lifting the fuel nozzle end needle for injecting fuel.

Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The intake throttle body.
- The Accelerator position (AP) sensor
- The ECM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.

Basic System Operation

Fuel is supplied through fuel filter to the fuel pump. The fuel pump is installed to the oil pump, and fuel is forced, through the fuel pump outlet, pipe and cylinder head inside, into the fuel injector. An orifice is provided at the rear fuel outlet of cylinder head to control the pressure of oil.

The injector is controlled by ECM which gives opening/closing commands to the solenoid installed on the top of the injector. Opening/closing operation of the pressurized engine oil circuit of the injector controls fuel injection quantity, fuel injection timing, etc.

A/C Clutch Diagnosis

A/C Request Signal

This signal tells the ECM when the A/C mode is selected at the A/C control head. The ECM uses this to adjust the idle speed.

Refer to *A/C Clutch Circuit Diagnosis* for A/C wiring diagrams and diagnosis for A/C electrical system.

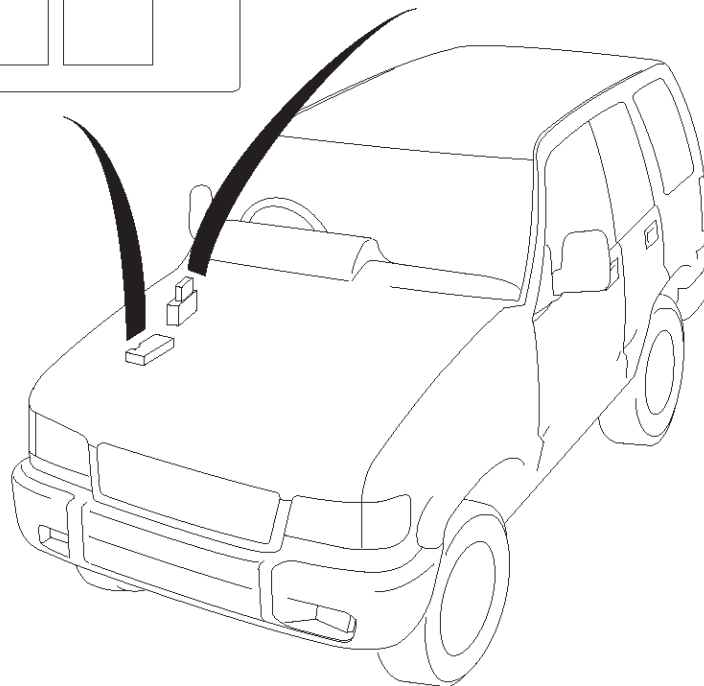
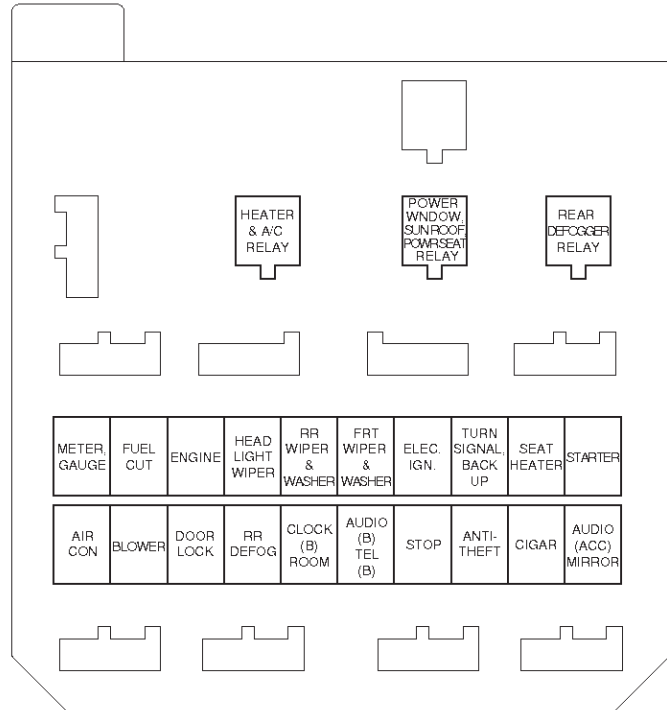
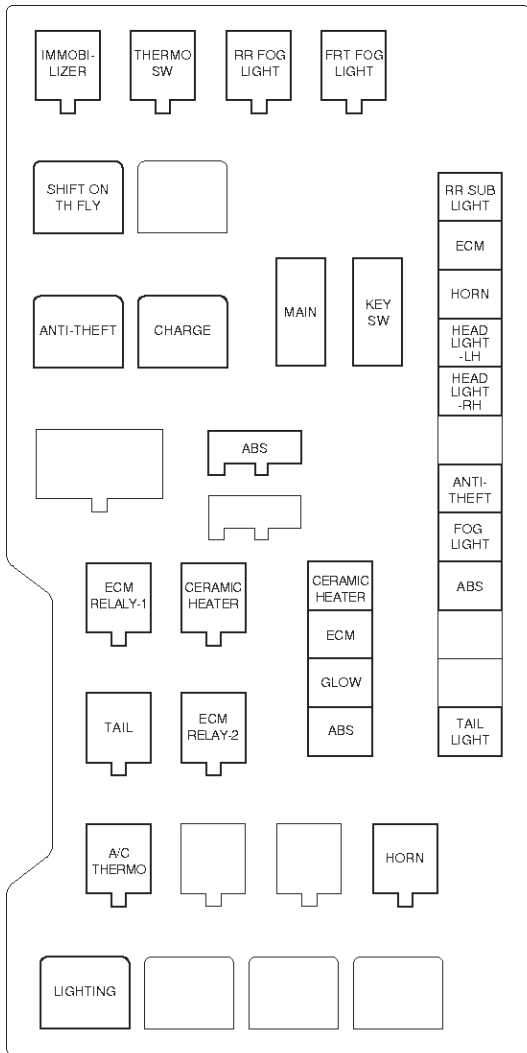
General Description Exhaust Gas Recirculation (EGR) System

EGR Purpose

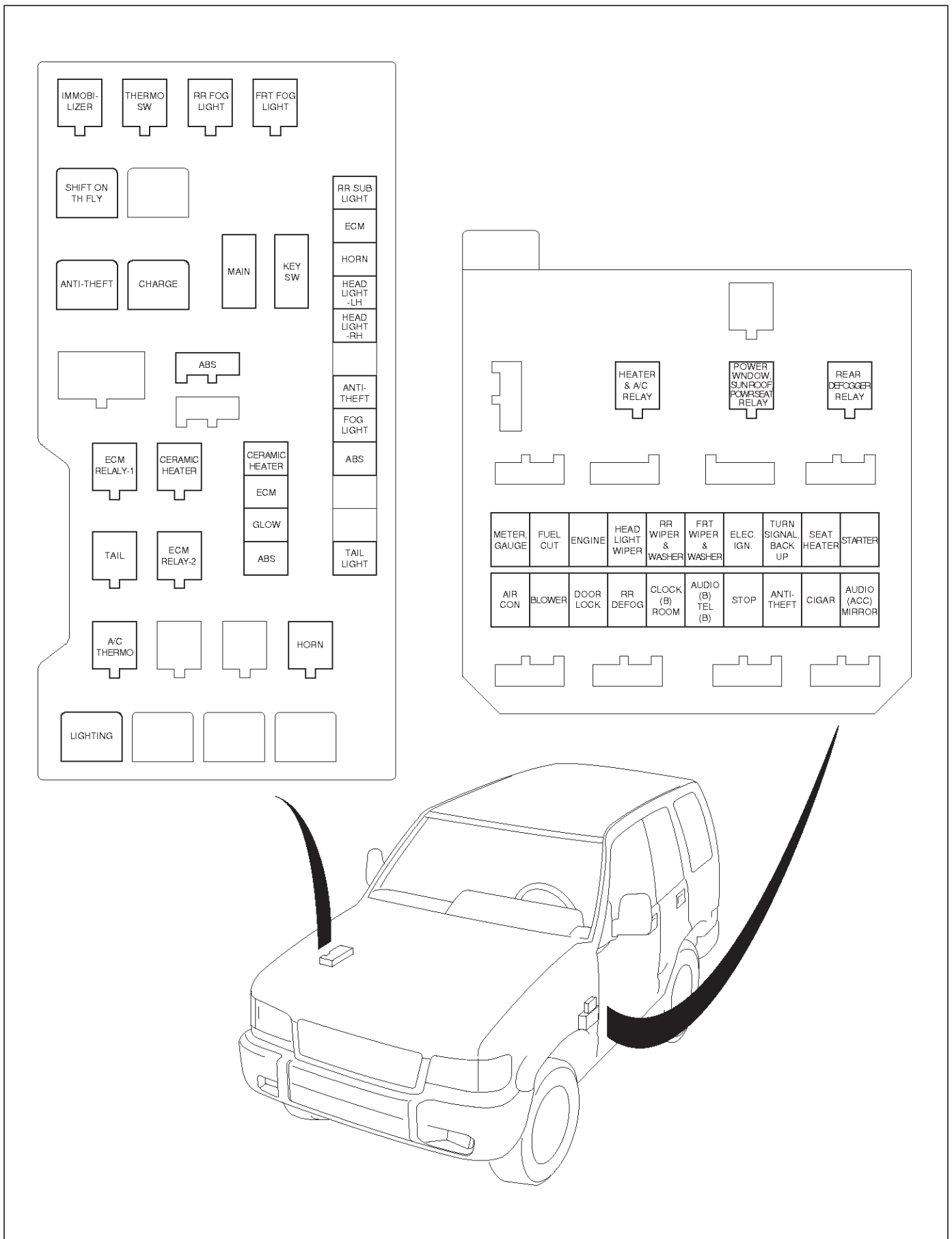
The exhaust gas recirculation (EGR) system is used to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature. The ECM uses information from the following sensors to control EGR valve boost pressure.

- ECT
- ITP
- Engine Speed
- AP sensor

Fuse and Relay Panel (Underhood Electrical Center) RHD



Fuse and Relay Panel (Underhood Electrical Center) LHD



ENGINE EXHAUST

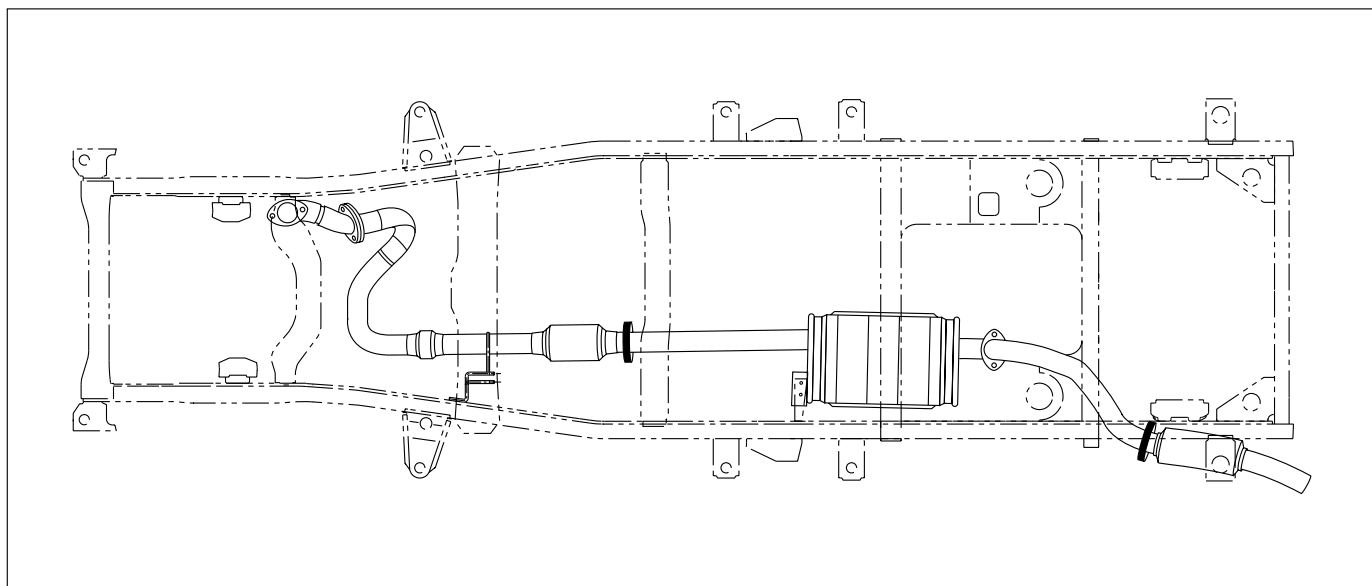
CAUTION: Exhaust system components must have enough clearance from the underbody to prevent overheating of the floor pan and possible damage

to the passenger compartment, insulation and trim materials.

CONTENTS

General Description	6F-2	Center Exhaust Pipe	6F-5
Hangers	6F-2	Exhaust Silencer	6F-6
Gasket	6F-2	Rear Exhaust Pipe	6F-7
On-Vehicle Service	6F-3		
Front Exhaust Pipe	6F-3		

GENERAL DESCRIPTION



When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating of the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

HANGERS

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

GASKET

The gasket must be replaced whenever a new exhaust pipe, muffler or exhaust throttle is installed.

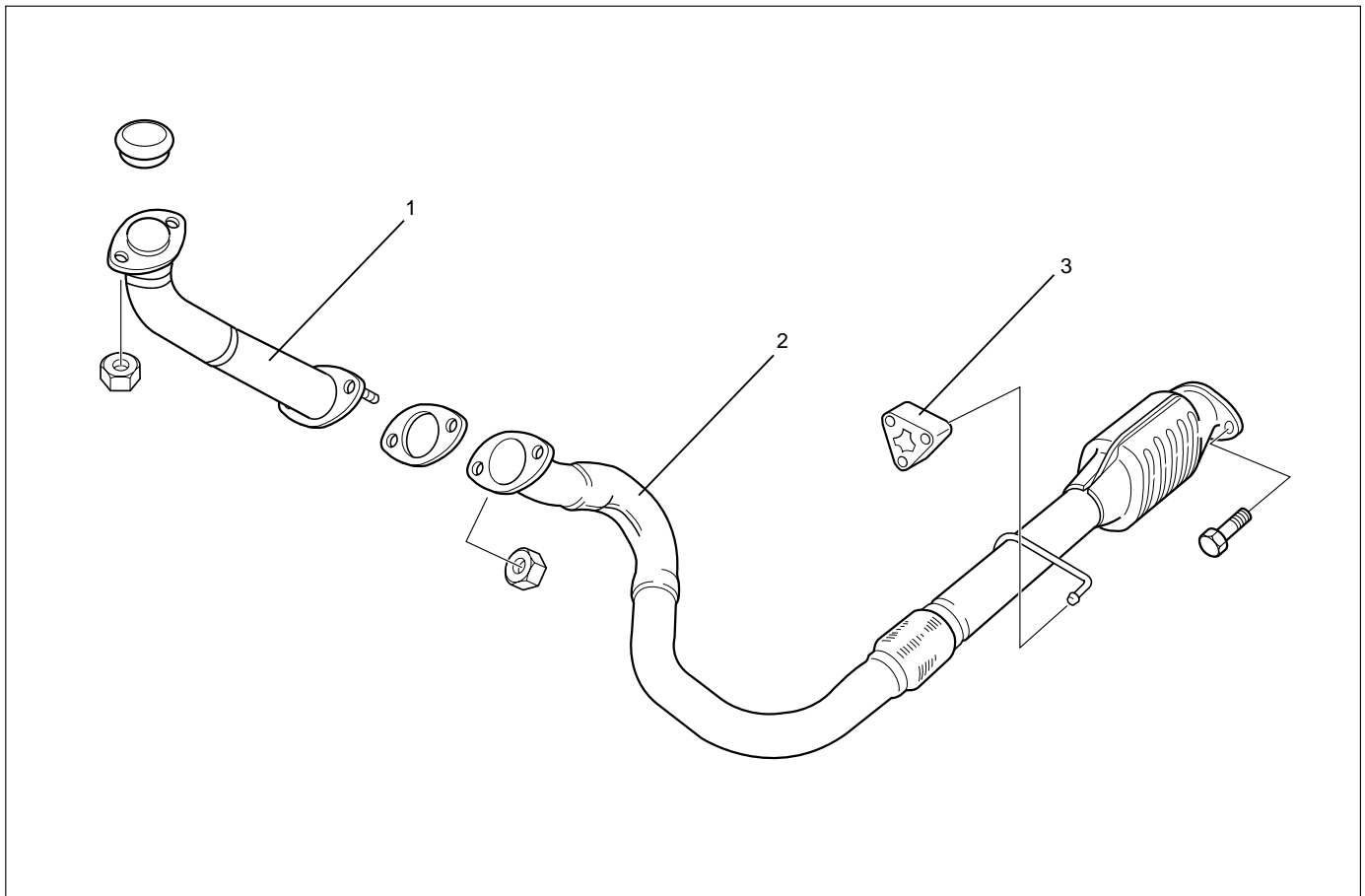
ON-VEHICLE SERVICE

Rattles and noise vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all bolts or nuts loose until all parts are properly aligned; then tighten, working from front to rear.

1. Check connections for looseness or damage, especially for exhaust gas leakage.
2. Check clamps and rubbers for weakness, cracks or damage.

3. If any part of the converter heat shield is damaged or dented to the extent that it contacts the catalyst, repair or replace.
4. Check for dents or damage and for any holes or cracks caused by corrosion.

FRONT EXHAUST PIPE



150RW071

Legend

- (1) Front exhaust pipe
- (2) Center exhaust pipe
- (3) Mounting rubber

REMOVAL

1. Battery negative cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove front exhaust pipe fixing nuts from engine side.
4. Remove fixing nuts between front exhaust pipe and center exhaust pipe, remove front exhaust pipe.
5. Disconnect center exhaust pipe and silencer, remove center exhaust pipe.
6. Remove fixing nuts from connection part of tail pipe, remove mounting rubber and remove silencer bracket, silencer.
7. Remove mounting rubber for tail pipe, remove tail pipe.

INSTALLATION

1. Install front exhaust pipe and tighten it temporarily.
2. Tighten fixing nuts of front exhaust pipe to the specified torque. (for engine side)

Torque: 67 N·m (6.8 kg·m/50 lb ft)

3. Tighten fixing nuts of front exhaust pipe to the specified torque. (for center pipe side)

Torque: 43 N·m (4.4 kg·m/32 lb ft)

4. Install silencer and tighten silencer bracket nuts to the specified torque.

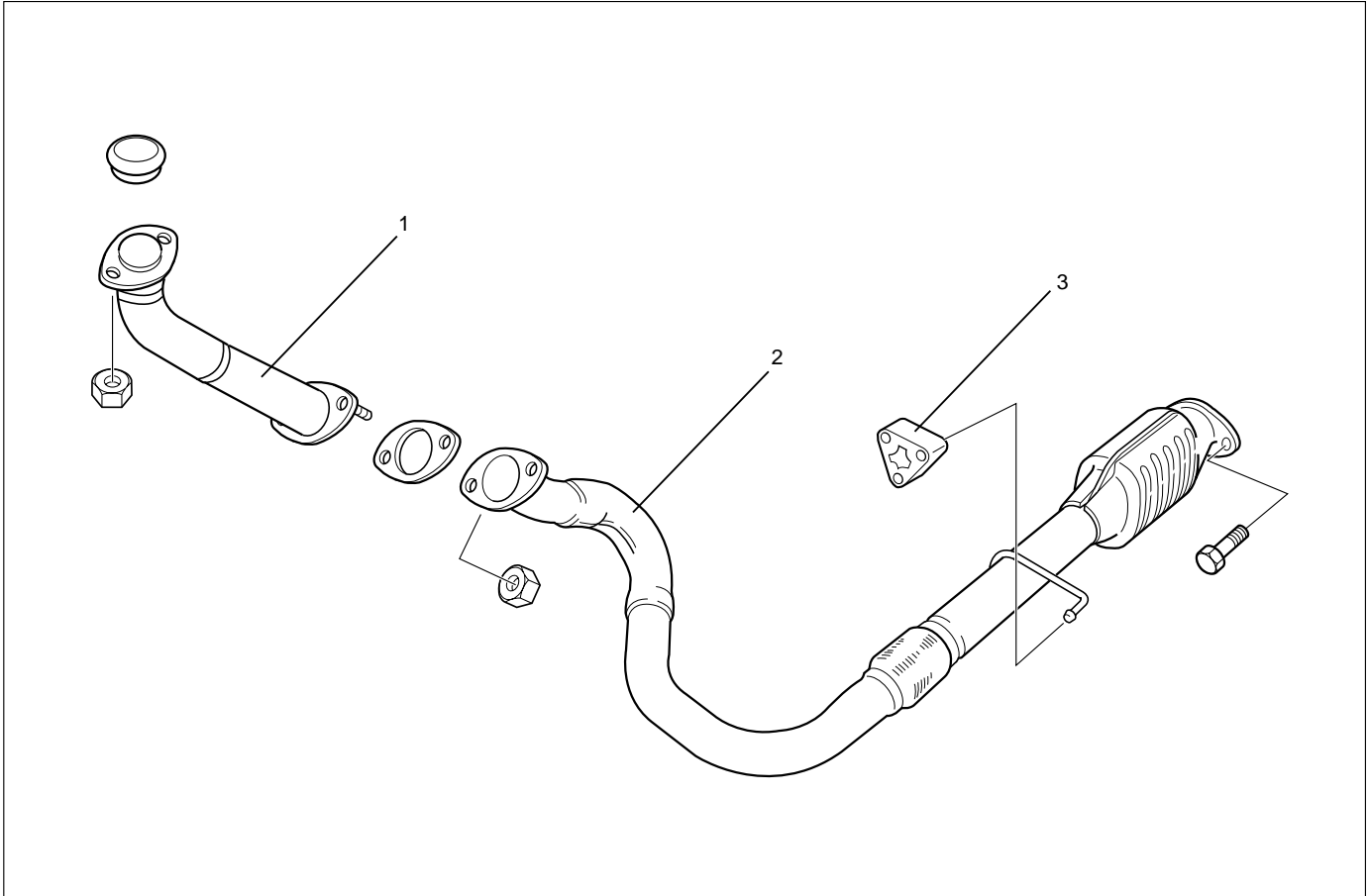
Torque: 16 N·m (1.6 kg·m/12 lb ft)

5. Install tail pipe and tighten it.

Torque: 43 N·m (4.4 kg·m/32 lb ft)

6. Install mounting rubbers.

CENTER EXHAUST PIPE



150RW071

Legend

- (1) Front Exhaust Pipe
- (2) Center Exhaust Pipe
- (3) Mounting Rubber

REMOVAL

1. Battery negative cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove mounting rubber.
4. Remove fixing nuts from silencer side.
5. Remove fixing nuts from front exhaust pipe.
6. Remove center exhaust pipe assembly.

INSTALLATION

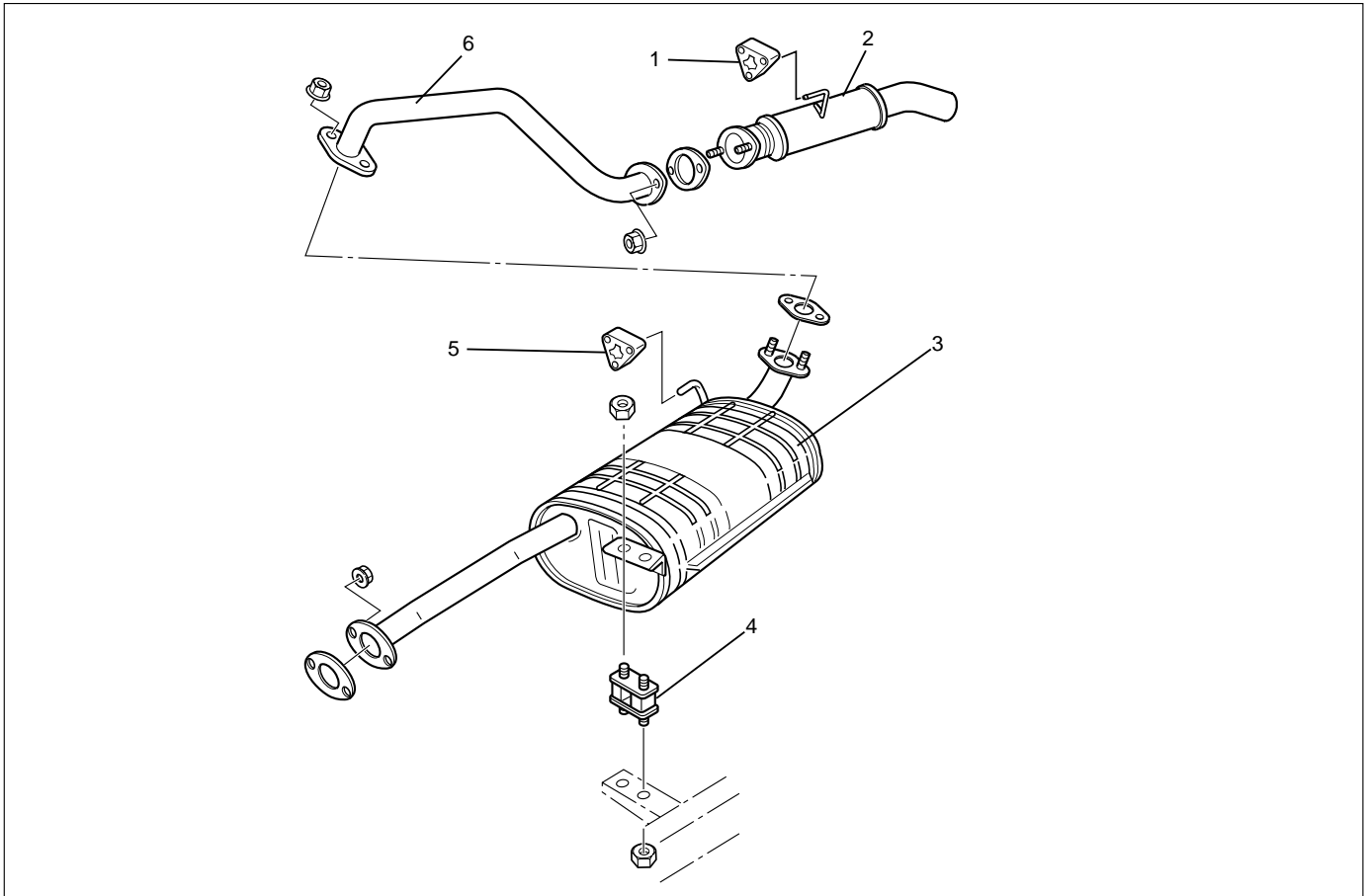
1. Place center exhaust pipe in the original position then tighten fixing nuts temporarily.
2. Install mounting rubber.
3. Tighten front exhaust pipe side nuts to the specified torque.

Torque : 43 N·m (4.4 kg·m/32 lb ft)

4. Tighten silencer side nuts to the specified torque.

Torque : 43 N·m (4.4 kg·m/32 lb ft)

EXHAUST SILENCER



150RW072

Legend

- | | |
|---------------------|----------------------|
| (1) Mounting Rubber | (4) Mounting Bracket |
| (2) Post Silencer | (5) Mounting Rubber |
| (3) Silencer | (6) Tail Pipe |

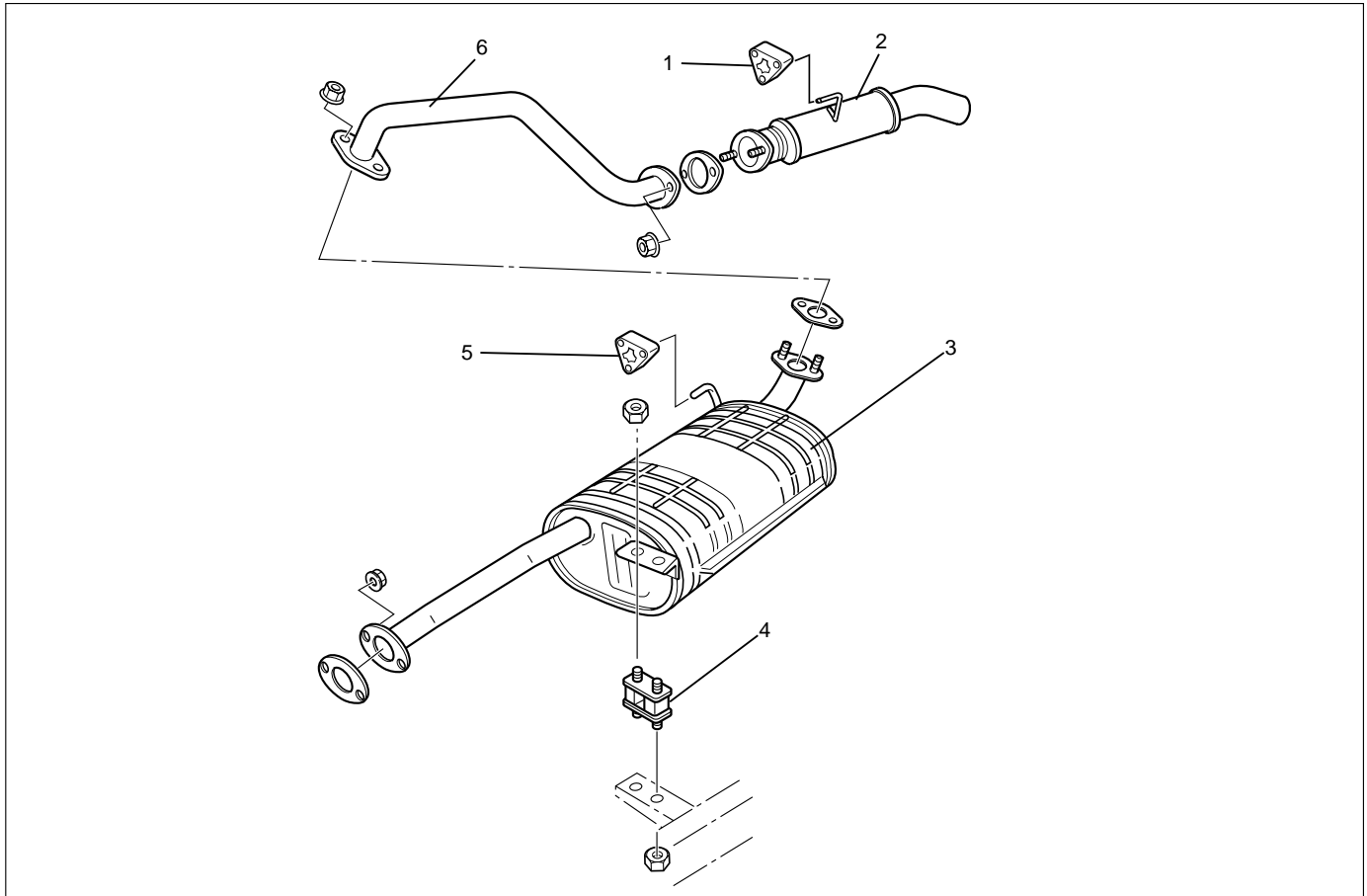
REMOVAL

1. Battery negative cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove mounting rubber from silencer.
4. Remove silencer mounting bracket.
5. Remove fixing nuts between center exhaust pipe and silencer.
6. Remove fixing nuts from tail pipe flange.
7. Remove silencer assembly.

INSTALLATION

1. Place silencer assembly in the original installation position, tighten both side (front and rear) nuts temporarily.
2. Tighten silencer mounting bracket to the specified torque.
Torque : 16 N·m (1.6 kg·m/12 lb ft)
3. Tighten center exhaust pipe side nuts to the specified torque.
Torque : 43 N·m (4.4 kg·m/32 lb ft)
4. Tighten tail pipe side nuts to the specified torque.
Torque : 43 N·m (4.4 kg·m/32 lb ft)
5. Install silencer mounting rubber.

REAR EXHAUST PIPE



150RW072

Legend

- | | |
|---------------------|----------------------|
| (1) Mounting Rubber | (4) Mounting Bracket |
| (2) Post Silencer | (5) Mounting Rubber |
| (3) Silencer | (6) Tail Pipe |

REMOVAL

1. Battery negative cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove mounting rubber from post silencer.
4. Remove fixing nuts at silencer side.
5. Remove tail pipe together with post silencer.
6. Remove fixing nuts between tail pipe and post silencer which separates them.

INSTALLATION

1. Install tail pipe and post silencer and tighten them to the specified torque.
Torque : 43 N·m (4.4 kg·m/32 lb ft)
2. Place tail pipe together with post silencer to original position and tighten fixing nuts at silencer side.
Torque : 43 N·m (4.4 kg·m/32 lb ft)
3. Install mounting rubber for post silencer.
4. Lower the vehicle.
5. Reconnect battery negative cable.

MEMO

A series of horizontal dotted lines for writing.

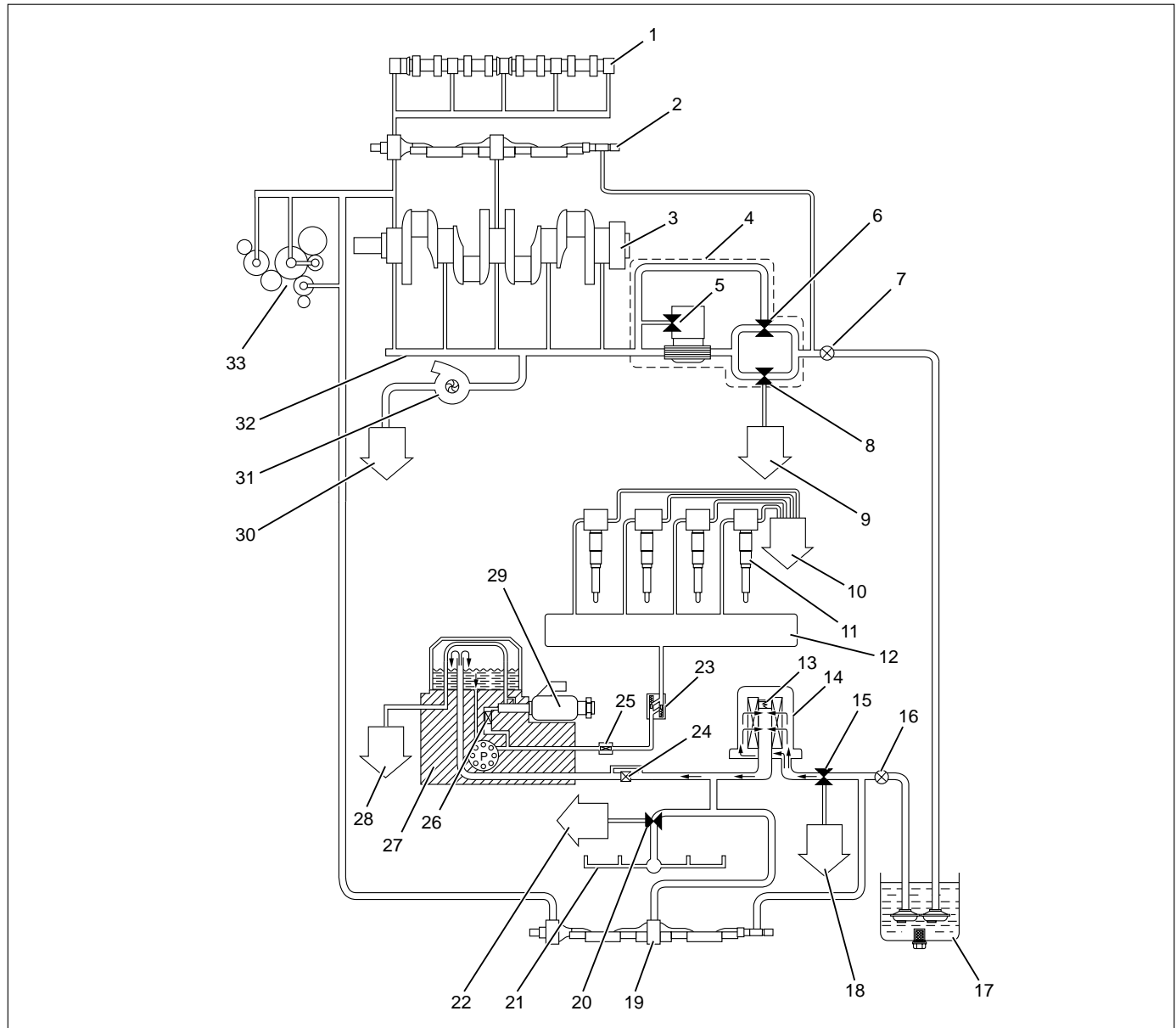
ENGINE LUBRICATION

CONTENTS

General Description	6G-2	Oil Pump	6G-5
Lubrication Chart	6G-2	Oil Cooler Assembly	6G-6
Oil Flow	6G-3	Oil Cooler Specification	6G-6
Oil Pump Specification	6G-3	Oil Filter	6G-6
Oil Filter Specification	6G-3	Sub Oil Filter	6G-6
Sub Oil Filter Specification	6G-4		

GENERAL DESCRIPTION

LUBRICATION CHART



040RW018

Legend

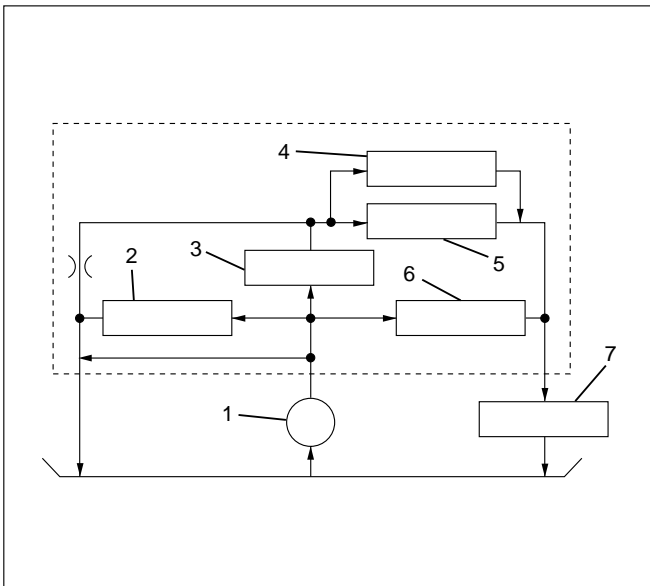
- | | |
|---|---|
| (1) Camshaft | (13) Sub Oil Filter Relief Valve 98 Kpa (1 kg/cm ² / 14.2 Psi) |
| (2) Balance Shaft | (14) Sub Oil Filter |
| (3) Crankshaft | (15) Relief Valve 588 Kpa (6 kg/cm ² / 85 Psi) |
| (4) Oil Cooler and Oil Filter Assembly | (16) Second Oil Pump |
| (5) Oil Filter Relief Valve 98 Kpa (1 kg/cm ² /14.2 Psi) | (17) Oil Pan |
| (6) Oil Cooler Relief Valve 245 Kpa (2.5 kg/cm ² / 36 Psi) | (18) To Oil Pan |
| (7) First Oil Pump | (19) Balance Shaft |
| (8) Main Oil Relief Valve 588 Kpa (6 kg/cm ² / 85 Psi) | (20) Cooling Jet Relief Valve 245 Kpa (2.5 kg/cm ² / 36 Psi) |
| (9) To Oil Pan | (21) Cooling Jet |
| (10) To Oil Pan | (22) To Oil Pan |
| (11) Injector | (23) Two Way Check Valve |
| (12) Oil Rail | (24) Nipple Filter |

- (25) Edge Filter
- (26) Edge Filter
- (27) High Pressure Oil Pump Assembly
- (28) To Oil Pan
- (29) Pressure Control Valve

- (30) To Oil Pan
- (31) Turbocharger
- (32) Oil Gallery
- (33) Timing Gear Train

To meet a newly adopted electronically controlled fuel injection system using engine oil two oil pumps have been provided to increase circulating oil capacity. The first oil pump serves mainly to lubricate the engine parts, while the second mainly serves the fuel injectors and partially cools the pistons. The oil cooler is provided on the first oil pump side and uses engine coolant.

OIL FLOW



050RW010

Legend

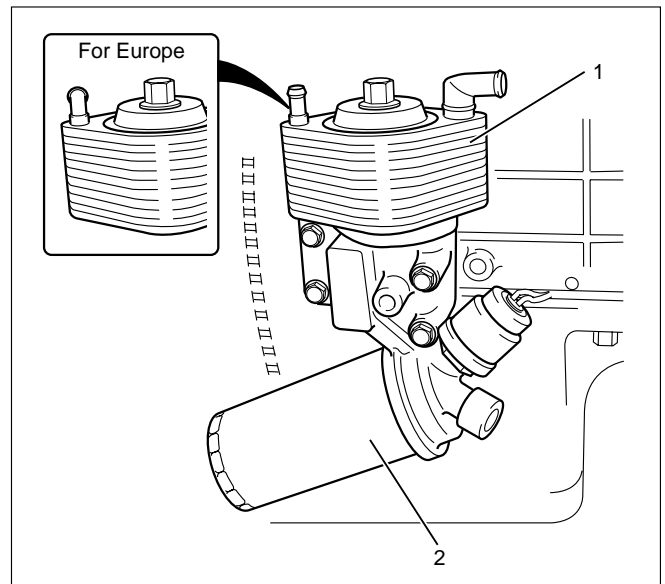
- (1) Oil Pump
- (2) Regulator Valve
- (3) Oil Cooler
- (4) Oil Filter Relief Valve
- (5) Full Flow Filter
- (6) Oil Cooler Relief Valve
- (7) Gallery

OIL PUMP SPECIFICATIONS

	First	Second
Pump Revolution	8800 rpm	
Delivery Pressure	392 Kpa (4.0 kg/cm ² /57 psi)	
Delivery Capacity	>48.8 l/min	>37.1 l/min

OIL FILTER SPECIFICATIONS

Filtration Method	Full flow Paper
Filtration Area	0.32 m ²
Relief Valve opening pressure	981 Kpa (10 kg/cm ² /142 psi)



050R200001

Legend

- (1) Oil cooler assembly
- (2) Oil filter assembly

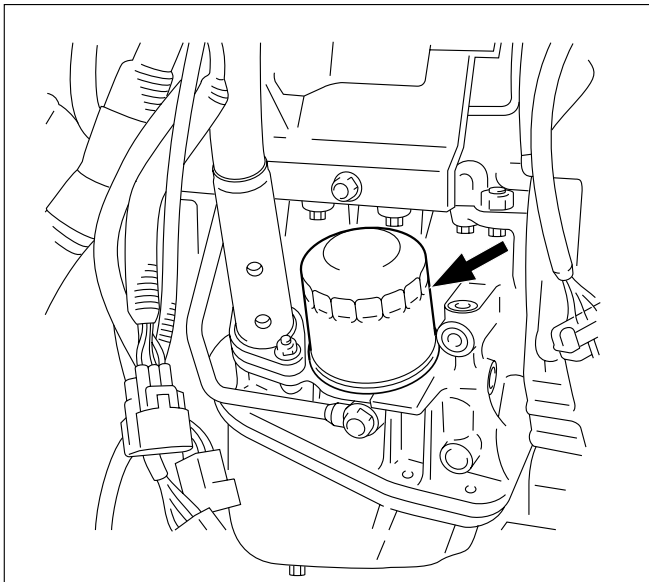
SUB OIL FILTER SPECIFICATIONS

Filtration Method	Full flow Paper
Filtration Area	0.12 m ²
Relief Valve opening pressure	981 Kpa (10 kg/cm ² /142 psi)

The sub oil filter requires no servicing until the replacement interval is reached.

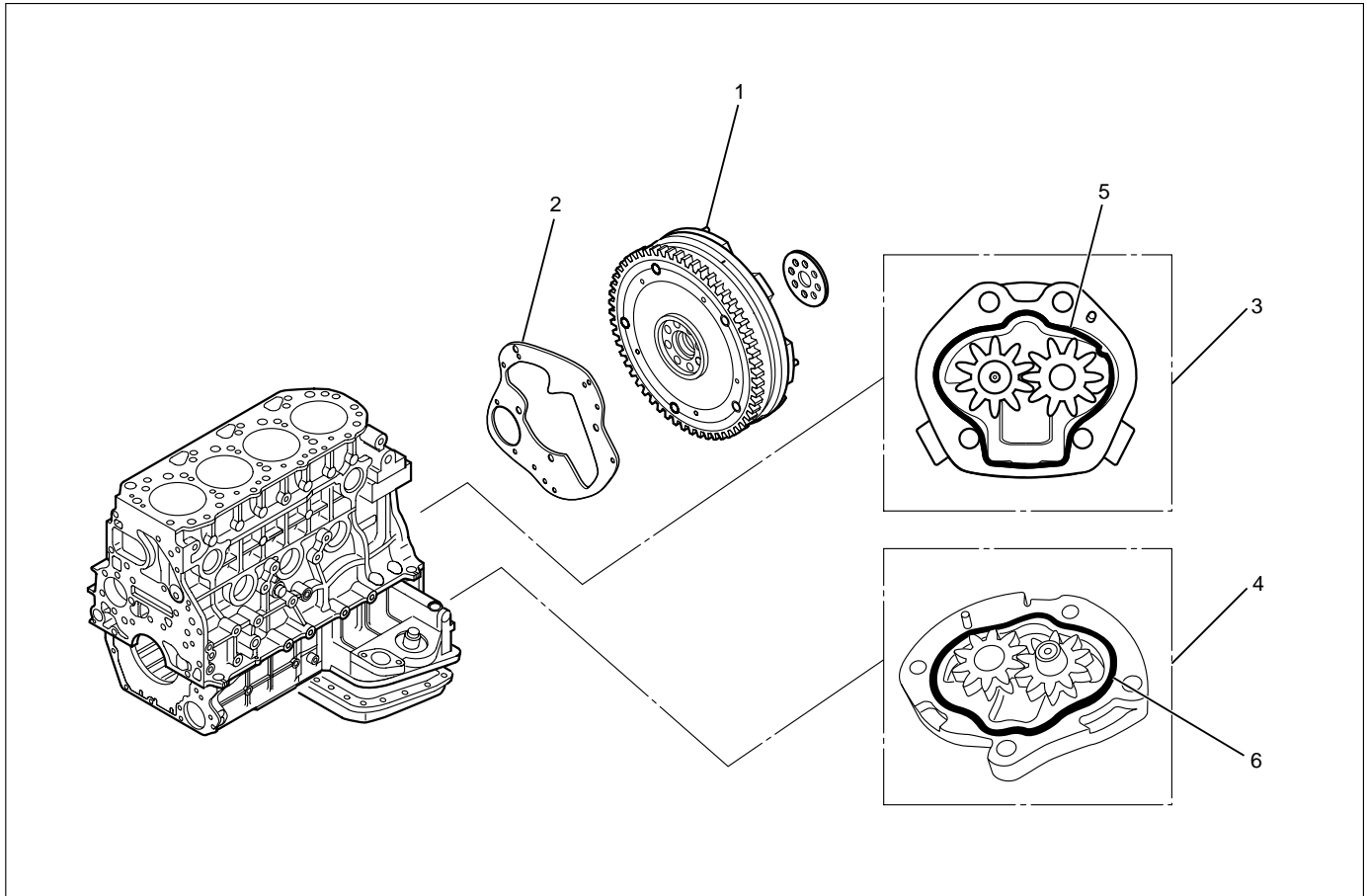
The element is designed to provide special filtering efficiency until it becomes due for replacement.

It is recommended to check and replace the sub filter when the engine is being overhauled or if it is broken inside the engine.



442RW004

OIL PUMP



012RW097

Legend

- | | |
|--------------------|-------------------------------|
| (1) Flywheel | (4) Second Oil Pump |
| (2) Rear Plate | (5) O-ring (For 1st oil pump) |
| (3) First Oil Pump | (6) O-ring (For 2nd oil pump) |

REMOVAL

1. Remove battery ground cable.
2. Raise the vehicle and support with suitable safety stand.
3. Drain engine oil.
4. Remove flywheel assembly.
5. Remove rear plate (For A/T) or flywheel housing (For MT).
6. Remove first oil pump assembly from cylinder block and second oil pump assembly from crank case.

INSPECTION AND REPAIR

1. Inspect flaws and/or wear on the teeth surface.
2. Inspect abnormal wear journal on the gear and in the drive spline.
3. If problem is found during inspection, the worn parts must be replaced.

INSTALLATION

1. Install first oil pump.
 - 1) Set O-ring to oil pump.
 - 2) Install oil pump drive gear to the end of balance shaft RH.
 - 3) Apply engine oil to oil pump gear and install gear to the end surface of cylinder block.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

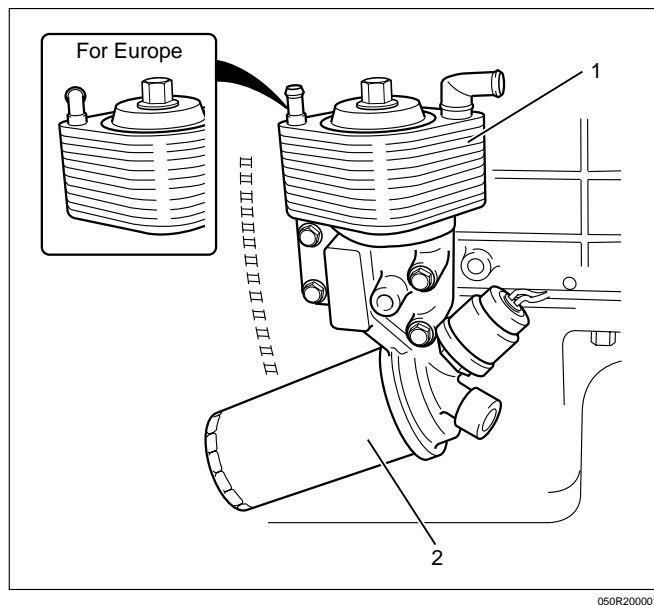
2. Install second oil pump.
 - 1) Set O-ring to oil pump.
 - 2) Install oil pump drive gear to the end of balance shaft LH.
 - 3) Apply engine oil to oil pump gear and install gear to the end surface of crankcase.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

OIL COOLER ASSEMBLY

REMOVAL

1. Disconnect battery ground cable.
2. Drain engine coolant.
3. Remove front exhaust pipe.
4. Remove heat protector.
5. Remove exhaust valve assembly.
6. Oil cooler assembly.
 - 1) Remove water hose from water inlet and outlet side.
 - 2) Cloth should be put under the oil cooler to prevent oil from flowing out.
 - 3) Loosen fixing bolt then remove oil cooler assembly.



Legend

- (1) Oil cooler assembly
- (2) Oil filter assembly

INSPECTION AND REPAIR

1. Inspect for corrosion, wear, and breaks on the oil cooler core.
2. If a problem is found on the oil cooler core, the oil cooler assembly must be replaced.

INSTALLATION

1. Oil cooler assembly
 - 1) Tighten oil cooler fixing bolt to the specified torque and install water hoses.

Torque: 29 N-m (3.0 kg-m / 21.7 lb ft)

2. Install exhaust valve assembly to turbocharger assembly and tighten to the specified torque.

Torque: 27 N-m (2.7 kg-m / 19.5 lb ft)

3. Install front exhaust pipe to the exhaust valve.

Torque:

67 N-m (6.8 kg-m / 49.2 lb ft)
(At exhaust valve side)

43 N-m (4.4 kg-m / 32 lb ft)
(At center exhaust pipe side)

4. Install heater protector.
5. Fill engine coolant.
6. Connect battery ground cable.
7. Start engine and carefully check for leakage of oil and coolant.

OIL COOLER SPECIFICATIONS

Cooling method	Water cooled Multi plate type
Heat exchange Area	0.323 m ²
Heat exchange capacity	>11,300 kcl/h
Relief Valve opening pressure	245 Kpa (2.5 kg/cm ² /36 psi)

OIL FILTER

REMOVAL

1. Put container under the oil filter to prevent oil from the oil filter from flowing out.
2. Use filter wrench to remove oil filter.
Filter wrench: 5-8840-0203-0

INSTALLATION

1. Apply engine oil thinly to oil filter O-ring.
2. Tighten oil filter by hand until O-ring comes in contact with the sealing surface.
3. Use filter wrench to tighten oil filter one turn and 1/8 turn.
4. Start engine and carefully check for oil leakage from oil filter.

SUB OIL FILTER

The sub oil filter requires no servicing until the replacement interval is reached.

The element is designed to provide special filtering efficiency until it becomes due for replacement.

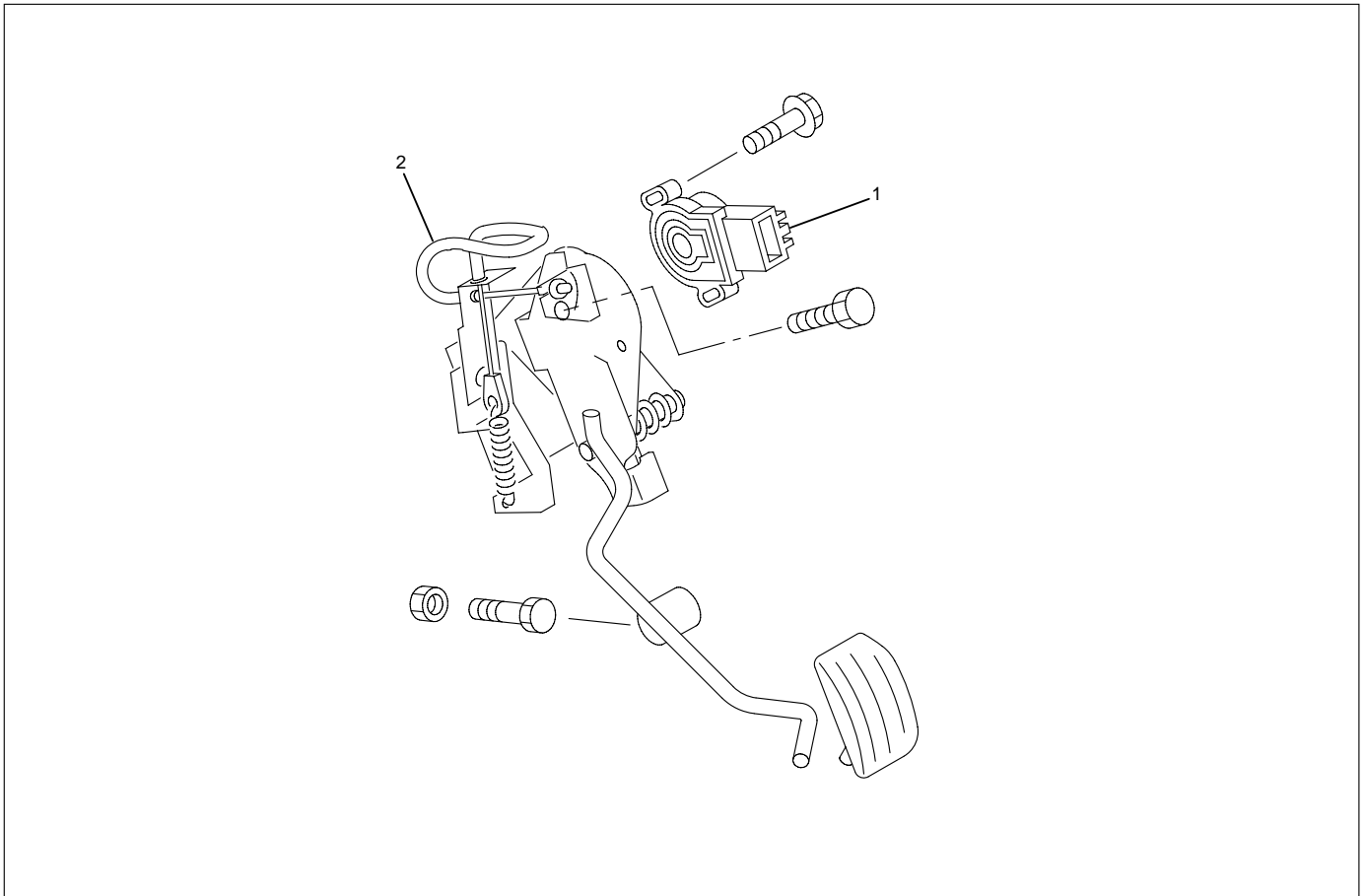
It is recommended to check and replace the sub oil filter when the engine is being overhauled or if it is broken inside the engine.

ENGINE SPEED CONTROL

CONTENTS

General Description 6H-2 Accelerator Pedal 6H-3

GENERAL DESCRIPTION



101R200006

Legend

- (1) Accelerator Position Sensor
- (2) Return Cable

Engine control has been changed from the control cable system to an electronically controlled TP (Throttle Position) sensor.

The TP sensor is a potentiometer (Variable resistance) type and installed to the accelerator pedal bracket.

A voltage of 5 V is always applied from the ECM (Electronic Control Module) to the TP sensor so that the operating angle of the accelerator pedal can be detected from a change in voltage.

Further, this sensor is equipped with an accelerator switch which sends signals to the ECM when the accelerator pedal is stepped on.

This switch remains on and turns off only when the accelerator pedal is stepped on.

All vehicles have no throttle cable, and therefore, a return spring is provided on the accelerator pedal and a return cable assembly having the sliding resistance of a cable is used to give the pedal a feeling.

To meet the newly adopted electronic control system, the idling control button has been dropped.

ACCELERATOR PEDAL

REMOVAL

1. Remove harness connector from accel position (AP) sensor.
2. Remove accelerator pedal assembly from chassis.

INSPECTION AND REPAIR

1. Check moving condition of accelerator pedal, if not smooth working, apply oil to the pivot etc.
2. Check tightening condition of accel position (AP) sensor, if not completely tightened, it should be tightened additionally.

INSTALLATION

1. Install accelerator pedal assembly to chassis.
2. Connect harness connector to accel position (AP) sensor.

MEMO

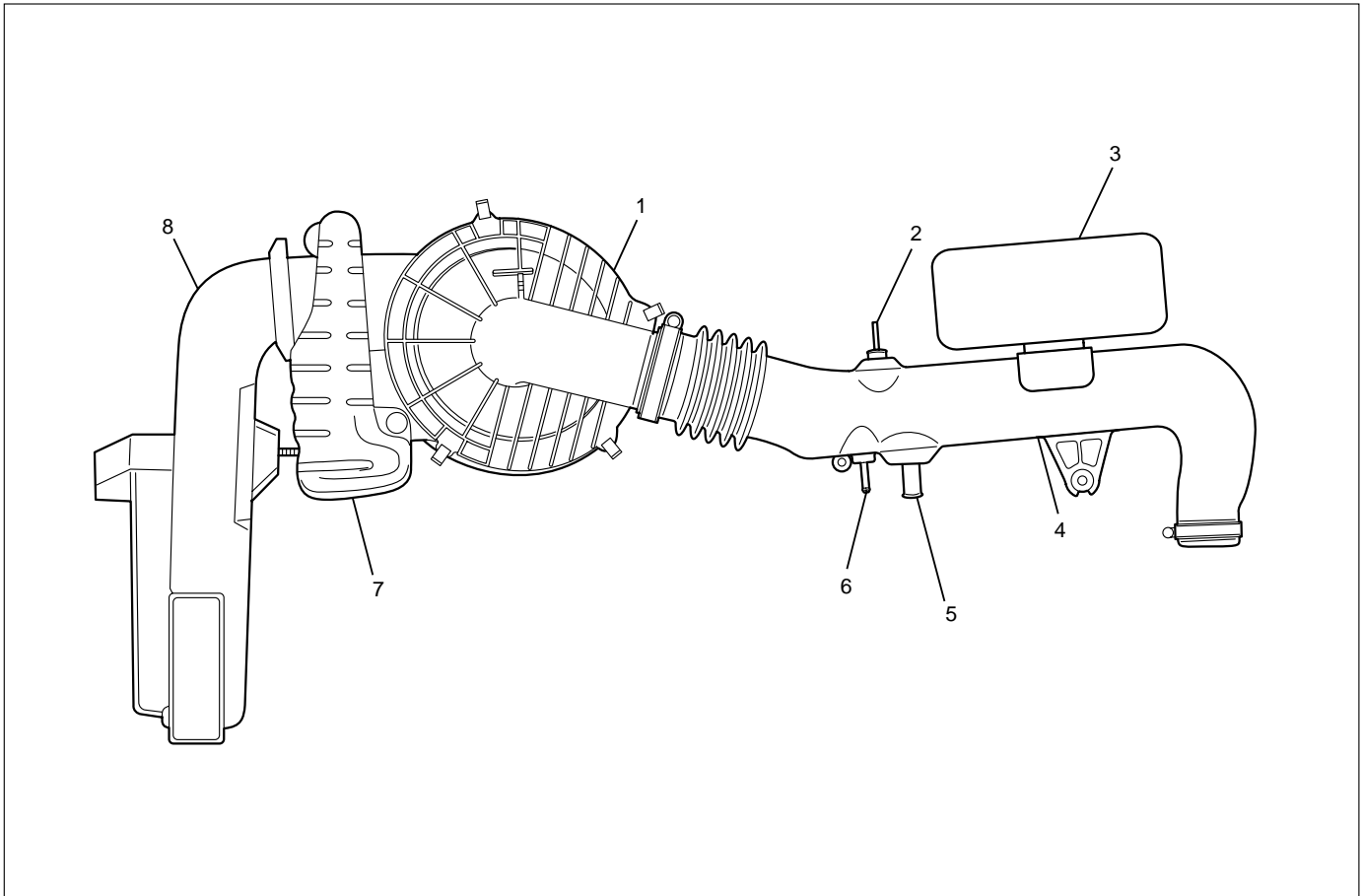
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INDUCTION

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Turbocharger	6J-4	Main Data and Specifications	6J-12
Intercooler	6J-9		

GENERAL DESCRIPTION



130R200003

Legend

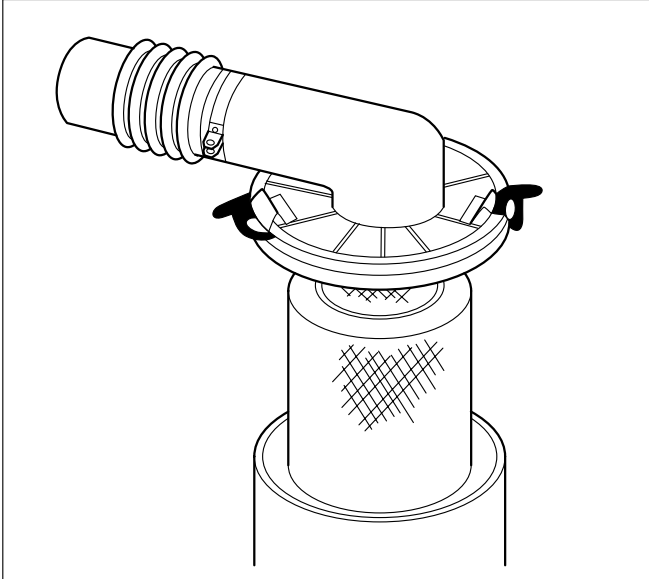
- | | |
|---|--------------------------------|
| (1) Air Cleaner | (5) Connector for PCV Hose |
| (2) Connector for Fuel Tank Breather Hose | (6) Connector for EGR VSV Hose |
| (3) Resonator | (7) Air Duct |
| (4) Air Duct | (8) Air Duct |

There is a large intake silencer provided at the entrance of the air cleaner. Air cleaner element is a viscous type which features high filtration efficiency. A resonator is used also in the air duct between the air cleaner and turbocharger to reduce air intake noise. The air taken in flows through the turbocharger to the intercooler where the air is cooled and then taken in the cylinder through the intake manifold.

AIR CLEANER

REMOVAL

1. Remove air cleaner cover with air duct.
2. Remove air cleaner element.



130RW010

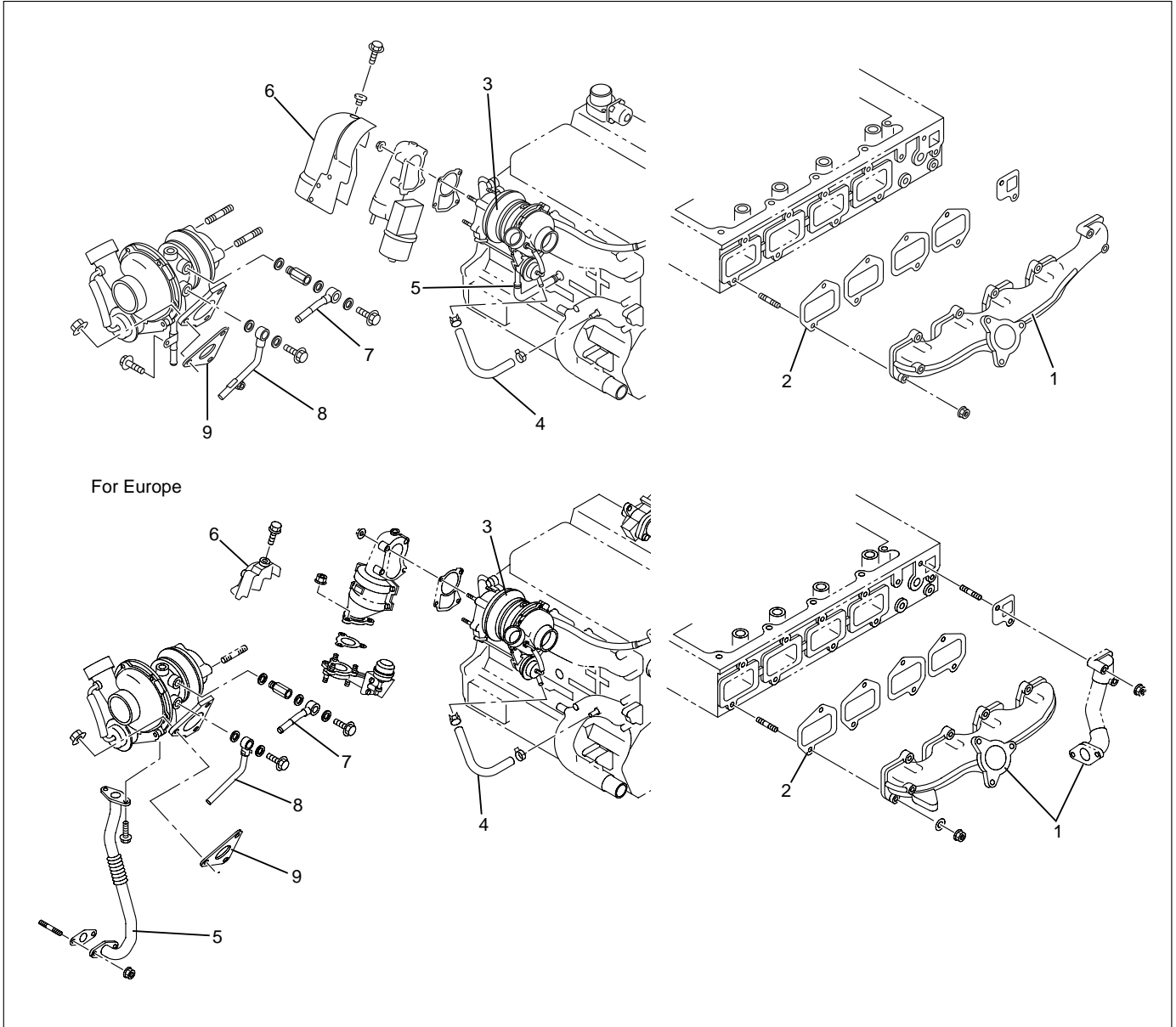
INSPECTION

Check air cleaner element for clogs, chokes and breaks, and if any problem is found during inspection, the element must be replaced.

INSTALLATION

1. Air cleaner element
2. Air cleaner cover with air duct.
 - 1) Put air cleaner cover in original position and tighten it with the clip.

TURBOCHARGER



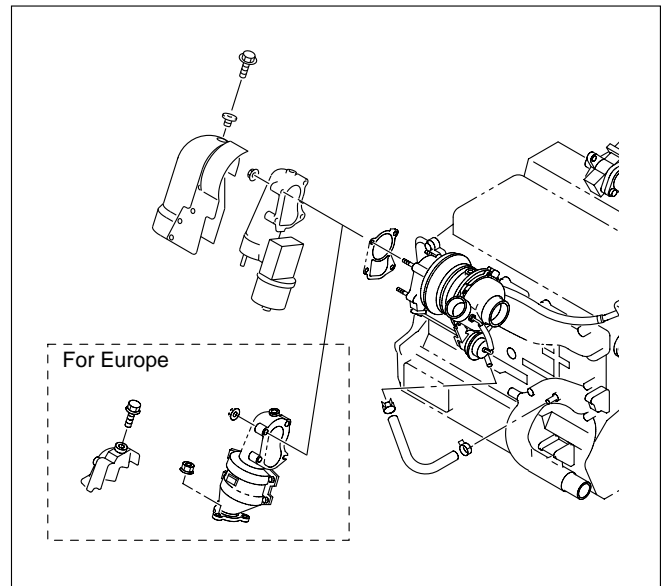
025R200004

Legend

- | | |
|---------------------------|--------------------|
| (1) Exhaust Manifold | (5) Water Hose |
| (2) Gasket | (6) Heat Protector |
| (3) Turbocharger Assembly | (7) Oil Pipe |
| (4) Water Hose | (8) Oil Pipe |
| | (9) Gasket |

REMOVAL

1. Remove battery.
2. Drain engine coolant.
3. Remove air cleaner cover and air duct.
4. Remove intercooler assembly.
Refer to "Intercooler" in this manual.
5. Remove water pipe from water inlet of turbocharger.
6. Remove oil pipe.
 - 1) Remove fixing bolts from oil inlet of turbocharger then remove oil pipe.
 - 2) Plug open port of turbocharger to prevent foreign materials from entering the turbocharger.
7. Remove oil drain pipe from turbocharger.
8. Remove water outlet pipe from turbocharger.
9. Remove heat protector.
10. Remove exhaust valve assembly.
11. Remove turbocharger fixing nuts from exhaust manifold then remove turbocharger assembly.



025R200006

INSPECTION AND REPAIR

Make the necessary adjustments, repairs and part replacements if excessive wear or damage is discovered during inspection.

Minor servicing operations are described in this section. Contact the nearest IHI SERVICE FACILITY for major repairs and maintenance.

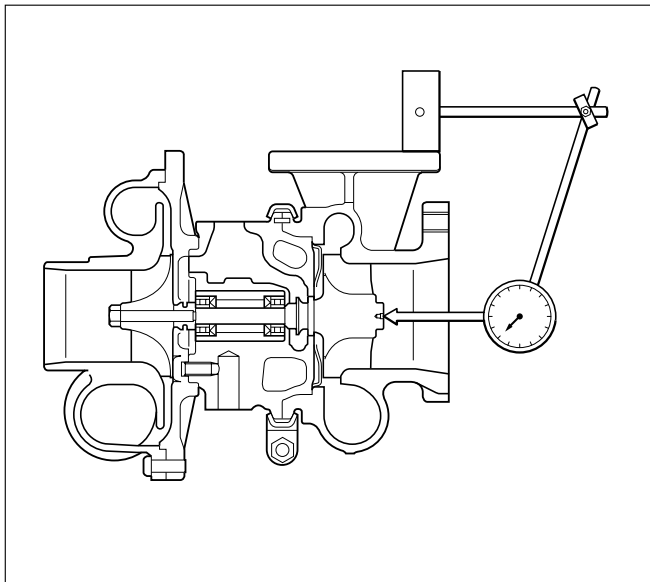
Refer to IHI SERVICE NETWORK at the end of this section for the location of your area's IHI SERVICE FACILITY.

Turbine shaft end play.

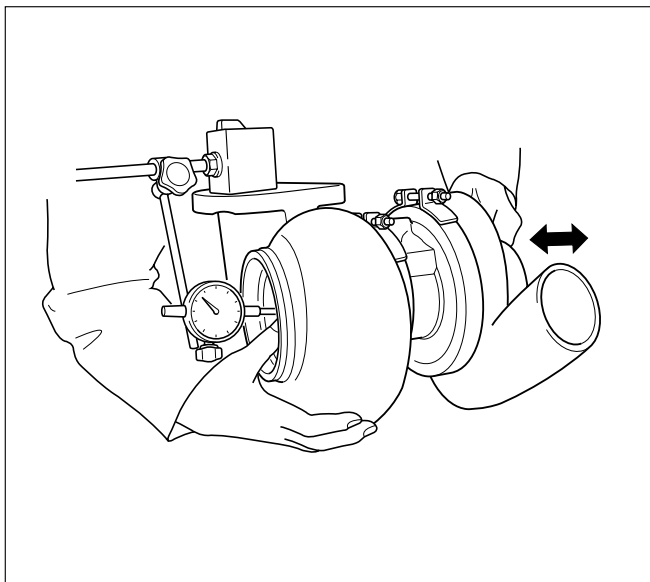
- 1) Set a dial indicator to the turbine shaft end.
- 2) Apply a force of 11.8 N (1.2 kg / 2.6 lb) alternately to the compressor wheel and the turbine wheel end.
- 3) Read the dial indicator.

Turbine End Play

Standard: 0.03 – 0.06 mm (0.0012 – 0.0024 in)
Limit: 0.09 mm (0.0035 in)



036RW006



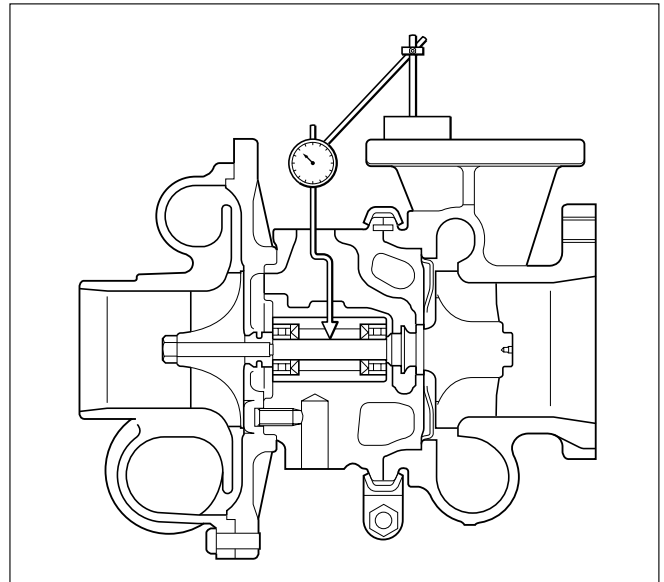
036RW010

Turbine shaft and bearing clearance

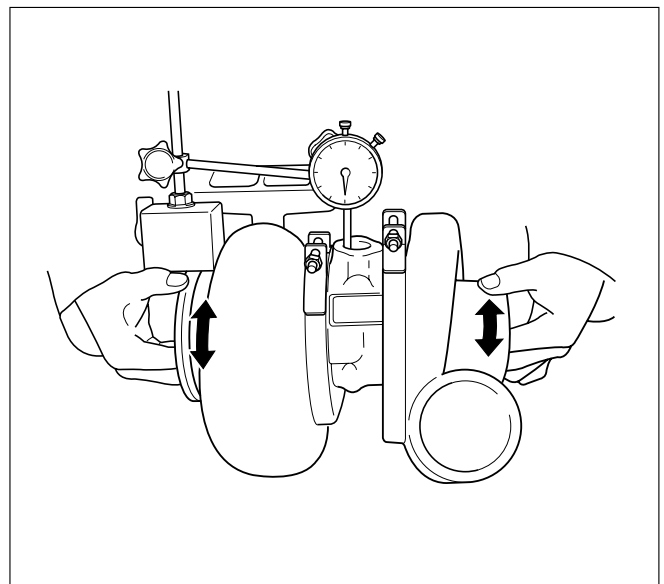
- 1) Set a dial indicator to the turbine shaft center through the center housing oil drain port.
- 2) Move the turbine shaft from side to side.
- 3) Read the dial indicator.

Turbine Shaft and Bearing Clearance

Standard: 0.056 - 0.127 mm (0.0022 - 0.0050 in)
Limit: 0.14 mm (0.0055 in)



036RW009

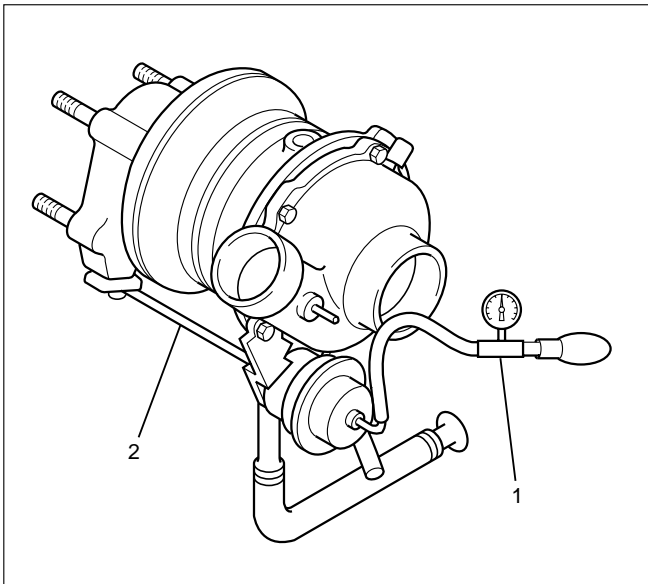


036RW007

Waste gate operation

- 1) Remove hose from waste gate actuator side and install pressure gauge (1) to the waste gate actuator.
- 2) Operate pump of pressure gauge while engine is stopped.
- 3) Read pressure at the control rod (2) move 2mm.

Pressure: 106 – 115 kPa
(796 – 862 mmHg/ 15.4 – 16.7 PSI)



036RW011

Legend

- (1) Pressure gauge
- (2) Waste gate control rod

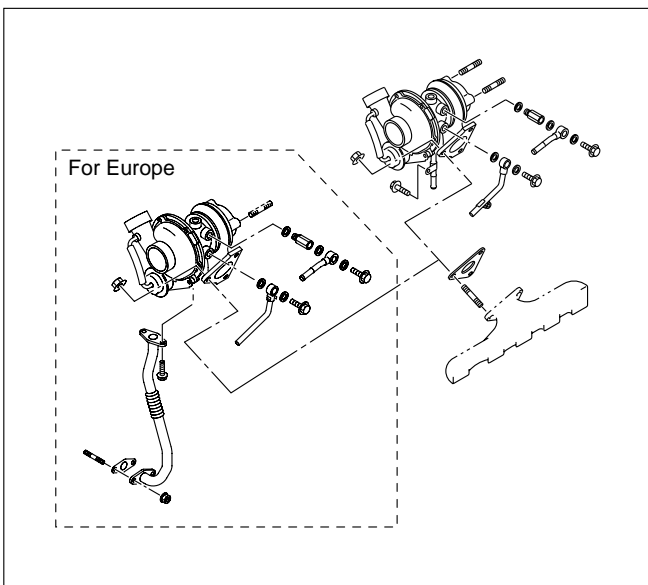
4) Check for cracks or breaks on the hose, if a problem is found, the hose must be replaced.

CAUTION: Do not apply more than 120 Kpa (900 mmHg / 18.7 PSI) to waste gate actuator.

INSTALLATION

1. Install turbocharger assembly to exhaust manifold, tighten to the specified torque.

Torque: 27 N-m (2.7 kg-m / 19.5 lb ft)



025R200007

2. Install exhaust valve assembly to outlet of turbocharger, tighten bolts to the specified torque.

Torque: 27 N-m (2.7 kg-m / 19.5 lb ft)

3. Install heat protector.

4. Water inlet pipe.

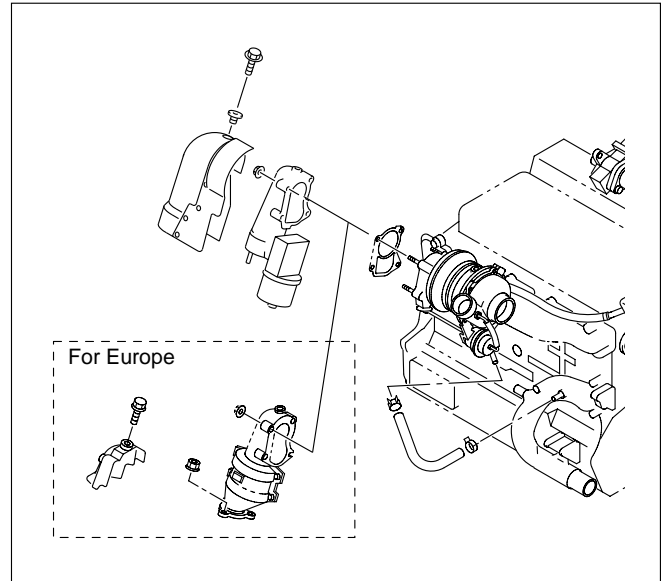
1) Tighten water inlet pipe with new gasket.

Torque: 9 N-m (0.9 kg-m / 6.5 lb ft)

5. Oil drain pipe.

1) Tighten oil drain pipe with new gasket.

Torque: 9 N-m (0.9 kg-m / 6.5 lb ft)



025R200006

6. Oil inlet pipe.

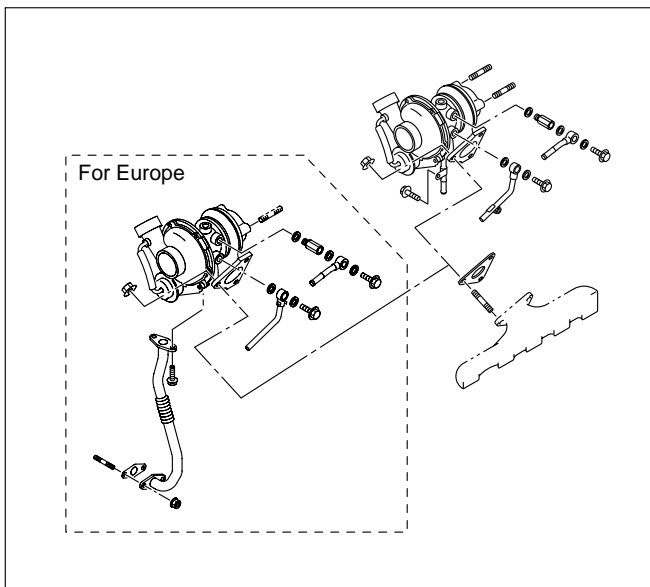
1) Apply about 100 cc engine oil to turbocharger housing before installing the oil pipe.

2) Turn the turbine shaft by hand to lubricate the bearing.

3) Install the oil inlet pipe with a new gasket, tighten bolt to the specified torque.

Torque: 22 N-m (2.2 kg-m / 15.9 lb ft) For M10

Torque: 54 N-m (5.5 kg-m / 39.8 lb ft) For M14



025R200007

7. Water inlet pipe.

- 1) Install water inlet pipe with a new gasket, tighten bolts to the specified torque.

Torque: 9 N·m (0.9 kg·m / 6.5 lb ft)

8. Install intercooler assembly.

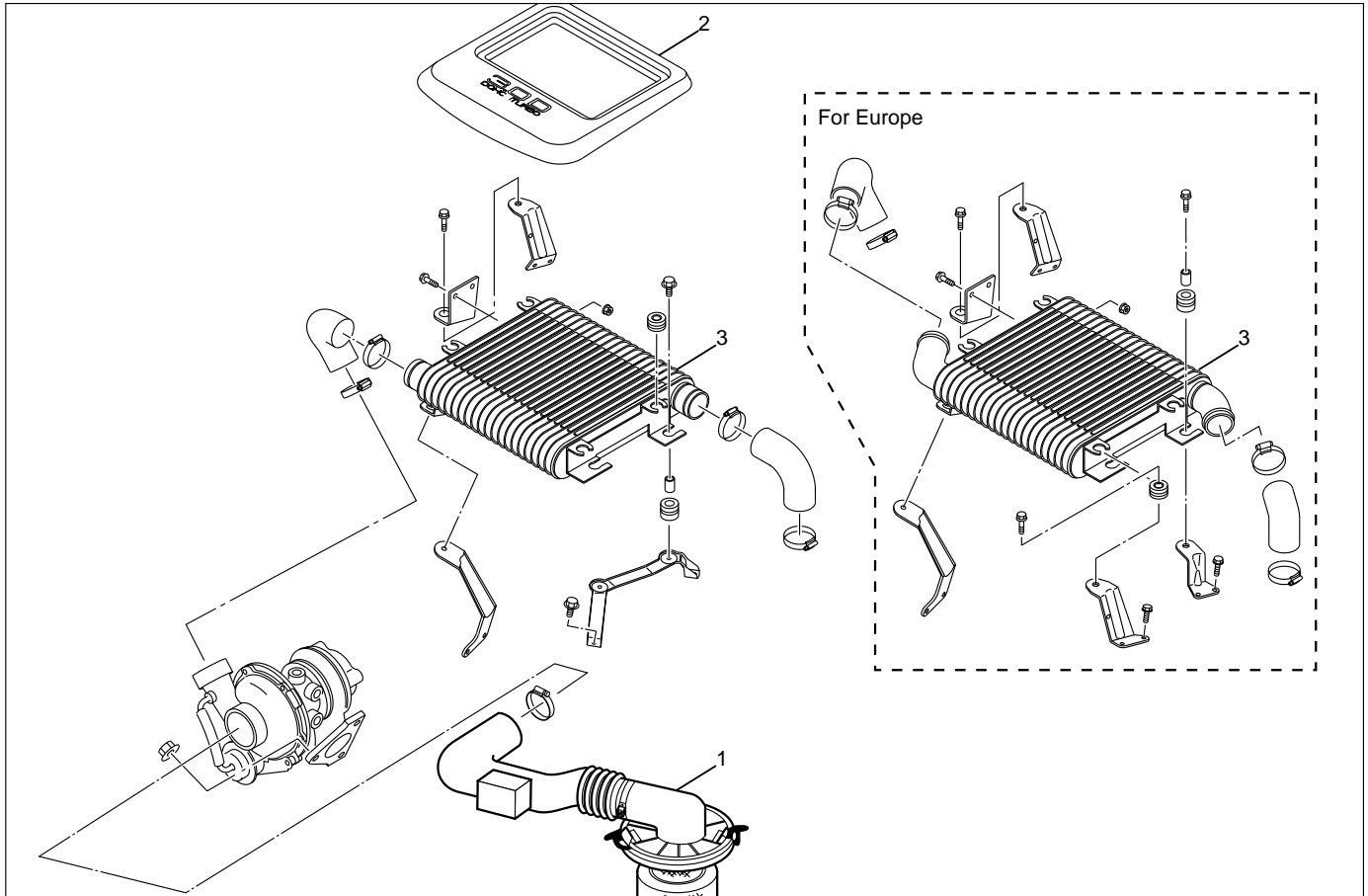
Refer to "Intercooler" in this manual.

9. Install air cleaner cover with air duct.

10. Fill engine coolant to full level.

11. Install battery and connect battery cable.

INTERCOOLER



135R20003

Legend

- (1) Air Cleaner Cover and Air Duct
- (2) Intercooler Cover
- (3) Intercooler Assembly

REMOVAL

1. Disconnect battery ground cable.
2. Remove air cleaner cover with air duct.
3. Remove intercooler cover.
4. Intercooler assembly.
 - 1) Remove rubber hose from intercooler outlet side.
 - 2) Remove rubber hose from intercooler inlet side.
 - 3) Remove four fixing bolts and remove intercooler assembly.

INSPECTION AND REPAIR

1. Visual check for clogs in the fins.
2. Check for broken on the tube.
3. If any problem on the intercooler is observed during inspection, clean or replace the intercooler.

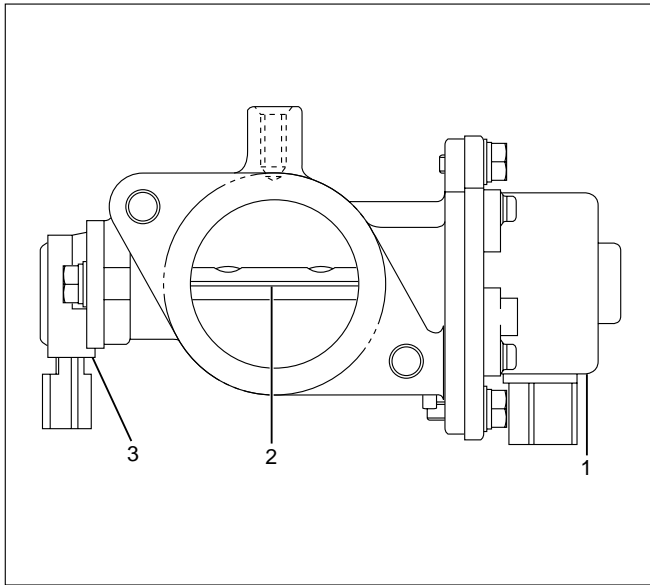
INSTALLATION

1. Intercooler assembly.
 - 1) Connect outlet hose to intake manifold.
Tighten hose clamp to the specified torque.
Torque: 4 N·m (0.4 kg·m / 3 lb ft)
 - 2) Connect inlet hose to the turbocharger outlet side.
Tighten hose clamp to the specified torque.
Torque: 4 N·m (0.4 kg·m / 3 lb ft)
 - 3) Install intercooler assembly, tighten fixing bolts to the specified torque.
Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)
2. Install intercooler cover.
3. Install air cleaner cover and air duct.
4. Connect battery ground cable.

INTAKE THROTTLE VALVE

REMOVAL

1. Remove intercooler assembly.
Refer to “Intercooler” in this manual.
2. Remove harness connector from motor and ITP sensor.
3. Loosen the two fixing nuts and remove the throttle valve assembly.



Legend

- (1) Motor
- (2) Intake Throttle Valve
- (3) ITP sensor

INSPECTION AND REPAIR

1. Check for catching somewhere on the throttle valve.
2. If some problem is discovered during inspection on the throttle valve, the throttle valve must replace.

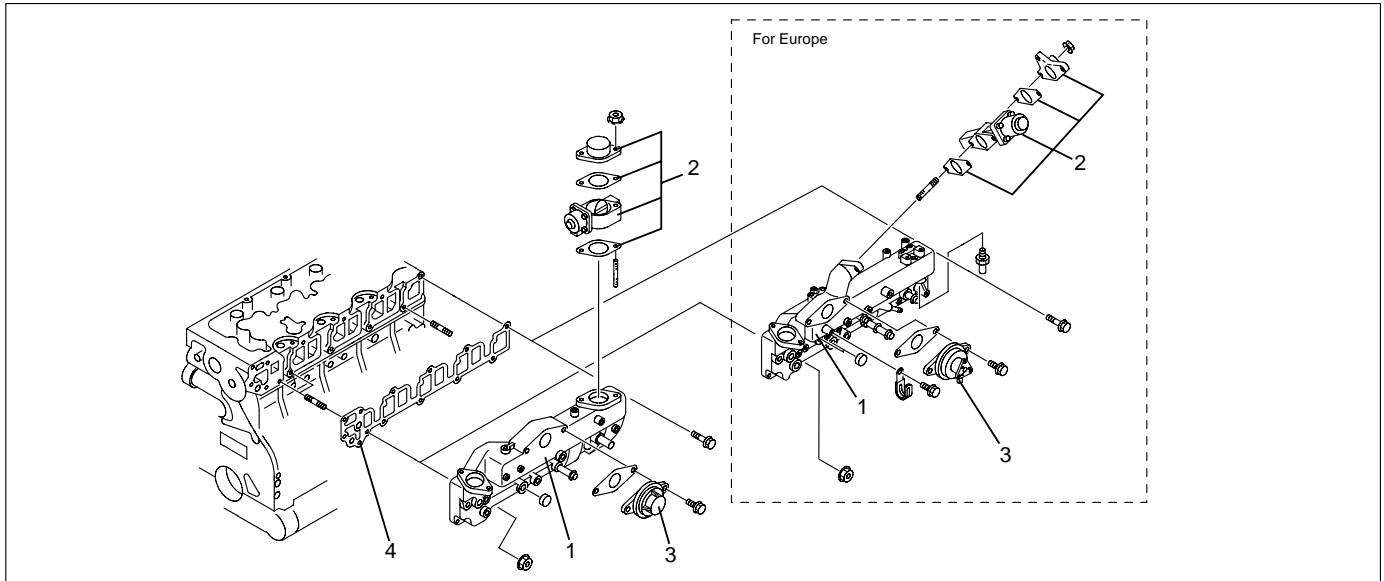
INSTALLATION

1. Put gasket on the intake manifold and install throttle valve.
2. Tighten nuts to the specified torque.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

3. Reconnect harness connector to motor and ITP sensor.
4. Install intercooler assembly.

INTAKE MANIFOLD



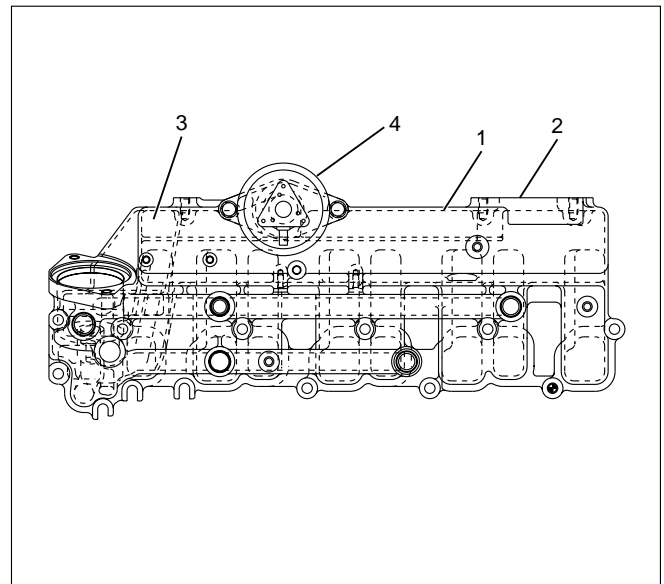
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Legend

- (1) Intake Manifold
- (2) Throttle Valve Assembly
- (3) EGR Valve
- (4) Gasket

REMOVAL

1. Drain engine coolant and remove water hose from thermostat housing
2. Remove intercooler assembly.
3. Remove bracket fixing bolt of oil level gauge guide tube.
4. Remove PCV hose.
5. Remove hoses from EGR valve, EGR vacuum sensor and outlet of heater unit.
6. Disconnect harness connector from MAP sensor, EGR vacuum sensor, ETC sensor, Water temperature unit, IAT sensor and EVRV.
7. Remove high pressure oil pipe.
8. Remove two way check valve.
9. Remove fuel pipe.
10. Remove fixing bolts and nuts of intake manifold, remove intake manifold assembly.



025RW031

Legend

- (1) Intake manifold
- (2) Fixing portion of throttle valve
- (3) EGR passage
- (4) EGR valve

INSPECTION AND RAPAIR

1. Visually check for cracks/clogs inside intake manifold.
2. If foreign material is observed, it should be taken out, and if there are some cracks on the intake manifold, it must be replaced.

INSTALLATION

1. Install the intake manifold assembly, tighten bolts and to the specified torque.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft) for bolt

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft) for nut

2. Install fuel pipe.

**Torque: 4 N·m (0.4 kg·m / 2.9 lb ft) for M16 nut
(Apply engine oil)**

Torque: 13 N·m (1.3 kg·m / 9.4 lb ft) for M10 cap nut

**Torque: 14 N·m (1.4 kg·m / 10 lb ft) for M10
(Apply engine oil)**

3. Install two way check valve.

Torque: 20 N·m (2.0 kg·m / 14.5 lb ft)

4. Fill with about 300 cc of engine oil from the high pressure oil pipe installation port of the oil rail using an oil filler.

If assembled without filling the oil rail with oil, the time for engine starting will be longer.

5. Install high pressure oil pipe, then tighten sleeve nut to the specified torque.

Torque: 29 N·m (3.0 kg·m / 21.7 lb ft)

6. Reconnect harness connector to MAP sensor, EGR vacuum sensor, ETC sensor, Water thermo unit, IAT sensor and EVRV sensor.
7. Install hoses to EGR valve, EGR vacuum sensor and Water outlet of heater.
8. Connect PCV hose.
9. Install oil level gauge guide and fix it.
10. Install intercooler assembly.
Refer to "Intercooler" in this manual.
11. Install water hose to thermostat housing and fill with engine coolant.

MAIN DATA AND SPECIFICATIONS

Model of Turbocharger	IHI RHF5
Turbine Maximum Speed	180,000 rpm
Maximum Inlet Gas Temperature	800 °C (1472 °F)
Vibration Peak (G) criteria	Maximum 4 (G) at Turbine Rotor Speed 140,000 rpm
Tolerance Limit of Compressor Blade Height	Less then 0.5 mm (0.0197 in)

IHI SERVICE NETWORK

For inquiries relating to turbochargers, please contact your ISUZU distributor or the nearest IHI Turbocharger Service Facility.

HEADQUARTERS

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9th Floor, Skyline Building Jl. M.H. Thamrin, No. 9, Jakarta, INDONESIA
TEL: 62-(21)-32-2147, 390-2211
FAX: 62-(21)-32-3273
TLX: 44175 IHIJKT

TRANSMISSION

AUTOMATIC TRANSMISSION (4L30-E)

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7A-2 AUTOMATIC TRANSMISSION (4L30-E)

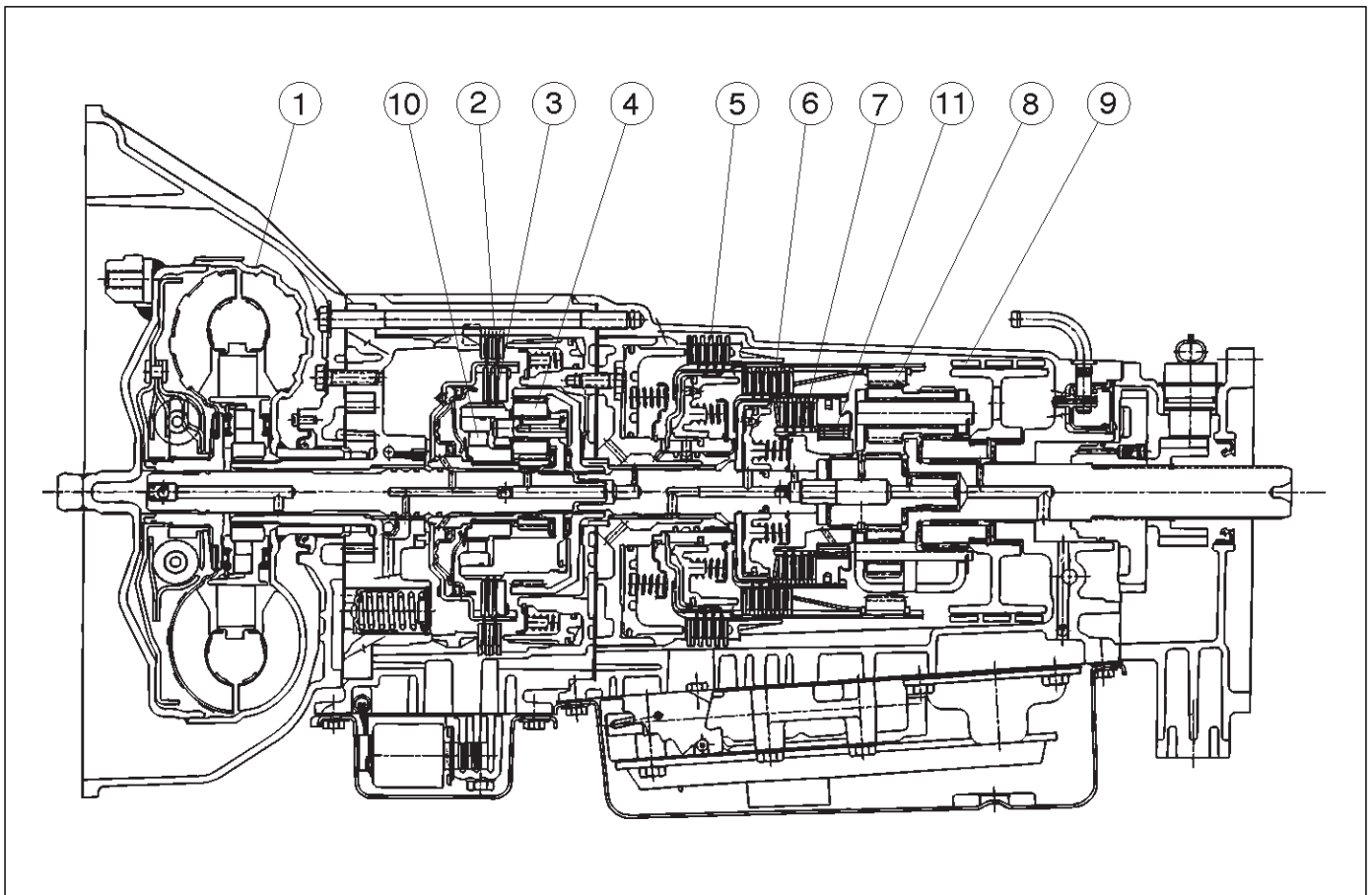
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Service Precaution

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

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

Construction

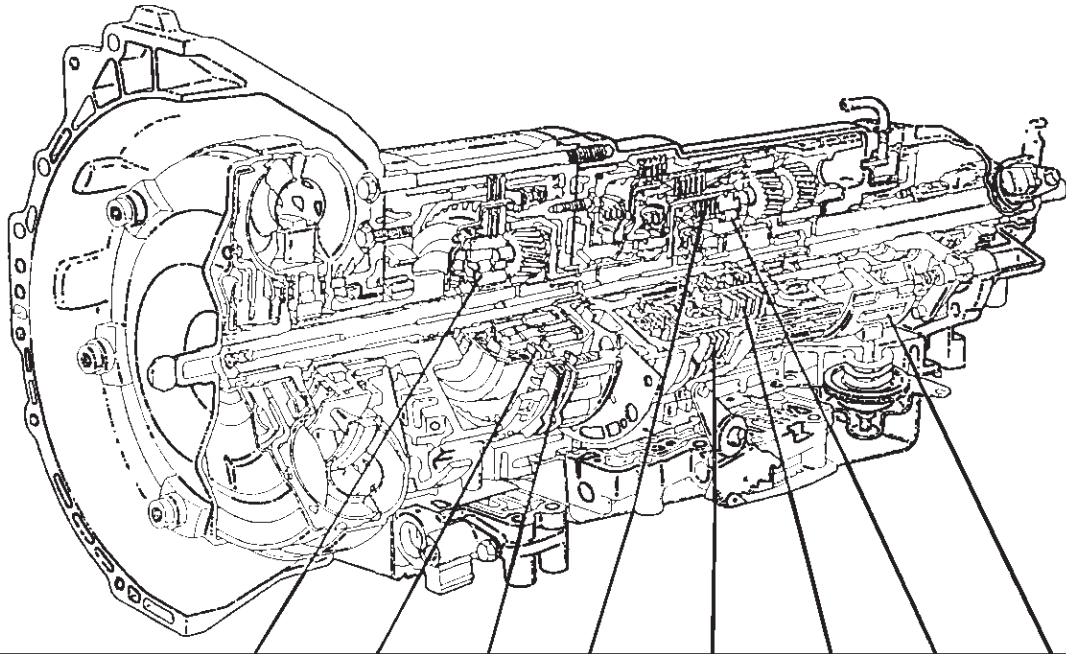


A07RS001

Legend

- | | |
|-----------------------------------|--|
| (1) Torque Converter Clutch (TCC) | (7) Third Clutch (C3) |
| (2) Fourth Clutch (C4) | (8) Ravigneaux Planetary Gear Set |
| (3) Overrun Clutch (OC) | (9) Brake Band (B) |
| (4) Overdrive Unit | (10) Overdrive Free Wheel (One Way Clutch) (OFW) |
| (5) Reverse Clutch (RC) | (11) Sprag Free Wheel (One Way Clutch) (PFW) |
| (6) Second Clutch (C2) | |

Range Reference Chart

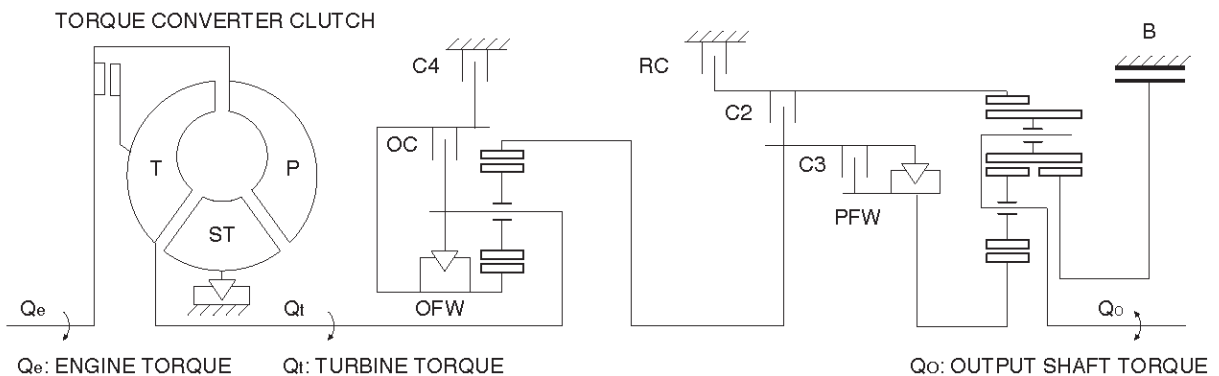


RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE ROLLER CLUTCH (OFW)	OVERRUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASSEMBLY (PFW)	BAND ASSEMBLY (B)	ENGINE BRAKING
P-N		OFF	ON		APPLIED							NO
R	REVERSE	OFF	ON	LD	APPLIED			APPLIED		LD		NO
D	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
	4TH	OFF	OFF	FW		APPLIED	APPLIED		APPLIED	NE		YES
3	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
2	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
L	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES

LD : LOCKED IN DRIVE

FW : FREEWHEELING

NE : NOT EFFECTIVE



Normal Operation Of 1998 4L30-E Transmission

Torque Converter Clutch (TCC)

Application Conditions:

The TCC is normally applied in 2nd, 3rd and 4th gears only when all of the following conditions exist:

- The engine coolant temperature is above 70°C (158°F).
- The brake pedal is released.
- The shift pattern requests TCC apply.

Moreover, TCC is always applied in 2nd, 3rd and 4th gears when the transmission oil temperature is above 135°C (275°F).

This mode should be canceled at 125°C (257°F).

ATF Warning Lamp

The ATF warning lamp will be constantly on (not flashing) if the transmission oil temperature is above 140°C (284°F).

The ATF warning lamp goes off again when the transmission oil temperature is below 130°C (266°F).

Special Shift Pattern When The Engine Is Cold:

A special shift pattern is activated when the engine coolant temperature is below 70°C (158°F). (3-4 shifts, for example, are delayed for small throttle openings and will occur a few MPH higher.)

Diagnosis

Introduction

The systematic troubleshooting information covered by this Section offers a practical and systematic approach to diagnosing 4L30-E transmission, using information that can be obtained from road tests, electrical diagnosis, oil pressure checks or noise evaluation.

The key to correcting a complaint is to make use of all of the available symptoms and logically letting them direct you to the cause.

When dealing with automatic transmission complaints, it is best to gather as many symptoms as possible before making the decision to remove the transmission from the vehicle.

Frequently, the correction of the complaint does not require removal of the transmission from the vehicle.

Driver Information

To analyze the problem fill out a complete description of the owner's complaint.

Please draw a circle around the right information and complete the following form. (The next page is an example of a completed form). You can draw a circle around many numbers if you are not sure.

7A-6 AUTOMATIC TRANSMISSION (4L30-E)

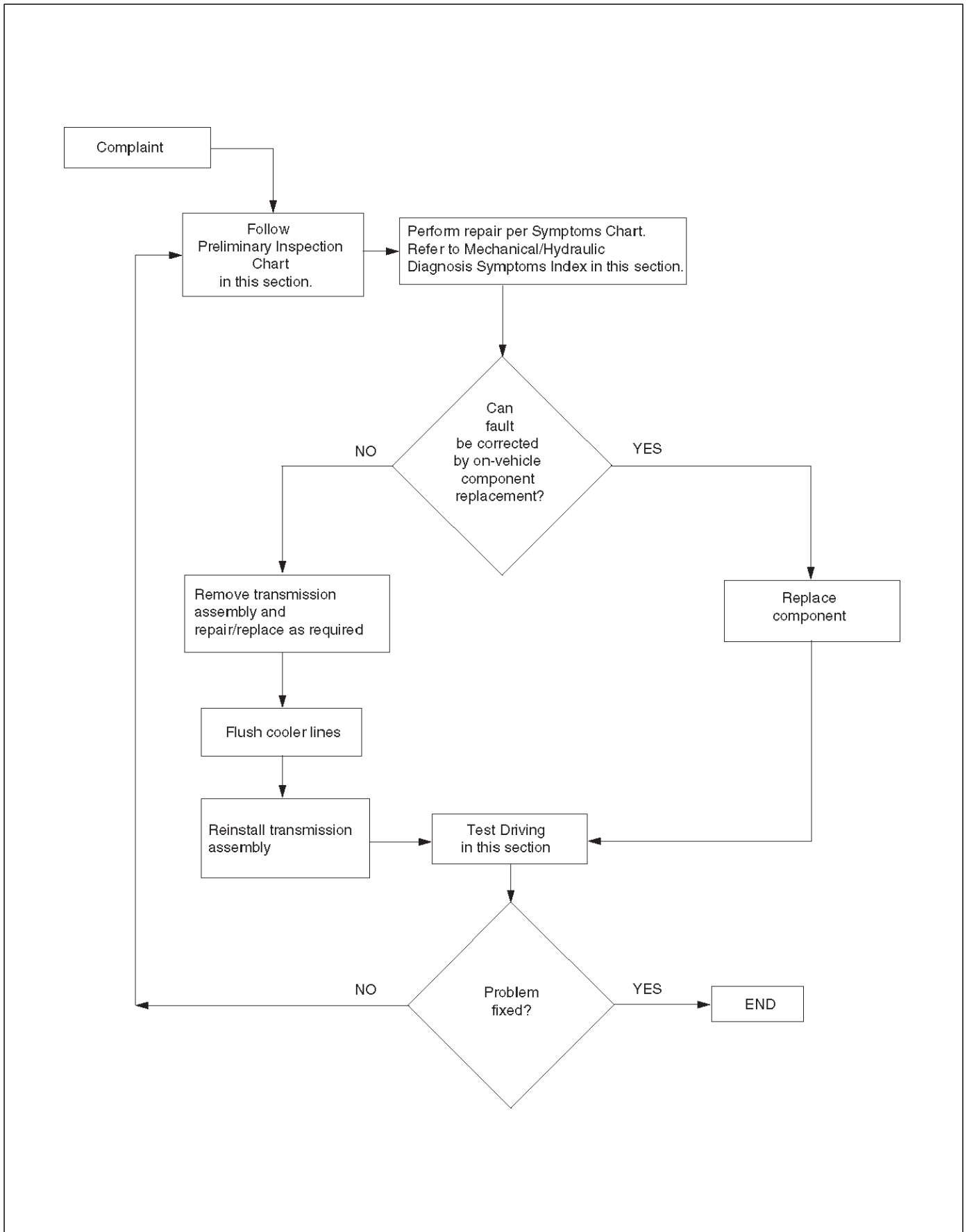
A - Today's date :		Month :	Day :	Year :
B - End User Name, Address :				
C - Date of Problem :		Month :	Day :	Year :
D - Mileage : Miles / Km	E - With Ignition ON is CHECK TRANS Indicator : 1- Flashing 2- Not Flashing		F - Car load when problem occurred : 1 - Towing a trailer 2- people OR Kg	
G - Weather conditions when problem : 1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable 6-Any	H - Weather Temperature when problem: 1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable 6- Any		I - Road Conditions when problem : 1- Any 2- Inter City 3- Outside City 4- Highway 5 - Uphill 6- Downhill 7- Unpaved 8- Snow 9 - Others :	J - Frequency of the Problem : 1- Always 2- Occasional : times/day, times/month 3- Only Once 4- Others :
K - Engine Condition : 1- Always 2- At Cold 3- During Warming up 4- After Warming or Hot 5- Others	L - Engine Speed when the problem occured : 1- Idling 2- Starting 3- Stalling 4- High RPM 5- Low RPM		M - Transmission Condition when it occurred : 1- Any 2- Idling 3- Starting 4- Driving 5- Accelerating 6-Coasting 7- In corner 8- Shifting	
N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING : 1- No Power in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3:4 or downshift : 4-3 / 3-2 / 2-1 2- No shift in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 3- Shift Shock in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 4- Shift Slip in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 5- Shift Delayed in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 6- Shift Point too high in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 7- Shift Point too low in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 8- TCC Shudder in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 9- Noise in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1 Noise type : 1- Buzz 2- Whine 3- Clunk 4- Rattle 5- Whistle // 6- light 7- medium 8- heavy 10- Other : in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1				
O - Other customer concern and comments				
P - Izuu Vehicle Code :		Q - VIN Number
R - Date of Vehicle Registration		Month :	Day :	Year :
S - Trans. model :		T - A/T Serial Number :
U - Your name :			
V - Dealer Name, Address, Phone				

Example of form completed.

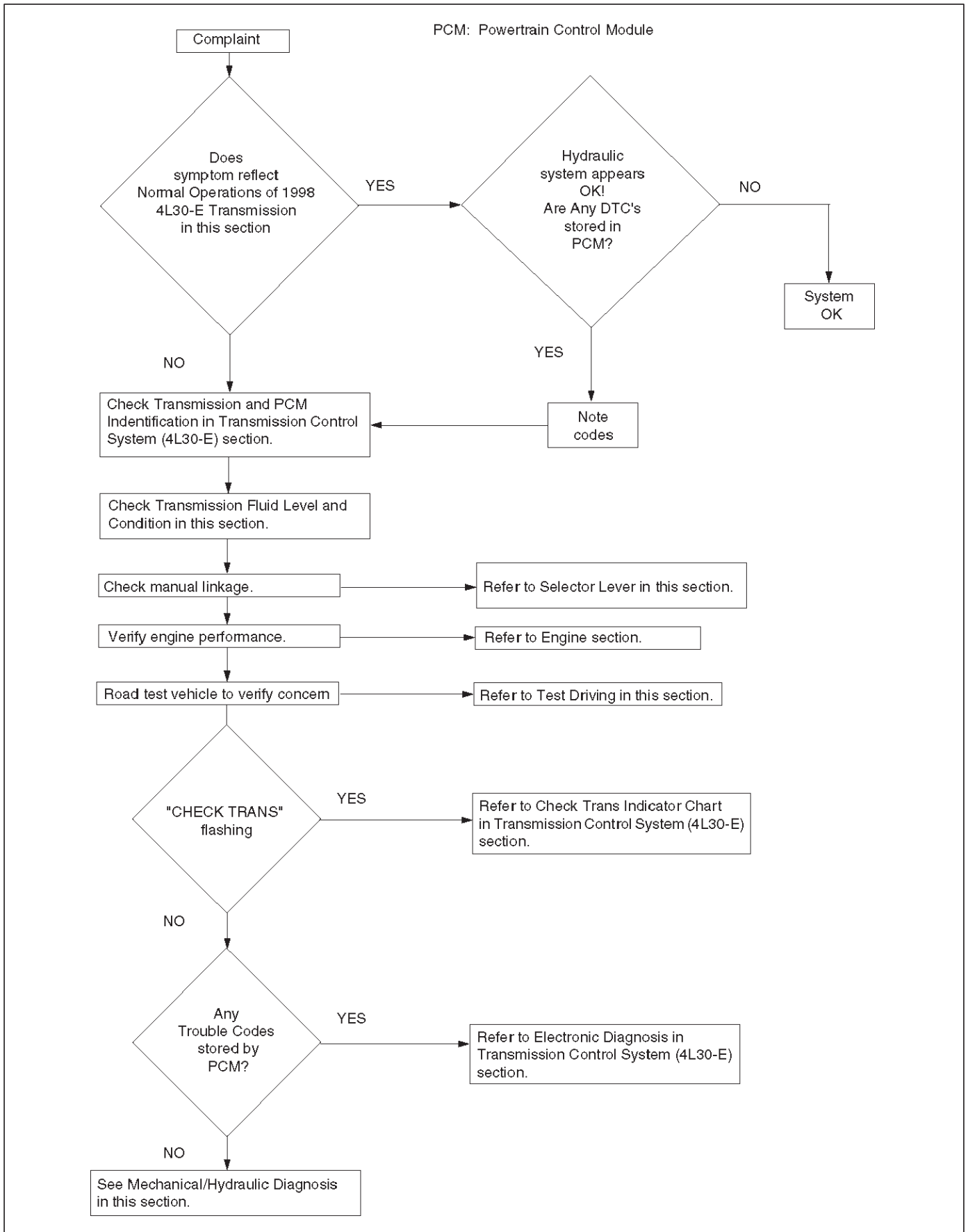
A - Today's date :		Month : April.....	Day : .13.....	Year : .1994.....
B - End User Name, Address :		Dave Smith 6584, Arlington road Plymouth MI 48170 USA		
C - Date of Problem :		Month : April.....	Day : .8.....	Year : .1994.....
D - Mileage :	E - With Ignition ON is CHECK TRANS Indicator :		F - Car load when problem occurred :	
12230... <input checked="" type="radio"/> Mile / Km	<input checked="" type="radio"/> Flashing 2- Not Flashing		1 - Towing a trailer 2- ..2..... people OR Kg	
G - Weather conditions when problem :	H - Weather Temperature when problem :		I - Road Conditions when problem :	J - Frequency of the Problem :
1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable <input checked="" type="radio"/> Any	1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable <input checked="" type="radio"/> Any		1- Any 2- Inter City 3- Outside City <input checked="" type="radio"/> Highway 5 - Uphill 6- Downhill 7- Unpaved <input checked="" type="radio"/> Snow 9 - Others	1- Always <input checked="" type="radio"/> Occasional : times/day, ...3... times/month 3- Only Once 4- Others :
K - Engine Condition :	L - Engine Speed when the problem occurred :		M - Transmission Condition when it occurred :	
1- Always 2- At Cold 3- During Warming up <input checked="" type="radio"/> After Warming or Hot 5- Others	1- Idling 2- Starting 3- Stalling <input checked="" type="radio"/> High RPM 5- Low RPM		1- Any 2- Idling 3- Starting 4- Driving <input checked="" type="radio"/> Accelerating <input checked="" type="radio"/> Coasting 7- In corner <input checked="" type="radio"/> Shifting	
<p>N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :</p> <p>1- No Power in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>2- No shift in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p><input checked="" type="radio"/> Shift Shock in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : <input checked="" type="radio"/> 2 / 2-3 / <input checked="" type="radio"/> 4 or downshift : <input checked="" type="radio"/> 1-3 / 3-2 / 2-1</p> <p>4- Shift Slip in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>5- Shift Delayed in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>6- Shift Point too high in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>7- Shift Point too low in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>8- TCC Shudder in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>9- Noise in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p> <p>Noise type : 1- Buzz 2- Whine 3- Chunk 4- Rattle 5- Whistle // 6- light 7-medium 8- heavy</p> <p>10- Other : in Range : All - P - R - N - D - 3 - 2 - L during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1</p>				
O - Other customer concern and comments :				
<p>(This is just an example). Shift shock very harsh overall during a downshift. Not sure if it's the 4-3 or 3-2.</p>				
P - Isuzu Vehicle Code :	94 UCR	Q - VIN Number	4S2CV58ZXM4324047	
R - Date of Vehicle Registration	Month : November.	Day :18.....	Year : ..1993.....	
S - Trans. model :	4L30-E	T - A/T Serial Number :	96 358 654	
U - Your name :	Joe Spring			
V - Dealer Name, Address, Phone	Kent Helfrich Home-town ISUZU 900 - 999 - 9999			

this means do not take this into account

General Diagnosis Procedure



Preliminary Inspection Chart



Checking Transmission Fluid Level and Condition

Checking fluid level and condition (color and odor) at regular intervals will provide early diagnosis information about the transmission. This information may be used to correct a condition that, if not detected early, could result in major transmission repairs.

IMPORTANT: When new, automatic transmission fluid is red in color. As the vehicle is driven, the transmission fluid will begin to look darker in color. The color may eventually appear light brown.

A dark brown color with burnt odor may indicate excessive fluid deterioration and signal a need for fluid change.

Fluid Level

When adding or changing fluid, use only DEXRON®-III. Refer to Maintenance and Lubrication in General Information section for maintenance information and servicing interval.

CAUTION: DO NOT OVERFILL.

Overfilling will cause foaming, loss of fluid, abnormal shifting and possible damage to the transmission.

1. Park the vehicle on level ground and apply the parking brake firmly.
2. Check fluid level with engine running at idle.

NOTE: Be sure that transmission fluid temperature is below 30°C (86°F).

3. Move the selector lever through all gear ranges.
4. Move the selector lever to "Park".
5. Let engine idle for 3 minutes and open the overfill screw (1).
6. Add released transmission fluid until it flows out over the overfill screw opening.
7. Let engine idle until a fluid temperature between 32°C (90°F) and 57°C (135°F) is reached, then close the overfill screw (1).

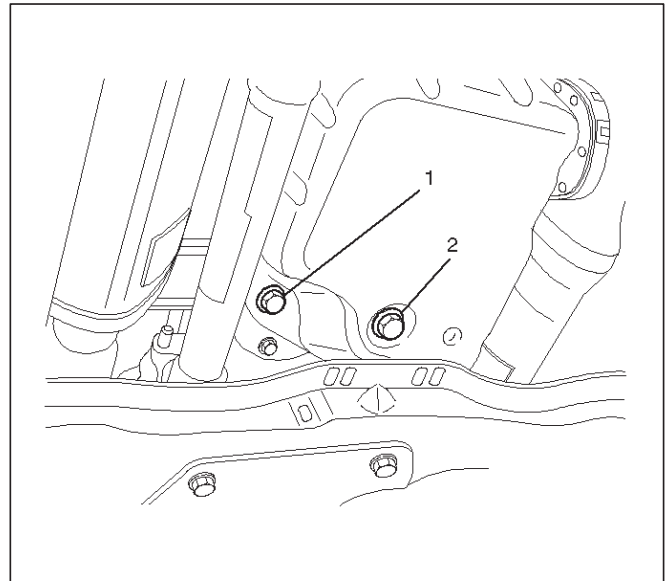
Torque: 38 N•m (3.9 kg•m/28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

Minimum fluid level → 57°C (135°F)

Maximum fluid level → 32°C (90°F)



242RW003

CAUTION: Do not open overfill screw with engine stopped.

CAUTION: DO NOT CHECK FLUID LEVEL UNDER THESE CONDITIONS:

- Immediately after driving at sustained highway speeds.
- In heavy city traffic during hot weather.
- If vehicle is towing a trailer.

If the vehicle has been operated under these conditions, shut the engine off and allow the vehicle to "cool" for thirty (30) minutes. After the cool down period, restart the vehicle and continue from step 2 above.

Fluid Condition

FLUID CONDITION				
	NORMAL*		CONTAMINATED	
COLOR	RED OR LIGHT BROWN	BROWN	NON-TRANSPARENT / PINK	BROWN
DRAIN REQUIRED?	NO	YES	YES	YES
CONTAMINATION	NONE	Very small amount of foreign material in bottom of pan	Contamination by coolant or other source	Large pieces of metal or other foreign material in bottom of pan
CORRECT LEVEL AND CONDITION	1. LOW LEVEL: A. Add fluid to obtain proper level & check for external leaks. B. Correct cause of leak. 2. HIGH LEVEL: - Remove excess fluid	- Remove both pans - Change filter - Flush cooler - Add new fluid - Check level	- Repair/replace radiator cooler - Transmission overhaul required - Check for: ● Damaged plates and seals ● Contaminated solenoids - Flush cooler - Add new fluid - Check level	- Transmission overhaul required - Flush cooler and cooler lines - Add new fluid - Check level

*Fluid should be changed according to maintenance schedule.

Test Driving

Some 4L30-E automatic transmission complaint will require a test drive as a part of the diagnostic procedure. Some codes will not set unless the vehicle is moving. The purpose of the test drive is to duplicate the customer's complaint condition and set a current Powertrain Control Module (PCM) trouble code. Perform this procedure before each 4L30-E automatic transmission repair, and again after repairs are made.

IMPORTANT:

- Duplicate the condition under which the customer's complaint was observed.
- Depending on the complaint, the line pressure gauge and the scan tool may be required during the test drive.
- During the test drive, it is important to record all necessary data from the areas being monitored, for use in diagnosis. Also listen for and note any unusual noises.

The following procedure should be used to test drive 4L30-E automatic transmission complaint vehicles:

1. Turn the ignition ON without starting the engine. Check that the "CHECK TRANS" lamp comes on for approximately 2 to 3 seconds and then goes out and remains out.
 - If the lamp is flashing, GOTO Check Trans Indicator in Transmission Control System (4L30-E) section.
 - If no serial data is present, GOTO OBD System Check. Refer to Driveability and Emissions in Engine section.

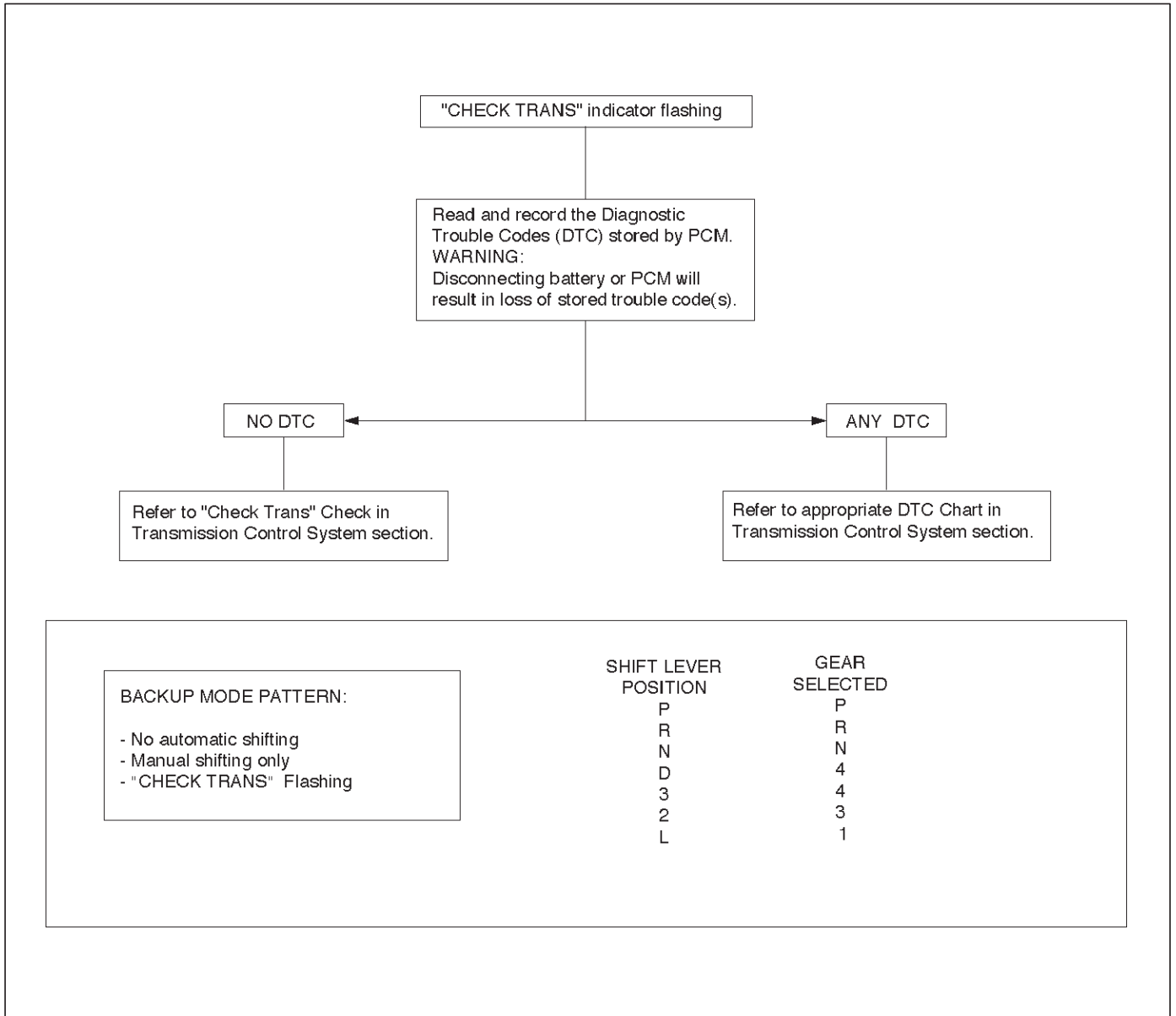
- If the lamp stays ON or stays OFF, GOTO "Check Trans" Check in Transmission Control System (4L30-E) section.
2. Drive the vehicle. During the test drive, be sure that the transmission achieves normal operating temperature (approx. 20 minutes). Allow the transmission to go through all of its gear ranges, checking shift timing and firmness. Duplicate the owner's complaint condition as closely as possible during the test drive.
3. If, during the test drive, the "CHECK TRANS" lamp comes on, use the scan tool to check for trouble codes.
4. If, during the test drive, a problem is felt, but the "CHECK TRANS" lamp does not come on and no trouble codes are present, drive the vehicle with the PCM disconnected (manually shifting the vehicle).
 - In Manual L, the vehicle operates in first gear.
 - In Manual 2, the vehicle operates in third gear.
 - In Manual 3 or "D", the vehicle operates in fourth gear.
 If the problem still exists with the PCM disconnected, refer to Mechanical/Hydraulic Diagnosis in this section.
5. If no problem has been found at this point, check all underhood connections that supply power to the PCM and ignition fuses. Physically and visually inspect all the PCM harness connectors for loose or corroded terminals. Inspect the PCM ground points.

Mechanical / Hydraulic Diagnosis Check Trans Indicator Chart

Preform Preliminary Inspection First!

When the "CHECK TRANS" indicator is flashing, it indicates that a problem related to the transmission, the Powertrain Control Module (PCM), or the vehicle harness has occurred.

The system is now operating in a "BACKUP MODE" where the risk of further damaging the transmission has been reduced. The vehicle may be shifted manually. If the initial problem is intermittent or seldom, switching the engine OFF/ON might allow normal operation again until the problem reoccurs.



Mechanical / Hydraulic Diagnosis Symptoms Index

Perform Preliminary Inspection First!

CHART	SYMPTOMS
1	NO ENGINE START IN NEUTRAL OR PARK
2	NO FORWARD GEARS IN ANY RANGE/NO REVERSE
3	NO ENGINE BRAKE IN ANY RANGE
4	POOR SHIFTING IN ALL GEARS (ALL HARSH OR ALL SOFT)
5a	DELAYS IN DRIVE AND REVERSE
5b	DELAYS IN REVERSE ONLY
6	DIAGNOSTIC TROUBLE CODE (DTC) P0730
7	HARSH 1-2 SHIFT
8	HARSH 3-4 SHIFT
9a	3-2 DOWNSHIFT COMPLAINT
9b	HARSH SHIFT WHEN SHIFTING INTO "D" OR ACCELERATING FROM STOP
9c	COASTDOWN HARSH SHIFT OR CLUNK AT 3-2 DOWNSHIFT
10	INTERMITTENT 4TH TO 2ND GEAR DOWNSHIFT AT STEADY SPEED
11	ENGINE FLARE AT SHIFTING DURING TURNING ONLY
12	ENGINE FLARE DURING 1-2 OR 2-3 SHIFT
13	SHUDDER ONLY DURING TORQUE CONVERTER CLUTCH (TCC) APPLYING
14	POSSIBLE CAUSES OF TRANSMISSION NOISE
15a	POSSIBLE CAUSES OF LOW LINE PRESSURE
15b	POSSIBLE CAUSES OF HIGH LINE PRESSURE
16	POSSIBLE CAUSES OF TRANSMISSION FLUID LEAKS

NOTE: Numbers with parenthesis on the following charts refer to Parts List at end of this section.

Chart 1: No Engine Start In Neutral Or Park

Step	Action	Yes	No
1	Does engine start when shift lever moved from drive to neutral mostly in hot condition?	Go to Step 2	Go to Step 3
2	Does engine start in park at any condition?	Re-test vehicle	Go to Step 4
3	Does engine also not start in neutral when shift lever moved from park to neutral?	Go to Step 4	Go to Step 5
4	Check mode switch (63) setting. Readjust if necessary. Problems fixed?	Re-test vehicle	Go to Step 5
5	Check start circuit of mode switch (63) open in neutral. Was open found?	Locate and repair open(s)	Replace mode switch (63)

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Chart 2: No Forward Gears In Any Range/No Reverse

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check internal linkage: – Manual linkage (58) not moving manual valve (326). 2. Check for internal mechanical damage: – Turbine shaft (506) broken loose. – Overrun roller clutch (516) broken loose. Was the problem found?	Repair or replace	—

Chart 3: No Engine Brake In Any Range

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for overrun clutch leaks caused by: – Damaged piston lip (513) – Check ball defective (504) 2. Check for overrun lockout valve (705) stuck by foreign material. 3. Check for leaks at turbine shaft (506) caused by: – Teflon seal rings damaged (508) – Excessive wear of turbine shaft bearing surfaces. Was the problem found?	Repair or replace	—

Chart 4: Poor Shifting In All Gears (All Harsh Or All Soft)

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Go to Step 3
2	1. Check for these conditions which could affect clutch apply time: <ul style="list-style-type: none"> - Defective band apply solenoid (323). - Defective servo or/and accumulator piston. - Excessive clutch piston travel. 2. Check of possible causes of internal leaks: <ul style="list-style-type: none"> - Cut or damaged sealing ring(s) - Damaged sealing gasket(s) - Check ball missing or out of location in 2nd and 3rd clutch pistons. 3. Check for caused of burned clutch plates or band. Was the problem found?	Repair or replace	—
3	Was the line pressure high?	Go to Step 4	Use Chart 15a: Possible Causes of Low Line Pressure in this section
4	Were DTCs P0560 and P0705 set?	Diagnose those DTC(s) first	Use Chart 15b: Possible Causes of High Line Pressure in this section

Chart 5a: Delays In Drive And Reverse

NOTE: A short delay (less than 3 seconds) when first engaging drive or reverse after allowing vehicle to sit overnight is normal.

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	More than 3 second delay in drive and reverse with engine off 1 hour or less. Teflon seals (508) on turbine shaft damaged. Repair	Use Chart 15a: Possible Causes of Low Line Pressure in this section.

Chart 5b: Delays In Reverse Only

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	Main case valve body gasket (88) damaged. <ul style="list-style-type: none"> - Reverse check ball (85) in valve body (84) missing or out of location. - Check for restrictions at valve body transfer plate orifice. Was the problem found?	Repair	—

Chart 6: Diagnostic Trouble Code (DTC) P0730

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	<ol style="list-style-type: none"> 1. 1st and 2nd gear missing or 3rd and 4th gear missing. Check appropriate shift valve. If OK replace solenoid. 2. No engine brake in any range (All ranges in Drive and Reverse are OK). Check for suspected conditions modifying delays to clutch apply: <ul style="list-style-type: none"> – Overrun clutch seal damaged. – Excessive overrun clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. 3. 1st and 4th gear missing or 2nd and 3rd gear missing. Shift solenoid A stuck. Replace shift solenoid A. 4. DTC P0730 is set in D range 1st gear above 3500 rpm. Go to Step 3. 5. DTC P0730 is set in D range 3rd gear between 55-80 mph. <p>NOTE: Perform this test within safe and legal limits. Check for suspected conditions modifying delays to clutch apply:</p> <ul style="list-style-type: none"> – 4th clutch seal damaged. – Excessive 4th clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. <p>Was the problem found?</p>	Repair or replace	—
3	Check 3rd gear in “D” in winter mode. Does vehicle move?	Shift solenoid A stuck. Replace shift solenoid A.	Go to Step 4
4	<p>Check for suspected conditions modifying delays to clutch apply:</p> <ul style="list-style-type: none"> – 2nd clutch seal damaged. – Excessive 2nd clutch piston travel. – Defective accumulator piston. – Causes of internal leaks. – Check ball missing or out of location in 2nd clutch. – Seals cut, damaged or missing. – Gaskets defective. – Causes of burned clutch plates. <p>Was the problem found?</p>	Repair or replace	—

Chart 7: Harsh 1-2 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Check for 1-2 accumulator valve (320) stuck by foreign material in main case valve body.	Use Chart 15b: Possible Causes of High Line Pressure in this section.

Chart 8: Harsh 3-4 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	1. Check for 3-4 accumulator valve (407) stuck in adapter case valve body (401). 2. Check for 3-4 accumulator piston (18) stuck in adapter case (20). Was the problem found?	Repair or replace	—

Chart 9a: 3-2 Downshift Complaint

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 9b: Harsh Shift When Shifting Into "D" Or Accelerating From Stop

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

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Chart 9c: Coastdown Harsh Shift Or Clunk At 3-2 Downshift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 10: Intermittent 4TH TO 2ND Gear Downshift At Steady Speed

Step	Action	Yes	No
1	Check for consistent speed sensor reading with scan tool. Was the reading correct?	Replace mode switch for intermittent contact.	Go to Step 2
2	1. Check for wiring harness damage or short to ground. If OK, go to (2). 2. Check transmission speed sensor connections. If OK, go to (3). 3. Replace transmission speed sensor. Was the replacement complete?	—	Replace speed sensor.

Chart 11: Engine Flare At Shifting During Turning Only (Usually With Warm Engine)

Step	Action	Yes	No
1	Check for oil leaks at transmission. Was the problem found?	Replace transmission oil filter and gasket	—

Chart 12: Engine Flare During 1-2 Or 2-3 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for a stuck 1-2 accumulator valve (320). 2. Check for servo piston (106) leaks. 3. Check for a stuck band apply solenoid (323). Was line pressure normal?	Repair or replace	—

Chart 13: Shudder Only During Torque Converter Clutch (TCC) Applying

Step	Action	Yes	No
1	<p>1. TCC shudder is one of the most commonly misdiagnosed conditions in an automatic transmission. The key to diagnosing TCC shudder is to note when it happens and under what conditions. Once the TCC has been fully applied, it is nearly impossible to make it shudder. TCC shudder (short burst of noise normally less than 1 second) will only occur during clutch applying. It is not a steady state condition.</p> <p>2. Drive until whole drivetrain is at normal operating temperature.</p> <ul style="list-style-type: none"> – On 4WD vehicles, the test must be performed with transfer case selector lever in “2H” position. – Shudder is a short burst of noise normally less than 1 second in duration, and can be induced by the following maneuver: <p>3. From coast condition at 50 mph in “D” range (Normal mode), depress the throttle to 1/4-1/3 throttle. If present, shudder will occur within 5 seconds together with TCC application. (The scan tool may be used to determine the exact time of TCC applying)</p> <p>Was the problem found?</p>	<p>Replace transmission fluid and filter (remove both pans) and flush cooler lines.</p> <p>Replace converter assembly and O-ring on turbine shaft</p>	<p>Perform mechanical inspection of other drivetrain components.</p>

Chart 14: Possible Causes Of Transmission Noise

CAUTION: Before checking transmission for what is believed to be transmission noise, ensure presence and positioning of insulating plugs, pads etc. Also make sure that noise does not come from other drivetrain components.

Condition	Possible cause	Correction
Whine or Buzz	Oil level low	Fill with ATF, check for external leaks.
	Plugged or restricted oil filter	Inspect oil filter. Replace oil filter or ATF as necessary.
	Damaged oil filter gasket	Replace oil filter gasket.
Knocking noise from front of transmission.	Loose bolts (Converter to flex plate)	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Converter damaged	Replace converter.
Knocking noise while driving, mostly on acceleration.	Transmission mount loose or broken	Tighten mount bolts or replace transmission mount.
	Cooler line mounts loose or broken	Tighten or replace cooler line mounts.
	Cooler lines touching body or frame	Repair or replace as necessary.
Knocking noise when vehicle is stationary.	Loose flex plate mounting bolts	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Damaged converter	Replace converter.

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Chart 15a: Possible Causes of Low Line Pressure

Step	Action	Yes	No
1	Check oil level. Was the problem found?	Fill with ATF	Go to Step 2
2	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor	Go to Step 3
3	Check for plugged, loose, or damaged oil filter (79). Was the problem found?	Inspect oil filter, tighten bolts or replace oil filter (79)	Go to Step 4
4	Check for a stuck force motor plunger (404). (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to Step 5
5	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace feed limit valve (412)	Go to Step 6
6	Check for loose converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to Step 7
7	Check for a stuck pressure regulator valve (208). (Oil pump) Was the problem found?	Replace pressure regulator valve (208)	Go to Step 8
8	Check for a stuck boost valve (205).(Oil pump) Was the problem found?	Replace boost valve (205)	Go to Step 9
9	Check for blocked intermediate oil passages to pressure regulator valve. (Oil pump) Was the problem found?	Replace oil pump	Go to Step 10
10	Check for defective oil pump (9, 201, 202 & 209). Was the problem found?	Replace oil pump	Go to Step 11
11	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or damaged – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

Chart 15b: Possible Causes Of High Line Pressure

NOTE: If transmission is operating in backup mode, high line pressure will be present.

Step	Action	Yes	No
1	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor.	Go to Step 2.
2	Check for a stuck force motor plunger (404). (Open circuit/intermittent) (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to Step 3
3	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace force motor plunger (412)	Go to Step 4
4	Check converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to Step 5
5	Check for a stuck pressure regulator valve (208). (Oil pump) Was the problem found?	Replace pressure regulator valve (208)	Go to Step 6
6	Check for a stuck boost valve (205). (Oil pump) Was the problem found?	Replace boost valve (205)	Go to Step 7
7	Check for internal leaks. <ul style="list-style-type: none"> – Check balls missing or out of location in valve bodies – Seals cut or missing – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

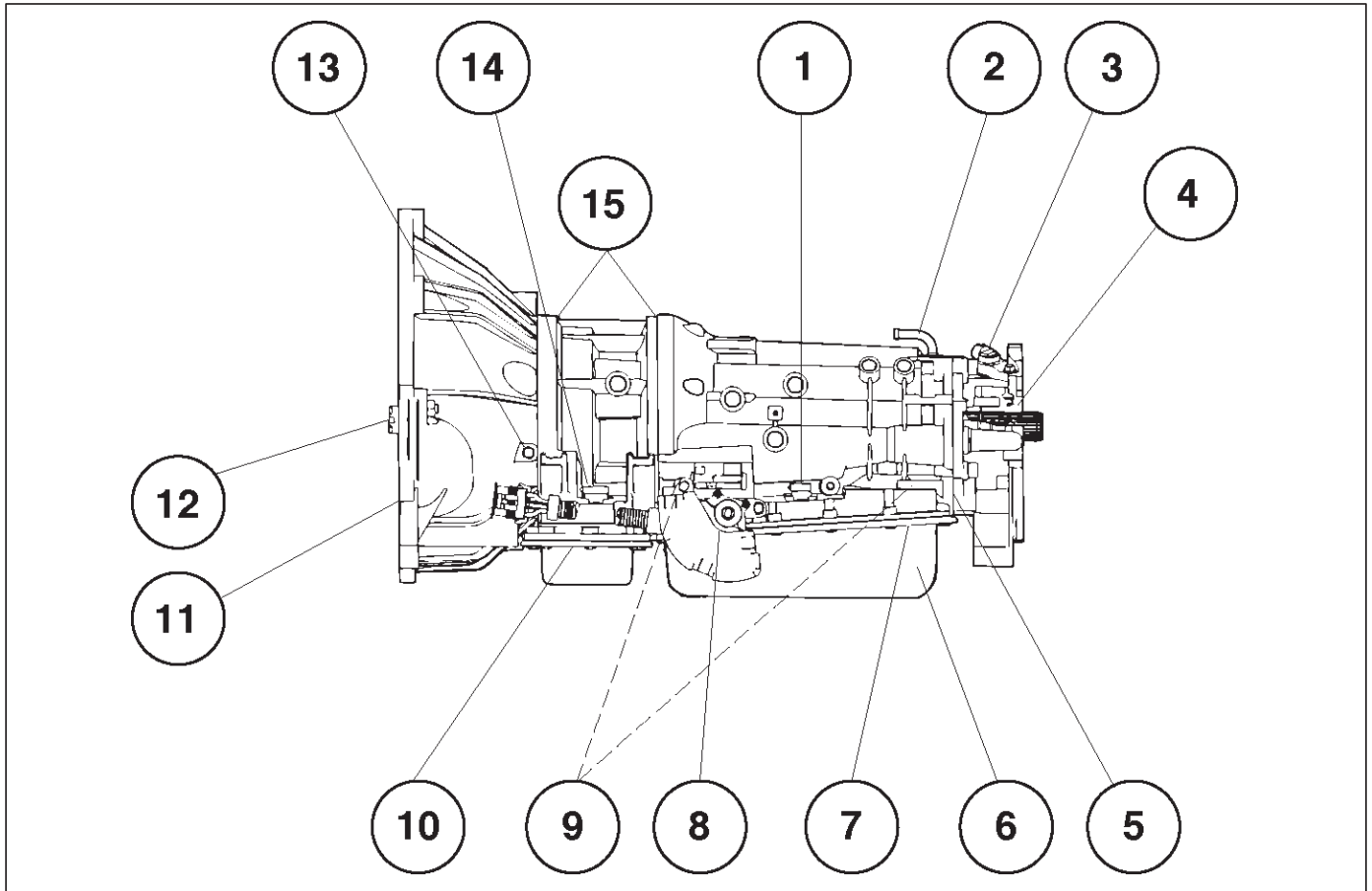
Chart 16: Possible Causes Of Transmission Fluid Leaks

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak may be difficult to determine due to "wind flow" around the engine and transmission. The suspected area should be wiped clean before inspecting for the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the vehicle by the air stream. In determining the source of an leak, the following two checks should be made:

1. With the engine running, check for external line pressure leaks.
2. With the engine off, check for oil leaks due to the raised oil level caused by drainback of converter oil into the transmission.

Possible Causes Of Fluid Leaks Due To Sealing Malfunction



240RS002

Legend

- | | |
|---|--|
| (1) Electrical Connector (Main Case) Seal | (9) Oil Cooler Connectors (2) |
| (2) Transmission Vent (Breather) | (10) Oil Pan Gasket (Adapter Case) |
| (3) Speed Sensor O-Ring | (11) Converter housing attaching bolts not correctly torqued |
| (4) Extension (Adapter) Lip Seal | (12) Converter Housing Lip Seal |
| (5) Extension (Adapter) to Main Case Gasket | (13) Line Pressure Tap Plug |
| (6) Oil Drain Plug Gasket | (14) Electrical Connector (Adapter Case) Seal |
| (7) Oil Pan Gasket (Main Case) | (15) Adapter Case Seal Rings (2) |
| (8) Selector Shaft Seal | |

Stall Test

The stall test allows you to check the transmission for internal abrasion and the one way clutch for slippage. Torque converter performance can also be evaluated. The stall test results together with the road test results will identify transmission components requiring servicing or adjustment.

Stall Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if necessary.
2. Block the wheels and set the parking brake.
3. Connect a tachometer to the engine.
4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80°C (158 – 176°F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Gradually push the accelerator pedal to the floor. The throttle valve will be fully open.

Note the engine speed at which the tachometer needle stabilizes.

Stall Speed : 2,100 ±150 rpm

NOTE: Do not continuously run this test longer than 5 seconds.

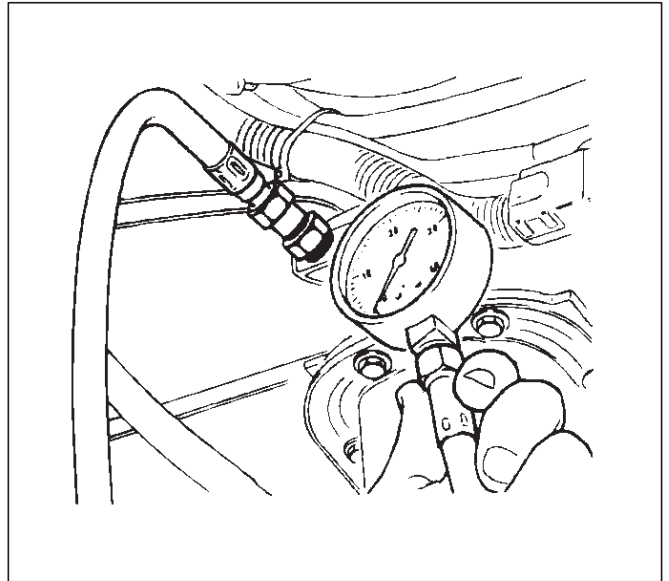
8. Release the accelerator pedal.
9. Place the selector in the “N” range.
10. Run the engine at 1,200 rpm for one minute. This will cool the transmission fluid.
11. Repeat Steps 7 – 10 for the “3”, “2”, “L” and “R” ranges.

Line Pressure Test

The line pressure test checks oil pump and control valve pressure regulator valve function. It will also detect oil leakage.

Line Pressure Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if required.
2. Block the wheels and set the parking brake.
3. Remove the pressure detection plug at the left side of the transmission case. Set 5-8840-0004-0 pressure gauge and adapter to the pressure detection plug hole.



4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80°C (158 – 176°F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Note the pressure gauge reading with the engine idling.
8. Gradually push the accelerator pedal to the floor. The throttle valve will be fully open. Note the pressure gauge reading with the accelerator pedal fully depressed.

NOTE: Do not continuously run this test longer than 5 seconds.

9. Release the accelerator pedal.
10. Place the selector in the “N” range.
11. Run the engine at 1,200 rpm for one minute. This will cool the transmission fluid.
12. Repeat Steps 7 – 11 for the “3”, “2”, “L”, and “R” ranges.
13. Install a pressure detection plug to the transmission case, applying recommended thread locking agent (LOCTITE 242) or its equivalent to thread of plug. Make sure that thread is cleaned before applying locking agents.
14. Tighten the pressure detection plug to the specified torque.

Torque: 9 – 14N·m (0.9 – 1.4 kg·m/7 – 10 lb ft)

7A-24 AUTOMATIC TRANSMISSION (4L30-E)

MODE	LEVER POSITION	ENGINE SPEED	LINE PRESSURE		FORCE MOTOR CURRENT
			kPa	PSI	
NORMAL/POWER	D,3,2,L	IDLE	312-363	45.2-52.6	VARIABLE
WINTER	D	IDLE	312 - 363	45.2 - 52.6	0.9 - 1.0A
NORMAL/POWER WINTER	REVERSE	IDLE	419 - 486	60.7 - 70.5	0.9 - 1.0A
NORMAL/POWER	D, 3, 2, L	STALL SPEED	1,236 - 1,320	179.3 - 191.4	0.1 - 0.2A
WINTER	D	STALL SPEED	1,236 - 1,320	179.3 - 191.4	0.1 - 0.2A
NORMAL/POWER WINTER	REVERSE	STALL SPEED	1,634 - 1,743	236.9 - 252.8	0.1 - 0.2A

Shift Speed Chart

Transfer gear ratio:	High: 1.000
Rear axle ratio:	4.555

“Normal mode”

Upshift

Range	Throttle opening	1 → 2	2 → 3	3 → 4
		(First Gear) (Second Gear) Km/h (mph)	(Second Gear) (Third Gear) Km/h (mph)	(Third Gear) (Fourth Gear) Km/h (mph)
D (Drive)	Fully opened	37 ~ 43 (23 ~ 27)	76 ~ 82 (47 ~ 51)	125 ~ 131 (78 ~ 81)
	Half throttle	29 ~ 35 (18 ~ 22)	54 ~ 60 (34 ~ 37)	107 ~ 113 (66 ~ 70)
3 (Third)	Fully opened	37 ~ 43 (23 ~ 27)	76 ~ 82 (47 ~ 51)	—
	Half throttle	29 ~ 35 (18 ~ 22)	54 ~ 60 (34 ~ 37)	—
2 (Second)	Fully opened	37 ~ 43 (23 ~ 27)	—	—
	Half throttle	29 ~ 35 (18 ~ 22)	—	—

Downshift

Range	Throttle opening	1 ← 2	2 ← 3	3 ← 4
		(First Gear) (Second Gear) Km/h (mph)	(Second Gear) (Third Gear) Km/h (mph)	(Third Gear) (Fourth Gear) Km/h (mph)
D (Drive)	Fully opened	14 ~ 20 (9 ~ 12)	69 ~ 75 (43 ~ 47)	107 ~ 113 (66 ~ 70)
	Half throttle	13 ~ 19 (8 ~ 12)	30 ~ 36 (19 ~ 22)	61 ~ 67 (38 ~ 42)
	Fully closed	12 ~ 18 (7 ~ 11)	20 ~ 26 (12 ~ 16)	27 ~ 33 (17 ~ 20)
3 (Third)	Fully opened	14 ~ 20 (9 ~ 12)	69 ~ 75 (43 ~ 47)	—
	Half throttle	13 ~ 19 (8 ~ 12)	30 ~ 36 (19 ~ 22)	—
	Fully closed	12 ~ 18 (7 ~ 11)	20 ~ 26 (12 ~ 16)	—
2 (Second)	Fully opened	14 ~ 20 (9 ~ 12)	82 ~ 88 (51 ~ 55)	—
	Half throttle	13 ~ 19 (8 ~ 12)	82 ~ 88 (51 ~ 55)	—
	Fully closed	12 ~ 18 (7 ~ 11)	82 ~ 88 (51 ~ 55)	—
L (First)	—	36 ~ 42 (22 ~ 26)	—	—

“Power mode”

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) Km/h (mph)	2 → 3 (Second Gear) (Third Gear) Km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) Km/h (mph)
D (Drive)	Fully opened	41 ~ 47 (25 ~ 29)	79 ~ 85 (49 ~ 53)	125 ~ 131 (78 ~ 81)
	Half throttle	36 ~ 42 (22 ~ 26)	69 ~ 75 (43 ~ 47)	119 ~ 125 (74 ~ 78)
3 (Third)	Fully opened	41 ~ 47 (25 ~ 29)	79 ~ 85 (49 ~ 53)	—
	Half throttle	36 ~ 42 (22 ~ 26)	69 ~ 75 (43 ~ 47)	—
2 (Second)	Fully opened	41 ~ 47 (25 ~ 29)	—	—
	Half throttle	36 ~ 42 (22 ~ 26)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) Km/h (mph)	2 ← 3 (Second Gear) (Third Gear) Km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) Km/h (mph)
D (Drive)	Fully opened	28 ~ 34 (17 ~ 21)	70 ~ 76 (43 ~ 47)	115 ~ 121 (71 ~ 75)
	Half throttle	20 ~ 26 (12 ~ 16)	46 ~ 52 (29 ~ 32)	90 ~ 96 (56 ~ 60)
	Fully closed	12 ~ 18 (7 ~ 11)	22 ~ 28 (14 ~ 17)	43 ~ 50 (27 ~ 31)
3 (Third)	Fully opened	28 ~ 34 (17 ~ 21)	70 ~ 76 (43 ~ 47)	—
	Half throttle	20 ~ 26 (12 ~ 16)	46 ~ 52 (29 ~ 32)	—
	Fully closed	12 ~ 18 (7 ~ 11)	22 ~ 28 (14 ~ 17)	—
2 (Second)	Fully opened	28 ~ 34 (17 ~ 21)	82 ~ 88 (51 ~ 55)	—
	Half throttle	20 ~ 26 (12 ~ 16)	82 ~ 88 (51 ~ 55)	—
	Fully closed	12 ~ 18 (7 ~ 11)	82 ~ 88 (51 ~ 55)	—
L (First)	—	36 ~ 42 (22 ~ 26)	—	—

“Winter mode”

D range, winter mode ON → OFF	27 ~ 33 Km/h (17 ~ 20 mph)
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Lockup Speed Chart

Transfer gear ratio:	High: 1.000
Rear axle ratio:	4.555

D range Throttle opening 6%	Mode	Lockup ON			Lockup OFF		
		2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)	2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)
	Normal	69 ~ 75 (43 ~ 47)	63 ~ 69 (39 ~ 43)	70 ~ 76 (43 ~ 47)	64 ~ 70 (40 ~ 43)	43 ~ 49 (27 ~ 30)	65 ~ 71 (40 ~ 44)
	Power	69 ~ 75 (43 ~ 47)	73 ~ 79 (45 ~ 49)	73 ~ 79 (45 ~ 49)	64 ~ 70 (40 ~ 43)	65 ~ 71 (40 ~ 44)	69 ~ 75 (43 ~ 47)

Changing Transmission Fluid

There is no need to change the transmission fluid unless the transmission is used under one or more of the following heavy duty conditions.

- A. Repeated short trips
- B. Driving on rough roads
- C. Driving on dusty roads
- D. Towing a trailer

If the vehicle is used under these conditions, change the fluid every 20,000 miles (32,000 km.)

More over, the remaining life percentage of ATF can be estimated by using Tech 2 as an auxiliary tool to judge the right time for ATF replacement.

The remaining life percentage is calculated from ATF'S heat history. When it is close to 0%, ATF replacement is recommended.

1. Place a large drain pan under the oil pan.
2. Remove the transmission oil drain screw (2) and drain fluid.
3. Tighten drain screw (2).

Torque: 38 N•m (3.9 kg-m/28 lb ft)

4. Remove the transmission overfill screw (1) and fill transmission through overfill screw opening, using DEXRON®-III ATF.

NOTE: Add transmission fluid until it flows out over the overfill screw opening.

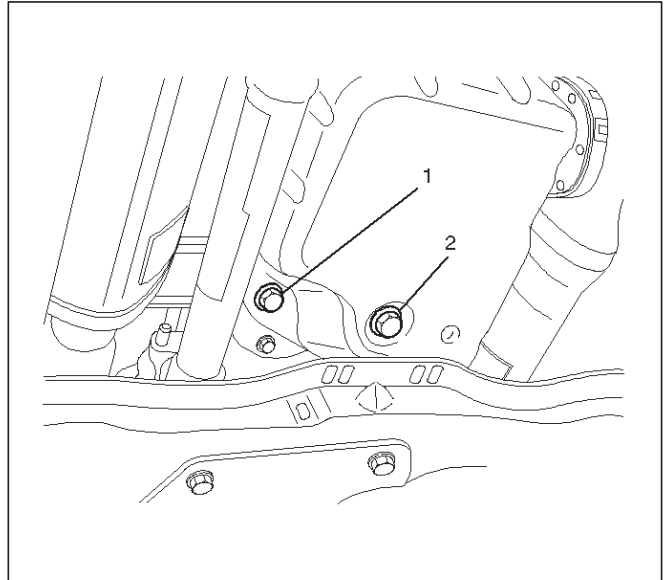
5. Let engine idle until a fluid temperature between 32°C (90°F) and 57°C (135°F) is reached.

6. Add transmission fluid until it flows out over the overfill screw opening, then close the overfill screw (1).

Torque: 38 N•m (3.9 kg-m/28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with service scan tool.

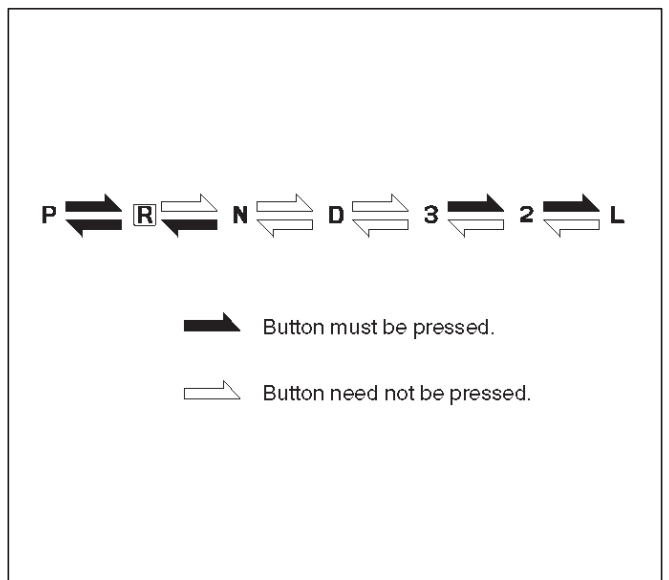


242RW003

Selector Lever

Inspection

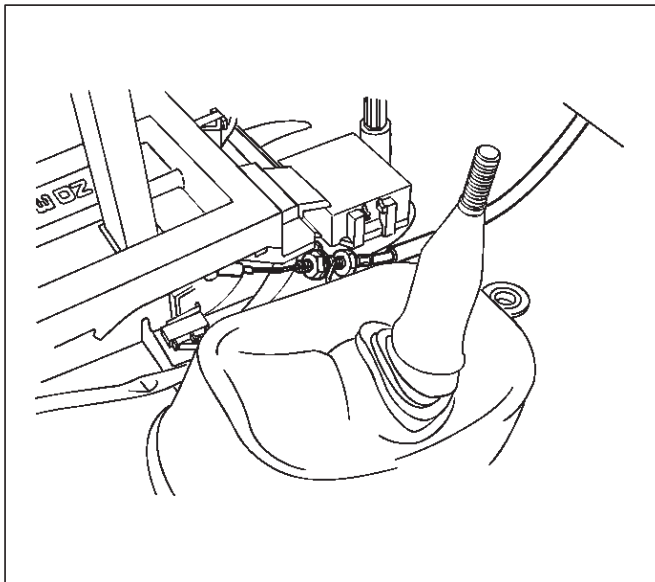
1. Make sure that when the shifter control lever is shifted from "P" to "L", a "clicking" can be felt at each shift position. Make sure that the gear corresponds to that of the position plate indicator.
2. Check to see if the shifter lever can be shifted as shown in illustration.



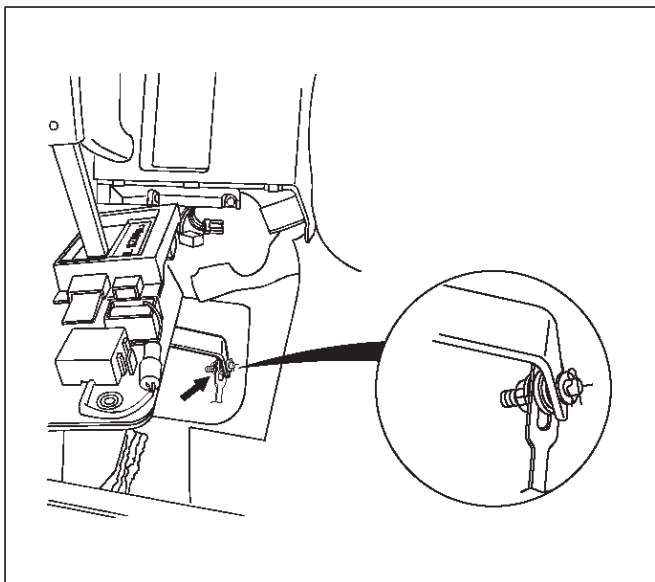
C07RW009

Removal

1. Disconnect battery ground cable.
2. Remove transfer control lever knob.
3. Remove front console.
 - Disconnect wiring harness connectors from front console.
4. Disconnect shift lock cable (1) from the selector lever assembly side.



5. Disconnect shift control rod (2) from the selector lever assembly side.



6. Disconnect wiring harness connectors from the selector lever assembly.
7. Remove selector lever assembly.

Installation

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

Adjustment of select lever and control rod

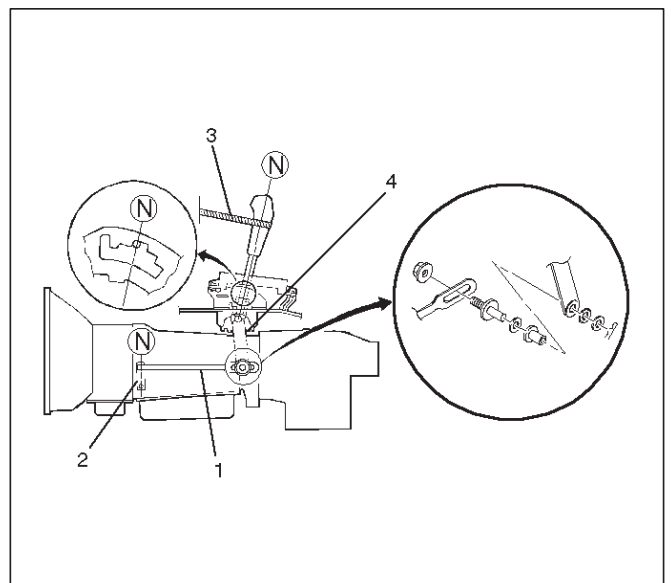
1. Place the vehicle on a level surface.

NOTE: If the vehicle is not on level surface, the shift select cable set positions will vary with the movement of engine. To prevent possible misadjustment of the cable, the vehicle must be placed on a level surface.

2. Install the shift control rod (1) to the transmission select lever (2), and then place the lever in the "N" position.
3. Set select lever in the "N" position.
4. Push select lever forward ("R" position side) and secure it (using a rubber band (3), etc.) so that the pin comes into contact with the wall of the detent plate.
5. Install the shift control rod (1) to the selector lever arm (4).

Torque: 32 N•m (3.3 kg-m/24 lb ft)

NOTE: Do not apply oil to the threaded portions.



6. After adjustment, make sure that the selector lever operates normally, and that each selector position is properly indicated. (The red mark shows through the window.)

Adjustment of shift lock cable

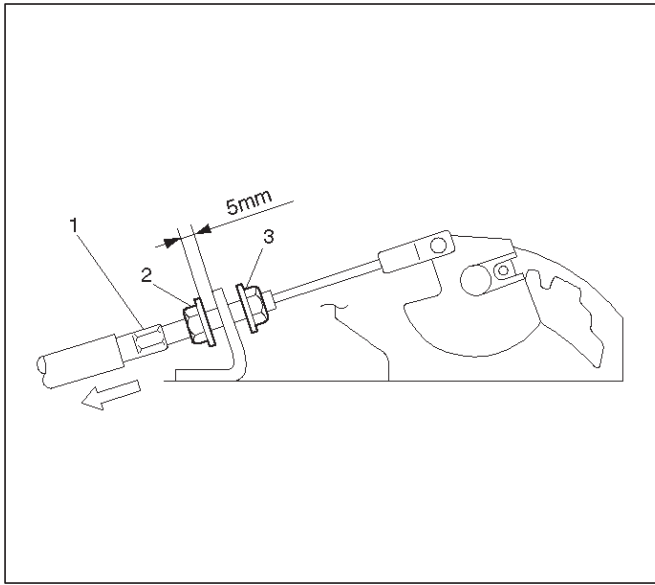
1. Set ignition key in "LOCK" position and selector lever in "P" position.
2. Adjust cable screw cap on selector lever side to provide a gap (slack for cable) of 1 – 2 mm between rod on steering lock side and stopper.

Adjust cap as follows:

 - a. Pull screw cap (1) in arrow direction to remove inner cable slack.
 - b. With cable kept as (a), adjust gap between nut (2) and bracket to 5 mm (0.2 in).
 - c. Lock inner cable by turning nut (3) while holding nut (2) in place.

Torque : 3.7 N•m (38 kg-cm/33 lb in)

NOTE: Clean the cable threads, and do not apply oil to them.

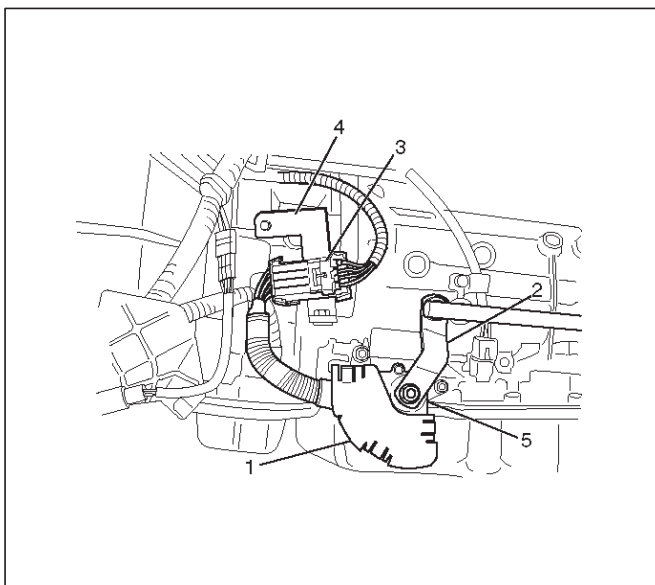


3. Check the shift lock operation:
 - a. Selector lever should not move out of "P" position with ignition key in "Lock" position.
 - b. Selector lever can be moved out of "P" position with ignition key in "ON" position only when brake pedal is depressed.
 - c. Ignition key can be turned to "LOCK" position only when selector lever is in "P" position (key can be pulled out).
- If (a) and (c) fail, readjust cable. If (b) fails, readjust connector wiring and brake pedal switch.

Mode Switch

Removal

1. Place selector lever in neutral.
2. Disconnect battery ground cable.
3. Remove mode switch cover (1).
4. Disconnect selector lever (2) from the mode switch.
5. Disconnect transmission harness from the mode switch connector (3).
6. Remove bracket with mode switch connector from the transmission case.
7. Remove mode switch connector (3) from the bracket (4).
8. Remove two mode switch bolts and nut then remove mode switch (5).



Installation

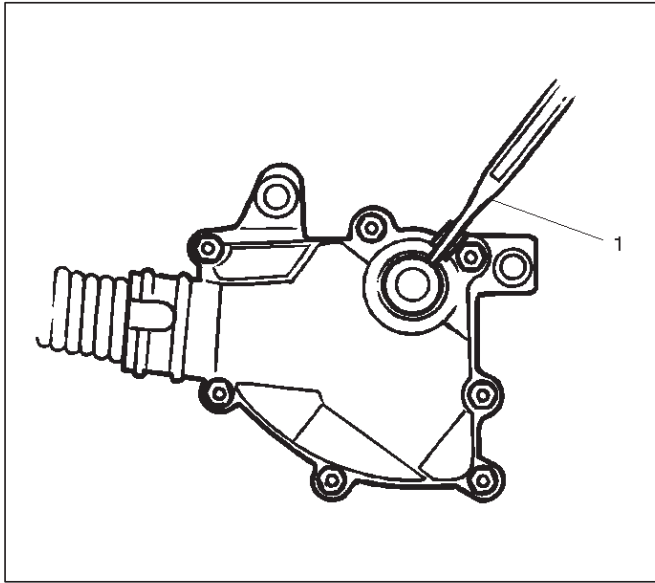
To install, follow the removal steps in the reverse order, noting the following points;

1. Torque
 - Mode switch bolt: 13 N•m (1.3 kg-m/113 lb in)**
 - Selector lever nut: 23 N•m (2.3 kg-m/17 lb ft)**
2. Mode switch setting procedure

Perform either of the following adjustment procedures:

Procedure 1

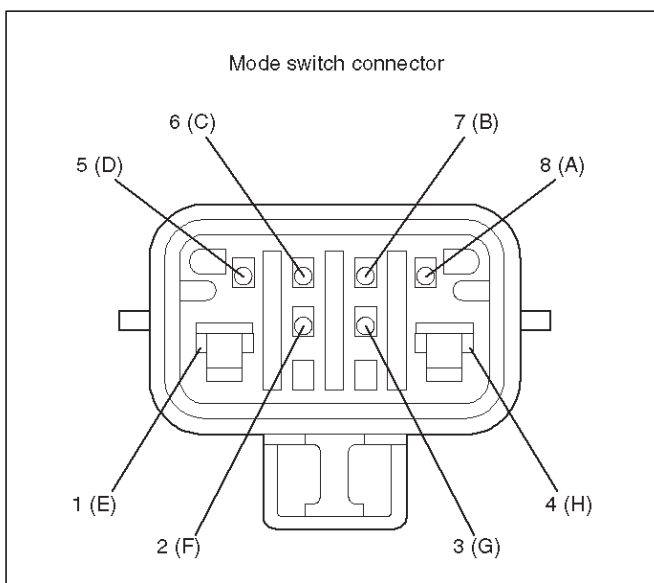
 - a. Place selector lever in neutral.
 - b. Remove selector lever from the mode switch.
 - c. Remove the mode switch cover.
 - d. Loosen the two 10 mm screws.
 - e. Rotate the mode switch until the slot in the mode switch housing aligns with the selector shaft bushing, and insert a 3/32 in. (2.4 mm) drill bit or punch (1) into the slot.
 - f. Tighten the screws to 13 N•m (1.3 kg-m/113 lb in).
 - g. After completing adjustment, snap the mode switch cover into place.
 - h. Reinstall the selector lever.



249RW001

Procedure 2

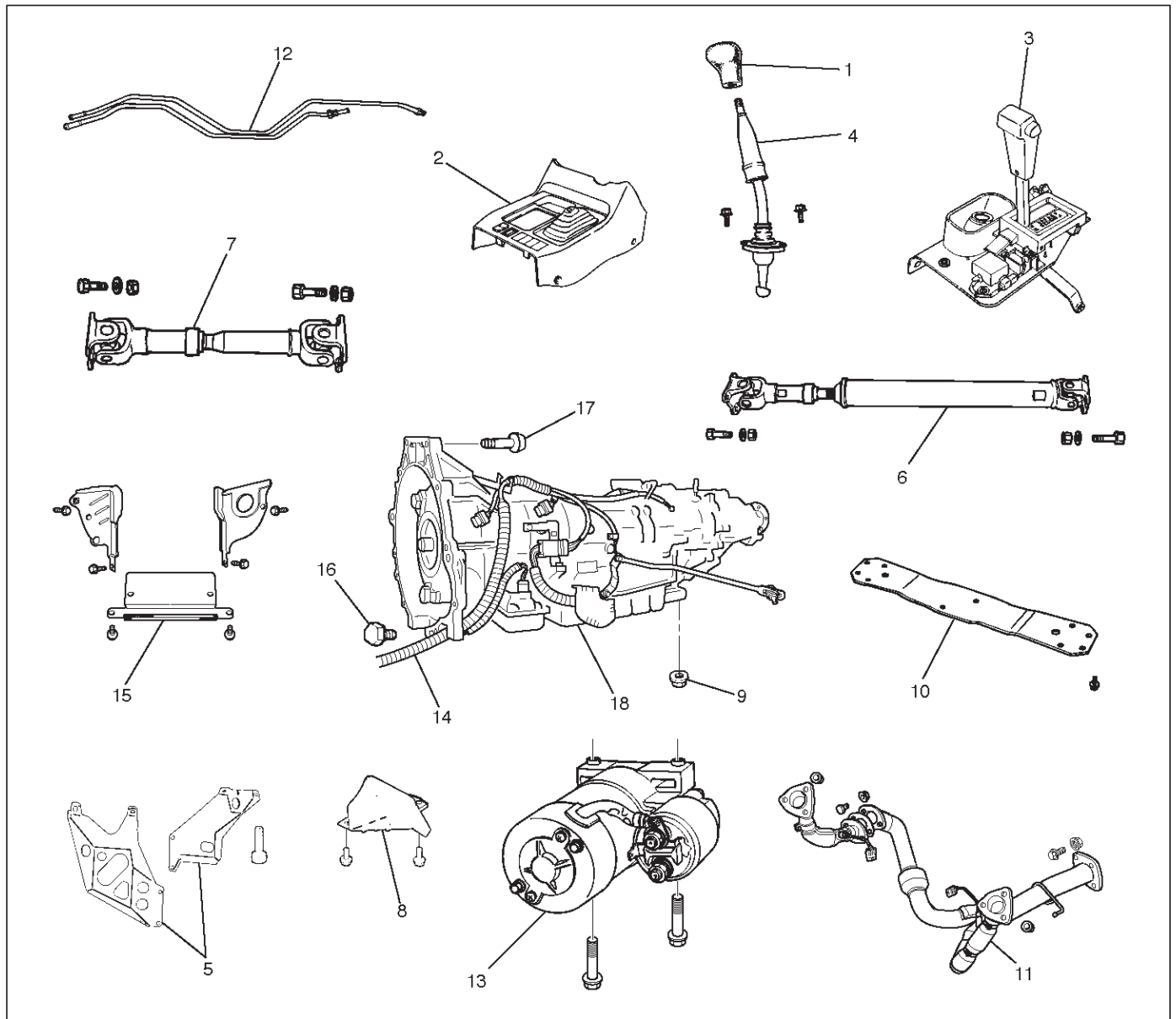
- a. Place selector lever in neutral.
- b. Disconnect transmission harness connector from mode switch connector.
- c. Remove mode switch connector with bracket from the transmission case.
- d. Connect multimeter (resistance mode) to terminals 1(E) and 4(H) on mode switch connector.
- e. Loosen two mounting screws.
- f. Rotate mode switch slightly in both directions to determine the range (approx. 5 degrees) of electrical contact.
- g. Position mode switch in middle of contact range.
- h. Tighten two mounting screws.
- i. Remove multimeter and install mode switch harness connector with bracket to the transmission case.
- j. Connect transmission harness connector to mode switch connector.



F07RW003

Transmission (With Transfer Case)

Transmission And Associated Parts



240RW027

Legend

- | | |
|------------------------------------|-------------------------------------|
| (1) Transfer Control Lever Knob | (10) Third Crossmember |
| (2) Front Console | (11) Exhaust Pipe |
| (3) Selector Lever Assembly | (12) Transmission Oil Cooler Pipe |
| (4) Transfer Control Lever | (13) Starter |
| (5) Transfer and Exhaust Protector | (14) Transmission Harness Connector |
| (6) Rear Propeller Shaft | (15) Under Cover |
| (7) Front Propeller Shaft | (16) Torque Converter Bolt |
| (8) Harness Protector | (17) Engine Transmission Bolt |
| (9) Rear Mount Nut | (18) Transmission Assembly |

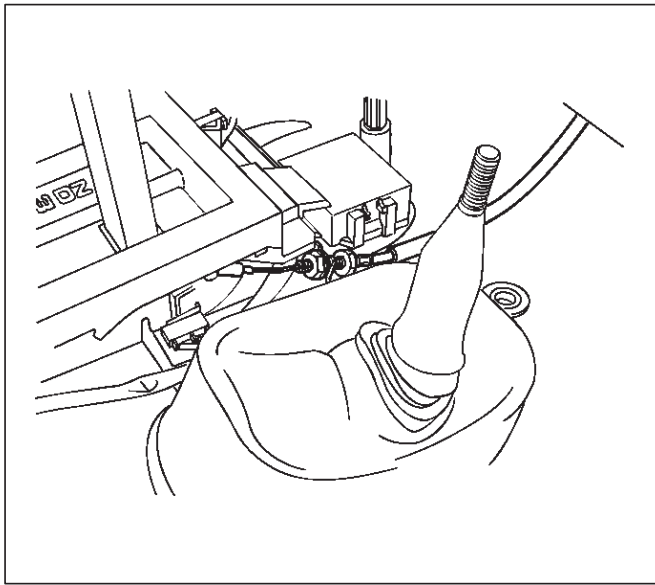
Removal

NOTE: Before remove transmission and transfer assembly from vehicle, change the transfer mode to 2WD using push button on dash panel.

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Remove transfer control lever knob (1) and disconnect wiring harness connectors, then remove front console (2).

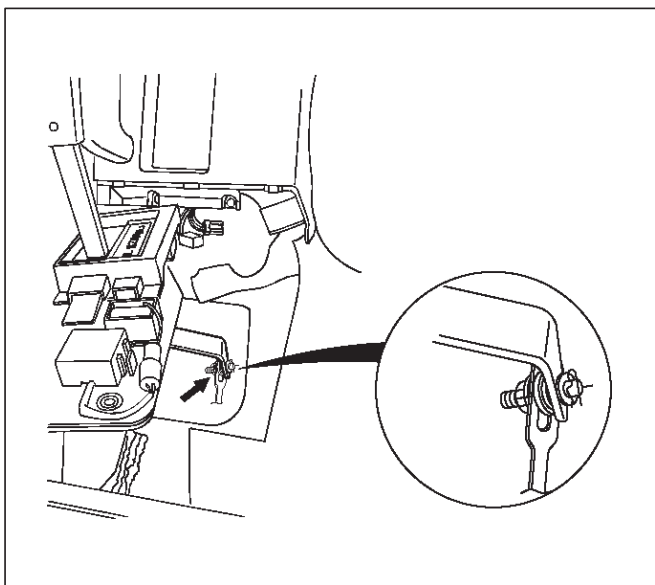
7A-32 AUTOMATIC TRANSMISSION (4L30-E)

4. Disconnect shift lock cable from the selector lever assembly side.



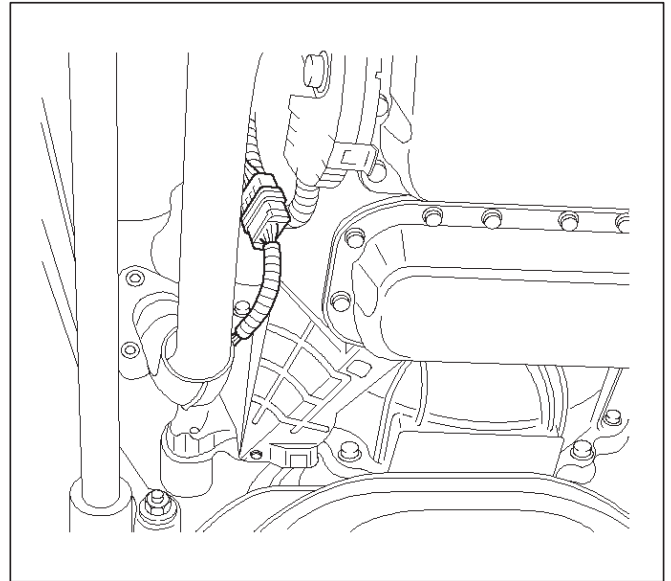
256RW012

5. Disconnect wiring harness connectors.
6. Disconnect shift control rod from the selector lever assembly side.



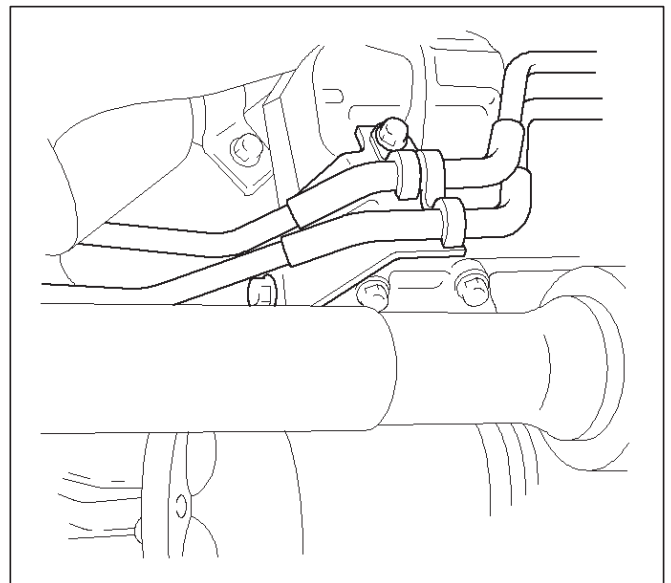
256RW013

7. Remove selector lever assembly (3).
8. Remove transfer control lever (4).
9. Remove transfer and exhaust protector (5).
10. Remove rear propeller shaft (6).
11. Remove front propeller shaft (7).
12. Remove harness protector (8).
13. Support transfer case with a jack and remove two rear mount nuts (9) from the 3rd crossmember side.
14. Remove eight third crossmember bolts and third crossmember (10).
15. Disconnect one oxygen sensor connector from the transmission harness.



150RW002

16. Remove exhaust pipe (11).
17. Disconnect transmission oil cooler pipe (12) from A/T side.
18. Remove oil pipe clamp from torque converter housing bracket.



253RW001

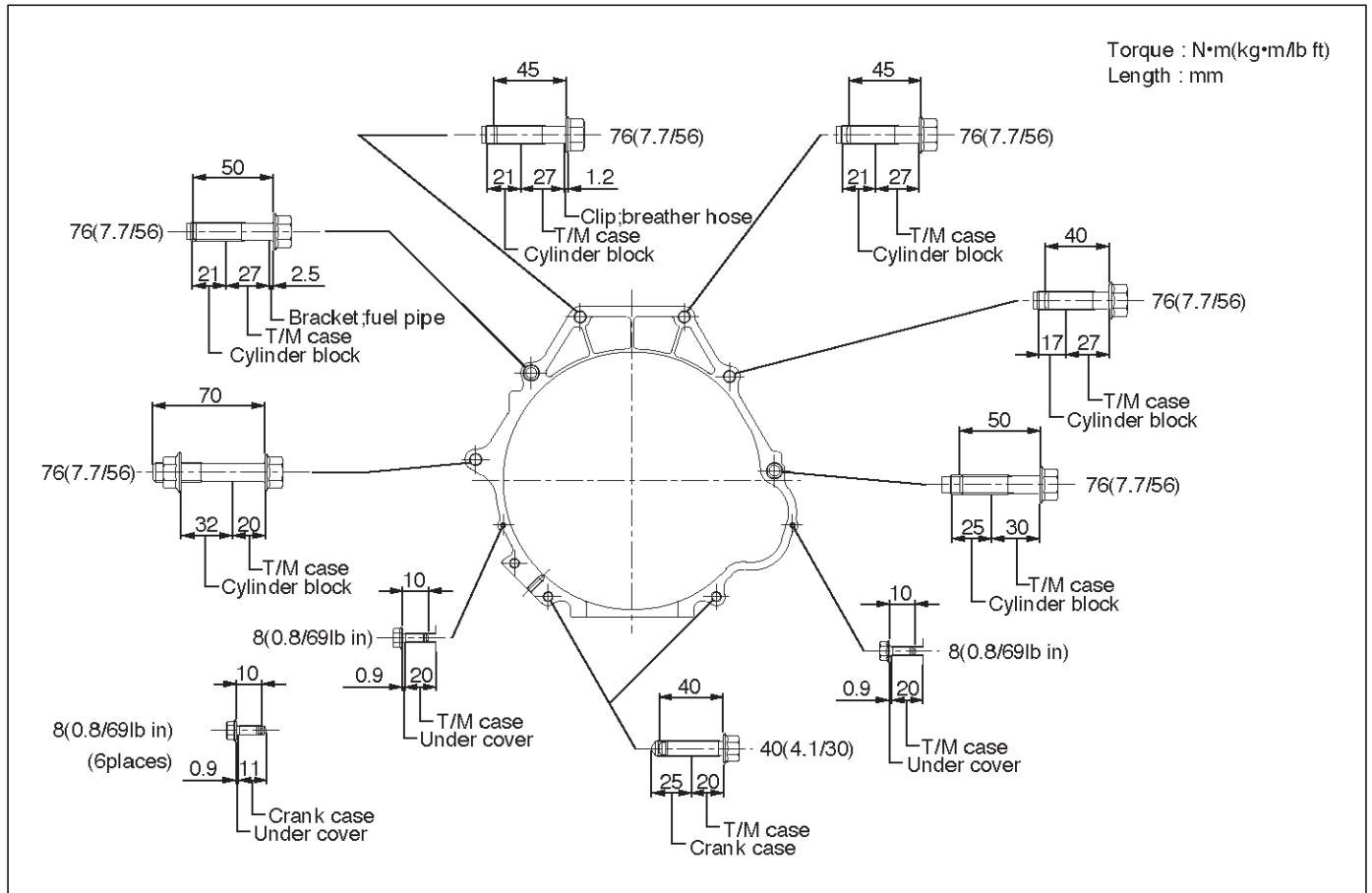
19. Loosen oil pipe clamp bolt at the engine mount side.
20. Remove starter (13).
21. Disconnect fuel pipe clamp bracket from transmission side.
22. Disconnect transmission harness connectors (14) from transmission, and transfer.
23. Remove flywheel under covers (3 pieces) (15) from transmission case.
24. Lower the front of the transmission a little, then remove flywheel torque converter fixing bolts (6 pieces) (16) by turning crankshaft.
25. Support the transmission with a transmission jack, and hoist engine with a chain block.
26. Remove engine transmission fixing bolts (17).

27. Remove transmission assembly (18).

2. Tighten engine transmission bolts to the specified torque.

Installation

1. Slowly raise transmission jack until front of the transmission is aligned with rear of the engine, then install transmission assembly.



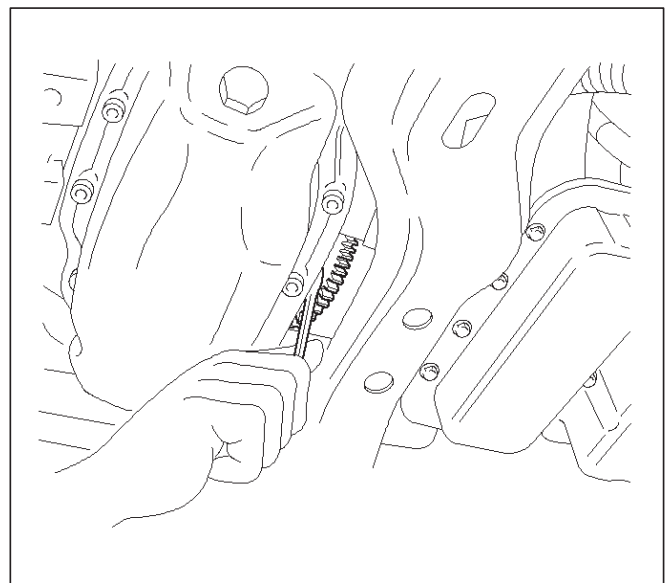
F07RW041

3. Support transfer case with a jack, and remove the transmission jack.

4. Install flywheel torque converter bolts (6 pieces) by turning crankshaft.

Torque: 54 N•m (5.5 kg•m/40 lb ft)

NOTE: Do not reuse the flywheel torque converter bolt.



240RW005

7A-34 AUTOMATIC TRANSMISSION (4L30-E)

5. Install the flywheel under cover (3 pieces), and tighten the bolts to the specified torque.

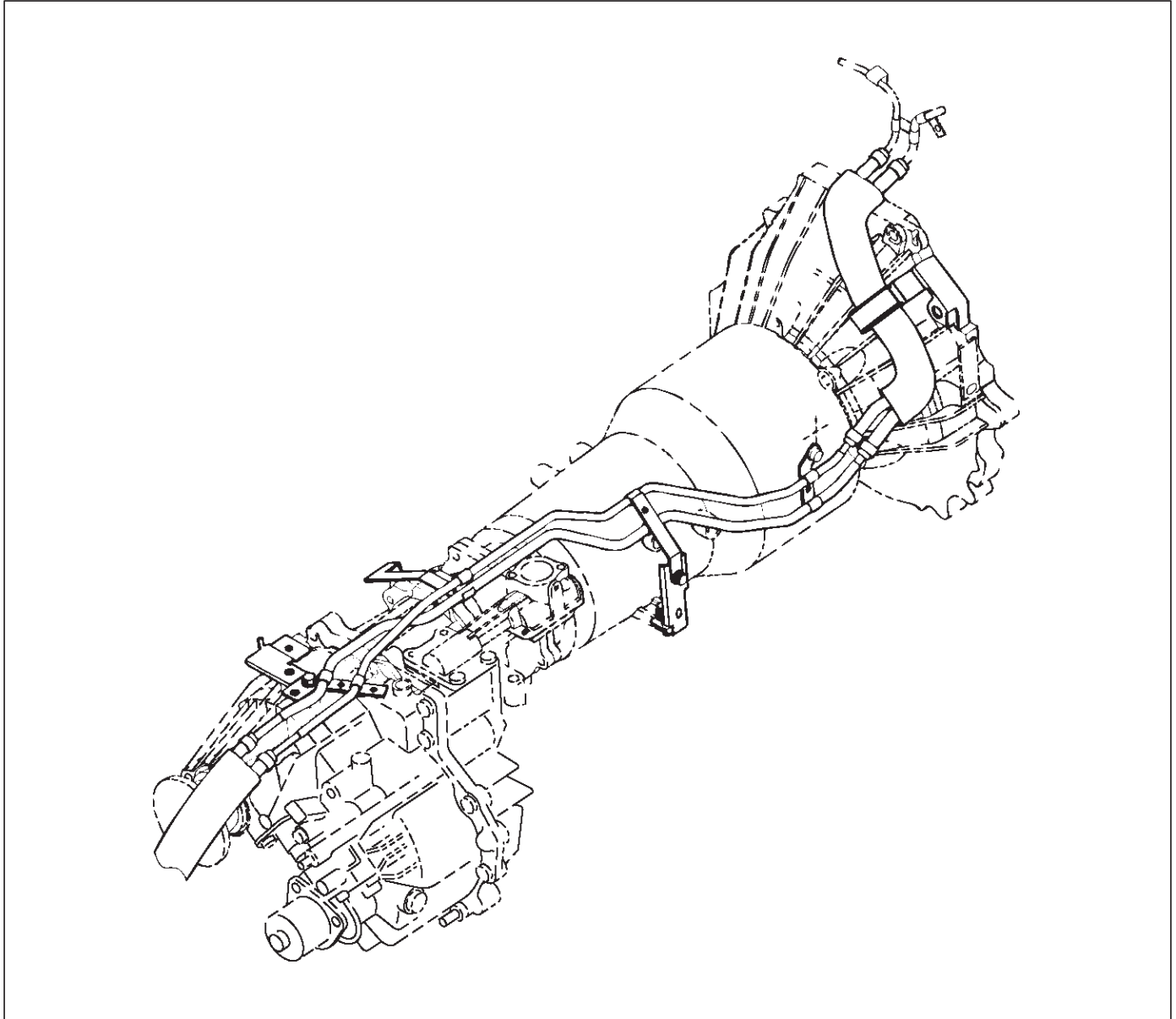
Torque: 8 N•m (0.8 kg-m/69 lb in)

6. Install the starter, and tighten the bolts to the specified torque.

Torque: 40 N•m (4.1 kg-m/30 lb ft)

7. Connect transmission harness connectors to transmission, and transfer.

8. Connect fuel pipe bracket to transmission side.



141RW027

9. Install transmission oil cooler pipe to transmission.

Torque: 54 N•m (5.5 kg-m/40 lb ft)

10. Install oil pipe clamp to torque converter housing bracket.

11. Tighten oil pipe clamp bolt at engine mount side.

12. Install exhaust pipe, and tighten the bolts to the specified torque.

**Exh. pipe to exh. manifold 67 N•m
(6.8 kg-m/49 lb ft)**

Exh. pipe flange bolt 43 N•m (4.4 kg-m/32 lb ft)

13. Connect one oxygen sensor connector to the transmission harness.

14. Install third crossmember, and tighten the bolts to the specified torque.

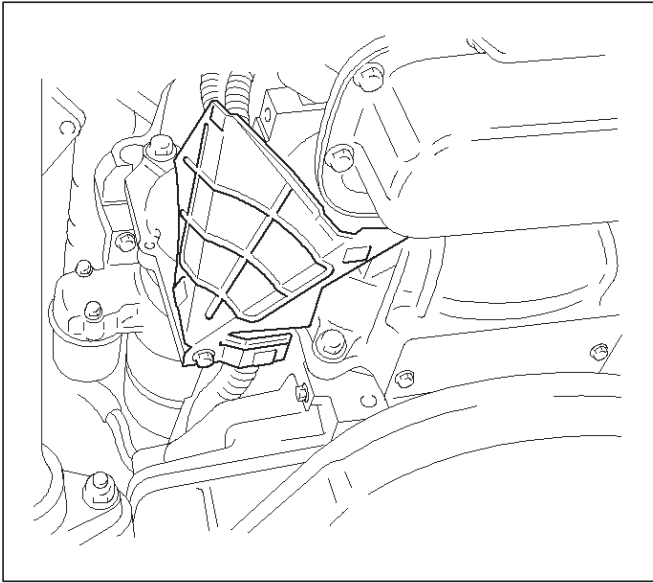
Torque: 50 N•m (5.1 kg-m/37 lb ft)

15. Install rear mount nuts, and tighten the nuts to the specified torque.

Torque: 50 N•m (5.1 kg-m/37 lb ft)

16. Remove the jack from the transfer case.

17. Install harness protector.



815RW002

18. Install the front propeller shaft, and tighten the bolts to the specified torque.

Torque: 63 N•m (6.4 kg-m/46 lb ft)

19. Install the rear propeller shaft, and tighten the bolts to the specified torque.

Torque: 63 N•m (6.4 kg-m/46 lb ft)

20. Install the transfer and exhaust protectors, and tighten the bolts to the specified torque.

Torque: 37 N•m (3.8 kg-m/27 lb ft)

21. Install the transfer control lever.

22. Install the selector lever assembly.

23. Connect the shift control rod to selector lever assembly.

24. Connect the wiring harness connectors.

25. Connect the shift lock cable to selector lever assembly. Refer to Selector Lever in this section.

26. Connect the wiring harness connectors to front console.

27. Install the front console.

28. Install the transfer control lever knob.

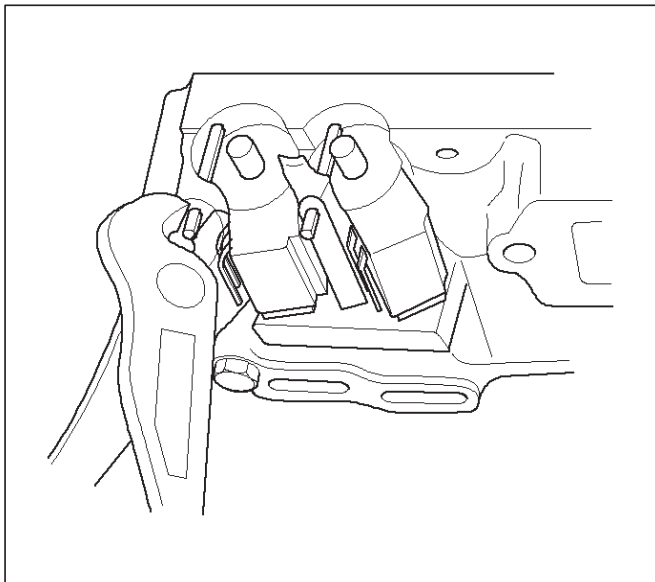
29. Connect the battery ground cable.

30. Install the engine hood.

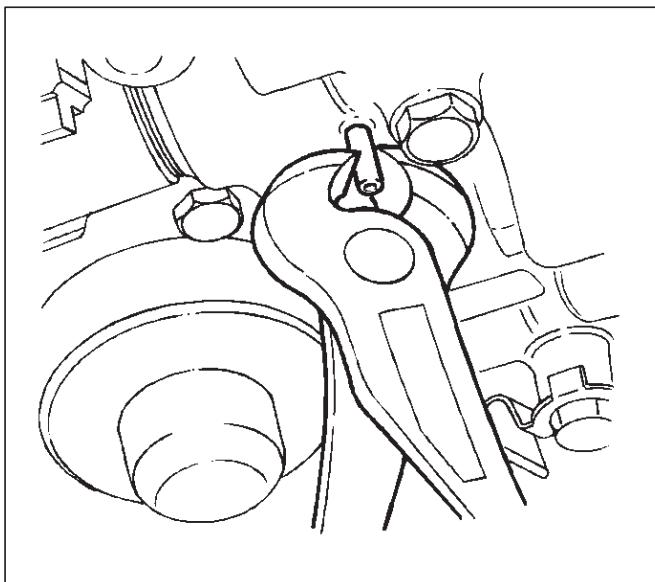
Solenoid (Main Case Valve Body)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer and exhaust protectors.
4. Drain fluid.
5. Remove exhaust pipe and disconnect oxygen sensor connector.
6. Support transfer case with a jack and remove third crossmember.
7. Remove sixteen 10 mm screws, main case oil pan, magnet, and gasket.
8. Remove three 13 mm screws, oil filter.
9. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
10. Remove spring pin for shift solenoid A, shift solenoid B, and band control solenoid respectively, using suitable pliers taking care not to damage solenoids.



210RW010

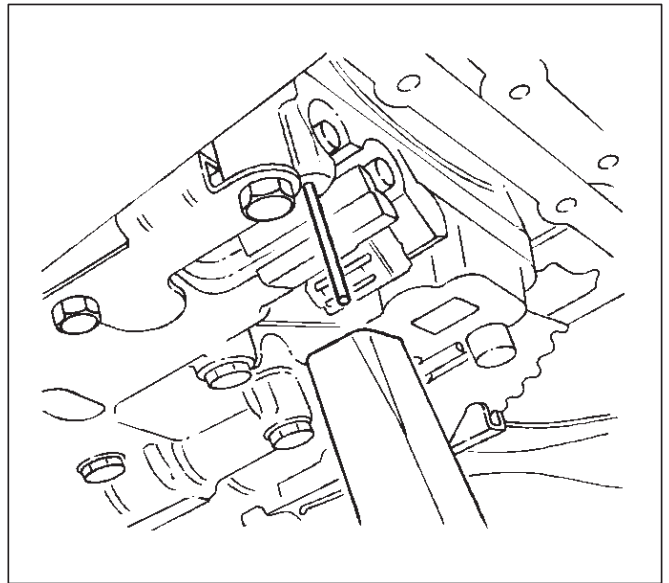


244RW003

11. Remove shift solenoid A, shift solenoid B, band control solenoid, and gaskets from main case valve body. Do not pull on wiring harness. Remove solenoids by grasping the metal tip.

Installation

1. Install shift solenoid A, shift solenoid B, band control solenoid with new gaskets to main case valve body respectively.
2. Carefully install spring pin with hammer to avoid damage to valve body, etc.



243RW004

3. Connect wiring harness to solenoids.
4. Install oil filter with a new gasket and the three 13 mm screws. Tighten the screws to the specified torque.
Torque: 20 N•m (2.0 kg-m/15 lb ft)
5. Install magnet, main case oil pan with new gasket, sixteen 10 mm screws. Tighten the screws to the specified torque.
Torque: 11 N•m (1.1 kg-m/96 lb in)
6. Install third crossmember and rear mount nuts. Tighten the nuts and bolts to the specified torque.
Third crossmember bolt: 50 N•m (5.1 kg-m/37 lb ft)
Rear mount nut: 50 N•m (5.1 kg-m/37 lb ft)
7. Install exhaust pipe and connect oxygen sensor connector. Tighten the bolts to the specified torque.
Exhaust pipe flange bolt torque: 43 N•m (4.4 kg-m/32 lb ft)
8. Install the transfer and exhaust protectors. Tighten the bolts to the specified torque.
Torque: 37 N•m (3.8 kg-m/27 lb ft)
9. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®-III. Refer to Changing Transmission Fluid in this section.
10. Connect the battery ground cable.

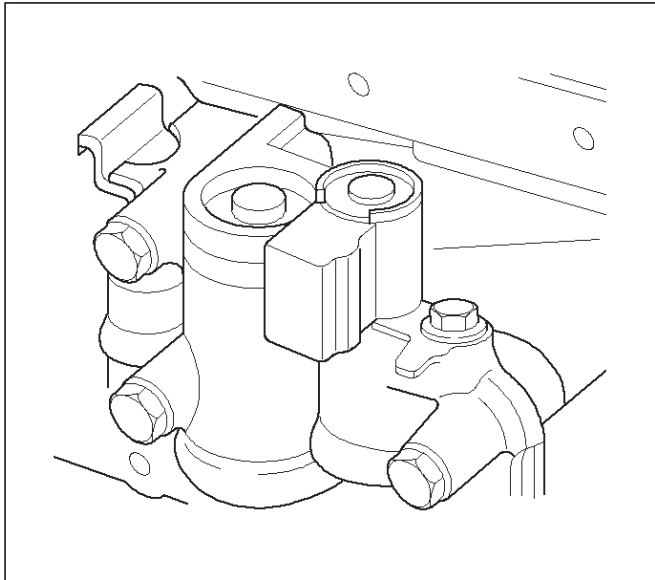
Solenoid (Adapter Case Valve Body)

Removal

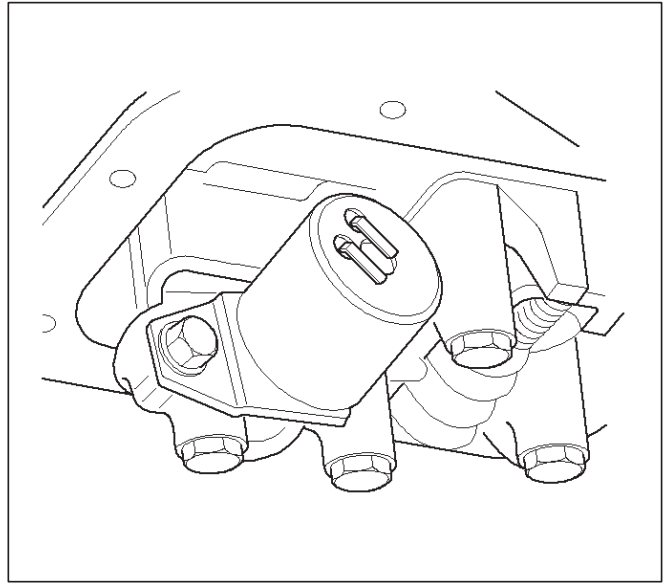
1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove transfer and exhaust protectors.
5. Remove exhaust pipe and disconnect oxygen sensor connector.
6. Remove adapter case oil pan twelve fixing 10 mm screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan and drain the fluid carefully.

7. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
8. Remove 11 mm bolt and converter clutch solenoid with two O-rings.



9. Remove 11 mm bolt, retainer, and force motor solenoid.



210RW009

Installation

1. Install force motor solenoid, retainer, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque: 10 N•m (1.0 kg-m/87 lb in)

2. Install converter clutch solenoid with two O-rings, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque : 10 N•m (1.0 kg-m/87 lb in)

3. Connect wiring harness assembly to solenoids.
4. Install adapter case oil pan, new gasket, and twelve 10 mm screws. Tighten the screws to the specified torque.

Torque : 11 N•m (1.1 kg-m/96 lb in)

5. Install exhaust pipe and connect oxygen sensor connector. Tighten the bolt to the specified torque.

**Exhaust pipe flange bolt torque :
43 N•m (4.4 kg-m/32 lb ft)**

6. Install transfer and exhaust protectors. Tighten the bolt to the specified torque.

Torque : 37 N•m (3.8 kg-m/27 lb ft)

7. Fill transmission through overfill screw hole oil pan, using ATF DEXRON®-III. Refer to Changing Transmission Fluid in this section.

8. Connect battery ground cable.

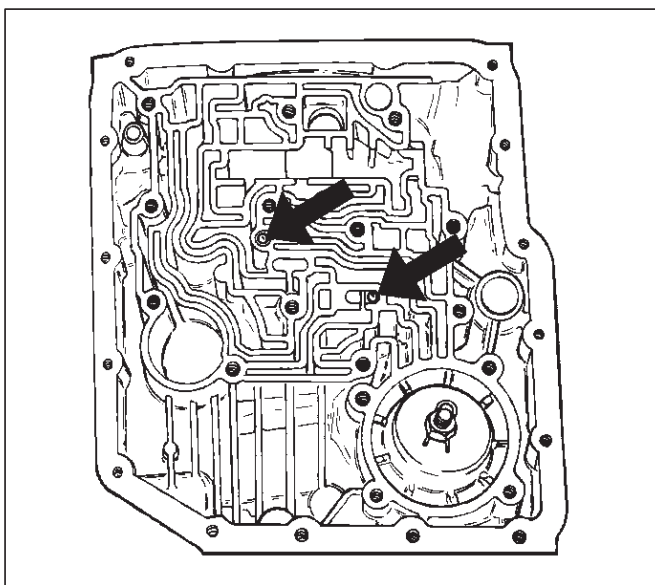
Valve Body Assembly (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer and exhaust protectors.
4. Drain fluid.
5. Remove exhaust pipe and disconnect oxygen sensor connector.
6. Support transfer case with a jack and remove third crossmember.
7. Remove sixteen 10 mm screws, main case oil pan, magnet and gasket.
8. Remove three 13 mm oil filter fixing screws, then remove oil filter.
9. Remove two 13 mm manual detent fixing screws, then remove roller and spring assembly.
10. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
11. Remove four 13 mm servo cover fixing screws, then remove servo cover and gasket.
12. Remove seven 13 mm valve body fixing screws.
 - Disconnect the ground wire from the main case valve body.
13. Remove main case valve body with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
14. Remove transfer plate gasket from main case.
15. Remove two check balls from main case.

Installation

1. Install two check balls to main case.



2. Inspect electrical 4 pin connector and seal of main case. Replace if necessary.

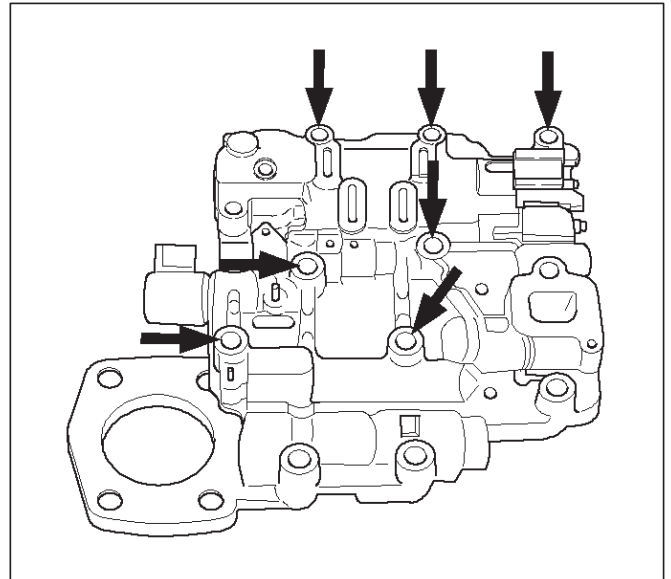
3. Use two 5-8840-0022-0 (J-25025-B) guide pin to install main case.

- Install valve body assembly and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

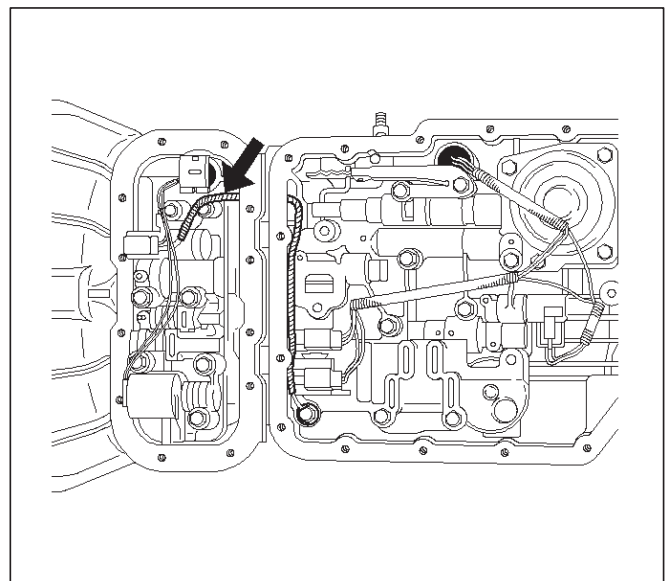
4. Install seven 13 mm screws, and tighten them to the specified torque.

Torque: 20 N•m (2.0 kg-m/15 lb ft)



5. Install 8.5 mm connector of ground wire the head of this valve body bolt and reinstall it. Tighten the bolt to the specified torque.

Torque: 20 N•m (2.0 kg-m/15 lb ft)



6. Remove two guide pins from main case.

7. Install servo cover gasket, cover, and four 13 mm screws. Tighten the screws to the specified torque.

Torque: 25 N•m (2.6 kg-m/18 lb ft)

8. Connect wiring harness to band control and shift solenoids.
9. Install roller and spring assembly to manual detent.
 - Install two 13 mm screws, and tighten them to the specified torque.
Torque: 20 N•m (2.0 kg-m/15 lb ft)
10. Install oil filter and three 13 mm screws. Tighten the screws to the specified torque.
Torque : 20 N•m (2.0 kg-m/15 lb ft)
11. Install oil pan gasket, magnet, oil pan and sixteen 10 mm screws. Tighten the screws to the specified torque.
Torque: 11 N•m (1.1 kg-m/96 lb in)
12. Install third crossmember and rear mount. Tighten the bolts and nuts to the specified torque.
Torque
**Third crossmember bolt:
50 N•m (5.1 kg-m/37 lb ft)**
Rear mount nut: 50 N•m (5.1 kg-m/37 lb ft)
13. Install exhaust pipe and connect oxygen sensor connector. Tighten the bolts to the specified torque.
**Exhaust pipe flange bolt torque:
43 N•m (4.4 kg-m/32 lb ft)**
14. Install transfer and exhaust protectors. Tighten the bolts to the specified torque.
Torque: 37 N•m (3.8 kg-m/27 lb ft)
15. Fill transmission through overfill screw hole of oil pan, using ATF DEXRON®-III, refer to Changing Transmission Fluid in this section.
16. Connect battery ground cable.

Valve Body Assembly (Adapter Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove transfer and exhaust protectors.
5. Remove exhaust pipe and disconnect oxygen sensor connector.
6. Remove twelve 10 mm adapter case oil pan fixing screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan.

Drain the fluid carefully.

7. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
8. Remove seven 13 mm screws from adapter case valve body assembly, then remove transfer plate, two gaskets, and adapter case valve body.

Installation

1. Inspect electrical 5 pin connector and seal of adapter case. Replace if necessary.

2. Install gasket, transfer plate, and gasket.
3. Install adapter case valve body and seven 13 mm screws. Tighten the screws to the specified torque.
Torque: 20 N•m (2.0 kg-m/15 lb ft)
4. Connect wiring harness assembly to converter clutch solenoid and force motor.
5. Install oil pan gasket, oil pan, and twelve 10 mm screws. Tighten the screws to the specified torque.
Torque: 11 N•m (1.1 kg-m/96 lb in)
6. Install exhaust pipe and connect oxygen sensor connector. Tighten the bolts to the specified torque.
**Exhaust pipe flange bolt torque:
43 N•m (4.4 kg-m/32 lb ft)**
7. Install transfer and exhaust protectors. Tighten the bolts to the specified torque.
Torque: 37 N•m (3.8 kg-m/27 lb ft)
8. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®-III. Refer to Changing Transmission Fluid in this section.
9. Connect battery ground cable.

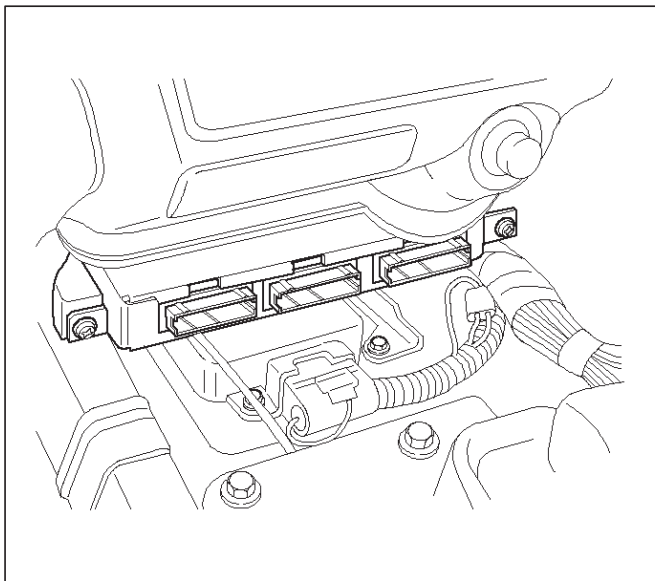
Powertrain Control Module (PCM)

Removal

1. Disconnect battery ground cable.
2. Remove front console.
3. Disconnect PCM wiring harness connectors from PCM.
4. Remove three PCM retaining screws.
5. Remove two brackets from PCM.

Installation

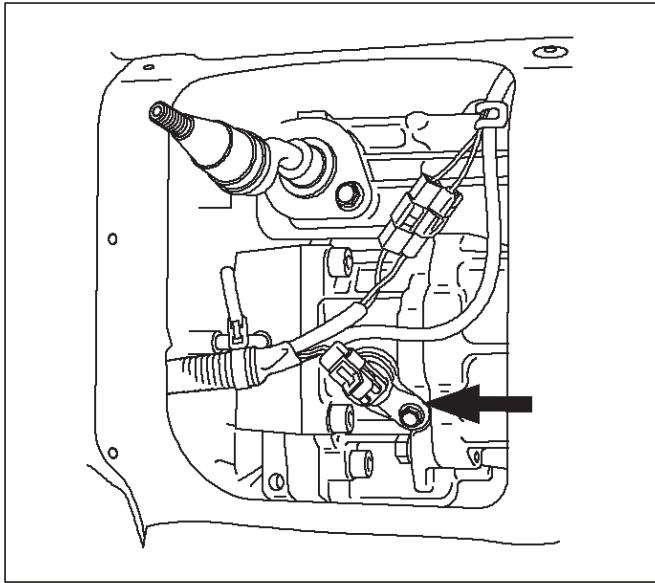
1. Install two brackets to PCM.
2. Install three PCM retaining screws.
3. Connect PCM wiring harness connectors to PCM.
4. Install front console.
5. Connect battery ground cable.



Speed Sensor (Extension Housing)

Removal

1. Disconnect battery ground cable.
2. Remove front console.
3. Remove selector lever assembly.
4. Disconnect speed sensor harness connector from speed sensor.
5. Remove one 10 mm screw and speed sensor with O-ring.



241RW007

Installation

1. Inspect the speed sensor O-ring, and replace it if necessary.
2. Install speed sensor assembly and 10 mm screw.
Torque: 9 N•m (0.9 kg-m/78 lb in)
3. Connect speed sensor harness connector to speed sensor.
4. Install selector lever assembly.
 - Adjust shift lock cable. Refer to Selector Lever in this section.
5. Install front console.
6. Connect battery ground cable.

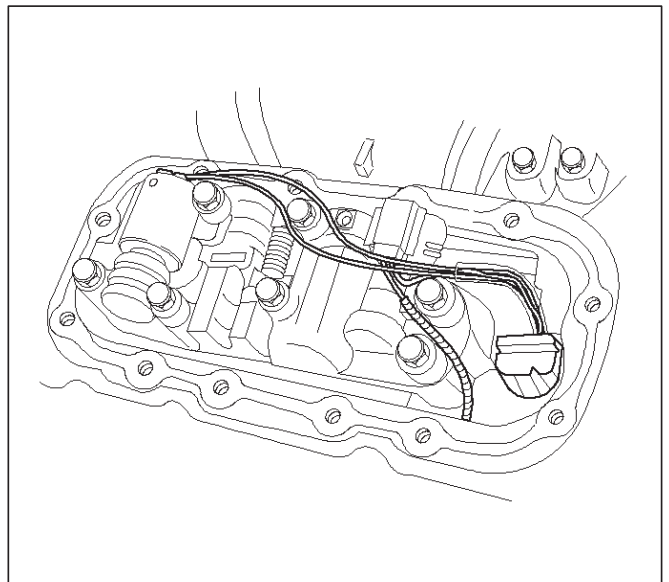
Transmission Oil Temperature Sensor (Adapter Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove transfer and exhaust protectors.
5. Remove exhaust pipe and disconnect oxygen sensor connector.
6. Remove twelve 10 mm adapter case oil pan fixing screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan, and drain the fluid carefully.

7. Disconnect wiring harness from force motor solenoid, converter clutch solenoid, and 5 pin connector of adapter case. Pull only on connectors, not on wiring harness.
8. Disconnect ground wire from converter clutch solenoid wiring harness connector.
9. Remove wiring harness assembly (transmission oil temperature sensor).



243RW002

Installation

1. Connect ground wire to converter clutch solenoid wiring harness connector of the wiring harness assembly.
2. Install wiring harness assembly to converter clutch solenoid, force motor, and 5 pin connector of adapter case.
3. Install oil pan gasket, oil pan, and twelve 10 mm fixing screws. Tighten the screws to the specified torque.

Torque: 11 N•m (1.1 kg-m/96 lb in)

4. Install exhaust pipe and connect oxygen sensor connector. Tighten the bolts to the specified torque.

**Exhaust pipe flange bolt torque:
43 N•m (4.4 kg-m/32 lb ft)**

5. Install transfer and exhaust protectors. Tighten the bolts to the specified torque.

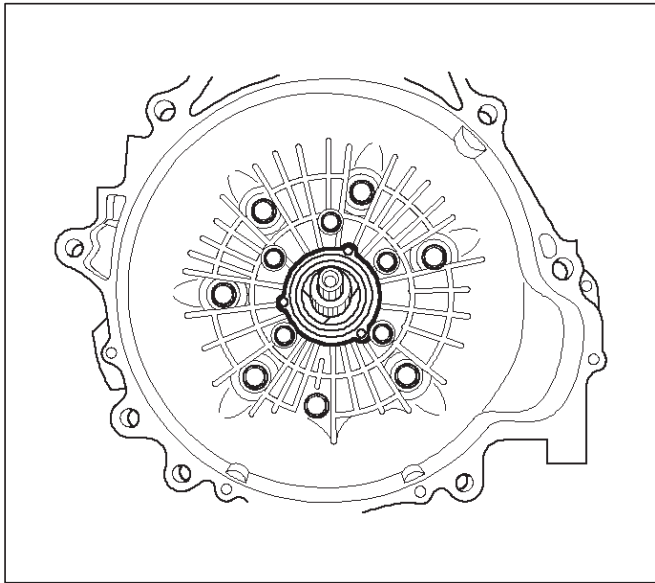
Torque: 37 N•m (3.8 kg-m/27 lb ft)

6. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®-III. Refer to Changing Transmission Fluid in this section.
7. Connect battery ground cable.

Front Oil Seal (Converter Housing)

Removal

1. Remove transmission assembly with transfer case from the vehicle. Refer to Transmission (with Transfer Case) in this section.
2. Remove torque converter from converter housing.
3. Remove three screws and oil seal ring from converter housing.



241RW008

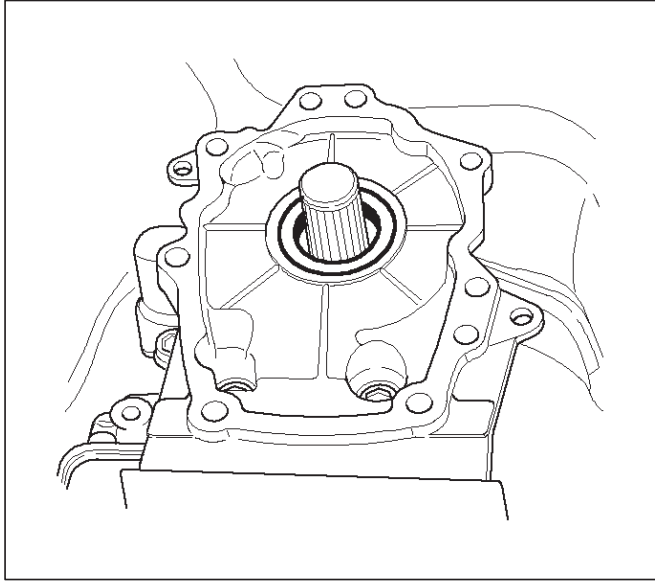
Installation

1. Apply clean ATF to the new oil seal ring lip.
 - Install oil seal ring to converter housing. Tighten the screws to the specified torque.
2. Install torque converter to converter housing.
3. Install transmission assembly with transfer case to the vehicle. Refer to Transmission (with Transfer Case) in this section.

Rear Oil Seal (Extension Housing)

Removal

1. Remove transfer case assembly from the vehicle. Refer to Transfer Case in Drive Line/Axle section.
2. Remove rear oil seal from transmission extension housing.



241RW005

Installation

1. Use 5-8840-2282-0 (J-36797) extension housing oil seal installer, and install the rear oil seal to the transmission extension housing.
2. Install the transfer case assembly to the vehicle. Refer to Transfer Case in Drive Line/Axle section.

Transmission (4L30-E)

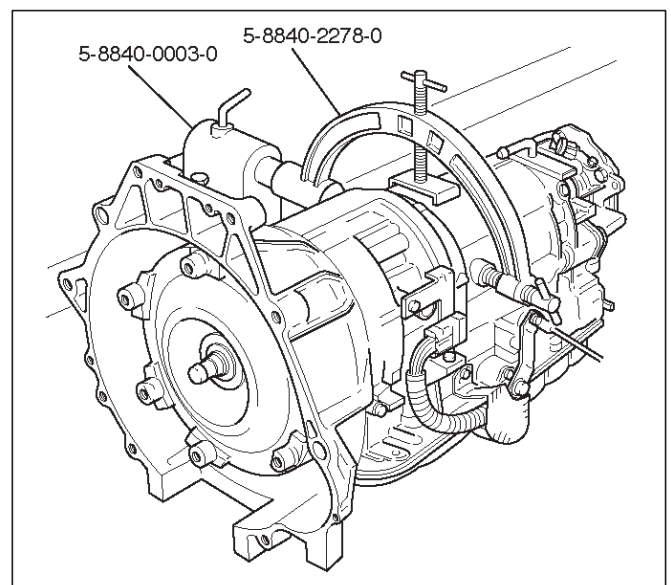
Disassembly

NOTE: During the disassembly and reassembly, perform the following:

- Wash each part thoroughly, and blow air through each oil passage and groove to eliminate blockage.
- Seal rings, roll pins, and gaskets should be replaced.
- When assembling the components, apply DEXRON®-III Automatic Transmission Fluid (ATF) to each seal, rotating part, and sliding part.
- Do not dip part facings, such as clutch or brake drive plates, in cleaner when washing it. Also, always coat parts with new ATF two or three times after cleaning with solvent.

1. Remove torque converter (1).
 - Drain fluid from torque converter.
 - Attach 5-8840-2278-0 (J-8763-02) holding fixture to the transmission and set it on 5-8840-0003-0 (J-3289-20) holding fixture base.

NOTE: Do not overtighten the tool, as case damage may result.

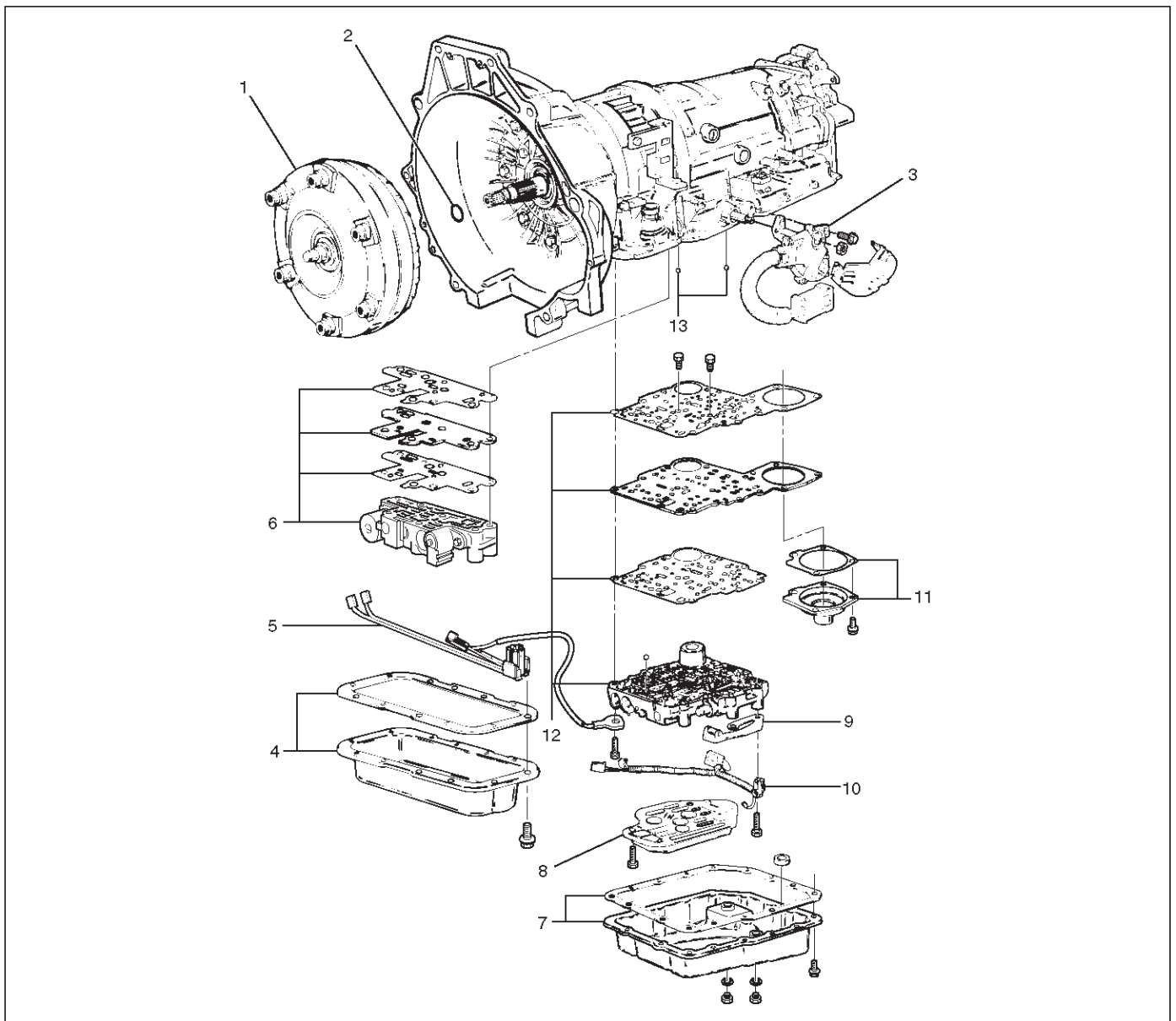


420RW019

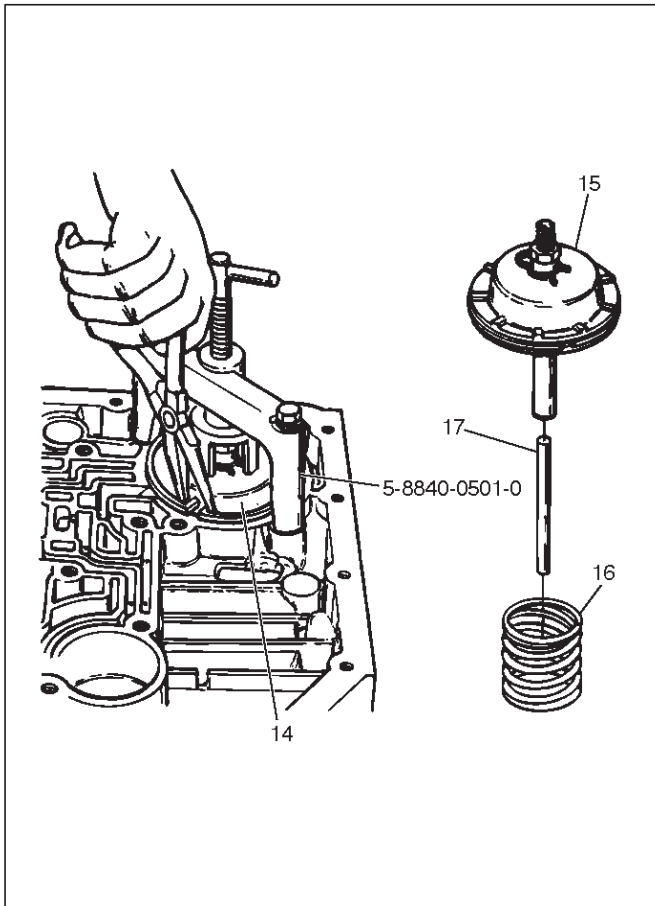
2. Remove O-ring (2) from turbine shaft.
3. Remove two 10mm mode switch screws, selector lever nut, cover, and mode switch (3).
4. Remove twelve 10mm adapter case oil pan (4) fixing screws, adapter oil pan, and gasket.
5. Disconnect electrical wiring connections (5) from solenoids and 5 pin connector of adapter case. Pull on connectors only, not on wiring harness.

7A-44 AUTOMATIC TRANSMISSION (4L30-E)

6. Remove seven 13mm adapter case valve body (6) fixing screws, adapter case valve body assembly, transfer plate, and two gaskets.
 - Remove wiring harness and 5 pin connector.
7. Remove sixteen 10mm main case oil pan (7) fixing screws, main oil pan, magnet, and gasket.
8. Remove three 13mm oil filter (8) fixing screws and oil filter.
9. Remove two 13mm manual detent (9) fixing screws, roller and spring, and manual detent.
10. Disconnect wiring harness assembly (10) from band apply solenoid, shift solenoids, and main case 4 pin connector.
Pull on connectors only, not on wiring harness.
11. Remove four 13mm servo cover (11) fixing screws, servo cover, and gasket.
12. Remove seven 13mm valve body screws and ground wire from main case.
 - Remove wiring harness assembly (5) from the adapter case side.
 - Remove main valve body assembly (12) with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
 - Remove 4 pin connector.
 - Remove gasket transfer plate from main case.
13. Remove two check balls (13) from main case.



14. Turn transmission to vertical position to drain fluid. Return back to horizontal position when drained.
 - Install 5-8840-0501-0 (J-23075) servo piston spring compressor with offset to the rear of case.
 - Compress servo piston assembly.
 - Remove servo piston retaining ring (14).
 - Slowly release servo piston assembly (15).
 - Remove tool.
15. Remove servo piston assembly (15), return spring (16), and servo apply rod (17).



16. Rotate transmission to horizontal position, pan side down.

- Remove one 10mm screw, and speed sensor (18) with "O" ring.

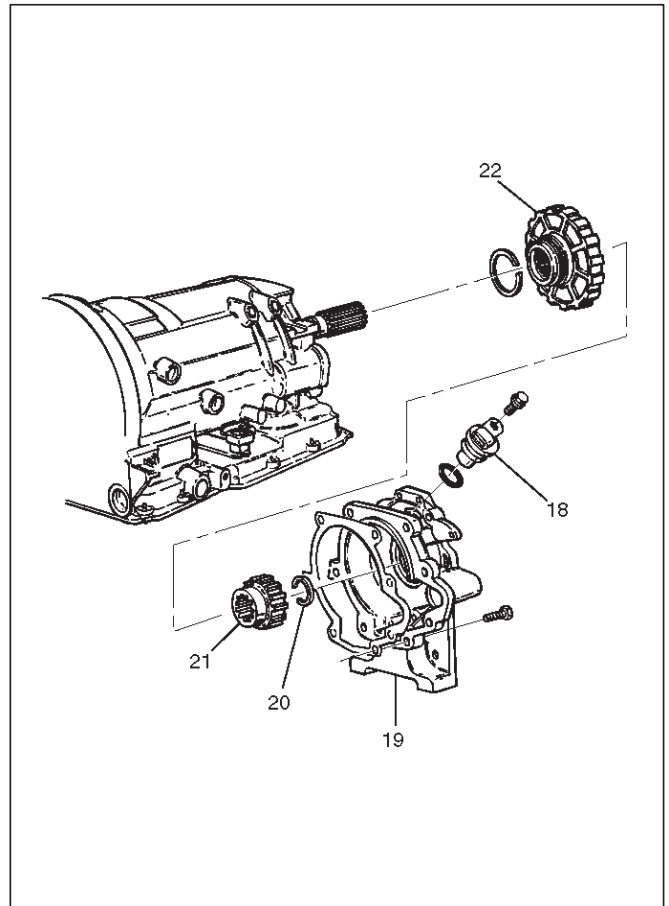
17. Remove seven 8mm extension housing hexagon socket head screws, extension housing assembly (19), and gasket.

18. Remove retaining ring (20).

NOTE: Use extra long, needle-nose pliers.

19. Remove speed wheel (21).

20. Remove wheel parking lock (with seal ring) (22).



21. Rotate transmission to vertical position, converter housing up.

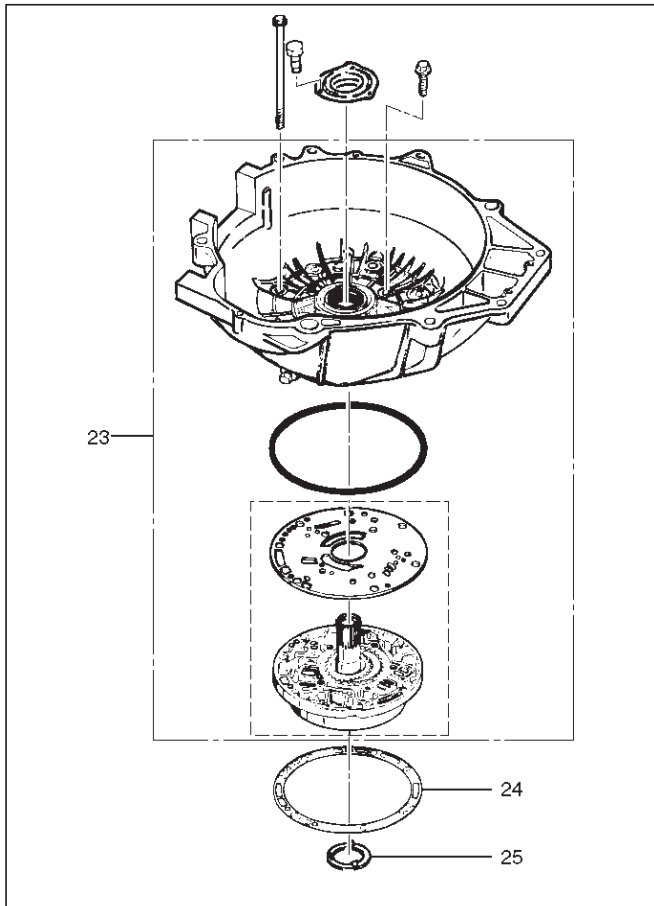
- Loosen the converter housing and oil pump assembly fixing screws, but do not remove the five 13 mm inner screws if oil pump disassembly is required.

- Remove seven outer screws.

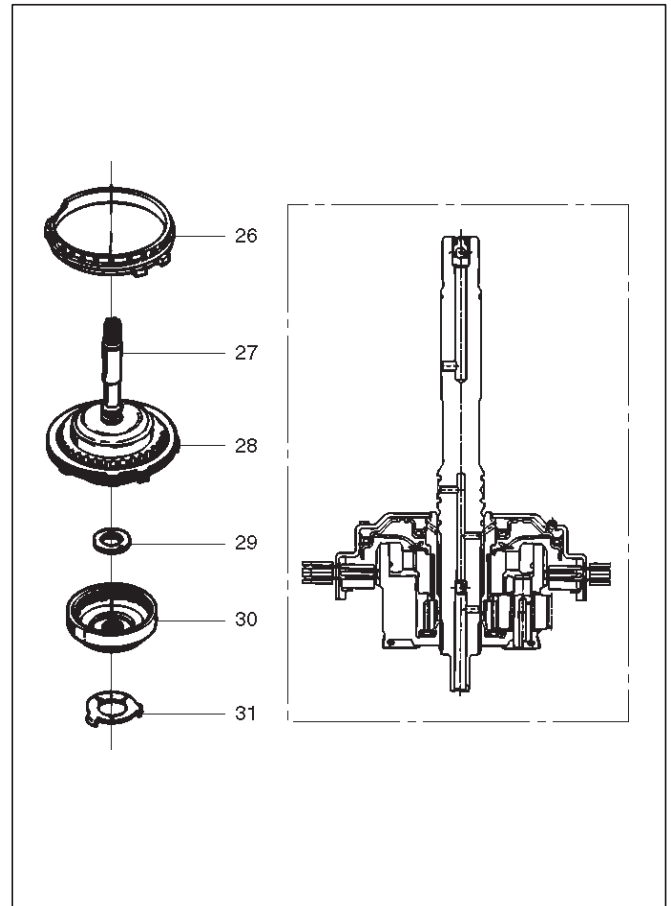
- Remove converter housing and oil pump assembly (23).

22. Remove gasket (24).

23. Remove selective thrust washer (25).



24. Remove fourth clutch retainer (26).
25. Grasp turbine shaft and lift out the overrun clutch housing assembly (27) and fourth clutch plates (28).
26. Remove thrust bearing assembly (29).
27. Remove overdrive internal gear (30).
28. Remove thrust washer (31).



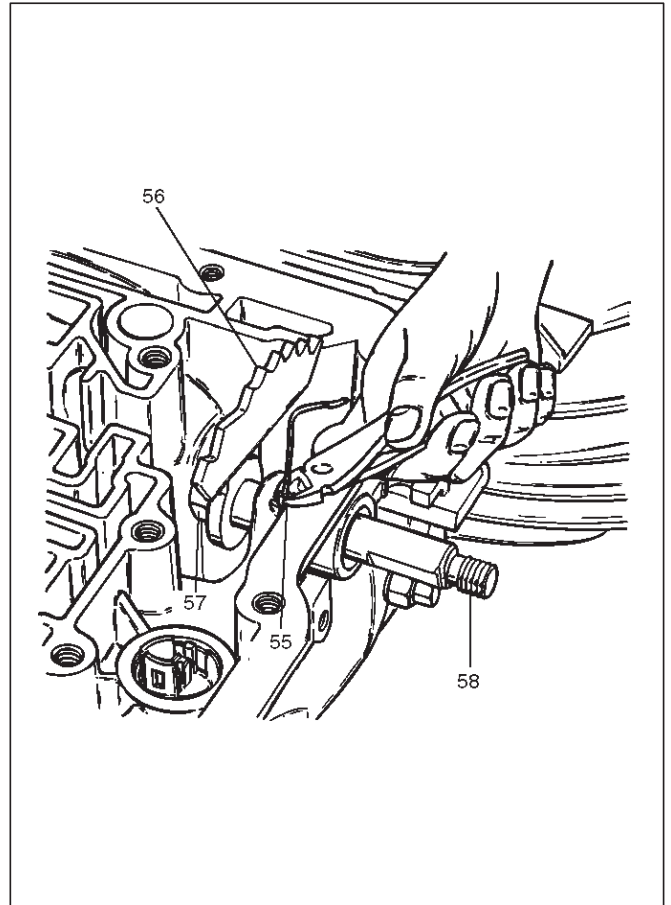
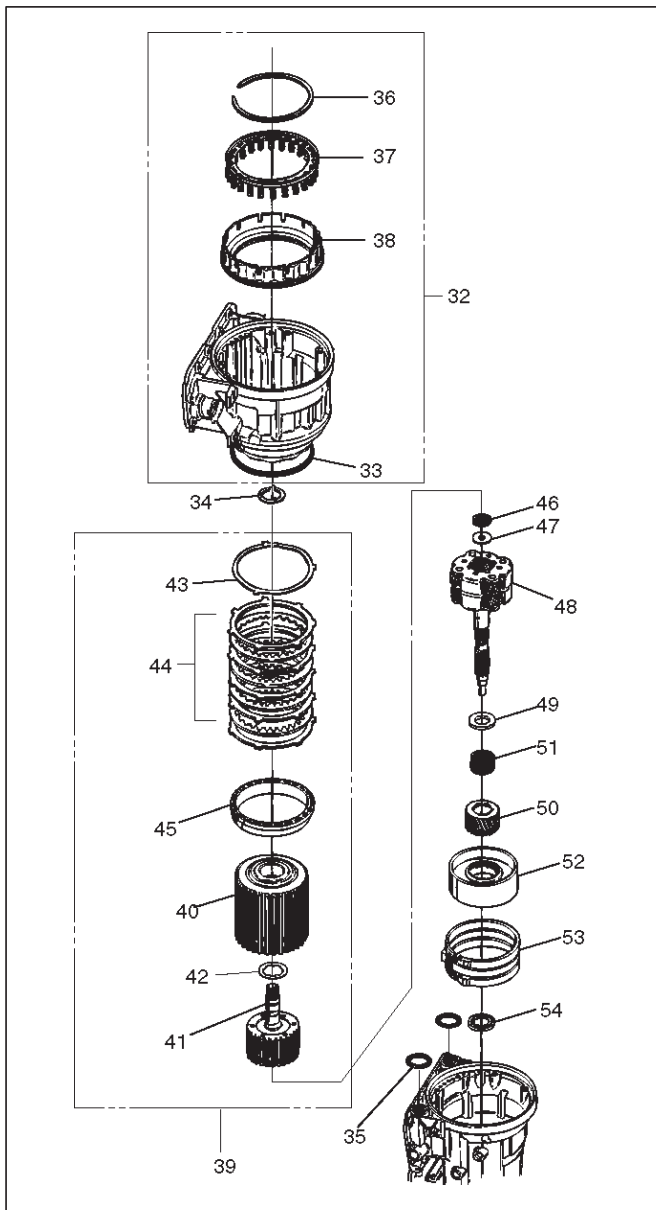
29. Remove adapter case and center support assembly (with fourth clutch piston) (32).
30. Remove seal ring (33).
31. Remove selective thrust washer (34) and two O-ring seals (35) from main case.
32. Use 5-8840-0195-0 (J-23327) and 5-8840-2263-0 (J-23327-90) compressor to compress the fourth clutch spring retainer and springs (37).
 - Release snap ring (36) from groove.
 - Remove clutch compressor and snap ring (36).
33. Remove retainer and spring assembly (37).
34. Insert two converter housing/main case screws to hold adapter case while pulling out fourth clutch piston (38).
 - Remove fourth clutch piston assembly (38) from the adapter case.
 - Remove converter housing/main case screws.
35. Grasp intermediate shaft, twist and pull out the second and third clutch drum assemblies with reverse clutch plates while holding onto output shaft (39).

- 36. Separate second (40) and third clutch (41) assemblies.
- 37. Remove thrust washer (42).
- 38. Remove reverse clutch plates (43 and 44) and reverse clutch pressure plate (45).
- 39. Remove bearing (46) and washer (47).
- 40. Remove planetary carrier assembly (48).
- 41. Remove thrust bearing (49).
- 42. Remove reaction sun gear (50)
- 43. Remove needle bearing (51).
- 44. Remove brake drum (52).
- 45. Remove brake band (53).
- 46. Remove thrust bearing (54).

NOTE: Insert wire in the center of the spring pin to prevent it from collapsing during removal. Be aware of pin height. Protect machined face of main case.

- 48. Remove parking lock and range selector lever 17 mm nut (57).
- 49. Remove parking lock and range selector lever (56), and actuator assembly.
- 50. Remove selector shaft (58).

NOTE: Inspect the shaft for burrs before removing to prevent damaging seal. If necessary, remove burrs by lightly sanding with an oilstone.



- 47. Rotate case to horizontal position, valve body side facing up.
 - Remove spring pin (55), using cutting pliers, then remove parking lock and selector lever assembly (56).

Reassembly

- 1. Inspect selector shaft seal, and replace it if necessary.

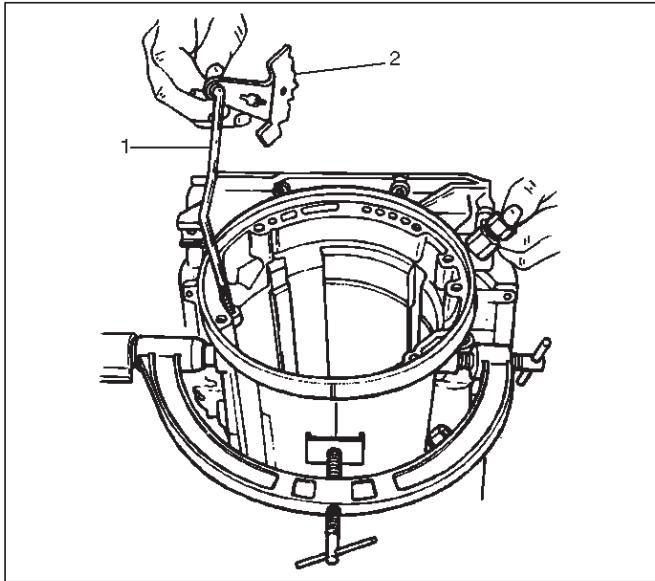
NOTE: Use a seal installer when replacing the seal.

- Install selector shaft.

NOTE: Spring pin groove must be positioned inside the case.

- 2. Install spring pin. Be sure the selector shaft can move freely. Do not push the pin flush with the case surface. Leave enough height for removal.
- 3. Install actuator assembly (1).
- 4. Install parking lock and range selector lever (2) and new 17 mm nut. Tighten the nut to the specified torque.

Torque: 22 N•m (2.2 kg-m/16 lb ft)



5. Rotate main case to vertical position, extension end facing down.

- Install brake band assembly (3).

NOTE: Be sure to align servo pin area with the servo hole.

6. Install thrust bearing (4).

NOTE: The case bushing acts as a guide for the thrust bearing.

7. Install brake drum (5).

8. Install reaction sun gear (6).

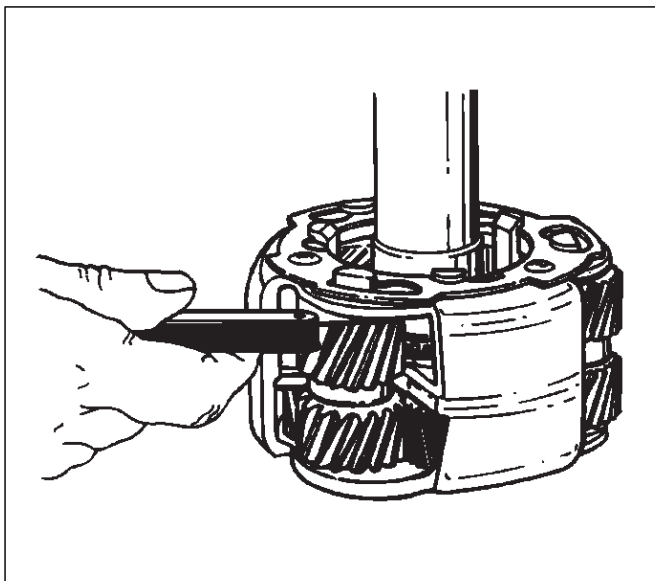
9. Install needle bearing (7).

10. Inspect planetary carrier assembly (8) for wear and damage. If necessary replace it.

- Measure pinion end play clearance with a feeler gauge.

Clearance: 0.13mm–0.89mm (0.005 in–0.035 in)

If clearance is outside specified value, replace the planetary carrier assembly.



11. Install the thrust bearing (9) on the output shaft.

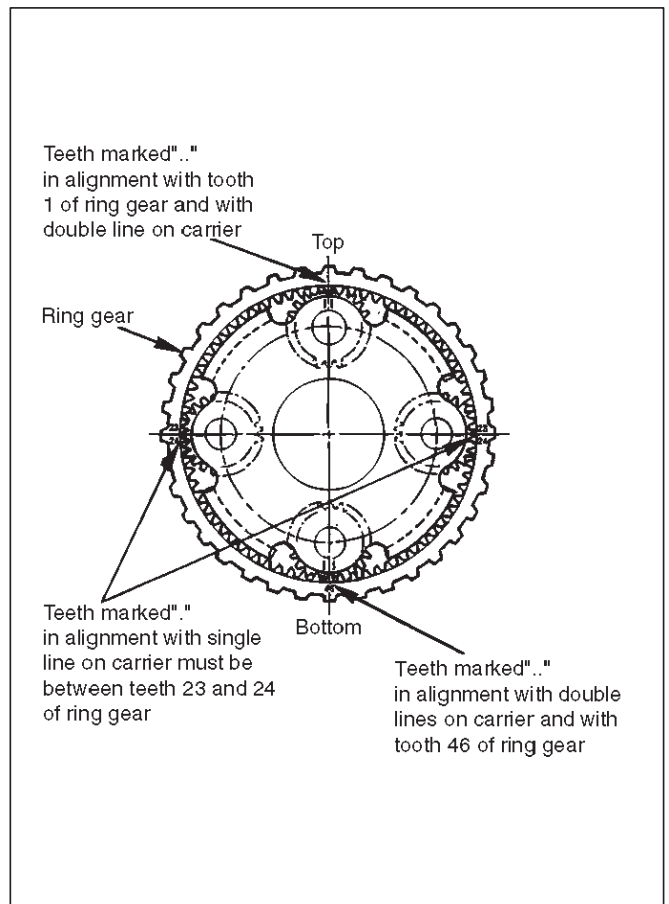
NOTE: Use petroleum jelly to hold the thrust bearing in place.

12. Align planetary pinions. Each pinion is marked with double points to indicate the master tooth space and exactly opposite with a single point to indicate the master tooth. The markings on the planetary carrier consist of double lines which are to be lined up with the double points on two opposite pinions; the single lines are to be lined up with the single points on the other two pinions.

- After all four pinions are lined up, slide on the third clutch assembly. Rotate third clutch and check mark alignment. Considering that the ring gear tooth between the double points of one planetary pinion is tooth number 1, count the teeth to check that the single points on the two adjacent pinions are between teeth 23 and 24 of the ring gear, and that the ring gear tooth between the double points of the opposite pinion is tooth number 46. If the ring gear and pinions are not lined up, remove, and realign them.

13. Install planetary carrier (8) with third clutch (12).

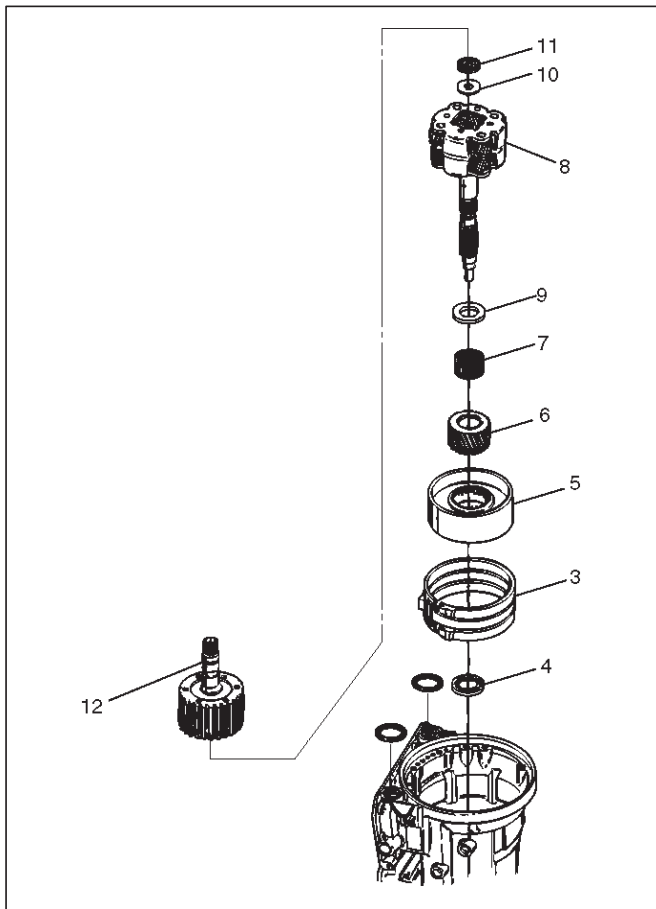
NOTE: Do not force. When properly aligned, the parts will fit together easily.



14. Remove the third clutch (12).

15. Install bearing (11) and washer (10).

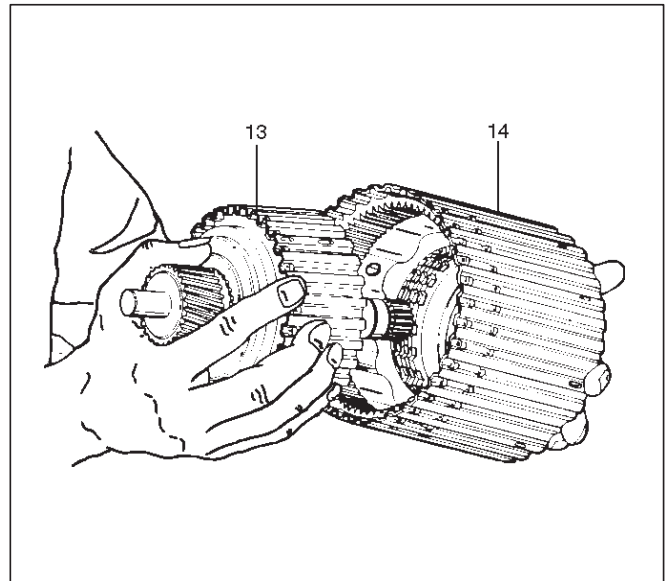
NOTE: Use petroleum jelly to hold the washer and bearing in place.



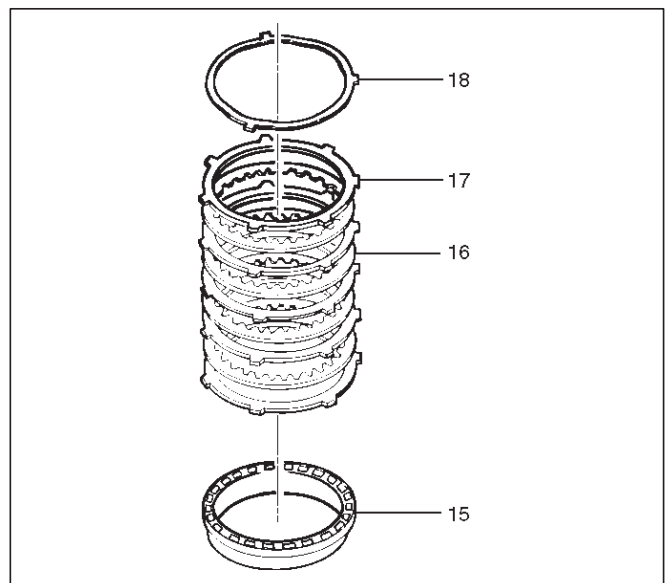
16. Carefully align the second clutch plate inner tangs.
- Install thrust washer, tangs pointing downward, and locating tang positioned in slot on second clutch hub.

NOTE: Use petroleum jelly to hold thrust washer in place.

17. Install third clutch and intermediate shaft assembly (13) into the second clutch drum (14).
18. Install second and third clutch assemblies into the main case. Twist output shaft and clutch assemblies to ensure proper fit.



19. Install pressure plate (15) with lip side up, tang facing valve body face.
20. Install reverse clutch plates. Start with a steel plate (17) and alternate with a lined plate (16).
21. Install waved clutch plate (18) with center tang facing valve body side.



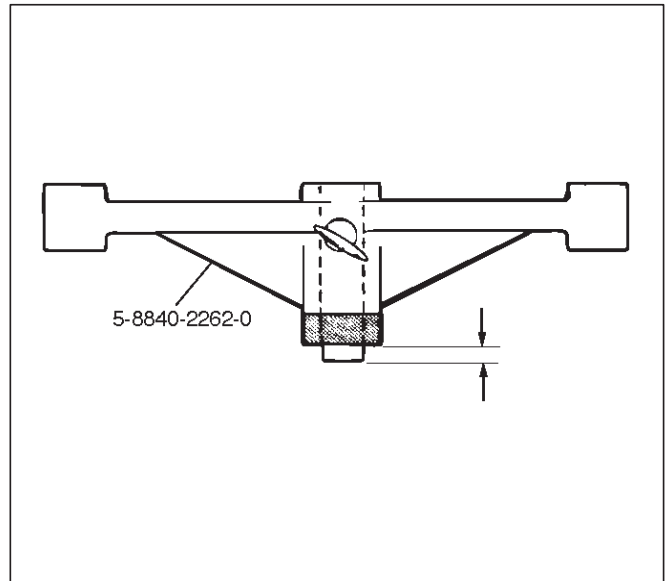
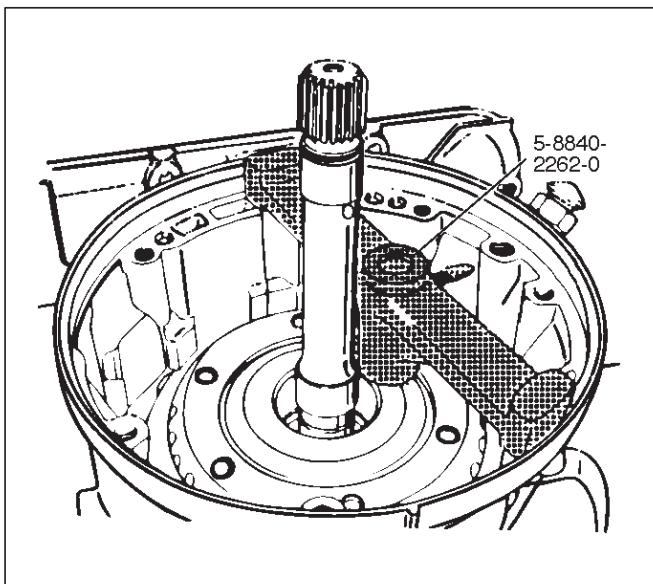
7A-50 AUTOMATIC TRANSMISSION (4L30-E)

22. Second clutch end play measurement

1. Install the 5-8840-2262-0 (J-23085-A) Selective washer gauging tool (with spacer ring) on the case flange and against the intermediate shaft.
2. Position the inner shaft of the gauging tool against the thrust surface of the second clutch hub.
3. Tighten thumb screw. Remove the tool.
4. Fit the spacer ring on the inner shaft of the tool.
5. Measure the gap, and select the appropriate washer as shown in the chart.

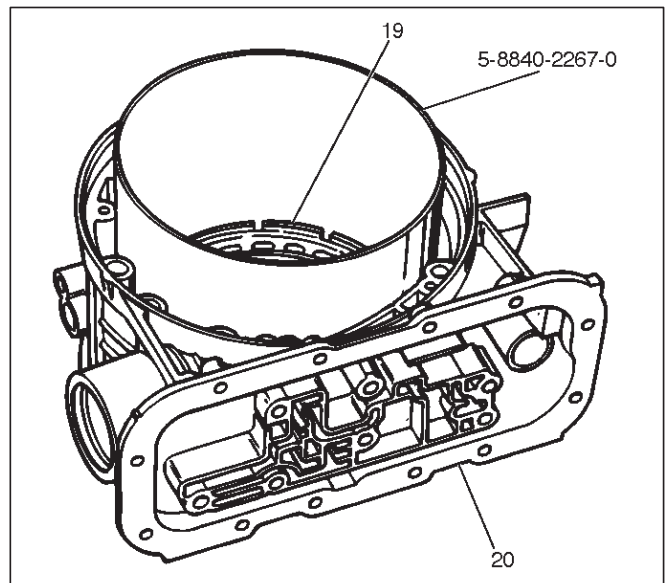
Selective Thrust Washer	
Gap: mm(in)	Color
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue

FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END-PLAY FROM 0.36 mm TO 0.79 mm (0.014 in TO 0.031 in)



23. Inspect fourth clutch piston seals and replace if necessary.

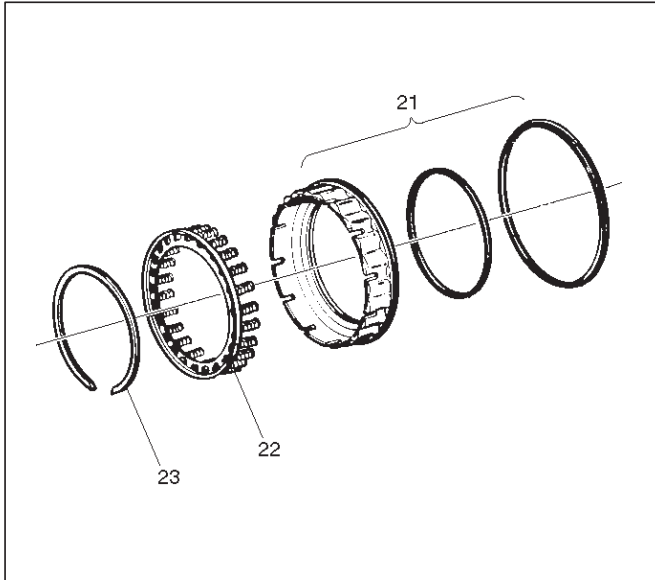
- Lubricate 5-8840-2267-0 (J-38554) fourth clutch piston fitter and install it on fourth clutch piston (19).
- Install fourth clutch piston (19) in adapter case (20).
- Remove fitter.



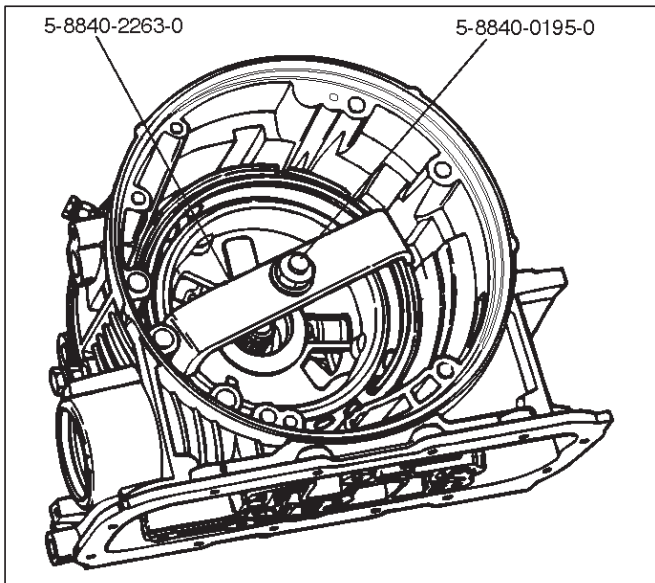
24. Install retainer and spring assembly (22) into fourth clutch piston (21).

25. Install snap ring (23) in adapter case.

- Install 5-8840-0195-0 (J-23327) and 5-8840-2263-0 (J-23327-90) fourth clutch spring compressor.
- Seat snap ring in groove.
- Remove compressor.



252RW002



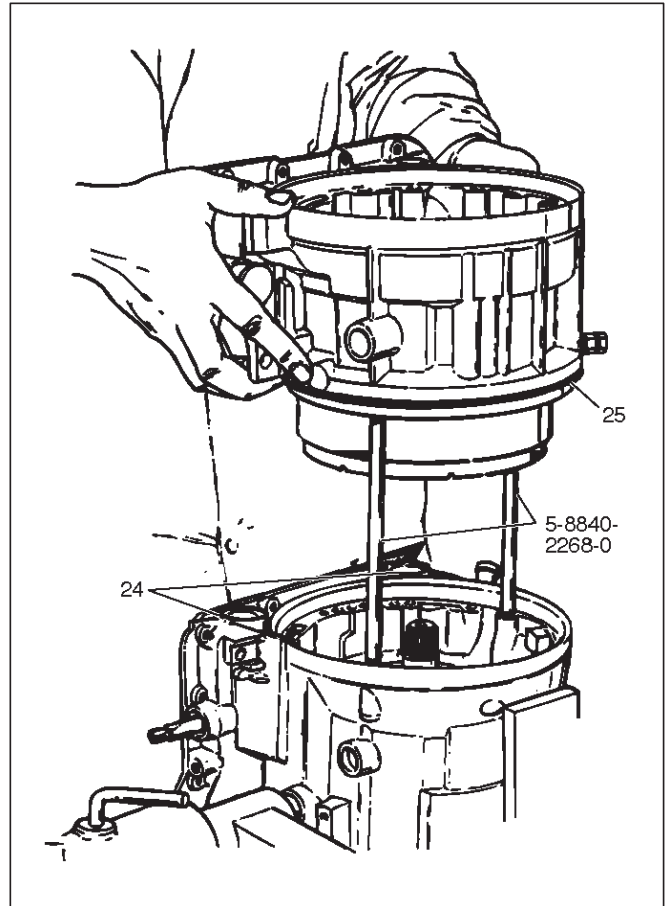
252RW007

26. Install selective washer using petroleum jelly.

27. Install two O-ring seals (24) in main case and adapter case/main case seal ring (25).

28. Install 5-8840-2268-0 (J-38588) guide pins.

- Install adapter case and center support assembly to main case.



242RW007

29. Install thrust washer (26) into adapter case, with tangs pointing downwards.

30. Preassemble overdrive internal gear (27) and thrust bearing assembly (28) onto the turbine shaft and overrun clutch assembly.

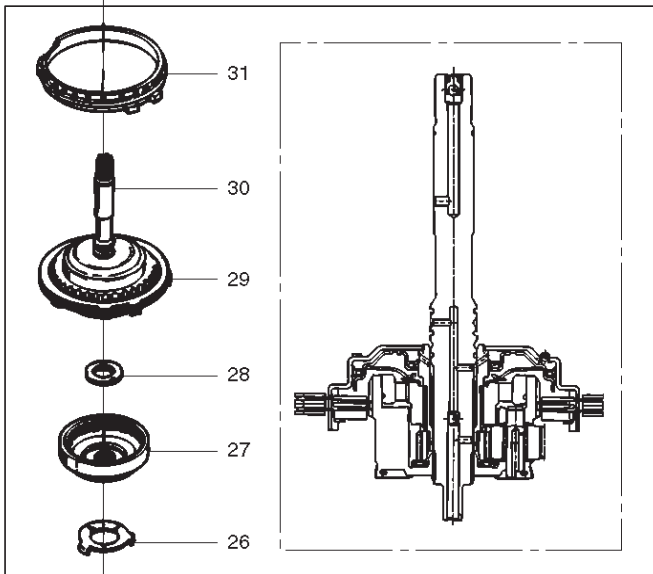
NOTE: Install bearing assembly, black side up. Use petroleum jelly to keep assembly in place.

31. Install overdrive carrier (30) and internal gear assembly into adapter case.

32. Install fourth clutch plates (29) in the following order: Steel, Lined, Steel, Steel, Lined, Steel. Steel plates go in with short tang facing towards valve body surface.

7A-52 AUTOMATIC TRANSMISSION (4L30-E)

33. Install fourth clutch retainer (31) with the notch facing up and positioned towards valve body surface.

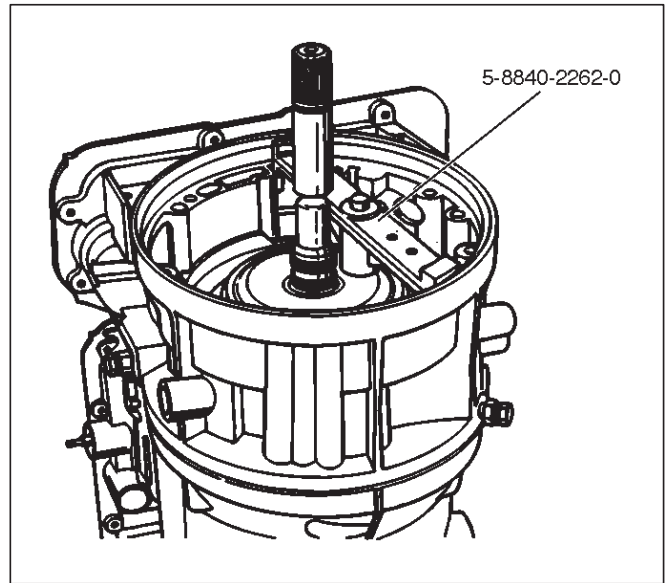


252RW004

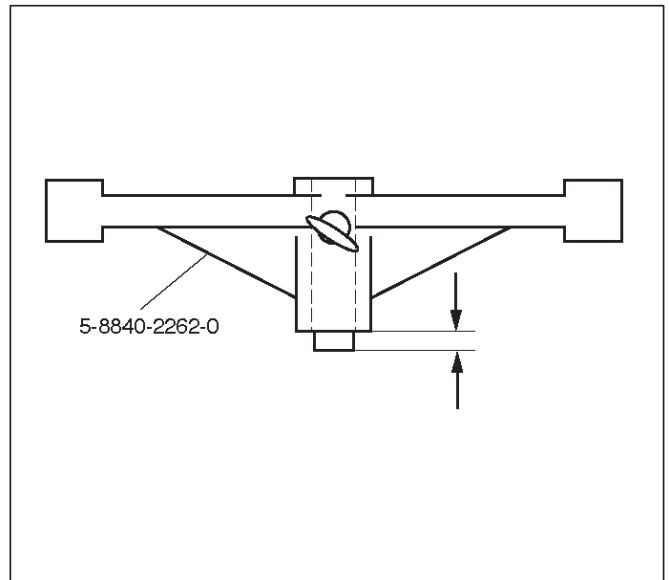
34. Overdrive clutch end play measurement

1. Install the 5-8840-2262-0 (J-23085-A) selective washer gauging tool on the adapter case flange and against the input shaft.
2. Position the inner shaft of the tool against the thrust surface of the overrun clutch housing.
3. Tighten thumb screw. Remove the tool.
4. Measure gap. Select appropriate size washer as shown in the chart.
5. Set selective thrust washer aside.

Selective Thrust Washer	
Gap: mm(in)	Color
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END-PLAY FROM 0.1 mm TO 0.8 mm (0.004 in TO 0.03 in)	



252RW006



252RW009

35. Install selective washer (32).

NOTE: Use petroleum jelly to hold selective washer in place.

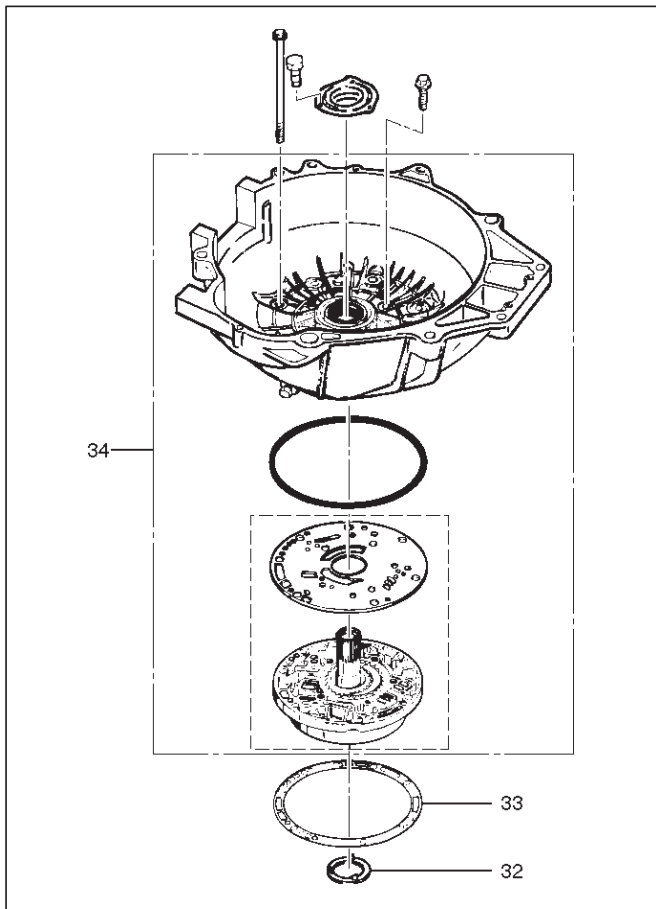
36. Install gasket (33).

37. Install converter housing and oil pump assembly (34) to adapter case.

- Fit and tighten seven outer 13 mm screws.

Torque: 39 N•m (4.0 kg-m/29 lb ft)

- Ensure free rotation of pump using 5-8840-2273-0 (J-23082-01) oil pump rotation tool.



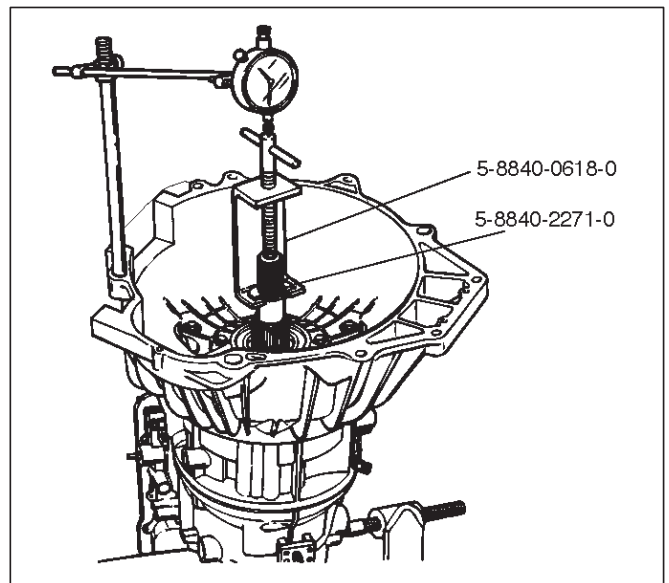
38. Overdrive clutch end play measurement.

1. Fit 5-8840-2271-0 (J-25022) and 5-8840-0618-0 (J-24773-1) turbine shaft puller on turbine shaft.
2. Position axial play checking tool on converter housing mating face.
3. Pull turbine shaft upwards with puller until first resistance is met. (due to weight of overdrive assembly).
4. Maintain shaft in this position and set indicator to zero.
5. Pull turbine shaft further upwards with puller. Read end play shown on indicator.

End play: 0.1mm – 0.8mm (0.004 in – 0.031in)

6. Remove axial play checking tool and puller.

NOTE: If end play is not correct, repeat selective washer selection.



39. Inspect extension housing oil seal and replace if necessary, using 5-8840-2282-0 (J-36797) extension housing oil seal installer.

- Rotate transmission to horizontal position, with valve body side down.
- Inspect parking wheel seal ring. Replace if necessary.
- Install wheel parking lock assembly (35).

40. Install speed wheel (36) and snap ring (37).

NOTE: Use extra long, needle-nose pliers.

41. Install gasket onto extension assembly with a thin coating of oil.

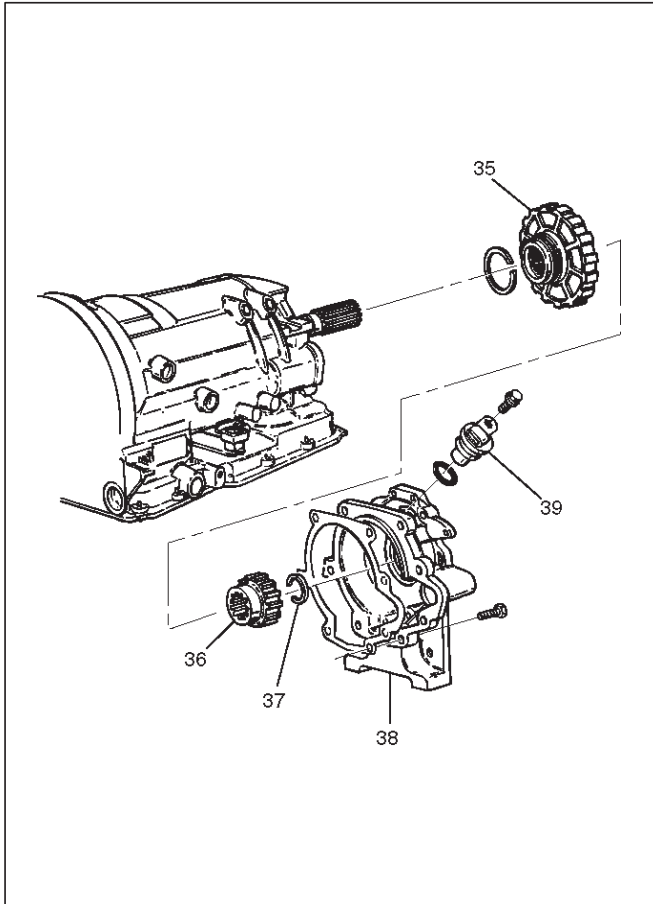
- Install extension housing assembly (38), and align parking pawl shaft.
- Install actuator assembly into extension assembly.
- Install seven 8 mm hexagon socket head screws.

Torque: 32 N•m (3.3 kg-m/24 lb ft)

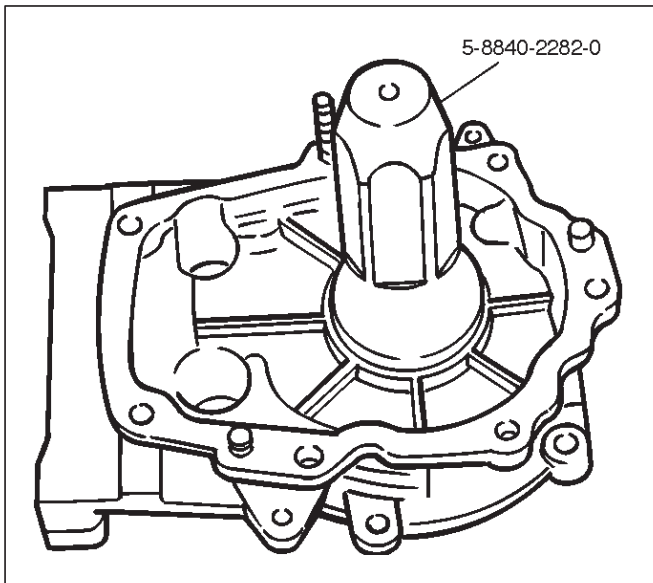
42. Inspect speed sensor O-ring. Replace if necessary.

- Install speed sensor assembly (39) and 10 mm screw.

Torque: 9 N•m (0.9 kg-m/78 lb in)



241RW009



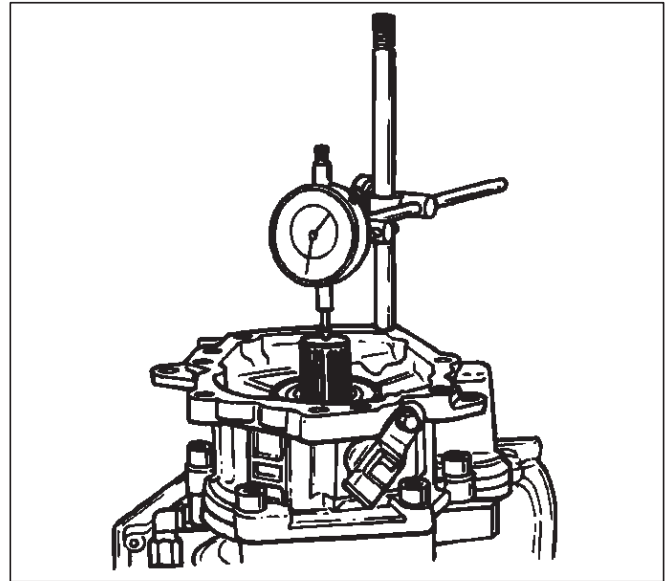
241RW019

43. Main case end play measurement.

1. Attach axial play checking tool on the extension housing and set indicator to zero on output shaft.
2. Manually push output shaft upwards.

End play: 0.36mm – 0.80mm (0.014 in – 0.031in)

3. Remove axial play checking tool.
4. If end play is not correct, repeat selective washer selection.



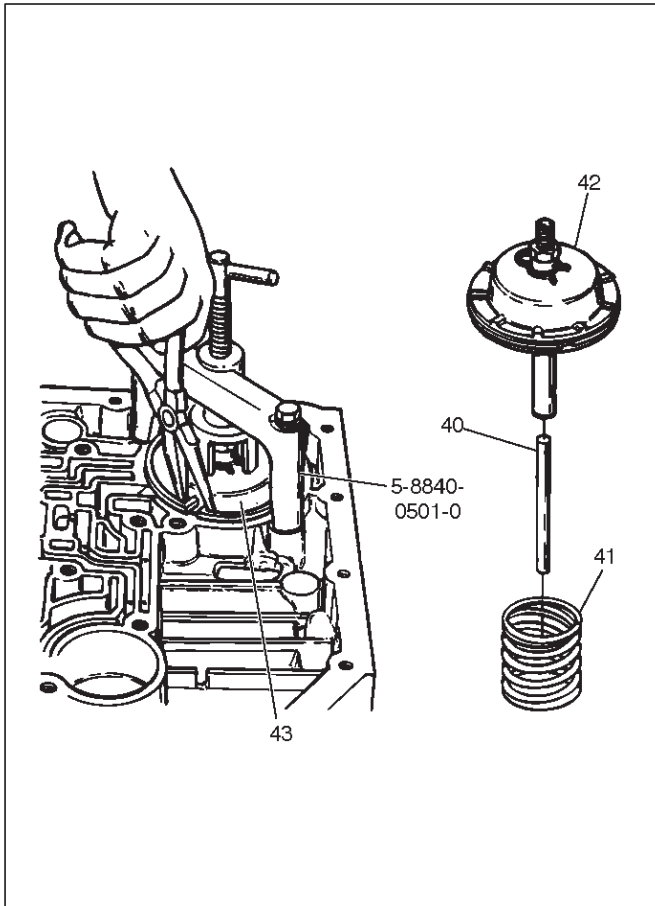
241RS005

44. Inspect servo piston seal ring. Replace if necessary.

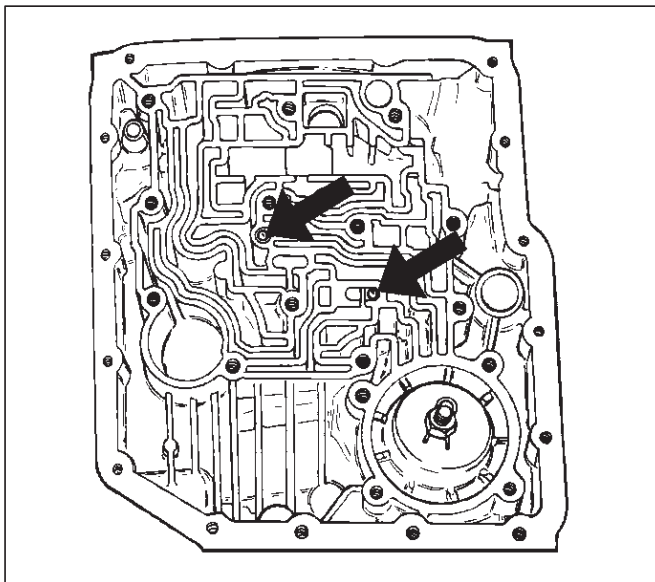
- Ensure brake band is correctly positioned. Rotate output shaft if necessary.
- Install 5-8840-2274-0 (J-38428) servo piston fitter in servo bore.
- Install apply rod (40), round end toward band, return spring (41) and piston assembly (42).

45. Install the 5-8840-0501-0 (J-23075) servo spring compressor with offset to rear of case.

- Compress servo piston seal ring, using fitter while tightening the tool screw.
- Install servo piston retaining ring (43).
- Remove tool.
- Adjust the brake band by tightening the servo adjusting screw to 4.5 N·m torque. Be certain the lock nut is loose, then back-off the screw five turns exactly. Hold piston sleeve with wrench and tighten lock nut to 18.5 N·m torque. Be certain the adjusting screw does not turn.



46. Install two check balls (44).



47. Inspect main case electrical connector and seal, replace if necessary.

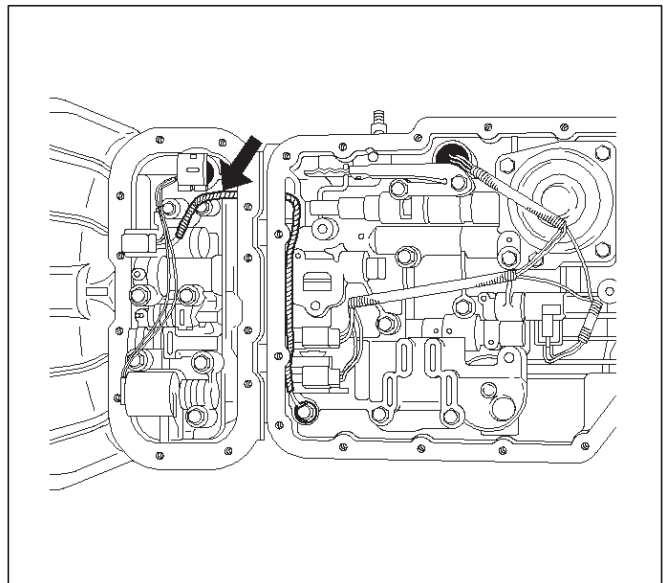
- Install electrical 4 pin connector/main case and wiring harness.
48. Install two 5-8840-0022-0 (J-25025-B) guide pins into main case.
- Install main case valve body complete assembly (45) and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

- Install seven 13 mm screws.

Torque: 20 N•m (2.0 kg-m/15 lb ft)

- Pass ground wire of adapter case wiring harness assembly through the hole joining adapter fluid area and main case fluid area.
- Assemble 8.5 mm connector of ground wire under the head of this valve body bolt and reinstall it.
- Remove two guide pins.



49. Install servo cover gasket, cover (46) and four 13 mm screws.

Torque: 25 N•m (2.6 kg-m/18 lb ft)

50. Connect wiring harness (47) to band control, shift solenoids, and main case 4 pin connector.

51. Install manual detent roller and spring assembly (48) with clip.

- Install two 13 mm screws.

Torque: 20 N•m (2.0 kg-m/15 lb ft)

52. Install oil filter (49), and three 13 mm screws.

Torque: 20 N•m (2.0 kg-m/15 lb ft)

53. Install oil pan gasket, magnet, main oil pan (50), and sixteen 10 mm screws.

Torque: 11 N•m (1.1 kg-m/96 lb in)

54. Inspect adapter case electrical connector and seal. Replace if necessary.

- Install electrical five pin connector and harness assembly (52) in bottom of adapter case.

55. Install gasket, transfer plate, and gasket.

- Install adapter case valve body (51) and seven 13 mm screws.

Torque: 20 N•m (2.0 kg-m/15 lb ft)

7A-56 AUTOMATIC TRANSMISSION (4L30-E)

56. Connect wiring harness assembly (52) to converter clutch solenoid, force motor, and 5 pin connector.

57. Install oil pan gasket, adapter case oil pan (53), and twelve 10 mm screws.

Torque: 11 N•m (1.1 kg-m/96 lb in)

- Rotate transmission, with bottom pan facing down.

58. Install mode switch (54), two 10 mm screws, selector lever nut, and cover.

10 mm screw

Torque: 13 N•m (1.3 kg-m/113 lb in)

Nut

Torque: 23 N•m (2.3 kg-m/17 lb ft)

- Adjust using setting tool, refer to Mode Switch in this section.

59. Install O-ring (55) on turbine shaft.

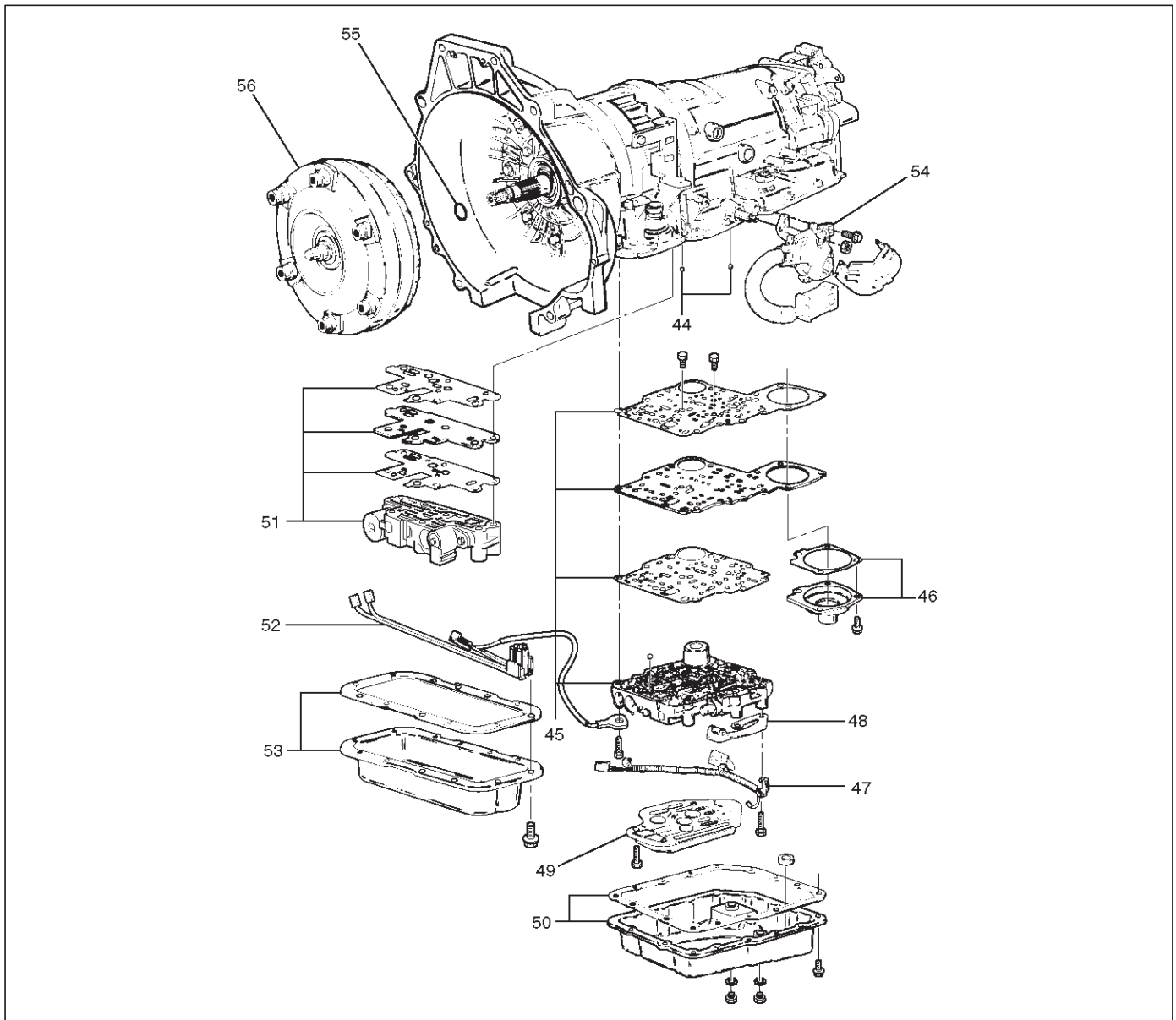
60. Install torque converter (56)

The converter assembly must be replaced under any of the following conditions:

- Evidence of damage to the pump assembly.
- Metal particles are found after flushing the cooler lines.
- External leaks in hub weld area.
- Converter pilot broken, damaged, or poor fit into crankshaft.
- Converter hub scored or damaged.
- Internal failure in stator.
- Contamination from engine coolant.
- Excess end play.

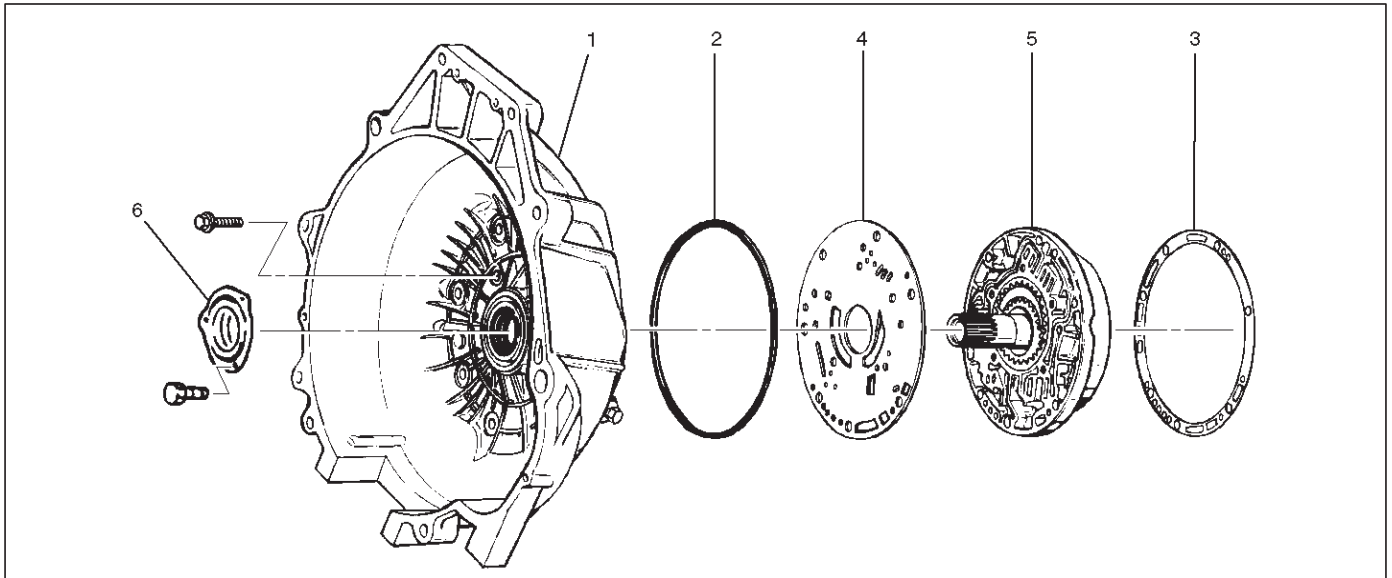
- Rotate transmission, bell housing up. Spin converter to insure proper fit.

61. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®-III. Refer to Changing Transmission Fluid in this section.



Converter Housing And Oil Pump Assembly

Disassembled View



241RW003

Legend

- | | |
|-----------------------|-----------------------|
| (1) Converter Housing | (4) Wear Plate |
| (2) Outer Seal Ring | (5) Oil Pump Assembly |
| (3) Gasket | (6) Oil Seal Ring |

Disassembly

1. Remove oil pump assembly from converter housing.
2. Remove outer seal ring.
3. Remove gasket.
4. Remove wear plate.
5. Remove oil seal ring.

Inspection And Repair

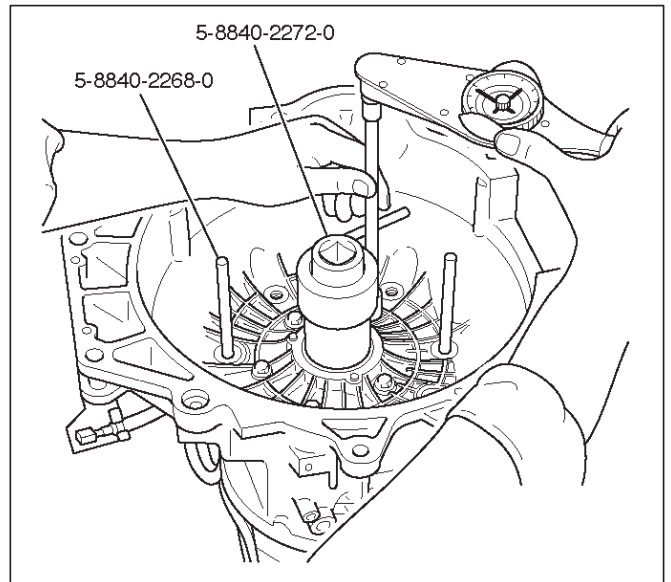
Visual Check:

If any damage, deformation, or local wear is found in a converter housing, outer seal ring, wear plate, or oil seal ring, replace it.

Reassembly

1. Install wear plate onto oil pump assembly.
2. Install converter housing onto complete oil pump assembly. Align with two short 5-8840-2268-0 (J-38588) guide pins on outer bolt holes.
 - Loosely install five 13mm bolts.
 - Center converter housing using 5-8840-2272-0 (J-38557) centering tool.
 - Tighten five inner 13mm bolts in an alternating pattern.

Torque: 20 N•m (2.0 kg-m/15 lb ft)

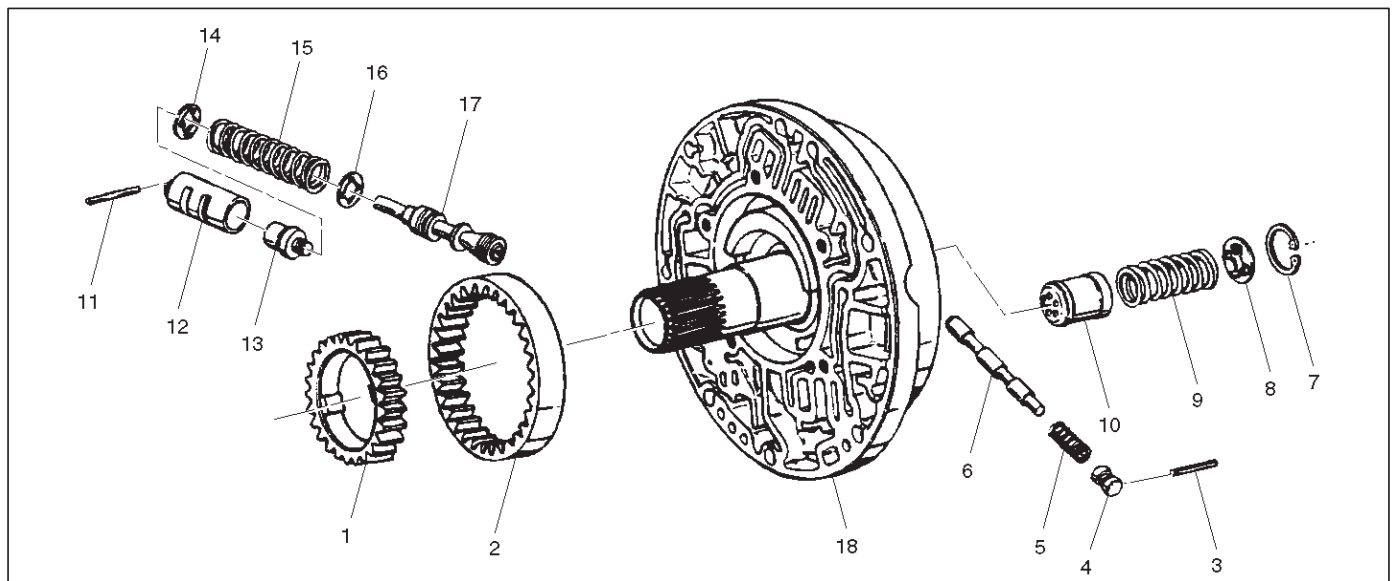


241RW020

3. Install oil seal ring (3 screws).
Torque: 3 N•m (0.3 kg-m/26 lb in)
4. Install gasket.
5. Install outer seal ring.

Oil Pump

Disassembled View



241RS014

Legend

- | | |
|------------------------------------|---|
| (1) Oil Pump Drive Gear | (10) Throttle Signal Accumulator Piston |
| (2) Oil Pump Driven Gear | (11) Sleeve Pin |
| (3) Pin | (12) Sleeve |
| (4) Plug | (13) Boost Valve |
| (5) Spring | (14) Spring Seat |
| (6) Converter Clutch Control Valve | (15) Valve Spring |
| (7) Snap Ring | (16) Spring Seat |
| (8) Spring Seat | (17) Pressure Regulator valve |
| (9) Spring | (18) Oil Pump Assembly |

Disassembly

1. Remove oil pump drive gear (1) and driven gear (2).
2. Remove pin (3) from oil pump assembly (18).
3. Remove plug (4), spring (5), and converter clutch control valve (6).
4. Remove snap ring (7) from oil pump assembly (18).
5. Remove spring seat (8), spring (9), and throttle signal accumulator piston (10).
6. Remove sleeve pin (11) from oil pump assembly (18).
7. Remove sleeve (12), boost valve (13), spring seat (14), valve spring (15), spring seat (16), and pressure regulator valve (17).

Inspection And Repair

Visual Check:

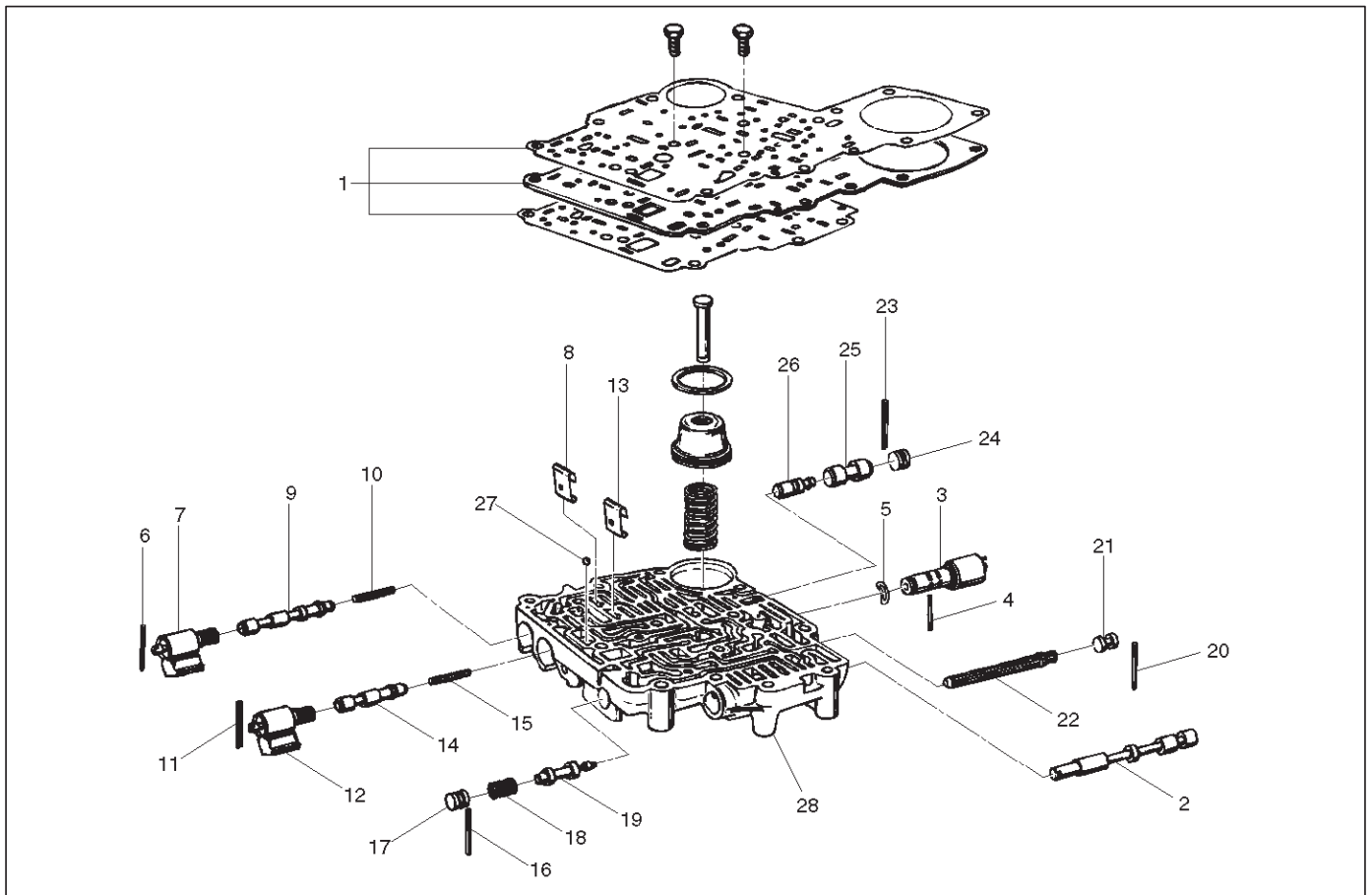
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Lubricate and preinstall pressure regulator spring seat (16) on valve (17), with the flat side against shoulder.
2. Install pressure regulator valve (17) and spring seat (16) assembly, valve spring (15), and spring seat (14) with the flat side away from spring to oil pump assembly (18).
3. Assemble boost valve (13) into sleeve (12).
4. Install boost valve and sleeve assembly, and sleeve pin (11) to oil pump assembly (18).
5. Install throttle signal accumulator piston (10), spring (9), and spring seat (8), with the flat side away from the spring, and snap ring (7) to oil pump assembly (18).
6. Install converter clutch control valve (6), spring (5), plug (4), and pin (3) to oil pump assembly (18).
7. Install oil pump driven gear (2) and drive gear (1).

Main Case Valve Body

Disassembled View



244RS010

Legend

- | | |
|--------------------------------|------------------------------------|
| (1) Gaskets and Transfer Plate | (15) Spring |
| (2) Manual Valve | (16) Spring Pin |
| (3) Band Control Solenoid | (17) Plug |
| (4) Pin | (18) Spring |
| (5) Waved Washer | (19) Low Pressure Control Valve |
| (6) Spring Pin | (20) Spring Pin |
| (7) Solenoid A | (21) Plug |
| (8) Retainer | (22) Band Control Screen Assembly |
| (9) 1-2/3-4 Shift Valve | (23) Spring Pin |
| (10) Spring | (24) Plug |
| (11) Spring Pin | (25) 1-2 Accumulator Valve |
| (12) Solenoid B | (26) 1-2 Accumulator Control Valve |
| (13) Retainer | (27) Check Ball |
| (14) 2-3 Shift Valve | (28) Main Case Valve Body |

Disassembly

1. Remove two 11mm bolts from valve body (28), then remove gaskets and transfer plate (1).
2. Remove manual valve (2).
3. Push in band control solenoid (3) to compress waved washer (5), and remove pin (4).
4. Remove band control solenoid (3) and waved washer (5).
5. Remove spring pin (6) with a 3 mm dia punch.
6. Remove solenoid A (7) by grasping the metal tip. Do not grasp the connector housing.
7. Remove retainer (8), 1-2/3-4 shift valve (9), and spring (10).
8. Remove spring pin (11) with a 3 mm dia punch.
9. Remove solenoid B (12) by grasping the metal tip. Do not grasp the connector housing.

7A-60 AUTOMATIC TRANSMISSION (4L30-E)

10. Remove retainer (13), 2-3 shift valve (14), and spring (15).
11. Remove spring pin (16), plug (17), spring (18), and low pressure control valve (19).
12. Remove spring pin (20), plug (21), and band control screen assembly (22).
13. Remove spring pin (23), plug (24), 1-2 accumulator valve (25), and 1-2 accumulator control valve (26).
14. Remove check ball (27) from valve body (28).

Inspection And Repair

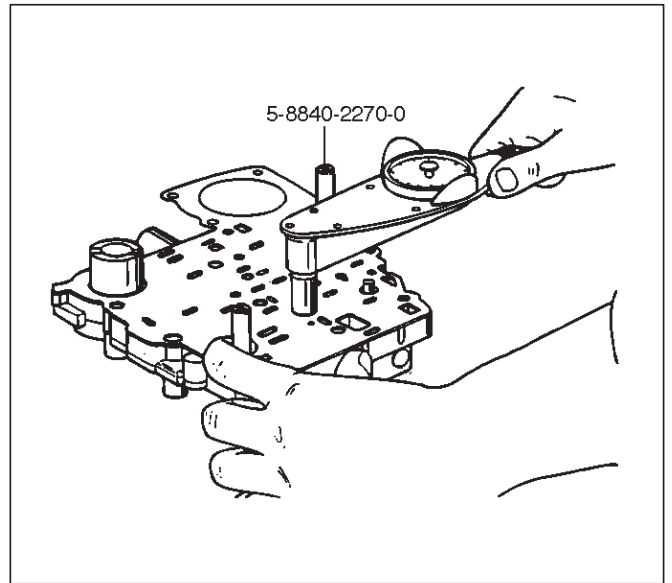
Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passages.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install 1-2 accumulator control valve (26), 1-2 accumulator valve (25), plug (24), and spring pin (23).
2. Install band control screen assembly (22), plug (21), and spring pin (20).
3. Install low pressure control valve (19), spring (18), plug (17), and spring pin (16).
4. Install spring (15), 2-3 shift valve (14), retainer (13), solenoid B (12), and spring pin (11).
5. Install spring (10), 1-2/3-4 shift valve (9), retainer (8), solenoid A (7), and spring pin (6).
6. Install waved washer (5), band control solenoid (3), and pin (4).
7. Install manual valve (2).
8. Install check ball (27) to valve body (28).
9. Install gasket (valve body/transfer plate) and transfer plate using two 5-8840-2270-0 (J-3387-2) guide pins.
 - Install two 11mm bolts.

Torque: 13 N•m (1.3 kg•m/113 lb in)

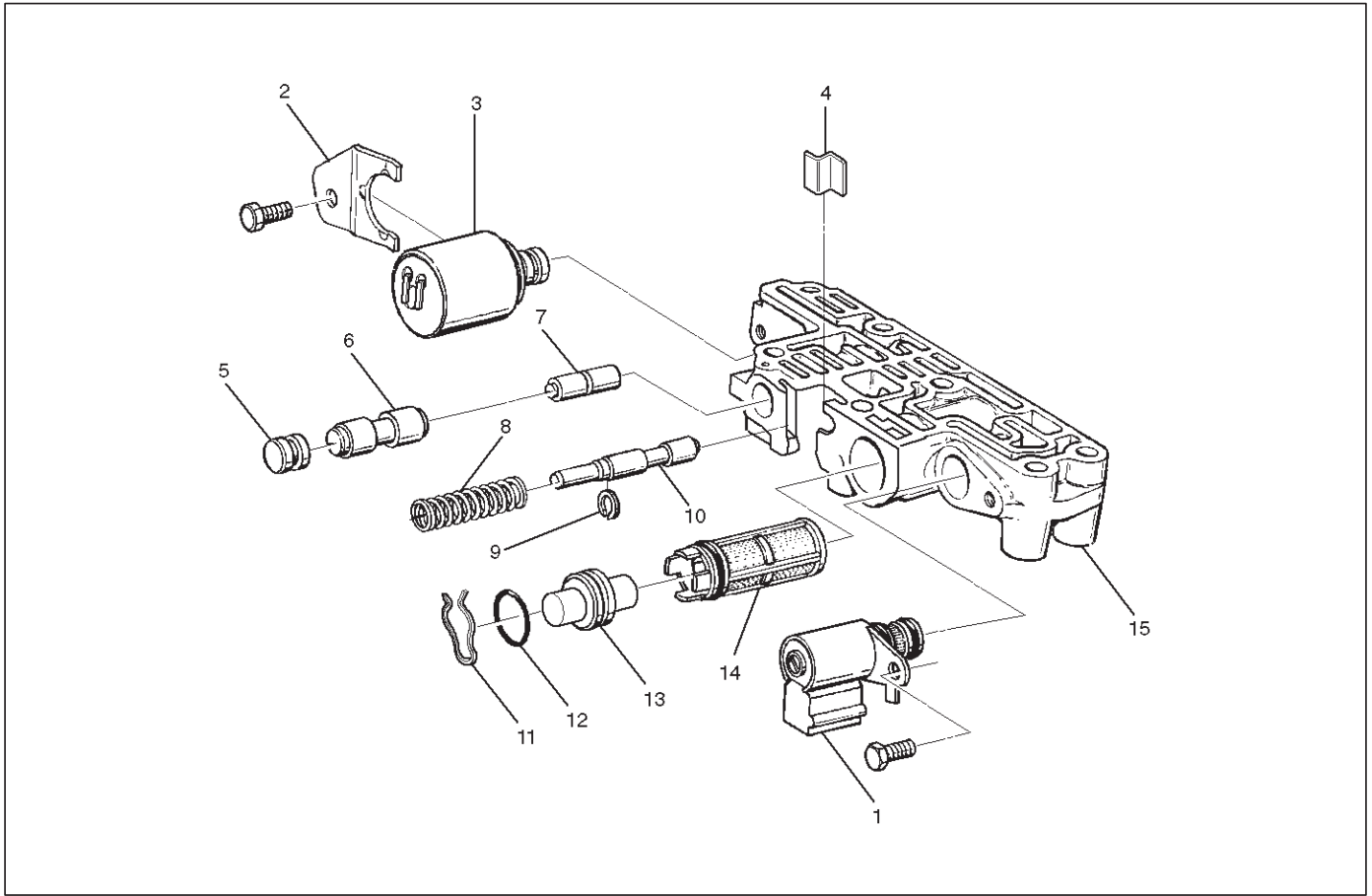


- Install gasket (transfer plate/main case).

244RW004

Adapter Case Valve Body

Disassembled View



243RW001

Legend

- | | |
|--|----------------------------------|
| (1) Converter Clutch Solenoid Assembly | (8) Spring |
| (2) Retainer | (9) Retaining Ring |
| (3) Force Motor Solenoid | (10) Feed Limit Valve |
| (4) Retainer | (11) Plug Retainer |
| (5) Plug | (12) O-Ring |
| (6) 3/4 Accumulator Valve | (13) Plug |
| (7) 3/4 Accumulator Control Valve | (14) Force Motor Screen Assembly |
| | (15) Adapter Case Valve Body |

Disassembly

1. Remove 11mm bolt from valve body.
 - Remove converter control solenoid assembly (1).
2. Remove 11mm bolt and retainer (2) from valve body.
 - Remove force motor solenoid (3).
3. Remove retainer (4), plug (5), 3/4 accumulator valve (6), and 3/4 accumulator control valve (7).
4. Remove spring (8), retaining ring (9), and feed limit valve (10).
5. Remove plug retainer (11), O-ring (12), plug (13), and force motor screen assembly (14).
 - Use 5 mm bolt to pull plug.

Inspection And Repair

Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passages.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install force motor screen assembly (14), plug (13), O-ring (12), and plug retainer (11).
2. Install feed limit valve (10), retaining ring (9), and spring (8).

7A-62 AUTOMATIC TRANSMISSION (4L30-E)

3. Install 3/4 accumulator control valve (7), 3/4 accumulator valve (6), plug (5), and retainer (4).

4. Install force motor solenoid (3).

- Place solenoid terminals pointing towards mating face.
- Install retainer (2) and bolt.

Torque: 10 N•m (1.0 kg-m/87 lb in)

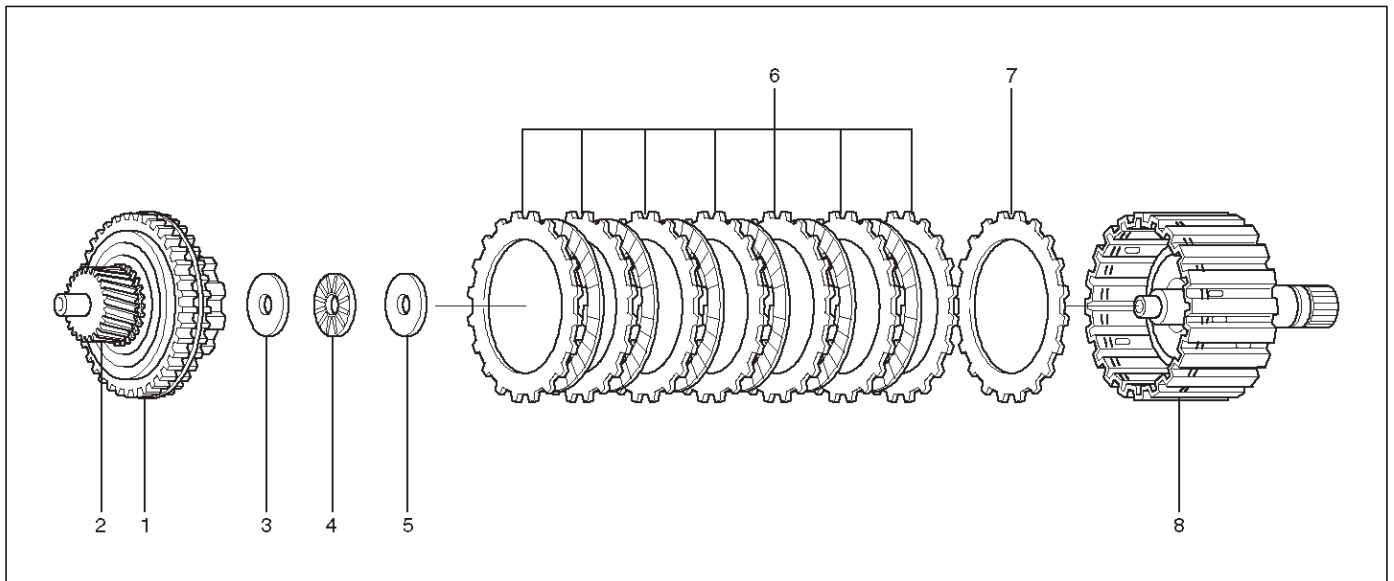
5. Install converter clutch solenoid assembly with two O-rings (1) to valve body.

- Install bolt.

Torque: 10 N•m (1.0 kg-m/87 lb in)

Third Clutch And Sprag Unit

Disassembled View



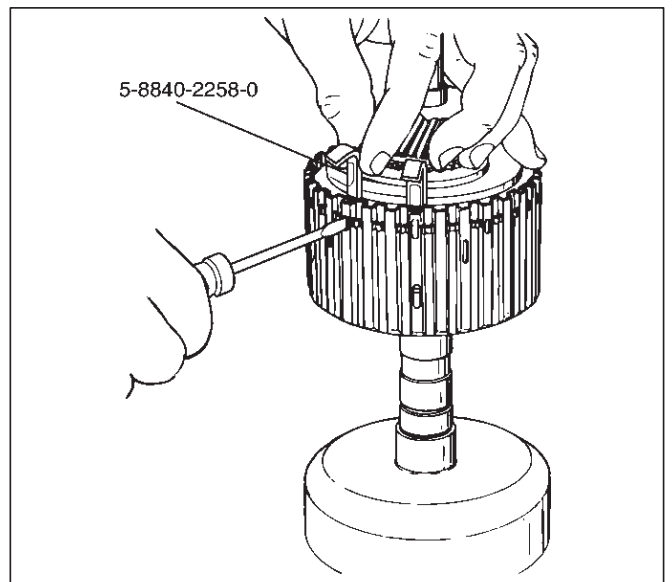
248RW001

Legend

- | | |
|--|---------------------------------------|
| (1) Retaining Ring | (5) Thrust Washer |
| (2) Input Sun Gear and Sprag Unit Assembly | (6) Clutch Plates |
| (3) Retaining Washer | (7) Third Clutch Spring Cushion Plate |
| (4) Bearing | (8) Third Clutch Drum Assembly |

Disassembly

1. Place the third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Locate the ends of the retaining ring. Depress one end of the ring using a small screwdriver instead of the depressor handle provided with the tool 5-8840-2258-0 (J-38450-A). Slide one blade down between the third clutch drum and the retaining ring.
3. Remove a screwdriver and repeat this step for the other end of retaining ring.
4. Install the remaining four blades approximately (five) notches apart using a screwdriver to depress the retaining ring.
5. Pull up on input sun gear and sprag unit assembly (1 and 2) to release the retaining ring from third clutch drum assembly (8).
6. Remove the tool blades.



248RW006

7. Remove retaining washer (3), bearing (4), thrust washer (5), and clutch plates (6 and 7) from the third clutch drum assembly (8).

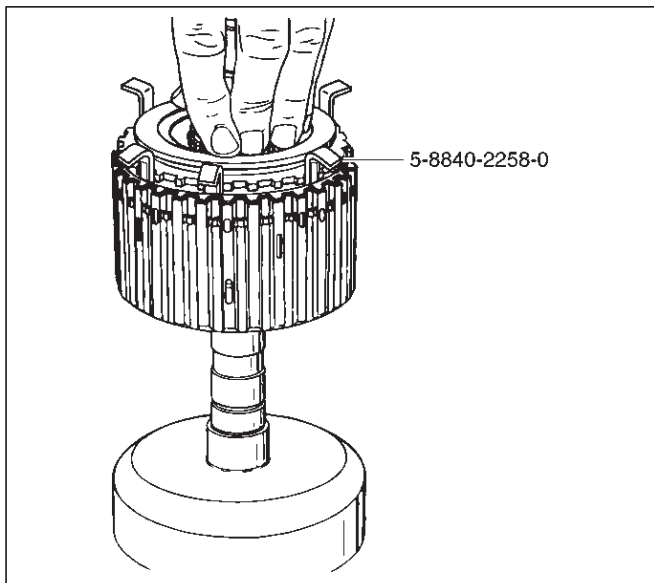
Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

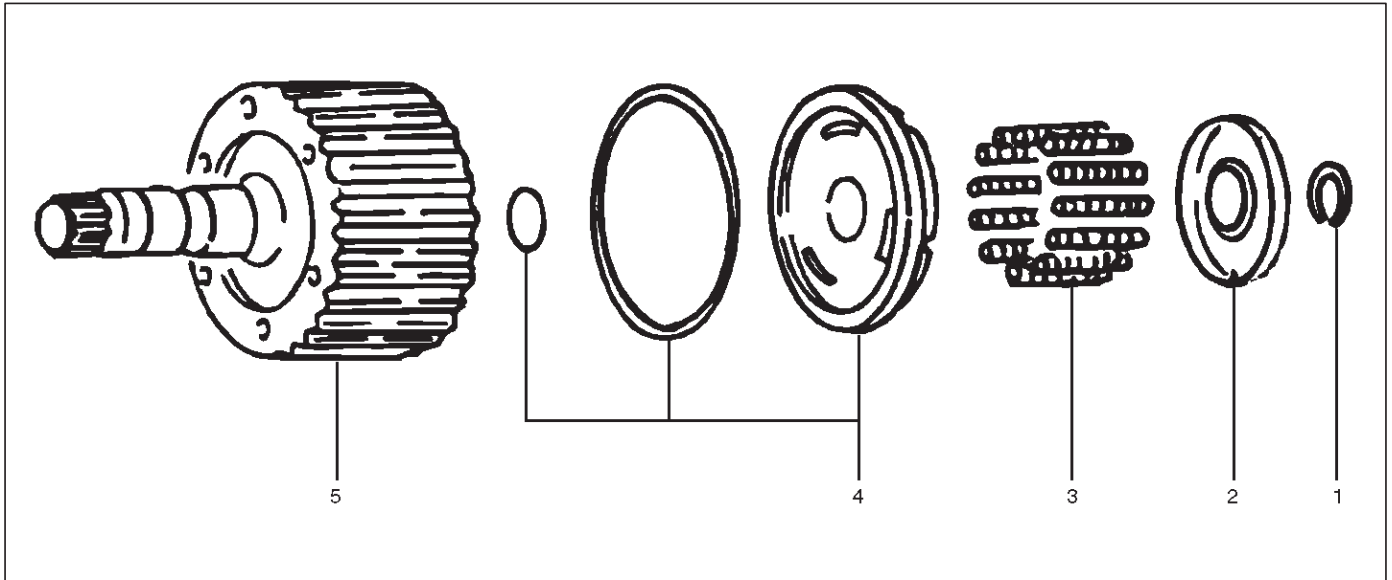
Reassembly

1. Place third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Install third clutch spring cushion plate (7), bevel face down.
3. Install third clutch plates (6) into third clutch drum assembly (8). Start with the steel clutch plate and alternate with lined plates.
4. Install thrust washer (5), bearing (4), and retaining washer (3).
5. Fully engage the hub splines of the input sun gear and sprag unit assembly (2) into the third clutch inner tangs.
 - Simultaneously rotate the outer sprag race to engage into the third clutch drum assembly (8).
6. Place 5-8840-2258-0 (J-38450-A) blades between the retaining ring and the third clutch drum approximately (five) notches apart, and one blade at each end of the retaining ring (1). Push down on sprag assembly until the assembly is seated into the third clutch drum assembly (8).
7. Remove the tool blades and engage retaining ring into groove of third clutch drum.



Third Clutch

Disassembled View



248RS006

Legend

- (1) Retaining Ring
- (2) Spring Seat

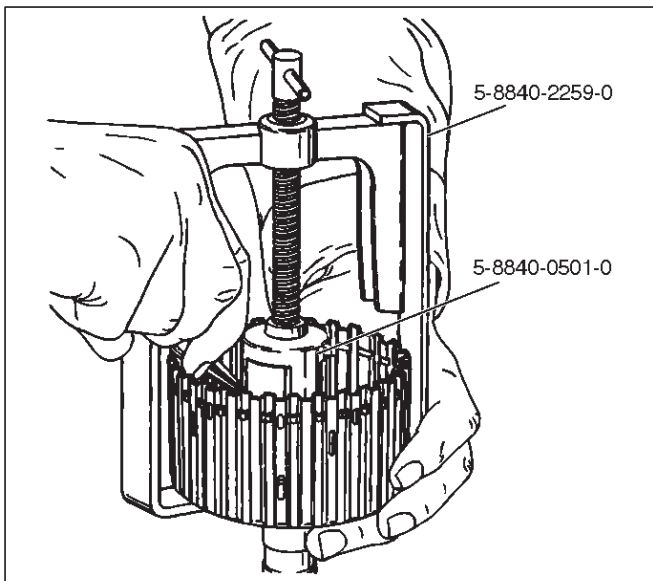
- (3) Springs
- (4) Piston Assembly
- (5) Third Clutch Drum

Disassemble

1. Compress spring seat using the 5-8840-0501-0 (J-23075) spring compressor and 5-8840-2259-0 (J-23075-12) adapter tool.

NOTE: Do not over-stress the springs and seat. This will cause damage to the spring seat.

- Remove the tool.
- Remove retaining ring (1).



248RW004

2. Release the spring seat (2).

NOTE: Do not let the spring seat catch in the ring groove.

- Remove spring seat (2) and springs (3).
3. Remove piston assembly (4) from third clutch drum (5).

Inspection And Repair

Visual check:

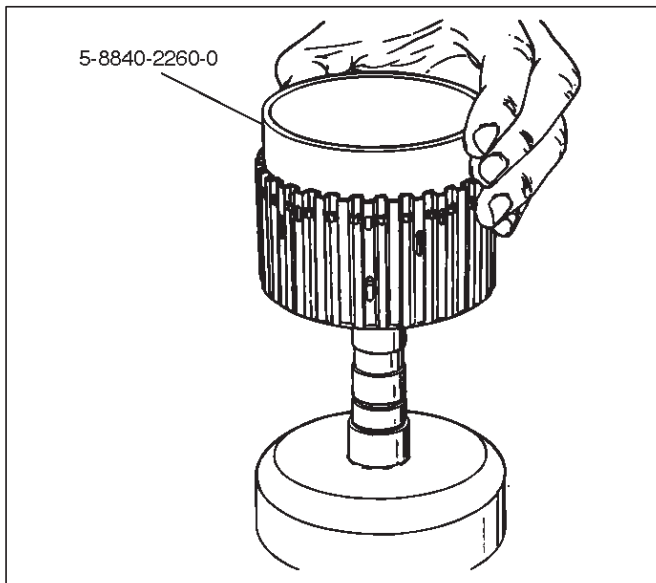
If any damage, deformation or wear is found, replace the damaged part.

Operation check:

Shake the piston and listen for check ball movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. The lip of the piston seal must point toward the front of the transmission. Lubricate the seal lip with transmission fluid.
 - Install piston assembly (4) into the third clutch drum (5). Use the 5-8840-2260-0 (J-23084) third clutch piston installer to protect the outer seal during installation.
 - Remove the seal installer.



2. Install twelve springs (3) and spring seat (2).

3. Place retaining ring (1) onto spring seat.

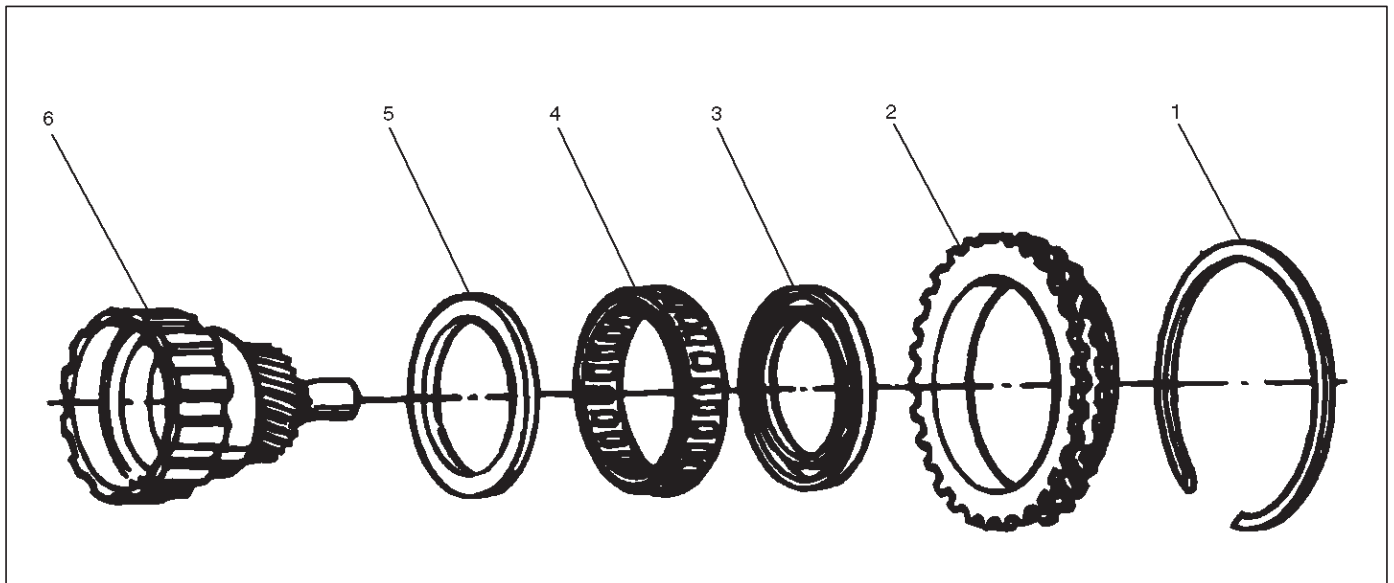
- Compress the piston springs, using the 5-8840-0501-0 (J-23075) piston spring compressor and 5-8840-2259-0 (J-23075-12) adapter.

CAUTION: Do not over stress the springs and seat. Do not let the spring seat catch in the ring groove. This may cause damage to the spring seat.

- Install spring seat retaining ring (1).
- Remove the piston spring compressor and adapter.

Sprag Unit

Disassembled View



248RS009

Legend

- | | |
|----------------------|--|
| (1) Retaining Ring | (4) Sprag Assembly |
| (2) Sprag Outer Race | (5) Ring |
| (3) Ring | (6) Third Clutch Hub and Sun Gear Assembly |

Disassembly

1. Remove the sprag outer race, retaining ring, and sprag assembly from the third clutch hub and sun gear assembly.
2. Remove the rings and sprag assembly from the sprag outer race.

Inspection And Repair

Visual Check:

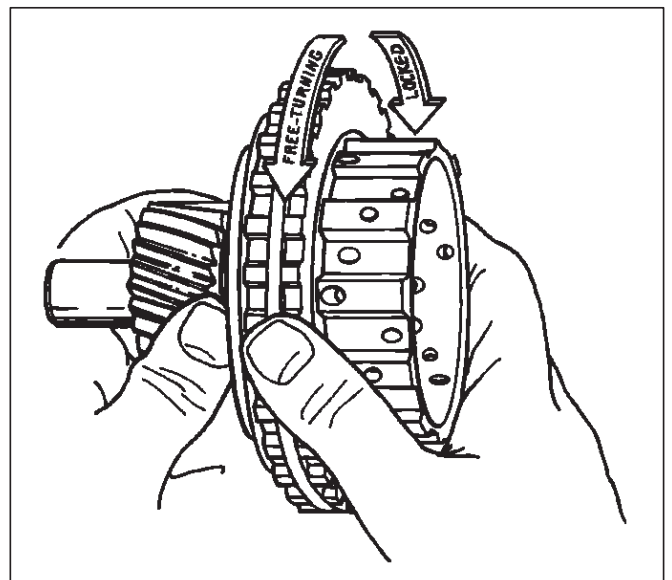
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

NOTE: Flared shoulder of the sprag cage faces the sun gear. This procedure must be followed exactly to be sure that the sprag assembly is installed properly.

1. Install rings and sprag assembly onto the third clutch hub and sun gear.
2. Install sprag outer race and retaining ring assembly over the sprag cage assembly.
 - Place third clutch hub and sun gear assembly on a flat surface, sun gear facing up. Place sprag outer race and sprag assembly over the sun gear assembly, push down and turn the input sun counterclockwise at the same time.

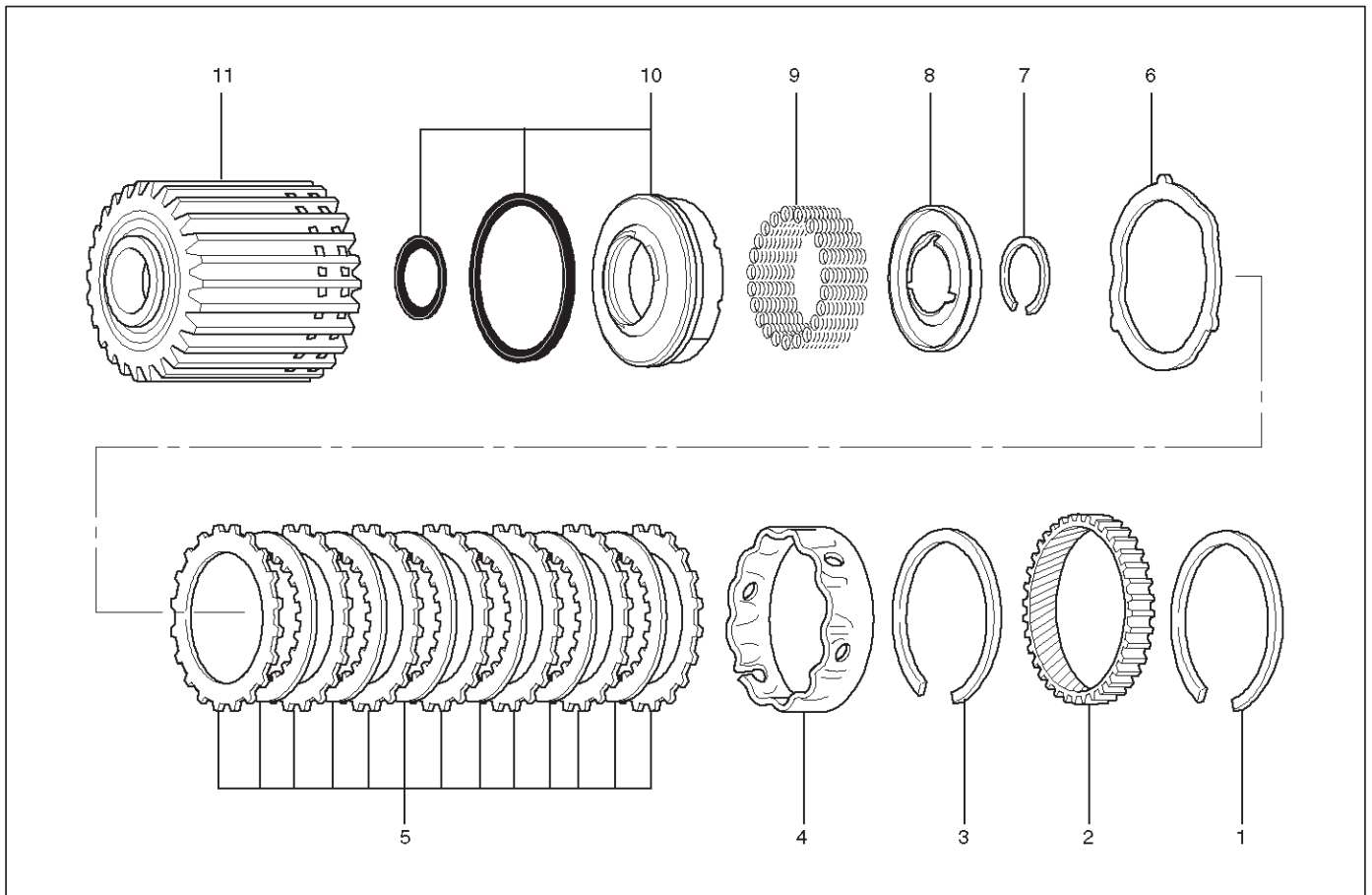
NOTE: Check correct rotation by holding the sun gear in your left hand and turning the outer race. The outer sprag race should turn freely towards you and should lock turning away from you.



248RS010

Second Clutch

Disassembled View



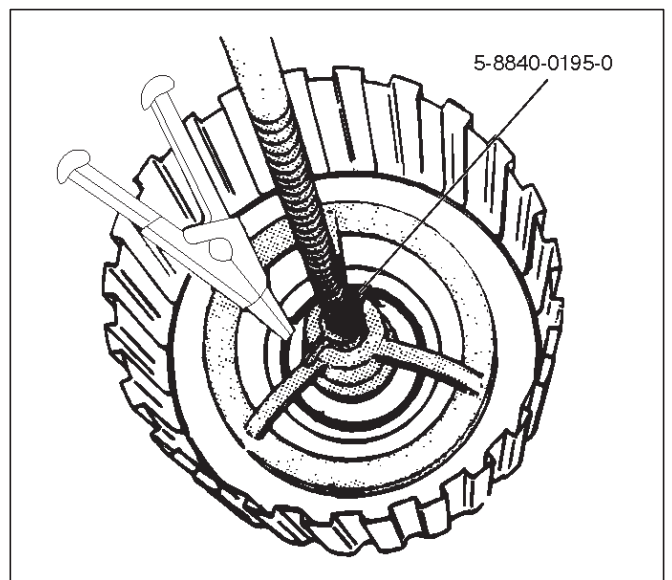
247RW001

Legend

- | | |
|--------------------|-------------------------|
| (1) Retaining Ring | (6) Waved Washer |
| (2) Ring Gear | (7) Retaining Ring |
| (3) Retaining Ring | (8) Spring Seat |
| (4) Spacer | (9) Springs |
| (5) Clutch Plates | (10) Piston Assembly |
| | (11) Second Clutch Drum |

Disassembly

1. Remove retaining ring (1) from second clutch drum (11).
2. Remove ring gear (2), retaining ring (3), and spacer (4).
3. Remove clutch plates (5) and waved washer (6).
4. Remove retaining ring (7) using 5-8840-0195-0 (J-23327) compressor to compress the spring seat (8).
5. Remove spring seat (8), springs (9) and piston assembly (10) from second clutch drum (11).



247RW005

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Operation Check:

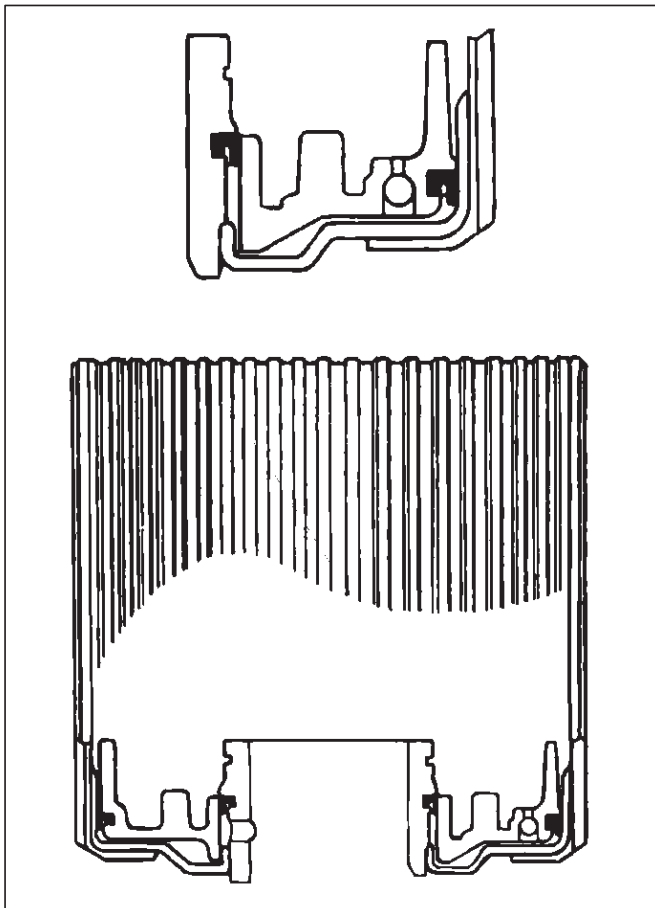
Shake the piston and listen for check ball movement. Movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. Install piston assembly (10) into the second clutch drum (11).
 - Lubricate the lip seal with transmission fluid. Use the 5-8840-2261-0 (J-23080-A) second clutch piston installer to protect the outer piston lip seal.

NOTE: Lip of the seal should point toward front of transmission.

- Remove the installer.



247RS007

2. Install twenty-two piston springs (9) and spring seat (8) on the second clutch piston (10). Place retaining ring (7) onto spring seat.
 - Use the 5-8840-0195-0 (J-23327) compressor to compress the piston springs.

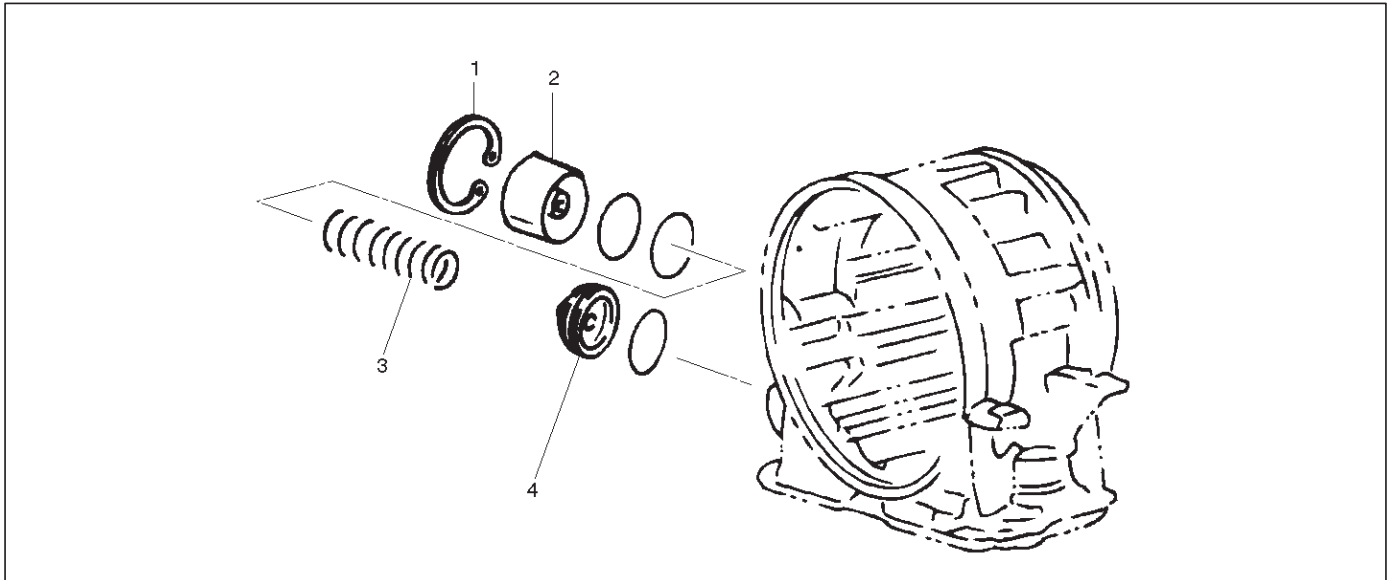
NOTE: Do not let spring seat catch in ring groove.

- Remove the compressor.

3. Install waved plate (6) and clutch plates (5). Start with a steel plate and alternate with lined plates.
 - Align second clutch inner tangs.
4. Install spacer (4), with the fluted end toward clutch plates.
5. Install retaining ring (3), ring gear (2) and retaining ring (1).

3-4 Accumulator Piston

Disassembled View



244RS005

Legend

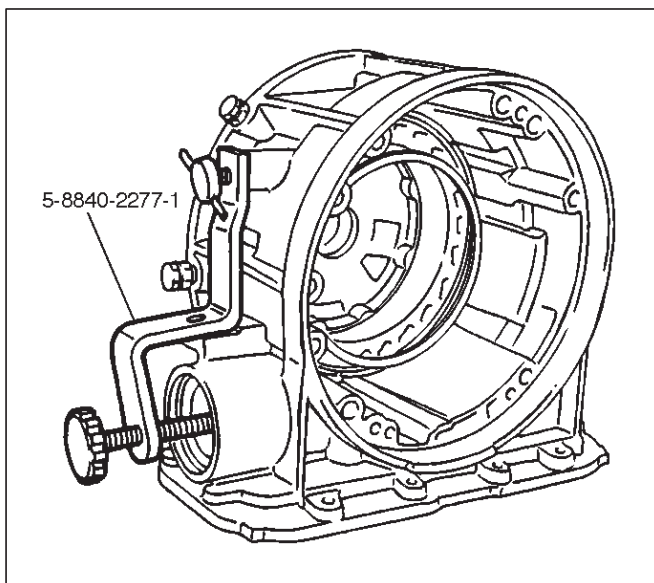
- (1) Snap Ring
- (2) Cover

- (3) Spring
- (4) Piston Assembly

Disassembly

1. Install the 5-8840-2277-1 (J-38559-A) cover compressor on adapter case.

- Compress piston cover then remove snap ring.

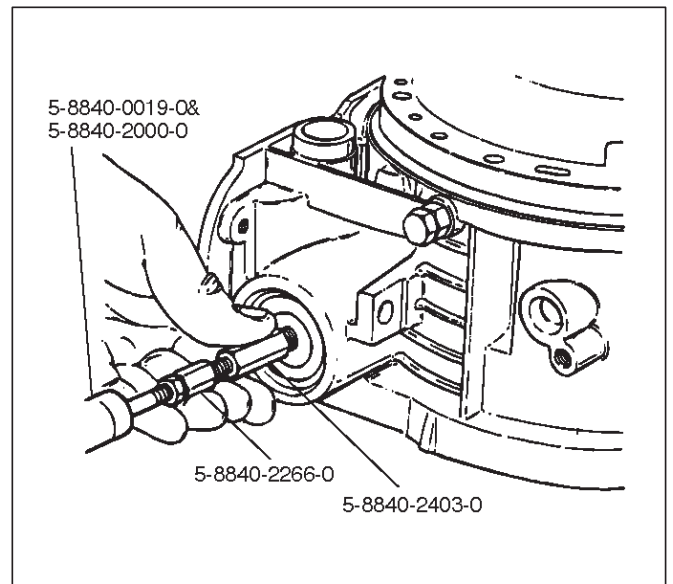


242RW009

2. Install the 5-8840-2403-0 (J-41096) cover remover and 5-8840-2266-0 (J-38584) adapter to center hole of cover.

- Use the 5-8840-0019-0 and 5-8840-2000-0 (J-23907) slide hammer to remove cover.

3. Remove spring and piston assembly.



242RW010

Inspection And Repair

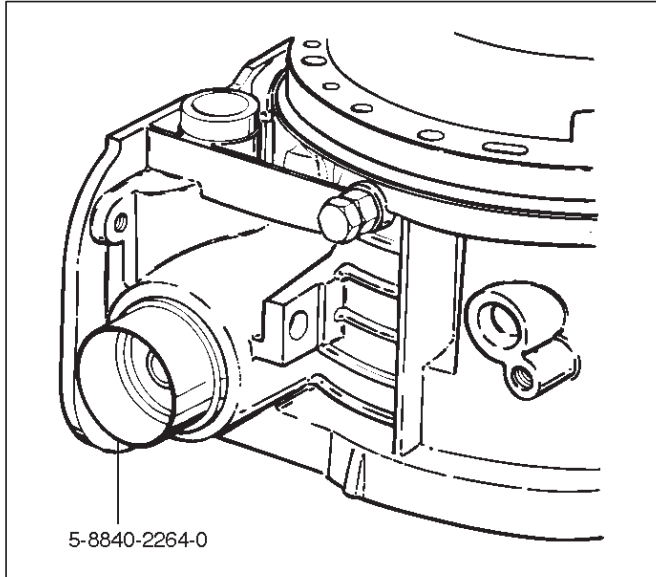
Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Place the 5-8840-2264-0 (J-38553) piston fitter into adaptor case and push the piston into position, using suitable diameter tube.

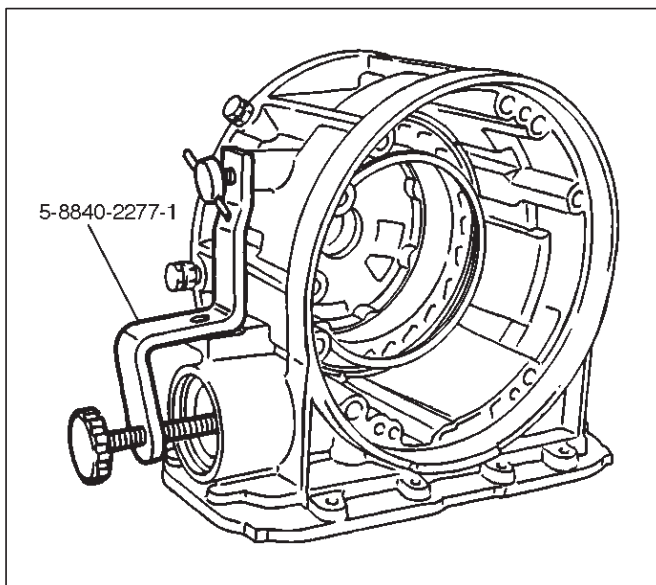
- Remove the piston fitter.



2. Install spring and cover.

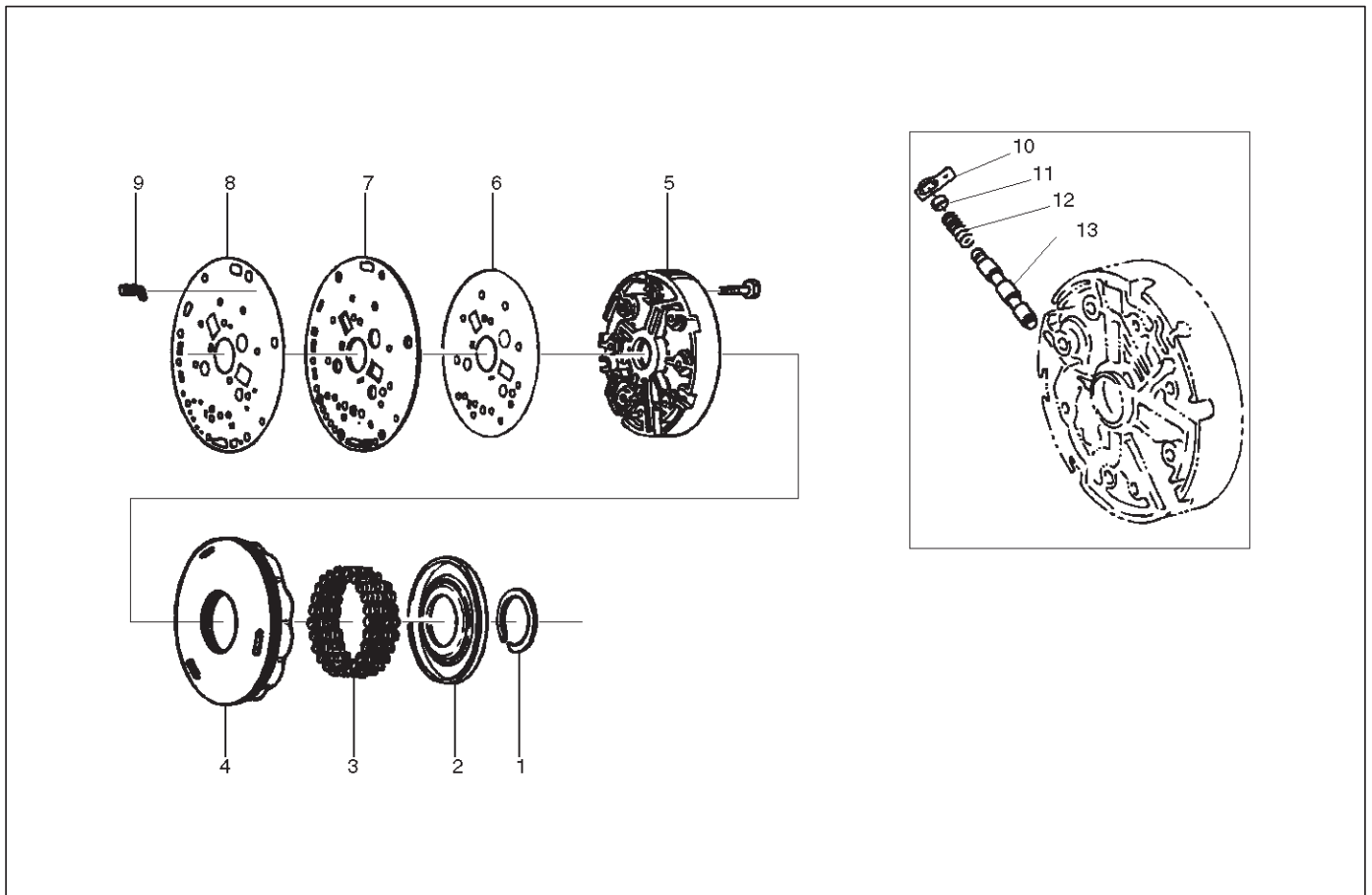
3. Install snap ring, using the 5-8840-2277-1 (J-38559-A) compressor tool.

- Install snap ring in groove.
- Remove the compressor tool.



Reverse Clutch Piston And Center Support

Disassembled View



242RS006

Legend

- | | |
|---------------------|-----------------------------|
| (1) Retaining Ring | (7) Transfer Plate |
| (2) Spring Seat | (8) Gasket |
| (3) Springs | (9) Restrictor |
| (4) Piston Assembly | (10) Retainer Plate |
| (5) Center Support | (11) Plug |
| (6) Gasket | (12) Spring |
| | (13) Overrun Lock Out Valve |

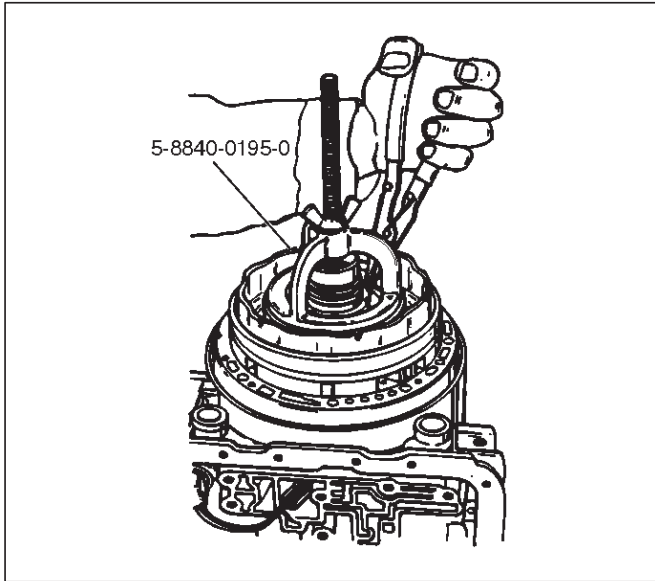
Disassembly

1. Install the 5-8840-0195-0 (J-23327) compressor tool on spring seat, then compress the spring seat.

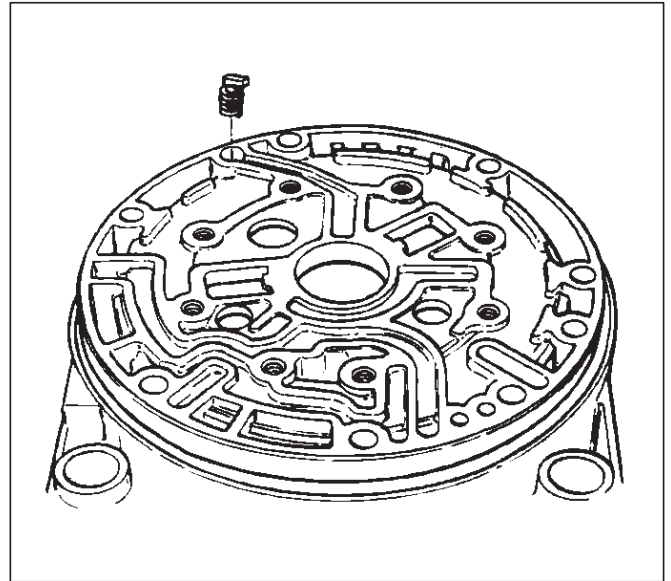
- Remove retaining ring (1).

NOTE: Do not over-stress the springs and seat, as this will cause damage to the spring seat.

- Remove the compressor tool.



2. Remove spring seat (2) and springs (3).
3. Remove piston assembly (4).
4. Remove 8 bolts from center support (5), then remove center support (5) from adapter case.
5. Remove gasket transfer plate/outer support (6), center support transfer plate (7), and gasket transfer plate/adapter case (8).
6. Remove restrictor (9) from adapter case housing.
7. Remove retainer plate (10), plug (11), spring (12), and overrun lock out valve (13) from center support (5).



4. Install gasket transfer plate/adapter case (8), center support transfer plate (7), and gasket transfer plate/center support (6).
5. Install center support (5) with 8 bolts.

Torque : 25 N•m (2.5 kg-m/18 lb ft)

6. Install piston assembly (4) into center support (5).
7. Install twenty four springs (3), spring seat (2), and retaining ring (1).
 - Install the 5-8840-0195-0 (J-23327) compressor and compress spring seat (2) and springs (3), then seat snap ring (1) in groove.
 - Remove the tool.

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

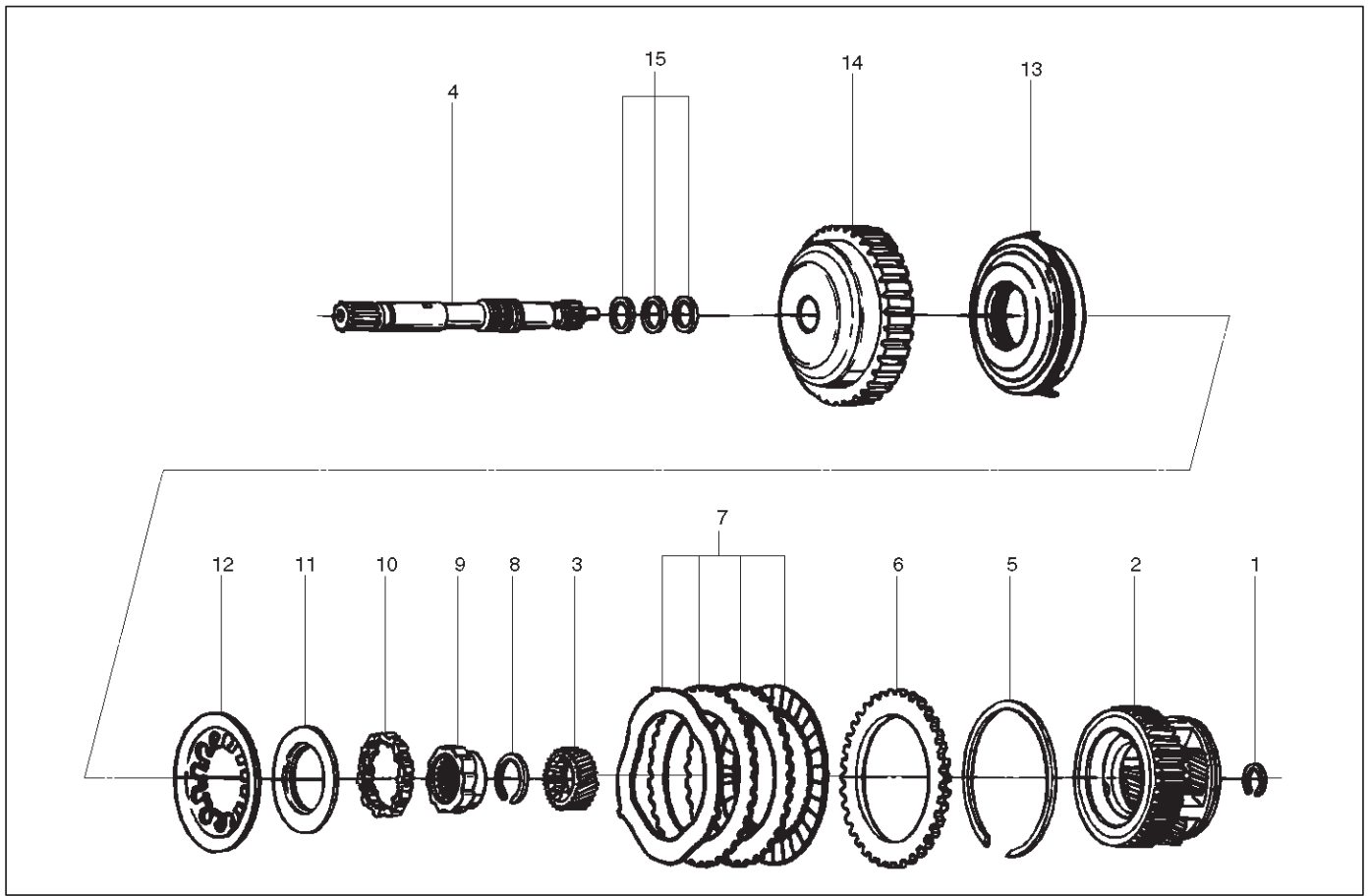
1. Install overrun lock out valve (13) and spring (12) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

2. Install plug (11) and retainer plate (10).
3. Place restrictor (9) in the lube overdrive channel in the adapter case housing.

Overrun Clutch And Turbine Shaft

Disassembled View



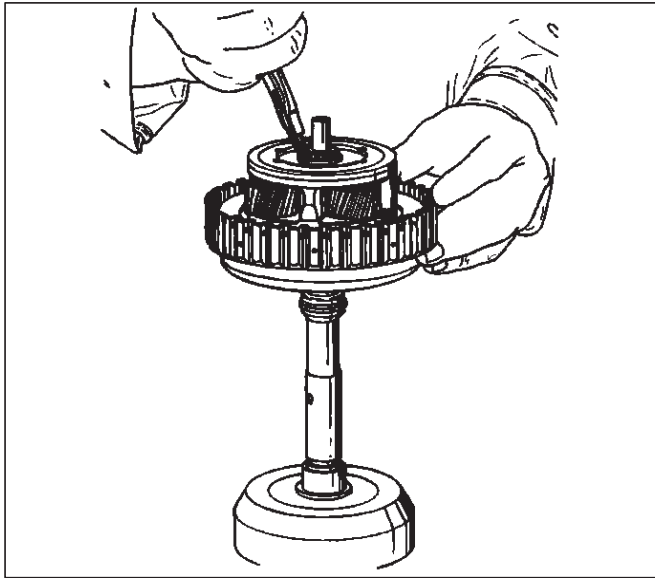
252RW005

Legend

- | | |
|--------------------------------|---|
| (1) Snap Ring | (8) Snap Ring |
| (2) Overdrive Carrier Assembly | (9) Overrun Roller Clutch Cam |
| (3) Sun Gear | (10) Roller Clutch Assembly |
| (4) Turbine Shaft | (11) Overrun Clutch Release Spring Retainer |
| (5) Snap Ring | (12) Diaphragm Spring |
| (6) Backing Plate | (13) Piston Assembly |
| (7) Clutch Plates | (14) Overrun Clutch Drum |
| | (15) Turbine Shaft Seal Rings |

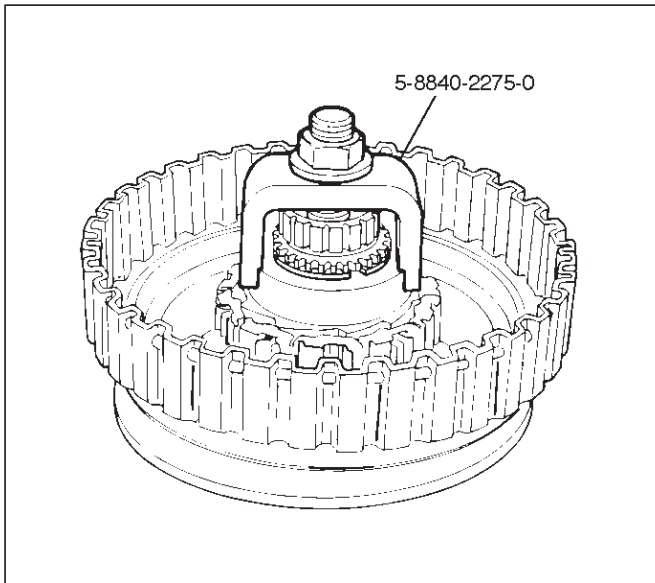
Disassembly

1. Position overrun clutch assembly upright, using the overdrive internal gear as a support.
 - Remove snap ring (1).



252RS009

2. Remove overdrive carrier assembly (2), sun gear (3) and turbine shaft (4).
3. Remove snap ring (5), backing plate (6), and clutch plates (7).
4. Compress diaphragm spring with the 5-8840-2275-0 (J-23327-91) compressor, then remove snap ring (8).



252RW011

5. Remove overrun roller clutch cam (9) and roller clutch assembly (10).
6. Remove overrun clutch release spring retainer (11) and diaphragm spring (12).
7. Remove piston assembly (13) from overrun clutch drum (14).
8. Remove turbine shaft seal rings (15).

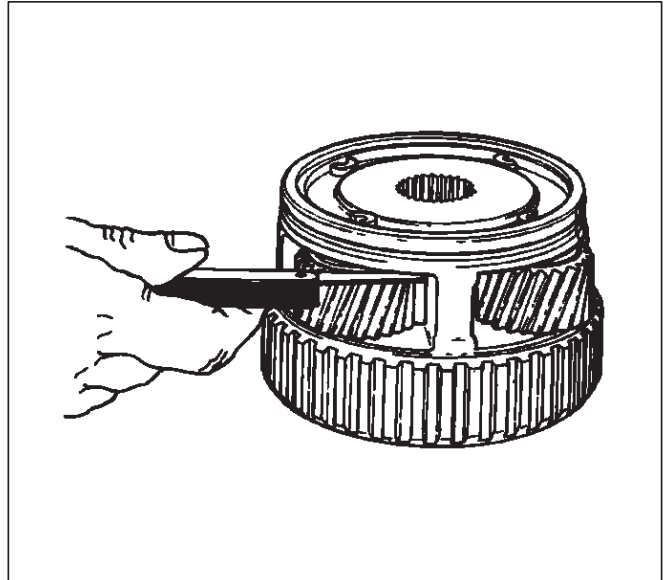
Inspection And Repair

Overdrive Carrier Check

- Check pinion end play with a feeler gauge.

Clearance: 0.24mm–0.64mm (0.0094in–0.025in)

If clearance is outside specified value, replace overdrive carrier assembly.



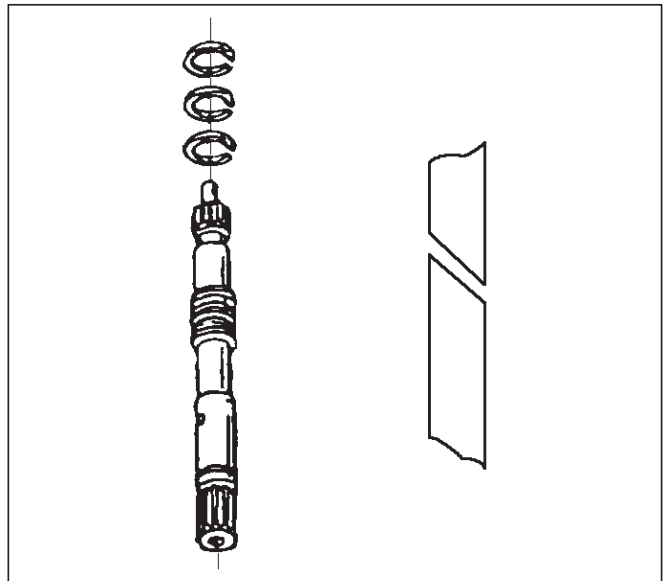
252RS011

Visual Check:

If any damage, deformation or local wear is found, replace the damaged part.

Reassembly

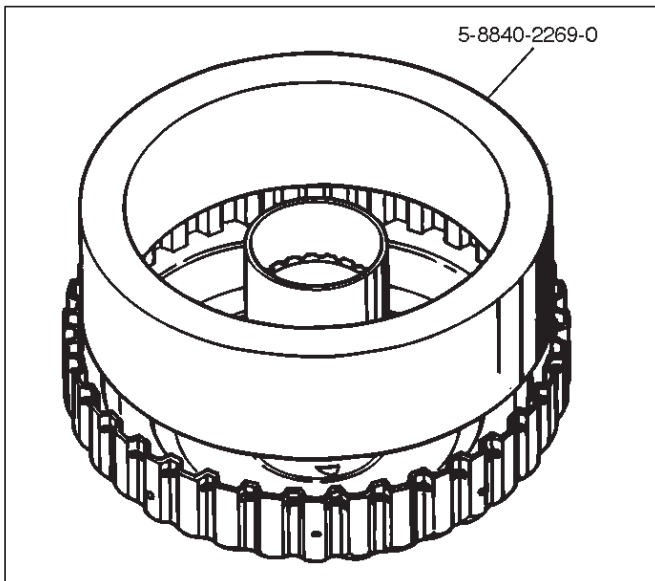
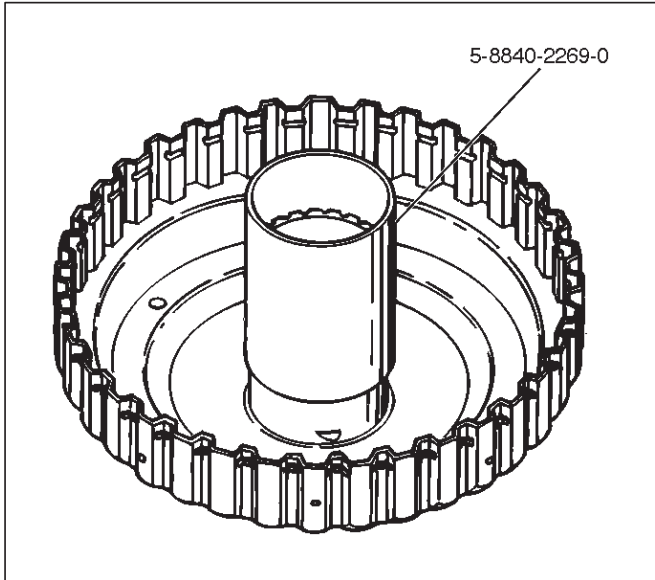
1. Install turbine shaft seal rings (15) with grease (petroleum jelly).



241RS008

7A-76 AUTOMATIC TRANSMISSION (4L30-E)

2. Install the 5-8840-2269-0 (J-38555) inner installer on the drum (14).
 - Pre-install piston assembly into 5-8840-2269-0 (J-38555) outer installer.
 - Install overrun clutch piston assembly (13). Use the outer installer while pushing piston into drum (14).
 - Remove the installer.



3. Install diaphragm spring (12).
4. Install overrun clutch release spring retainer (11) (lip faces upwards), overrun roller clutch assembly (10), and cam (9).
5. Place snap ring loosely on spring retainer.
 - Hold the 5-8840-2275-0 (J-23327-91) compressor in a vise and compress piston return spring with compressor.
 - Set snap ring (8) in ring groove.
 - Remove the compressor.
6. Install clutch plates (7), start with steel plate and alternate with lined plates.
7. Install backing plate (6).

8. Install snap ring (5).
9. Install overdrive sun gear with countersink pointing downwards.
10. Install the overdrive carrier assembly (2).

NOTE: Turn the assembly in a counter-clockwise direction only until roller clutch enters the outer race. After installation, rotate the assembly and listen for loose rollers.

11. Install turbine shaft (4) and snap ring (1).

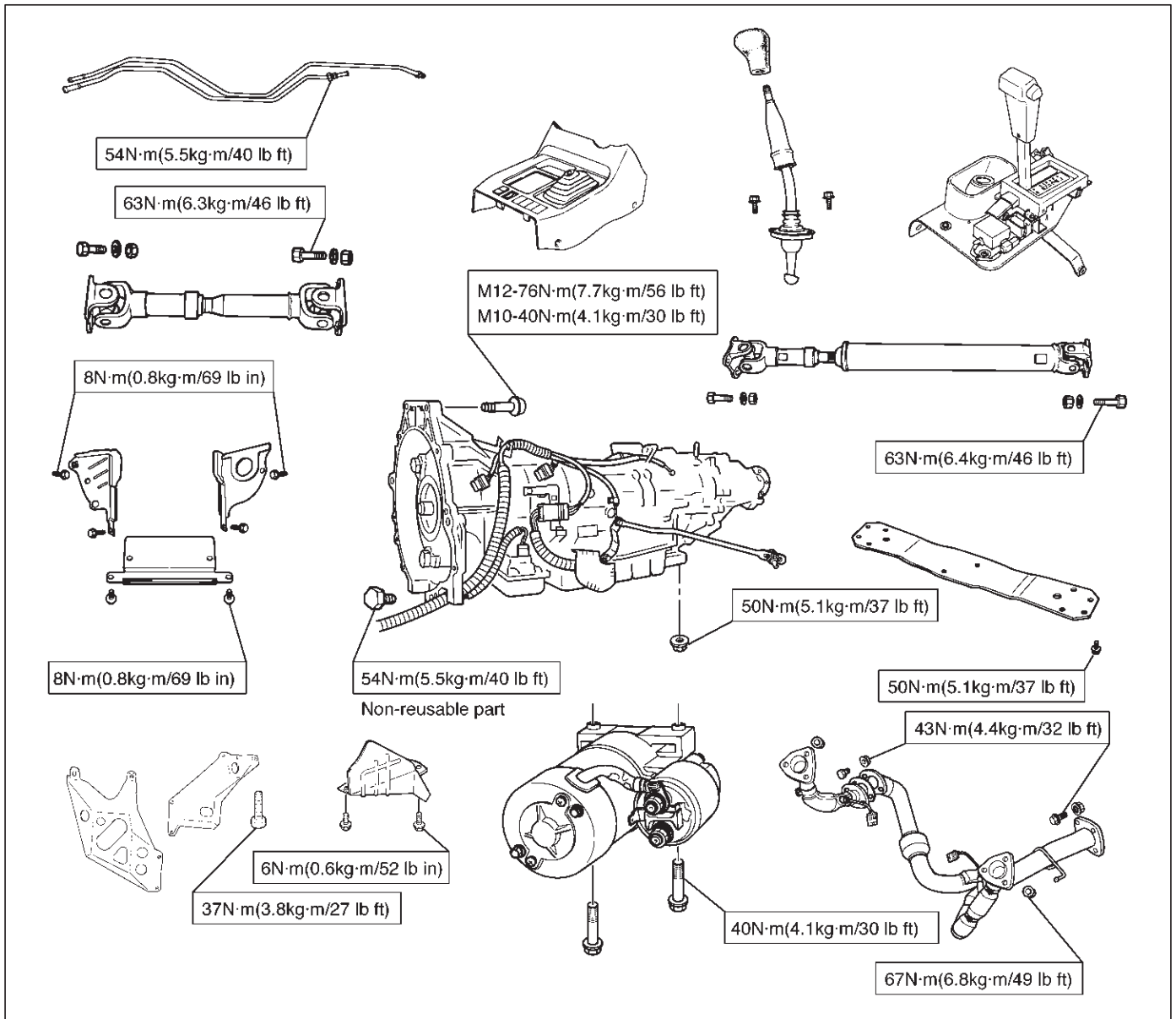
Main Data And Specification

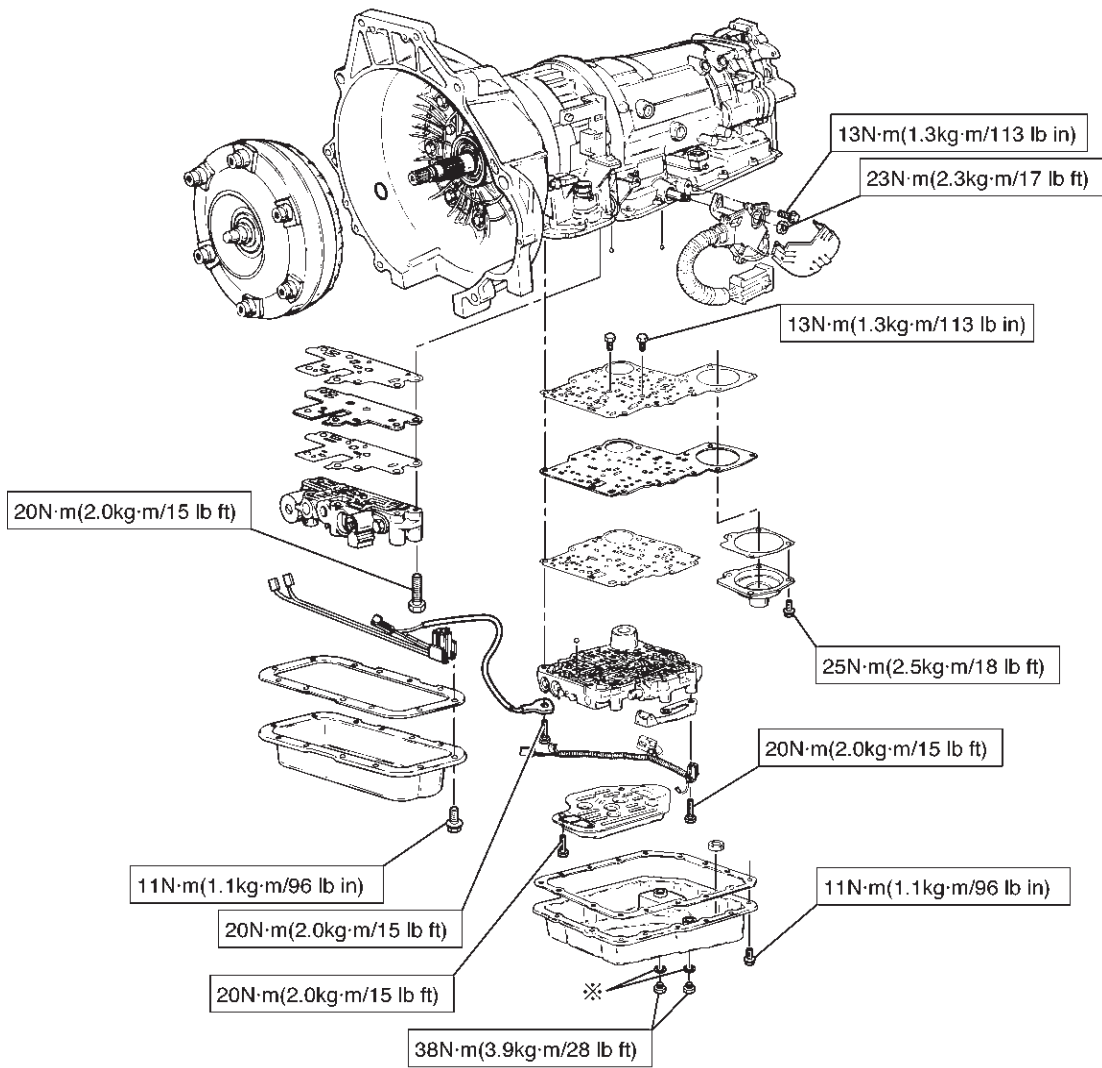
General Specifications

		Remarks		
Model		THM 4L30-E		
Engine		V6 3.2L 6VD1		
Type		Automatic four speed overdrive in 4th gear lock-up clutch torque converter		
Control systems	Shift control	Hydraulic		
	Shift pattern	Electronic		
	Shift quality	Electronic		
	Lock-up clutch	Electronic		
Gear ratio	1st	2.856		
	2nd	1.618		
	3rd	1.000		
	4th (O/D)	0.723		
	Reverse	2.000		
Gear set		Noiseless, high torque capability		
Oil used	Name	ATF DEXRON®-III		
	Q'ty liter (qt)	8.6 (9.1)		
Torque converter		2,100 ± 150		
		Stall speed (rpm)		
Reverse clutch	RC	4	Number of discs	
	C2	6		
	C3	6		
	Brake band			Double wrap
	Fourth clutch	C4	2	Number of discs
		OC	1	
Overdrive	OFW	10	Number of rollers	
	PFW	26	Number of sprags	
Ravigneaux planetary gear set	Input sun gear	30	Number of teeth	
	Pinion gear	19		
	Long pinion	23		
	Ring gear	90		
	Long pinion	19		
	Output sun gear	46		
Overdrive planetary gear set	Sun gear	31	Number of teeth	
	Pinion gear	24		
	Ring gear	81		

7A-78 AUTOMATIC TRANSMISSION (4L30-E)

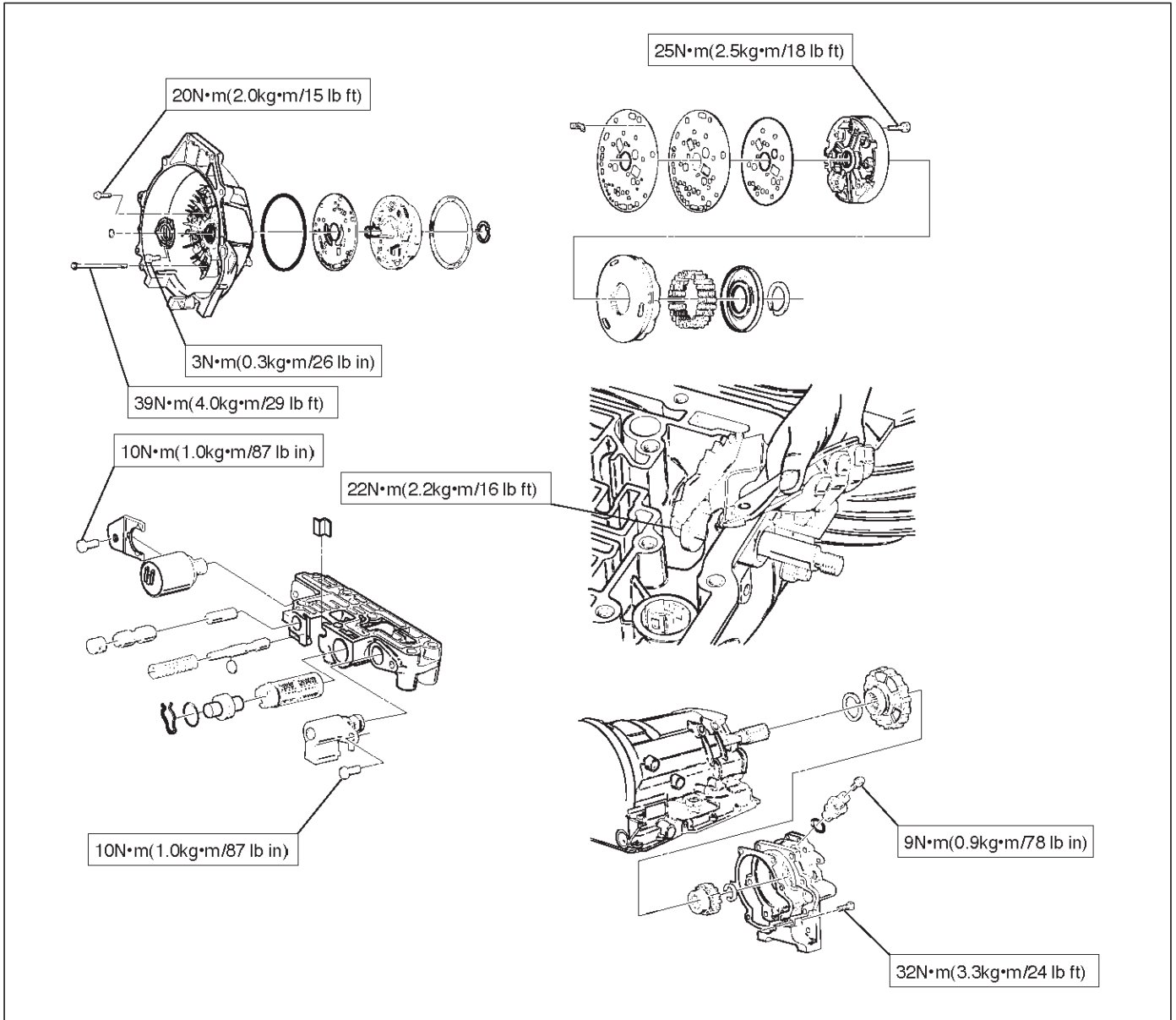
Torque Specifications



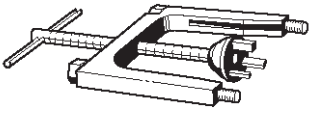
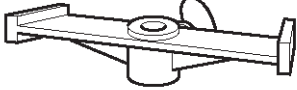
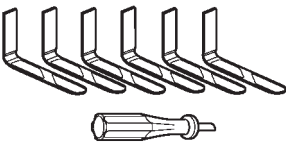
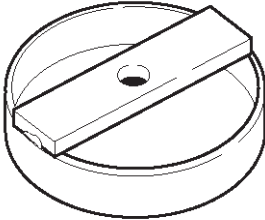
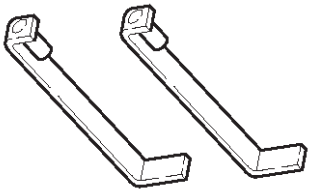
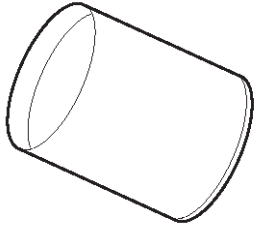
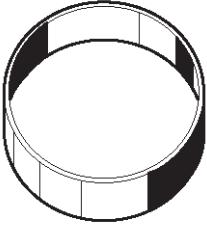

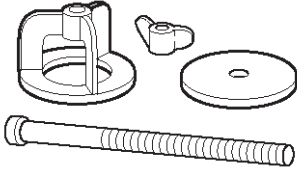
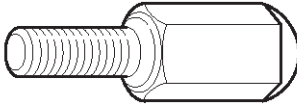
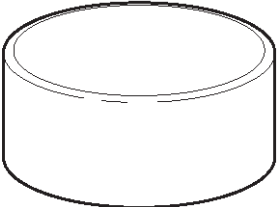
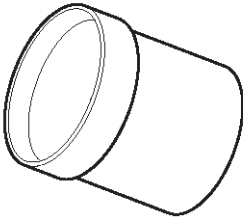


※ : Non-reusable part

7A-80 AUTOMATIC TRANSMISSION (4L30-E)



Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME	ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RT071</p>	<p>5-8840-0501-0 (J-23075) Spring compressor (For servo piston)</p>	 <p>901RT077</p>	<p>5-8840-2262-0 (J-23085-A) Selective washer gauging tool</p>
 <p>901RX007</p>	<p>5-8840-2258-0 (J-38450-A) Third clutch snap ring compressor</p>	 <p>901RT078</p>	<p>5-8840-2263-0 (J-23327-90) Fourth clutch spring compressor (Use with 5-8840-0195-0 (J-23327))</p>
 <p>901RT073</p>	<p>5-8840-2259-0 (J-23075-12) Third clutch spring compressor adapter (Use with 5-8840-0501-0 (J-23075))</p>	 <p>901RT079</p>	<p>5-8840-2264-0 (J-38553) 3/4 Accumulator piston fitter</p>
 <p>901RT074</p>	<p>5-8840-2260-0 (J-23084) Third clutch piston installer</p>	 <p>901RT080</p>	<p>5-8840-2403-0 (J-41096) Cover remover (Use with 5-8840-2266-0 (J-38584))</p>
 <p>901RT075</p>	<p>5-8840-0195-0 (J-23327) Third clutch spring compressor</p>	 <p>901RT081</p>	<p>5-8840-2266-0 (J-38584) Slide hammer adapter (Use with 5-8840-0019-0 (J-23907))</p>
 <p>901RT076</p>	<p>5-8850-2261-0 (J-23080-A) Second clutch piston installer</p>	 <p>901RT082</p>	<p>5-8840-2267-0 (J-38554) Fourth clutch piston fitter</p>

7A-82 AUTOMATIC TRANSMISSION (4L30-E)

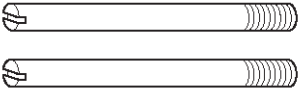
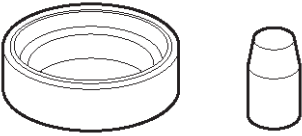
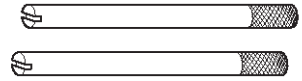
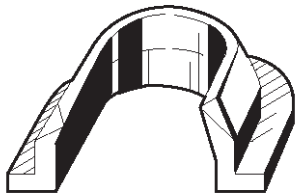
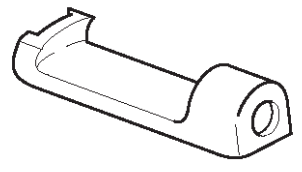
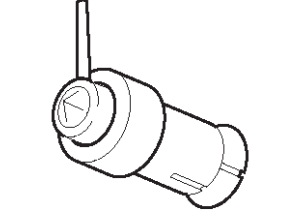
ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RT083</p>	<p>5-8840-2268-0 (J-38588) Guide pins; adapter case to main case</p>
 <p style="text-align: right; font-size: small;">901RT084</p>	<p>5-8840-2269-0 (J-38555) Overrun clutch piston seal installer set</p>
 <p style="text-align: right; font-size: small;">901RT085</p>	<p>5-8840-2270-0 (J-3387-2) Guide pins; gasket and transfer plate to valve body</p>
 <p style="text-align: right; font-size: small;">901RT086</p>	<p>5-8840-2271-0 (J-25022) Turbine shaft puller (Use with 5-8840-0618-0 (J-24773-1))</p>
 <p style="text-align: right; font-size: small;">901RT087</p>	<p>5-8840-0196-0 (J-23129) Oil seal remover (Use with 5-8840-2266-0 (J-23907) and 5-8840-0019-0 (J-38584))</p>
 <p style="text-align: right; font-size: small;">901RT088</p>	<p>5-8840-2272-0 (J-38557) Oil pump centering tool</p>

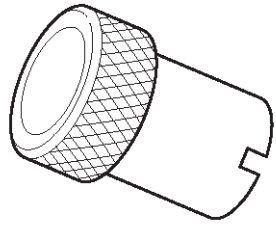
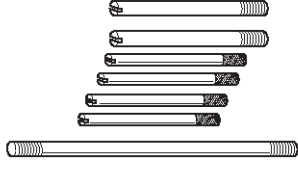
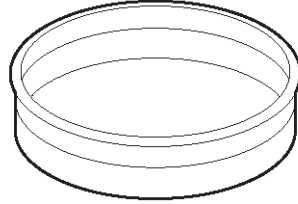
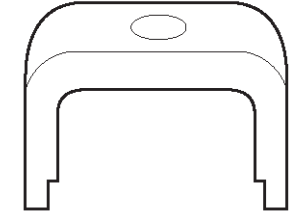
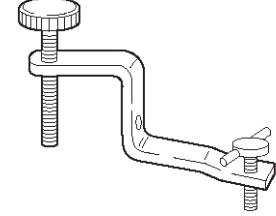
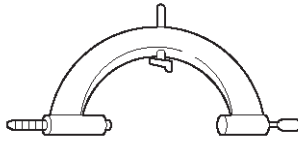
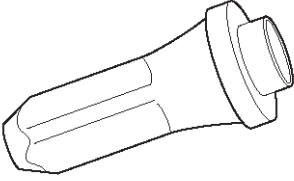
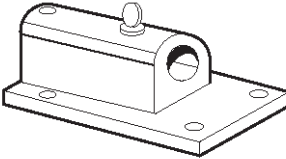

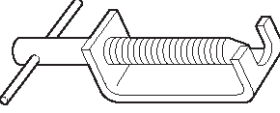
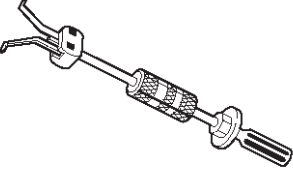
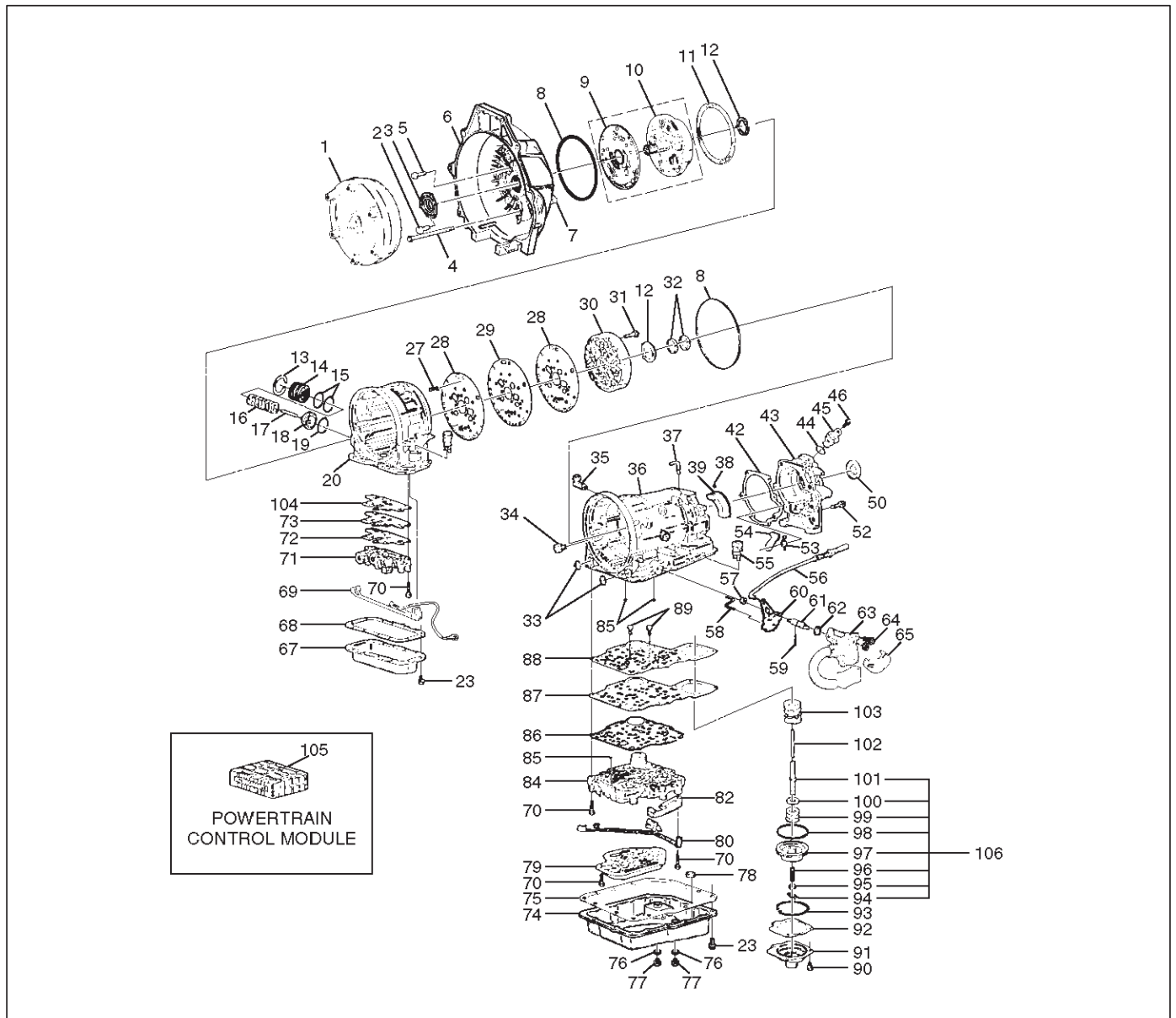
ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RT089</p>	<p>5-8840-2273-0 (J-23082-01) Oil pump rotation tool</p>
 <p style="text-align: right; font-size: small;">901RT090</p>	<p>5-8840-0022-0 (J-25025-B) Guide pins; valve body to main case</p>
 <p style="text-align: right; font-size: small;">901RT091</p>	<p>5-8840-2274-0 (J-38428) Servo piston fitter</p>
 <p style="text-align: right; font-size: small;">901RT092</p>	<p>5-8840-2275-0 (J-23327-91) Overrun clutch spring compressor</p>
 <p style="text-align: right; font-size: small;">901RT093</p>	<p>5-8840-2277-1 (J-38559-A) 3/4 Accumulator piston cover compressor</p>
 <p style="text-align: right; font-size: small;">901RT094</p>	<p>5-8840-2278-0 (J-8763-02) Holding fixture</p>

ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RT096</p>	<p>5-8840-2282-0 (J-36797) A/T extension housing oil seal installer (Inside)</p>
 <p style="text-align: right; font-size: small;">901RT096</p>	<p>5-8840-0003-0 (J-3289-20) Holding fixture base</p>
 <p style="text-align: right; font-size: small;">901RT097</p>	<p>5-8840-0004-0 Pressure gauge</p>
 <p style="text-align: right; font-size: small;">901RT098</p>	<p>5-8840-0618-0 (J-24773-1) End play fixture (Use with 5-8840-2271-0 (J-25022))</p>
 <p style="text-align: right; font-size: small;">901RT099</p>	<p>5-8840-0019-0 & 5-8840-2000-0 (J-23907) Slide hammer</p>

4L30-E Parts List

Case And Associated Parts



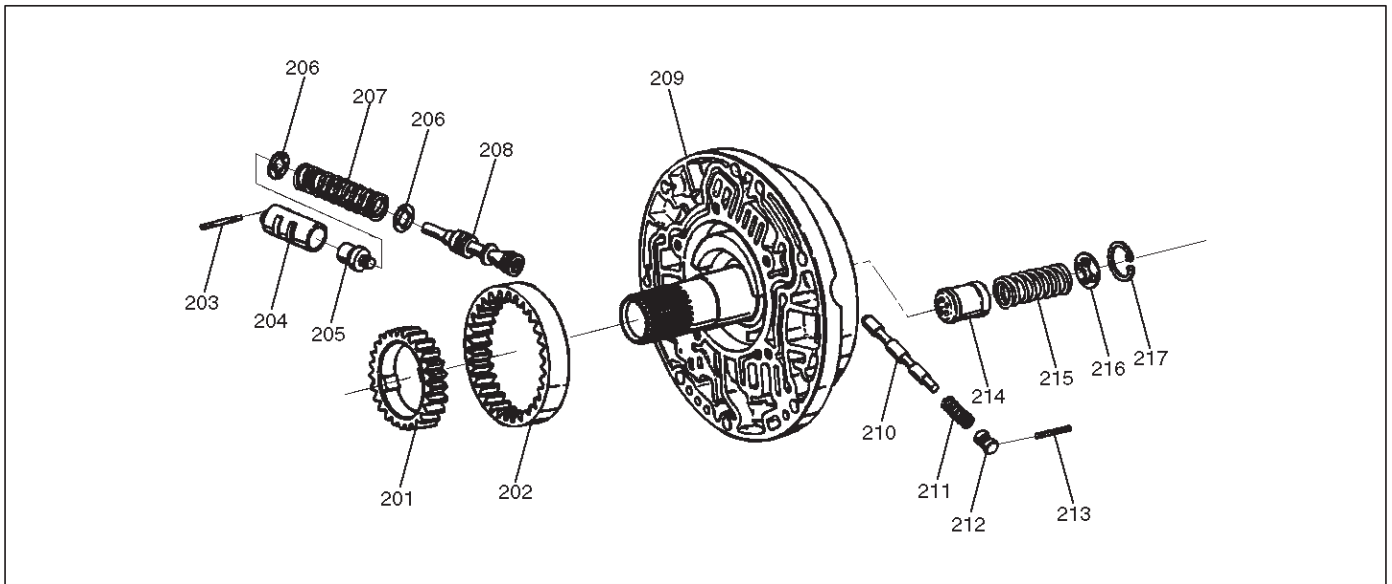
241RW014

Legend

- | | |
|---|---|
| (1) Torque Converter | (17) Pin, 3-4 Accumulator Piston |
| (2) Screw, Seal Ring Assembly | (18) Piston, 3-4 Accumulator |
| (3) Seal Ring Assembly, Converter Housing | (19) Ring, 3-4, Accumulator Piston |
| (4) Screw, Converter Housing/Main Case | (20) Case, Adapter |
| (5) Screw, Converter Housing/Oil Pump | (22) Connector, Electrical/Adapter Case |
| (6) Housing, Converter | (23) Screw, Pan |
| (7) Plug, Converter Housing | (27) Restrictor, Oil |
| (8) Seal, O-Ring | (28) Gasket, Transfer Plate/Adapter |
| (9) Wear Plate, Oil Pump Body | (29) Plate, Transfer Adapter/Center Support |
| (10) Pump Assembly, Oil | (30) Support Assembly, Center |
| (11) Gasket | (31) Screw, Center Support |
| (12) Washer, Thrust Selective | (32) Ring, Oil Seal |
| (13) Ring, Snap | (33) Seal, O-Ring Main Case |
| (14) Cover, 3-4 Accumulator Piston | (34) Fitting, Cooler |
| (15) Seal, O-Ring, 3-4 Accumulator | (35) Fitting Assembly, Cooler |
| (16) Spring, 3-4 Accumulator Piston | (36) Case, Main |
| | (37) Breather, Pipe |

- | | |
|---|--|
| (38) Seal, O-Ring | (75) Gasket, Bottom Pan/Main Case |
| (39) Reservoir | (76) Gasket, Oil Drain or Overfill Screw |
| (42) Gasket, Extension Case | (77) Screw, Oil Drain or Overfill |
| (43) Extension Assembly | (78) Magnet, Chip Collector |
| (44) Seal, O-Ring/Speed Sensor | (79) Filter Oil |
| (45) Sensor Assembly, Speed | (80) Harness Assembly, Main Case |
| (46) Screw, Speed Sensor | (82) Roller and Spring Assembly, Manual Detent |
| (50) Seal, Extension Assembly | (84) Valve Body Assembly, Main Case |
| (52) Screw, Extension/Main Case | (85) Ball, Check |
| (53) Spring, Parking Pawl Lock | (86) Gasket, Main V.B./Transfer Plate |
| (54) Pawl, Parking Lock | (87) Plate, Main V.B./Transfer |
| (55) Connector, Electrical/Main Case | (88) Gasket, Transfer/Main Case |
| (56) Actuator Assembly, Parking Lock | (89) Screw, Transfer Plate on V.B. |
| (57) Nut, Parking Lock Lever | (90) Screw, Servo Cover |
| (58) Link, Manual Valve | (91) Cover, Servo Piston |
| (59) Pin, Spring | (92) Gasket, Cover/Servo Piston |
| (60) Lever, Parking Lock and Range Selector | (93) Ring, Retaining Servo Piston |
| (61) Shaft, Selector | (94) Clip, Servo Piston |
| (62) Seal, Selector Shaft | (95) Nut, Servo Screw |
| (63) Mode Switch Assembly | (96) Screw, Servo Piston |
| (64) Screw and Conical Washer Assembly | (97) Piston, Servo |
| (65) Shield, Mode Switch | (98) Seal, Ring/Servo Piston |
| (67) Pan, Bottom/Adapter Case | (99) Spring, Cushion/Servo Piston |
| (68) Gasket, Bottom Pan/Adapter Case | (100) Seat, Cushion Spring |
| (69) Harness Assembly, Adapter Case | (101) Sleeve, Servo Piston Adjust |
| (70) Screw, Valve Body | (102) Rod, Apply/Servo Piston |
| (71) Valve Body Assembly, Adapter Case | (103) Spring, Return/Servo Piston |
| (72) Gasket, Adapter Valve Body | (104) Gasket, Adapter Case/Transfer Plate |
| (73) Plate, Adapter Valve Body/Transfer | (105) Powertrain Control Module |
| (74) Pan, Bottom/Main Case | (106) Servo Piston Assembly |
-

Pump Assembly

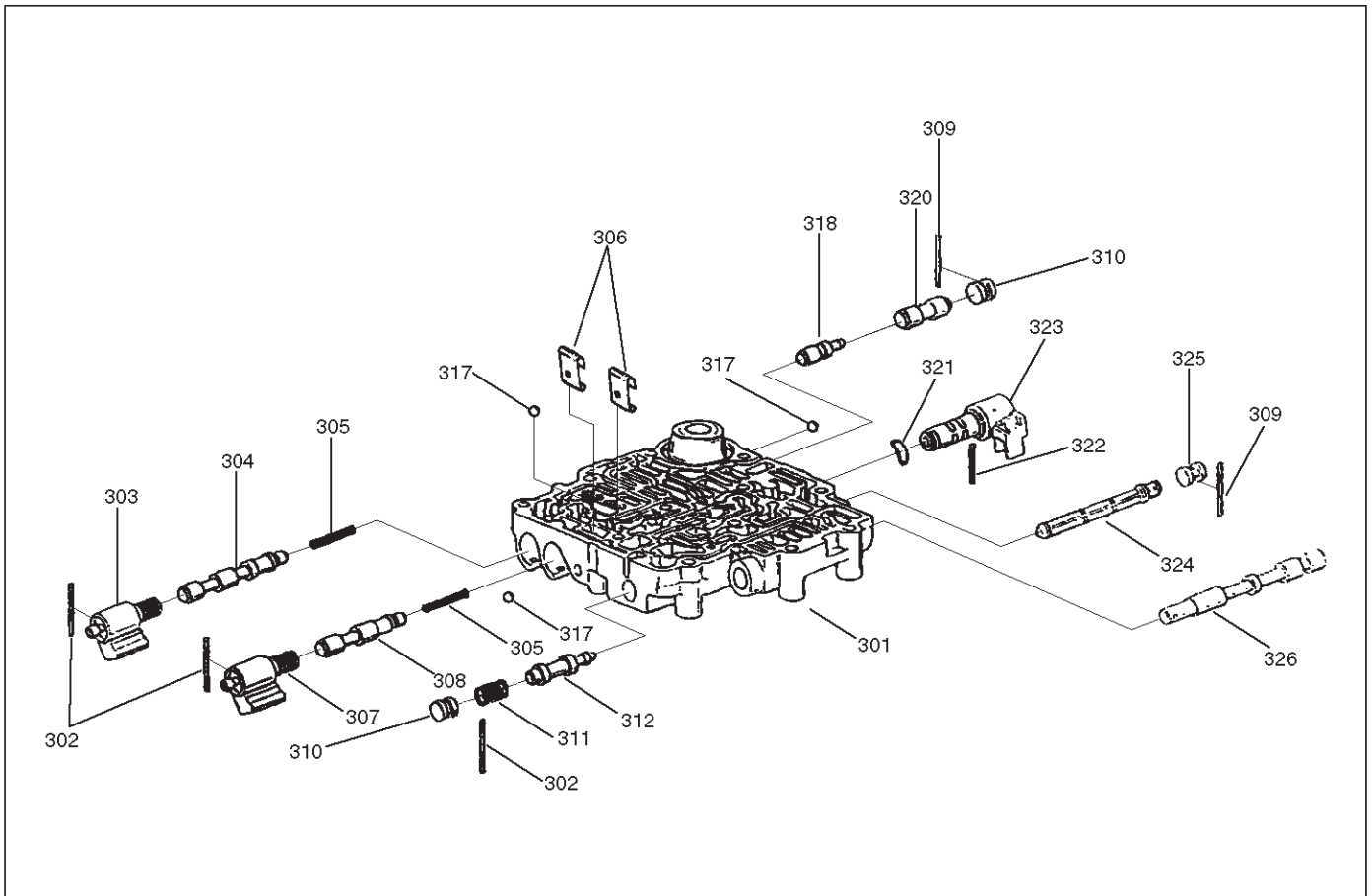


241RS019

Legend

- | | |
|---|--|
| (201) Gear, Oil Pump Drive | (209) Pump Assembly, Oil |
| (202) Gear, Oil Pump Driven | (210) Valve, Converter Clutch Control |
| (203) Pin, Boost Valve Sleeve | (211) Spring, Converter Clutch Control Valve |
| (204) Sleeve, Boost Valve | (212) Plug, Converter Clutch Control Valve |
| (205) Valve, Boost | (213) Pin, Spring |
| (206) Seat, Spring/Pressure Regulator Valve | (214) Piston, Throttle Signal Accumulator |
| (207) Spring, Pressure Regulator Valve | (215) Spring, Throttle Signal Accumulator |
| (208) Valve, Pressure Regulator | (216) Seat, Spring/Throttle Signal Accumulator |
| | (217) Ring, Snap/Throttle Signal Accumulator |

Valve Body Assemblies

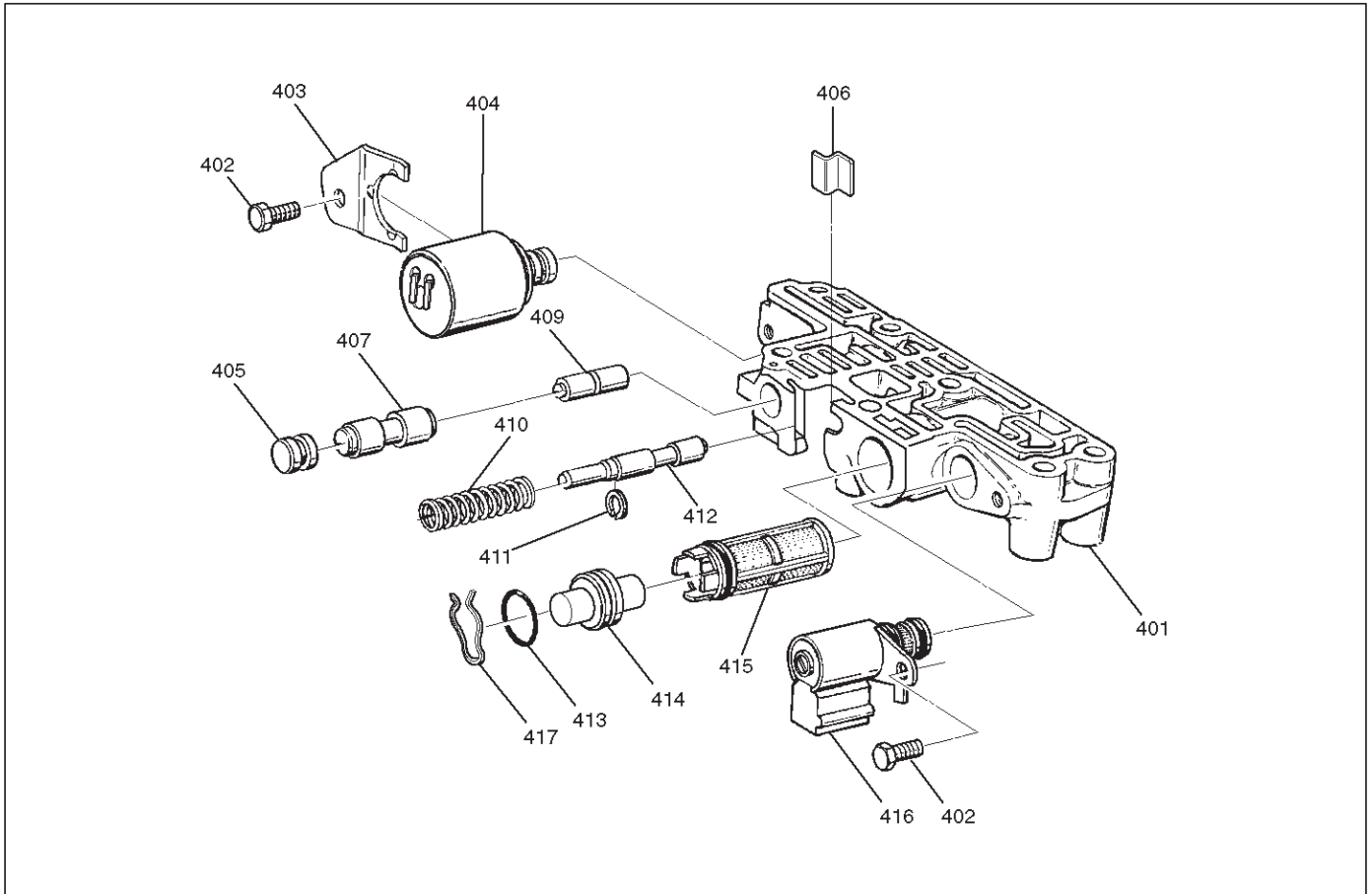


244RS009

Legend

- | | |
|---------------------------------------|---|
| (301) Body, Valve Main Case | (311) Spring, Valve Low Pressure Control |
| (302) Pin, Spring | (312) Valve, Low Pressure Control |
| (303) Solenoid Assembly, ON/OFF N.C. | (317) Ball, Check |
| (304) Valve, 1-2 and 3-4 Shift | (318) Valve, 1-2 Accumulator Control |
| (305) Spring, 1-2 and 3-4 (2-3) Shift | (320) Valve, 1-2 Accumulator |
| (306) Retainer, Valve | (321) Washer, Waved PWM Solenoid |
| (307) Solenoid Assembly, ON/OFF N.O. | (322) Pin, Solenoid PWM |
| (308) Valve, 2-3 Shift | (323) Solenoid Assembly, Band Control PWM |
| (309) Pin, Spring | (324) Screen Assembly, PWM Solenoid |
| (310) Plug, Valve Bore | (325) Plug, Screen |
| | (326) Valve, Manual |

7A-88 AUTOMATIC TRANSMISSION (4L30-E)

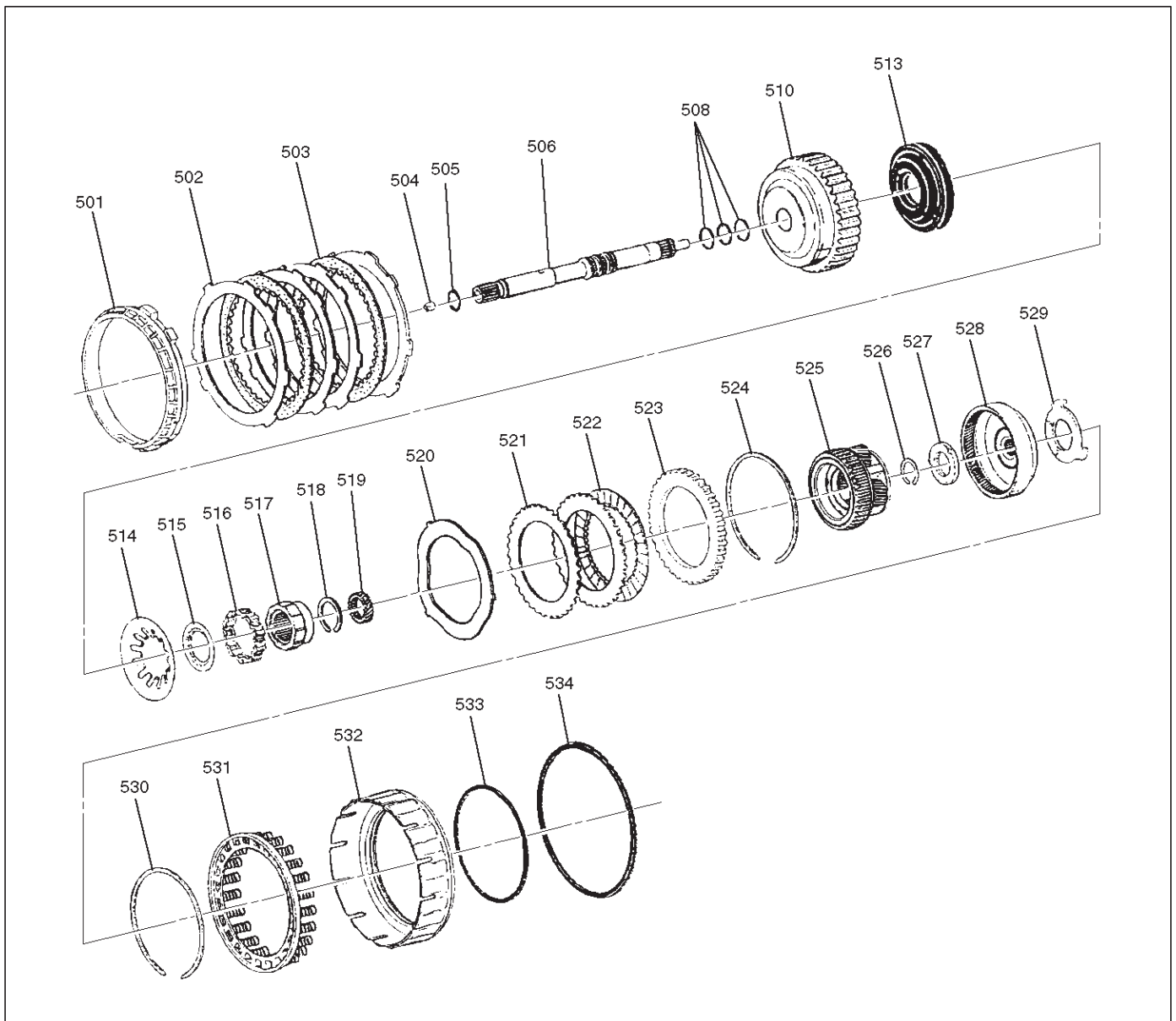


243RW003

Legend

- | | |
|--------------------------------------|---|
| (401) Body, Valve/Adapter Case | (410) Spring, Feed Limit Valve |
| (402) Screw, Solenoid Force Motor | (411) Ring, Retainer |
| (403) Retainer, Force Motor | (412) Valve, Feed Limit |
| (404) Solenoid, Force Motor | (413) Seal, O-Ring Plug Filter |
| (405) Plug, 3-4 Accumulator | (414) Plug, Screen |
| (406) Plug and Spring Retainer | (415) Screen Assembly, Force Motor |
| (407) Valve, 3-4 Accumulator | (416) Solenoid, Torque Conv. Clutch ON/OFF N.C. |
| (409) Valve, 3-4 Accumulator Control | (417) Plug Retainer |

Overdrive Internal Components

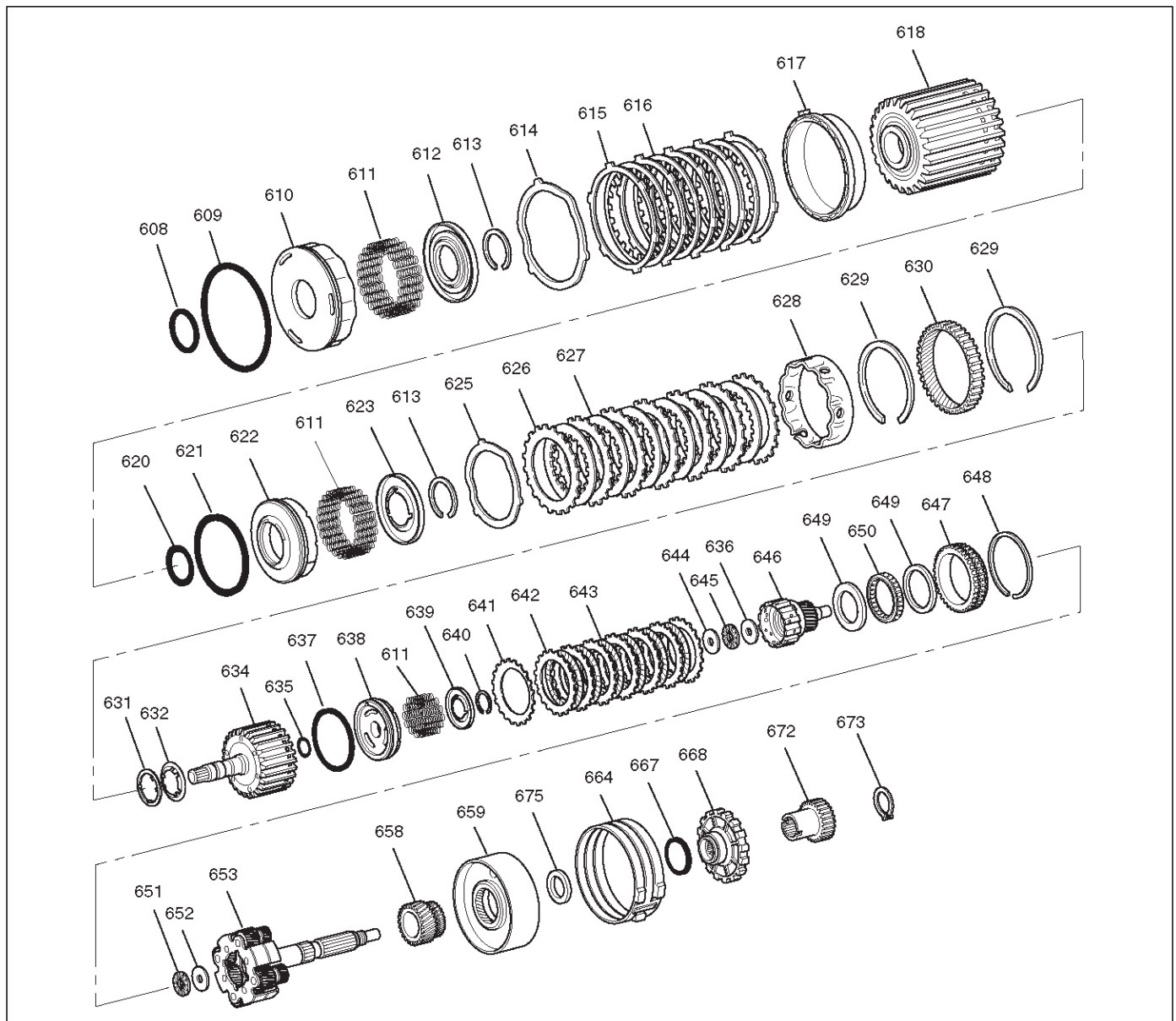


252RW003

Legend

- | | |
|---|--|
| (501) Retainer, 4th Clutch | (520) Plate, Waved/Overrun Clutch |
| (502) Plate, 4th Clutch (Steel) | (521) Plate, Overrun Clutch (Steel) |
| (503) Plate Assembly, 4th Clutch (Lined) | (522) Plate Assembly, Overrun Clutch (Lined) |
| (504) Retainer And Ball Assembly, Check Valve | (523) Plate, Backing/Overrun Clutch |
| (505) Seal, O-Ring/Turbine Shaft | (524) Ring, Snap/Overrun Clutch Housing |
| (506) Shaft, Turbine | (525) Carrier Assembly, Overdrive Complete |
| (508) Ring, Oil Seal/Turbine Shaft | (526) Ring, Snap/Turbine Shaft/Carrier |
| (510) Housing, Overrun Clutch | (527) Bearing Assembly, Thrust |
| (513) Piston, Overrun Clutch | (528) Gear, Overdrive Internal |
| (514) Spring, Overrun Clutch Release | (529) Washer, Thrust/Internal Gear/Support |
| (515) Retainer, Release Spring/Overrun Clutch | (530) Ring, Snap/Adapter/4th Clutch Spring |
| (516) Roller Assembly, Overdrive Clutch | (531) Retainer and spring assembly, 4th clutch |
| (517) Cam, Overdrive Roller Clutch | (532) Piston, 4th Clutch |
| (518) Ring, Snap/Overrun Clutch Hub | (533) Seal, 4th Clutch Piston (Inner) |
| (519) Gear, Overdrive Sun | (534) Seal, 4th Clutch Piston (outer) |

Internal Components



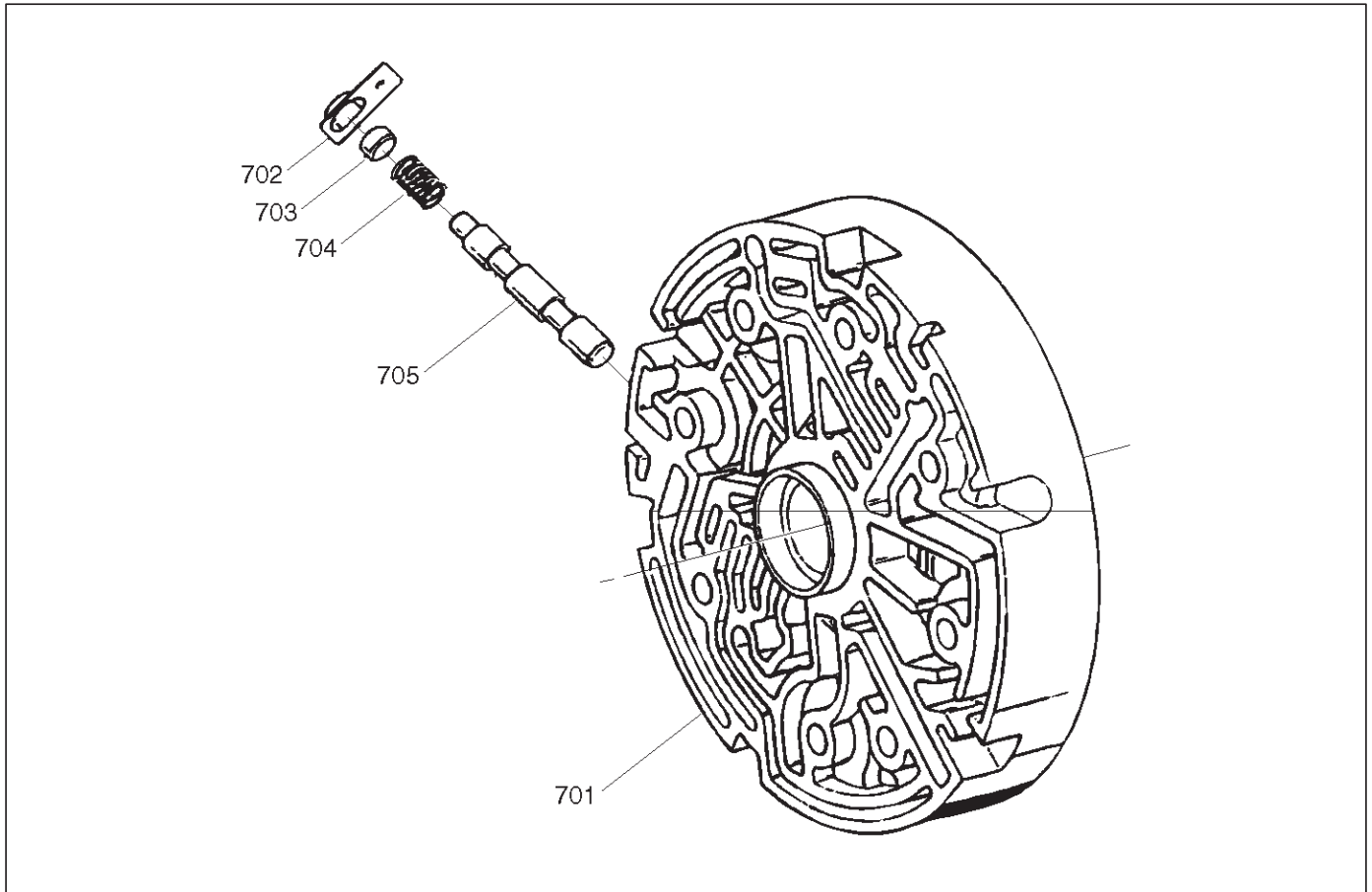
247RW002

Legend

- | | |
|--|--|
| (608) Seal, Reverse Clutch Piston (Inner) | (627) Plate Assembly, 2nd Clutch (Lined) |
| (609) Seal, Reverse Clutch Piston (Outer) | (628) Spacer, 2nd Clutch |
| (610) Piston, Reverse Clutch | (629) Ring, Retaining |
| (611) Spring, Piston Clutch | (630) Gear, Ring |
| (612) Seat, Spring/Reverse Clutch | (631) Washer, Thrust/2nd Clutch/3rd Clutch |
| (613) Ring, Retaining | (632) Thrust Washer, Clutch Hub |
| (614) Plate, Waved/Reverse Clutch | (634) Drum Assembly, 3rd Clutch |
| (615) Plate, Reverse Clutch (Steel) | (635) Seal, 3rd clutch piston (Inner) |
| (616) Plate Assembly, Reverse Clutch (Lined) | (636) Washer, Retaining |
| (617) Plate, Reverse Clutch Pressure/Selective | (637) Seal, 3rd Clutch Piston (Outer) |
| (618) Drum Assembly, 2nd Clutch | (638) Piston 3rd Clutch |
| (620) Seal, 2nd Clutch Piston (Inner) | (639) Seat, Spring/3rd Clutch |
| (621) Seal, 2nd Clutch Piston (Outer) | (640) Ring, Retaining |
| (622) Piston, 2nd Clutch | (641) Plate, Spring Cushion/3rd Clutch |
| (623) Seat, Spring/2nd Clutch | (642) Plate, 3rd Clutch (Steel) |
| (625) Plate, Waved/2nd Clutch | (643) Plate Assembly, 3rd Clutch (Lined) |
| (626) Plate, 2nd Clutch (Steel) | (644) Washer, Thrust/Input Sun |
| | (645) Bearing, Input Shaft/Gear Assembly |

- | | |
|---------------------------------------|-------------------------------------|
| (646) Gear Assembly, Input Sun | (658) Gear, Reaction Sun |
| (647) Race Assembly, Sprag | (659) Drum, Reaction Sun |
| (648) Ring, Retaining/Sprag | (664) Band Assembly, Brake |
| (649) Ring, Retaining | (667) Seal, Ring/Wheel Parking Lock |
| (650) Cage Assembly, Sprag | (668) Wheel, Parking Lock |
| (651) Bearing, Output Shaft/Input Sun | (672) Wheel, Speed |
| (652) Washer, Output Shaft/Input Sun | (673) Ring, Retaining |
| (653) Carrier Assembly, Planetary | (675) Bearing, Thrust Assembly |

Center Support Assembly



241RS010

Legend

- | | |
|----------------------|-------------------------------|
| (701) Center Support | (703) Plug, Lockout |
| (702) Retainer Plate | (704) Spring, Overrun Lockout |
| | (705) Valve, Overrun Lockout |

TRANSMISSION

TRANSMISSION CONTROL SYSTEM (4L30-E)

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Service Precaution

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

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

General Description

The 4L30-E is a 4-speed fully automatic transmission. It uses a microcomputer as a control unit to judge running conditions including throttle opening rate and vehicle speed, then it sets the shifting point in the optimum timing so that best driving performance can be achieved.

In addition, the built-in shift mode select function can select three shift modes according to the driver's preference:

- Normal mode –Normal shift pattern.
- Winter mode –Starts in 3rd gear to reduce slippage on ice or snow.
- Power mode has a delayed upshift for when more powerful acceleration is required.

Also, the built-in fail safe function ("backup mode") assures driving performance even if the vehicle speed sensor, throttle signal or any solenoid fails.

Further, the self-diagnostic function conducts diagnosis in a short time when the control system fails, thus improving serviceability.

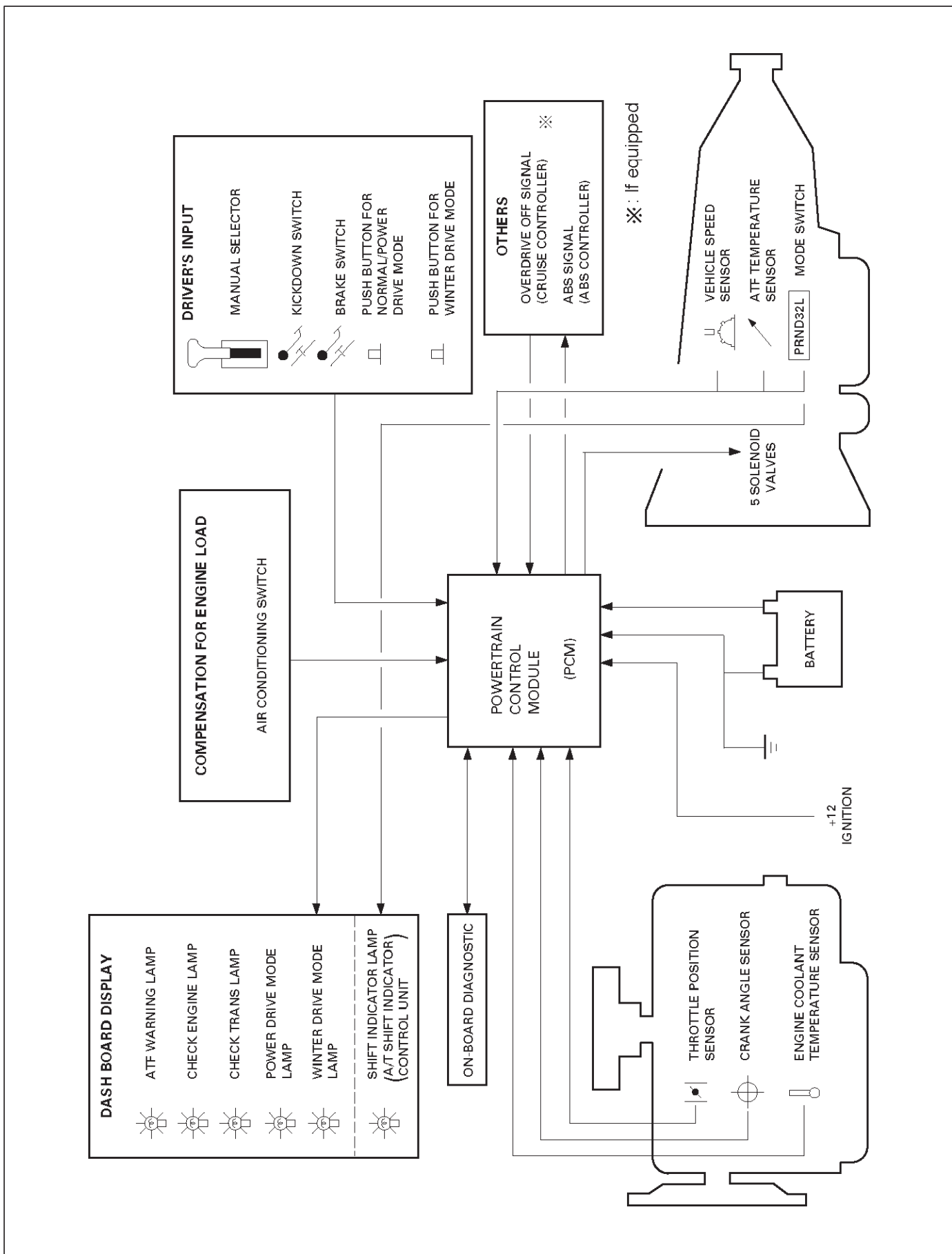
The major features of 4L30-E are as follows:

- A compact structure consisting of 2 sets of planetary gears and flat torque converter.
- Electronic control selects the optimum shift mode according to the driving conditions.
- Electronic control maintains the optimum hydraulic pressure for clutch, band brake as well as transmission so that shift feeling is improved.
- Two sets of planetary gears reduce friction of power train.

Also, a lockup mechanism in the torque converter reduces fuel consumption.

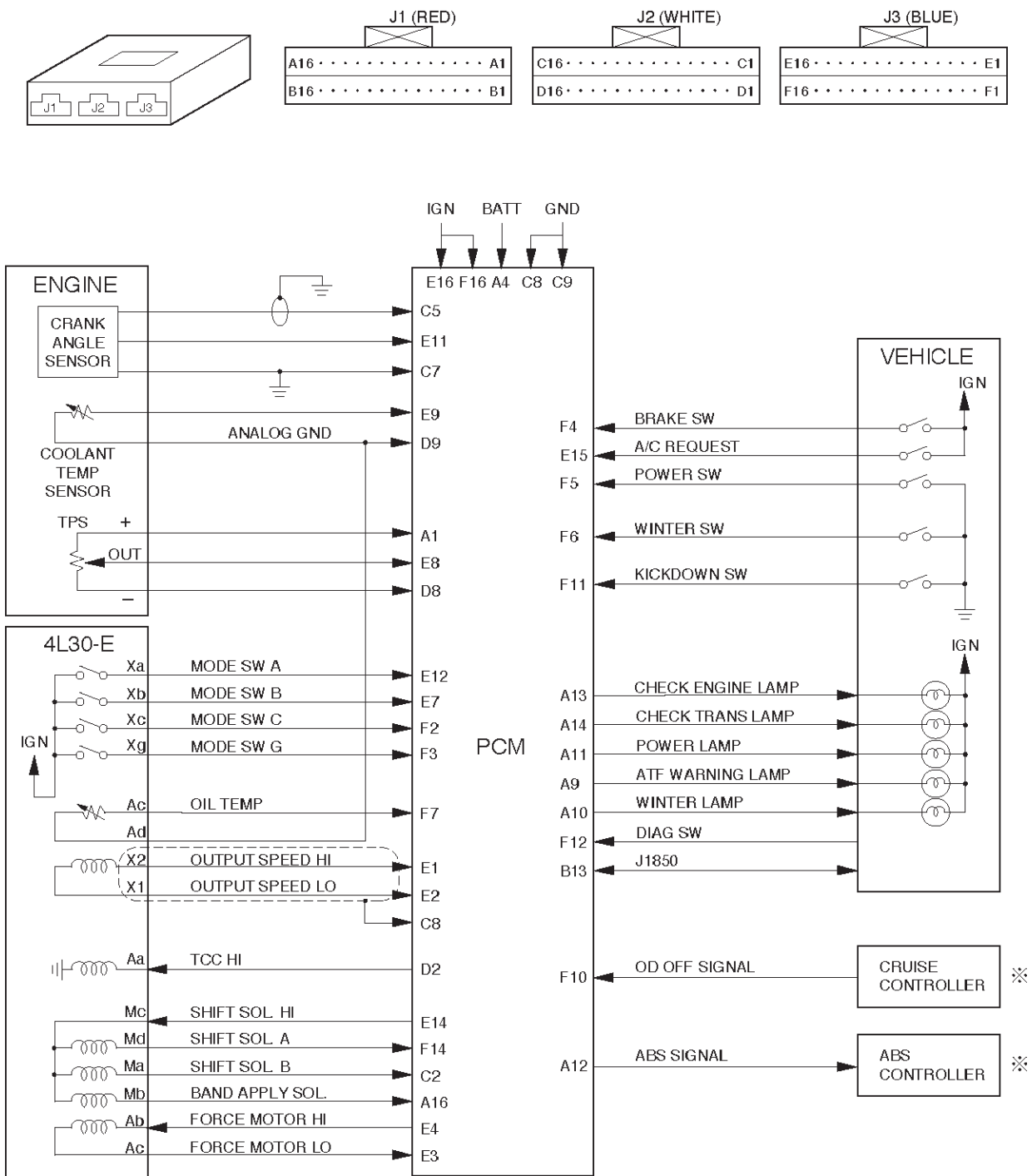
- Wide gear ratio and high torque rate of torque converter provide excellent starting performance.

Electronic Control Diagram

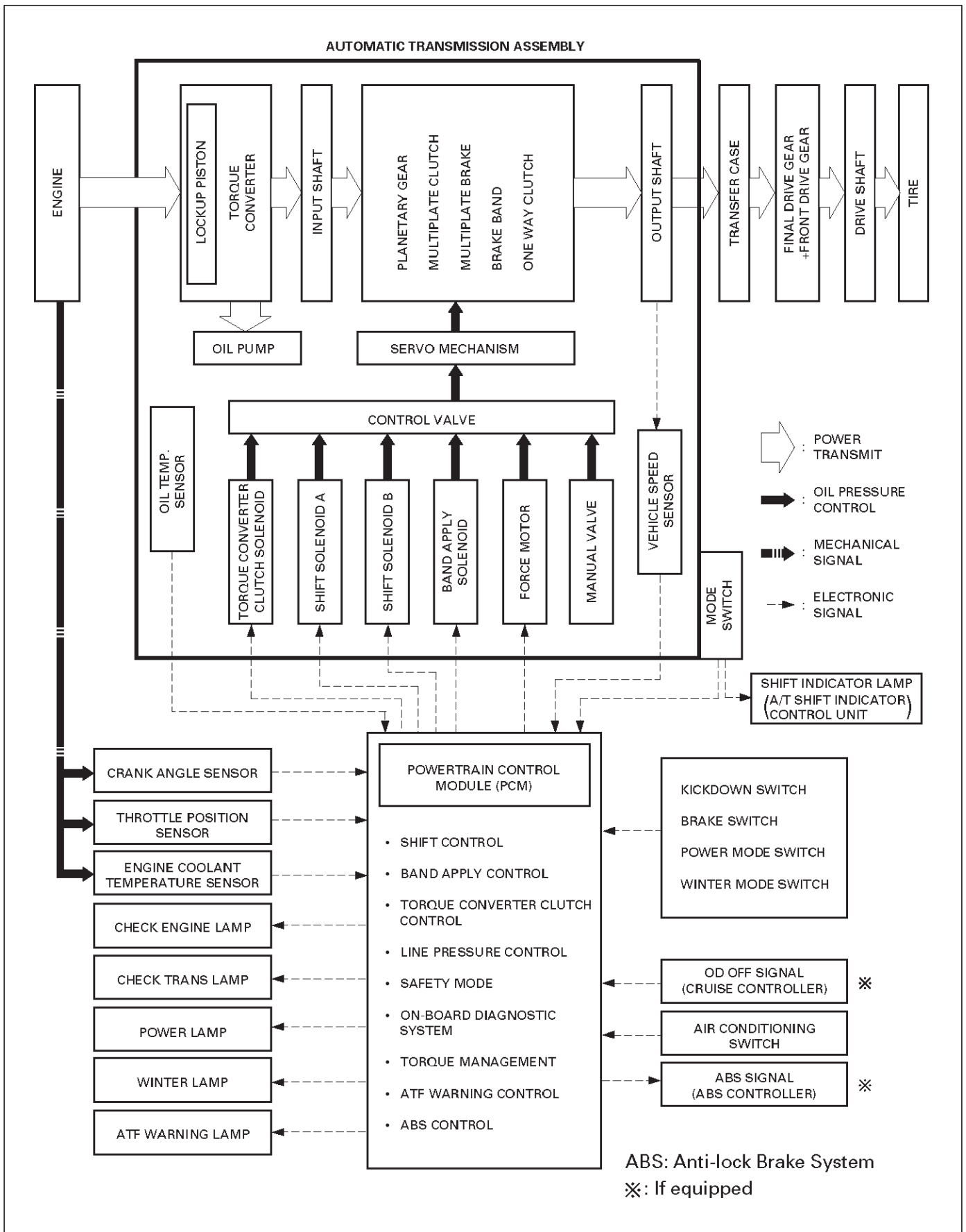


7A1-4 TRANSMISSION CONTROL SYSTEM (4L30-E)

Powertrain Control Module (PCM)



Control System Diagram



7A1-6 TRANSMISSION CONTROL SYSTEM (4L30-E)

Shift Control

The transmission gear is shifted according to the shift pattern selected by the driver. In shifting gears, the gear ratio is controlled by the ON/ OFF signal using the shift solenoid A and the shift solenoid B.

Band Apply Control

The band apply is controlled when in the 3-2 downshift (engine overrun prevention) and the garage shift (shock control).

The band apply solenoid is controlled by the signal from the Pulse Width Modulation (PWM) to regulate the flow of the oil.

Torque Converter Clutch Control

The clutch ON/OFF is controlled by moving the converter clutch valve through shifting Torque Converter Clutch (TCC) solenoid using the ON/OFF signal.

Line Pressure Control

The throttle signal allows the current signal to be sent to the force motor. After receiving the current signal, the force motor activates the pressure regulator valve to regulate the line pressure.

On-Board Diagnostic System

Several malfunction displays can be stored in the Powertrain Control Module (PCM) memory, and read out of it afterward.

The serial data lines, which are required for the testing of the final assembly and the coupling to other electronic modules, can be regulated by this function.

Fail Safe Mechanism

If there is a problem in the transmission system, the PCM will go into a "backup" mode.

The vehicle can still be driven, but the driver must use the select lever to shift gears.

Torque Management Control

The transmission control side sends the absolute spark advance signal to the engine control side while the transmission is being shifted. This controls the engine spark timing in compliance with the vehicle running condition to reduce the shocks caused by the change of speed.

ATF Warning Control

The oil temperature sensor detects the ATF oil temperature to control the oil temperature warning, TCC, and the winter mode.

ABS Control (If equipped)

When the select lever is at "L" or "R" range, a signal is sent to the ABS controller as one of the ABS control conditions.

Shift Mode Control

① Mode Type

Mode Type	Select lever position
Normal drive mode (NOR)	Entire range (excluding "R")
Power drive mode (PWR)	Entire range (excluding "R")
Winter drive mode	"D", "N", "R" and "P" range

② Mode selection

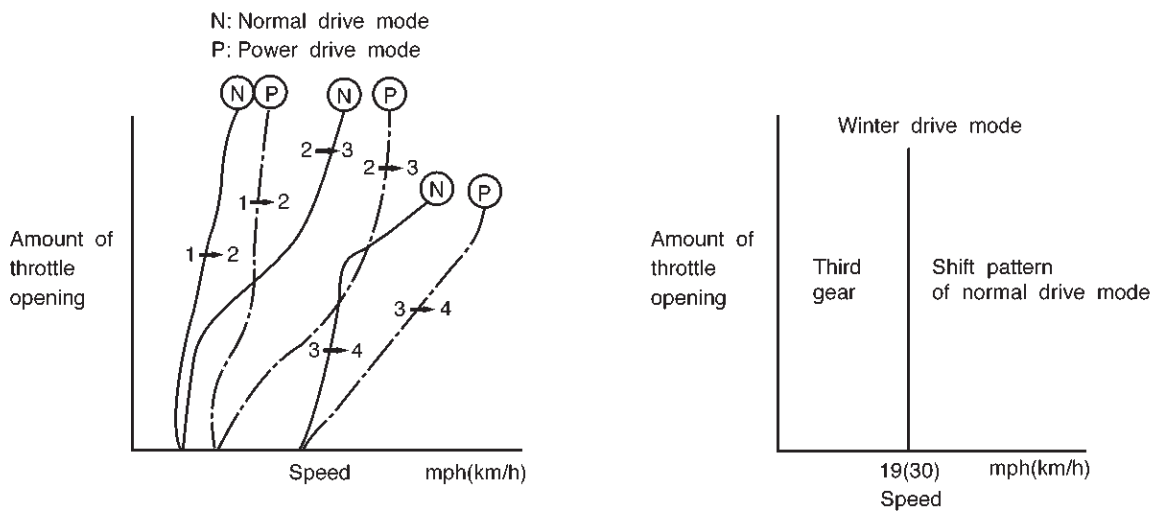
Mode Type	SWITCH (SW)		LAMP	
	POW/NOR. SW	WINTER SW	POWER DRIVE LAMP	WINTER DRIVE LAMP
Normal drive mode (NOR)	OFF	OFF	OFF	OFF
Power drive mode (PWR)	ON	OFF	ON	OFF
Winter drive mode	ON/OFF	ON	OFF	ON

However, the winter switch prevails over the PWR/NOR switch.
The mode becomes normal drive mode when the winter switch is operated from ON to OFF.

③ Comparison of mode

- (1) The normal drive mode is set at the normal shift points.
- (2) The shift points of the power drive mode are shifted to the higher speed side, compared to the normal drive mode.
- (3) The winter drive mode is a special mode used exclusively for starting in third gear.

Shift diagram



7A1-8 TRANSMISSION CONTROL SYSTEM (4L30-E)

Gear Shift Control

① Shift pattern

SELECT LEVER RANGE	SHIFT PATTERN
D (Drive)	1 ⇄ 2TCC ⇄ 3TCC ⇄ 4TCC
3 (Third)	1 ⇄ 2TCC ⇄ 3TCC ← 4TCC
2 (Second)	1 ⇄ 2TCC ← 3TCC
L (First)	1 ← 2

TCC = Torque Converter Clutch

② Gear position

The gear is selected by ON/OFF of two solenoids.

Gear \ SOL	A	B
4 (Fourth)	×	×
3 (Third)	○	×
2 (Second)	○	○
1 (First)	×	○
P (park)		
R (Reverse)	×	○
N (Neutral)		

○ = ON

× = OFF

Shift solenoid A
(Normally closed)

ON → PRESSURE TO
SHIFT VALVE

Shift solenoid B
(Normally open)

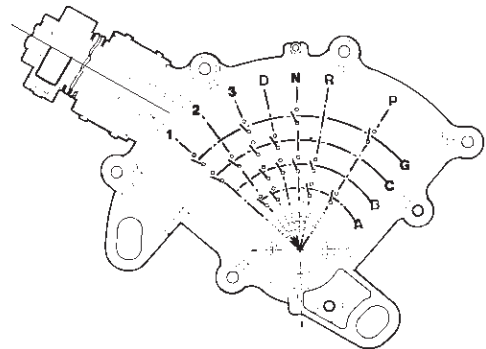
OFF → PRESSURE TO
SHIFT VALVE

③ Selecting gear position

Seven types of positions can be selected according to 5 signals from the mode switch as below.

SELECT LEVER RANGE	MODE SW TERMINALS				
	5(D)	8(A)	7(B)	6(C)	3(G)
P (park)	•	•			•
R (Reverse)	•	•	•		
N (Neutral)	•		•		•
D (Drive)	•		•	•	
3 (Third)	•	•	•	•	•
2 (Second)	•	•		•	
L (First)	•			•	•

• = Continuity



Winter Drive Mode

1. Operation

The winter switch will operate when switched on after all of the following conditions are present:

- a. The gear select position is "D", "N", "R" and "P" range.
- b. Vehicle speed is 7 mph (11 km/h) or less.
- c. Transmission oil temperature is 120°C (248°F) or less.
- d. Kickdown switch is off.
- e. Accelerator opening is at 8% or less.

2. Cancel Release

1. Cancellation by driver
 - a. Turning off the winter drive mode switch
 - b. Shifting select position to "3", "2", or "L" (Winter drive mode is not canceled by selecting "D", "N", "R", or "P")
 - c. Ignition key is turned off.
2. Automatic cancellation
 - a. When vehicle runs at 21mph (34 km/h) or more for 1 second or more
 - b. When transmission oil temperature reaches 140°C (284°F) or above

NOTE: The mode returns to normal drive mode or power drive mode after the winter drive mode is canceled.

Backup Mode

If a major system failure occurs which could affect safety or damage the transmission under normal vehicle operation, the diagnostic system detects the fault and overrides the Powertrain Control Module (PCM).

The "CHECK TRANS" light flashes to alert the driver, and the transmission must be manually shifted as follows:

Select lever position	Gear Ratio Selected
D	4 (Fourth)
Manual 3	4 (Fourth)
Manual 2	3 (Third)
Manual L	1 (First)
R	Reverse

Shifts are firmer to prevent clutch slip and consequent wear. The fault should be corrected as soon as possible.

7A1-10 TRANSMISSION CONTROL SYSTEM (4L30-E)

Functions of Input / Output Components

Components		Function
I N P U T S I G N A L	Speed sensor (fixed to transmission (T/M))	Senses rotation of output shaft and feeds the data to Powertrain Control Module (PCM).
	Throttle position sensor (TPS) (fixed to engine)	Senses the extent of throttle valve opening and the speed of the throttle valve lever motion to open the valve. Feeds the data to PCM.
	Brake Switch (SW) (fixed to brake pedal)	Senses whether the driver has pressed the brake pedal or not and feeds the information to PCM.
	Kickdown SW (fixed to accelerator pedal)	Senses whether the driver has pushed the accelerator pedal fully or not, and feeds the information to PCM.
	Mode SW (fixed to T/M)	Senses the select lever position, and feeds the information to PCM.
	Power drive SW (fixed to front console)	Senses whether the driver has selected the power mode, and feeds the information to PCM.
	T/M oil temp. sensor	Senses the T/M oil temperature and feeds the data to PCM
	Engine coolant temperature sensor	Senses the engine coolant temperature, and feeds the data to PCM.
	Engine speed signal	Feeds the signals monitoring engine speed to PCM from crank angle sensor.
	Air conditioning information	Senses whether the air conditioner has been switched on or not, and feeds the information to PCM.
	Winter switch (fixed to front console)	Senses whether the driver has selected the winter mode, and feeds the information to PCM.
	Cruise controller * (Overdrive OFF signal)	Downshift takes place when Overdrive OFF signal is received from auto cruise control unit.
O U T P U T S I G N A L	Shift solenoid A, B	Selects shift point and gear position suited to the vehicle running condition on the basis of PCM output.
	Band apply solenoid	Controls oil flow suited to the vehicle running condition on the basis of PCM output.
	Torque Converter Clutch solenoid	Controls clutch engagement/disengagement suited to the vehicle running condition on the basis of PCM output.
	Force motor (Pressure regulator valve)	Adjusts the oil pump delivery pressure to line pressure suited to the vehicle running condition on the basis of PCM output.
	Power drive mode lamp	Informs the driver whether the vehicle is in power mode or not.
	Winter drive mode lamp	Informs the driver whether the vehicle is in winter mode or not.
	T/M monitor lamp ("CHECK TRANS")	Informs the driver of failure in the system.
	ATF warning lamp	Lights when ATF oil temperature rises.
	ABS signal *	When the select lever is at "Reverse" or "L" range, sends a signal to the ABS controller as one of the ABS control conditions.

* If equipped

Diagnosis

Electronic Diagnosis

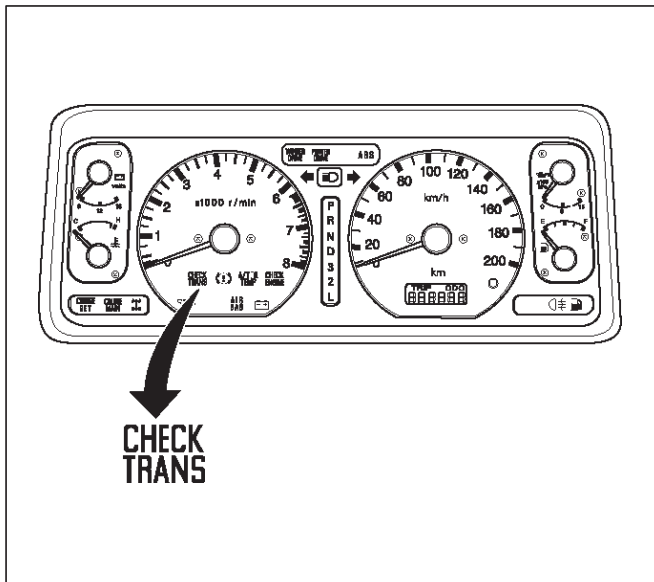
How To Diagnose The Problem

1. To avoid incorrect diagnostics, this book needs to be followed accurately. Unless stated, do not jump directly to a section that could contain the solution. Some important information may be missed.
2. The sections in CAPITALS and bold are the main sections that can be found in the contents.
3. The GOTO "**SECTION**" means to continue to check going to the "section".
4. The GOTHROUGH "**SECTION**" means to go through the "section" and then to go back to the place the GOTHROUGH was written.
5. BASIC ELECTRIC CIRCUITS:
You should understand the basic theory of electricity. This includes the meaning of voltage, amps, ohms, and what happens in a circuit with an open or shorted wire. You should also be able to read and understand wiring diagrams.

Check Trans Indicator

Find CHECK TRANS indicator and verify if it is

- A. Flashing: GOTO **DIAGNOSTIC CHECK.**
- B. Staying on: GOTHROUGH **CHECK TRANS CHECK.**
- C. Is never ON when the ignition key is turned on: GOTHROUGH **CHECK TRANS CHECK**
- D. Is ON during 2 to 3 seconds at ignition but OFF after: Normal operation. No DTC or malfunction.



Diagnostic Check

This test determines if the transmission or its inputs, outputs, connections, or sensors are failing.

1. Connect the Tech2: GOTHROUGH **Tech2 OBD II CONNECTION.**
2. Turn on the ignition but not the engine.

3. Push "F2" on Tech2 to see the Diagnostic Trouble Code (DTC):

4. Do you have a DTC?

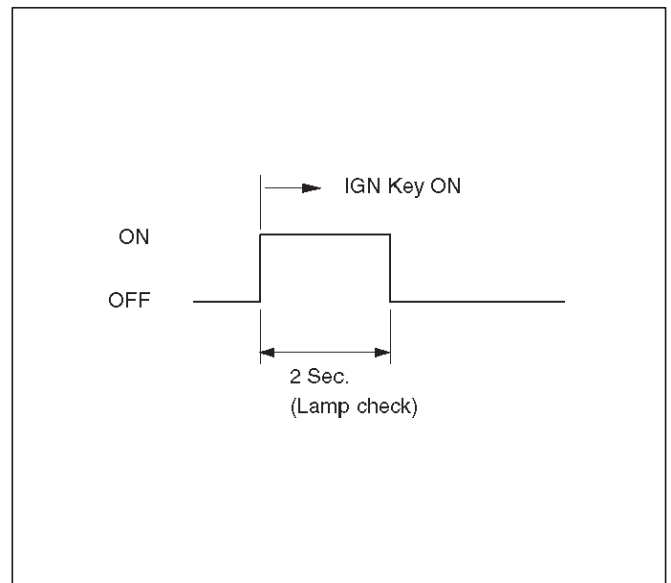
YES: write down all code numbers and do the **DTC CHECK**

NO: the DTC can not help you finding the problem.

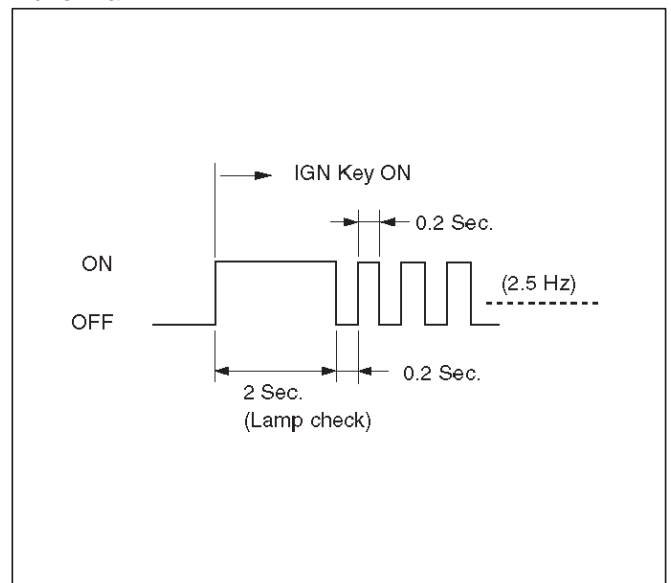
1. GOTHROUGH "**CHECK TRANS**" **CHECK**

2. IF it is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF, this means that you should have a DTC stored. Please recheck GOTO **DIAGNOSTIC CHECK** and if you find the same problem, replace the Powertrain Control Module (PCM).

Normal



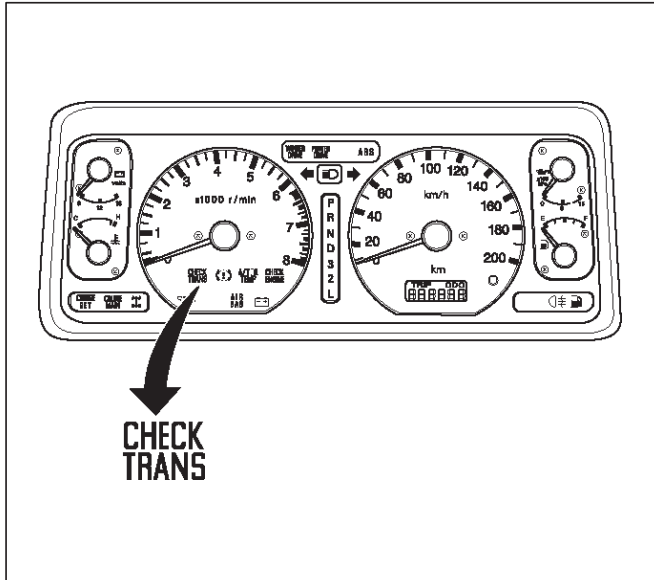
Abnormal



7A1-12 TRANSMISSION CONTROL SYSTEM (4L30-E)

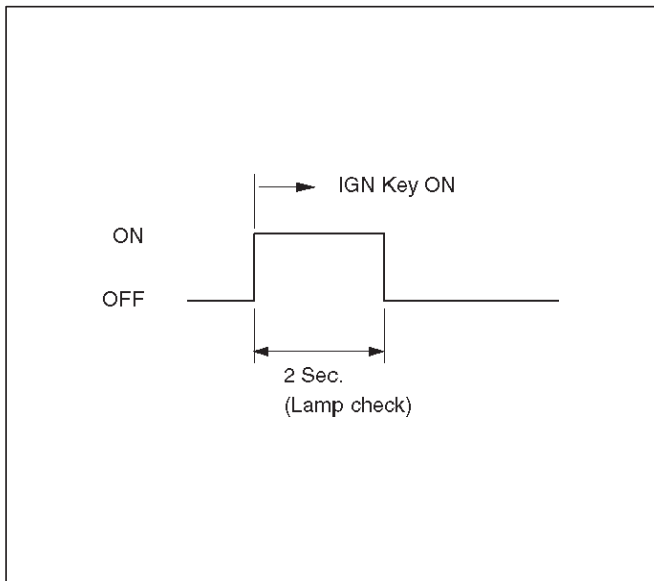
“Check Trans” Check

- Indicator is ON during 2 to 3 seconds at ignition (or when the engine is cranked) but it is OFF after the engine starts. The indicator is working normally GOTO **DIAGNOSTIC CHECK**.



821RW261

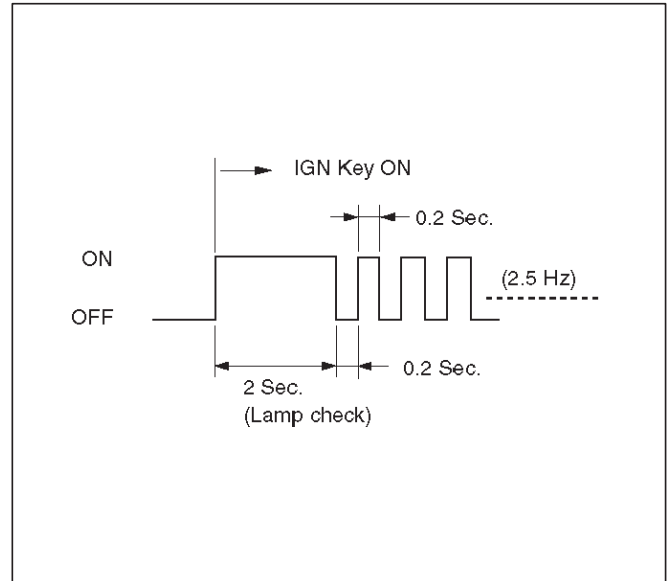
Normal



C07RW047

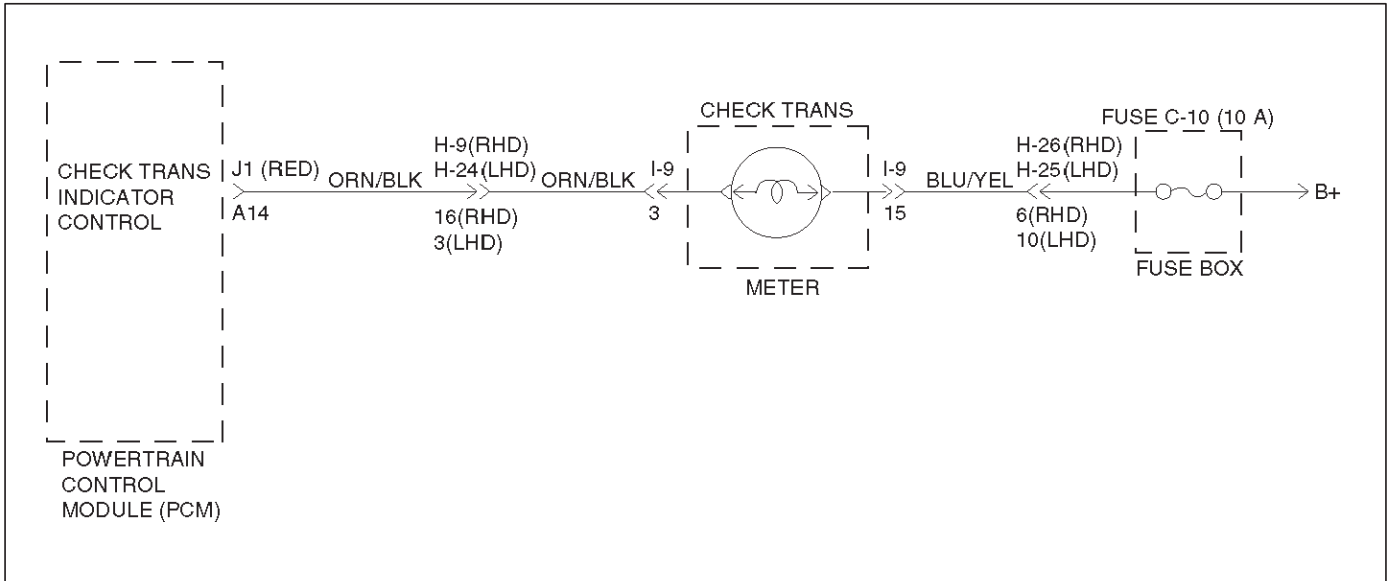
- Indicator is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF always when ignition is on (engine cranked or not). This means that there is a malfunction. GOTO **DIAGNOSTIC**

Abnormal



C07RW046

- Indicator is staying ON always when Ignition is ON.
 - This means that connection between the lamp and the PCM is shorted to ground.
 - Verify if instrument panel terminal 3 of connector I-9 is shorted to ground.
 - Verify if the PCM connector J1 (RED) terminal A14 is shorted to ground.
 - Verify that the instrument panel terminal 15 of connector I-9 is connected to battery.
 - IF problem solved: GOTO **CHECK TRANS INDICATOR**.
NO: Replace Powertrain Control Module (PCM).
- Indicator is staying OFF with the ignition ON (engine OFF).
 - This means that connection between the lamp and the PCM is shorted to battery or opened.
 - Verify if instrument panel terminal 3 of connector I-9 is shorted to battery or open.
 - Verify if the PCM connector J1 (RED) terminal A14 is shorted to battery or open.
 - Verify that the instrument panel terminal 15 of connector I-9 is connected to battery. If not, check the fuses and the connections voltage.
 - IF problem solved: GOTO **CHECK TRANS INDICATOR**.
NO: Replace Powertrain Control Module (PCM).

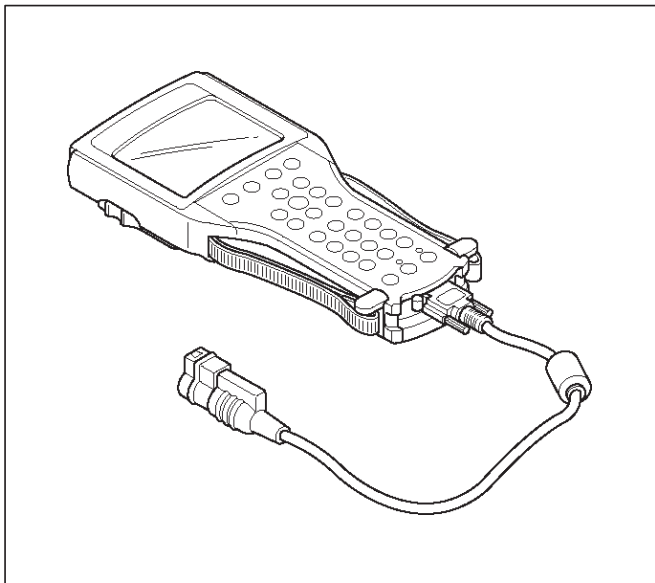


D07RW028

Tech2 OBD II Connection

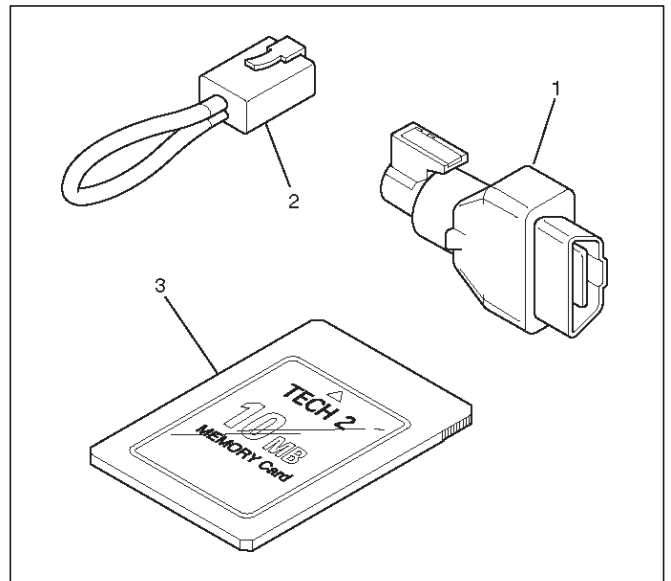
In order to access OBD II Powertrain Control Module (PCM) data, use of the Tech2 scan tool is required.

1. The electronic diagnosis equipment is composed of:
 1. Tech2 (3000094) hand-held scan tool, and DLC cable (3000095).



901RW176

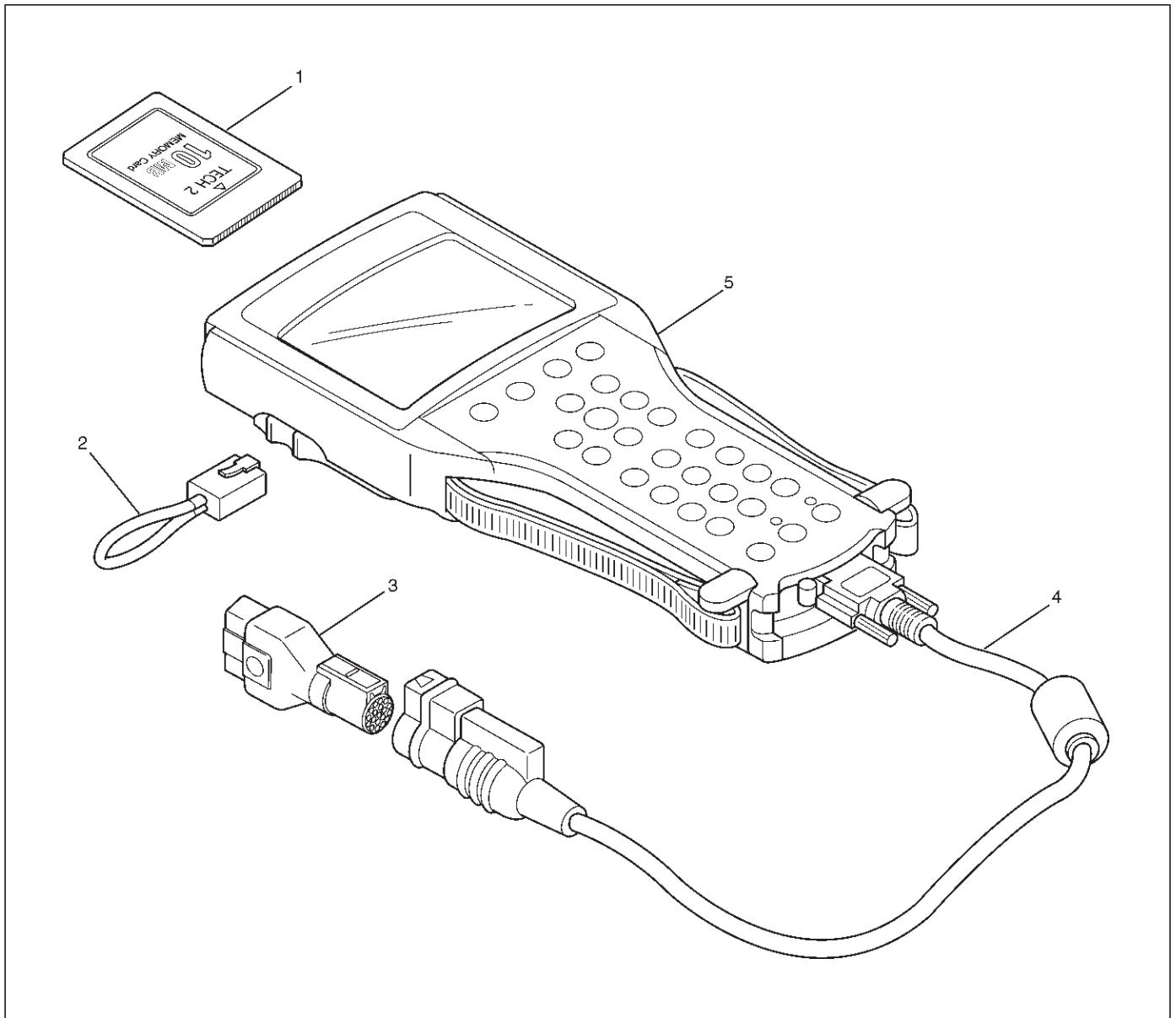
2. SAE 16/19 adapter (3000098) (1), RS 232 loop back connector (3000112) (2), and PCMCIA card (3000117) (3).



F07RW033

7A1-14 TRANSMISSION CONTROL SYSTEM (4L30-E)

2. Connecting the TECH2



901RW180

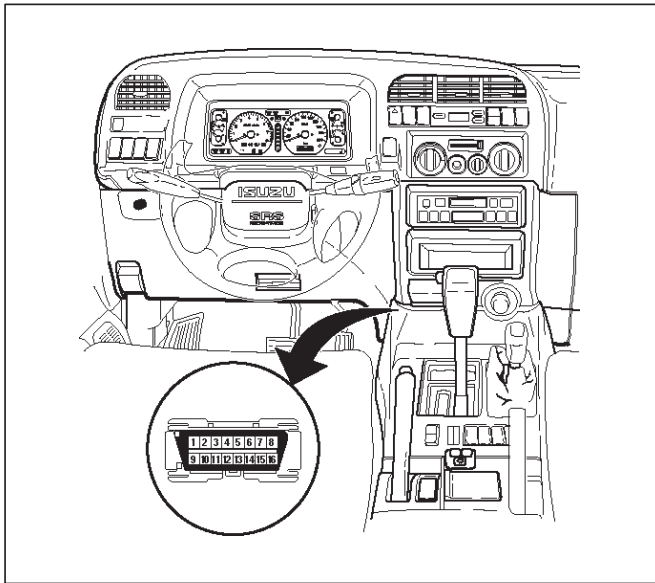
Legend

- | | |
|--------------------------------|-----------------------|
| (1) PCMCIA Card | (3) SAE 16/19 Adapter |
| (2) RS 232 Loop Back Connector | (4) DLC Cable |
| | (5) Tech2 |

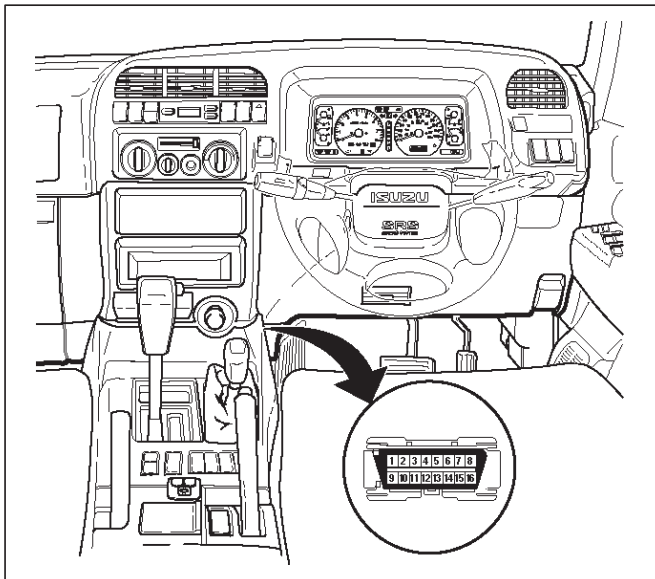
● Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.

5. Connect the Tech 2 SAE 16/19 adaptor to the vehicle DLC.



821RW262



821RW263

6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

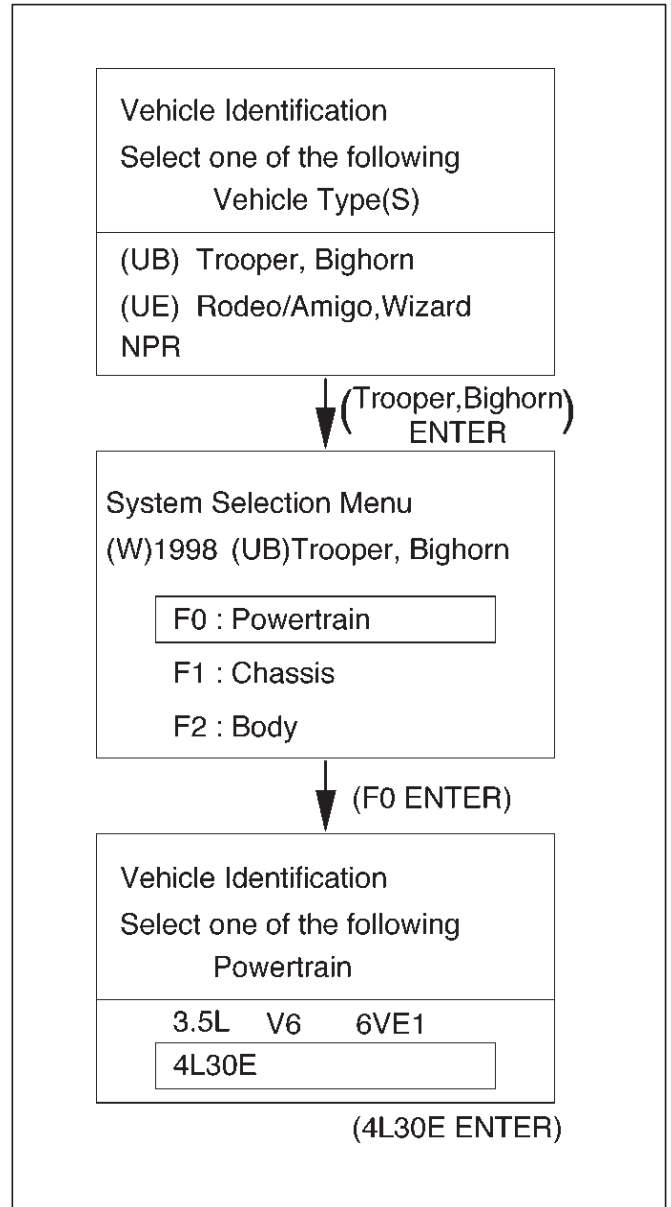
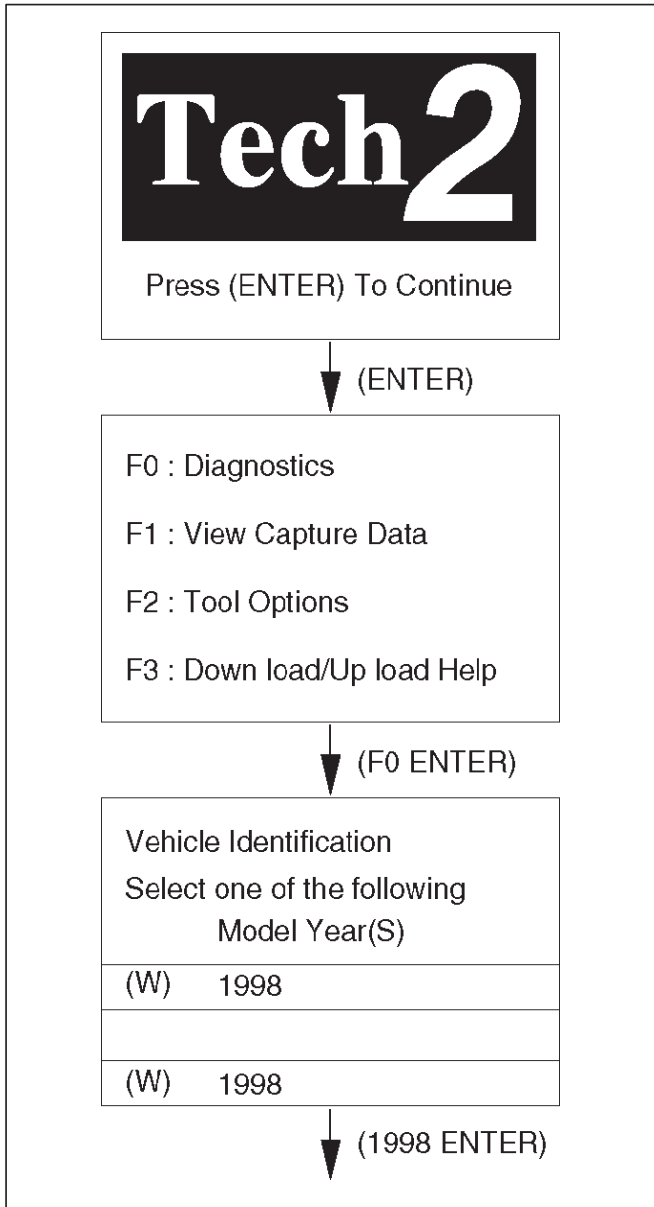


060RW009

NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

8. The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.

7A1-16 TRANSMISSION CONTROL SYSTEM (4L30-E)



Menu

- The following table shows, which functions are used the available equipment versions.

F0: Diagnostic Trouble Codes
F0: Read DTC Info Ordered By Priority
F1: Clear DTC Information
F2: DTC Information
F0: History
F1: MIL SVS or Message Requested
F2: Last Test Failed
F3: Test Failed Since Code Cleared
F4: Not Ran Since Code Cleared
F5: Failed This Ignition
F1: Data Display

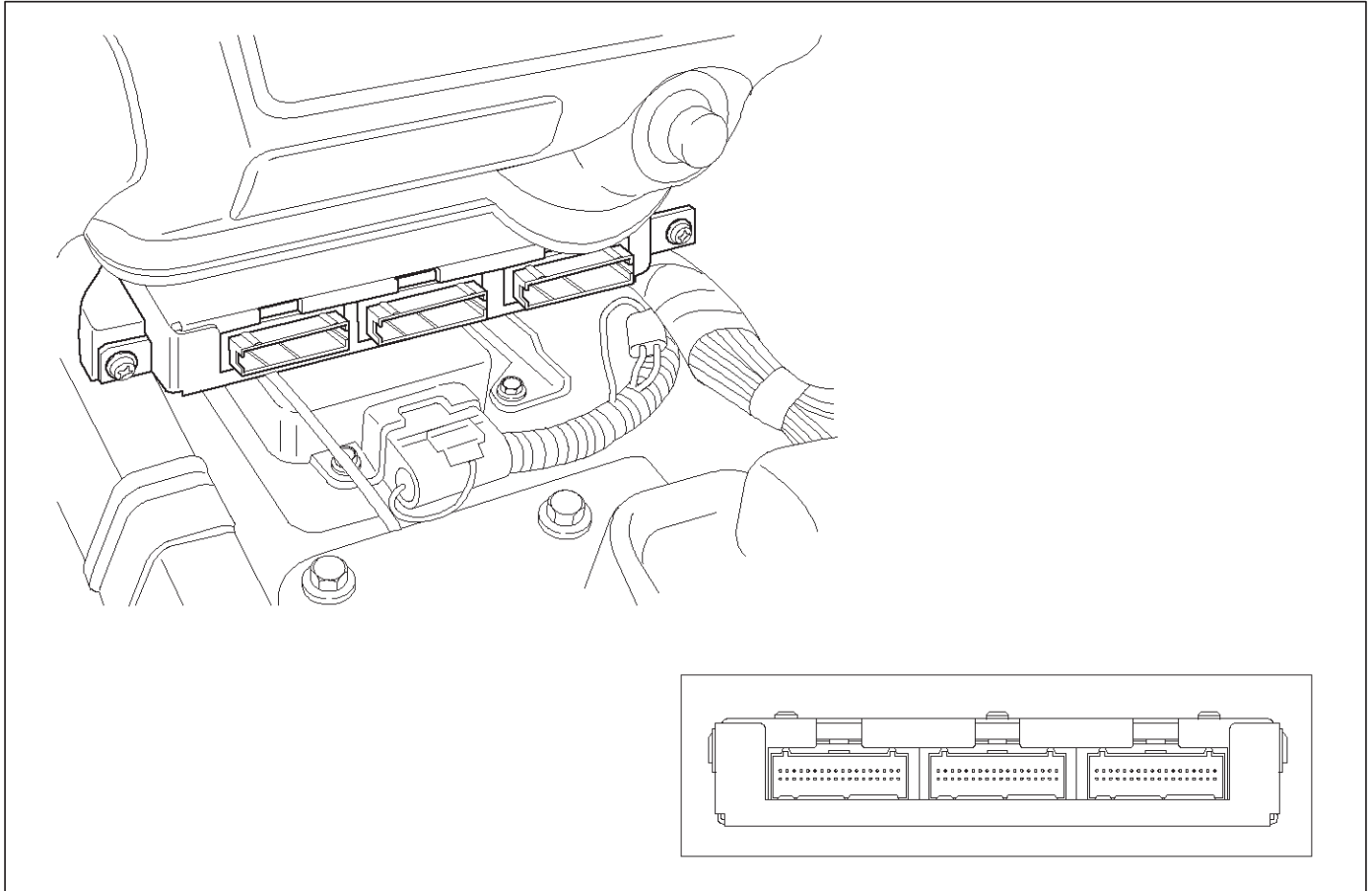
3. DVOM

When instructed to use a voltmeter or ohmmeter within a troubleshooting procedure, use only a high impedance DVOM (Digital Volt Ohmmeter) such as J-39200 or equivalent.

7A1-18 TRANSMISSION CONTROL SYSTEM (4L30-E)

OBD II Diagnostic Management System

Powertrain Control Module (PCM) Location



C07RW005

Class 2 Serial Data Bus

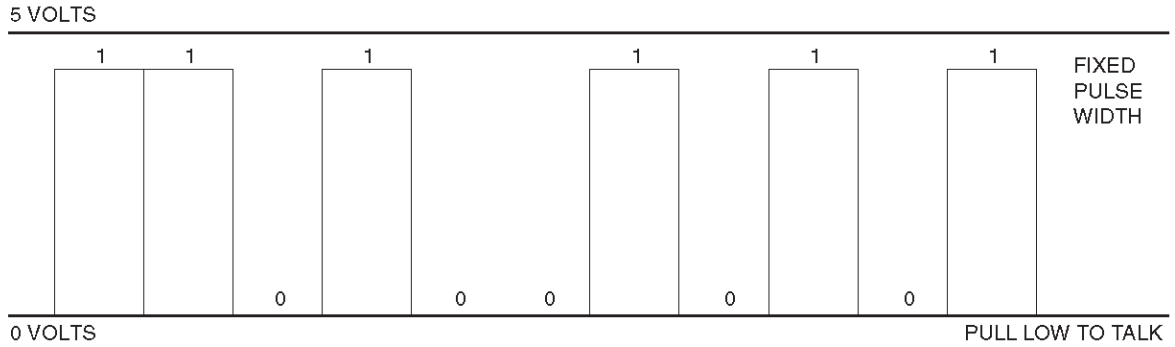
OB2 II technology requires a much more sophisticated PCM than does OB2 I technology. The OB2 II PCM diagnostic management system not only monitors systems and components that can impact emissions, but they also run active tests on these systems and components. The decision making functions of OB2 II PCMs have also greatly increased. To accommodate this expansion in diagnostic complexity, Isuzu engineers have designed the Class 2 serial data bus, which meets SAE J1850 recommended practice for serial data.

“Serial Data” refers to information which is transferred in a linear fashion – over a single line, one bit at a time. A “Data Bus” is an electronic pathway through which serial data travels.

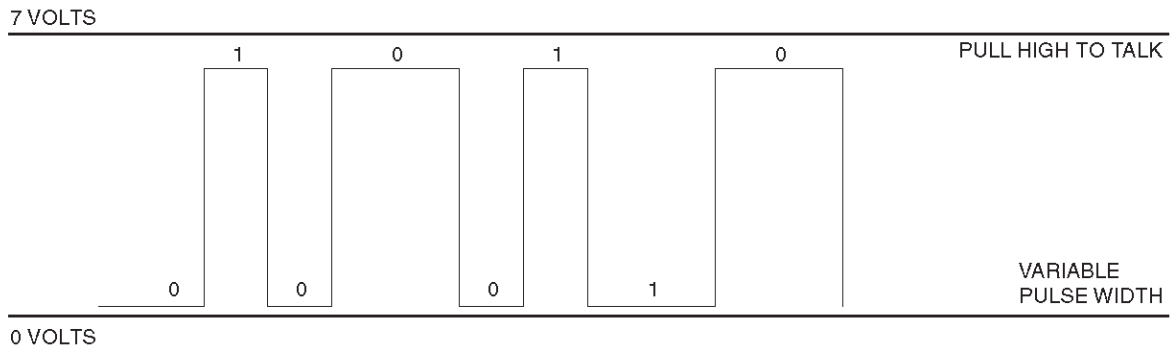
TROOPER previously used a 5 volt data bus called UART, which is an acronym for “Universal Asynchronous Receive and Transmit”. When neither the vehicle’s control module nor the diagnostic tool, such as a Tech2, are “talking,” the voltage level of the bus at rest is 5 volts. The two computers talk to each other at a rate of 8,192 bits per second, by toggling or switching the voltage on the data bus from 5 volts to ground.

Class 2 data, which is used on OB2 II vehicles, is quite different. Data is transferred at a rate of 10.4 kilobits per second, and the voltage is toggled between zero and 7 volts.

UART



CLASS 2



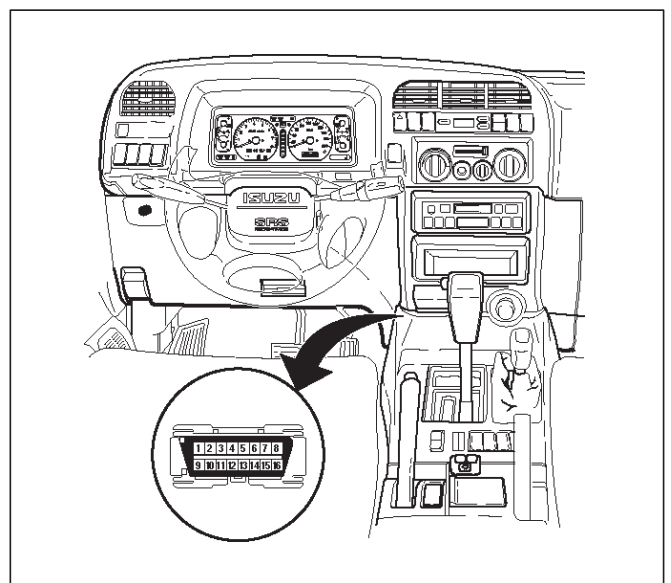
Class 2 data is also pulse width modulated. Each bit of information can have one of two lengths: long or short. On the other hand, UART data bits come in only one length (short). The pulse width modulation of Class 2 data allows better utilization of the data line.

The message carried on Class 2 data streams are also prioritized. This means that if two devices try to communication on the data line at the same time, only the higher priority message will continue. The device with the lower priority message must wait.

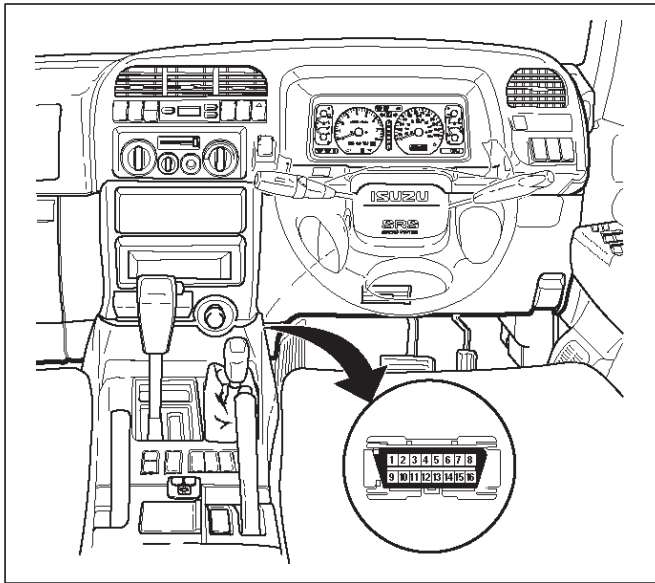
NOTE: The Class 2 data wire is always terminal 2 of the new 16-terminal Data Link Connector (DLC).

16 – Terminal Data Link Connector (DLC)

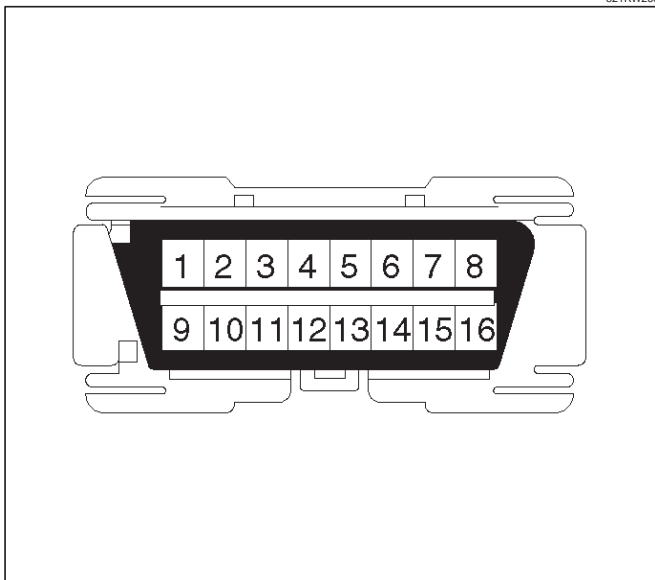
OB2 II standardizes Data Link Connector (DLC) configurations. The DLC, formerly referred to as the ALDL, will be a 16-terminal connector found on the lower left side of the driver's side instrument panel. All manufacturers must conform to this 16-terminal standard.



7A1-20 TRANSMISSION CONTROL SYSTEM (4L30-E)



821RW263



810RT022

- PIN 1 – (Not used)
- PIN 2 – J1850 Bus + L line on 2-wire systems, or single wire (Class 2)
- PIN 3 – (Not used)
- PIN 4 – Chassis ground pin
- PIN 5 – Signal ground pin
- PIN 6 – PCM diagnostic enable
- PIN 7 – (Not used)
- PIN 8 – (Not used)
- PIN 9 – Primary UART
- PIN 10 – (Not used)
- PIN 11 – (Not used)
- PIN 12 – ABS diagnostic or CCM diagnostic enable
- PIN 13 – SIR diagnostic enable
- PIN 14 – (Not used)
- PIN 15 – (Not used)
- PIN 16 – Battery power from vehicle unswitched (4 AMP MAX.)

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (“CHECK ENGINE” lamp). However, OBD II requires that it illuminate under a strict set of guidelines. Basically, the MIL is turned on when the PCM detects a DTC that will impact the vehicle’s emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if a component or system which has an impact on vehicle emissions indicates a malfunction or fails to pass an emissions-related diagnostic test. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions-related faults.

Types Of Diagnostic Trouble Codes (DTCs)

The Diagnostic Executive classifies Diagnostic Trouble Codes (DTCs) into certain categories. Each type has different requirements to set the code, and the Diagnostic Executive will only illuminate the Malfunction Indicator Lamp (MIL) for emissions-related DTCs. DTCs fall into four categories: A, B, C, and D; only types A and B are emission-related. The following descriptions define these categories:

TYPE A

Will store the DTC and turn on the MIL (“Check Engine” lamp) on the first trip in which an emission-related diagnostic test has run and reported a “test failed” to the Diagnostic Executive.

TYPE B

Will store the DTC and turn on the MIL on the second consecutive trip in which an emission-related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. After one failure, the type B DTC is “armed,” or prepared to store a history code and turn on the MIL if a second failure occurs. One passed test will disarm a type B DTC. Some special conditions apply to misfire and fuel trim DTCs. For a type B DTC to store and turn on the MIL, two ignition cycles are required.

TYPE C

Will store the DTC and turn on a “SERVICE” lamp (“Check Trans” lamp) on the first trip that a non-emission-related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. This type of DTC will be used in future applications.

TYPE D

Will store a DTC but will not turn on the MIL on the first trip that a non-emission-related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. These codes can be very helpful for vehicle service when the driver may comment about a condition, but the MIL did not turn on.

Clear DTC

NOTE: If you clear the DTC (Diagnostic Trouble Codes) you will not be able to read any codes recorded during the last occurrence.

NOTE: To use the DTC again to identify a problem, you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. IF you have a Tech2:
 1. Connect the Tech2 if it is still not connected **GOTROUGH Tech2 OBD II CONNECTION.**
 2. Push "F4" and answer "Yes" to the question "Do you really want to clear the codes?"
 - a. When a malfunction remains as it is the Tech2 displays "4L30E CODES NOT CLEARED". This means that the problem is still there or that the recovery was not done. Please **GOTO DTC CHECK.**
 - b. When a malfunction has been repaired and the recovery is done. The Tech2 displays "4L30E CODES CLEARED".
2. IF you have no Tech2:
To clear the DTC, remove Fuse "Stop, A/T CONT" (C-14, 15A) for at least 10 seconds.

DTC Check

1. Diagnostic Trouble Codes (DTC) have been identified by Tech2.
2. You have written the list of the DTCs. The order of the malfunctions has no meanings for this PCM. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTCs are sorted by number. Refer to Diagnostic Trouble Code (DTC) Identification in this section.

PCM Precaution

The PCM can be damaged by:

1. Electrostatic discharge
2. The short circuit of some terminals to voltage or to ground.

Electrostatic Discharge Damage Description:

1. Electronic components used to control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

2. There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges for the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible electrostatic discharge damage:

1. Do not touch the PCM connector pins or soldered components on the PCM circuit board.
2. Be sure to follow the guidelines listed below if servicing any of these electronic components:
3. Do not open the replacement part package until it is time to install the part.
4. Avoid touching electrical terminals of the part.
5. Before removing the part from its package, ground the package to a known good ground on the vehicle.
6. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position or while walking some distance.

Information On PCM

1. The Powertrain Control Module (PCM) is located in the center console and is the control center of the electronic transmission control system.
2. The PCM must be maintained at a temperature below 185°F (85°C) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85°C (185°F). Therefore, it is recommended that the PCM be removed or that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature process.
3. The PCM is designed to process the various inputs and then respond by sending the appropriate electrical signals to control transmission upshift, downshift, shift feel and torque converter clutch engagement.
4. The PCM constantly interprets information from the various sensors, and controls the systems that affect transmission and vehicle performance. By analyzing operational problems, the PCM is able to perform a diagnostic function by displaying DTC(s) and aid the technician in making repairs.

Intermittent Conditions

If the Tech2 displays a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present, the problem is most likely a faulty electrical

7A1-22 TRANSMISSION CONTROL SYSTEM (4L30-E)

connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the PCM.

Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:
HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro-Magnetic Interference (EMI):

HINT: Check that all wires are properly routed away from spark plug wires, distributor wires, coil, and generator. Also check for improperly installed electrical options, such as lights, 2-way radios, etc.

Use the F3 SNAPSHOT mode of the Tech2 to help isolate the cause of an intermittent fault. The snapshot mode will record information before and after the problem occurs. Set the snapshot to "trigger" on the suspect DTC. If you notice the reported symptom during the test drive, trigger the snapshot manually.

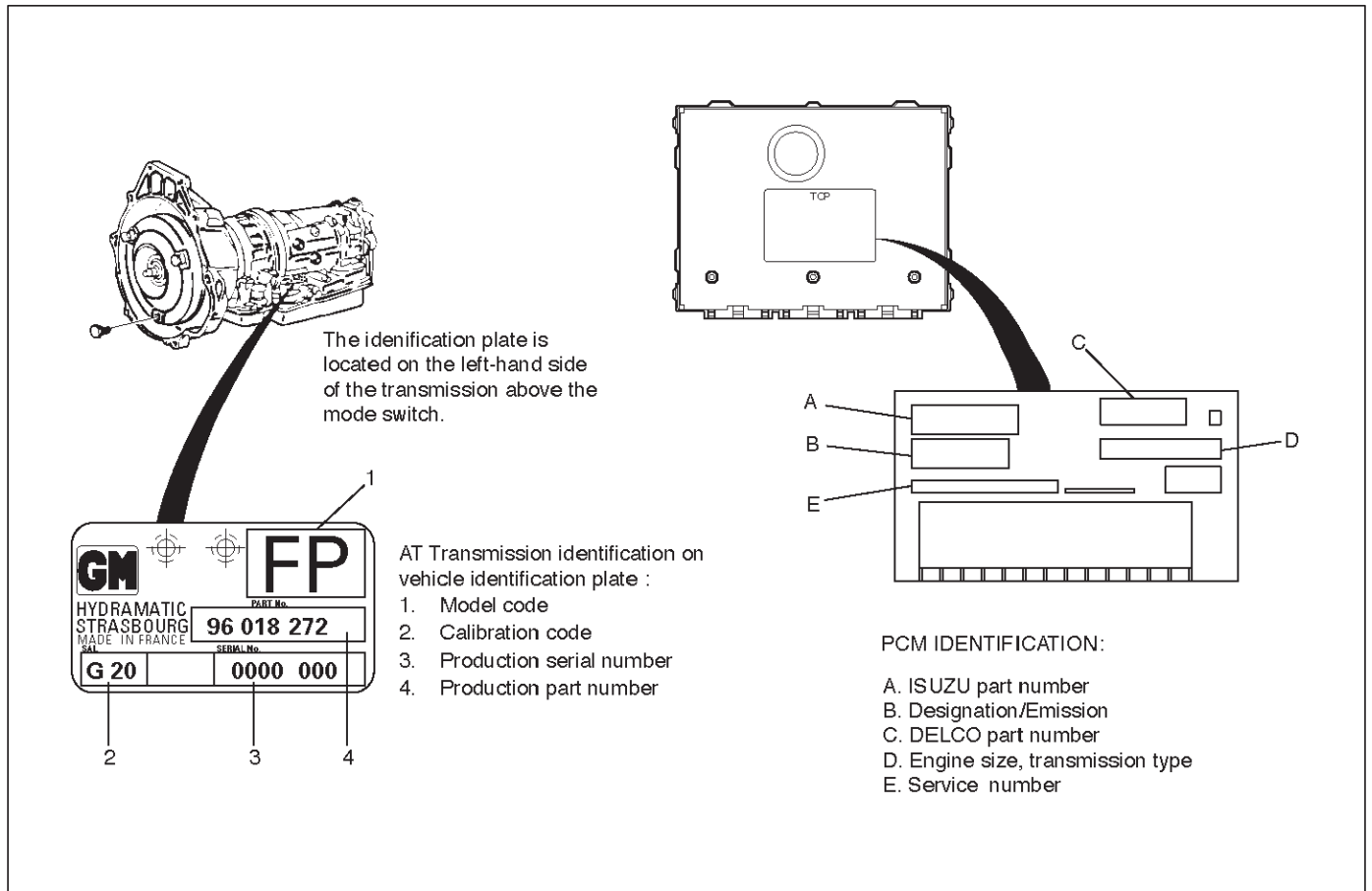
After the snapshot has been triggered, command the Tech2 to play back the flow of data recorded from each of the various sensors. Signs of an intermittent fault in a sensor circuit are sudden unexplainable jump in data values out of the normal range.

Transmission And PCM Identification

The chart below contains a list of all important information concerning rear axle ratio, Powertrain Control Module (PCM), and transmission identification.

VEHICLE		Rr axle Ratio	PCM	TRANSMISSION		
Type	Engine		ISUZU Parts No.	Calibration Code	Isuzu Part No.	Model Code
Isuzu / Trooper	3.2L V6	4.555	8-16254-949-0 8-16254-749-0 8-16253-989-0	G20	8-96018-272-3	FP (4X4)

Isuzu Trooper



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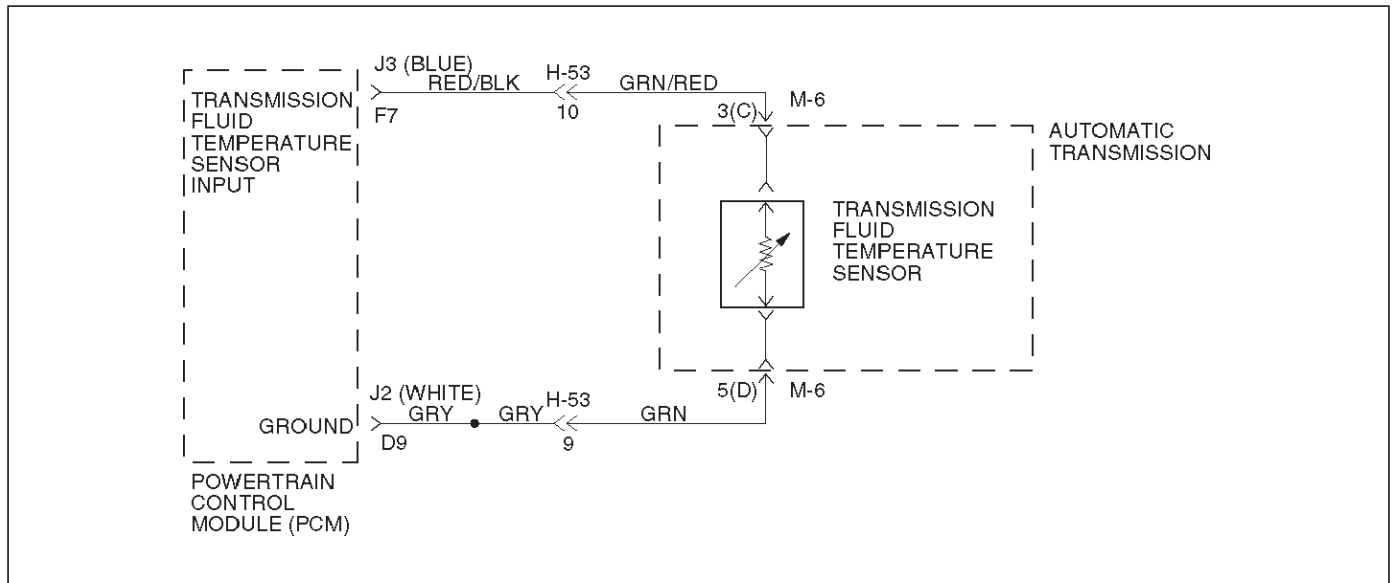
Diagnostic Trouble Code (DTC) Identification

DTC NUMBER	DTC NAME	DTC TYPE	"CHECK TRANS"
P0218	Transmission Fluid Over Temperature	D	
P0560	System Voltage Malfunction	C	Flash
P0705	Transmission Range Switch (Mode Switch) Illegal Position	D	
P0706	Transmission Range Switch (Mode Switch) Performance	D	
P0712	Transmission Fluid Temperature Sensor Circuit Low Input (TFT)	D	
P0713	Transmission Fluid Temperature (TFT) Sensor Circuit High Input	D	
P0719	TCC Brake Switch Circuit High (Stuck ON)	D	
P0722	Transmission Output Speed Sensor (OSS) Low Input	C	Flash
P0723	Transmission Output Speed Sensor (OSS) Intermittent	C	Flash
P0730	Transmission Incorrect Gear Ratio Flash	C	Flash
P0748	Pressure Control Solenoid (PCS) (FORCE MOTOR) Circuit Electrical	C	Flash
P0753	Shift Solenoid A Electrical	C	Flash
P0758	Shift Solenoid B Electrical	C	Flash
P1790	ROM Transmission Side Bad Check Sum	C	Flash
P1792	EEPROM Transmission Side Bad Check Sum	C	Flash
P1835	Kickdown Switch Always ON	D	
P1850	Brake Band Apply Solenoid Malfunction	D	
P1860	TCC Solenoid Electrical	D	

DTC TYPE	DEFINITION
C	Flashing Check Trans on 1st failure
D	No lamps

NOTE: On the following charts, refer to the Powertrain Control Module (PCM) section for the Wiring System, and the Body and Accessories section for circuit diagram details, parts location, and connector configuration.

DTC P0218 Transmission Fluid Over Temperature



D07RW029

Circuit Description

The Transmission Fluid Temperature (TFT) sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5-volt reference to the sensor on circuit RED/BLK-GRN/RED. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the fluid temperature warms to a normal transmission operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts. This DTC detects a high transmission temperature for a long period of time. This is a type "D" DTC.

Conditions For Setting The DTC

- No TFT DTCs P0712 or P0713.
- TFT is greater than 135°C (275°F).
- All conditions met for 21 seconds.

Action Taken When The DTC Sets

- Hot mode TCC Shift Pattern.
- The PCM will not illuminate the CHECK TRANS Lamp.
- ATF Lamp ON. (TFT is greater than 145°C (293°F).)
- Disable E-side TCC OFF request.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warm-up cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit RED/BLK-GRN/RED.
- Scan tool TFT sensor temperature should rise steadily to about 100°C (212°F), then stabilize.
- Check for a "skewed" (mis-scaled) sensor by comparing the TFT sensor temperature to the ambient temperature after a vehicle cold soak. A "skewed" sensor can cause delayed garage shifts or TCC complaints.
- Check for a possible torque converter stator problem.
- Verify customer driving habits, trailer towing, etc.

Test Description

The numbers below refer to the step numbers on the diagnostic chart.

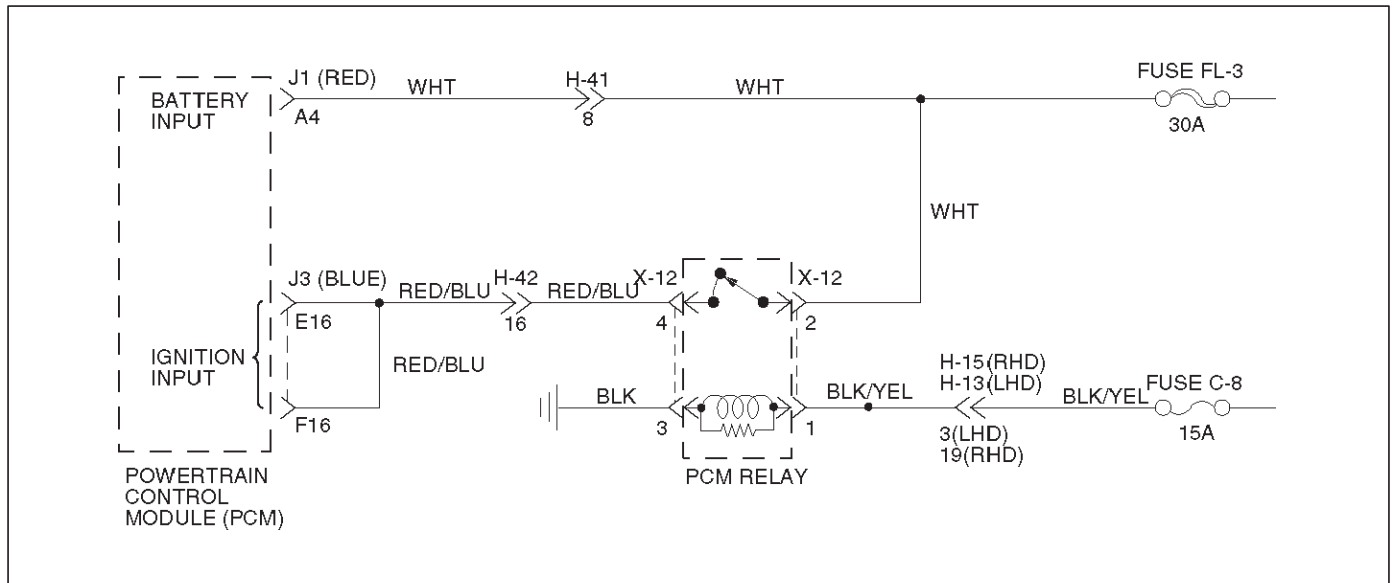
3. This test checks for a "skewed" sensor or shorted circuit.
4. This test simulates a TFT DTC P0713.

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DTC P0218 Transmission Fluid Over Temperature

Step	Action	Yes	No
1	<p>Perform the following checks:</p> <ul style="list-style-type: none"> ● Check for possible engine system problems. ● Transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30-E) Section. <p>Were the checks performed?</p>	Go to Step 2	—
2	<p>1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”.</p> <p>NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when “Clear Info” function is used.</p> <p>3. Record the DTC “Failure Records”.</p> <p>Is the TFT sensor signal voltage less than 0.33 volts?</p>	Go to Step 3	Go to Diagnostic Aids
3	<p>1. Turn the ignition “off”. 2. Disconnect the transmission 16-way connector H-53 (additional DTCs may set).</p> <p>Is the TFT sensor signal voltage greater than 4.92 volts?</p>	Go to Internal Wiring Harness Check.	Go to Step 4
4	<p>Inspect/repair circuit RED/BLK-GRN/RED for a short to ground.</p> <p>Was a problem found?</p>	Go to Step 6	Go to Step 5
5	<p>1. Inspect the PCM for poor connections. 2. Replace the PCM if no poor connections were found.</p> <p>Is the replacement complete?</p>	Go to Step 6	—
6	<p>1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: TFT is less than 125°C (257°F) for at least 10 seconds.</p> <p>2. Review the scan tool “DTC Info”.</p> <p>Has the last test failed or is the current DTC displayed?</p>	<p>Begin diagnosis again Go to Step 1</p>	<p>Repair verified Exit DTC table</p>

DTC P0560 System Voltage Malfunction



D07RW030

Circuit Description

Circuit WHT is the battery voltage feed for the PCM. Circuit RED/BLU is the ignition voltage feed for the PCM. This DTC detects a low voltage or a high voltage. This is a type "C" DTC.

Conditions For Clearing The DTC

System Voltage Low:

- Engine speed is greater than 1,000 rpm.
- System voltage is less than 10 volts at a maximum transmission temperature of 150°C (302°F).
- System voltage is less than 7.3 volts at a minimum transmission temperature of -40°C (-40°F).
- All conditions met for 4 seconds.

System Voltage High:

- System voltage is greater than 16 volts for 2 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Charging the battery with a battery charger and jump starting an engine may set DTC(s). If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw.
- Check for faulty connections at the starter solenoid or fusible link.
- Check for loose/damaged terminals at generator.
- Check belt wear/tension.

Test Description

The numbers below refer to the step numbers on the diagnostic chart.

4. This test checks charging system voltage.
5. This test checks battery voltage input at the PCM.
7. This test checks ignition voltage input at the PCM.

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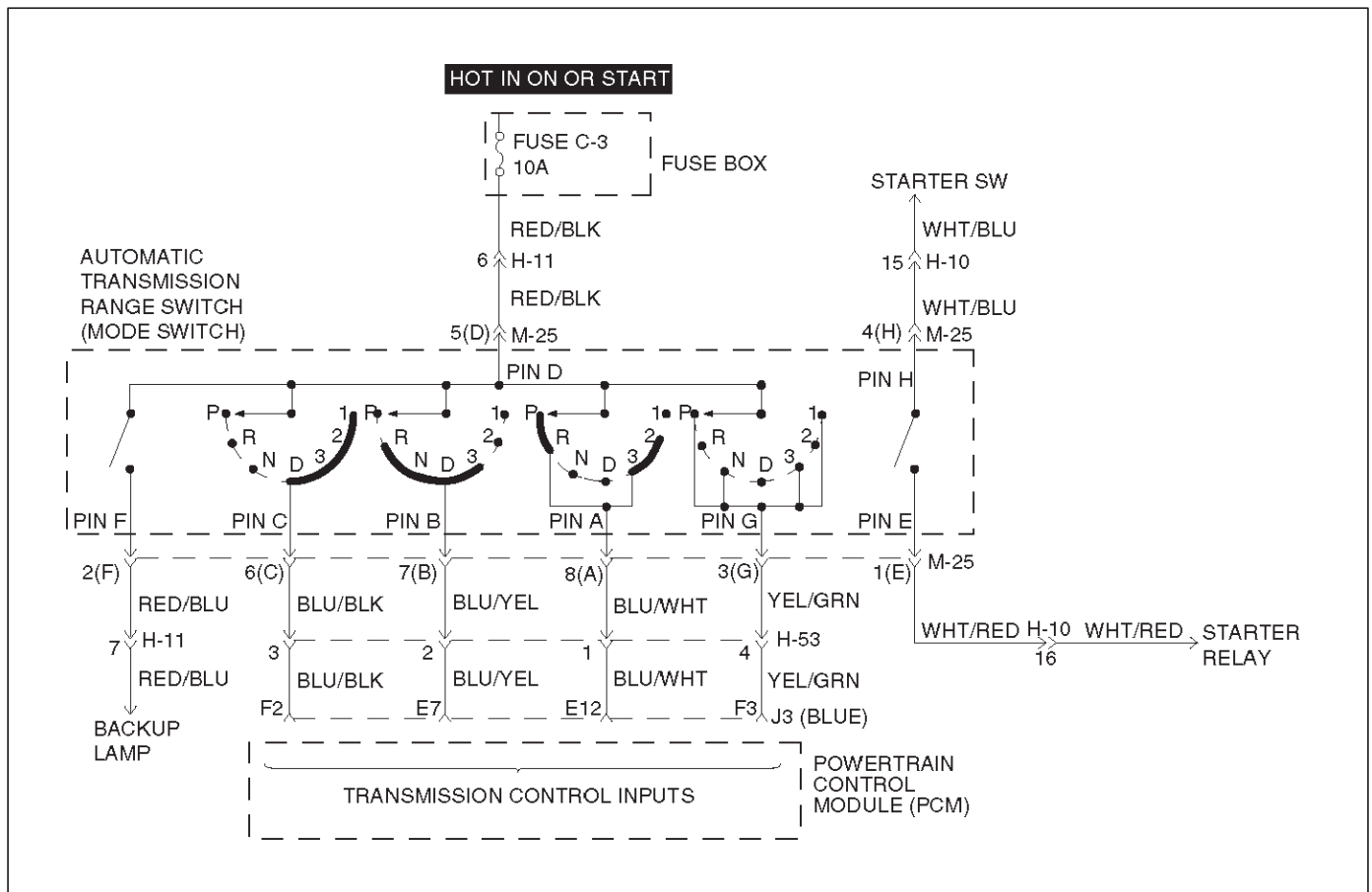
DTC P0560 System Voltage Malfunction

Step	Action	Yes	No
1	<p>1. Install the scan tool.</p> <p>2. With the engine "off", turn the ignition switch "on".</p> <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <p>3. Record the DTC "Failure Records". Note: If any other DTCs are present, refer to their applicable diagnostic charts before continuing.</p> <p>4. Using the J-39200 DVOM, measure the battery voltage across the battery terminals. Record the measurement for future reference.</p> <p>Is the voltage higher than 10.5 volts?</p>	Go to Step 2	Go to Engine Electrical in Engine section
2	<p>Start the engine and warm to normal operating temperature.</p> <p>Is the generator/check engine light "on"?</p>	Go to Starting and Charging System in Engine section	Go to Step 3
3	<p>1. Increase the engine speed to 1,000–1,500 rpm.</p> <p>2. Observe scan tool system voltage.</p> <p>Is the system voltage within 13–15 volts.</p>	Go to Step 4	Go to Starting and Charging System in Engine section
4	<p>1. Turn the ignition switch "off".</p> <p>2. Disconnect the J1 (RED) and J3 (BLUE) PCM connector (additional DTCs will set).</p> <p>3. With the engine "off", turn the ignition switch "on".</p> <p>4. Using the J39200 DVOM, measure the battery voltage input at PCM connector terminals J1–A4 and J3–E16.</p> <p>Is there a voltage variance between the voltage measured at the battery (taken in Step 1) and at terminals J1–A4 and J3–E16 that is greater than 0.5 volts?</p>	Go to Step 5	Go to Step 6
5	<p>Repair the high resistance condition in circuit WHT.</p> <p>Was the circuit repaired?</p>	Go to Step 10	—
6	<p>1. Disconnect the J3 (BLUE) PCM connector.</p> <p>2. Measure the ignition voltage input at PCM connector terminals J3–E16 and J3–F16.</p> <p>Is there a voltage variance between the voltage measured at the battery (taken in Step 1) and at terminals J3–E16 and J3–F16 that is greater than 0.5 volts?</p>	Go to Step 7	Go to Step 8
7	<p>Repair the high resistance condition in circuit RED/BLU.</p> <p>Was the circuit repaired?</p>	Go to Step 10	—
8	<p>Check PCM connector terminals J1–A4, J3–E16 and J3–F16 for bent, damaged, or backed out connector pins. Also check for weak terminal tension.</p> <p>Was a problem found?</p>	Go to Step 10	Go to Step 9

DTC P0560 System Voltage Malfunction (Cont'd)

Step	Action	Yes	No
9	Replace the PCM. Is the replacement complete?	Go to Step 10	—
10	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Start the vehicle and warm to normal operating temperature. The PCM must see a system voltage between 10 and 16 volts. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position



D07RW031

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contracts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector M-25 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is why the range switch is supplied through a 10A fuse (C-3). This fuse can burn due to a short circuit in the backup lamp.

This DTC detects when a fuse is open or the range switch circuit does not work. This is a type "D" DTC.

Conditions For Setting The DTC

- Range switch illegal positions met for 5 seconds.

Action Taken When The DTC Sets

- Default to D position.
- Inhibit torque management.
- Maximum line pressure.

- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Refer to accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

- Refer to the “Range Switch Logic Table” or “Functional Test Procedure” for further information.

Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the indicated range signal to the manual valve actually selected.
5. This test checks for continuity between each selected range switch connector terminals.

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position

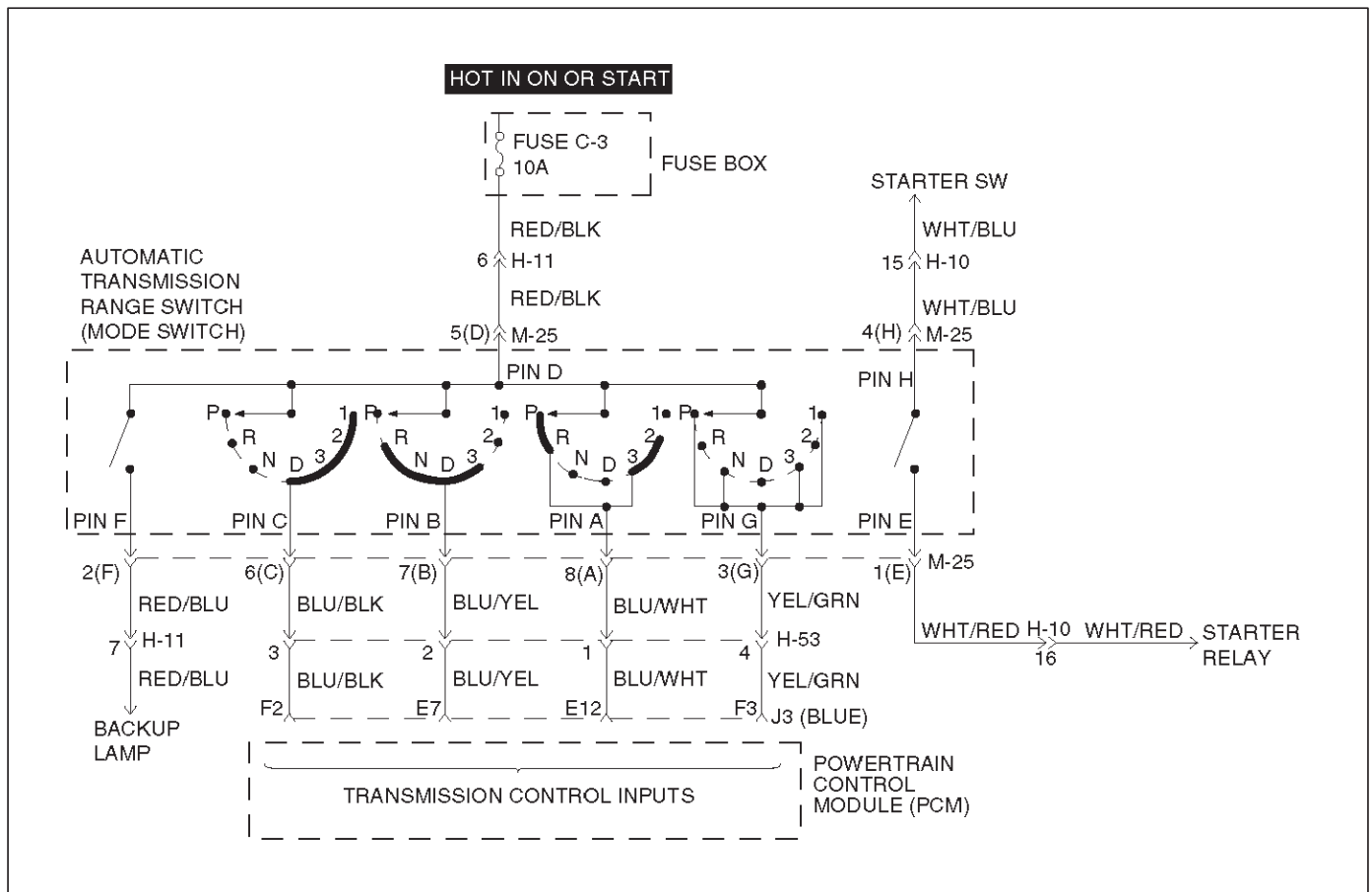
Step	Action	Yes	No
1	Perform the following checks: <ul style="list-style-type: none"> • The transmission linkage from the select lever to the manual valve is adjusted properly. • Diagnostic circuit check. Were the checks performed?	Go to Step 2	—
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Failure Records”. 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to Diagnostic Aids	Go to Step 3
3	Are all range switch pin displays incorrect?	Go to Step 4	Go to Step 5
4	Check fuse and wiring to the 8-way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30-E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 8	—
5	1. Disconnect the 8-way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8-way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to Step 6	Go to Step 7
6	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 8	—

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DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position (Cont'd)

Step	Action	Yes	No
7	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 8	—
8	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and road test the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0706 Transmission Range Switch (Mode Switch) Performance



D07RW031

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contracts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector M-25 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is why the mode switch is supplied through a 10A fuse (C-3). This fuse can burn due to a shot circuit in the backup lamp.
- This DTC detects an invalid state of the range switch or the range switch circuit by deciphering the range switch inputs. This is a type "D" DTC.

Conditions For Setting The DTC

This DTC will set if any of the following conditions occurs:

Condition 1 ("R" bad position):

- Engine is running.
- No output speed DTCP0722, P0723.

- Output speed greater than 3,200 RPM.
- Range switch indicates "R".
- All conditions met for 4 seconds.

Condition 2 ("P" or "N" bad position):

- Engine is running.
- No TPS codes.
- Engine speed is less than 3,000 RPM.
- TP angle is greater than 20%.
- Range switch indicates "P" or "N".
- All conditions met for 4 seconds.

Action Taken When The DTC Sets

- Default to "D" position.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

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Diagnostic Aids

- Refer to the accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the “Range Switch Logic Table” or “Functional Test Procedure” for further information.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the indicated range signal to the manual valve actually selected.

5. This test checks for continuity between each selected range switch connector terminals.

Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

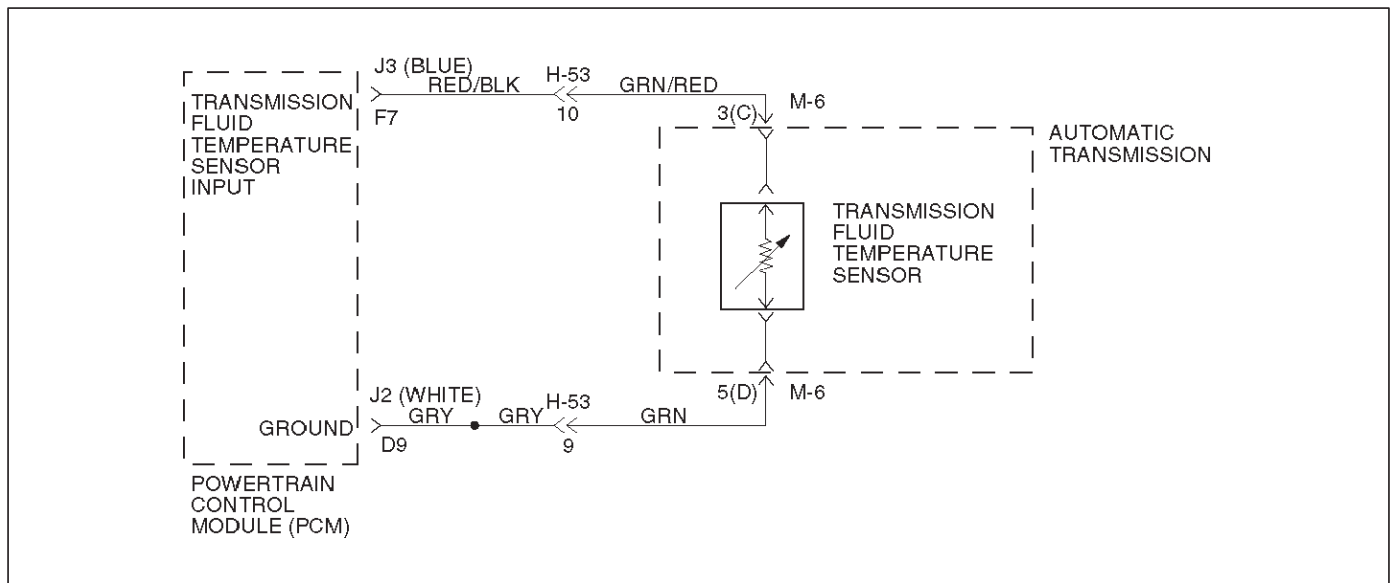
DTC P0706 Transmission Range Switch (Mode Switch) Performance

Step	Action	Yes	No
1	Perform the following checks: <ul style="list-style-type: none"> • The transmission linkage from the select lever to the manual valve is adjusted properly. • Diagnostic circuit check. <p>Were the checks performed?</p>	Go to Step 2	—
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Failure Records”. 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to Diagnostic Aids	Go to Step 3
3	Are all range switch pin displays incorrect?	Go to Step 4	Go to Step 5
4	Check fuse and wiring to the 8-way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30-E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 8	—
5	1. Disconnect the 8-way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8-way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to Step 6	Go to Step 7
6	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 8	—

DTC P0706 Transmission Range Switch (Mode Switch) Performance (Cont'd)

Step	Action	Yes	No
7	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 8	—
8	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and road test the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input



D07RW029

Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5-volt reference signal to the sensor on circuit RED/BLK-GRN/RED. When the transmission fluid is cold, the sensor resistance is high. The PCM detects high signal voltage. As the transmission fluid temperature increases to the normal operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts. With transmission fluid over temperature and DTC P0218 also set, check the transmission cooling system.

This DTC detects a continuous short to ground in the TFT signal circuit or the TFT sensor. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on".
- TFT sensor indicating a voltage less than 0.4 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:
 - 80°C (176°F) if engine temperature code is set.
 - 100°C (212°F) if engine temperature is warm.
 - 80°C (176°F) if engine run time is greater than 5 minutes.
 - 21°C (69.8°F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.

- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Check harness routing for a potential short to ground in circuit RED/BLK-GRN/RED. Scan tool TFT display should rise steadily to about 100°C (212°F), then stabilize.
- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- The temperature to resistance value scale may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor.
 - A "skewed" sensor could result in delayed garage shifts or TCC complaints.
- Verify customer driving habits, trailer towing, etc.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for a short to ground or a "skewed" sensor.
4. This test checks for an internal fault within the transmission by creating an open.

Resistance Chart

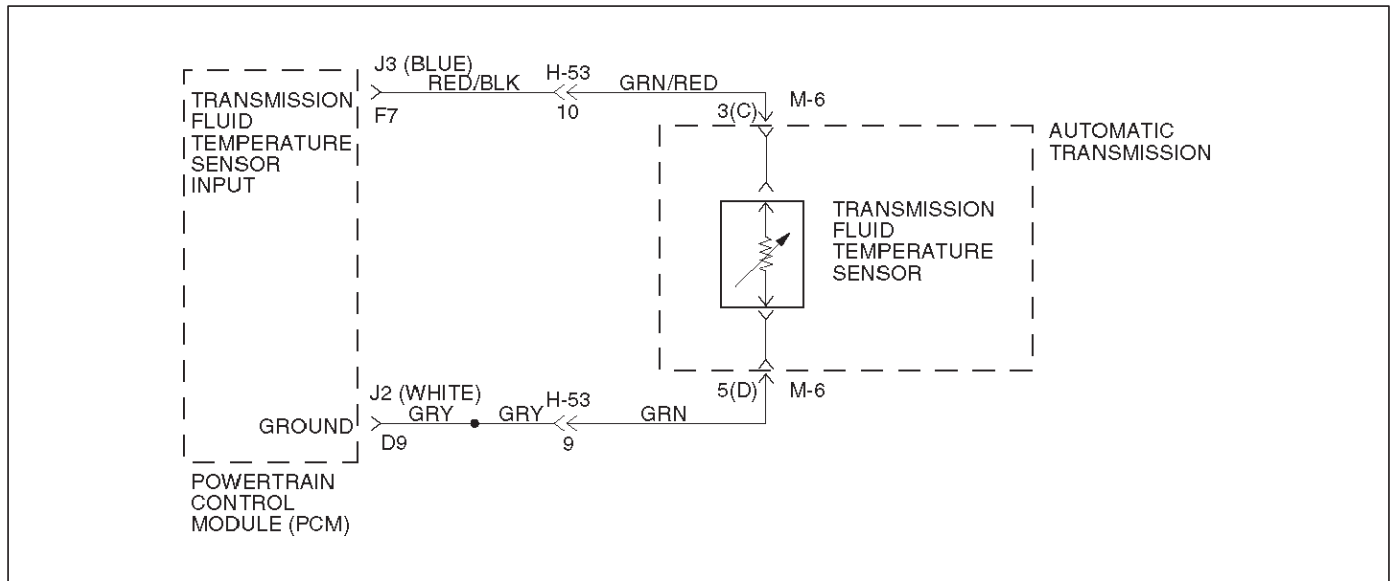
°C	°F	Resistance (k Ω)
-40	-40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input

Step	Action	Yes	No
1	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30-E) section. Was the fluid checking procedure performed?	Go to Step 2	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30-E) section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". Does the scan tool display a TFT sensor signal voltage less than 0.4 volts?	Go to Step 3	Go to Diagnostic Aids
3	1. Turn the ignition "off". 2. Disconnect the transmission 16-way connector H-53. 3. Turn the ignition "on". Does the TFT signal voltage change to match the voltage 4.92 volts?	Go to Step 4	Go to Step 9
4	Using the J39200 DVOM, measure the resistance between terminals 3(C) and 5 (D). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 5
5	1. Disconnect the transmission 5-way connector M-6. 2. Using the J39200 DVOM, measure the resistance between terminals 3(C) and 5(D). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Remove the transmission oil pan. Refer to Transmission Oil Temperature Sensor (Adapter Case) in Automatic Transmission (4L30-E) section. 2. Check the internal wiring harness for a short to ground. Was a problem found?	Go to Step 8	Go to Step 7
7	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 8
8	Replace the TFT Sensor. Is the replacement complete?	Go to Step 12	—

7A1-38 TRANSMISSION CONTROL SYSTEM (4L30-E)**DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (Cont'd)**

Step	Action	Yes	No
9	Check circuit RED/BLK-GRN/RED for a short to ground. Was a problem found?	Go to Step 12	Go to Step 10
10	Check the PCM for faulty connections. Was a problem found?	Go to Step 12	Go to Step 11
11	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 12	—
12	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT sensor indicates a voltage greater than 0.33 volts for 2 seconds. 2. Review the scan tool "DTC info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input

D07RW029

Circuit Description

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM supplies a 5-volt reference signal to the sensor on circuit RED/BLK-GRN/RED. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the transmission fluid temperature warms to the normal operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to about 1.5 to 2 volts.

This DTC detects a continuous open or short to power in the TFT signal circuit or the TFT sensor. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on".
- TFT sensor indicating a voltage greater than 4.86 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:
 - 80°C (176°F) if engine temperature code is set.
 - 100°C (212°F) if engine temperature is warm.
 - 80°C (176°F) if engine run time is greater than 5 minutes.
 - 21°C (69.8°F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.

- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100°C (212°F), then stabilize.
- The temperature to resistance value scale may be used to check the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor.

A "skewed" sensor could result in hard shifts or TCC complaints.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This check verifies problem in the TFT sensor circuit.
4. This test simulates a TFT sensor DTC P0712. If the PCM recognizes the low signal voltage (high temperature), and the scan tool displays 146°C (295°F) or greater, the PCM and wiring are OK.

7A1-40 TRANSMISSION CONTROL SYSTEM (4L30-E)

5. This test checks the TFT sensor and internal wiring harness.

Resistance Chart

°C	°F	Resistance (k Ω)
-40	-40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

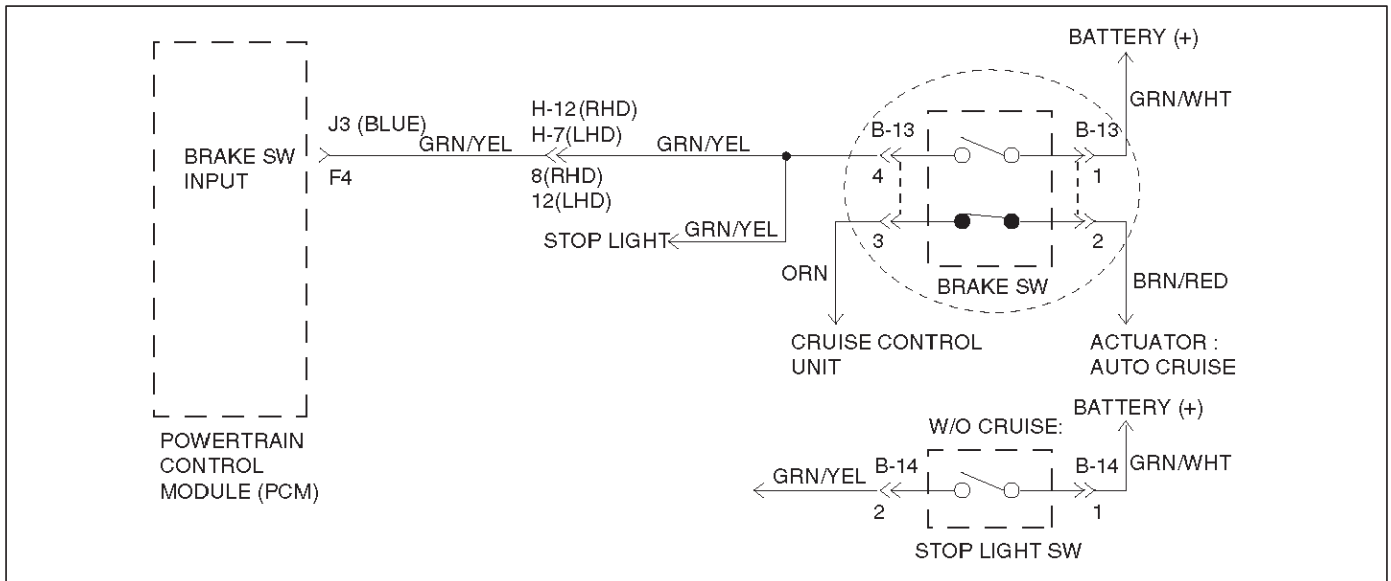
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input

Step	Action	Yes	No
1	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30-E) section. Was the fluid checking procedure performed?	Go to Step 2	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30-E) section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". Does the scan tool display a TFT sensor signal voltage greater than 4.86 volts?	Go to Step 3	Go to Diagnostic Aids
3	1. Turn the ignition "off". 2. Disconnect the transmission 16-way connector H-53. 3. Install a fused jumper wire from terminal 3(C) to 5(D) on the engine harness. 4. Turn the ignition "on". Does the TFT signal voltage drop to less than 0.4 volts?	Go to Step 4	Go to Step 9
4	1. Turn the ignition "off". 2. Using the J39200 DVOM, measure the resistance between terminals 3(C) and 5(D). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 5
5	1. Disconnect the transmission 5-way connector M-6. 2. Using the J39200 DVOM, measure the resistance between terminals 3(C) and 5(D). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Remove the transmission oil pan. 2. Check the internal wiring harness for an open. Refer to Transmission Oil Temperature Sensor (Adapter Case) in Automatic Transmission (4L30-E) section. Was a problem found and corrected?	Go to Step 13	Go to Step 7
7	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 8

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (Cont'd)

Step	Action	Yes	No
8	Replace TFT sensor. Refer to Transmission Oil Temperature Sensor (Adapter Case) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 13	—
9	Check circuit RED/BLK-GRN/RED for an open or short to B+. Was a problem found?	Go to Step 13	Go to Step 10
10	Check circuit GRY-GRN for an open. Was a problem found?	Go to Step 13	Go to Step 11
11	Check the PCM for faulty or intermittent connections. Was a problem found?	Go to Step 13	Go to Step 12
12	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: 2. TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0719 TCC Brake Switch Circuit High (Stuck On)



D07RW032

Circuit Description

The TCC brake switch is used to indicate brake pedal status. The normally opened brake switch signal voltage circuit is opened.

Brake switch supplies a B+ signal on circuit GRN/YEL to the PCM when the brakes are applied. The PCM uses this signal to deenergize the TCC solenoid when the brakes are applied.

This DTC detects a closed brake switch during accelerations. This is a type "D" DTC.

Conditions For Setting The DTC

- No OSS DTCs P0722 or P0723.
- The PCM detects a closed brake switch/circuit (12 volts) for 2 seconds, and the following events occur seven consecutive times: vehicle speed is less than 8 km/h (5 mph); then vehicle speed is between 8 and 32 km/h (5 and 20 mph) for 4 seconds; then vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.

Action Taken When The DTC Sets

- If throttle opening is greater than 10% and vehicle speed is greater than 45 km/h (28 mph), then disregard brake switch contingency for TCC off mode.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.

- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and TCC brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for voltage at the brake switch.
6. This test checks the brake switch.
9. This test checks circuit GRN/YEL at the PCM.

DTC P0719 TCC Brake Switch Circuit High (Stuck On)

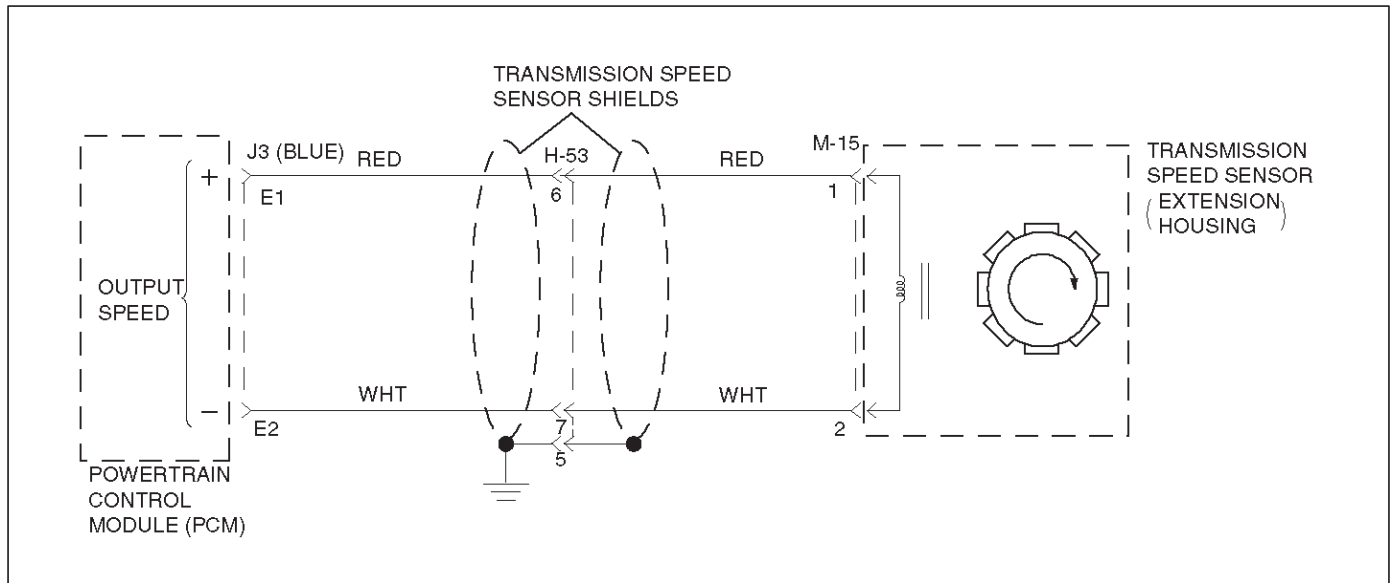
Step	Action	Yes	No
1	<p>1. Install the scan tool.</p> <p>2. With the engine "off", turn the ignition switch "on". If ABS code is set, check applicable fuse.</p> <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <p>3. Record the DTC "Failure Records".</p> <p>4. Apply then release the brake pedal.</p> <p>Does the scan tool display "TCC Brake Switch" as "closed" with the brake pedal applied, and then display "open" when the brake pedal is released?</p>	Go to Diagnostic Aids	Go to Step 2
2	<p>1. Connect the test light to ground.</p> <p>2. Back probe ignition feed circuit terminal B13-1 at the brake switch.</p> <p>Is the test light "on"?</p>	Go to Step 3	Go to Step 4
3	<p>1. Connect the test light to ground.</p> <p>2. Back probe circuit terminal B13-4 at the brake switch.</p> <p>Is the test light "off"?</p>	Go to Step 7	Go to Step 5
4	<p>Repair the open in battery feed circuit terminal B13-1 to the brake switch.</p> <p>If fuse is open, check circuit terminal B13-4 for a short to ground.</p> <p>Is the repair complete?</p>	Go to Step 13	—
5	<p>Disconnect brake switch connector B-13 and ignition switch "on".</p> <p>Is the test light "on"?</p>	Go to Step 8	Go to Step 6
6	<p>Check the brake switch short (B13-1 and B13-4).</p> <p>Was a problem found?</p>	Go to Step 9	Go to Step 10
7	<p>Check circuit terminal B13-4 for a short to voltage.</p> <p>Ignition switch "on".</p> <p>Is the test light "on"?</p>	Go to Step 8	Go to Step 10
8	<p>1. Disconnect the J3 (BLUE) PCM connector.</p> <p>2. Check circuit terminal B13-4 for a short to voltage.</p> <p>Was a problem found?</p>	Go to Step 13	Go to Step 10
9	<p>Replace the brake switch.</p> <p>Is the replacement complete?</p>	Go to Step 13	—
10	<p>1. Turn the ignition "off".</p> <p>2. Reconnect the J3 (BLUE) PCM connector.</p> <p>3. Turn the ignition "on".</p> <p>Does the scan tool display "TCC Brake Switch" as "open" with the brake applied, then display "closed" with the brake pedal released?</p>	Go to Diagnostic Aids	Go to Step 11
11	<p>Check the PCM for faulty or intermittent connections.</p> <p>Was a problem found and corrected?</p>	Go to Step 13	Go to Step 12

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DTC P0719 TCC Brake Switch Circuit High (Stuck On) (Cont'd)

Step	Action	Yes	No
12	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: The PCM brake switch signal must indicate 0 volts for 1 seconds with the brake pedal applied. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0722 Transmission Output Speed Sensor (OSS) Low Input



D07RW006

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type "C" DTC.

Conditions For Setting The DTC

- No MAP DTCs P0107 or P0108, P0106, P1106, P1107.
- No TPS DTCs P0122 or P0123.
- Not in Park or Neutral.
- TP angle is greater than 10%.
- Engine vacuum is between 0 and 70kPa.
- Engine speed is between 3,000 and 7,000 rpm.
- Transmission output speed is less than 0 rpm.
- All conditions met for 5 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool. The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- An OSS DTC P0722 will set when no output speed is at detected at start off.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

5. This test checks the OSS circuit.
6. This test checks the integrity of the OSS.
8. This test checks the 5-volt and ground circuit of the PCM.

7A1-46 TRANSMISSION CONTROL SYSTEM (4L30-E)

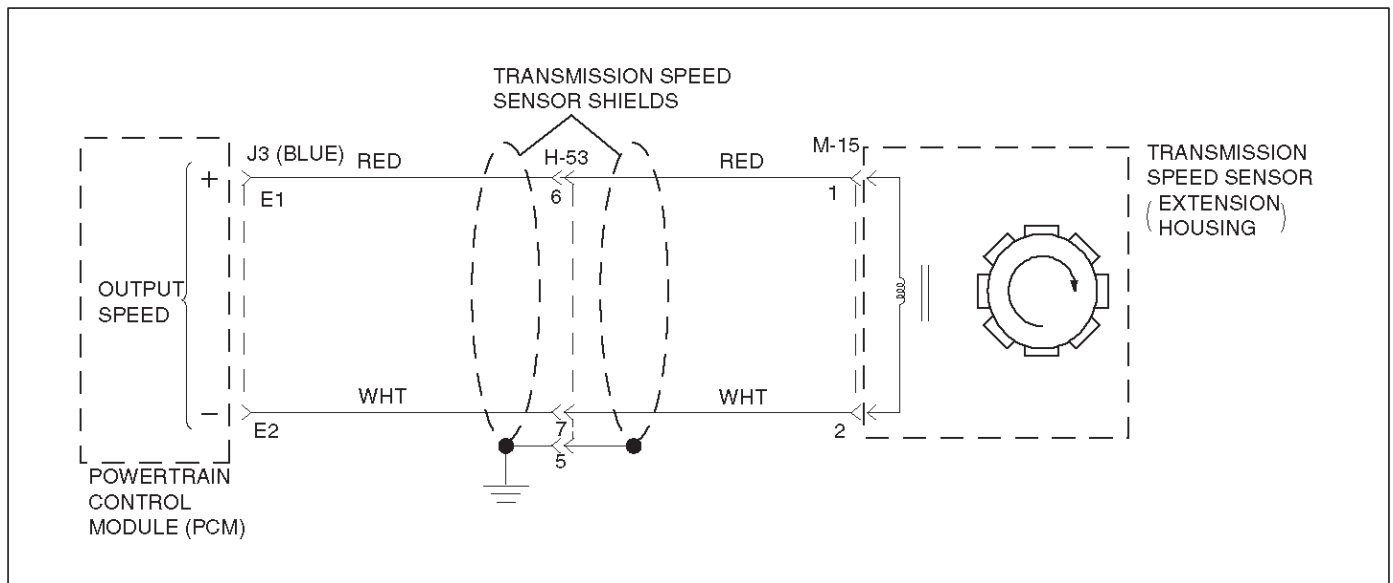
DTC P0722 Transmission Output Speed Sensor (OSS) Low Input

Step	Action	Yes	No
1	<ol style="list-style-type: none"> 1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <ol style="list-style-type: none"> 3. Record the DTC "Failure Records". 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. <p>With the drive wheels rotating, does the "Trans Output Speed" increase with the drive wheel speed?</p>	Go to Diagnostic Aids	Go to Step 2
2	Does the speedometer work?	Go to Step 3	Go to Step 4
3	<p>Check for the most current and/or incorrect calibration.</p> <p>Is the calibration current?</p>	Go to Step 16	Go to Step 4
4	<ol style="list-style-type: none"> 1. Turn the ignition "off". 2. Disconnect the J3 (BLUE) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J3-E1 and J3-E2. <p>Is the reading 3,000 ohms?</p>	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> 1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. <p>Is the voltage greater than 0.5 volts?</p>	Go to Step 7	Go to Step 8
6	<p>Inspect circuits RED and WHT for a poor connection or an open circuit.</p> <p>Was a problem found?</p>	Go to Step 17	Go to Step 8
7	<ol style="list-style-type: none"> 1. Reconnect the J3 (BLUE) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine "off", turn the ignition "on". 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals M15-1 and M15-2. <p>Is the reading between 4.0 to 5.1 volts?</p>	Go to Step 16	Go to Step 10
8	<ol style="list-style-type: none"> 1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30-E) section. <p>Was a problem found?</p>	Go to Step 17	Go to Step 9
9	<p>Replace the OSS.</p> <p>Is the replacement complete?</p>	Go to Step 17	—
10	Was the reading in step 8 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 8 greater than 5.1 volts?	Go to Step 15	—
12	<p>Using the J 39200 DVOM to chassis ground, measure the voltage on circuit RED.</p> <p>Is the reading between 4.0 to 5.1 volts?</p>	Go to Step 13	Go to Step 14
13	<p>Repair the open in circuit WHT.</p> <p>Is the repair complete?</p>	Go to Step 17	—
14	<p>Check circuit RED for a short to ground or open.</p> <p>Was a problem found and corrected?</p>	Go to Step 17	Go to Step 16

DTC P0722 Transmission Output Speed Sensor (OSS) Low Input (Cont'd)

Step	Action	Yes	No
15	Repair the short to B+ in circuit RED. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0723 Transmission Output Speed Sensor (OSS) Intermittent



D07RW006

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type "C" DTC.

Conditions For Setting The DTC

In Park or Neutral:

- Transmission output speed change is greater than 10,000 rpm.
- Conditions met for 6 seconds.
- Engine running time is greater than 2 seconds.

Not in Park or Neutral:

- Transmission output speed change is greater than 512 rpm.
- Conditions met for 0.075 seconds
- Engine running time is greater than 2 seconds.
- Engine vacuum is less than 70 kPa.
- Output speed is greater than 1,380 rpm for 1 second.
- NORAW-NOLAST < 60 rpm for 6 seconds.

NORAW: Latest raw data of output shaft speed.

NOLAST: Filtered pervious data of output speed.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.

- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- A OSS DTC P0723 will set when output speed has been detected and is lost.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

5. This test checks the OSS circuit.
6. This test checks the integrity of the OSS.
8. This test checks the 5-volt and ground circuit of the PCM.

DTC P0723 Transmission Output Speed Sensor (OSS) Intermittent

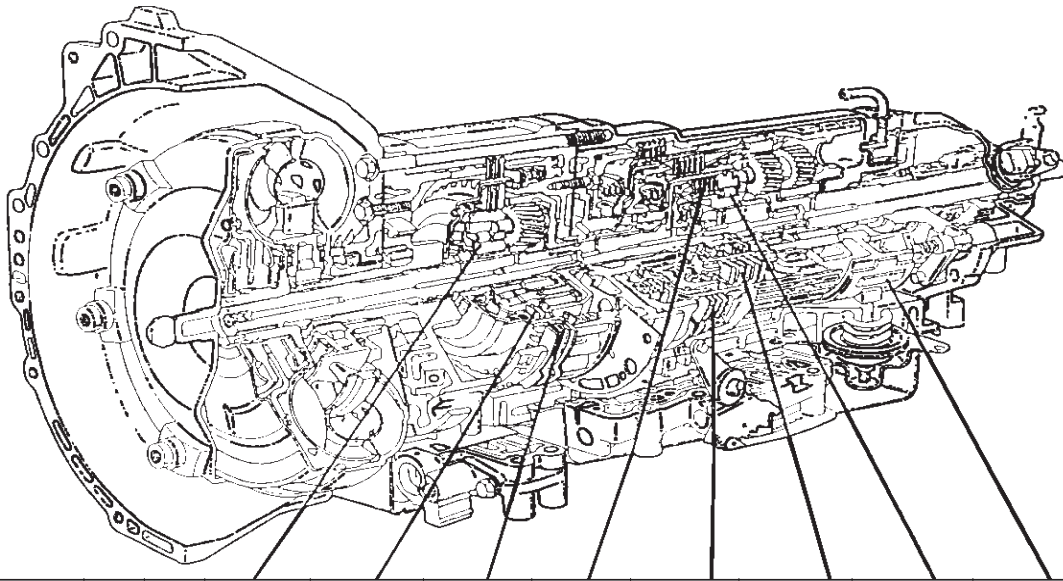
Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the "Trans Output Speed" increase with the drive wheel speed?	Go to Diagnostic Aids	Go to Step 2
2	Does the speedometer work?	Go to Step 3	Go to Step 4
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to Step 16	Go to Step 4
4	1. Turn the ignition "off". 2. Disconnect the J3 (BLUE) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J3-E1 and J3-E2. Is the reading 3,000 ohms?	Go to Step 5	Go to Step 6
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to Step 7	Go to Step 8
6	Inspect circuits RED and WHT for a poor connection or an open circuit. Was a problem found?	Go to Step 17	Go to Step 8
7	1. Reconnect the J3 (BLUE) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine "off", turn the ignition "on". 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals M15-1 and M15-2. Is the reading between 4.0 to 5.1 volts?	Go to Step 16	Go to Step 10
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30-E) section. Was a problem found?	Go to Step 17	Go to Step 9
9	Replace the OSS. Is the replacement complete?	Go to Step 17	—
10	Was the reading in step 8 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 8 greater than 5.1 volts?	Go to Step 15	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit RED. Is the reading between 4.0 to 5.1 volts?	Go to Step 13	Go to Step 14
13	Repair the open in circuit WHT. Is the repair complete?	Go to Step 17	—
14	Check circuit RED for a short to ground or open. Was a problem found and corrected?	Go to Step 17	Go to Step 16

7A1-50 TRANSMISSION CONTROL SYSTEM (4L30-E)

DTC P0723 Transmission Output Speed Sensor (OSS) Intermittent (Cont'd)

Step	Action	Yes	No
15	Repair the short to B+ in circuit RED. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0730 Transmission Incorrect Gear Ratio



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE ROLLER CLUTCH (OFW)	OVERRUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASSEMBLY (PFW)	BAND ASSEMBLY (B)	ENGINE BRAKING
P-N		OFF	ON		APPLIED							NO
R	REVERSE	OFF	ON	LD	APPLIED			APPLIED		LD		NO
D	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
	4TH	OFF	OFF	FW		APPLIED	APPLIED		APPLIED	NE		YES
3	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
2	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
L	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES

LD : LOCKED IN DRIVE

FW : FREEWHEELING

NE : NOT EFFECTIVE

D07RT015

Circuit Description

- The Powertrain Control Module (PCM) calculates the slippage of the converter and transmission based upon the engine speed, the output speed, and the current gear ratio.
- The slippage of the converter at a high enough engine speed is low. The transmission should not slip more than a given value when there is no shift.
- This DTC detects a slip at each gear. This is a type "C" DTC.

- 3 seconds since upshift.
- 3 seconds since downshift.
- 3 seconds since garage shift (N→D).
- And one of the following conditions occur:
 - Slip is greater than 508 rpm in 1st gear.
 - Slip is greater than 468 rpm in 2nd gear.
 - Slip is greater than 449 rpm on 3rd gear.
 - Slip is greater than 440 rpm on 4th gear.
- All conditions met for 5.5 seconds.

Conditions For Setting The DTC

- No Output Speed Sensor DTC(s) P0722, P0723.
- Not in Park, Neutral, or Reverse.
- Engine speed is greater than 3,500 rpm.

Action Taken When The DTC Sets

- Maximum line pressure.
- The PCM will illuminate the CHECK TRANS Lamp.

7A1–52 TRANSMISSION CONTROL SYSTEM (4L30–E)

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM memory by using a scan tool.
- The DTC can also be cleared from memory when the vehicle has made 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC Actions Taken items when the fault conditions no longer exist and the ignition is cycles “off” long enough to power down the PCM.

Diagnostic Aids

- Check for intermittent output speed sensor circuit problems.
- Check for possible incorrect calibration. (PCM part No., tire specification, and rear axle ratio)

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This step checks for possible low fluid level causing slipping resulting in an undefined gear ratio.
4. This step checks for correct gear ratios for commanded gears.
5. This step checks for low line pressure.

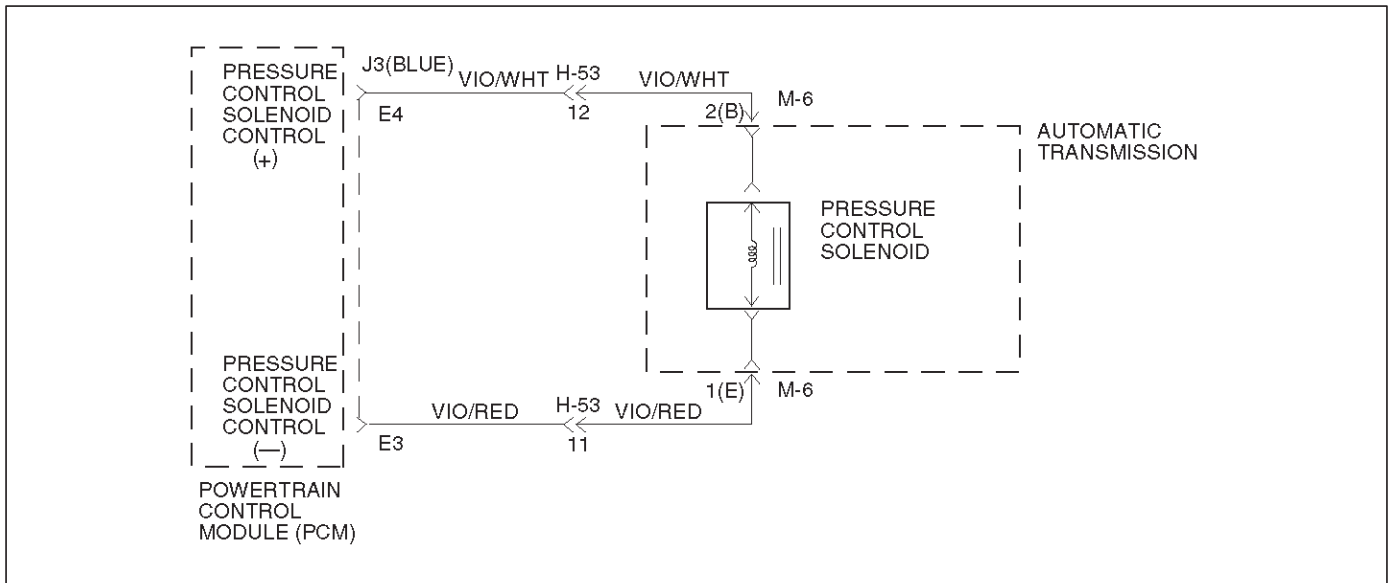
DTC P0730 Transmission Incorrect Gear Ratio

Step	Action	Yes	No
1	Visually inspect the transmission cooling system for fluid leaks. <ul style="list-style-type: none"> • Refer to Chart 16: Possible Causes of Transmission Fluid Leaks of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section <p>Was condition found and corrected?</p>	Go to Step 6	Go to Step 2
2	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. <p>Has transmission fluid checking procedure been performed?</p>	Go to Step 3	Go to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. Turn the ignition switch to the “on” position. 3. Engine not running. NOTE: Before clearing DTC(s) use the scan tool to record the “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 4. Record the Failure Record data. 5. Use the scan tool snapshot mode to record transmission gear ratios. 6. Drive vehicle in transmission gear ranges 1, 2, 3, and D with the engine speed is greater than 3,500 rpm for 5.5 seconds. 7. Record each transmission gear. 1st:2.73 – 2.99 2nd:1.54 – 1.71 3rd:0.93 – 1.05 4th:0.66 – 0.78 Does commanded gear ratio match ranges as shown?	Refer to Diagnostic Aids	Go to Step 4
4	Perform line pressure check. <ul style="list-style-type: none"> • Refer to Line Pressure Test in Automatic Transmission (4L30–E) section. <p>Was condition found and corrected?</p>	Go to Step 6	Go to Step 5

DTC P0730 Transmission Incorrect Gear Ratio (Cont'd)

Step	Action	Yes	No
5	Check for possible clutch slippage. <ul style="list-style-type: none"> ● Refer to Chart 6: Diagnostic Trouble Code (DTC) P0730 of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30-E) section. Was condition found and corrected?	Go to Step 6	—
6	1. After the repair is complete, use the scan tool to select "DTC", then "Clear info" function. 2. Operate the vehicle under the following conditions: <ul style="list-style-type: none"> ● Drive the vehicle in D4 with the engine speed greater than 3,500 rpm to obtain anyone of the following gear ratios for seven seconds. 1st 1:2.73 – 1:2.99 2nd 1:1.54 – 1:1.71 3rd 1:0.93 – 1:1.05 4th 1:0.66 – 1:0.78 Has the last test failed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical



D07RW008

Circuit Description

The PCS is a PCM-controlled device used to regulate transmission line pressure. The PCM compares TPS voltage, engine rpm, and other inputs to determine the line pressure appropriate for a given load. The PCM will regulate the pressure by applying a varying amperage to the PCS. The applied amperage can vary from 0.1 to 1 amp, and is monitored by the PCM.

This DTC detects a continuous open or short to ground in the PCS circuit or the PCS. This is a type "C" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- The PCM detects that the different between commanded and actual current is 200 milliamperes (mA) for over 1 second.

Action Taken When the DTC Sets

- Maximum line pressure.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn "off" the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM history by using a scan tool.

- The DTC will be cleared from memory when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 5-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

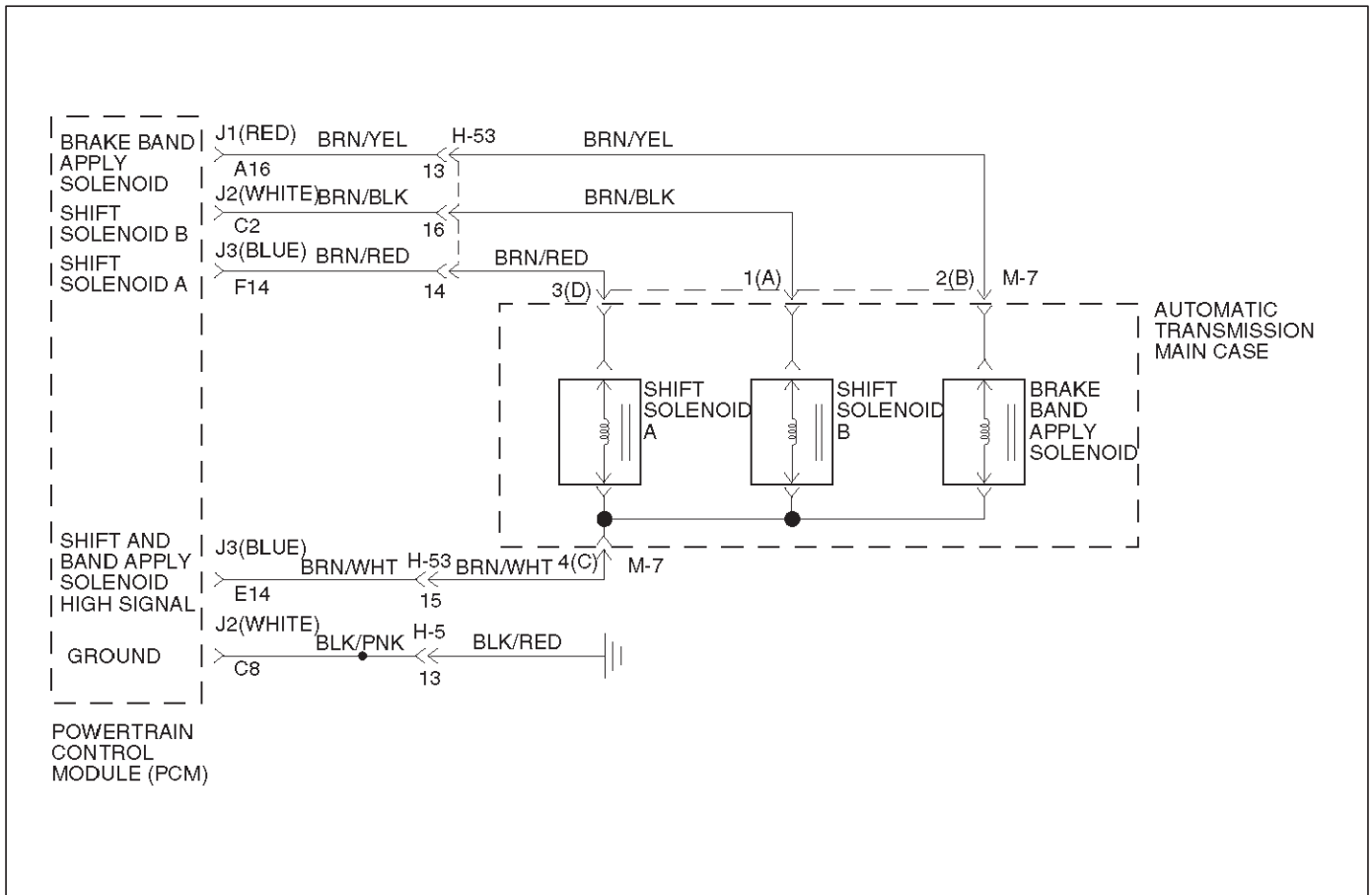
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the ability of the PCM to command the PCS.
3. This test checks the PCS and internal wiring harness for incorrect resistance.

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical

Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". 4. While the engine is operating, put the transmission in Park. 5. Using the scan tool, apply 0.1 amp through 1.0 amp while observing "PC Ref. Current" and "PC Act. Current". Is the "PC Act. Current" reading always within 0.16 amp?	Go to Diagnostic Aids	Go to Step 2
2	1. Turn the ignition "off". 2. Disconnect the transmission 5-way connector M-6. 3. Using the J39200 DVOM, measure the resistance between terminals M6-2(B) and M6-1(E). Is the resistance within 3-7 ohms?	Go to Step 6	Go to Step 3
3	1. Remove the transmission oil pan. Refer to Solenoid (Adapter Case Valve Body) in Automatic Transmission (4L30-E) section. 2. Disconnect the internal wiring harness at the PCS. 3. Measure the resistance of the PCS. Is the resistance within 3-7 ohms?	Go to Step 5	Go to Step 4
4	Replace the PCS. Is the replacement complete?	Go to Step 9	—
5	Repair the internal wiring harness for an open. Is the repair complete?	Go to Step 9	—
6	Inspect/repair circuits J3-E4, M6-2(B), J3-E3, and M6-1(E). Was a problem found?	Go to Step 9	Go to Step 7
7	Inspect/repair circuits J3-E4, M6-2(B), J3-E3, and M6-1(E) for a short to ground or poor connections. Was a problem found?	Go to Step 9	Go to Step 8
8	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: The PCS duty cycle is not at its electrical high or low limit. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0753 Shift Solenoid A Electrical



Circuit Description

- The shift solenoid A is a simple on/off solenoid located in the main case valve body. The solenoid is the normally closed type. In second or third gear, the Powertrain Control Module (PCM) energizes the solenoid to open a fluid inlet port. When the port is open, fluid pressure actuates the shift valve.
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage, except in BACKUP MODE or when ignition is off the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid A circuit or the shift solenoid A. This is a type "C" DTC.

Conditions For Setting The DTC

- Ignition is "on", Engine "run".
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid "on" and the voltage remains high (B+) or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met for 0.33 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- An open ignition feed circuit can cause multiple DTCs to set.

9. This test checks the function of the shift solenoid A and the transmission internal wiring harness.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

- This test checks for power to the shift solenoid A from the ignition through the PCM.
- This test measures the resistance of the component.

DTC P0753 Shift Solenoid A Electrical

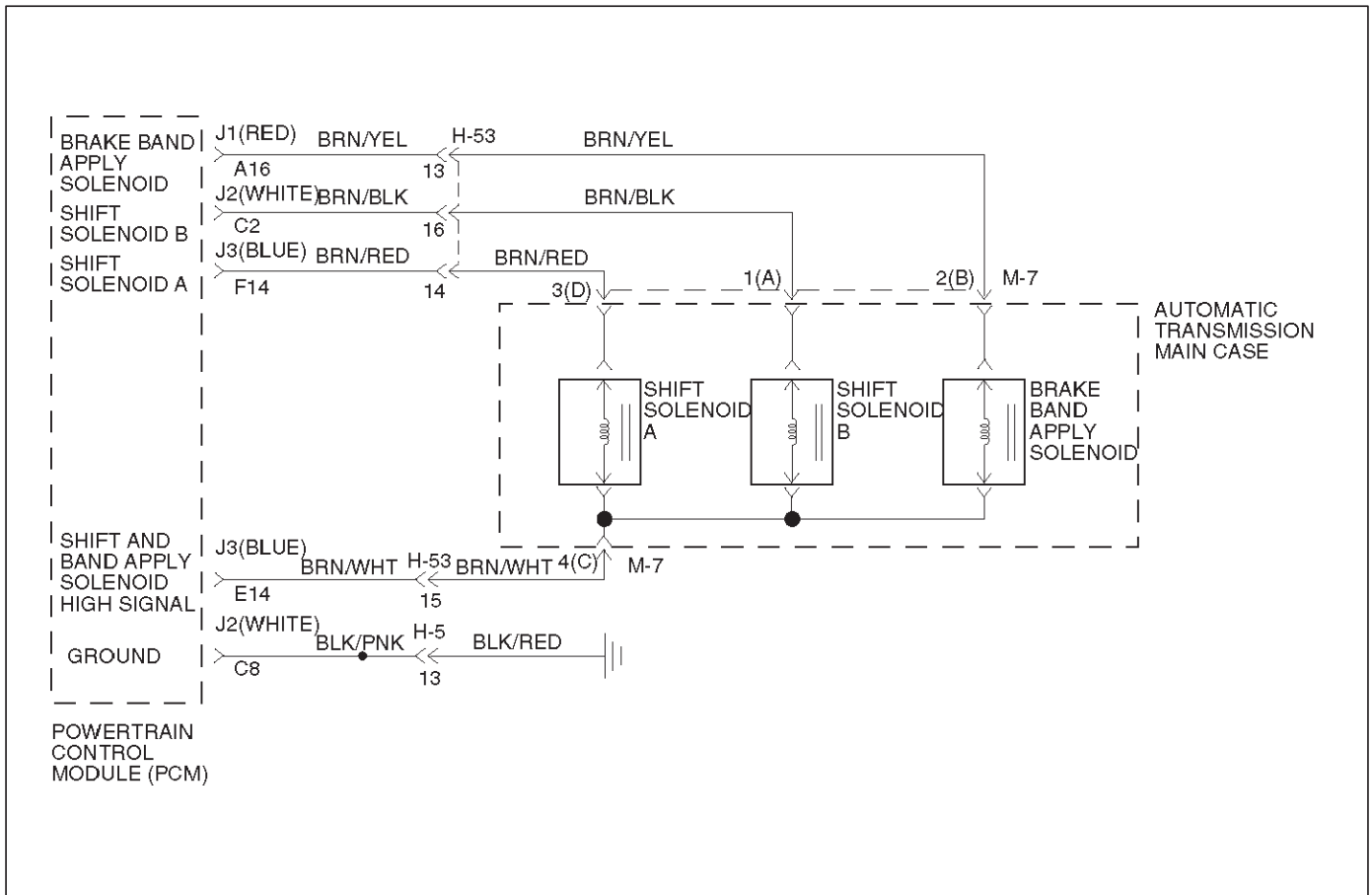
Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "on", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". Were DTCs P0753, P0758, P1860 set?	Go to Step 2	Go to Diagnostic Aids
2	1. Turn the ignition "on". 2. Using the J39200 DVOM, measure the voltage between PCM connector terminals J3-E14 and J2-C8 (GND). Is the voltage within 10-12 volts?	Go to Step 3	Go to Step 4
3	1. Turn the ignition "off". 2. Disconnect the J3 (BLUE) PCM connector. 3. Turn the ignition "on". 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals J3-F14 and ground. Is the voltage within 10 - 12 volts?	Go to Step 10	Go to Step 4
4	1. Turn the ignition "off". 2. Disconnect the J3 (BLUE) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J3-E14 and J3-F14. Is the resistance within 18 - 20 ohms?	Go to Step 5	Go to Step 6
5	1. Disconnect the J1 (RED) and J2 (WHITE) PCM connectors. 2. Using the J39200 DVOM, check a continuity between PCM terminals J3-F14 and ground. Is there a continuity?	Go to Step 11	Go to Step 7
6	1. Disconnect the 16-way harness connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminals H53-14 and H53-15. Is the resistance within 18-20 ohms?	Go to Step 13	Go to Step 8
7	Using the J39200 DVOM, check a continuity between J3 (BLUE) PCM terminal E14 and ground. Is there a continuity?	Go to Step 12	Go to Step 9
8	1. Disconnect the transmission main case 4 pin connector M-7. 2. Using the J39200 DVOM, measure the resistance between terminals M7-3(D) and M7-4(C). Is the resistance within 18-20 ohms?	Go to Step 14	Go to Step 15

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DTC P0753 Shift Solenoid A Electrical (Cont'd)

Step	Action	Yes	No
9	Check every connection at the PCM connector. Was a problem found?	Go to Step 17	Go to Step 16
10	The wiring harness between PCM connector terminals J3-F14 and transmission harness terminal M7-3(D) is shorted to voltage. Was a problem found and corrected?	Go to Step 18	—
11	The wiring harness between PCM connector terminal J3-F14 and transmission harness terminal M7-3(D) is shorted to ground. Was a problem found and corrected?	Go to Step 18	—
12	The wiring harness between PCM connector terminals J3-E14 and transmission harness terminal M7-4(C) is shorted to ground. Was a problem found and corrected?	Go to Step 18	—
13	The wiring harness between PCM connector J3 and transmission 16-way connector H-53 is open or poor connection. Was a problem found and corrected?	Go to Step 18	—
14	The wiring harness between transmission 16-way connector H-53 and transmission main case connector M-7 is open or has a poor connection. Was a problem found and corrected?	Go to Step 18	—
15	The shift solenoid A is faulty. Replace the shift solenoid A. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 18	—
16	The PCM may be faulty. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 18	—
17	Repair the PCM connector connection. Was a problem found and corrected?	Go to Step 18	—
18	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: <ul style="list-style-type: none"> ● The shift solenoid A is commanded "on" and voltage drops to zero. ● The shift solenoid A is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0758 Shift Solenoid B Electrical



Circuit Description

- The shift solenoid B is a simple on/off solenoid located in the main case valve body. It is normally open. When the port is open, fluid pressure actuates the shift valve. In first or second gear, the Powertrain Control Module (PCM) energizes the solenoid to close a fluid inlet port.
- The solenoid is activated by current. This current is provided by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. In BACKUP MODE or when the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid B circuit or shift solenoid B. This is a type "C" DTC.

Conditions For Setting The DTC

- Ignition is "on", Engine "run".
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid "on" and the voltage remains high (B+) or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met for 0.33 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

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- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

- This test measures the resistance of the component.
- This test checks the function of the shift solenoid B and the transmission internal wiring harness.
- This test checks for power to the shift solenoid B from the ignition through the PCM.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

DTC P0758 Shift Solenoid B Electrical

Step	Action	Yes	No
1	<ol style="list-style-type: none"> Install the scan tool. With the engine "on", turn the ignition switch "on". <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <ol style="list-style-type: none"> Record the DTC "Failure Records". <p>Were DTCs P0753, P0758, P1860 set?</p>	Go to Step 3	Go to Step 2
2	<ol style="list-style-type: none"> The engine "on". Apply brake pedal and select transmission range "D". Press and hold down the winter switch and select transmission mode "winter". <p>Does the scan tool display DTC P0758 at 3rd gear?</p>	Go to Step 7	Go to Diagnostic Aids
3	<ol style="list-style-type: none"> Turn the ignition "off". Disconnect the J2 (WHITE) and J3 (BLUE) PCM connectors. Turn the ignition "on". Using the J39200 DVOM, measure the voltage between PCM connector terminals J2-C2 and J2-C8. <p>Is the voltage within 10 – 12 volts?</p>	Go to Step 14	Go to Step 4
4	<ol style="list-style-type: none"> Turn the ignition "off". Using the J39200 DVOM, measure the resistance between PCM connector terminals J2-C2 and J3-E14. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 15	Go to Step 5
5	<ol style="list-style-type: none"> Disconnect the transmission 16-way connector H-53. Using the J39200 DVOM, measure the resistance between terminals H53-16 and H53-15. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 16	Go to Step 6
6	<ol style="list-style-type: none"> Disconnect the transmission main case connector M-7. Using the J39200 DVOM, measure the resistance between terminals M7-1(A) and M7-4(C). <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 17	Go to Step 18
7	<ol style="list-style-type: none"> Turn the ignition "off". Disconnect the J2 (WHITE) and J3 (BLUE) PCM connectors. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2-C2 and J3-E14. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 8	Go to Step 9
8	<p>Using the J39200 DVOM, check a continuity between PCM connector terminal J2-C2 and ground.</p> <p>Is there a continuity?</p>	Go to Step 19	Go to Step 10

DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
9	1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminals H53-16 and H53-15. Is the resistance within 18-20 ohms?	Go to Step 20	Go to Step 11
10	Using the J39200 DVOM, check a continuity between PCM connector terminal J3-E14 and ground. Is there a continuity?	Go to Step 21	Go to Step 12
11	1. Disconnect the transmission main case connector M-7. 2. Using the J39200 DVOM, measure the resistance between terminals M7-1(A) and M7-4(C). Is the resistance within 18 - 20 ohms?	Go to Step 22	Go to Step 23
12	Check every connection of the PCM and transmission 16-way connector H-53. Was a problem found and corrected?	Go to Step 25	Go to Step 13
13	1. Connect the J2 (WHITE) and J3 (BLUE) PCM connectors to the PCM. 2. Turn the ignition "on", the engine "on". 3. Repeat Step 3. Does the scan tool display DTC P0758 at 3rd gear?	Go to Step 24	Go to Diagnostic Aids
14	The wiring harness between PCM connector terminal J2-C2 and transmission main case terminal M7-1(A) is shorted to voltage. Was a problem found and corrected?	Go to Step 25	—
15	The PCM internal terminal J2-C2 is shorted to voltage. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 25	—
16	The wiring harness between PCM connector and transmission 16-way connector is shorted. Was a problem found and corrected?	Go to Step 25	—
17	The wiring harness between transmission 16-way connector and transmission main case connector is shorted. Was a problem found and corrected?	Go to Step 25	—
18	The shift solenoid B is faulty, or the internal wiring harness from the shift solenoid B is shorted. Was a problem found and corrected?	Go to Step 25	—
19	The wiring harness between PCM connector terminal J2-C2 and transmission main case connector terminal M7-1(A) is shorted to ground. Was a problem found and corrected?	Go to Step 25	—
20	The wiring harness between PCM connector terminal J2-C2 and transmission 16-way connector terminal H53-16, or between PCM connector terminal J3-E14 and 16-way connector terminal H53-15 is open. Was a problem found and corrected?	Go to Step 25	—

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DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
21	The wiring harness between PCM connector terminal J3-E14 and transmission main case connector terminal M7-4(C) is shorted to ground. Was a problem found and corrected?	Go to Step 25	—
22	The wiring harness between transmission 16-way connector terminal H53-16 and transmission main case connector terminal M7-1(A), or between H53-15 and M7-4(C) is open. Was a problem found and corrected?	Go to Step 25	—
23	The internal wiring harness from the shift solenoid B is open, or the shift solenoid B is faulty. Was a problem found and corrected?	Go to Step 25	—
24	Replace the PCM. Is the replacement complete?	Go to Step 25	—
25	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: <ul style="list-style-type: none"> ● The shift solenoid B is commanded "on" and voltage drop to zero. ● The shift solenoid B is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1790 ROM Transmission Side Bad Check Sum

Circuit Description

Transmission Side Read Only Memory (ROM) and Electronically Erasable Programmable Read Only Memory (EEPROM) is an electronic circuit that controls the transmission control in the Powertrain Control Module (PCM).

This DTC detects a check sum error. This is a type "C" DTC.

Conditions For Setting The DTC

- Detects check sum error for 1 second.

Action Taken When The DTC Sets

- Maximum line pressure.

- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

DTC P1790 ROM Transmission Side Bad Check Sum

Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". Was DTC P1790 set?	Go to Step 4	Go to Step 2
2	Was DTC P1792 set?	Go to Step 3	—
3	1. Remove the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. 2. Using the ITCS, make a reprogramming the transmission EEPROM. Was the reprogramming complete?	Go to Step 5	—
4	Replace the PCM. Is the replacement complete?	Go to Step 5	—
5	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

7A1-64 TRANSMISSION CONTROL SYSTEM (4L30-E)

DTC P1792 EEPROM Transmission Side Bad Check Sum

Circuit Description

Transmission Side Read Only Memory (ROM) and Electronically Erasable Programmable Read Only Memory (EEPROM) is an electronic circuit that controls the transmission control in the Powertrain Control Module (PCM).

This DTC detects a check sum error. This is a type "C" DTC.

Conditions For Setting The DTC

- Detects check sum error for 1 second.

Action Taken When The DTC Sets

- Maximum line pressure.

- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- The PCM will illuminate the CHECK TRANS Lamp.

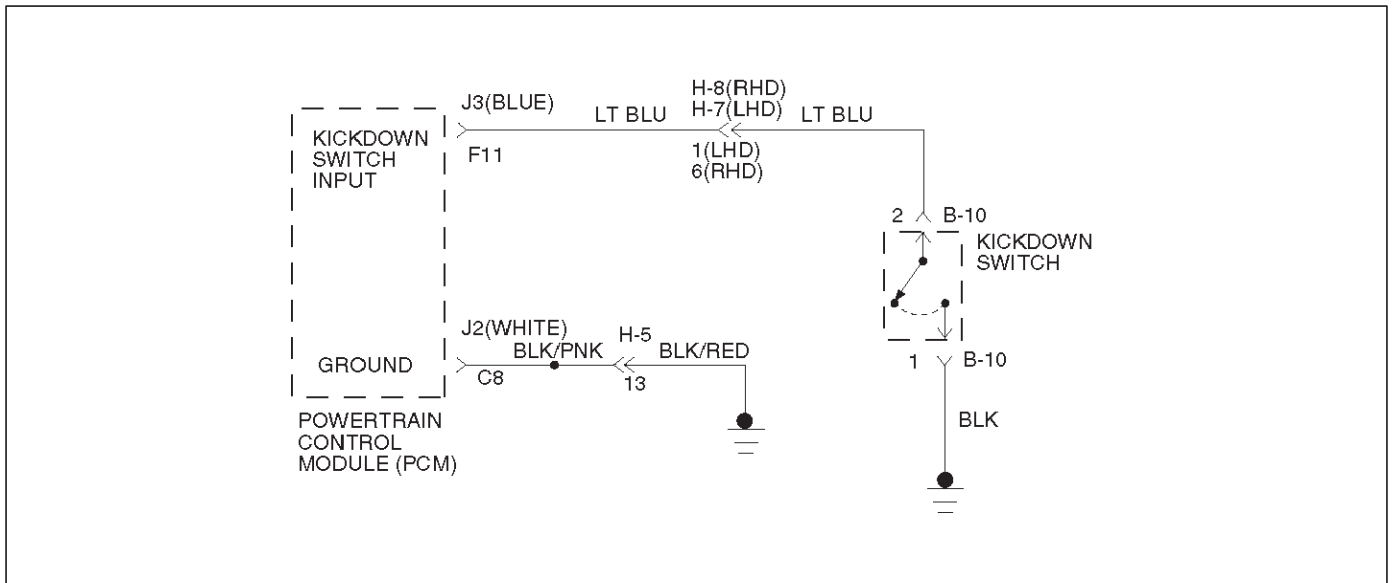
Conditions For Clearing The MIL/DTC

- The PCM will turn off the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

DTC P1792 EEPROM Transmission Side Check Bad Check Sum

Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". Was DTC P1790 set?	Go to Step 4	Go to Step 2
2	Was DTC P1792 set?	Go to Step 3	—
3	1. Remove the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. 2. Using the ITCS, make a reprogramming the transmission EEPROM. Was the reprogramming complete?	Go to Step 5	—
4	Replace the PCM. Is the replacement complete?	Go to Step 5	—
5	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1835 Kickdown Switch Always On



D07RW033

Circuit Description

- When the driver presses the accelerator pedal down fully, the kickdown switch closes, sending a ground signal to the Powertrain Control Module (PCM).
- This information is used to perform shifts at high engine speed.
- When the kickdown switch is closed, the Throttle Position Sensor (TPS) is already at 100%.
- This DTC detects a closed kickdown switch when TP angle is less than 70%.
- This is a type "D" DTC.

Conditions For Setting The DTC

- No TPS DTCs P0122 or P0123.
- TP angle is less than 70%.
- Kickdown switch is "on".
- All conditions met for 1 second.

Action Taken When The DTC Sets.

- Kickdown mode control is off.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Check the wiring harness for a short to ground between the PCM and kickdown switch.
- Check the kickdown switch for failure.
- Check kickdown adjustment.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

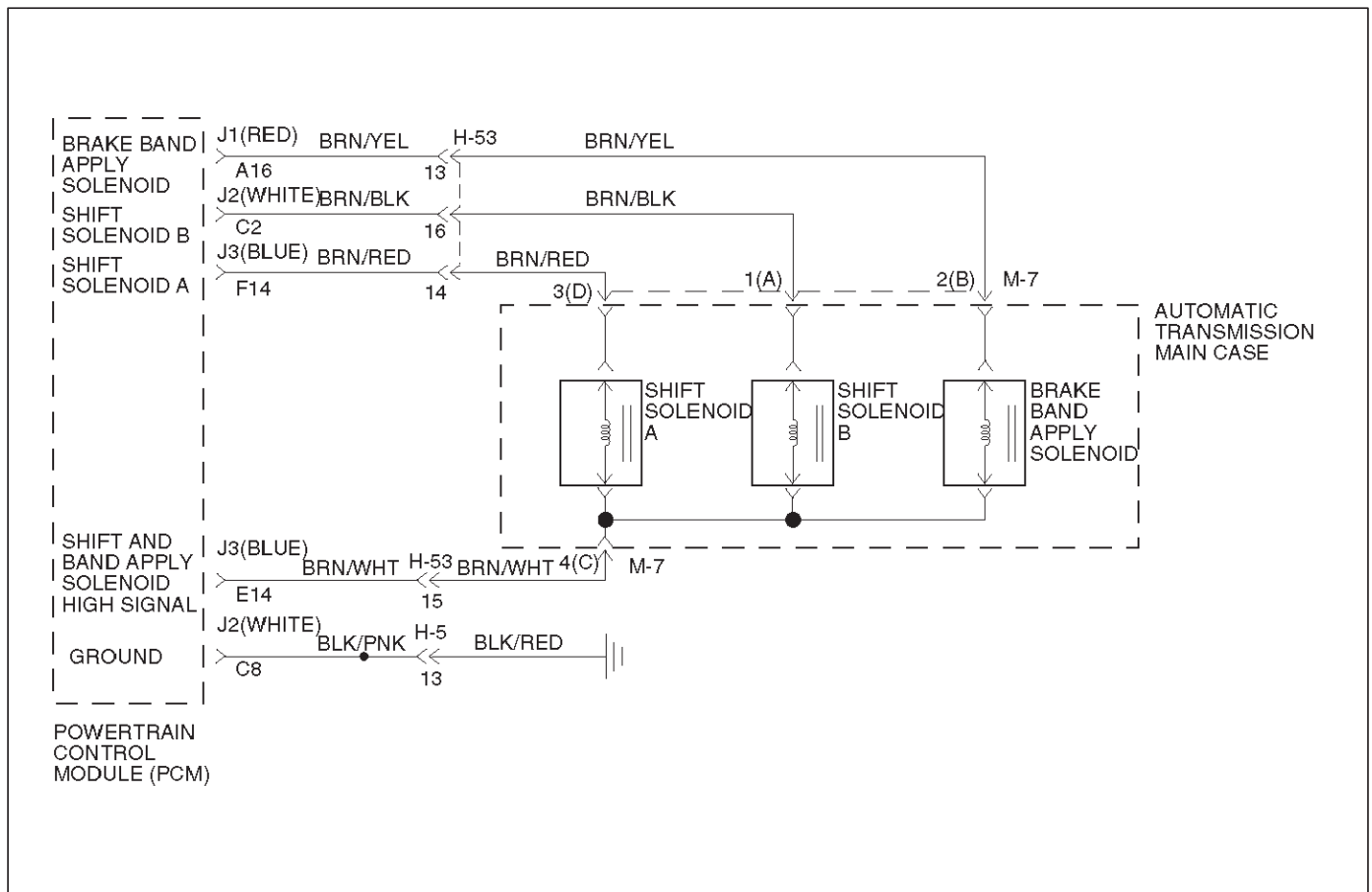
2. This test checks for short to ground or kickdown switch failure.
4. This test checks for regulation kickdown switch.

7A1-66 TRANSMISSION CONTROL SYSTEM (4L30-E)

DTC P1835 Kickdown Switch Always On

Step	Action	Yes	No
1	<p>1. Install the scan tool. 2. With the engine "on", turn the ignition switch "on".</p> <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <p>3. Record the DTC "Failure Records".</p> <p>Does the scan tool display "Kickdown switch" "low" (closed switch)?</p>	Go to Step 2	Go to Step 3
2	<p>1. Turn the ignition "off". 2. Disconnect the J3 (BLUE) PCM connector. 3. Using the J39200 DVOM, check a continuity between PCM connector terminal J3-F11 and ground.</p> <p>Is there a continuity?</p>	Go to Step 4	Go to Step 7
3	<p>The TP angle goes from 0% to 100% with the accelerator pedal depressed.</p> <p>Is the kickdown switch "on" when TP angle is below 70%?</p>	Go to Step 5	Go to Diagnostic Aids
4	<p>1. Disconnect the kickdown switch connector B-10. 2. Using the J39200 DVOM, check a continuity between terminals B10-1 and B10-2.</p> <p>Is there a continuity?</p>	Go to Step 6	Go to Step 8
5	<p>Adjust the kickdown switch.</p> <p>Is the kickdown switch "on" when TP angle is above 95%?</p>	Go to Step 9	—
6	<p>Replace the kickdown switch.</p> <p>Is the replacement complete?</p>	Go to Step 9	—
7	<p>Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section.</p> <p>Is the replacement complete?</p>	Go to Step 9	—
8	<p>Repair the short to ground in circuit LT BLUE.</p> <p>Is the repair complete?</p>	Go to Step 9	—
9	<p>1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following condition is met: The torque converter stator temperature switch circuit does not indicate a hot mode when the transmission fluid temperature is less than 60°C (140°F) for at least 5 seconds.</p> <p>2. Review the scan tool "DTC Info".</p> <p>Has the last test failed or is the current DTC displayed?</p>	<p>Begin diagnosis again Go to Step 1</p>	<p>Repair verified Exit DTC table</p>

DTC P1850 Brake Band Apply Solenoid Malfunction



D07RW009

Circuit Description

- The brake band apply solenoid is a normally open solenoid which controls the flow of fluid for brake band application. The Powertrain Control Module (PCM) uses Pulse Width Modulation (PWM) and changes the duty cycle to control the solenoid. The PCM turns the solenoid on (energized) and off (deenergized) at a constant frequency. The length of time the solenoid is energized during each on/off cycle is called the pulse width. By varying or "modulating" the pulse width, the solenoid output pressure is changed. Since the solenoid is normally open, increasing the pulse width increases the duty cycle and decreases the output pressure. PWM control provides smooth band application without an accumulator. The band is only applied in first and second gears.
- In the event of an electrical failure (open), the solenoid regulates at the maximum oil flow (0% duty cycle).
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. When the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the brake band apply solenoid circuit or the brake band apply solenoid. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on", Engine "run".
- The PCM commands the solenoid "on" and the voltage remains high (B+) or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met in 1.3 seconds.

Action Taken When The DTC Sets

- Inhibit brake band apply solenoid.
- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

7A1-68 TRANSMISSION CONTROL SYSTEM (4L30-E)

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the brake band apply solenoid from the ignition through the PCM.
4. This test checks the resistance of the transmission internal wiring harness and brake band apply solenoid.
5. This test checks the ability of the PCM and wiring to control the ground circuit.

DTC P1850 Brake Band Apply Solenoid Malfunction

Step	Action	Yes	No
1	1. Install the scan tool. 2. With the engine "on", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". Were DTCs P0753, P0758 set?	Go to Step 2	Go to Step 3
2	Using the J39200 DVOM, back probe between PCM connector terminals J3-E14 and J2-C8. Is the voltage between 10 to 12 volts?	Go to Step 4	Go to Step 5
3	1. Turn the ignition "off". 2. Disconnect the J1 (RED) and J3 (BLUE) PCM connectors. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J1-A16 and J3-E14. Is the resistance within 10-12 ohms?	Go to Step 11	Go to Step 12
4	Using the J39200 DVOM, back probe between PCM connector terminals J1-A16 and J2-C8. Is the voltage between 10 to 12 volts?	Go to Step 25	Go to Step 3
5	1. Turn the ignition "off". 2. Disconnect the J1 (RED) and J3 (BLUE) PCM connectors. 3. Using the J39200 DVOM, check continuity between PCM terminal J3-E14 and ground. Is there a continuity?	Go to Step 6	Go to Step 8
6	1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, check continuity between connector H53-13 and ground. Is there a continuity?	Go to Step 7	Go to Step 16
7	1. Disconnect the transmission main case connector M-7. 2. Using the J39200 DVOM, check continuity between the terminal M7-2(B) and ground. Is there a continuity?	Go to Step 17	Go to Step 18
8	1. Disconnect the J1 (RED) PCM Connector. 2. Using the J39200 DVOM, measure the resistance between PCM connector terminals J1-A16 and J3-E14. Is the resistance within 10-12 ohms?	Go to Step 25	Go to Step 9
9	1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminal H53-13 and H53-15. Is the resistance within 10-12 ohms?	Go to Step 16	Go to Step 10

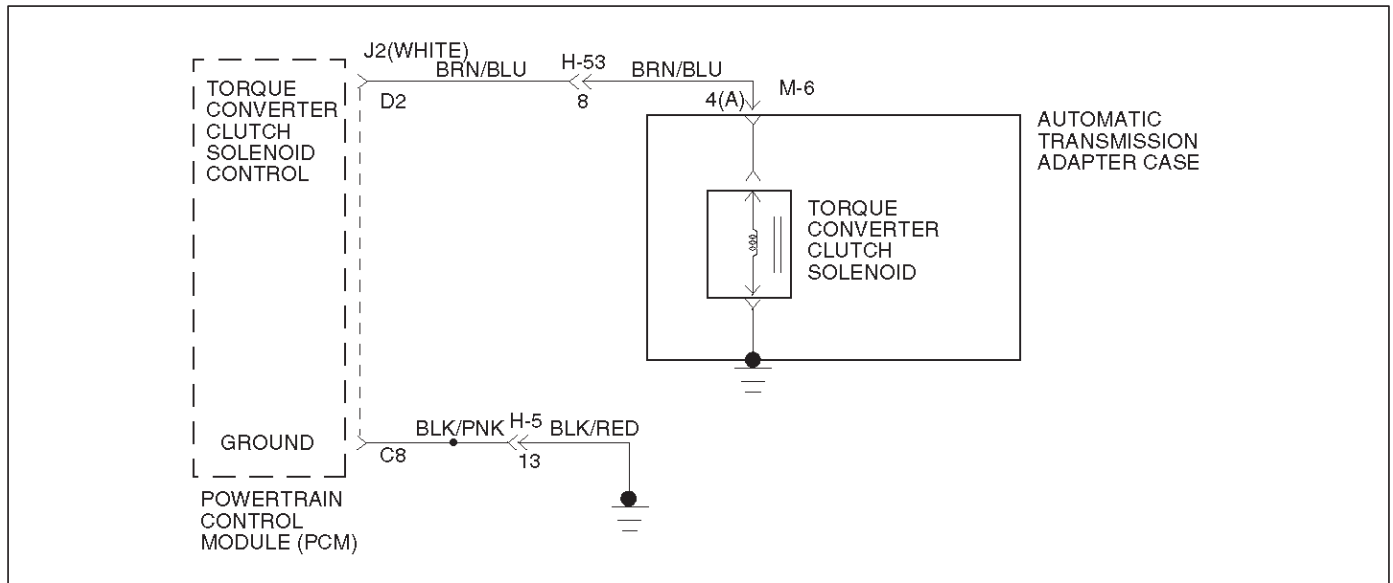
DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)

Step	Action	Yes	No
10	1. Disconnect the transmission main case connector M-7. 2. Using the J39200 DVOM, measure the resistance between terminals M7-2(B) and M7-4(C). Is the resistance within 10-12 ohms?	Go to Step 19	Go to Step 20
11	Using the J39200 DVOM, check continuity between PCM terminal J1-A16 and ground. Is there a continuity?	Go to Step 13	Go to Step 25
12	1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminal H53-13 and H53-15. Is the resistance within 10-12 ohms?	Go to Step 23	Go to Step 14
13	1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, check continuity between terminal H53-13 and ground. Is there a continuity?	Go to Step 15	Go to Step 21
14	1. Disconnect the transmission main case connector M-7. 2. Using the J39200 DVOM, measure the resistance between terminals M7-2(B) and M7-4(C). Is the resistance within 10-12 ohms?	Go to Step 24	Go to Step 20
15	1. Disconnect the transmission main case connector M-7. 2. Using the J39200 DVOM, check continuity between the terminal M7-2(B) and ground. Is there a continuity?	Go to Step 17	Go to Step 22
16	The wiring harness between PCM terminal J3-E14 and transmission 16-way connector terminal H53-15 is open. Was a problem found and corrected?	Go to Step 26	—
17	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 26	—
18	The wiring harness between the transmission 16-way connector terminal H53-15 and the transmission main case connector terminal M7-4(C) is shorted to ground. Was a problem found and corrected?	Go to Step 26	—
19	The wiring harness between the transmission 16-way connector terminal H53-15 and the transmission main case connector terminal M7-4(C) is open. Was a problem found and corrected?	Go to Step 26	—
20	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is open. Was a problem found and corrected?	Go to Step 26	—
21	The wiring harness between the PCM connector terminal J1-A16 and transmission 16-way connector terminal H53-13 is shorted to ground. Was a problem found and corrected?	Go to Step 26	—
22	The wiring harness between the transmission 16-way connector terminal H53-13 and the transmission main case connector terminal M7-2(B) is shorted to ground. Was a problem found and corrected?	Go to Step 26	—

7A1-70 TRANSMISSION CONTROL SYSTEM (4L30-E)**DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)**

Step	Action	Yes	No
23	The wiring harness between the PCM connector terminal J1-A16 and the 16-way connector terminal H53-13 is open. Was a problem found and corrected?	Go to Step 26	—
24	The wiring harness between the transmission 16-way connector terminal H53-13 and the transmission main case connector terminal M7-2(B) is open. Was a problem found and corrected?	Go to Step 26	—
25	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 26	—
26	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: <ul style="list-style-type: none">• The brake band apply solenoid is commanded "on" and the volts drop to zero.• The brake band apply solenoid is commanded "off" and the volts increase to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1860 TCC Solenoid Electrical



D07RW010

Circuit Description

The PCM allows current to flow through the solenoid coil according to the duty cycle (percentage of “on” and “off” time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows 2–3 drive fluid to feed to TCC signal circuit. The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift valve. When the TCC shift valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch. The TCC solenoid is used in conjunction with the TCC solenoid to regulate fluid to the torque converter. The TCC solenoid is attached to the valve body within the transmission.

This DTC detects a continuous open or short to ground or ignition in the TCC circuit or the TCC solenoid. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Ignition is “on”, Engine “run”.
- The PCM commands the solenoid “on” and the voltage remains low (zero volts).
- The PCM commands the solenoid “off” and the voltage remains high (B+).
- All conditions met for 0.25 seconds.

Action Taken When The DTC Sets

- Inhibit TCC engagement.

- The PCM will not illuminate the CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 16-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for voltage to the solenoid.
4. This test checks the ability of the PCM and wiring to control the ignition circuit.
9. This test checks the resistance of the TCC solenoid and the internal wiring harness.

7A1-72 TRANSMISSION CONTROL SYSTEM (4L30-E)

DTC P1860 TCC Solenoid Electrical

Step	Action	Yes	No
1	<ol style="list-style-type: none"> 1. Install the scan tool. 2. With the engine "on", turn the ignition switch "on". <p>NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used.</p> <ol style="list-style-type: none"> 3. Record the DTC "Failure Records". 	Go to Step 2	Go to Step 3
2	<p>Using the J39200 DVOM, back probe between PCM connector terminals J2-D2 and J2-C8.</p> <p>Is the voltage 0 ?</p>	Go to Step 4	Go to Step 5
3	<ol style="list-style-type: none"> 1. Apply brake pedal and select transmission range "D". 2. Do a test drive, and increase the vehicle speed to TCC "on" at 4th. <p>Does the scan tool display DTC P1860 at TCC "ON"?</p>	Go to Step 9	Go to Diagnostic Aids
4	<ol style="list-style-type: none"> 1. Turn the ignition "off". 2. Disconnect the J2 (WHITE) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2-D2 and J2-C8. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 6	Go to Step 7
5	<p>The wiring harness between PCM connector terminal J2-D2 and transmission adapter case connector terminal M6-4(A) is shorted to voltage.</p> <p>Was a problem found and corrected?</p>	Go to Step 18	Go to Step 19
6	<p>Intermittent condition.</p> <p>Check the wiring harness and terminals between PCM connector J2 and transmission adapter case connector M-6.</p> <p>Was a problem found and corrected?</p>	Go to Step 18	Go to Step 19
7	<ol style="list-style-type: none"> 1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminal H53-8 and ground. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 15	Go to Step 8
8	<ol style="list-style-type: none"> 1. Disconnect the transmission adapter case connector M-6. 2. Using the J39200 DVOM, measure the resistance between terminal M6-4(A) and ground. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 16	Go to Step 17
9	<ol style="list-style-type: none"> 1. Turn the ignition "off". 2. Disconnect the J2 (WHITE) PCM connector. 3. Using the J39200 DVOM, measure the resistance between terminals J2-D2 and J2-C8. <p>Is the resistance within 18 – 20 ohms?</p>	Go to Step 18	Go to Step 10
10	<ol style="list-style-type: none"> 1. Disconnect the transmission 16-way connector H-53. 2. Using the J39200 DVOM, measure the resistance between terminal H53-8 and ground. <p>Is the resistance within 18-20 ohms?</p>	Go to Step 12	Go to Step 11
11	<ol style="list-style-type: none"> 1. Disconnect the transmission adapter case connector M-6. 2. Using the J39200 DVOM, measure the resistance between terminal M6-4(A) and ground. <p>Is the resistance within 18-20 ohms?</p>	Go to Step 13	Go to Step 14

DTC P1860 TCC Solenoid Electrical (Cont'd)

Step	Action	Yes	No
12	The wiring harness between PCM connector terminal J2-D2 and transmission 16-way connector terminal H53-8 is shorted to ground. Was a problem found and corrected?	Go to Step 20	—
13	The wiring harness between transmission 16-way connector H-53 and adapter case connector M-6 is shorted to ground. Was a problem found and corrected?	Go to Step 20	—
14	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 20	—
15	The wiring harness between PCM connector terminal J2-D2 and transmission 16-way connector terminal H53-8 is open. Was a problem found and corrected?	Go to Step 20	—
16	The wiring harness between transmission 16-way connector terminal H53-8 and adapter case terminal M6-4(A) is open. Was a problem found and corrected?	Go to Step 20	—
17	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is open. Was a problem found and corrected?	Go to Step 20	—
18	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30-E) section. Is the replacement complete?	Go to Step 20	—
19	Check the PCM connector terminal J2-D2, transmission 16-way connector terminal H53-8 and transmission adapter case connector terminal M6-4(A). Was a problem found and corrected?	Go to Step 20	—
20	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: <ul style="list-style-type: none"> ● The TCC solenoid is commanded "on" and the volts increase to B+. ● The TCC solenoid is commanded "off" and the volts drop to zero. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

TRANSMISSION

MANUAL TRANSMISSION

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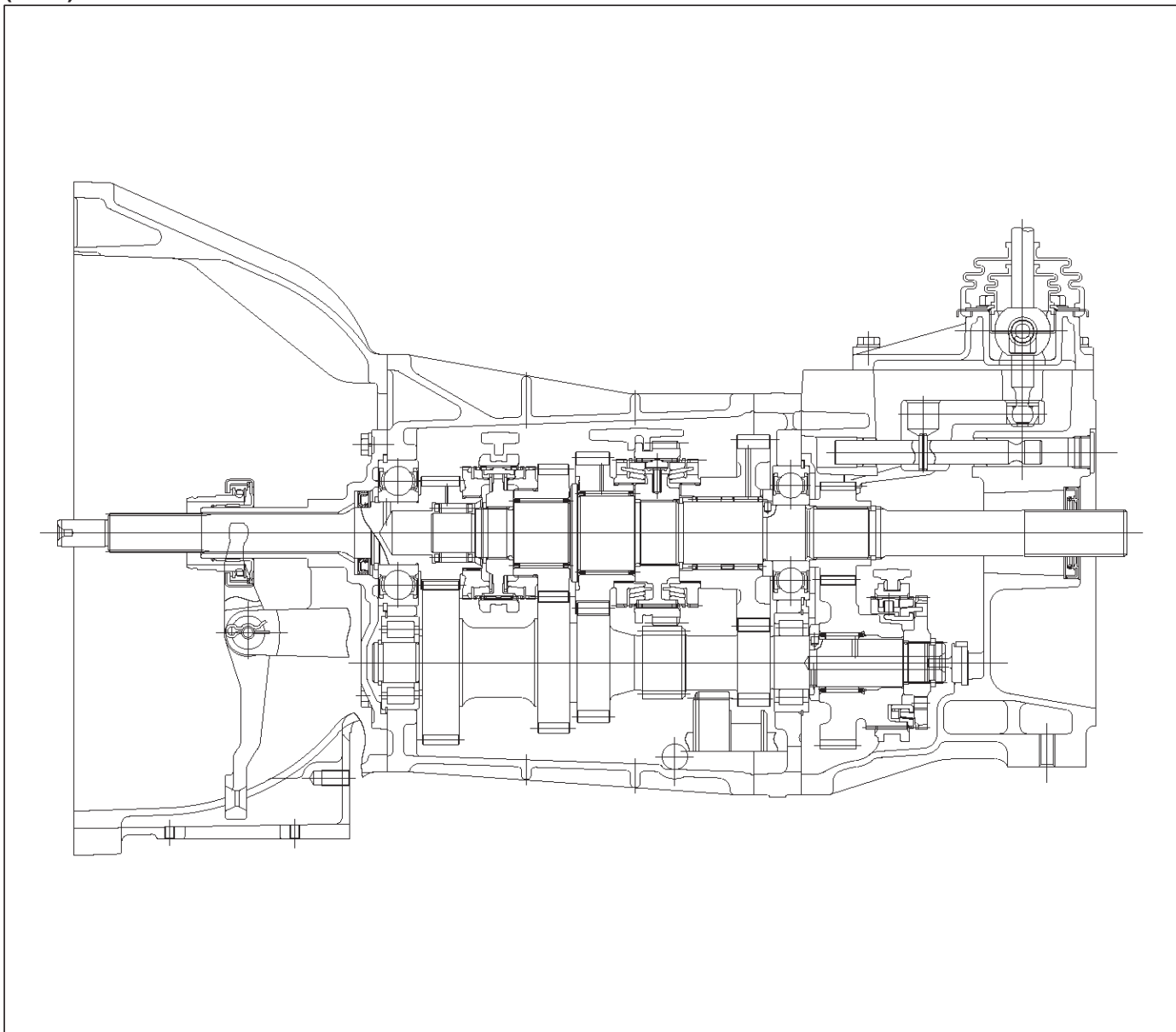
Service Precaution

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

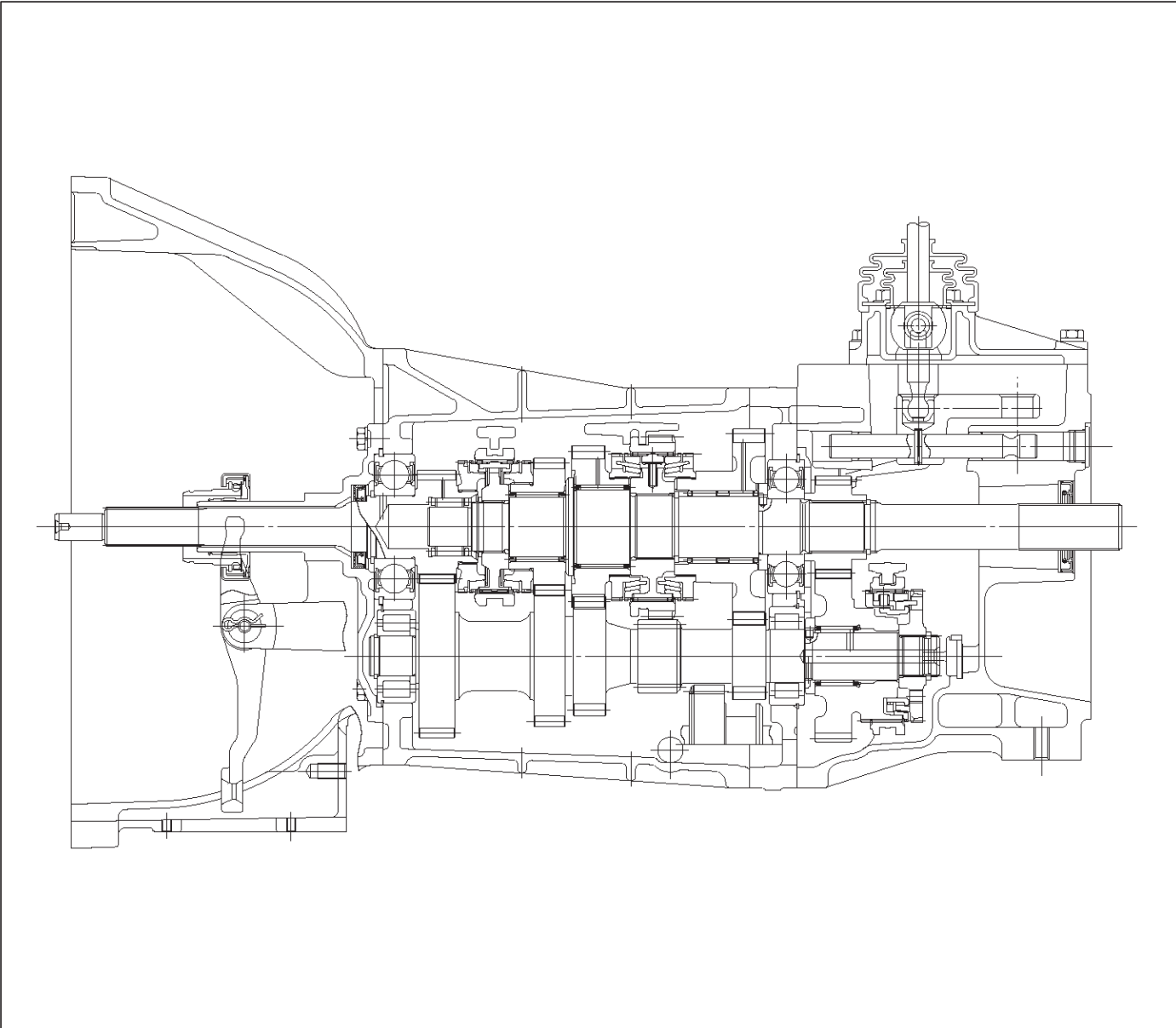
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread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

General Description

(6VE1)



(4JX1)



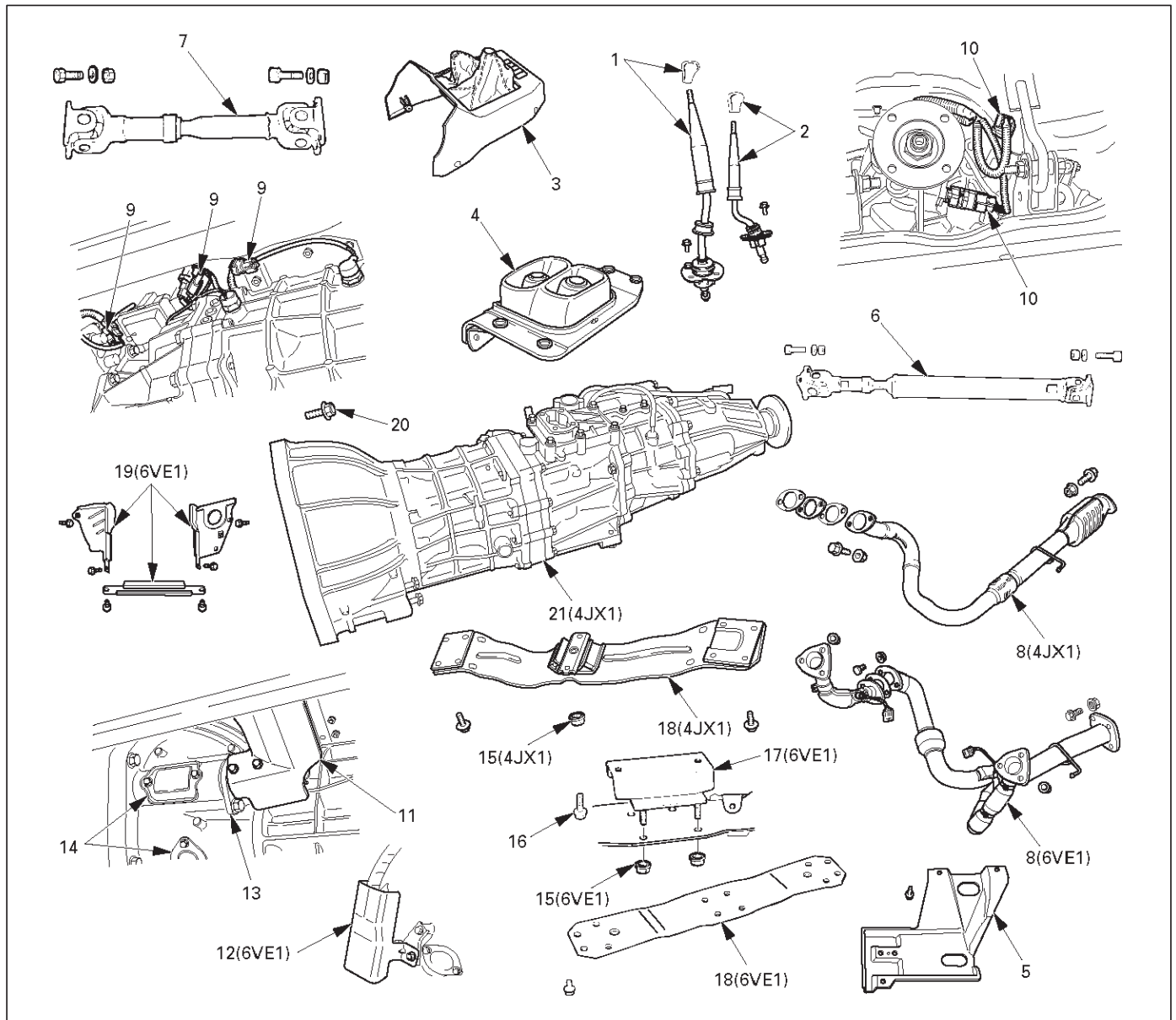
7B-4 MANUAL TRANSMISSION

Diagnosis

Condition	Possible cause	Correction
Abnormal noise	Flywheel pilot bearing worn	Replace
	Bearings worn or broken (Mainshaft, counter shaft, and transfer shaft)	Replace
	Gear tooth contact surfaces worn or scuffed (Mainshaft, counter shaft, reverse idler gear and transfer gears)	Replace
	Splines worn (Mainshaft, synchronizer clutch hub)	Replace
	Gear or bearing thrust face seized	Replace
	Lack of backlash between meshing gears	Replace
Hard Shifting	Improper clutch pedal free play	Readjust
	Change lever sliding portions worn	Repair or replace Regrease
	Shift block, shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Synchronizer parts worn	Replace
Walking or Jumping out of gear	Detent ball worn	Replace
	Detent spring weakened or broken	Replace
	Shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Bearings worn or broken	Replace
	Splines worn (Mainshaft, synchronizer hub)	Replace
	Synchronizer spring weakened or broken	Replace
Oil leakage	Loose drain plug(s) and/or filler plug(s)	Tighten Replenish oil
	Defective or improperly installed gasket(s)	Replace
	Oil seal worn or scratched	Replace

Manual Transmission Assembly

Transmission and Associated Parts



220RW108

Legend

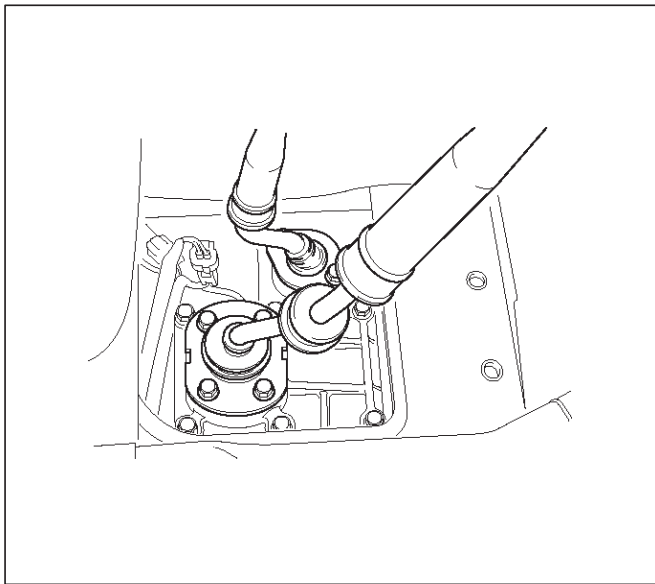
- | | |
|--|---|
| (1) Gear Control Lever and Knob | (11) Slave Cylinder Heat Protector |
| (2) Transfer Control Lever and Knob | (12) Harness Heat Protector |
| (3) Front Console Assembly | (13) Slave Cylinder |
| (4) Grommet Assembly | (14) Dust Cover |
| (5) Transfer Protector | (15) Engine Rear Mount Nut |
| (6) Rear Propeller Shaft | (16) Engine Rear Mount Bolt |
| (7) Front Propeller Shaft | (17) Engine Rear Mount |
| (8) Exhaust Pipe | (18) Third Crossmember |
| (9) Backup Lamp, 4WD Indicator, and 1-2 Indicator Switch Harness Connector | (19) Flywheel Under Cover |
| (10) Speedometer Sensor and 2WD-4WD Actuator Harness Connector | (20) Transmission Retaining Bolt |
| | (21) Transmission Assembly with Transfer Case |

7B-6 MANUAL TRANSMISSION

Removal

NOTE: Before remove the transmission and transfer assembly from the vehicle, change the transfer mode to 2WD using push button on dash panel.

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Remove the gear control lever knob.
4. Remove the front console assembly.
5. Remove the grommet assembly.
6. Remove the transmission control lever and transfer control lever.

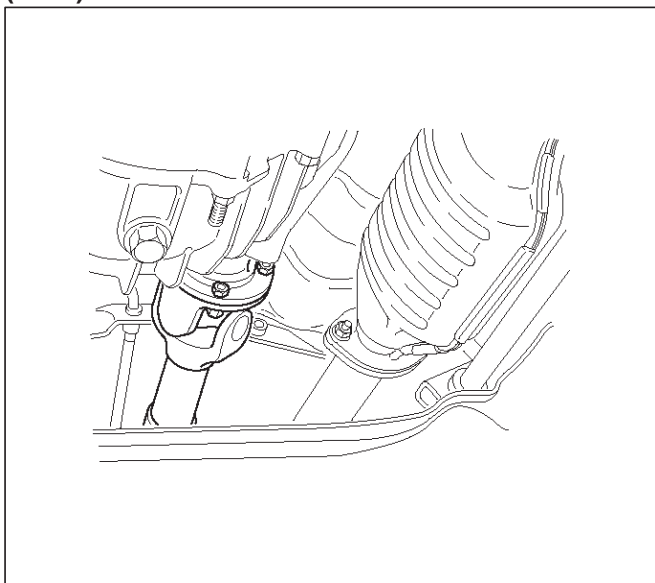


235RW014

7. Raise and support the vehicle with suitable jack stand.
8. Remove transfer protector.
9. Remove the rear propeller shaft.

NOTE: Apply alignment marks on the flange at the both front and rear side.

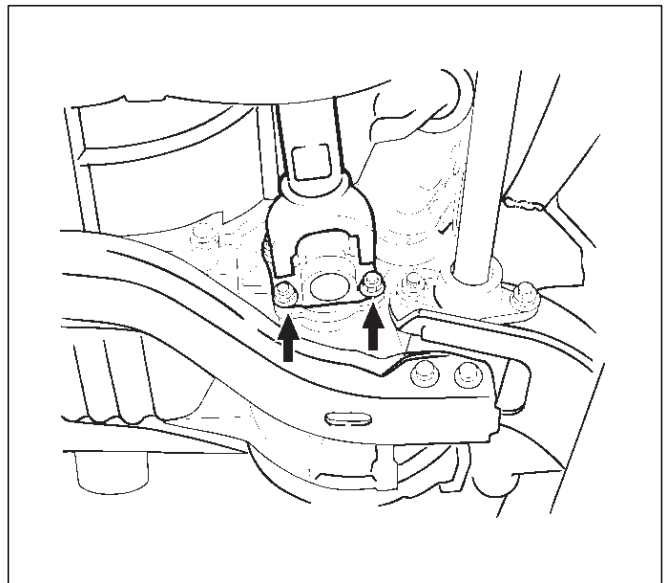
(4JX1)



401RW060

10. Remove the front propeller shaft.

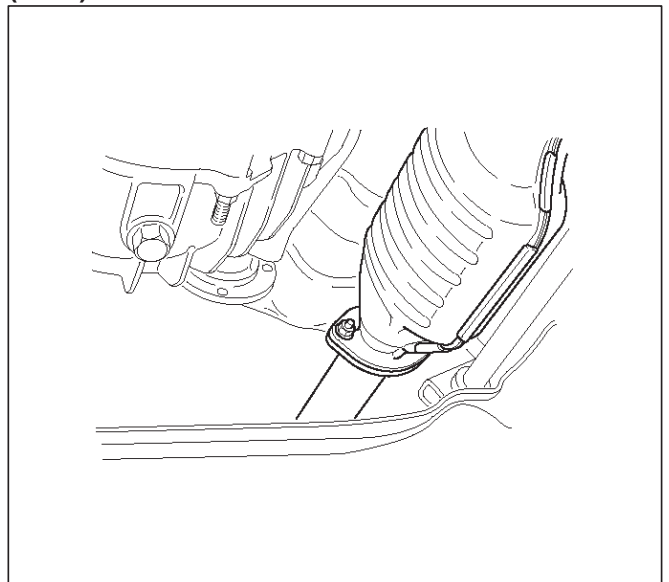
NOTE: Apply alignment marks on the flange at both the front and rear sides.



401RS003

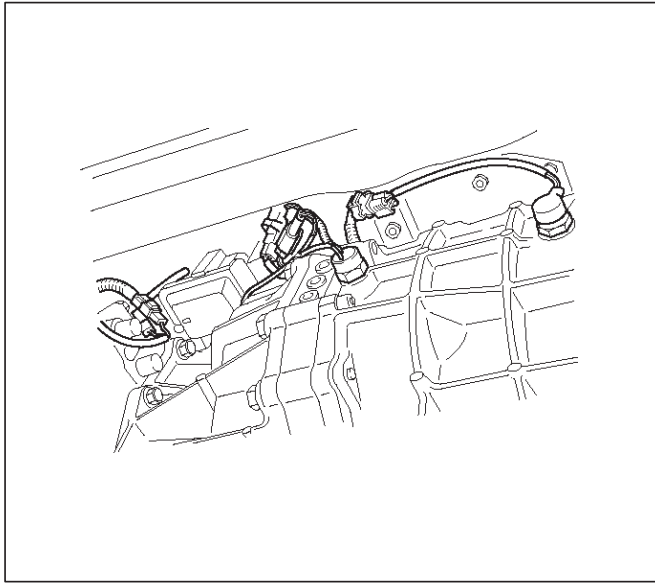
11. Disconnect two oxygen sensor connectors from the transmission harness (6VE1).
12. Remove the front and 3 way exhaust pipe (6VE1). Remove the exhaust pipe with catalytic converter (4JX1).

(4JX1)



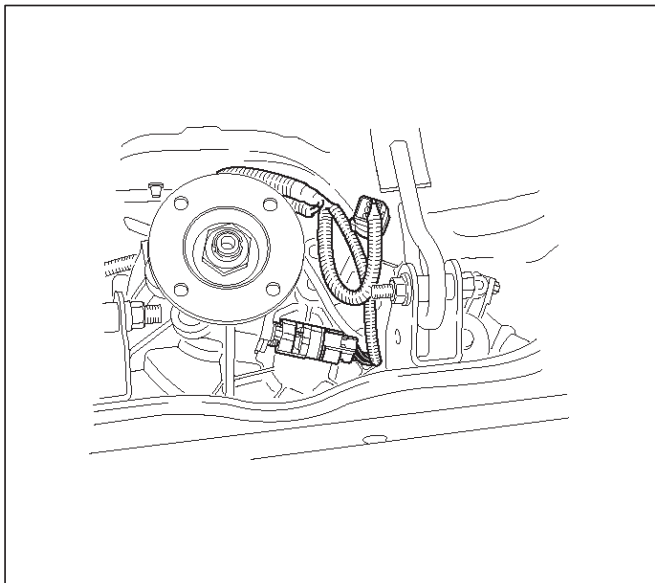
150RW041

13. Disconnect the backup lamp switch, 4WD indicator switch and 1-2 indicator switch harness connectors.



826RW023

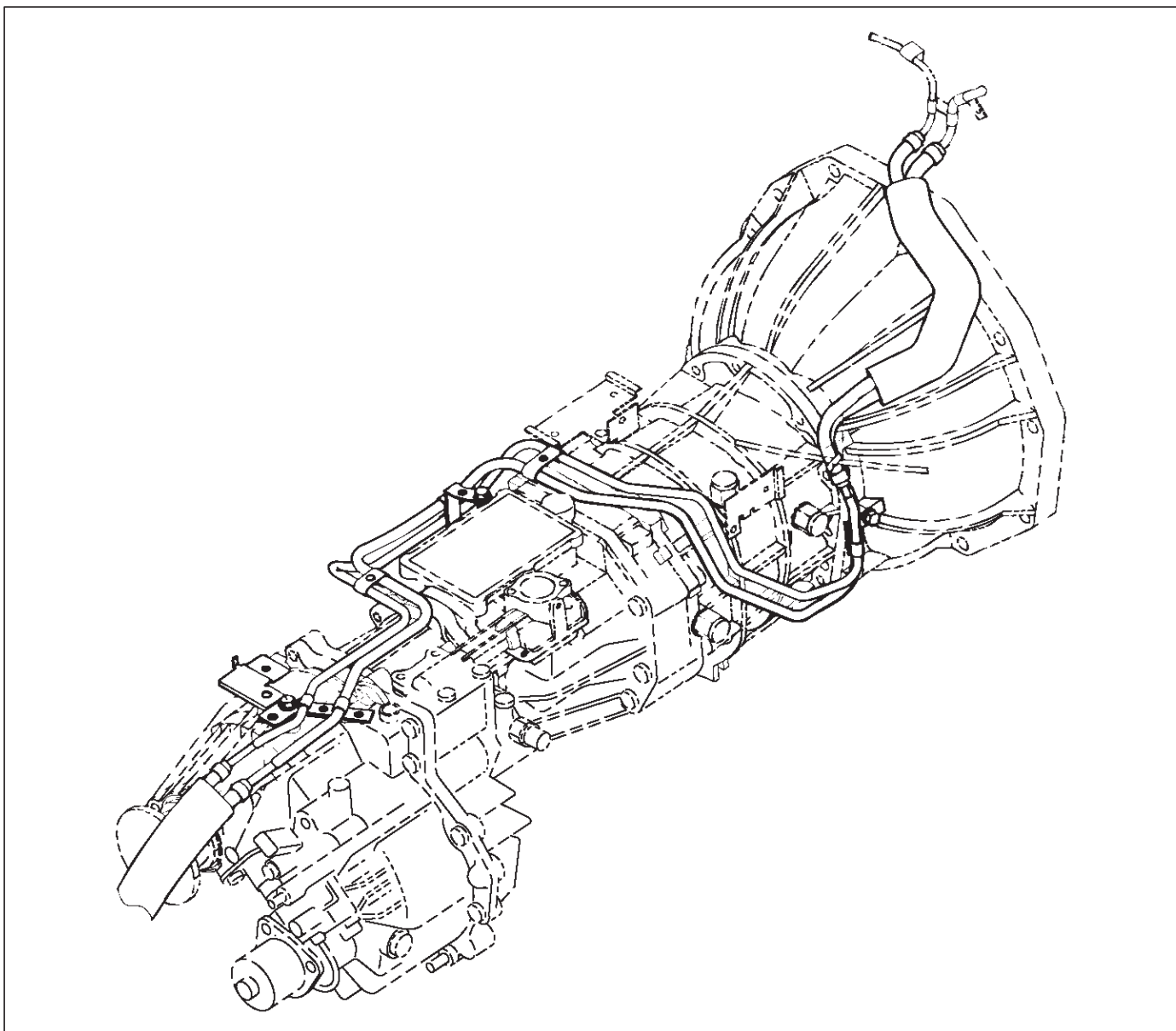
14. Disconnect the speedometer sensor and 2WD-4WD actuator harness connectors.



826RW024

7B-8 MANUAL TRANSMISSION

15. Remove four fuel pipe bracket from the transmission case (6VE1).



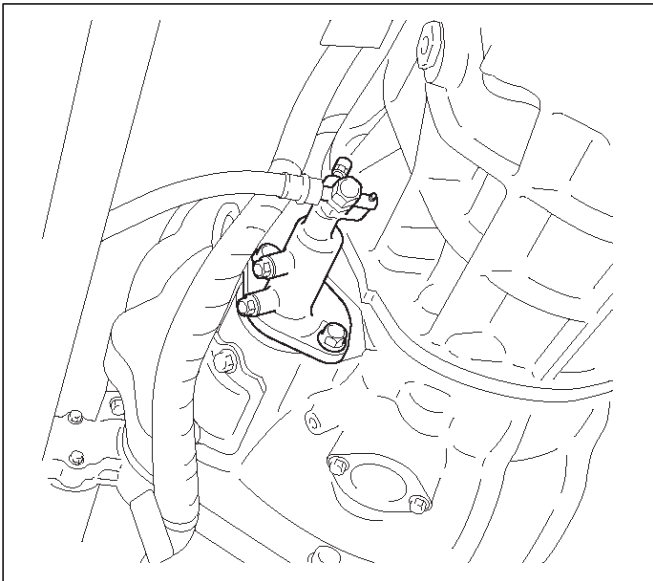
- 16. Remove the slave cylinder heat protector.
- 17. Remove the harness heat protector (6VE1).

(6VE1)



225RW006

- 18. Remove two transmission harness clamps and bracket (6VE1).
- 19. Remove the slave cylinder.

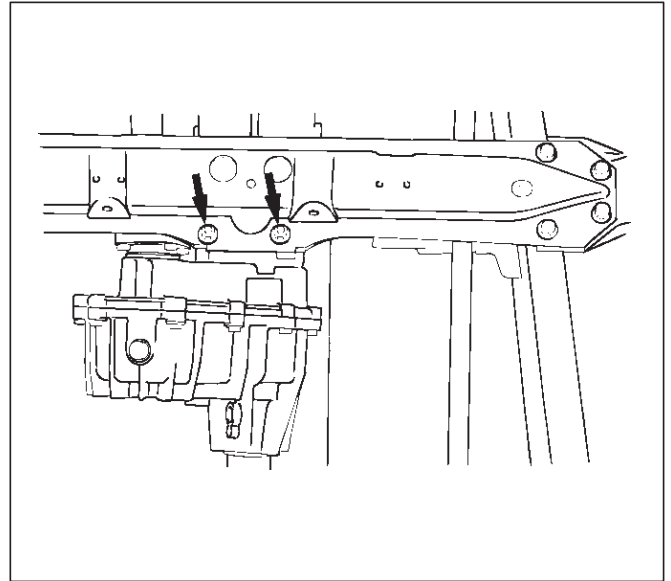


206RW002

- 20. Remove the two dust cover from transmission case.
- 21. Support the transfer case with a jack.

- 22. Remove two engine rear mount nuts.

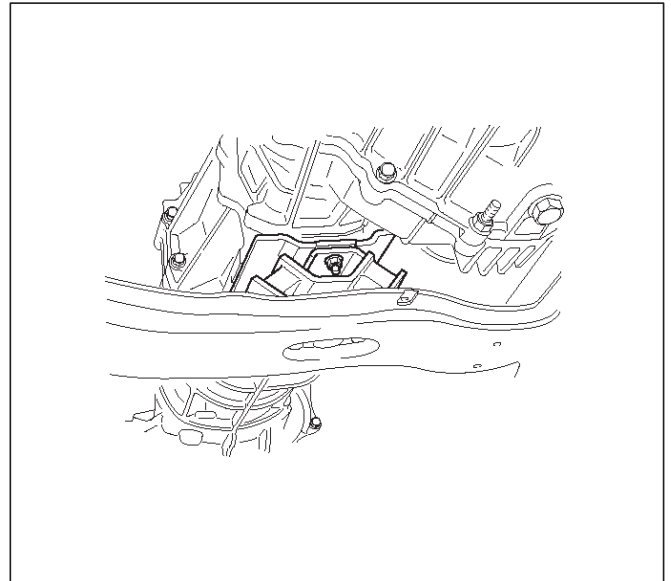
(6VE1)



022RT002

- 23. Remove third crossmember (6VE1).
- 24. Remove third crossmember with rear mount rubber (4JX1).

(4JX1)

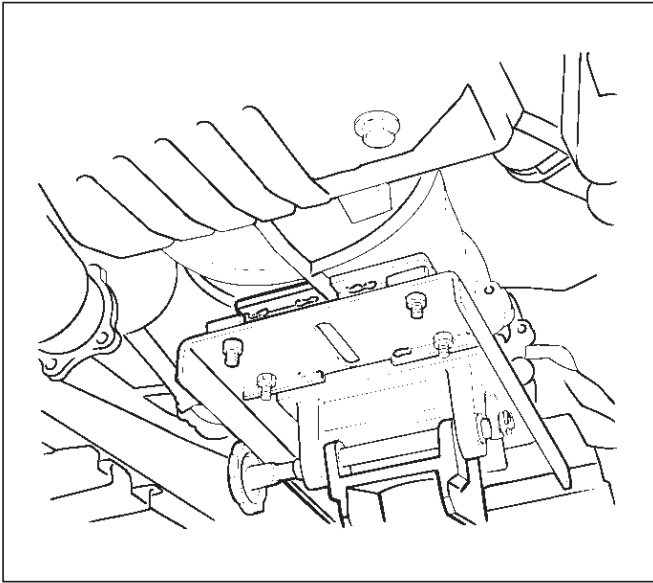


022RW013

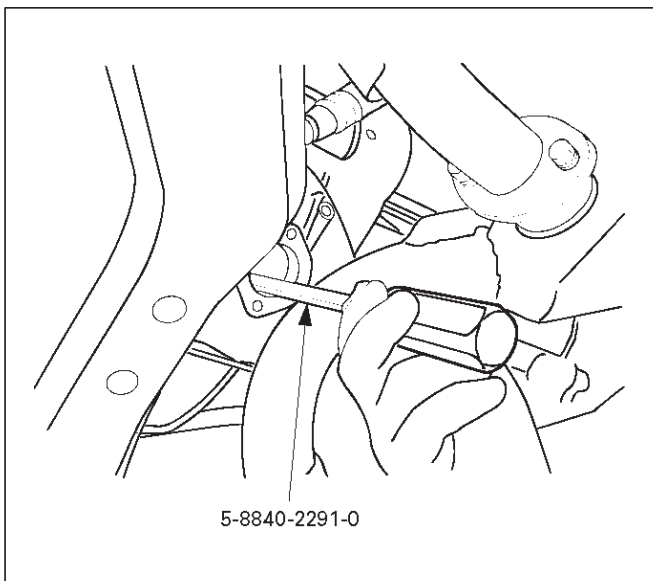
- 25. Remove two engine rear mount bolts (6VE1).
- 26. Remove the rear mount from the transmission (6VE1).
- 27. Remove three flywheel under cover (6VE1).

7B-10 MANUAL TRANSMISSION

28. Support the transmission with a transmission jack and then remove jack from the transfer case side.



29. Use the clutch release bearing remover 5-8840-2291-0 (J-39207) to disconnect the clutch release bearing from the clutch pressure plate.

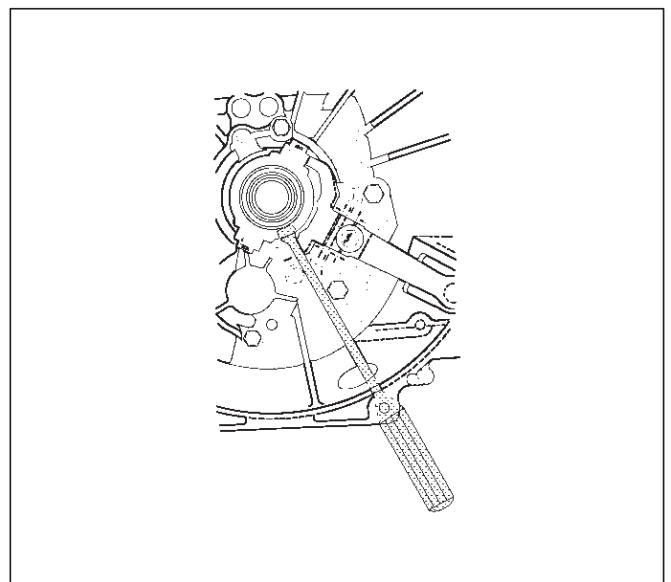
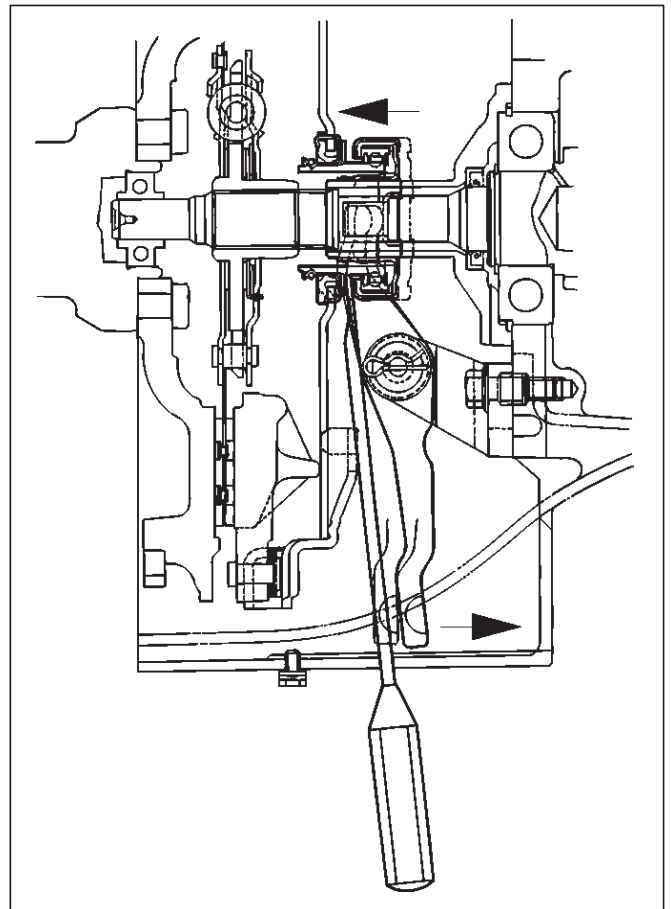


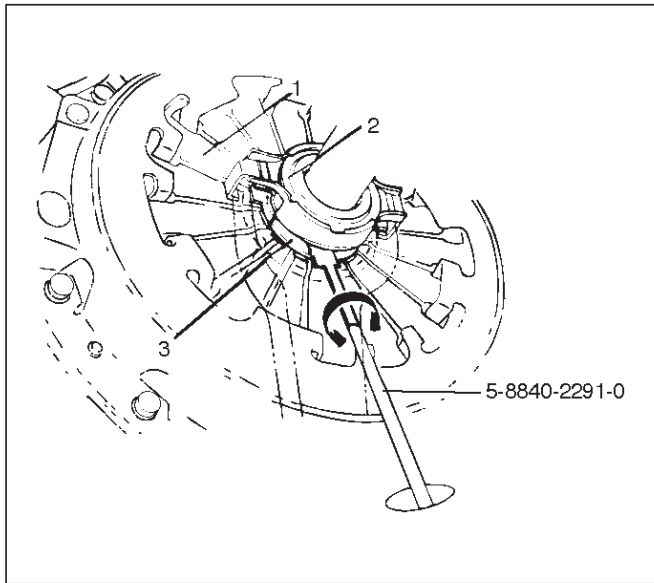
Release bearing disconnection

1. Pull the shift fork toward the transmission to press the clutch release bearing against the clutch.
2. Insert the clutch release bearing remover between the wedge collar and the release bearing.

3. Turn the remover to separate the release bearing.

NOTE: Be sure not to insert the remover between the wedge collar and the clutch.





Legend

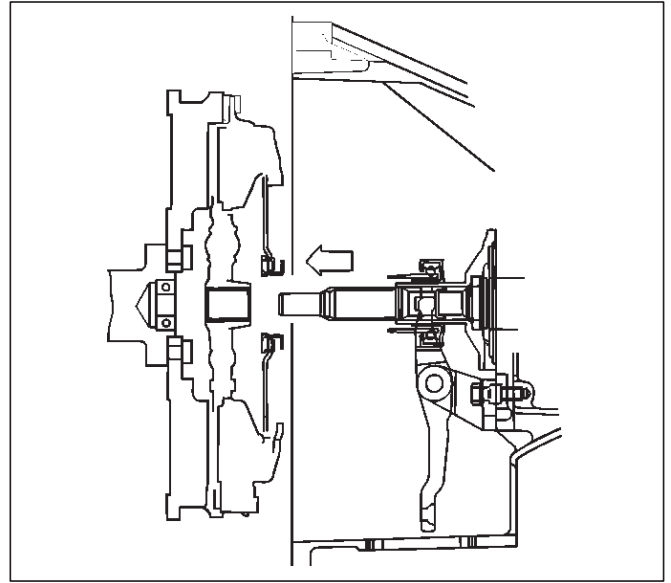
- (1) Pressure Plate Assembly
- (2) Release Bearing
- (3) Wedge Collar

- 30. Remove the transmission retaining nuts and bolts.
- 31. Remove the transmission assembly with transfer case from the vehicle.

NOTE: Remove the transfer case from the transmission assembly if the transmission disassembly required. Refer to Transfer Case in Drive Line/Axle section.

Installation

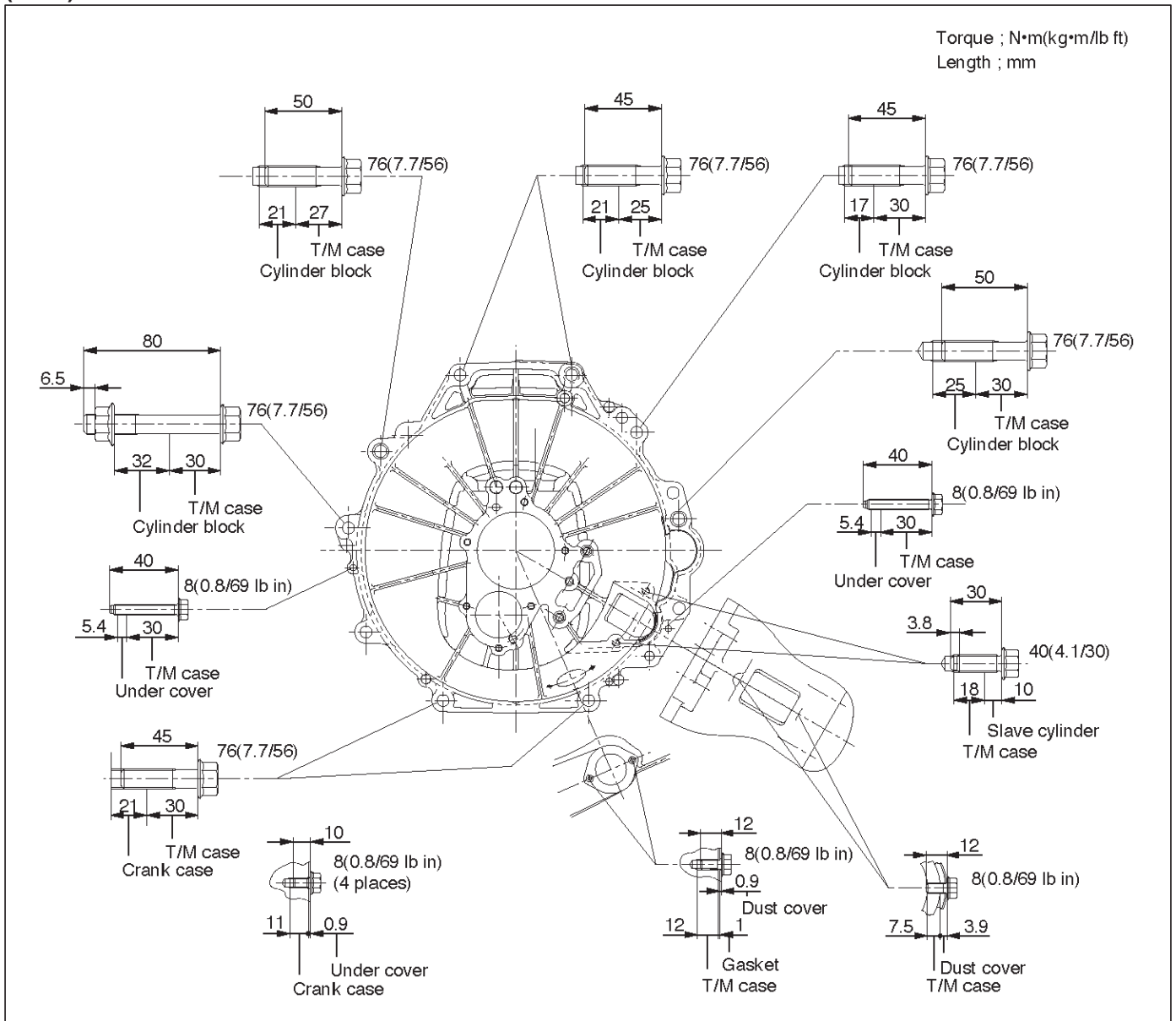
- 1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Slowly operate the transmission jack until the front of transmission is aligned with the rear of the engine. The slope of the engine and the transmission must be the same.
- 3. Align the top gear shaft spline with the clutch driven plate spline.



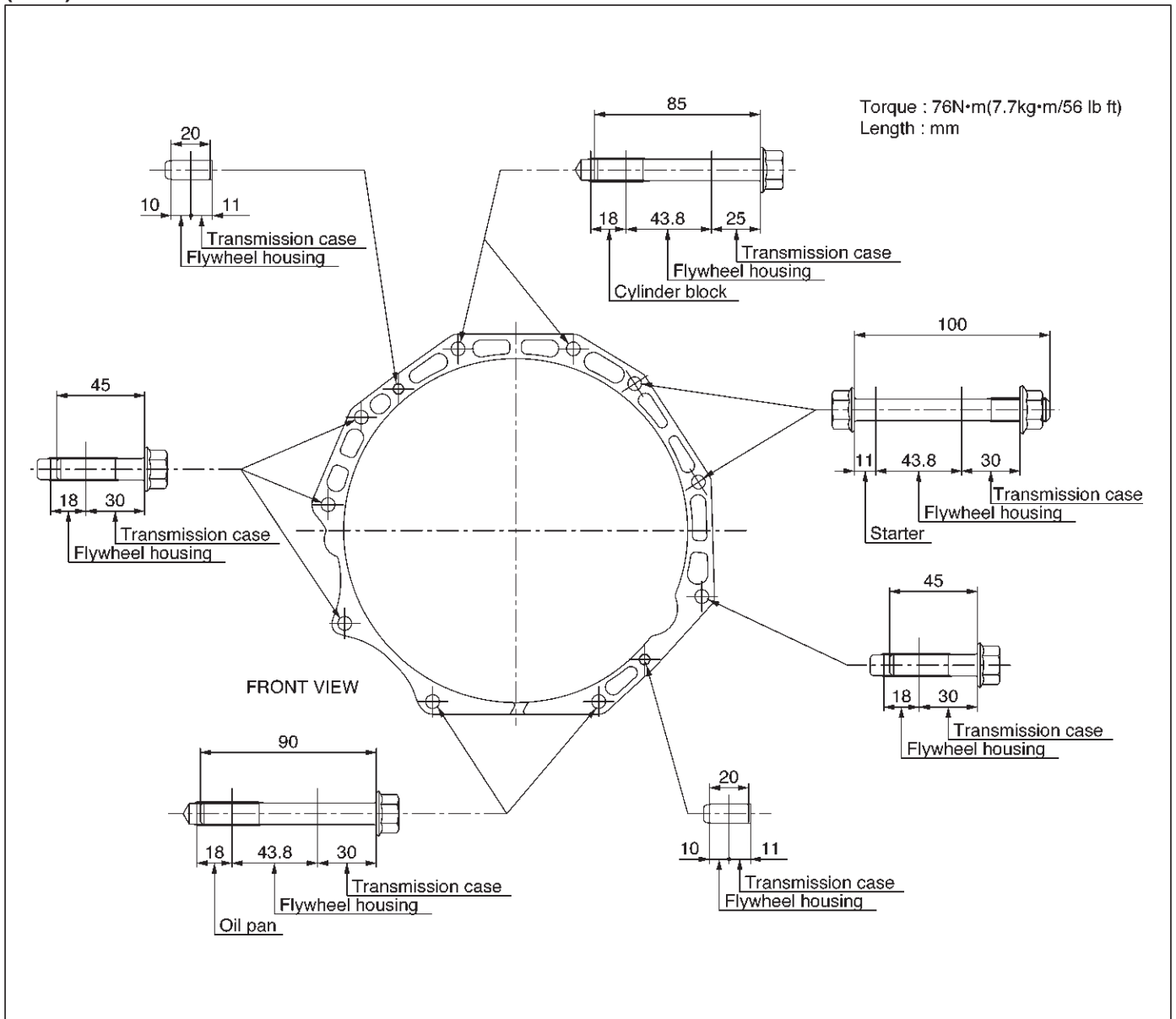
- 4. Install the transmission to the engine. Tighten the transmission retaining nuts and bolts.

7B-12 MANUAL TRANSMISSION

(6VE1)



(4JX1)

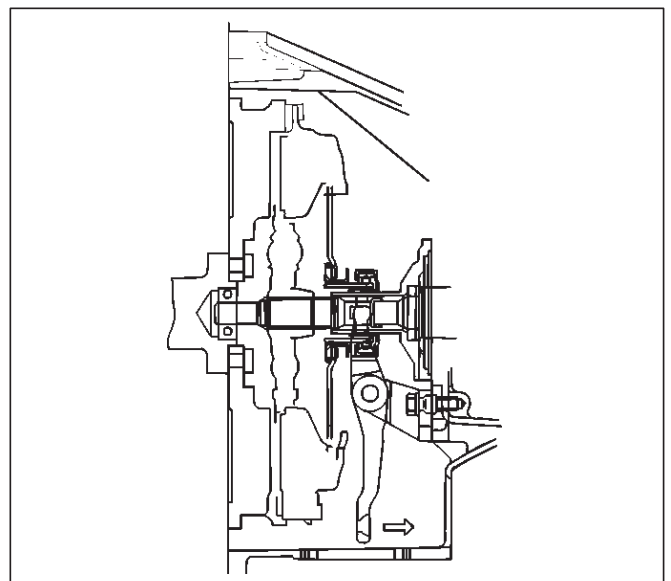


225RW020

5. Apply a force of about 113N (26 lb) to the tip of the shift fork in the direction of the transmission to engage the clutch pressure plate and release bearing.

NOTE: A clicking sound is heard when the release bearing and the tip of the diaphragm spring engage each other.

Check to see if they are securely engaged by pushing the tip of the shift fork toward the engine while applying a force of about 25 N (5.5 lb). If the shift fork will not move, then they are securely engaged.



220RS006

6. Install three flywheel under cover (6VE1).

7B-14 MANUAL TRANSMISSION

7. Install the engine rear mount to the transmission case and tighten the fixing bolts specified torque (6VE1).

Torque: 41 N·m (4.2kg·m/30 lb ft)

8. Install the third crossmember to the frame and tighten the fixing bolts specified torque.

Torque: 50 N·m (5.1kg·m/37 lb ft)

9. Tighten the engine rear mount nuts specified torque.

Torque: 50 N·m (5.1kg·m/37 lb ft)

10. Remove the transmission jack.

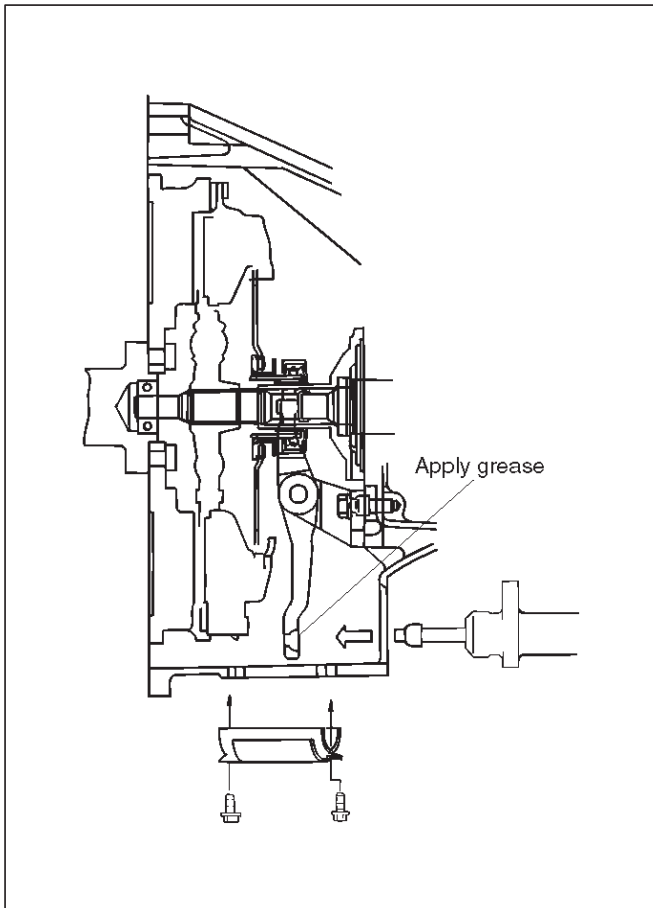
11. Apply the grease to top hole portion of the shift fork.

12. Install the slave cylinder and tighten the fixing bolts specified torque.

Torque: 43 N·m (4.4kg·m/32 lb ft)

13. Install the clutch dust cover to the clutch housing and tighten the fixing bolts specified torque.

Torque: 8 N·m (0.8kg·m/69 lb in)



14. Install the slave cylinder heat protector to the slave cylinder.

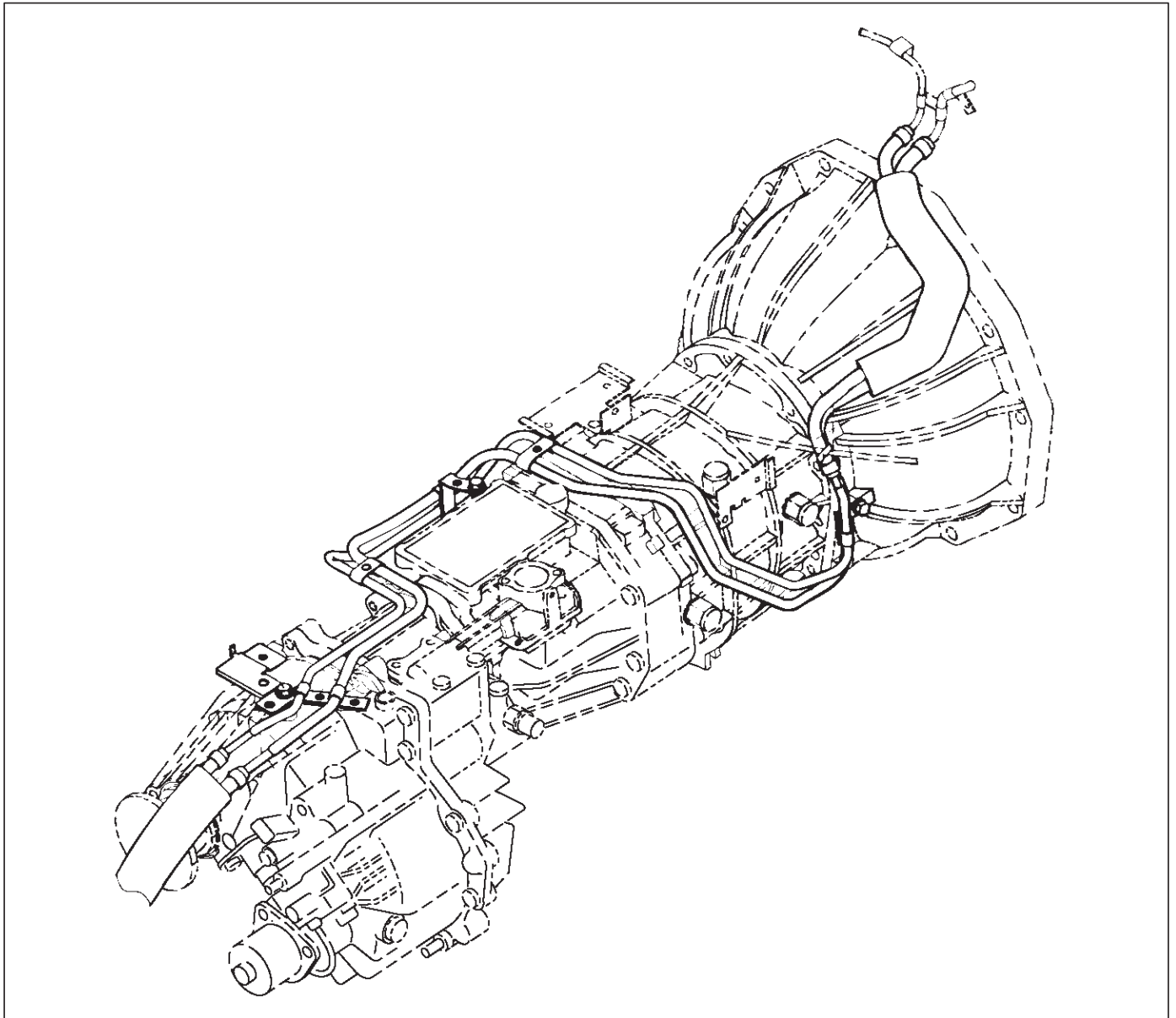
15. Install bracket and two transmission harness clamps to the transmission case (6VE1).

16. Install harness heat protector (6VE1).

(6VE1)

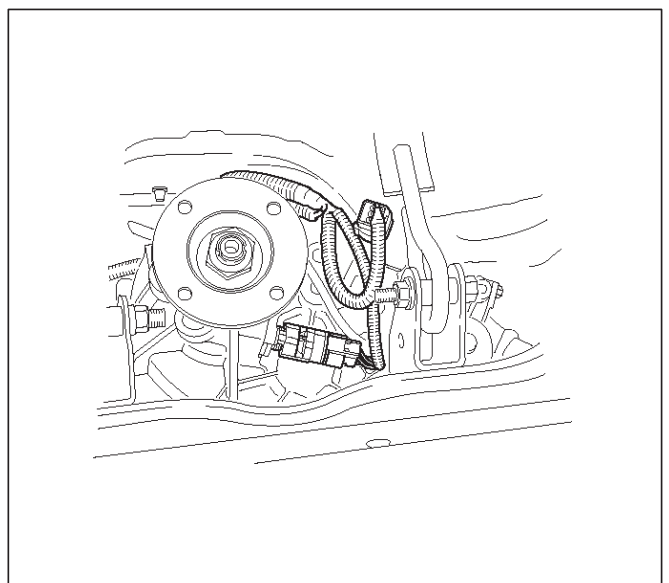


17. Install four fuel pipe bracket (6VE1).



141RW024

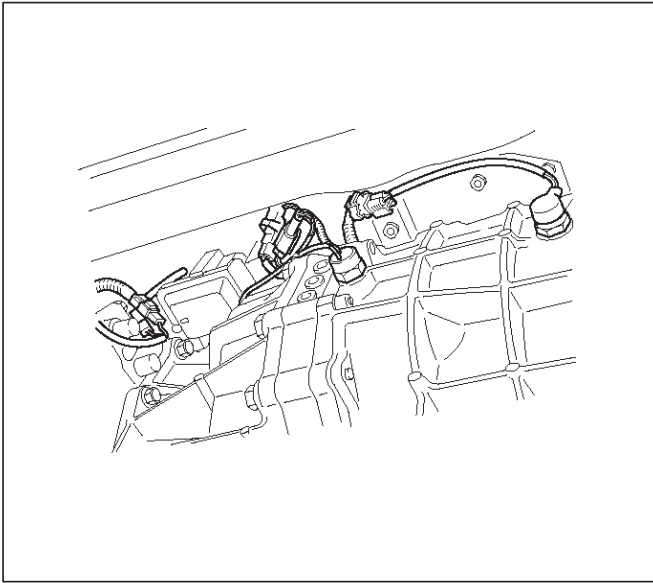
18. Connect the speedometer sensor and 2WD-4WD actuator harness connector.



826RW024

7B-16 MANUAL TRANSMISSION

19. Connect the backup lamp switch, 4WD indicator switch, and 1-2 indicator switch harness connectors.



826RW023

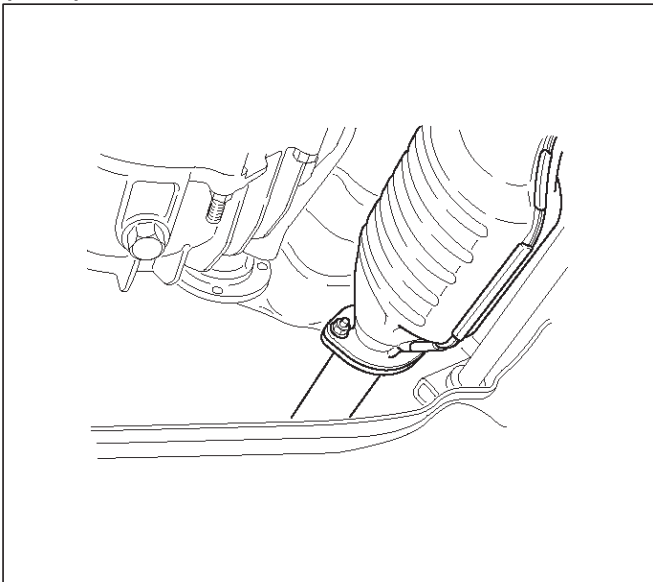
20. Install the front and 3 way exhaust pipe (6VE1).
Install the exhaust pipe with catalytic converter (4JX1).

Torque:

Exhaust pipe to exhaust manifold:
67 N·m (6.8 kg·m/49 lb ft)

Exhaust pipe flange bolt:
43 N·m (4.4 kg·m/32 lb ft)

(4JX1)



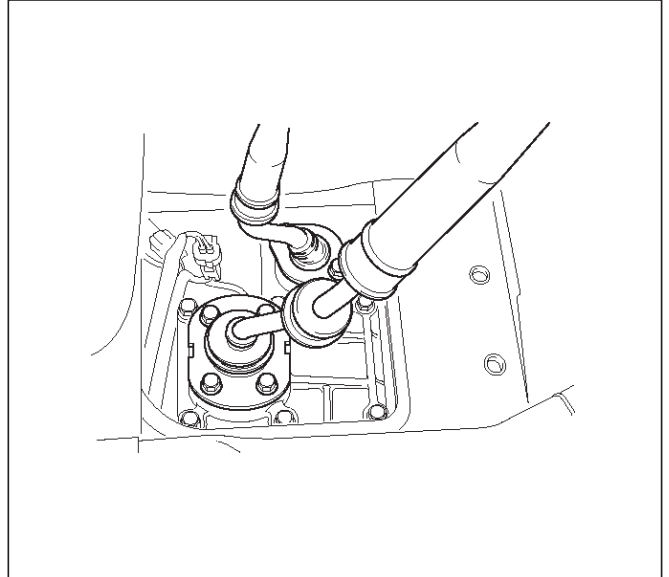
150RW041

21. Connect two oxygen sensor connectors to the transmission harness (6VE1).
22. Install the front propeller shaft and tighten the fixing bolts and nuts specified torque.
- Torque: 63 N·m (6.4 kg·m/46 lb ft)**
23. Install the rear propeller shaft and tighten the fixing bolts and nuts specified torque.
- Torque: 63 N·m (6.4 kg·m/46 lb ft)**

24. Install transfer protector and tighten the fixing bolts specified torque.

Torque: 37 N·m (3.8 kg·m/27 lb ft)

25. Install the transmission control lever and transfer control lever.



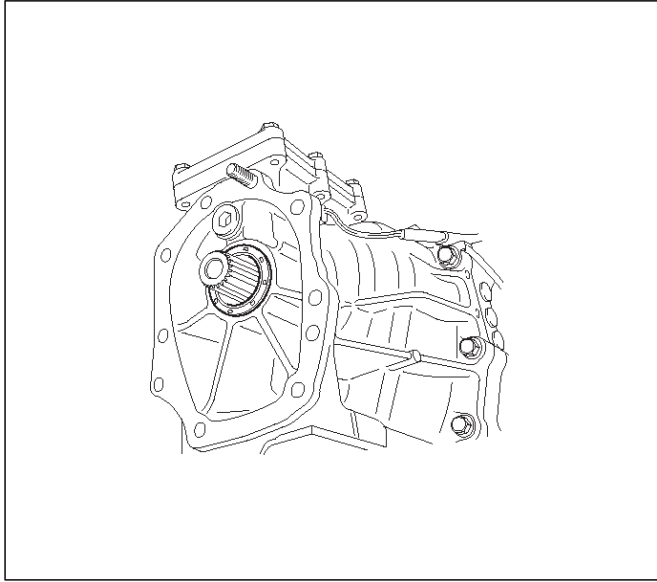
235RW014

26. Install the grommet assembly.
27. Install the front console assembly.
28. Install the gear control lever knob.
29. Connect battery ground cable.
30. Install engine hood.

Rear Oil Seal (Transfer Adapter)

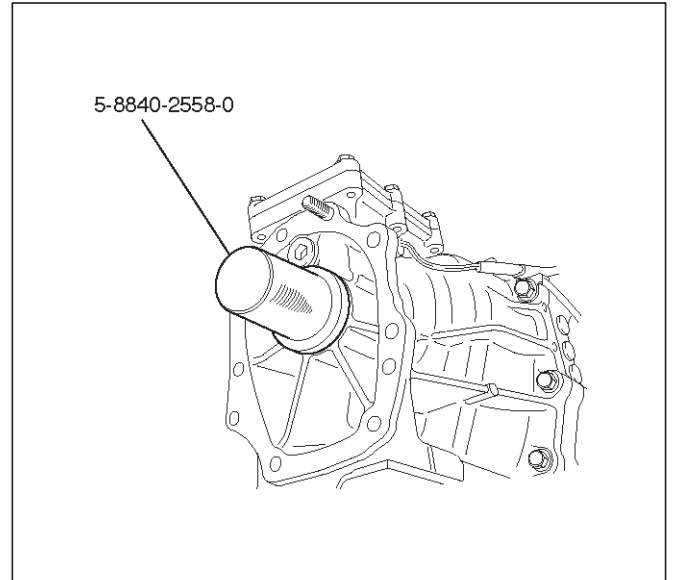
Removal

1. Remove the transfer case assembly from the vehicle.
Refer to Transfer Case in Drive Line/Axle section.
2. Remove the rear oil seal from the transfer adapter.



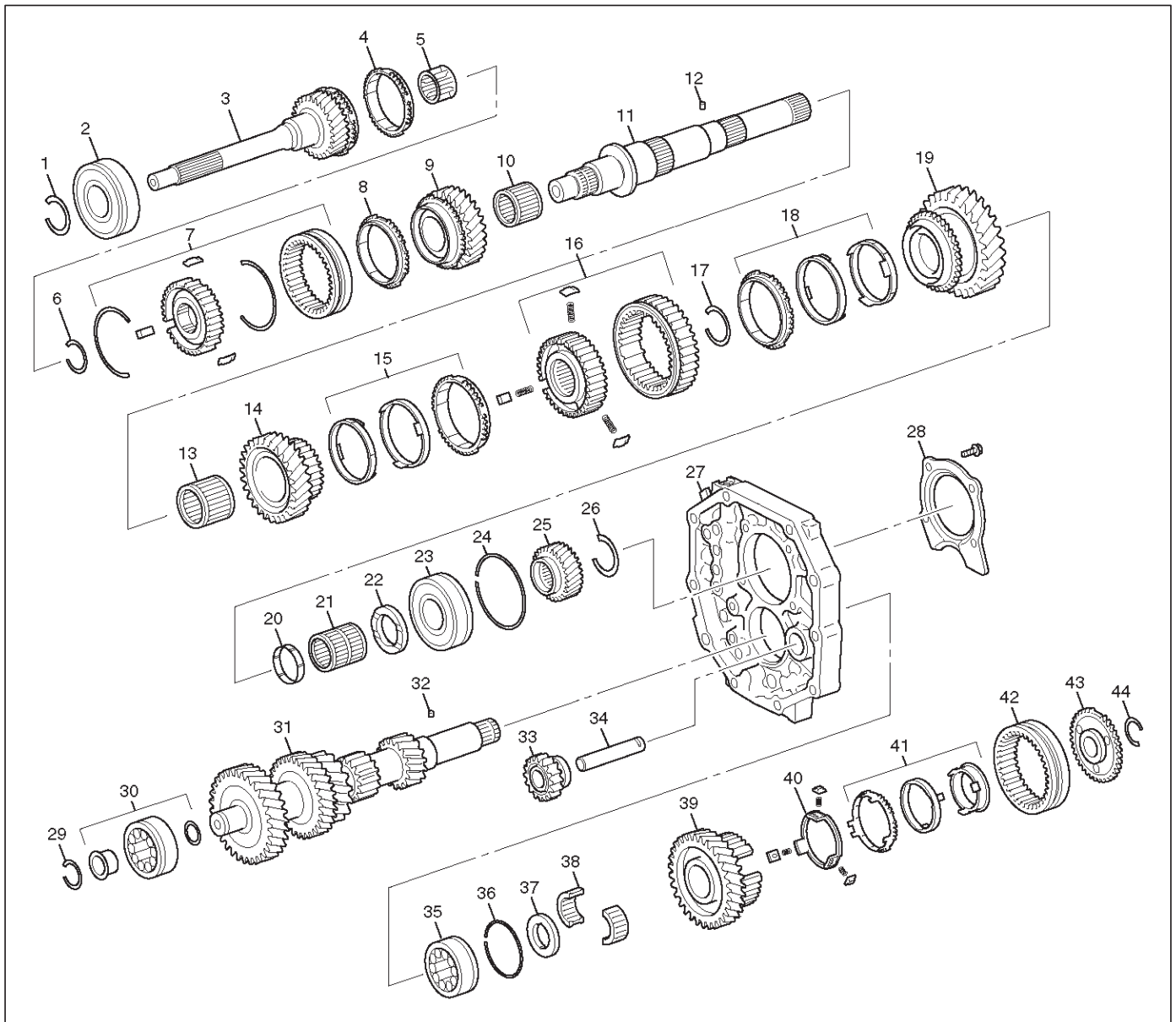
Installation

1. Use 5-8840-2558-0 (J-42802) transfer adapter oil seal installer, and install the rear oil seal to the transfer adapter.
2. Apply grease to the oil seal lip.
3. Install the transfer case assembly to the vehicle.
Refer to Transfer Case in Drive Line/Axle section.



Transmission (AR-5)

Disassembled View

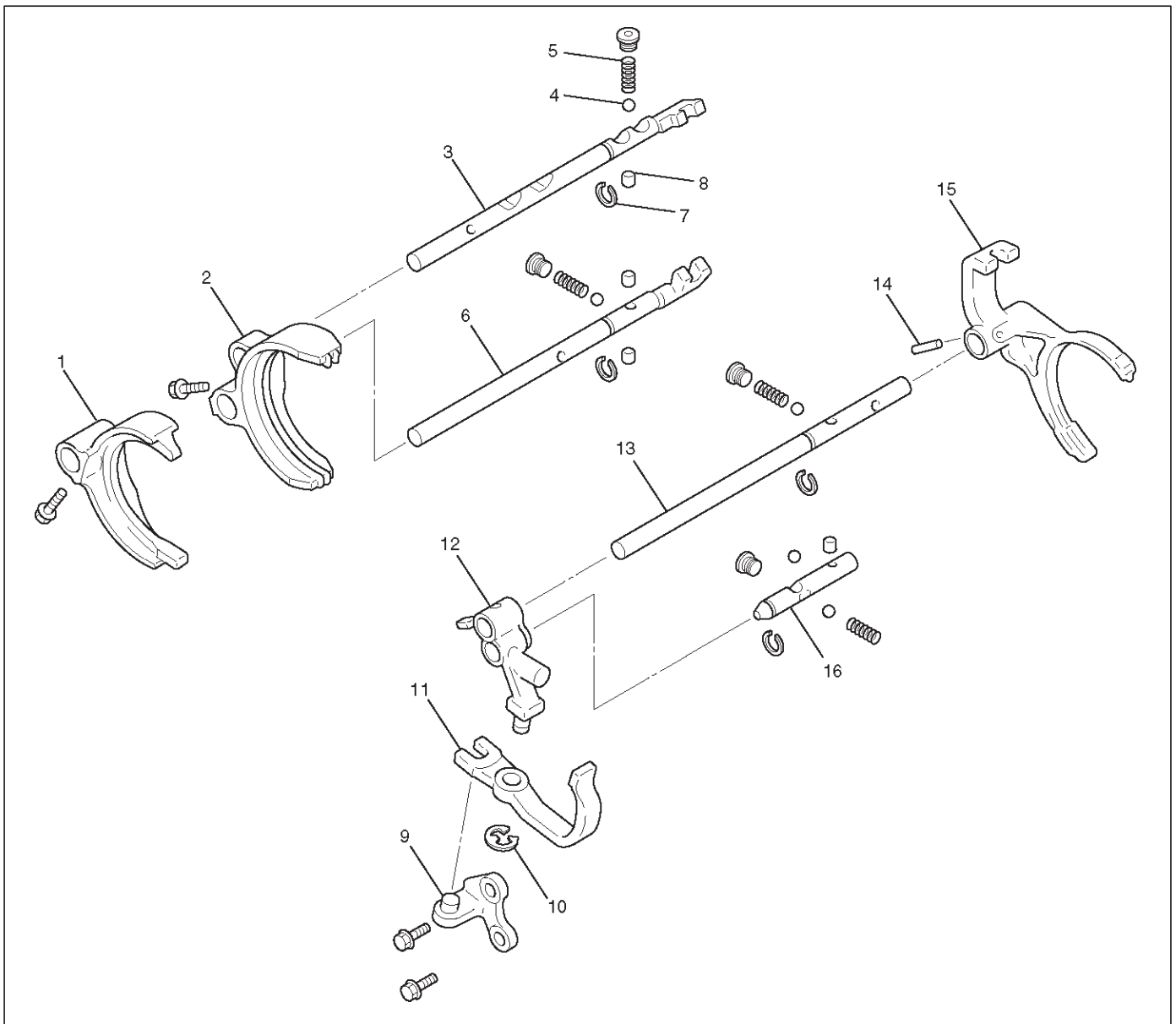


226RW182

Legend

- | | |
|-------------------------------------|-------------------------------------|
| (1) Snap Ring | (16) Clutch Hub No.1 Assembly |
| (2) Bearing | (17) Snap Ring |
| (3) Top Gear Shaft | (18) Synchronizer Assembly |
| (4) Block Ring | (19) 1st Gear |
| (5) Roller Bearing | (20) 1st Gear Bearing Spacer |
| (6) Snap Ring | (21) 1st Gear Needle Roller Bearing |
| (7) Clutch Hub No.2 Assembly | (22) 1st Gear Thrust Washer |
| (8) 3rd Block Ring | (23) Mainshaft Bearing |
| (9) 3rd Gear | (24) Snap Ring |
| (10) 3rd Gear Needle Roller Bearing | (25) 5th Gear |
| (11) Mainshaft | (26) Snap Ring |
| (12) Thrust Washer Pin | (27) Intermediate Plate |
| (13) 2nd Gear Needle Roller Bearing | (28) Bearing Retainer |
| (14) 2nd Gear | (29) Snap Ring |
| (15) Synchronizer Assembly | (30) Front Bearing Assembly |
| | (31) Counter Gear Shaft |

- | | |
|--|----------------------------|
| (32) Thrust Washer Pin | (39) Counter 5th Gear |
| (33) Reverse Idle Gear | (40) Reverse Block Ring |
| (34) Reverse Idle Gear Shaft | (41) Synchronizer Assembly |
| (35) Counter Gear Shaft Center Bearing | (42) Hub Sleeve No.3 |
| (36) Snap Ring | (43) 5th Gear Spline Piece |
| (37) Thrust Washer | (44) Snap Ring |
| (38) Roller Bearing | |

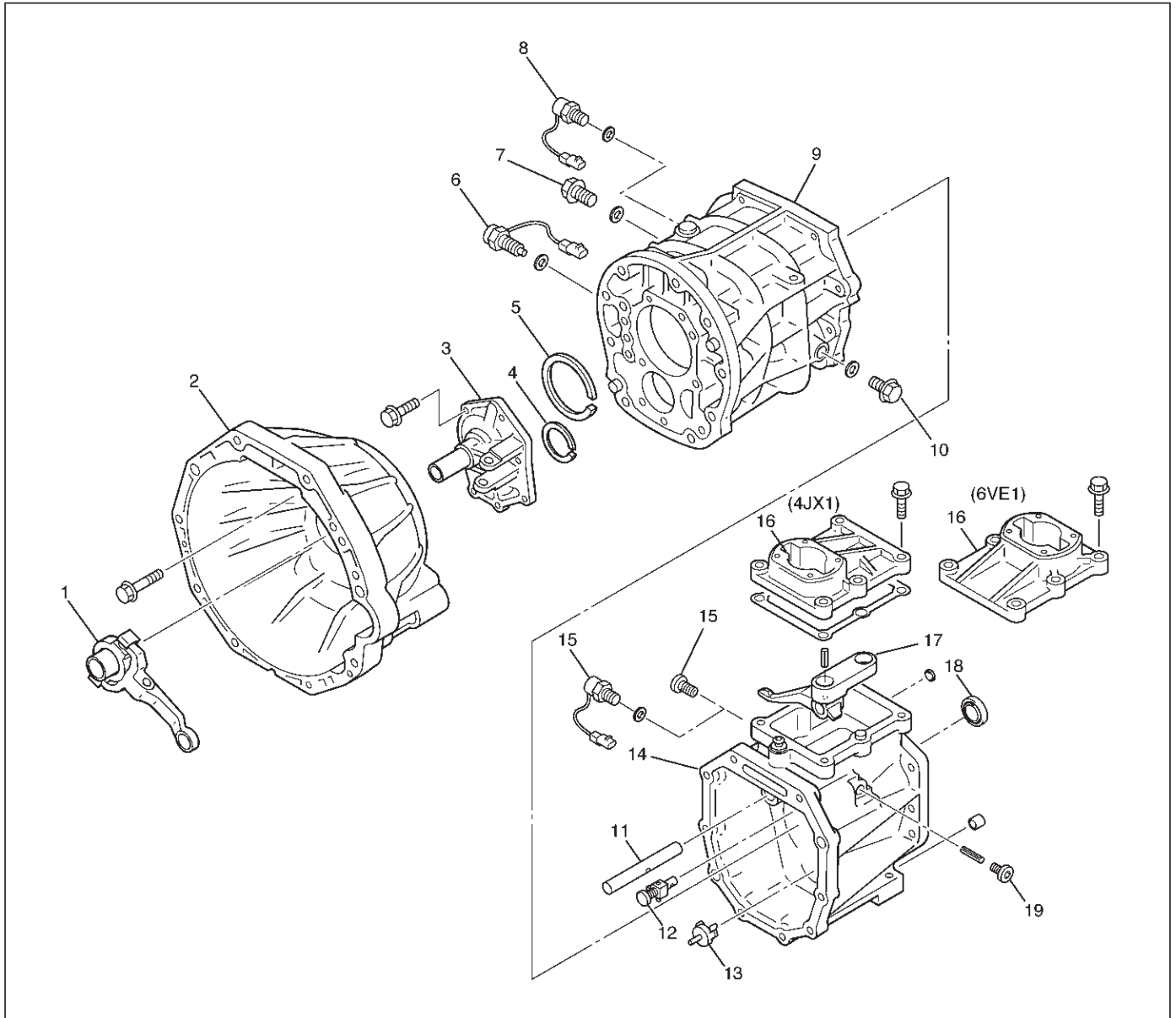


226RW00001

Legend

- | | |
|-----------------------|-------------------------------|
| (1) 3rd-4th Shift Arm | (9) Reverse Shift Arm Bracket |
| (2) 1st-2nd Shift Arm | (10) E-Ring |
| (3) 3rd-4th Shift Rod | (11) Reverse Shift Arm No.2 |
| (4) Ball | (12) Reverse Shift Arm No.1 |
| (5) Spring | (13) 5th Reverse Shift Rod |
| (6) 1st-2nd Shift Rod | (14) Spring Pin |
| (7) Snap Ring | (15) 5th Shift Arm |
| (8) Interlock Pin | (16) Reverse Shift Rod |

7B-20 MANUAL TRANSMISSION



220RW095

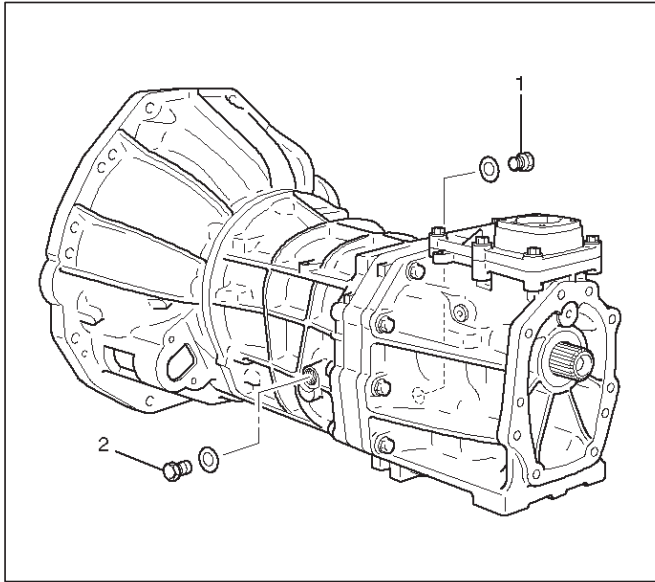
Legend

- | | |
|------------------------------------|---|
| (1) Release Bearing and Shift Fork | (10) Filler Plug |
| (2) Clutch Housing | (11) Gear Control Rod |
| (3) Front Cover | (12) Reverse Restrict Pin |
| (4) Snap Ring | (13) Oil Receiver Pipe |
| (5) Snap Ring | (14) Transfer Adapter |
| (6) 1st and 2nd Switch | (15) Plug (6VE1) or Neutral Switch (4JX1) |
| (7) Drain Plug | (16) Gear Control Box |
| (8) Backup Light Switch | (17) Shift Lever Housing |
| (9) Transmission Case | (18) Oil Seal |
| | (19) Plug |

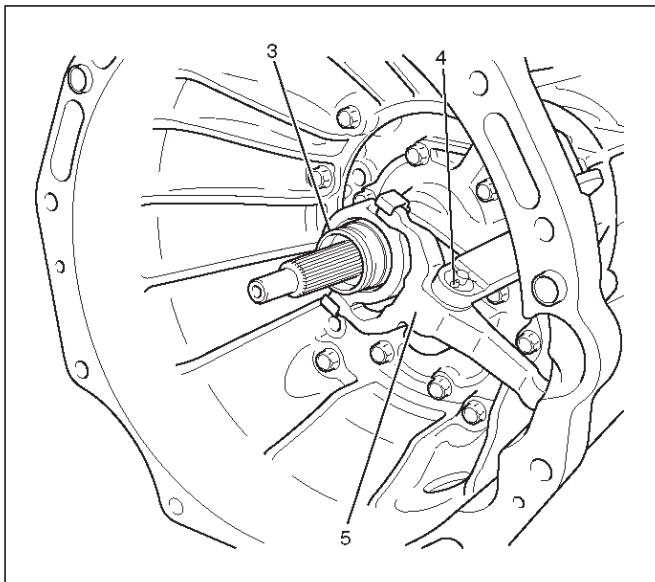
Disassembly

1. Remove the drain plug and filler plug.
 1. Remove the drain plug (1) and gasket.
 2. Remove the filler plug (2) and gasket.

(6VE1)

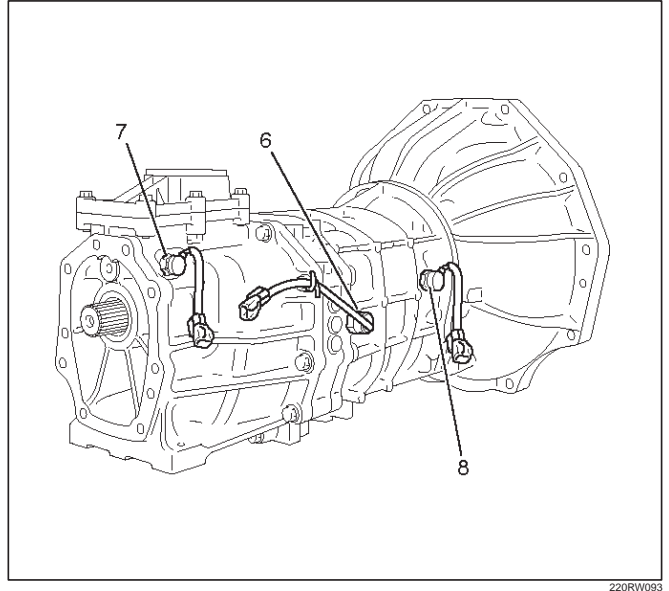


2. Remove the clutch release bearing and shift fork.
 1. Remove the clutch release bearing (3) from the front cover.
 2. Remove the split pin (4). Remove the shaft from the under. Remove the shift fork (5).

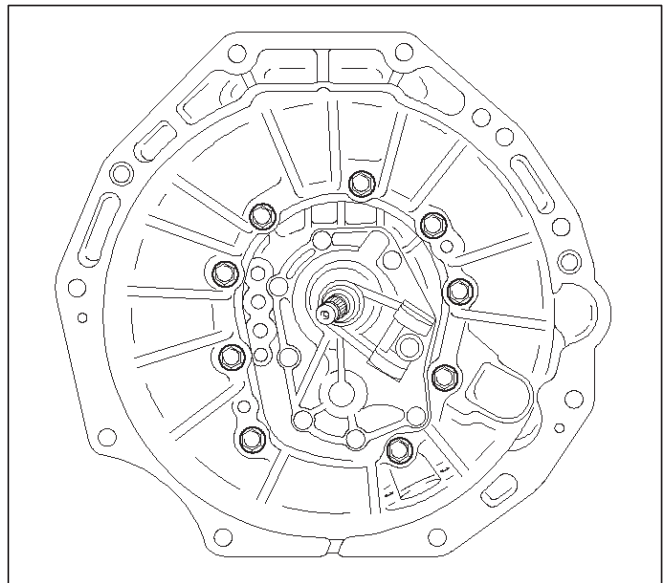


3. Remove the switch.
 1. Remove backup light switch (6) and gasket.
 2. Remove neutral switch (7) and gasket (4JX1).
 3. Remove 1st and 2nd switch (8) and gasket.

(4JX1)



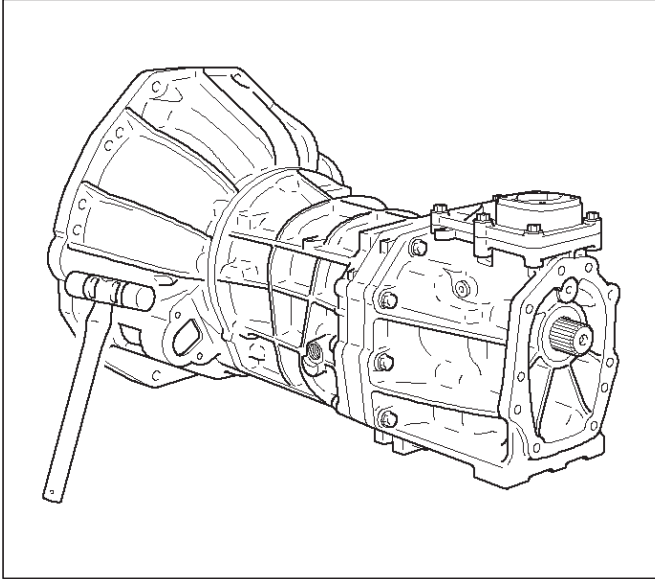
4. Remove the clutch housing.
 1. Remove the 9 bolts.



7B-22 MANUAL TRANSMISSION

- Using a plastic hammer, carefully tap the clutch housing.

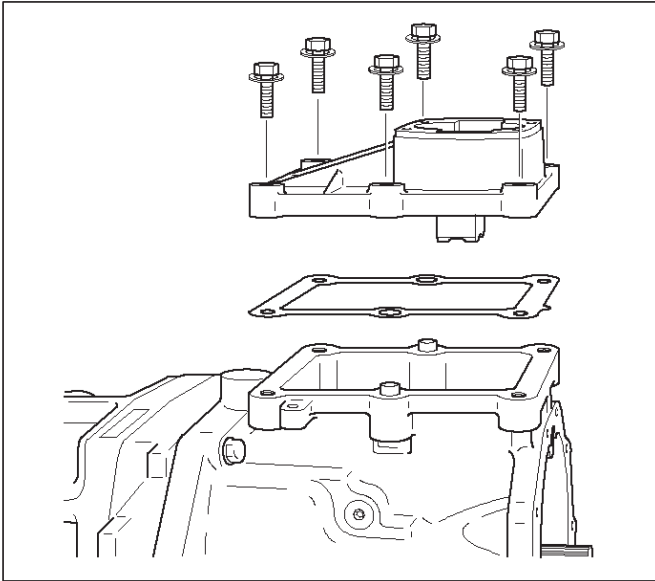
(6VE1)



- Remove gear control box and gasket.

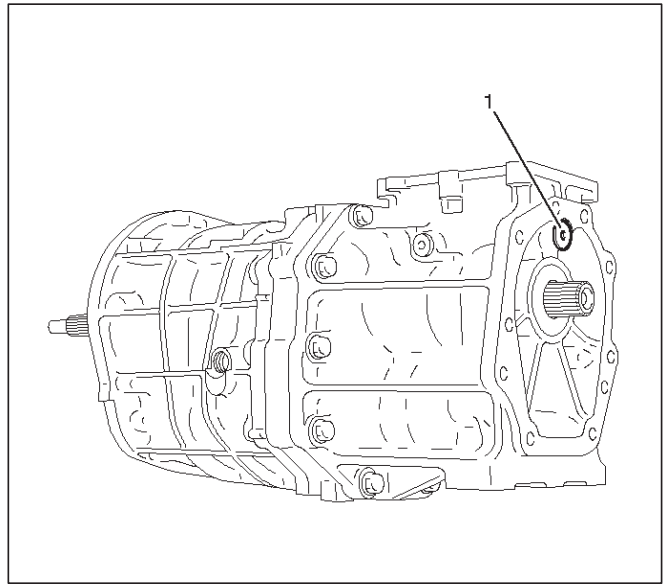
- Remove the 6 bolts, gear control box and gasket.

(6VE1)

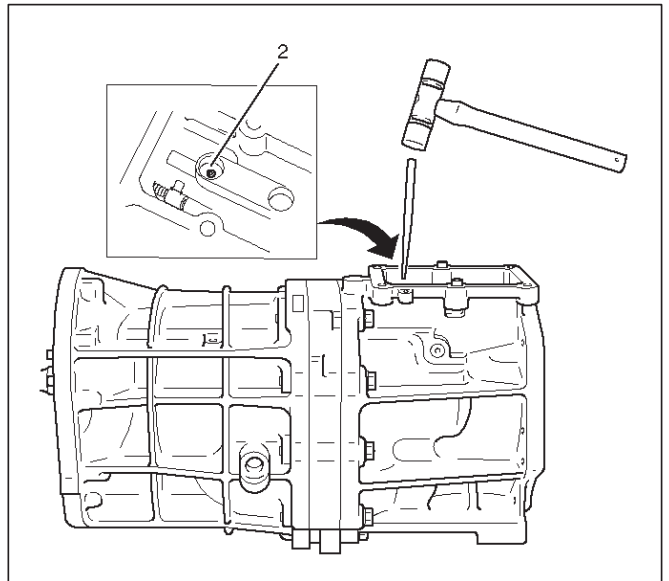


- Remove transfer adapter.

- Using a hexagon wrench, remove the plug (1).

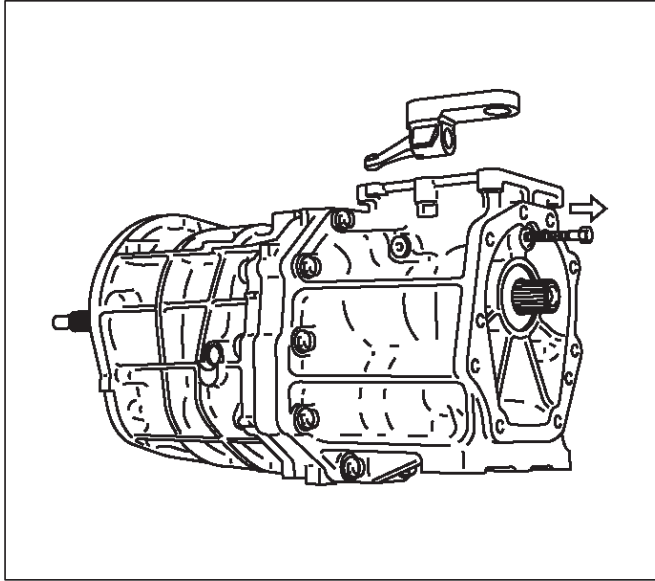


- Using a pin punch and hammer, drive out the slotted spring pin (2).



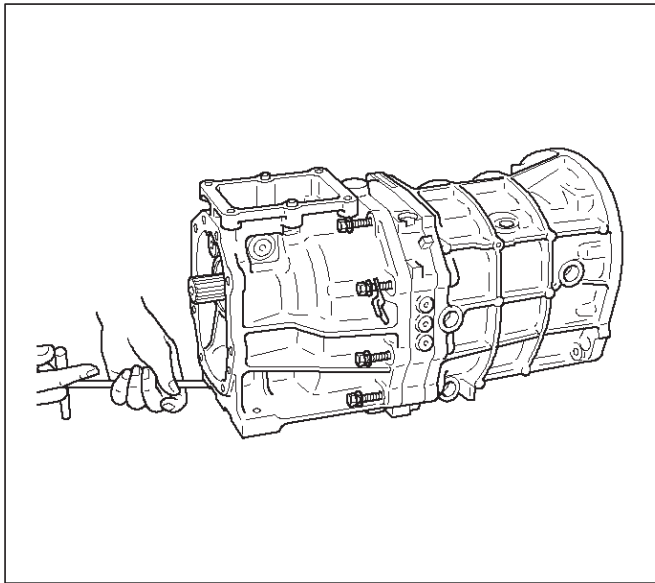
- Using the M8 × 1.25 bolt, remove the gear control rod and the shift lever housing.

NOTE: Turn the M8 bolt a few times, before remove the gear control rod.



220RW098

- Remove the 10 bolts and clamp.

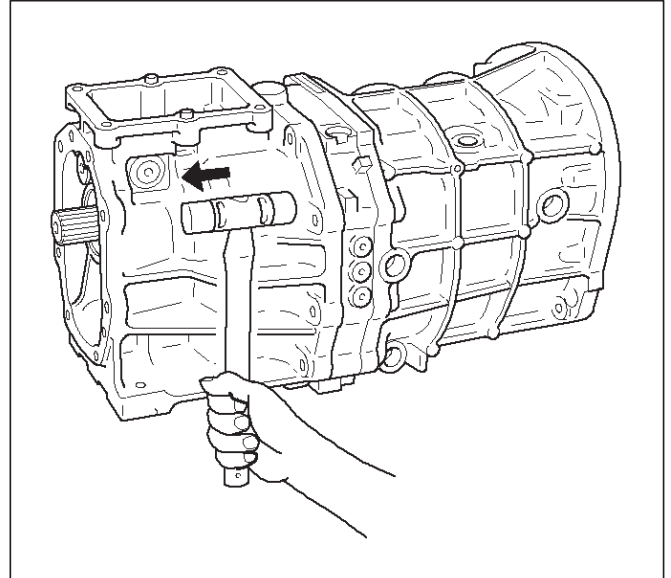


220RW016

- Using a plastic hammer, tap the transfer adapter.

NOTE:

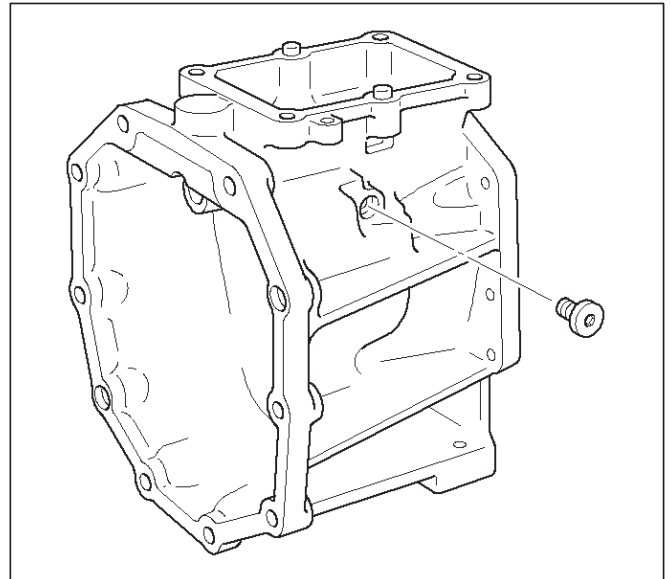
- Be careful not to lose the pin.
- Cover the mainshaft splines with adhesive tape. This will prevent damage to the oil seal lip.



220RW015

- Disassemble the transfer adapter assembly.

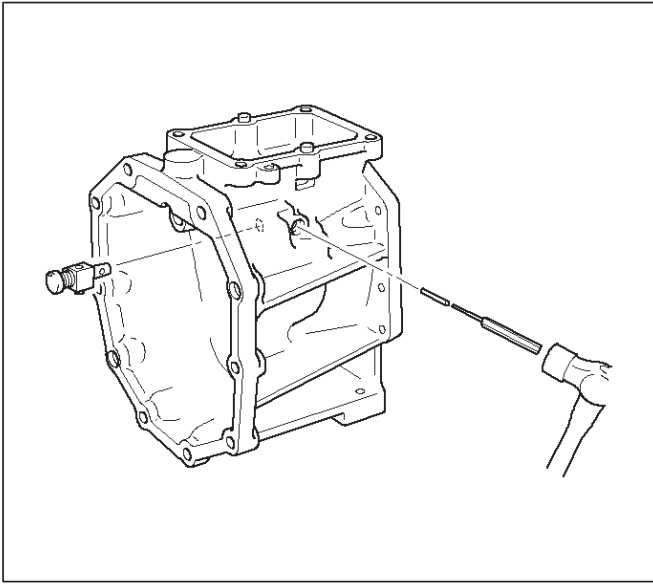
- Using a torx socket wrench (T40), remove the plug.



220RW013

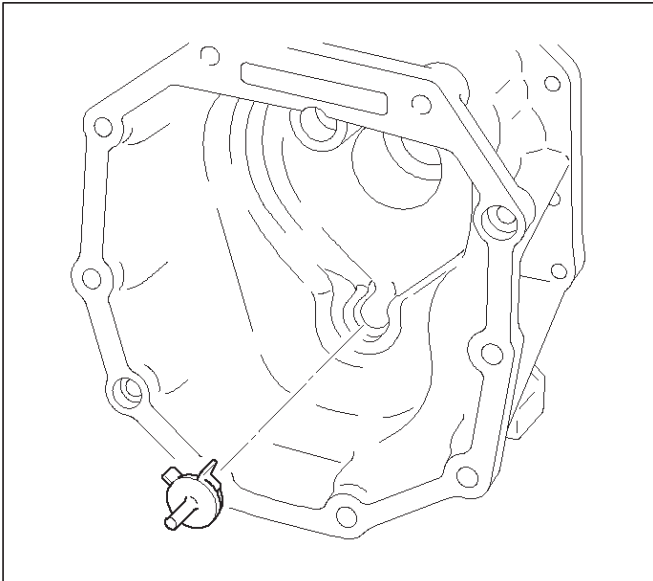
7B-24 MANUAL TRANSMISSION

- Using a pin punch and hammer, drive out the slotted spring pin. Remove the reverse restrict pin.



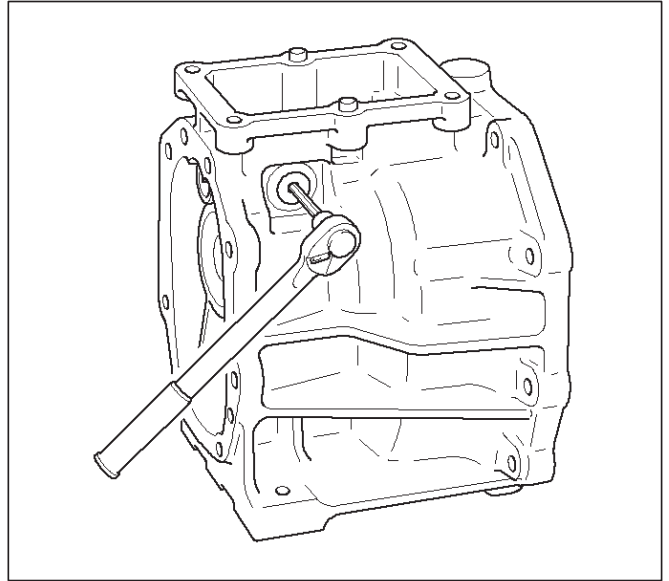
220RW012

- Remove the oil receiver pipe.



220RW011

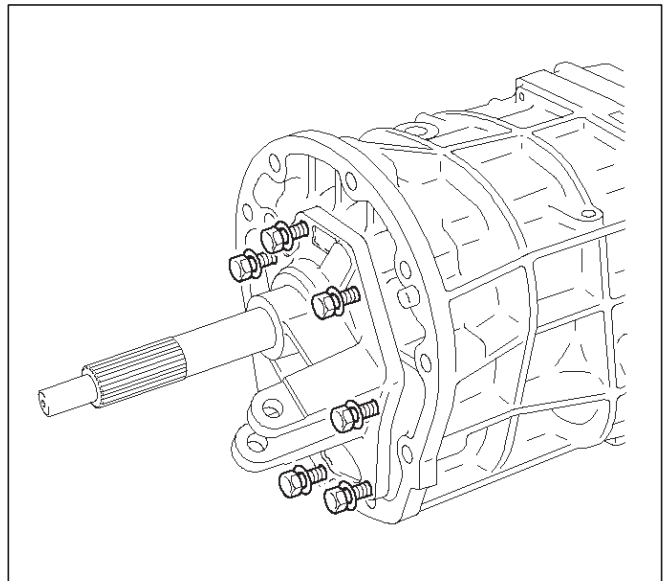
- Remove the oil seal.
- Using socket hexagon wrench, remove the plug.



220RW014

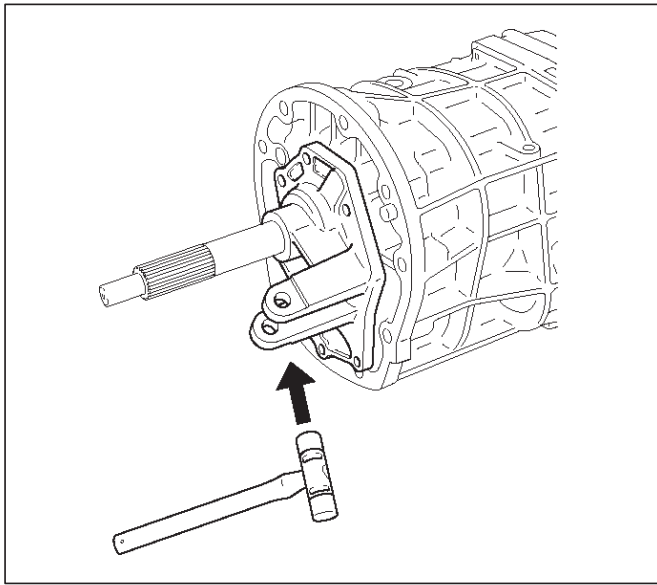
- Remove the front cover.

- Remove the 8 bolts.



220RW018

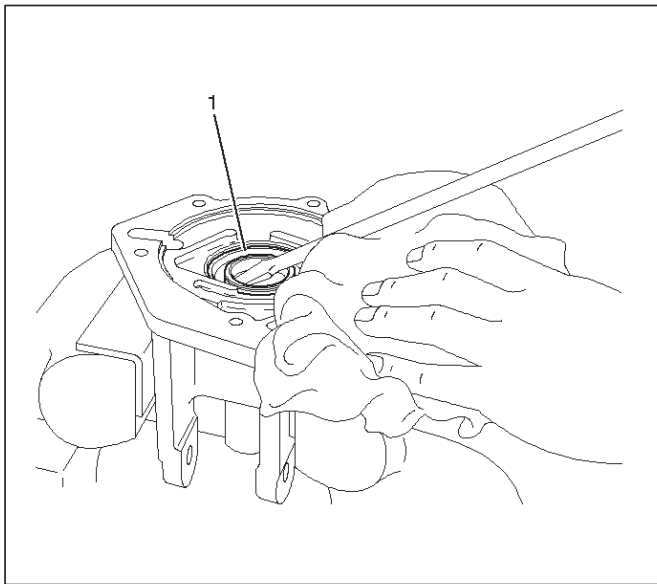
- Using a plastic hammer, carefully tap the front cover.



220RW017

9. Remove the front cover oil seal.

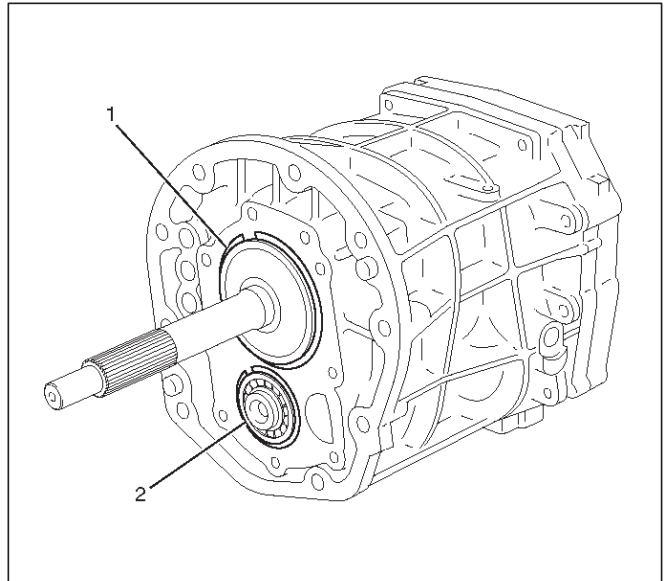
- Mount the front cover through the aluminum plate in a vise.
- Using screwdriver, remove oil seal (1).



220RW019

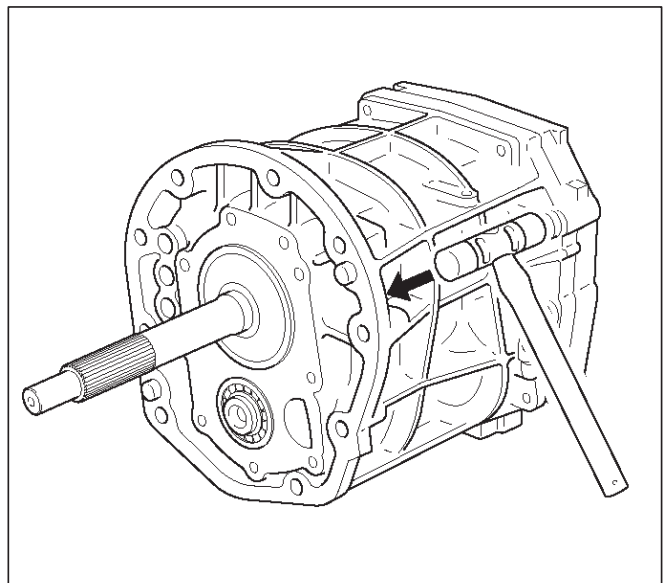
10. Remove the transmission case.

- Using a snap ring expander, remove the 2 snap rings (1)(2).



226RW004

- Using a plastic hammer, carefully tap the transmission case.

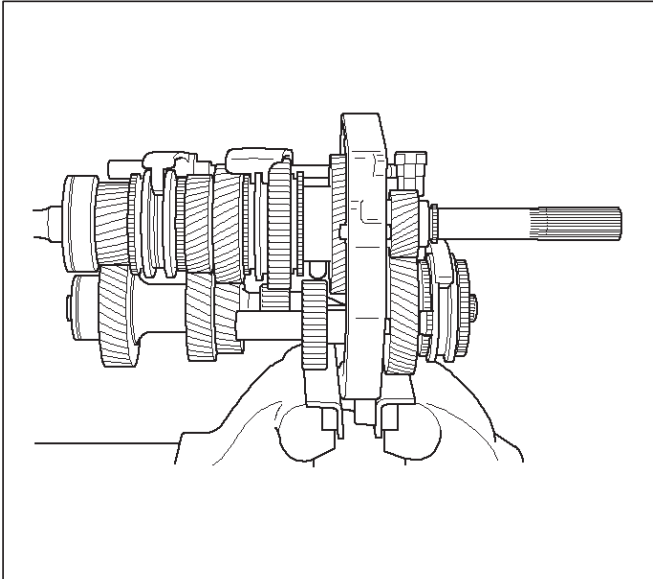


220RW020

7B-26 MANUAL TRANSMISSION

11. Mount the intermediate plate.

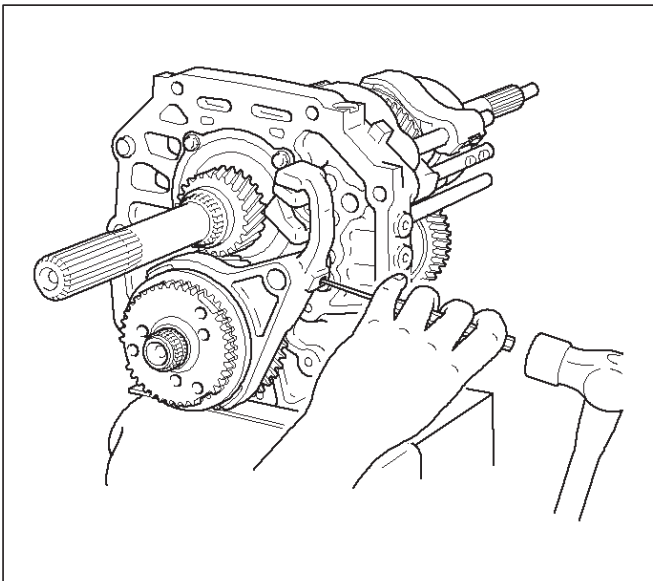
1. Mount the intermediate plate through the aluminum plate in a vise.



226RW005

12. Remove the slotted spring pin.

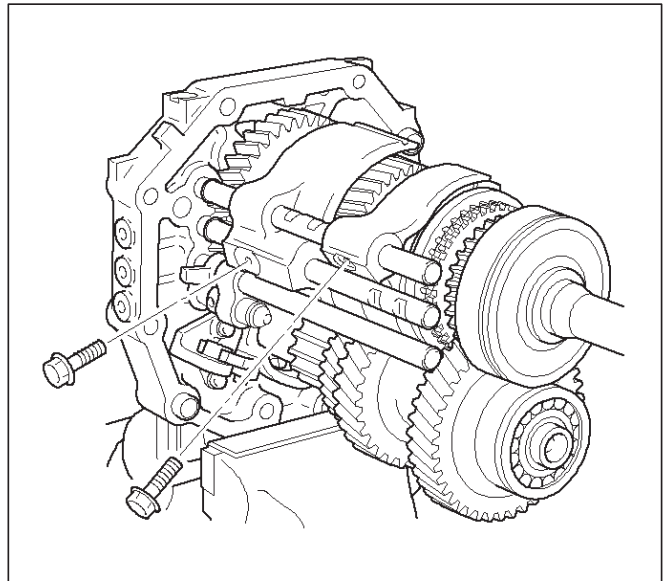
1. Using a pin punch and hammer, drive out the pin from the arm.



226RW025

13. Remove the shift arm set bolt.

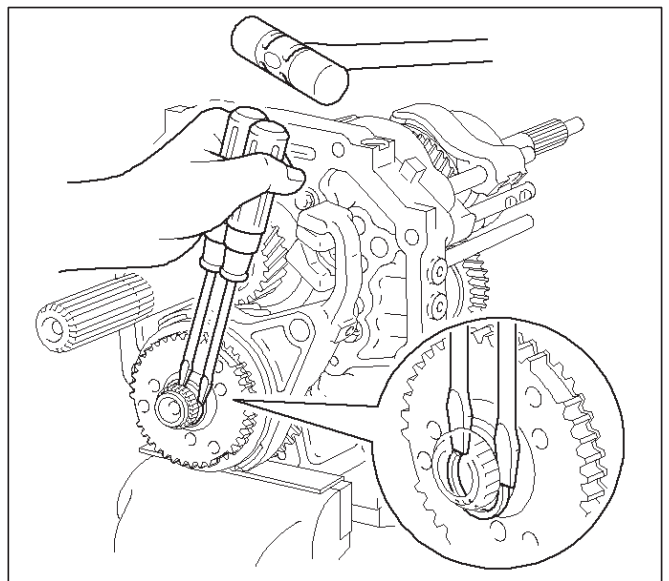
1. Remove the 2 bolts from the shift arm.



226RW023

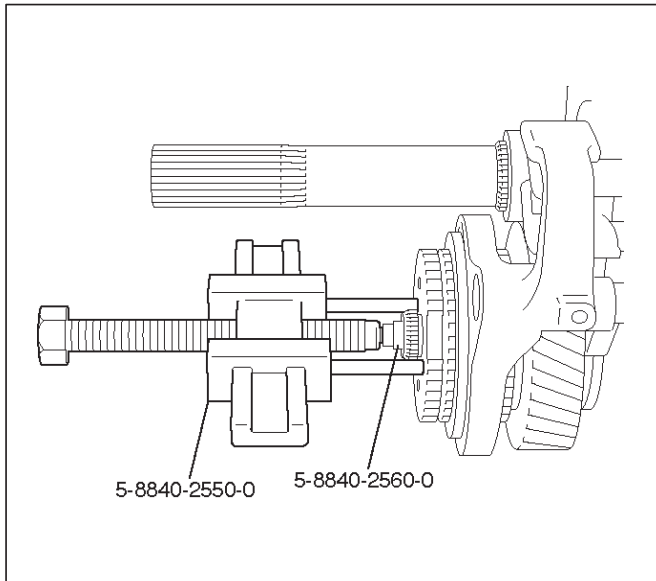
14. Remove the counter 5th gear.

1. Using 2 screwdrivers and hammer, tap out the snap ring.



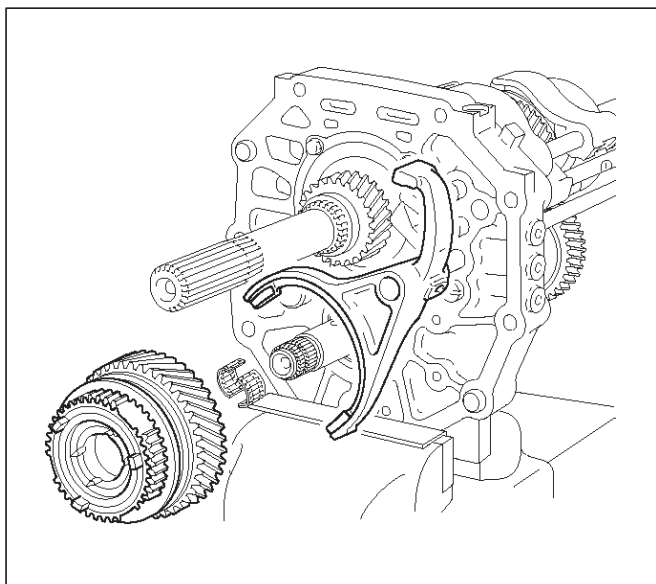
226RW024

- Using remover 5-8840-2550-0 (J-42794) and attachment 5-8840-2560-0 (J-42988), remove the 5th gear spline piece.



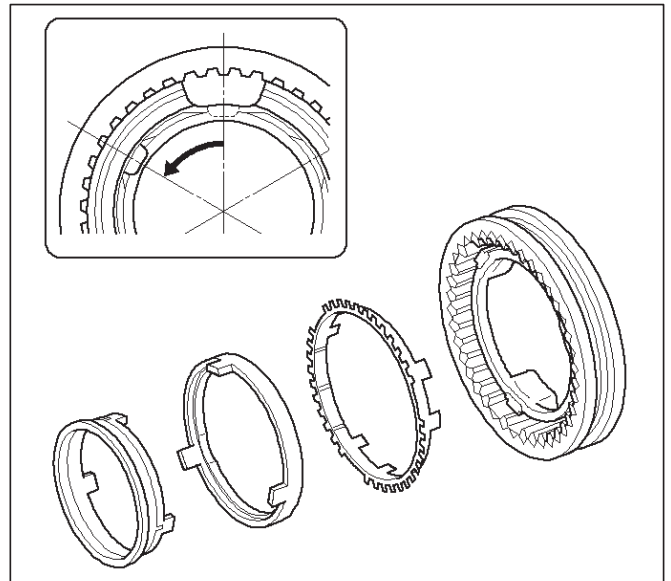
226RW201

- Remove the hub sleeve No.3, block ring set, counter 5th gear, bearing and 5th shift arm.



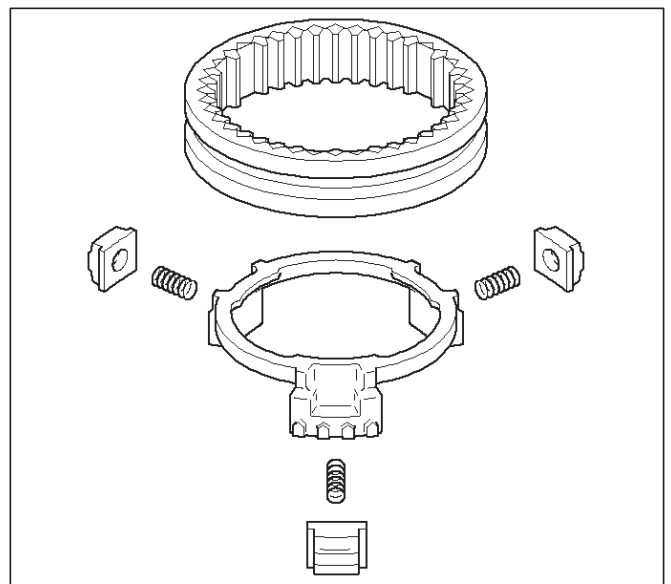
220RW101

- Remove the synchronizer pull ring, synchronizer cone ring, and synchronizer outer ring from hub sleeve No.3.



226RW066

- Remove the reverse block ring from the hub sleeve No.3. Remove the 3 inserts and 3 compression springs.

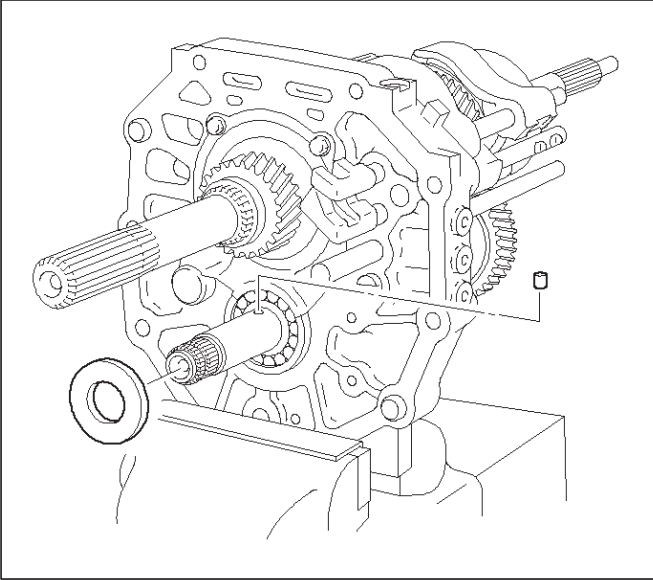


226RW067

7B-28 MANUAL TRANSMISSION

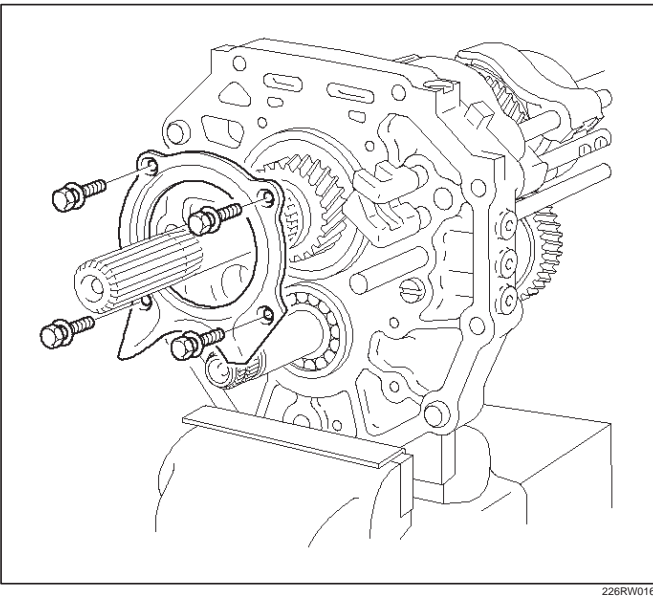
15. Remove the thrust washer.

1. Remove the thrust washer from counter gear shaft.
2. Remove the thrust washer pin from counter gear shaft.



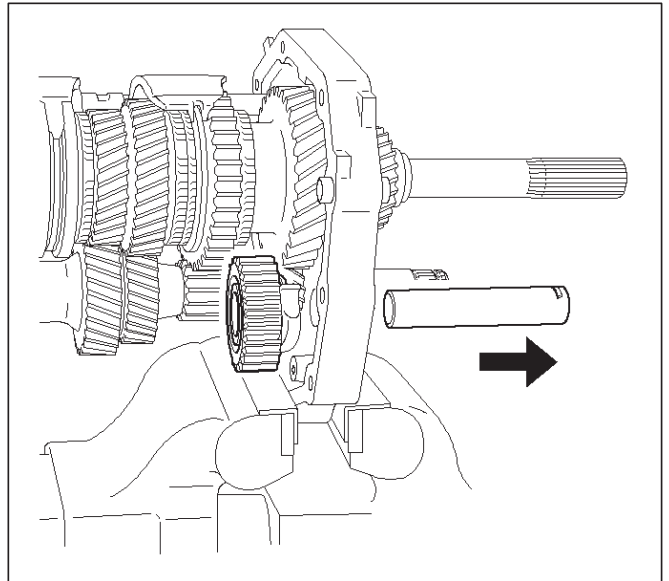
16. Remove the bearing plate.

1. Remove the 4 bolts and bearing retainer.



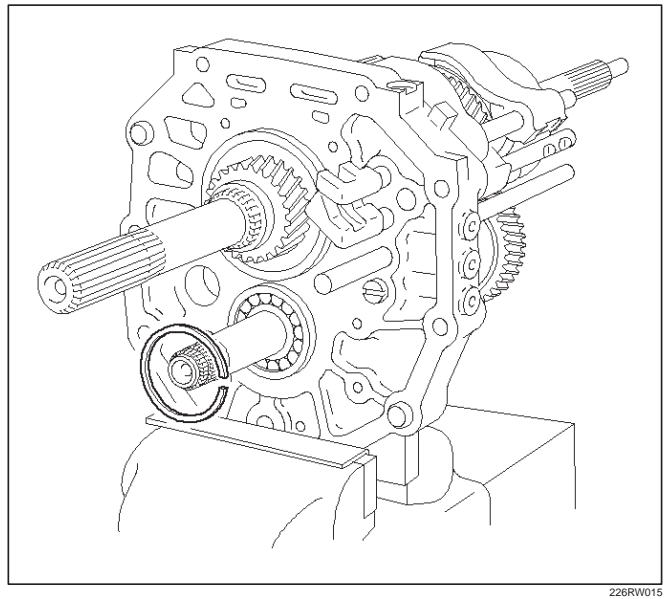
17. Remove the reverse idle gear.

1. Pull out the shaft forward the rear and remove the reverse idle gear.



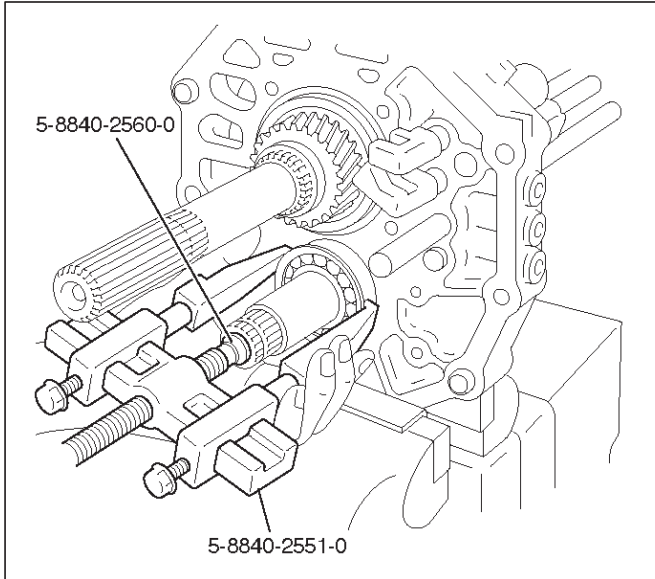
18. Remove the counter gear shaft.

1. Using snap ring plier, remove counter gear shaft center bearing snap ring.

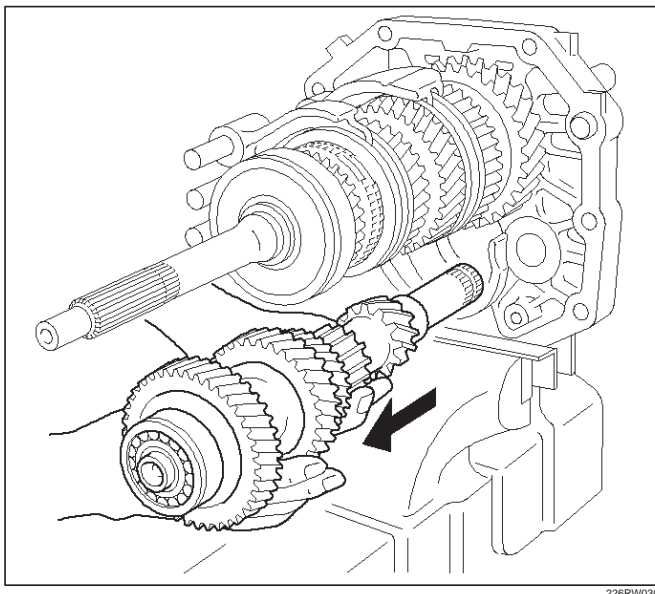


- Using remover 5-8840-2551-0 (J-42795) and attachment 5-8840-2560-0 (J-42988), remove counter gear shaft center bearing.

NOTE: Be careful not to drop the counter gear, when removing the bearing.

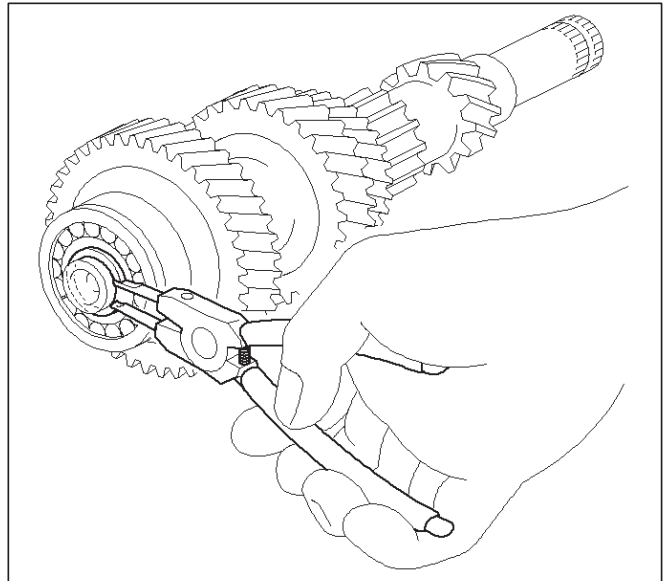


- Remove the counter gear from intermediate plate.

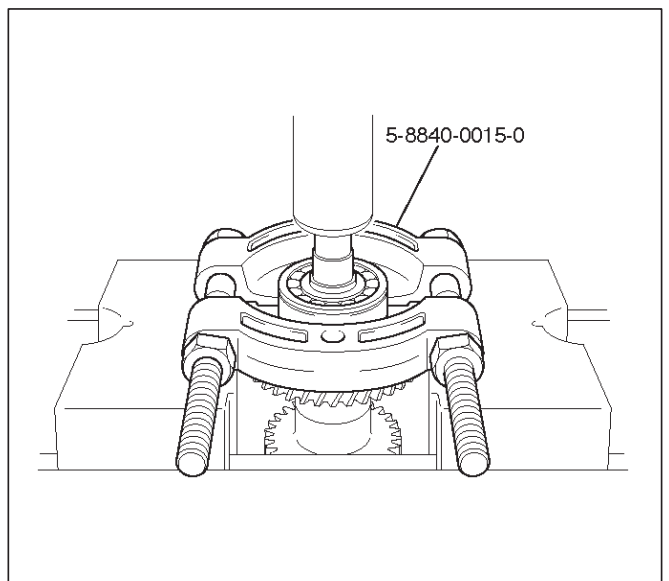


- Disassemble the counter gear shaft assembly.

- Using snap ring pliers, remove the counter gear shaft front bearing snap ring.



- Using bearing separator 5-8840-0015-0 (J-22912-01) and a press, remove the bearing.

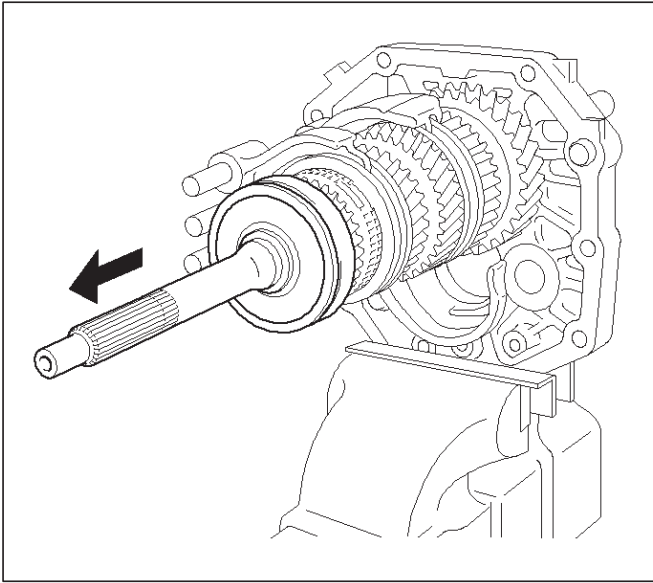


7B-30 MANUAL TRANSMISSION

20. Remove the top gear shaft.

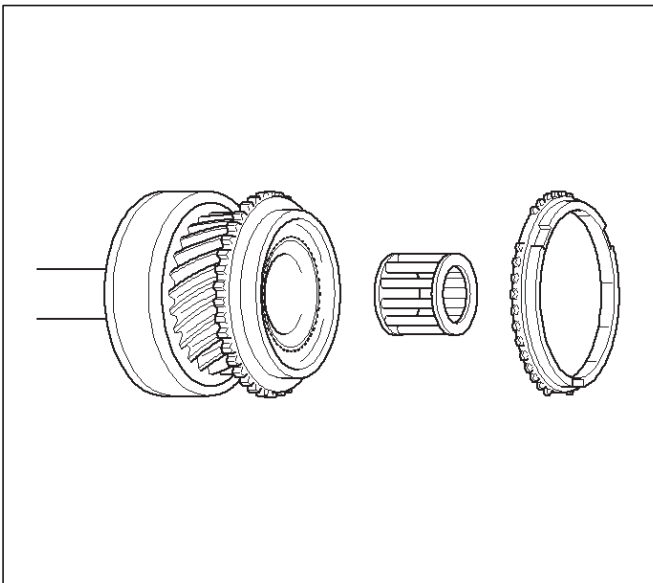
1. Remove the top gear shaft from mainshaft.

NOTE: Don't fall needle roller bearing.



226RW029

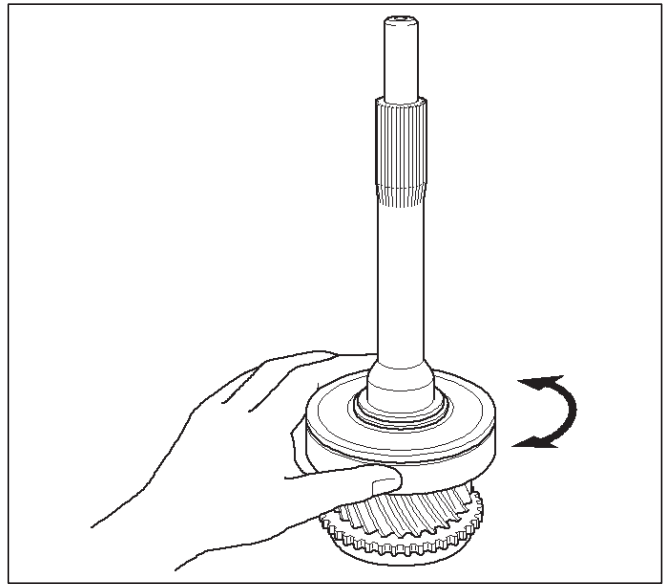
2. Remove the 4th block ring and roller bearing.



226RW031

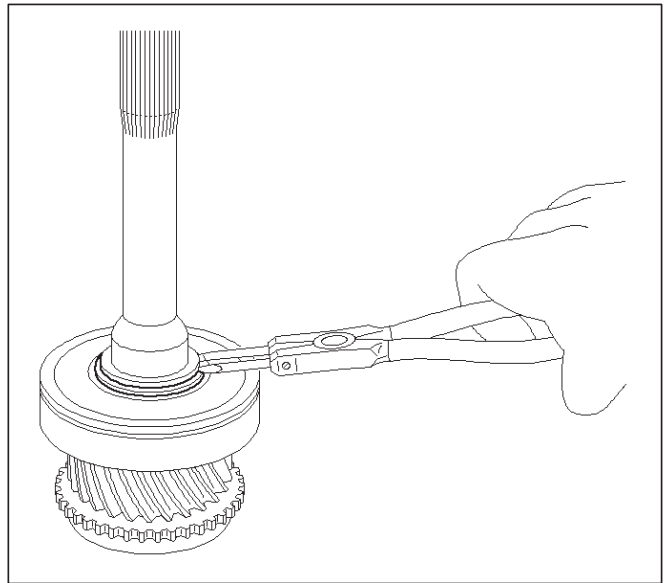
21. Disassemble the top gear shaft assembly.

1. Check for wear or damage.



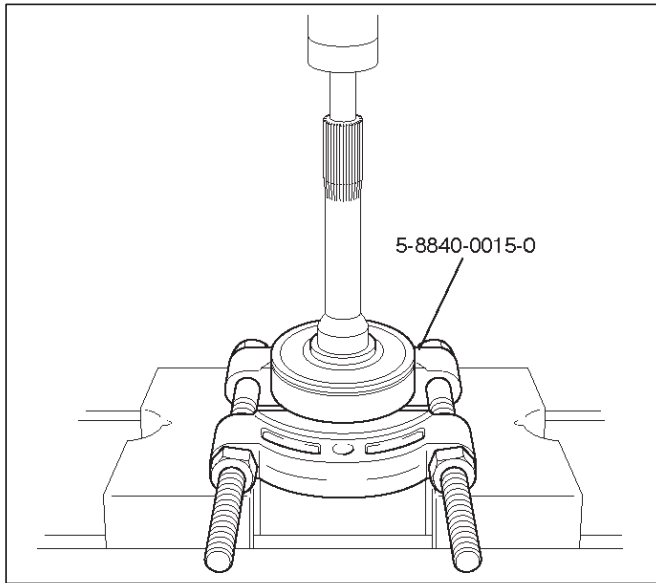
226RW033

2. Remove the front bearing shaft snap ring.



226RW062

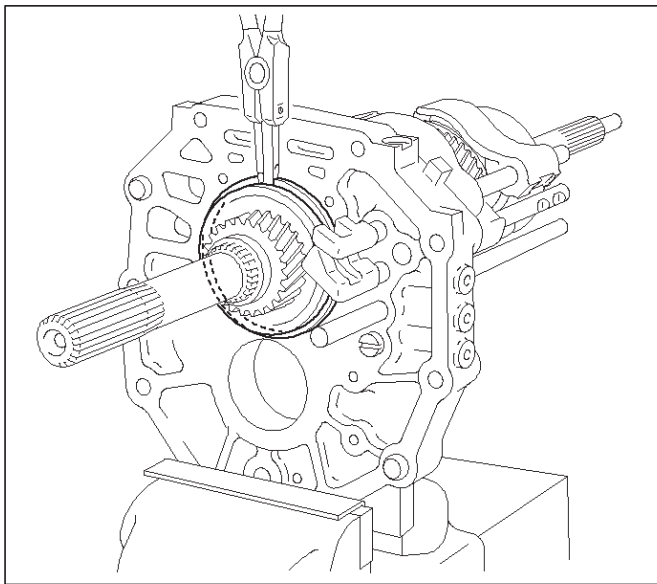
3. Using bearing separator 5-8840-0015-0 (J-22912-01) and a press, remove the bearing.



226RW202

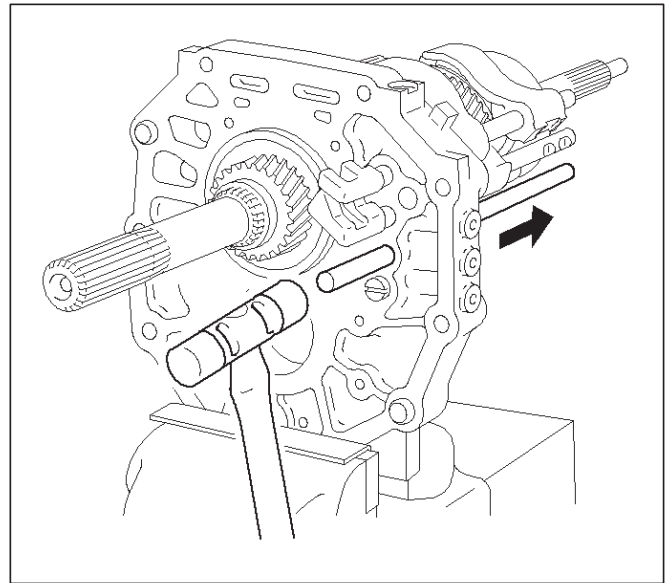
22. Remove the mainshaft.

1. Remove mainshaft bearing snap ring.



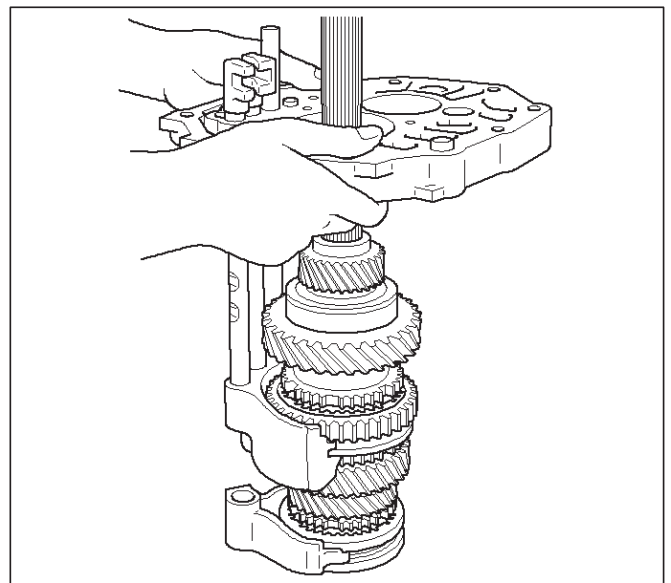
226RW035

2. Using a plastic hammer, tap the 5th-reverse shift rod at the reverse shift side.



226RW034

3. Remove the intermediate plate from a vise.
4. Remove the mainshaft, 1st-2nd shift arm and 3rd-4th shift arm.

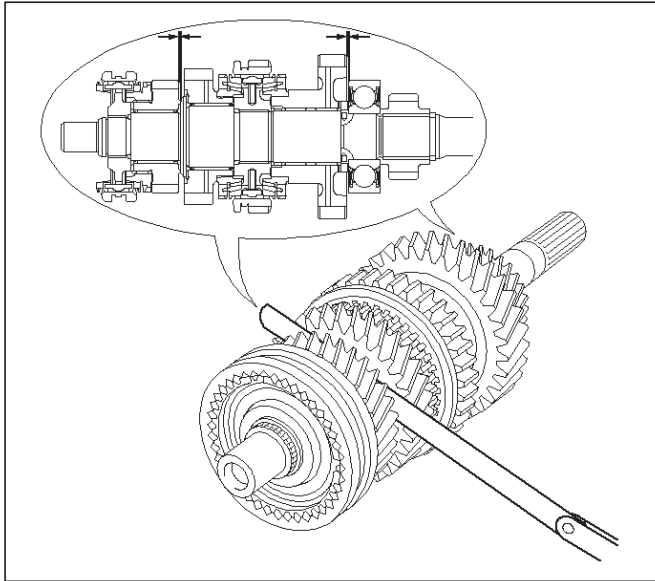


226RW014

7B-32 MANUAL TRANSMISSION

23. Disassemble the mainshaft assembly.

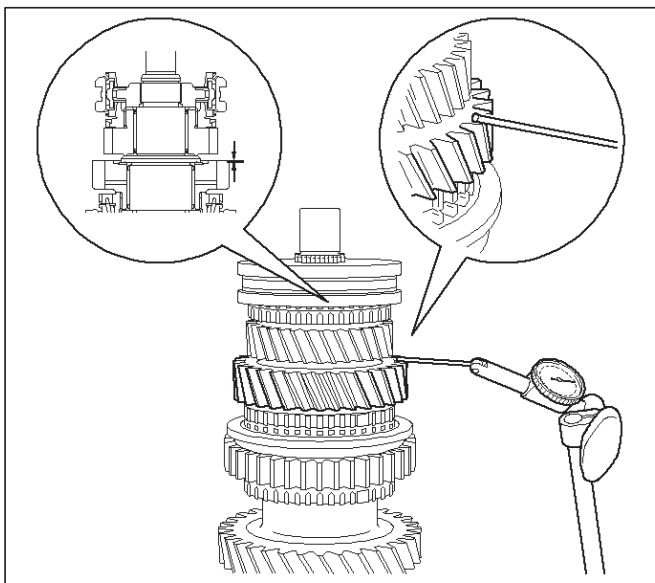
1. Inspect each gear thrust clearance.
 1. Using thickness gauge, inspect thrust clearance (1st gear, 3rd gear).



226RW077

2. Mount the mainshaft through the aluminum plate in a vise.
3. Using a dial indicator, measure each gear thrust clearance.

Gear	Standard Clearance
1st	0.15 – 0.45 mm (0.0059 – 0.0177 in)
2nd	0.10 – 0.25 mm (0.0039 – 0.0098 in)
3rd	0.10 – 0.25 mm (0.0039 – 0.0098 in)

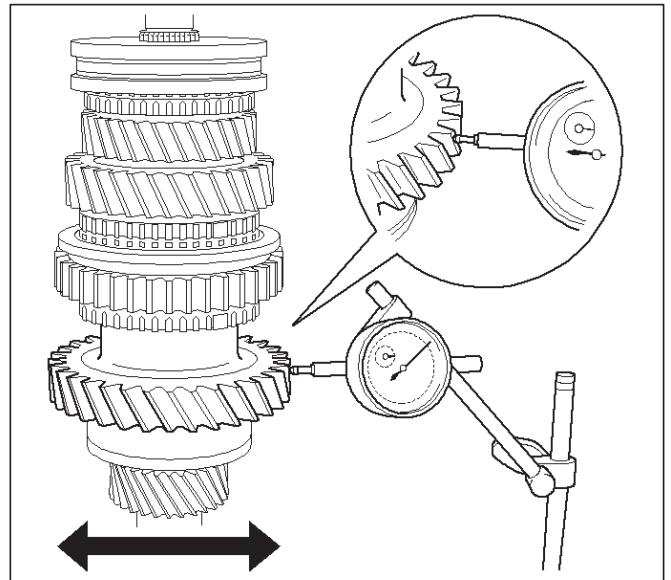


226RW070

2. Inspect each gear radial clearance

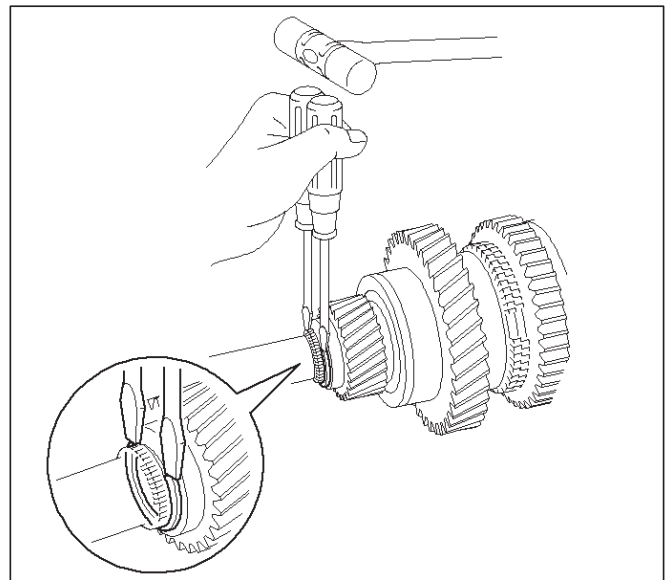
1. Using a dial indicator, measure the radial clearance of each gear.

Gear	Standard Clearance
1st	0.020 – 0.074 mm (0.00078 – 0.00291 in)
2nd	0.015 – 0.068 mm (0.00059 – 0.00268 in)
3rd	0.015 – 0.068 mm (0.00059 – 0.00268 in)



226RW071

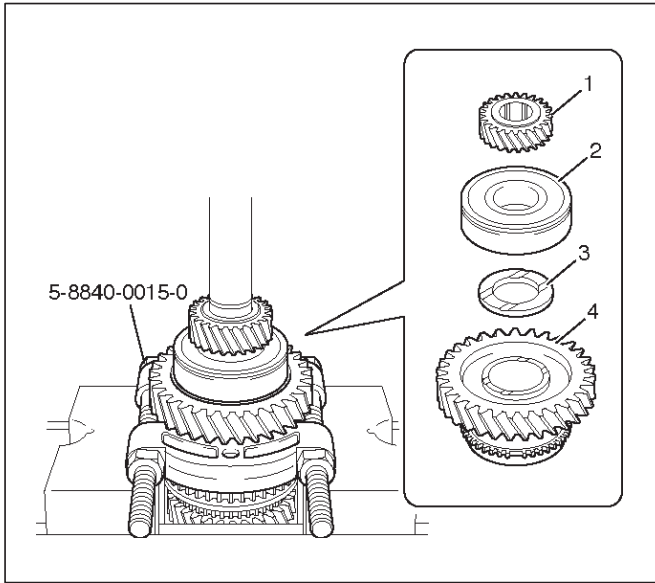
3. Using 2 screwdrivers and hammer, tap out the snap ring.



226RW053

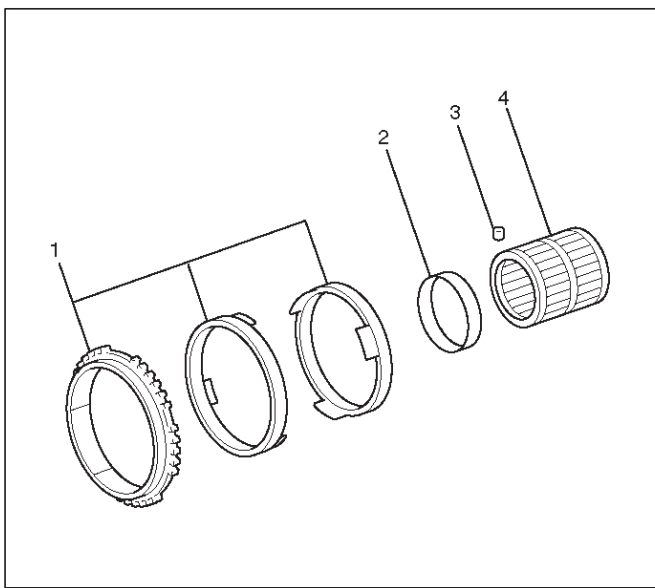
4. Using bearing separator 5-8840-0015-0 (J-22912-01) and a press, remove the following parts.

1. 5th gear (1).
2. Mainshaft bearing (2).
3. 1st gear thrust washer (3).
4. 1st gear (4).

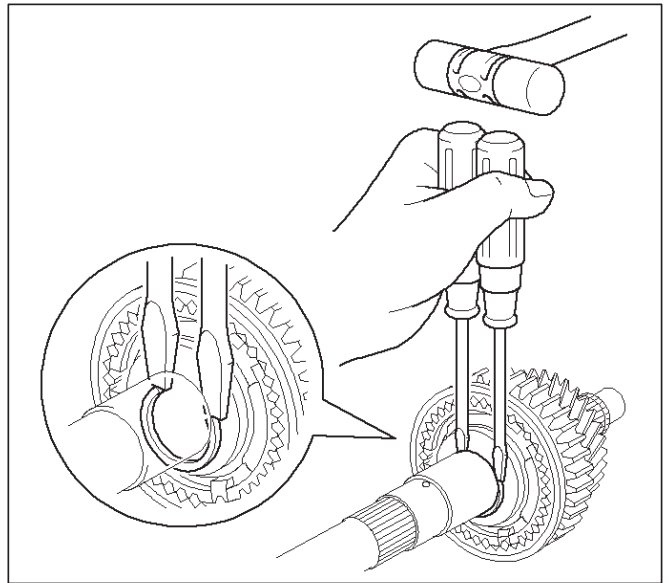


5. Remove following parts from mainshaft.

1. Synchronizer assembly (1).
2. 1st gear thrust washer pin (3).
3. 1st gear needle roller bearing (4).
4. 1st gear bearing spacer (2).

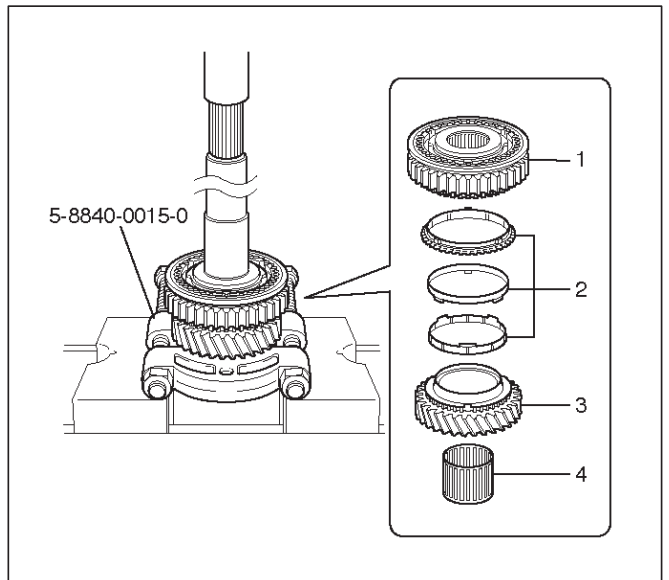


6. Using 2 screwdrivers and hammer, tap out snap ring.



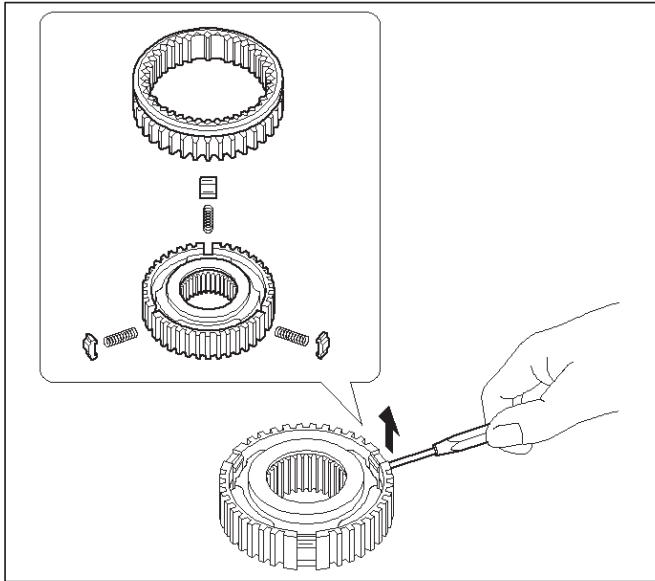
7. Using bearing separator 5-8840-0015-0 (J-22912-01) and a press, remove the following parts.

1. Clutch hub No.1 assembly (1).
2. Synchronizer assembly (2).
3. 2nd gear (3).
4. 2nd gear needle roller bearing (4).



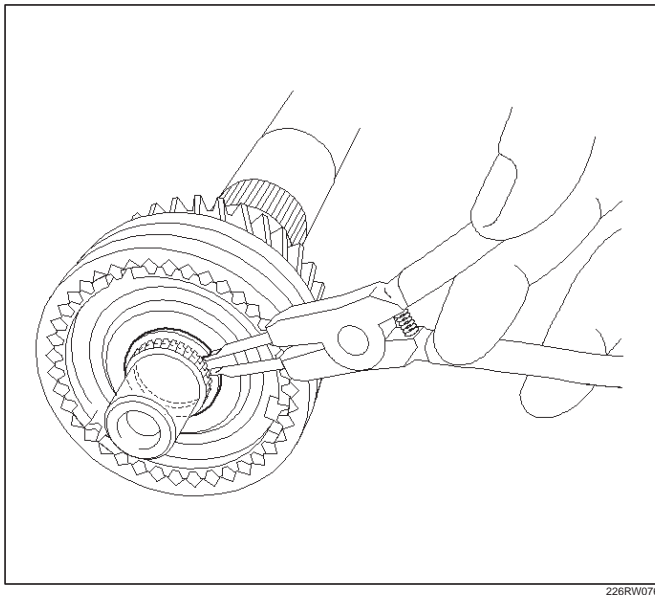
7B-34 MANUAL TRANSMISSION

8. Remove the reverse gear from clutch hub No.1.
9. Remove the 3 inserts and 3 compression springs.
 - When removing the inserts, push the insert spring with a screwdriver.



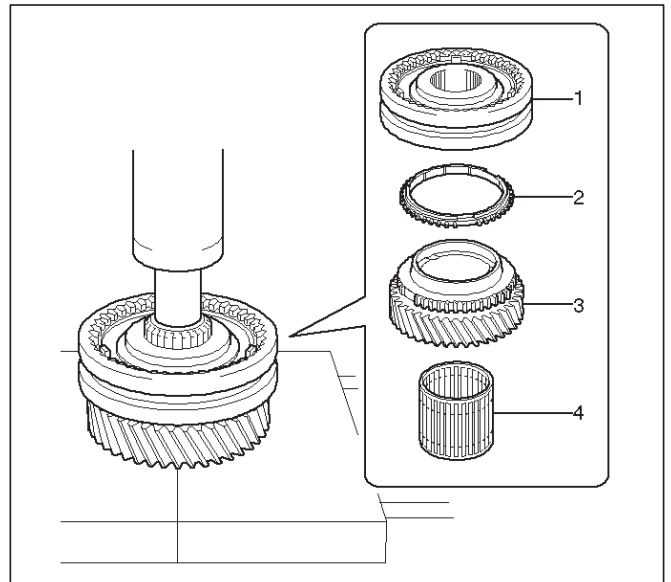
10. Remove the snap ring.

NOTE: Don't damage the bearing surface.

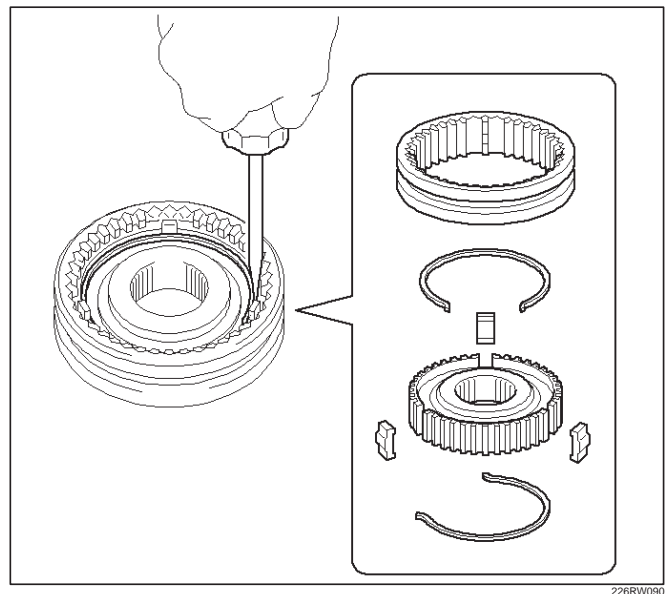


11. Using a press, remove following parts.

1. Clutch hub No.2 assembly (1).
2. 3rd block ring (2).
3. 3rd gear (3).
4. 3rd gear needle roller bearing (4).

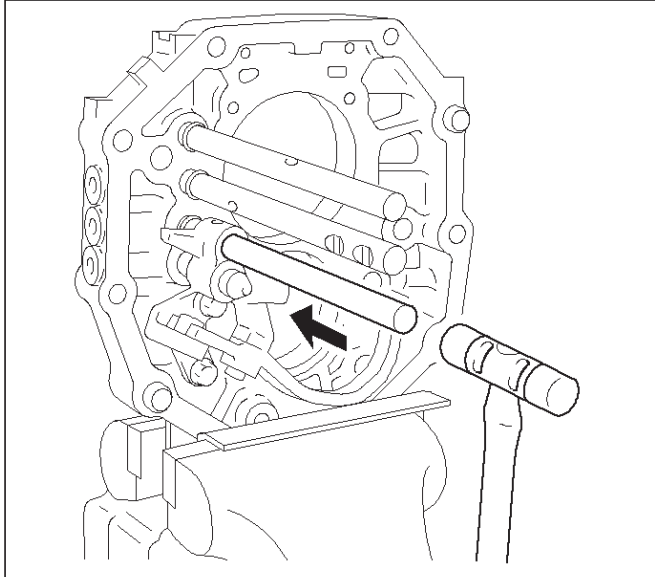


12. Using screwdriver, remove the 2 insert springs, hub sleeve No.2, clutch hub No.2 and 3 inserts.

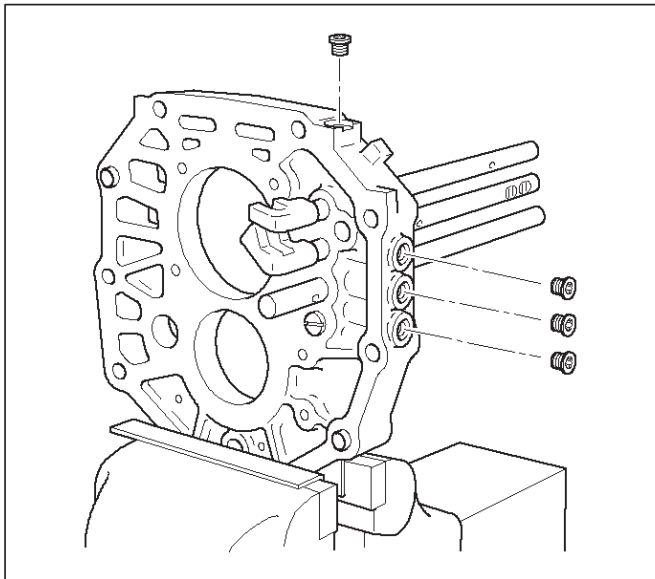


24. Remove the shift parts and interlock parts.

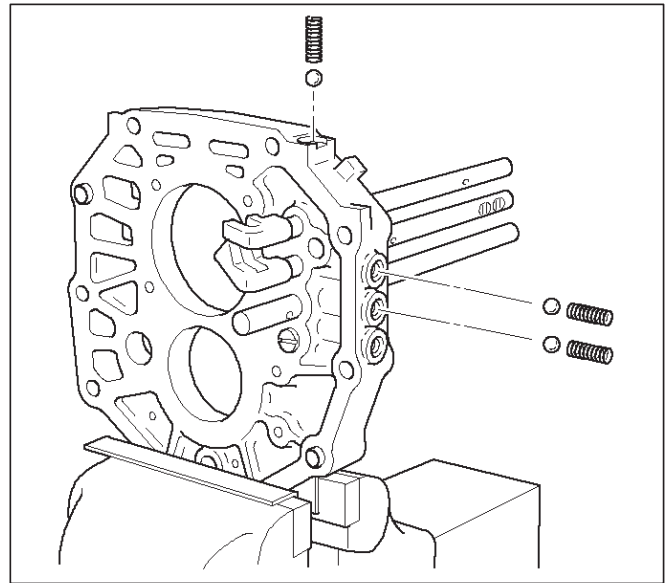
1. Mount the intermediate plate through the aluminum plate in a vise.
2. Using a plastic hammer, tap the 5th shift rod on the neutral.



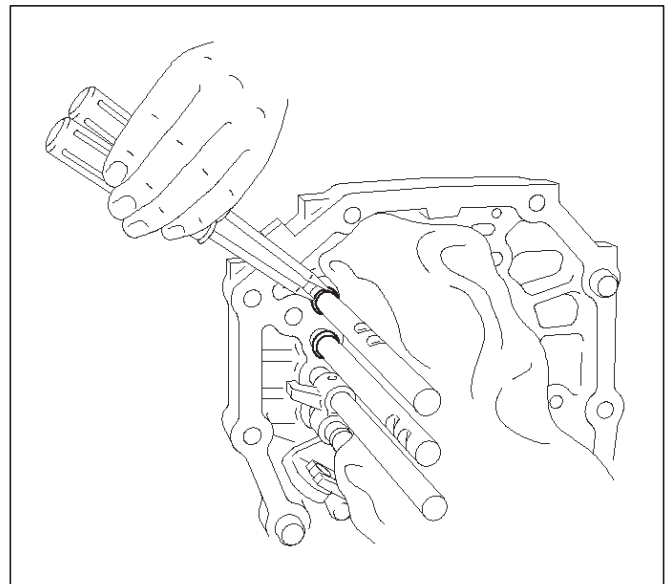
3. Using a torx socket wrench(T40), remove the 4 plugs.



4. Using a magnetic finger, remove 3 springs and balls.

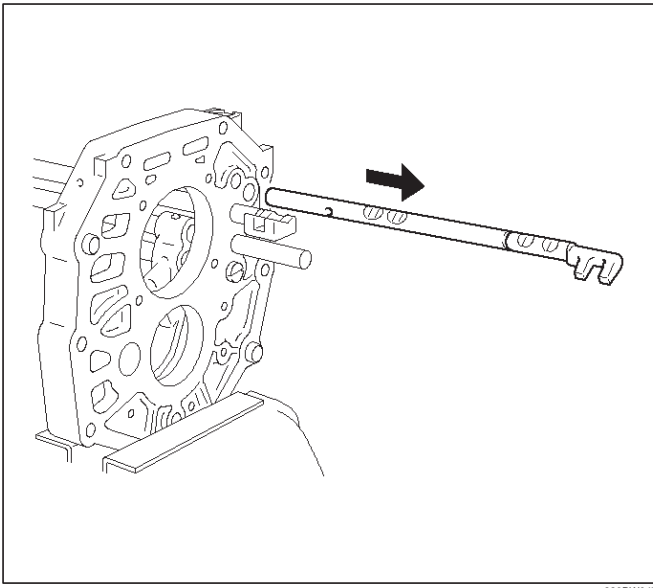


5. Using 2 screwdrivers and a hammer, remove 2 snap rings from each shift fork rod.



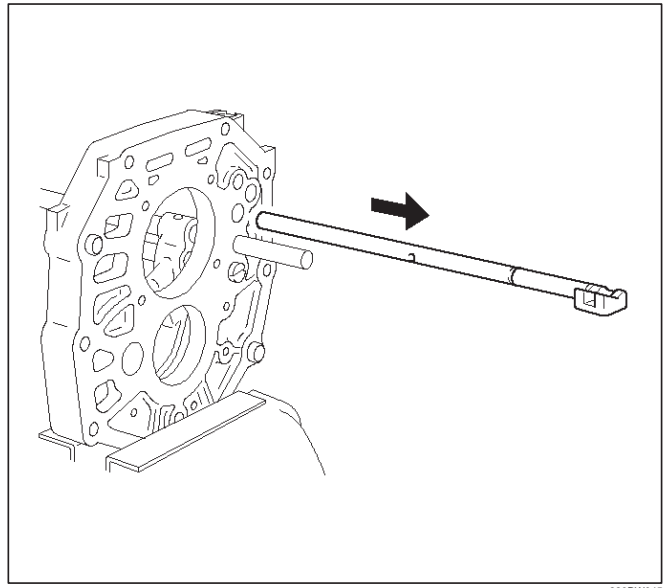
7B-36 MANUAL TRANSMISSION

6. Pull out the 3rd-4th shift rod at the rear.



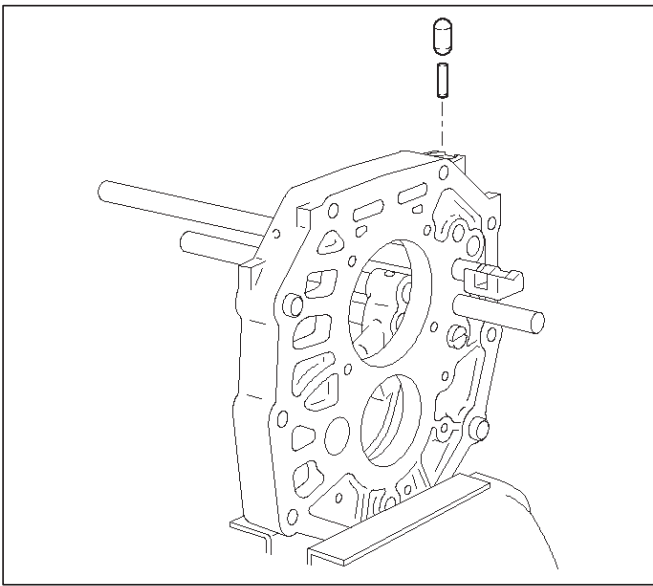
226RW047

8. Pull out the 1st-2nd shift rod at the rear.



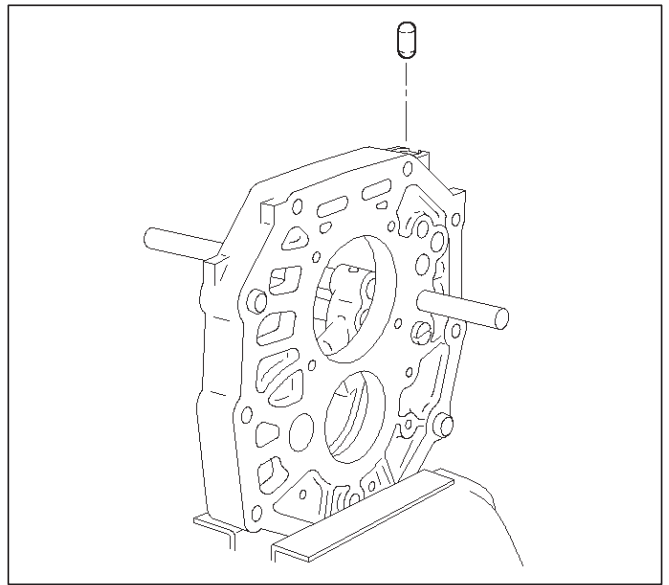
226RW045

7. Using a magnetic finger, remove the interlock pin and straight pin.



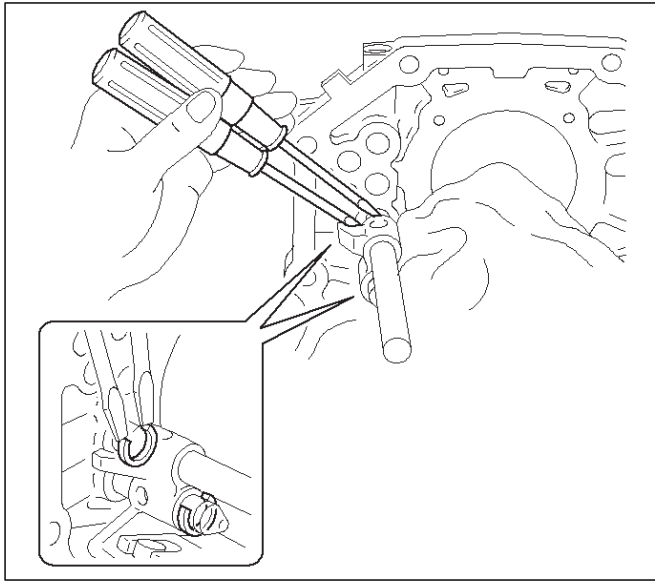
226RW043

9. Using a magnetic finger, remove the interlock pin.



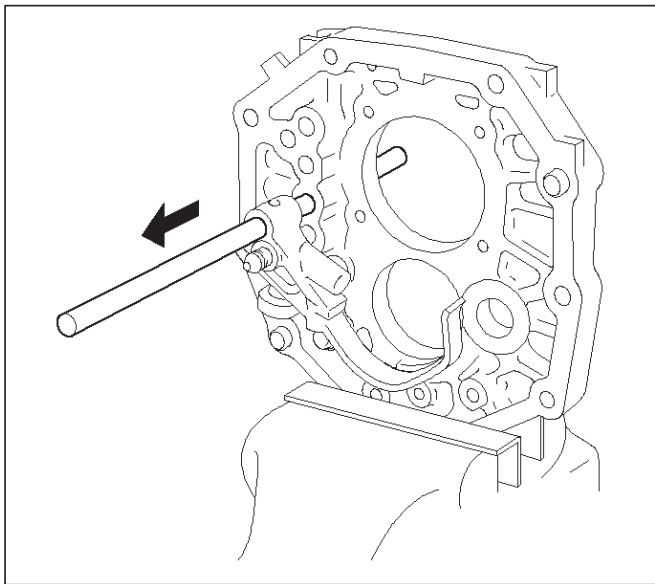
226RW042

10. Using 2 screwdrivers and a hammer, remove 2 snap rings.



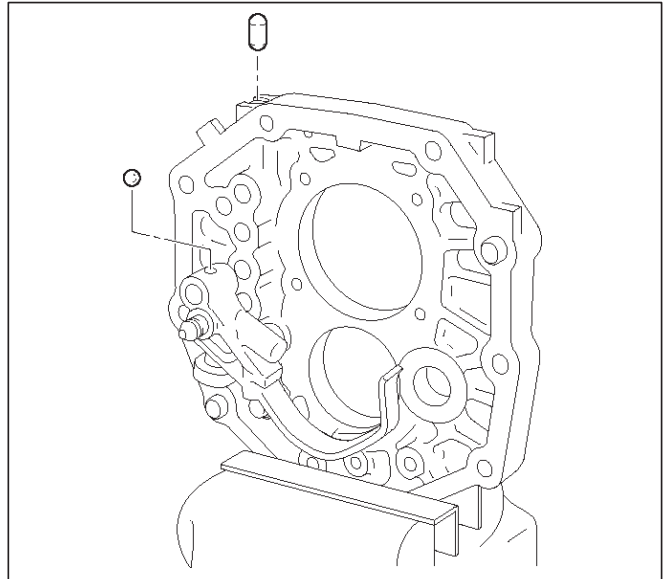
226RW041

11. Pull out the 5th-reverse shift rod at the front.



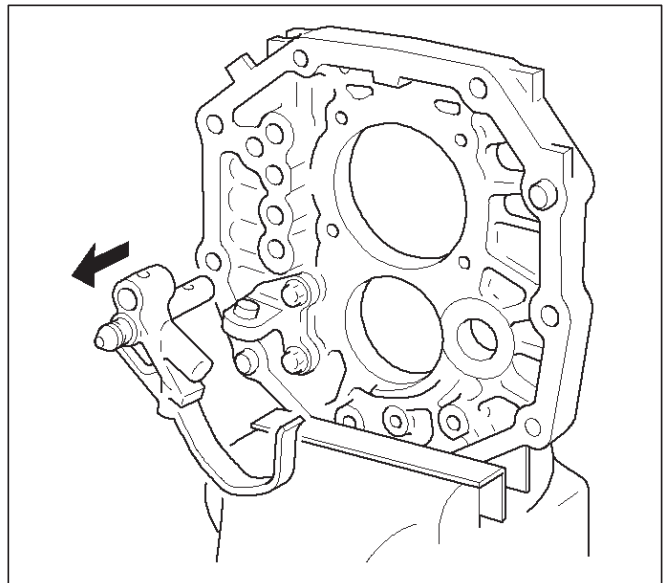
226RW040

12. Using a magnetic finger, remove the interlock pin from the intermediate plate. Remove the ball from the reverse shift arm No.1.



226RW039

13. Pull out at the rear reverse shift rod, reverse shift arm No.1 and reverse shift arm No.2 at the same time.

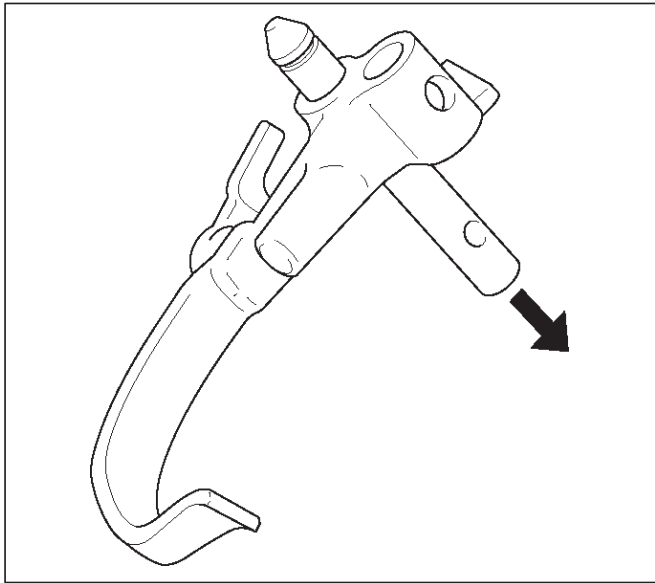


226RW038

7B-38 MANUAL TRANSMISSION

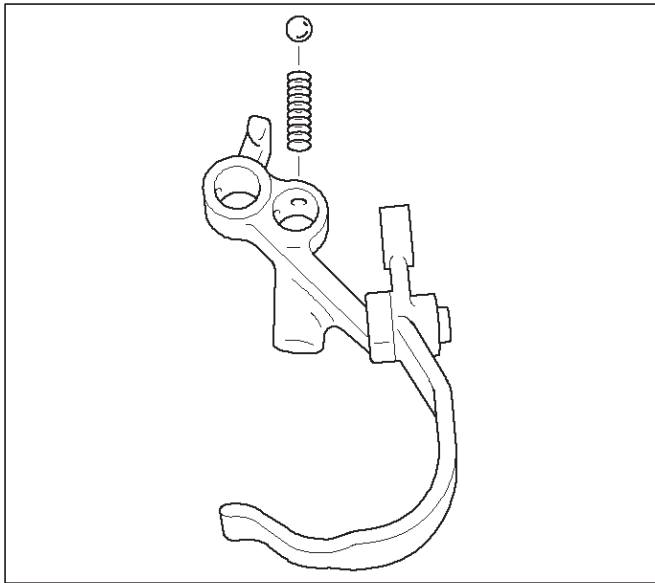
14. Pull out reverse shift rod from reverse shift arm No.1.

NOTE: Be sure remove at the rear.



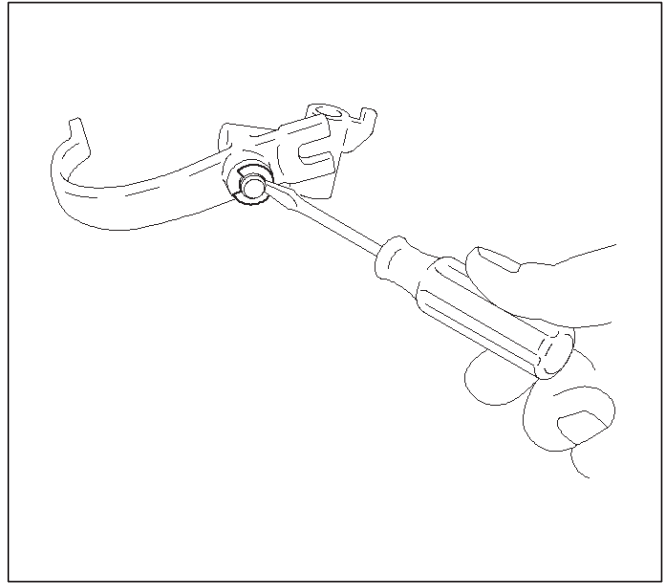
226RW055

15. Using a magnetic finger, remove the ball and spring from reverse shift arm No.1.



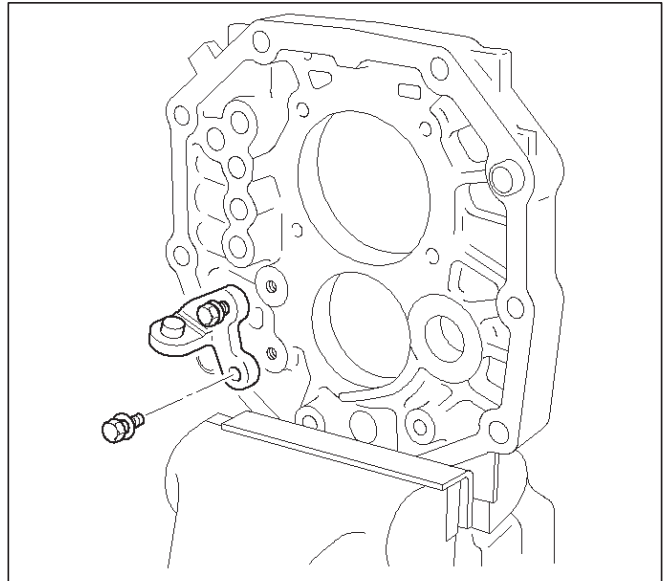
226RW056

16. Remove the reverse shift arm No.2 E-ring. Remove the reverse shift arm No.2 from reverse shift arm No.1.



226RW089

17. Remove the 2 bolts and reverse shift arm bracket.

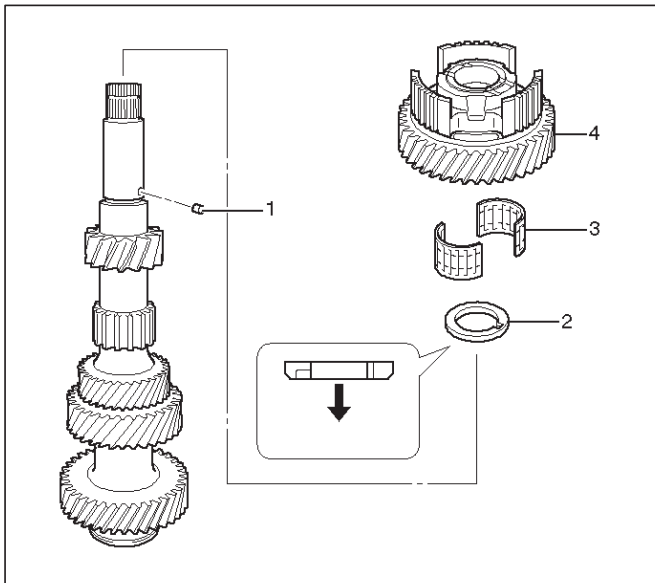


226RW054

Inspection

1. Counter 5th gear radial clearance.

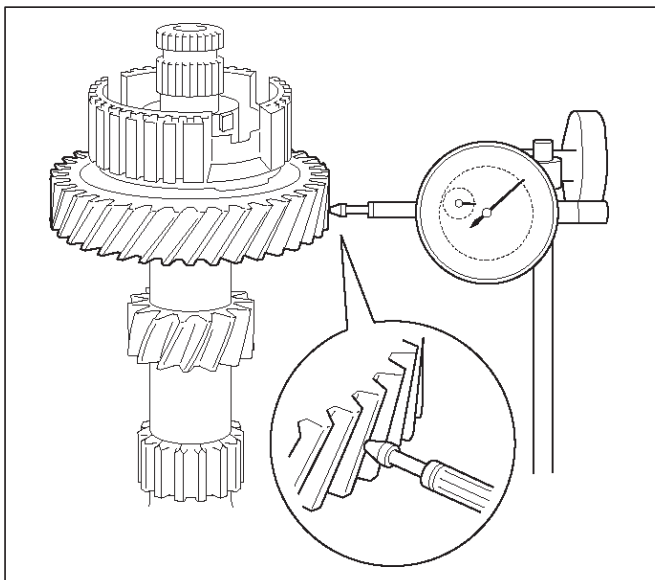
1. Install the following parts to the counter gear shaft.
 1. Counter 5th gear thrust washer pin (1).
 2. Counter 5th gear thrust washer (2).
 3. Counter 5th gear needle bearing (3).
 4. Counter 5th gear (4).



226RW086

2. Mount the counter gear shaft through the aluminum plate in vise.
3. Using a dial indicator, measure the counter 5th gear radial clearance.

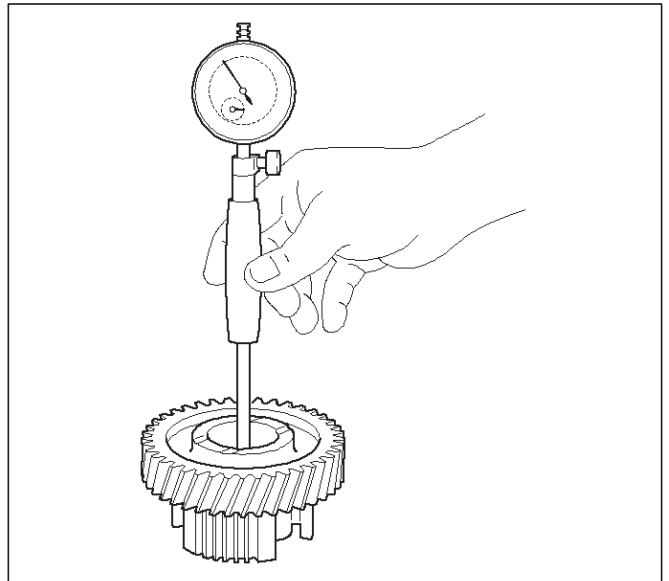
**Standard: 0.015 – 0.068 mm
(0.00059 – 0.00268 in)**



226RW183

4. Using a inside dial indicator, measure the gear inside diameter.

**Standard: 38.015 – 38.040 mm
(1.49665 – 1.49763 in)**



226RW085

2. 5th-reverse shift arm and hub sleeve No.3 clearance.

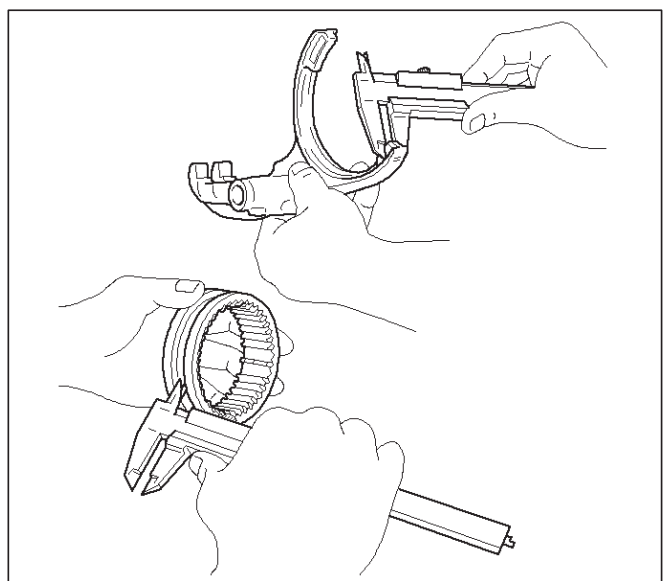
1. Using a vernier caliper, measure the 5th-reverse shift arm thickness.

Reference: 10.2 mm (0.402 in)

2. Using a vernier caliper, measure the center groove of hub sleeve No.3. Calculate the clearance between the hub sleeve No.3 and shift arm.

Standard: 0.26 – 0.84 mm (0.0102 – 0.0331 in)

**Reference: Center groove dimension 10.5mm
(0.413 in)**



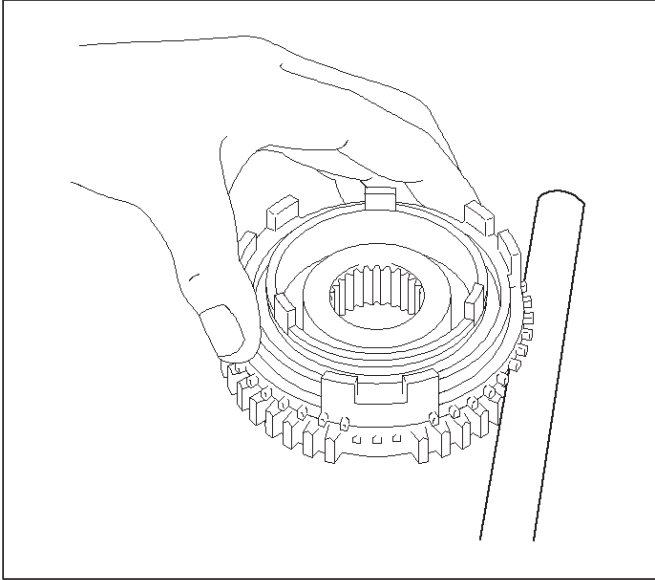
226RW086

7B-40 MANUAL TRANSMISSION

3. Reverse block ring set.

1. Using a thickness gauge, measure the clearance between the counter 5th gear spline piece and reverse block ring.

Standard: 0.7 – 1.7 mm (0.028 – 0.067 in)

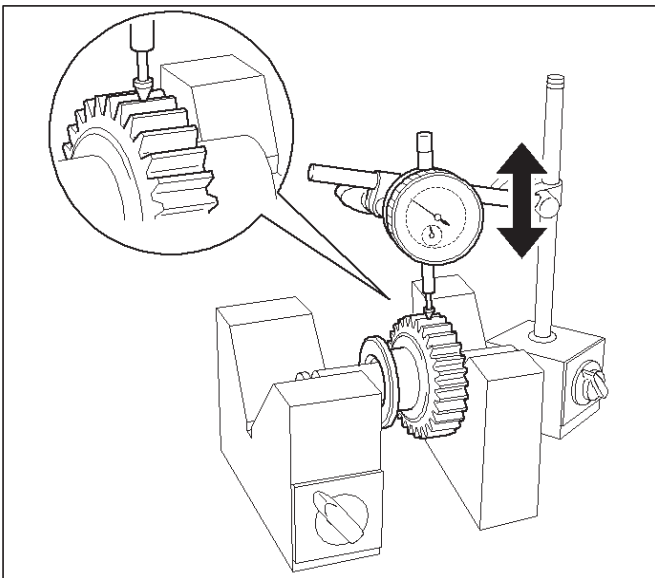


226RW084

4. Reverse idle gear and reverse idle gear shaft.

1. Mount the reverse idle gear and reverse idle gear shaft in a vise.
2. Using a dial indicator, measure the reverse idle gear radial clearance.

Standard: 0.040 – 0.082 mm (0.0016 – 0.0032 in)



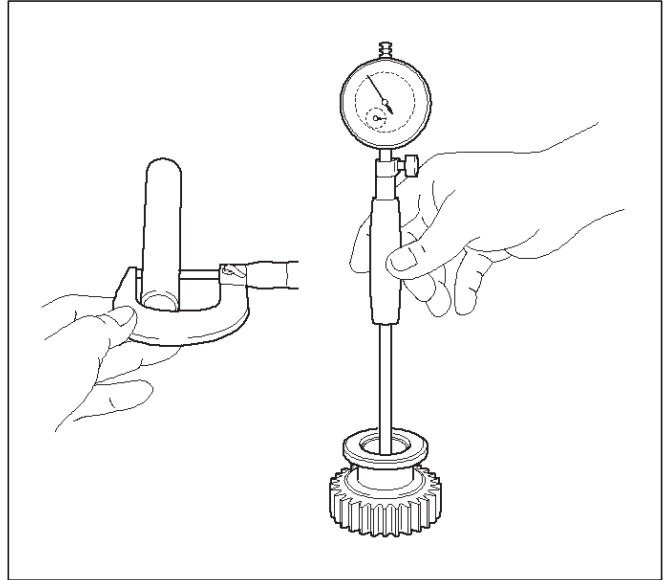
226RW083

3. If the clearance exceeds the maximum, measure the gear inside diameter and shaft diameter.

Standard

**Shaft Diameter: 23.979 – 24.000 mm
(0.94405 – 0.94488 in)**

**Gear Diameter: 24.040 – 24.061 mm
(0.94645 – 0.94728 in)**

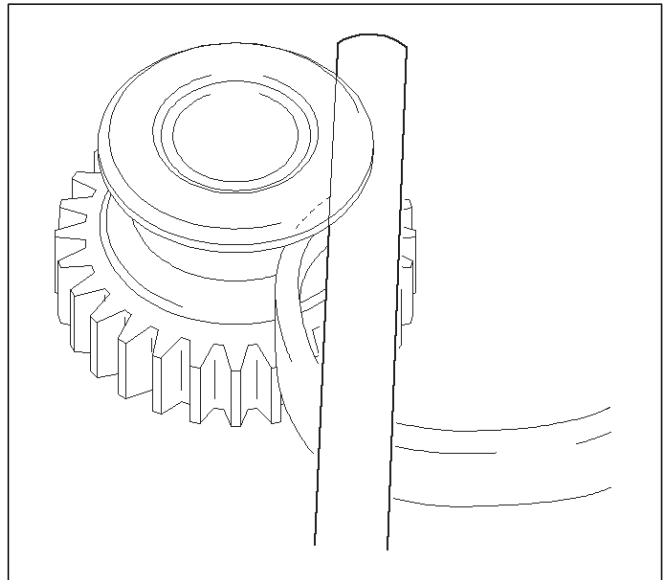


226RW082

5. Reverse shift arm No.2 thrust clearance.

1. Using a thickness gauge, measure the clearance between the reverse idle gear and shift arm No.2.

Standard: 0.05 – 0.35 mm (0.002 – 0.014 in)



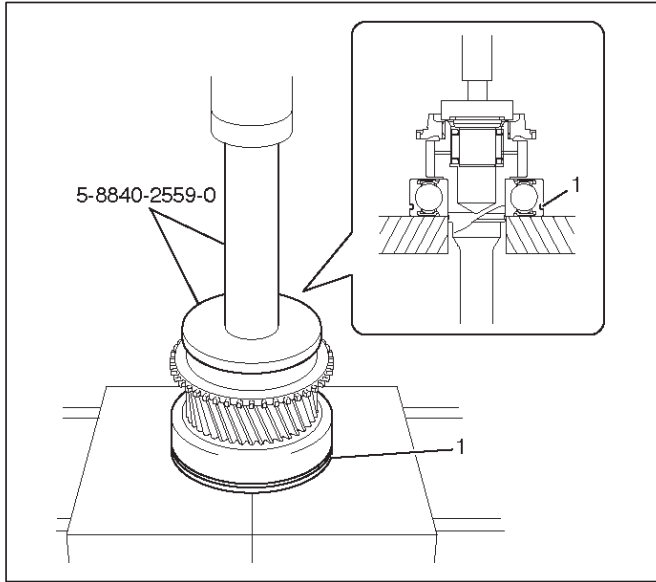
226RW081

Reassembly

1. Install the top gear shaft assembly.

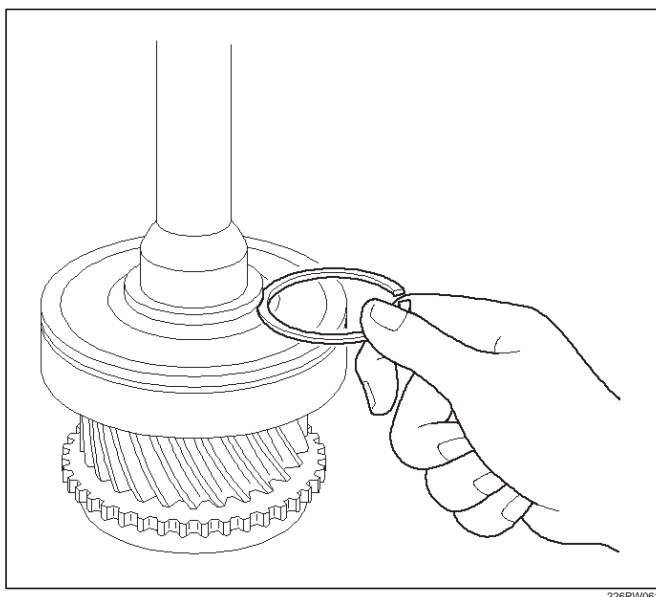
1. Using installer 5-8840-2559-0 (J-42904) and a press, install a new bearing.

NOTE: Outer race snap ring groove (1) toward front.

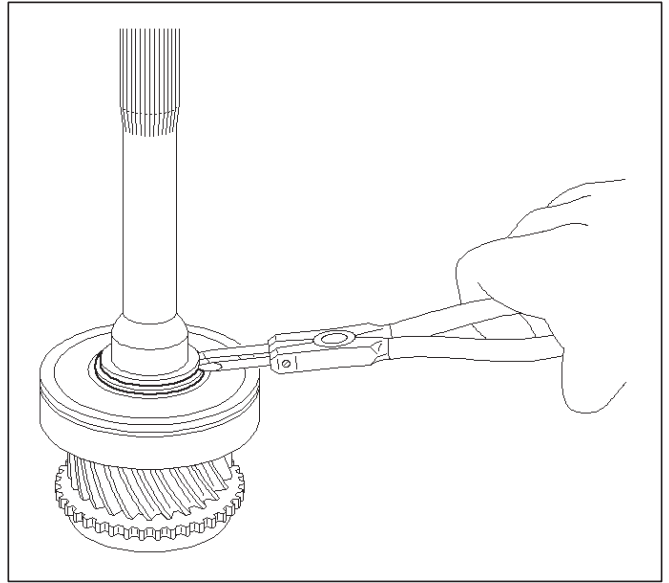


2. Select a snap ring that will allow minimum axial play.

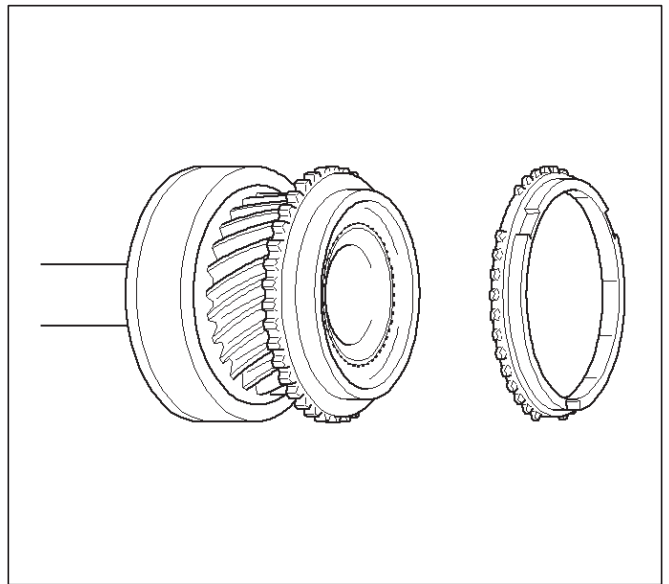
Mark	Thickness
A	2.10 – 2.15 mm (0.083 – 0.085 in)
B	2.15 – 2.20 mm (0.085 – 0.087 in)
C	2.20 – 2.25 mm (0.087 – 0.089 in)
D	2.25 – 2.30 mm (0.089 – 0.091 in)
E	2.30 – 2.35 mm (0.091 – 0.093 in)
F	2.35 – 2.40 mm (0.093 – 0.095 in)
G	2.40 – 2.45 mm (0.095 – 0.097 in)



3. Using a snap ring expander, install the new snap ring.



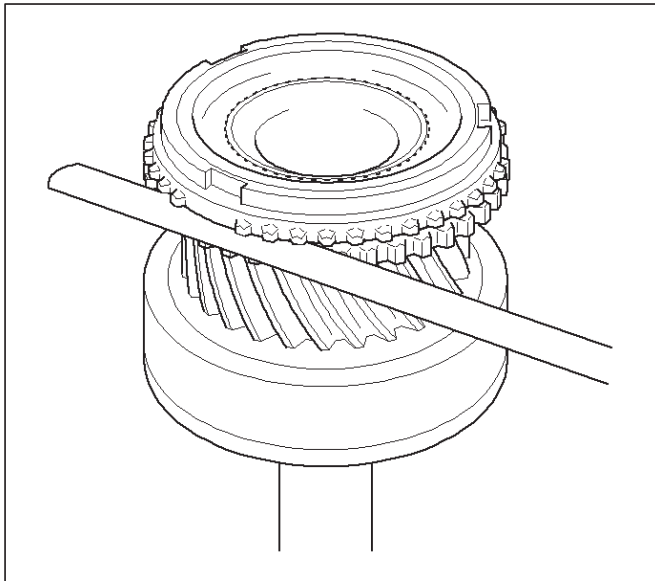
4. Install the 4th block ring.



7B-42 MANUAL TRANSMISSION

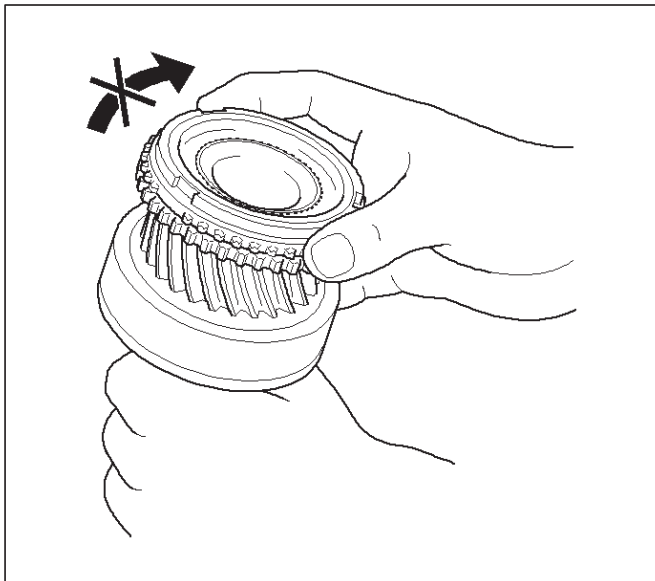
- Using a thickness gauge, measure the clearance between the 4th block ring back and gear spline end.

Standard: 0.75 – 1.65 mm (0.030 – 0.065 in)



226RW064

- Check the braking effect of the block ring. Turn the block ring in one direction while pushing it to the gear cone. Check that the ring locks. If it does not lock, replace the block ring.



226RW060

- Install the needle roller bearing.

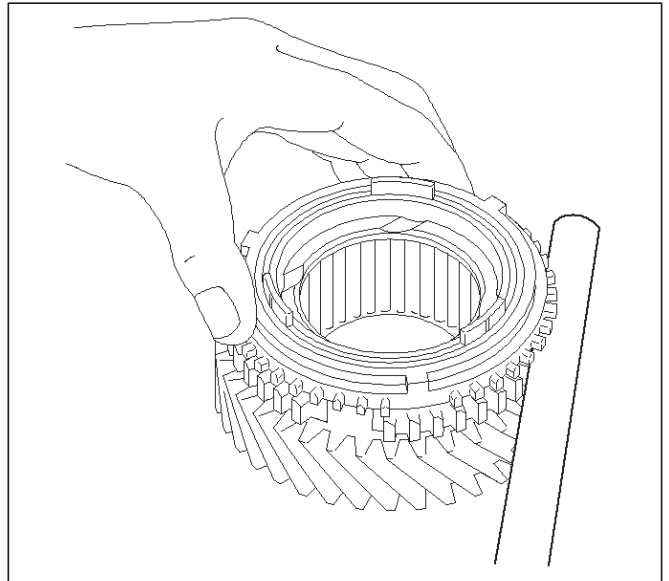
- Reassemble the mainshaft assembly.

NOTE: Apply all parts with engine oil before installing them.

- Inspect block ring

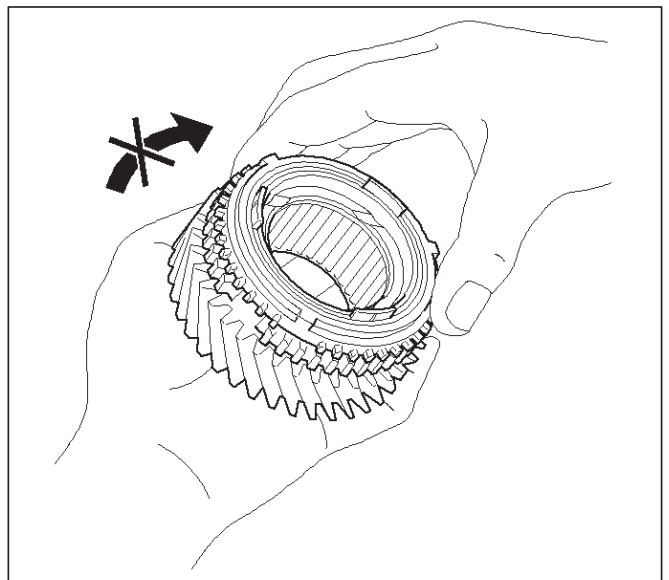
- Using a thickness gauge, measure the clearance between the synchronizer ring back and gear spline end.

Gear	Standard Clearanse
1st	0.80 – 1.60 mm (0.032 – 0.063 in)
2nd	0.65 – 1.75 mm (0.026 – 0.069 in)
3rd	0.75 – 1.65 mm (0.030 – 0.065 in)



226RW105

- Turn the synchronizer ring in one direction while pushing it to the gear cone. Check that the ring locks.



226RW106

4. Inspect hub sleeve and shift arm.

1st-2nd shift arm

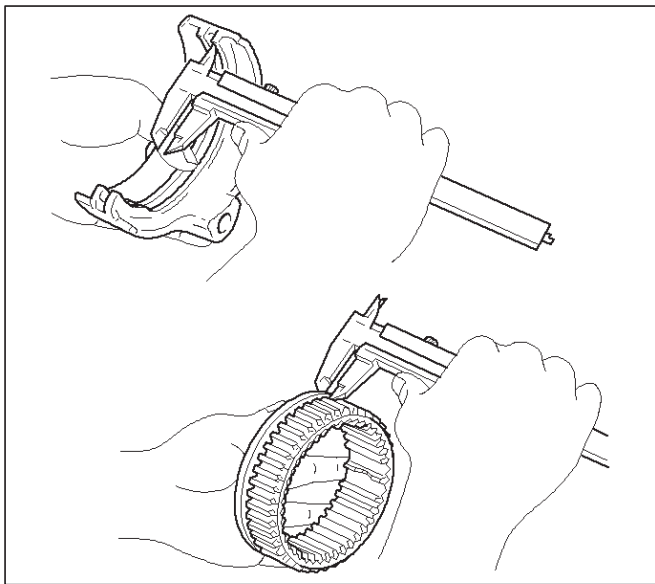
1. Using a vernier caliper, measure center groove of the 1st-2nd shift arm.

Reference: 5.28 mm (0.208 in)

2. Using a vernier caliper, measure flange of the reverse gear. Calculate the clearance between the reverse gear and shift arm.

Reference: Reverse gear flange thickness 5.0 mm. (0.197 in)

Standard: 0.15 – 0.41 mm (0.006 – 0.016 in)



226RW093

3rd-4th shift arm

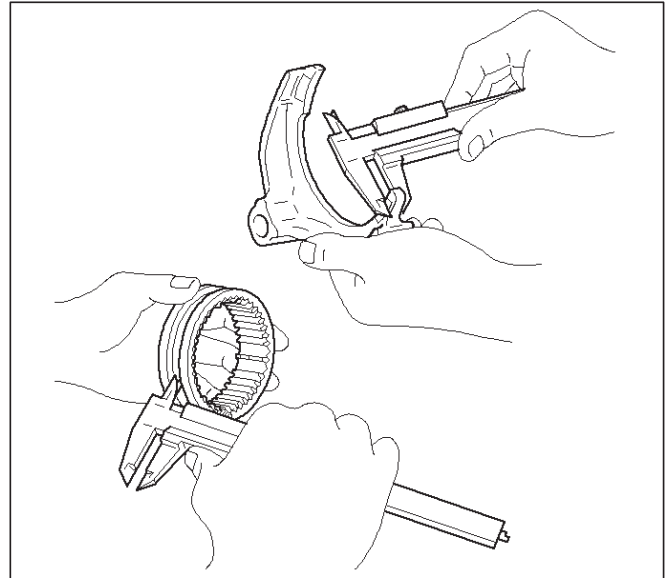
1. Using a vernier caliper, measure tip of the shift arm thickness.

Reference: 10.0mm (0.39 in)

2. Using a vernier caliper, measure center groove of the hub sleeve No.2. Calculate the clearance between the hub sleeve No.2 and shift arm.

Reference: Center groove dimension 10.2 mm (0.402 in)

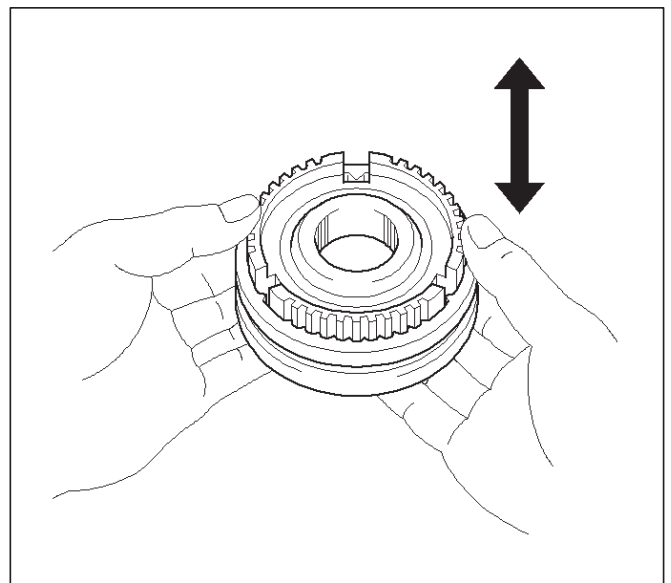
Standard: 0.15 – 0.35 mm (0.006 – 0.014 in)



226RW095

5. Inspect clutch hub and hub sleeve.

1. Check for wear or damage.
2. Install the hub sleeve to the clutch hub, and check sliding smoothly.



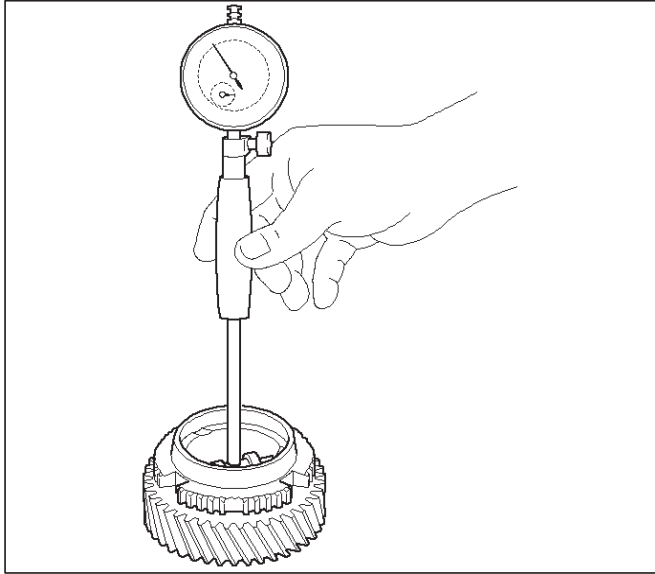
226RW094

6. Inspect gear inside diameter.

1. Using a inside dial indicator, measure the gear inside diameter.

Gear	Standard Diameter
1st	46.015 – 46.040 mm (1.8116 – 1.8126 in)
2nd	53.015 – 53.040 mm (2.0872 – 2.0882 in)
3rd	44.015 – 44.040 mm (1.7329 – 1.7339 in)

7B-44 MANUAL TRANSMISSION

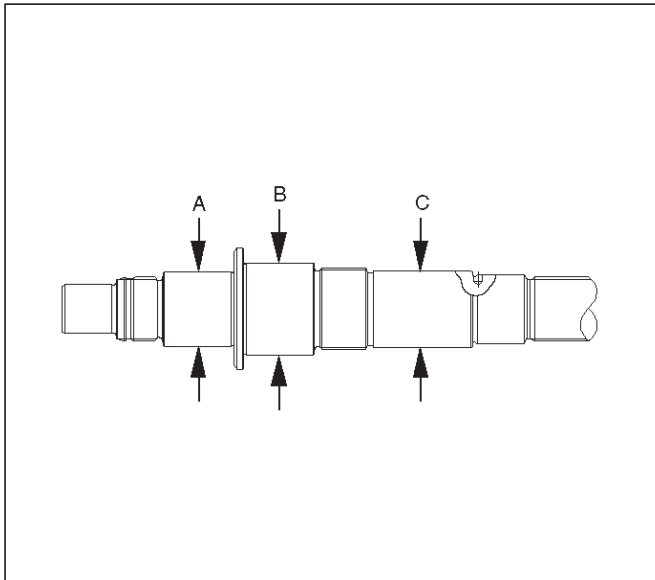


226RW096

7. Inspect mainshaft.

1. Using a micrometer, measure the outer diameter of the mainshaft journal.

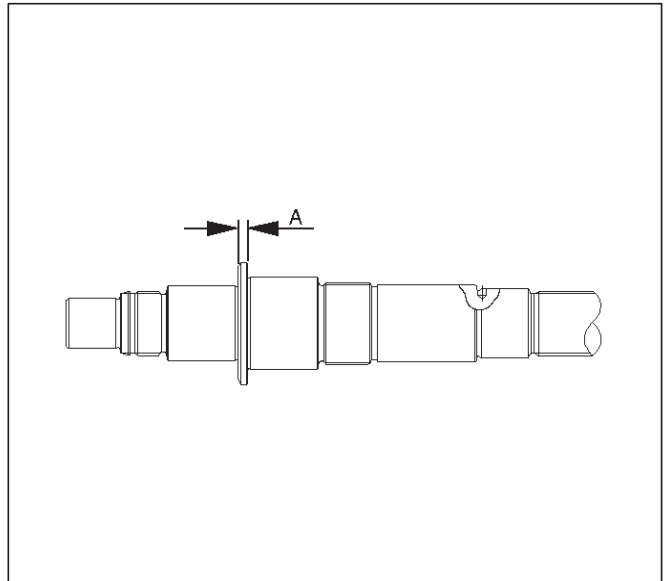
Measure Position	Standard
A	37.984 – 38.000 mm (1.4954 – 1.4961 in)
B	46.984 – 47.000 mm (1.8498 – 1.8504 in)
C	38.979 – 38.995 mm (1.5346 – 1.5352 in)



226RW078

2. Using a micrometer, measure the mainshaft flange thickness.

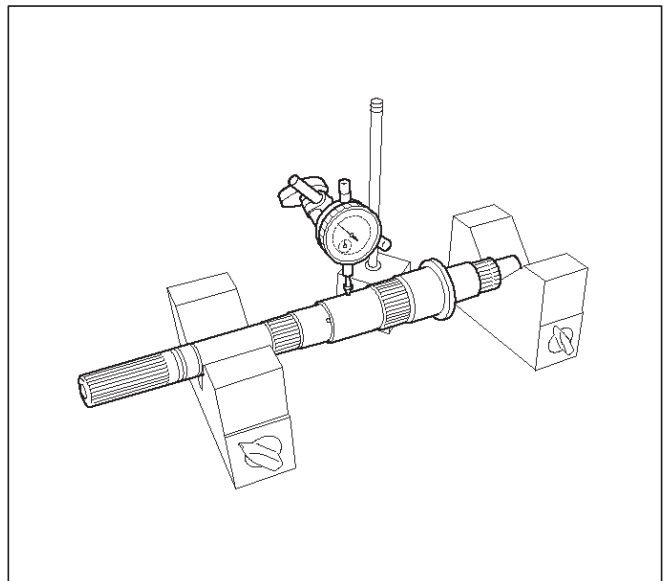
Standard: 5.0 mm (0.197 in)



226RW079

3. Install the mainshaft to V-blocks.
4. Use a dial indicator to measure the mainshaft central portion run-out.

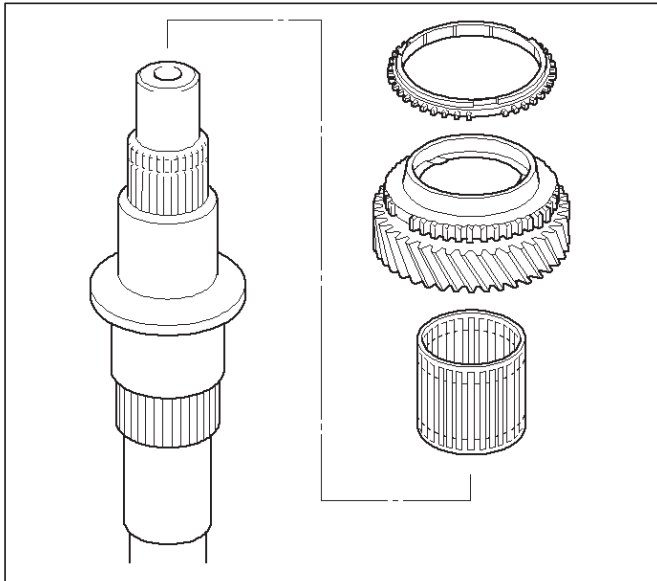
Standard: less than 0.015 mm (0.0006 in)



226RW097

8. Install 3rd gear.

1. Install the 3rd gear needle bearing, 3rd gear and 3rd block ring to the mainshaft.



226RW098

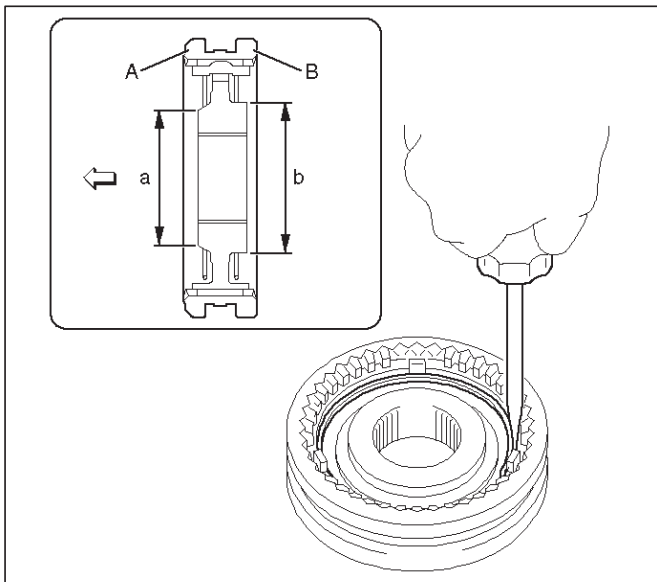
9. Install the clutch hub No.2.

1. Install the clutch hub No.2 and hub sleeve No.2.

NOTE: Be careful the direction of the clutch hub No.2, as shown.

2. Using a screwdriver, install 3 inserts and 2 springs.

NOTE: Position the insert springs so that their end gaps are not in line.

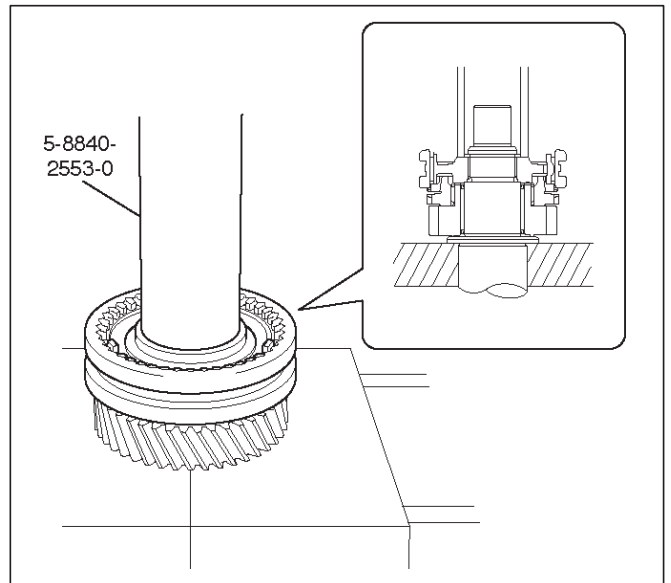


226RW099

3. Using installer 5-8840-2553-0 (J-42797) and a press, install the clutch nob No.2 and hub sleeve No.2 to the mainshaft.

NOTE:

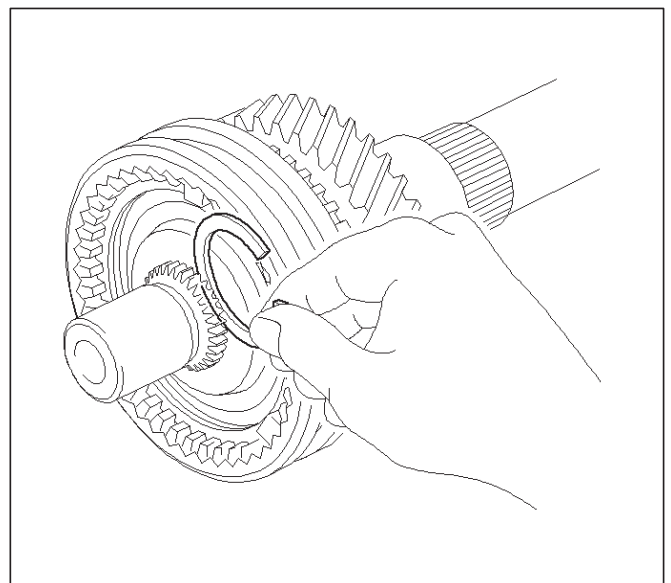
- Align the brock ring slots with the inserts.
- Check that the gear rotates smoothly.



226RW206

4. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	1.80 – 1.85 mm (0.071 – 0.073 in)
B	1.85 – 1.90 mm (0.073 – 0.075 in)
C	1.90 – 1.95 mm (0.075 – 0.077 in)
D	1.95 – 2.00 mm (0.077 – 0.079 in)
E	2.00 – 2.05 mm (0.079 – 0.081 in)
F	2.05 – 2.10 mm (0.081 – 0.083 in)
G	2.10 – 2.15 mm (0.083 – 0.085 in)

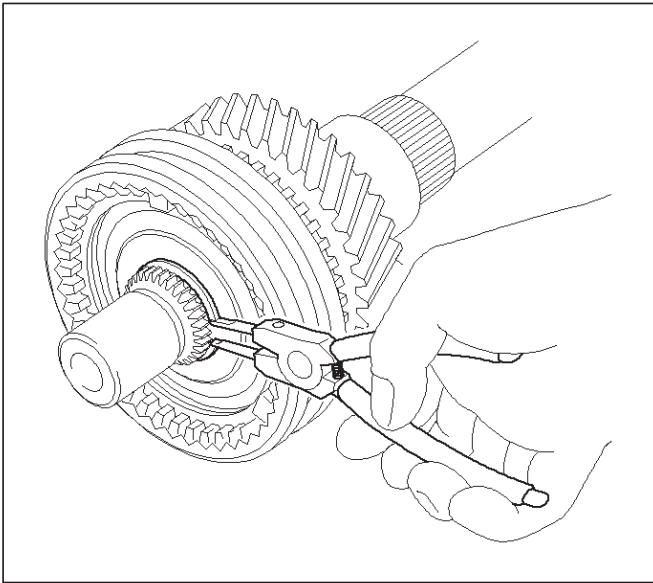


226RW102

7B-46 MANUAL TRANSMISSION

- Using a snap ring expander, install the new snap ring.

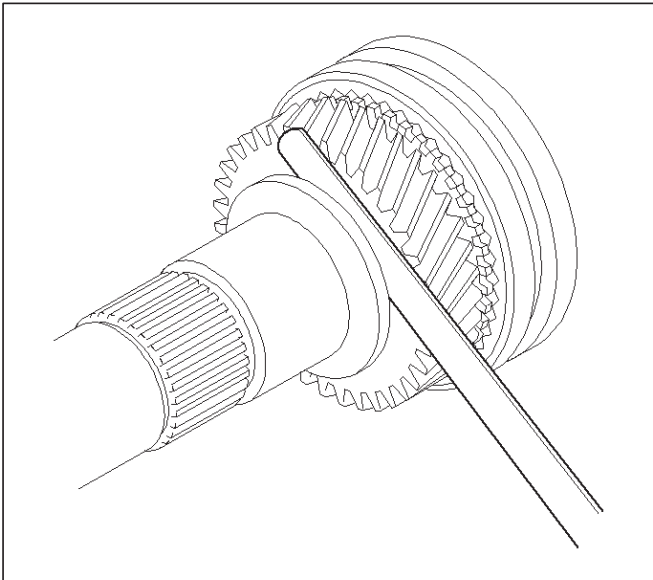
NOTE: Be careful not to damage the bearing surface.



226RW101

- Using a thickness gauge, inspect the 3rd gear thrust clearance.

Standard: 0.10 – 0.25mm (0.004 – 0.010 in)

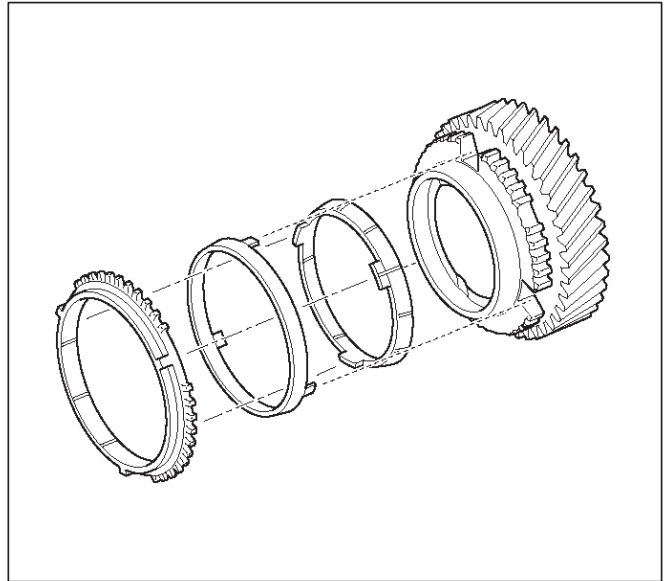


226RW103

- Install the 2nd gear.

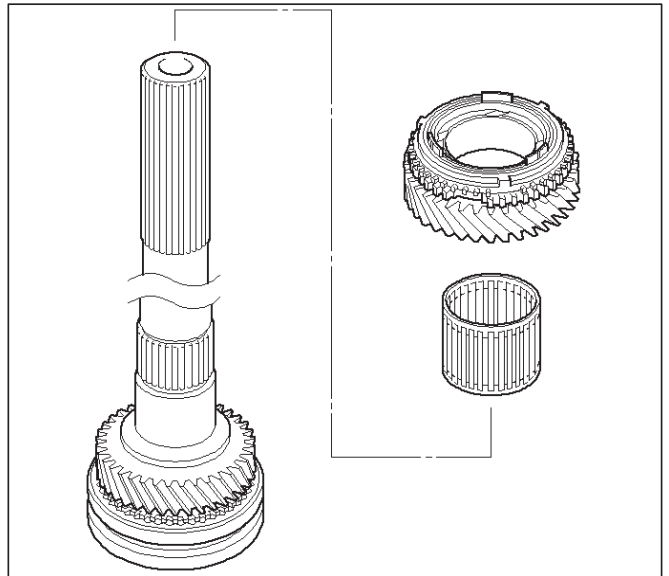
- Install the synchronizer ring set No.1 to the 2nd gear.

NOTE: Align the nail of middle ring with gear spline slots.



226RW104

- Install the needle roller bearing, 2nd gear and 2nd gear block ring set to the mainshaft.

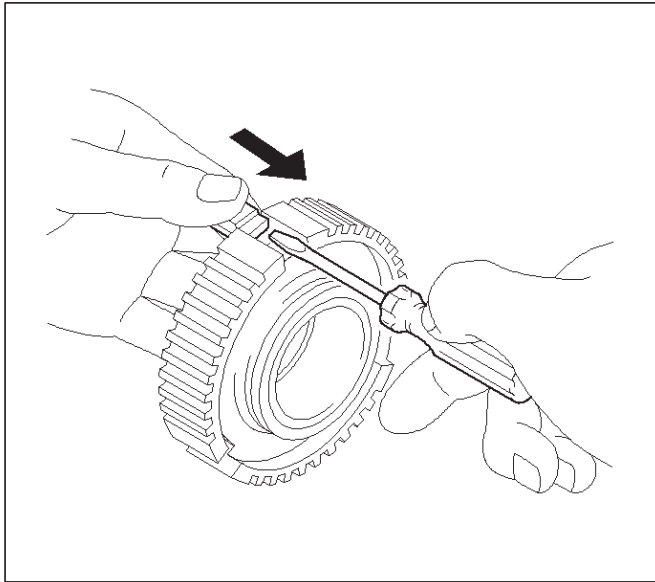


226RW107

11. Install the clutch hub No.1.

1. Install the 3 inserts and 3 insert springs to the clutch hub No.1.

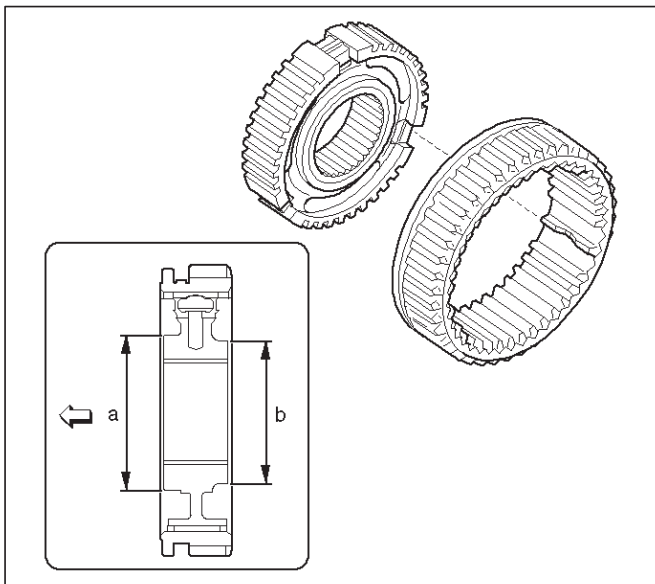
Reference: While pushing the insert spring with a screwdriver, install the inserts.



226RW108

2. Install the clutch hub No.1 to the reverse gear.

NOTE: Check the clutch hub No.1 installing direction, as shown.

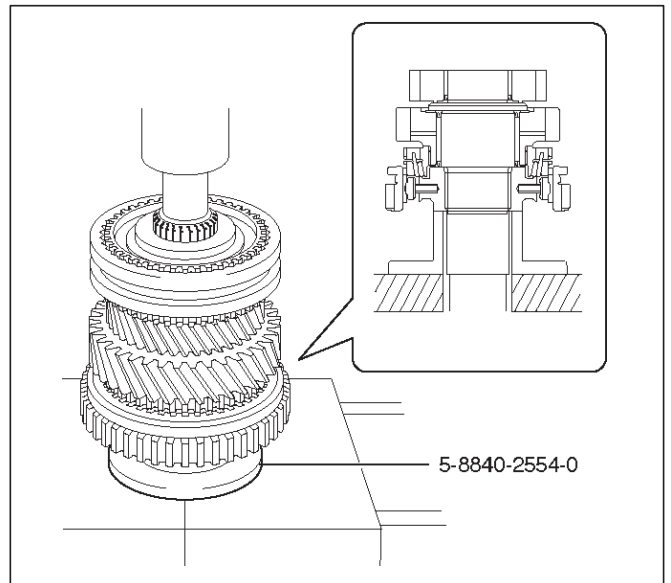


226RW109

3. Using installer 5-8840-2554-0 and a press, install the hub No.1 by retaining the reverse gear.

NOTE:

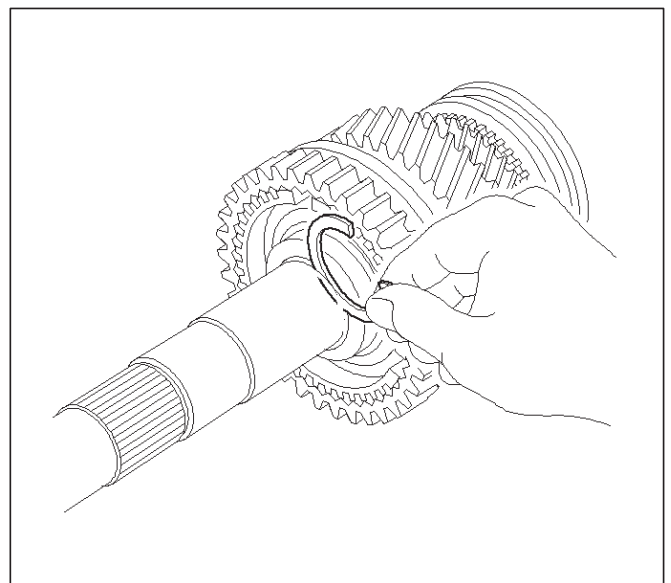
- Align the projection of inner ring with hub No.1 slots.
- Check that the gear rotates smoothly.



226RW205

4. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.30 – 2.35 mm (0.091 – 0.093 in)
B	2.35 – 2.40 mm (0.093 – 0.095 in)
C	2.40 – 2.45 mm (0.095 – 0.097 in)
D	2.45 – 2.50 mm (0.097 – 0.098 in)
E	2.50 – 2.55 mm (0.098 – 0.100 in)
F	2.55 – 2.60 mm (0.100 – 0.102 in)
G	2.60 – 2.65 mm (0.102 – 0.104 in)



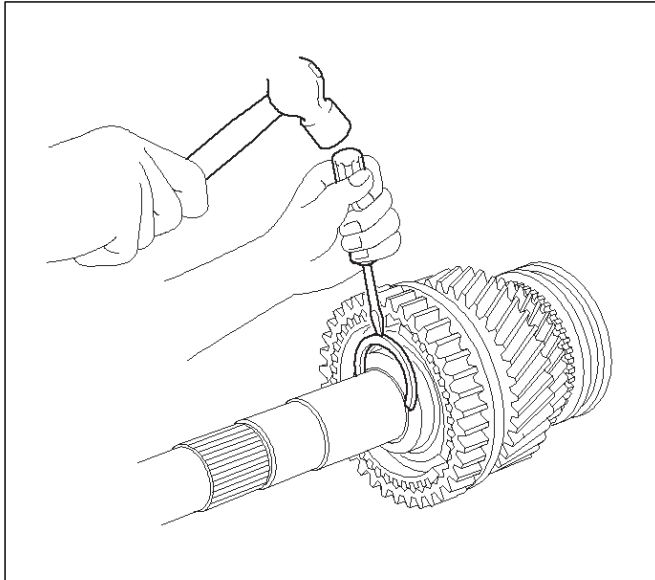
226RW111

7B-48 MANUAL TRANSMISSION

- Using a screwdriver and hammer, install the snap ring.

NOTE: Be careful not to damage the bearing surface.

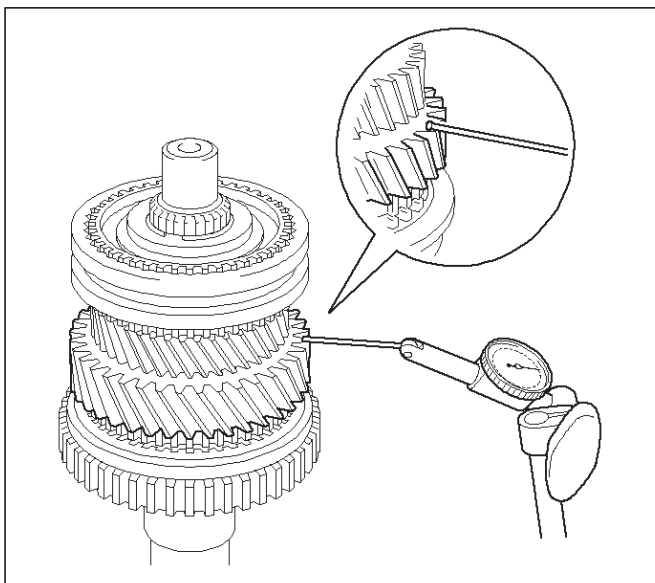
- Check that the gear rotates smoothly.



226RW112

- Using a dial indicator, measure the 2nd gear thrust clearance.

Standard: 0.10 – 0.25mm (0.004 – 0.010 in)



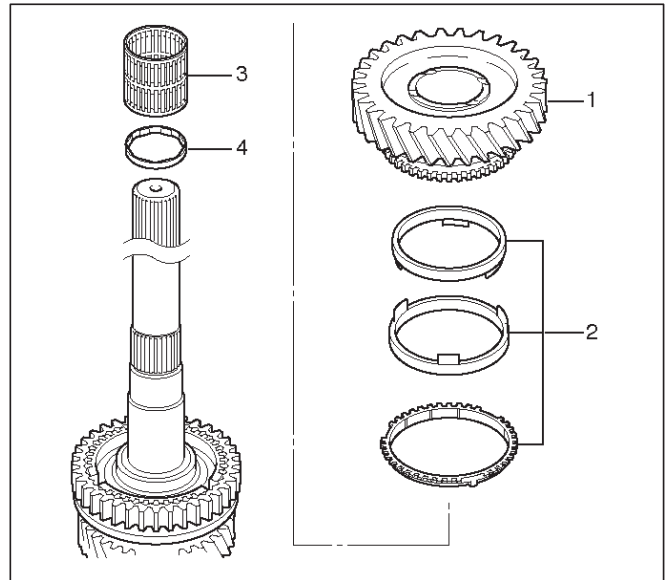
226RW113

- Install the 1st gear.

- Install the following parts:
 - 1st gear bearing spacer (4).
 - 1st gear needle roller bearing (3).
 - Synchronizer assembly (2).
 - 1st gear (1).

NOTE:

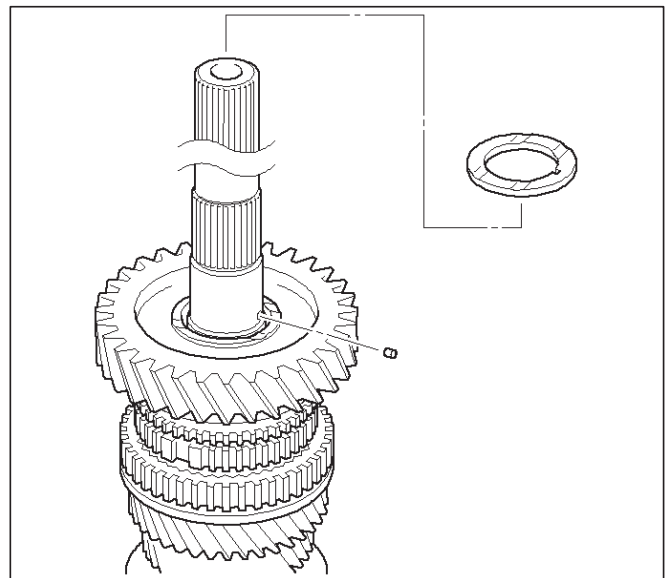
- Align the projection of inner ring with hub No.1 slots.
- Check that the gear rotates smoothly.



226RW114

- Install the 1st gear thrust washer pin and 1st gear thrust washer to the mainshaft.

NOTE: Align the straight pin with the thrust washer slot.

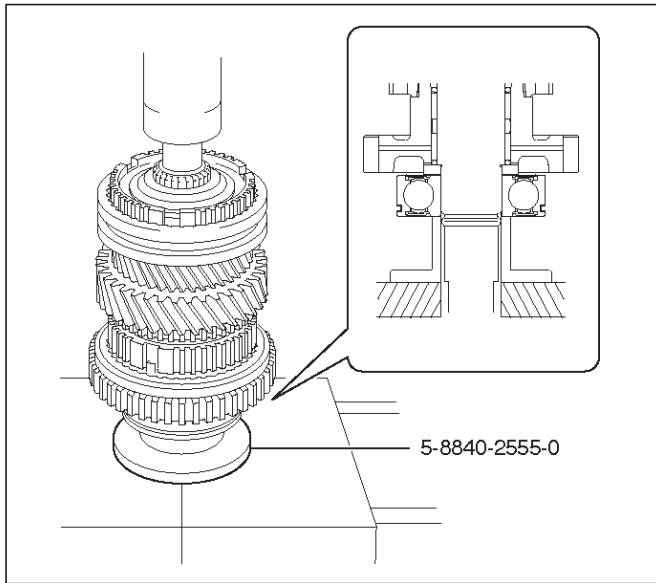


226RW115

13. Install the mainshaft center bearing.

- Using installer 5-8840-2555-0 (J-42799) and a press, install the mainshaft center bearing.

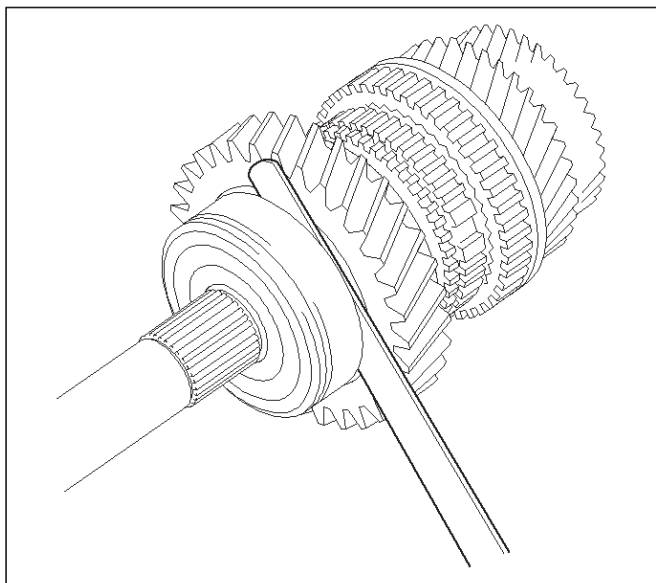
NOTE: Center bearing snap ring groove toward rear.



226RW195

- Using a thickness gauge, measure 1st gear thrust clearance.

Standard: 0.10 – 0.45mm (0.004 – 0.018 in)

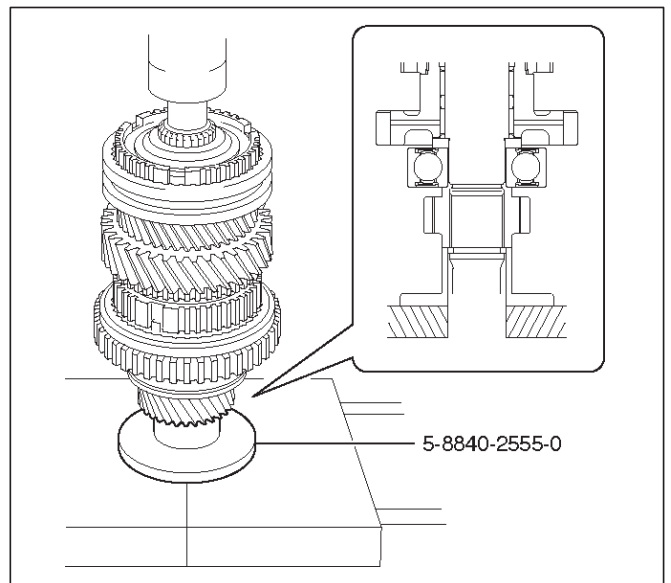


226RW118

14. Install the 5th gear.

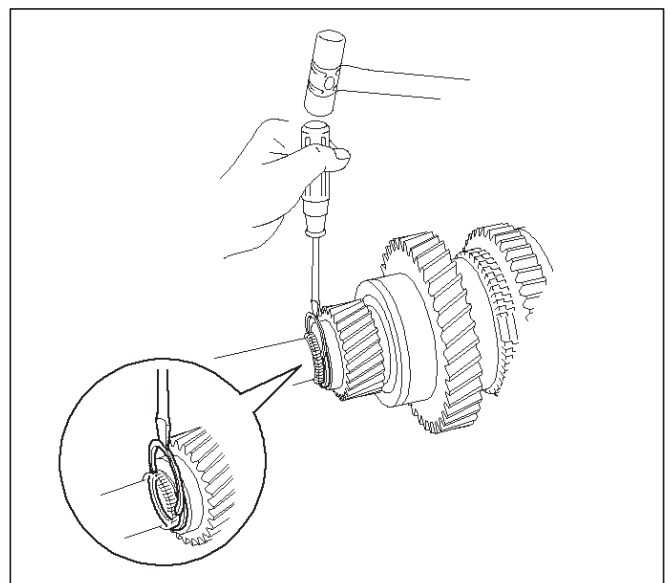
- Using installer 5-8840-2555-0 (J-42799) and a press, install the 5th gear.
- Select a snap ring that will allow minimum axial play.

Mark	Thickness
C	2.75 – 2.80 mm (0.108 – 0.110 in)
D	2.80 – 2.85 mm (0.110 – 0.112 in)
E	2.85 – 2.90 mm (0.112 – 0.114 in)
F	2.90 – 2.95 mm (0.114 – 0.116 in)
G	2.95 – 3.00 mm (0.116 – 0.118 in)
H	3.00 – 3.05 mm (0.118 – 0.120 in)
J	3.05 – 3.10 mm (0.120 – 0.122 in)
K	3.10 – 3.15 mm (0.122 – 0.124 in)
L	3.15 – 3.20 mm (0.124 – 0.126 in)
M	3.20 – 3.25 mm (0.126 – 0.128 in)
N	3.25 – 3.30 mm (0.128 – 0.130 in)
P	3.30 – 3.35 mm (0.130 – 0.132 in)



226RW203

- Using a screwdriver and hammer, install the new snap ring.



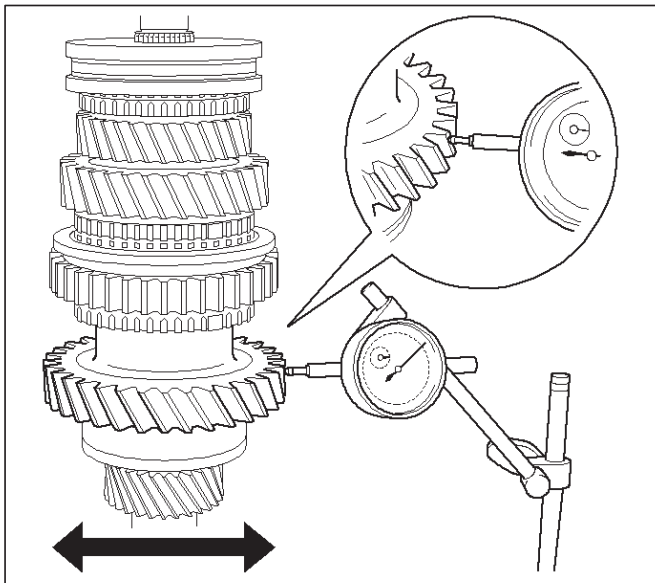
226RW127

7B-50 MANUAL TRANSMISSION

15. Inspect each gear radial clearance.

1. Mount the mainshaft through the aluminum plate in a vise.
2. Using a dial indicator, measure the radial clearance of each gear.

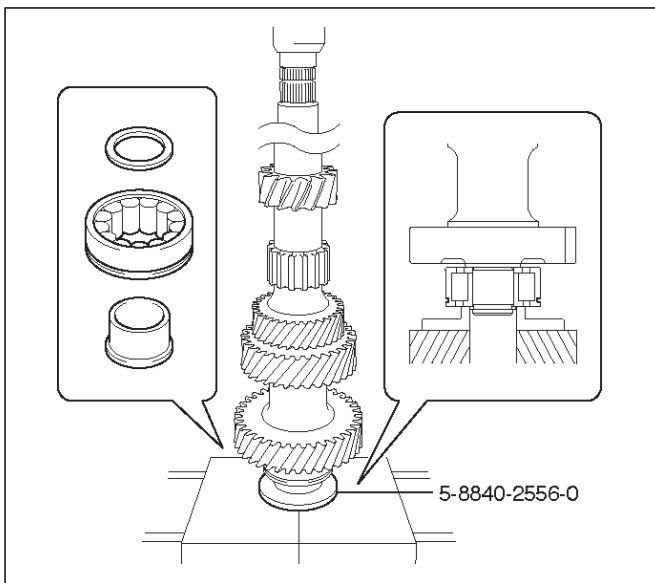
Gear	Standard Clearanse
1st	0.020 – 0.073 mm (0.0008 – 0.0029 in)
2nd	0.015 – 0.068 mm (0.0006 – 0.0027 in)
3rd	0.015 – 0.068 mm (0.0006 – 0.0027 in)



226RW071

16. Install the counter gear shaft.

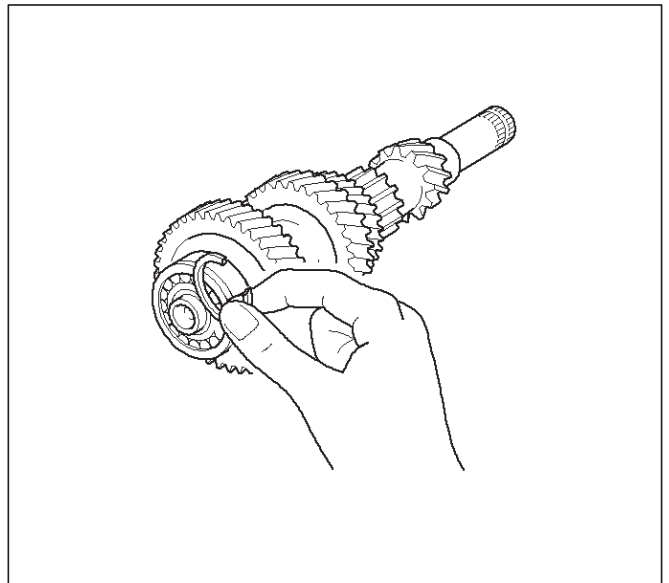
1. Check the new counter front bearing inner race and the side race, as shown.
2. Using installer 5-8840-2556-0 (J-42800) and a press, install the counter gear shaft front bearing.



226RW194

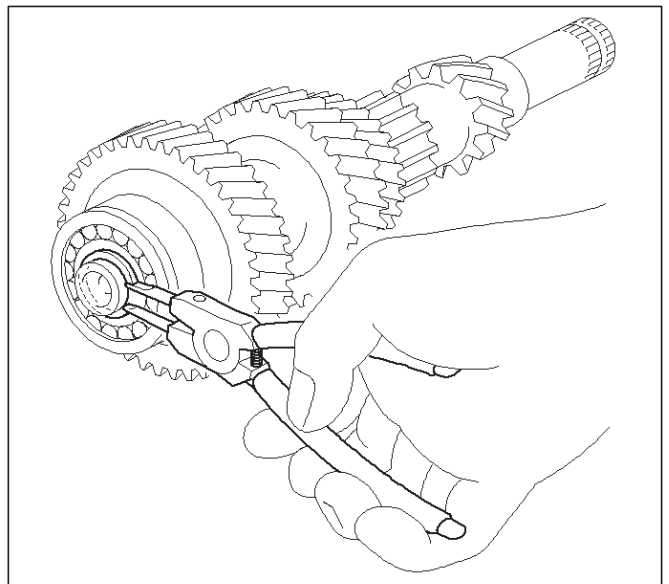
3. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.00 – 2.05 mm (0.079 – 0.081 in)
B	2.05 – 2.10 mm (0.081 – 0.083 in)
C	2.10 – 2.15 mm (0.083 – 0.085 in)
D	2.15 – 2.20 mm (0.085 – 0.087 in)
E	2.20 – 2.25 mm (0.087 – 0.089 in)
F	2.25 – 2.30 mm (0.089 – 0.091 in)



226RW128

4. Using a snap ring expander, install the new snap ring.



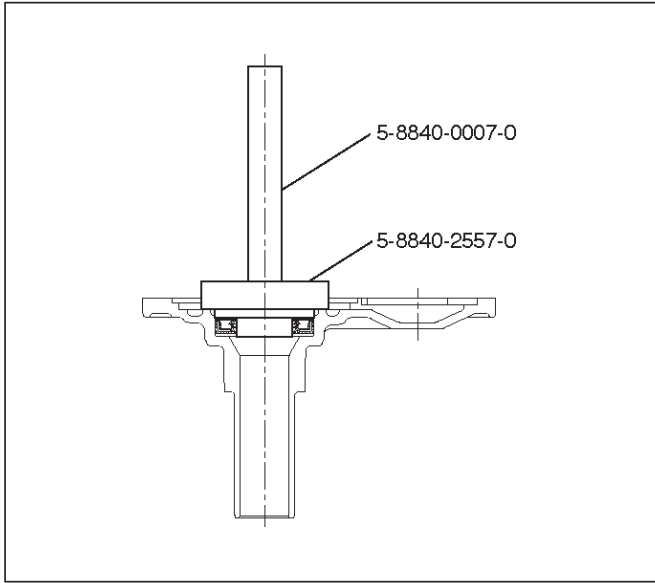
226RW129

17. Install the front cover.

- Using installer 5-8840-2557-0 (J-42801), grip 5-8840-0007-0 (J-8092) and a hammer, drive in a new oil seal.

Drive in depth (from cover end): 11.7 ± 0.5 mm (0.46 ± 0.02 in)

- Apply grease to the seal lip.

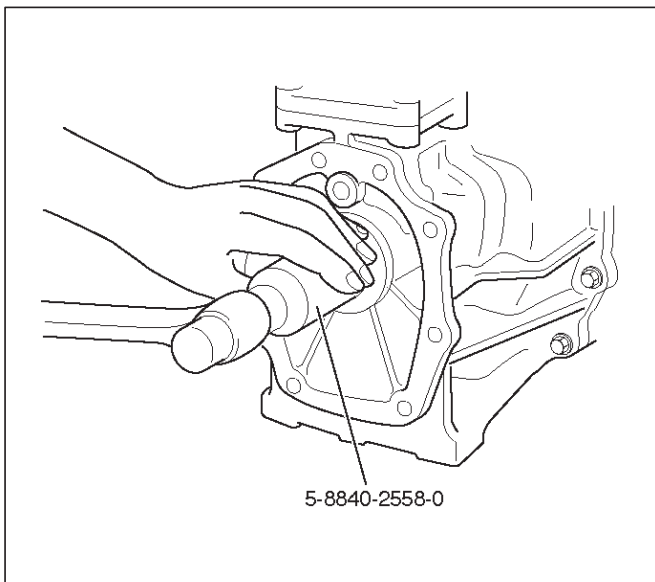


18. Install the transfer adapter.

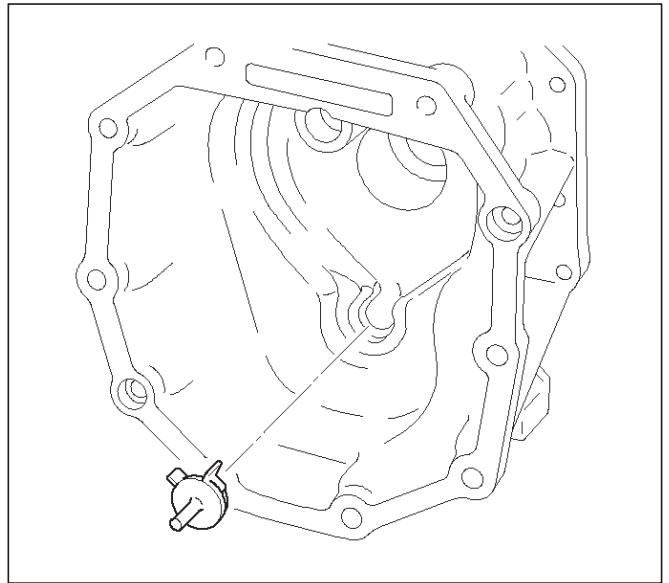
- Using installer 5-8840-2558-0 (J-42802), and a hammer drive in a new oil seal.

Drive in depth (from transfer adapter): 10.95 ± 0.5 mm (0.431 ± 0.02 in)

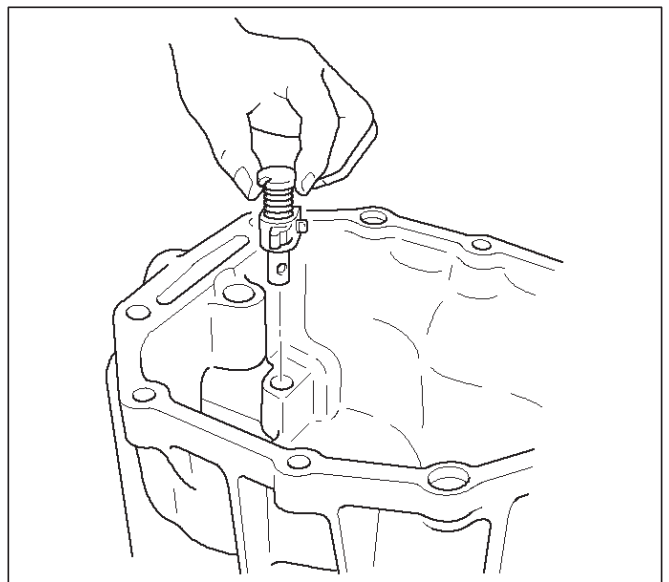
- Apply grease to the oil seal lip.



3. Install the oil receiver pipe.

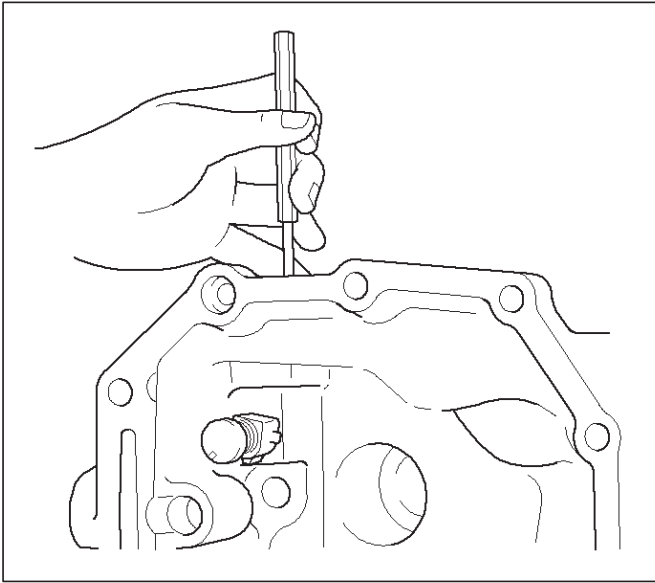


4. Install the reverse restrict to the transfer adapter.



7B-52 MANUAL TRANSMISSION

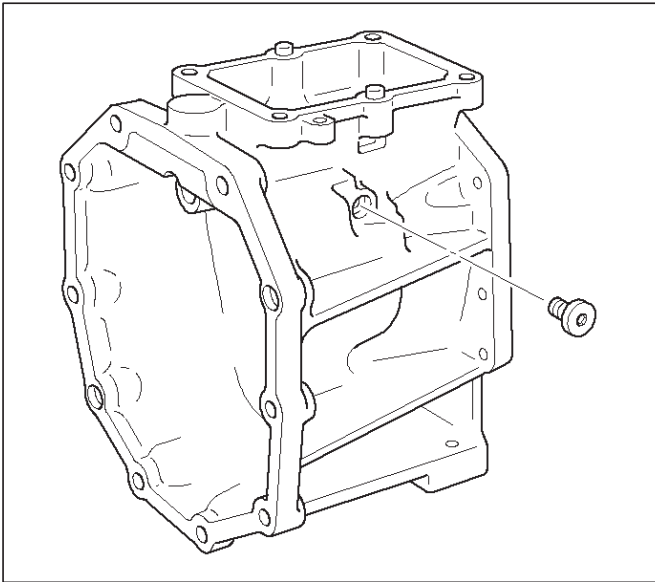
- Using a pin punch and hammer, drive in the slotted spring pin.



226RW058

- Clean up the plug and plug hole.
- Apply sealant to the plug threads. (THREE BOND 1344 or equivalent)
- Using a torx socket wrench (T40), install and torque the plug.

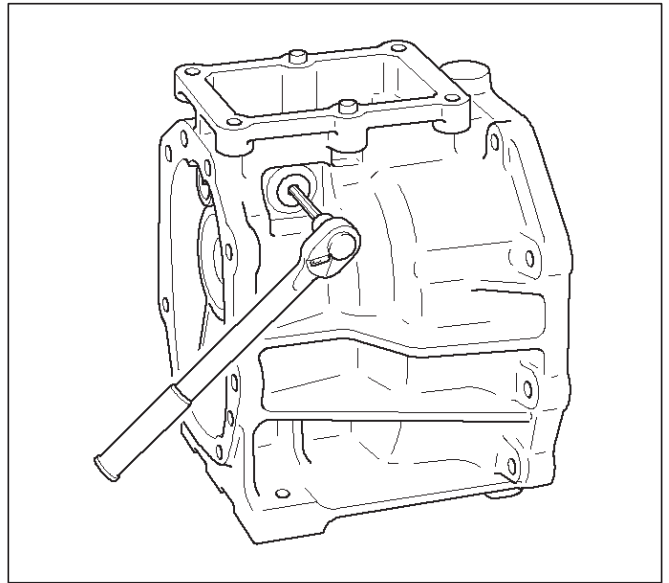
Torque: 19 N-m (1.9 kg-m/14 lb ft)



220RW013

- Using hexagon wrench, install and torque the plug.

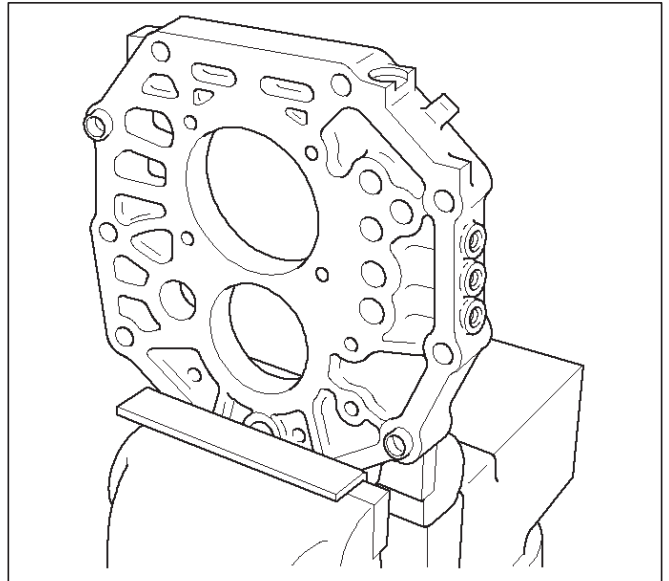
Torque: 37 N-m (3.8 kg-m/27 lb ft)



220RW014

- Install the reverse shift arm No.1 and reverse shift arm No.2.

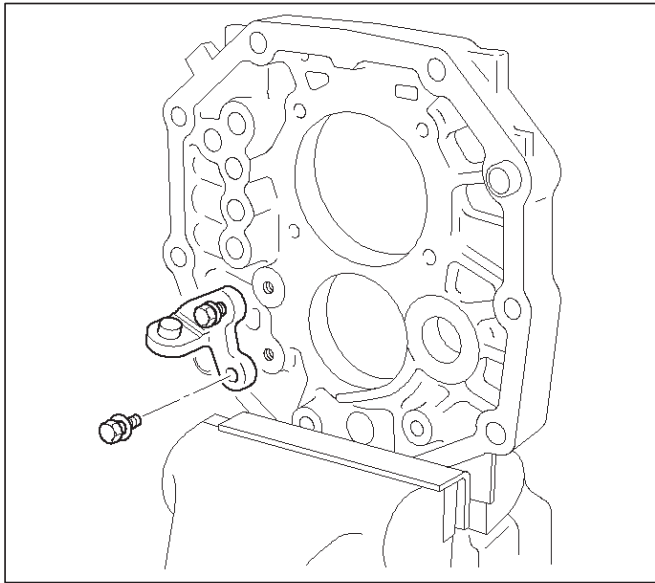
- Mount the intermediate plate through the aluminum plate in a vise.



226RW057

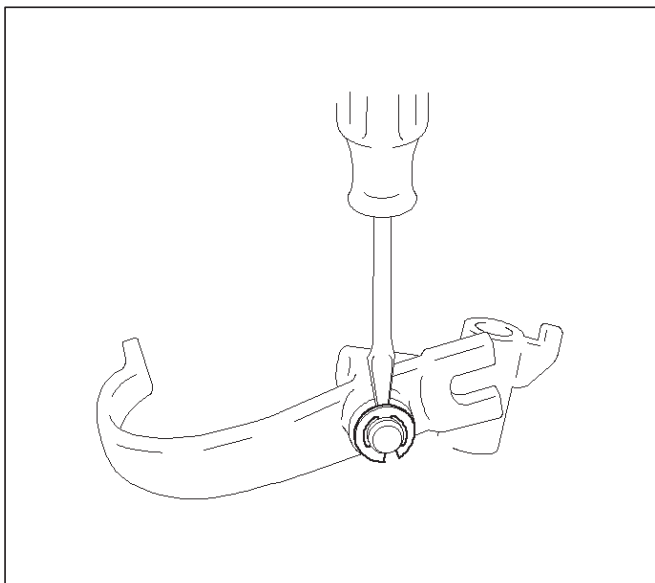
- Using 2 bolts, install reverse shift arm bracket.

Torque: 18 N·m (1.8 kg·m/13 lb ft)



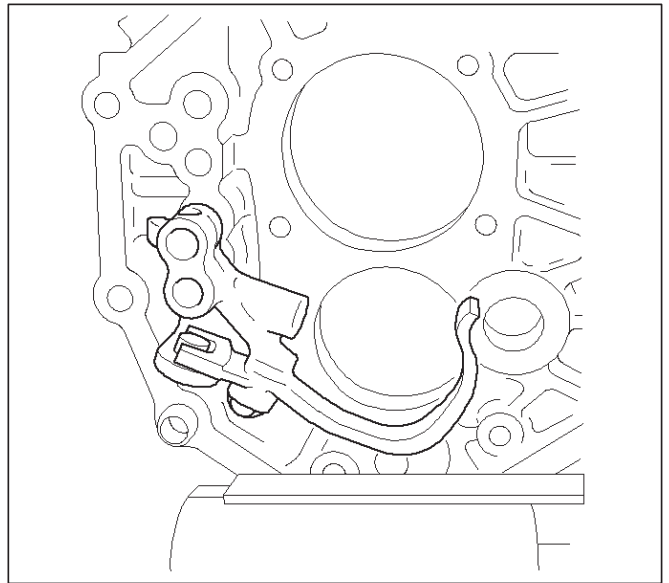
226RW054

- Install reverse shift arm No.2 to the reverse shift arm No.1. Using screwdriver and a hammer, install the new E-ring.



226RW138

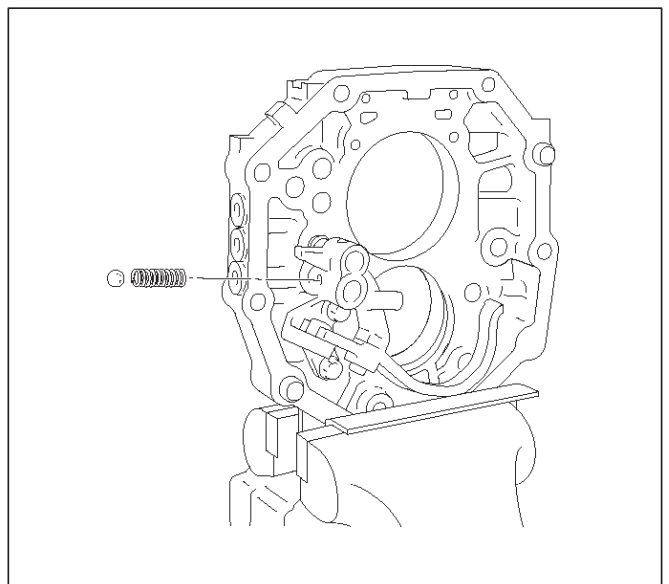
- Install reverse shift arm No.2 to the reverse shift arm bracket.



226RW012

- Install the reverse shift rod.

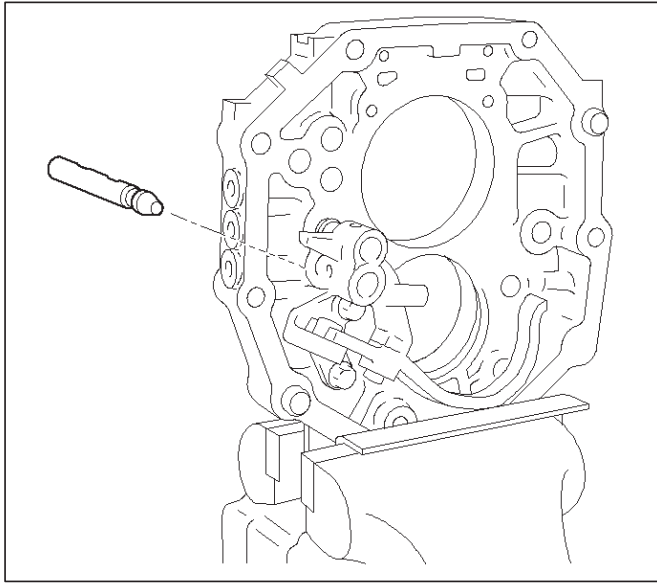
- Install the reverse shift arm No.1 compression spring and ball to the reverse shift arm No.1.



226RW125

7B-54 MANUAL TRANSMISSION

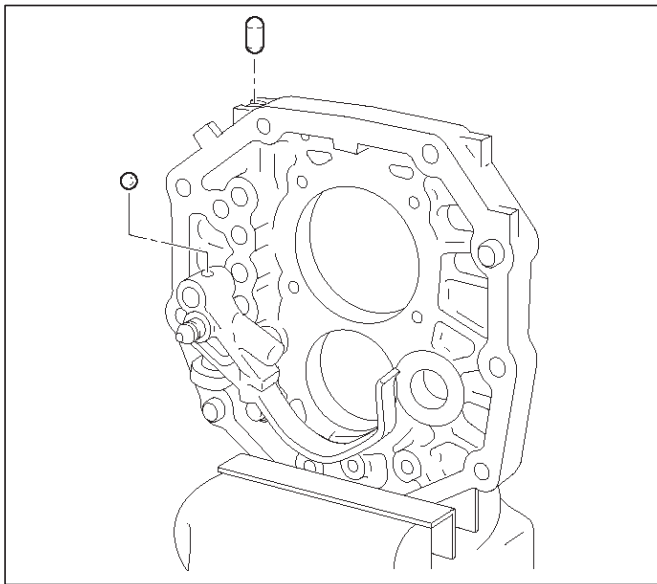
2. Install the reverse shift rod from the rear side by pushing the ball on using a screwdriver.



226RW126

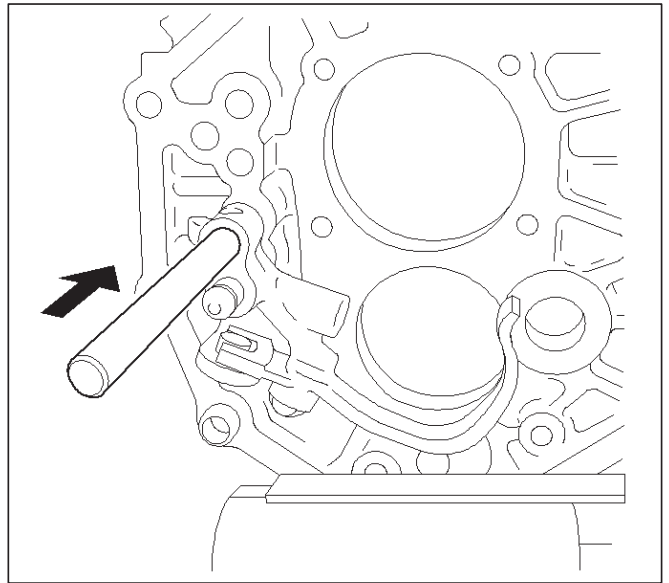
21. Install the reverse-5th shift rod.

1. Install the reverse shift arm No.1 lock ball to the reverse shift arm No.1.
2. Install the interlock pin to the intermediate plate.



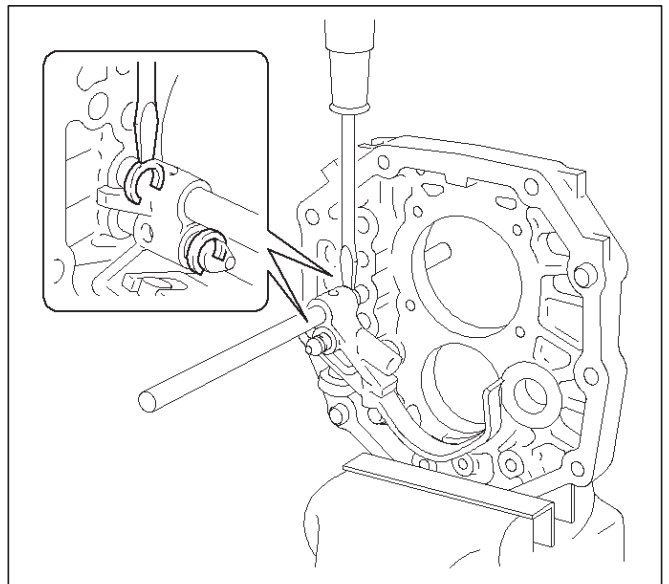
226RW039

3. Put in the reverse-5th shift rod from the front.



226RW011

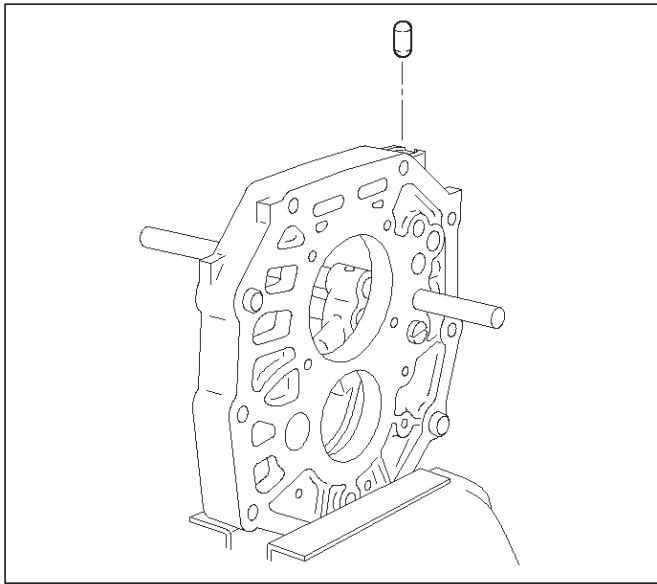
4. Using a screwdriver and a hammer, install the 2 new shift rod snap rings to the 5th-reverse shift rod and reverse shift rod.



226RW037

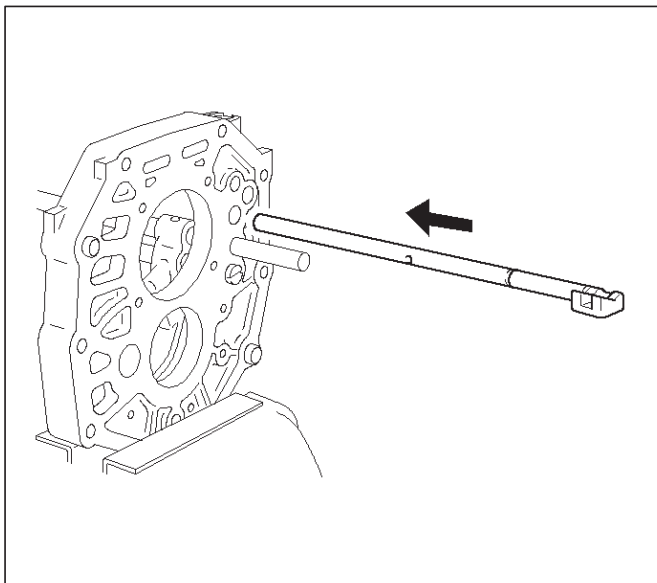
22. Install 1st-2nd shift rod.

1. Install the interlock pin to the intermediate plate.



226RW042

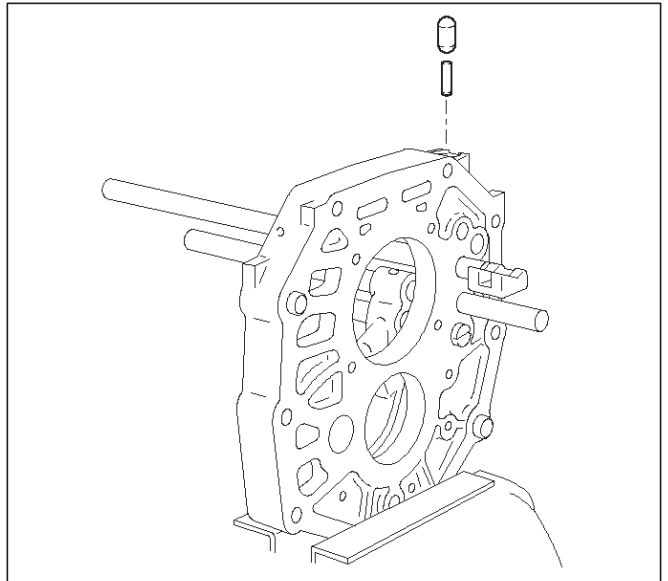
2. Put in the 1st-2nd shift rod from the rear.



226RW044

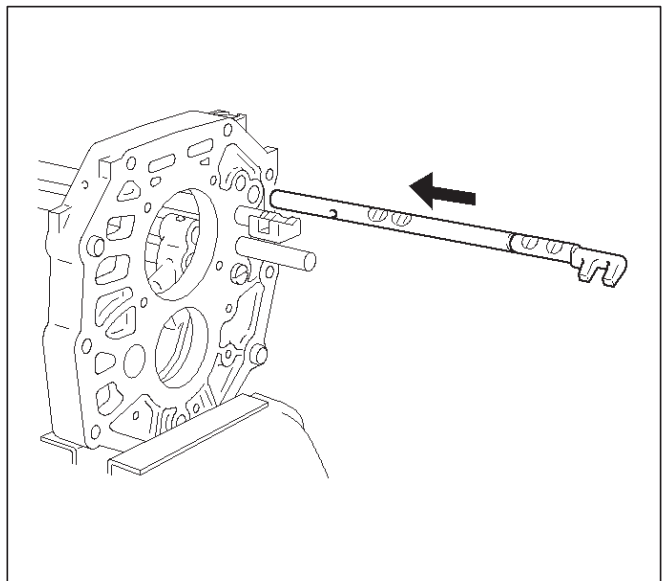
23. Install 3rd-4th shift rod.

1. Install the straight pin and interlock pin to the intermediate plate.



226RW043

2. Put in the 3rd-4th shift rod from the rear.

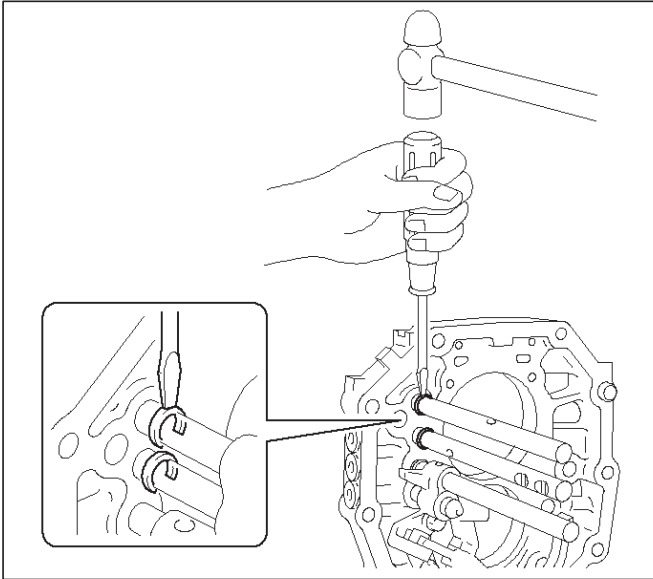


226RW046

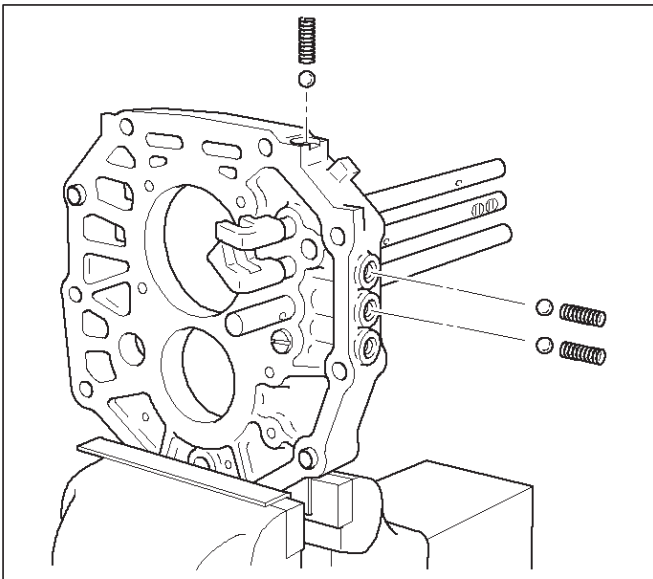
7B-56 MANUAL TRANSMISSION

24. Install the interlock parts.

1. Using a screwdriver and hammer, 2 new shift rod snap rings to the 1st-2nd and 3rd-4th shift rod.



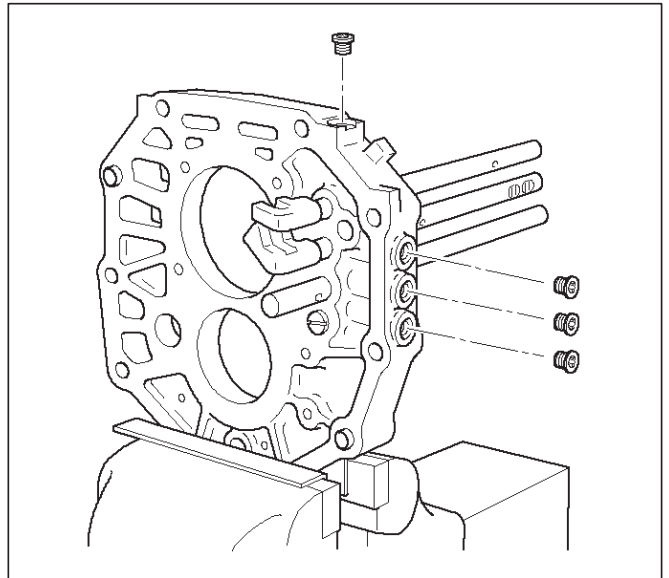
2. Install the 3 shift detent ball and springs to the intermediate plate.



3. Clean up the plug hole.
4. Apply sealant to the plug threads.
sealant: THREE BOND 1344 or equivalent

5. Using a torx socket wrench(T40), install and torque the 4 plugs.

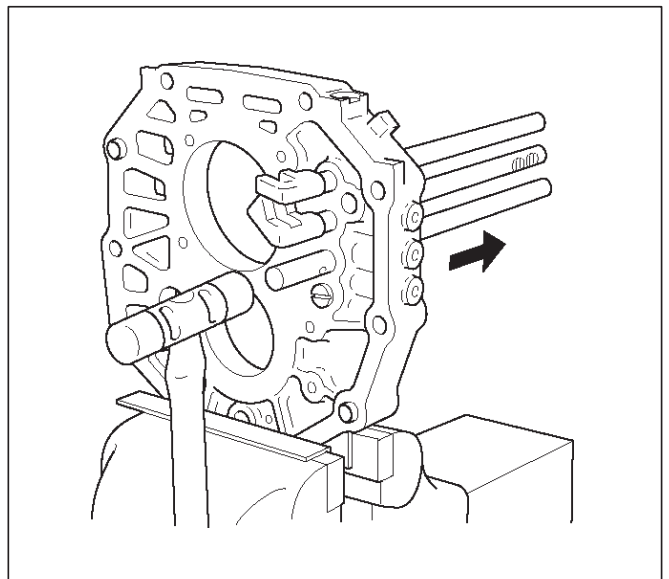
Torque: 19 N-m (1.9 kg-m/14 lb ft)



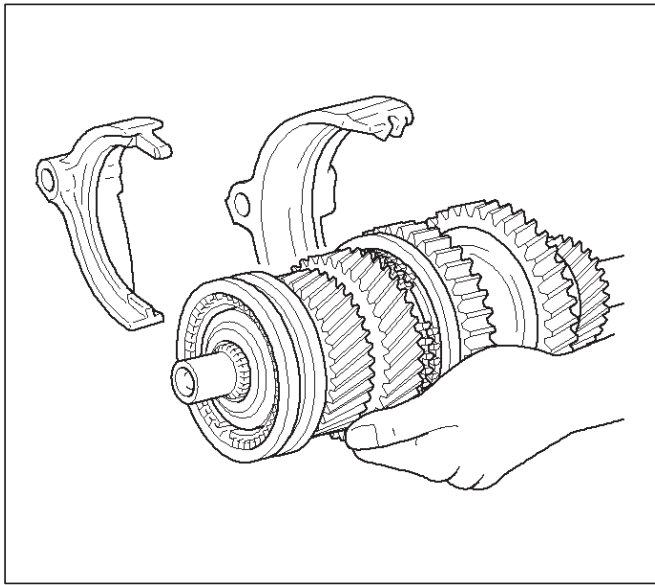
25. Install mainshaft assembly.

NOTE: Coat all parts with gear oil before installing them.

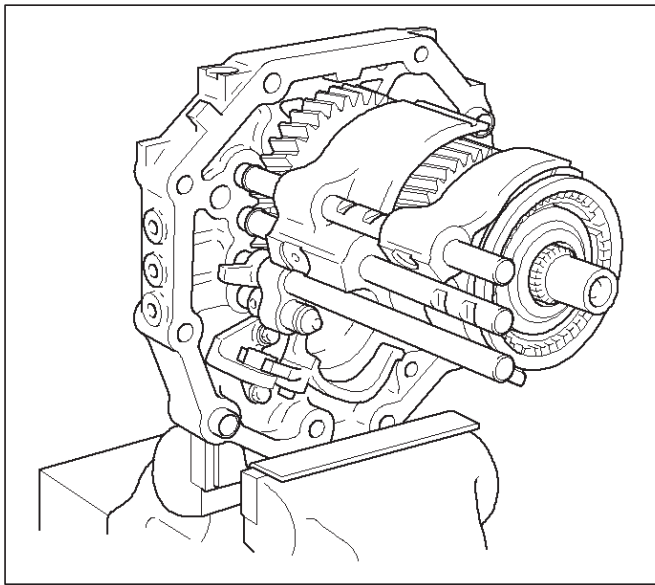
1. Using a plastic hammer, tap the 5th-reverse shift rod at the reverse shift.



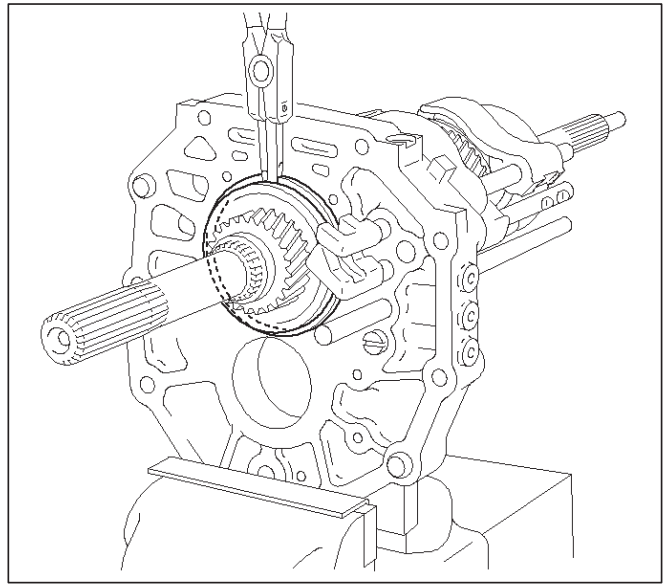
2. Install the shift arm No.1 and No.2 to the mainshaft.



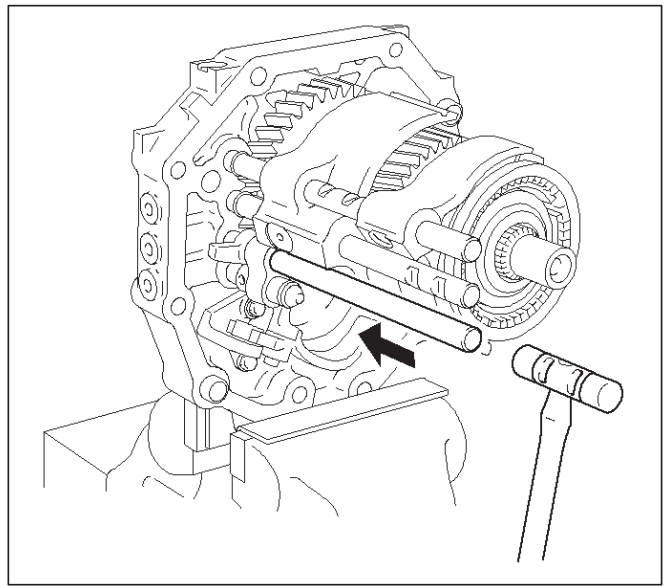
3. Using a plastic hammer, tap the intermediate plate and install the mainshaft. Through the shift arm No.1 and No.2 to the shift rod.



4. Using a snap ring expander, install the snap ring.



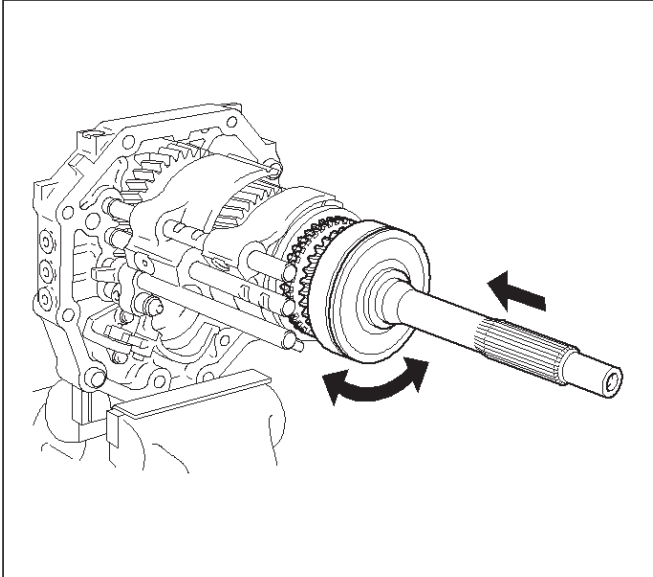
5. Using a plastic hammer, tap the 5th-reverse shift rod at the neutral shift.



7B-58 MANUAL TRANSMISSION

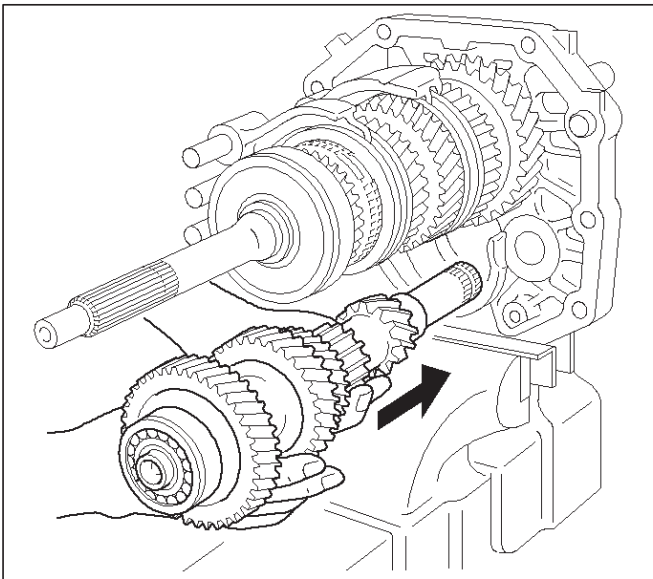
26. Install the top gear shaft.

1. Align the projection of the hub No.2 with the synchronizer ring slots, and install the top gear shaft assembly to the mainshaft.
2. Check that the gear rotates smoothly.



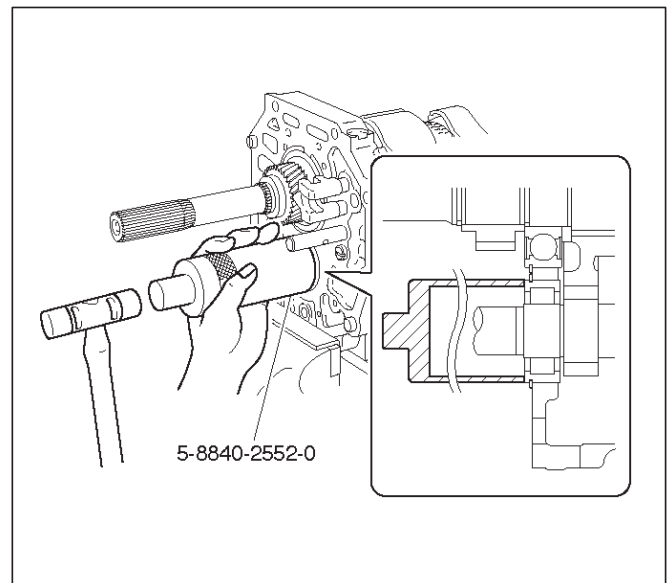
27. Install the counter gear shaft.

1. Temporarily install the counter gear shaft to the intermediate plate.

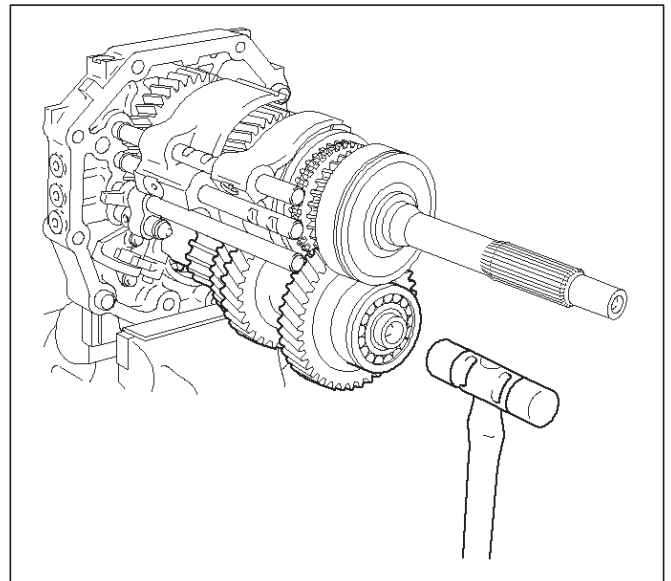


2. Using installer 5-8840-2552-0 (J-42796) and a hammer, drive in the center bearing as shown.

NOTE: Outer race snap ring groove toward rear.



Reference: Drive in the counter rear bearing by tapping on the front end of the counter shaft.

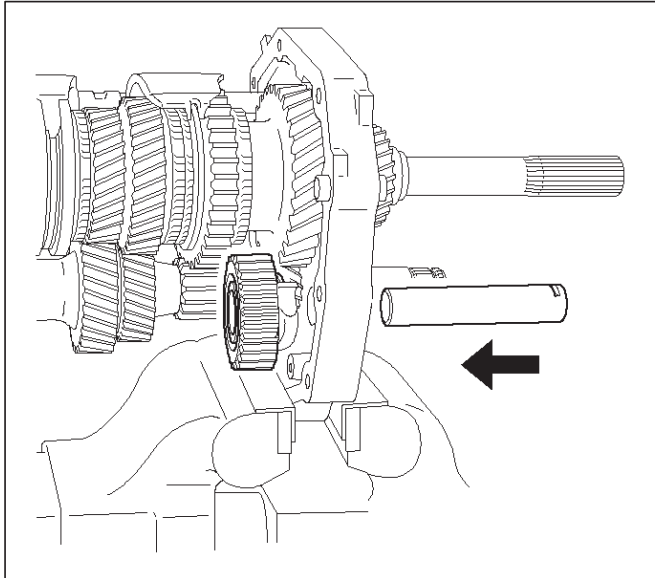


28. Install the reverse idle gear.

1. Install the reverse idle gear and reverse idle gear shaft.

NOTE:

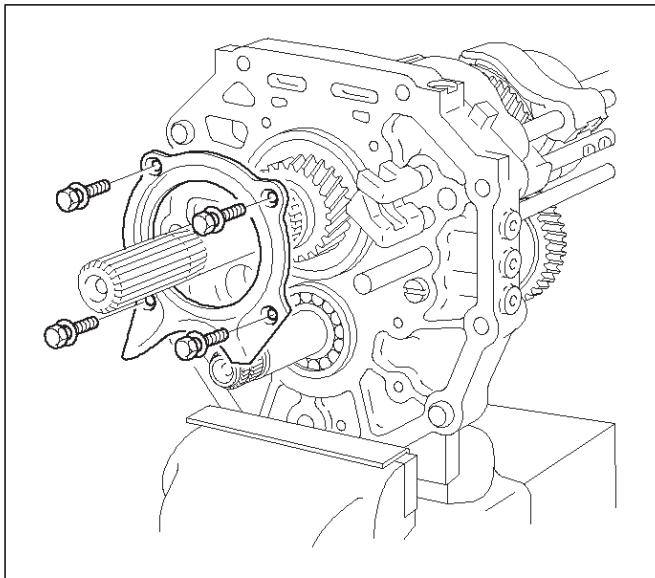
- Insert the reverse idle gear shaft with the slot toward rear.
- Install the reverse idle gear with the reverse shift arm No.2.



29. Install the bearing plate.

1. Align the bearing plate to groove of the reverse idle gear shaft.

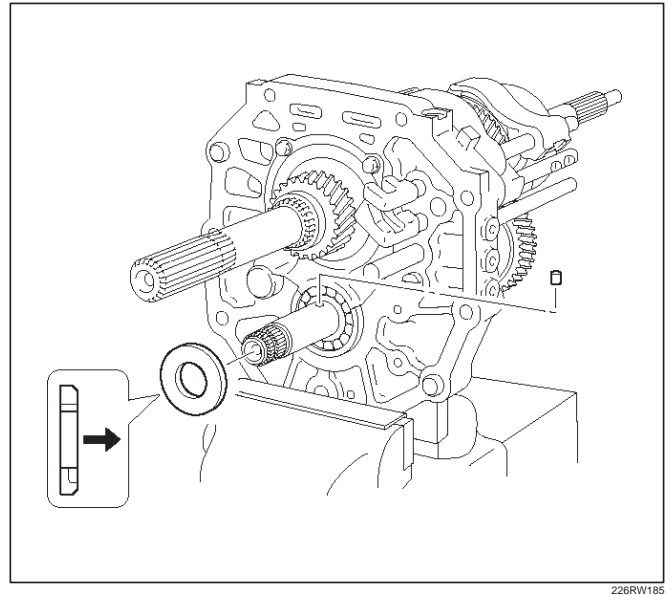
Torque: 13 N·m (1.3 kg·m/113 lb in)



30. Install the 5th gear thrust washer.

1. Install the 5th gear thrust washer pin to the counter gear shaft.
2. Install the 5th gear thrust washer to the counter gear shaft.

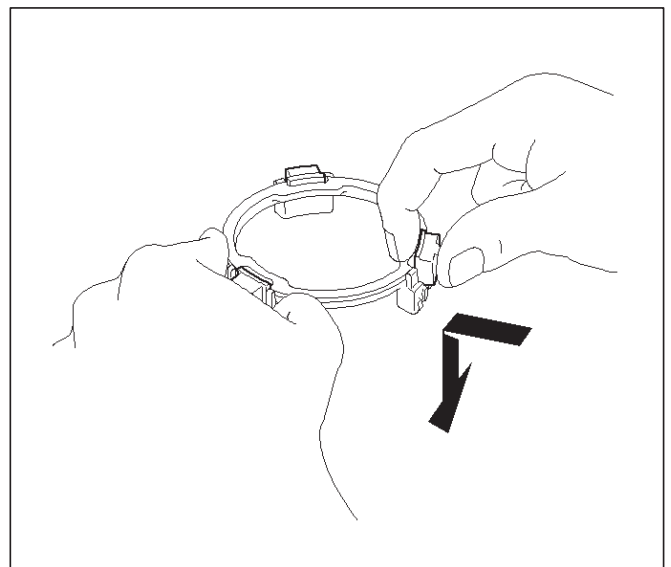
NOTE: Thrust washer must be assembled with the chamfered face of the washer toward the front.



31. Install the counter 5th gear.

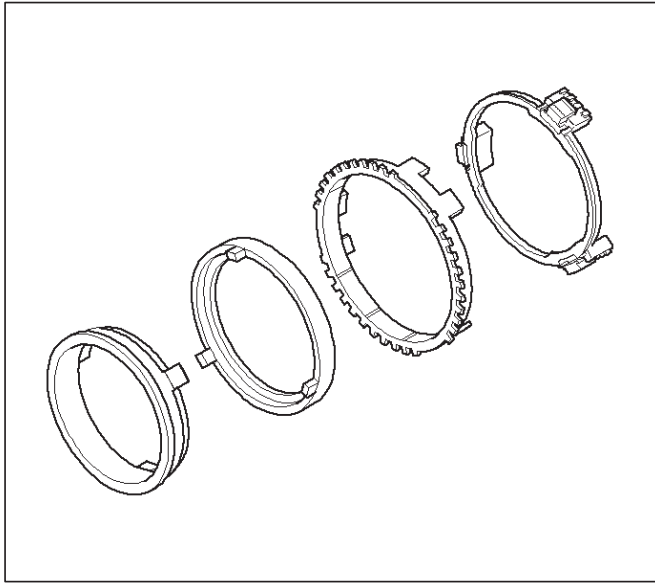
1. Install the 3 inserts and 3 compression springs to the reverse block ring.

Reference: Push the 3 inserts with the 3 compression springs to the reverse synchronizer ring.



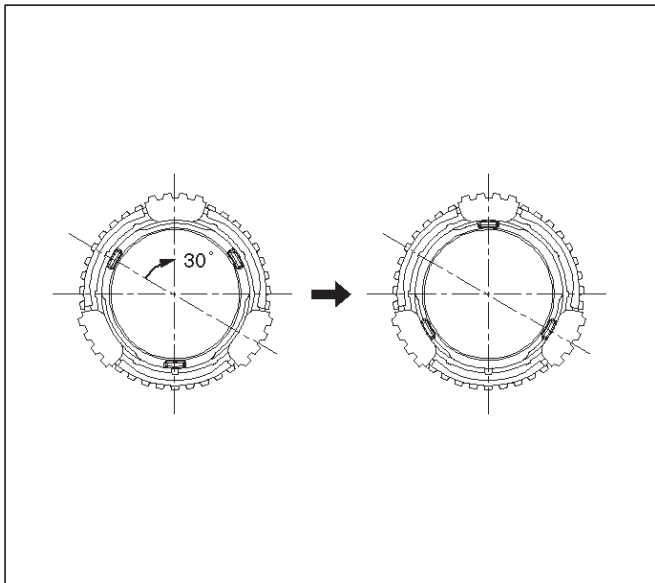
7B-60 MANUAL TRANSMISSION

2. Install the synchronizer outer ring, synchronizer cone ring, and synchronizer pull ring to the reverse block ring.



226RW121

3. Turn to 30 degree the reverse synchronizer pull ring.

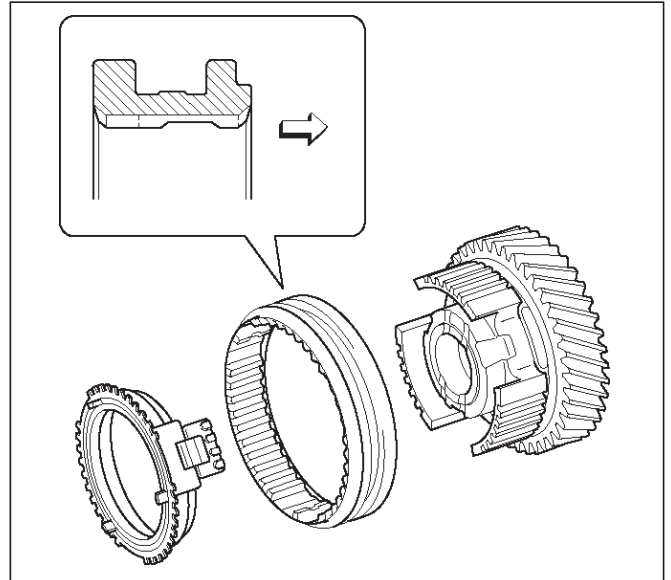


226RW080

4. Install the hub sleeve No.3 and reverse block ring set to the counter 5th gear.

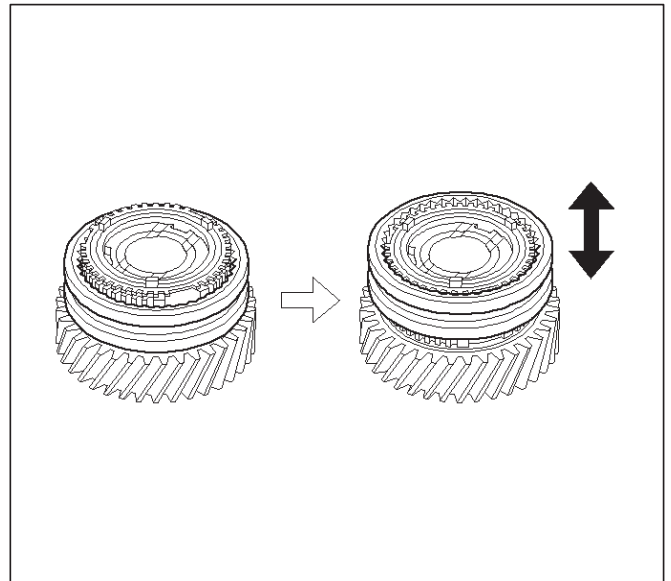
NOTE: Check the hub sleeve No.3 direction, as shown.

Reference: While pushing the 3 inserts, install the synchronizer ring assembly to the hub sleeve No.3.



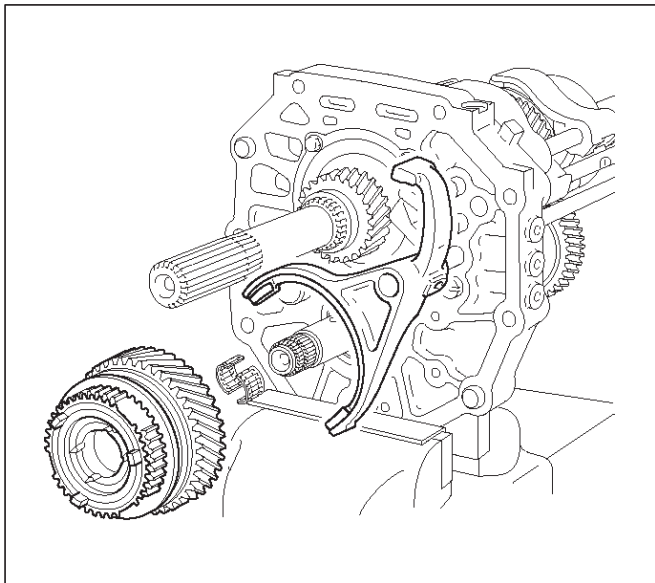
226RW184

5. Slide the hub sleeve No.3.



226RW123

6. Install the counter 5th gear bearing, counter 5th gear and reverse block ring set to the counter gear shaft, through the 5th reverse shift arm to the 5th reverse shift rod.

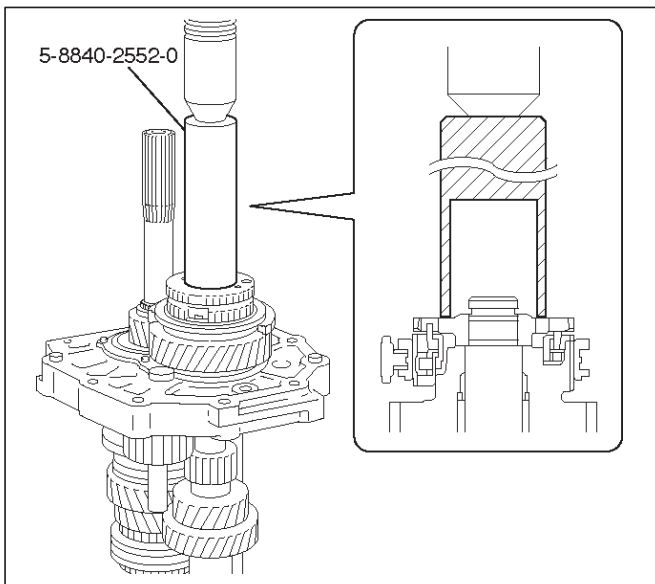


220RW101

7. Using installer 5-8840-2552-0 (J-42796) and a press, install counter 5th gear spline piece.

NOTE:

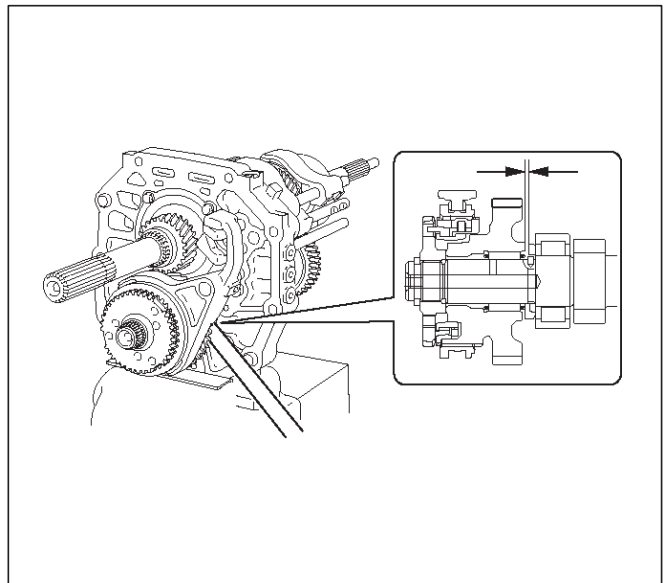
- Align the projection of the cone ring to the holes of the 5th gear spline piece.
- Check that the gear rotates smoothly.



226RW193

8. Using thickness gauge, measure the counter 5th gear thrust clearance.

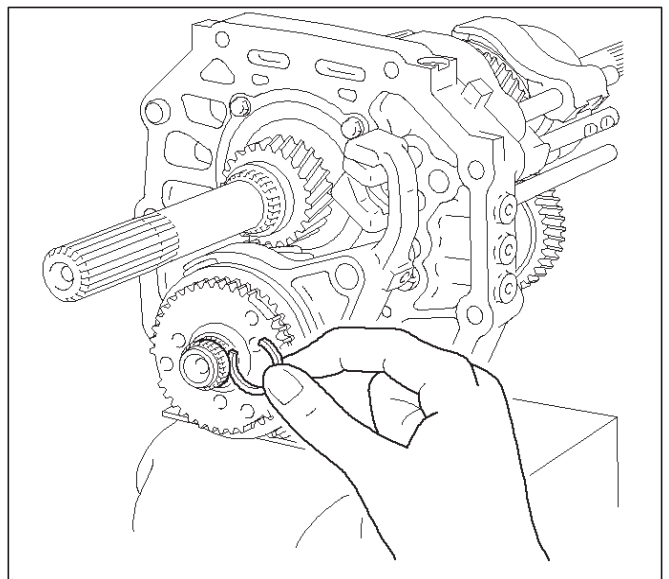
Standard: 0.10 – 0.35mm (0.004 – 0.014 in)



220RW100

9. Select a snap ring that will allow minimum axial play.

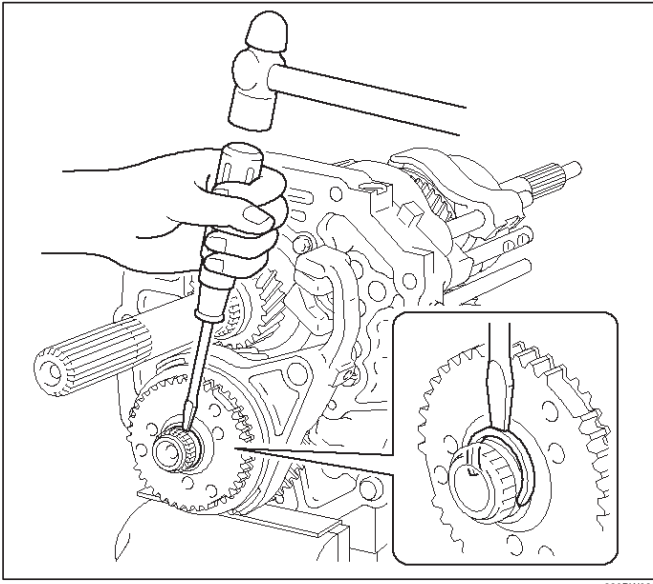
Mark	Thickness
A	2.80 – 2.85 (0.110 – 0.112 in)
B	2.85 – 2.90 (0.112 – 0.114 in)
C	2.90 – 2.95 (0.114 – 0.116 in)
D	2.95 – 3.00 (0.116 – 0.118 in)
E	3.00 – 3.05 (0.118 – 0.120 in)
F	3.05 – 3.10 (0.120 – 0.122 in)
G	3.10 – 3.15 (0.122 – 0.124 in)



226RW027

7B-62 MANUAL TRANSMISSION

10. Install the new snap ring.

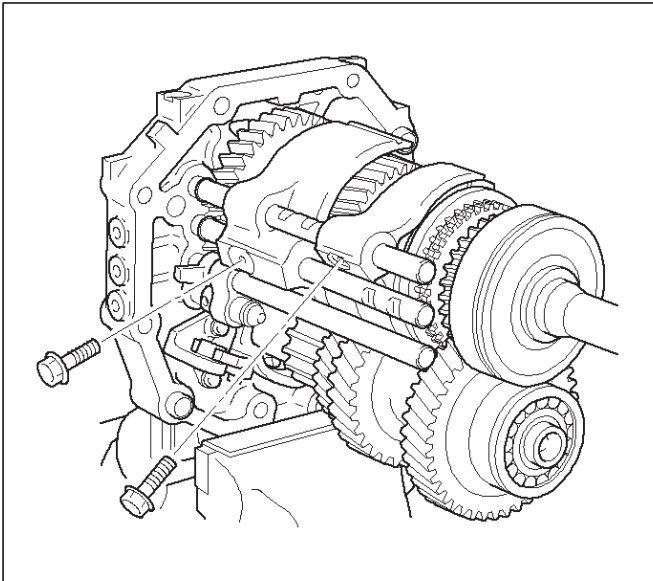


226RW026

32. Install the shift arm bolts.

1. Install and torque the 2 shift arm bolts.

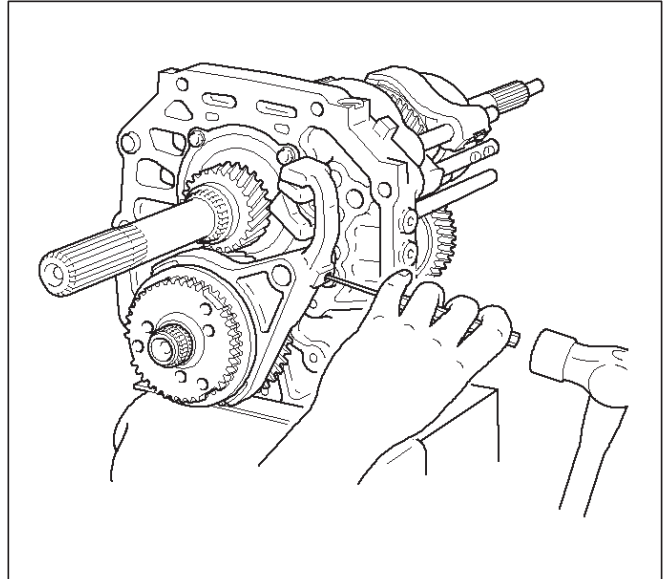
Torque: 20 N·m (2.0 kg·m/14 lb ft)



226RW023

33. Install the shift arm slotted pin.

1. Using a pin punch and a hammer, drive in the slotted pin to the shift arm.



226RW025

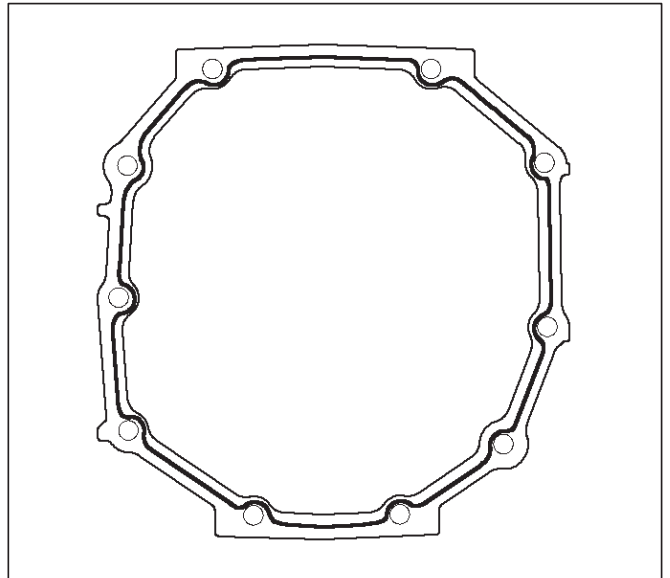
34. Install the transmission case.

1. Clean up the fitting surface.

2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

NOTE:

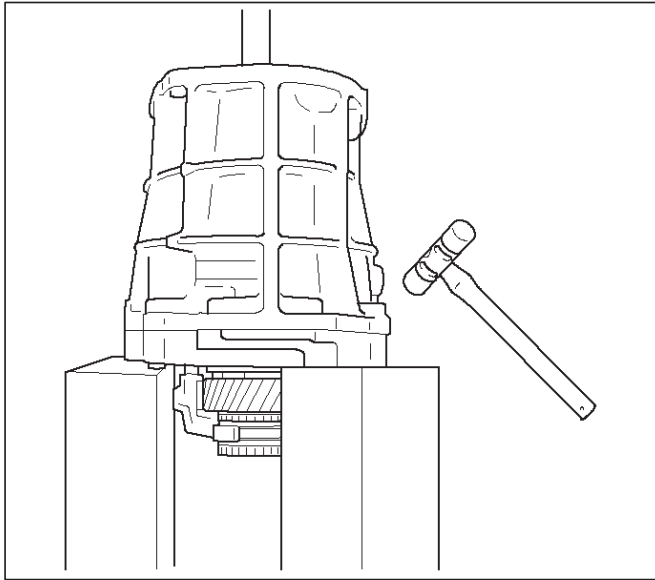
- Don't dry the liquid gasket.



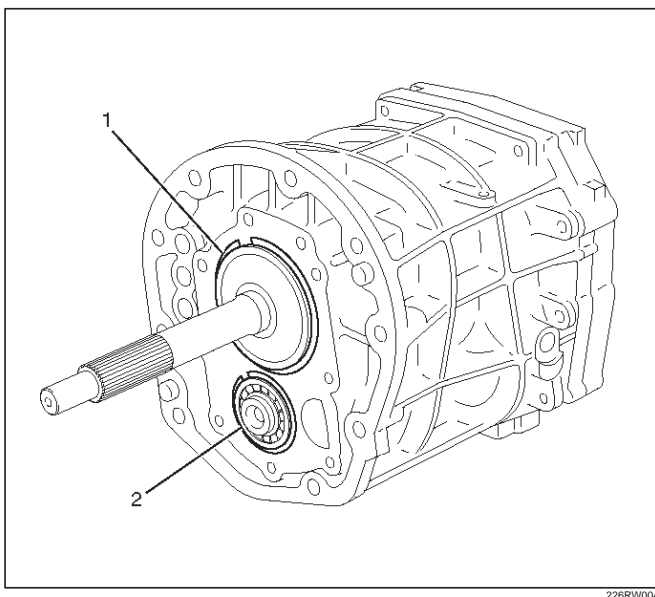
220RW024

3. Stand the transmission by the wood blocks.
4. Using a plastic hammer, tap the transmission case and attach it to the intermediate plate.

NOTE: Be careful not to add over force to bearing.



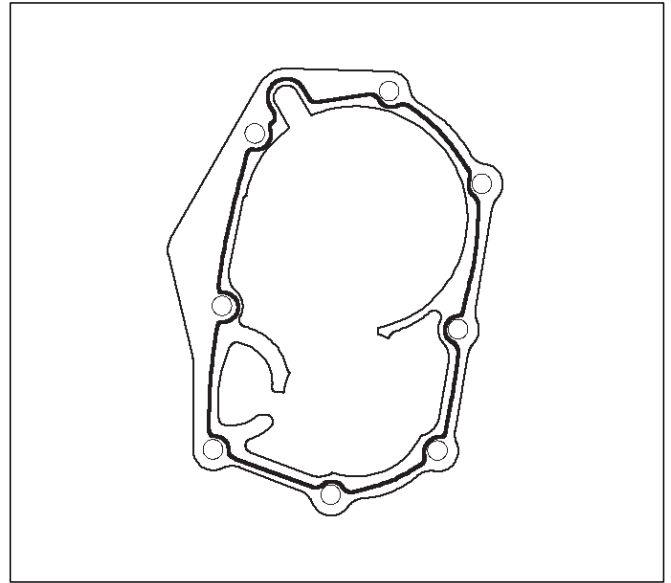
5. Using a snap ring expander, install the front bearing shaft snap ring (1) and counter gear shaft bearing snap ring (2).



6. Turn over the transmission.
35. Install the front cover.
 1. Clean up the fitting surface.
 2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

NOTE:

- Don't dry the liquid gasket.

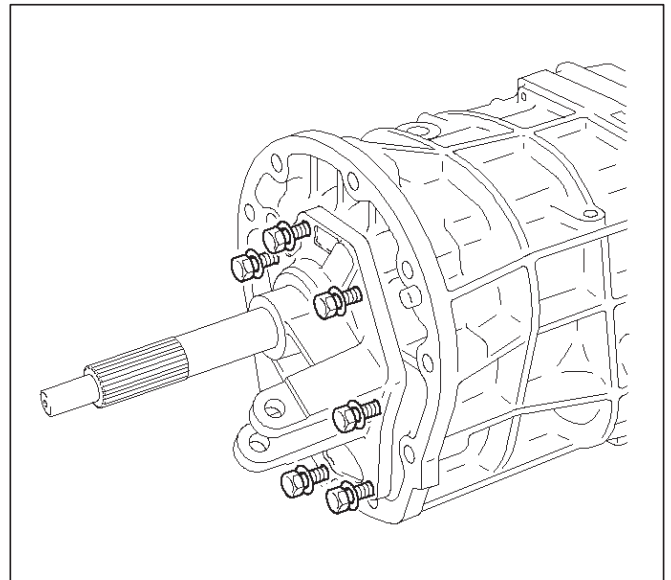


3. Clean up and dry the bolts.
4. Apply thread sealant (THREE BOND 1344 or equivalent) to the 8 bolts.
5. Using 8 bolts, install the front cover to the transmission case.

Torque: 17 N·m (1.7 kg·m/12 lb ft)

NOTE:

- Tighten the all bolts evenly.
- Be careful not to damage the oil seal.



7B-64 MANUAL TRANSMISSION

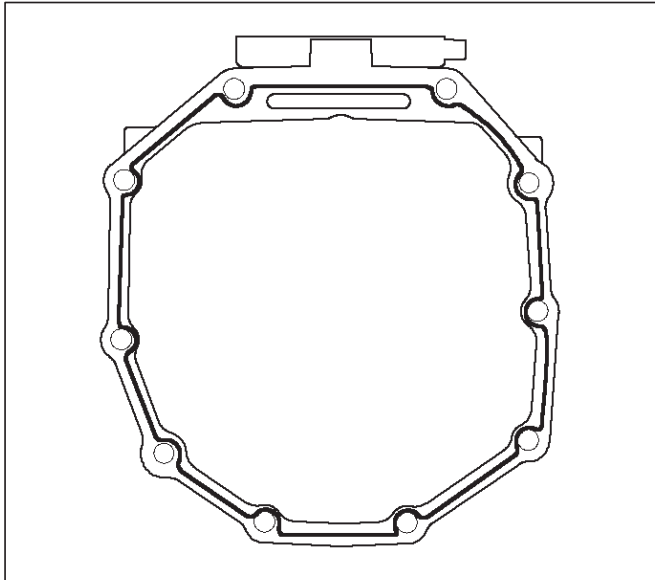
6. Check that the top gear shaft and mainshaft rotate.

36. Install the transfer adapter.

1. Clean up the fitting surface.
2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

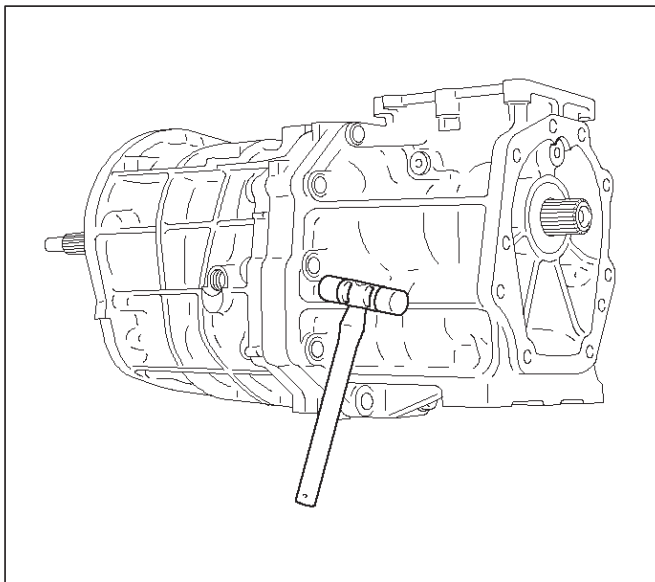
NOTE:

- Don't dry the liquid gasket.



220RW026

3. Using a plastic hammer, tap the transfer adapter and attach it to the intermediate plate.



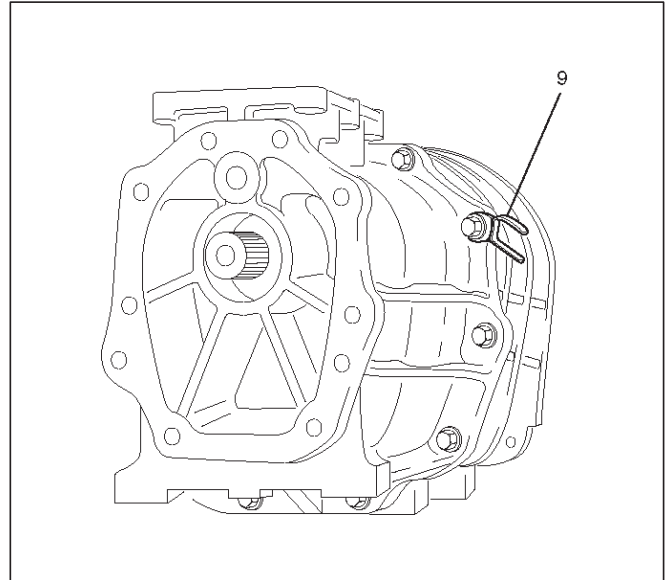
220RW034

4. Using 10 bolts, install the transfer adapter.

Torque: 37 N·m (3.8 kg·m/27 lb ft)

NOTE:

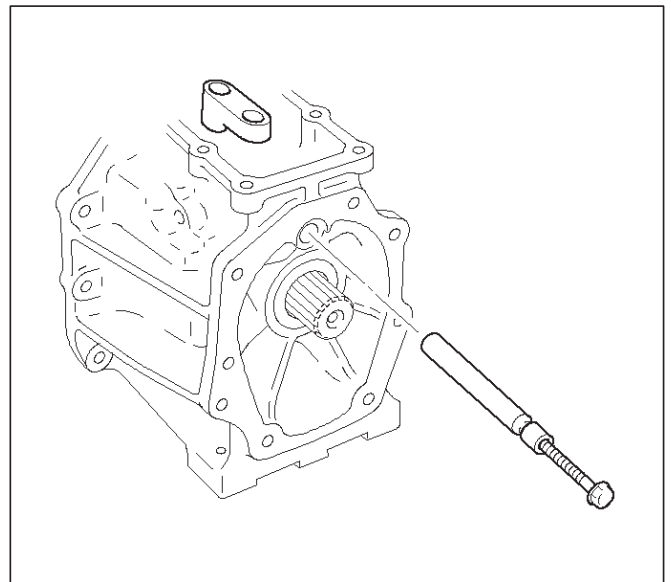
- Tighten the all bolts evenly.
- Don't damage the lip of the oil seal.
- Install the wire clamp (9) to the transfer adapter.



220RW083

37. Install the gear control box.

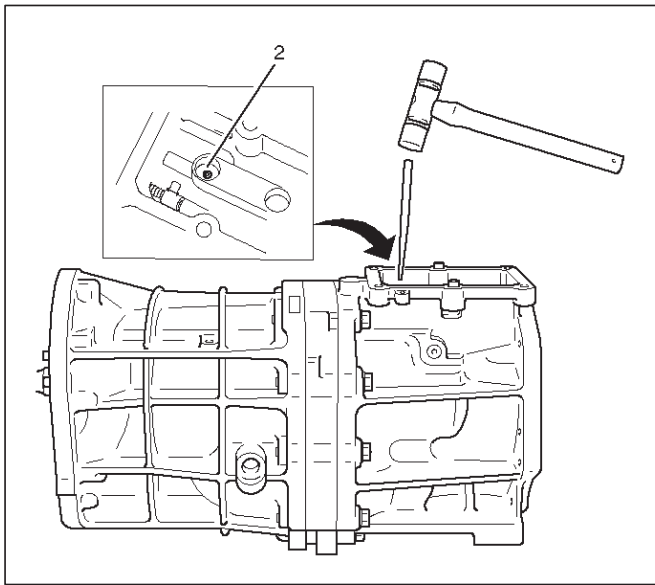
1. Align the projection of the shift lever housing to the shaft rod groove, and install the gear control rod.



230RW003

- Using a pin punch and hammer, drive in the slotted spring pin (2) to the shift lever housing.

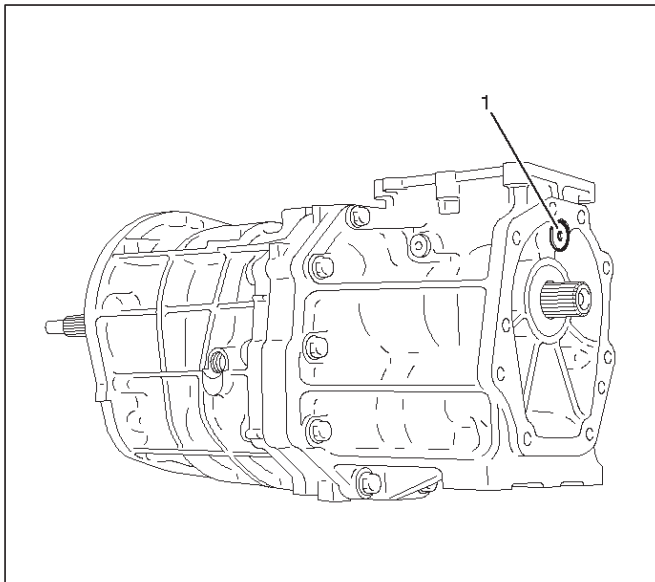
NOTE: Be carefull not to drop the slotted spring pin.



230RW002

- Apply sealant (THREE BOND 1344 or equivalent) to the plug (1) thread.
- Using hexagon wrench, install and torque the plug (1).

Torque: 18 N-m (1.8 kg-m/13 lb ft)

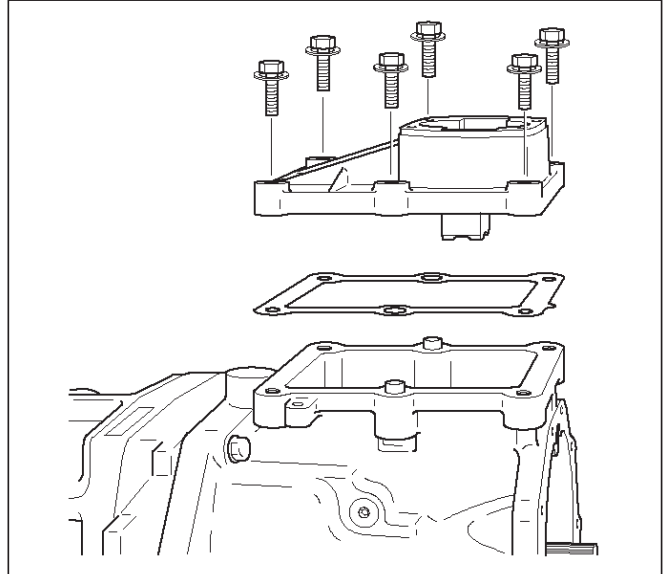


220RW010

- Clean up the bolts and bolt hole.
- Using 6 bolts, install the gear control box through the gasket.

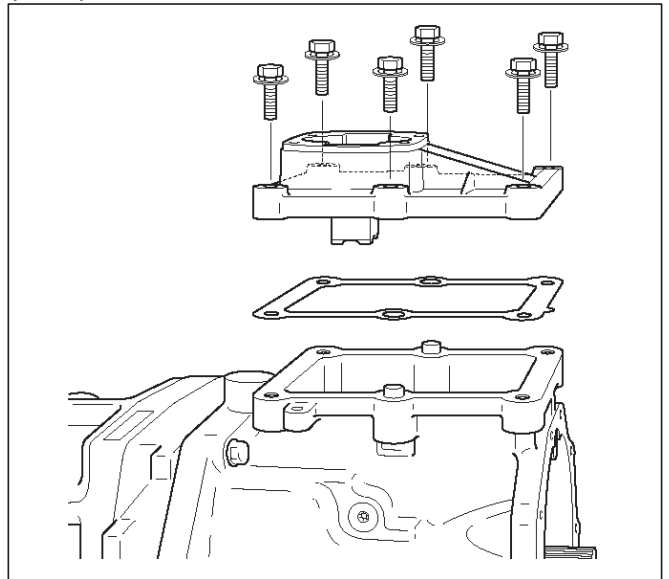
Torque 18 N-m (1.8 kg-m/13 lb ft)

(6VE1)



230RW001

(4JX1)



220RW097

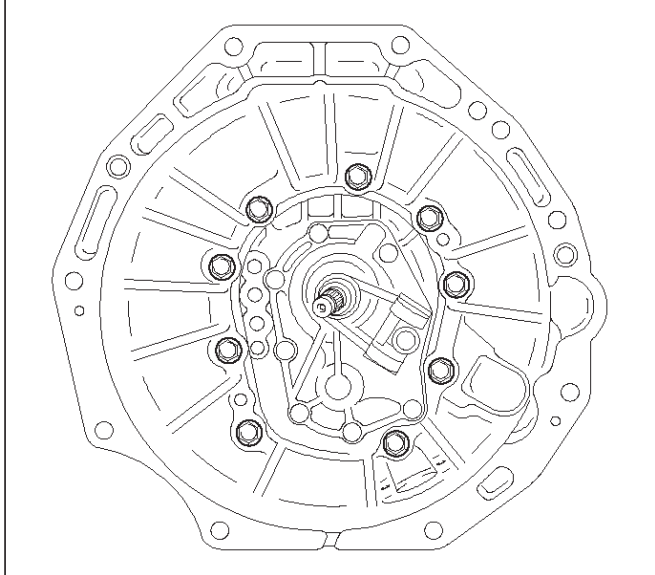
7B-66 MANUAL TRANSMISSION

38. Install clutch housing.

1. Install the clutch housing to the transmission case.

Torque: 36 N·m (3.7 kg-m/27 lb ft)

NOTE: Tighten the all bolts evenly.



39. Install the switches.

1. Install the new gasket to the 1st and 2nd switch.
2. Install the 1st and 2nd switch assembly (8).

Torque: 39 N·m (4.0 kg-m/29 lb ft)

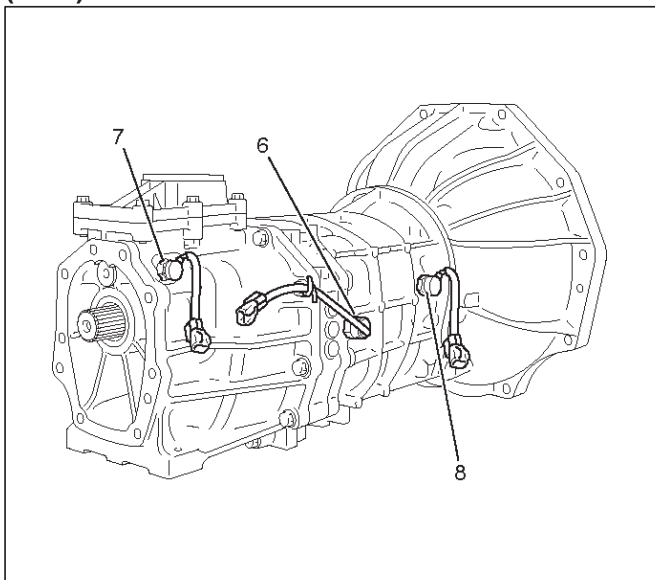
3. Install the new gasket to the backup light switch.
4. Install the backup light switch assembly (6).

Torque: 44 N·m (4.5 kg-m/33 lb ft)

5. Install the new gasket to the neutral switch.
6. Install the neutral switch (7) to the transfer adapter (4JX1).

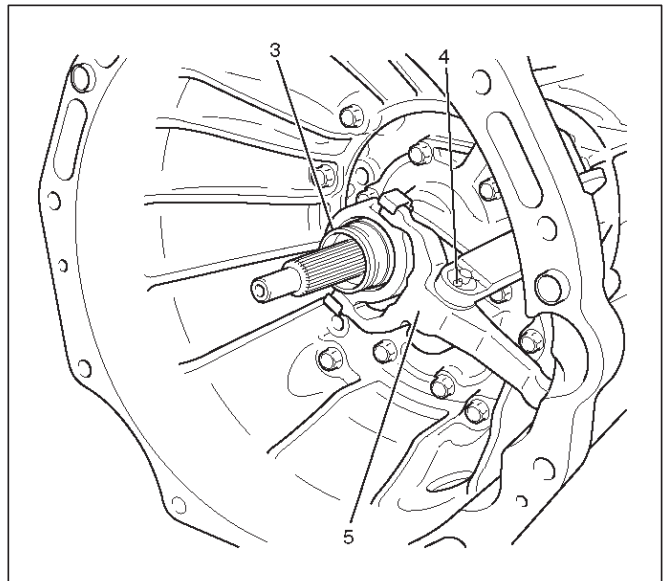
Torque: 37 N·m (3.8 kg-m/27 lb ft)

(4JX1)



40. Install the clutch release bearing (3) and clutch shift fork (5).

1. Apply the clutch release grease.
 1. Fitting surface of the cylinder push rod.
 2. Fitting surface of the release bearing hub.
 3. The hole of the fork split pin (4).
2. Apply the clutch release grease.
 1. The spline surface of the top gear shaft.
3. Install the clutch shift fork (5).
4. Install the snap pin.
5. Install the clutch release bearing (3) to the clutch shift fork (5).



41. Install the drain plug and filler plug.

1. Install the drain plug (1) through the new gasket.

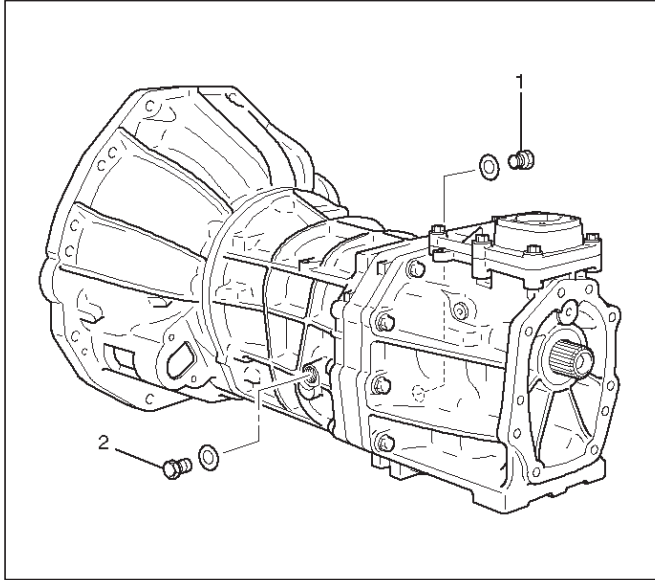
Torque: 37 N·m (3.8 kg·m/27 lb ft)

2. Install the filler plug (2) through the new gasket.

Reference: Plug after the gear oil fill in.

Torque: 37 N·m (3.8 kg·m/27 lb ft)

(6VE1)

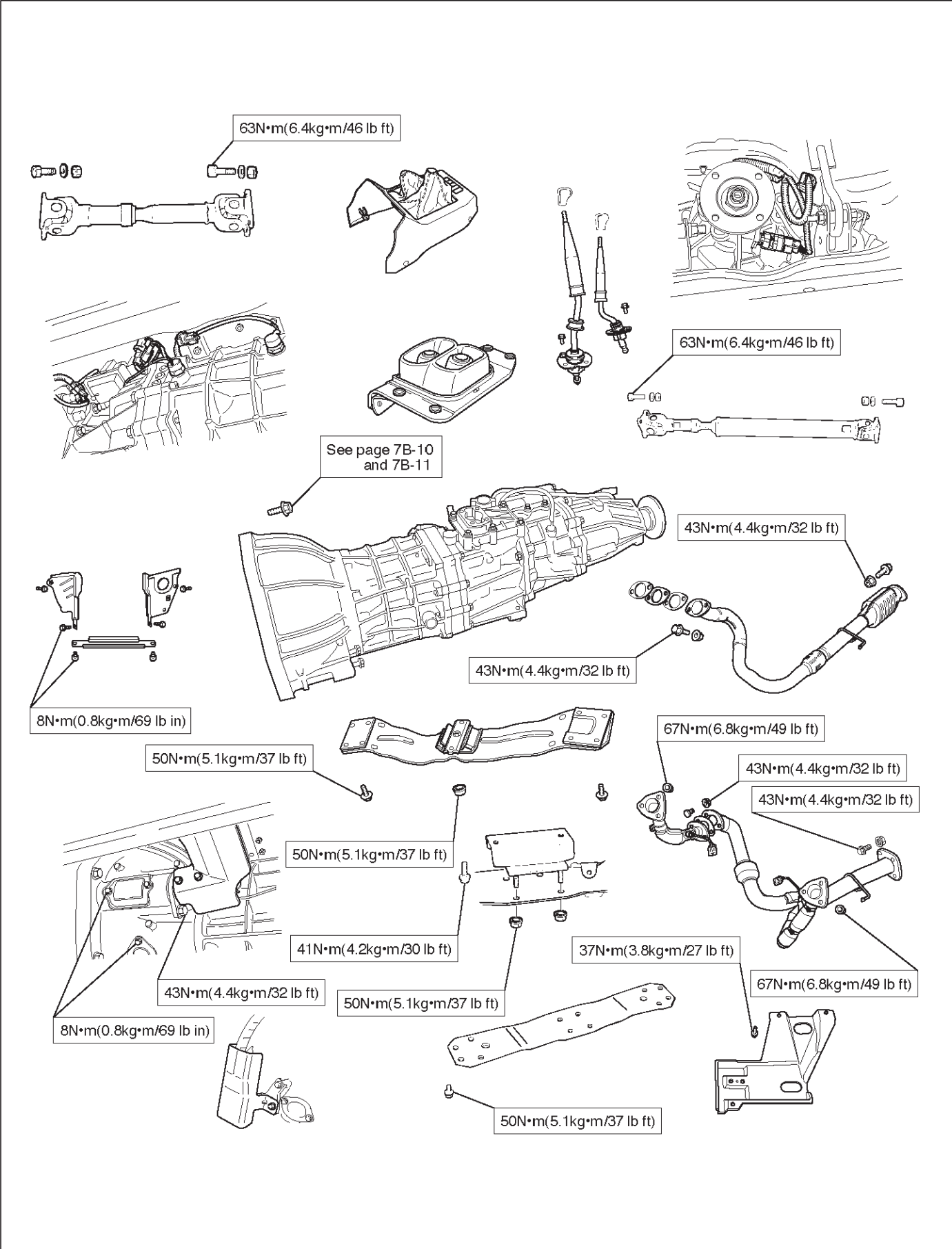


220RW007

Main Data and Specifications**General Specifications**

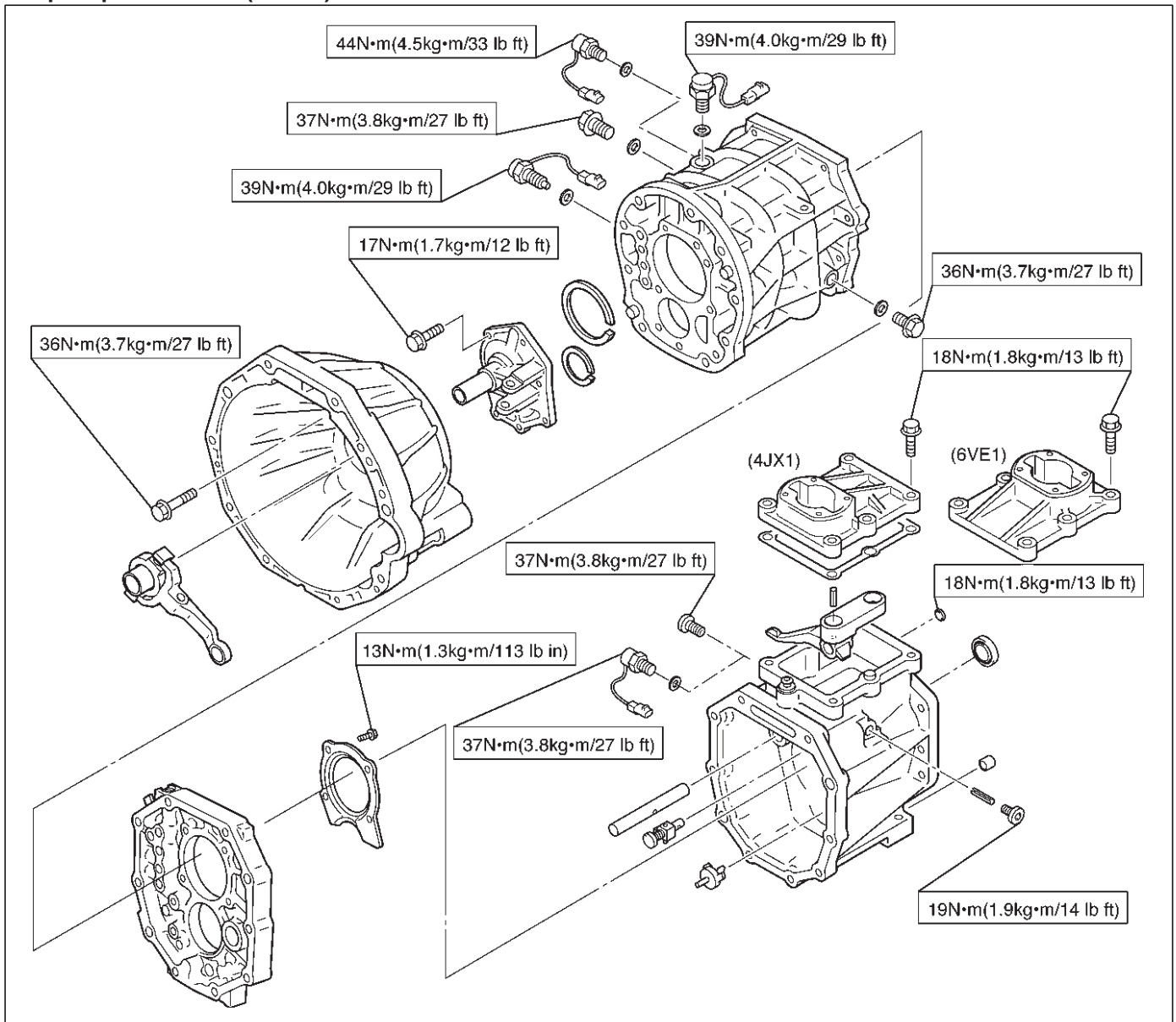
Transmission type		Fully synchronized forward and reverse gears
Control method		Direct control with the gear shift lever on the floor
Gear ratio	1st	3.954
	2nd	2.330
	3rd	1.436
	4th	1.000
	5th	0.788
	Rev	3.918
Oil capacity lit (US qt)		2.7 (2.86)
Type of lubricant		Engine oil : Refer to the chart in "SECTION 0"

Torque Specifications

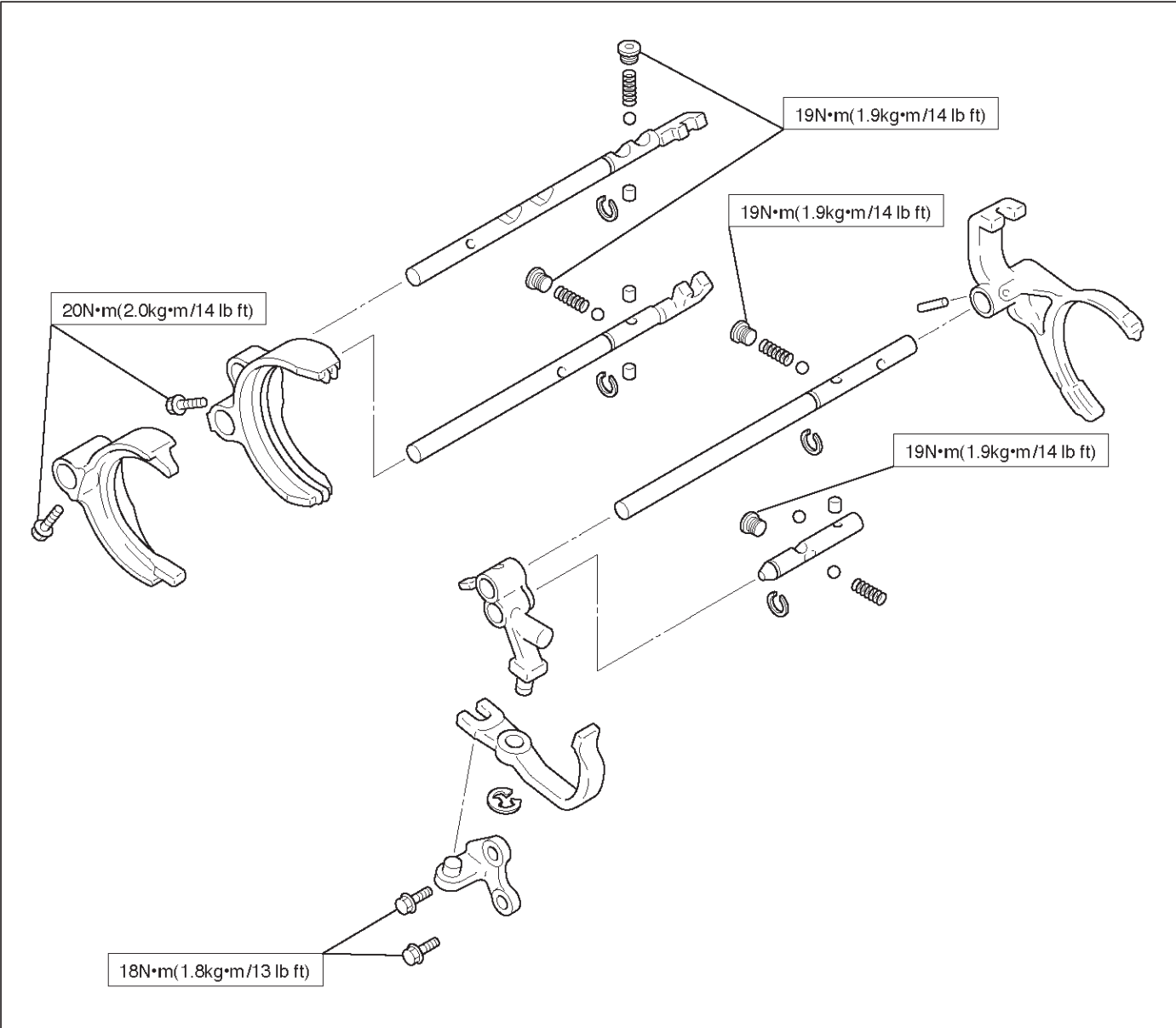


7B-70 MANUAL TRANSMISSION

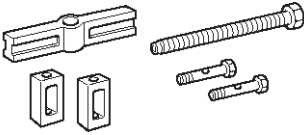
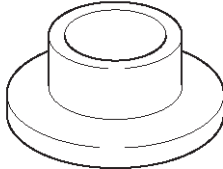
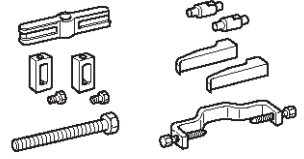
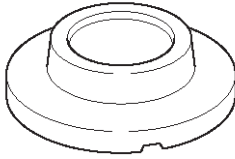
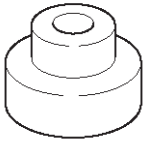
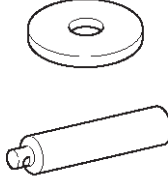
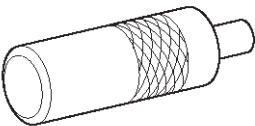
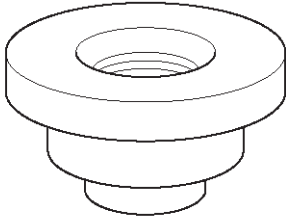
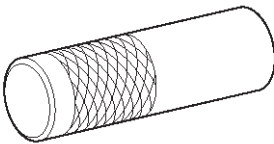
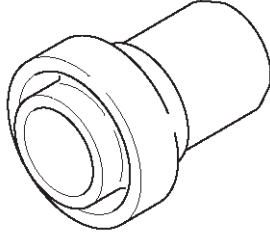
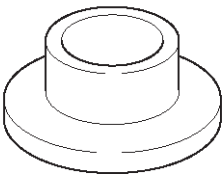
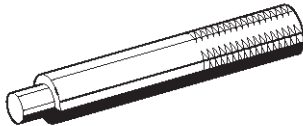
Torque Specifications (Cont'd)



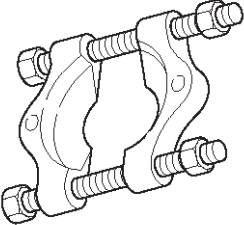
Torque Specifications (Cont'd)



Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME	ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RW201</p>	<p>5-8840-2550-0 (J-42794) Gear spline piece remover</p>	 <p style="text-align: right; font-size: small;">901RW206</p>	<p>5-8840-2555-0 (J-42799) Installer</p>
 <p style="text-align: right; font-size: small;">901RW202</p>	<p>5-8840-2551-0 (J-42795) Center bearing remover</p>	 <p style="text-align: right; font-size: small;">901RW207</p>	<p>5-8840-2556-0 (J-42800) Counter gear shaft front bearing installer</p>
 <p style="text-align: right; font-size: small;">901RW203</p>	<p>5-8840-2560-0 (J-42988) Attachment</p>	 <p style="text-align: right; font-size: small;">901RW208</p>	<p>5-8840-2559-0 (J-42904) Top gear shaft front bearing installer</p>
 <p style="text-align: right; font-size: small;">901RW204</p>	<p>5-8840-2552-0 (J-42796) Counter gear shaft center bearing installer</p>	 <p style="text-align: right; font-size: small;">901RS296</p>	<p>5-8840-2557-0 (J-42801) Front rerainer oil seal installer</p>
 <p style="text-align: right; font-size: small;">901RW205</p>	<p>5-8840-2553-0 (J-42797) Clutch hub (No.2) installer</p>	 <p style="text-align: right; font-size: small;">901RW095</p>	<p>5-8840-2558-0 (J-42802) Transfer adapter oil seal installer</p>
 <p style="text-align: right; font-size: small;">901RW206</p>	<p>5-8840-2554-0 (J-42798) Clutch hub (No.1) installer</p>	 <p style="text-align: right; font-size: small;">901RS218</p>	<p>5-8840-0007-0 (J-8092) Driver handle</p>

Special Tools (Cont'd)

ILLUSTRATION	TOOL NO. TOOL NAME
 <p>901RW091</p>	<p>5-8840-0015-0 (J-22912-01) Bearing separator</p>

SECTION 7B1

MANUAL TRANSMISSION

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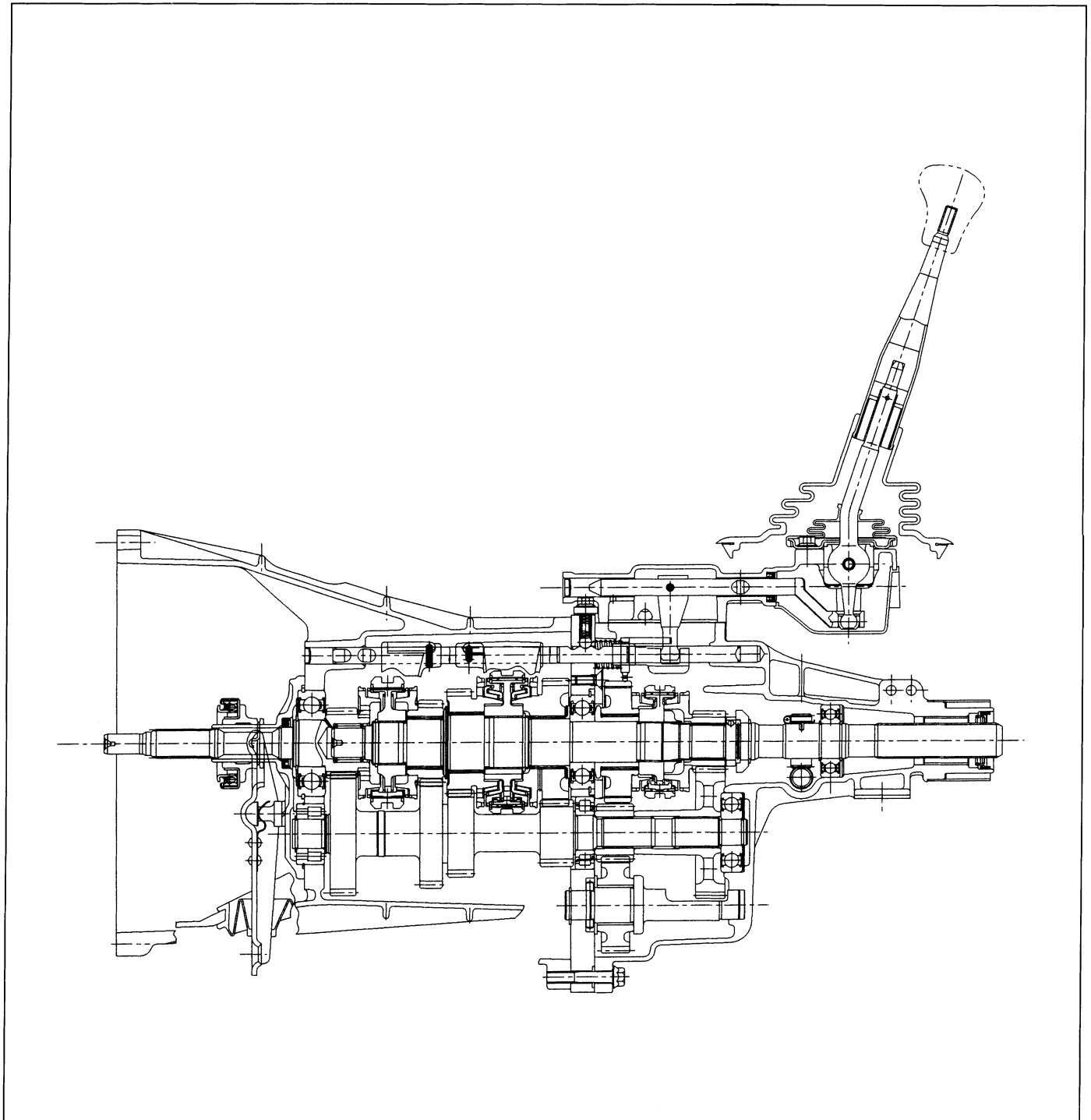
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4 x 2 MODEL TRANSMISSION

MAIN DATA AND SPECIFICATIONS

Models	MUA 5C	MUA 5S
Transmission type	Fully synchronized 5-forward and revers gears.	
Gear ratio		
1st	3.767	4.357
2nd	2.248	2.502
3rd	1.404	1.501
4th	1.000	1.000
5th	0.809	0.809
Rev.	3.873	3.970
Oil capacity	2.95 (0.78)	
lit (US gal.)		

GENERAL DESCRIPTION



A07LV003

The transmission is designed for the quietest possible operation.

A longer center distance (77.5 mm (3.05 in)) provides increased durability.

Principle parts of the transmission are the integral clutch housing, the intermediate plate, the rear cover, and the gears.








The gear control box is built-in to the rear cover.

TORQUE SPECIFICATIONS

STANDARD BOLTS

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

N·m (kg·m / lb·ft)

Strength Class Bolt Identification Bolt Diameter× Pitch (mm)		4.8/4T	7T	8.8		9.8/9T
				Refined	Non-Refined	
						
		 No mark	—			
Standard Hex. Head Bolt	M6 × 1.0	6 (0.6 / 52 lb-in)	7 (0.7 / 61 lb-in)	8 (0.8 / 69 lb-in)		—
	M8 × 1.25	13 (1.3 / 113 lb-in)	17 (1.7 / 12)	20 (2.0 / 14)		24 (2.4 / 17)
	M10 × 1.25	27 (2.8 / 20)	37 (3.8 / 27)	42 (4.3 / 31)		50 (5.1 / 37)
	M12 × 1.25	61 (6.3 / 45)	76 (7.8 / 56)	87 (8.9 / 64)		95 (9.7 / 70)
	M14 × 1.5	96 (9.8 / 71)	116 (11.8 / 85)	133 (13.6 / 98)		142 (14.5 / 105)
	M16 × 1.5	130 (13.3 / 96)	170 (17.3 / 125)	193 (19.7 / 143)		200 (20.4 / 148)
	M18 × 1.5	188 (19.2 / 139)	244 (24.9 / 180)	278 (28.3 / 205)		287 (29.3 / 212)
	M20 × 1.5	258 (26.3 / 190)	337 (34.4 / 249)	385 (39.3 / 284)		396 (40.4 / 292)
	M22 × 1.5	332 (33.9 / 245)	453 (46.3 / 335)	517 (52.7 / 381)		530 (54.1 / 391)
	M24 × 2.0	449 (45.8 / 331)	570 (58.2 / 421)	651 (66.3 / 480)		692 (70.6 / 511)
	* M10 × 1.5	26 (2.7 / 20)	36 (3.7 / 27)	41 (4.2 / 30)		48 (4.9 / 35)
	* M12 × 1.75	57 (5.8 / 42)	71 (7.2 / 52)	80 (8.2 / 59)		89 (9.1 / 66)
	* M14 × 2.0	89 (9.1 / 66)	110 (11.2 / 81)	125 (12.7 / 92)		133 (13.6 / 98)
* M16 × 2.0	124 (12.7 / 92)	162 (16.5 / 119)	185 (18.9 / 137)		191 (19.5 / 141)	
Flange Bolt	M6 × 1.0	7 (0.7 / 61 lb-in)	8 (0.8 / 69 lb-in)	9 (0.9 / 78 lb-in)		—
	M8 × 1.25	15 (1.5 / 11)	19 (1.9 / 14)	22 (2.2 / 16)		26 (2.7 / 20)
	M10 × 1.25	31 (3.2 / 23)	41 (4.2 / 30)	47 (4.8 / 35)		56 (5.7 / 41)
	M12 × 1.25	69 (7.0 / 51)	85 (8.7 / 63)	97 (9.9 / 72)		106 (10.8 / 78)
	M14 × 1.5	104 (10.6 / 77)	126 (12.8 / 93)	144 (14.6 / 106)		154 (15.7 / 114)
	M16 × 1.5	145 (14.8 / 127)	188 (19.2 / 139)	214 (21.8 / 158)		221 (22.5 / 163)
	M18 × 1.5	—	—	—		—
	M20 × 1.5	—	—	—		—
	M22 × 1.5	—	—	—		—
	M24 × 2.0	—	—	—		—
	* M10 × 1.5	30 (3.1 / 22)	40 (4.1 / 30)	46 (4.7 / 34)		54 (5.5 / 40)
	* M12 × 1.75	64 (6.5 / 47)	78 (8.0 / 58)	89 (9.1 / 66)		99 (10.1 / 73)
	* M14 × 2.0	97 (9.9 / 72)	119 (12.1 / 88)	135 (13.8 / 99.7)		144 (14.7 / 107)
* M16 × 2.0	137 (14.0 / 101)	178 (18.2 / 132)	203 (20.7 / 150)		210 (21.5 / 155)	

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

FLARE NUTS

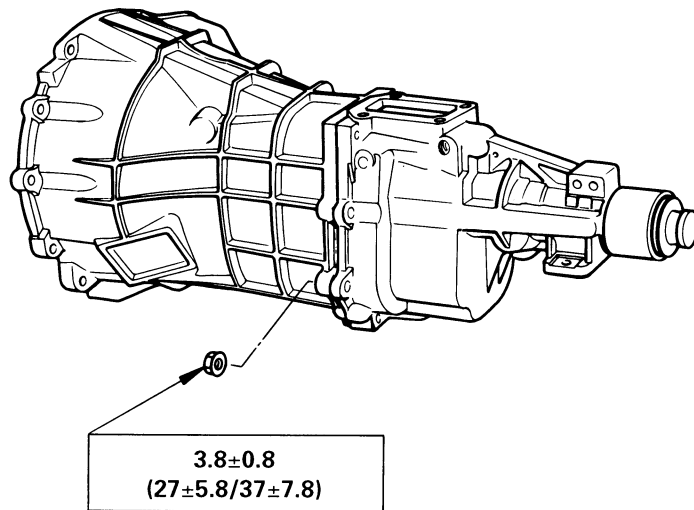
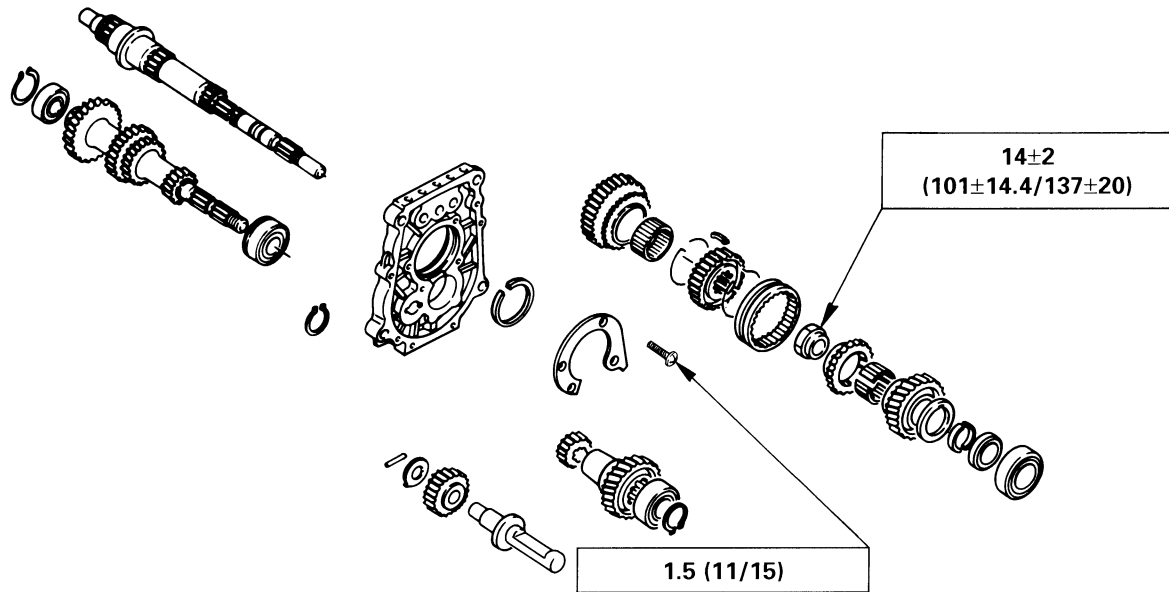
N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



SPECIAL PARTS FIXING NUTS AND BOLTS

kg·m(lb.ft/N·m)





RECOMMENDED LIQUID GASKET

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	For Engine Repairs
	ThreeBond 1215 ThreeBond 1281	Three Bond Three Bond	For Axle Case and Transmission Repairs
Water Base	ThreeBond 1141E	Three Bond	For Engine Repairs
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anerobic	LOCTITE 515 LOCTITE 518	Loctite Loctite	All

* RTV : Room Temperature Vulcanizer

Note:

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



REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



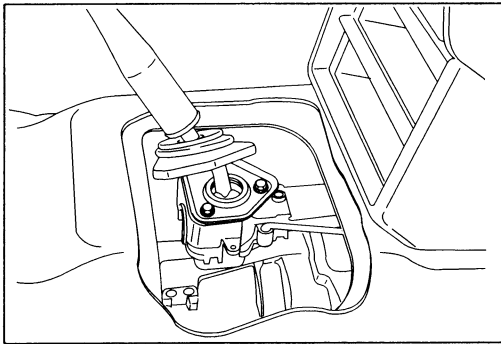
Important Operations – Removal

Battery Cable

Disconnect the negative (-) cable from the battery terminal.

Engine Hood

Apply setting marks to the engine hood and the engine hood hinges before removing the engine hood.



235RT005

Gear Shift Lever

1. Place the gear shift lever in the neutral position.
2. Remove the gear shift lever knob.
3. Remove the front console assembly.
4. Remove the gear shift lever grommet and dust cover.
5. Remove the gear shift lever cover bolts.
6. Remove the gear shift lever.

Note:

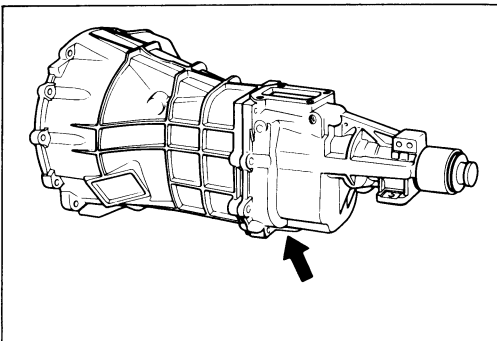
Cover the shift lever hole to prevent the entry of foreign material into the transmission.

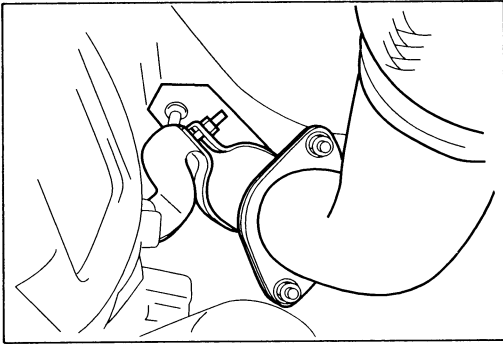
Lifting the Vehicle

1. Jack up the vehicle.
2. Place chassis stands at the front and the rear of the vehicle.

Transmission Oil Draining

1. Remove the transmission oil drain plug.
2. Replace the drain plug after draining the oil.

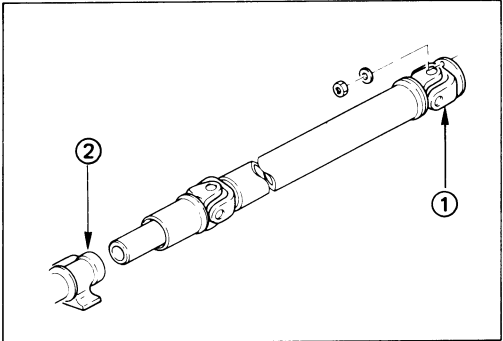




220LV018

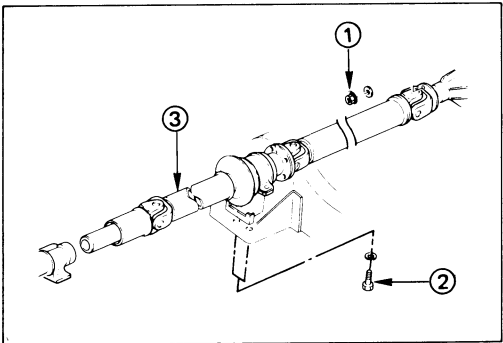
Exhaust Pipe

1. Remove the exhaust pipe bracket from the transmission case.
2. Remove the front exhaust pipe and 2nd-3rd exhaust pipe.



Rear Propeller Shaft (Single Shaft Type)

1. Remove the propeller shaft flange yoke at the drive pinion side ①.
2. Remove the propeller shaft from the transmission main shaft spline ②.

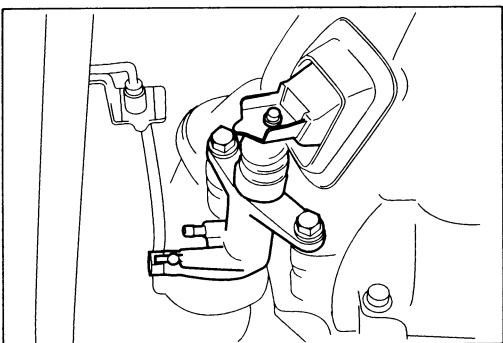


Rear Propeller Shaft (Dual Shaft Type)

1. Apply setting marks to the 2nd propeller shaft flange yoke.
This will prevent mispositioning during the installation procedure.
2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
3. Remove the center bearing retainer bolts ②.
4. Remove the 1st propeller shaft ③ with the center bearing and the 2nd propeller shaft.
Pull the 1st propeller shaft toward the rear of the vehicle unit the spline yoke is free of the transmission main shaft.

Harness Connector

Disconnect the back up light switch connector and the speedometer sensor connector.



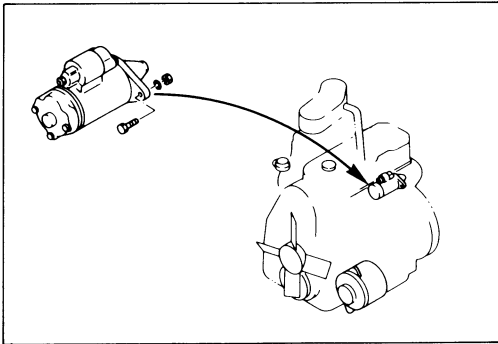
220LV019

Slave Cylinder

Remove the slave cylinder from the transmission case.

Engine Lifting Hanger

1. Attach the engine lifting hanger to the front portion of the engine.
2. Attach the lifting wire to both ends of the engine lifting hanger.

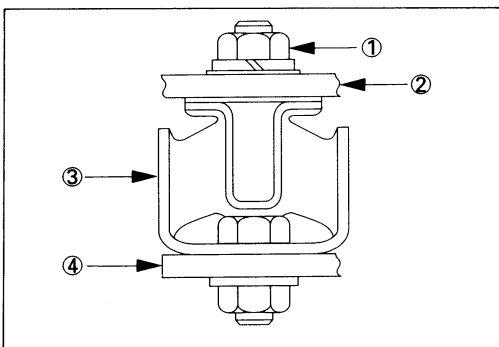


Starter Motor

Remove the starter motor from the engine rear plate.

Flywheel Under Cover (6VD1)

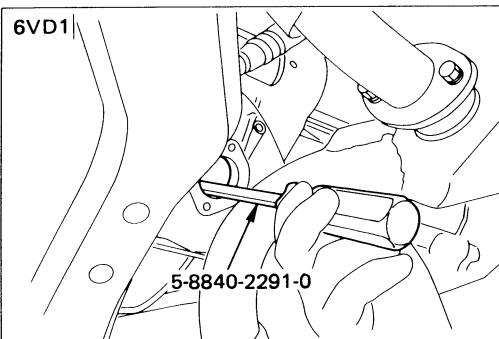
Remove flywheel under cover bolts.



022LV001

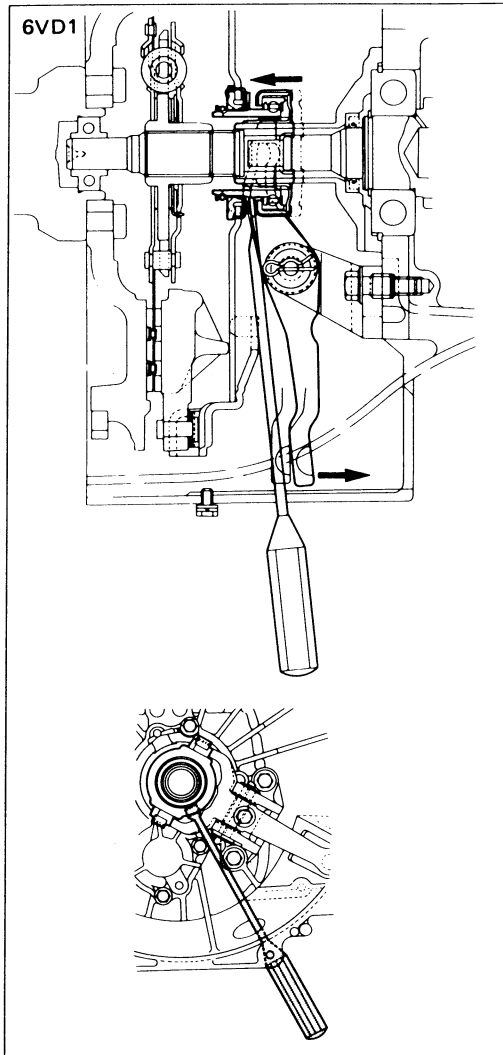
Transmission

1. Support the transmission with a transmission jack.
2. Remove the engine rear mounting rubber nuts ① from the transmission ②.
3. Remove the rear mounting rubber ③ from the No.3 crossmember ④.
4. Remove the gear control box from the transmission.



5. Use the remover for disconnect the clutch release bearing from the clutch pressure plate (6VD1).

Clutch release bearing remover : 5-8840-2291-0
(J-39207)

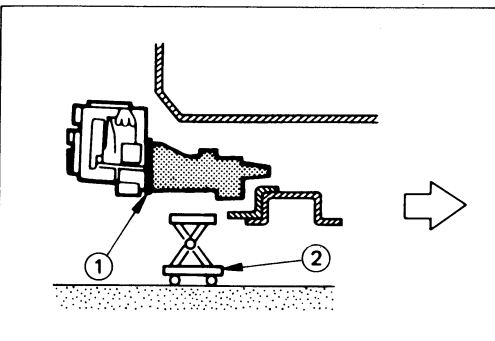
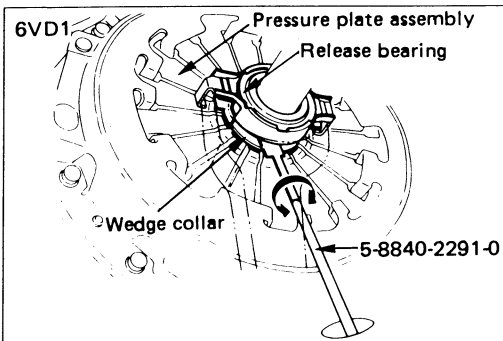


Release Bearing Disconnection (6VD1)

- ① Pull the shift fork toward the transmission to press the clutch release bearing against the clutch.
- ② Insert the clutch release bearing remover between the wedge collar and the release bearing.
- ③ Turn the remover to separate the release bearing.

NOTE:

Be sure not to insert the remover between the wedge collar and the clutch.

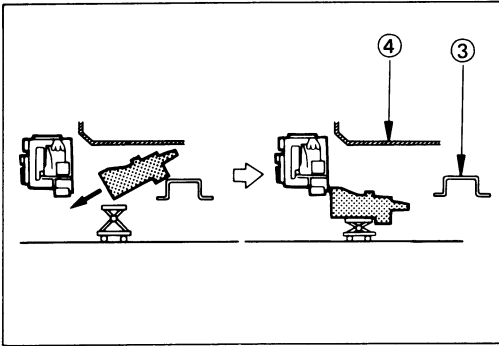


6. Remove the transmission from the engine.

The removal of the transmission will require the cooperative efforts of two mechanics.

- 1) Remove the transmission nuts and bolts ① from the engine rear plate.
- 2) Place a transmission jack ② beneath the transmission.

Do not raise the transmission jack.



3) Manually move the transmission as far as possible toward the rear of the vehicle (into the space between the No.3 crossmember ③ and the floor panel ④).

4) Lower the clutch housing end of the transmission toward the transmission jack.

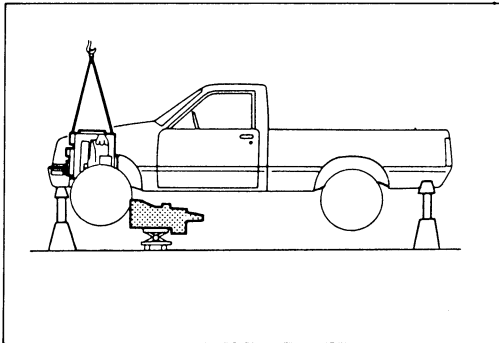
The rear of the transmission is supported by the No. 3 crossmember at this time.

5) Firmly grasp the transmission rear cover (1st mechanic).

Raise the transmission jack toward the transmission (2nd mechanic).

Carefully lower the transmission onto the transmission jack.

The transmission must be centered on the transmission jack.

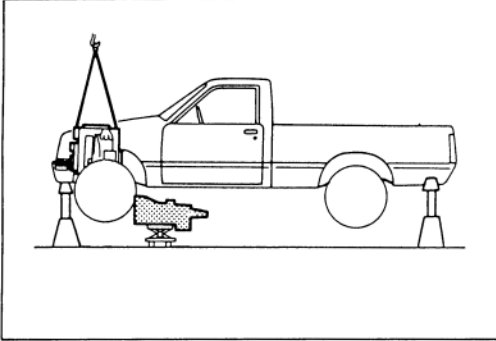


7. Carefully pull the transmission jack with the transmission from beneath the vehicle.



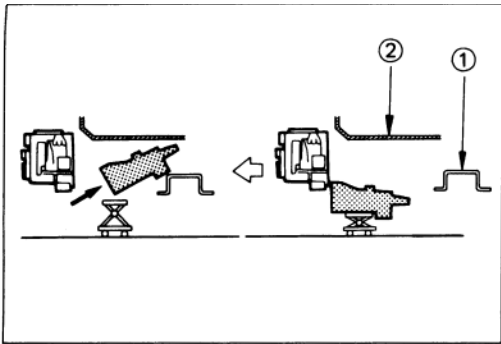
Important Operations – Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

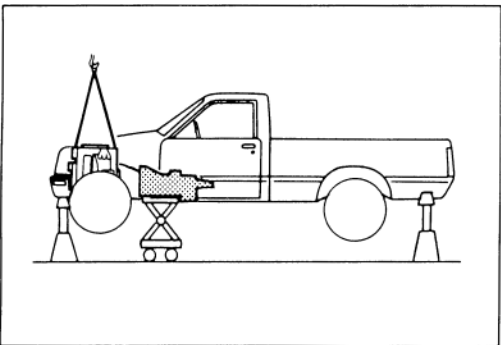


Transmission

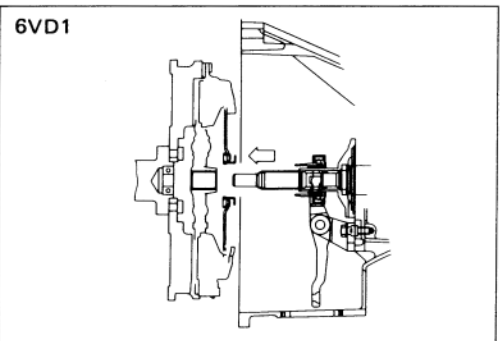
1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Place the transmission on a transmission jack.
3. Carefully move the transmission jack and transmission into position behind the engine.



4. Slowly operate the transmission jack to raise the transmission until the rear of the transmission is at the same level as the No.3 crossmember ①.
5. Manually support the transmission rear cover.
Move the transmission into position between the No.3 crossmember and the floor panel ②.



6. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.
The slope of the engine and the transmission must be the same.
7. Install the gear control box to the transmission.

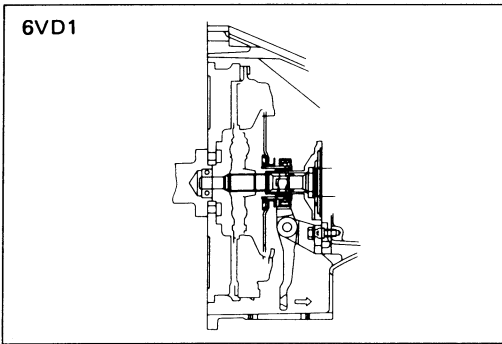


8. Align the top gear shaft spline with the clutch drive plate spline.
9. Install the transmission to the engine.
Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque kg·m(lb·ft/N·m)

M10: 4.1 ± 1.0 (30 ± 7.2/40 ± 10)

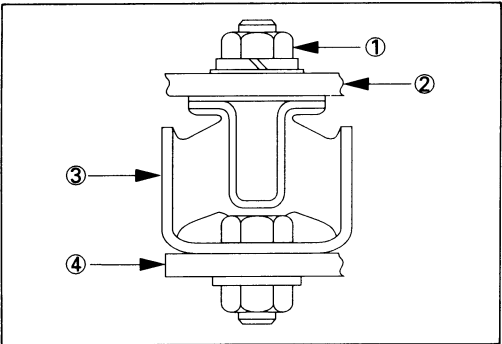
M12: 8.0 ± 1.6 (58 ± 12/78 ± 16)



- Apply a force of 59–78N (6–8 kg / 13.2–17.6 lb) to the tip of the shift fork in the direction of the transmission to engage the clutch pressure plate and release bearing (6VD1).

NOTE (6VD1):

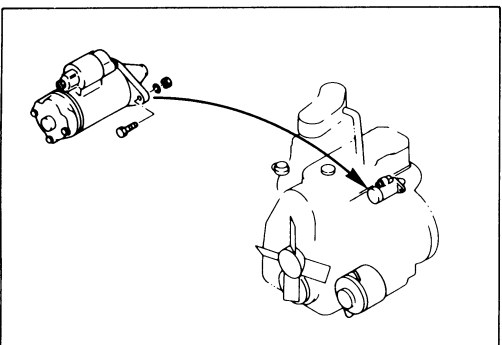
A click sound is heard when the release bearing and the tip of the diaphragm spring engage each other. Check to see if they are securely engaged by pushing the tip of the shift fork toward the engine while applying a force of about 25N (2.5 kg / 5.5 lb). If the shift fork will not move, then they are securely engaged.



- Install the rear mounting rubber (3) to the transmission (2).
Install the rear mounting rubber (3) to the No.3 cross-member (4).
- Tighten the rear mounting rubber nuts (1) to the specified torque.

Rear Mounting Rubber Nut Torque	kg·m(lb·ft/N·m)
	4.2 ± 0.5 ($30 \pm 3.6/41 \pm 4.9$)

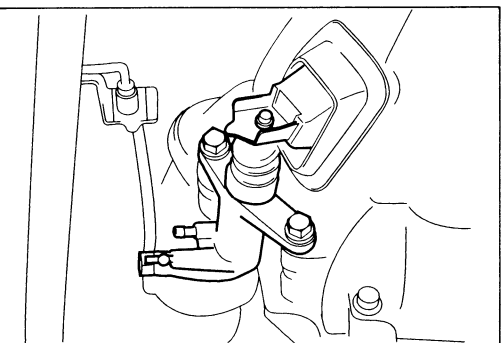
Mounting Bolt Torque	kg·m(lb·ft/N·m)
	5.1 ± 0.6 ($37 \pm 4.3/50 \pm 6$)



Starter Motor

- Install the starter motor to the engine rear plate.
- Tighten the starter motor bolts to the specified torque.

Starter Motor Bolt Torque	kg·m(lb·ft/N·m)
	8.0 ± 1.6 ($58 \pm 12/78 \pm 16$)



Slave Cylinder

Install the slave cylinder to the transmission case.

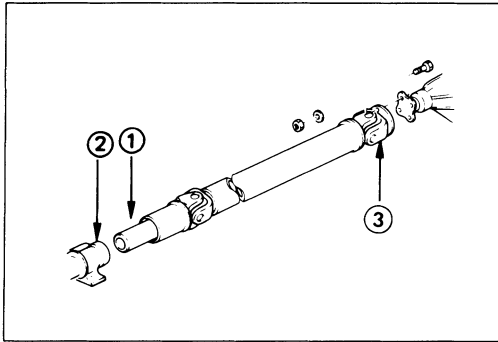
Slave Cylinder Bolt Torque	kg·m(lb·ft/N·m)
	4.1 ± 1.0 ($30 \pm 7.2/40 \pm 10$)

022LV001

220LV019

Harness Connector

Connect the back up light switch connector and speedometer sensor connector.

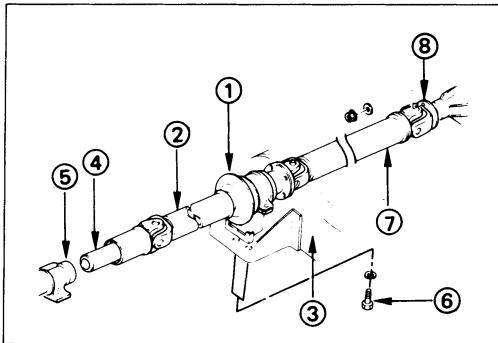


Rear Propeller Shaft (Single Shaft Type)

1. Insert the splined yoke ① with the propeller shaft into the transmission main shaft spline ②.
2. Install the propeller shaft flange yoke ③ to the drive pinion side.
3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque kg·m(lb·ft/N·m)

6.4 ± 0.4 ($46.3 \pm 2.9/62.7 \pm 3.9$)



Rear Propeller Shaft (Dual Shaft Type)

1. Place the center bearing and retainer ① together with the 1st propeller shaft ② and 2nd propeller shaft ⑦ on the No.4 crossmember ③.
2. Insert the splined yoke ④ into the transmission main shaft spline ⑤.
3. Tighten the center bearing retainer bolts ⑥ to the specified torque.

Center Bearing Retainer Bolt Torque kg·m(lb·ft/N·m)

6.2 ± 1.2 ($44.8 \pm 8.7/60.8 \pm 11.8$)



4. Connect the 2nd propeller shaft ⑦ and drive pinion side ⑧.

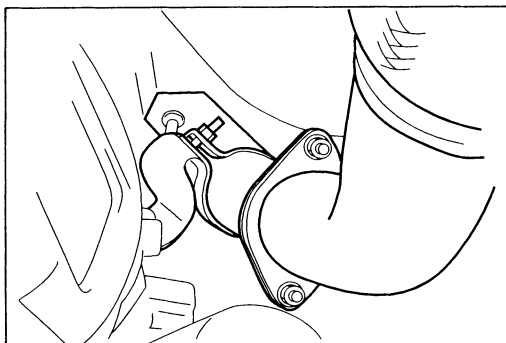
Be sure to align the setting marks applied at disassembly.



5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque kg·m(lb·ft/N·m)

6.4 ± 0.4 ($46.3 \pm 2.9/62.7 \pm 3.9$)



Exhaust Pipe

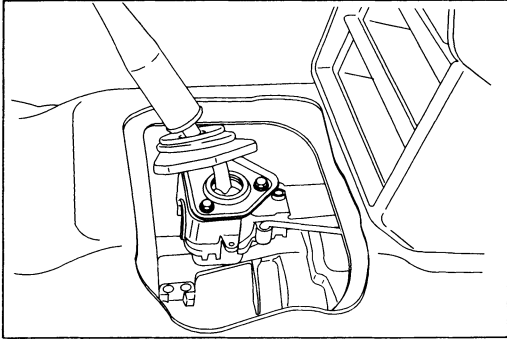
1. Install the front exhaust pipe and 2nd-3rd exhaust pipe.
2. Install the exhaust pipe bracket to the transmission case.



Gear Shift Lever

1. Replenish the transmission case with the specified engine oil.

Transmission Case Oil	lit(US/UK gt.)
	2.95 (3.12/2.6)



235RT005



2. Install the gear shift lever to the gear control box.
3. Tighten the gear shift lever cover bolts to the specified torque.

Shift Lever Cover Bolt Torque	kg·m(lb·ft/N·m)
	2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 1.96)

4. Install the dust cover and the grommet.
5. Install the front console assembly.
6. Install the gear shift lever knob.

Lowering the Vehicle

1. Place a jack beneath the vehicle.
2. Raise the jack to remove the chassis stands.
3. Lower the vehicle to the ground.

Engine Hood

Align the setting marks (applied at removal) on the engine hood and the engine hood hinges to install the engine hood.

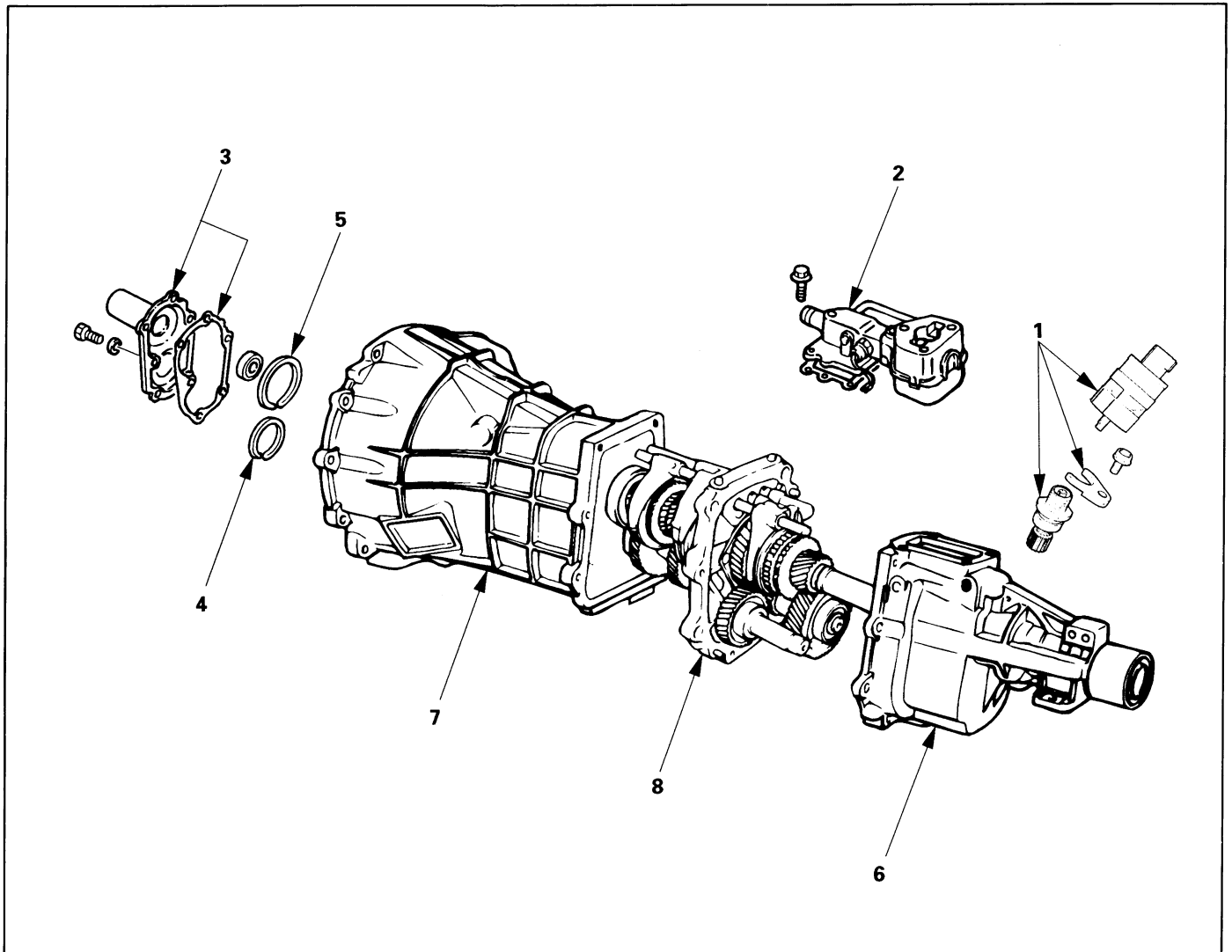
Battery Cable

Connect the negative (-) cable to the battery terminal.



DISASSEMBLY

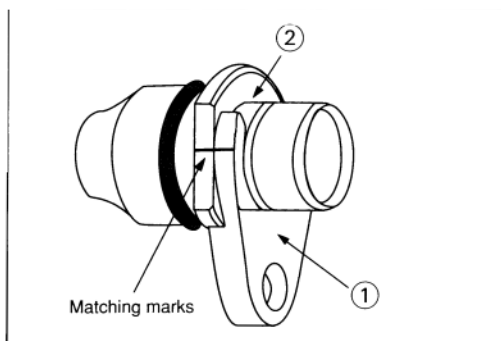
MAJOR COMPONENTS



220LV004

Disassembly Steps

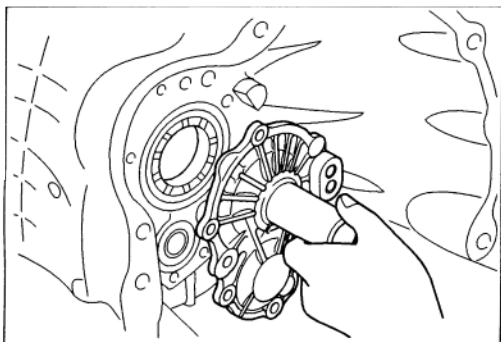
- ▲ 1. Speedometer sensor and speedometer driven gear
- ▲ 2. Gear control box assembly
- ▲ 3. Front cover with oil seal
- ▲ 4. Counter front bearing snap ring
- ▲ 5. Front bearing snap ring
- ▲ 6. Rear cover with oil seal
- ▲ 7. Transmission case
- ▲ 8. Intermediate plate with gear assembly



Important Operations

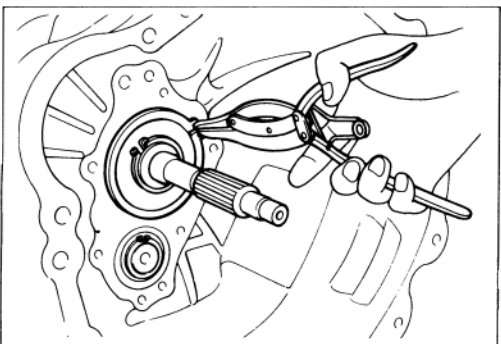
1. Speedometer Sensor and Speedometer Driven Gear

Mark the plate (1) and bush (2) alignment for reassembly.



3. Front Cover with Oil Seal

Remove the front cover with oil seal from the transmission case



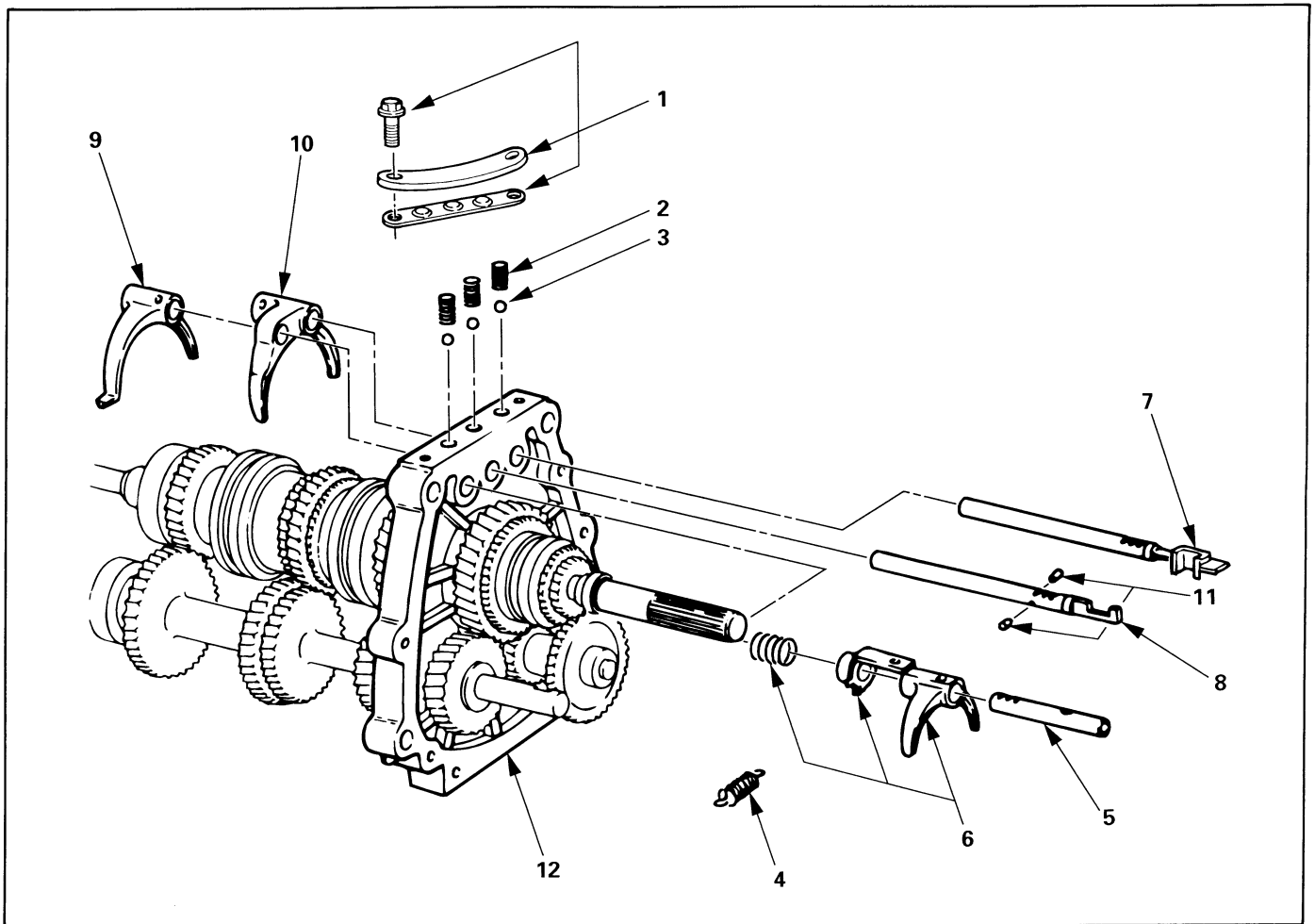
4. Counter Front Bearing Snap Ring

5. Front Bearing Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

 **MINOR COMPONENTS**

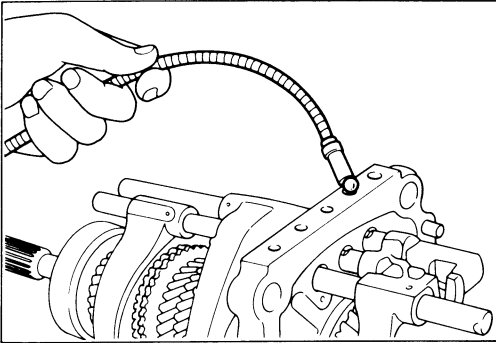
INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM ASSEMBLY, AND INTERLOCK PIN



220RW071

Disassembly Steps

- | | |
|--|--|
| 1. Detent spring plate and gasket | 7. 1st-2nd shift rod |
| 2. Detent spring | ▲ 8. 3rd-4th shift rod |
| ▲ 3. Detent ball | ▲ 9. 3rd-4th shift arm |
| 4. Spring | ▲ 10. 1st-2nd shift arm |
| 5. Rev-5th shift rod | 11. Interlock pin |
| 6. Rev-5th shift arm and reverse inhibitor | 12. Intermediate plate and gear assembly |

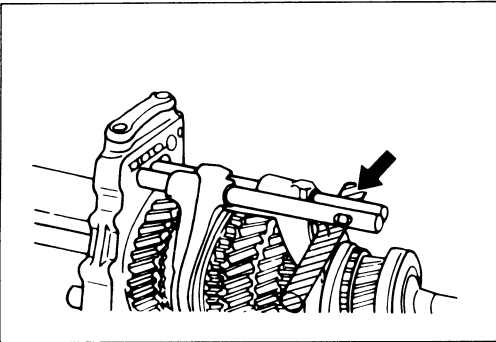


Important Operations

3. Detent Ball

Use a magnetic hand to remove the detent balls from the intermediate plate.

Take care not to lose the detent balls.



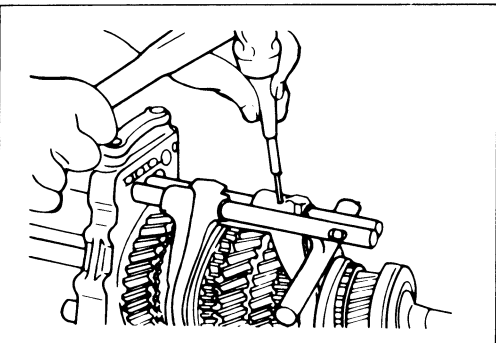
8. 3rd-4th Shift Rod

9. 3rd-4th Shift Arm

10. 1st-2nd Shift Arm

1) Hold a round bar against the shift arm end.

This will prevent damage to other components.



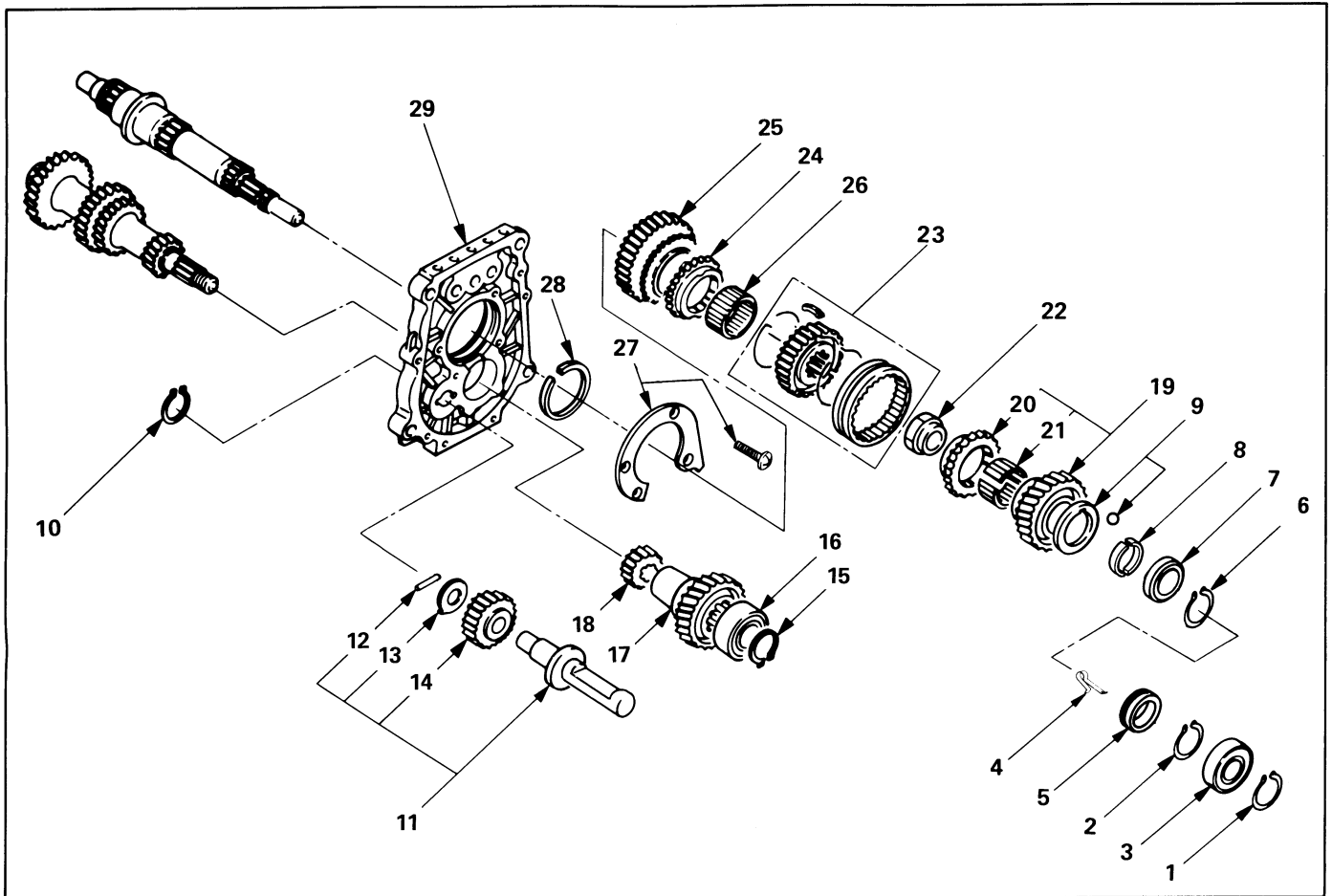
2) Use a spring pin remover to remove the shift arm spring pin from the shift arm and the shift rod.

3) Move the 3rd-4th shift rod forward.

Take care not to lose the interlock pins.

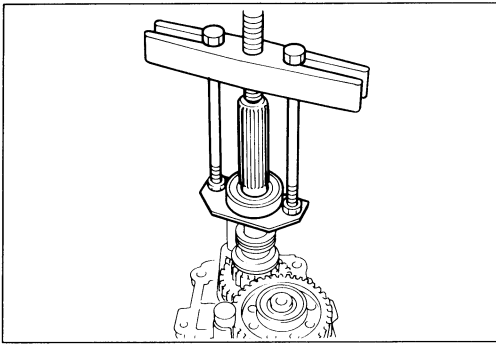


REVERSE GEAR AND 5TH GEAR



Disassembly Steps

- | | |
|--------------------------------|-------------------------------------|
| 1. Bearing snap ring | ▲ 16. Ball bearing |
| 2. Bearing snap ring | ▲ 17. Counter 5th gear |
| ▲ 3. Ball bearing | 18. Counter reverse gear |
| 4. Clip | 19. 5th gear |
| 5. Speedometer drive gear | 20. 5th block ring |
| 6. Retainer snap ring | ▲ 21. Needle bearing |
| 7. Retaining ring | ▲ 22. Mainshaft nut |
| 8. Thrust plate | ▲ 23. Rev-5th synchronizer assembly |
| 9. Thrust washer and lock ball | ▲ 24. Reverse block ring |
| ▲ 10. Reverse gear snap ring | ▲ 25. Reverse gear |
| 11. Reverse shaft | 26. Needle bearing |
| 12. Idler shaft pin | ▲ 27. Bearing plate and screw |
| 13. Thrust washer | ▲ 28. Bearing snap ring |
| 14. Reverse idler gear | ▲ 29. Intermediate plate |
| 15. Bearing snap ring | |



Important Operations

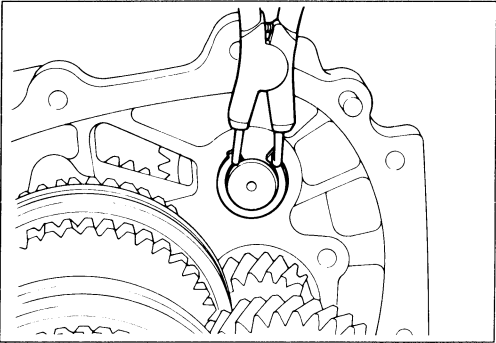


3. Ball Bearing

Set the bearing remover to the bearing and the mainshaft end to remove the bearing.

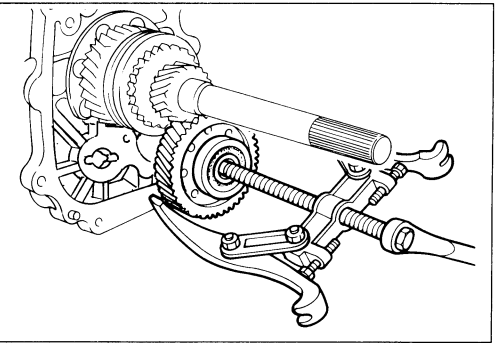
Bearing Remover : 5-8840-2155-0 (J-32717)

Puller : 5-8840-2027-0



10. Reverse Gear Snap Ring

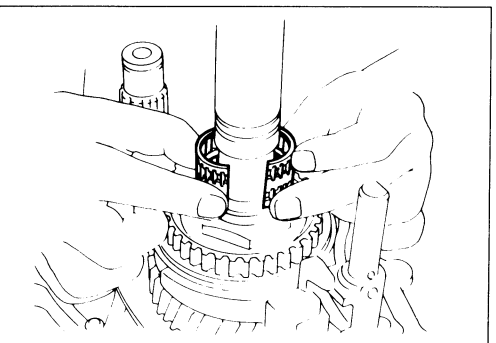
Use a pair of snap ring pliers to remove the snap ring.



16. Ball Bearing

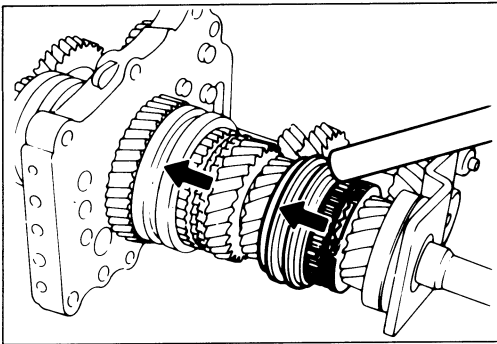
17. Counter 5th Gear

Use the bearing remover to remove the bearing.



21. Needle Bearing

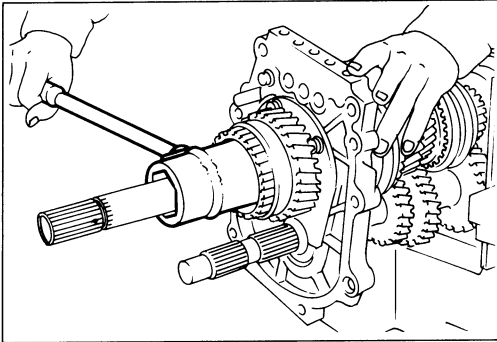
Remove the needle bearing (2 piece type).



22. Mainshaft Nut

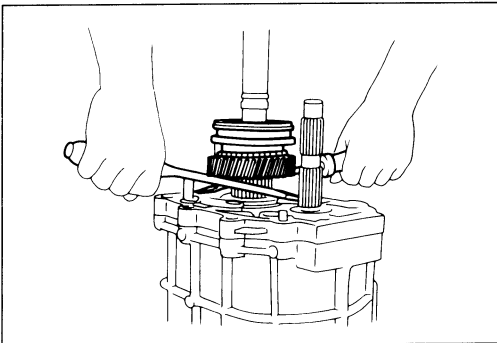
- 1) Engage the 3rd - 4th synchronizer with the 3rd gear.
- 2) Engage the 1st-2nd synchronizer with the 1st gear.
- 3) Attach the holding fixture to the mainshaft and the counter gear.

Holding Fixture: 5-8840-2160-0 (J-37224)



- 4) Use the mainshaft nut wrench to remove the mainshaft nut.

Wrench: 5-8840-2156-0 (J-37219)

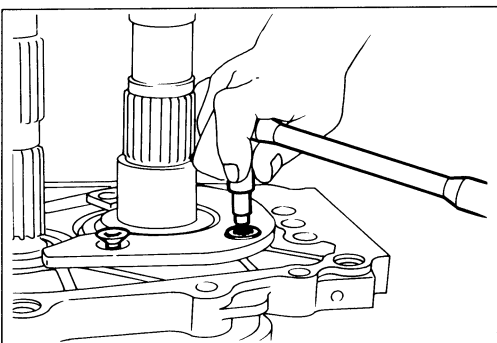


23. Rev.-5th Synchronizer Assembly

24. Reverse Ring

25. Reverse Gear

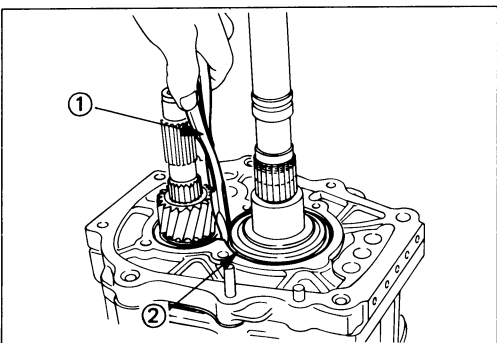
Use screw drivers between the reverse gear and bearing plate to remove the Rev.-5th synchronizer assembly together with reverse ring and gear.



27. Bearing Plate and Screw

Use the torx bit wrench to remove the bearing plate screw from the intermediate plate.

Torx Bit Wrench: 5-8840-0047-0 (J-37225 : T45)



28. Bearing Snap Ring

29. Intermediate Plate

- 1) Insert the snap ring pliers into the mainshaft bearing snap ring hole.
- 2) Use the snap ring pliers ① to force open the mainshaft bearing snap ring ②.

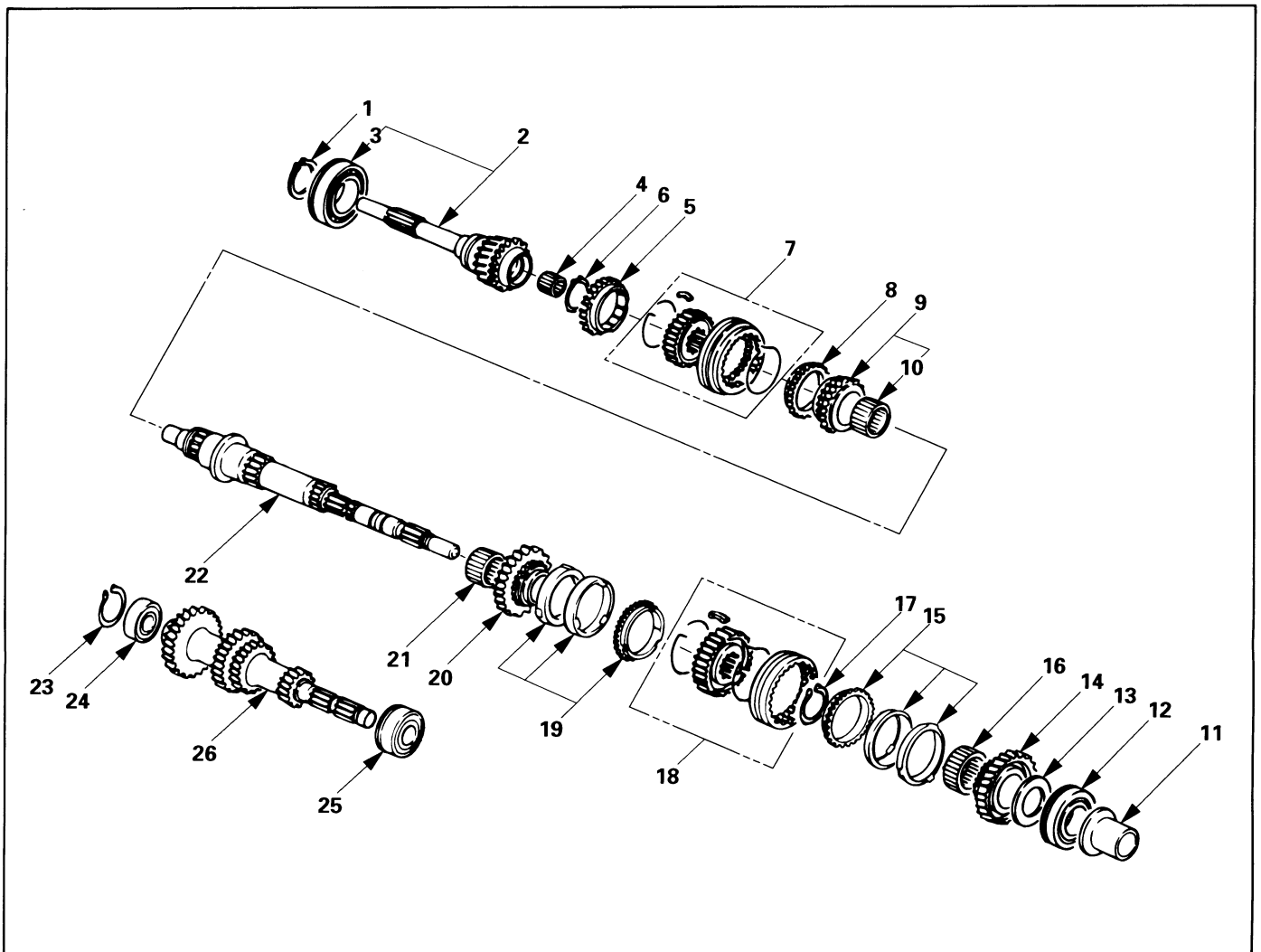
Hold the snap ring open with the pliers.

- 3) Push the intermediate plate toward the rear of the transmission to remove it.

The ball bearing snap ring will come free.



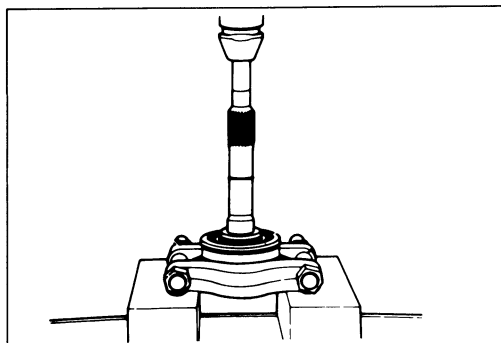
TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR



228LV002

Disassembly Steps

- | | |
|---|-------------------------------------|
| 1. Top gear shaft snap ring | ▲ 14. 1st gear |
| 2. Top gear shaft | 15. 1st block ring (set) |
| ▲ 3. Top gear ball bearing | 16. Needle bearing |
| 4. Needle bearing | ▲ 17. Clutch hub snap ring |
| 5. Top block ring | ▲ 18. 1st-2nd synchronizer assembly |
| ▲ 6. Mainshaft snap ring | ▲ 19. 2nd block ring (set) |
| ▲ 7. 3rd-4th synchronizer assembly | ▲ 20. 2nd gear |
| 8. 3rd block ring | 21. Needle bearing |
| 9. 3rd gear | 22. Mainshaft |
| 10. Needle bearing | 23. Bearing snap ring |
| ▲ 11. Needle bearing collar | ▲ 24. Counter gear front bearing |
| ▲ 12. Mainshaft ball bearing | 25. Counter gear center bearing |
| ▲ 13. 1st gear thrust bearing and plate | 26. Counter gear |



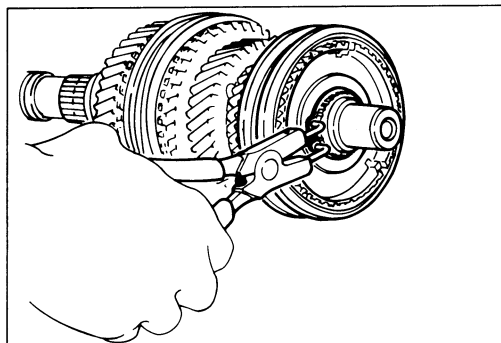
Important Operations



3. Top Gear Ball Bearing

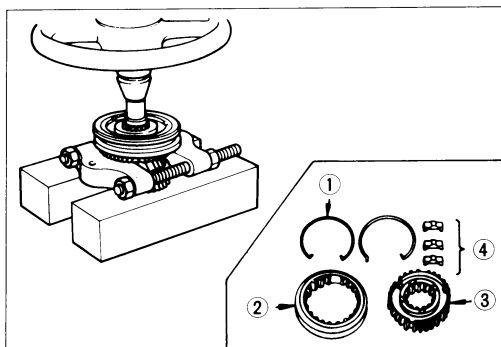
Use a bench press and the bearing replacer to remove the ball bearing.

Bearing Replacer : 5-8840-0015-0 (J-22912-01)



6. Mainshaft Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



7. 3rd-4th Synchronizer Assembly

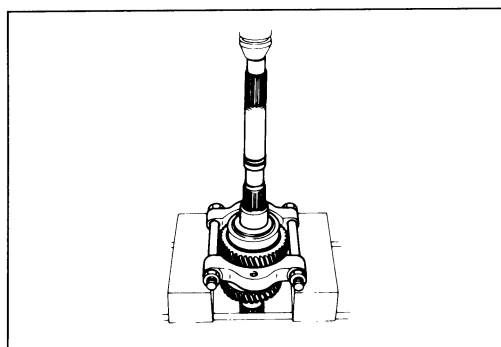
1) Use a bench press and the bearing replacer to remove the synchronizer assembly as a set.

2) Disassemble the synchronizer assembly.

- ① Springs
- ② Sleeve
- ③ Clutch Hub
- ④ Inserts

Note:

Mark the hub and sleeve alignment for reassembly.



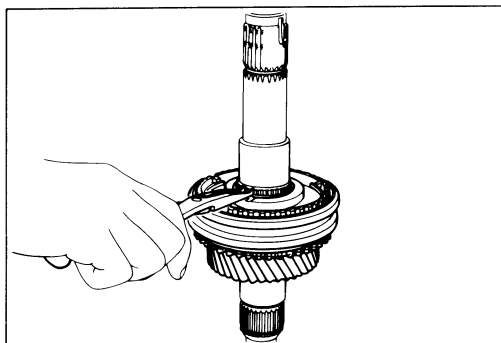
11. Needle Bearing Collar

12. Mainshaft Ball Bearing

13. 1st Gear Thrust Bearing and Plate

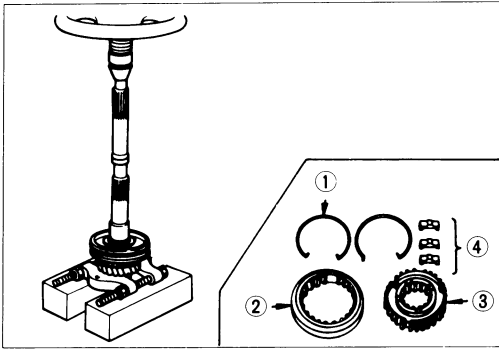
14. 1st Gear

Use a bench press and the bearing replacer to remove the ball bearing.



17. Clutch Hub Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

**18. 1st-2nd Synchronizer Assembly****19. 2nd Block Ring (Set)****20. 2nd Gear**

- 1) Use a bench press and the bearing remover to remove the 2nd gear together with synchronizer assembly.

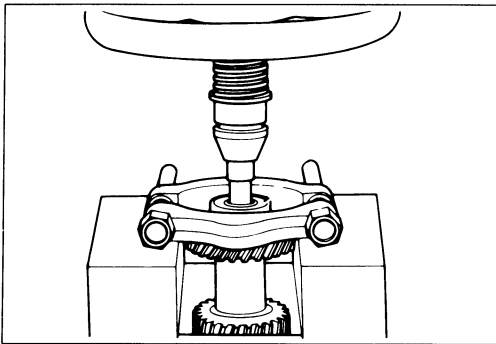
Remover: 5-8840-0015-0 (J-22912-01)

- 2) Disassemble the synchronizer assembly.

- ① Springs
- ② Sleeve
- ③ Clutch Hub
- ④ Inserts

Note:

Mark the hub and sleeve alignment for reassembly.

**24. Counter Gear Front Bearing**

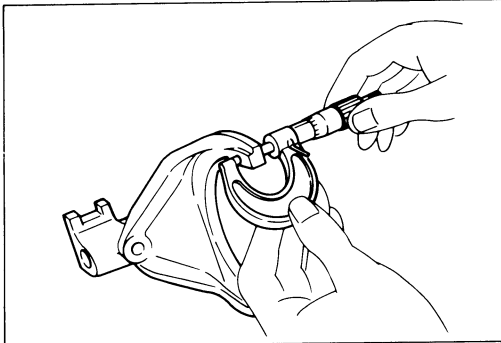
Use a bench press and the bearing remover to remove the bearing.

Bearing Remover : 5-8840-0015-0 (J-22912-01)



INSPECTION AND REPAIR

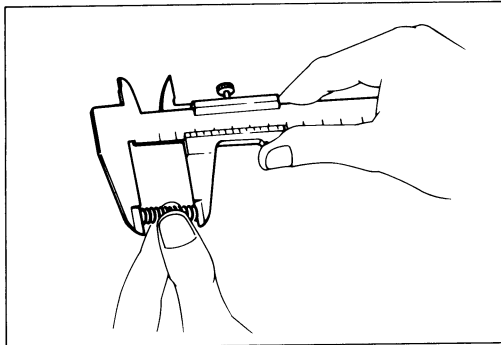
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



SHIFT ARM THICKNESS

Use a micrometer to measure the shift arm thickness. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness		mm(in)
	Standard	Limit
1st–2nd	9.60–9.85 (0.378–0.388)	9.0 (0.354)
3rd–4th Rev.–5th	9.60–9.80 (0.378–0.386)	

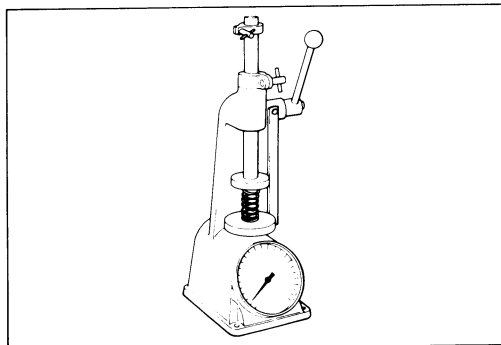


DETENT SPRING FREE LENGTH

Use a vernier caliper to measure the detent spring free length.

If the measured value is less than the specified limit, the detent spring must be replaced.

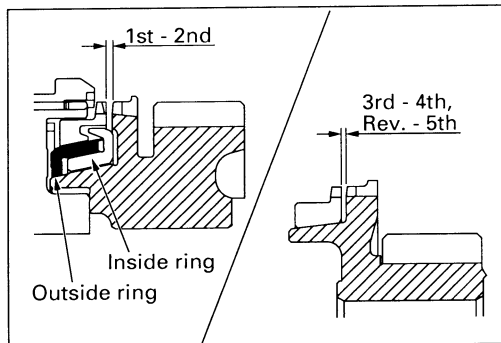
Detent Spring Free Length		mm(in)
Standard	Limit	
26.8 (1.06)	26.2 (1.03)	



DETENT SPRING TENSION

Use a spring tester to measure the detent spring tension. If the measured value is less than the specified standard, the detent spring must be replaced.

Detent Spring Tension		kg(lb/N)
Compressed Height	Standard	
20 mm (0.787 in)	8.9–9.9 (19.6–21.8/87.2–97)	

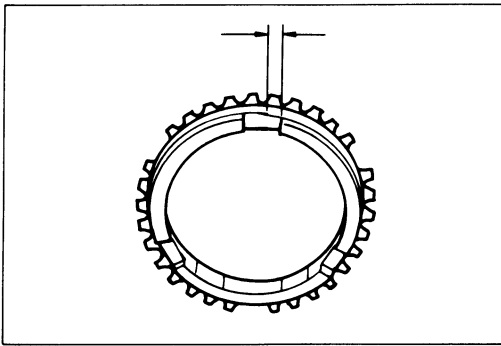


BLOCK RING AND DOG TEETH CLEARANCE

Use a thickness gauge to measure the clearance between the block ring and the dog teeth.

If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Dog Teeth Clearance		mm(in)
Standard	Limit	
1.5 (0.059)	0.8 (0.032)	



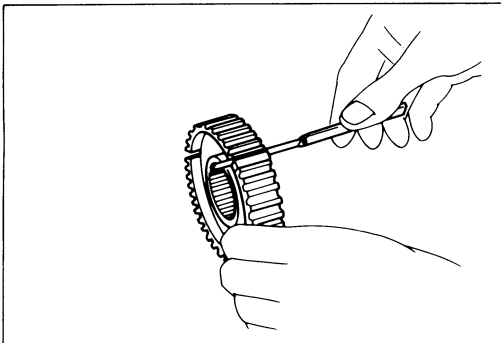
BLOCK RING AND INSERT CLEARANCE

Use a vernier caliper or thickness gauge to measure the clearance between the block ring and the insert.

If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block Ring and Insert Clearance mm(in)

	Standard	Limit
3rd-4th	3.46–3.74 (0.136–0.147)	4.0 (0.158)
1st-2nd	4.34–4.66 (0.171–0.183)	4.9 (0.193)
Rev.-5th	3.59–3.91 (0.141–0.154)	4.1 (0.161)



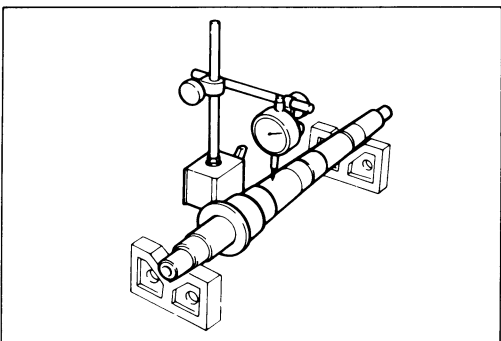
CLUTCH HUB AND INSERT CLEARANCE

Use a thickness gauge to measure the clearance between the clutch hub and the insert.

If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch Hub and Insert Clearance mm(in)

	Standard	Limit
3rd-4th	0.01-0.19 (0.0004-0.0075)	0.4 (0.016)
1st-2nd	0.09-0.31 (0.0035-0.0122)	
Rev.-5th		



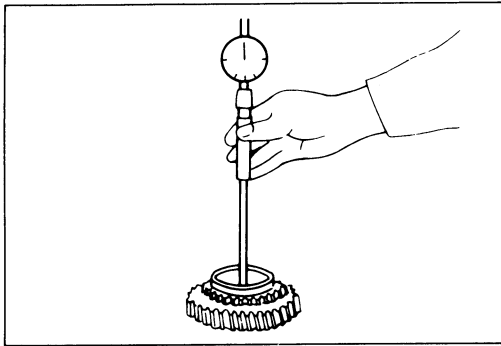
MAINSHAFT RUN-OUT

1. Install the mainshaft to a grinding machine.
2. Use a dial indicator to measure the mainshaft central portion run-out.

If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run Out mm(in)

Limit
0.05 (0.0020)

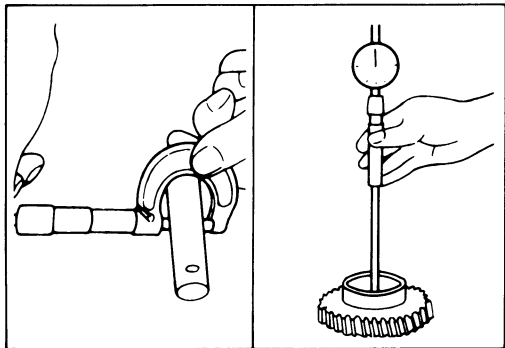


GEAR INSIDE DIAMETER

Use an inside dial indicator to measure the gear inside diameter.

If the measured value is less than the specified limit, the gear must be replaced.

Gear Inside Diameter		mm(in)
	Standard	Limit
1st 3rd	45.000-45.013 (1.771-1.772)	45.100 (1.776)
2nd	52.000-52.013 (2.047-2.048)	52.100 (2.051)
Rev.	48.000-48.013 (1.889-1.890)	48.100 (1.894)
5th	32.000-32.013 (1.259-1.260)	32.100 (1.264)

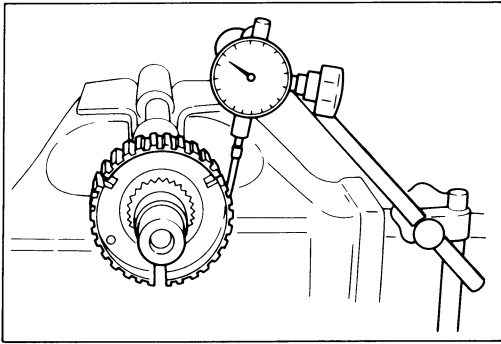


REVERSE IDLER GEAR AND IDLER GEAR SHAFT CLEARANCE

1. Use a micrometer to measure the idler gear shaft diameter.
2. Use an inside dial indicator to measure the idler gear inside diameter.
3. Calculate the idler gear and idler gear shaft clearance.
 $\text{Idler gear inside diameter} - \text{idler gear shaft diameter} = \text{idler gear and idler gear shaft clearance.}$

If the measured value exceeds the specified limit, the idler gear and/or the idler gear shaft must be replaced.

Idler Gear and Idler Gear Shaft Clearance		mm(in)
	Standard	Limit
	0.041 – 0.074 (0.0016 – 0.0029)	0.150 (0.0059)



CLUTCH HUB SPLINE PLAY

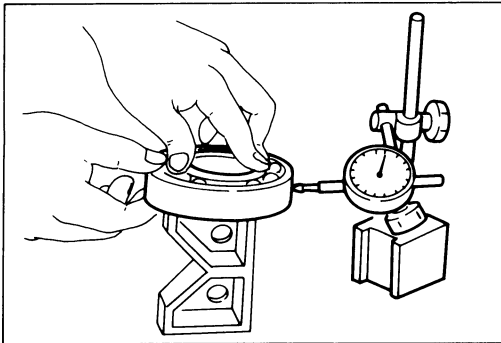
1. Set a dial indicator to the clutch hub to be measured.
2. Move the clutch hub as far as possible to both the right and the left.

Note the dial indicator reading.

If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch Hub Spline Play mm(in)

	Standard	Limit
1st-2nd 3rd-4th	0-0.1 (0-0.0039)	0.2 (0.0079)
Rev.-5th	0-0.2 (0-0.0079)	0.3 (0.0118)



BALL BEARING PLAY

Use a dial indicator to measure the ball bearing play.

Ball Bearing Play mm(in)

Limit
0.2 (0.0079)

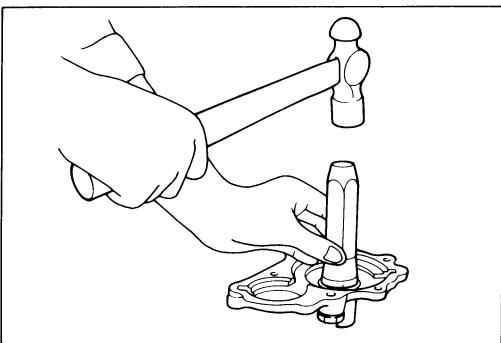


FRONT COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the front cover.



Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the front cover.

Oil Seal Installer : 5-8840-0026-0 (J-26540)



2. Apply gear oil to the oil seal lip.

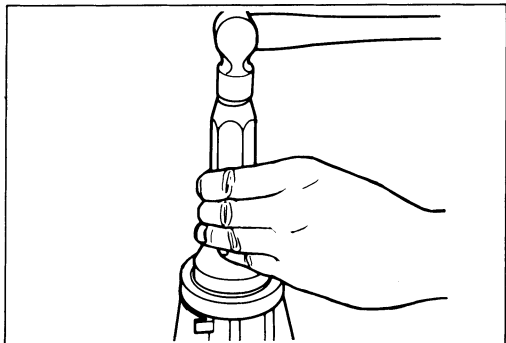


REAR COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the rear cover.

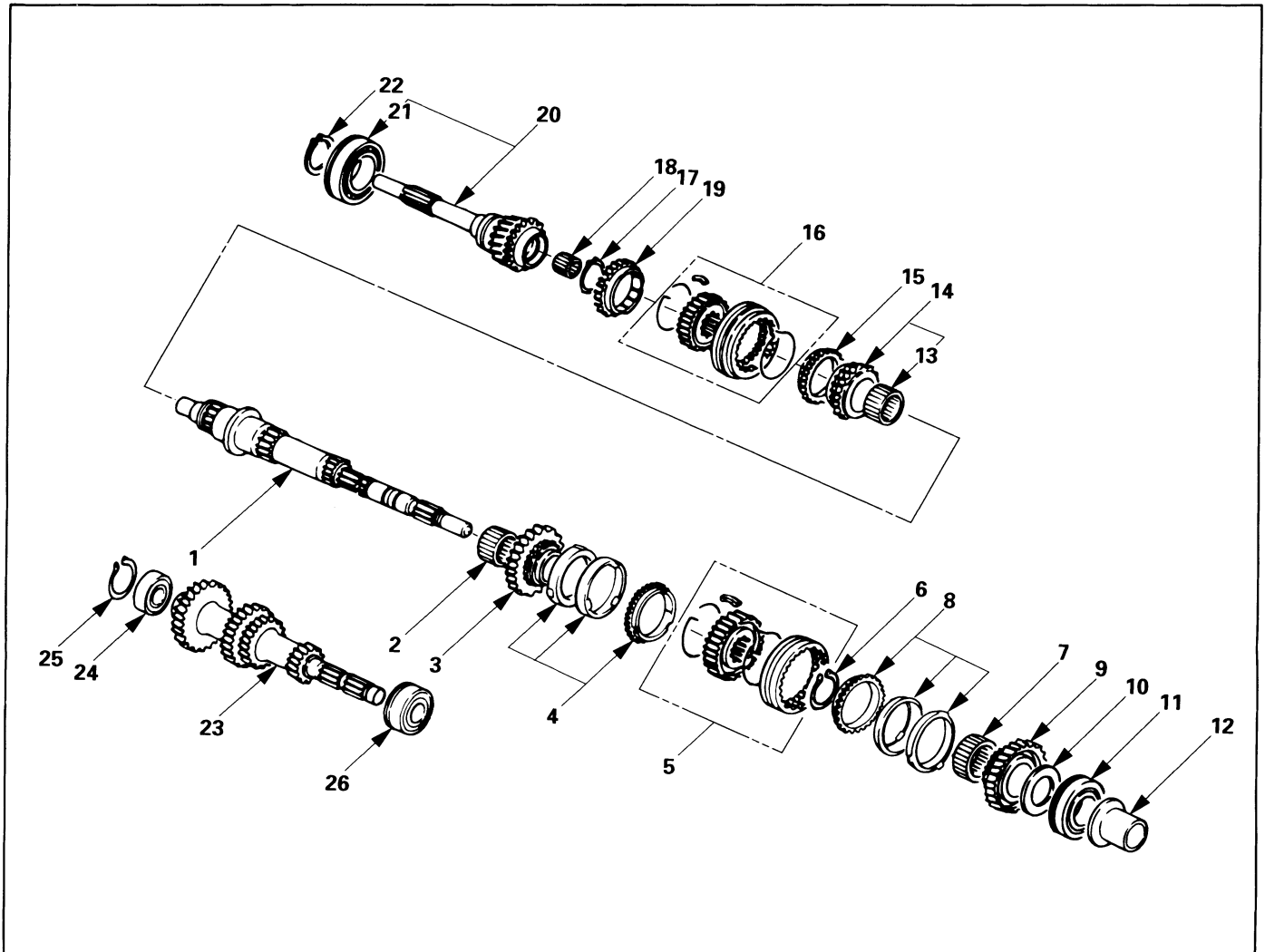


Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer : 5-8522-0050 (J-29769)

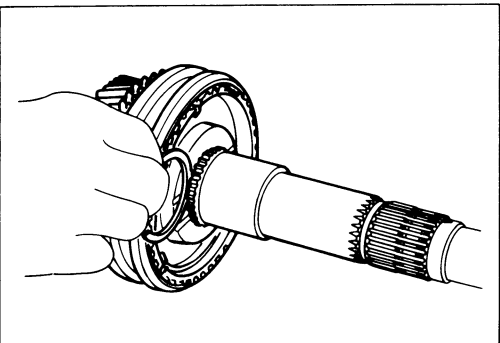
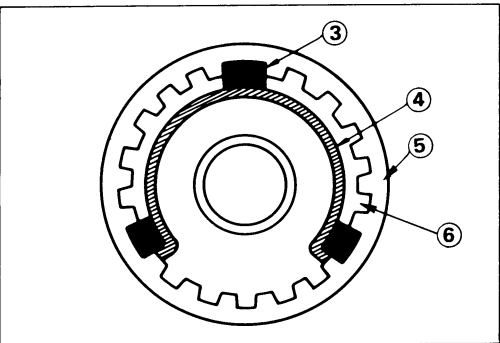
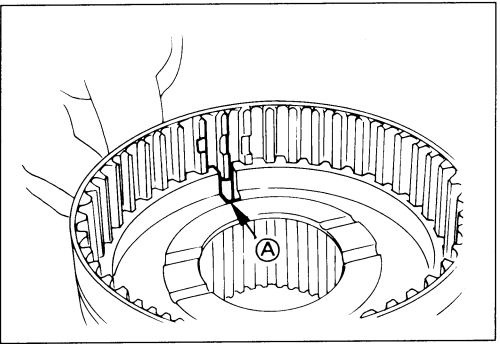
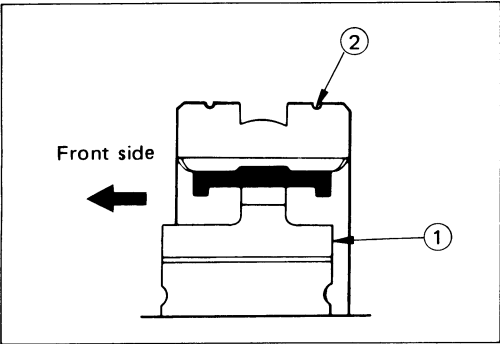
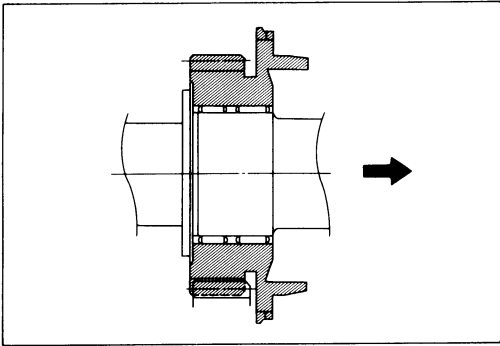
2. Apply engine oil to the oil seal lip.


REASSEMBLY
MINOR COMPONENTS**TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR**

226LV003

Reassembly Steps

- | | |
|---|-------------------------------------|
| 1. Mainshaft | ▲ 14. 3rd gear |
| ▲ 2. Needle bearing | 15. 3rd block ring |
| ▲ 3. 2nd gear | ▲ 16. 3rd-4th synchronizer assembly |
| 4. 2nd block ring (set) | ▲ 17. Mainshaft snap ring |
| ▲ 5. 1st-2nd synchronizer assembly | 18. Needle bearing |
| ▲ 6. Clutch hub snap ring | 19. Top block ring |
| ▲ 7. Needle bearing | 20. Top gear shaft |
| 8. 1st block ring (set) | ▲ 21. Top gear ball bearing |
| ▲ 9. 1st gear | ▲ 22. Top gear shaft snap ring |
| ▲ 10. 1st gear thrust bearing and plate | 23. Counter gear |
| ▲ 11. Mainshaft ball bearing | ▲ 24. Counter gear front bearing |
| ▲ 12. Needle bearing collar | 25. Snap ring |
| ▲ 13. Needle bearing | ▲ 26. Counter gear center bearing |



Important Operations



2. Needle Bearing



3. 2nd Gear

1) Apply engine oil to the needle bearing and the 2nd gear thrust surfaces.

2) Install the needle bearing and the 2nd gear to the mainshaft.

The 2nd gear dog teeth must be facing the transmission rear side.



5. 1st-2nd Synchronizer Assembly

1) Turn the clutch hub face ① shallow toward the sleeve small groove ② on the outer circumference.

Note:

The clutch hub groove (A) must be aligned with the key groove of sleeve.

2) Check that the inserts ③ fit snugly into the block ring insert grooves.

3) Check that the insert springs ④ are fitted to the inserts as shown in the illustration.

4) Check that the clutch hub ⑤ and the sleeve ⑥ slide smoothly.

5) Install the synchronizer assembly to the mainshaft.

The clutch hub face (with the heavy boss) must be facing the 2nd gear side.



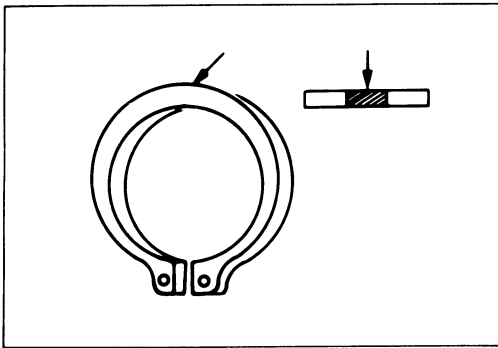
6. Clutch Hub Snap Ring

1) Select the snap ring which will provide the minimum clearance between the 1st-2nd clutch hub and the snap ring.

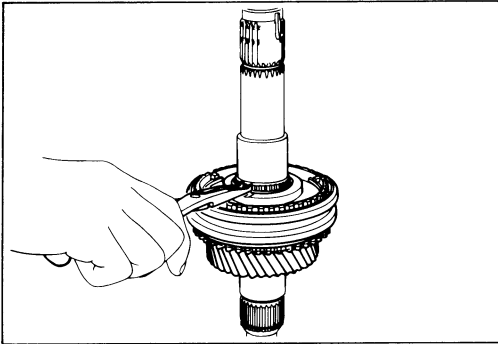
There are three snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance	mm(in)
Standard	
	0 – 0.1 (0 – 0.0039)



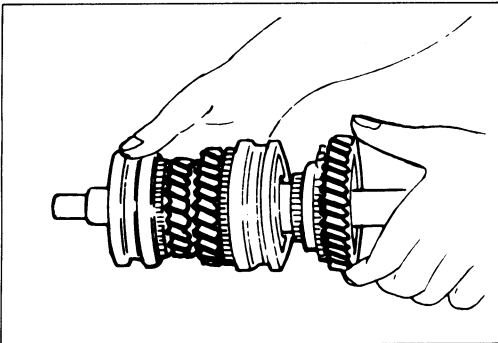
Snap Ring Availability		mm(in)
Thickness	Color-Coding	
1.80 (0.071)	White	
1.85 (0.073)	Yellow	
1.90 (0.075)	Blue	



- 2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

Snap Ring Pliers

The snap ring must be fully inserted into the mainshaft snap ring groove.



7. Needle Bearing

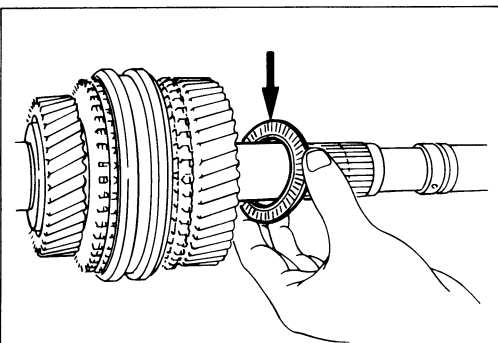


9. 1st Gear

- 1) Apply engine oil to the needle bearing and the 1st gear thrust surfaces.

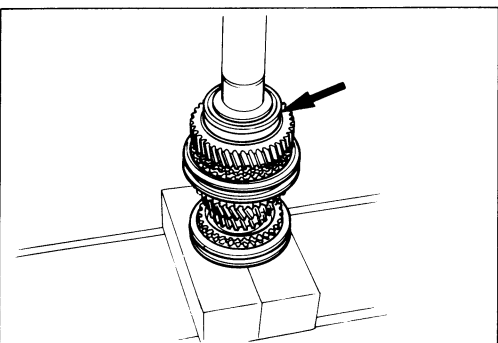
- 2) Install the needle bearing and the 1st gear to the mainshaft.

The 1st gear dog teeth must be facing the transmission front side.



10. 1st Gear Thrust Bearing and Plate

Install the thrust bearing and the race to the main shaft. The thrust bearing side must be facing the transmission front side.



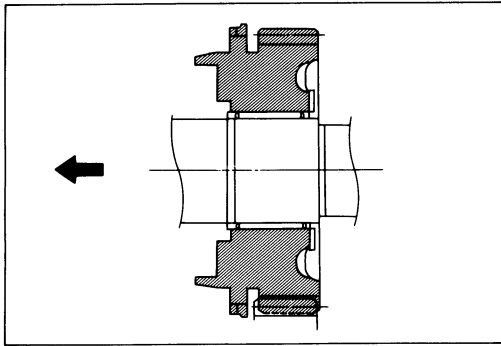
11. Mainshaft Ball Bearing



12. Needle Bearing Collar

- 1) Apply engine oil to the ball bearing and the mainshaft.
- 2) Install the ball bearing and collar to the mainshaft. The ball bearing snap ring groove must be facing the transmission rear side.
- 3) Use a bench press to slowly force the collar into place.

Installer : 5-8840-2195-0 (J-6133-01)



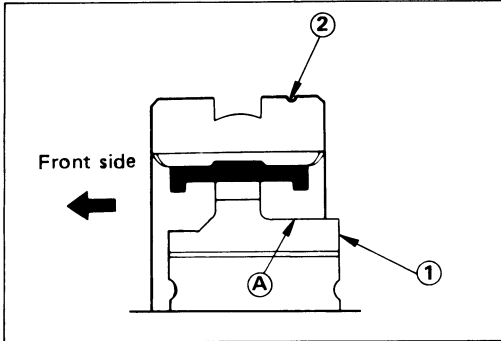
13. Needle Bearing



14. 3rd Gear

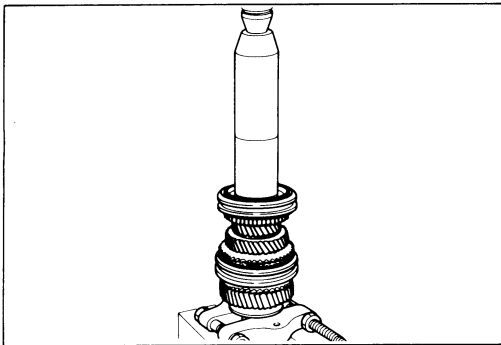
- 1) Apply engine oil to the needle bearing and the 3rd gear thrust surfaces.
- 2) Install the needle bearing and the 3rd gear to the mainshaft.

The 3rd gear dog teeth must be facing the transmission front side.

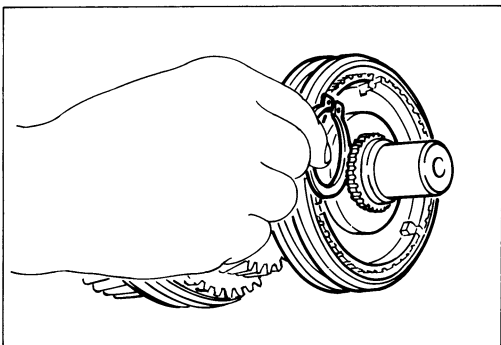


16. 3rd-4th Synchronizer Assembly

- 1) Turn the clutch hub face ① with the heavy boss ① toward the sleeve small groove ② on the outer circumference.



- 2) Check that the inserts fit snugly into the block ring insert grooves.
- 3) Check that the insert springs are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub and the sleeve slide smoothly.
- 5) Install the synchronizer assembly to the main shaft.
The clutch hub face (with the heavy boss) must be facing the 3rd gear side.



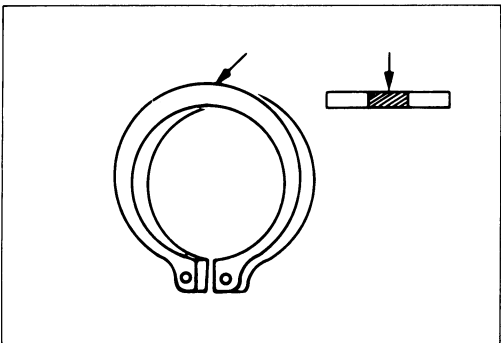
17. Mainshaft Snap Ring

- 1) Select the snap ring which will provide the minimum clearance between the 3rd-4th clutch hub and the snap ring.

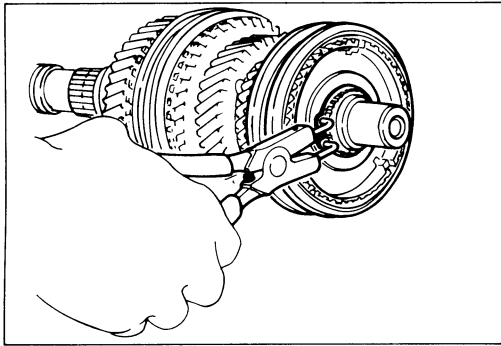
There are three snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance	mm(in)
Standard	
	0 - 0.1 (0 - 0.0039)

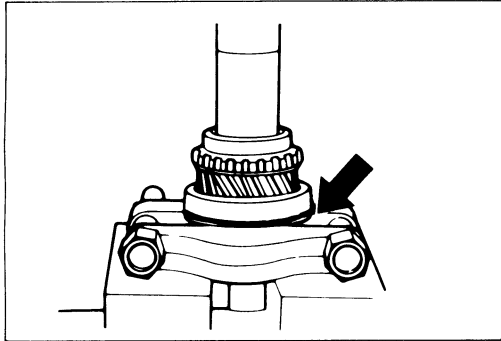


Snap Ring Availability		mm(in)
Thickness mm(in)	Color-Coding	
1.80 (0.071)	White	
1.85 (0.073)	Yellow	
1.90 (0.075)	Blue	



- 2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the mainshaft snap ring groove.



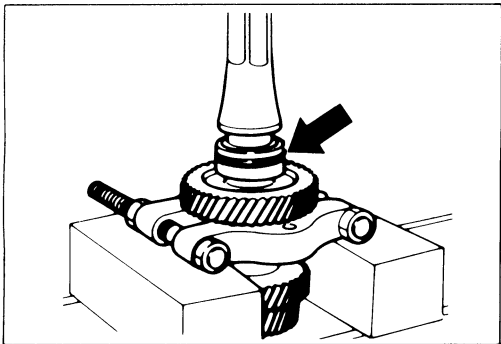
21. Top Gear Ball Bearing

22. 4th Gear Shaft Snap Ring

- 1) Use a bench press to install the top gear shaft ball bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

- 2) Use a pair of snap ring pliers to install the snap ring to the bearing.



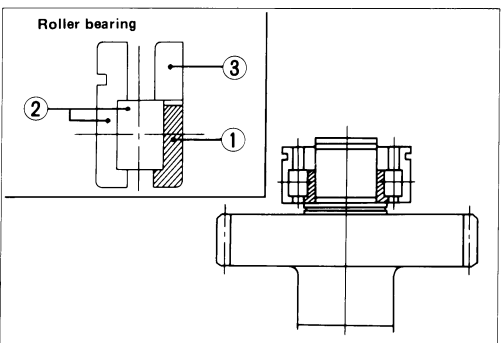
24. Counter Gear Front Bearing

Use a bench press to install the counter gear front bearing to the mainshaft.



The snap ring groove must be facing the transmission front side.

Bearing Installer: 5-8840-2194-0 (J-35283)



- 1) Apply engine oil to the bearing and install the inner race ① and outer race with roller ② in the proper direction to the mainshaft.



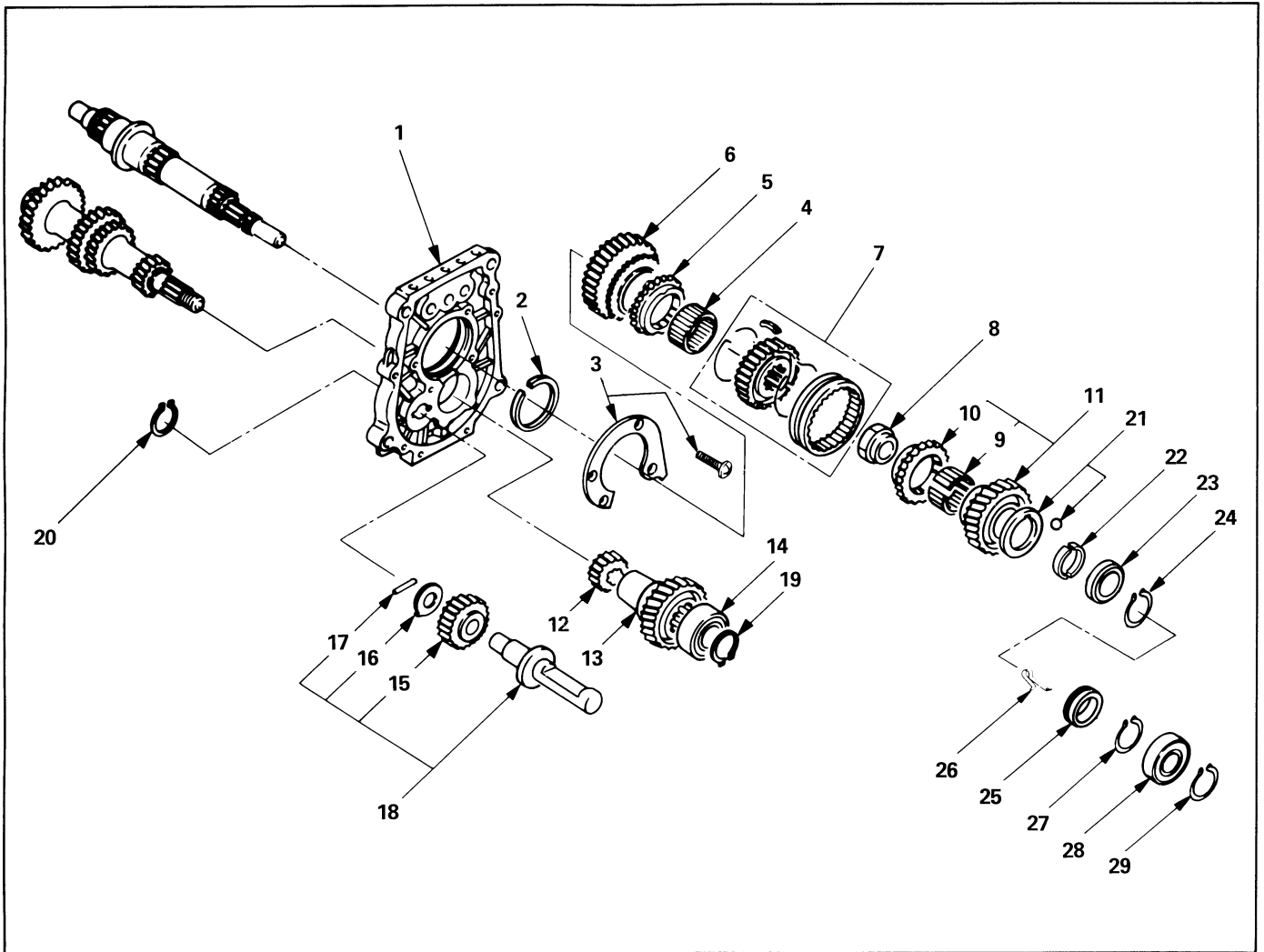
- 2) Then install the inner race ③ with taper side turned to outer race ②.

Note:

The inner race ③ should be installed with stamp on die face side turned to the front side of transmission.

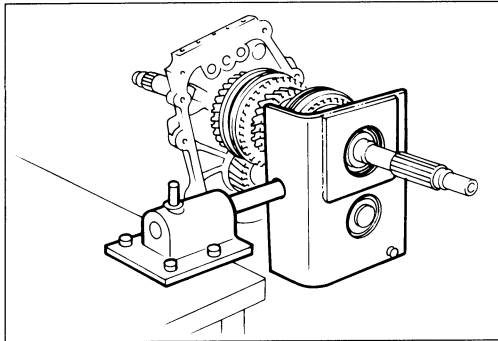


REVERSE GEAR AND 5TH GEAR



Reassembly Steps

- ▲ 1. Intermediate plate
- 2. Bearing snap ring
- ▲ 3. Bearing plate and screw
- 4. Needle bearing
- 5. Reverse block ring
- 6. Reverse gear
- ▲ 7. Rev.-5th synchronizer assembly
- ▲ 8. Mainshaft nut
- 9. Needle bearing
- 10. 5th block ring
- 11. 5th gear
- ▲ 12. Counter reverse gear
- 13. Counter 5th gear
- 14. Ball bearing
- 15. Reverse idler gear
- 16. Thrust washer
- 17. Idler shaft pin
- 18. Reverse idler shaft
- ▲ 19. Bearing snap ring
- ▲ 20. Reverse gear snap ring
- ▲ 21. Thrust washer and lock ball
- 22. Thrust plate
- 23. Retaining ring
- 24. Retainer snap ring
- 25. Speedometer drive gear
- 26. Clip
- 27. Bearing snap ring
- ▲ 28. Ball bearing
- 29. Bearing snap ring



Important Operations



1. Intermediate Plate

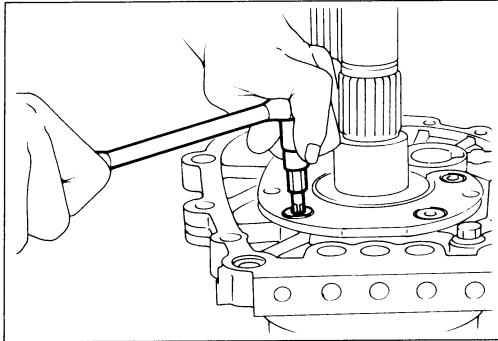
- 1) Mesh the counter gear with the mainshaft assembly.
- 2) Install the holding fixture to the mainshaft and the counter gear.

Holding Fixture: 5-8840-2160-0 (J-37224)

Holding Base: 5-8840-0003-0 (J-3289-20)

- 3) Place the holding fixture (with the mainshaft and the countershaft) in a vise.

- 4) Install the intermediate plate.



3. Bearing Plate and Screw

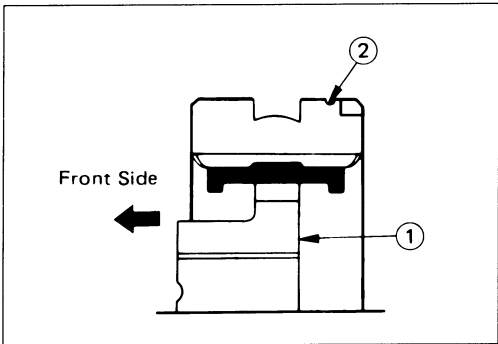
- 1) Apply recommended thread locking agents or its equivalent to each of the bearing plate screw threads.

- 2) Tighten the screws to the specified torque.

Torx Bit Wrench: 5-8840-0047-0 (J-37225 : T45)

Bearing Plate Screw Torque **kg·m (lb·ft/N·m)**

1.5 (11/15)

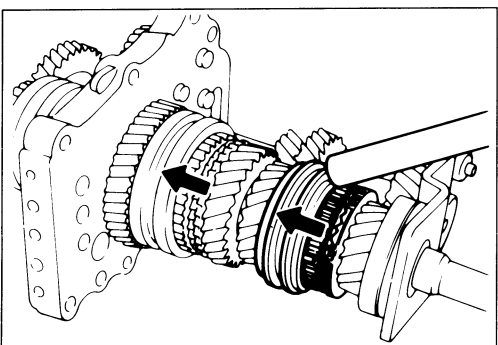


7. Rev-5th Synchronizer Assembly

- 1) Turn the clutch hub face ① toward the sleeve small groove ② on the outer circumference.

- 2) Install the synchronizer assembly to the mainshaft.

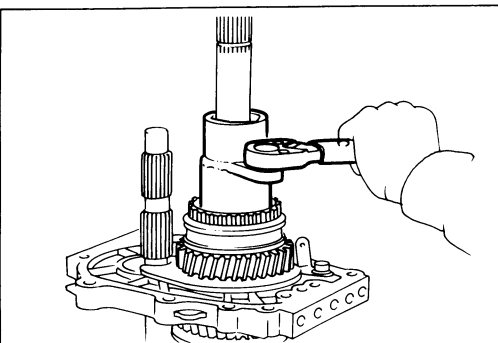
The clutch hub face (with the heavy boss) must be facing the reverse gear side.



8. Mainshaft Nut

- 1) Mesh the 1st-2nd synchronizer with both the 1st and 3rd gears (double engagement).

This will prevent the mainshaft from turning.



- 2) Install the mainshaft hub nut.

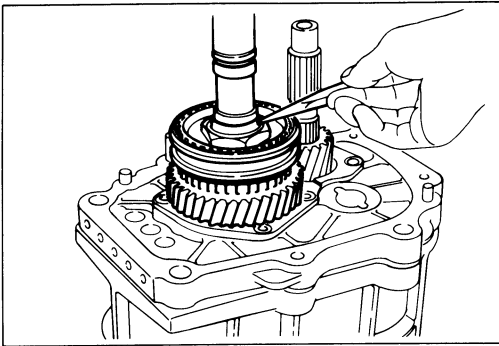
- 3) Use the mainshaft nut wrench to tighten the mainshaft nut to the specified torque.

Wrench: 5-8840-2156-0 (J-37219)

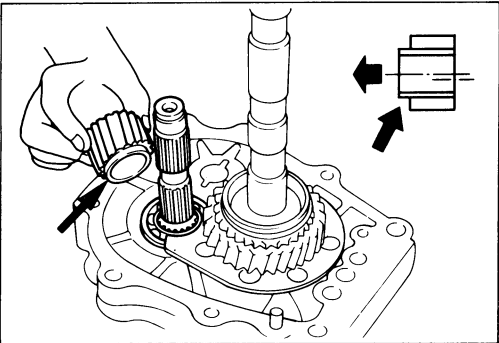
Mainshaft Nut Torque **kg·m (lb·ft/N·m)**

14 ± 2 (101 ± 14.2/137 ± 20)





4) Use a punch to caulk the mainshaft nut.



12. Counter Reverse Gear

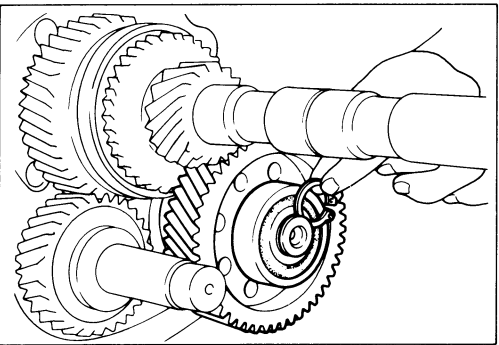
1) Apply engine oil to the counter reverse gear and the reverse gear.



2) Install the counter reverse gear to the counter gear.

Note the projection at either side of the counter reverse gear.

The larger projection must be facing the intermediate plate.



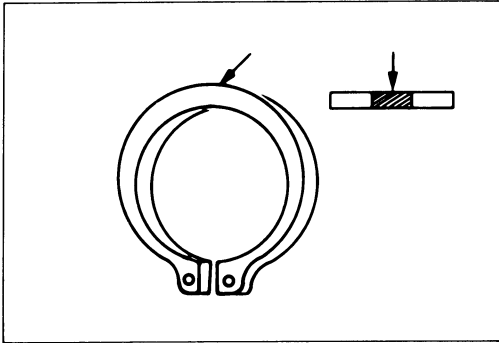
19. Bearing Snap Ring

1) Select the snap ring which will provide the minimum clearance between the ball bearing and the snap ring.

There are six snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

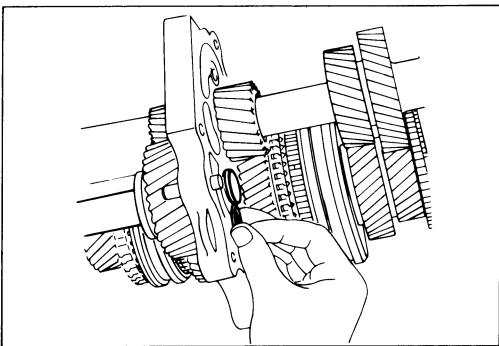
Ball Bearing and Snap Ring Clearance	mm(in)
Standard	
0 – 0.15 (0 – 0.0059)	



Snap Ring Availability mm(in)

Thickness mm(in)	Color-Coding
1.1 (0.043)	White
1.2 (0.047)	Yellow
1.3 (0.051)	Blue
1.4 (0.055)	Pink
1.5 (0.059)	Green
1.6 (0.063)	Brown

- Use a pair of snap ring pliers to install the snap ring to the counter 5th gear.
Snap Ring Pliers
 The snap ring must be fully inserted into the reverse idler shaft snap ring groove.

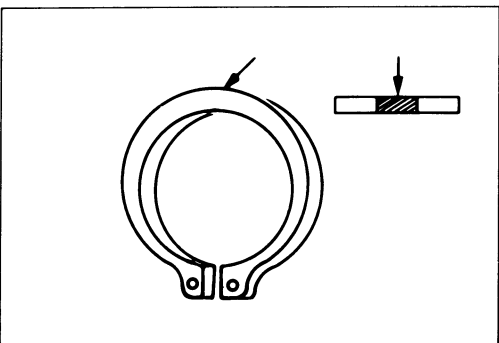


20. Reverse Gear Snap Ring

- Select the snap ring which will provide the minimum clearance between the intermediate plate and the snap ring.
 There are three snap ring sizes available.
 The snap rings are color-coded to indicate their thickness.

Intermediate Plate and Snap Ring Clearance mm(in)

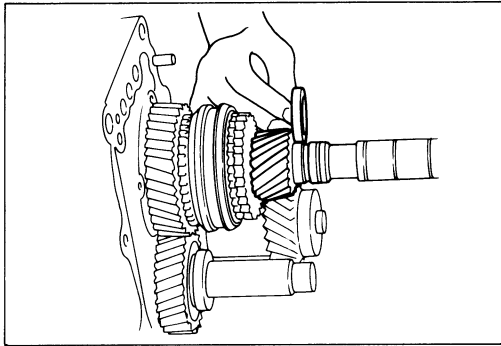
Standard
0 – 0.15 (0 – 0.0059)



Snap Ring Availability mm(in)

Thickness mm(in)	Color-Coding
1.2 (0.047)	White
1.3 (0.051)	Yellow
1.4 (0.055)	Blue

- Use a pair of snap ring pliers to install the snap ring to the reverse idler shaft.
Snap Ring Pliers
 The snap ring must be fully inserted into the reverse idler shaft snap ring groove.



21. Thrust Washer and Lock Ball

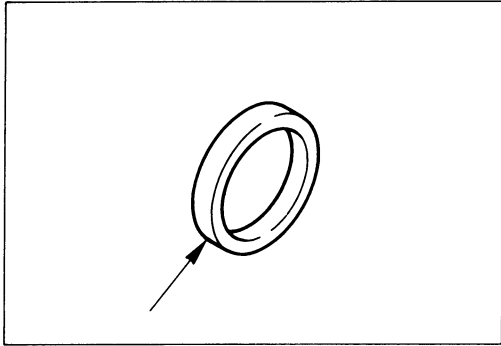
- 1) Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance	mm(in)
Standard	
0.10 – 0.25 (0.0039 – 0.0098)	

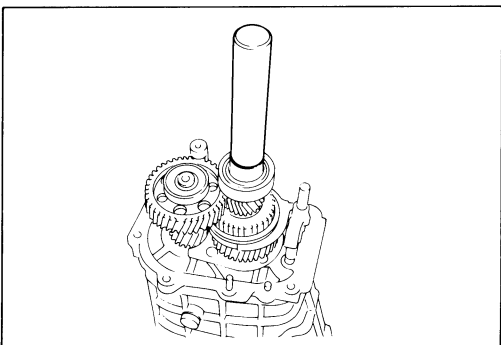
If required, replace the existing thrust washer with a new thrust washer to bring the clearance to specification.

There are four thrust washer sizes available. The snap rings are color-coded to indicate their thickness.

Thrust Washer Availability		mm(in)
Thickness	Color-Coding	
7.9 (0.311)	White	
8.0 (0.315)	Yellow	
8.1 (0.319)	Green	
8.2 (0.323)	Blue	



- 2) Apply grease to the thrust washer and the lock ball.
- 3) Install the thrust washer and the lock ball.

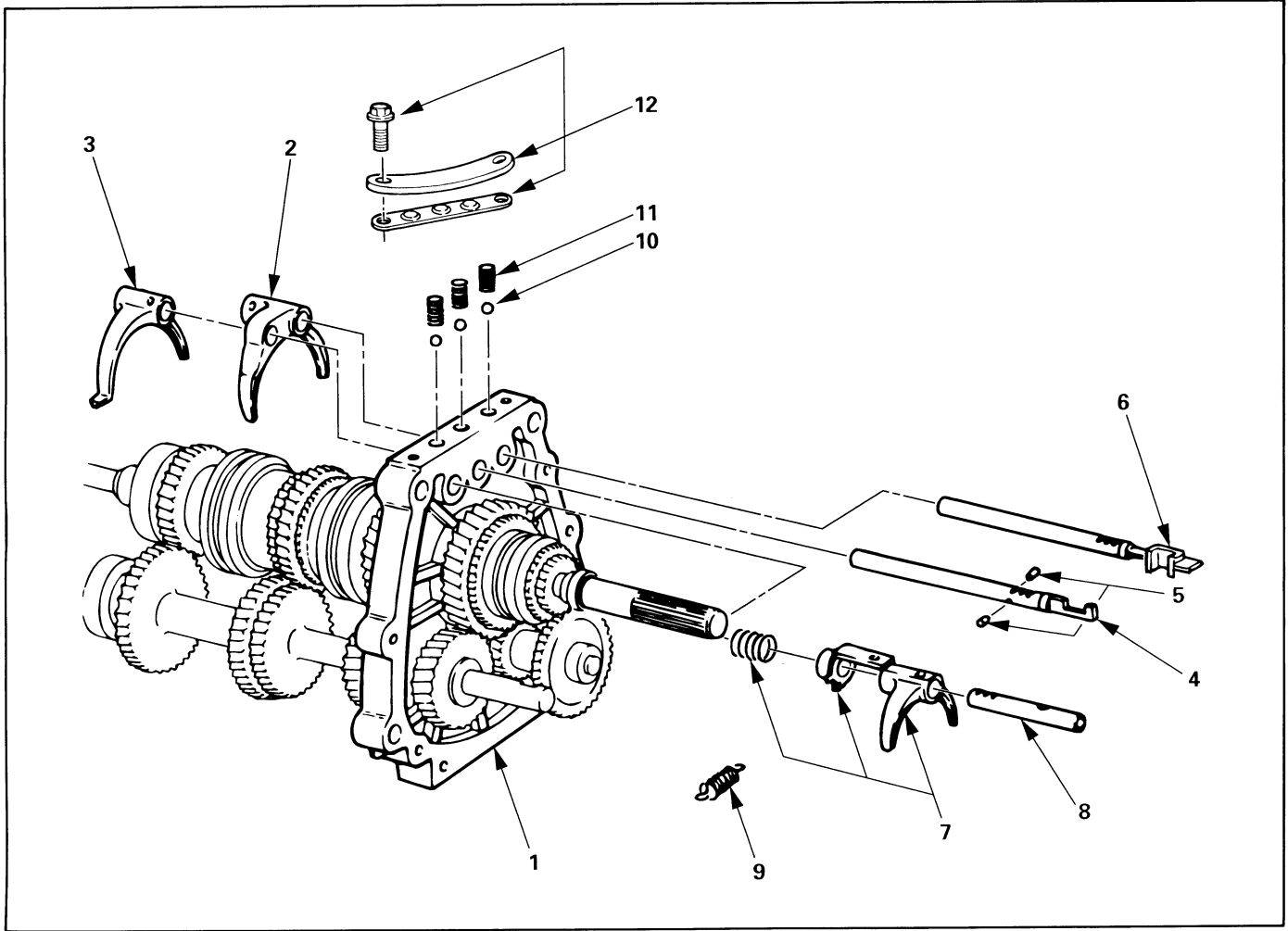


28. Ball Bearing

Use the installer to install the ball bearing to the mainshaft.
 Installer: 5-8840-2159-0 (J-37223)



INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM ASSEMBLY, AND INTERLOCK PIN



220RW072

Reassembly Steps

- | | |
|---|--|
| 1. Intermediate plate and gear assembly | 7. Rev-5th shift arm and reverse inhibitor |
| 2. 1st-2nd shift arm | 8. Rev-5th shift rod |
| 3. 3rd-4th shift arm | 9. Spring |
| ▲ 4. 3rd-4th shift rod | 10. Detent ball |
| ▲ 5. Interlock pin | 11. Detent spring |
| 6. 1st-2nd shift rod | ▲ 12. Detent spring plate and gasket |



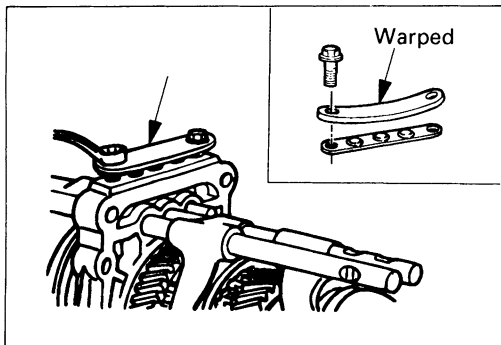
Important Operations

4. 3rd-4th Shift Rod

5. Interlock Pin

- 1) Install the interlock pin to the shift rod.
- 2) Install the shift rod together with the interlock pin to the intermediate plate.

Do not allow the interlock pin to fall from the shift rod.



220LV017



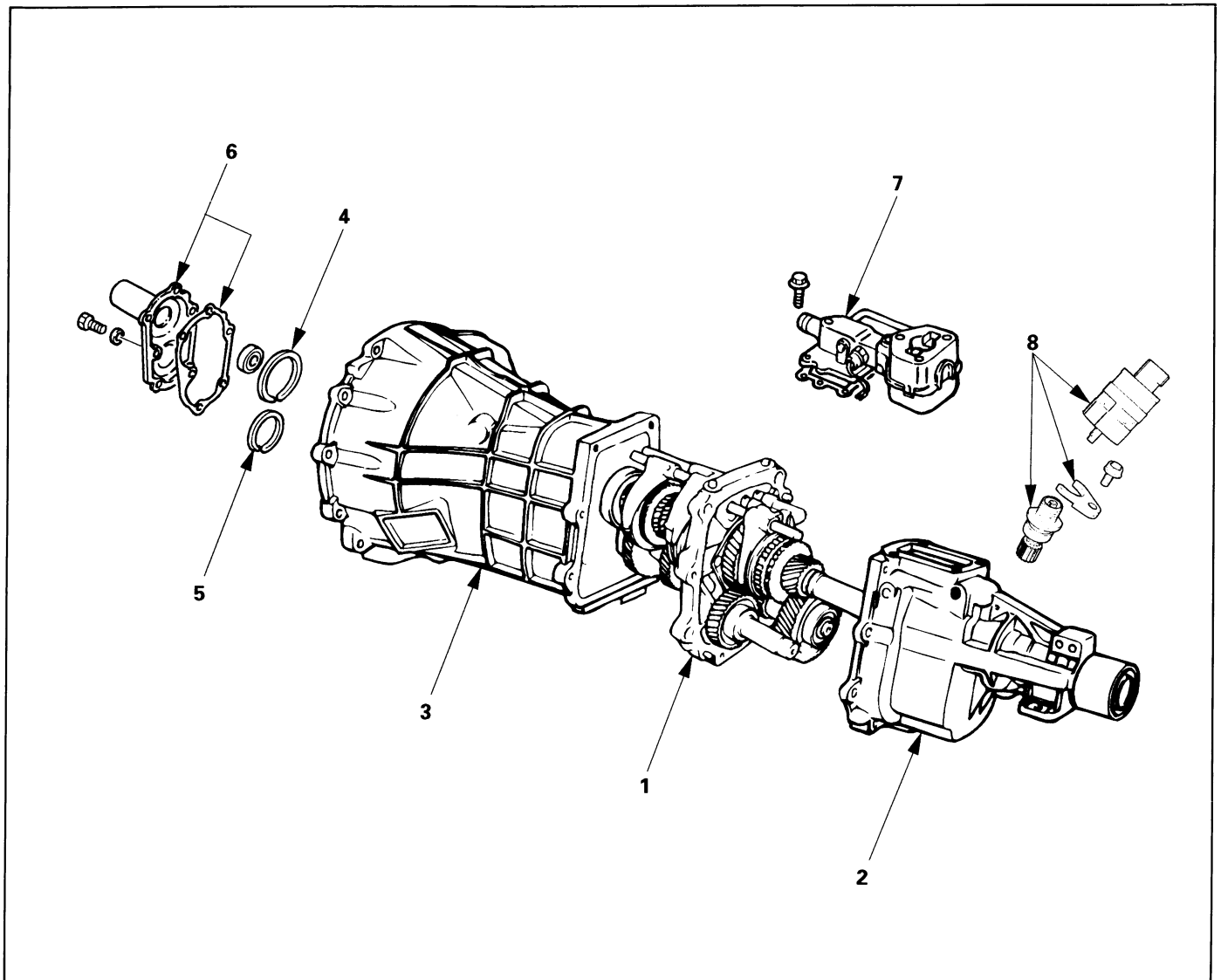
12. Detent Spring Plate and Gasket

- 1) Install the new-detent plate and new gasket onto the transmission case into the correct direction.
- 2) Tighten the detent spring plate bolts to the specified torque.

Detent Spring Plate Bolt Torque	kg·m(lb·ft/N·m)
	2.0 ± 0.4 ($14 \pm 3/20 \pm 4$)



MAJOR COMPONENTS



220LV005

Reassembly Steps

- ▲ 1. Intermediate plate with gear assembly
- ▲ 2. Rear cover with oil seal
- ▲ 3. Transmission case
- ▲ 4. Front bearing snap ring
- ▲ 5. Counter front bearing snap ring
- ▲ 6. Front cover with oil seal
- ▲ 7. Gear control box assembly
- ▲ 8. Speedometer driven gear and speedometer sensor

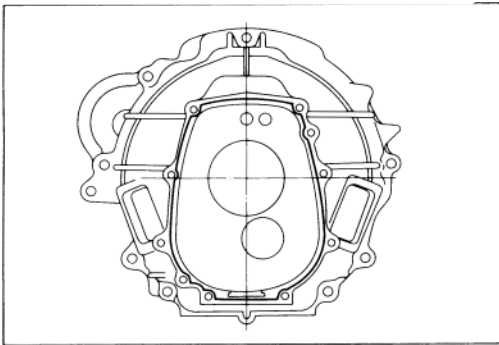


Important Operations

1. Intermediate Plate with Gear Assembly

- 1) Apply a light coat of oil to the transmission case top gear shaft ball bearing fitting faces and the shift rods. This will facilitate smooth installation.
- 2) Install the intermediate plate assembly.
- 3) Pull out the top gear shaft until the ball bearing snap ring groove protrudes from the transmission case front cover fitting face.

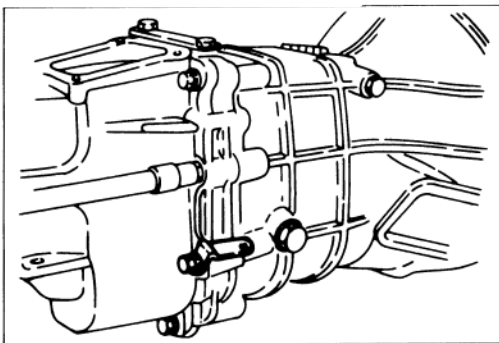
Avoid subjecting the mainshaft to sudden shock or stress.



2. Rear Cover with Oil Seal

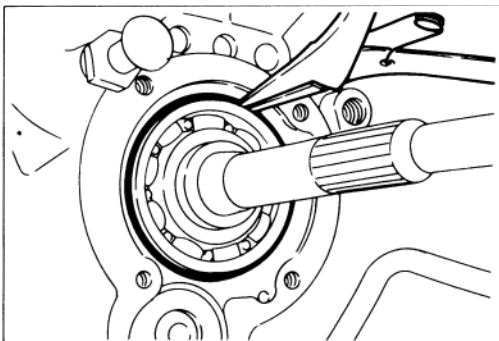
3. Transmission Case

- 1) Apply recommended liquid gasket or its equivalent to the transmission case and rear cover fitting surfaces.



- 2) Install the rear cover and the transmission case to the intermediate plate.
- 3) Tighten the rear cover bolts to the specified torque.

Rear Cover Bolt Torque	kg·m (lb·ft/N·m)
	3.8 ± 0.8 (27 ± 5.8 / 37 ± 7.8)

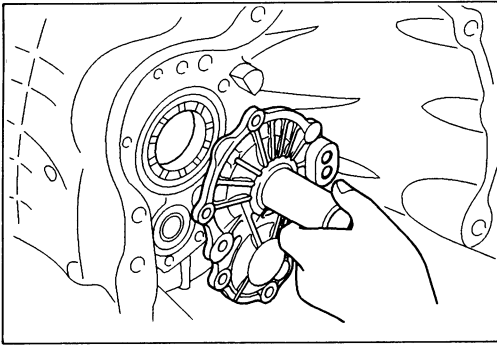


4. Front Bearing Snap Ring

5. Counter Front Bearing Snap Ring

Use a pair of snap ring pliers to install the snap rings to the mainshaft.

The snap rings must be fully inserted into the ball bearing snap ring groove.



220RT017

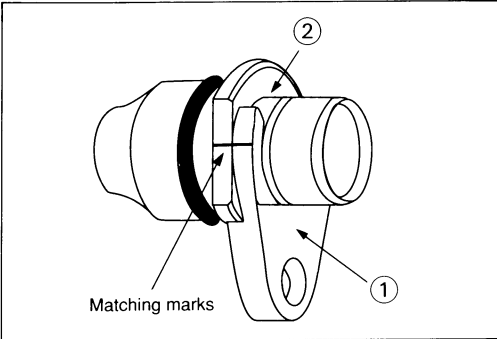


6. Front Cover with Oil Seal

- 1) Apply recommended liquid gasket or its equivalent to the through bolt threads.
- 2) Install the new gasket and the front cover to the transmission case
Take care not to damage the oil seal.
- 3) Tighten the front cover bolts to the specified torque.

Front Cover Bolt Torque kg·m (lb·ft/N·m)

 1.9 ± 0.4 ($13.7 \pm 2.9/18.6 \pm 3.9$)



Matching marks



7. Speedometer Driven Gear and Speedometer Sensor

- 1) Install the O-ring to the speedometer driven gear bushing.
- 2) Install the driven gear to the speedometer driven gear bushing.
- 3) Align the matching marks on plate ① and bush ②, then tighten the bolt.



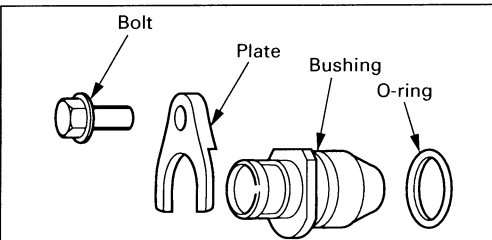
Bolt Torque kg·m (lb·ft/N·m)

 1.5 (10.8/14.7)

- 4) Install the speedometer sensor.

Speedometer Sensor Torque kg·m (lb·ft/N·m)

 2.8 (20/27)



Type	Drive gear teeth × Driven gear teeth
A	6 × 17 6 × 18
B	6 × 19 5 × 16

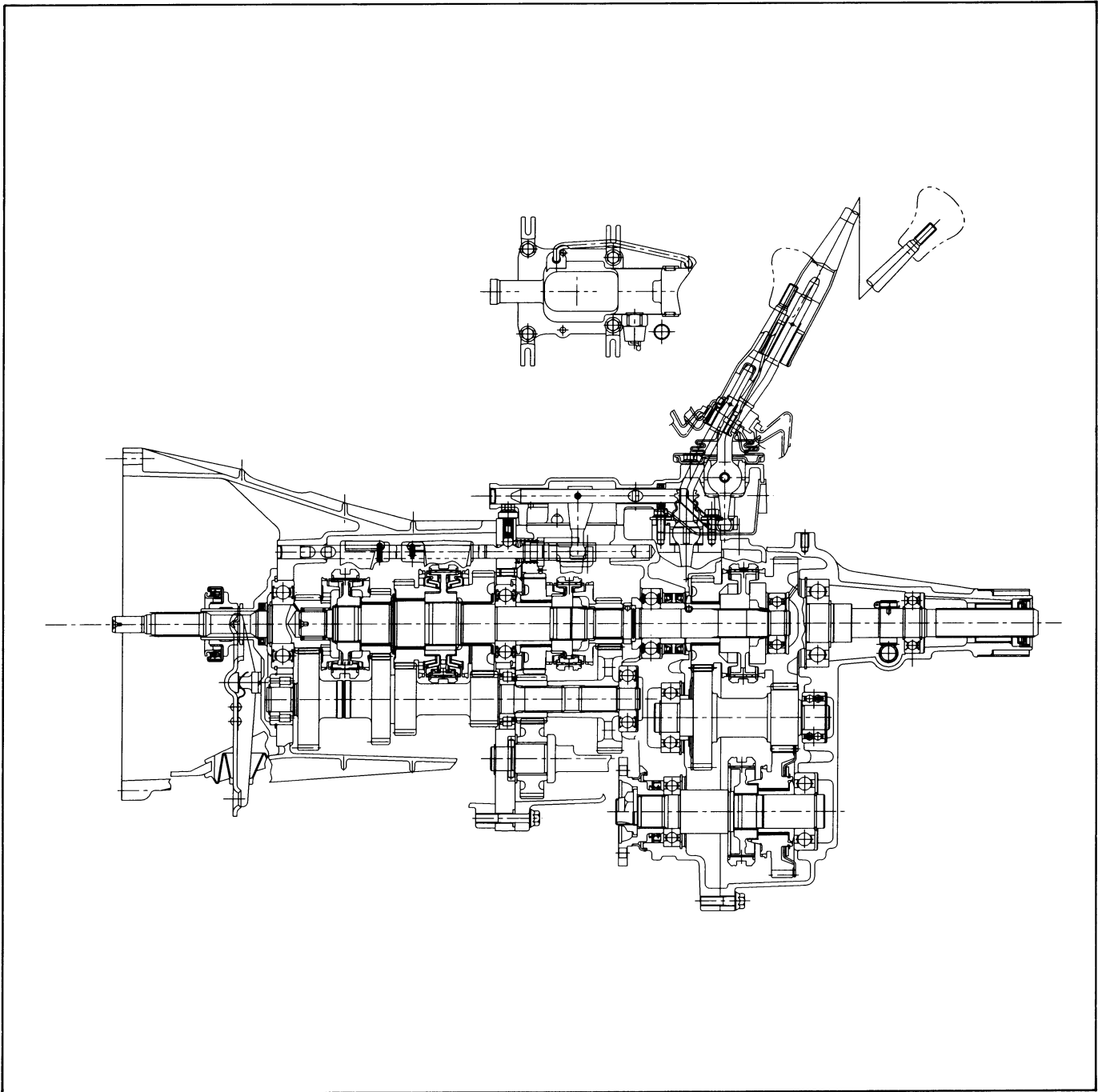
225RW009

4 x 4 MODEL TRANSMISSION

MAIN DATA AND SPECIFICATIONS

	MUA 5C	MUA 5S
Transmission type	Fully synchronized 5-forward and reverse gears.	
Transfer case type	Constant mesh type Low-High and 2H-4H gears.	
Gear ratio : Transmissior		
1st	3.767	4.357
2nd	2.248	2.502
3rd	1.404	1.501
4th	1.000	1.000
5th	0.809	0.809
Rev.	3.873	3.970
Transfer		
High	1.000	
Low	2.050	
Oil capacity : Transmission	lit (US gal.)	2.95 (0.78)
: Transfer	lit (US gal.)	1.45 (0.38)

GENERAL DESCRIPTION



A07LV004

The transmission is designed for the quietest possible operation.

A longer center distance (77.5 mm (3.05 in)) provides increased durability.

Principle parts of the transmission are the integral clutch housing, the intermediate plate, the rear cover, and the gears.

The gear control box is built-in to the transfer case.









Transfer gear ratio is 1 : 2.050.

TORQUE SPECIFICATIONS

STANDARD BOLTS

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

N·m (kg·m / lb·ft)

Strength Class		4.8/4T	7T	8.8		9.8/9T
				Refined	Non-Refined	
		Bolt Identification				
Bolt Diameter x Pitch (mm)	 No mark	—				
Standard Hex. Head Bolt	M6 x 1.0	6 (0.6 / 52 lb-in)	7 (0.7 / 61 lb-in)	8 (0.8 / 69 lb-in)		—
	M8 x 1.25	13 (1.3 / 113 lb-in)	17 (1.7 / 12)	20 (2.0 / 14)		24 (2.4 / 17)
	M10 x 1.25	27 (2.8 / 20)	37 (3.8 / 27)	42 (4.3 / 31)		50 (5.1 / 37)
	M12 x 1.25	61 (6.3 / 45)	76 (7.8 / 56)	87 (8.9 / 64)		95 (9.7 / 70)
	M14 x 1.5	96 (9.8 / 71)	116 (11.8 / 85)	133 (13.6 / 98)		142 (14.5 / 105)
	M16 x 1.5	130 (13.3 / 96)	170 (17.3 / 125)	193 (19.7 / 143)		200 (20.4 / 148)
	M18 x 1.5	188 (19.2 / 139)	244 (24.9 / 180)	278 (28.3 / 205)		287 (29.3 / 212)
	M20 x 1.5	258 (26.3 / 190)	337 (34.4 / 249)	385 (39.3 / 284)		396 (40.4 / 292)
	M22 x 1.5	332 (33.9 / 245)	453 (46.3 / 335)	517 (52.7 / 381)		530 (54.1 / 391)
	M24 x 2.0	449 (45.8 / 331)	570 (58.2 / 421)	651 (66.3 / 480)		692 (70.6 / 511)
	* M10 x 1.5	26 (2.7 / 20)	36 (3.7 / 27)	41 (4.2 / 30)		48 (4.9 / 35)
	* M12 x 1.75	57 (5.8 / 42)	71 (7.2 / 52)	80 (8.2 / 59)		89 (9.1 / 66)
	* M14 x 2.0	89 (9.1 / 66)	110 (11.2 / 81)	125 (12.7 / 92)		133 (13.6 / 98)
* M16 x 2.0	124 (12.7 / 92)	162 (16.5 / 119)	185 (18.9 / 137)		191 (19.5 / 141)	
Flange Bolt	M6 x 1.0	7 (0.7 / 61 lb-in)	8 (0.8 / 69 lb-in)	9 (0.9 / 78 lb-in)		—
	M8 x 1.25	15 (1.5 / 11)	19 (1.9 / 14)	22 (2.2 / 16)		26 (2.7 / 20)
	M10 x 1.25	31 (3.2 / 23)	41 (4.2 / 30)	47 (4.8 / 35)		56 (5.7 / 41)
	M12 x 1.25	69 (7.0 / 51)	85 (8.7 / 63)	97 (9.9 / 72)		106 (10.8 / 78)
	M14 x 1.5	104 (10.6 / 77)	126 (12.8 / 93)	144 (14.6 / 106)		154 (15.7 / 114)
	M16 x 1.5	145 (14.8 / 127)	188 (19.2 / 139)	214 (21.8 / 158)		221 (22.5 / 163)
	M18 x 1.5	—	—	—		—
	M20 x 1.5	—	—	—		—
	M22 x 1.5	—	—	—		—
	M24 x 2.0	—	—	—		—
	* M10 x 1.5	30 (3.1 / 22)	40 (4.1 / 30)	46 (4.7 / 34)		54 (5.5 / 40)
	* M12 x 1.75	64 (6.5 / 47)	78 (8.0 / 58)	89 (9.1 / 66)		99 (10.1 / 73)
	* M14 x 2.0	97 (9.9 / 72)	119 (12.1 / 88)	135 (13.8 / 99.7)		144 (14.7 / 107)
* M16 x 2.0	137 (14.0 / 101)	178 (18.2 / 132)	203 (20.7 / 150)		210 (21.5 / 155)	

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

FLARE NUTS

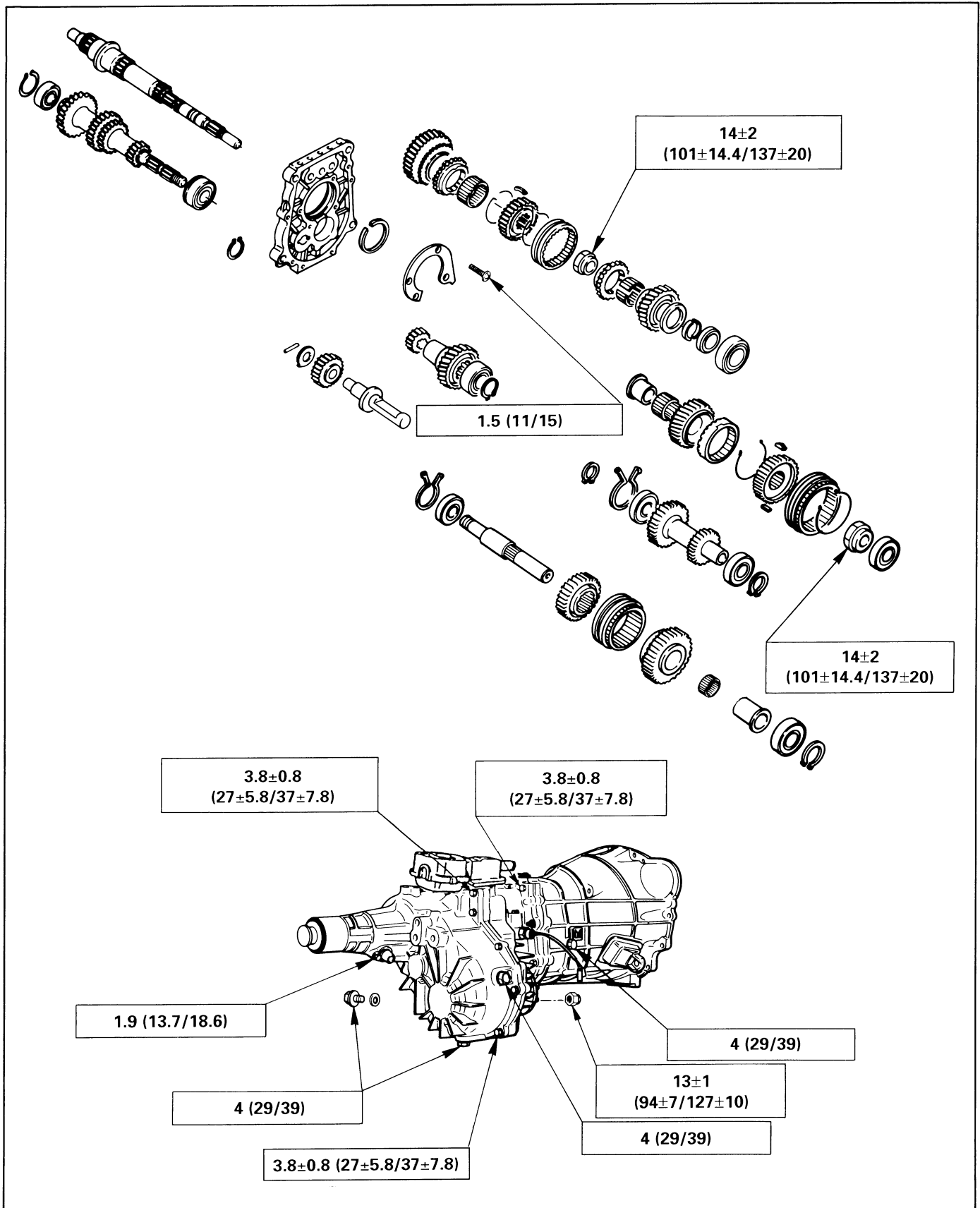
N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



SPECIAL PARTS FIXING NUTS AND BOLTS

kg·m (lb.ft/N·m)





RECOMMENDED LIQUID GASKET

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	For Engine Repairs
	ThreeBond 1215 ThreeBond 1281	Three Bond Three Bond	For Axle Case and Transmission Repairs
Water Base	ThreeBond 1141E	Three Bond	For Engine Repairs
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anerobic	LOCTITE 515 LOCTITE 518	Loctite Loctite	All

* RTV : Room Temperature Vulcanizer

Note:

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

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



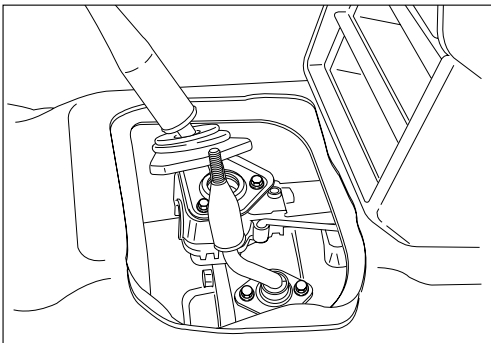
Important Operations - Removal

Battery Cable

Disconnect the negative (-) cable from the battery terminal.

Engine Hood

Apply setting marks to the engine hood and the engine hood hinges before removing the engine hood.



235RT004

Gear Shift Lever and Transfer Change Lever

1. Place the gear shift lever in the neutral position.
2. Place the transfer change lever in the "H" position.
3. Remove the gear shift lever knob and transfer change lever knob.
4. Remove the center console assembly and front console assembly.
5. Remove the grommet and dust cover.
6. Remove the gear shift lever cover bolt.
7. Remove the gear shift lever.
8. Remove the transfer change lever retainer bolts.
9. Remove the transfer change lever and O-ring.

Note:

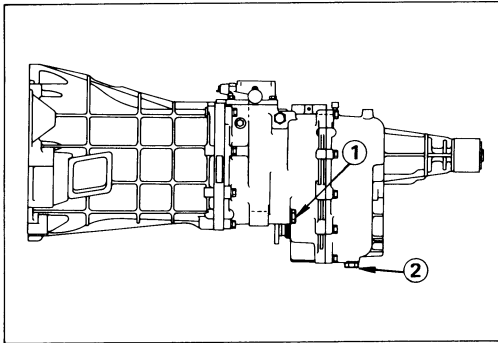
Cover the shift lever and change lever holes to prevent the entry of foreign material into the transmission.

Lifting the Vehicle

1. Jack up the vehicle.
2. Place chassis stands at the front and the rear of the vehicle.

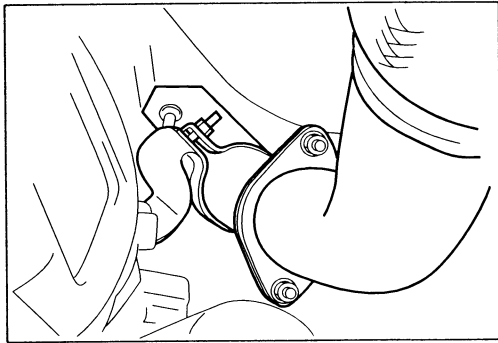
Transfer Case Protector (Except 00 Year or Subsequent ones)

Remove the transfer case protector from the transmission mounting member and the side member.



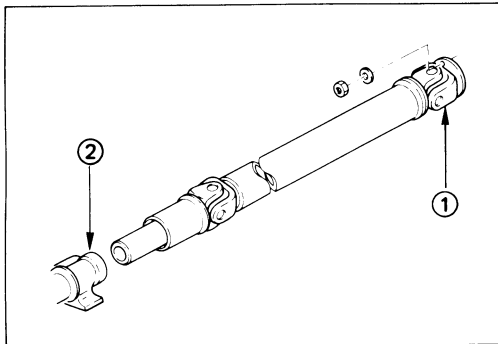
Transmission and Transfer Case Oil Draining

1. Remove the transmission oil drain plug ①.
2. Remove the transfer case oil drain plug ②.
3. Replace the drain plug(s) after draining the oil.



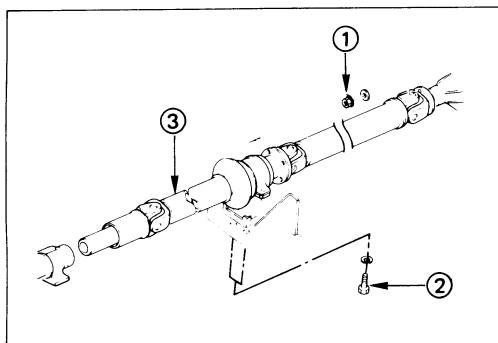
Exhaust Pipe

1. Remove the exhaust pipe bracket from the transmission case.
2. Remove the front exhaust pipe and 2nd-3rd exhaust pipe.



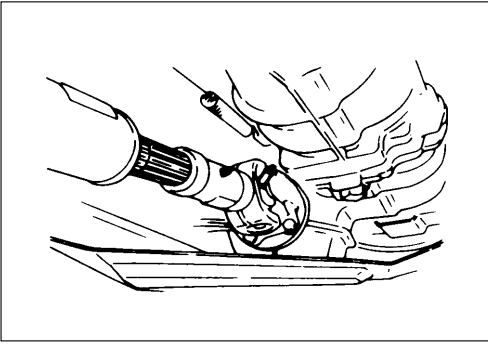
Rear Propeller Shaft (Single Shaft Type)

1. Remove the propeller shaft flange yoke at the drive pinion side ①.
2. Remove the propeller shaft from the transmission main shaft spline ②.



Rear Propeller Shaft (Dual Shaft Type)

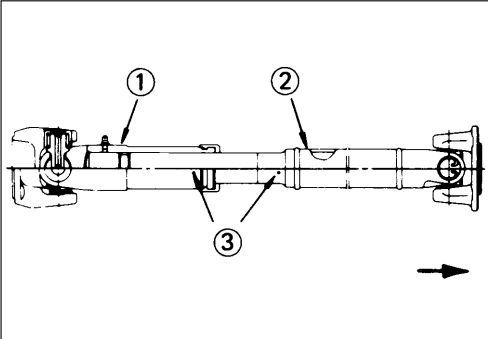
1. Apply setting marks to the 2nd propeller shaft flange yoke.
This will prevent mispositioning during the installation procedure.
2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
3. Remove the center bearing retainer bolts ②.
4. Remove the 1st propeller shaft ③ with the center bearing and the 2nd propeller shaft.
Pull the 1st propeller shaft toward the rear of the vehicle until the spline yoke is free of the transmission main shaft.



Front Propeller Shaft

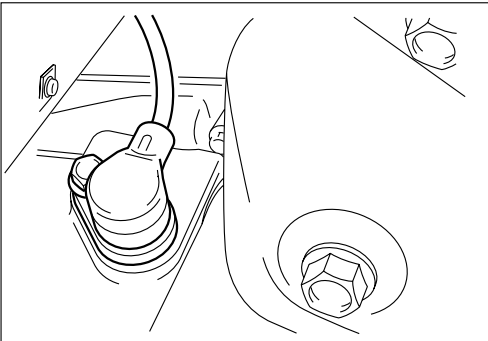
Remove the splined yoke flange bolt at the transfer case side.

Do not allow the splined yoke to fall away from the front propeller shaft.



If the splined yoke should fall away from the front propeller shaft, align the setting marks ③ on the splined yoke ① and the propeller shaft ② to reassemble the two parts.

The setting marks ③ are punched circles approximately 3 mm (0.12 in) in diameter.



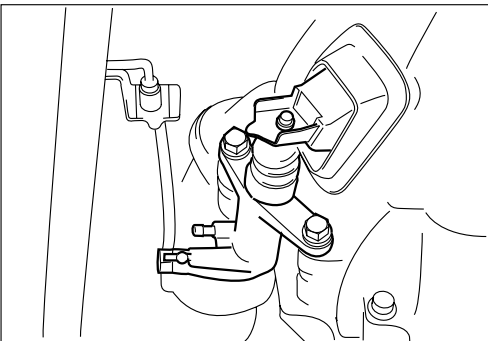
220R200001

TDC Sensor (4JA1TC Model)

Disconnect the TDC sensor from the transmission housing.

Harness Connector

Disconnect the 4WD switch connectors, back up light switch connector and the speedometer sensor connector.



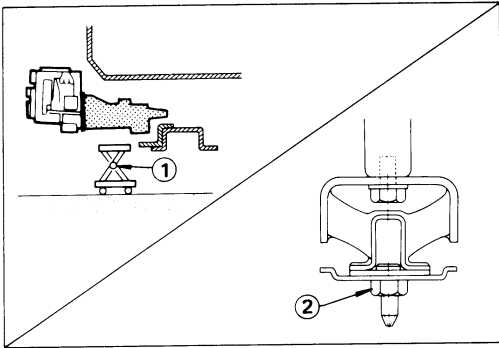
220LV019

Slave Cylinder

Remove the slave cylinder from the transmission case.

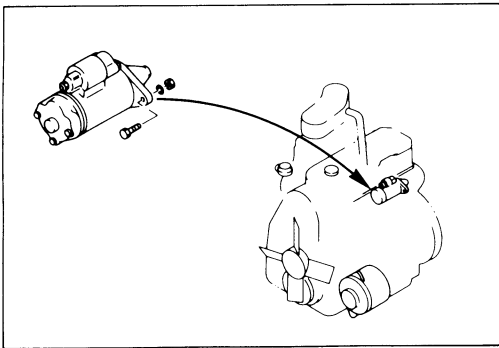
Engine Lifting Hanger

1. Attach the engine lifting hanger to the front portion of the engine.
2. Attach the lifting wire to both ends of the engine lifting hange.



Engine Rear Mounting and Mounting Member

1. Support the transmission with a transmission jack (1).
2. Remove the engine rear mounting nuts (2).
3. Remove the engine rear mounting bolts.
4. Loosen the mounting member bolts.
5. Remove the mounting member from the sidemembers.
6. Remove the engine rear mounting.

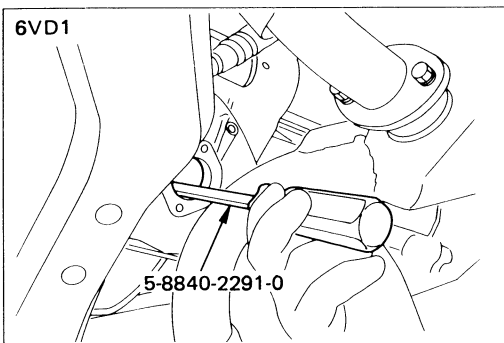


Starter Motor

Remove the starter motor from the engine rear plate.

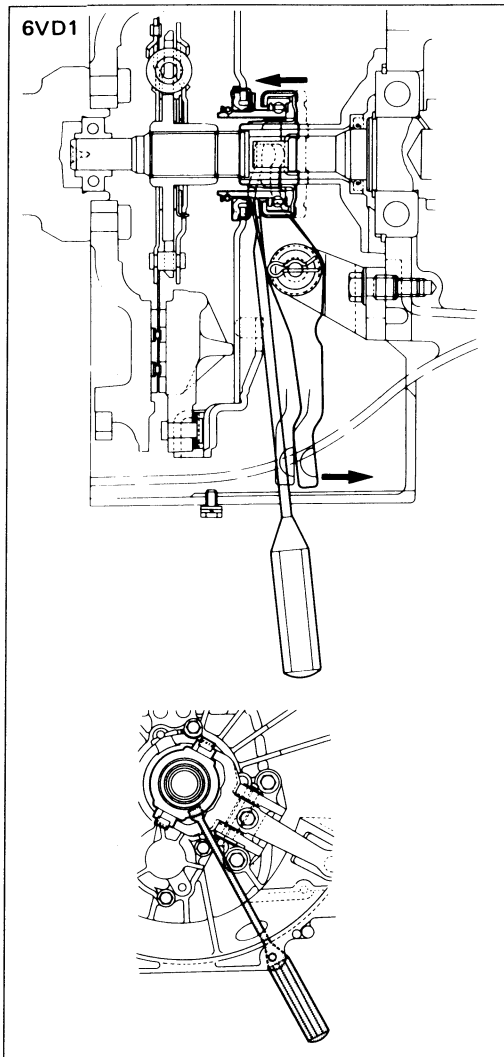
Flywheel Under Cover (6VD1)

Remove flywheel under cover bolts.



Transmission with Transfer

1. Use the remover for disconnect the clutch release bearing from the clutch pressure plate (6VD1).
Clutch release bearing remover: 5-8840-2291-0 (J-39207)

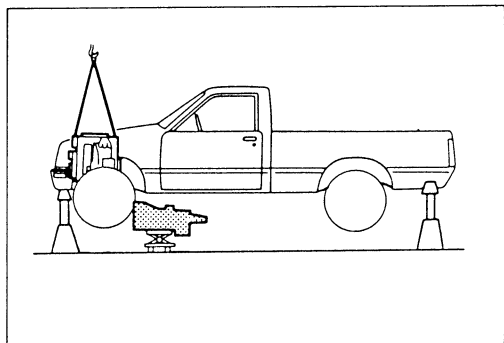


Release Bearing Disconnection (6VD1)

- ① Pull the shift fork toward the transmission to press the clutch release bearing against the clutch.
- ② Insert the clutch release bearing remover between the wedge collar and the release bearing.
- ③ Turn the remover to separate the release bearing.

NOTE:

Be sure not to insert the remover between the wedge collar and the clutch.

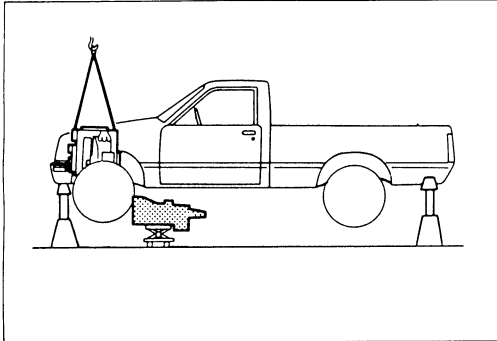


2. Remove the transmission nuts and bolts from the engine rear plate.
3. Carefully pull the transmission with the transmission jack toward the rear of the vehicle.
4. Operate the transmission jack to slowly lower the transmission.



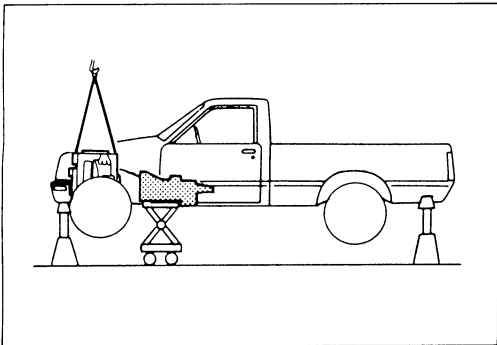
Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



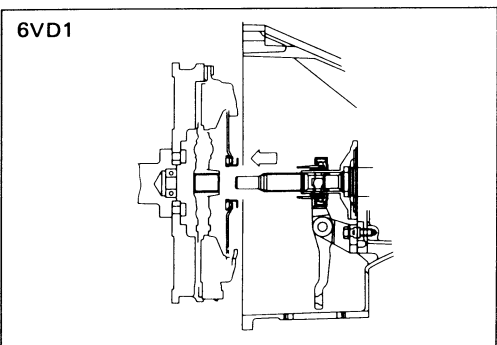
Transmission with Transfer

1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Place the transmission on a transmission jack.
3. Carefully move the transmission jack and transmission into position behind the engine.



4. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

The slope of the engine and the transmission must be the same.

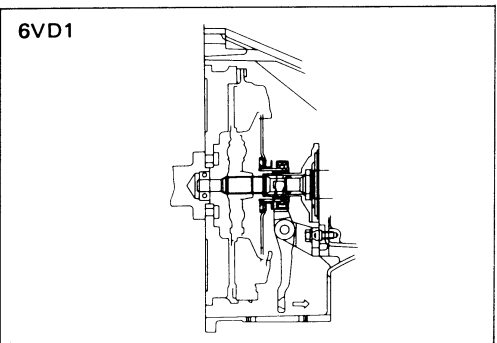


5. Align the top gear shaft spline with the clutch driven plate spline.

6. Install the transmission to the engine.

Tighten the transmission nuts and bolts to the specified torque.

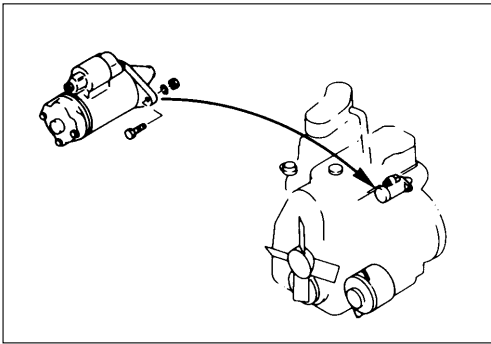
Transmission Nut and Bolt Torque	kg·m(lb·ft/N·m)
M10:	4.1 ± 1.0 ($30 \pm 7.2/40 \pm 10$)
M12:	8.0 ± 1.6 ($58 \pm 12/78 \pm 16$)



7. Apply a force of 59–78N (6–8 kg / 13.2–17.6 lb) to the tip of the shift fork in the direction of the transmission to engage the clutch pressure plate and release bearing (6VD1).

NOTE (6VD1):

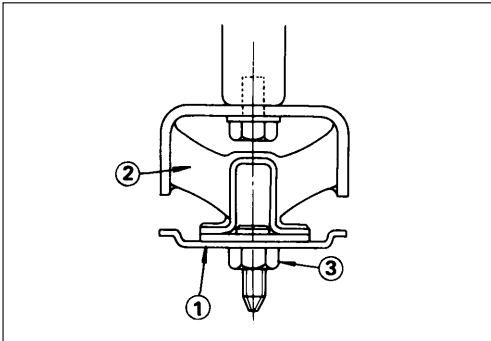
A click sound is heard when the release bearing and the tip of the diaphragm spring engage each other. Check to see if they are securely engaged by pushing the tip of the shift fork toward the engine while applying a force of about 25N (2.5 kg / 5.5 lb). If the shift fork will not move, then they are securely engaged.



Starter Motor

1. Install the starter motor to the engine rear plate.

Starter Motor Bolt Torque	kg·m (lb·ft/N·m)
$8.0 \pm 1.6 (58 \pm 12/78 \pm 16)$	



Engine Rear Mounting and Mounting Member

1. Install the engine rear mounting to the transmission.

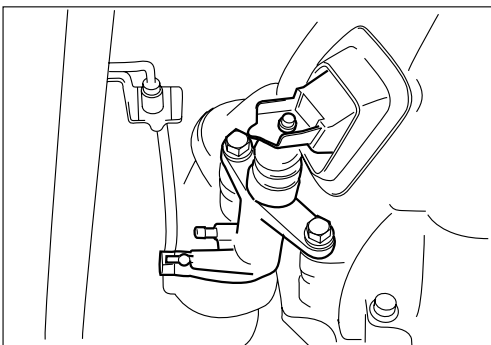
Rear Mounting Bolt Torque	kg·m (lb·ft/N·m)
$4.2 \pm 0.5 (30 \pm 3.6/41 \pm 4.9)$	

2. Install the mounting member ① to the mounting rubber ②.

Mounting Rubber Nut Torque	kg·m (lb·ft/N·m)
$5.1 \pm 0.6 (37 \pm 4.3/50 \pm 6)$	

3. Install the mounting member to the sidemembers.

Mounting Member Bolt Torque	kg·m (lb·ft/N·m)
$5.1 \pm 0.6 (37 \pm 4.3/50 \pm 6)$	



220LV019



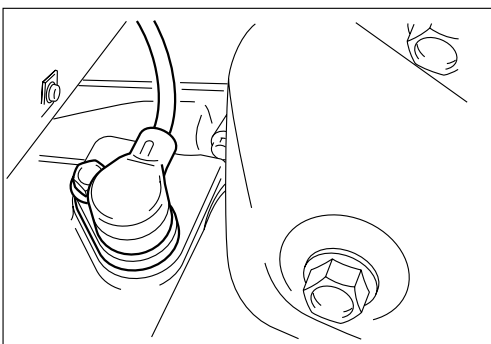
Slave Cylinder

Install the slave cylinder to the transmission case.

Slave Cylinder Bolt Torque	kg·m (lb·ft/N·m)
$4.1 \pm 1.0 (30 \pm 7.2/40 \pm 10)$	

Harness Connector

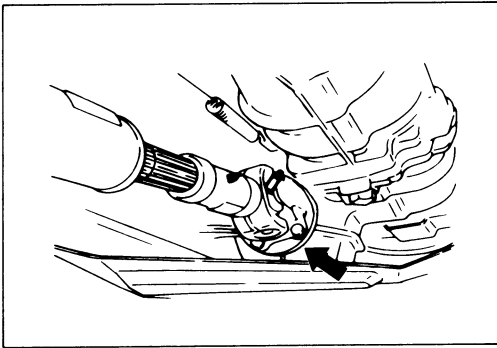
Disconnect the 4WD switch connectors back up light switch connector and speedometer sensor connector.



220R200001

TDC Sensor (4JA1TC Model)

Connect the TDC sensor from the transmission housing.



Front Propeller Shaft

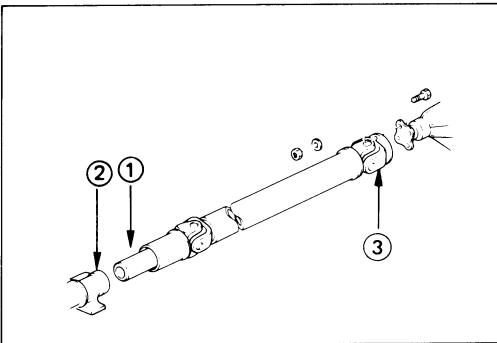
1. Connect the propeller shaft flange yoke to the matching flange.
2. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m (lb·ft/N·m)
	6.4 ± 0.4 ($46.3 \pm 2.9/62.7 \pm 3.9$)

Note:

If the splined yoke and the front propeller shaft have accidentally separated, align their setting marks and recouple them.

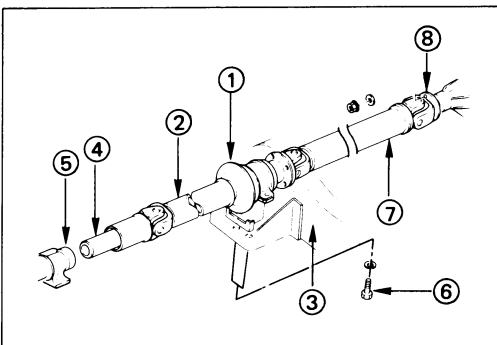
Refer to "FRONT PROPELLER SHAFT REMOVAL".



Rear Propeller Shaft (Single Shaft Type)

1. Insert the splined yoke ① with the propeller shaft into the transmission main shaft spline ②.
2. Install the propeller shaft flange yoke ③ to the drive pinion side.
3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m (lb·ft/N·m)
	6.4 ± 0.4 ($46.3 \pm 2.9/62.7 \pm 3.9$)



Rear Propeller Shaft (Dual Shaft Type)

1. Place the center bearing ① together with the 1st propeller shaft ② and 2nd propeller shaft ⑦ on the No.4 crossmember ③.
2. Insert the splined yoke ④ into the transmission main shaft spline ⑤.
3. Tighten the center bearing retainer bolts ⑥ to the specified torque.

Center Bearing Retainer Bolt Torque	kg·m(lb·ft/N·m)
	6.2 ± 1.2 ($44.8 \pm 8.7/60.8 \pm 11.8$)

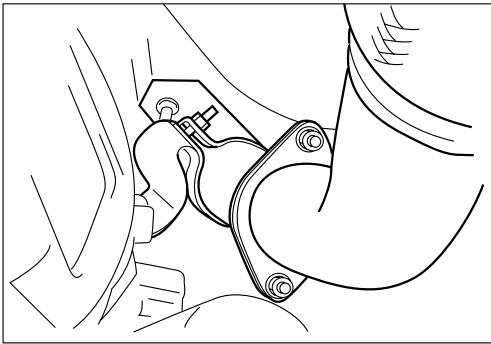
4. Connect the 2nd propeller shaft ⑦ and drive pinion side ⑧.

Be sure to align the setting marks applied at disassembly.

5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m(lb·ft/N·m)
	6.4 ± 0.4 ($46.3 \pm 2.9/62.7 \pm 3.9$)

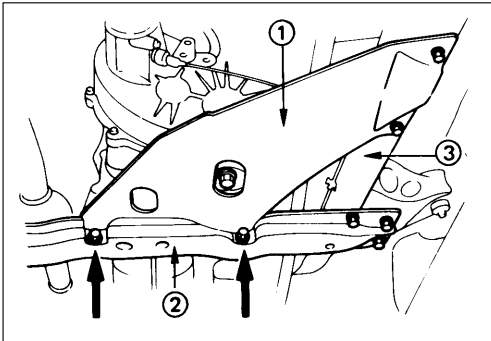




220LV018

Exhaust Pipe

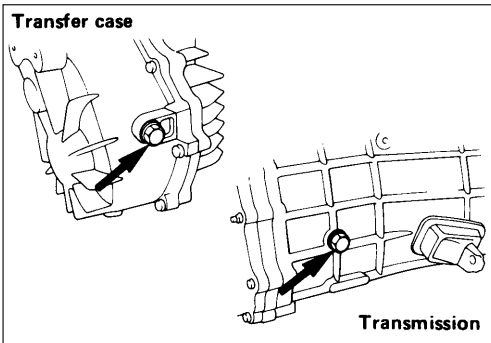
1. Connect the front exhaust pipe and 2nd-3rd exhaust pipe.
2. Install the exhaust pipe bracket to the transmission case.



Transfer Case Protector (Except 00 Year or Subsequent ones)

1. Install the transfer case protector ① to the mounting member ② and the sidemembers ③.
2. Tighten the transfer case protector bolts to the specified torque.

Transfer Case Protector Bolt Torque	kg·m (lb·ft/N·m)
	3.7 ± 1.0 (26.8 ± 7.2/36.3 ± 9.8)



Gear Shift Lever and Transfer Change Lever

1. Replenish the transmission case and the transfer case with the specified engine oil.



Transmission and Transfer Case Oil	lit (US/UK qt.)
Transmission Case	2.95 (3.12/2.6)
Transfer Case	1.45 (1.53/1.28)



2. Install the gear shift lever to the gear control box.

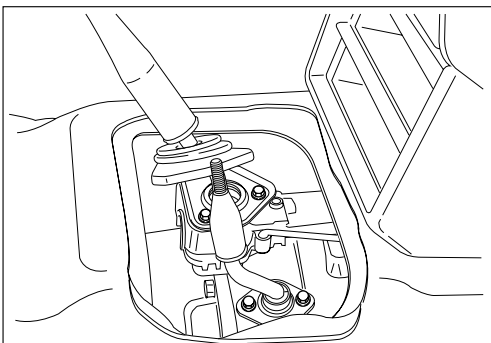
Shift Lever Cover Bolt Torque	kg·m (lb·ft/N·m)
	2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 1.96)



3. Install the dust cover.

4. Insert the transfer change lever to the transfer case.

Change Lever Retainer Bolt Torque	kg·m (lb·ft/N·m)
	2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 1.96)



235RT004

5. Install the grommet.

6. Install the front console assembly and center console assembly.

7. Install the gear shift lever and the transfer change lever knobs.

Lowering the Vehicle

1. Place a jack beneath the vehicle.
2. Raise the jack to remove the chassis stands.
3. Lower the vehicle to the ground.

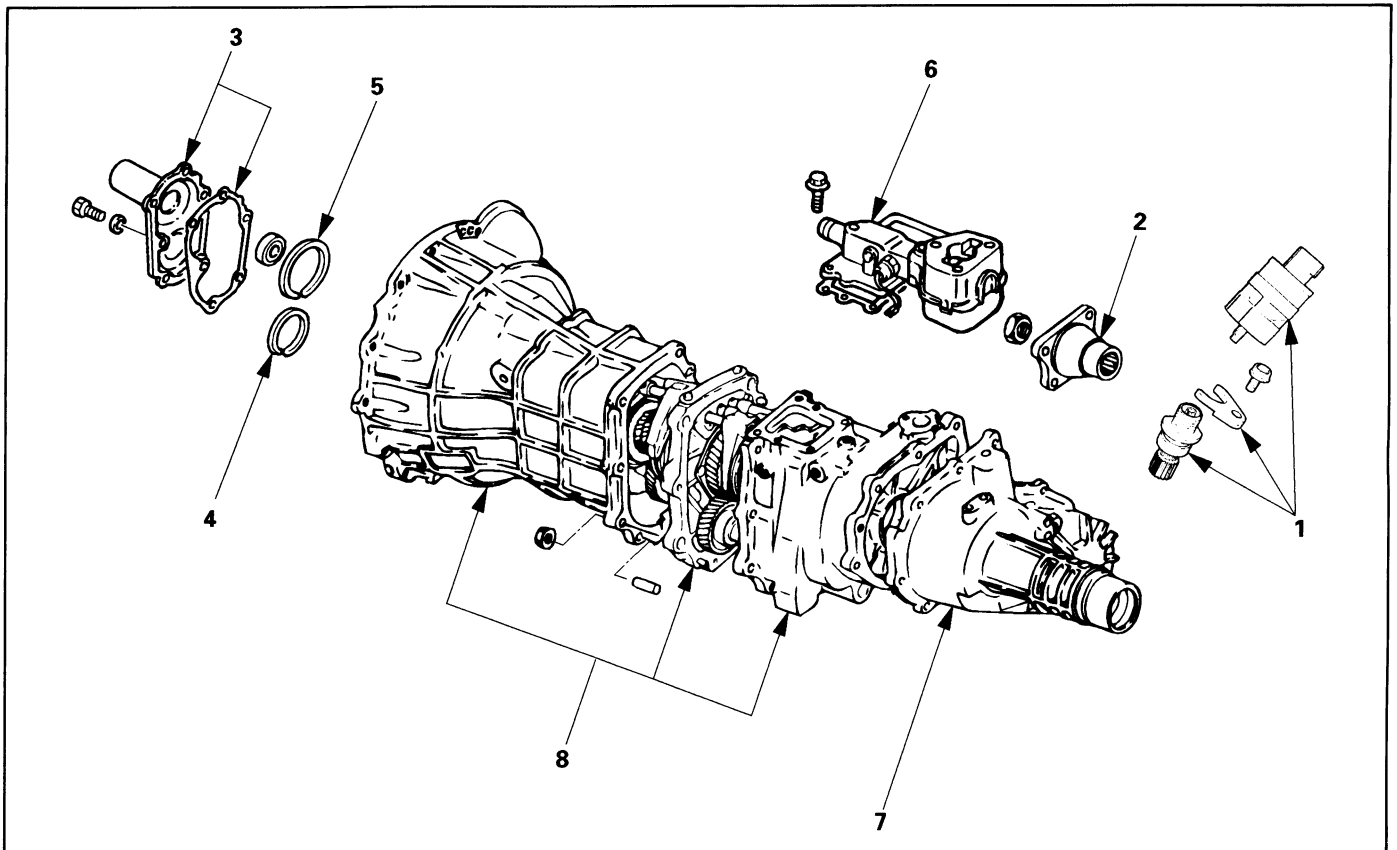
Engine Hood

Align the setting marks (applied at removal) on the engine hood and the engine hood hinges to install the engine hood.

Battery Cable

Connect the negative (-) cable to the battery terminal.

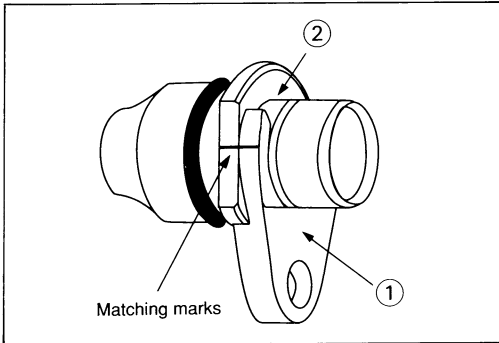

DISASSEMBLY
EXTERAL COMPONENTS



220LV002

Disassembly Steps

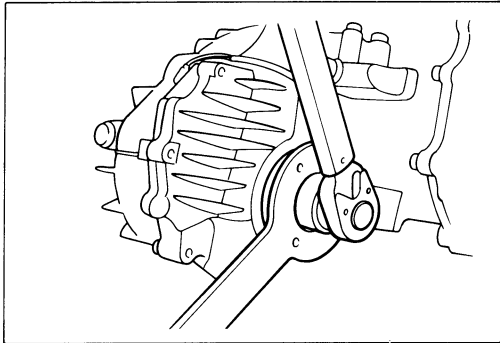
- ▲ 1. Speedometer sensor and speedometer driven gear
- ▲ 2. Transfer flange
- ▲ 3. Front cover with oil seal
- ▲ 4. Counter gear snap ring
- ▲ 5. Bearing snap ring
- ▲ 6. Gear control box assembly
- ▲ 7. Transfer rear case assembly
- ▲ 8. Transmission and transfer case assembly



Important Operations

1. Speedometer Sensor and Speedometer Driven Gear

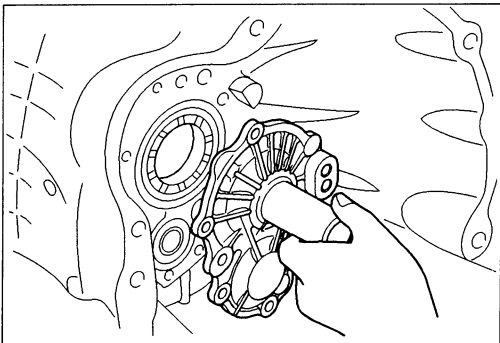
Mark the plate ① and bush ② alignment for reassembly.



2. Transfer Flange

Use the transfer flange holder to remove the transfer flange.

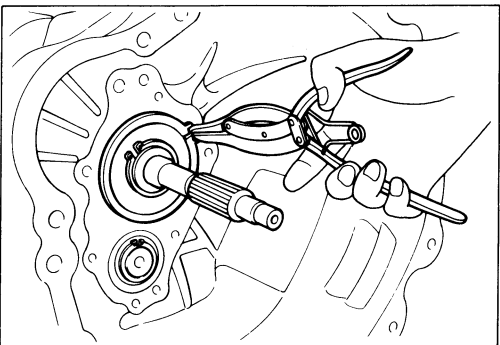
Transfer Flange Holder: 5-8840-2157-0 (J-37221)



220RT017

3. Front Cover with Oil Seal

Remove the front cover with oil seal from the transmission case.

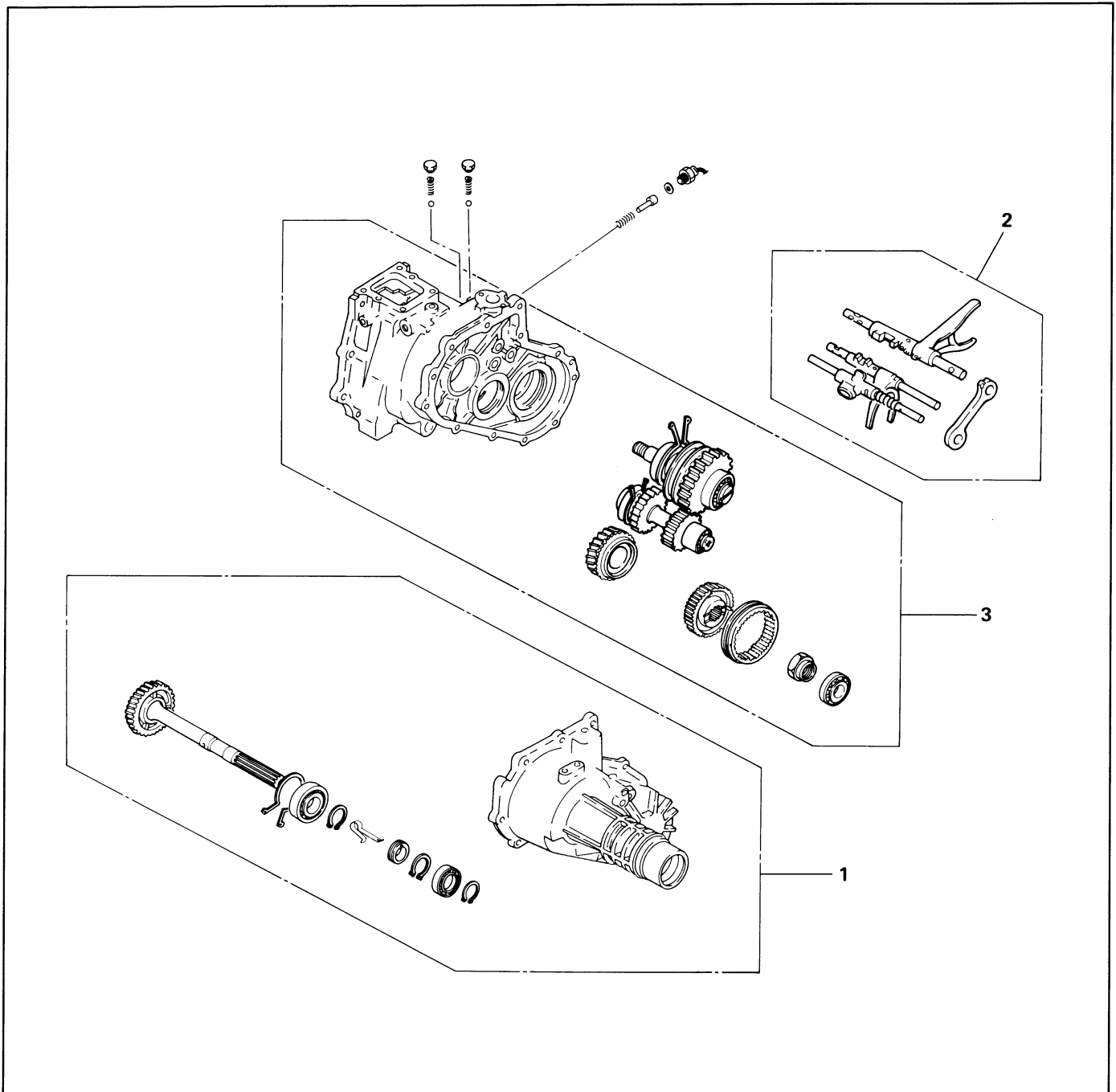


4. Counter Gear Snap Ring

5. Bearing Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

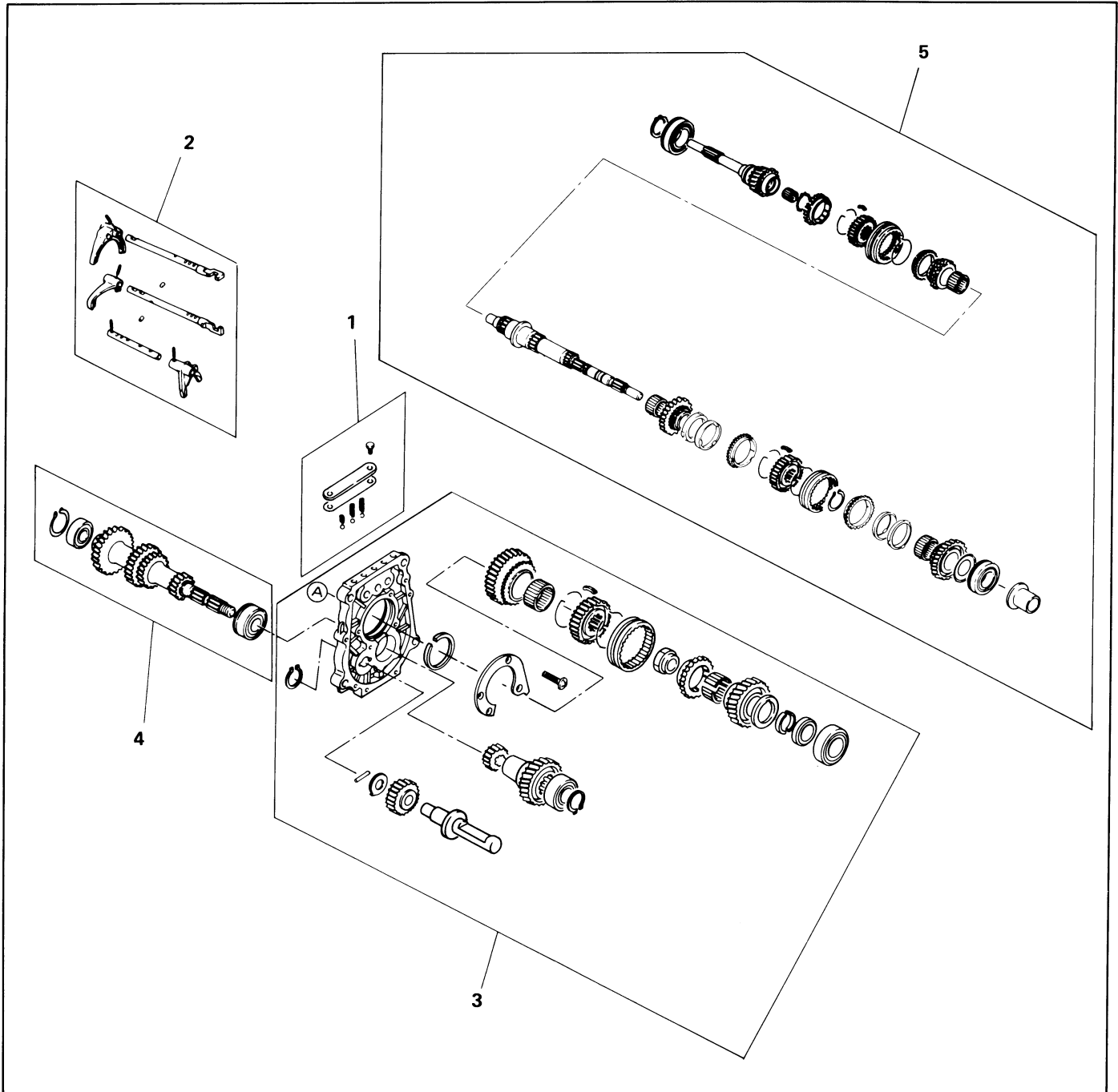
MAJOR COMPONENT (TRANSFER CASE)



Disassembly Steps

- 1 Transfer rear case assembly
2. Shift fork assembly & interlock pin & detent assembly
3. Transfer case assembly

MAJOR COMPONENT (TRANSMISSION)



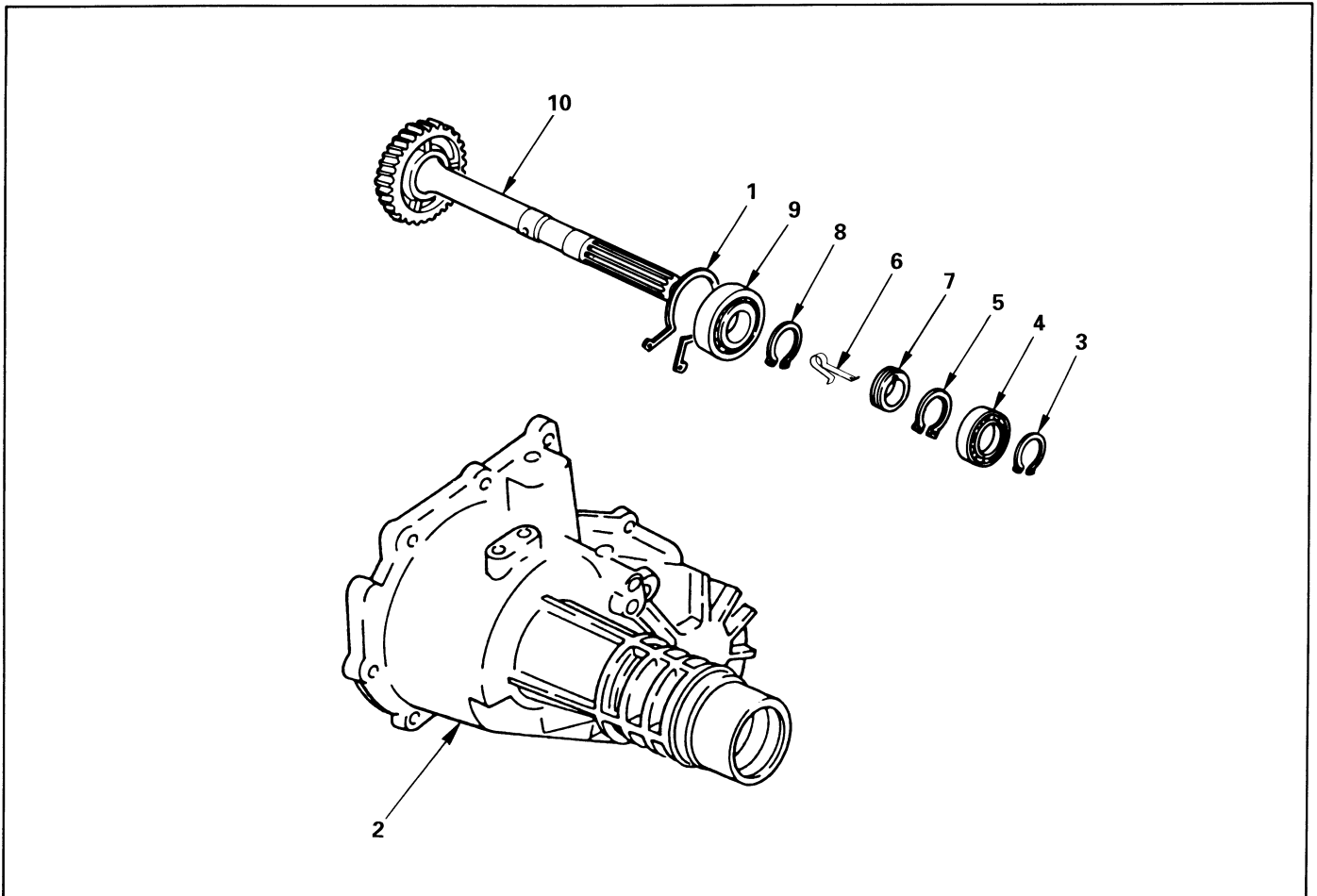
Disassembly Steps

1. Detent assembly
2. Shift fork assembly & interlock pin
3. Rev. and 5th gear assembly
4. Counter gear shaft assembly
5. Top & main gear shaft assembly

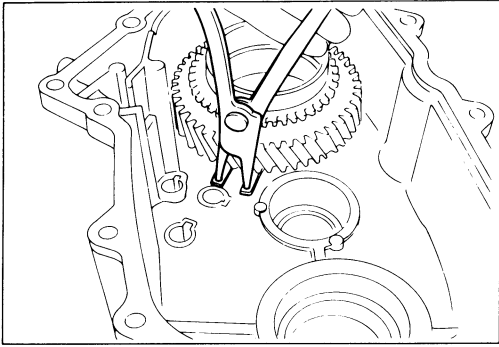
MINOR COMPONENT



TRANSFER REAR CASE ASSEMBLY

**Disassembly Steps**

- ▲ 1. Bearing snap ring
- 2. Transfer rear case
- 3. Bearing snap ring
- ▲ 4. Ball bearing
- 5. Bearing snap ring
- 6. Clip
- 7. Speedometer drive gear
- 8. Bearing snap ring
- ▲ 9. Ball bearing
- 10. Rear output shaft

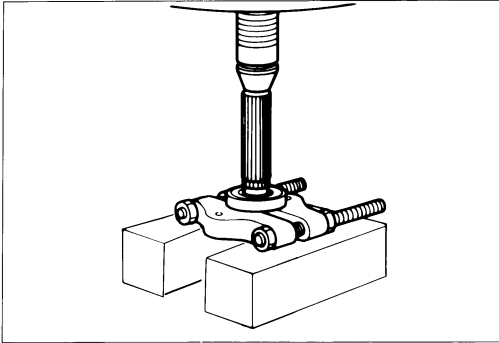


Important Operations



1. Bearing Snap Ring

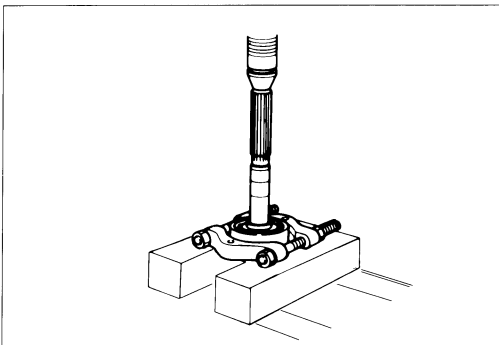
Use a pair of snap ring pliers to remove the snap ring.



4. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)

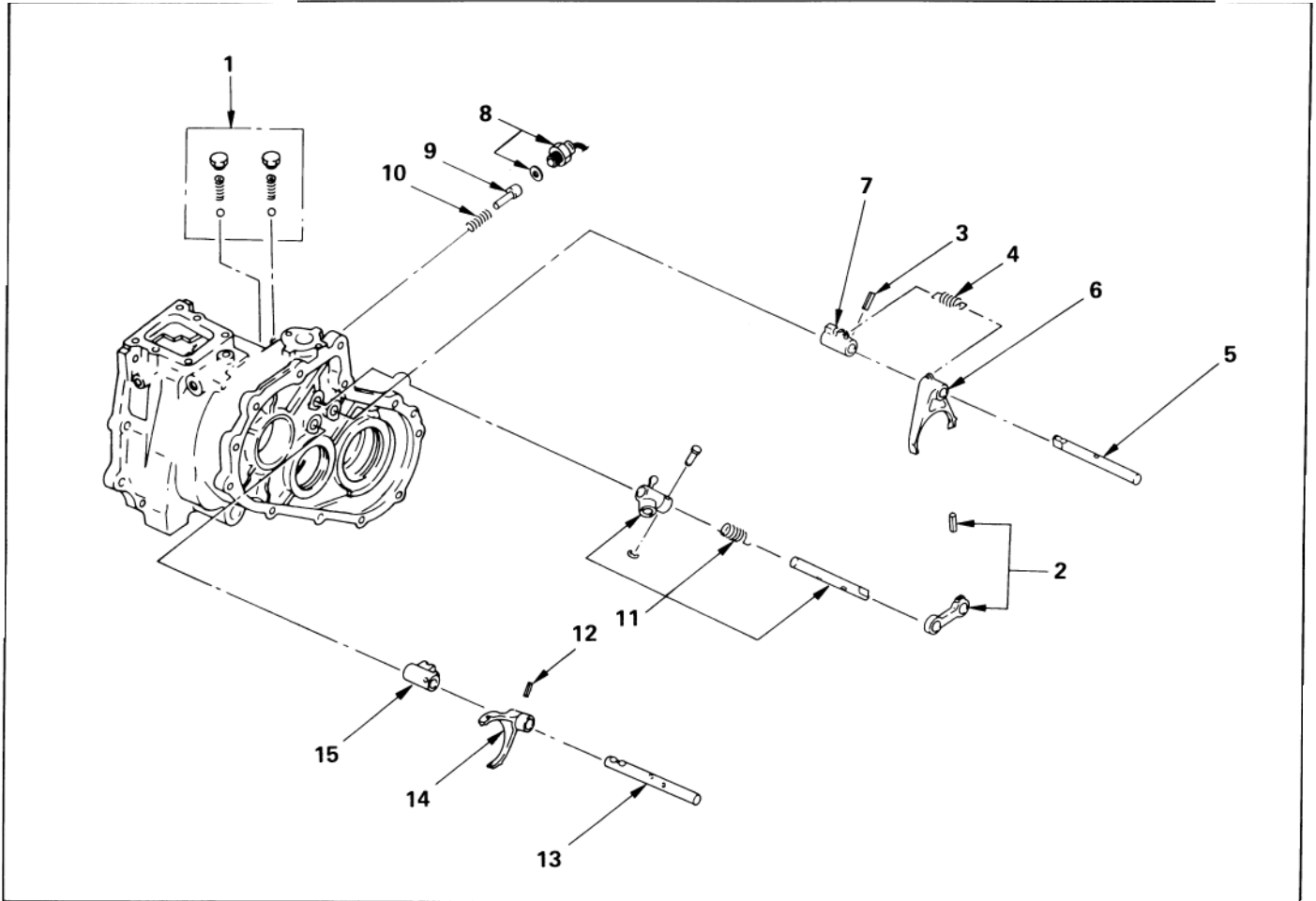


9. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

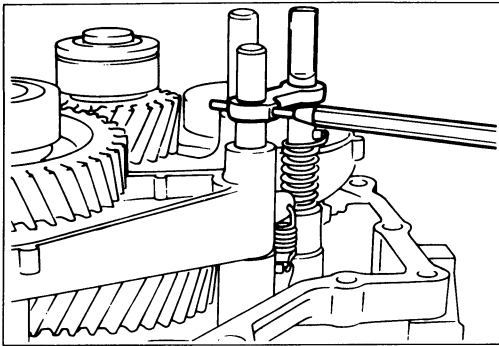


DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



Disassembly Steps

- | | |
|---------------------------------|--------------------------|
| 1. Detent ball, spring and plug | ▲ 9. Interlock pin |
| ▲ 2. Pin and bridge | 10. Spring |
| 3. Pin | 11. Select rod assembly |
| 4. Spring | 12. Pin |
| ▲ 5. 2WD-4WD shift rod | ▲ 13. High-low shift rod |
| 6. Shift arm | 14. Shift arm |
| 7. Shift block | 15. Shift block |
| 8. 4WD indicator switch | |

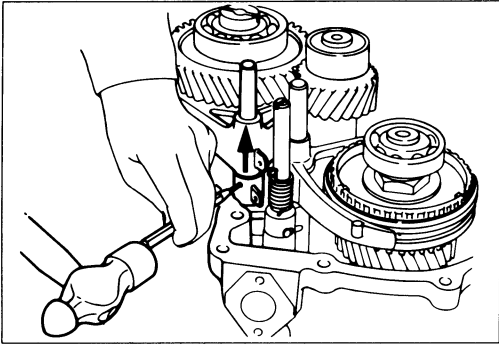


Important Operations



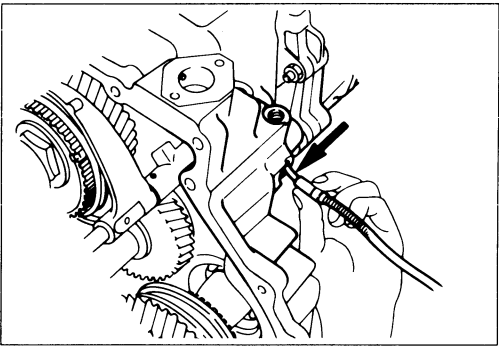
2. Bridge

Use a spring pin remover to remove the spring from the bridge.



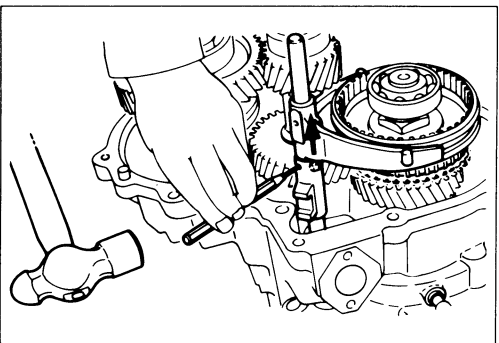
5. 2WD-4WD Shift Rod

- 1) Engage the 2nd-4th sleeve with the front output gear.
- 2) Remove the spring pin from the block.
- 3) Remove the shift rod.



9. Interlock Pin

Use a magnetic tool to remove the interlock pin from the transfer case.

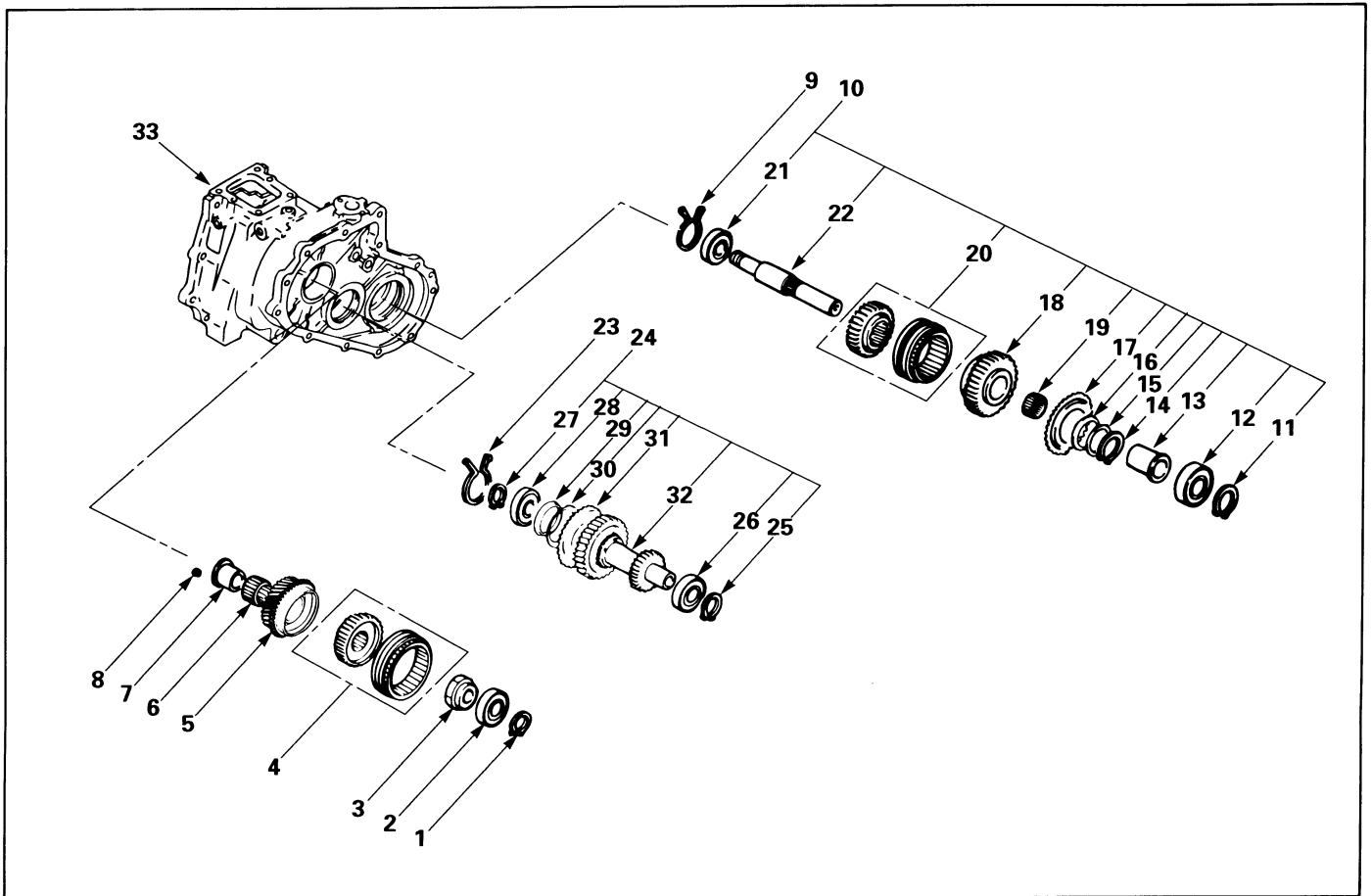


13. High-Low Shift Rod

Use a spring pin remover to remove the shift arm spring from the shift arm and the shift rod.



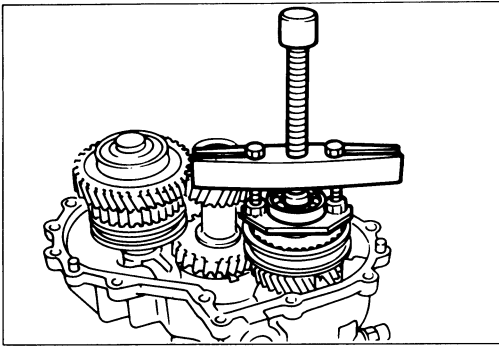
TRANSFER CASE ASSEMBLY AND MAINSHAFT GEAR



220RT007

Disassembly Steps

- | | |
|-------------------------------------|--------------------------------|
| 1. Bearing snap ring | 18. Front output gear |
| ▲ 2. Mainshaft end ball bearing | 19. Needle bearing |
| ▲ 3. Mainshaft end lock nut | 20. Clutch hub and sleeve |
| ▲ 4. High-low clutch hub and sleeve | ▲ 21. Ball bearing |
| ▲ 5. Transfer input gear | 22. Front output shaft |
| 6. Needle bearing | 23. Bearing snap ring |
| ▲ 7. Bearing collar | 24. Counter gear assembly |
| 8. Ball | 25. Bearing snap ring |
| ▲ 9. Bearing snap ring | ▲ 26. Ball bearing |
| 10. Front output gear assembly | 27. Bearing snap ring |
| 11. Bearing snap ring | ▲ 28. Ball bearing |
| ▲ 12. Ball bearing | 29. Spacer |
| 13. Bearing collar | 30. Belleville spring |
| ▲ 14. Anti-lash plate snap ring | 31. Sub gear (Anti-lash plate) |
| 15. Spacer | 32. Counter gear |
| 16. Belleville spring | 33. Transfer case |
| 17. Sub gear (Anti-lash plate) | |



Important Operations

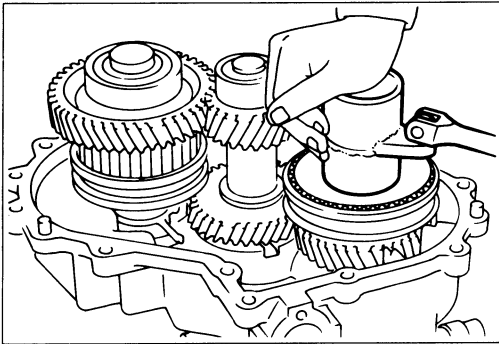


2. Mainshaft End Ball Bearing

Use a bearing remover to remove the ball bearing.

Remover : 5-8840-2155-0 (J-37217)

Puller : 5-8840-2027-0



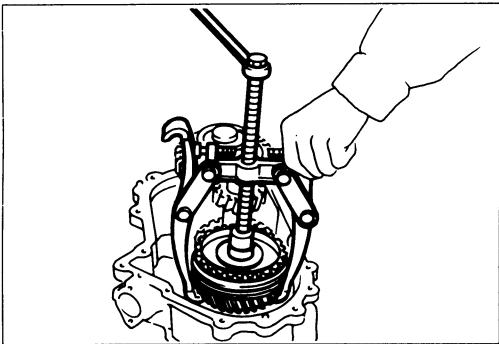
3. Mainshaft End Lock Nut

1) Engage the 3rd-top synchronizer with the 3rd gear.

2) Engage the low-2nd synchronizer with the low gear.

3) Use the lock nut wrench to remove the lock nut.

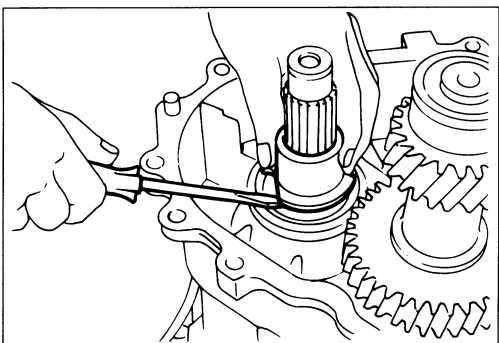
Lock Nut Wrench: 5-8840-2156-0 (J-37219)



4. High-Low Clutch Hub and Sleeve

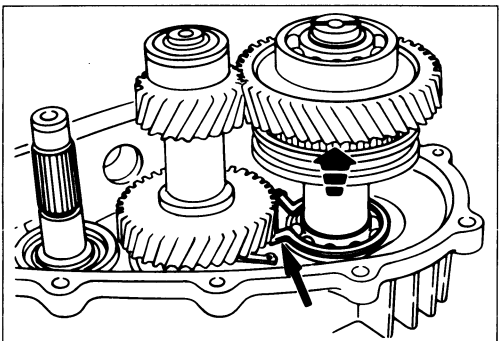
5. Transfer Input Gear

Use the universal puller to remove the high-low synchronizer assembly, the high-low block ring, and the transfer input gear.



7. 8. Bearing Collar and Ball

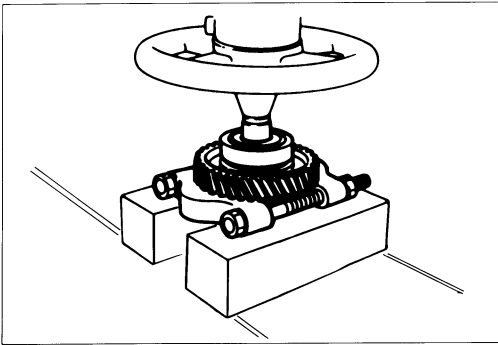
Using screw driver to remove the bearing collar.



9. Bearing Snap Ring

Use a pair of snap ring pliers to expand the bearing snap ring.

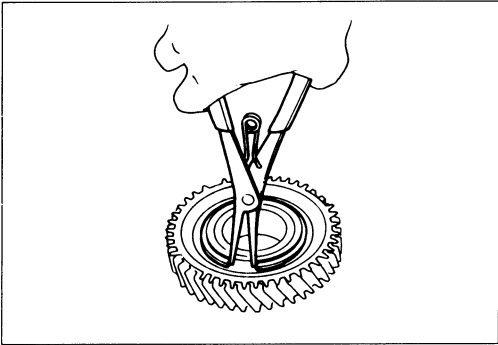
Use a plastic hammer to tap the front output gear assembly free.



12. Ball Bearing

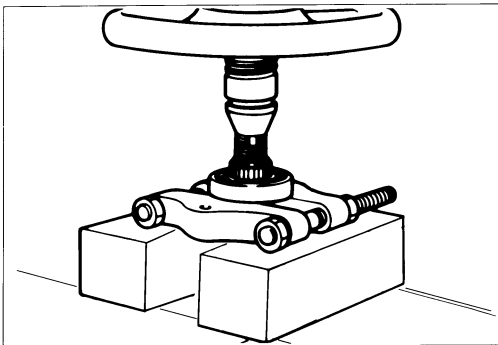
Use a bench press and the ball bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



14. Anti-lash Plate Snap Ring

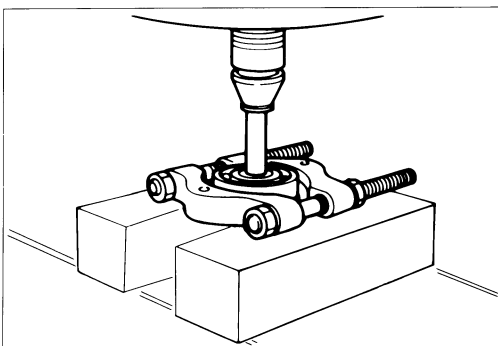
Use a pair of pliers to remove the snap ring.



21. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



26. Ball Bearing

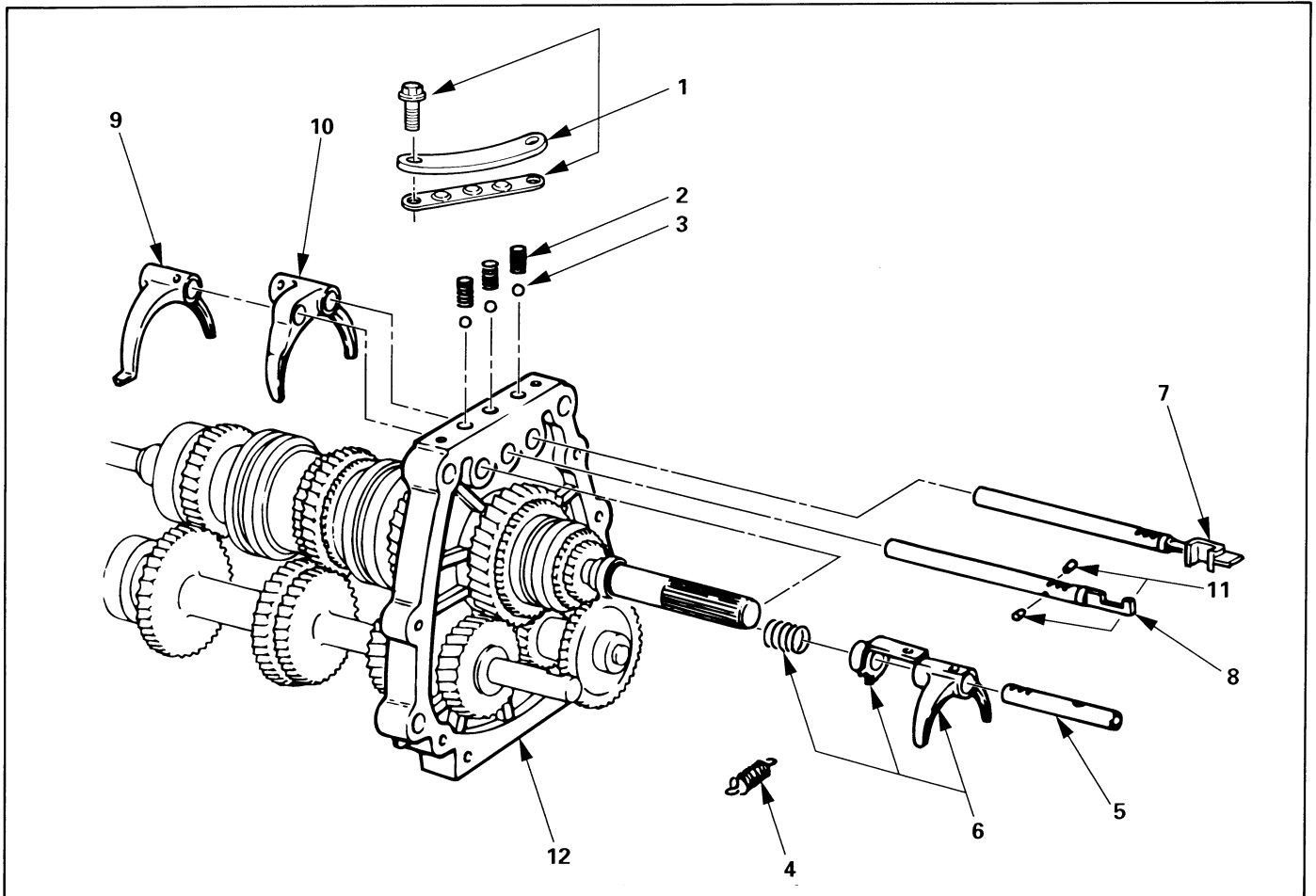
28. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearings.

MINOR COMPONENT



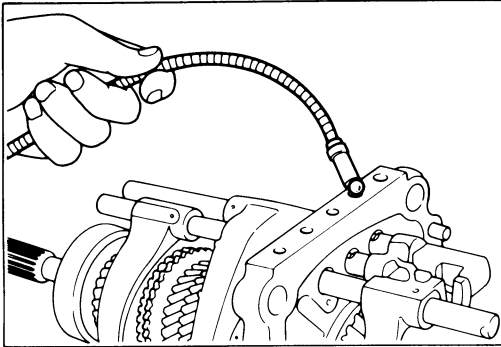
INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM ASSEMBLY, AND INTERLOCK PIN



220RW071

Disassembly Steps

- | | |
|--|--|
| 1. Detent spring plate and gasket | 7. 1st-2nd shift rod |
| 2. Detent spring | ▲ 8. 3rd-4th shift rod |
| ▲ 3. Detent ball | ▲ 9. 3rd-4th shift arm |
| 4. Spring | ▲ 10. 1st-2nd shift arm |
| 5. Rev-5th shift rod | ▲ 11. Interlock pin |
| 6. Rev-5th shift arm and reverse inhibitor | 12. Intermediate plate and gear assembly |



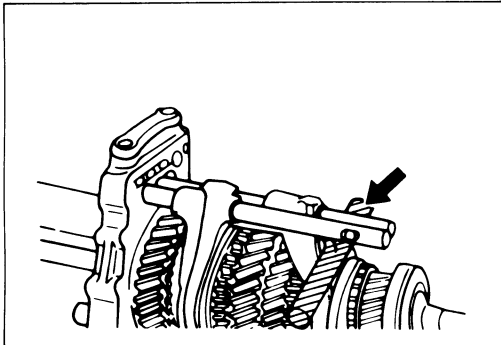
Important Operations



3. Detent Ball

Use a magnetic tool to remove the detent balls from the intermediate plate.

Take care not to lose the detent balls.



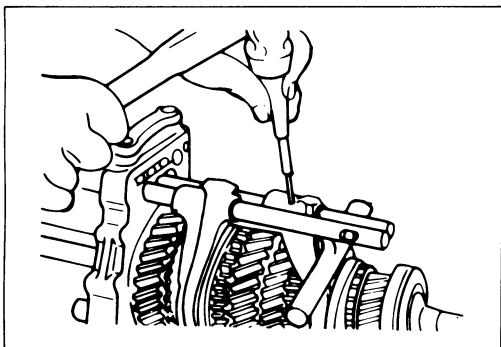
8. 3rd-4th Shift Rod

9. 3rd-4th Shift Arm

10. 1st-2nd Shift Arm

1) Hold a round bar against the shift arm end.

This will prevent damage to other components.

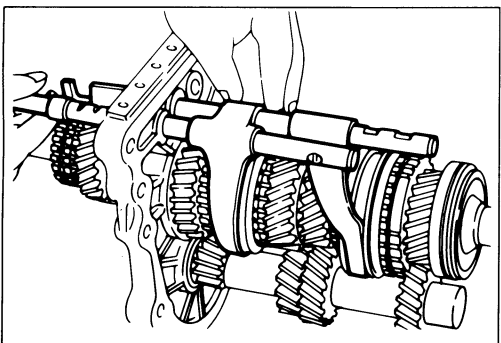


2) Use a spring pin remover to remove the shift arm spring pin from the shift arm and the shift rod.

Discard the used spring pin.

3) Move the 3rd-4th shift rod forward.

Take care not to lose the interlock pins.



11. Interlock Pin

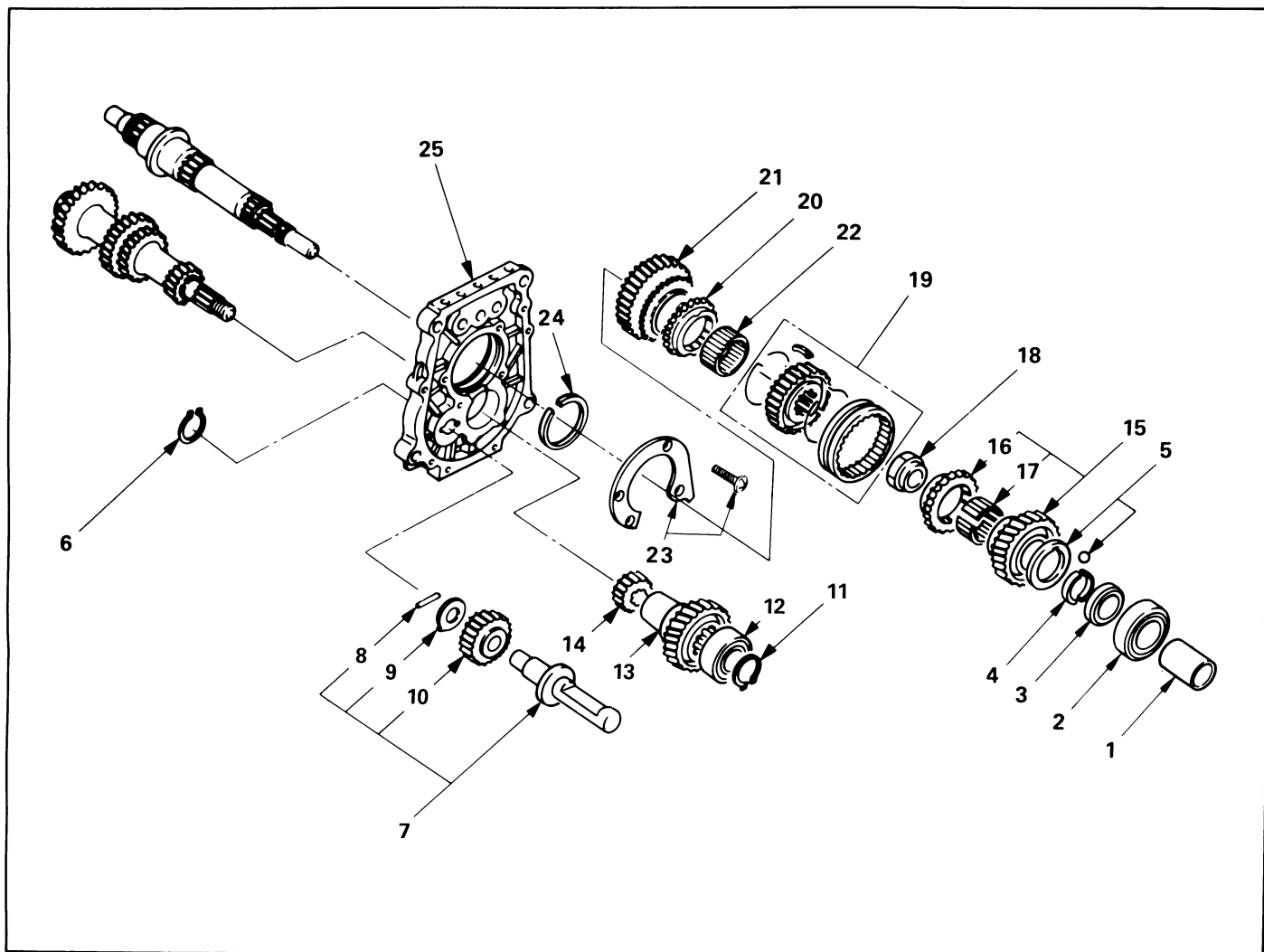
Carefully remove the reverse shifter rod forward to avoid losing the interlock pins.

Note:

Remove the shifter rods carefully. Interlock pins are located between the shifter rod in the intermediate plate.

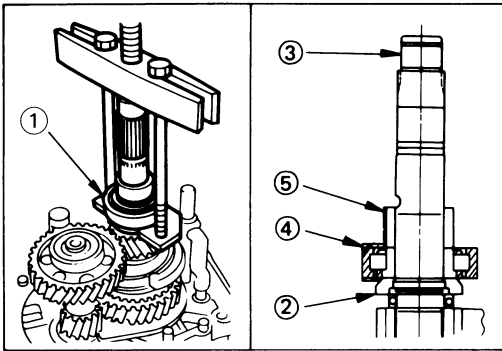


REVERSE GEAR AND 5TH GEAR



Disassembly Steps

- ▲ 1. Oil seal collar
- ▲ 2. Bearing
- ▲ 3. Retainer
- 4. Thrust plate
- 5. Thrust washer and lock ball
- ▲ 6. Reverse idler gear snap ring
- 7. Reverse idler shaft
- 8. Idle shaft pin
- 9. Thrust washer
- 10. Reverse idler gear
- 11. Bearing snap ring
- ▲ 12. Ball bearing
- ▲ 13. Counter 5th gear
- 14. Counter reverse gear
- 15. 5th gear
- 16. 5th block ring
- ▲ 17. Needle bearing
- ▲ 18. Clutch hub nut
- ▲ 19. Rev-5th synchronizer assembly
- ▲ 20. Reverse block ring
- ▲ 21. Reverse gear
- 22. Needle bearing
- ▲ 23. Bearing plate and screw
- ▲ 24. Bearing snap ring
- ▲ 25. Intermediate plate



Important Operations



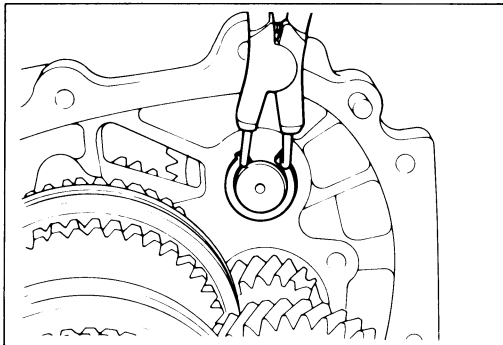
1. Oil Seal Collar
2. Bearing
3. Retainer

- 1) Set the retaining ring remover ① to the retainer ② and the mainshaft end ③.
- 2) Remove the retainer together with the bearing ④ and the oil seal collar ⑤.

The universal puller may be used in place of the retaining ring remover.

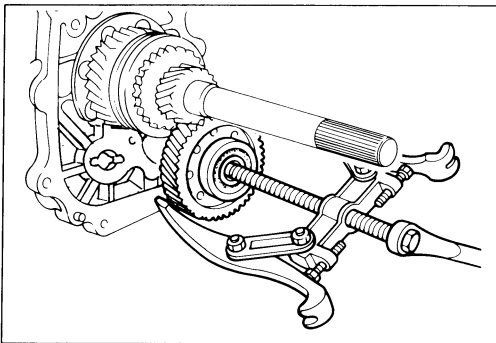
Retainer Remover: 5-8840-2158-0 (J-37222)

Universal Puller: 5-8840-2027-0



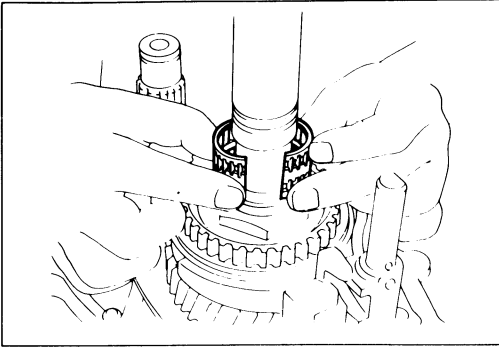
6. Reverse Idler Gear Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



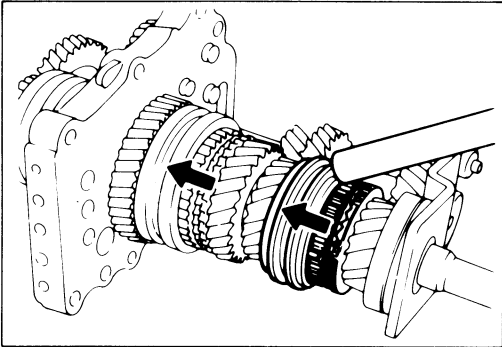
12. Ball Bearing
13. Counter 5th Gear

Use the bearing remover to remove the ball bearing.



17. Needle Bearing

Remove the needle bearing (2 piece type).

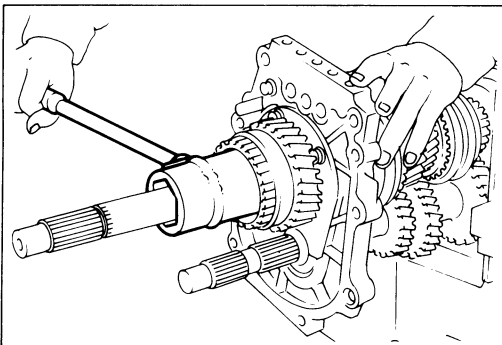


18. Clutch Hub Nut

- 1) Engage the 3rd-4th synchronizer with the 3rd gear.
- 2) Engage the 1st-2nd synchronizer with the 1st gear.
- 3) Attach the holding fixture together with the holding base to the mainshaft front bearing and the counter gear front bearing.

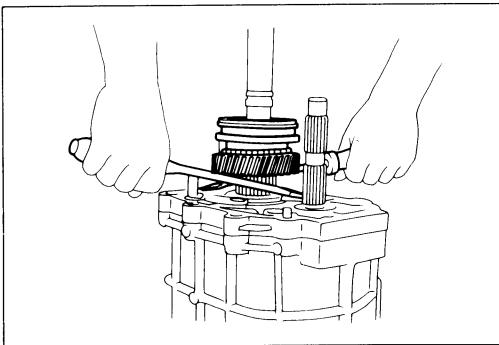
Holding Fixture: 5-8840-2160-0 (J-37224)

Holding Base: 5-8840-0003-0 (J-3289-20)



- 4) Use the hub nut wrench to remove the hub nut.

Hub Nut Wrench: 5-8840-2156-0 (J-37219)

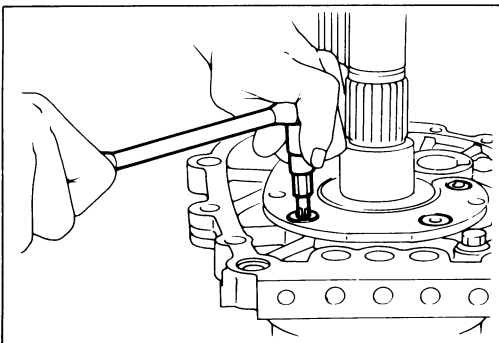


19. Rev.-5th Synchronizer Assembly

20. Reverse Ring

21. Reverse Gear

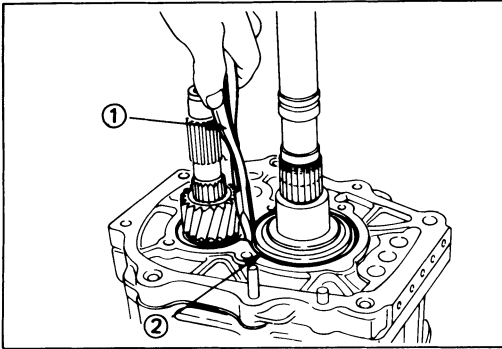
Use screw drivers between the reverse gear and bearing plate to remove the Rev.-5th synchronizer assembly together with reverse ring and gear.



23. Bearing Plate and Screw

Use the Torx bit to remove the bearing plate screw from the intermediate plate.

Torx Bit Wrench: 5-8840-0047-0 (J-37225) (T45)

**24. Ball Bearing Snap Ring****25. Intermediate Plate**

- 1) Insert the snap ring pliers into the mainshaft bearing snap ring hole.
- 2) Use the snap ring pliers ① to force open the mainshaft bearing snap ring ②.

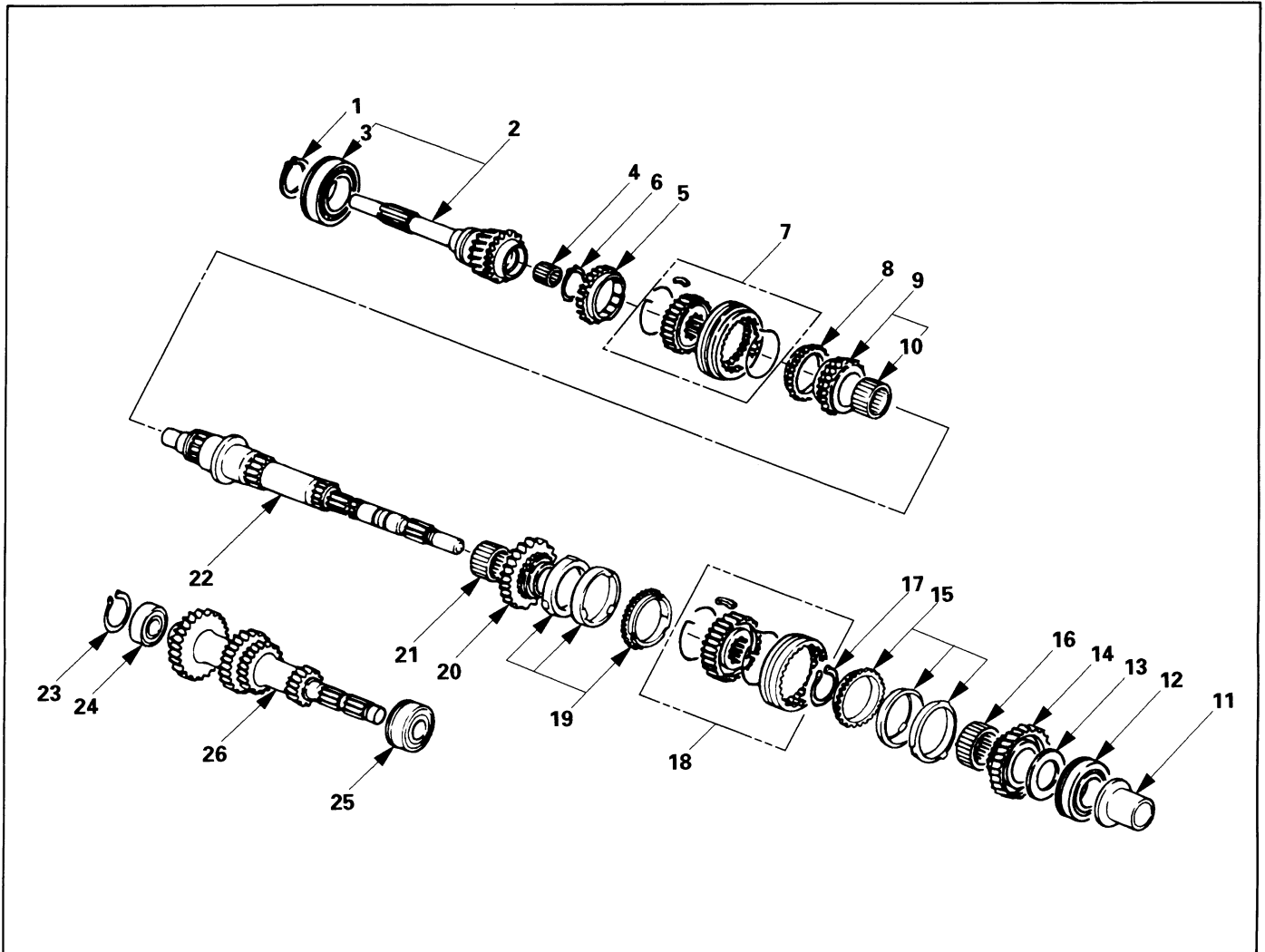
Hold the snap ring open with the pliers.

- 3) Push the intermediate plate toward the rear of the transmission to remove it.

The ball bearing snap ring will come free.



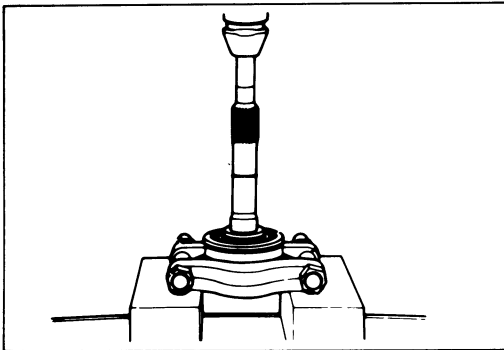
TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR



226L.V002

Disassembly Steps

- | | |
|------------------------------------|-------------------------------------|
| 1. Top gear shaft snap ring | ▲ 14. 1st gear |
| 2. Top gear shaft | 15. 1st block ring (set) |
| ▲ 3. Top gear ball bearing | 16. Needle bearing |
| 4. Needle bearing | ▲ 17. Clutch hub snap ring |
| 5. Top block ring | ▲ 18. 1st-2nd synchronizer assembly |
| ▲ 6. Mainshaft snap ring | ▲ 19. 2nd block ring (set) |
| ▲ 7. 3rd-4th synchronizer assembly | ▲ 20. 2nd gear |
| 8. 3rd block ring | 21. Needle bearing |
| 9. 3rd gear | 22. Mainshaft |
| 10. Needle bearing | 23. Bearing snap ring |
| ▲ 11. Needle bearing collar | ▲ 24. Counter gear front bearing |
| ▲ 12. Mainshaft ball bearing | 25. Counter gear center bearing |
| ▲ 13. 1st gear thrust bearing | 26. Counter gear |



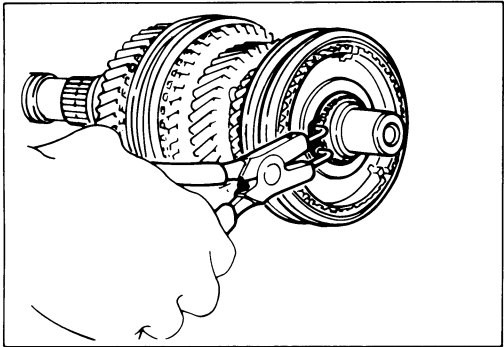
Important Operations



3. Top Gear Ball Bearing

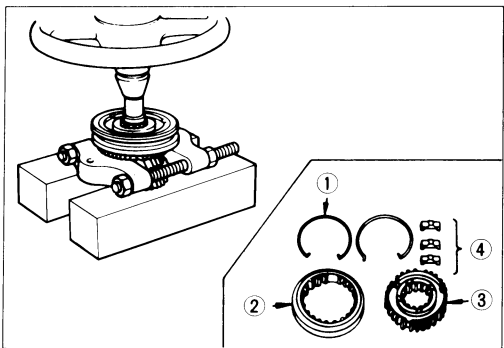
Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover : 5-8840-0015-0 (J-22912-01)



6. Mainshaft Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



7. 3rd-4th Synchronizer Assembly

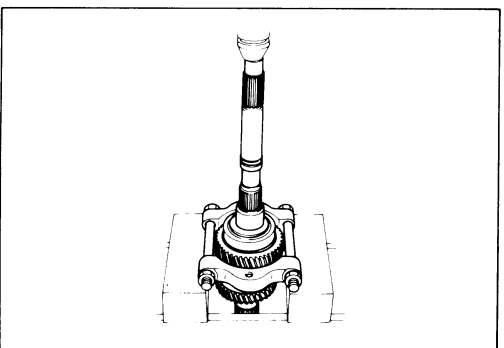
1) Use a bench press and the bearing replacer to remove the synchronizer assembly as a set.

2) Disassemble the synchronizer assembly.

- ① Springs
- ② Sleeve
- ③ Clutch Hub
- ④ Inserts

Note:

Mark the hub and sleeve alignment for reassembly.



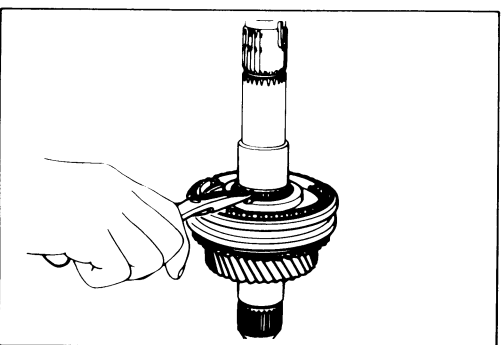
11. Needle Bearing Collar

12. Mainshaft Ball Bearing

13. 1st Gear Thrust Bearing

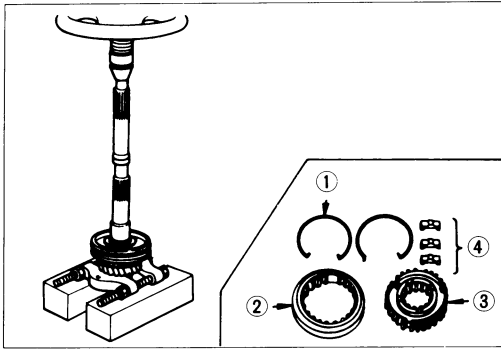
14. 1st Gear

Use a bench press and the bearing remover to remove the ball bearing.



17. Clutch Hub Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



18. 1st-2nd Synchronizer Assembly

19. 2nd Block Ring (Set)

20. 2nd Gear

- 1) Use a bench press and the bearing remover to remove the ball bearing 2nd gear together with synchronizer assembly.

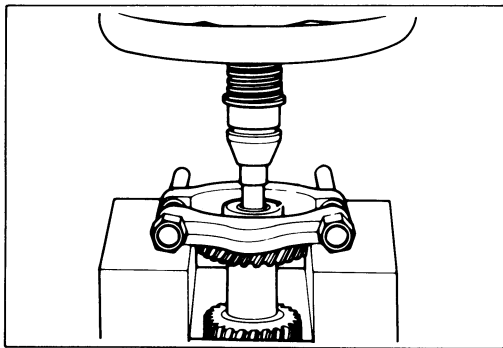
Remover: 5-8840-0015-0 (J-22912-01)

- 2) Disassemble the synchronizer assembly.

- ① Springs
- ② Sleeve
- ③ Clutch Hub
- ④ Inserts

Note:

Mark the hub and sleeve alignment for reassembly.



24. Counter Gear Front Bearing

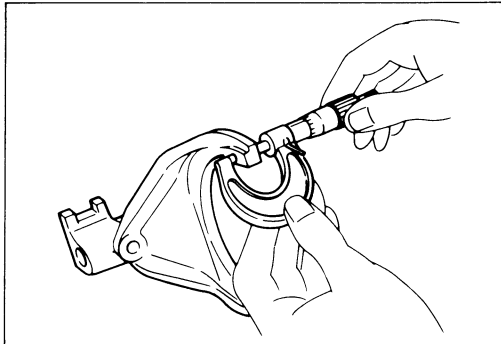
Use a bench press and the bearing remover to remove the bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

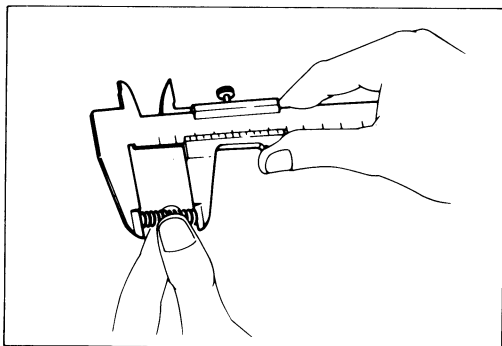


SHIFT ARM THICKNESS

Use a micrometer to measure the shift arm thickness.

If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness		mm(in)	
		Standard	Limit
1st–2nd Transfer 4x4/4x2 High/Low		9.60–9.85 (0.378–0.388)	9.0 (0.354)
3rd–4th Rev.–5th		9.60–9.80 (0.378–0.386)	

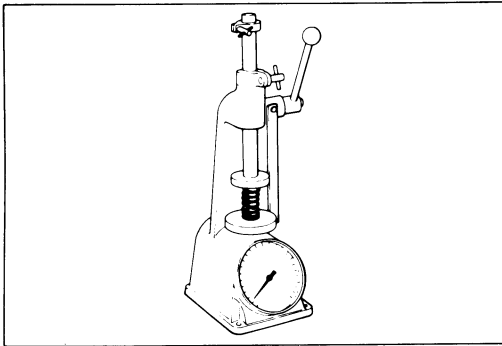


DETENT AND INTERLOCK SPRINGS FREE LENGTH

Use a vernier caliper to measure the springs free length.

If the measured value is less than the specified limit, the springs must be replaced.

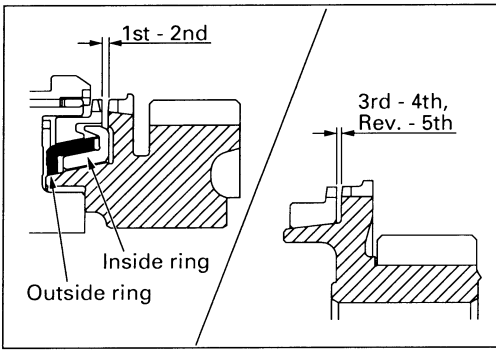
Springs Free Length		mm(in)	
		Standard	Limit
(Detent Ball)	Transmission	26.8 (1.06)	26.2 (1.03)
	Transfer case	23.4 (0.92)	22.8 (0.90)
(Interlock Pin)	Transfer case	15.9 (0.626)	15.3 (0.602)



DETENT SPRING TENSION

Use a spring tester to measure the springs tension. If the measured value is less than the specified standard, the springs must be replaced.

Springs Tension		kg(lb/N)	
		Compressed Height	Standard
(Detent Ball)	Transmission	20 mm (0.787 in)	8.9—9.9 (19.6—21.8/ 87.2—97)
	Transfer case	18.7 mm (0.736 in)	7.0—9.0 (15.4—19.8/ 68.6—88.2)
(Interlock Pin)	Transfer case	11.5 mm (0.453 in)	1.0 (2.2/9.8)



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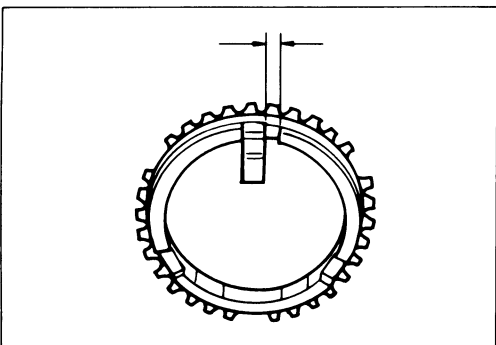


BLOCK RING AND DOG TEETH CLEARANCE

Use a thickness gauge to measure the clearance between the block ring and the dog teeth.

If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Dog Teeth Clearance		mm(in)
Standard	Limit	
1.5 (0.059)	0.8 (0.032)	

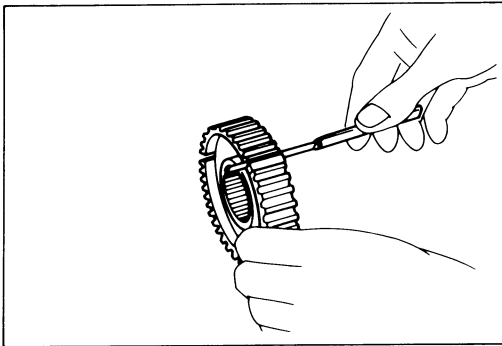


BLOCK RING AND INSERT CLEARANCE

Use a vernier caliper to measure the clearance between the block ring and the insert.

If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block Ring and Insert Clearance		mm(in)
	Standard	Limit
3rd-4th	3.46—3.74 (0.136—0.147)	4.0 (0.158)
1st-2nd	4.34—4.66 (0.171—0.183)	4.9 (0.193)
Transfer	2.46—2.74 (0.097—0.108)	3.0 (0.118)
Rev.-5th	3.59—3.91 (0.141—0.154)	4.1 (0.161)

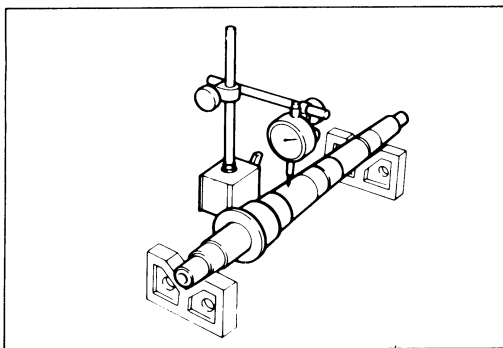


CLUTCH HUB AND INSERT CLEARANCE

Use a thickness gauge to measure the clearance between the clutch hub and the insert.

If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

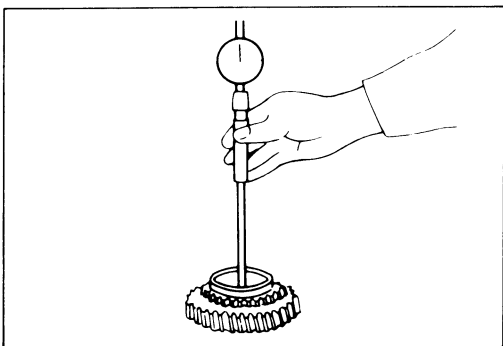
Clutch Hub and Insert Clearance		mm(in)
	Standard	Limit
3rd-4th	0.01-0.19 (0.0004-0.0075)	0.3 (0.012)
1st-2nd Rev.-5th	0.09-0.31 (0.0035-0.0122)	0.4 (0.016)



MAINSHAFT RUN-OUT

1. Install the mainshaft to a grinding machine.
2. Use a dial indicator to measure the mainshaft central portion run-out.
If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run Out	mm(in)
Limit	
	0.05 (0.0020)

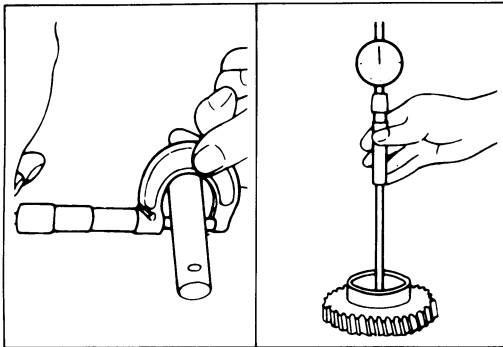


GEAR INSIDE DIAMETER

Use an inside dial indicator to measure the gear inside diameter.

If the measured value is less than the specified limit, the gear must be replaced.

Gear Inside Diameter		mm(in)
	Standard	Limit
1st 3rd	45.000-45.013 (1.771-1.772)	45.100 (1.776)
2nd	52.000-52.013 (2.047-2.048)	52.100 (2.051)
Rev. Transfer	48.000-48.013 (1.889-1.890)	48.100 (1.894)
5th	32.000-32.013 (1.259-1.260)	32.100 (1.264)



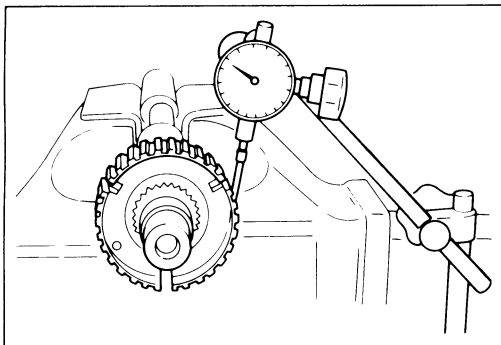
REVERSE IDLER GEAR AND IDLER GEAR SHAFT CLEARANCE

1. Use a micrometer to measure the idler gear shaft diameter.
2. Use an inside dial indicator to measure the idler gear inside diameter.
3. Calculate the idler gear and idler gear shaft clearance.

$$\text{Idler gear inside diameter} - \text{idler gear shaft diameter} = \text{idler gear and idler gear shaft clearance.}$$

If the measured value exceeds the specified limit, the idler gear and/or the idler gear shaft must be replaced.

Idler Gear and Idler Gear Shaft Clearance		mm(in)
Standard	Limit	
0.041 – 0.074 (0.0016 – 0.0029)	0.150 (0.0059)	



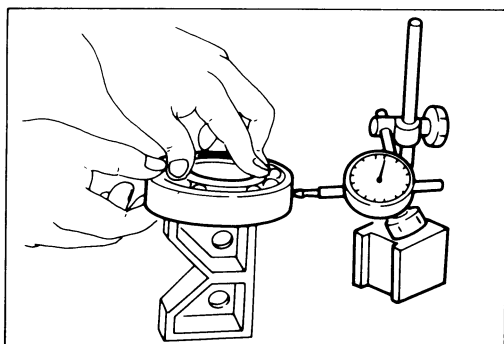
CLUTCH HUB SPLINE PLAY

1. Set a dial indicator to the clutch hub to be measured.
2. Move the clutch hub as far as possible to both the right and the left.

Note the dial indicator reading.

If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch Hub Spline Play			mm(in)
	Standard	Limit	
1st—2nd	0 — 0.1 (0 — 0.0039)	0.2 (0.0079)	
3rd—4th			
Transfer			
4×2/4×4			
High/Low			
Rev.—5th	0 — 0.2 (0 — 0.0079)	0.3 (0.0118)	



BALL BEARING PLAY

Use a dial indicator to measure the ball bearing play.

Ball Bearing Play	mm(in)
Limit	
0.2 (0.0079)	

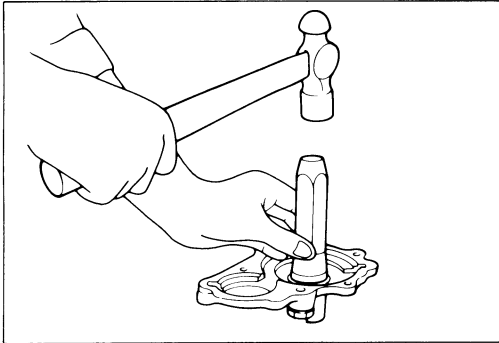


FRONT COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the front cover.



Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the front cover.

Oil Seal Installer : 5-8840-0026-0 (J-26540)

2. Apply gear oil to the oil seal lip.

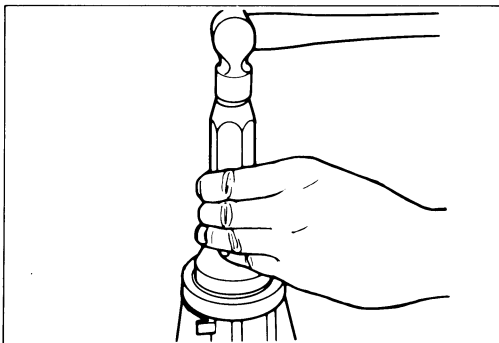


REAR COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the rear cover.



Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer : 5-8522-0050 (J-29769)

2. Apply engine oil to the oil seal lip.

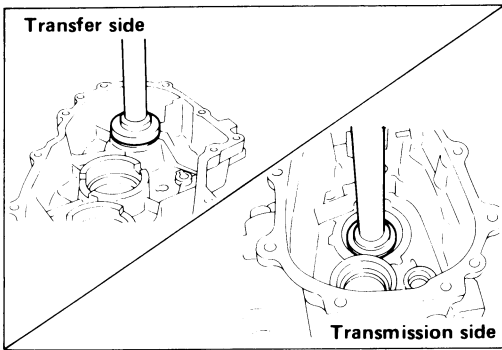


TRANSFER CASE MAINSHAFT OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the transfer case.



Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the transfer case.

Oil Seal Installer : 5-8840-2193-0 (J-37488)

Drive Handle : 5-8840-0007-0 (J-8092)

2. Apply engine oil to the oil seal lip.

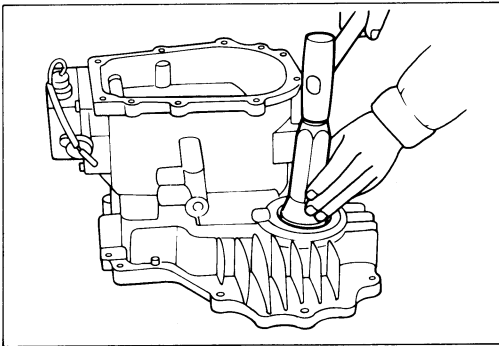


TRANSFER CASE FRONT OUTPUT SHAFT OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the transfer case.



Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the transfer case.

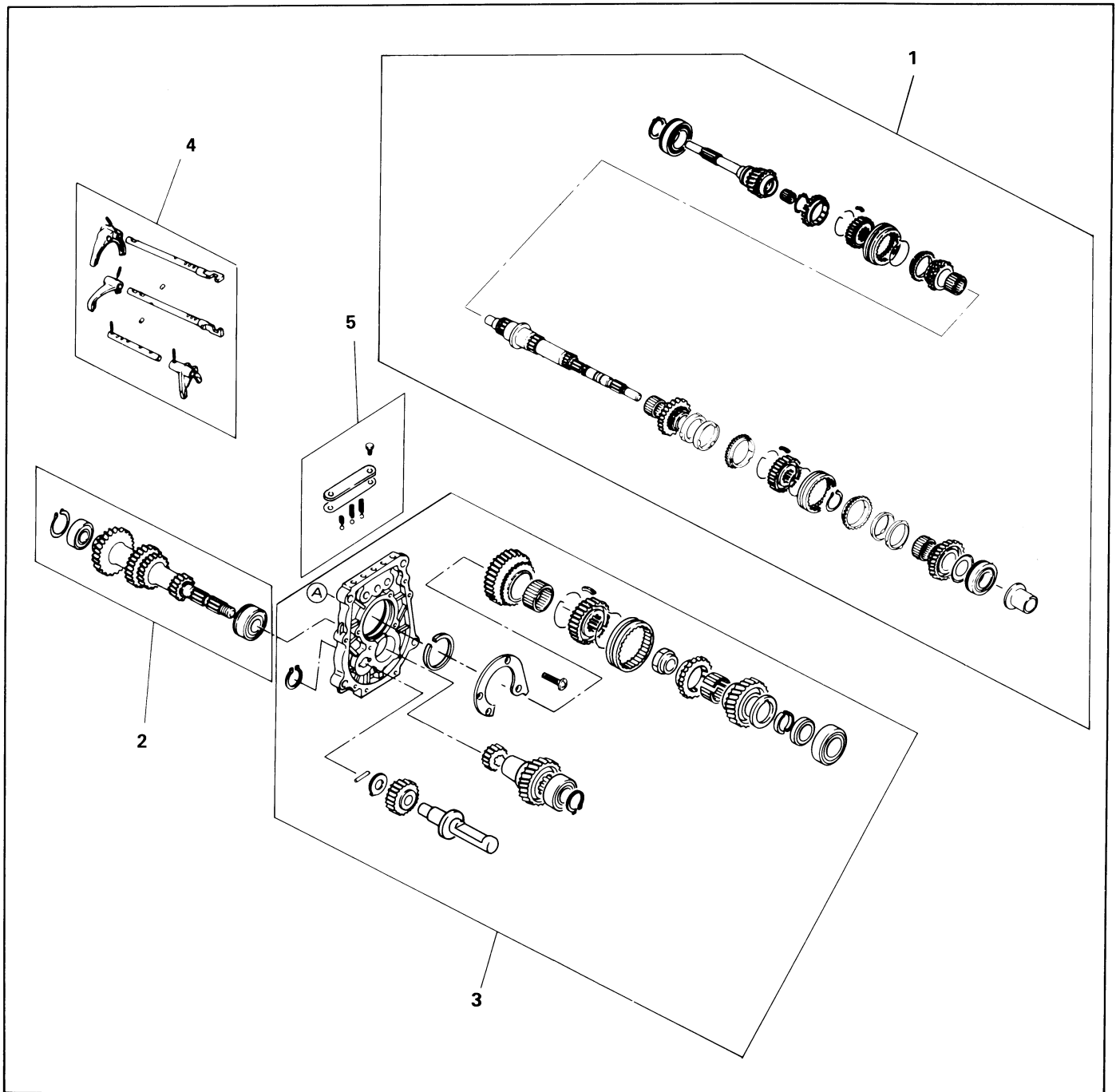
Oil Seal Installer : 5-8840-2161-0 (J-37226)

2. Apply engine oil to the oil seal lip.



REASSEMBLY

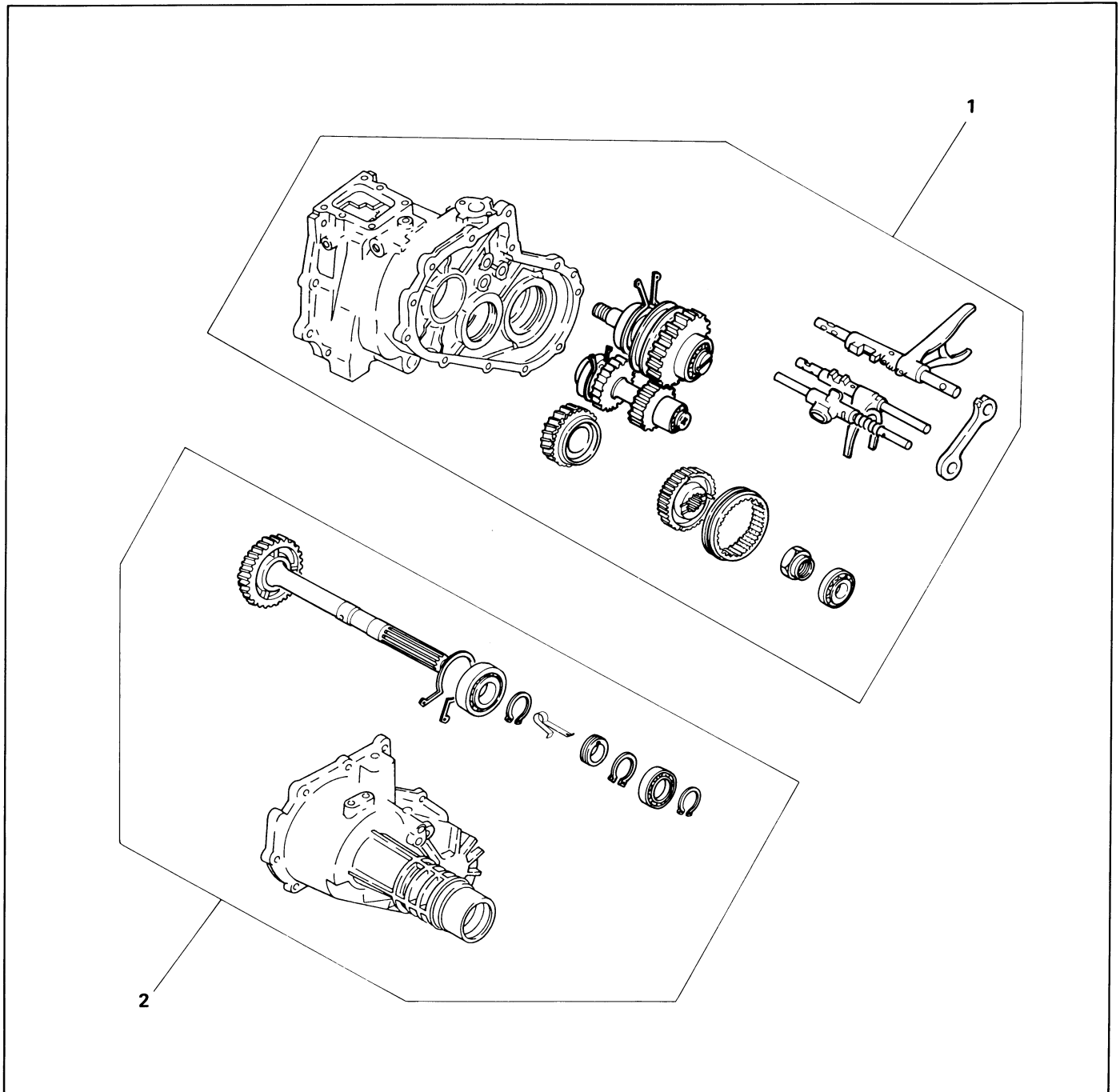
MAJOR COMPONENT (TRANSMISSION)



Reassembly Steps

1. Top & main gear shaft assembly
2. Counter gear shaft assembly
3. Rev. and 5th gear assembly
4. Shift arm assembly & interlock pin
5. Detent assembly

MAJOR COMPONENT (TRANSFER CASE)



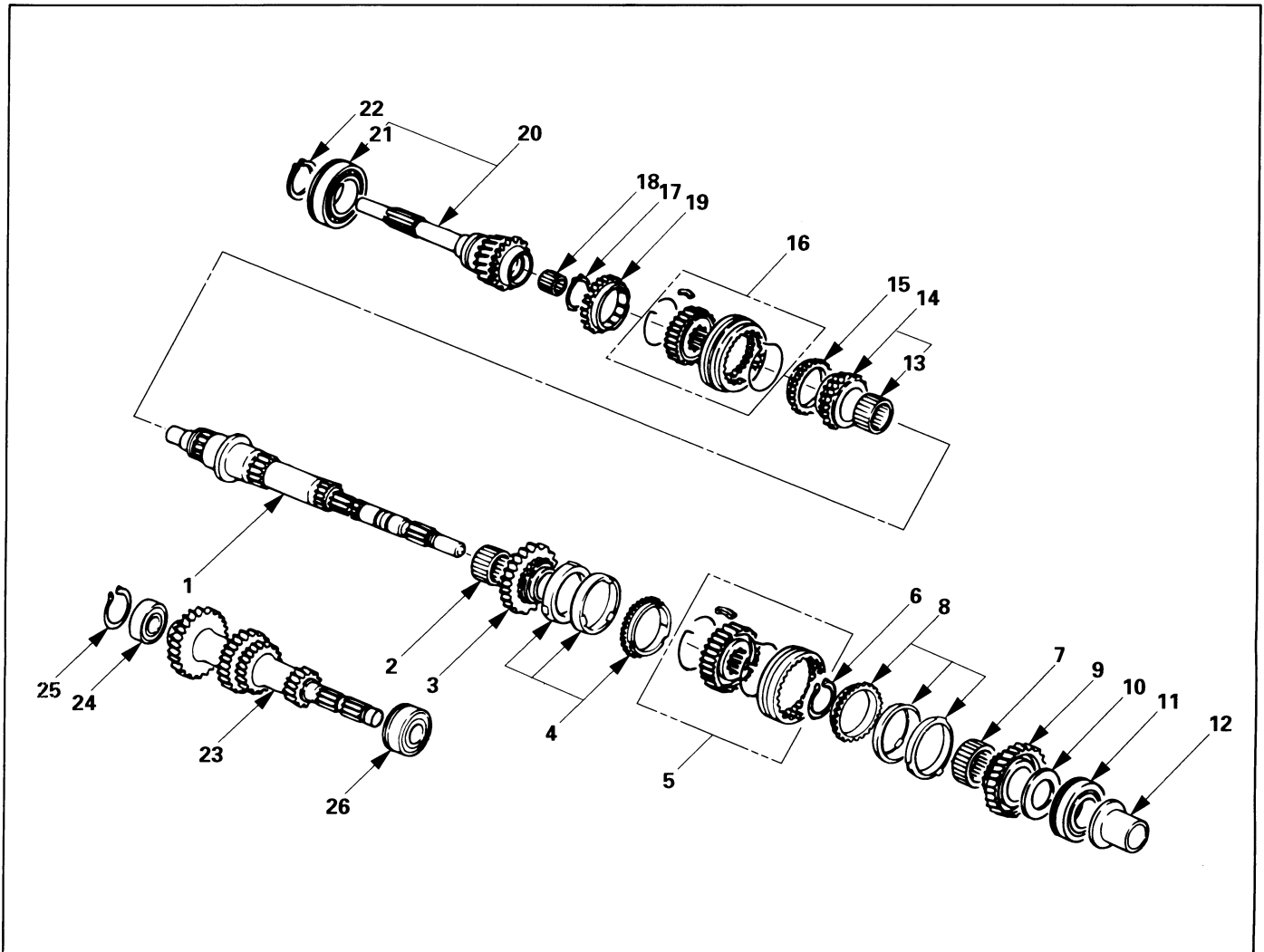
Reassembly Steps

- 1 Transfer case assembly
2. Transfer rear case assembly

MINOR COMPONENT (TRANSMISSION)



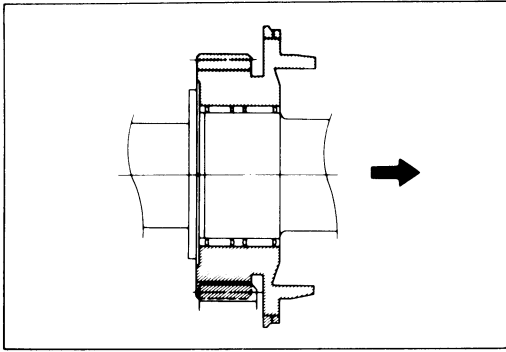
INTERMEDIATE PLATE AND GEAR ASSEMBLY TOP GEAR SHAFT, MAIN SHAFT GEAR AND COUNTER GEAR



226LV003

Reassembly Steps

- | | |
|------------------------------------|-------------------------------------|
| 1. Mainshaft | ▲ 14. 3rd gear |
| ▲ 2. Needle bearing | 15. 3rd block ring |
| ▲ 3. 2nd gear | ▲ 16. 3rd—4th synchronizer assembly |
| 4. 2nd block ring (set) | ▲ 17. Mainshaft snap ring |
| ▲ 5. 1st—2nd synchronizer assembly | 18. Needle bearing |
| ▲ 6. Clutch hub snap ring | 19. Top block ring |
| ▲ 7. Needle bearing | 20. Top gear shaft |
| 8. 1st block ring (set) | ▲ 21. Ball bearing |
| ▲ 9. 1st gear | ▲ 22. Top gear shaft snap ring |
| ▲ 10. 1st gear thrust bearing | 23. Counter gear |
| ▲ 11. Mainshaft ball bearing | ▲ 24. Counter gear front bearing |
| ▲ 12. Needle bearing collar | 25. Snap ring |
| ▲ 13. Needle bearing | ▲ 26. Counter gear center bearing |



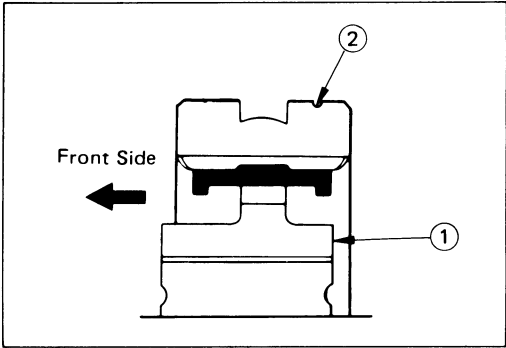
Important Operations



2. Needle Bearing

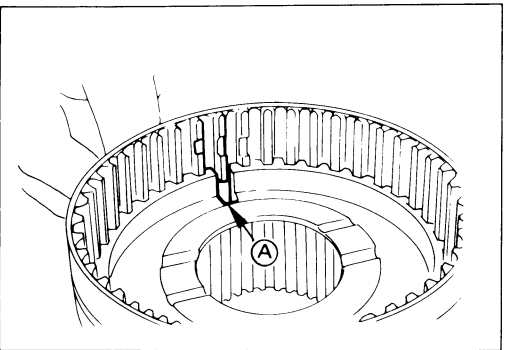
3. 2nd Gear

- 1) Apply engine oil to the needle bearing and the 2nd gear thrust surfaces.
- 2) Install the needle bearing and the 2nd gear to the mainshaft.
The dog teeth of the 2nd gear must be facing the rear side of the transmission.



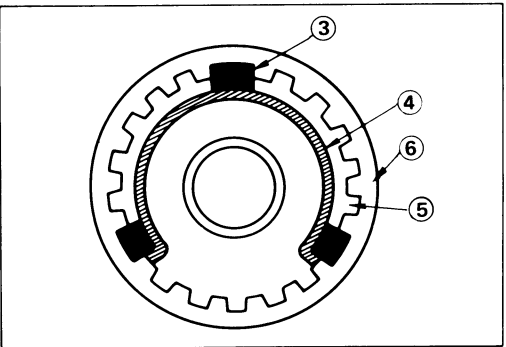
5. 1st-2nd Synchronizer Assembly

- 1) Turn the shallow clutch hub face ① toward the side of the sleeve with small groove ② on the outer circumference.

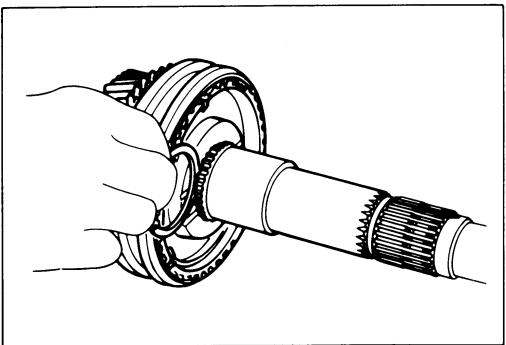


Note:

The clutch hub groove (A) must be aligned with the key groove of sleeve.



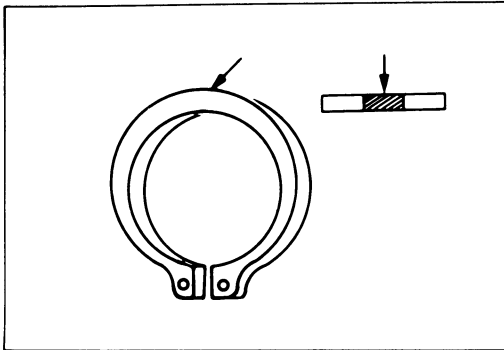
- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs ④ are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub ⑤ and the sleeve ⑥ slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft.
The clutch hub face (with the heavy boss) must be facing the 2nd gear side.



6. Clutch Hub Snap Ring

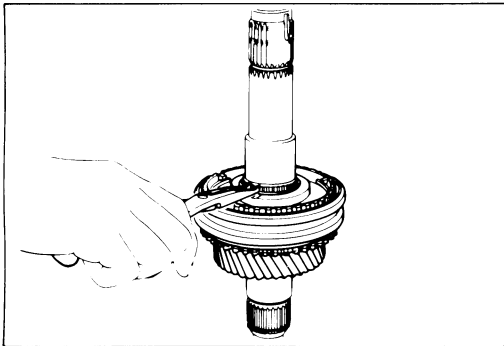
- 1) Select the snap ring which will provide the minimum clearance between the 1st/2nd clutch hub and the snap ring.
There are three snap ring sizes available.
The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance	mm(in)
Standard	
	0 - 0.1 (0.0039)



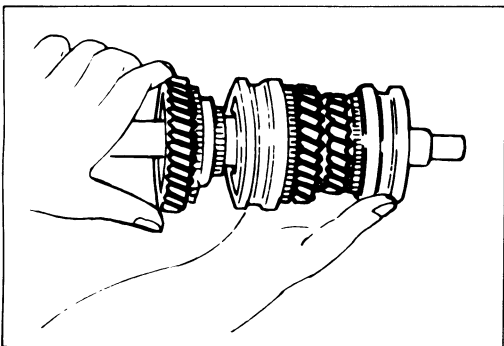
Snap Ring Availability

Thickness mm(in)	Color-Coding
1.80 (0.071)	White
1.85 (0.073)	Yellow
1.90 (0.075)	Blue



2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the mainshaft snap ring groove.



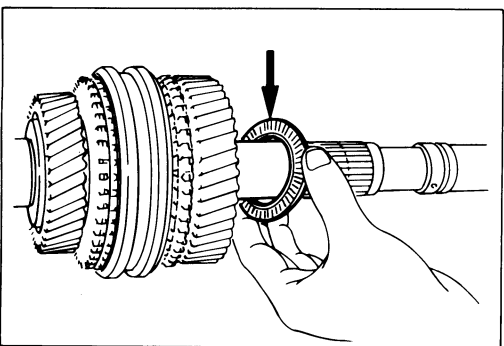
7. Needle Bearing

9. 1st Gear

1) Apply engine oil to the needle bearing and the 1st gear thrust surfaces.

2) Install the needle bearing and the 1st gear to the mainshaft.

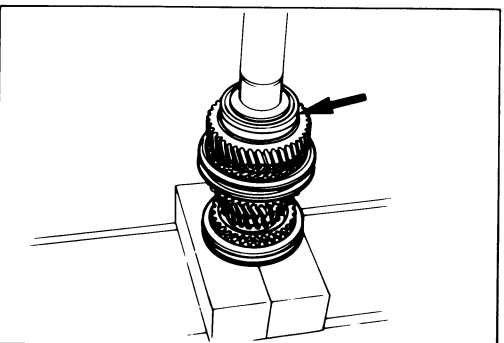
The 1st gear dog teeth must be facing the transmission front side.



10. 1st Gear Thrust Bearing

Install the thrust bearing to the mainshaft.

The thrust bearing side must be facing the transmission front side.



11. Mainshaft Ball Bearing

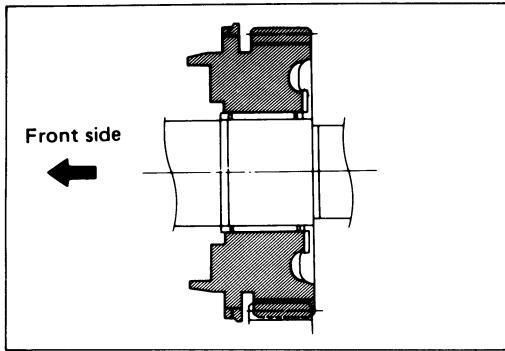
12. Needle Bearing Collar

1) Apply engine oil to the ball bearing and the mainshaft.

2) Install the ball bearing and collar to the mainshaft. The ball bearing snap ring groove must be facing the transmission rear side.

3) Use a bench press to slowly force the collar into place.



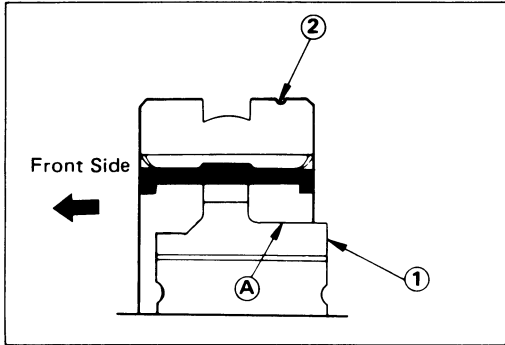


13. Needle Bearing

14. 3rd Gear

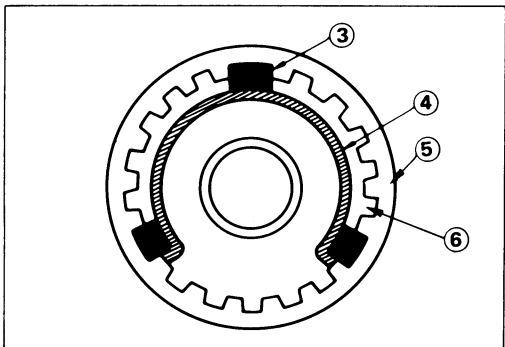
- 1) Apply engine oil to the needle bearing and the 3rd gear thrust surfaces.
- 2) Install the needle bearing and the 3rd gear to the mainshaft.

The dog teeth of the 3rd gear must be facing the front side of the transmission.



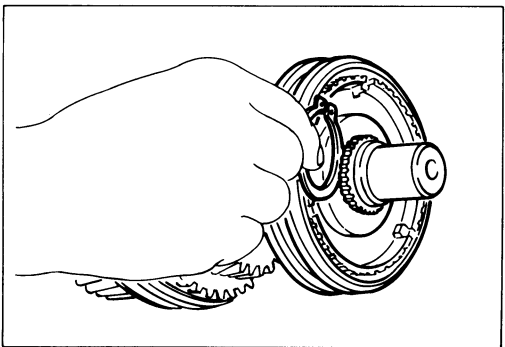
16. 3rd-4th Synchronizer Assembly

- 1) Turn the clutch hub face ① with the heavy boss ①A toward the side of the sleeve with small groove ② on the outer circumference.



- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs ④ are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub ⑤ and the sleeve ⑥ slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft.

The clutch hub face (with the heavy boss) must be facing the 3rd gear side.



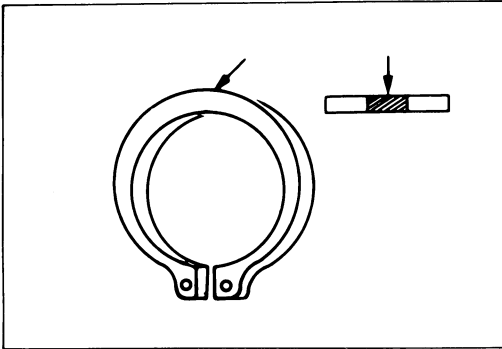
17. Mainshaft Snap Ring

- 1) Select the snap ring which will provide the minimum clearance between the 3rd-4th clutch hub and the snap ring.

There are three snap ring sizes available.

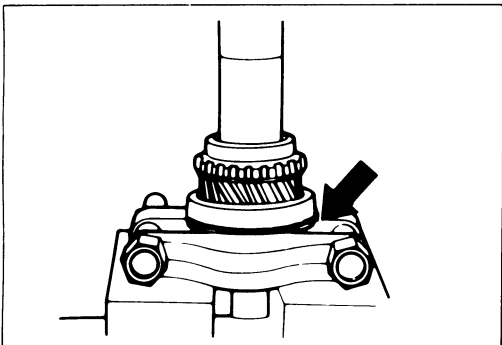
The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance	mm(in)
Standard	
	0 - 0.1 (0.0039)



Snap Ring Availability		mm(in)
Thickness	Color-Coding	
1.80 (0.071)	White	
1.85 (0.073)	Yellow	
1.90 (0.075)	Blue	

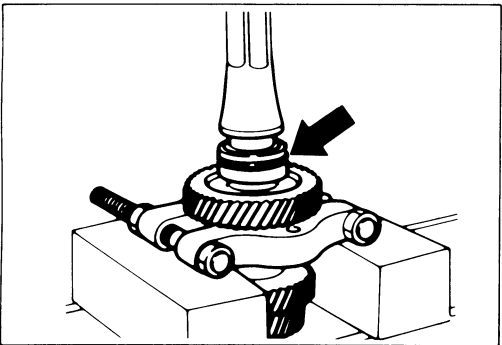
- 2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.
- 3) The snap ring must be fully inserted into the mainshaft snap ring groove.



21. Ball Bearing

22. Top Gear Shaft Snap Ring

- 1) Use a bench press to install the top gear shaft ball bearing to the mainshaft.
The snap ring groove must be facing the transmission front side.
- 2) Use a pair of snap ring pliers to install the snap ring to the bearing.

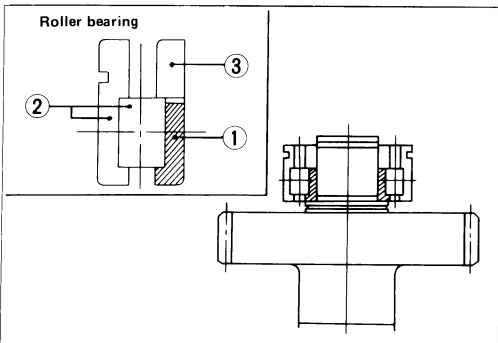


24. Counter Gear Front Bearing

Use a bench press to install the counter gear front ball bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

Bearing installer : 5-8840-2194-0 (J-35283)



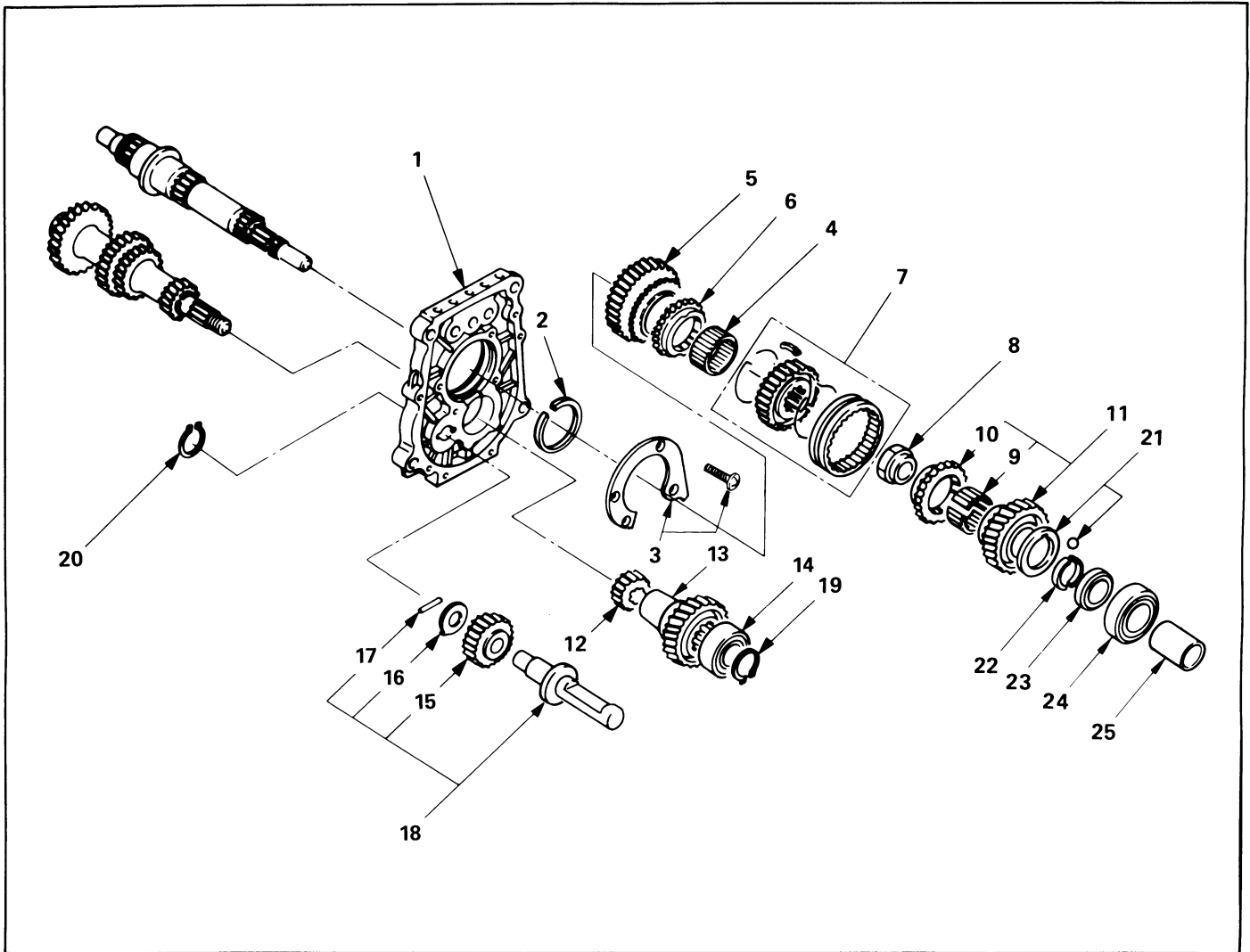
- 1) Apply engine oil to the bearing and install the inner race ① and outer race with roller ② in the proper direction to the mainshaft.
- 2) Then install the inner race ③ with taper side turned to outer race ②.

Note:

The inner race ③ should be installed with stamp on die face side turned to the front side of transmission.

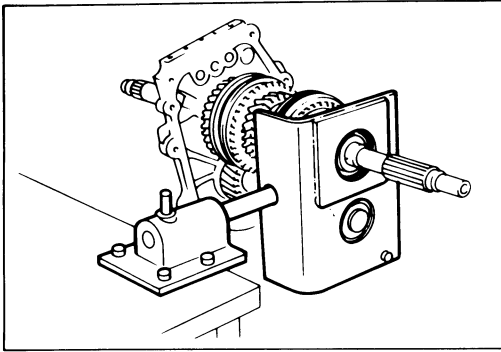


REVERSE GEAR AND 5TH GEAR



Reassembly Steps

- | | |
|-------------------------------------|-----------------------------------|
| ▲ 1. Intermediate plate | 14. Ball bearing |
| 2. Bearing snap ring | 15. Reverse idler gear |
| ▲ 3. Bearing plate and screw | 16. Thrust washer |
| 4. Needle bearing | 17. Idler shaft pin |
| 5. Mainshaft reverse gear | 18. Reverse idler shaft |
| 6. Reverse block ring | ▲ 19. Bearing snap ring |
| ▲ 7. Rev.-5th synchronizer assembly | ▲ 20. Reverse gear snap ring |
| ▲ 8. Clutch hub nut | ▲ 21. Thrust washer and lock ball |
| 9. Needle bearing | 22. Thrust plate |
| 10. 5th block ring | 23. Retainer |
| 11. 5th gear | ▲ 24. Roller bearing |
| ▲ 12. Counter reverse gear | 25. Oil seal collar |
| 13. Counter 5th gear | |



Important Operations

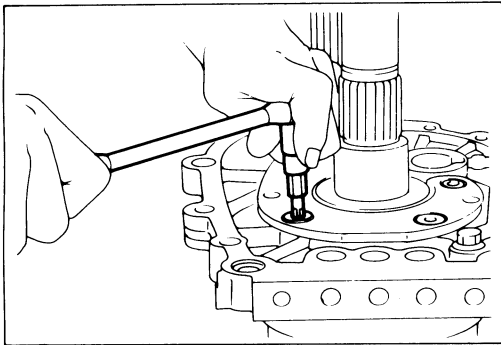
1. Intermediate Plate

- 1) Mesh the counter gear with the mainshaft assembly.
- 2) Install the holding fixture to the mainshaft and the counter gear.

Holding Fixture : 5-8840-2160-0 (J-37224)

Holding base : 5-8840-0003-0 (J-3289-20)

- 3) Place the holding fixture (with the mainshaft and the counter shaft) in a vise.
- 4) Install the intermediate plate.



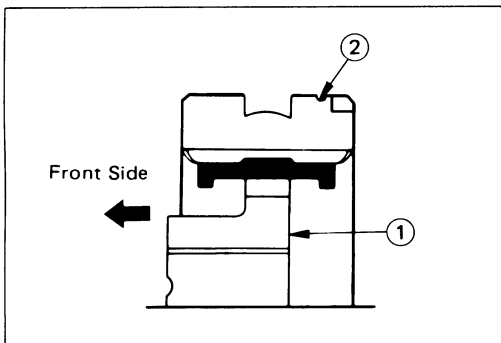
3. Bearing Plate and Screw

- 1) Apply recommended thread locking agents or its equivalent to each of the plate screw threads.
- 2) Use the wrench to tighten the screws to the specified torque.

Torx Bit Wrench : 5-8840-0047-0 (J-37225) (T45)

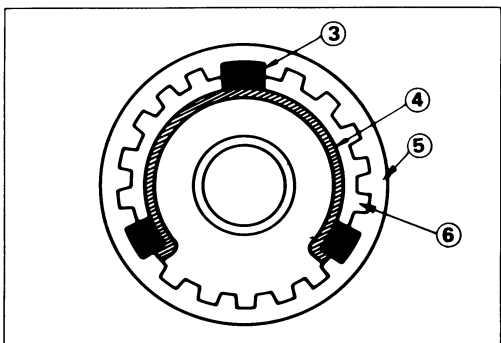
Plate Screw Torque kg·m (lb-ft/N·m)

1.5 (11/15)

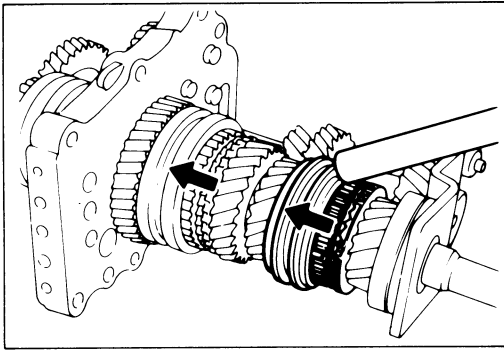


7. Rev.—5th Synchronizer Assembly

- 1) Turn the clutch hub face ① toward the side of the sleeve with small groove ② on the outer circumference.

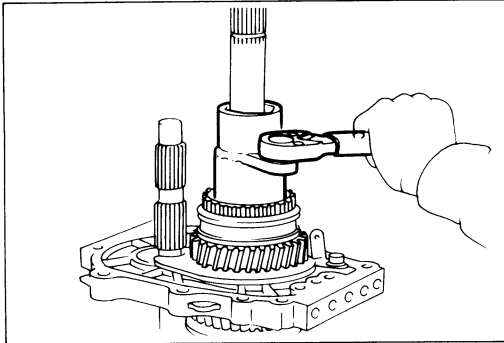


- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs ④ are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub ⑤ and the sleeve ⑥ slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft.
The clutch hub face (with the heavy boss) must be facing the reverse gear side.



8. Clutch Hub Nut

- 1) Mesh the 1st—2nd synchronizer with both the 1st and 3rd gears (double engagement).
This will prevent the mainshaft from turning.

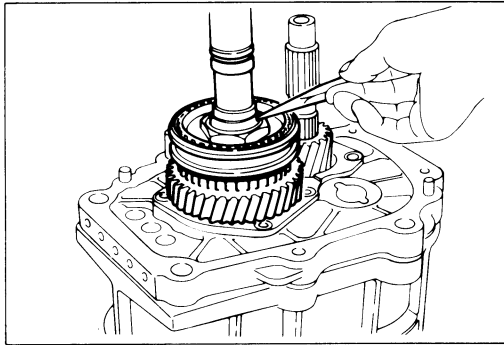


- 2) Install the mainshaft lock nut.
- 3) Use the lock nut wrench to tighten the lock nut to the specified torque.

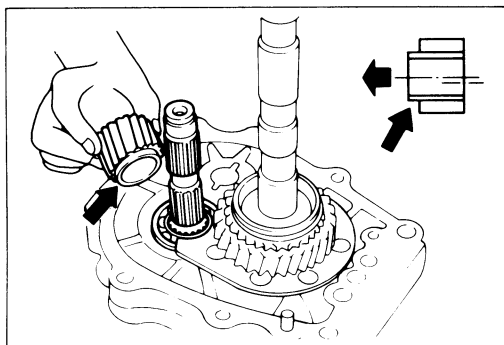


Wrench: 5-8840-2156-0 (J-37219)

Hub Nut Torque	kg·m(lb.ft/N·m)
14 ± 2 ($101 \pm 14.4/137 \pm 20$)	



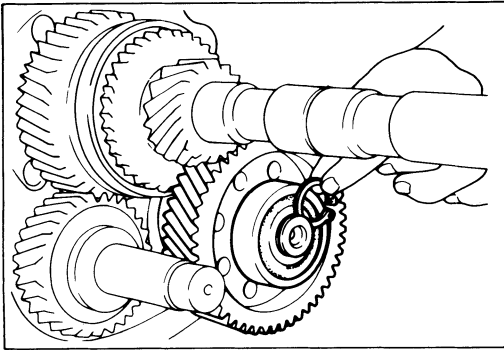
- 4) Use a punch to stake the lock nut.



12. Counter Reverse Gear

- 1) Apply engine oil to the counter reverse gear and the reverse gear.
- 2) Install the counter reverse gear to the counter gear.
The reverse gear projection must be facing the side of the intermediate plate.





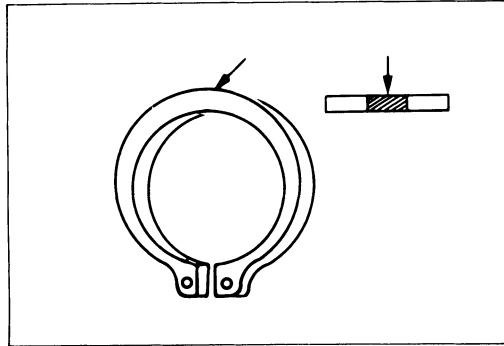
19. Bearing Snap Ring

- 1) Select the snap ring which will provide the minimum clearance between the ball bearing and the snap ring.

There are six snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

Ball Bearing and Snap Ring Clearance		mm(in)
Standard		0 – 0.15 (0 – 0.0059)

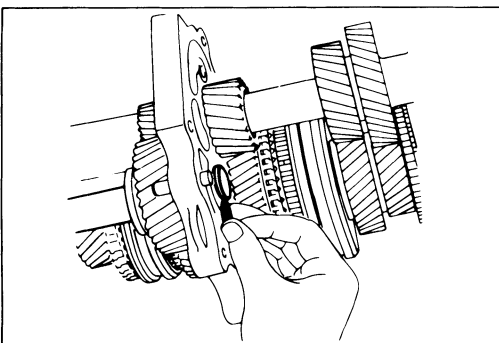


Snap Ring Availability mm(in)

Thickness mm(in)	Color-Coding
1.1 (0.043)	White
1.2 (0.047)	Yellow
1.3 (0.051)	Blue
1.4 (0.055)	Pink
1.5 (0.059)	Green
1.6 (0.063)	Brown

- 2) Use a pair of snap ring pliers to install the snap ring to the counter 5th gear.

The snap ring must be fully inserted into the counter 5th gear snap ring groove.



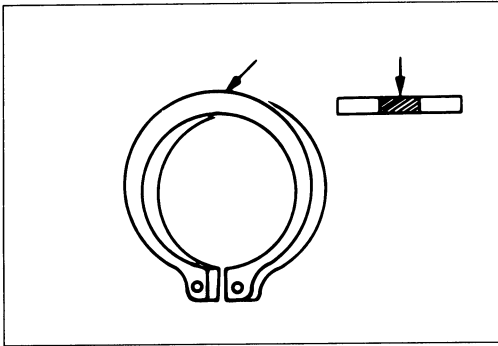
20. Reverse Gear Snap Ring

- 1) Select the snap ring which will provide the minimum clearance between the intermediate plate and the snap ring.

There are three snap ring sizes available.

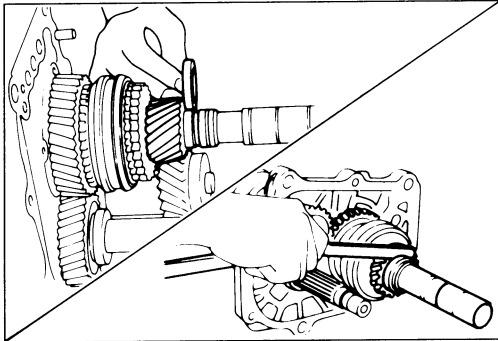
The snap rings are color-coded to indicate their thickness.

Intermediate Plate and Snap Ring Clearance		mm(in)
Standard		0 – 0.15 (0 – 0.0059)



Snap Ring Availability		mm(in)
Thickness mm(in)	Color-Coding	
1.2 (0.047)	White	
1.3 (0.051)	Yellow	
1.4 (0.055)	Blue	

- 2) Use a pair of snap ring pliers to install the snap ring to the reverse idler shaft. The snap ring must be fully inserted into the reverse idler shaft snap ring groove.

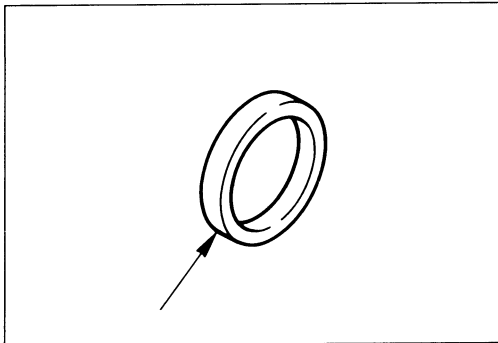


21. Thrust Washer and Lock Ball

- 1) Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance	mm(in)
Standard	
0.10 – 0.25 (0.0039 – 0.0098)	

If required, replace the existing thrust washer with a new thrust washer to bring the clearance to specification.



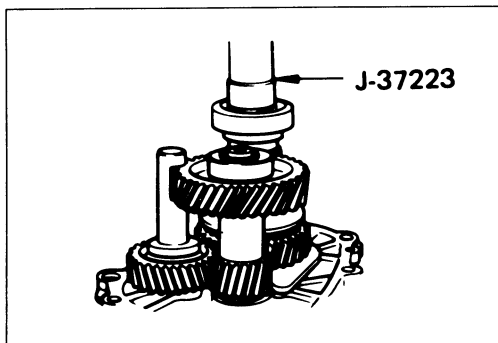
There are four thrust washer sizes available.

The snap rings are color-coded to indicate their thickness.



Thrust Washer Availability		mm(in)
Thickness	Color-Coding	
7.9 (0.311)	White	
8.0 (0.315)	Yellow	
8.1 (0.319)	Green	
8.2 (0.323)	Blue	

- 2) Apply grease to the thrust washer and the lock ball.
- 3) Install the thrust washer and the lock ball to the mainshaft.



24. Roller Bearing

Apply engine oil to the bearing inner and outer circumference.

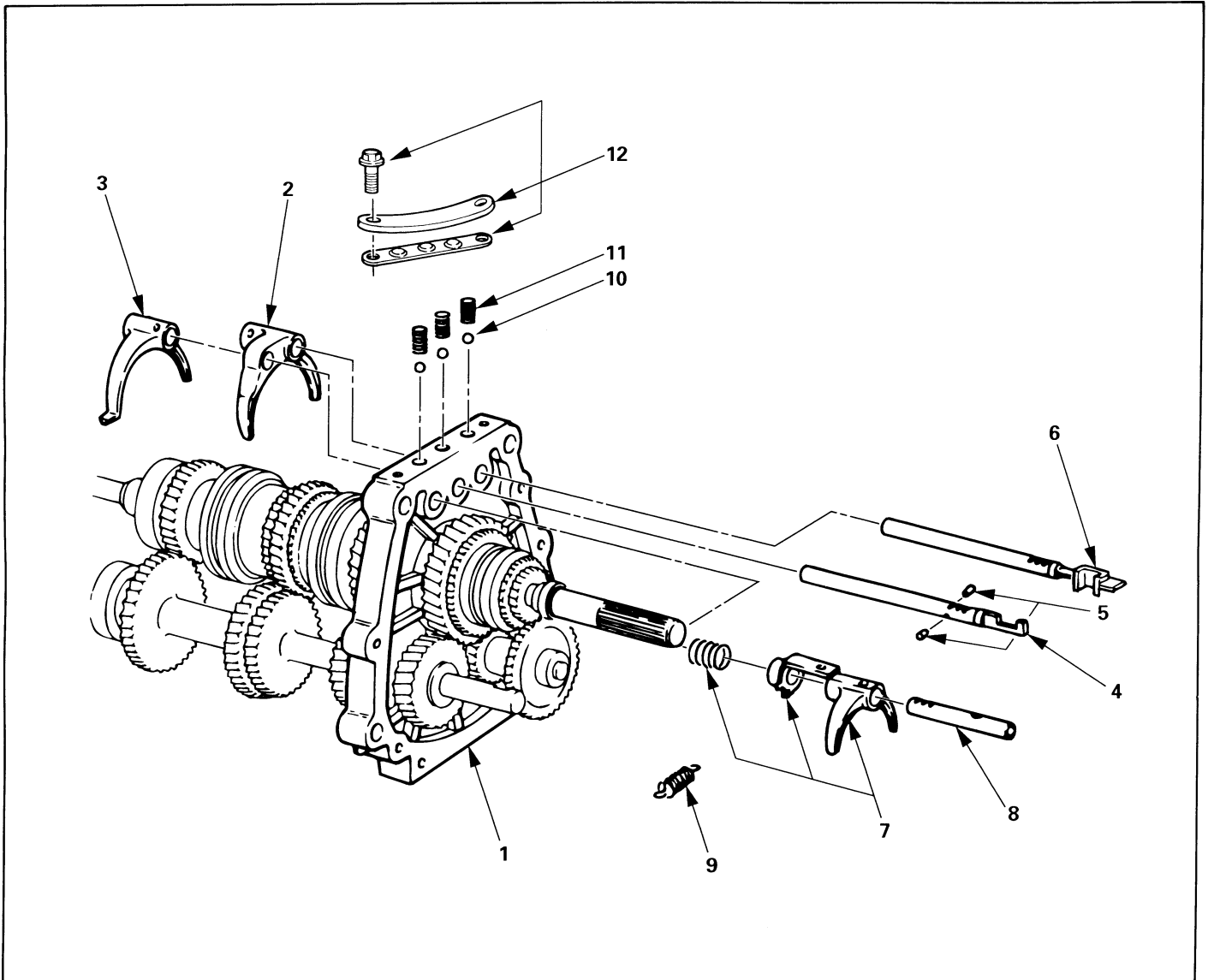
Use the installer to install the roller bearing to the mainshaft. Installer : 5-8840-2159-0 (J-37223)

Note:

Be sure the bearing is installed in the direction it was removed from.



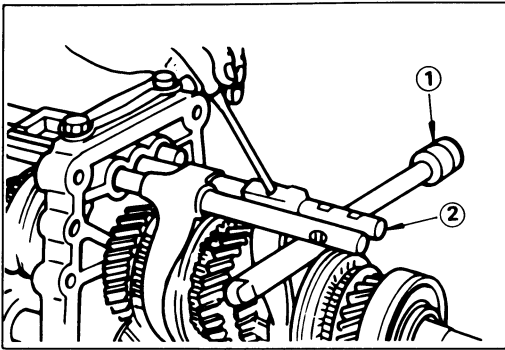
DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



220RW072

Reassembly Steps

- | | |
|---|---------------------------------------|
| 1. Intermediate plate and gear assembly | 7. Rev. — 5th shift arm and inhibitor |
| ▲ 2. 1st—2nd shift arm | 8. Rev. — 5th shift rod |
| ▲ 3. 3rd—4th shift arm | 9. Spring |
| ▲ 4. 3rd—4th shift rod | 10. Detent ball |
| ▲ 5. Interlock pin | 11. Detent spring |
| 6. 1st—2nd shift rod | ▲ 12. Detent spring plate and gasket |



Important Operations

2. 1st–2nd Shift Arm

3. 3rd–4th Shift Arm

Hold a round bar ① against the shift rod end lower face ② to protect it against damage.

Install the new spring pin.

Never reinstall the used spring pin.

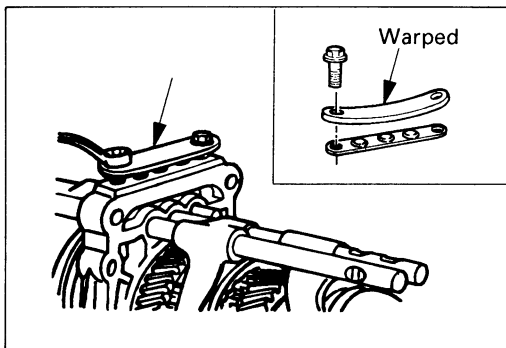
4. 3rd–4th Shift Rod

5. Interlock pin

1) Install the interlock pin to the shift rod.

2) Install the shift rod together with the interlock pin to the intermediate plate.

Do not allow the interlock pin to fall from the shift rod.



12. Detent Spring Plate and Gasket

1) Install the new-detent plate and new gasket onto the transmission case into the correct direction.

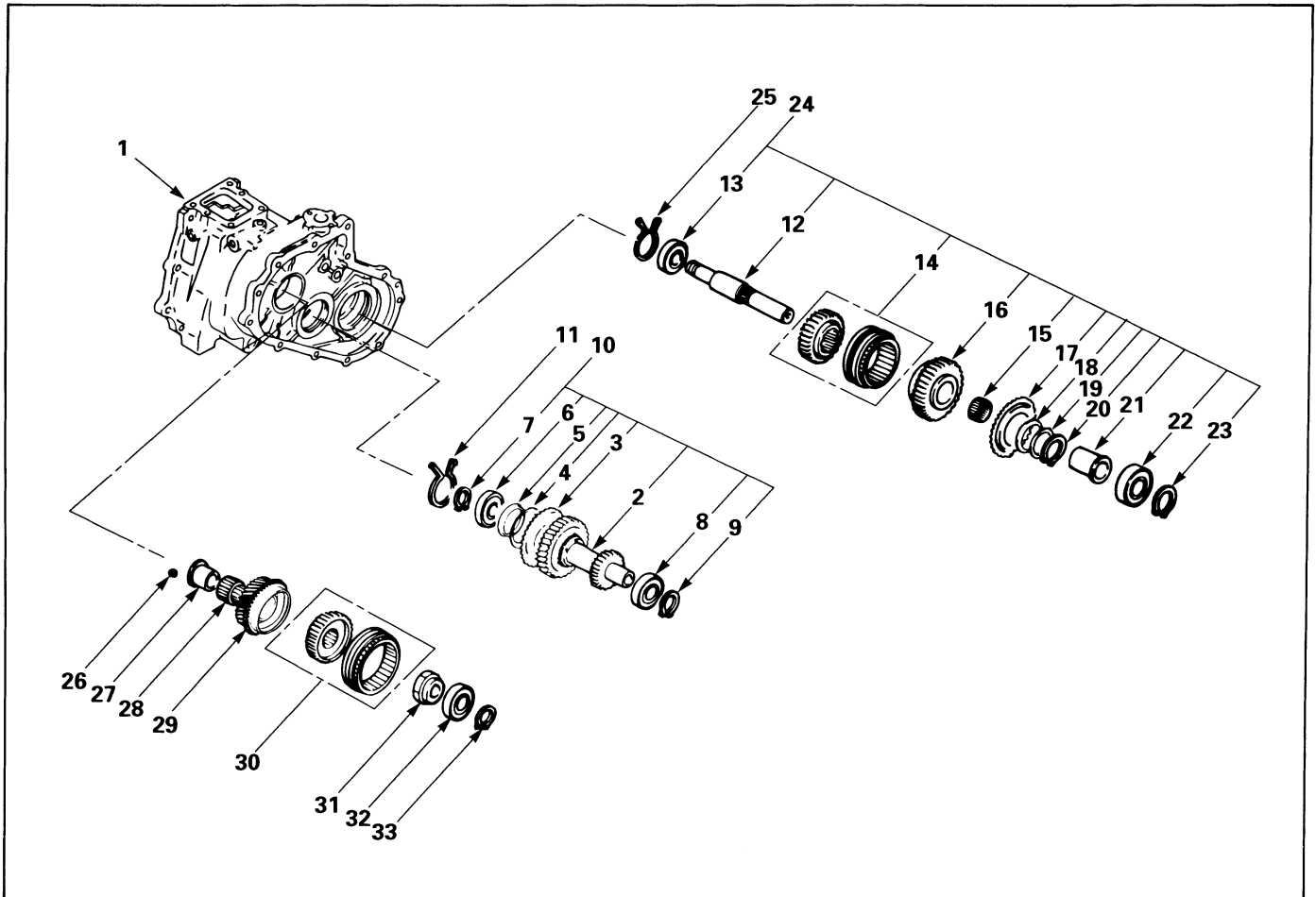
2) Tighten the detent spring plate bolts to specified torque.

Detent Spring Plate Bolt Torque	kg·m(lb.ft/N·m)
	2.0 ± 0.4 ($14 \pm 3/20 \pm 4$)

MINOR COMPONENT



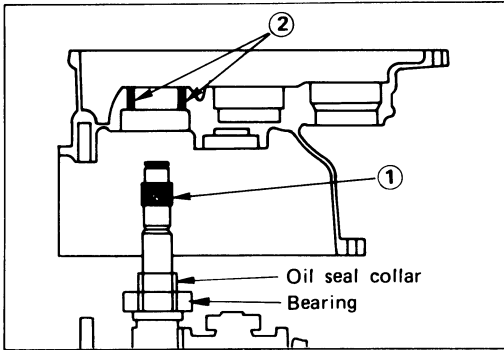
TRANSFER CASE ASSEMBLY



226LV001

Reassembly Steps

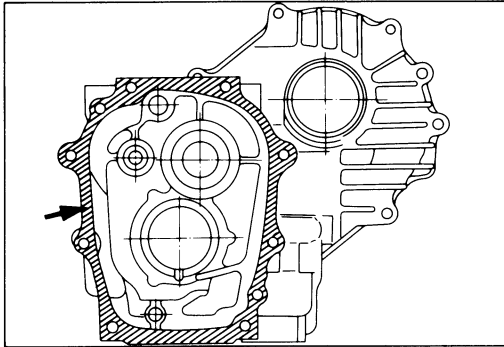
- ▲ 1. Transfer case
- ▲ 2. Counter gear
- ▲ 3. Sub gear (Anti-lash plate)
- 4. Belleville spring
- 5. Spacer
- 6. Ball bearing
- ▲ 7. Snap ring
- 8. Ball bearing
- 9. Snap ring
- 10. Counter gear assembly
- 11. Bearing snap ring
- 12. Front output shaft
- 13. Ball bearing
- 14. Clutch hub and sleeve
- 15. Needle bearing
- ▲ 16. Front output gear
- ▲ 17. Sub gear (Anti-lash plate)
- ▲ 18. Belleville spring
- ▲ 19. Spacer
- ▲ 20. Anti-lash plate snap ring
- ▲ 21. Bearing collar
- 22. Ball bearing
- ▲ 23. Snap ring
- 24. Front output gear assembly
- 25. Bearing snap ring
- 26. Ball
- 27. Bearing collar
- 28. Needle bearing
- 29. Transfer input gear
- ▲ 30. High-low clutch hub and sleeve
- ▲ 31. Mainshaft end lock nut
- ▲ 32. Ball bearing
- ▲ 33. Snap ring



Important Operations

1. Transfer Case

- 1) Cover the shaft spline with adhesive tape ①.
This will prevent damage to the oil seal lip ②.

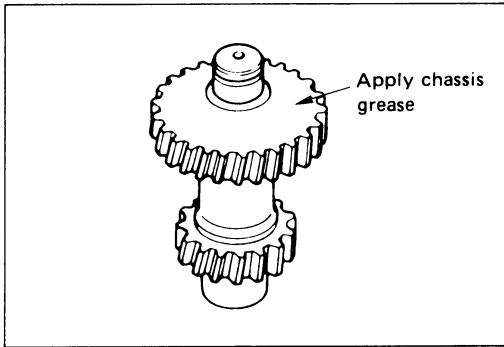


- 2) Apply recommend liquid gasket or its equivalent to the transfer case fitting surfaces.



- 3) Tighten the transfer case bolts to the specified torque a little at a time.

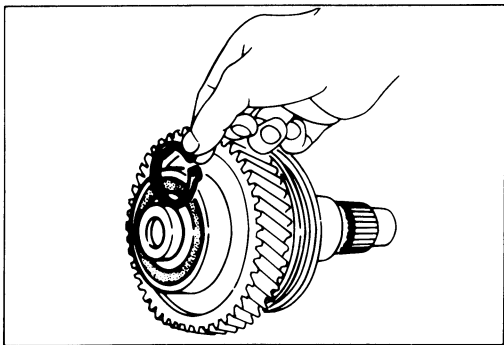
Transfer Case Bolt Torque	kg·m (lb-ft/N·m)
3.8 ± 0.8 (27 ± 5.8 / 37 ± 7.8)	



2. Counter Gear

3. Sub Gear (Anti-lash Plate)

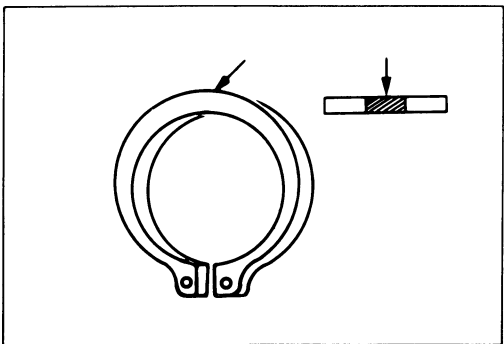
Apply chassis grease to the sub-gear and the counter gear thrust surfaces.



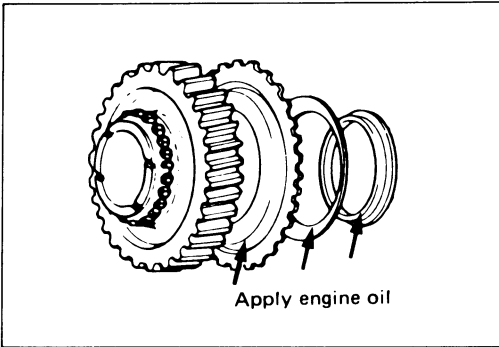
7. Snap Ring

- 1) Select a snap ring that will allow the minimum axial play.
- 2) Use a pair of snap ring pliers to install the snap ring to the counter gear.

Bearing and Snap Ring Clearance	mm(in)
Standard	
0 – 0.1 (0 – 0.0039)	

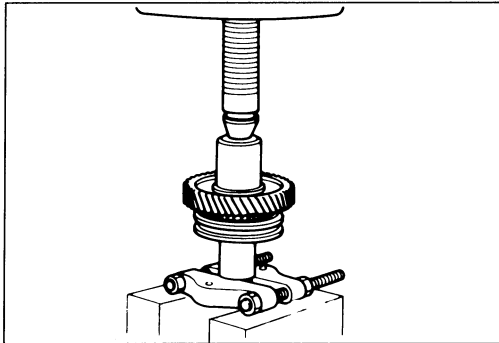


Snap Ring Availability		mm(in)
Thickness	Color-Coding	
1.50 (0.059)	White	
1.55 (0.061)	Yellow	
1.60 (0.063)	Blue	



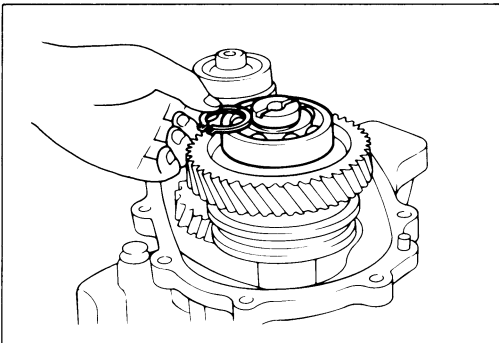
- 16. Front Output Gear**
- 17. Sub Gear (Anti-lash Plate)**
- 18. Belleville Spring**
- 19. Spacer**

Apply engine oil to the thrust surfaces of the sub-gear, the Belleville spring, and the spacer.



- 20. Anti-lash Plate Snap Ring**
- 21. Bearing Collar**

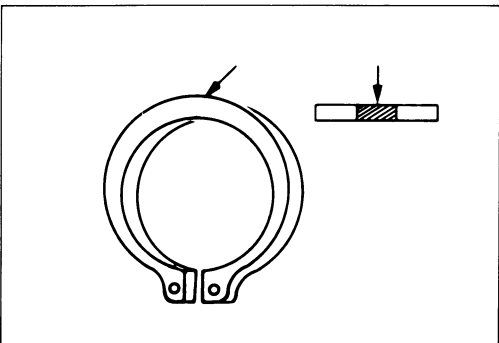
Use a bench press to install the needle bearing and collar together with the front output gear.



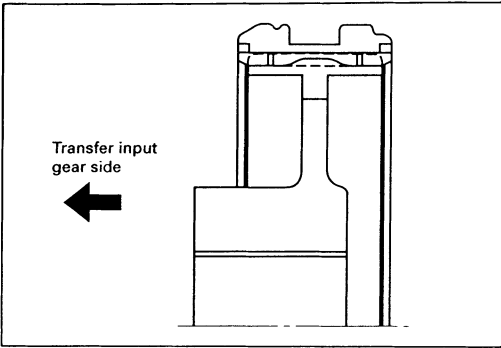
23. Snap Ring

- 1) Select a snap ring that will allow the minimum axial play.
- 2) Use a pair of snap ring pliers to install the snap ring to the output shaft.

Bearing and Snap Ring Clearance	mm(in)
Standard	
	0 – 0.1 (0 – 0.0039)



Snap Ring Availability		mm(in)
Snap Ring Thickness	Color Coding	
1.55 (0.061)	White	
1.60 (0.063)	Yellow	
1.65 (0.065)	Blue	
1.70 (0.067)	Pink	
1.75 (0.069)	Green	
1.80 (0.071)	Brown	
1.85 (0.073)	Red	
1.90 (0.075)	Orange	

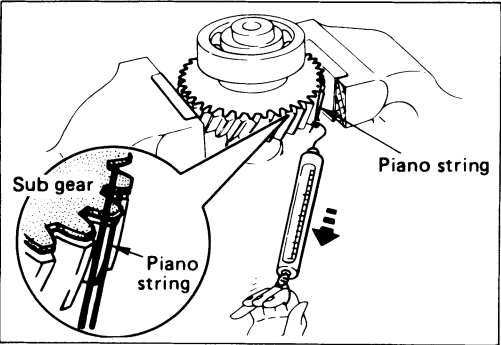


226RV003



30. High-Low Clutch Hub and Sleeve

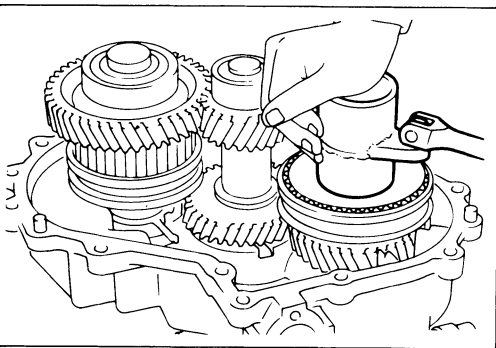
The clutch hub face with the heavy bass must be facing the transfer input gear side.



Sub Gear (Anti-lash Plate) Preload

- 1) Hook a length of piano wire over one of the sub-gear teeth.
- 2) Attach the other end of the piano wire to a spring balancer.
- 3) Measure the sub-gear preload.

Sub-Gear Preload	kg(lb/N)
Standard	
6 – 10 (13 – 22/59 – 98)	



32. Mainshaft End Lock Nut

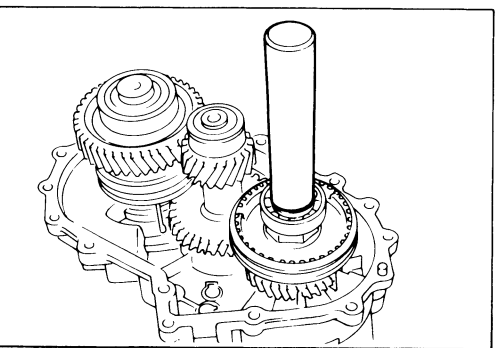
- 1) Use the lock nut wrench to tighten the mainshaft end lock nut to the specified torque.

Lock Nut Wrench : J-37219

Mainshaft End Lock Nut Torque	kg·m (lb·ft/N·m)
14 ± 2 ($101 \pm 14.4/137 \pm 20$)	



- 2) Stake the lock nut.



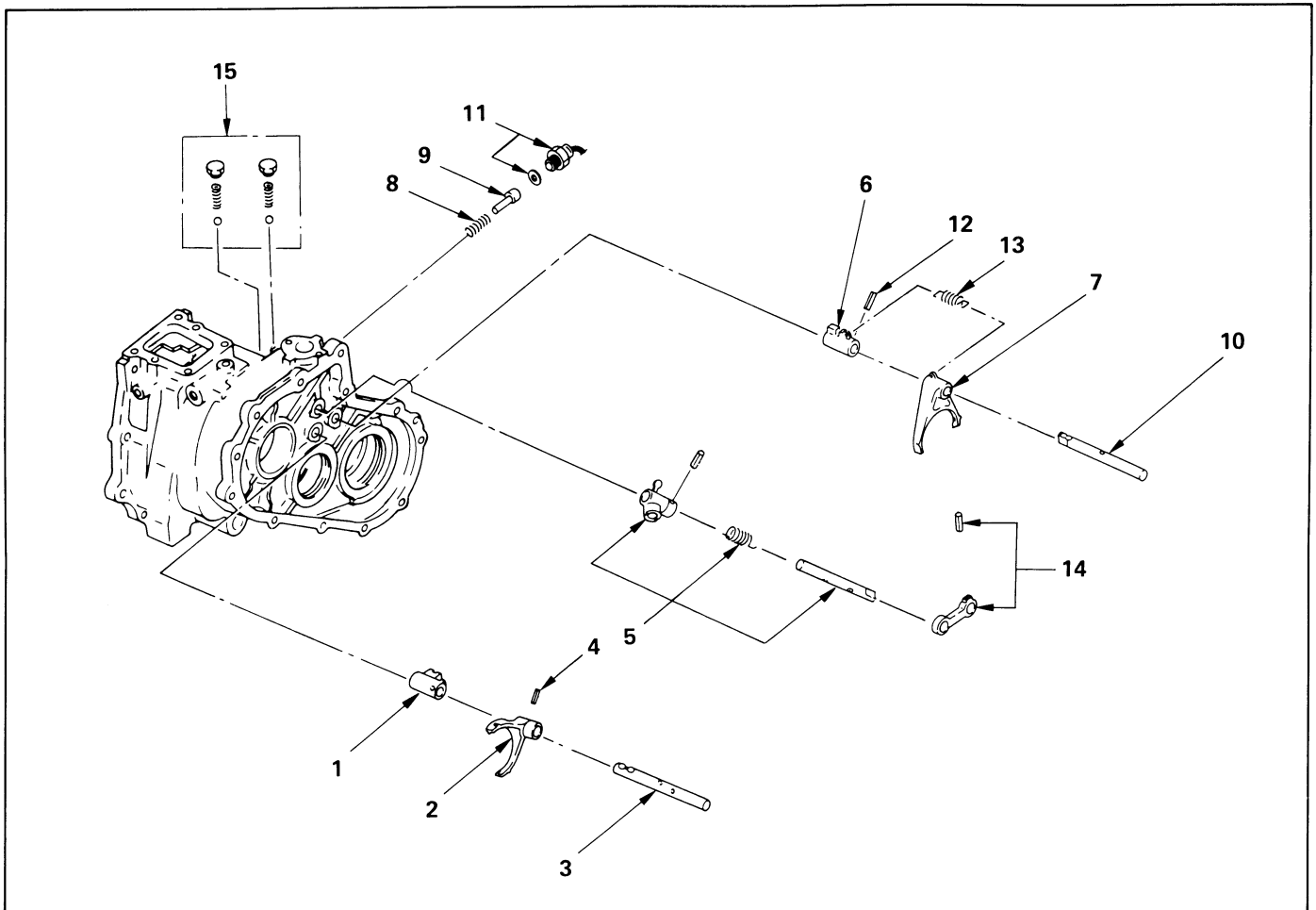
33. Ball Bearing

Use the ball bearing installer to install the ball bearing.

Installer: 5-8840-2159-0 (J-37223)

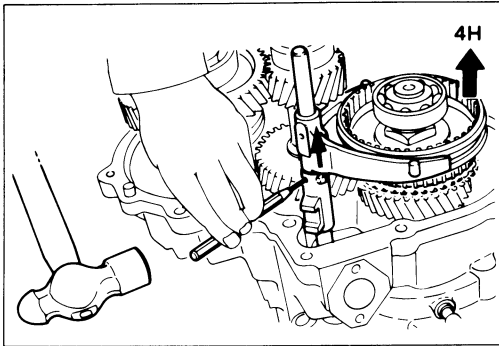


DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



Reassembly Steps

- | | |
|-------------------------|------------------------------------|
| 1. Shift block | ▲ 9. Interlock pin |
| 2. Shift arm | ▲ 10. 2WD-4WD shift rod |
| ▲ 3. High-low shift rod | ▲ 11. 4WD indicator switch |
| ▲ 4. Spring pin | ▲ 12. Spring pin |
| 5. Select rod assembly | ▲ 13. Spring |
| 6. Shift block | ▲ 14. Pin and bridge |
| 7. Shift arm | ▲ 15. Detent ball, spring and plug |
| 8. Spring | |

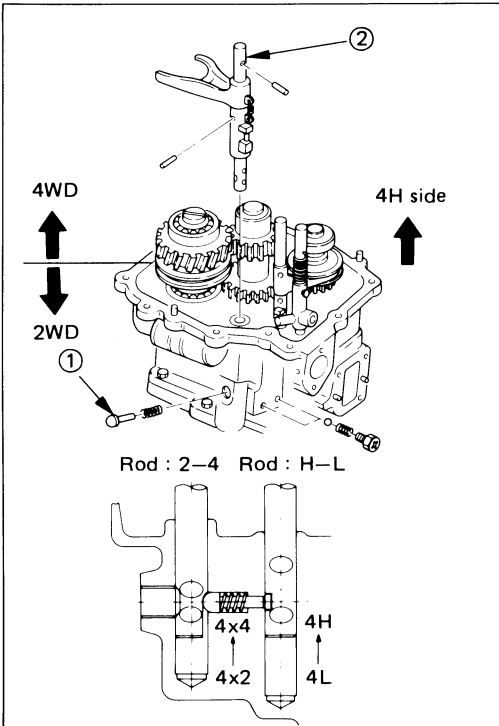


Important Operations

3. High-Low Shift Rod

4. Spring Pin

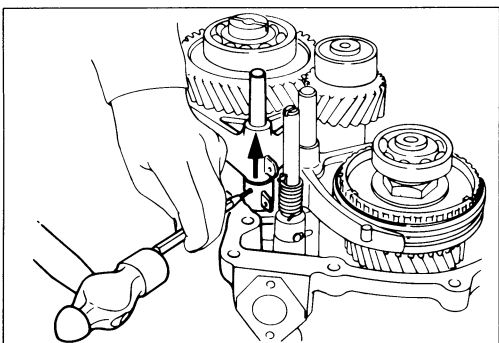
- 1) Engage the High-Low sleeve with 4H side.
- 2) Install the spring pin to the shift block.



9. Interlock Pin

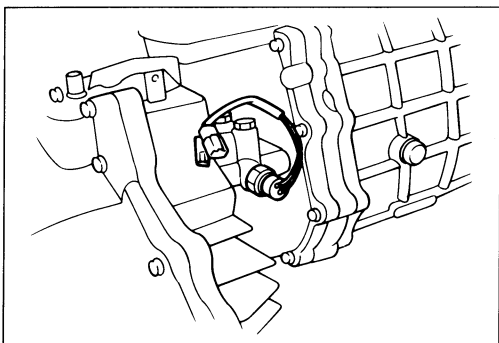
10. 2WD-4WD Shift Rod

- 1) Engage the High-Low synchronizers with 4H side and install the interlock pin 1 in proper direction.
- 2) Install the shift rod: 2WD-4WD 2 with the interlock pin pushed it in.



12. Spring Pin

- 1) Engage the 2WD-4WD sleeve with the 4WD side and install the spring pin.



11. 4WD Indicator Switch

Tighten the switch to the specified torque.

Switch Torque kg·m(lb.ft/N·m)

4 (29.0/39.2)



15. Detent Ball, Spring and Plug

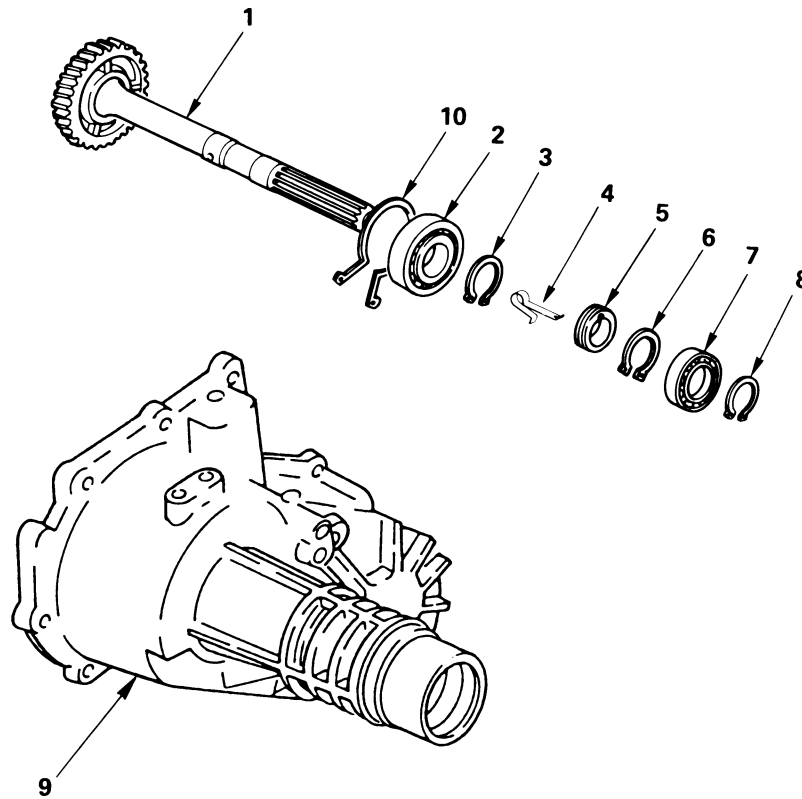
Tighten the plugs to the specified torque.

Plug Torque kg·m(lb.ft/N·m)

1.9 ± 0.4 (13.7 ± 2.9/18.6 ± 3.9)



TRANSFER REAR CASE ASSEMBLY



Reassembly Steps

- | | |
|---------------------------|-----------------------|
| 1. Rear output shaft | ▲ 7. Ball bearing |
| ▲ 2. Ball bearing | 8. Bearing snap ring |
| 3. Bearing snap ring | 9. Rear case |
| ▲ 4. Clip | 10. Bearing snap ring |
| 5. Speedometer drive gear | |
| 6. Bearing snap ring | |



Important Operations

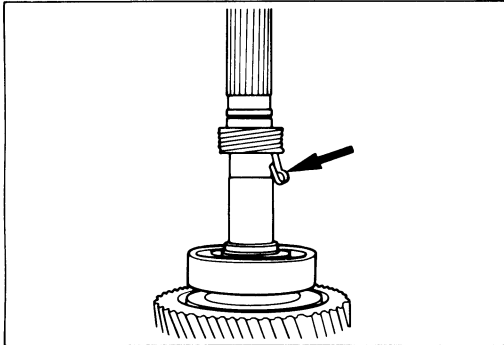


2. Ball Bearing

Use the ball bearing installer and the adapter to install the ball bearing.

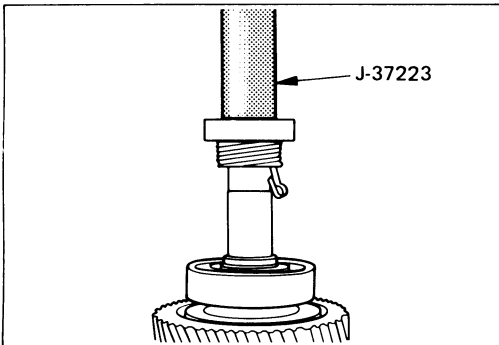
Ball Bearing Installer : 5-8840-2159-0 (J-37223)

Adapter : 5-8840-2192-1 (J-37486-A)



4. Clip

Install the clip to the drive gear groove.



7. Ball Bearing

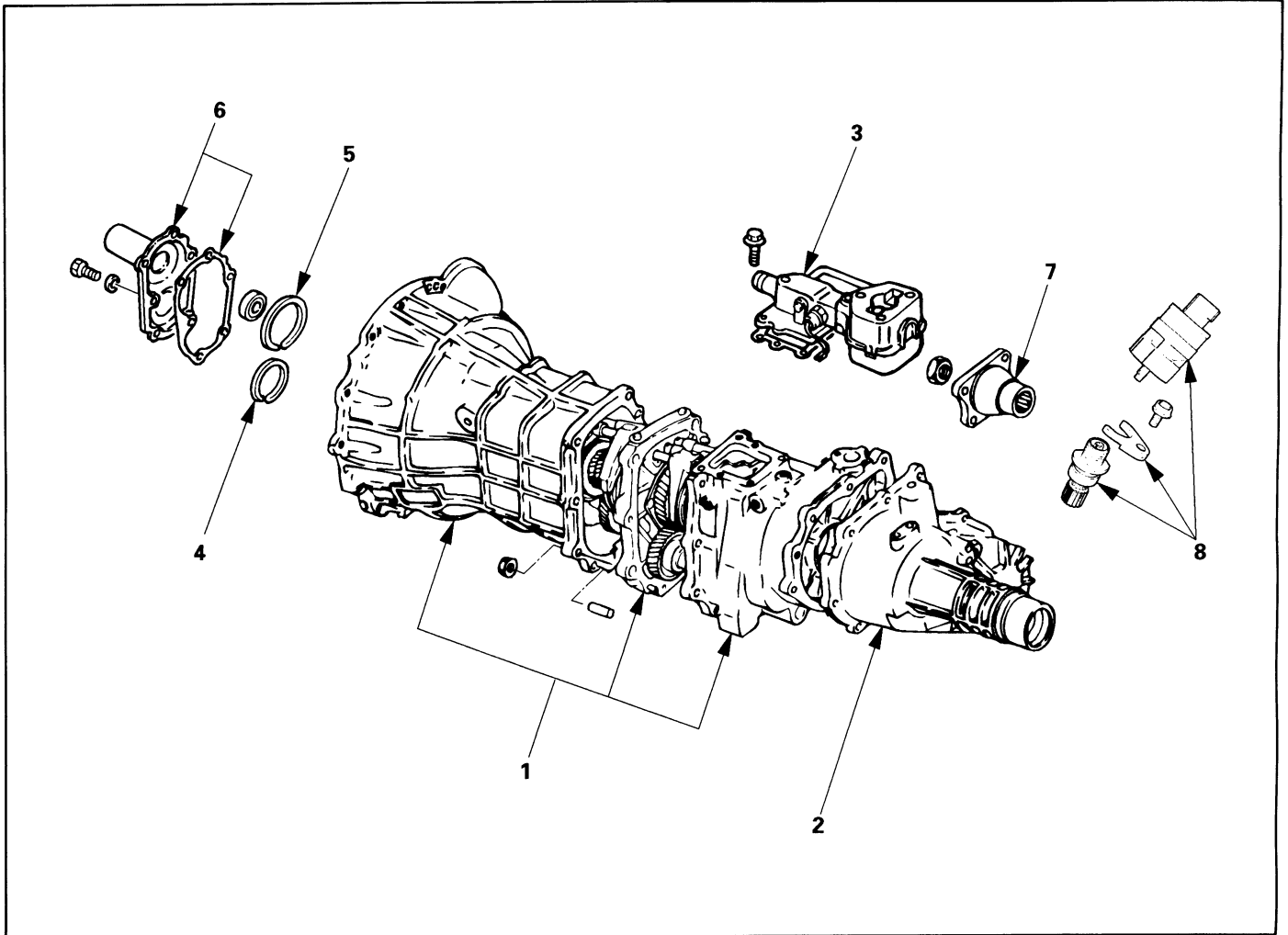
Use the ball bearing installer to install the ball bearing.

Ball Bearing Installer : 5-8840-2159-0 (J-37223)



REASSEMBLY

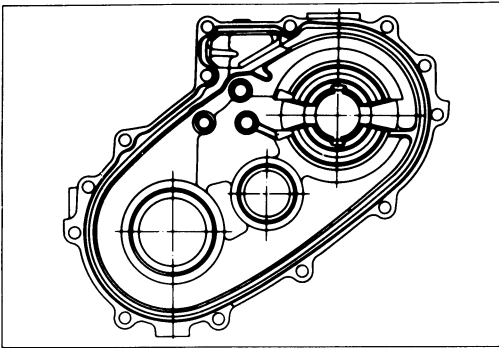
EXTERNAL COMPONENTS



220LV003

Reassembly Steps

- | | |
|---------------------------------------|---|
| 1. Transmission and transfer assembly | ▲ 5. Bearing snap ring |
| ▲ 2. Transfer rear case assembly | ▲ 6. Front cover with oil seal |
| 3. Gear control box assembly | ▲ 7. Transfer flange |
| ▲ 4. Counter gear snap ring | ▲ 8. Speedometer driven gear and speedometer sensor |

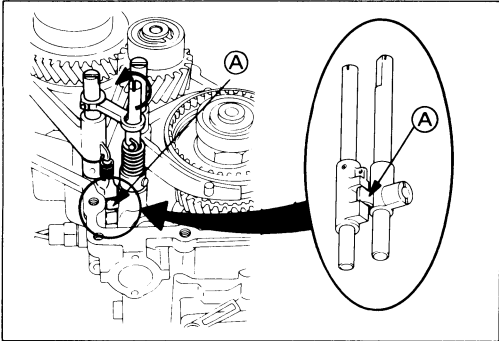


Important Operations



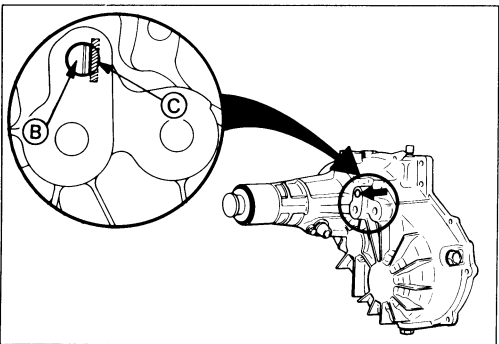
2. Transfer Rear Case Assembly

- 1) Apply recommended liquid gasket or its equivalent to the transfer rear case fitting faces.



- 2) Apply the following steps before fitting the transfer rear case.

- ① Shift the High-Low synchronizer to the 4H side.
- ② Turn the select rod counterclockwise so that the select block projection **A** may enter into the 2WD-4WD shift block.

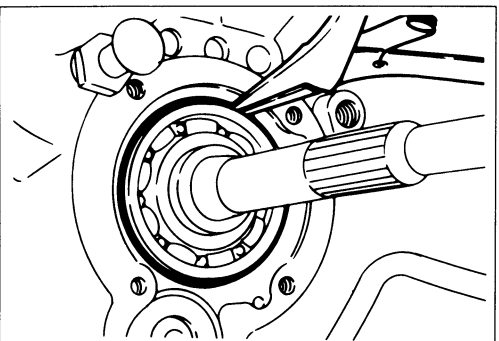


When the rear case is fitted under this condition ②, the direction of the cut-away portion of select rod head **B** aligns with that of the rear case hole's stopper **C**.

- 3) Tighten the rear transfer rear case bolts to the specified torque.



Transfer Case Bolt Torque	kg·m (lb·ft/N·m)
	3.8 ± 0.8 ($27 \pm 5.8 / 37 \pm 7.8$)

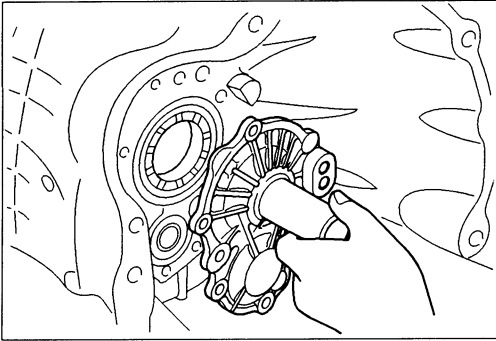


4. Counter Gear Snap Ring

5. Bearing Snap Ring

Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the ball bearing snap ring groove.



220RT017



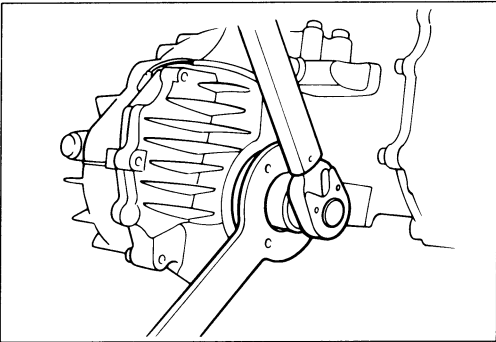
6. Front Cover with Oil Seal

- 1) Apply recommended liquid gasket or its equivalent to the through bolt threads.
- 2) Install the new gasket and the front cover with oil seal to the transmission case.

Take care not to damage the oil seal.

- 3) Tighten the front cover bolts to the specified torque.

Front Cover Bolt Torque	kg·m (lb·ft/N·m)
1.9 ± 0.4 ($13.7 \pm 2.9/18.6 \pm 3.9$)	



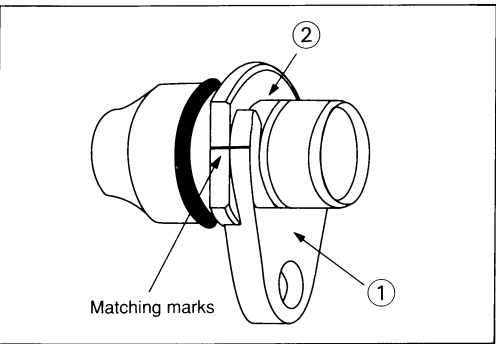
7. Transfer Flange

- 1) Use the flange holder to install the flange to the rear transfer case.

Flange Holder : 5-8840-2157-0 (J-27221)

- 2) Tighten the transfer flange bolts to the specified torque.

Transfer Flange Bolt Torque	kg·m(lb·ft/N·m)
14 ± 2 ($101 \pm 14.4/ 137 \pm 20$)	



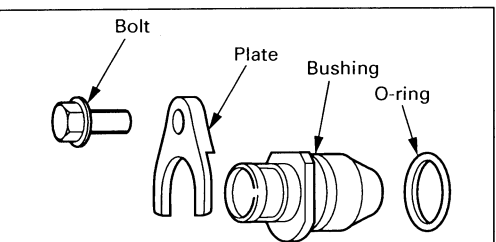
Matching marks



8. Speedometer Driven Gear and Speedometer Sensor

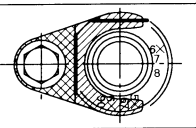
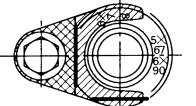
- 1) Install the O-ring to the speedometer driven gear bushing.
- 2) Install the driven gear to the speedometer driven gear bushing.
- 3) Align the matching marks on plate ① and bush ② then tighten the bolt.

Bolt Torque	kg·m (lb·ft/N·m)
1.5 ($10.8/14.7$)	



- 4) Install the speedometer sensor.

	kg·m (lb·ft/N·m)
2.8 ($20/27$)	

Type	Drive gear teeth × Driven gear teeth
A	 6×17 6×18
B	 6×19 5×16

225RW009

TROUBLESHOOTING

Refer to this Section to quickly diagnose and repair engine problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint (2) Trouble Cause (3) Countermeasure

This Section is divided into four sub-sections:

1. Abnormal Noise
 - 1) Noise in Neutral
 - 2) Noisy Operation
2. Head Shifting
3. Walking or Jumping Out of Gear
4. Oil Leakage

1. ABNORMAL NOISE

1) NOISY IN NEUTRAL

Checkpoint	Trouble Cause	Countermeasure
Gear oil	Insufficient or improper gear oil	Replenish or replace the gear oil
OK		
Flywheel pilot bearing	Worn flywheel pilot bearing	Replace the flywheel pilot
OK		
Bearings (Mainshaft, countershaft, and transfer shaft)	Worn or broken bearing(s)	Replace the bearing(s)
OK		
Gears (Mainshaft, countershaft, reverse idler gear and transfer gears)	Worn or scuffed gear tooth contact surfaces	Replace the gear(s)
OK		
Mainshaft splines Synchronizer clutch hub splines	Worn splines	Replace the main shaft and the synchronizer clutch hub
OK		
Transmission	Transmission misalignment	Realign the transmission

2) NOISY OPERATION

Checkpoint	Trouble Cause	Countermeasure
Gear oil (Metallic rattling)	Insufficient or improper gear oil	Replenish or replace the gear oil
OK		
Bearings (Hissing, thumping or bumping)	Worn or broken bearing(s)	Replace the bearing(s)
OK		
Gears (Growling, humming, or grinding)	Worn, chipped, or cracked gear(s)	Replace the gear(s)
OK		
Gears (Squealing at high speeds)	Free running gears seizing on the thrust face or the inner face	Replace the gear(s)
OK		
Gears (Gear whining)	Lack of backlash between meshing gears	Replace the gear(s)

2. HARD SHIFTING

Checkpoint		Trouble Cause	Countermeasure
Gear oil	NG	Insufficient or improper gear oil	Replenish or replace the gear oil
OK			
Clutch pedal free play	NG	Improper clutch pedal free play	Readjust the clutch pedal free play
OK			
Change lever operation	NG	Hard operating change lever caused insufficient grease	Repair or regrease the change lever assembly
OK			
Change lever play	NG	Worn change lever sliding portions	Repair or replace the applicable parts and regrease
OK			
Shift block sleeve movement	NG	Sleeve movement failure	Repair or replace the sleeve
OK			
Shift rod and quadrant box sliding faces, and other parts	NG	Worn shift rod and/or sliding faces	Replace the shift rod and/or the quadrant box

Continued on the next page

Checkpoint

Trouble Cause

Countermeasure

Continued from the previous page

Checkpoint	Trouble Cause	Countermeasure
OK Shift arm and synchronizer sleeve	NG Worn shift arm and/or synchronizer sleeve groove	Replace the worn parts
OK Mainshaft and countershaft thrust play	NG Worn thrust washer, collar, and/or gear thrust faces	Replace the worn parts
OK Synchronizer assembly	NG Worn synchronizer parts	Replace the worn parts

3. WALKING OR JUMPING OUT OR GEAR

Checkpoint	Trouble Cause	Countermeasure
Change lever play	Insufficient stroke caused by sliding position wear and excessive play	Replace the worn parts
OK		
Detent ball	Worn detent ball	Replace the detent ball
OK		
Detent spring	Detent spring weak or broken	Repair or replace the detent spring
OK		
Shift rod and quadrant box sliding faces	Worn shift rod and/or sliding faces	Replace the shift rod and/or the quadrant box
OK		
Shift arm and synchronizer sleeve	Worn shift arm and/or synchronizer sleeve groove	Replace the worn parts
OK		
Mainshaft and countershaft thrust play	Worn thrust washer, collar, and/or gear thrust faces	Replace the worn parts

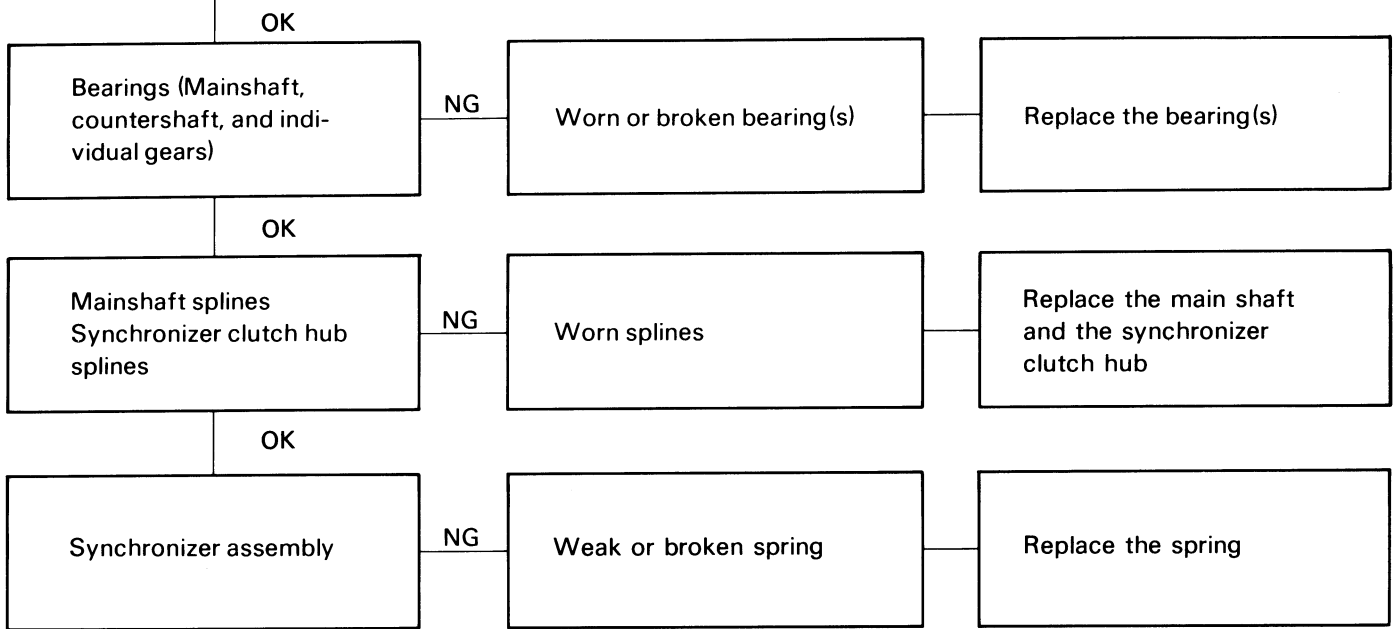
Continued on the next page

Checkpoint

Trouble Cause

Countermeasure

Continued from the previous page



4. OIL LEAKAGE

Checkpoint		Trouble Cause	Countermeasure
Oil level	NG	Oil level too high	Drain the oil to the correct level
	OK		
Gear oil	NG	Improper gear oil	Replace the gear oil
	OK		
Drain plug and/or filler plug	NG	Loose plug(s)	Tighten the plug(s) and replenish the oil
	OK		
Gaskets	NG	Defective or improperly installed gasket(s)	Replace the gasket(s)
	OK		
Air breather	NG	Air breather not installed Air breather clogged	Install the air breather Replace the air breather
	OK		
Front cover oil seal	NG	Worn or scratched oil seal	Replace the oil seal
	OK		
Rear cover oil seal	NG	Worn or scratched oil seal	Replace the oil seal

TRANSMISSION

CLUTCH

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Diagnosis	7C-8	Slave Cylinder	7C-24
Clutch Assembly	7C-9	Disassembled View	7C-24
Clutch Assembly and Associated Parts ...	7C-9	Disassembly	7C-24
Removal	7C-9	Inspection and Repair	7C-24
Inspection and Repair	7C-10	Reassembly	7C-25
Installation	7C-15	Damper Cylinder	7C-26
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Removal	7C-18	Inspection and Repair	7C-26
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Master Cylinder	7C-22	Torque Specifications	7C-27
Disassembled View	7C-22	Special Tools	7C-30
Disassembly	7C-23		

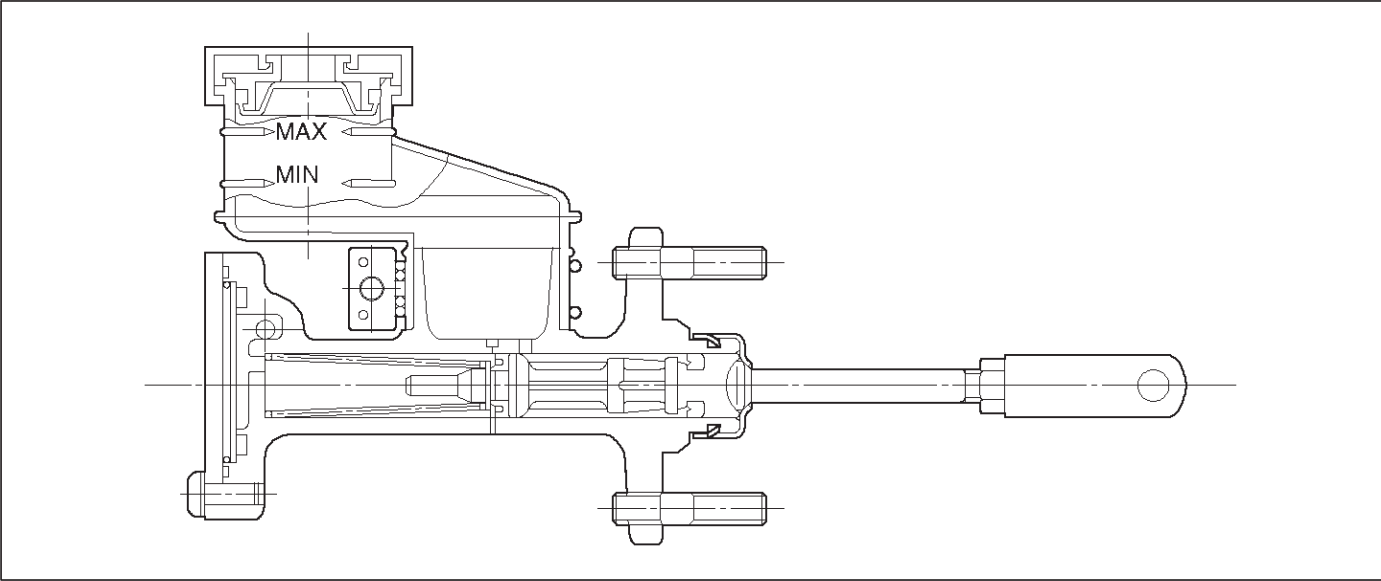
Service Precaution

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

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

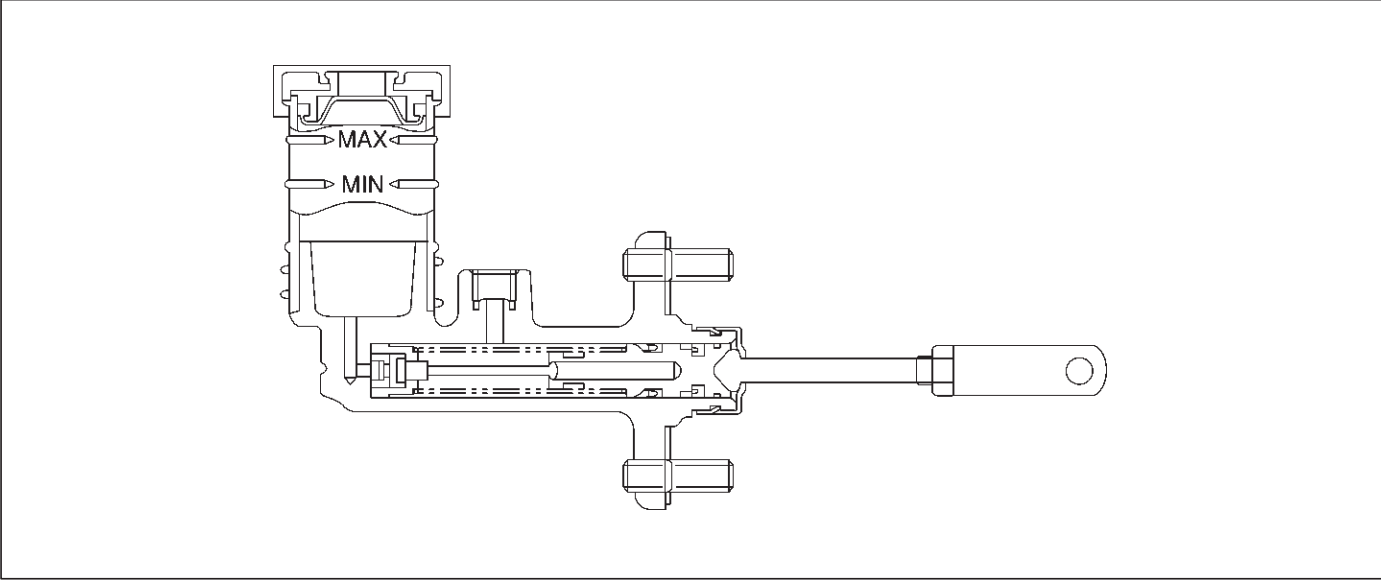
Master Cylinder

(6VE1 LHD)



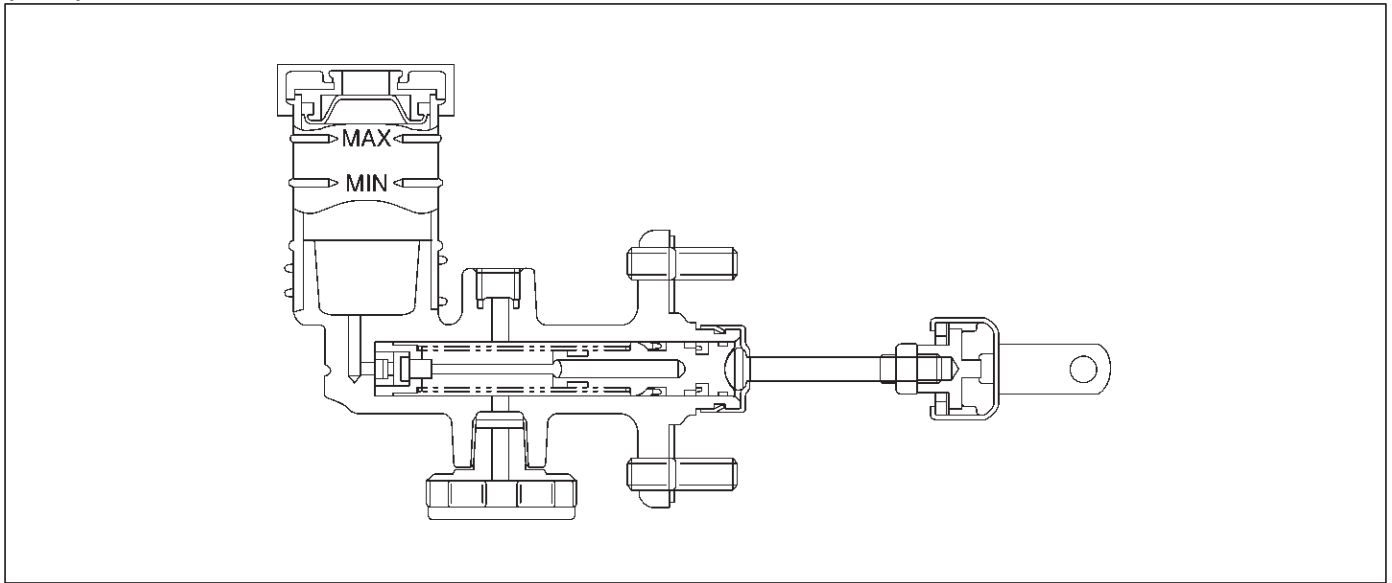
A07RW007

(6VE1 RHD)



A07RW066

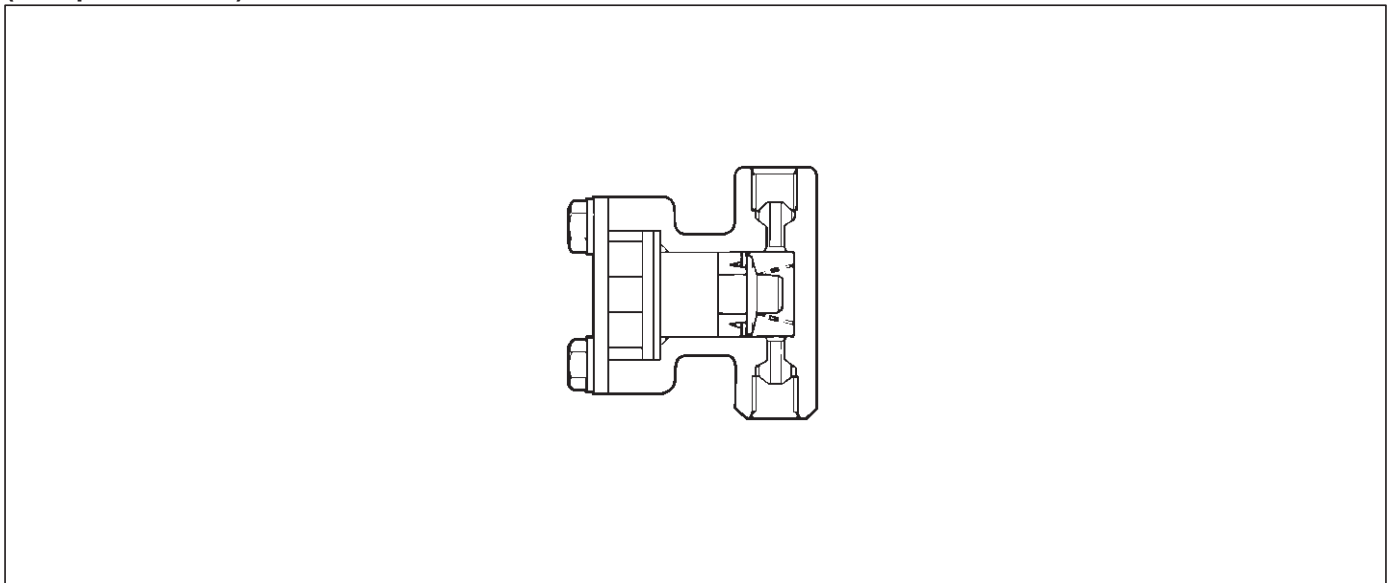
(4JX1)



A07RW067

Damper Cylinder

(Except 6VE1 LHD)

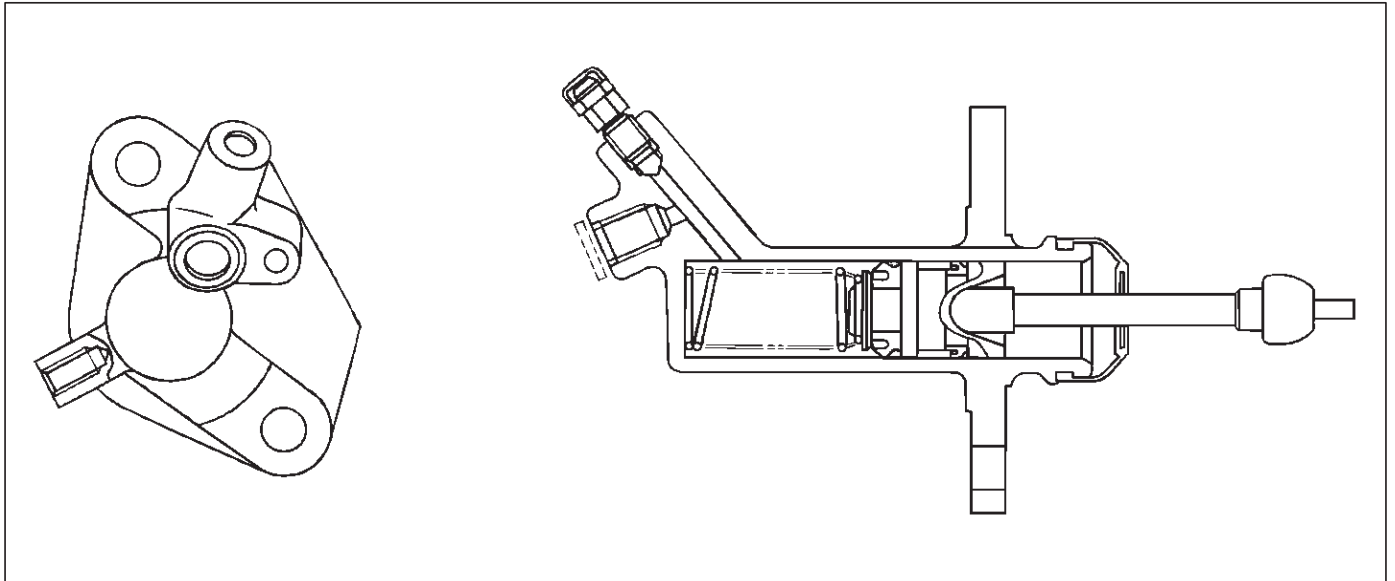


A07RS004

In order to reduce the occurrence of noises at the clutch hydraulic system, the damper cylinder is used in the

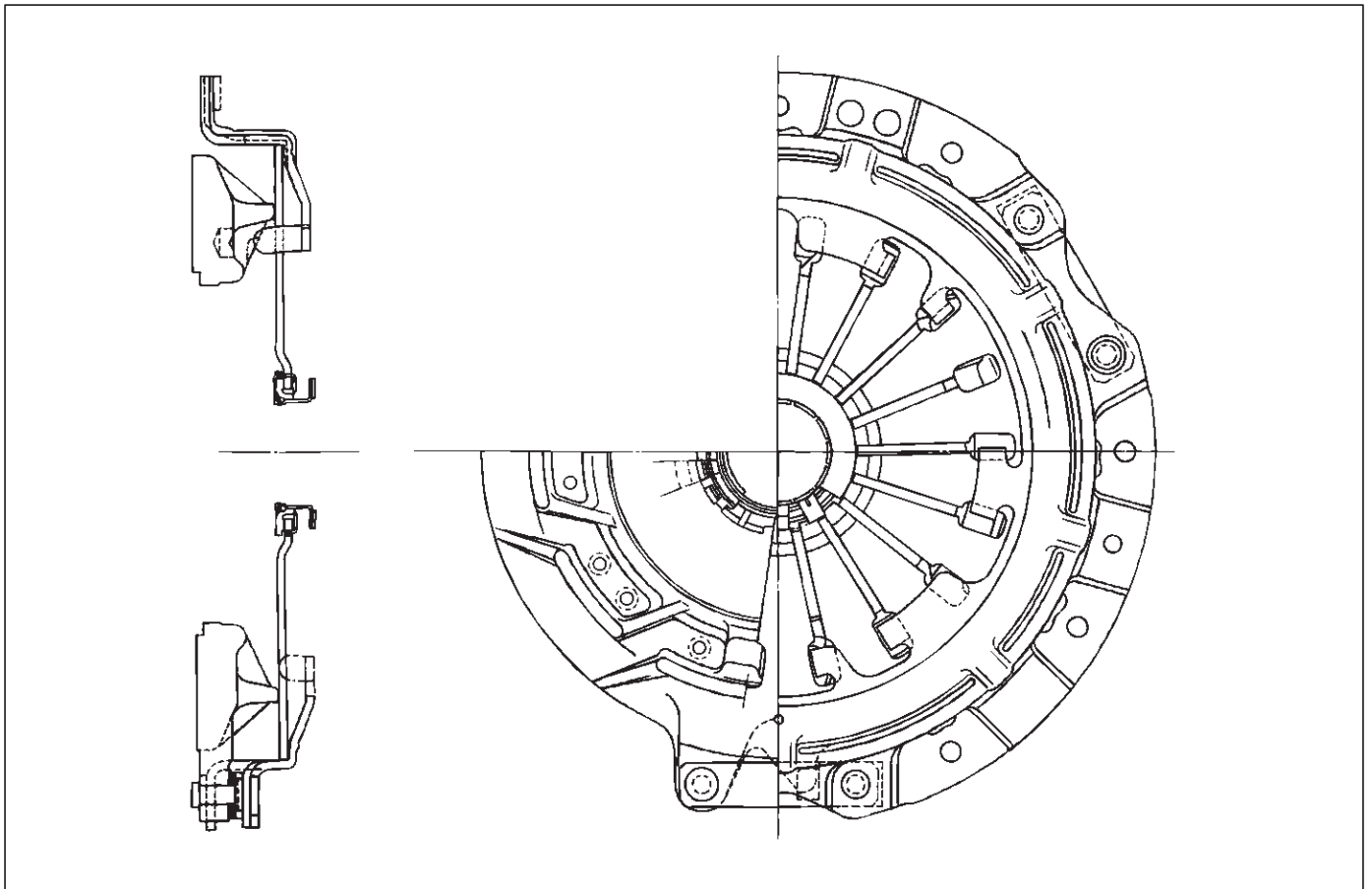
clutch hydraulic line between the master cylinder and slave cylinder.

Slave Cylinder



A07RS005

Pressure Plate Assembly

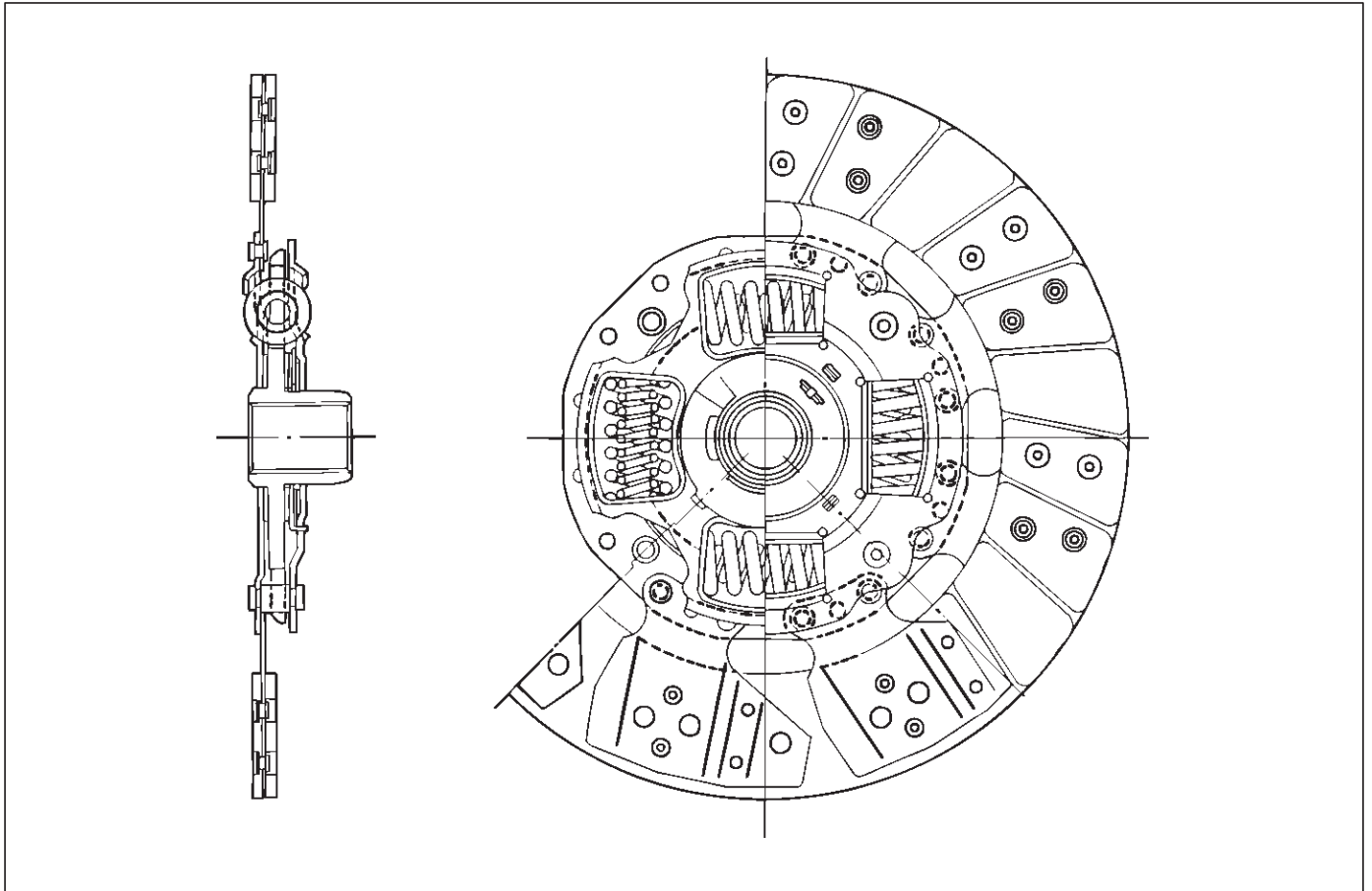


A07RS006

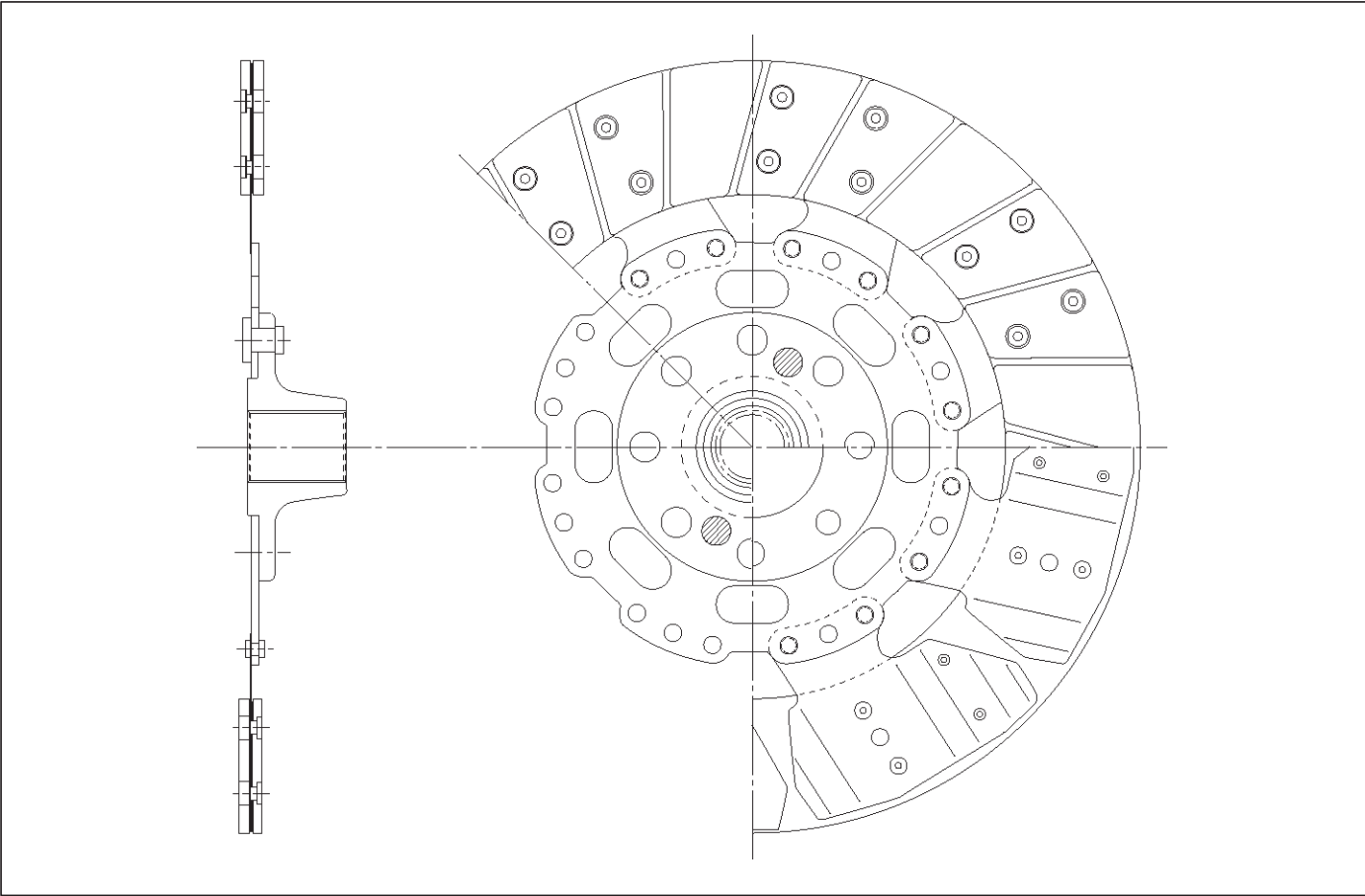
7C-6 CLUTCH

Driven Plate Assembly

(6VE1)



(4JX1)

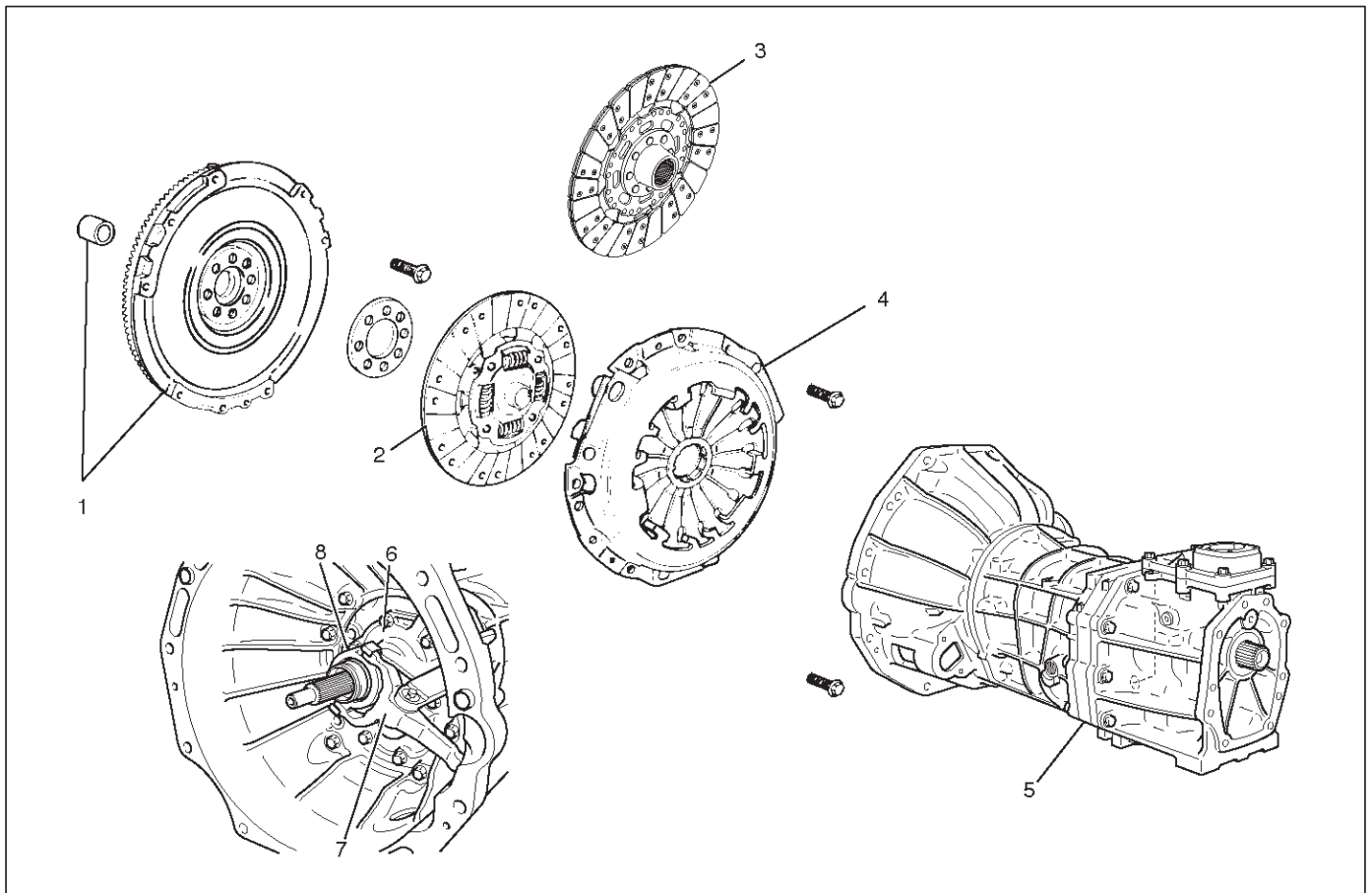


Diagnosis

Condition	Possible cause	Correction
Dragging	Fluid leakage.	Repair
	Air in hydraulic line.	Bleed
	Master cylinder and slave cylinder seals worn.	Replace master cylinder. Replace slave cylinder seals.
	Driven plate warped.	Replace driven plate.
	Diaphragm spring weakened or tip of fingers worn.	Replace pressure plate
	Driven plate sticking on splines.	Lubricate with grease or replace.
	Clutch spline worn.	Repair
	Release bearing worn or damaged.	Replace release bearing.
Slipping	Driven plate facing worn or oil-soaked.	Replace driven plate and check for leaks.
	Diaphragm spring weakened.	Replace pressure plate.
	Pressure plate or flywheel warped.	Correct or replace.
	Master cylinder and slave cylinder seals worn.	Replace master cylinder. Replace slave cylinder seals.
Chattering	Engine mounts loose or damaged.	Tighten or replace.
	Driven plate facing warped.	Replace driven plate.
	Surface of facing hardened.	Replace driven plate
	Driven plate facing oil soaked.	Replace driven plate and check for leaks.
	Damper springs weakened or broken.	Replace.
	Pressure plate or flywheel warped.	Correct or replace.
Noisy	Replace bearing binding.	Correct, or replace if damaged, and lubricate.
	Replace bearing worn or damaged.	Replace release bearing.
	Release bearing poorly lubricated.	Lubricate.
	Pilot bearing worn.	Replace pilot bearing.
	Damper springs weakened or broken.	Replace driven plate.
	Rivets of driven plate exposed.	Replace driven plate.
Replace driven plate.	Hydraulic line blocked.	Clean out or replace.
	Master or slave cylinders binding.	Repair or replace as needed.

Clutch Assembly

Clutch Assembly and Associated Parts



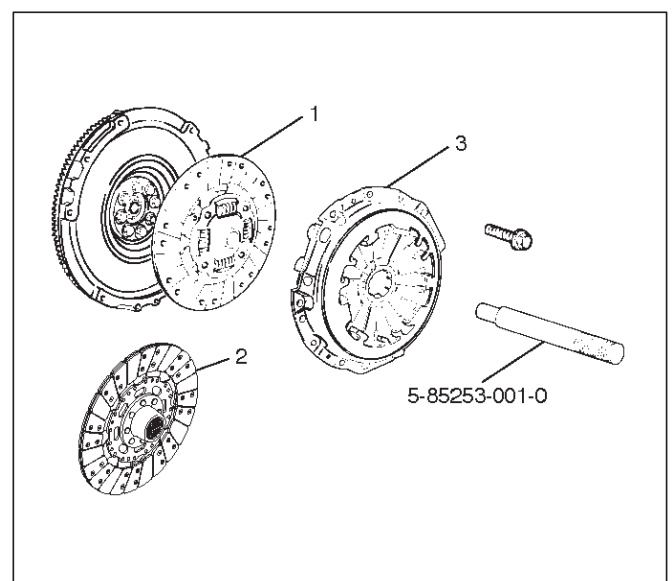
201RW029

Legend

- | | |
|--|---------------------------|
| (1) Flywheel Assembly and Crankshaft Bearing | (5) Transmission Assembly |
| (2) Driven Plate Assembly (6VE1) | (6) Front Cover |
| (3) Driven Plate Assembly (4JX1) | (7) Shift Fork |
| (4) Pressure Plate Assembly | (8) Release Bearing |

Removal

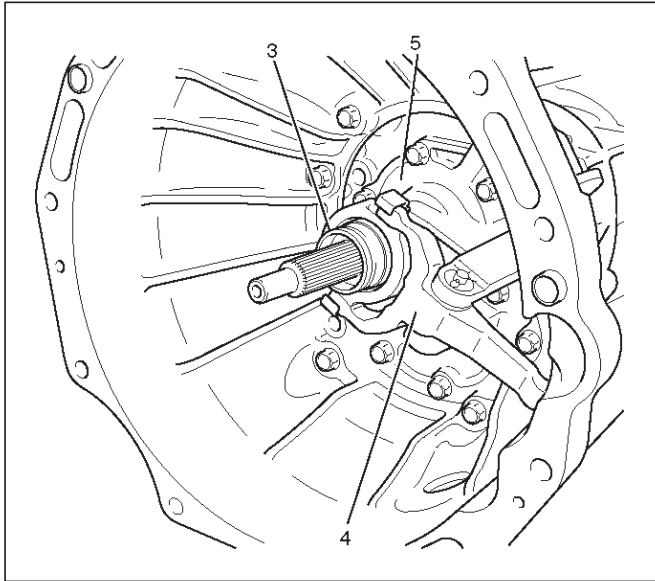
1. Remove transmission assembly, refer to "MANUAL TRANSMISSION" of Section 7B for "Removal AND INSTALLATION" procedure.
2. Mark the flywheel, clutch cover and pressure plate lug for alignment when installing.
3. Remove pressure plate assembly (3).
4. Remove driven plate assembly (1) or (2). Use the pilot aligner 5-85253-001-0 (J-24547) to prevent the driven plate assembly from falling free.



201RW031

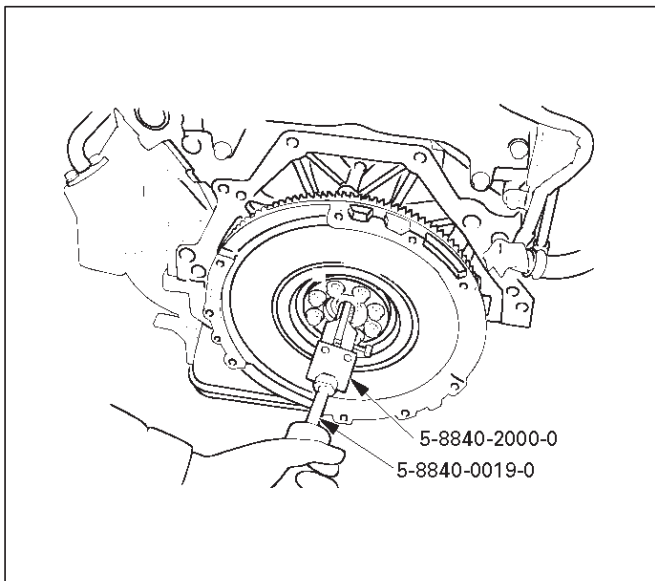
7C-10 CLUTCH

5. Mark the flywheel, clutch cover and pressure plate lug for alignment when installing.
6. Remove the release bearing (3) from the transmission case.
7. Remove the shift fork snap pin.
8. Remove the shift fork pin and shift fork (4) from the front cover.
9. Remove the front cover bolts.
10. Remove the front cover (5) from the transmission case.



220RW088

11. Remove flywheel assembly and crankshaft bearing. Do not remove except for replacement.
12. Use the remover 5-8840-2000-0 (J-5822) and sliding hammer 5-8840-0019-0 (J-23907) to remove the crankshaft bearing

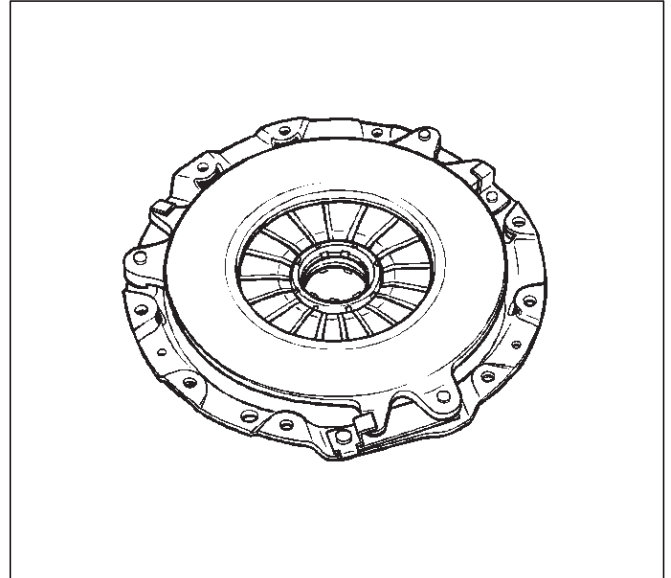


015RW053

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, or any other abnormal condition are found through inspection.

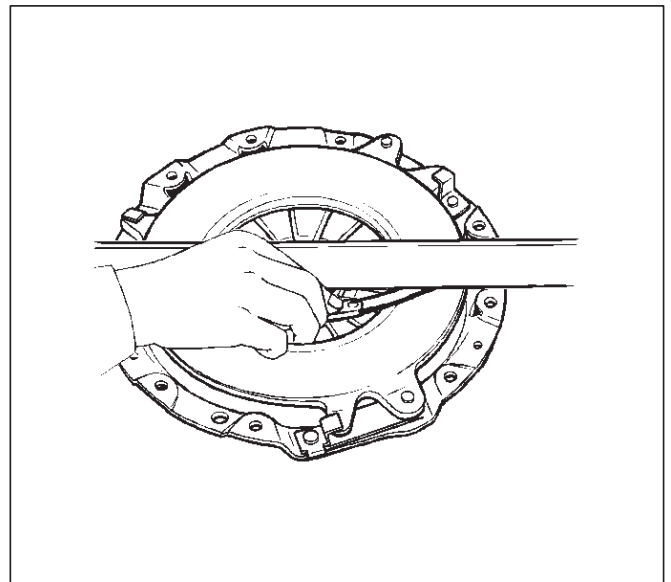
Pressure Plate Assembly



201RS002

1. Visually check the pressure plate friction surface for excessive wear and heat cracks.
2. If excessive wear or deep heat cracks are present, the pressure plate must be replaced.

Pressure Plate Warpage



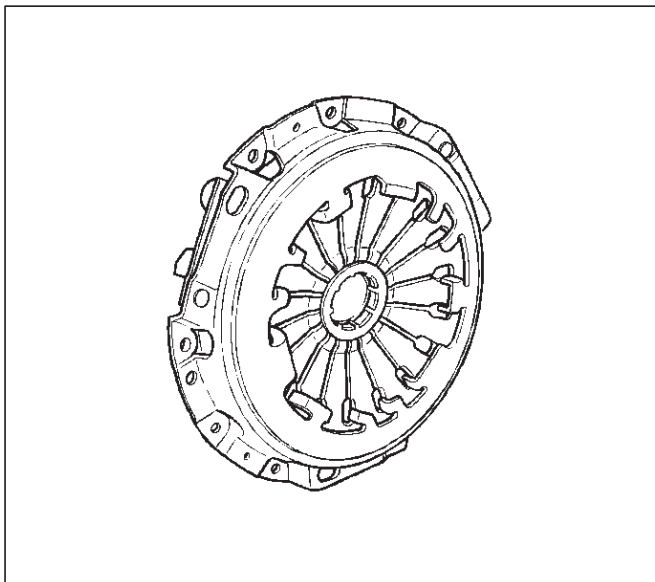
201RS003

1. Use a straight edge and a feeler gauge to measure the pressure plate friction surface flatness in four directions.
2. If any of the measured values exceeds the specified limit, the pressure plate must be replaced.

Pressure Plate Warpage

Limit: 0.3 mm (0.012 in)

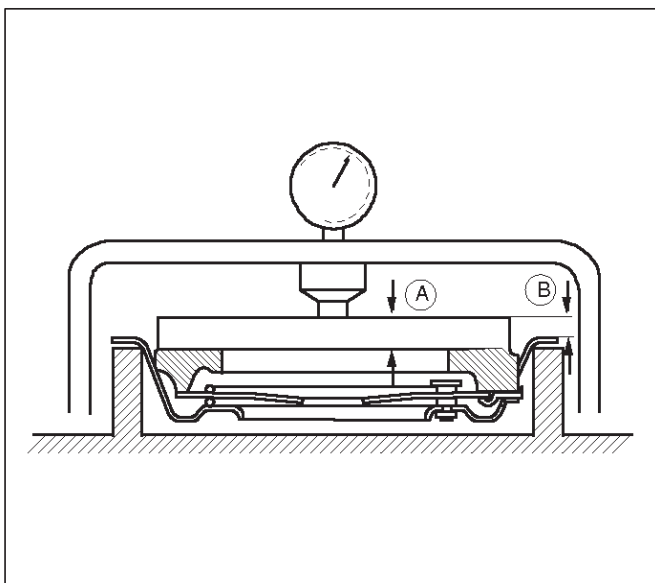
Clutch Cover



201RS004

1. Visually check the entire clutch cover for excessive wear, cracking, and other damage.
2. The clutch cover must be replaced if any of these conditions are present.

Clutch Set Force



201RS005

1. Invert the pressure plate assembly.

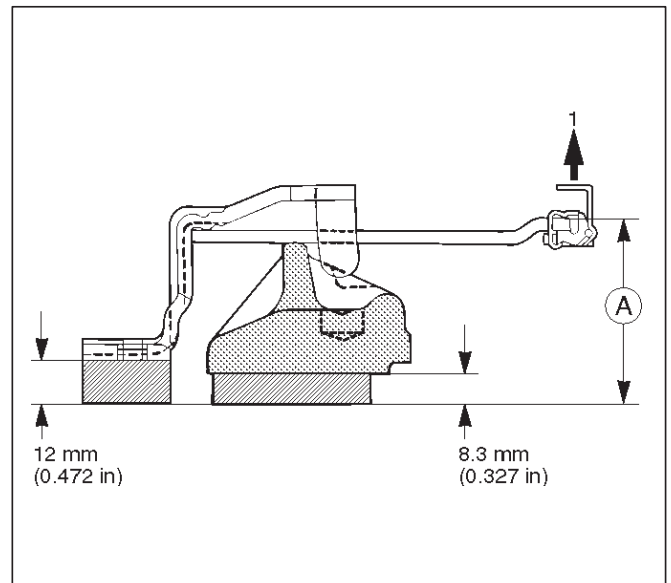
2. Place a new driven plate over the pressure plate. A metal sheet with "A" thickness of 8.3 mm (0.327 in) may be used in place of the driven plate.
3. Compress the pressure plate assembly until the distance "B" becomes 12 mm (0.472 in).
4. Note the pressure gauge reading.
5. If the measured value is less than the specified limit, the pressure plate assembly must be replaced.

Clutch Set Force

Standard: 7208 N (1621 lb)

Limit: 6468 N (1454 lb)

Diaphragm Spring Finger Height



201RW009

Legend

(1) Release Side

1. Place a new driven plate or a 8.3 mm (0.327 in) spacer beneath the pressure plate.
2. Fully compress the pressure plate and diaphragm spring.
3. There are two ways to do this.
4. Use a bench press to press down on the assembly from the top.
5. Tighten the fixing bolts.

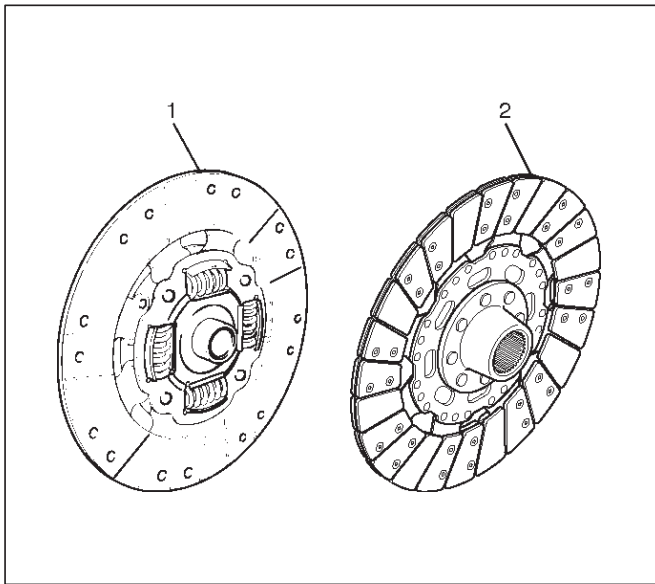
NOTE: Preload on diaphragm spring finger must be 49 – 98 N (11 – 22 lb) in direction of release, when clutch cover assembly is bolted to the flywheel.

6. Measure the spring height from base to spring tip "A". If the measured value exceeds the specified limit, the pressure plate assembly must be replaced.

Diaphragm Spring Finger Height

Standard: 49.9 mm – 51.9 mm (1.965 in – 2.043 in)

Driven Plate Assembly



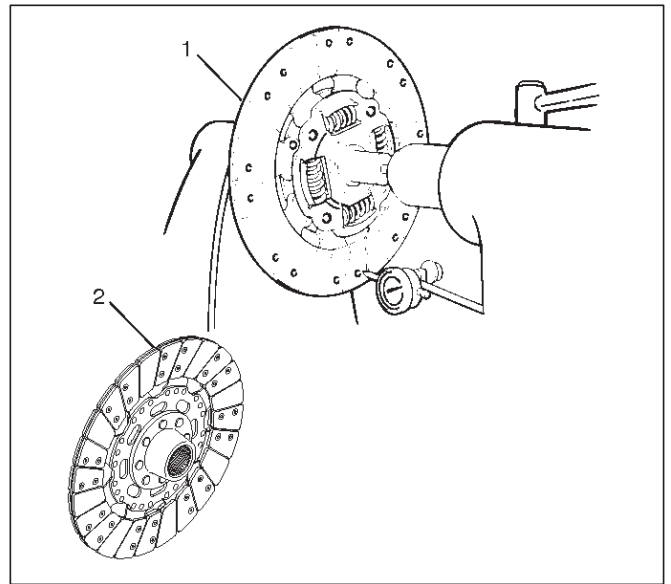
201RW033

Legend

- (1) Driven Plate Assembly (6VE1)
- (2) Driven Plate Assembly (4JX1)

1. Visually check the torsion spring for looseness, breakage, and weakening.
2. If any of these conditions are discovered, the driven plate assembly must be replaced.
3. Visually check the facing surfaces for cracking and excessive scorching.
4. Visually inspect the facing surfaces for the presence of oil or grease.
5. If any of these conditions are discovered, the facing must be cleaned or replaced.
6. Check that the driven plate moves smoothly on the transmission top gear shaft spline.
7. Minor ridges on the top gear shaft spline may be removed with an oil stone.

Driven Plate Warpage



201RW034

Legend

- (1) Driven Plate Assembly (6VE1)
- (2) Driven Plate Assembly (4JX1)

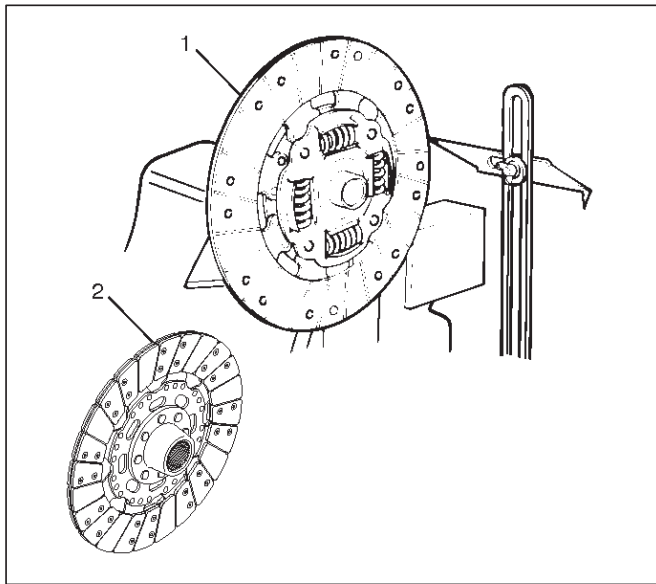
1. Insert the clutch pilot aligner into the driven plate splined hub.
2. The clutch pilot aligner J-24547 must be held perfectly horizontal.
3. Set a dial indicator to the driven plate outside circumference.
4. Slowly turn the driven plate.
5. Read the dial indicator as you turn the driven plate.
6. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Warpage

Standard: 0.7 mm (0.028 in)

Limit: 1.0 mm (0.039 in)

Driven Plate Splined Hub Spline Wear



201RW032

Legend

- (1) Driven Plate Assembly (6VE1)
- (2) Driven Plate Assembly (4JX1)

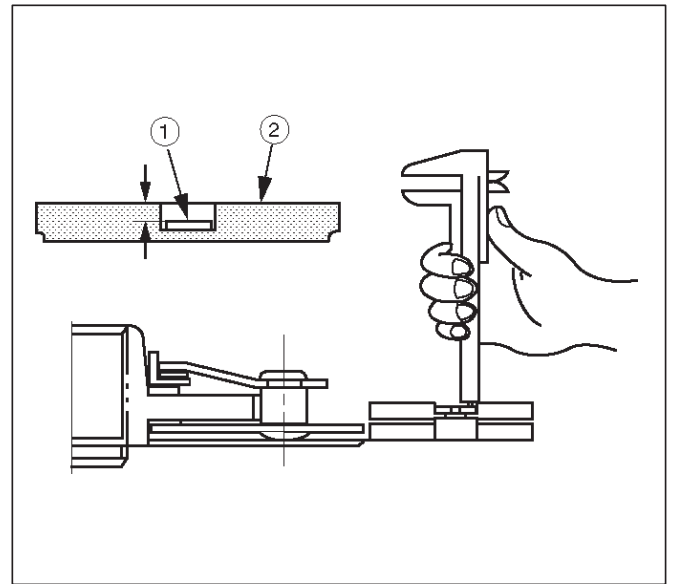
1. Clean the driven plate splined hub.
2. Install the driven plate to the transmission top gear shaft spline.
3. Set a surface gauge to the driven plate outside circumference.
4. Slowly turn the driven plate counterclockwise.
5. Measure the spline rotation play as you turn the driven plate.
6. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Splined Hub Spline Wear

Standard: 0.5 mm (0.020 in)

Limit: 1.0 mm (0.039 in)

Rivet Head Depression



201RS010

1. Use a depth gauge or a straight edge with steel rule to measure the rivet head depression 1 from the facing surface 2.
2. Be sure to measure the rivet head depression on both sides of the driven plate.
3. If the measured value is less than the specified limit, the driven plate assembly must be replaced.

Rivet Head Depression

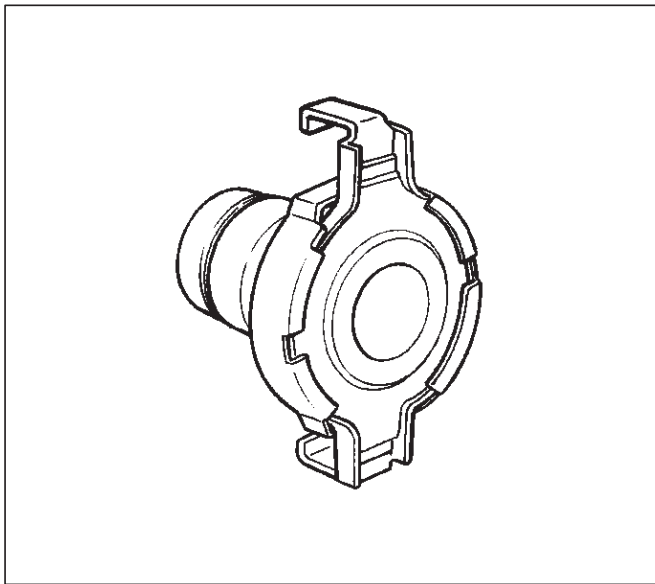
Standard:

	Flywheel side	Pressure plate side
6VE1	1.95mm (0.077 in)	1.95mm (0.077 in)
4JX1	1.60mm (0.063 in)	1.60mm (0.063 in)

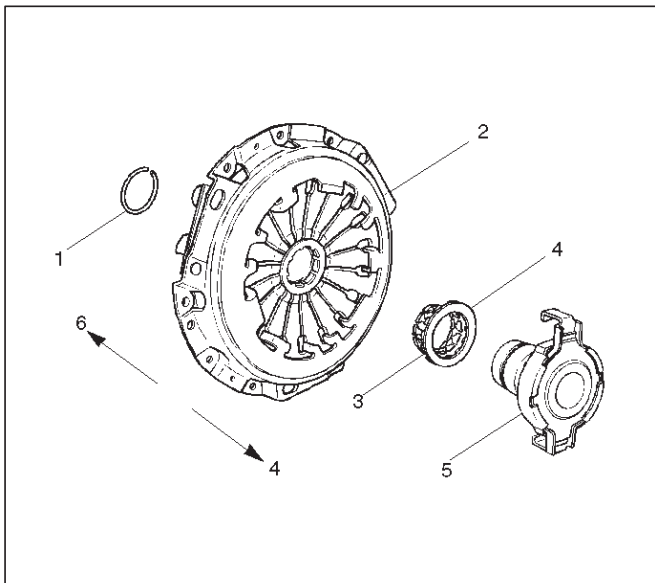
Limit: 0.2 mm (0.008 in)

7C-14 CLUTCH

Release Bearing



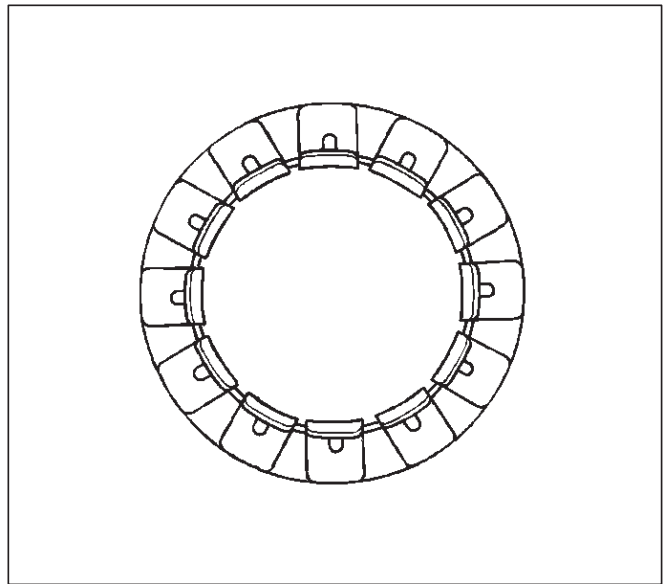
1. Visually check the release bearing for excessive play, noise and breakage.
2. If any of these conditions are discovered, the release bearing must be replaced.
3. When replacing the release bearing, replace both the wedge collar and wire ring at the same time.



Legend

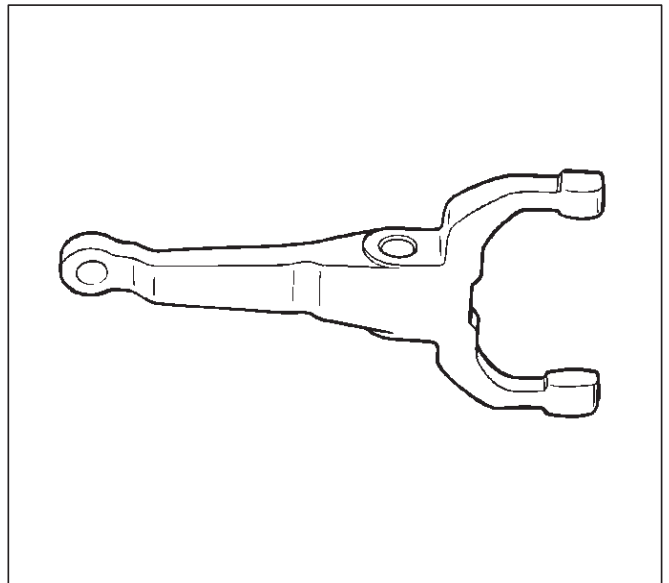
- (1) Wire Ring
- (2) Pressure Plate Assembly
- (3) Wedge Collar
- (4) T/M Side
- (5) Release Bearing
- (6) Engine Side

Wedge Collar



1. Visually check the surfaces of the wedge collar making contact with the release bearing for excessive wear and damage.
2. Replace any exhibiting excessive wear or damage.

Shift Fork

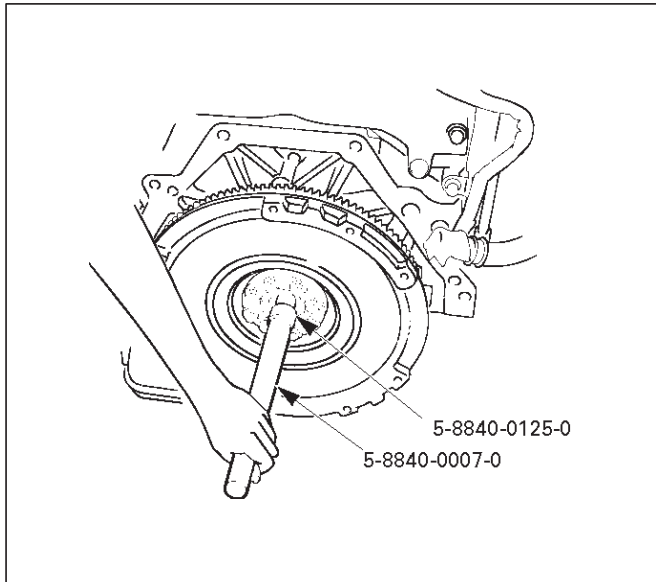


1. Visually check the surfaces of the shift fork making contact with the release bearing for excessive wear and damage.
2. Remove any minor stepping or abrasion from shift fork with an oil stone.
3. Replace any exhibiting excessive wear or damage.

Installation

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

1. Install flywheel assembly and crankshaft bearing. Use the installer 5-8840-0125-0 (J-26516-A) and driver handle 5-8840-0007-0 (J-8092) to install the crankshaft bearing then clean and lubricate with grease.



015RW054

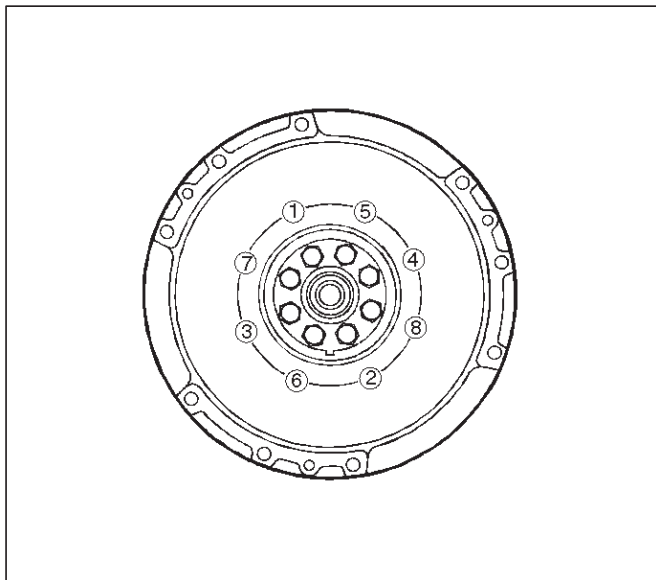
2. Install new flywheel fixing bolts in the order illustrated and tighten them to the specified torque.

Torque:

6VE1: 54 N·m (5.5 kg·m/40 lb ft)

4JX1: 60 N·m (6.1 kg·m/44 lb ft)+60°

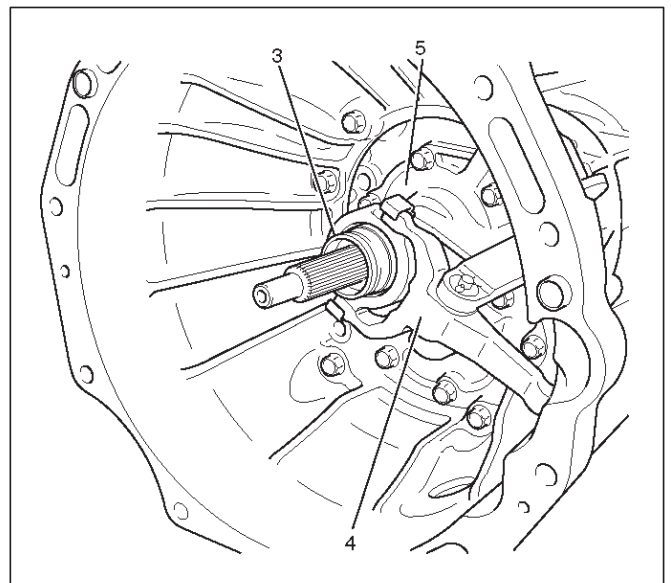
NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS047

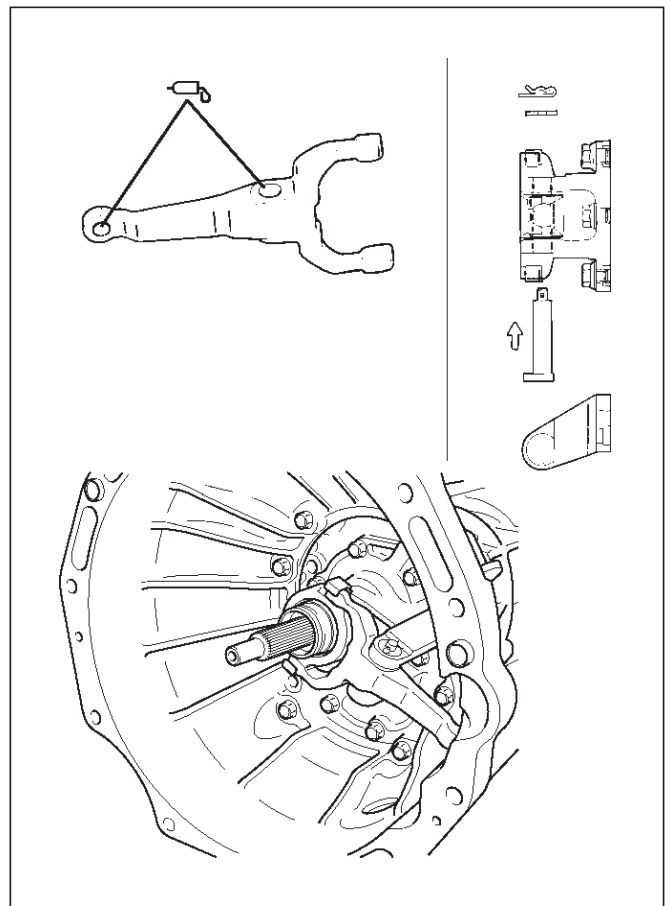
3. Install the front cover (5) to the transmission case.
4. Tighten eight front cover bolts to the specified torque.

Torque: 17 N·m (1.7 kg·m/12 lb ft)



220RW088

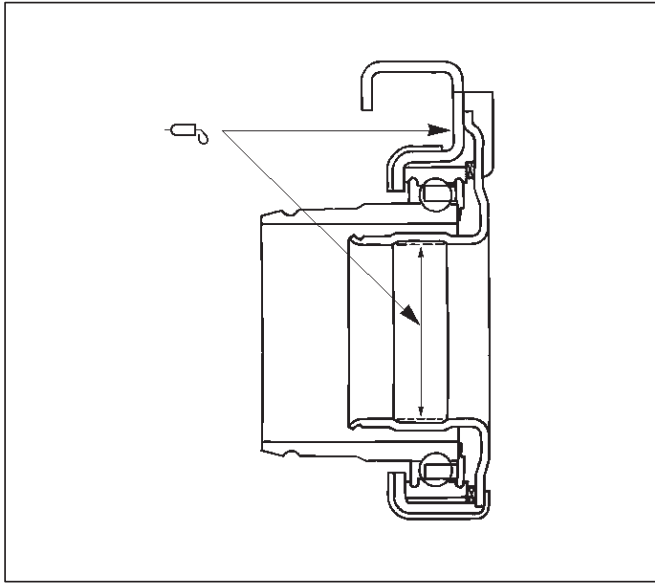
5. Apply molybdenum disulfide type grease to the pin hole inner circumferences and thrust surfaces.
6. Attach the shift fork to the front cover and insert the pin from below of the front cover.
7. Install the washer and snap pin.



201RW019

7C-16 CLUTCH

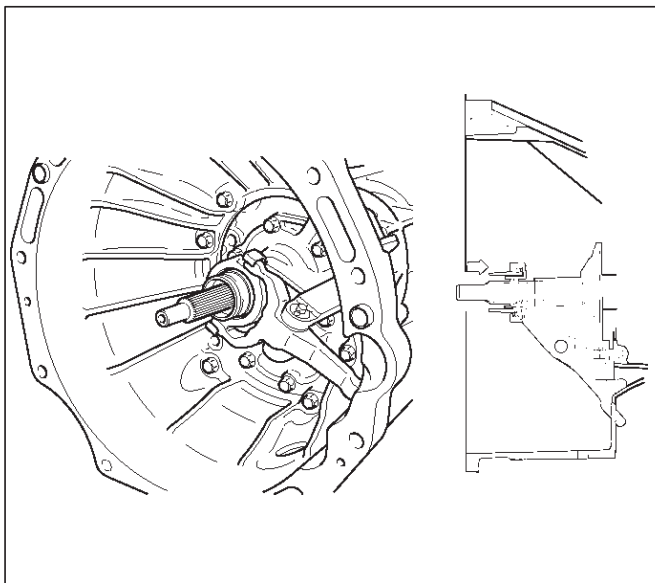
8. Apply molybdenum disulfide type grease to the areas shown in illustration.



201RW012

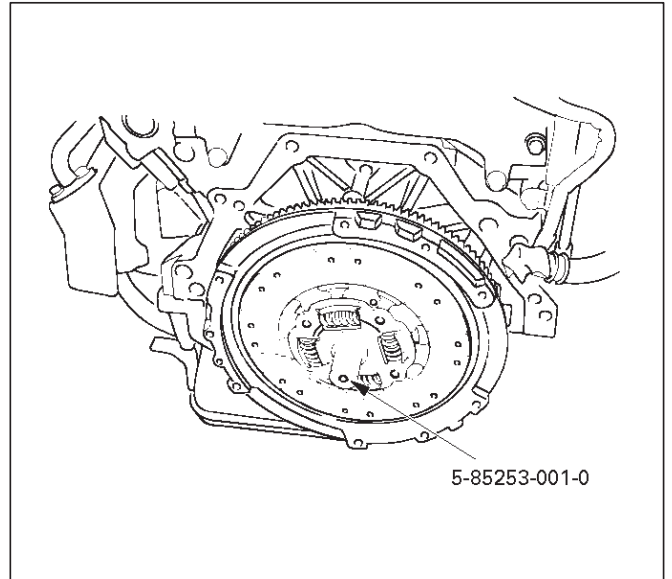
9. Install the release bearing in the proper direction.

NOTE: Ensure release bearing is properly positioned during installation, as shown in illustration.



201RW020

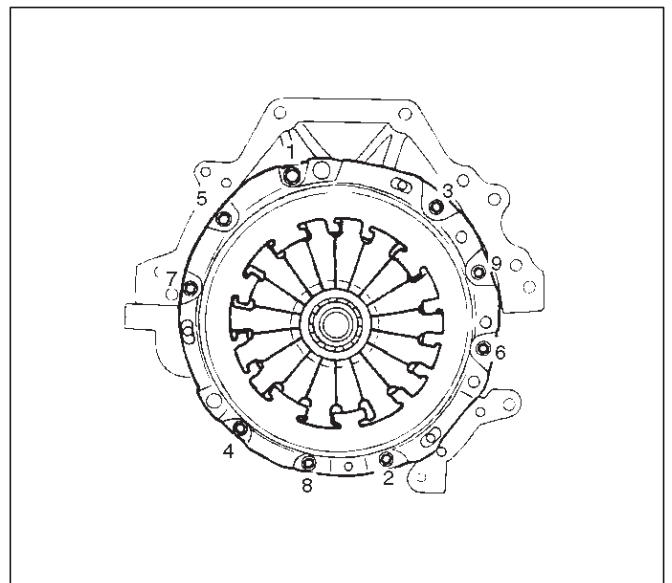
10. Install driven plate assembly. Use the pilot aligner 5-85253-001-0 (J-24547) to install the driven plate assembly.



201RW027

11. Install pressure plate assembly and tighten the bolts holding the pressure plate assembly in the order shown in illustration.

Torque: 18 N·m (1.8 kg·m/13 lb ft)



201RS017

12. Remove the aligner.

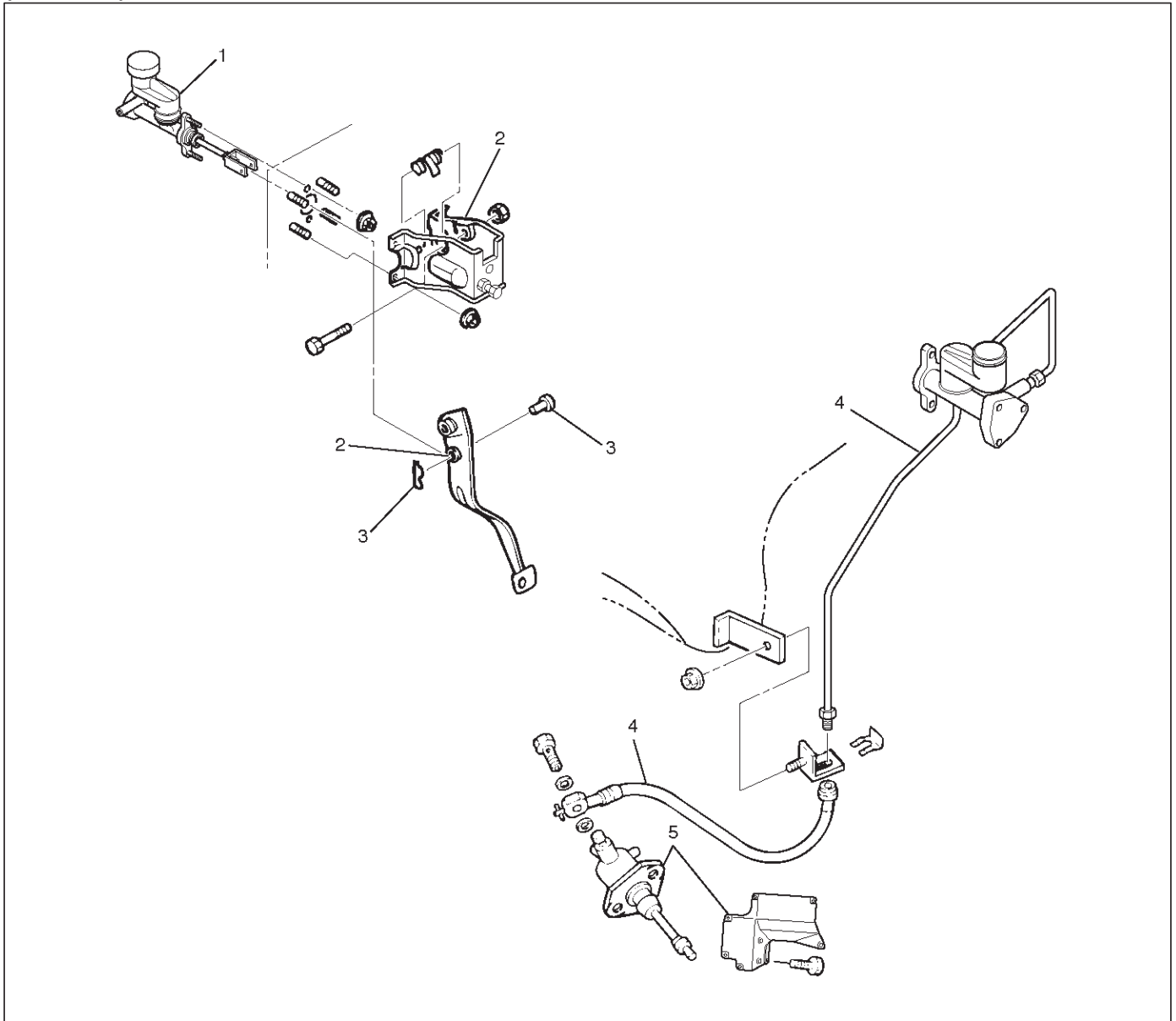
NOTE: Do not strike the aligner with a hammer to remove it.

13. Install transmission assembly.

Clutch Control

Clutch Control Parts

(6VE1 LHD)



203RW017

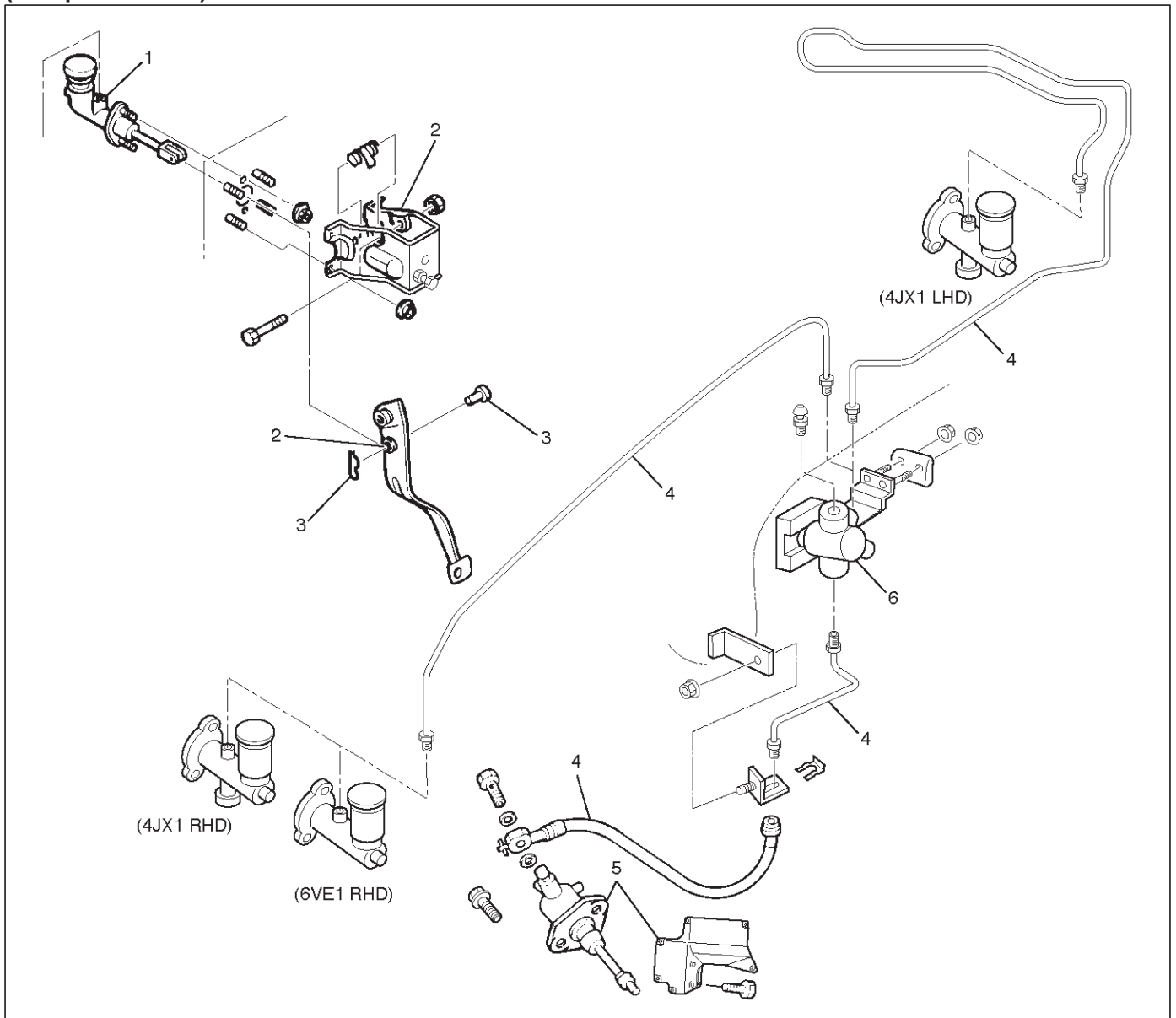
Legend

- (1) Master Cylinder Assembly
- (2) Pedal Assembly

- (3) Pin and Jaw Joint Pin
- (4) Oil Line Pipe
- (5) Slave Cylinder Assembly and Heat Protector

7C-18 CLUTCH

(Except 6VE1 LHD)



203RW009

Legend

- (1) Master Cylinder Assembly
- (2) Pedal Assembly
- (3) Pin and Joint Pin

(4) Oil Line Pipe

- (5) Slave Cylinder Assembly and Heat Protector
- (6) Damper Cylinder Assembly

Removal

1. Remove pin and jaw joint pin.
2. Remove pedal assembly.
3. Remove oil line pipe.
4. Remove slave cylinder assembly and heat protector.
5. Remove master cylinder assembly.
6. Remove damper cylinder assembly (except V6 LHD).

Inspection and Repair

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

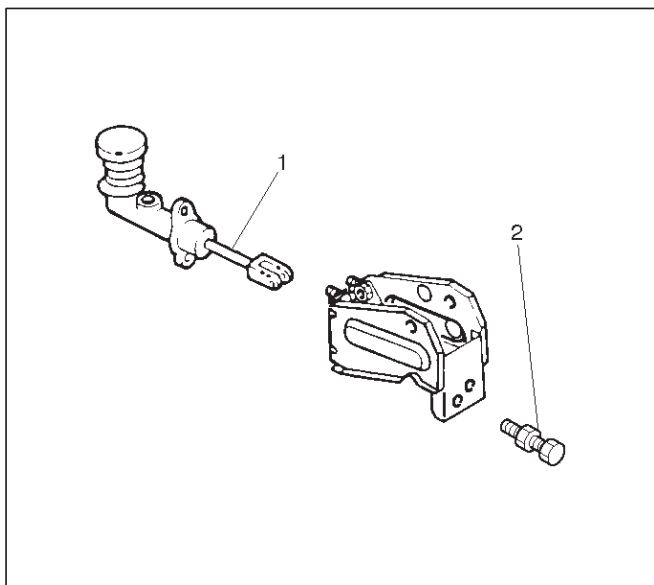
Installation

1. Install damper cylinder assembly (except V6 LHD).
2. Install master cylinder assembly.
3. Install slave cylinder assembly and heat protector.
4. Install oil line pipe.
5. Install pedal assembly.
6. Install pin and jaw joint pin.

Adjustment

Clutch Pedal Adjustment

1. Loosen the clutch pedal adjusting bolt so that there is enough gap between the clutch pedal and the adjusting bolt to allow push rod adjustment.



203RW011

Legend

- (1) Push Rod
- (2) Adjusting Bolt

2. Loosen clutch master cylinder push rod lock nut. Turn push rod by hand to set clutch pedal height (5) to within specification.

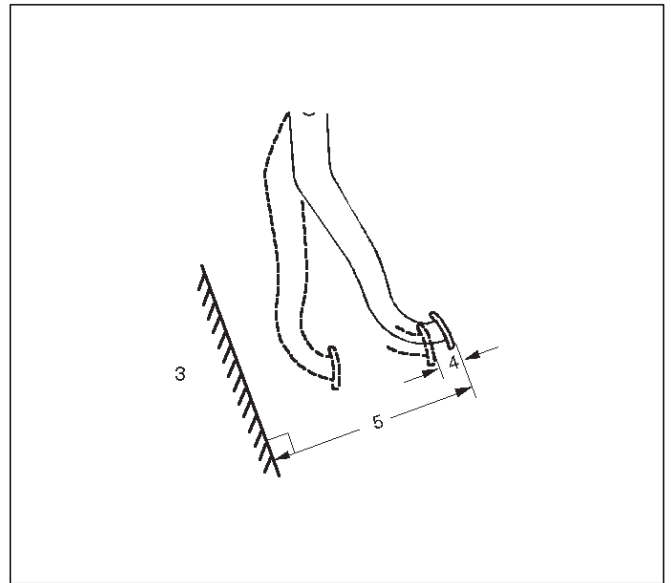
Clutch pedal height (5):

LHD: 217 mm – 227 mm (8.543 in – 8.937 in)

RHD:

(6VE1) 238.5 mm – 248.5 mm (9.390 in – 9.783 in)

(4JX1) 231 mm – 241 mm (9.094 in – 9.488 in)



203RW004

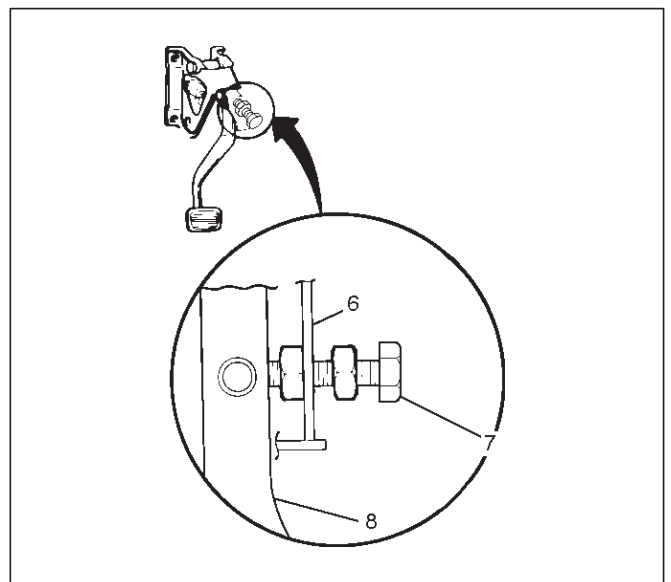
Legend

- (3) Floor Panel
- (4) Pedal Free Play
- (5) Clutch Pedal Height

3. Tighten push rod lock nut.

4. Adjusting bolt adjustment.

1. Turn the adjusting bolt until it just touches the clutch pedal arm.



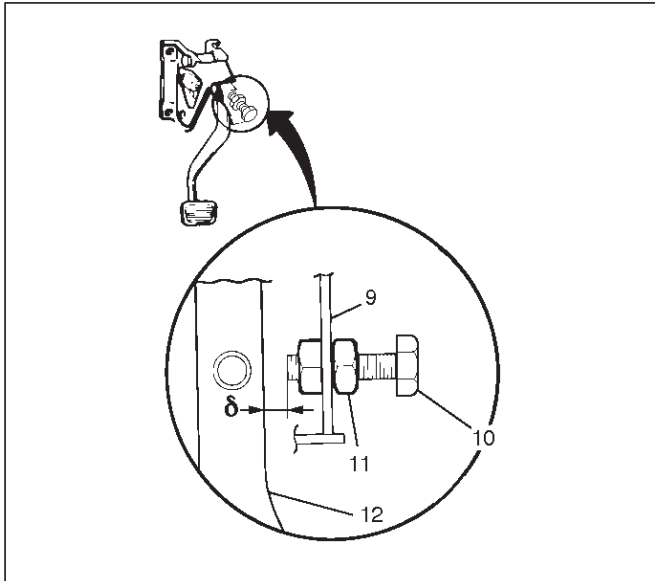
203RW012

Legend

- (6) Bracket
- (7) Adjusting Bolt
- (8) Clutch Pedal Arm

7C-20 CLUTCH

- Adjust clutch pedal adjusting bolt by backing it out half a turn, and measure the clearance (δ) between the clutch pedal arm and the adjusting bolt.



203RW010

Legend

- (9) Bracket
- (10) Clutch Pedal Adjusting Bolt
- (11) Lock Nut
- (12) Clutch Pedal Arm

- Lock the lock nut.

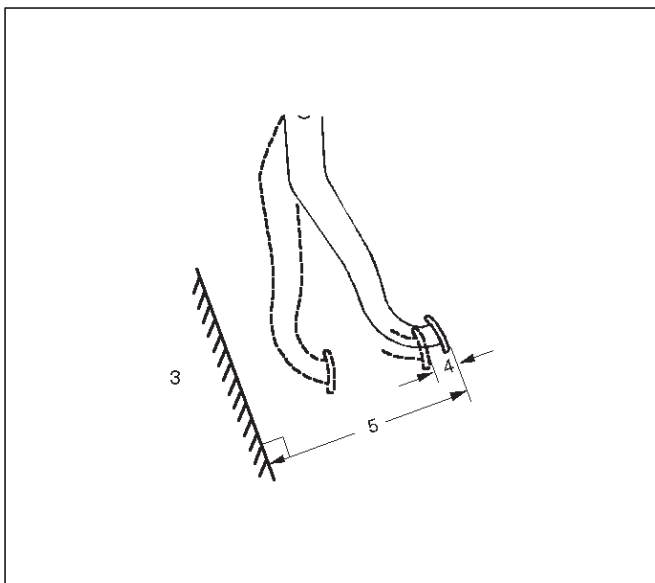
Clutch Switch and Clutch Pedal Clearance (δ)

0.5 mm – 1.5 mm (0.020 in – 0.059 in)

- After adjusting the clutch pedal height, push the clutch pedal by hand rightly to check the clutch pedal free play (4) to within specification.

Pedal Free Play (4)

5 mm – 15 mm (0.20 in – 0.59 in)



203RW004

- Clutch pedal engagement height inspection:

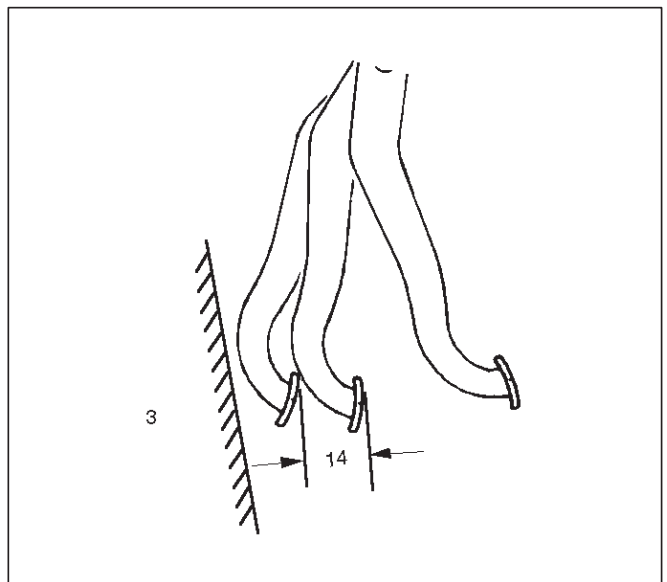
- Operate the parking brake lever and block the wheels.
- Start the engine, fully step on the clutch pedal, and move the shift lever to 1st position.
- With the engine idling, release the clutch pedal slowly and measure its stroke just prior to its clutching position.

Clutch Pedal Engagement Height (14)

MIN. 30 mm (1.18 in)

- If the measured value exceeds the specified limit, check the following points. Repair if necessary:

- Hydraulic circuit for fluid leakage or air in circuit.
- Clutch disc warped.
- Diaphragm spring weakened or tip of fingers worn.
- Driven plate sticking on sprines.
- Release bearing worn or damaged.
- Master cylinder and slave cylinder worn.



203RW007

Legend

- (3) Floor Panel
- (14) Clutch Pedal Engagement Height

Torque Specifications

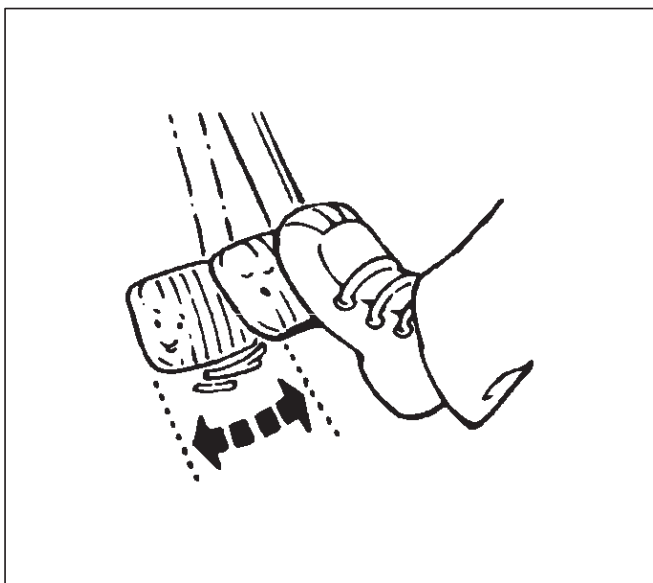
- Master cylinder to dash panel
Torque: 16 N·m (1.6 kg·m/12 lb ft)
- Clutch pedal to dash panel
Torque: 21 N·m (2.1 kg·m/15 lb ft)
- Master cylinder push rod to yoke
Torque: 17 N·m (1.7 kg·m/12 lb ft)
- Clutch pipe to master cylinder
Torque: 20 N·m (2.0 kg·m/14 lb ft)
- Clutch pipe to flex, hose
Torque:
M 10: 16 N·m (1.6 kg·m/12 lb ft)
M 12: 20 N·m (2.0 kg·m/14 lb ft)
- Slave cylinder to case
Torque: 43 N·m (4.4 kg·m/32 lb ft)
- Slave cylinder bleeder screw
Torque: 8 N·m (0.8 kg·m/69 lb in)
- Flexible hose to slave cylinder
Torque: 20 N·m (2.0 kg·m/14 lb ft)
- Clutch pipe to damper cylinder
Torque: 12 N·m (1.2 kg·m/104 lb in)
- Damper cylinder bleeder screw
Torque: 8 N·m (0.8 kg·m/69 lb in)

Bleeding

1. Check the level of clutch fluid in the reservoir and replenish if necessary.

Bleeding the damper cylinder (except V6 LHD model).

2. Remove the rubber cap from the bleeder screw and wipe clean the bleeder screw. Connect a vinyl tube to the bleeder screw and insert the other end of the vinyl tube into a transparent container.
3. Pump the clutch pedal repeatedly and hold it depressed.

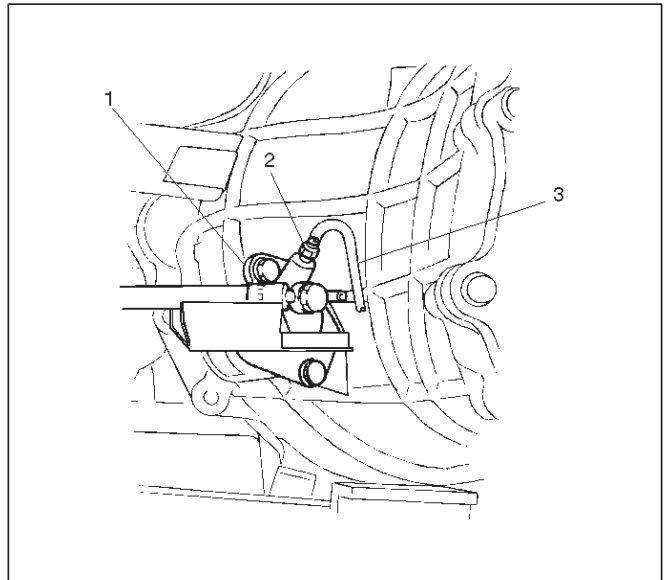


4. Loosen the bleeder screw to release clutch fluid with air bubbles into the container, then tighten the bleeder screw immediately.

5. Release the clutch pedal carefully. Repeat the above operation until air bubbles disappear from the clutch fluid being pumped out into the container. During the bleeding operation, keep the clutch fluid reservoir filled to the specified level. Reinstall the rubber cap.

Bleeding the slave cylinder

6. Repeat step 2 through 5 for bleeding the slave cylinder.

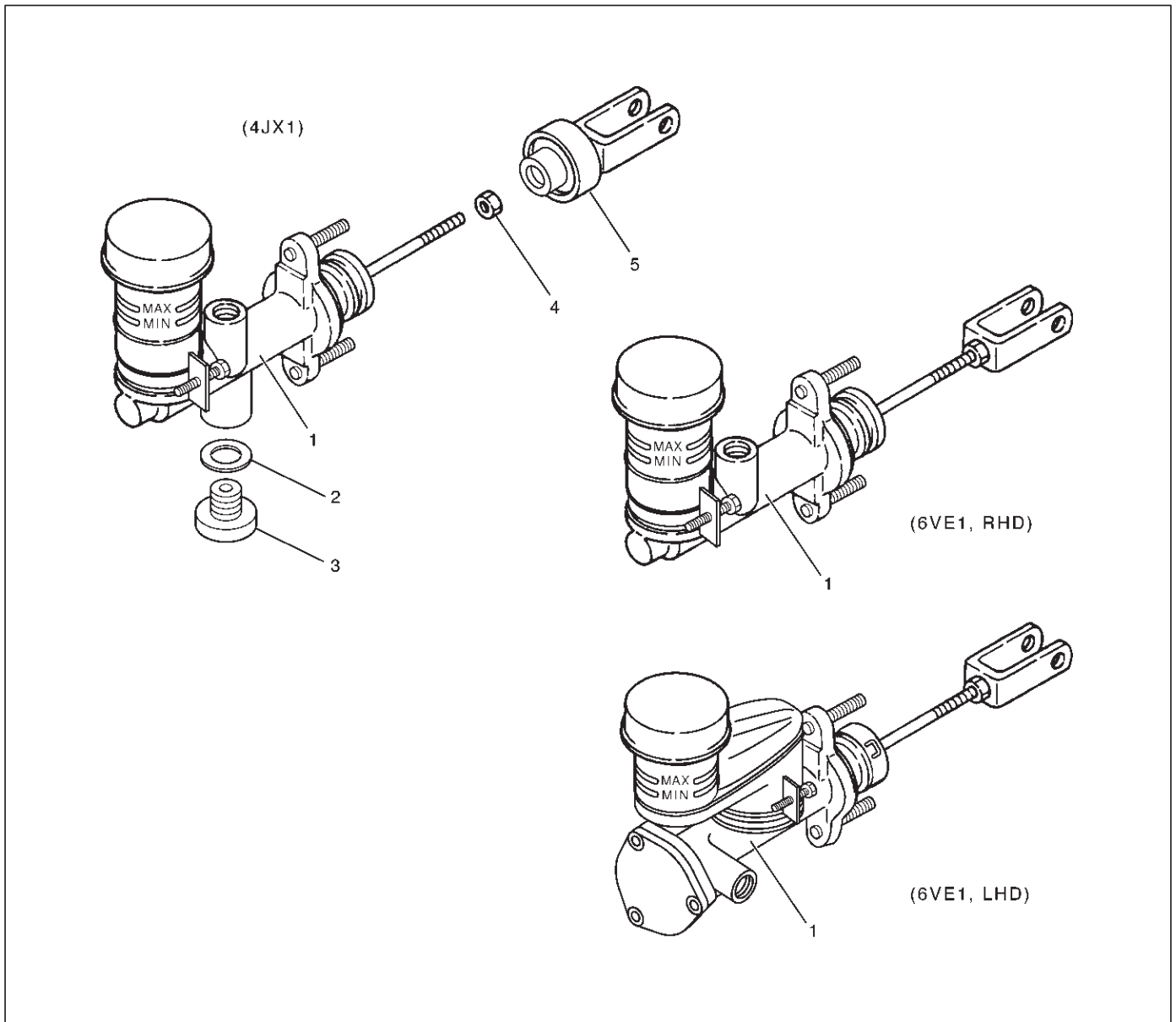


Legend

- (1) Slave Cylinder
- (2) Bleeder Screw
- (3) Vinyl Tube

Master Cylinder

Disassembled View



208RW016

Legend

- (1) Master Cylinder Assembly
- (2) Gasket
- (3) Damper Cylinder Assembly
- (4) Nut
- (5) Push Rod Damper

Disassembly

(4JX1)

1. Remove damper cylinder assembly and gasket.
2. Remove push rod damper.

NOTE: The master cylinder assembly cannot be disassembled because of point-staked rod stopper.

Inspection and Repair

Clean and inspect the removed parts.

Make necessary parts replacement if any abnormalities such as wear, oil leaks or other damage are found through inspection.

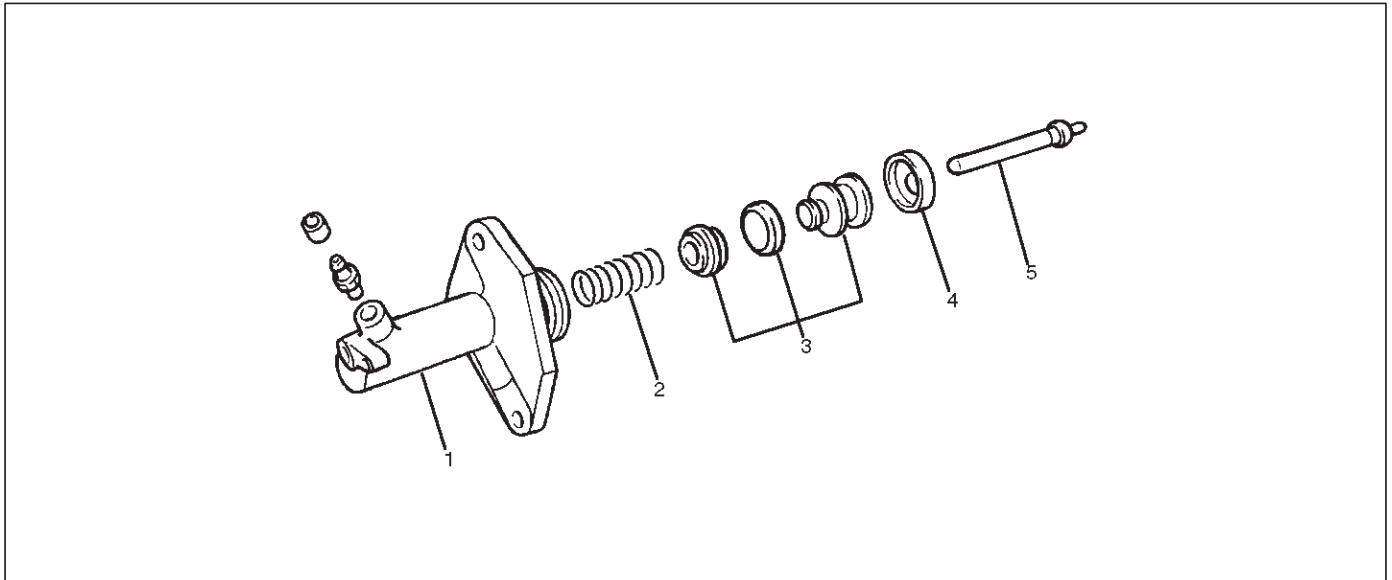
Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

1. **Push rod set length**
RHD: 117.5 mm (4.626 in)
LHD: 119 mm (4.685 in)
2. **Push rod nut torque**
17 N·m (1.7 kg·m/12 lb ft)
3. **Damper cylinder torque**
47 N·m (4.8 kg·m/35 lb ft)

Slave Cylinder

Disassembled View



206RW004

Legend

- (1) Cylinder Body
- (2) Spring

- (3) Piston and Piston Cup
- (4) Boot
- (5) Push Rod

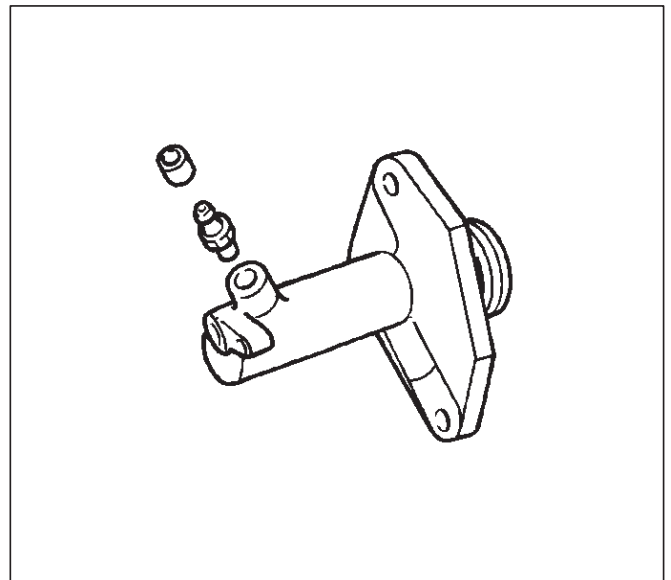
Disassembly

1. Remove boot.
2. Remove push rod.
3. Remove piston and piston cup.
4. Remove spring.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Cylinder Body

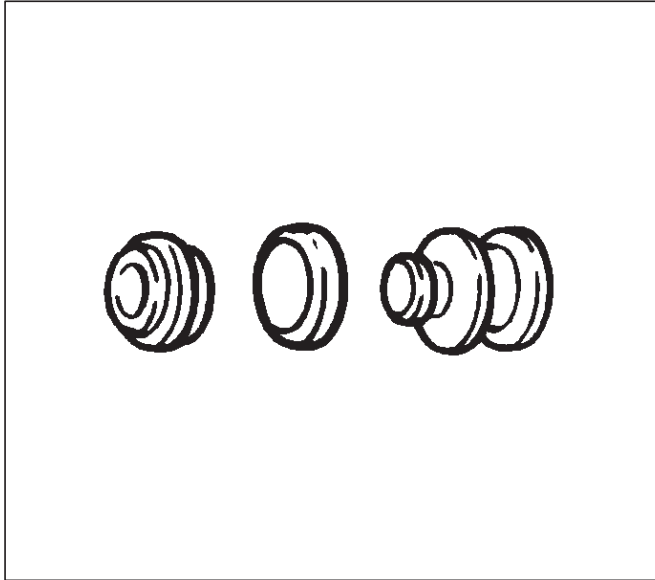


206RS003

1. Clean the cylinder body.
2. Check the fluid return port for restrictions and clean it if necessary.

Piston and Piston Cup

1. Visually inspect the disassembled piston and piston cup for excessive wear and damage.
2. Replace the inner parts with new parts shown in the illustration.

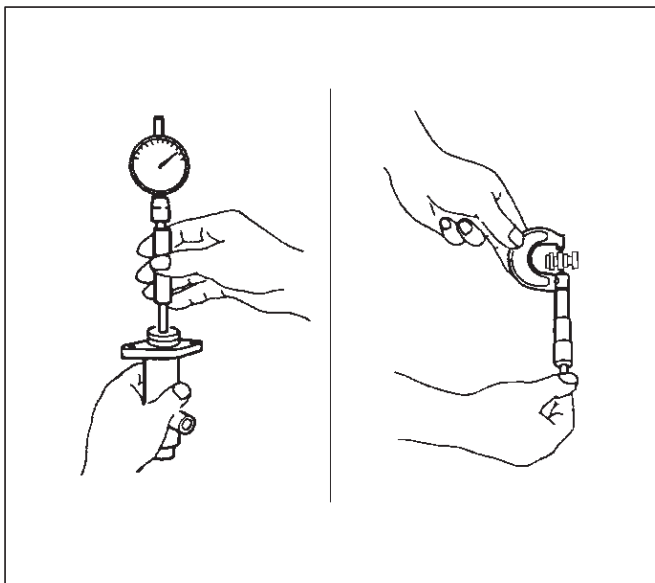


206RS004

3. Measure the clearance between slave cylinder wall and piston.
4. If the measured value exceeds the specified limit, the slave cylinder assembly must be replaced.

Standard: 0.07 mm (0.0028 in)

Limit: 0.15 mm (0.0059 in)

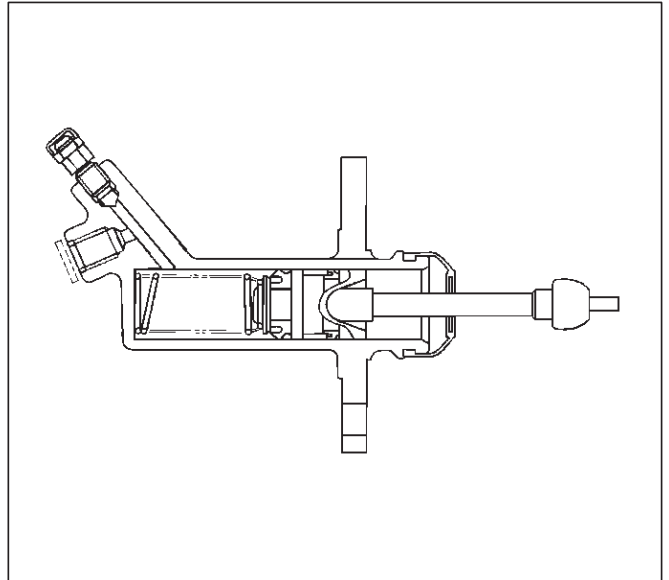


206RS005

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

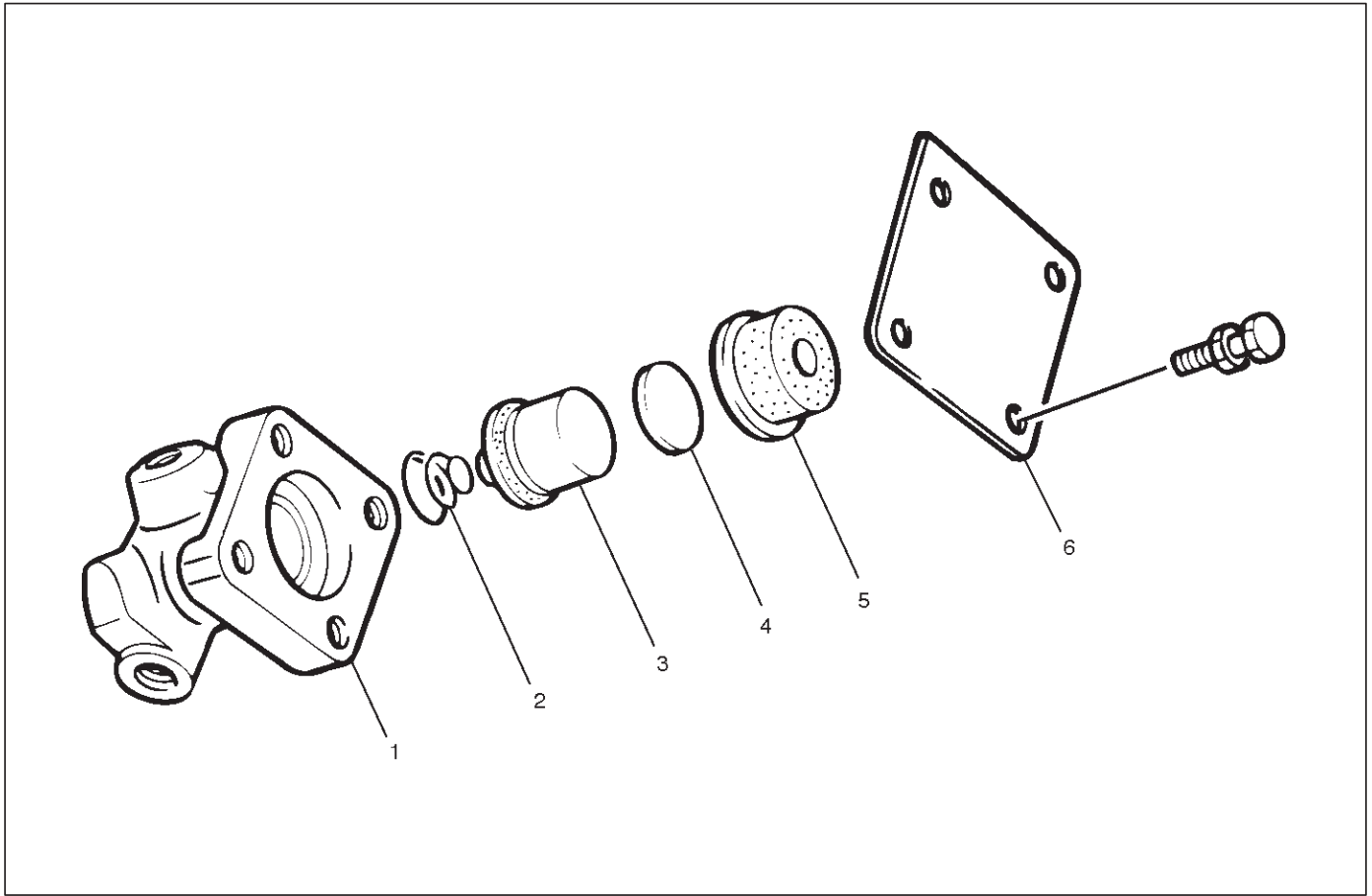
1. Before installing the parts, apply a thin coat of rubber grease.
2. Install cup in groove in piston with the lip turned to the front of cylinder. Use care so as not to scratch the cylinder.



206RS006

Damper Cylinder

Disassembled View



205RW005

Legend

- | | |
|---------------------|----------------------|
| (1) Cylinder Body | (4) Spacer |
| (2) Spring | (5) Damper Rubber |
| (3) Piston Assembly | (6) Cover and Gasket |

Disassembly

1. Remove cover and gasket.
2. Remove damper rubber.
3. Remove spacer.
4. Remove piston assembly.
5. Remove spring.

Reassembly

To assemble, follow the disassembly steps in the reverse order.

Inspection and Repair

Check damper rubber and piston cup for cracks, deformation or damage.

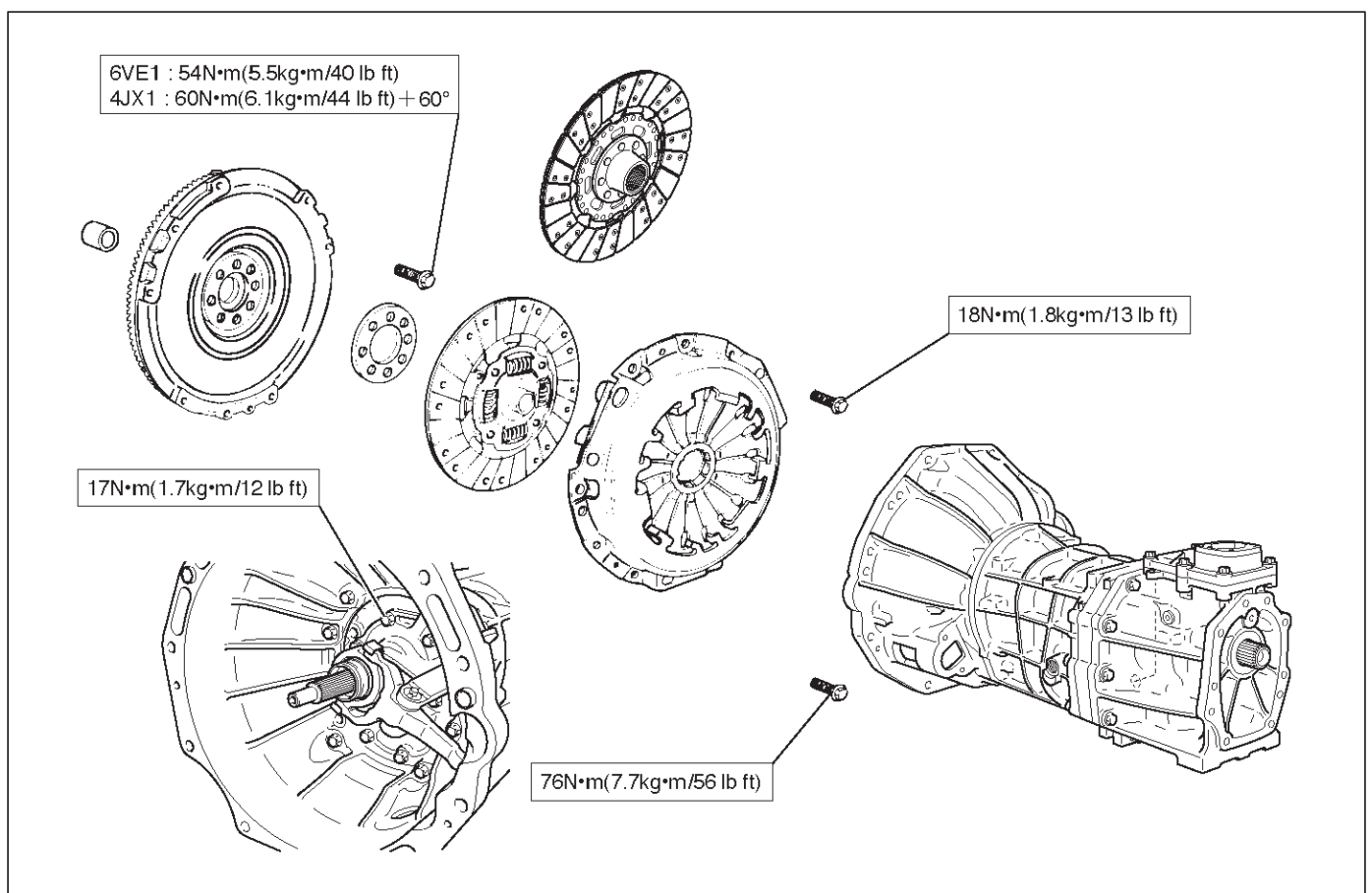
Replace the damper cylinder assembly if necessary.

Main Data and Specifications

General Specifications

Type	Dry single plate type with diaphragm spring
Size	275 mm (10.83 in)
Pressure plate Outside diameter	332 mm (13.07 in)
Pressure plate Clamping force	7208 N (1621 lb)
Pressure plate Spring finger height	49.9 – 51.9 mm (1.965 – 2.043 in)
Driven plate Outside diameter x inside diameter	275 × 180 mm (10.83 × 6.69 in)
Thickness Clutch disengaged	8.8 mm (0.346 in)
Thickness Clutch engaged	8.3 mm (0.327 in)
Total friction area	339 × 2 cm ² (52 × 2 in ²)
Clutch control type	Hydraulic
Clutch pedal free play	5 – 15 mm (0.20 – 0.59 in)
Clutch pedal height	LHD: 217 – 227 mm (8.543 – 8.937 in) RHD: (6VE1) 238.5 mm – 248.5 mm (9.390 in – 9.783 in) (4JX1) 231 mm – 241 mm (9.094 in – 9.488 in)
Clutch pedal stroke	152.5 – 162.5 mm (6.004 – 6.398 in) 4JX1, RHD: 145 – 155mm (5.709 – 6.102 in)

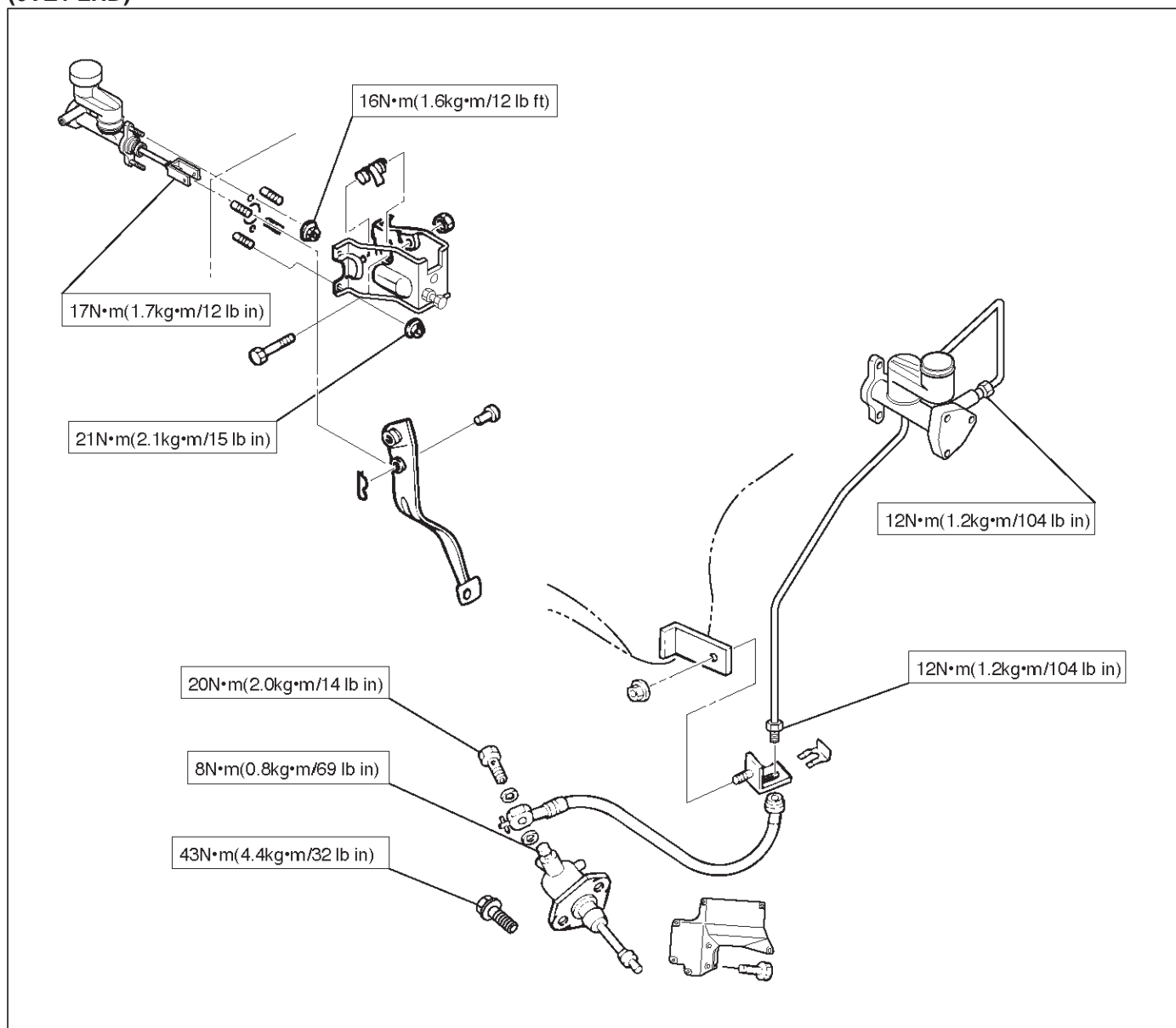
Torque Specifications



7C-28 CLUTCH

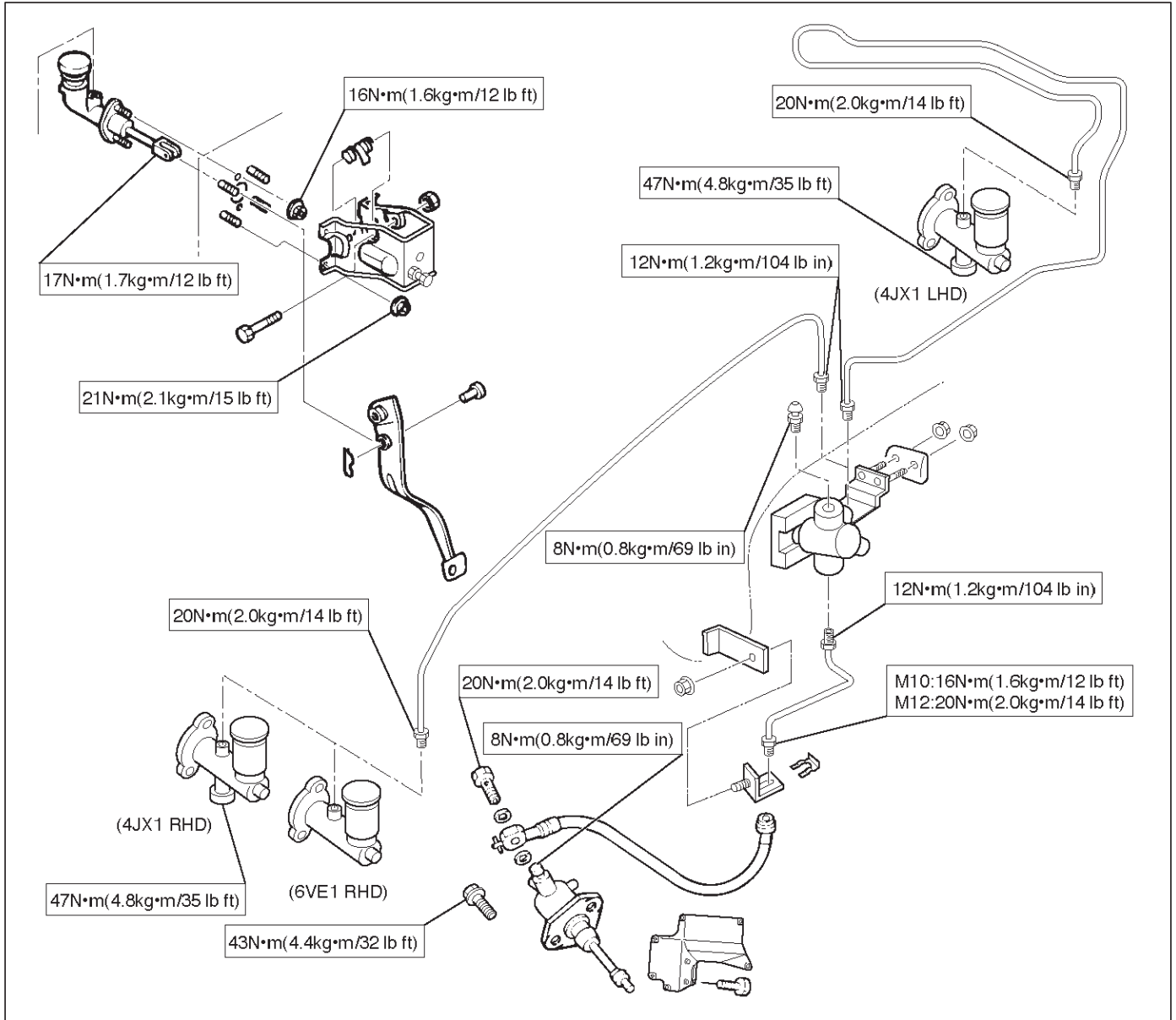
Torque Specifications (Cont'd)

(6VE1 LHD)


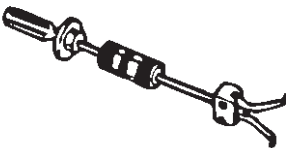
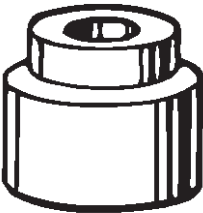
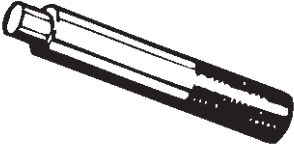


Torque Specifications (Cont'd)

(Except 6VE1 LHD)



Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME
 <small>901RS266</small>	5-85253-001-0 (J-24547) Driven plate aligner
 <small>901RS266</small>	5-8840-2000-0 and 5-8840-0019-0 (J-5822 and J-23907) Pilot bearing remover and Sliding hammer
 <small>901RS267</small>	5-8840-0125-0 (J-26516-A) Crankshaft pilot bearing installer
 <small>901RS268</small>	5-8840-0007-0 (J-8092) Driver handle

BODY AND ACCESSORIES

CONTENTS

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LIGHTING SYSTEM

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8A-2 LIGHTING SYSTEM

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Service Precaution

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

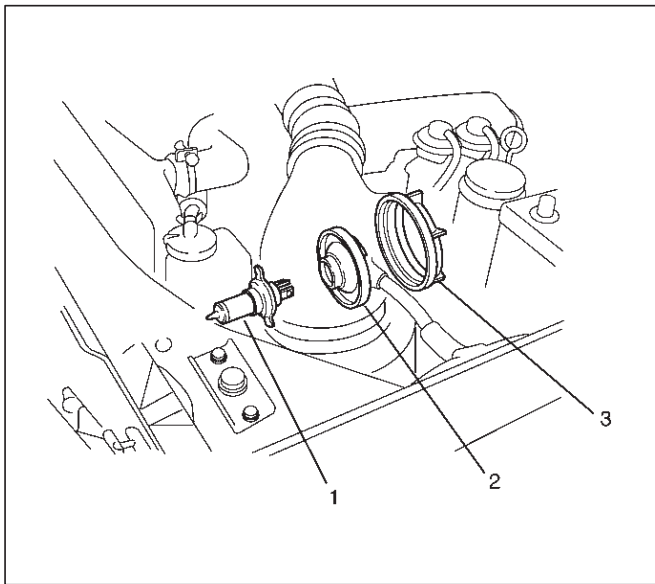
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread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

Headlight Bulb

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove the cap(3) while turning it counter clockwise.
4. Remove the cover(2).
5. Pull the bulb(1) out from the headlight body.

CAUTION: The halogen bulb develops a very high temperature. Do not touch the glass portion. If any stain is on the glass surface, It will scorch and the glass will be damaged.



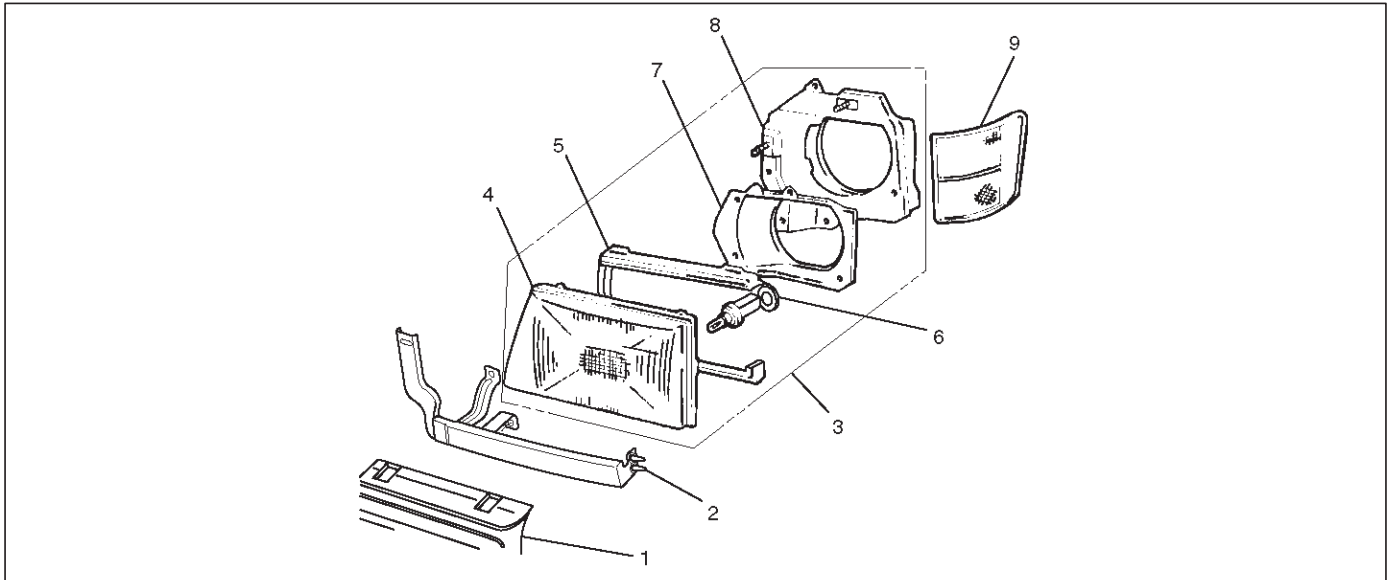
801RW014

Installation

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

Headlight

Headlight and Associated Parts



801RW003

Legend

- | | |
|---------------------------|-----------------------------|
| (1) Radiator Grille | (5) Headlight Rim |
| (2) Front End Lower Panel | (6) Headlight Bulb |
| (3) Headlight Assembly | (7) Rear Cover |
| (4) Headlight | (8) Bracket |
| | (9) Front Combination Light |

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and pull out the two projecting portions on the fender to remove the front combination light.
3. Remove five clips and two screws to remove the radiator grille.
4. Remove two screws to remove the front end lower panel(2).
5. Remove two bolts and two nuts to remove the headlight assembly (with bracket).
6. Remove the headlight bulb.
7. Remove two screws, two nuts and the spring for the headlight aim adjustment to remove the bracket.
8. Remove four screws to remove the rear cover.
9. Remove the headlight rim.
10. Remove the headlight.

Installation

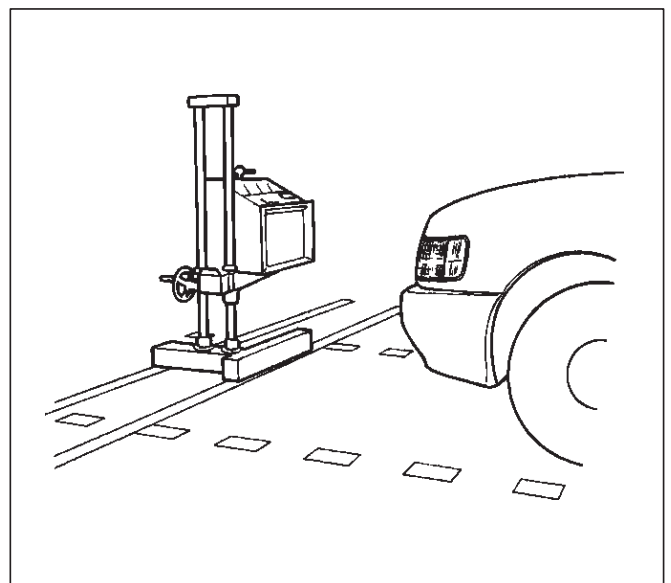
To install, follow the removal steps in the reverse order.

CAUTION: After installing the headlight, be sure to adjust the headlight aim.

Headlight Adjustment

Preparation

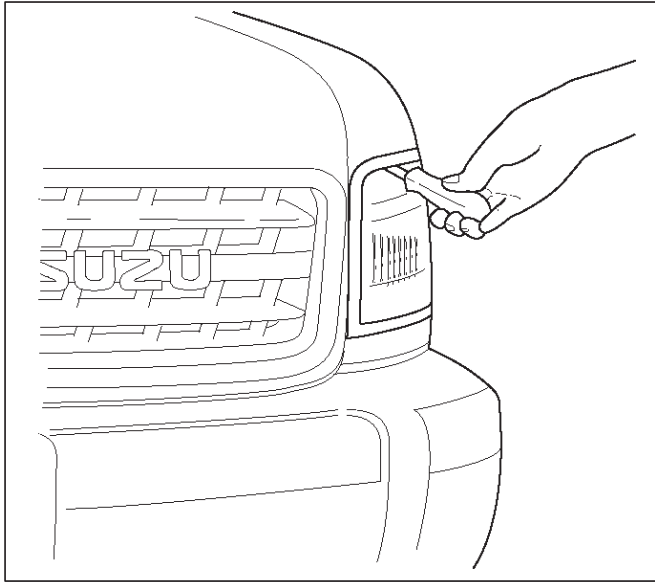
Place the unloaded vehicle on a level surface and check to see if the inflation pressure of the tires is correct, the lenses are clean, and the battery is sufficiently charged. Adjust the aim with the headlight tester, if necessary. When adjusting, follow the procedure of the tester manufacturer's.



801RS009

Vertical adjustment

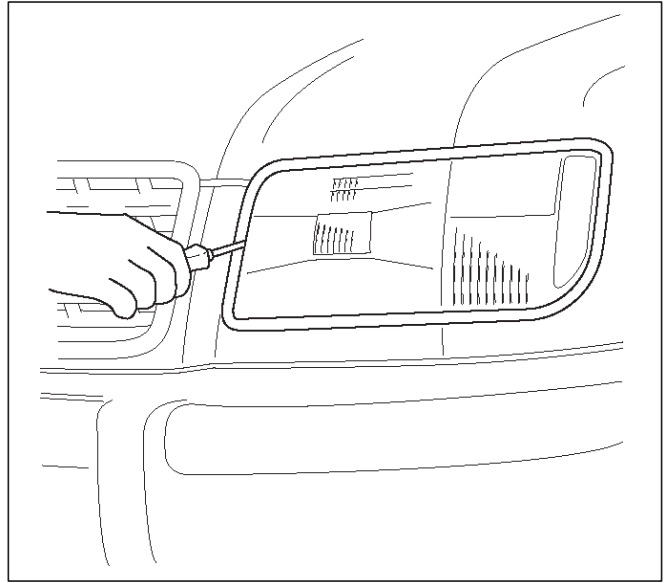
Use a screwdriver for vertical adjustment.



801RW004

Horizontal adjustment

Use a screwdriver for horizontal adjustment.

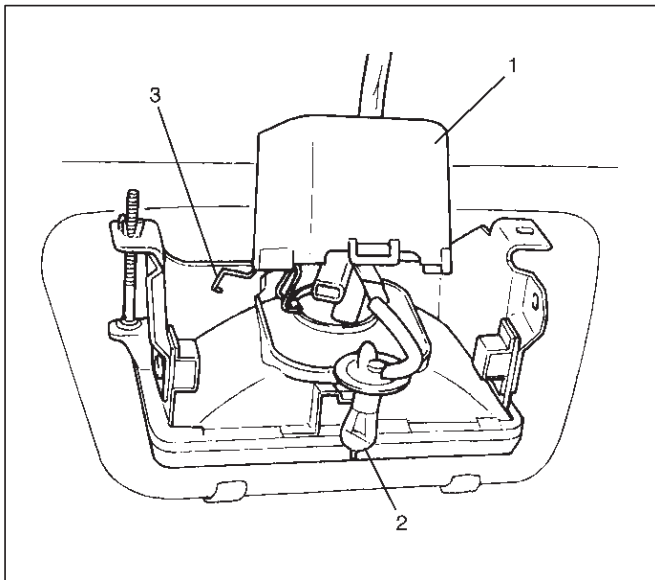


801RW005

Fog Light Bulb

Removal

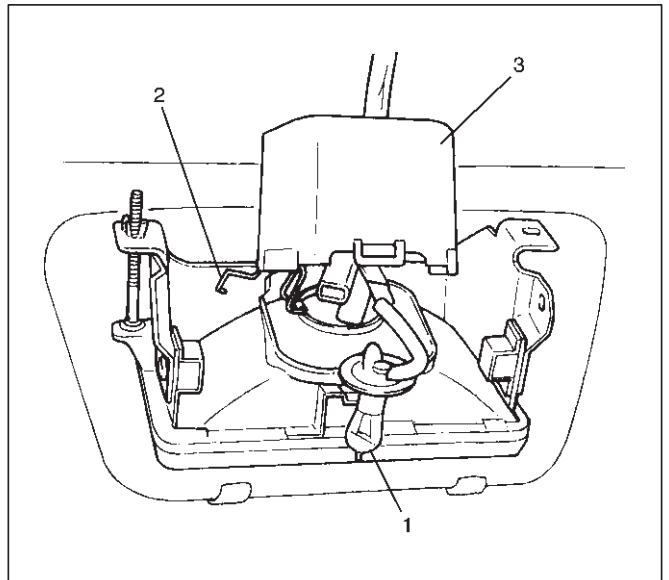
1. Disconnect the battery ground cable.
2. Open the rear cover(1) of the case.
3. Remove the dust cover.
4. Disconnect the bulb connector.
5. Remove the clip(3).
6. Remove the fog light bulb(2).



801RW012

Installation

1. Install the fog light bulb(1).
2. Install the clip(2).
3. Connect the bulb connector.
4. Install the dust cover.
5. Close the rear cover(3) of the case.



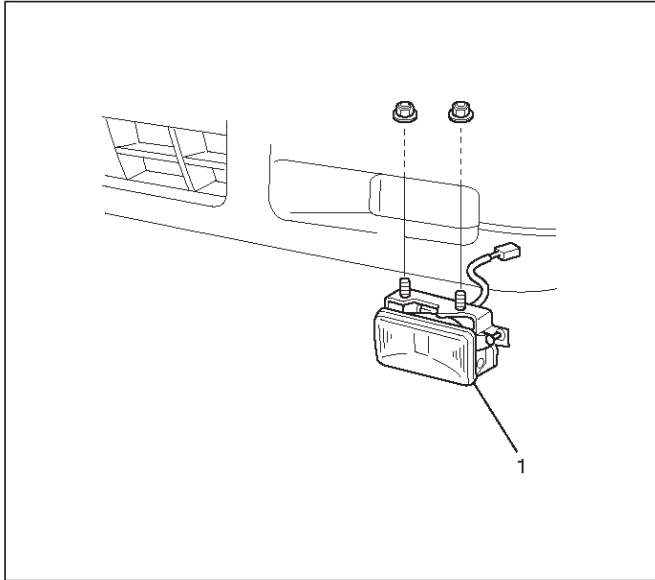
801RW017

6. Connect the battery ground cable.

Fog Light Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove two nuts from the bracket.
3. Disconnect the connector.
4. Remove the fog light assembly (1).

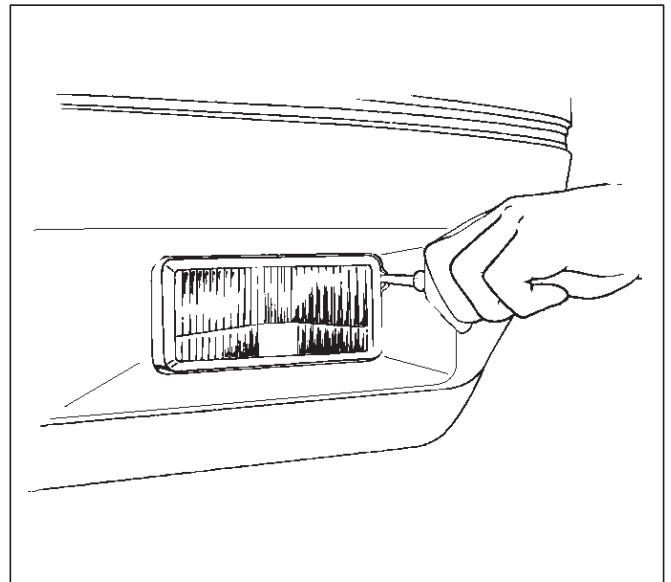


825RW104

CAUTION: After installing the fog light, be sure to adjust the fog light aim.

Fog Light Adjustment

Turn the adjusting screw with a screwdriver to adjust the aim of the fog light vertically.



801RW007

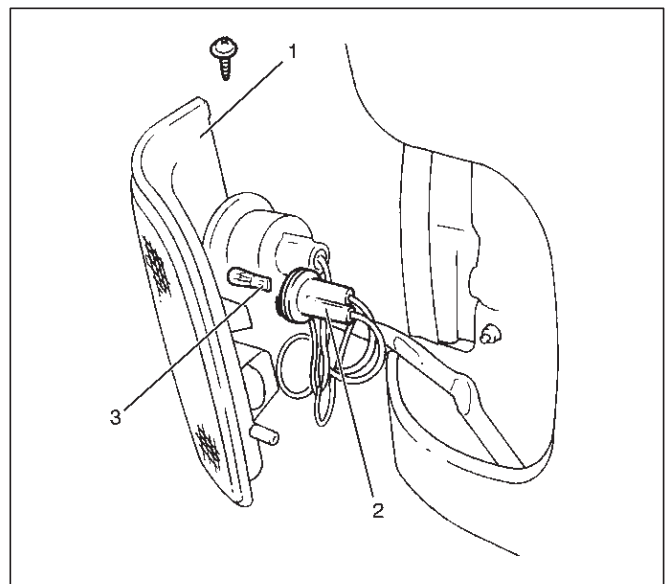
Installation

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

Clarence Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the screw at the upper portion of the light bracket and then remove the bracket from the fender.
3. Remove the front combination light assembly(1).
4. Remove the front side marker light socket(2) by turning it counterclockwise.
5. Pull out the bulb(3) from the socket.



801RW015

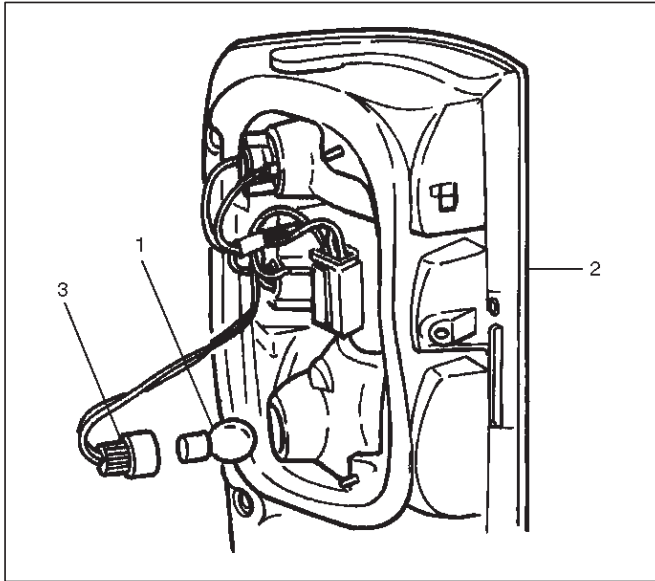
Installation

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

Rear Fog Light Bulb (RHD)

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and release locks at two locations to remove the rear combination light assembly(2).
3. Remove the socket(3) by turning it counterclockwise.
4. Turn the bulb(1) counterclockwise while pushing it to remove it from the socket.



803RS005

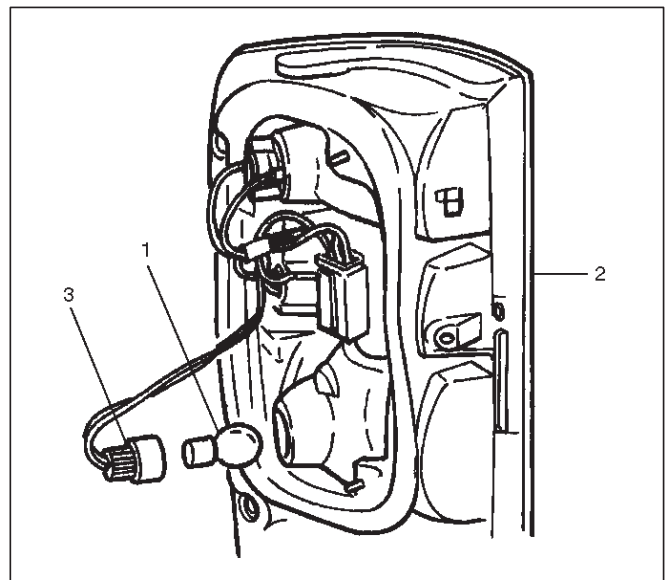
Installation

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

Taillight Bulb (Body)

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and release locks at two locations to remove the rear combination light assembly(2).
3. Remove the socket(3) by turning it counterclockwise.
4. Turn the bulb(1) counterclockwise while pushing it to remove it from the socket.



803RS005

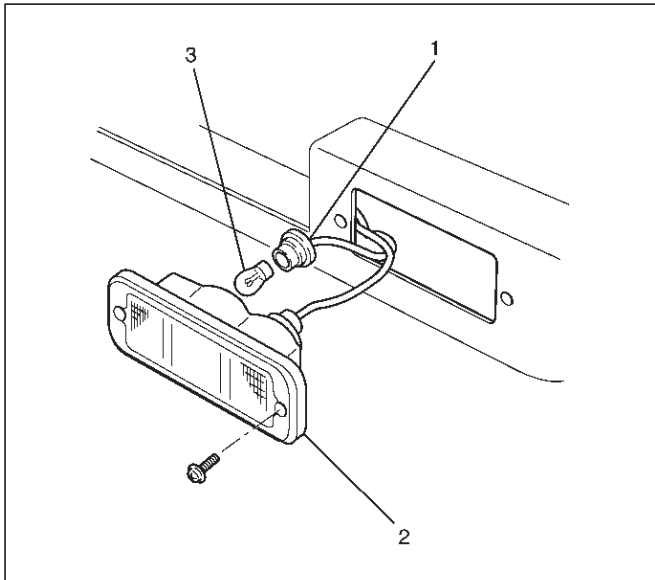
Installation

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

Taillight Bulb (Bumper)

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the rear combination light assembly(2).
3. Remove the socket(1) by turning it counterclockwise.
4. Remove the bulb(3) by turning it counterclockwise while pushing.



803RW004

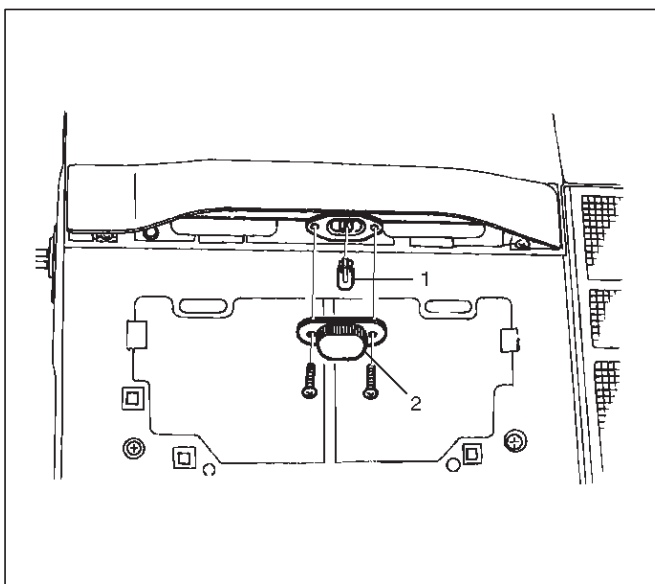
Installation

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

License Plate Light Bulb (Body)

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the lens(2).
3. Pull out the bulb(1) from the socket.



803RS006

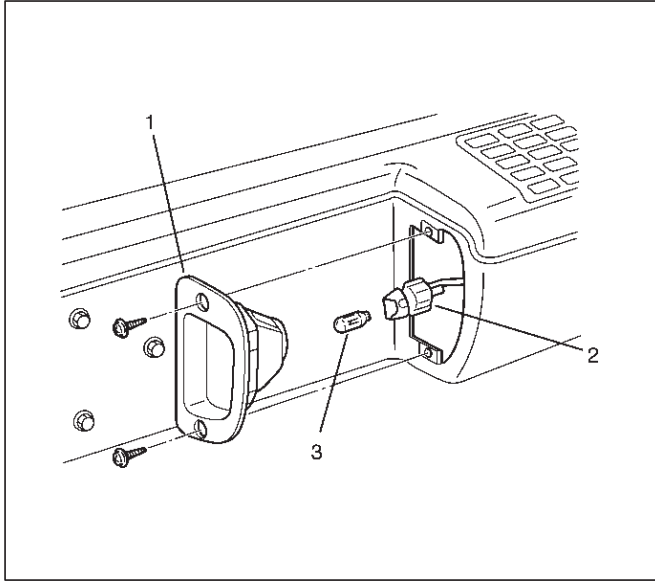
Installation

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

License Plate Light Bulb (Bumper)

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the license plate light(1).
3. Pull out the bulb(3) from the socket(2).



803RW003

Installation

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

Stoplight Bulb

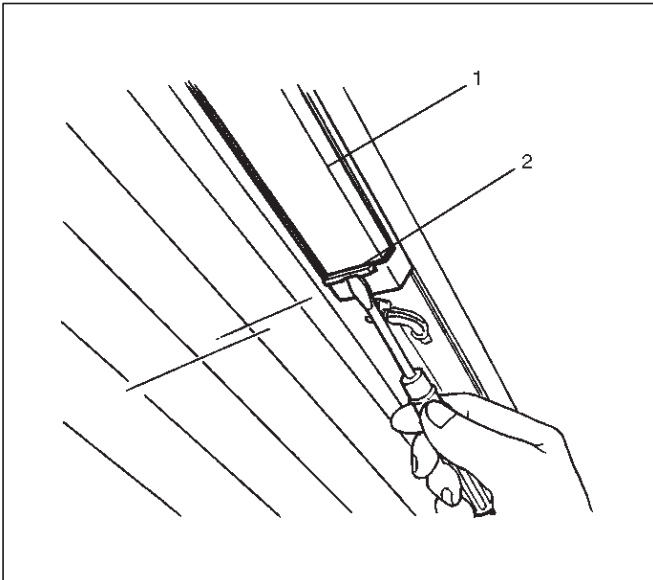
Removal and Installation

Refer to the Taillight Bulb in this section.

High Mount Stoplight

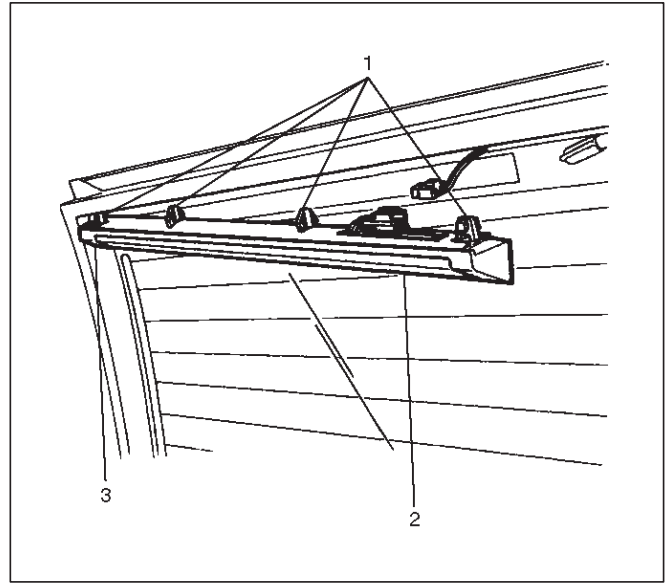
Removal

1. Disconnect the battery ground cable.
2. Remove the clips(2).
3. Pull out the high mount stoplight(1).
4. Remove the connector.
5. Remove the high mount stoplight.



Installation

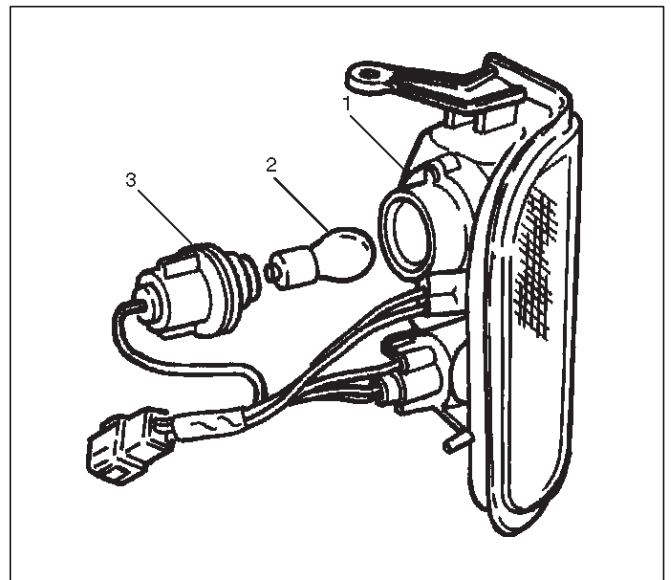
1. Insert the clips(1)(3) into the high mount stoplight(2).
2. Reconnect the connector.
3. Install the high mount stoplight.



Front Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the screw at the upper portion of the light bracket, and remove the bracket from the fender.
3. Remove the front combination light(1).
4. Remove the turn signal light socket(3) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



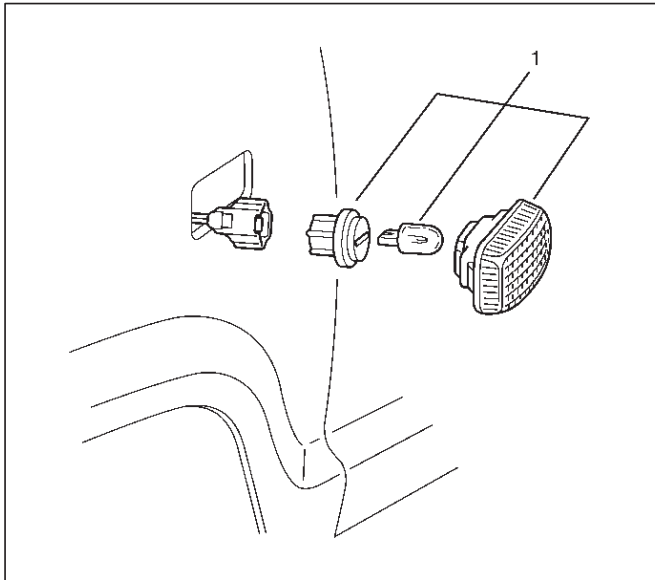
Installation

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

Side Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Pull the light/bulb(1) toward you while pushing the light housing in the rear direction of the vehicle to release its lock.
3. Remove the bulb by turning it counterclockwise while pushing it at the same time.



801RW013

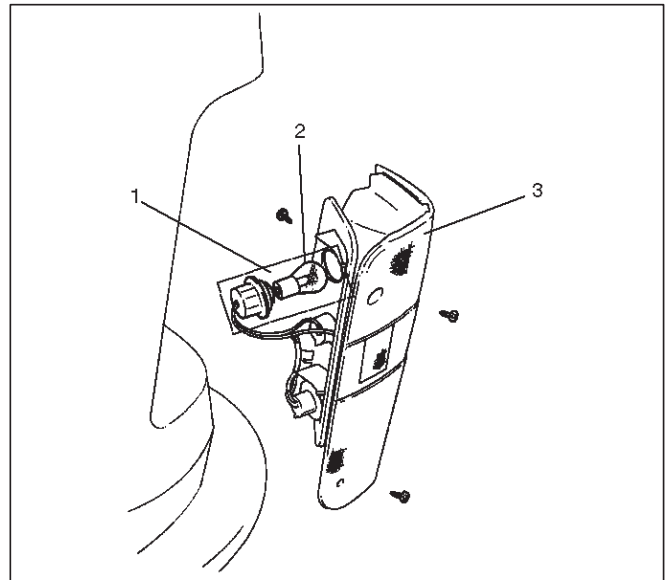
Installation

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

Rear Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the three screws and release the lock at two positions.
3. Remove the rear combination light(3).
4. Remove the turn signal light socket/bulb(1) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



803RS002

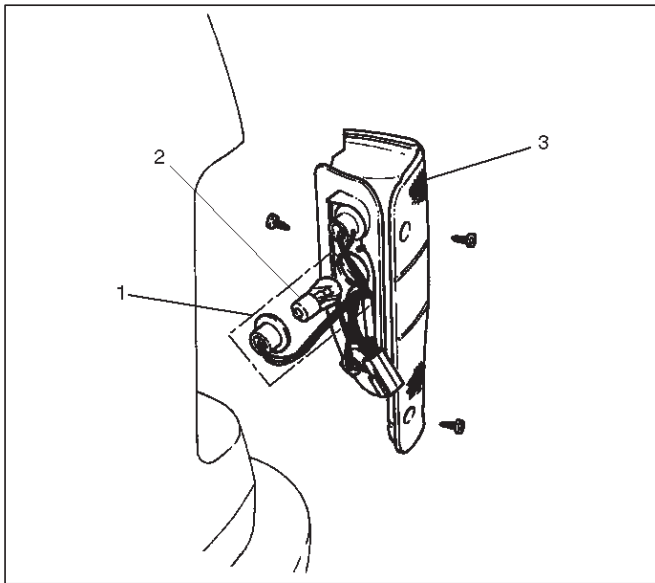
Installation

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

Backup Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and release the lock at two positions.
3. Remove the rear combination light(3).
4. Remove the backup light socket/bulb(1) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



803RS001

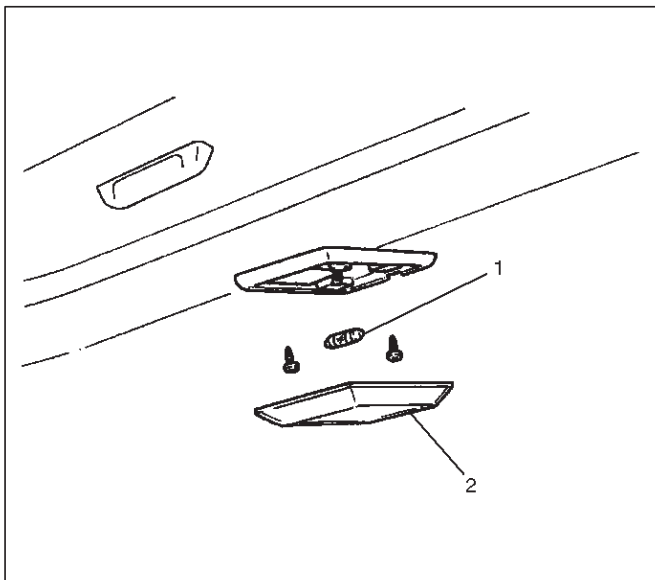
Installation

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

Dome Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2) by releasing the locks at three locations.
3. Remove the bulb(1).



805RS005

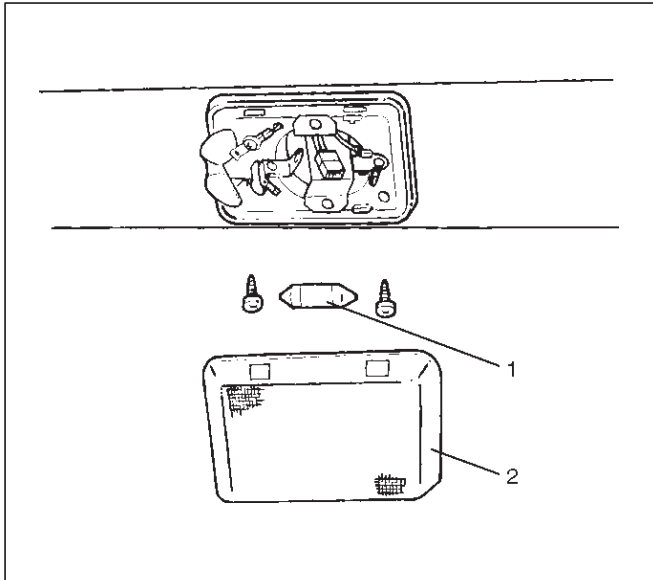
Installation

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

Luggage Room Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2) by releasing the locks at four locations.
3. Remove the bulb(1).



803RS007

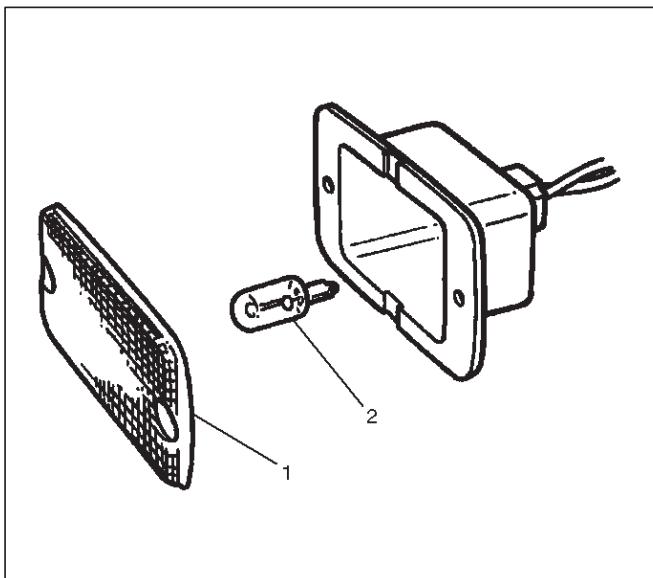
Installation

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

Courtesy Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the lens(1).
3. Pull out the bulb(2) from the socket.



805RS006

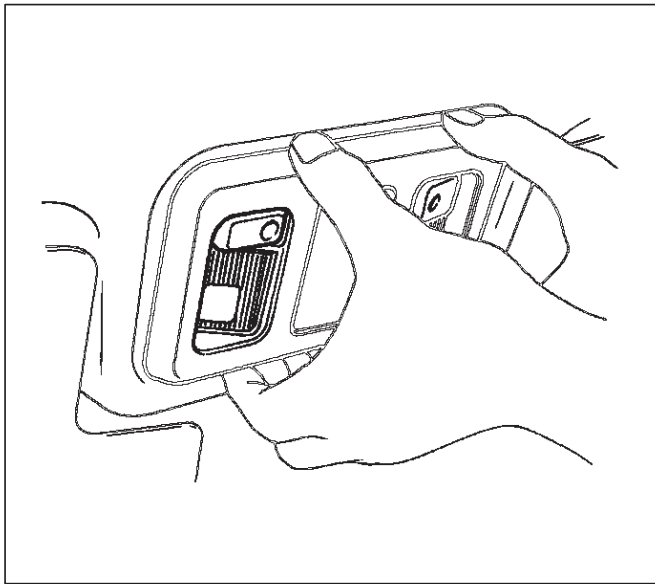
Installation

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

Map Light Switch/Bulb

Removal

1. Disconnect the battery ground cable.
2. Pull the map light body downward to release the lock.
3. Disconnect the connectors of the map light and the sun roof switch.
4. Remove the map light switch.
5. Turn the socket counterclockwise to remove it.
6. Pull out the bulb from the socket.



805RS008

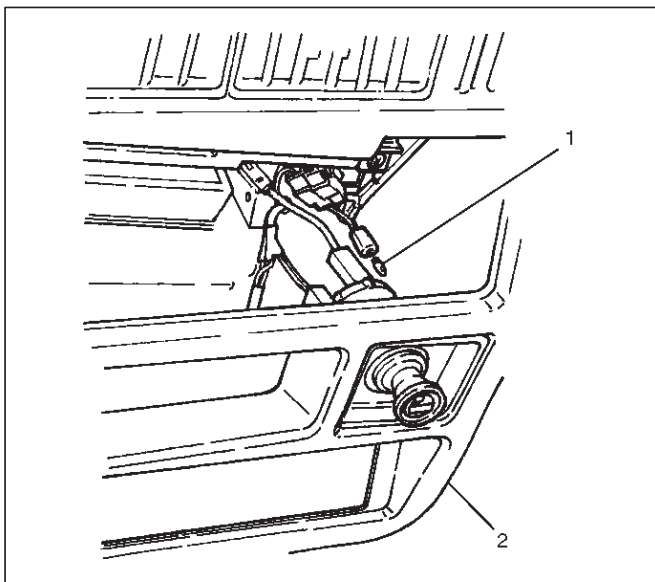
Installation

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

Cigarette Lighter Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove eight screws to remove the instrument cluster panel(2).
3. Turn the socket counterclockwise to remove it then pull out the bulb(1).



826RS013

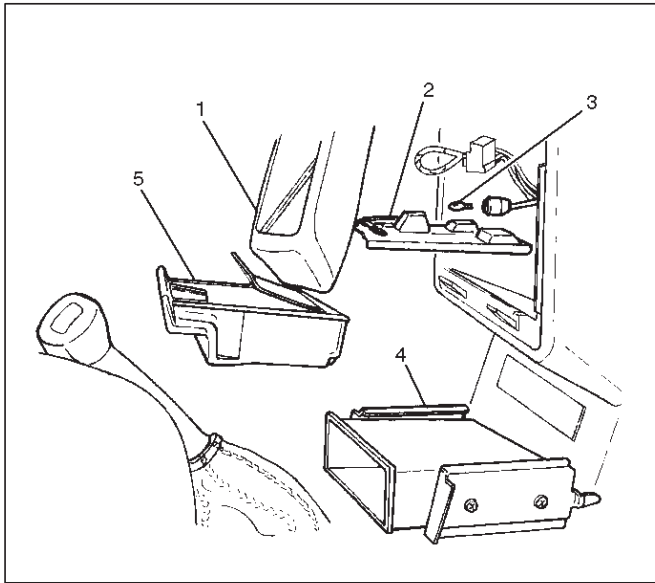
Installation

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

Ashtray Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Removal eight screws to remove the instrument cluster panel(1).
3. Remove the ashtray(5).
4. Remove four screws to remove the audio box(4).
5. Remove two screws to remove the ashtray guide(2).
6. Turn the socket counterclockwise to remove it then pull out the bulb(3).



742RS001

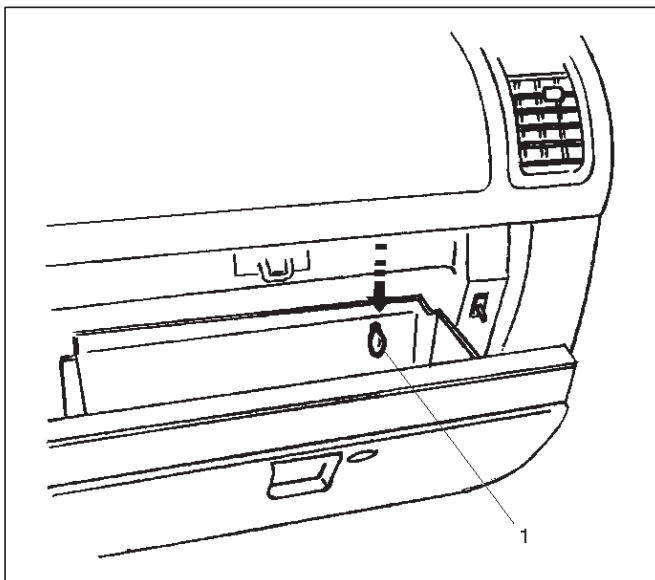
Installation

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

Glove Box Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Open the glove box lid, and then pull out the bulb(1).



805RS004

Installation

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

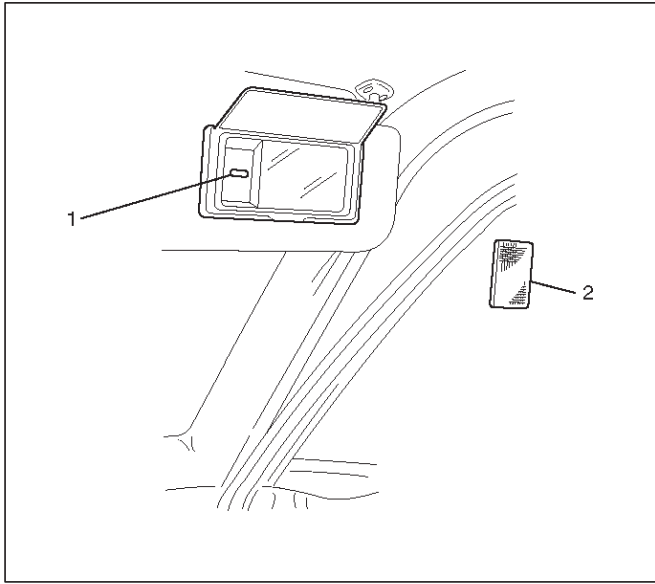
Vanity Mirror Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2).
3. Remove the bulb(1).

Installation

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

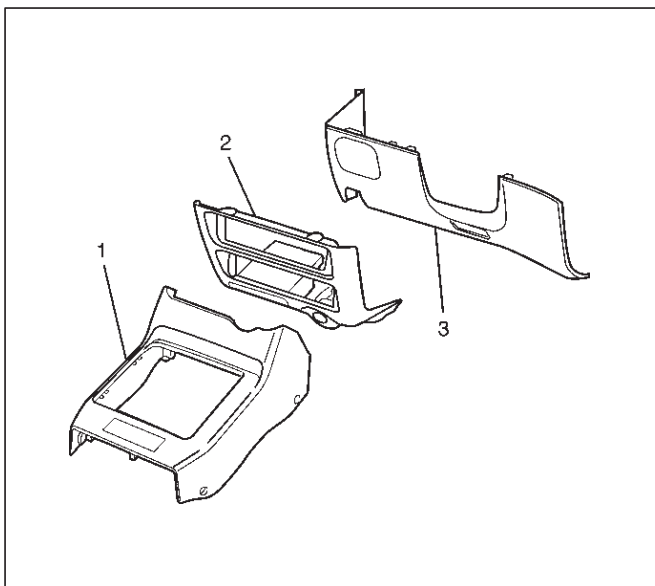


743RW007

Starter Switch

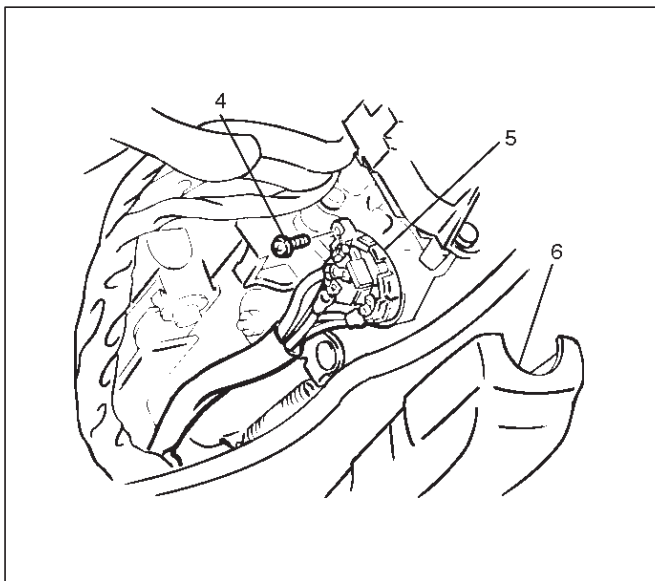
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove seven screws to remove the steering cowl(6).
6. Disconnect the connector, remove the screw(4) and then remove the starter switch(5).

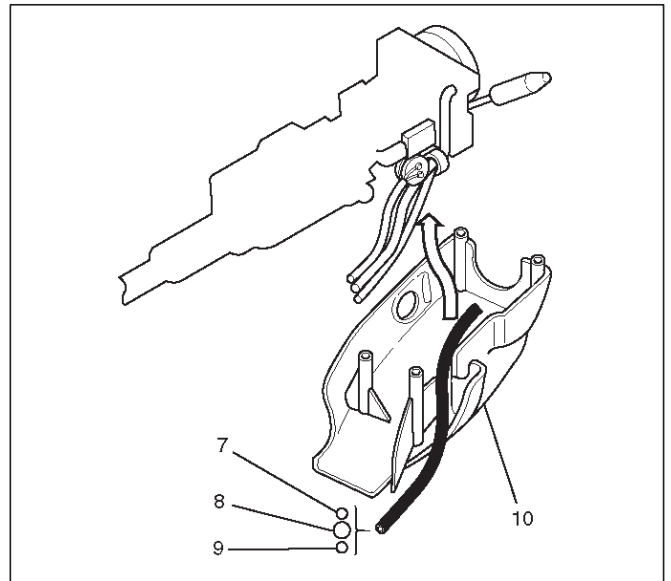


431RW005

Installation

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

1. When installing the steering cowl(10), be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness(7), the combination switch harness(8) and the inflator module harness(9) will not get caught.



431RW006

Lighting Switch (Combination Switch)

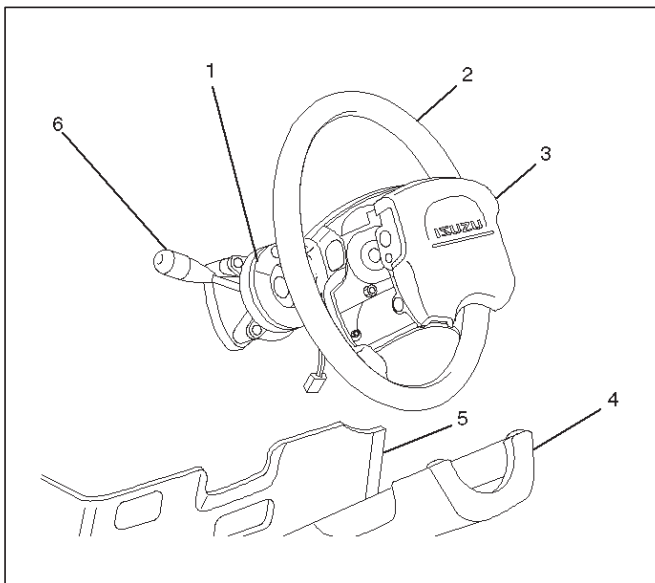
Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel driver lower cover(5). Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove seven screws to remove the steering cowl(4).
4. Disconnect the SDM (air bag controller) connector located at lower of the instrument panel driver lower cover.
5. Remove four fixing screws and disconnect the driver inflator module connector to remove the driver inflator module(3).

CAUTION: When carrying a live inflator module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the inflator module by the wires or connector on the underside of the module.

When placing a live inflator module on a bench or other surface, always face the bag and trim cover up, away from the surface. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.

6. Remove the steering wheel(2). Refer to the Steering Wheel in Steering section.
7. Disconnect the SRS coil assembly connector, remove four fixing screws to remove the SRS coil assembly(1).
8. Disconnect the lighting switch connector, remove four fixing screws to remove the lighting switch(6).



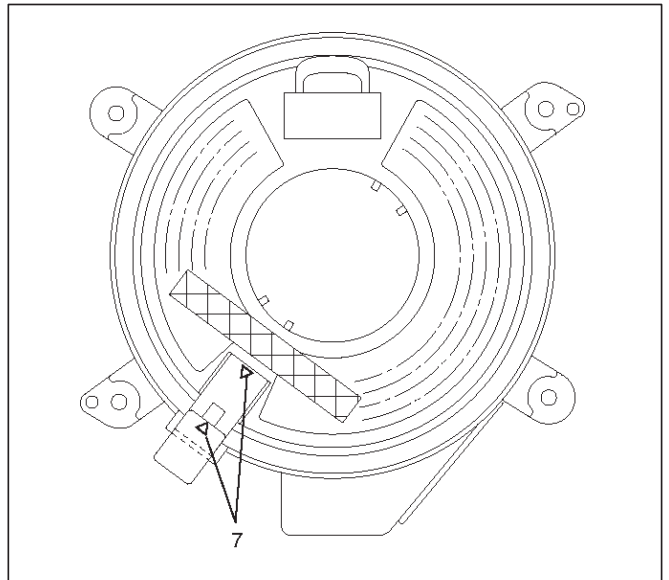
825RS039

Installation

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

1. Check to see if the vehicle is in the straight driving condition and turn the rotary section of the SRS coil assembly provided to the upper surface of the lighting switch (combination switch) counterclockwise fully until it stops.

Then from where it stops, turn it back about 3 rotations to set the alignment marks(7) together before installing the steering wheel.



825RW099

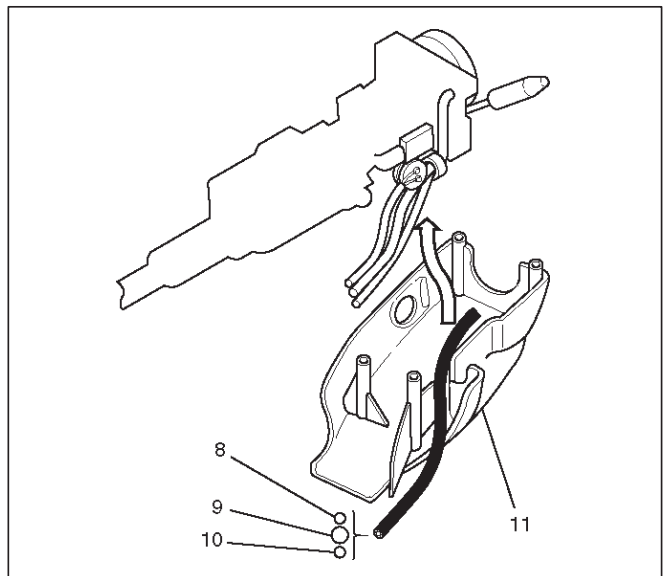
2. Tighten the steering shaft nut to the specified torque.

Torque: 34 N·m (3.5 kg·m/25 lb ft)

3. When connect the double lock type of inflator module connector, insert the connector completely and lock at outside.

Imperfect locking may cause malfunction of SRS system circuit.

4. When installing the steering cowl(11), be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness(8), the combination switch harness(9) and inflator module harness(10) will not get caught.

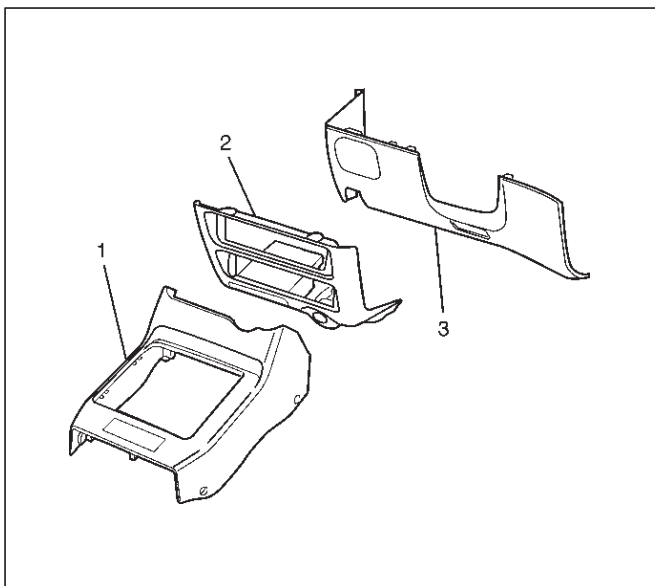


431RW014

Fog Light Switch

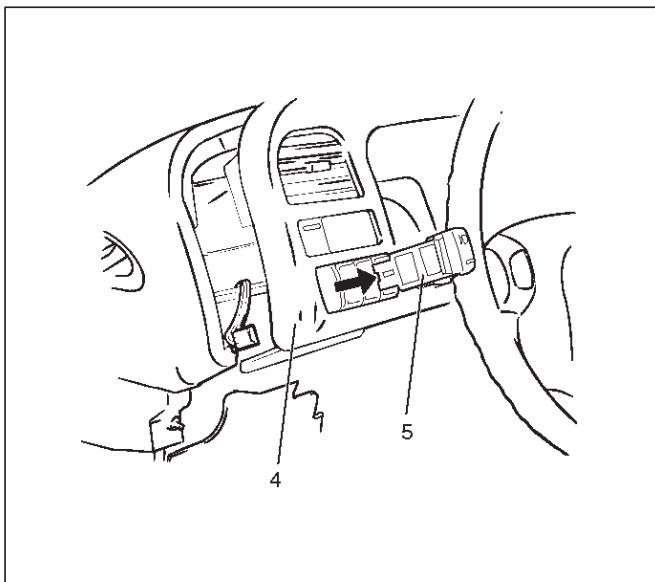
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the fog light switch(5).



825RW027

Installation

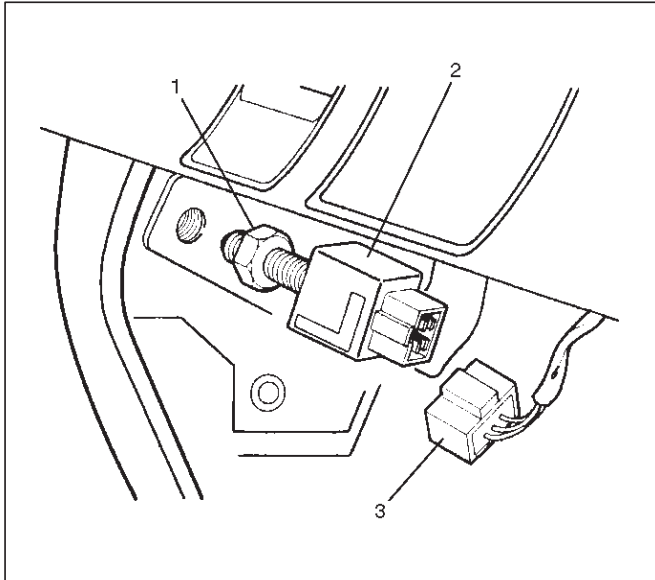
To install, follow the removal steps in the reverse order, noting the following point:

1. Push in the switch with your fingers until the switch is locked securely.

Stoplight Switch (W/O Cruise Control)

Removal

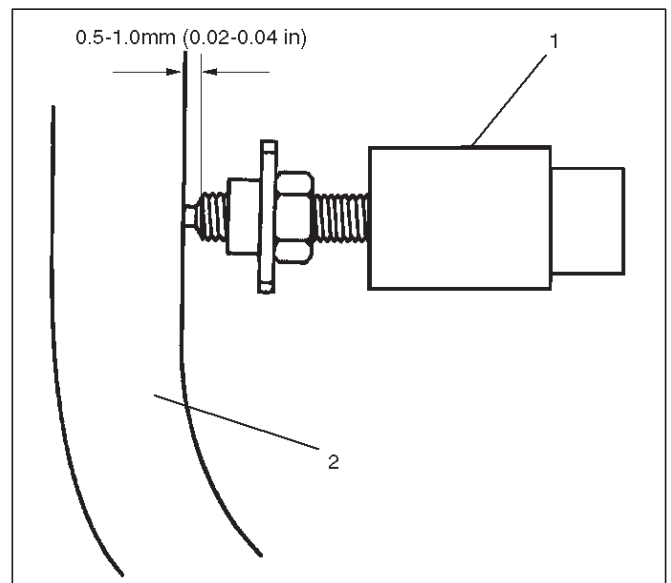
1. Disconnect the battery ground cable.
2. Disconnect the connector(3), loosen the lock nut(1) and then remove the stoplight switch(2) by turning it.



Installation

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

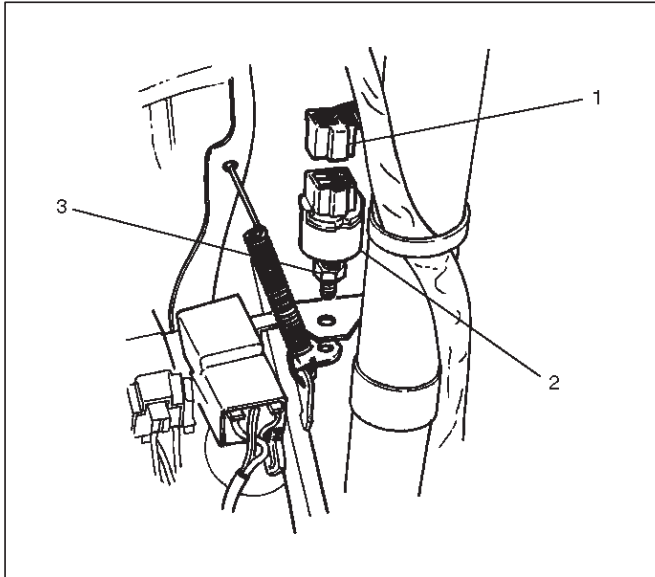
1. Check to see if the brake pedal has been returned by the return spring to the specified position.
2. Turn the stoplight switch(1) clockwise until the tip of the threaded portion of the switch contacts the pedal arm(2).
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02 – 0.04 in.).



Brake Switch (W/Cruise Control)

Removal

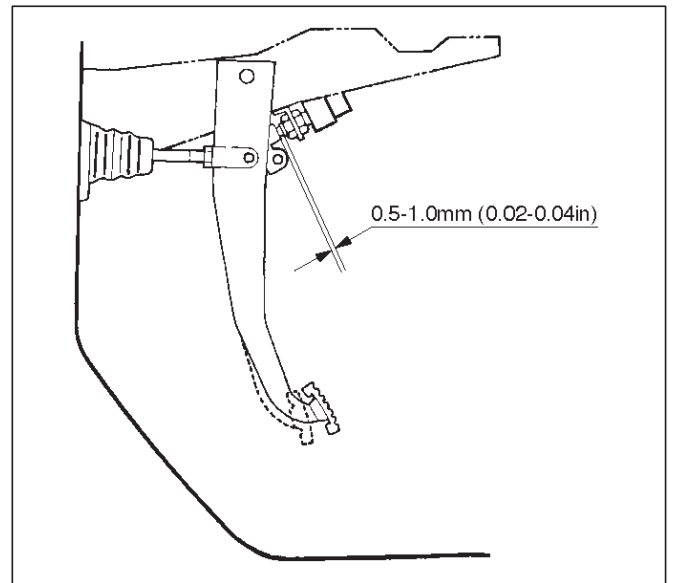
1. Disconnect the battery ground cable.
2. Disconnect the connector(1), loosen the lock nut(3) and then remove the brake switch(2) by turning it.



Installation

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

1. Check to see if the brake pedal has been returned by the return spring to the specified position.
2. Turn the switch clockwise until the tip of the threaded portion of the brake switch contacts the pedal arm.
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02 – 0.04 in.).



Turn Signal Switch (Combination Switch)

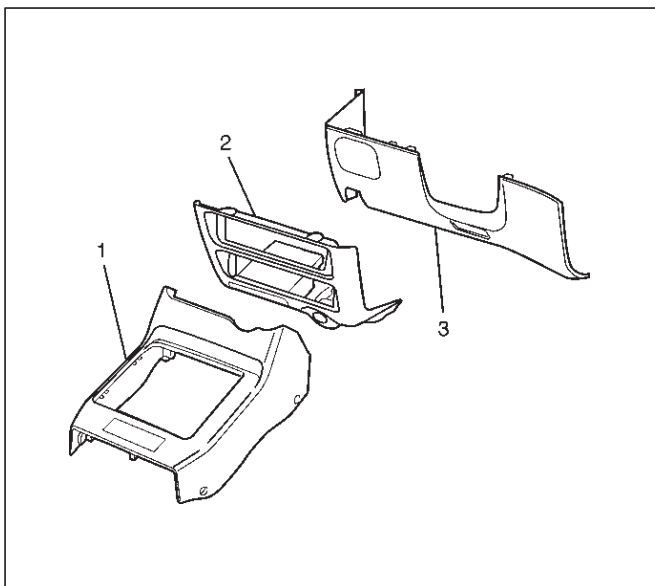
Removal and Installation

Refer to the removal and installation steps of the Lighting Switch (Combination Switch) in this section.

Hazard Warning Switch

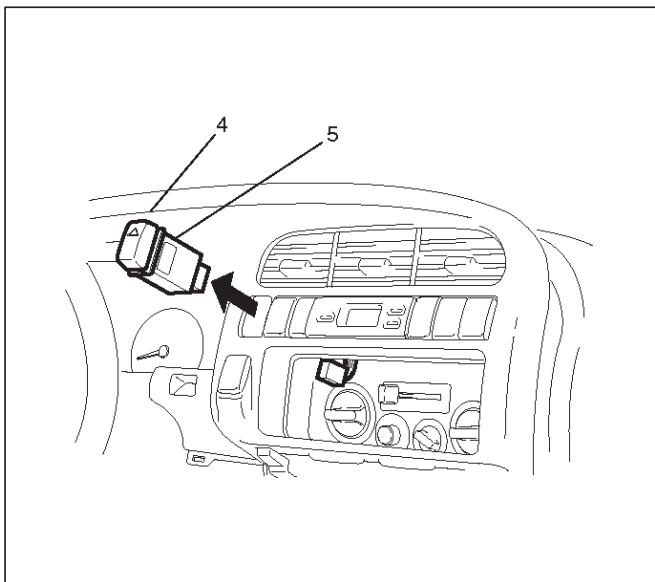
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



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5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the hazard warning switch(5).



825RW024

Installation

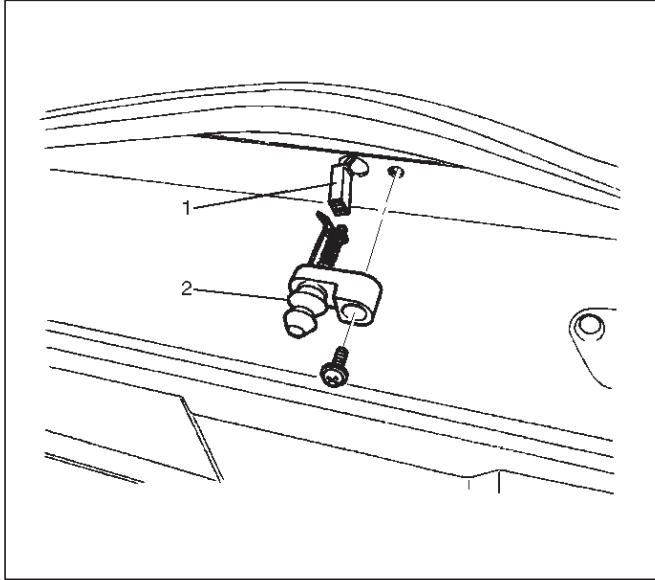
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until it locks securely.

Tailgate Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and disconnect the connector(1) to remove the tailgate switch(2).



683RS014

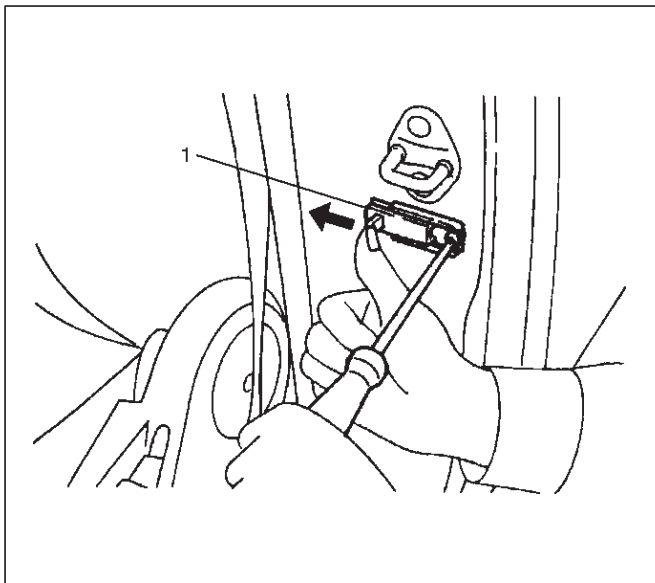
Installation

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

Door Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and disconnect the connector to remove the door switch(1).



825RS043

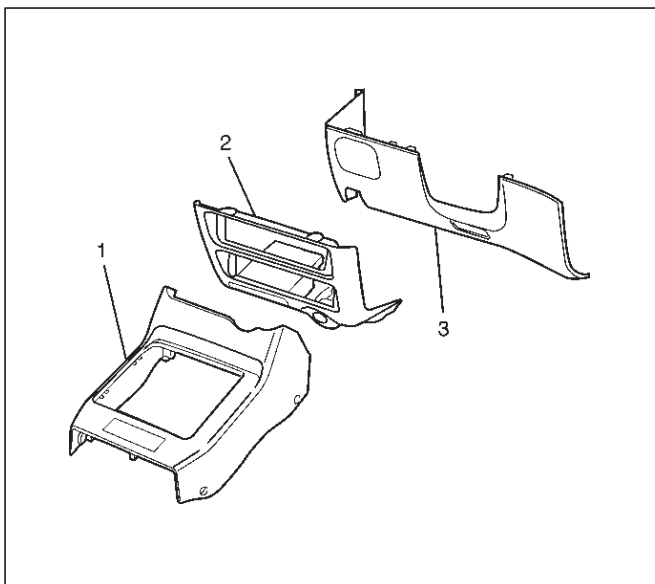
Installation

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

Rear Defogger Switch

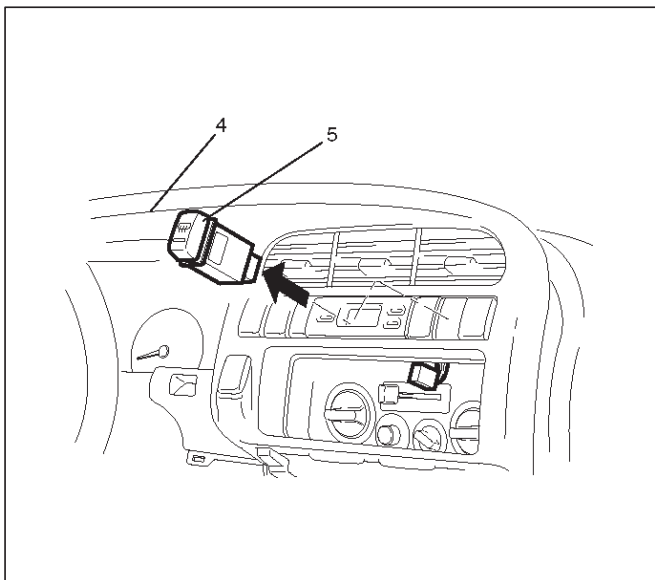
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the rear defogger switch(5).



825RW023

Installation

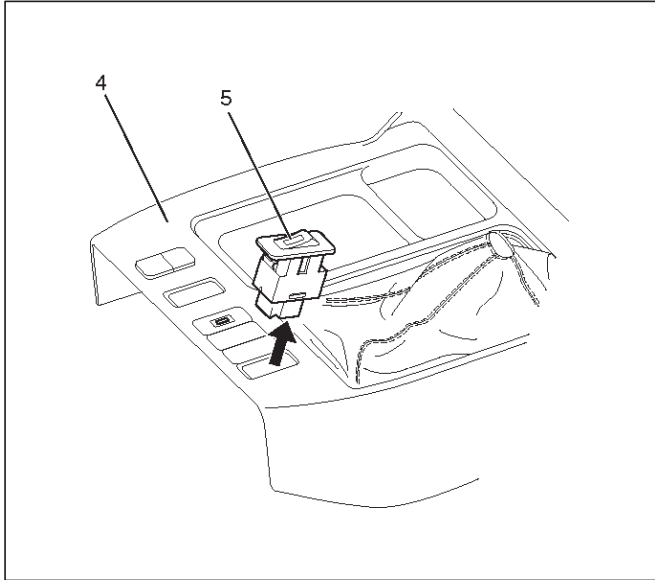
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until it locks securely.

Seat Heater Switch

Removal

1. Disconnect the battery ground cable.
2. Remove four fixing screws and disconnect the switch connectors to remove the front console assembly(4).
3. Push the lock from the back side of the front console assembly to remove the seat heater switch(5).



825RW025

Installation

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

1. Push the switch with your fingers until it locks securely.

Key Remind Switch (Starter Switch)

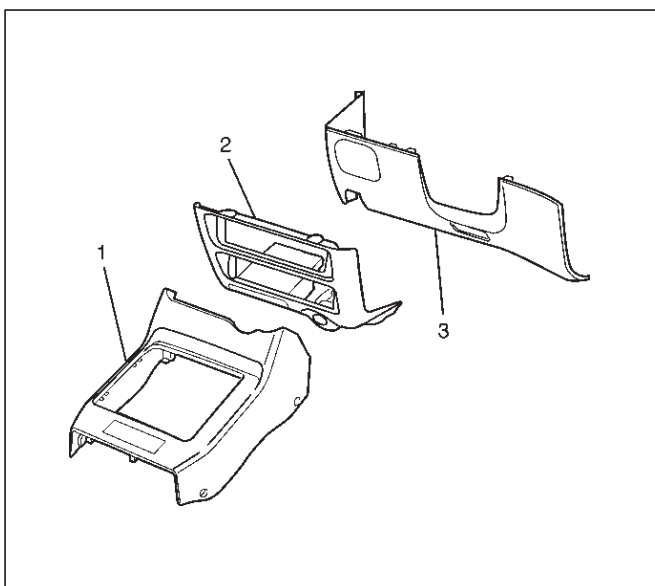
Removal and Installation

Refer to the removal and installation on steps of the Starter Switch in this section.

Illumination Controller

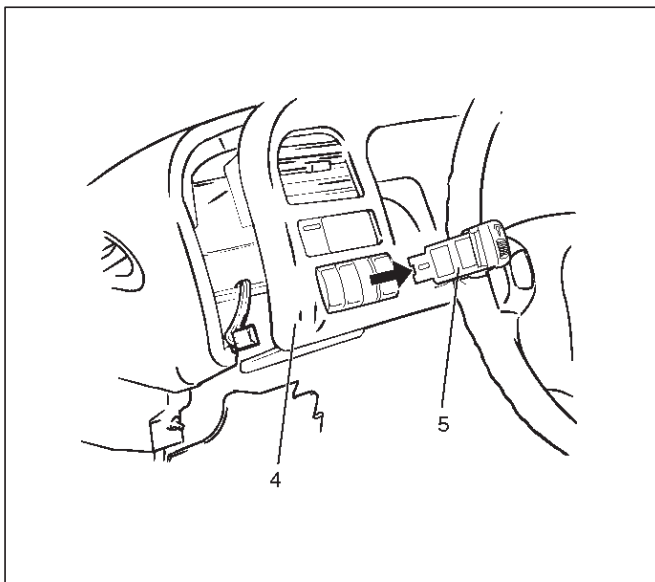
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the illumination controller(5).



825RW026

Installation

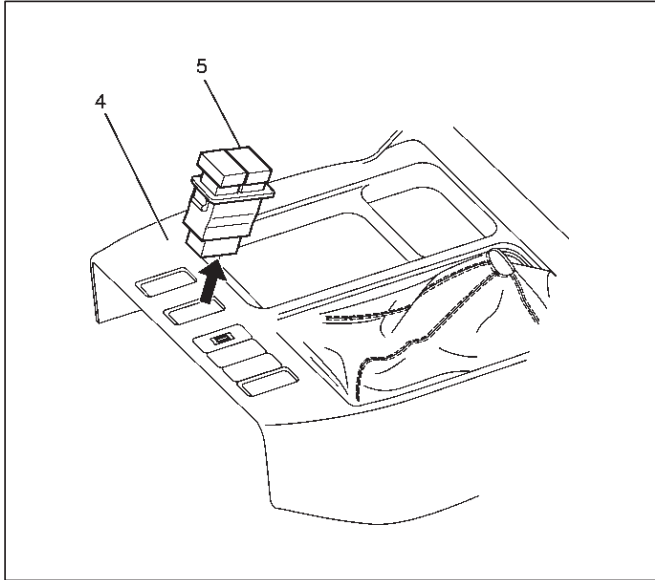
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until the switch is locked securely.

Power/Winter Switch

Removal

1. Disconnect the battery ground cable.
2. Remove four fixing screws and disconnect the switch connectors to remove the front console assembly(4).
3. Push the lock from the back side of the front console assembly to remove the power/winter switch(5).



825RW204

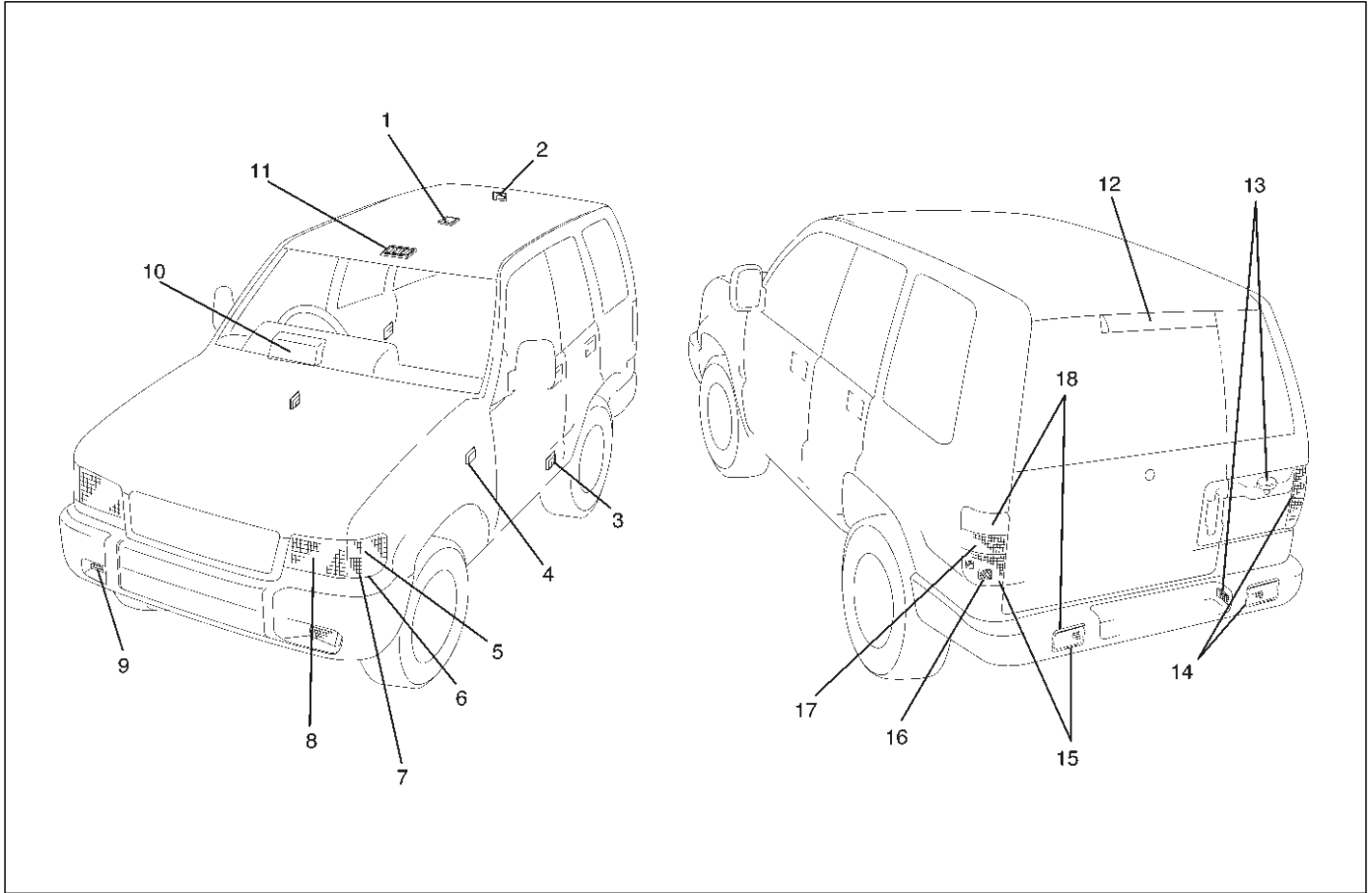
Installation

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

1. Push the switch with your fingers until it locks securely.

Main Data and Specifications

Light and Bulb Specifications



D08RW539

Legend

- | | |
|-----------------------------|------------------------------|
| (1) Dome Light | (10) Meter |
| (2) Luggage Room Light | (11) Map Light |
| (3) Courtesy Light | (12) High Mount Step Light |
| (4) Side Turn Signal Light | (13) License Plate Light |
| (5) Front Turn Signal Light | (14) Rear combination Light |
| (6) Clearance Light | (15) Taillight/Stoplight |
| (7) Front Combination Light | (16) Rear Fog Light |
| (8) Headlight | (17) Backup Light |
| (9) Fog Light | (18) Rear Turn Signal Light. |

LIGHTING SYSTEM 8A-29

Light Name		Rated Power	Number of Bulbs	Lens Color	Remarks
Headlight		60w/55w	2	White	Halogen
Front combination light	Turn signal light	21w	2	White	
	Clearance light	5w	2	Amber	
FRT fog light		55w	2	White	Halogen
Rear combination light	Bumper	Taillight/Stoplight	5w/21w	2	Red
		Turn signal light	21w	2	Amber
	Body	Taillight/Stoplight	5w/21w	2	Red
		Turn signal light	21w	2	Amber
Backup light		21w	2	White	
RR fog light		21w	2	Red	
Side turn signal light		5w	2	Amber	
License plate light	Bumper	5w	2	White	
	Body	5W	1	White	
High mount stoplight		—	—	Red	LED
Map light		5w	2	White	
Dome light		10w	1	White	
Luggage room light		8w	1	White	
Courtesy light		3.8w	2	White	
Indicator/ Warning light	A/C SW	60mA	1		
	RR defogger SW	0.84w	1		
	Mirror defogger SW	0.84w	1		
	FRT fog light SW	0.7w	1		
	RR fog light SW	0.7w	1		
	Cruise (Set)	1.4w	1		Meter
	Cruise (Main)	1.4w	1		Meter
	Check trans	3w	1		Meter
	Anti-theft	3w	1		Warning box
	Turn signal	1.4w	2		Meter
	Golw	1.4w	1		Meter
	Water sedimenter	1.4w	1		Meter
	High beam	1.4w	1		Meter
	ABS	1.4w	1		Meter
	Check engine	1.4w	1		Meter
	Low fuel	1.4w	1		Meter
	4WD	1.4w	1		Meter
	Oil Pressure	1.4w	1		Meter
	Brake system	1.4w	1		Meter
	Charge	1.4w	1		Meter
Seat belt	2w	1		Meter	
A/T shift position	0.91w	7		Meter	
A/T oil temp	3w	1		Meter	

8A-30 LIGHTING SYSTEM

	Power drive	1.4w	1		Meter
	Winter drive	1.4w	1		Meter
	Air bag	2w	1		Meter
Illumination Light	Engine warming SW	0.84w	1		
	FRT fog light SW	0.84w	1		
	RR fog light SW	0.84w	1		
	Glove box	1.2w	1		
	Ashtray	1.4w	1		
	Illumination controller	0.7w	1		
	Heater bezel	150mA	2		
	Hazard warning light SW	0.84w	1		
	Meter	3.4w	4		Meter ASM
	Cigar lighter	1.4w	1		
	Rear wiper & washer SW	0.84w	1		
	Rear defogger SW	0.84w	1		
	Mirror control SW	45mA	1		
	Mirror defogger SW	0.7w	1		
	Mirror folding SW	0.7w	1		
	A/T select lever	1.2w	1		
	Power & Winter SW	50mA	2		
	Cruise control main SW	0.84w	1		
Headlight wiper SW	0.84w	1			

Torque Specifications

Application	N-m	kg-m	Lb Ft	Lb In
Steering Shaft Nut	34	3.5	25	—

WIPER / WASHER SYSTEM

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Service Precaution

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

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

Windshield Wiper/Washer System

General Description

The circuit consists of the starter switch, windshield wiper & washer switch, windshield wiper motor, windshield washer motor and windshield intermittent relay.

When the wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.

The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The intermittent relay is used to control motion of the wiper.

Windshield Wiper And Washer Switch

Removal and Installation

Refer to the Lighting Switch (Combination Switch) in Lighting System section.

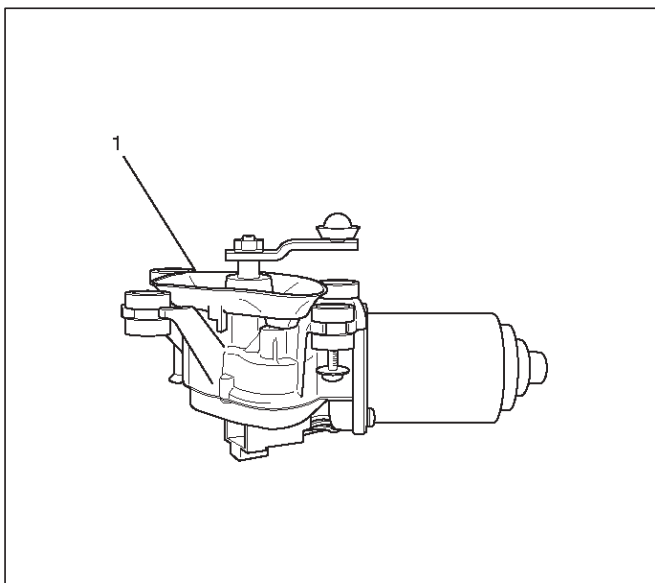
Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove 4 mounting bolts.
4. Remove the windshield wiper motor(1).

Installation

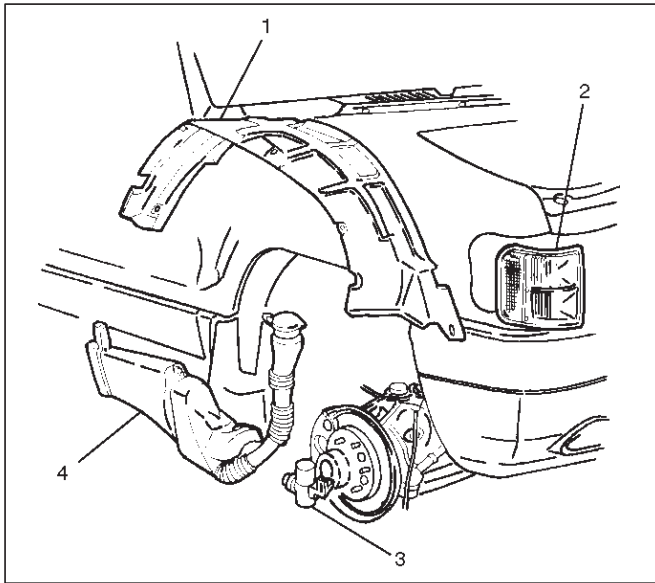
To install, follow the removal steps in the reverse order.



Windshield Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender inner liner (right side) (1).
3. Remove the screws and then remove the front combination light(2).
4. Remove 2 screws, the filler neck and the hose.
5. Disconnect the windshield washer motor connector and remove the washer tank (4).
6. Pull the windshield washer motor(3) from the washer tank(4).



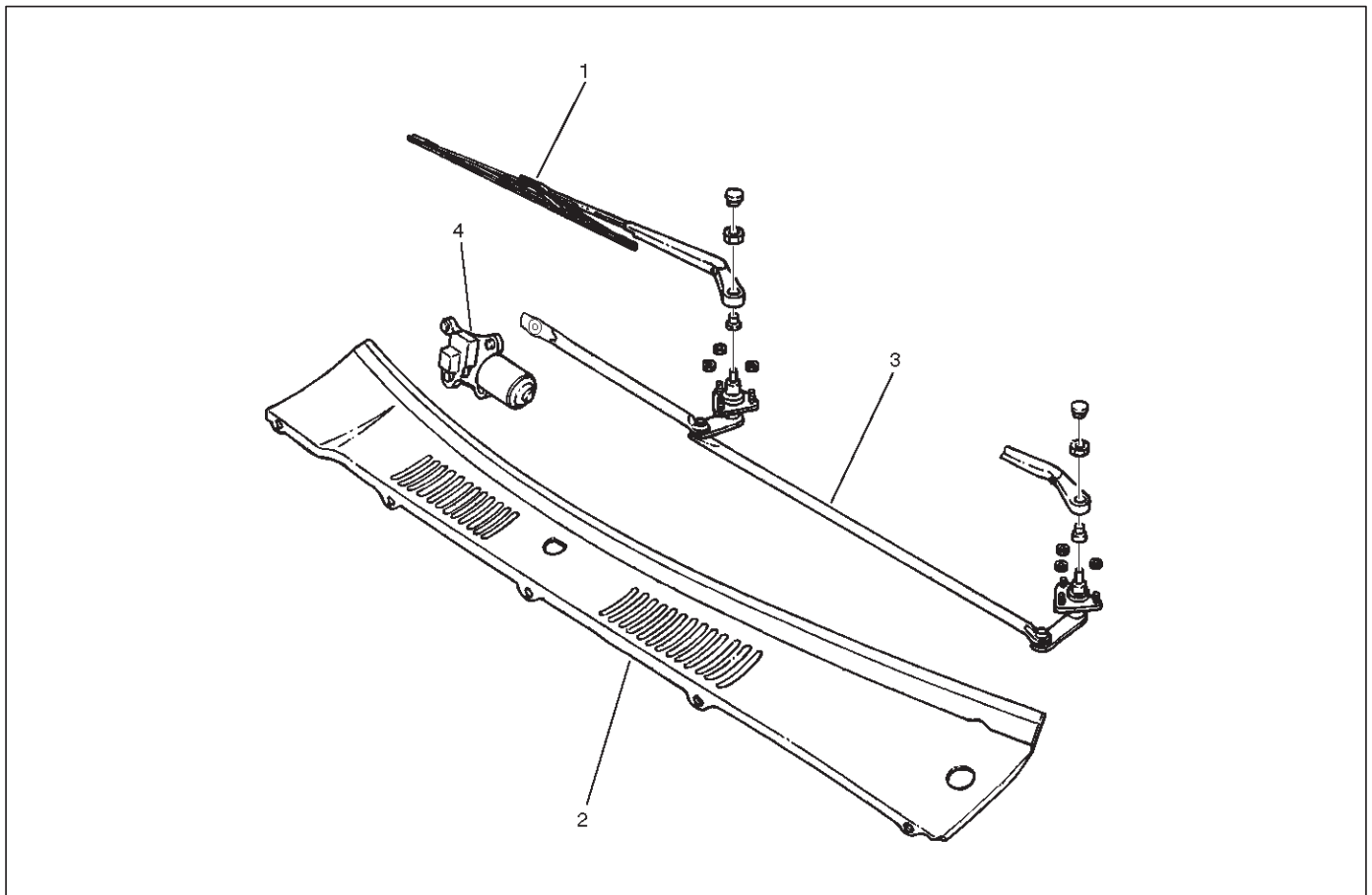
88ORS006

Installation

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

Windshield Wiper Linkage

Windshield Wiper Linkage and Associated Parts



8B0RW008

Legend

- | | |
|--------------------------------|---------------------------------------|
| (1) Windshield Wiper Arm/Blade | (3) Windshield Wiper Linkage Assembly |
| (2) Vent Cowl Cover | (4) Windshield Wiper Motor |

Removal

1. Disconnect the battery ground cable.
2. Remove the windshield wiper arm/blade.
3. Remove the windshield wiper motor.
4. Remove the pivot assembly mounting nuts, fixing screws and then remove the vent cowl cover.
5. Take out the windshield wiper linkage assembly from the opening of the cowl.

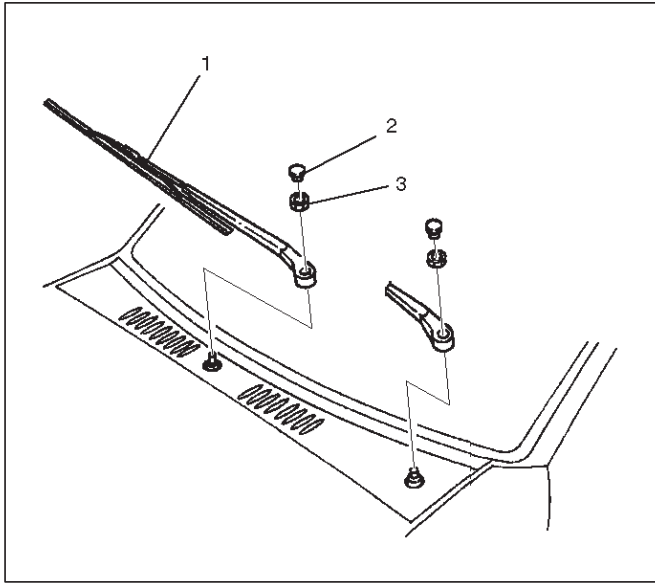
Installation

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

Windshield Wiper Arm/Blade

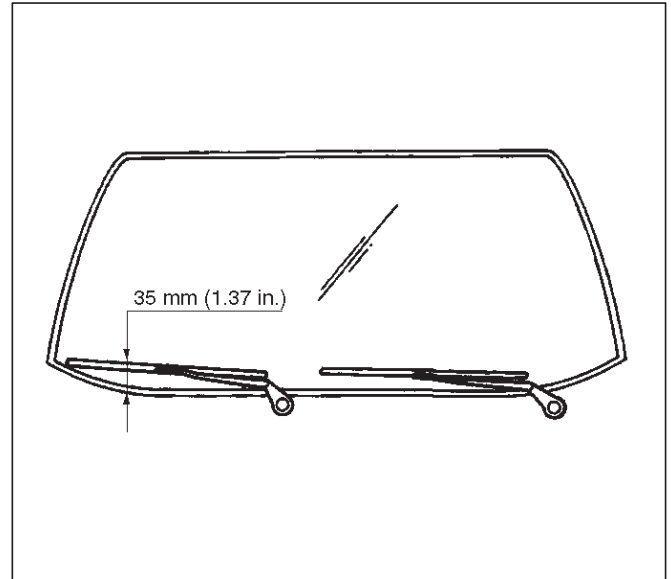
Removal

1. Pry the cap(2) off with the tip of a screwdriver.
2. Remove the nut(3).
3. Remove the wiper/blade(1).



Installation

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



1. Wiper arm/blade

- Before installing the wiper arm/blade to the shaft, confirm that the motor stops at the auto-stop position.
- Set the wiper arm/blade so that the tips of both blades are positioned about 35 mm (1.37 in) from the upper edge of the cowl cover as shown in the figure.
- Tighten the nuts to the specified torque.

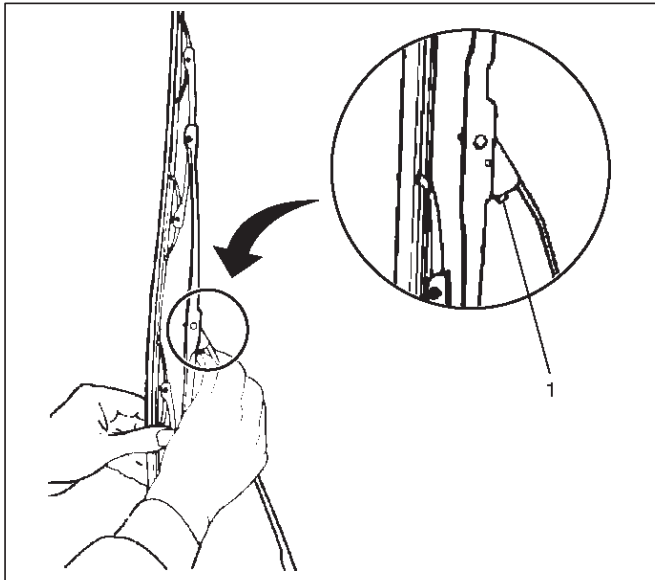
Torque: 31 N·m (3.2 kg·m/23 lb ft)

Windshield Wiper Blade Rubber

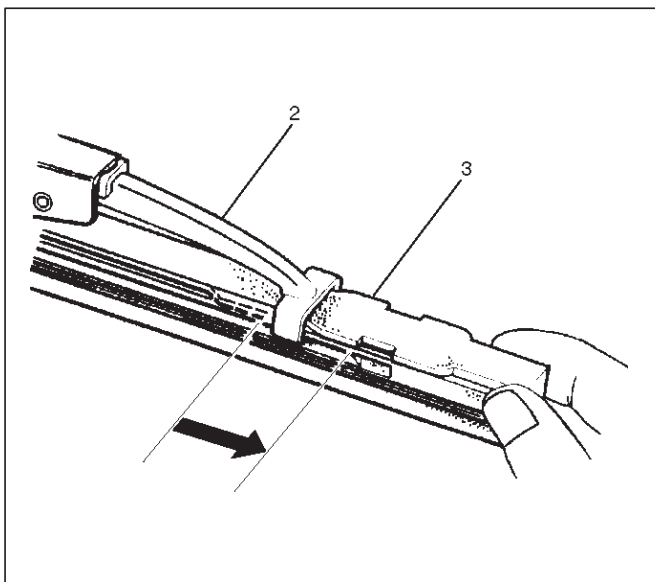
Removal

1. Push the wiper blade lock(1) while pulling the wiper blade in the arrow direction as shown in the figure.

CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



2. Pull the end of rubber and remove the projection(3) from the click of the blade stay (2).

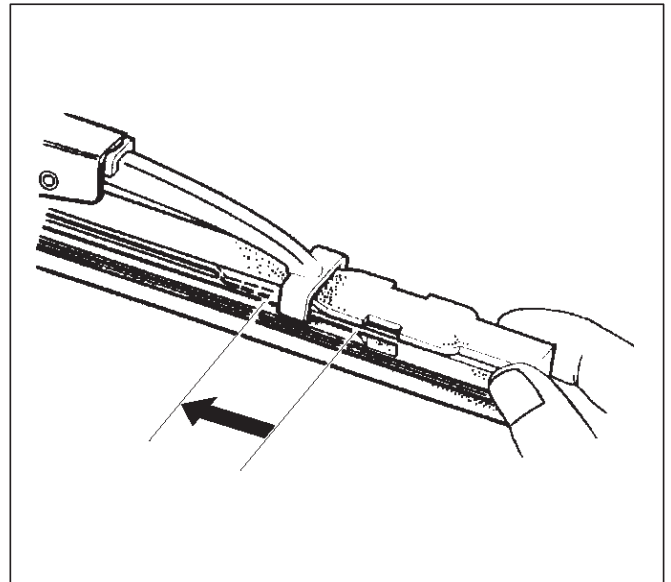


3. Pull the rubber out in the same direction.

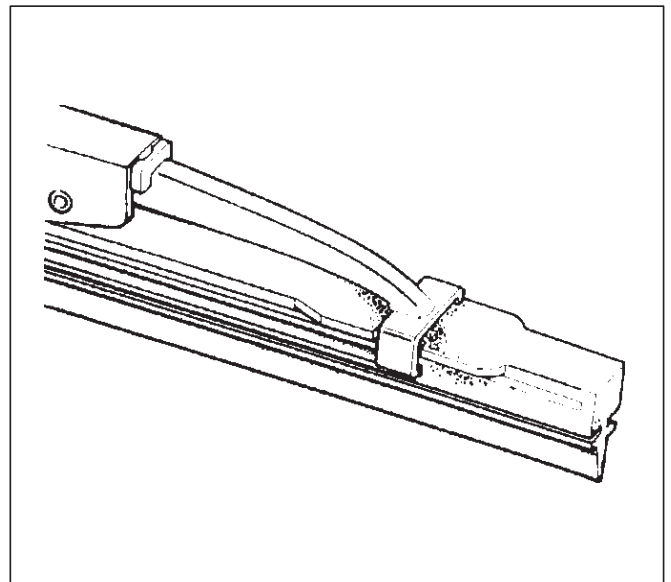
Installation

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

1. Install the click of the blade stay in the groove of the new rubber and slide it in. Complete wiper blade installation by pushing the click.



2. Finally, check that the click of the stay has caught in the hole of the rubber.



Rear Wiper/Washer System

General Description

The circuit consists of the starter switch, rear wiper & washer switch, rear wiper motor, rear washer motor and rear intermittent relay.

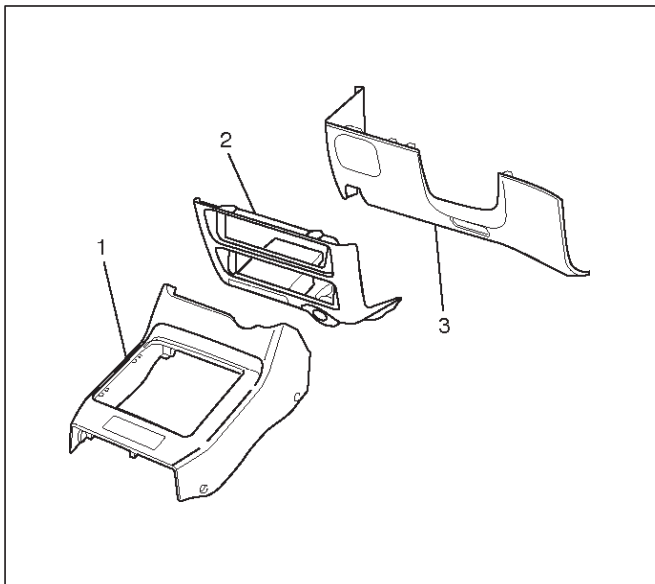
When the wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.

The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The intermittent relay is used to control motion of the wiper.

Rear Wiper and Washer Switch

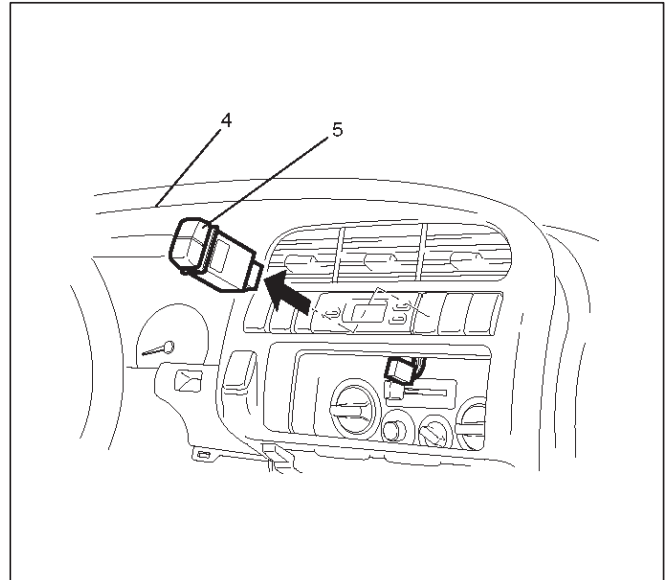
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the rear wiper & washer switch(5).



821RW023

Installation

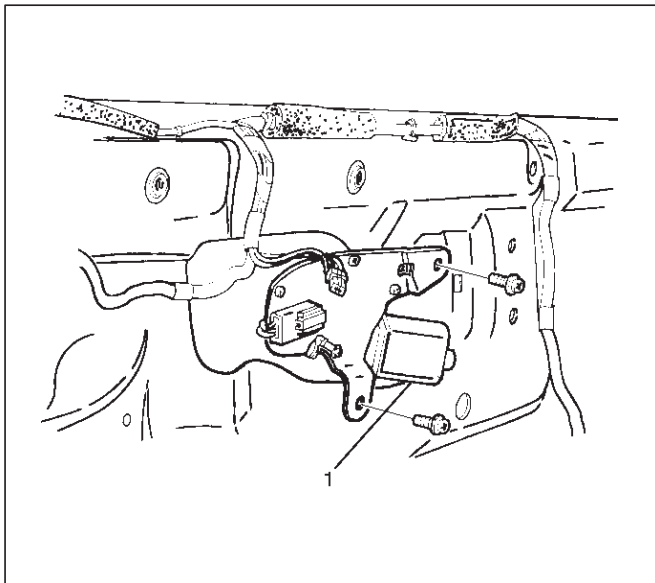
To install, follow the removal steps in the reverse order, noting the following point:

1. Push the switch with your fingers until it locks securely.

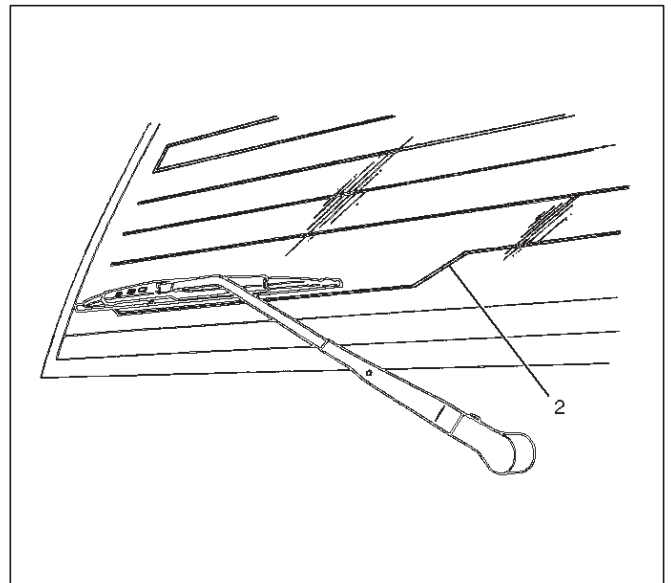
Rear Wiper Motor

Removal

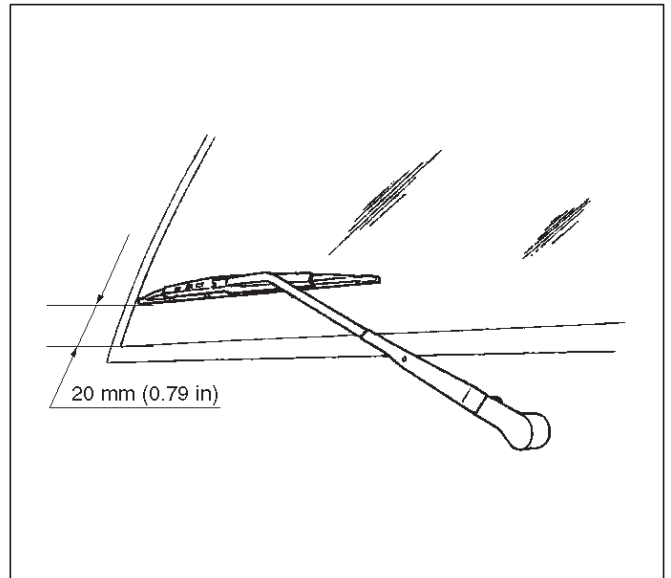
1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad.
3. Remove the wiper arm/blade.
Refer to the removal steps of the Rear Wiper Arm/Blade in this section.
4. Disconnect the connector remove the wiper shaft nut, remove the fixing screws and then remove the rear wiper motor(1).



885RS013



885RS012



885RS011

Installation

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

1. Before installing the wiper arm/blade to the motor shaft, confirm that the motor stops at the auto-stop position.
2. Install the wiper arm so that the blade gets parallel to the lowermost heat wire(2) of the rear defogger (w/rear defogger), or position the blade 20 mm (0.79 in) from edge of tailgate glass (W/O rear defogger).

3. Tighten the motor shaft nut to the specified torque.

Torque: 6 N·m (0.6 kg·m/52 lb in)

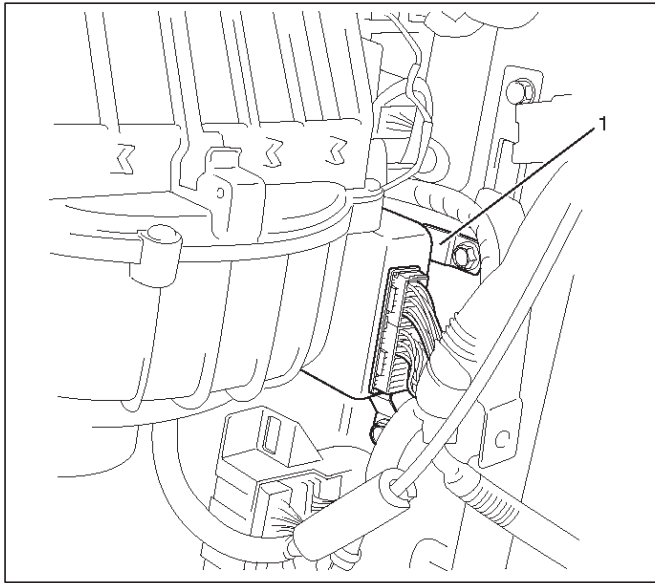
4. Tighten the wiper arm nut to the specified torque.

Torque: 9 N·m (0.9 kg·m/78 lb in)

Alarm & Relay Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the glove box.
3. Remove the instrument panel passenger lower cover assembly.
4. Remove the passenger Knee bolster reinforcement assembly.
5. Remove the fixing bolts, disconnect the connectors and then remove the alarm & relay control unit (1).



826RW020

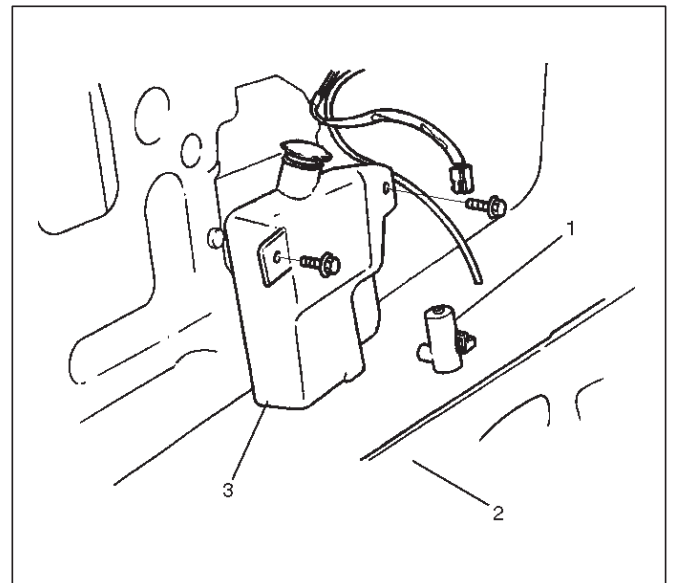
Installation

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

Rear Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad(2).
3. Remove two screws, disconnect the connector, remove the washer hose and then remove the rear washer tank(3).
4. Pull out the rear washer motor(1) from the washer tank.



885RS009

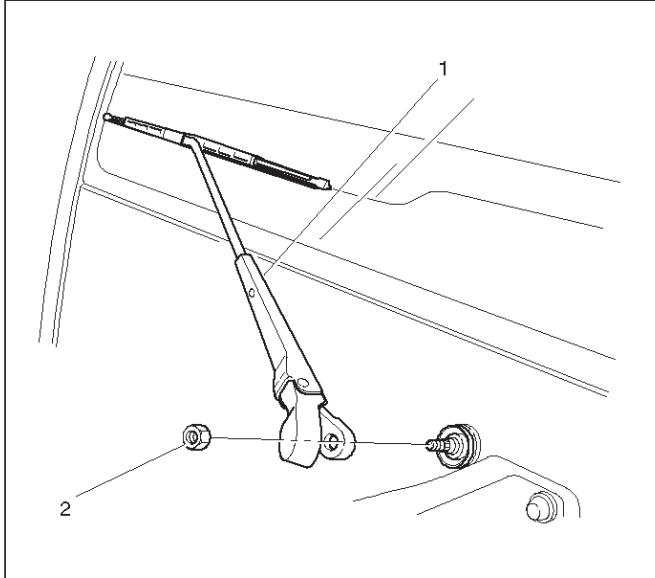
Installation

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

Rear Wiper Arm/Blade

Removal

1. Remove the arm nut(2).
2. Remove the wiper arm/blade(1).



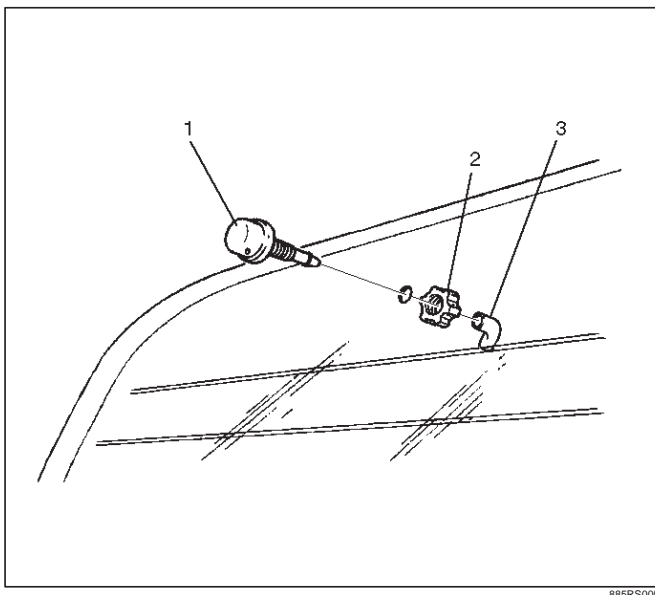
Installation

Refer to the installation steps of the Rear Wiper Motor in Wiper/Washer System section.

Rear Washer Nozzle

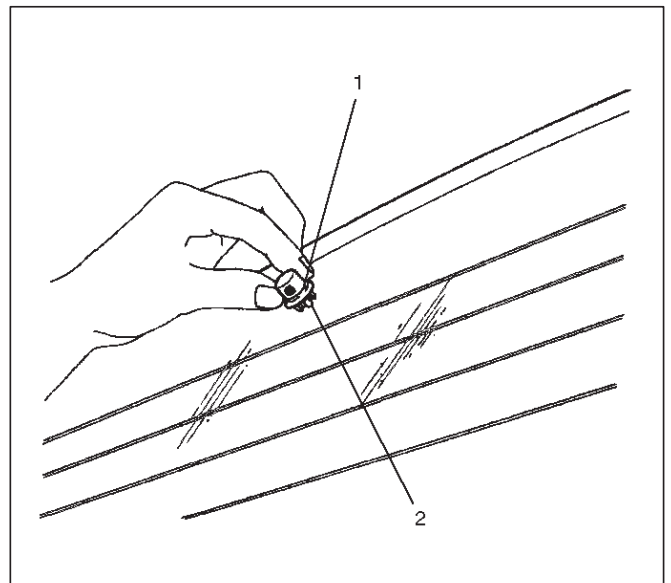
Removal

1. Disconnect the hose(3).
2. Remove the lock nut(2), and then remove the washer nozzle(1).



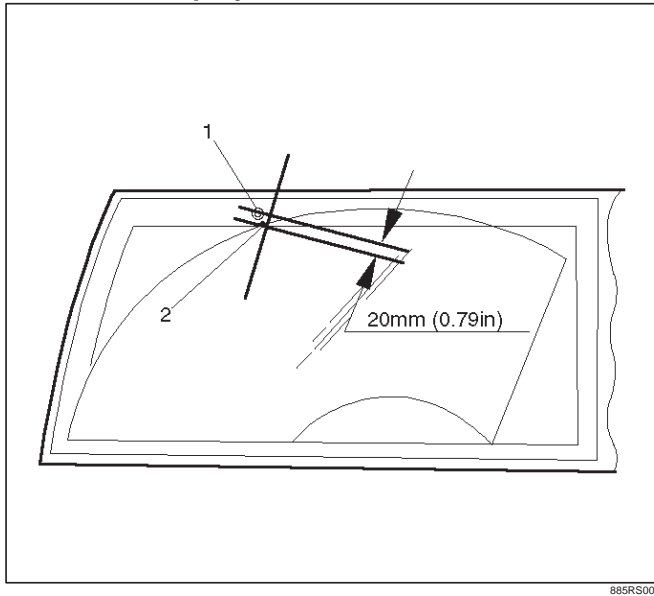
Rear Washer Nozzle Angle Adjustment

Loosen the lock nut(2) of the washer nozzle(1) to adjust the injection angle of the cleaning fluid, and then retighten the lock nut(2).



Installation

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

Rear Washer Spray Pattern**Legend**

- (1) Washer Nozzle
- (2) Spray Target

Rear Wiper Blade Rubber**Removal and Installation**

Refer to the Windshield Wiper Blade Rubber in this section.

Headlight Wiper/Washer**General Description**

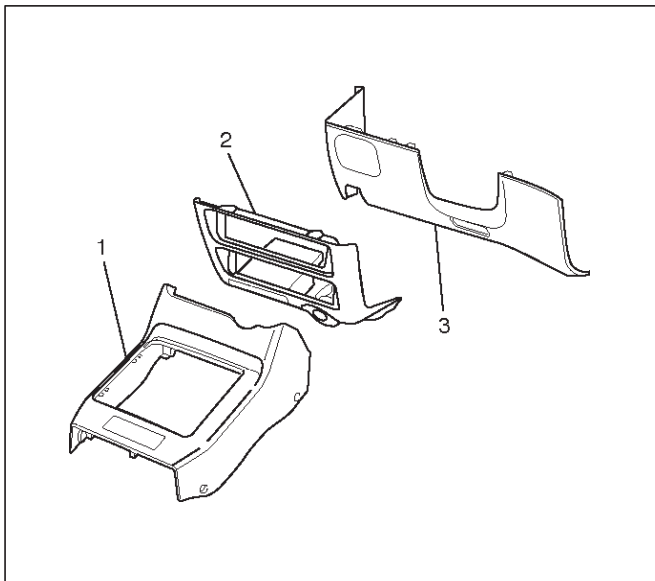
The circuit consists of the starter switch, headlight wiper/washer switch, headlight wiper motor and washer motor. By pushing the headlight wiper/washer switch with the starter switch on, the wiper will make 5 strokes with washer solution applied between each of the first 4 strokes, regardless of the length of time the switch is held down.

The washer nozzle is installed to the wiper blade, and the tank to which the washer motor is installed shared among the headlight washer and the windshield washer.

Headlight Wiper and Washer Switch

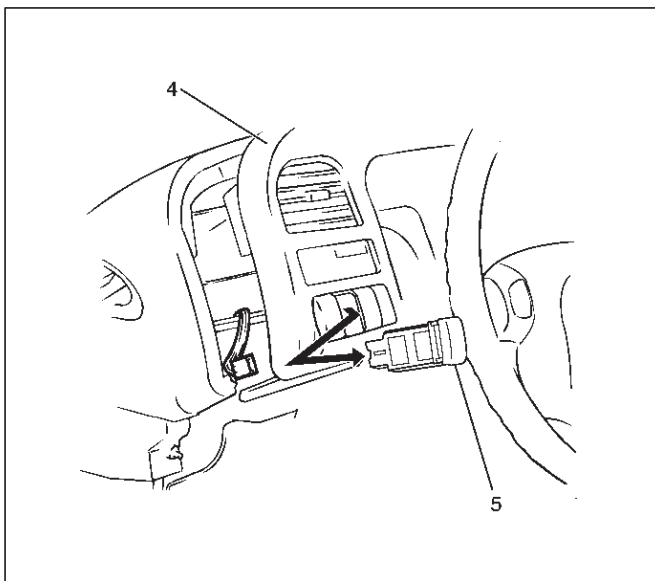
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the headlight wiper switch(5).



825RW245

Installation

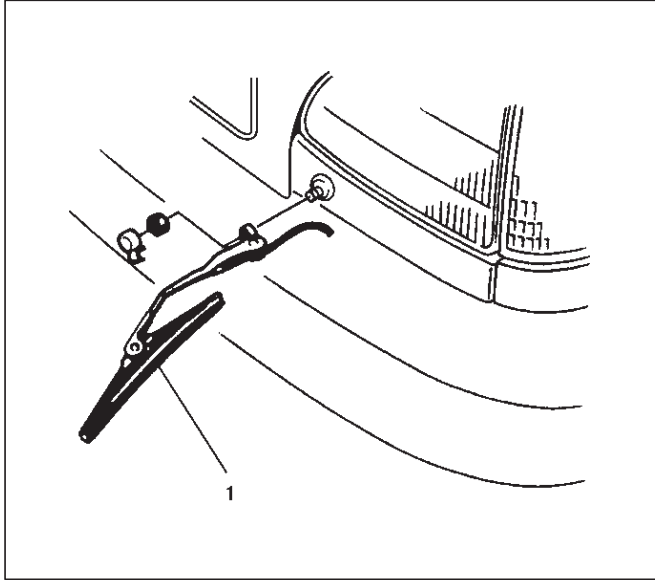
To install, follow the removal steps in the reverse order, noting the following point:

1. Push the switch with your fingers until it locks securely.

Headlight Wiper Arm & Blade

Removal

1. Remove the wiper arm nut and the wiper arm & blade(1).
2. Disconnect the washer hose.



808RW001

Installation

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

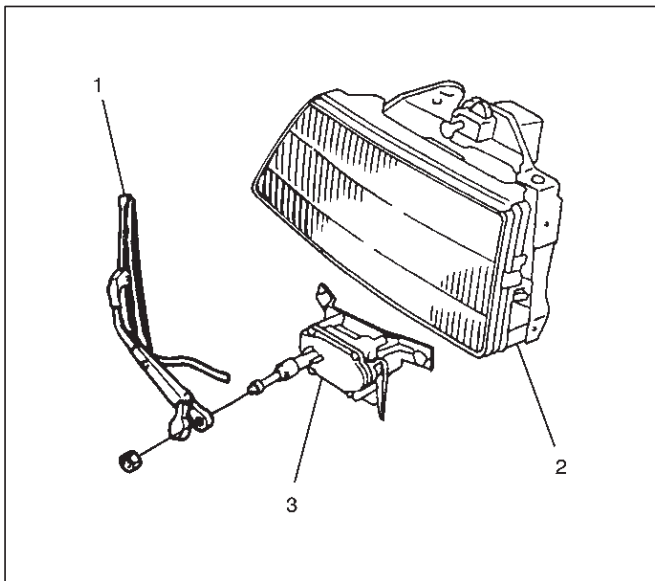
1. Tighten the wiper arm nut to the specified torque.

Torque: 5 N·m (0.5 kg·m/44 lb ft)

Headlight Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the headlight wiper arm/blade(1).
3. Remove the headlight assembly(2).
Refer to the Headlight removal steps in this section.
4. Remove 2 nuts and screws, the remove headlight wiper motor(3).



808RW002

Installation

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

1. Make sure that the motor stops at auto stop position prior to installing the wiper arm & blade to the motor shaft.

Headlight Washer Motor

Removal and Installation

Refer to the removal and installation steps of the windshield washer tank/motor under »Windshield Wiper/Washer And Rear Wiper/Washer” in this section.

Main Data and Specifications

Torque Specifications

Application	N·m	kg·m	Lb Ft	Lb In
Windshield Wiper Motor Shaft Nut	14	1.4	—	122
Windshield Wiper Arm Nuts	31	3.2	23	—
Rear Wiper Motor Shaft Nut	6	0.6	—	52
Rear Wiper Arm Nut	9	0.9	—	78
Headlight Wiper Arm Nuts	5	0.5	—	44

BODY AND ACCESSORIES

ENTERTAINMENT

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Cigarette Lighter	8C-2	Antenna Rod	8C-6
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Service Precaution

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

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

Cigarette Lighter

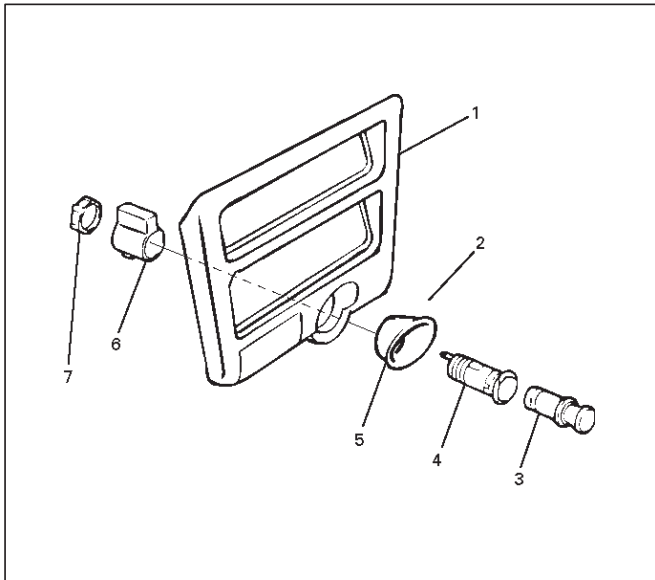
General Description

When the cigarette lighter is pushed in with the starter switch at either "ACC" or "ON" position, a circuit is formed in the cigarette lighter case to heat the lighter coil.

The cigarette lighter is sprung back to its original position after the lighter coil is heated.

Removal

1. Disconnect the battery ground cable.
2. Remove the lower cluster assembly(1).
Refer to the Instrument Panel Assembly removal steps in Body Structure section.
3. Disconnect the connectors, remove the socket of the illumination light, the retaining ring(7), the outer case(6), the cigarette lighter(3) and socket(4), the bezel(5) and then remove the cigarette lighter assembly(2).



826RS007

Installation

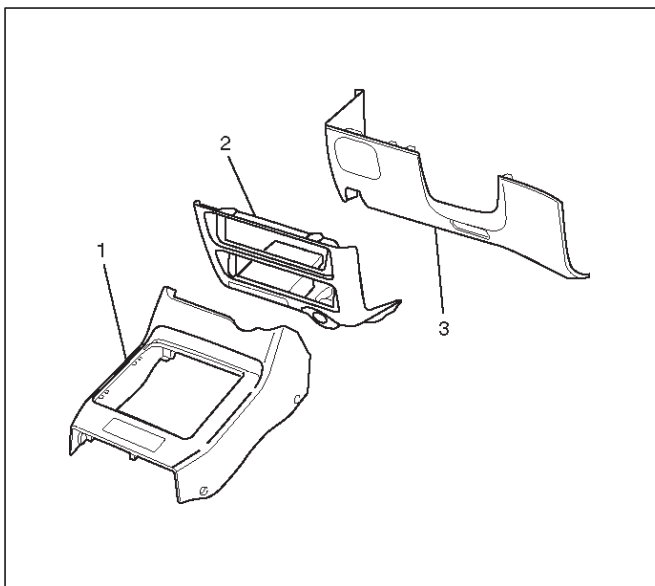
To install, follow the removal steps in the reverse order, noting the following point.

1. When installing the bezel, align the projected portion of the socket with the notch of the bezel.

Digital Clock

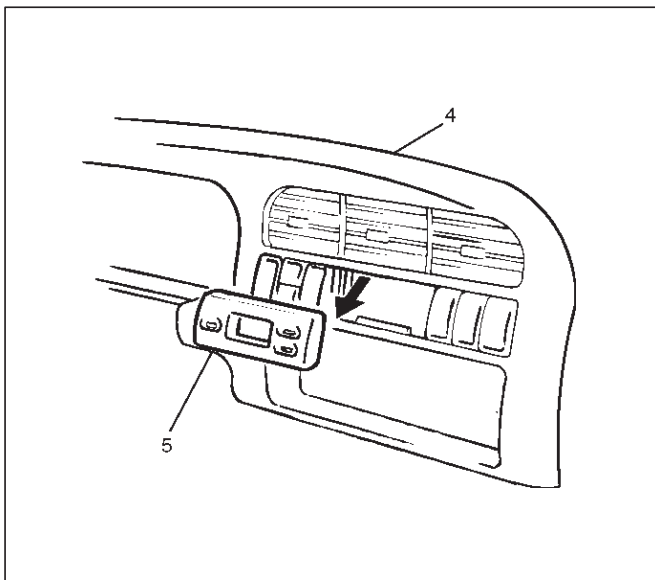
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the digital clock(5).



821RW034

Installation

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

1. Push in the switch with your fingers until it locks securely.

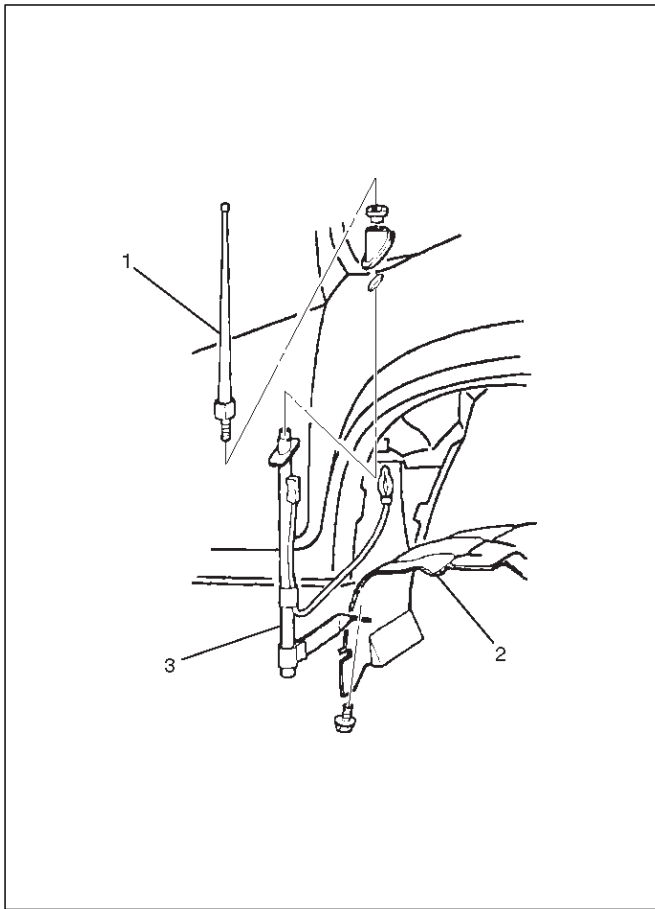
Rod Type Antenna

Removal

1. Disconnect the battery ground cable.
2. Turn the antenna rod(1) counterclockwise to remove it.
3. Remove three screws and nine clips to remove the fender inner liner(2).
4. Disconnect the feeder cable connector at the inside of the vehicle, remove the housing bracket screw, turn the lock nut counterclockwise to remove it together with the base mold and then remove the housing(3).

Installation

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



89ORS004

Auto Antenna

General Description

The auto antenna is interlocked with the radio switch. The antenna rod goes up when the switch is on, and goes down when the switch is off. The antenna rod also goes down when the starter switch is turned off with the radio on.

The antenna rod goes up or down when the cable connected to the uppermost rod is let out or taken up by the rotation of motor.

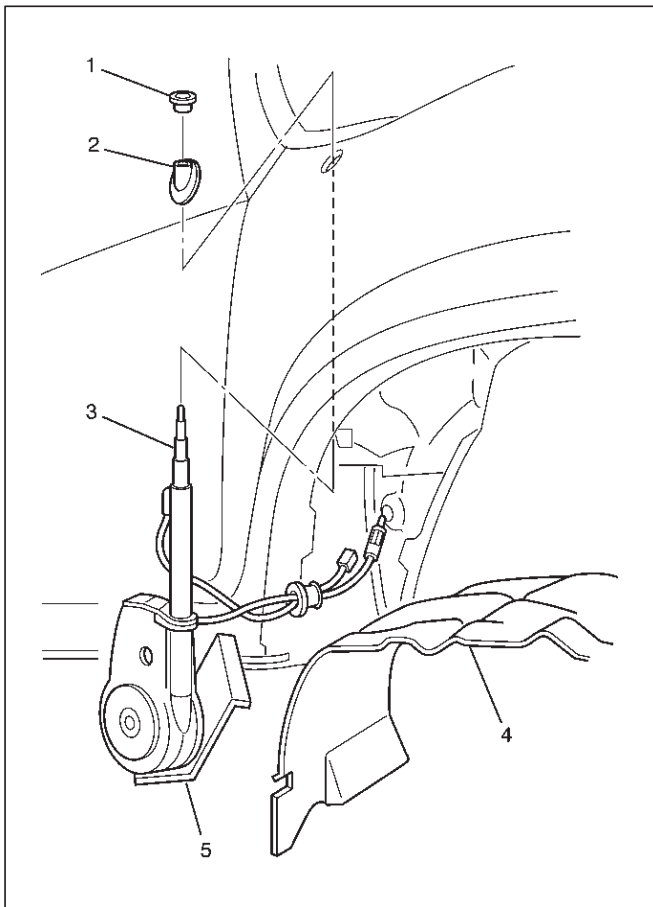
The motor is provided with a built-in limit switch. When the up/down motion of the antenna is completed, the limit switch is activated to cut off the circuit.

Installation

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

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and nine clips to remove the fender inner liner(4).
3. Disconnect the feeder cord and the antenna motor connector at the inside of the vehicle.
4. Remove the lock nut(1) and base mold(2).
5. After taking off the clips and screws, remove the motor bracket(5).



890RW075

Antenna Rod

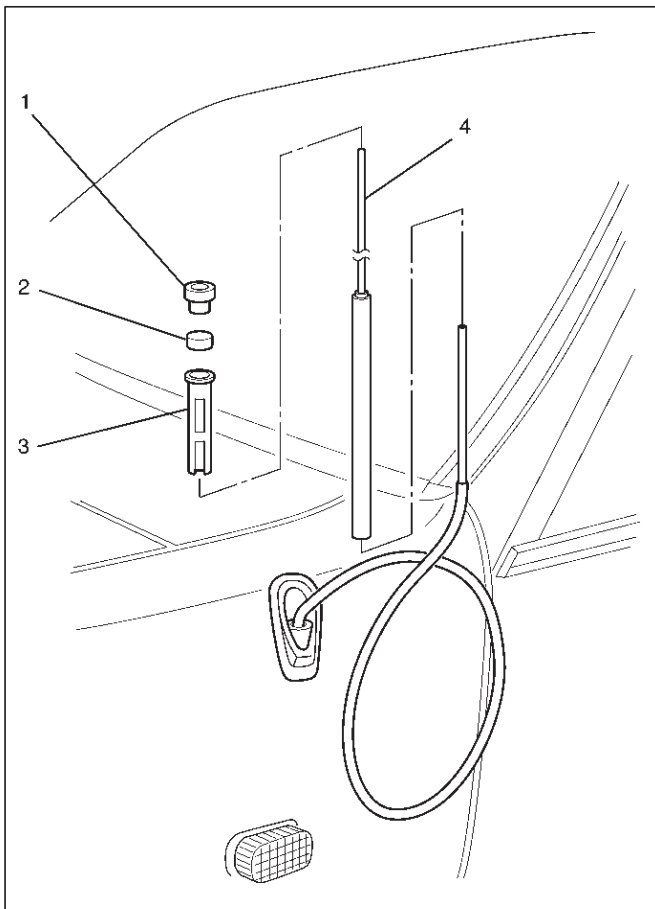
Removal

1. Disconnect the battery ground cable.
2. Remove the antenna nut(1).
3. Until the lower part of the antenna rod(4) is removed from the bezel part, rotate the antenna motor in an ascending way, and expand the rod.
4. Turn the antenna top(2) counterclockwise.
5. Remove the contact sleeve(3).
6. Remove the antenna rod(4).

Installation

To install, follow the removal steps in the reverse order, nothing the following points.

1. Rotate the antenna motor in a descend way, and push in vertically until the antenna rod is in the complete state of storage.
2. After ending the installation, confirm that the antenna rod works correctly.

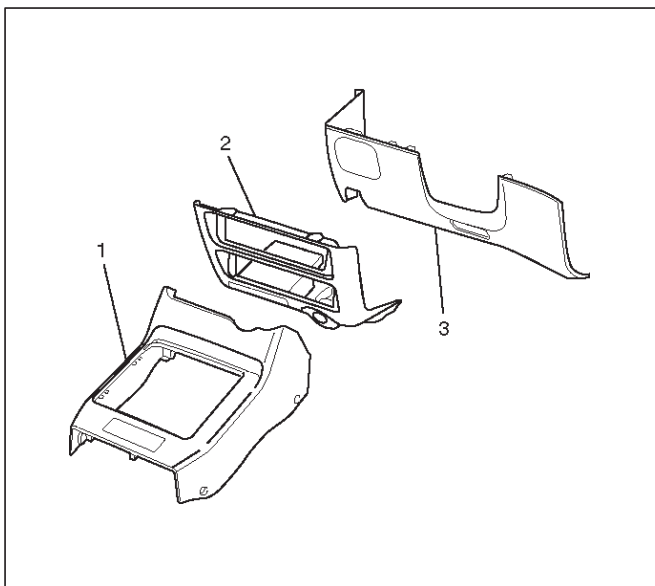


890RW076

Radio

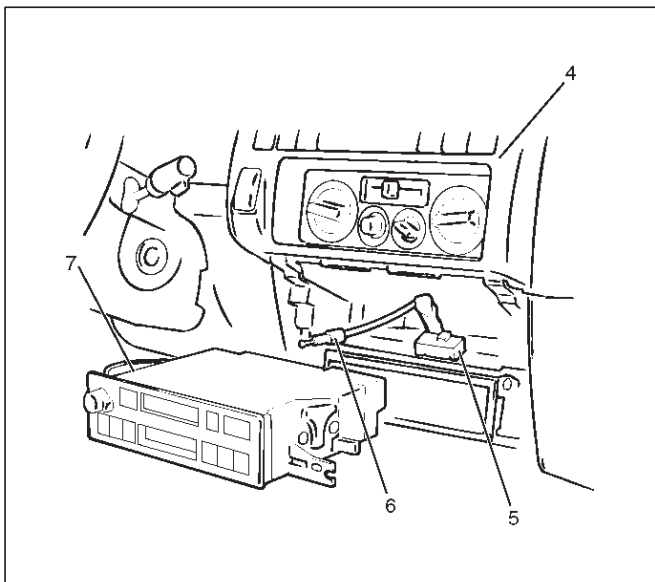
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly (4).
Refer to the Instrument Panel Assembly in Body Structure section.
6. Remove two screws and disconnect the radio connector (5) and antenna feeder plug (6) to remove the radio (7).



825RW039

Installation

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

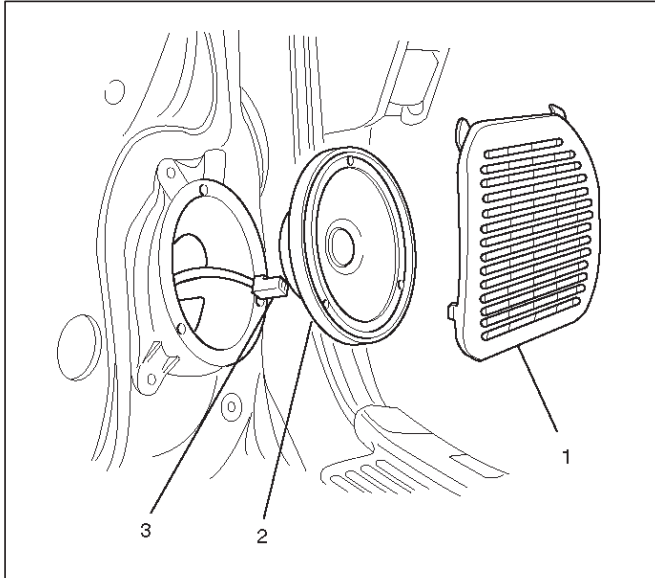
Front Speaker

Removal

1. Disconnect the battery ground cable.
2. Pull the grille(1) to release the locks and then remove it.
3. Remove four screws and disconnect the connector(3) to remove the speaker(2).

Installation

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

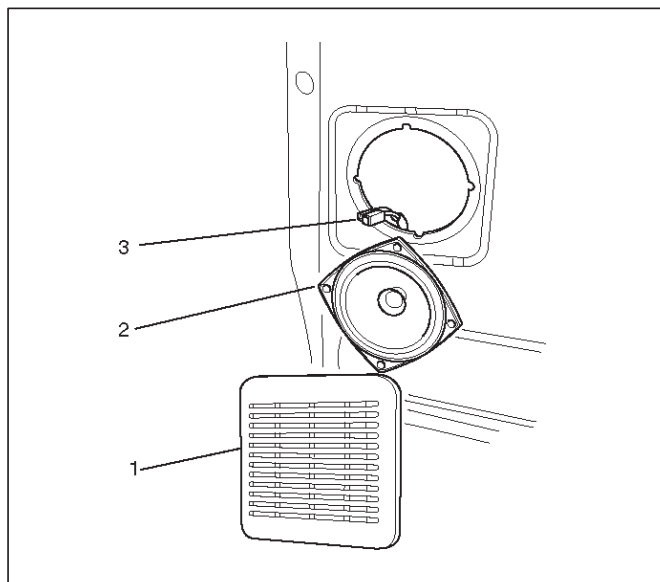


890RW013

Rear Speaker

Removal

1. Disconnect the battery ground cable.
2. Pull the grille(1) to release the locks and then remove it.
3. Remove four screws and disconnect the connector(3) to remove the speaker(2).



890RW015

Installation

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

MEMO

BODY AND ACCESSORIES

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Service Precaution

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

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General Description

The chassis electrical system is a 12-volt system with a negative ground polarity.

Wire size are appropriate to respective circuits, and classified by color. (The classification of harnesses by color is shown on the circuit diagram for ease of harness identification.)

The wire size is determined by load capacity and the length of wire required.

The vehicle harnesses are: body harness, chassis harness, engine room harness, instrument harness, transmission harness, engine ECGI harness, dome light harness, door harness, rear body harness, tailgate harness, SRS harness and battery cables.

The harnesses are protected either by tape or corrugated tube, depending on harness location.

The circuit for each system consists of the power source, wire, fuse, relay, switch, load parts and ground, all of which are shown on the circuit diagram.

In this section, each electrical device is classified by system.

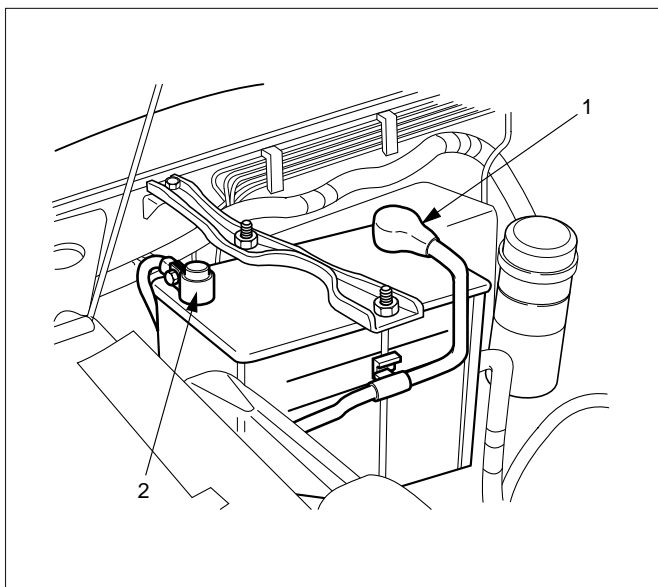
For major parts shown on the circuit based on the circuit diagram for each system, a summary, diagnosis of troubles and inspection procedures are detailed.

Notes for Working on Electrical Items

Disconnecting the Battery Cable

1. All switches should be in the "OFF" position.
2. Disconnect the battery ground cable (2).
3. Disconnect the battery positive cable (1).

CAUTION: It is important that the battery ground cable be disconnected first. Disconnecting the battery positive cable first can result in a short circuit.



Connecting the Battery Cable

Follow the disconnecting procedure in the reverse order.

CAUTION: Clean the battery terminal and apply a light coat of grease to prevent terminal corrosion.

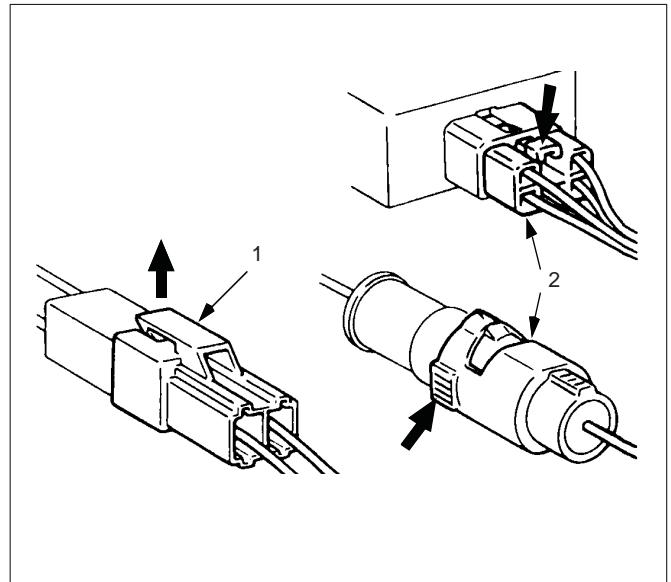
Disconnecting the Connector

Some connectors have a tang lock to hold the connectors together during vehicle operation.

Some tang locks are released by pulling them towards you (1).

Other tang locks are released by pressing them forward (2).

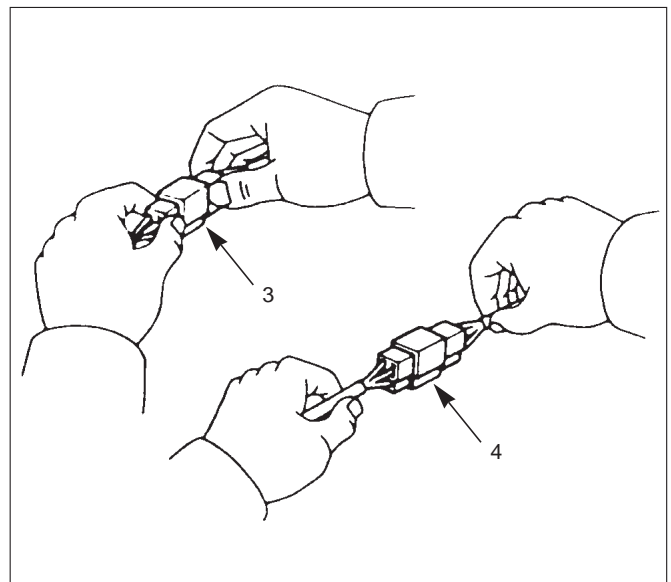
Determine which type of tang lock is on the connector being handled.



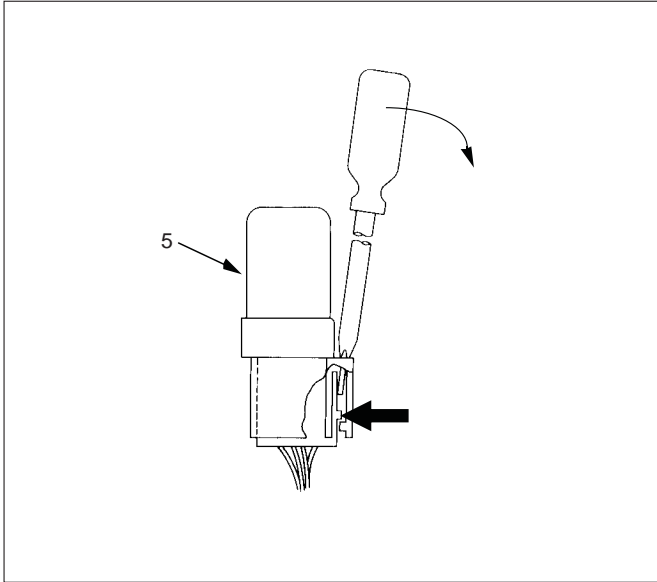
Firmly grasp both sides (male and female) of the connector (3).

Release the tang lock and carefully pull the two halves of the connector apart.

Never pull on the wires to separate the connectors (4).

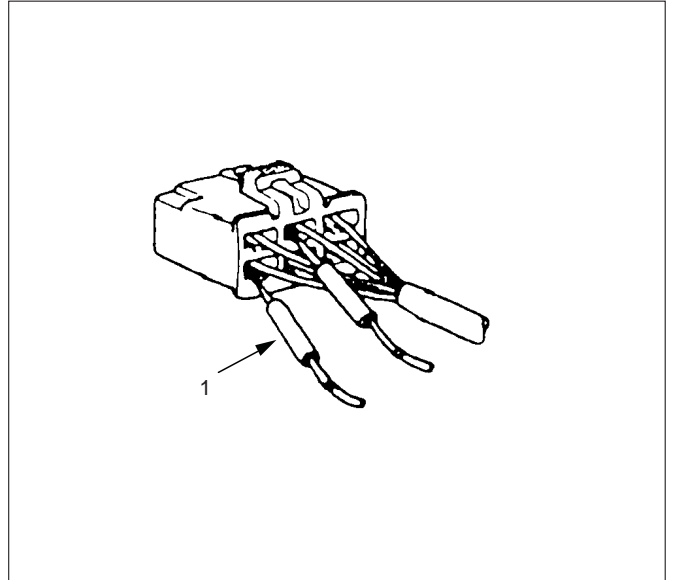


When removing the connector for relay (MR5B type) (5), unfasten the tang lock of the connector by using a screwdriver, then pull the relay out as shown in the figure.



Connector Inspection

Use a circuit tester to check the connector for continuity. Insert the test probes (1) from the connector wire side.

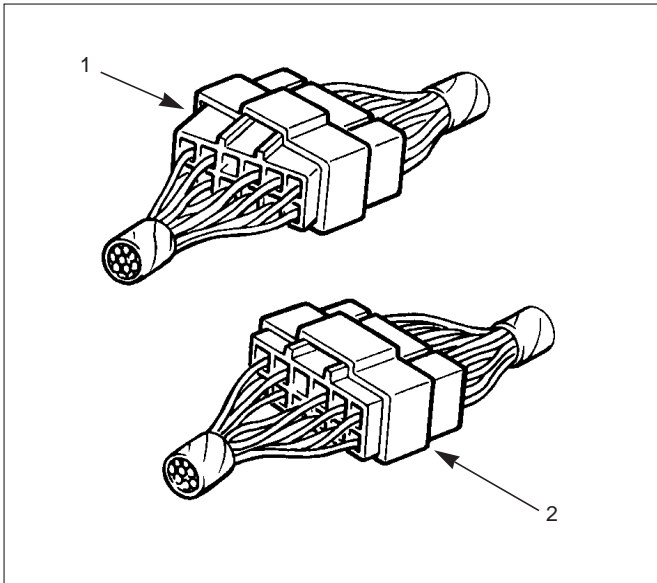


Connecting the Connector

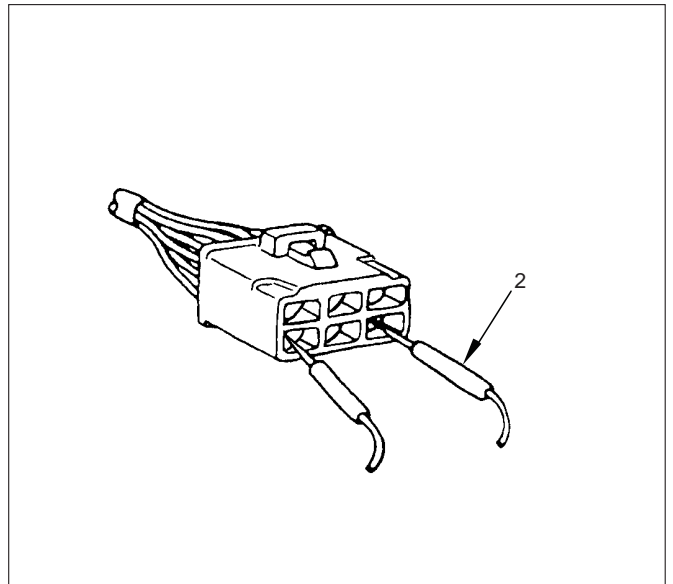
Firmly grasp both sides (male and female) of the connectors. Be sure that both sides of the connectors are aligned with each other.

Firmly but carefully push the two sides of the connectors together until a distinct click is heard (2).

Do not connect them by force if they can not be connected smoothly (1).

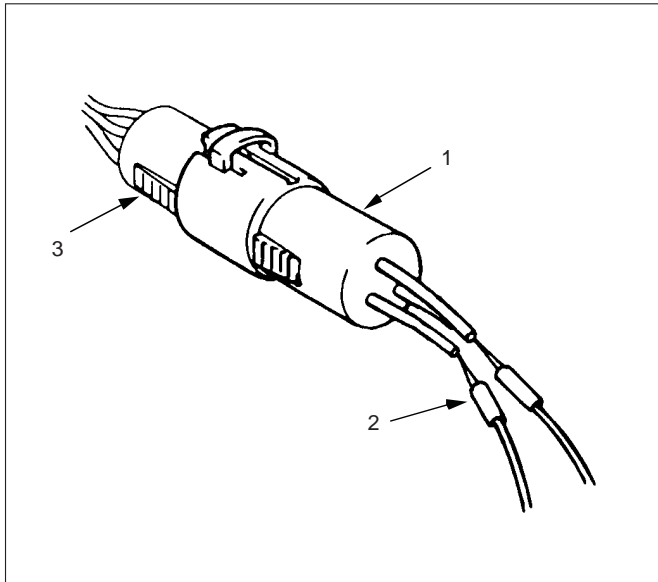


Never insert the circuit tester test probes (2) into the connector open end to test the continuity. Broken or open connector terminals will result.



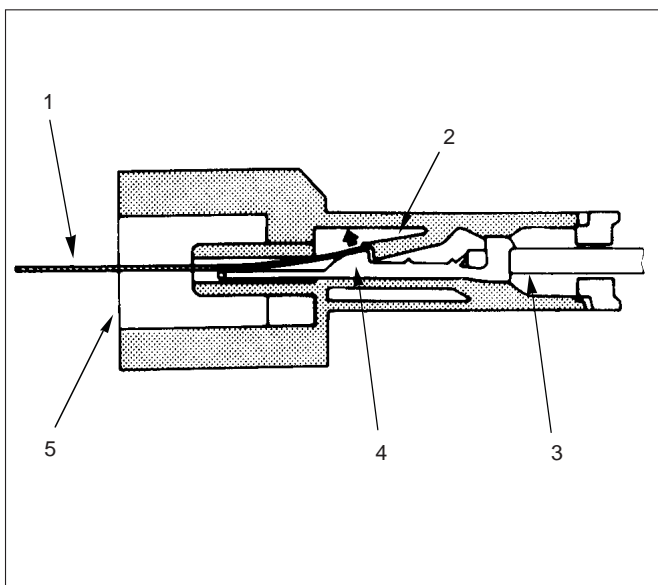
Waterproof Connector Inspection

It is not possible to insert the test probes (2) into the connector wire side of a waterproof connector. Use one side of a connector (1) with its wires cut to make the test. Connect the test connector to the connector to be tested (3). Connect the test probes to the cut wires to check the connector continuity.



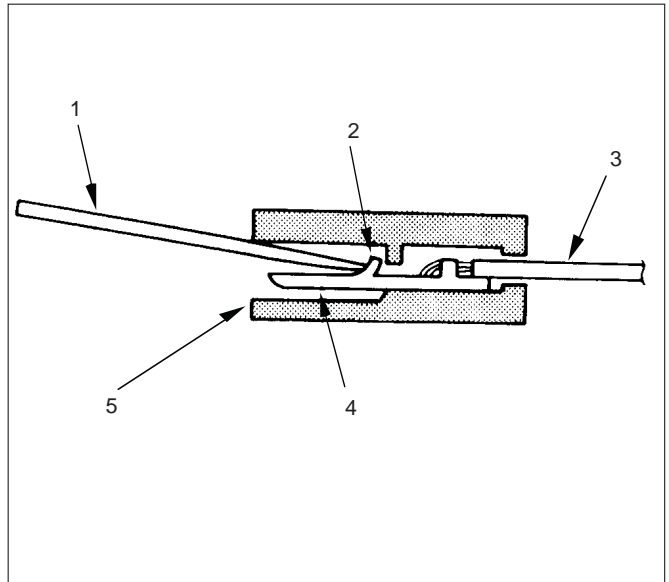
Connector Pin Removal – Connector Housing Tang Lock Type

1. Insert a slender shaft (1) into the connector housing open end (5).
 2. Push the tang lock (2) up (in the direction of the arrow in the illustration).
- Pull the wire (3) with pin (4) free from the wire side of the connector.



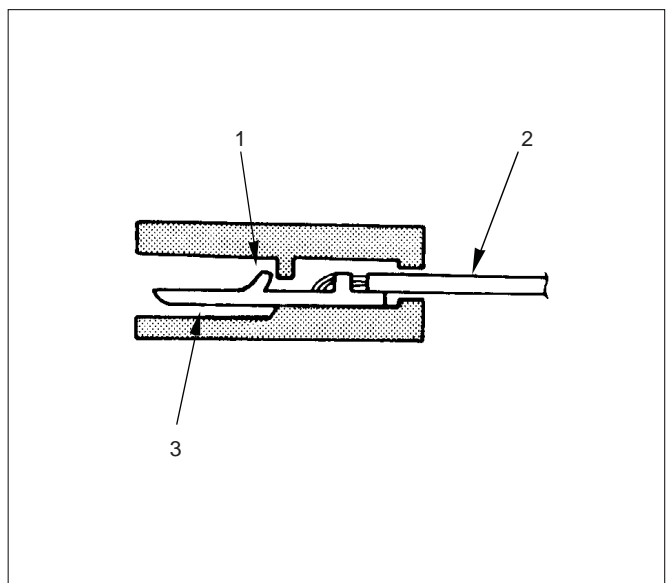
Connector Pin Removal – Pin Tang Lock Type

1. Insert a slender shaft (1) into the connector housing open end (5).
 2. Push the tang lock (2) flat (toward the wire (3) side of the connector).
- Pull the wire with pin (4) free from the wire side of the connector.



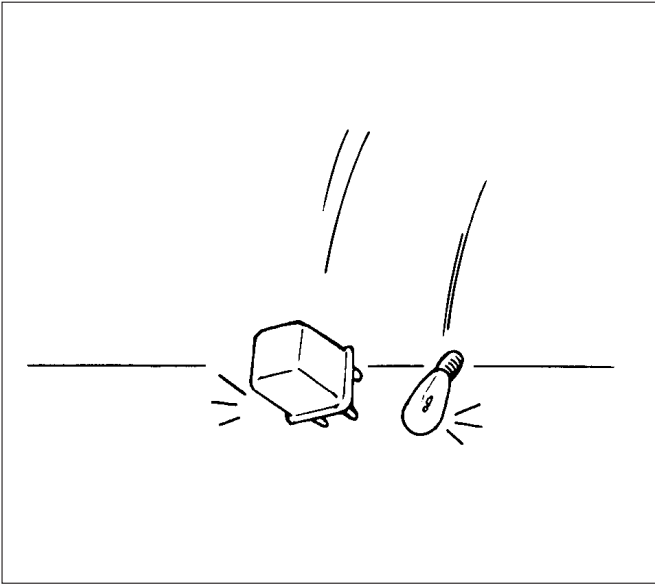
Connector Pin Insertion

1. Check that the tang lock (1) is fully up.
2. Insert the pin (3) from the connector wire (2) side. Push the pin in until the tang lock closes firmly.
3. Gently pull on the wires to make sure that the connector pin is firmly set in place.



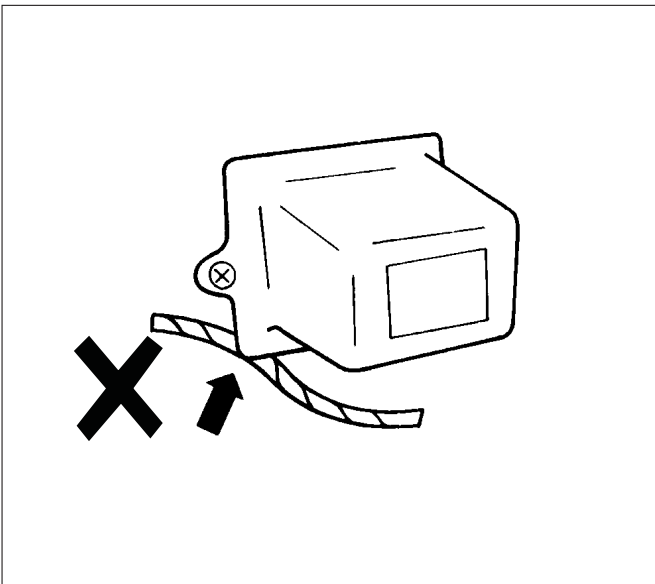
Parts Handling

Be careful when handling electrical parts. They should not be dropped or thrown, because short circuit or other damage may result.

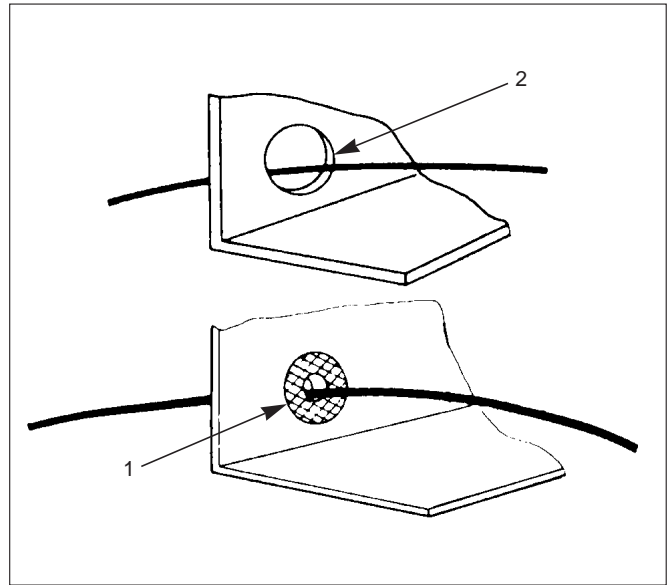


Cable Harness

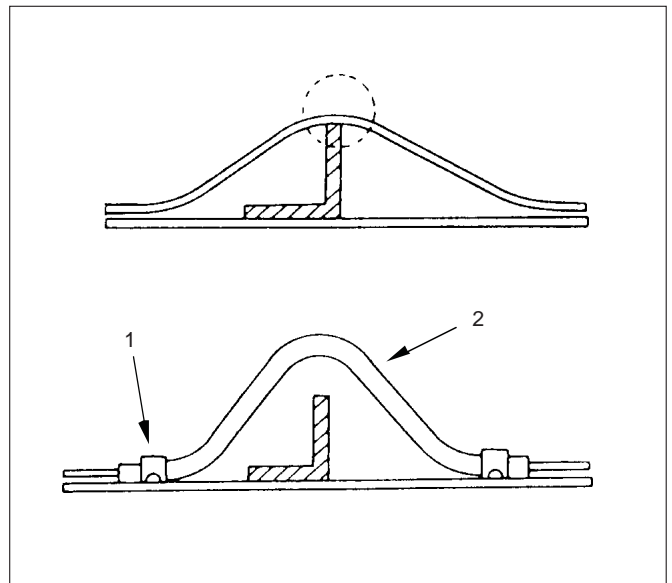
1. When installing the parts, be careful not to pinch or wedge the wiring harness.
2. All electrical connections must be kept clean and tight.



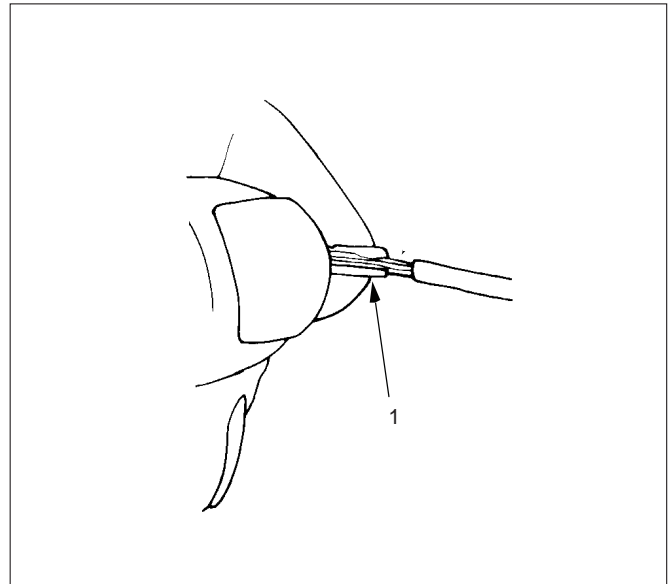
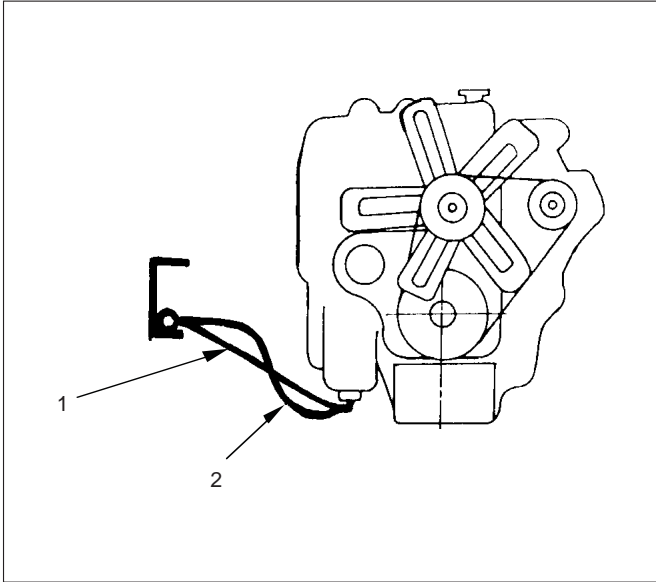
3. Use a grommet or guard tube (1) to protect the wiring harness from contacting a sharp edge or surface (2).



4. Position the wiring harness with enough clearance from the other parts and guard the wiring harness with a vinyl tube (2) and clips (1) to avoid direct contact.



5. The wiring harness between engine and chassis should be long enough (2). Tension of the wire (1) may causes chafing or damage due to various vibrations.



- Open the crimping tool to its full width and rest one handle on a firm flat surface.
- Center the back of the splice clip on the proper anvil and close the crimping tool to the point where the back of the splice clip touches the wings of the clip.
- Make sure that the clip and wires are still in the correct position. Then, apply steady pressure until the crimping tool closes as shown in the figure.

Splicing Wire

1. If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing “seam ripper” (available from sewing supply stores) to cut open the harness.

If the harness has a black plastic conduit, simply pull out the desired wire.

2. Begin by cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire off to change the location of a splice. You may have to adjust splice locations to make certain that each splice is at least 1-1/2” (40 mm) away from other splices, harness branches, or connectors.

3. When replacing a wire, use a wire of the same size as the original wire.

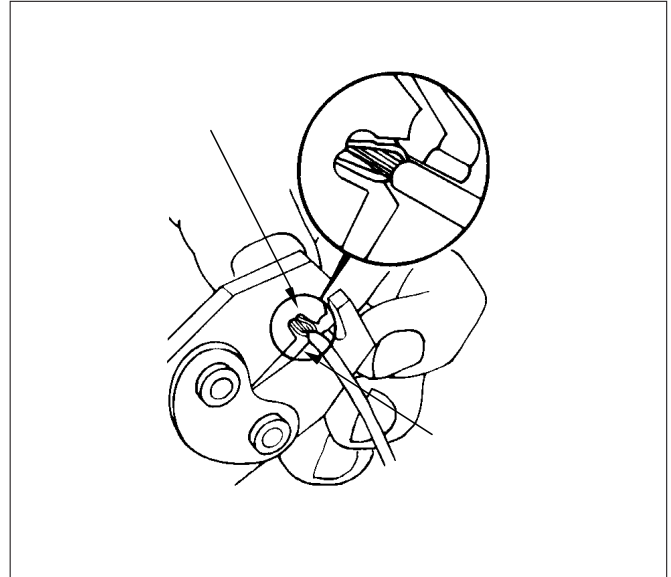
Check the stripped wire for nicks or cut stands. If the wire is damaged, repeat the procedure on a new section of wire. The two stripped wire ends should be equal in length.

4. Select the proper clip to secure the splice.

To determine the proper clip size for the wire being spliced, follow the directions included with your clips. Select the correct anvil on the crimper. (On most crimpers your choice is limited to either a small or large anvil.)

Overlap the two stripped wire ends and hold them between your thumb and forefinger as shown in the figure.

The center the spline clip (1) under the stripped wires and hold it in place.

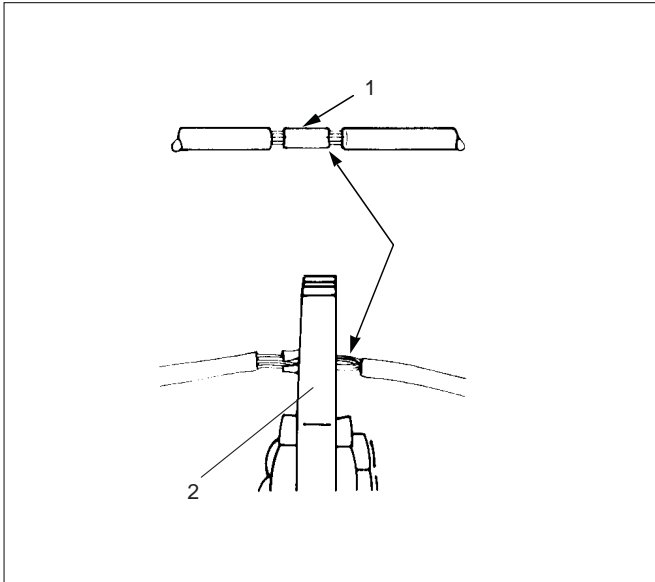


Before crimping the ends of the clip (1), be sure that:

- The wires extend beyond the clip in each direction.
- No strands of wire are cut loose, and
- No insulation is caught under the clip.

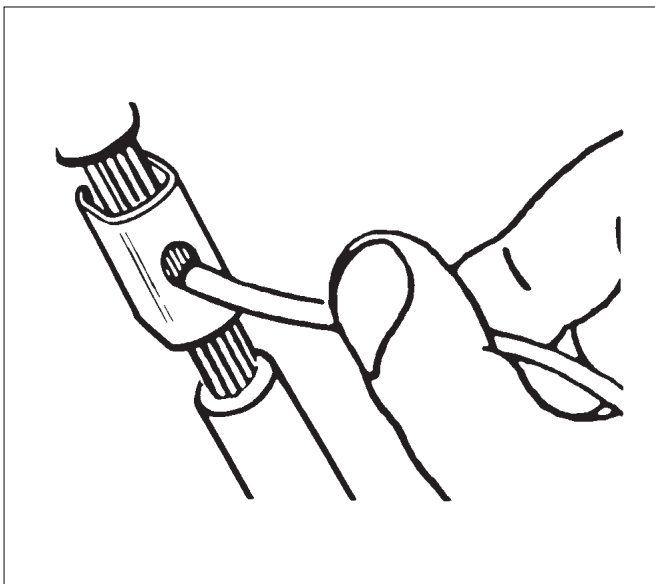
Crimp the splice again, once on each end.

Does not let the crimping tool (2) extend beyond the edge of the clip or you may damage or nick the wires as shown in the figure.



5. Apply 60/40 resin core solder to the opening in the back of the clip as shown in the figure.

Follow the manufacturer's instructions for the solder equipment you are using.

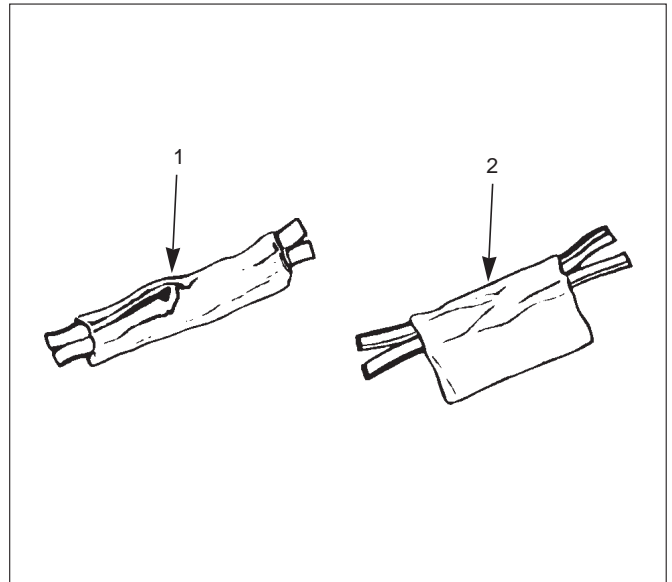


6. Center and roll the splicing tape.

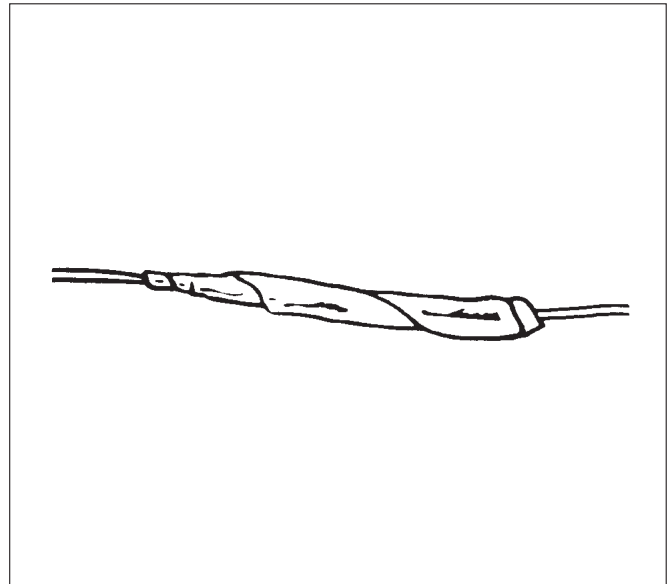
The tape should cover the entire splice.

Roll on enough tape (1) to duplicate the thickness of the insulation on the existing wires.

Does not flag the tape (2). Flagged tape may not provide enough insulation, and the flagged ends will tangle with the other wires in the harness as shown in the figure.







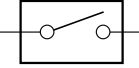

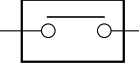
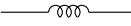
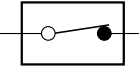
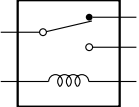

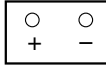
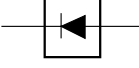
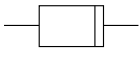

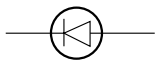




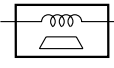
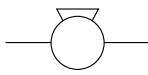
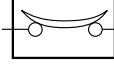
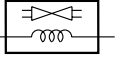


If the wire does not belong in a conduit or other harness covering, tape the wire again. Use a winding motion to cover the first piece of tape as shown in the figure.



Symbols and Abbreviations

Symbols

Symbol	Meaning of Symbol	Symbol	Meaning of Symbol
	Fuse		Bulb
	Fusible link		Double filament bulb
	Fusible link wire		Motor
	Switch		Variable register Rheostat
	Switch		Coil (inductor), solenoid, magnetic valve
	Switch (Normal close type)		Relay
	Contact wiring		
	Battery		
	Diode		Connector
	Electronic parts		Light emitting diode
	Resistor		Reed switch
	Speaker		Condenser
	Buzzer		Horn
	Circuit breaker		Vacuum switching valve

Abbreviations

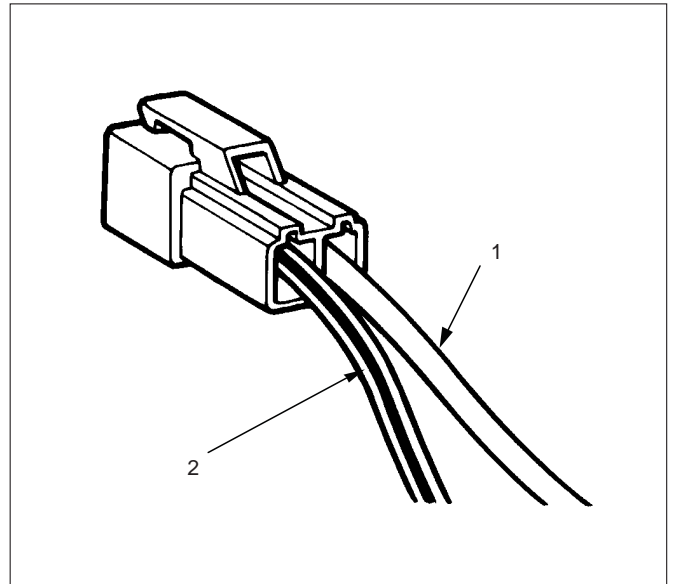
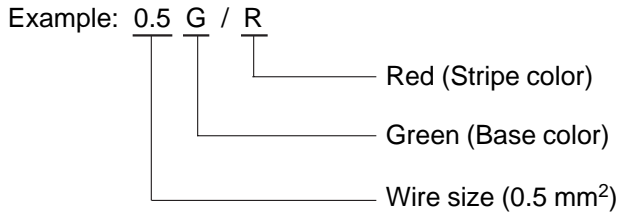
Abbreviation	Meaning of Abbreviation	Abbreviation	Meaning of Abbreviation
A	Ampere (S)	kW	Kilowatt
ABS	Anti-lock brake system	LH	Left hand
ASM	Assembly	LWB	Long wheel base
AC	Alternating current	M/T	Manual transmission
A/C	Air conditioner	OD	Over drive
ACC	Accessories	OPT	Option
A/T	Automatic transmission	PCM	Powertrain control module
C/B	Circuit breaker	QOS	Quick on start
CSD	Cold start device	RH	Right hand
DIS	Direct ignition system	RR	Rear
EBCM	Electronic brake control module	SDM	Sensing and diagnostic module
ECGI	Electronic control gasoline injection	SRS	Supplemental restraint system
ECM	Engine control module	ST	Start
ECU	Electronic control unit	STD	Standard
EFE	Early fuel evaporation	SW	Switch
EGR	Exhaust gas recirculation	SWB	Short wheel base
4A/T	4-speed automatic transmission	3A/T	3-speed automatic transmission
4WD	Four-wheel drive	V	Volt
FL	Fusible link	VSV	Vacuum switching valve
FRT	Front	W	Watt (S)
H/L	Headlight	WOT	Wide open throttle
IC	Integrated circuit	W/	With
IG	Ignition	W/O	Without

Parts for Electrical Circuit

Wiring – Wire color

All wires have color-coded insulation.

Wires belonging to a system's main harness will have a single color (1). Wires belonging to a system's subcircuits will have a colored stripe (2). Striped wires use the following code to show wire size and colors.



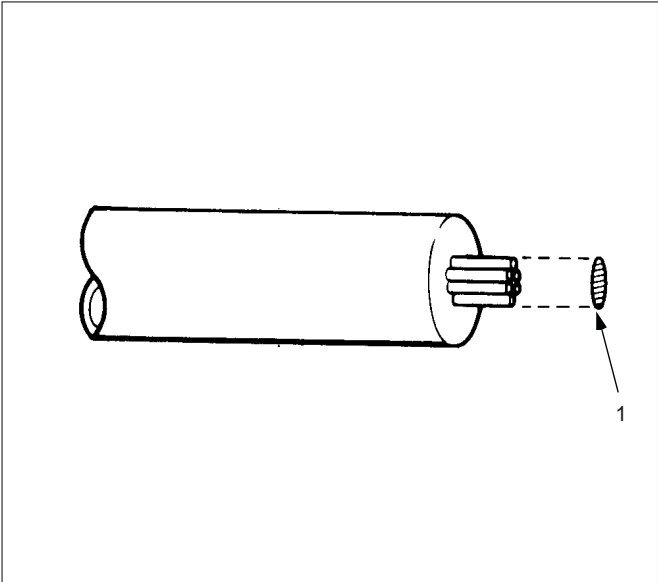
Wiring – Wire Color Coding

Abbreviations are used to indicate wire color within a circuit diagram. Refer to the following table.

Color Coding	Meaning	Color Coding	Meaning
B	Black	BR	Brown
W	White	LG	Light green
R	Red	GR	Grey
G	Green	P	Pink
Y	Yellow	LB	Light blue
L	Blue	V	Violet
O	Orange		

Wiring – Wire Size

The size of wire used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, shown below, are specified by AWG (American Wire Gauge). (Nominal size means approximate cross sectional area (1).)



Wiring – Wire Size Table

Nominal size	Cross sectional area (mm ²)	Outside diameter (mm)	Allowable current (A)
0.3	0.372	1.5	9
0.5	0.563	1.7	12
0.85	0.885	1.9	16
1.25	1.287	2.2	21
2	2.091	2.7	28
3	3.296	3.6	37.5
5	5.227	4.4	53
8	7.952	5.5	67
15	13.36	7.0	75
20	20.61	8.2	97

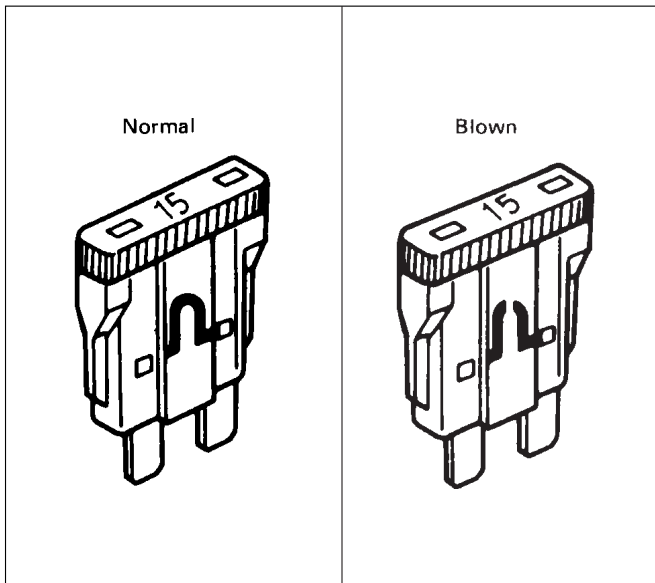
Fuse

Fuses are the most common form of circuit protection used in vehicle wiring. A fuse is a thin piece of wire or strip of metal encased in a glass or plastic housing. It is wired in series with the circuit it protects. When there is an overload of current in a circuit, such as a short to ground, the metal strip is designed to burn out and interrupt the flow of current. This prevents a surge of high current from reaching and damaging other components in the circuit. Determine the cause of the overloaded before replacing the fuse.

The replacement fuse must have the same amperage specification as the original fuse.

Never replace a blown fuse with a fuse of a different amperage specification.

Doing so can result in an electrical fire or other serious circuit damage. A blown fuse is easily identified as shown in the figure.

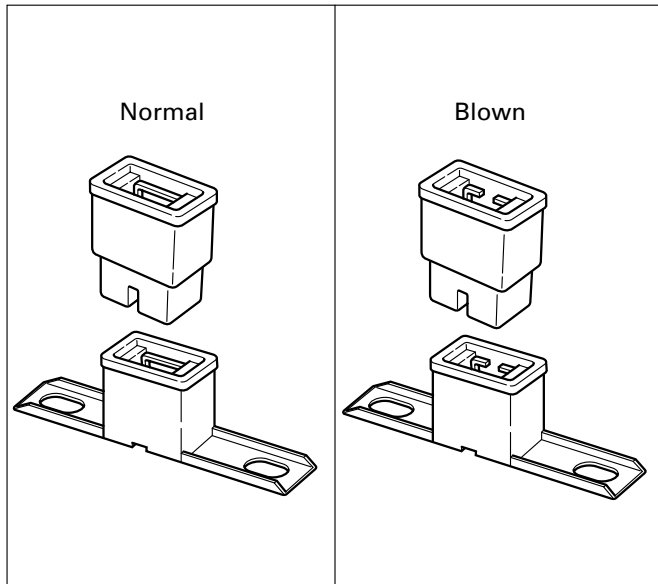


Fusible Link

The fusible link is primarily used to protect circuits where high amounts of current flow and where it would not be practical to use a fuse. For example, the starter circuit. When a current overload occurs, the fusible link melts open and interrupts the flow of current so as to prevent the rest of the wiring harness from burning.

Determine the cause of the overload before replacing the fusible link. The replacement fusible link must have the same amperage specification as the original fusible link. Never replace a blown fusible link with a fusible link of a different amperage specification. Doing so can result in an electrical fire or other serious circuit damage.

A blown fusible link is easily identified as shown in the figure.

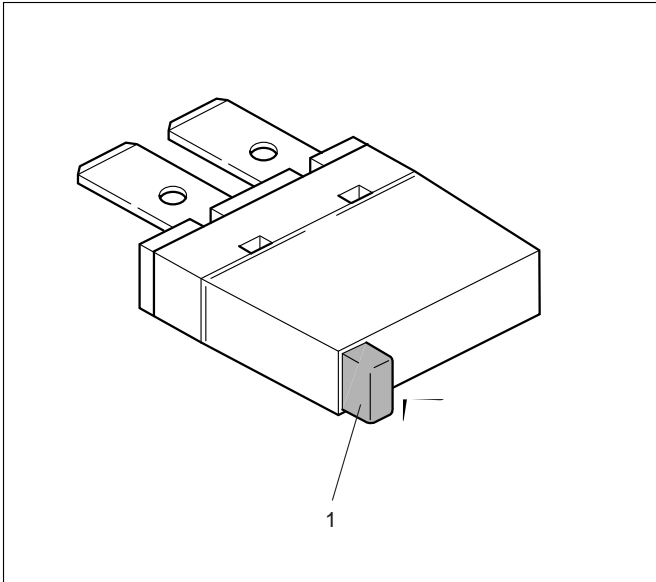


Fusible Link Specifications

Type	Rating	Case Color	Maximum Circuit Current (A)
Connector	30A	Pink	15
Connector	40A	Green	20
Bolted	50A	Red	25
Bolted	60A	Yellow	30
Bolted	80A	Black	40

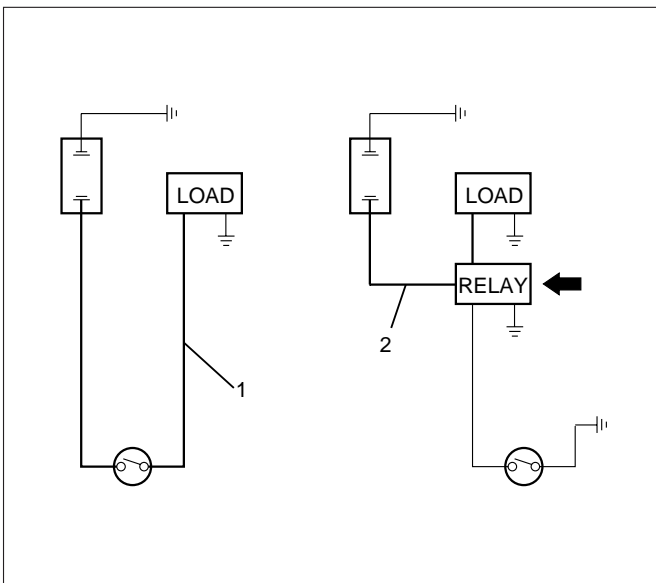
Circuit Breaker

The circuit breaker is a protective device designed to open the circuit when a current load is in excess of rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excessive current will open the circuit between the circuit breaker terminals. The reset knob (1) pops out when the circuit is open. Push the reset knob in place to restore the circuit after repairing it.



Relay

Battery and load location may require that a switch be placed some distance from either component. This means a longer wire and a higher voltage drop (1). The installation of a relay between the battery and the load reduces the voltage drop (2). Because the switch controls the relay, amperage through the switch can be reduced.

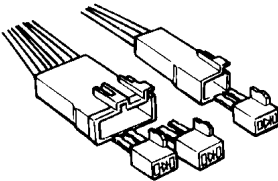

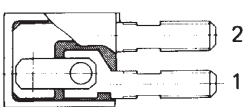
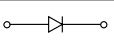
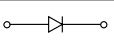
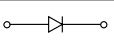
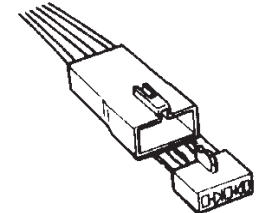
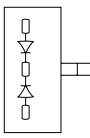
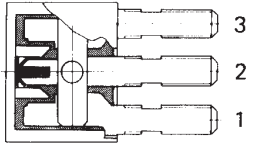
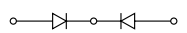
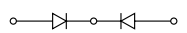
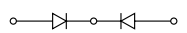
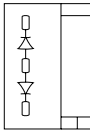
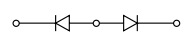
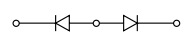
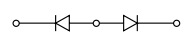
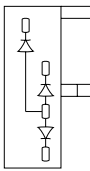
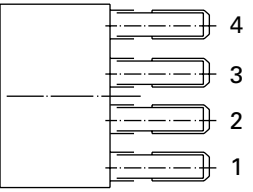





Relay Specifications and Configurations

Name/ Color	Rated voltage/Coil resistance	Internal circuit	Name/ Color	Rated voltage/Coil resistance	Internal circuit
1M (MR5L)/ Black	12V/ Approx. 80Ω Minimum operating voltage: 7V at 77°F (25°C)		2M (MR5)/ Brown	12V/ Approx. 80Ω Minimum operating voltage: 7V at 77°F (25°C)	
1B (MR5L)/ Grey	↑		1B-1M (MR5)/ Grey	↑	
1M (MR5)/ Black (Case), Blue (Base)	↑		1M	↑ Minimum operating voltage: 9V at 68°F (20°C)	
1T (MR5)/ Black/ Blue	↑		1M (MR5B)/ Black	12V Minimum operating voltage: 4.3V at 77°F (25°C)	
1M (Horn relay)	12V/ Minimum operating voltage: 8V at 68°F (20°C)				

* Relay contact shown in the wiring diagram indicates condition before actuation.

Diode – Diode Specifications and Configurations

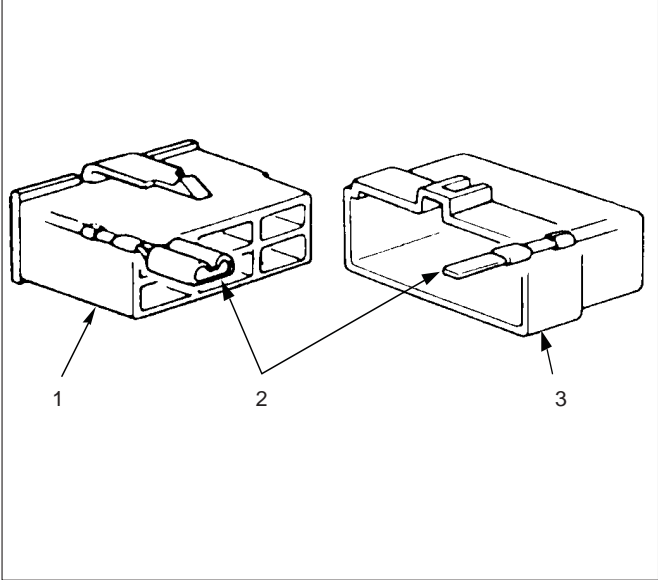
SHAPE	MARK/COLOR	CONSTRUCTION	CHECKING																									
	 BLACK		THERE SHOULD BE CONTINUITY IN EITHER A OR B WHEN A CIRCUIT TESTER IS CONNECTED WITH DIODE TERMINAL <table border="1"> <tr> <td>TERMINAL NO.</td> <td colspan="2"></td> </tr> <tr> <td></td> <td>2</td> <td>1</td> </tr> <tr> <td rowspan="2">CONNECTION PATTERN</td> <td>A</td> <td>⊕ ⊖</td> </tr> <tr> <td>B</td> <td>⊖ ⊕</td> </tr> </table>	TERMINAL NO.				2	1	CONNECTION PATTERN	A	⊕ ⊖	B	⊖ ⊕														
TERMINAL NO.																												
	2	1																										
CONNECTION PATTERN	A	⊕ ⊖																										
	B	⊖ ⊕																										
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TERMINAL NO.																												
	4	3	2	1																								
CONNECTION PATTERN	A		⊕ ⊖	⊖ ⊕																								
		⊖ ⊕	⊕ ⊖																									
	B		⊖ ⊕	⊕ ⊖																								
		⊕ ⊖	⊖ ⊕																									

Diode – Maximum Rating (Temp. = 77°F (25°C))

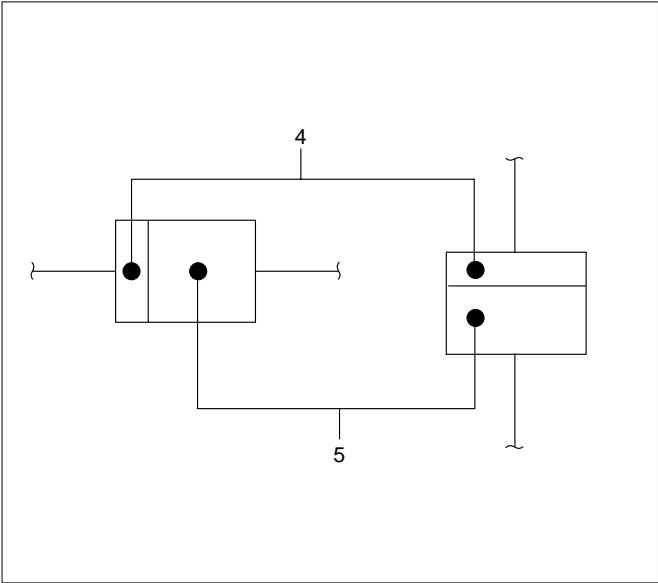
Items	Rating	Remarks
Peak reverse voltage	400V	
Transient peak reverse voltage	500V	
Average output current	1.5A	Temp. = 104°F (40°C)
Working ambient temperature	-22°F~176°F (-30°C~80°C)	
Storage temperature	-40°F~212°F (-40°C~100°C)	

Connector

The connector pin shape (2) determines whether the connector is male (3) or female (1).



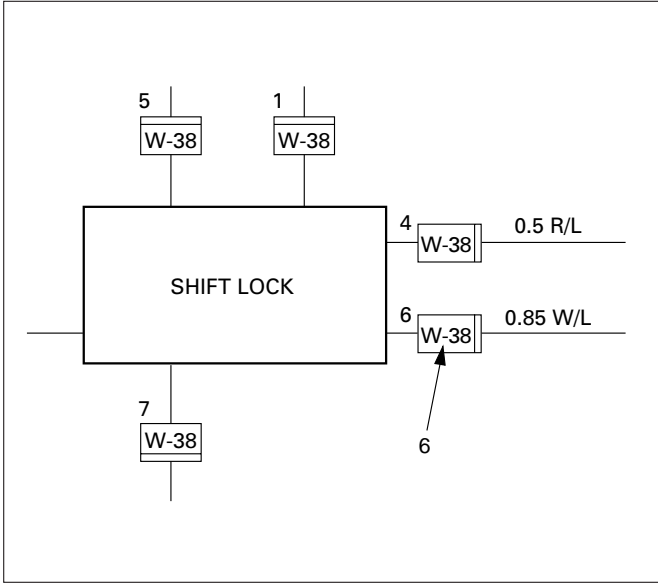
The symbol illustrated in the figure is used as connector, in the circuit of this section.



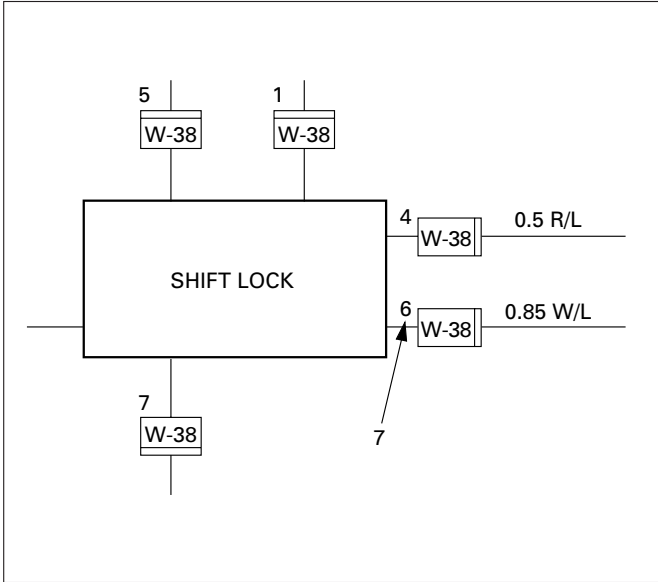
Legend

- (4) Female Side Connector
- (5) Male Side Connector

Connector is identified with a connector number (6)

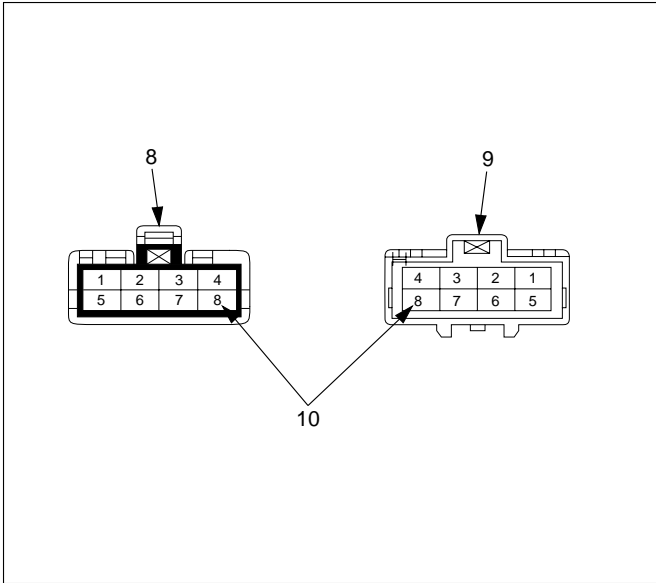


The applicable terminal number (7) is shown for each connector.



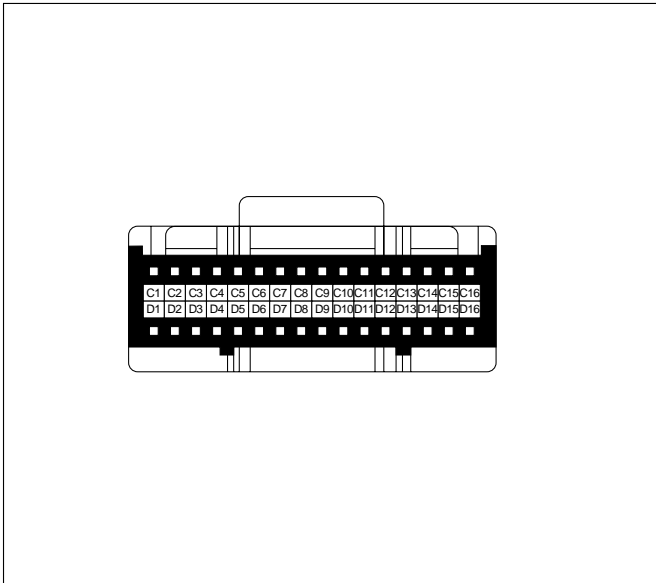
8D-20 WIRING SYSTEM

Connector terminal numbers (10) are clearly shown. Male side connector (9) terminal numbers are in sequence from upper right to lower left. Female side connector (8) terminal numbers are in sequence from upper left to lower right.

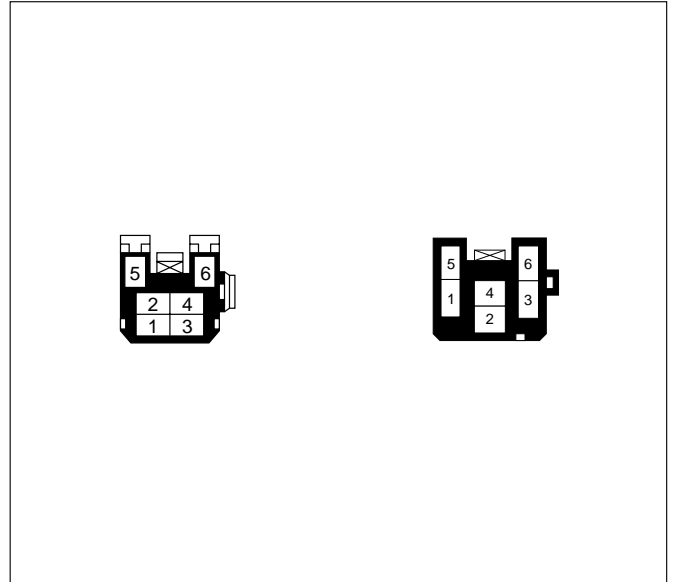


NOTE:

1. For those connectors on which specific terminal numbers or symbols are shown (such as PCM), the terminal numbers or symbols are used in the circuit diagram, irrespective of the above rule. Refer to the following figure.

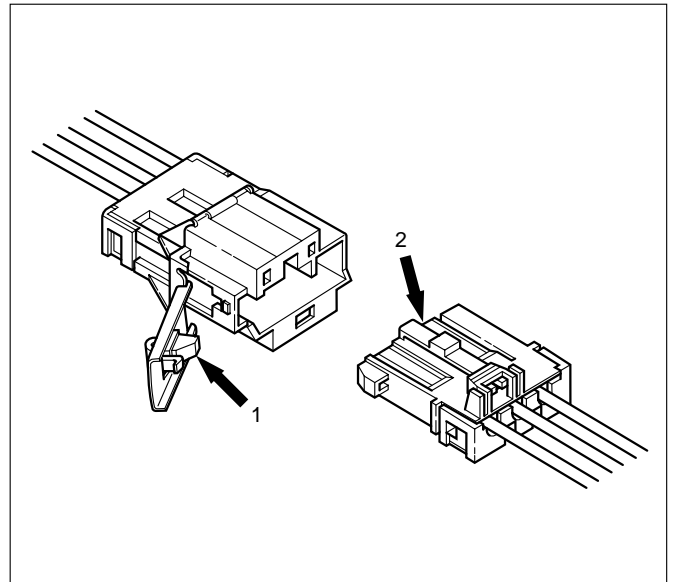


2. The connectors used for relays have their own terminal number assignment, irrespective of the above rule. Refer to the following figure.



Double Lock Type Connector

Double lock type yellow color connectors are used for supplemental restraint system–air bag circuit. When removing the cable harness, disconnect the connector by unlocking at two places, outside (1) and inside (2). In such a case, do not pull the cables. Otherwise, cable disconnection may occur. When connecting the connector, insert the connector completely and lock at outside. Imperfect locking may cause malfunction of SRS system circuit.

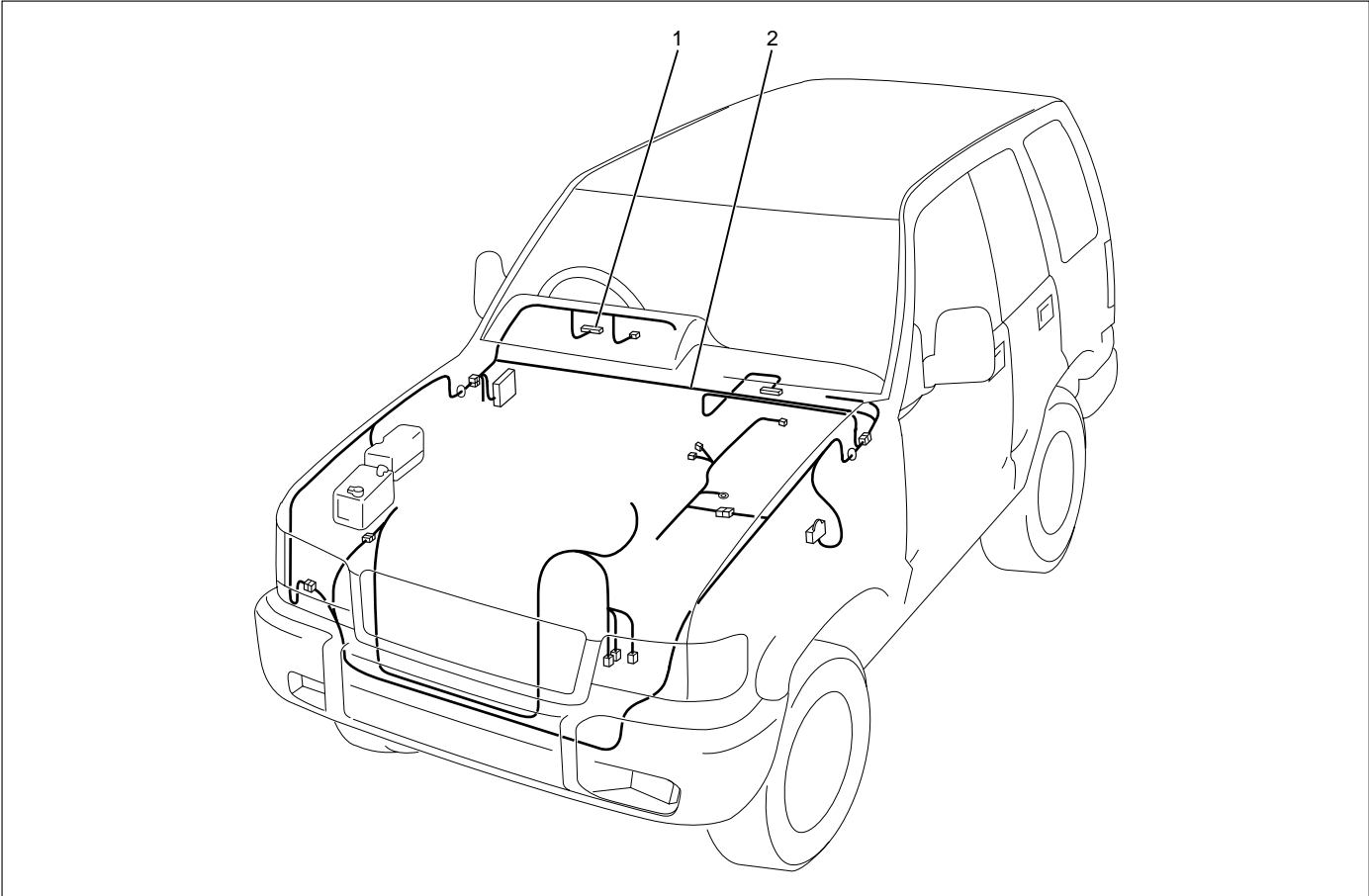


Reading the Circuit Diagram

In this section, each system has its own parts location illustration and circuit diagram. And harness connector faces used in the circuit diagram are shown at the end of this section.

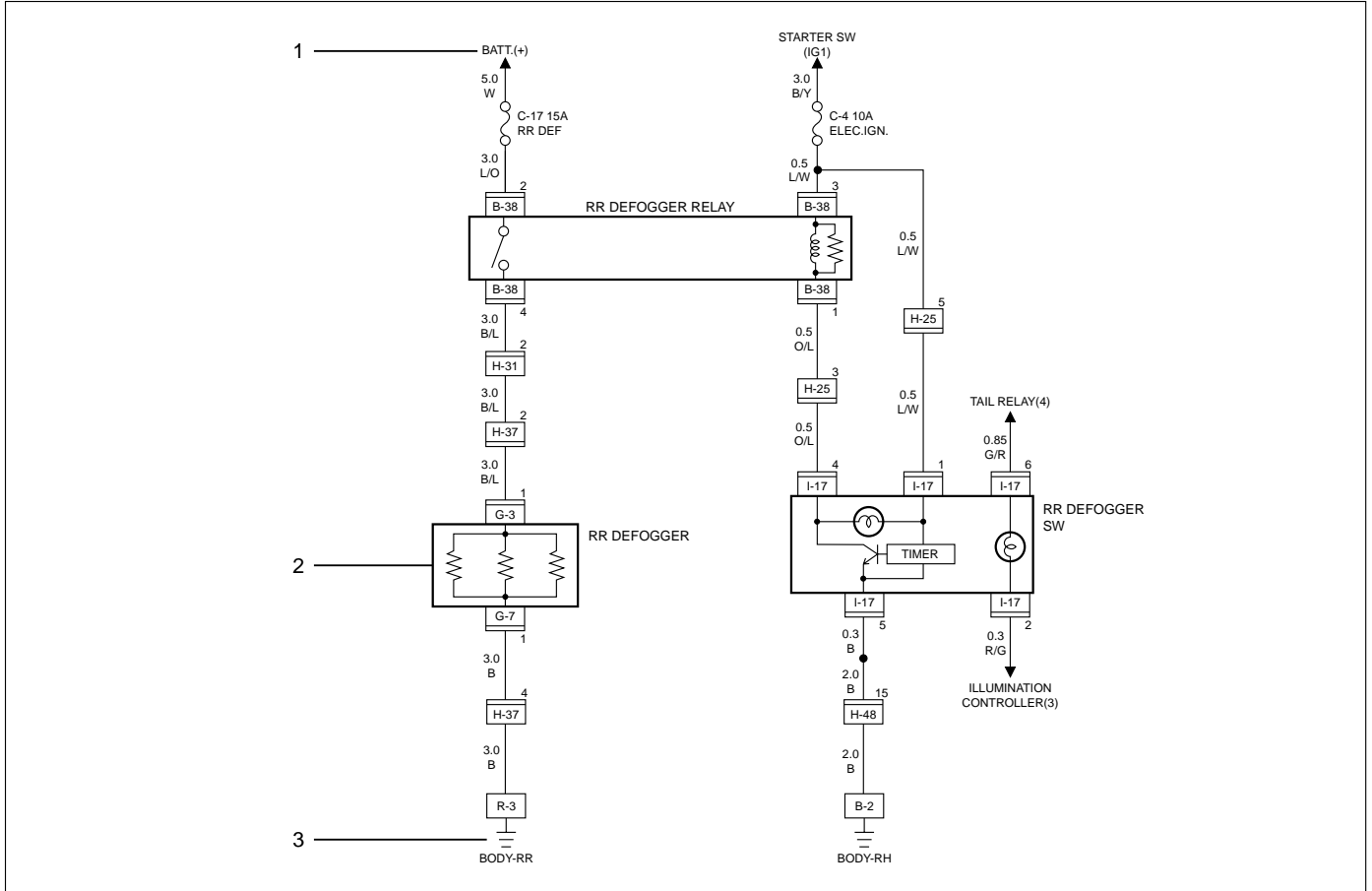
Parts Location

The parts location shows the location of the connectors (1) and the harness (2) used in each harness routing.



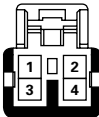

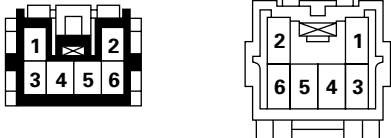

Circuit Diagram

The circuit diagram shows the power supply (1), the load or loads (2) and the grounding point(s) (3).



Harness Connector Faces

The harness connector faces show each connector's number (1), configuration (2) and the pin number (3).

No.	Connector face	No.	Connector face
B-21	NOT USED	B-31	
B-22		B-32	
B-23	NOT USED	B-33	

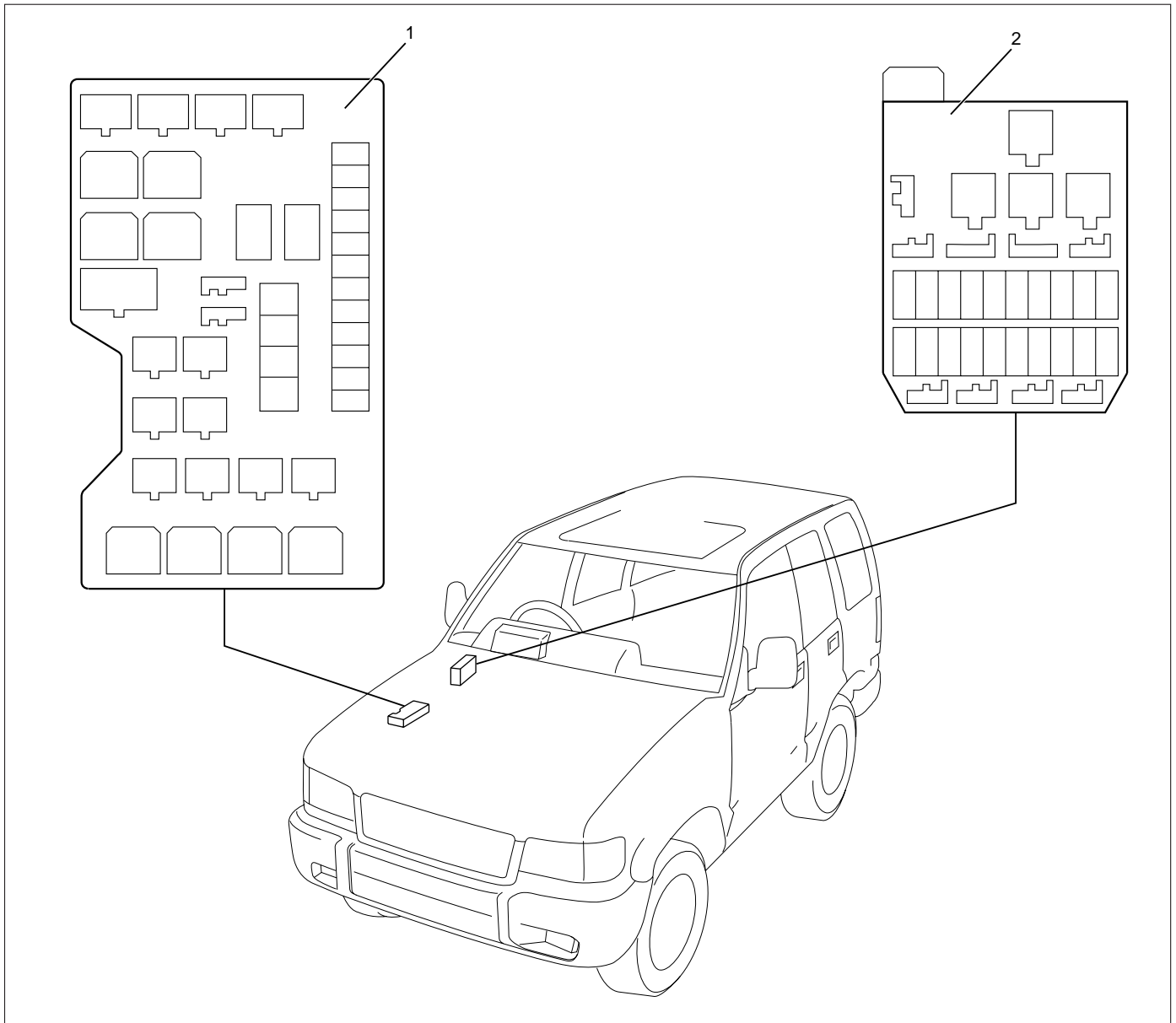
1

2

3

Main Data and Specifications

Fuse, Fusible Link and Circuit Breaker Location



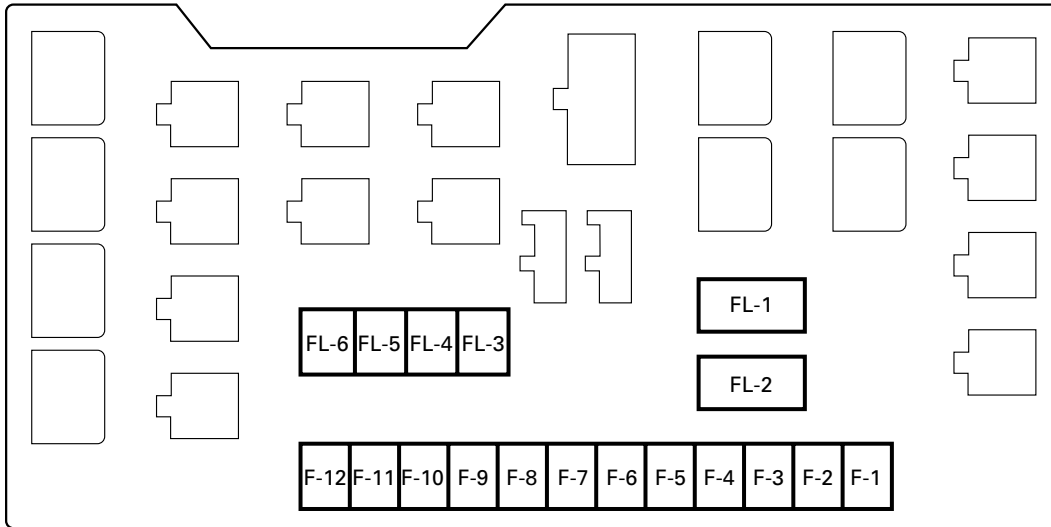
D08RWAG3

Legend

- (1) Relay and Fuse Box
- (2) Fuse Box

Relay & Fuse Box

RELAY AND FUSE BOX

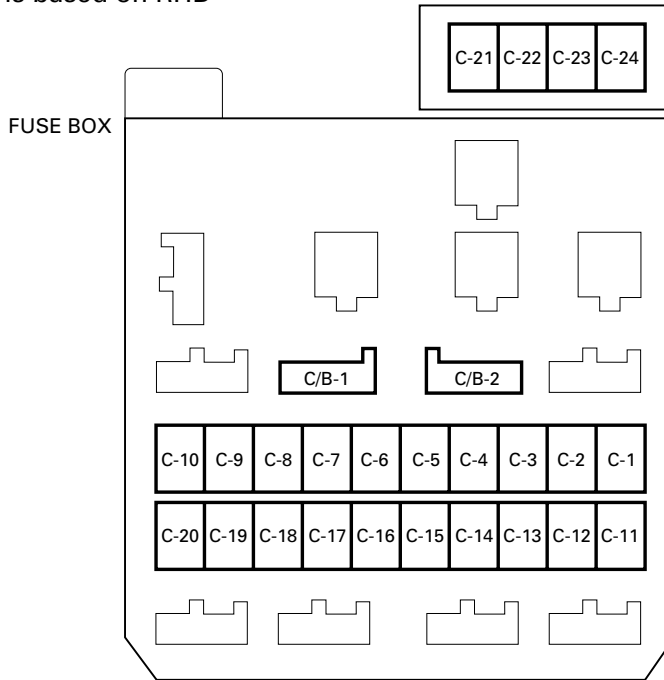


810RS027

	MODEL		
	No.		
FUSIBLE LINK	FL-1	80A MAIN	80A MAIN
	FL-2	50A KEY SW	50A KEY SW
	FL-3	30A ECM (GASOLINE)	30A ECM (GASOLINE)
	FL-4	30A CONDENSER FAN	30A CONDENSER FAN
	FL-5	50A GLOW (4JG2)	50A GLOW (4JG2)
	FL-6	40A ABS	40A ABS
FUSE	F-1	—	—
	F-2	10A O ₂ SENSOR (GASOLINE)	10A O ₂ SENSOR (GASOLINE)
	F-3	15A HORN HAZARD	15A HORN HAZARD
	F-4	15A H/LAMP-LH	10A H/LAMP-LH (HI)
	F-5	15A H/LAMP-RH	10A H/LAMP-RH (HI)
	F-6	—	10A H/LAMP-LH (LOW)
	F-7	15A ANTI-THEFT	10A H/LAMP-RH (LOW)
	F-8	20A FOG	20A FOG
	F-9	20A ABS	20A ABS
	F-10	15A FUEL PUMP (GASOLINE)	15A FUEL PUMP (GASOLINE)
	F-11	—	10A TAIL-LH
	F-12	15A TAIL	10A TAIL-RH

Fuse Box

This illustration is based on RHD



810RV026

FUSE

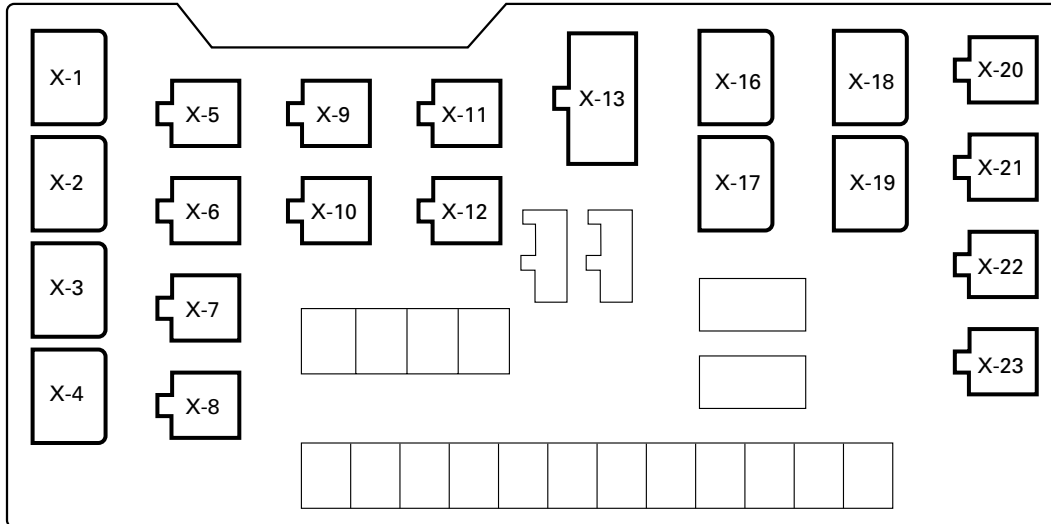
No.	RHD	LHD
C-1	10A STARTER RELAY	10A STARTER RELAY
C-2	15A SEAT HEATER	15A SEAT HEATER
C-3	10A TURN, BACK	10A TURN, BACK
C-4	10A ELEC. IGN.	10A ELEC. IGN.
C-5	15A FRT WIPER AND WASHER	15A FRT WIPER AND WASHER
C-6	10A RR WIPER AND WASHER	10A RR WIPER AND WASHER
C-7	10A H/LAMP WIPER	10A H/LAMP WIPER
C-8	15A ENGINE	15A ENGINE
C-9	15A IGN. COIL (GASOLINE) 15A FUEL CUT (4JG2)	15A IGN. COIL (GASOLINE) 15A FUEL CUT (4JG2)
C-10	10A METER, GAUGE	10A METER, GAUGE
C-11	10A AUDIO, MIRROR	10A AUDIO, MIRROR
C-12	20A CIGARETTE	20A CIGARETTE
C-13	10A ANTI-THEFT	10A ANTI-THEFT
C-14	15A STOP, A/T CONT.	15A STOP, A/T CONT.
C-15	20A TELEPHONE	20A TELEPHONE
C-16	10A CLOCK, ROOM	10A CLOCK, ROOM
C-17	25A RR DEFOG.	25A RR DEFOG.
C-18	20A DOOR LOCK	20A DOOR LOCK
C-19	25A BLOWER	25A BLOWER
C-20	10A AIR CON.	10A AIR CON.
C-21	10A SRS-1	10A SRS-1
C-22	—	—
C-23	—	—
C-24	—	—

CIRCUIT BREAKER

No.	RHD	LHD
C/B-1	—	—
C/B-2	30A P/W, P/S, S/R	30A P/W, P/S, S/R

Relay Location-1 (Relay and Fuse Box)

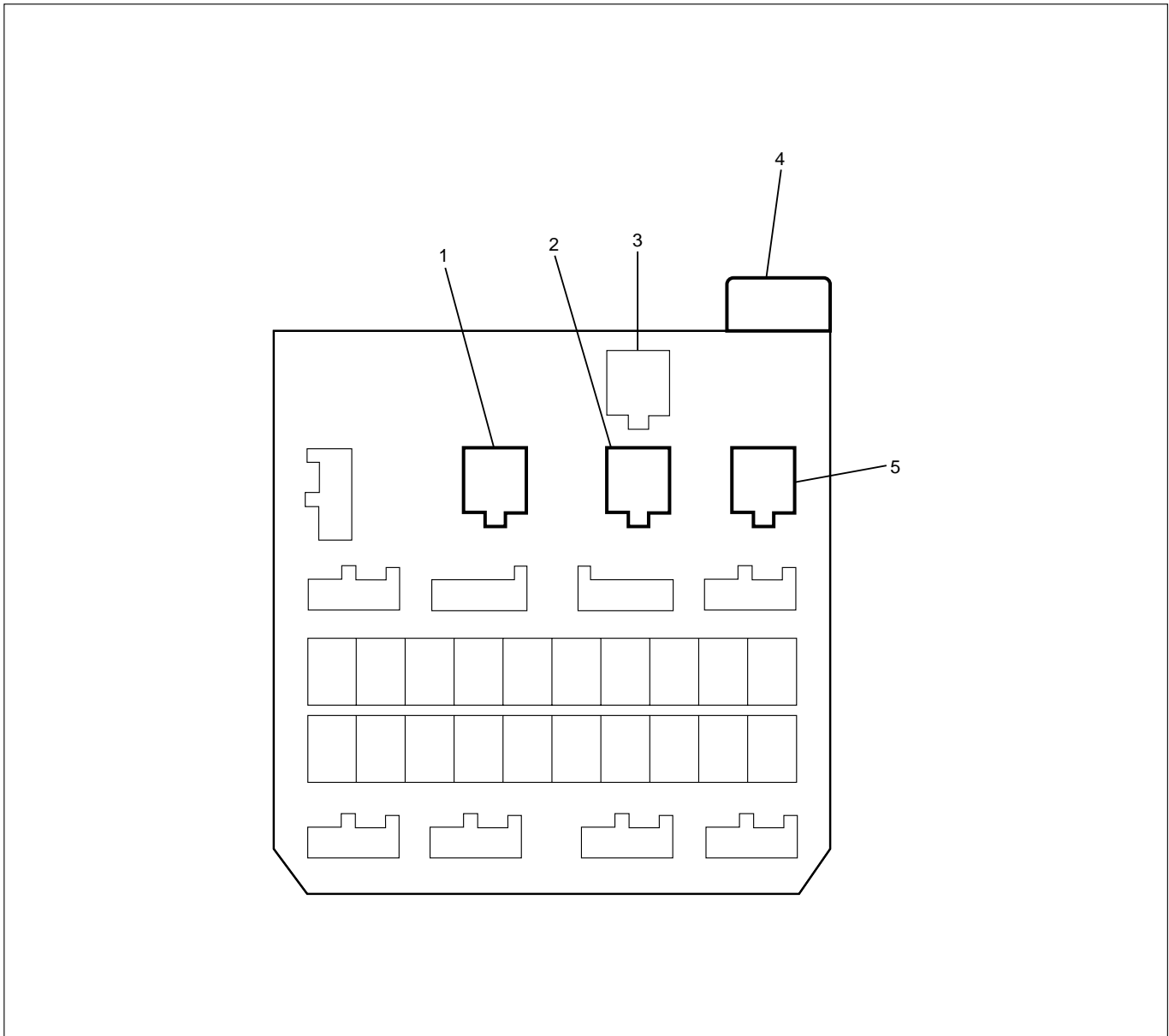
RELAY AND FUSE BOX



810RS029

No.	RHD	LHD
X-1	RELAY ; LIGHTING	RELAY ; LIGHTING
X-2	—	—
X-3	—	RELAY ; DIMMER
X-4	—	—
X-5	RELAY ; A/C THERMO	RELAY ; A/C THERMO
X-6	—	—
X-7	RELAY ; COMPRESSOR (GASOLINE)	RELAY ; COMPRESSOR (GASOLINE)
X-8	RELAY ; HORN	RELAY ; HORN
X-9	RELAY ; TAIL	RELAY ; TAIL
X-10	—	—
X-11	RELAY ; FUEL PUMP (GASOLINE)	RELAY ; FUEL PUMP (GASOLINE)
X-12	RELAY ; ECM MAIN (GASOLINE)	RELAY ; ECM MAIN (GASOLINE)
X-13	—	—
X-16	RELAY ; ANTI-THEFT	RELAY ; ANTI-THEFT
X-17	RELAY ; STARTER (GASOLINE) RELAY ; CHARGE (DIESEL)	RELAY ; STARTER (GASOLINE) RELAY ; CHARGE (DIESEL)
X-18	RELAY ; SHIFT ON THE FLY	RELAY ; SHIFT ON THE FLY
X-19	RELAY ; CONDENSER FAN (GASOLINE)	RELAY ; CONDENSER FAN
X-20	—	—
X-21	—	—
X-22	RELAY ; RR FOG LIGHT	—
X-23	RELAY ; FRT FOG LIGHT	RELAY ; FRT FOG LIGHT

Relay Location-2 (Fuse Box)



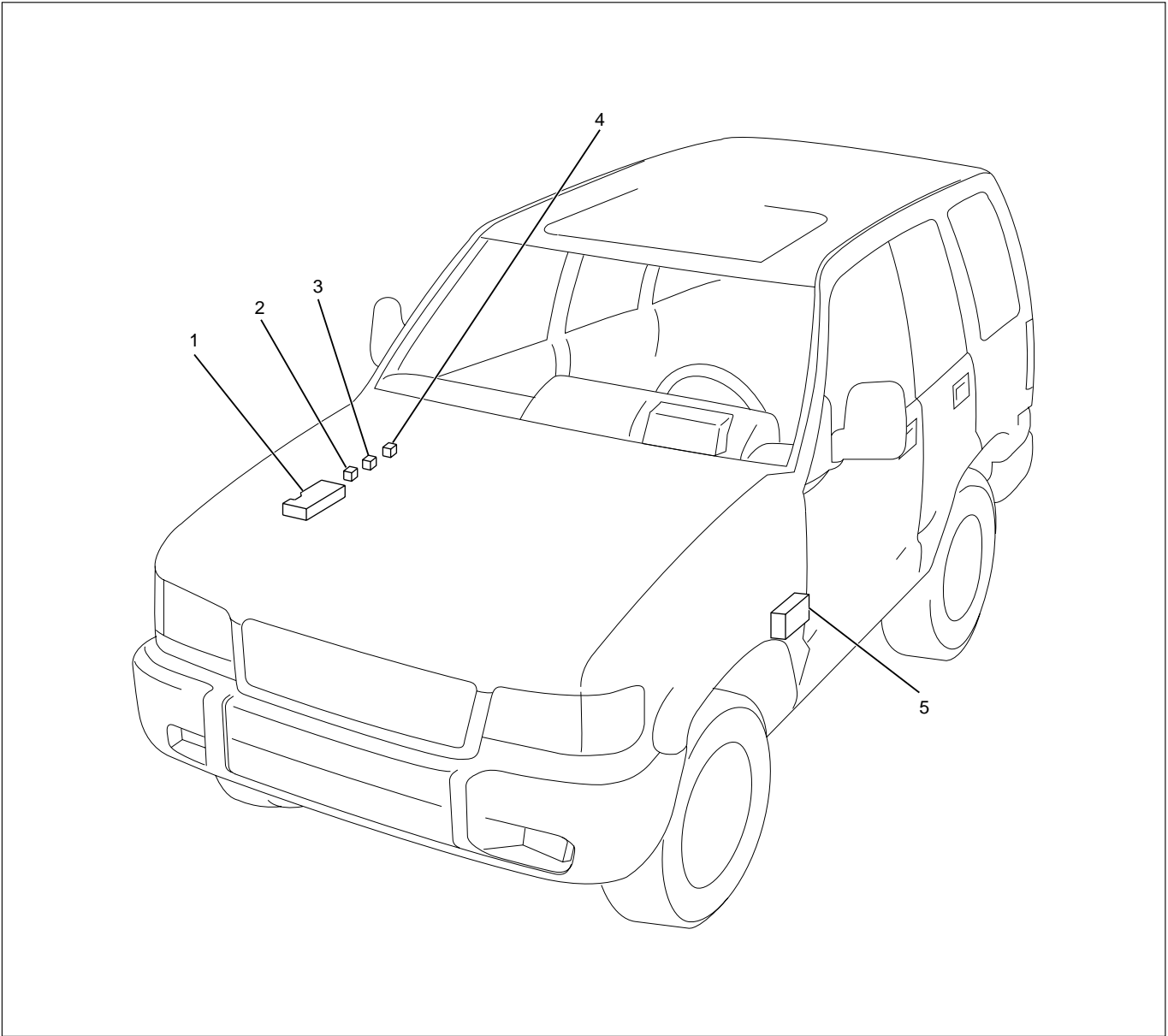
810RW330

Legend

- (1) Heater & A/C Relay
- (2) Power Window Relay
- (3) H-63

- (4) Flasher Unit
- (5) Rear Defogger Relay

Relay Location-3



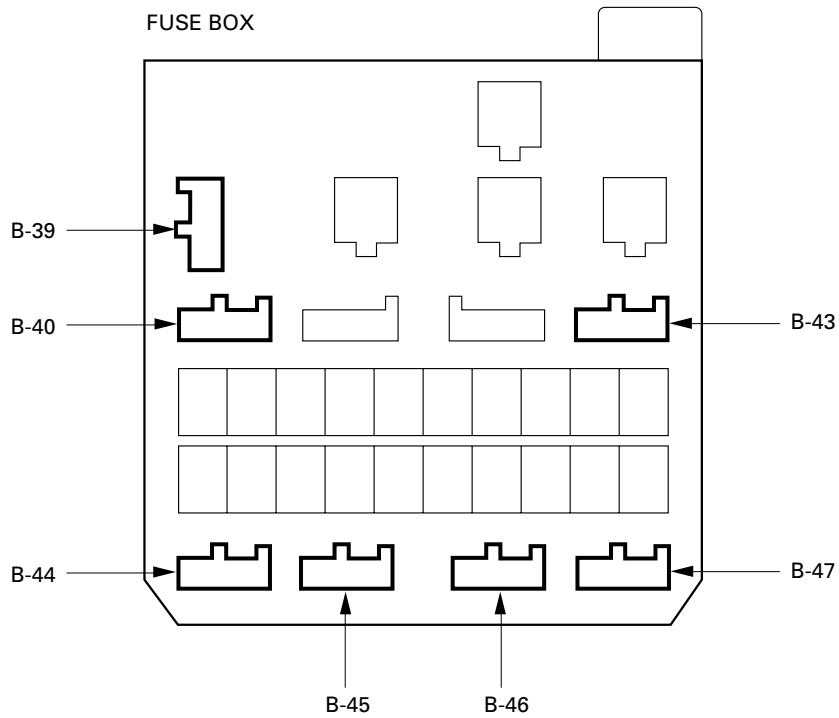
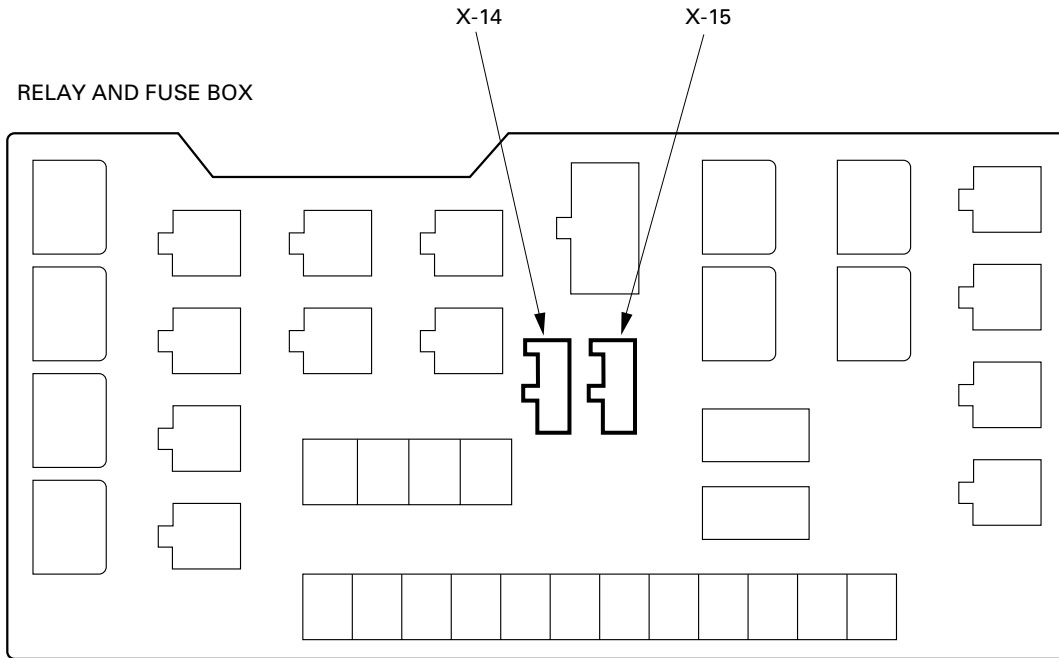
810RW331

Legend

- (1) Relay and Fuse Box
- (2) Glow Relay-1
- (3) Glow Relay-2

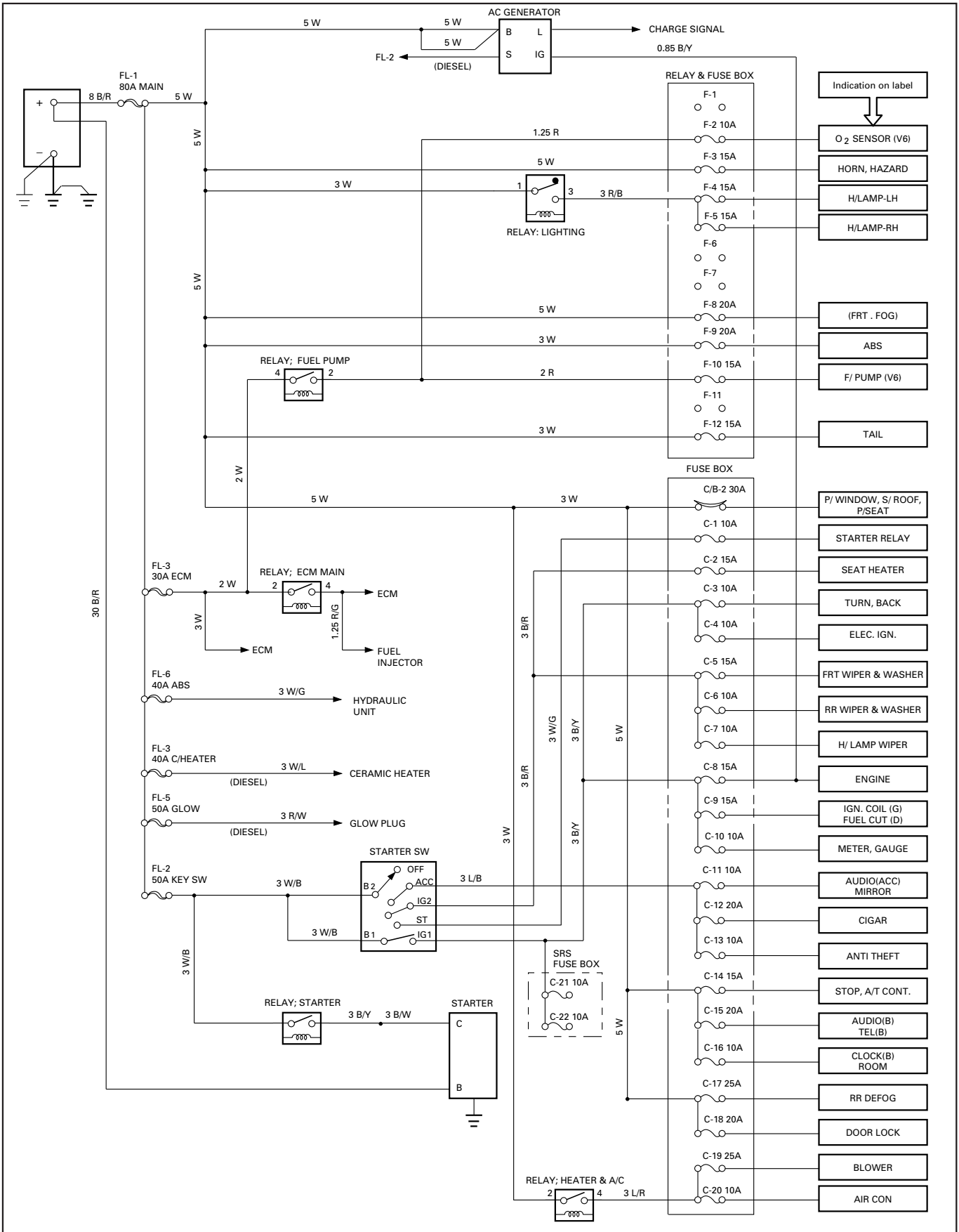
- (4) Starter Relay
- (5) Fuse Box

Diode Location



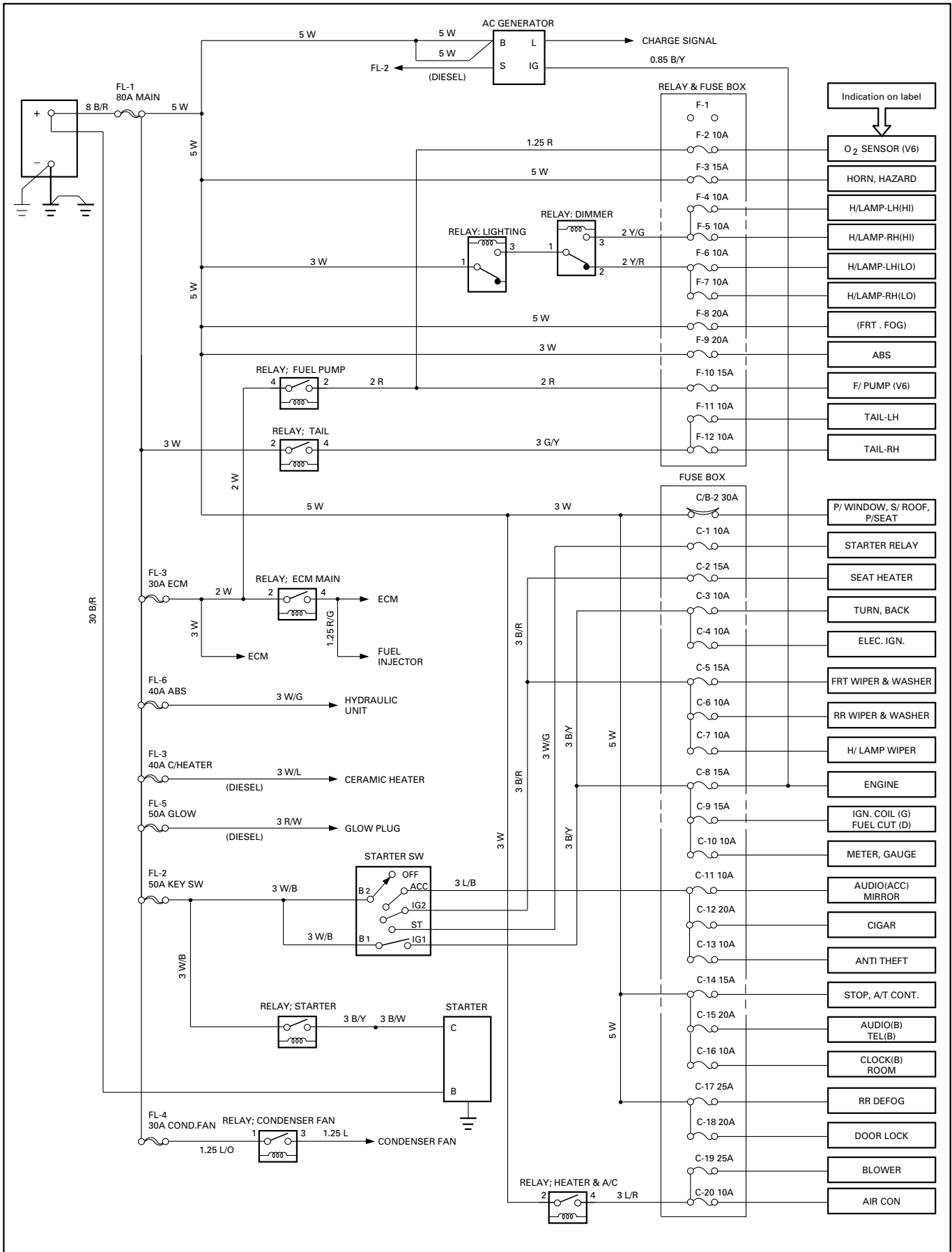
Fuse Block Circuit

RHD Models



8D-32 WIRING SYSTEM

LHD Models



**Grounding Point
Reference Table
(6VD1 RHD)**

Connector No.	Cable harness	Location	Parts (Load)
B-1	Body harness	Body-LH	Door mirror defogger (LH), Fan SW, FRT power window & door lock SW-LH, Cruise control unit, FRT door key SW-LH, FRT door lock actuator-LH, FRT door lock SW-LH
B-2			Sun roof SW, Sun roof control unit, Safety SW, Limit SW
B-18		Body-RH	FRT door key SW-RH, FRT door lock & power window SW-RH, FRT door lock actuator & lock SW-RH, FRT door lock SW-RH, Door mirror defogger (RH), RR wiper intermittent relay, Mode SW (A/T), Starter relay
B-19			Cigar lighter, Dimmer-passing SW, Illumination controller, RR defogger SW, Flasher unit, Power window relay, Cruise main indicator light, Lighting SW, Glove box illumination light, Ashtray illumination light, Headlight wiper SW, Clock, FRT fog light SW, Variable intermittent (FRT wiper & washer SW), Kick down SW, Anti-theft controller, Turn signal indicator light, Heater & A/C relay
B-26			RR Power window SW-RH, Mirror control SW, Mirror defogger SW, Mirror folding SW, Car telephone, Shift lock controller, POWER & WINTER SW, Seat heater, Seat heater SW, RR door lock actuator-LH, EBCM
B-28		RR power window SW-RH, Power & winter SW, Power seat SW, Tilt motor & SW, Recliner motor & SW, RR door lock actuator-RH, EBCM	
1 C-16		Engine room harness	Fender-LH
2 C-16	Pump & VSV, Headlight wiper timer		
3 C-16	4WD SW, VSV;FRT axle, FRT axle SW		
4 C-16	Headlight wiper motor		
5 C-16	FRT fog light		
6 C-16	O ₂ Sensor, Headlight leveling actuator-RH		
7 C-16	P/S pressure SW, Headlight leveling actuator-LH		
8 C-16	Side turn signal light (LH)		

8D-34 WIRING SYSTEM

Connector No.	Cable harness	Location	Parts (Load)
1 C-39	Engine room harness	Fender-RH	Windshield washer motor
2 C-39			Windshield wiper motor
3 C-39			Windshield intermittent relay
4 C-39			FRT fog light relay
5 C-39			Fuel pump relay, ECM main relay
6 C-39			Meter, Vehicle speed sensor (Meter), Fuel tank unit
7 C-39			Side turn signal light (RH)
8 C-39			Vehicle speed sensor, Brake fluid SW
E-28	Engine ECGI harness	Engine-common chamber	ECM, O ₂ sensor
E-29			ECM, Data link connector
E-30			DIS
E-31			ECM, Data link connector, A/T Shift indicator control unit
R-3	Rear body harness	Body-RR	RR washer motor, Rear wiper motor, Luggage room light, RR defogger, High mount stoplight, Tailgate key SW, RR door lock actuator-LH, Tailgate lock actuator-LH, RR power window SW-LH
R-4			Taillight, Stoplight, RR turn signal light, Backup light, License plate light, Fuel tank unit, Fuel pump, Trailer harness connector, RR fog light
M-16	Mission harness	Engine	TCM
I-39	Instrument harness	Body-FRT	Audio
C-85	Engine room harness	Body-Center	EBCM
U-2	SRS harness	Body-FRT	SDM

(6VD1 LHD)

Connector No.	Cable harness	Location	Parts (Load)
B-1	Body harness	Body-RH	FRT power window & door lock SW-RH, FRT door key SW-RH, FRT door lock actuator-RH, Door lock SW-RH, Door mirror defogger (RH), Key & light remind buzzer (Saudi Arabia), Sun roof SW, Sun roof control unit, Safety SW, Limit SW
B-2			Seat belt warning light (Saudi Arabia), Cruise control unit, Fan SW, Turn signal indicator light, Clock, Glove box illumination light, Ashtray illumination light, RR defogger SW, Cigar lighter
B-18		Body-LH	FRT door key SW-LH, FRT door lock actuator & lock SW-LH, Door lock SW-LH, FRT door lock & power window SW-LH, Door mirror defogger (LH), RR wiper intermittent relay, Starter relay, Mode SW (A/T), Power window relay
B-19			Dimmer-passing SW, Illumination controller, RR defogger SW, Flasher unit, Cruise main indicator light, Lighting SW, Headlight wiper SW, Clock, FRT fog light SW, Variable intermittent (FRT wiper & washer SW), Anti-theft controller, Heater & A/C relay, Kick down SW
B-26		Body-center	Mirror control SW, Mirror folding SW, Mirror defogger SW, RR Door lock actuator-RH, Car telephone, Shift lock controller, POWER & WINTER SW, Seat heater, Seat heater SW, EBCM, RR power window SW-RH
B-28			EBCM, Seat belt SW (Saudi Arabia), Tilt motor & SW, Recliner motor & SW, Power seat SW
1 C-16	Engine room harness	Fender-LH	Clearance light, FRT turn signal light
3 C-16			4WD SW, VSV;FRT axle, FRT axle SW
4 C-16			Headlight wiper motor
5 C-16			FRT fog light
6 C-16			P/S pressure SW
7 C-16			O ₂ Sensor
8 C-16			Side turn signal light (LH)

8D-36 WIRING SYSTEM

Connector No.	Cable harness	Location	Parts (Load)
1 C-39	Engine room harness	Fender-RH	Windshield washer motor, Side turn signal light (RH)
2 C-39			Windshield wiper motor
3 C-39			Windshield intermittent relay
4 C-39			Headlight-LH, FRT fog light relay
5 C-39			Condenser fan (Saudi Arabia)
6 C-39			Meter, Vehicle speed sensor (Meter), Fuel tank unit
7 C-39			Pump & VSV, Headlight-RH, Fuel pump relay, ECM main relay
8 C-39			High-beam indicator light, Vehicle speed sensor, Headlight wiper timer
C-85		Body-Center	EBCM
E-28	Engine ECGI harness	Engine-common chamber	ECM, O ₂ sensor
E-29			ECM, Data link connector
E-30			DIS
E-31			ECM, Data link connector, A/T Shift indicator control unit
R-3	Rear body harness	Body-RR	RR washer motor, Rear wiper motor, Luggage room light, RR defogger, Tailgate key SW, Tailgate lock actuator-LH, RR Door lock actuator-LH, High mount stoplight, RR power window SW-LH
R-4			Taillight, Stoplight, RR turn signal light, License plate light, Fuel tank unit, Fuel pump, Backup light
M-16	Mission harness	Engine	TCM
I-39	Instrument harness	Body-FRT	Audio

(4JG2 RHD)

Connector No.	Cable harness	Location	Parts (Load)	
B-1	Body harness	Body-LH	Door mirror defogger (LH), FRT power window & door lock SW-LH, Fan SW, FRT door key SW-LH, FRT door lock actuator-LH, FRT door lock SW-LH	
B-2			Sun roof SW, Sun roof control unit, Safety SW, Limit SW	
B-18		Body-RH	FRT door key SW-RH, FRT door lock & power window SW-RH, FRT door lock actuator & lock SW-RH, Door lock SW-RH, Door mirror defogger (RH), RR wiper intermittent relay, Starter relay	
B-19			Headlight wiper SW, Dimmer-passing SW, Illumination controller, RR defogger SW, Flasher unit, Power window relay, Lighting SW, Glove box illumination light, Ashtray illumination light, Clock, FRT fog light SW, Variable intermittent (FRT wiper & washer SW), Cigar lighter, Vehicle speed sensor (Meter), Heater & A/C relay, Turn signal indicator light, Anti-theft controller, RR power window SW-RH	
B-26			Body-center	Mirror control SW, Mirror folding SW, Mirror defogger SW, Car telephone, Seat heater, Seat heater SW, RR door lock actuator-LH, EBCM
B-28		RR power window SW-RH, EBCM, RR door lock actuator-RH, Tilt motor & SW, Power seat SW, Recliner motor & SW		
1 C-16		Engine room harness	Fender-LH	Clearance light, FRT turn signal light
2 C-16				4WD SW, Fuel filter SW
3 C-16	VSV;FRT axle, FRT axle SW			
4 C-16	Headlight wiper motor			
5 C-16	FRT fog light			
7 C-16	QOS-III control unit, Headlight wiper timer, VSV;FICD, QOS/EGR control unit, Data link connector			
8 C-16	Side turn signal light (LH)			

8D-38 WIRING SYSTEM

Connector No.	Cable harness	Location	Parts (Load)
1 <input type="text" value="C-39"/>	Engine room harness	Fender-RH	Windshield washer motor
2 <input type="text" value="C-39"/>			Windshield wiper motor
3 <input type="text" value="C-39"/>			Windshield intermittent relay, Charge relay
4 <input type="text" value="C-39"/>			FRT fog light relay
5 <input type="text" value="C-39"/>			Tacho sensor
6 <input type="text" value="C-39"/>			Vehicle speed sensor (Meter), Meter, Fuel tank unit
7 <input type="text" value="C-39"/>			Side turn signal light (RH)
8 <input type="text" value="C-39"/>			Vehicle speed sensor, Brake fluid SW
<input type="text" value="C-85"/>			Body-FRT
<input type="text" value="R-3"/>	Rear body harness	Body-RR	RR washer motor, Rear wiper motor, Luggage room light, RR defogger, High mount stoplight, Tailgate key SW, RR door lock actuator-LH, Tailgate lock actuator-LH, RR power window SW-LH
<input type="text" value="R-4"/>			Taillight, Stoplight, RR turn signal light, Backup light, License plate light, Fuel tank unit, RR fog light, Trailer harness connector
<input type="text" value="I-39"/>	Instrument harness	Body-FRT	Audio

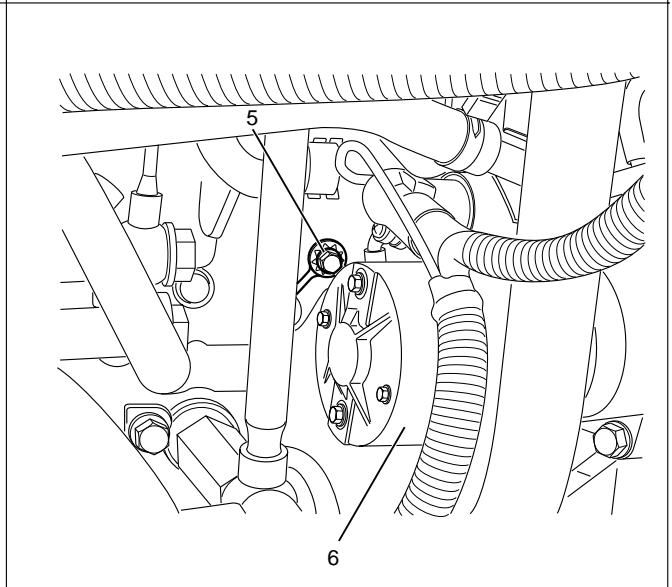
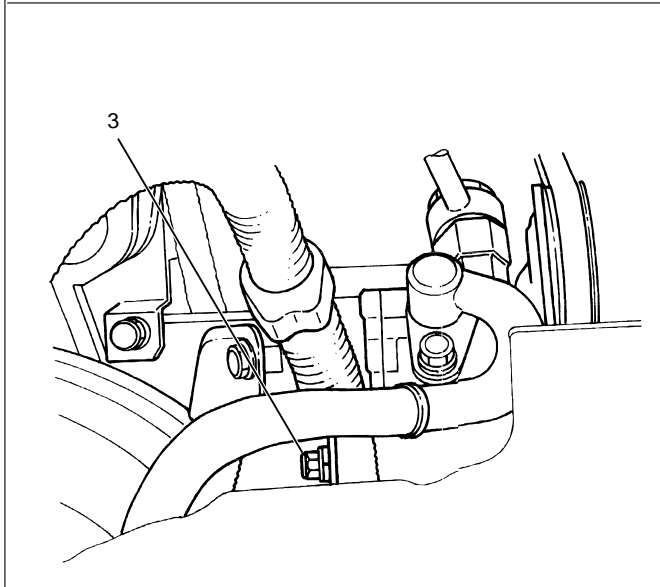
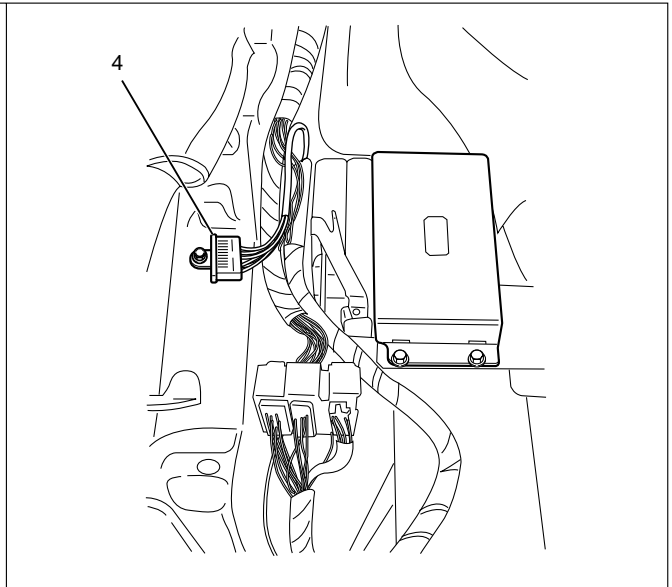
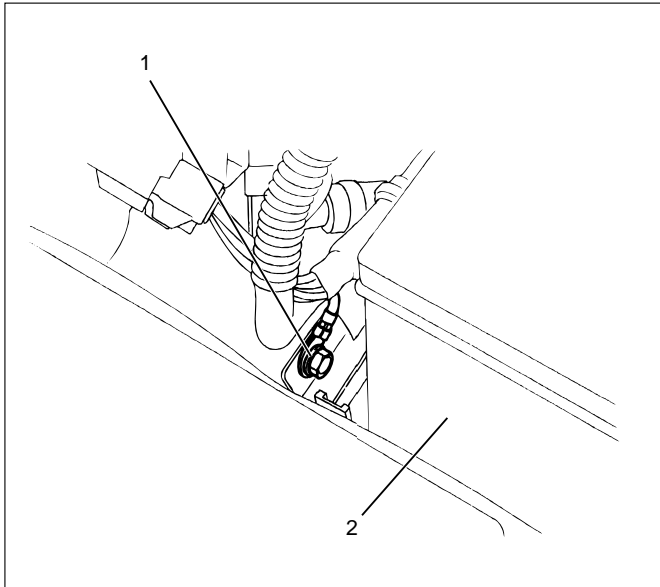
(4JG2 LHD)

Connector No.	Cable harness	Location	Parts (Load)
B-1	Body harness	Body-RH	Door mirror defogger (RH), FRT door lock key SW-RH, FRT door lock actuator-RH, Door lock SW-RH, FRT power window & door lock SW-RH, Key & light remind buzzer (Saudi Arabia), Sun roof SW, Sun roof control unit, Safety SW, Limit SW
B-2			Seat belt warning light (Saudi Arabia), Fan SW, Turn signal indicator light, Vehicle speed sensor (Meter), RR defogger SW, Clock, Cigar lighter, Glove box illumination light, Ashtray illumination light
B-18		Body-LH	FRT door lock key SW-LH, FRT door lock actuator & lock SW-LH, Door lock SW-LH, FRT door lock & power window SW-LH, Door mirror defogger (LH), RR wiper intermittent relay, Starter relay, Power window relay
B-19			Dimmer-passing SW, Illumination controller, RR defogger SW, Flasher unit, Lighting SW, Headlight wiper SW, FRT fog light SW, Variable intermittent (FRT wiper & washer SW), Heater & A/C relay, Anti-theft controller
B-26		Body-center	Mirror control SW, Mirror folding SW, Mirror defogger SW, RR power window SW-RH, Car telephone, RR door lock actuator-RH, Seat heater, Seat heater SW, EBCM
B-28			Seat belt SW (Saudi Arabia), EBCM, Tilt motor & SW, Power seat SW, Recliner motor & SW
1 C-16	Engine room harness	Fender-LH	Clearance light, FRT turn signal light
2 C-16			4WD SW, Fuel filter SW
3 C-16			VSV;FRT axle, FRT axle SW, Brake fluid SW
4 C-16			Headlight wiper motor
5 C-16			FRT fog light
7 C-16			VSV; FICD
8 C-16			Data link connector, Side turn signal light (LH), QOS-III control unit

8D-40 WIRING SYSTEM

Connector No.	Cable harness	Location	Parts (Load)
1 <input type="text" value="C-39"/>	Engine room harness	Fender-RH	Windshield washer motor, Headlight-LH, Side turn signal light (RH)
2 <input type="text" value="C-39"/>			Windshield wiper motor
3 <input type="text" value="C-39"/>			Windshield intermittent relay
4 <input type="text" value="C-39"/>			FRT fog light relay, Charge relay, Headlight-LH
5 <input type="text" value="C-39"/>			Condenser fan (Saudi Arabia)
6 <input type="text" value="C-39"/>			Meter, Vehicle speed sensor (Meter), Fuel tank unit
7 <input type="text" value="C-39"/>			Headlight-RH, Tacho sensor
8 <input type="text" value="C-39"/>			Headlight wiper timer, High-beam indicator light, Vehicle speed sensor
<input type="text" value="C-85"/>		Body-FRT	EBCM
<input type="text" value="R-3"/>	Rear body harness	Body-RR	RR washer motor, Rear wiper motor, Luggage room light, RR defogger, Tailgate key SW, Tailgate lock actuator-LH, RR door lock actuator-LH, RR power window SW-LH, High mount stoplight
<input type="text" value="R-4"/>			Taillight, Stoplight, RR turn signal light, License plate light, Backup light
<input type="text" value="I-39"/>	Instrument harness	Body-FRT	Audio

Grounding Point



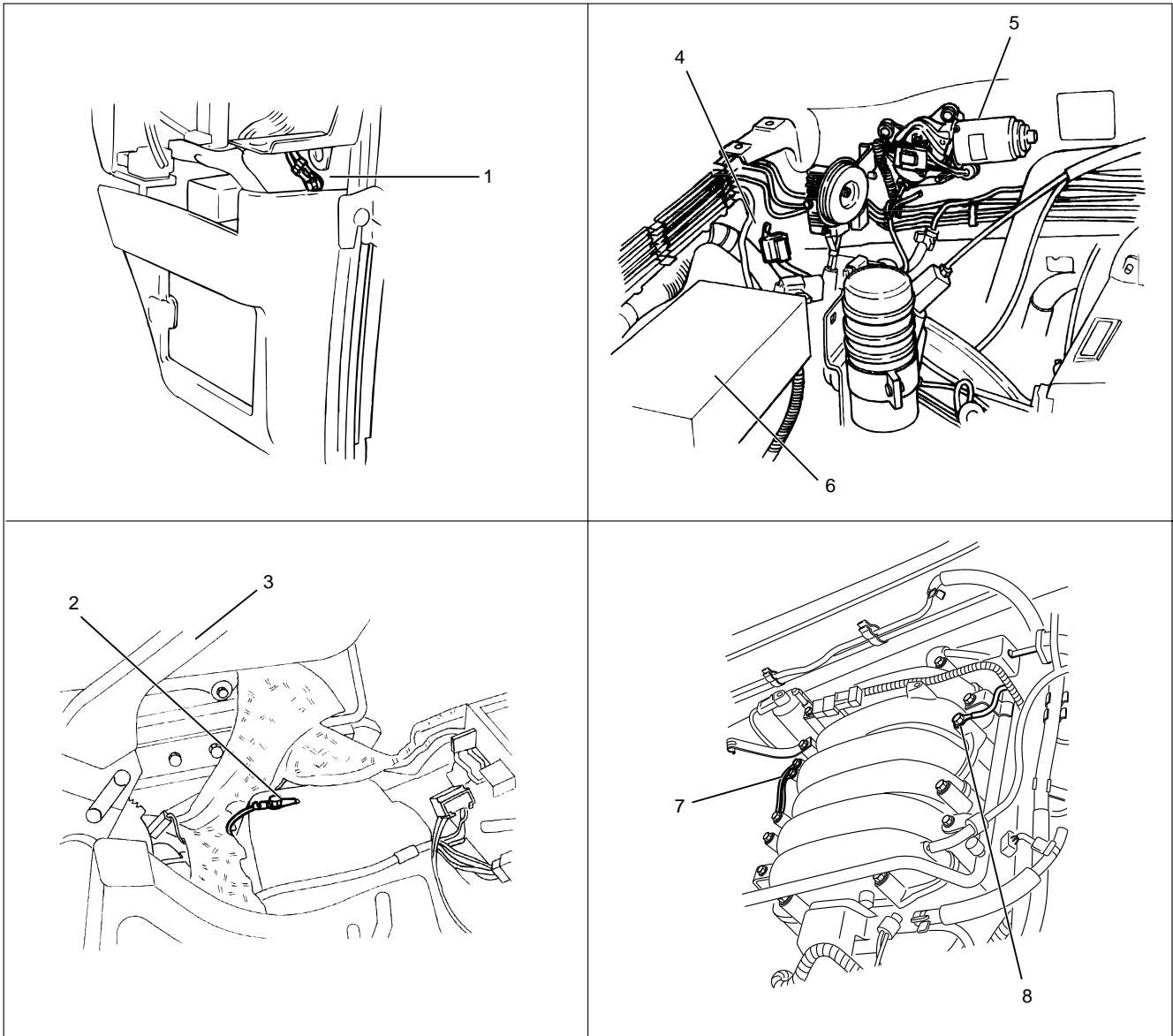
D08RWA22

Legend

- (1) P-6
- (2) Battery
- (3) P-7

- (4) C-85
- (5) E-4
- (6) Starter

8D-42 WIRING SYSTEM

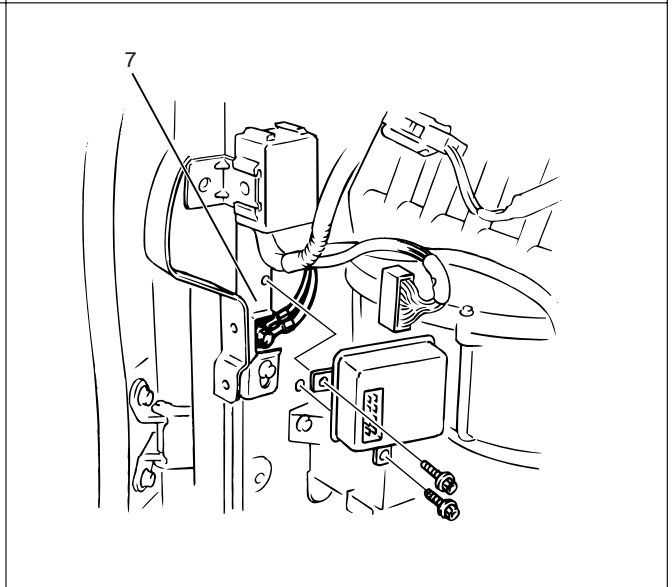
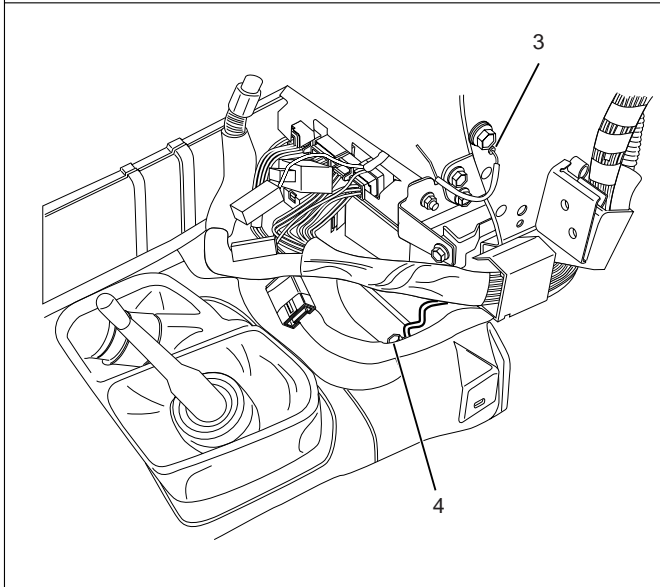
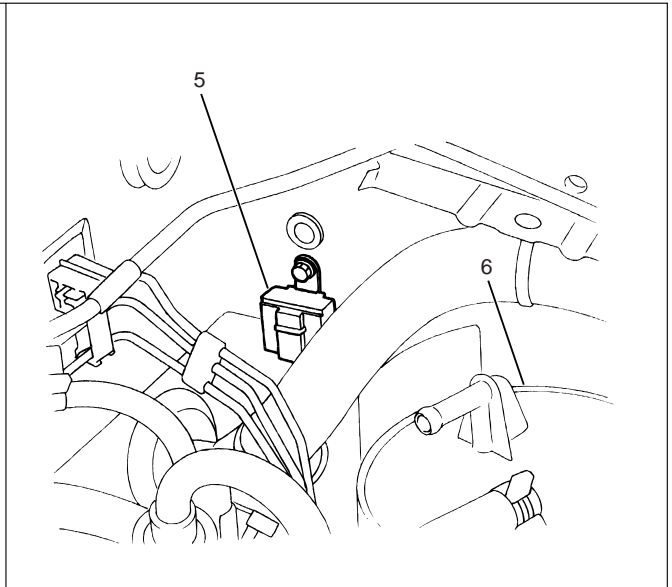
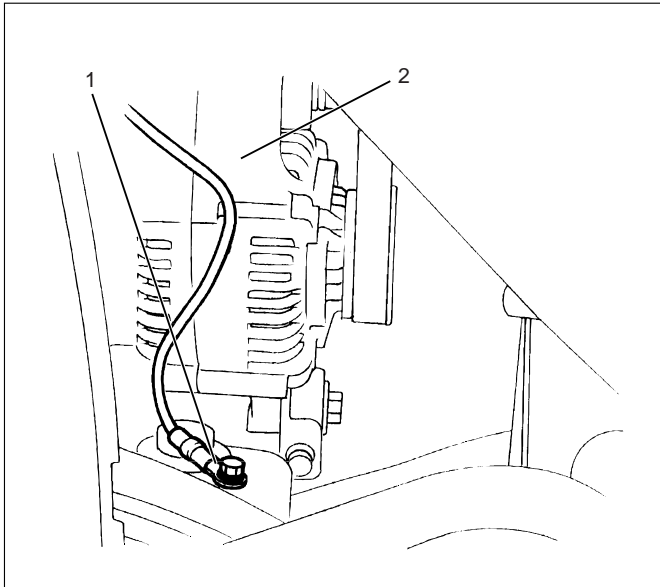


D08RWA24

Legend

- (1) B-18, B-19
- (2) B-26
- (3) Parking Brake Lever
- (4) C-39

- (5) Windshield Wiper Motor
- (6) Relay and Fuse Box
- (7) Common Chamber: RH
- (8) Common Chamber: LH



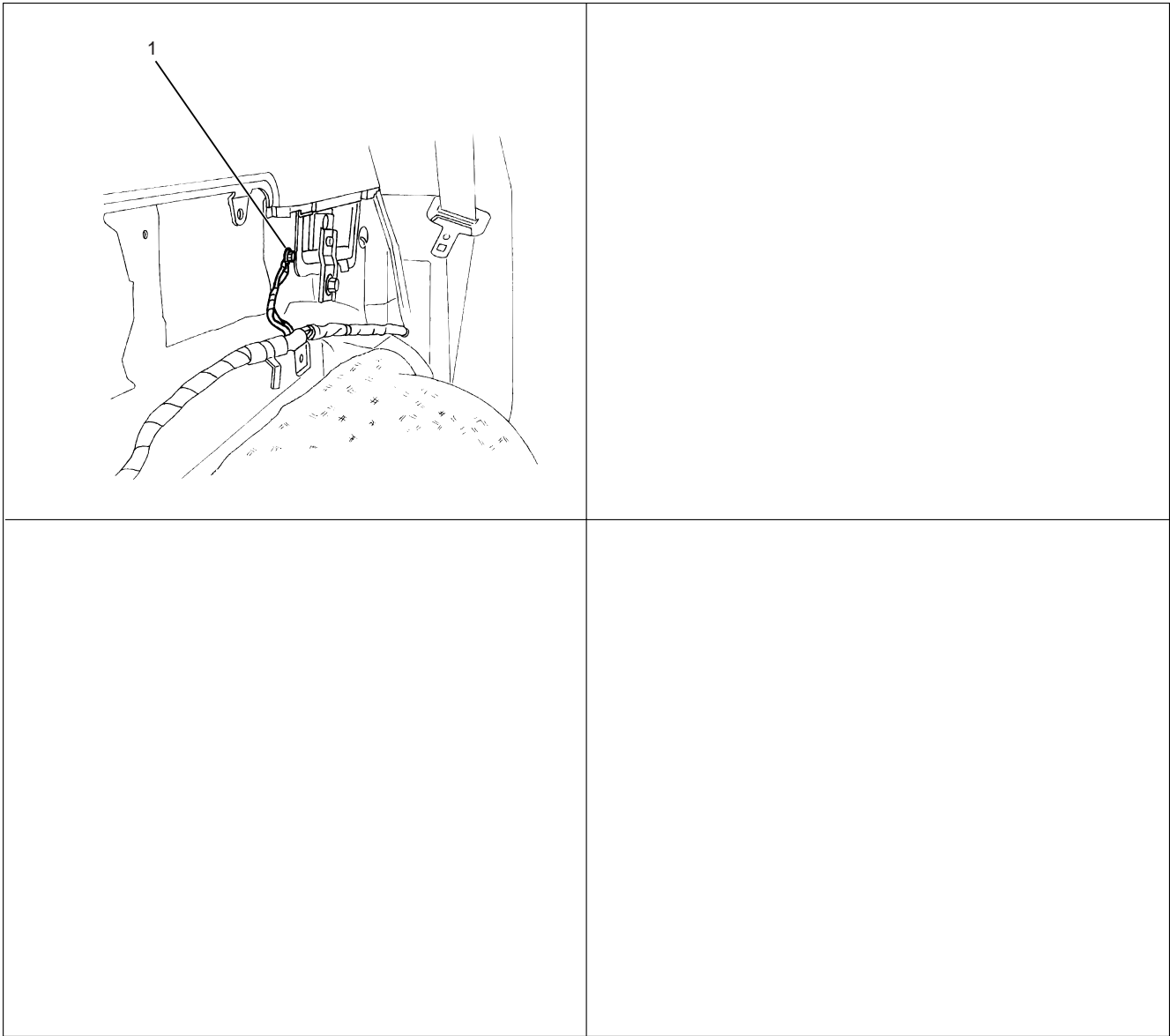
D08RWA23

Legend

- (1) P-10
- (2) AC Generator
- (3) I-39
- (4) U-2

- (5) C-16
- (6) Canister
- (7) B-1, B-2

8D-44 WIRING SYSTEM

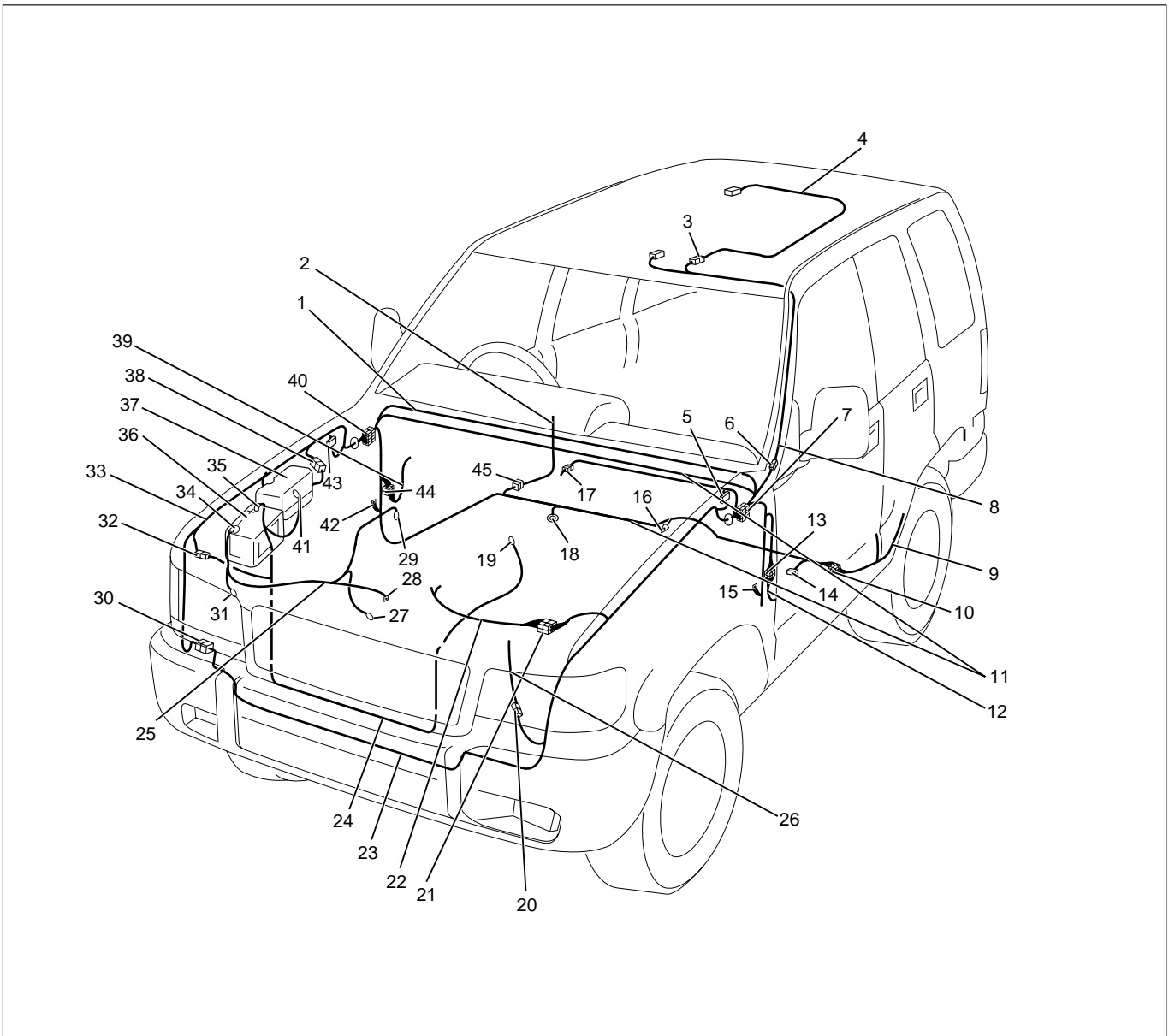


D08RWA30

Legend

(1) R-3, R-4

Cable Harness Routing (RHD) – 1



D08RWA34

Legend

- | | |
|-------------------------------------|-------------------------------|
| (1) Instrument Harness | (16) B-26 |
| (2) RR Door Extension Harness | (17) H-12 |
| (3) H-45 | (18) B-28 |
| (4) Sun Roof Harness | (19) P-4 |
| (5) C-16 | (20) H-10, H-11, H-53 |
| (6) H-21 | (21) H-4, H-5, H-6 |
| (7) H-7, H-8, H-9, H-20, H-24, H-65 | (22) Engine Harness |
| (8) Domelight Harness | (23) Engine Room Harness (LH) |
| (9) RR Body Harness | (24) Battery Positive Cable |
| (10) H-31, H-32, H-46 | (25) Battery Negative Cable |
| (11) Body Harness | (26) Transmission Harness |
| (12) FRT Door Harness | (27) P-7 |
| (13) H-18, H-19 | (28) P-10 |
| (14) C-85 | (29) P-9 |
| (15) B-1, B-2 | (30) H-41, H-42, H-43, H-60 |
| | (31) P-6 |

8D-46 WIRING SYSTEM

(32) H-2, H-3 (4J**)

(33) Engine Room Harness (RH)

(34) P-5

(35) P-1

(36) Battery

(37) Relay and Fuse Box

(38) H-1, H-2, H-3 (6V*1)

(39) FRT Door Harness (RH)

(40) H-13, H-14, H-15, H-16, H-25, H-26, H-27,
H-61, H-62, H-64, H-66

(41) P-2

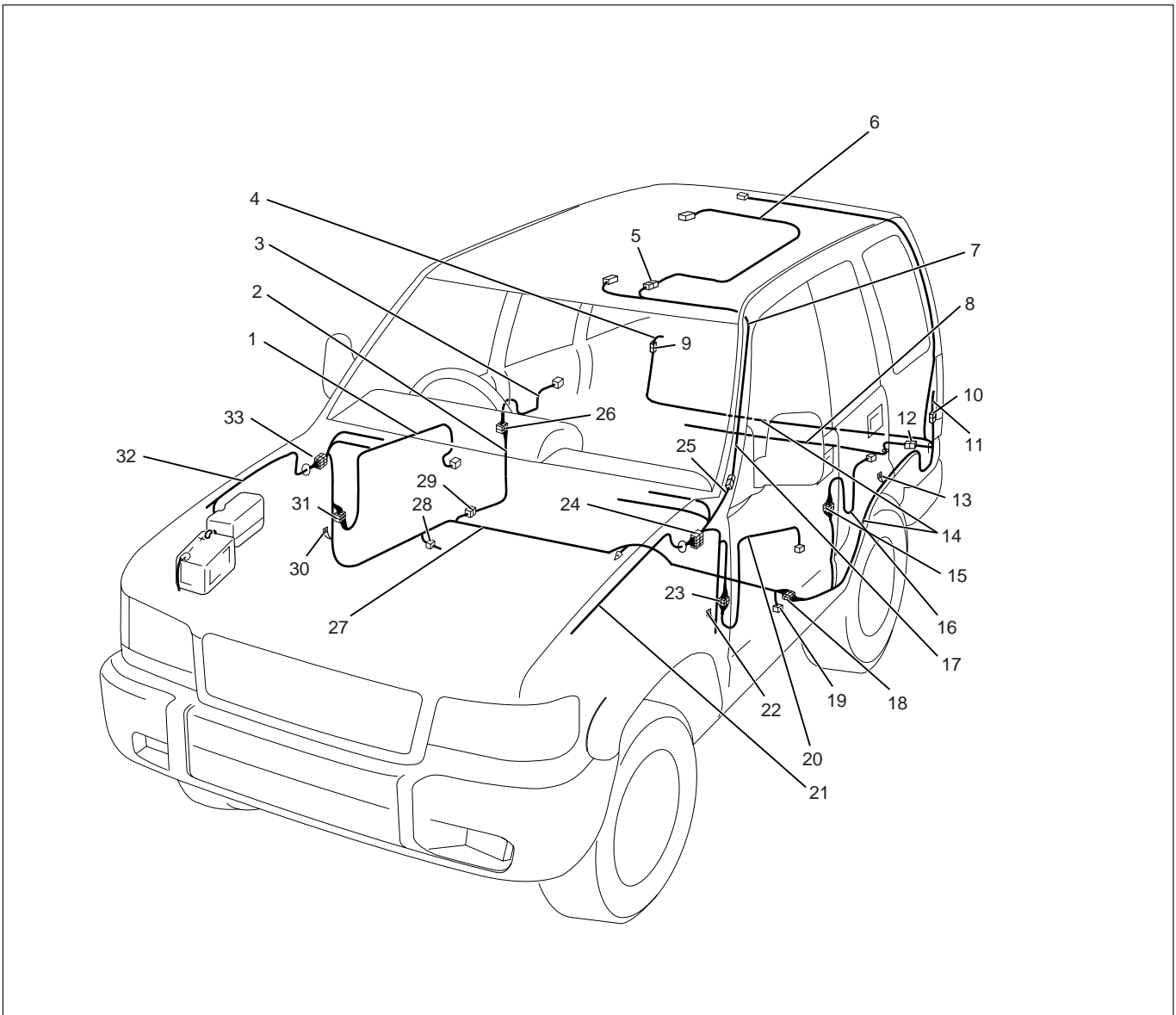
(42) B-18, B-19

(43) C-39

(44) H-22, H-23

(45) H-47

Cable Harness Routing (RHD) – 2

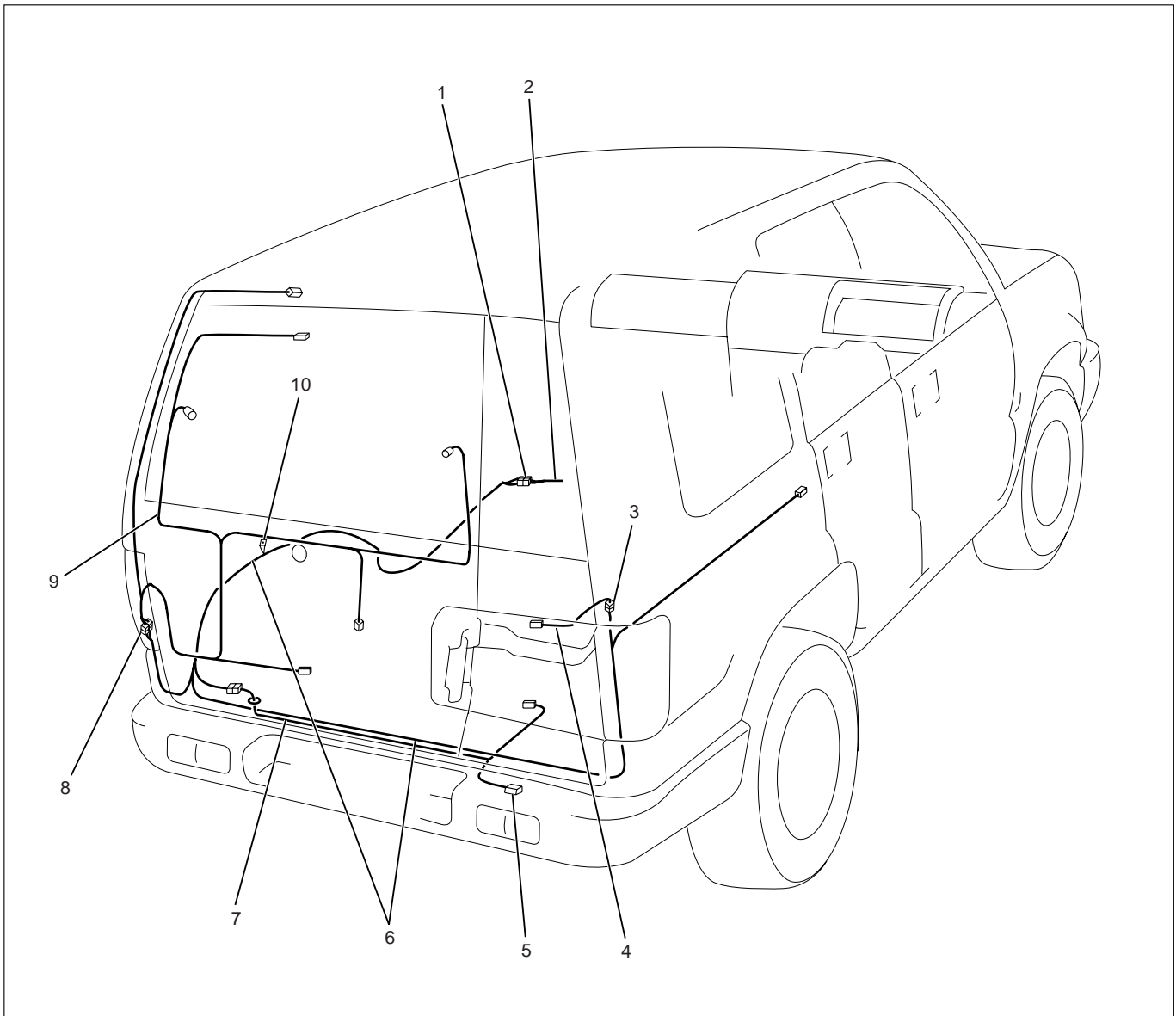


D08RWA35

Legend

- | | |
|-------------------------------|---|
| (1) FRT Door Harness (RH) | (18) H-31, H-32, H-46 |
| (2) RR Door Extension Harness | (19) H-58 |
| (3) RR Door Harness (RH) | (20) FRT Door Harness (LH) |
| (4) Tail Gate Harness (RH) | (21) Engine Room Harness (LH) |
| (5) H-45 | (22) B-1, B-2 |
| (6) Sun Roof Harness | (23) H-18, H-19 |
| (7) Domelight Harness | (24) H-7, H-8, H-9, H-20, H-24, H-65 |
| (8) Chassis Harness | (25) H-21 |
| (9) H-39 | (26) H-34, H-35 |
| (10) H-37, H-38 | (27) Body Harness |
| (11) Tailgate Harness (LH) | (28) H-57 |
| (12) H-33 | (29) H-47 |
| (13) R-3, R-4 | (30) B-18, B-19 |
| (14) RR Body Harness | (31) H-22, H-23 |
| (15) H-28, H-29 | (32) Engine Room Harness (RH) |
| (16) RR Door Harness (LH) | (33) H-13, H-14, H-15, H-16, H-25, H-26, H-27, H-61, H-62, H-64, H-65 |
| (17) Domelight Harness | |

Cable Harness Routing (RHD) – 3



D08RWA33

Legend

(1) H-31, H-32, H-46

(2) Body Harness

(3) H-39

(4) Tail Gate Harness (RH)

(5) H-44

(6) RR Body Harness

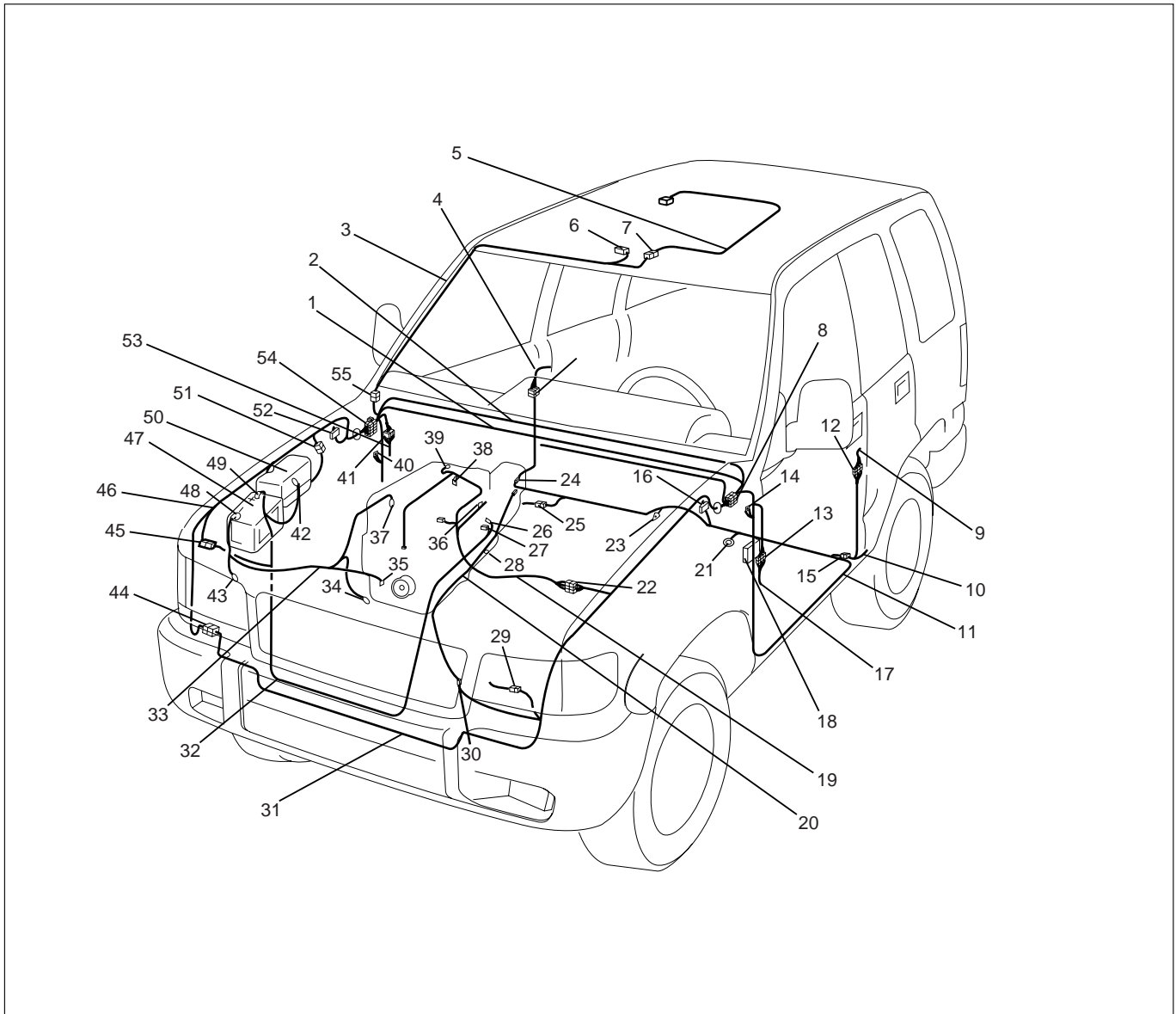
(7) Chassis Harness

(8) H-37, H-38

(9) Tail Gate Harness (LH)

(10) R-3, R-4

Cable Harness Routing (LHD) – 1



D08RWB04

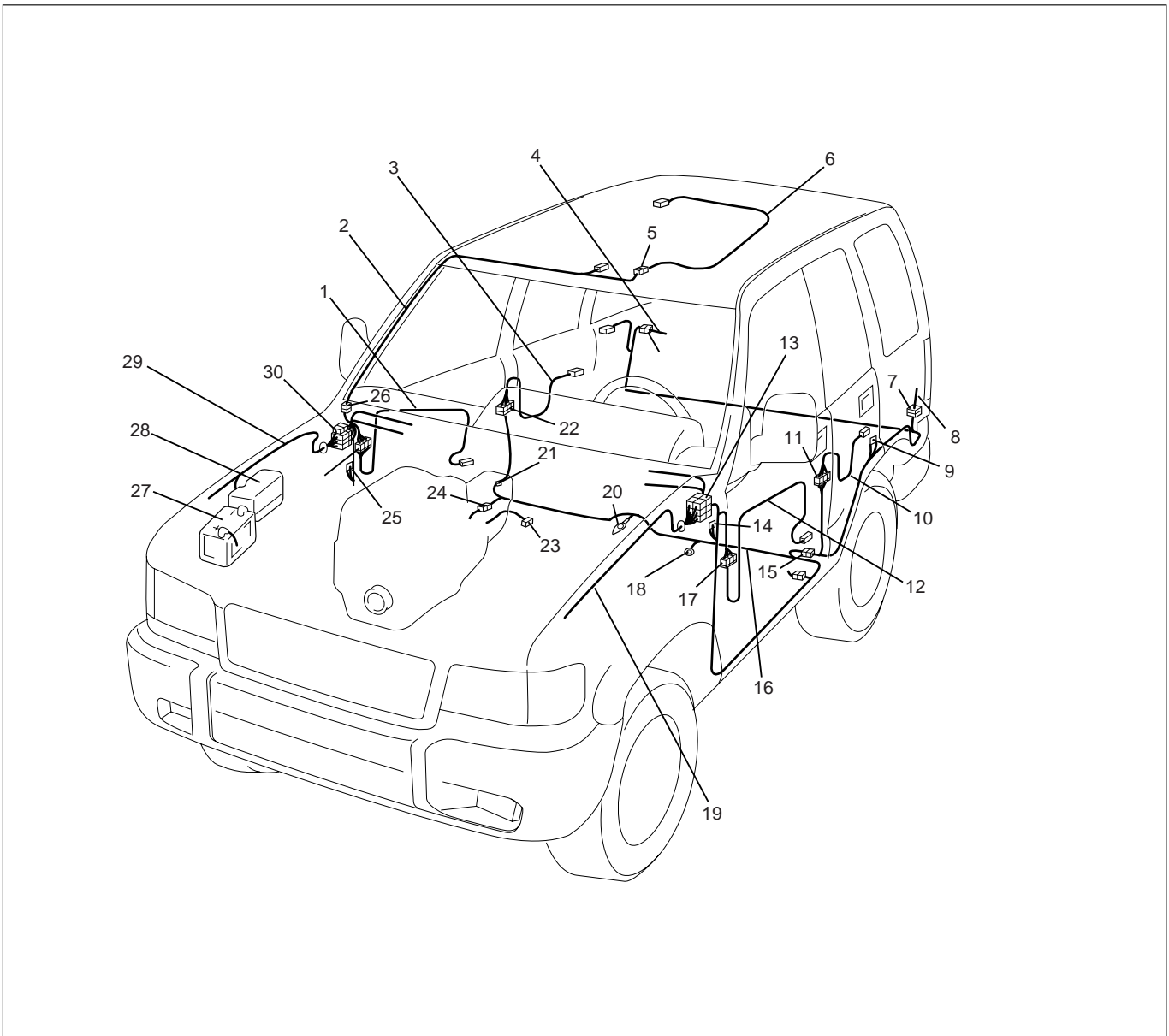
Legend

- | | |
|--|-------------------------------|
| (1) Body Harness | (16) C-16 |
| (2) Instrument Harness | (17) FRT Door Harness (LH) |
| (3) Domelight Harness | (18) Fuse Box |
| (4) RR Door Harness (RH) | (19) Engine Harness |
| (5) Sun Roof Harness | (20) Transmission Harness |
| (6) L-1 | (21) B-28 |
| (7) H-45 | (22) H-4, H-5, H-6 |
| (8) H-7, H-8, H-9, H-24, H-25, H-26, H-61, H-62,
H-64, H-65, H-66 | (23) B-26 |
| (9) RR Door Harness (LH) | (24) H-47 |
| (10) RR Body Harness | (25) H-58 |
| (11) Body Harness | (26) P-4 |
| (12) H-28, H-29 | (27) P-3 |
| (13) H-22, H-23 | (28) M-16 |
| (14) B-18, B-19 | (29) H-51 |
| (15) H-31, H-32, H-46 | (30) H-10, H-11, H-53 |
| | (31) Engine Room Harness (LH) |
| | (32) Battery Positive Cable |

8D-50 WIRING SYSTEM

- | | |
|-----------------------------|---|
| (33) Battery Negative Cable | (45) H-2, H-3 (4J**) |
| (34) P-7 | (46) Engine Room Harness (RH) |
| (35) P-10 | (47) Battery |
| (36) E-16 | (48) P-5 |
| (37) P-9 | (49) P-1 |
| (38) E-31, E-32 | (50) Relay and Fuse Box |
| (39) E-5 | (51) H-1, H-2, H-3 (6V*1) |
| (40) B-1, B-2 | (52) C-39 |
| (41) H-18, H-19 | (53) FRT Door Harness (RH) |
| (42) P-2 | (54) H-12, H-13, H-14, H-15, H-16, H-20, H-48 |
| (43) P-6 | (55) H-21 |
| (44) H-41, H-42, H-43, H-60 | |
-

Cable Harness Routing (LHD) – 2

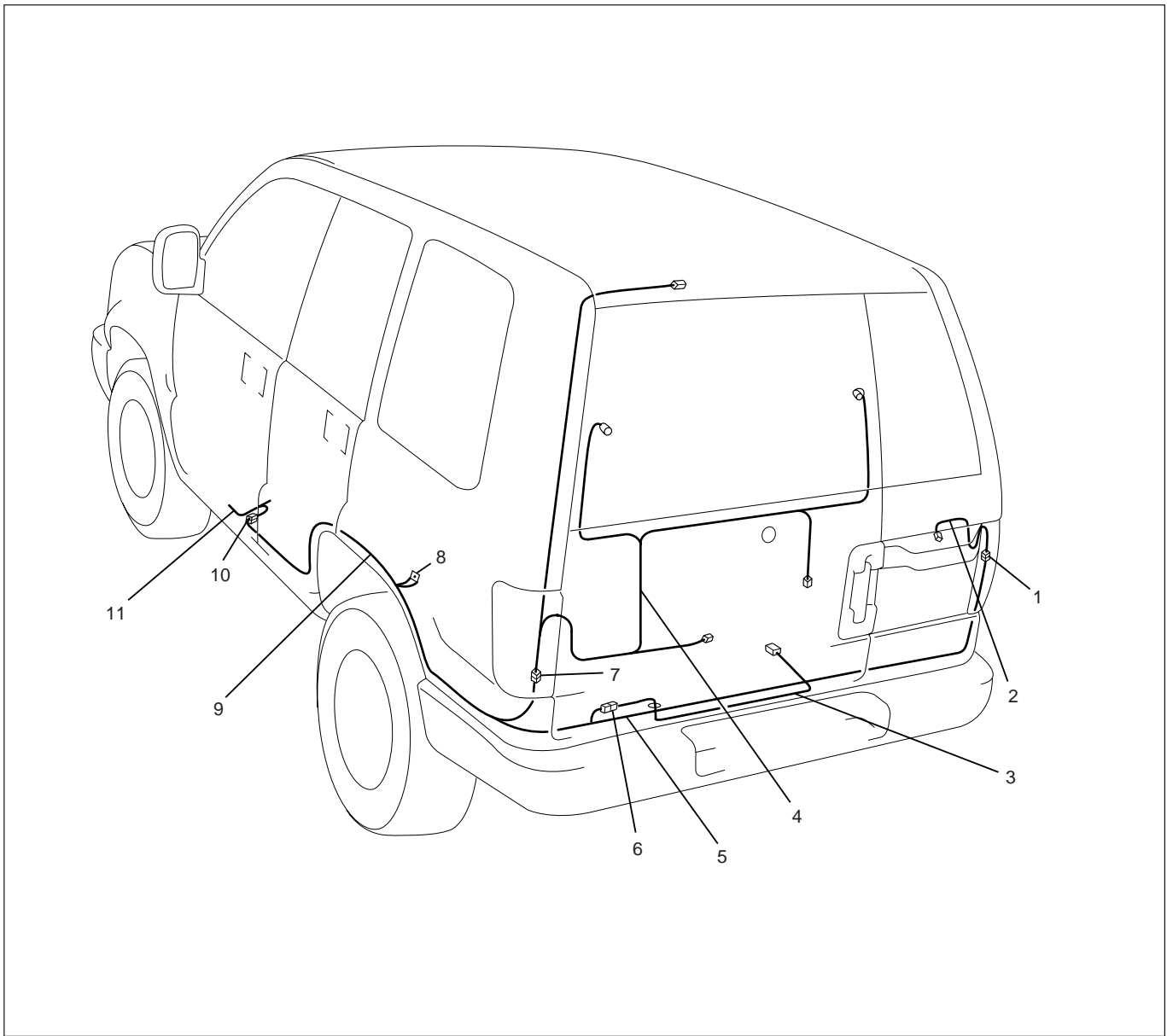


D08RWB03

Legend

- | | |
|--|---|
| (1) FRT Door Harness (RH) | (15) H-31, H-32, H-46 |
| (2) Domelight Harness | (16) Body Harness |
| (3) RR Door Harness (RH) | (17) H-22, H-23 |
| (4) Tail Gate Harness (RH) | (18) B-28 |
| (5) H-45 | (19) Engine Room Harness (LH) |
| (6) Sun Roof Harness | (20) B-26 |
| (7) H-37, H-38 | (21) H-47 |
| (8) Tail Gate Harness (LH) | (22) H-34, H-35 |
| (9) R-3, R-4 | (23) C-85 |
| (10) RR Door Harness (LH) | (24) H-58 |
| (11) H-28, H-29 | (25) B-1, B-2 |
| (12) FRT Door Harness (LH) | (26) H-21 |
| (13) H-7, H-8, H-9, H-24, H-25, H-26, H-61, H-62, H-64, H-65, H-66 | (27) Battery |
| (14) B-18, B-19 | (28) Relay and Fuse Box |
| | (29) Engine Room Harness (RH) |
| | (30) H-12, H-13, H-14, H-15, H-16, H-20, H-48 |

Cable Harness Routing (LHD) – 3



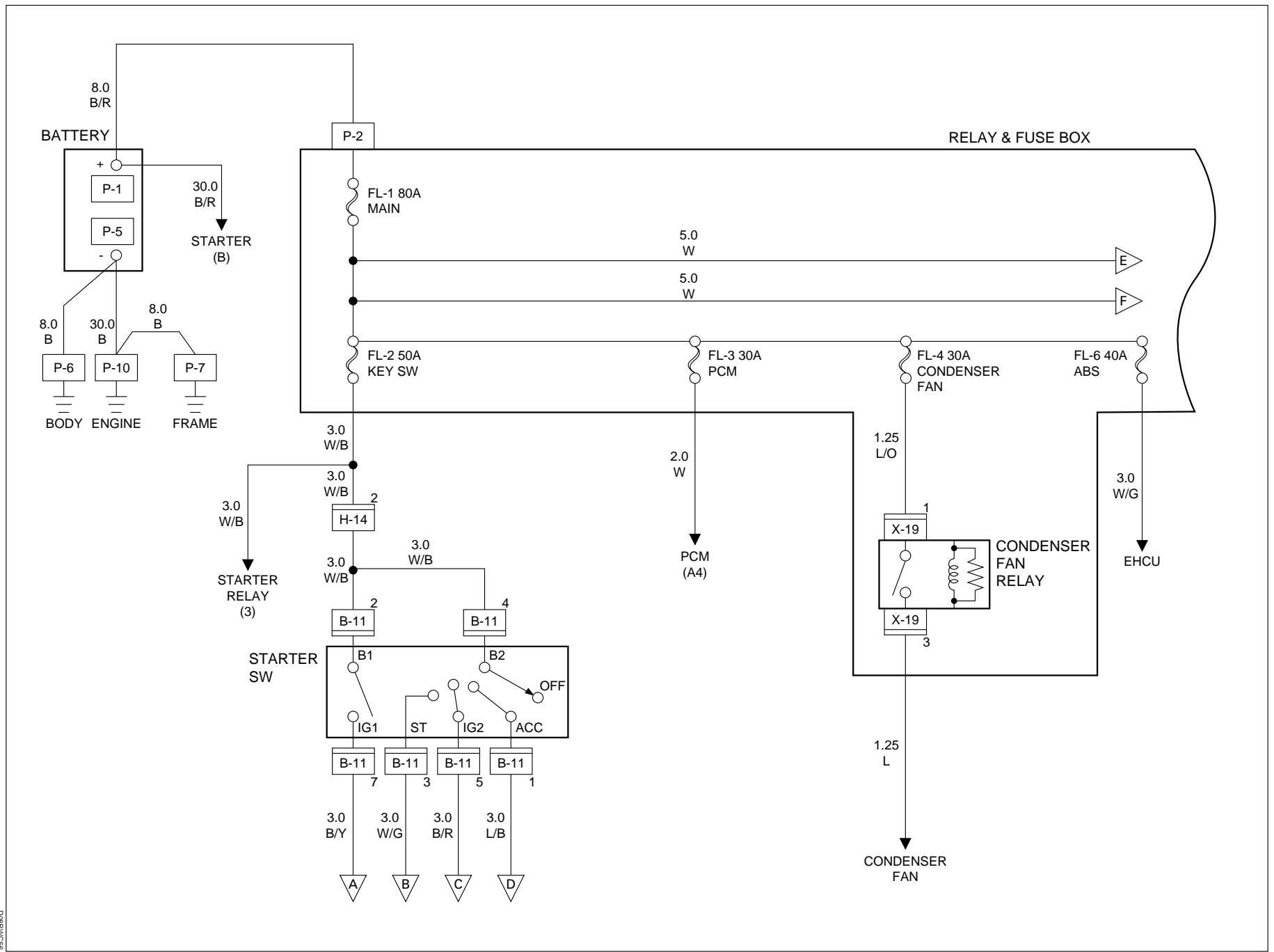
D08RWB02

Legend

- | | |
|----------------------------|-----------------------|
| (1) H-39 | (6) H-33 |
| (2) Tail Gate Harness (RH) | (7) H-37, H-38 |
| (3) Chassis Harness | (8) R-3, R-4 |
| (4) Tail Gate Harness (LH) | (9) RR Body Harness |
| (5) RR Body Harness | (10) H-31, H-32, H-46 |
| | (11) Body Harness |

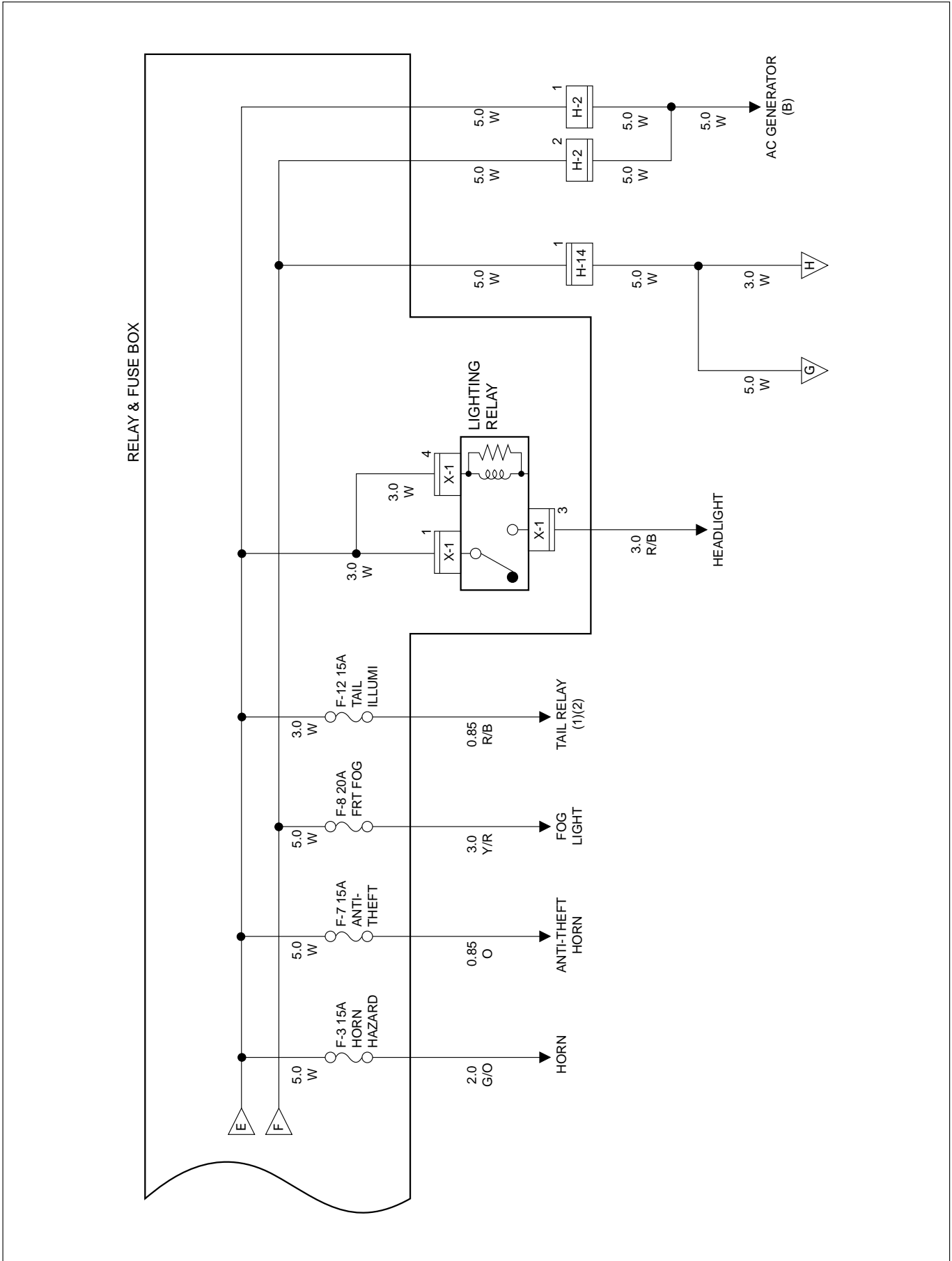
Fuse Block Circuit

Circuit Diagram (6V*1) - 1

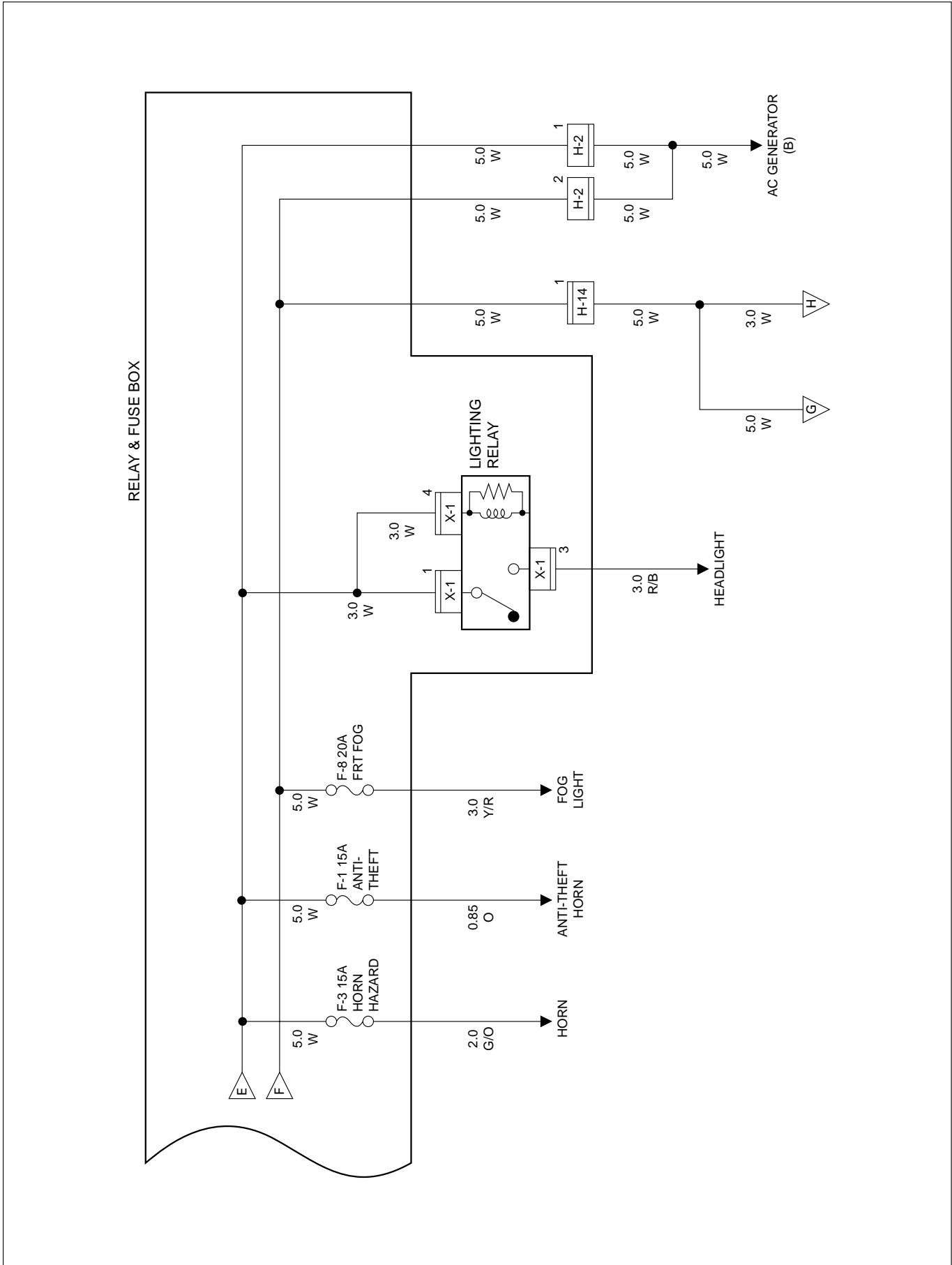


DBR/RVCS66

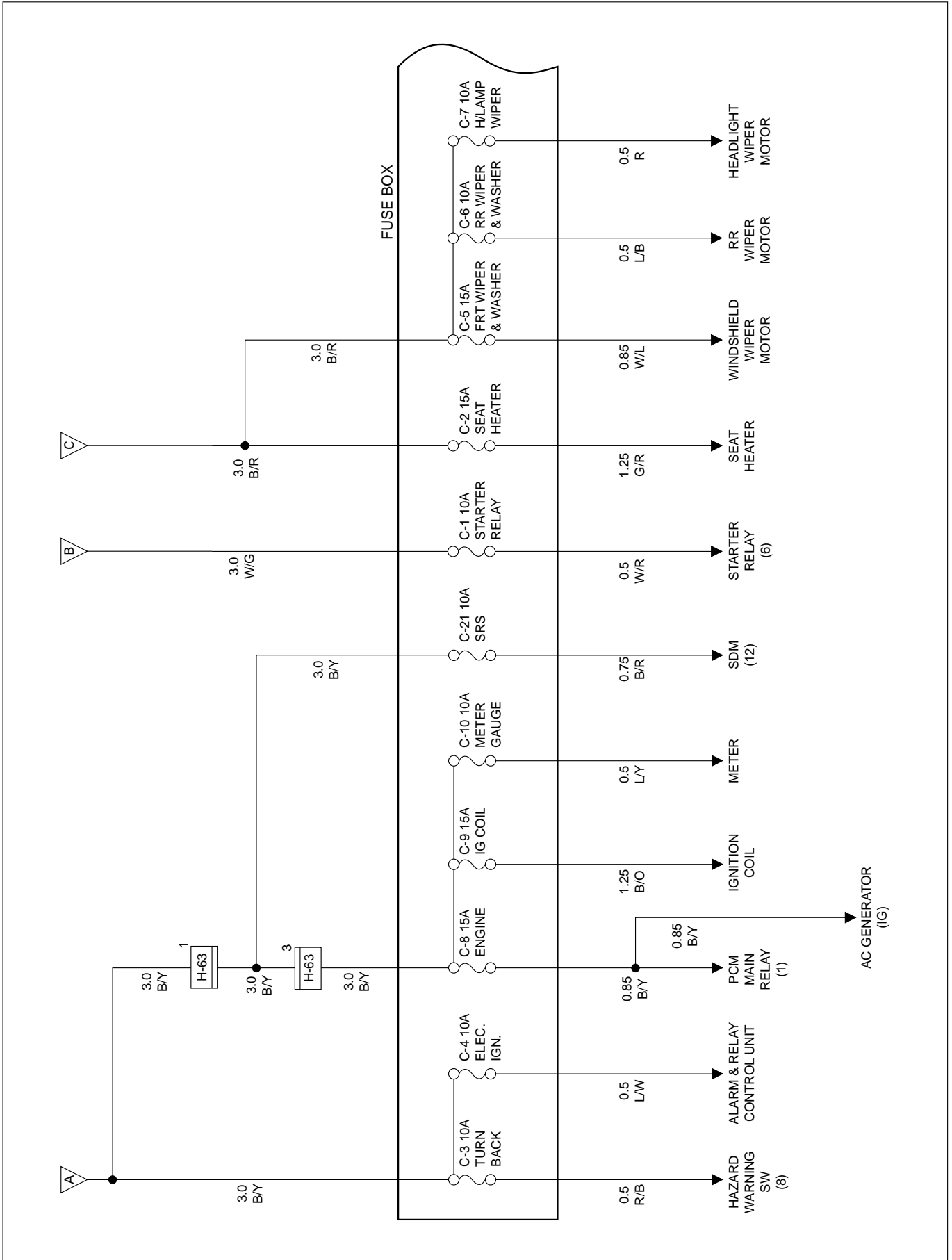
Circuit Diagram (RHD 6V*1) – 2



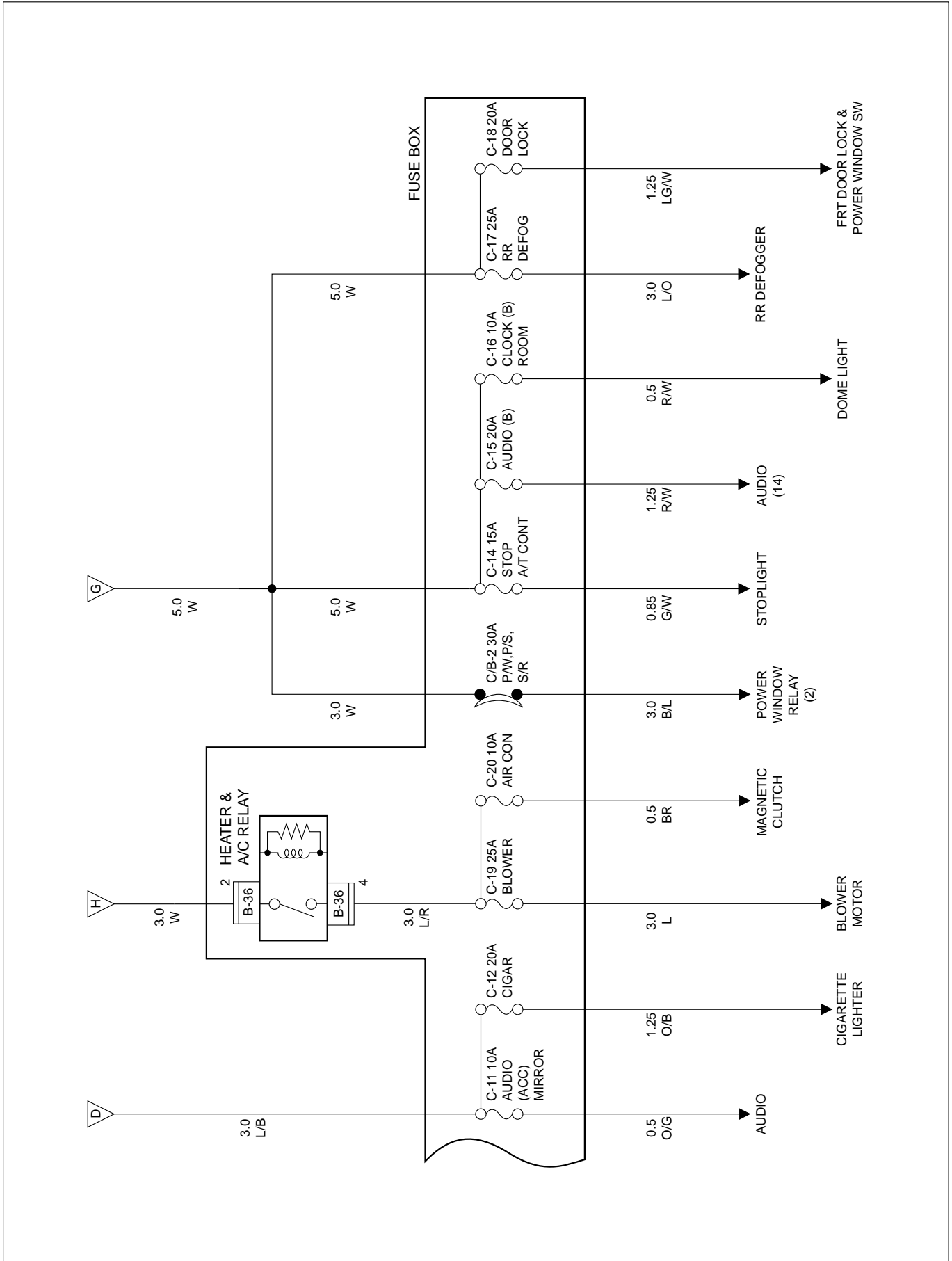
Circuit Diagram (LHD 6V*1) – 2



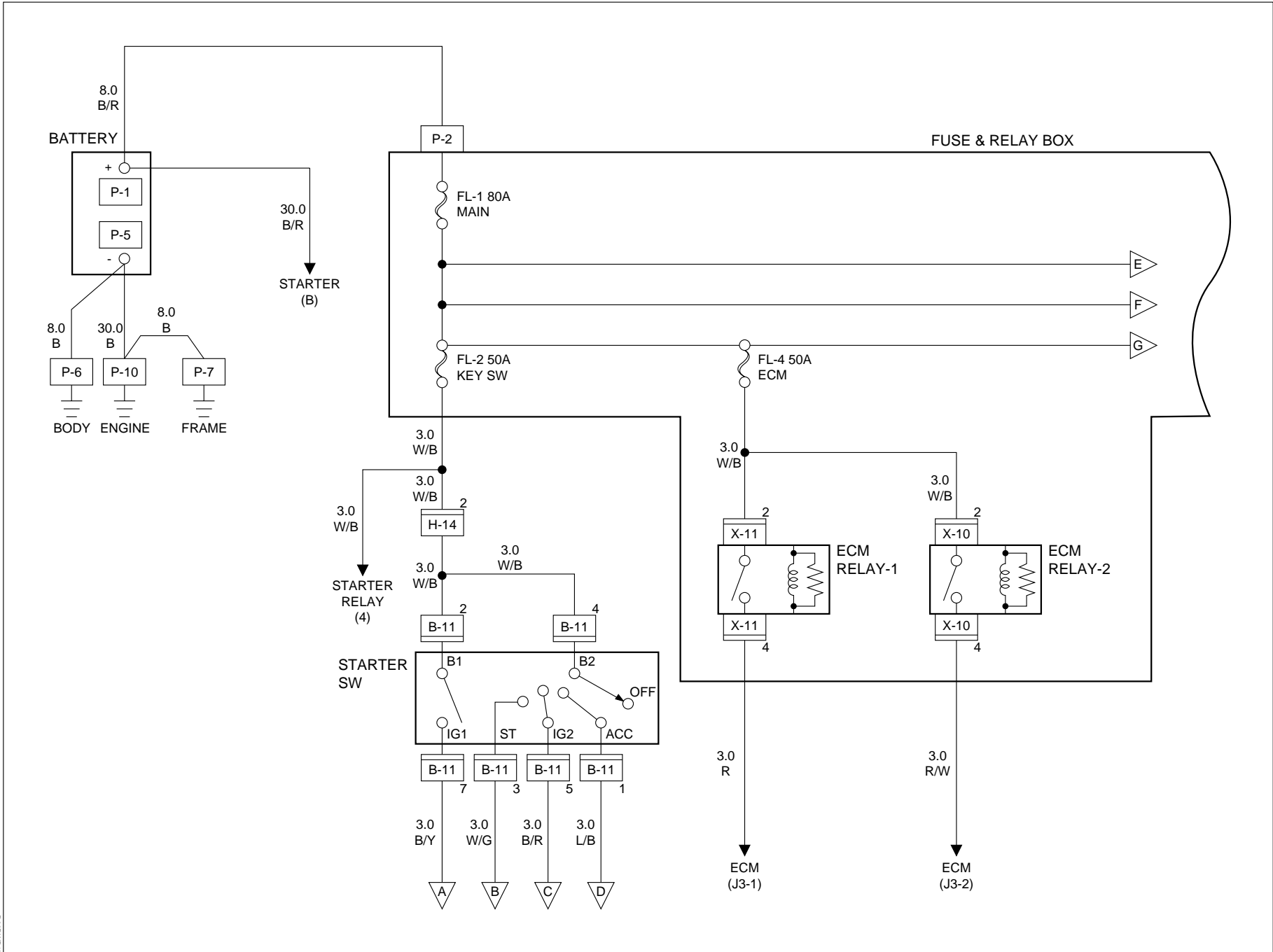
Circuit Diagram (6V*1) – 3



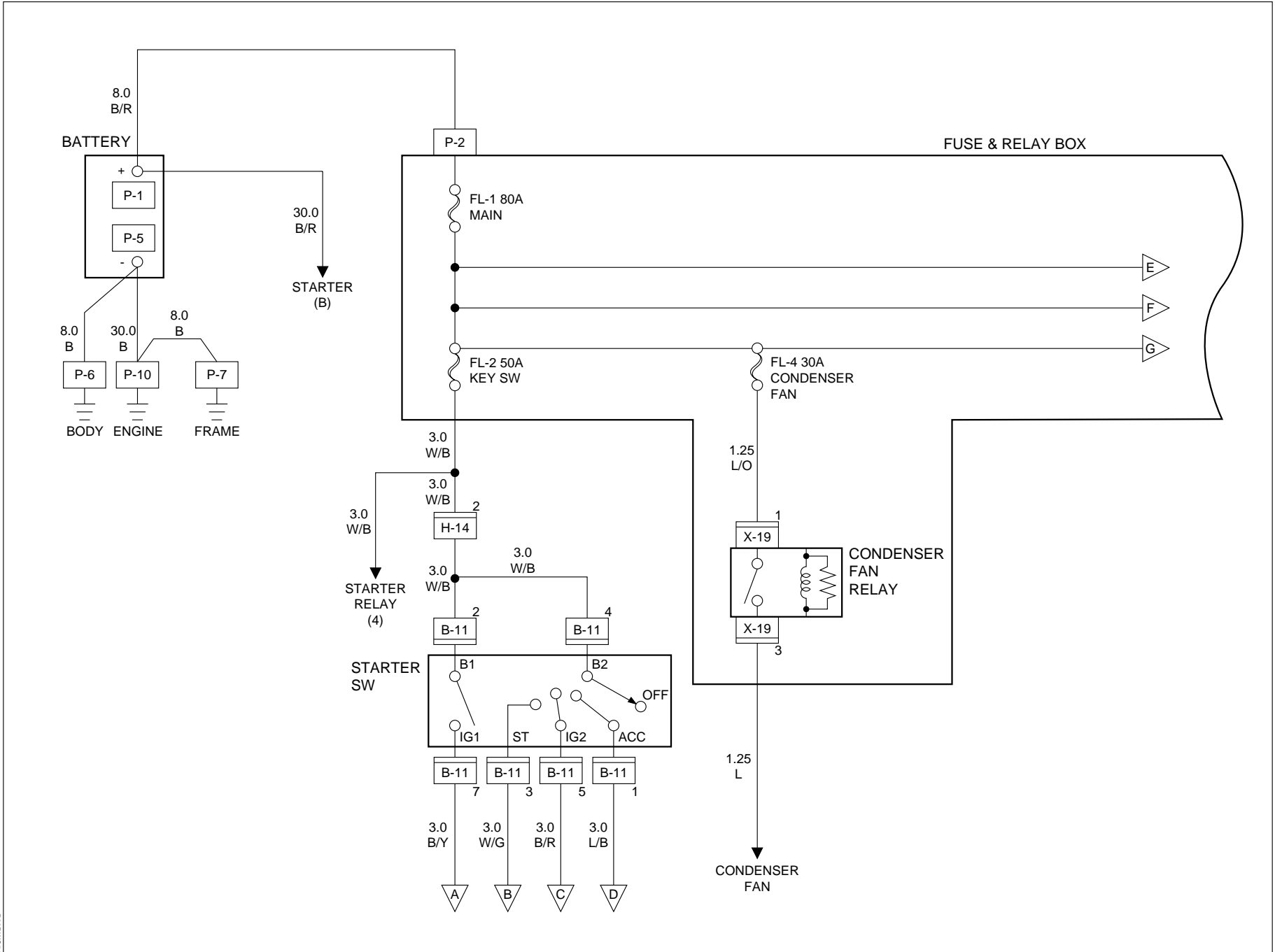
Circuit Diagram (6V*1) – 4



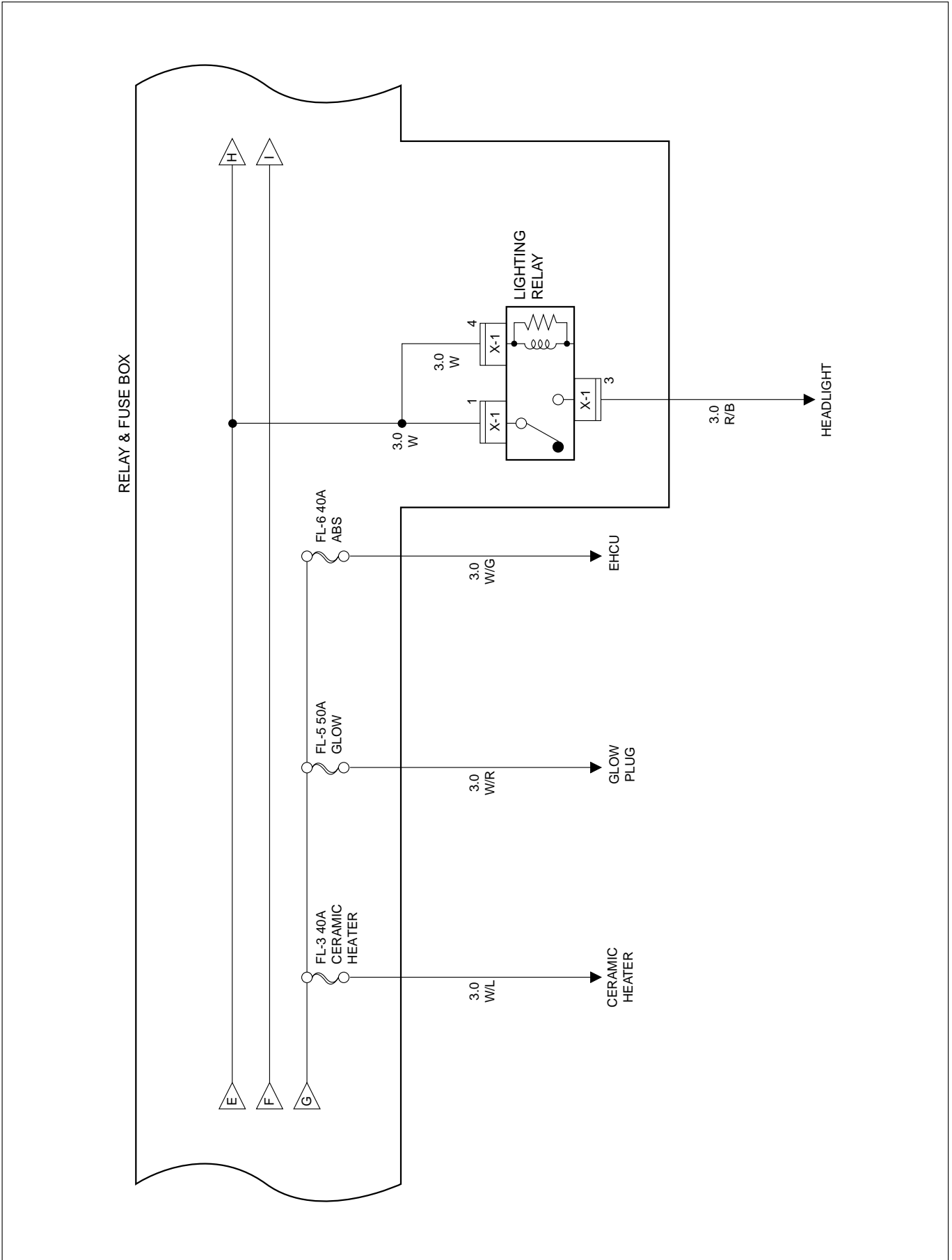
Circuit Diagram (4JX1) - 1



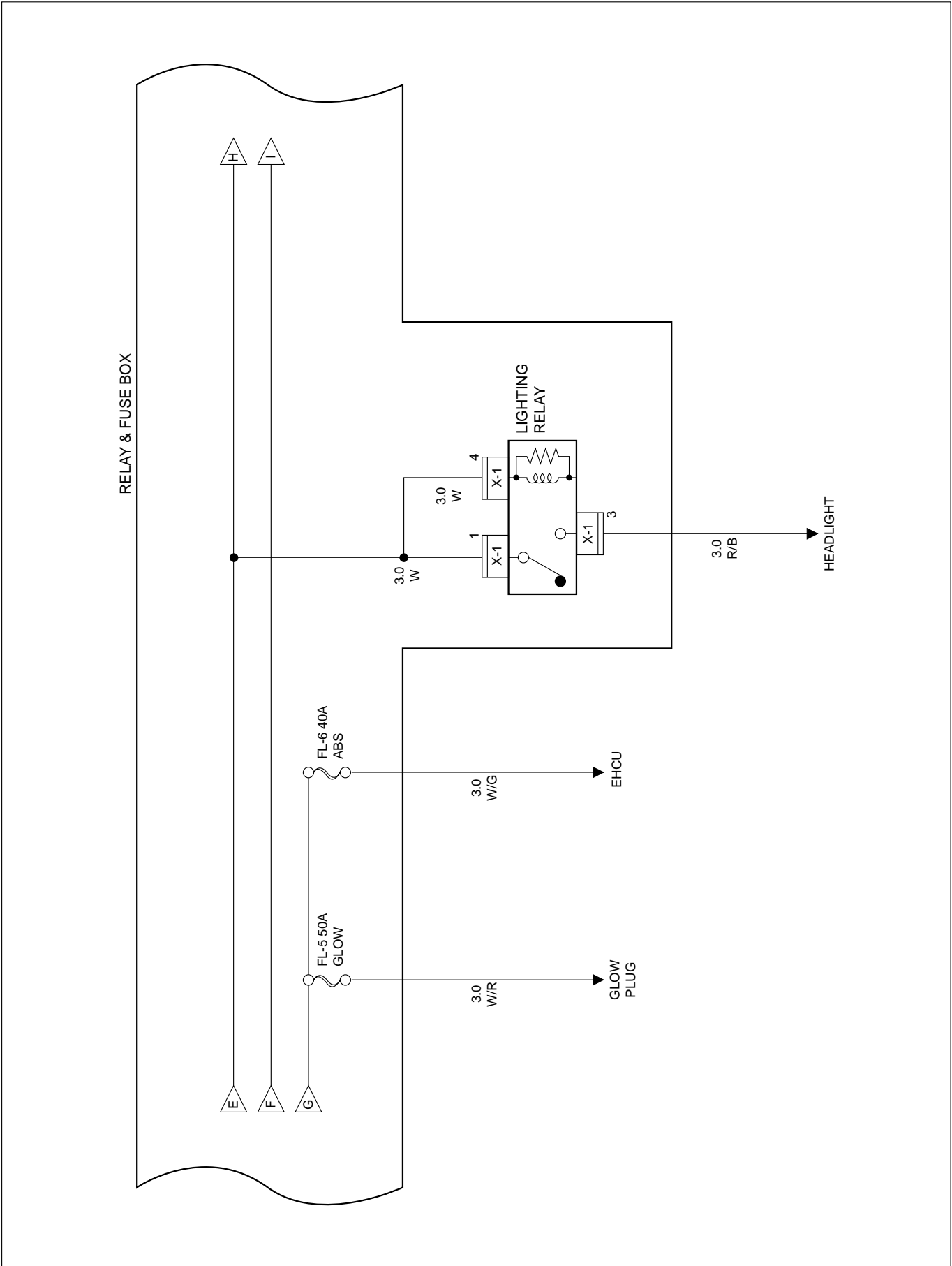
Circuit Diagram (4JG2) - 1



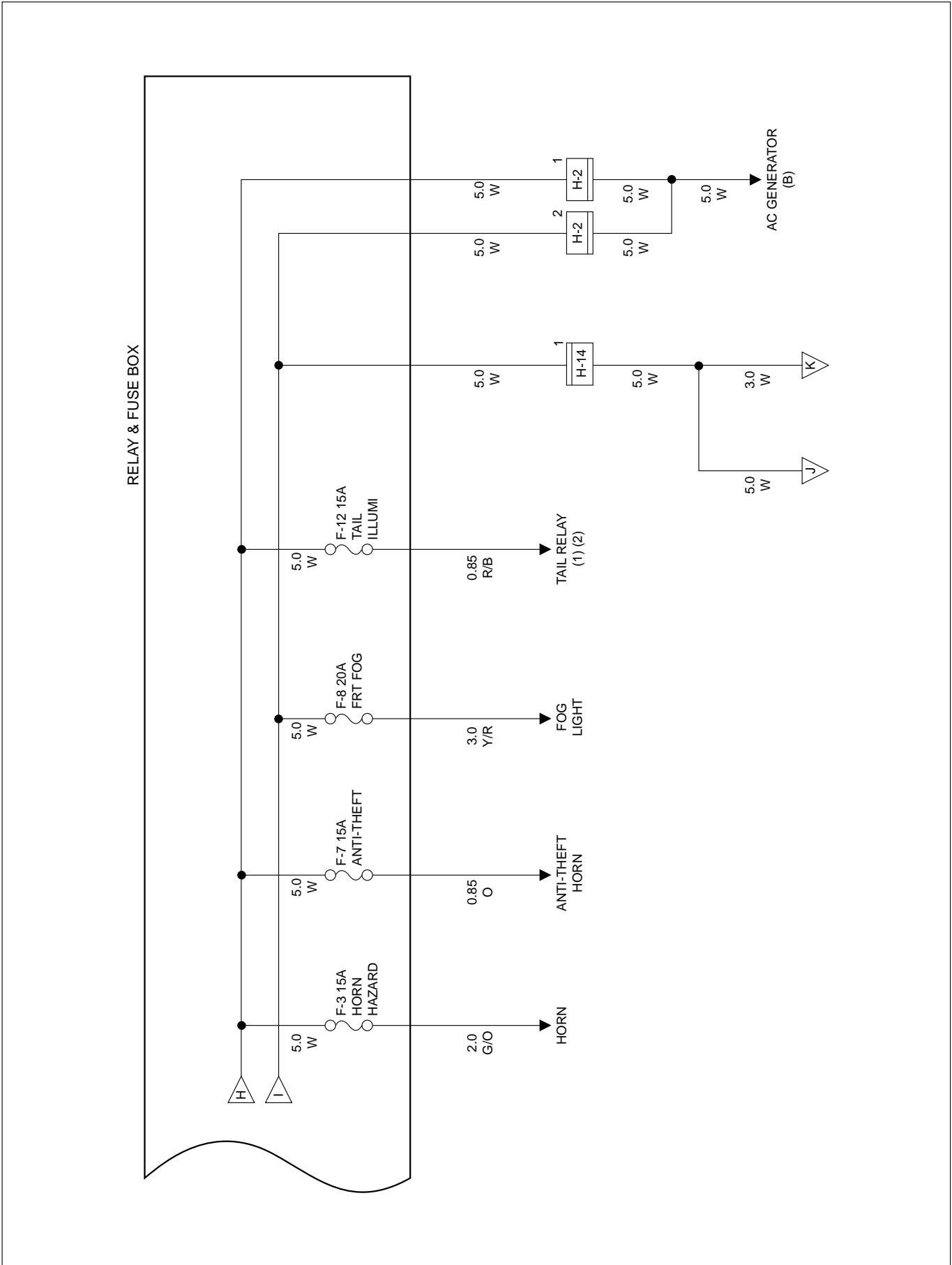
Circuit Diagram (4JX1) – 2



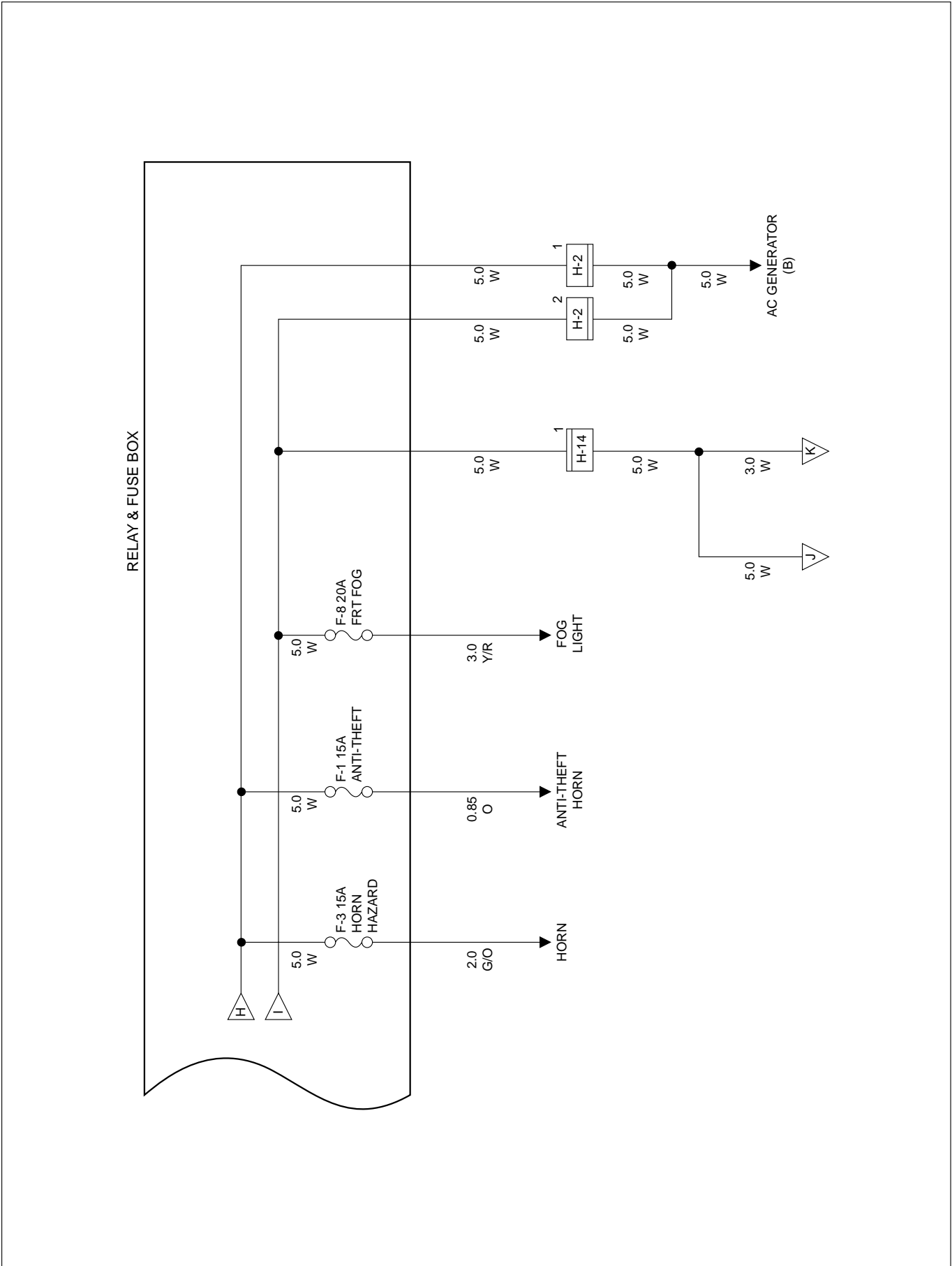
Circuit Diagram (4JG2) – 2



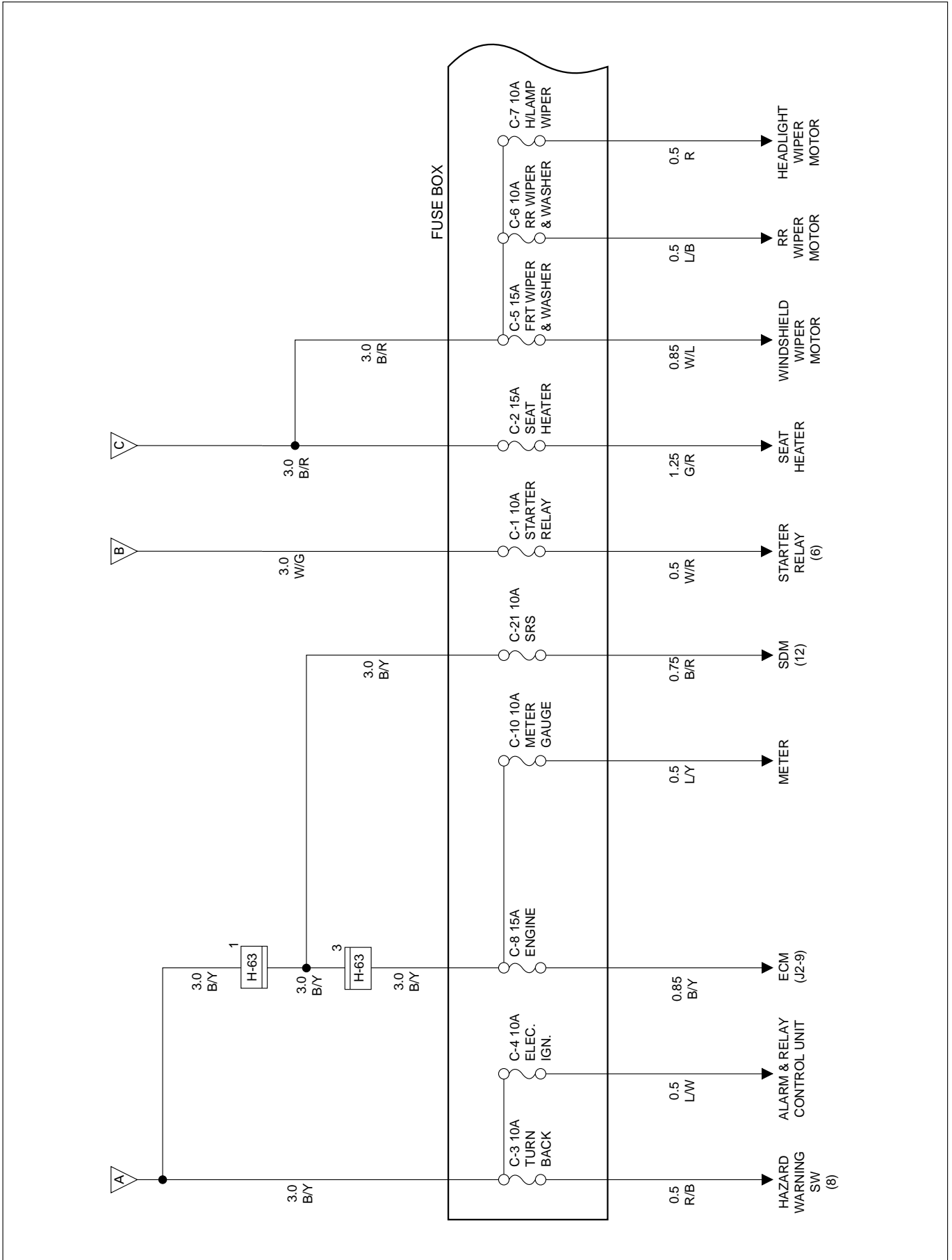
Circuit Diagram (RHD Diesel) – 3



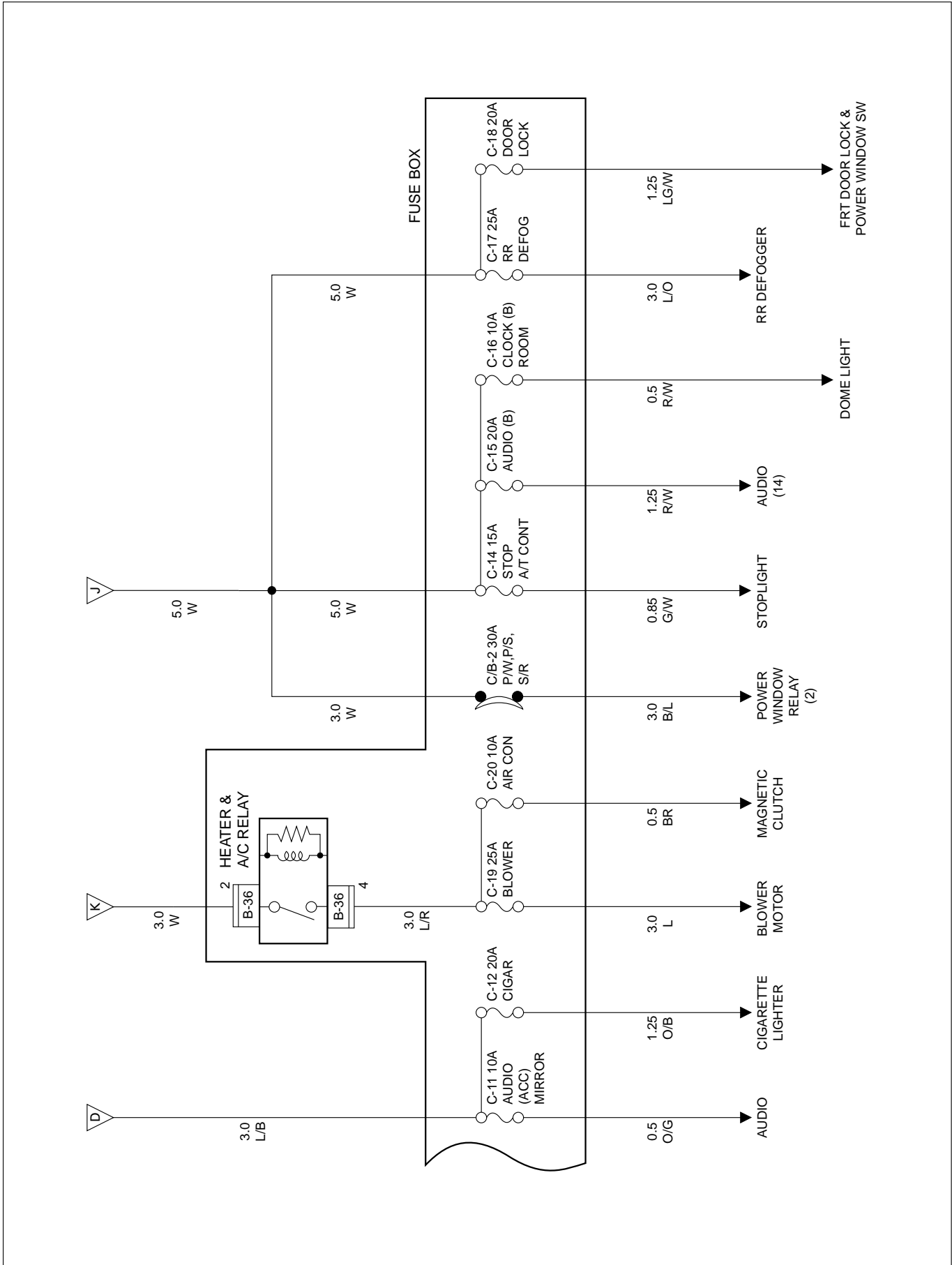
Circuit Diagram (LHD Diesel) – 3



Circuit Diagram (Diesel) – 4



Circuit Diagram (Diesel) – 5



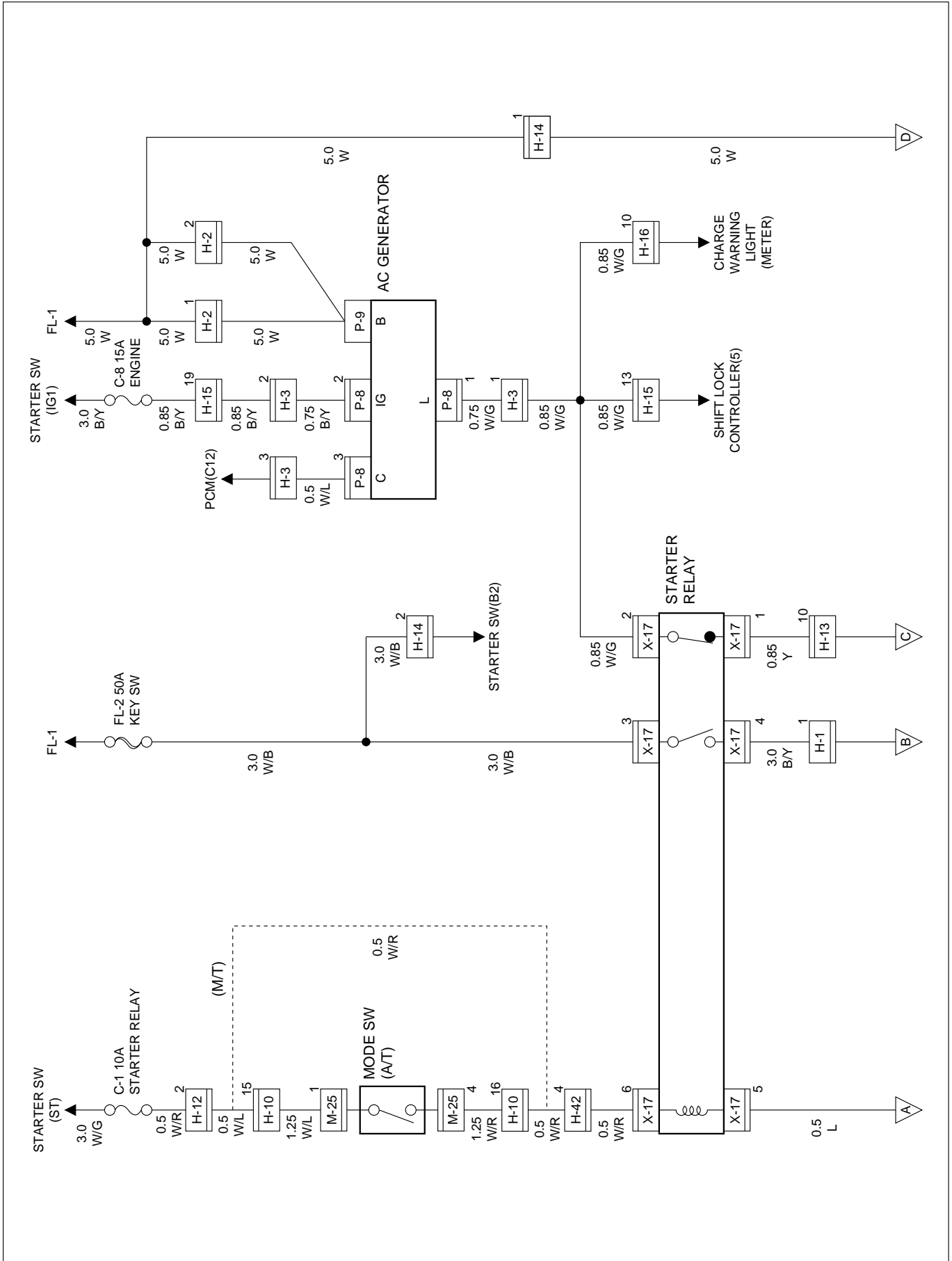
Start and Charging

General Description

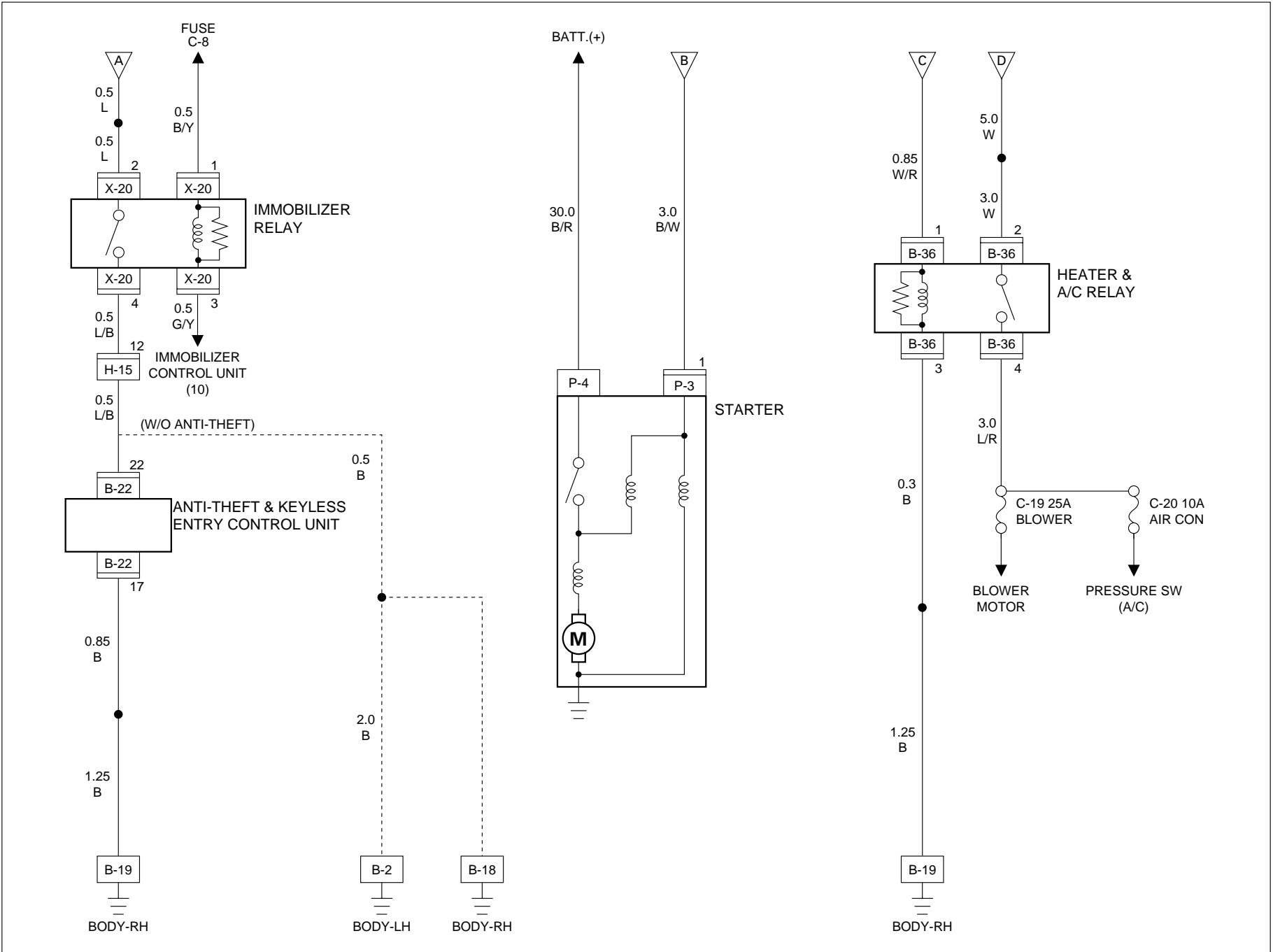
The system consists of the starter switch, starter, AC generator, starter relay, mode SW (A/T), charge relay (Diesel) and heater & A/C relay.

When the starter SW is set to the "ST" position with the A/T select at "P" (Parking) or "N" (Neutral) position (Mode SW "ON"), the battery voltage is applied to the starter solenoid coil through the starter relay to start the starter. At the same time, the starter relay (charge relay; Diesel) cuts off the blower motor and the A/C circuit.

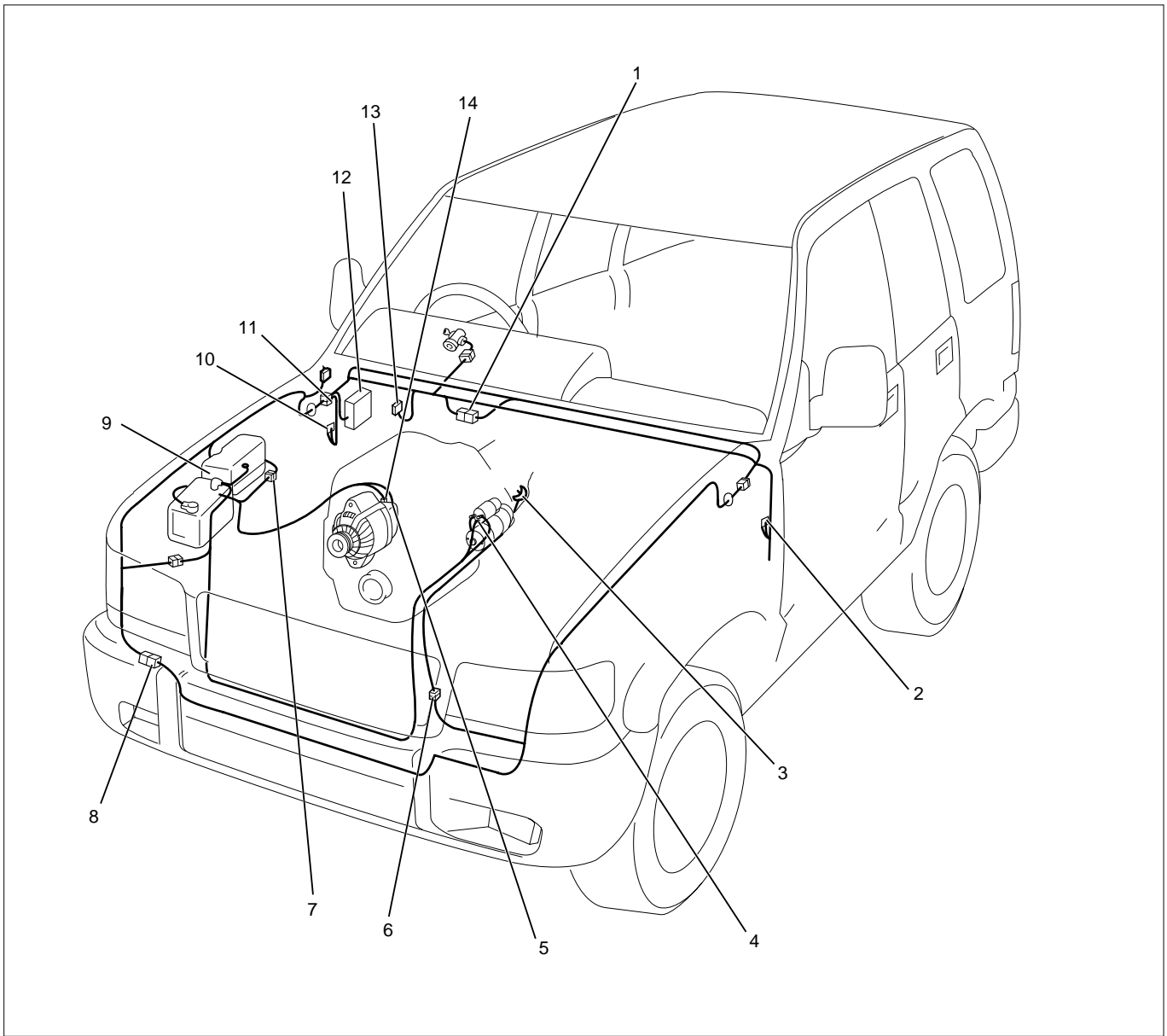
Circuit Diagram (RHD 6V*1) - 1



Circuit Diagram (RHD 6V*1) - 2



Parts Location (RHD 6V*1)



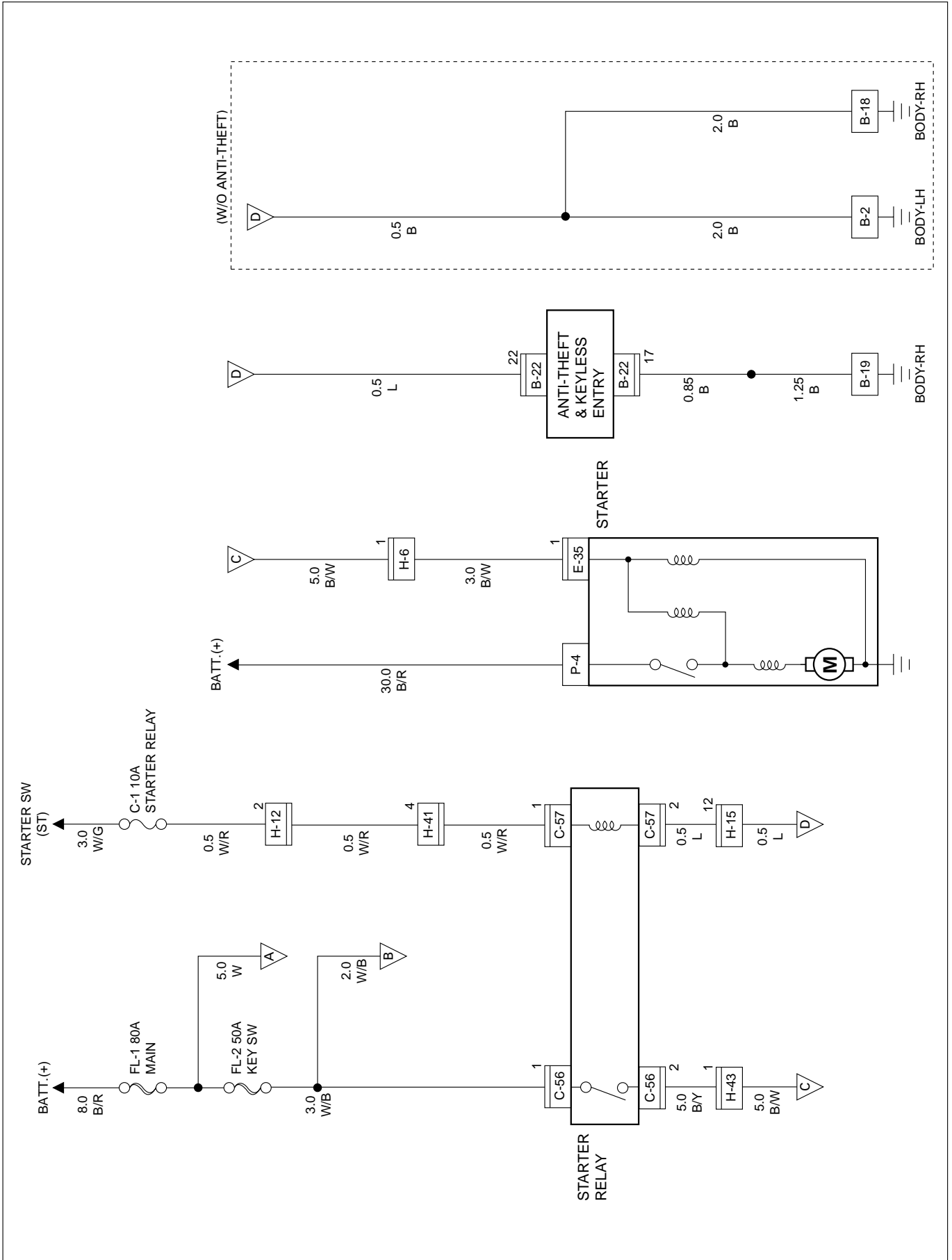
D08RW617

Legend

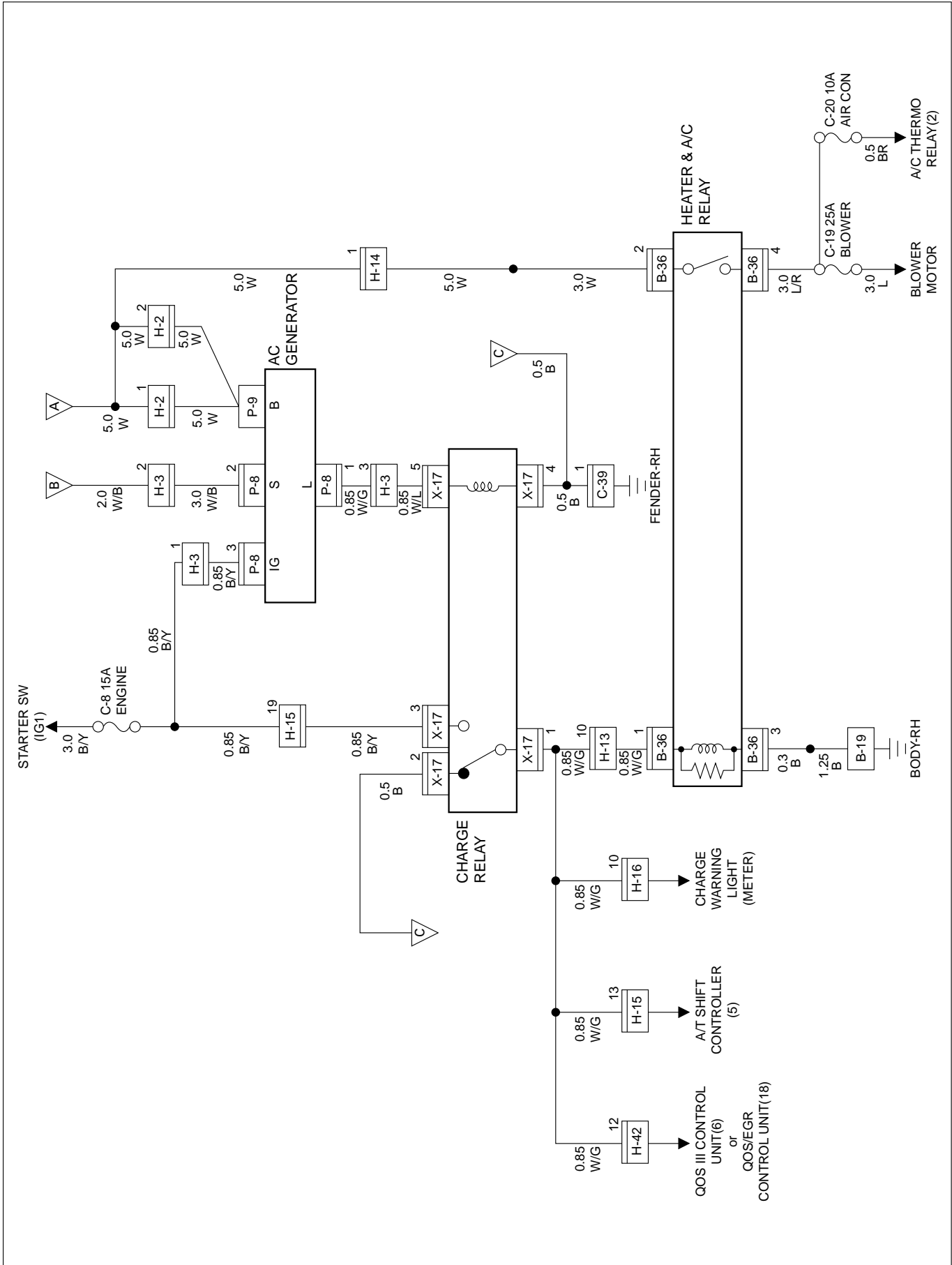
- (1) H-12
- (2) B-2
- (3) M-25
- (4) P-3
- (5) P-9
- (6) H-10
- (7) H-1, H-2, H-3

- (8) H-42
- (9) Relay and Fuse Box (X-17, X-20)
- (10) B-18, B-19
- (11) H-13, H-14, H-15, H-16
- (12) Fuse Box (B-36)
- (13) B-20
- (14) P-8

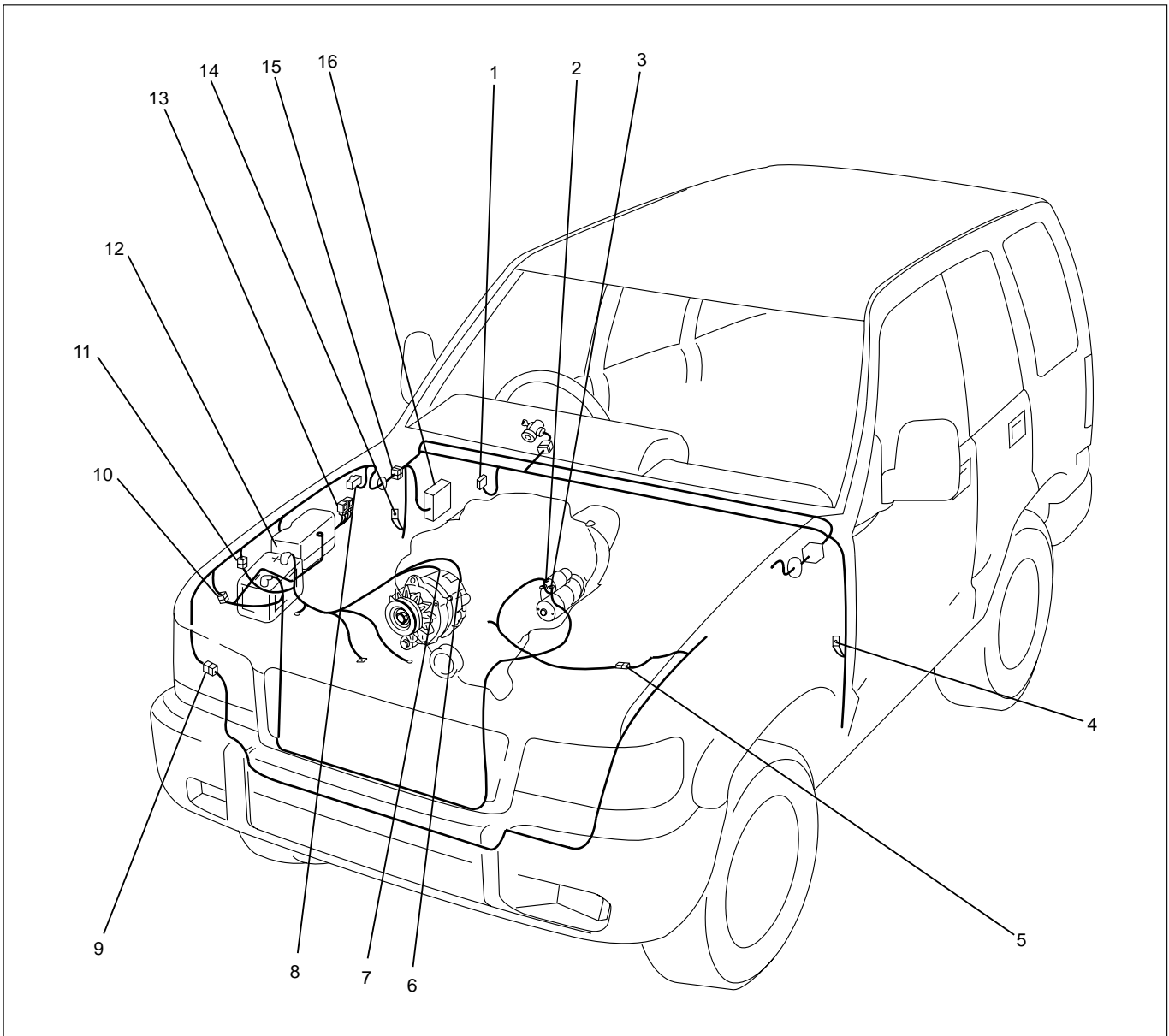
Circuit Diagram (RHD 4JG2)-1



Circuit Diagram (RHD 4JG2) – 2



Parts Location (RHD 4JG2)

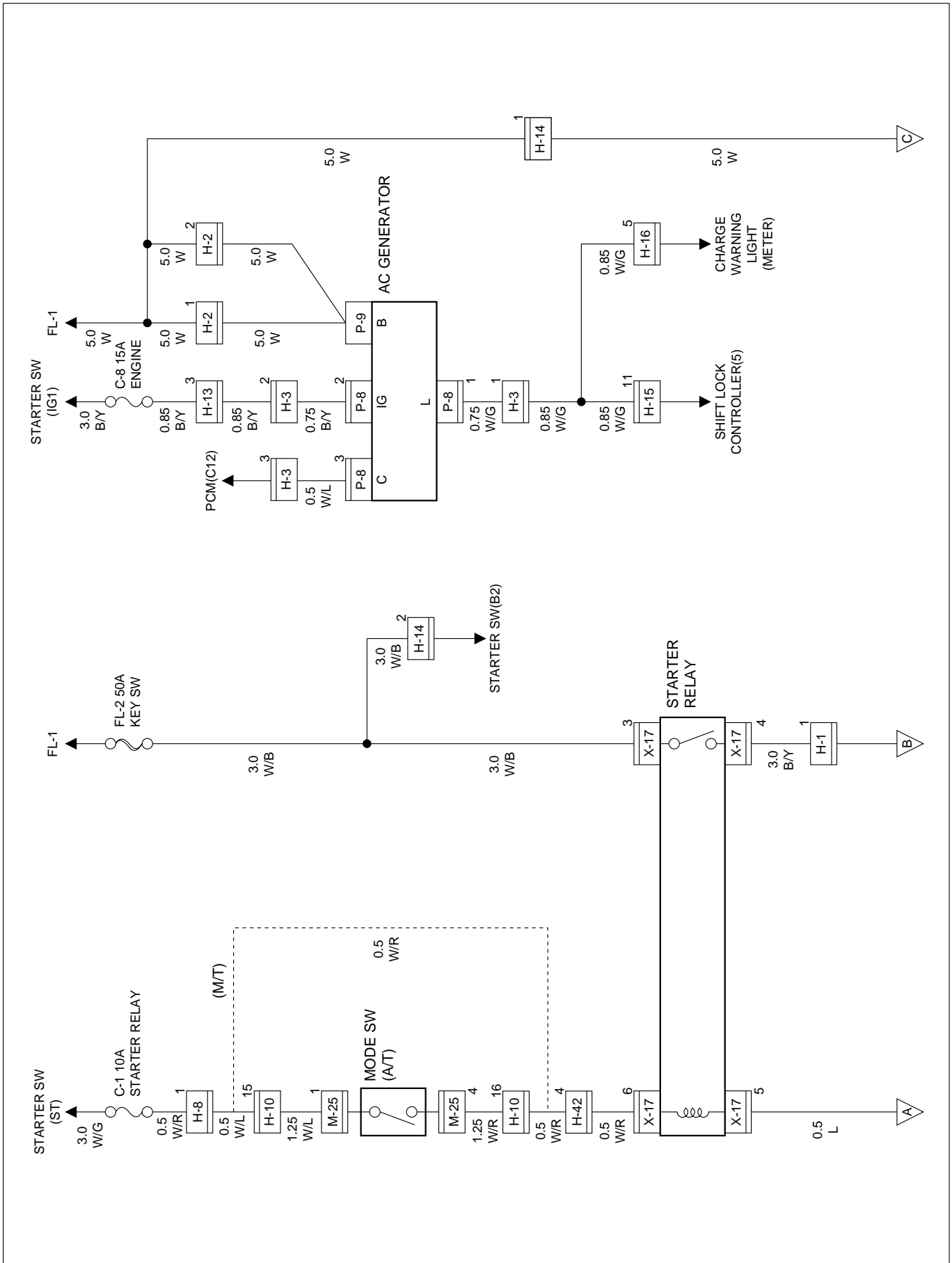


D08RW839

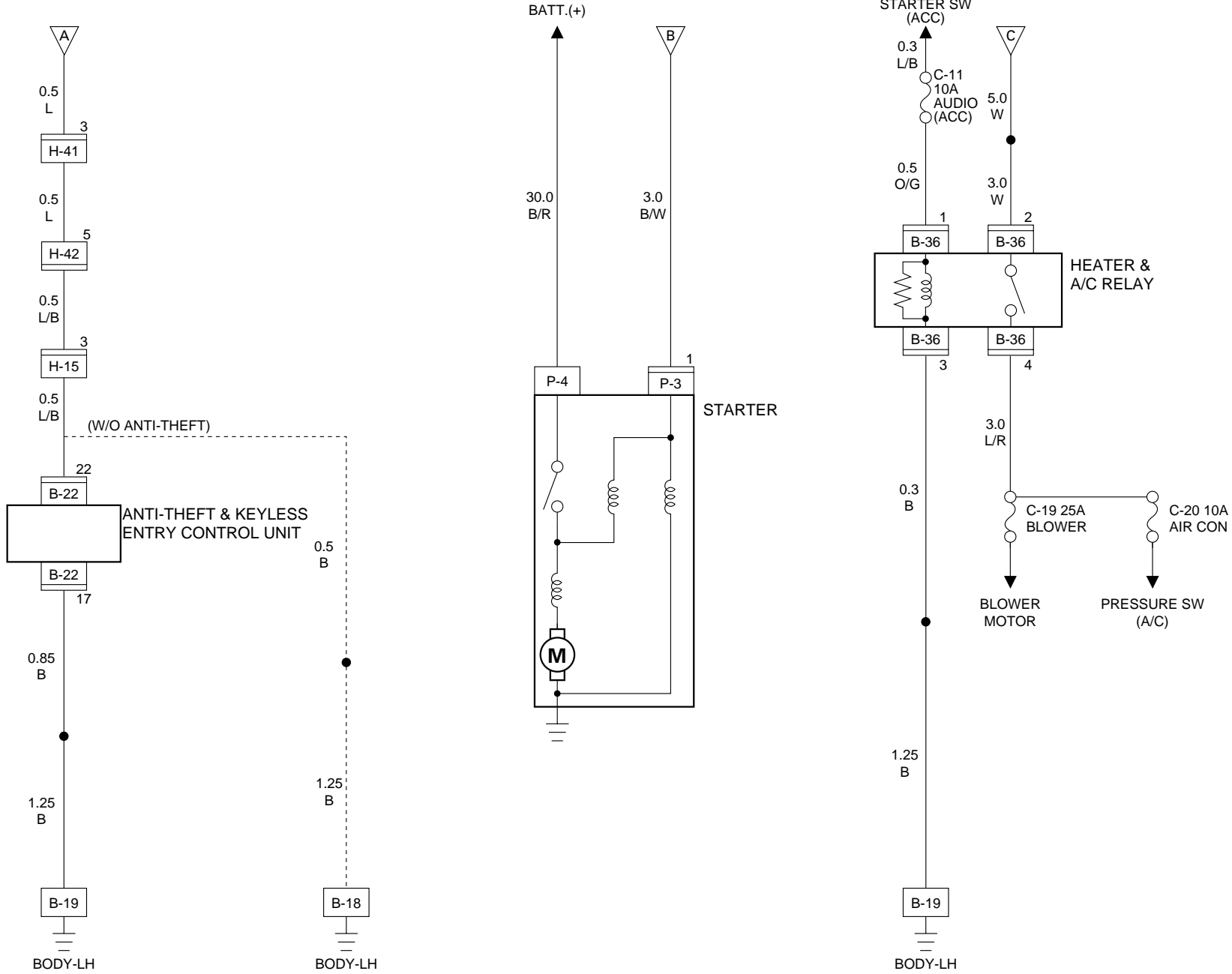
Legend

- | | |
|----------|-----------------------------------|
| (1) B-22 | (9) H-41, H-42, H-43 |
| (2) E-35 | (10) H-2 |
| (3) P-4 | (11) H-3 |
| (4) B-2 | (12) Relay and Fuse Box (X-17) |
| (5) H-6 | (13) C-56, C-57 |
| (6) P-9 | (14) B-18, B-19 |
| (7) P-8 | (15) H-12, H-13, H-14, H-15, H-16 |
| (8) C-39 | (16) Fuse Box (B-36) |

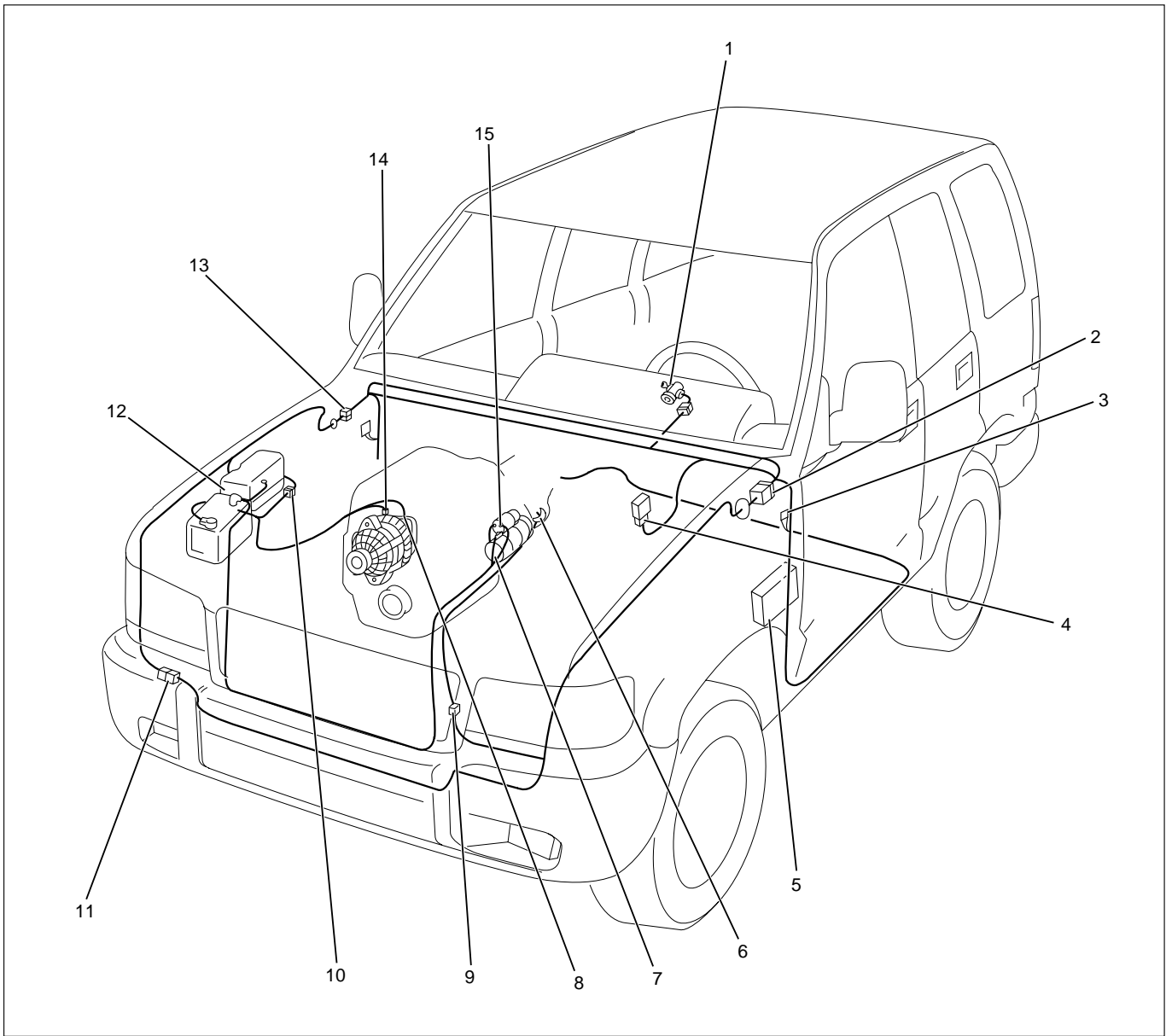
Circuit Diagram (LHD 6V*1)-1



Circuit Diagram (LHD 6V*1) - 2



Parts Location (LHD 6V*1)

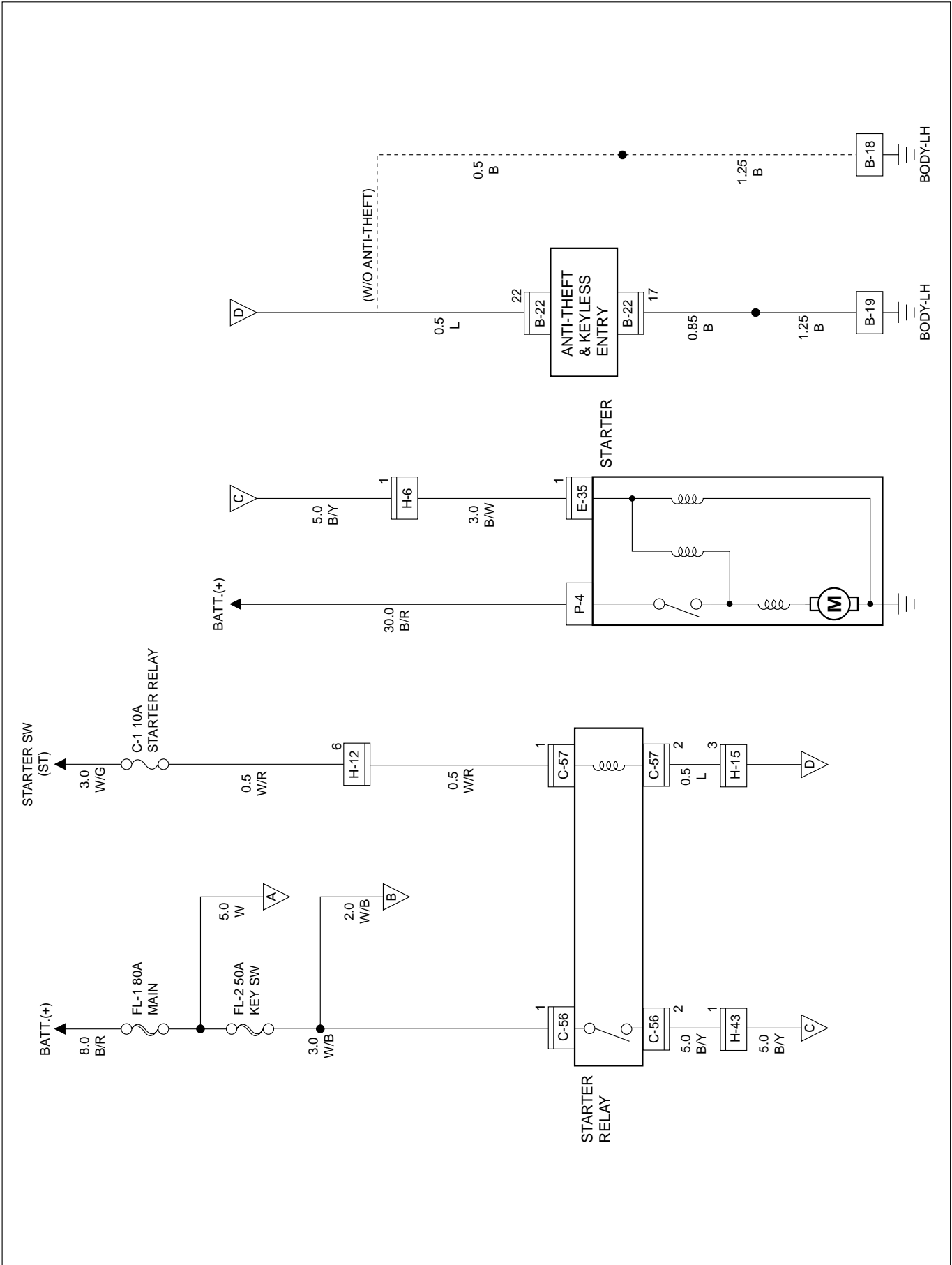


D08RW896

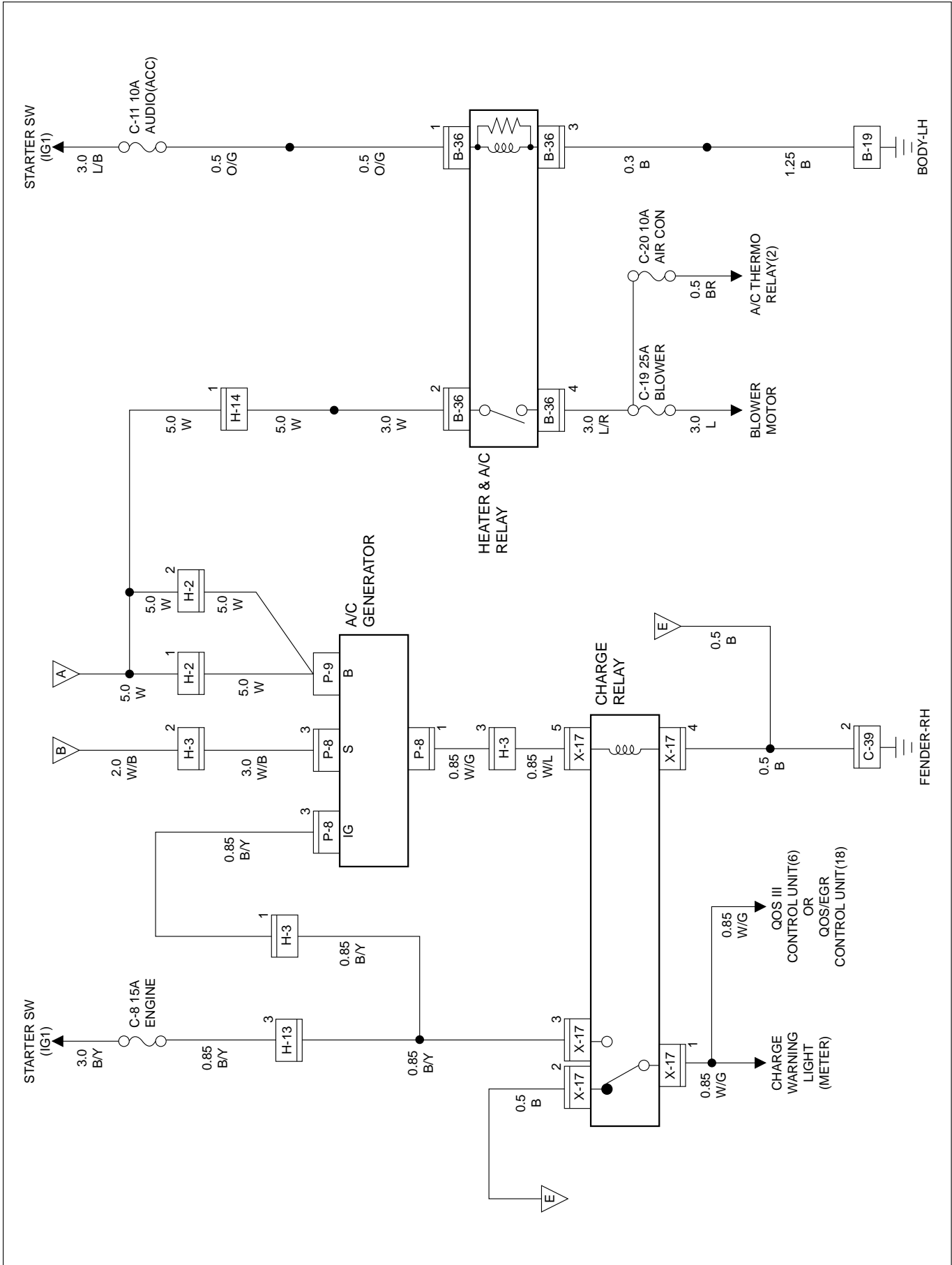
Legend

- | | |
|---------------------|--------------------------------|
| (1) Starter Switch | (8) P-9 |
| (2) H-8 | (9) H-10 |
| (3) B-18, B-19 | (10) H-1, H-2, H-3 |
| (4) B-20 | (11) H-41, H-42 |
| (5) Fuse Box (B-36) | (12) Relay and Fuse Box (X-17) |
| (6) M-25 | (13) H-13, H-14, H-15, H-16 |
| (7) P-3 | (14) P-8 |
| | (15) P-4 |

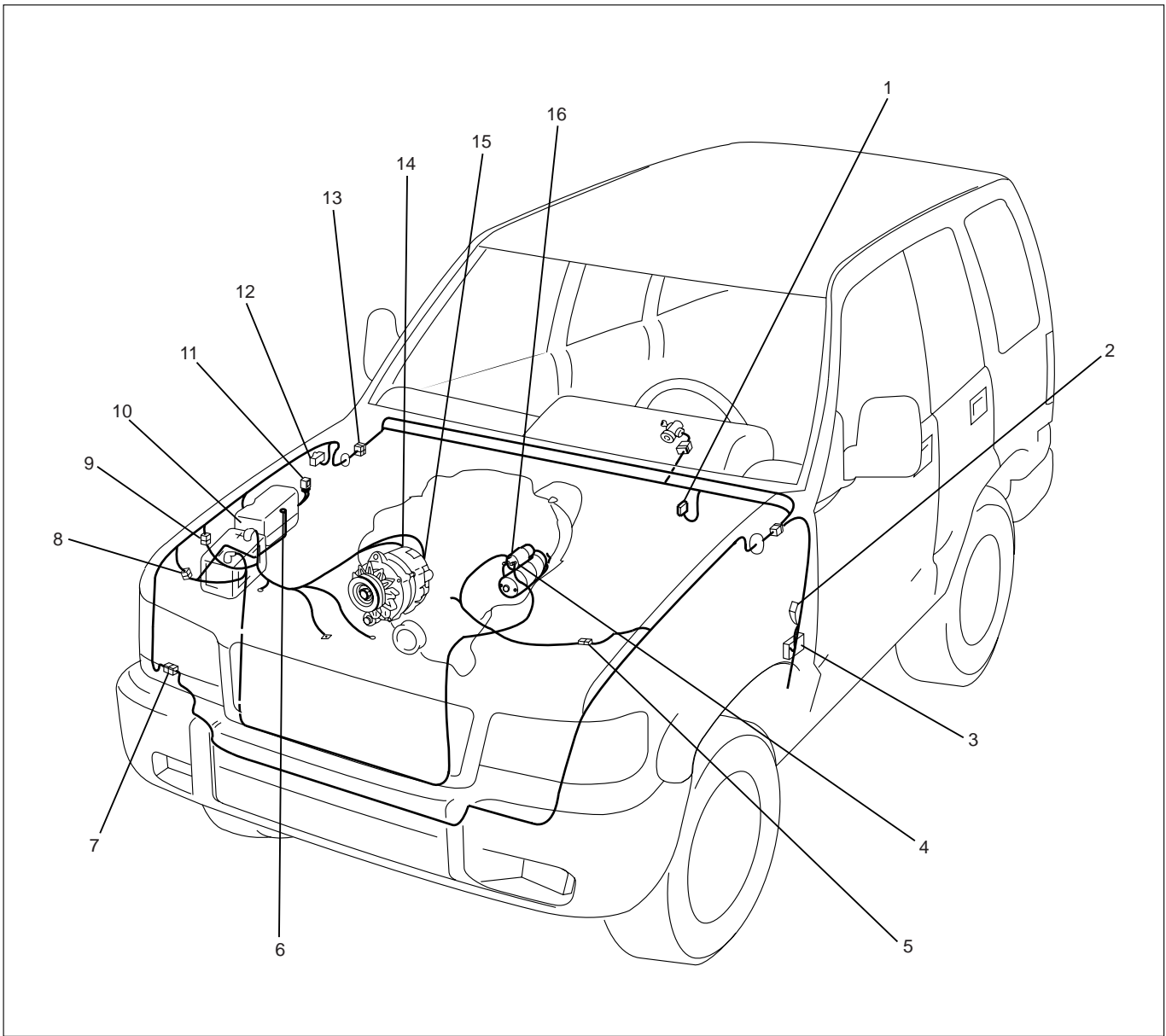
Circuit Diagram (LHD 4JG2)-1



Circuit Diagram (LHD 4JG2)-2



Parts Location (LHD 4JG2)



D08RW900

Legend

- | | |
|---------------------|--------------------------------|
| (1) B-22 | (9) H-3 |
| (2) B-18, B-19 | (10) Relay and Fuse Box (X-17) |
| (3) Fuse Box (B-36) | (11) C-56, C-57 |
| (4) P-4 | (12) C-39 |
| (5) H-6 | (13) H-13, H-14, H-16 |
| (6) P-2 | (14) P-8 |
| (7) H-43 | (15) P-9 |
| (8) H-2 | (16) E-35 |

Powertrain Control Module (PCM)

General Description

The Powertrain Control Module (PCM) is located in the passenger compartment.

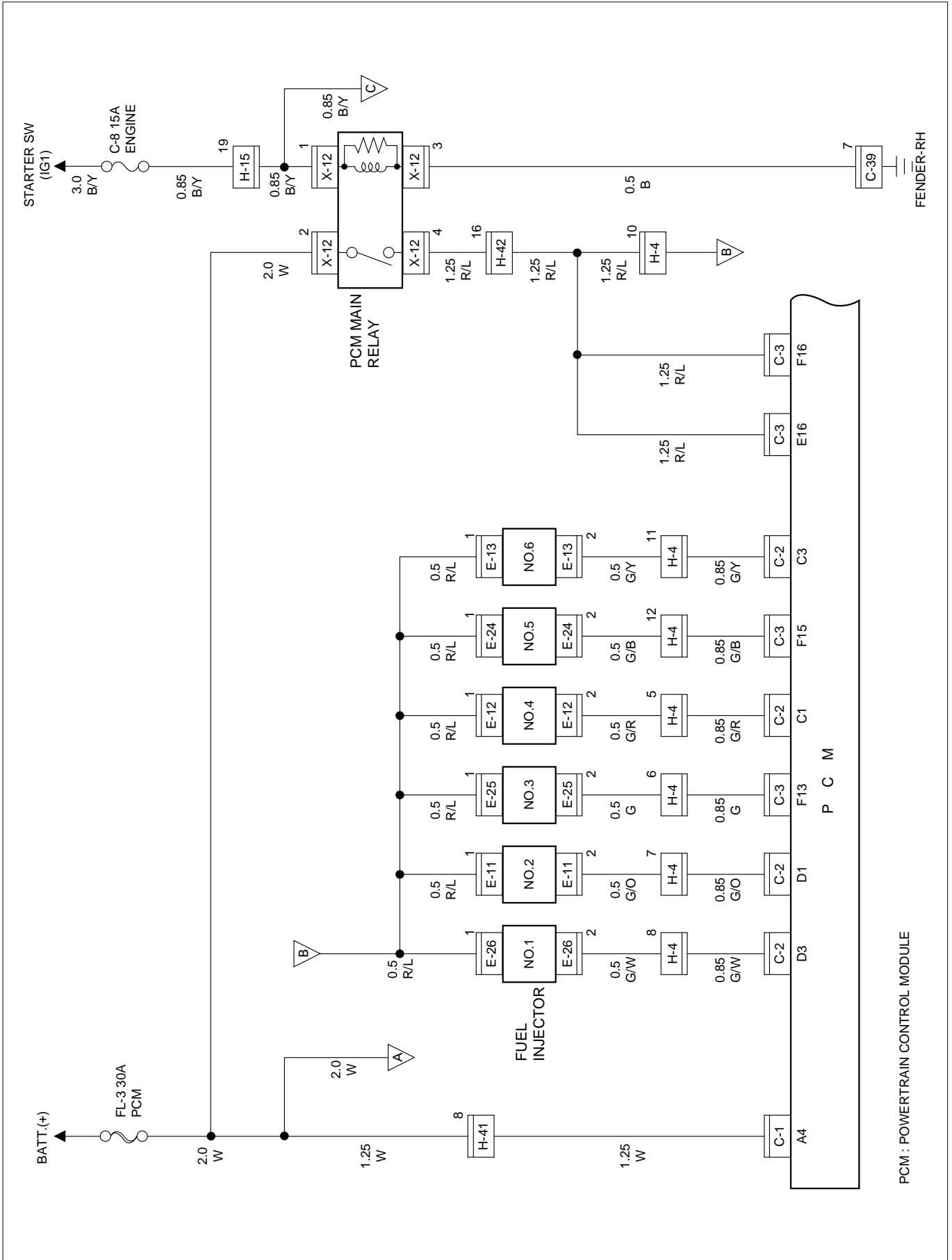
The PCM constantly monitors the information from various sensors, and controls the systems that affect vehicle performance.

The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Light (MIL) and store a Diagnostic Trouble Code (DTC) or DTC(s) which identify the problem areas to aid the technician in making repairs.

The PCM is designed to process the various input informations and then sends the necessary electrical responses to control fuel delivery, spark timing and other emission control systems. The input information has an interrelation to more than one output, therefore, if the one input failed, it could affect more than one system operation.

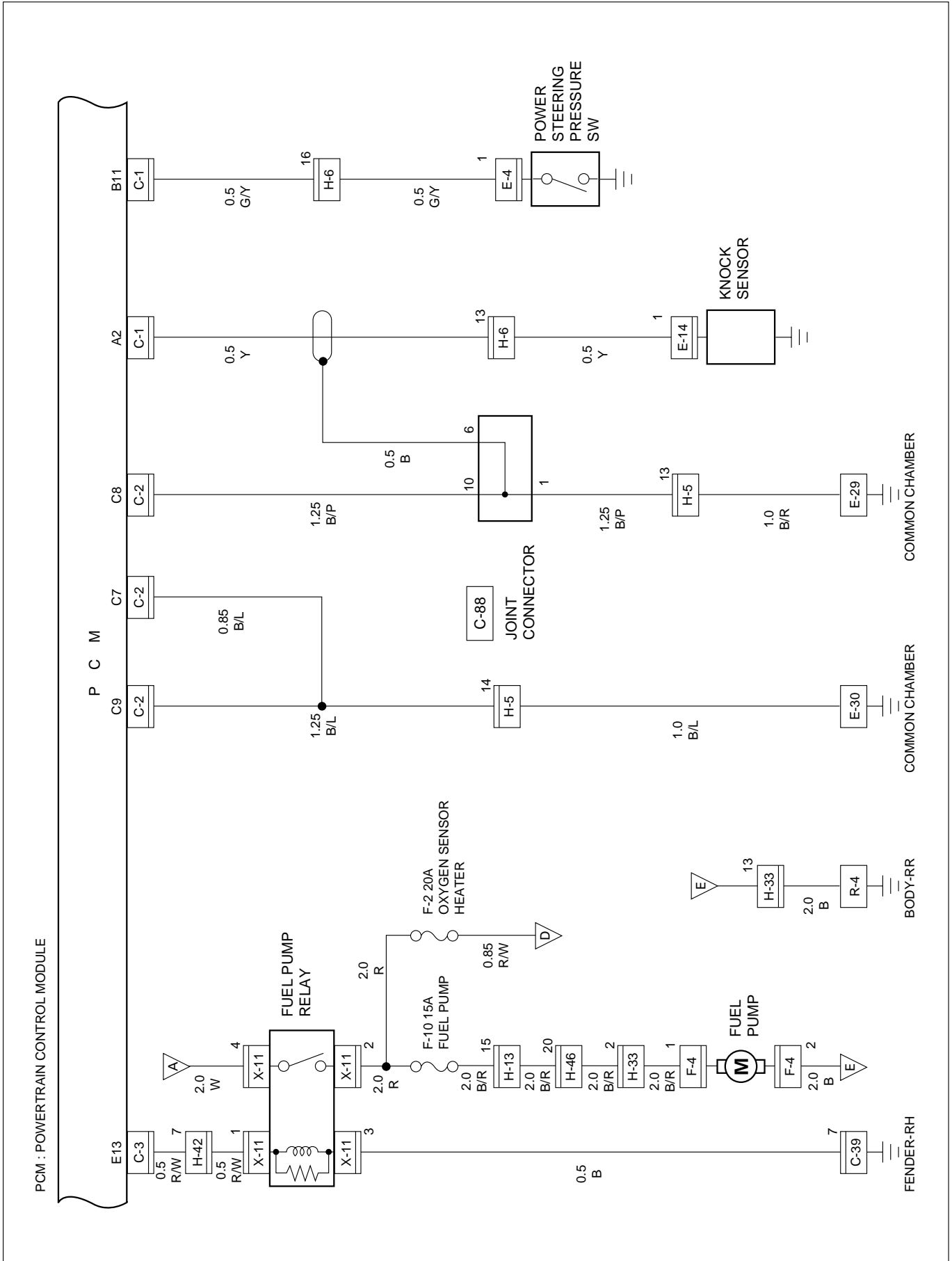
Refer to Driveability and Emission in Engine section and Automatic Transmission in Transmission section.

Circuit Diagram (RHD 6V*1)-1

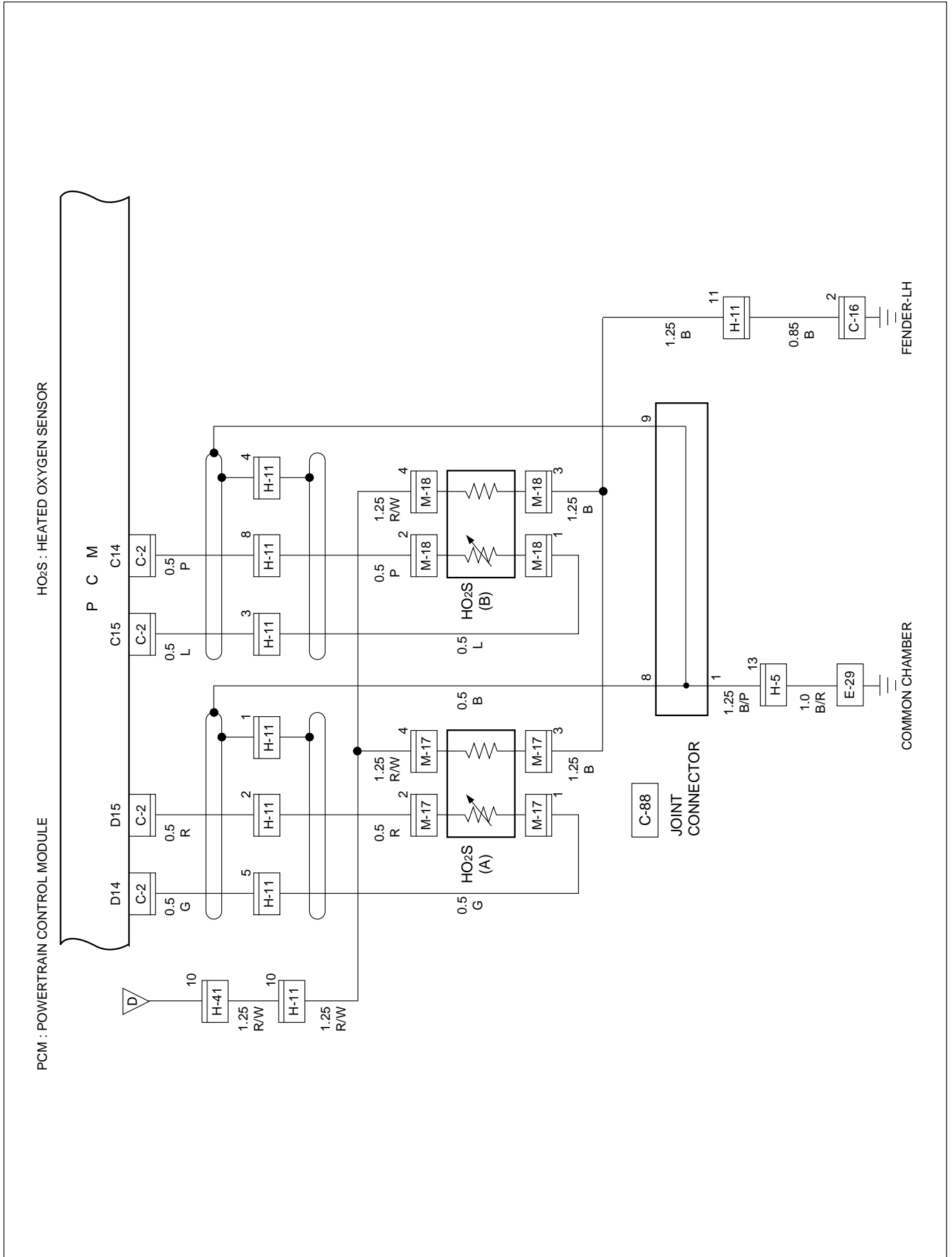


PCM : POWERTRAIN CONTROL MODULE

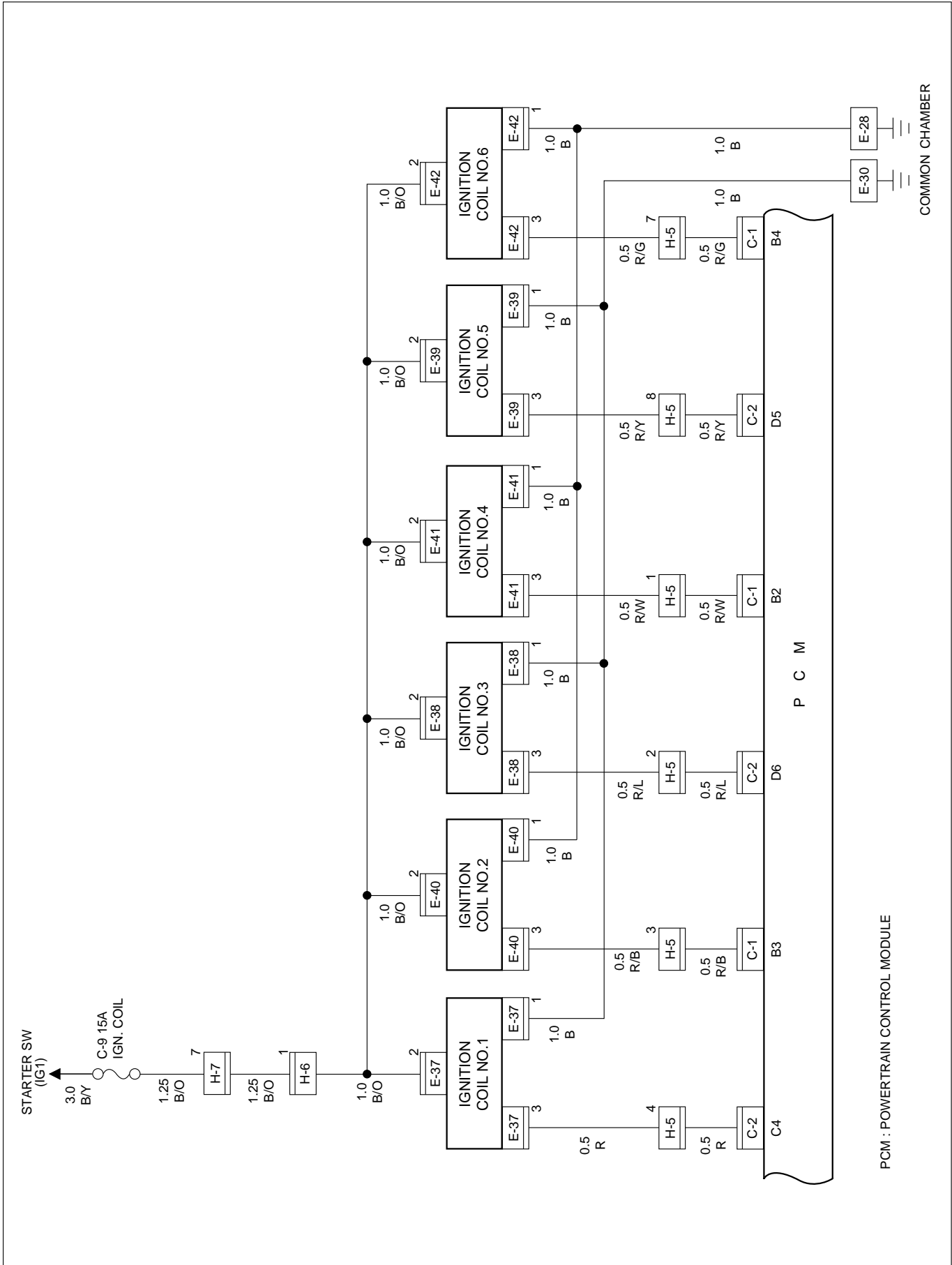
Circuit Diagram (RHD 6V*1)-2



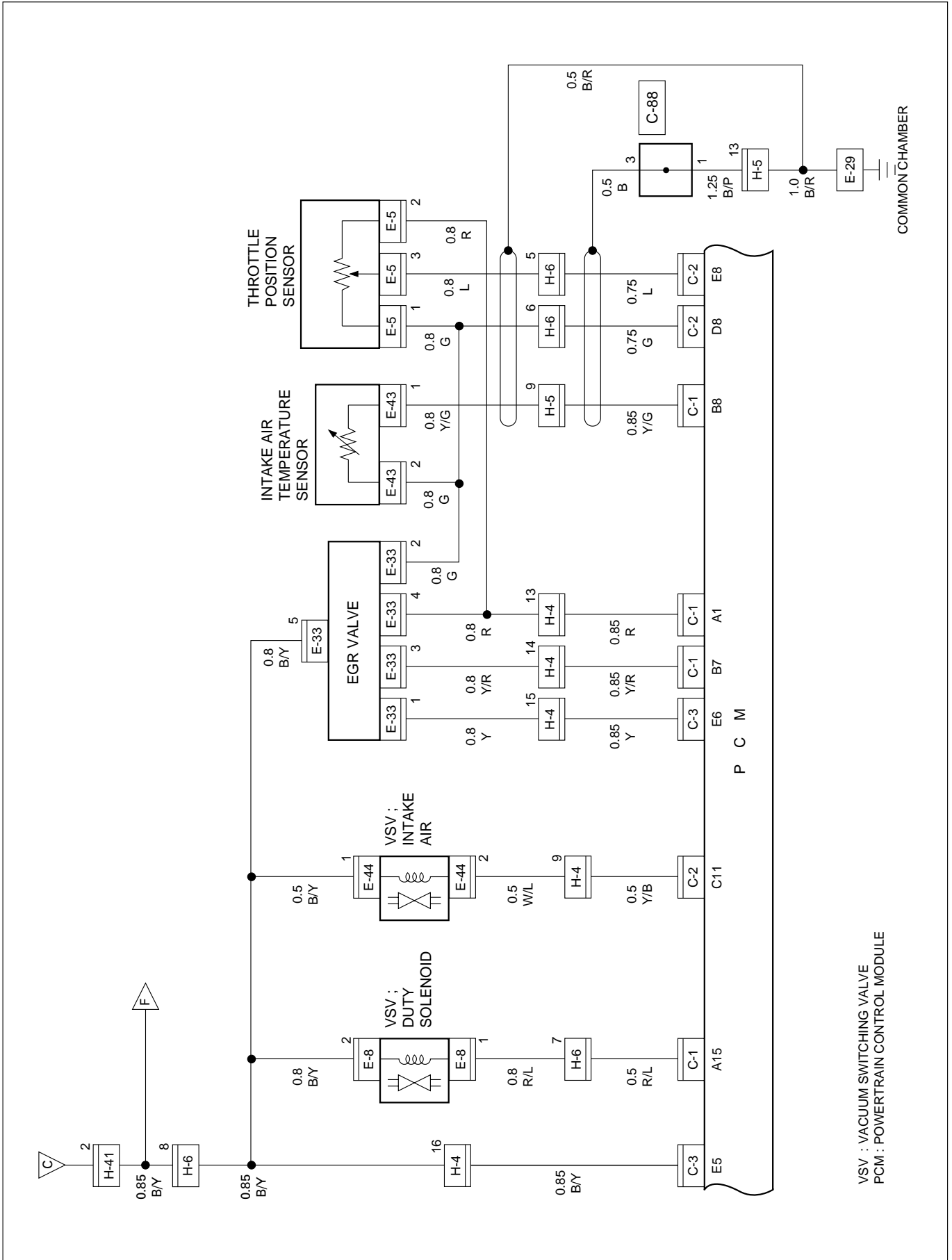
Circuit Diagram (RHD 6V*1)-3



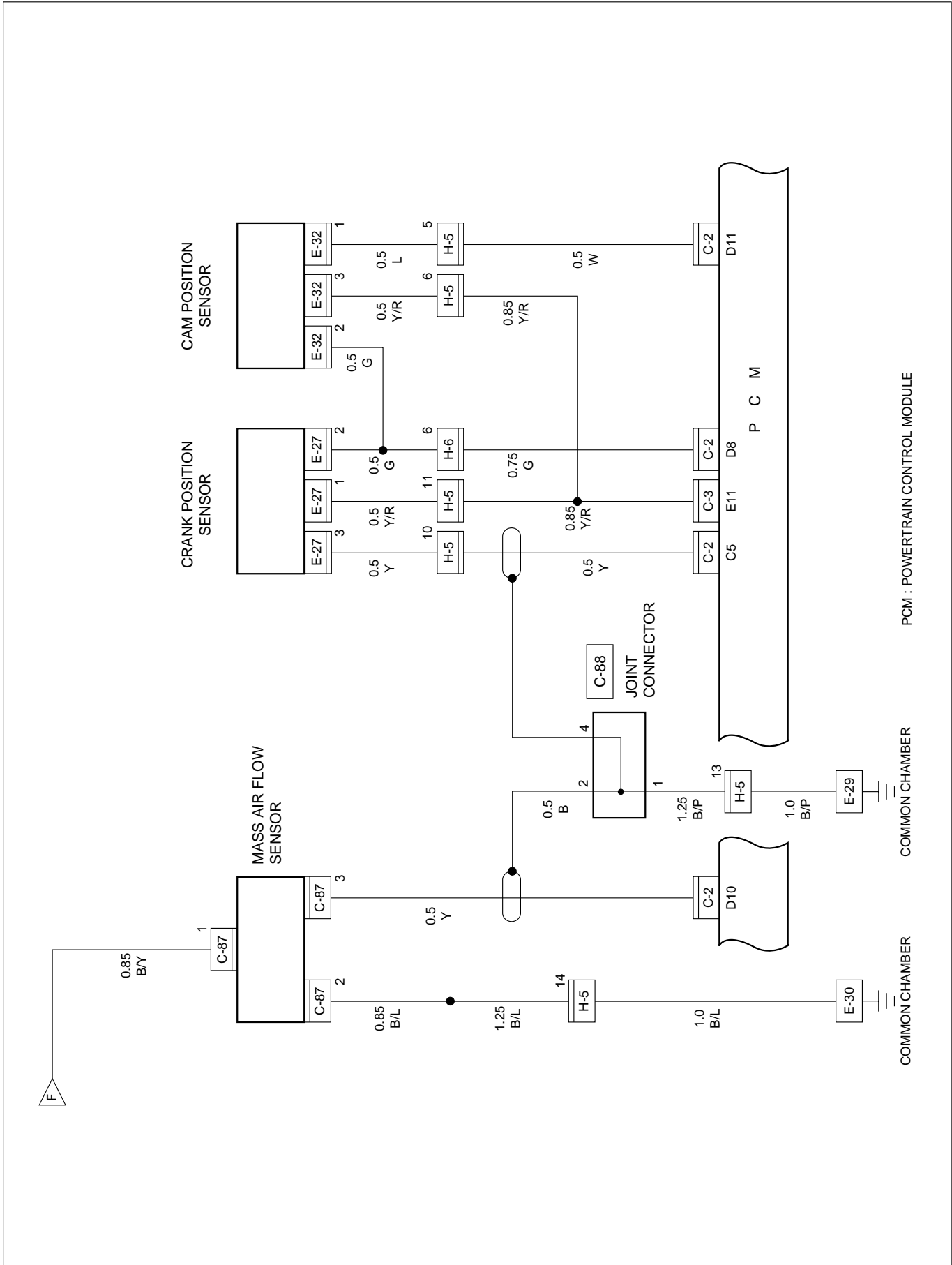
Circuit Diagram (RHD 6V*1)-4



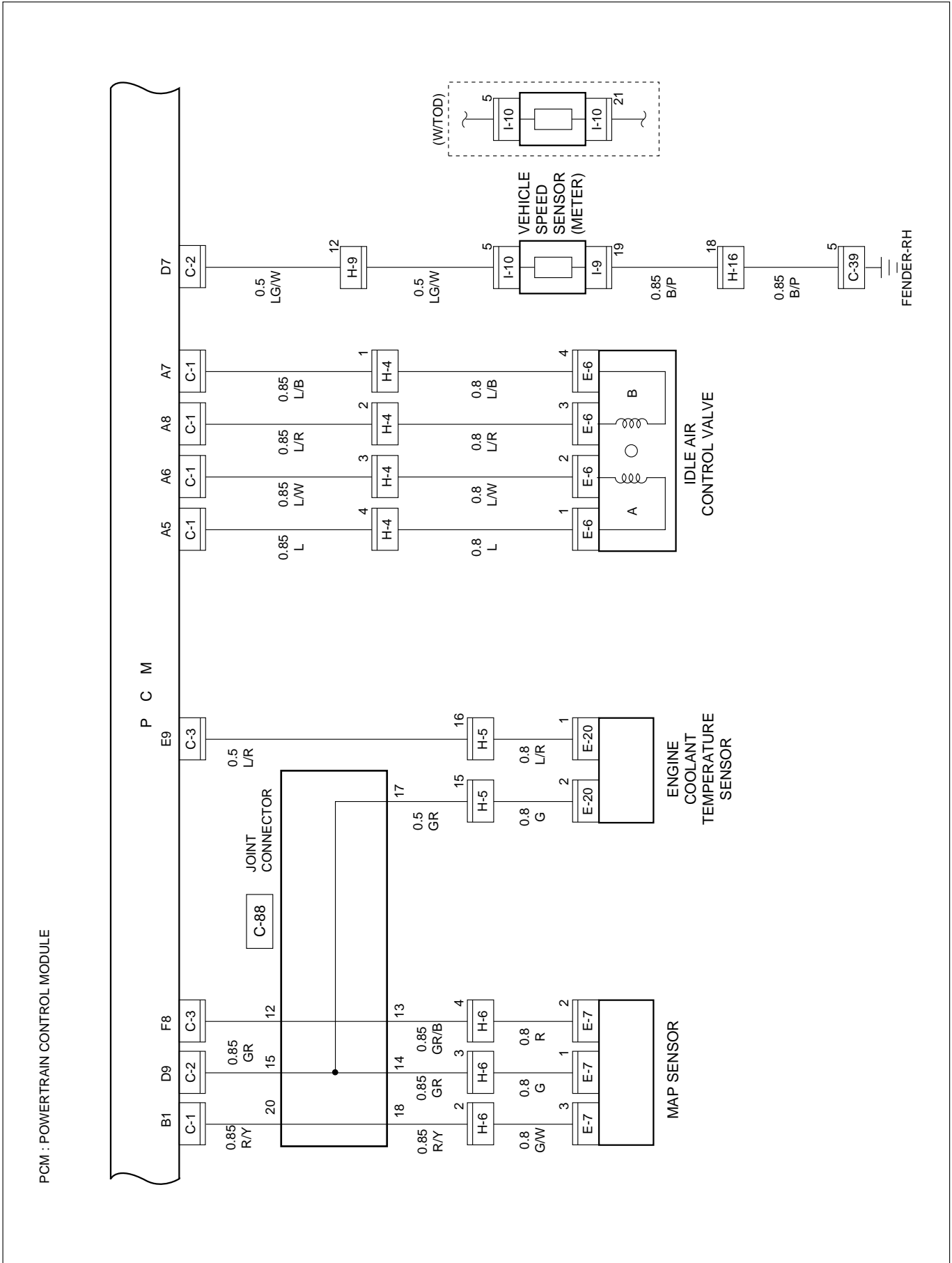
Circuit Diagram (RHD 6V*1)-5



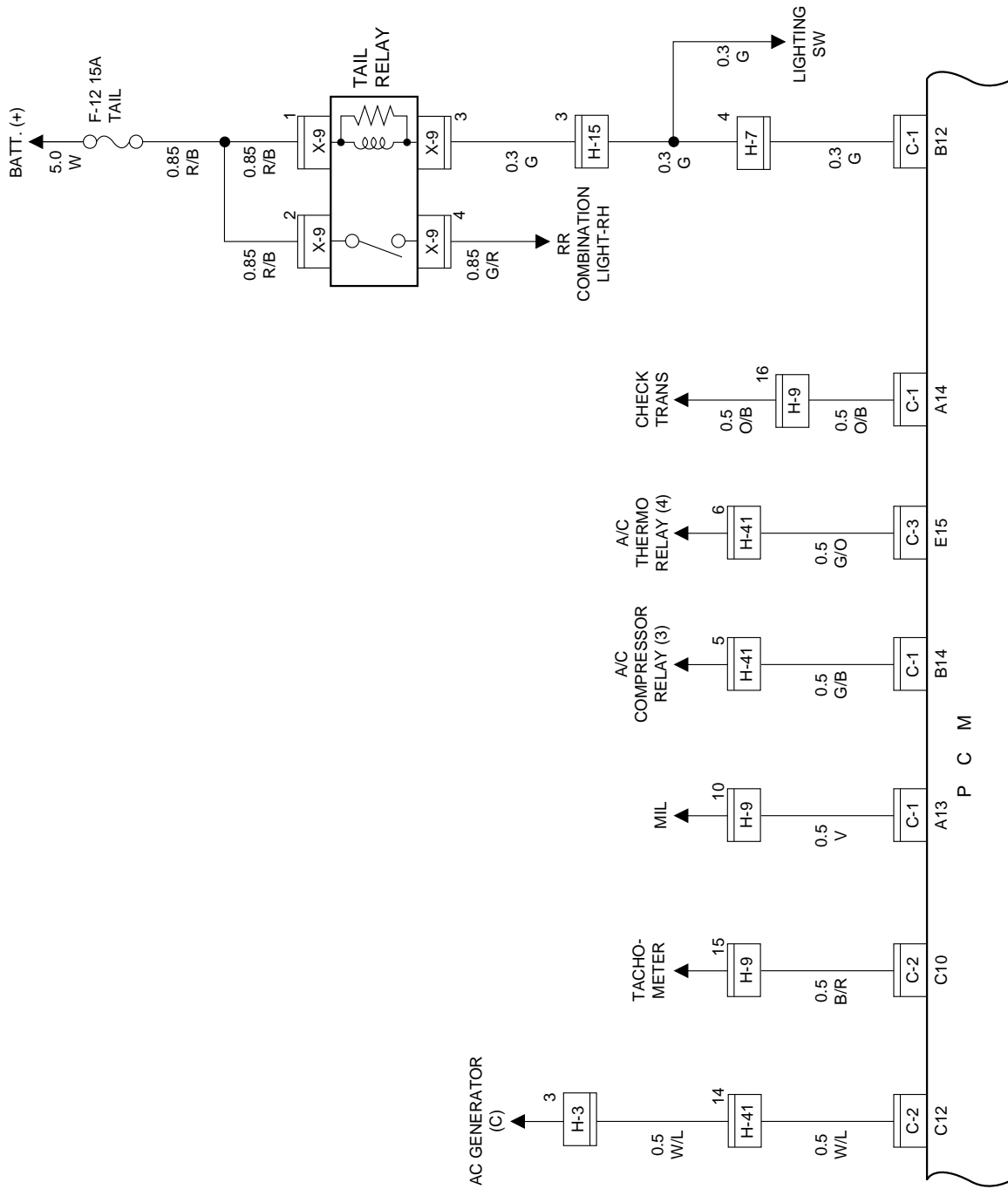
Circuit Diagram (RHD 6V*1)-6



Circuit Diagram (RHD 6V*1)-7

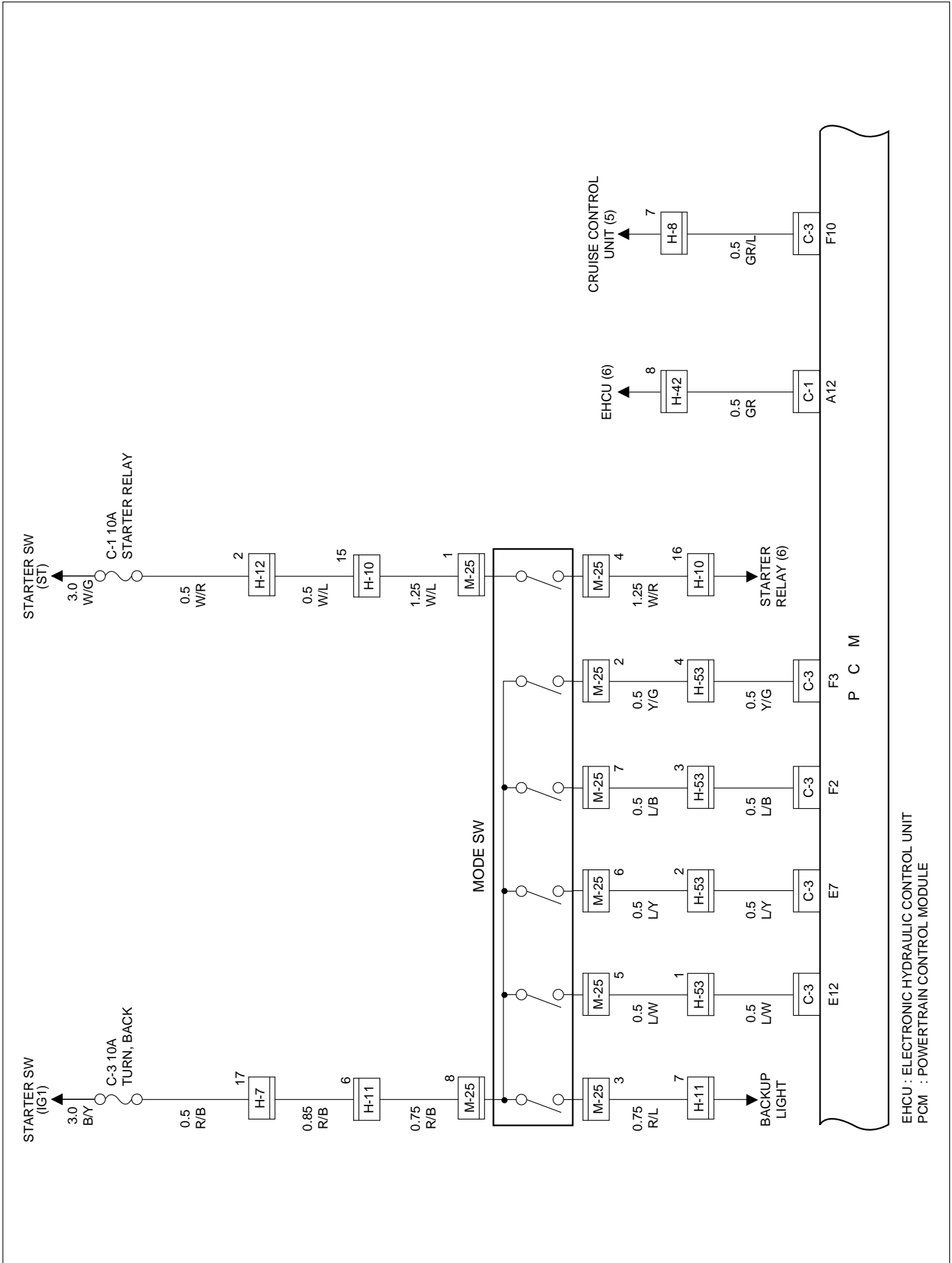


Circuit Diagram (RHD 6V*1)-8

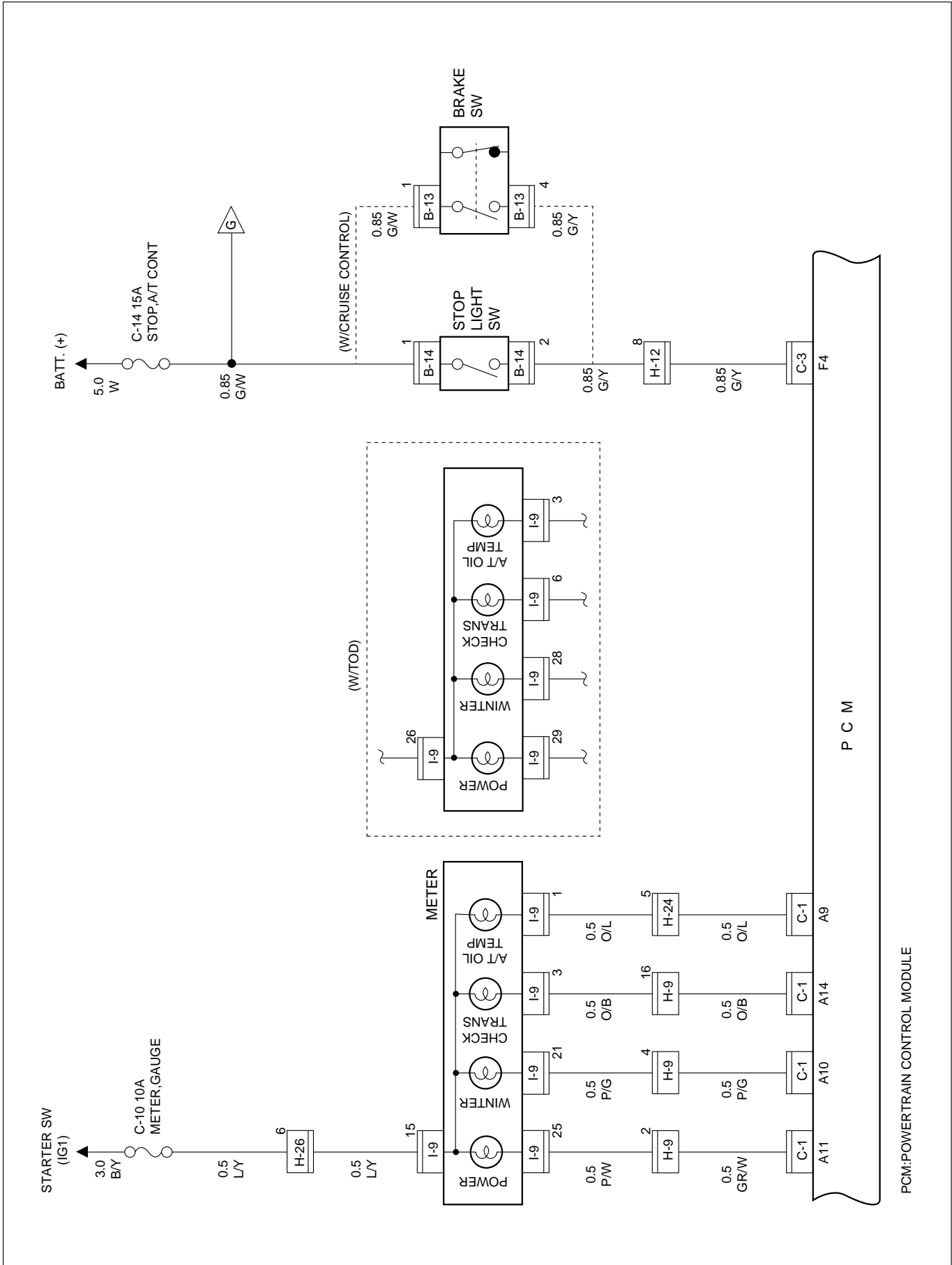


MIL : MALFUNCTION INDICATOR LIGHT
 PCM : POWERTRAIN CONTROL MODULE

Circuit Diagram (RHD 6V*1)-9

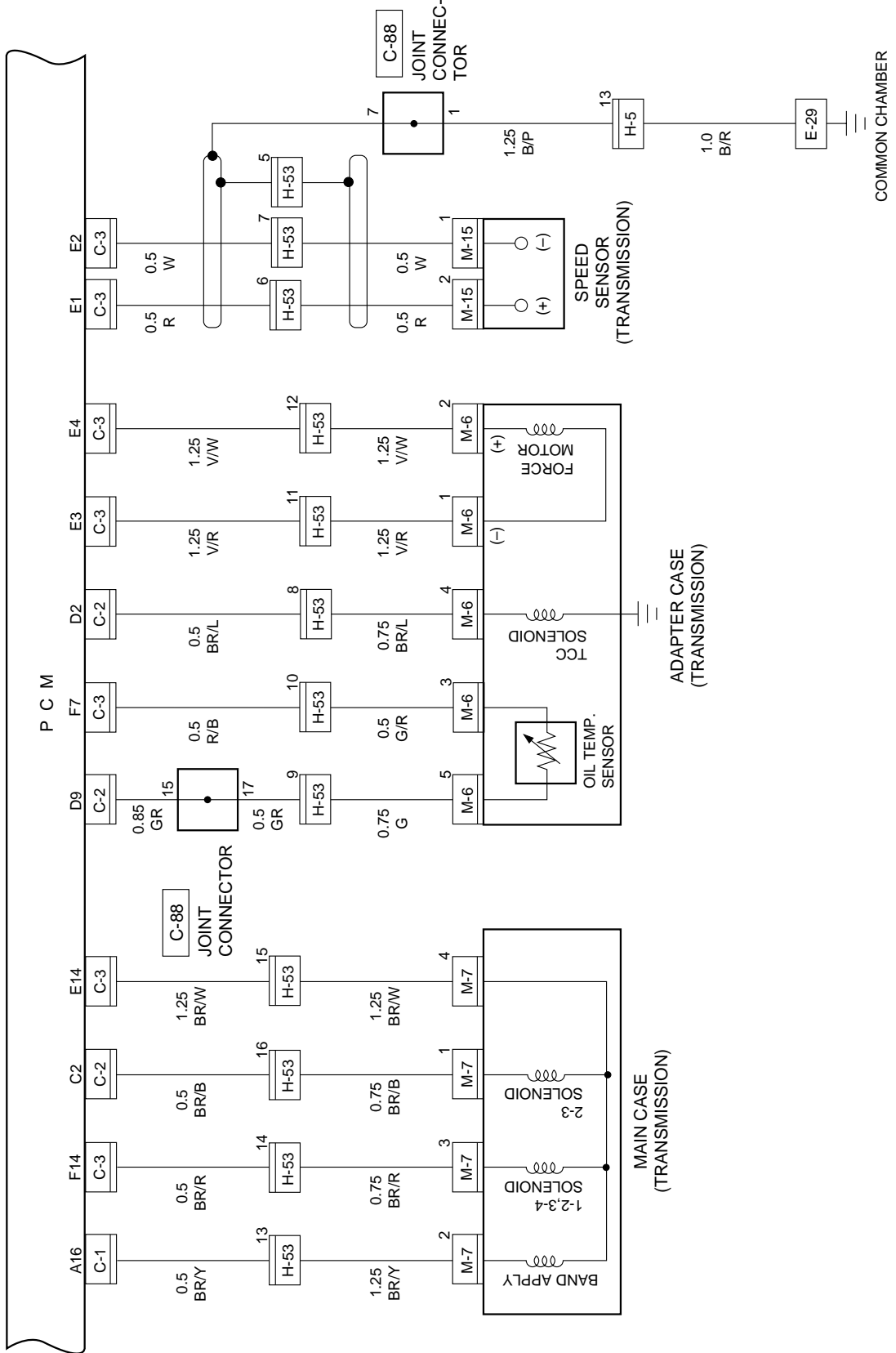


Circuit Diagram (RHD 6V*1)-10

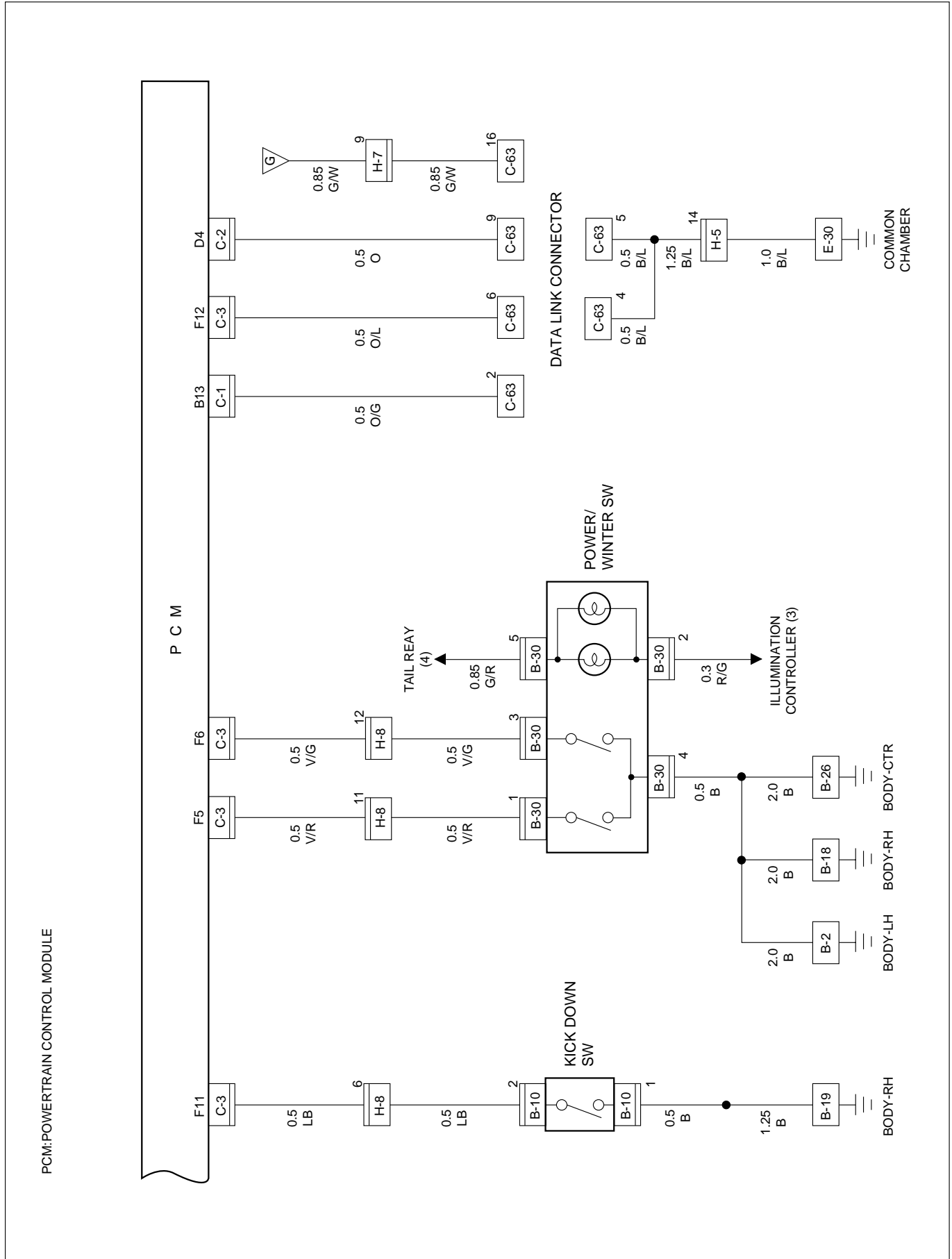


Circuit Diagram (RHD 6V*1)-11

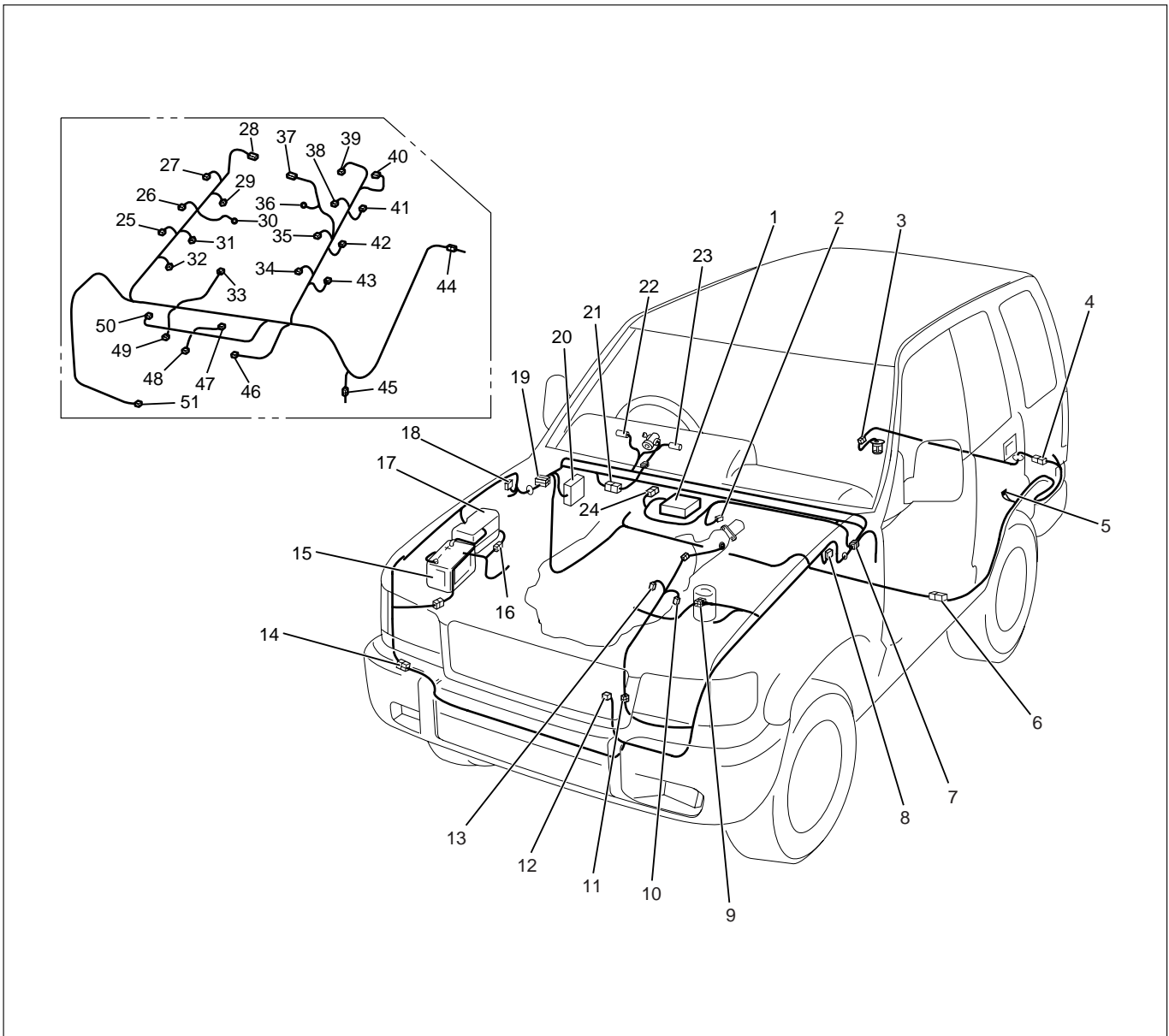
PCM: POWERTRAIN CONTROL MODULE



Circuit Diagram (RHD 6V*1)-12



Parts Location (RHD 6V*1)



D08RW616

Legend

- | | |
|-------------------------|---|
| (1) PCM | (16) H-3 |
| (2) C-63 | (17) Relay and Fuse Box (X-9, X-11, X-12) |
| (3) F-4 | (18) C-39 |
| (4) H-33 | (19) H-13, H-15, H-16, H-26 |
| (5) R-4 | (20) Fuse Box |
| (6) H-46 | (21) H-12 |
| (7) H-7, H-8, H-9, H-24 | (22) I-10 |
| (8) C-16 | (23) I-9 |
| (9) H-4, H-5, H-6 | (24) C-88 |
| (10) M-18 | (25) E-37 |
| (11) H-10, H-11 | (26) E-38 |
| (12) C-87 | (27) E-39 |
| (13) M-17 | (28) E-33 |
| (14) H-41, H-42 | (29) E-24 |
| (15) Battery | (30) E-30 |
| | (31) E-25 |

8D-94 WIRING SYSTEM

(32) E-26

(33) E-14

(34) E-11

(35) E-12

(36) E-28, E-29

(37) E-7

(38) E-13

(39) E-32

(40) E-44

(41) E-42

(42) E-41

(43) E-40

(44) H-4, H-5, H-6

(45) E-4

(46) E-8

(47) E-5

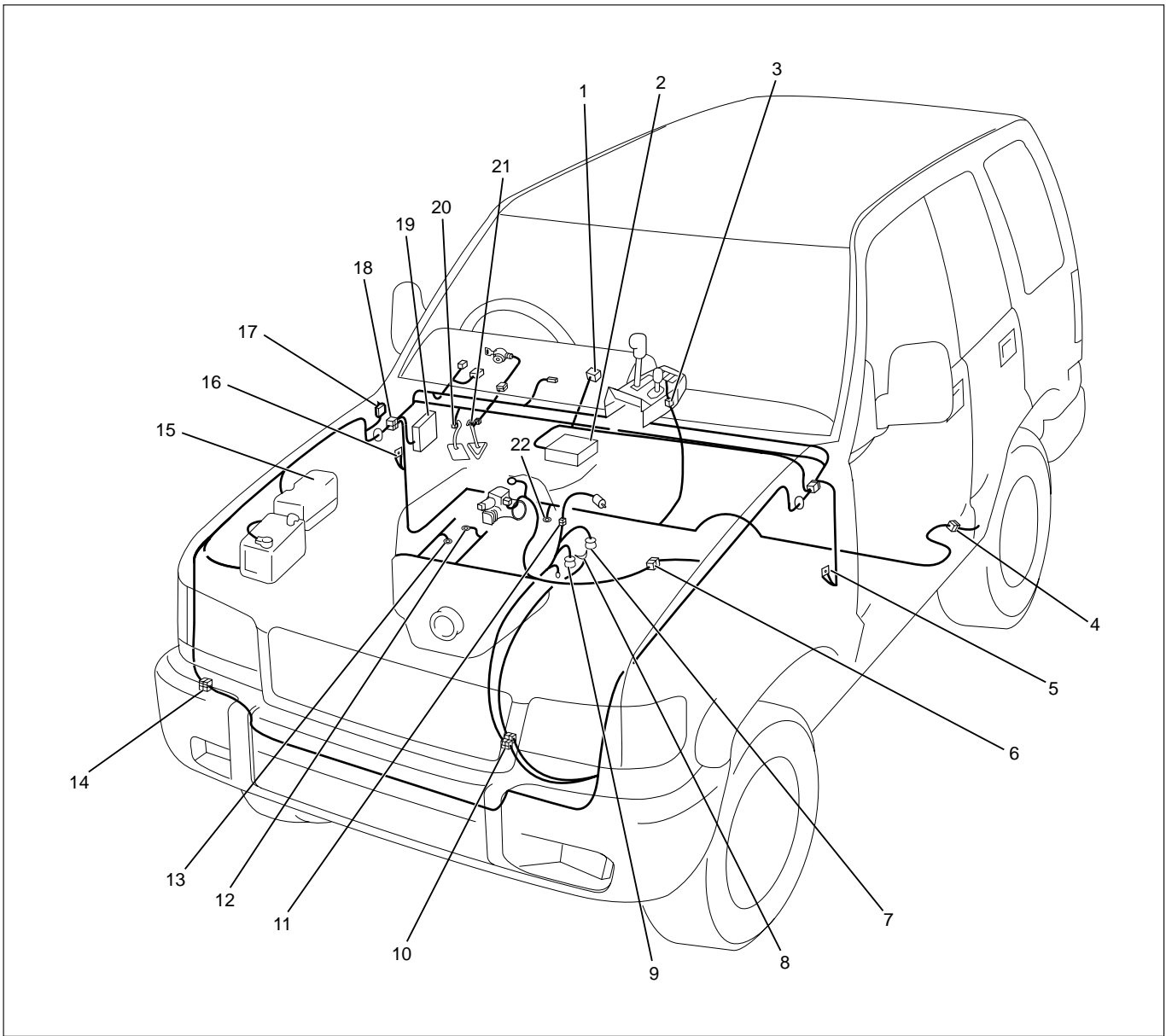
(48) E-43

(49) E-20

(50) E-6

(51) E-27

Parts Location (RHD 6V*1) – 2

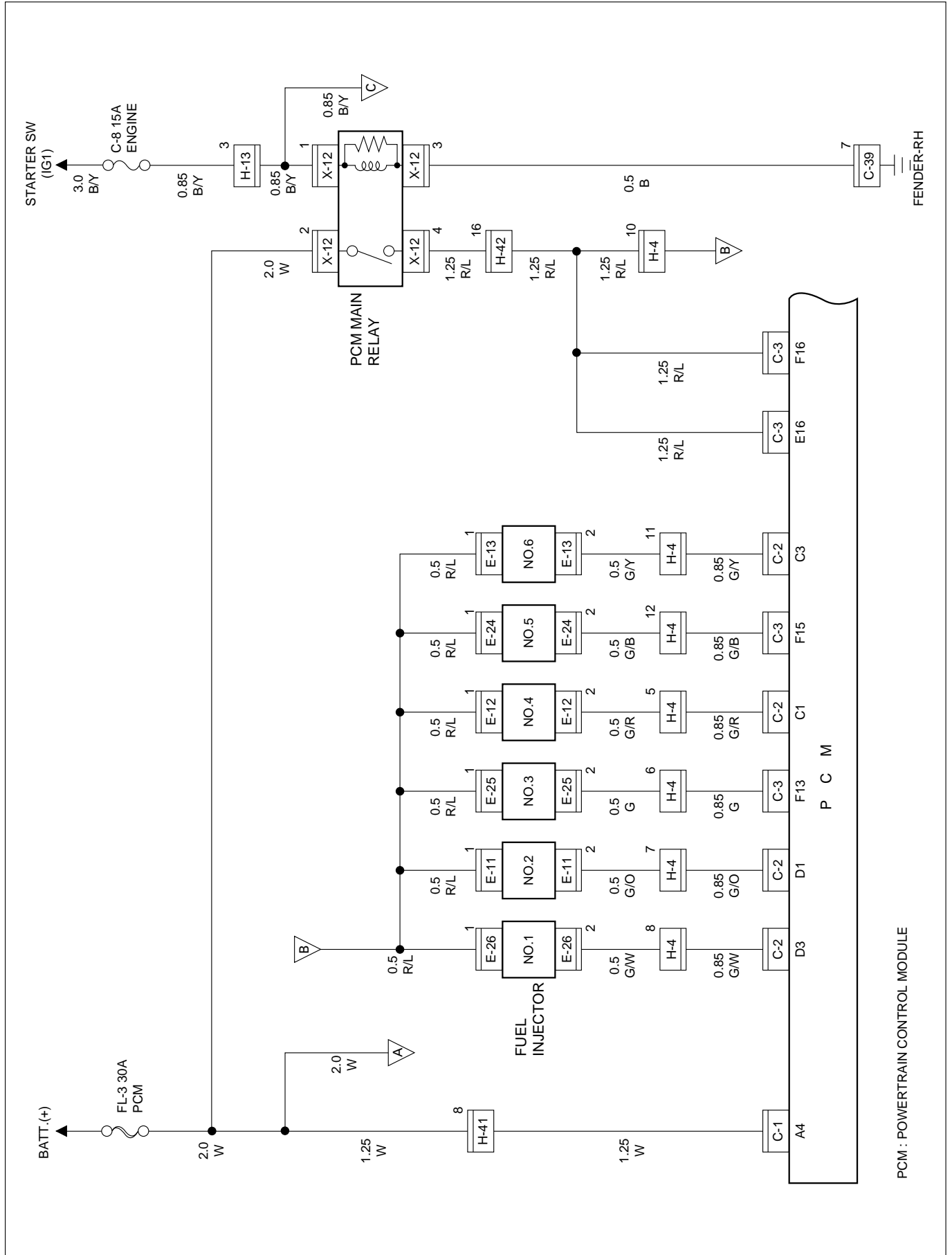


D08RW615

Legend

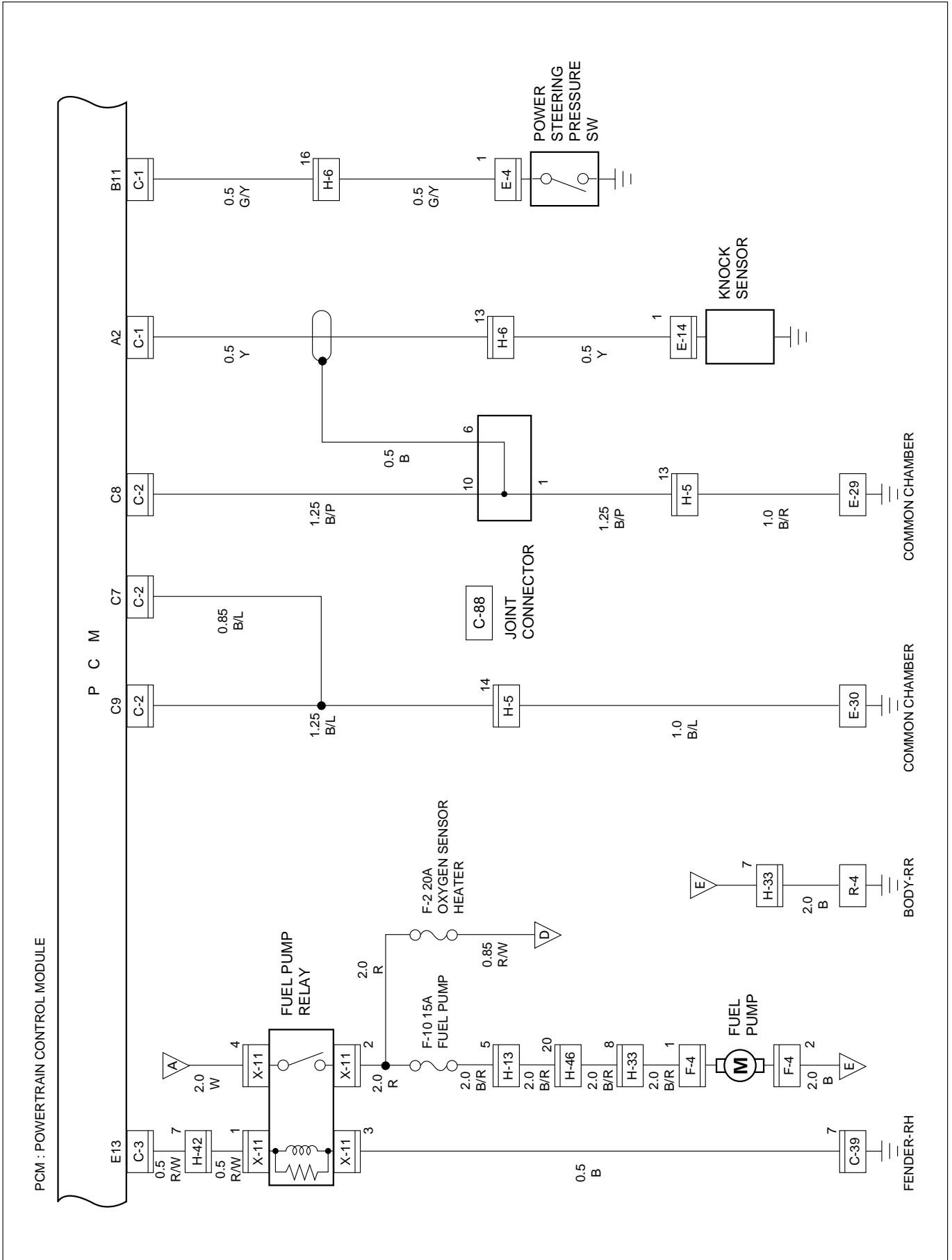
- | | |
|-------------------------|-----------------------------|
| (1) C-63 | (12) E-28, E-29 |
| (2) PCM | (13) E-30 |
| (3) B-30 | (14) H-41 |
| (4) H-7, H-8, H-9, H-24 | (15) Relay and Fuse Box |
| (5) B-2 | (16) B-18, B-19 |
| (6) H-4, H-5, H-6 | (17) C-39 |
| (7) M-7 | (18) H-13, H-15, H-16, H-26 |
| (8) M-25 | (19) Fuse Box |
| (9) M-6 | (20) B-10 |
| (10) H-10, H-11, H-53 | (21) B-13, B-14 |
| (11) M-15 | (22) B-26 |

Circuit Diagram (LHD 6V*1)-1

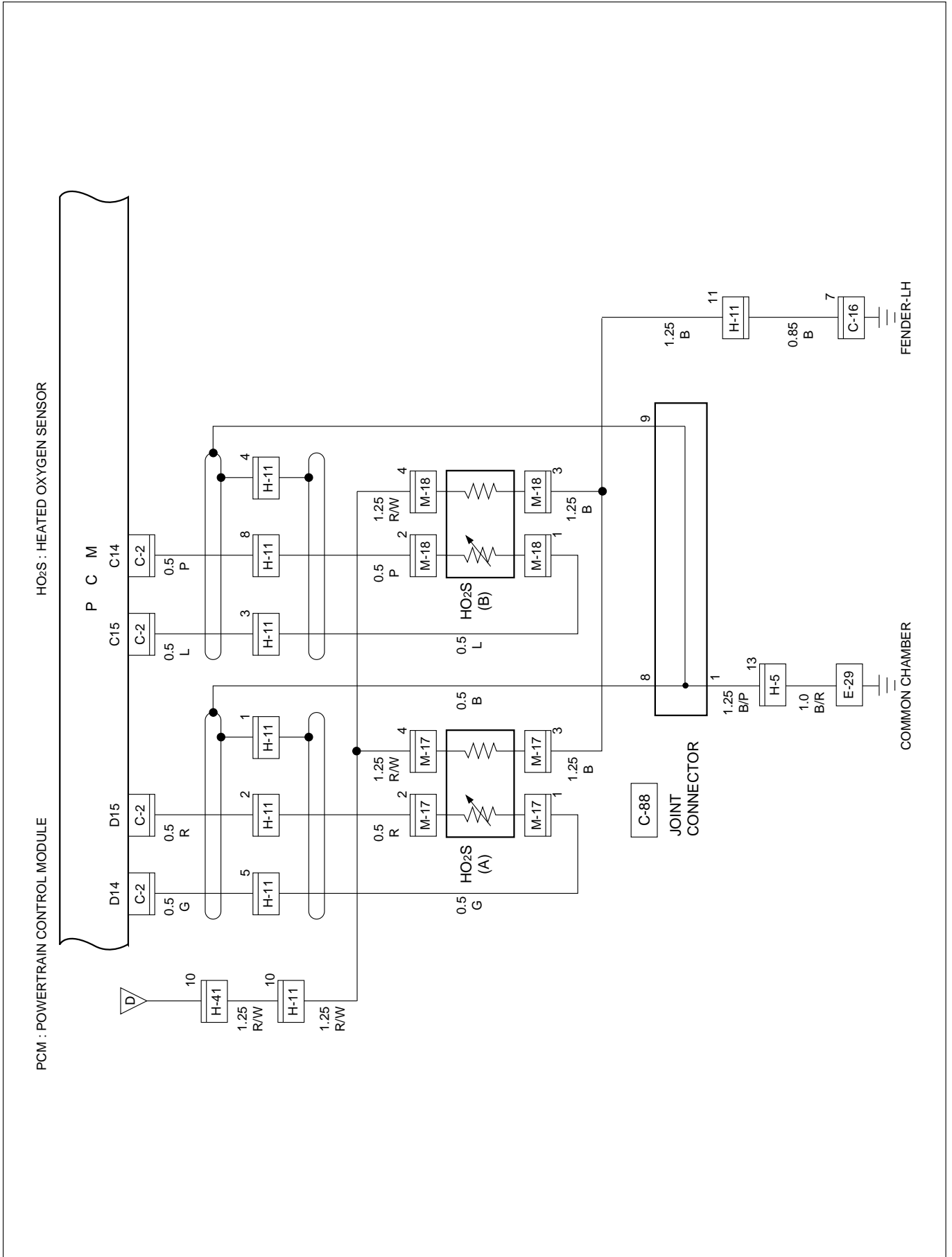


PCM : POWERTRAIN CONTROL MODULE

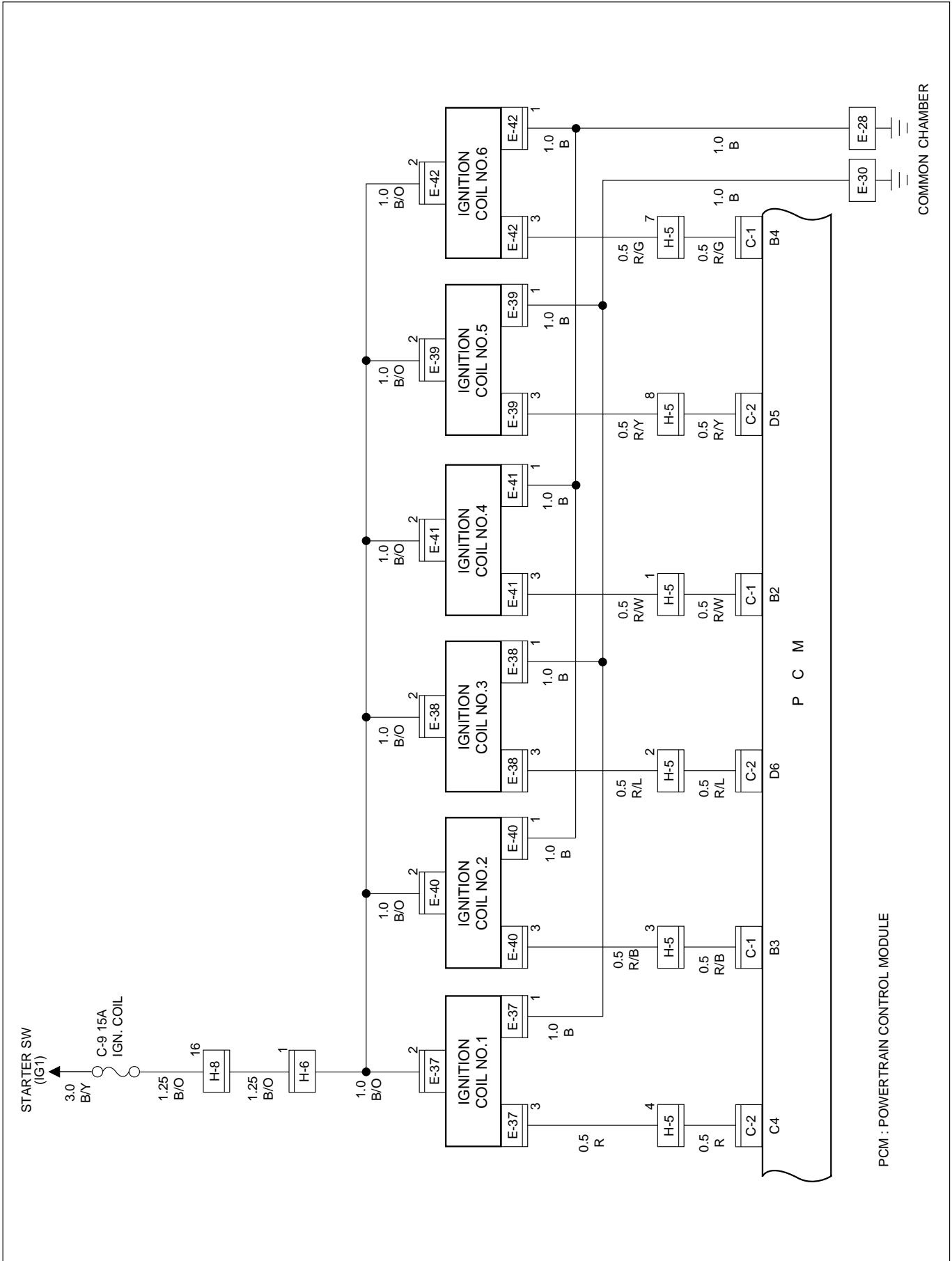
Circuit Diagram (LHD 6V*1)-2



Circuit Diagram (LHD 6V*1)-3

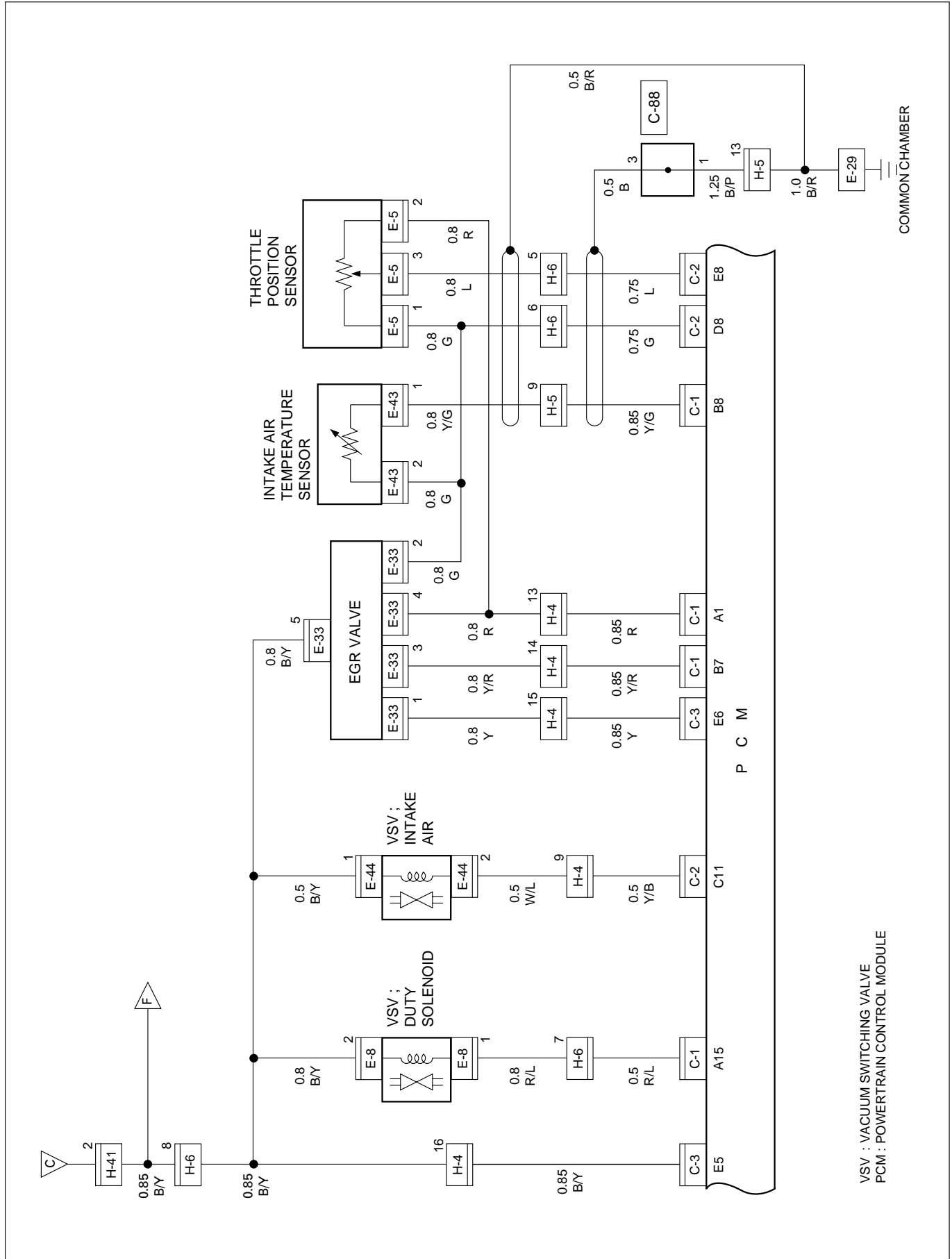


Circuit Diagram (LHD 6V*1)-4

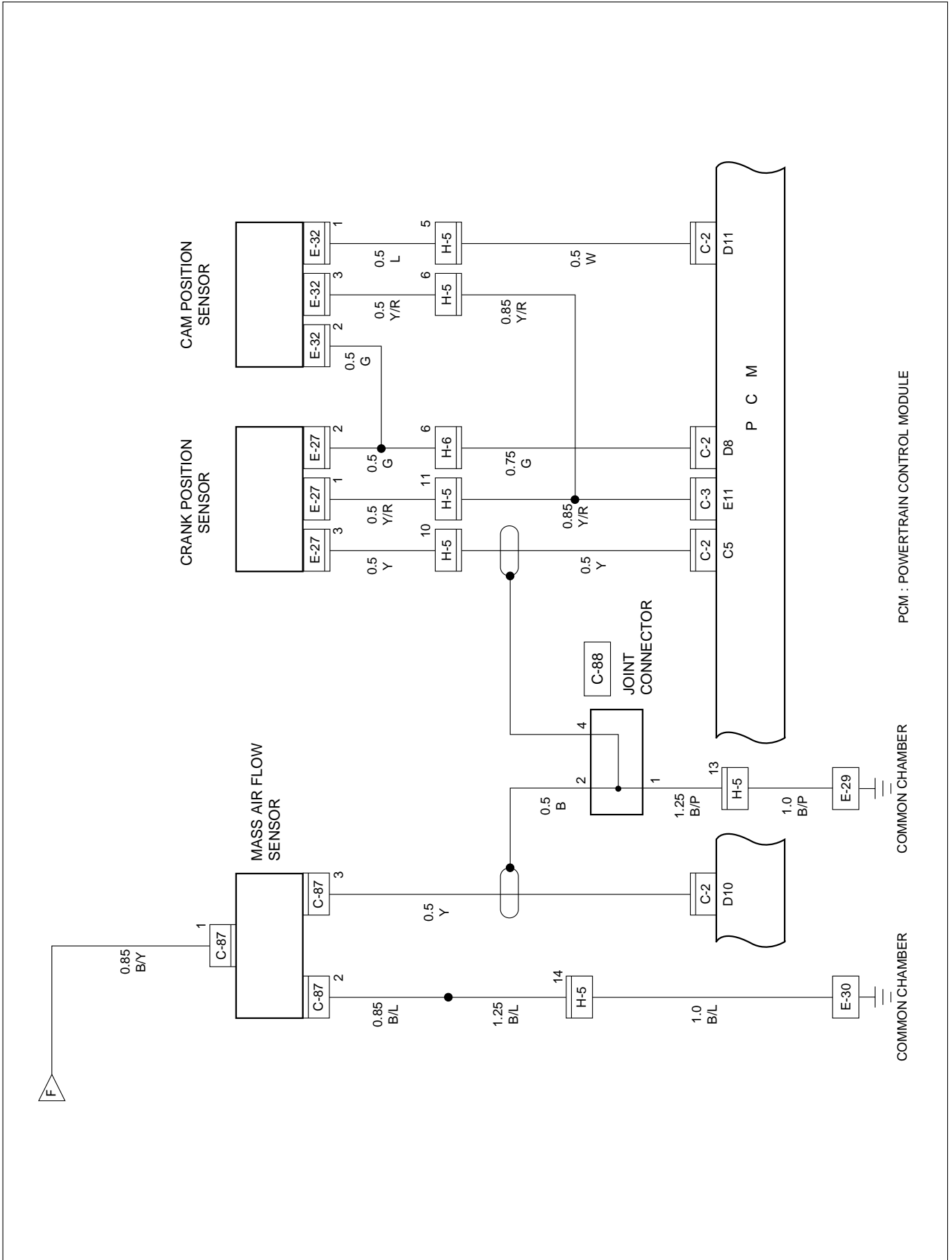


PCM : POWERTRAIN CONTROL MODULE

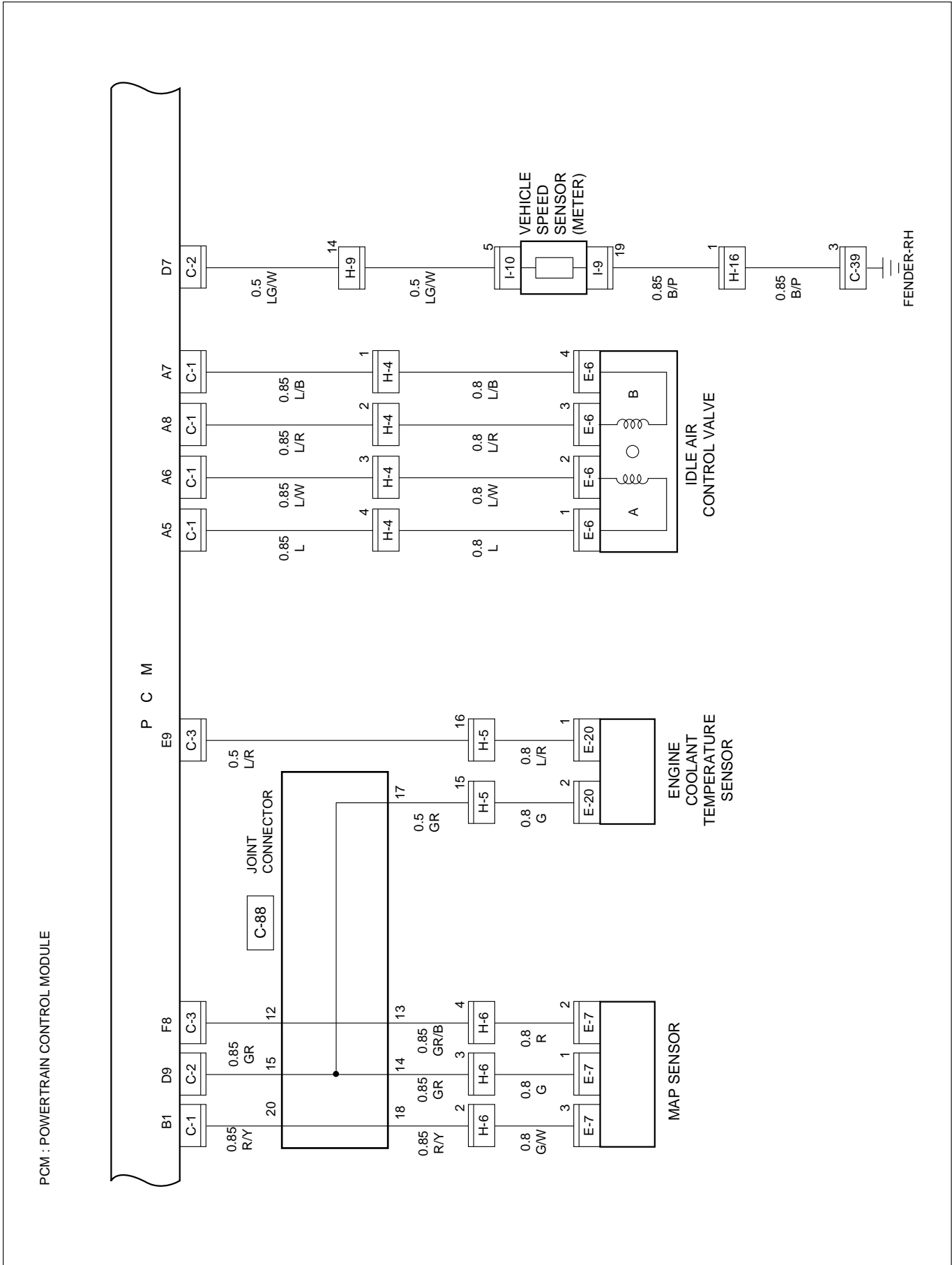
Circuit Diagram (LHD 6V*1)-5



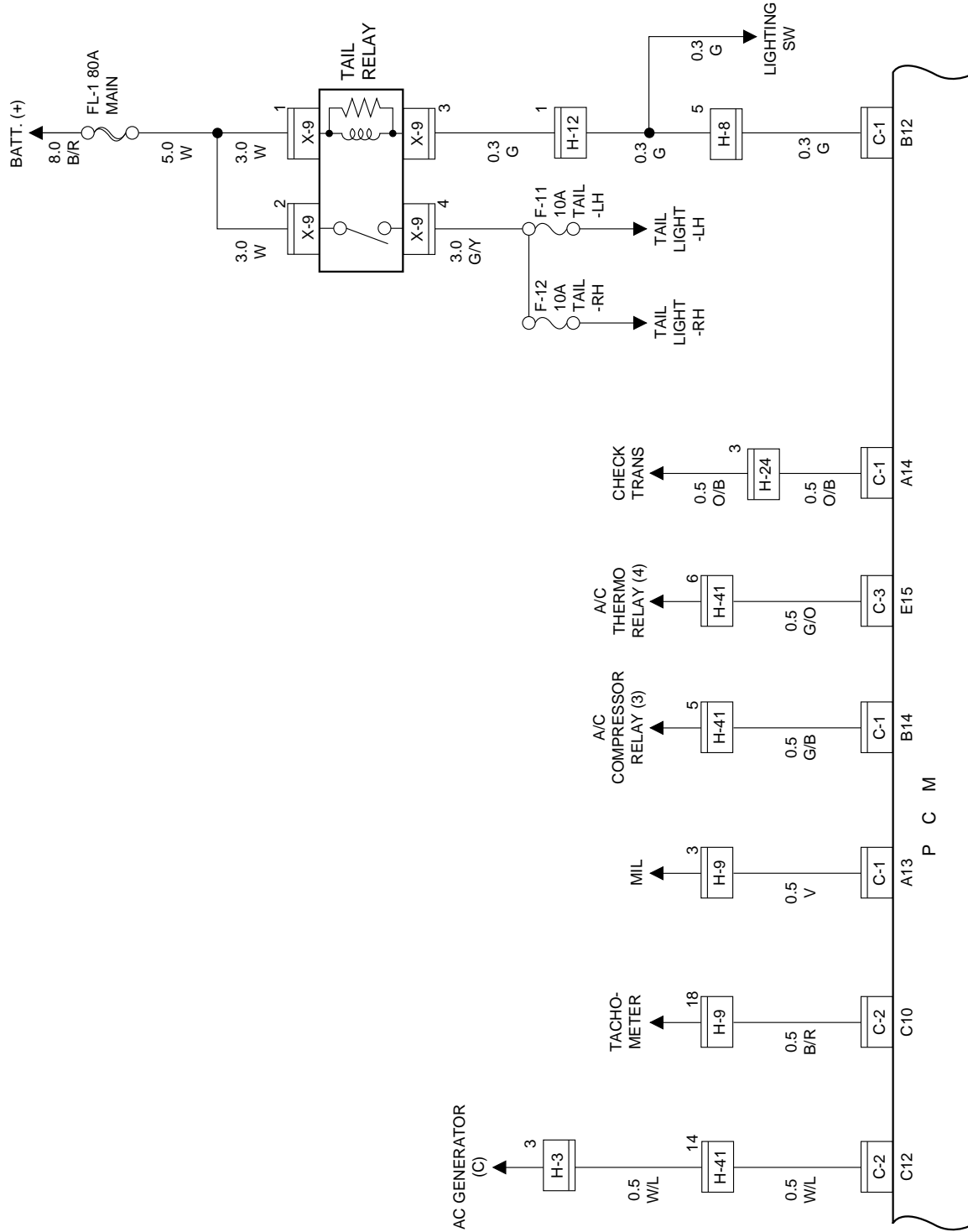
Circuit Diagram (LHD 6V*1)-6



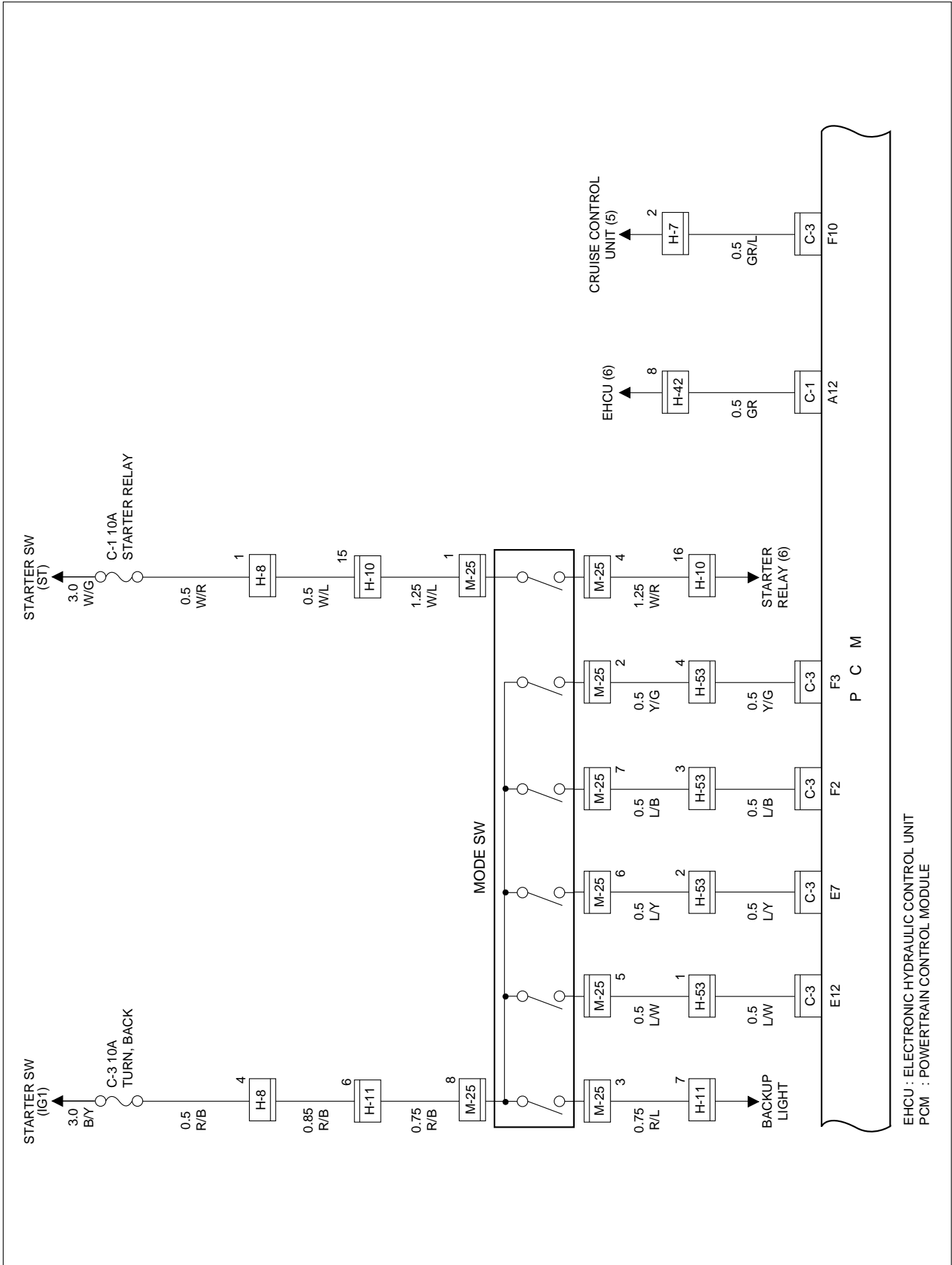
Circuit Diagram (LHD 6V*1)-7



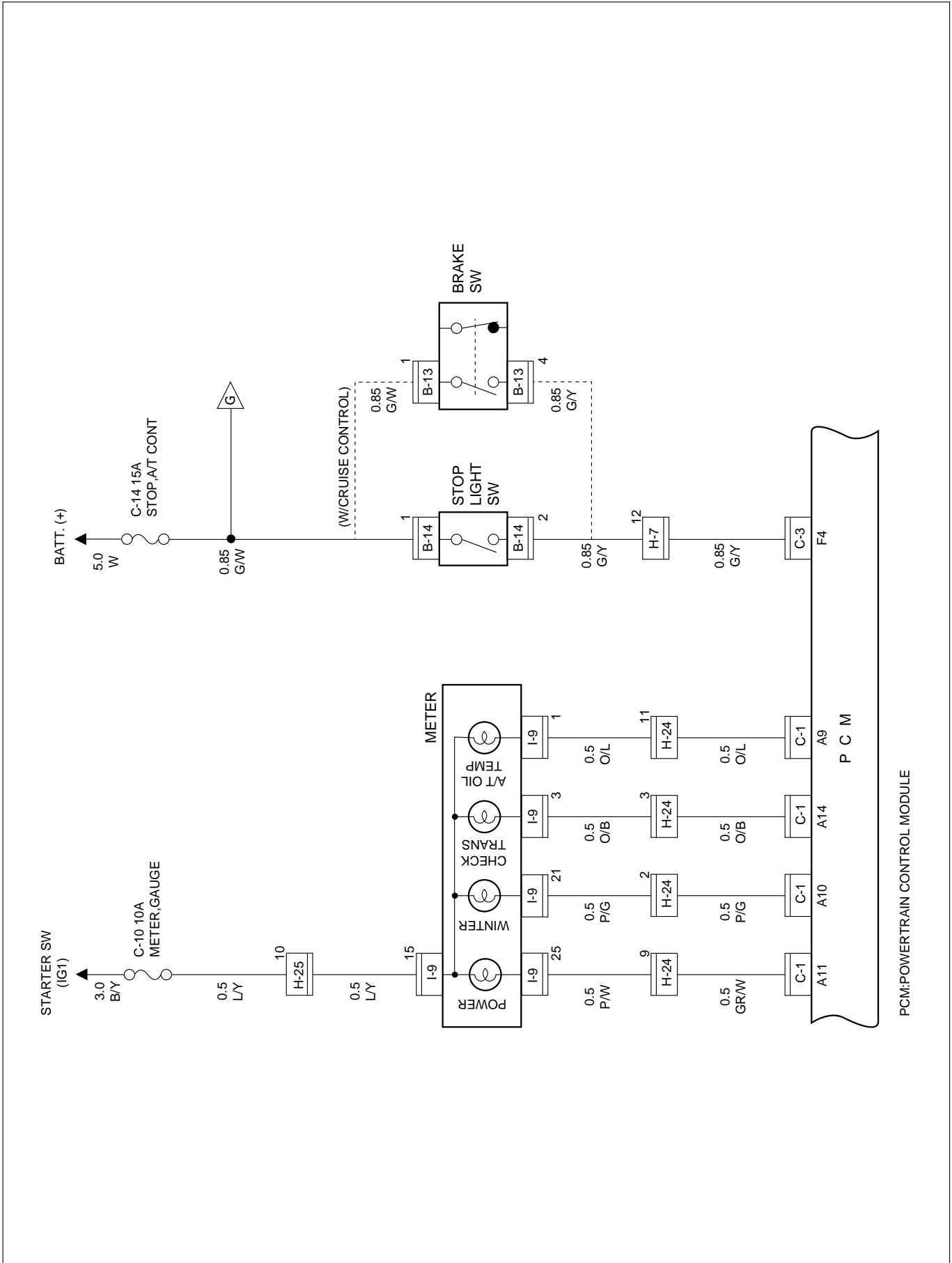
Circuit Diagram (LHD 6V*1)-8



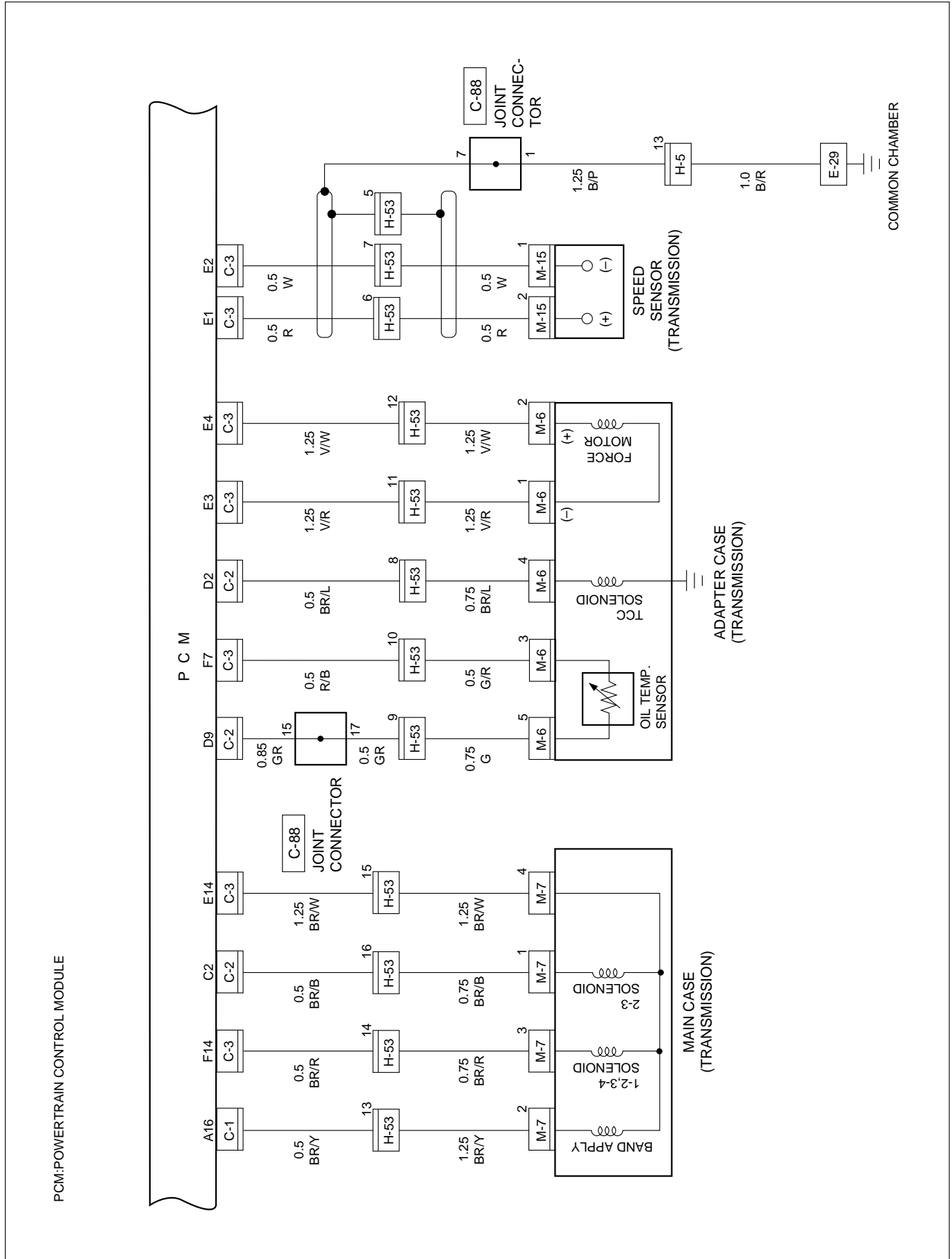
Circuit Diagram (LHD 6V*1)-9



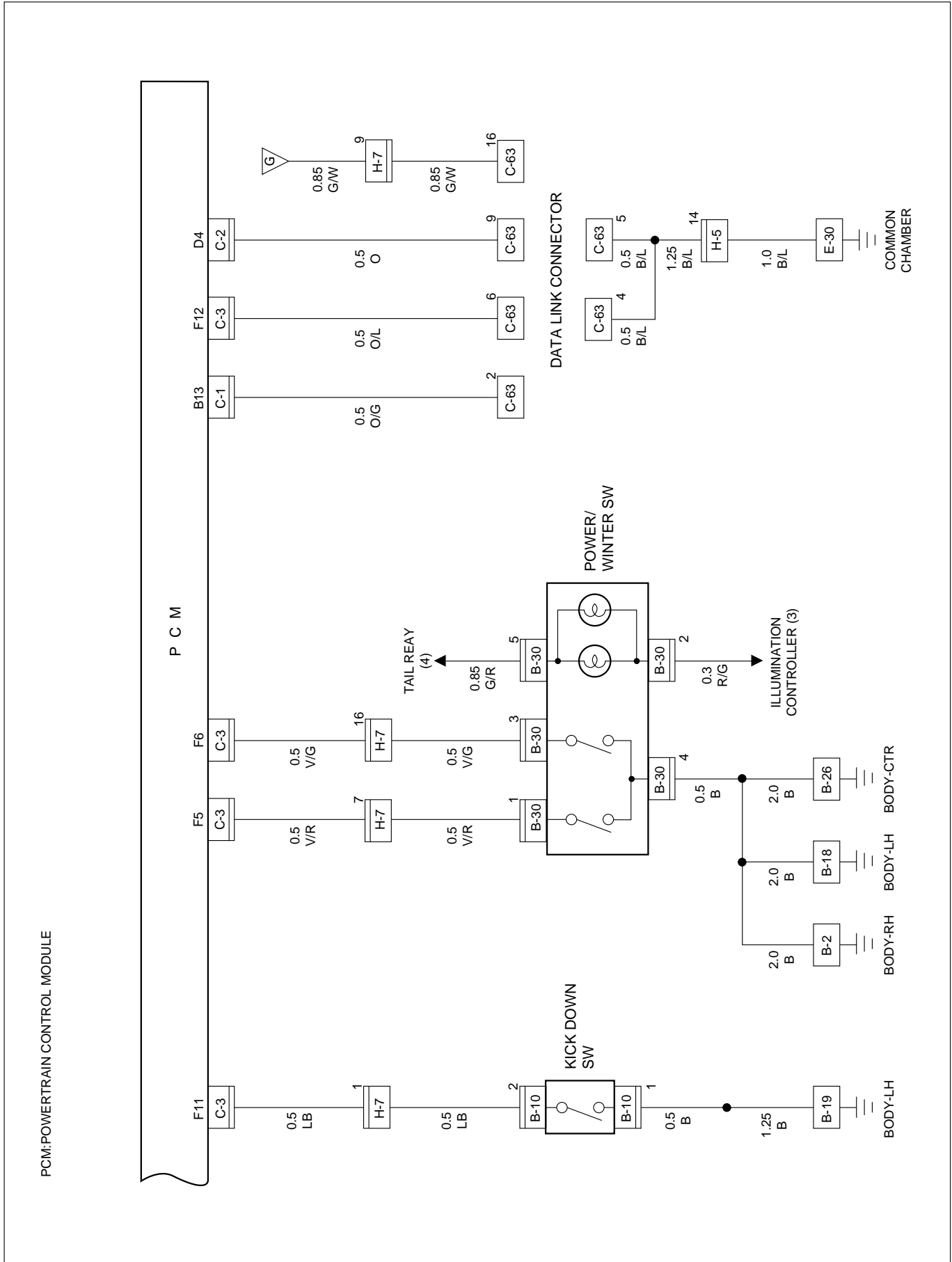
Circuit Diagram (LHD 6V*1)-10



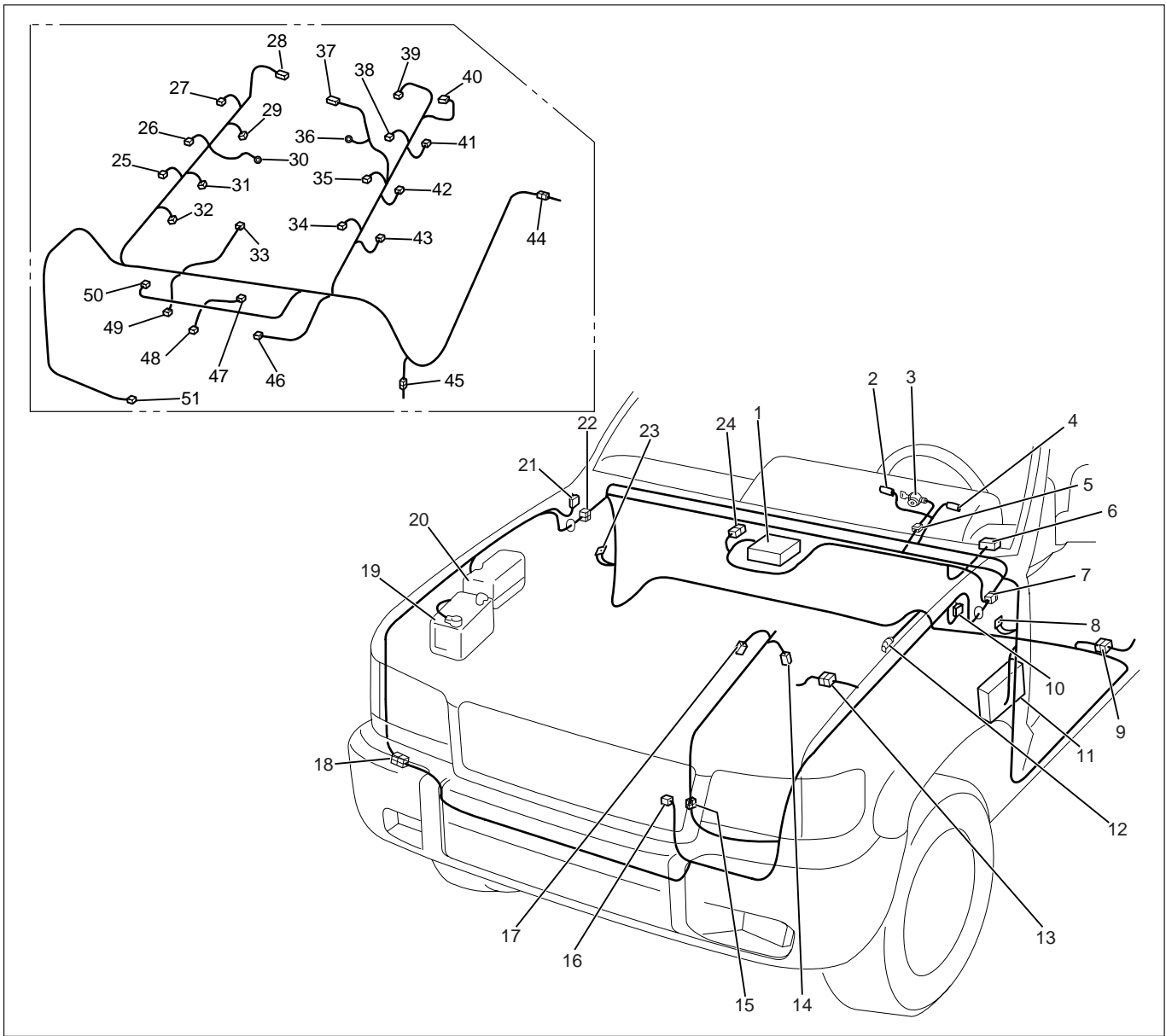
Circuit Diagram (LHD 6V*1)-11



Circuit Diagram (LHD 6V*1)-12



Parts Location (LHD 6V*1) – 1



D08RW912

Legend

- | | |
|-------------------------|--------------------------------------|
| (1) PCM | (17) M-17 |
| (2) I-10 | (18) H-41, H-42 |
| (3) Starter Switch | (19) Battery |
| (4) I-9 | (20) Relay and Fuse Box (X-12, X-11) |
| (5) B-10 | (21) C-39 |
| (6) C-63 | (22) H-12, H-13, H-16 |
| (7) H-7, H-8, H-9, H-24 | (23) B-1, B-2 |
| (8) B-18, B-19 | (24) C-88 |
| (9) H-46 | (25) E-37 |
| (10) C-16 | (26) E-38 |
| (11) Fuse Box | (27) E-39 |
| (12) B-26 | (28) E-33 |
| (13) H-4, H-5, H-6 | (29) E-24 |
| (14) M-18 | (30) E-30 |
| (15) H-11 | (31) E-25 |
| (16) C-87 | (32) E-26 |
| | (33) E-14 |

(34) E-11

(35) E-12

(36) E-28, E-29

(37) E-7

(38) E-13

(39) E-32

(40) E-44

(41) E-42

(42) E-41

(43) E-40

(44) H-4, H-5, H-6

(45) E-4

(46) E-8

(47) E-5

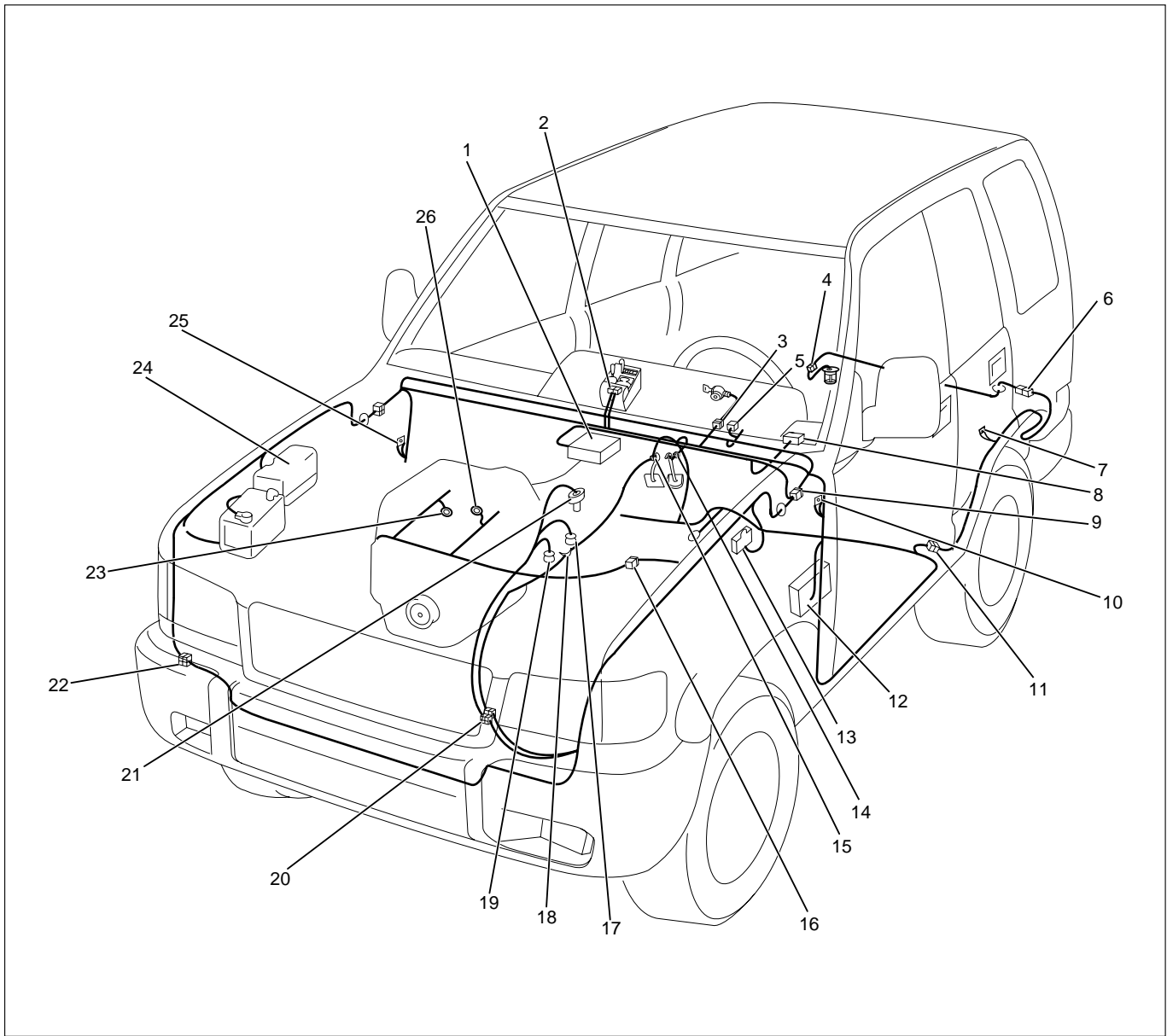
(48) E-43

(49) E-20

(50) E-6

(51) E-27

Parts Location (LHD 6V*1) – 2



D08RW913

Legend

- | | |
|-------------------|-------------------------|
| (1) PCM | (14) B-13 or B-14 |
| (2) B-30 | (15) B-10 |
| (3) B-11 | (16) H-5 |
| (4) F-4 | (17) M-7 |
| (5) I-9 | (18) M-25 |
| (6) H-33 | (19) M-6 |
| (7) R-4 | (20) H-10, H-11, H-53 |
| (8) C-63 | (21) M-15 |
| (9) H-7, H-8, H-9 | (22) H-41 |
| (10) B-18, B-19 | (23) E-30 |
| (11) H-46 | (24) Relay and Fuse Box |
| (12) Fuse Box | (25) B-2 |
| (13) C-16 | (26) E-28, E-29 |

QOS-III (4JG2)

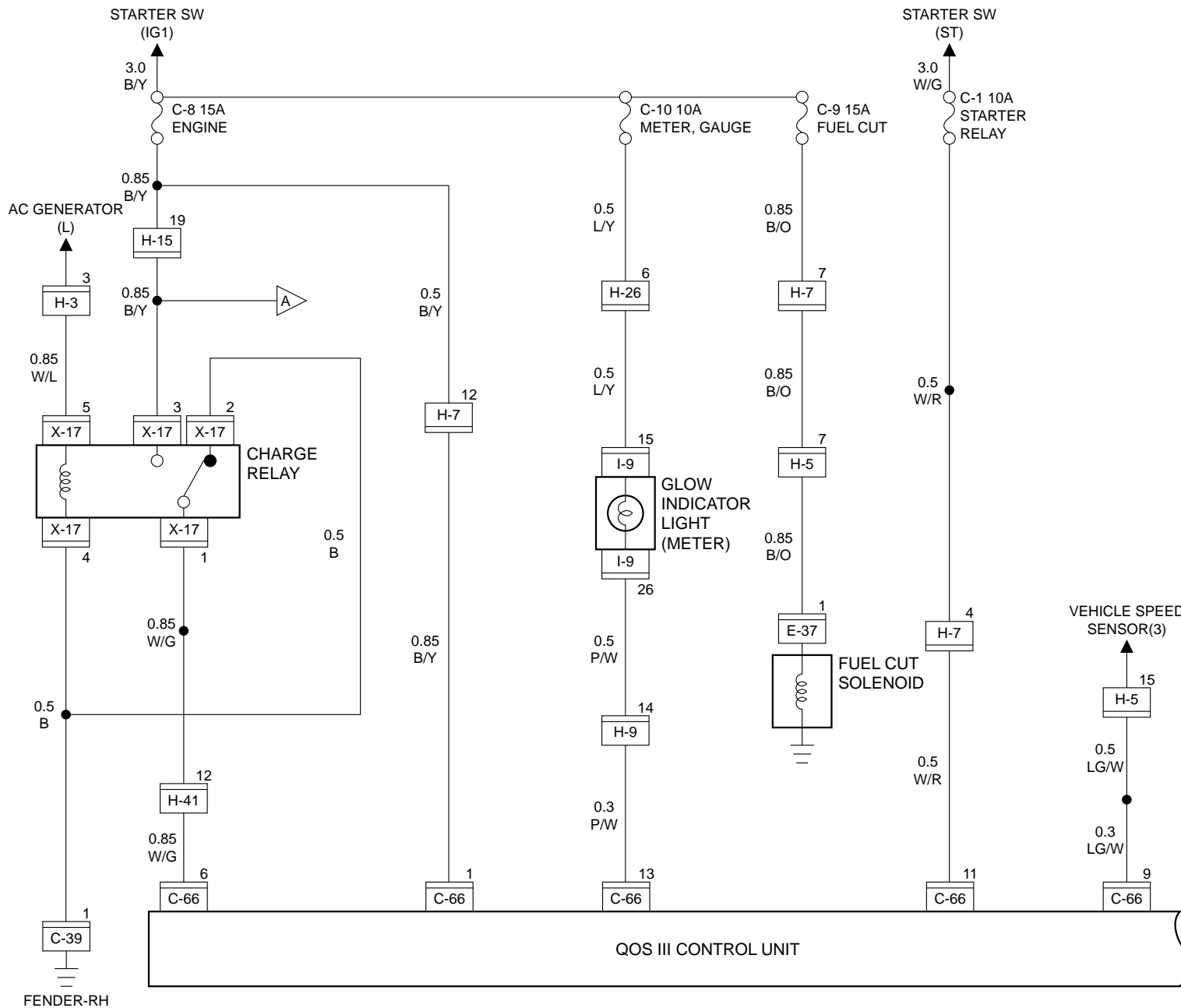
General Description

The circuit consists of the starter switch, QOS-III control unit, glow relay, charge relay, fuel cut solenoid, dropping resistor, thermo sensor, glow indicator light (meter), glow plug and car speed sensor. The engine coolant temperature at the time of the engine start-up is sensed by the thermo sensor to change the glow time so that the optimum starting conditions can always be obtained.

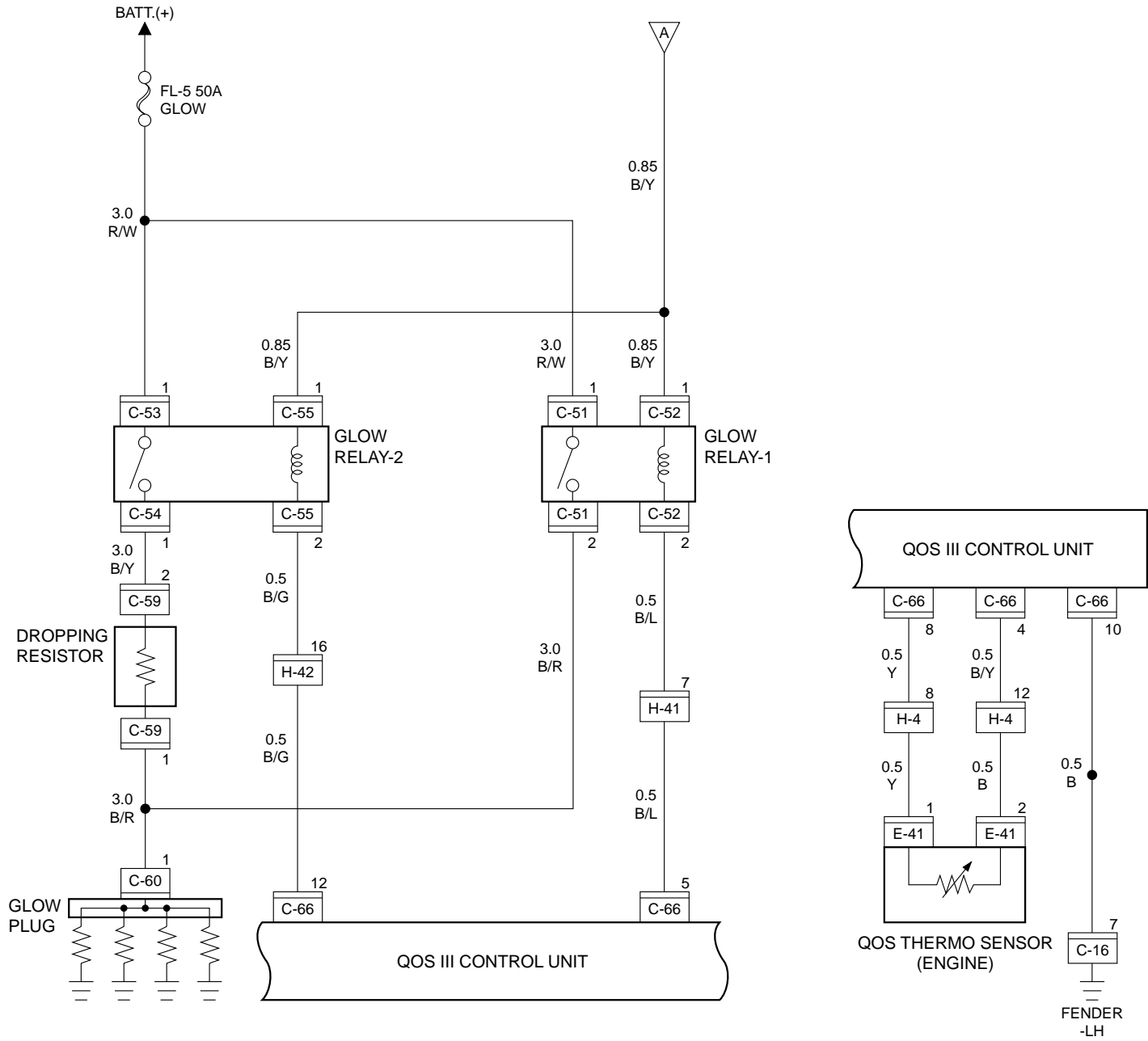
The idling speed just after the engine start-up can also be placed in the most suitable conditions in accordance with the coolant temperature by the operation of the delay timer.

The indicator timer is activated upon the starter switch turned to the ON position, and the indicator light comes on for as much time as suitable for the engine coolant temperature at the time of the engine start-up.

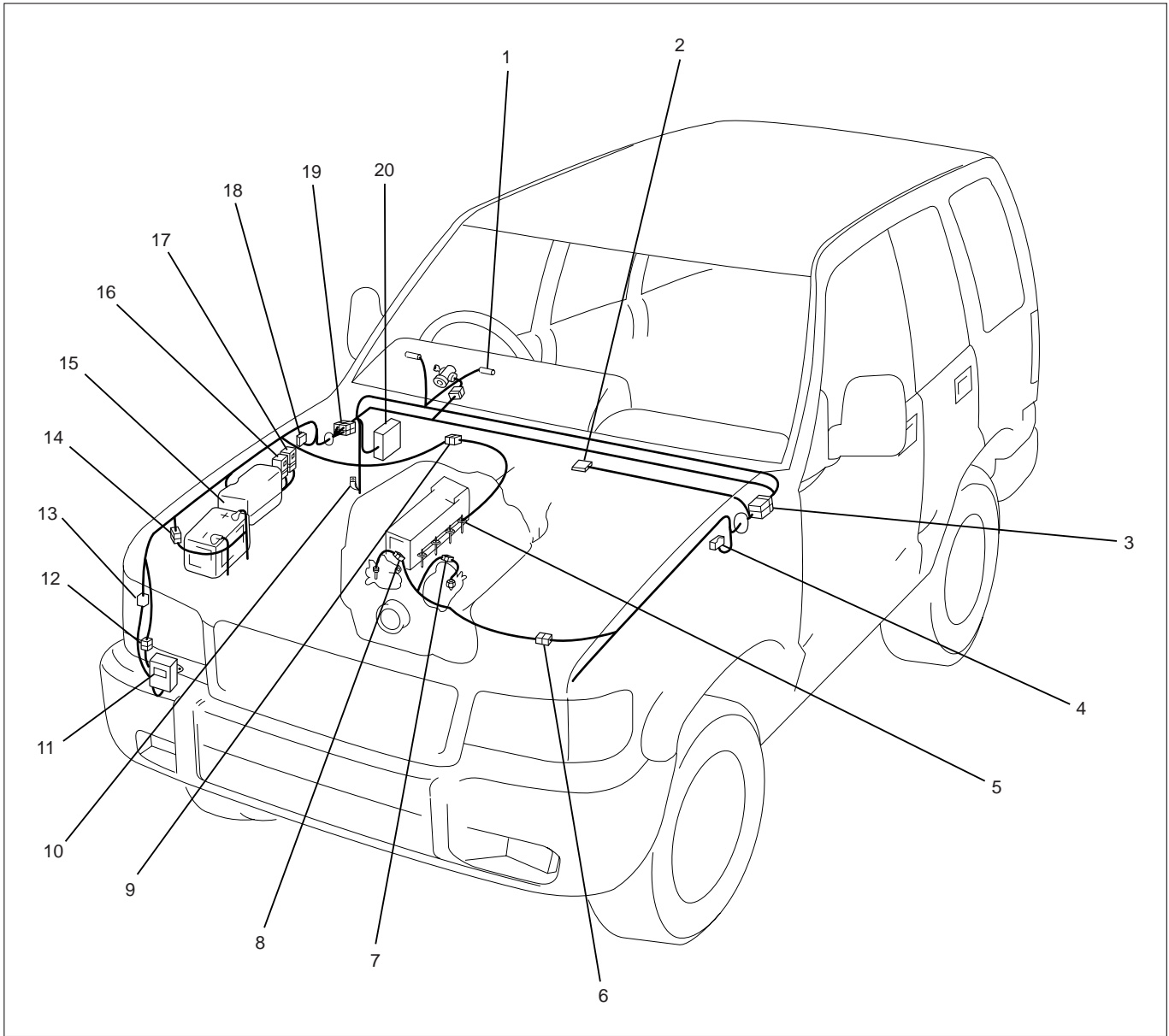
Circuit Diagram (RHD)-1



Circuit Diagram (RHD)-2



Parts Location (RHD)

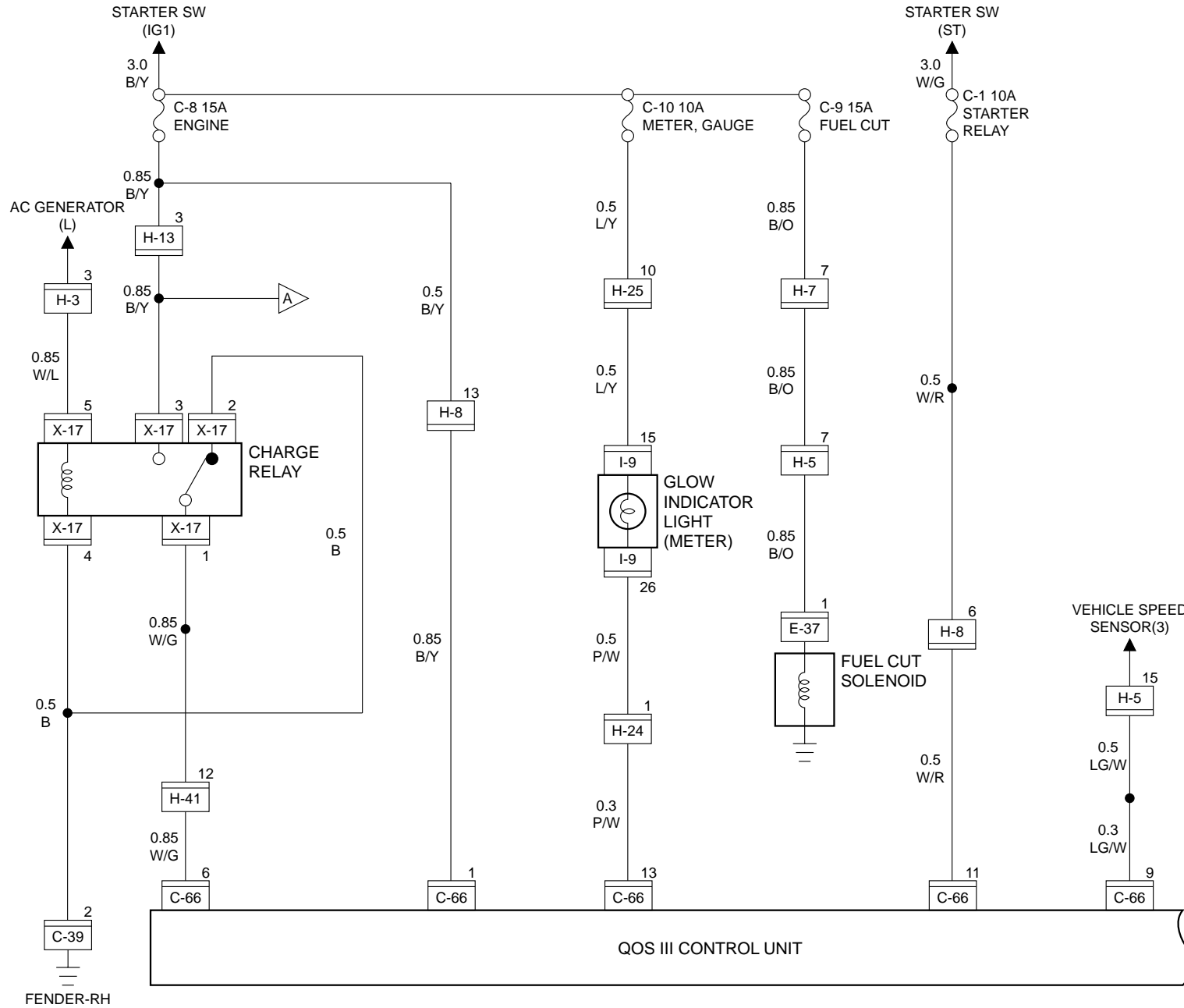


D08RWA27

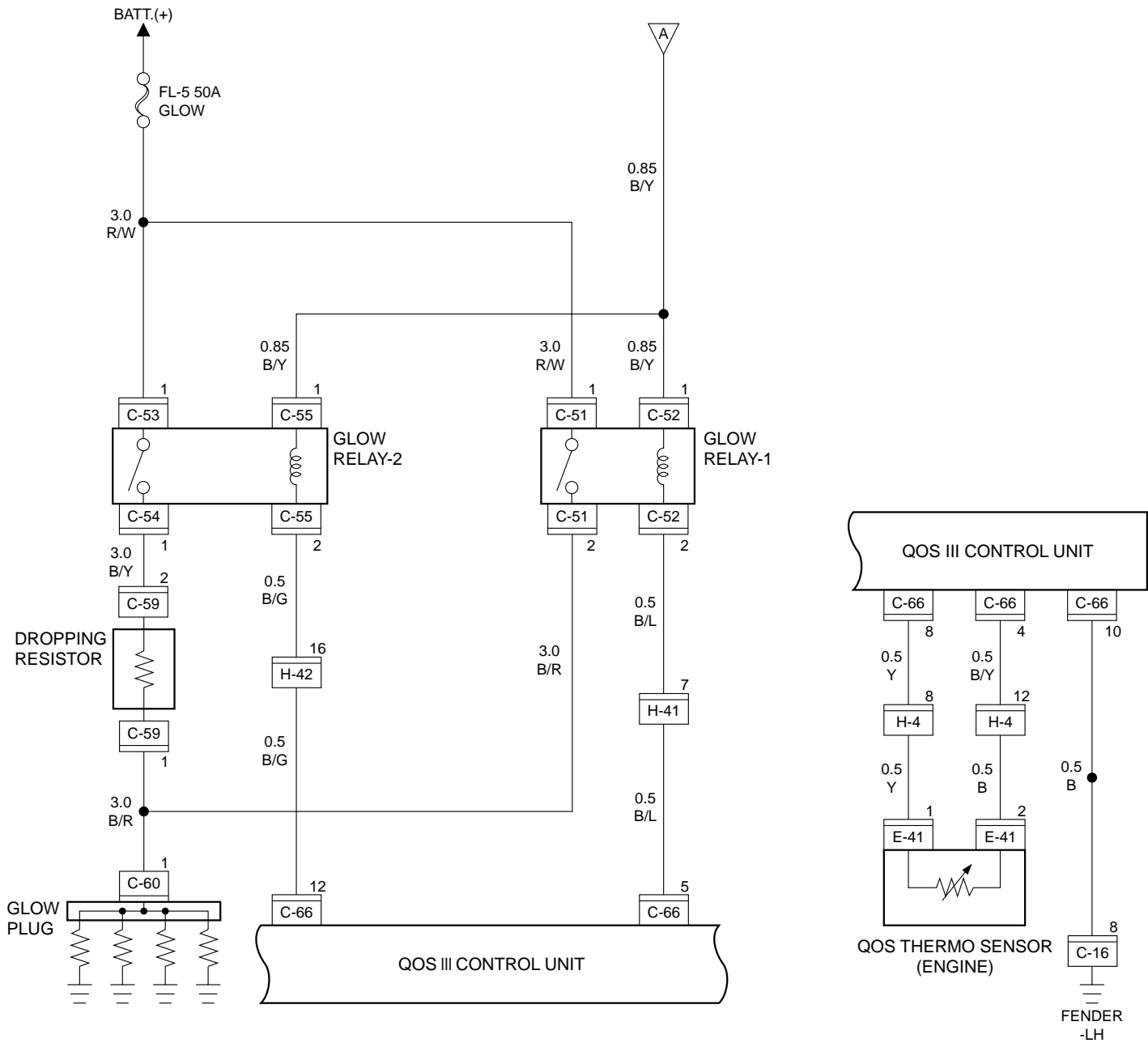
Legend

- | | |
|-------------------|--------------------------------------|
| (1) I-9 | (11) Dropping Resistor |
| (2) C-66 | (12) C-59 |
| (3) H-7, H-9 | (13) H-41, H-42 |
| (4) C-16 | (14) H-3 |
| (5) Glow Plug × 4 | (15) Relay and Fuse Box (X-17) |
| (6) H-4, H-5 | (16) Glow Relay-1 (C-51, C-52) |
| (7) E-37 | (17) Glow Relay-2 (C-53, C-54, C-55) |
| (8) E-41 | (18) C-39 |
| (9) C-60 | (19) H-15, H-26 |
| (10) B-19 | (20) Fuse Box |

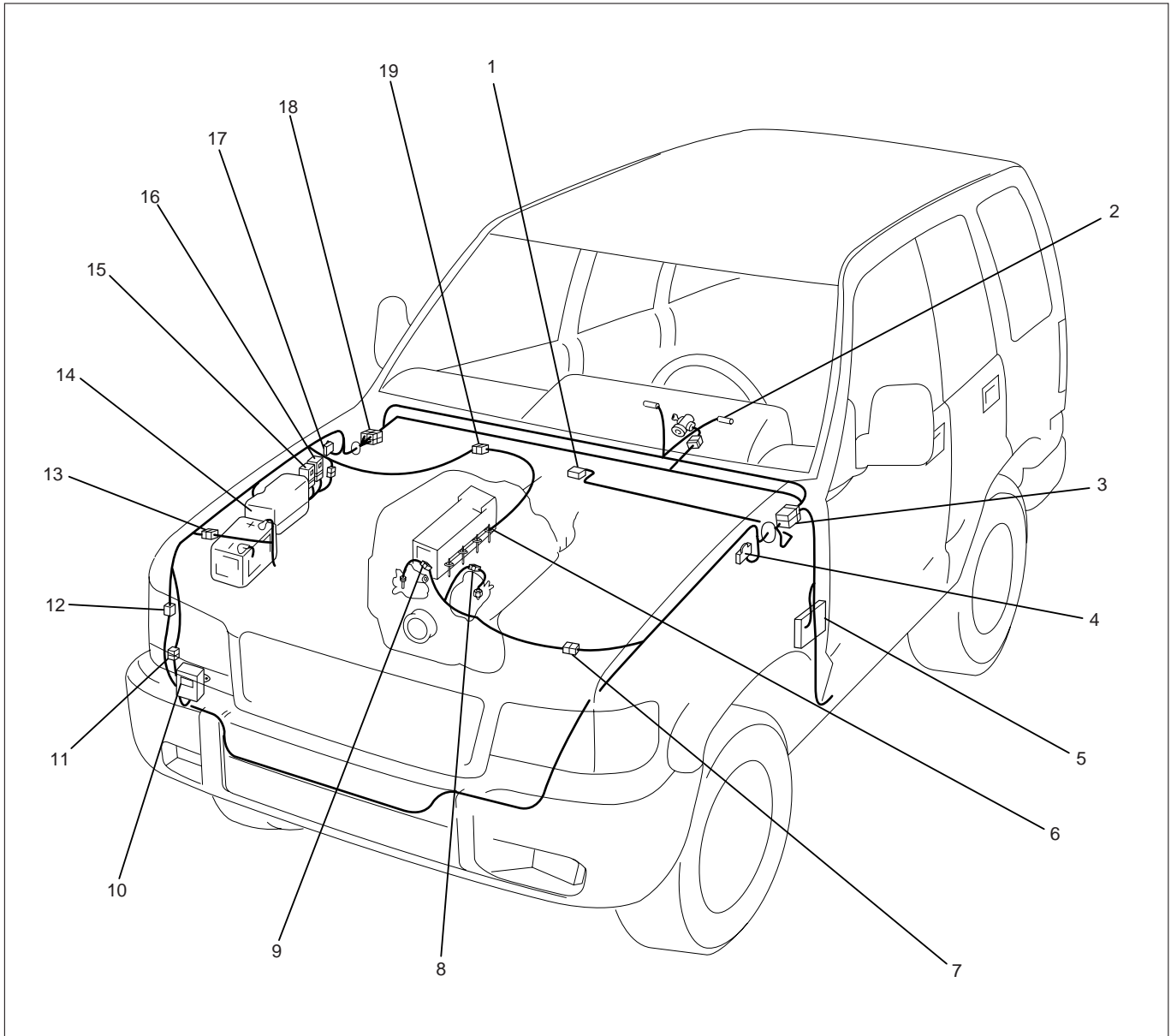
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RWA26

Legend

- | | |
|--------------------------|--------------------------------------|
| (1) C-66 | (10) Dropping Resistor |
| (2) I-9 | (11) C-59 |
| (3) H-7, H-8, H-24, H-25 | (12) H-41, H-42 |
| (4) C-16 | (13) H-3 |
| (5) Fuse Box | (14) Relay and Fuse Box (X-17) |
| (6) Glow Plug × 4 | (15) Glow Relay-1 (C-51, C-52) |
| (7) H-4, H-5 | (16) Glow Relay-2 (C-53, C-54, C-55) |
| (8) E-37 | (17) C-39 |
| (9) E-41 | (18) H-13 |
| | (19) C-60 |

QOS and EGR System (4JG2)

General Description

The circuit consists of the starter switch, QOS/EGR control unit, glow relay, charge relay, fuel cut solenoid, dropping resistor, thermo sensor, glow indicator light (meter), glow plug, vehicle speed sensor, tachometer, throttle position sensor, EVRV and VSV; EGR.

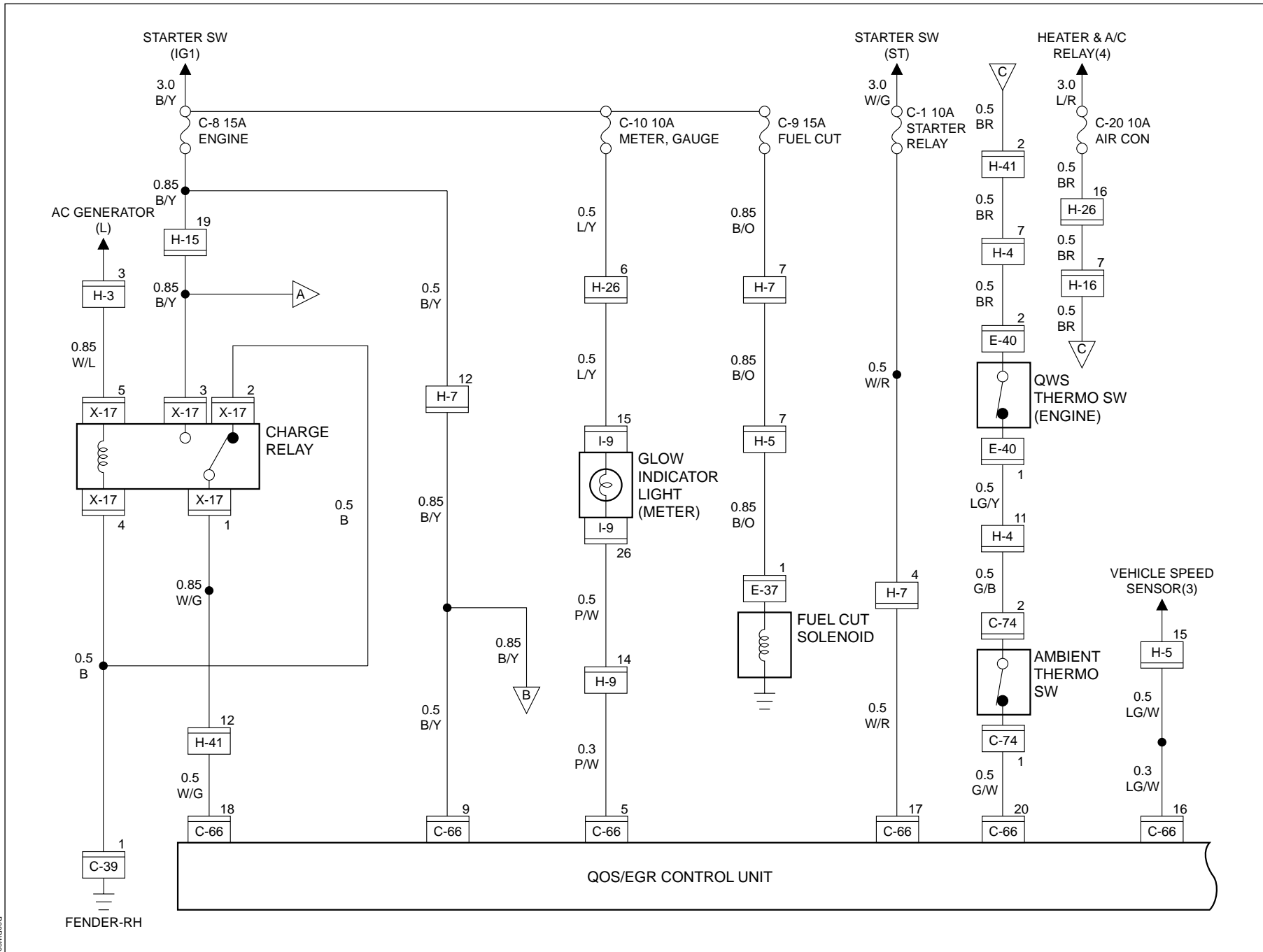
The engine coolant temperature at the time of the engine start-up is sensed by the thermo sensor to change the glow time so that the optimum starting conditions can always be obtained.

The idling speed just after the engine start-up can also be placed in the most suitable conditions in accordance with the coolant temperature by the operation of the delay timer.

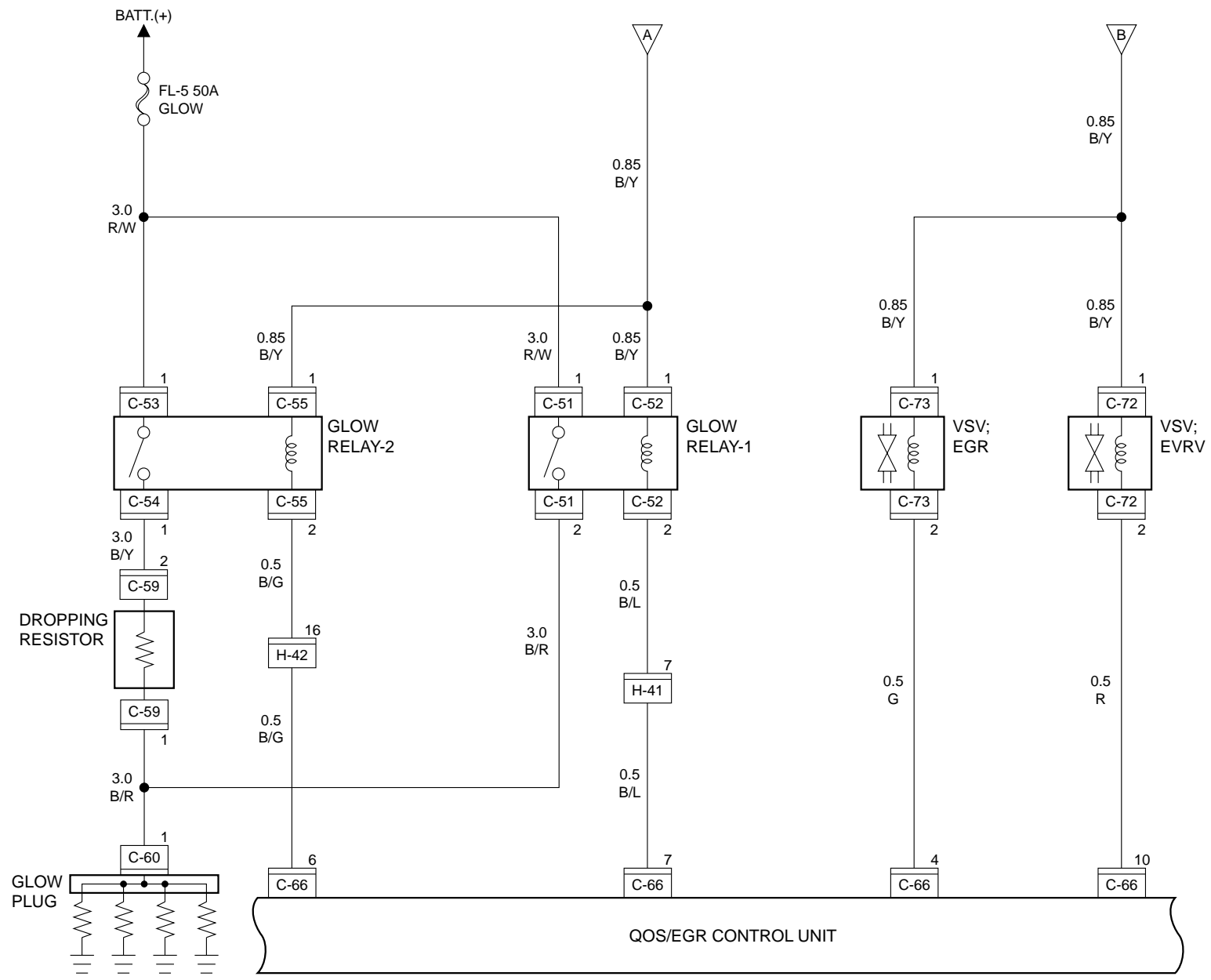
The indicator timer is activated upon the starter switch turned to the ON position, and the indicator light comes on for as much time as suitable for the engine coolant temperature at the time of the engine start-up.

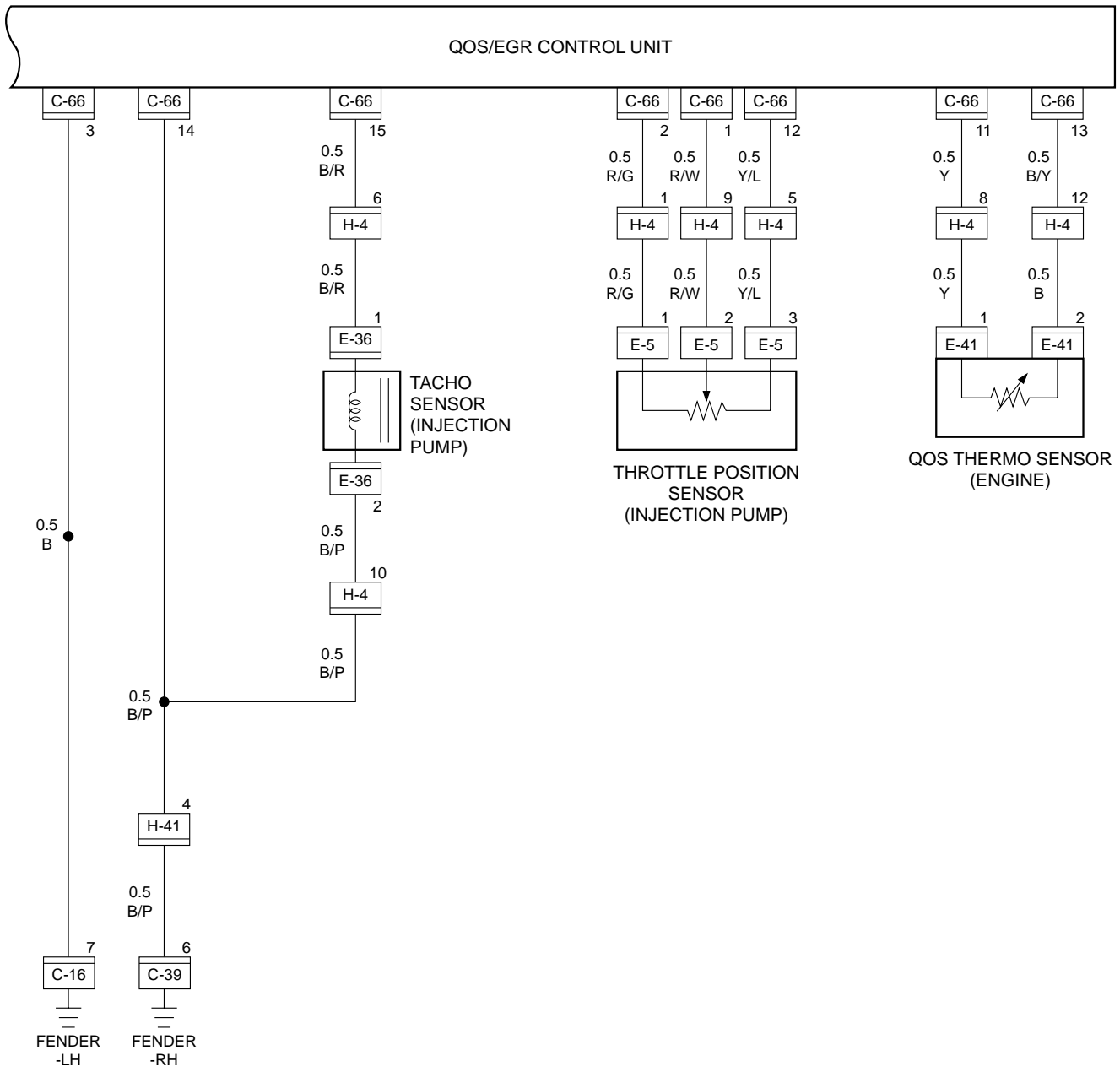
EGR system controls the information of NO_x by returning a small amount of exhaust gas from the intake manifold to the combustion chamber through the EGR valve.

Circuit Diagram (RHD)-1



Circuit Diagram (RHD)-2

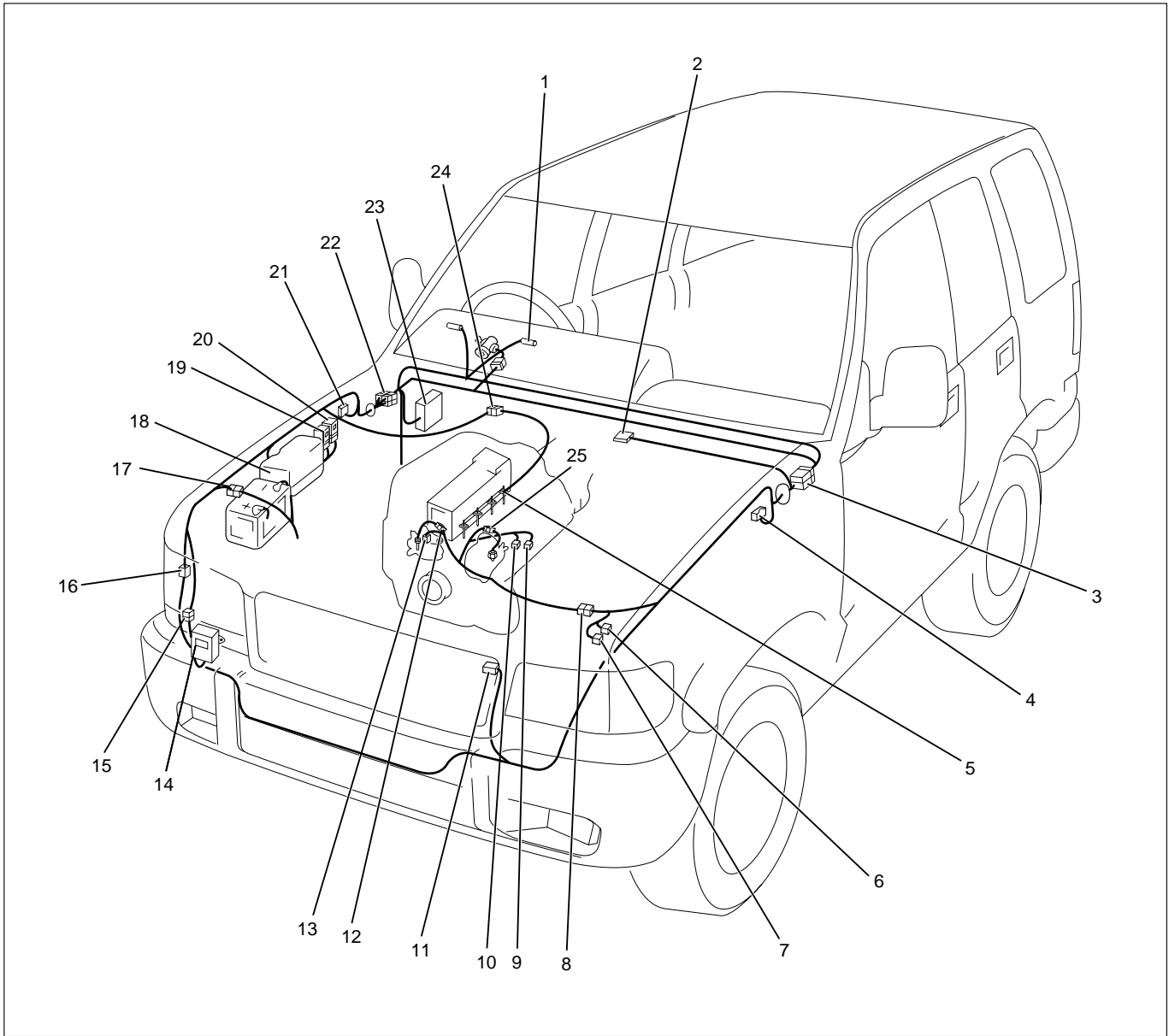




Circuit Diagram (RHD)-3

08R9W097

Parts Location (RHD)

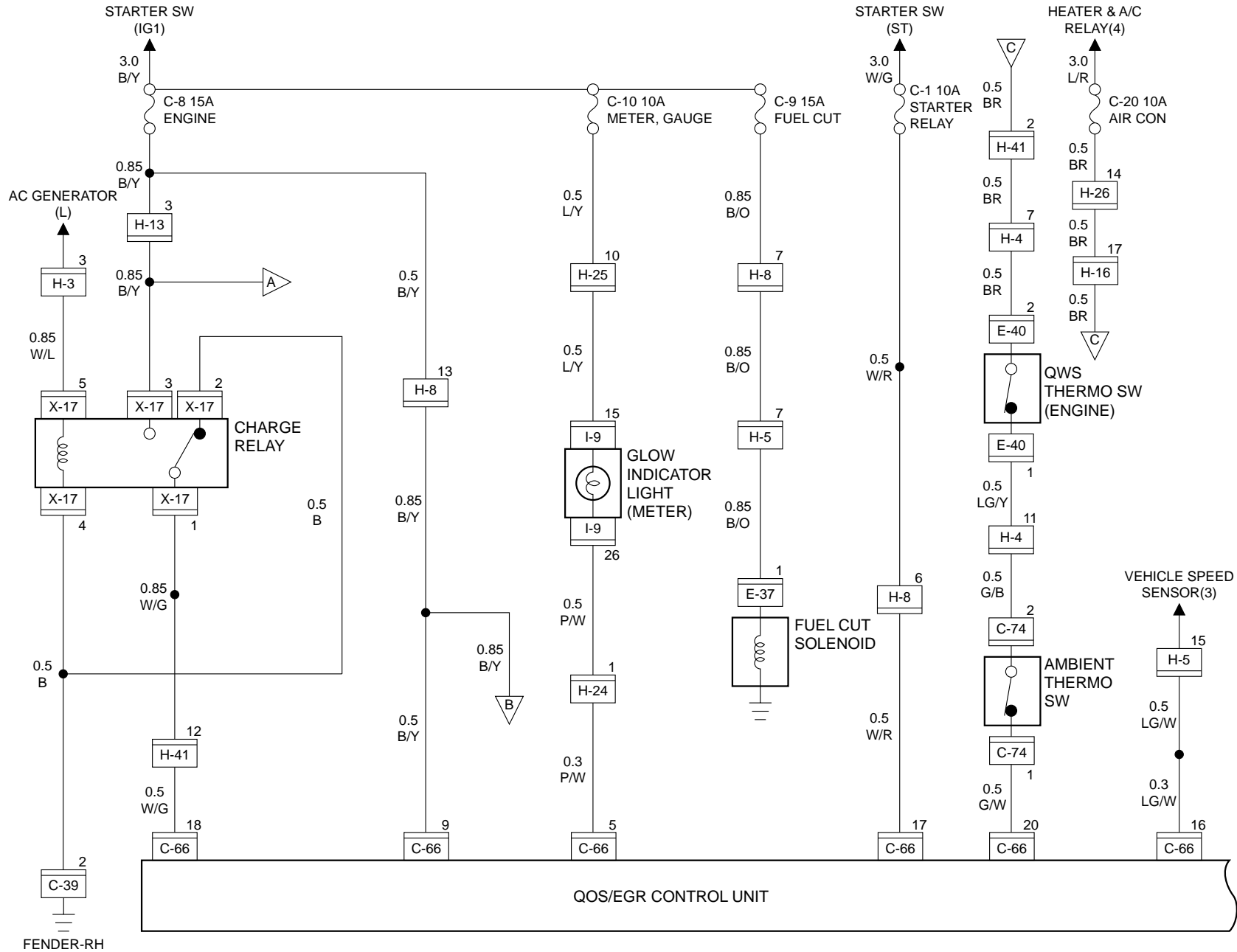


D08RW846

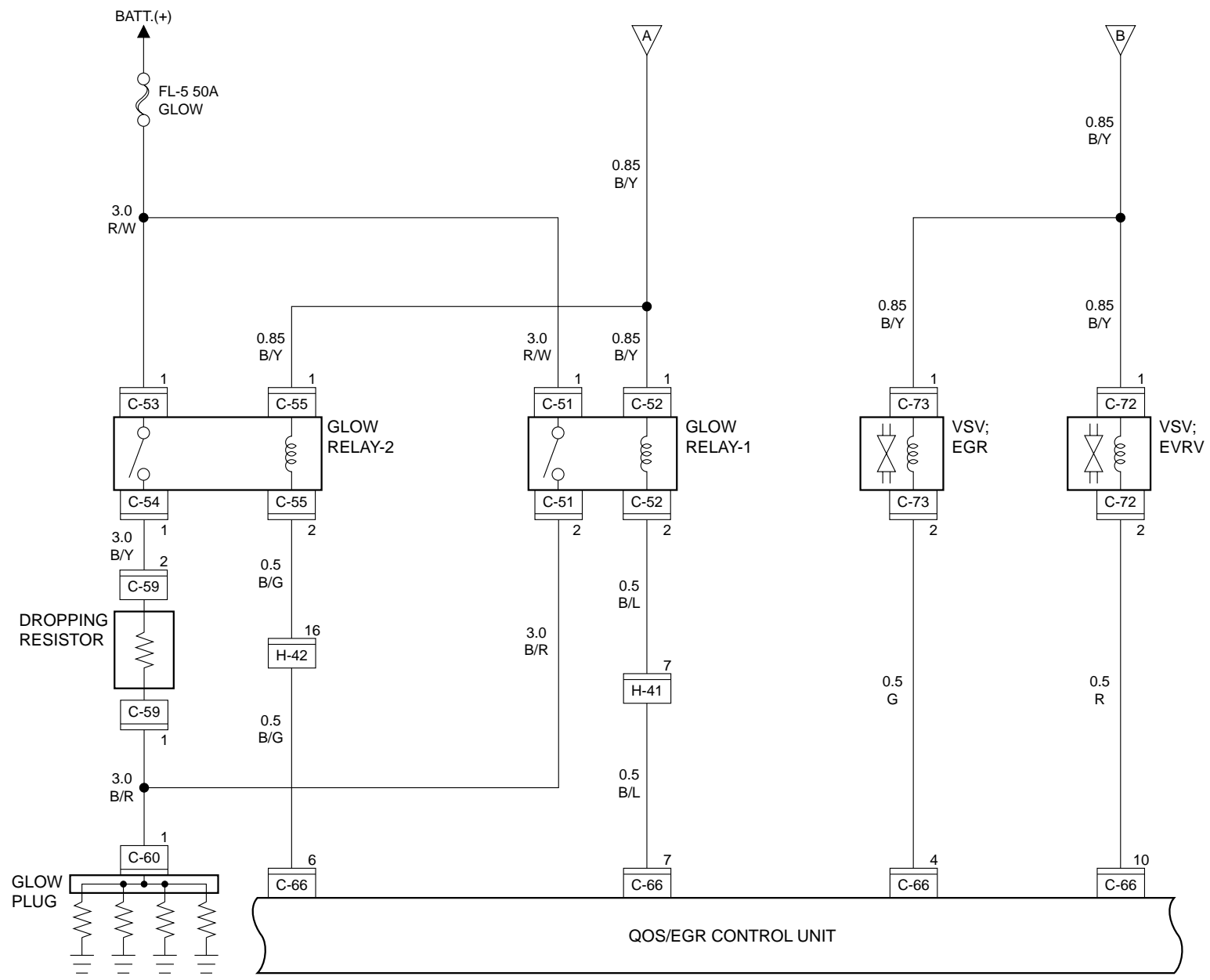
Legend

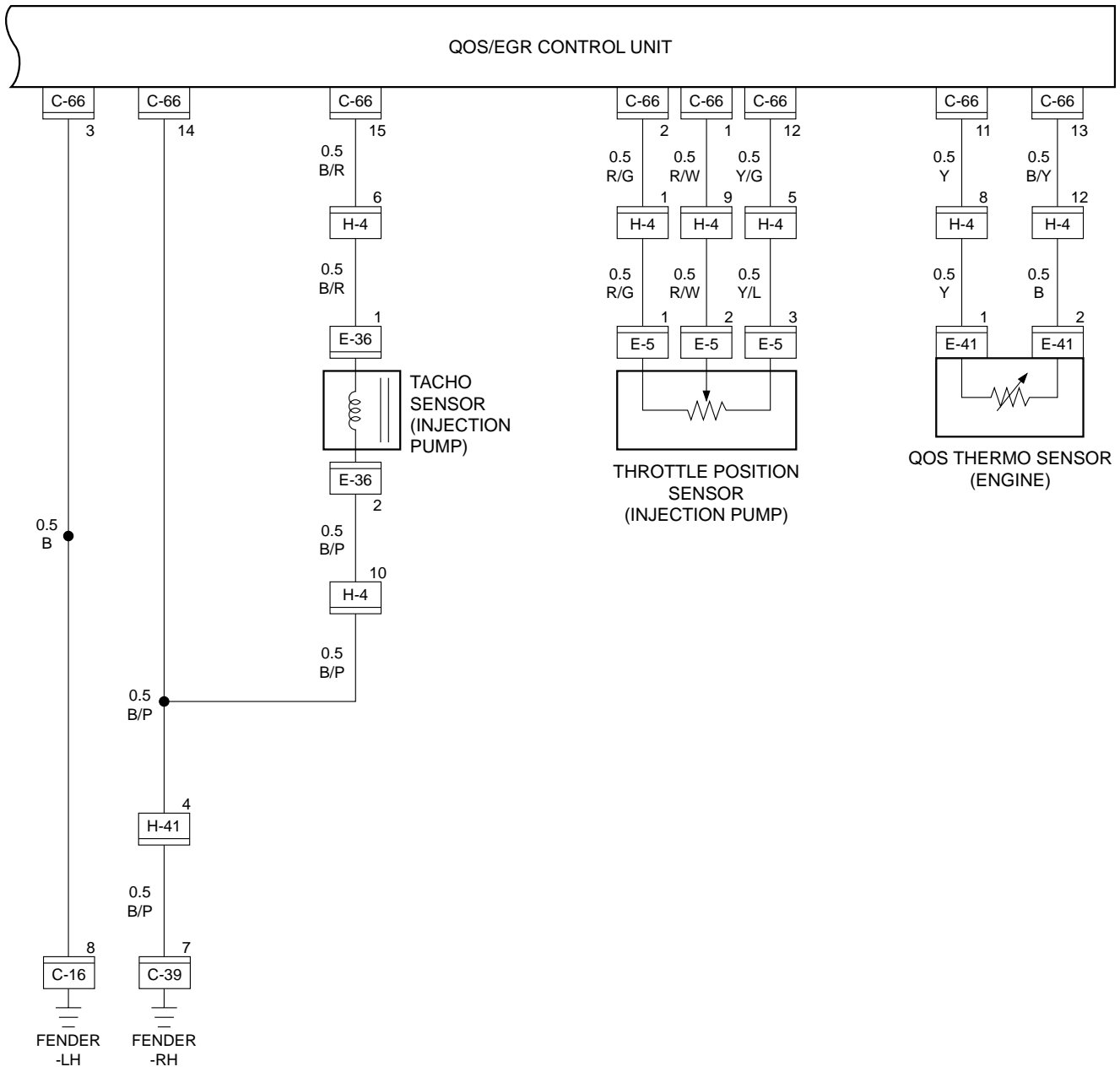
- | | |
|---------------------------------|--------------------------------------|
| (1) I-9 | (13) E-40 |
| (2) C-66 (QOS/EGR Control Unit) | (14) Dropping Resistor |
| (3) H-7, H-9 | (15) C-59 |
| (4) C-16 | (16) H-41, H-42 |
| (5) Glow Plug | (17) H-3 |
| (6) C-72 | (18) Relay and Fuse Box (X-17) |
| (7) C-73 | (19) C-51, C-52 (Glow Relay-1) |
| (8) H-4, H-5 | (20) C-53, C-54, C-55 (Glow Relay-2) |
| (9) E-36 | (21) C-39 |
| (10) E-5 | (22) H-15, H-16, H-26 |
| (11) C-74 | (23) Fuse Box |
| (12) E-41 | (24) C-60 |
| | (25) E-37 |

Circuit Diagram (LHD)-1



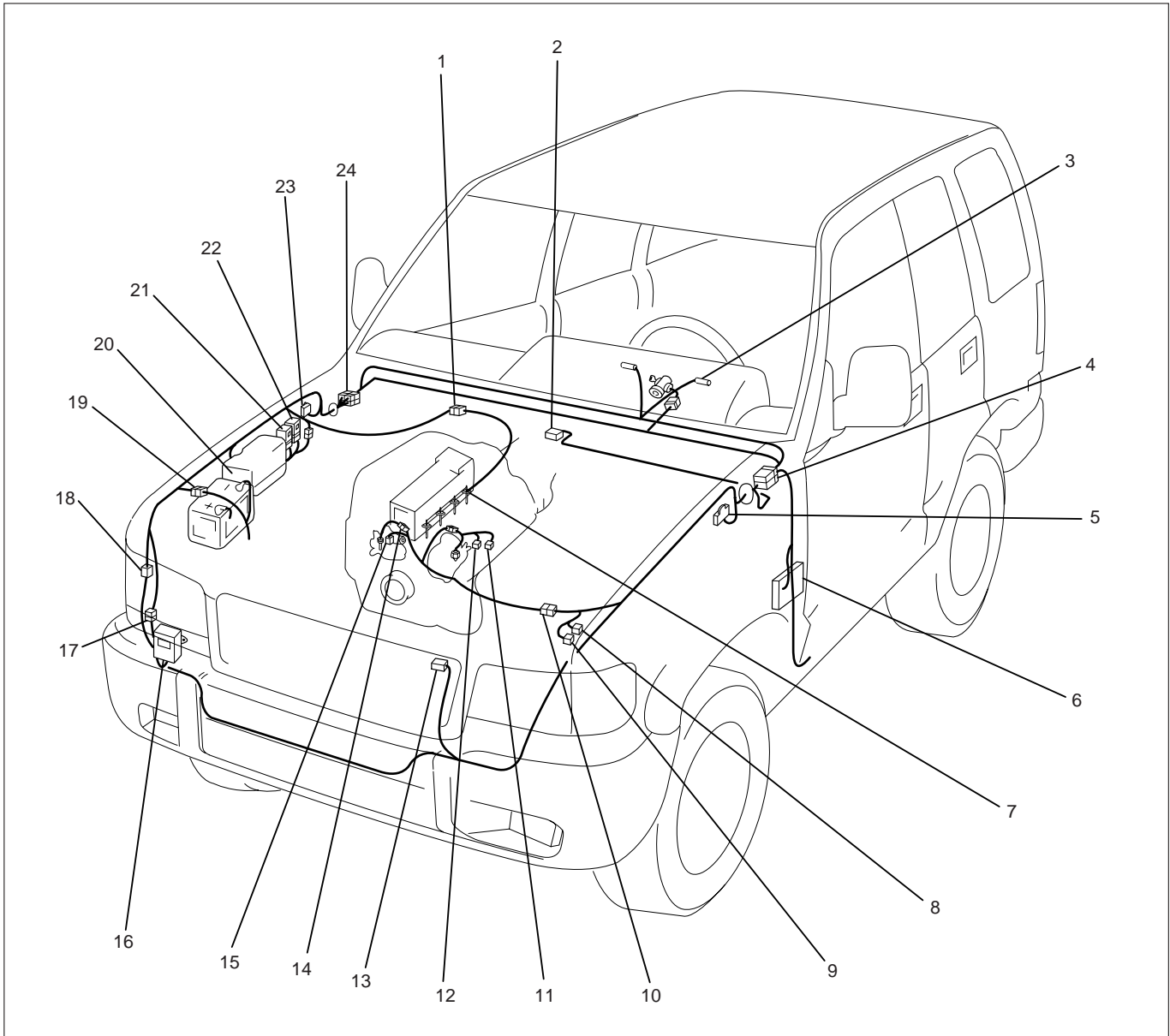
Circuit Diagram (LHD)-2





Circuit Diagram (LHD)-3

Parts Location (LHD)



D08RWA25

Legend

- | | |
|---------------------------------|--------------------------------------|
| (1) C-60 | (13) C-74 |
| (2) QOS/EGR Control Unit (C-66) | (14) E-41 |
| (3) I-9 | (15) E-40 |
| (4) H-8, H-24, H-25, H-26 | (16) Dropping Resistor |
| (5) C-16 | (17) C-59 |
| (6) Fuse Box | (18) H-41, H-42 |
| (7) Glow Plug × 4 | (19) H-3 |
| (8) C-72 | (20) Relay and Fuse Box (X-17) |
| (9) C-73 | (21) Glow Relay-1 (C-51, C-52) |
| (10) H-4, H-5 | (22) Glow Relay-2 (C-53, C-54, C-55) |
| (11) E-36 | (23) C-39 |
| (12) E-5 | (24) H-13, H-16 |

Headlight and Fog Light

General Description

The circuit consists of the headlight, FRT fog light, lighting SW, dimmer, passing SW, FRT fog light SW, high beam indicator, tail relay, lighting relay, FRT fog light relay and dimmer relay (LHD).

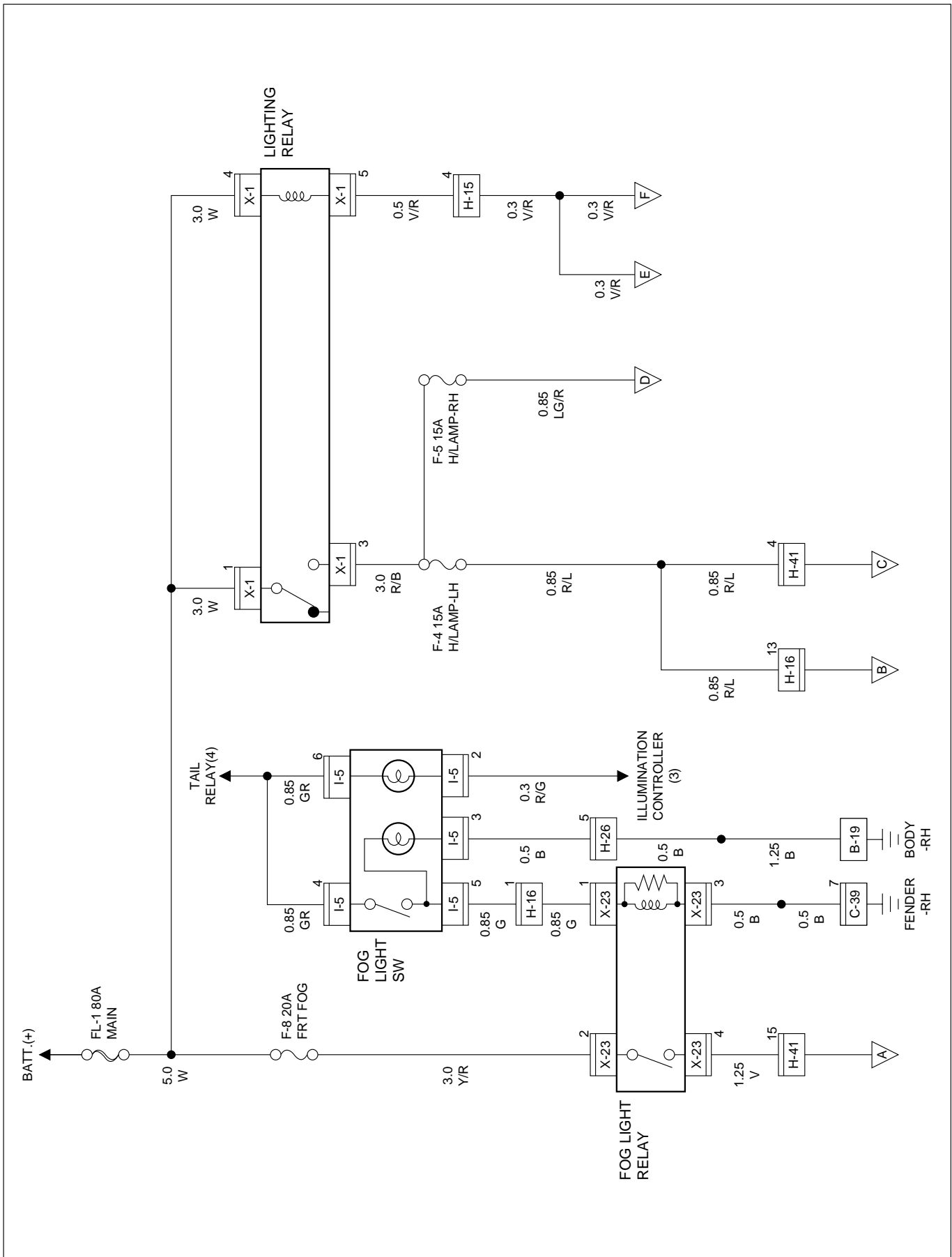
When the lighting SW is turned on by setting it at headlight position, the lighting relay is activated to turn on the headlight. The optical axis of the headlight can be turned up or down by operating the dimmer SW while the headlight is on.

The passing SW is independent of the lighting SW, and the optical axis of the passing light can be

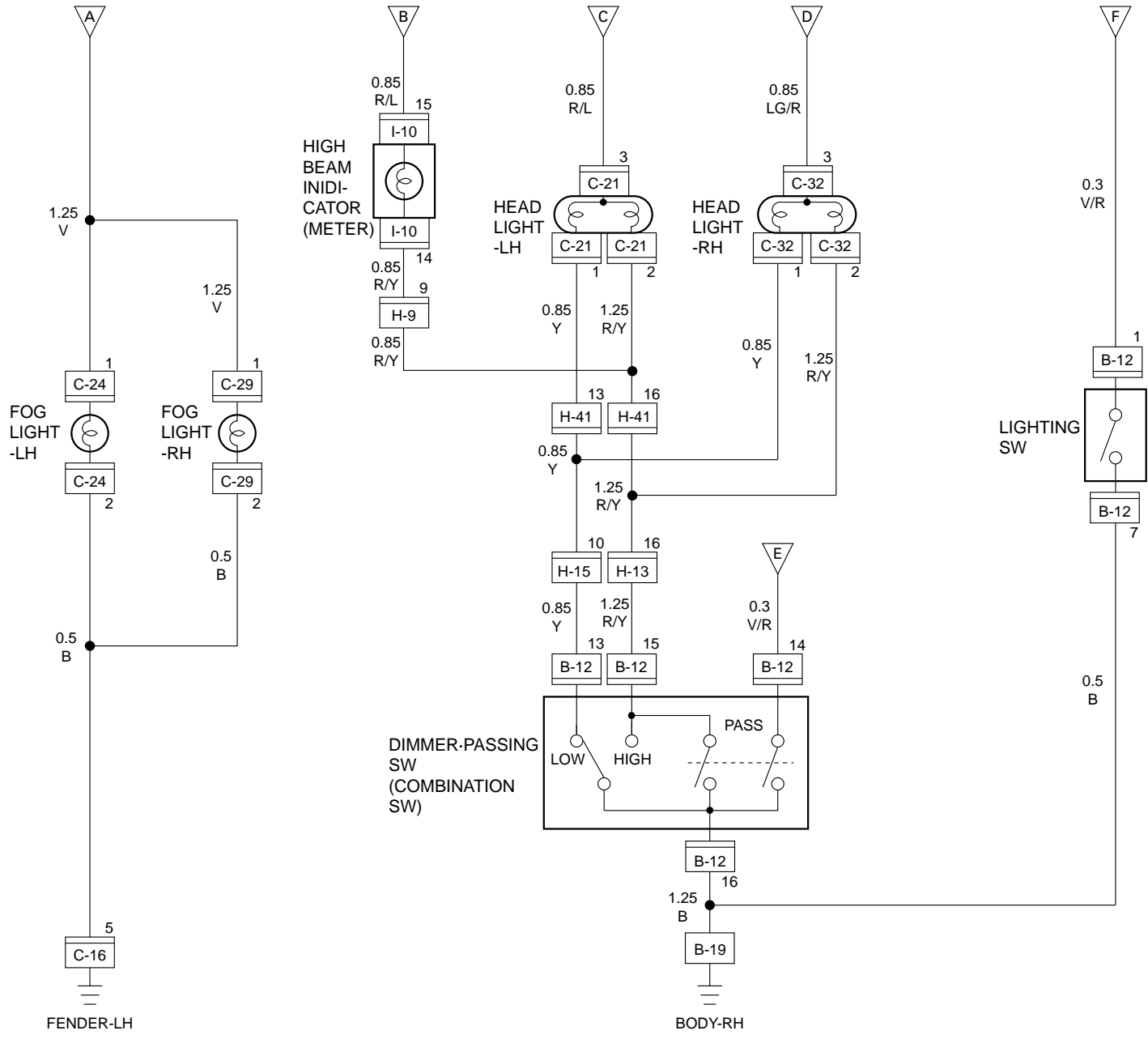
turned up only while the switch lever is pulled up and held in this state.

FRT fog lights turn on when the lighting SW is at clearance light or headlight position.

Circuit Diagram (RHD)-1

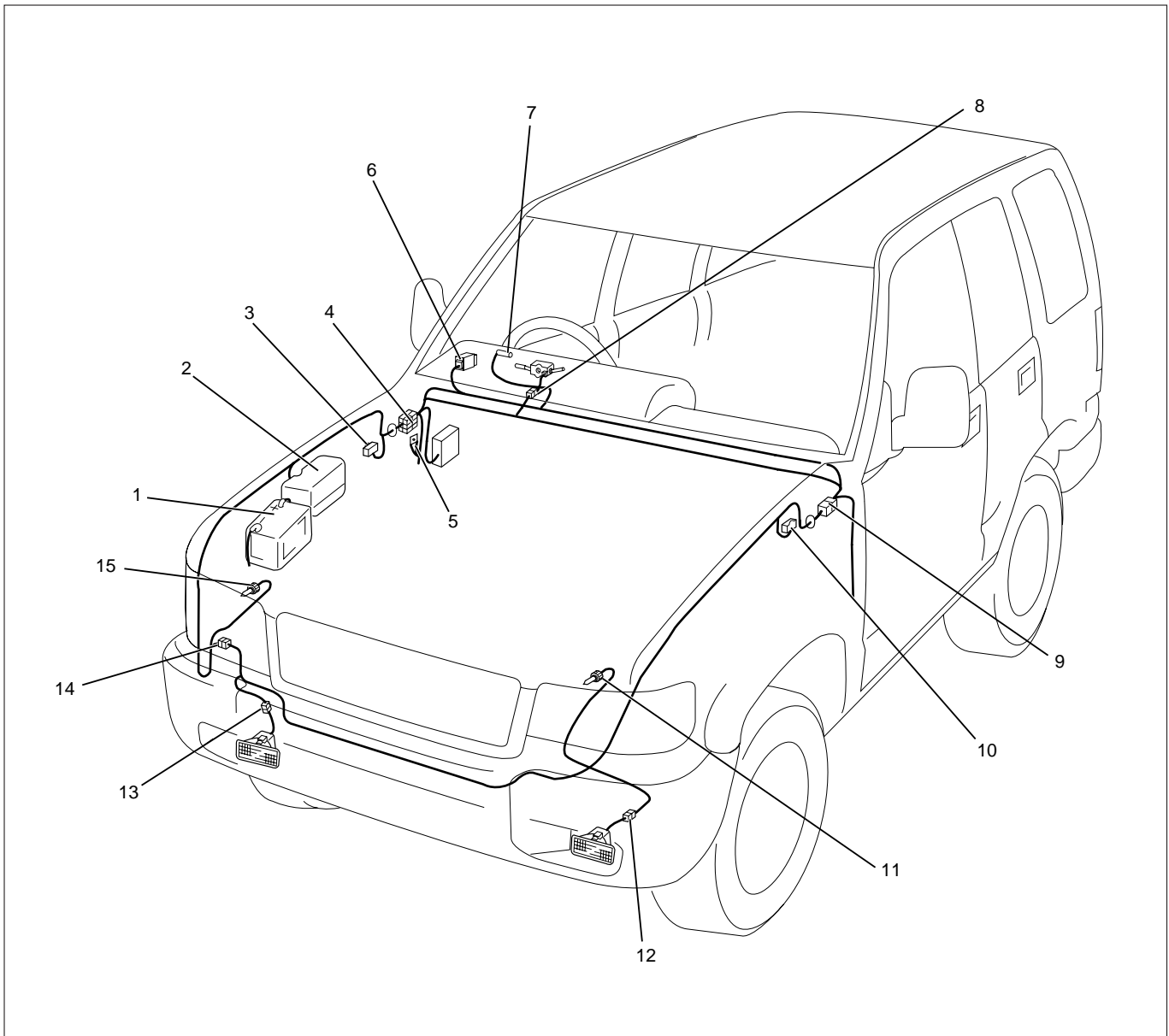


Circuit Diagram (RHD)-2



DDRRV093

Parts Location (RHD)

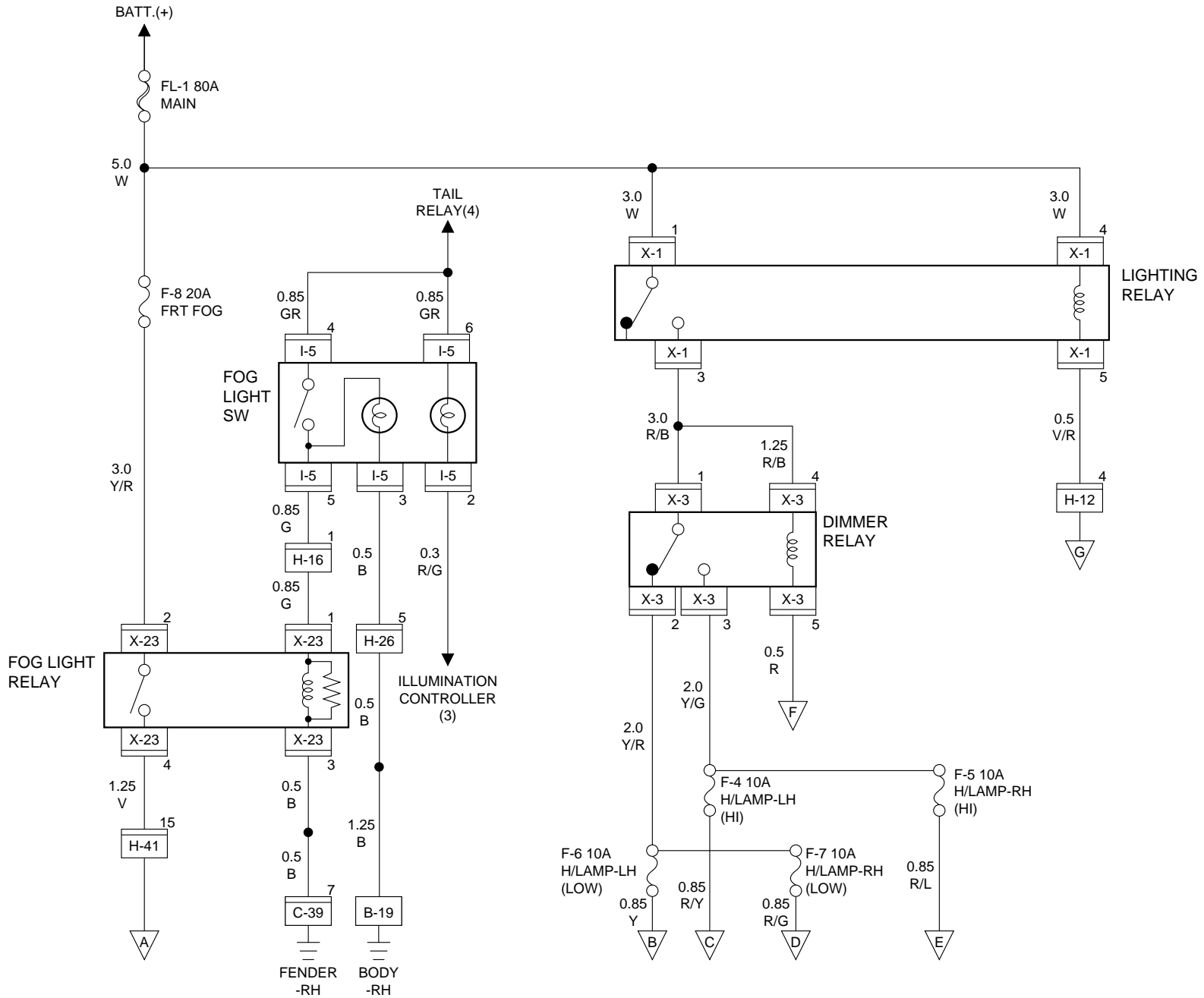


D08RW607

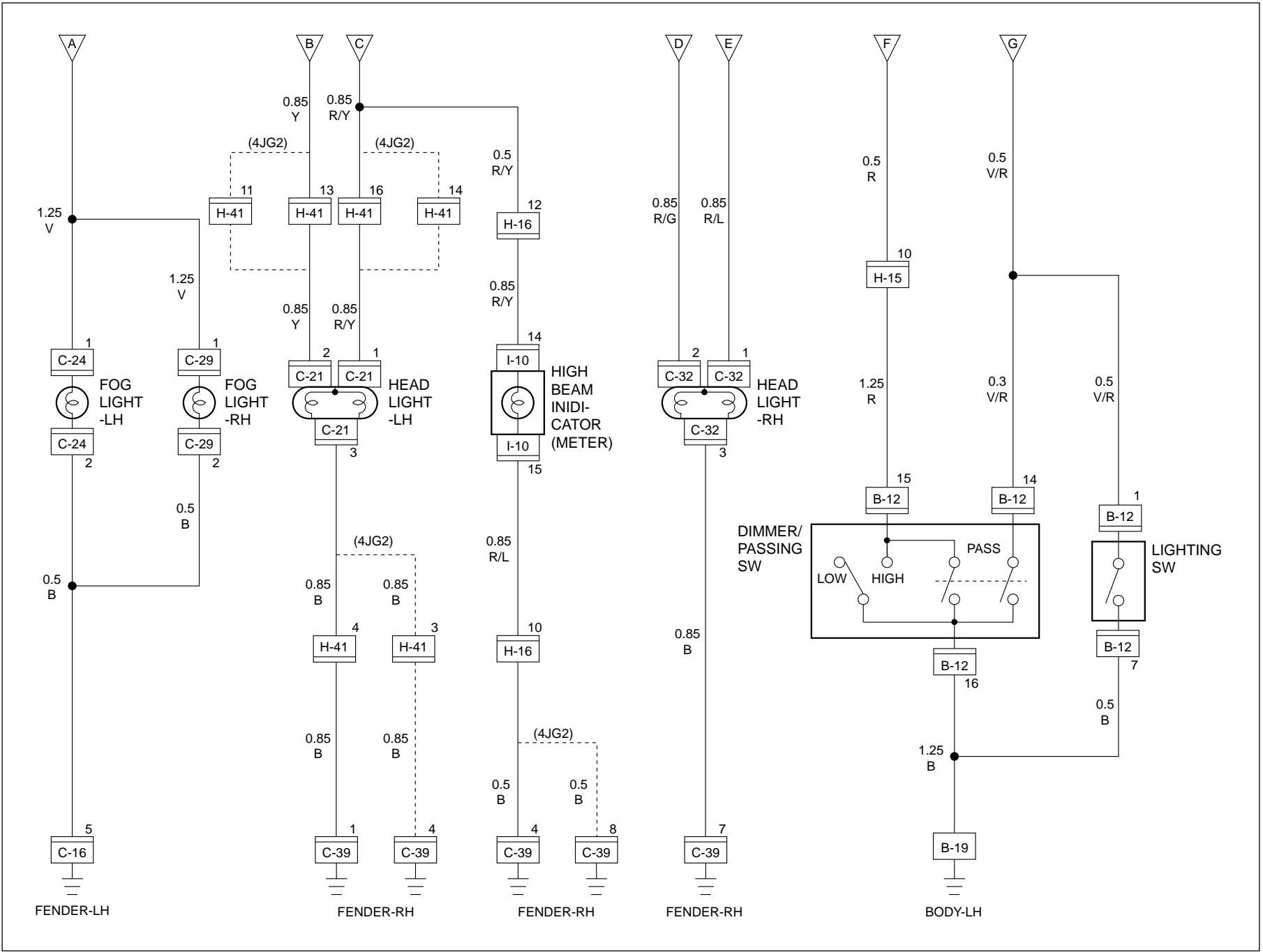
Legend

- | | |
|------------------------------------|-----------------|
| (1) Battery | (8) B-12 |
| (2) Relay and Fuse Box (X-1, X-23) | (9) H-9 |
| (3) C-39 | (10) C-16 |
| (4) H-13, H-15, H-16, H-26 | (11) C-21 |
| (5) B-19 | (12) C-24 |
| (6) I-5 | (13) C-29 |
| (7) I-10 | (14) H-41, H-42 |
| | (15) C-32 |

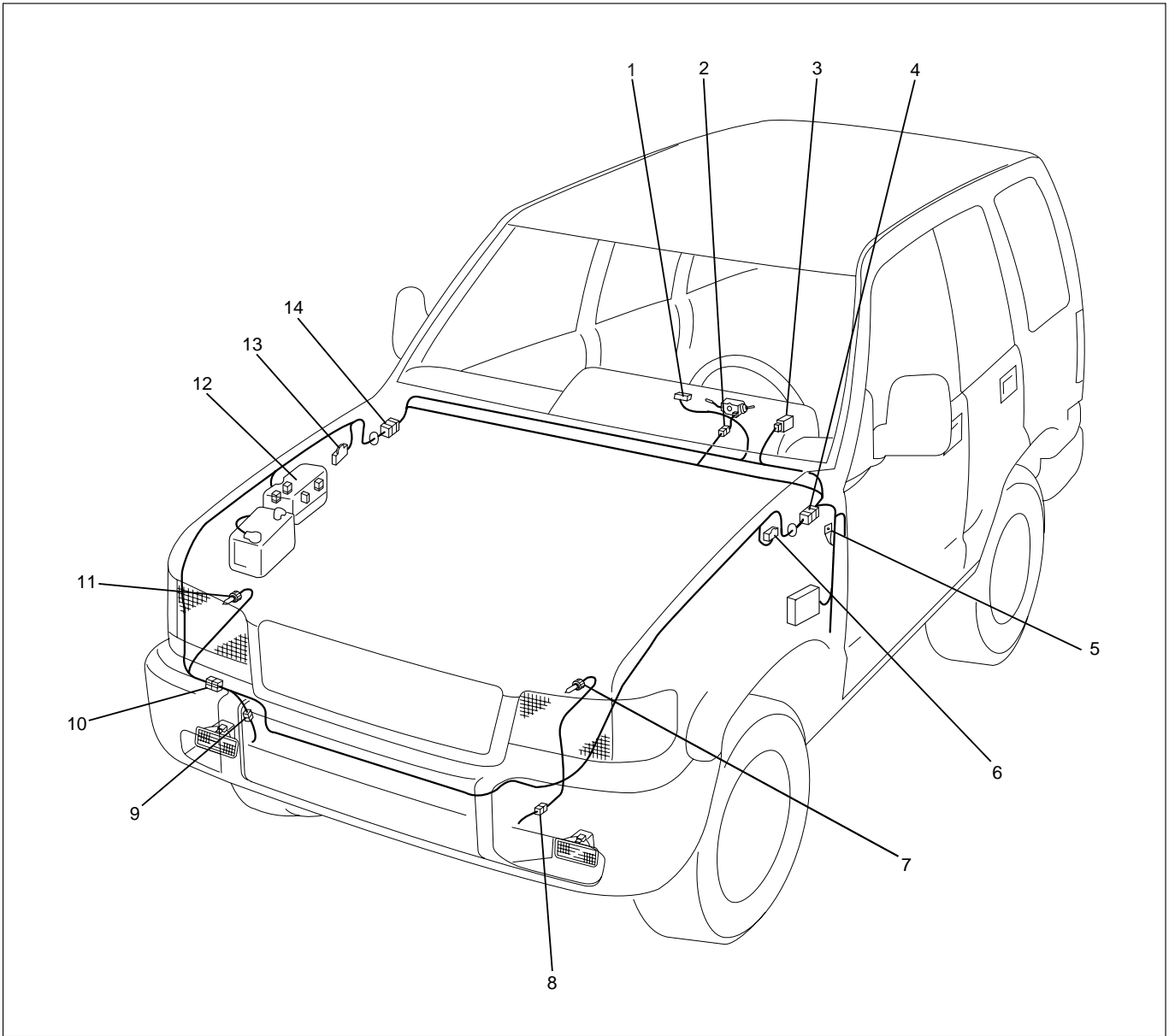
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW806

Legend

- | | |
|----------|--|
| (1) I-10 | (8) C-24 |
| (2) B-12 | (9) C-29 |
| (3) I-5 | (10) H-41, H-42 |
| (4) H-26 | (11) C-32 |
| (5) B-19 | (12) Relay and Fuse Box (X-1, X-3, X-23) |
| (6) C-16 | (13) C-39 |
| (7) C-21 | (14) H-12, H-15, H-16 |

Diagnosis

Quick Chart for Check Points

1. Headlight (RHD)

Check point Trouble mode	Fuse		Lighting relay	Lighting SW	Dimmer Passing SW	Headlight bulb		Cable harness
	F-4 (15A)	F-5 (15A)				LH	RH	
1-1. Both Headlights inoperative			○	○	○			○
1-2. Headlight on the left (or right) side inoperative	○	○				○	○	○
1-3. Both headlights in low-beam inoperative					○			○
1-4. Headlight low-beam on the left (or right) side inoperative	○	○			○	○	○	○
1-5. Both headlights in high-beam inoperative					○			○
1-6. Headlight high-beam on the left (or right) side inoperative	○	○			○	○	○	○
1-7. Headlight beam does not change					○			○
1-8. Headlights remain on when the lighting SW is turned off			○	○				○
1-9. Headlights come on with the lighting SW at the clearance light position				○				
1-10. Passing lights inoperative					○			○

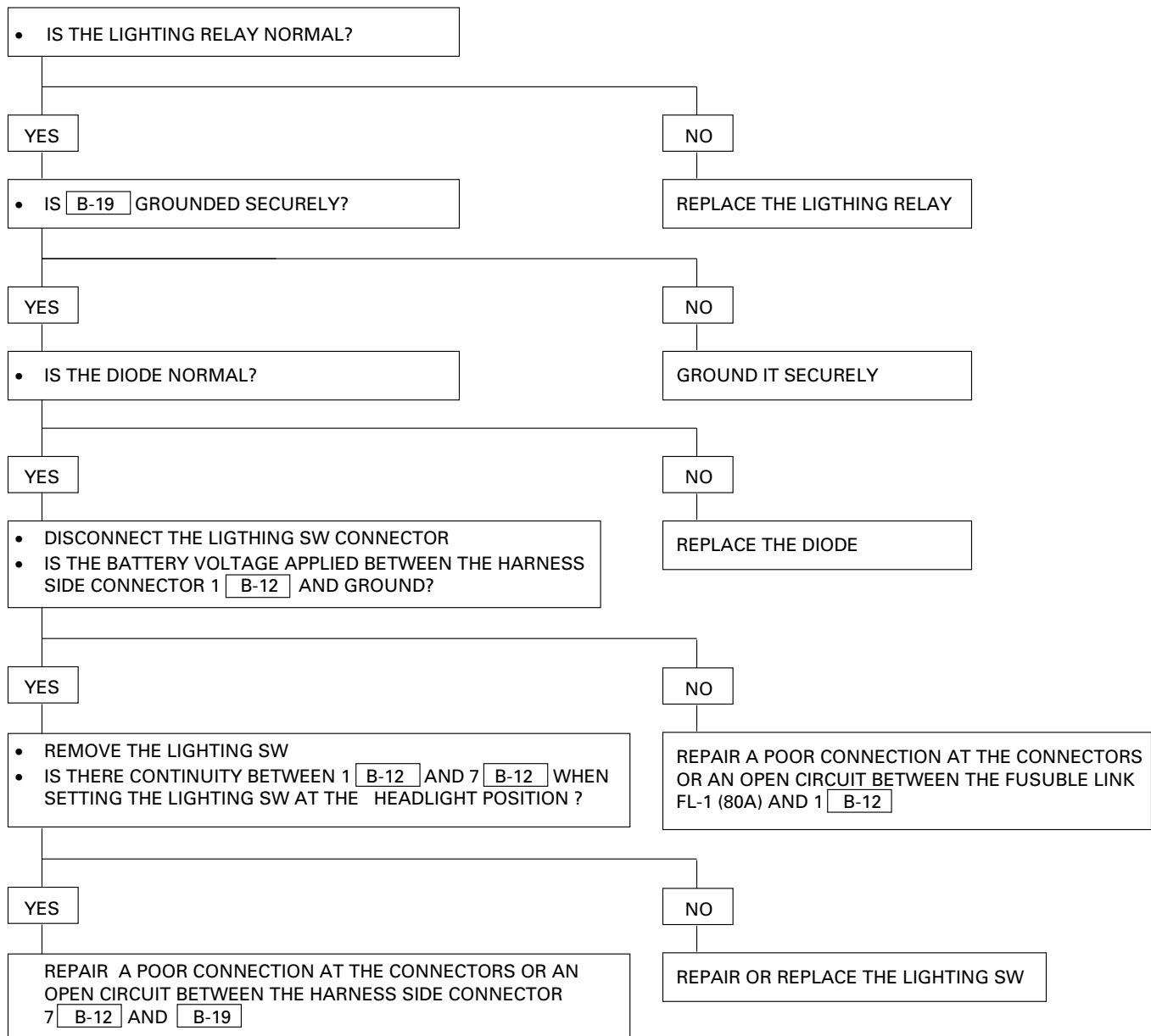
2. Headlight (LHD)

Check point Trouble mode	Fuse				Lighting relay	Dimmer relay	Diode	Lighting SW	Dimmer Passing SW	Headlight bulb		Cable harness
	F-4 (10A)	F-5 (10A)	F-6 (10A)	F-7 (10A)						LH	RH	
2-1. Both Headlights inoperative					○	○	○	○				○
2-2. Headlight on the left (or right) side inoperative										○	○	○
2-3. Both headlights in low-beam inoperative						○						○
2-4. Headlight low-beam on the left (or right) side inoperative			○	○						○	○	○
2-5. Both headlights in high-beam inoperative						○			○			○
2-6. Headlight high-beam on the left (or right) side inoperative	○	○								○	○	○
2-7. Headlight beam does not change						○			○			○
2-8. Headlights remain on when the lighting SW is turned off					○			○				○
2-9. Headlights come on with the lighting SW at the clearance light position								○				
2-10. Passing lights inoperative									○			○

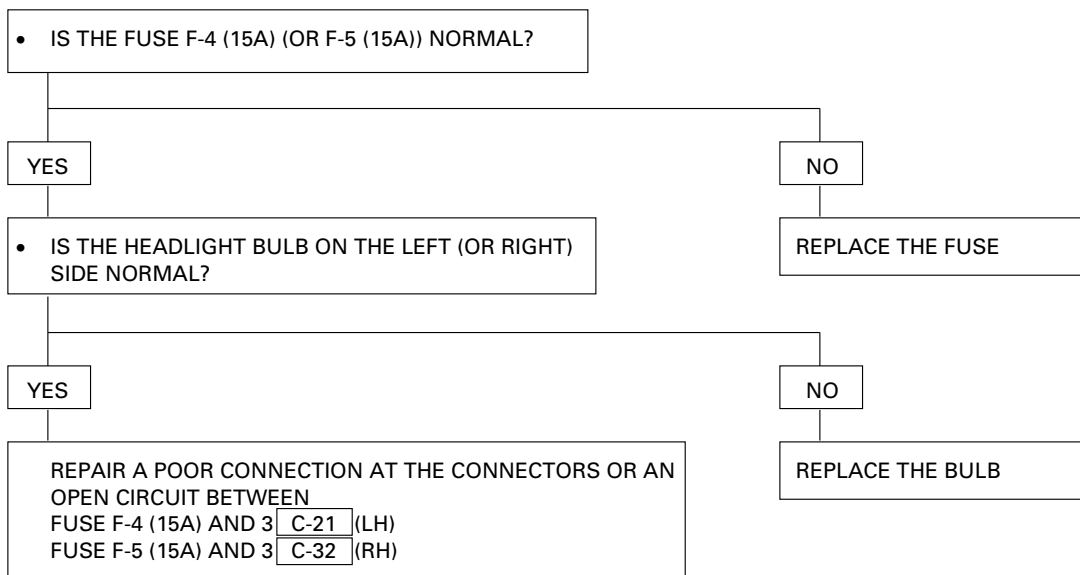
3. FRT fog lights

Trouble mode \ Check point	Fuse F-8 (15A or 20A)	FRT fog light SW	FRT fog light relay	RR fog light SW	RR fog light relay	Fog light bulb		Cable harness
						LH	RH	
3-1. Both FRT fog lights inoperative (while the clearance light is ON)	○	○	○					○
3-2. FRT fog light on the left (or righth) side inoperative (while the clearance light is ON)						○	○	○

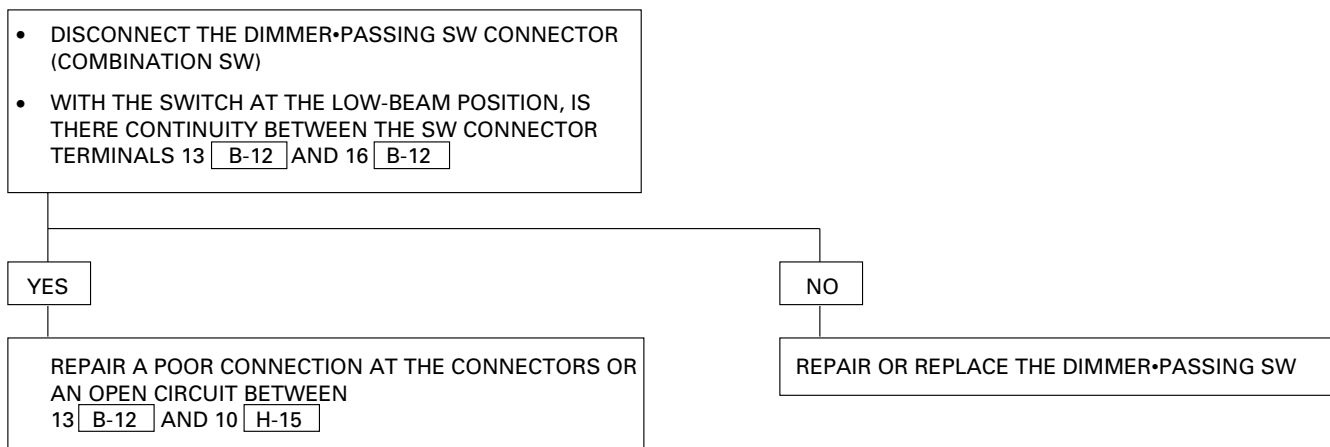
1-1. Both Headlights Inoperative



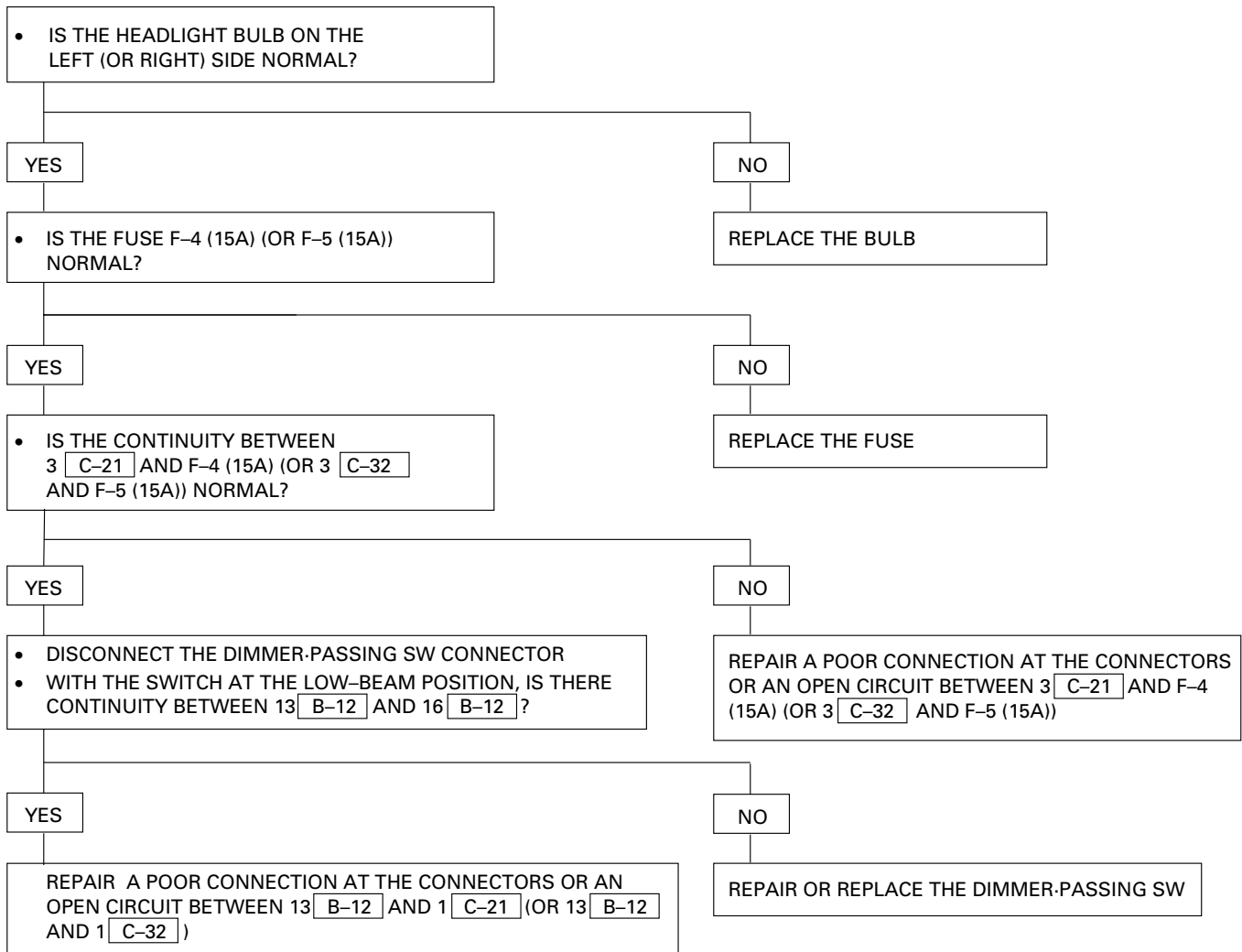
1-2. Headlight On The Left (Or Right) Side Inoperative



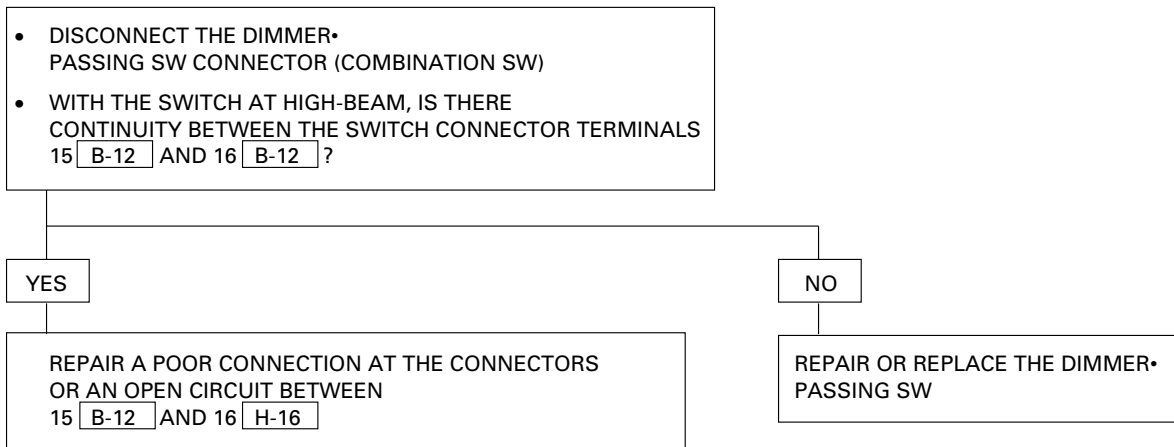
1-3. Both Headlights In Low-Beam Inoperative



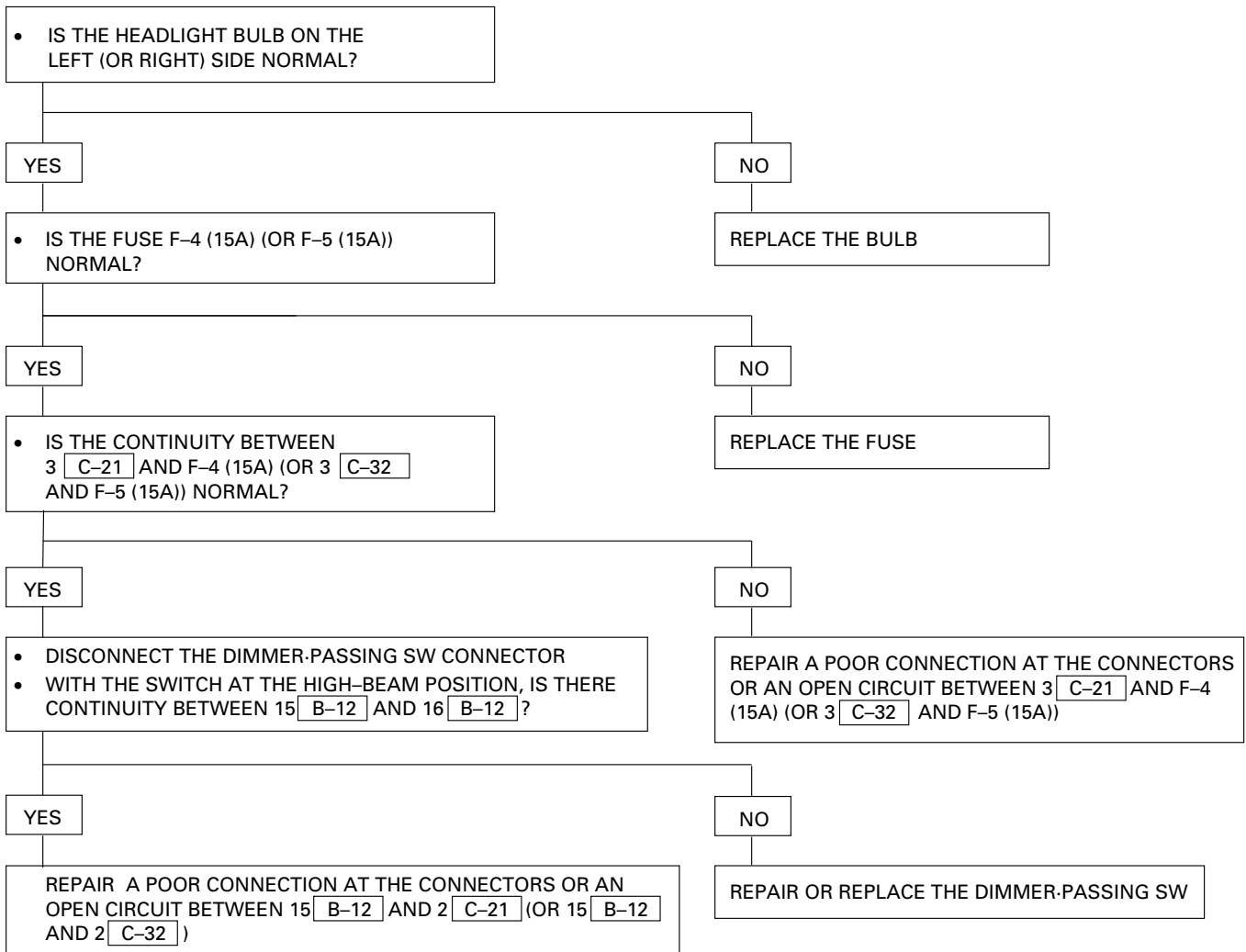
1-4. Headlight Low-Beam On The Left (Or Right) Side Inoperative



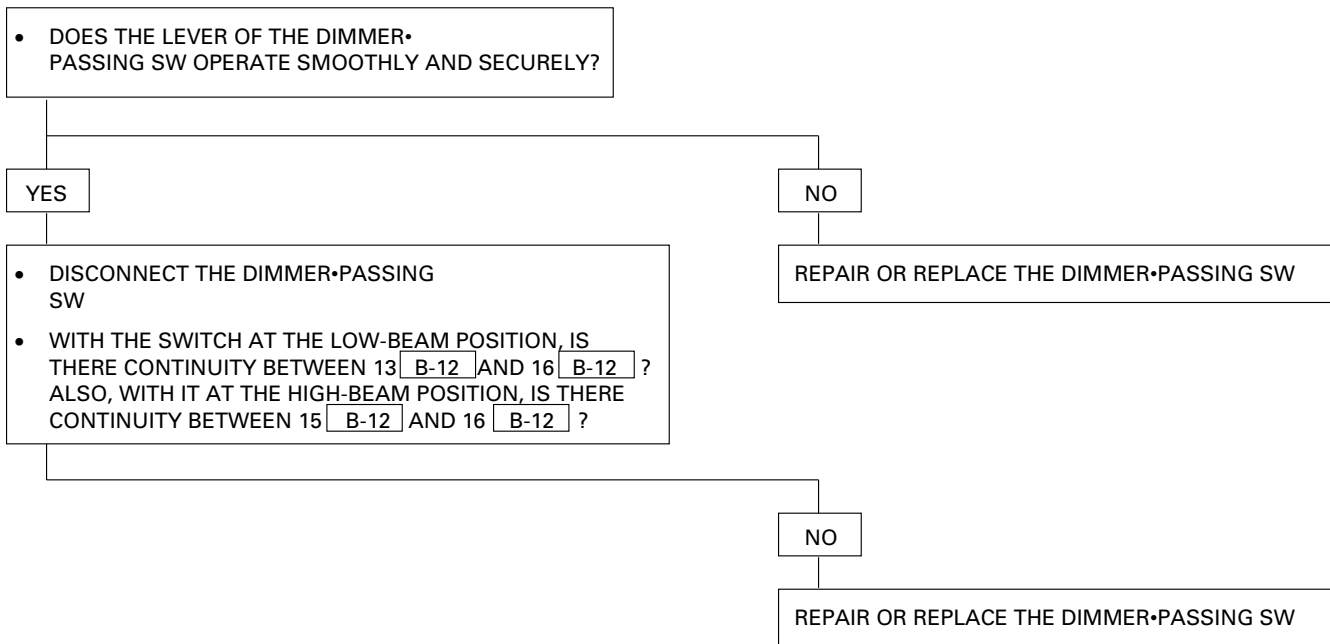
1-5. Both Headlights In High-Beam Inoperative



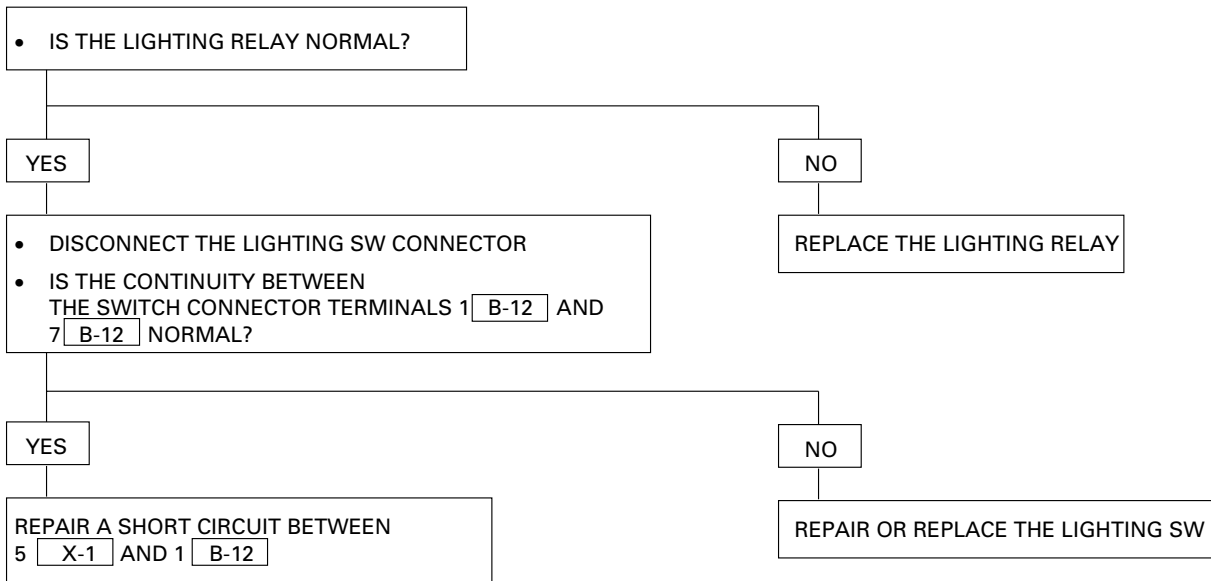
1-6. Headlight High-Beam On The Left (Or Right) Side Inoperative



1-7. Headlight Beam Does Not Change



1-8. Headlights Remain On When The Lighting SW Is Turned Off



1-9. Headlights Come On With The Lighting SW At The Clearance Light Position

REPAIR OR REPLACE THE LIGHTING SW

1-10. Passing Lights Inoperative

- DISCONNECT THE DIMMER-PASSING SW CONNECTOR
- WITH THE SWITCH AT PASSING POSITION, IS THERE CONTINUITY BETWEEN THE SWITCH CONNECTOR TERMINALS 14 **B-12** AND 16 **B-12** , AND 15 **B-12** AND 16 **B-12** ?

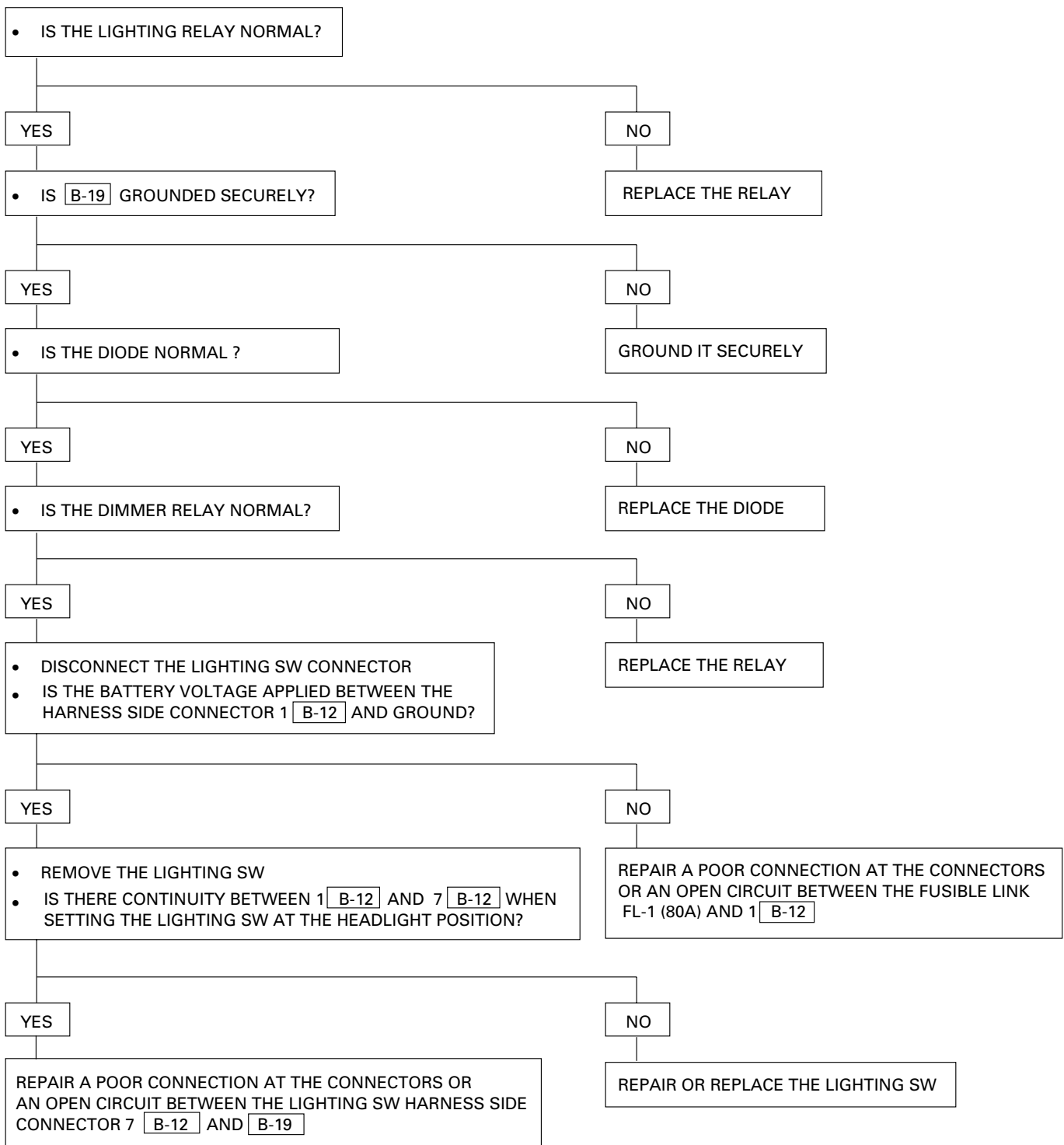
YES

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 5 **H-15** AND 14 **B-12**

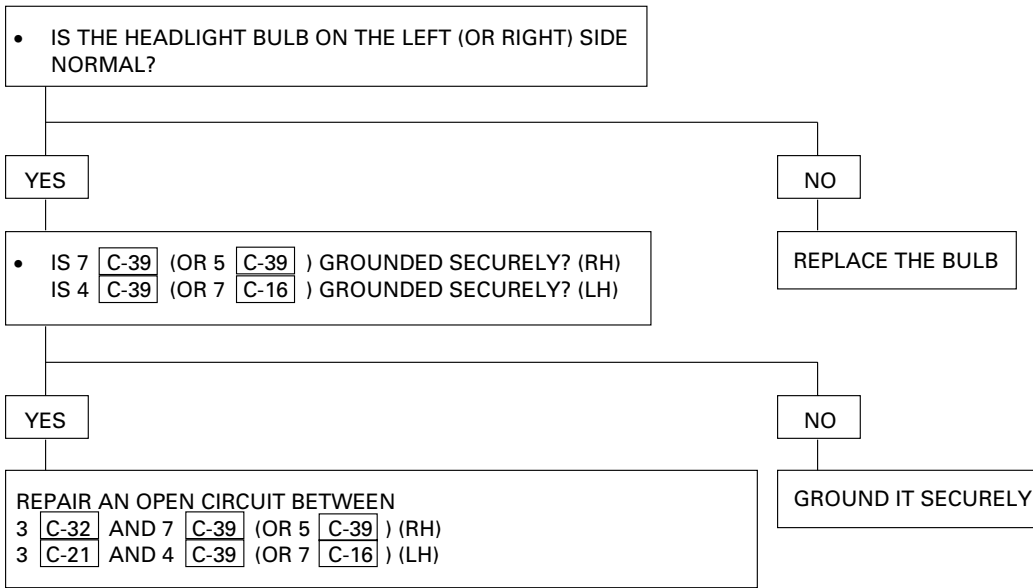
NO

REPAIR OR REPLACE THE SWITCH

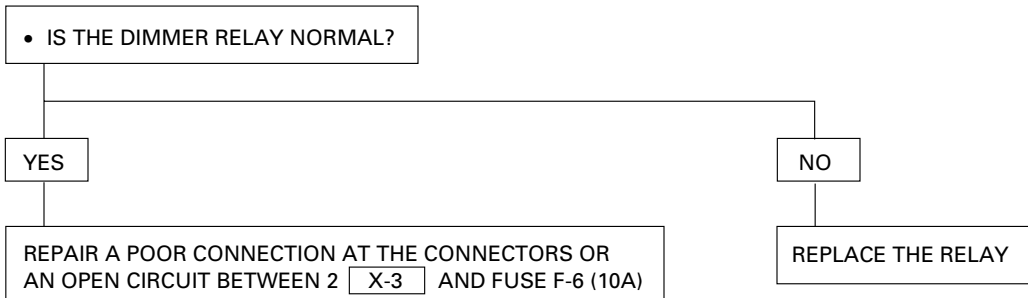
2-1. Both Headlights Inoperative



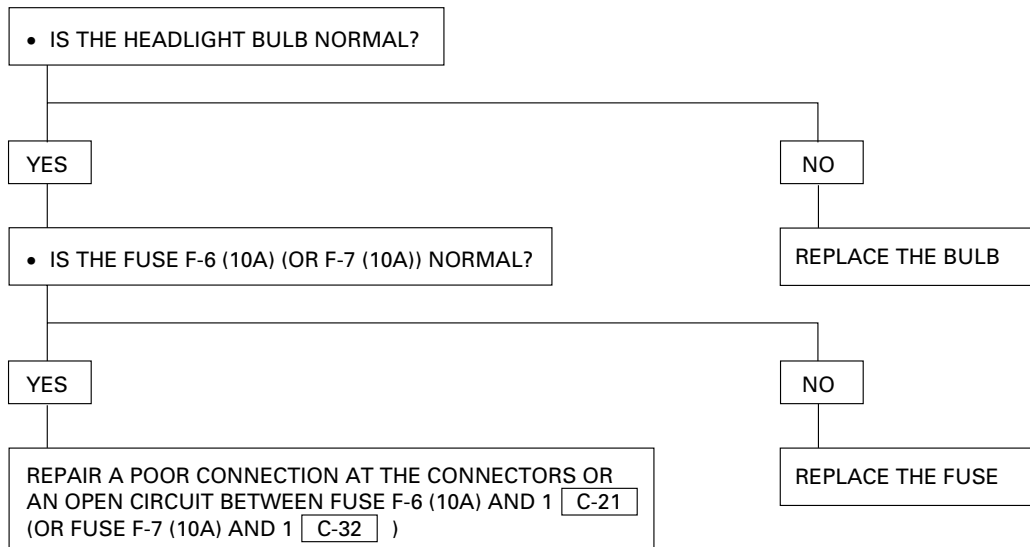
2-2. Headlight On The Left (Or Right) Side Inoperative



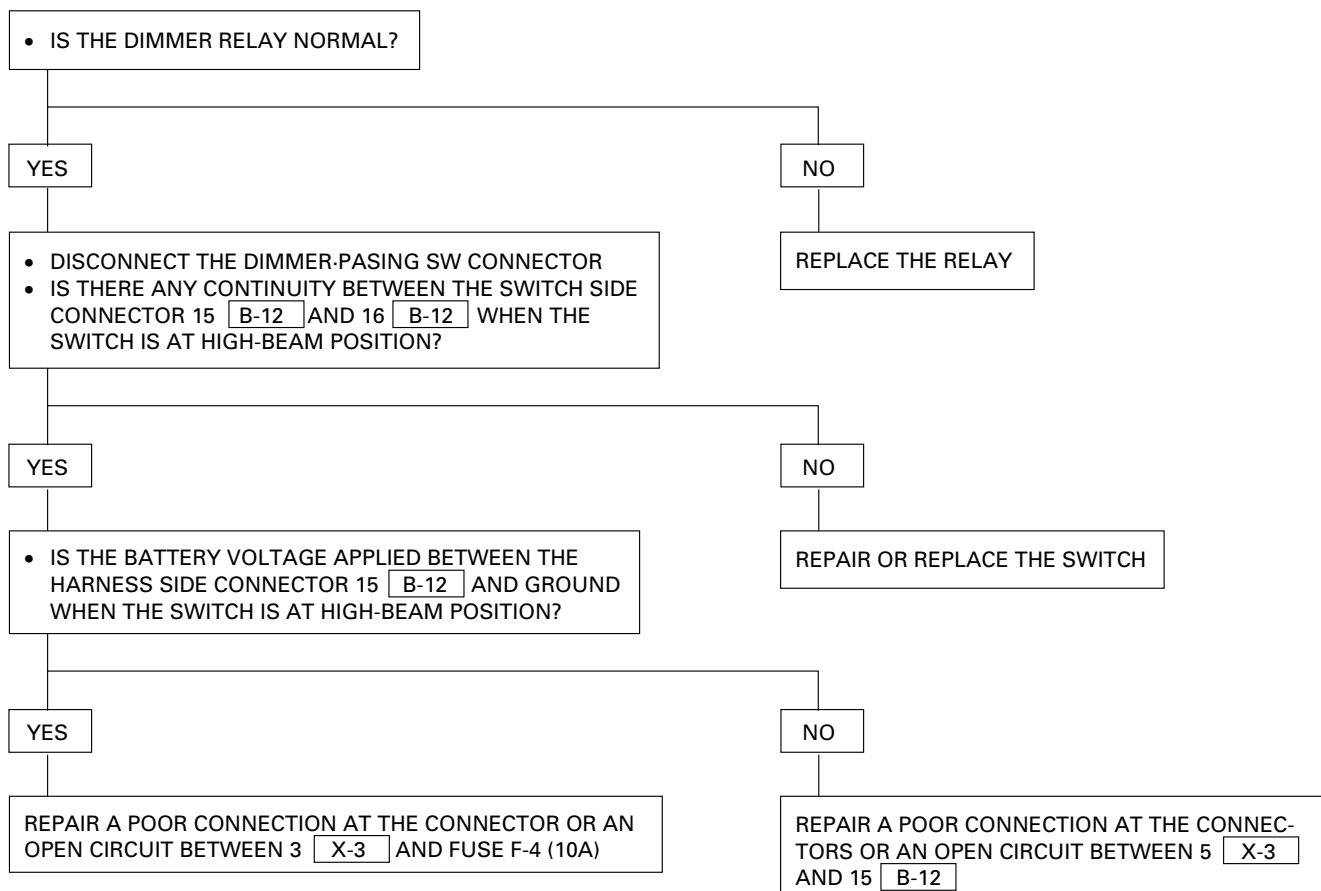
2-3. Both Headlights In Low-Beam Inoperative



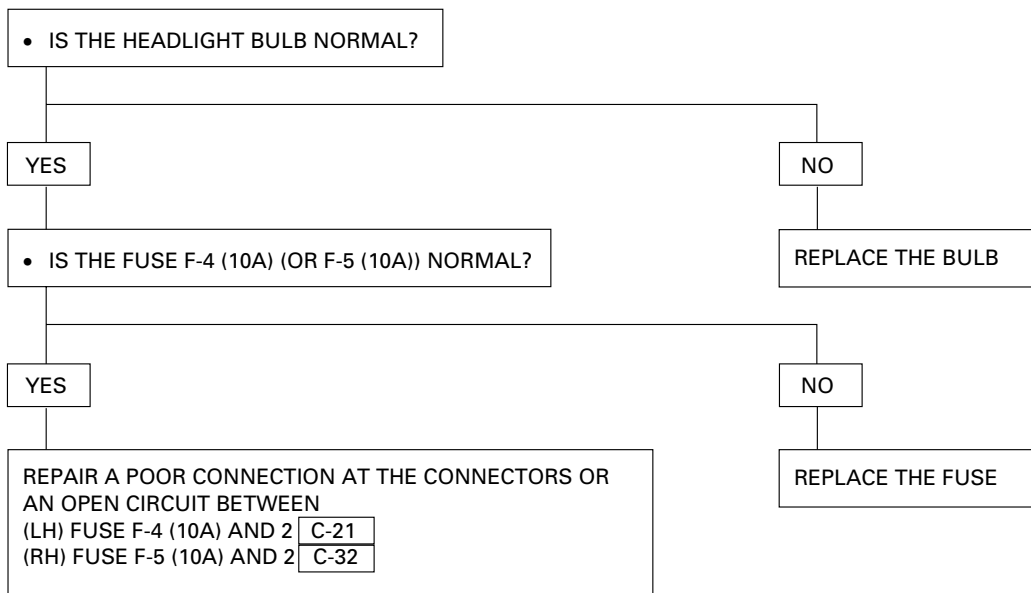
2-4. Headlight Low-Beam On The Left (Or Right) Side Inoperative



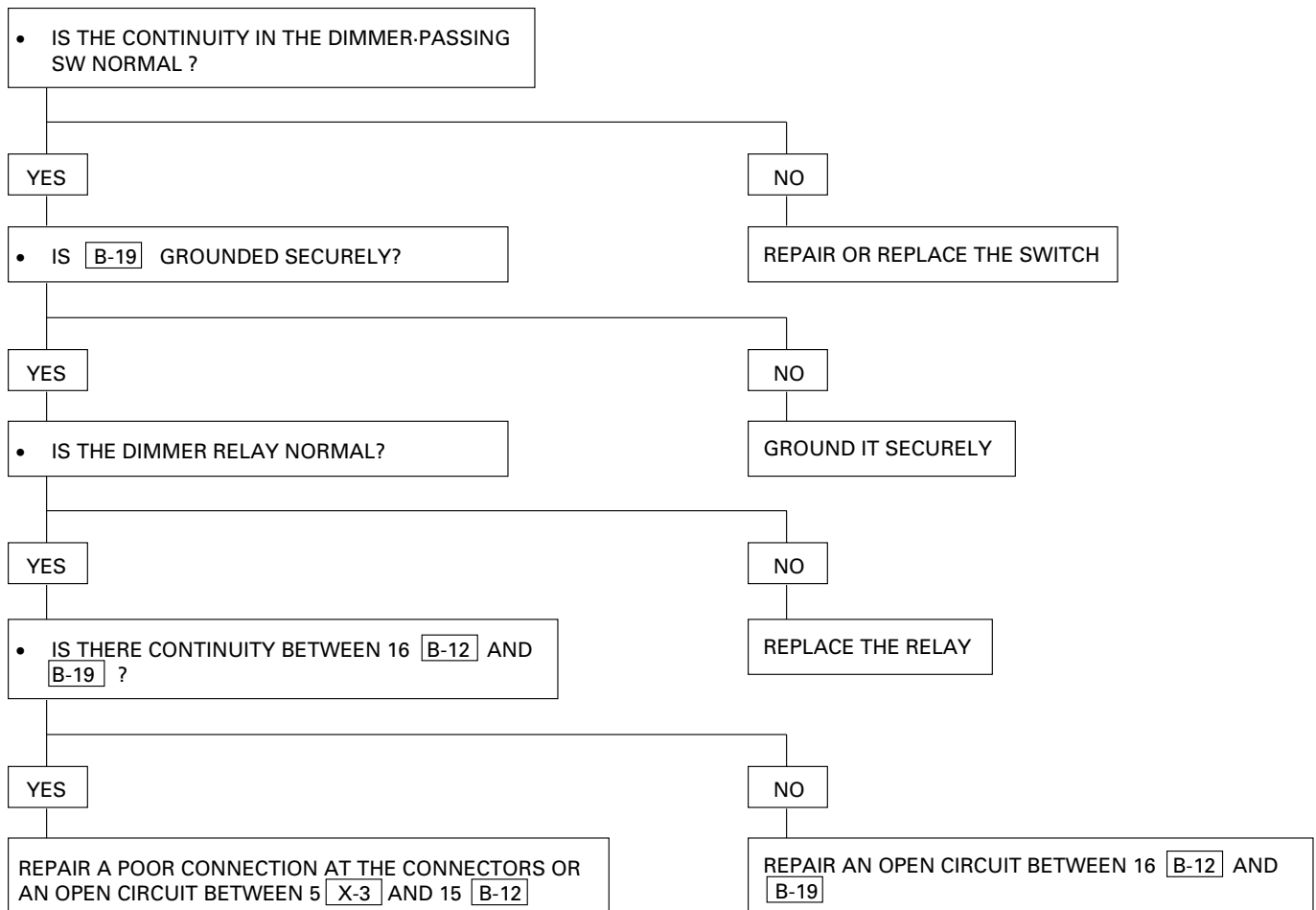
2-5. Both Headlights In High-Beam Inoperative



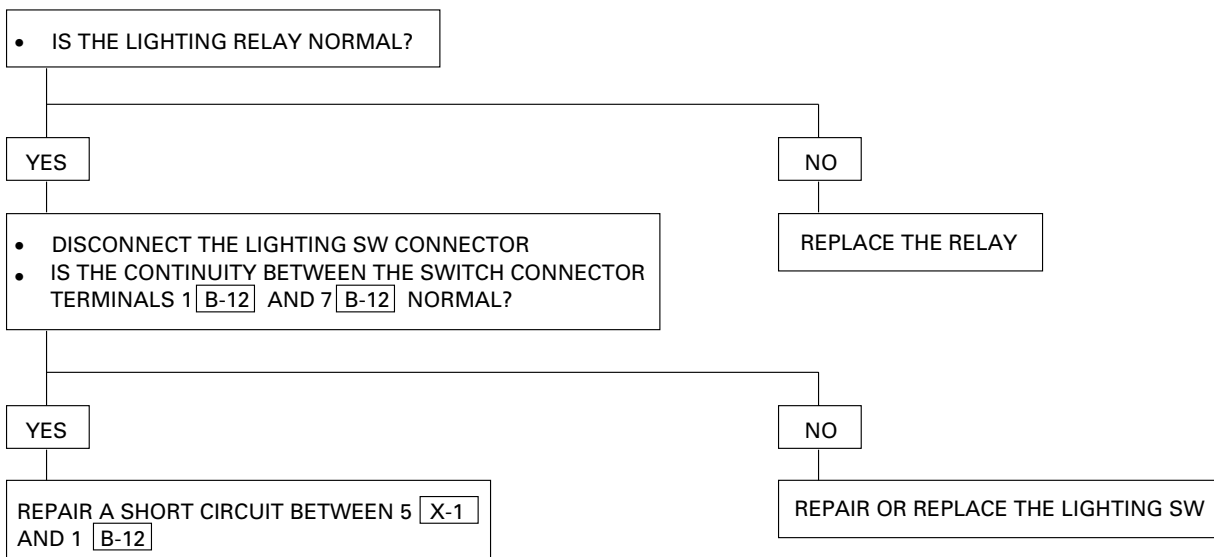
2-6. Headlight High-Beam On The Left (Or Right) Side Inoperative



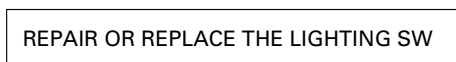
2-7. Headlight Beam Does Not Change



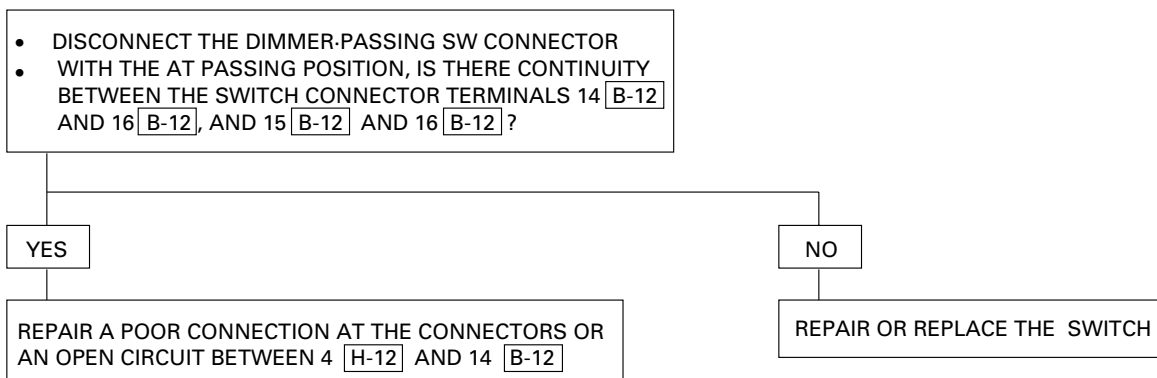
2-8. Headlights Remain On When The Lighting SW Is Turned Off



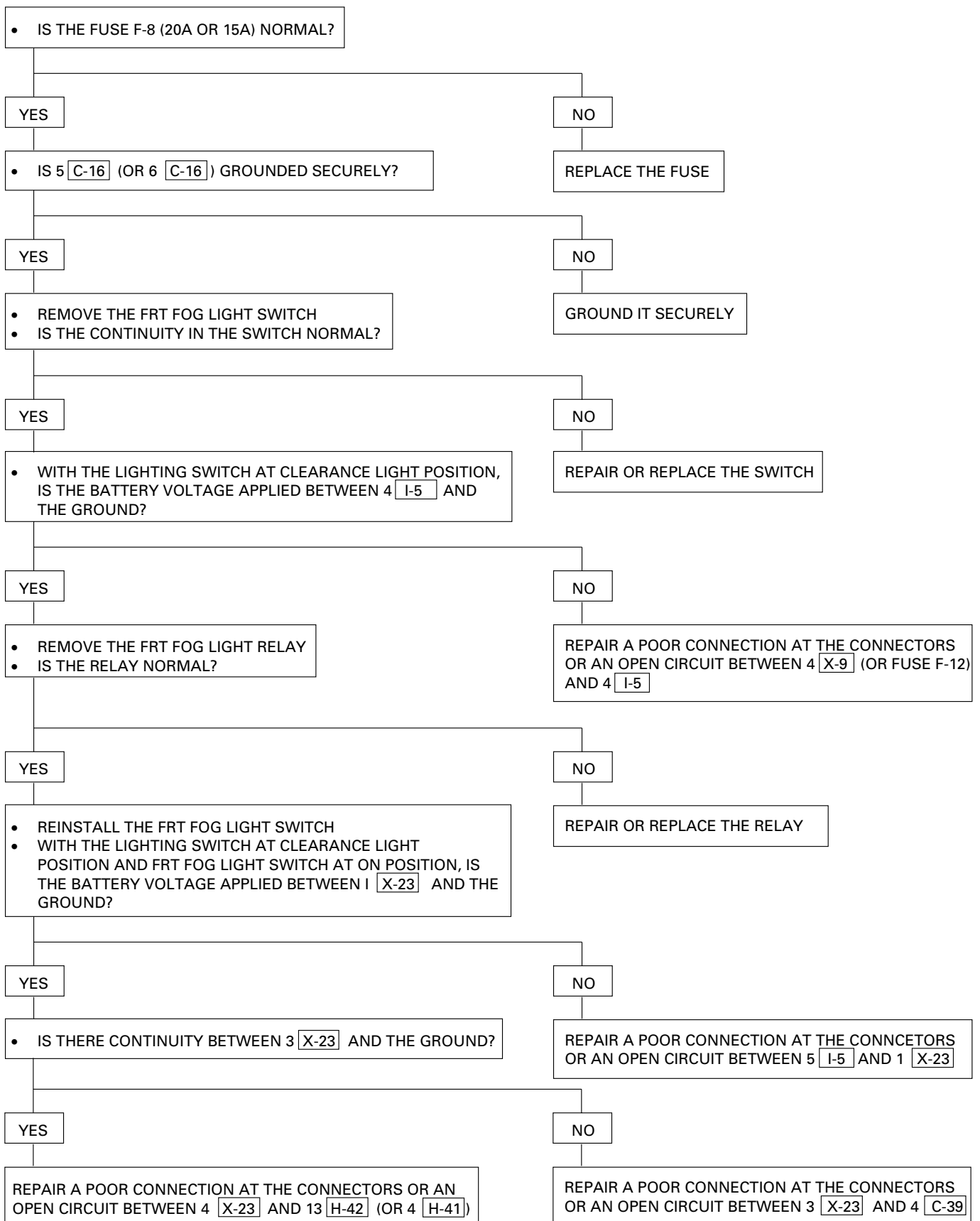
2-9. Headlights Come On When The Lighting SW At The Clearance Light Position



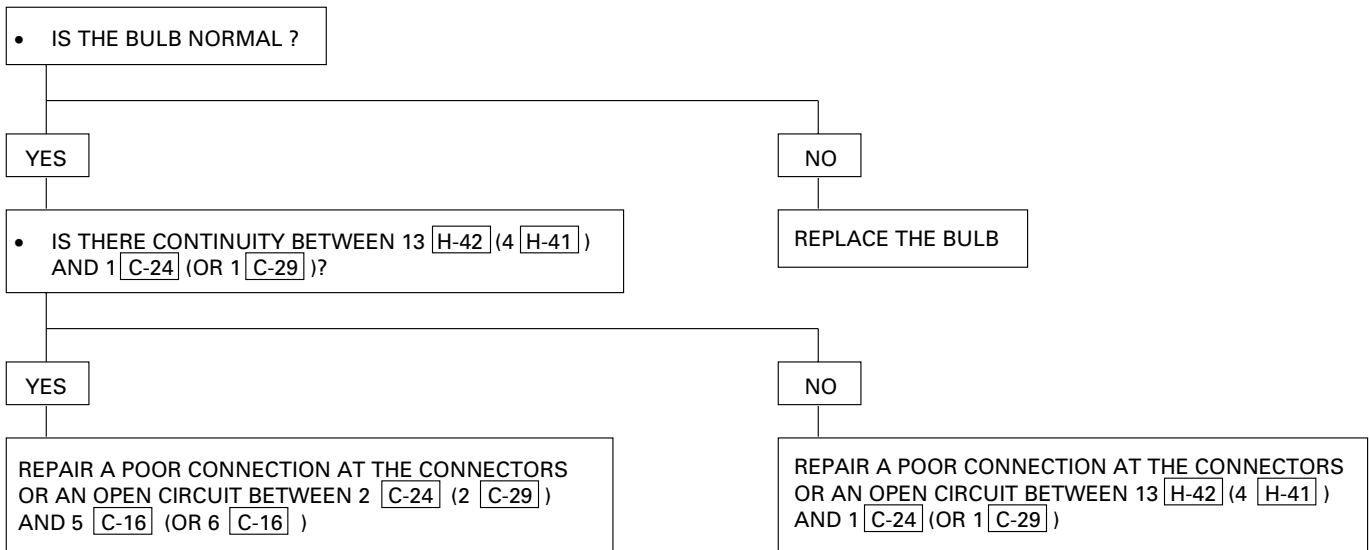
2-10. Passing Lights Inoperative



3-1. Both FRT Fog Lights Inoperative (While The Clearance Light Is On)

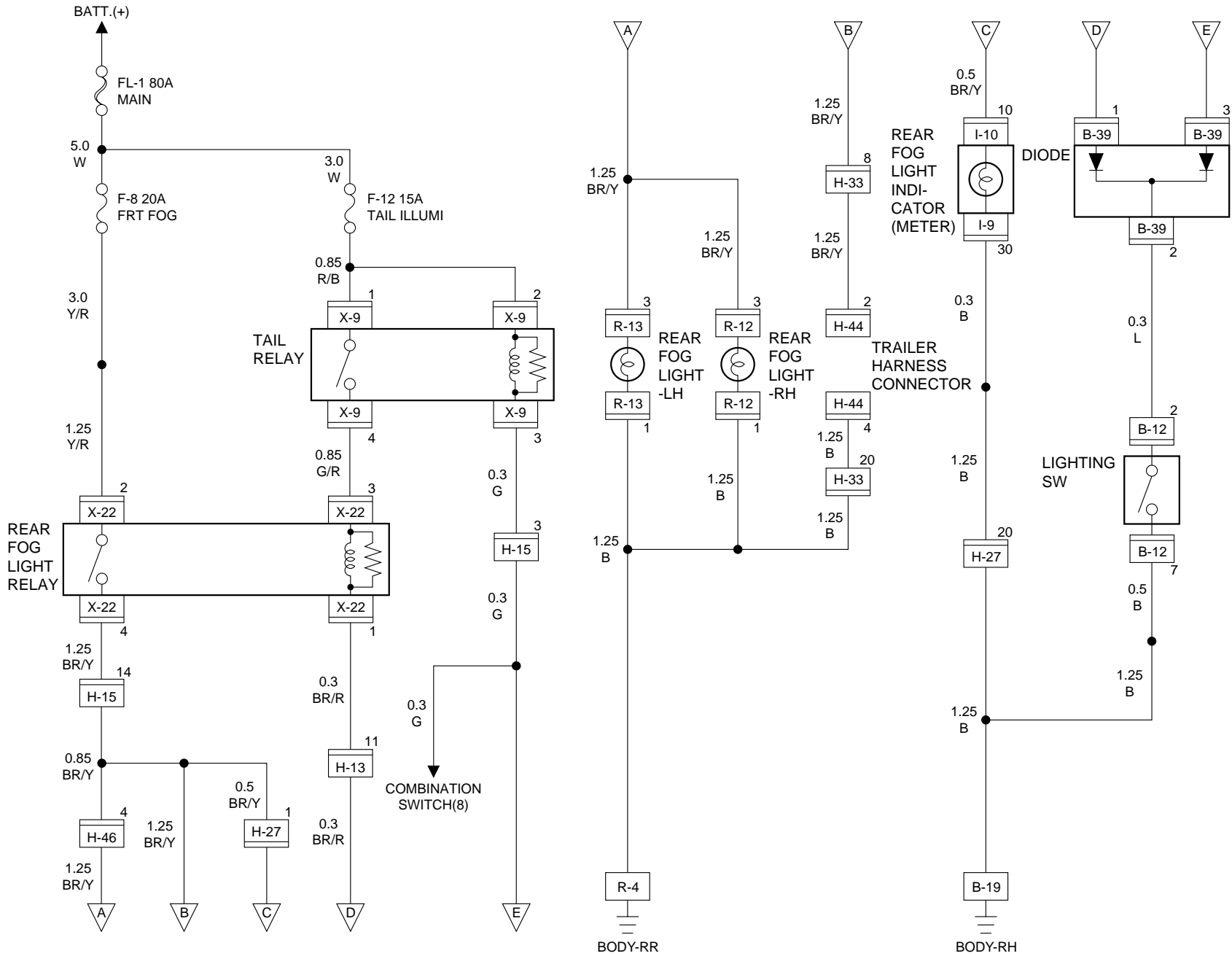


**3-2. FRT Fog Light On The Left (Or Right) Side Inoperative
(While The Clearance Light Is ON)**

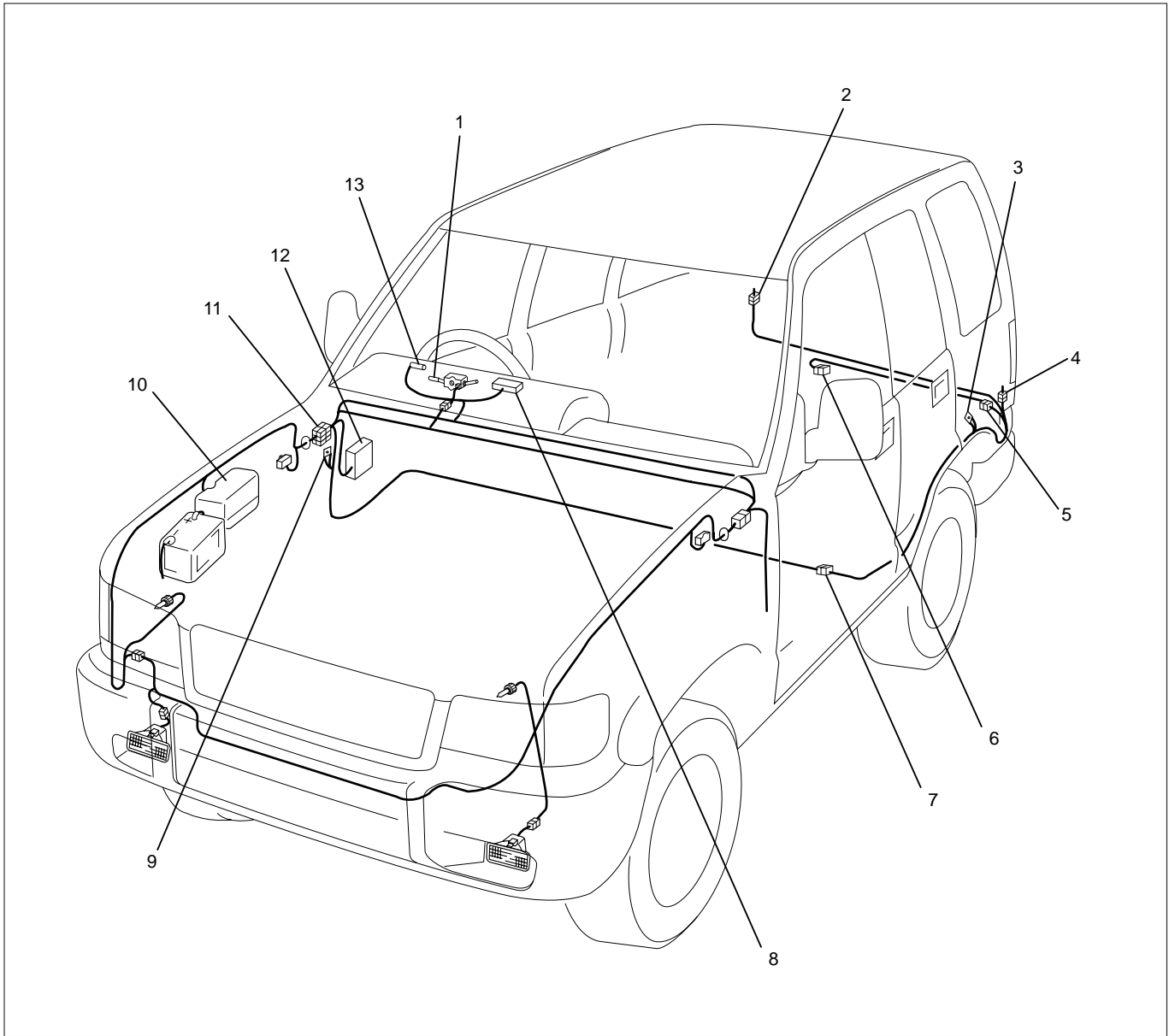


Rear Fog Light

Circuit Diagram



Parts Location



D08RWA01

Legend

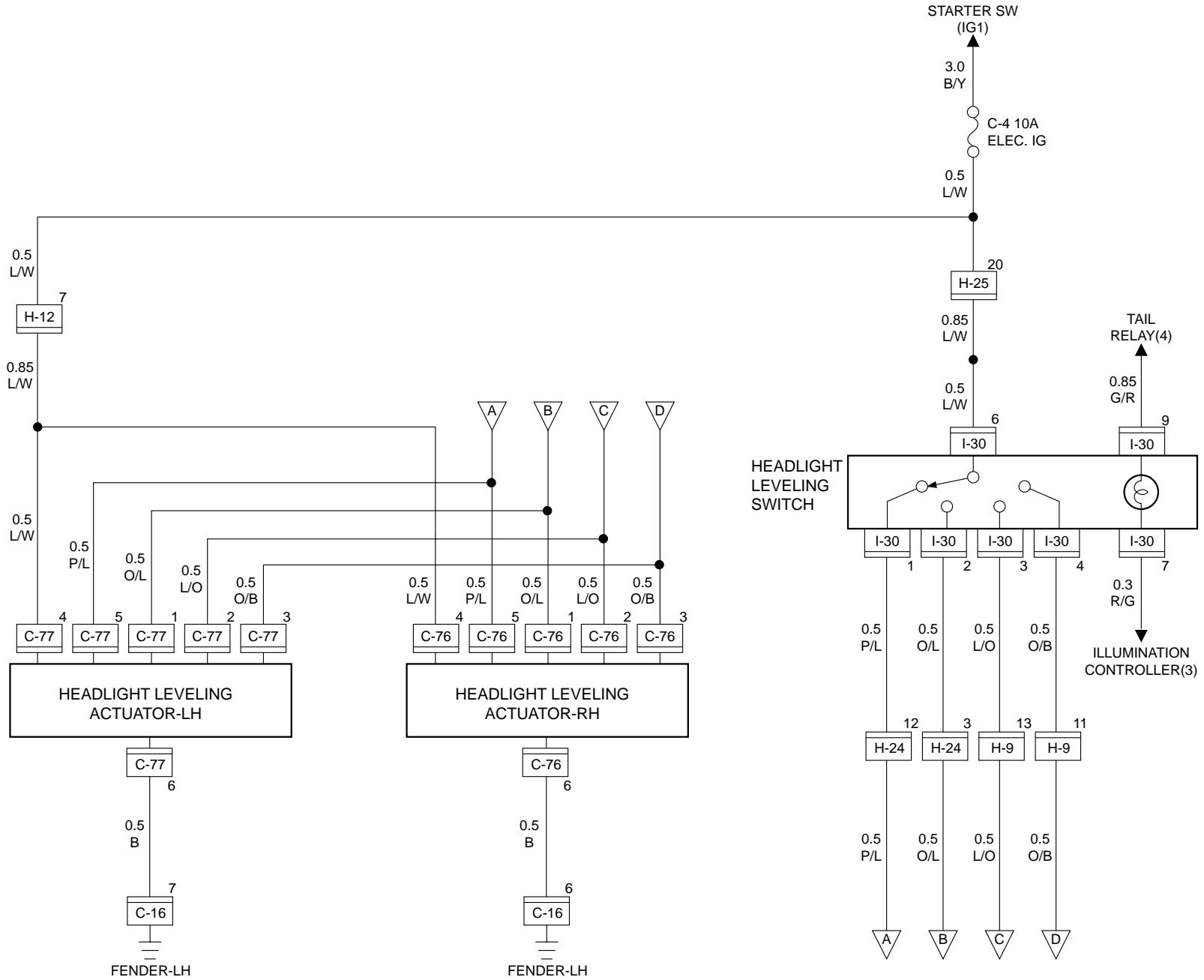
- | | |
|---------------------|-------------------------------------|
| (1) Lighting Switch | (7) H-46 |
| (2) R-12 | (8) I-9 |
| (3) R-4 | (9) B-19 |
| (4) R-13 | (10) Relay and Fuse Box (X-9, X-22) |
| (5) H-33 | (11) H-13, H-15, H-27 |
| (6) H-44 | (12) Fuse Box (B-39) |
| | (13) I-10 |

Headlight Leveling

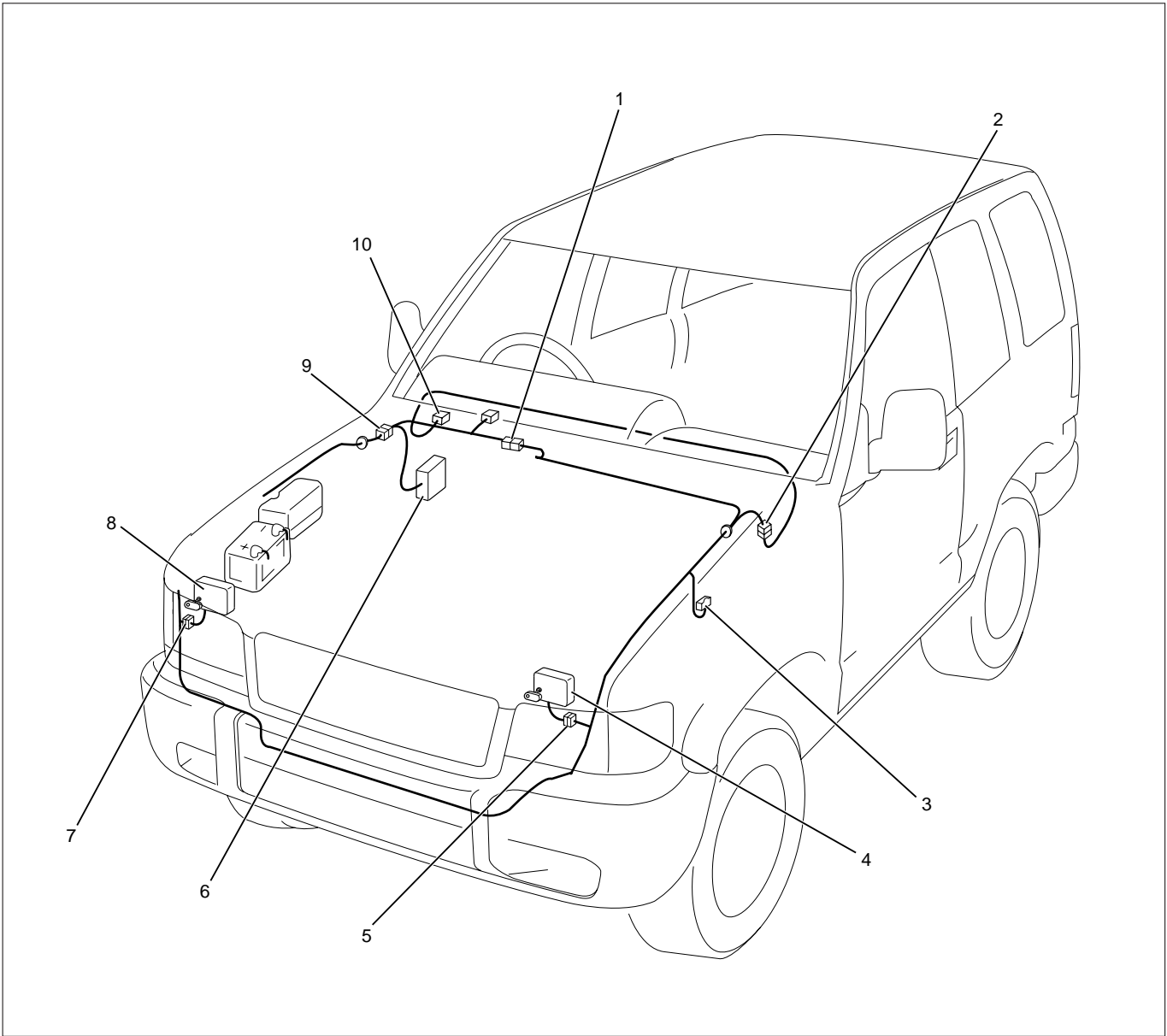
General Description

The circuit consists of the headlight leveling SW and headlight leveling actuators. The actuator is made up of a motor, two relays and disk-type sensor. The sensor rotates in accordance with the rotation of the motor and stops the rotation of the motor at each position corresponding to the levels 0 to 3.

Circuit Diagram



Parts Location



D08RW999

Legend

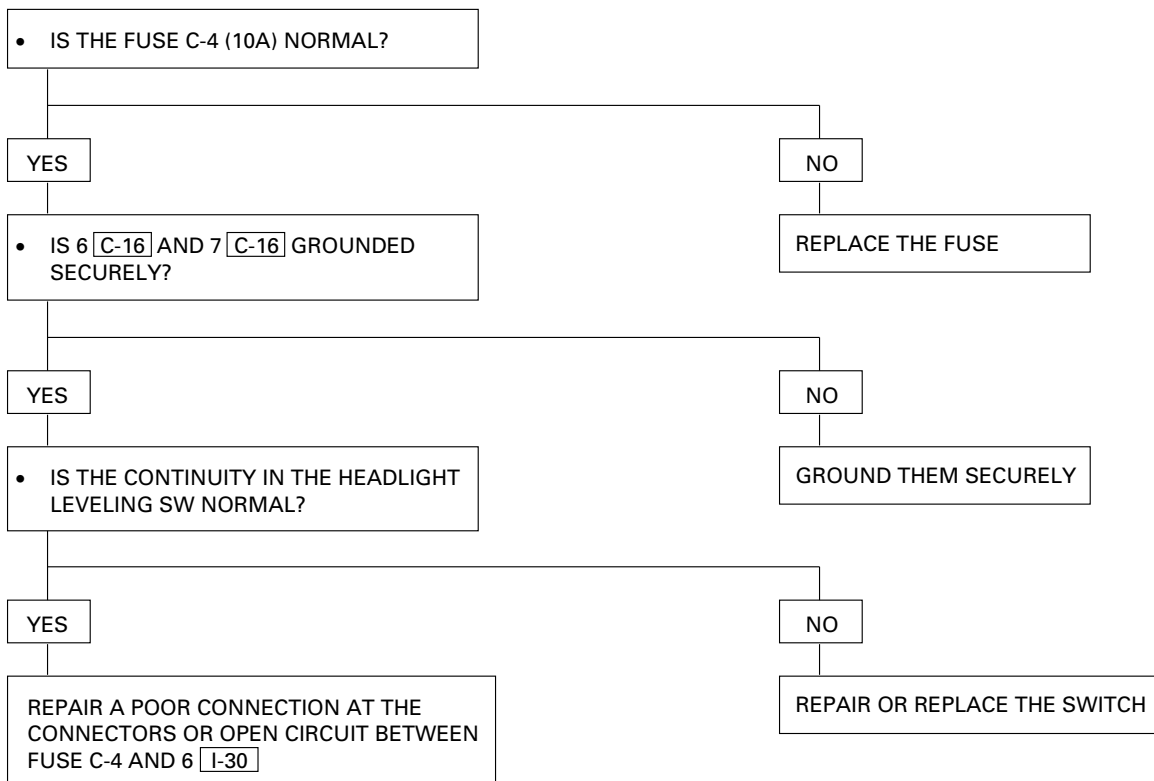
- | | |
|------------------------------------|------------------------------------|
| (1) H-12 | (6) Fuse Box |
| (2) H-9, H-24 | (7) C-76 |
| (3) C-16 | (8) Headlight Leveling Actuator-RH |
| (4) Headlight Leveling Actuator-LH | (9) H-25 |
| (5) C-77 | (10) I-30 |

Diagnosis

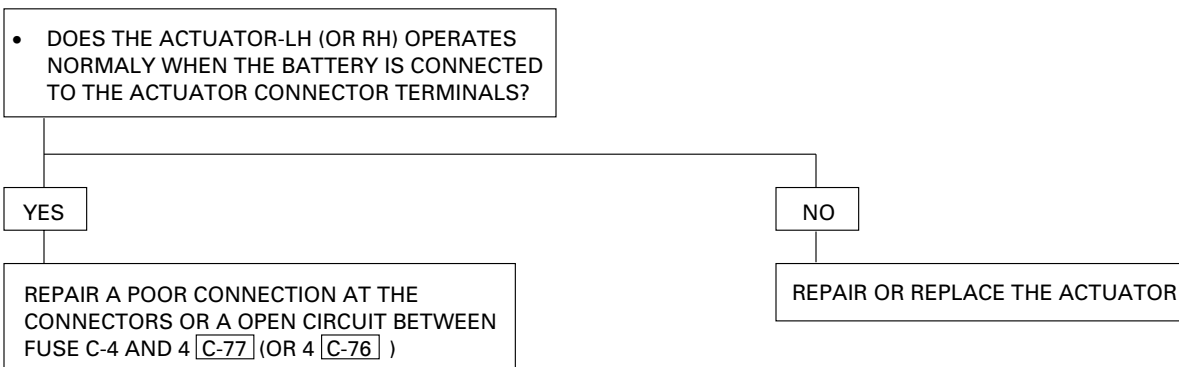
Quick Chart for Check Points

Trouble mode	Check point	Fuse C-4 (10A)	Leveling SW	Actuator		Cable harness
				LH	RH	
1. Both actuators inoperative		○	○			○
2. Actuator on the left (or right) side inoperative				○	○	○
3. Actuator on the left (or right) side does not stop				○	○	

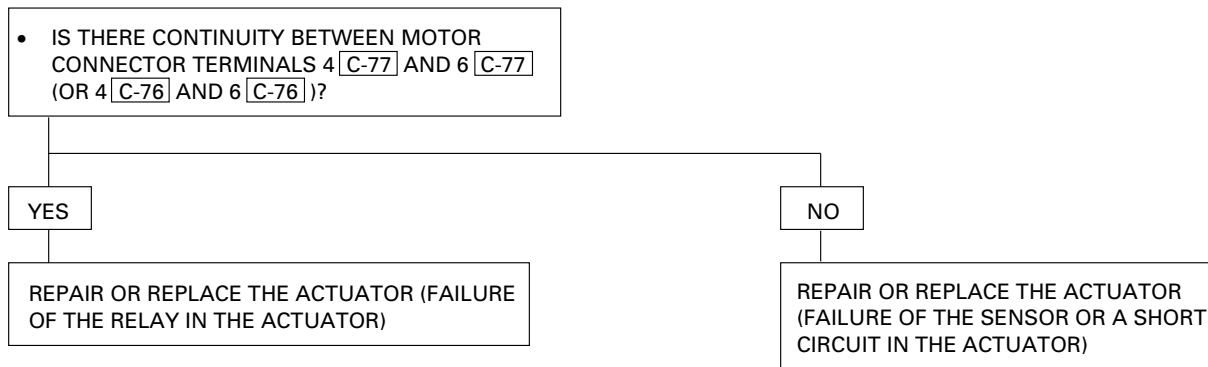
1. Both Actuators Inoperative



2. Actuator On The Left (Or Right) Side Inoperative



3. Actuator On The Left (Or Right) Side Does Not Stop



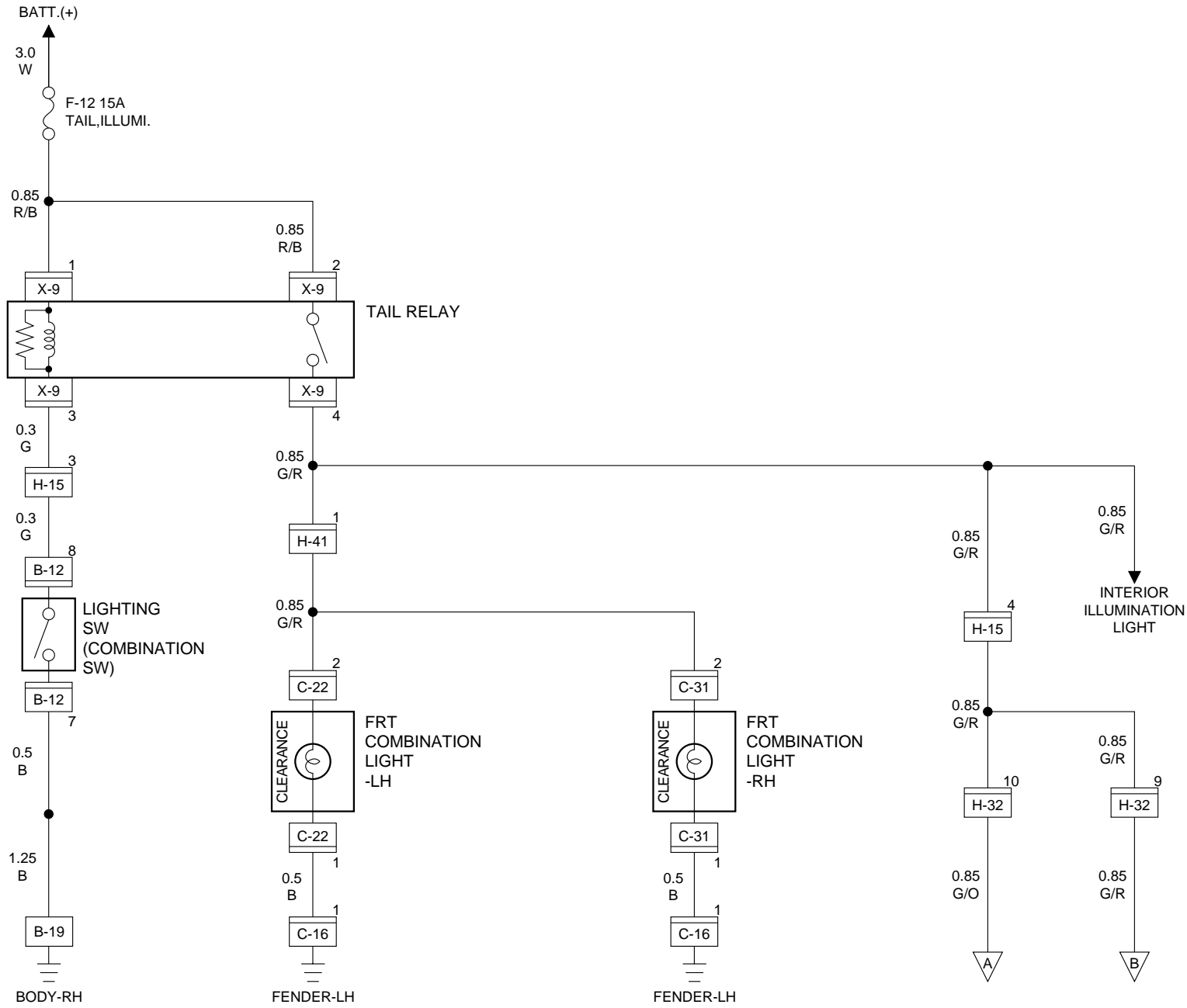
Clearance Light, Taillight and License Plate Light

General Description

The circuit consists of the lighting switch, clearance light, taillight and license plate light.

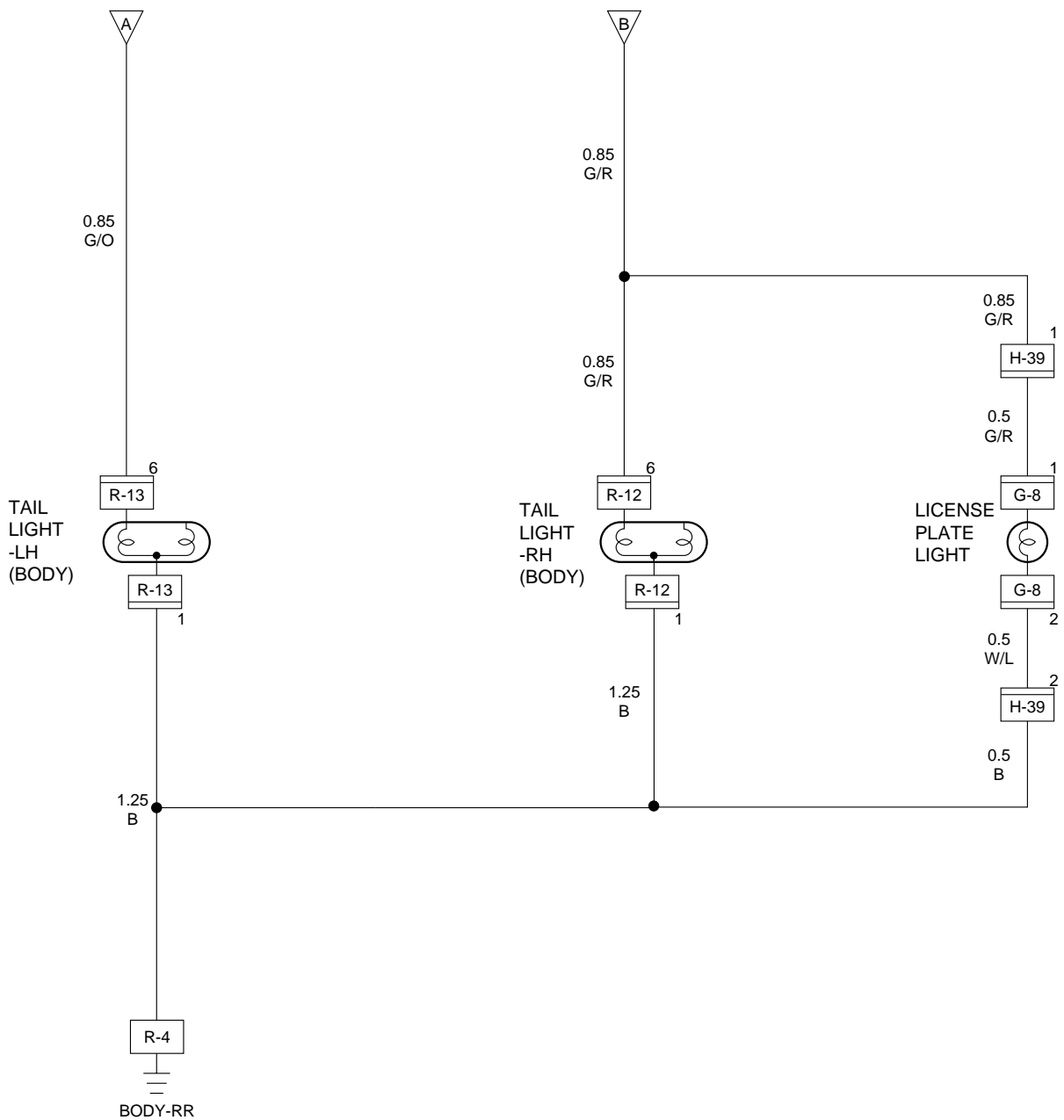
All these lights come on when the lighting switch are turned on with the switch to either clearance or headlight position.

Circuit Diagram (RHD)-1

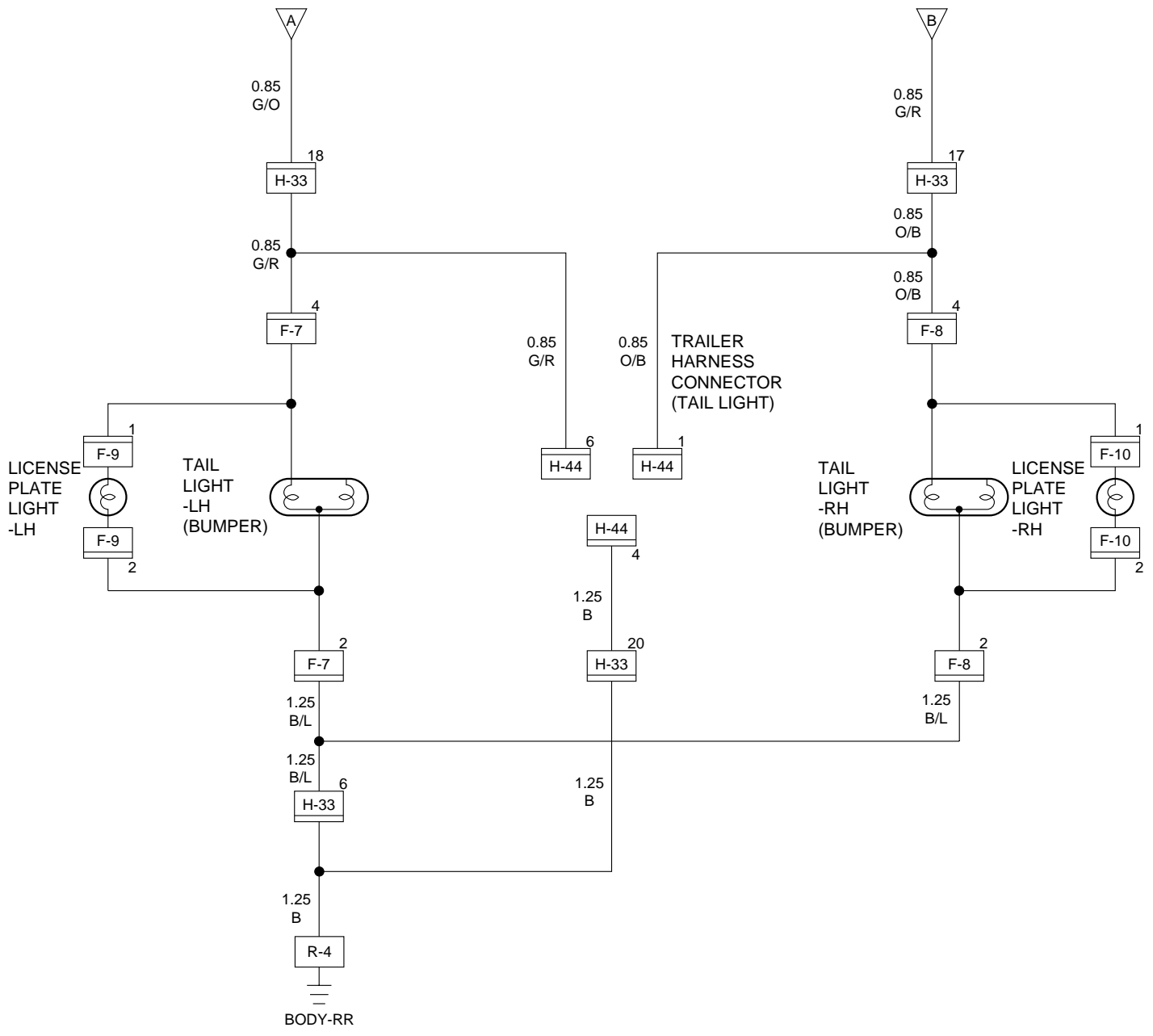


DDRRW1619

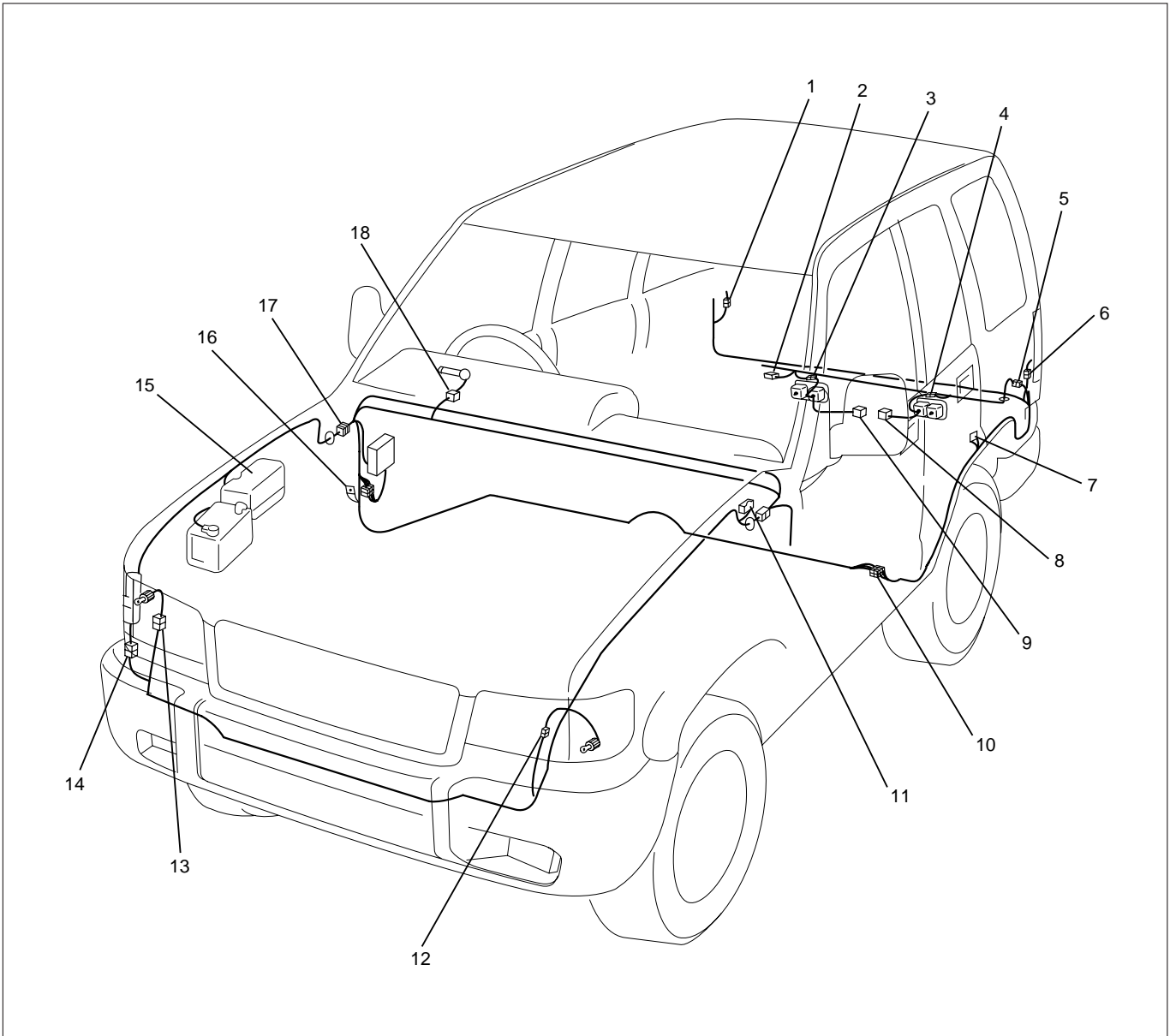
Circuit Diagram (RHD)-2



Circuit Diagram (Bumper Built-in Type Taillight)-2



Parts Location (RHD)

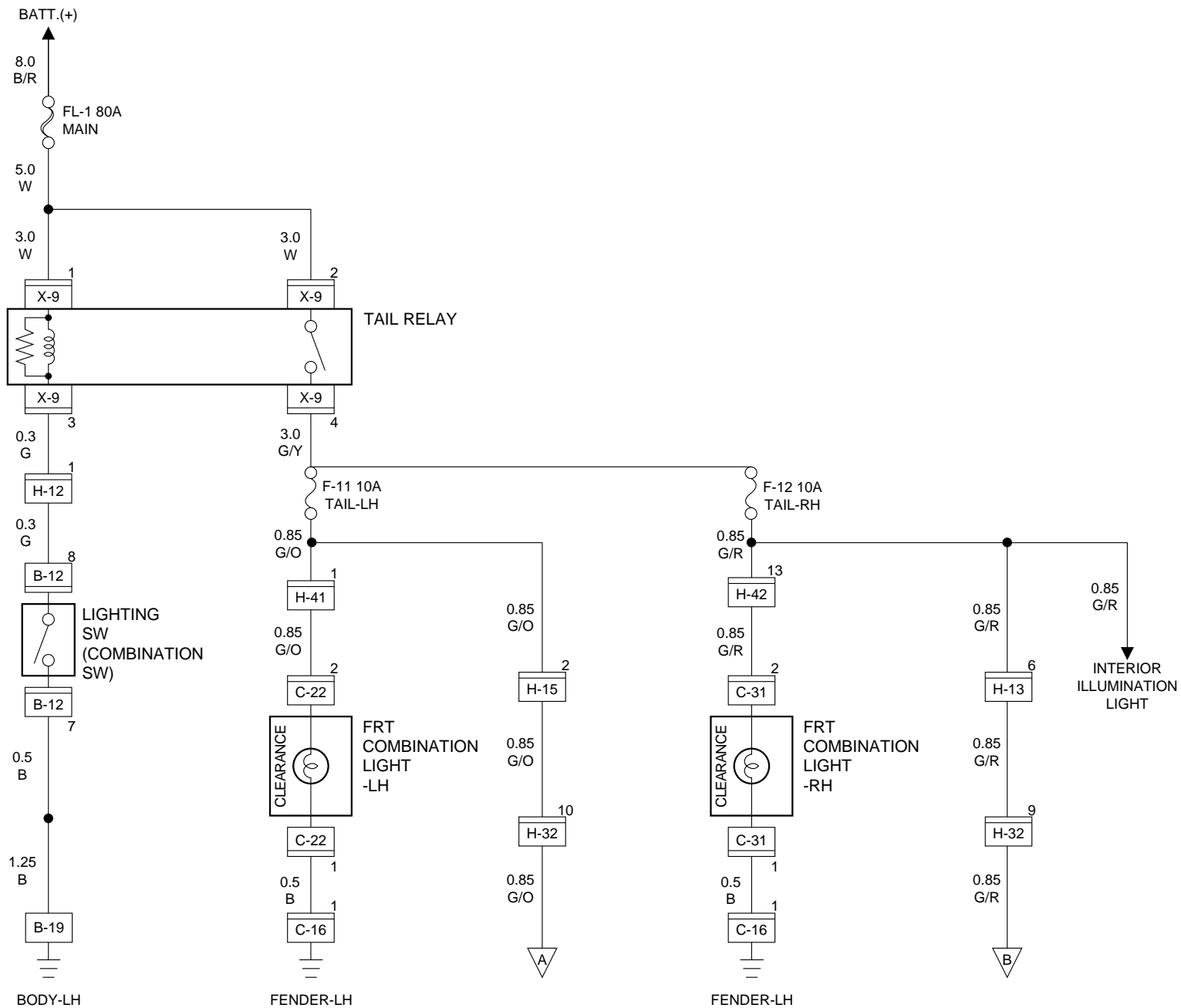


D08RW620

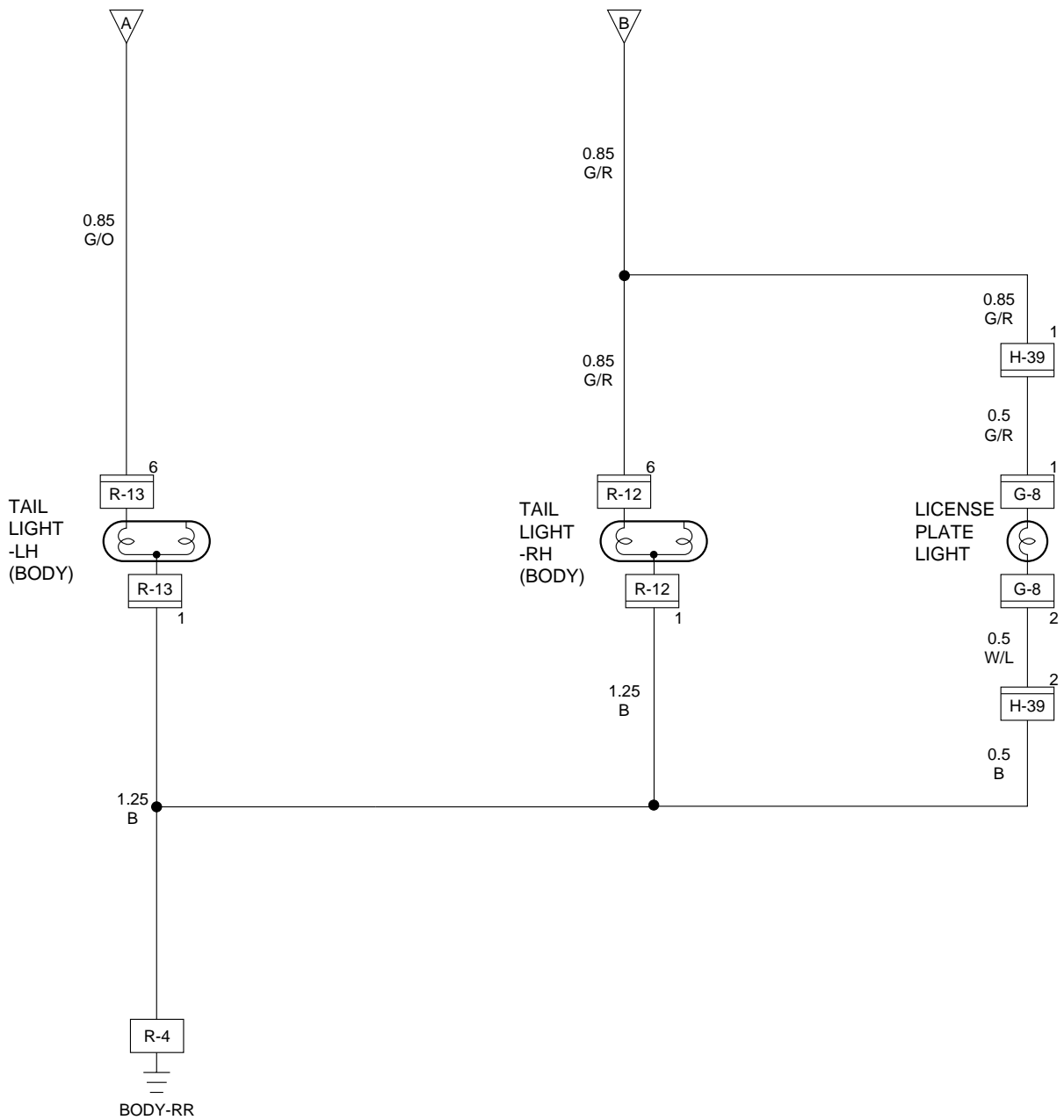
Legend

- | | |
|----------|-------------------------------|
| (1) R-12 | (10) H-32 |
| (2) H-44 | (11) C-16 |
| (3) F-8 | (12) C-22 |
| (4) F-7 | (13) C-31 |
| (5) H-33 | (14) H-41 |
| (6) R-13 | (15) Relay and Fuse Box (X-9) |
| (7) R-4 | (16) B-19 |
| (8) F-9 | (17) H-15 |
| (9) F-10 | (18) B-12 |

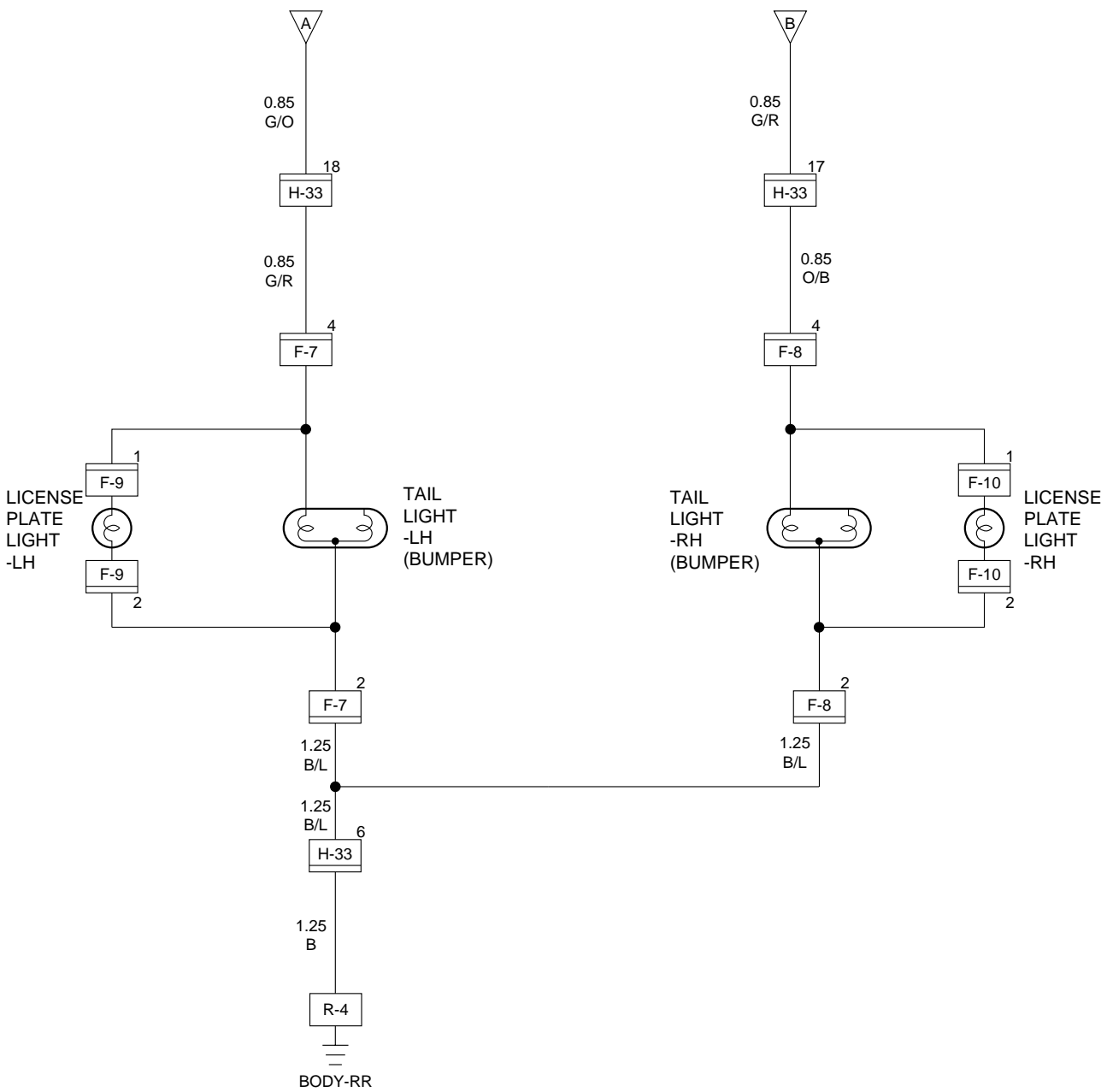
Circuit Diagram (LHD)-1



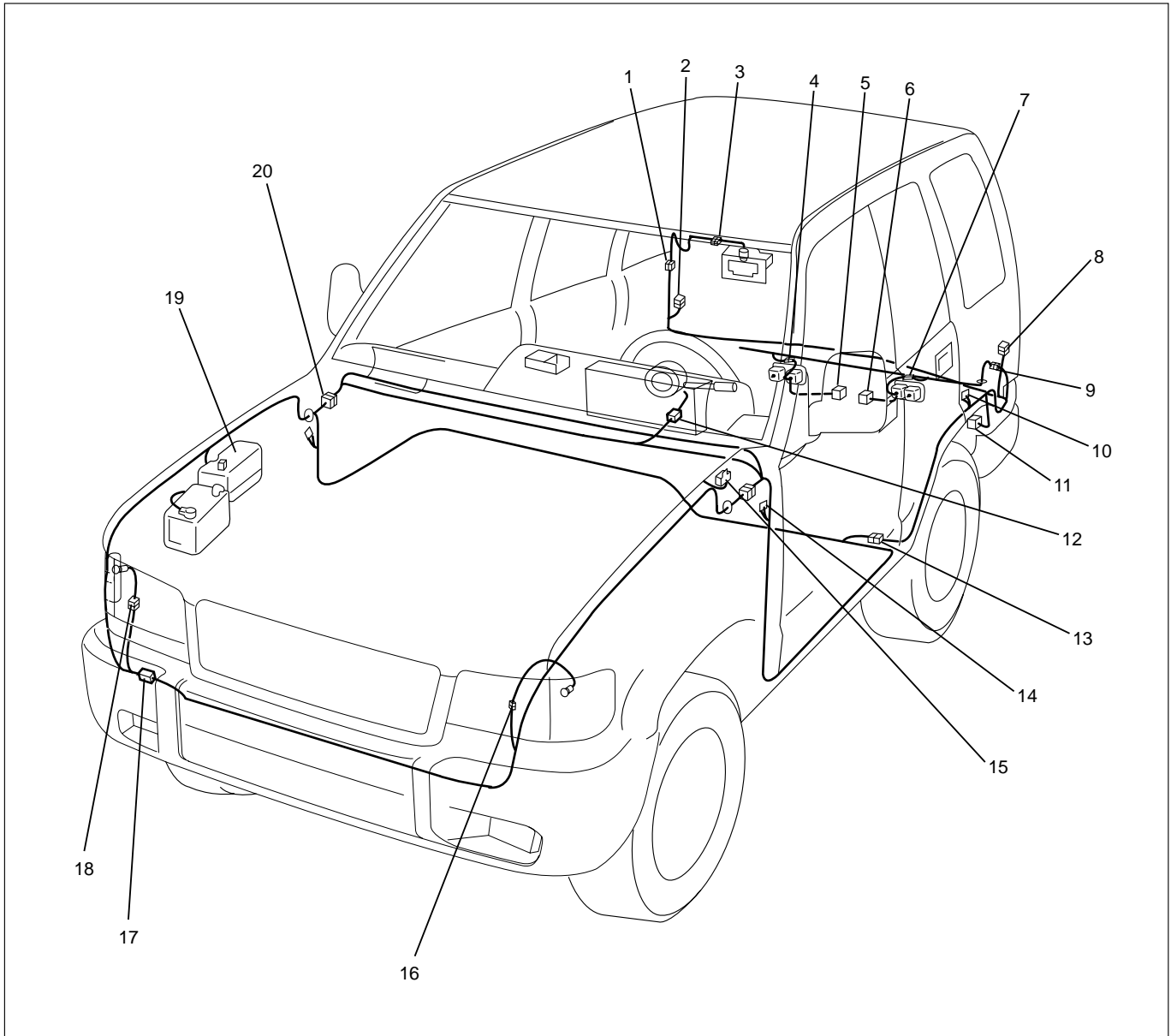
Circuit Diagram (LHD)-2



Circuit Diagram (Bumper Built-in Type Taillight)-2



Parts Location (LHD)



D08RW801

Legend

- | | |
|----------|-------------------------------|
| (1) H-39 | (11) H-44 |
| (2) R-12 | (12) B-12 |
| (3) G-8 | (13) H-32 |
| (4) F-8 | (14) B-19 |
| (5) F-10 | (15) C-16 |
| (6) F-9 | (16) C-22 |
| (7) F-7 | (17) H-41, H-42 |
| (8) R-13 | (18) C-31 |
| (9) H-33 | (19) Relay and Fuse Box (X-9) |
| (10) R-4 | (20) H-12, H-13, H-15 |

Diagnosis

Quick Chart for Check Point

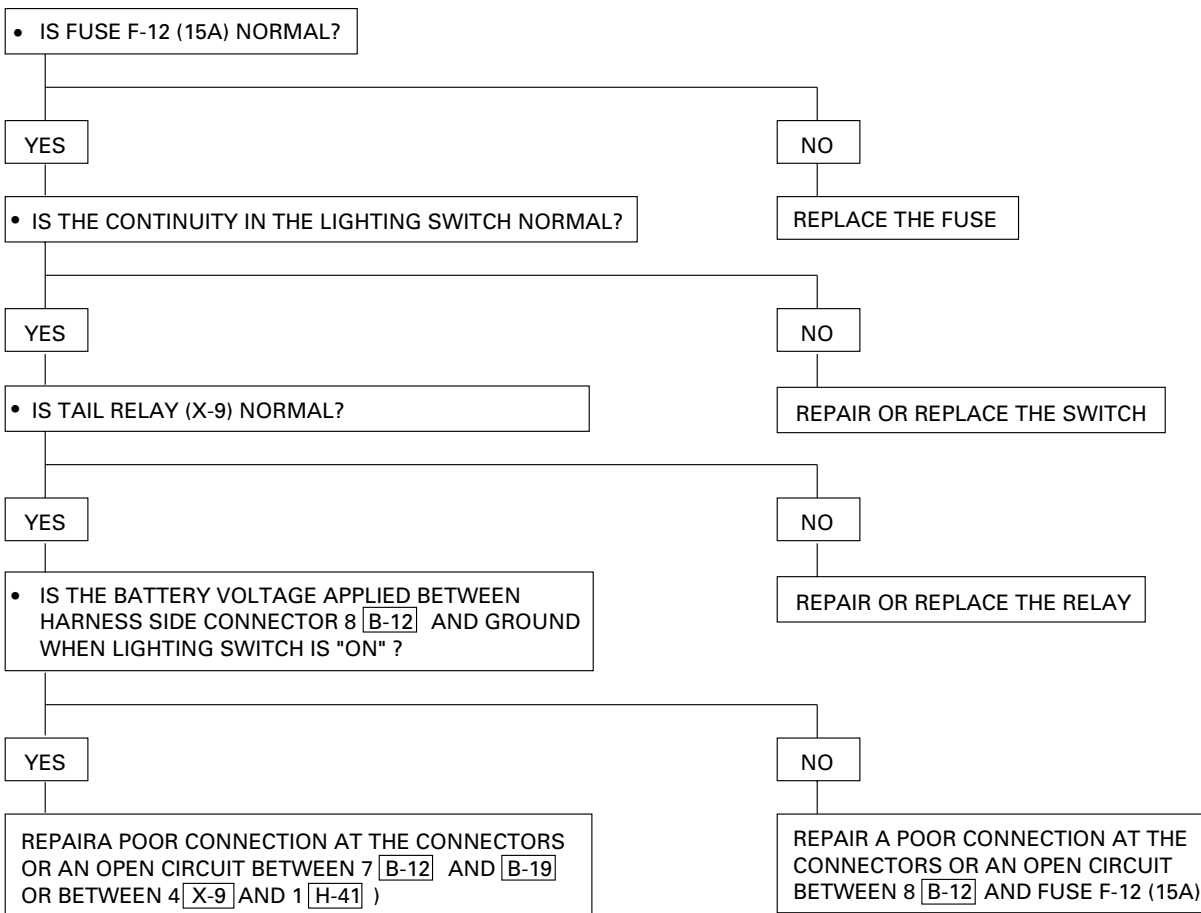
1. RHD

Trouble mode	Check point	Fuse F-12 (15A)	Lighting SW	Tail relay	Taillight bulb	Clearance light bulb	License plate light bulb	Cable harness
1-1 All illumination lights inoperative		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>
1-2 Both Taillights inoperative								<input type="radio"/>
1-3 Taillight on the left (or right) side inoperative					<input type="radio"/>			<input type="radio"/>
1-4 Both clearance lights inoperative		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>
1-5 Clearance light on the left (or right) side inoperative						<input type="radio"/>		<input type="radio"/>
1-6 License plate light inoperative	RHD-1						<input type="radio"/>	<input type="radio"/>
	RHD-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>
1-7 License plate light on the left (or right) side inoperative	RHD-2						<input type="radio"/>	<input type="radio"/>

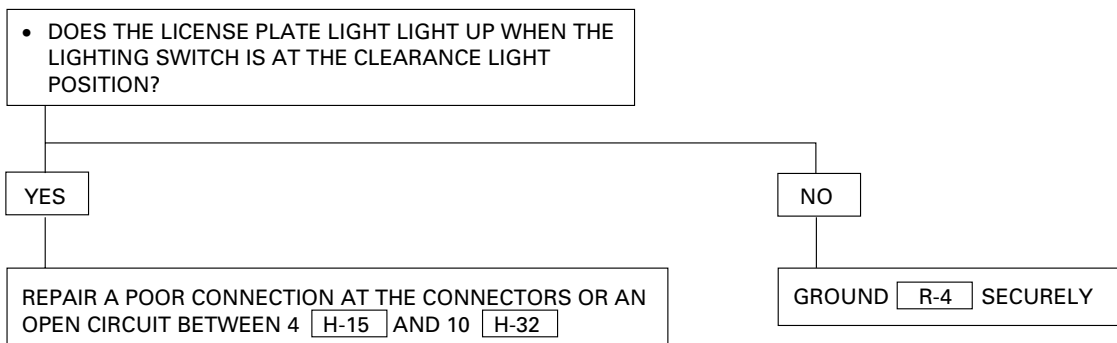
2. LHD

Trouble Mode	Check point	Tail relay	Fuse F-11 (10A)	Fuse F-12 (10A)	Lighting SW	Taillight bulb	Clearance light bulb	License plate light bulb	Cable harness
2-1 All illumination lights inoperative		<input type="radio"/>			<input type="radio"/>				<input type="radio"/>
2-2 Both taillights inoperative									<input type="radio"/>
2-3 Taillight on the left (or right) side inoperative			<input type="radio"/>	<input type="radio"/>		<input type="radio"/>			<input type="radio"/>
2-4 Both clearance lights inoperative									<input type="radio"/>
2-5 Clearance light on the left (or right) side inoperative							<input type="radio"/>		<input type="radio"/>
2-6 License plate light inoperative	LHD-1			<input type="radio"/>				<input type="radio"/>	<input type="radio"/>
	LHD-2								<input type="radio"/>
2-7 License plate light on the left (or right) side inoperative	LHD-2		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>
2-8 Both taillight and clearance light on the left (or right) side inoperative			<input type="radio"/>	<input type="radio"/>					<input type="radio"/>

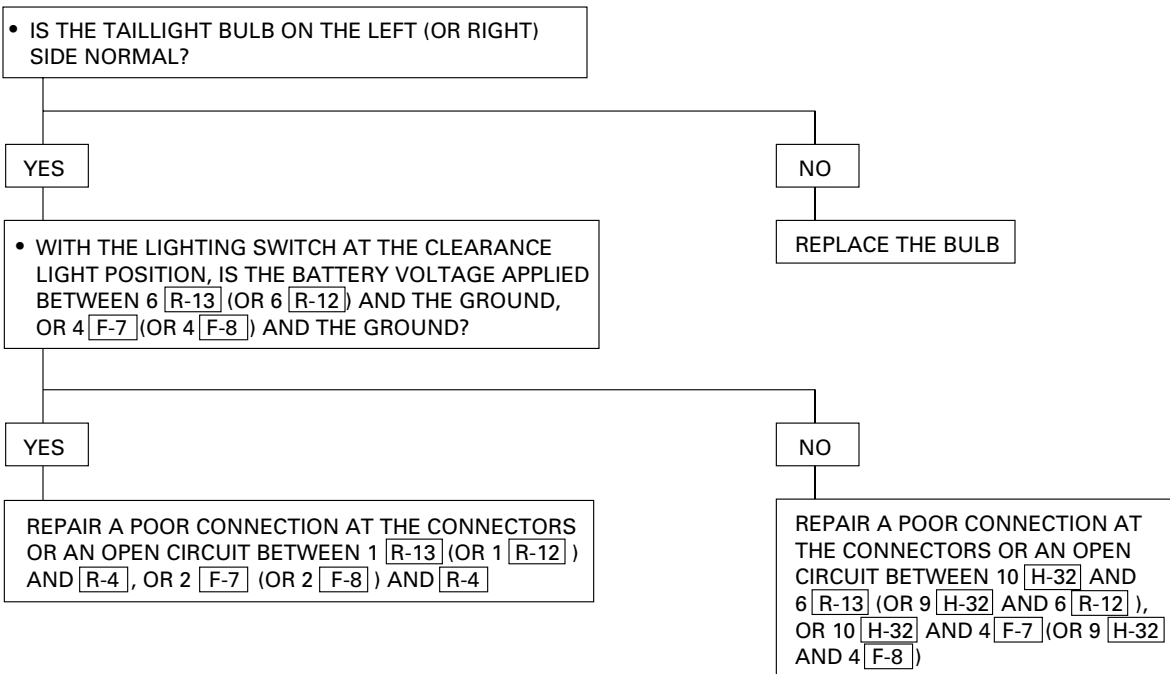
1-1 All Illuminations Lights Inoperative



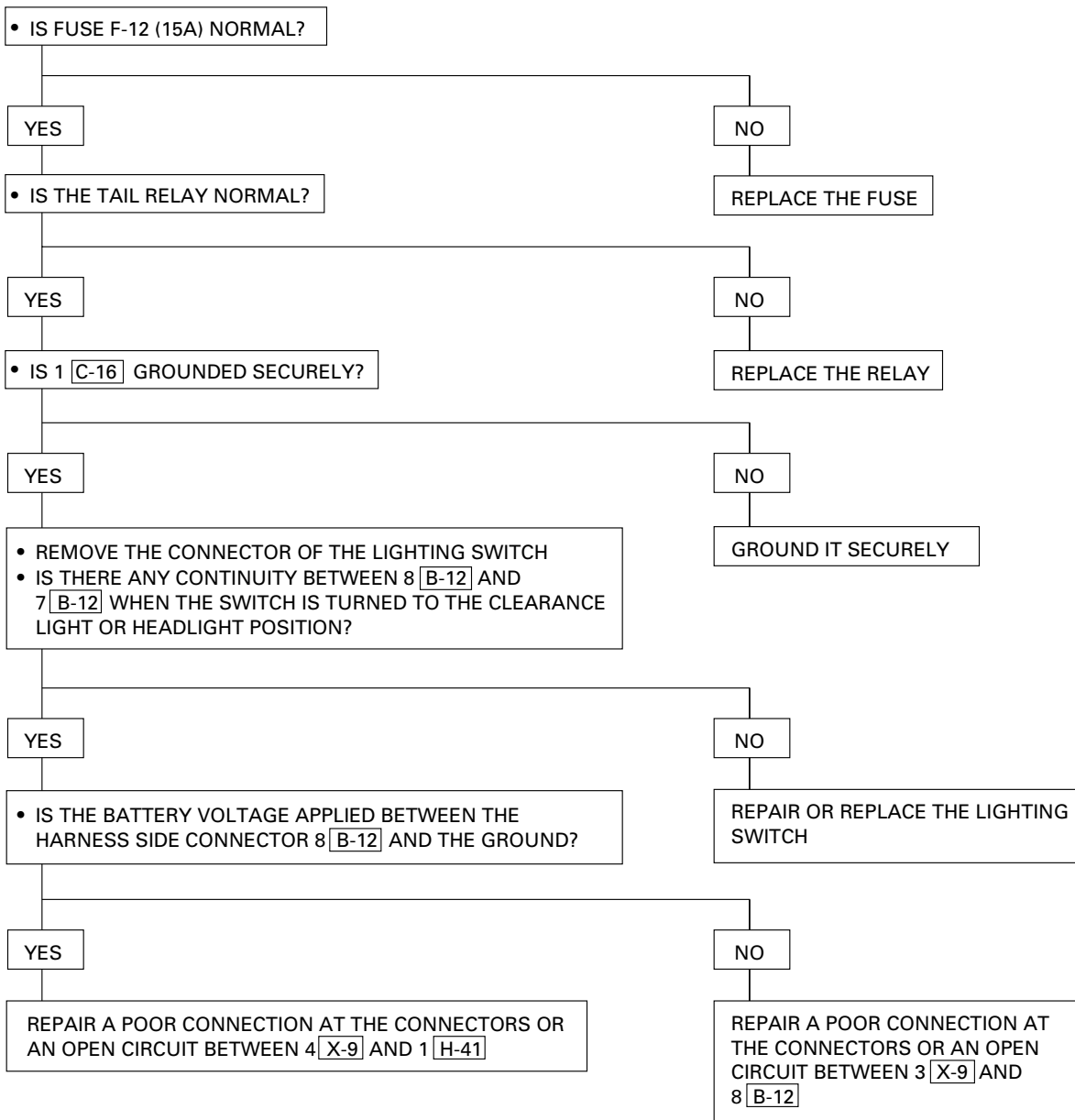
1-2 Both Taillights Inoperative



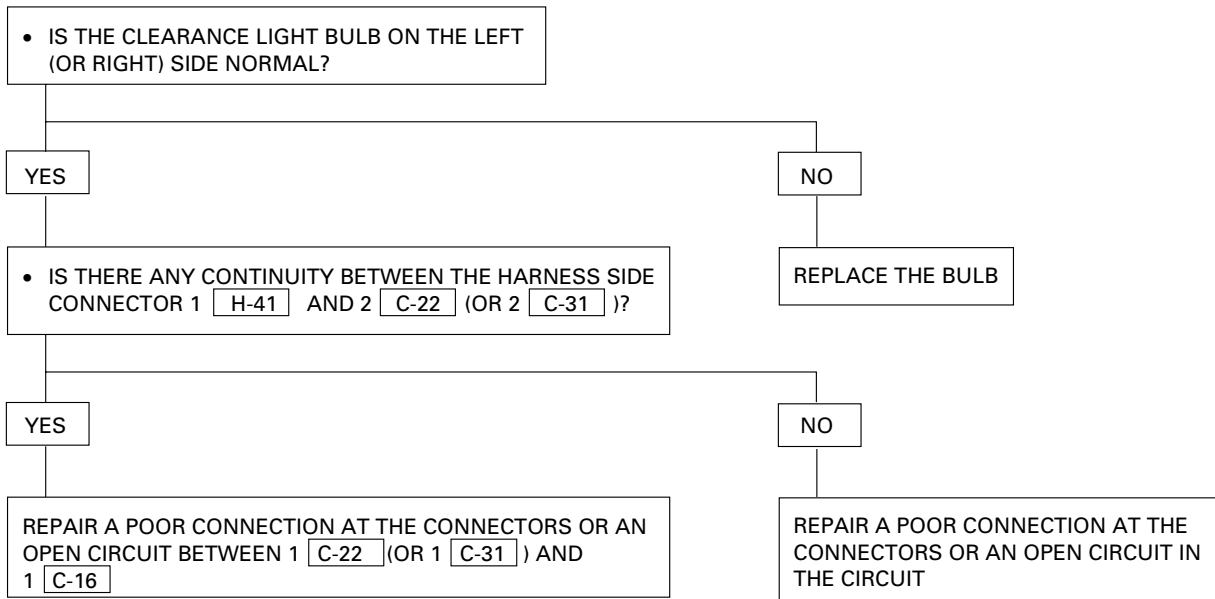
1-3 Taillight On The Left (Or Right) Side Inoperative



1-4 Both Clearance Lights Inoperative

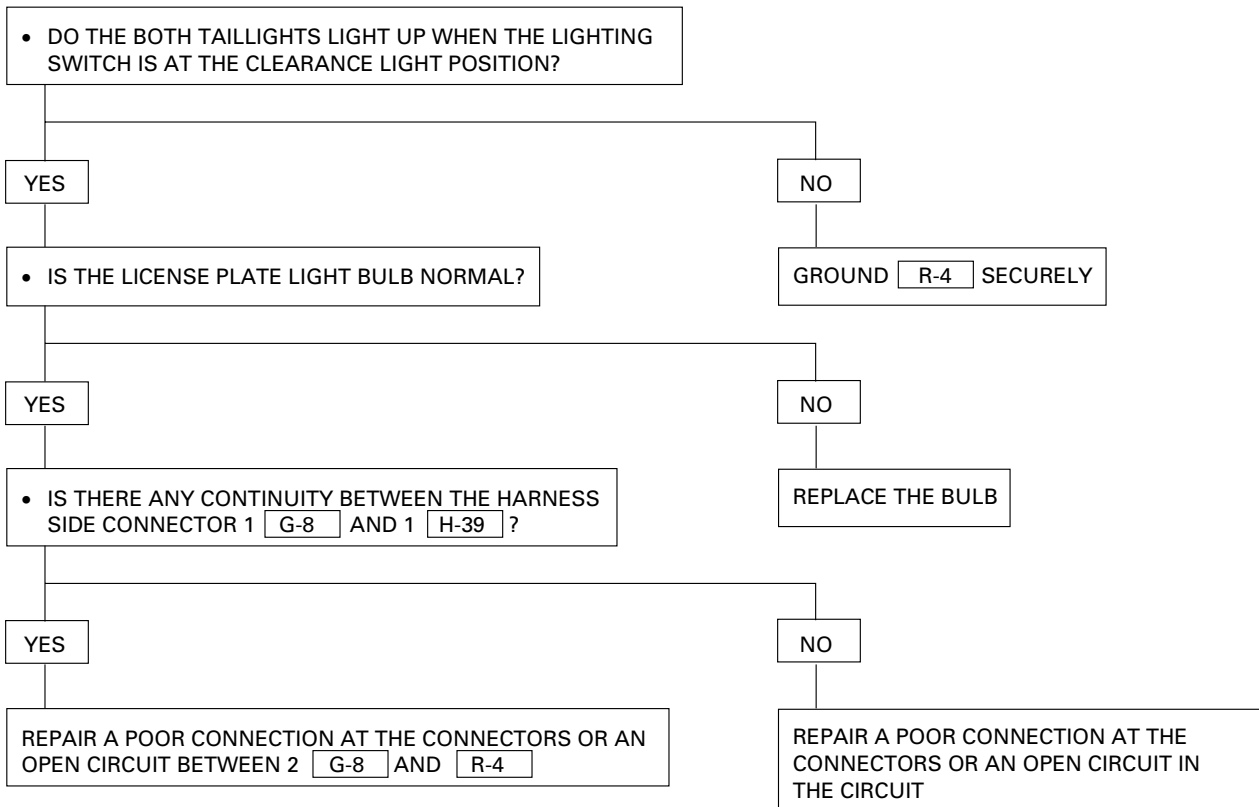


1-5 Clearance Light On The Left (Or Right) Side Inoperative

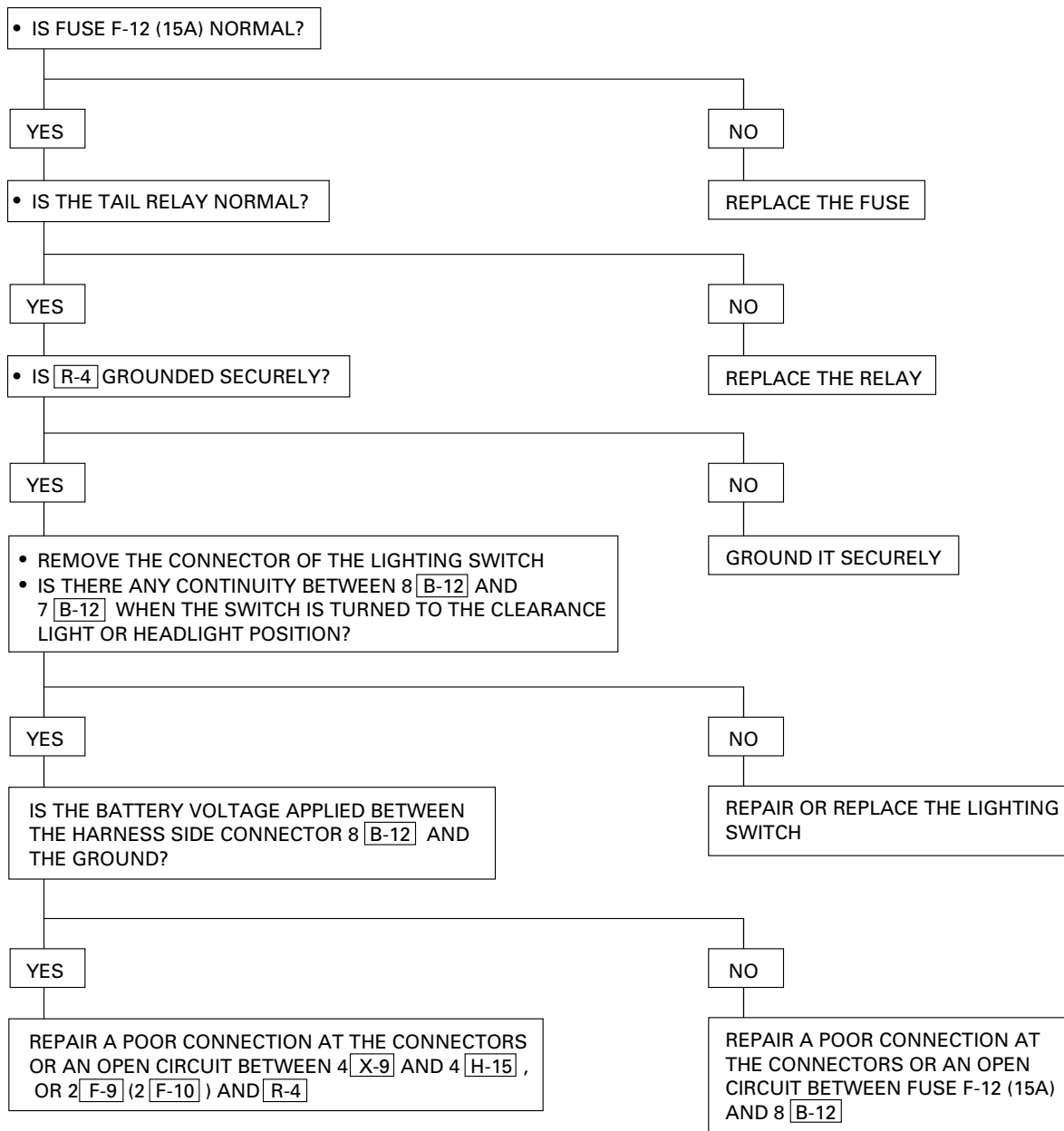


1-6 License Plate Light Inoperative

(RHD-1)

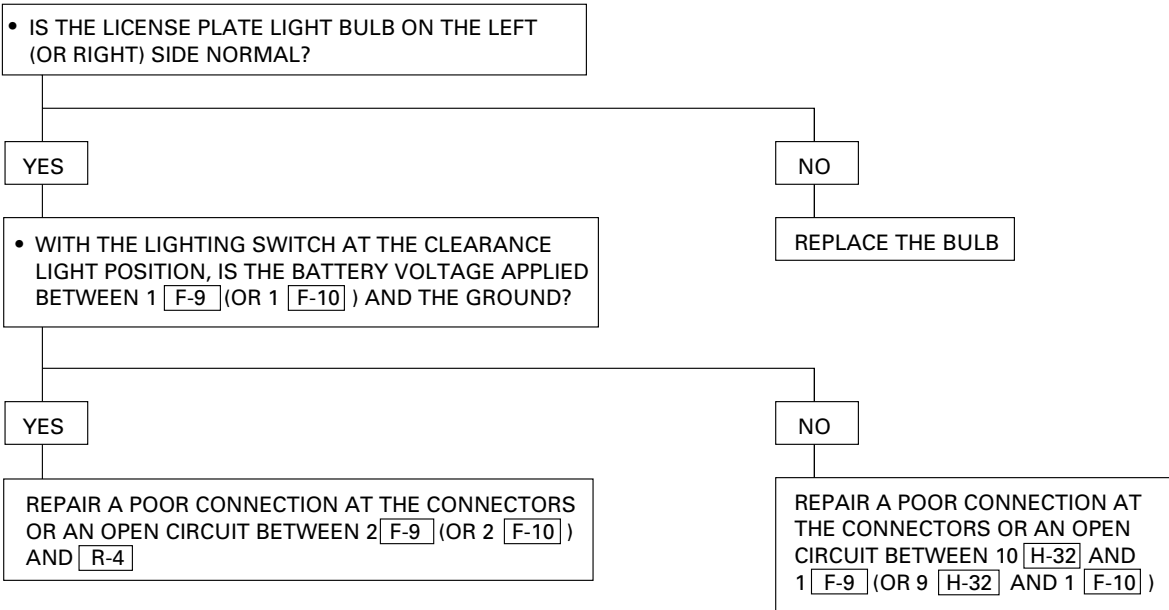


(RHD-2)

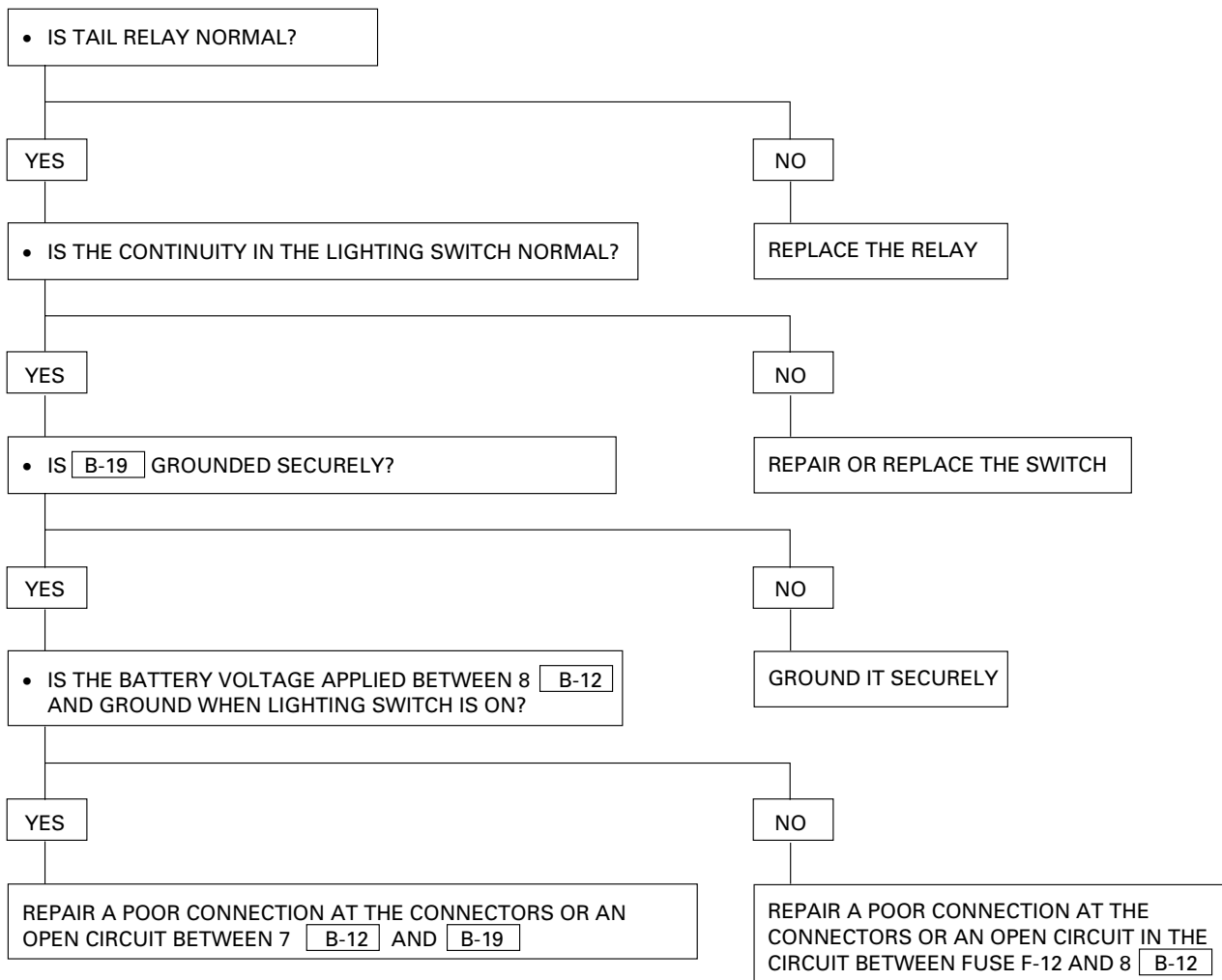


1-7 License Plate Light On The Left (Or Right) Side Inoperative

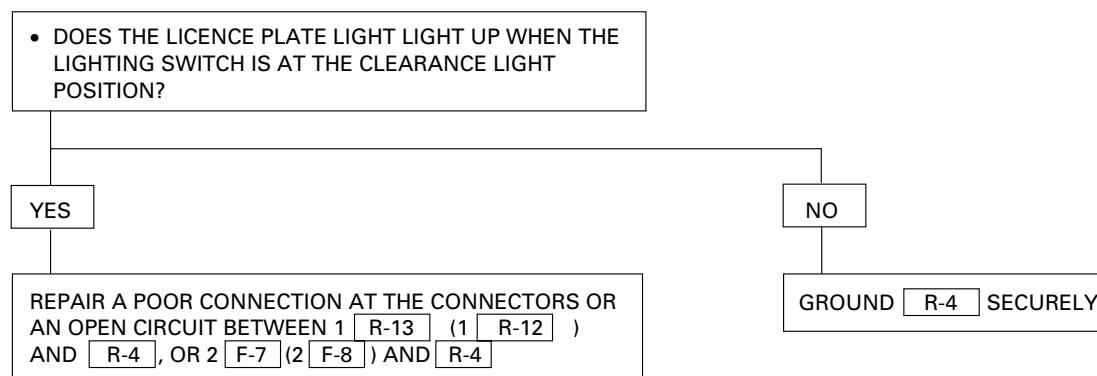
(RHD-2)



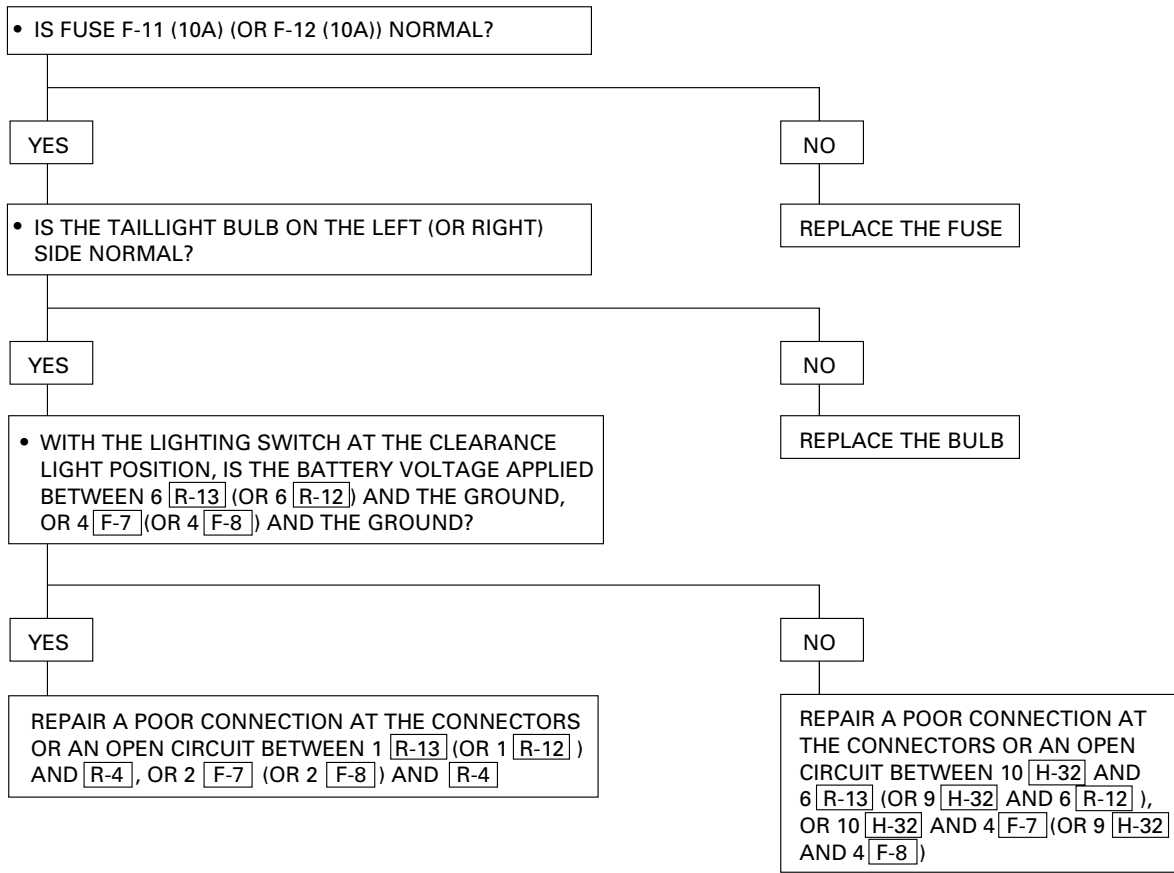
2-1 All Illumination Lights Inoperative



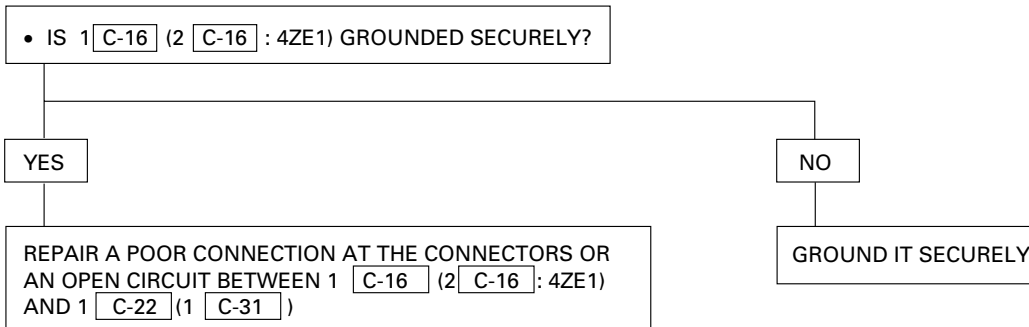
2-2 Both Taillights Inoperative



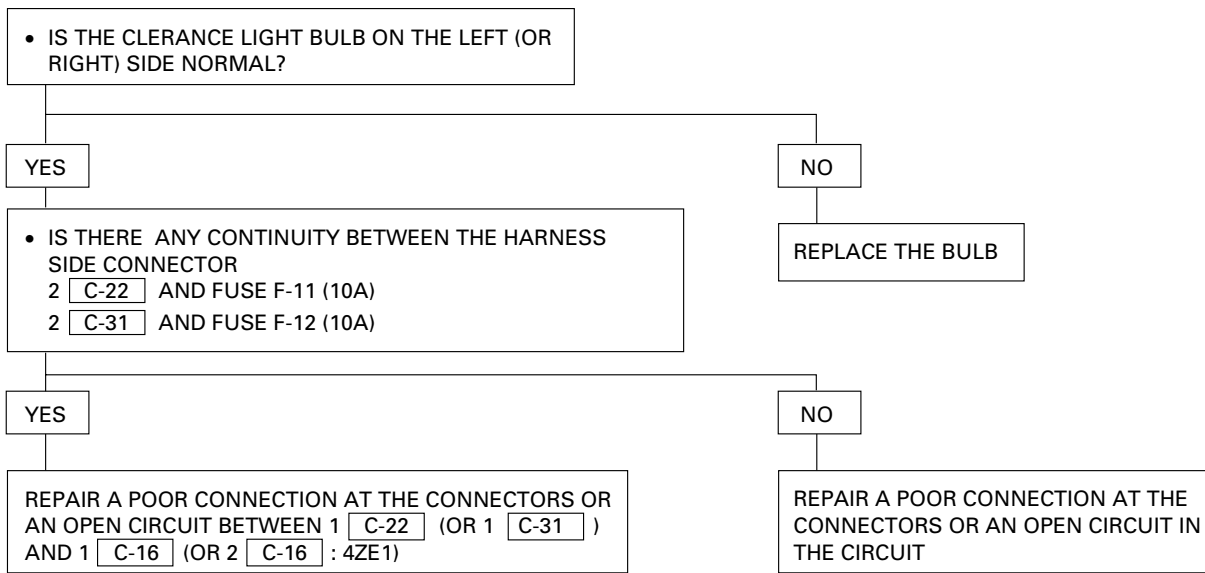
2-3 Taillight On The Left (Or Right) Side Inoperative



2-4 Both Clearance Lights Inoperative

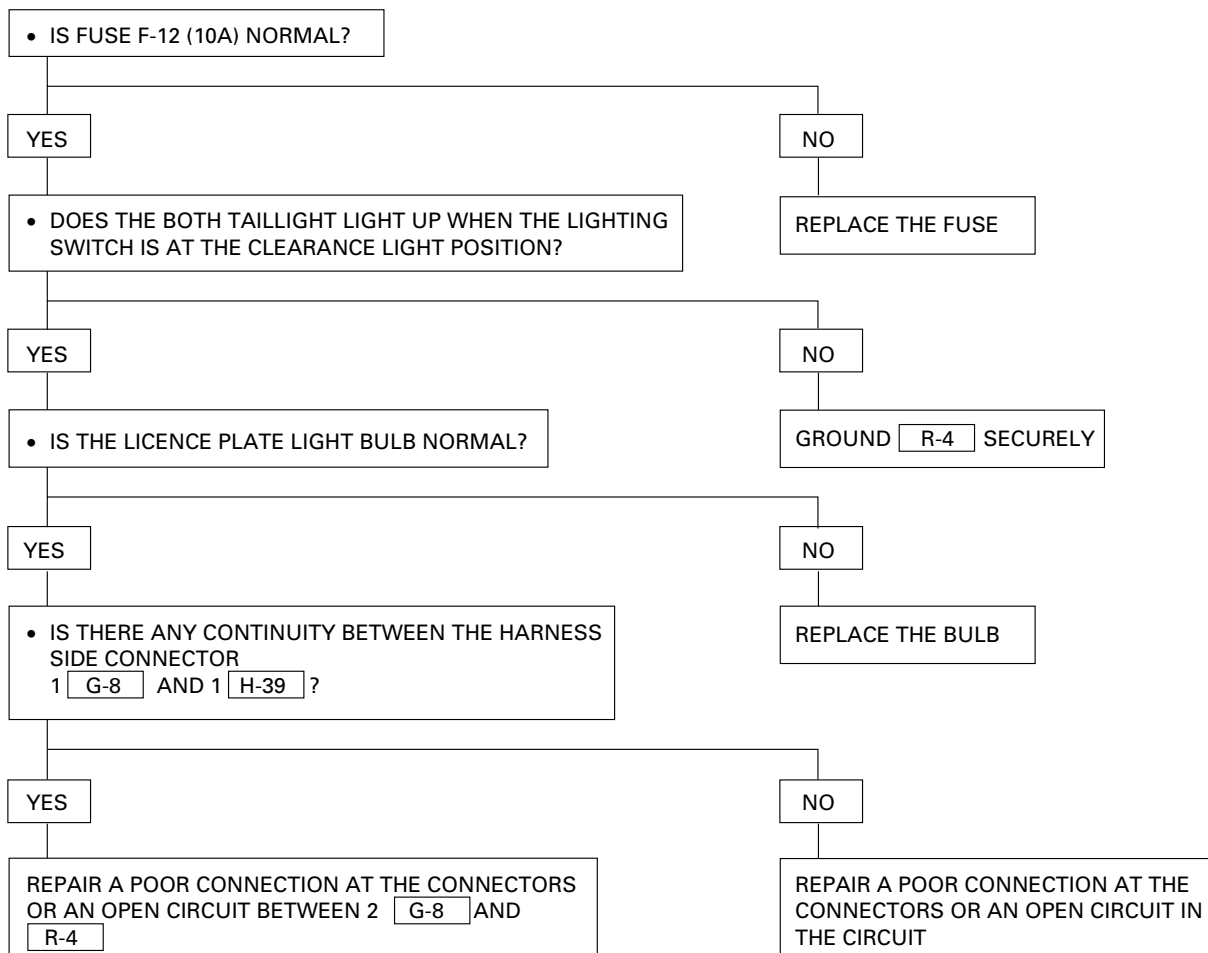


2-5 Clearance Light On The Left (Or Right) Side Operative

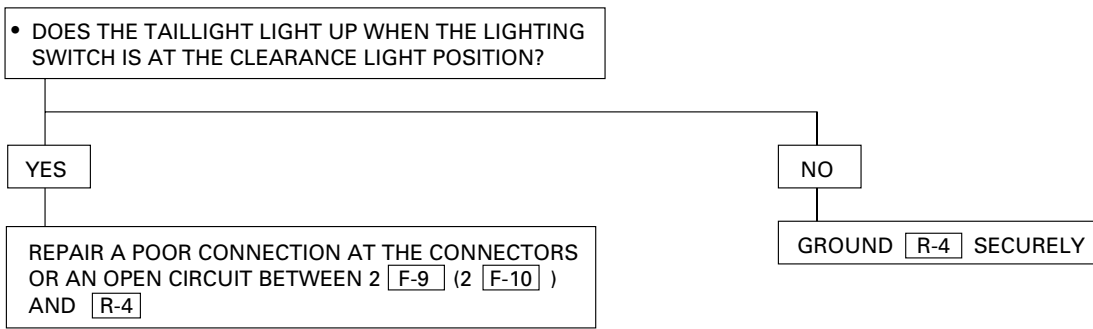


2-6 License Plate Light Inoperative

(LHD-1)

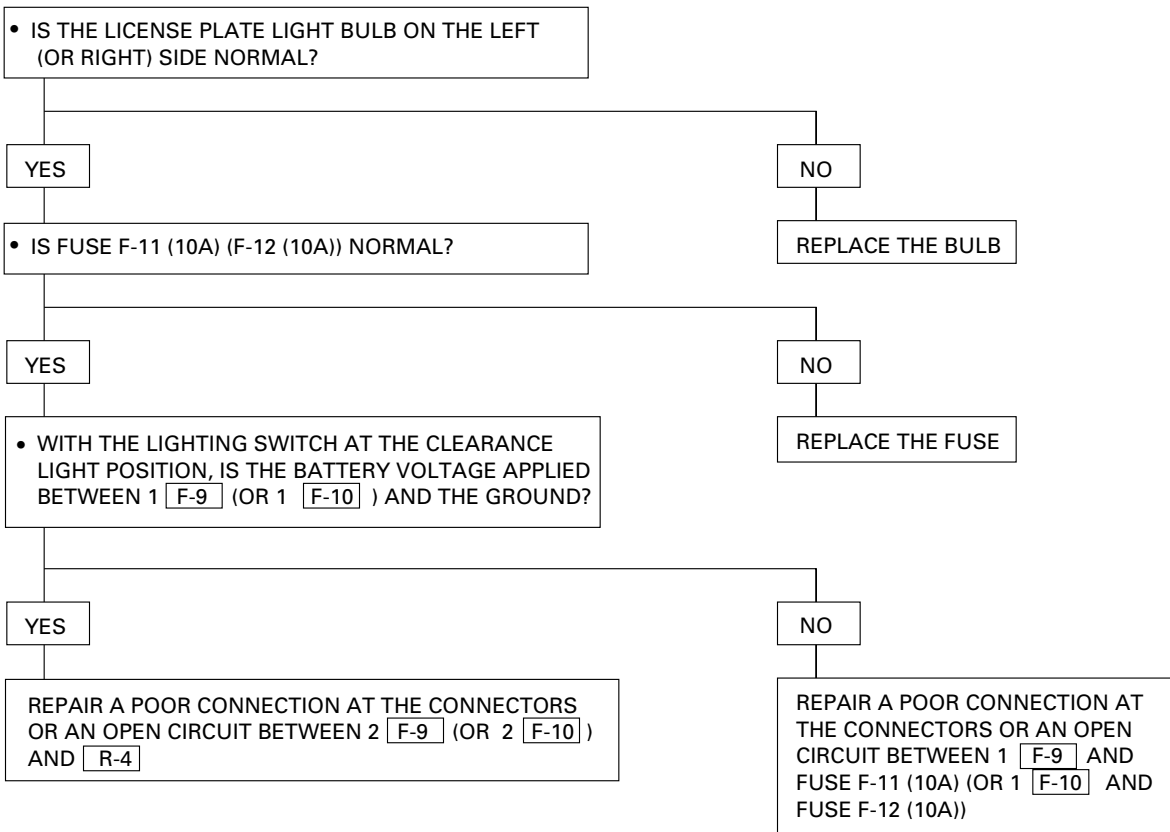


(LHD-2)

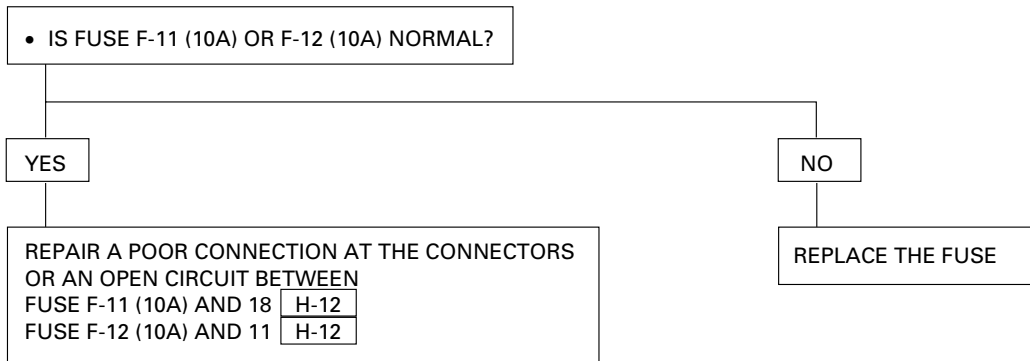


2-7 License Plate Light On The Left (Or Right) Side Inoperative

(LHD-2)



2-8 Both Taillights And Clearance Lights On The Left (Or Right) Side Inoperative



Interior Illumination Light

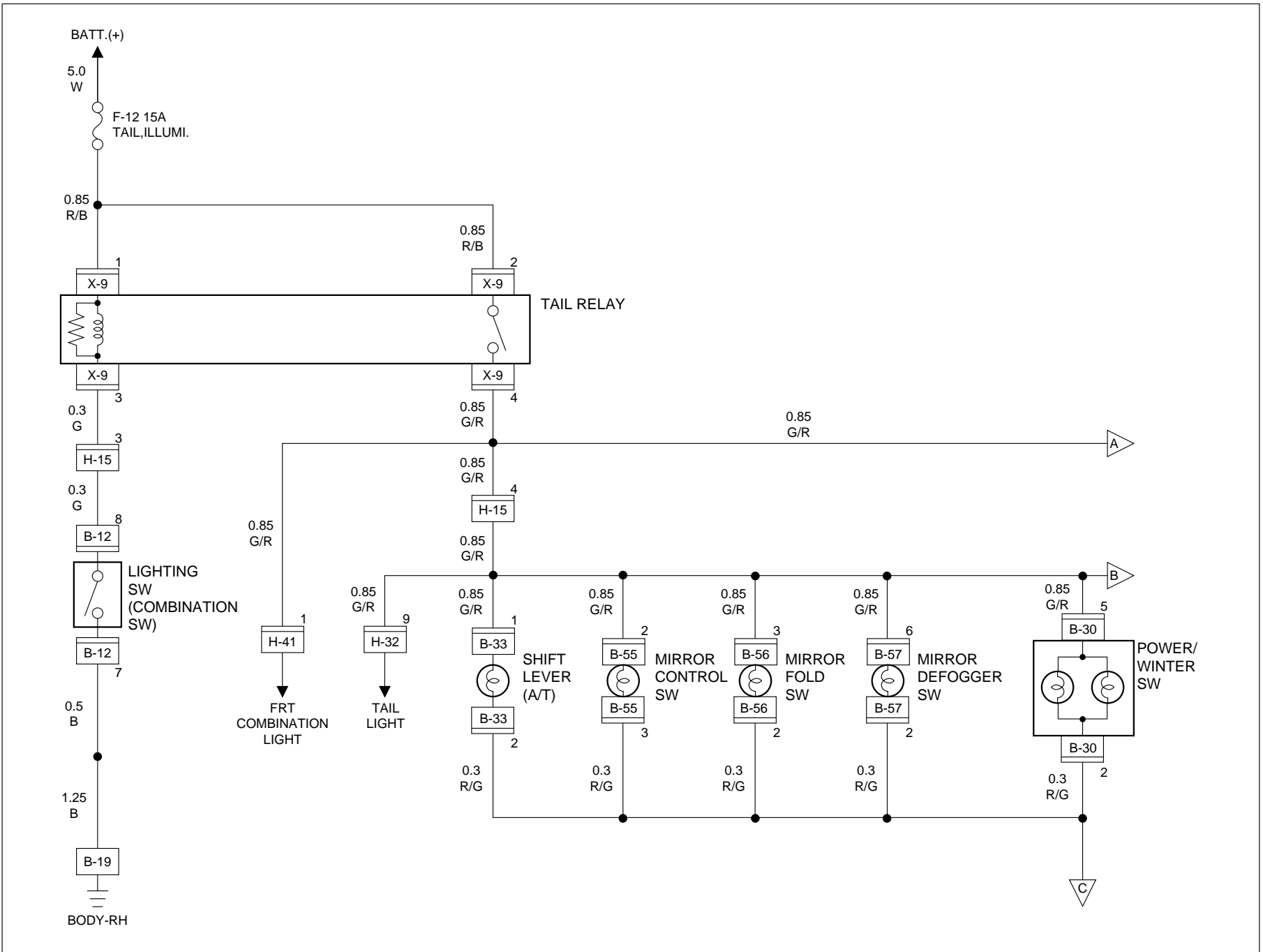
General Description

The circuit consists of a lighting switch, tail relay, illumination controller and illumination lights.

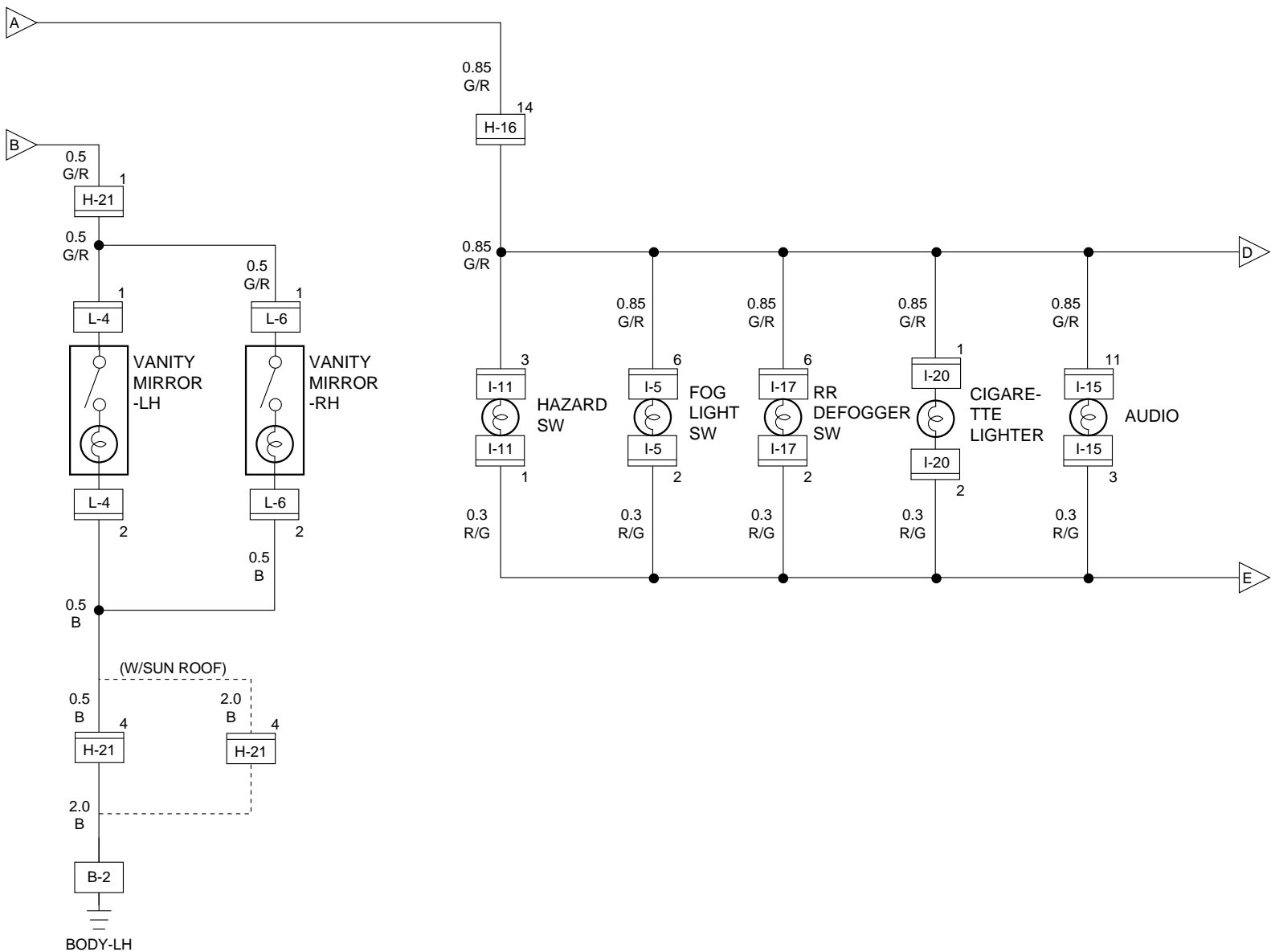
All these lights come on when the lighting switch is turned on with the switch turned to either parking or headlight position.

The brightness of illumination lights except the ones for ashtray, glove box and vanity mirror, can be adjusted by the illumination controller.

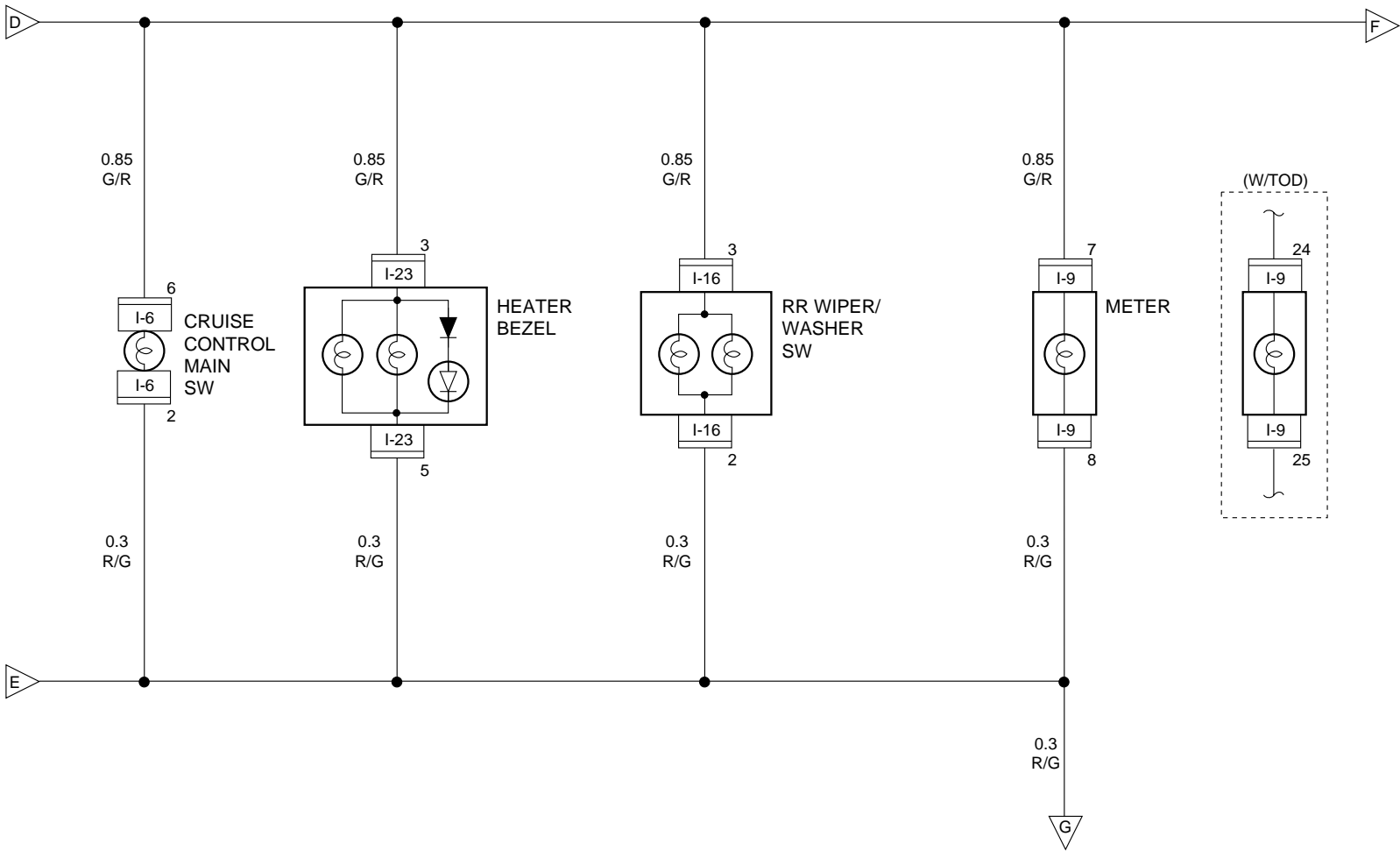
Circuit Diagram (RHD)-1



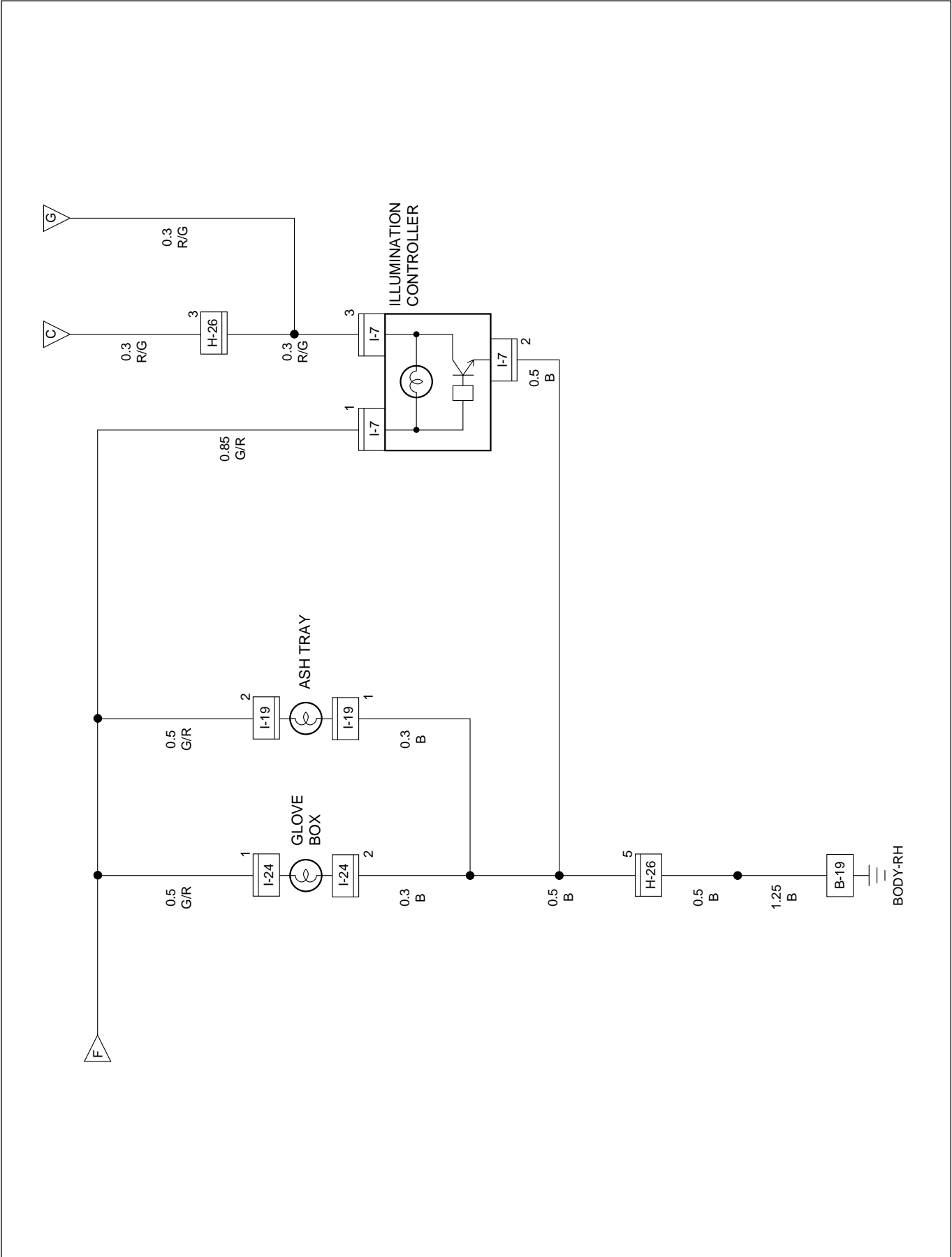
Circuit Diagram (RHD)-2



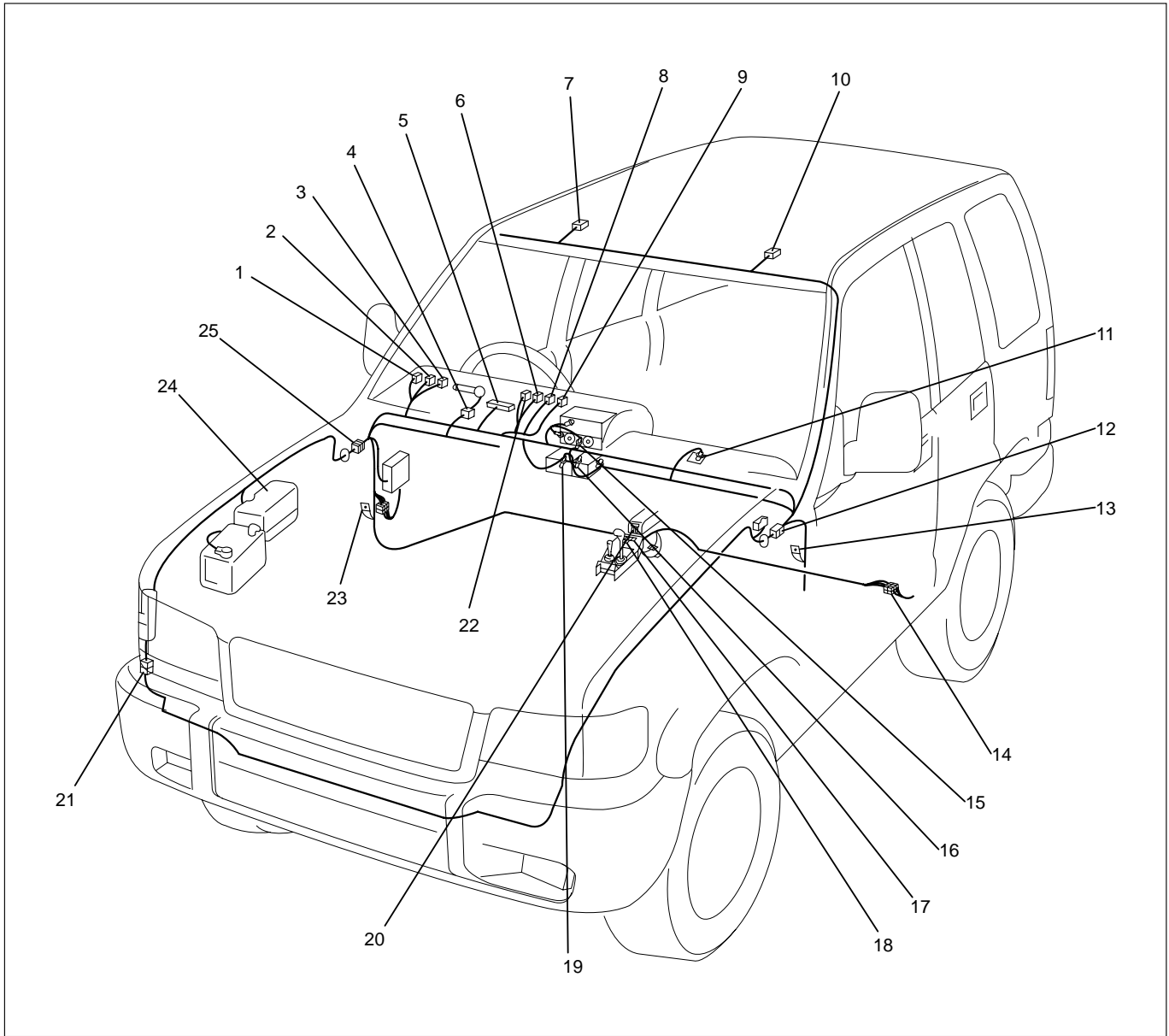
Circuit Diagram (RHD)-3



Circuit Diagram (RHD)-4



Parts Location (RHD)

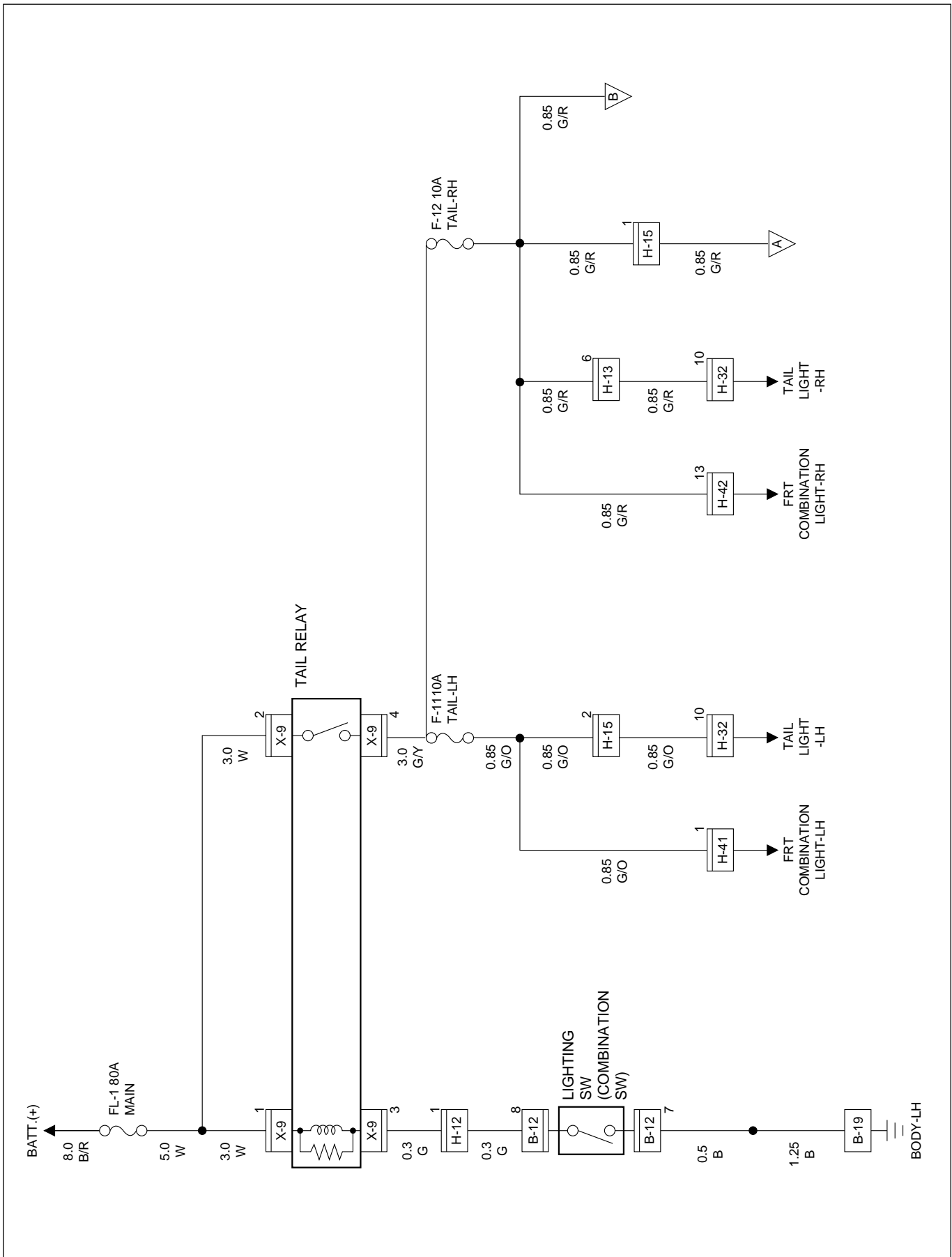


D08RW651

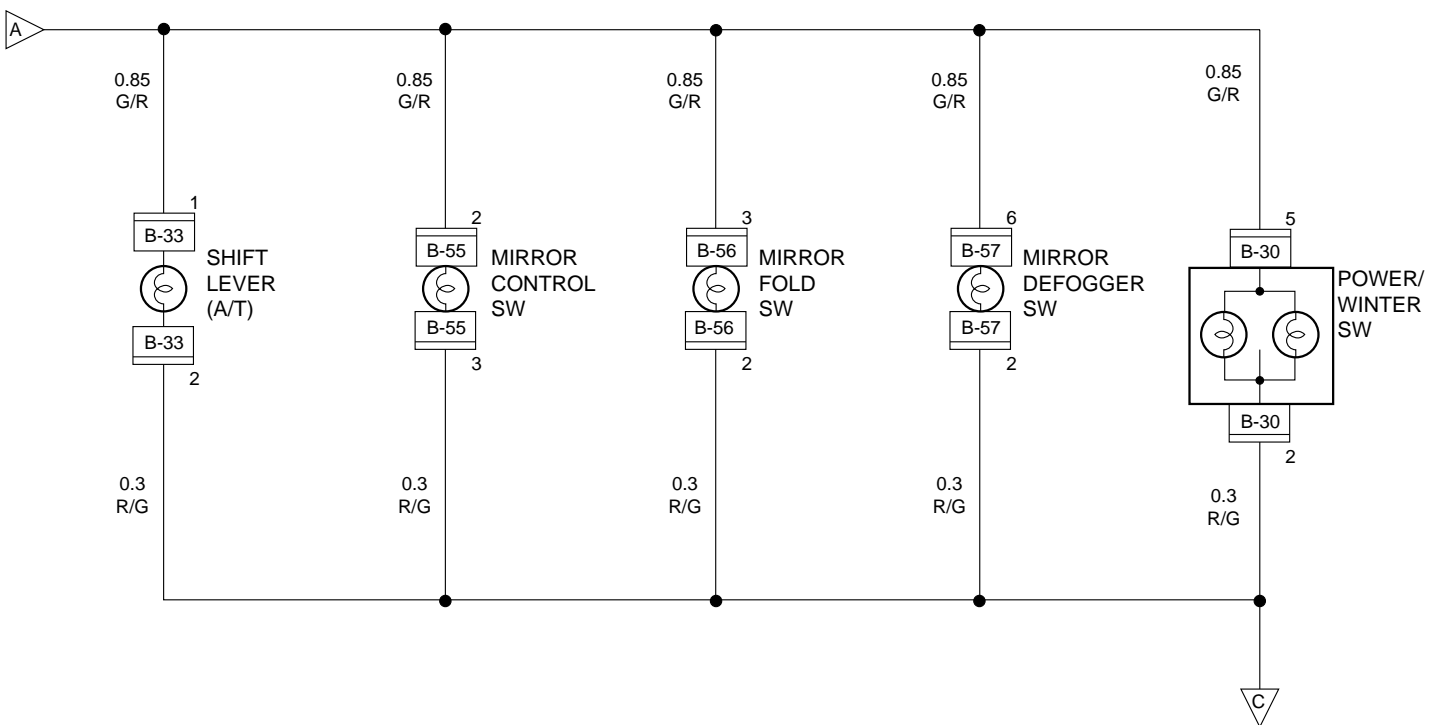
Legend

- | | |
|--|-------------------------------|
| (1) Front Fog Light Switch (I-5) | (13) B-2 |
| (2) Head Light Wiper / Washer Switch (I-4) | (14) H-32 |
| (3) Illumination Controller | (15) I-23 |
| (4) B-12 | (16) I-20 |
| (5) I-9 | (17) B-30 |
| (6) Hazard Switch (I-11) | (18) B-33 |
| (7) L-6 | (19) I-19 |
| (8) I-16 | (20) B-55, B-56, B-57 |
| (9) I-17 | (21) H-41 |
| (10) L-4 | (22) I-16 |
| (11) I-24 | (23) B-19 |
| (12) H-21 | (24) Relay and Fuse Box (X-9) |
| | (25) H-15, H-16, H-26 |

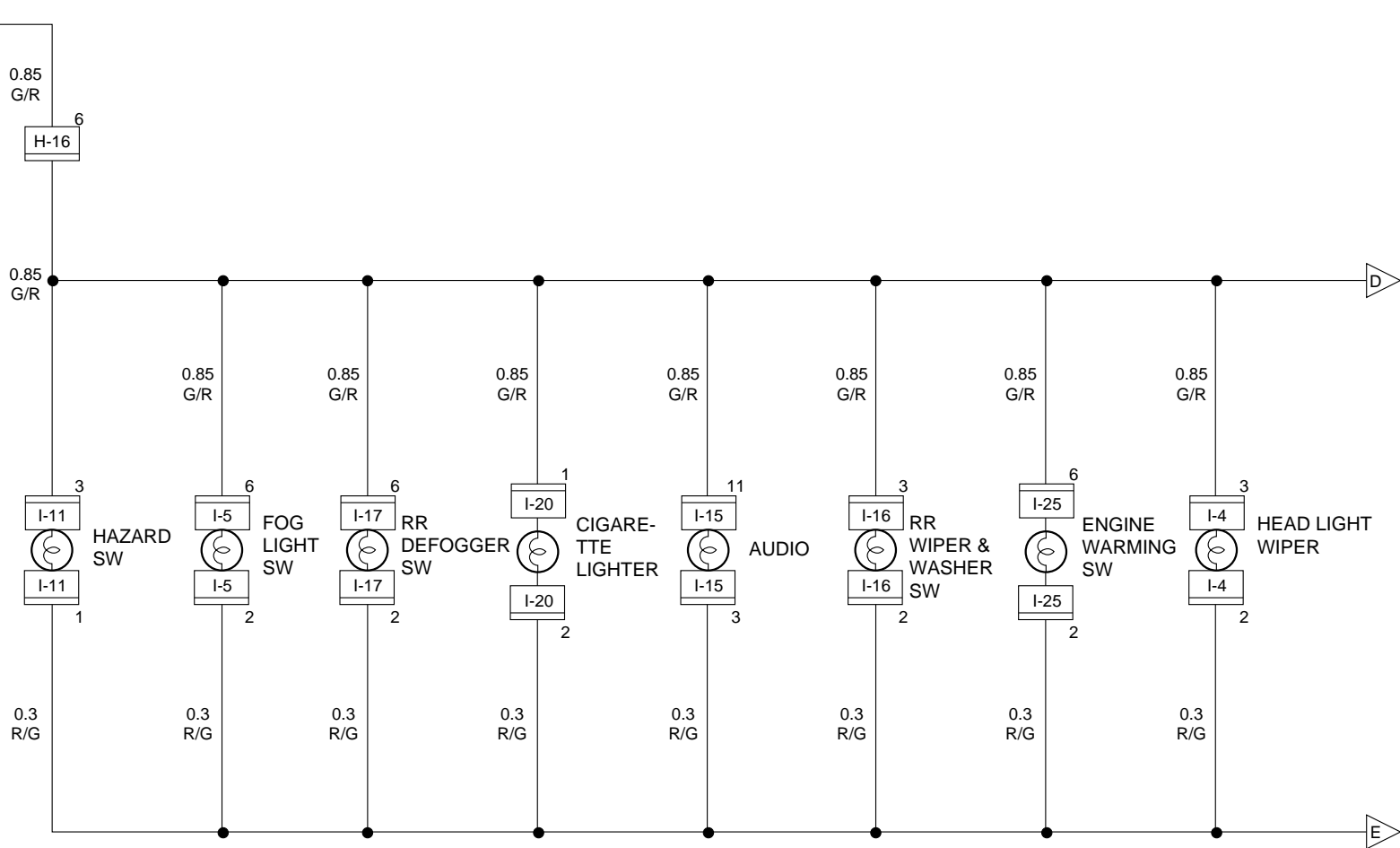
Circuit Diagram (LHD)-1



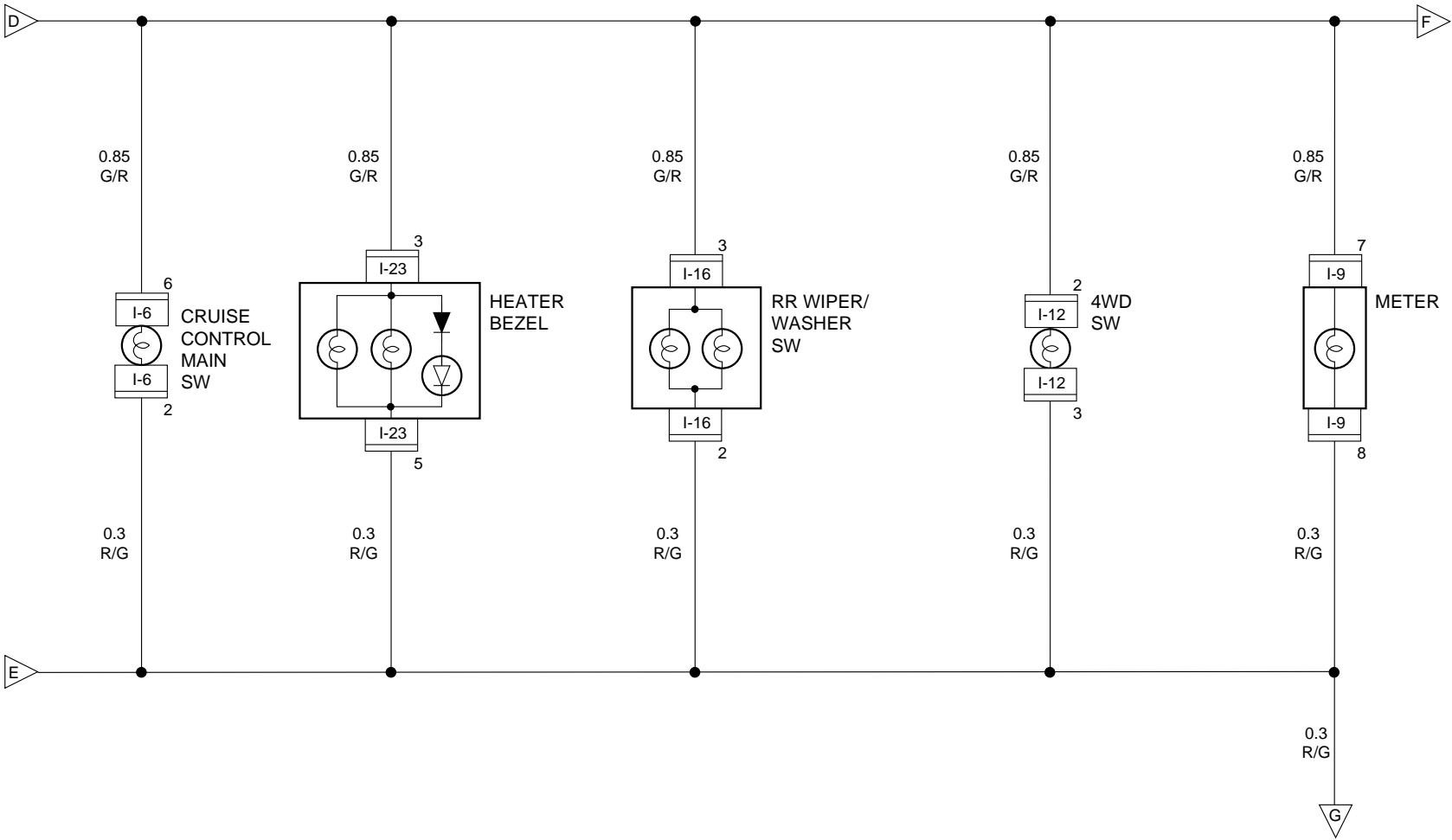
Circuit Diagram (LHD)-2



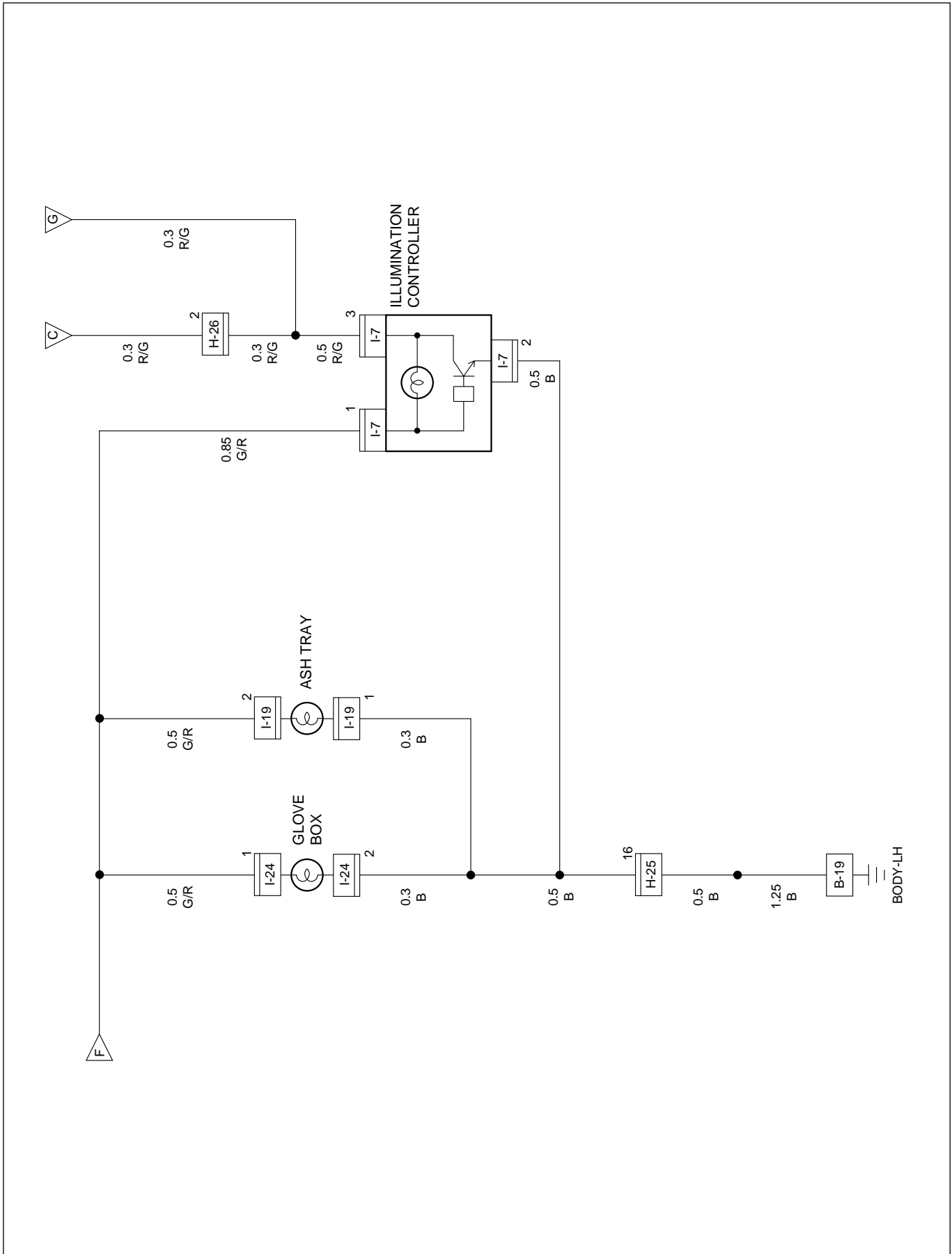
Circuit Diagram (LHD)-3



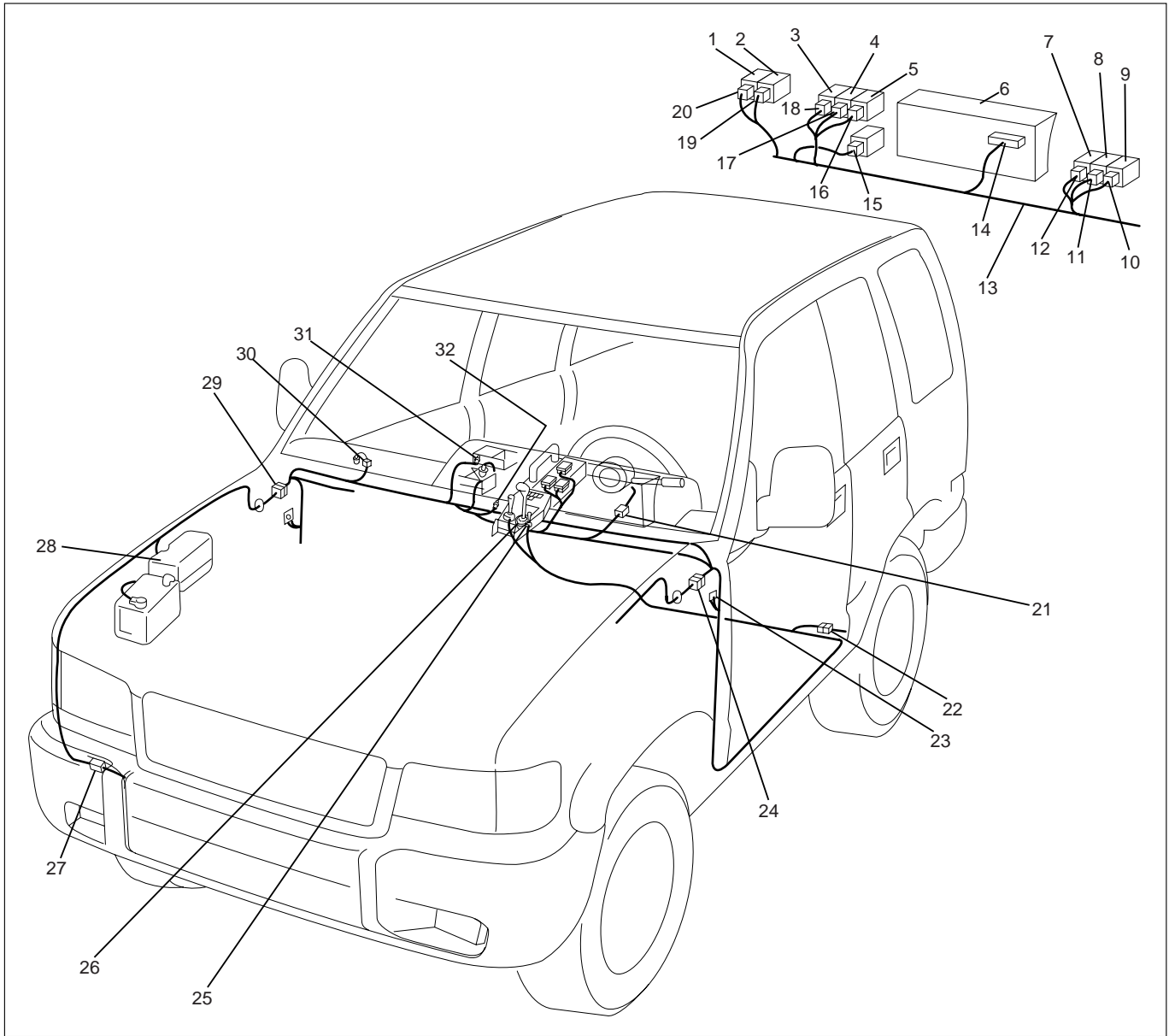
Circuit Diagram (LHD)-4



Circuit Diagram (LHD)-5



Parts Location (LHD)



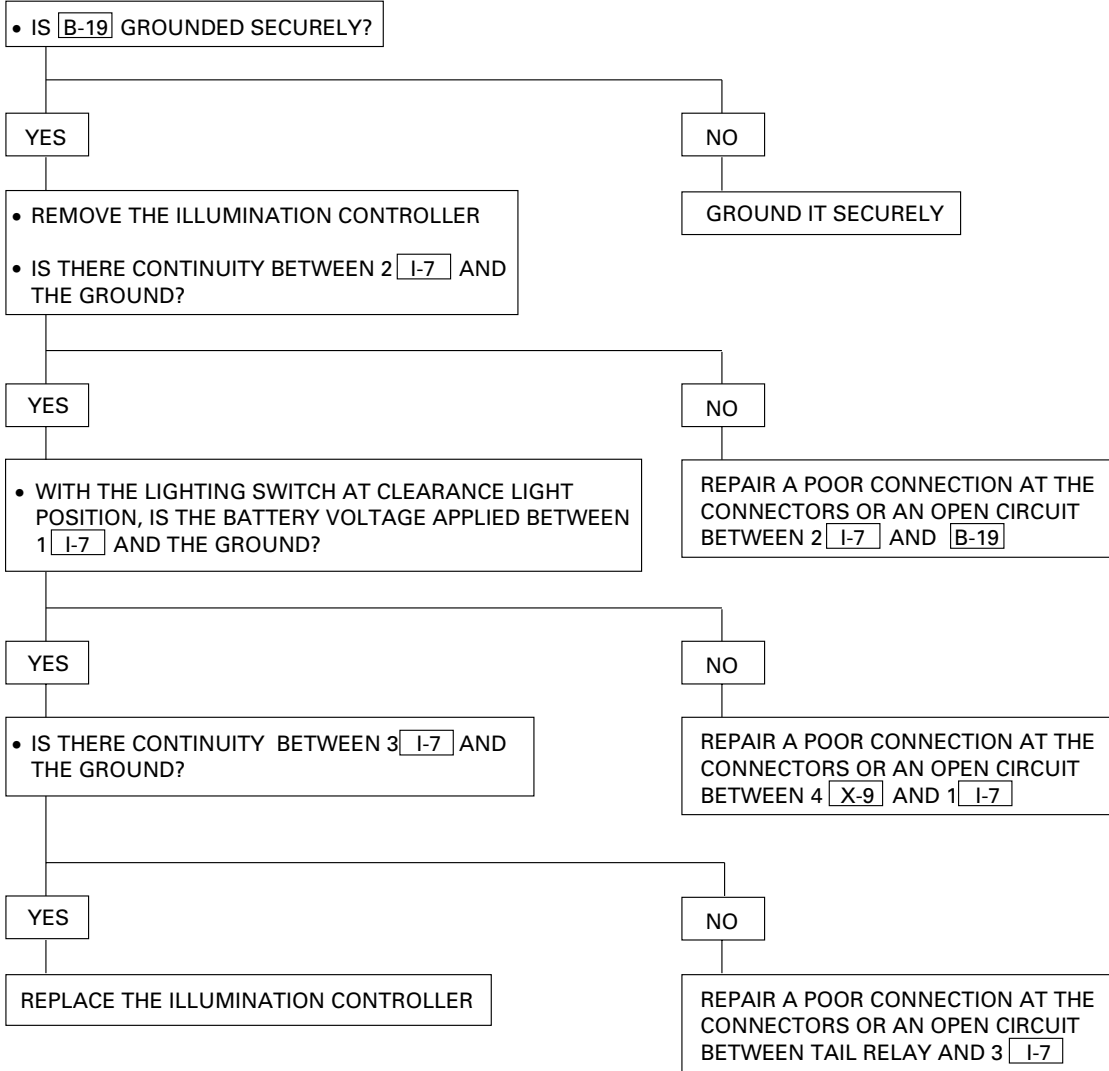
D08RW893

Legend

- | | |
|--|-------------------------------|
| (1) Rear Deffoger Switch | (17) I-12 |
| (2) Rear Wiper / Washer Switch | (18) I-25 |
| (3) Engin Warming Switch | (19) I-16 |
| (4) 4WD Switch | (20) I-17 |
| (5) Hazard Switch | (21) B-12 |
| (6) Meter | (22) H-32 |
| (7) Illumination Contorller | (23) B-19 |
| (8) Head Light Wiper and Washer Switch | (24) H-25, H-26 |
| (9) Fog Light Switch | (25) B-33 |
| (10) I-5 | (26) B-30 |
| (11) I-4 | (27) H-41, H-42 |
| (12) I-7 | (28) Relay and Fuse Box (X-9) |
| (13) Instrument Harness | (29) H-13, H-15, H-16 |
| (14) I-9 | (30) I-24 |
| (15) I-6 | (31) I-28 |
| (16) I-11 | (32) I-20 |

Diagnosis

Interior Illumination Lights Inoperative

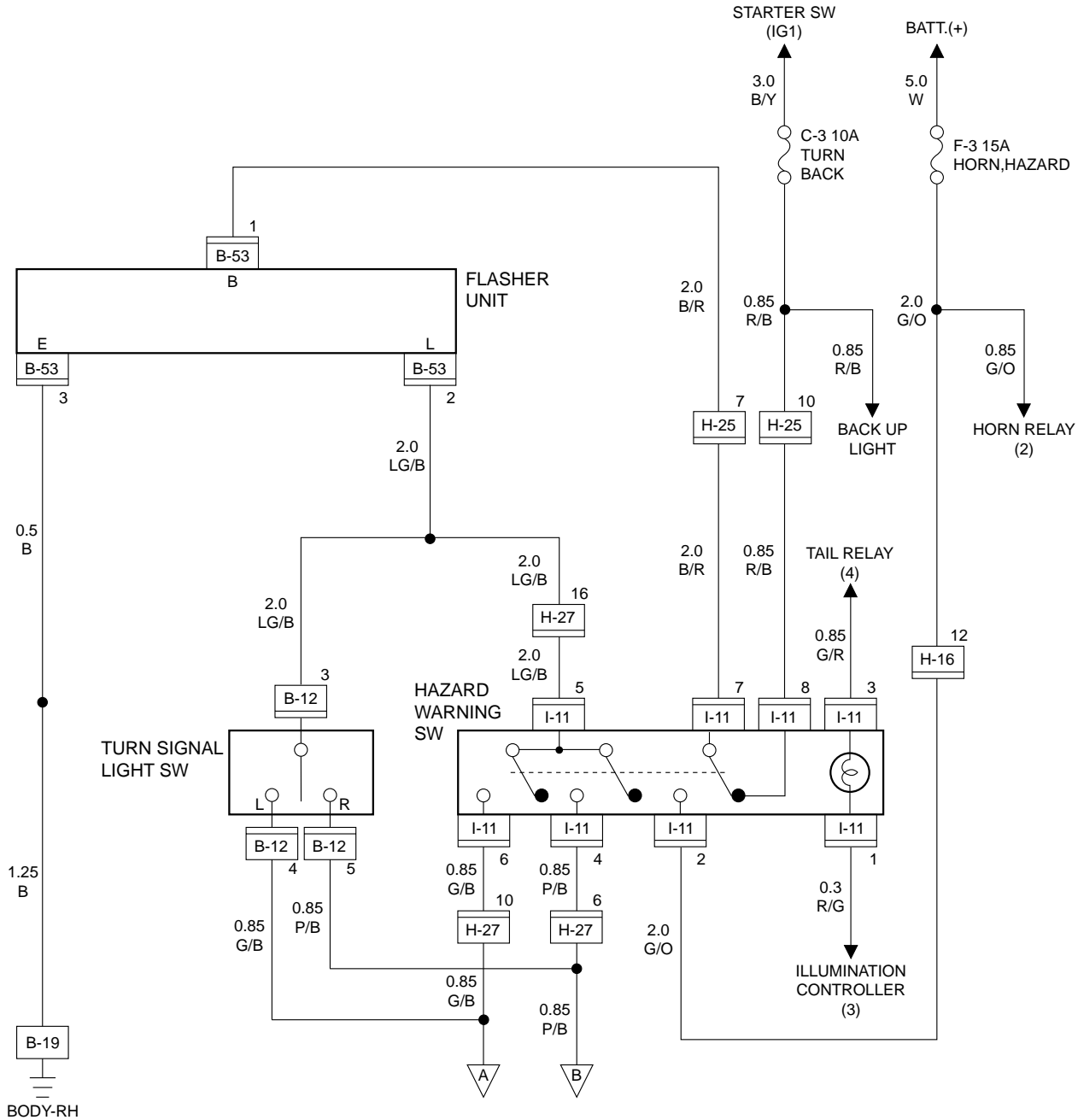


Turn Signal Light and Hazard Warning Light

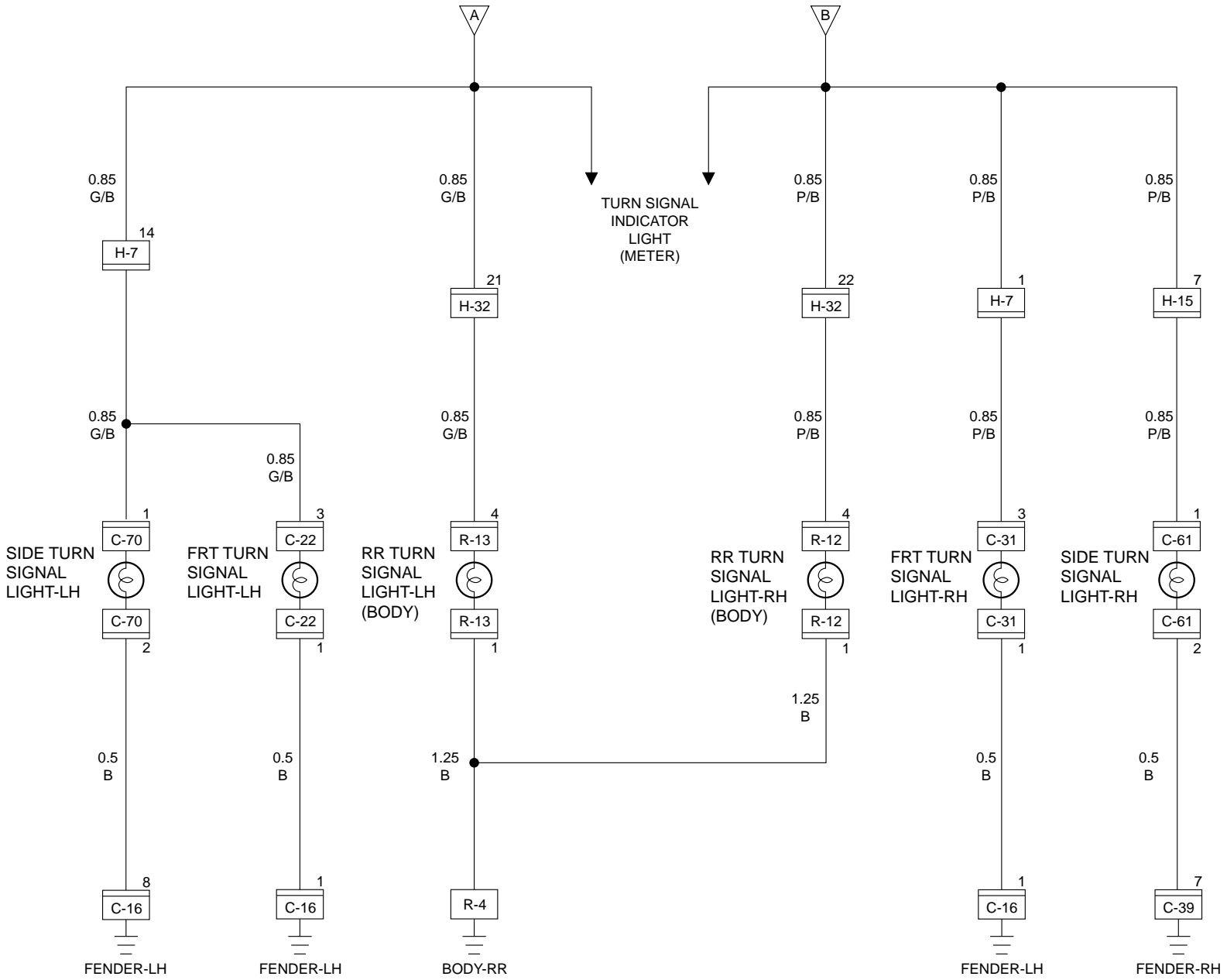
General Description

The circuit consists of a turn signal switch (combination switch), turn signal light, hazard warning switch and flasher unit. When the turn signal light switch is turned on with starter switch on, turn signal light will operate. When turn signal light is flashing, indicator light in meter also starts flashing. When hazard warning switch is turned on, current flows to flasher unit through hazard warning switch to cause hazard warning light to flash independent of position of starter switch. At the same time, indicator lights in meter also start flashing.

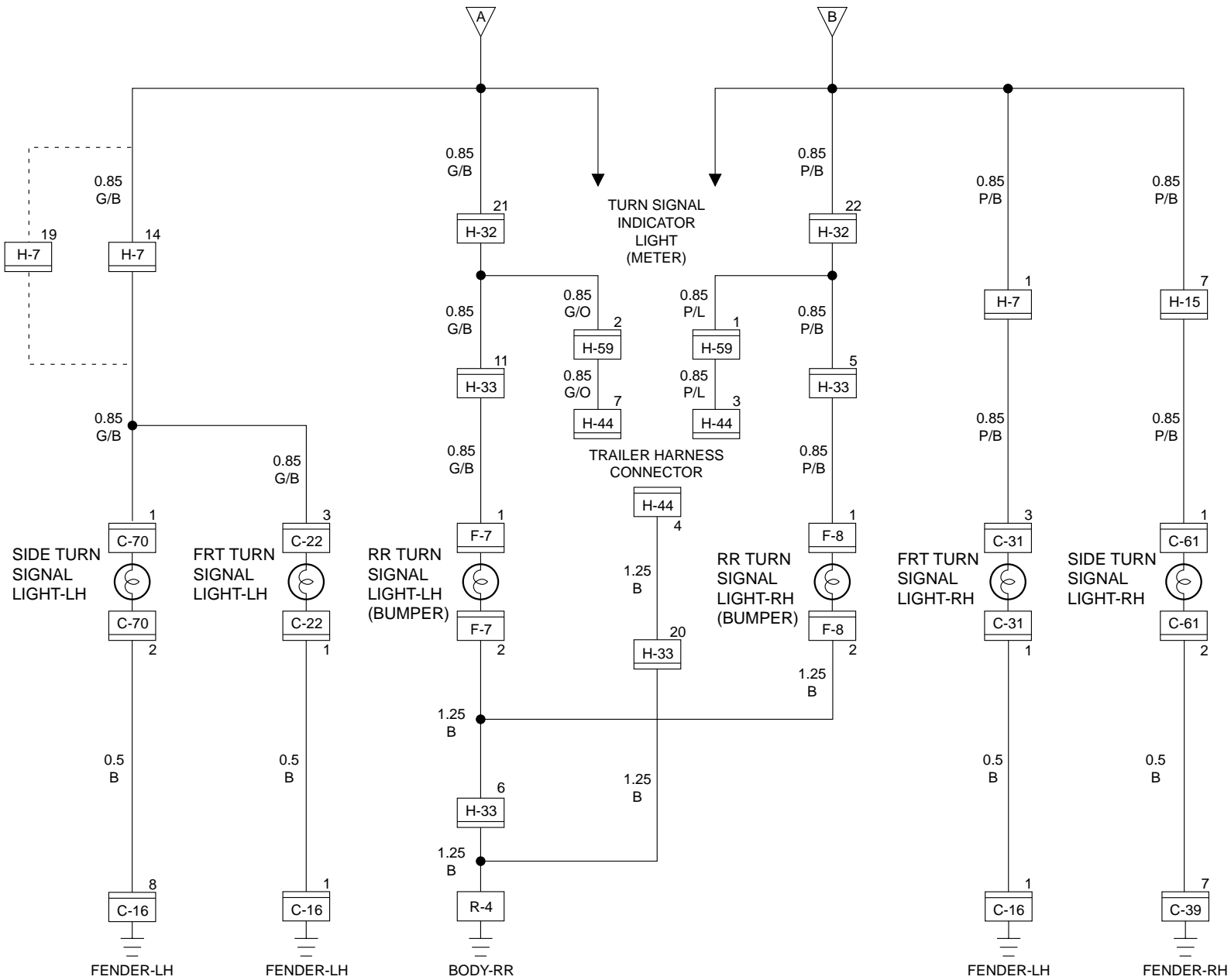
Circuit Diagram (RHD)-1



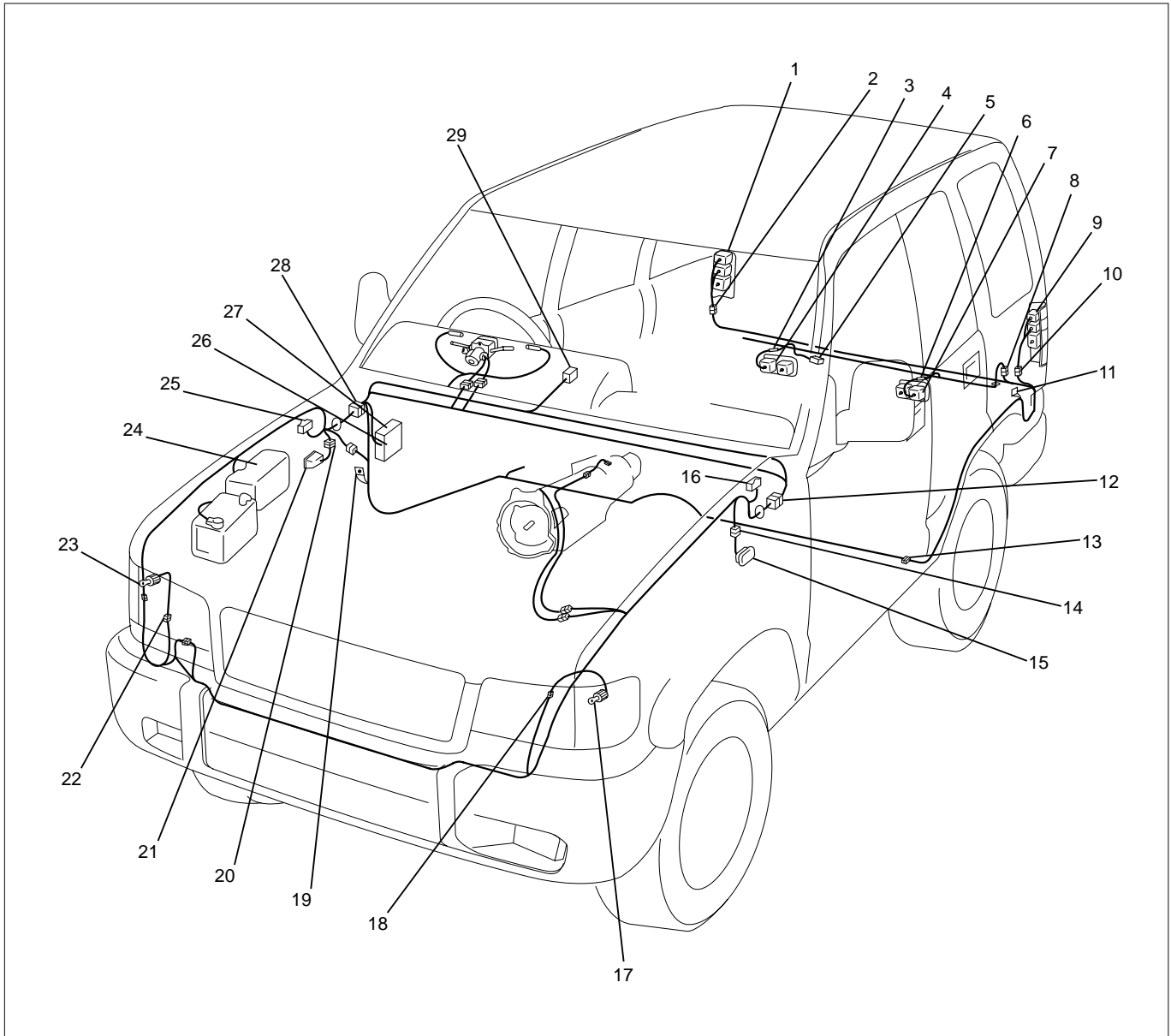
Circuit Diagram (RHD)-2



Circuit Diagram (RHD W/Bumper Built-in Type RR Turn Signal Light) -2



Parts Location (RHD)

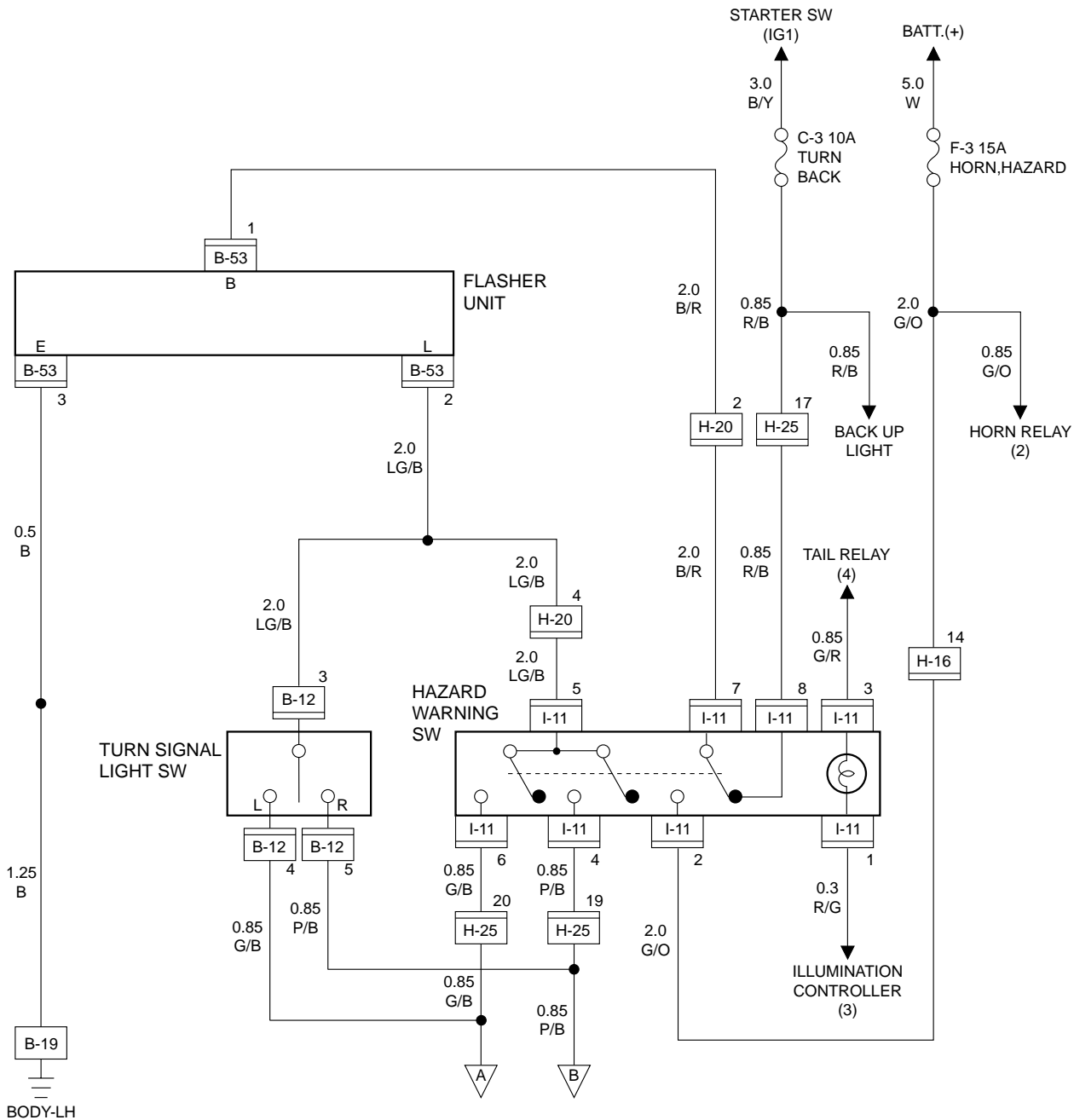


D08RW678

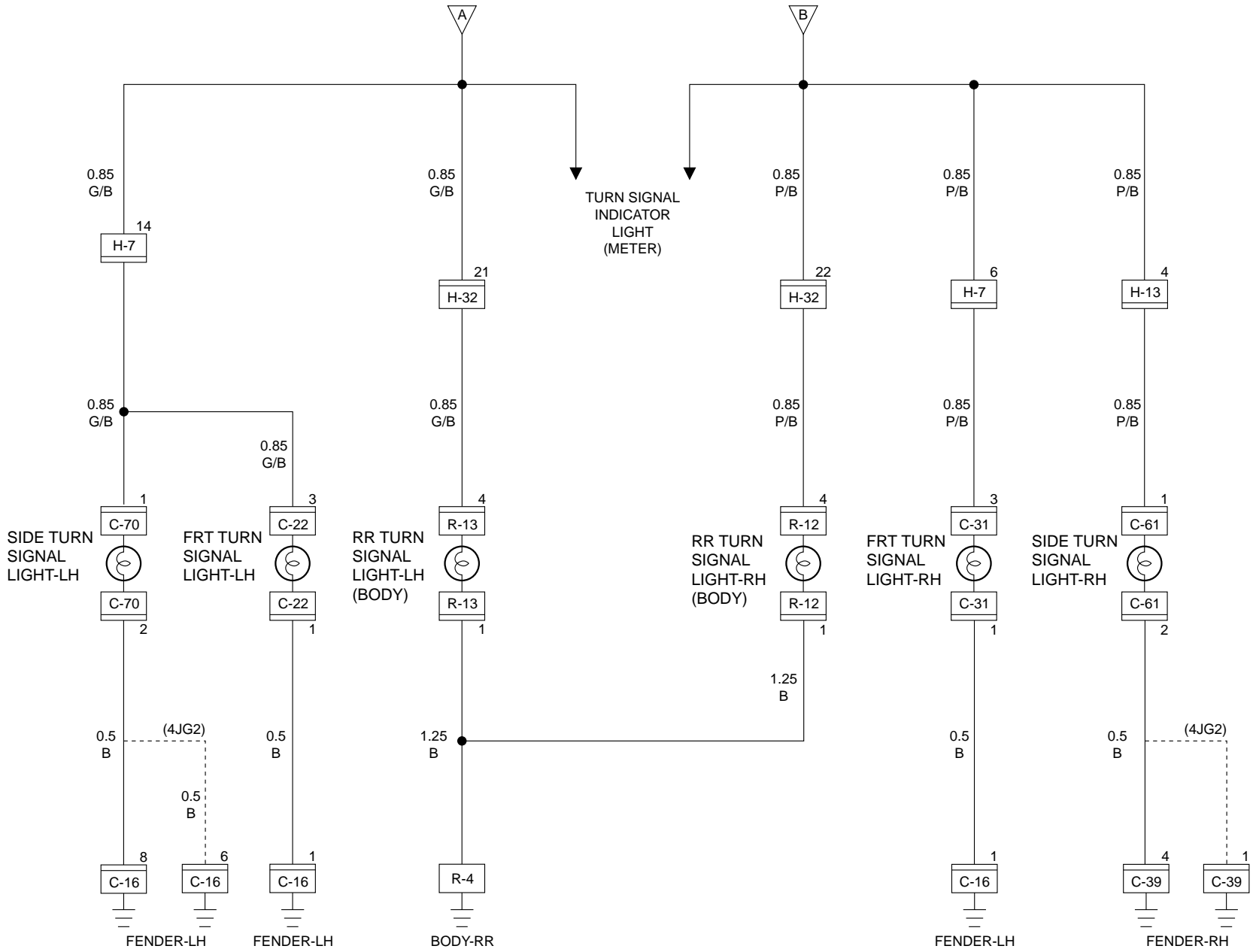
Legend

- | | |
|--|---------------------------------|
| (1) Rear Turn Signal Light-RH (Body) | (15) Side Turn Signal Light-LH |
| (2) R-12 | (16) C-16 |
| (3) F-8 | (17) Front Turn Signal Light-LH |
| (4) Rear Turn Signal Light-RH (Bumper) | (18) C-22 |
| (5) H-44 | (19) B-19 |
| (6) F-7 | (20) C-61 |
| (7) Rear Turn Signal Light-LH (Bumper) | (21) Side Turn Signal Light-RH |
| (8) H-33, H-59 | (22) C-31 |
| (9) Rear Turn Signal Light-LH (Body) | (23) Front Turn Signal Light-RH |
| (10) R-13 | (24) Relay and Fuse |
| (11) R-4 | (25) C-39 |
| (12) H-7 | (26) Fuse Box (Flasher Unit) |
| (13) H-32 | (27) Fuse Box |
| (14) C-70 | (28) H-15, H-16, H-25, H-27 |
| | (29) I-11 |

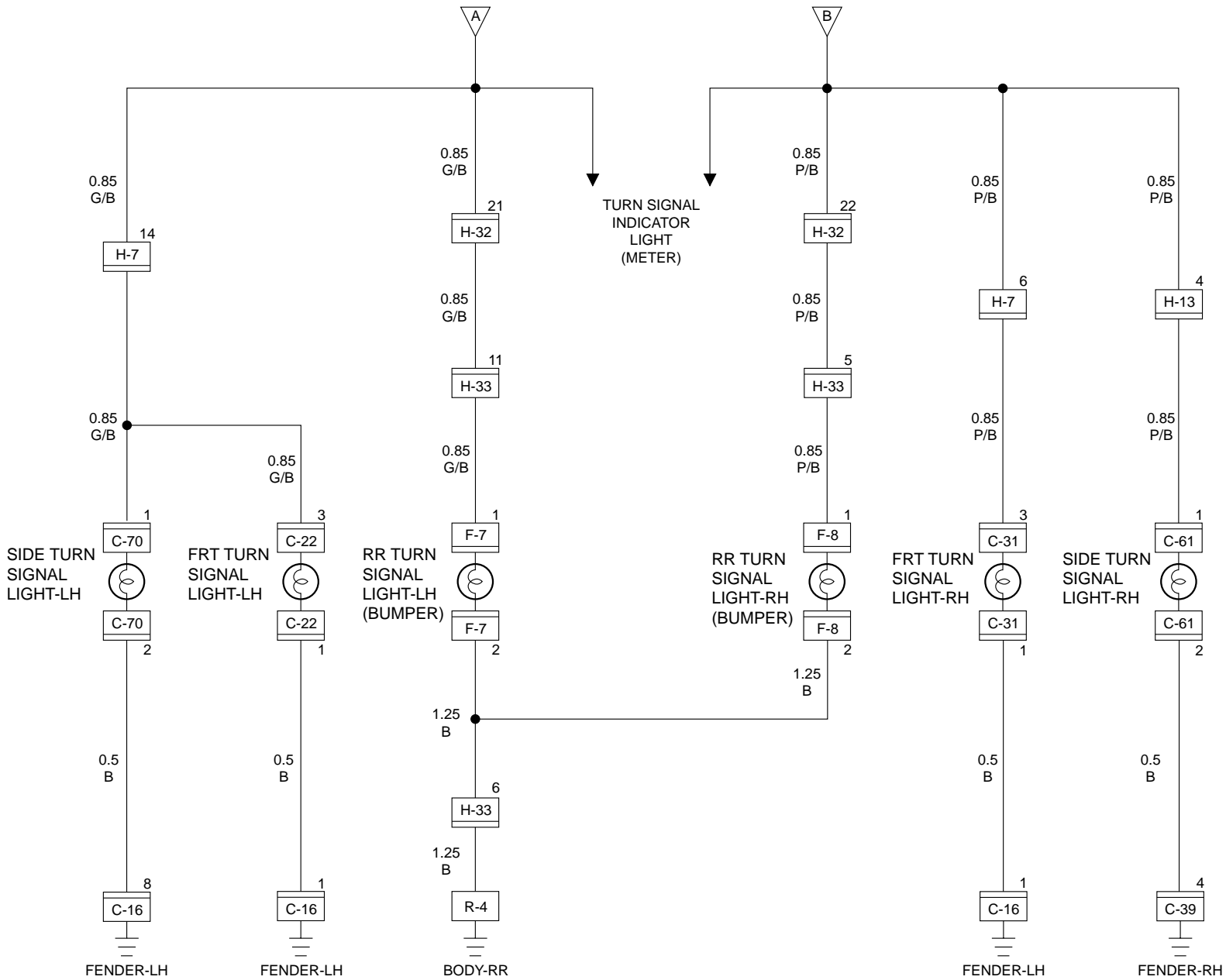
Circuit Diagram (LHD)-1



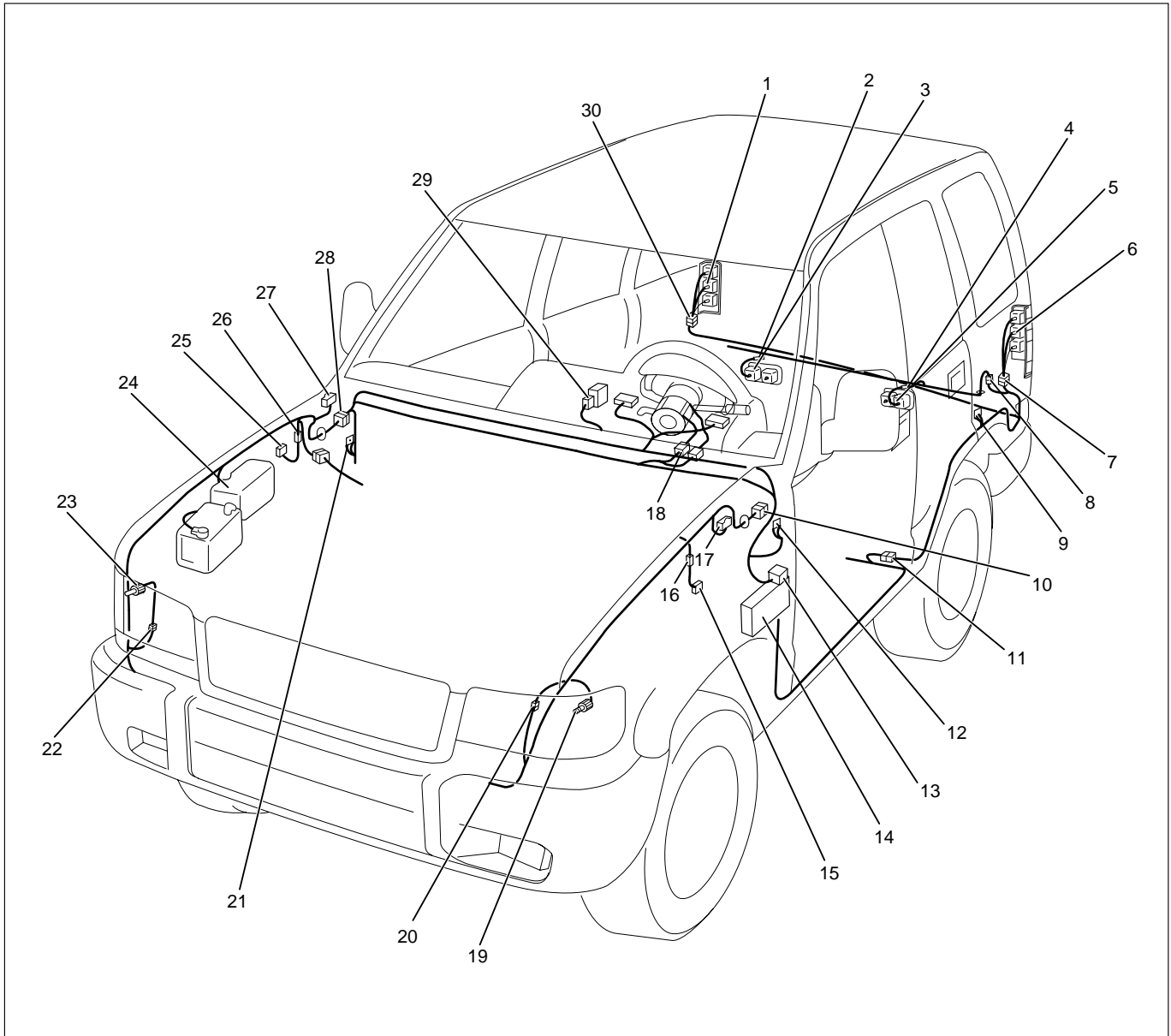
Circuit Diagram (LHD)-2



Circuit Diagram (LHD W/Bumper Built-in Type RR Turn signal Light)-2



Parts Location (LHD)



D08RW873

Legend

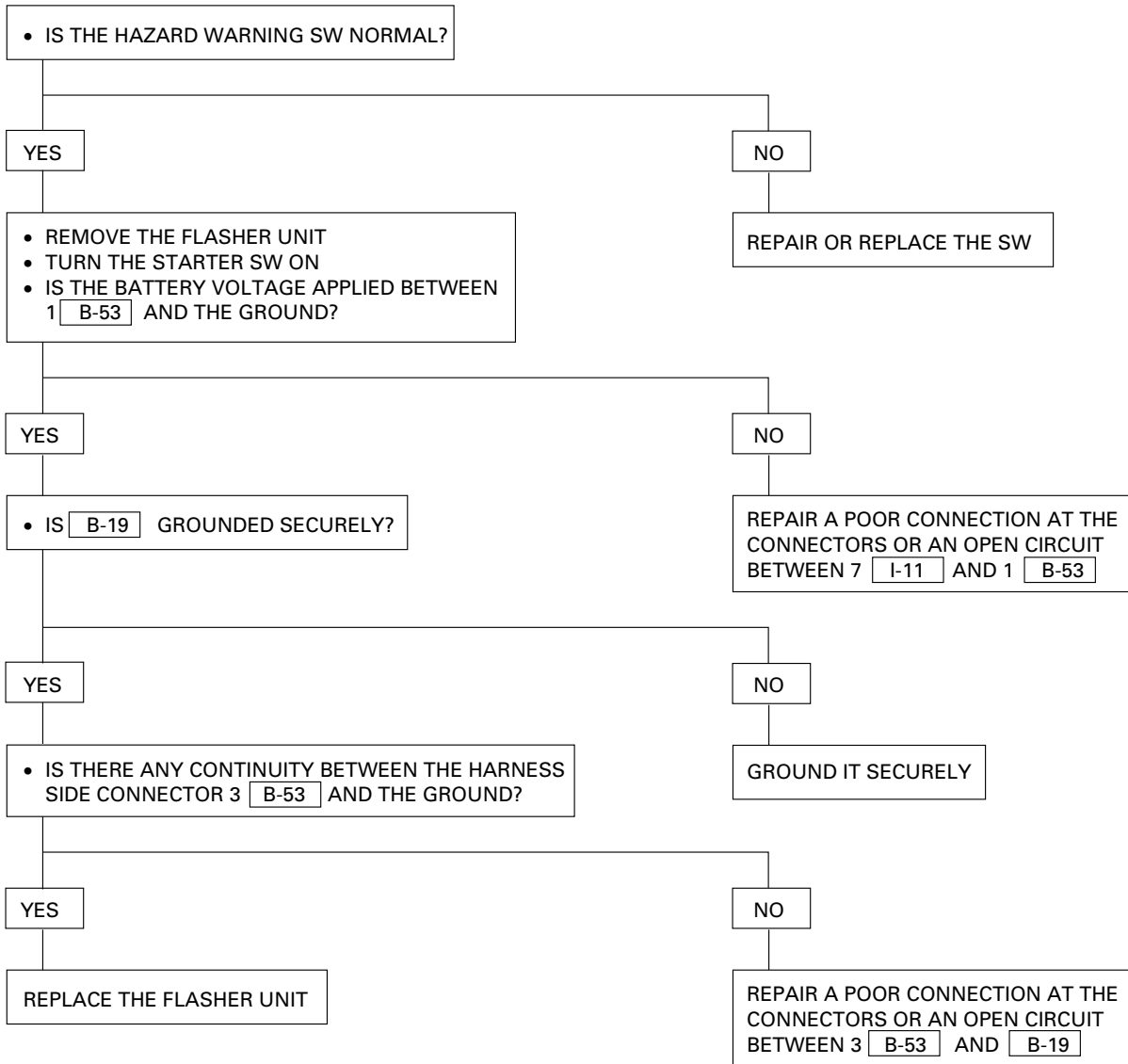
- | | |
|--|-----------------------------------|
| (1) Rear Turn Signal Light–RH (Body) | (16) C–70 |
| (2) F–8 | (17) C–16 |
| (3) Rear Turn Signal Light–RH (Bumper) | (18) B–12 |
| (4) F–7 | (19) Front Turn Signal Light–LH |
| (5) Rear Turn Signal Light–LH (Bumper) | (20) C–22 |
| (6) Rear Turn Signal Light–LH (Body) | (21) B–2 |
| (7) R–13 | (22) C–31 |
| (8) H–33 | (23) Front Turn Signal Light–RH |
| (9) R–4 | (24) Relay and Fuse Box |
| (10) H–7, H–25 | (25) Side Turn Signal Light–RH |
| (11) H–32 | (26) C–61 |
| (12) B–19 | (27) C–39 |
| (13) B–53 | (28) H–12, H–13, H–16, H–20 |
| (14) Fuse Box | (29) I–11 (Hazard Warning Switch) |
| (15) Side Turn Signal Light–LH | (30) R–12 |

Diagnosis

Quick Chart for Check Points

Check point Trouble mode	Fuse		Turn signal SW	Hazard SW	Flasher unit	Turn signal bulb	Cable harness
	C-3 (10A)	F-3 (15A)					
1 Both turn signal lights and hazard warning lights inoperative				<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
2 Turn signal light flashes too quickly						<input type="radio"/>	
3 Hazard warning lights inoperative		<input type="radio"/>		<input type="radio"/>			<input type="radio"/>
4 Turn signal lights inoperative	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
5 Turn signal lights on the right (or left) side inoperative			<input type="radio"/>				<input type="radio"/>
6 Hazard warning lights on the right (or left) side inoperative				<input type="radio"/>			<input type="radio"/>
7 Turn signal lights and hazard warning lights on the right (or left) side inoperative							<input type="radio"/>

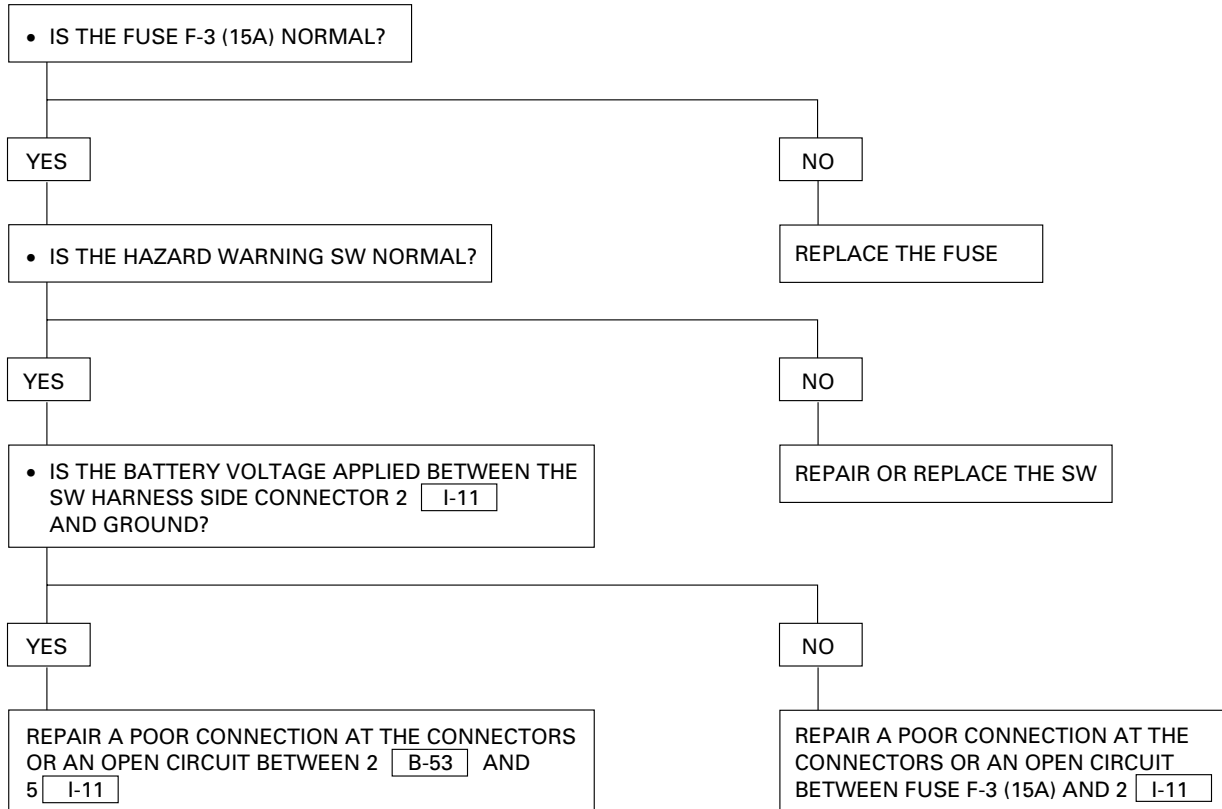
1 Both Turn Signal Lights and Hazard Warning Lights Inoperative



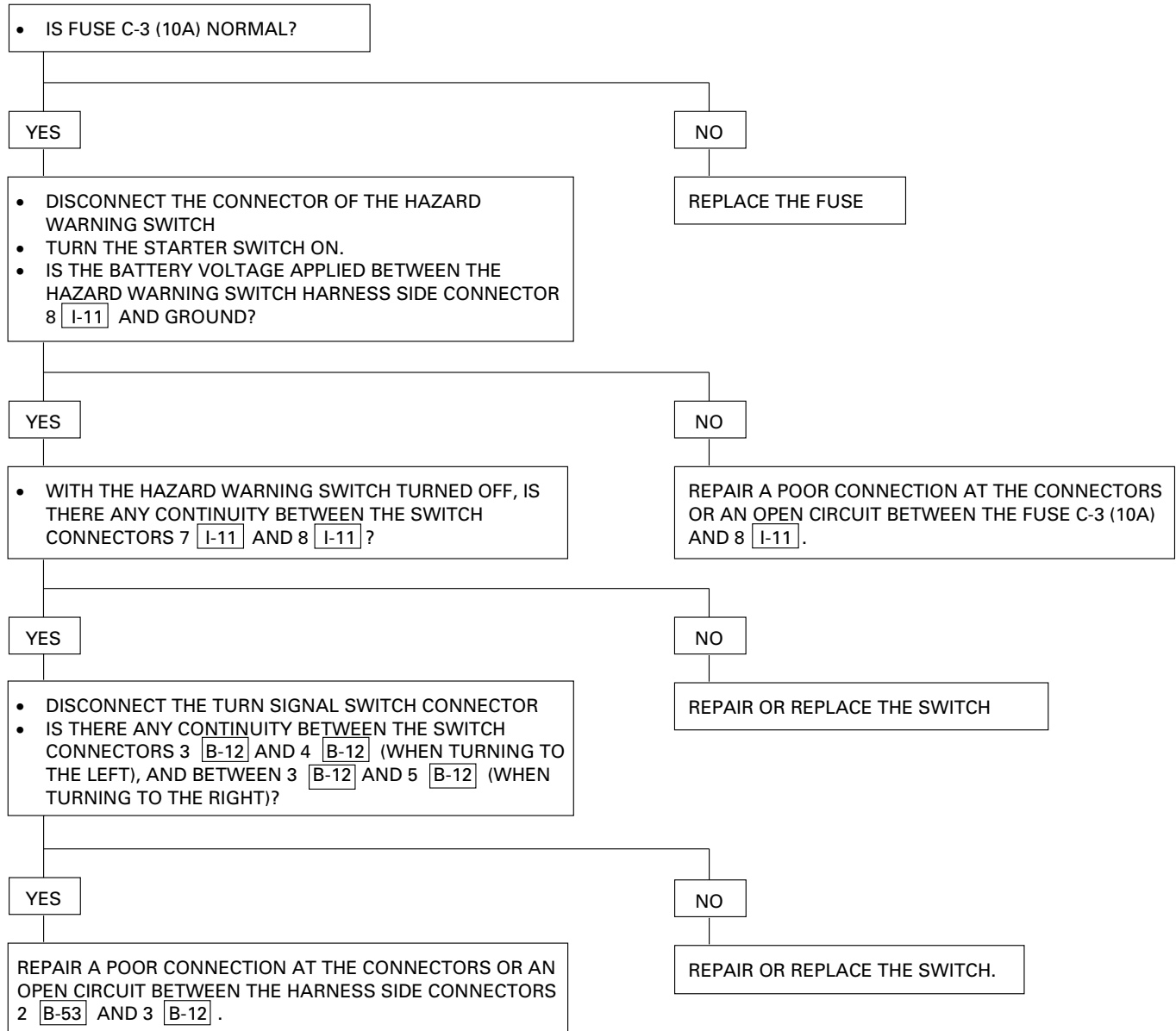
2 Turn Signal Light Flashes Too Quickly

REINSTALL OR REPLACE THE BULB, REPAIR AN OPEN CIRCUIT IN THE CIRCUIT, OR CHECK THE GROUND CONNECTION

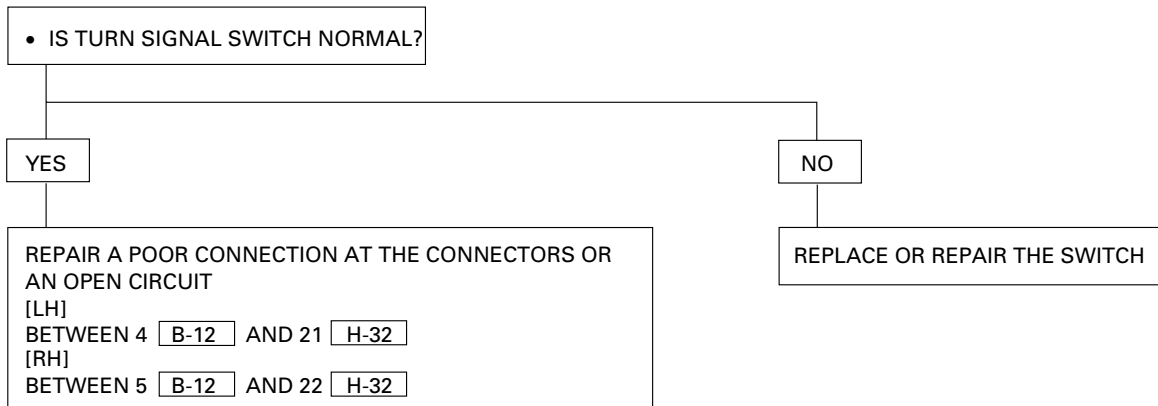
3 Hazard Warning Lights Inoperative



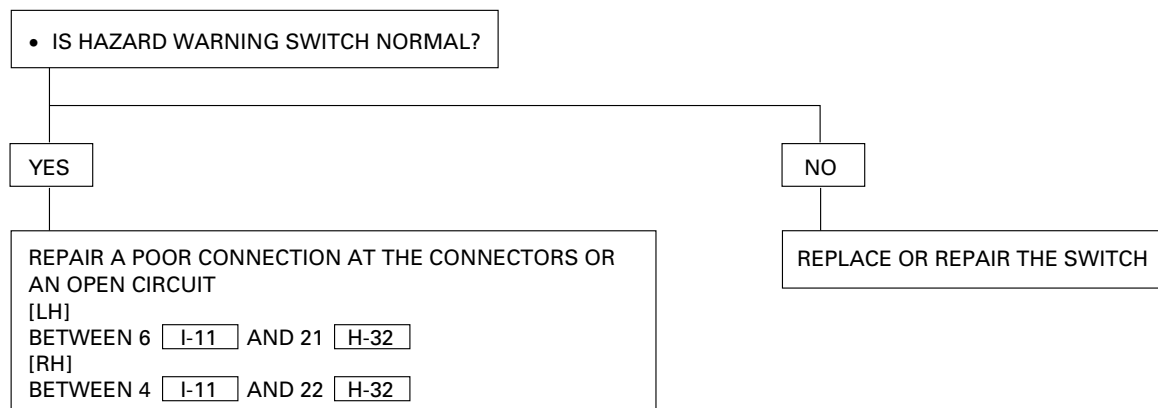
4 Turn Signal Lights Inoperative



5 Turn Signal Lights On The Right (Or Left) Side Inoperative



6 Hazard Warning Lights On The Right (Or Left) Side Inoperative



7 Turn Signal Lights and Hazard Warning Lights On The Right (Or Left) Side Inoperative

REPAIR A POOR CONNECTION AT THE CONNECTORS OR
AN OPEN CIRCUIT

[LH]

BETWEEN 4 B-12 AND 21 H-32

[RH]

BETWEEN 5 B-12 AND 22 H-32

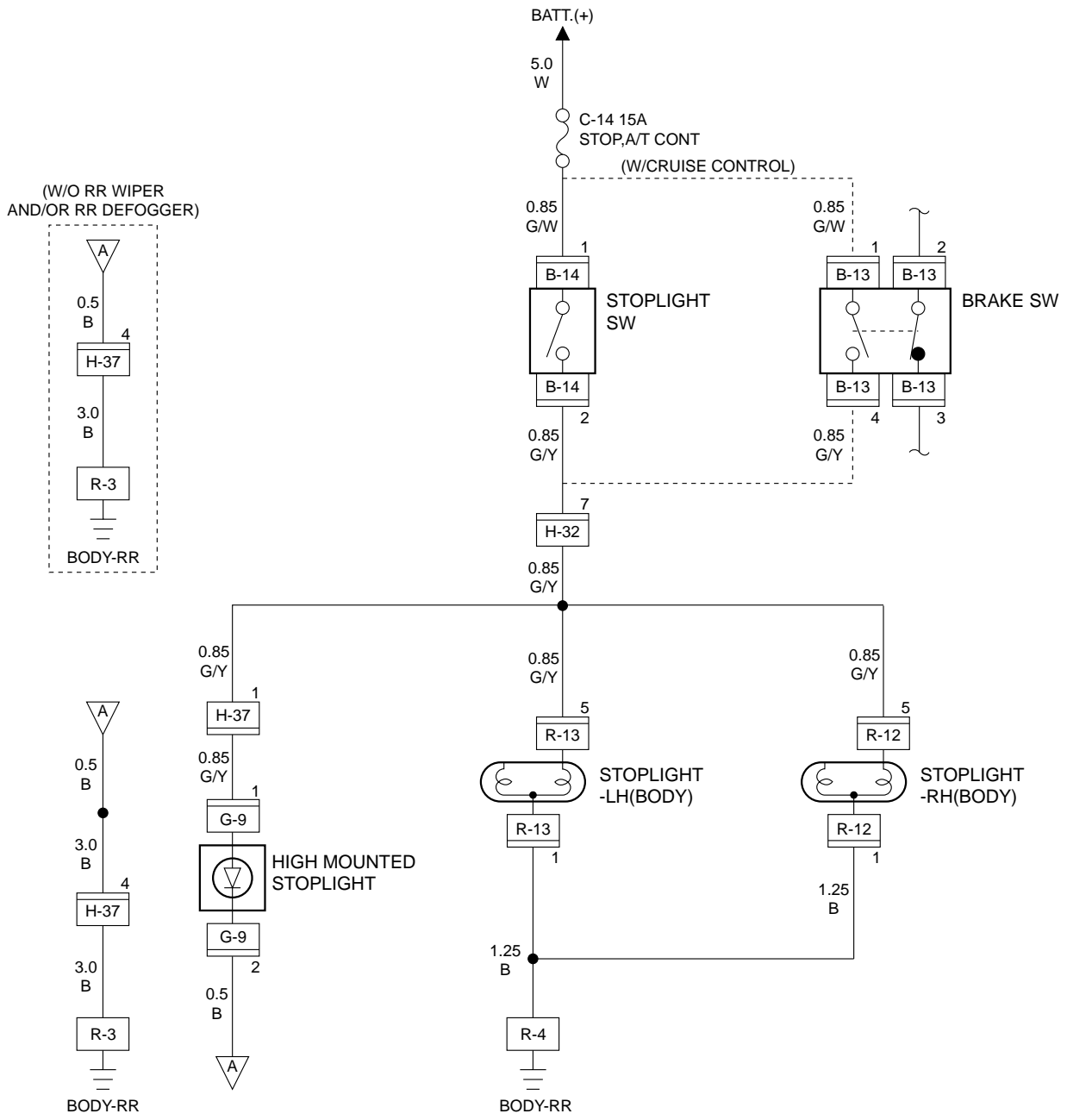
Stoplight

General Description

The circuit consists of the stoplight, stoplight switch (vehicles w/o cruise control), brake switch (vehicles w/ cruise control).

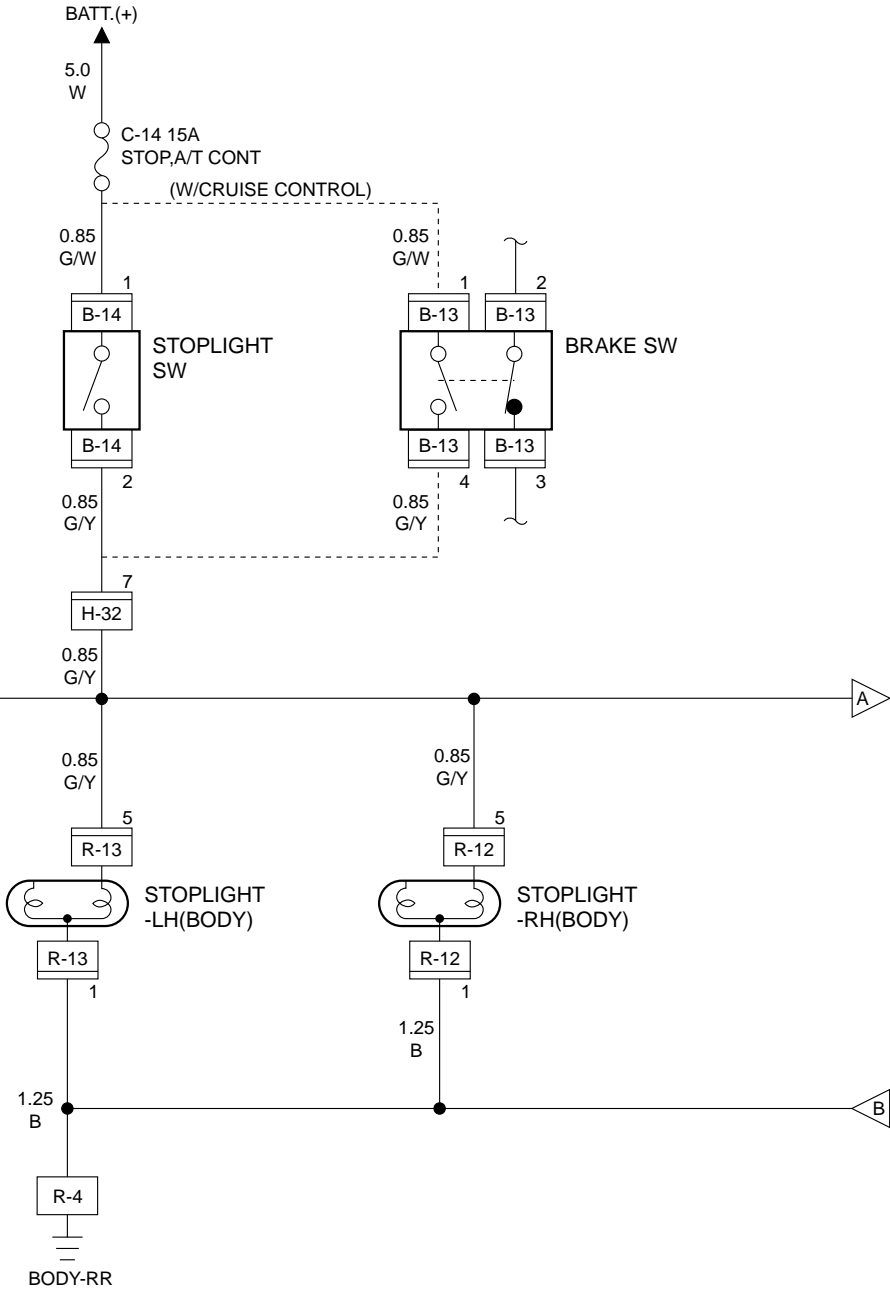
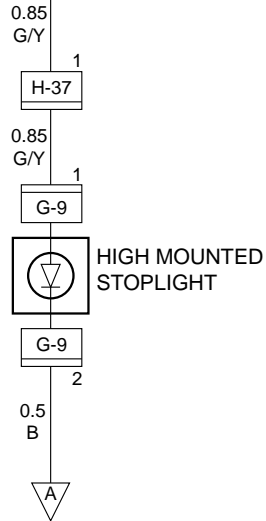
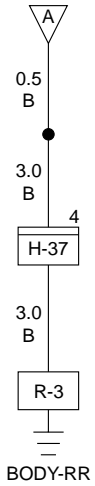
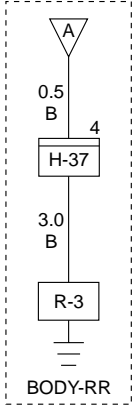
With the brake pedal depressed, the stoplight switch or the brake switch is turned on to illuminate the stoplight. The brake switch controls not only the operation of the stoplight but also the input of the cruise cancel signals to the cruise control unit.

Circuit Diagram (RHD)

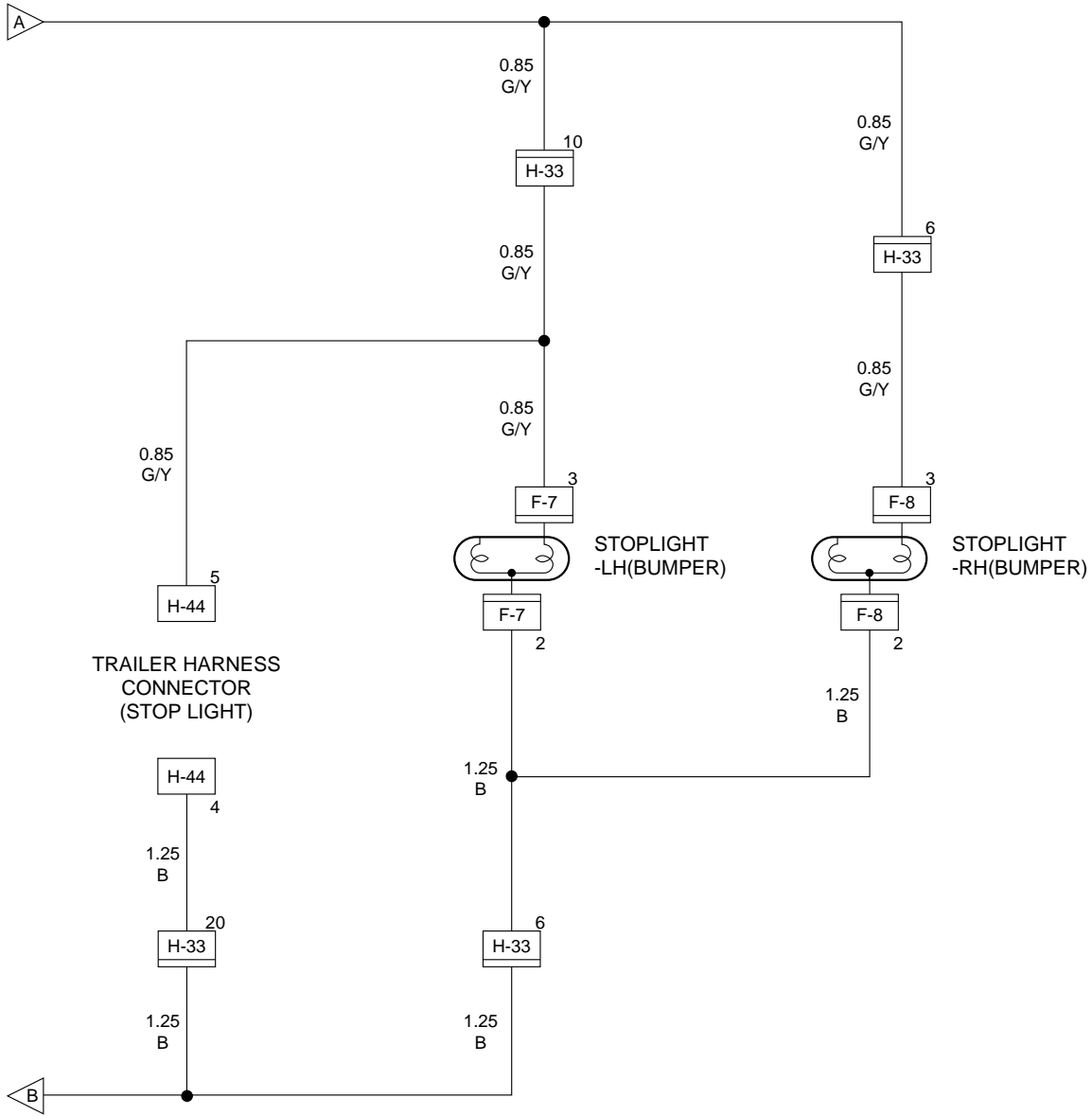


Circuit Diagram (RHD)-1

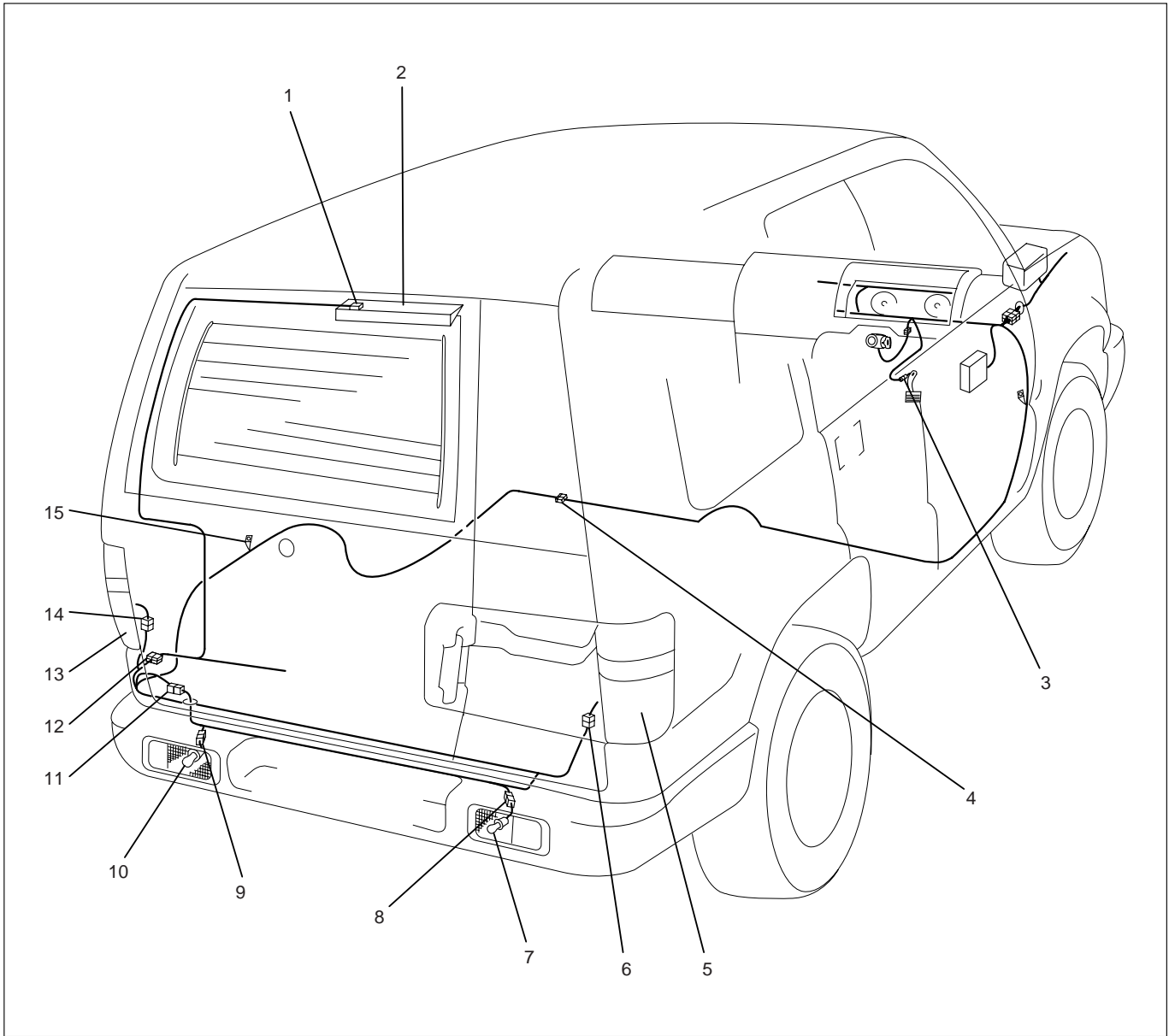
(W/O RR WIPER
AND/OR RR DEFOGGER)



Circuit Diagram (RHD)-2



Parts Location (RHD)

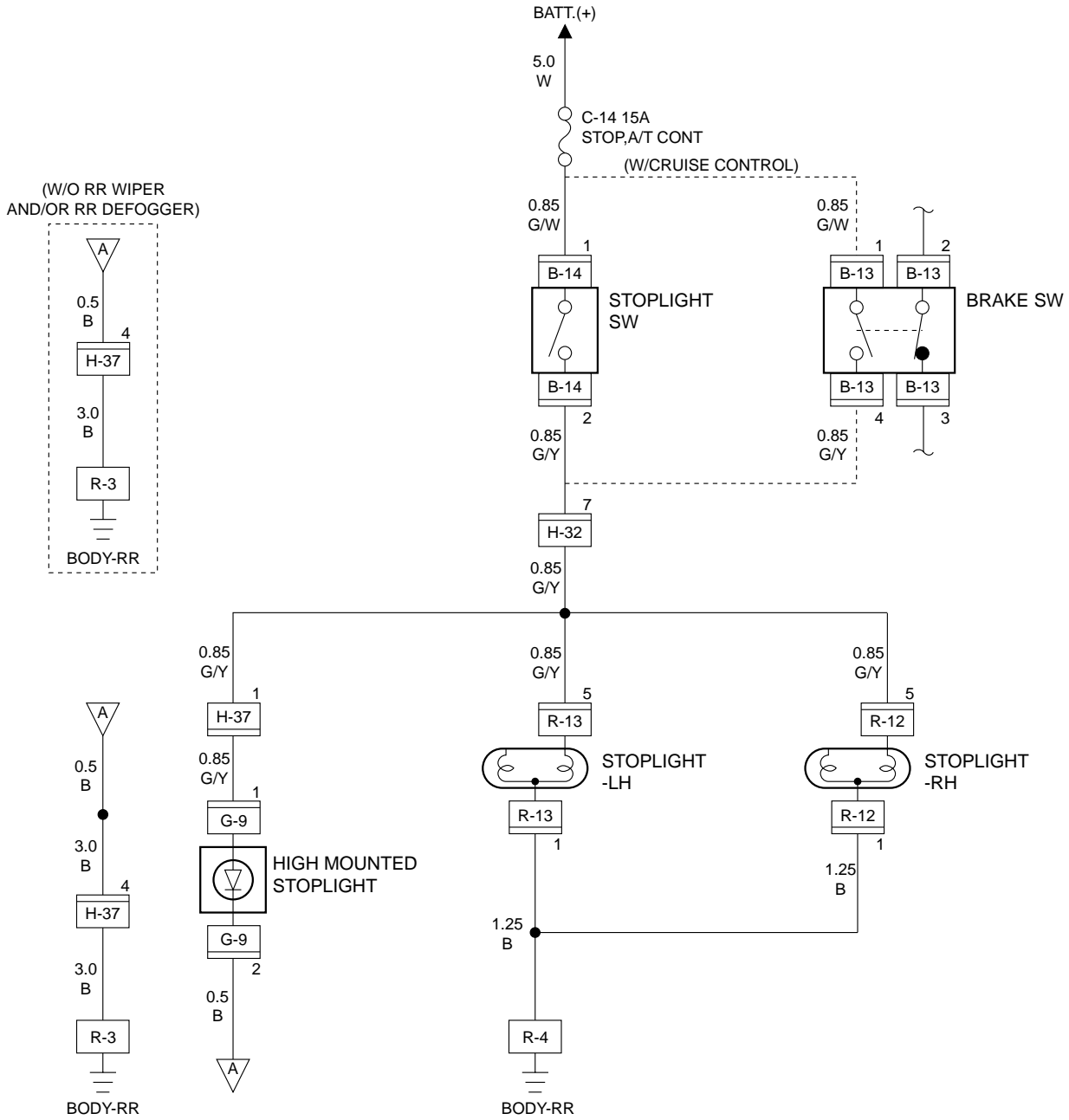


D08RW877

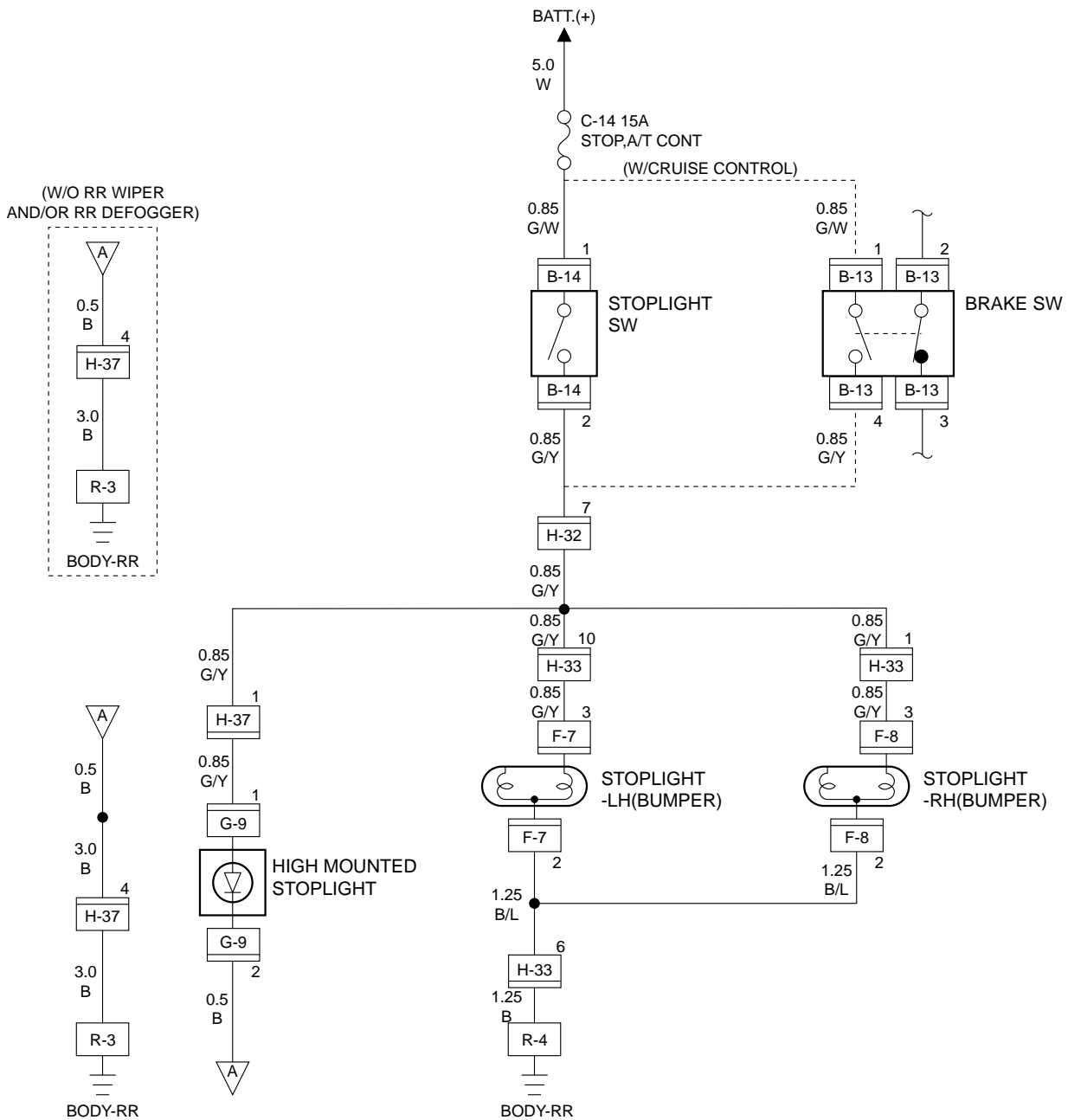
Legend

- | | |
|----------------------------|----------------------------|
| (1) G-9 | (8) F-8 |
| (2) High Mounted Stoplight | (9) F-7 |
| (3) B-13 or B-14 | (10) Stoplight-LH (Bumper) |
| (4) H-32 | (11) H-33 |
| (5) Stoplight-RH (Body) | (12) H-37 |
| (6) R-12 | (13) Stoplight-LH (Body) |
| (7) Stoplight-RH (Bumper) | (14) R-13 |
| | (15) R-3, R-4 |

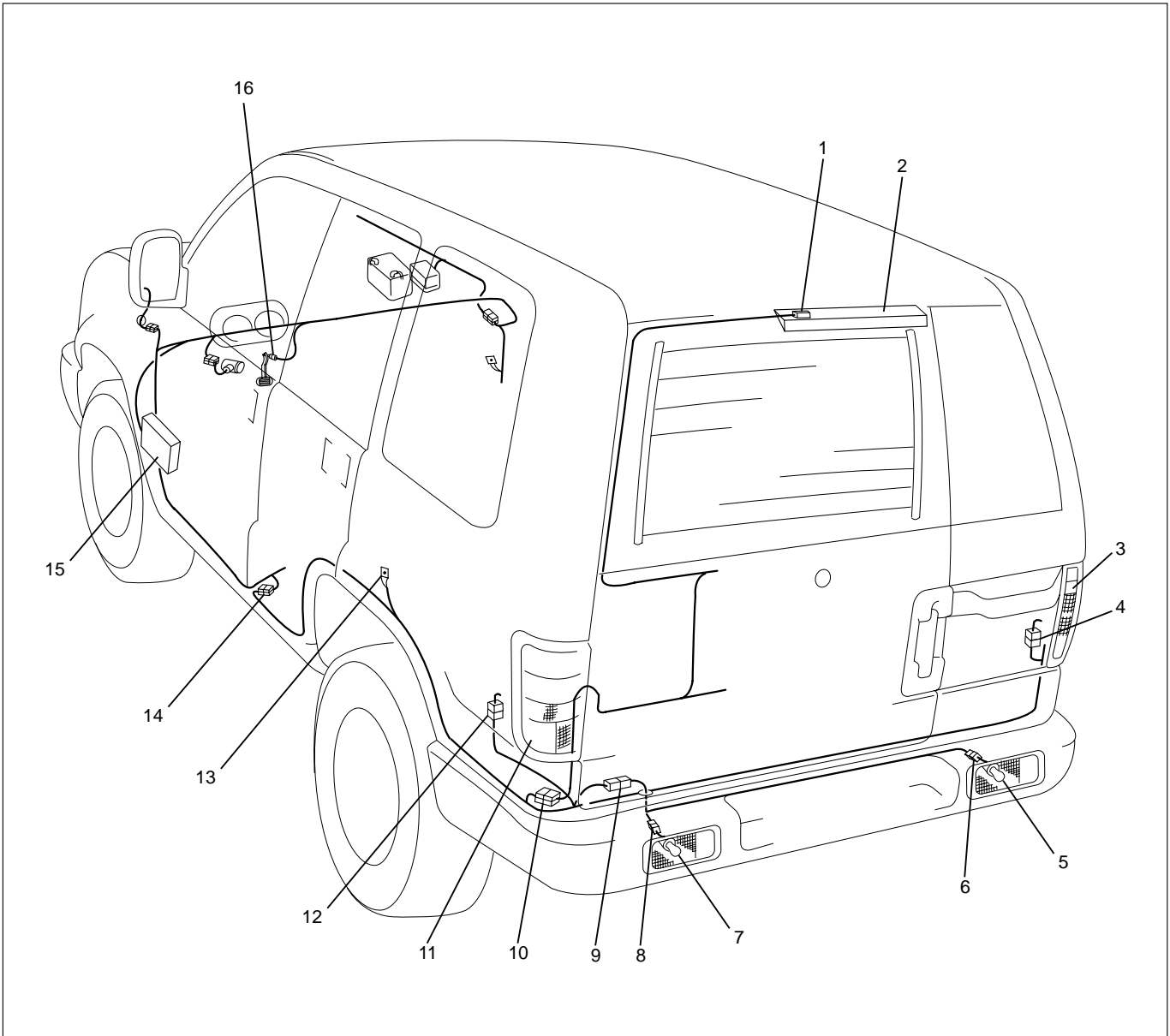
Circuit Diagram (LHD)



Circuit Diagram (LHD W/Bumper Built-in Type Stoplight)



Parts Location (LHD)



D08RW940

Legend

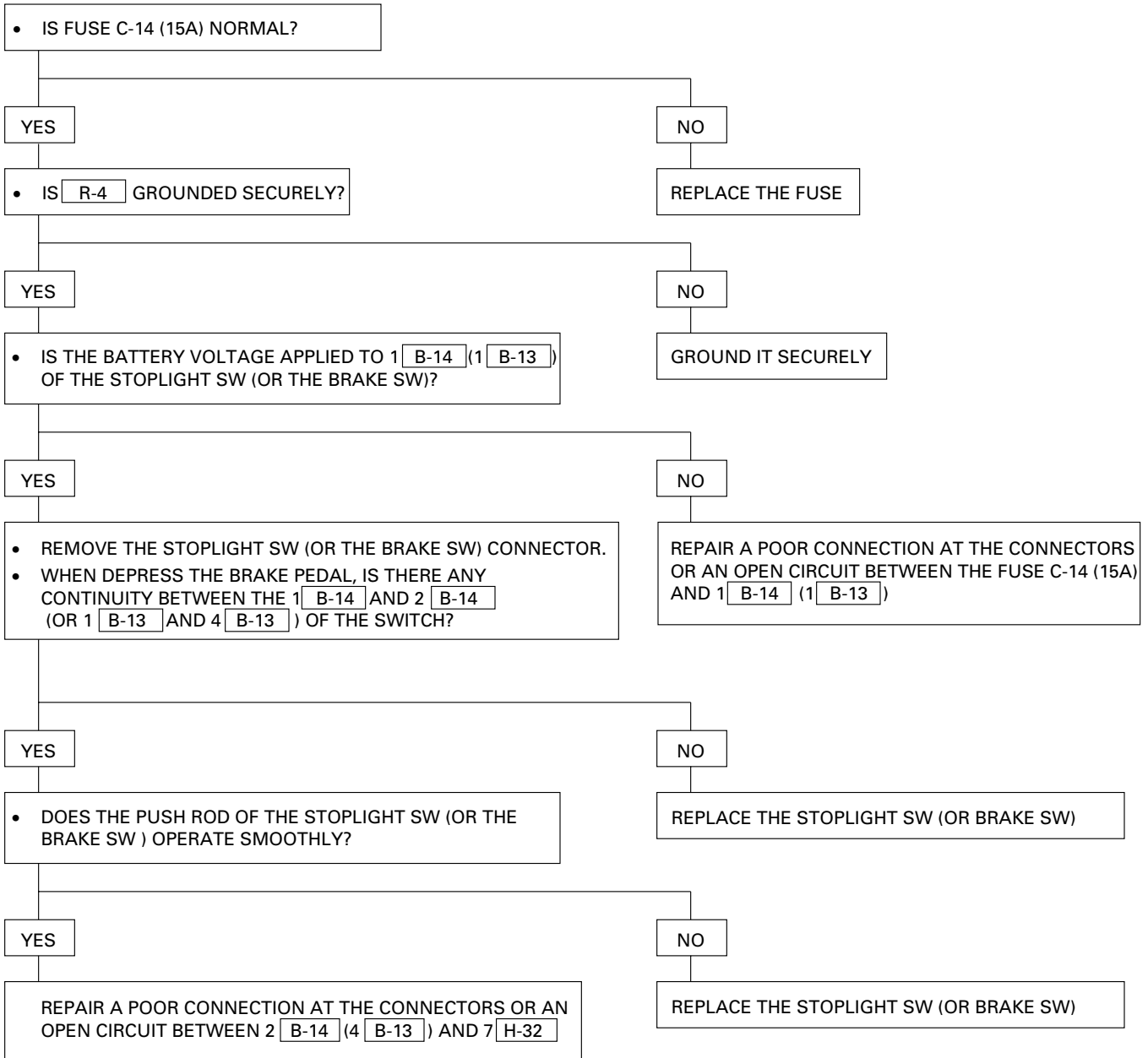
- | | |
|----------------------------|--------------------------|
| (1) G-9 | (9) H-33 |
| (2) High Mounted Stoplight | (10) H-37 |
| (3) Stoplight-RH (Body) | (11) Stoplight-LH (Body) |
| (4) R-12 | (12) R-13 |
| (5) Stoplight-RH (Bumper) | (13) R-3, R-4 |
| (6) F-8 | (14) H-32 |
| (7) Stoplight-LH (Bumper) | (15) Fuse Box |
| (8) F-7 | (16) B-13 or B-14 |

DIAGNOSIS

Quick Chart for Check Points

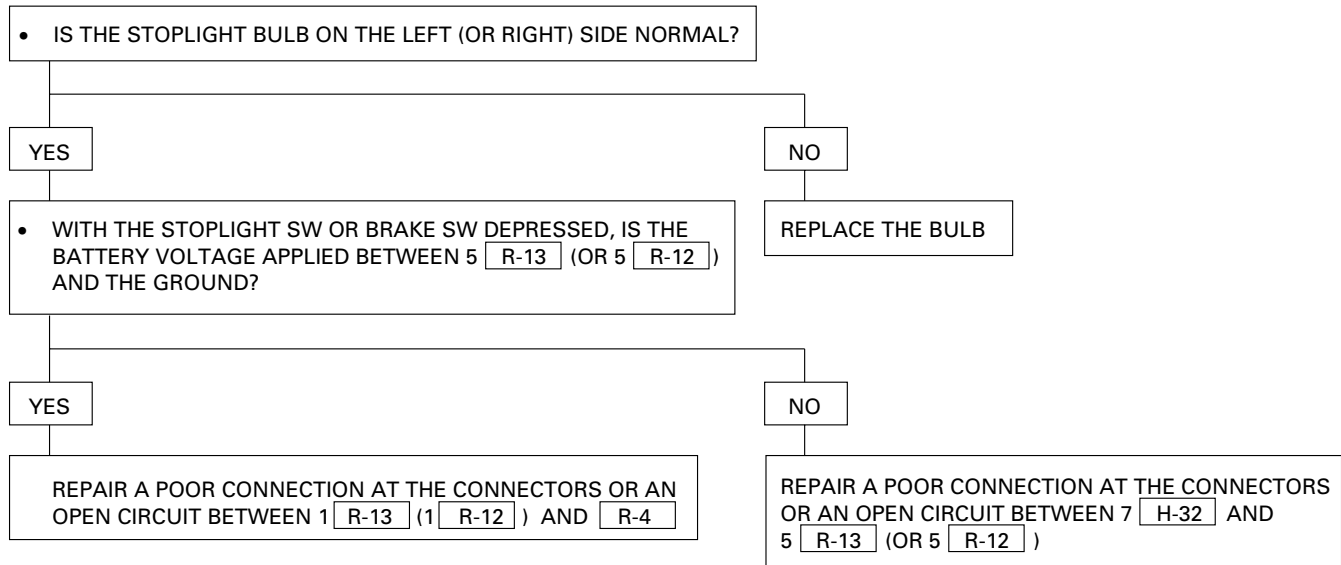
Trouble mode	Check point	Fuse C-14 (15A)	Stoplight SW or brake SW	Stoplight bulb	High mount stoplight ASM	Cable harness
1 Both stoplights inoperative		○	○			○
2 Stoplight on the left (or right) side inoperative				○		○
3 High mounted stoplight inoperative					○	○

1 Both Stoplights Inoperative

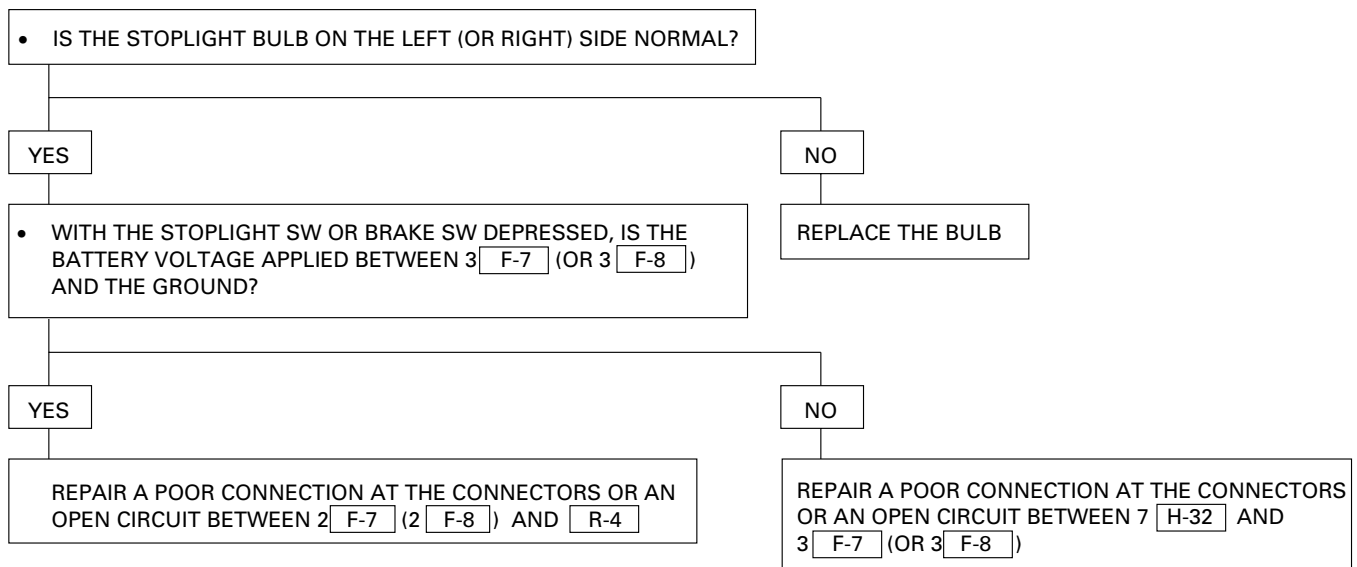


2 Stoplight On The Left (Or Right) Side Inoperative

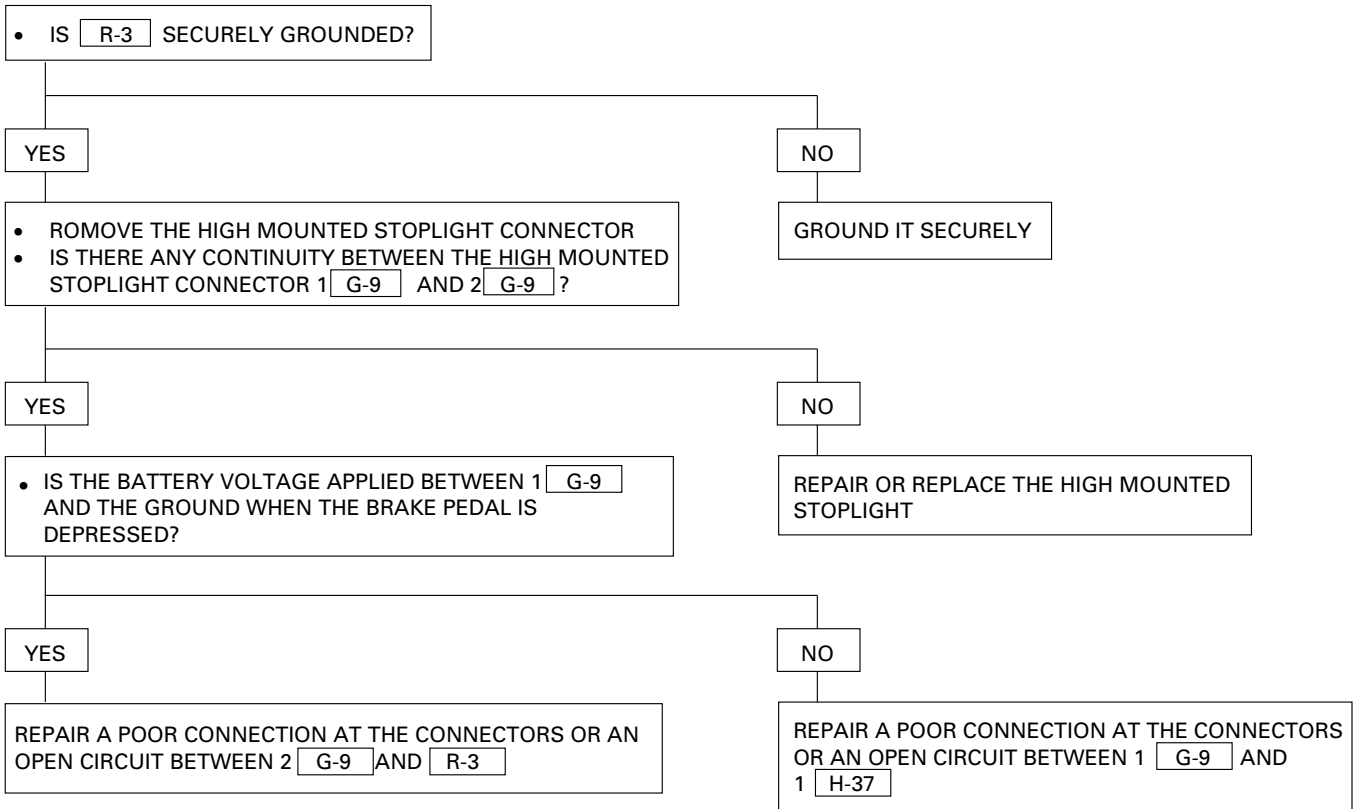
(Body Build-in Type Stoplight)



(Bumper Build-in Type Stoplight)



3 High Mounted Stoplight Inoperative



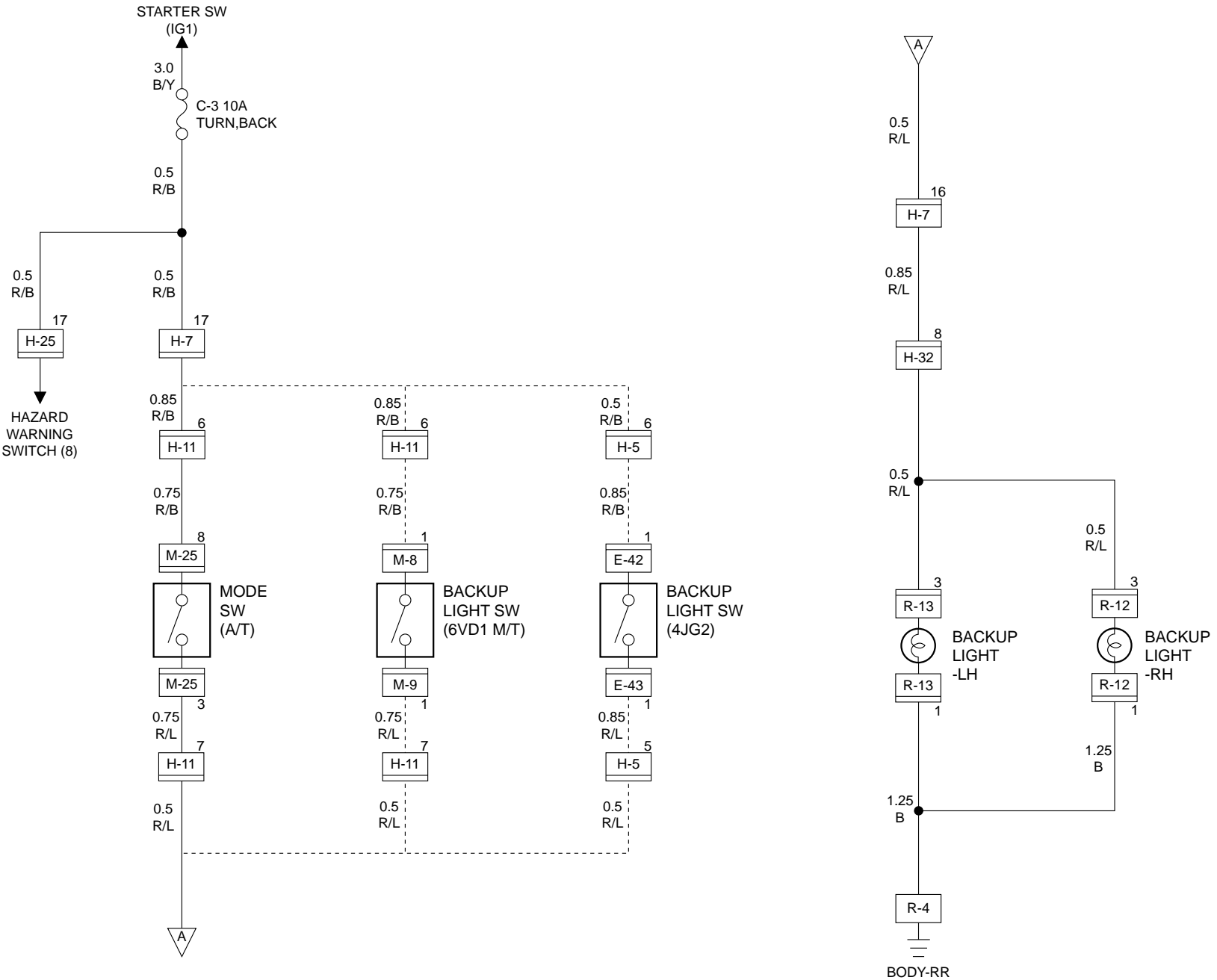
Backup Light

General Description

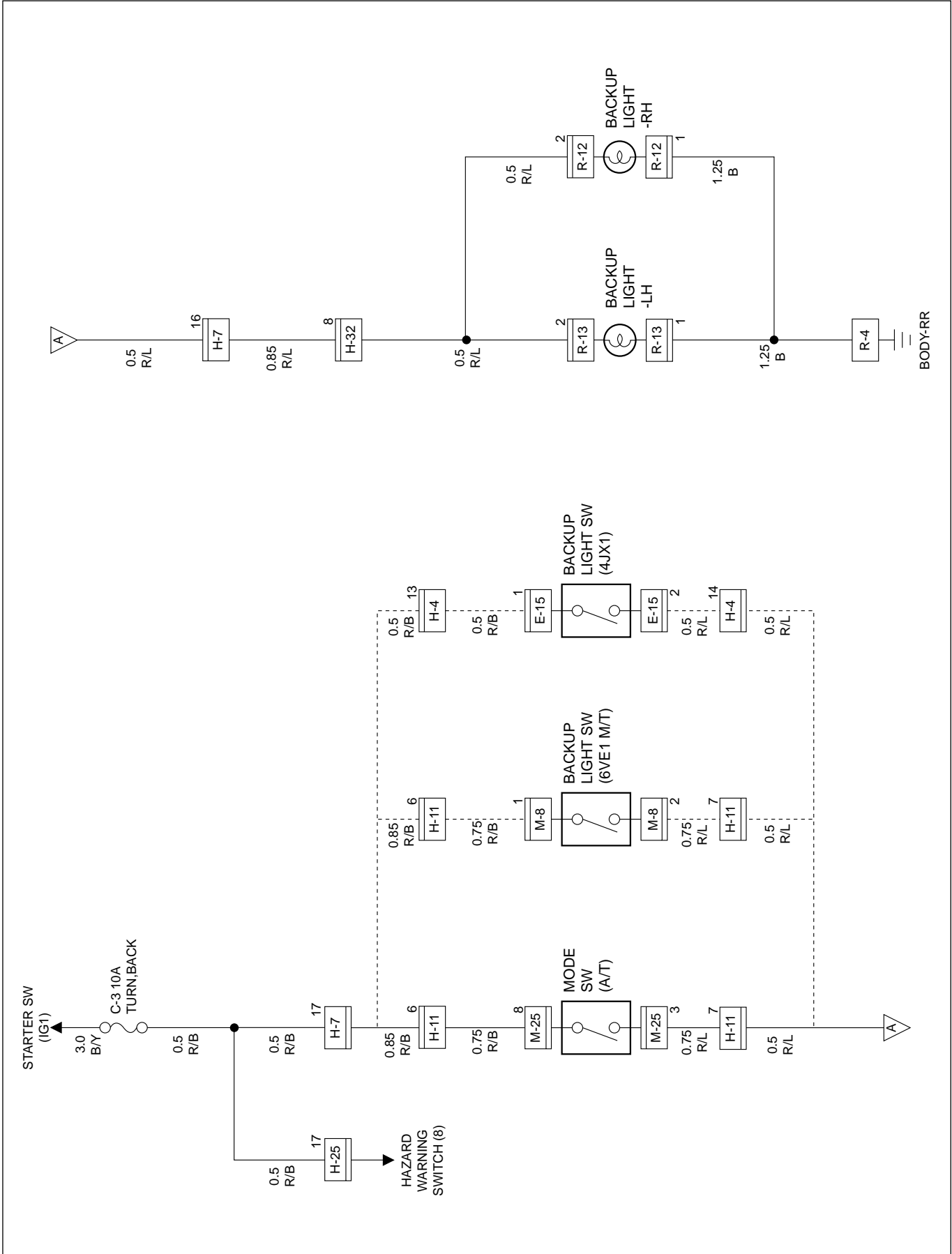
The circuit consists of backup light switch (M/T), mode switch (A/T) and backup light.

When shift lever is set to "R" position, backup light switch (M/T) or mode switch (A/T) is activated to illuminate backup light.

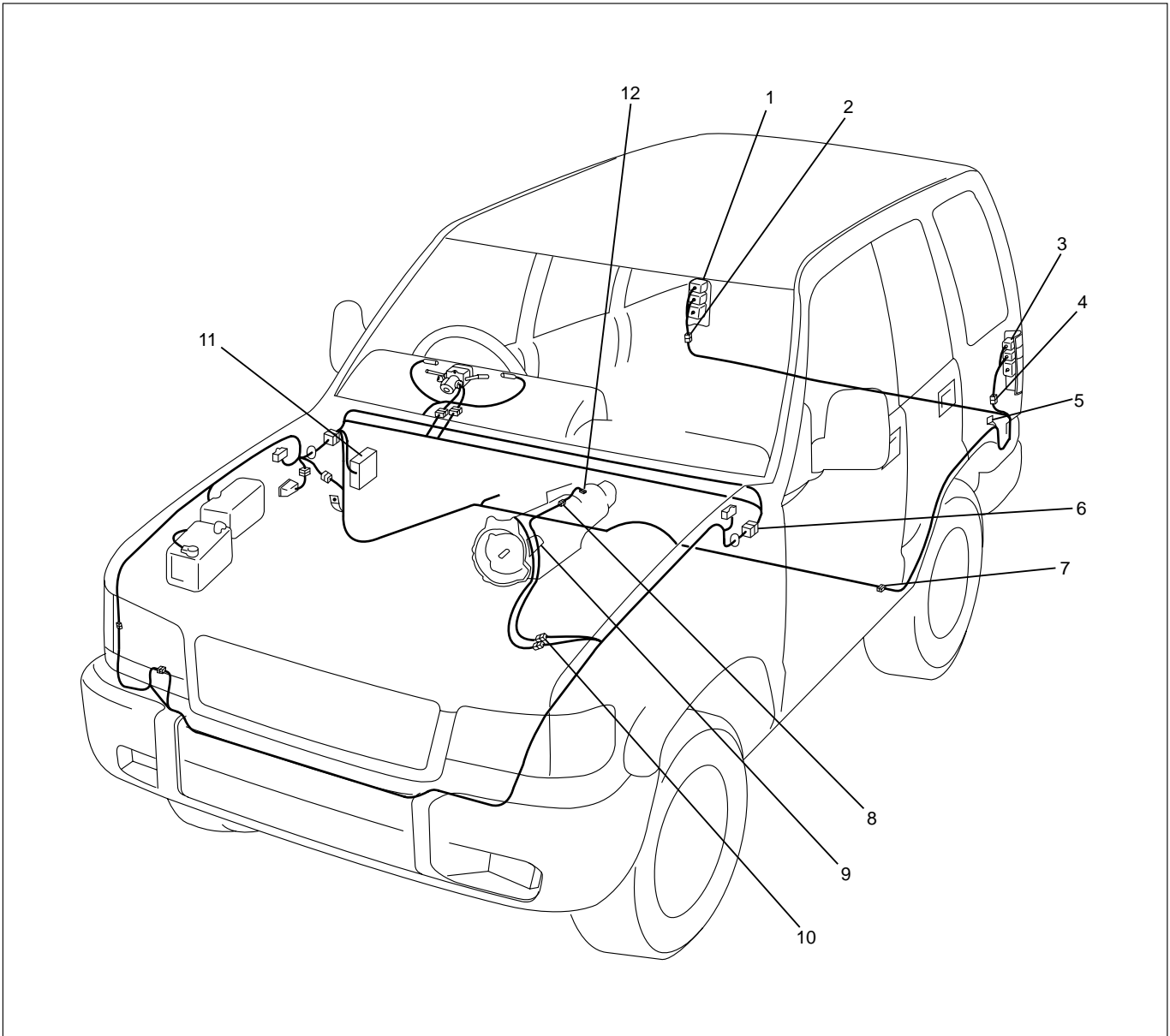
Circuit Diagram (RHD)



Circuit Diagram (RHD W/Bumper Built-in Type RR Combination Light)



Parts Location (RHD)

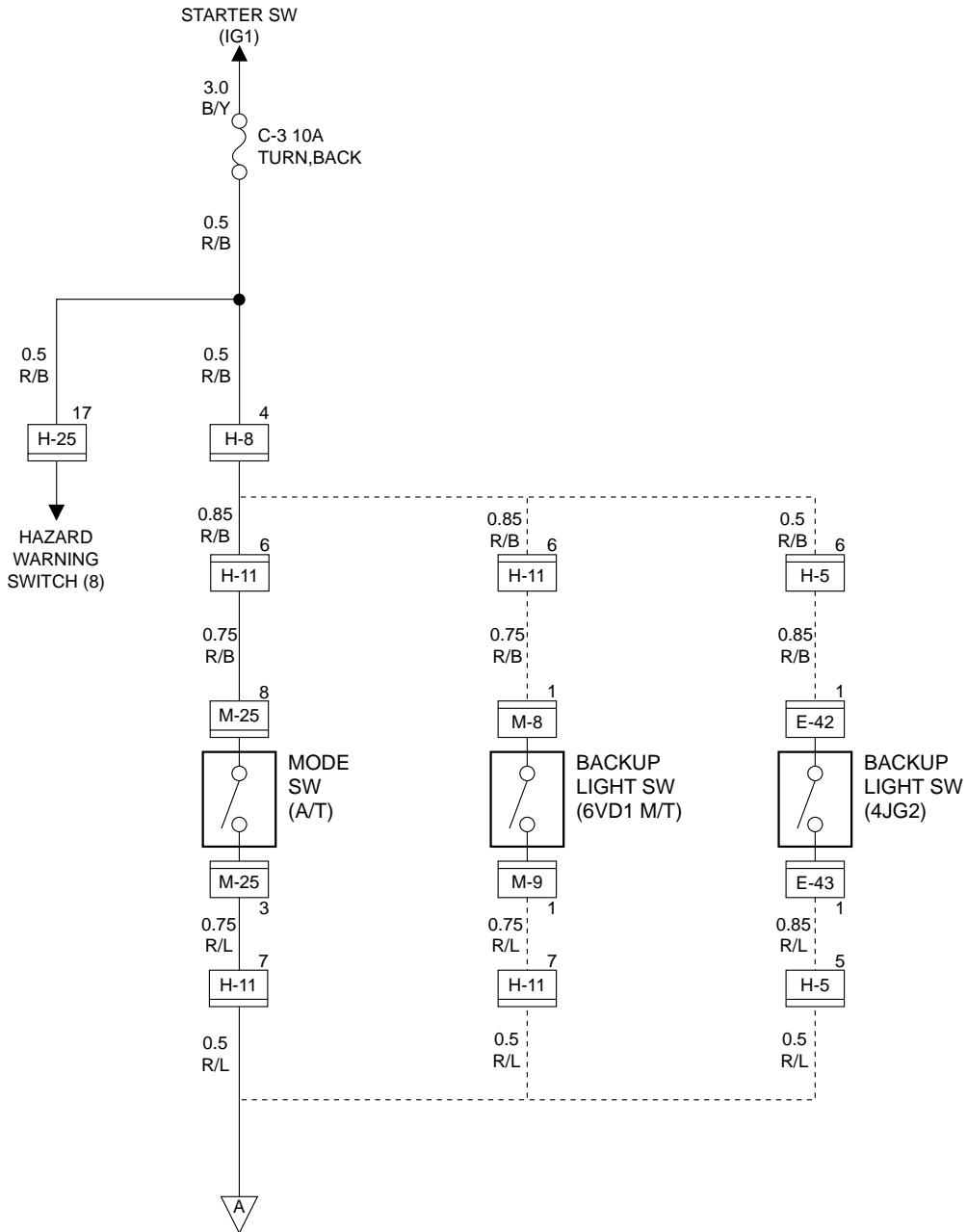
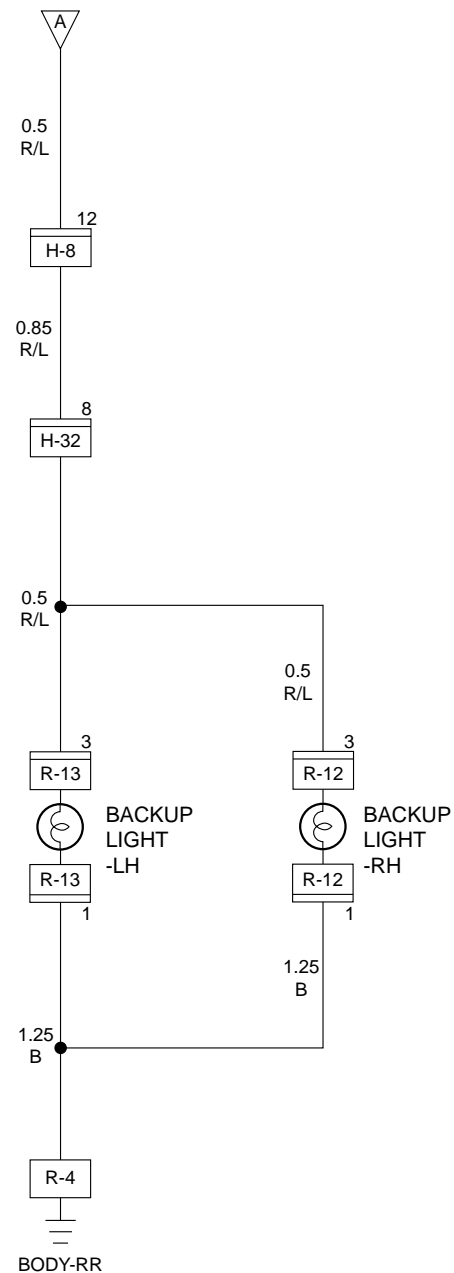


D08RW881

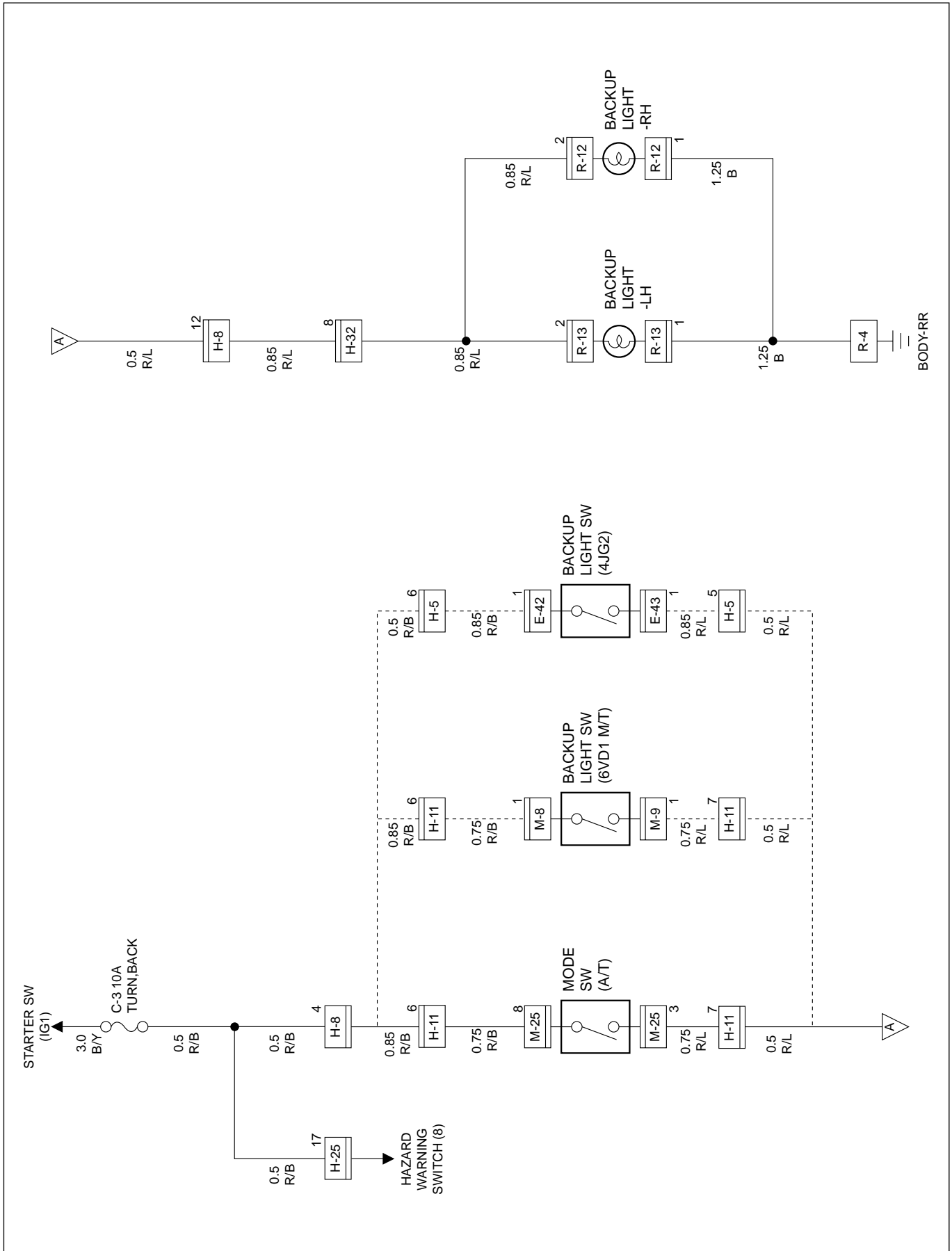
Legend

- | | |
|---------------------|---------------------------------------|
| (1) Backup Light-RH | (7) H-32 |
| (2) R-12 | (8) M-8 (6V*1 M/T), E-42, E-43 (4JG2) |
| (3) Backup Light-LH | (9) Mode Switch (A/T), M-25 |
| (4) R-13 | (10) H-4, H-5 |
| (5) R-4 | (11) Fuse Box |
| (6) H-7, H-25 | (12) Backup Light Switch (M/T) |

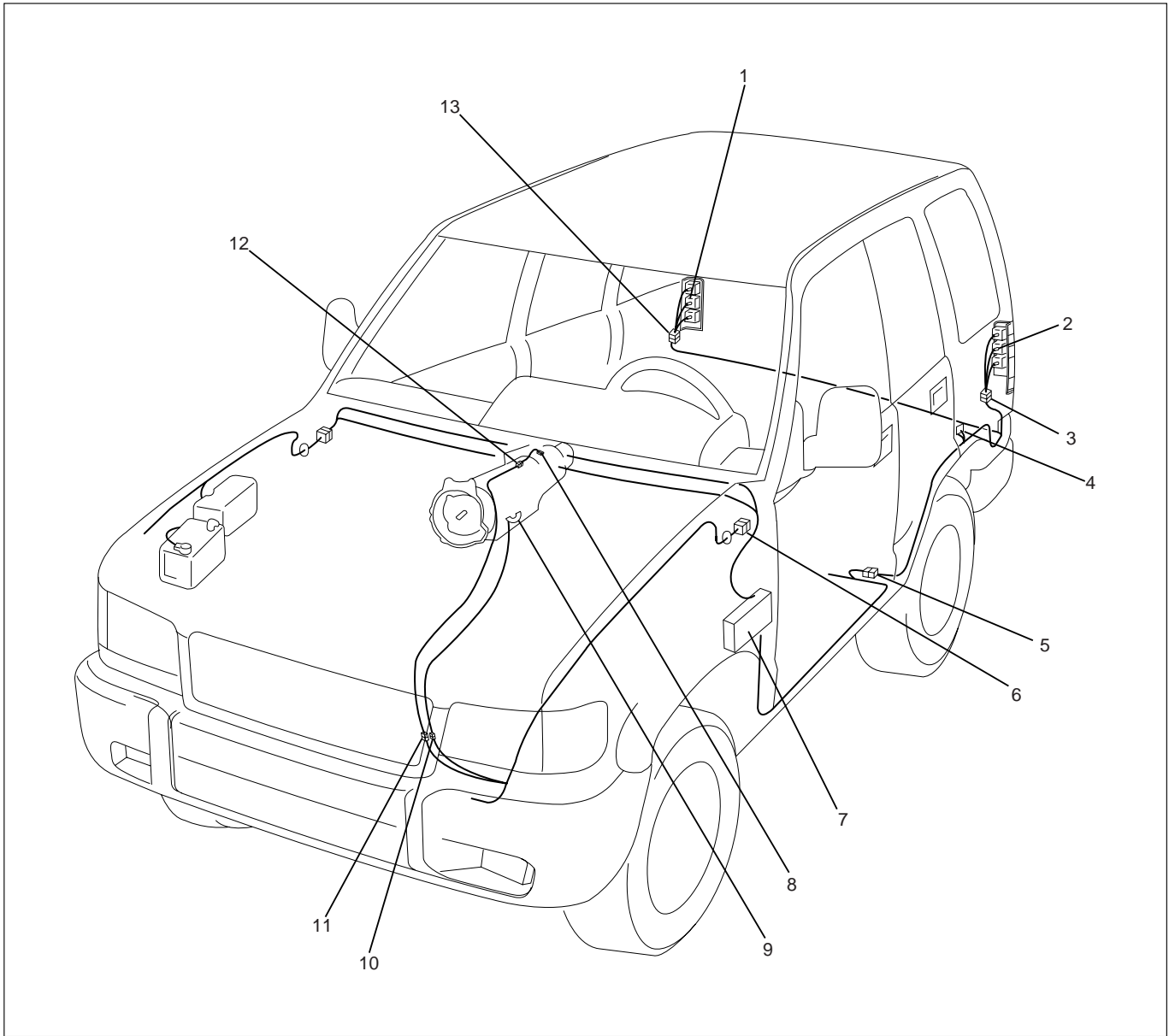
Circuit Diagram (LHD)



Circuit Diagram (LHD W/Bumper Built-in Type RR Combination Light)



Parts Location (LHD)



D08RW371

Legend

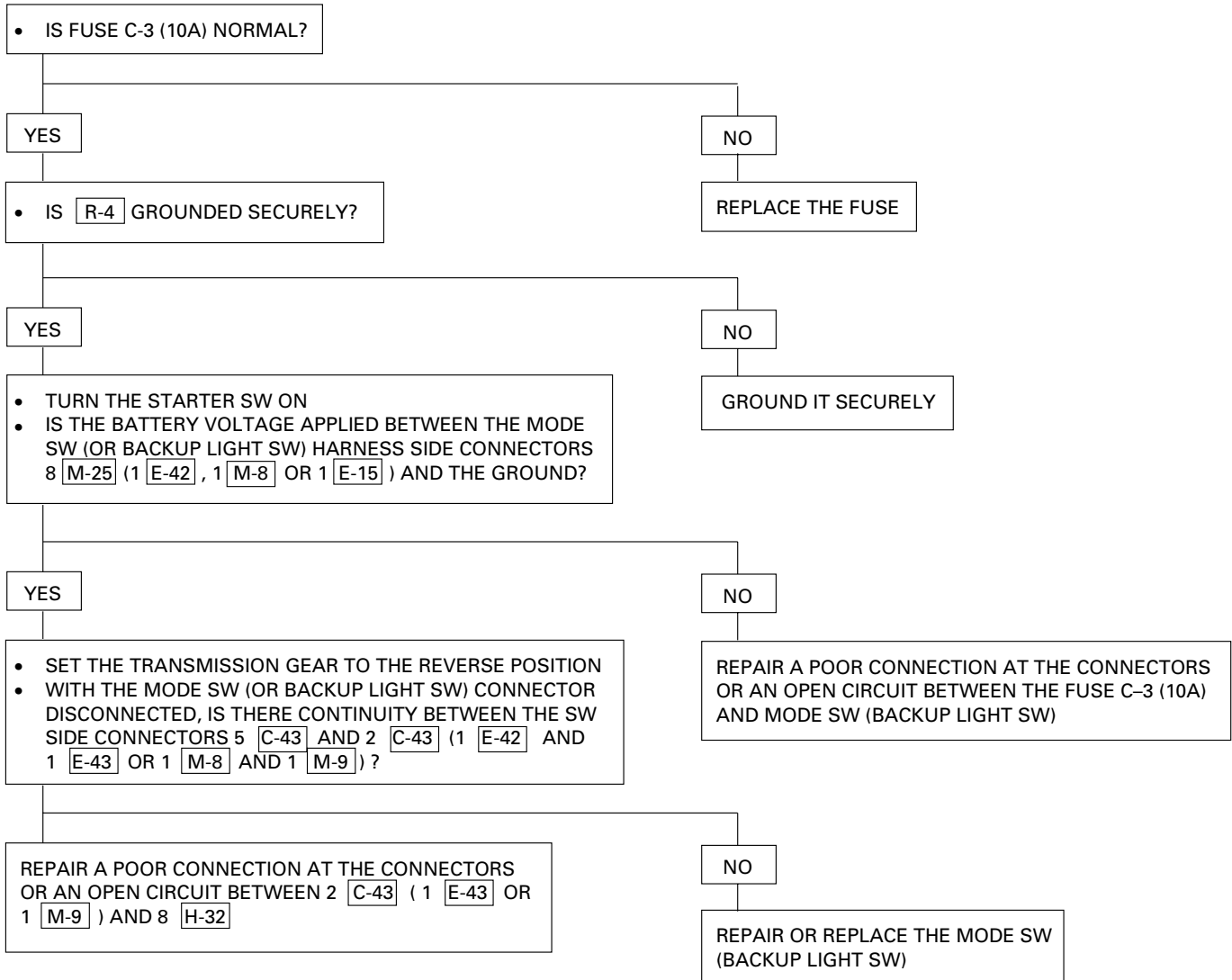
- | | |
|---------------------|-------------------------------|
| (1) Backup Light-RH | (7) Fuse Box |
| (2) Backup Light-LH | (8) Backup Light Switch (M/T) |
| (3) R-13 | (9) Mode Switch (A/T) M-25 |
| (4) R-4 | (10) H-11 |
| (5) H-32 | (11) H-5 |
| (6) H-8, H-25 | (12) M-8, M-9, E-42, E-43 |
| | (13) R-12 |

Diagnosis

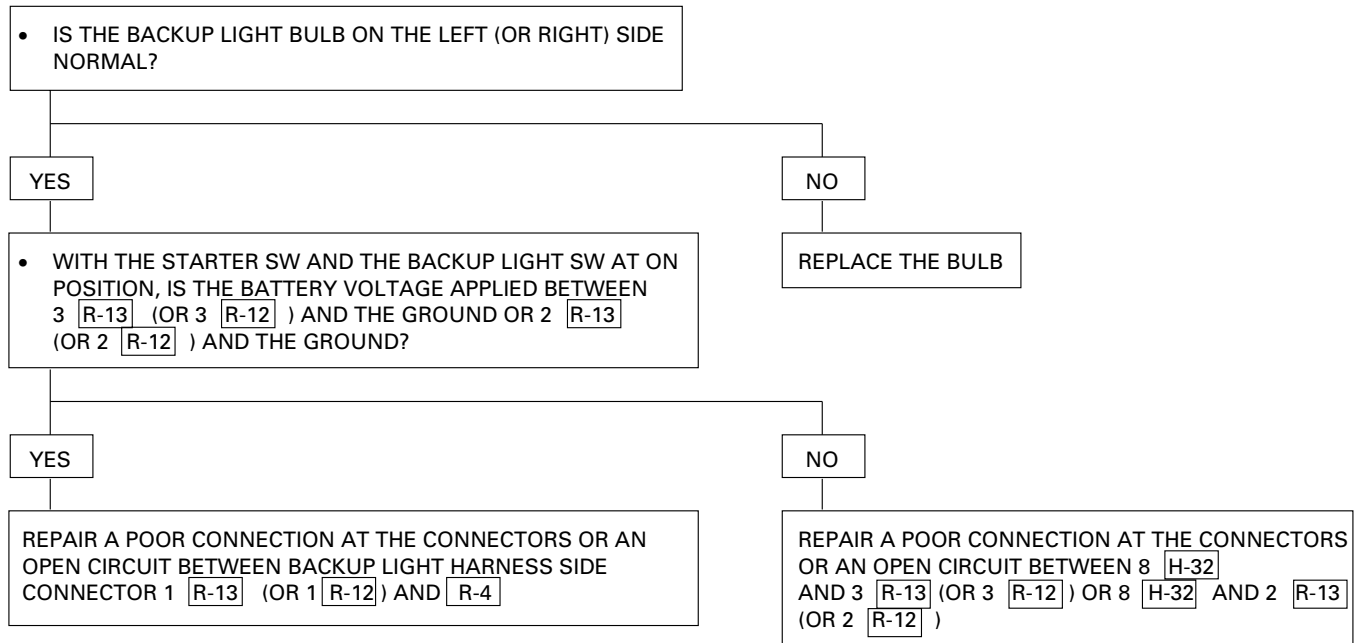
Quick Chart for Check Points

Trouble mode	Check point	Fuse		Backup light SW/ Mode SW	Backup light bulb	Horn SW	Horn relay	Cable harness
		C-3 (10A)	F-3 (15A)					
1	Both backup lights inoperative	<input type="radio"/>		<input type="radio"/>				<input type="radio"/>
2	Backup light on the left (or right) side do not light up				<input type="radio"/>			<input type="radio"/>
3	Backup light remains on			<input type="radio"/>				

1 Both Backup Lights Inoperative



2 Backup Light On The Left (Or Right) Side Inoperative



3 Backup Light Remains ON

REPAIR OR REPLACE THE MODE SW (BACKUP LIGHT SW)

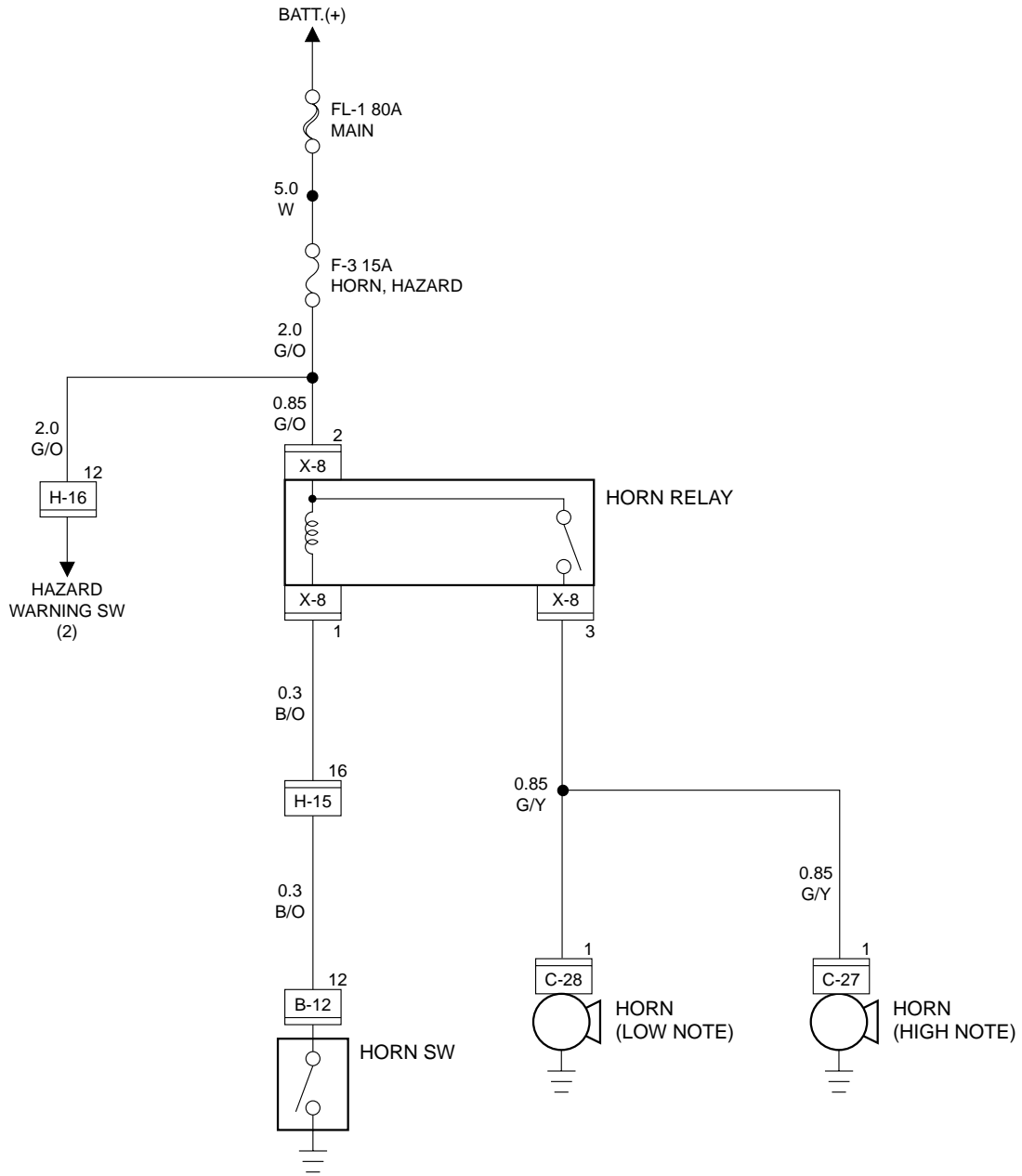
Horn

General Description

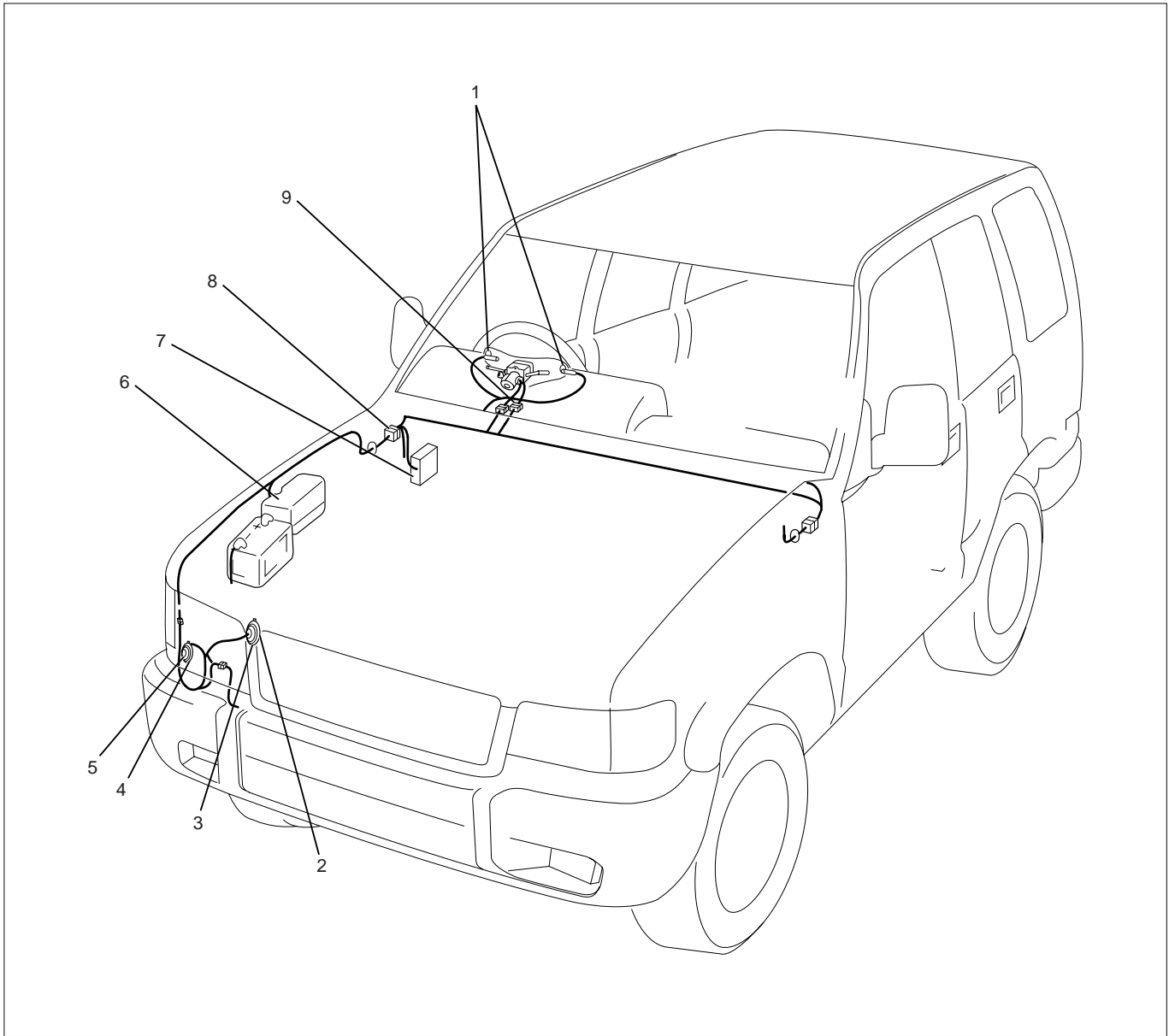
The circuit consists of horn (high note), horn (low note), horn relay and horn switch.

When horn switch is pushed, (independent of position of starter switch) horn relay is activated to sound horns.

Circuit Diagram (RHD)



Parts Location (RHD)

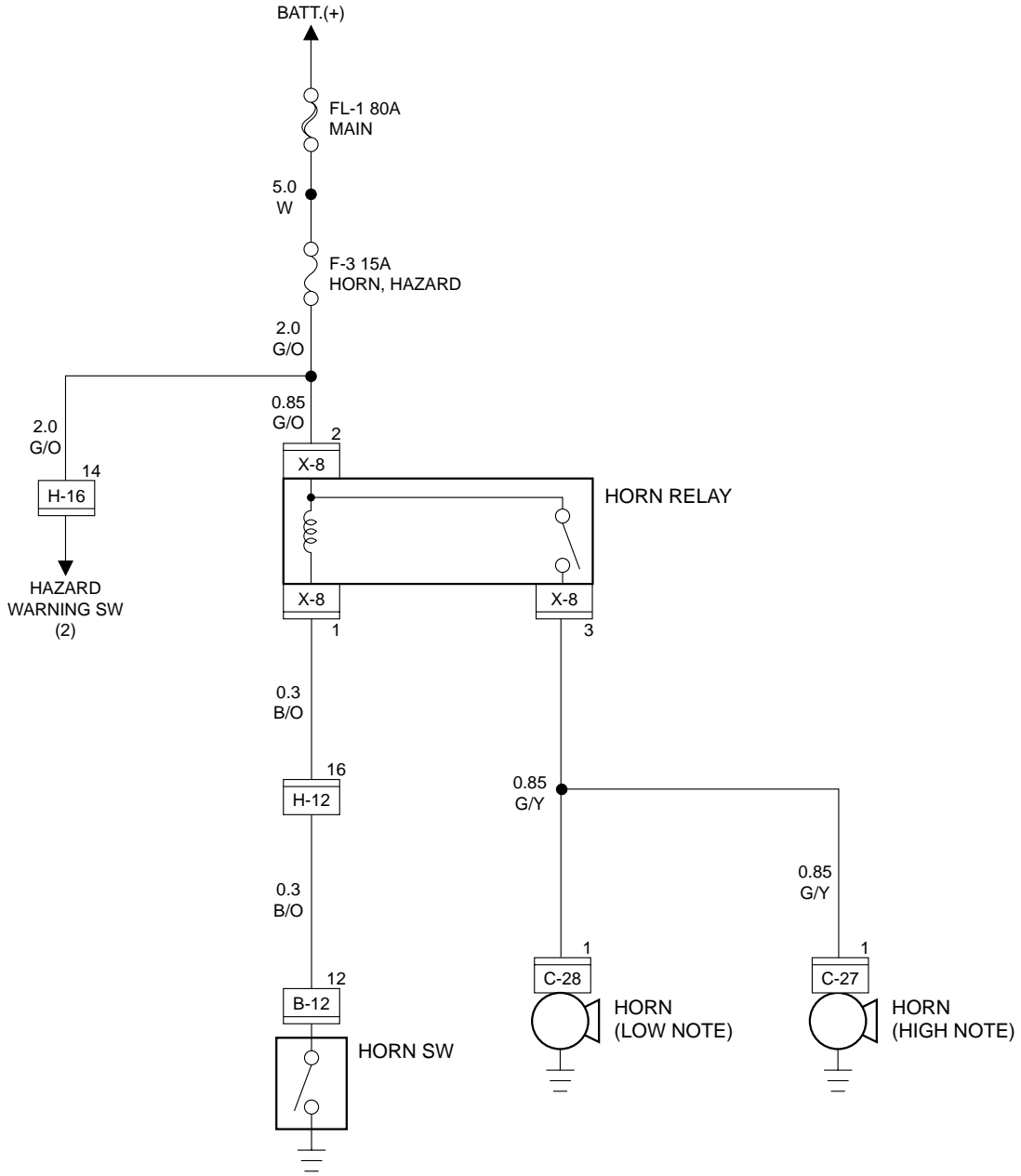


D08RW880

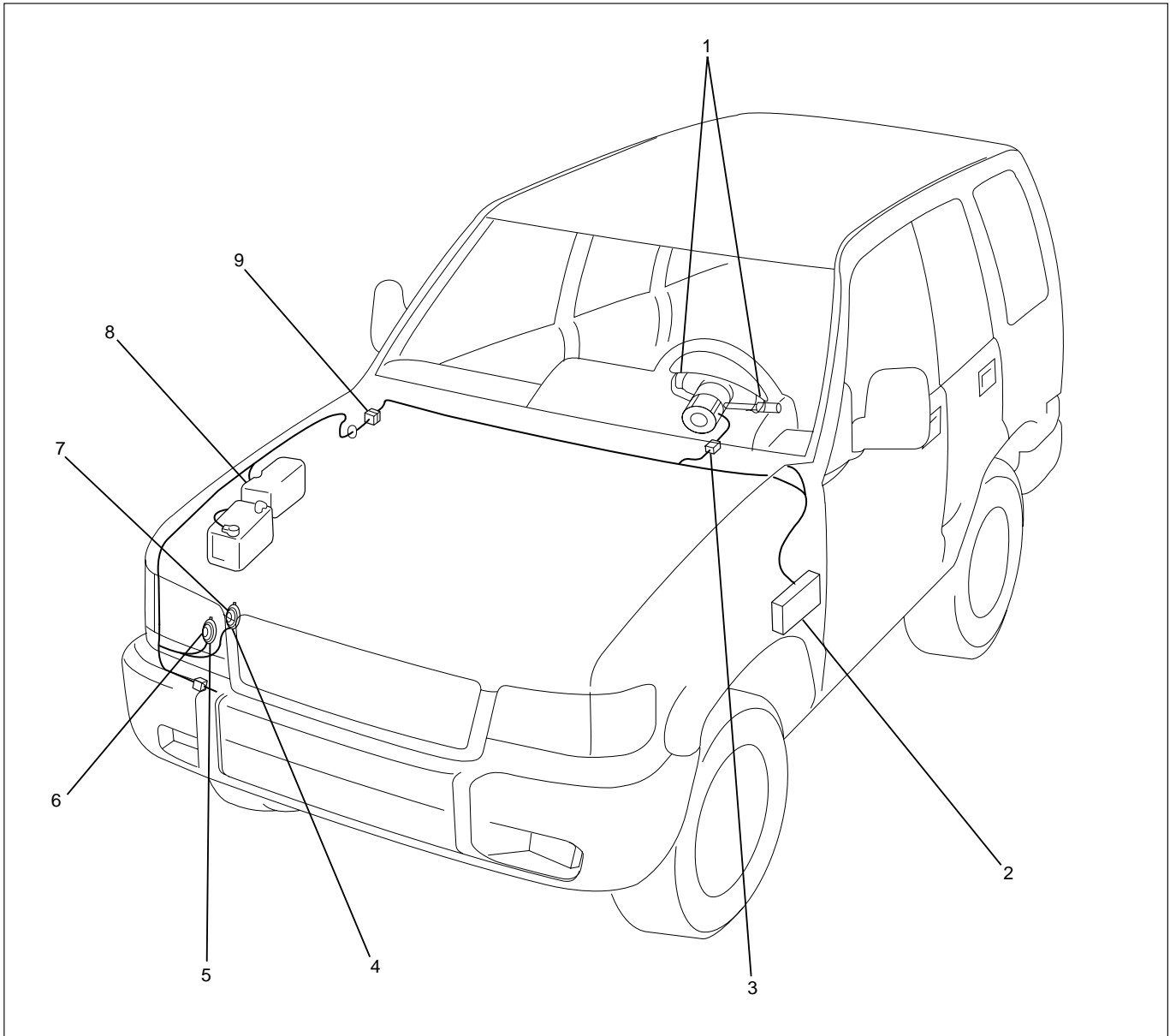
Legend

- | | |
|---------------------|------------------------------|
| (1) Horn Switch | (5) Horn (High Note) |
| (2) Horn (Low Note) | (6) Relay and Fuse Box (X-8) |
| (3) C-28 | (7) Fuse Box |
| (4) C-27 | (8) H-15, H-16 |
| | (9) B-12 |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RW398

Legend

- | | |
|-----------------|------------------------------|
| (1) Horn Switch | (5) C-27 |
| (2) Fuse Box | (6) Horn (High Note) |
| (3) B-12 | (7) Horn (Low Note) |
| (4) C-28 | (8) Relay and Fuse Box (X-8) |
| | (9) H-12, H-16 |

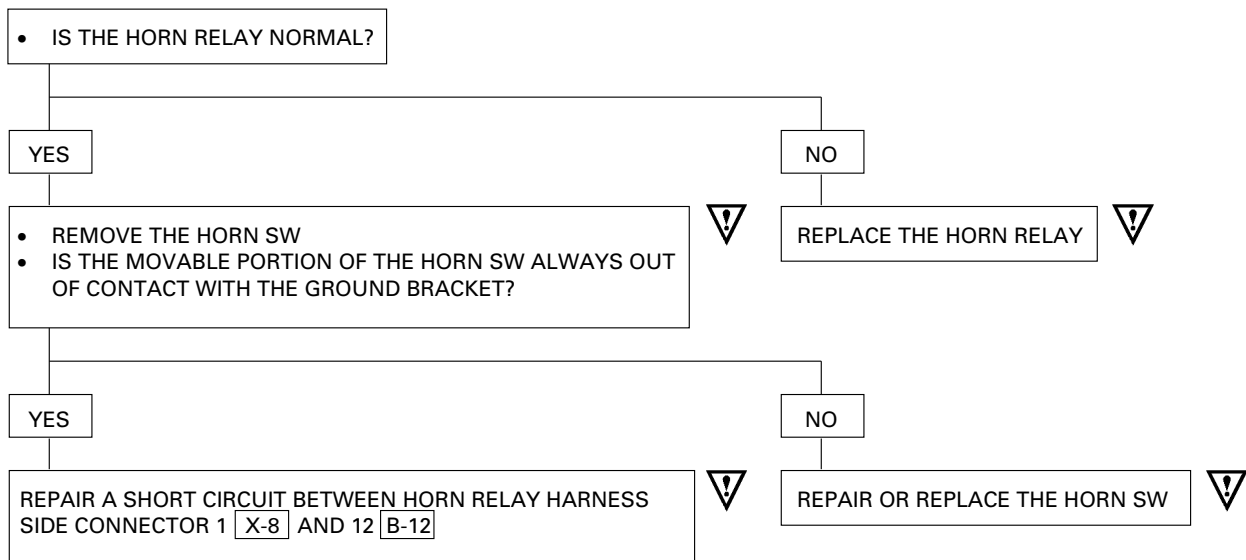
1 Horns Do Not Sound



WARNING:

WHEN SERVICING A VEHICLE EQUIPPED WITH SUPPLEMENTAL RESTRAINT SYSTEM, PAY CLOSE ATTENTION TO ALL WARNINGS AND CAUTIONS. FOR DETAILED EXPLANATION ABOUT SRS, REFER TO SECTION 9J "SUPPLEMENTAL RESTRAINT SYSTEM (SRS)" AND 3F4 "SUPPLEMENTAL RESTRAINT SYSTEM STEERING WHEEL & COLUMN".

2 Horns Do Not Shut Off



WARNING:

WHEN SERVICING A VEHICLE EQUIPPED WITH SUPPLEMENTAL RESTRAINT SYSTEM, PAY CLOSE ATTENTION TO ALL WARNINGS AND CAUTIONS. FOR DETAILED EXPLANATION ABOUT SRS, REFER TO SECTION 9J "SUPPLEMENTAL RESTRAINT SYSTEM (SRS)" AND 3F4 "SUPPLEMENTAL RESTRAINT SYSTEM STEERING WHEEL & COLUMN".

Dome Light, Luggage Room Light, Courtesy Light and Map Light

General Description

This circuit consists of the starter switch, door switch, dome light, luggage room light, courtesy light, map light, and alarm & relay control unit.

The dome light lights up when any one of doors except the tailgate is opened with the switch set at the door mode.

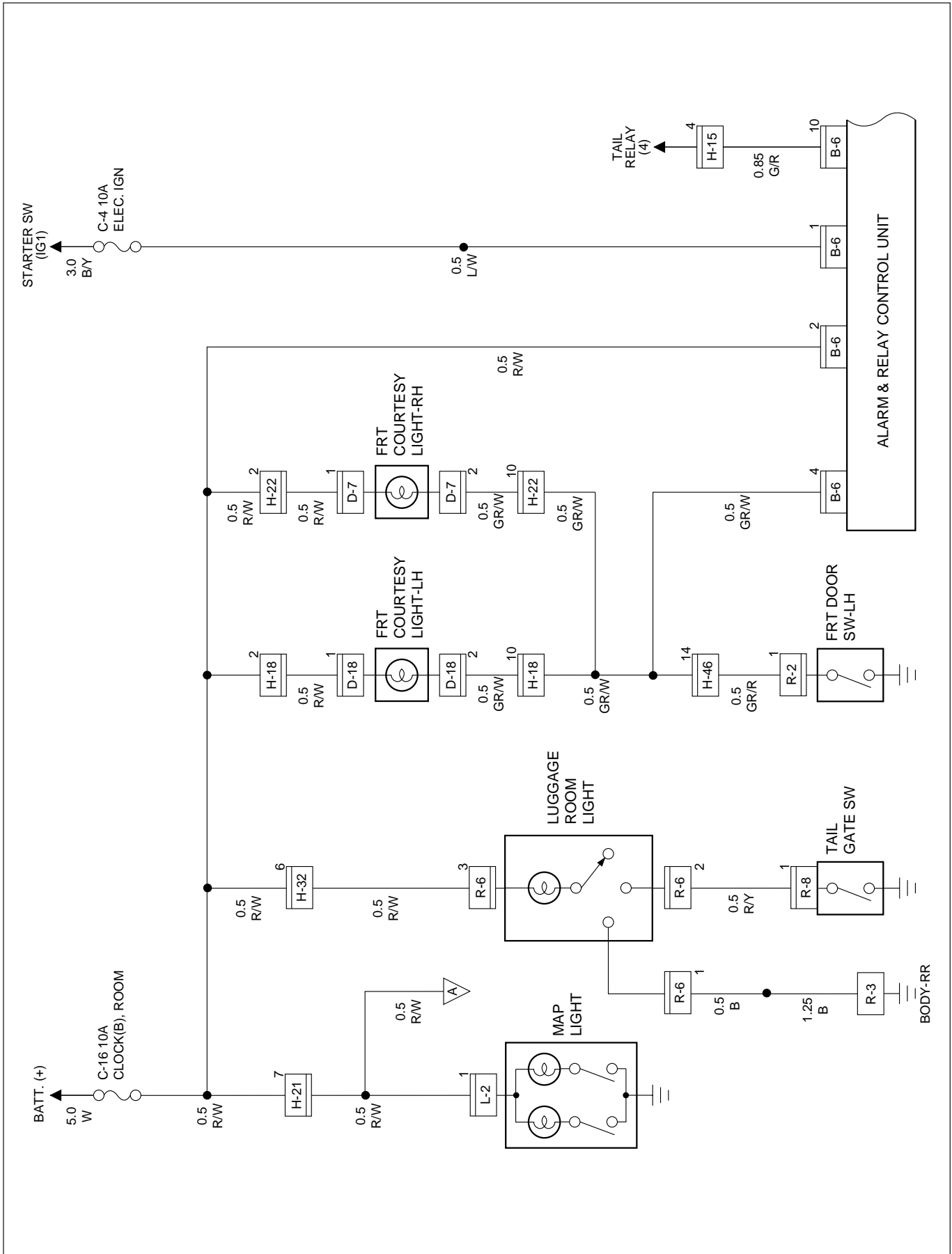
The courtesy lights for the front doors are controlled by front door switch-LH.

The luggage room light illuminates by opening the tailgate when the switch is set at the door mode.

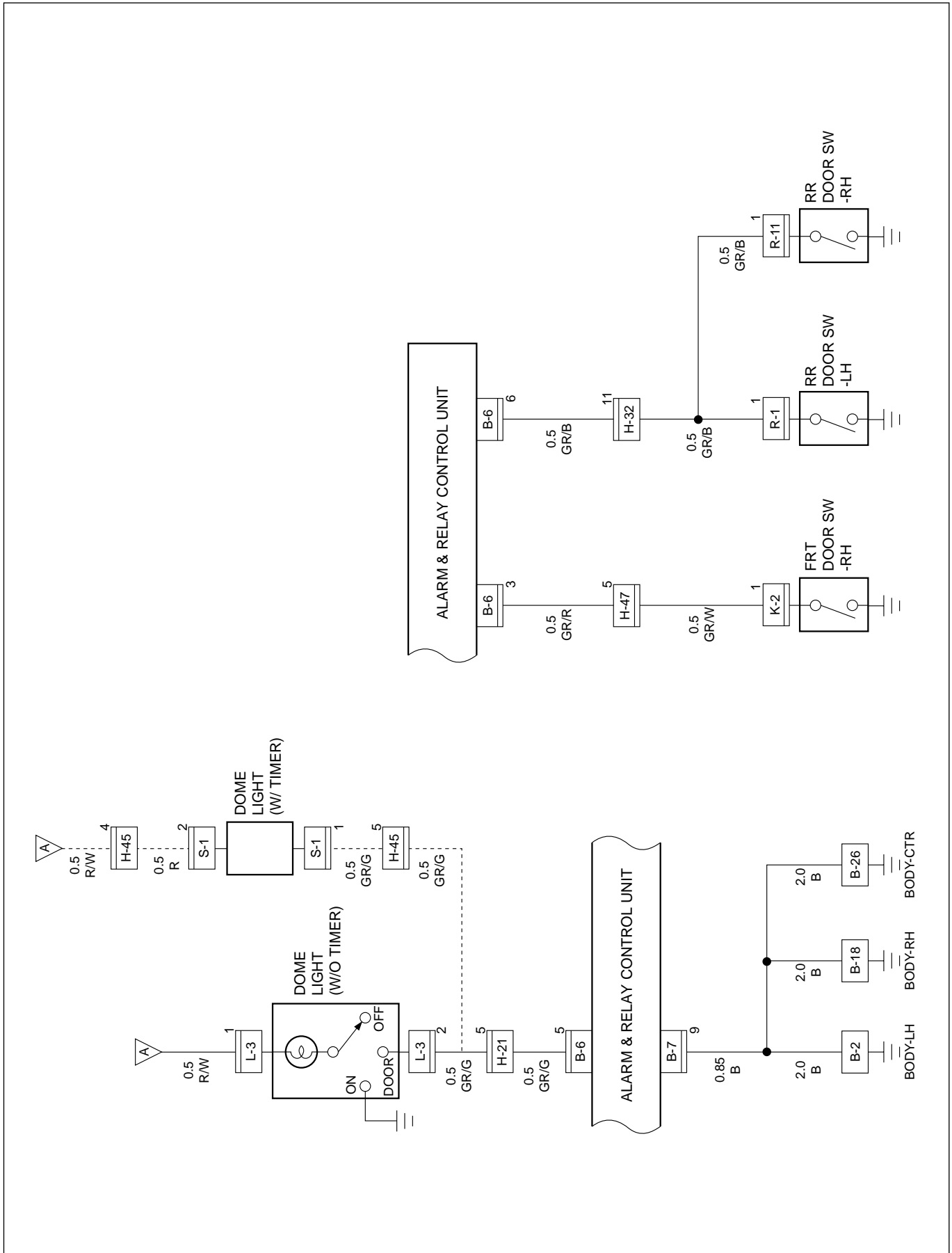
The map light illuminates by turning the switch on. All these lights light up by turning on respective switches regardless of the position of the starter switch key.

The buzzer in the alarm & relay control unit sounds to remind the driver to turn off the lights when the starter switch is turned off.

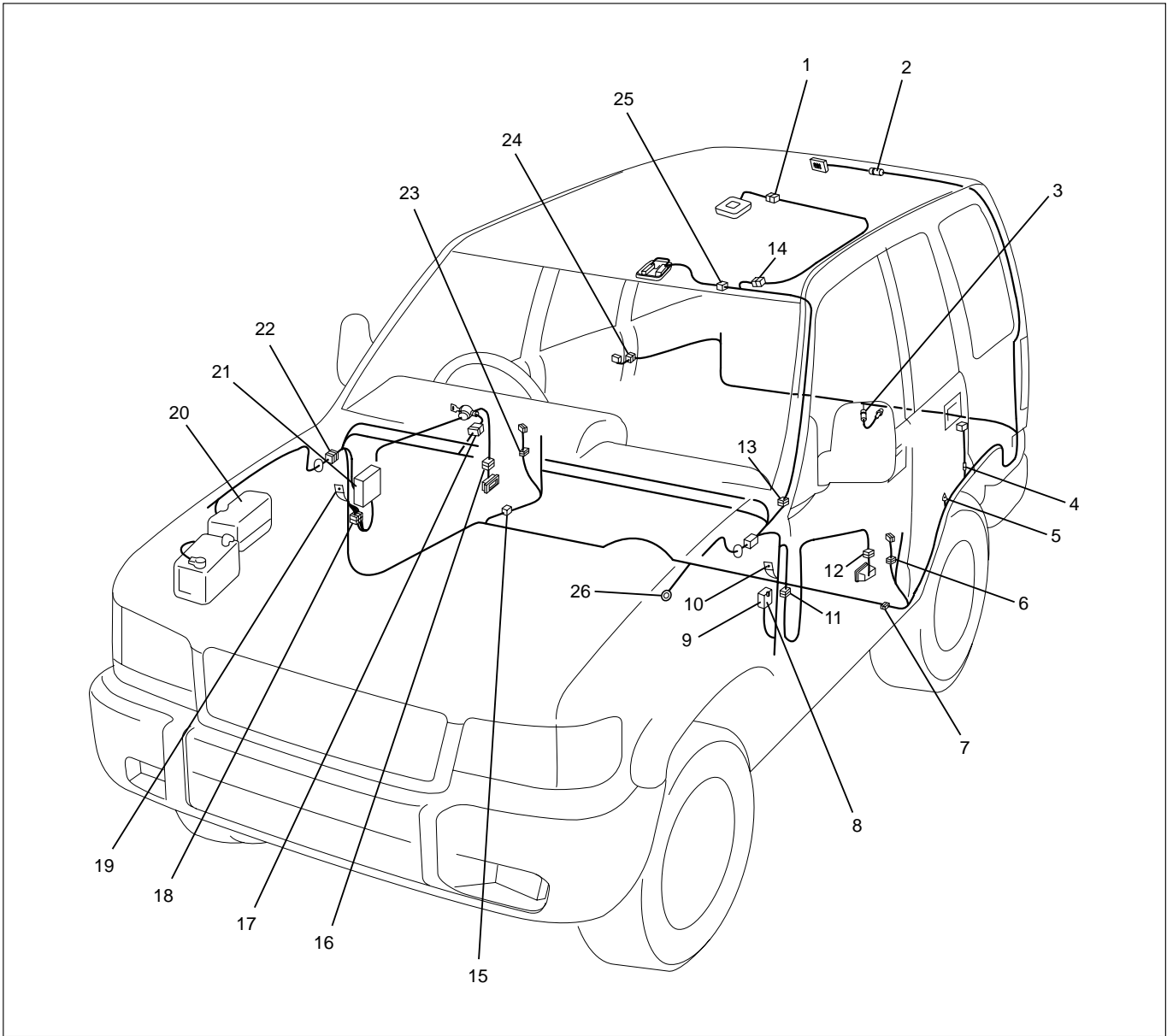
Circuit Diagram (RHD)-1



Circuit Diagram (RHD)-2



Parts Location (RHD)

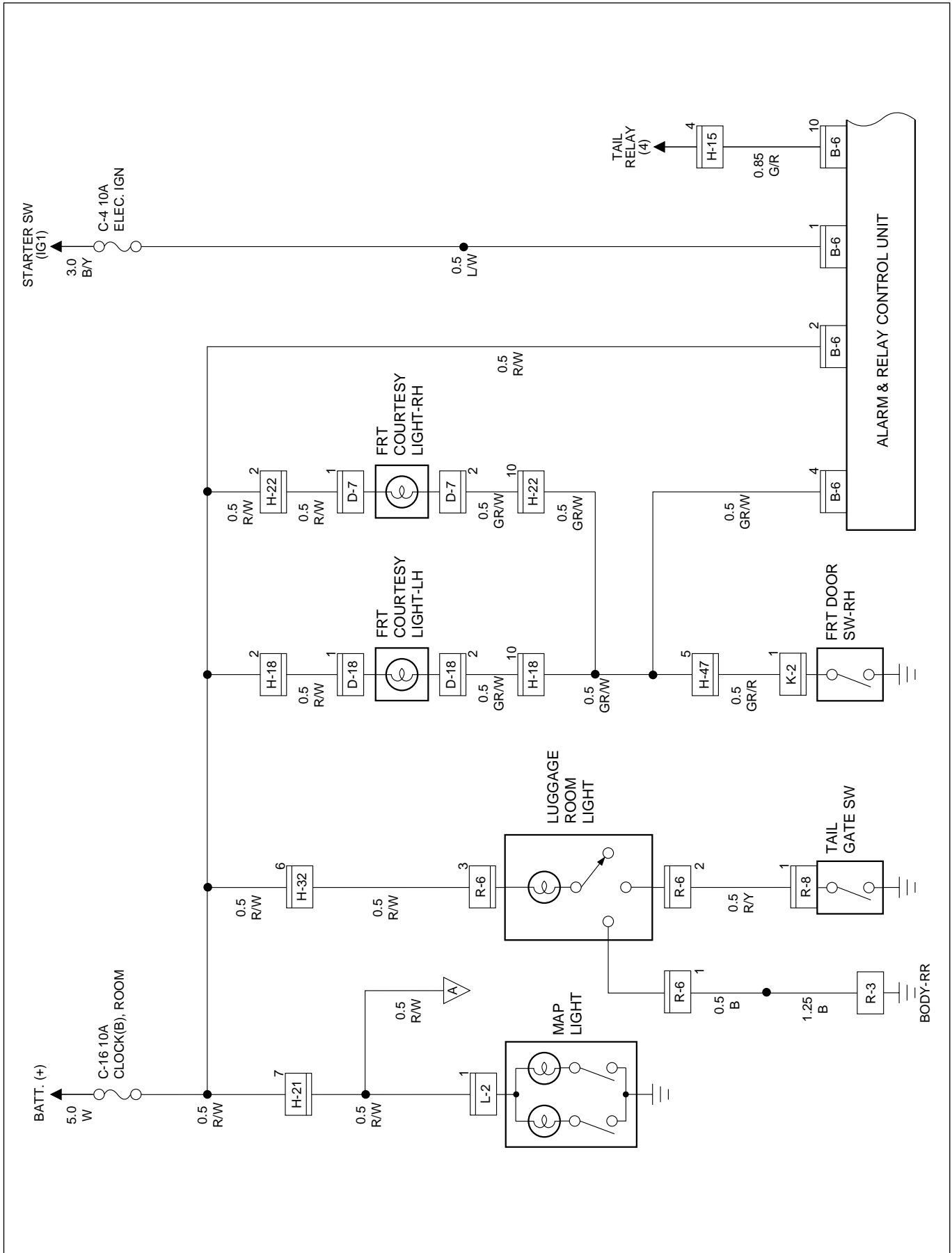


D08RW653

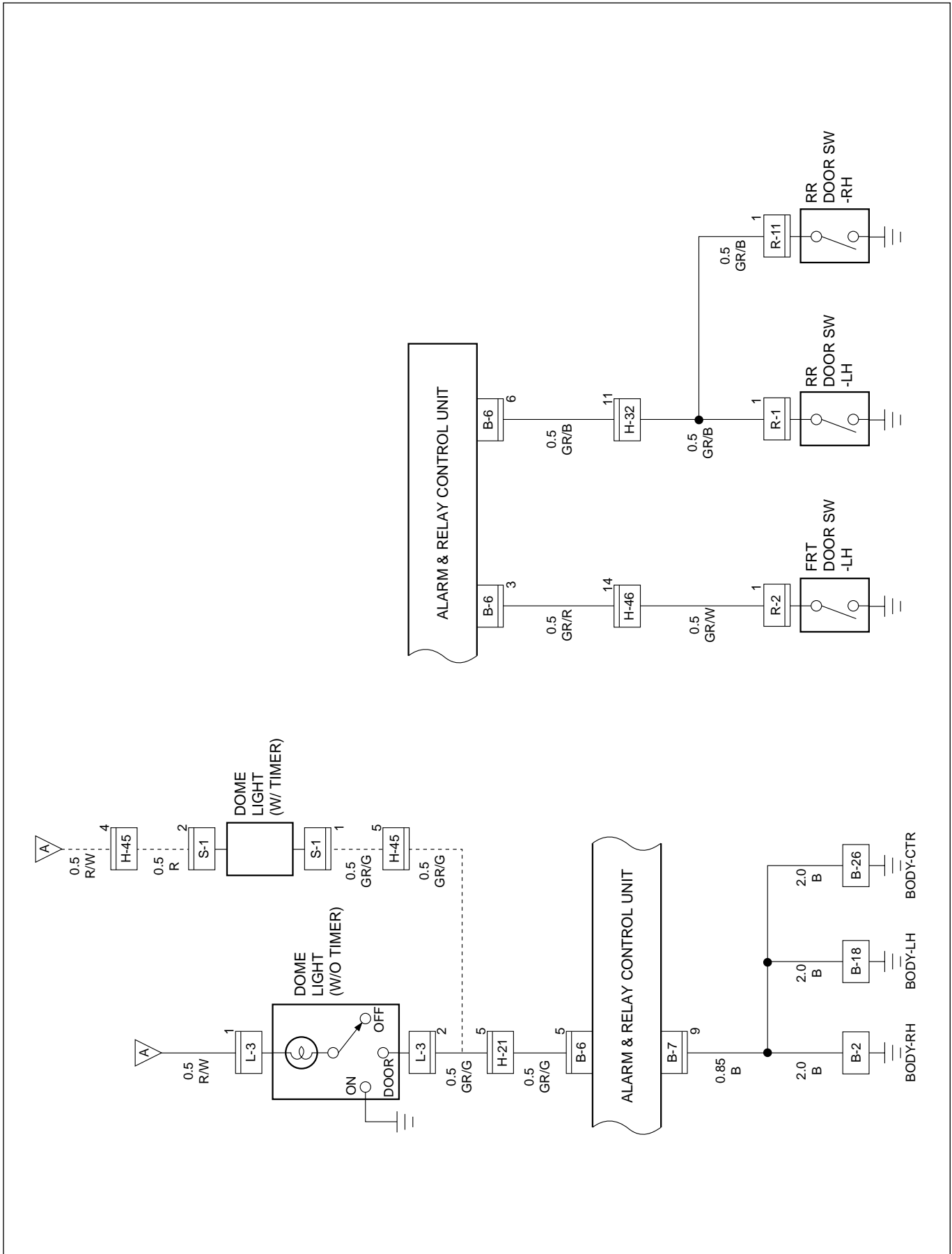
Legend

- | | |
|----------------------------------|-------------------------|
| (1) S-1, L-3 (W/O Sun Roof) | (14) H-45 |
| (2) R-6 | (15) H-47 |
| (3) R-8 | (16) D-7 |
| (4) R-1 | (17) B-11 |
| (5) R-3 | (18) H-22 |
| (6) R-2 | (19) B-18 |
| (7) H-32, H-46 | (20) Relay and Fuse Box |
| (8) Alarm and Relay control Unit | (21) Fuse Box |
| (9) B-6, B-7 | (22) H-25, H-26 |
| (10) B-2 | (23) K-2 |
| (11) H-18 | (24) R-11 |
| (12) D-18 | (25) L-2 |
| (13) H-21 | (26) B-26 |

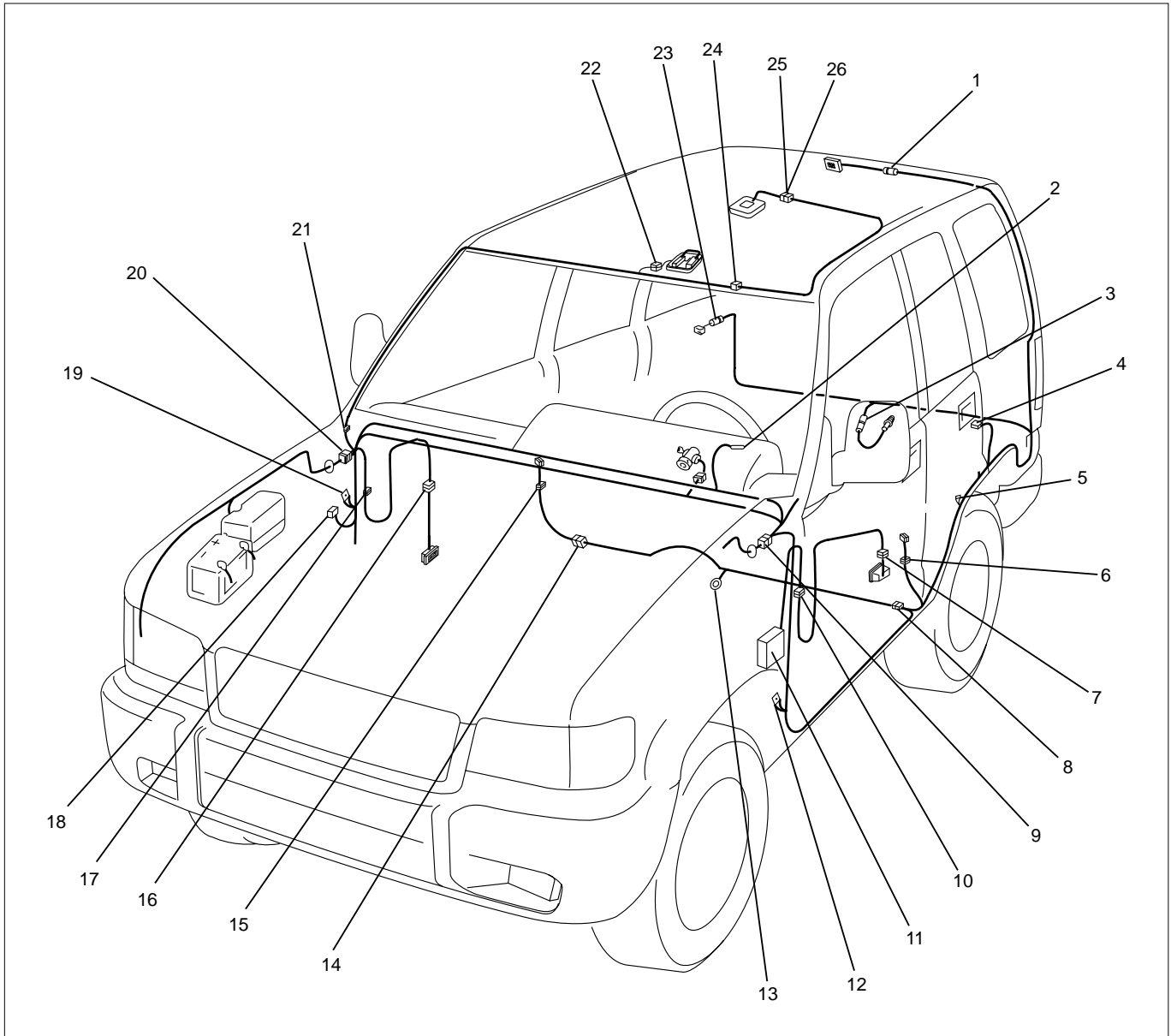
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW814

Legend

- | | |
|-------------------|--------------------------------------|
| (1) I-9 | (11) Dropping Resistor |
| (2) C-66 | (12) C-59 |
| (3) H-87, H-9 | (13) H-41, H-42 |
| (4) C-16 | (14) H-3 |
| (5) Glow Plug × 4 | (15) Relay and Fuse Box (X-17) |
| (6) H-4, H-5 | (16) Glow Relay-1 (C-51, C-52) |
| (7) E-37 | (17) Glow Relay-2 (C-53, C-54, C-55) |
| (8) E-41 | (18) C-39 |
| (9) C-60 | (19) H-15, H-26 |
| (10) B-19 | (20) Fuse Box |

Power Door Lock

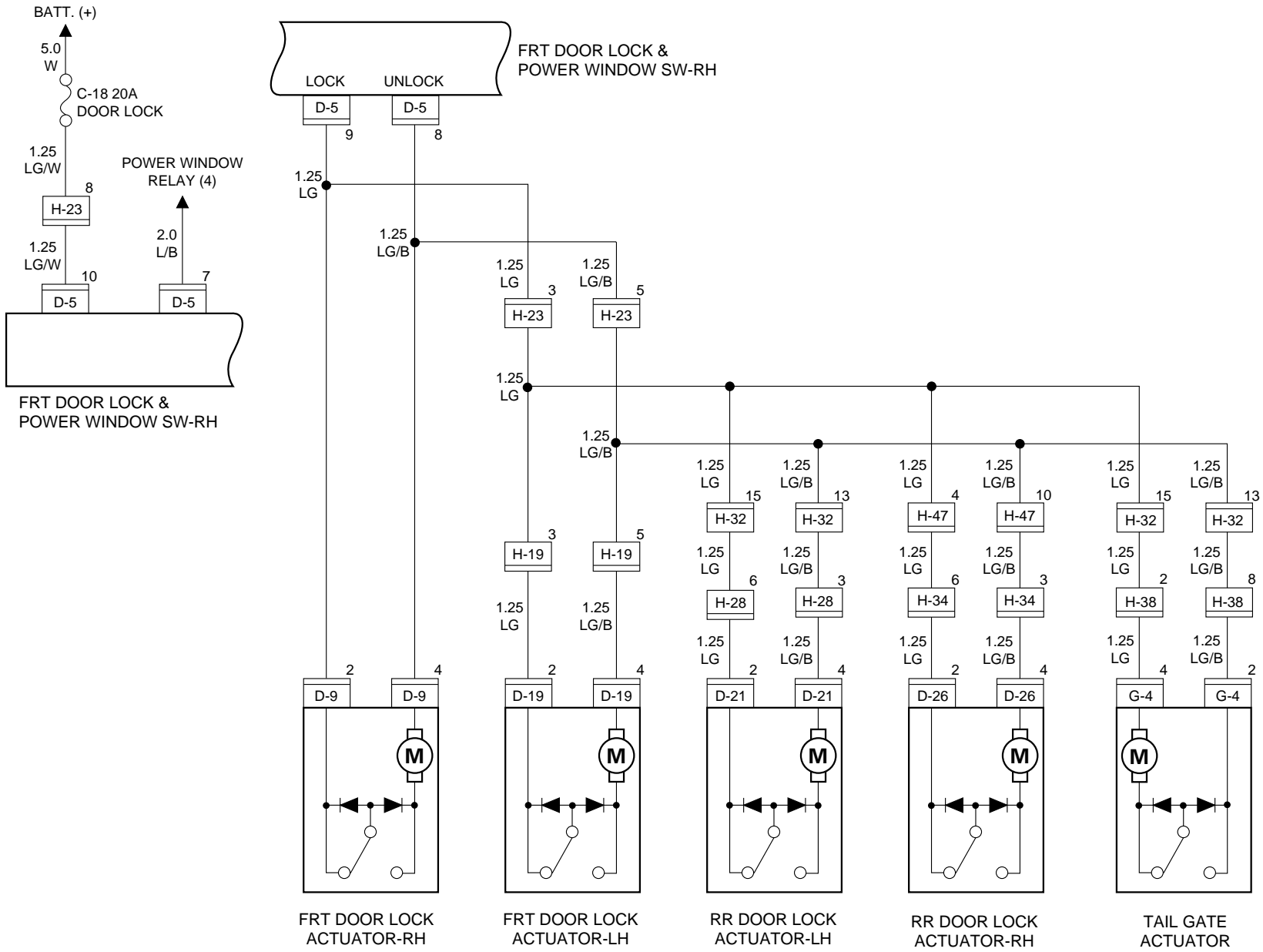
General Description

The circuit consists of door lock (& power window) switch, door lock actuator for front and rear door, tailgate lock actuator and door lock key switch.

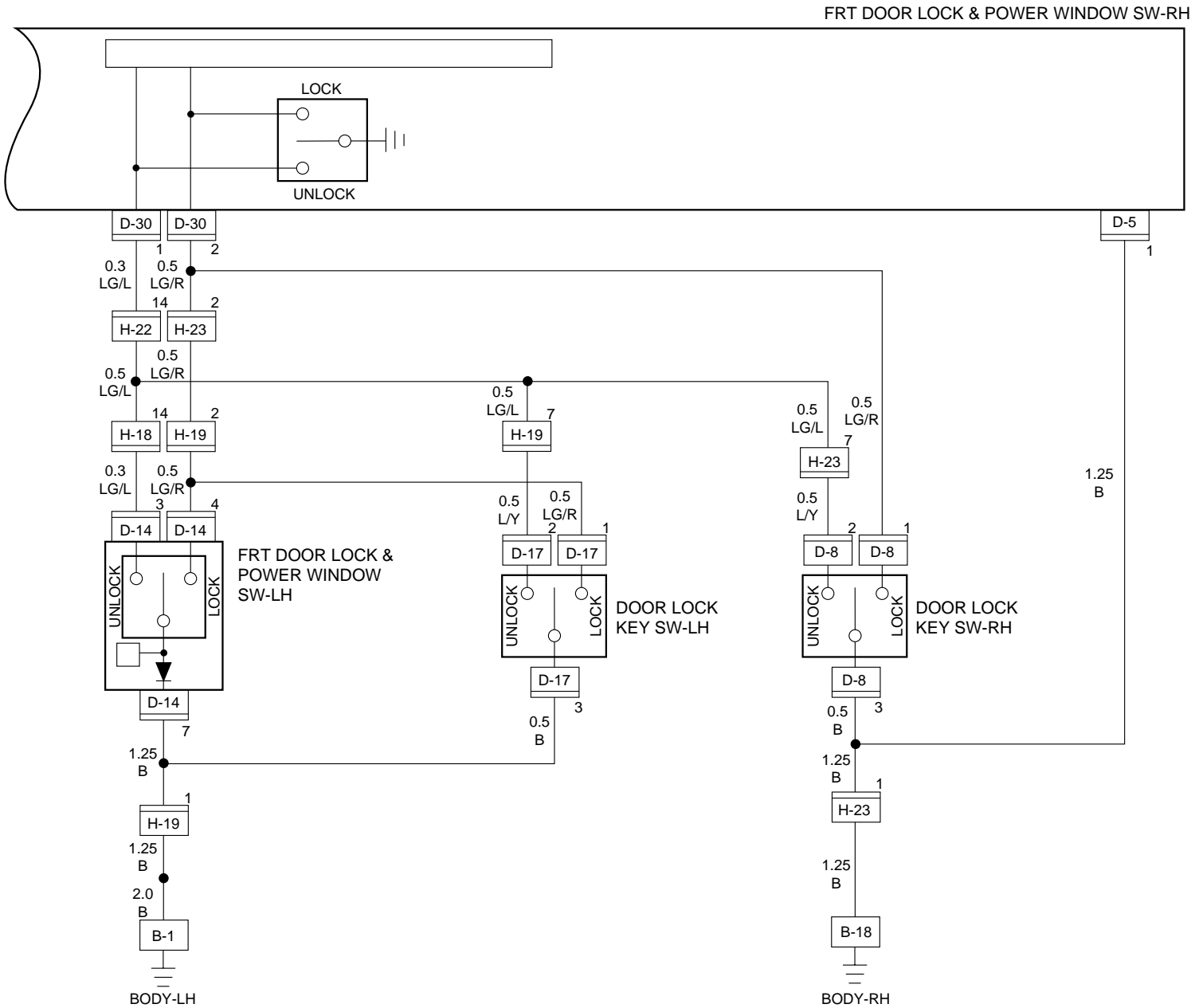
Front door lock switch-LH is always provided with battery voltage. The key or the inside lock button on the both driver's and front passenger's door can activate the lock mechanism of all the door (including tailgate).

When driver's door lock switch or front passenger's door lock switch is turned on, current flows for about one second to door lock actuator of each door connected in parallel with front door lock (& power window) switch-LH to activate actuator to lock and unlock doors.

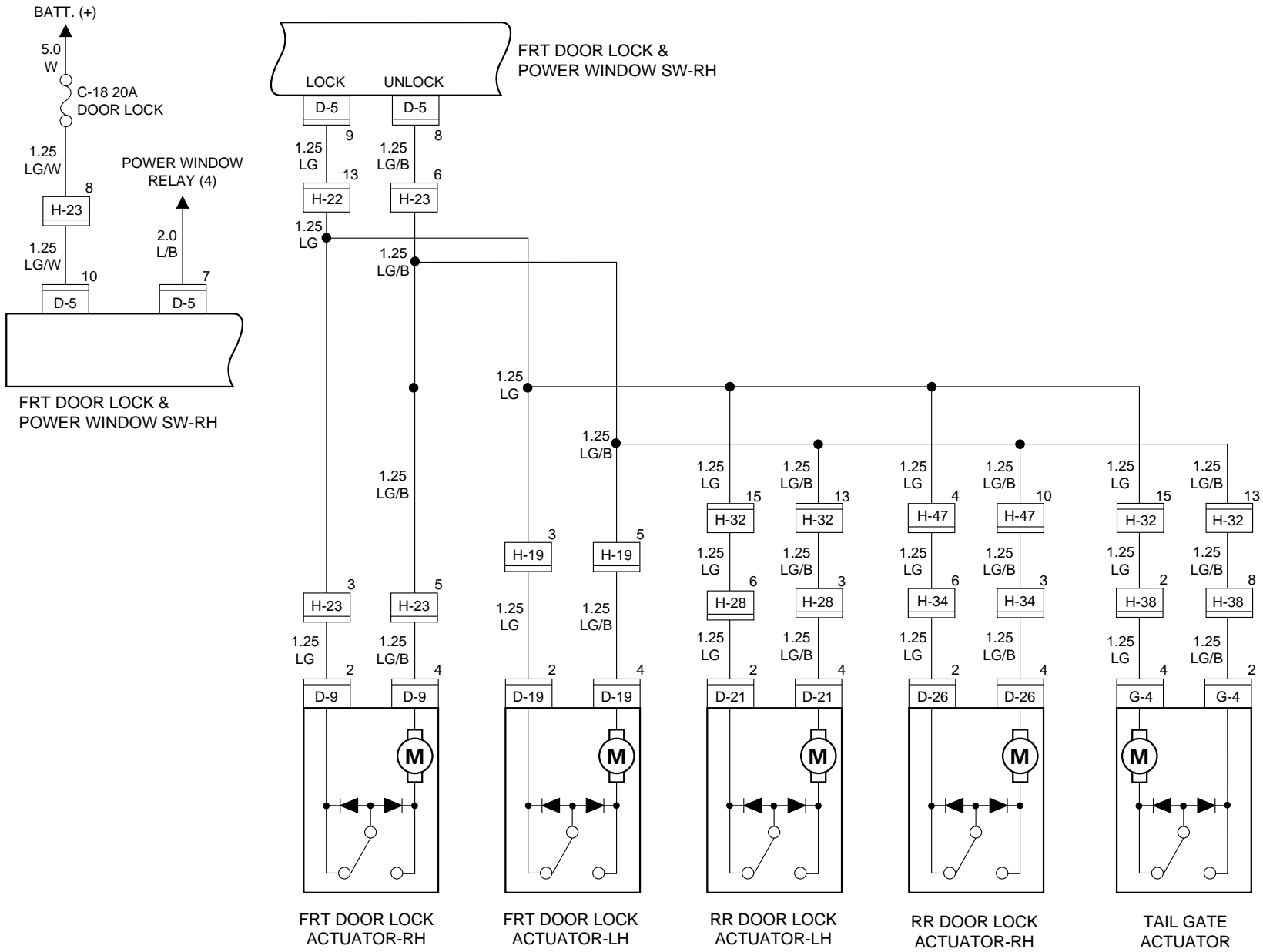
Circuit Diagram (RHD)-1



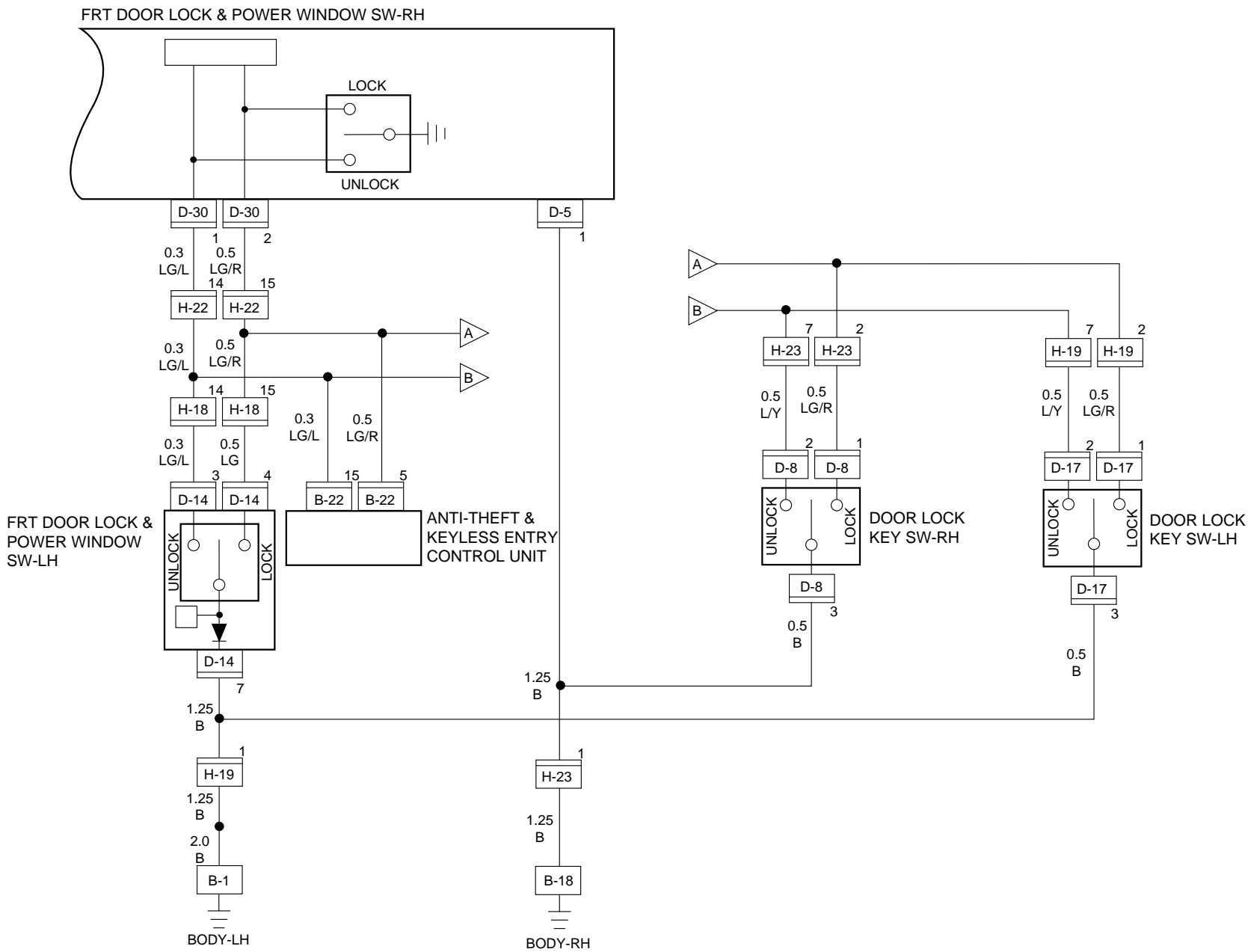
Circuit Diagram (RHD)-2



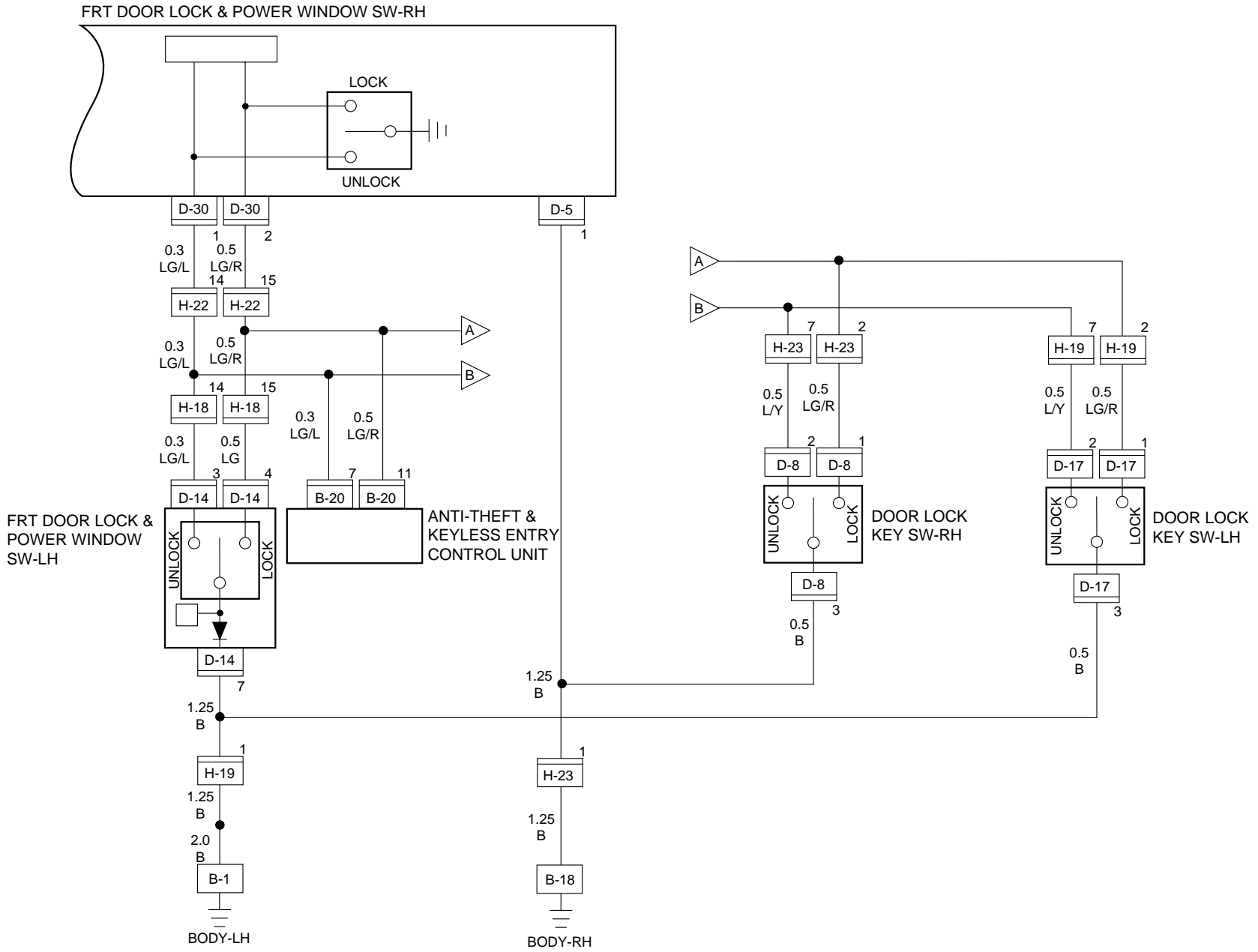
Circuit Diagram (RHD W/Keyless Entry)-1



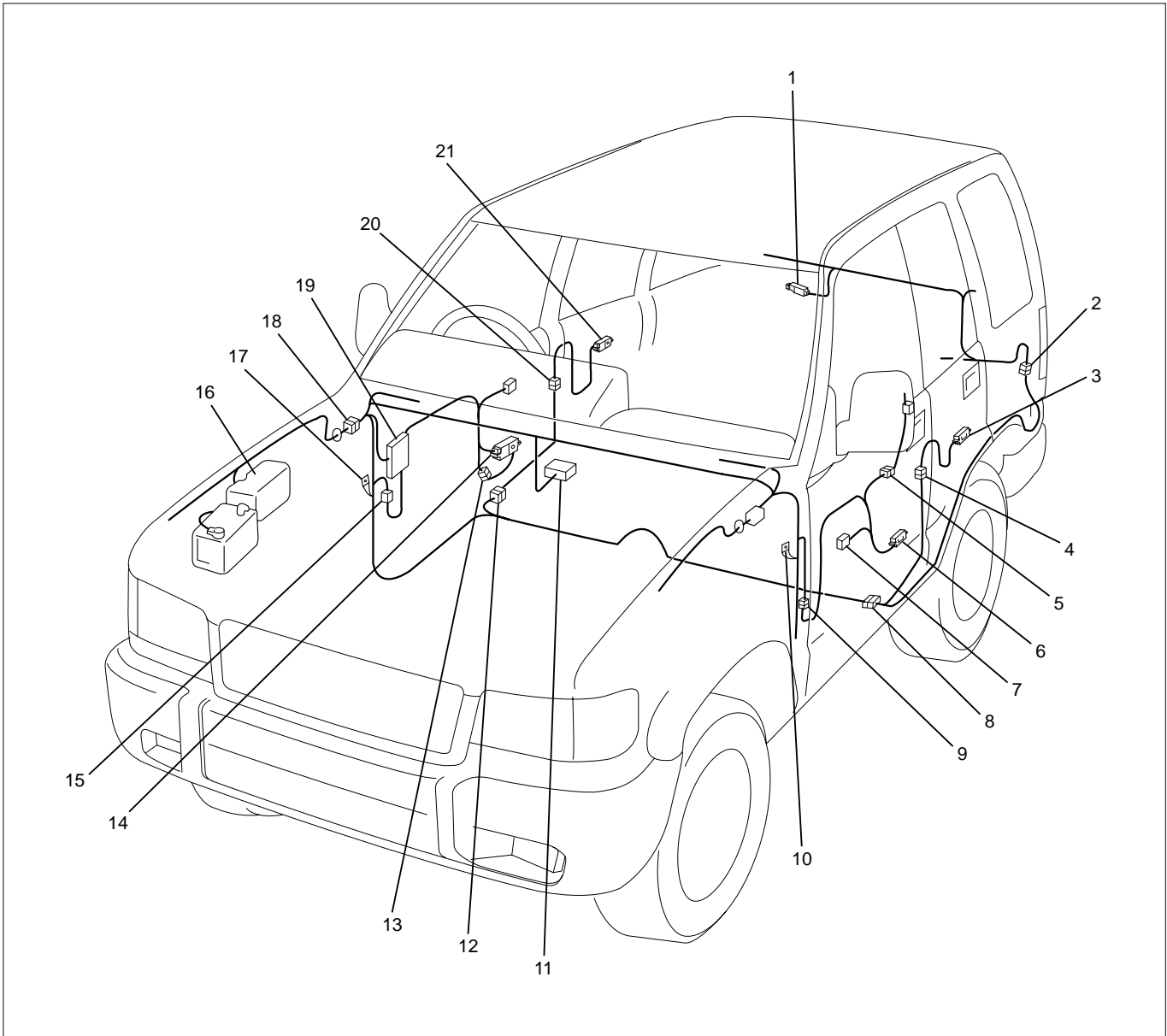
Circuit Diagram (RHD W/Keyless Entry)-2



Circuit Diagram (South Africa W/Keyless Entry)-2



Parts Location (RHD)

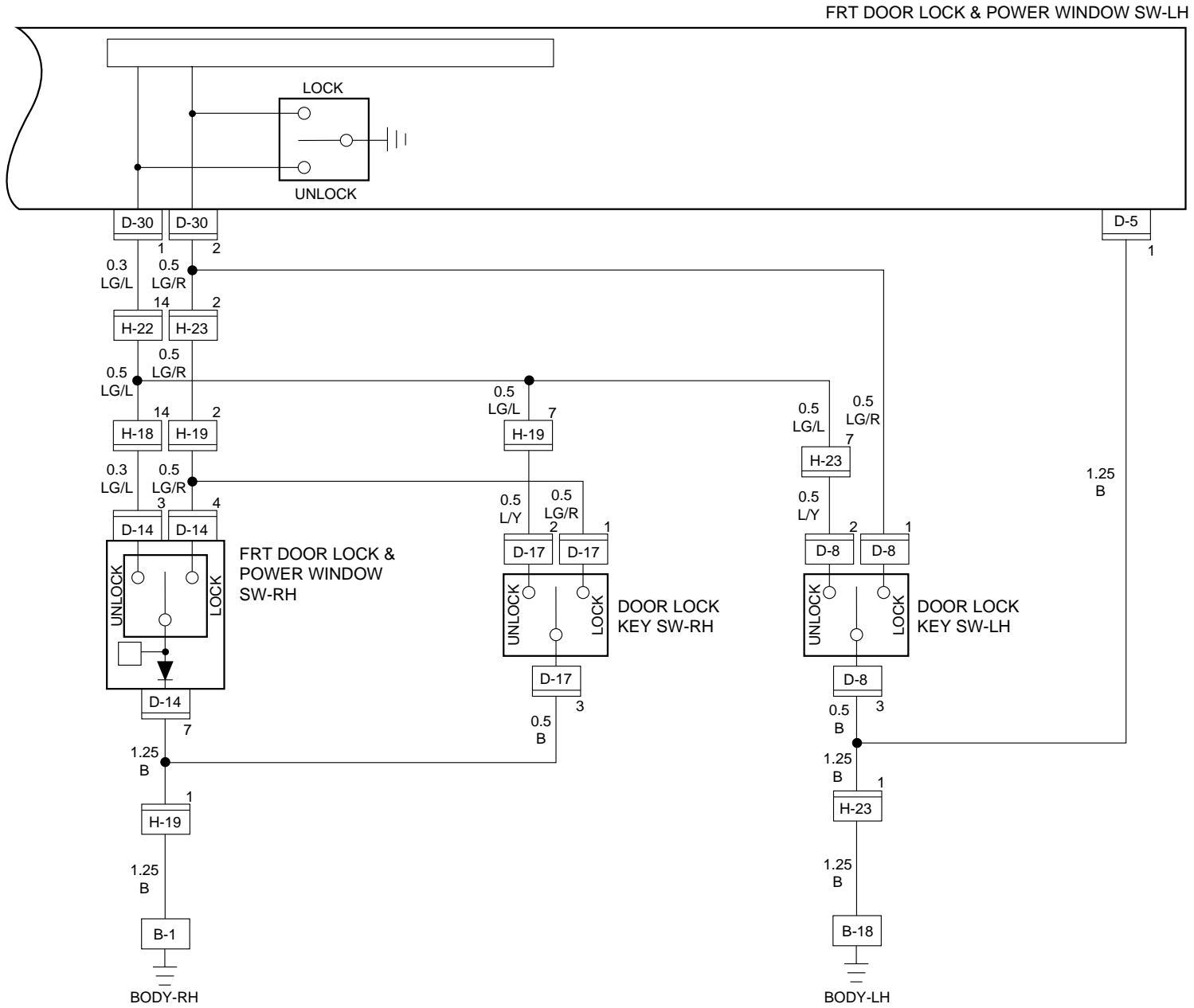


D08RW677

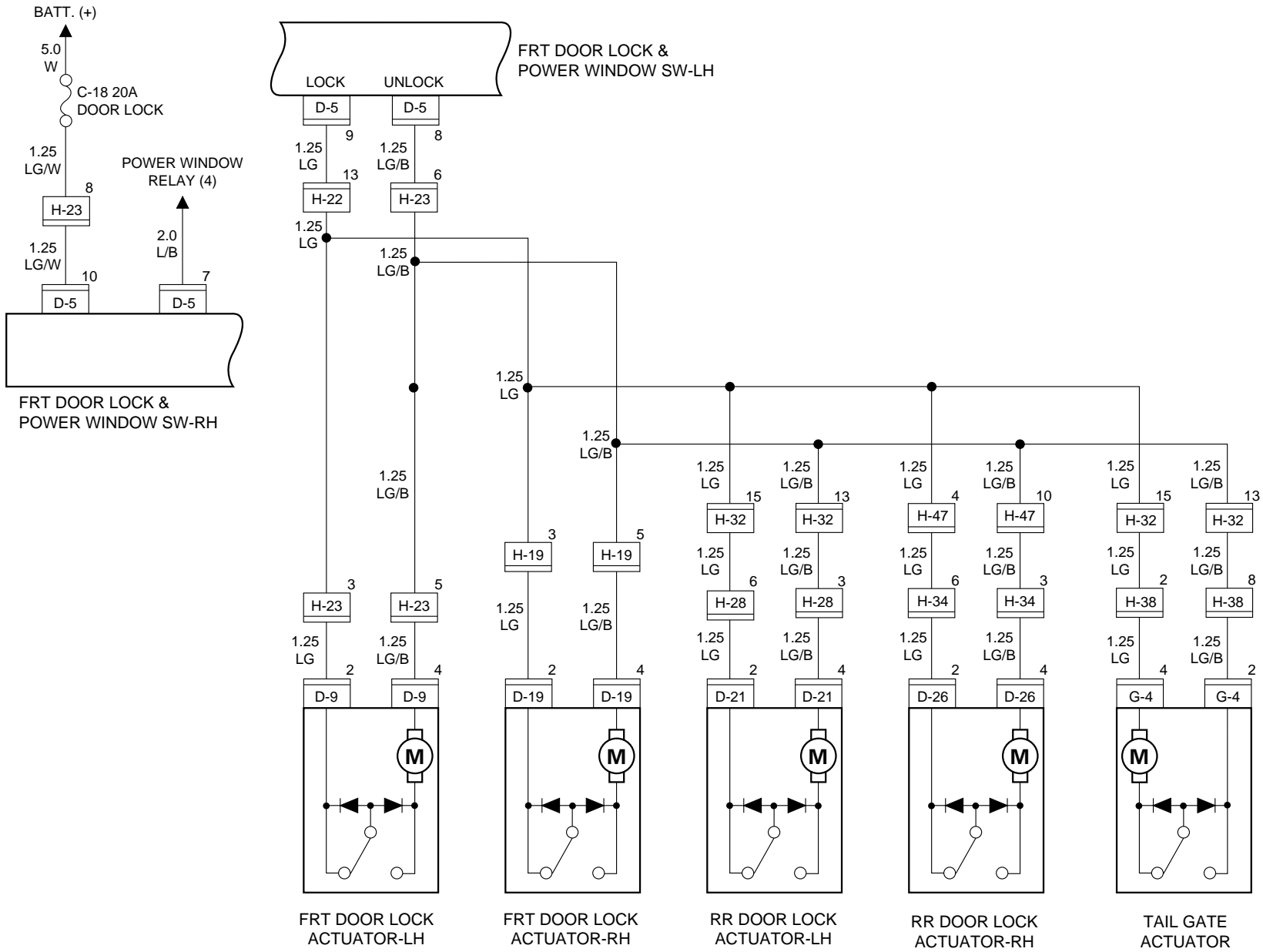
Legend

- | | |
|----------------|--------------------------------|
| (1) G-4 | (11) B-22 (B-20, South Africa) |
| (2) H-38 | (12) H-47 |
| (3) D-21 | (13) D-8 |
| (4) H-28 | (14) D-9 |
| (5) D-17 | (15) H-22, H-23 |
| (6) D-19 | (16) Relay and Fuse Box |
| (7) D-14 | (17) B-18 |
| (8) H-32 | (18) H-14 |
| (9) H-18, H-19 | (19) Fuse Box |
| (10) B-1 | (20) H-34 |
| | (21) D-26 |

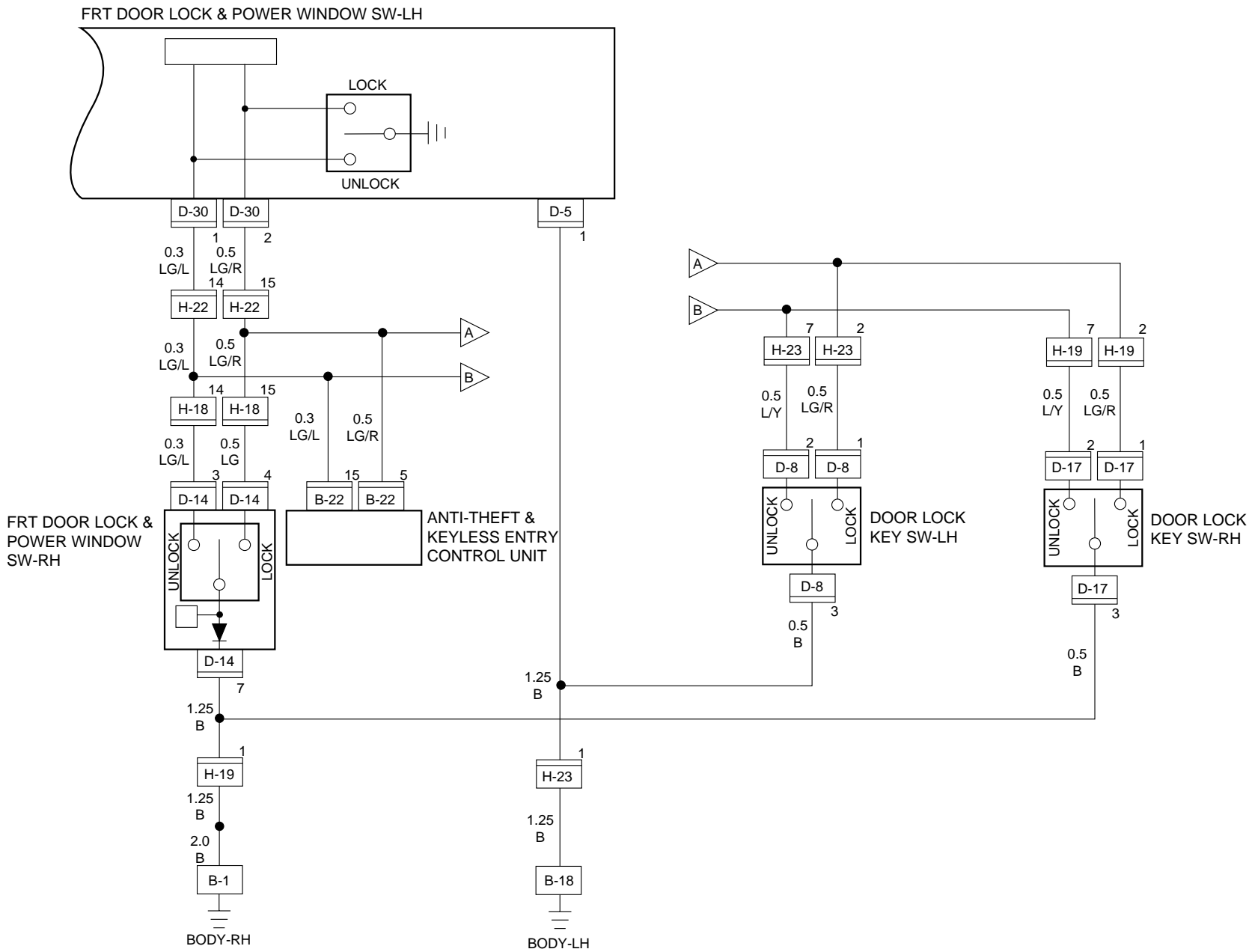
Circuit Diagram (LHD)-2



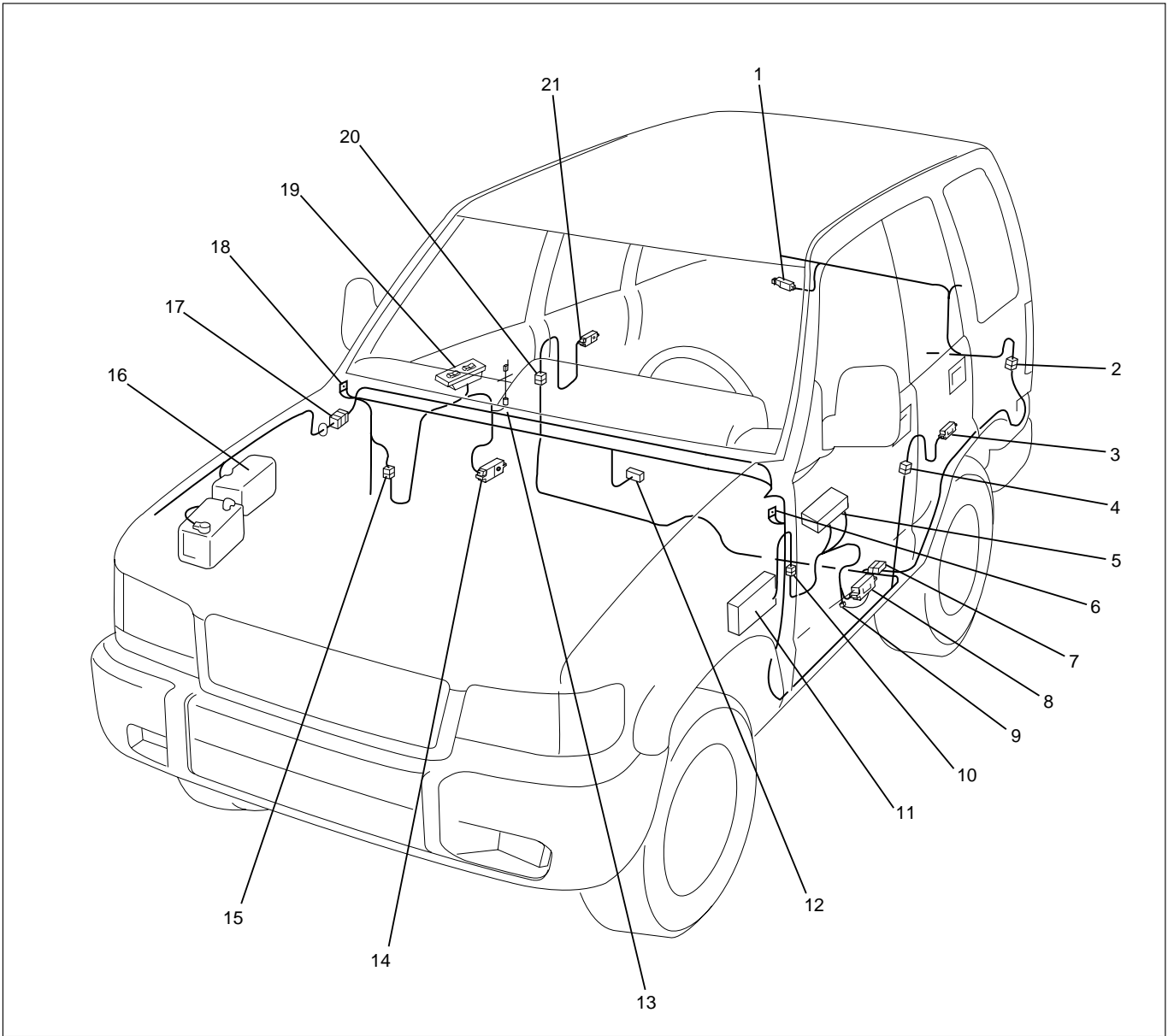
Circuit Diagram (LHD W/Keyless Entry)-1



Circuit Diagram (LHD W/Keyless Entry)-2



Parts Location (LHD)



D08RW392

Legend

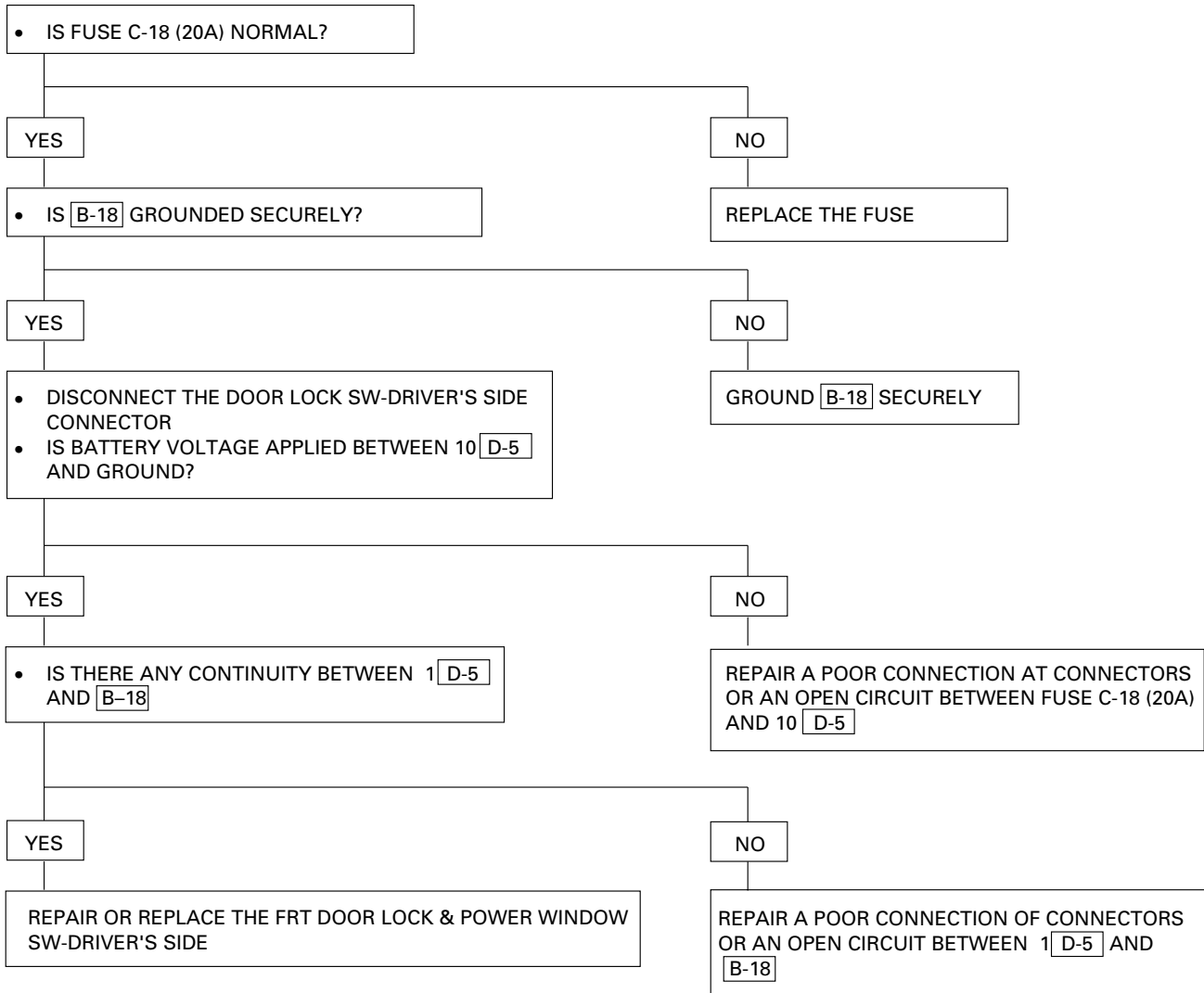
- | | |
|-----------------|-------------------------|
| (1) G-4 | (11) Fuse Box |
| (2) H-38 | (12) B-22 |
| (3) D-21 | (13) D-17 |
| (4) D-28 | (14) D-19 |
| (5) D-5, D-30 | (15) H-18, H-19 |
| (6) B-18 | (16) Relay and Fuse Box |
| (7) H-32 | (17) H-14 |
| (8) D-9 | (18) B-2 |
| (9) D-8 | (19) D-14 |
| (10) H-22, H-23 | (20) H-34 |
| | (21) D-26 |

Diagnosis

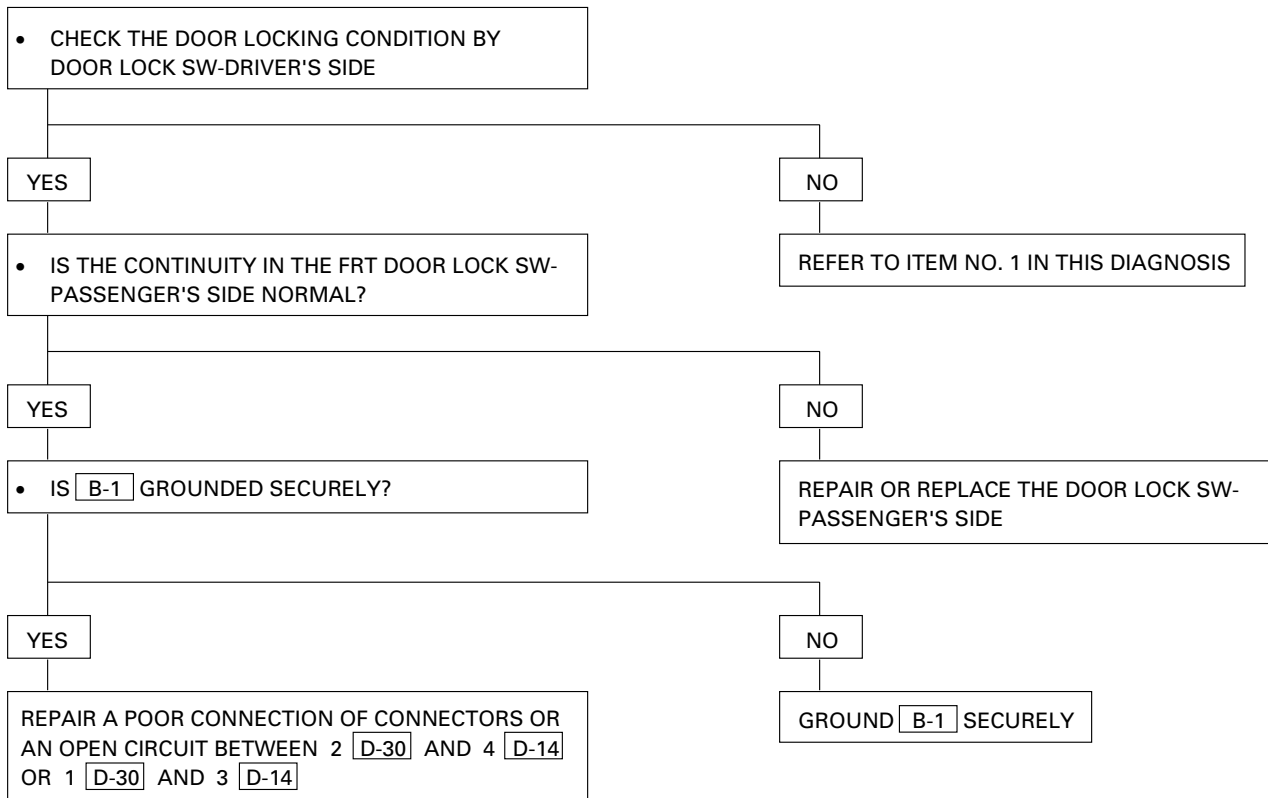
Quick Chart for Check Points

Check point Trouble mode	Fuse (C-18 20A)	FRT Door lock (& power window) SW-Driver's side	FRT Door lock (& power window) SW-Passenger's side	Door lock switch FRT-Driver's side	Door lock switch FRT-Passenger's side	Door lock actuator					
						FRT-LH	FRT-RH	RR-LH	RR-RH	Tailgate	Cable harness
1. All the doors do not lock and unlock by door lock SW-Driver's side	<input type="radio"/>	<input type="radio"/>									<input type="radio"/>
2. All the doors do not get locked (or unlocked) by door lock SW-Passenger's side		<input type="radio"/>	<input type="radio"/>								<input type="radio"/>
3. FRT door-LH does not get locked (or unlocked)						<input type="radio"/>					<input type="radio"/>
4. FRT door-RH does not get locked (or unlocked)							<input type="radio"/>				<input type="radio"/>
5. RR door-LH does not get locked (or unlocked)								<input type="radio"/>			<input type="radio"/>
6. RR door-RH does not get locked (or unlocked)									<input type="radio"/>		<input type="radio"/>
7. Tailgate does not get locked (or unlocked)										<input type="radio"/>	<input type="radio"/>
8. Door lock does not operate when operated from the door lock key SW-Driver's side		<input type="radio"/>		<input type="radio"/>							<input type="radio"/>
9. Door lock does not operate when operated from the door lock key SW-Passenger's side		<input type="radio"/>			<input type="radio"/>						<input type="radio"/>

1. All The Doors Do Not Lock And Unlock By Door Lock SW-Driver's Side



2. All The Doors Do Not Get Locked (Or Unlocked) By FRT Door Lock SW-Passenger's Side



3. FRT Door-LH Does Not Get Locked (Or Unlocked)

4. FRT Door-RH Does Not Get Locked (Or Unlocked)

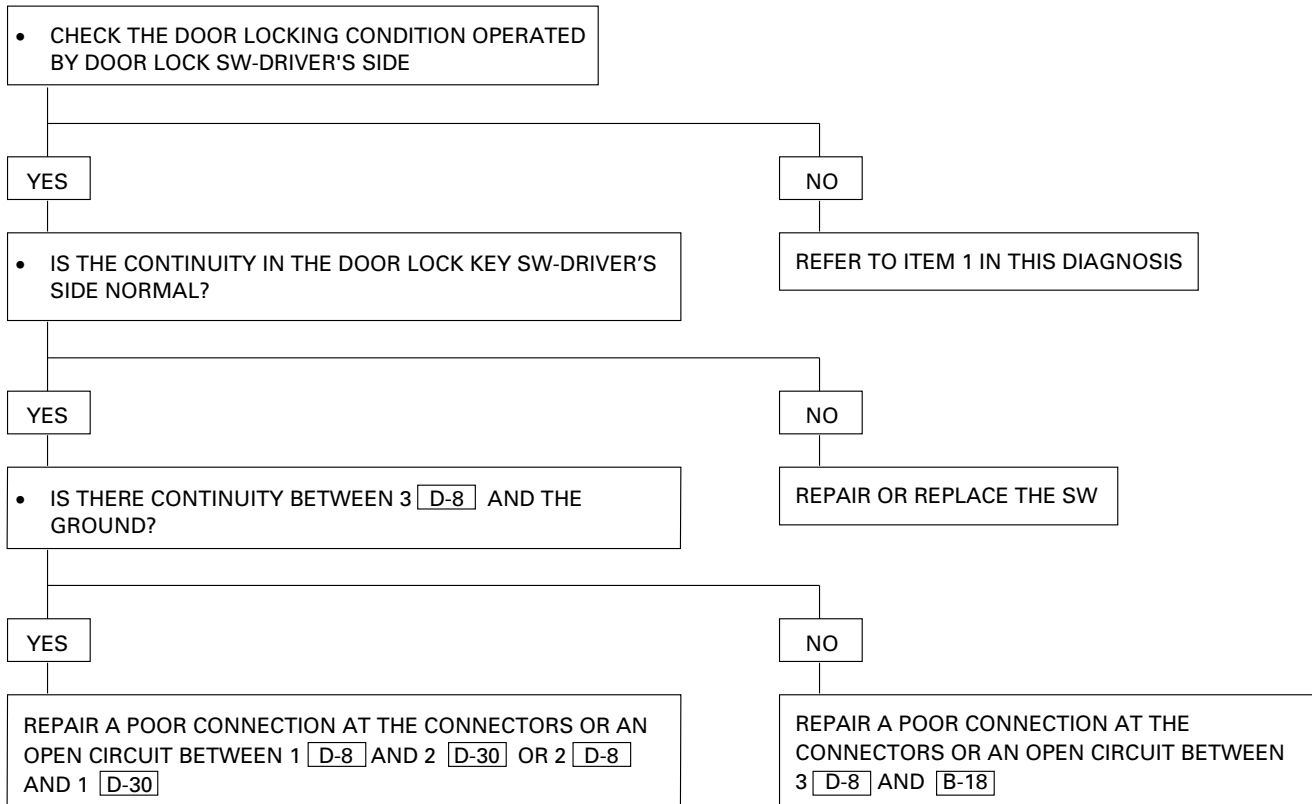
5. RR Door-LH Does Not Get Locked (Or Unlocked)

6. RR Door-RH Does Not Get Locked (Or Unlocked)

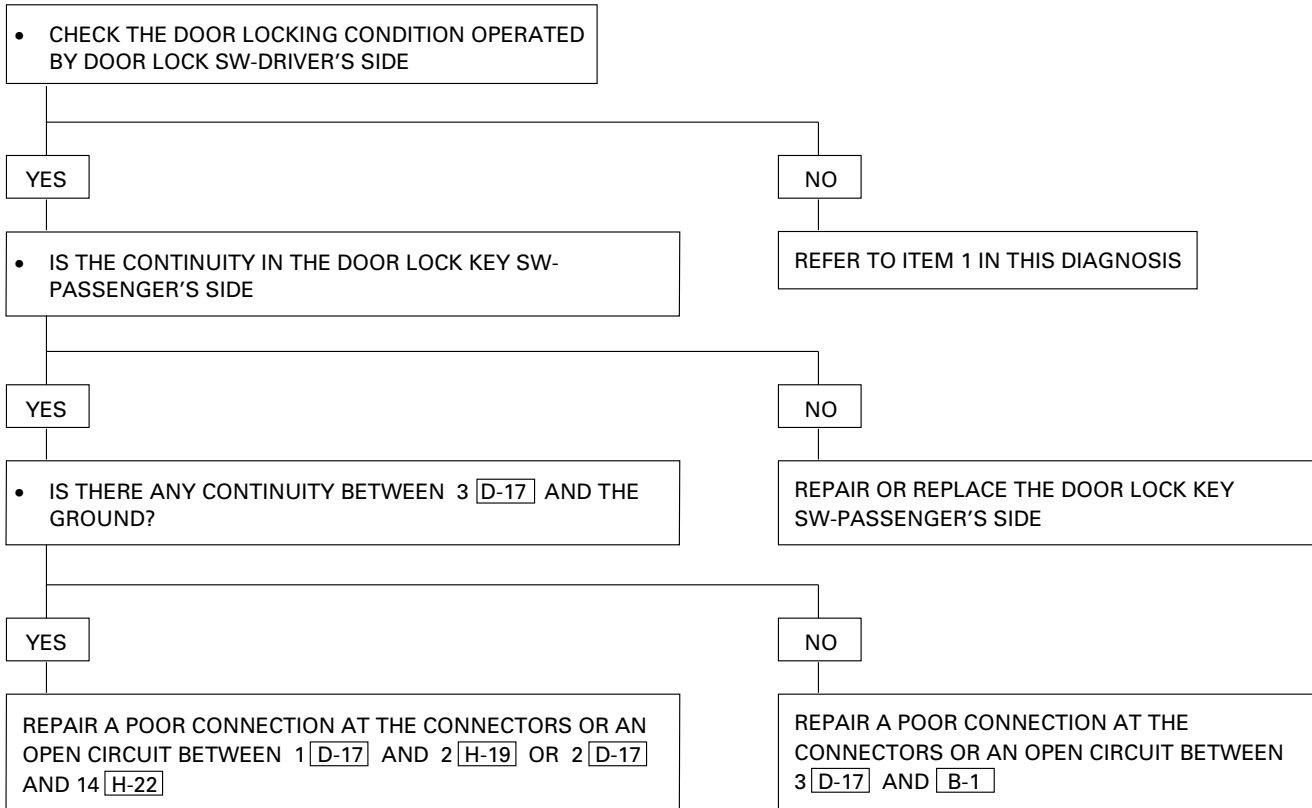
7. Tailgate Does Not Get Locked (Or Unlocked)

REPLACE THE DOOR LOCK ACTUATOR

8. Door Lock Does Not Operate When Operated From The Door Lock Key SW-Driver's Side



9. Door Lock Does Not Operate When Operated From The Door Lock Key SW-Passenger's Side



Power Window

General Description

The circuit consists of (door lock &) power window switch for each of front windows, power window switch for rear doors and power window motors.

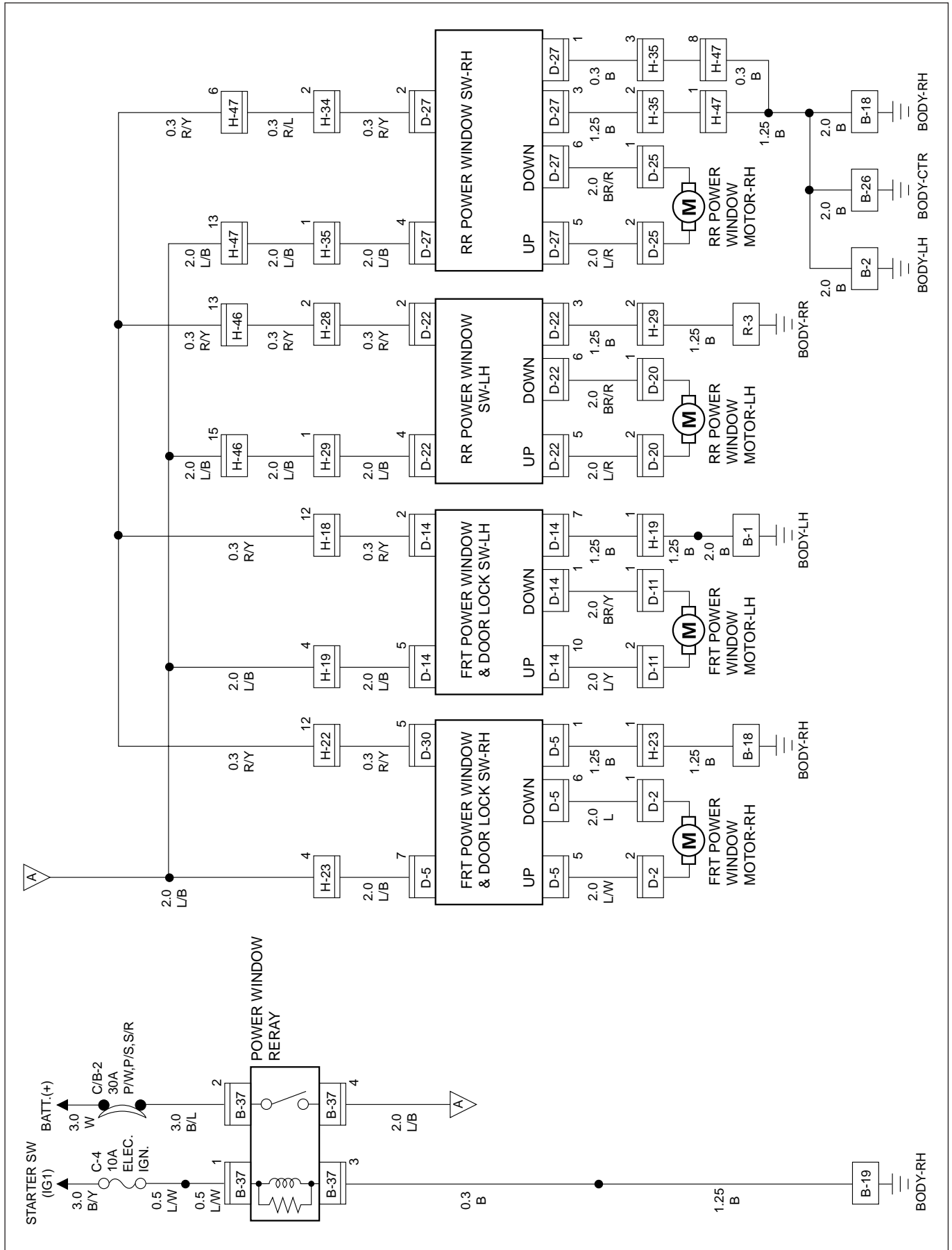
When starter switch is turned on, battery voltage is applied to each of power window switches through circuit breaker and power window relay on the circuit.

Driver's power window switch has "ONE TOUCH" function for driver's side window.

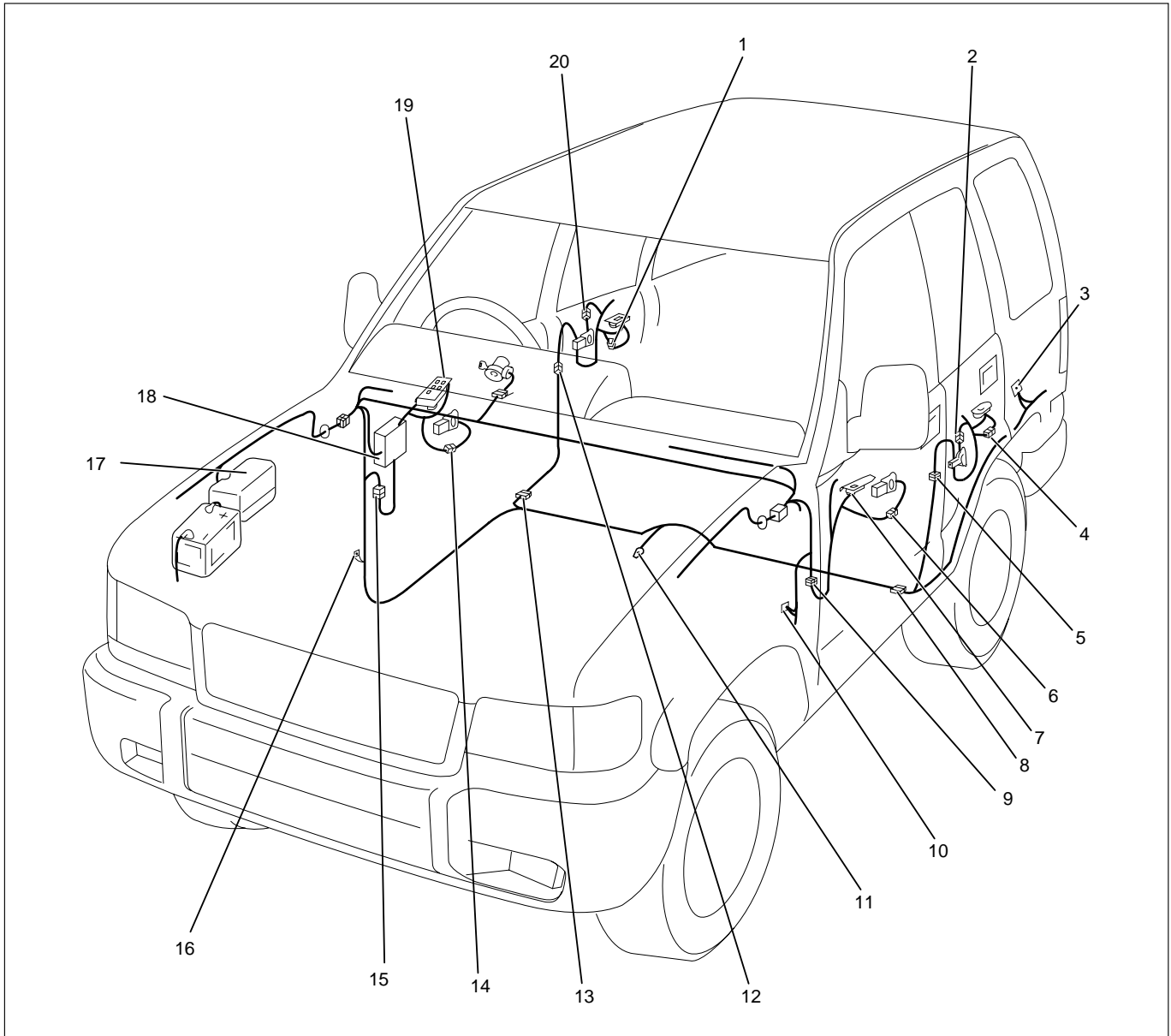
This function opens driver's side window fully by just setting the switch to "AUTO" position.

When lock switch on driver's side power window switch is depressed, battery voltage to passenger's power window switches are shut off. So, even if these switches are operated, power window motor does not operate.

Circuit Diagram (RHD)



Parts Location (RHD)

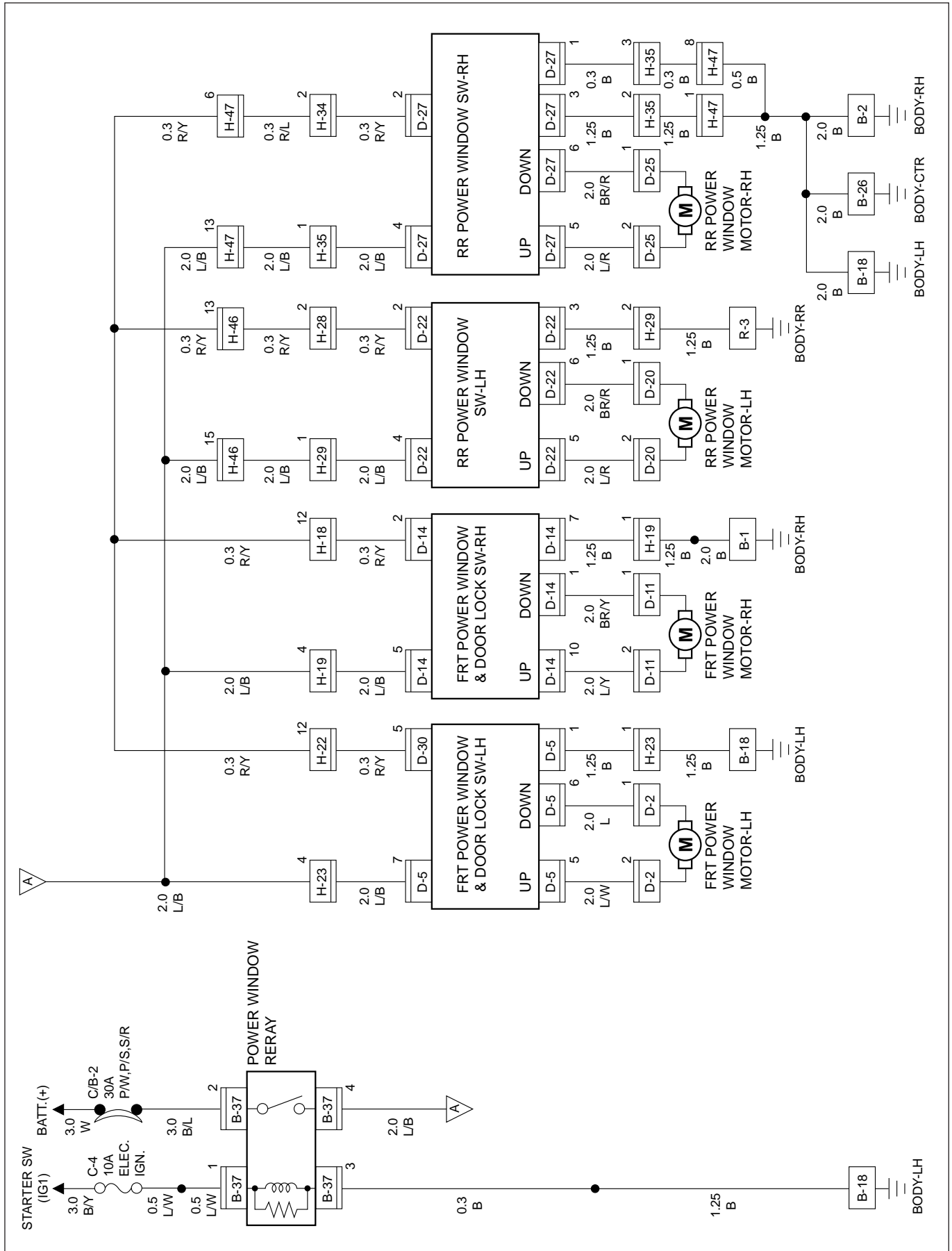


D08RW883

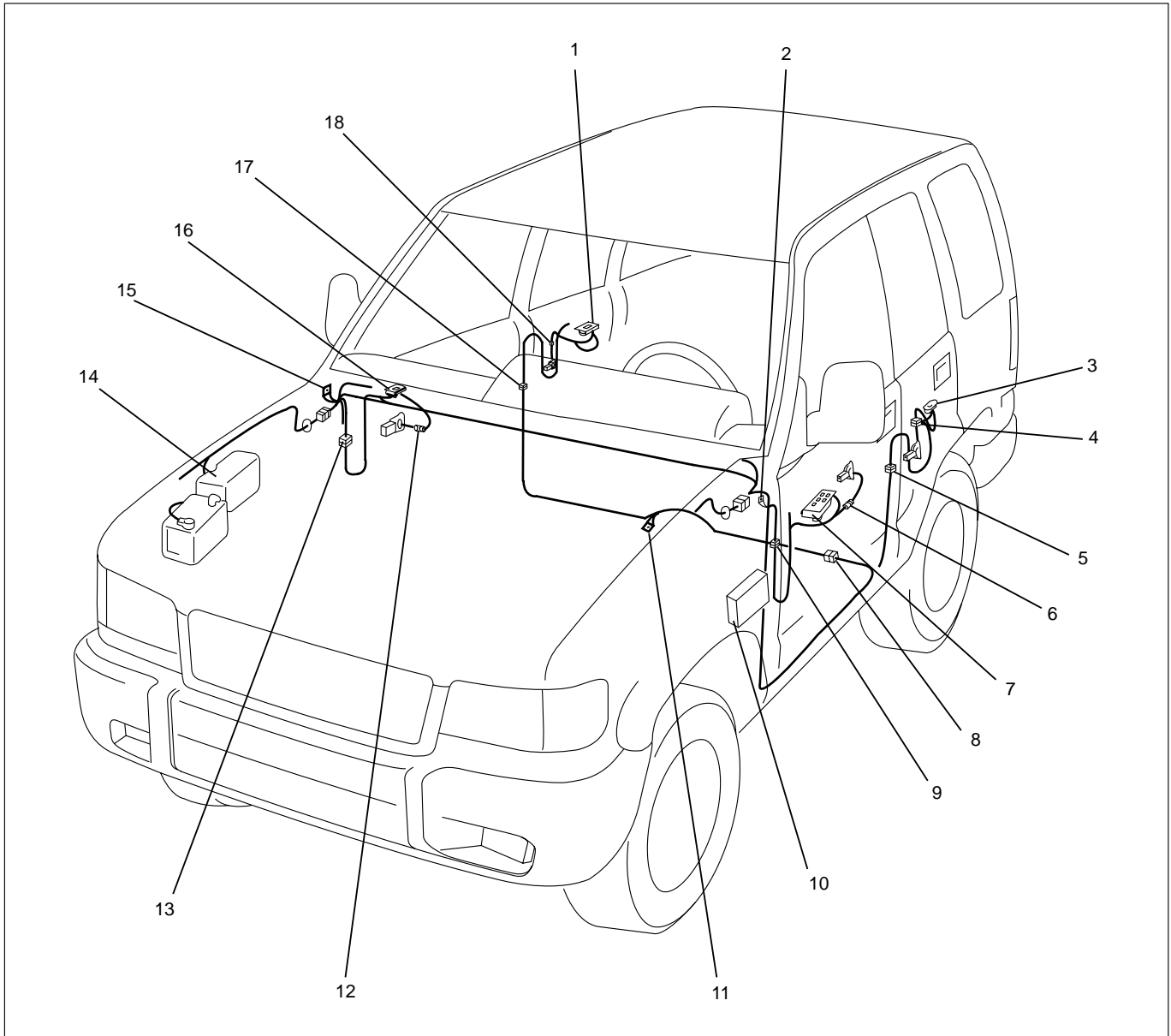
Legend

- | | |
|----------------|-------------------------|
| (1) D-27 | (11) B-26 |
| (2) D-20 | (12) H-34, H-35 |
| (3) R-3 | (13) H-47 |
| (4) D-22 | (14) D-2 |
| (5) H-28, H-29 | (15) H-22, H-23 |
| (6) D-11 | (16) B-18, B-19 |
| (7) D-14 | (17) Relay and Fuse Box |
| (8) H-46 | (18) Fuse Box (B-37) |
| (9) H-18, H-19 | (19) D-5, D-30 |
| (10) B-1, B-2 | (20) D-25 |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RW882

Legend

- | | |
|----------------|-------------------------|
| (1) D-27 | (10) Fuse Box (B-37) |
| (2) B-18, B-19 | (11) B-26 |
| (3) D-22 | (12) D-11 |
| (4) D-20 | (13) H-18, H-19 |
| (5) H-28, H-29 | (14) Relay and Fuse Box |
| (6) D-2 | (15) B-2 |
| (7) D-5, D-30 | (16) D-14 |
| (8) H-46 | (17) H-34, H-35 |
| (9) H-22, H-23 | (18) D-25 |

Diagnosis

All Windows Do Not Operate

STEP	ACTION	VALUE(S)	YES	NO
1	Is the fuse C-4 normal?	–	Go to step 2	Replace the fuse
2	Is the circuit breaker C/B-2 normal?	–	Go to step 3	Replace the circuit breaker
3	Is B-19 grounded securely?	–	Go to step 4	Ground it securely
4	Disconnect the power window relay connector B-37. Is the battery voltage applied between harness side connector B-37 terminal 2 and the ground?	Approx. 12V	Go to step 6	Go to step 5
5	Repair an open circuit between the circuit breaker C/B-2 and connector B-37 terminal 2. Is the action complete?	–	Go to step 4	–
6	Turn the starter switch on Is the battery voltage applied between harness side connector B-37 terminal 1 and the ground?	Approx. 12V	Go to step 8	Go to step 7
7	Repair an open circuit between the fuse C-4 and connector B-37 terminal 1. Is the action complete?	–	Go to step 6	–
8	Is there continuity between harness side connector B-37 terminal 3 and the ground B-19?	–	Replace the relay	Go to step 9
9	Repair an open circuit between connector B-37 terminal 3 and the ground B-19. Is the action complete?	–	Verify repair	–

Window On The Driver's Side Does Not Operate

STEP	ACTION	VALUE(S)	YES	NO
1	Is B-18 grounded securely?	-	Go to step 2	Ground it securely
2	Is there continuity between harness side connector D-5 terminal 1 and the ground B-18?	-	Go to step 4	Go to step 3
3	Repair an open circuit between connector D-5 terminal 1 and the ground B-18. Is the action complete?	-	Go to step 2	-
4	Turn the starter switch on. Is the battery voltage applied between harness side connector D-5 terminal 7 and the ground?	Approx. 12V	Go to step 6	Go to step 5
5	Repair an open circuit between connector B-37 terminal 4 and connector D-5 terminal 7. Is the action complete?	-	Go to step 4	-
6	Connect the battery positive terminal with harness side connector D-5 terminal 5 or 6, and the negative terminal with harness side connector D-5 terminal 6 or 5. Does the motor operate?	-	Replace the front power window & door lock switch-RH	Go to step 7
7	1. Disconnect the front power window motor-RH connector D-2. 2. Connect the battery positive terminal with the motor side connector D-2 terminal 1 or 2, and connect the battery negative terminal with the motor side connector D-2 terminal 2 or 1. Does the motor operate?	-	Go to step 8	Replace the motor
8	Repair an open circuit between the front power window & door lock switch-RH and the front power window motor-RH. Is the action complete?	-	Verify repair	-

Window On The Front Passenger's Side Does Not Operate

STEP	ACTION	VALUE(S)	YES	NO
1	Is B-1 grounded securely?	–	Go to step 2	Ground it securely
2	Disconnect the front power window & door lock switch-LH connector D-14. Is there continuity between harness side connector D-14 terminal 7 and the ground B-1?	–	Go to step 4	Go to step 3
3	Repair an open circuit between connector D-14 terminal 7 and the ground B-1. Is the action complete?	–	Go to step 2	–
4	Turn the starter switch on. Is the battery voltage applied between harness side connector D-14 terminal 5 and the ground?	Approx. 12V	Go to step 6	Go to step 5
5	Repair an open circuit between connector B-37 terminal 4 and connector D-14 terminal 5. Is the action complete?	–	Go to step 4	–
6	Connect the battery positive terminal with harness side connector D-14 terminal 10 or 1, and connect the battery negative terminal with harness side connector D-14 terminal 1 or 10. Does the motor operate?	–	Replace the front power window & door lock switch-LH	Go to step 7
7	1. Disconnect the front power window motor-LH connector D-11. 2. Connect the battery positive terminal with the motor side connector D-11 terminal 1 or 2, and connect the battery negative terminal with the motor side connector D-11 terminal 2 or 1. Does the motor operate?	–	Go to step 8	Replace the motor
8	Repair an open circuit between the front power window & door lock switch-LH and the front power window motor-LH. Is the action complete?	–	Verify repair	–

Rear Window On The Left (or Right) Side Does Not Operate

STEP	ACTION	VALUE(S)	YES	NO
1	1. Disconnect the rear power window switch–LH connector D–22 or the rear power window & door lock switch–RH connector D–27. 2. Turn the starter switch on. Is the battery voltage applied between harness side connector D–22 terminal 4 and the ground, or harness side connector D–27 terminal 4 and the ground?	Approx. 12V	Go to step 3	Go to step 2
2	Repair an open circuit between connector B–37 terminal 4 and connector D–22 terminal 4 or connector D–27 terminal 4. Is the action complete?	–	Go to step 1	–
3	Is there continuity between harness side connector D–22 terminal 3 and the ground, or harness side connector D–27 terminal 3 and the ground?	–	Go to step 5	Go to step 4
4	Repair an open circuit between connector D–22 terminal 3 or connector D–27 terminal 3 and the ground. Is the action complete?	–	Go to step 3	–
5	Connect the battery positive terminal with harness side connector D–22 terminals 5 or harness side connector D–27 terminal 5, and connect the battery negative terminal with harness side connector D–22 terminal 6 or harness side connector D–27 terminal 6. Does the motor operate?	–	Replace the rear power window switch–LH or –RH	Go to step 6
6	1. Disconnect the rear power window motor connector D–20 or D–25. 2. Connect the battery positive terminal with motor side connector D–20 or D–25 terminal 1 or 2, and connect the battery negative terminal with the motor side connector D–20 or D–25 terminal 2 or 1. Does the motor operate?	–	Go to step 7	Replace the motor
7	Repair an open circuit between the rear power window switch and the rear power window motor. Is the action complete?	–	Verify repair	–

Window on the Front Passenger's Side Does Not Operate by the Front Power Window & Door Lock Switch – RH

STEP	ACTION	VALUE(S)	YES	NO
1	Disconnect the front power window & door lock switch–RH connector D–30 and the front power window & door lock switch–RH connector D–14. Is there continuity between harness side connector D–30 terminal 5 and harness side connector D–14 terminal 2?	–	Replace the front power window & door lock switch–RH	Go to step 2
2	Repair an open circuit between connector D–30 terminal 5 and connector D–14 terminal 2. Is the action complete?	–	Verify repair	–

Lock SW Does Not Function

STEP	ACTION	VALUE(S)	YES	NO
1	Repair or replace the front power window & door lock switch–RH. Is the action complete?	–	Verify repair	–

Cruise Control

General Description

The circuit consists of cruise control unit, cruise main switch, combination switch, clutch switch (M/T), mode switch (A/T), brake switch, actuator and indicator lights.

Cruise control system keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received.

When the cruise main switch is turned on with the vehicle in the running mode, the battery voltage is applied to the control unit.

When a signal from the combination switch is input to the control unit while vehicle is in this state, the actuator is activated to operate the system. Also, while the system is operating, the cruise indicator light in the meter panel lights up.

Set Function

When the cruise main switch turned on and the set switch is depressed with the vehicle speed within the set limit and cancel operation is refused, the vehicle speed when the set switch is released is stored in the control unit as the set speed. But in case of the vehicle speed is over maximum limit speed of cruise control, maximum limit speed in the control unit is stored as the set speed.

Resume Function

Unless the vehicle speed falls below the minimum speed limit after canceling the set speed by the cancel switch, pushing the resume switch causes the vehicle to resume the speed before cancellation.

Acceleration Function

During cruise control driving, pushing the acceleration switch (on time is more than 0.6 sec.) causes an increase in cruise speed and vehicle accelerates at a controlled rate until acceleration switch released.

Vehicle speed at the acceleration switch released plus 1.0 km/h is stored in the control unit as the set speed.

Tap up Function

During cruise control driving, pushing the coast switch (on time is more than 0.6 sec.) causes a decrease in cruise speed and the vehicle decelerate at a controlled rate until coast switch released.

Vehicle speed at the coast switch released minus approx. 1.0 km/h is stored in the control unit as the set speed.

Tap down Function

During cruise control driving, the set speed can be lowered approx. 1.0 km/h each time by operating the coast switch quickly within 0.6 sec.

Cancel Function

During cruise control driving, the cruise control is released if the control unit receives a signal from the cancel switch, mode switch, clutch switch or brake switch. The set speed is still stored.

Down Cancel Function

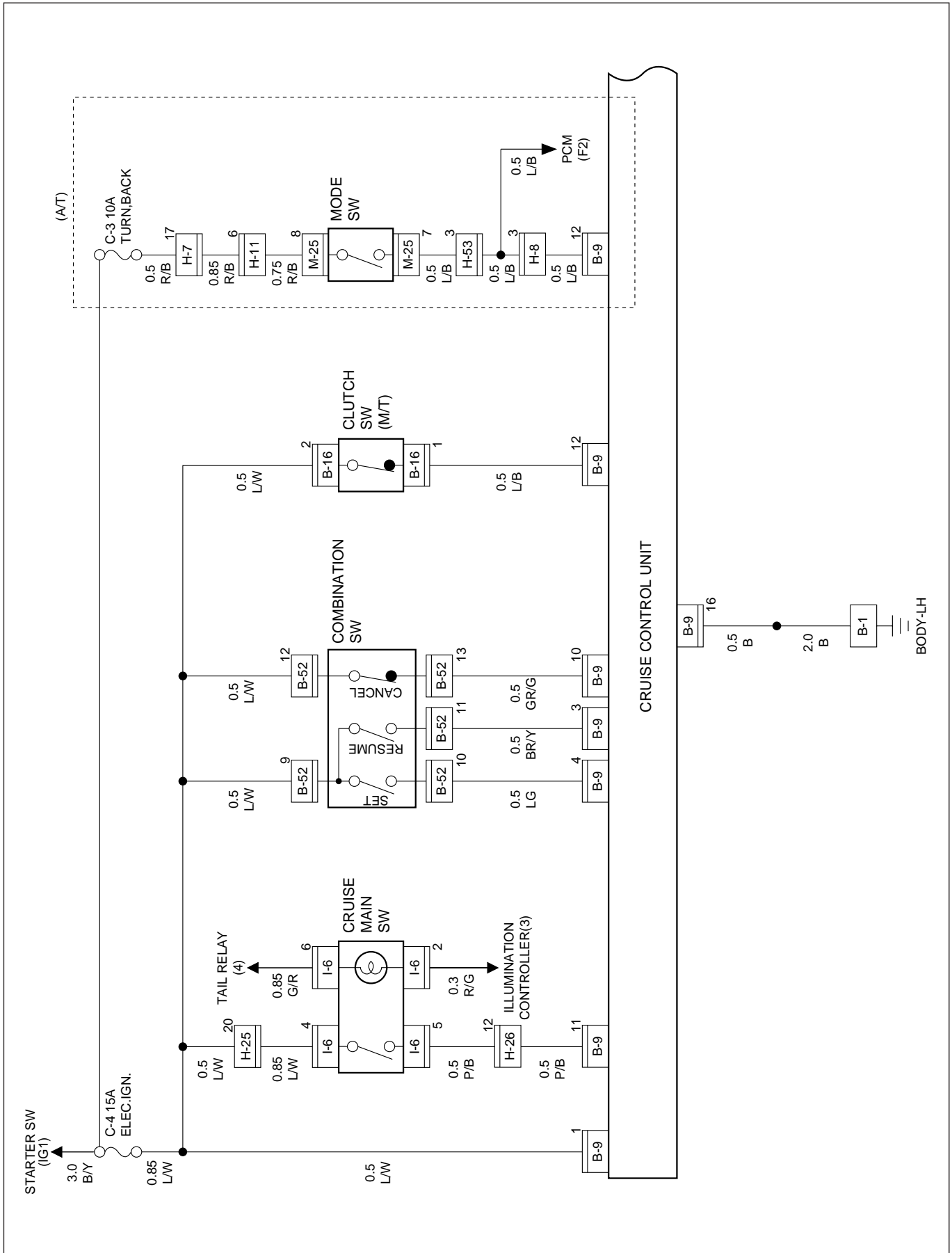
The cruise control is canceled when the vehicle speed becomes the set speed minus 20 km/h during the cruise control working and the set speed is erased.

Over Drive (OD) Cancel Function

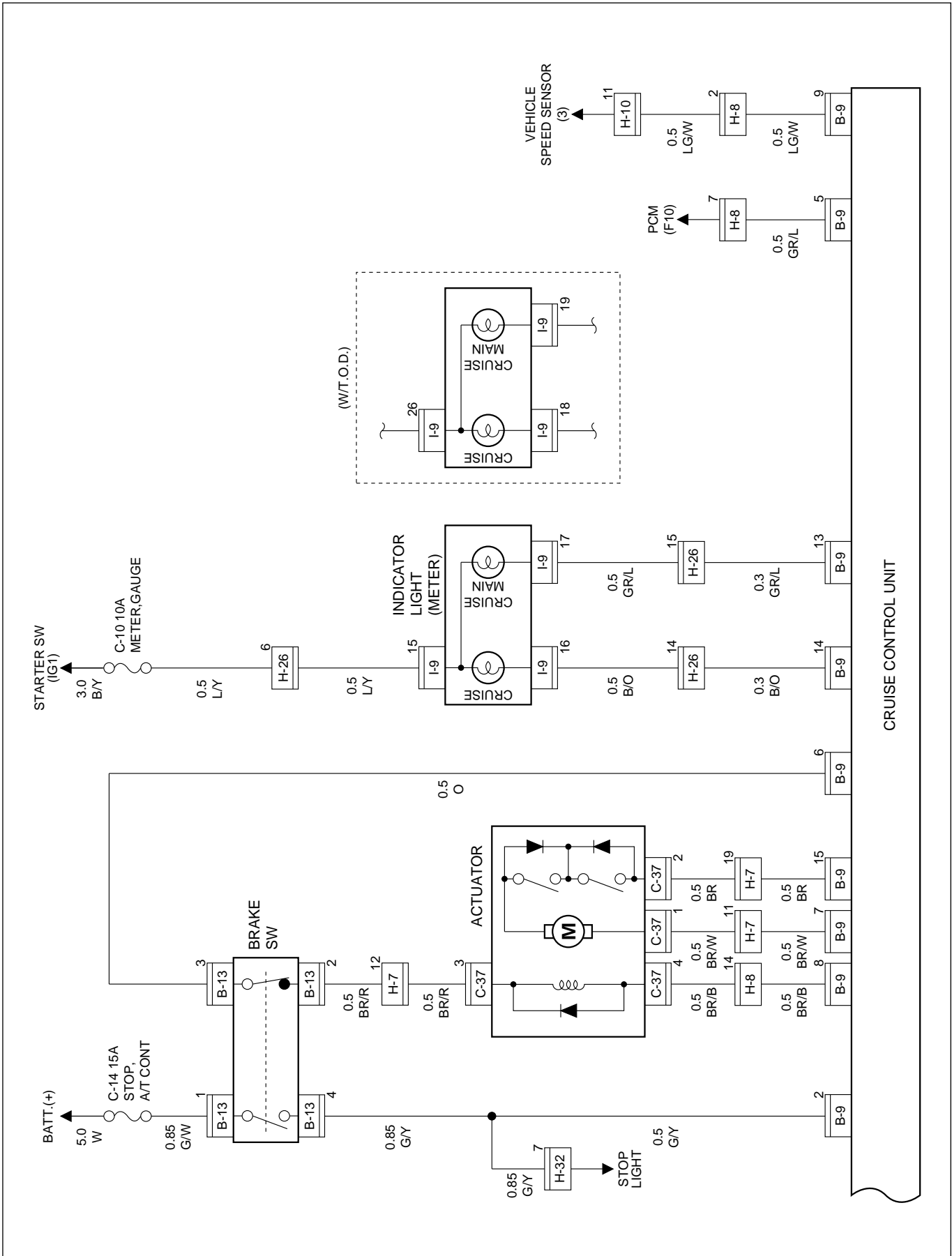
OD cancel function is required when the vehicle speed becomes the set speed minus 3 km/h during the cruise control working.

OD cancel function is enabled when the acceleration function and/or resume function are working except the vehicle speed is in more than 120 km/h.

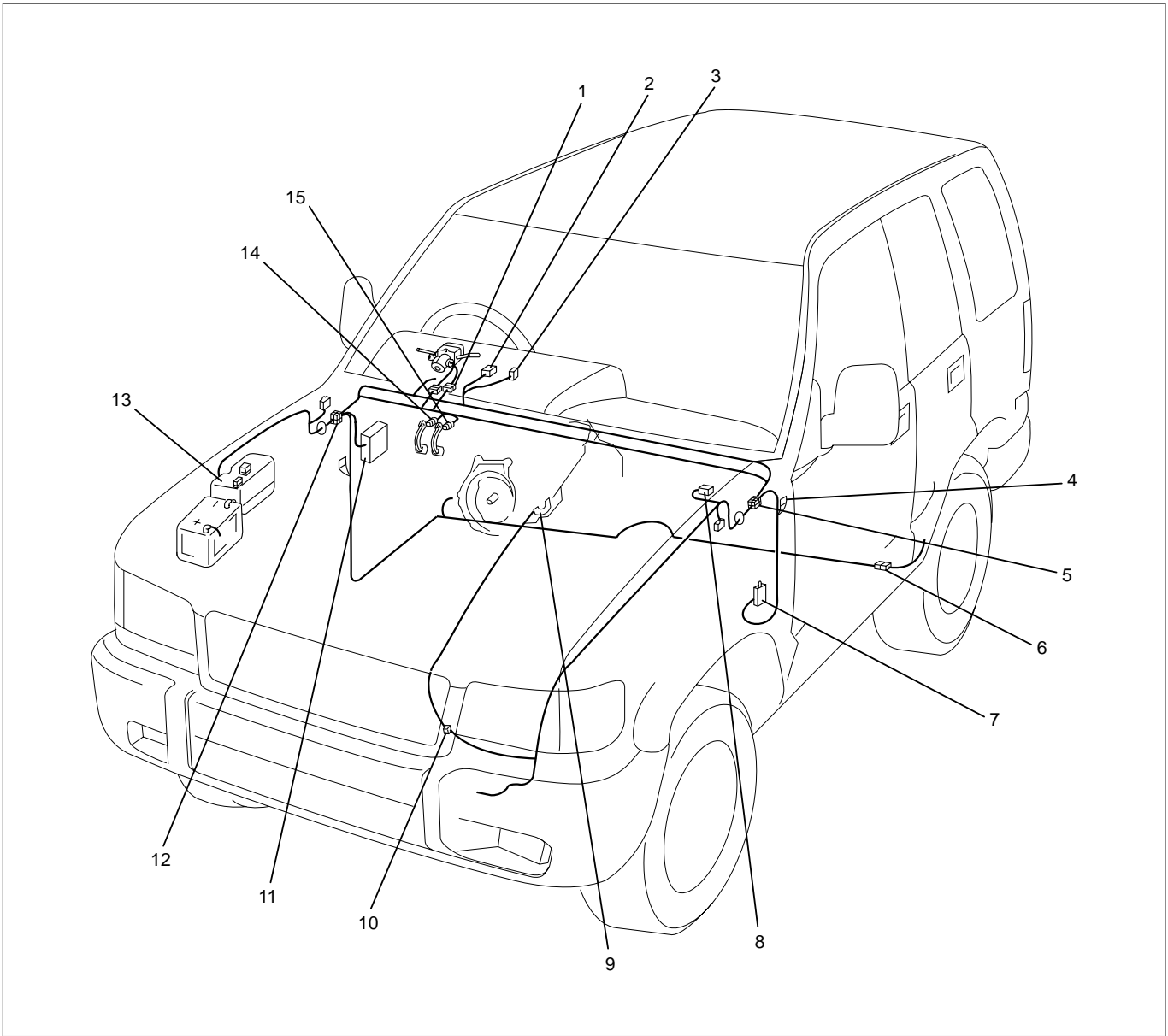
Circuit Diagram (RHD)-1



Circuit Diagram (RHD)-2



Parts Location (RHD)

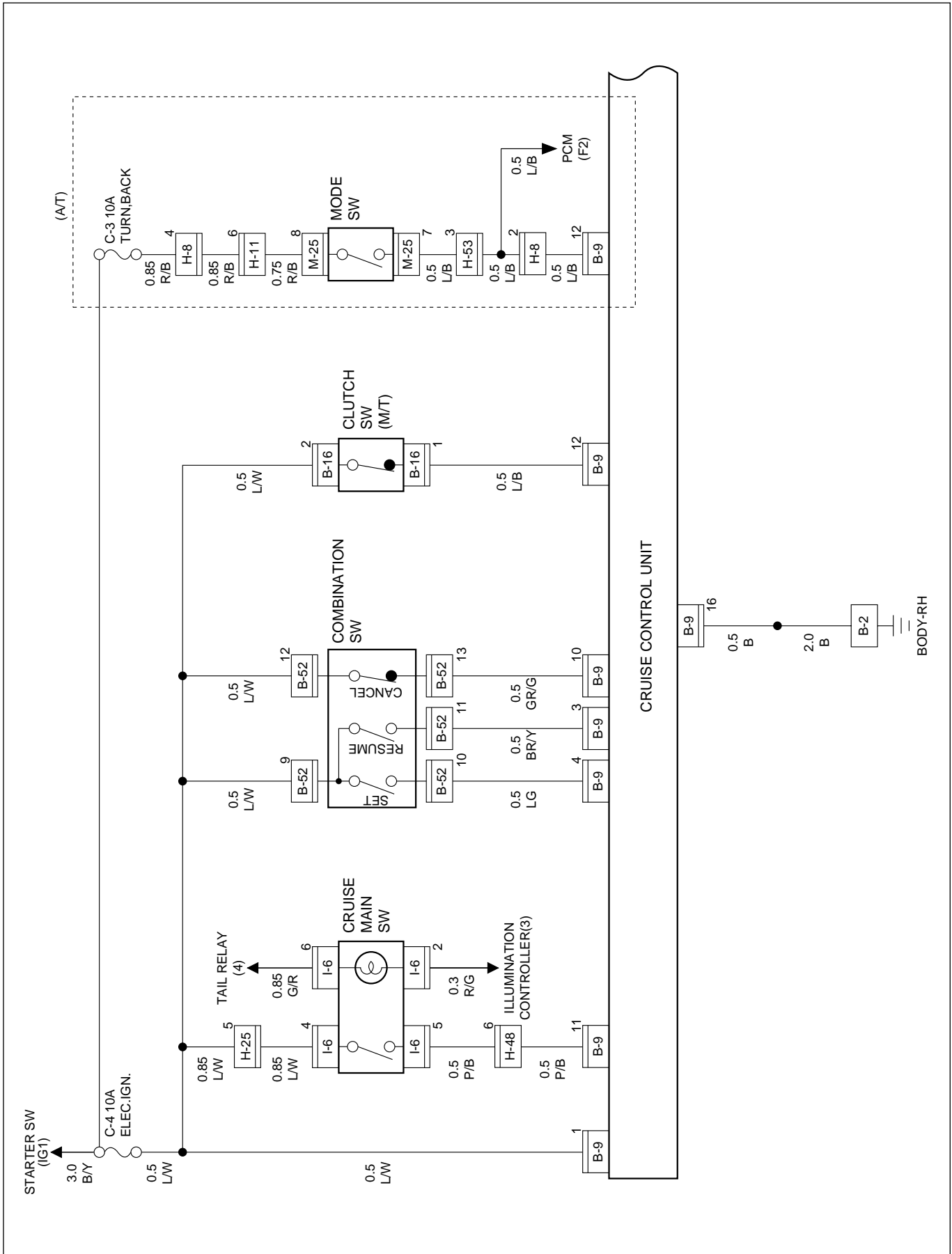


D08RW941

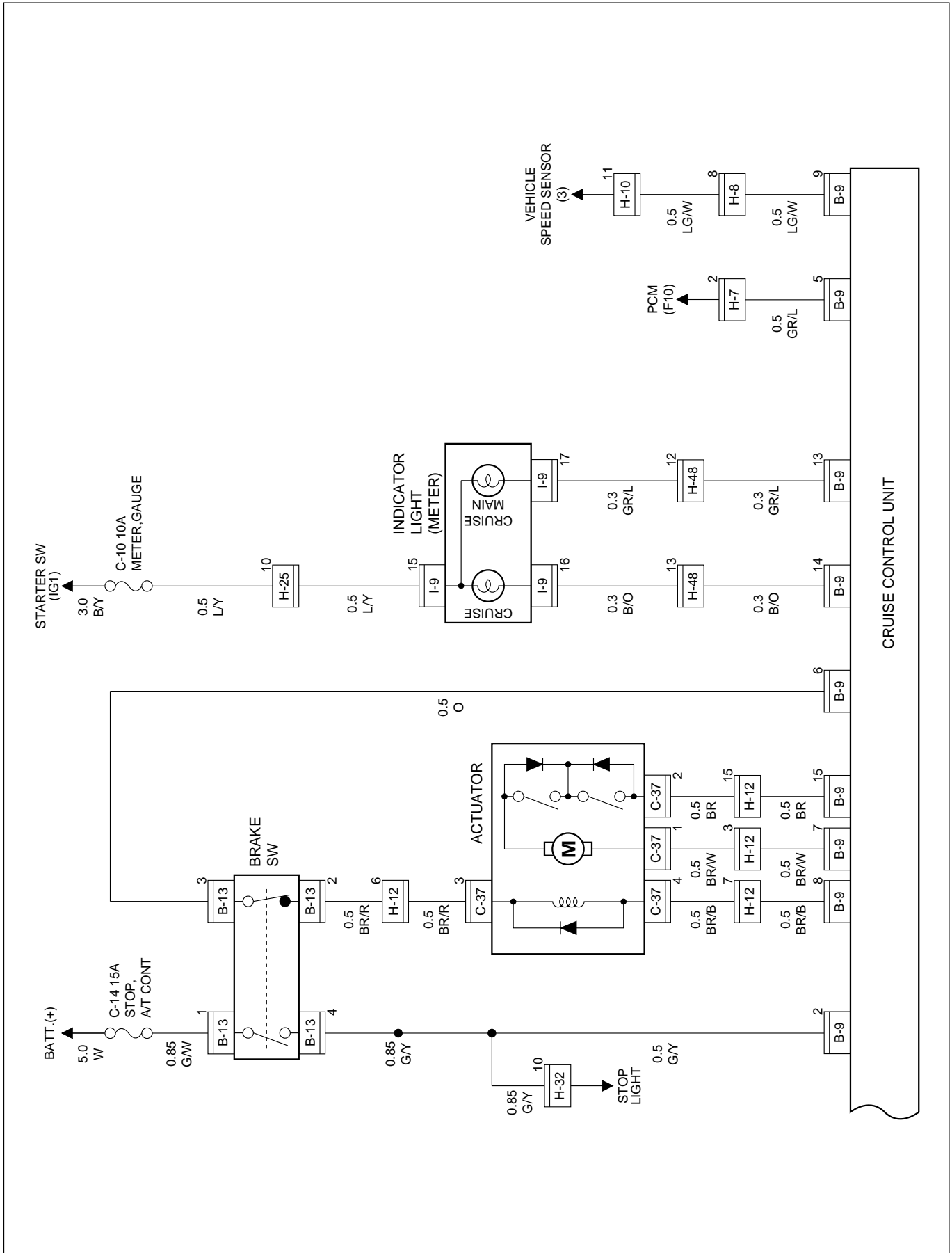
Legend

- | | |
|------------------------------|----------------------------|
| (1) B-52 | (8) C-37 |
| (2) I-9 | (9) Mode Switch A/T (M-25) |
| (3) I-6 | (10) H-10, H-11, H-53 |
| (4) B-1 | (11) Fuse Box |
| (5) H-7, H-8 | (12) H-25, H-26 |
| (6) H-32 | (13) Relay and Fuse Box |
| (7) Cruis Control Unit (B-9) | (14) B-13 |
| | (15) B-16 |

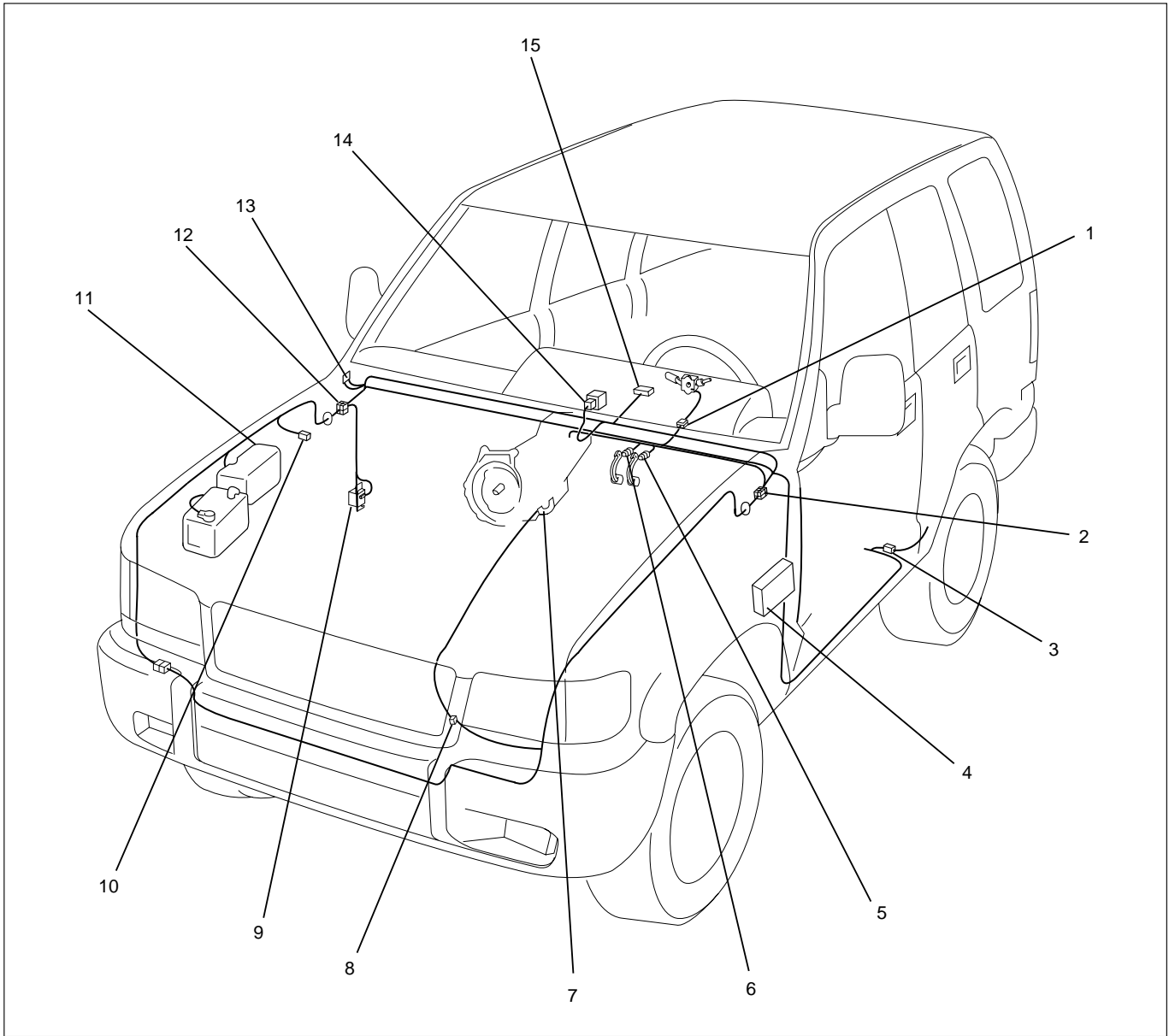
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW394

Legend

- | | |
|------------------------|-------------------------------|
| (1) B-52 | (8) H-10, H-11, H-53 |
| (2) H-7, H-8, H-25 | (9) Cruise Control Unit (B-9) |
| (3) H-32 | (10) C-37 |
| (4) Fuse Box | (11) Relay and Fuse Box |
| (5) B-16 | (12) H-12, H-48 |
| (6) B-13 | (13) B-2 |
| (7) Mode Switch (M-25) | (14) I-6 |
| | (15) I-9 |

Diagnosis

The cruise control unit uses the cruise main indicator light and diagnoses the failure, when the control unit detects abnormality on the table below.

PART	POSSIBLE CAUSE	DETECTION PERIOD	DTC
Actuator	Motor system short circuit	Energizing motor	1-1
	Clutch system short circuit	Energizing clutch	1-2
	Clutch system open circuit	Energizing clutch	1-2
	Mechanical defect	Cruise controlling	1-3
	Close side of motor system open circuit	Cruise controlling	1-1
Cruise control unit	Open side of motor system continuously energizing	While starter sw on	1-4
	Clutch output abnormality	While starter sw on	1-4
Vehicle speed sensor	Signal of vehicle speed disconnection	Cruise controlling	2-1
	Signal of vehicle speed abnormality	Cruise controlling	2-1
Switch	Turning on switch at all times	While starter sw on	3-1
	Turning on switch at the same time.	While starter sw on	3-1

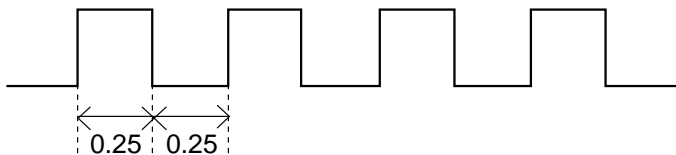
DTC: Diagnostic Trouble Code

DTC Display Condition

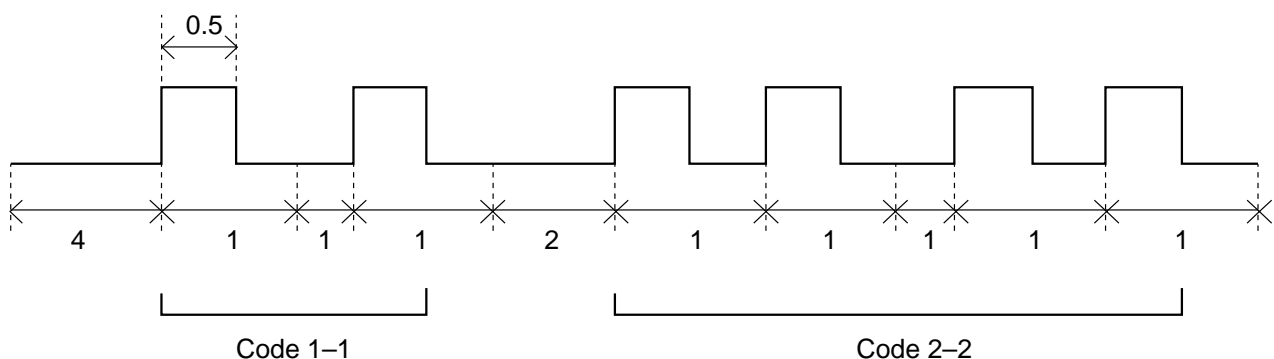
1. While starter switch on and vehicle speed is 0 km/h, the DTC output begins in top priority by cancel switch turn on and off being repeated three times for 2 sec. while cruise main switch pushing on, and stops the DTC output whether vehicle speed is more than 10 km/h or the resume switch is turned on.
2. The cruise control unit outputs the DTC(s) in order from small figure of the code.
3. The header of display of DTC(s) is assumed 4 sec., and it is 2 sec. between different kind of codes.
4. The DTC(s) are erased with the starter switch turned off.

DTC Display Format

1. When no DTCs are detected. (The unit : sec.)



2. When two or more DTCs are detected. (The unit ; sec.)



DTC 1-1 Motor System Short Circuit

STEP	ACTION	VALUE(S)	YES	NO
1	1. Turn the starter switch off. 2. Disconnect the actuator connector C-37. 3. Measure resistance between actuator side connector terminal 1 and 2. NOTE: If control plate position is fully opened or fully closed, resistance can not be measured. Is the resistance within range specified in the value(s) column?	More than 4.2Ω	Go to step 2	Replace the actuator
2	Measure continuity between harness side connector C-37 terminal 1 and the ground, terminal 2 and the ground, and terminal 1 and 2. Are the results same as specified in the value(s) columns?	No continuity	Replace the control unit	Repair or replace the harness

DTC 1-2 Clutch System Open or Short Circuit

STEP	ACTION	VALUE(S)	YES	NO
1	1. Turn the starter switch off. 2. Disconnect the actuator connector C-37. 3. Measure resistance between actuator side connector terminal 3 and 4. Is the resistance within range specified in the value(s) column?	34.7 – 42.4Ω	Go to step 2	Replace the actuator
2	1. Disconnect the brake switch connector B-13. 2. Check continuity between switch side connector terminal 2 and 3. Is there continuity between terminals?	–	Go to step 3	Adjust the switch or replace it
3	1. Reconnect the brake switch connector B-13. 2. Check continuity between harness side connector B-9 terminal 6 and connector C-37 terminal 3, connector C-37 terminal 4 and connector B-9 terminal 8. Is there continuity between terminals?	–	Go to step 4	Repair open circuit
4	Is there continuity between harness side connector C-37 terminal 3 and the ground, connector C-37 terminal 4 and the ground, connector B-9 terminal 6 and the ground? Are the results same as specified in the value(s) column?	No continuity	Replace the control unit	Repair short circuit

DTC 1-3 Mechanical Defect

STEP	ACTION	VALUE(S)	YES	NO
1	1. Turn the starter switch off. 2. Disconnect the actuator connector C-37. 3. Connect the battery positive terminal with the actuator side connector terminal 3 and the battery negative terminal with terminal 4. Does the control plate move by hand?	-	Replace the actuator	Go to step 2
2	Connect the battery positive terminal with the actuator side connector terminal 1 and 3, and the battery negative terminal with terminal 2 and 4. Does the control plate move to full open side?	-	Go to step 3	Replace the actuator
3	Connect the battery positive terminal with the actuator side connector terminal 2 and 3, and the battery negative terminal with terminal 1 and 4. Does the control plate move to full close side?	-	Go to step 4	Replace the actuator
4	Is there continuity between harness side connector C-37 terminal 1 and connector B-9 terminal 7, connector C-37 terminal 2 and connector B-9 terminal 15?	-	Replace the control unit	Repair or replace harness

DTC 1-4 Open Side of Motor System Continuously Energizing

STEP	ACTION	VALUE(S)	YES	NO
1	1. Turn the starter switch off. 2. Disconnect the actuator connector C-37. 3. Measure resistance between actuator side connector terminal 1 and 2. NOTE: If control plate position is fully opened or fully closed, resistance can not be measured. Is there resistance within range specified in the value(s) column?	More than 4.2Ω	Go to step 2	Replace the actuator
2	Is there continuity between harness side connector C-37 terminal 1 and connector B-9 terminal 7, harness side connector C-37 terminal 2 and connector B-9 terminal 15?	–	Replace the control unit	Repair or replace harness

Anti-lock Brake System (ABS)

General Description

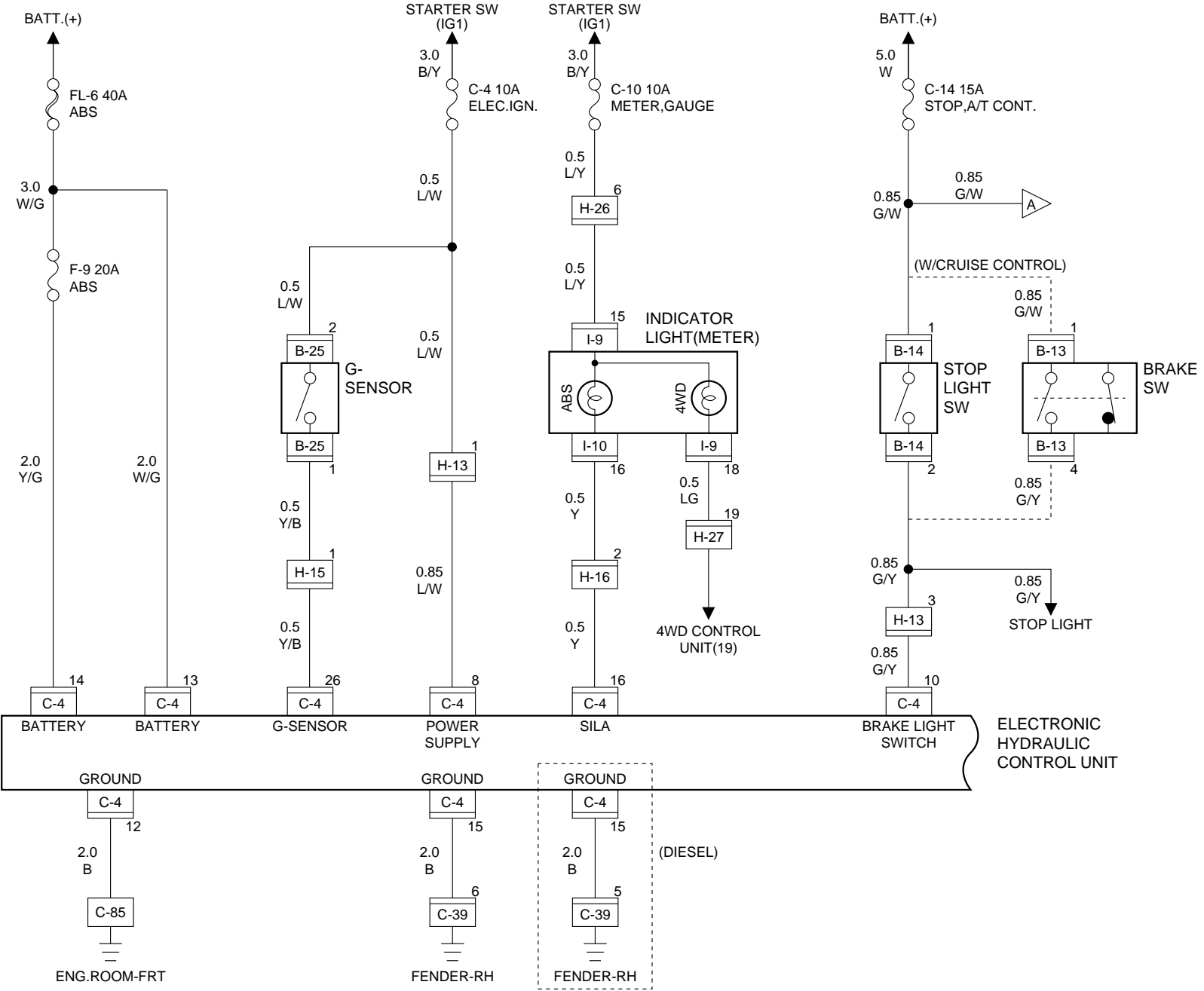
The circuit consists of EHCU (Electronic Hydraulic Control Unit), wheel speed sensor, G-sensor, stoplight switch or brake switch (w/cruise control), backup light switch, transmission switch-1, 2, indicator light and data link connector.

EHCU controls brake fluid pressure applied to front and rear wheels to prevent wheels from locking by using speed sensor and G-sensor signals.

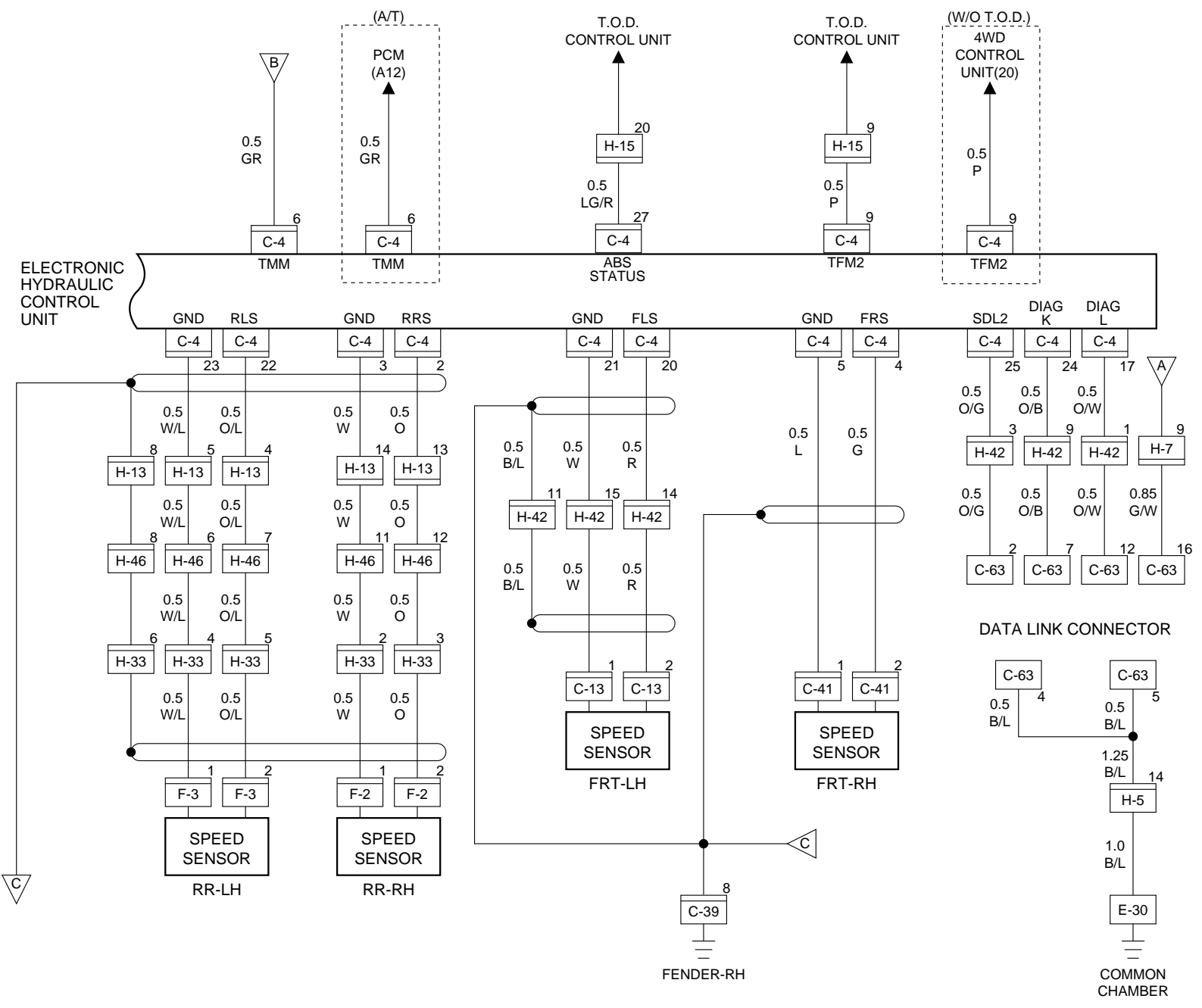
Based on wheel speed signals from speed sensor, EHCU activates solenoid valves incorporated into the control unit to increase, maintain or decrease brake fluid pressure.

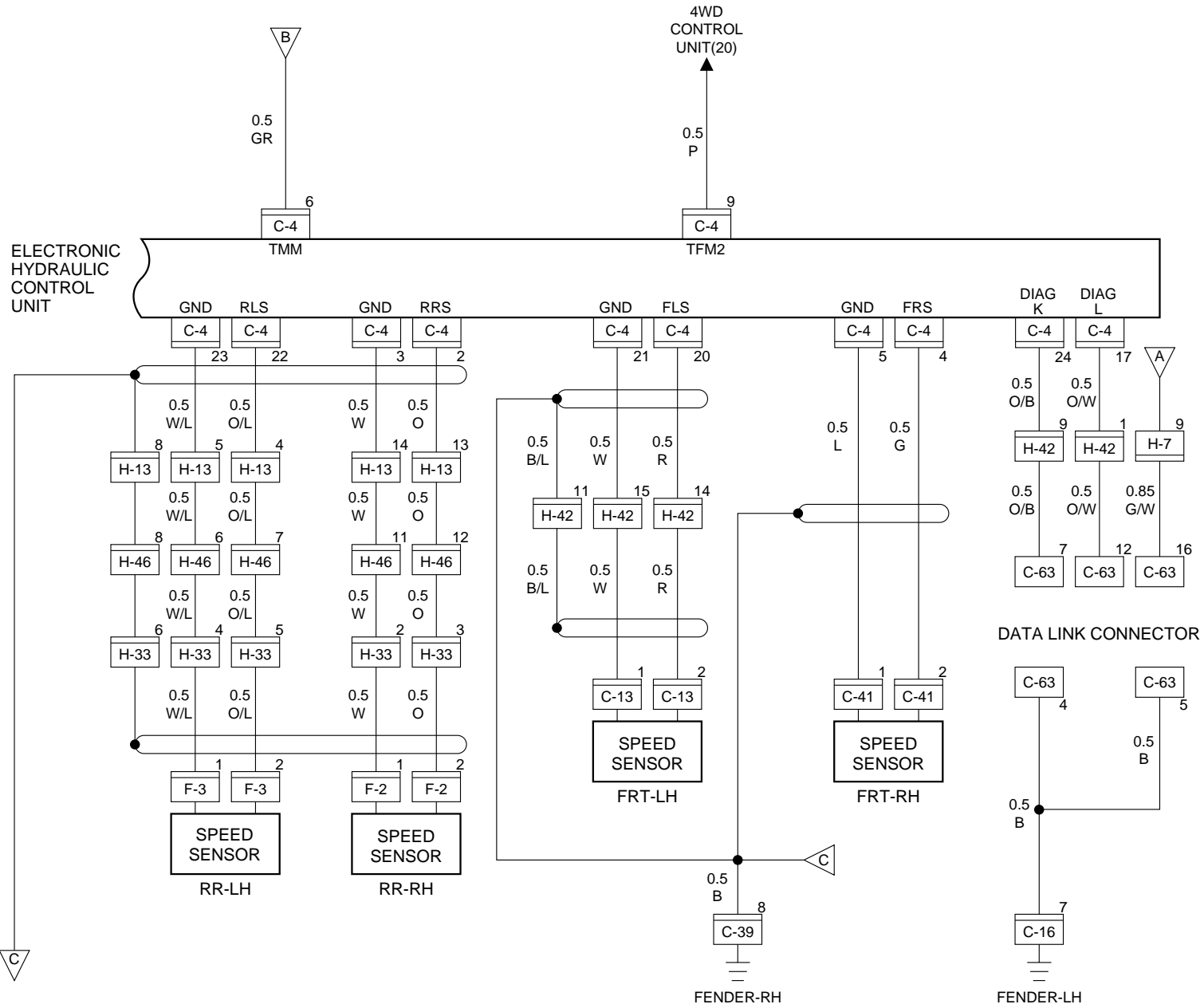
Refer to Anti-lock Brake System in Brakes section.

Circuit Diagram (RHD)-1

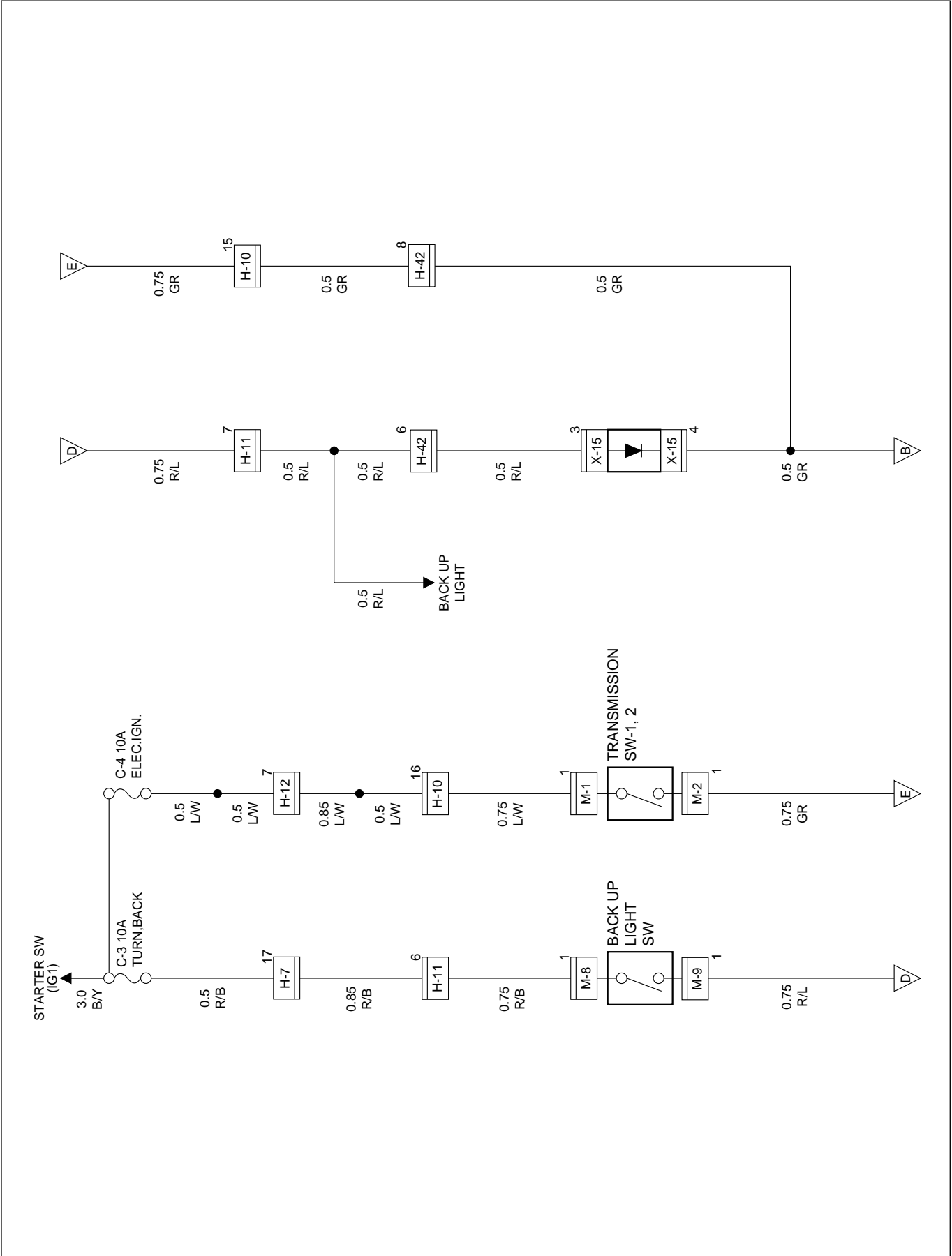


Circuit Diagram (RHD 6V*1)-2

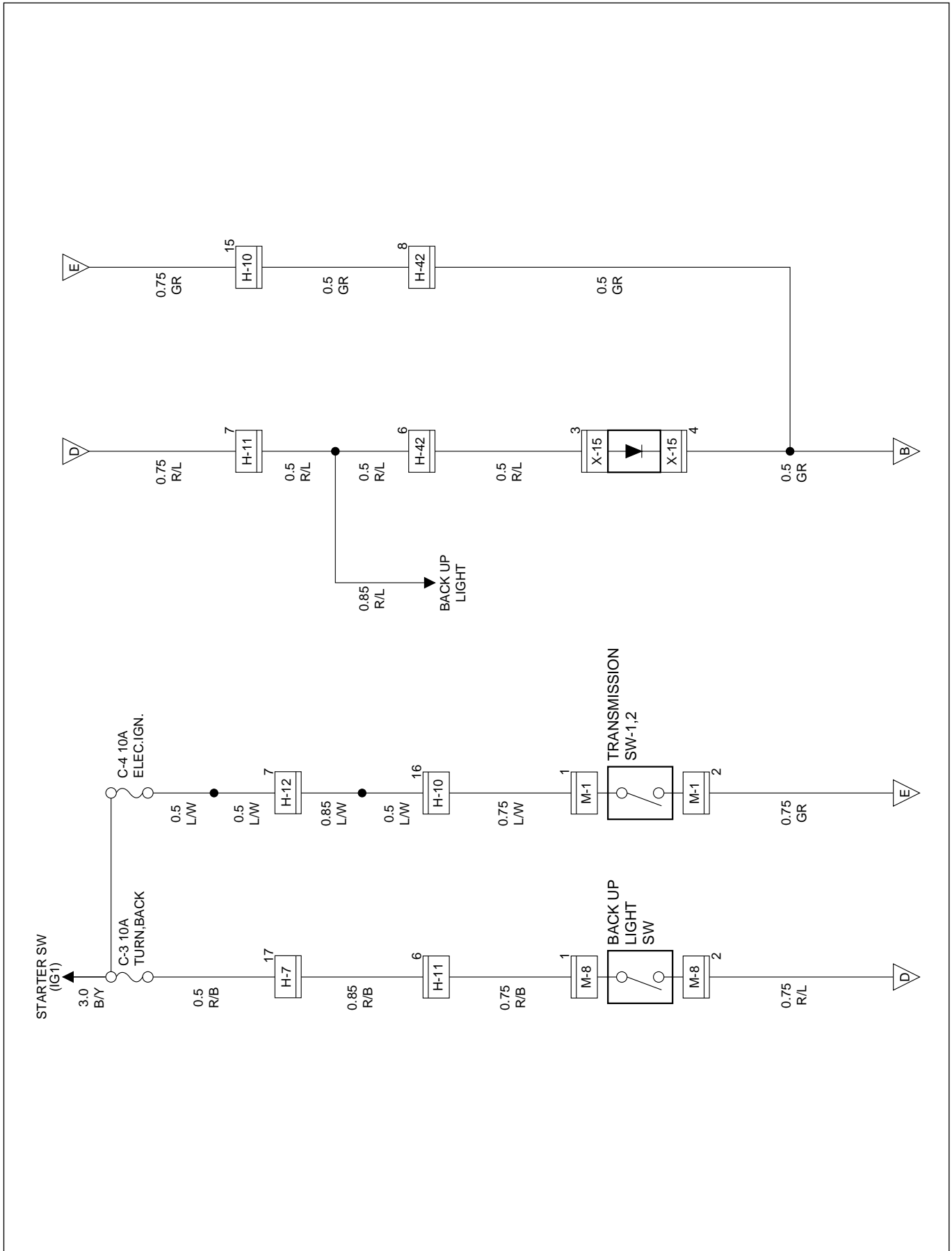




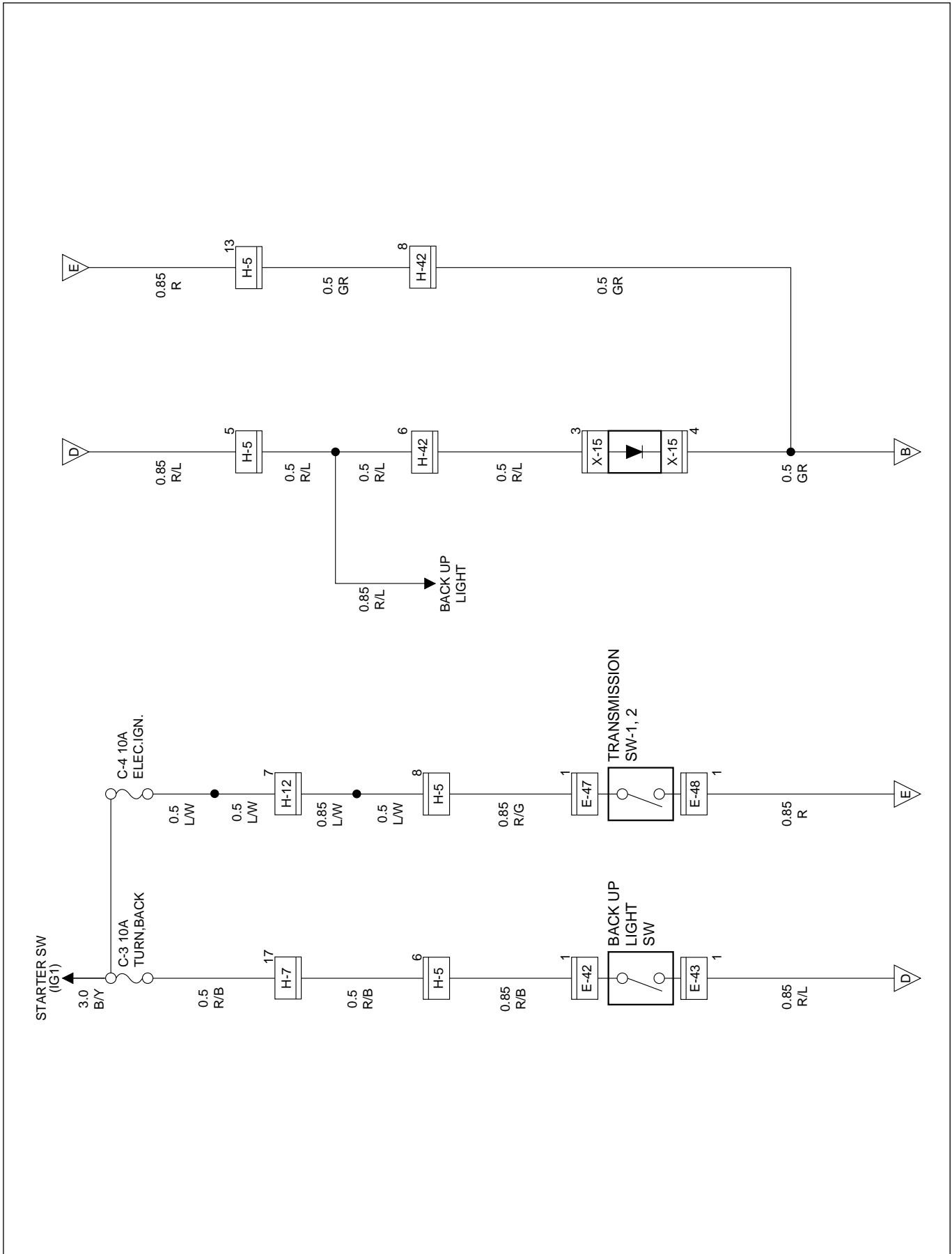
Circuit Diagram (RHD 6VD1)-3



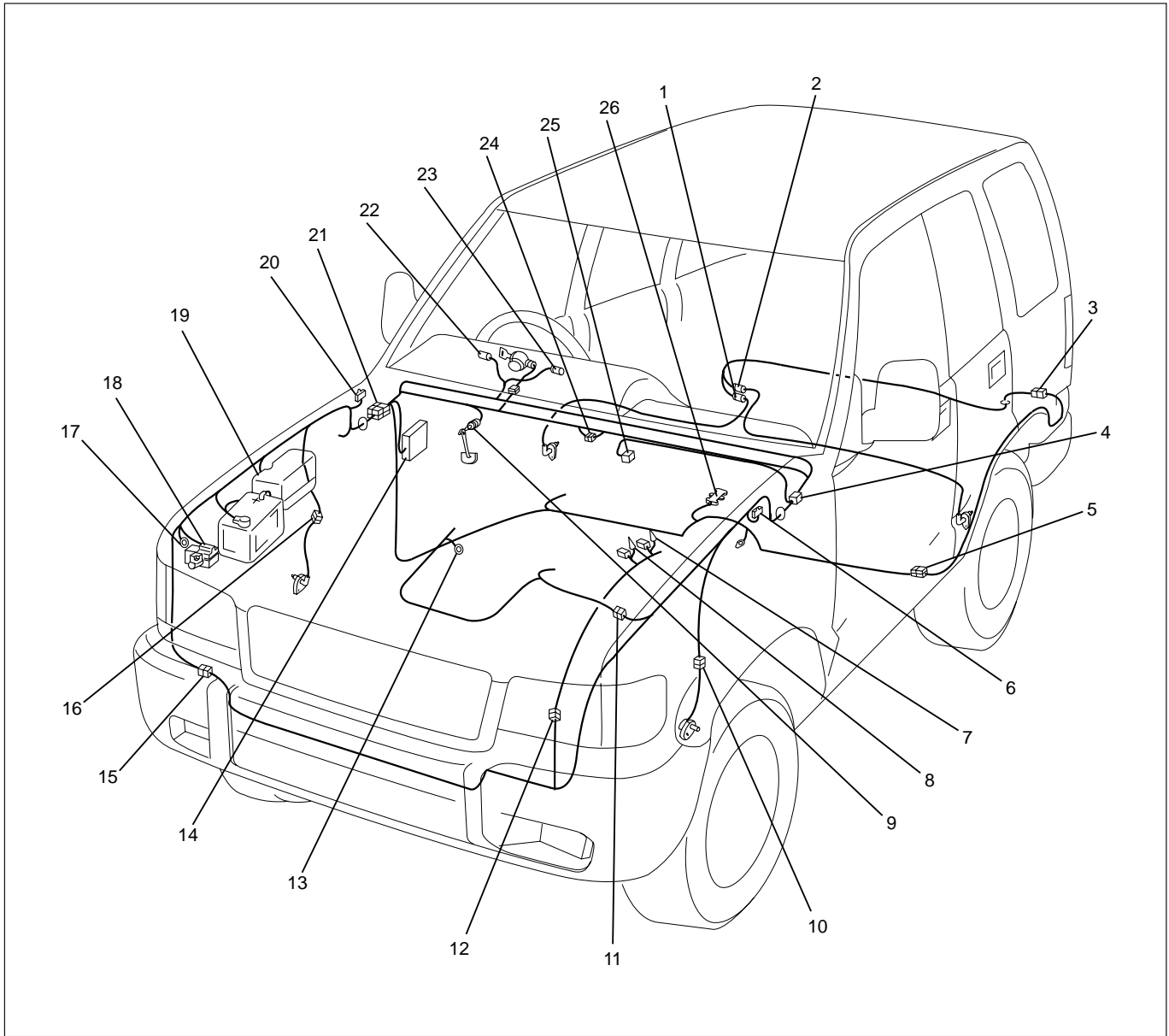
Circuit Diagram (RHD 6VE1)-3



Circuit Diagram (RHD 4J**)-3



Parts Location (RHD)

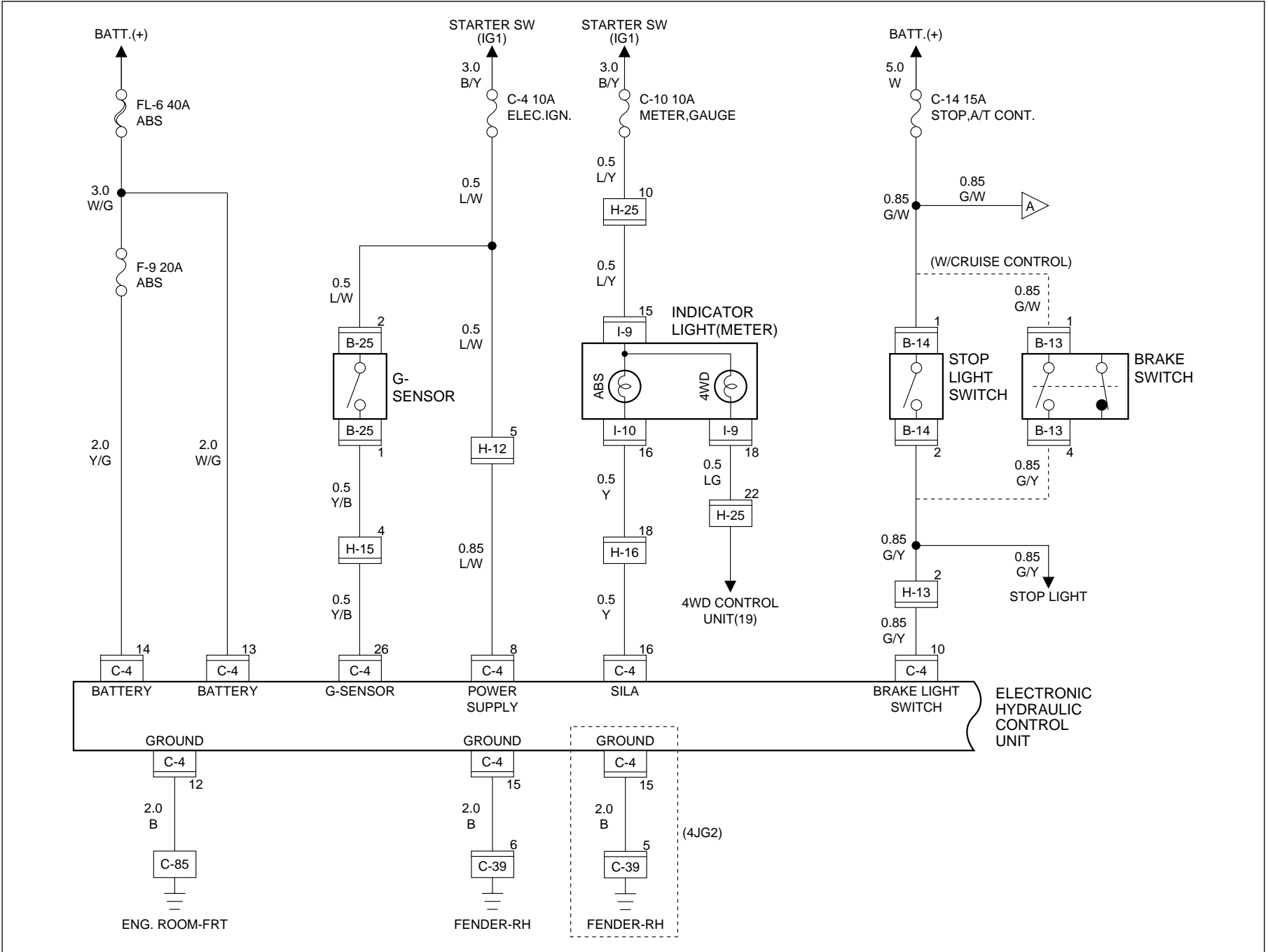


D08RW807

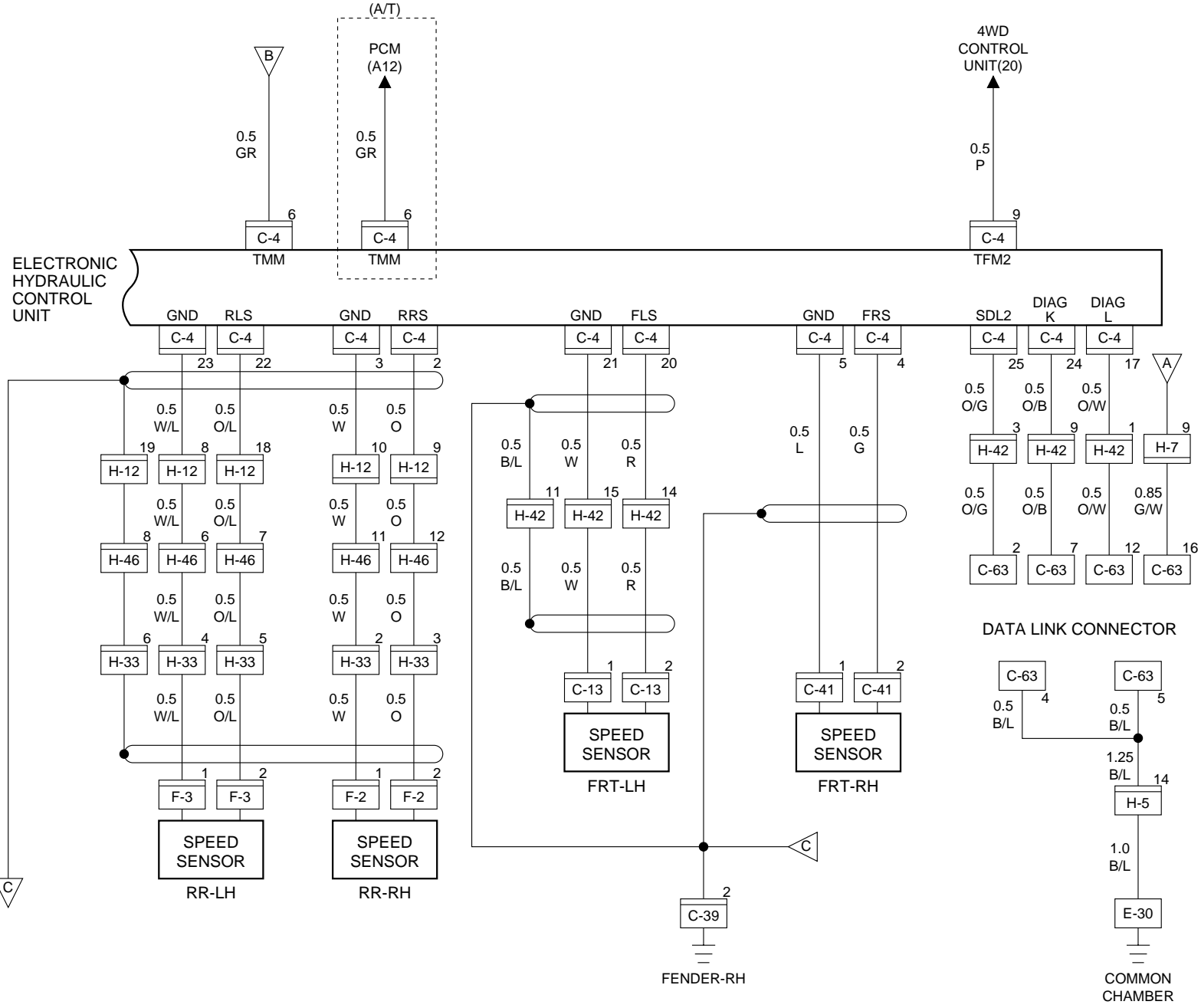
Legend

- | | |
|---------------------|-----------------------------------|
| (1) F-2 | (14) Fuse Box |
| (2) F-3 | (15) H-42 |
| (3) H-33 | (16) C-41 |
| (4) H-7 | (17) C-85 |
| (5) H-46 | (18) C-4 (EHCUC) |
| (6) C-16 | (19) Relay and Fuse Box |
| (7) E-42, E-43, M-8 | (20) C-39 |
| (8) E-47, E-48, M-1 | (21) H-13, H-15, H-16, H-26, H-27 |
| (9) B-13 or B-14 | (22) I-10 |
| (10) C-13 | (23) I-9 |
| (11) H-4, H-5, H-6 | (24) H-12 |
| (12) H-10, H-11 | (25) C-63 |
| (13) E-30 | (26) B-25 |

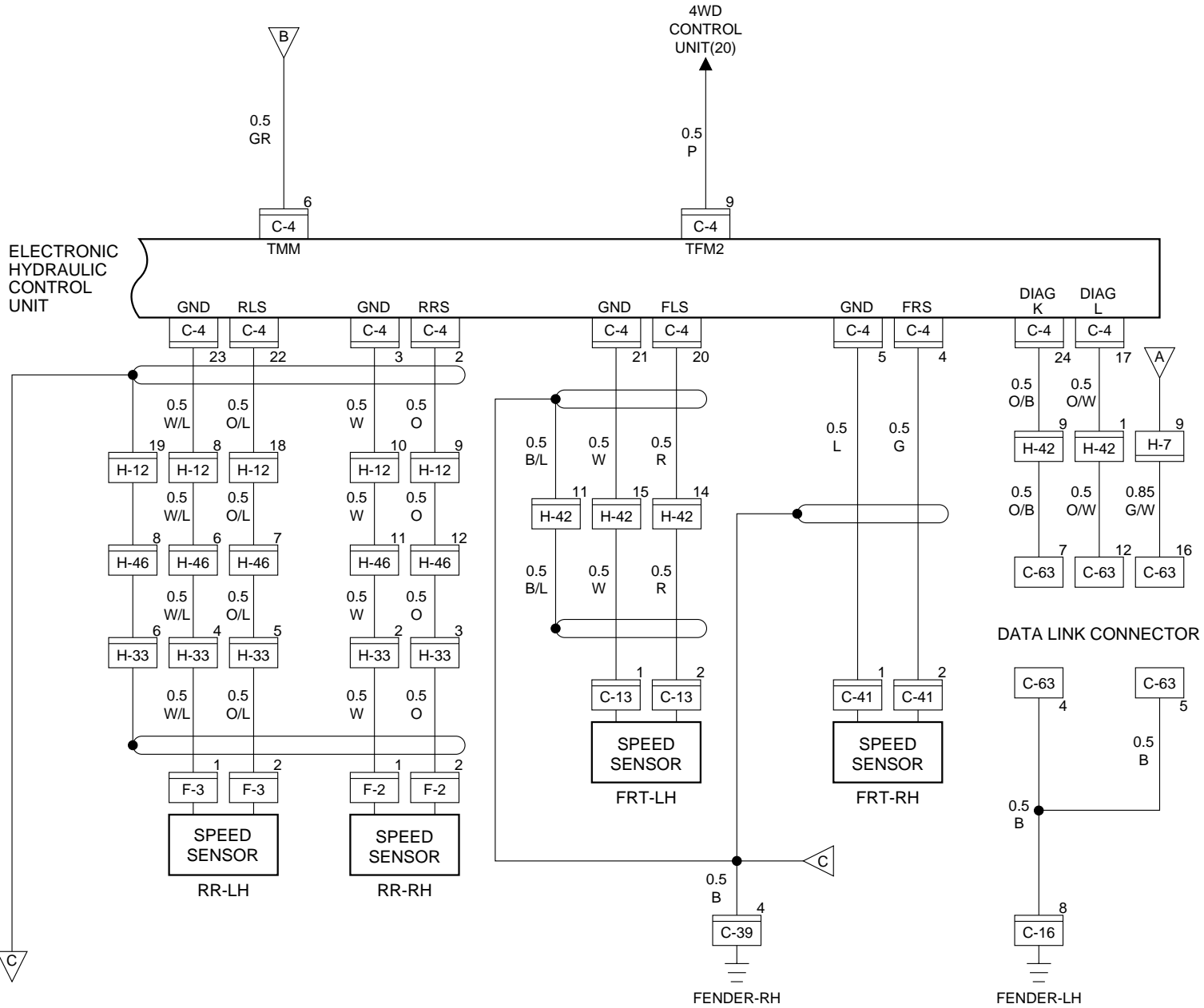
Circuit Diagram (LHD)-1



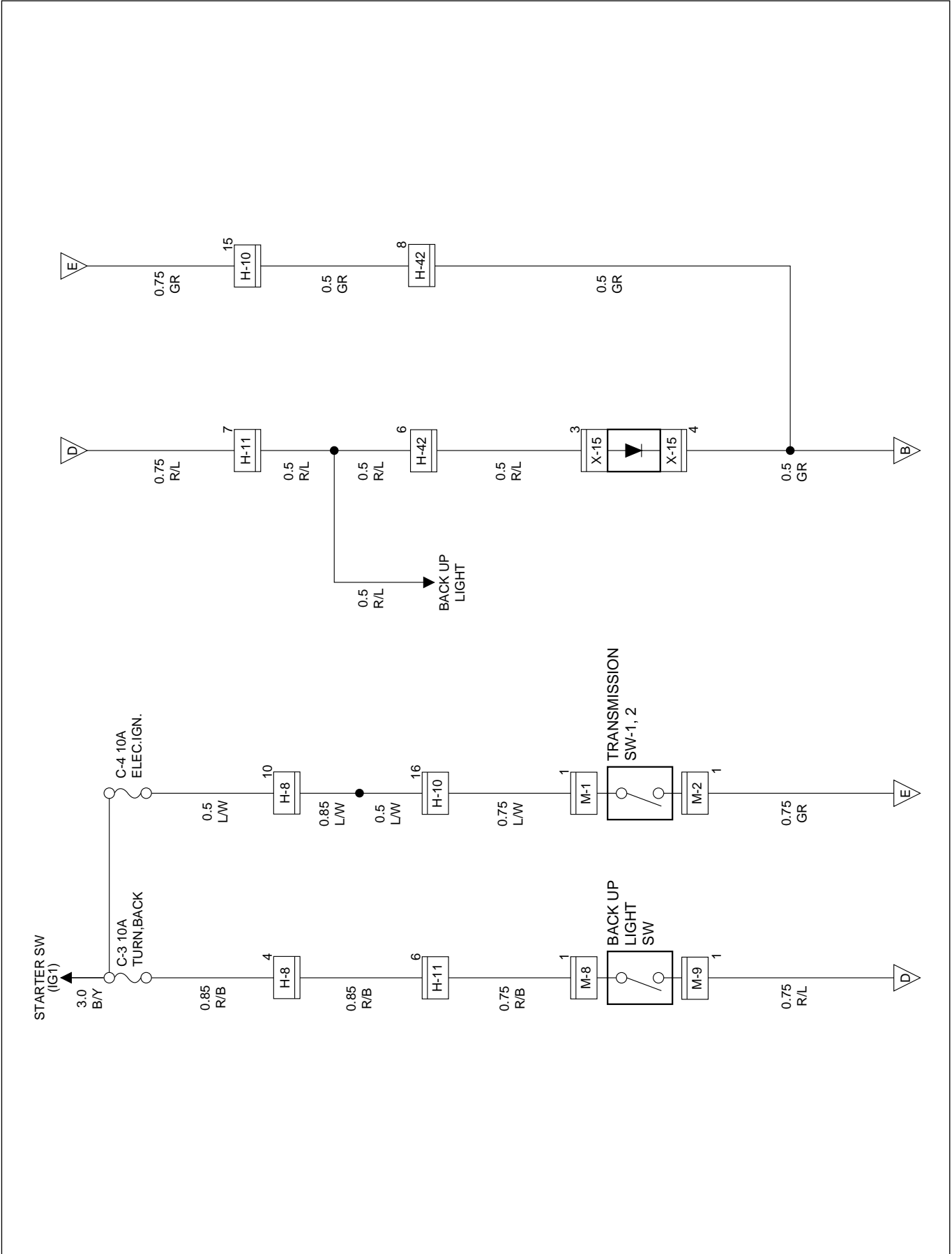
Circuit Diagram (LHD 6VD1)-2



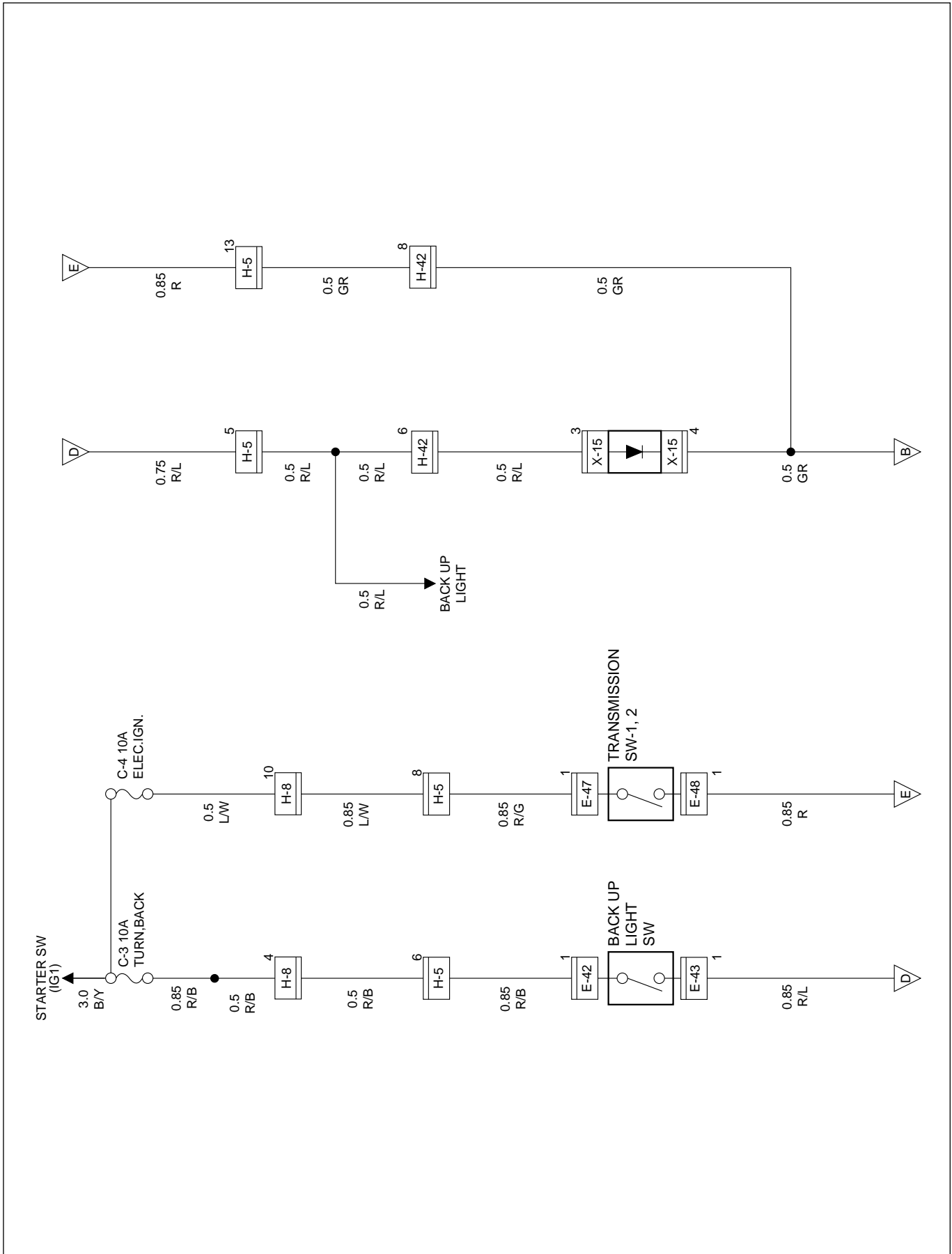
Circuit Diagram (LHD 4JG2)-2



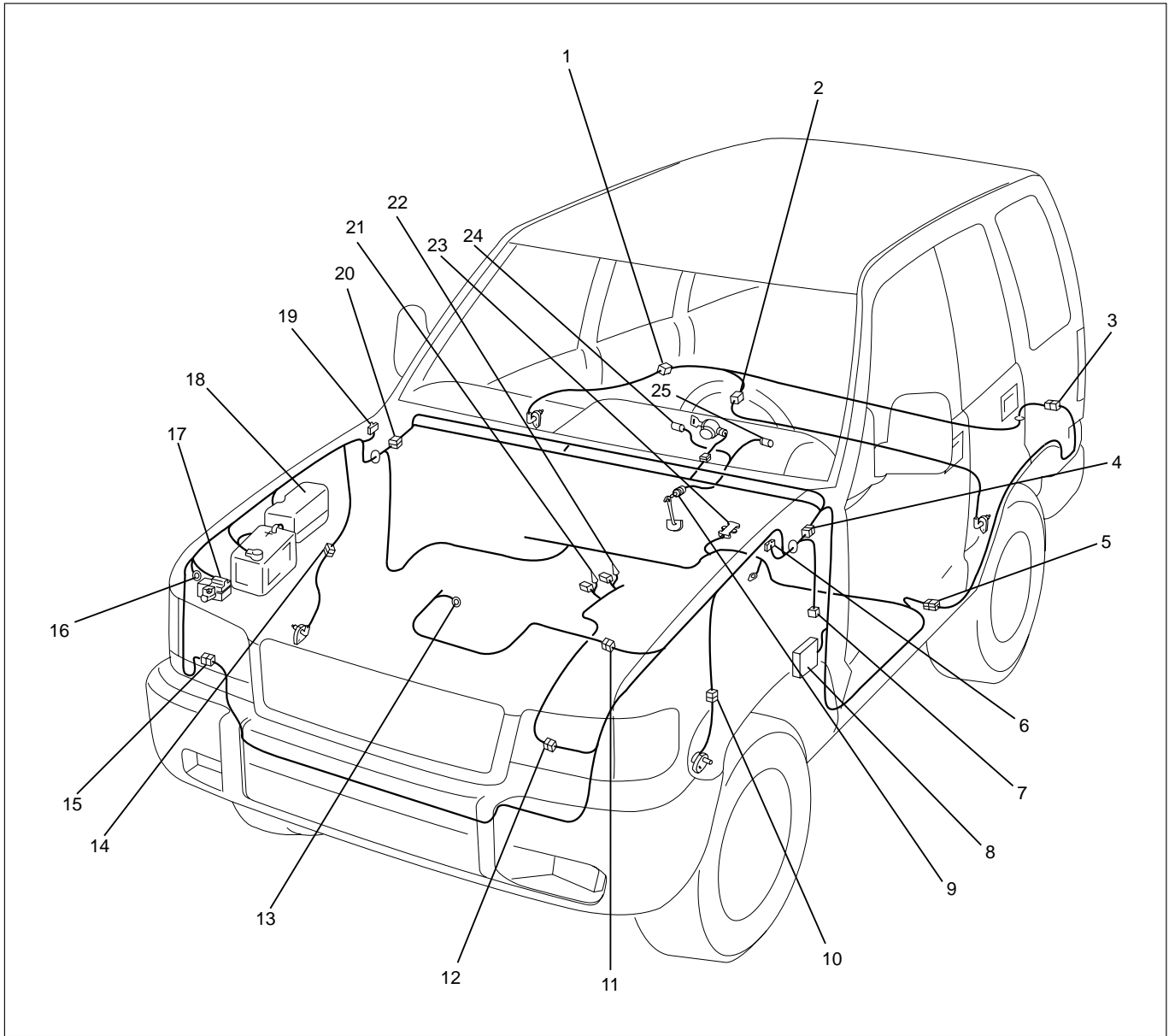
Circuit Diagram (LHD 6VD1)-3



Circuit Diagram (LHD 4JG2)-3



Parts Location (LHD)



D08RW808

Legend

- | | |
|--------------------|-----------------------------|
| (1) F-2 | (14) C-41 |
| (2) F-3 | (15) H-42 |
| (3) H-33 | (16) C-85 |
| (4) H-7, H-8, H-25 | (17) C-4 (EHCUC) |
| (5) H-46 | (18) Relay and Fuse Box |
| (6) C-16 | (19) C-39 |
| (7) C-63 | (20) H-12, H-13, H-15, H-16 |
| (8) Fuse Box | (21) E-47, E-48, M-1 |
| (9) B-13 or B-14 | (22) E-42, E-43, M-8 |
| (10) C-13 | (23) B-25 |
| (11) H-5 | (24) I-10 |
| (12) H-10, H-11 | (25) I-9 |
| (13) E-30 | |

A/T Shift Lock

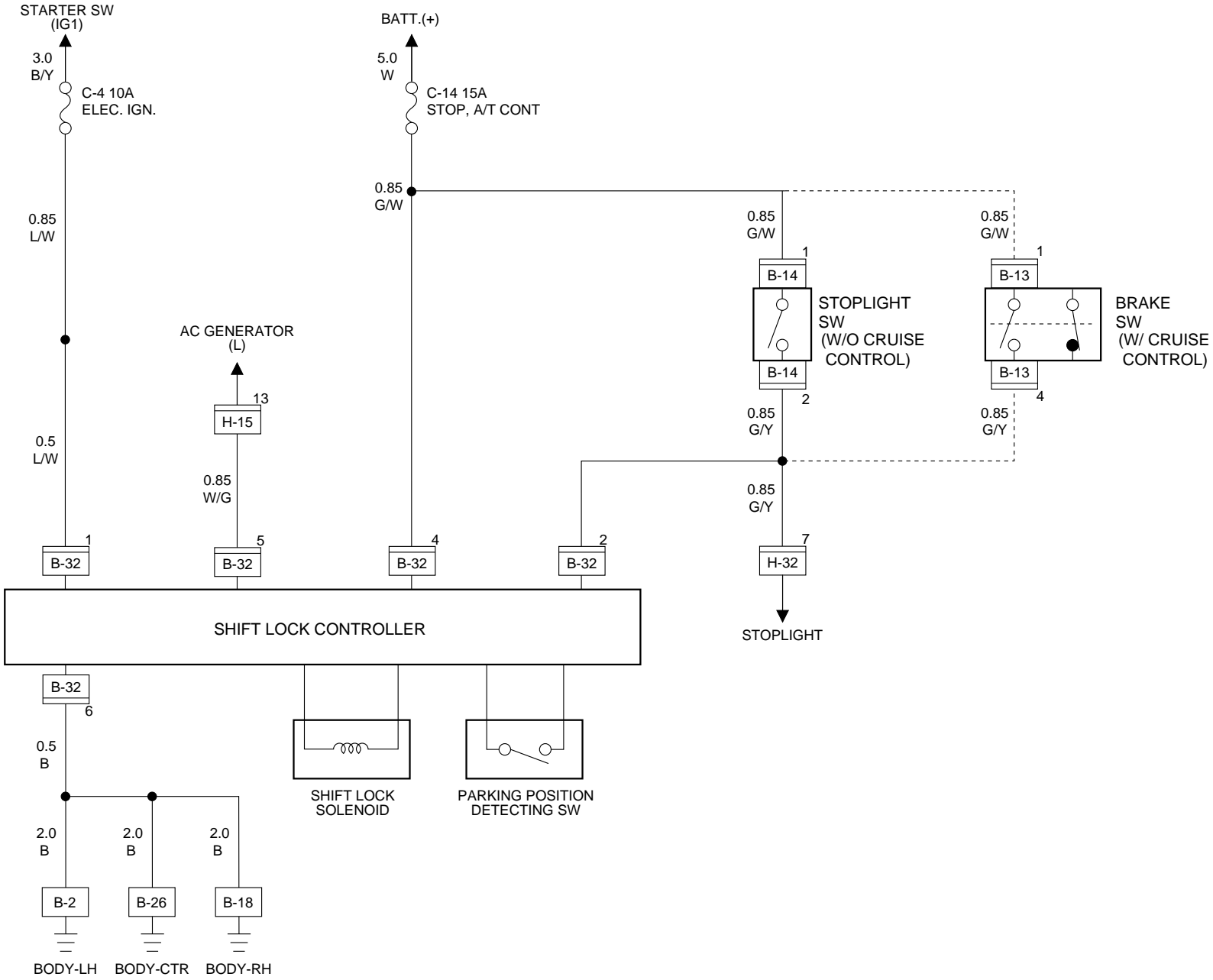
General Description

The circuit consists of stoplight switch or brake switch and shift lock controller.

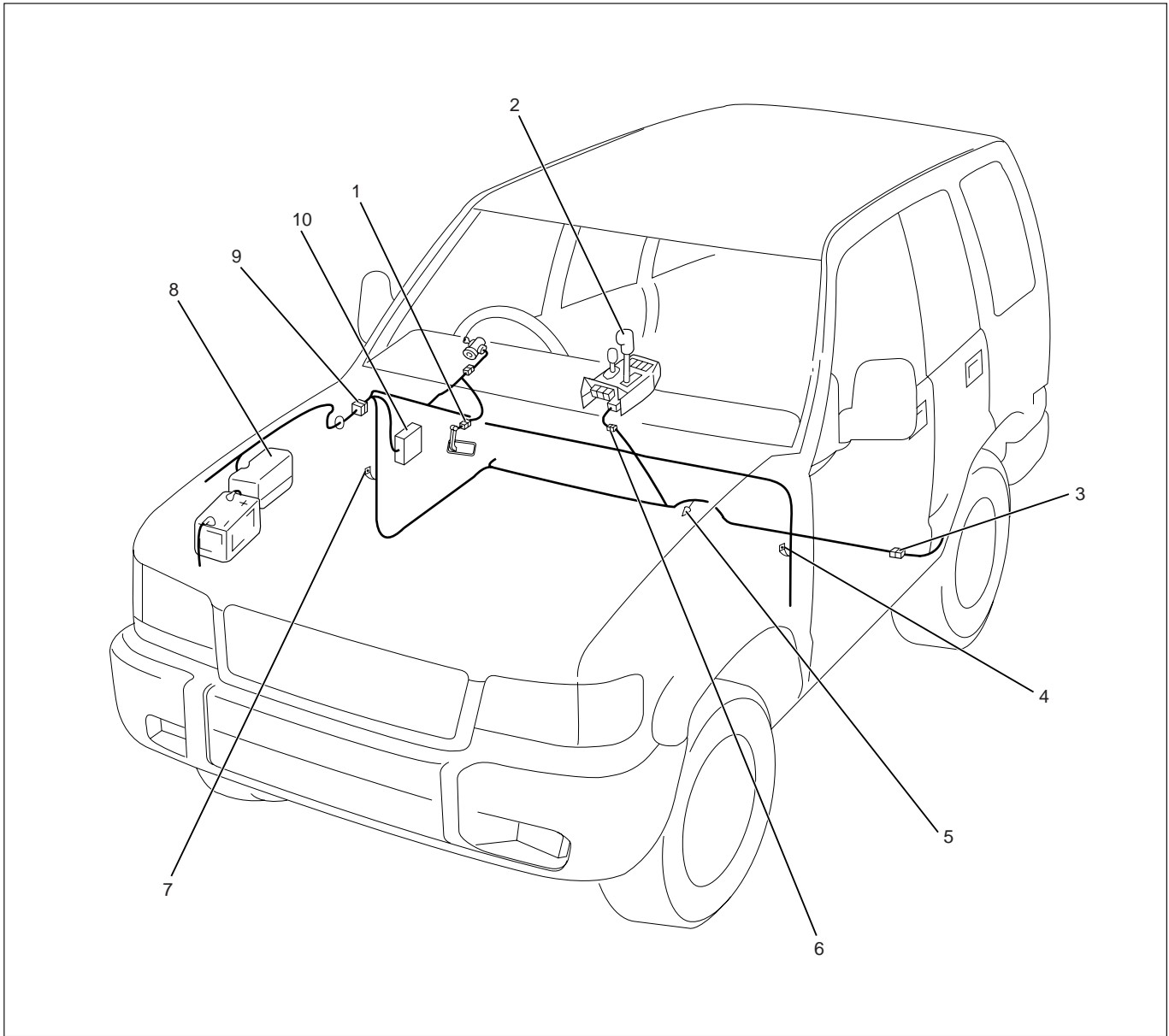
This system is designed not to allow shift lever to be shifted from "P" position to any other position without depressing brake pedal while starter switch is turned on.

The solenoid pin at the lower portion of shift lever retracts when brake pedal is not depressed, thus causing shift lever cam to be locked by link lever.

Circuit Diagram (RHD)



Parts Location (RHD)

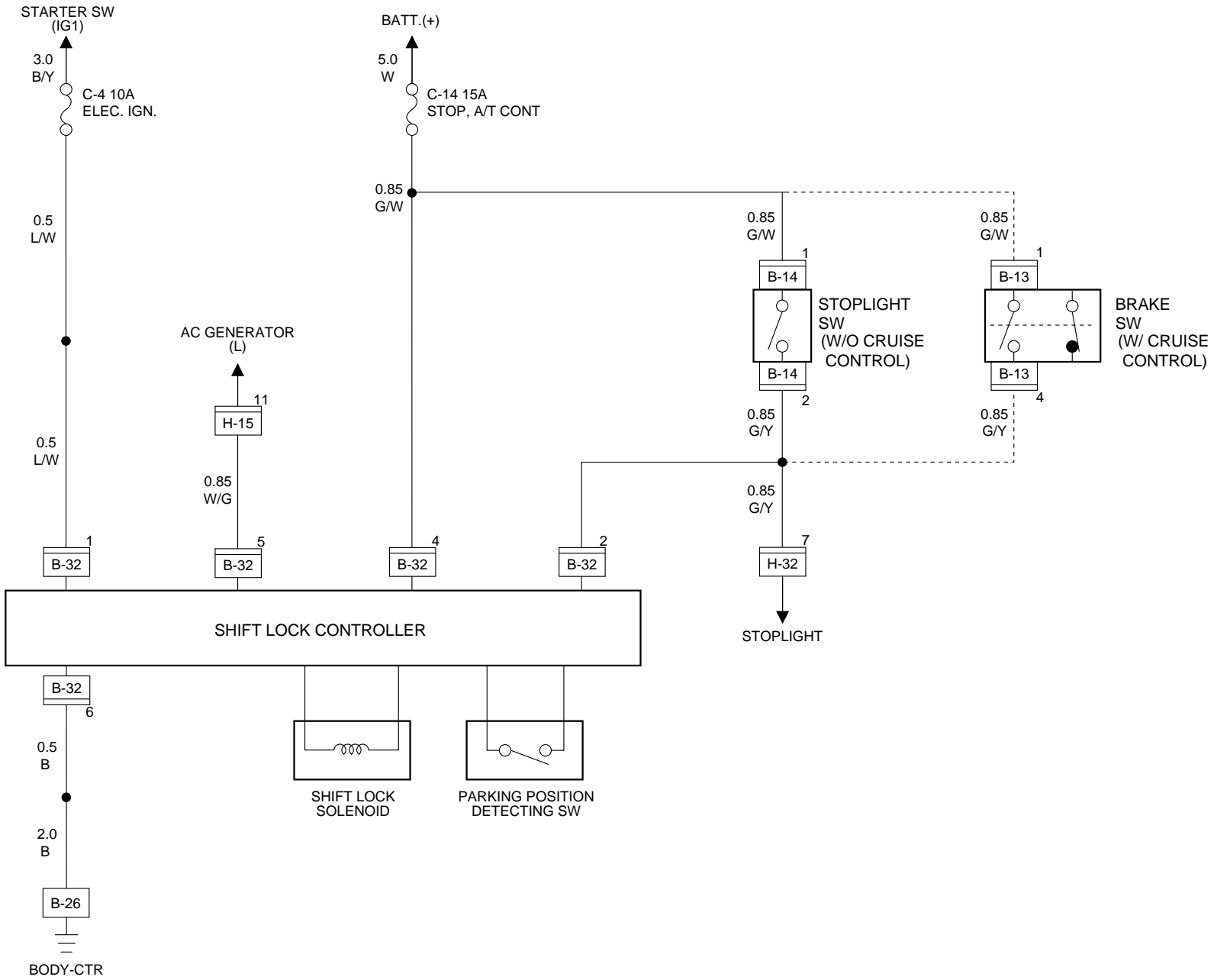


D08RWA08

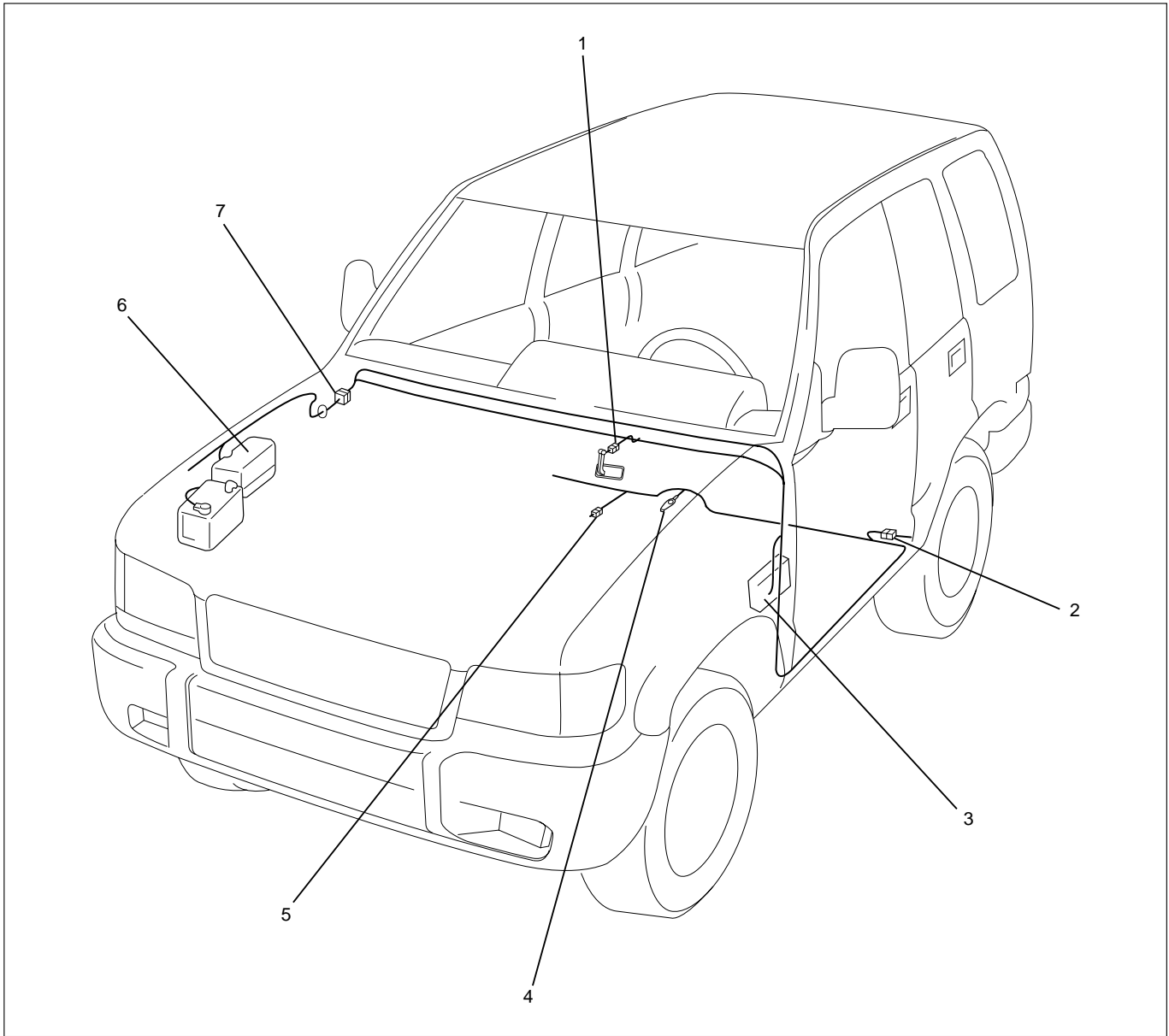
Legend

- | | |
|------------------|----------------------------------|
| (1) B-13 or B-14 | (6) Shift Lock Controller (B-32) |
| (2) Shift Lever | (7) B-18 |
| (3) H-32 | (8) Relay and Fuse Box |
| (4) B-2 | (9) H-15 |
| (5) B-26 | (10) Fuse Box |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RW395

Legend

- | | |
|------------------|------------------------|
| (1) B-13 or B-14 | (4) B-26 |
| (2) H-32 | (5) B-32 |
| (3) Fuse Box | (6) Relay and Fuse Box |
| | (7) H-15 |

Windshield Wiper/Washer

General Description

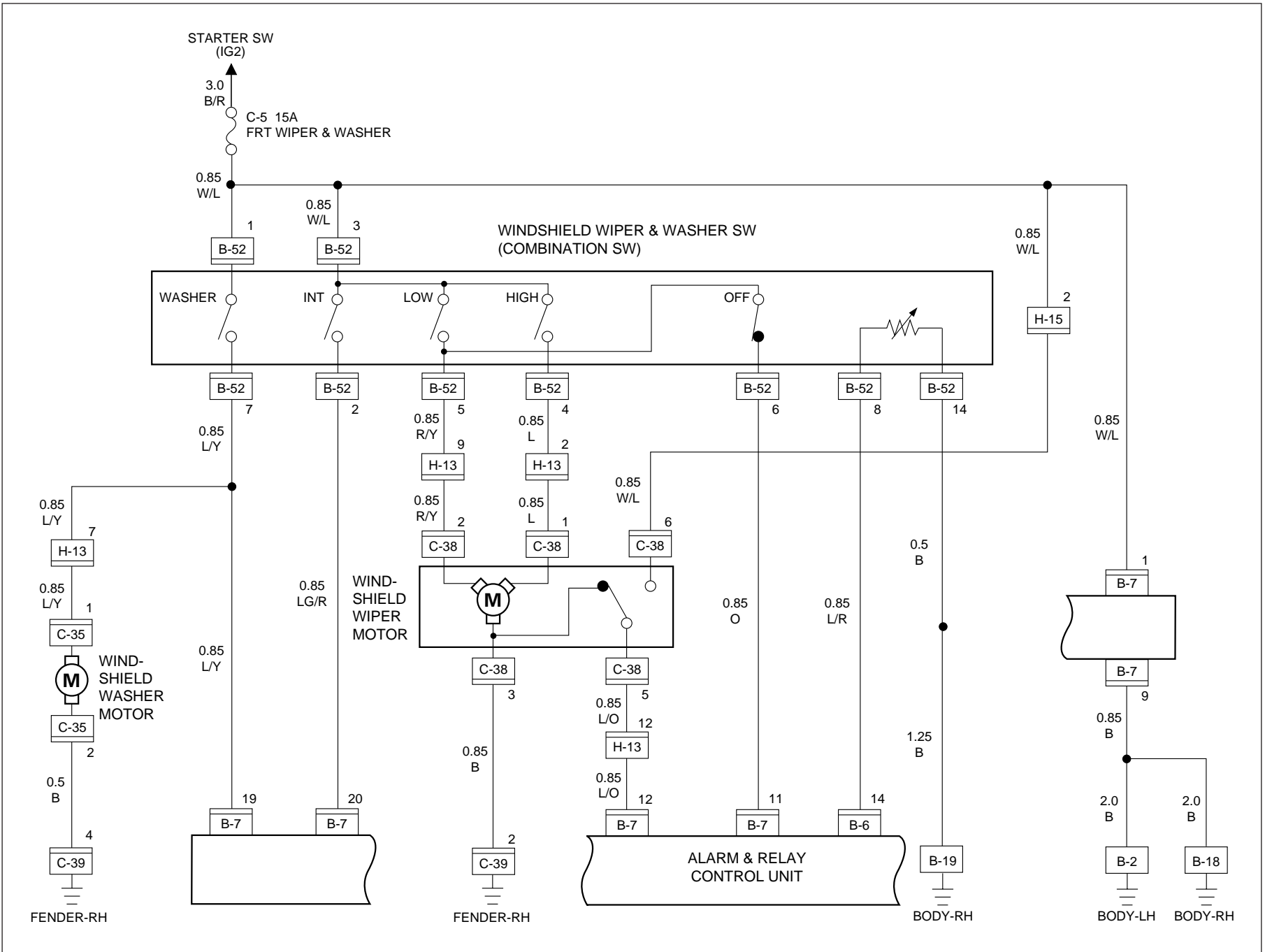
The circuit consists of windshield wiper/washer switch, windshield wiper motor, windshield washer motor and alarm & relay control unit.

When windshield wiper/washer switch is turned on with starter switch on, battery voltage is applied to windshield wiper motor to activate wipers.

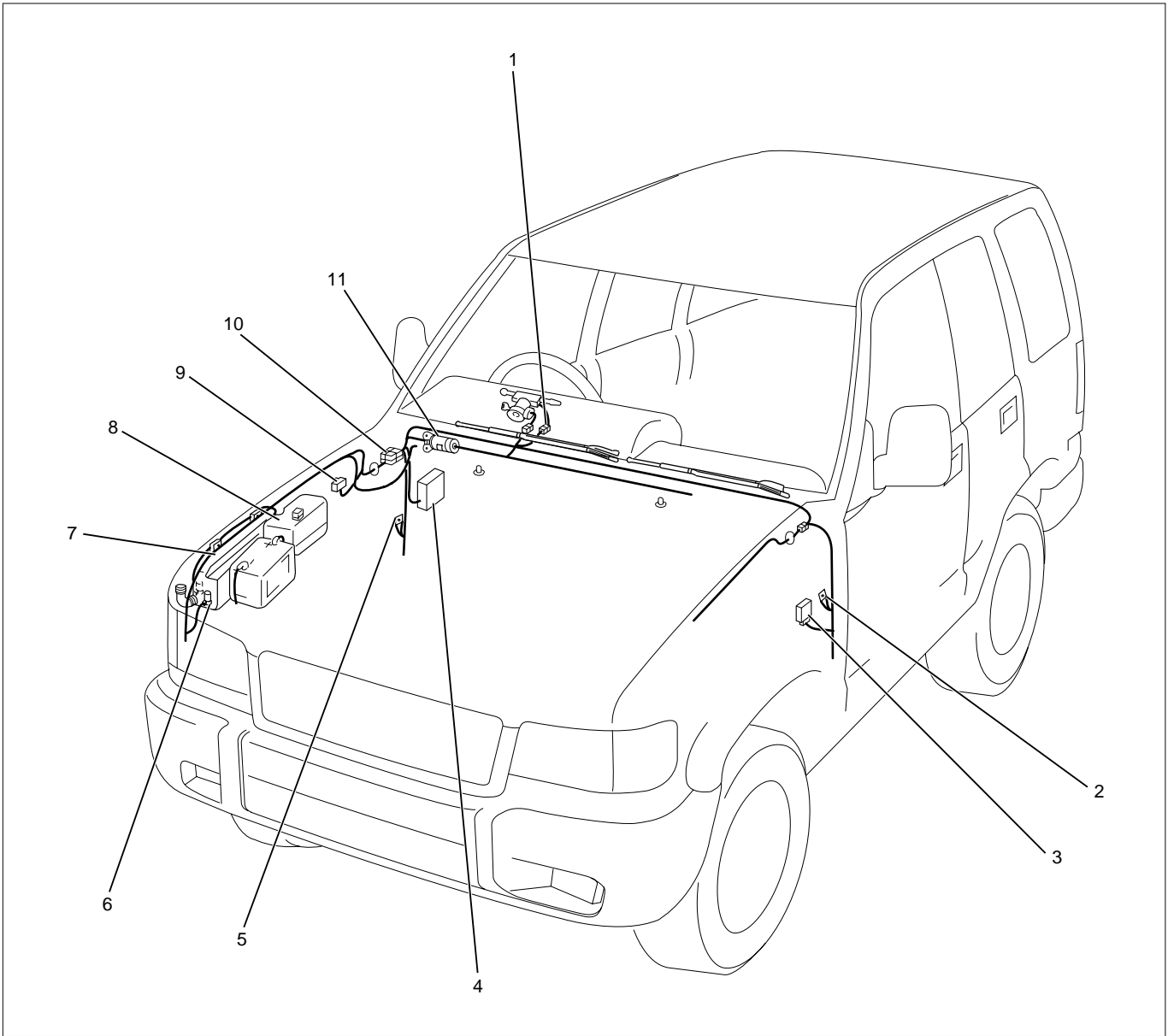
When windshield washer switch is turned on with starter switch on, battery voltage is applied to windshield washer motor.

Windshield washer motor squirts glass cleaning fluid while windshield washer switch is pushed and at the same time, alarm & relay control unit activates windshield wiper motor to wipe glass cleaning fluid at low speed.

Circuit Diagram (RHD)



Parts Location (RHD)

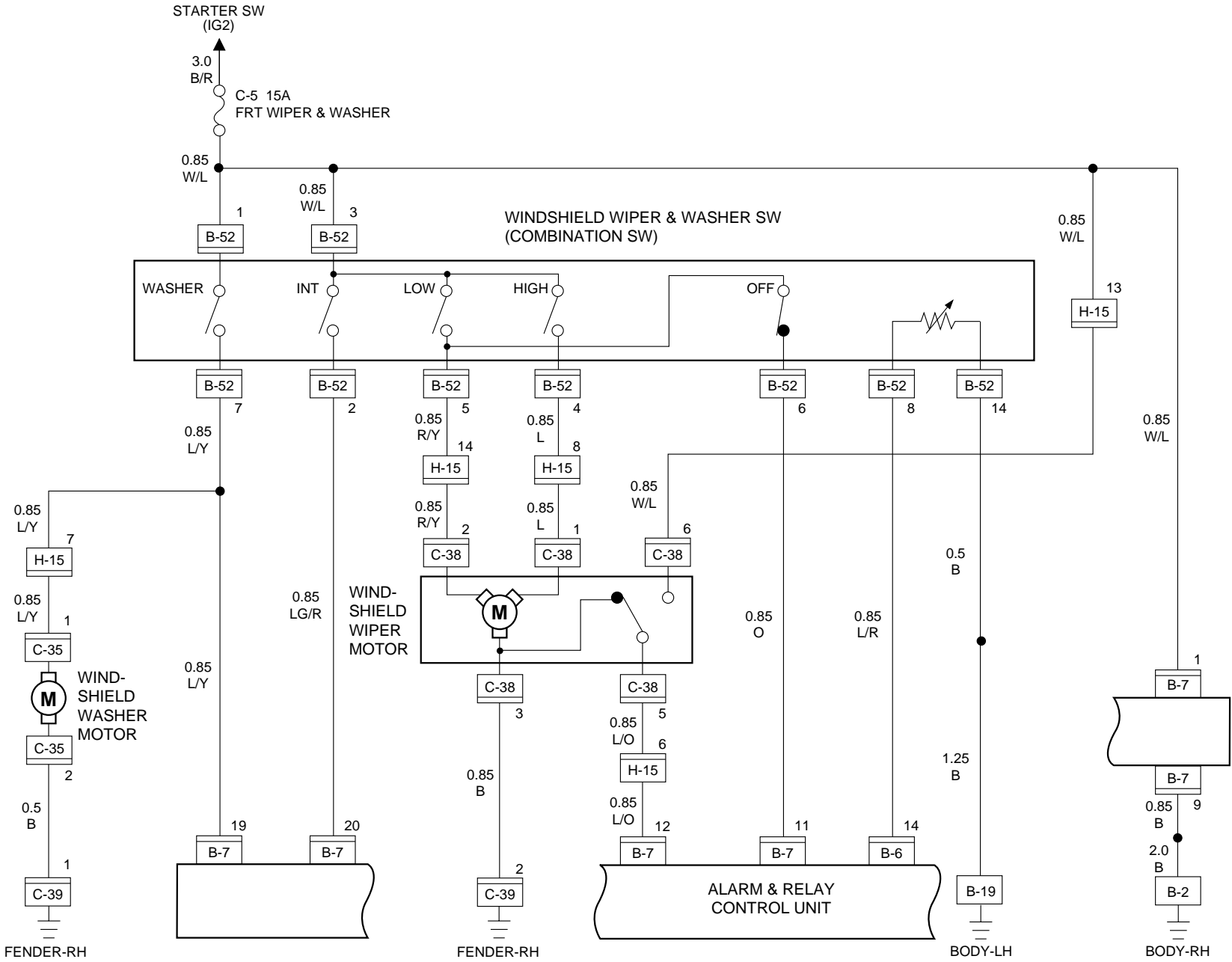


D08RWA06

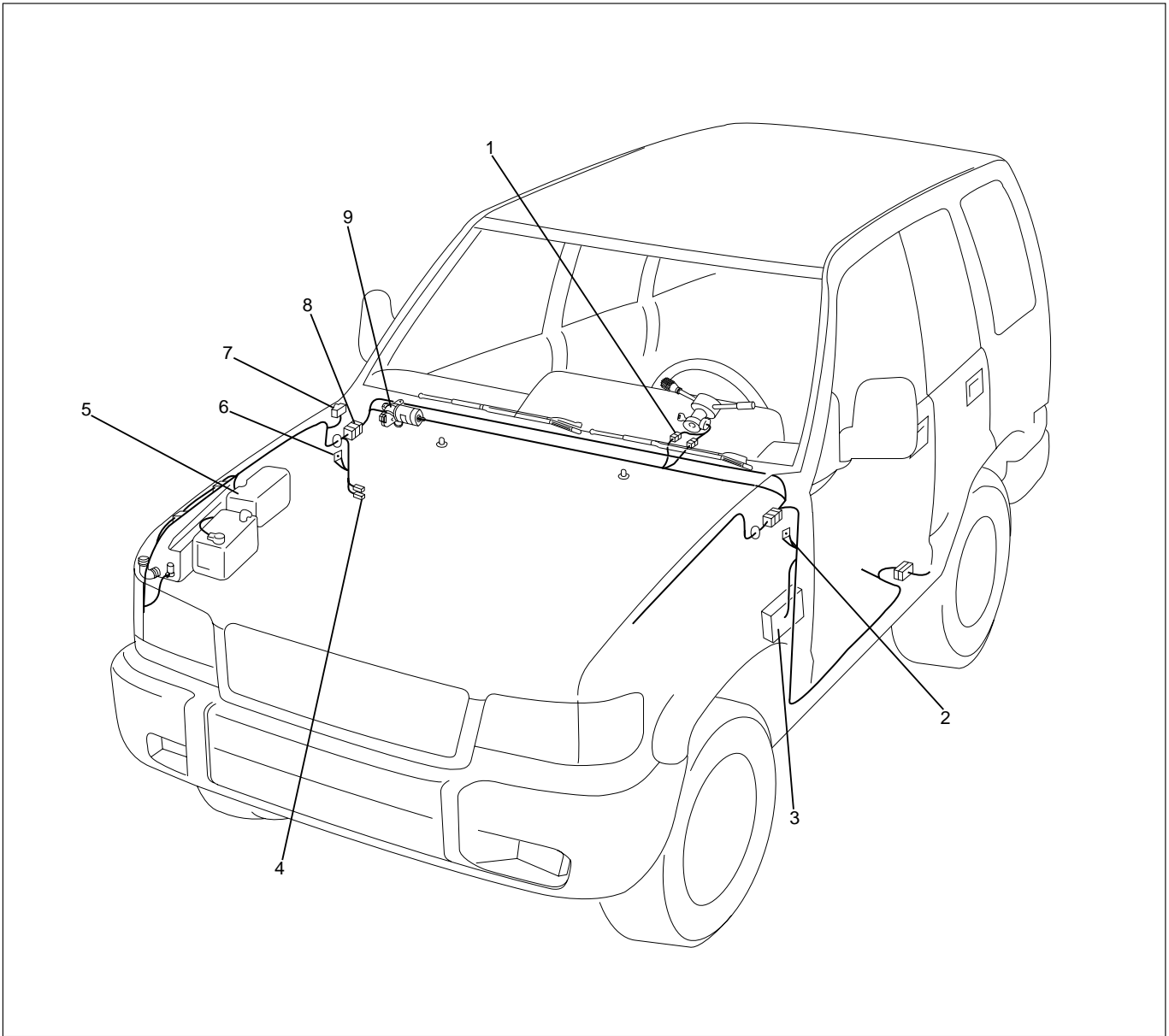
Legend

- | | |
|---|--|
| (1) B-52 | (6) FRT Wind Shild Washer Motor (C-35) |
| (2) B-2 | (7) Wind Shield Washer Tank |
| (3) Alarm and Relay Control Unit (B-6, B-7) | (8) Relay and Fuse Box |
| (4) Fuse Box | (9) C-39 |
| (5) B-18, B-19 | (10) H-13, H-15 |
| | (11) Wind Shild Wiper Motor (C-38) |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RW381

Legend

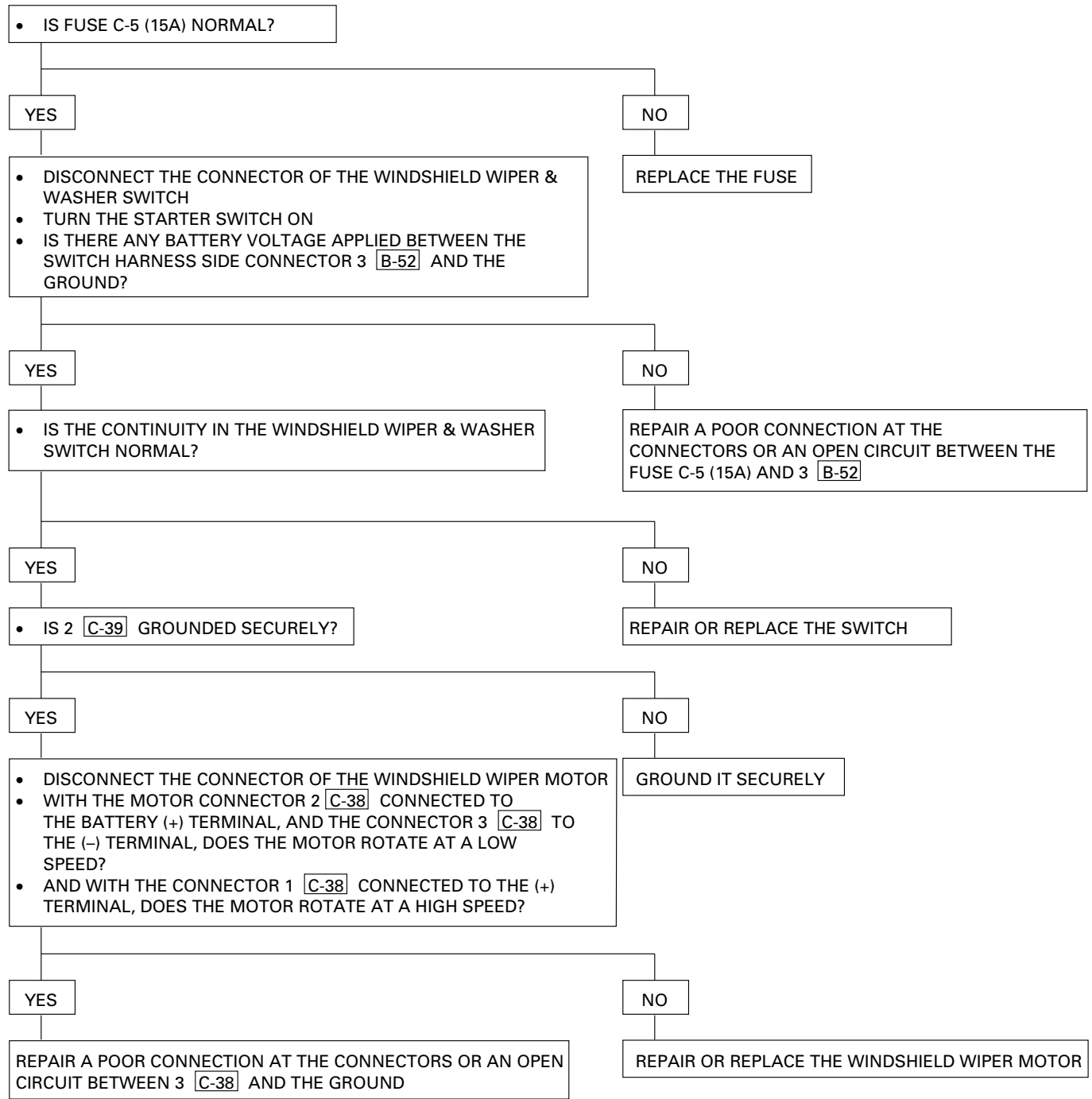
- | | |
|--------------|------------------------|
| (1) B-52 | (5) Relay and Fuse Box |
| (2) B-19 | (6) B-2 |
| (3) Fuse Box | (7) C-39 |
| (4) B-6, B-7 | (8) H-15 |
| | (9) C-38 |

Diagnosis

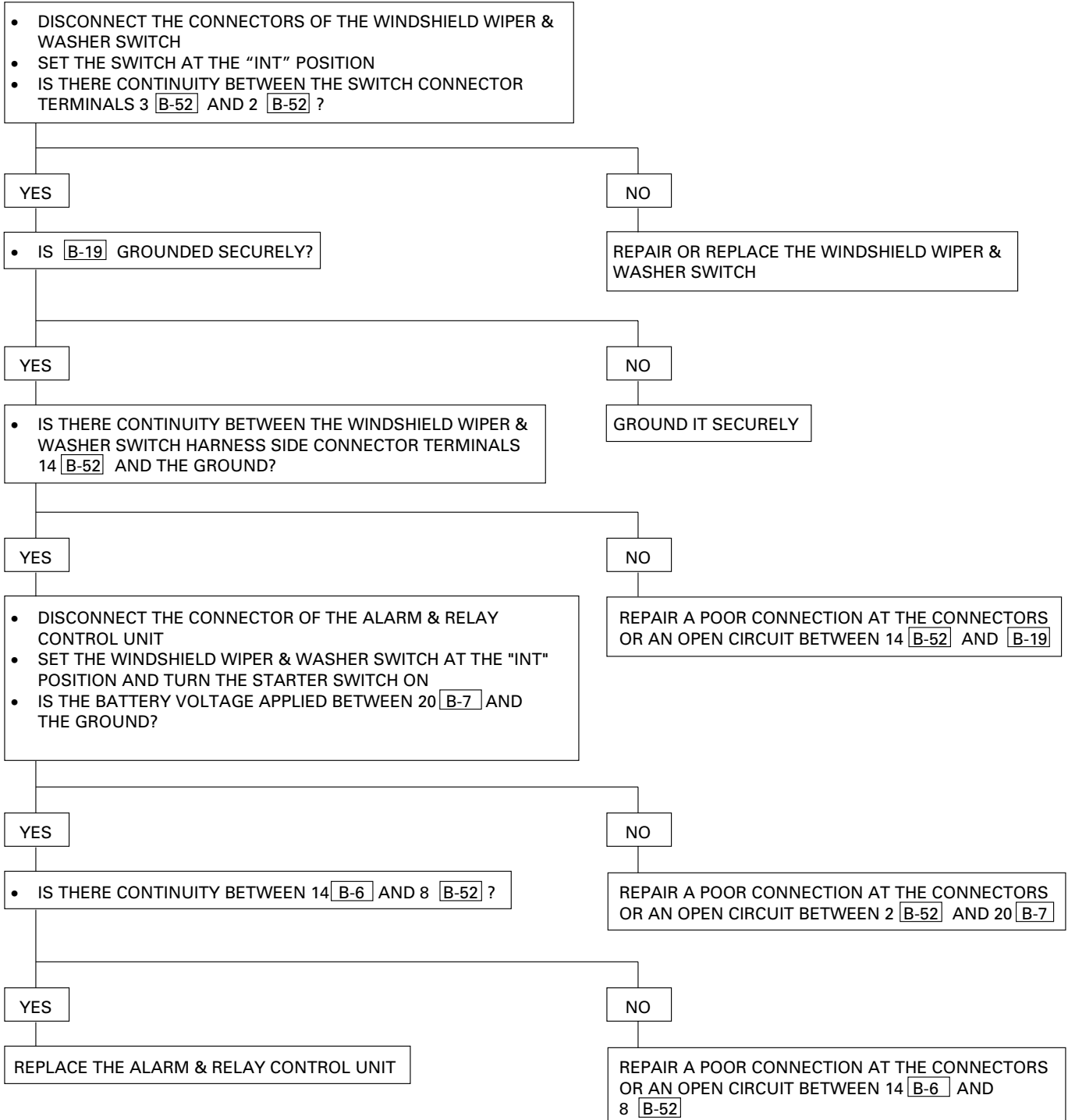
Quick Chart for Check Points

Trouble mode	Check point	Fuse C-5 (15A)	Wiper & washer SW	Alarm & relay control unit	Wiper motor	Washer motor	Cable harness
1 Windshield wiper does not operate at any position		○	○		○		○
2 Windshield wiper does not operate at "INT" position			○	○			○
3 Intermittent interval does not change			○	○			○
4 Windshield wiper does not operate at "LO" position			○		○		○
5 Windshield wiper does not operate at "HI" position			○		○		○
6 Auto-stop function of the windshield wiper motor does not operate			○	○	○		○
7 Rotation of the front wiper motor does not stop			○		○		
8 Windshield washer motor does not operate		○	○			○	○

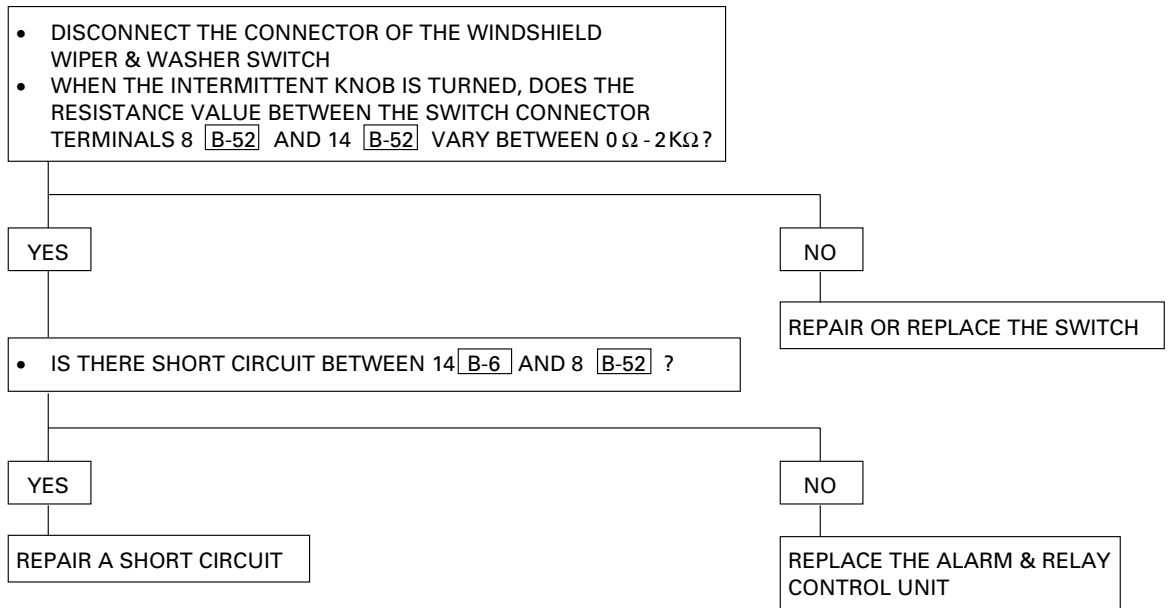
1 Windshield Wiper Does Not Operate At Any Switch Position



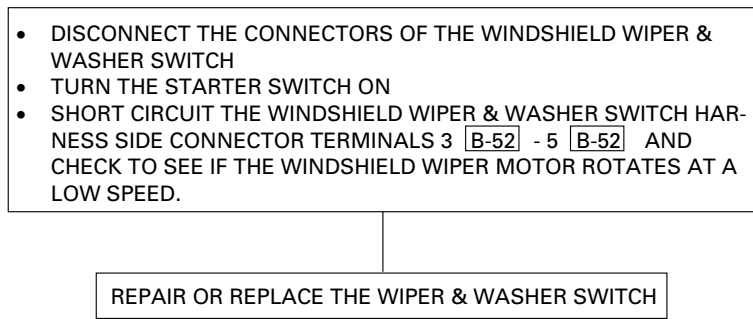
2 Windshield Wiper Does Not Operate At "INT" Position



3 Intermittent Interval Does Not Change



4 Windshield Wiper Does Not Operate At “LO” Position



5 Windshield Wiper Does Not Operate At "HI" Position

- DISCONNECT THE CONNECTOR OF THE WINDSHIELD WIPER & WASHER SWITCH
- WITH THE SWITCH SET AT "HI" POSITION, IS THERE CONTINUITY BETWEEN THE SWITCH CONNECTOR TERMINALS 3 [B-52] AND 4 [B-52] ?

YES

- DISCONNECT THE CONNECTOR OF THE WINDSHIELD WIPER MOTOR
- CONNECT THE MOTOR CONNECTOR 1 [C-38] TO THE BATTERY (+) TERMINAL, AND 3 [C-38] TO THE BATTERY (-) TERMINAL
- DOES THE MOTOR ROTATE AT A HIGH SPEED?

YES

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 4 [B-52] AND 1 [C-38]

NO

REPAIR OR REPLACE THE WINDSHIELD WIPER & WASHER SWITCH

NO

REPAIR OR REPLACE THE WINDSHIELD WIPER MOTOR

6 Auto-Stop Function of The Windshield Wiper Motor Does Not Operate

- DISCONNECT THE CONNECTOR OF THE WINDSHIELD WIPER & WASHER SWITCH
- WITH THE SWITCH SET AT "OFF" POSITION, IS THERE CONTINUITY BETWEEN THE SWITCH CONNECTOR TERMINALS 5 [B-52] AND 6 [B-52] ?

YES

NO

- DISCONNECT THE CONNECTOR OF THE WINDSHIELD WIPER MOTOR
- CONNECT THE MOTOR CONNECTOR 2 [C-38] TO THE BATTERY (+) TERMINAL AND 3 [C-38] TO THE (-) TERMINAL, AND THEN CHANGE THE CONNECTION OF THE BATTERY (+) TERMINAL TO THE CONNECTOR 6 [C-38] WHILE THE MOTOR ROTATING AT A LOW SPEED
- WHEN CONNECTING THE CONNECTOR TERMINALS 2 [C-38] AND 5 [C-38] IN THIS CONDITION, DOES THE MOTOR STOP AT AUTO-STOP POSITION?

REPAIR OR REPLACE THE WINDSHIELD WIPER & WASHER SWITCH

YES

NO

- TURN THE STARTER SWITCH ON
- IS THERE ANY BATTERY VOLTAGE APPLIED BETWEEN THE WINDSHIELD WIPER MOTOR HARNESS SIDE CONNECTOR TERMINAL 6 [C-38] AND GROUND?

REPAIR OR REPLACE THE WINDSHIELD WIPER MOTOR

YES

NO

- DISCONNECT THE CONNECTOR OF THE ALARM & RELAY CONTROL UNIT
- IS THERE CONTINUITY BETWEEN THE HARNESS SIDE CONNECTOR 12 [B-7] AND THE WINDSHIELD WIPER MOTOR HARNESS SIDE CONNECTOR 5 [C-38] ?

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN THE FUSE C-5 (15A) AND 6 [C-38]

YES

NO

REPLACE THE ALARM & RELAY CONTROL UNIT

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 5 [C-38] AND 12 [B-7]

7 Rotation of The Windshield Wiper Motor Does Not Stop

• IS THE CONTINUITY IN THE WINDSHIELD WIPER & WASHER SWITCH NORMAL?

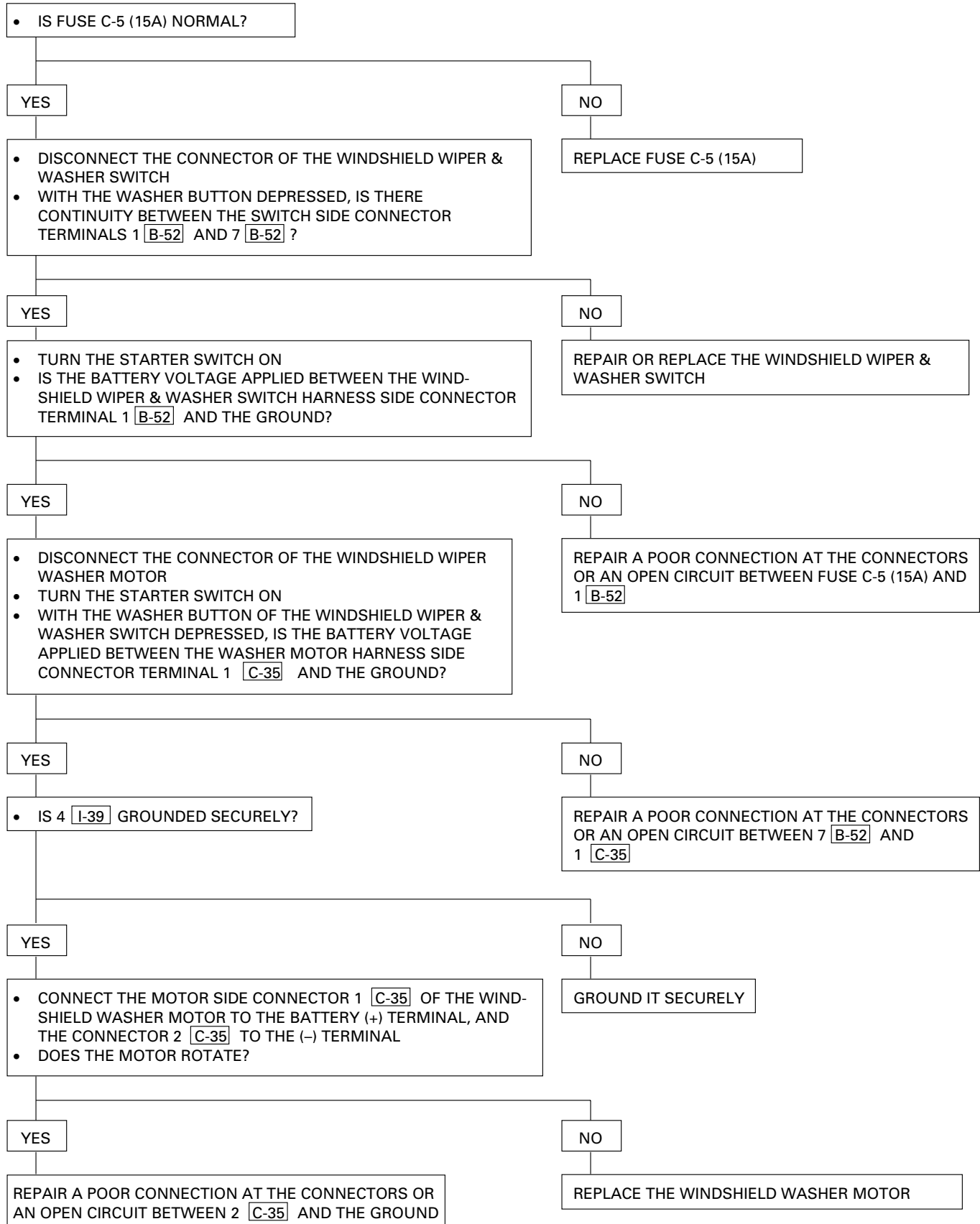
YES

REPAIR OR REPLACE THE WINDSHIELD WIPER MOTOR

NO

REPAIR OR REPLACE THE WINDSHIELD WIPER & WASHER SWITCH

8 Windshield Washer Motor Does Not Operate



Rear Wiper/Washer

General Description

The circuit consists of rear wiper/washer switch, alarm & relay control unit, rear wiper motor and rear washer motor.

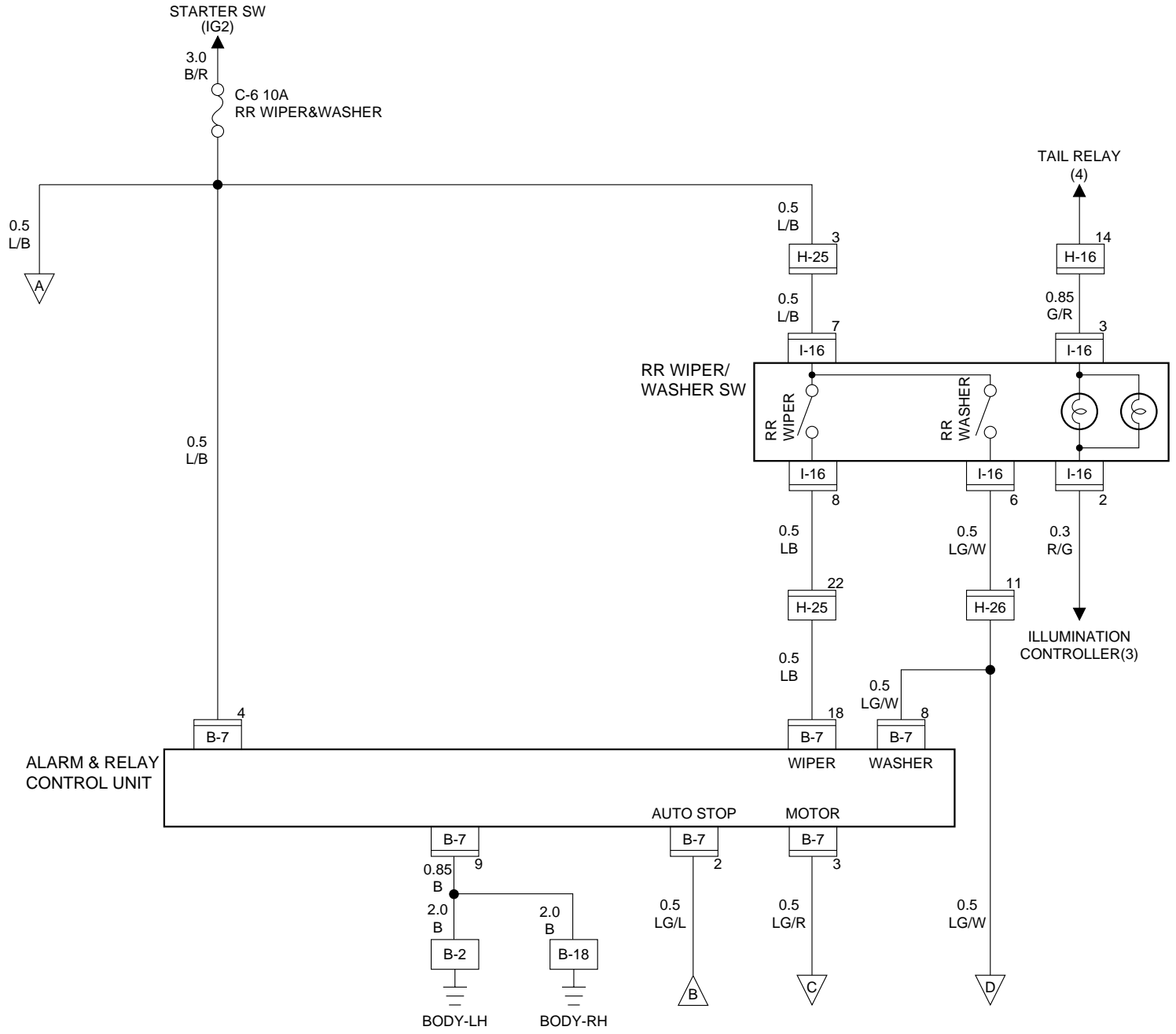
When rear wiper switch on rear wiper/washer switch is depressed, battery voltage is applied to rear wiper motor through alarm & relay control unit and activates rear wiper motor.

When rear washer switch on rear wiper/washer switch is depressed, battery voltage is applied to rear washer motor and activates rear washer motor.

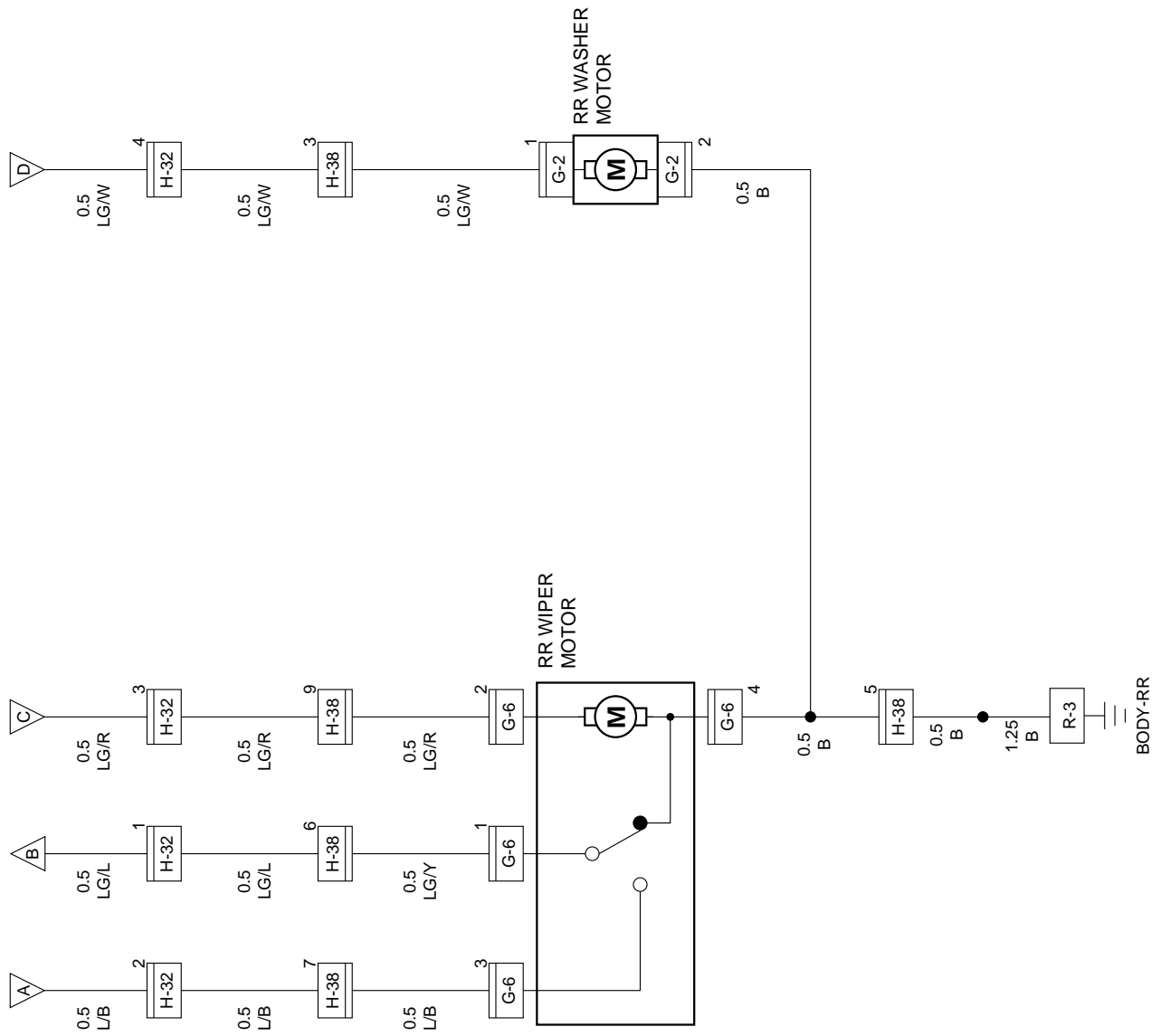
At the same time, the current as an input signal for activating rear wiper motor flows to alarm & relay control unit, then alarm & relay control unit activates rear wiper motor to wipe glass cleaning fluid.

Circuit Diagram (RHD)-1

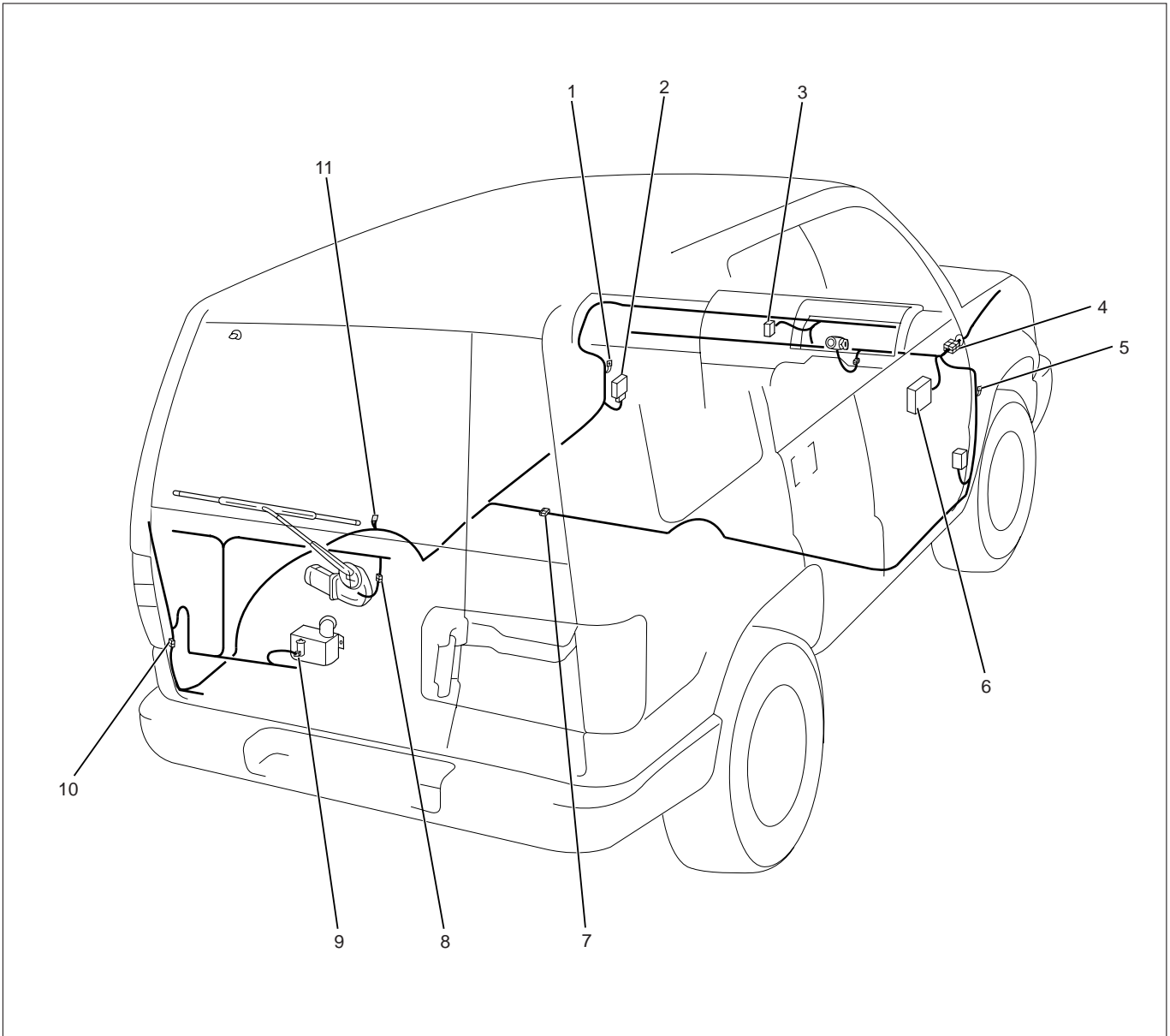
WIRING SYSTEM 8D-317



Circuit Diagram (RHD)-2



Parts Location (RHD)

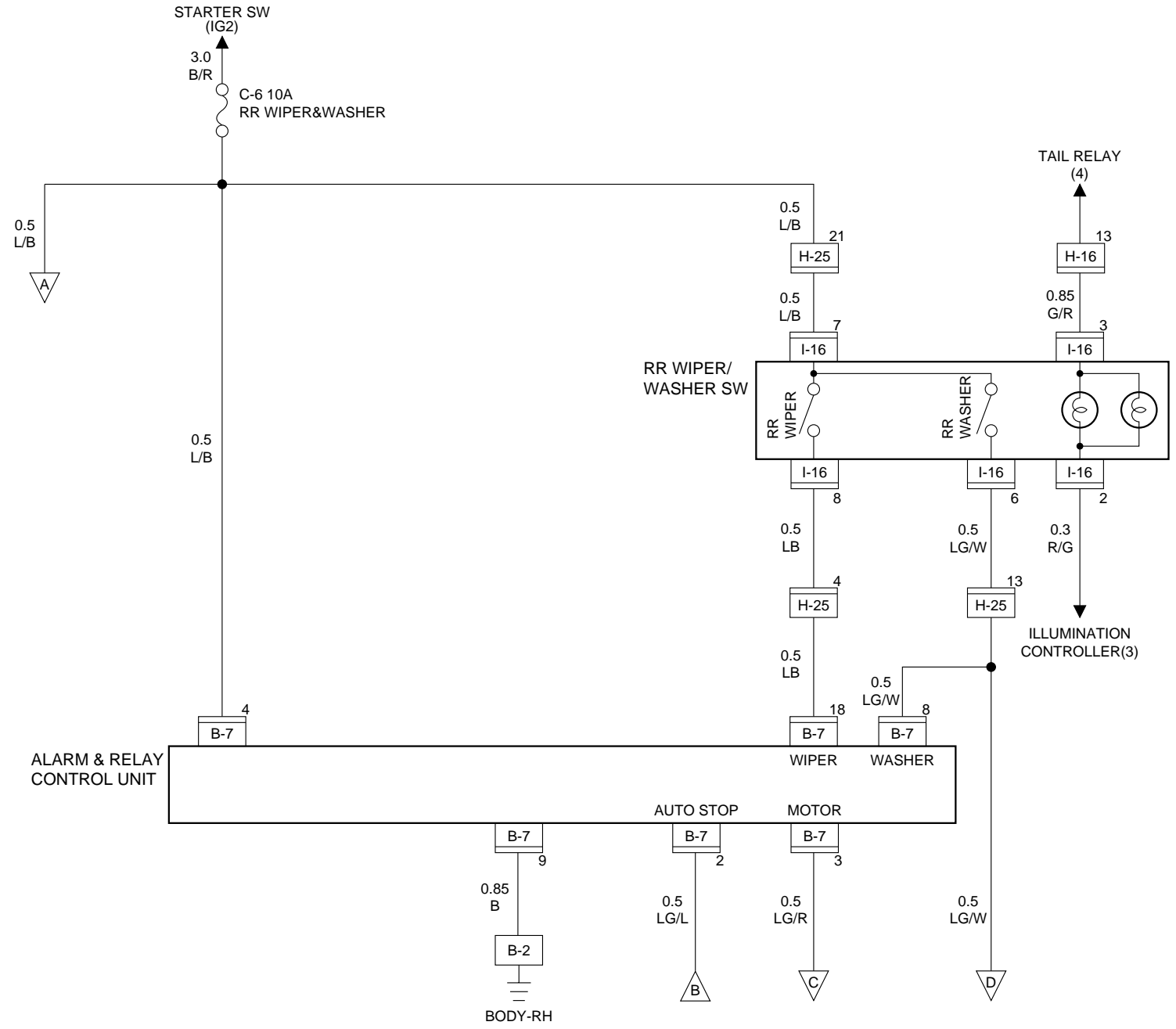


D08RWA07

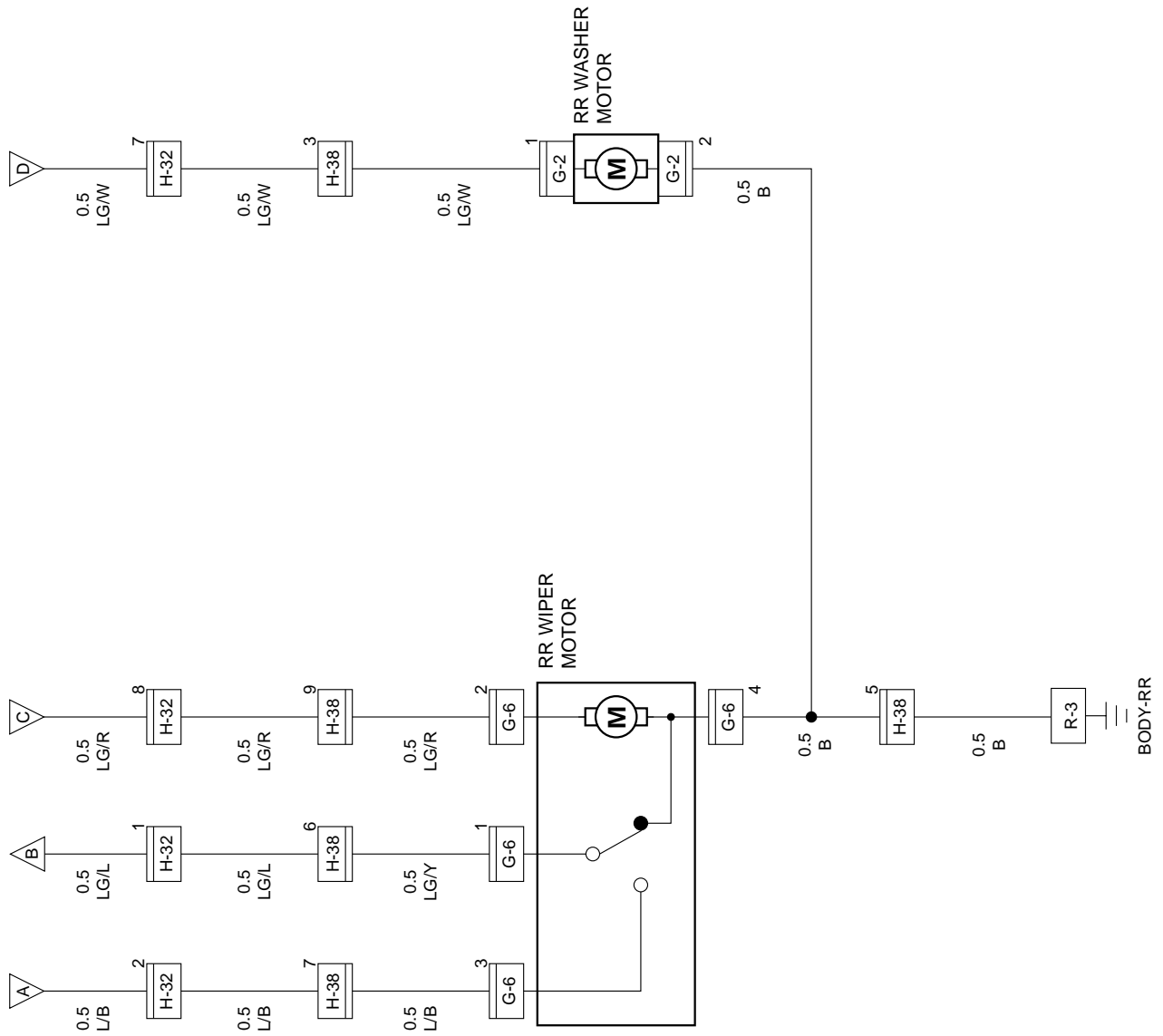
Legend

- | | |
|--|---------------------------|
| (1) B-2 | (6) Fuse Box |
| (2) Alarm and Relay Control Unit (B-7) | (7) H-32 |
| (3) I-16 | (8) RR Wiper Motor (G-6) |
| (4) H-16, H-25, H-26 | (9) RR Washer Motor (G-2) |
| (5) B-18 | (10) H-38 |
| | (11) R-3 |

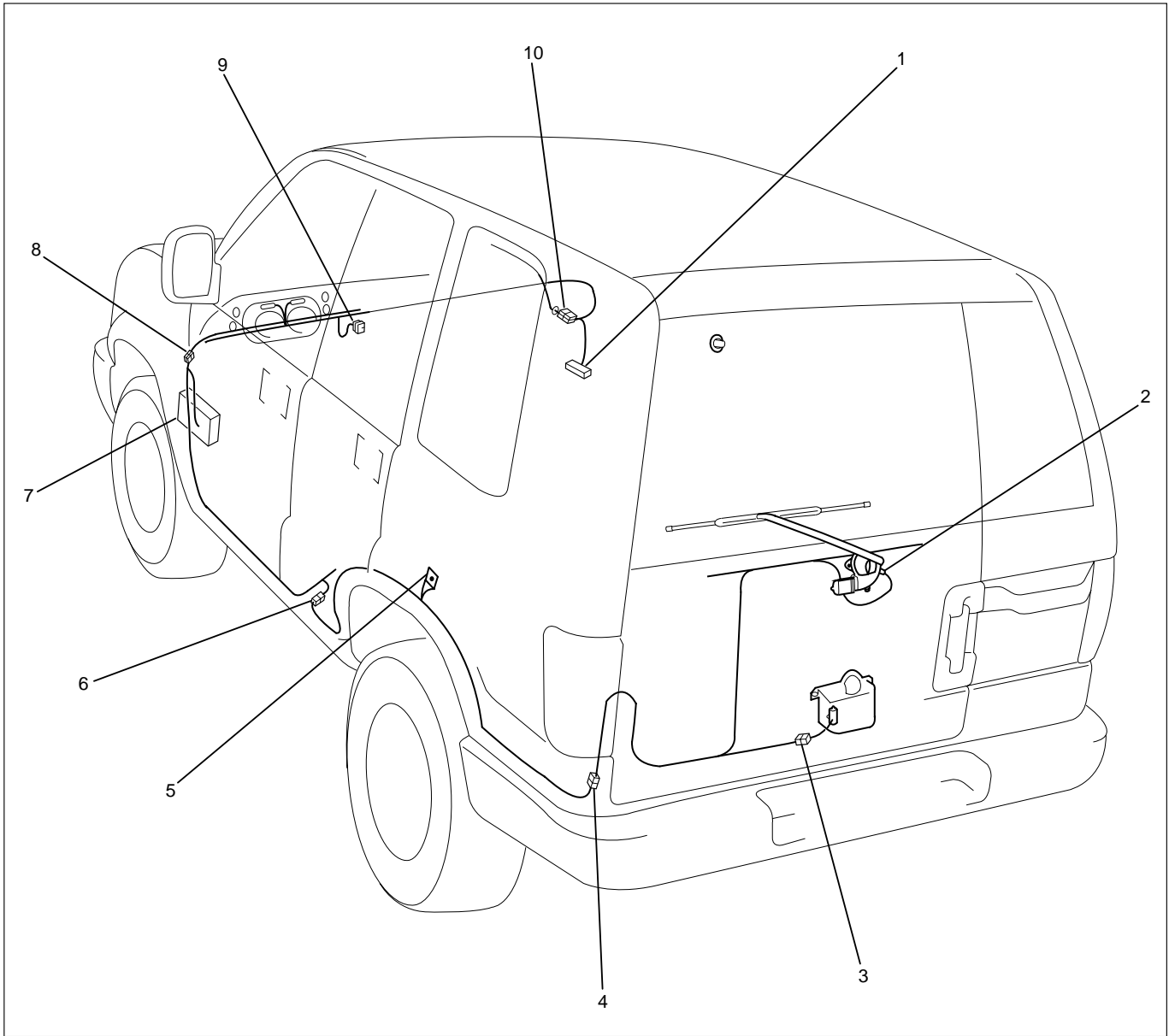
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW396

Legend

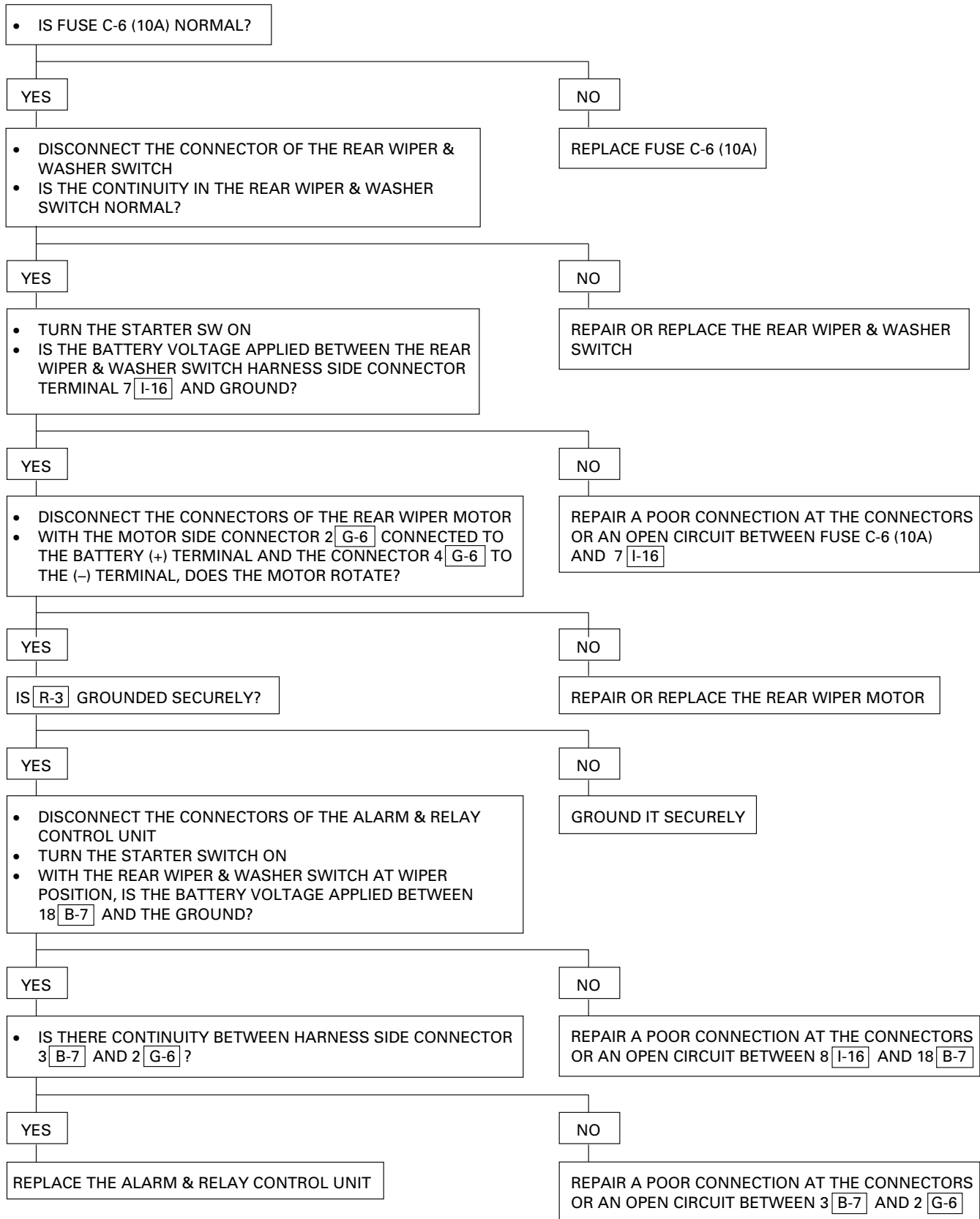
- | | |
|----------|--------------|
| (1) B-7 | (6) H-32 |
| (2) G-6 | (7) Fuse Box |
| (3) G-2 | (8) H-25 |
| (4) H-38 | (9) I-16 |
| (5) R-3 | (10) H-16 |

Diagnosis

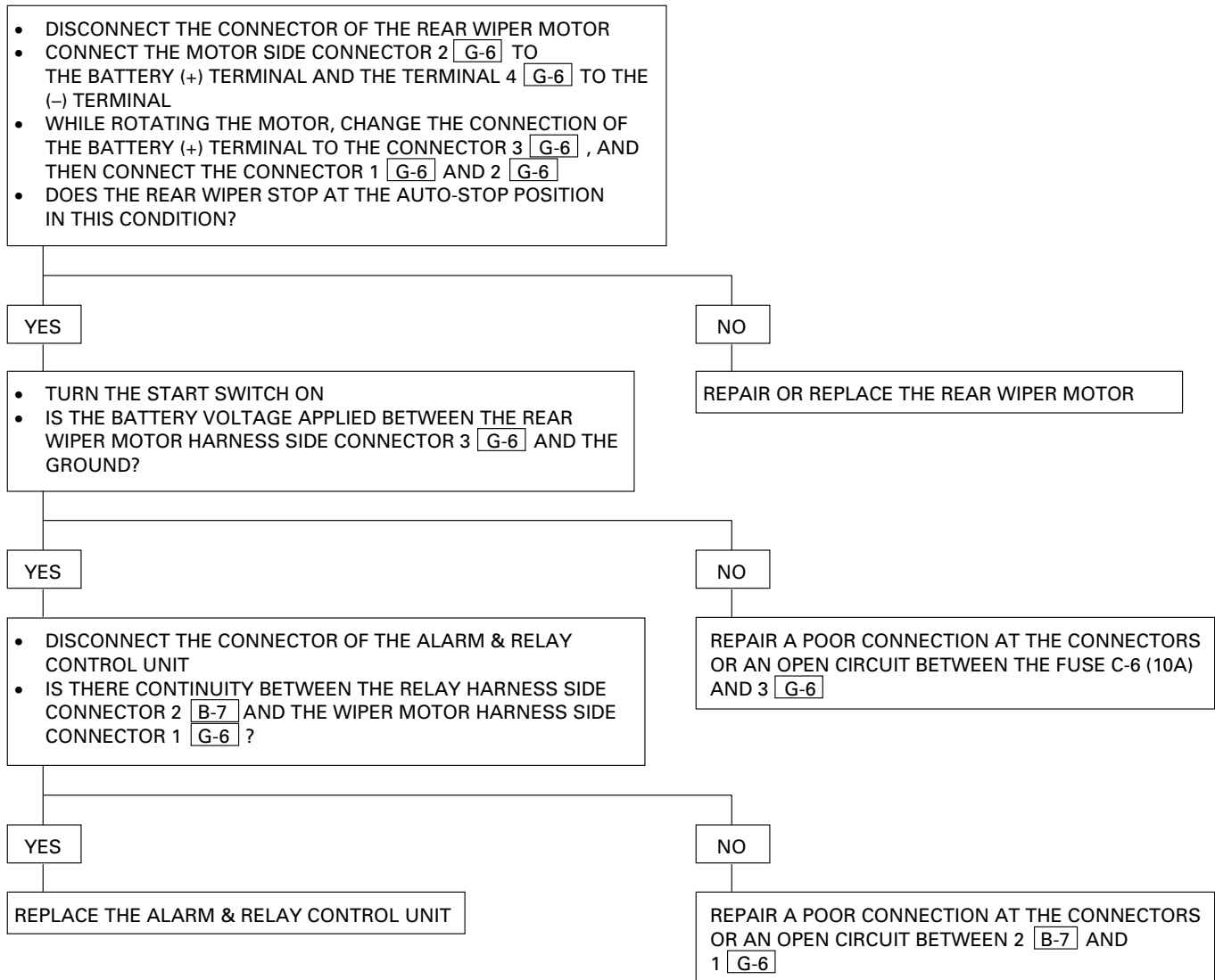
Quick Chart for Check Points

Trouble mode	Check point	Fuse C-6 (10A)	Wiper & washer SW	Rear wiper motor	Washer motor	Alarm & relay control unit	Cable harness
1 Rear wiper motor does not operate		○	○	○		○	○
2 Auto-stop function of the rear wiper motor does not operate				○		○	○
3 Rear wiper motor does not operate at "WIPER" position			○			○	○
4 Rear wiper motor does not operate at "WIPER & WASHER" position			○			○	○
5 Rotation of the rear wiper motor does not stop			○	○			
6 Rear washer motor does not operate			○	○	○		○

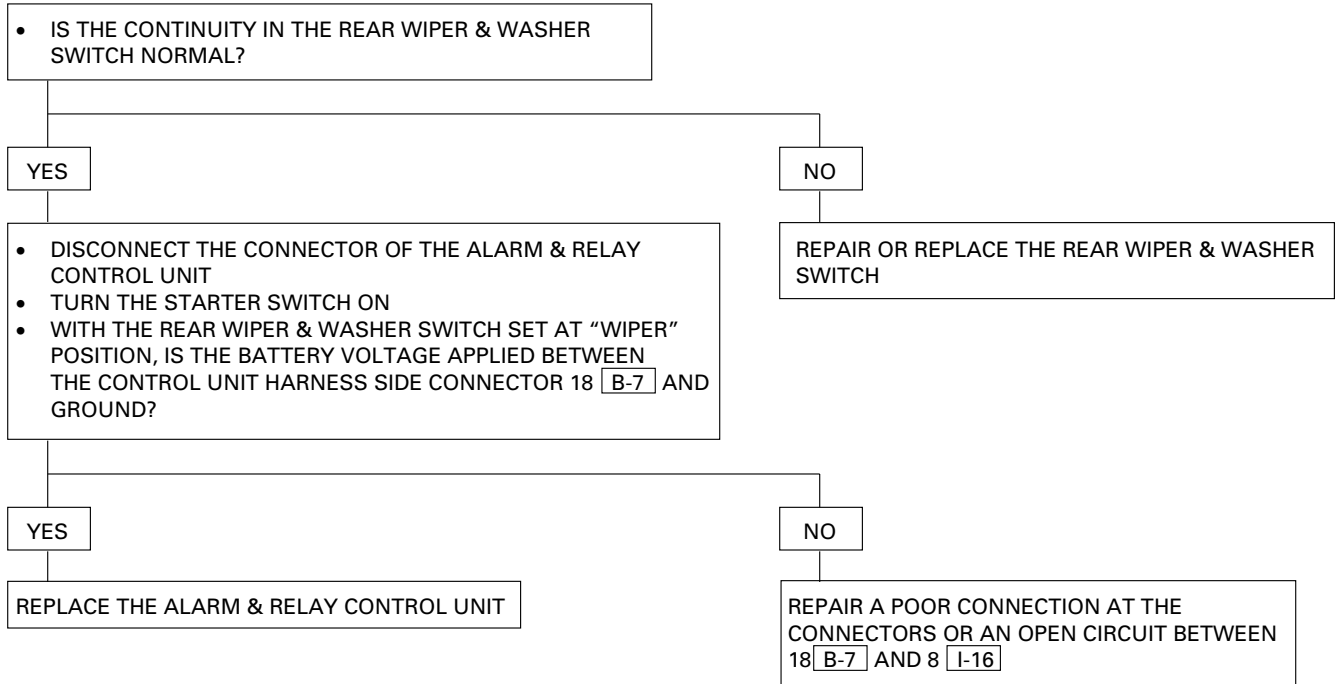
1 Rear Wiper Motor Does Not Operate



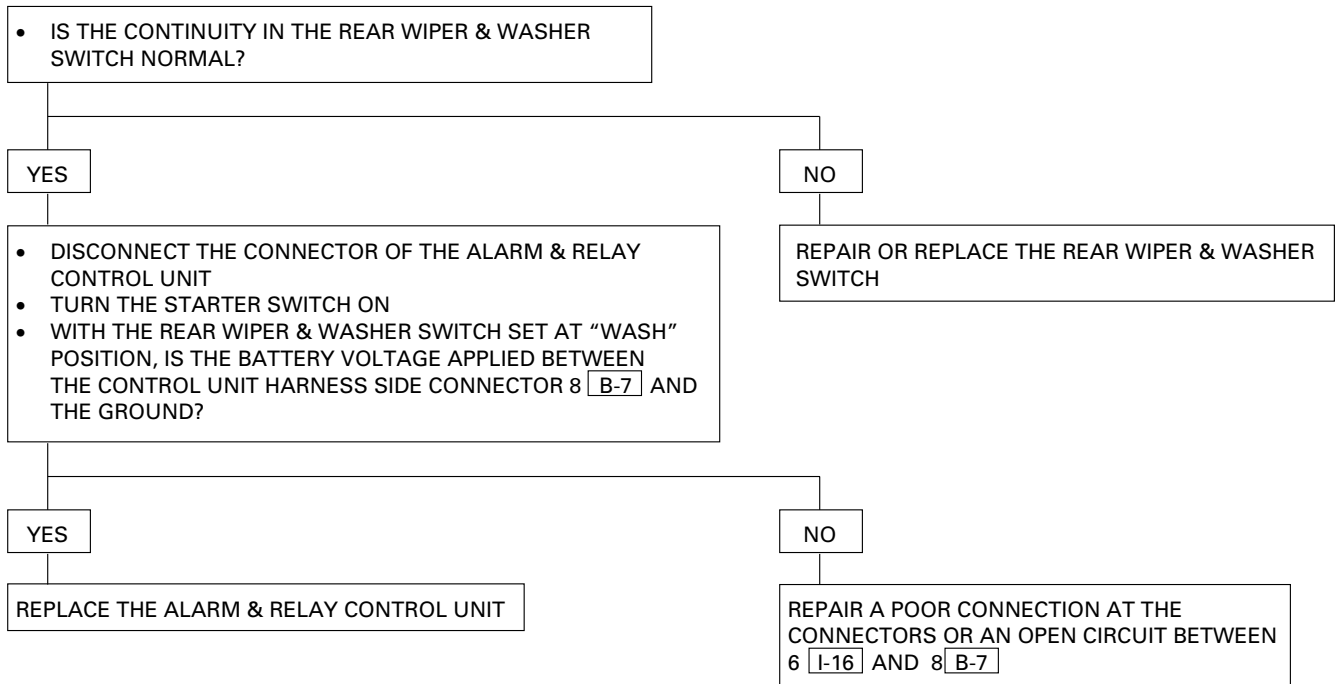
2 Auto-Stop Function of The Rear Wiper Motor Does Not Operate



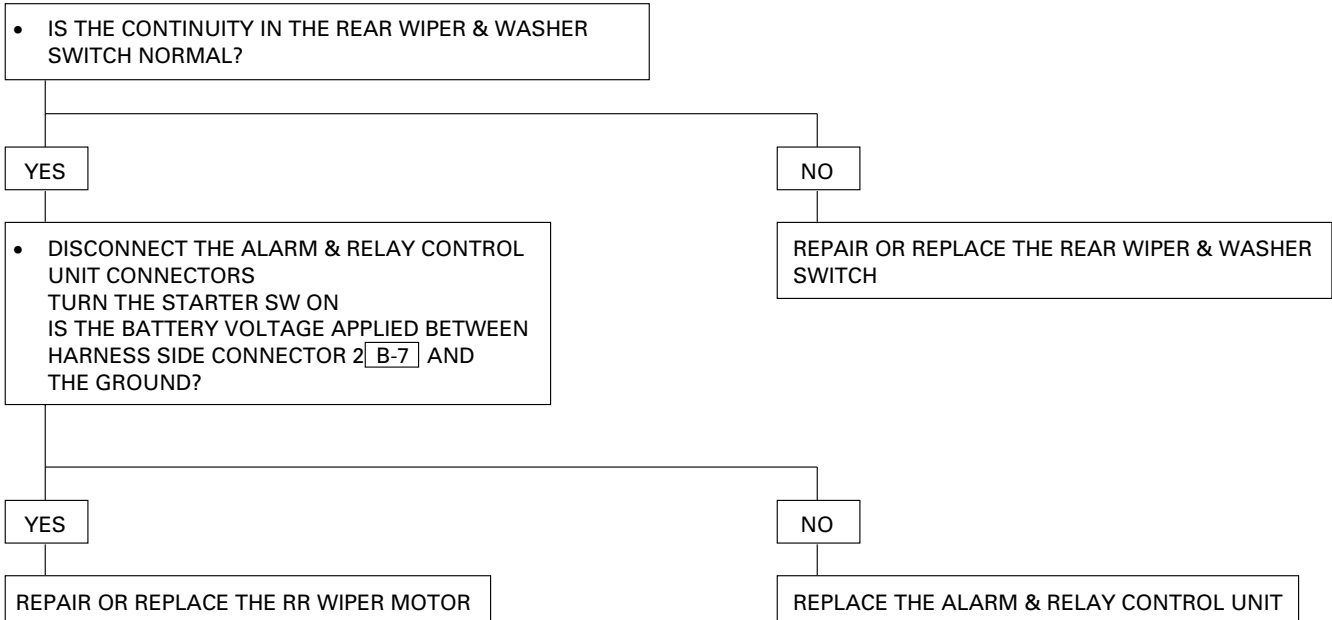
3 Rear Wiper Motor Does Not Operate at “Wiper” Position



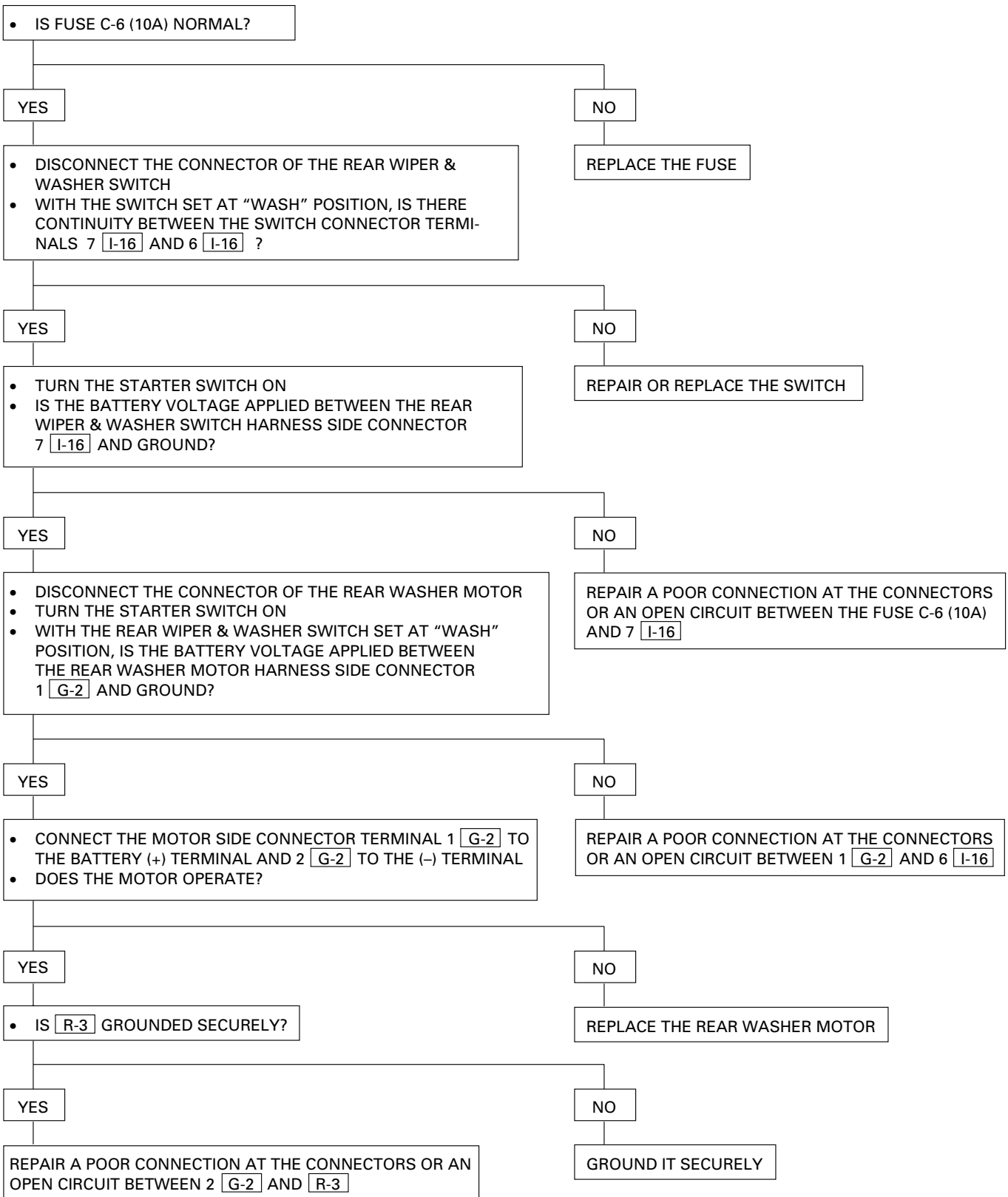
4 Rear Wiper Motor Does Not Operate at “Washer” Position



5 Rotation of The Rear Wiper Motor Does Not Stop



6 Rear Washer Motor Does Not Operate



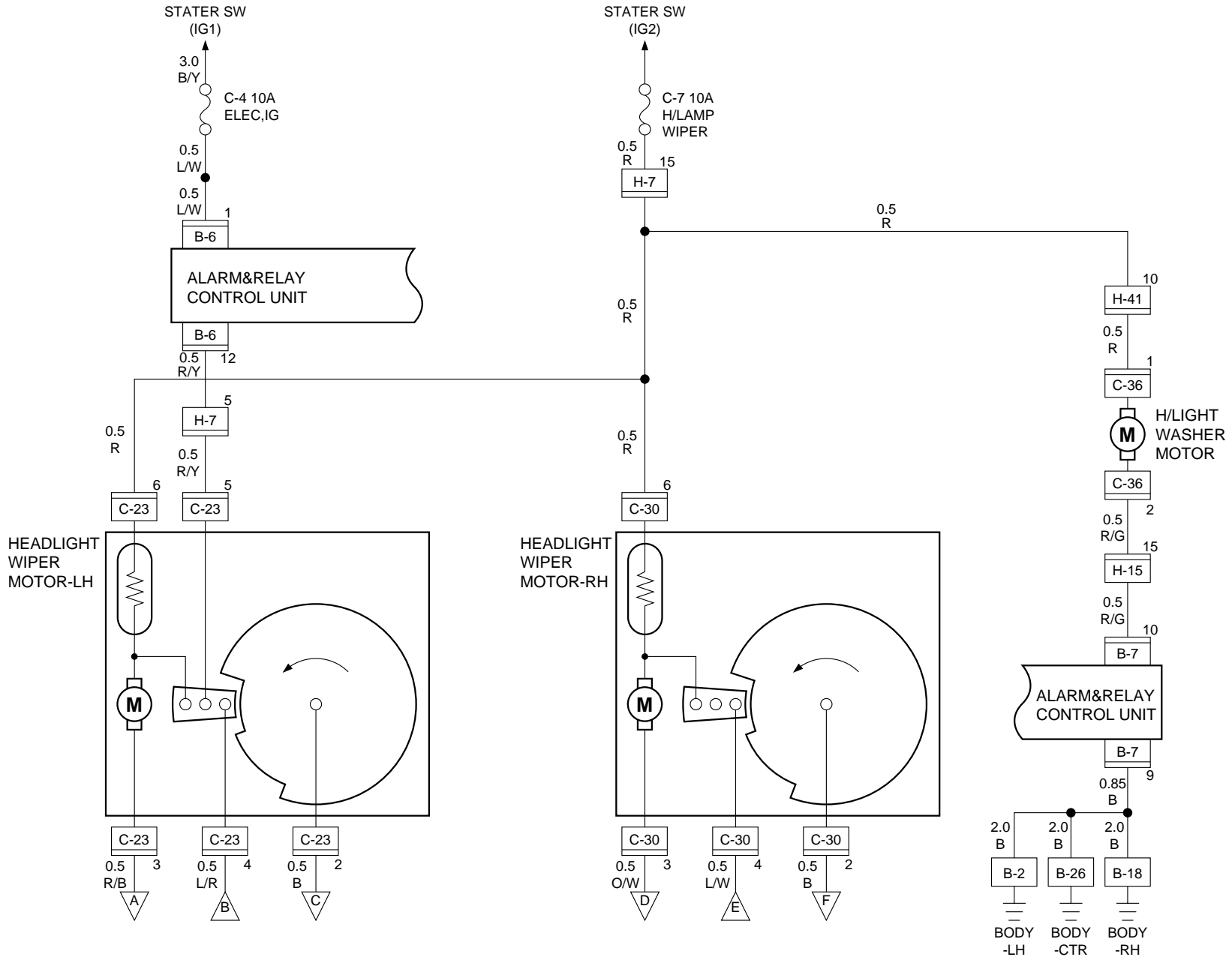
Headlight Wiper/Washer

General Description

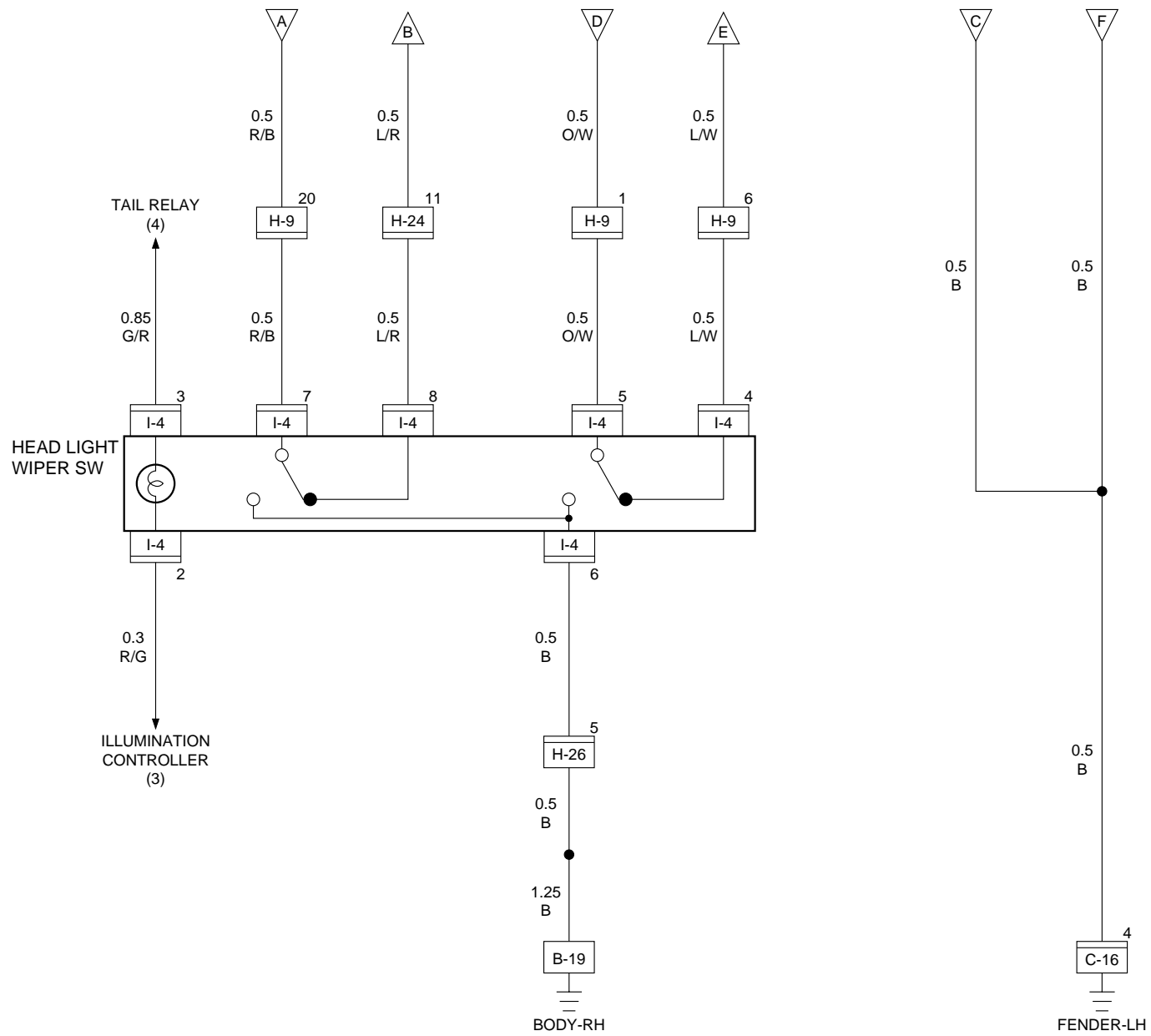
The circuit consists of the starter switch, headlight wiper switch, headlight wiper motor and washer motor. By pushing the headlight wiper/washer switch with the starter switch on, the wiper will make 5 strokes with washer solution applied between each of the first 4 strokes, regardless of the length of time the switch is held down.

The washer nozzle is installed to the wiper blade, and the tank to which the washer motor is installed shared between the headlight washer and the windshield washer.

Circuit Diagram (RHD) - 1

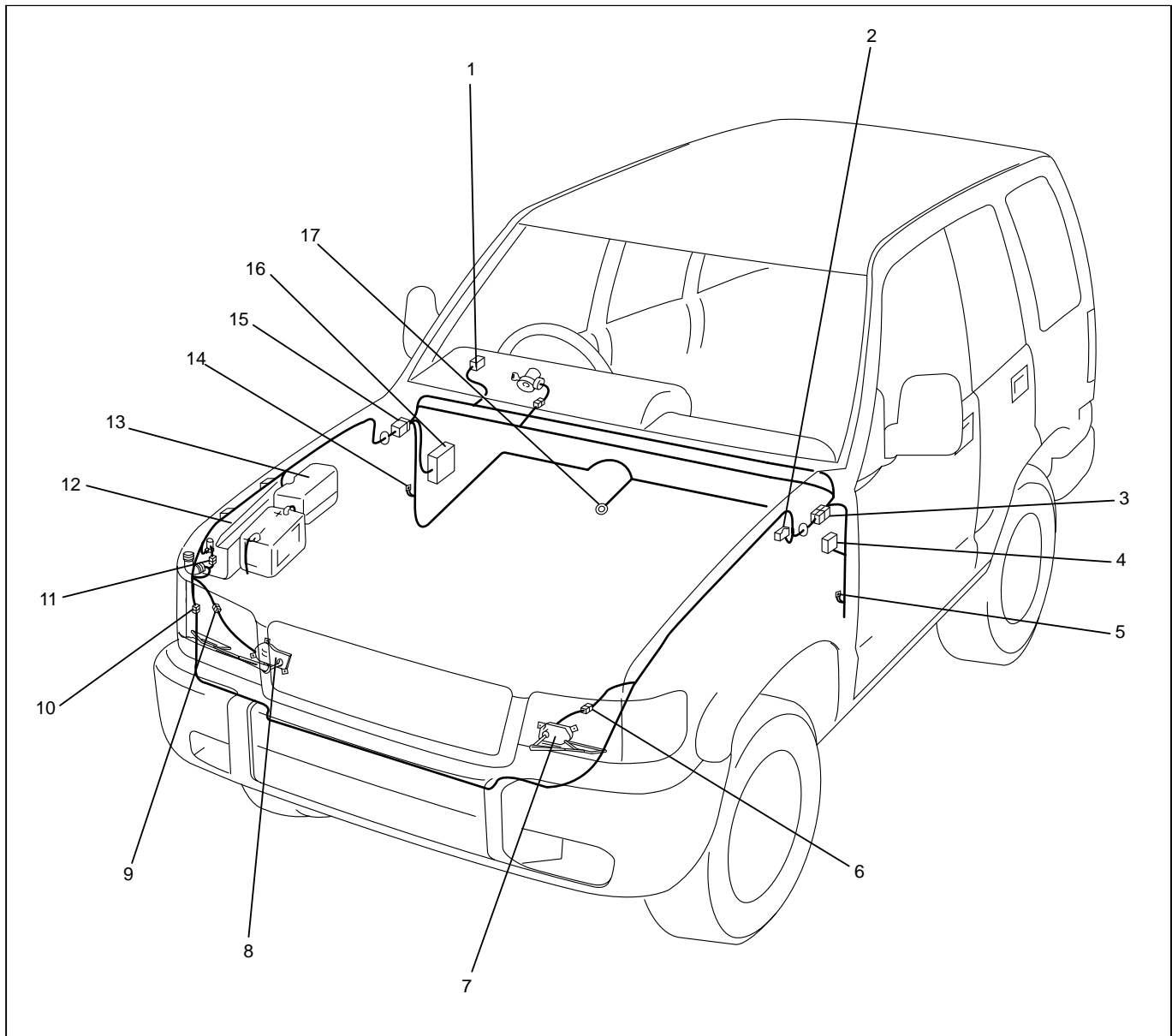


Circuit Diagram (RHD) - 2



D08R00032

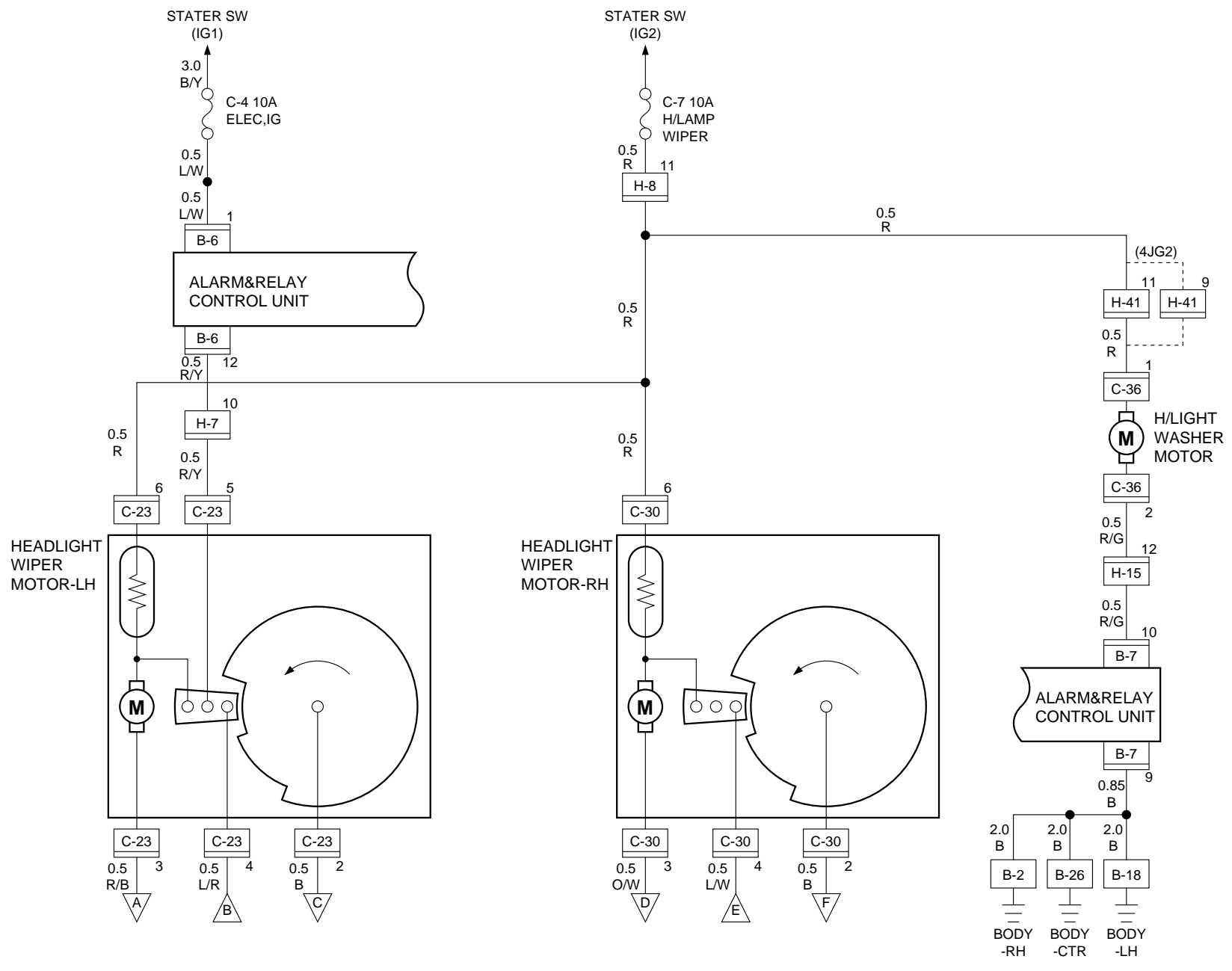
Parts Location (RHD)



D08RW938

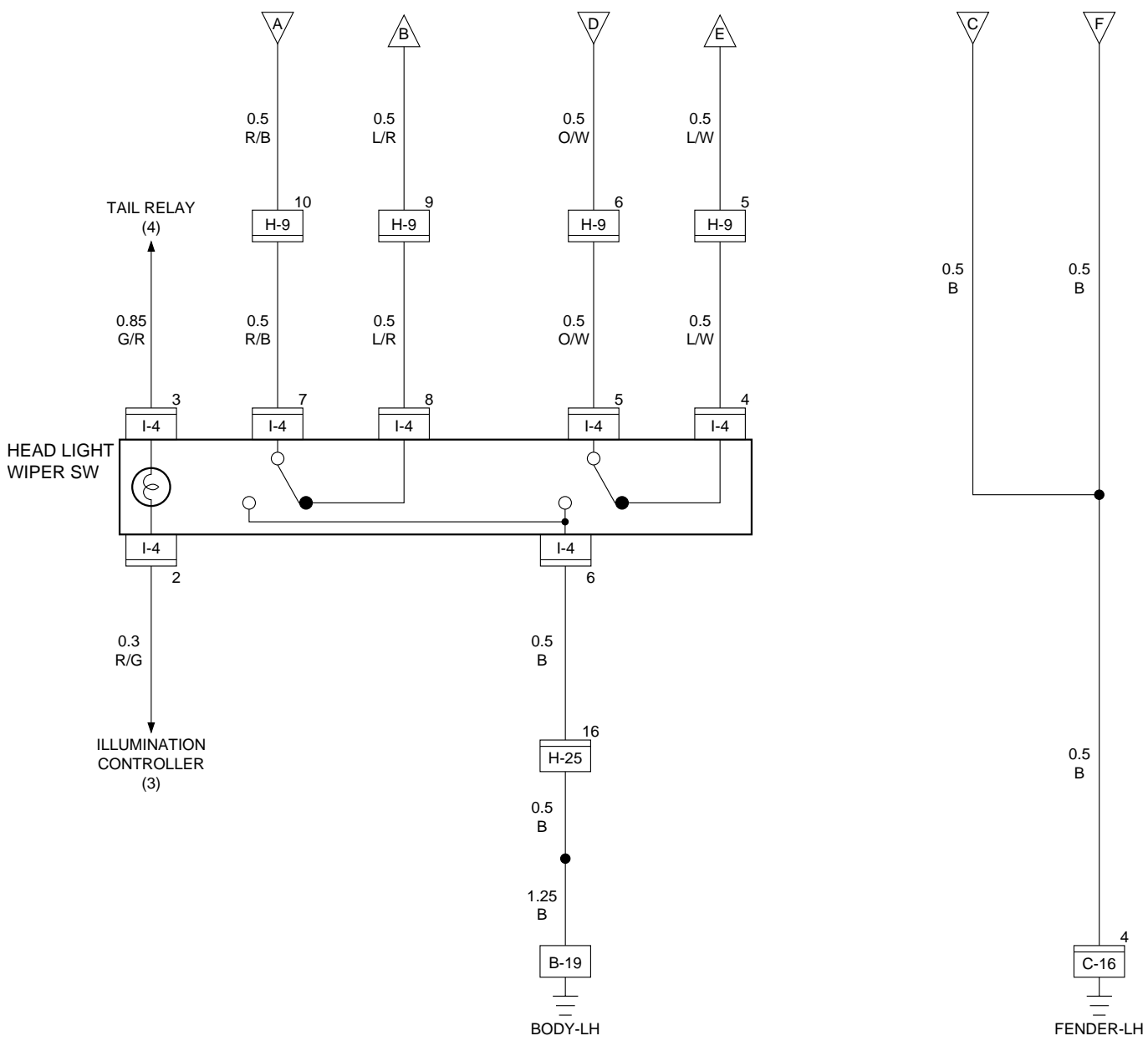
Legend

- | | |
|------------------------------|-------------------------|
| (1) I-4 | (9) C-30 |
| (2) C-16 | (10) H-41 |
| (3) H-7, H-9, H-24 | (11) C-36 |
| (4) B-6, B-7 | (12) Washer Tank |
| (5) B-2 | (13) Relay and Fuse Box |
| (6) C-23 | (14) B-18, B-19 |
| (7) Headlight Wiper Motor-LH | (15) H-15, H-26 |
| (8) Headlight Wiper Motor-RH | (16) Fuse Box |
| | (17) B-26 |

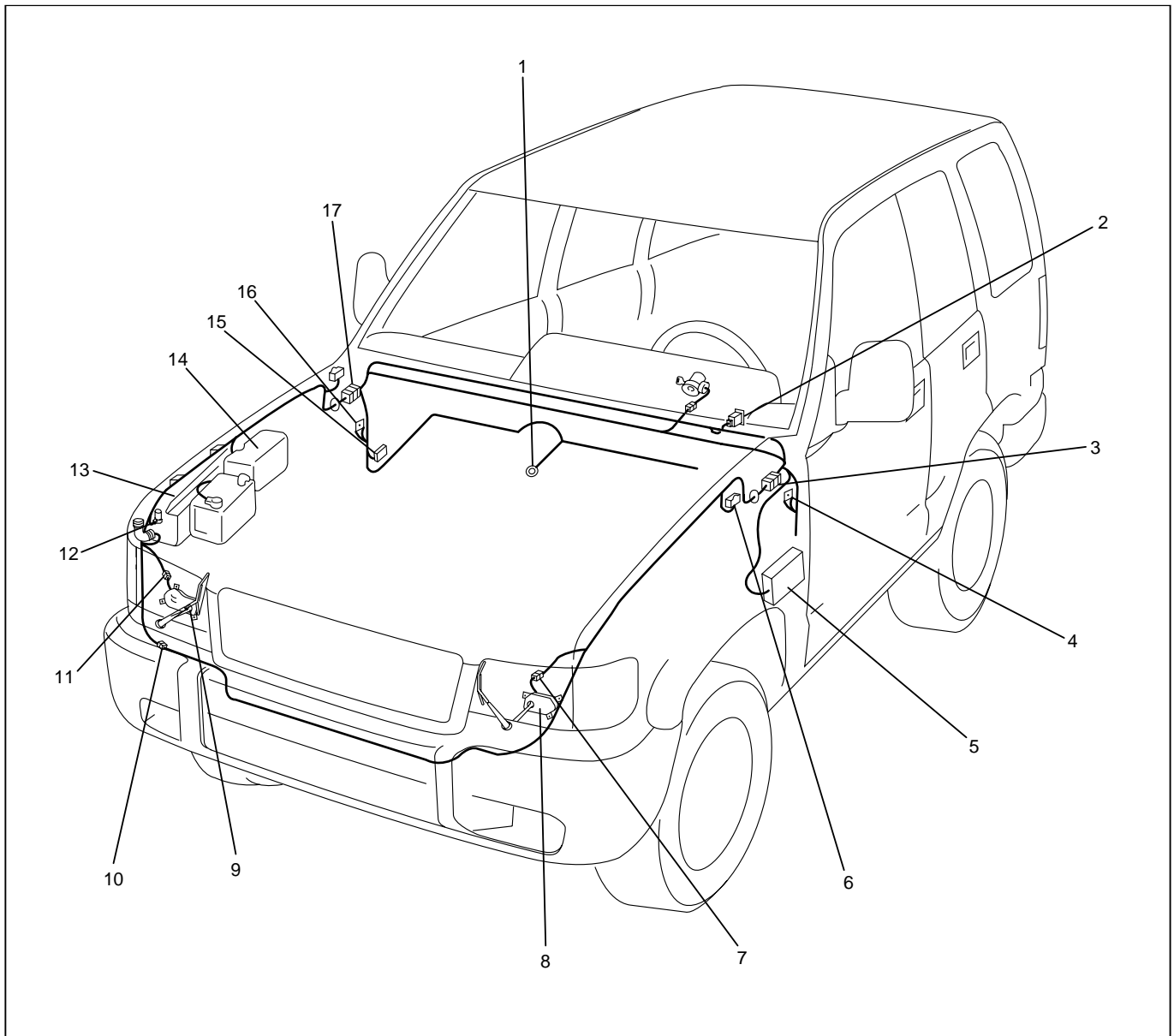


DAEWOO

Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW937

Legend

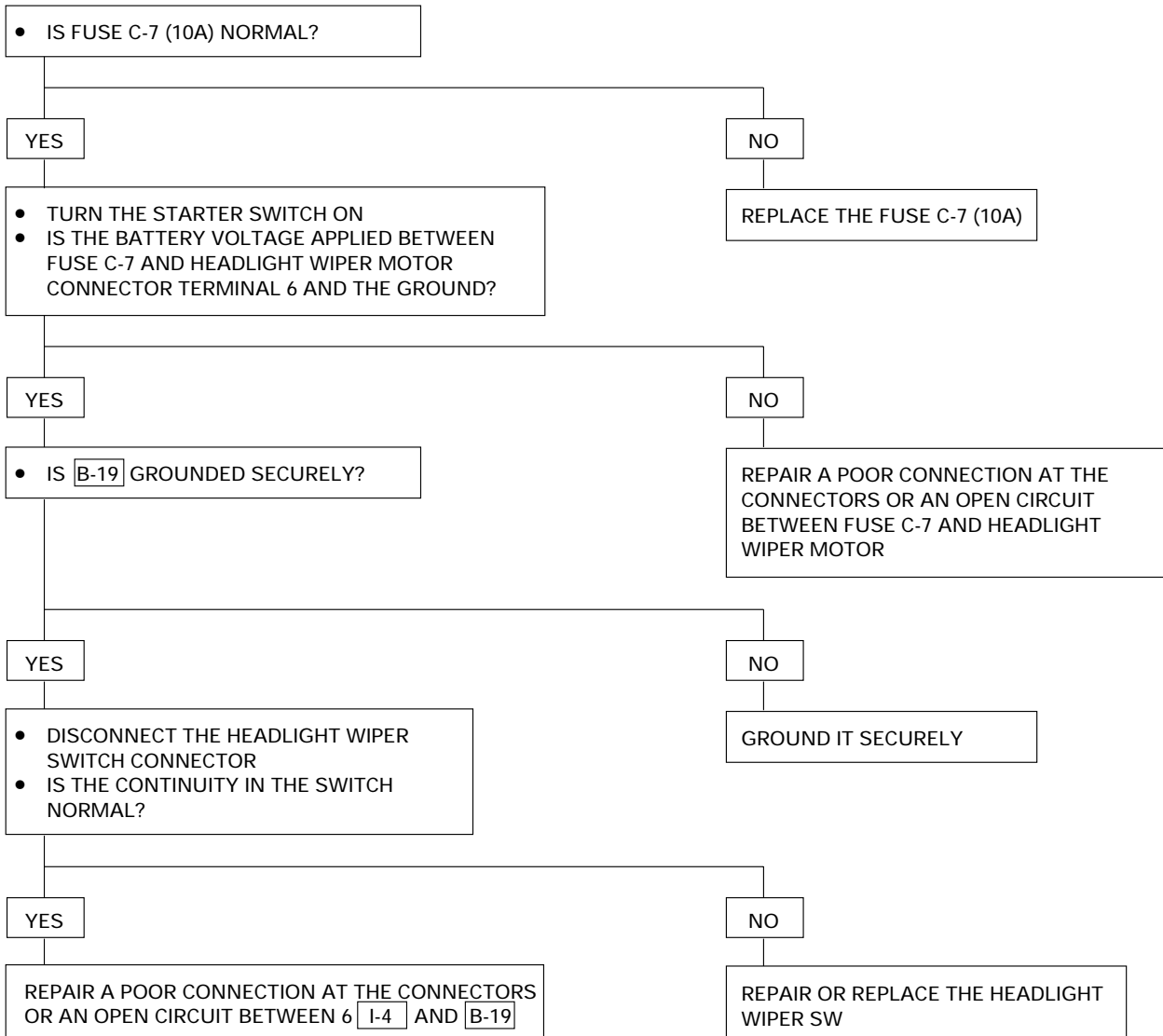
- | | |
|------------------------------|------------------------------|
| (1) B-26 | (9) Headlight Wiper Motor-RH |
| (2) I-4 | (10) H-41 |
| (3) H-7, H-8, H-9, H-25 | (11) C-30 |
| (4) B-18, B-19 | (12) C-36 |
| (5) Fuse Box | (13) Washer Tank |
| (6) C-16 | (14) Relay and Fuse Box |
| (7) C-23 | (15) B-6, B-7 |
| (8) Headlight Wiper Motor-LH | (16) B-2 |
| | (17) H-15 |

Diagnosis

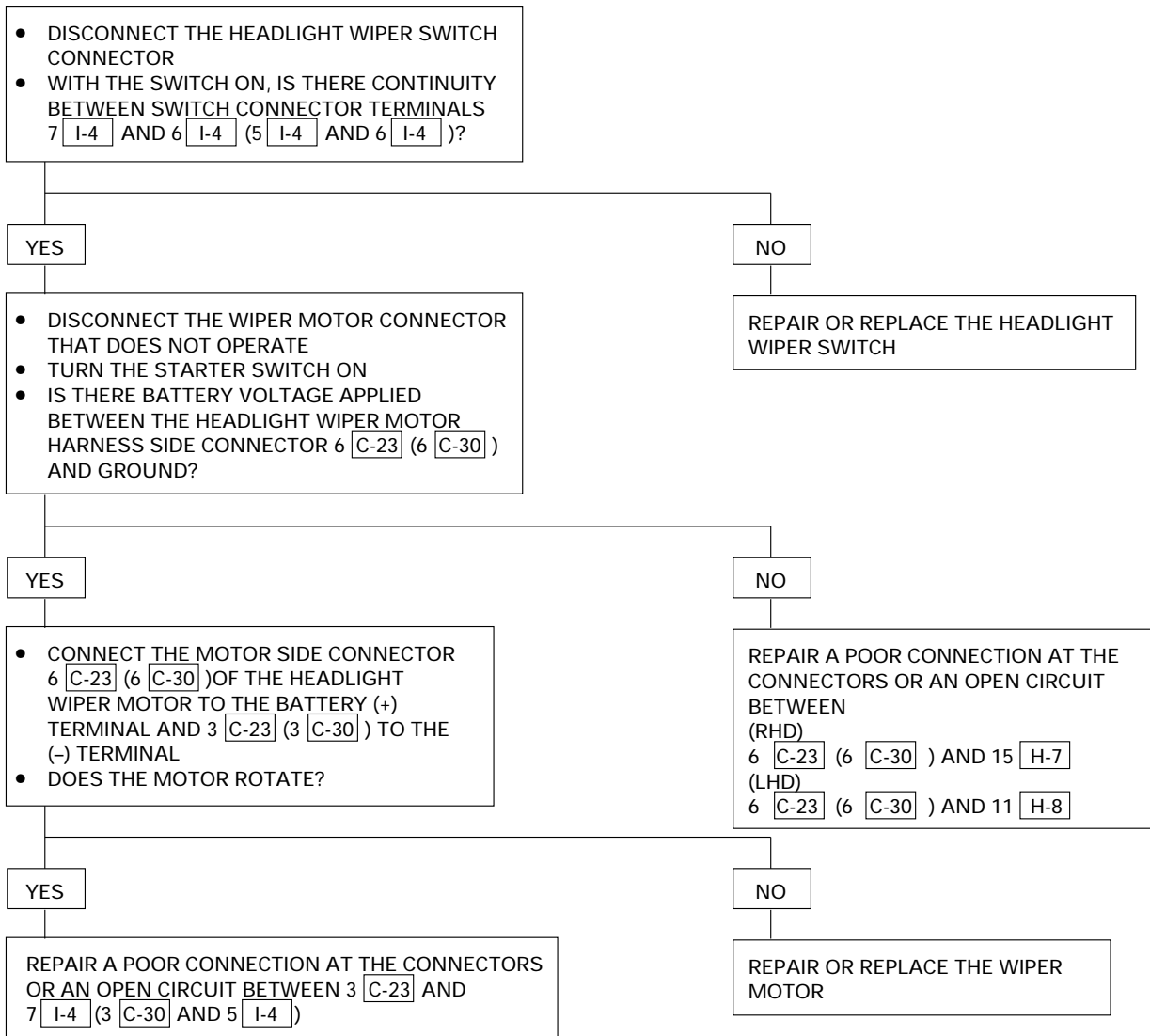
Quick Chart for Check Points

Trouble mode \ Check point	Fuse		Headlight wiper SW	Headlight wiper motor	Headlight washer motor	Alarm & relay control unit	Cable harness
	C-7	C-4					
1. Headlight wipers and washer do not operate on either side	<input type="radio"/>		<input type="radio"/>				<input type="radio"/>
2. Wiper on the left (or right) side does not operate			<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
3. Auto-stop function of the wiper on the left (or right) side does not operate			<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
4. Wiper on the left (or right) side does not stop			<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
5. Washer motor does not operate		<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

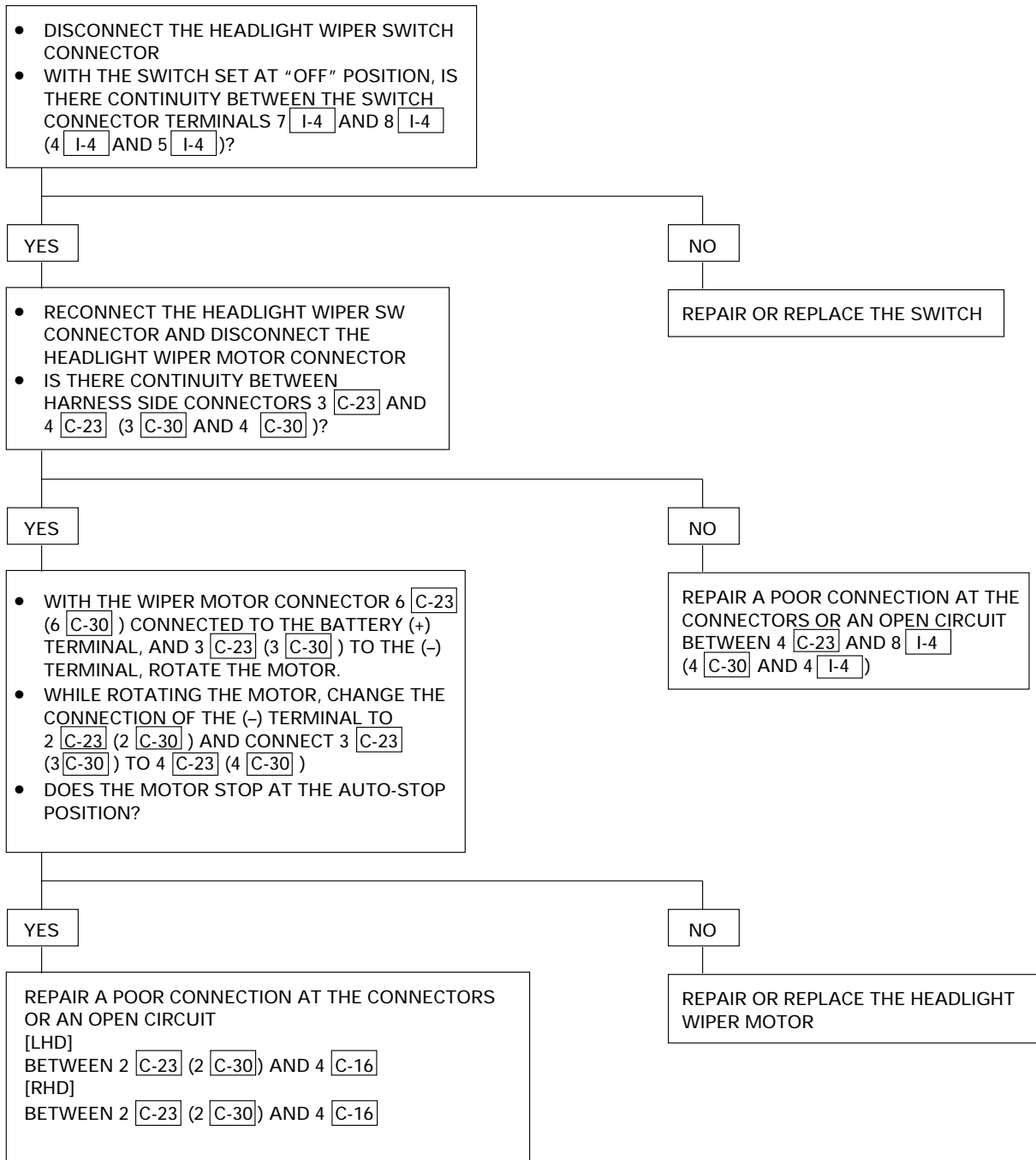
1. Headlight Wipers And Washer Do Not Operate On Either Side



2. Wiper On The Left (Or Right) Side Does Not Operate

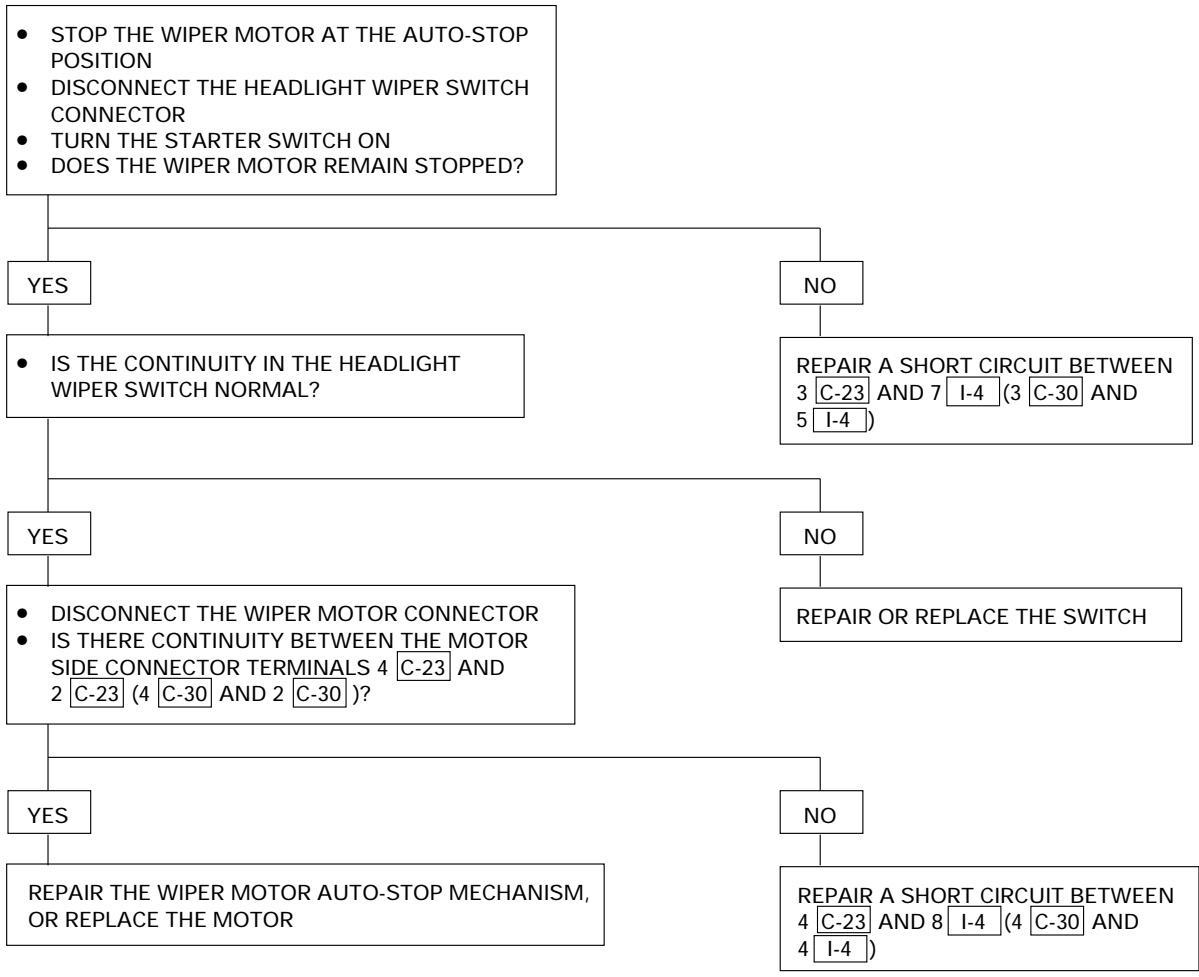


3. Auto-stop Function Of The Wiper On The Left (Or Right) Side Does Not Operate

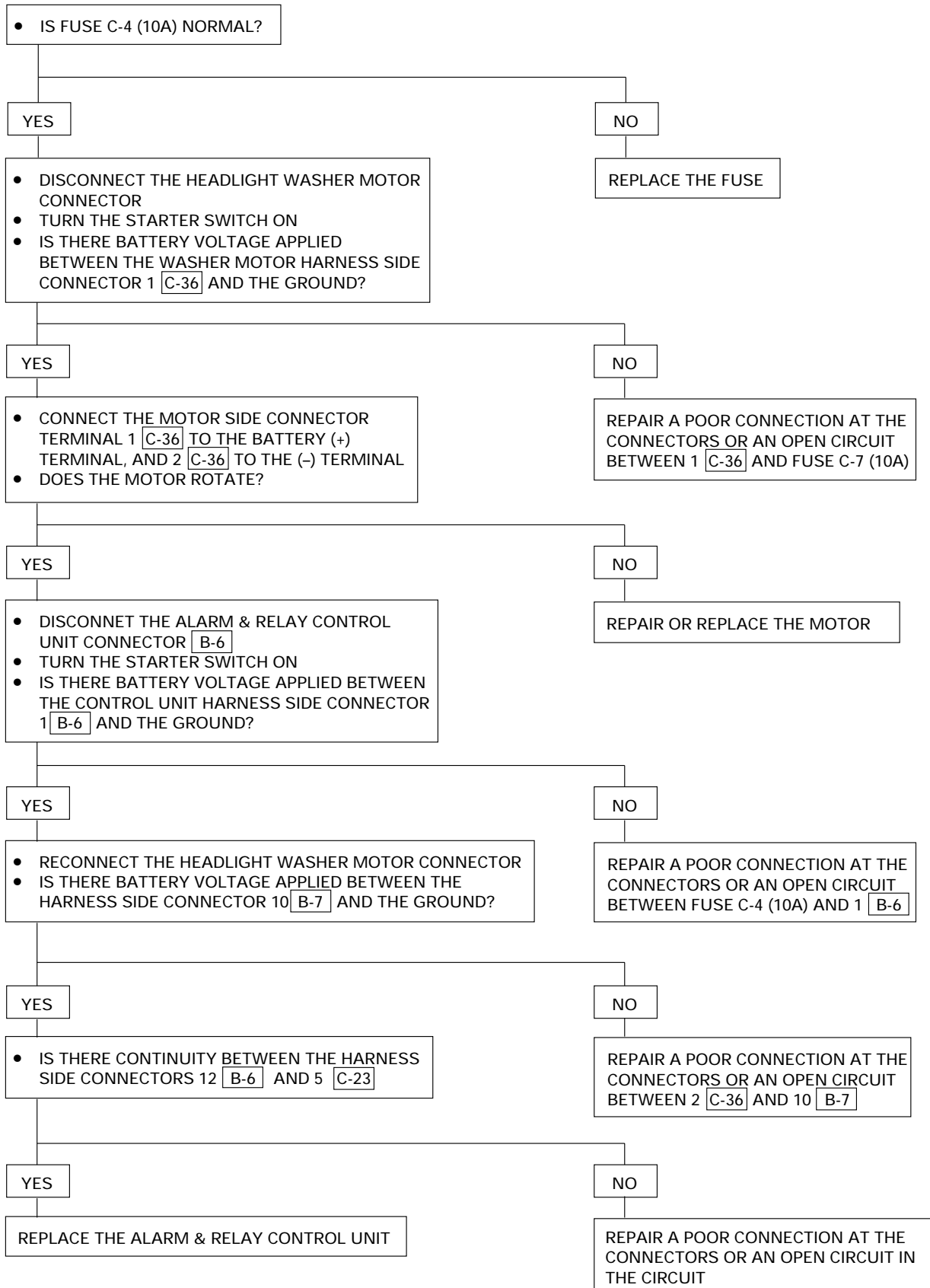


NOTE : If headlight wiper motor auto-stop on both sides does not function, it may be attributable either to headlight wiper switch trouble or to poor grounding of connector C-16 .

4. Wiper On The Left (Or Right) Side Does Not Stop



5. Washer Motor Does Not Operate

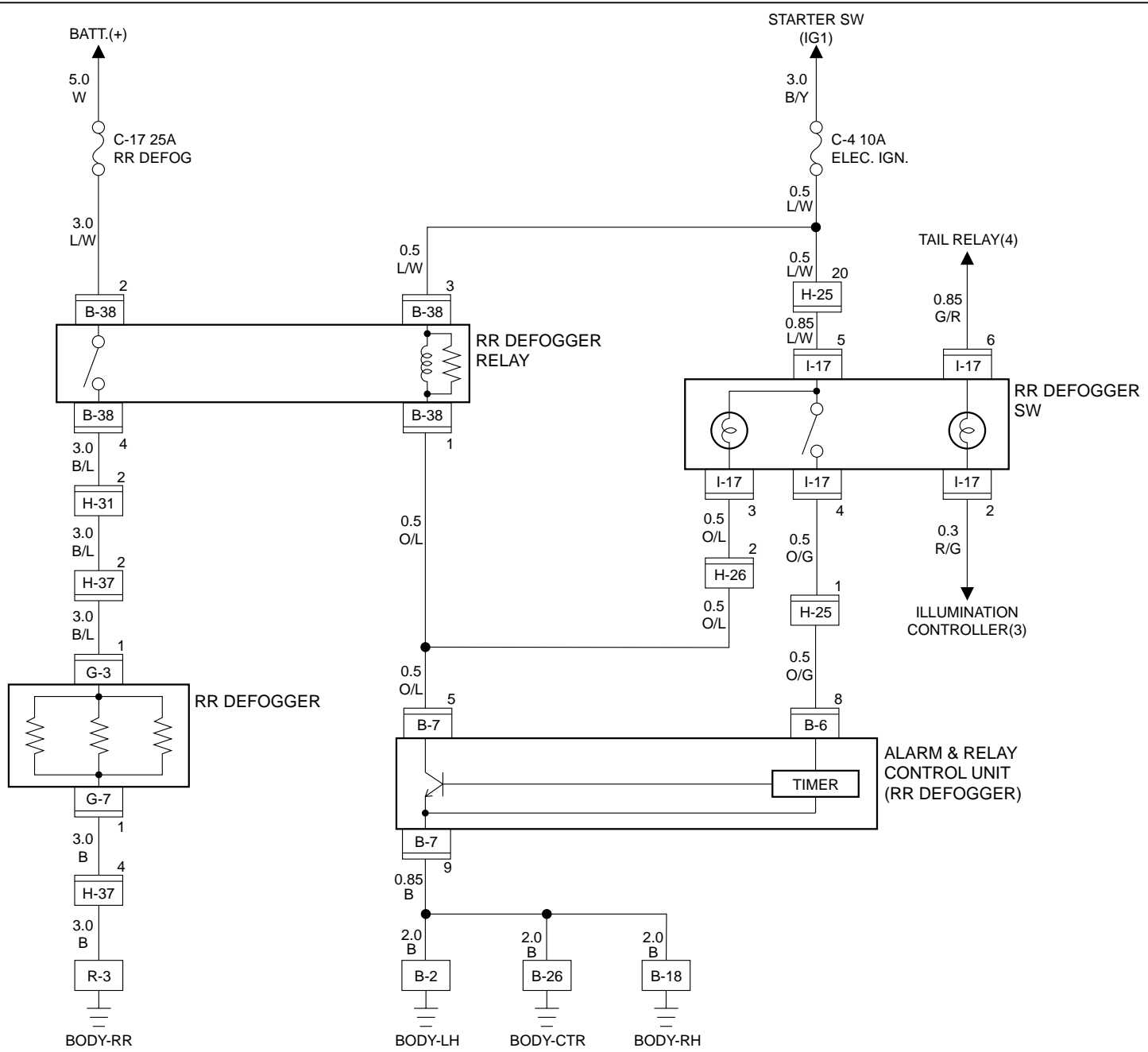


Rear Defogger

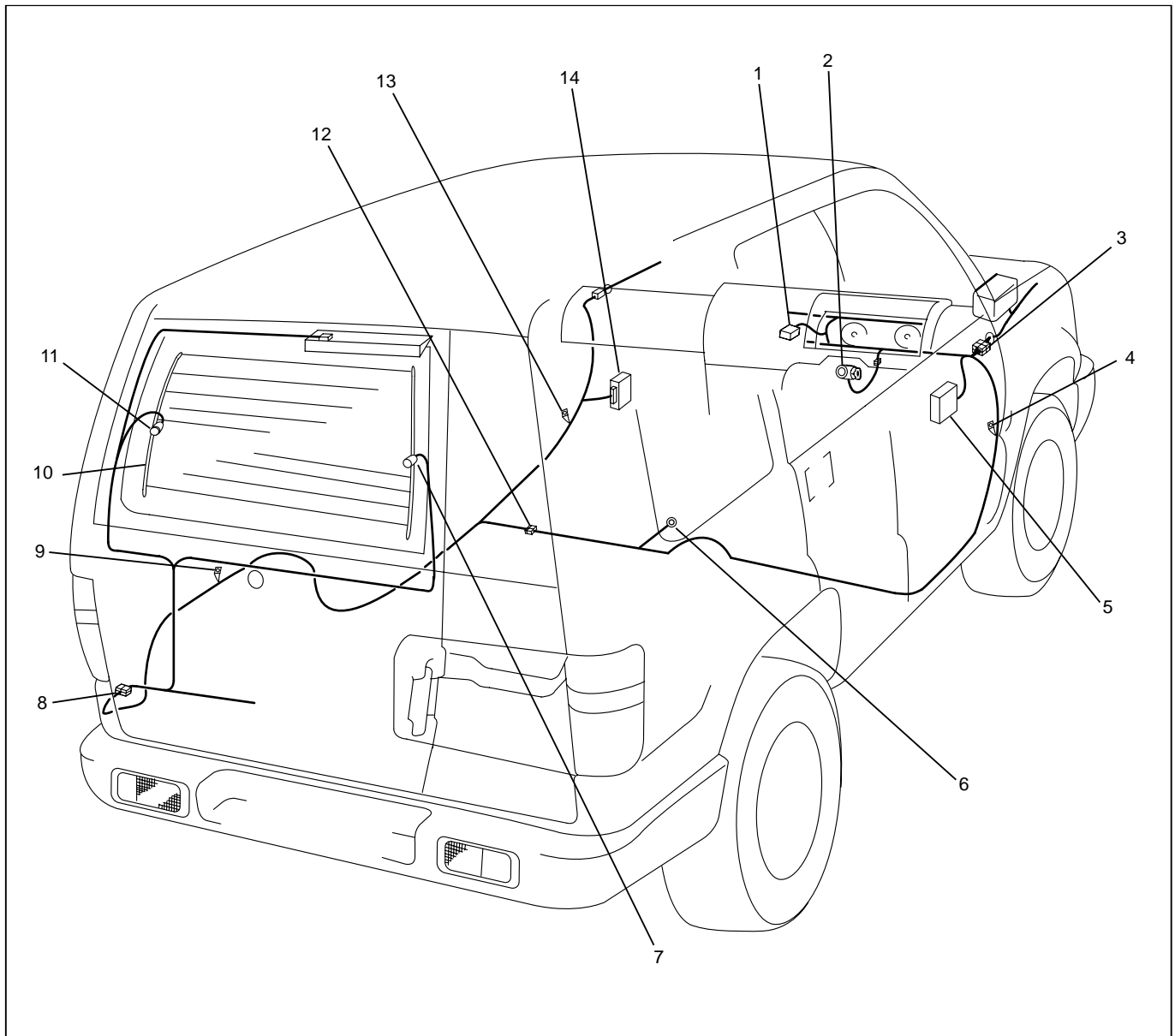
General Description

When rear defogger switch is turned on with starter switch on, battery voltage is applied to rear defogger through rear defogger relay to operate rear defogger. Alarm & relay control unit is provided with a timer. When the operation time of the timer elapses which has been set in advance at manufacture, the switch is automatically turned off. (The timer operating time is normally about 30 minutes).

Circuit Diagram (RHD)



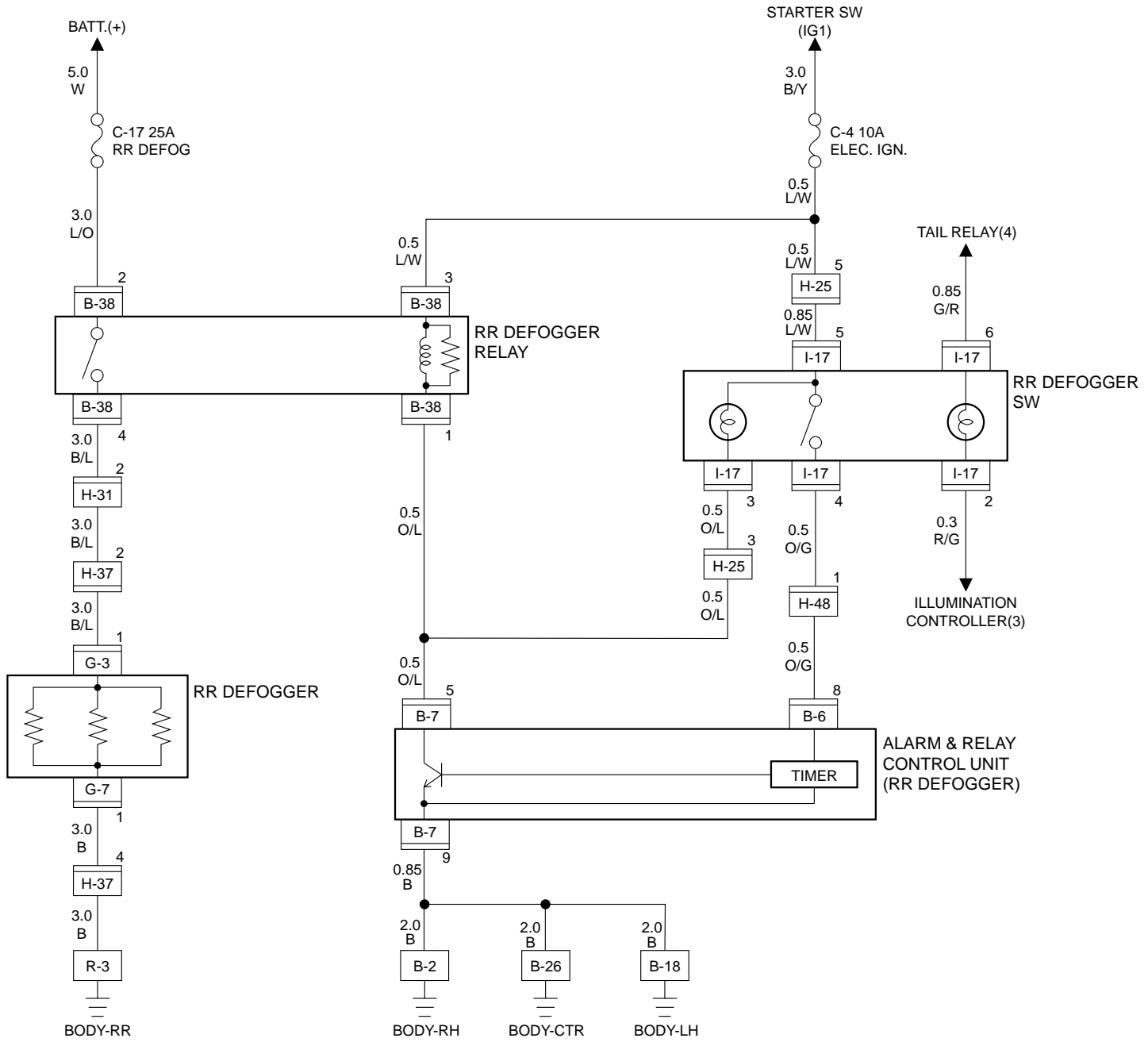
Parts Location (RHD)



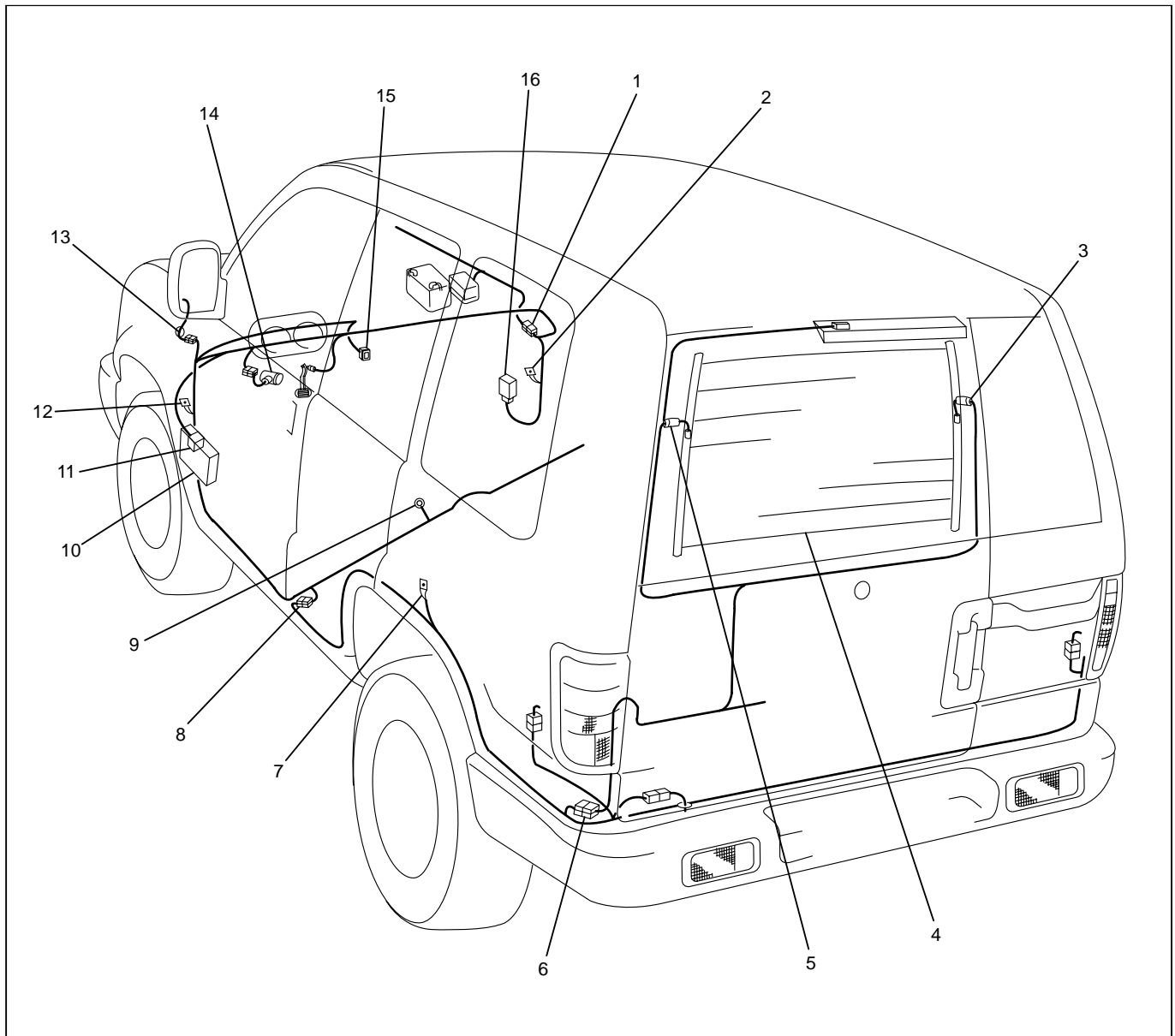
D08RW811

Legend

- | | |
|---------------------------------|--|
| (1) I-17 (Rear Defogger Switch) | (8) H-37 |
| (2) Starter Switch | (9) R-3 |
| (3) H-25, H-26 | (10) Rear Defogger |
| (4) B-19 | (11) G-3 |
| (5) Fuse Box (B-38) | (12) H-31 |
| (6) B-26 | (13) B-2 |
| (7) G-7 | (14) B-6, B-7 (Alarm and Relay Control Unit) |



Parts Location (RHD)



D08RW810

Legend

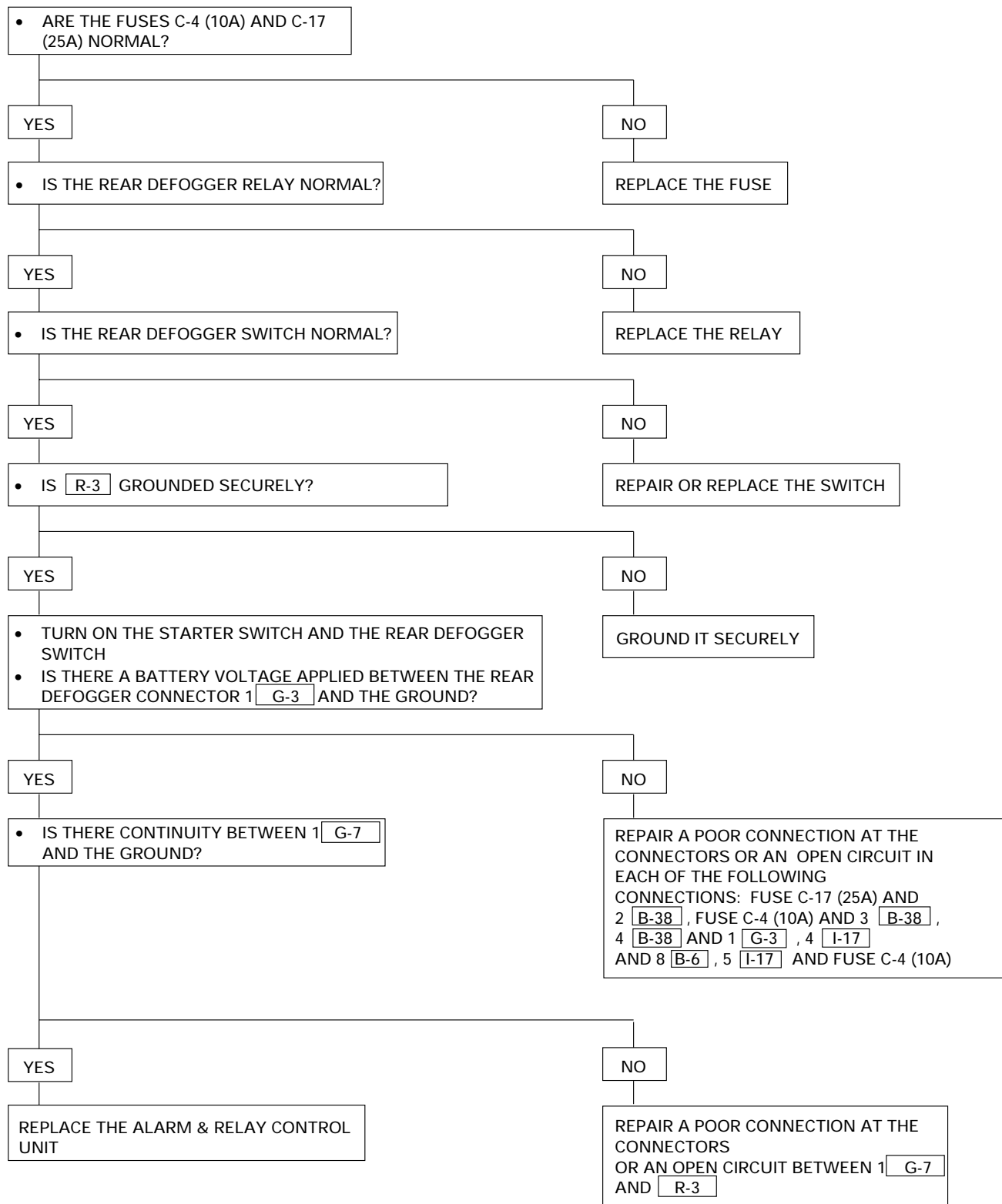
- | | |
|-------------------|--|
| (1) H-48 | (9) B-26 |
| (2) B-2 | (10) Fuse Box |
| (3) G-7 | (11) B-38 |
| (4) Rear Defogger | (12) B-18 |
| (5) G-3 | (13) H-25 |
| (6) H-37 | (14) Starter Switch |
| (7) R-3 | (15) I-17 (Rear Defogger Switch) |
| (8) H-31 | (16) B-6, B-7 (Alarm and Relay Control Unit) |

Diagnosis

Quick Chart for Check Points

Trouble mode	Check point	Fuse		Rear defogger SW	Rear defogger relay	Alarm & relay control unit	Cable harness
		C-4 (10A)	C-17 (25A)				
1	Rear defogger does not operate	○	○	○	○	○	○
2	Rear defogger timer does not function					○	

1 Rear Defogger Does Not Operate



2 Rear Defogger Timer Does Not Function

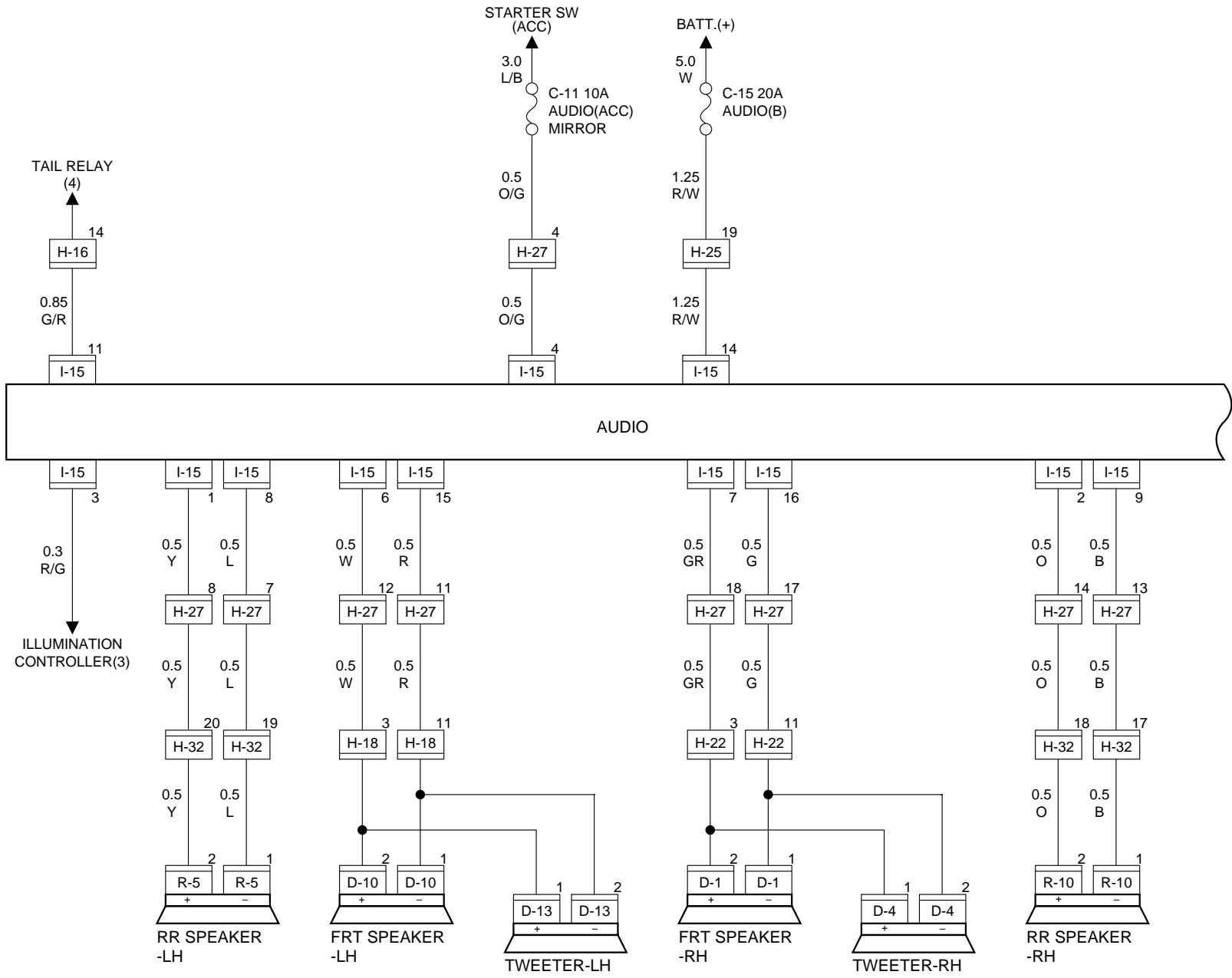
REPLACE THE ALARM & RELAY CONTROL UNIT

Audio

General Description

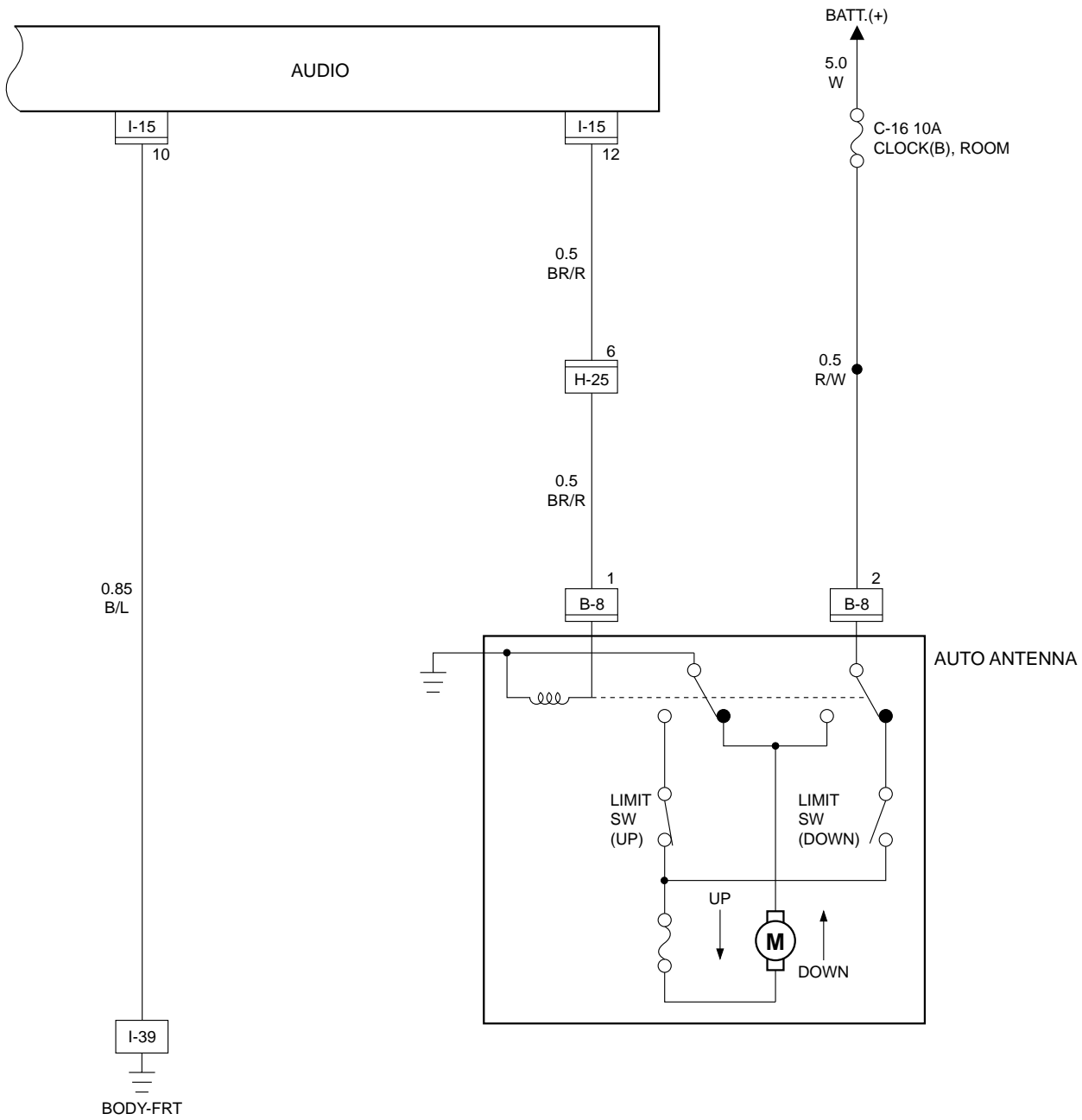
The audio circuit is designed for the current to flow through the receiver circuit when the radio switch is turned on with the starter switch in "ACC" or "ON". Current runs through the memory circuit of the audio regardless of the position of the starter switch.

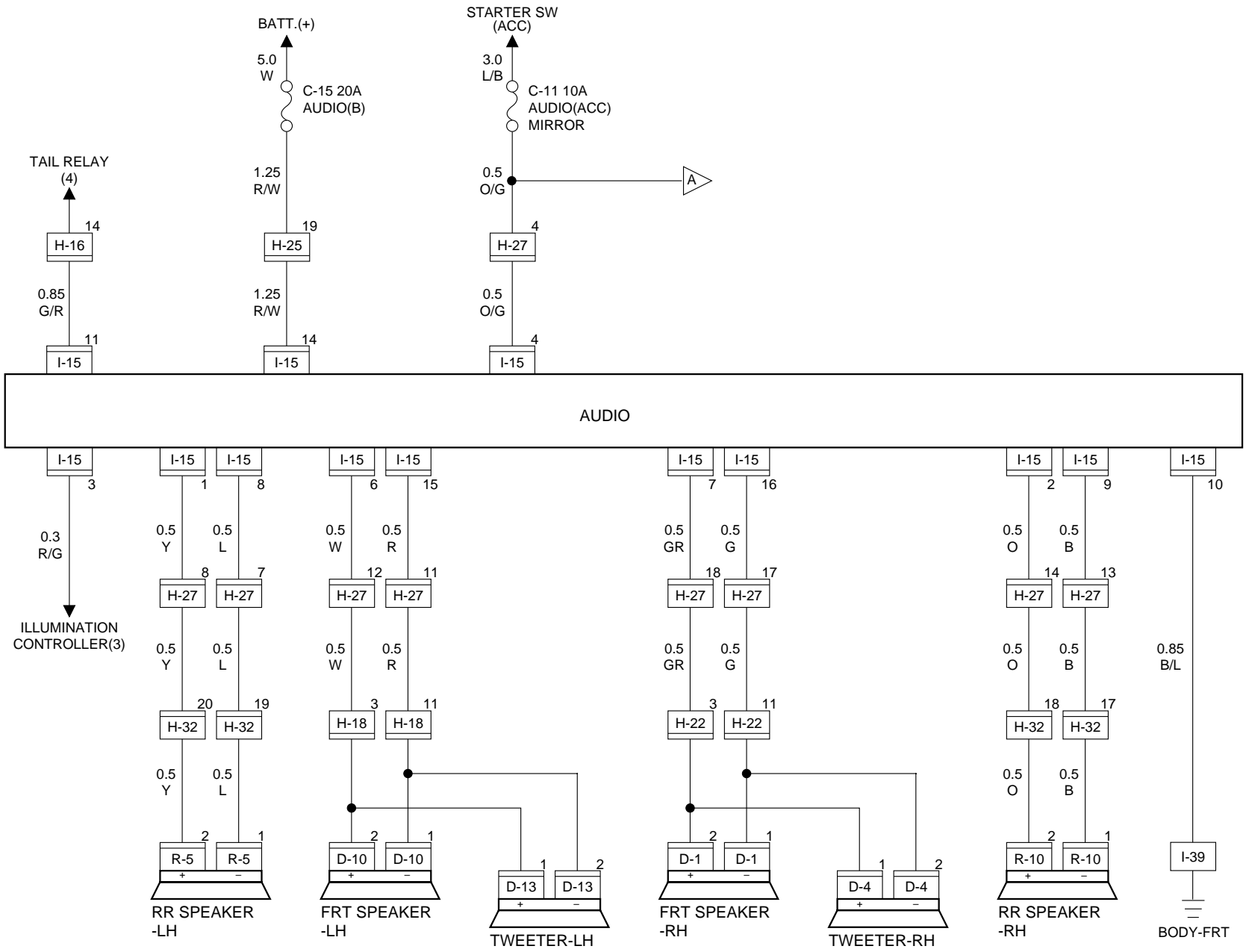
The radio antenna operates in connection to the radio switch. The antenna rod goes up when the switch is ON and goes down to be stored in the fender with the switch OFF. The antenna rod also goes down when the starter switch is turned off with radio on.



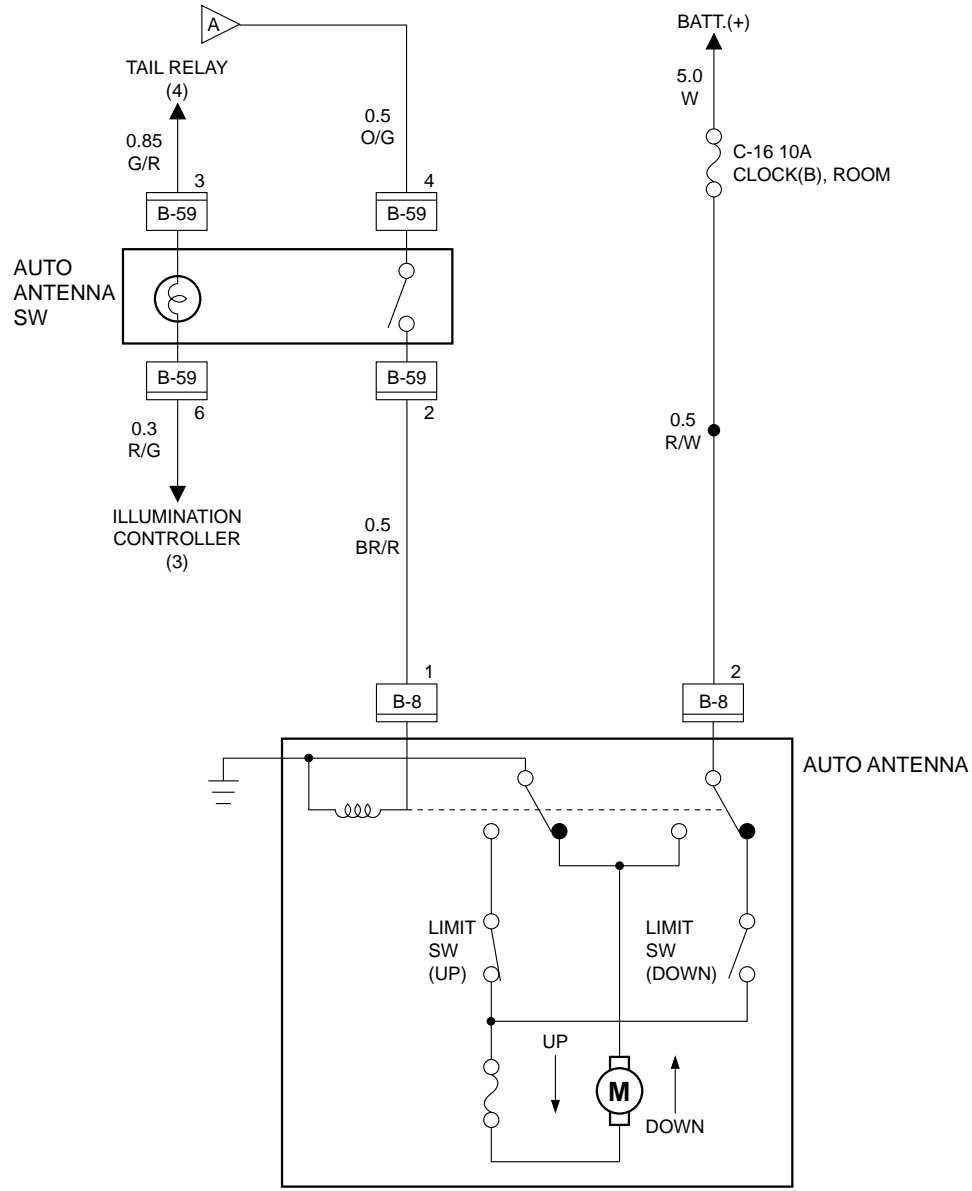
D88R4776

Circuit Diagram (RHD)-2

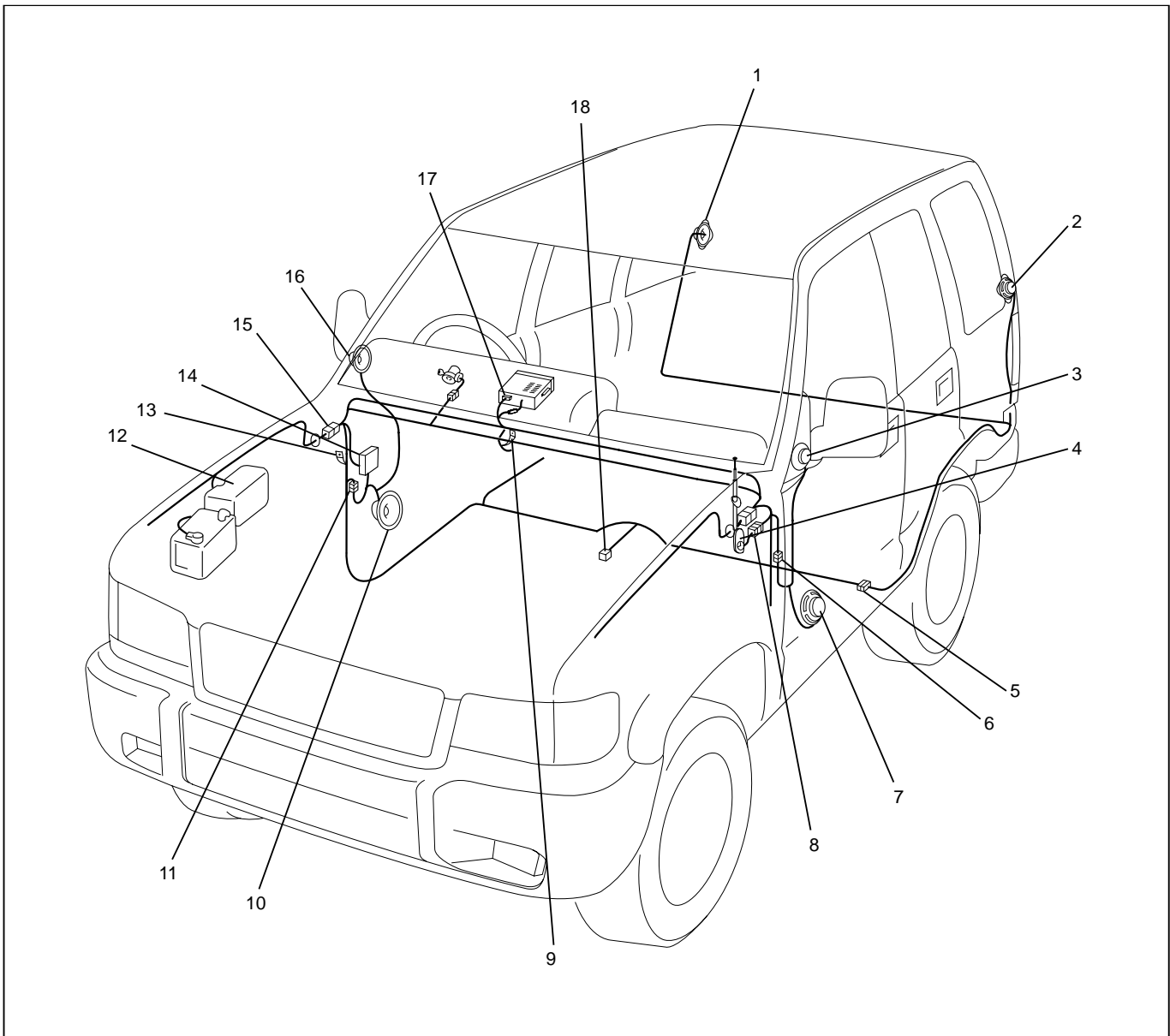




Circuit Diagram (South Africa)-2



Parts Location (RHD)

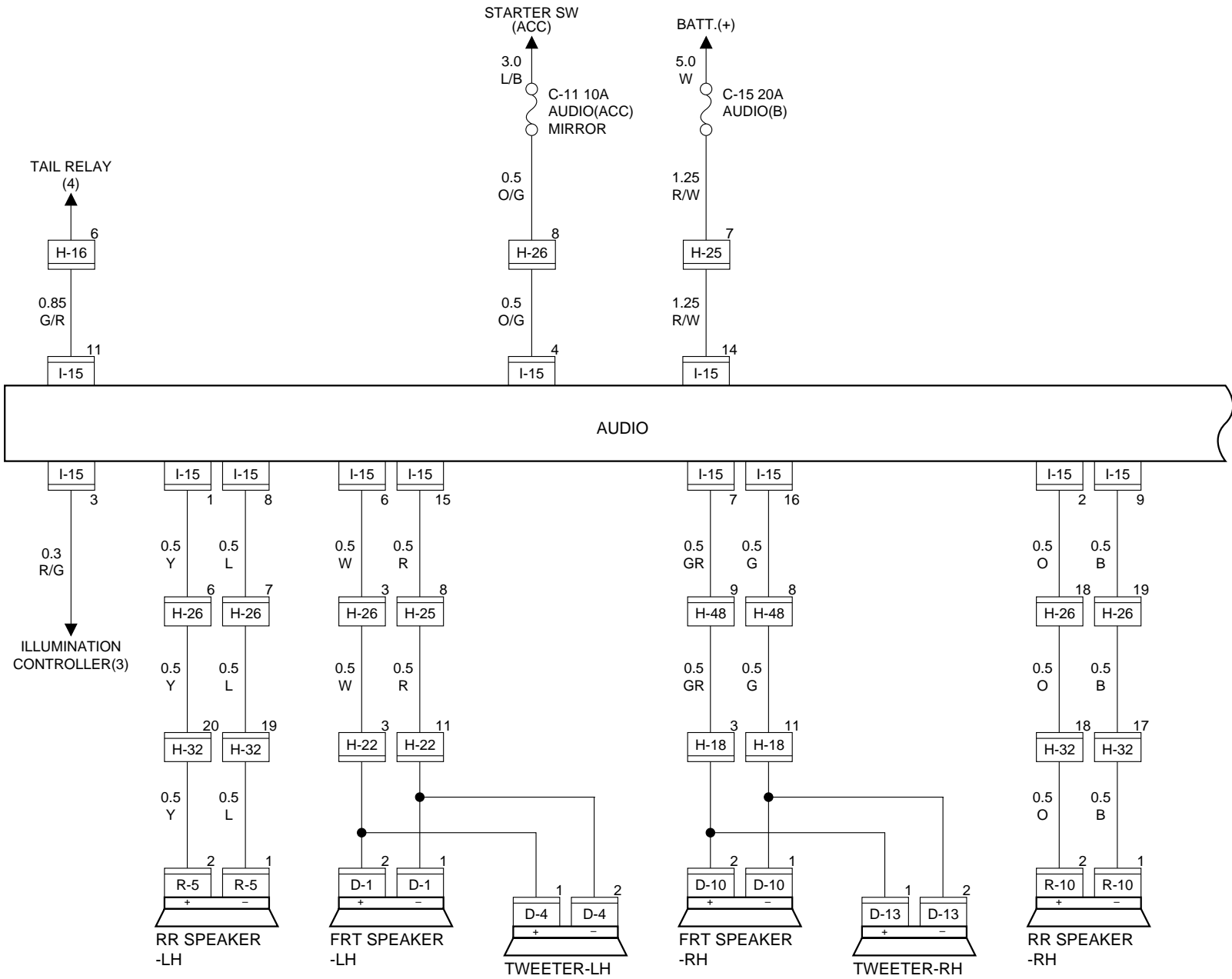


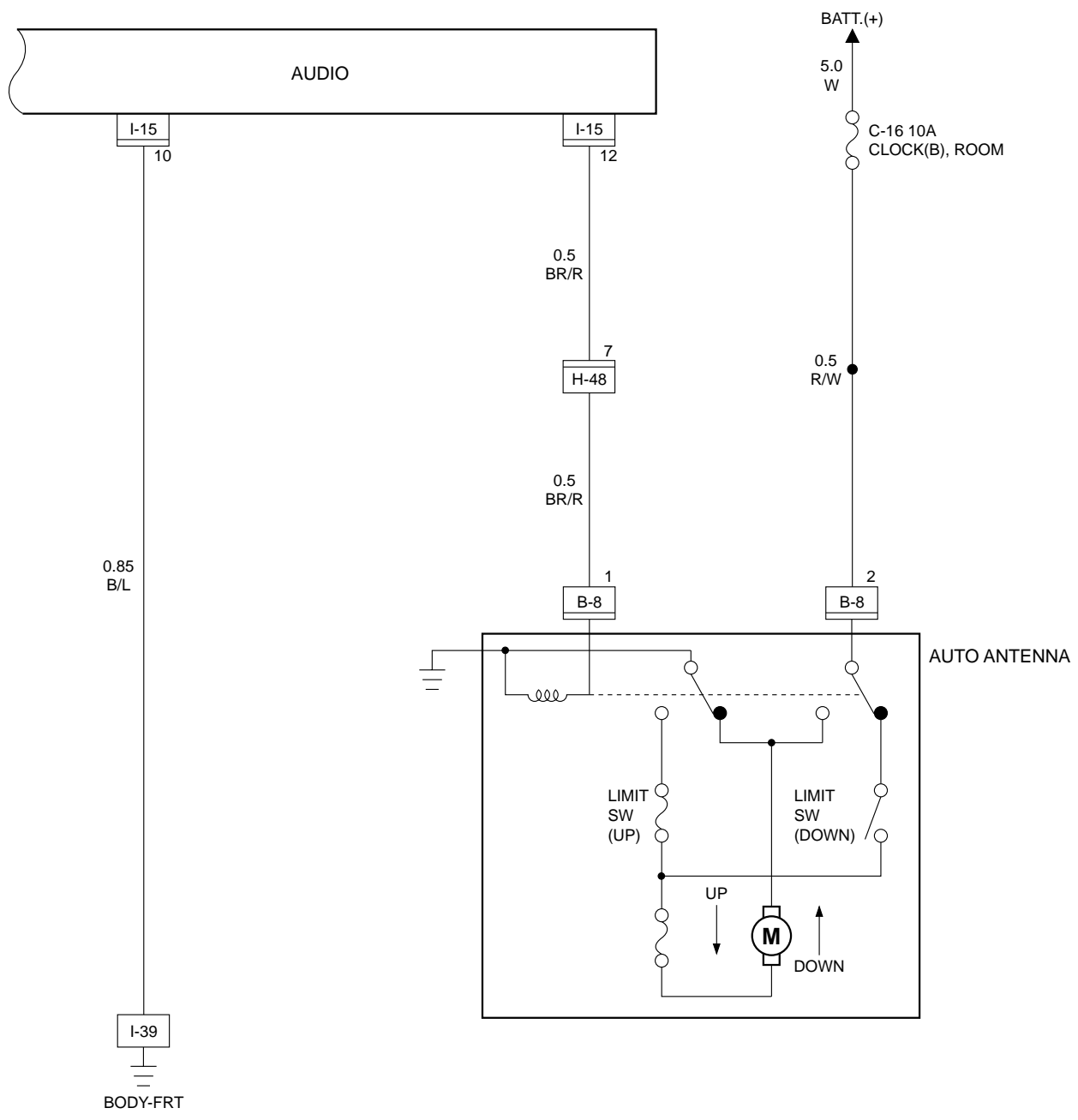
D08RWB91

Legend

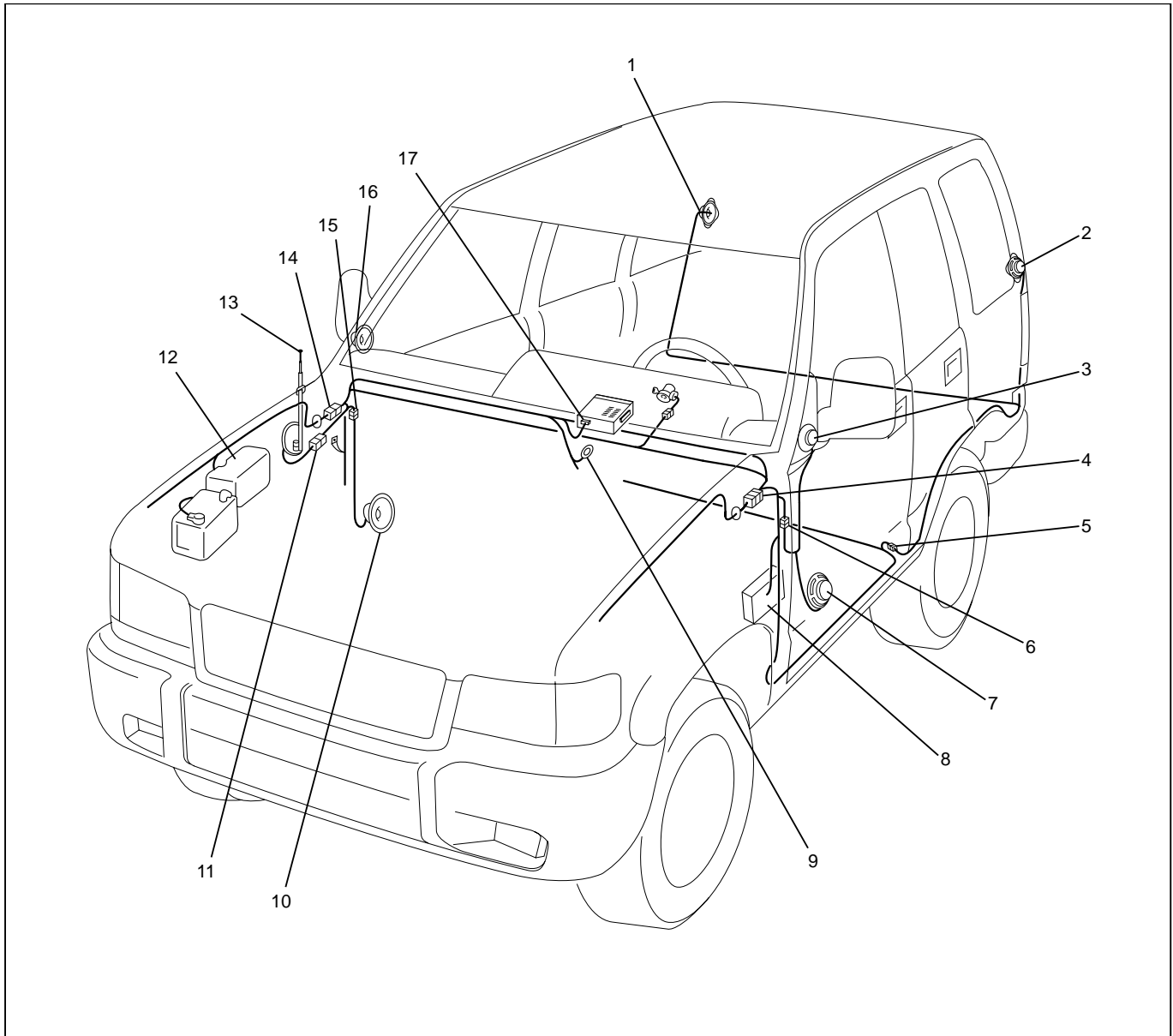
- | | |
|------------------|-------------------------|
| (1) R-10 | (10) D-1 |
| (2) R-5 | (11) H-22 |
| (3) D-13 | (12) Relay and Fuse Box |
| (4) Auto Antenna | (13) B-19 |
| (5) H-32 | (14) Fuse Box |
| (6) H-18 | (15) H-25, H-26, H-27 |
| (7) D-10 | (16) D-4 |
| (8) B-8 | (17) I-15 |
| (9) I-39 | (18) B-59 |

Circuit Diagram (LHD)-1





Parts Location (LHD)



D08RW676

Legend

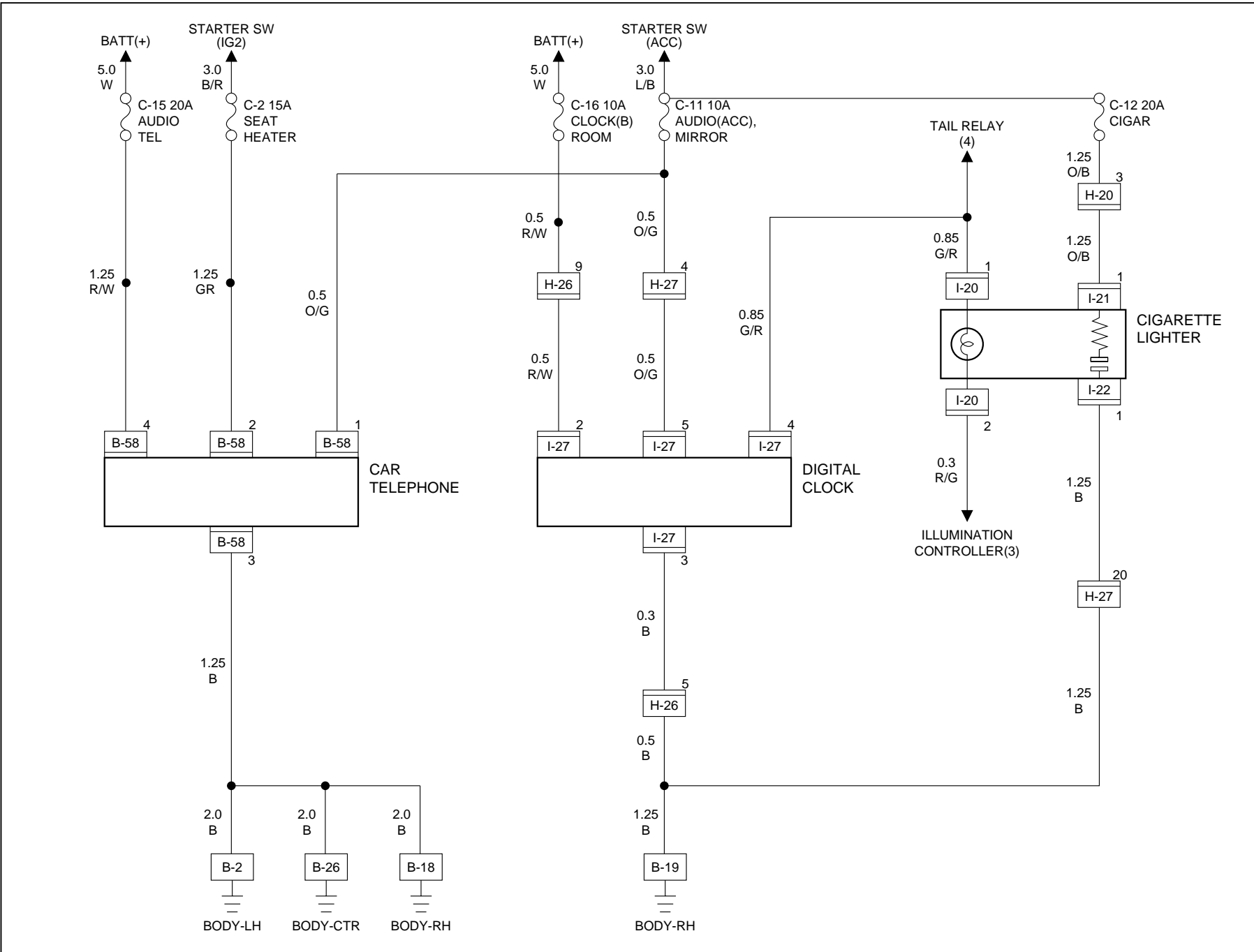
- | | |
|----------------|-------------------------|
| (1) R-10 | (9) I-39 |
| (2) R-5 | (10) D-10 |
| (3) D-4 | (11) B-8 |
| (4) H-25, H-26 | (12) Relay and Fuse Box |
| (5) H-32 | (13) Auto Antenna |
| (6) H-22 | (14) H-48 |
| (7) D-1 | (15) H-18 |
| (8) Fuse Box | (16) D-13 |
| | (17) I-15 |

Cigarette Lighter and Digital Clock

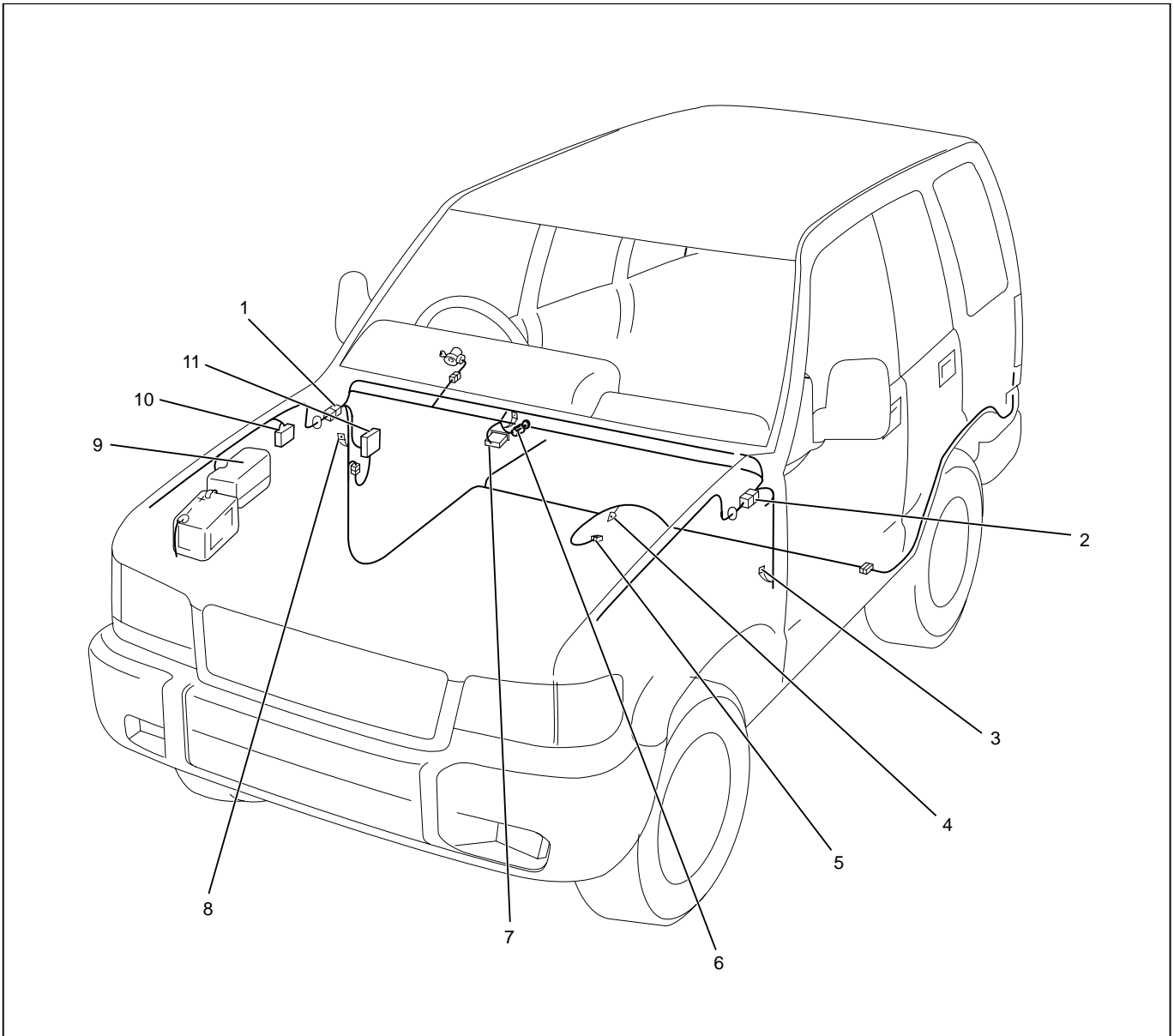
General Description

When cigarette lighter is pushed in with starter switch at either "ACC" or "ON" position, a circuit is formed in cigarette lighter case to heat lighter coil. Cigarette lighter springs back to its original position after lighter coil is heated.

Circuit Diagram (RHD)



Parts Location (RHD)

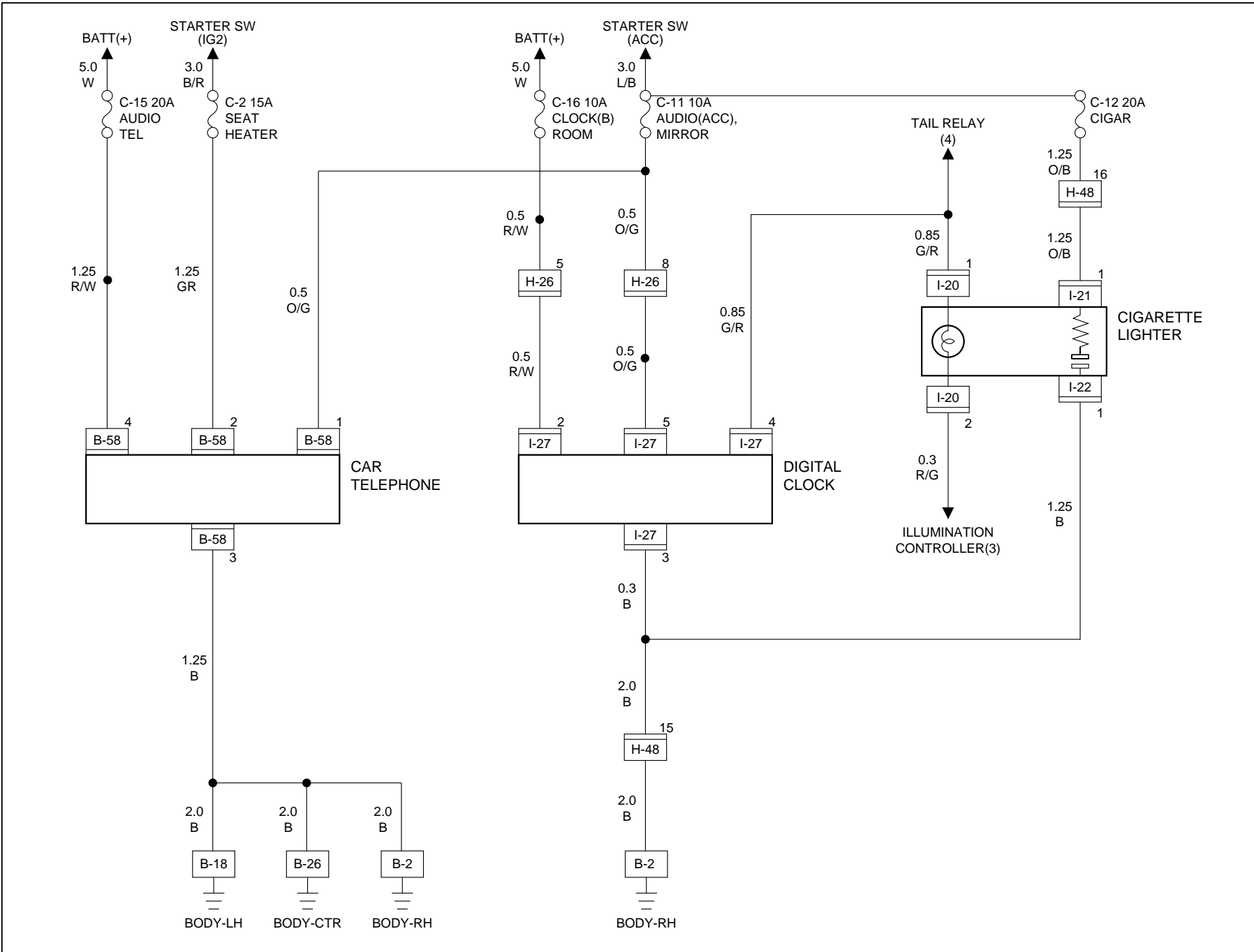


D08RWAS2

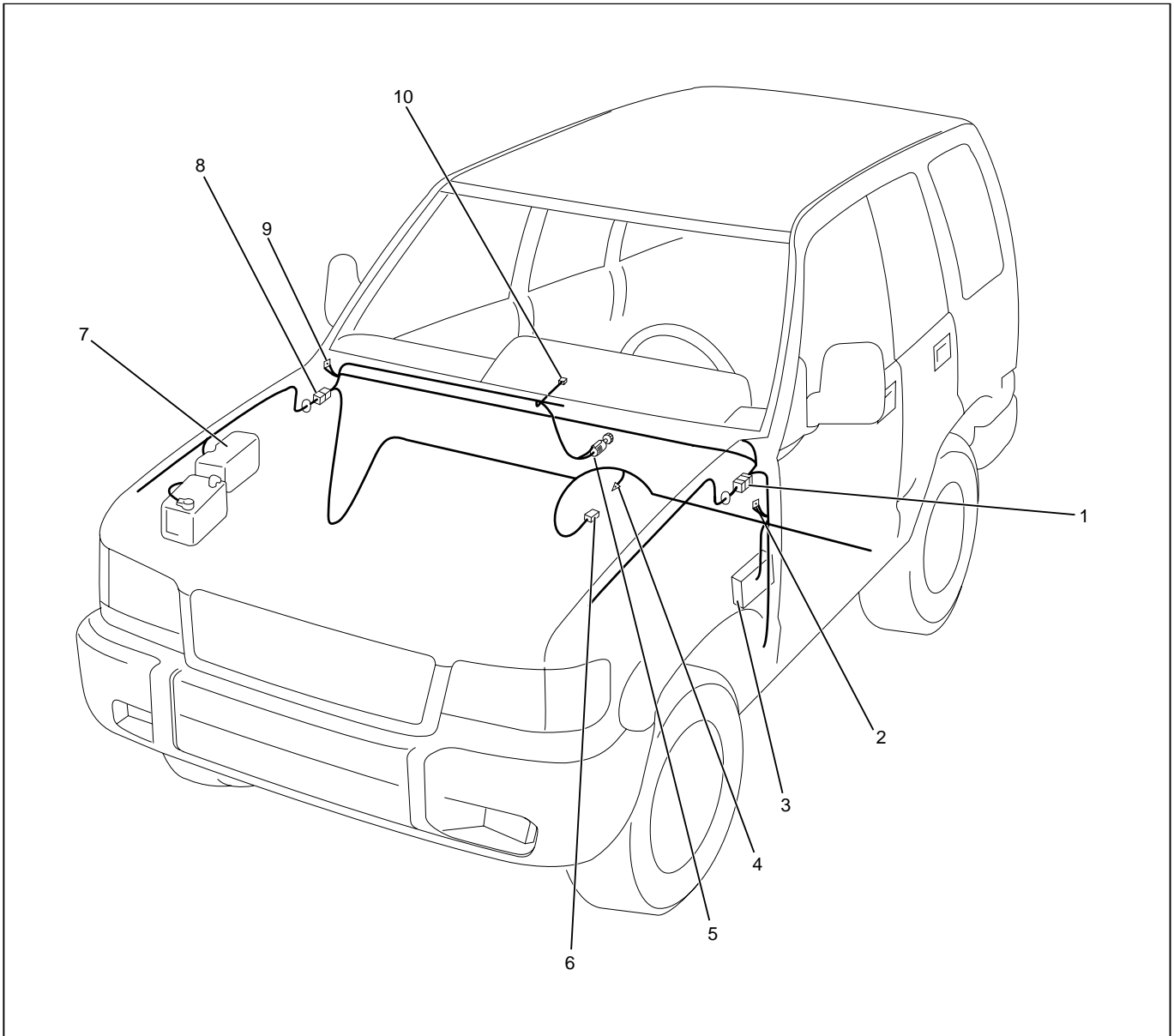
Legend

- | | |
|----------------|------------------------|
| (1) H-26, H-27 | (6) I-20, I-21, I-22 |
| (2) H-20 | (7) I-27 |
| (3) B-2 | (8) B-18, B-19 |
| (4) B-26 | (9) Relay and Fuse Box |
| (5) B-58 | (10) C-39 |
| | (11) Fuse Box |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RWAS0

Legend

- | | |
|----------------------|------------------------|
| (1) H-26 | (6) B-58 |
| (2) B-18 | (7) Relay and Fuse Box |
| (3) Fuse Box | (8) H-48 |
| (4) B-26 | (9) B-2 |
| (5) I-20, I-21, I-22 | (10) I-27 |

Power Door Mirror

General Description

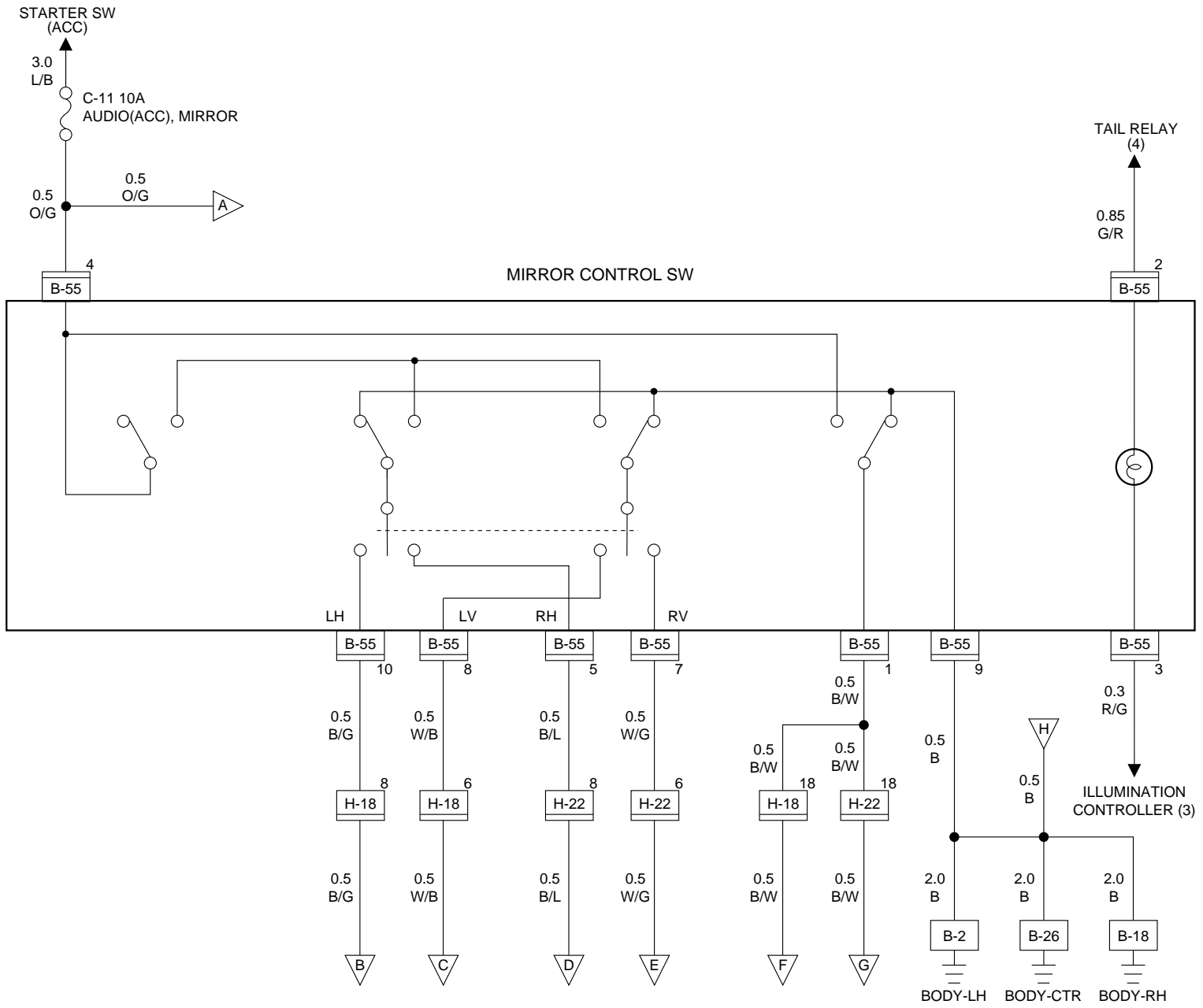
The circuit consists of door mirror control switch, folding switch, defogger switch and door mirrors on both sides.

When control switch is operated with starter switch at either "ACC" or "ON" position, motors incorporated in door mirrors on both sides rotates to allow the horizontal and vertical adjustment of mirror angle.

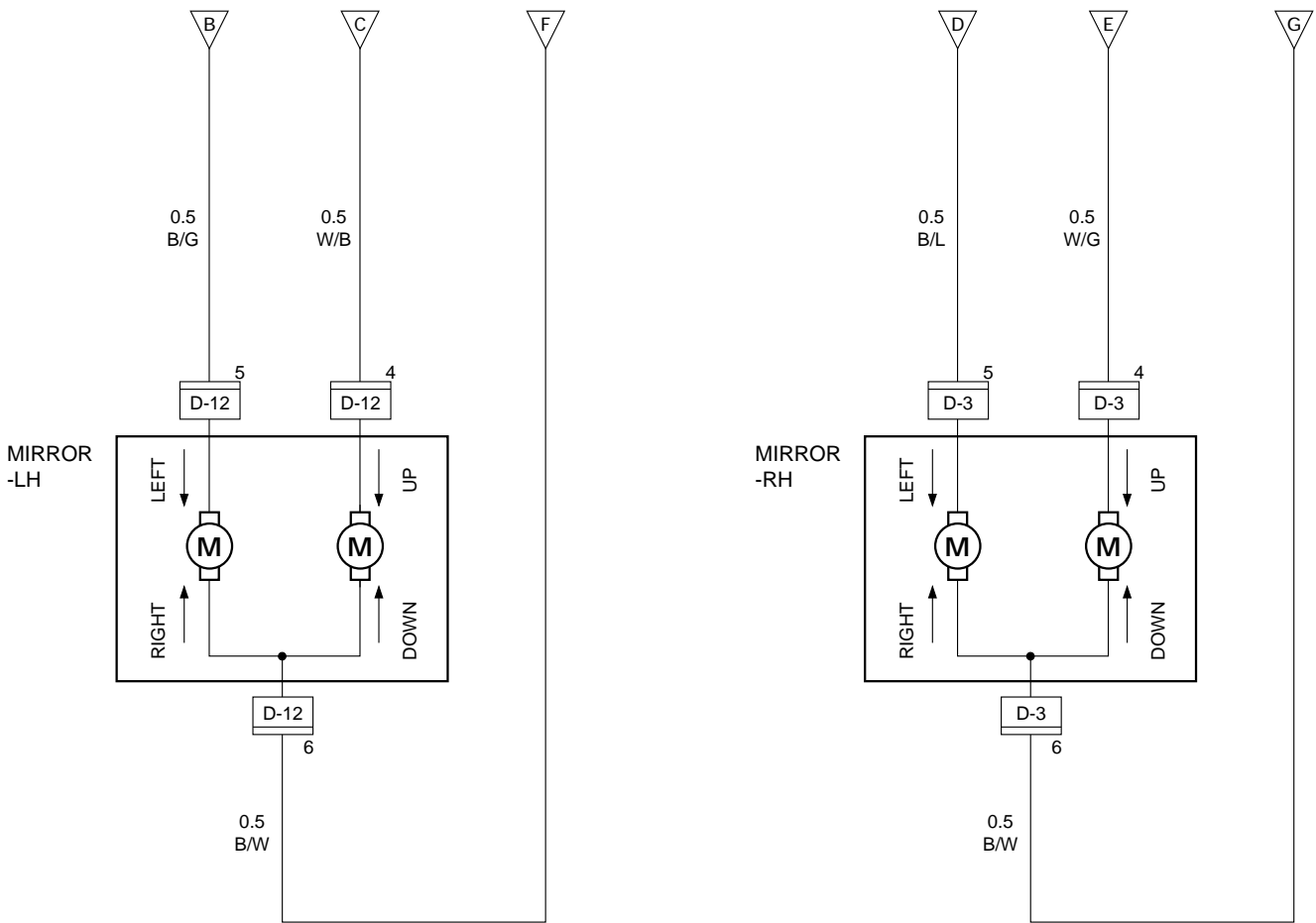
Folding switch can be used to fold mirror and return it to its original position.

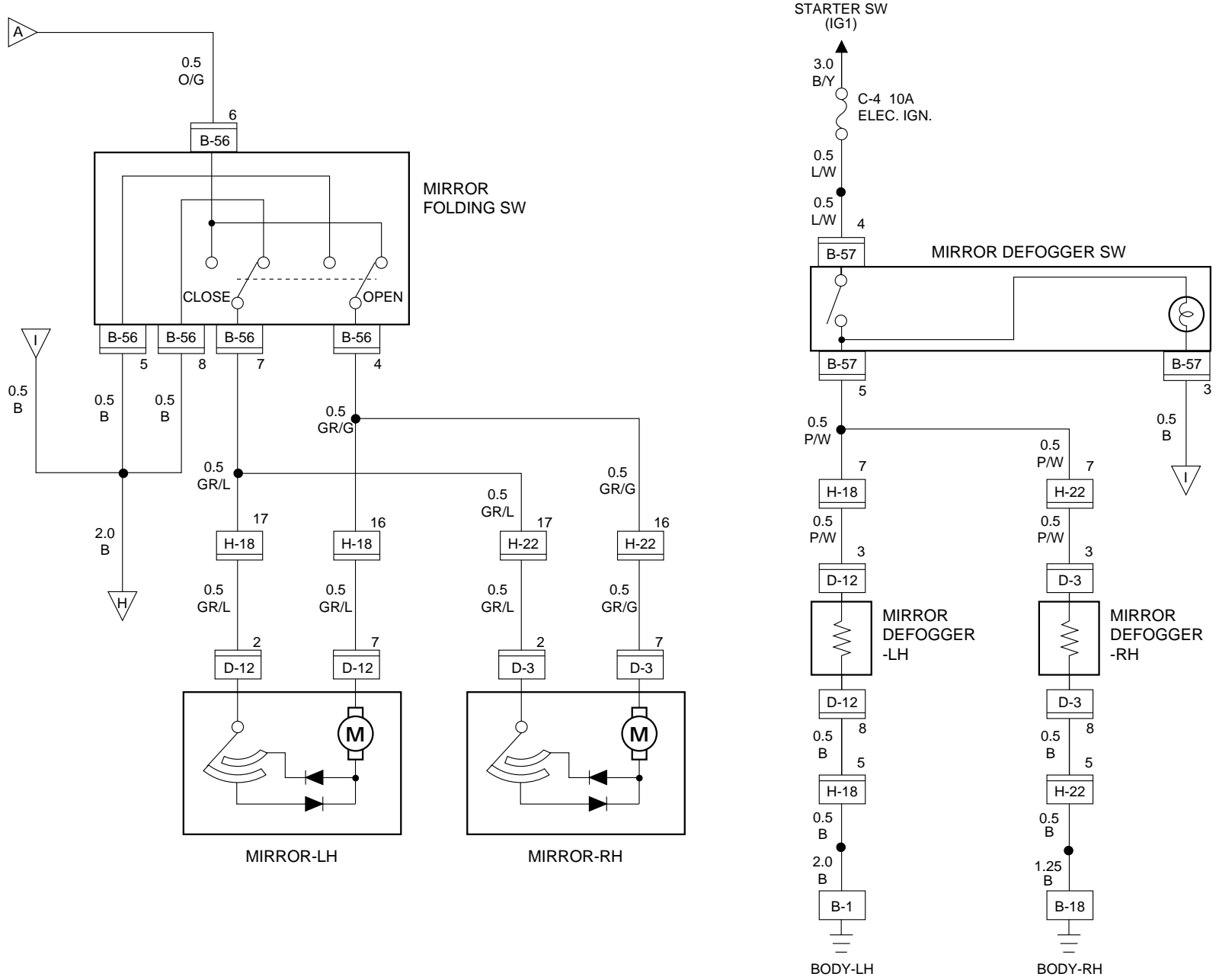
When turning on door mirror defogger switch with starter switch at "ON" position, built-in heater in mirror is activated to perform defogger function.

Circuit Diagram (RHD)-1

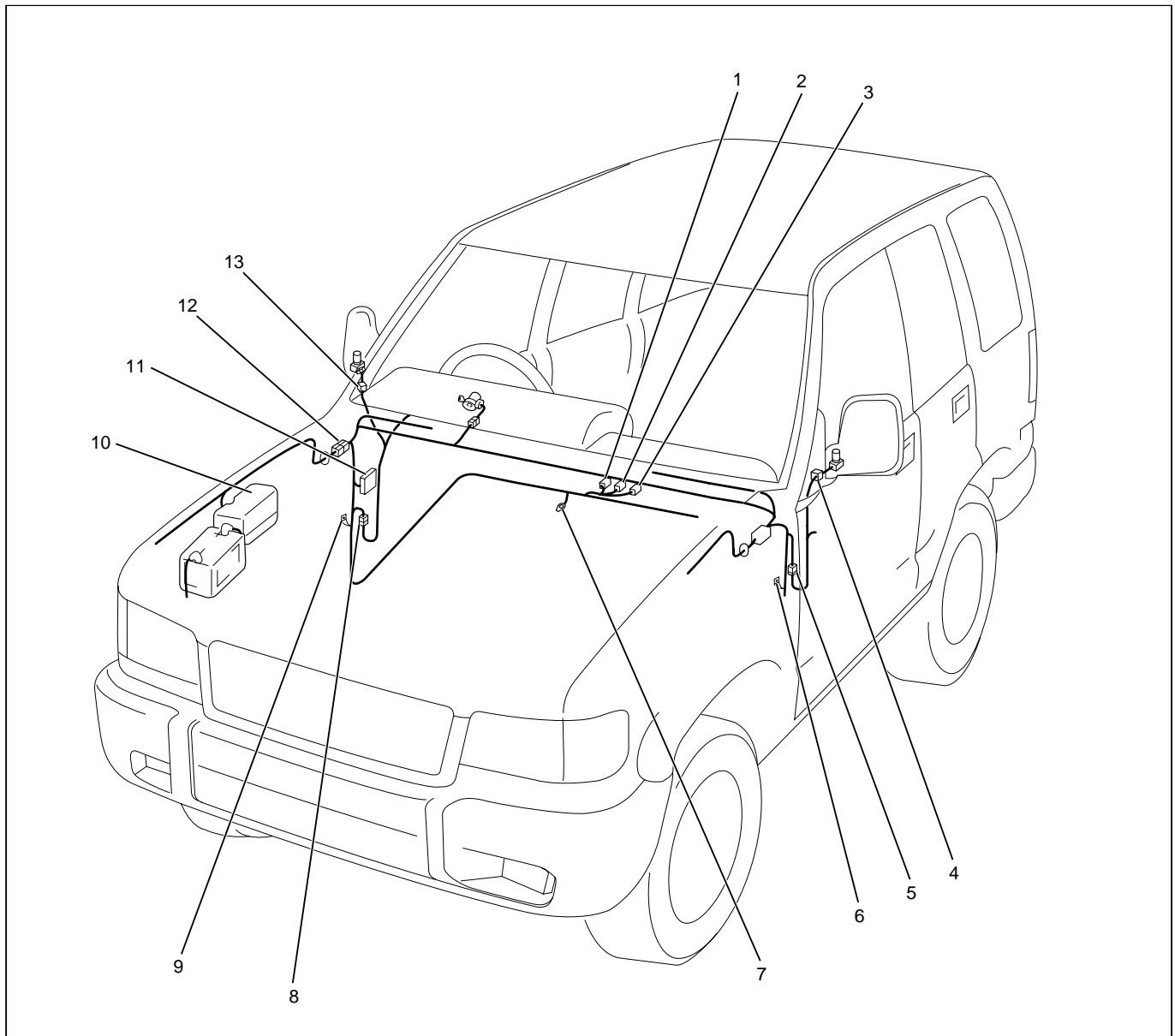


Circuit Diagram (RHD)-2





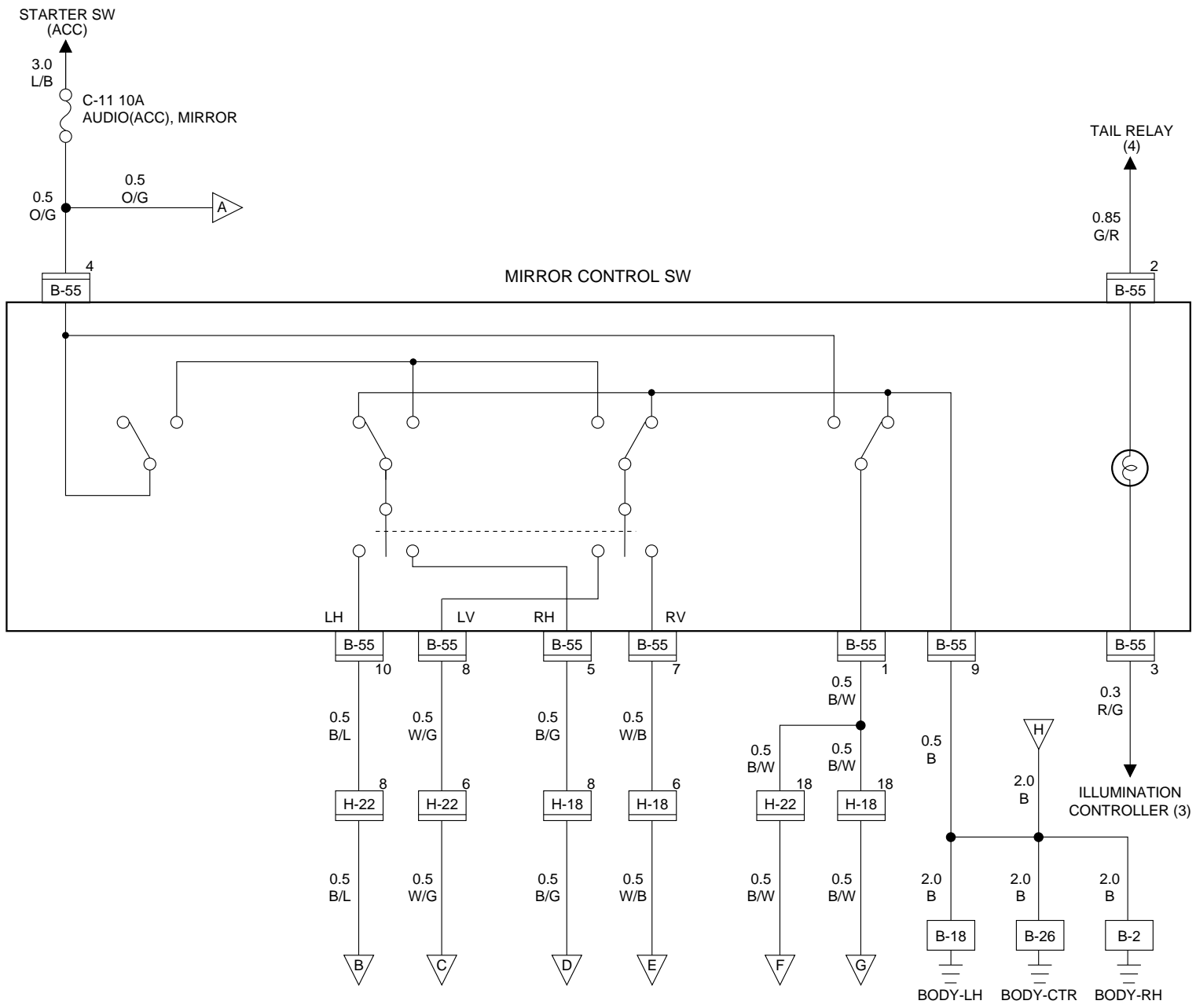
Parts Location (RHD)



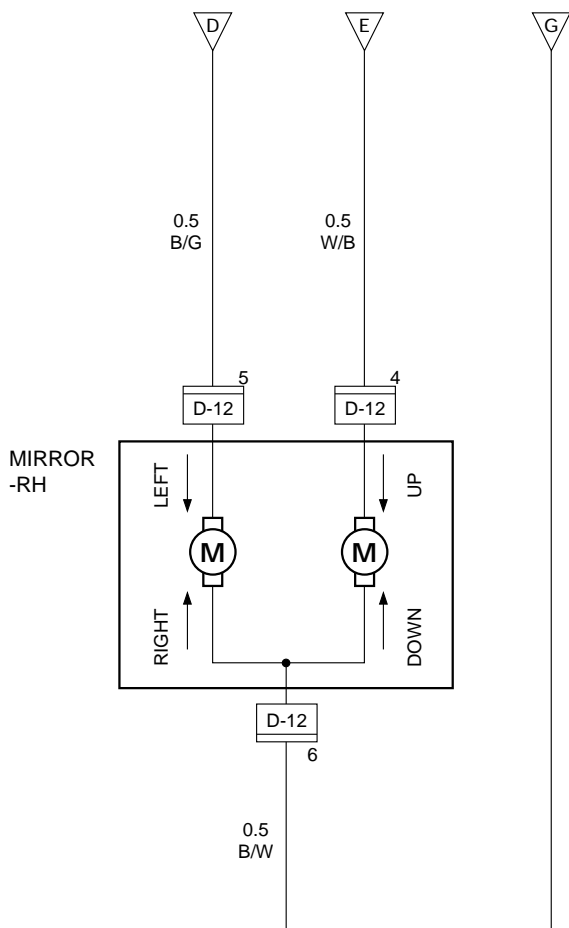
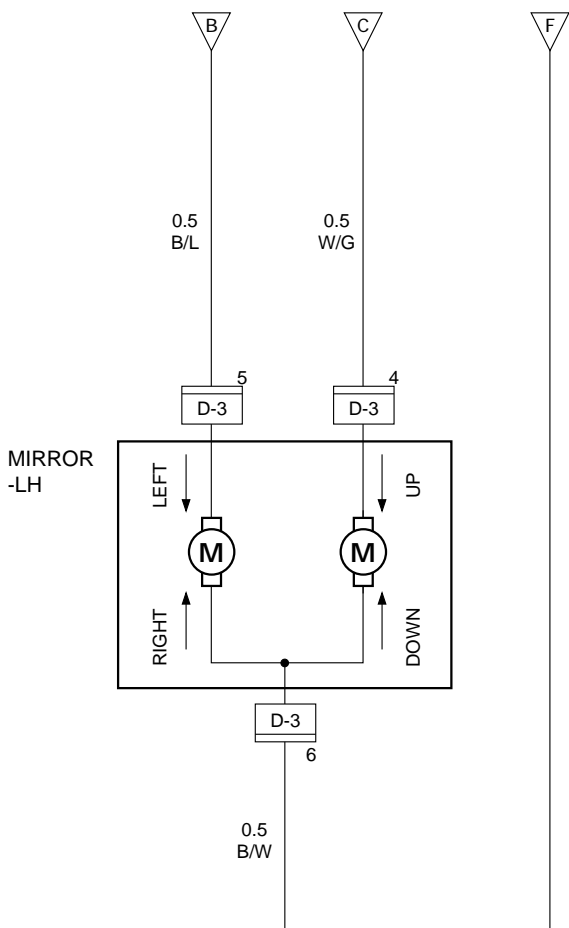
D08RWA05

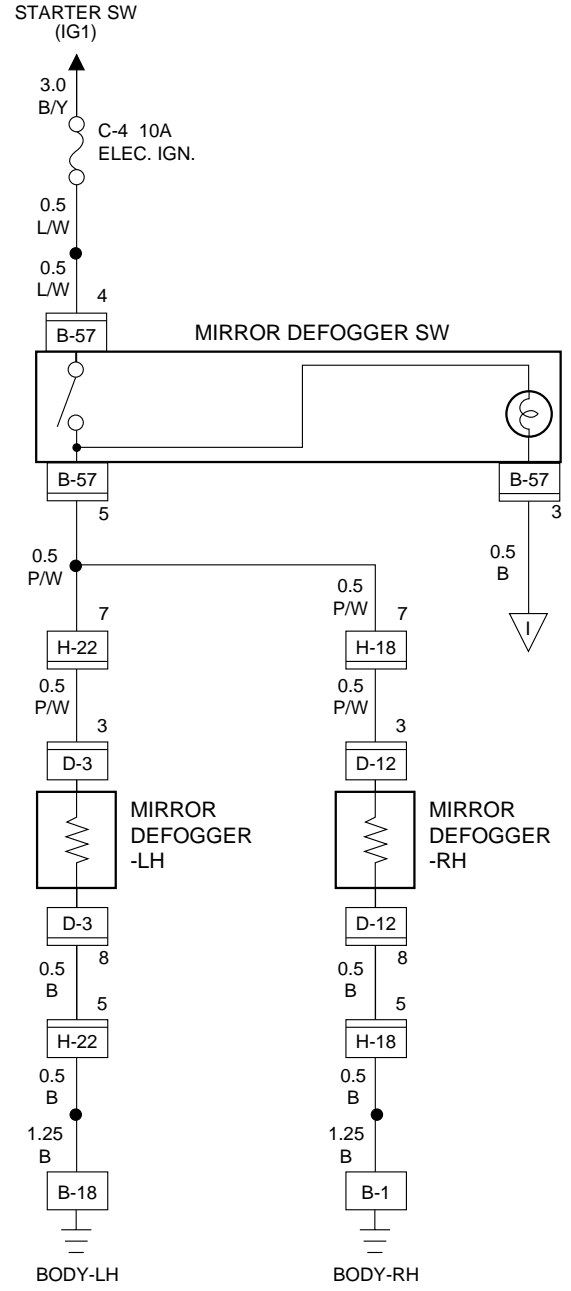
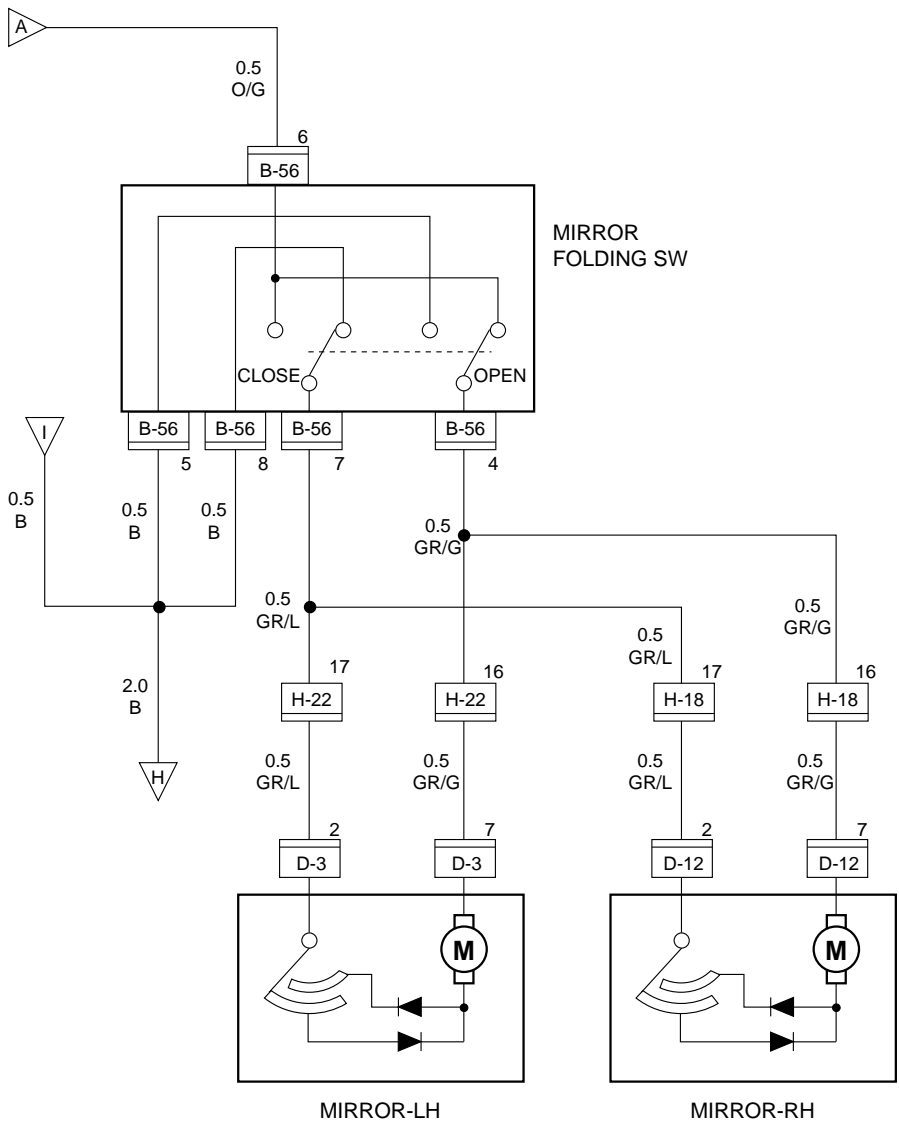
Legend

- | | |
|---------------------------|-----------------------|
| (1) B-56 (Center Console) | (7) B-26 |
| (2) B-57 (Center Console) | (8) H-22 |
| (3) B-55 (Center Console) | (9) B-18 |
| (4) D-12 | (10) Relay & Fuse Box |
| (5) H-18 | (11) Fuse Box |
| (6) B-1, B-2 | (12) H-14 |
| | (13) D-3 |

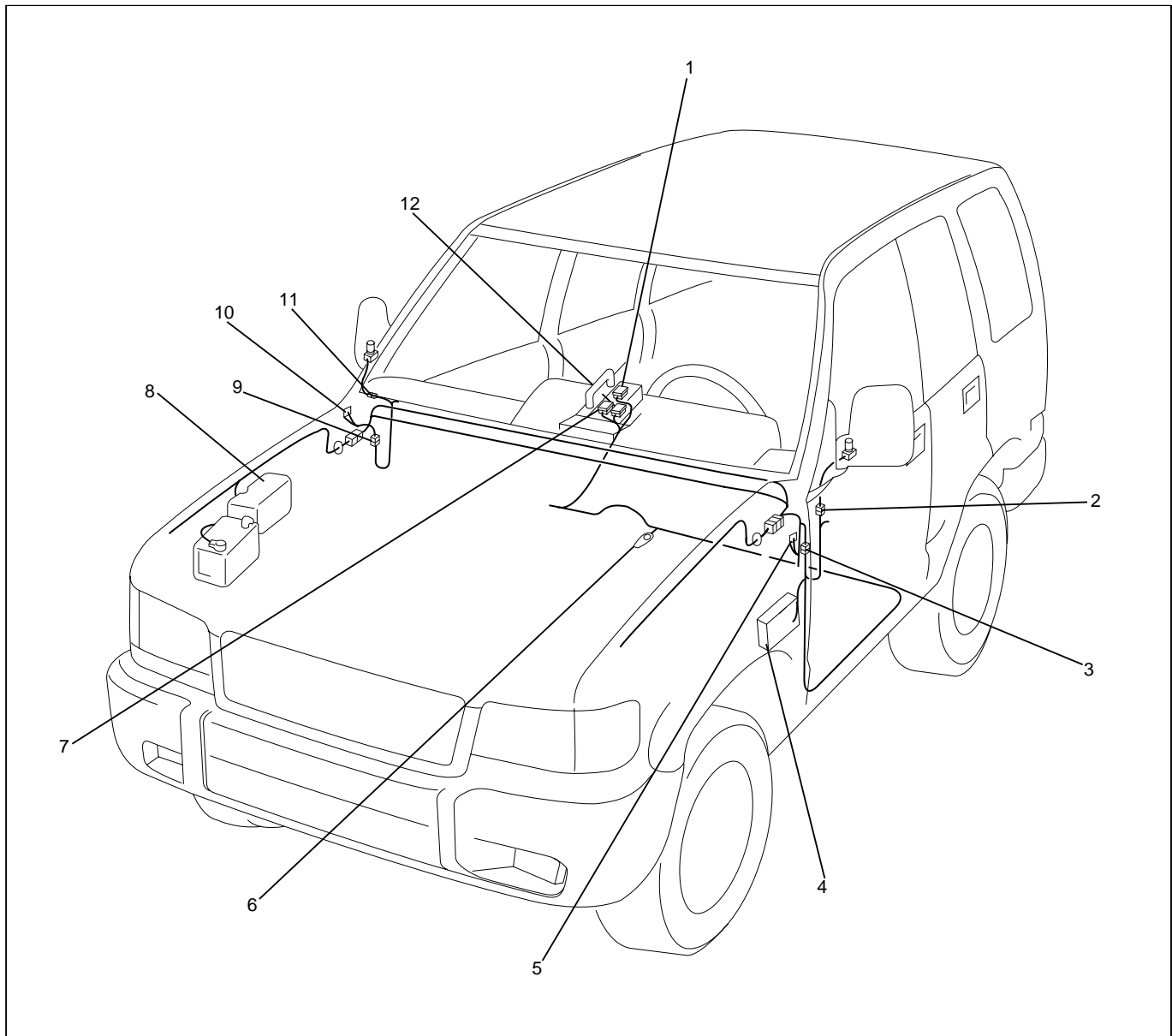


Circuit Diagram (LHD)-2





Parts Location (LHD)



D08RW380

Legend

- (1) B-55
- (2) D-3
- (3) H-22
- (4) Fuse Box
- (5) B-18
- (6) B-26

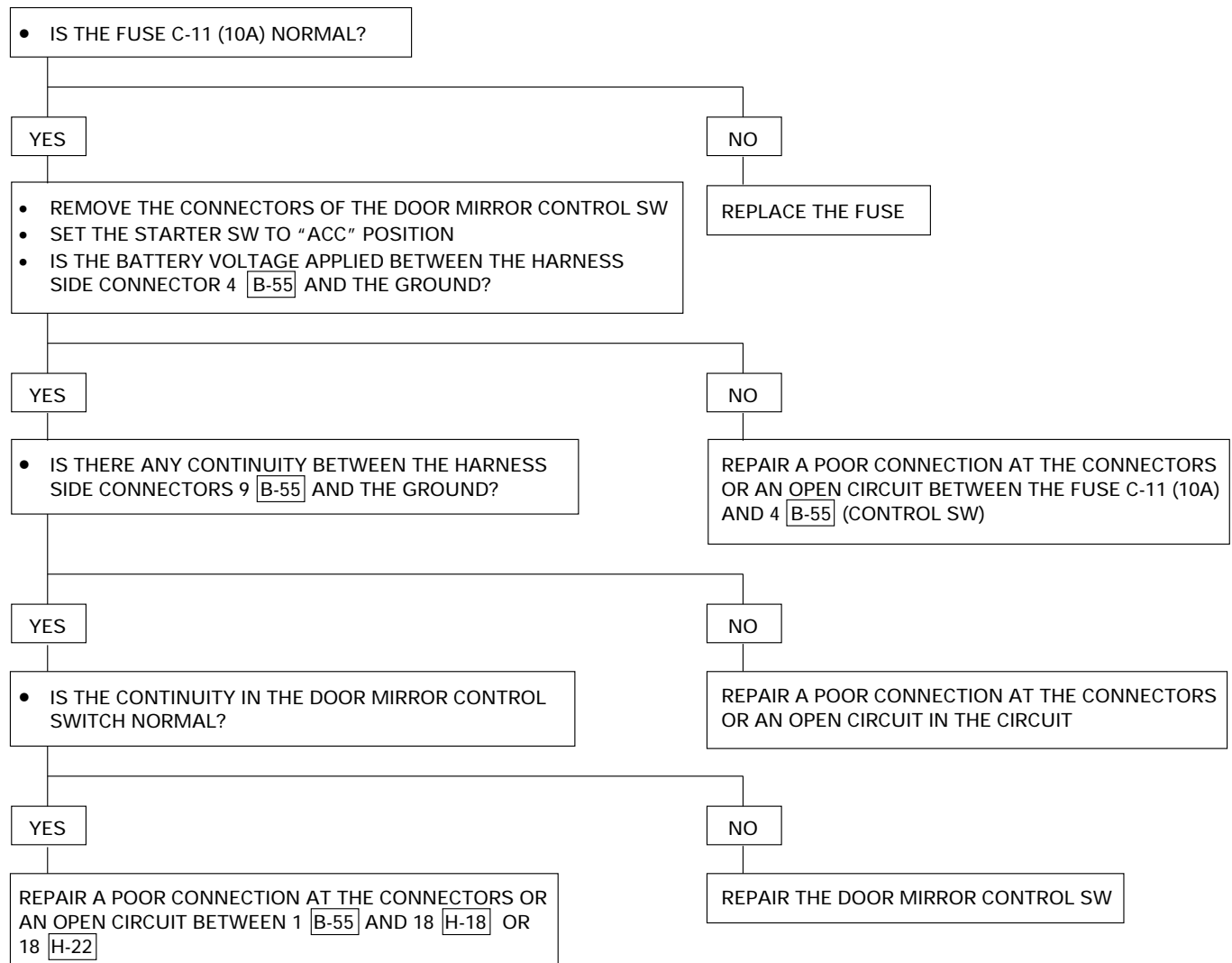
- (7) B-57
- (8) Relay and Fuse Box
- (9) H-18
- (10) B-1, B-2
- (11) D-12
- (12) B-56

Diagnosis

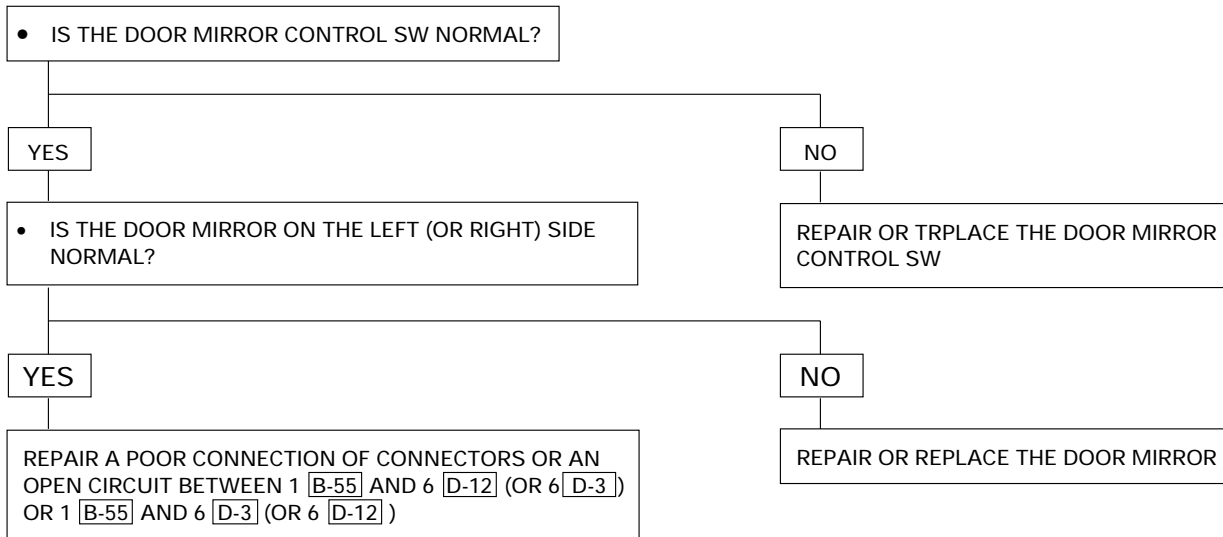
Quick Chart for Check Points

SW	Check point Trouble mode	Fuse		Door mirror SW			Door mirror		Cable harness
		C-4 (10A)	C-11 (10A)	Control	Folding	Defogger	LH	RH	
Control switch	1. Mirrors on both sides do not operate		○	○					○
	2. Mirror on the left (or right) side does not operate			○			○	○	○
	3. Mirrors on both sides operate only in the vertical (or horizontal) direction			○					
	4. Mirror on the left side operates only in the vertical (or horizontal) direction			○			○		○
	5. Mirror on the right side operates only in the vertical (or horizontal) direction			○				○	○
Folding switch	6. Folding mechanism of the both mirrors does not operate		○		○				○
	7. Folding mechanism of the mirror on the left (or right) side does not operate				○		○	○	○
Defogger switch	8. Mirror defoggers on both sides do not operate	○				○			○
	9. Mirror defogger on the left (or right) side does not operate						○	○	○

1. Mirrors On Both Sides Do Not Operate



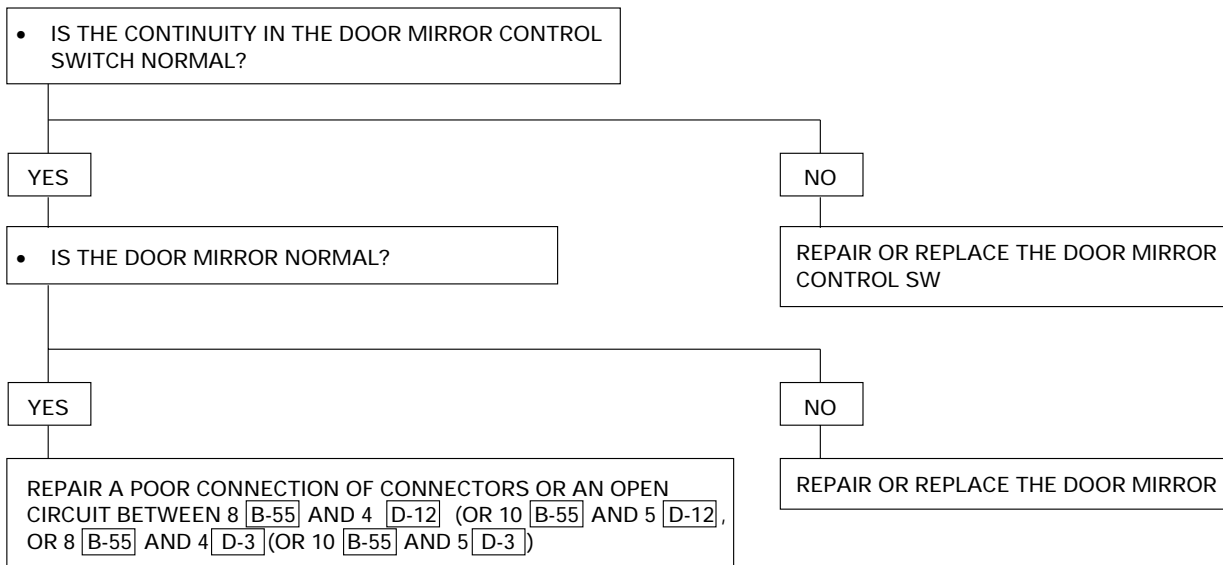
2. Mirror on The Left (Or Right) Side Does Not Operate



3. Mirrors On Both Sides Operate Only In The Vertical (Or Horizontal) Direction

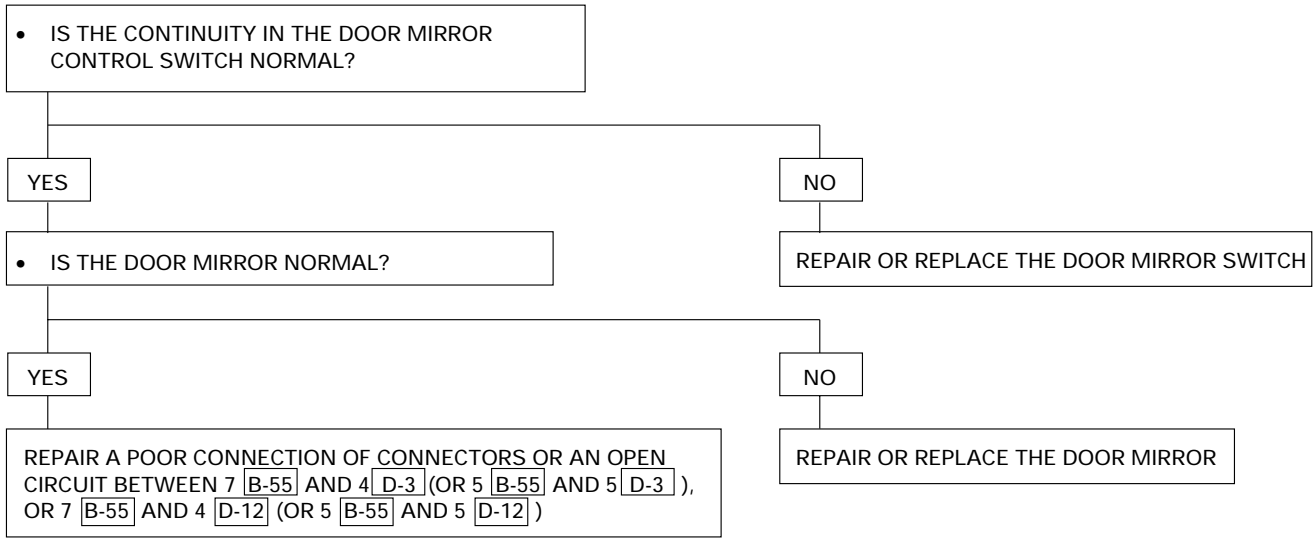
REPAIR OR REPLACE THE DOOR MIRROR CONTROL SW

4. Mirror On The Left Side Operates Only In The Vertical (Or Horizontal) Direction



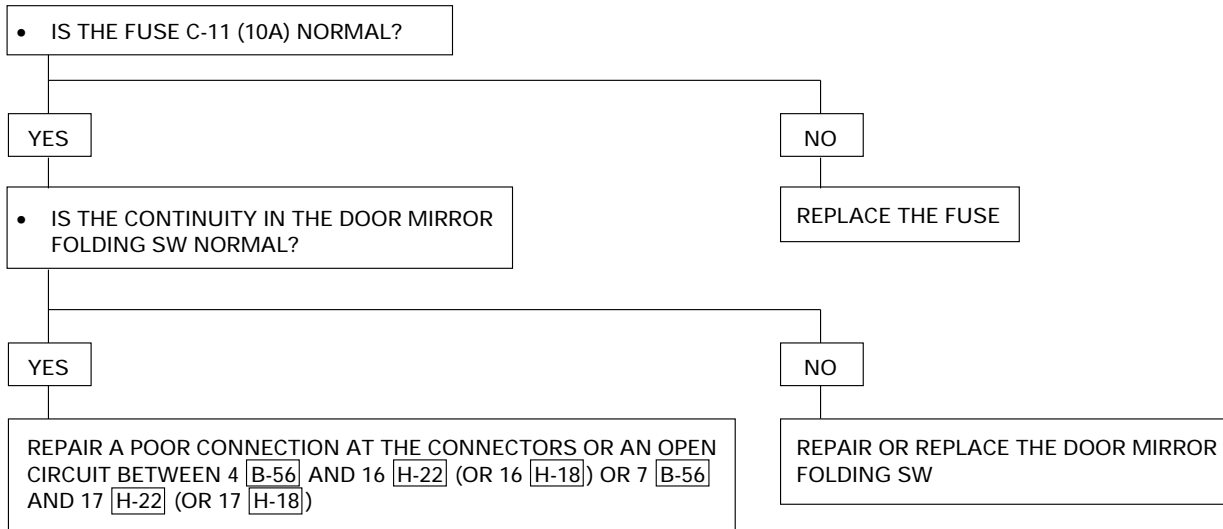
NOTE: Connectors shown in the parenthesis "(")" indicate a check point of the mirror that does not operate in the horizontal direction.

5. Mirror On The Right Side Operates Only In The Vertical (Or Horizontal) Direction



NOTE: Connectors shown in the parenthesis "(") indicate a check point of the mirror that does not operate in the horizontal direction.

6. Folding Mechanism Of The Both Mirrors Does Not Operate



7. Folding Mechanism Of The Mirror On The Left (Or Right) Side Does Not Operate

- DISCONNECT THE CONNECTOR OF THE DOOR MIRROR
- CONNECT THE DOOR MIRROR CONNECTOR 2 [D-12] (OR 2 [D-3]) OR 2 [D-3] (OR 2 [D-12]) TO THE BATTERY (+) TERMINAL AND 7 [D-12] (OR 7 [D-3]) OR 7 [D-3] (OR 7 [D-12]) TO THE BATTERY (-) TERMINAL. DOES THE MIRROR OPERATE TO THE FOLDING DIRECTION?

CONNECT THE DOOR MIRROR CONNECTOR 7 [D-12] (OR 7 [D-3]) OR 7 [D-3] (OR 7 [D-12]) TO THE BATTERY (+) TERMINAL AND 2 [D-12] (OR 2 [D-3]) OR 2 [D-3] (OR 2 [D-12]) TO THE BATTERY (-) TERMINAL. DOES THE MIRROR OPERATE TO THE DRIVING POSITION?

YES

- IS THE FOLDING SW NORMAL?

YES

REPAIR A POOR CONNECTION OF THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 7 [B-56] AND 2 [D-12] (OR 2 [D-3]) OR 4 [B-56] AND 7 [D-12] (OR 7 [D-3]), OR 7 [B-56] AND 2 [D-3] (OR 2 [D-12]) OR 4 [B-56] AND 7 [D-3] (OR 7 [D-12])

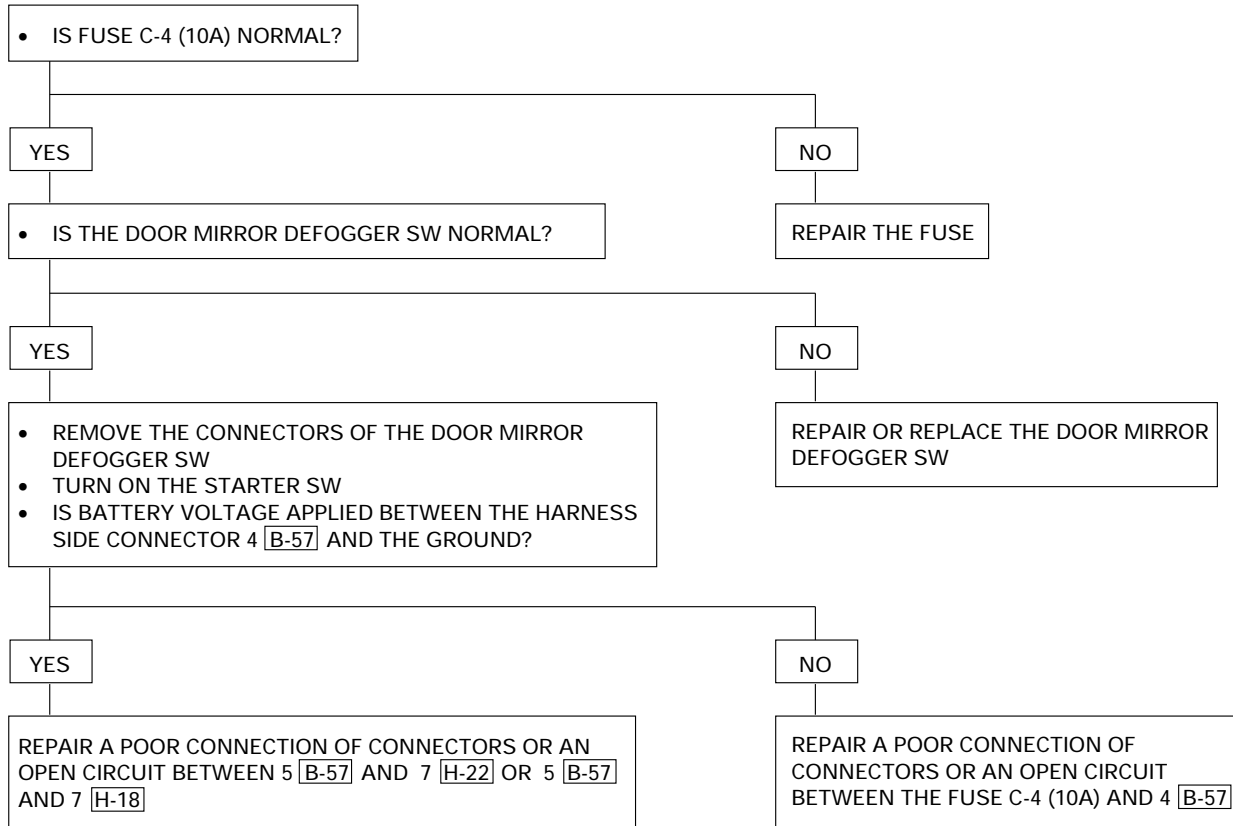
NO

REPAIR OR REPLACE THE DOOR MIRROR

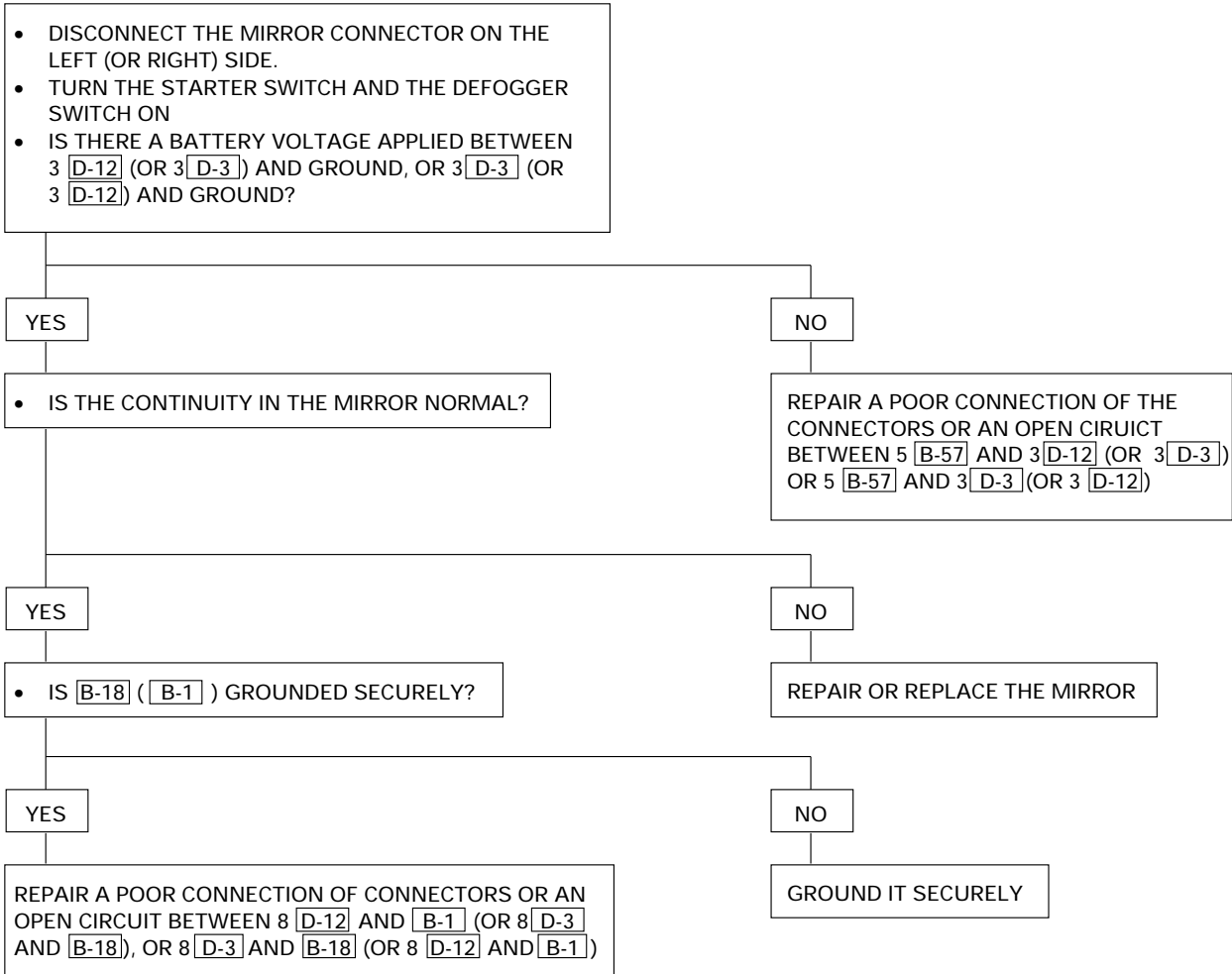
NO

REPAIR OR REPLACE THE FOLDING SW

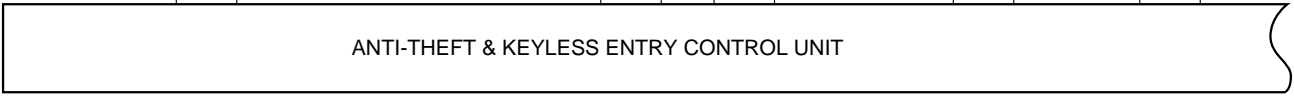
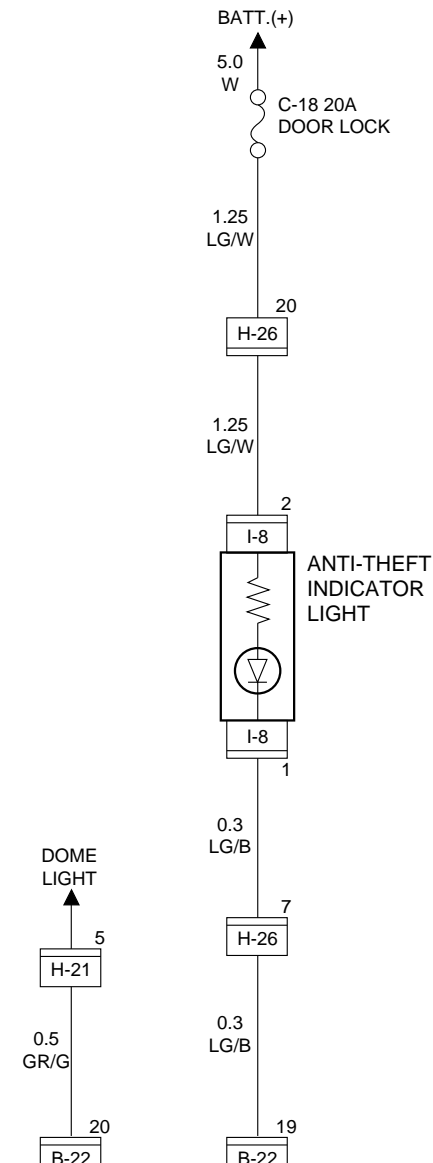
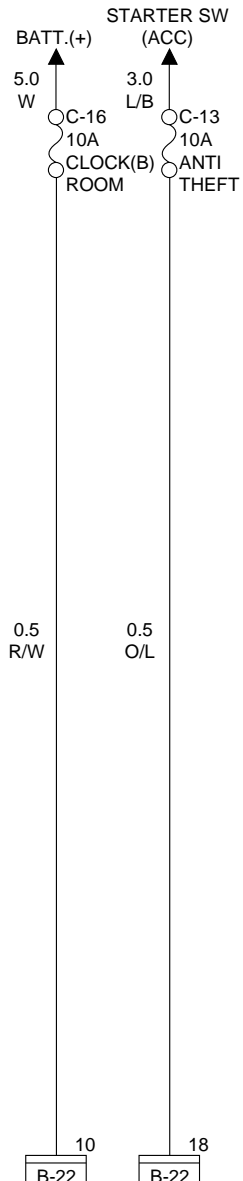
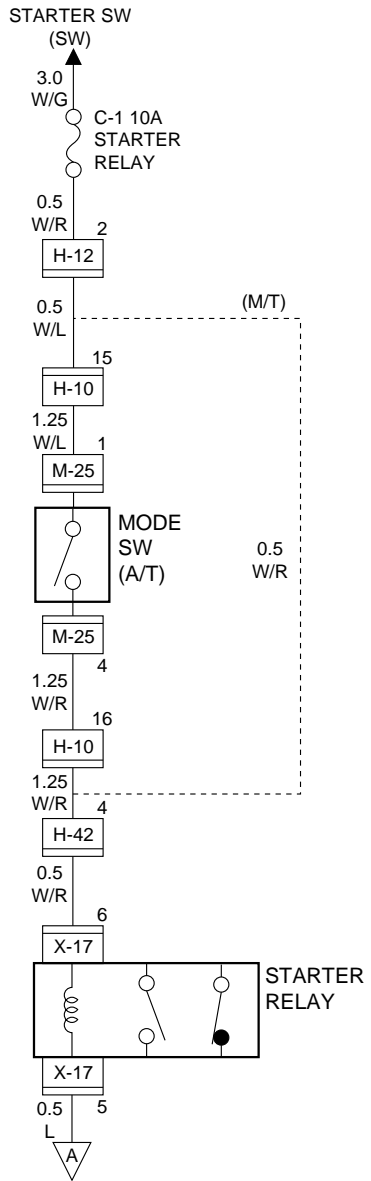
8. Mirror Defogger On Both Sides Do Not Operate



9. Mirror Defogger On The Left (Or Right) Side Does Not Operate

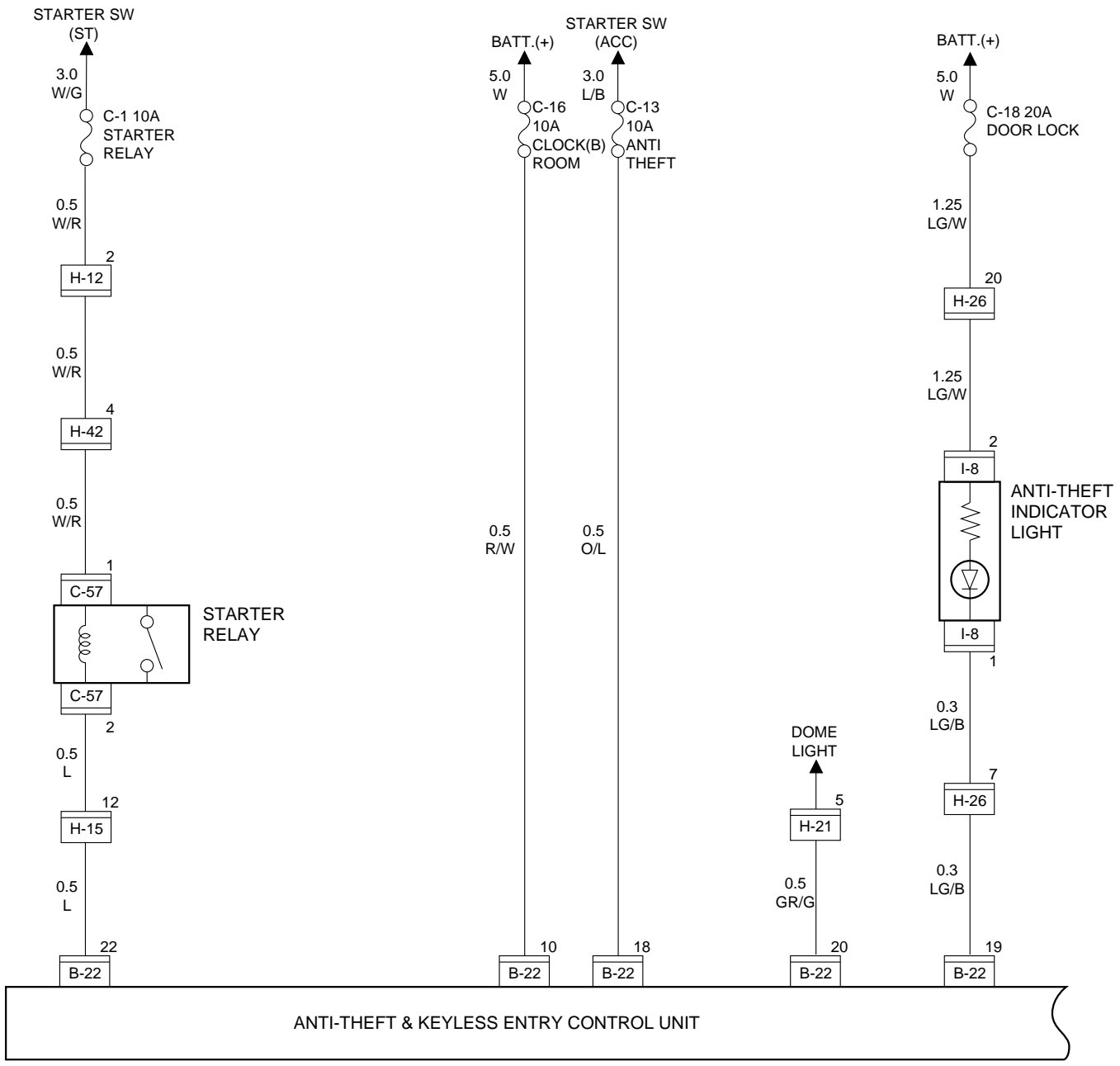


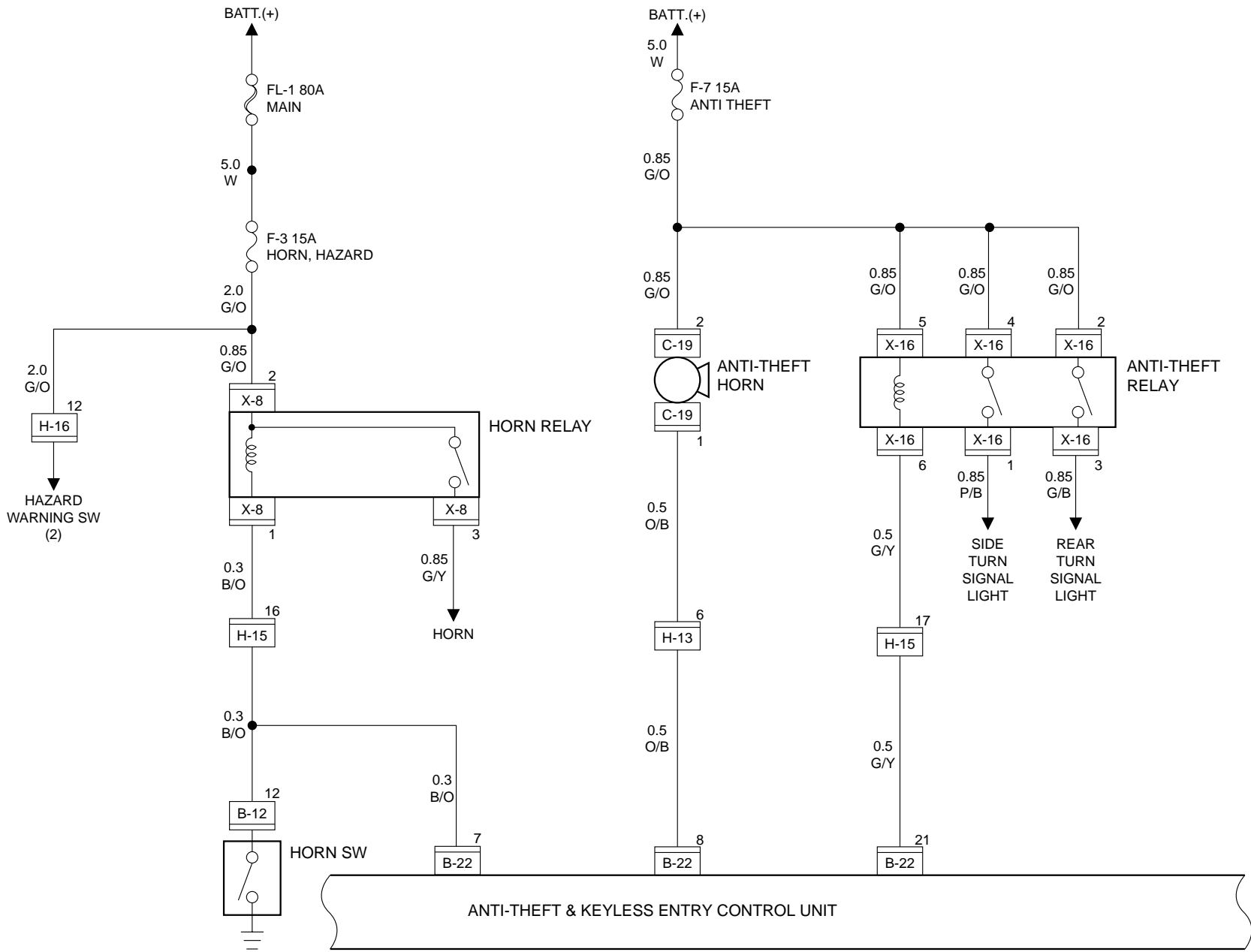
Anti-Theft System with Keyless Entry



ANTI-THEFT & KEYLESS ENTRY CONTROL UNIT

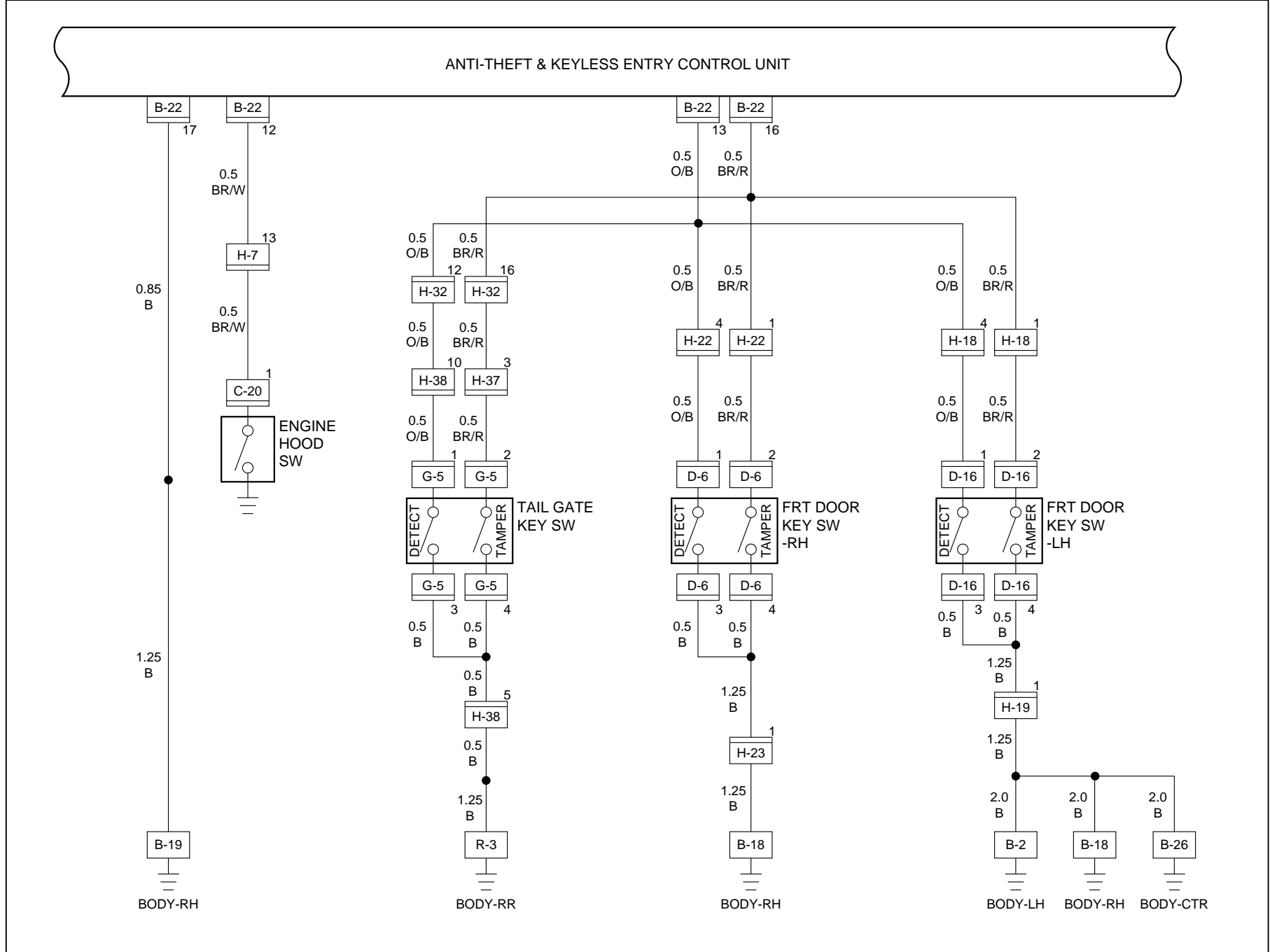
Circuit Diagram (RHD 4J***)-1





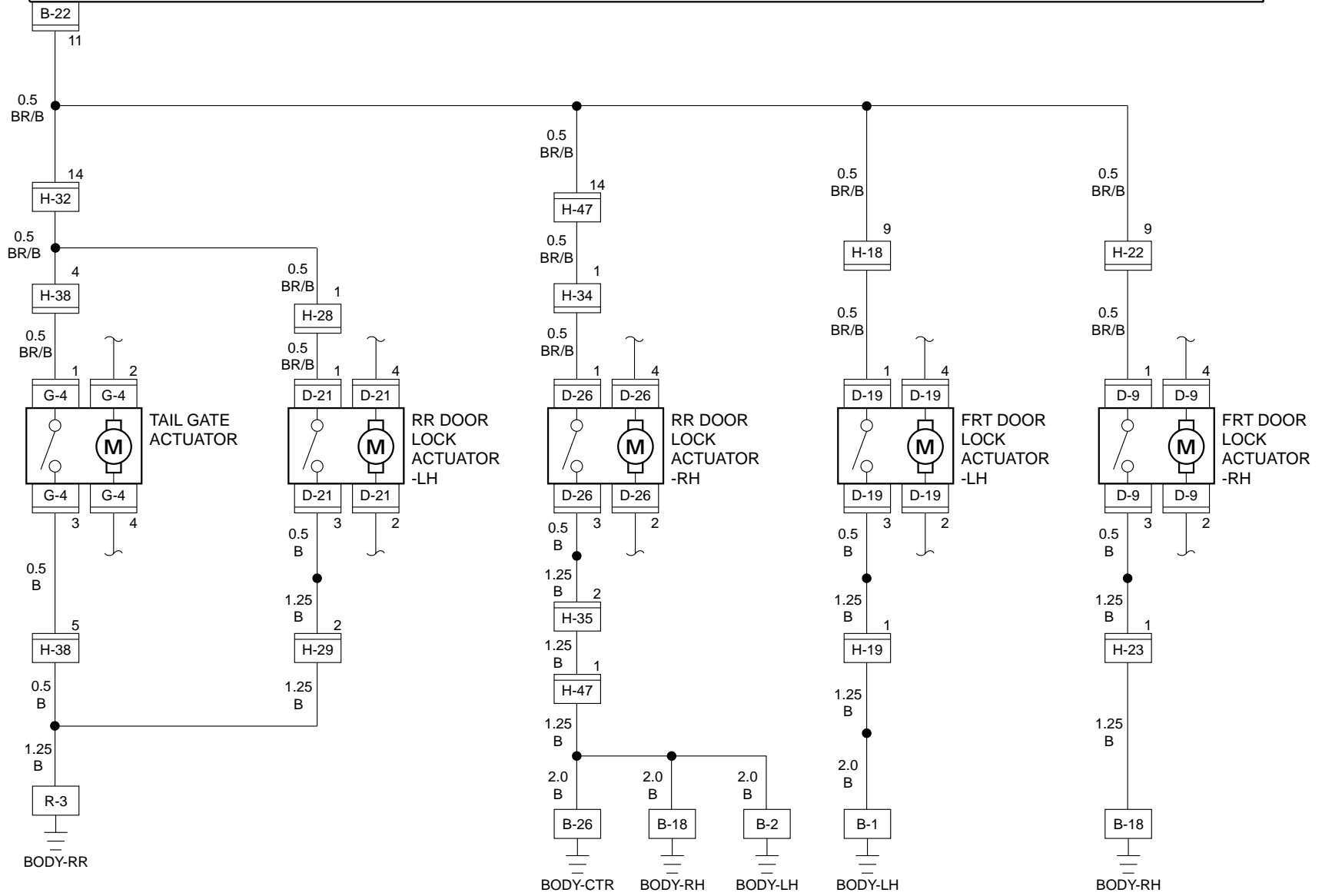
DBR/W705

Circuit Diagram (RHD)-3

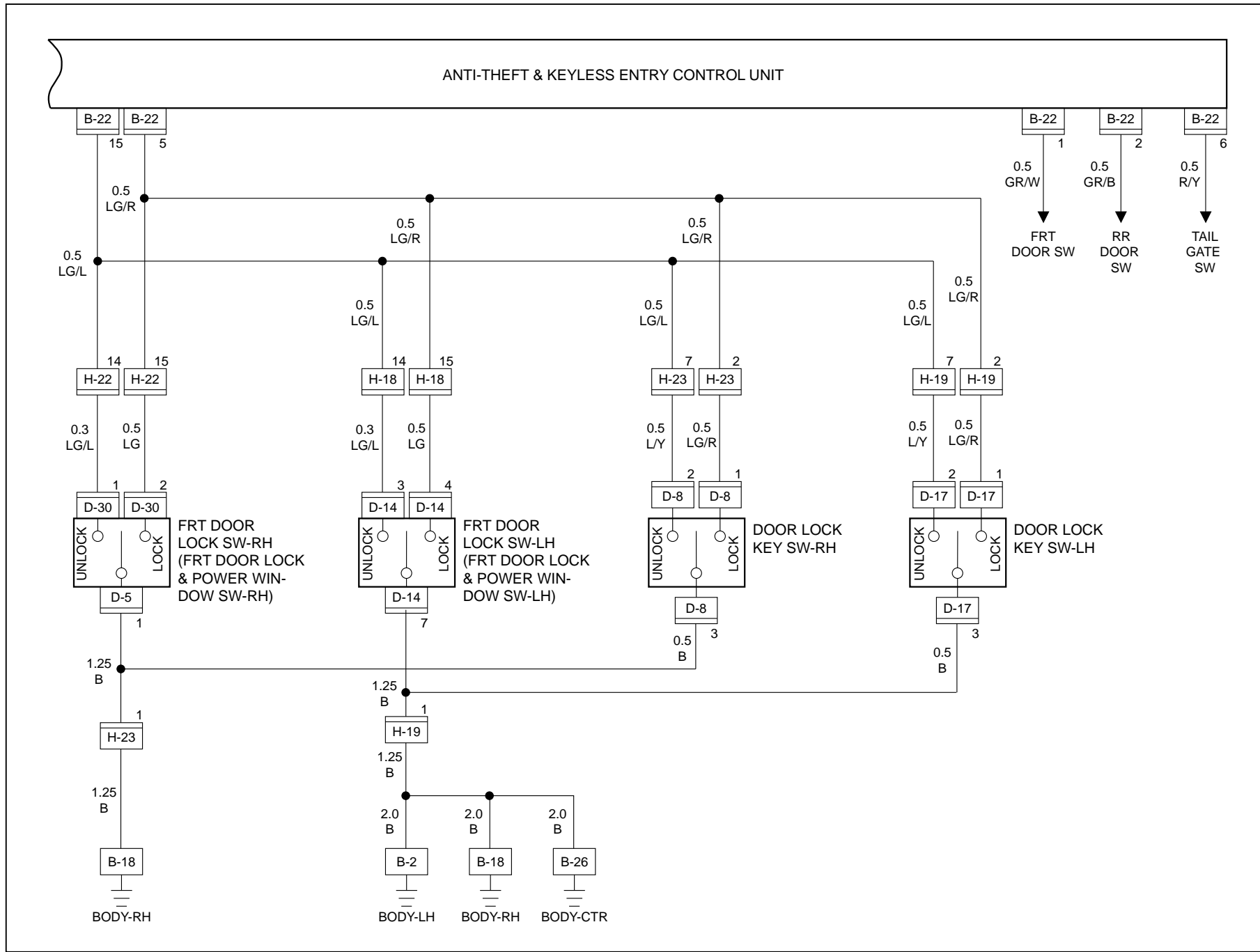


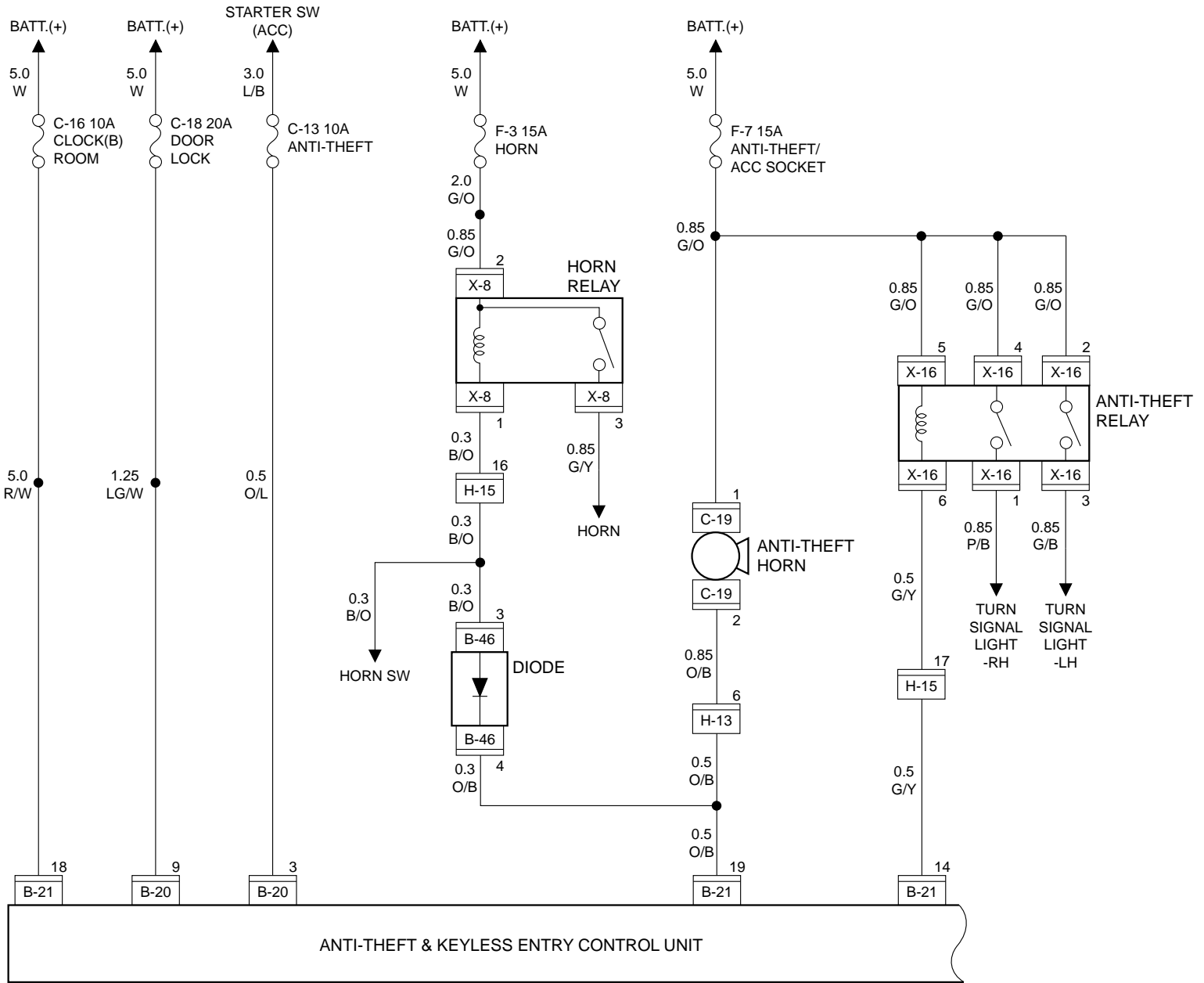
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ANTI-THEFT & KEYLESS ENTRY CONTROL UNIT

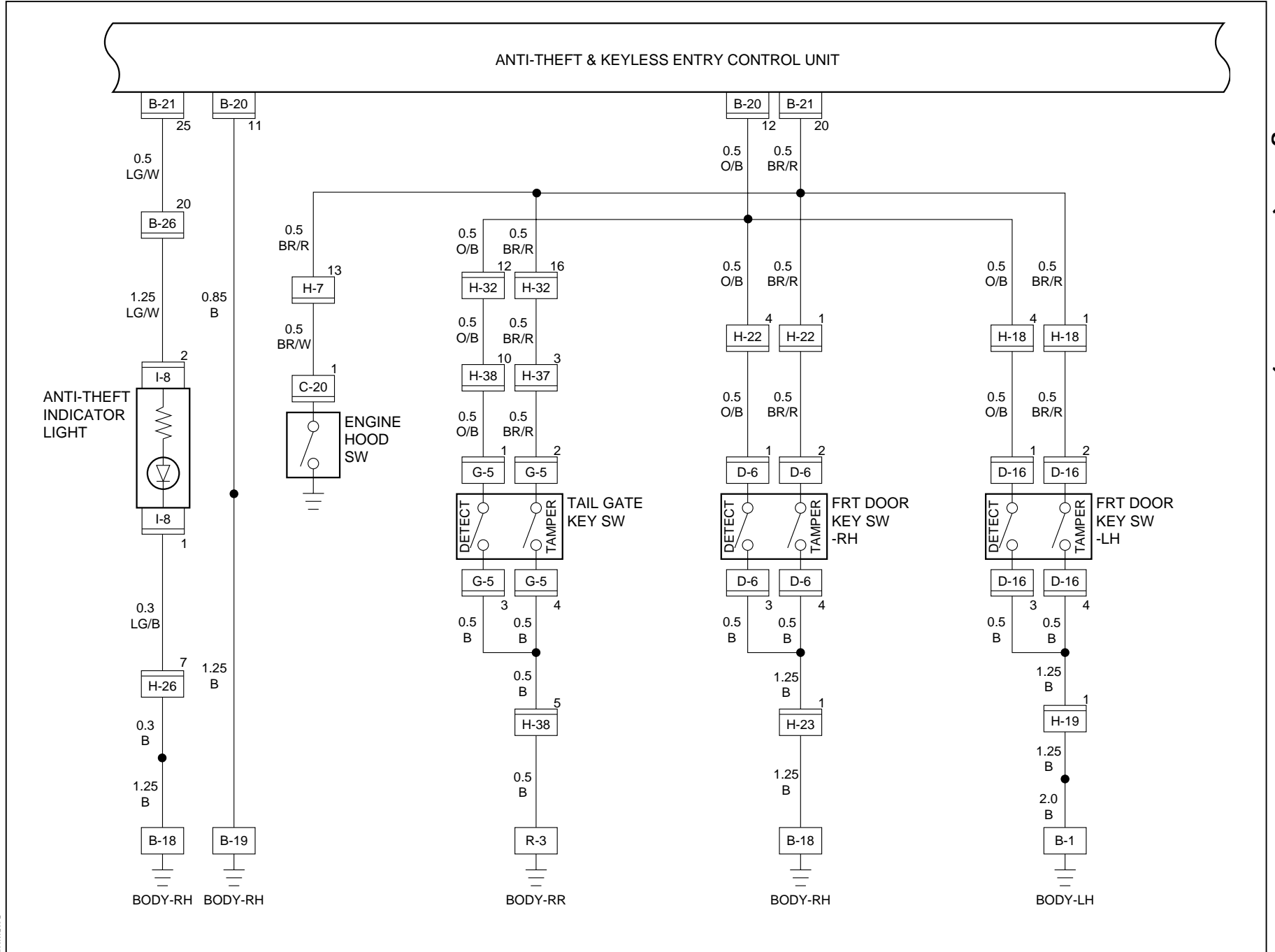


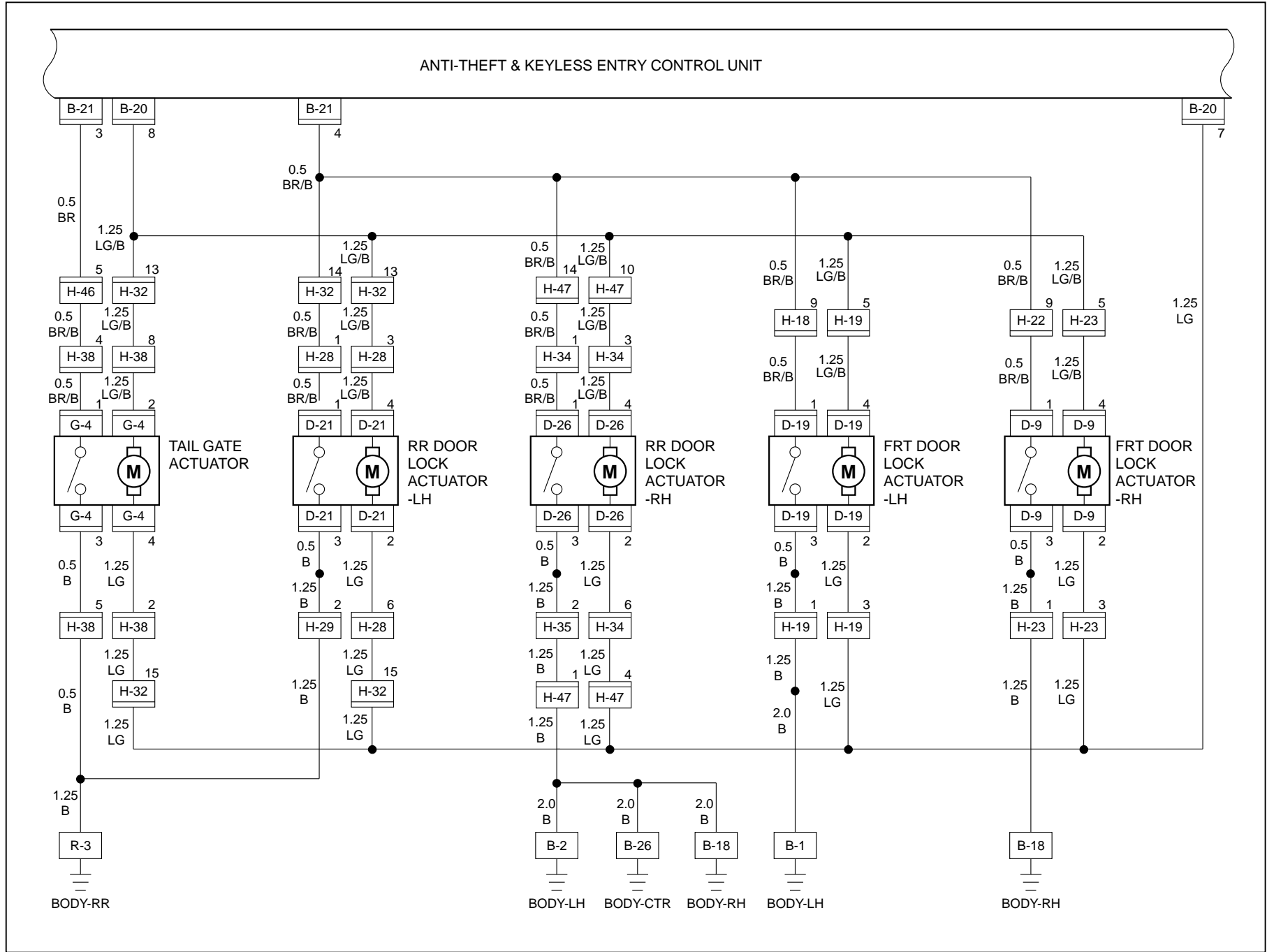
Circuit Diagram (RHD)-5





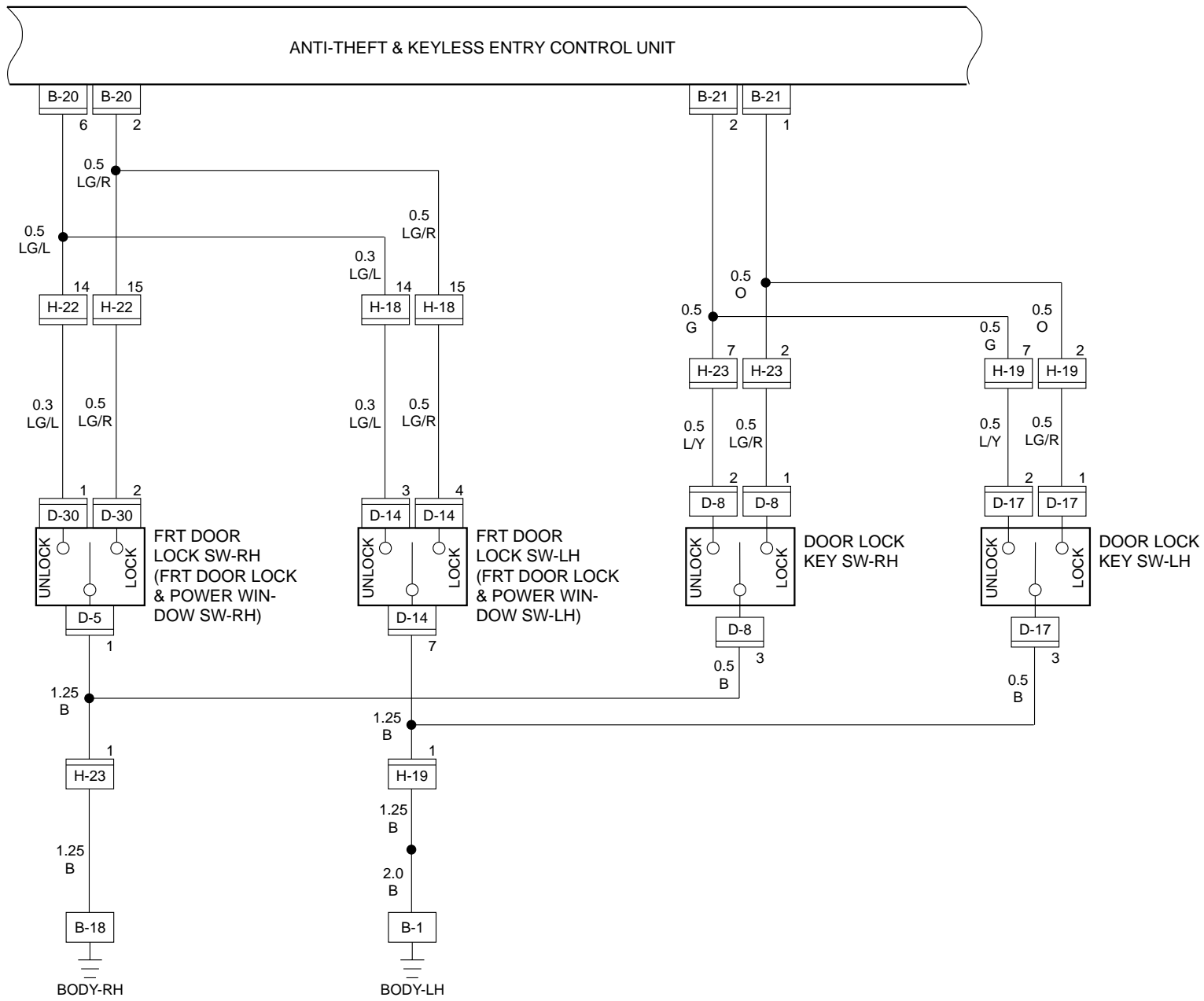
Circuit Diagram (South Africa)-2

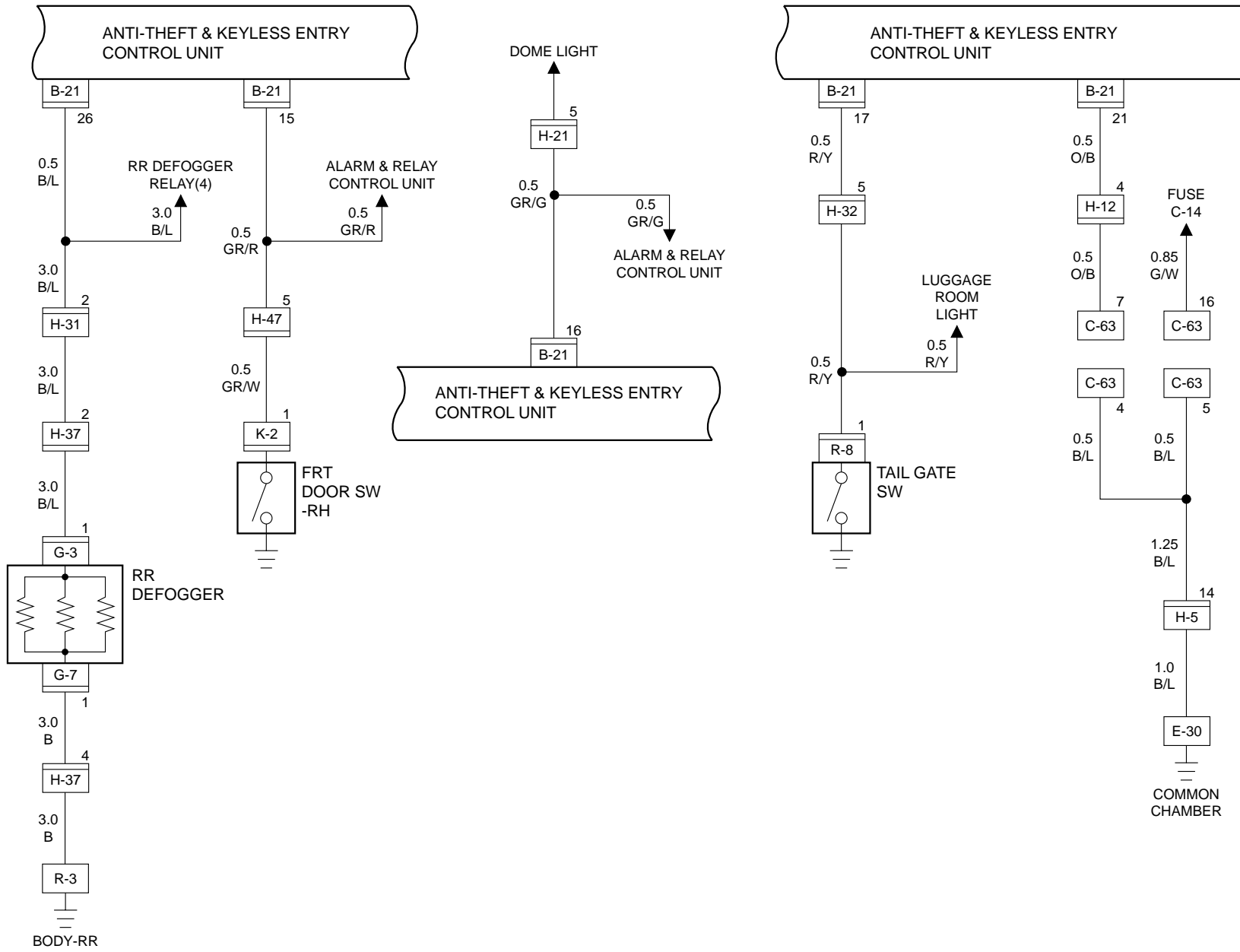




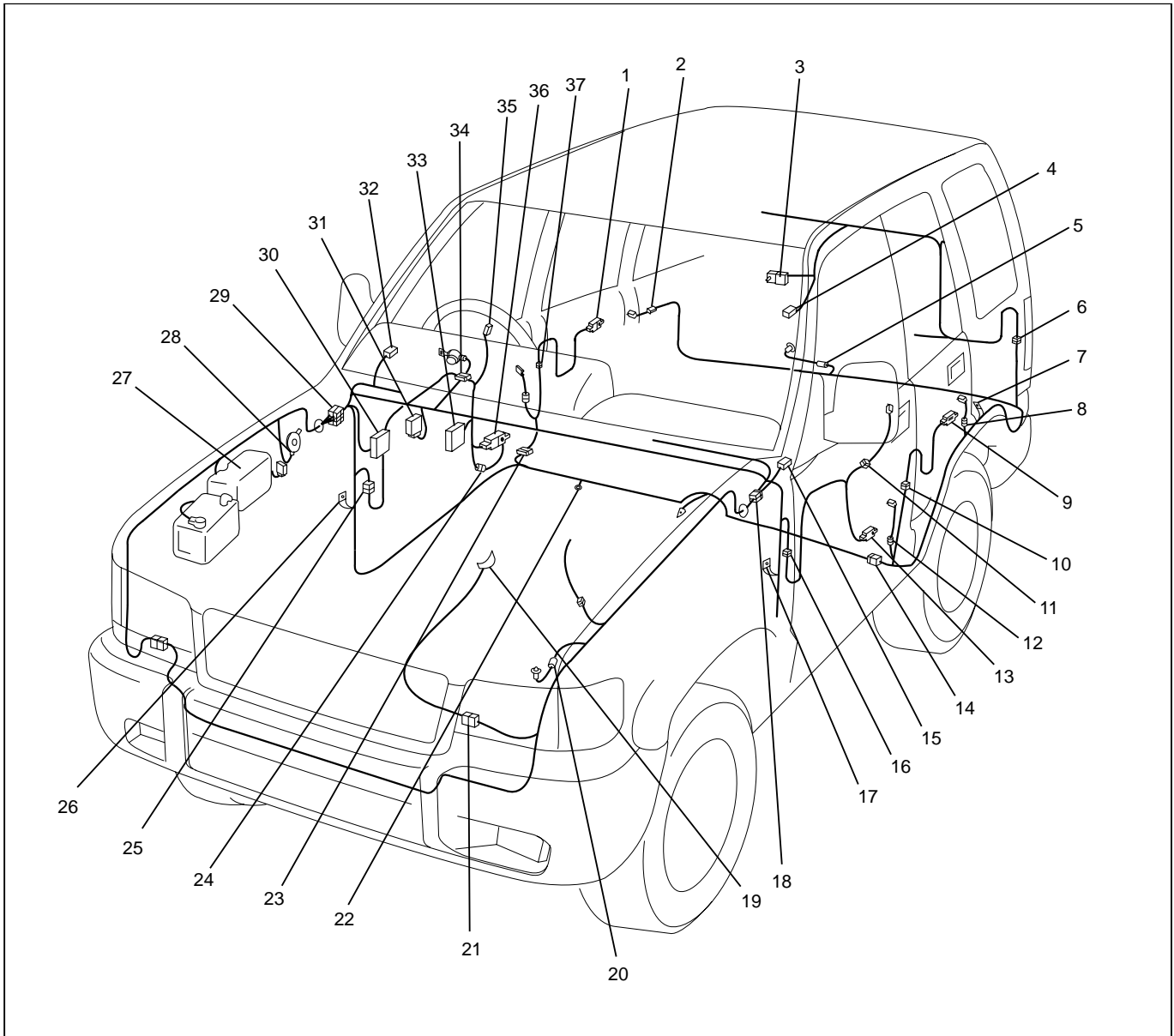
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Circuit Diagram (South Africa)-4





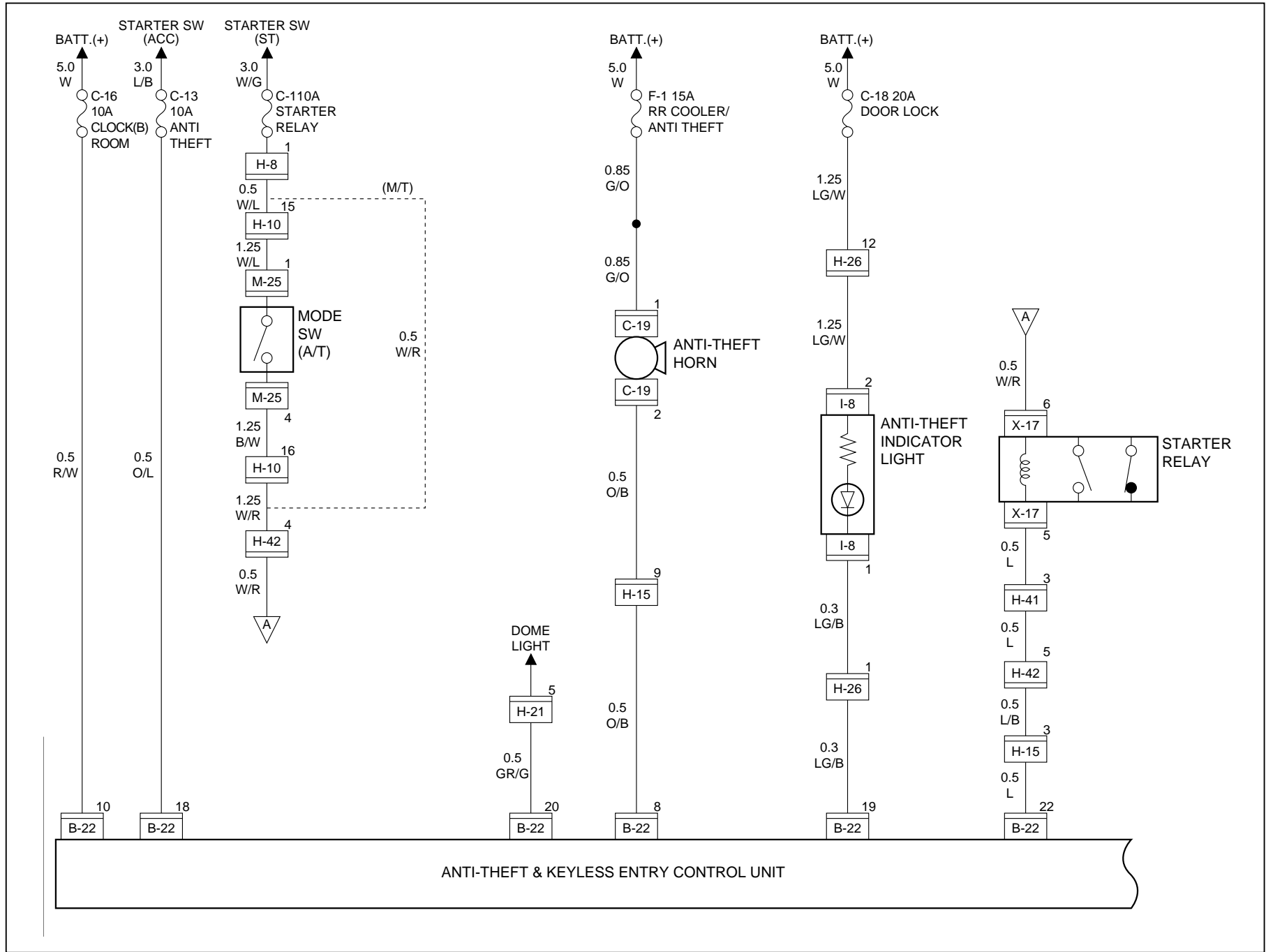
Parts Location (RHD)



D08RW680

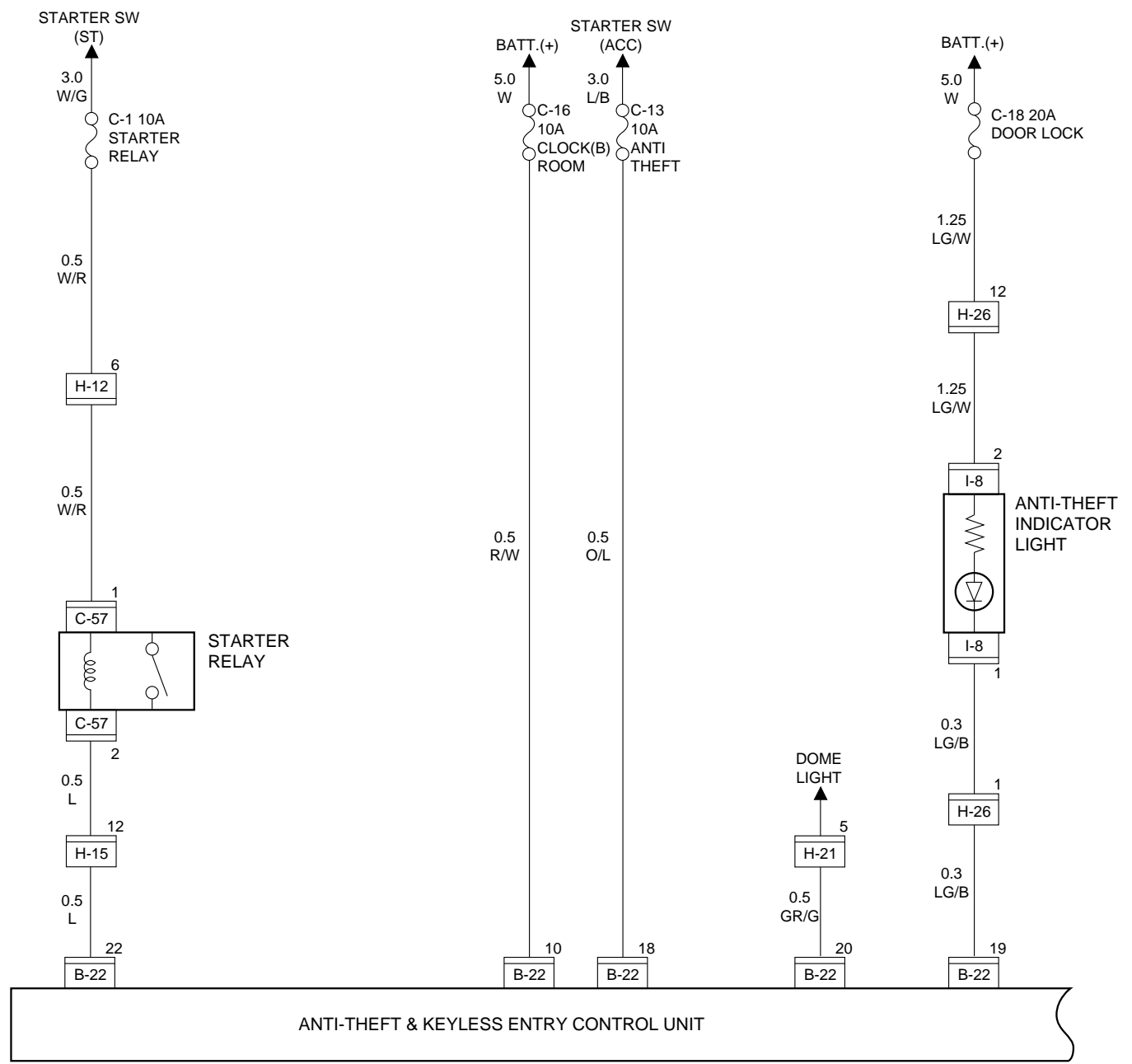
Legend

- | | |
|-----------------|---|
| (1) D-26 | (19) M-25 |
| (2) R-11 | (20) C-20 |
| (3) G-4 | (21) H-10 |
| (4) G-5 | (22) B-26 |
| (5) R-8 | (23) H-47 |
| (6) H-37, H-38 | (24) D-8 |
| (7) R-3 | (25) H-22, H-23 |
| (8) R-1 | (26) B-18, B-19 |
| (9) D-21 | (27) Relay and Fuse Box |
| (10) H-28, H-29 | (28) C-19 |
| (11) D-17 | (29) H-13, H-14, H-15, H-16, H-26 |
| (12) R-2 | (30) Fuse Box |
| (13) D-19 | (31) B-22 (B-20, B-21 for South Africa) |
| (14) H-32 | (32) I-8 |
| (15) H-21 | (33) D-5, D-30 |
| (16) H-18, H-19 | (34) B-12 |
| (17) B-1, B-2 | (35) D-6 |
| (18) H-7, H-8 | (36) D-9 |
| | (37) D-26 |

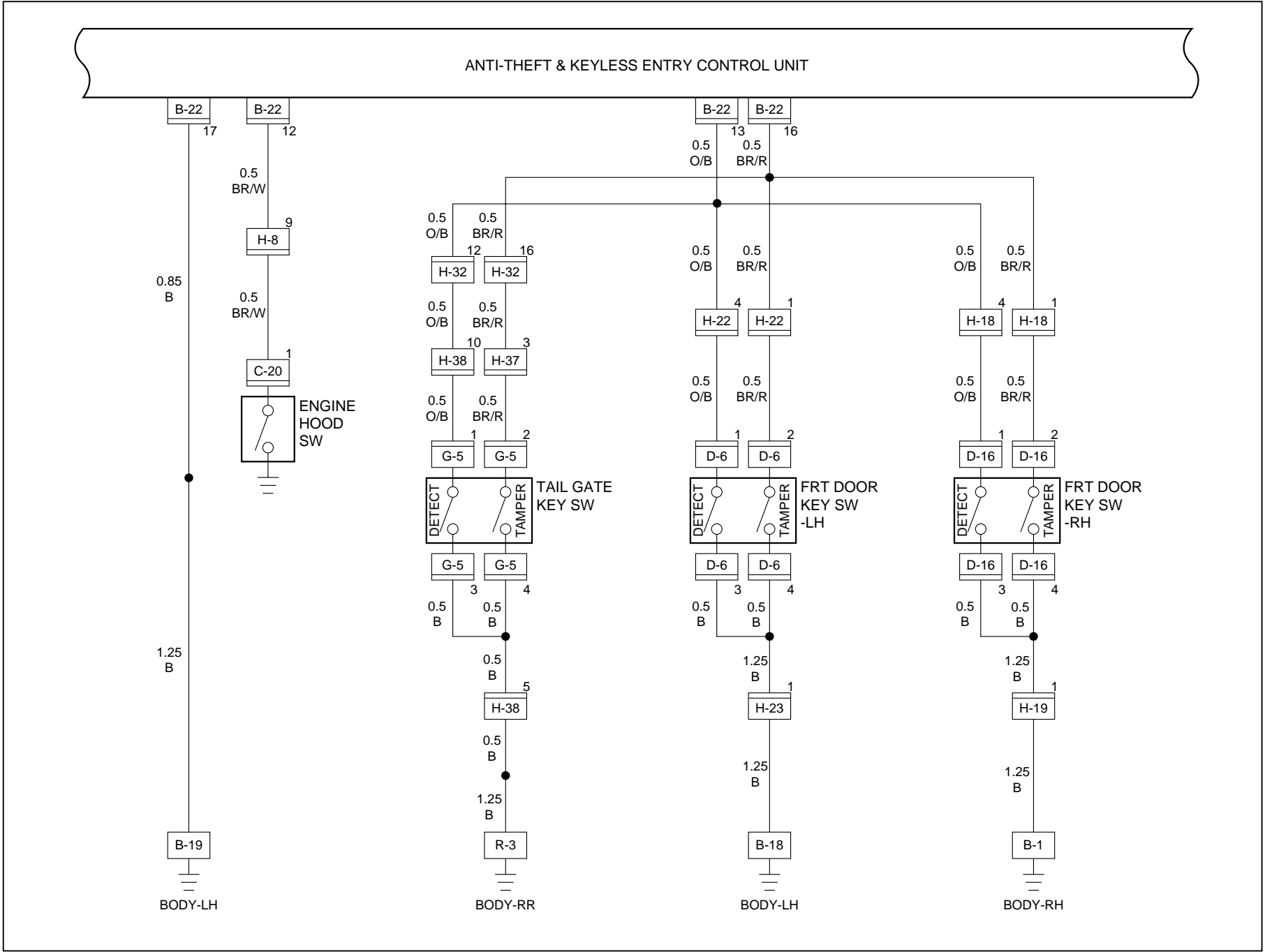


DBR/W920

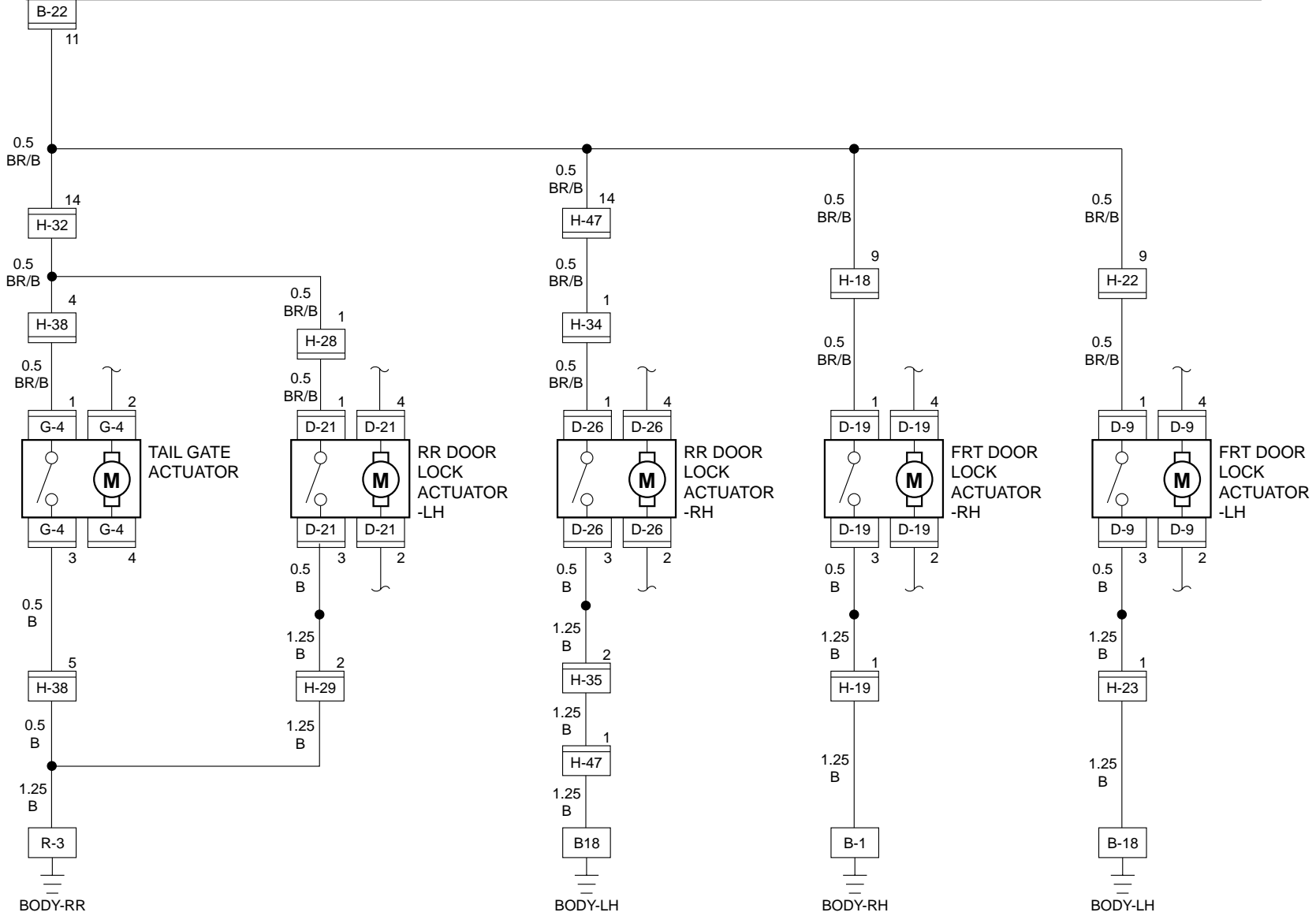
Circuit Diagram (LHD 4JG2)-1

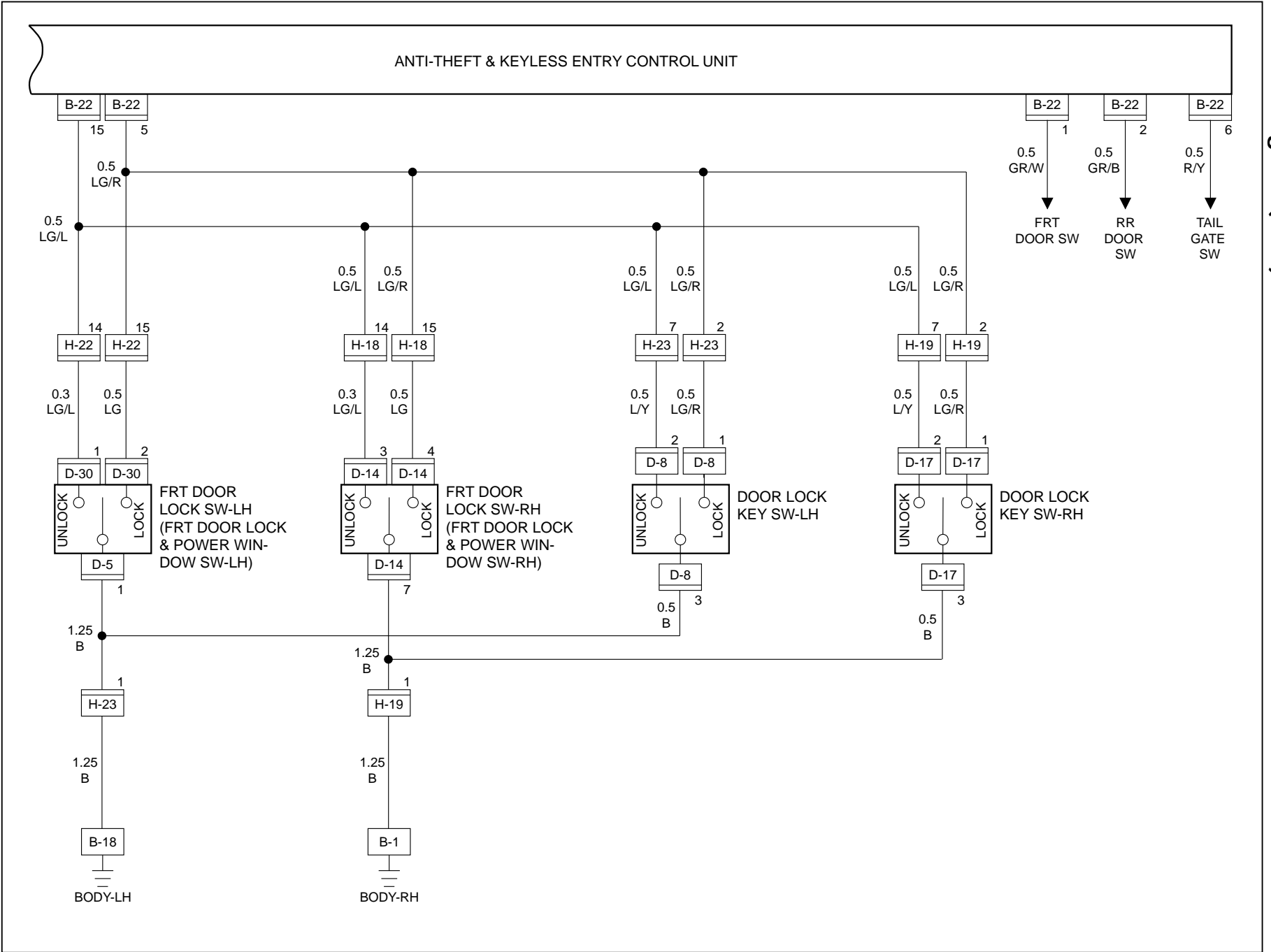


D08RNV709

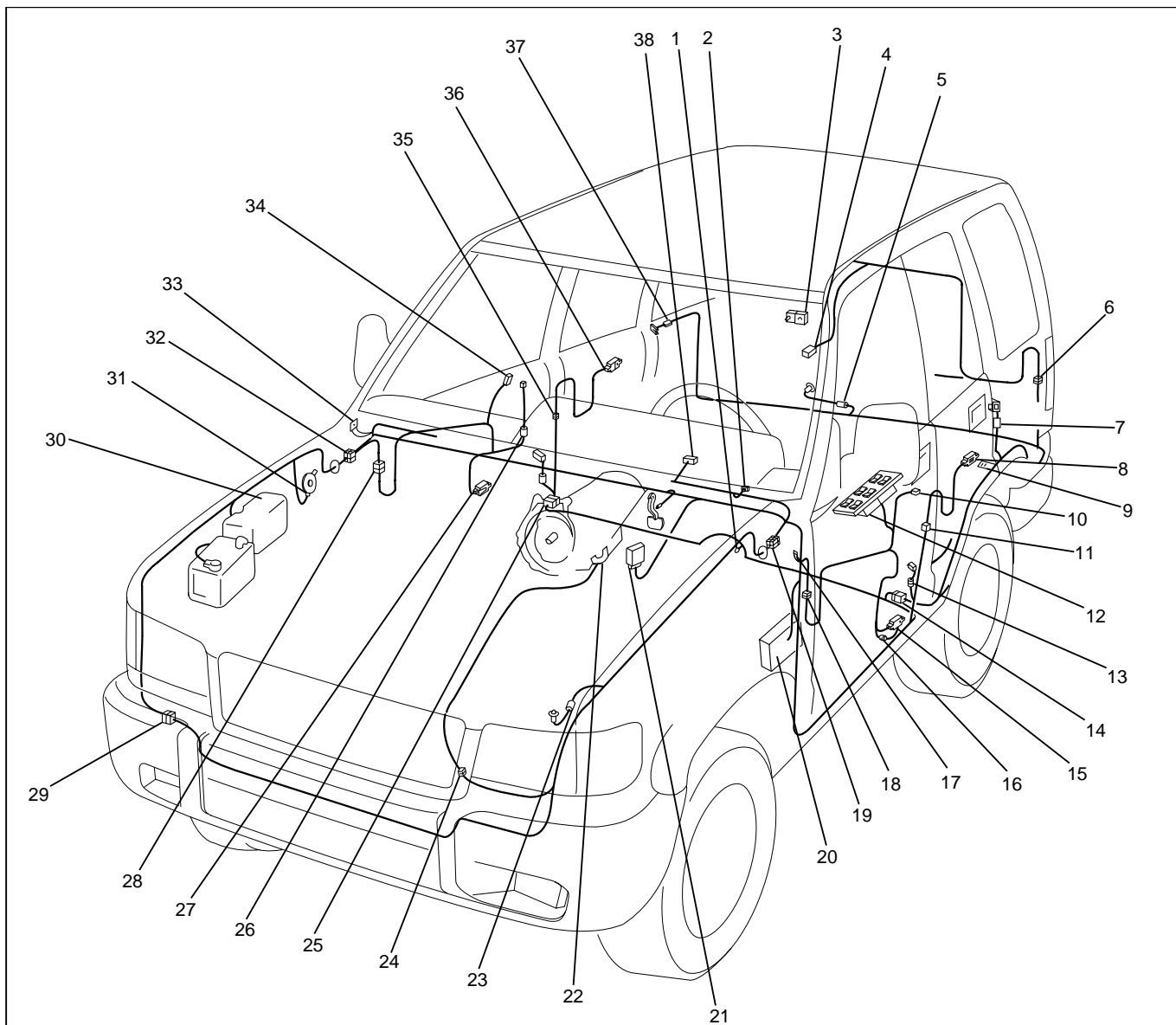


ANTI-THEFT & KEYLESS ENTRY CONTROL UNIT





Parts Location (LHD)



D08RW679

Legend

- | | |
|-----------------|--------------------------------|
| (1) B-26 | (19) H-8, H-26 |
| (2) I-8 | (20) Fuse Box |
| (3) G-4 | (21) B-22 |
| (4) G-5 | (22) M-25 |
| (5) R-8 | (23) C-20 |
| (6) H-37, H-38 | (24) H-10 |
| (7) R-1 | (25) H-47 |
| (8) D-21 | (26) D-17 |
| (9) R-3 | (27) D-19 |
| (10) D-6 | (28) H-18, H-19 |
| (11) H-28, H-29 | (29) H-41, H-42 |
| (12) D-5, D-30 | (30) Relay and Fuse Box (X-17) |
| (13) B-22 | (31) C-19 |
| (14) H-32 | (32) H-12, H-15, H-21 |
| (15) D-9 | (33) B-1 |
| (16) D-8 | (34) D-16 |
| (17) B-18, B-19 | (35) H-34, H-35 |
| (18) H-22, H-23 | (36) D-26 |
| | (37) R-11 |
| | (38) B-12 |

Diagnosis

Diagnosis Procedure

1. Check to see if the battery voltage is normal.
2. Check to see if the fuse is normal.
3. Replace the anti-theft & keyless entry control unit with one reserved for test. If a trouble recurs even after replacing the control unit, find out the cause of the trouble by referring to "System check procedure" and the following list.

ITEM	MALFUNCTION	POSSIBLE CAUSE	DETECTING METHOD	REMARKS
A	ANTI-THEFT indicator light does not flash	Defective contact of door switch, or open circuit in door switch wiring.	With door open, dome light and courtesy light do not come on.	Burnt out indicator light bulb possible.
		Short circuit in the detect switch.	Check the control unit connector.	Refer to "Connector check table" in this system.
B	Indicator light does not change to fully ON condition, or does not come on at all.	Engine hood, doors and tailgate are not fully closed and locked.	Check to see if doors are closed and locked.	
		Defective door switch, or short circuit in switch wiring.	Dome light and courtesy light remain lit on after closing doors.	
		Defective tamper switch, or short circuit in wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.
		Defective lock switch, or short circuit in wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.
		Defective engine hood switch, or short circuit in wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.
		Defective tailgate switch, or short circuit in wiring.	Luggage room light remains lit after closing tailgate.	
C	ANTI-THEFT indicator light does not turn off. (Steadily on)	Defective control unit.		
D	When door is opened by pulling up locking knob, alarm does not operate	Poor contact of lock switch, or open circuit in wiring.	Check alarm operation (See No. 46 of "System check procedure"), possible cause is a poor contact of lock switch of an open circuit in wiring.	
		Broken wire in wiring to headlight and horn, or a blown fuse.	Check to see if headlights go out. Check the control unit connector.	Refer to "Connector check table" in this system.
E	Alarm does not stop.	Defective contact of detect switch, or damaged switch wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.

8D-400 WIRING SYSTEM

ITEM	MALFUNCTION	POSSIBLE CAUSE	DETECTING METHOD	REMARKS
F	Even when door unlocked with key, alarm operates.	Defective contact of detect switch, or damaged switch wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.
		Door detect switch is assembled to wrong door.	When key is turned to lock position, alarm stops.	
G	Alarm does not operate even with tailgate open.	Defective contact of tailgate switch, or defective wiring.	When luggage room light switch is turned on with tailgate open, luggage room light does not come on.	
H	Even when tailgate is opened with key, alarm does not stop.	Defective contact of tailgate detect switch, or damage wiring.	Check the control unit connector.	Refer to "Connector check table" in this system.
I	Even when engine hood is opened with remote release, alarm does not operate	Damaged engine hood switch or wiring.		
J	Even when starter switch is turned, alarm does not stop	Defective contact of starter switch.	With starter switch turned to "ACC" position, audio, cigarette lighter and door mirrors (on "ACC" circuit) do not operate.	
K	Indicator light continues flashing	Damaged door switch, or a short circuit in wiring.	After closing door, dome light and courtesy light remain on.	Refer to "Connector check table" in this system.
		Damaged tamper switch, or a short circuit in wiring.	Check the control unit connector.	

System Check Procedure

STEP	OPERATION	ITEM TO BE CHECKED	ITEM OF MALFUNCTION	REMARKS
1	Turn starter key to "ON" position.	Check to see if engine hood, tailgate and doors are closed and locked.		
2	Open windows fully.			
3	Pull out starter key after turning it back to "OFF" position.	Check to see if indicator light remains lit off.	K	
4	Unlock left front door with locking knob.			
5	Open left front door. (And get out of the vehicle.)	Check to see if indicator light flashes.	A	
		Check to see if dome light and courtesy light illuminate.		
6	Close left front door.			
7	Lock left front door.	Check to see if indicator light changes from flashing to steadily on.	B	Be sure to lock door with locking knob.
8	Wait about 10 seconds	Check to see if indicator light turns off in about 10 seconds.	C	Activate alarm device.
9	Unlock left front door with locking knob.	Check to see if alarm operates (with headlight flashing, and horn blaring intermittently.)	D	All doors are unlocked.
10	Insert key into key cylinder of left front door and turn it in unlock direction.	Check to see if alarm stops.	E	With key set at unlock position, check to see if alarm stops.
11	Lock left front door.	Check to see if indicator light turns on.	B	All doors are locked.
12	Wait for about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
13	Unlock left front door with key.	Check to see if alarm does not operate.	F	
14	Lock left front door with key.	Check to see if indicator light turns on.	B	
15	Wait for about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
16	Unlock left rear door with locking knob.	Check to see if alarm starts.	D	Only left rear door is unlocked.

8D-402 WIRING SYSTEM

STEP	OPERATION	ITEM TO BE CHECKED	ITEM OF MALFUNCTION	REMARKS
17	Insert key into key cylinder of left front door and turn it to unlock direction.	Check to see if alarm stops.	E	With key set at unlock position, check to see if alarm stops. (All doors are unlocked.)
18	Open left rear door.	Check to see if indicator light flashes.	A	
		Check to see if dome light and courtesy light come on.		
19	With one person in vehicle, close left rear door.			
20	Lock left front door with locking knob.	Check to see if indicator light is steadily on.	B	All doors are locked.
21	Wait about 10 seconds.	Check to see if indicator light turns off in about 10 seconds.	C	Activate alarm device.
22	Unlock tailgate from inside with locking knob.	Check to see if alarm operates.	D	Only tailgate is unlocked.
23	Open tailgate, insert key into key cylinder of tailgate and turn it in lock direction.	Check to see if alarm stops.	H	With key set at unlock position, check to see if alarm stops.
24	Leave tailgate open.	Check to see if indicator light flashes.	A	
		Check to see if luggage room light on.	G	
25	Close tailgate			
26	Insert key into tailgate key cylinder and turn it in lock direction.	Check to see if indicator light changes over from flashing into lighting condition.	B	
27	Wait about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
28	Unlock tailgate with key.	Check to see if alarm does not operate.	F	
29	Lock tailgate with key.	Check to see if indicator light come on.	B	
30	Wait about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.

STEP	OPERATION	ITEM TO BE CHECKED	ITEM OF MALFUNCTION	REMARKS
31	Unlock right rear door with locking knob.	Check to see if alarm operates.	D	Only right rear door is unlocked.
32	Insert key into key cylinder of right front door and turn it in unlock direction.	Check to see if alarm stops.	E	With key at unlock position, check to see if alarm stops. (With all doors unlocked.)
33	Open right rear door.	Check to see if indicator light flashes.	A	
		Check to see if dome light and courtesy light come on.		
34	Close right rear door.			
35	Insert key into key cylinder of right front door and turn it in lock direction.	Check to see if indicator light stays on steadily.	B	
36	Wait about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
37	Unlock right front door with locking knob.	Check to see if alarm operates.	D	Only right front door is unlocked.
38	Insert key into key cylinder of right front door and turn it in unlock direction.	Check to see if alarm stops.	E	With key at unlock position, check to see if alarm stops. (With all doors unlocked.)
39	Open right front door.	Check to see if indicator light flashes.	A	
		Check to see if dome light and courtesy light come on.		
40	Close right front door.			
41	Lock right front door with key.	Check to see if indicator light stays on steadily.	B	
42	Wait about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
43	Unlock right front door with key.	Check to see if alarm does not operate.	F	
44	Lock right front door with key.	Check to see if indicator light stays on steadily.	B	

8D-404 WIRING SYSTEM

STEP	OPERATION	ITEM TO BE CHECKED	ITEM OF MALFUNCTION	REMARKS
45	Wait about 10 seconds.	Check to see if indicator light goes off after about 10 seconds.	C	Activate alarm device.
46	Open engine hood with engine hood release handle.	Check to see if alarm operates.	I	
47	Insert key into starter switch and turn it to "ACC" position.	Check to see if alarm stops.	J	

NOTE: When the connector of the anti-theft & keyless entry control unit is disconnected, the starter is inoperative.
In the checking of short wheel base model, Step Nos. 16 through 21 and Step Nos. 31 through 36 are omitted.

Connector Check Table

Check the anti-theft & keyless entry control unit harness side connector B-20 by using a circuit tester.

TERMINAL NO.	CONNECTION	CHECK ITEM	OPERATION	CIRCUIT CONDITION
1	FRT door switch-LH, RH	Continuity	Open door	Continuity
			Close door	No continuity
2	RR door switch-LH, RH	Continuity	Open door	Continuity
			Close door	No continuity
3	—	—	—	—
4	Door lock key switch-LH, RH	Continuity	Lock with key	Continuity
5	FRT door lock switch-LH, RH	Continuity	Lock	Continuity
6	Tailgate switch	Continuity	Open tailgate	Continuity
			Close tailgate	No continuity
8	Anti-theft horn	Voltage	—	Approx. 12V
10	Battery	Voltage	—	Approx. 12V
11	Door switch	Continuity	Unlock with locking knob	Continuity
			Lock with locking knob	No continuity
12	Engine hood switch	Continuity	Open engine hood	Continuity
			Close engine hood	No continuity
13	Detect switch	Continuity	Unlock with key	Continuity
			Lock with key	No continuity
14	Door lock key switch	Continuity	Unlock	Continuity
15	FRT door lock switch-LH, RH	Continuity	Unlock	Continuity
16	Tamper switch	Continuity	—	No continuity
17	Ground	Continuity	—	Continuity
18	Starter switch	Voltage	Starter switch "ACC"	Approx. 12V
19	Indicator light	Voltage	—	Approx. 12V
20	Dome light	Voltage	Dome light "DOOR" position	Approx. 12V
21	Anti-theft relay	Voltage	—	Approx. 12V
22	Starter relay	Voltage	Mode switch "P" or "N"	Approx. 12V
			Clutch pedal depressed	Approx. 12V

ID Code Registration

There are four kinds of ID codes which can be registered, for which these three modes, ID code new registration, ID code additional registration and ID code check, are available.

ID Code New Registration

This procedure erases all registered ID codes and registers a new received ID code instead.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off five times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Go to Step 6	—
6	Operate the lock or unlock button of transmitter within twenty seconds after step 5. Is the action complete?	Go to Step 7	Finished
7	The control unit makes lock/unlock response once with interval of one second as ID temporary registration. Is the response complete?	Go to Step 8	—
8	Operate the lock or unlock button of transmitter within twenty seconds after step 7. Is the action complete?	Go to Step 9	Finished
9	The control unit compares temporary registered ID code with receiving ID code. Is temporary registered ID code the same as receiving ID code?	Go to Step 11	Go to Step 11
10	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—
11	The control unit erases all registered ID codes and registers new ID code. Is the registration complete?	Go to Step 12	Go to Step 13

Step	Action	Yes	No
12	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
13	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

ID Code Additional Registration

This procedure additionally registers a new received ID code with holding registered ID codes. When total number of registered ID codes and newly registered ID code exceeds four, they are erased in order of older one.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off three times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response two times with interval of one second. Is the response complete?	Go to Step 6	—
6	Operate the lock or unlock button of transmitter within twenty seconds after step 5. Is the action complete?	Go to Step 7	Finished
7	The control unit makes lock/unlock response two times with interval of one second as ID temporary registration. Is the response complete?	Go to Step 8	—
8	Operate the lock or unlock transmitter within twenty seconds after step 7. Is the action complete?	Go to Step 9	Finished
9	The control unit compares temporary registered ID code with receiving ID code. Is temporary registered ID code the same as receiving ID code?	Go to Step 11	Go to Step 10
10	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—
11	The control unit registers new ID code. Is the registration complete?	Go to Step 12	Go to Step 13

8D-408 WIRING SYSTEM

Step	Action	Yes	No
12	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
13	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

ID Code Check

This procedure checks how many kinds of ID code are registered.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response twice as many the number of registered ID code with interval of two seconds. (In case of no registered code, the response is made ten times.) Is the response complete?	Finished	—

Answer Back (Anti-theft Horn Operation) Change Mode

Anti-theft horn, as an answer back function for the transmitter operation, changes from available into unavailing or from unavailing into available by this procedure.

Step	Action	Yes	No
1	Open the driver's side door. Is the action complete?	Go to Step 2	—
2	Lock the door and then unlock it three times within ten seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished

Step	Action	Yes	No
4	1. Lock the door and unlock it three times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	Answer back mode changes. Is this step complete?	Go to Step 6	Go to Step 7
6	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
7	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

Anti-theft & Keyless Entry Control Unit/Transmitter Replacement

Anti-theft & Keyless Entry Control Unit Replacement

1. Remove and install the control unit.
 - Refer to Anti-theft & Keyless Entry Control Unit Removal and Installation in this section.
2. Register ID code.
 - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Replacement

1. Prepare a new transmitter.
2. Register ID code.
 - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Battery Replacement

1. Remove a screw to remove the cover.
2. Remove the batteries.
3. Set the new batteries into the transmitter.
4. Install the cover to the transmitter.
5. Check that the keyless entry system works normally.

Meter and Warning/Indicator Light

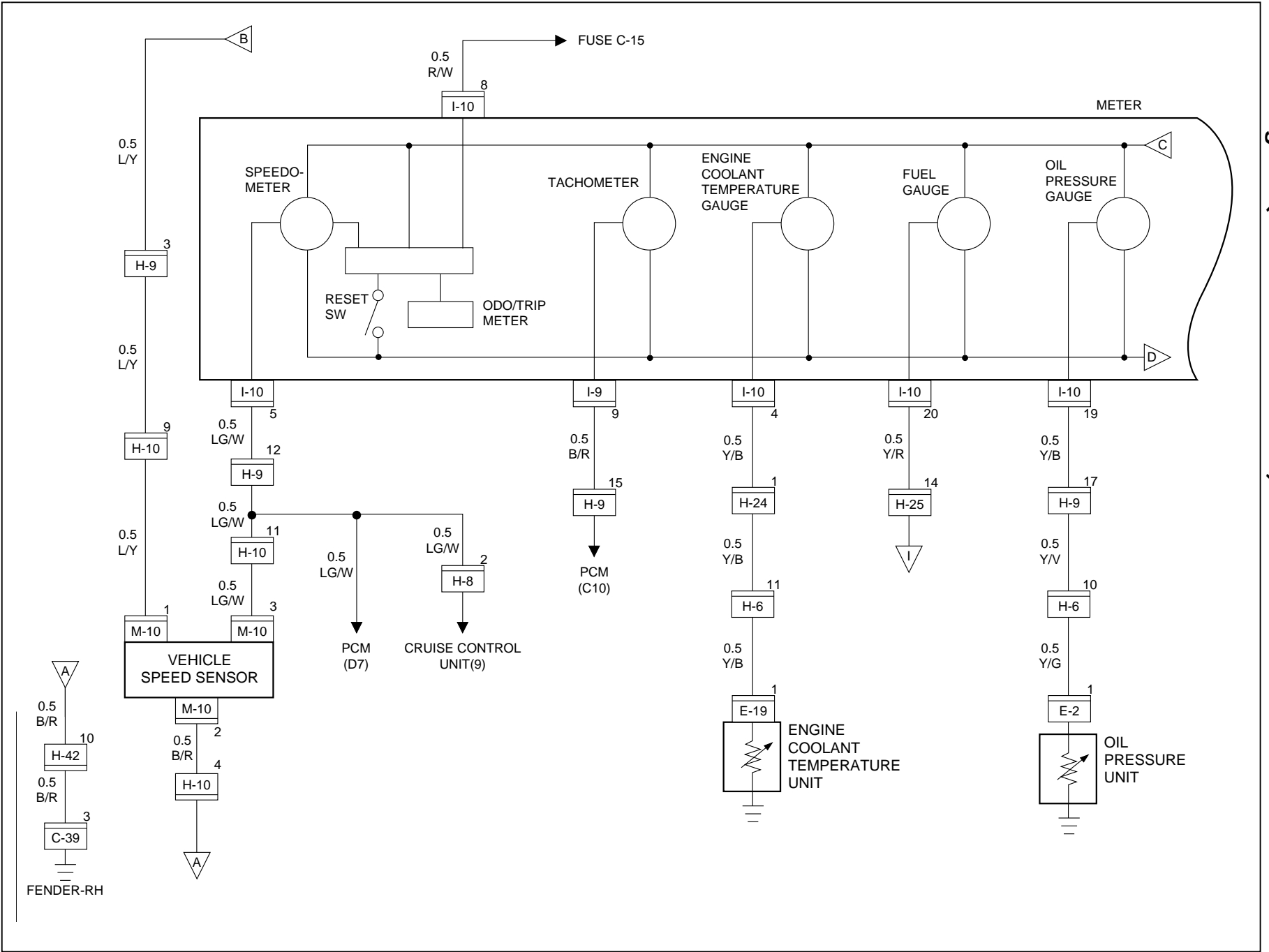
General Description

The circuit consists of meter assembly vehicle speed sensor, engine coolant temperature sensor, seat belt switch, oil pressure switch, brake fluid switch, parking brake switch and other some switches and sensors.

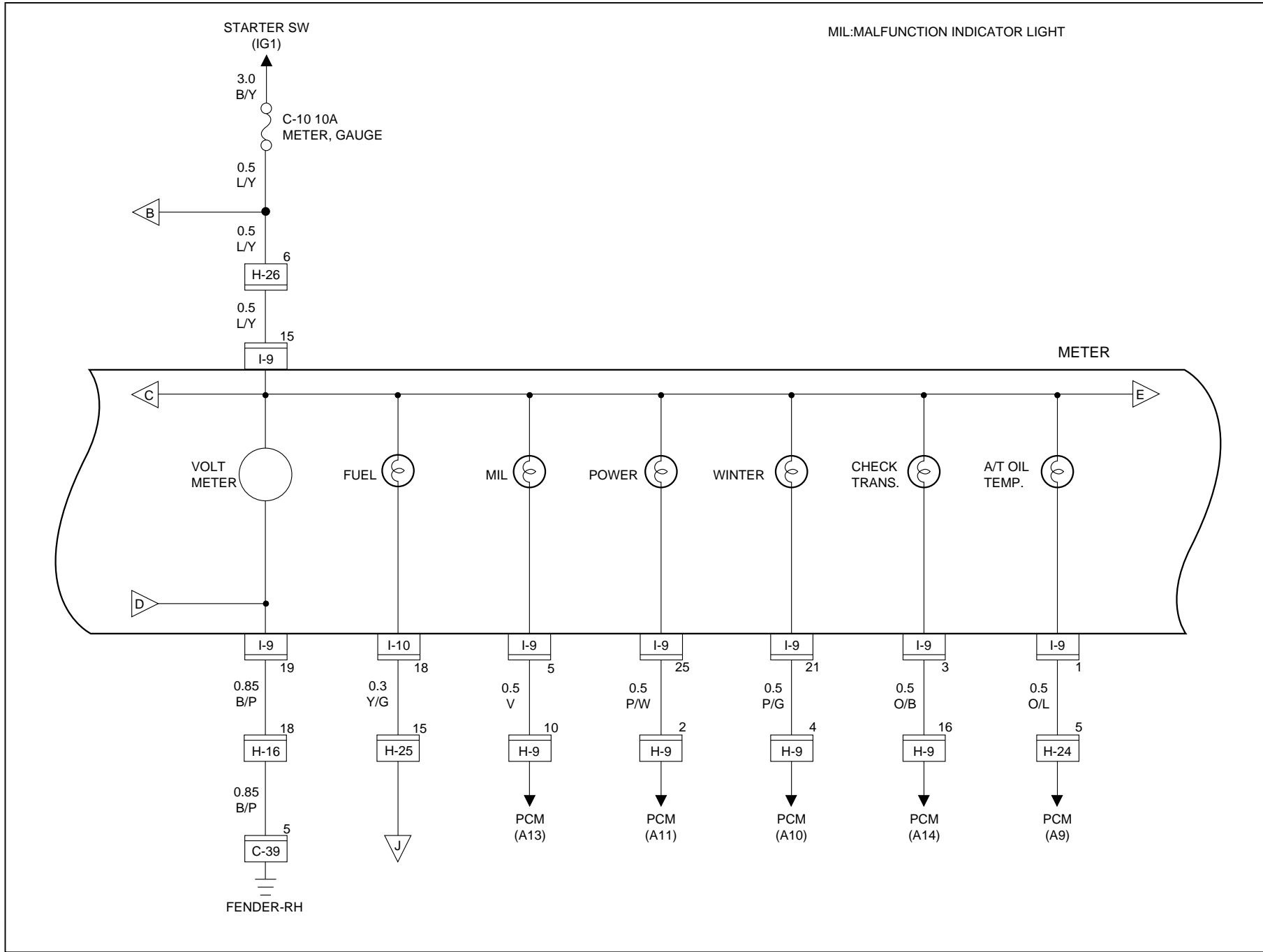
Meter assembly contains speedometer, tachometer, voltmeter, engine coolant temperature gauge, oil pressure gauge, fuel gauge, warning/indicator light and illumination light.

Circuit Diagram (RHD 6V*1 W/O T.O.D.)-1

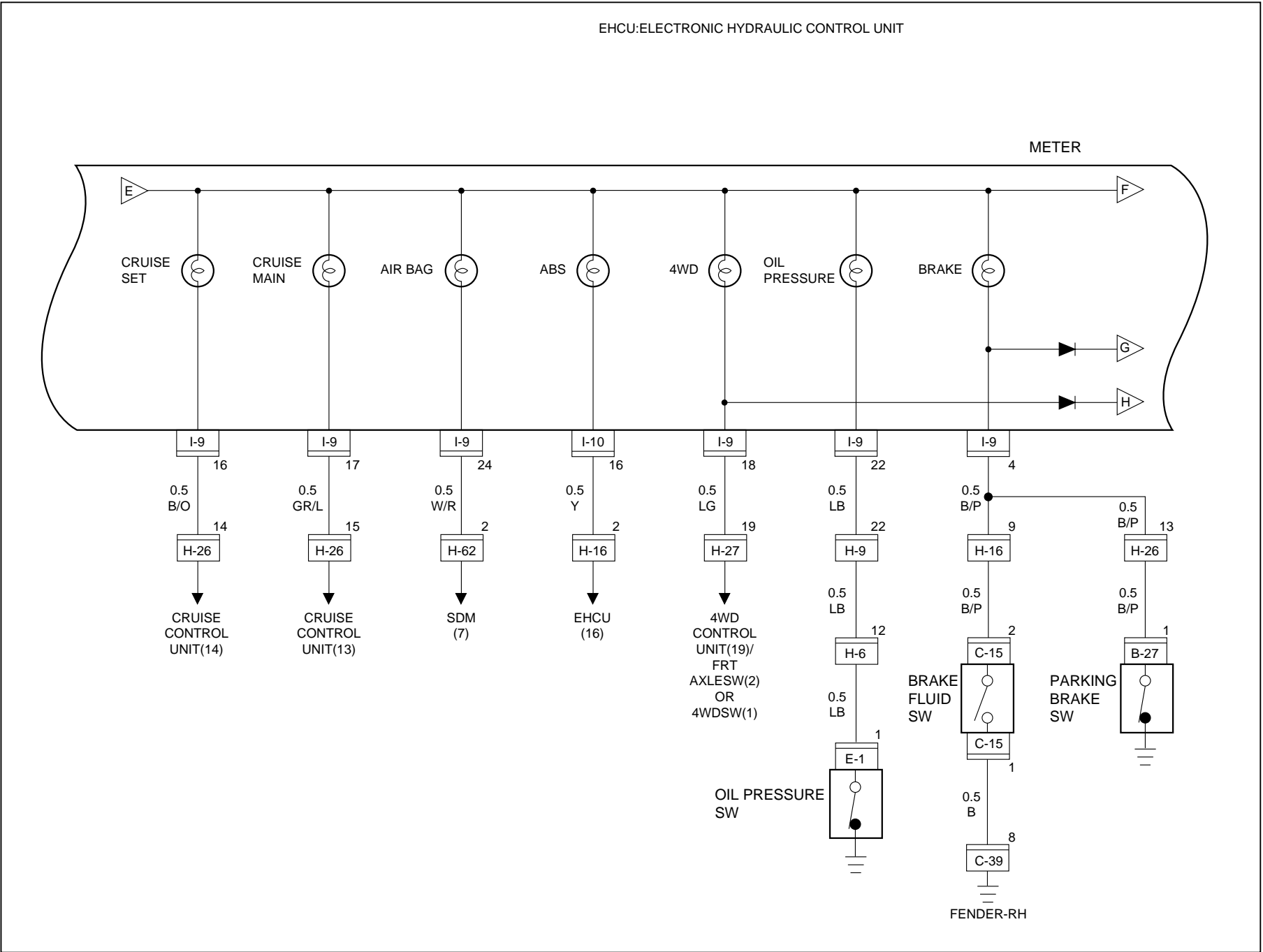
WIRING SYSTEM 8D - 411



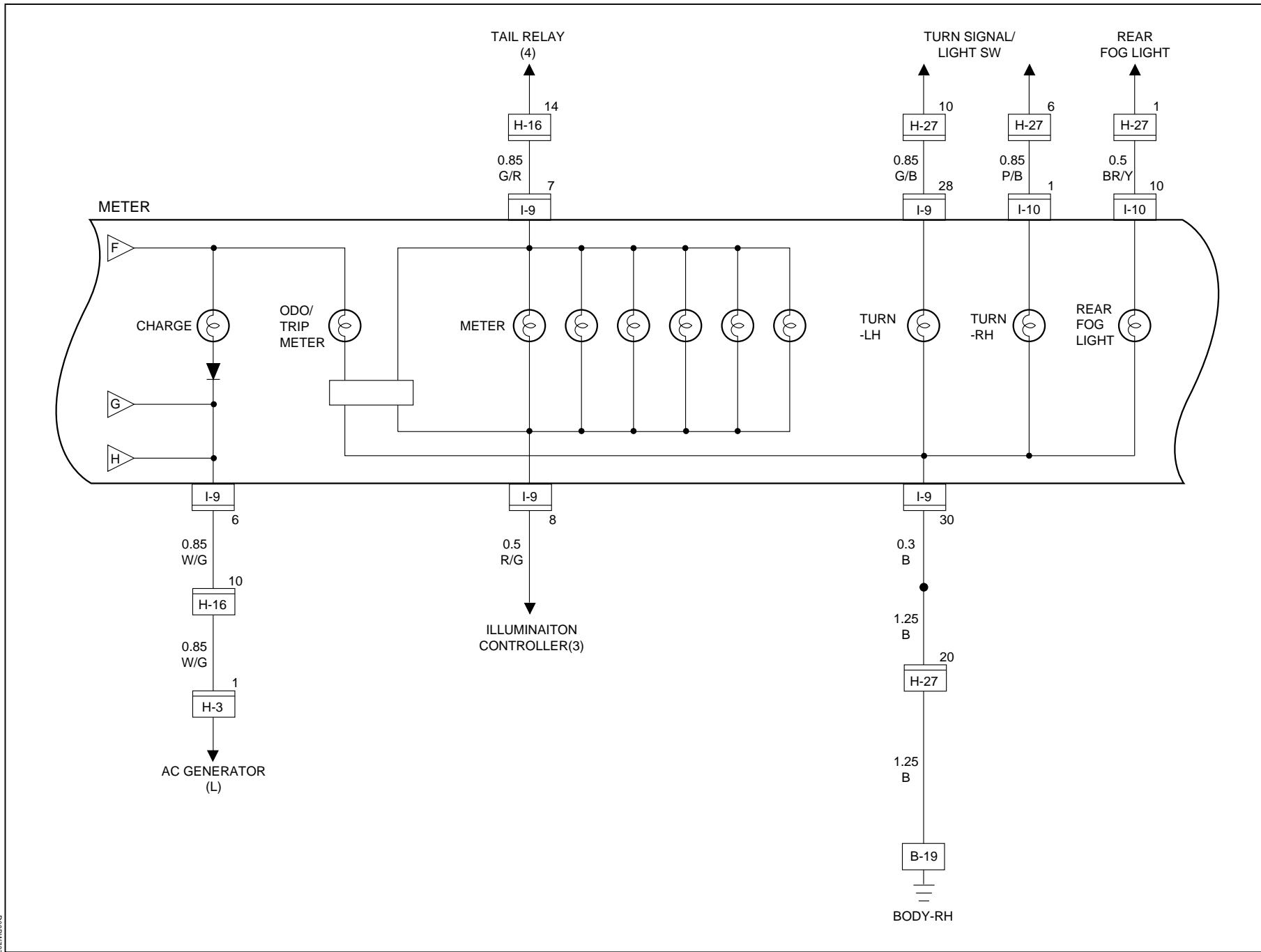
Circuit Diagram (RHD 6V*1 W/O T.O.D)-2

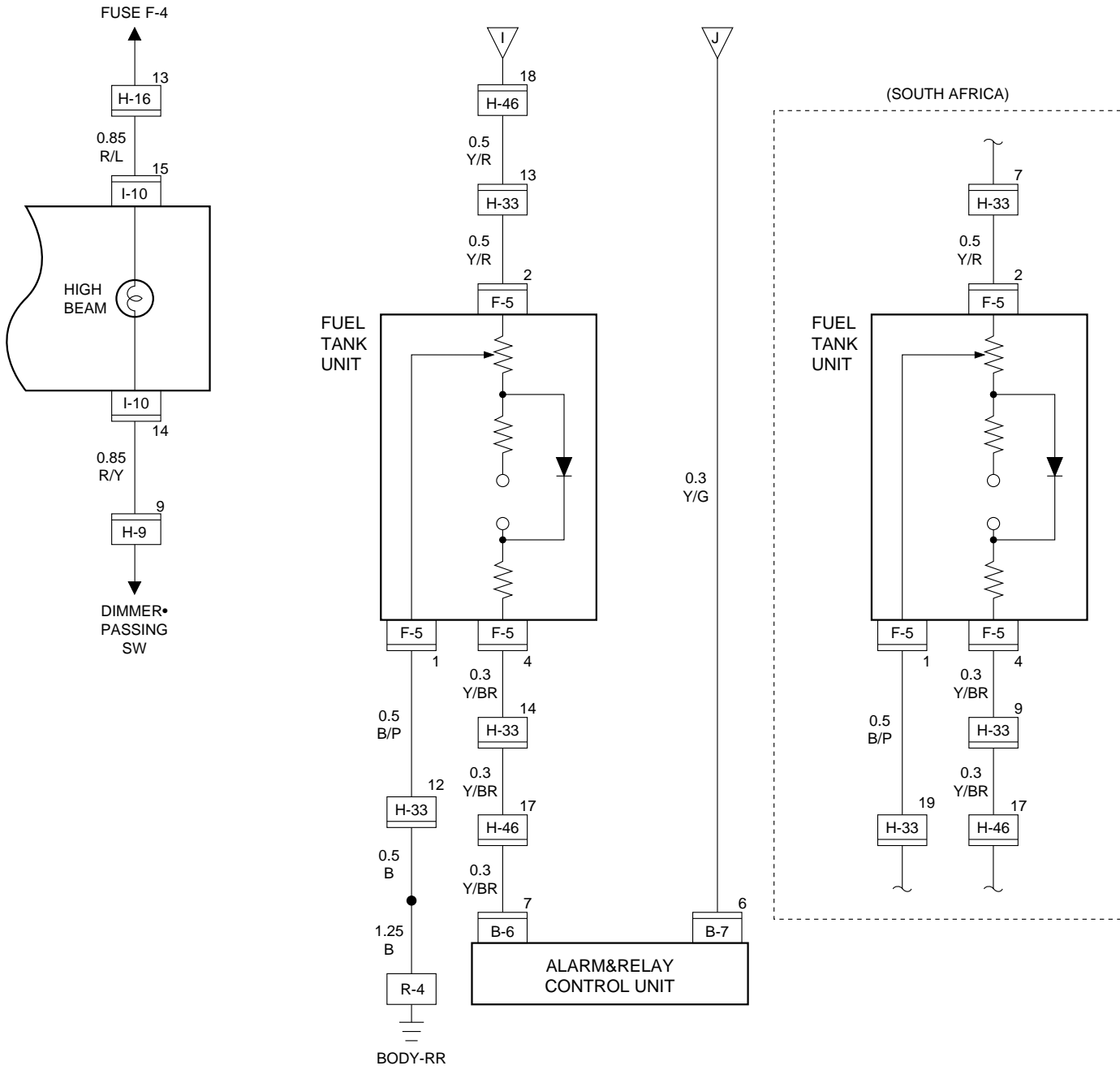


Circuit Diagram (RHD 6V*1 W/O T.O.D.)-3

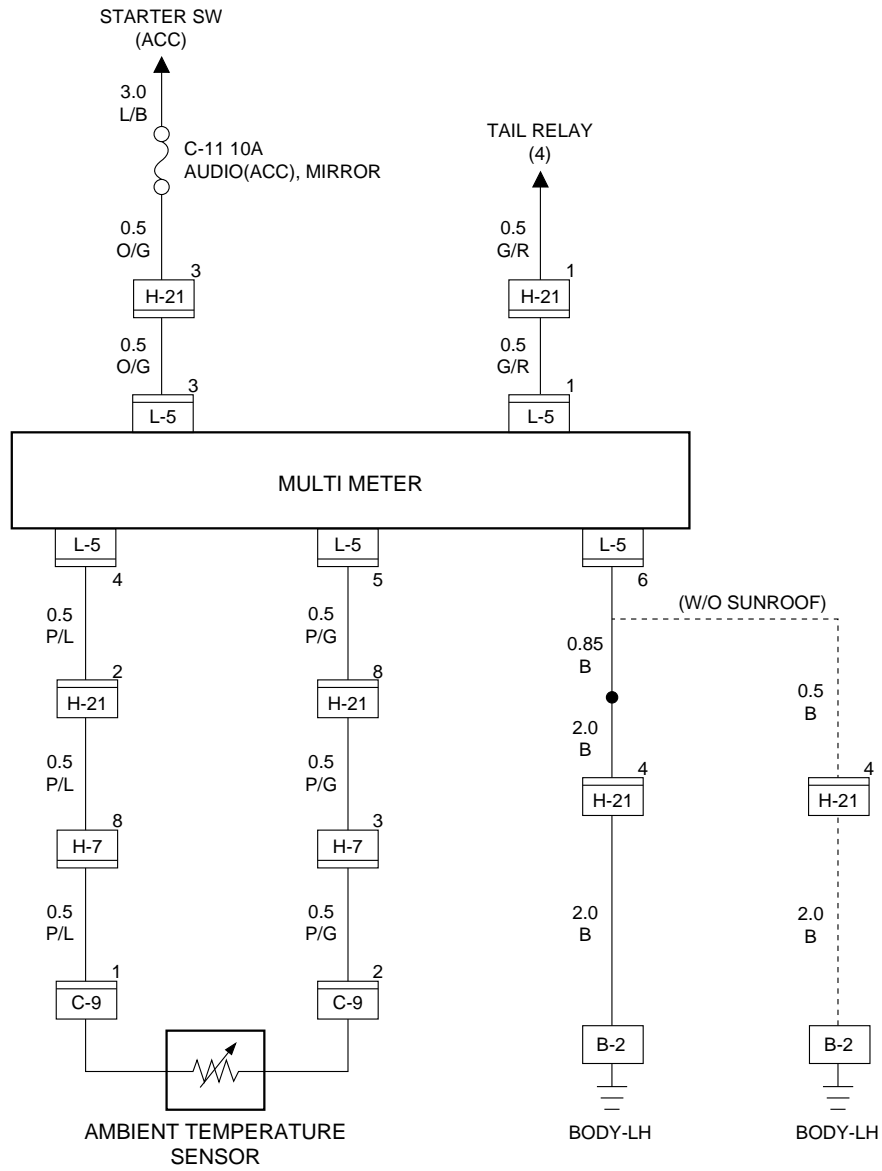


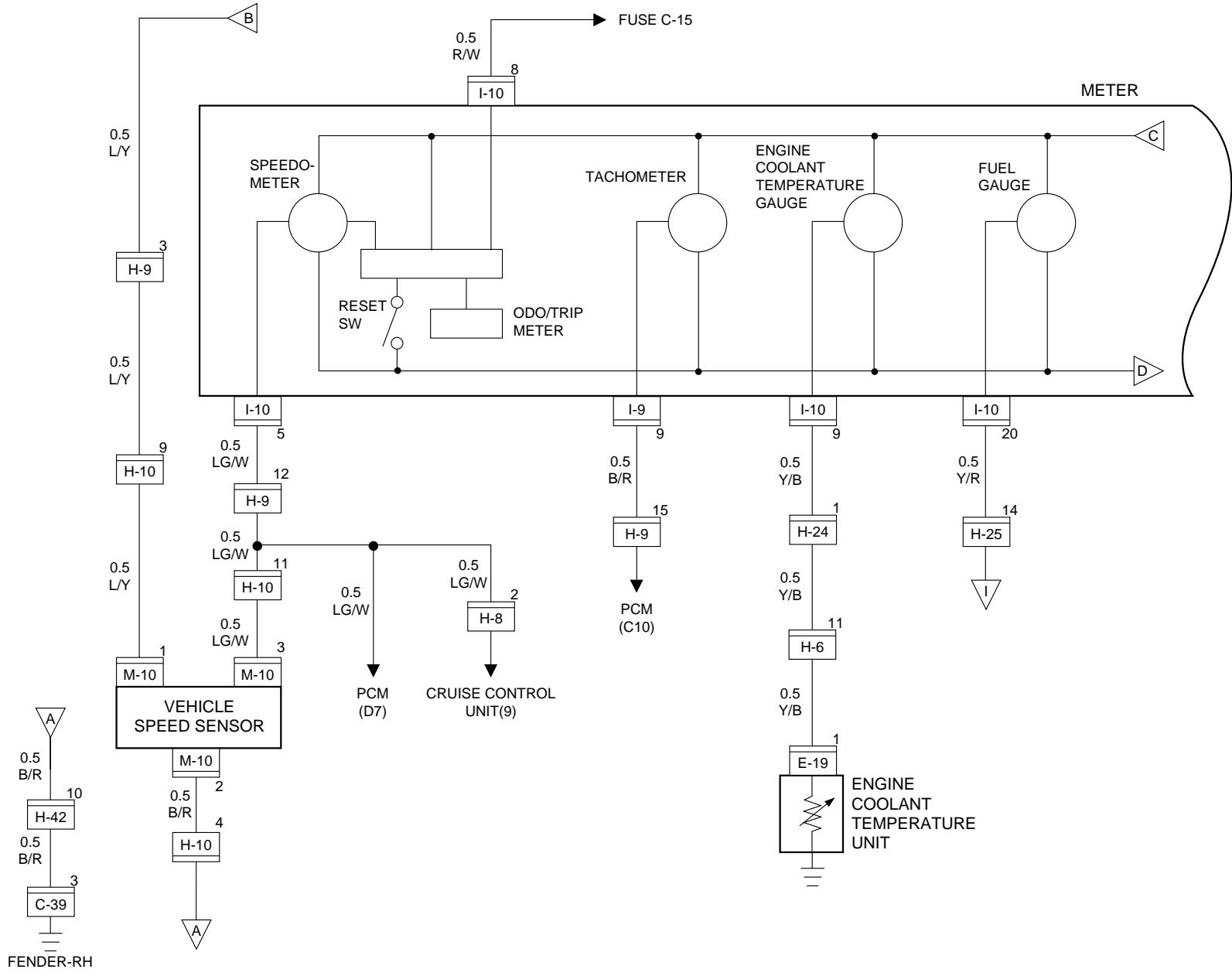
Circuit Diagram (RHD 6VD1 W/O T.O.D.)-4



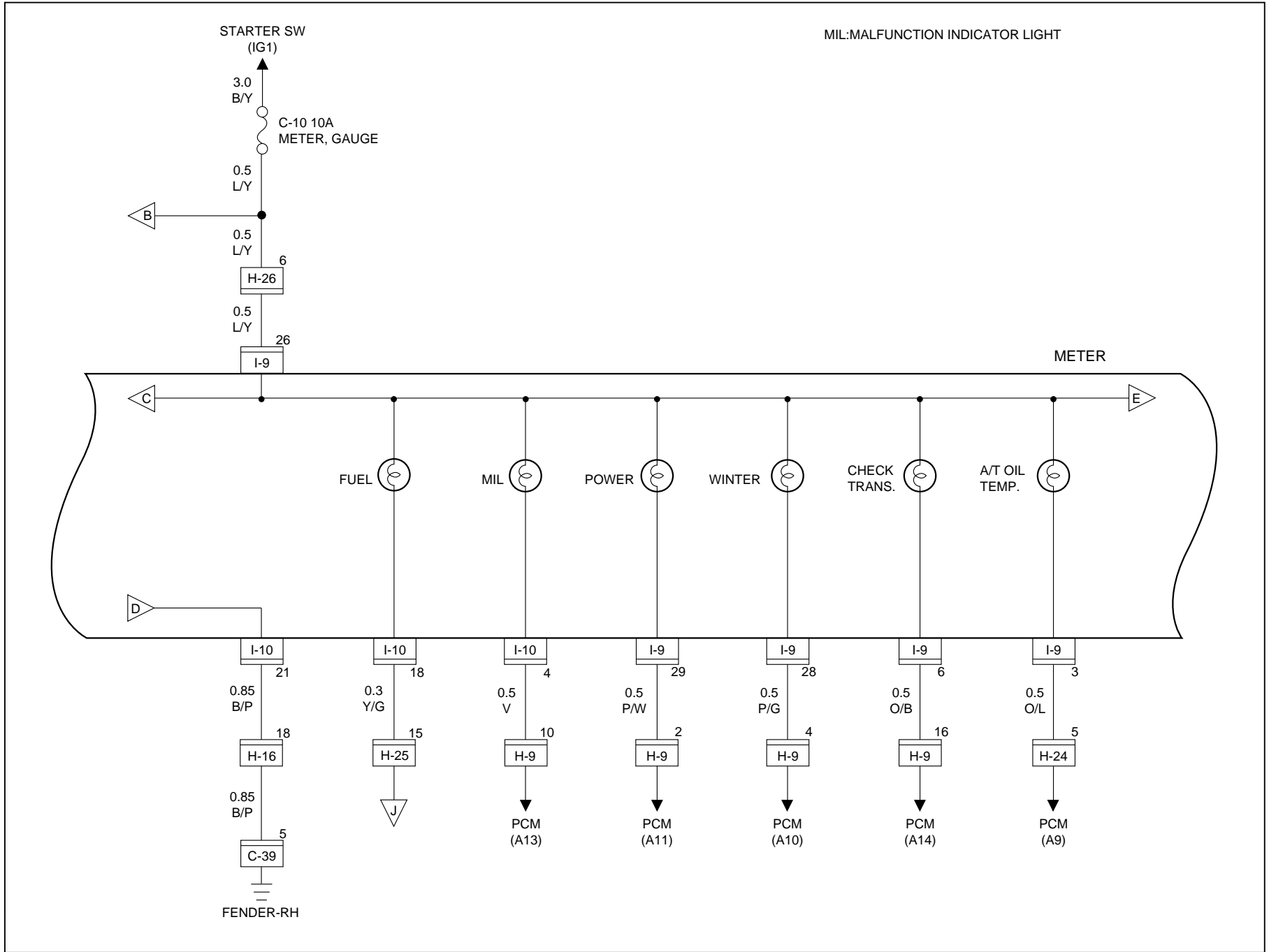


Circuit Diagram (RHD 6V*1 W/O T.O.D.)-6

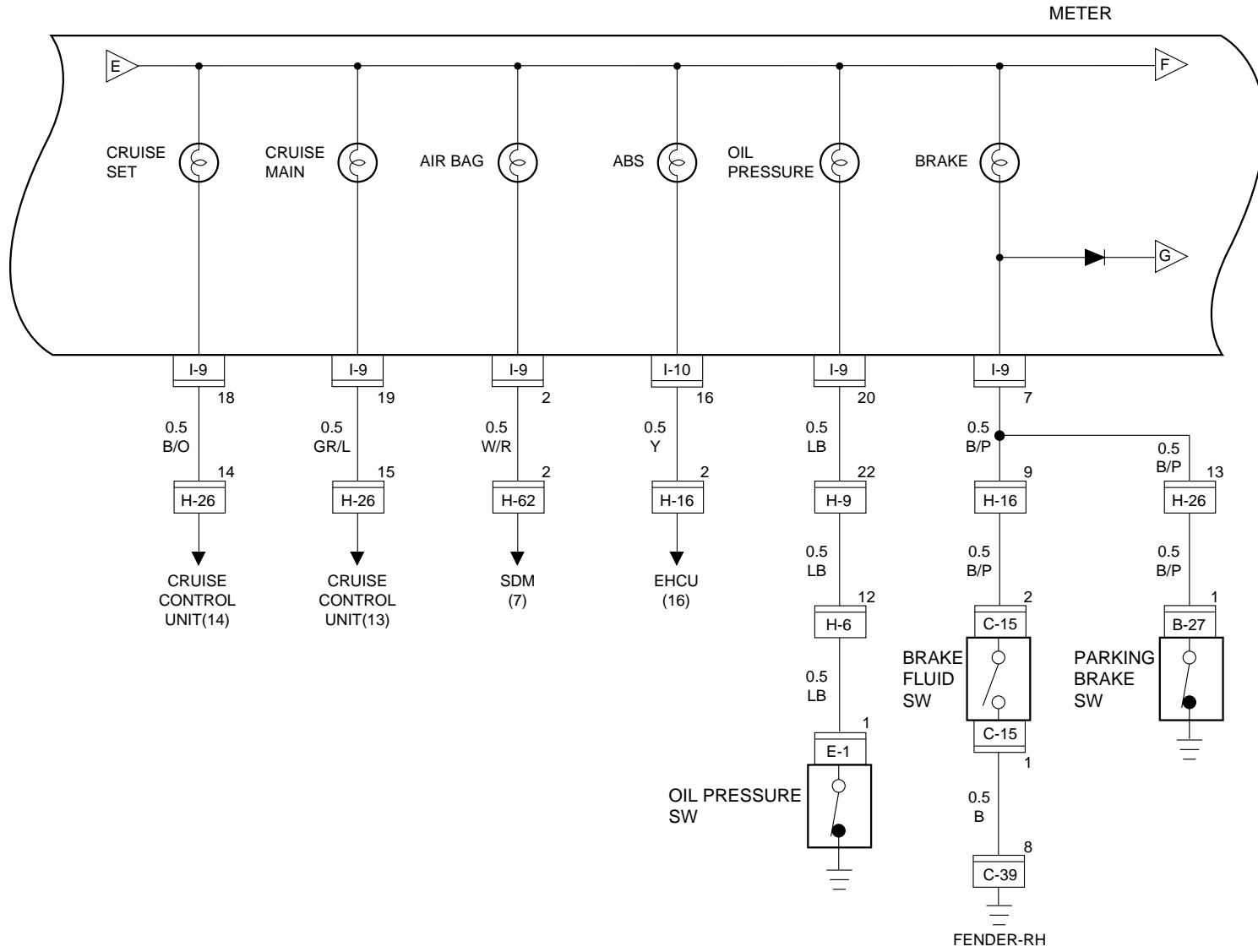




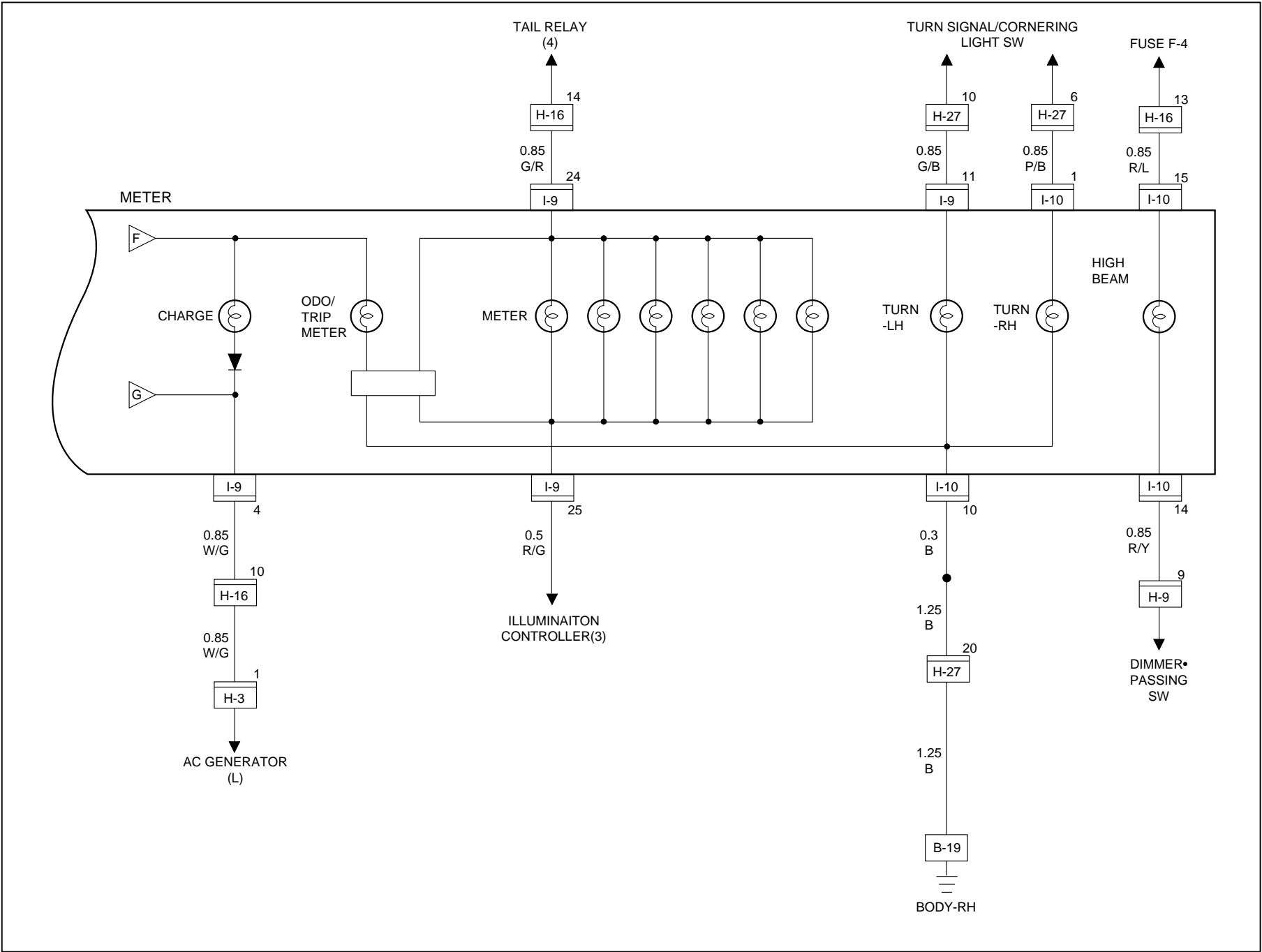
Circuit Diagram (RHD 6V*1 W/T.O.D.)-2



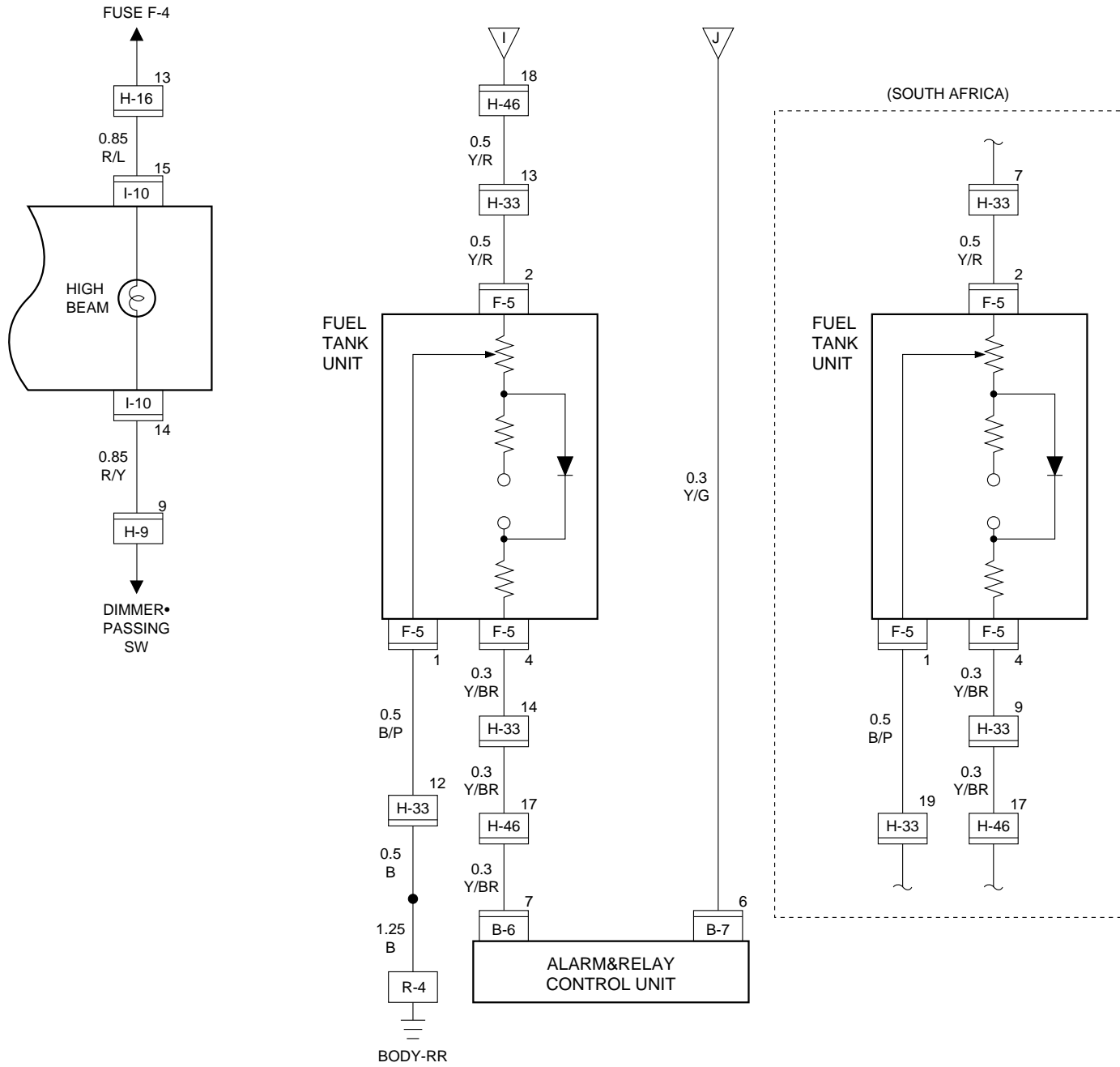
EHCU: ELECTRONIC HYDRAULIC CONTROL UNIT



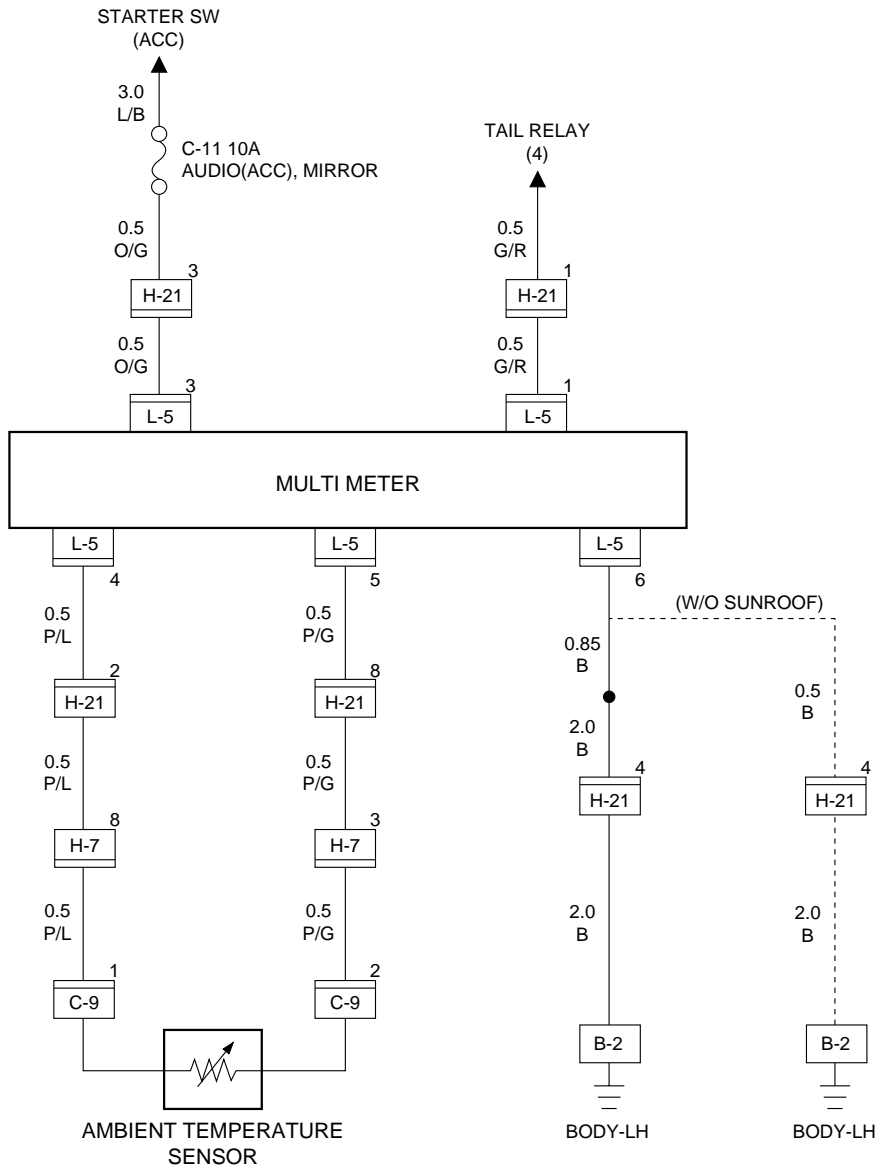
Circuit Diagram (RHD 6V*1 W/T.O.D)-4

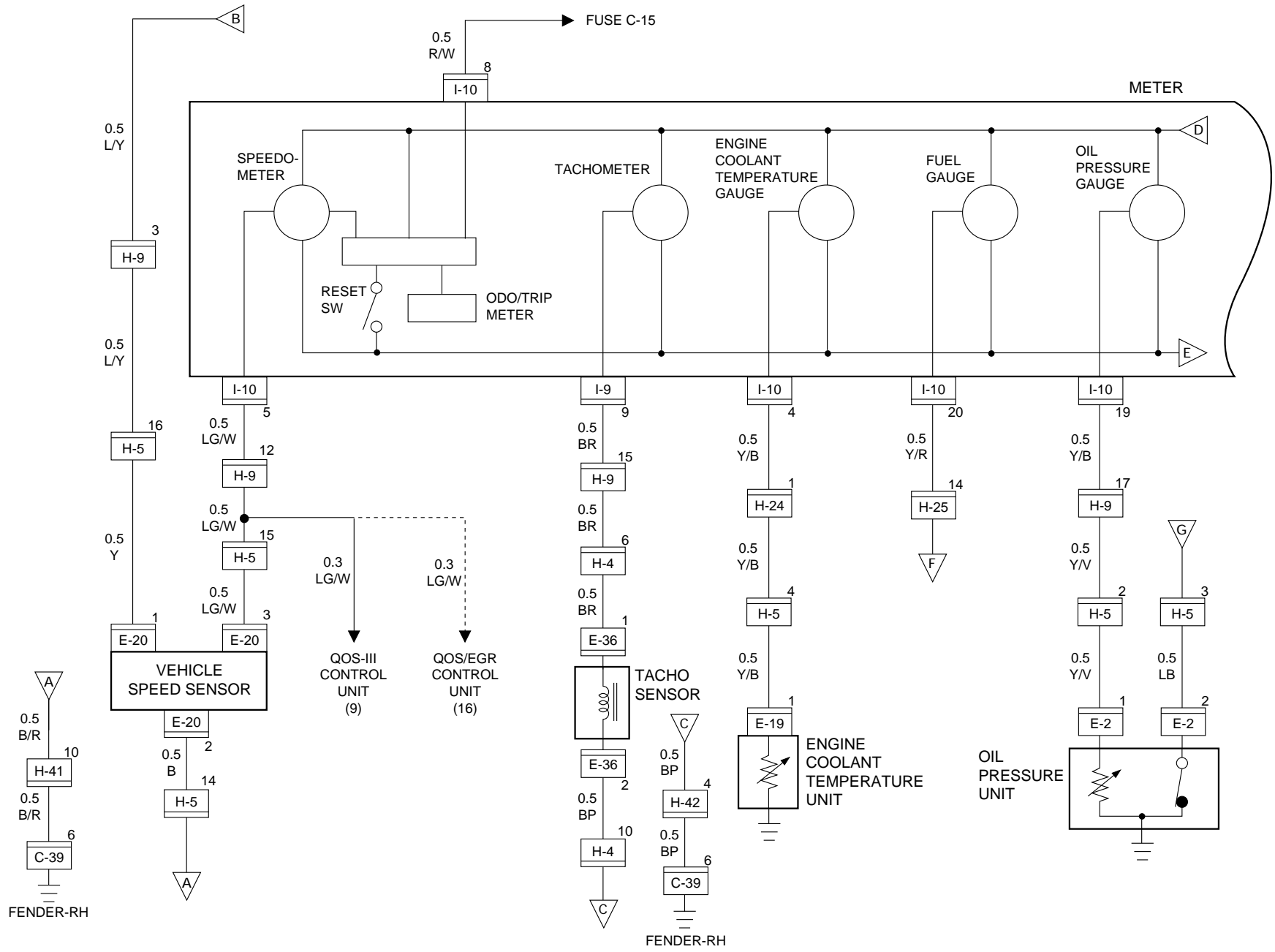


Circuit Diagram (RHD 6V*1 W/T.O.D)-5

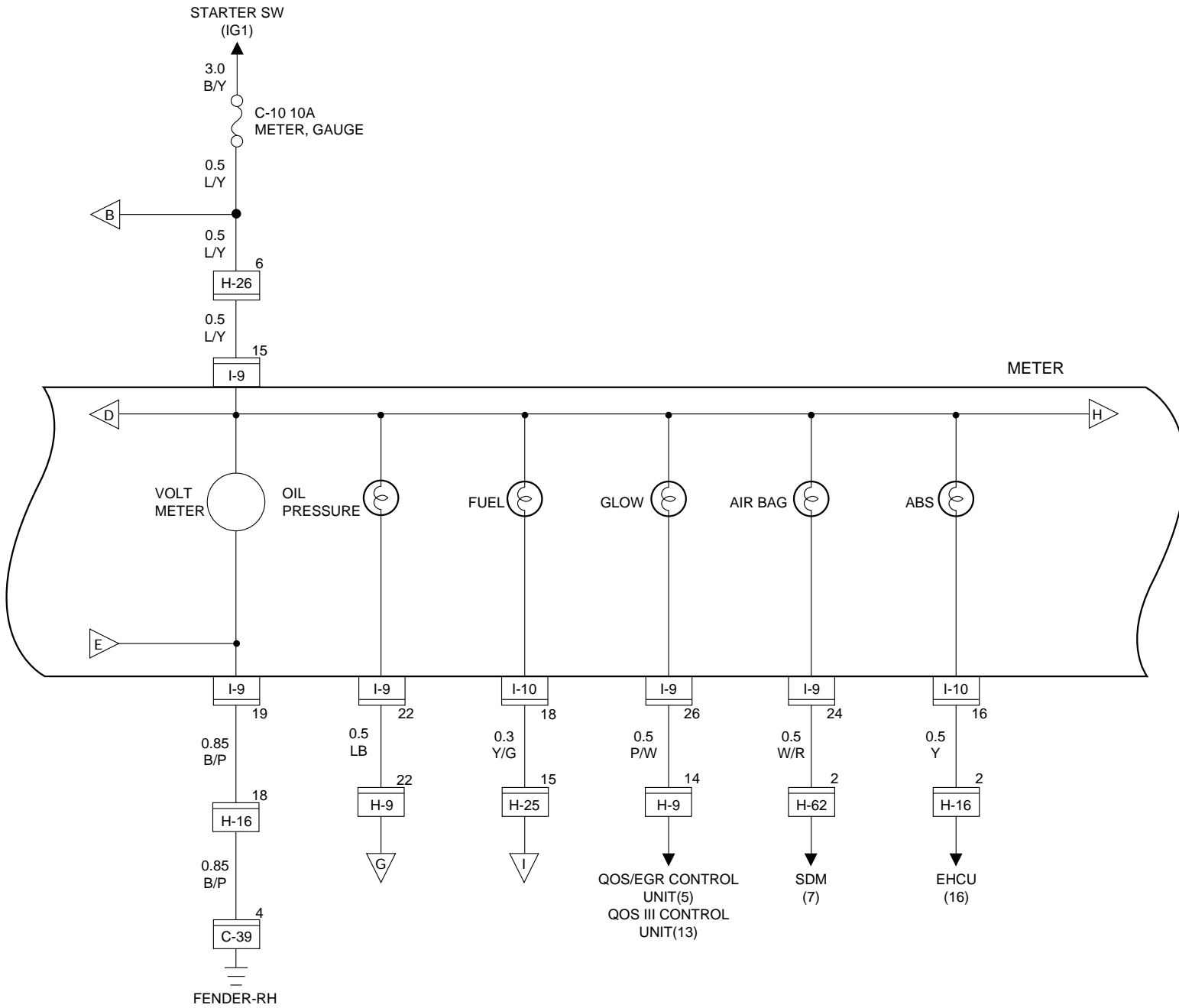


Circuit Diagram (RHD 6V*1 W/T.O.D.)-6

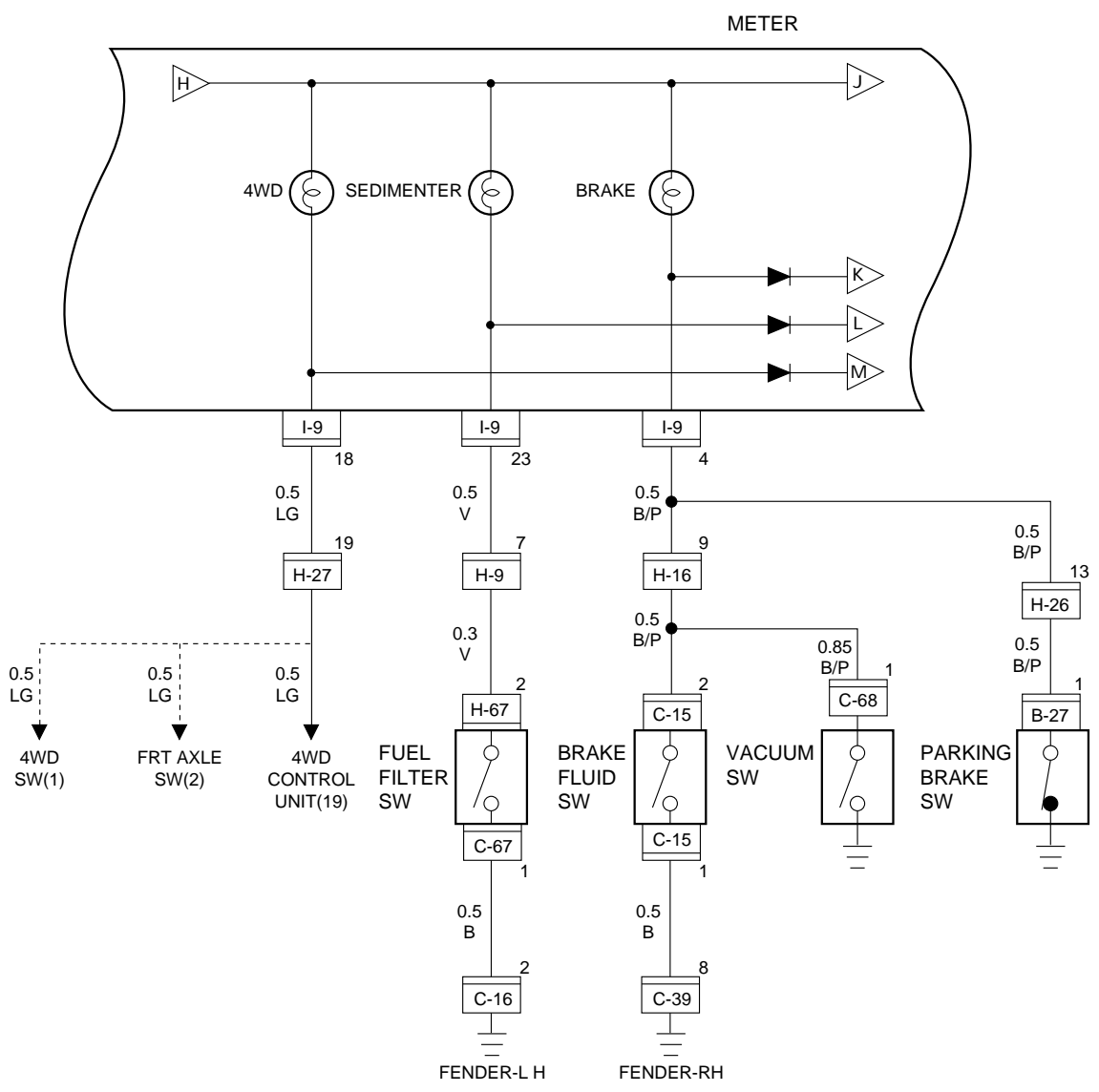




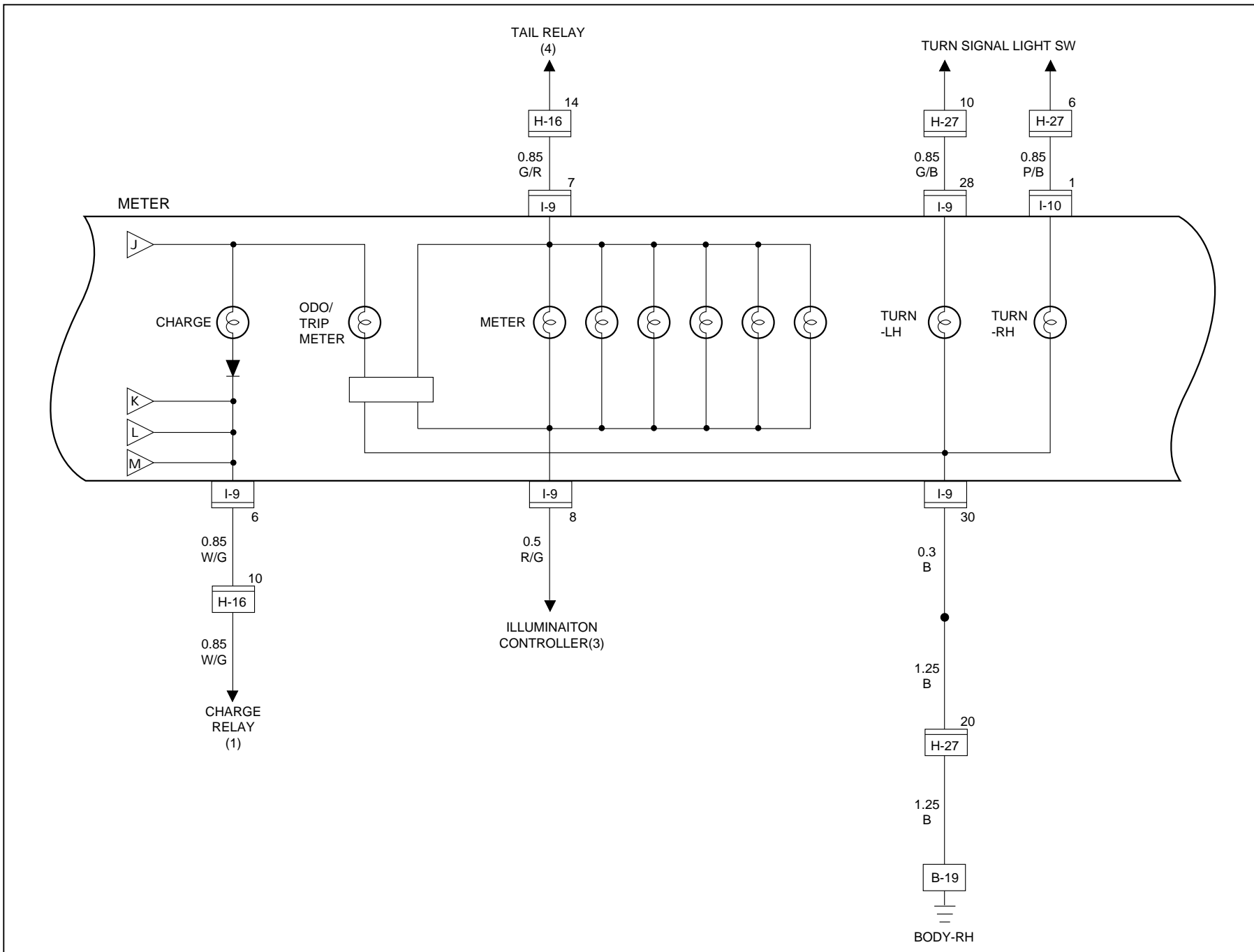
Circuit Diagram (RHD 4JG2)-2



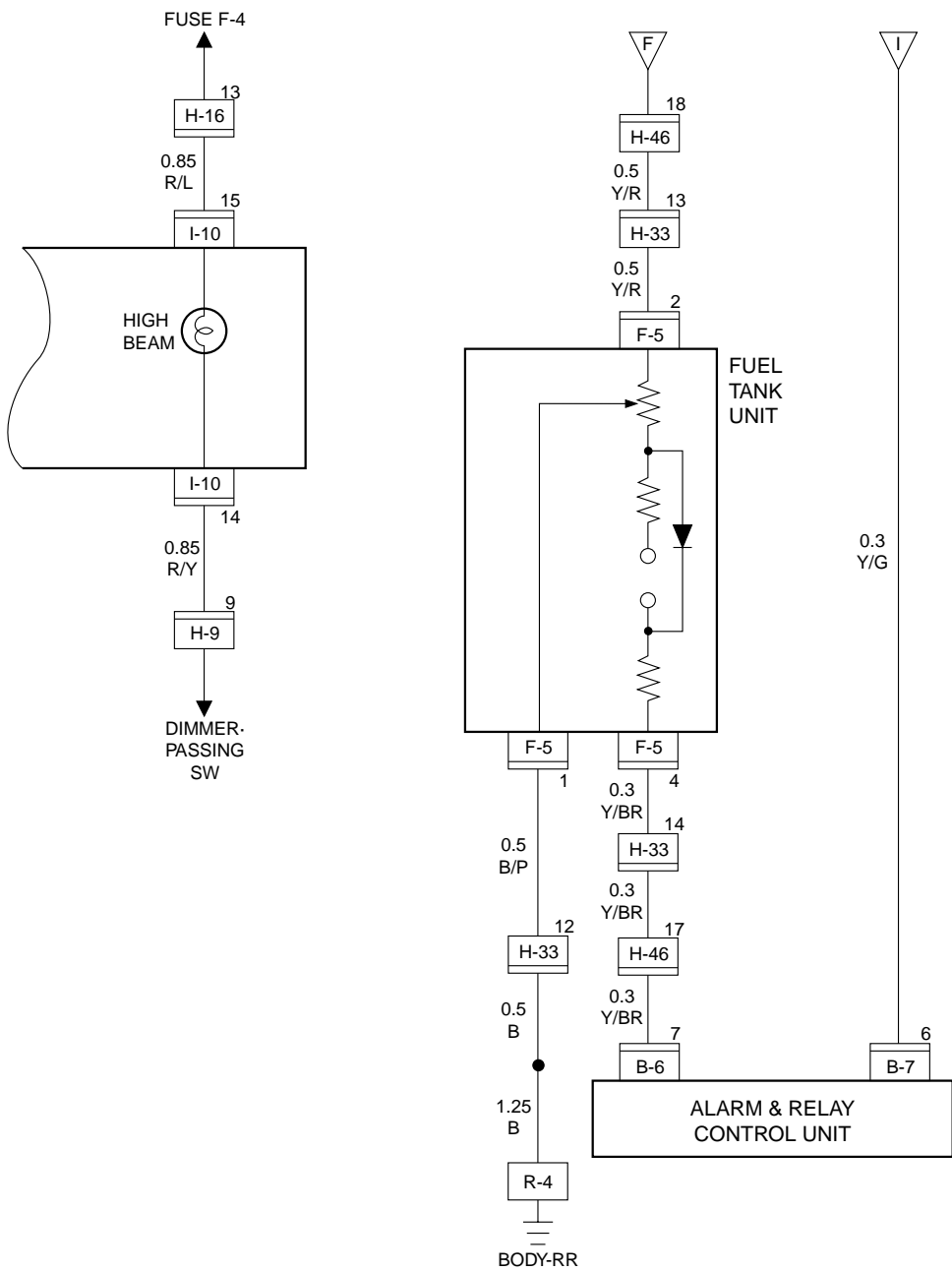
EHCU: ELECTRONIC HYDRAULIC CONTROL UNIT



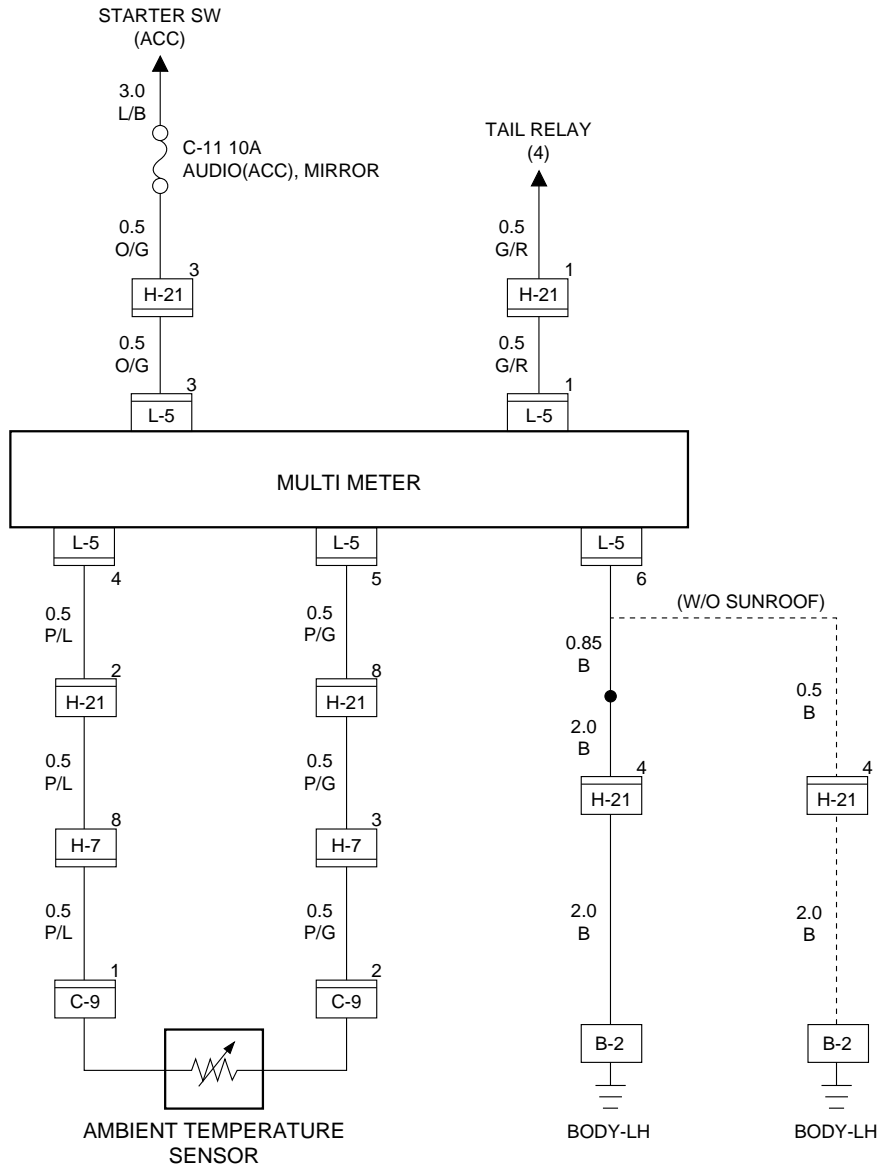
Circuit Diagram (RHD 4JG2)-4



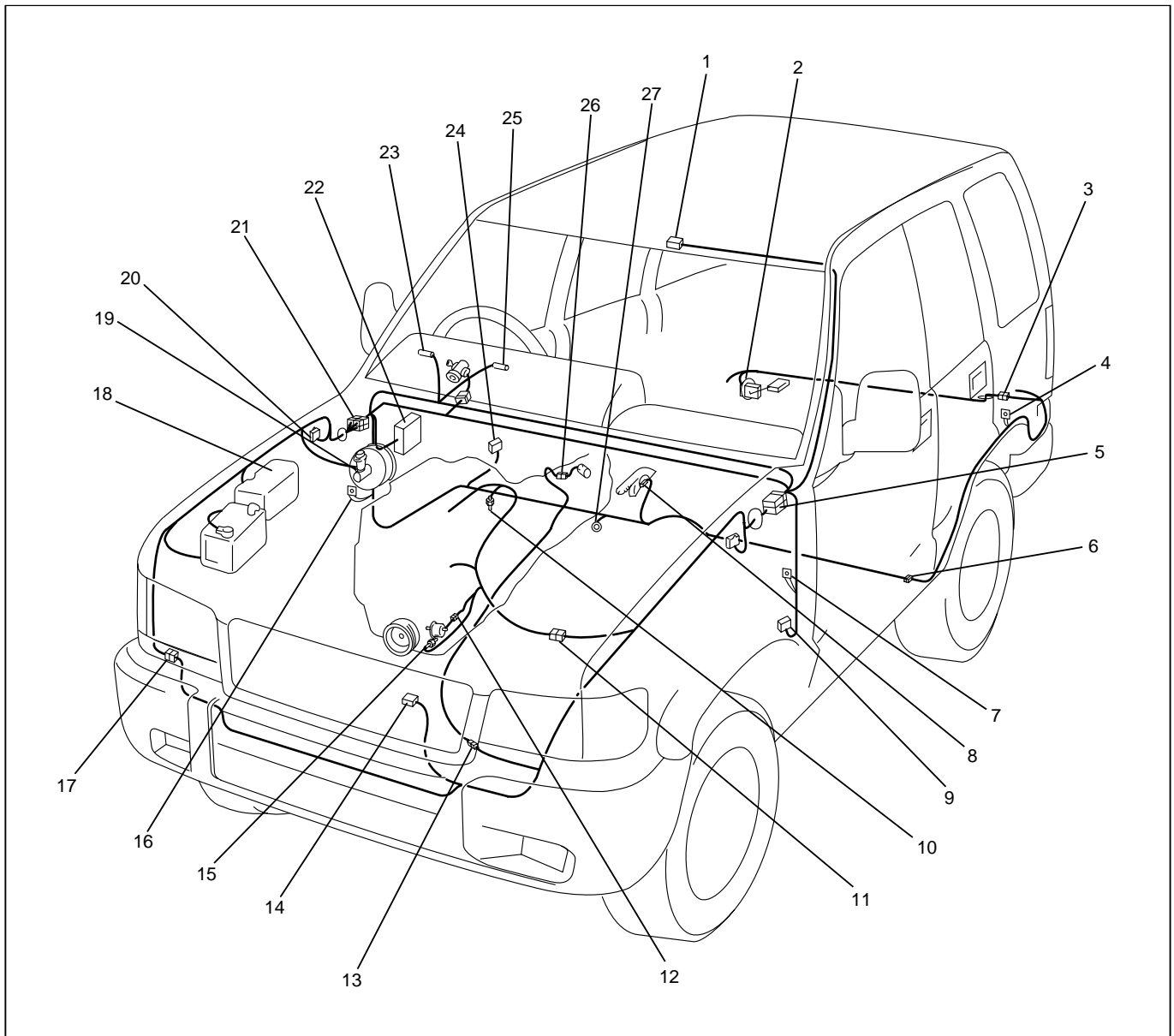
Circuit Diagram (RHD 4JG2)-5



Circuit Diagram (RHD 4JG2)-6



Parts Location (RHD 6V*1)

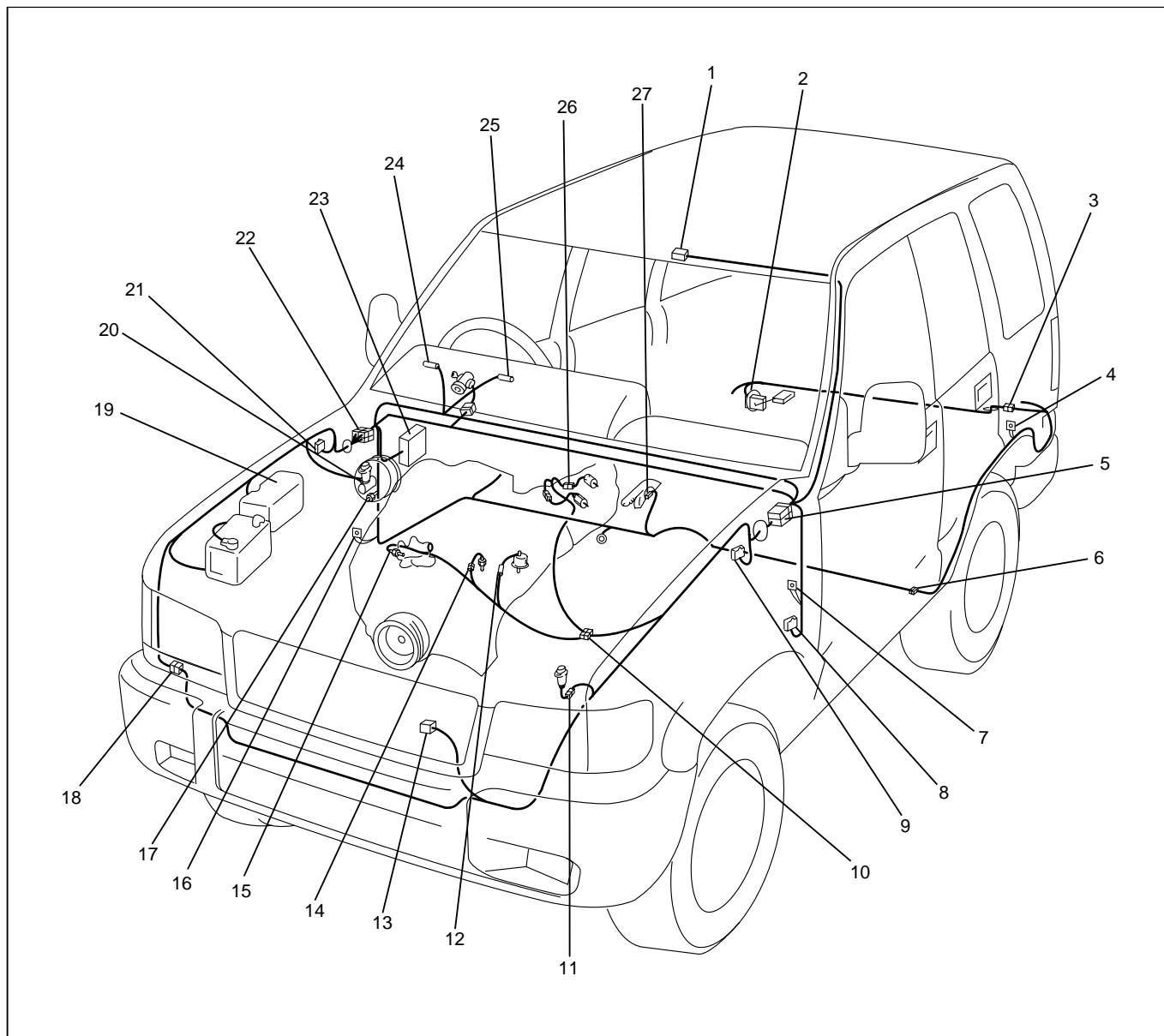


D08RW747

Legend

- | | |
|---|---|
| (1) L-5 | (14) C-9 |
| (2) F-5 | (15) E-1 |
| (3) H-33 | (16) B-19 |
| (4) R-4 | (17) H-41 |
| (5) H-7, H-8, H-9, H-21, H-24 | (18) Relay and Fuse Box |
| (6) H-46 | (19) C-15 |
| (7) B-1, B-2 | (20) C-39 |
| (8) B-27 | (21) H-13, H-14, H-15, H-25, H-26, H-27, H-62 |
| (9) B-6, B-7 (Alarm and Relay Control Unit) | (22) Fuse Box |
| (10) E-19 | (23) I-10 |
| (11) H-6 | (24) B-24 |
| (12) E-2 | (25) I-9 |
| (13) H-10 | (26) M-10 |
| | (27) B-26 |

Parts Location (RHD 4JG2)

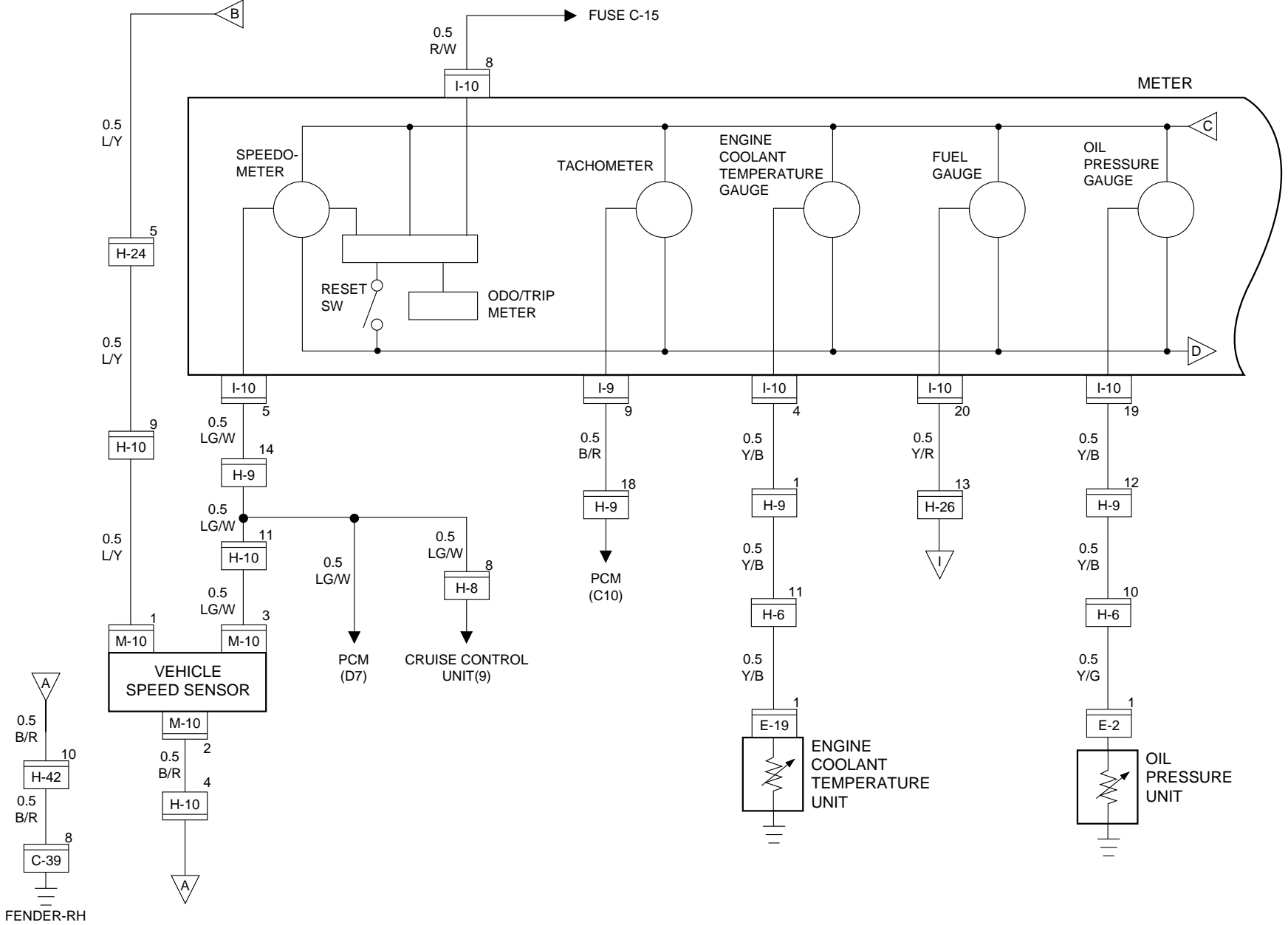


D08RW748

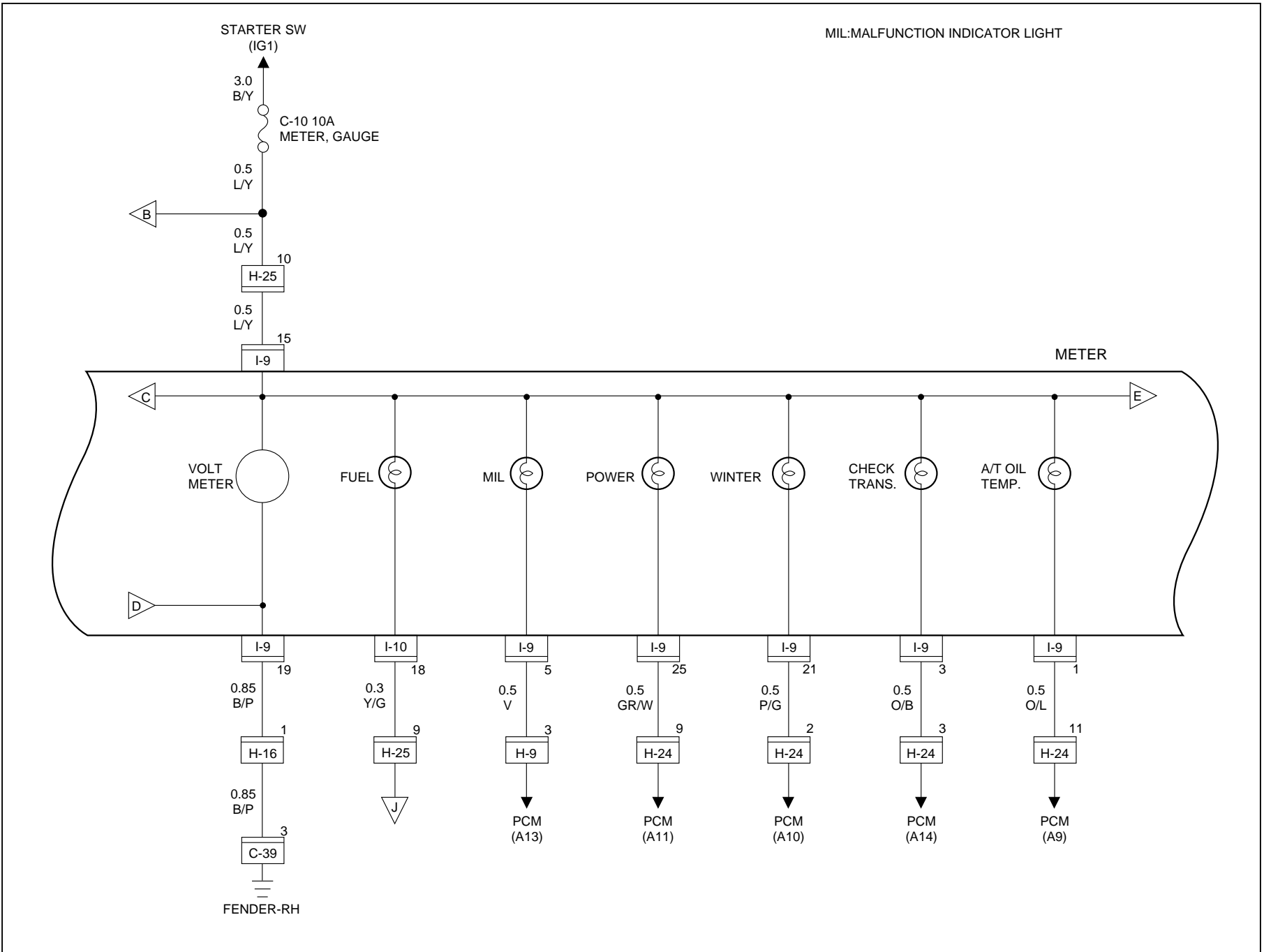
Legend

- | | |
|---|---|
| (1) L-5 | (14) E-36 |
| (2) F-5 | (15) E-19 |
| (3) H-33 | (16) B-19 |
| (4) R-4 | (17) C-68 |
| (5) H-7, H-9, H-21, H-24 | (18) H-41, H-42 |
| (6) H-46 | (19) Relay and Fuse Box |
| (7) B-1 | (20) C-15 |
| (8) B-6, B-7 (Alarm and Relay Control Unit) | (21) C-39 |
| (9) C-16 | (22) H-13, H-15, H-16, H-25, H-26, H-27, H-62 |
| (10) H-4, H-5 | (23) Fuse Box |
| (11) C-67 | (24) I-10 |
| (12) E-2 | (25) I-9 |
| (13) C-9 | (26) E-44 |
| | (27) B-27 |

Circuit Diagram (LHD 6V*1 W/O T.O.D.)-1



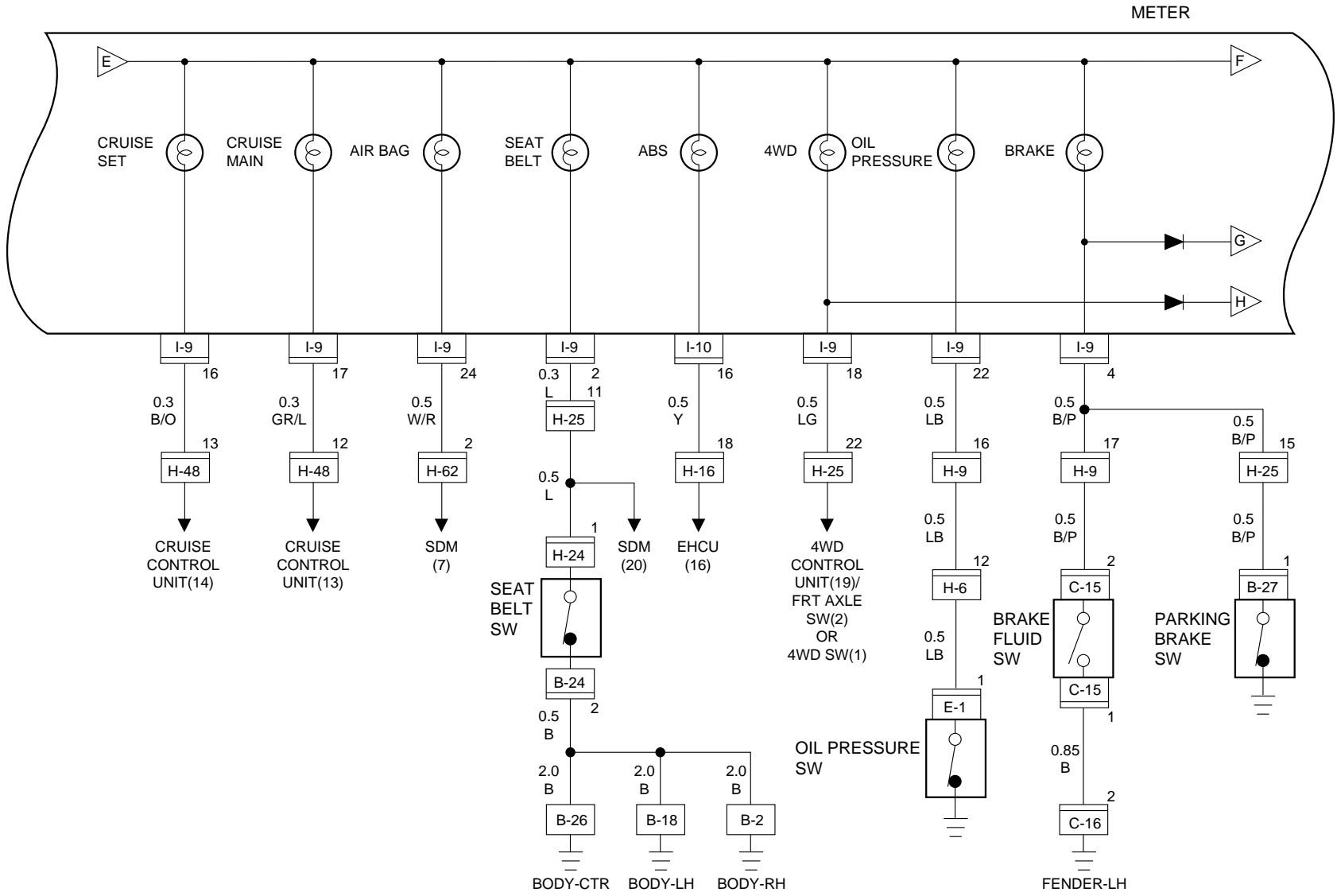
Circuit Diagram (LHD 6V*1 W/O T.O.D.)-2



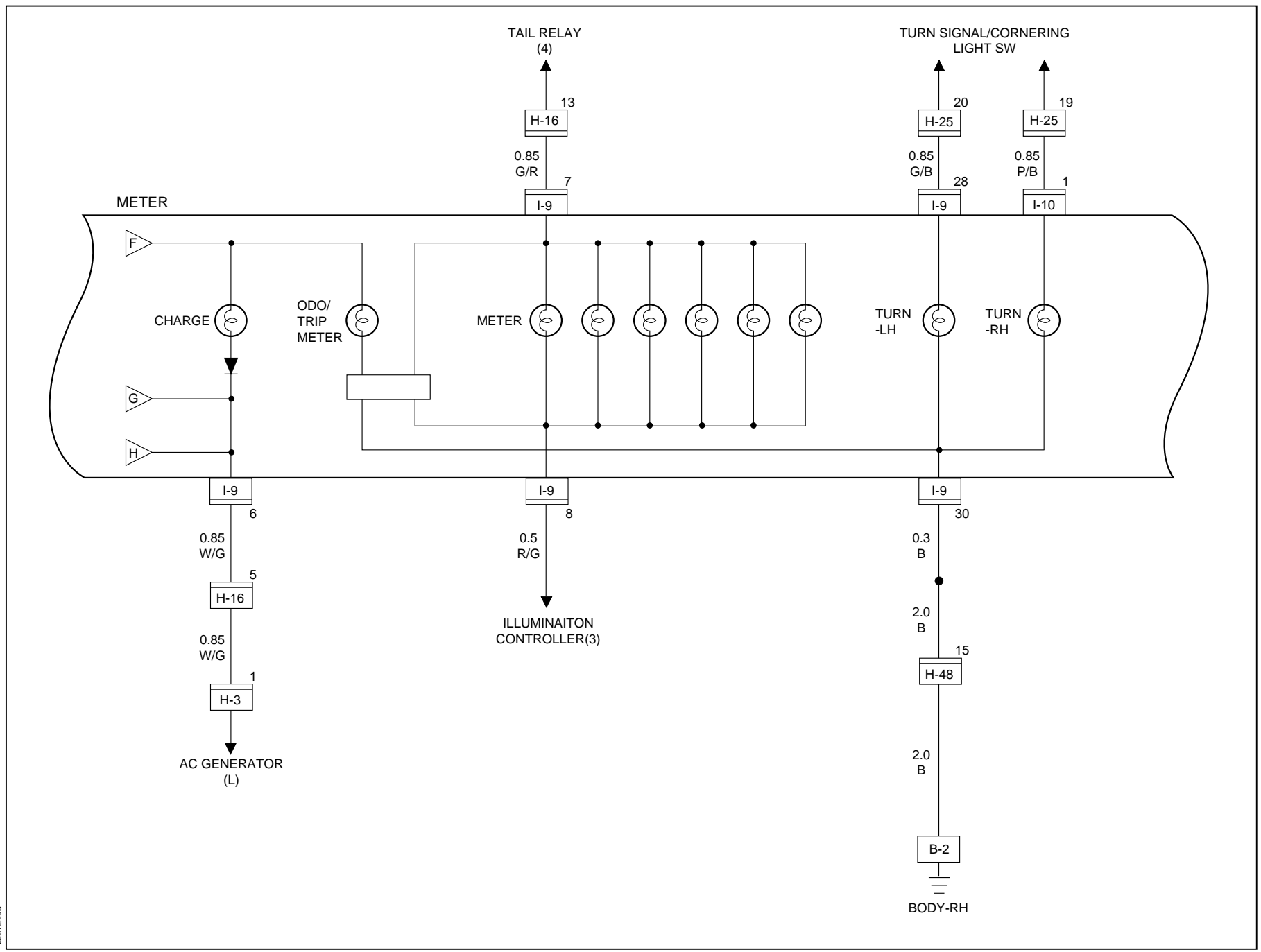
EHCU: ELECTRONIC HYDRAULIC CONTROL UNIT

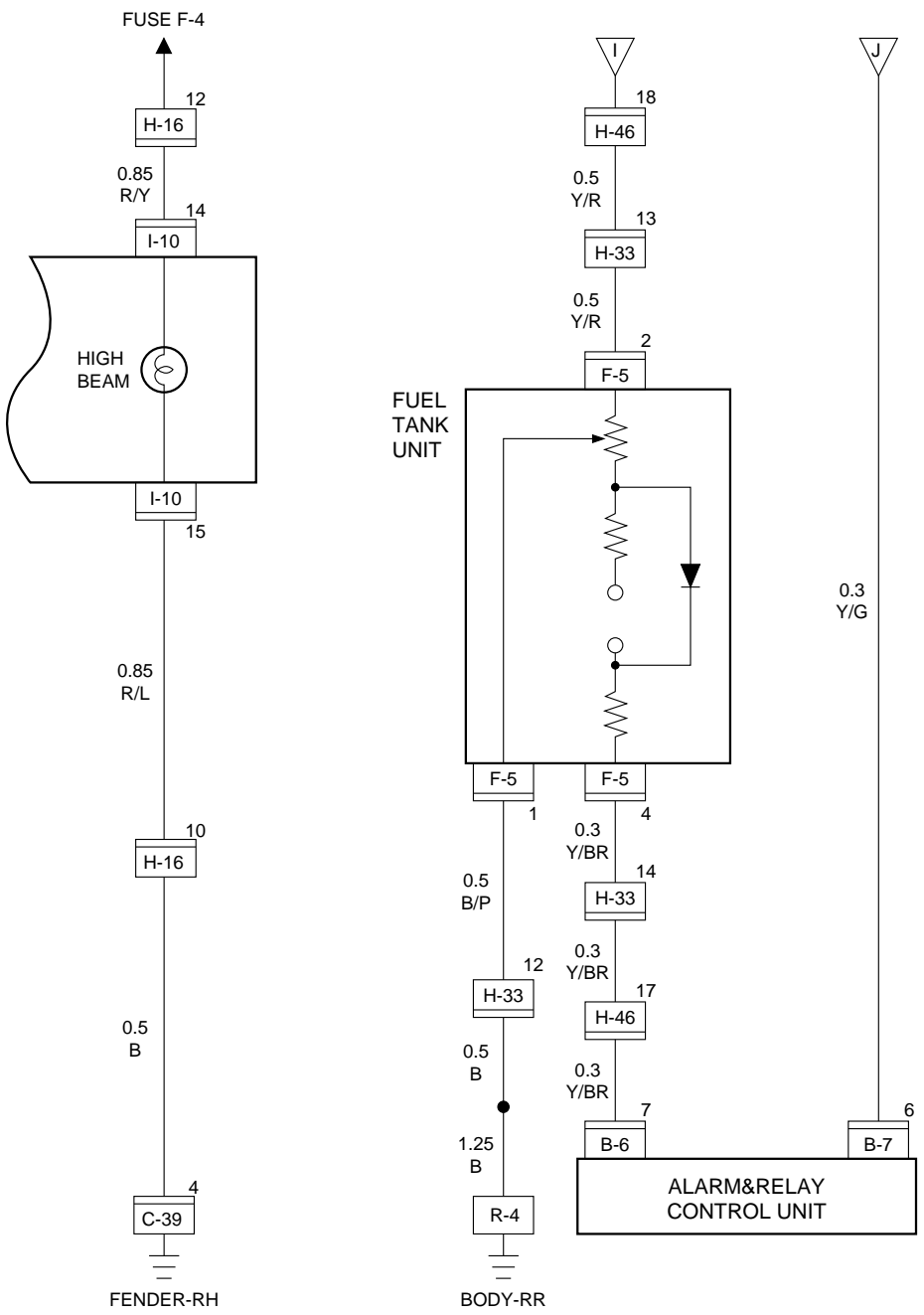
Circuit Diagram (LHD 6V*1 W/O T.O.D.)-3

WIRING SYSTEM 8D - 433

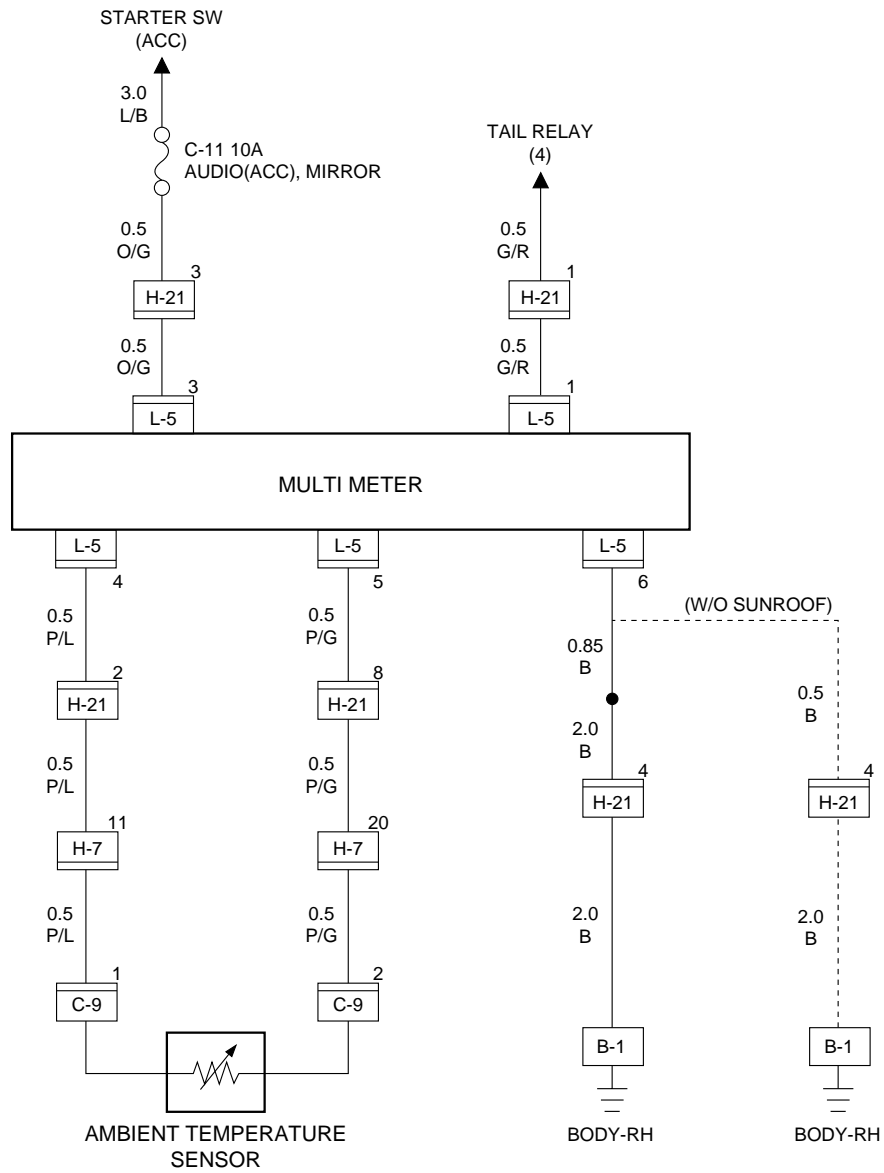


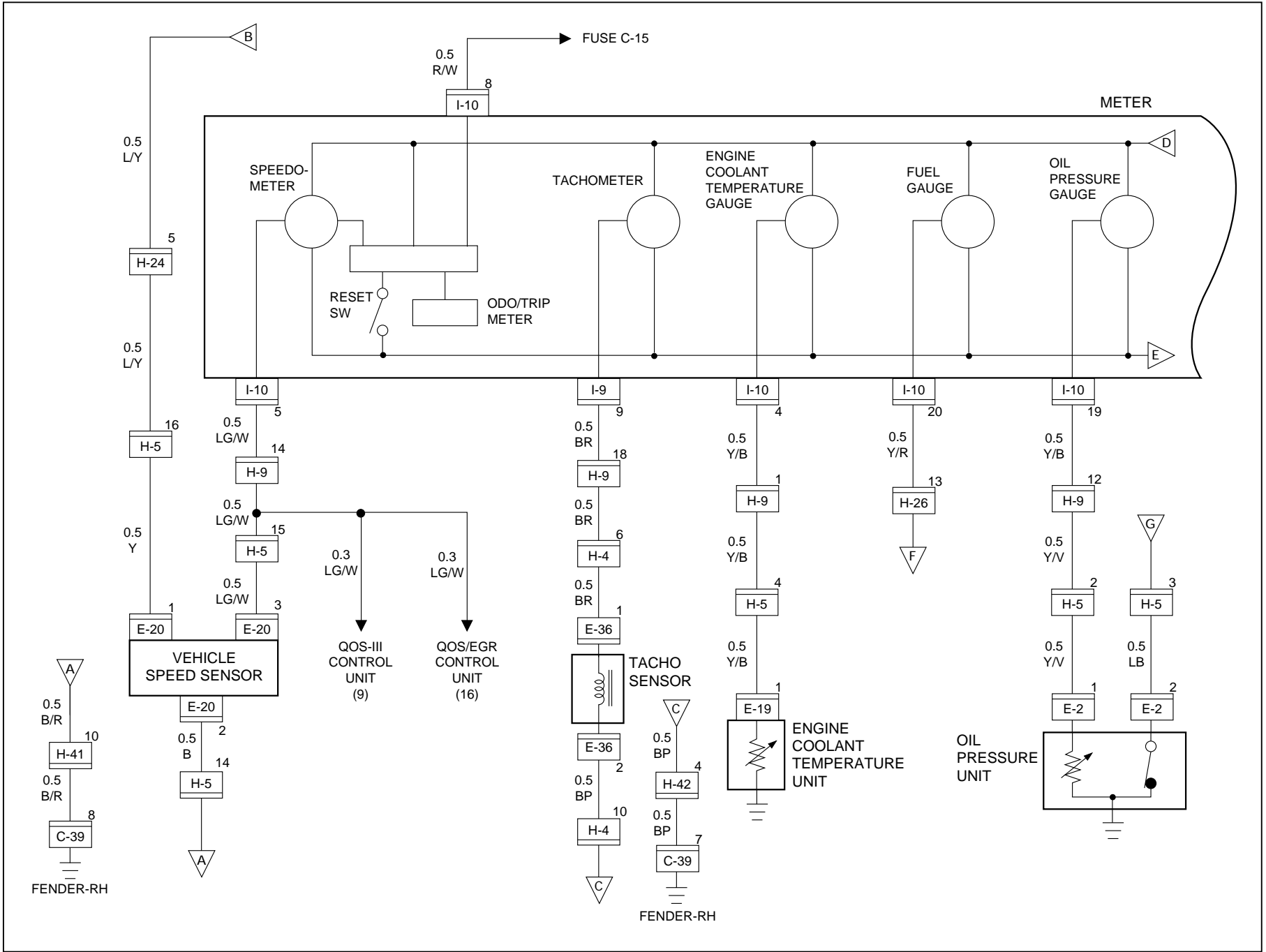
Circuit Diagram (LHD 6V*1 W/O T.O.D.)-4





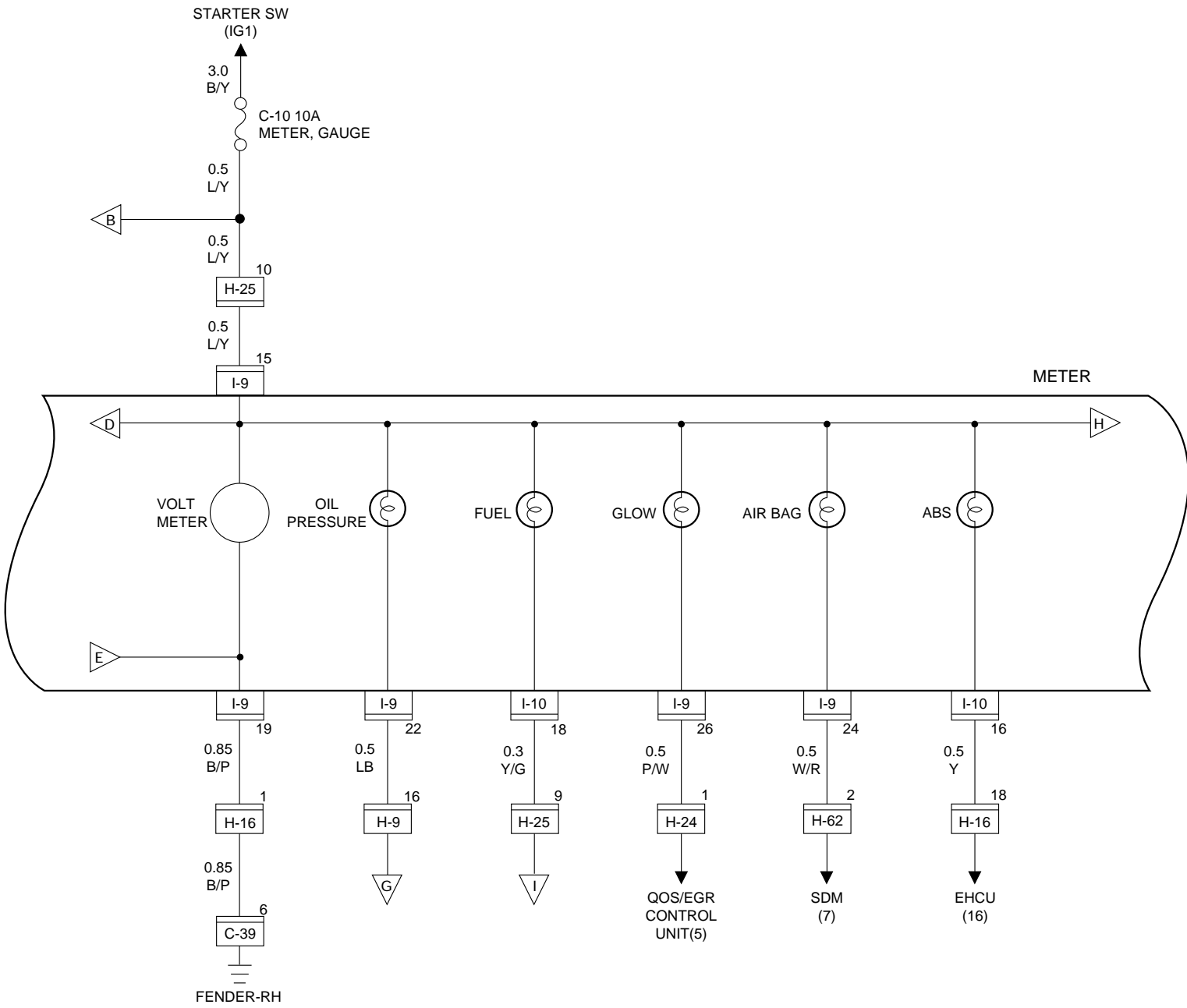
Circuit Diagram (LHD 6V*1 W/O T.O.D.)-6

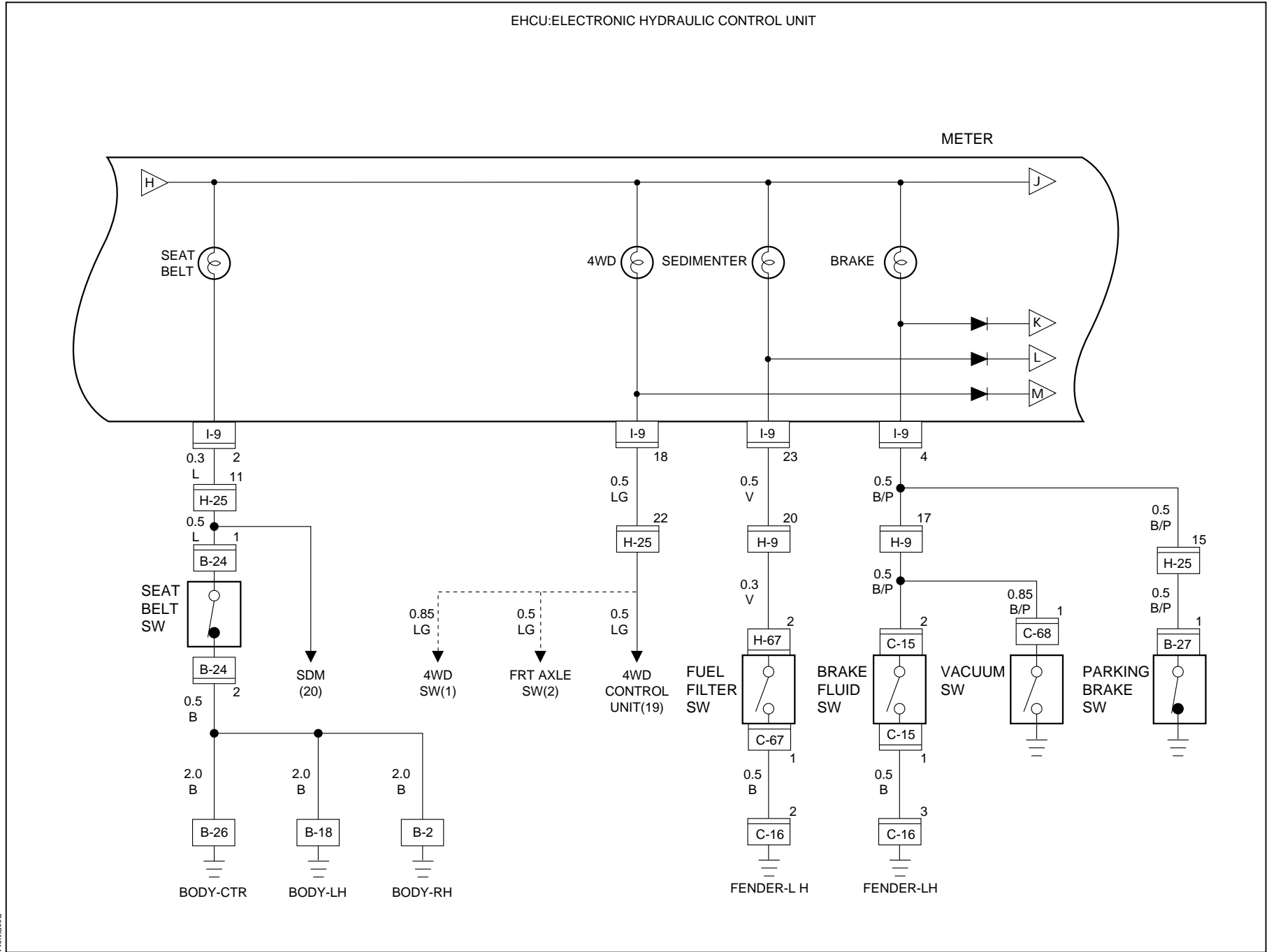




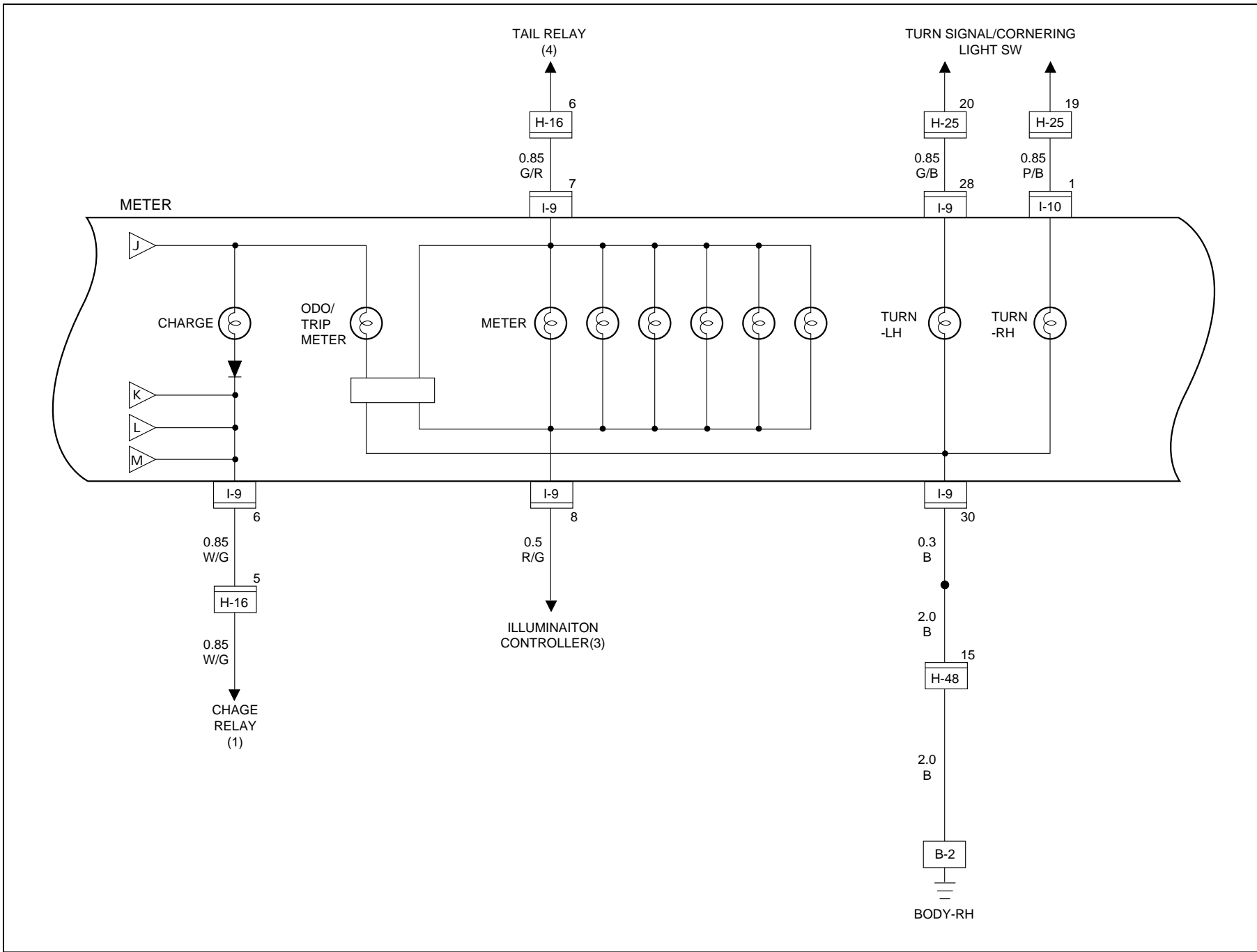
DOB/MS/15

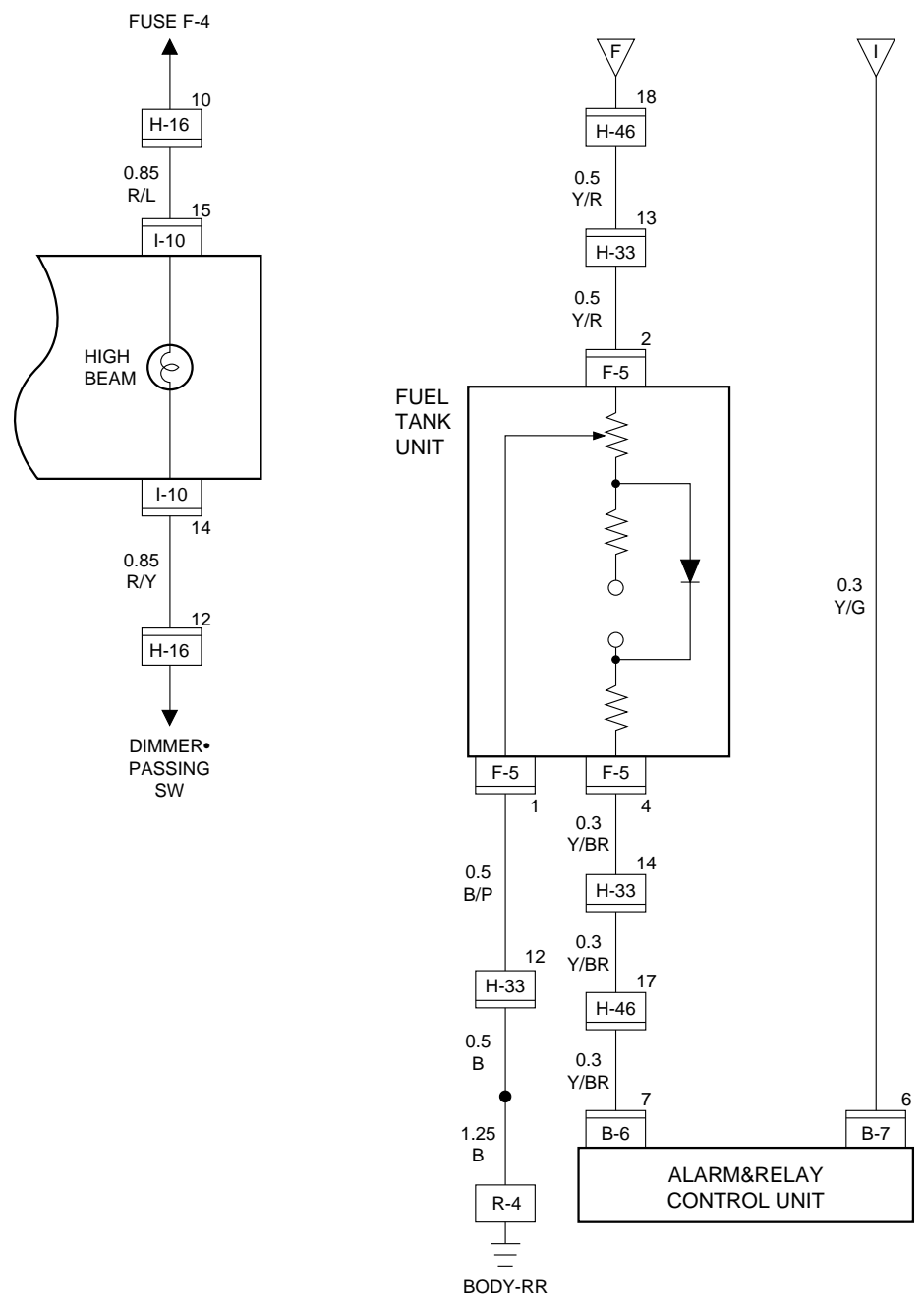
Circuit Diagram (LHD 4JG2)-2



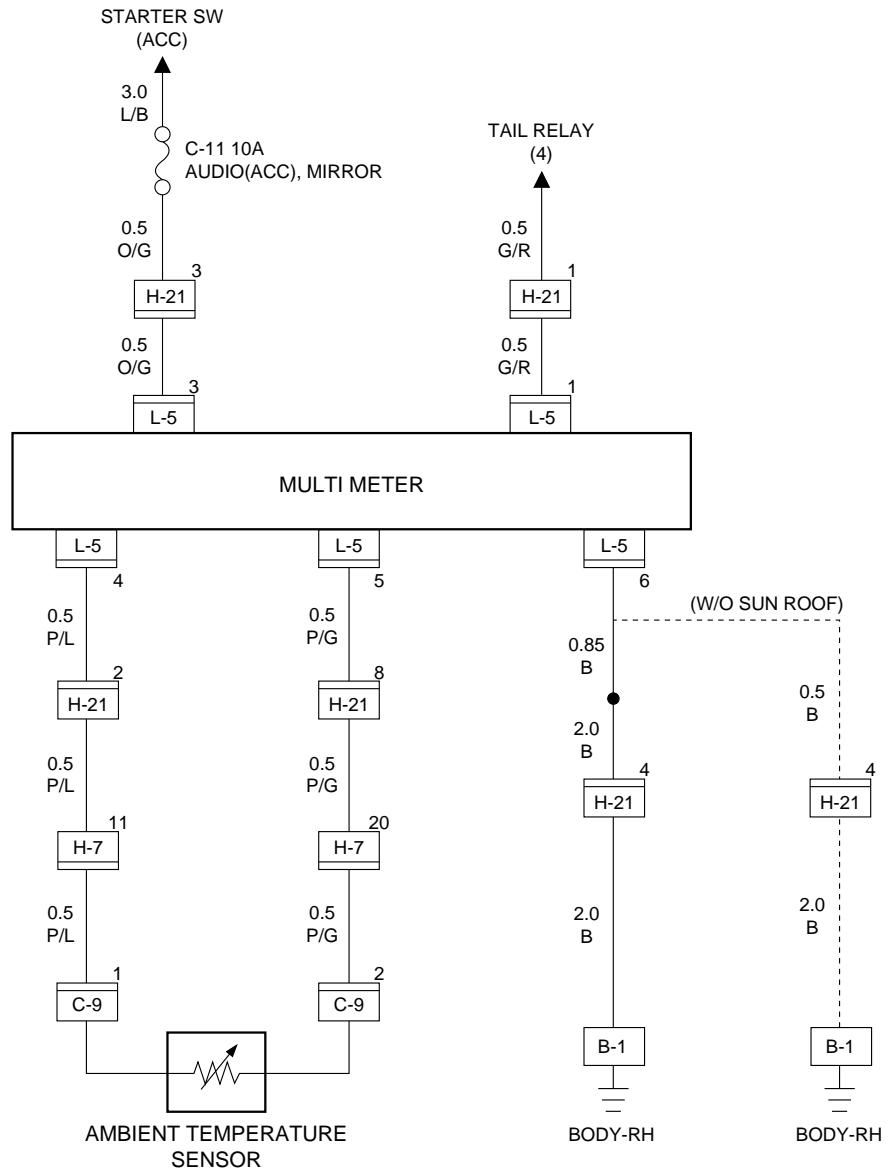


Circuit Diagram (LHD 4JG2)-4

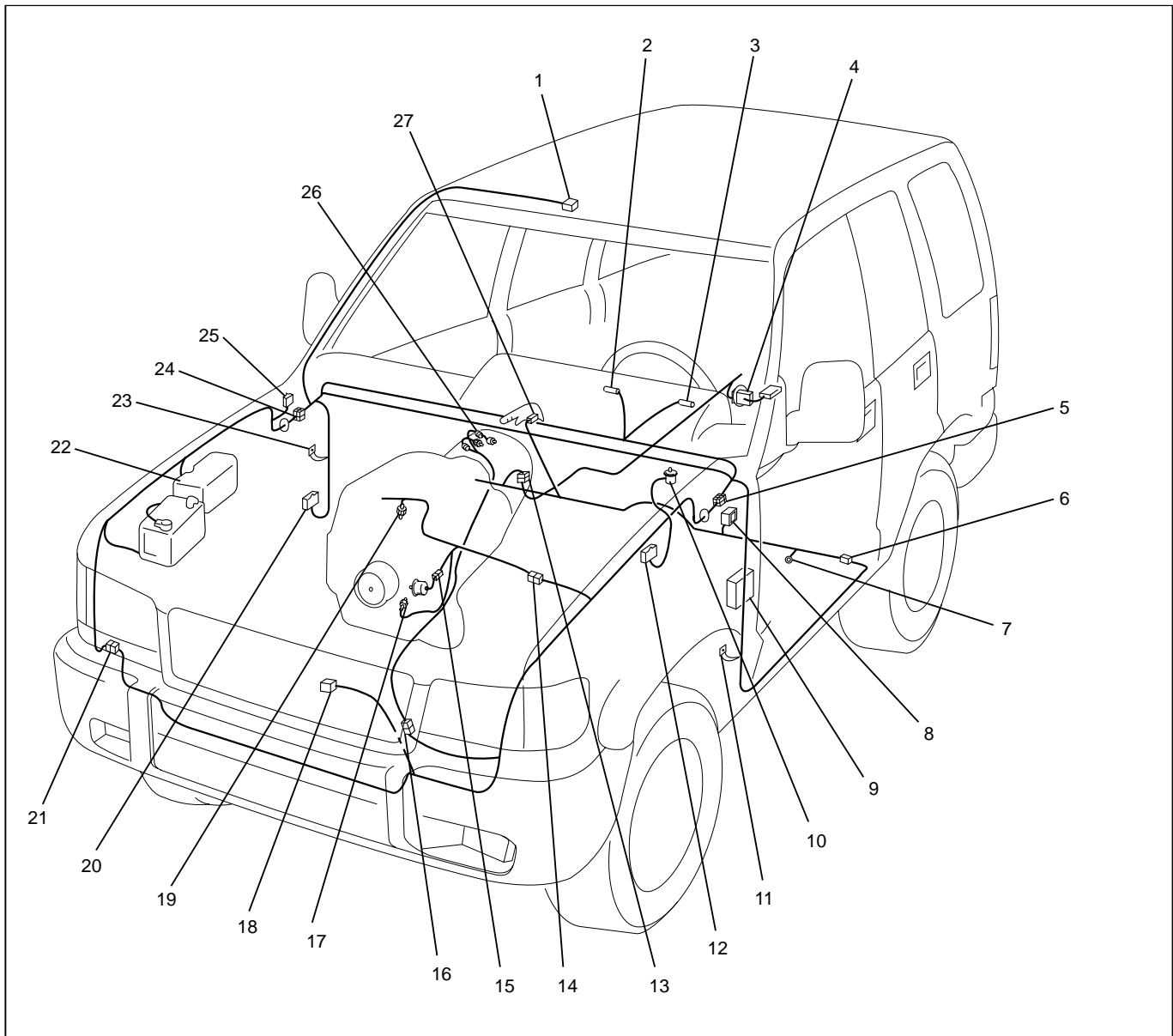




Circuit Diagram (LHD 4JG2)-6



Parts Location (LHD W/O T.O.D 6V*1)

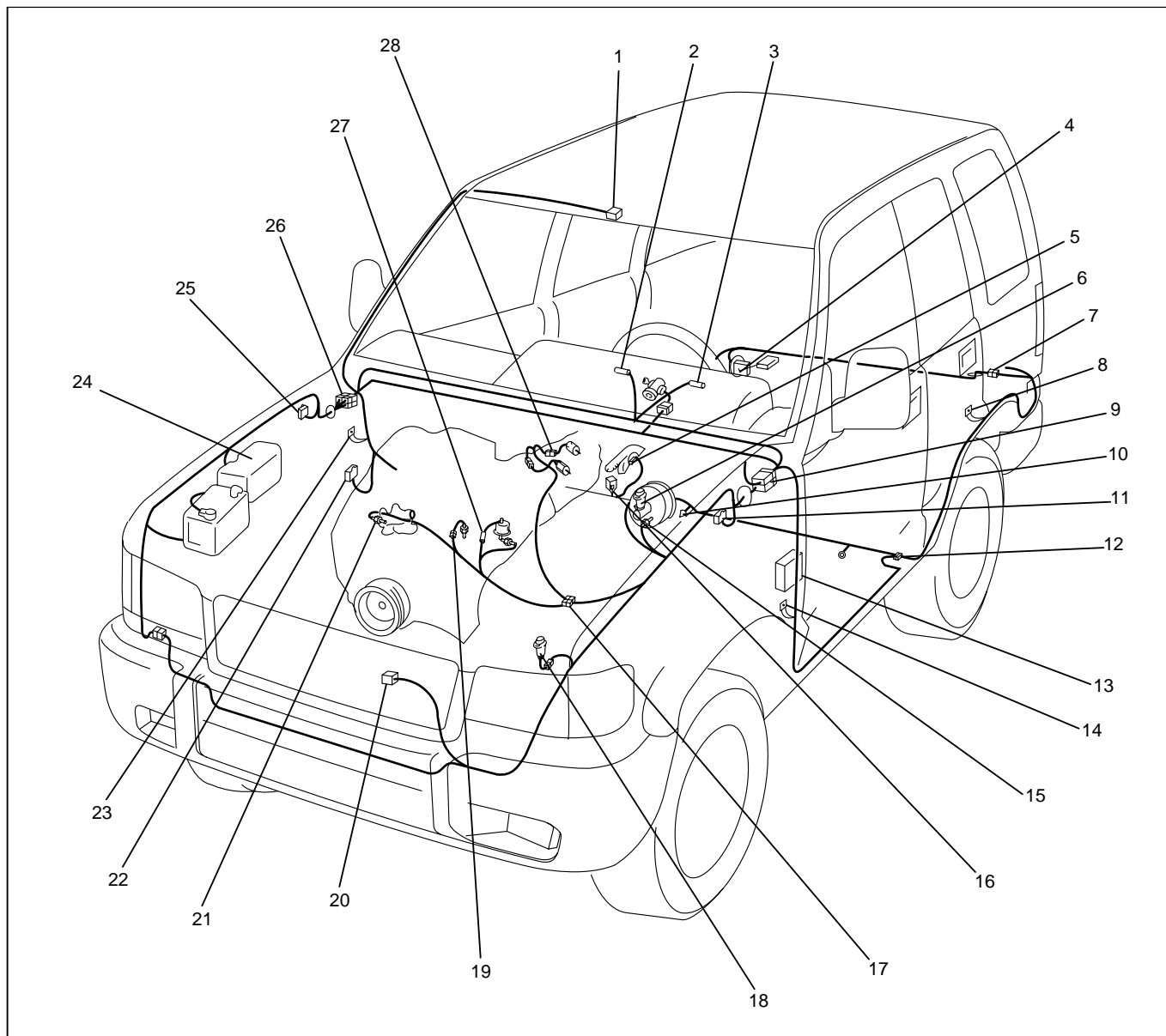


D08RW930

Legend

- | | |
|---|--|
| (1) L-5 | (14) H-6 |
| (2) I-10 | (15) E-2 |
| (3) I-9 | (16) H-10 |
| (4) F-5 | (17) E-1 |
| (5) H-7, H-8, H-9, H-24, H-25, H-26, H-62 | (18) C-9 |
| (6) H-46 | (19) E-19 |
| (7) B-26 | (20) B-6, B-7 (Alarm and Relay Control Unit) |
| (8) B-62 | (21) H-42 |
| (9) Fuse Box | (22) Relay and Fuse Box |
| (10) C-15 | (23) B-1, B-2 |
| (11) B-18 | (24) H-16, H-21, H-48 |
| (12) C-16 | (25) C-39 |
| (13) H-33 | (26) M-10 |
| | (27) B-27 |

Parts Location (LHD 4JG2)



D08RW897

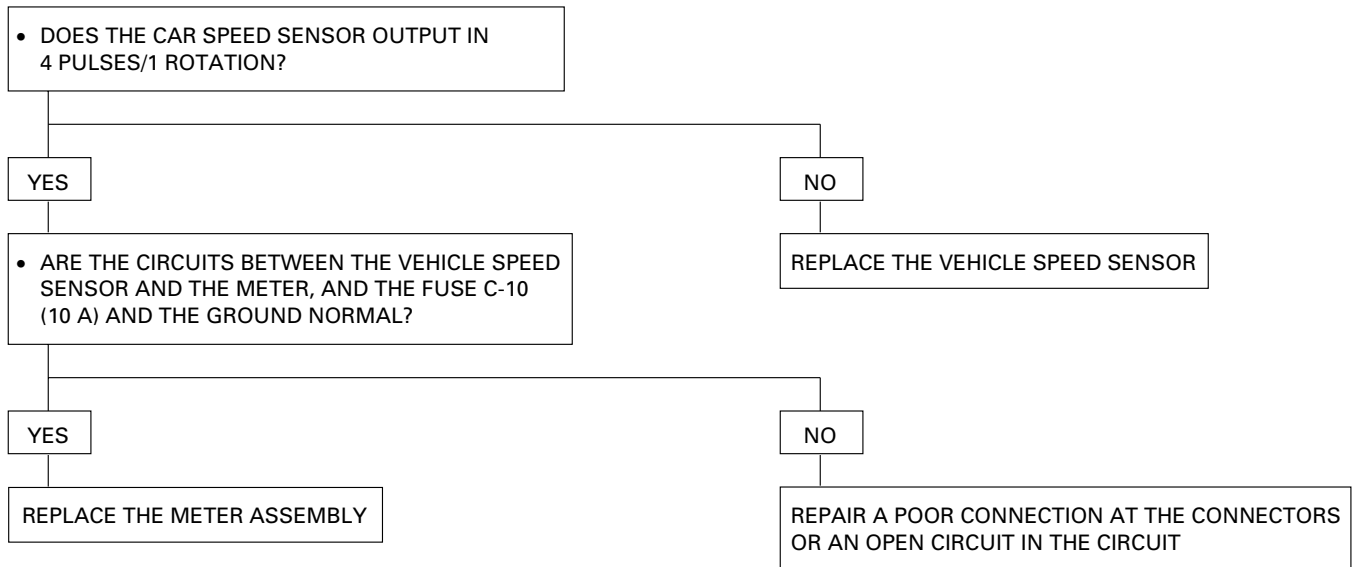
Legend

- | | |
|--------------------------------|--|
| (1) L-5 | (15) C-68 |
| (2) I-10 | (16) B-62 |
| (3) I-9 | (17) H-4, H-5 |
| (4) F-5 | (18) C-67 |
| (5) B-27 | (19) E-36 |
| (6) C-15 | (20) C-9 |
| (7) H-33 | (21) E-19 |
| (8) R-4 | (22) B-6, B-7 (Alarm and Relay Control Unit) |
| (9) H-7, H-9, H-24, H-25, H-62 | (23) B-1, B-2 |
| (10) B-26 | (24) Relay and Fuse Box |
| (11) C-16 | (25) C-39 |
| (12) H-46 | (26) H-12, H-14, H-16, H-21, H-48 |
| (13) Fuse Box | (27) E-2 |
| (14) B-18 | (28) E-20 |

Diagnosis

1. Speedometer

1-1. Speedometer and Odometer Do Not Function



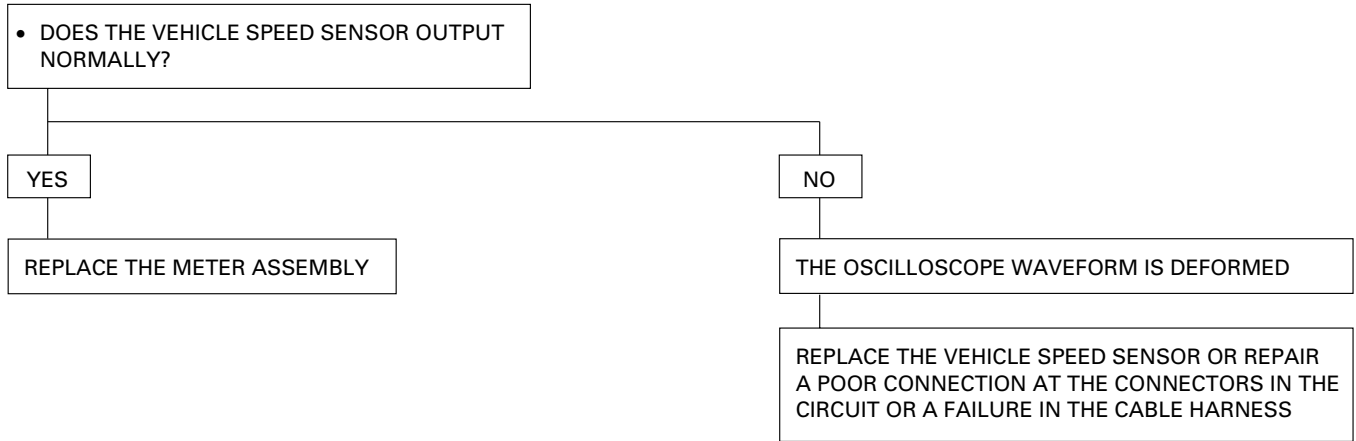
1-2. Speedometer Does Not Function (Odometer is Normal)

REPLACE THE METER ASSEMBLY

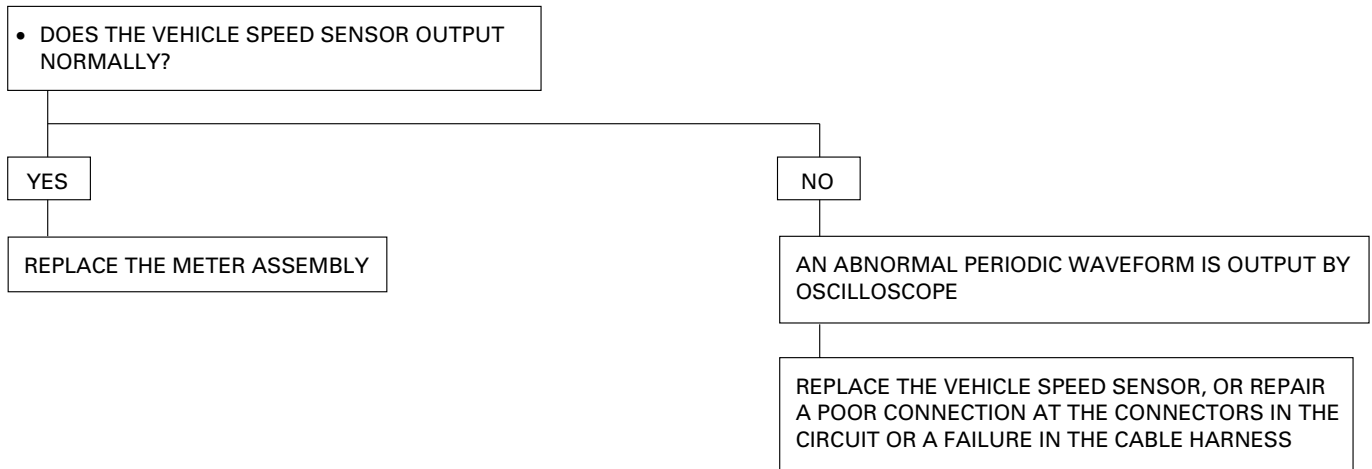
1-3. Odometer Does Not Function (Speedometer is Normal)

REPLACE THE METER ASSEMBLY

1-4. Speedometer Needle Fluctuations (May Be Wide Fluctuation)

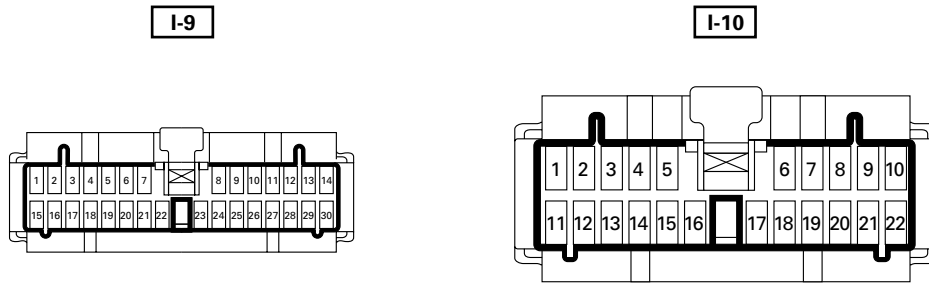


1-5. Speedometer Needle Jumps Erratically

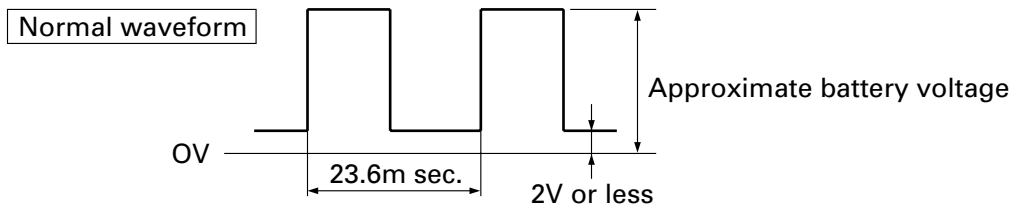


Inspection of a waveform by oscilloscope

1. Connect a resistance of 1.3 to 5k ohm (1.4W or more) between the harness side connectors 15 **I-9** and 5 **I-10** (w/o TOD) or 26 **I-9** and 5 **I-10**

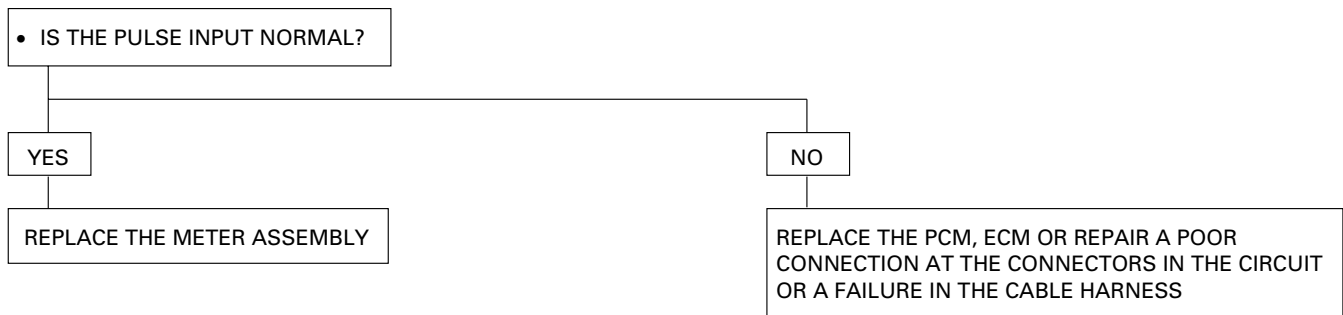


2. Install a speedometer tester.
3. Turn on the starter SW.
4. Check the waveform at the time when the car speed is at 60 km/h.

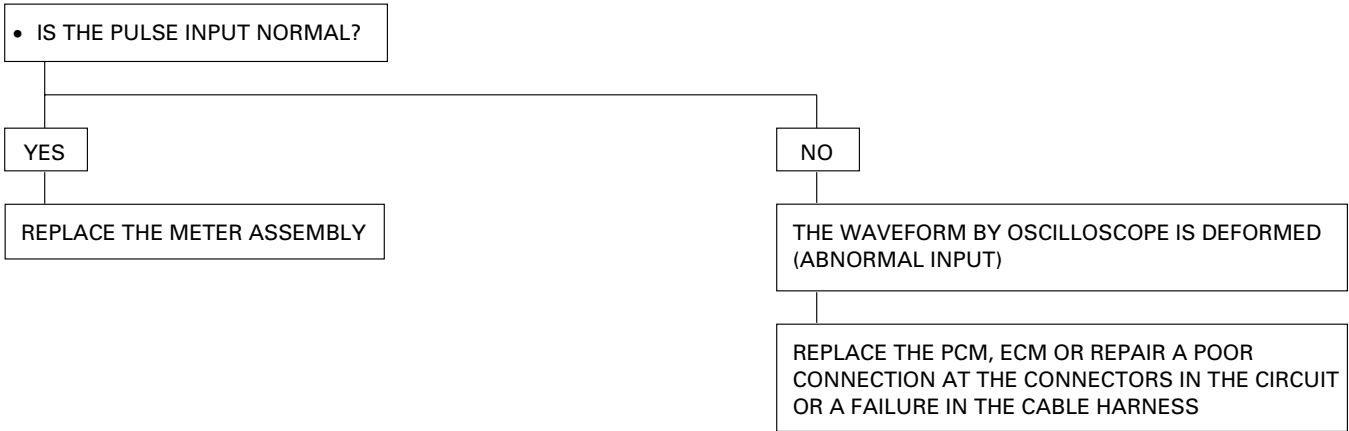


2. Tachometer

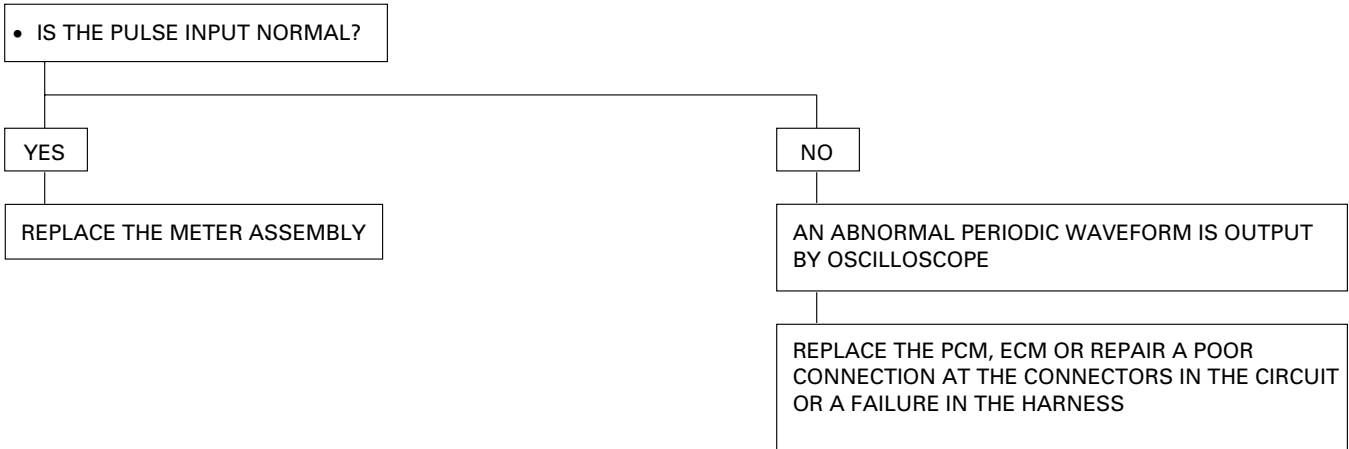
2-1. Tachometer Does Not Function



2-2. Tachometer Needle Fluctuates (May Be Wide Fluctuation)



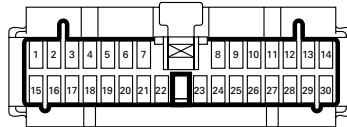
2-3. Tachometer Needle Jumps Erratically



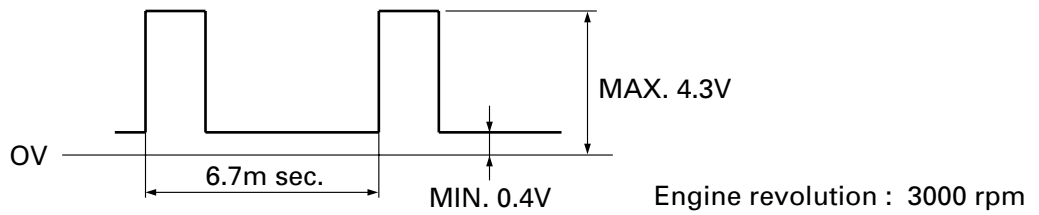
Inspection of a waveform by oscilloscope

1. Check the waveform of the meter assembly connector 9 **I-9** (Tachometer pulse).

I-9



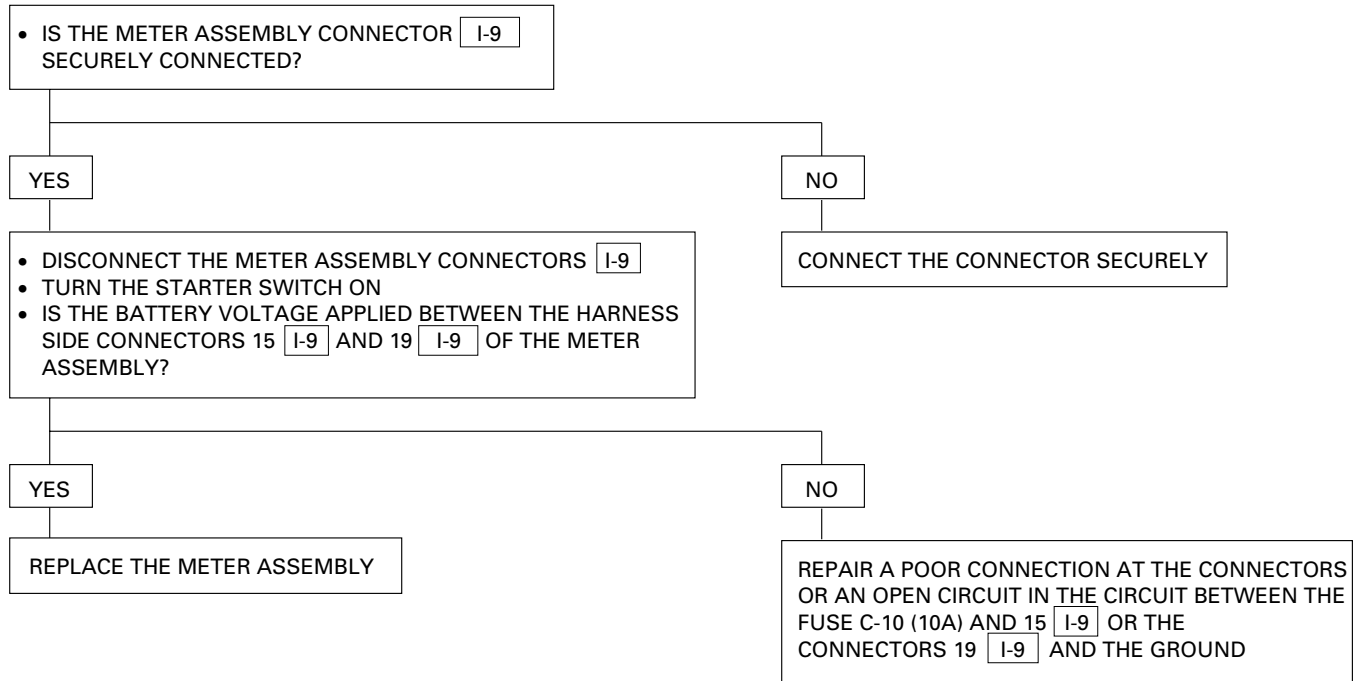
Normal waveform



3. Voltmeter

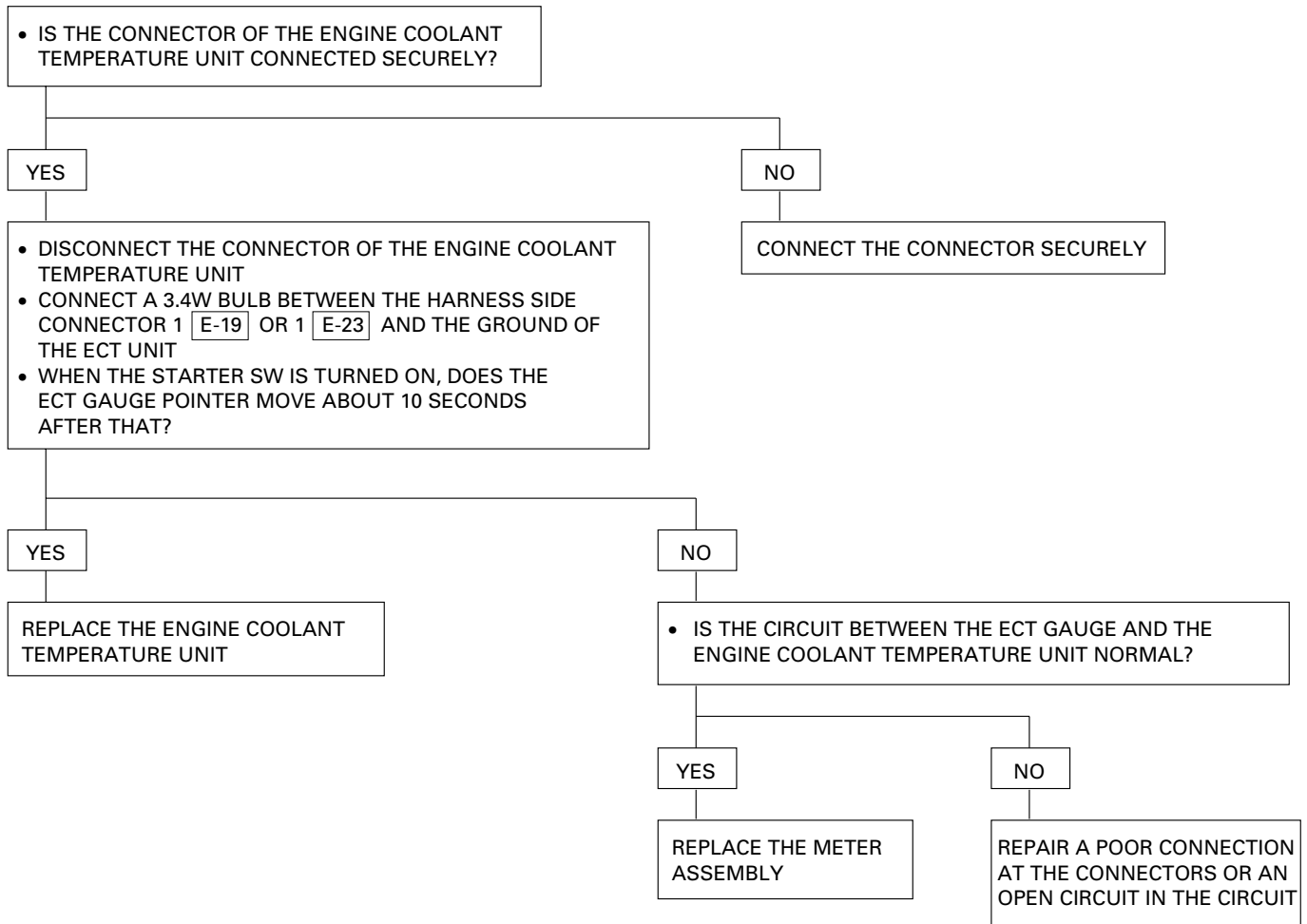
3-1. Voltmeter Needle Does Not Move

3-2. Voltage Reading Is Too Low (Or High)

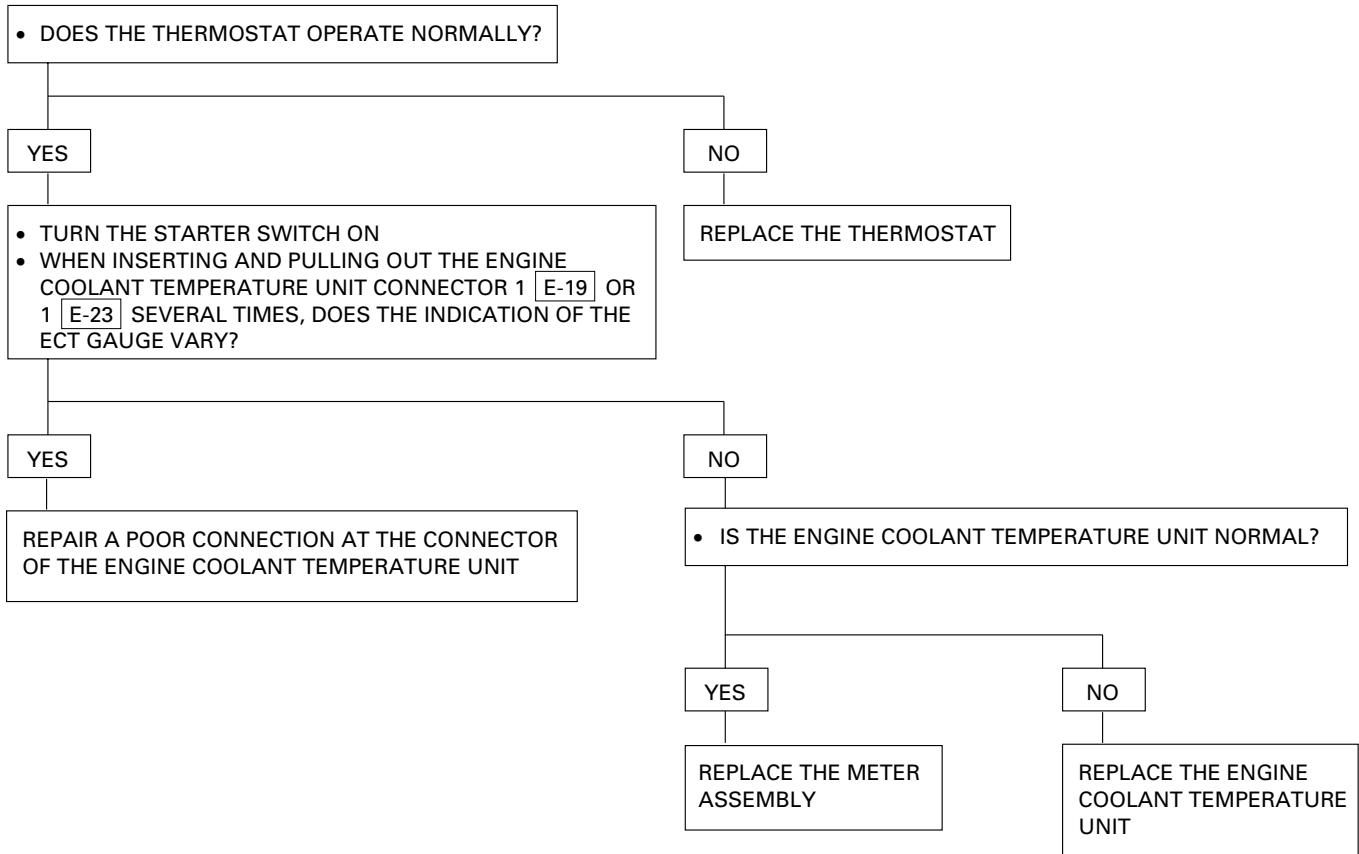


4. Engine Coolant Temperature (ECT) Gauge

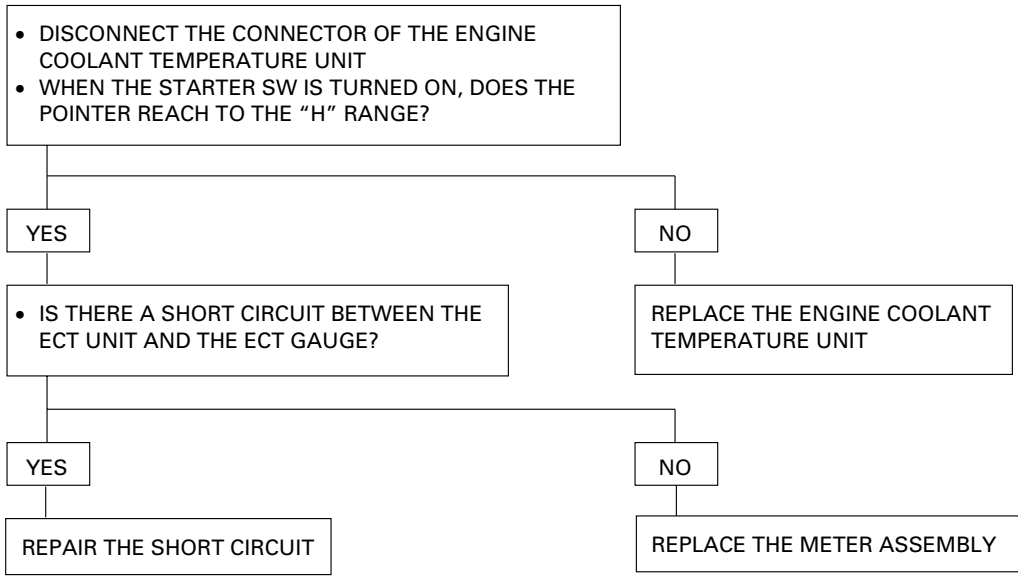
4-1 Gauge Needle Does Not Move



4-2 Gauge Reading Is Too Low (Or High)

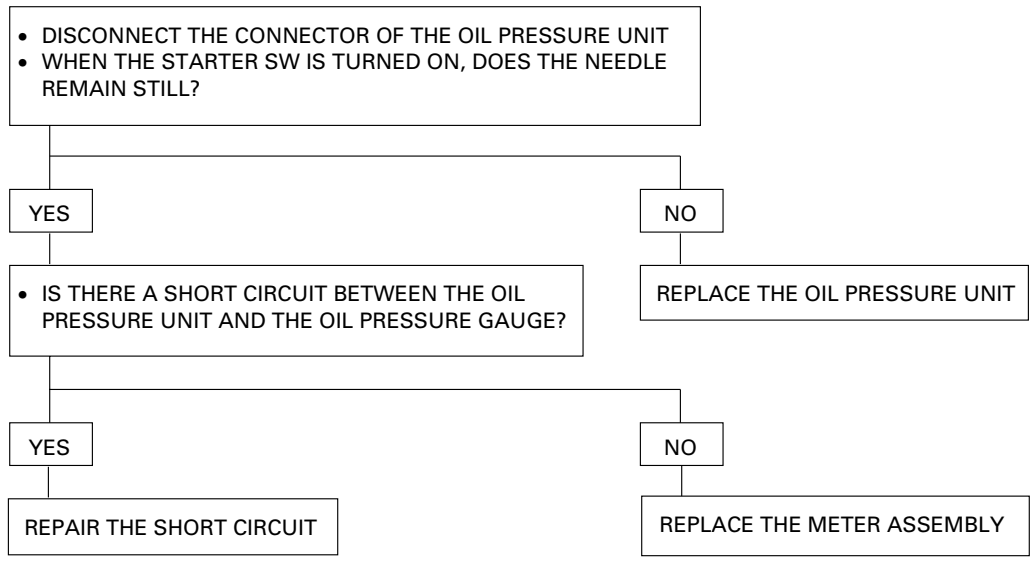


4-3 Needle Overshoots (Goes Up To The "H" Range)

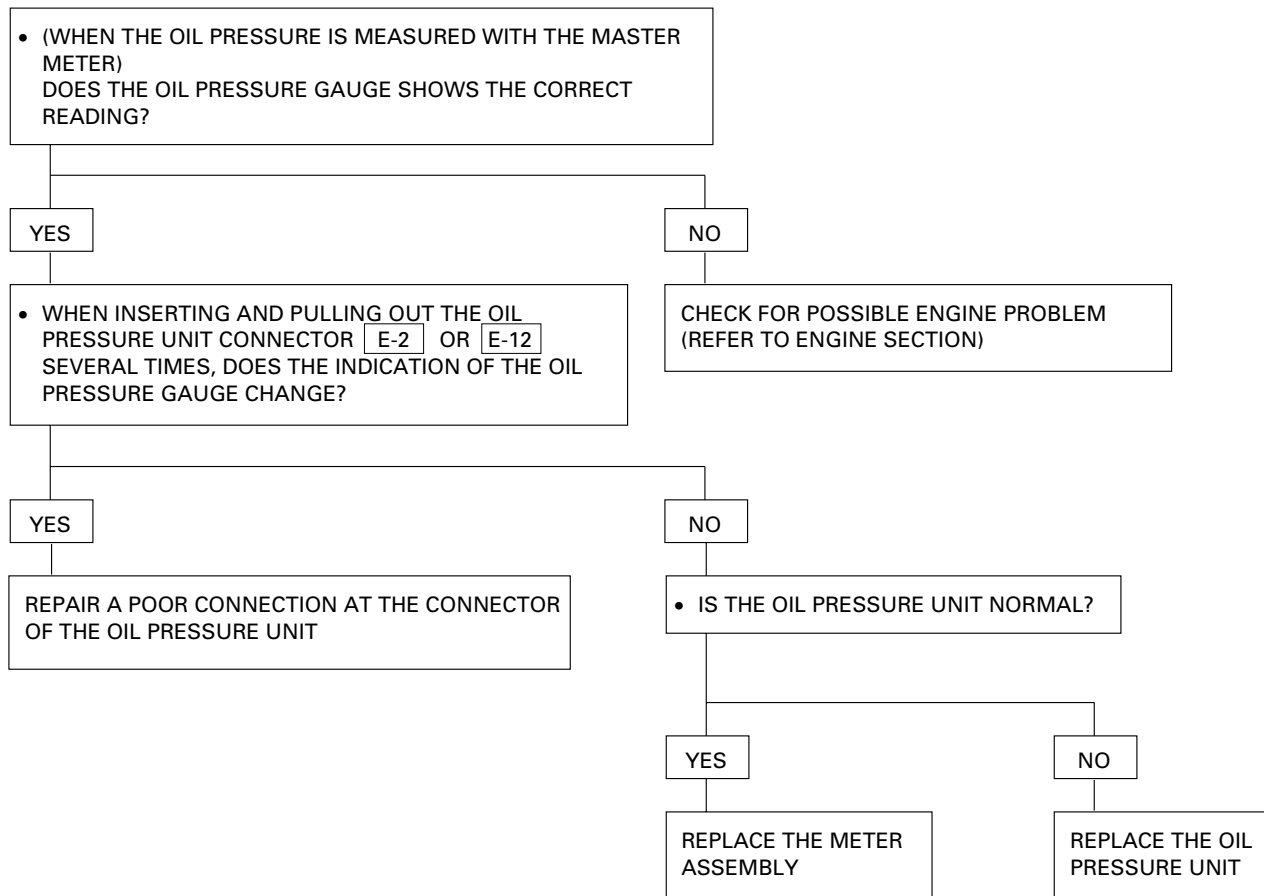


5. Oil Pressure Gauge

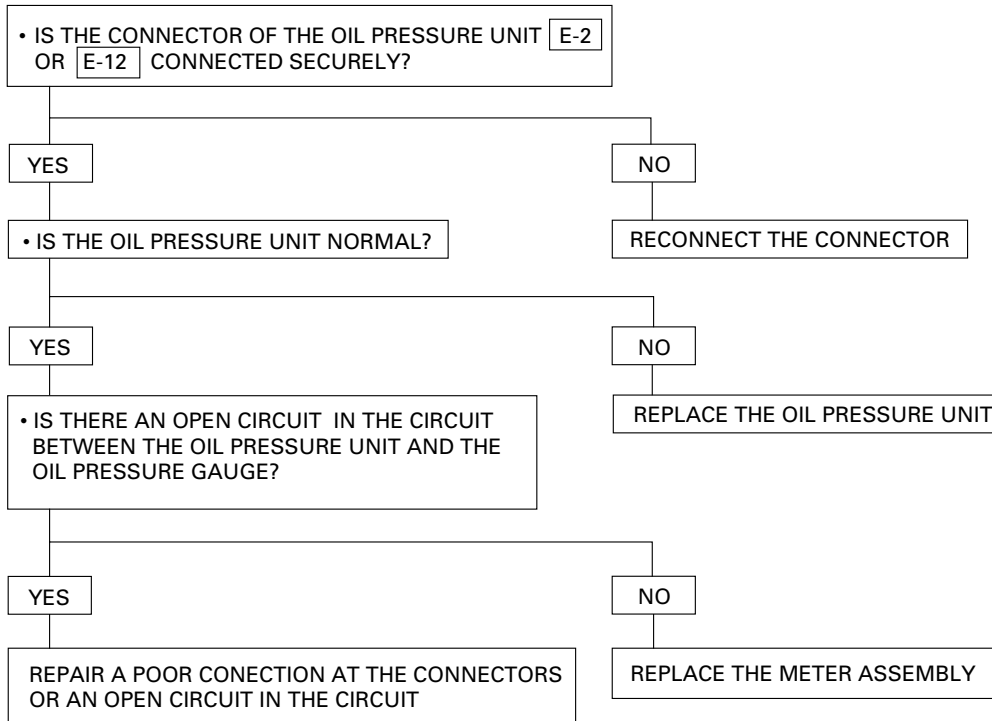
5-1 Needle Does Not Move



5-2 Oil Pressure Gauge Reading Is Too Low (Or High)

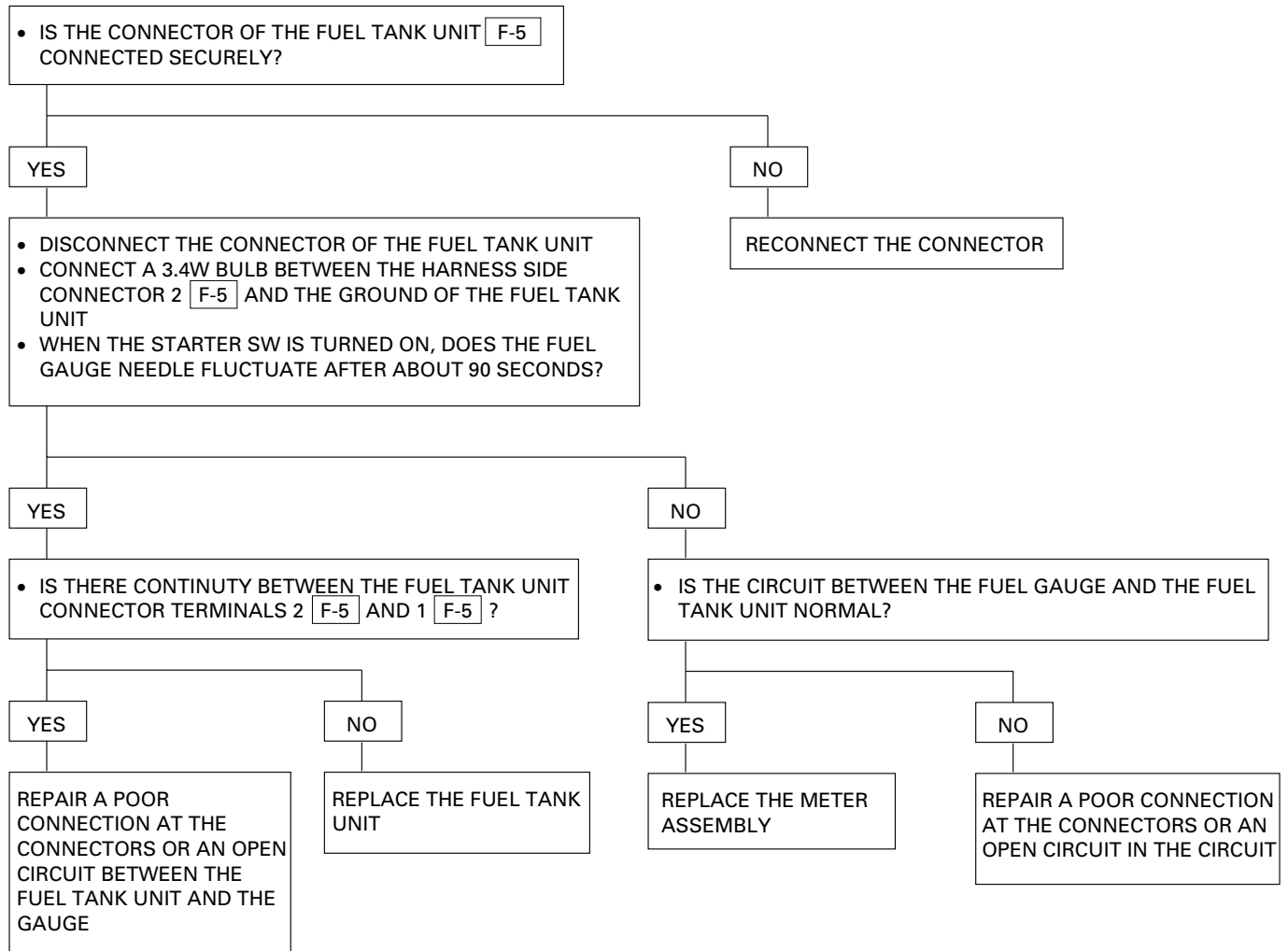


5-3 Needle Overshoots (Goes Up To 15 (x100 kPa))

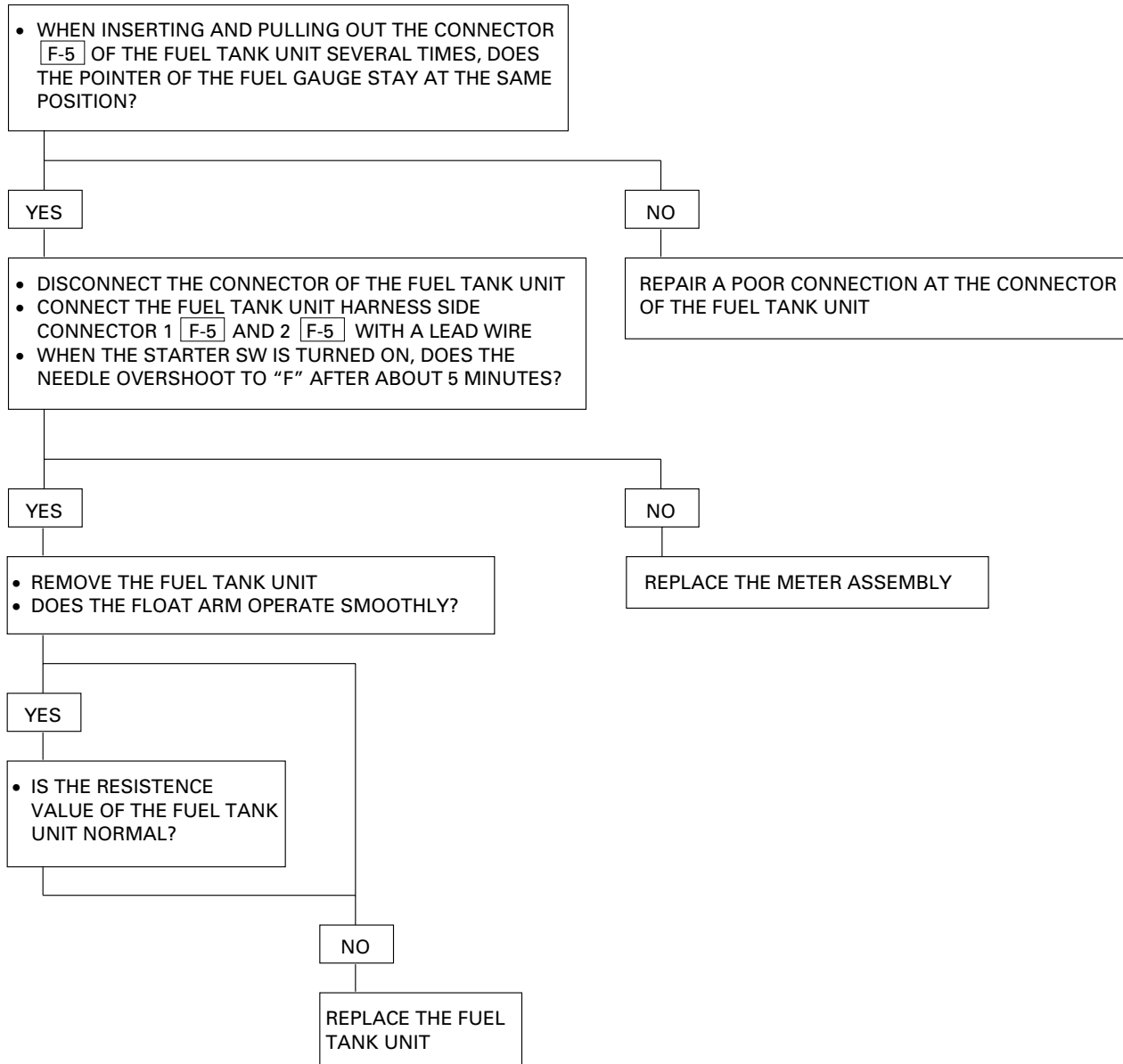


6. Fuel Gauge

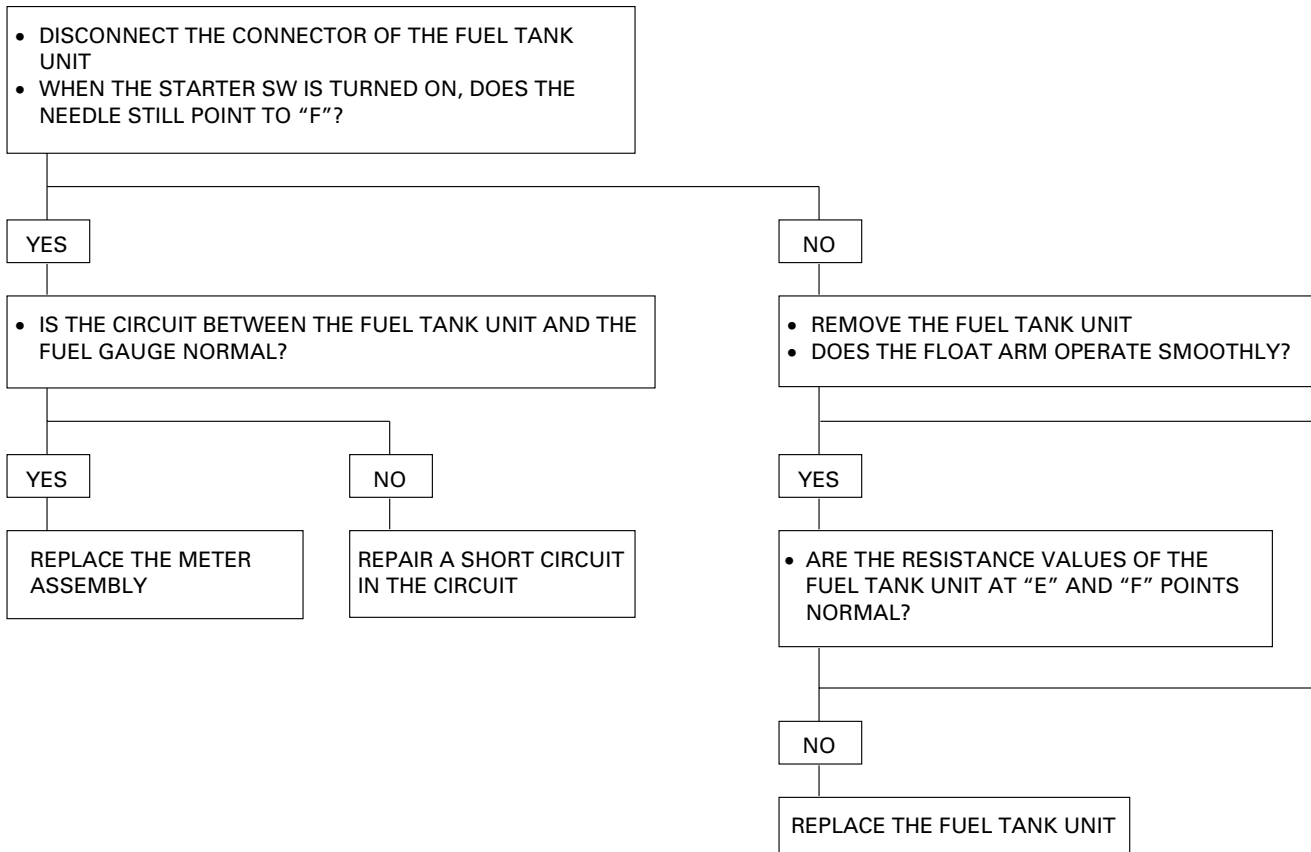
6-1 Fuel Gauge Needle Does Not Move



6-2 Even When The Tank Is Filled Up With Fuel, The Needle Does Not Reach "F"

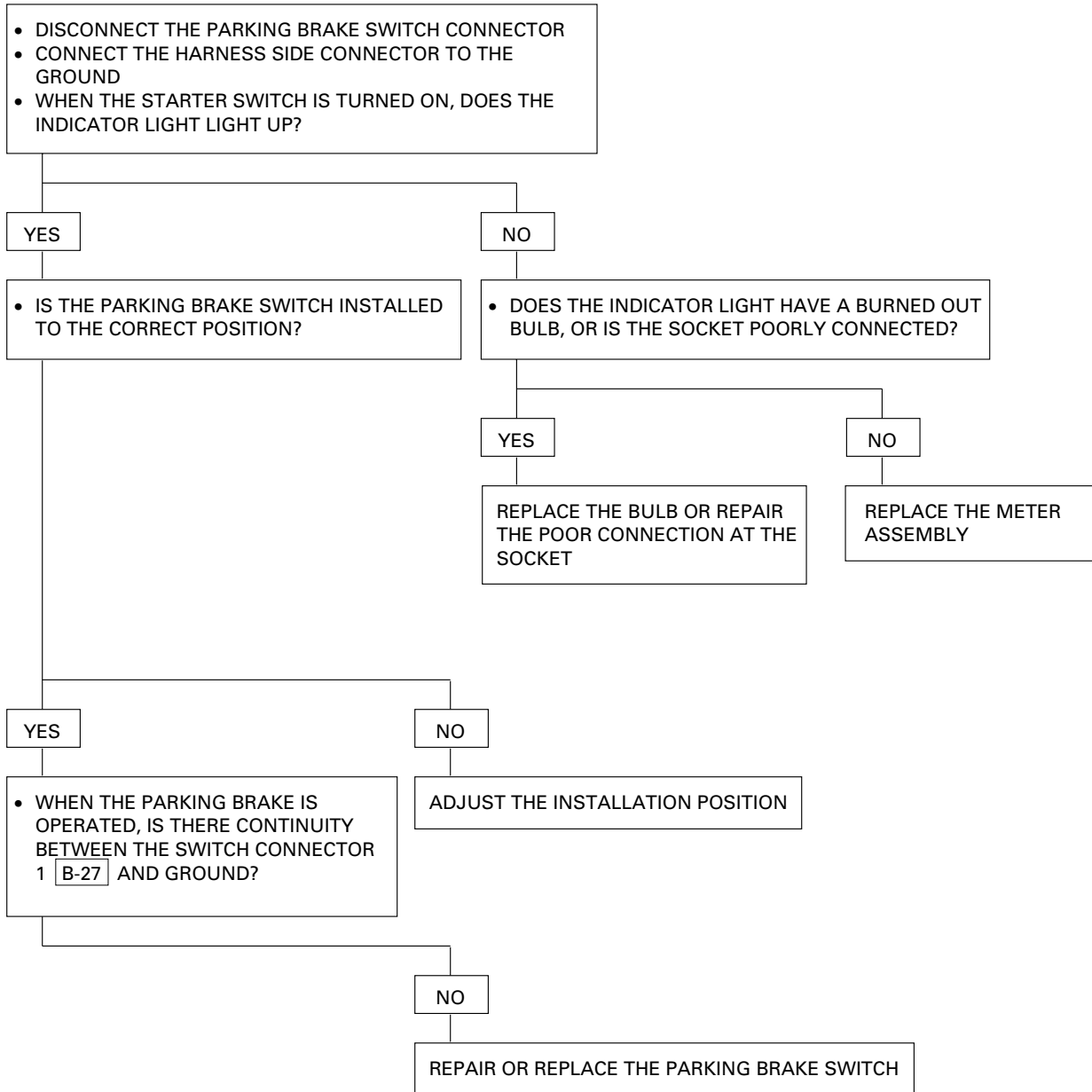


6-3 Even When The Tank Is Not Full of Fuel, The Needle Overshoots (Or Goes Up To "F")

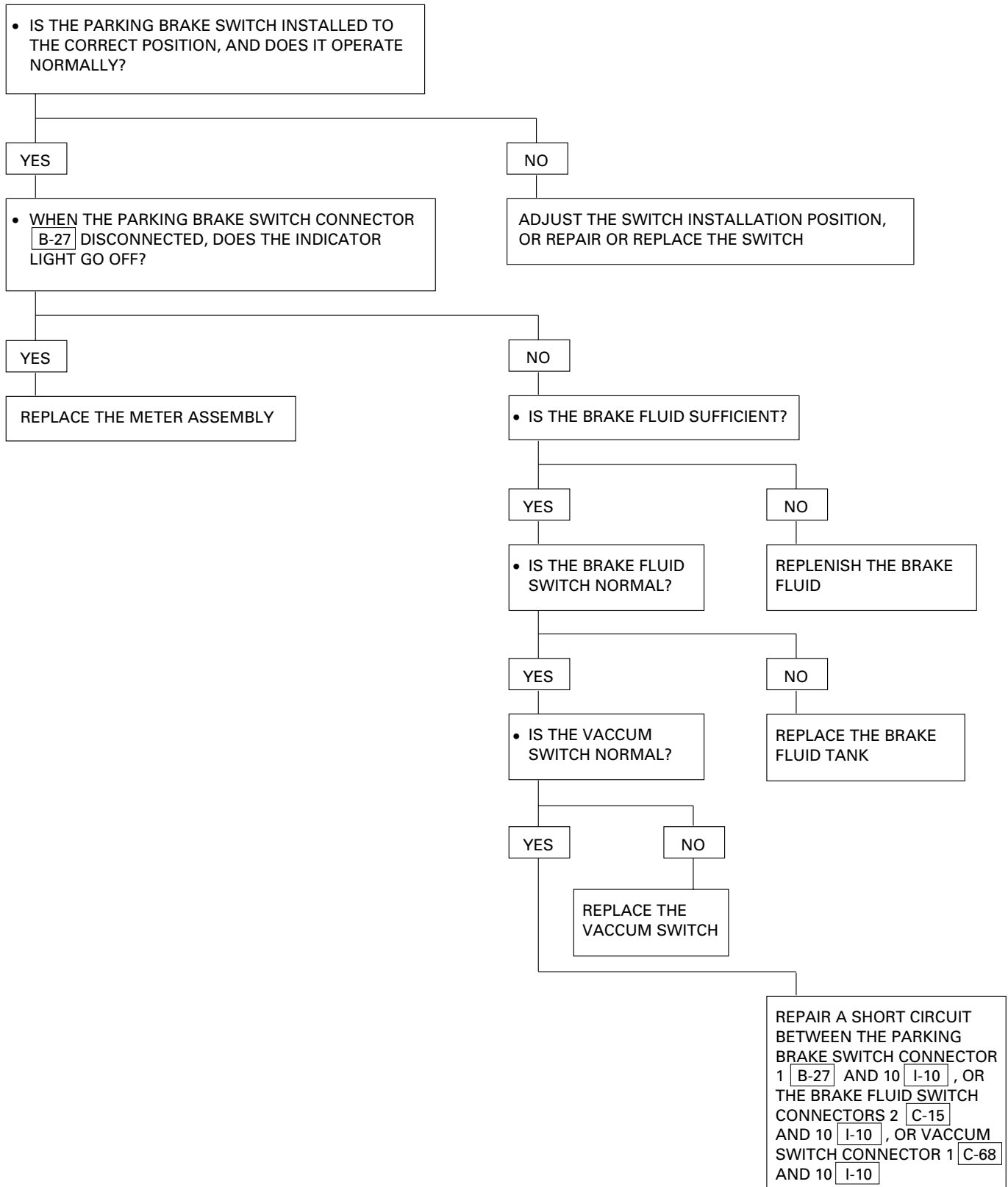


7. Warning/Indicator Light

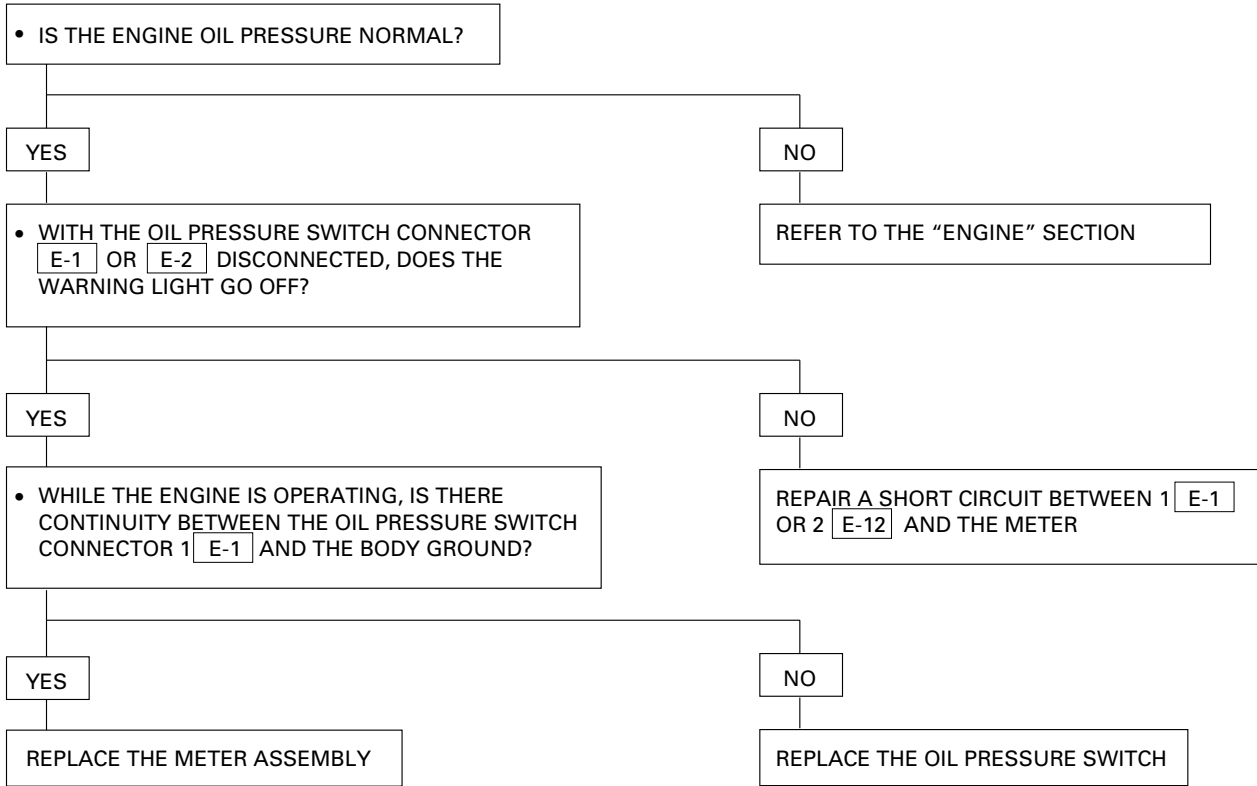
7-1 When The Parking Brake Lever Is Pulled, The Indicator Light Does Not Light Up



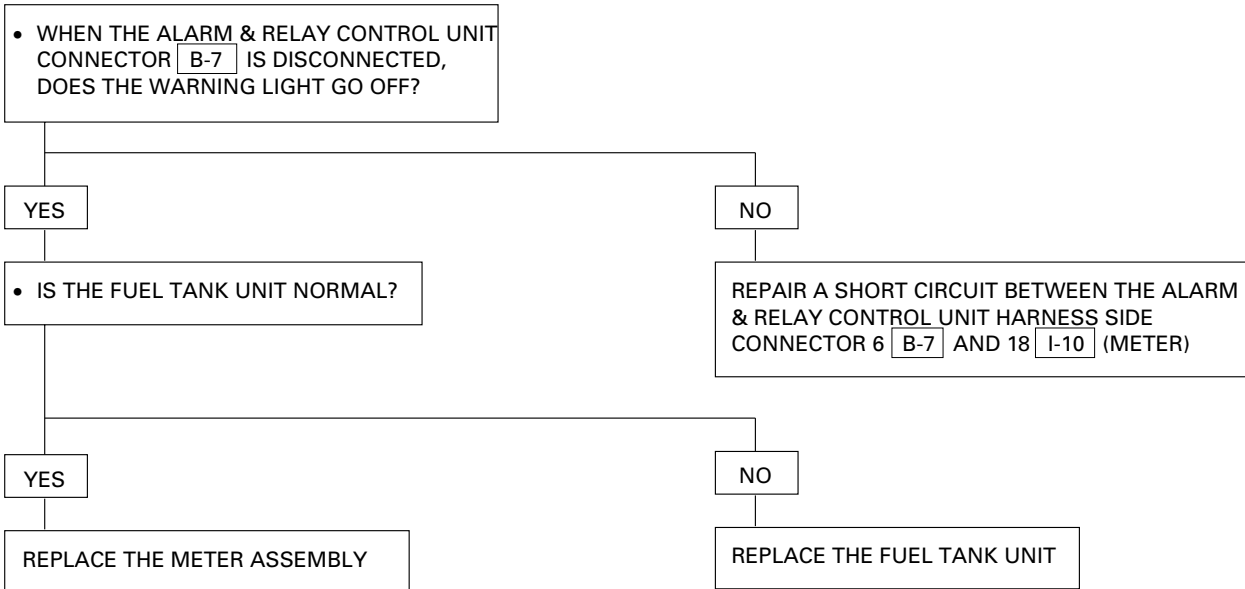
7-2 Even When The Parking Brake Lever Is Released, The Indicator Light Does Not Go Off



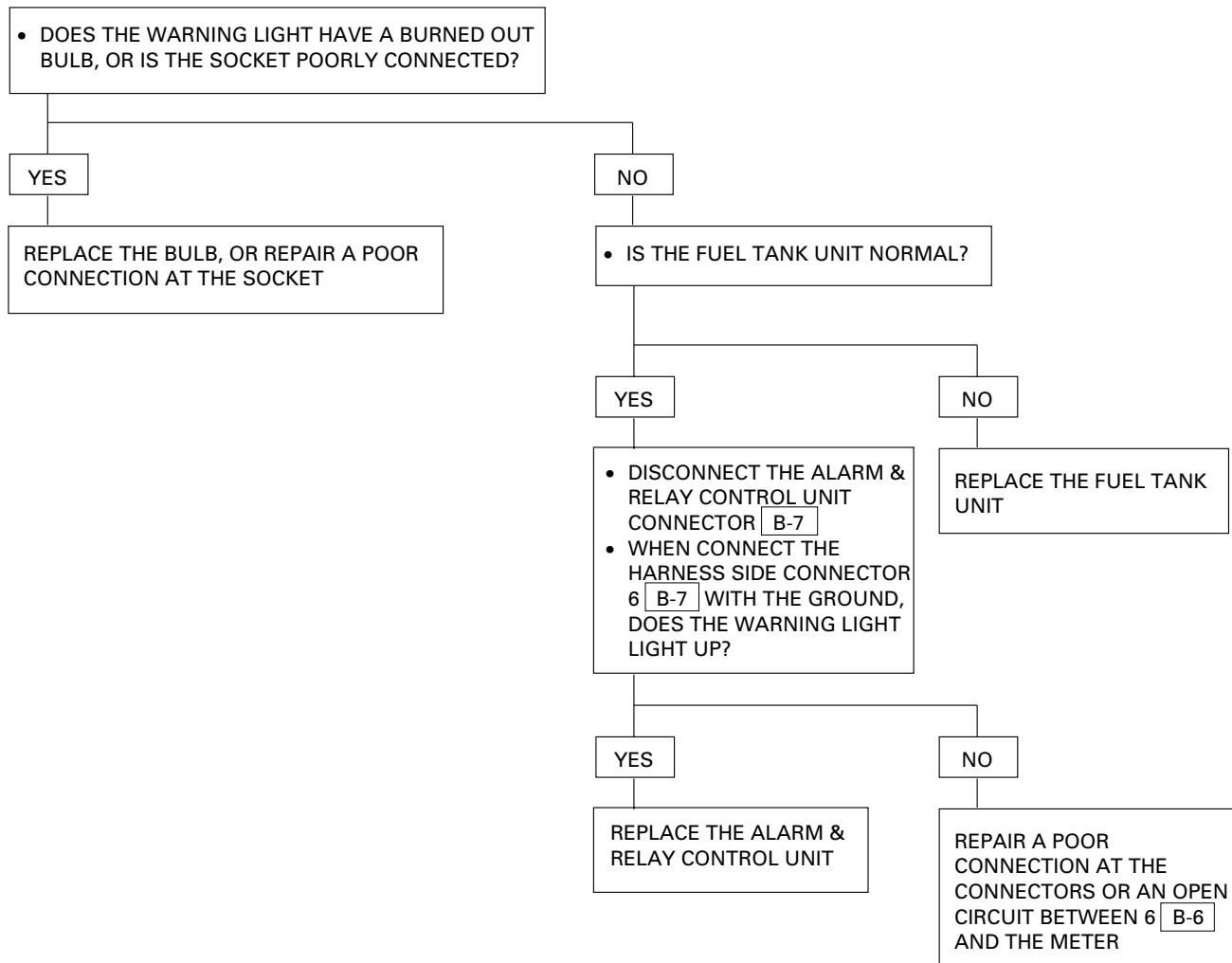
7-3 While The Engine Is Operating, The Oil Pressure Warning Light Does Not Go Off



7-4 Even When The Fuel Tank Is Full With Fuel, The Low Fuel Warning Light Lights Up



7-5 Even When The Fuel Tank Is Empty, The Low Fuel Warning Light Does Not Light Up



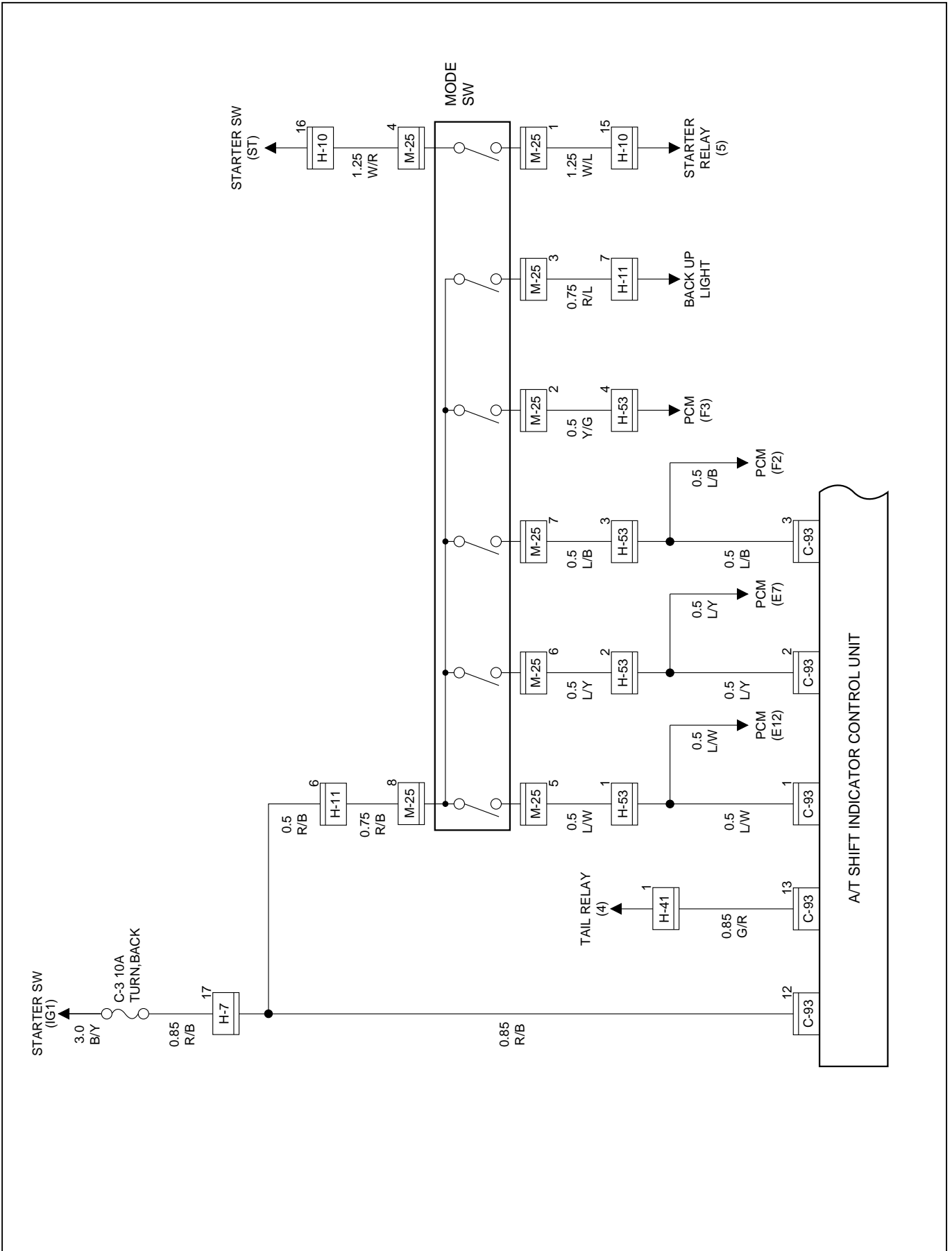
A/T Shift Indicator

General Description

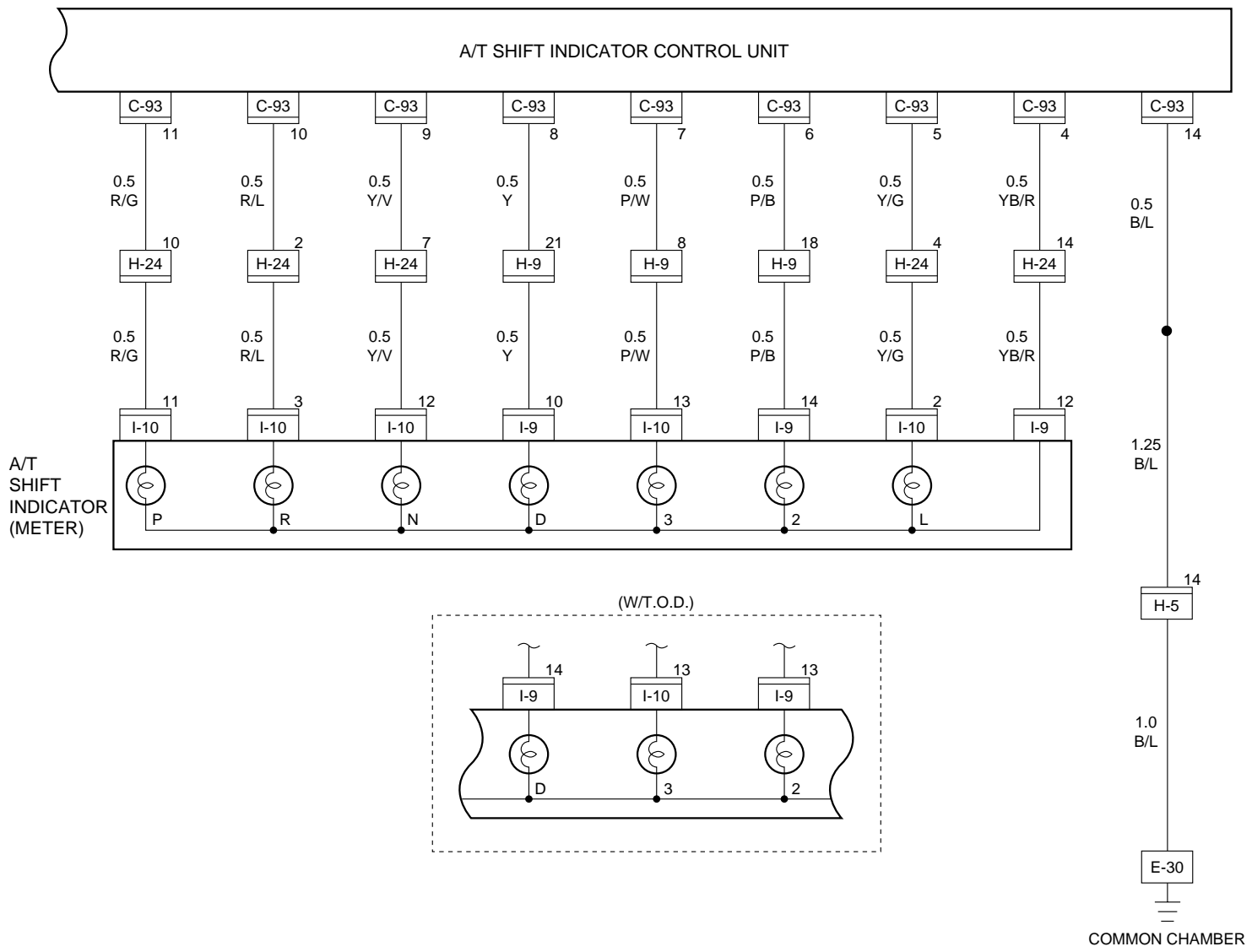
The circuit consists of mode switch, A/T shift indicator control unit and A/T shift indicator (meter).

A/T shift indicator control unit controls to illuminate A/T shift indicator light according to signals from mode switch.

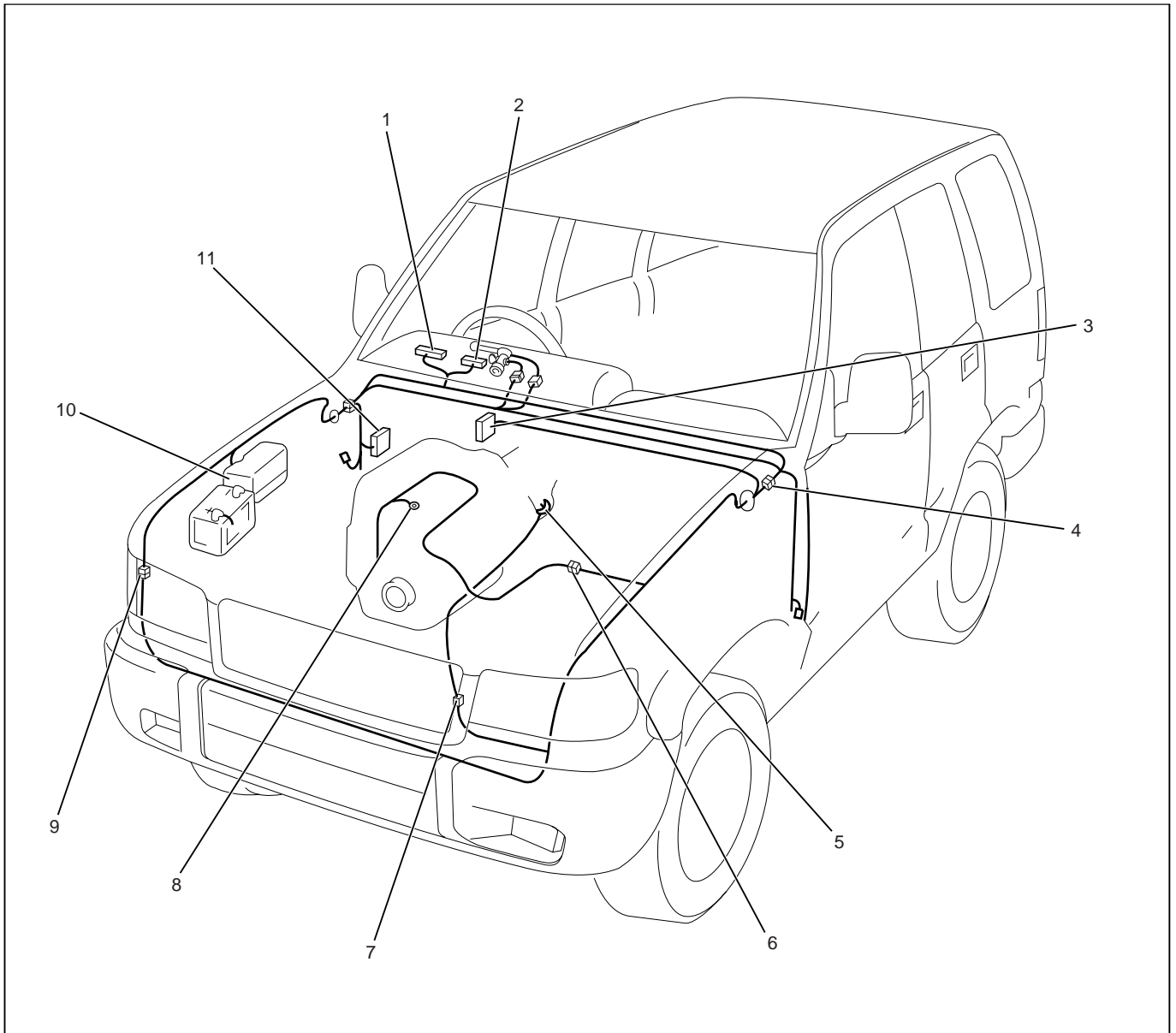
Circuit Diagram (RHD)-1



Circuit Diagram (RHD)-2



Parts Location (RHD)

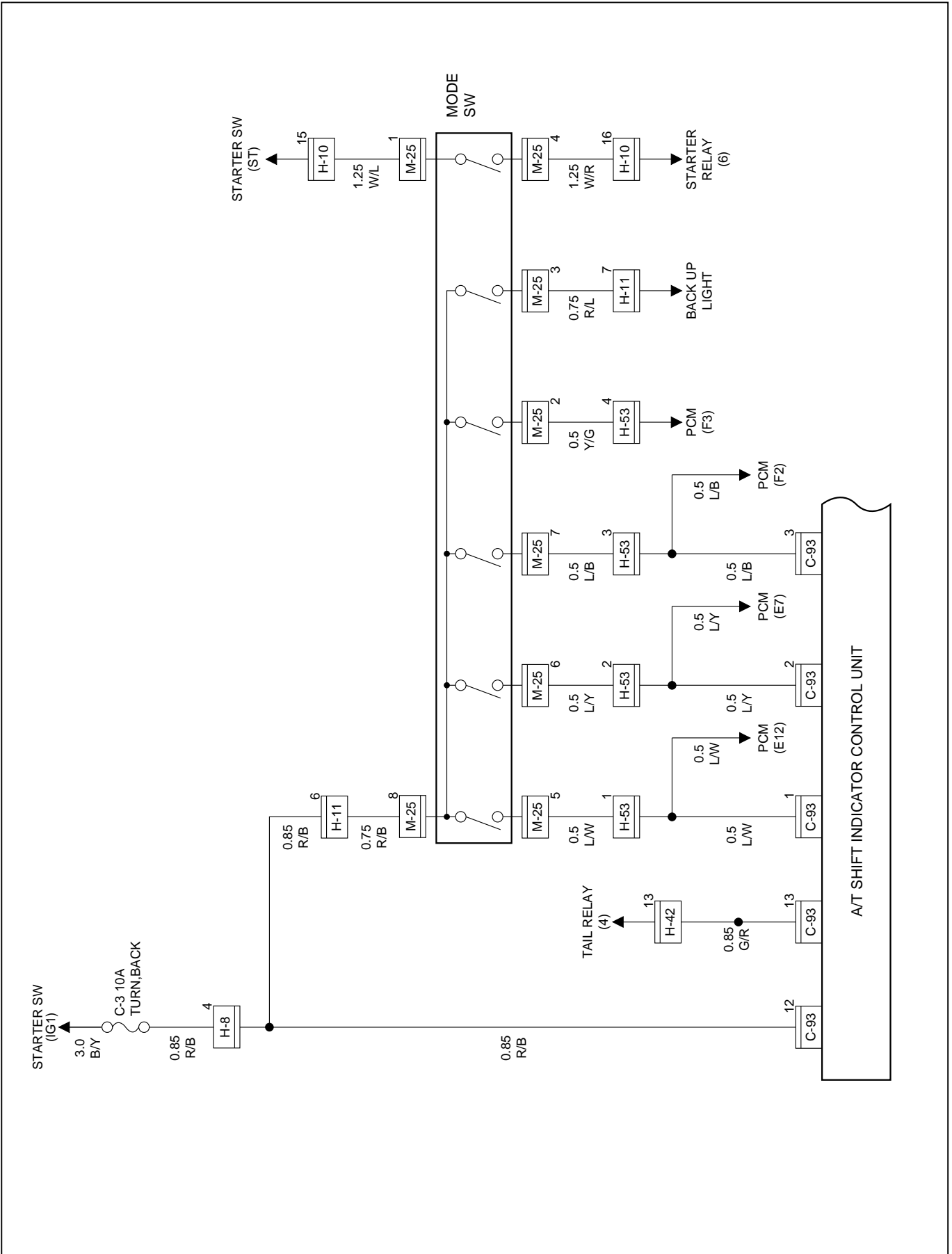


D08RWA10

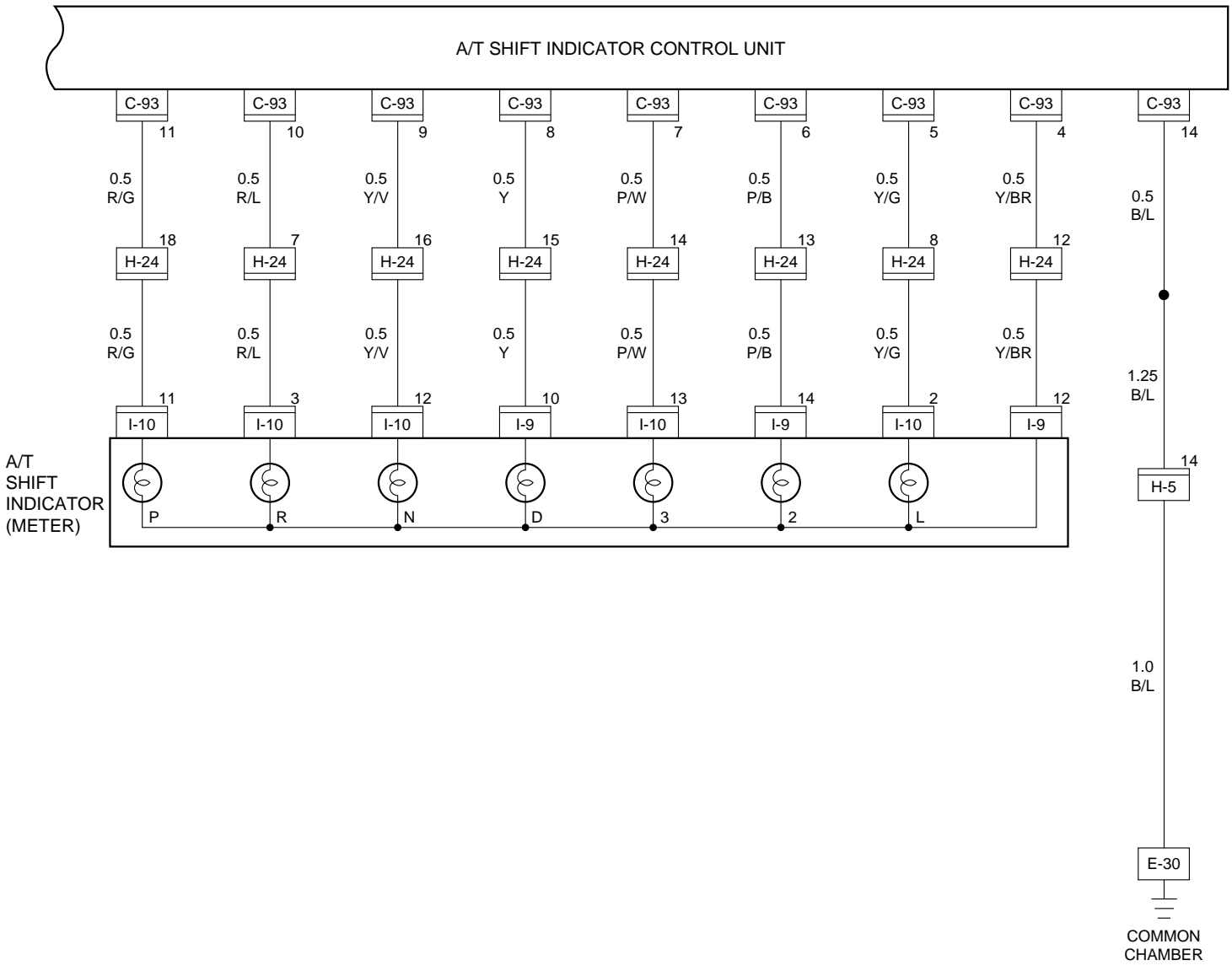
Legend

- | | |
|-------------------------|-------------------------|
| (1) I-10 | (6) H-5 |
| (2) I-9 | (7) H-10, H-11, H-53 |
| (3) C-93 | (8) E-30 |
| (4) H-7, H-8, H-9, H-24 | (9) H-41 |
| (5) Mode Switch | (10) Relay and Fuse Box |
| | (11) Fuse Box |

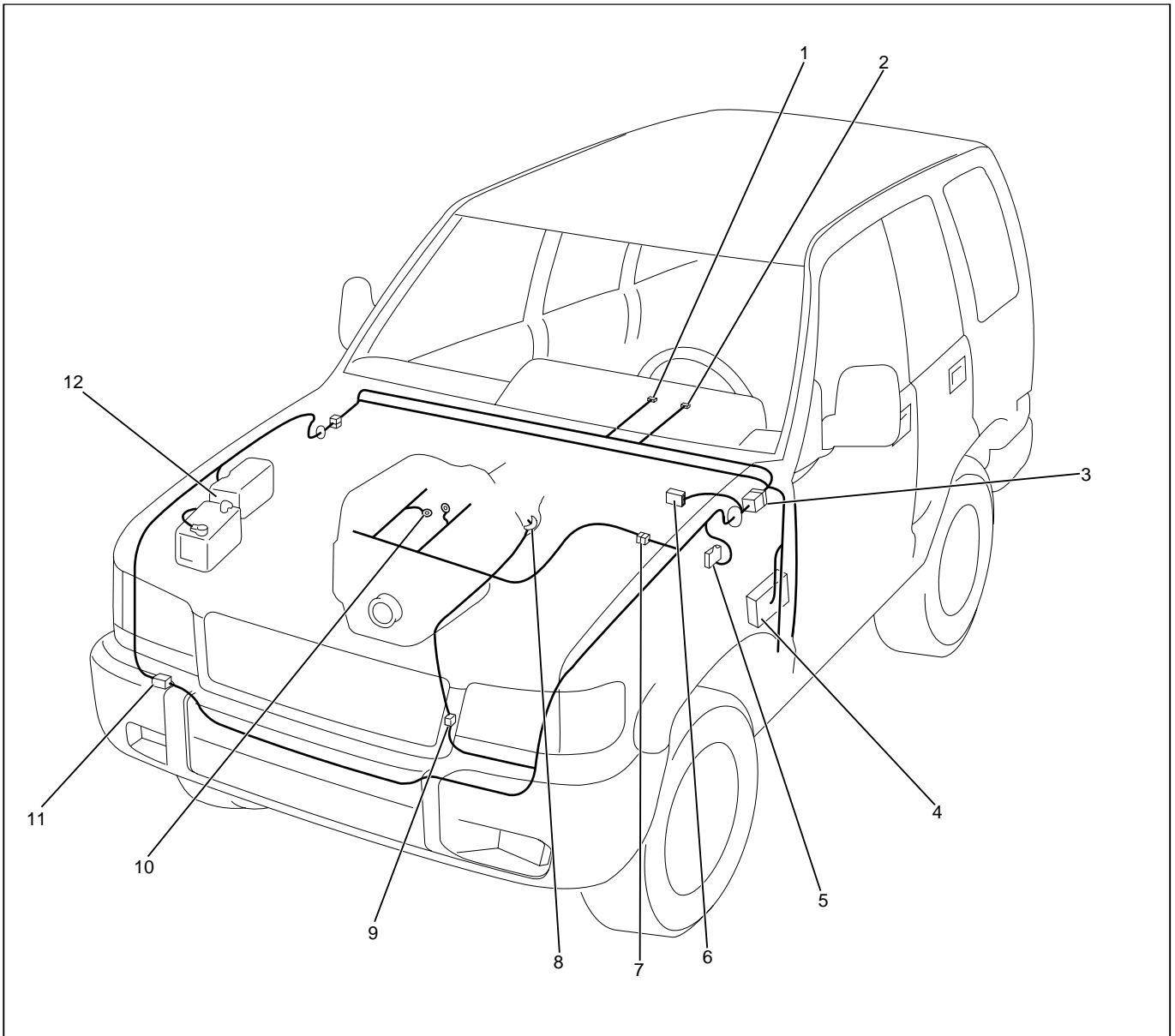
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RWA09

Legend

- | | |
|--------------------|-------------------------|
| (1) I-10 | (7) H-5 |
| (2) I-9 | (8) M-25 |
| (3) H-8, H-9, H-24 | (9) H-10, H-11, H-53 |
| (4) Fuse Box | (10) E-30 |
| (5) C-16 | (11) H-42 |
| (6) C-93 | (12) Relay and Fuse Box |

Heater and Air Conditioning

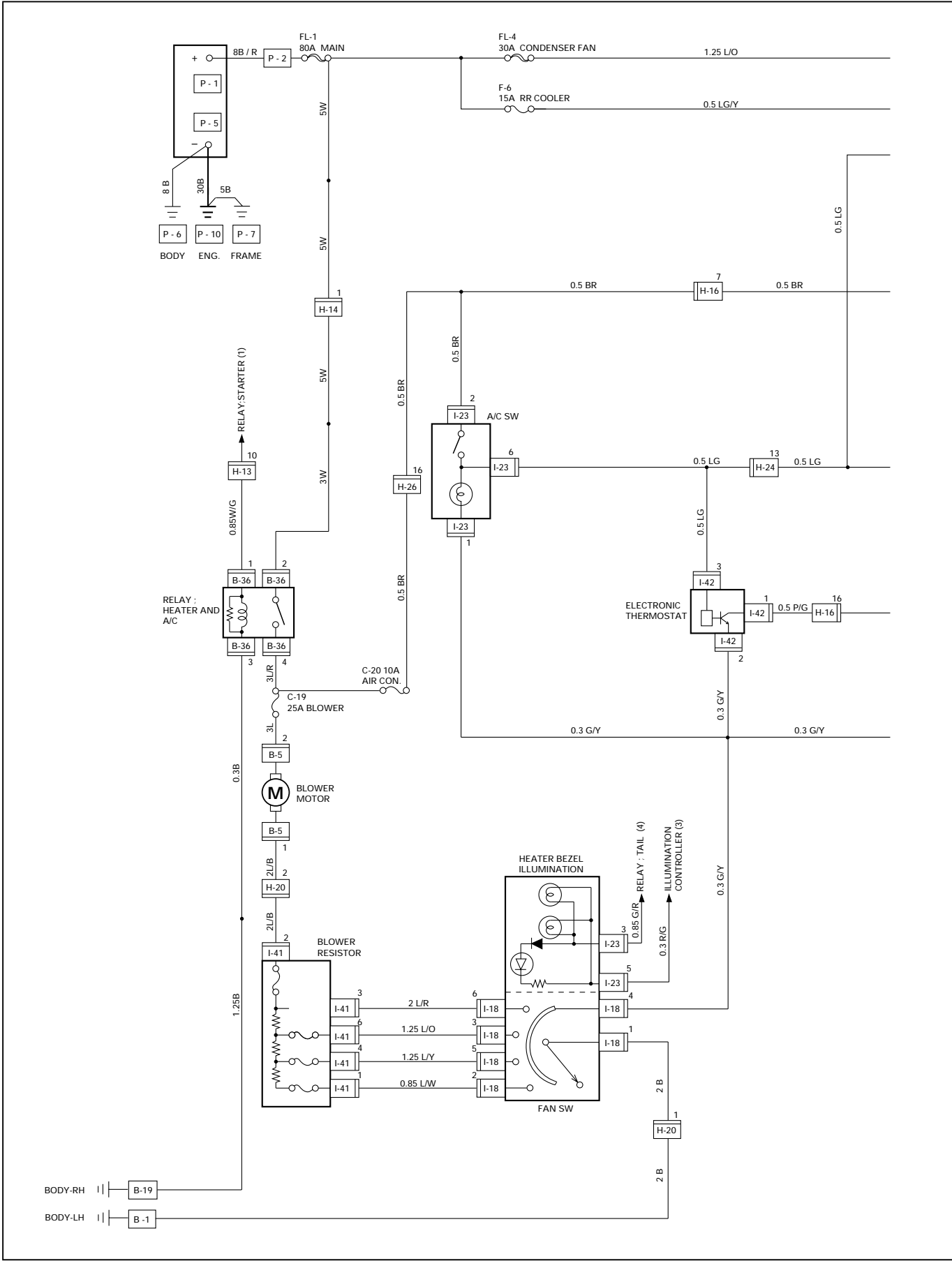
General Description

The circuit consists of pressure switch, A/C switch, electronic thermostat, blower motor, fan switch, magnetic clutch of A/C compressor, blower resistor and relay.

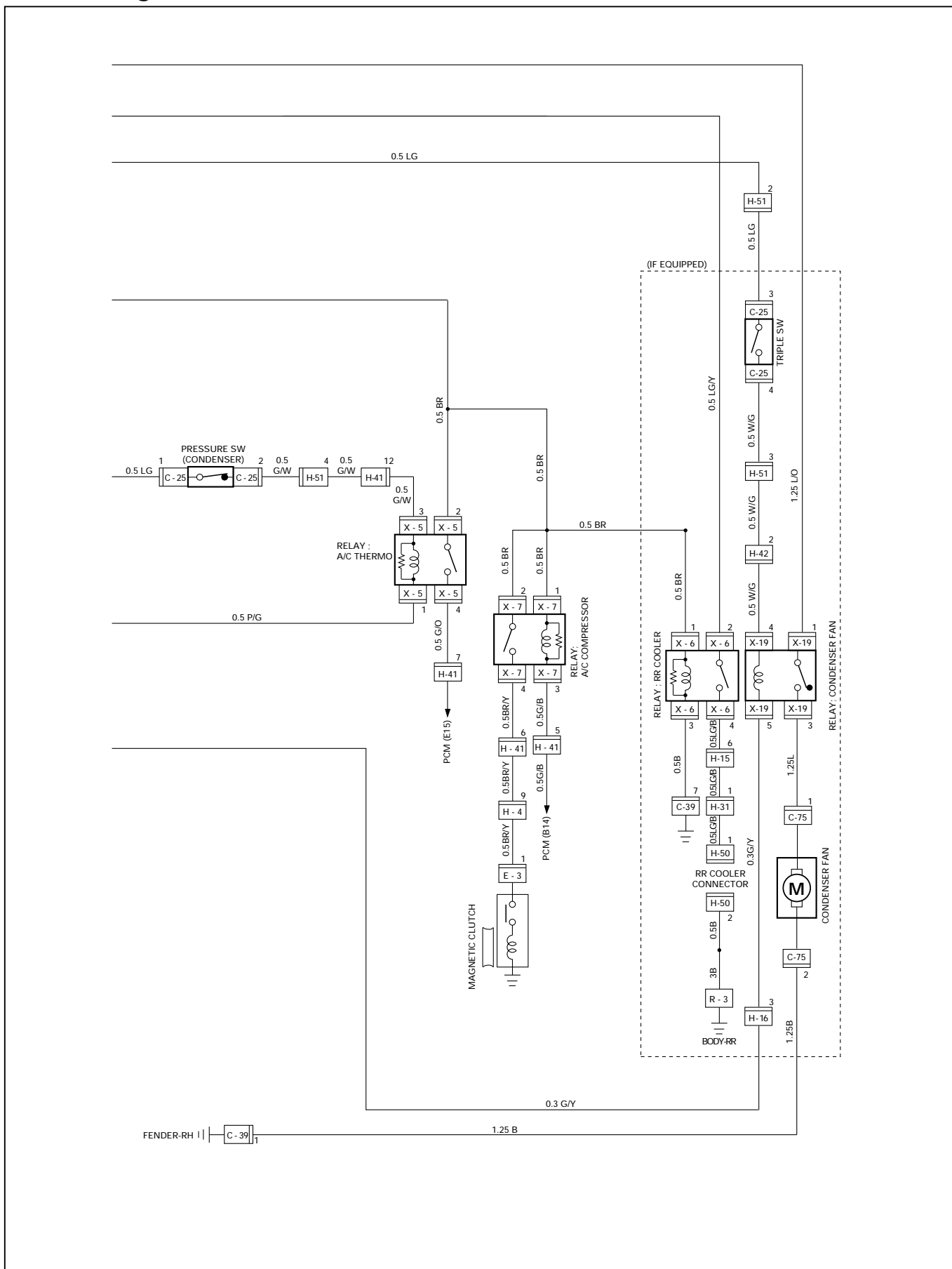
The operation of A/C system is controlled by turning A/C switch on and off. Electronic thermostat and PCM can stop operation of A/C temporarily by disconnecting magnetic clutch under the predetermined conditions to adjust room temperature, preventing abnormal rise of engine coolant and reduce engine load while A/C is in operation.

Refer to Heating, Ventilation and Air Conditioning in HVAC section.

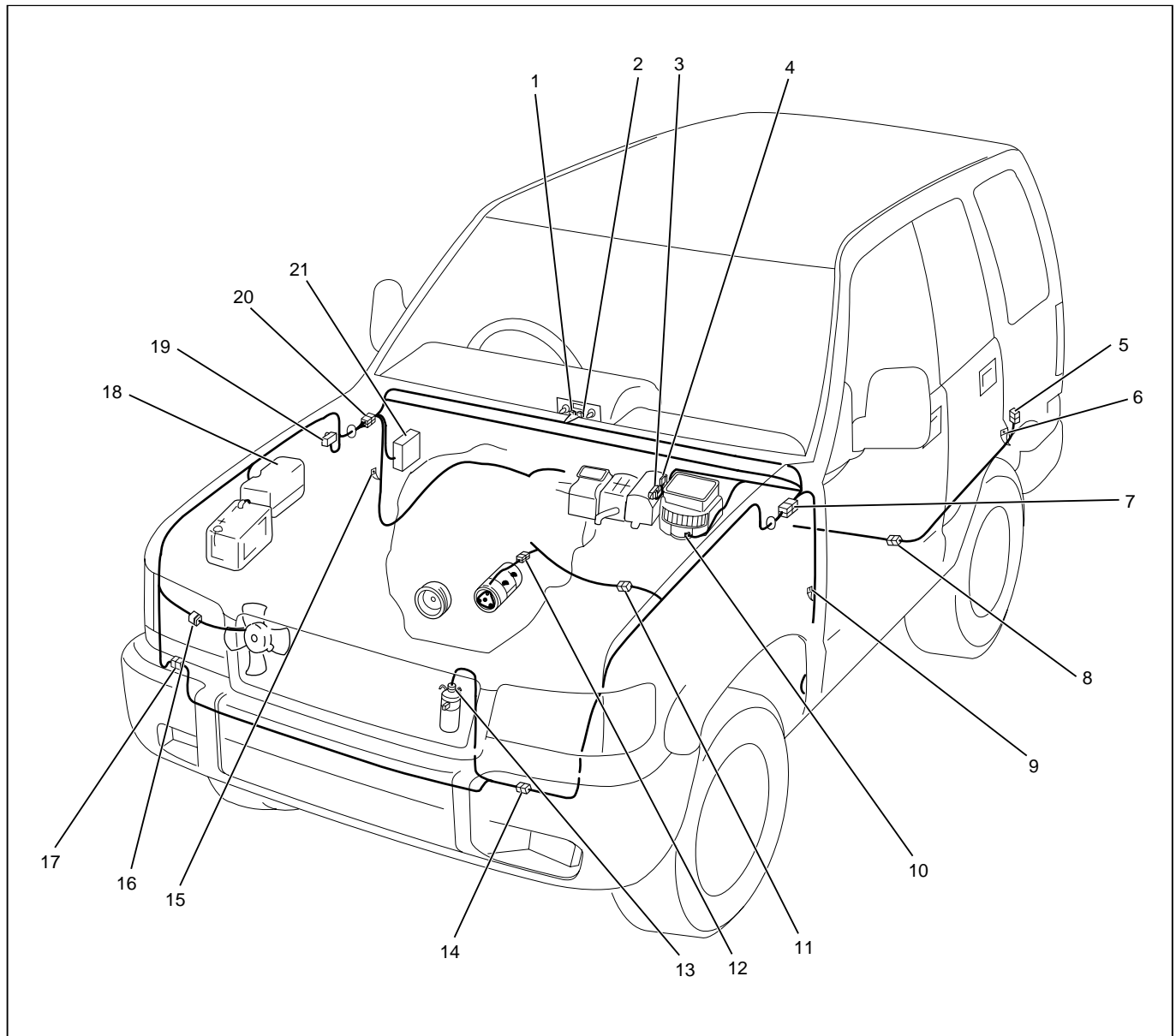
Circuit Diagram (RHD 6VD1)-1



Circuit Diagram (RHD 6VD1)-2



Parts Location (RHD 6VD1)

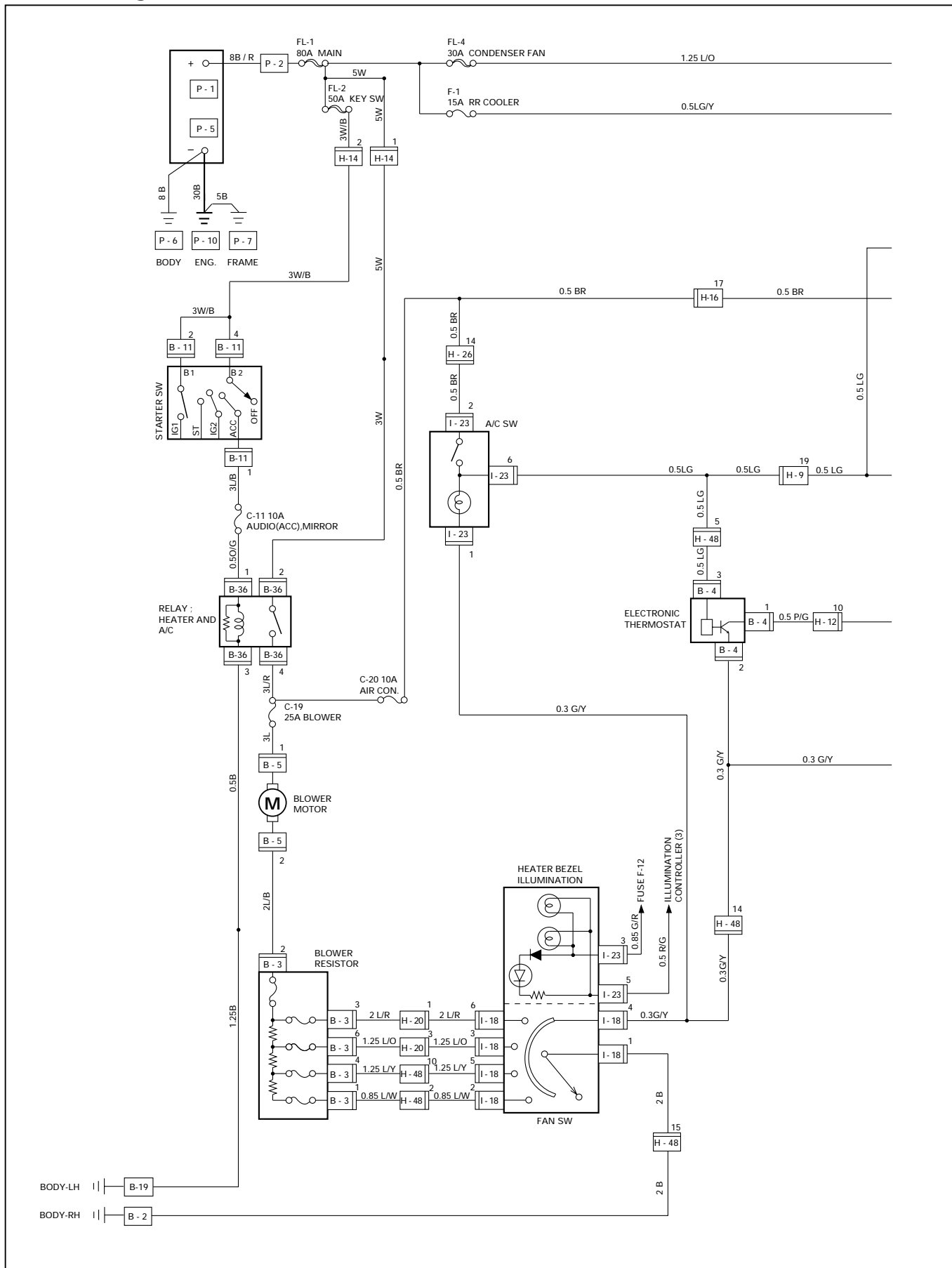


D08RWA15

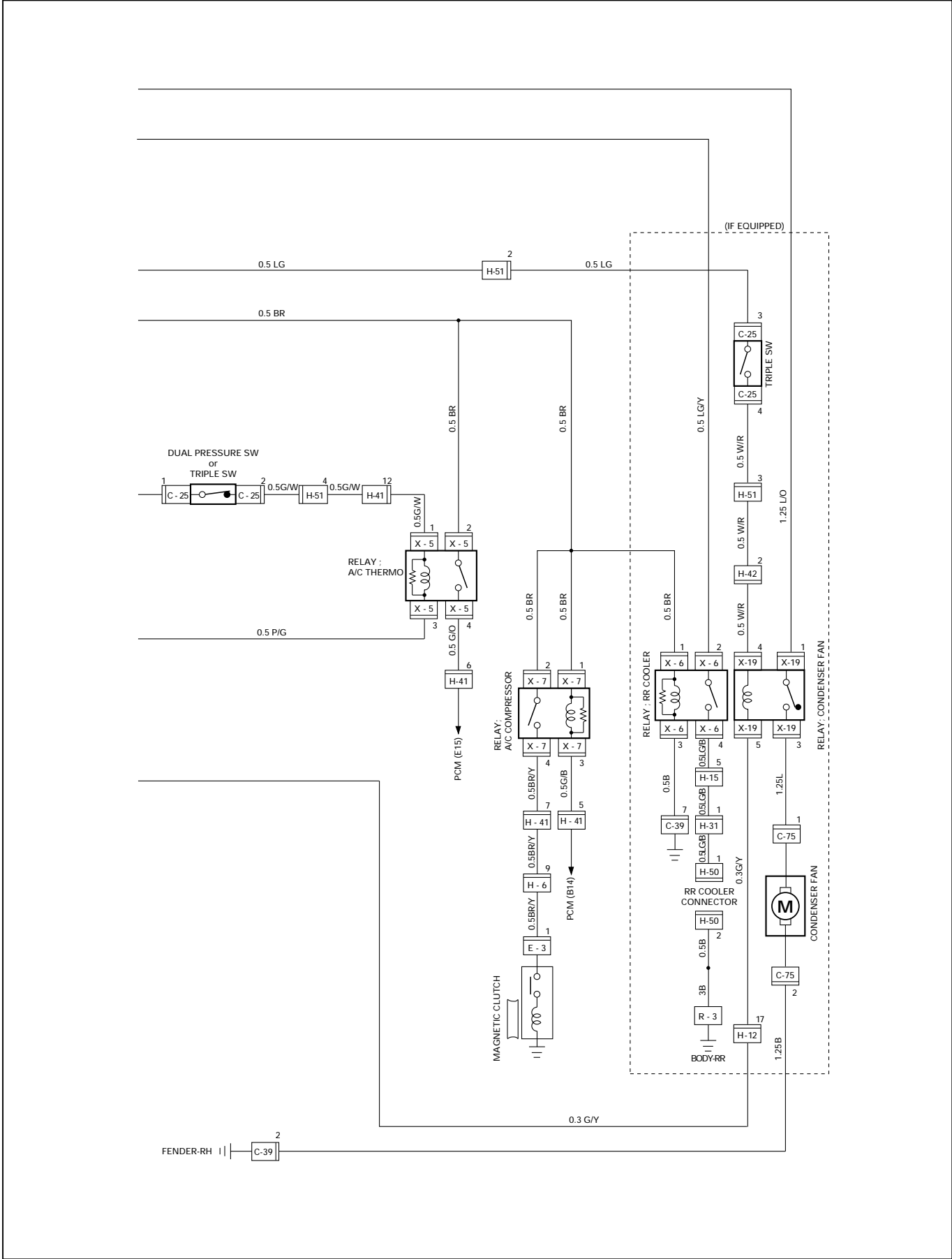
Legend

- | | |
|----------------------------------|---|
| (1) I-23 | (11) X-4 |
| (2) I-18 | (12) E-3 |
| (3) Blower Resistor (I-41) | (13) C-25 |
| (4) Electronic Thermostat (I-42) | (14) H-51 |
| (5) H-50 | (15) B-19 |
| (6) R-3 | (16) C-75 |
| (7) H-7, H-20, H-24 | (17) H-41, H-42 |
| (8) H-31 | (18) Relay and Fuse Box (X-5, X-6, X-7, X-19) |
| (9) B-1 | (19) C-39 |
| (10) Blower Motor (B-5) | (20) H-13, H-14, H-15, H-16, H-24 |
| | (21) Fuse Box (B-36) |

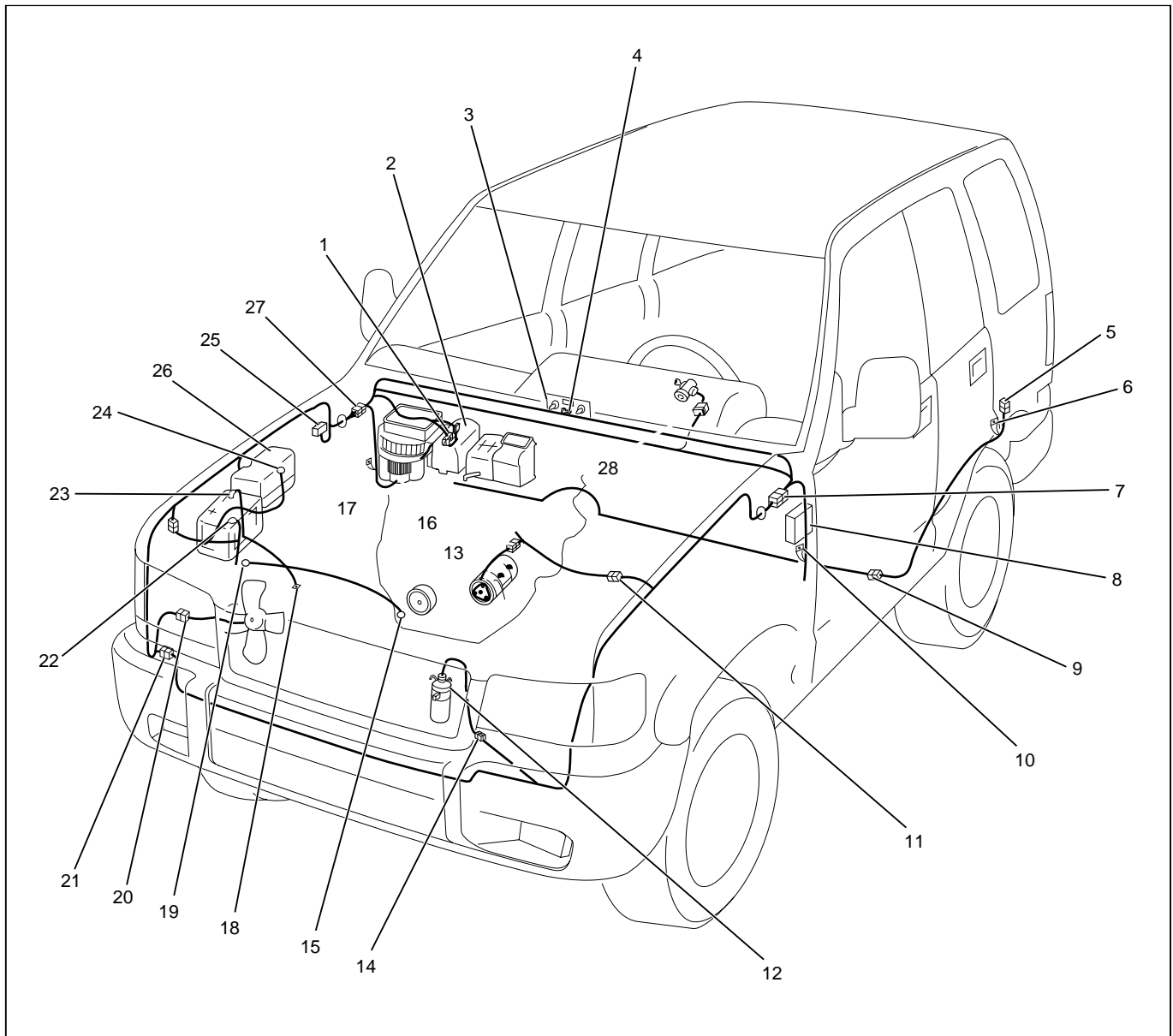
Circuit Diagram (LHD 6VD1)-1



Circuit Diagram (LHD 6VD1)-2



Parts Location (LHD 6VD1)

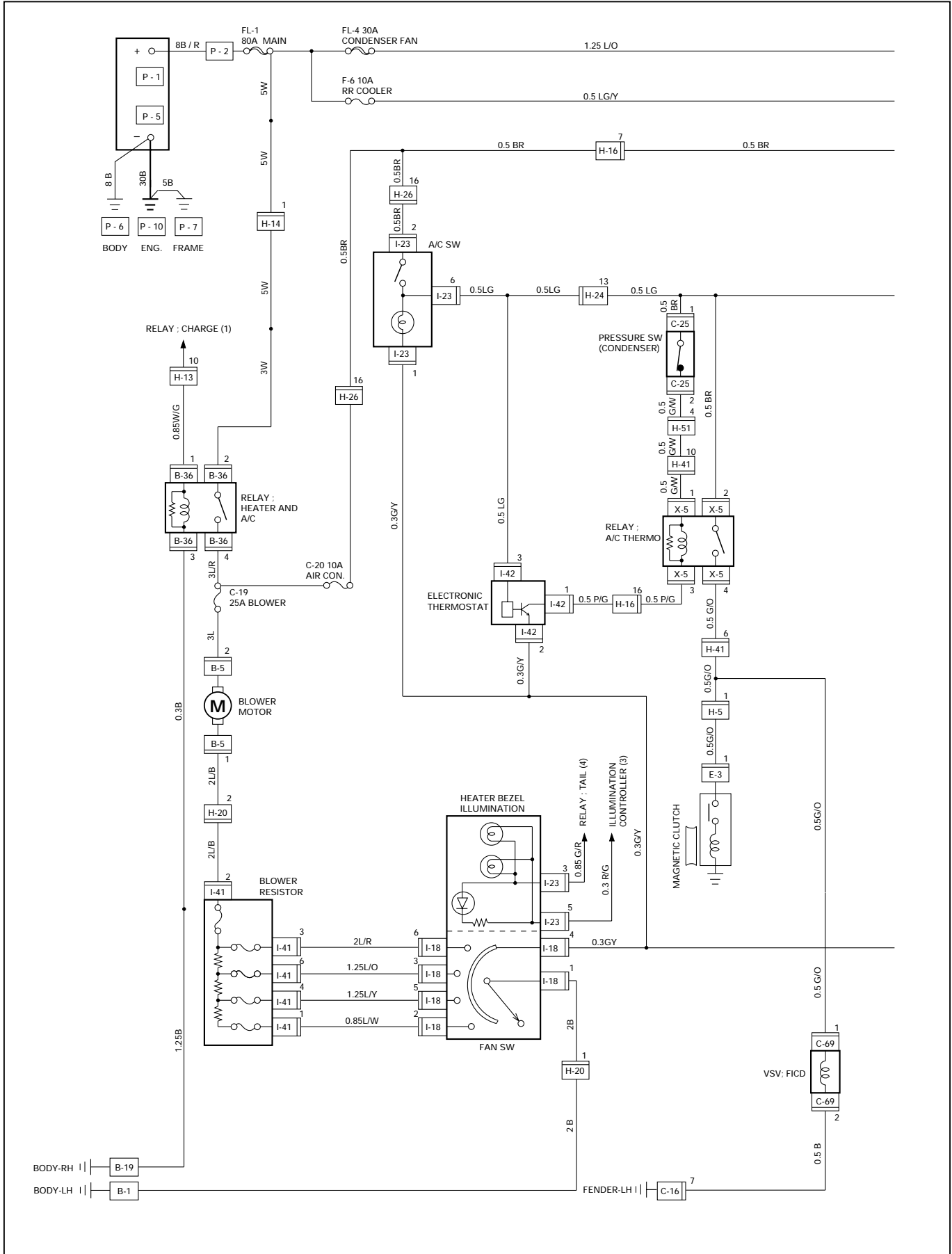


D08RWA14

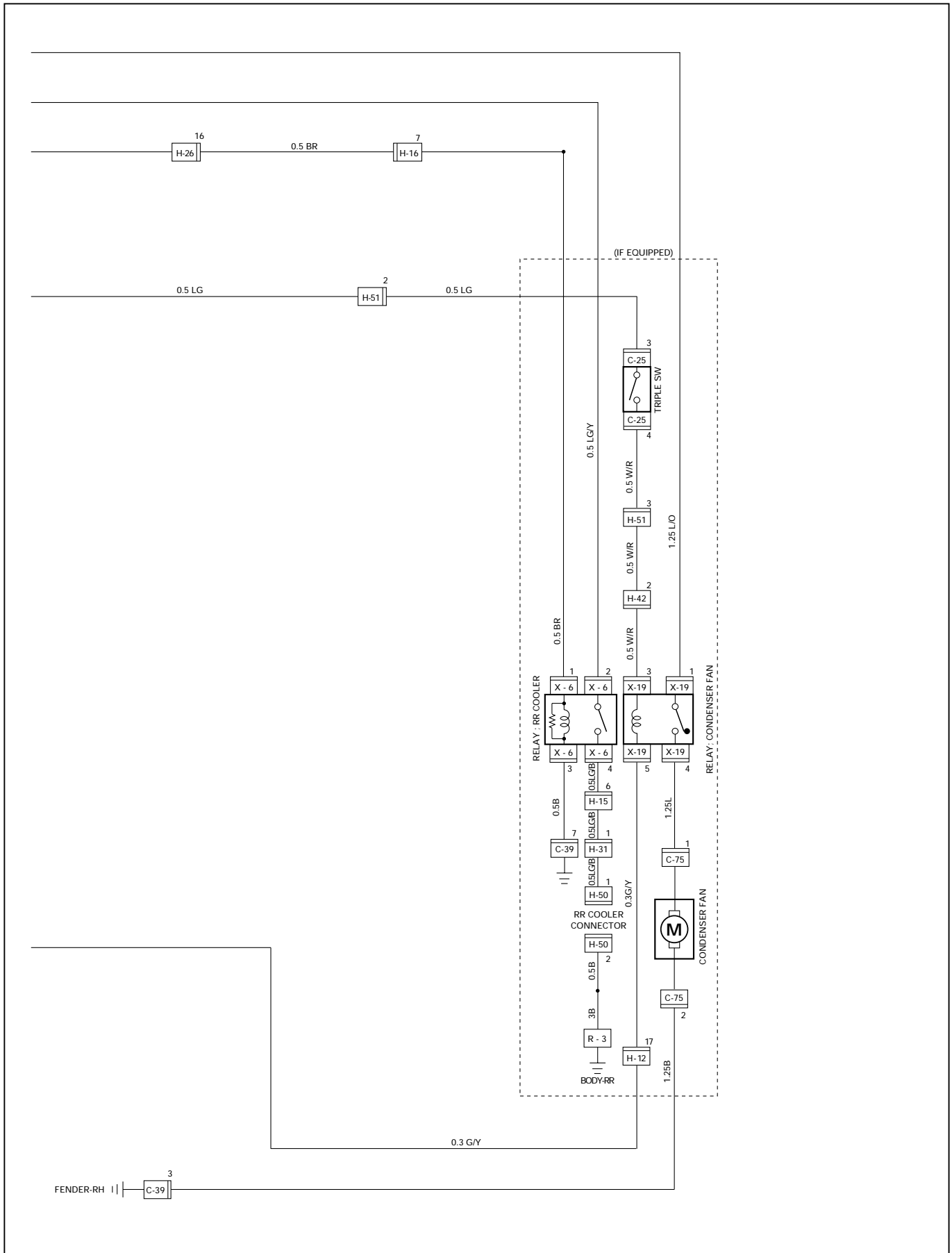
Legend

- | | |
|---------------------------------|---|
| (1) Blower Resistor (B-3) | (15) P-10 |
| (2) Electronic Thermostat (B-4) | (16) Blower Motor (B-5) |
| (3) I-23 | (17) B-2 |
| (4) I-18 | (18) P-7 |
| (5) H-50 | (19) P-6 |
| (6) R-3 | (20) C-75 |
| (7) H-9, H-24 | (21) H-41, H-42 |
| (8) Fuse Box (B-36) | (22) P-5 |
| (9) H-31 | (23) P-1 |
| (10) B-19 | (24) P-2 |
| (11) H-6 | (25) C-39 |
| (12) C-25 | (26) Relay and Fuse Box (X-5, X-6, X-7, X-19) |
| (13) E-3 | (27) H-12, H-14, H-16, H-20, H-26, H-48 |
| (14) H-51 | (28) B-11 |

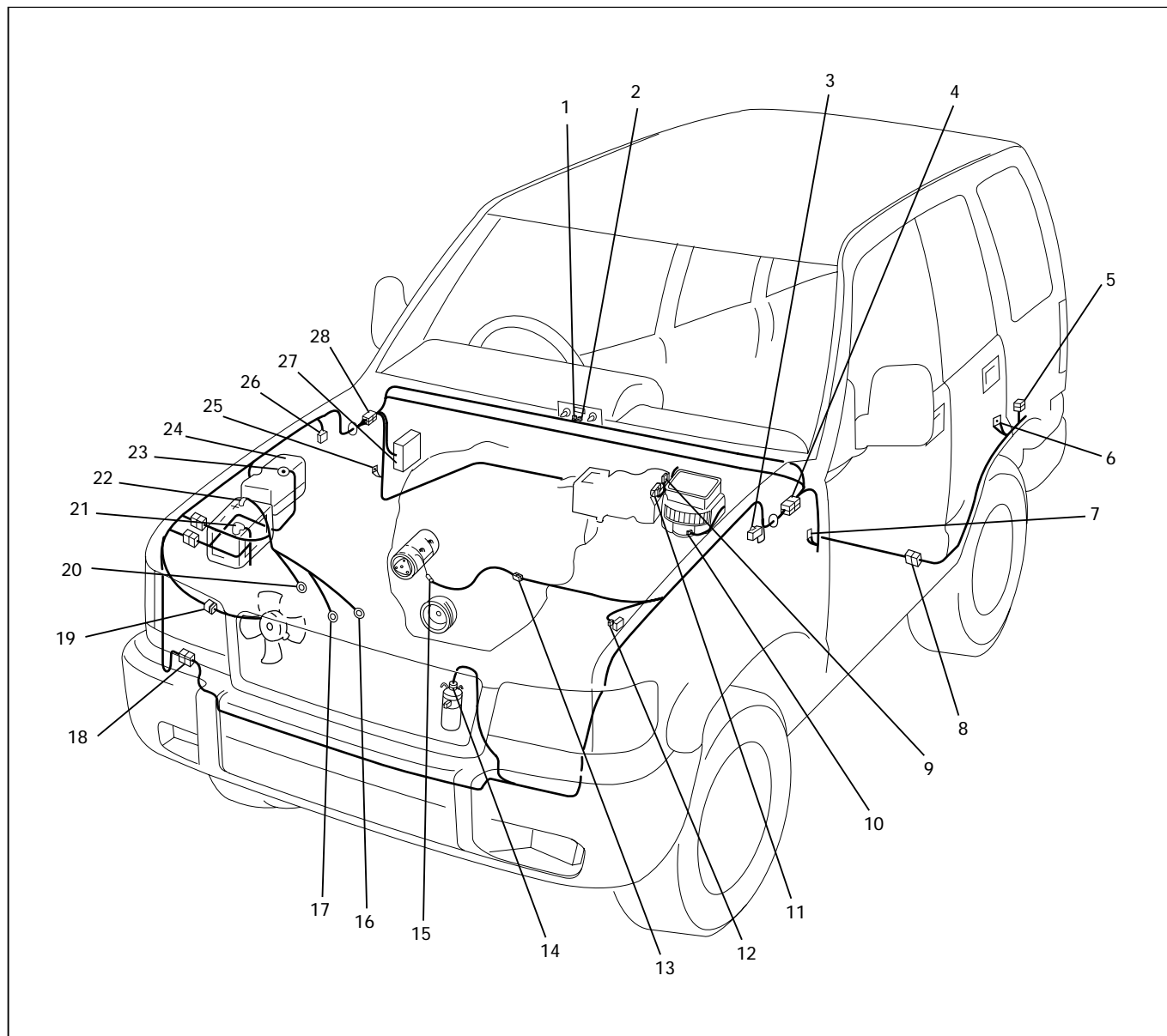
Circuit Diagram (RHD 4JG2)-1



Circuit Diagram (RHD 4JG2)-2



Parts Location (RHD 4JG2)

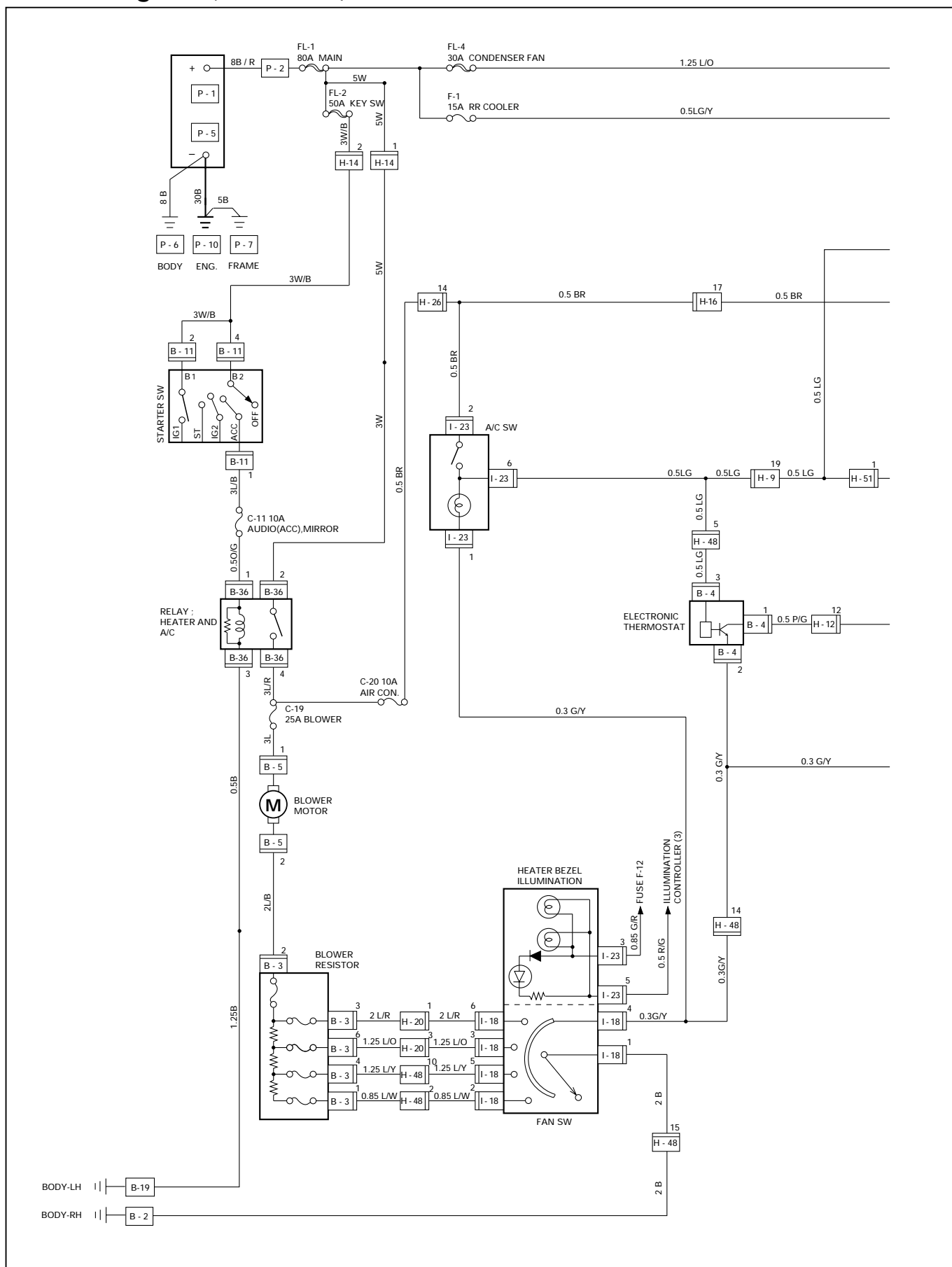


D08RWA29

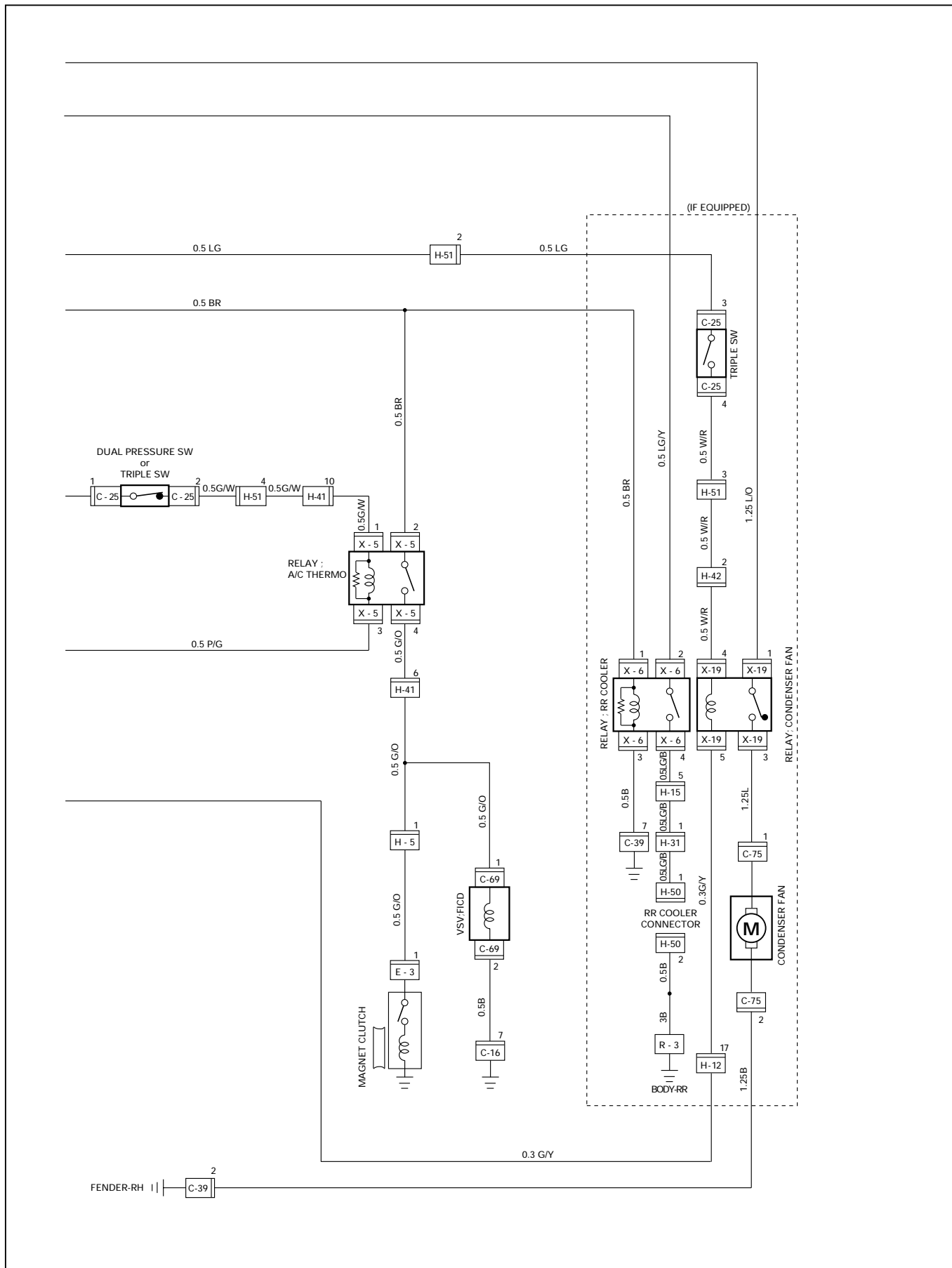
Legend

- | | |
|----------------------------------|--|
| (1) I-18 | (15) E-3 |
| (2) I-23 | (16) P-10 |
| (3) C-16 | (17) P-7 |
| (4) H-7, H-20, H-24 | (18) H-41, H-42 |
| (5) H-50 | (19) C-75 |
| (6) R-3 | (20) P-6 |
| (7) B-1 | (21) P-1 |
| (8) H-31 | (22) P-5 |
| (9) Electronic Thermostat (I-42) | (23) P-2 |
| (10) Blower Motor (B-5) | (24) Relay and Fuse Box (X-5, X-6, X-19) |
| (11) Blower Resistor (I-41) | (25) B-19 |
| (12) C-69 | (26) C-39 |
| (13) H-5 | (27) Fuse Box (B-36) |
| (14) C-25 | (28) H-12, H-13, H-14, H-16, H-26 |

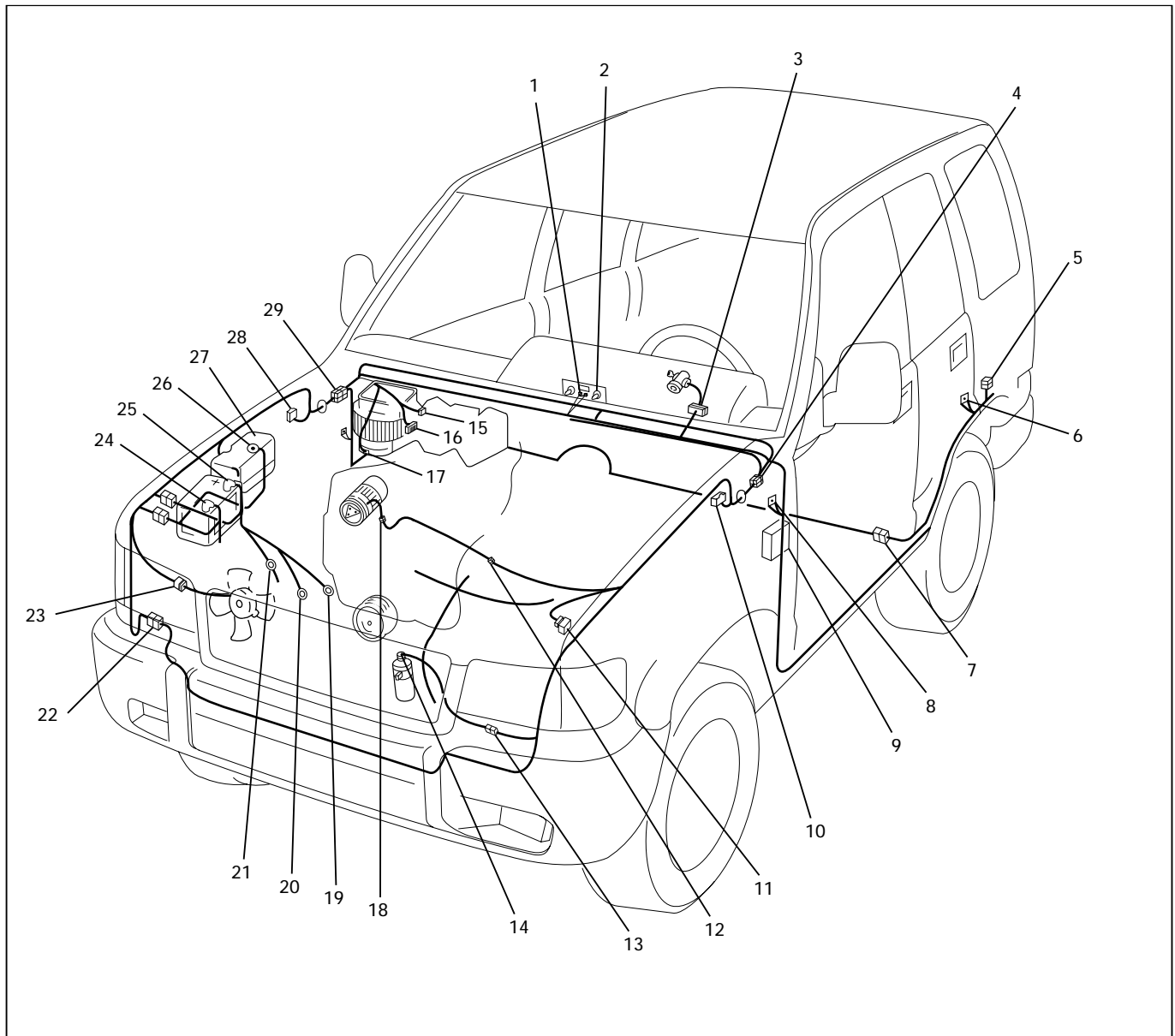
Circuit Diagram (LHD 4JG2)-1



Circuit Diagram (LHD 4JG2)-2



Parts Location (LHD 4JG2)



D08RWA28

Legend

- | | |
|---------------------|--|
| (1) I-18 | (15) Electronic Thermostat (B-4) |
| (2) I-23 | (16) Blower Resistor (B-3) |
| (3) B-11 | (17) Blower Motor (B-5) |
| (4) H-7, H-9, H-26 | (18) E-3 |
| (5) H-50 | (19) P-10 |
| (6) R-3 | (20) P-7 |
| (7) H-31 | (21) P-6 |
| (8) B-19 | (22) H-41, H-42 |
| (9) Fuse Box (B-36) | (23) C-75 |
| (10) C-16 | (24) P-1 |
| (11) C-69 | (25) P-5 |
| (12) H-5 | (26) P-2 |
| (13) H-51 | (27) Relay and Fuse Box (X-5, X-6, X-19) |
| (14) C-25 | (28) C-39 |
| | (29) H-12, H-14, H-16, H-20, H-48 |

Sun Roof

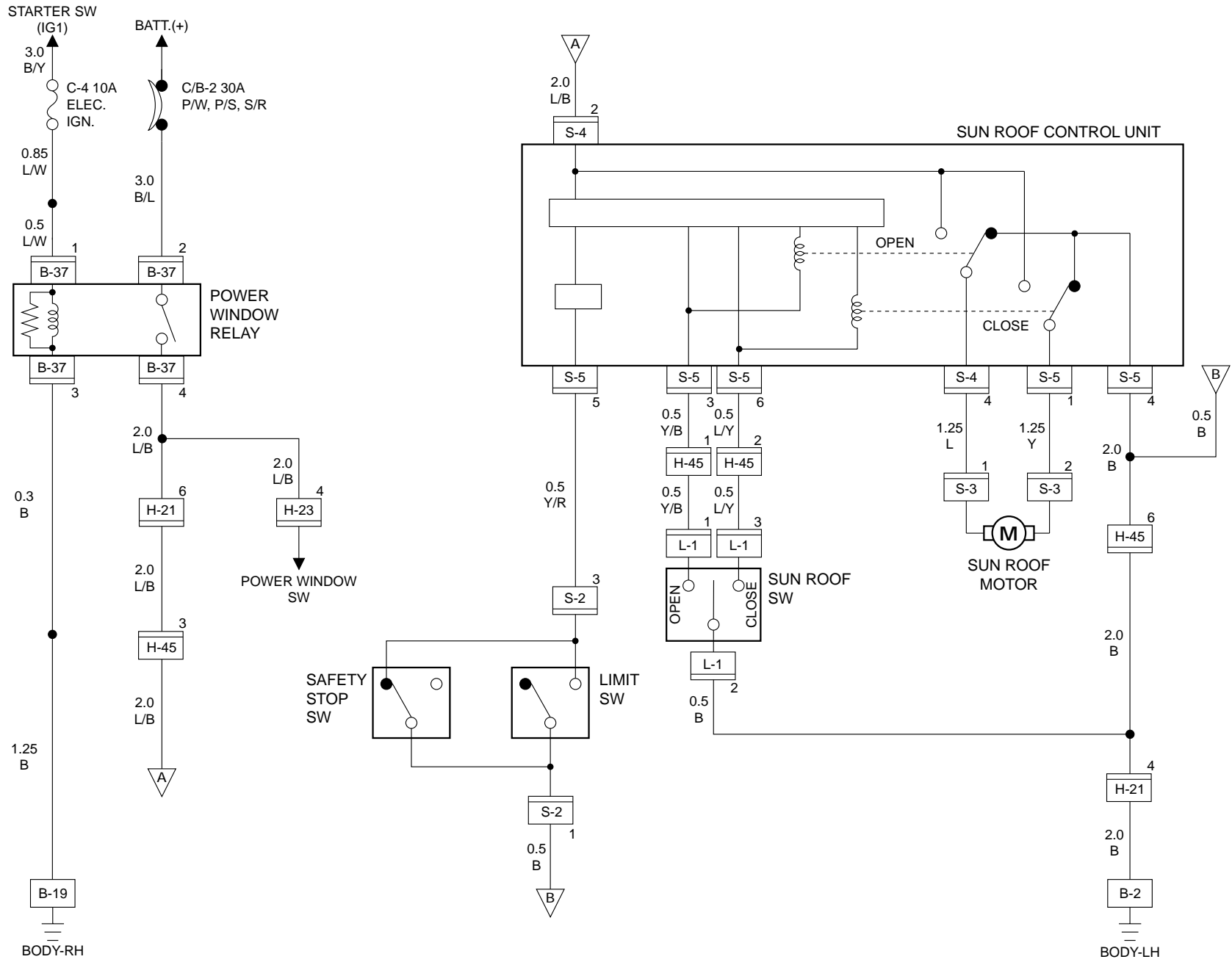
General Description

The circuit consists of sun roof switch, sun roof control unit, safety stop switch, limit switch and sun roof motor.

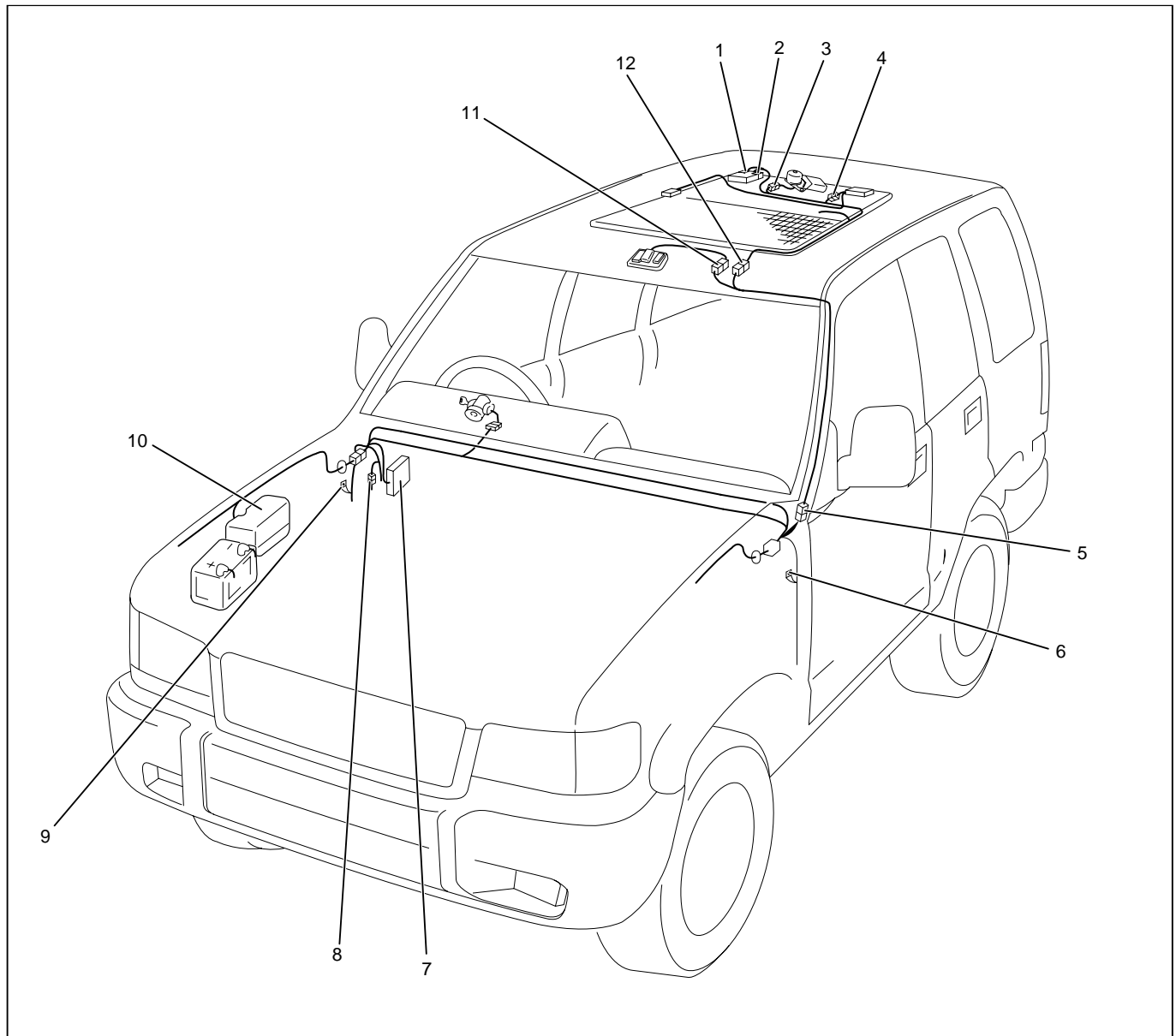
When sun roof switch is turned on, battery voltage is applied to sun roof control unit through circuit breaker and power window relay.

Accordingly, when sun roof switch is set to "Open" or "Close" position, open or close relay incorporated into the control unit is activated to change rotational direction of sun roof motor to open or close sun roof.

Also, operational process (full close → limit stop → full open → safety stop → full close) of sun roof is controlled by the control unit in accordance with signals received from safety stop switch and limit switch.



Parts Location (RHD)

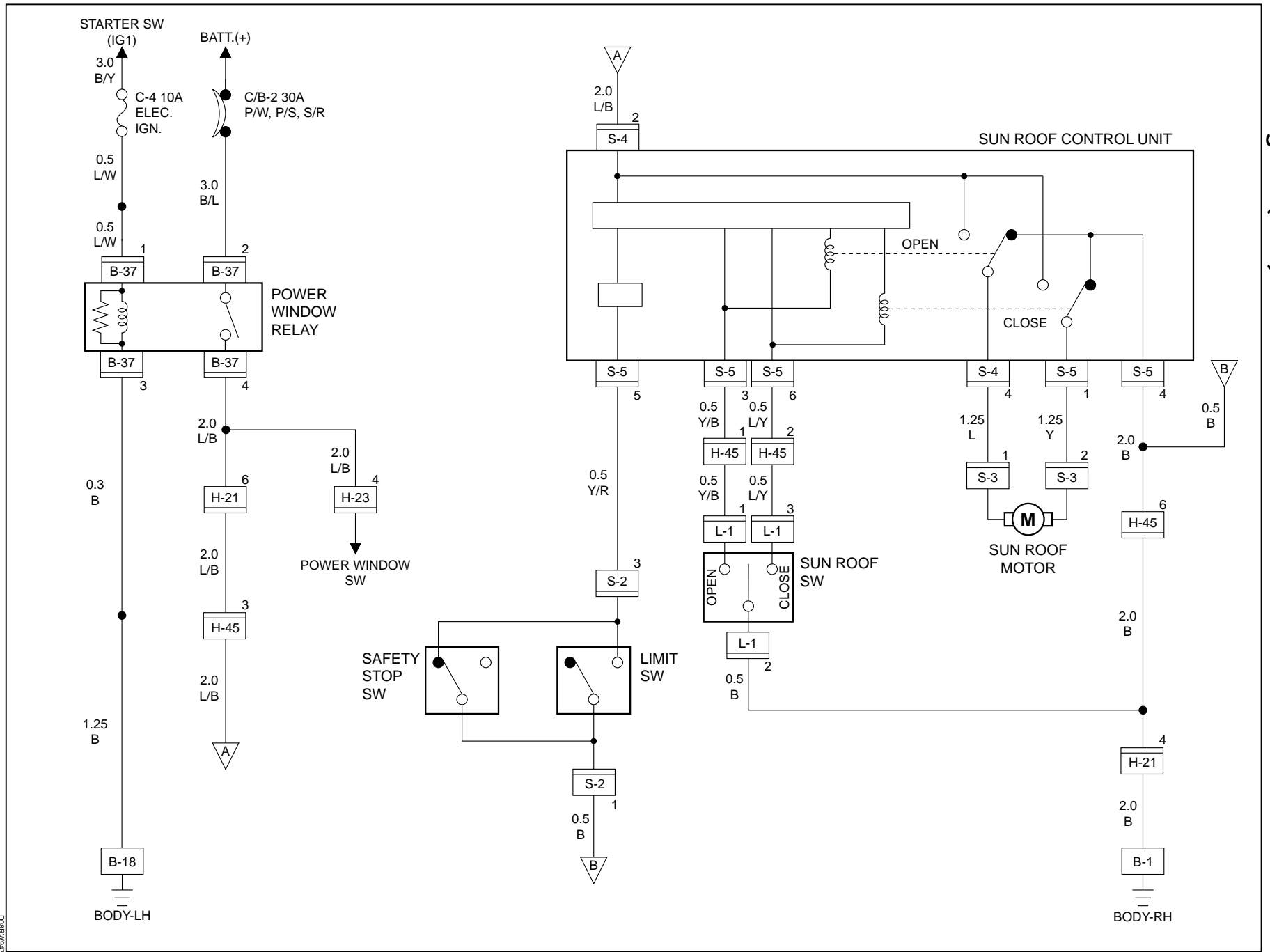


D08RW995

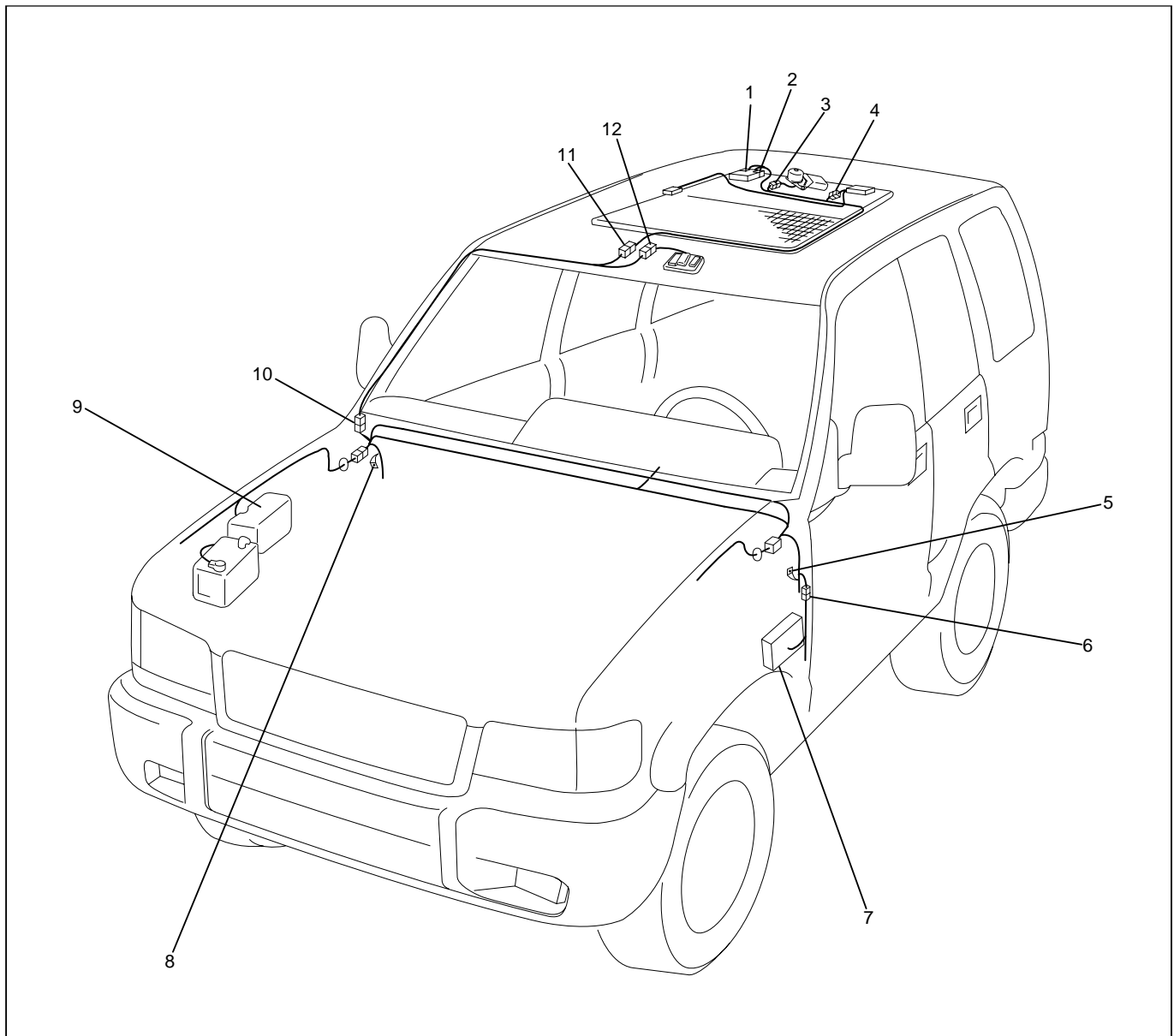
Legend

- (1) S-5
- (2) S-4
- (3) S-3
- (4) S-2
- (5) H-21
- (6) B-2

- (7) Fuse Box (B-37)
- (8) H-23
- (9) B-19
- (10) Relay and Fuse Box
- (11) L-1
- (12) H-45



Parts Location (LHD)



D08RW388

Legend

- | | |
|----------|------------------------|
| (1) S-5 | (7) Fuse Box (B-37) |
| (2) S-4 | (8) B-1 |
| (3) S-3 | (9) Relay and Fuse Box |
| (4) S-2 | (10) H-21 |
| (5) B-18 | (11) H-45 |
| (6) H-23 | (12) L-1 |

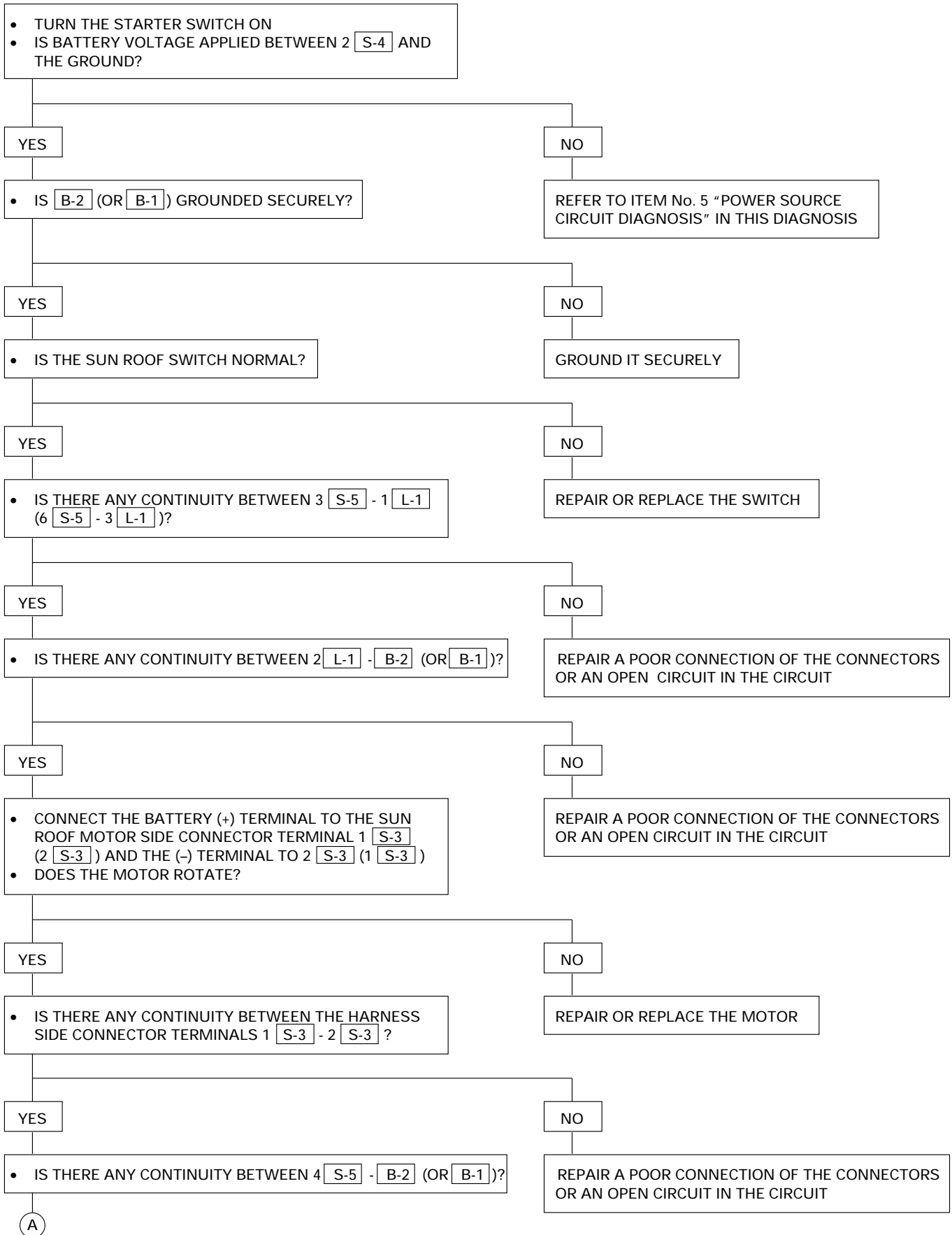
Diagnosis

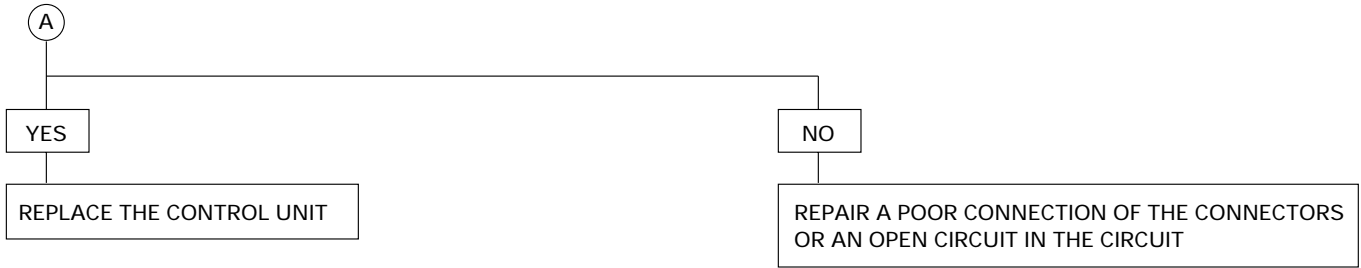
Quick Chart for Check Points

Check point Trouble mode	C/B-2 (30A)	Fuse C-4 (10A)	Power win- dow relay	Sun roof switch	Sun roof control unit	Sun roof motor	Safety stop switch	Limit switch	Cable har- ness
1. Sun roof does not open				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
2. Sun roof does not close				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
3. Safety stop mechanism does not operate before sun roof closes completely					<input type="radio"/>		<input type="radio"/>		<input type="radio"/>
4. Limit switch mechanism does not operate before sun roof open completely					<input type="radio"/>			<input type="radio"/>	<input type="radio"/>
5. Power source circuit diagnosis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>

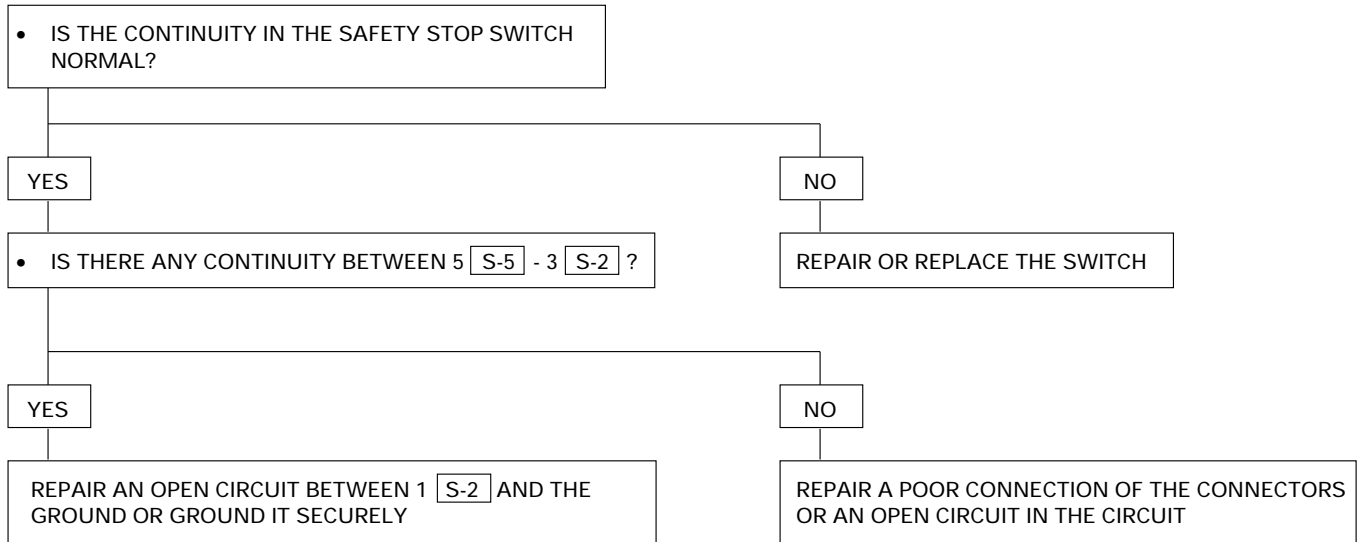
1. Sun Roof Does Not Open

2. Sun Roof Does Not Close

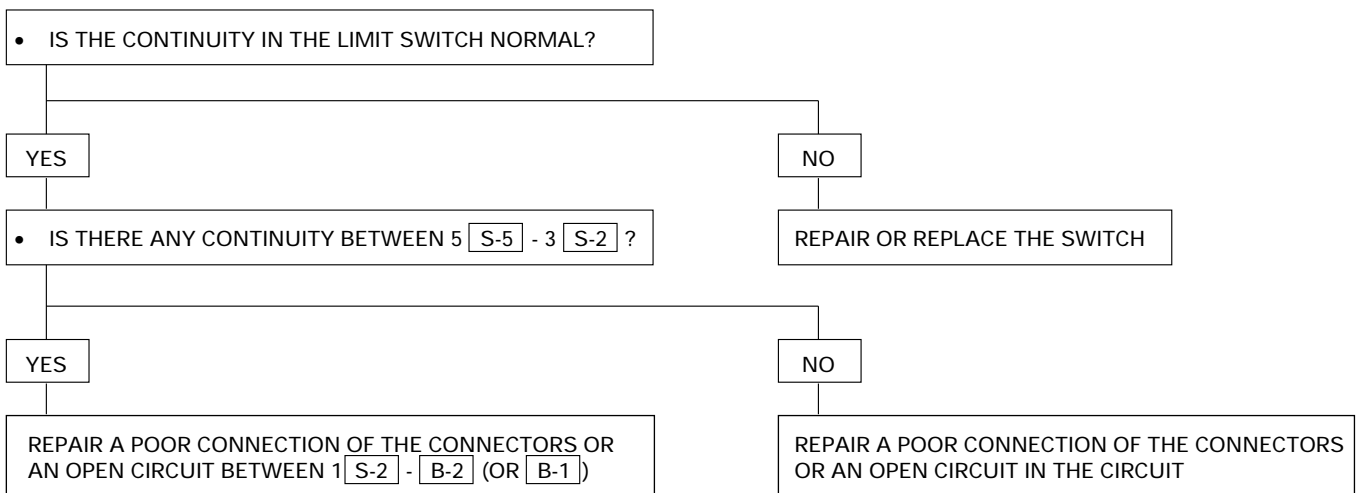




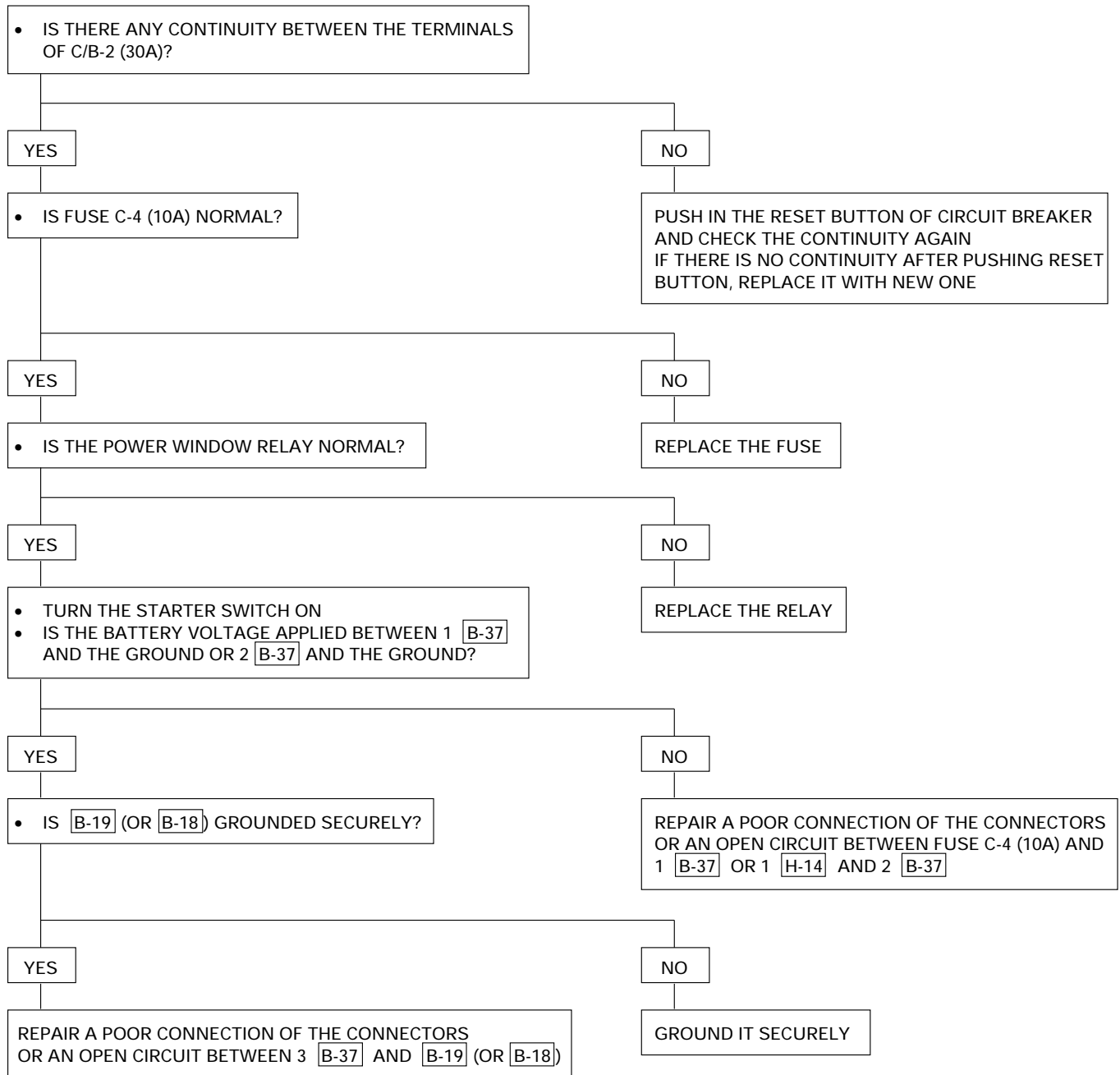
3. Safety Stop Mechanism Does Not Operate Before Sun Roof Closes Completely



4. Limit Switch Mechanism Does Not Operate Before Sun Roof Open Completely



5. Power Source Circuit Diagnosis



Seat Heater

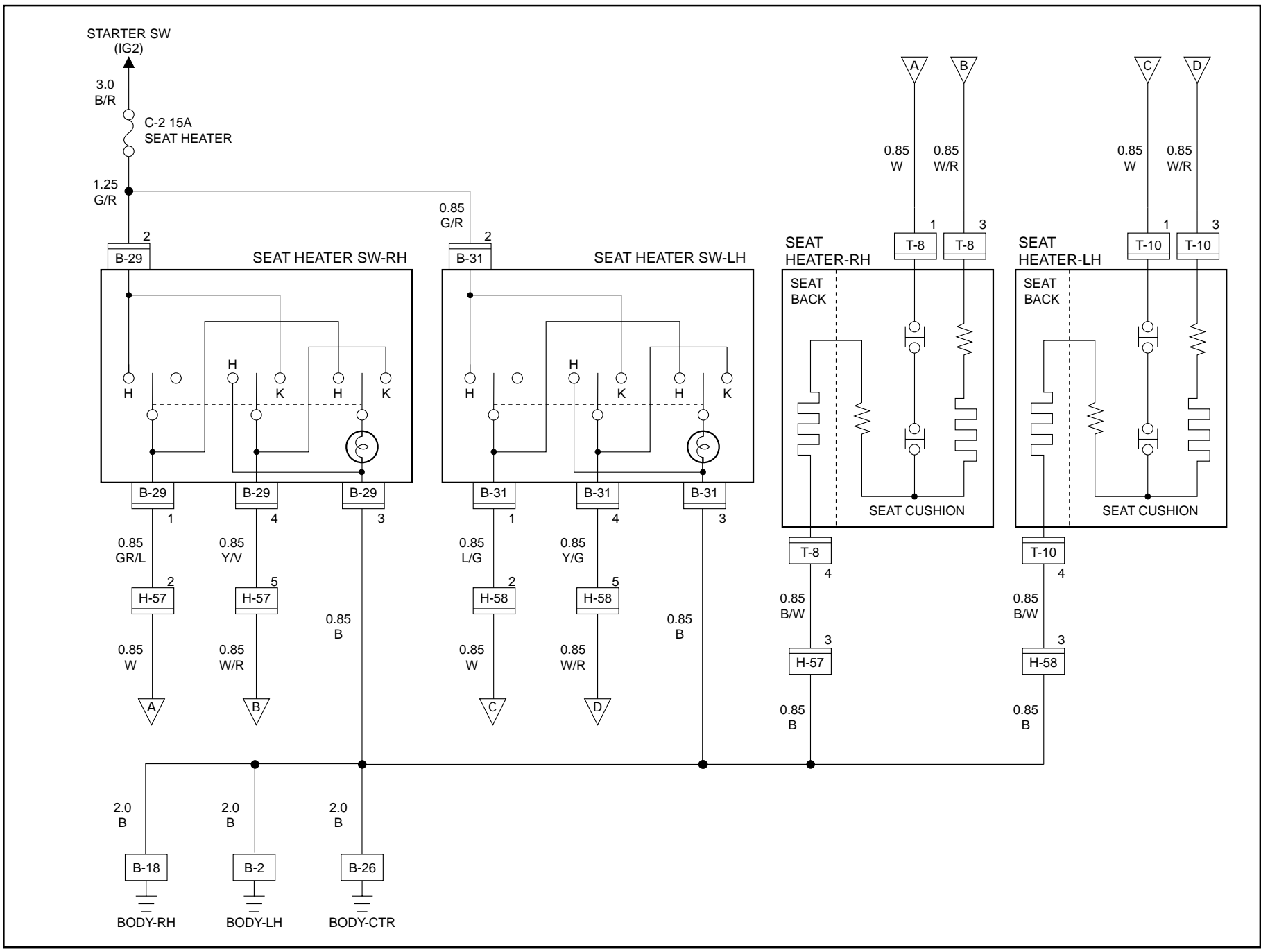
General Description

The circuit consists of seat heater switch and seat heater unit.

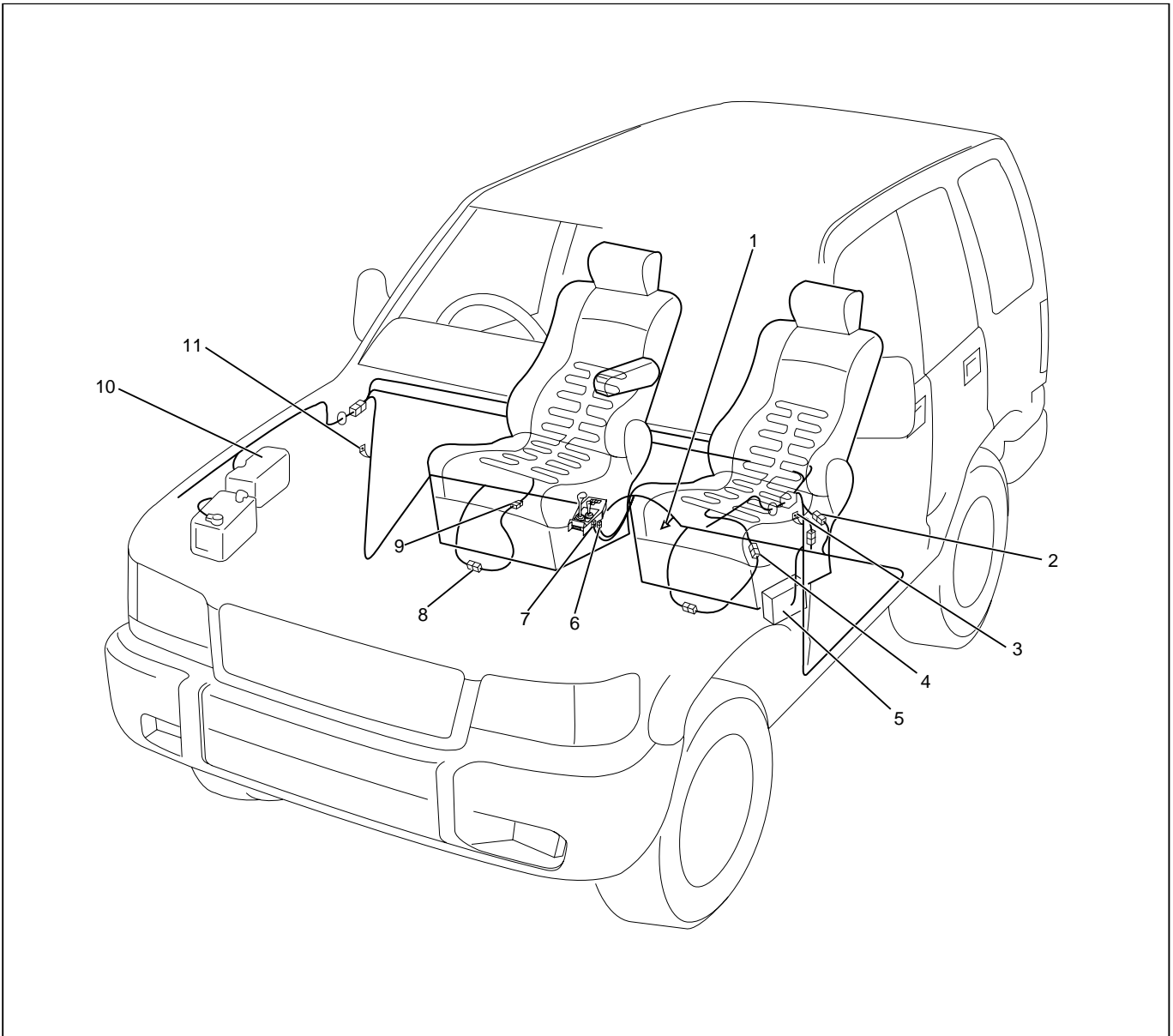
Seat heater unit is incorporated into front seats.

To prevent from being overheated, seat heater unit has thermostat.

Circuit Diagram (RHD)



Parts Location (RHD)

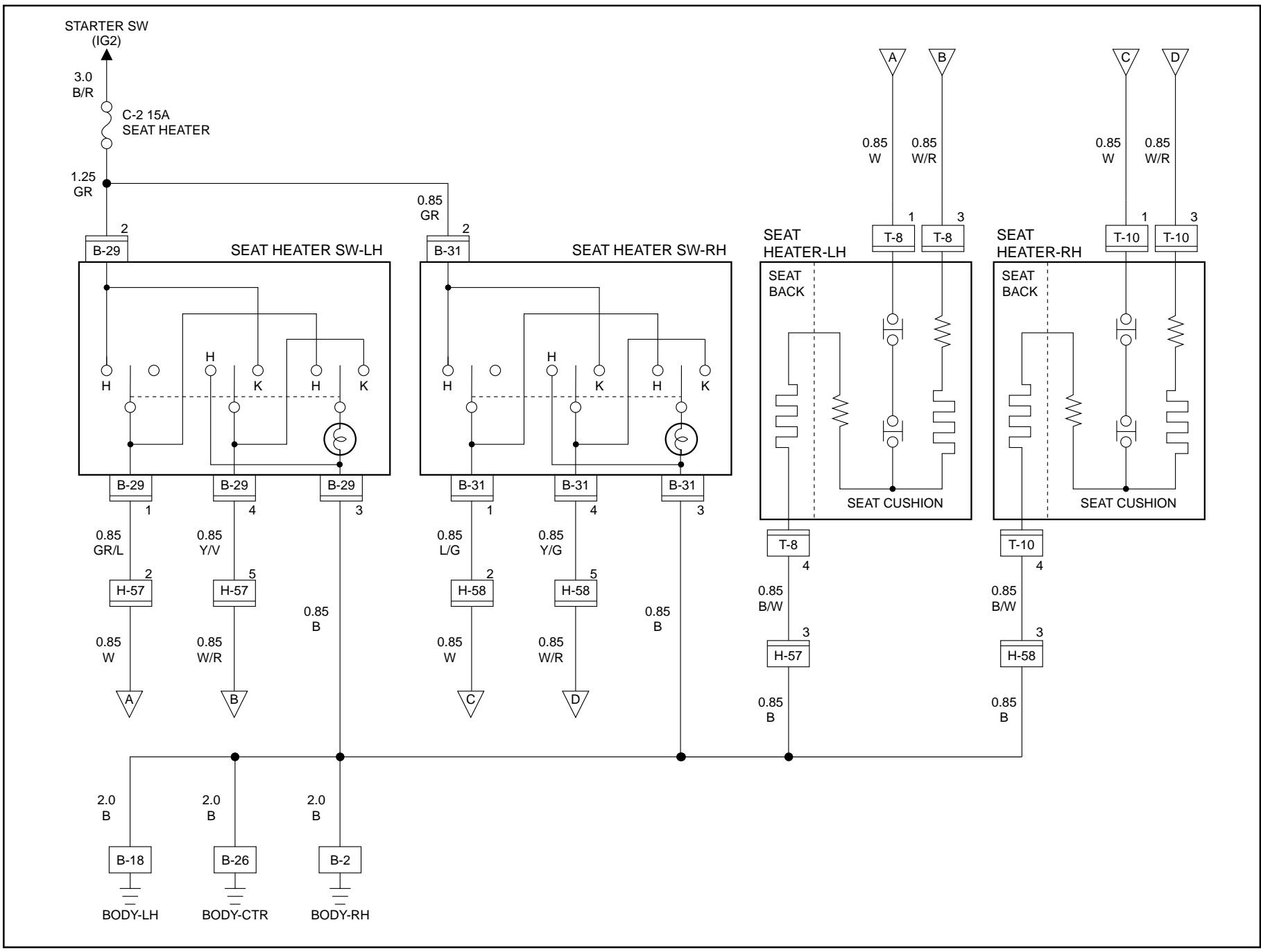


D08RW993

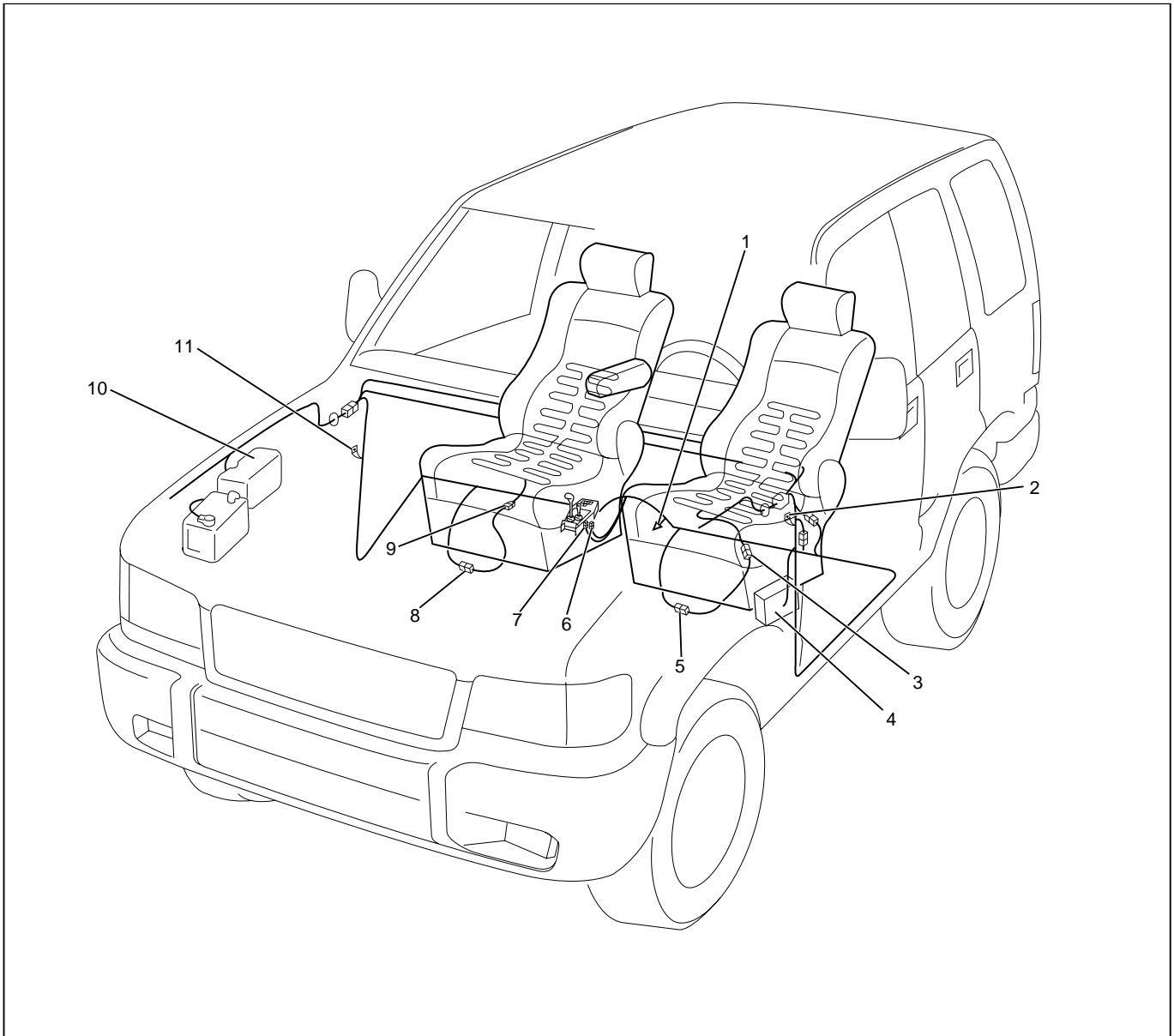
Legend

- | | |
|--------------|-------------------------|
| (1) B-26 | (6) B-31 |
| (2) H-58 | (7) B-29 |
| (3) B-2 | (8) H-57 |
| (4) T-10 | (9) T-8 |
| (5) Fuse Box | (10) Relay and Fuse Box |
| | (11) B-18 |

Circuit Diagram (LHD)



Parts Location (LHD)



D08RW992

Legend

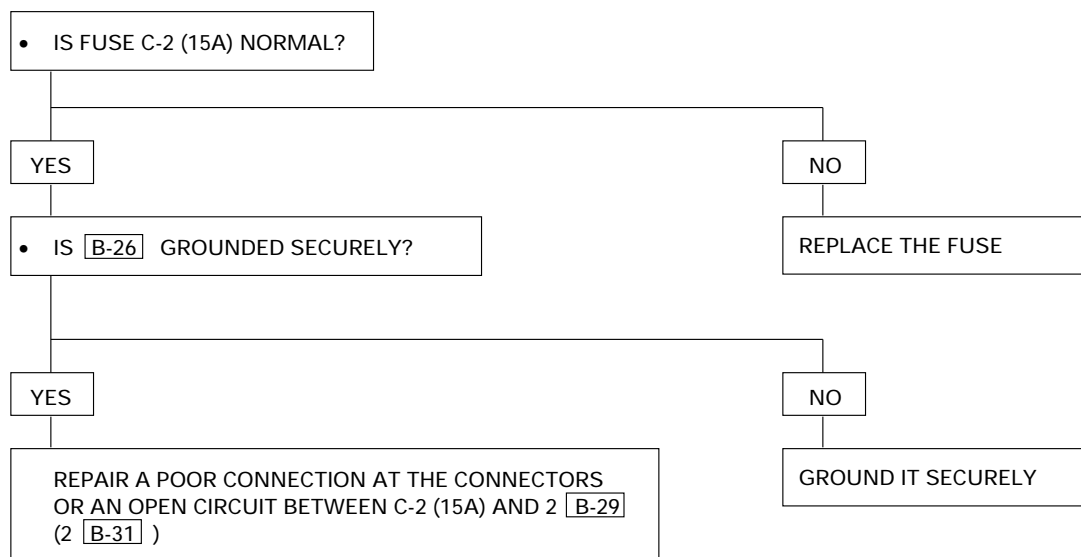
- | | |
|--------------|-------------------------|
| (1) B-26 | (6) B-31 |
| (2) B-18 | (7) B-29 |
| (3) T-8 | (8) H-58 |
| (4) Fuse Box | (9) T-10 |
| (5) H-57 | (10) Relay and Fuse Box |
| | (11) B-2 |

Diagnosis

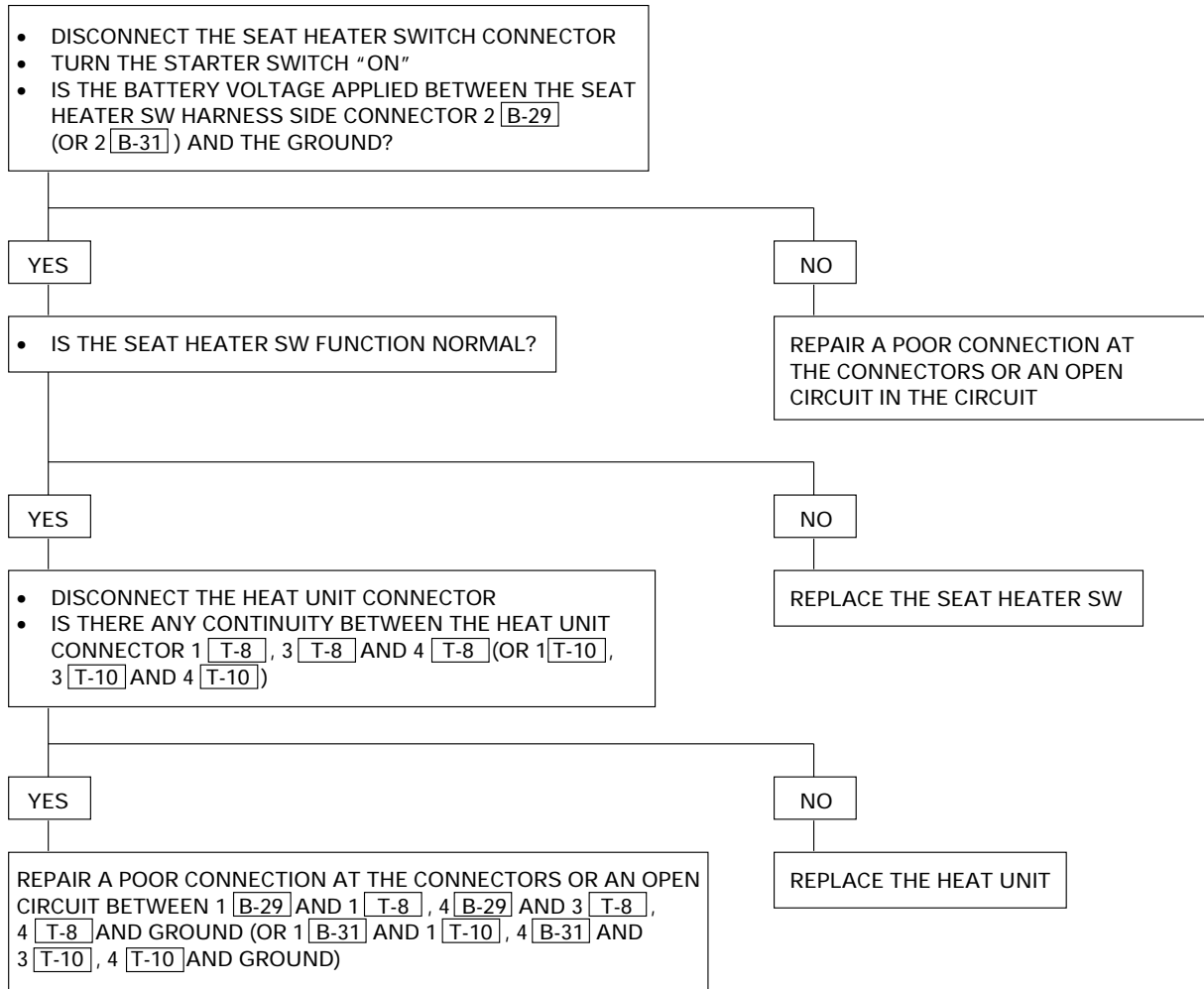
Quick Chart for Check Points

Trouble mode	Check point	Fuse C-2 (15A)	Seat heater SW		Heat unit		Cable harness
			Driver side	Passenger side	Driver side	Passenger side	
1. Seat heater on both sides does not heat up		○					○
2. Seat heater on the driver (or passenger) side does not heat up			○	○	○	○	○
3. Heat (or keep) position does not heat up			○	○	○	○	

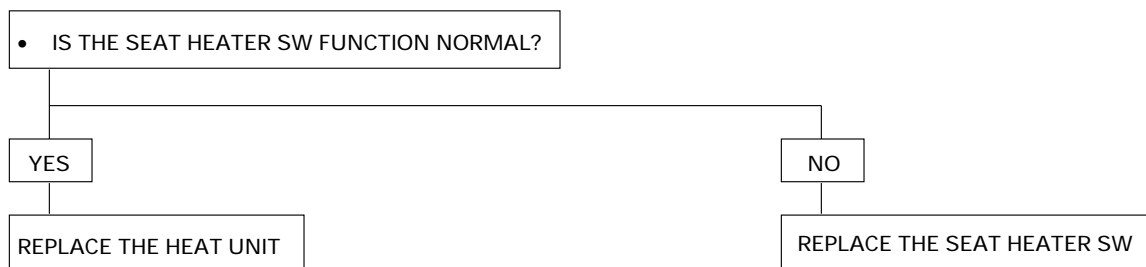
1. Seat Heater on Both Sides Does Not Heat Up



2. Seat Heater on The Driver (Or Passenger) Side Does Not Heat Up



3. Heat (Or Keep) Position Does Not Heat Up

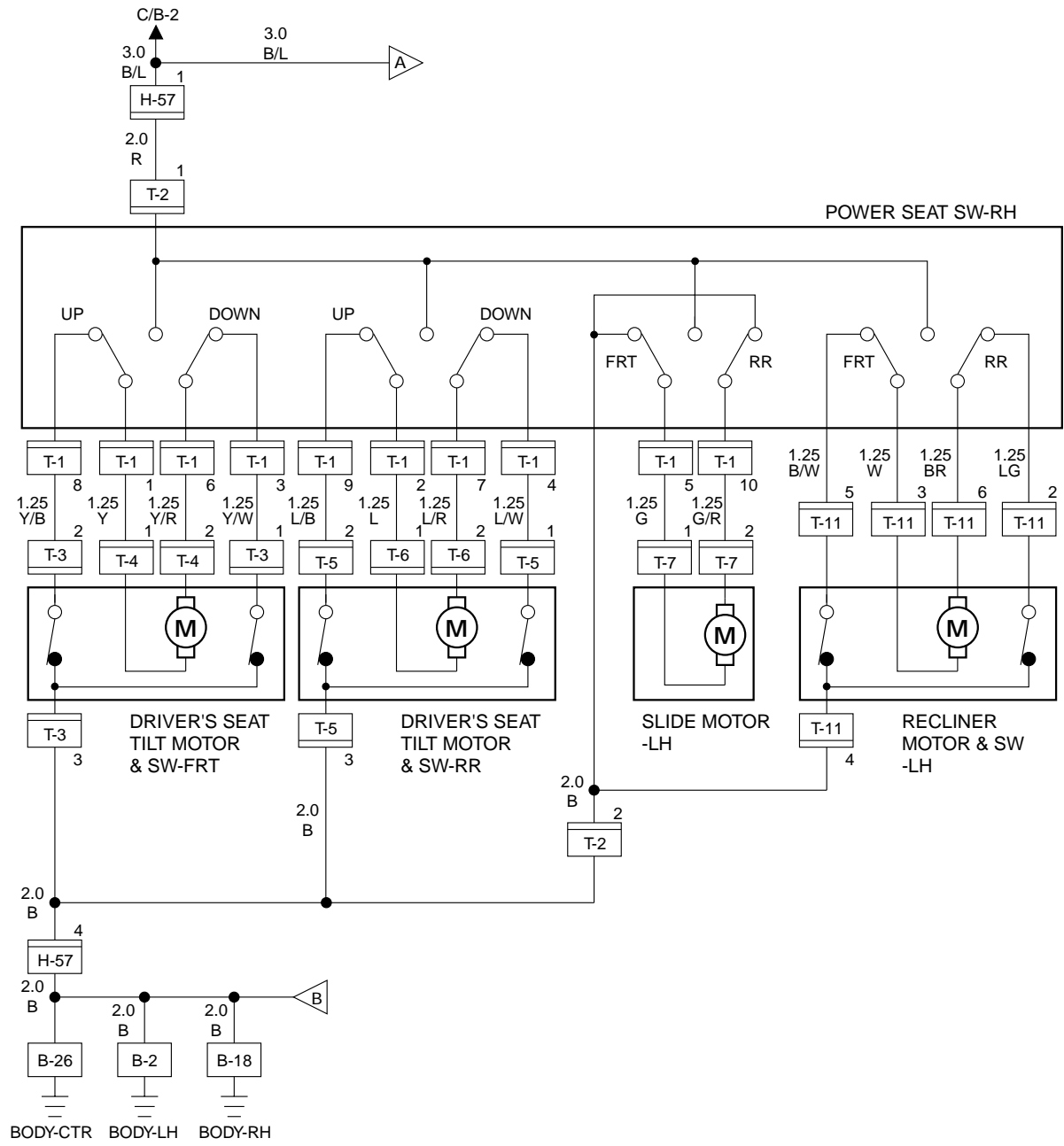


Power Seat

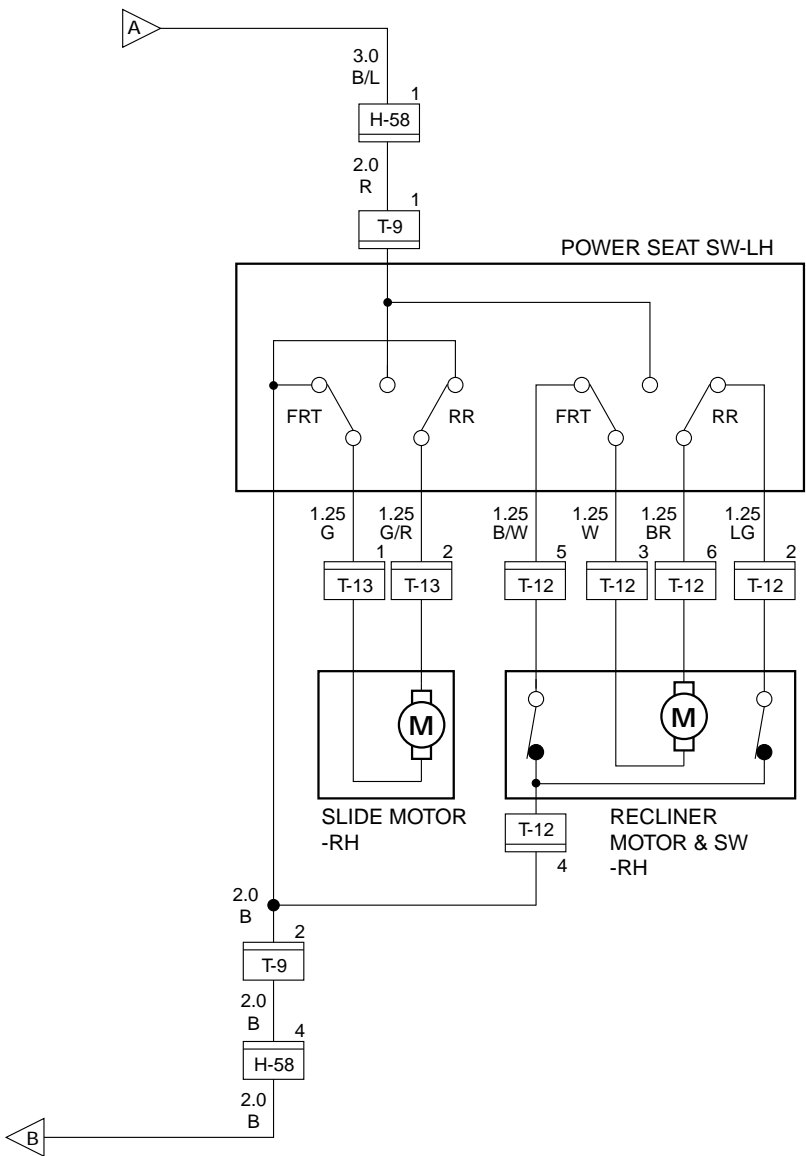
General Description

The circuit consists of power seat switch, front tilt motor (driver's seat only), rear tilt motor (driver's seat only), slide motor and recliner motor.

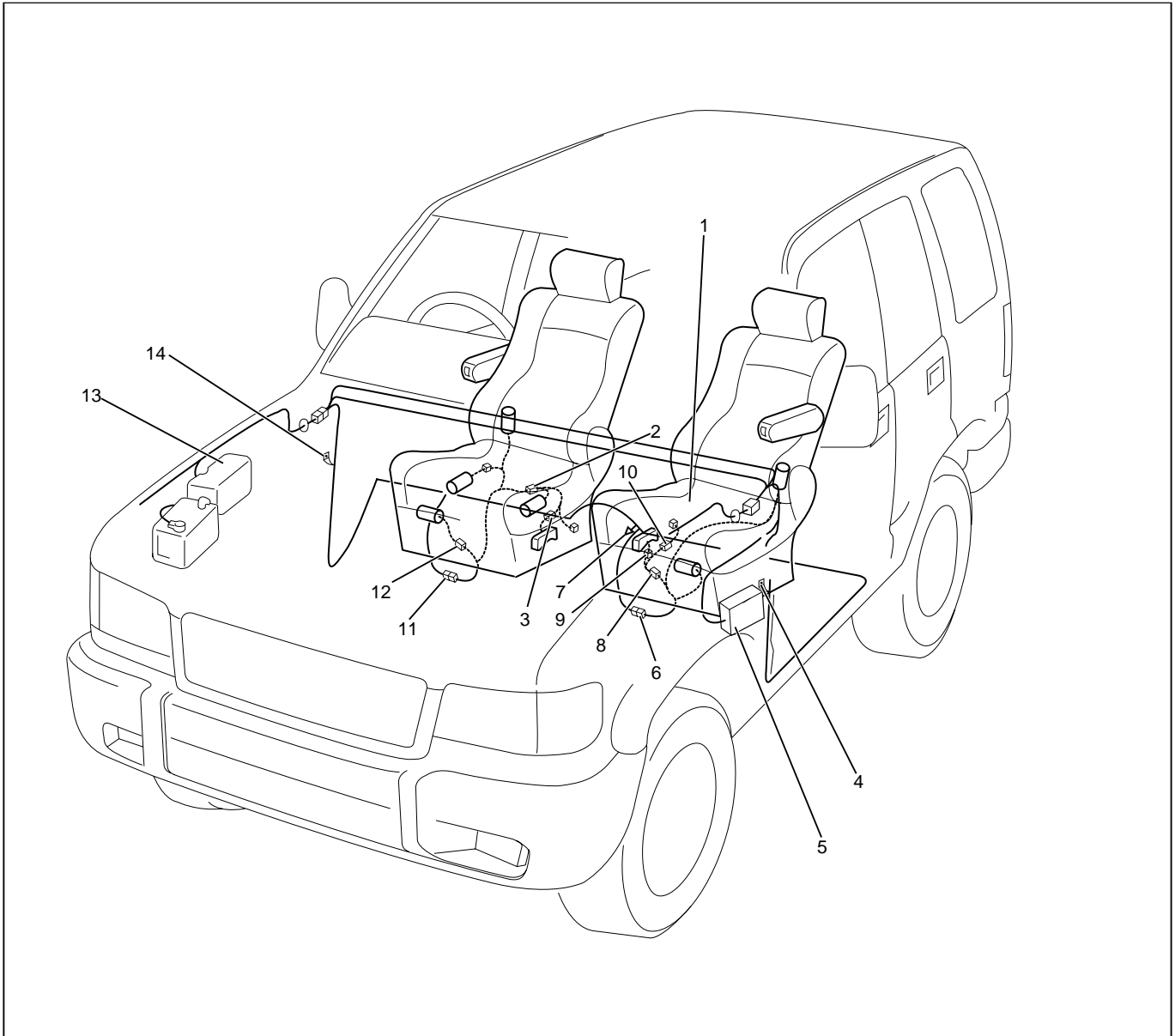
Power seat switch has a tilt and slide switch and a recliner switch. The motor built in the seat can be actuated by operating these switches to move the seat to desired position, independent of position of starter switch.



Circuit Diagram (RHD)-2



Parts Location (RHD)

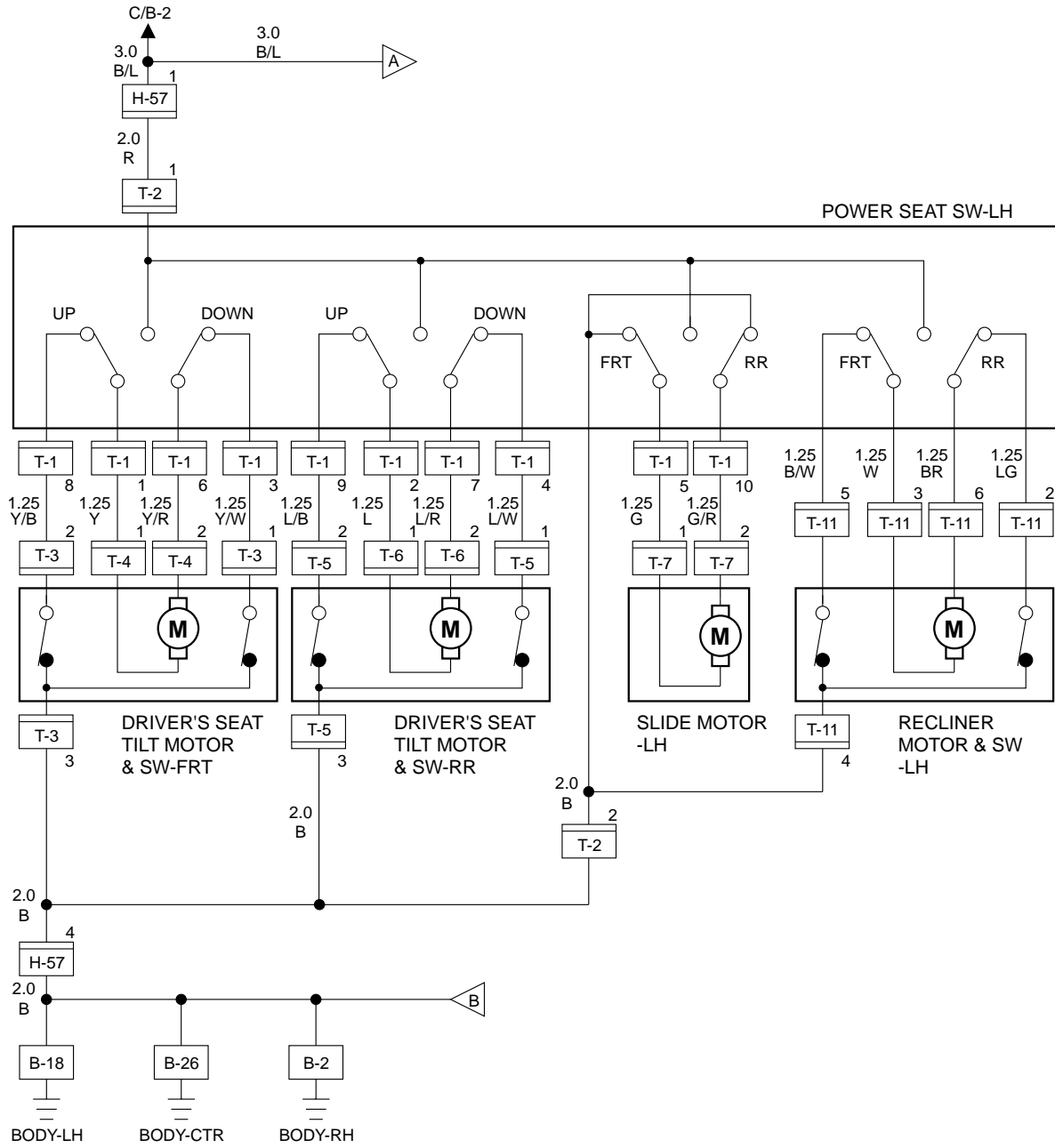


D08RW996

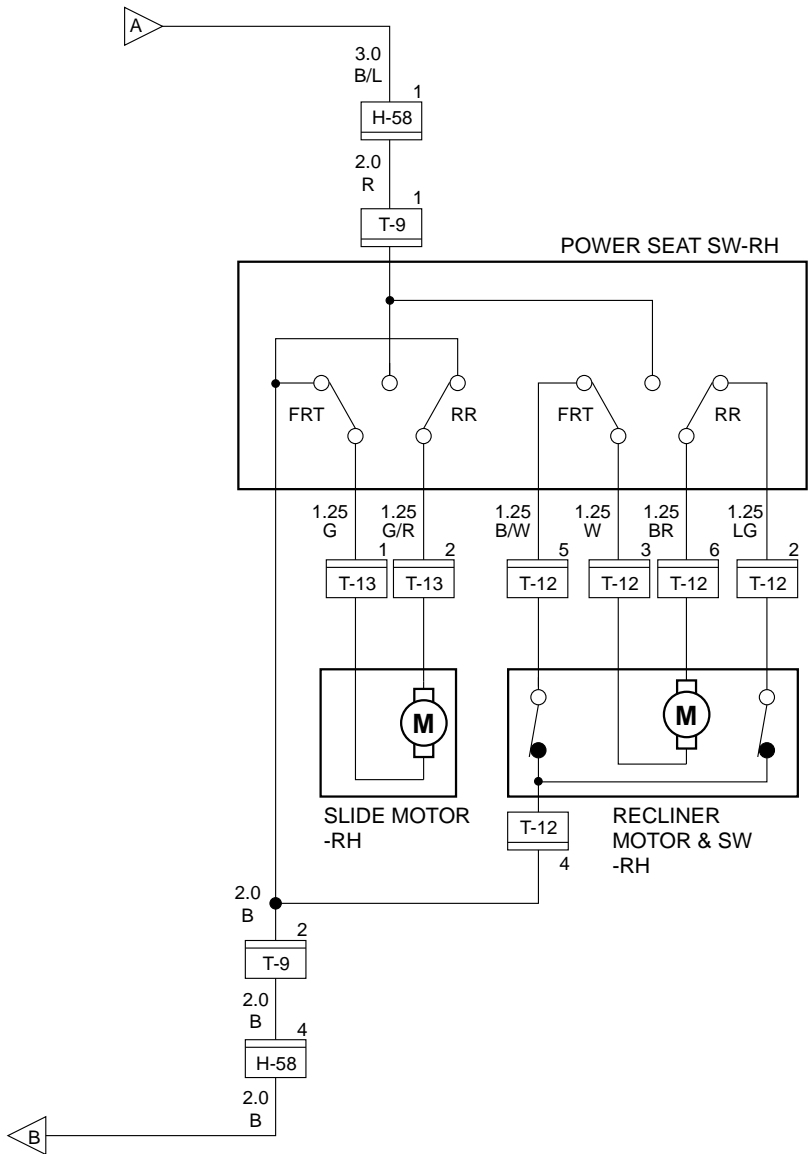
Legend

- | | |
|--------------|-------------------------|
| (1) T-6 | (8) T-9 |
| (2) T-4 | (9) T-13 |
| (3) T-1 | (10) T-12 |
| (4) B-2 | (11) H-57 |
| (5) Fuse Box | (12) T-7 |
| (6) H-58 | (13) Relay and Fuse Box |
| (7) B-26 | (14) B-18 |

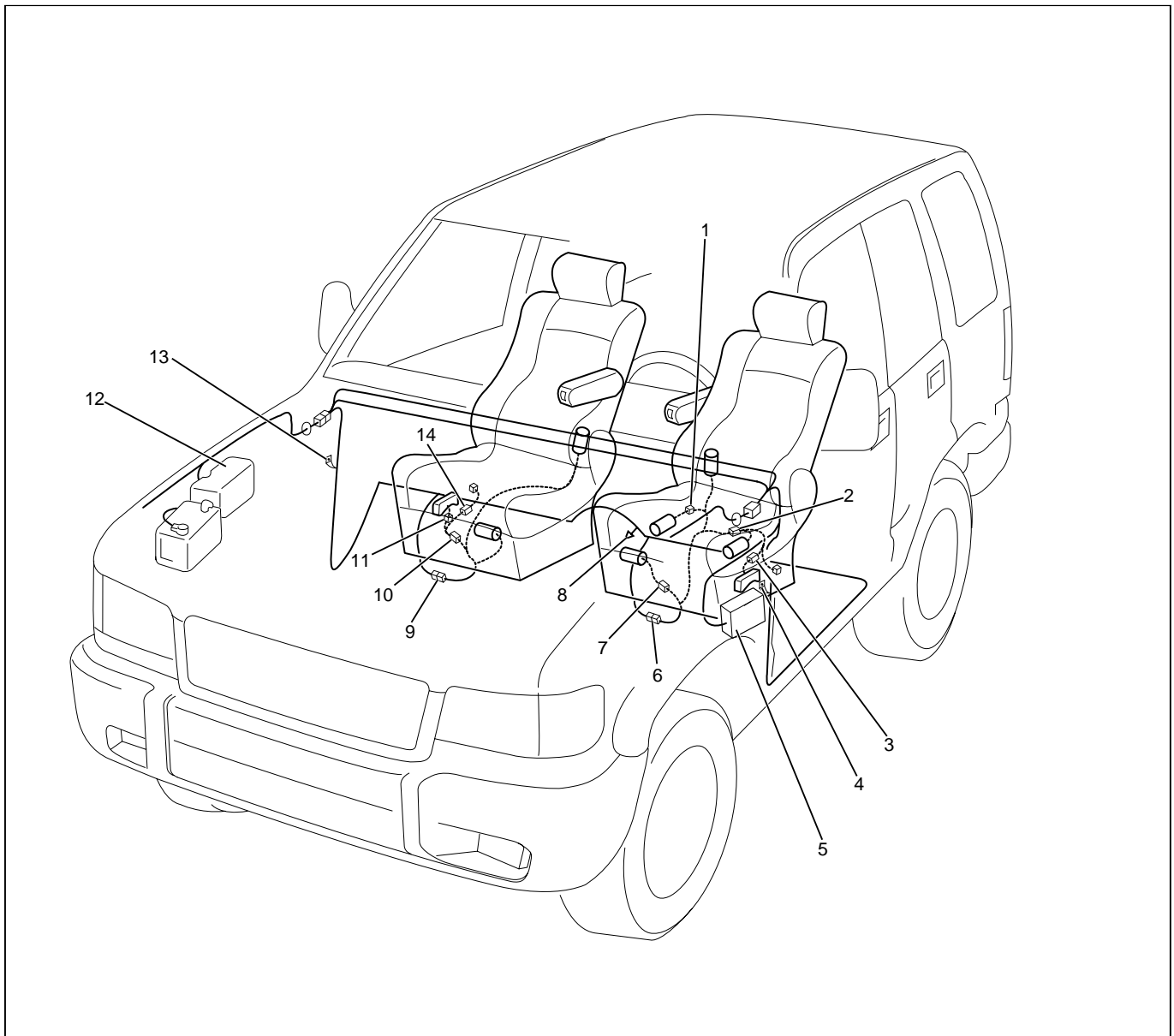
Circuit Diagram (LHD)-1



Circuit Diagram (LHD)-2



Parts Location (LHD)



D08RW994

Legend

- | | |
|--------------|-------------------------|
| (1) T-6 | (8) B-26 |
| (2) T-4 | (9) H-58 |
| (3) T-1 | (10) T-9 |
| (4) B-18 | (11) T-13 |
| (5) Fuse Box | (12) Relay and Fuse Box |
| (6) H-57 | (13) B-2 |
| (7) T-7 | (14) T-12 |

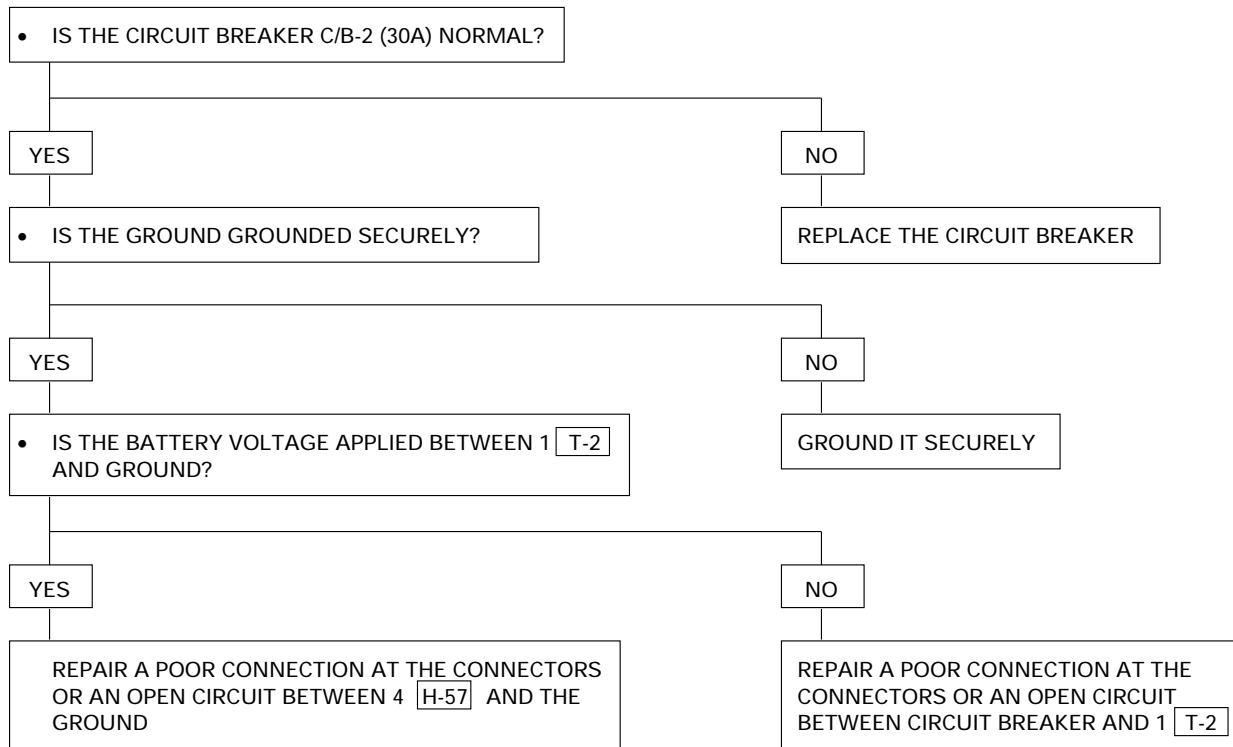
Diagnosis

Quick Chart for Check Points

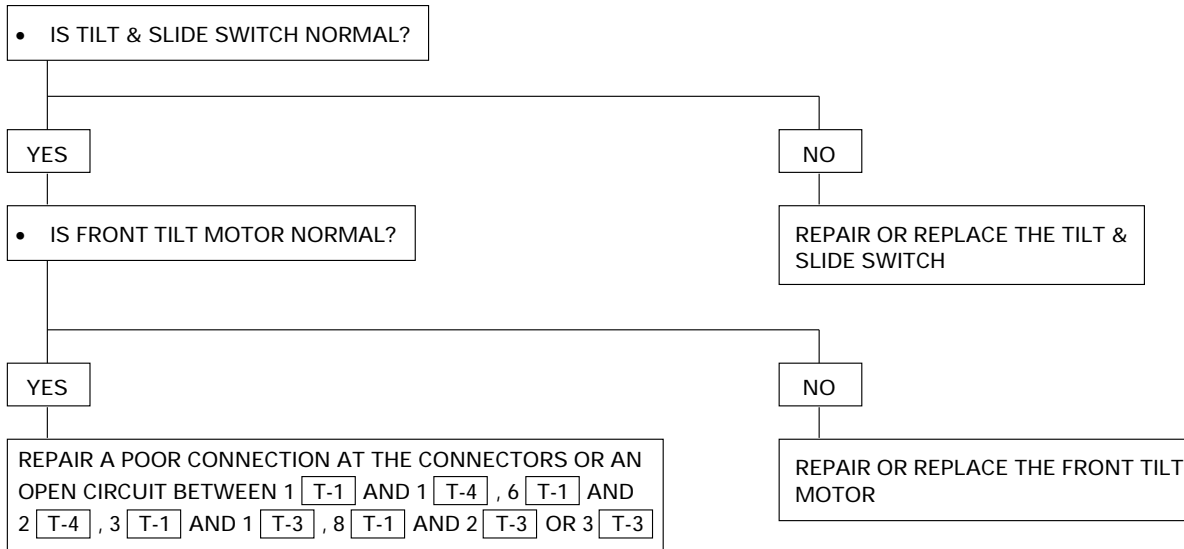
Trouble mode / Check point		Circuit breaker (30A)	Tilt & slide SW			Tilt & slide motor			Reclin- ing SW	Reclin- ing motor	Cable har- ness
			FRT tilt	RR tilt	Slide	FRT tilt	RR tilt	Slide			
Driver seat	1. Power seat does not operate at any direction	○									○
	2. Front tilt mechanism does not operate		○			○					○
	3. Rear tilt mechanism does not operate			○			○				○
	4. Sliding mechanism does not operate				○			○			○
	5. Reclining mechanism does not operate								○	○	○
Passen- ger seat	1. Power seat does not operate at any direction	○									○
	2. Sliding mechanism does not operate				○			○			○
	3. Reclining mechanism does not operate								○	○	○

Driver Seat

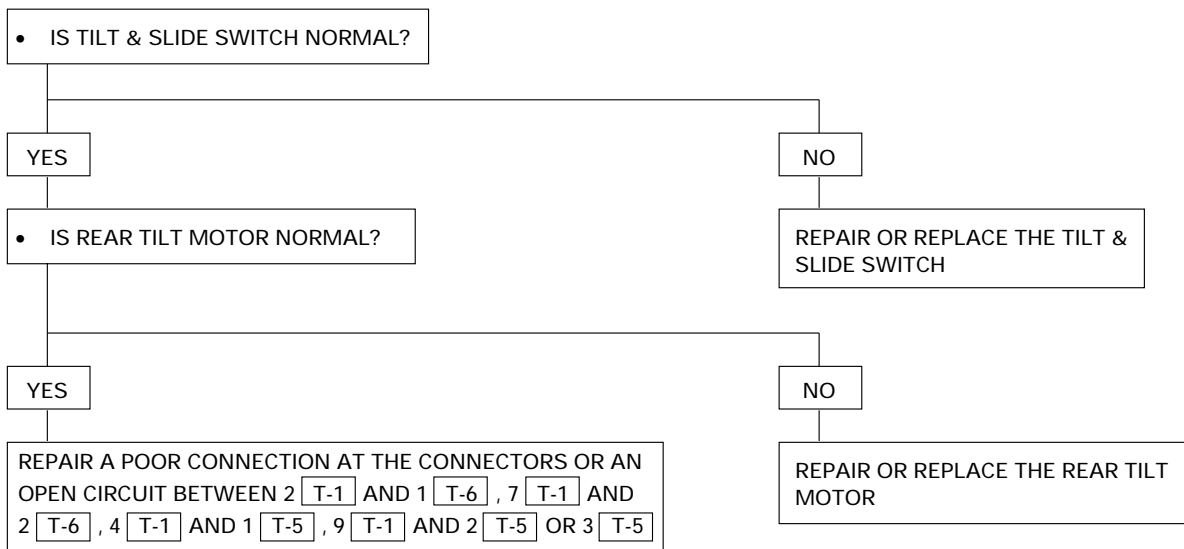
1. Power Seat Does Not Operate At Any Direction



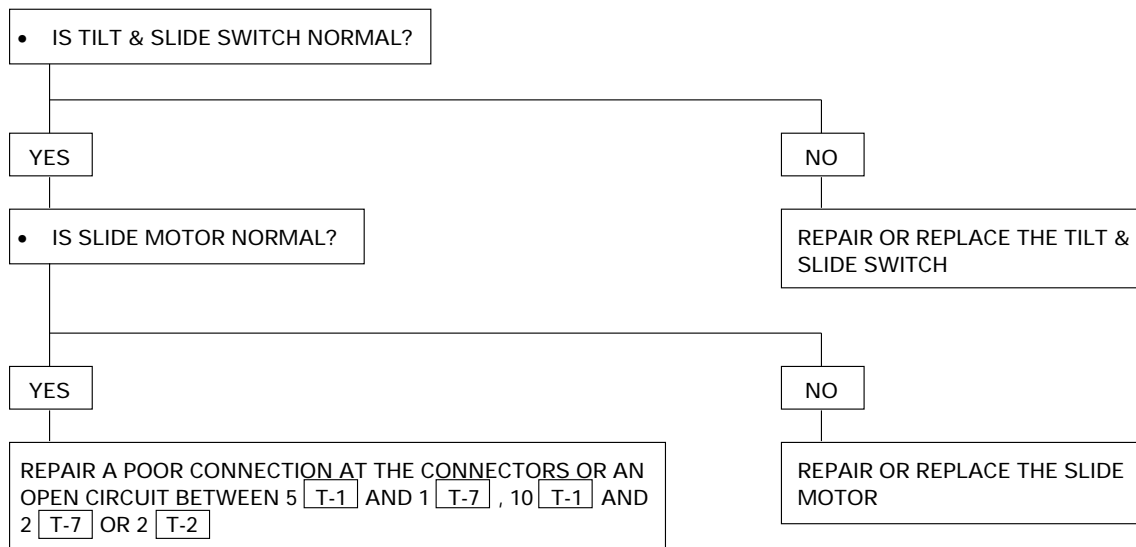
2. Front Tilt Mechanism Does Not Operate



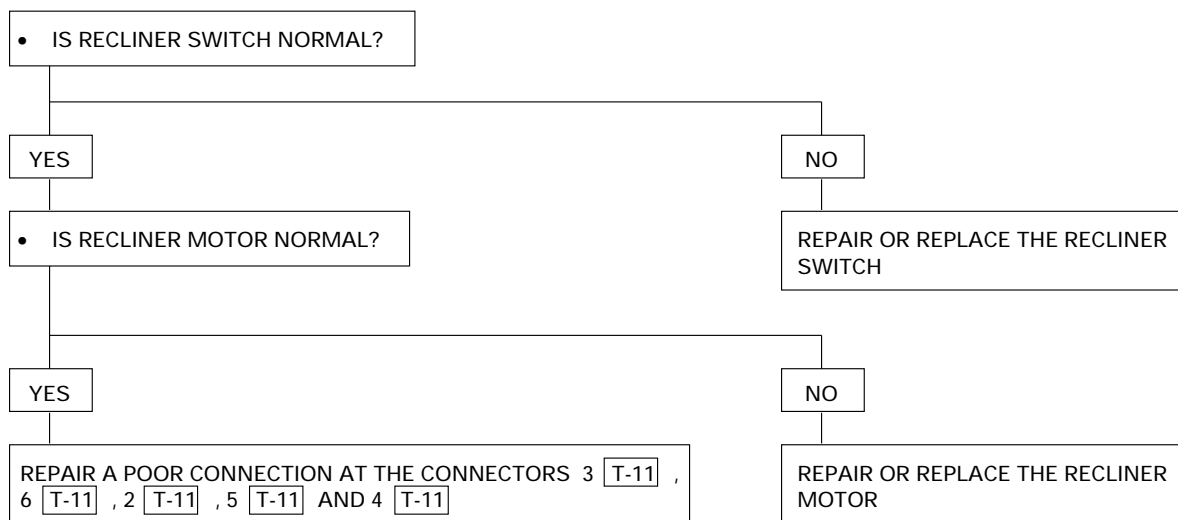
3. Rear Tilt Mechanism Does Not Operate



4. Sliding Mechanism Does Not Operate

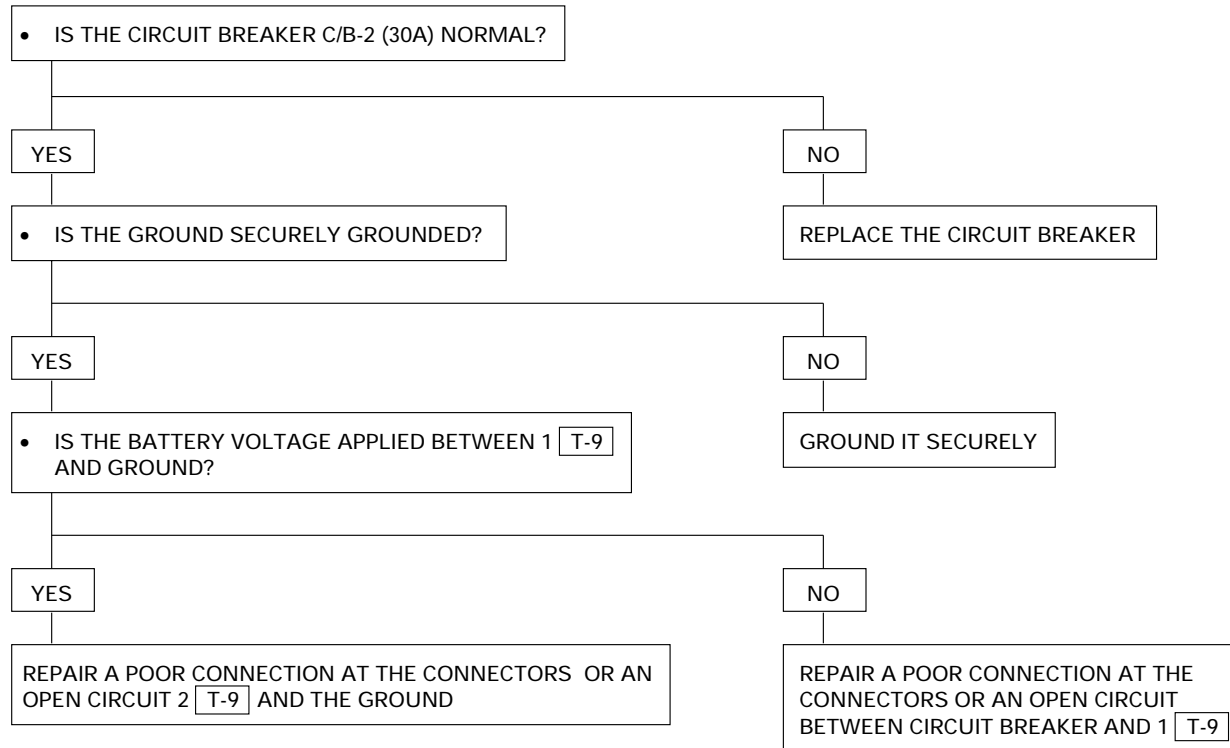


5. Reclining Mechanism Does Not Operate

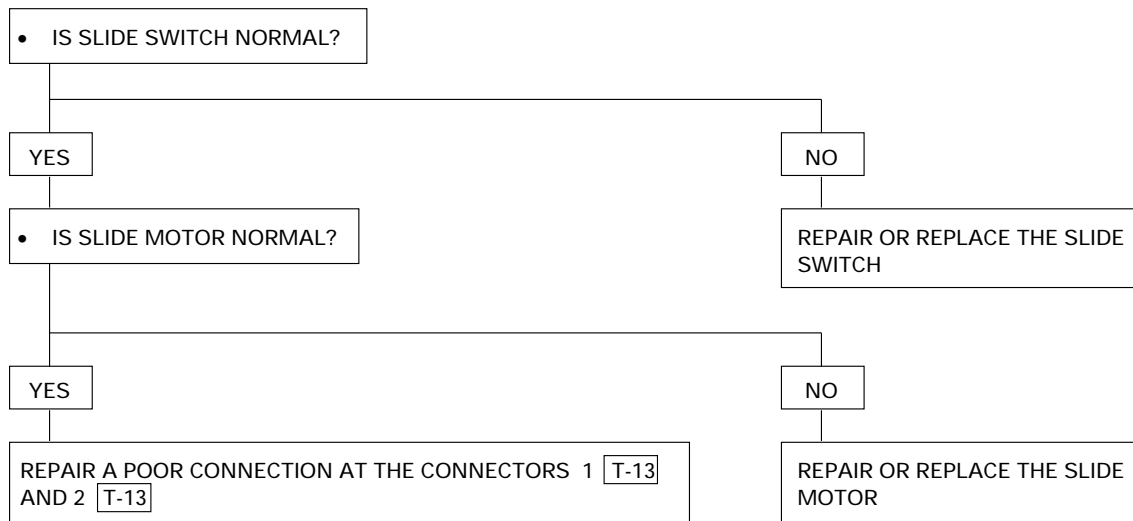


Passenger Seat

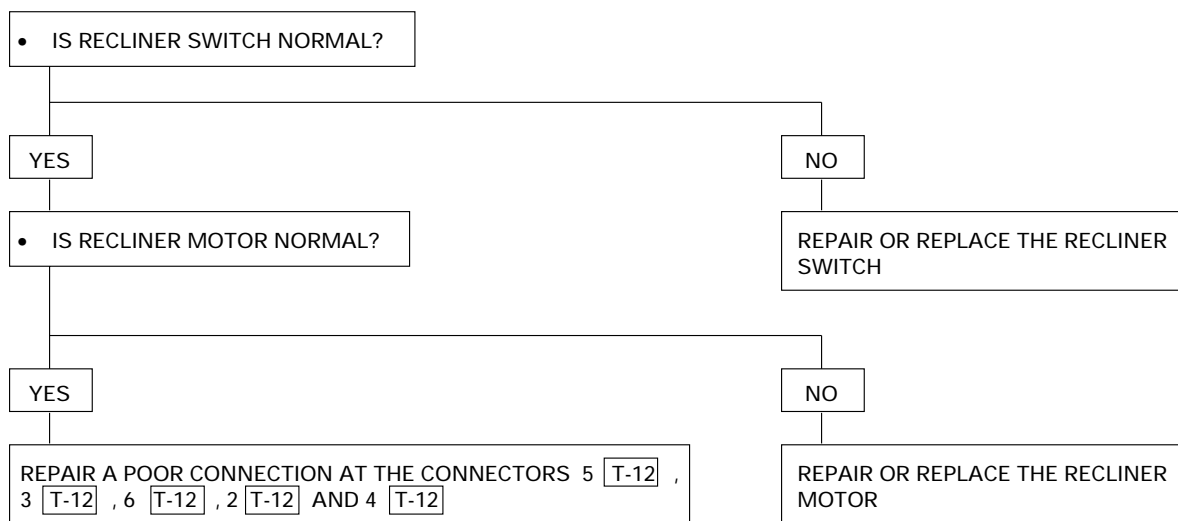
1. Power Seat Does Not Operate At Any Direction



2. Sliding Mechanism Does Not Operate

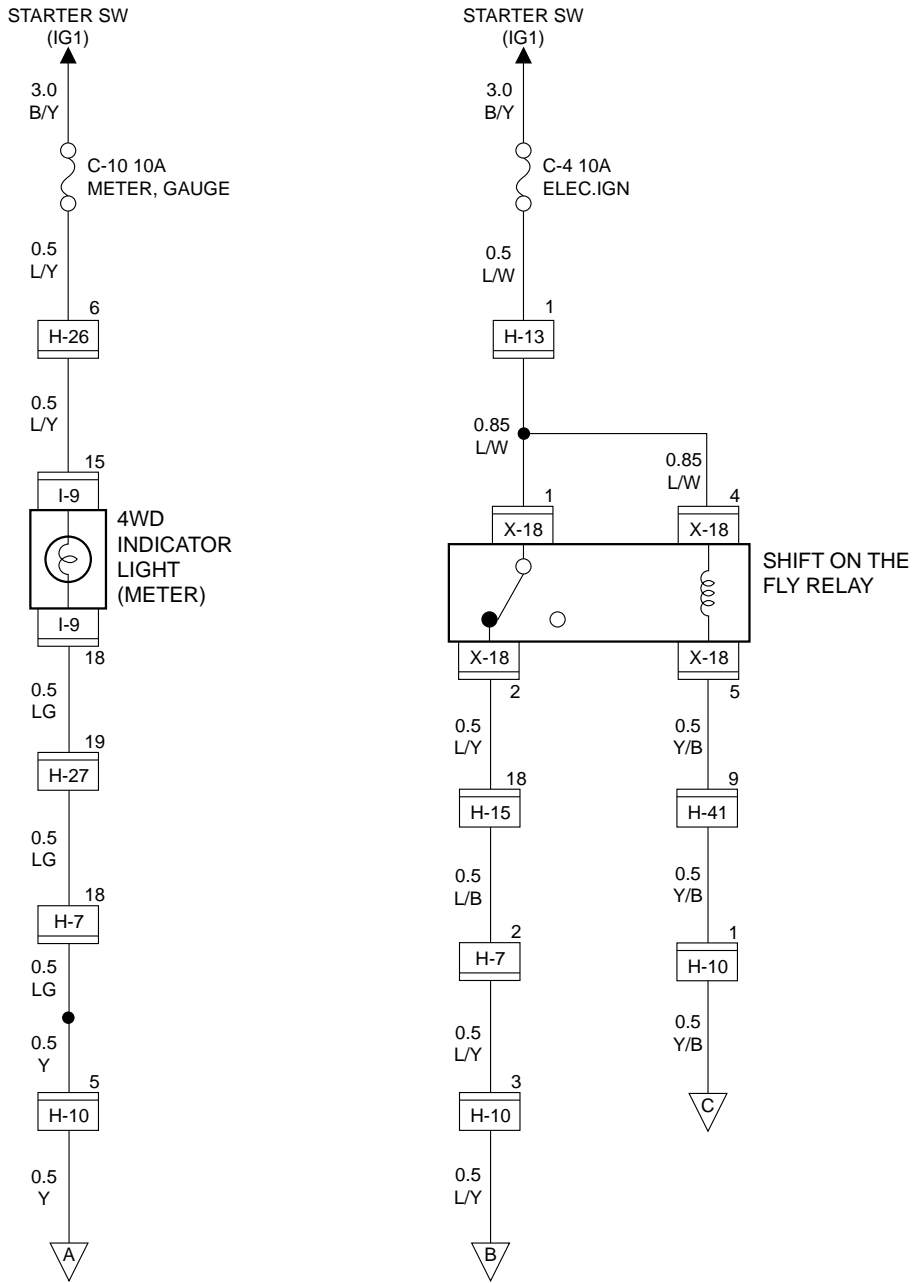


3. Reclining Mechanism Does Not Operate

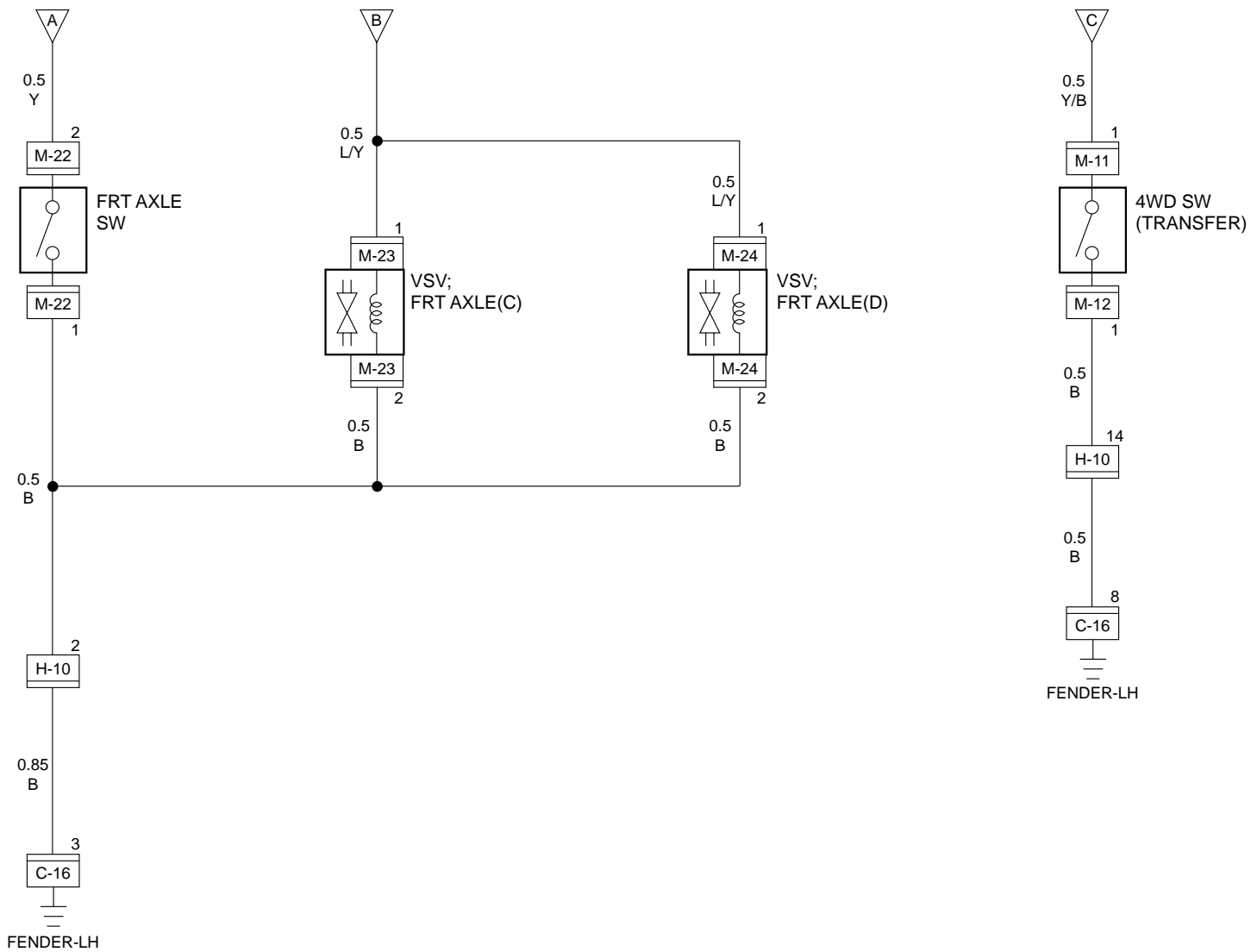


Shift On The Fly System

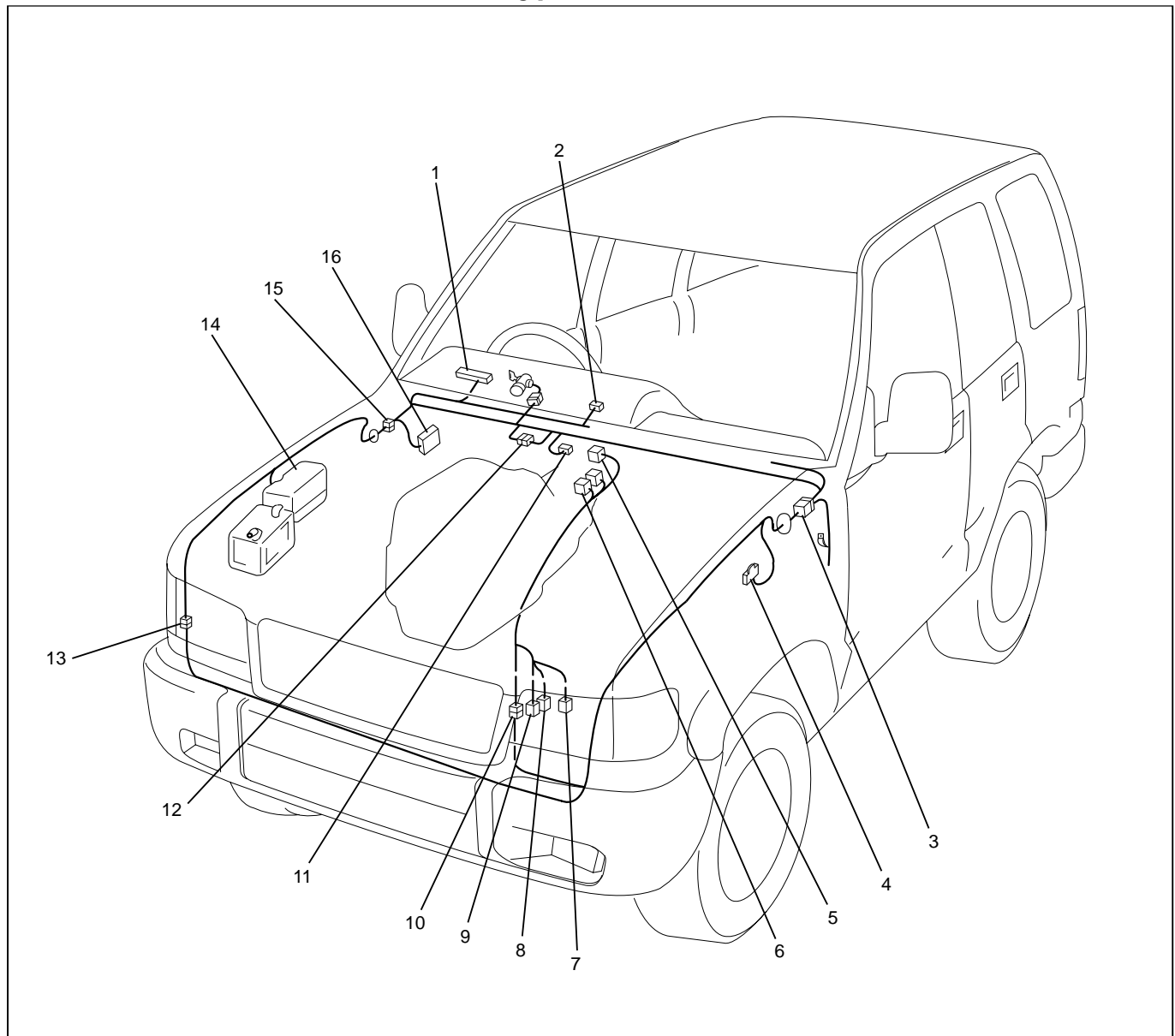
Circuit Diagram (RHD 6V*1 Lever Type)-1



Circuit Diagram (RHD 6V*1 Lever Type)-2



Parts Location (RHD 6V*1 Lever Type)

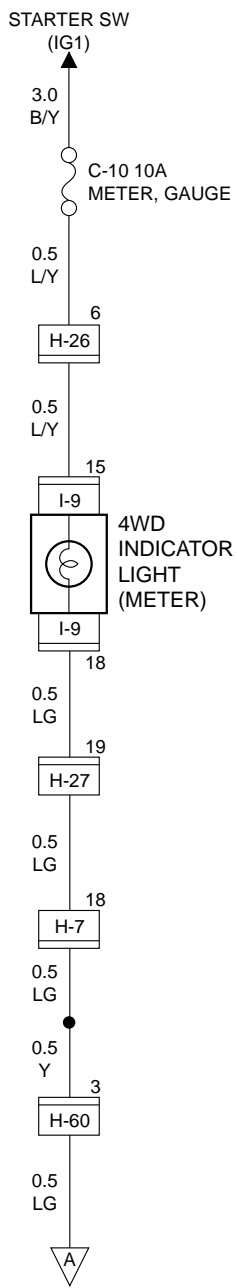
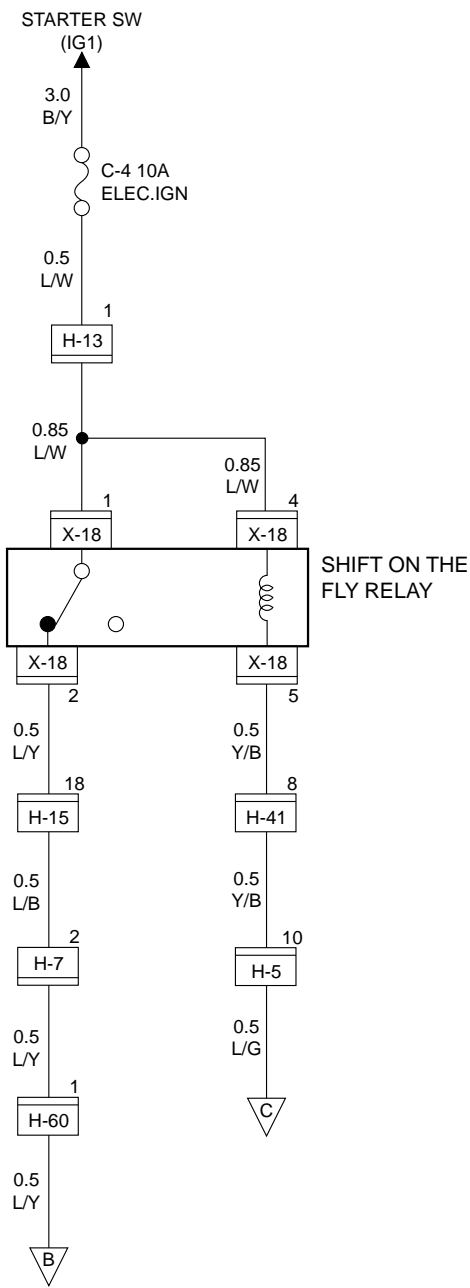


D08RW624

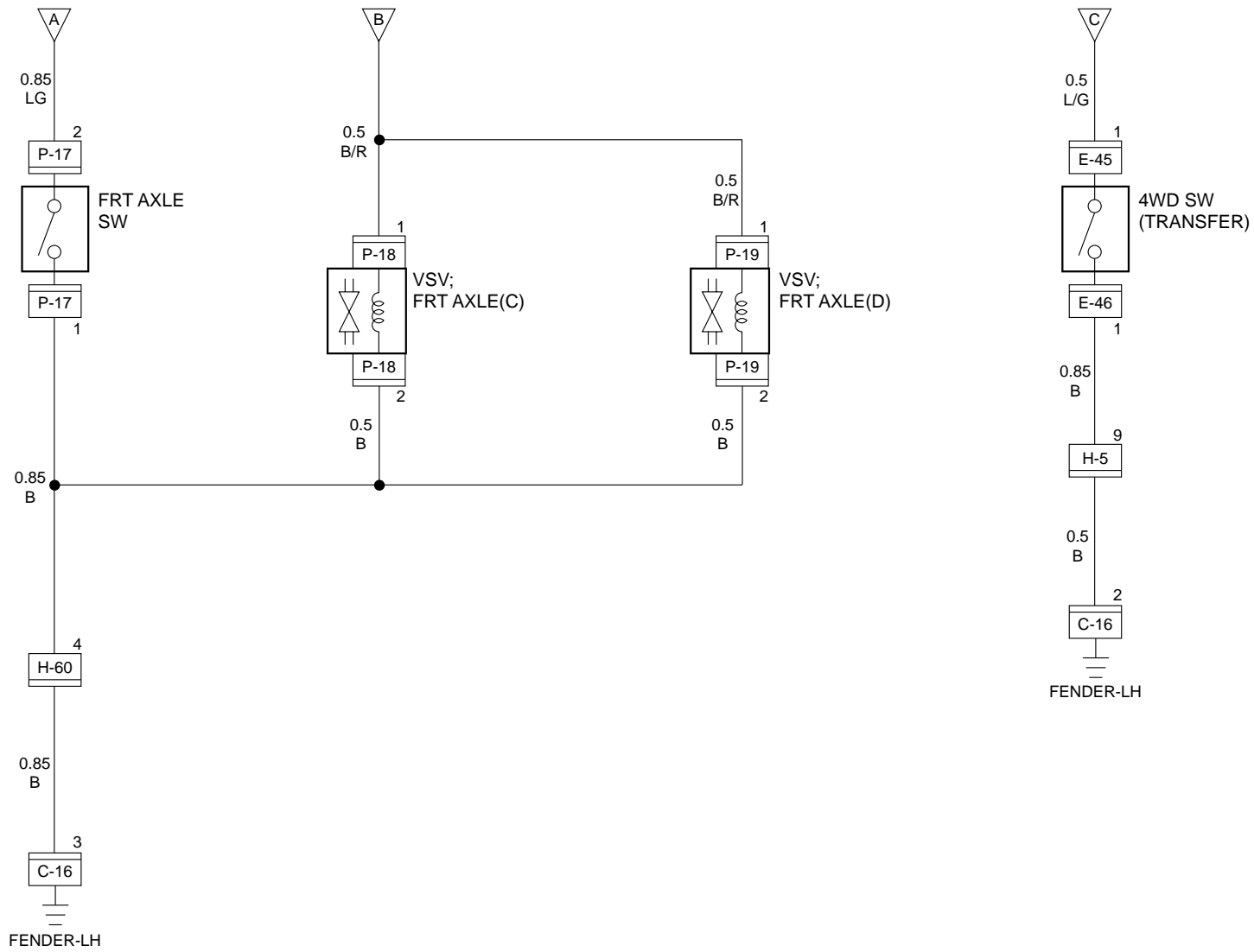
Legend

- | | |
|----------------|-------------------------|
| (1) I-9 | (9) M-24 |
| (2) I-12 | (10) H-10 |
| (3) H-7, H-9 | (11) C-94 |
| (4) C-16 | (12) H-12 |
| (5) M-26 | (13) H-41 |
| (6) M-11, M-12 | (14) Relay and Fuse Box |
| (7) M-22 | (15) H-15, H-25 |
| (8) M-23 | (16) Fuse Box |

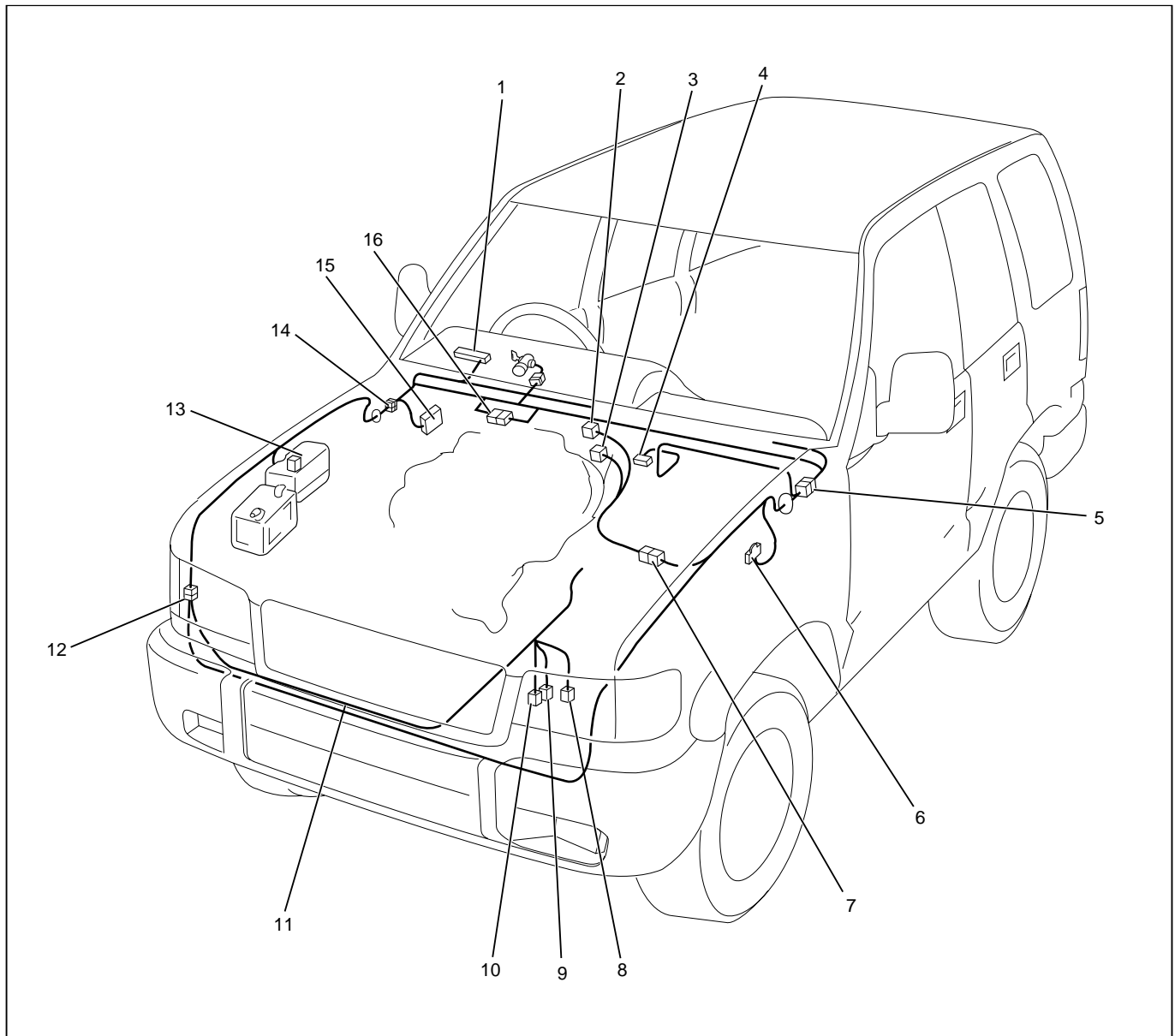
Circuit Diagram (RHD 4JG2 Lever Type)-1



Circuit Diagram (RHD 4JG2 Lever Type)-2



Parts Location (RHD 4JG2 Lever Type)

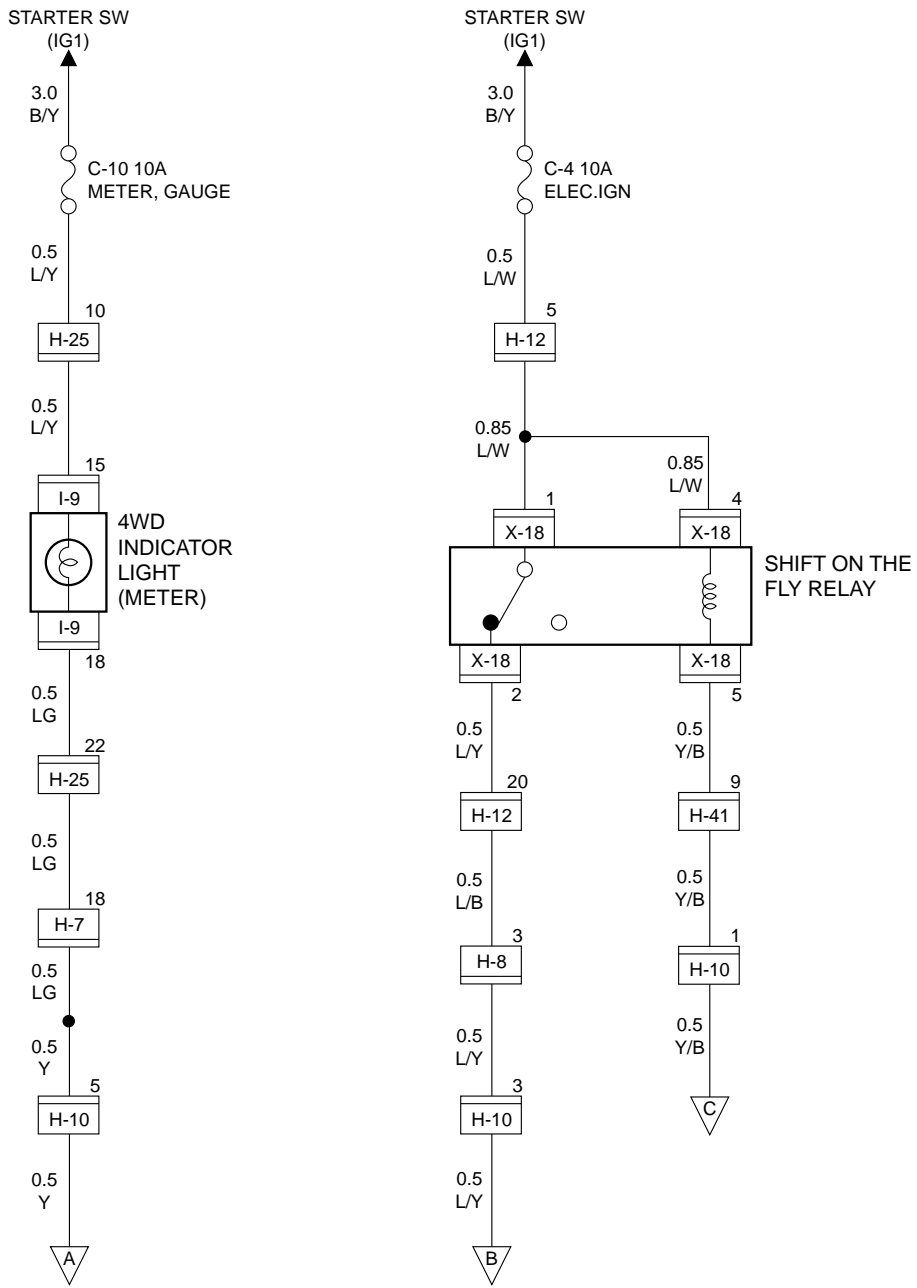


D08RW830

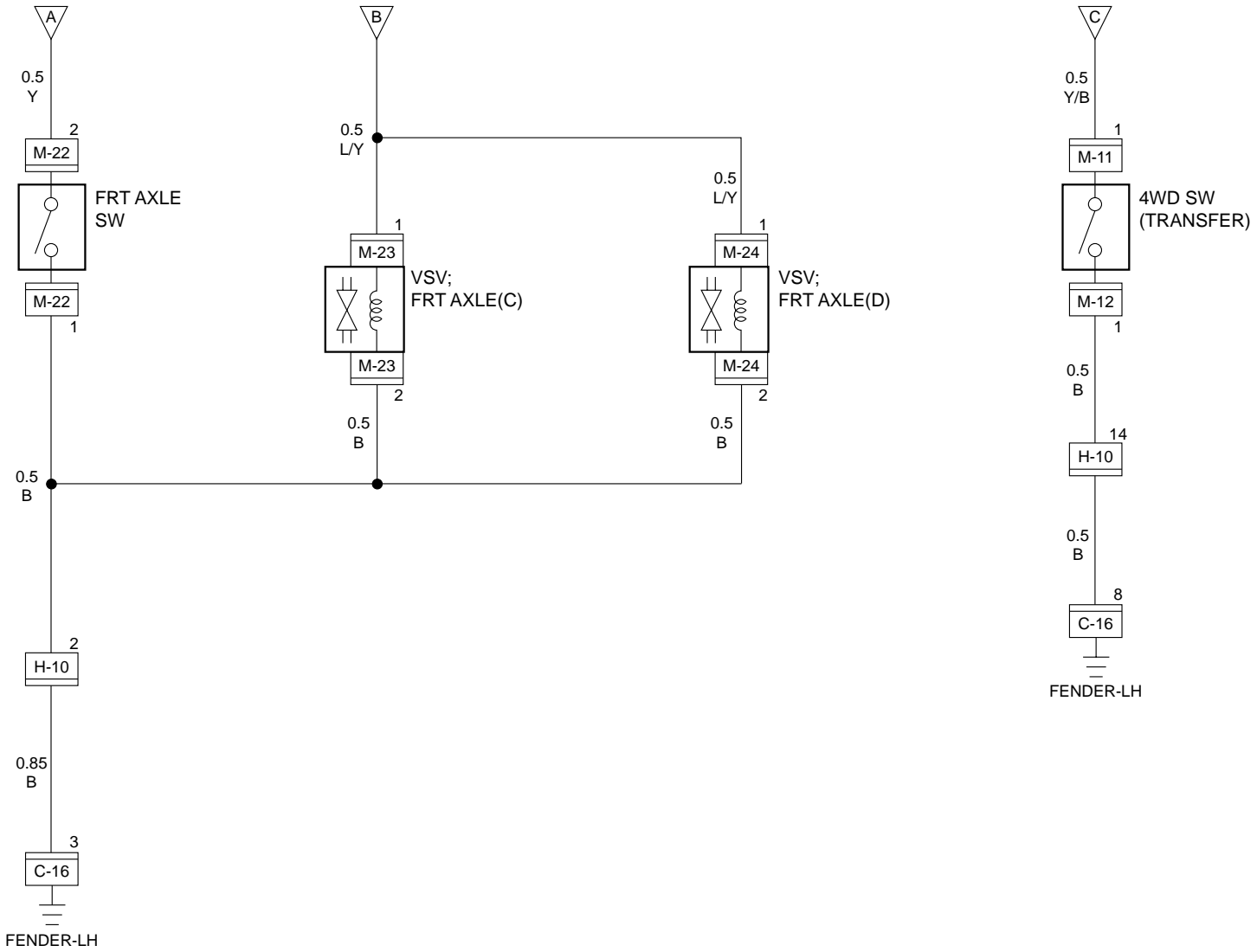
Legend

- | | |
|----------|--------------------------------|
| (1) I-9 | (8) P-18 |
| (2) E-45 | (9) P-19 |
| (3) E-46 | (10) Battery (+) Cable |
| (4) H-7 | (11) H-41, H-60 |
| (5) C-16 | (12) Relay and Fuse Box (X-18) |
| (6) H-5 | (13) H-13, H-15, H-26, H-27 |
| (7) P-17 | (14) Fuse Box |

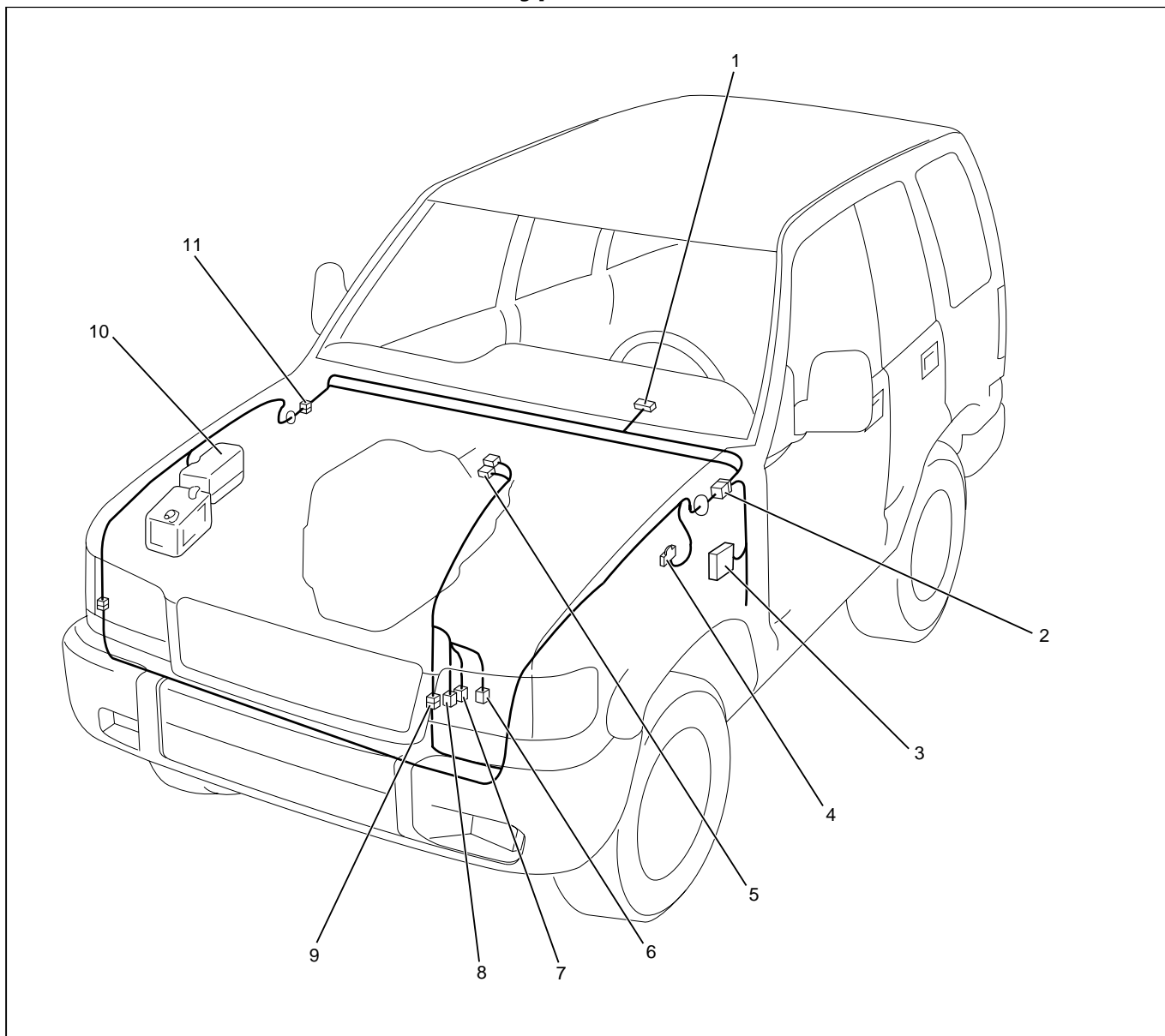
Circuit Diagram (LHD 6VD1 LeverType)-1



Circuit Diagram (LHD 6VD1 Lever Type)-2



Parts Location (LHD 6VD1 Lever Type)



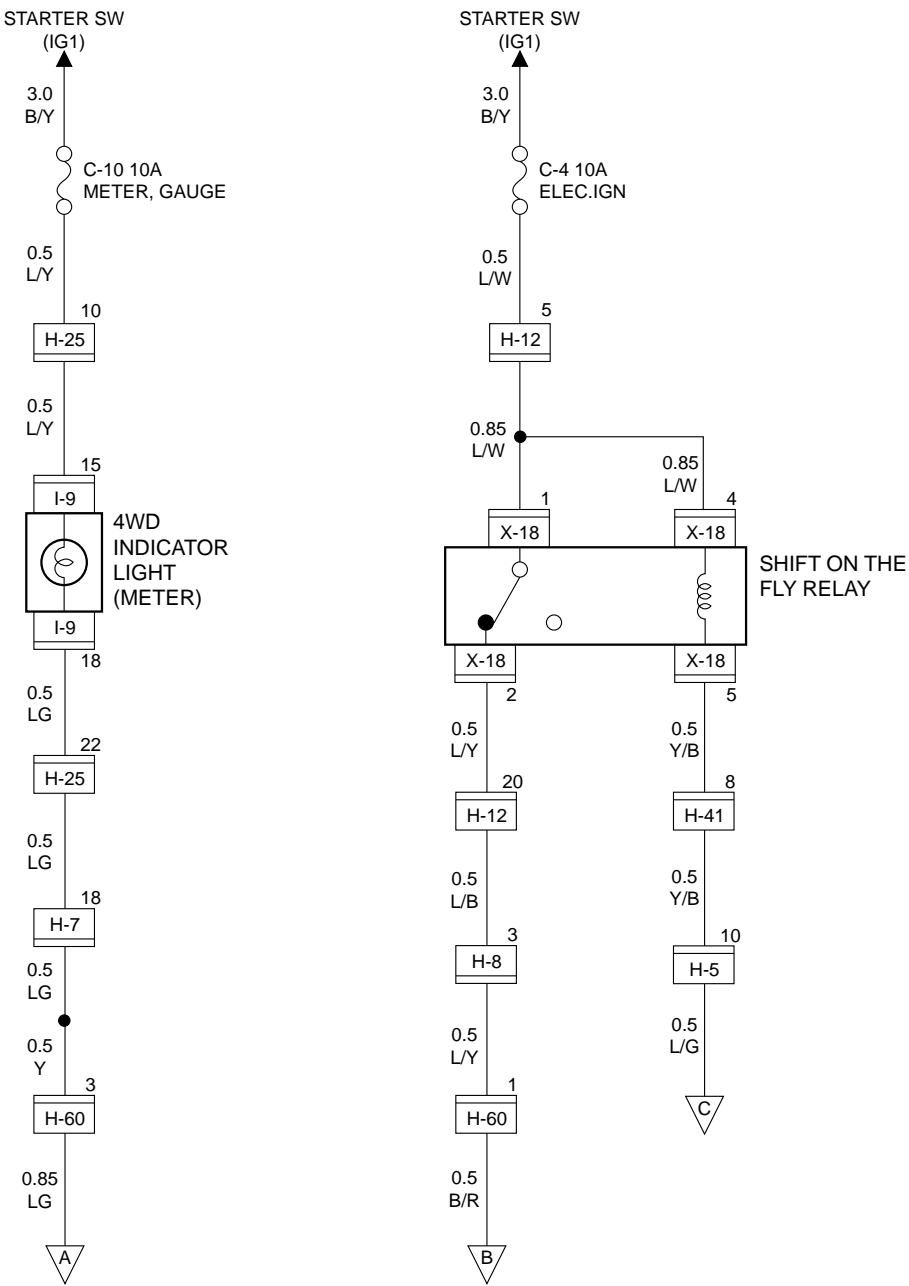
D08RW833

Legend

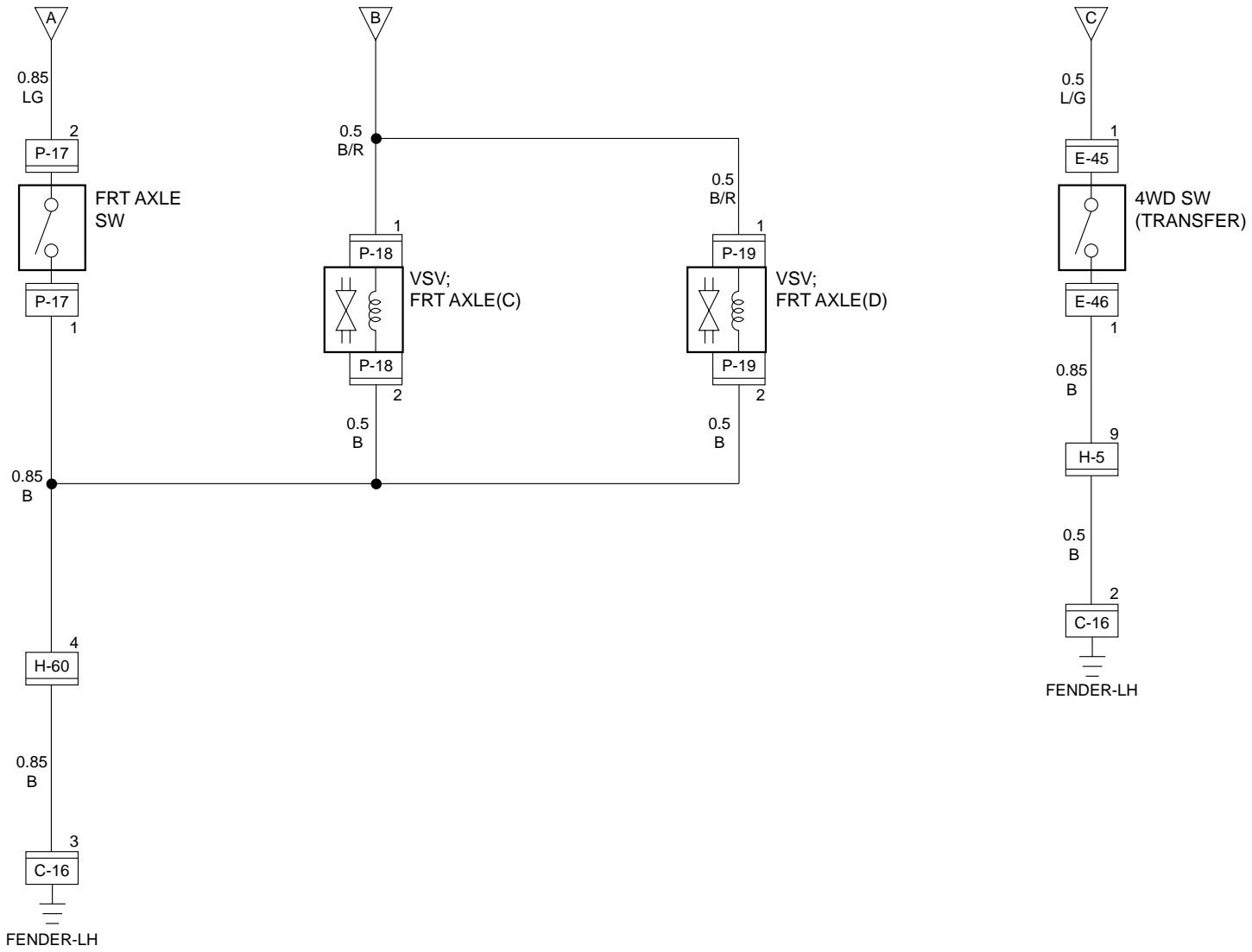
- (1) I-9
- (2) H-7, H-8, H-25
- (3) Fuse Box
- (4) C-16
- (5) M-11, M-12

- (6) M-22
- (7) M-23
- (8) M-24
- (9) H-10
- (10) Relay and Fuse Box (X-18)
- (11) H-12

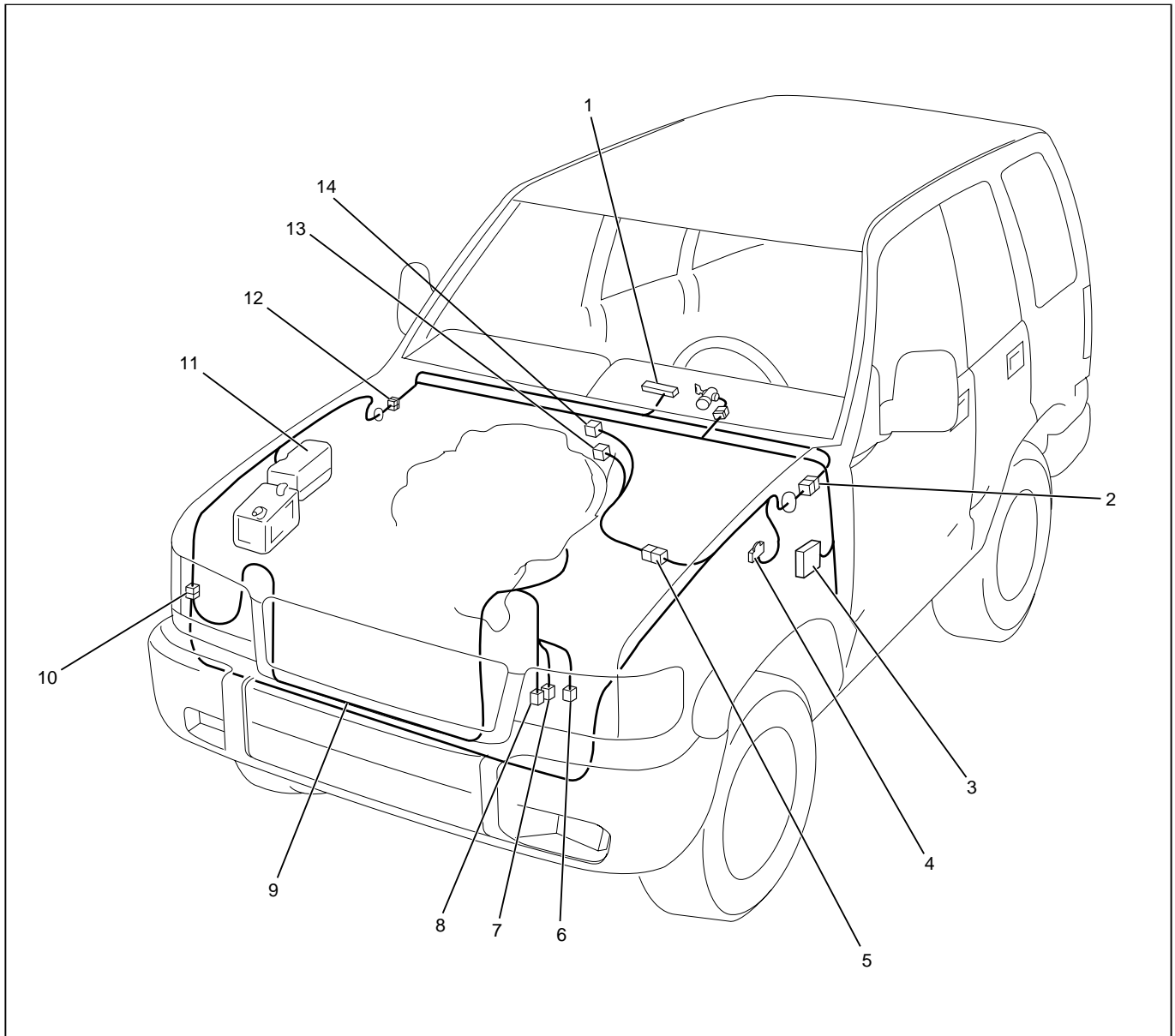
Circuit Diagram (LHD 4JG2 Lever Type)-1



Circuit Diagram (LHD 4JG2 Lever Type)-2



Parts Location (LHD 4JG2 Lever Type)

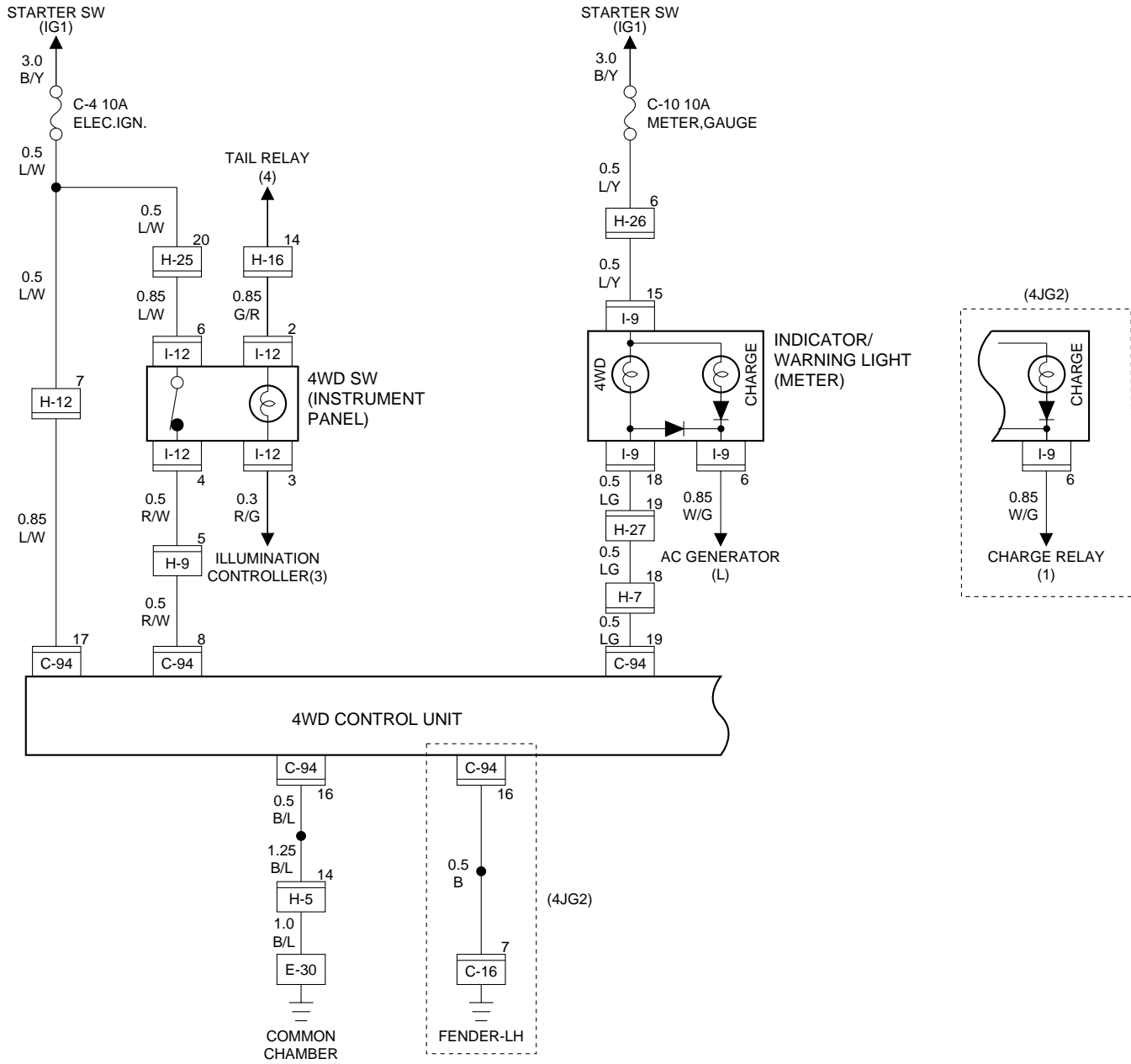


D08RW629

Legend

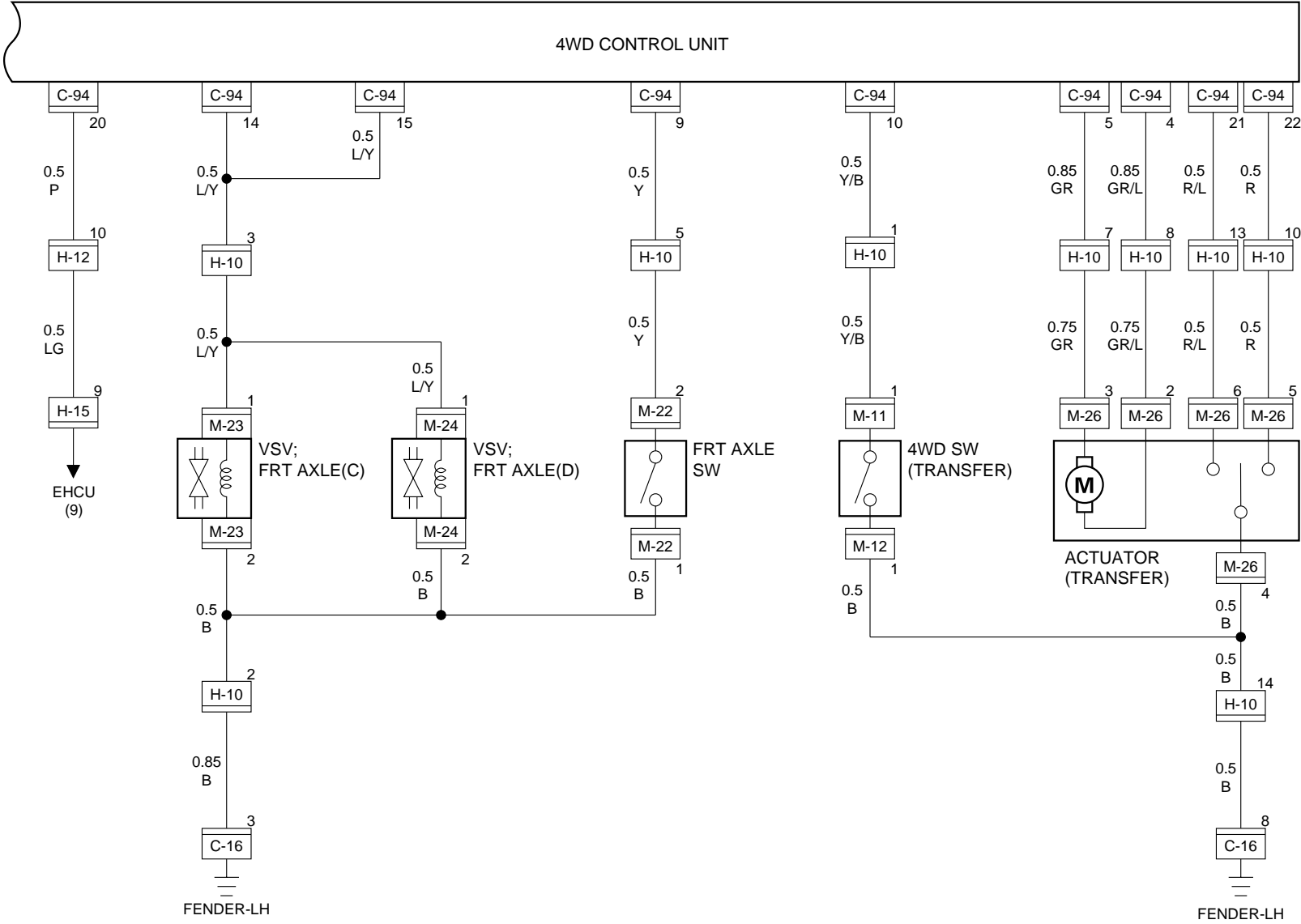
- | | |
|--------------------|--------------------------------|
| (1) I-9 | (8) P-19 |
| (2) H-7, H-8, H-25 | (9) Battery (+) Cable |
| (3) Fuse Box | (10) H-42, H-60 |
| (4) C-16 | (11) Relay and Fuse Box (X-18) |
| (5) H-5 | (12) H-12 |
| (6) P-17 | (13) E-46 |
| (7) P-18 | (14) E-45 |

Circuit Diagram (RHD 6V*1 Push Button Type)-1

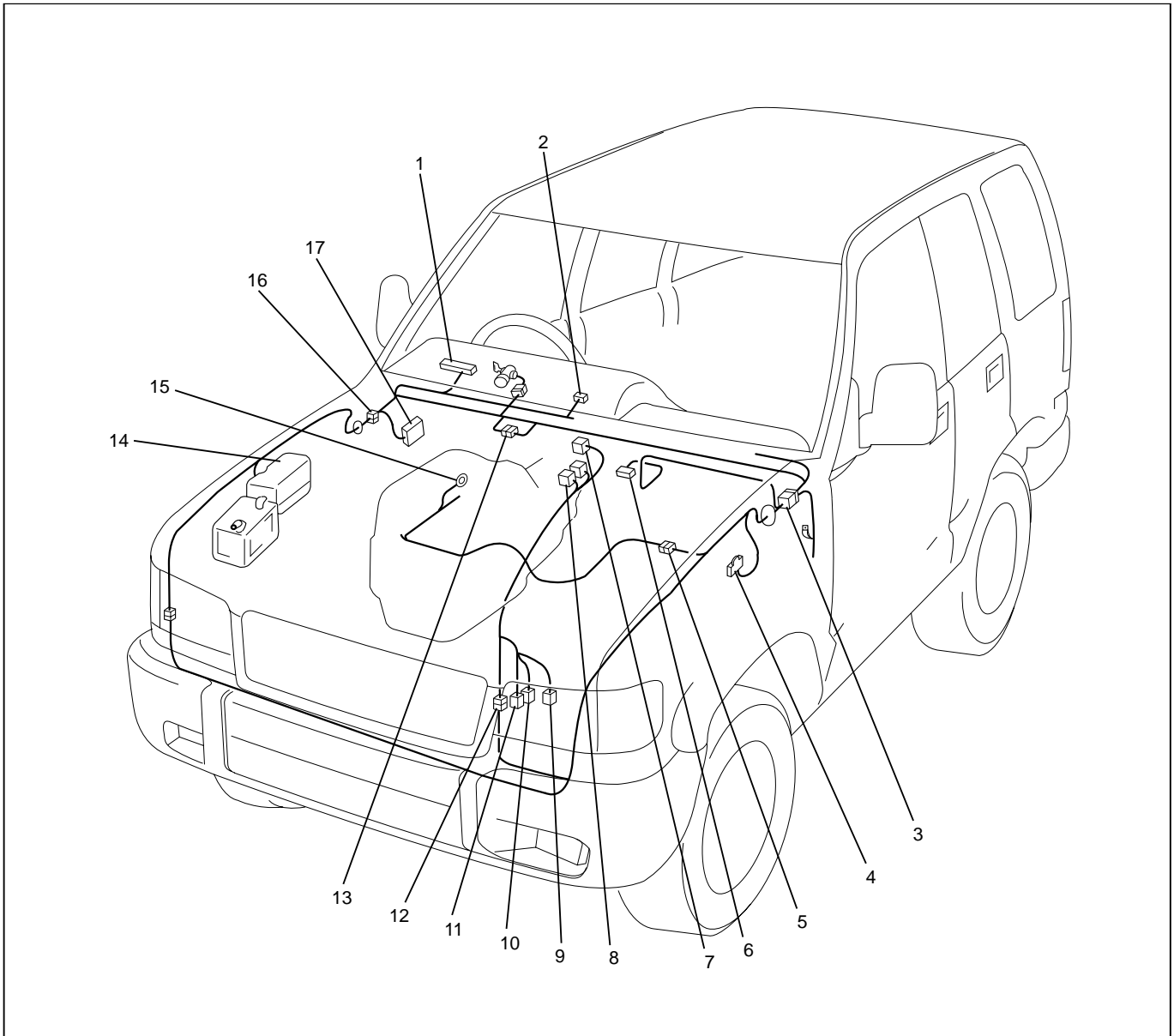


EHCU : ELECTRONIC HYDRAULIC CONTROL UNIT

4WD CONTROL UNIT



Parts Location (RHD 6V*1 Push Button Type)

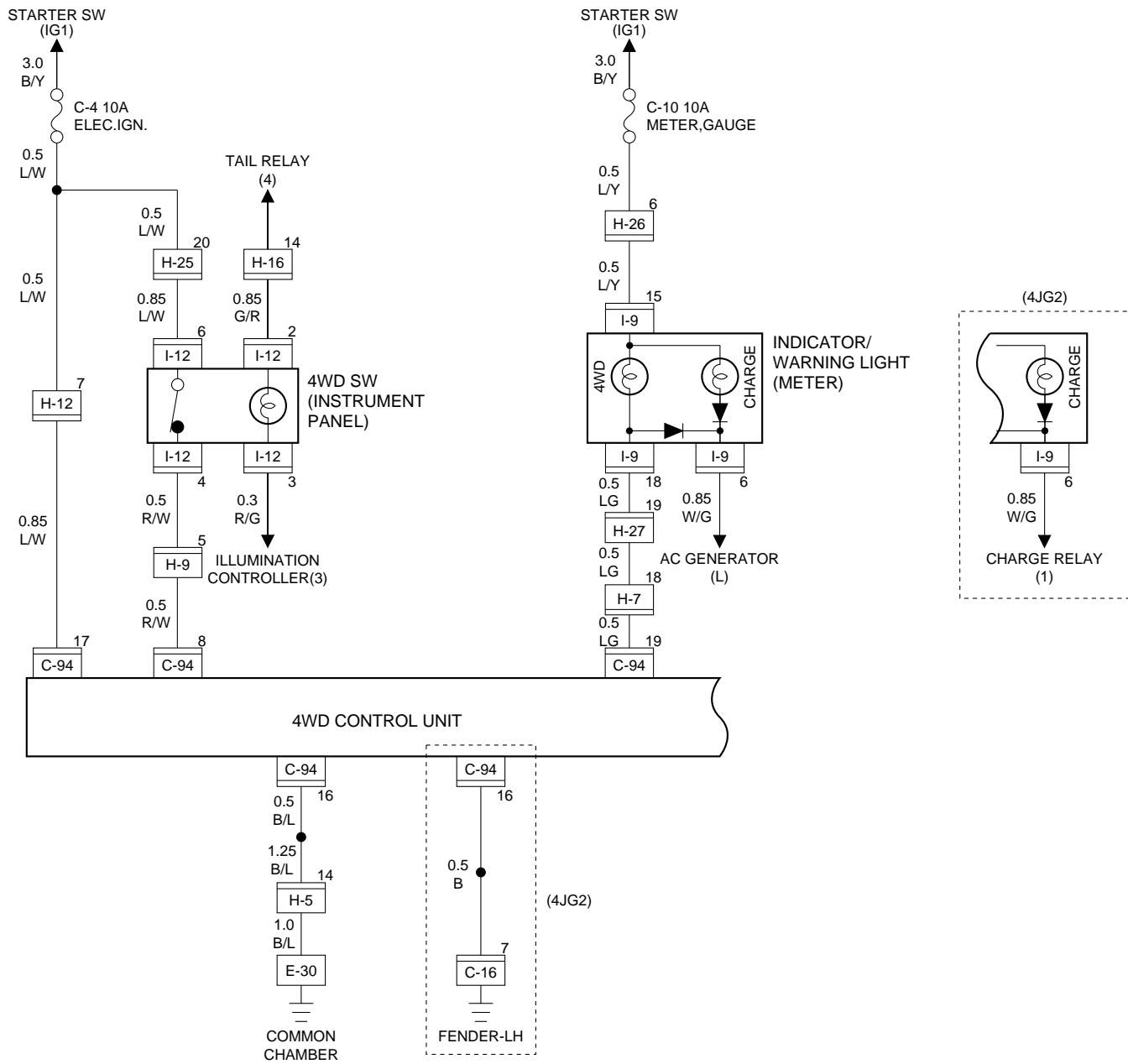


D08RW853

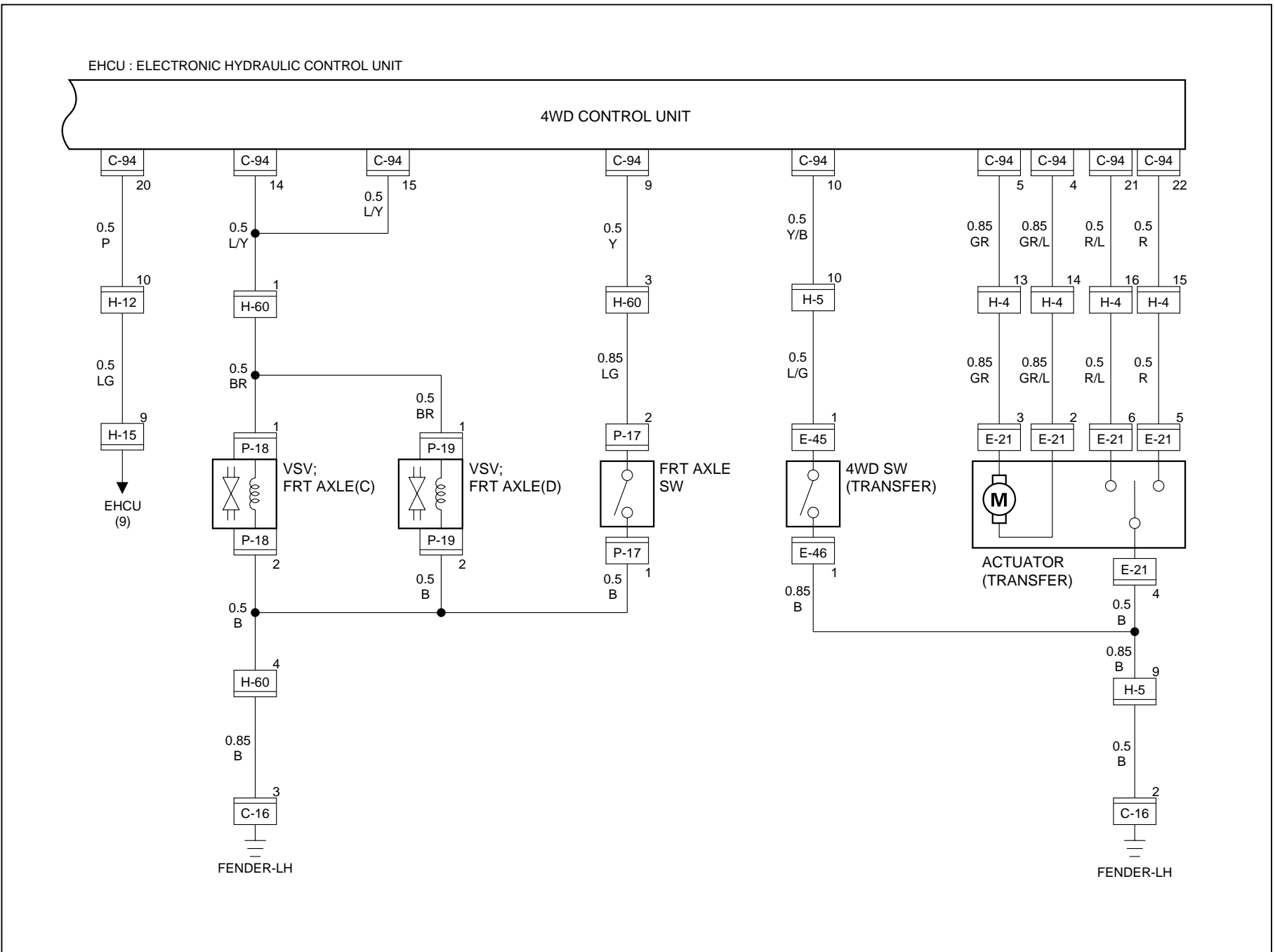
Legend

- | | |
|----------------|-----------------------------------|
| (1) I-9 | (9) M-22 |
| (2) I-12 | (10) M-23 |
| (3) I-12 | (11) M-24 |
| (4) H-7, H-9 | (12) H-10 |
| (5) C-16 | (13) H-12 |
| (6) C-94 | (14) Relay and Fuse Box |
| (7) M-26 | (15) E-30 |
| (8) M-11, M-12 | (16) H-15, H-16, H-25, H-26, H-27 |
| | (17) Fuse Box |

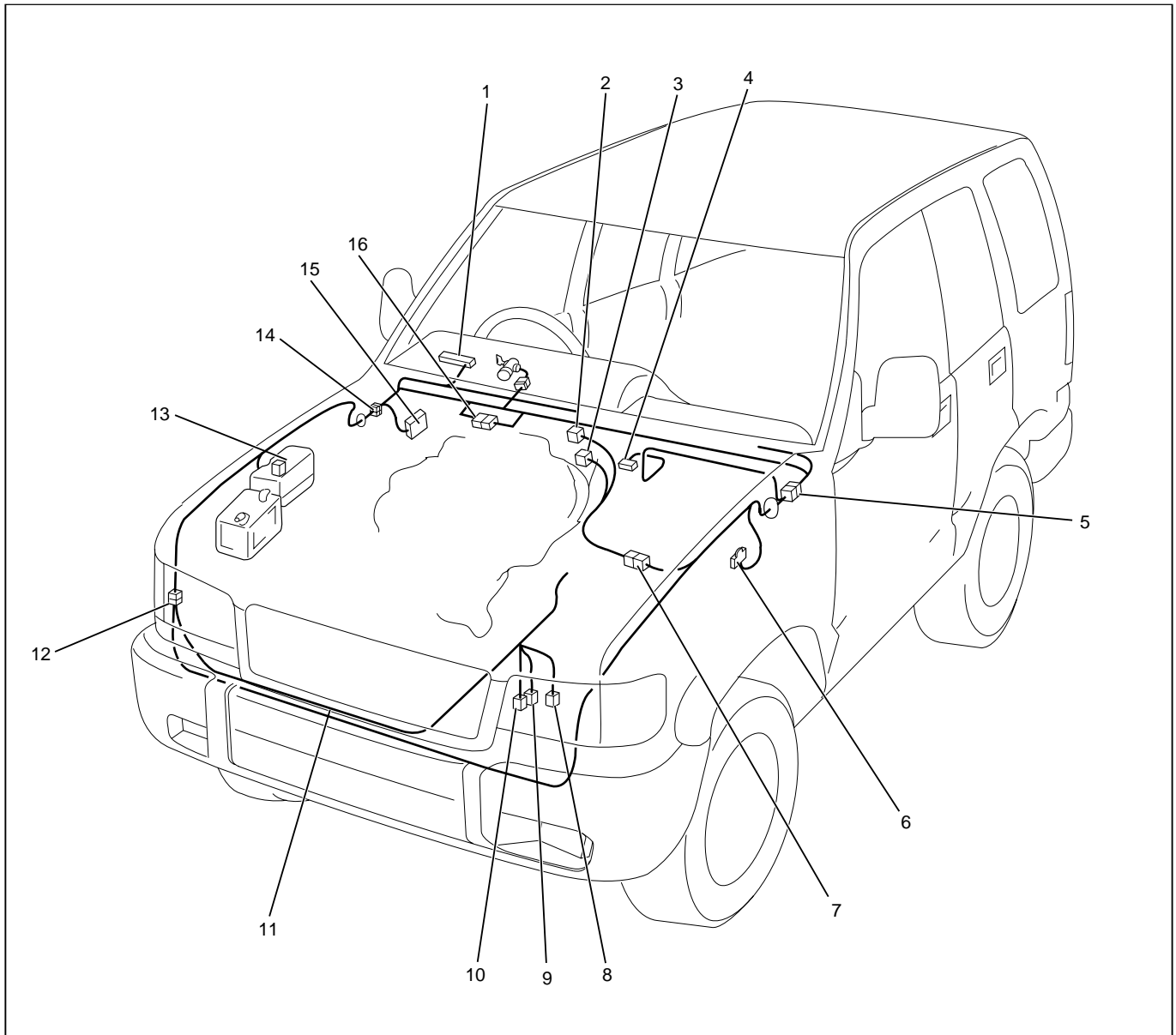
Circuit Diagram (RHD 4JG2 Push Button Type)-1



Circuit Diagram (RHD 4JG2 Push Button Type)-2



Parts Location (RHD 4JG2 Push Button Type)

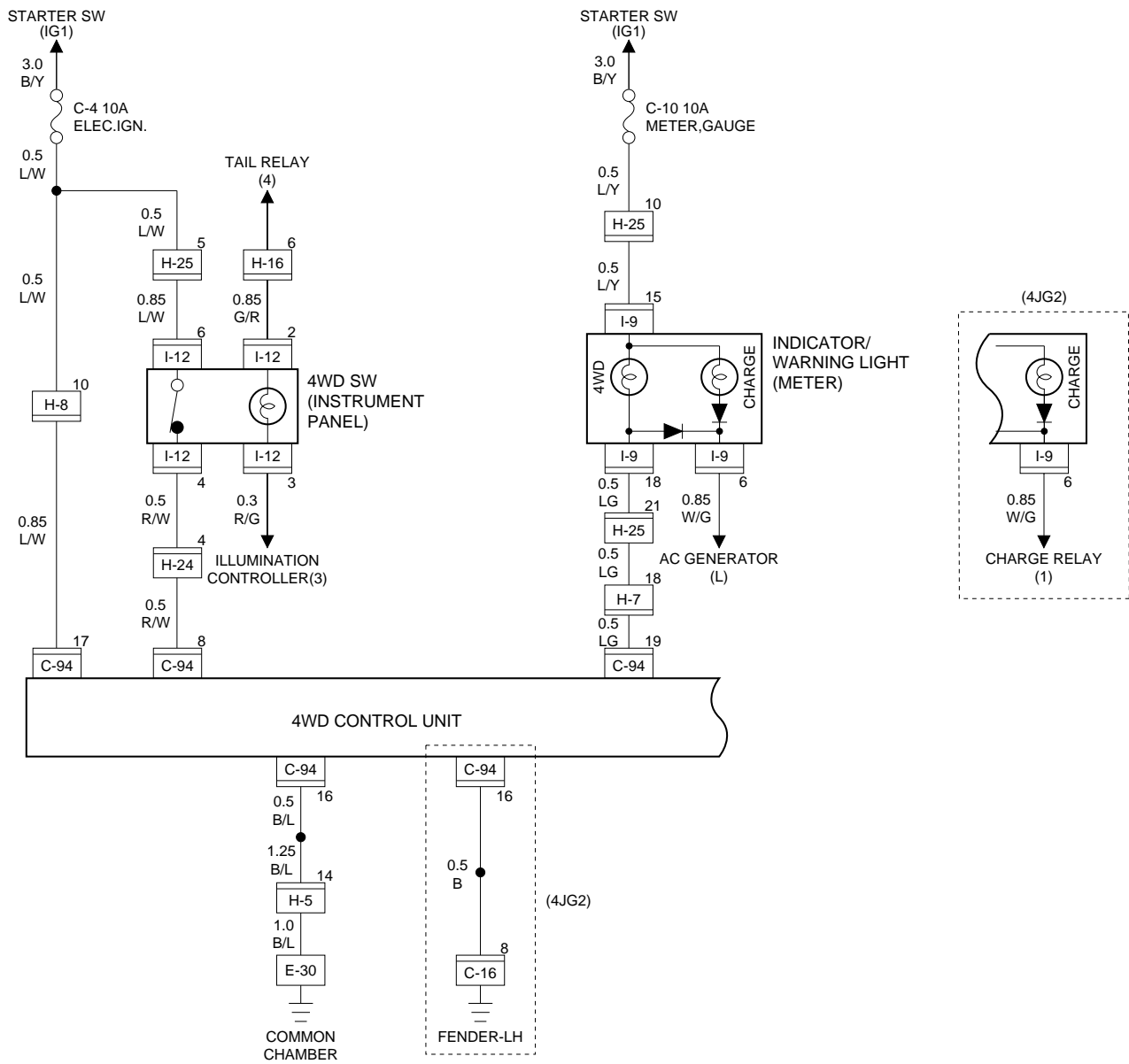


D08RW830

Legend

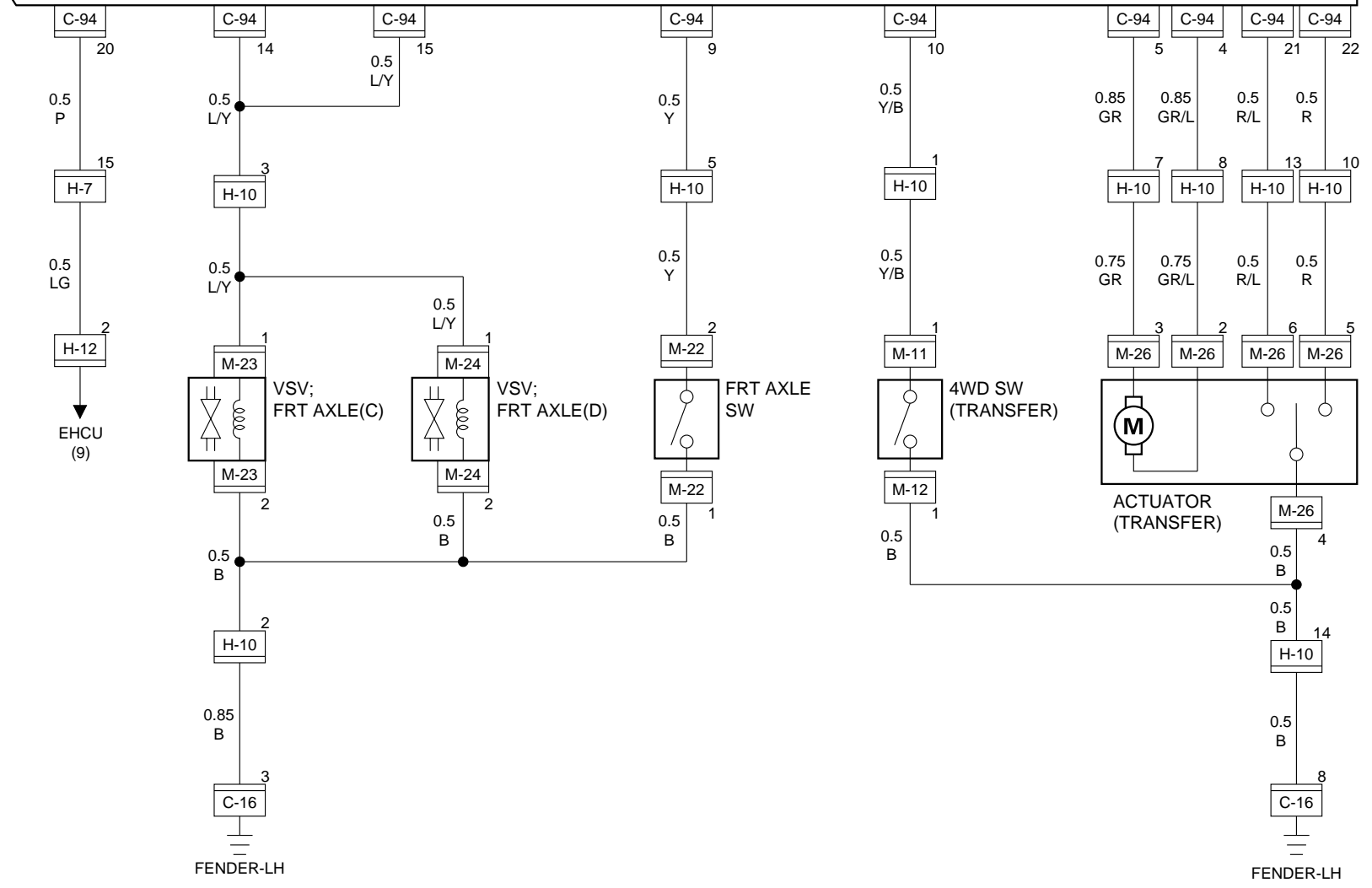
- | | |
|----------------|-----------------------------------|
| (1) I-9 | (9) P-18 |
| (2) E-21 | (10) P-19 |
| (3) E-45, E-46 | (11) Battery Positive Cable |
| (4) C-94 | (12) H-60 |
| (5) H-7, H-9 | (13) Relay and Fuse Box |
| (6) C-16 | (14) H-15, H-16, H-25, H-26, H-27 |
| (7) H-4, H-5 | (15) Fuse Box |
| (8) P-17 | (16) H-12 |

Circuit Diagram (LHD 6VD1 Push Button Type)-1

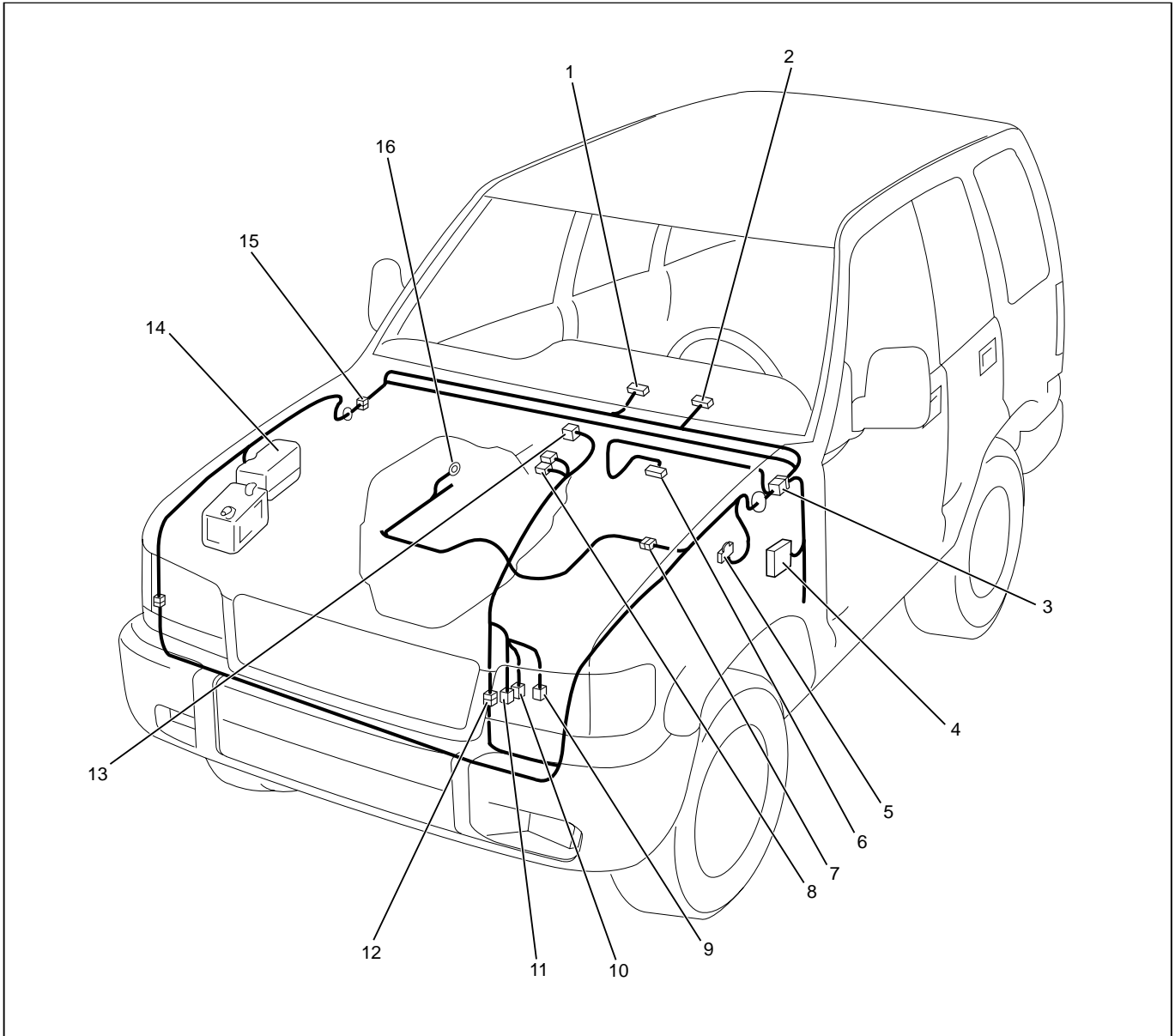


EHCUC : ELECTRONIC HYDRAULIC CONTROL UNIT

4WD CONTROL UNIT



Parts Location (LHD 6VD1 Push Button Type)

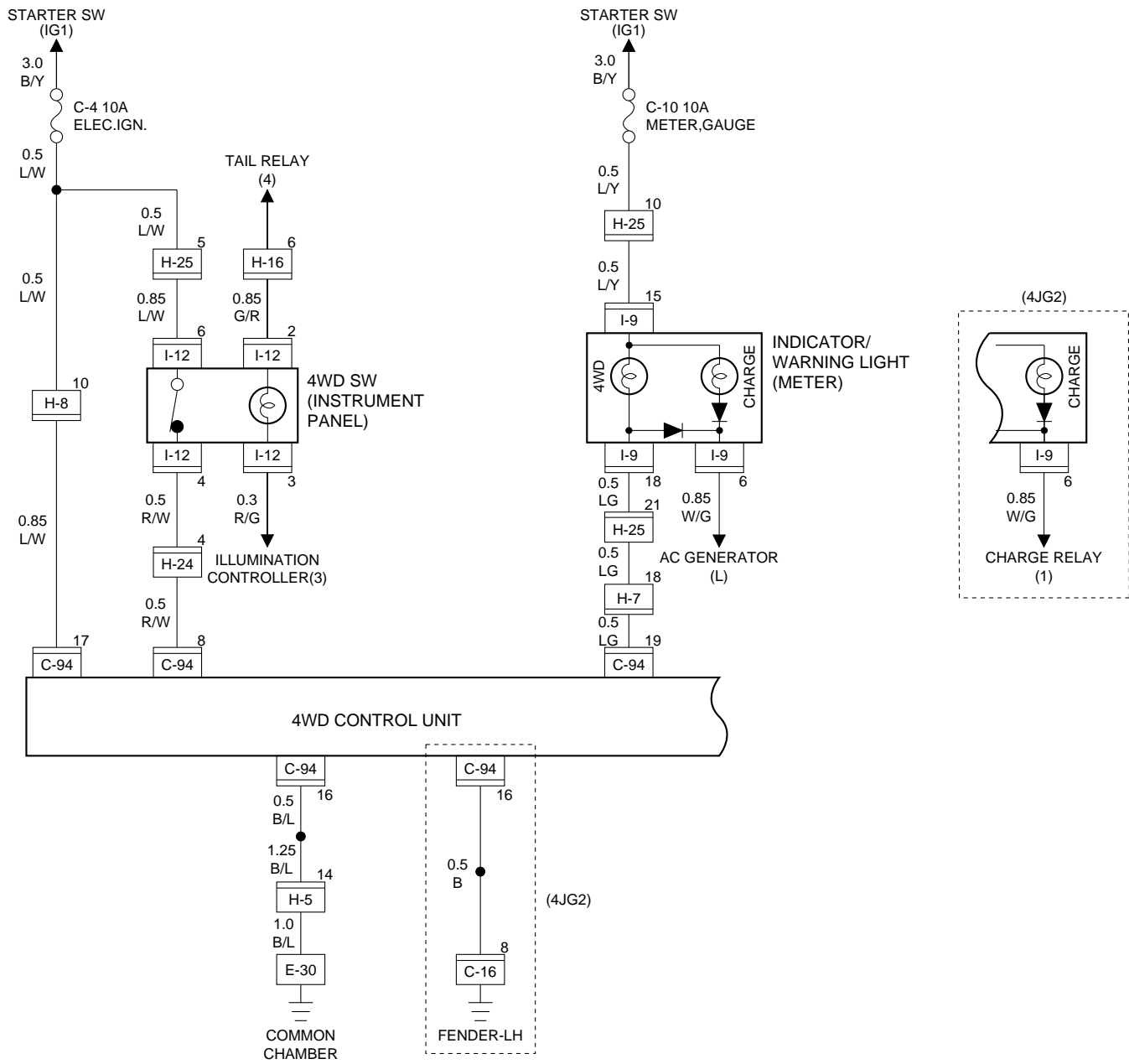


D08RW854

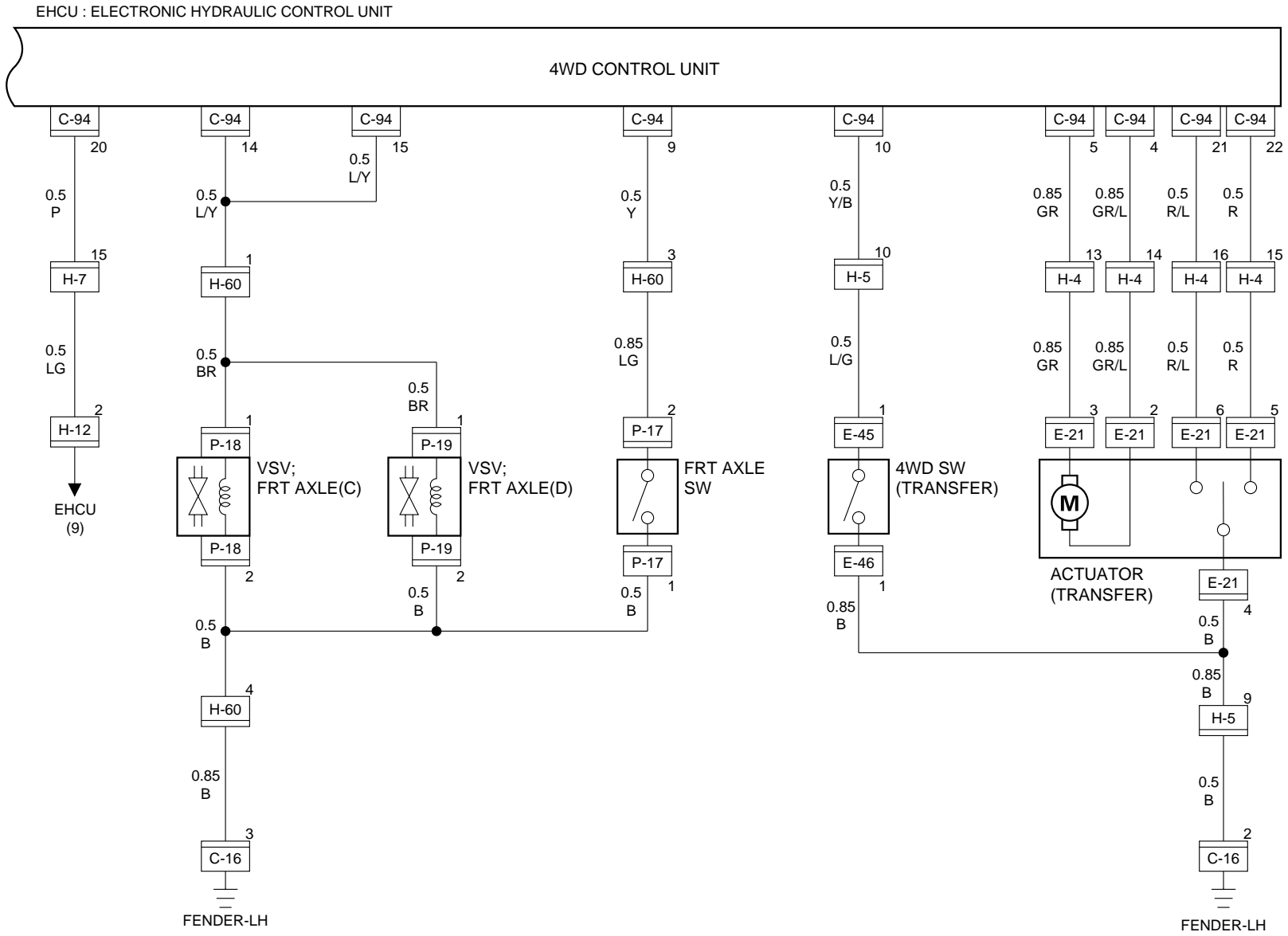
Legend

- | | |
|--------------------------|-------------------------|
| (1) I-12 | (9) M-22 |
| (2) I-9 | (10) M-23 |
| (3) H-7, H-8, H-24, H-25 | (11) M-24 |
| (4) Fuse Box | (12) H-10 |
| (5) C-16 | (13) M-26 |
| (6) C-94 | (14) Relay and Fuse Box |
| (7) H-5 | (15) H-12, H-16 |
| (8) M-11, M-12 | (16) E-30 |

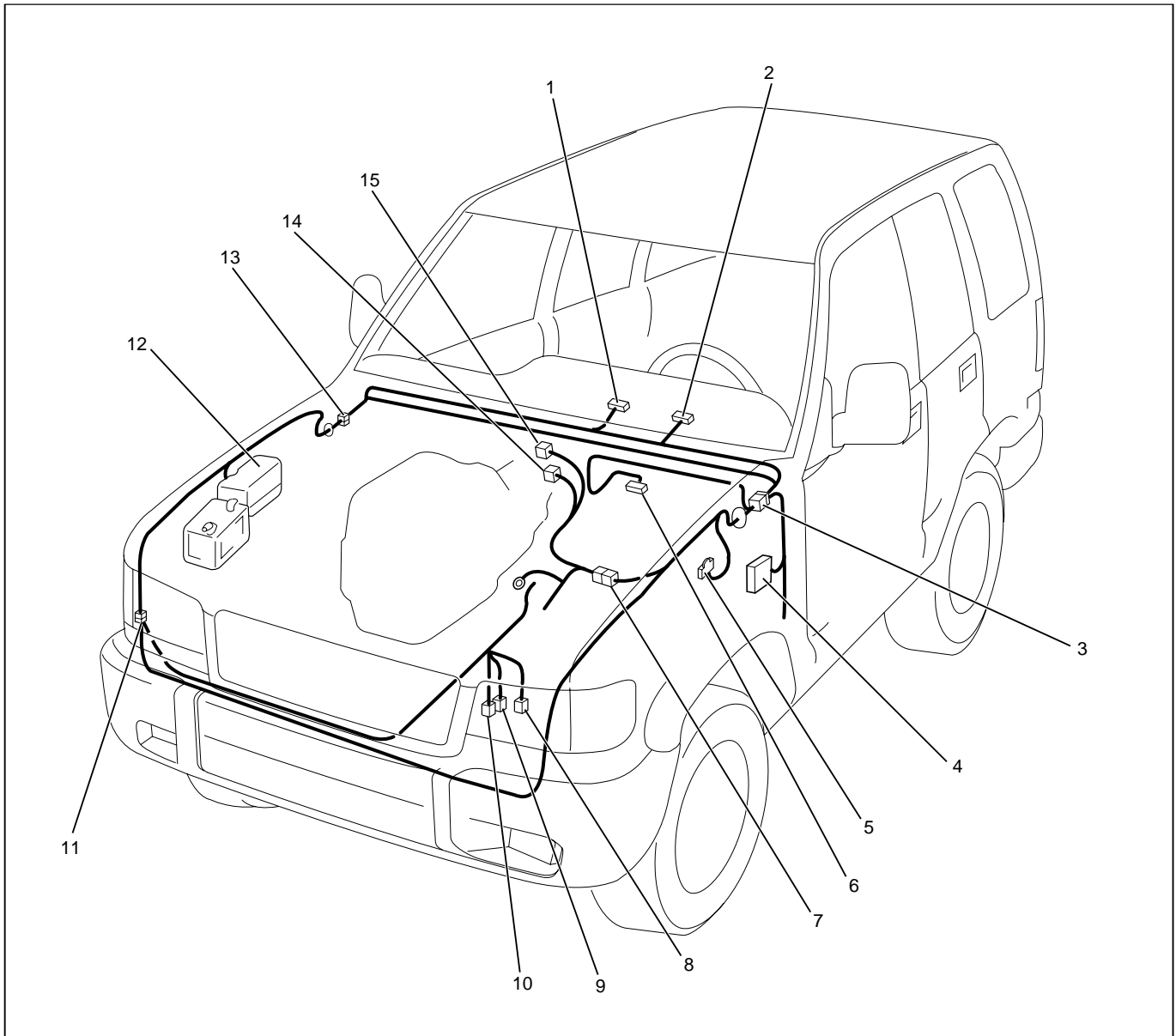
Circuit Diagram (LHD 4JG2 Push Button Type)-1



Circuit Diagram (LHD 4JG2 Push Button Type)-2



Parts Location (LHD 4JG2 Push Button Type)

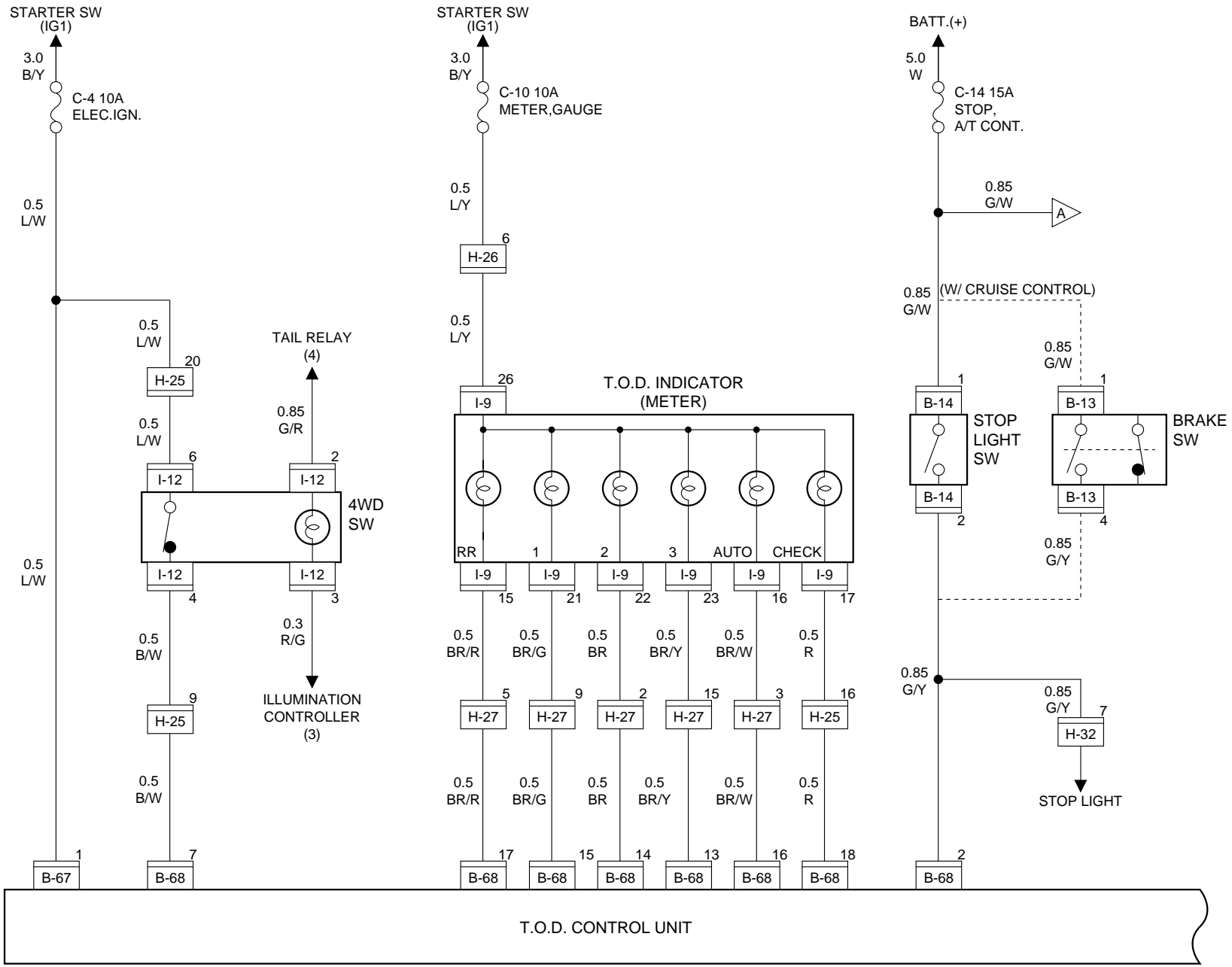


D08RW852

Legend

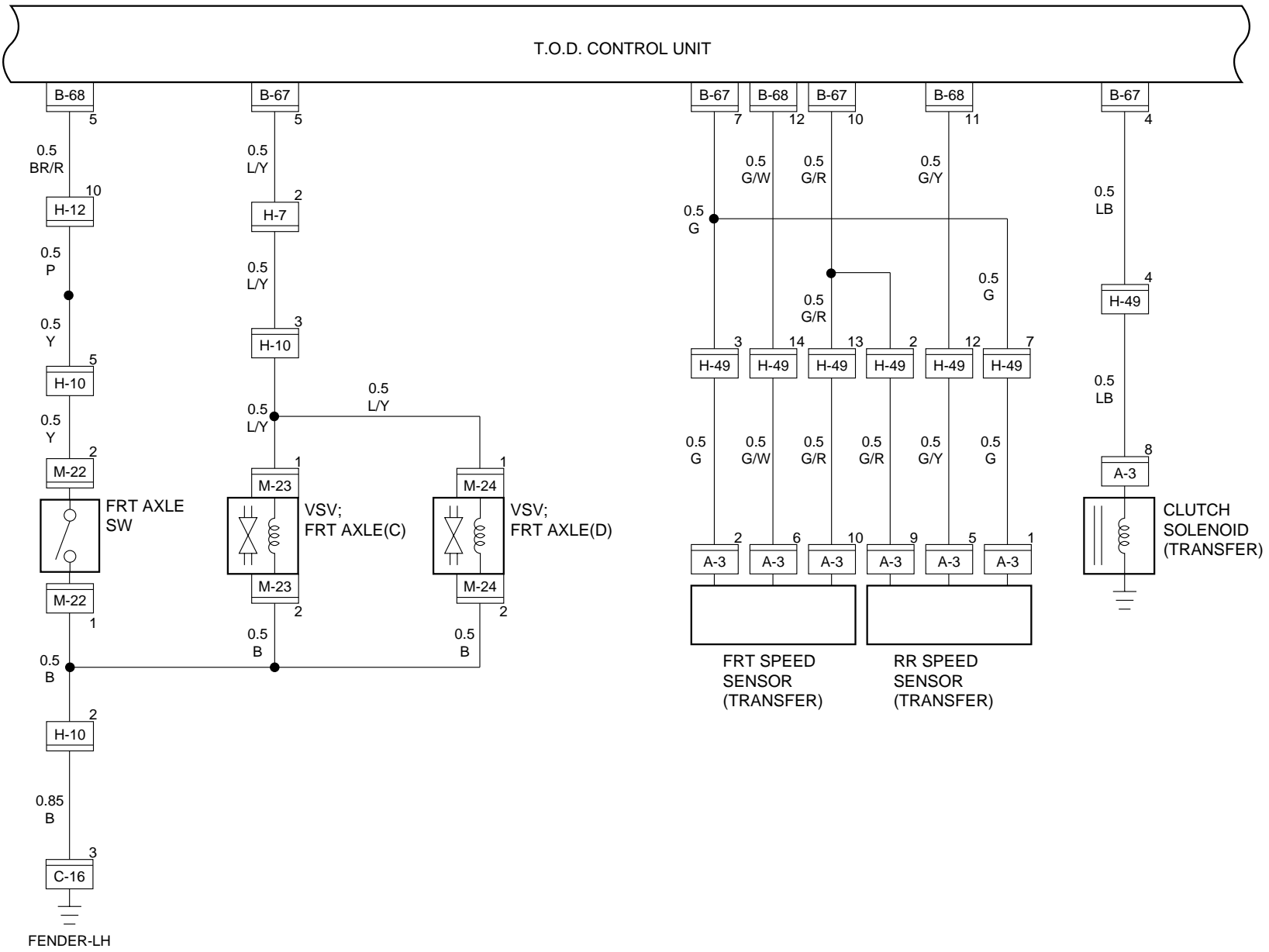
- | | |
|-------------------------|-------------------------|
| (1) I-12 | (8) P-17 |
| (2) I-9 | (9) P-18 |
| (3) H-7 H-8, H-24, H-25 | (10) P-19 |
| (4) Fuse Box | (11) H-60 |
| (5) C-16 | (12) Relay and Fuse Box |
| (6) C-94 | (13) H-12, H-16 |
| (7) H-4, H-5 | (14) E-45, E-46 |
| | (15) E-21 |

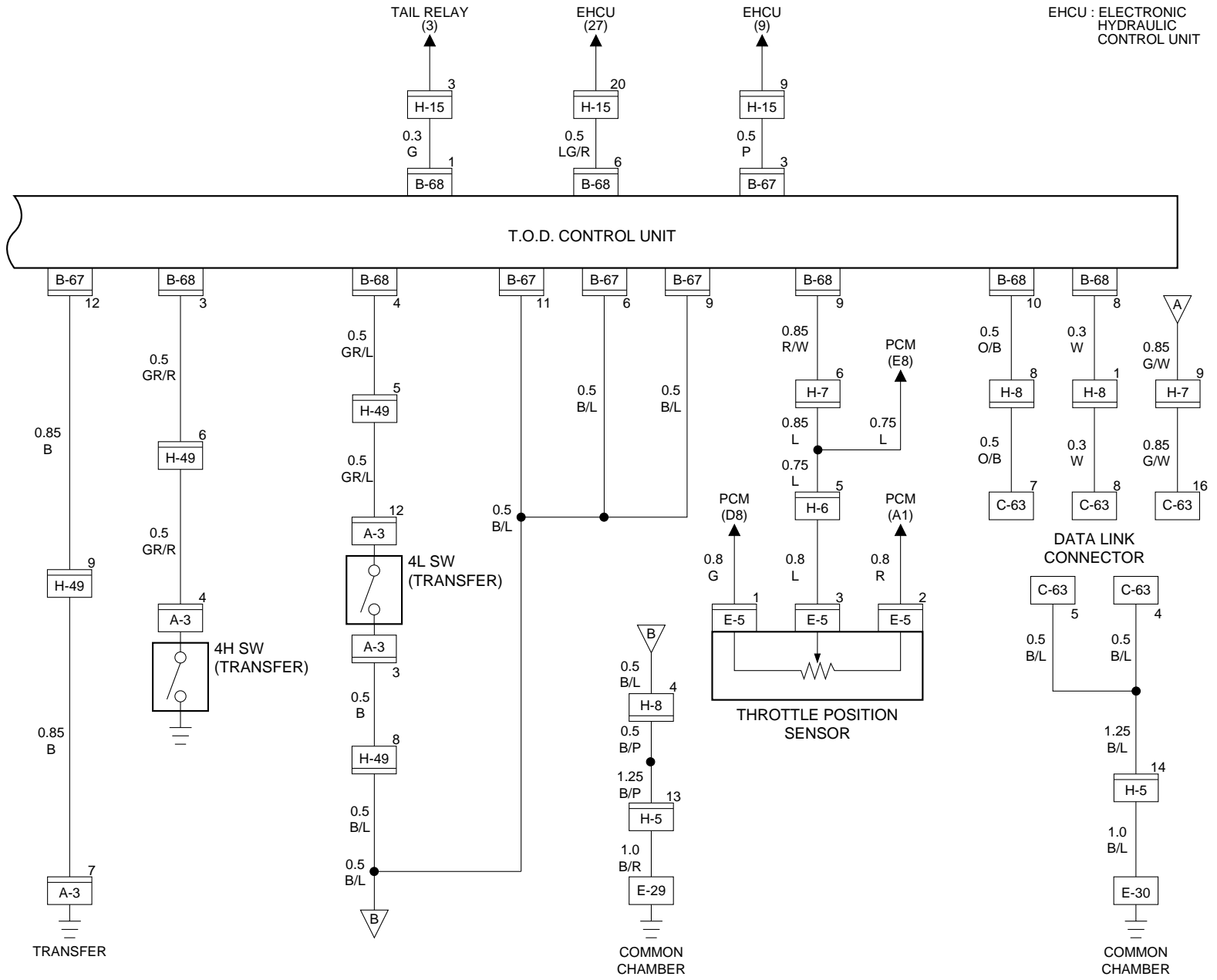
Torque on Demand (T.O.D.)



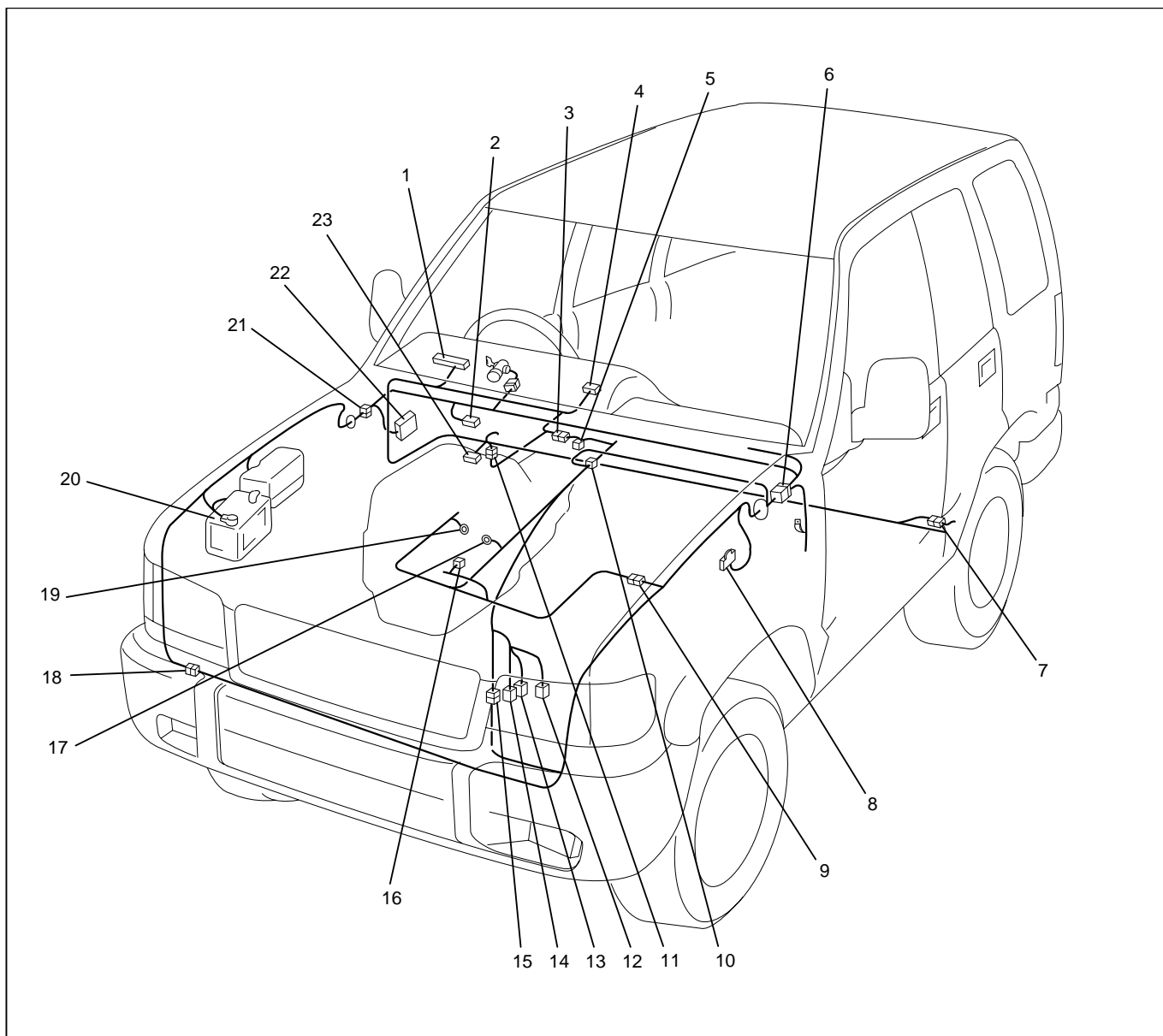
DUBOIS/610

Circuit Diagram (RHD 6VE1)-2





Parts Location



D08RW621

Legend

- | | |
|------------------|-----------------------|
| (1) I-9 | (12) M-22 |
| (2) B-13 or B-14 | (13) M-23 |
| (3) H-12 | (14) M-24 |
| (4) I-12 | (15) H-10 |
| (5) A-3 | (16) E-5 |
| (6) H-7, H-8 | (17) E-29 |
| (7) H-32 | (18) H-42 |
| (8) C-16 | (19) E-30 |
| (9) H-5, H-6 | (20) Battery |
| (10) C-63 | (21) H-13, H-15, H-26 |
| (11) H-49 | (22) Fuse Box |
| | (23) B-67, B-68 |

Supplemental Restraint System (SRS) – Air Bag

General Description

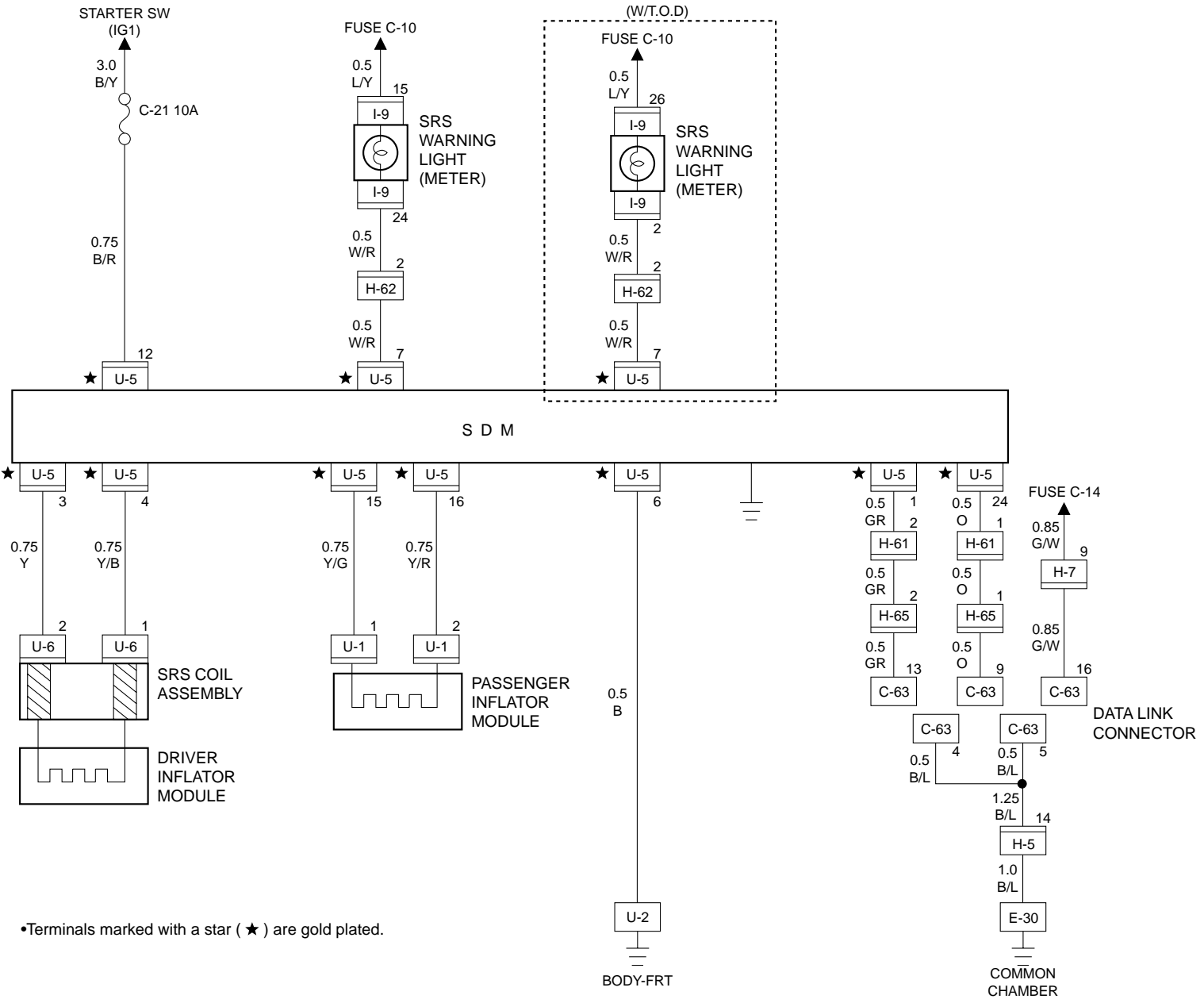
The circuit consists of Sensing and Diagnostic Module (SDM), driver's air bag assembly, SRS coil assembly, passenger's air bag assembly, and "AIR BAG" warning light. SDM, SRS coil assembly (driver side only), driver air bag assembly, passenger air bag assembly and connector wire make up the deployment loops. The function of the deployment loops is to supply current through air bag assembly, which will cause deployment of the air bags in the event of a frontal crash of sufficient force, up to 30 degrees off the center line of the vehicle. The air bag assemblies are only supplied enough current to deploy when the SDM detects vehicle velocity changes severe enough to warrant deployment.

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal.

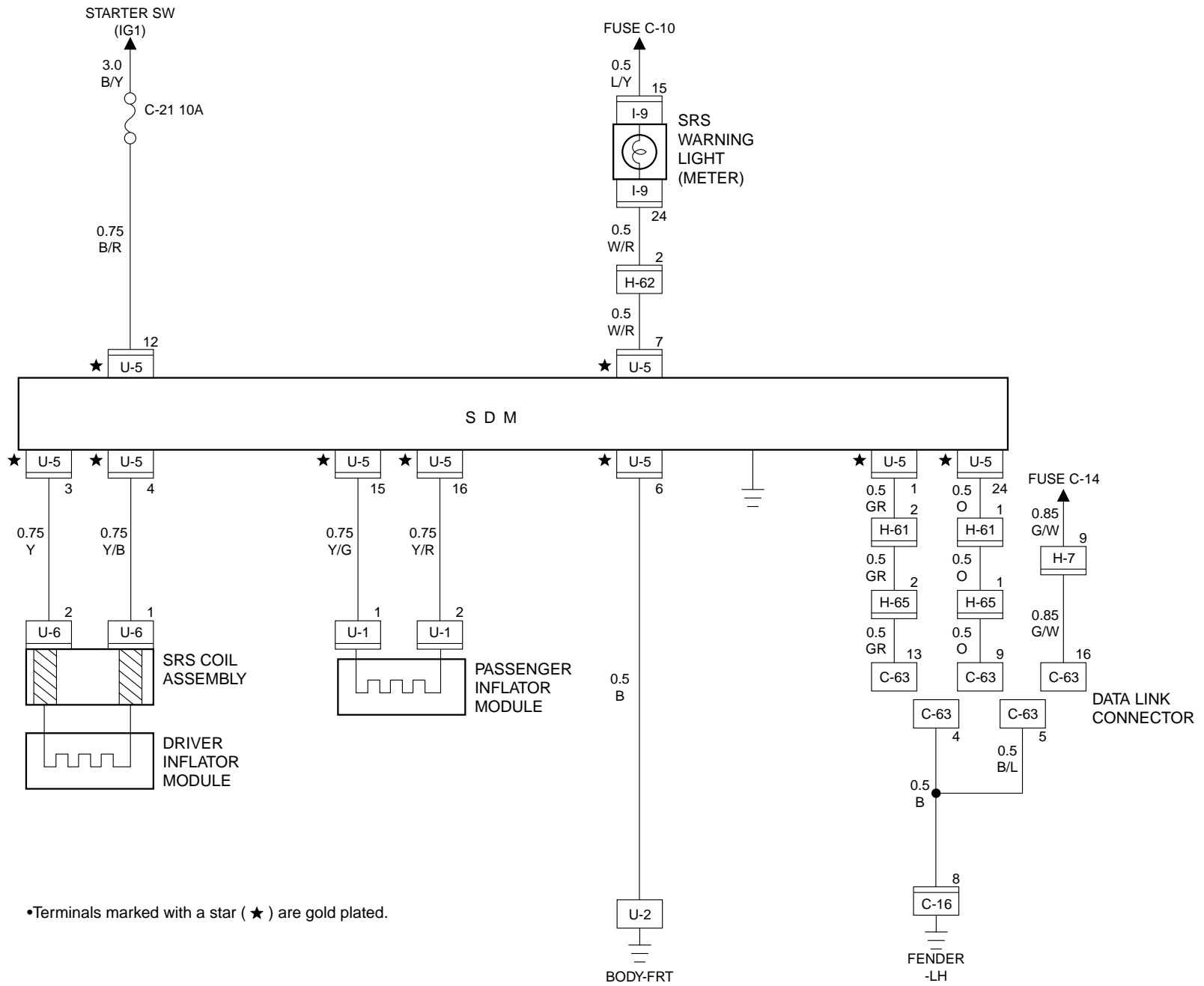
The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags.

Refer to Supplemental Restraint System in Restraints section.

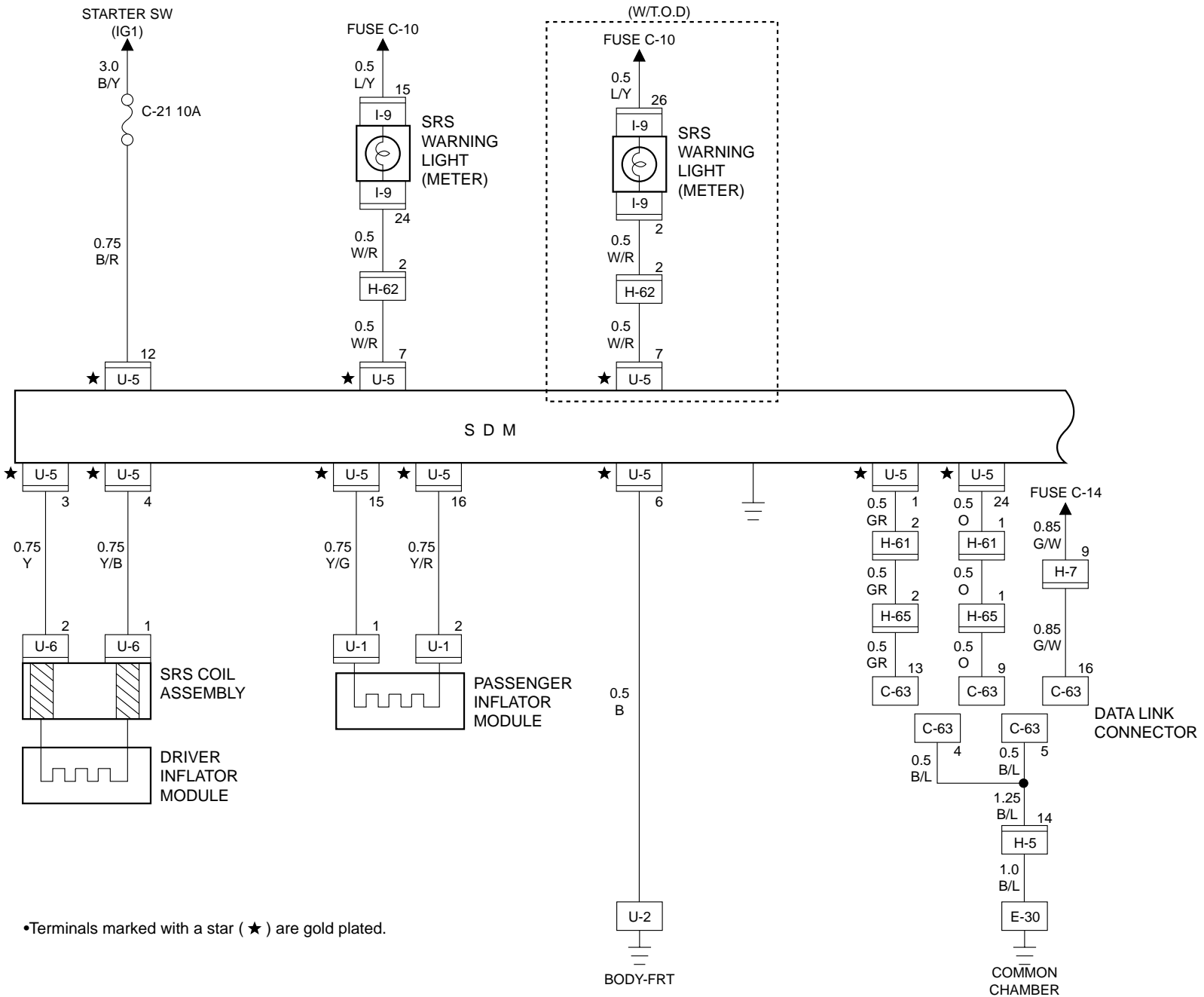
Circuit Diagram (6VD1)



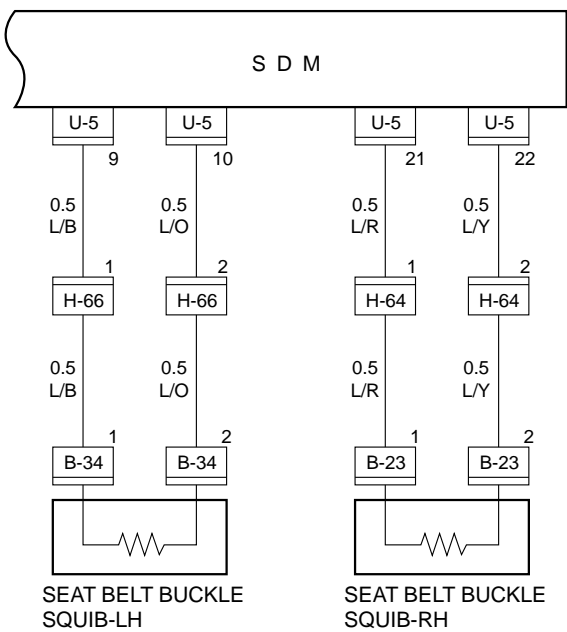
50309490B01



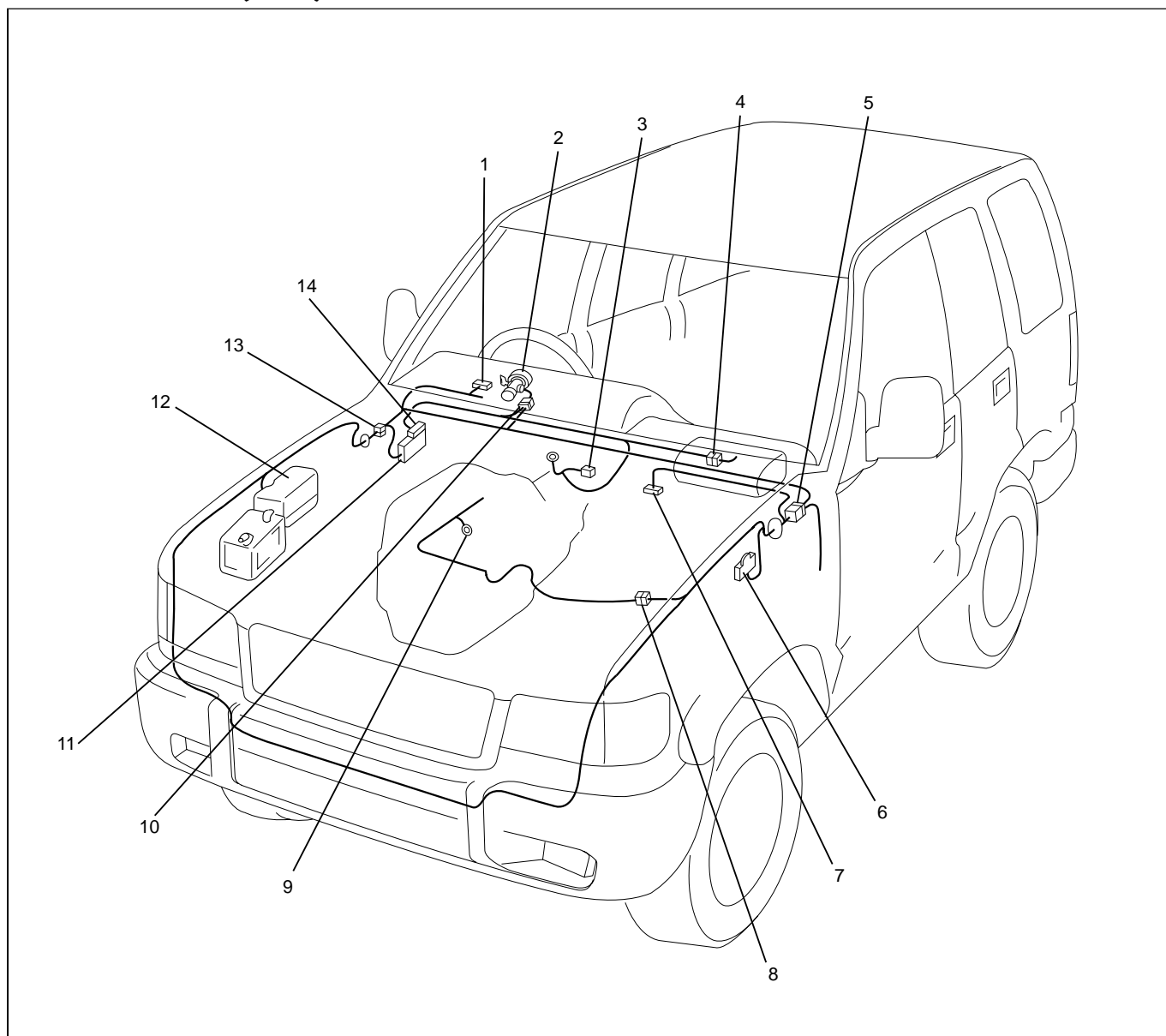
Circuit Diagram (6VE1 South Africa)-1



Circuit Diagram (6VE1 South Africa)-2



Parts Location (RHD)

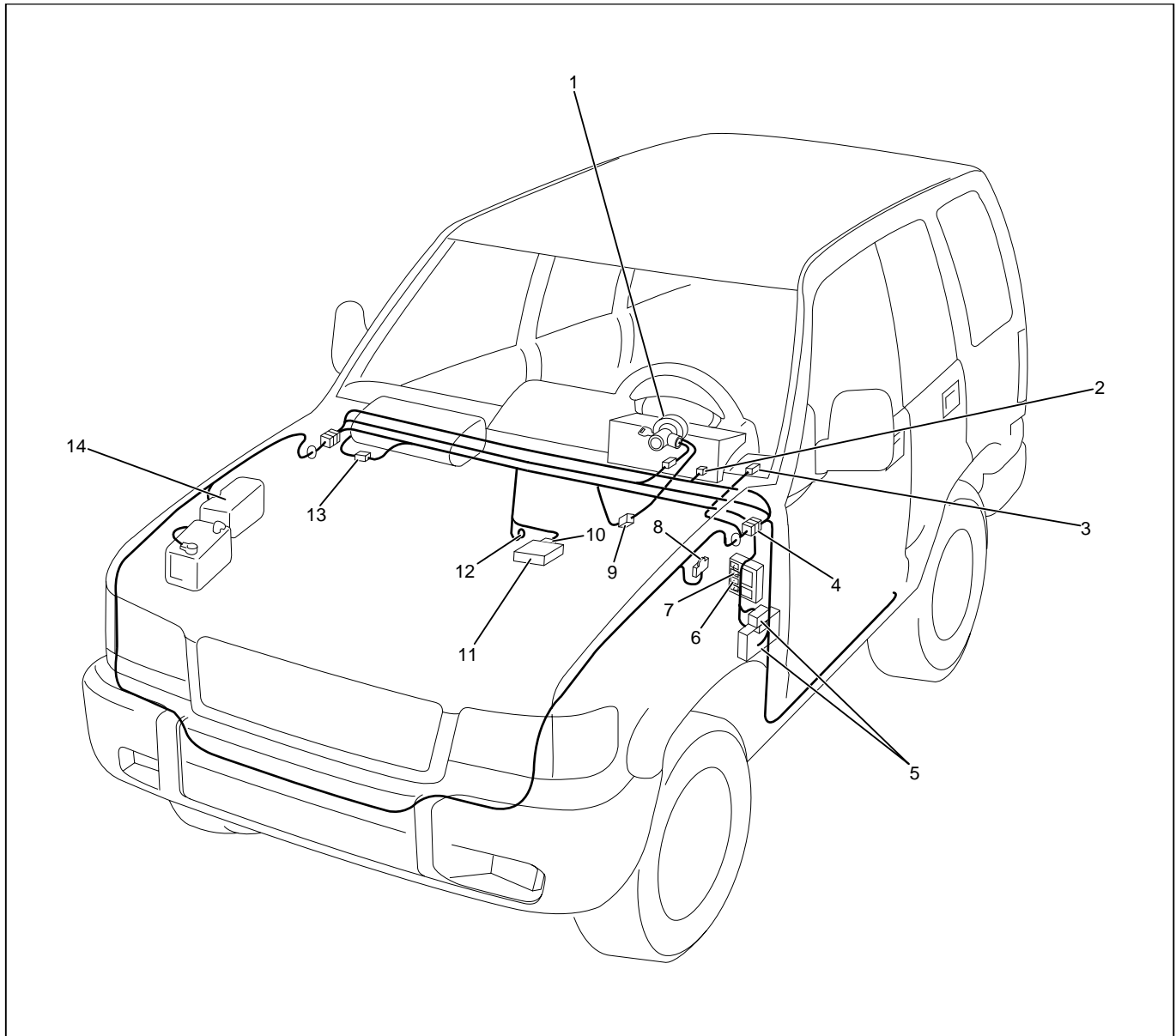


D08RW622

Legend

- | | |
|-----------------------|-------------------------|
| (1) I-9 | (8) H-5 |
| (2) SRS Coil Assembly | (9) E-30 |
| (3) U-5 | (10) U-2 |
| (4) U-1 | (11) Fuse Box |
| (5) H-7, H-65 | (12) Relay and Fuse Box |
| (6) C-16 | (13) H-61, H-62 |
| (7) C-63 | (14) Fuse Box (C-21) |

Parts Location (LHD)




D08RW997

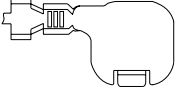

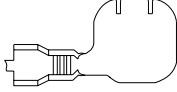
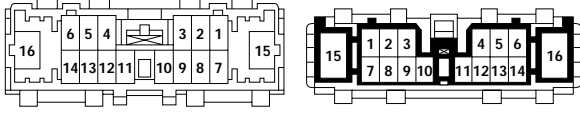
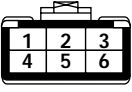

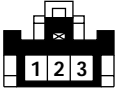
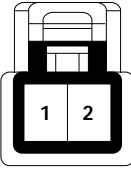

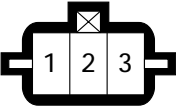
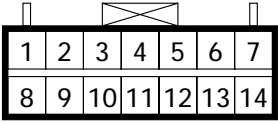

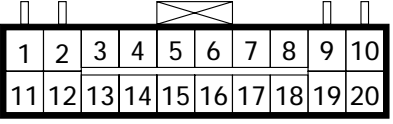
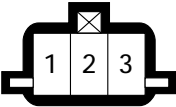

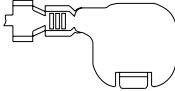
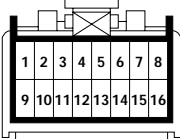
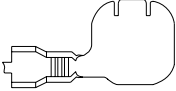

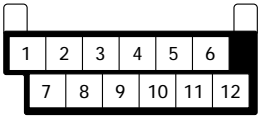
Legend

- (1) SRS Coil Assembly
- (2) I-37
- (3) C-63
- (4) H-7
- (5) Fuse Box (H-49)
- (6) H-52
- (7) H-51

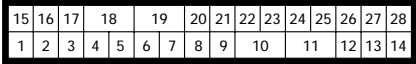
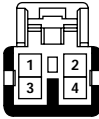
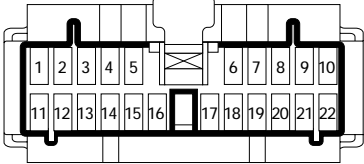
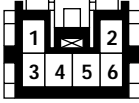





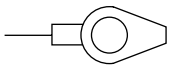

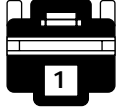

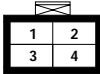
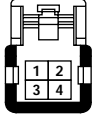


- (8) C-16
- (9) U-6
- (10) U-5
- (11) SDM
- (12) U-2
- (13) U-1
- (14) Relay and Fuse Box

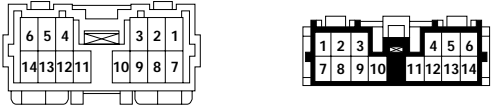
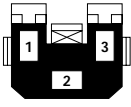
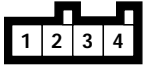

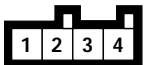
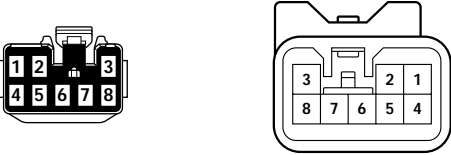
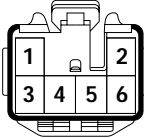

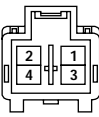


Connector List

No.	Connector face	No.	Connector face
A-1	NOT USED		
A-2	NOT USED		
A-3			

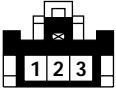
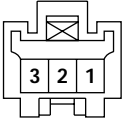
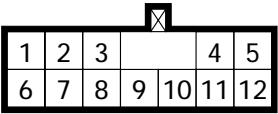
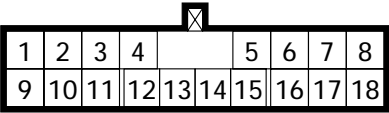
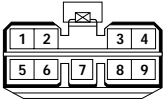
No.	Connector face	No.	Connector face
B-1		B-11	
B-2		B-12	
B-3		B-13	
B-4		B-14	
B-5		B-15	
B-6		B-16	
B-7		B-17	
B-8		B-18	
B-9		B-19	
B-10		B-20	

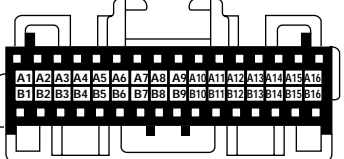
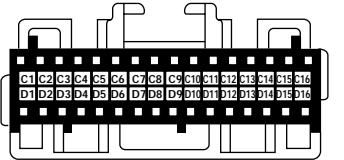
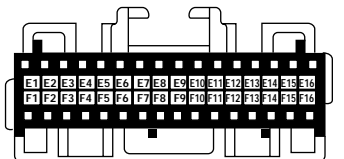

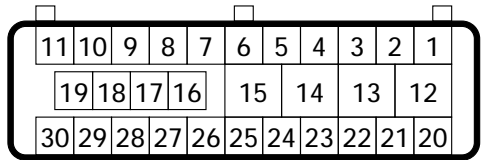





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No.	Connector face	No.	Connector face
B-21		B-31	
B-22		B-32	
B-23		B-33	
B-24	<p>NOT USED</p>	B-34	
B-25		B-35	
B-26		B-36	
B-27		B-37	
B-28	<p>NOT USED</p>	B-38	
B-29		B-39	
B-30		B-40	<p>NOT USED</p>

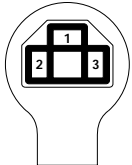
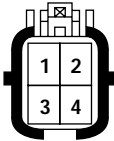
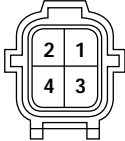
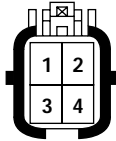
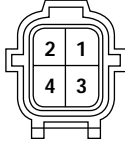
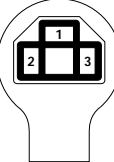
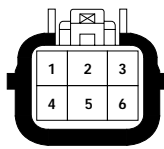
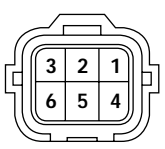
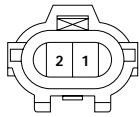
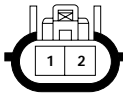

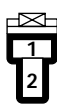
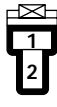
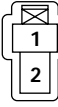

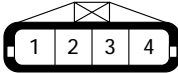

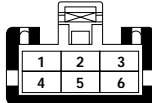

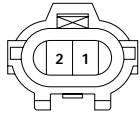

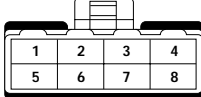
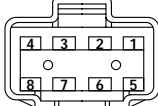
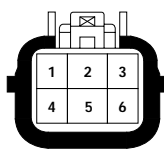
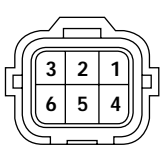
No.	Connector face	No.	Connector face
B-41	NOT USED	B-51	NOT USED
B-42	—	B-52	
B-43	NOT USED	B-53	
B-44		B-54	NOT USED
B-45	NOT USED	B-55	
B-46		B-56	
B-47	NOT USED	B-57	
B-48		B-58	
B-49		B-59	
B-50	NOT USED	B-60	NOT USED



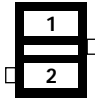
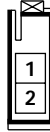



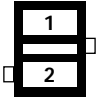
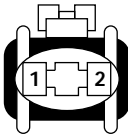


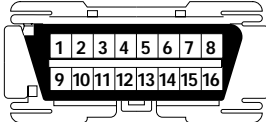

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No.	Connector face	No.	Connector face
B-61	NOT USED		
B-62	 		
B-63	NOT USED		
B-64	NOT USED		
B-65	NOT USED		
B-66	NOT USED		
B-67			
B-68			
B-69			


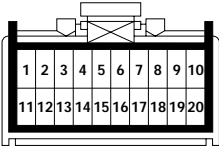

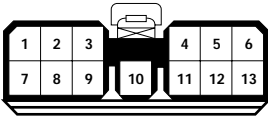



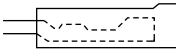
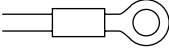


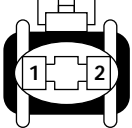

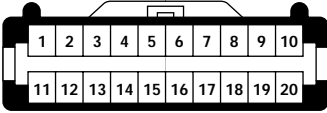


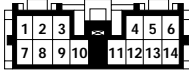
No.	Connector face	No.	Connector face
C-1		C-11	NOT USED
C-2		C-12	NOT USED
C-3		C-13	
C-4		C-14	NOT USED
C-5	NOT USED	C-15	
C-6	NOT USED	C-16	
C-7	NOT USED	C-17	NOT USED
C-8	NOT USED	C-18	NOT USED
C-9		C-19	
C-10	NOT USED	C-20	

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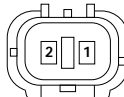

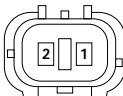
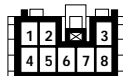
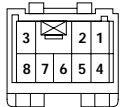

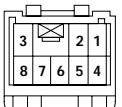

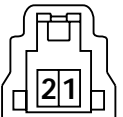

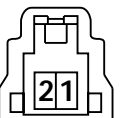


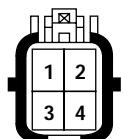
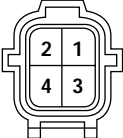
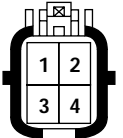
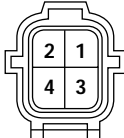

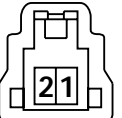



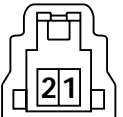
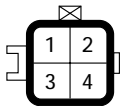
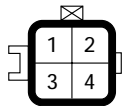

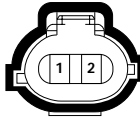

No.	Connector face	No.	Connector face
C-21		C-31	 
C-22	 	C-32	
C-23	 	C-33	NOT USED
C-24	 	C-34	NOT USED
C-25		C-35	
C-26	NOT USED	C-36	 
C-27		C-37	
C-28		C-38	 
C-29	 	C-39	 
C-30	 	C-40	NOT USED

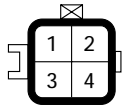
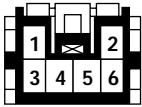



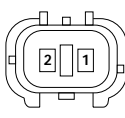
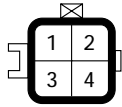
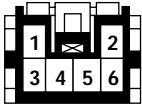


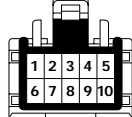
No.	Connector face	No.	Connector face
C-41		C-55	
C-42	NOT USED	C-56	
C-43	NOT USED	C-57	
C-44		C-58	NOT USED
C-45		C-59	NOT USED
C-46 } C-50	NOT USED	C-60	
C-51		C-61	
C-52		C-62	NOT USED
C-53		C-63	
C-54		C-64	NOT USED

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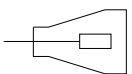
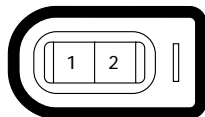

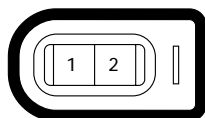

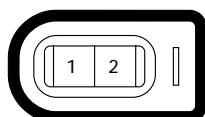


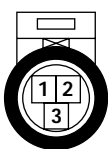

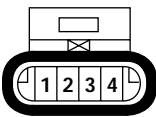



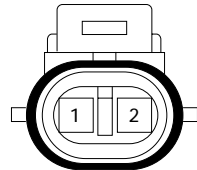

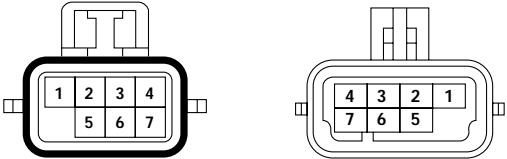

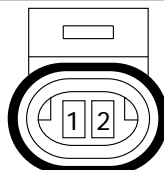
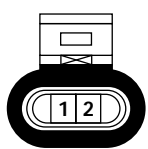
No.	Connector face	No.	Connector face
C-65	NOT USED	C-74	
C-66 (QOS/EGR)		C-75	
C-66 (QOS-)		C-76	
C-67		C-77	
C-68		C-85	
C-69		C-86	
C-70		C-87	
C-71	NOT USED	C-88	
C-72		C-89 } C-92	NOT USED
C-73		C-93	



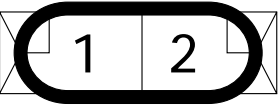
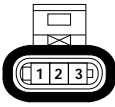

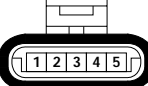
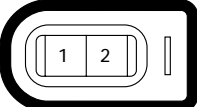
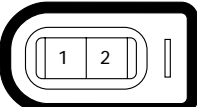
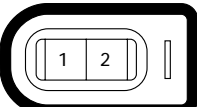

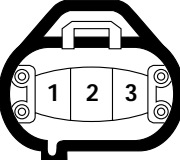
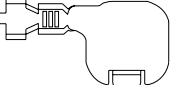
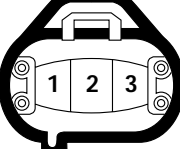
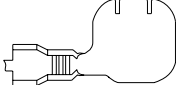
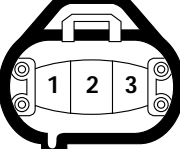
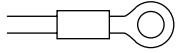
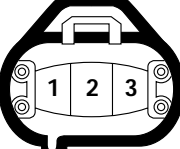
8D-560 WIRING SYSTEM

No.	Connector face	No.	Connector face
D-1		D-11	 
D-2	 	D-12	 
D-3	 	D-13	 
D-4	 	D-14	
D-5		D-15	NOT USED
D-6	 	D-16	 
D-7	 	D-17	
D-8		D-18	 
D-9		D-19	
D-10		D-20	 

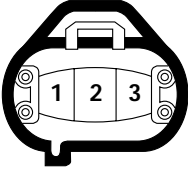
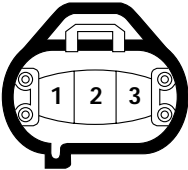
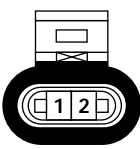
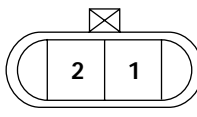

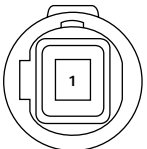
No.	Connector face		No.	Connector face	
D-21					
D-22					
D-23	<p>NOT USED</p>				
D-24					
D-25					
D-26					
D-27					
D-28	<p>NOT USED</p>				
D-29					
D-30					




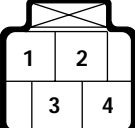


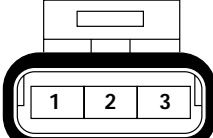
8D-562 WIRING SYSTEM

No.	Connector face	No.	Connector face
E-1		E-11	
E-2		E-12	
E-3		E-13	
E-4		E-14	
E-5		E-15	
E-6		E-16	
E-7		E-17	
E-8		E-18	
E-9		E-19	
E-10		E-20	



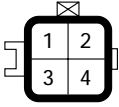
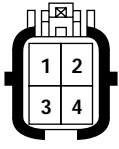
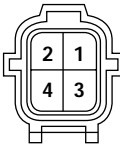
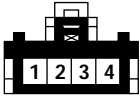

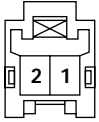


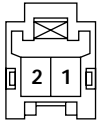
No.	Connector face	No.	Connector face
E-21		E-31	
E-22		E-32	
E-23		E-33	
E-24		E-34	NOT USED
E-25		E-35	NOT USED
E-26		E-36	NOT USED
E-27		E-37	
E-28		E-38	
E-29		E-39	
E-30		E-40	

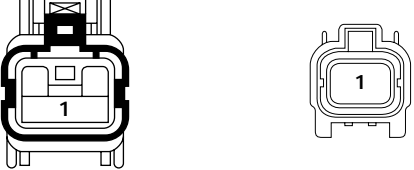
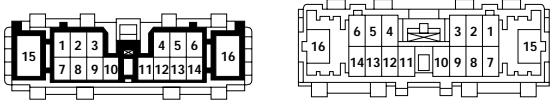

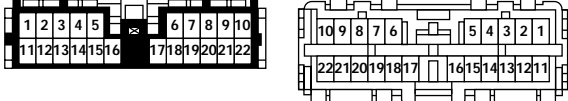



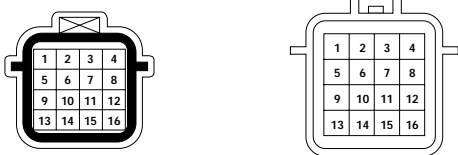







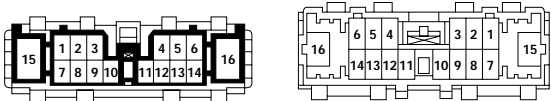


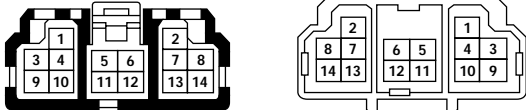

8D-564 WIRING SYSTEM

No.	Connector face	No.	Connector face
E-41			
E-42			
E-43			
E-44			
E-45			

No.	Connector face	No.	Connector face
F-1	NOT USED		
F-2			
F-3			
F-4			
F-5			
F-6	NOT USED		
F-7			
F-8			
F-9			

8D-566 WIRING SYSTEM

No.	Connector face	No.	Connector face
G-1	NOT USED		
G-2			
G-3			
G-4			
G-5			
G-6			
G-7			
G-8			
G-9			



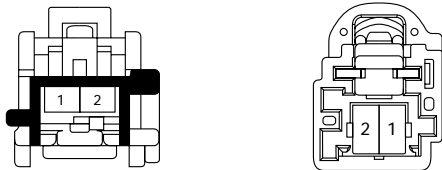

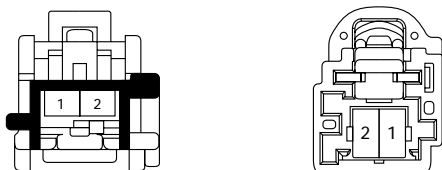





No.	Connector face	No.	Connector face
H-1		H-8 (LHD)	
H-2		H-9 (RHD)	
H-3 (6V*1)		H-9 (LHD)	
H-3 (4JG2)		H-10	
H-4		H-11	
H-5		H-12 (RHD)	
H-6 (6V*1)		H-12 (LHD)	
H-6 (4JG2)		H-13 (RHD)	
H-7		H-13 (LHD)	
H-8 (RHD)		H-14	

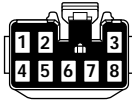
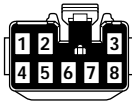


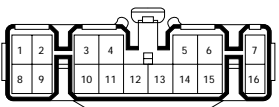
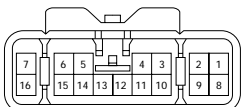

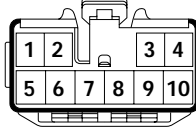
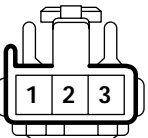


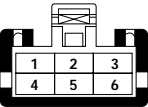
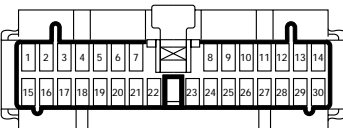
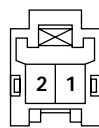

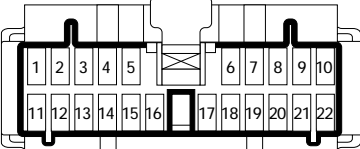

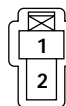
8D-568 WIRING SYSTEM

No.	Connector face	No.	Connector face
H-15 (RHD)		H-23	
H-15 (LHD)		H-24 (RHD)	
H-16 (RHD)		H-24 (LHD)	
H-16 (LHD)		H-25	
H-17	<p>NOT USED</p>	H-26	
H-18		H-27	
H-19		H-28	
H-20		H-29	
H-21		H-30	<p>NOT USED</p>
H-22		H-31	


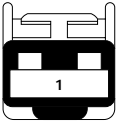
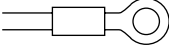
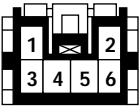
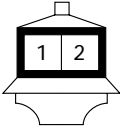
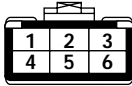
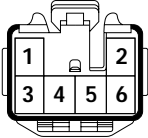
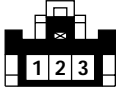
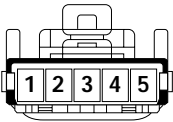
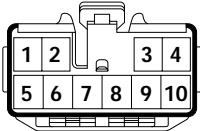
No.	Connector face	No.	Connector face
H-32		H-41 (4JG2)	
H-33		H-43	
H-34		H-44	
H-35		H-45	
H-36	NOT USED	H-46	
H-37		H-47	
H-38		H-48	
H-39		H-49 (W/ TOD)	
H-40	NOT USED	H-49 (W/O TOD)	
H-41 (6V*1)		H-50	NOT USED

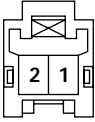

8D-570 WIRING SYSTEM

No.	Connector face	No.	Connector face
H-51		H-61	
H-52	NOT USED	H-62	
H-53	NOT USED	H-63	
H-54	NOT USED	H-64	
H-55	NOT USED	H-65	
H-56	NOT USED		
H-57			
H-58			
H-59			
H-60			





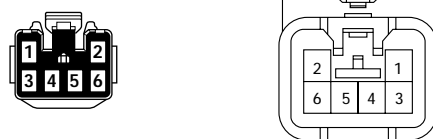

No.	Connector face	No.	Connector face
I-1	NOT USED	I-11	
I-2	NOT USED	I-12	
I-3	NOT USED	I-13	NOT USED
I-4		I-14	NOT USED
I-5		I-15	 
I-6		I-16	
I-7		I-17	
I-8		I-18	
I-9		I-19	 
I-10		I-20	 







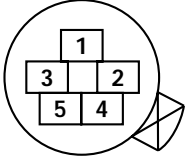
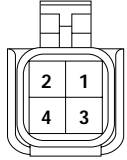
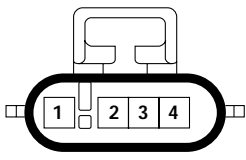
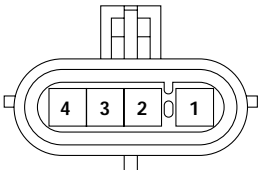
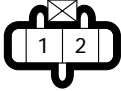
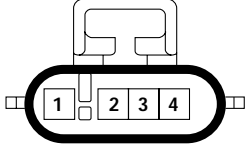
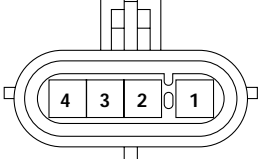

8D-572 WIRING SYSTEM

No.	Connector face	No.	Connector face
I-21		I-30 } I-38	NOT USED
I-22		I-39	
I-23		I-40	NOT USED
I-24		I-41	
I-25		I-42	
I-26	NOT USED		
I-27			
I-28	NOT USED		
I-29	NOT USED		
I-30			




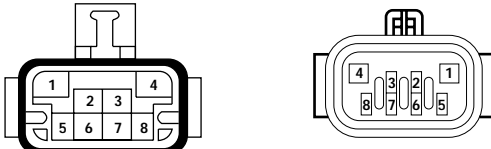

No.	Connector face	No.	Connector face
K-1	NOT USED		
K-2	 		


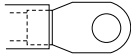
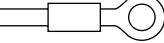

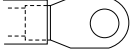

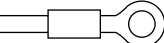
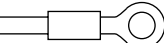
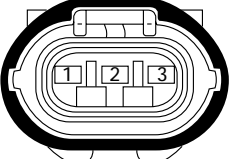


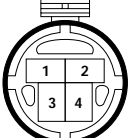

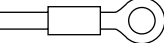

8D-574 WIRING SYSTEM

No.	Connector face	No.	Connector face
L-1			
L-2			
L-3			
L-4			
L-5			
L-6			





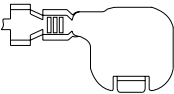

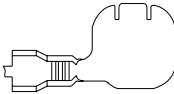







No.	Connector face	No.	Connector face
M-1		M-11	 
M-2	NOT USED	M-12	 
M-3	NOT USED	M-13	NOT USED
M-4	NOT USED	M-14	NOT USED
M-5	NOT USED	M-15	
M-6		M-16	NOT USED
M-7		M-17	 
M-8		M-18	 
M-9	NOT USED	M-19	NOT USED
M-10		M-20	NOT USED

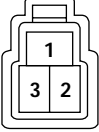
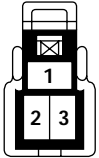


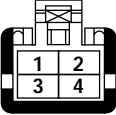
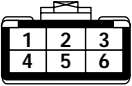
8D-576 WIRING SYSTEM

No.	Connector face	No.	Connector face
M-21	NOT USED		
M-22			
M-23			
M-24			
M-25			
M-26			

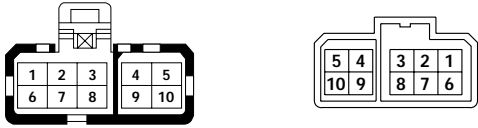












No.	Connector face	No.	Connector face
P-1		P-10	
P-2		P-11	NOT USED
P-3		P-12	NOT USED
P-4		P-13	NOT USED
P-5		P-14	NOT USED
P-6		P-15	NOT USED
P-7		P-16	NOT USED
P-8 (6V*1)		P-17	 
P-8 (4JG2)		P-18	
P-9		P-19	


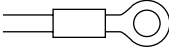
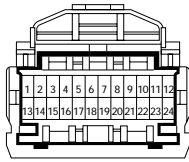

8D-578 WIRING SYSTEM

No.	Connector face	No.	Connector face
R-1		R-11	
R-2		R-12	
R-3		R-12	 <p>(South Africa, China)</p>
R-4		R-13	
R-5		R-13	 <p>(South Africa, China)</p>
R-6		R-14	NOT USED
R-7	NOT USED	R-15	NOT USED
R-8		R-16	
R-9	NOT USED		
R-10			

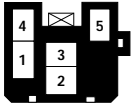


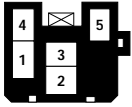

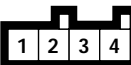
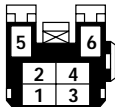

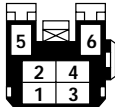
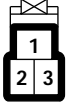
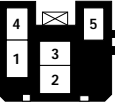

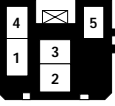
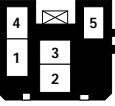
No.	Connector face	No.	Connector face
S-1	NOT USED		
S-2			
S-3			
S-4			
S-5			





8D-580 WIRING SYSTEM

No.	Connector face	No.	Connector face
T-1		T-11	
T-2		T-12	
T-3		T-13	
T-4			
T-5			
T-6			
T-7			
T-8			
T-9			
T-10			

No.	Connector face	No.	Connector face
U-1			
U-2			
U-3	<p>NOT USED</p>		
U-4	<p>NOT USED</p>		
U-5			
U-6			

8D-582 WIRING SYSTEM

No.	Connector face	No.	Connector face
X-1		X-11	
X-2	NOT USED	X-12	
X-3		X-13	NOT USED
X-4	NOT USED	X-14	NOT USED
X-5		X-15	
X-6	NOT USED	X-16	
X-7		X-17 (6V*1)	
X-8		X-17 (4JG2)	
X-9		X-18	
X-10	NOT USED	X-19	

No.	Connector face	No.	Connector face
X-20			
X-21			
X-22			
X-23			

MEMO

A series of horizontal dotted lines for writing.

METER AND GAUGE

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Service Precaution

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

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

General Description

The circuit consists of the starter switch, meter assembly, vehicle speed sensor, transmission switch, lighting switch, turn signal switch, thermo unit, oil pressure unit, Powertrain Control Module (PCM), fuel tank unit, 4WD switch, oil pressure switch, parking brake switch, brake fluid switch, seat belt switch, illumination controller, multi meter and ambient sensor.

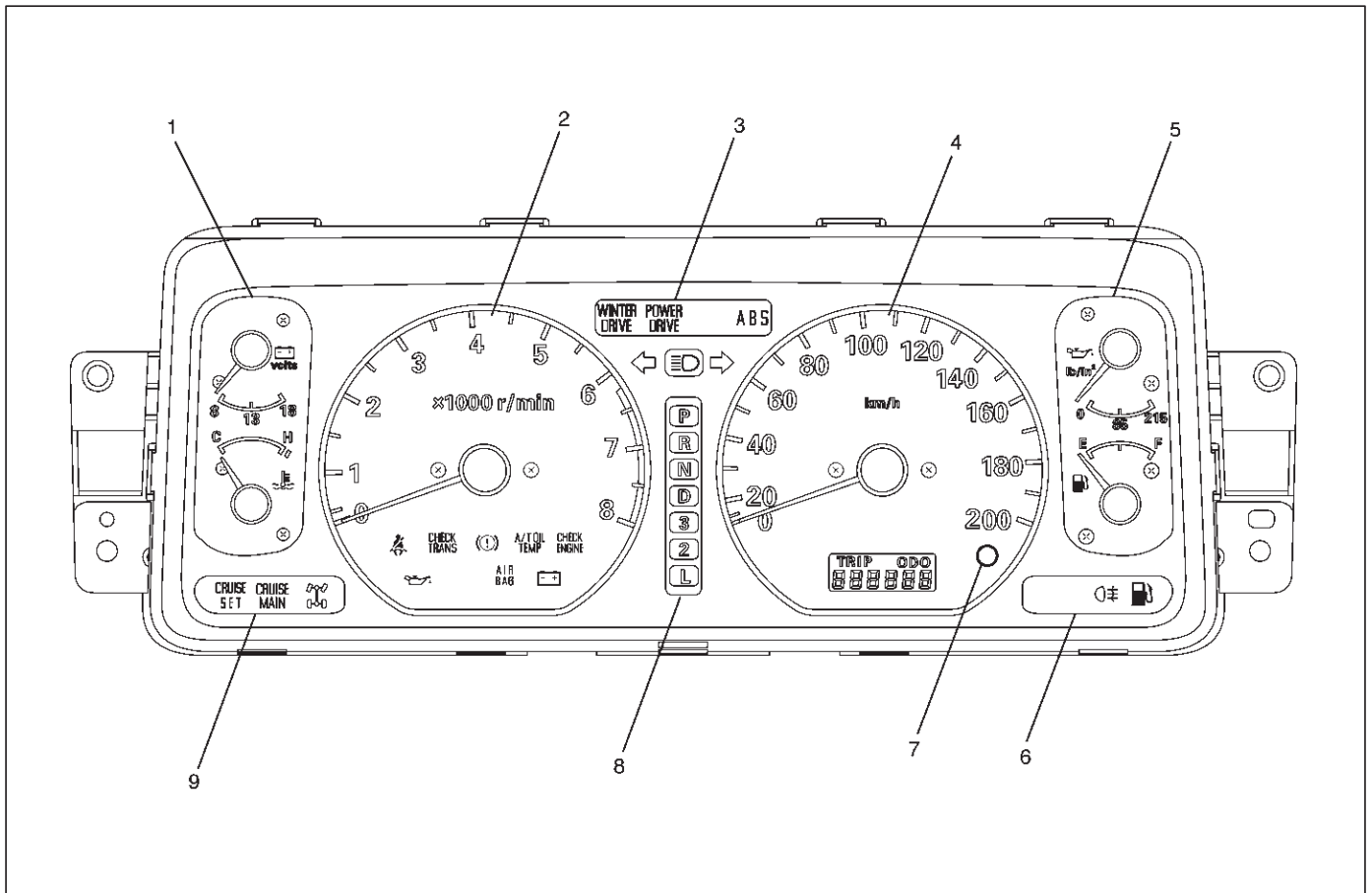
Meter Assembly

General Description

The meter assembly has the speedometer, tachometer, engine coolant temperature gauge, fuel gauge and warning/indicator lights. In addition, the meter assembly containing TOD (Torque on Demand) has the TOD indicator light, or the meter assembly not containing TOD has the voltmeter and oil pressure gauge instead of the TOD indicator.

Layout for Meters/Gauges, Warning Lights, Indicator Lights and Illumination Lights

Meter Assembly—Gasoline W/O TOD (Front View)

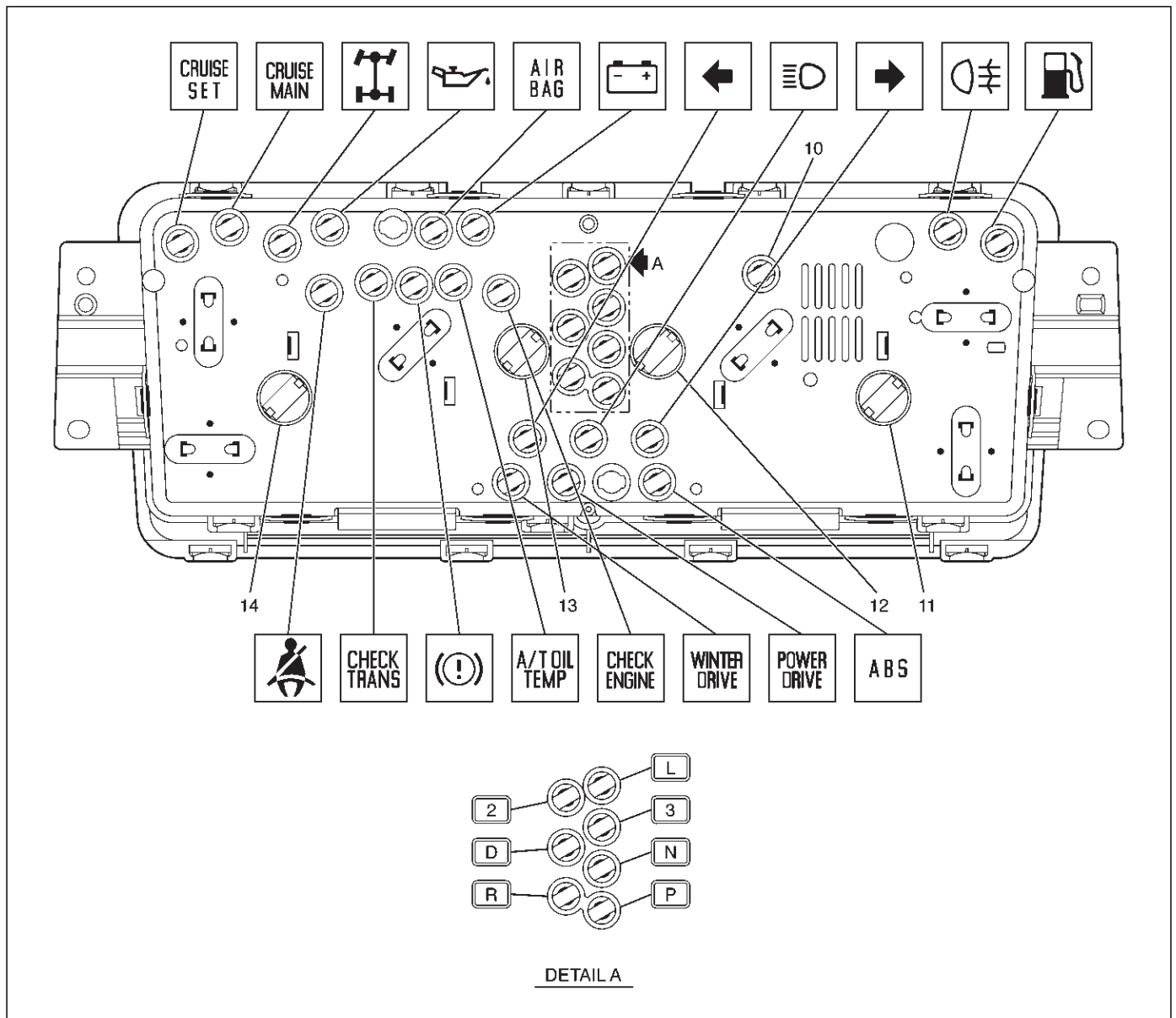


825RW207

Legend

- | | |
|--|-------------------------------------|
| (1) Voltmeter & Engine Coolant Temperature Gauge | (5) Oil Pressure Gauge & Fuel Gauge |
| (2) Tachometer | (6) Warning Light Lens |
| (3) Warning Light Lens | (7) Reset Knob |
| (4) Speedometer | (8) A/T Shift Indicator |
| | (9) Warning Light Lens |

Meter Assembly—Gasoline W/O TOD (Rear View)



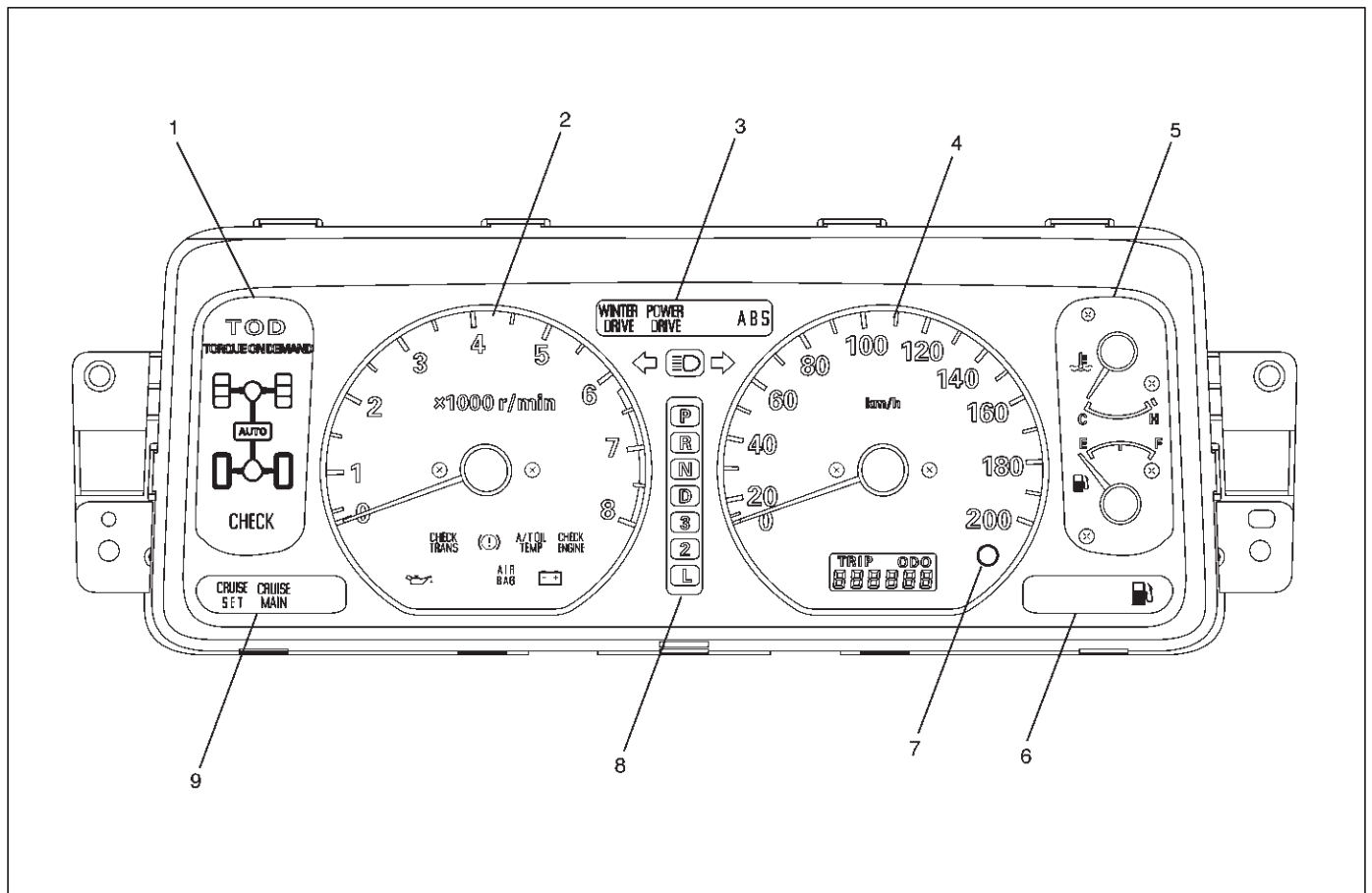
Legend

- (10) LCD Light
- (11) Illumination Light

- (12) Illumination Light
- (13) Illumination Light
- (14) Illumination Light

8E-4 METER AND GAUGE

Meter Assembly—Gasoline W/TOD (Front View)

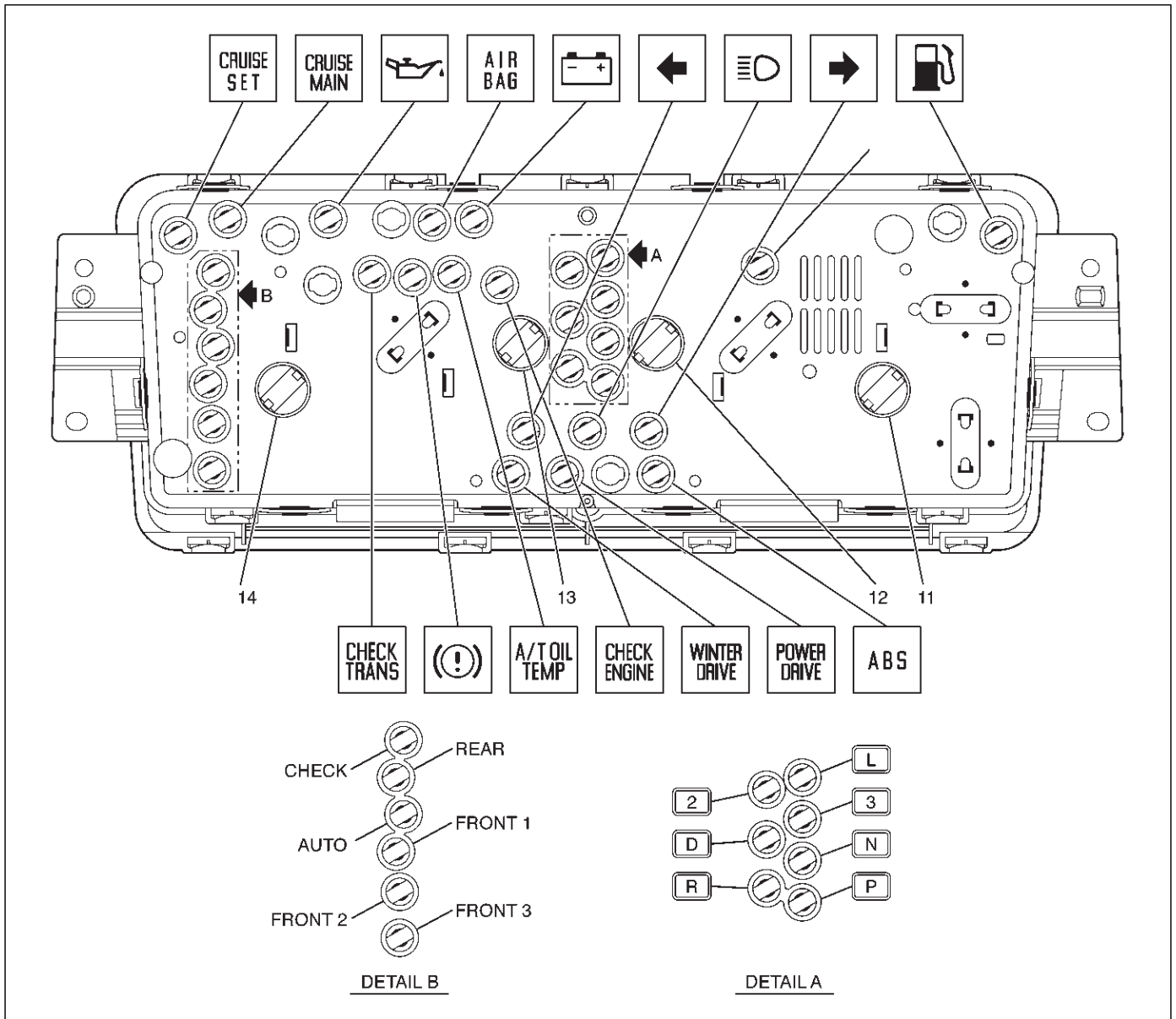


825RW210

Legend

- | | |
|------------------------|--|
| (1) TOD Indicator | (5) Coolant Temperature Gauge & Fuel Gauge |
| (2) Tachometer | (6) Warning Light Lens |
| (3) Warning Light Lens | (7) Reset Knob |
| (4) Speedometer | (8) A/T Shift Indicator |
| | (9) Warning Light Lens |

Meter Assembly—Gasoline W/TOD (Rear View)



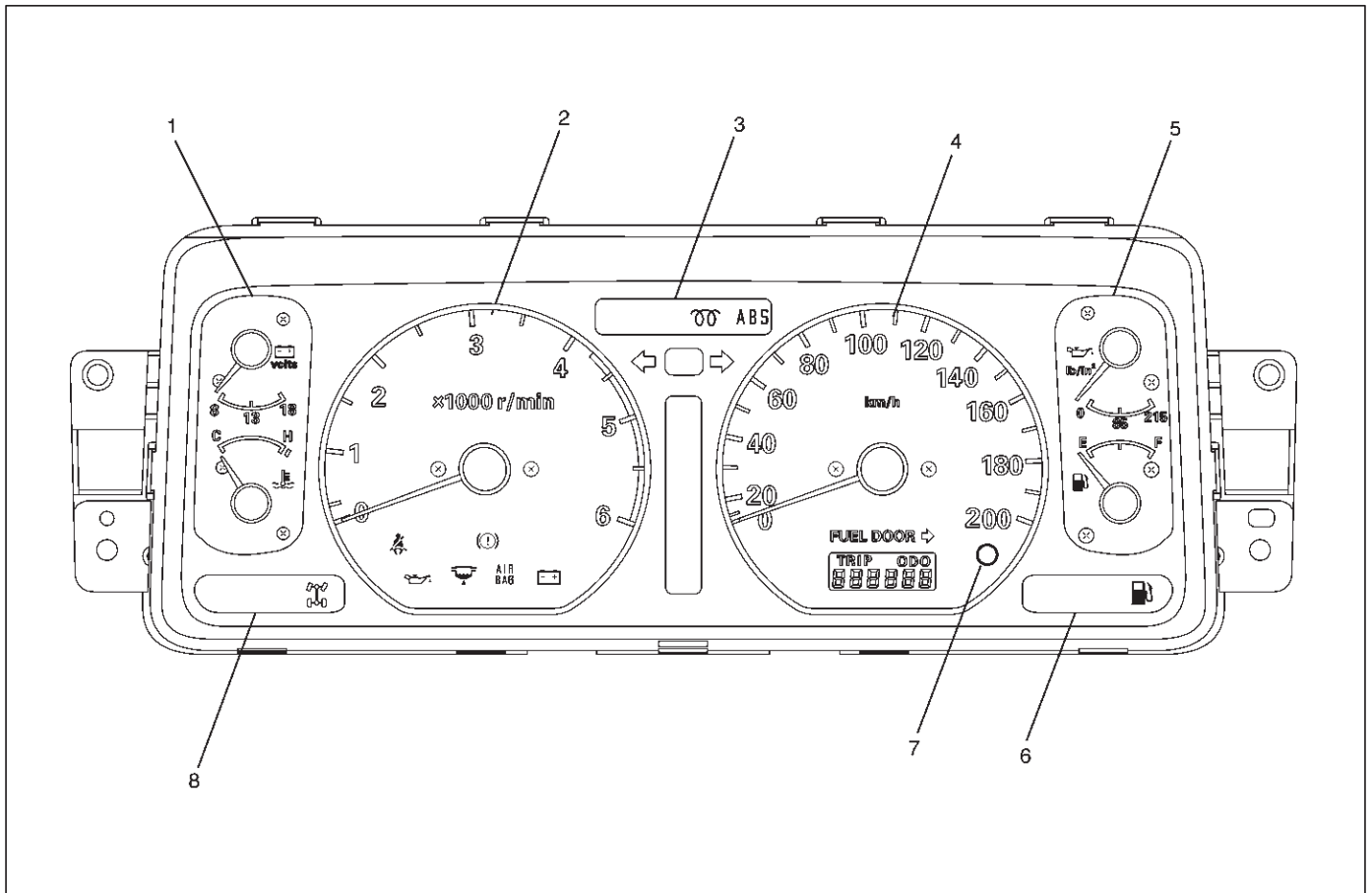
Legend

- (10) LCD Light
- (11) Illumination Light

- (12) Illumination Light
- (13) Illumination Light
- (14) Illumination Light

8E-6 METER AND GAUGE

Meter Assembly–Diesel (Front View)

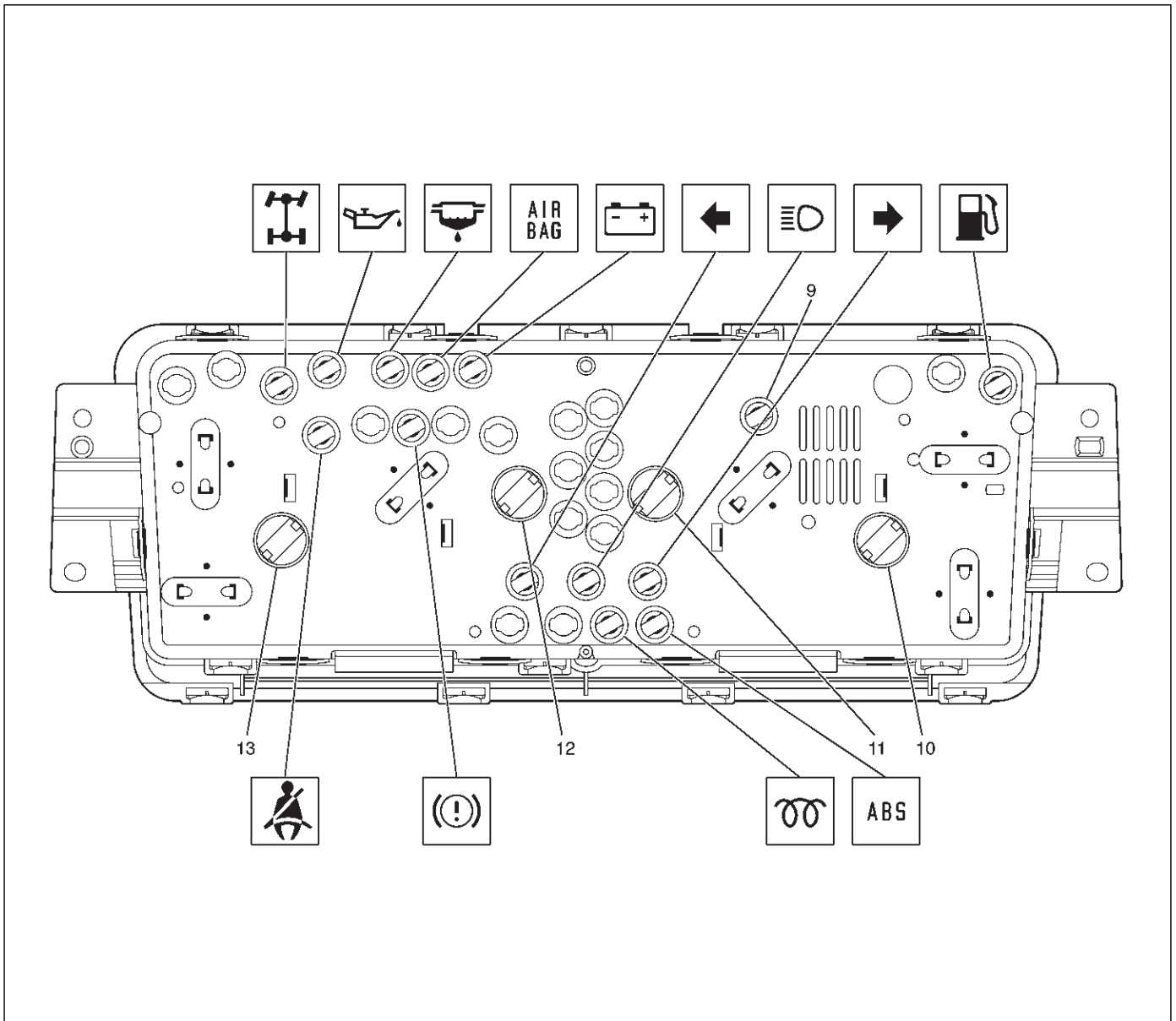


825RW211

Legend

- | | |
|------------------------|--|
| (1) TOD Indicator | (5) Coolant Temperature Gauge & Fuel Gauge |
| (2) Tachometer | (6) Warning Light Lens |
| (3) Warning Light Lens | (7) Reset Knob |
| (4) Speedometer | (8) Warning Light Lens |

Meter Assembly–Diesel (Rear View)



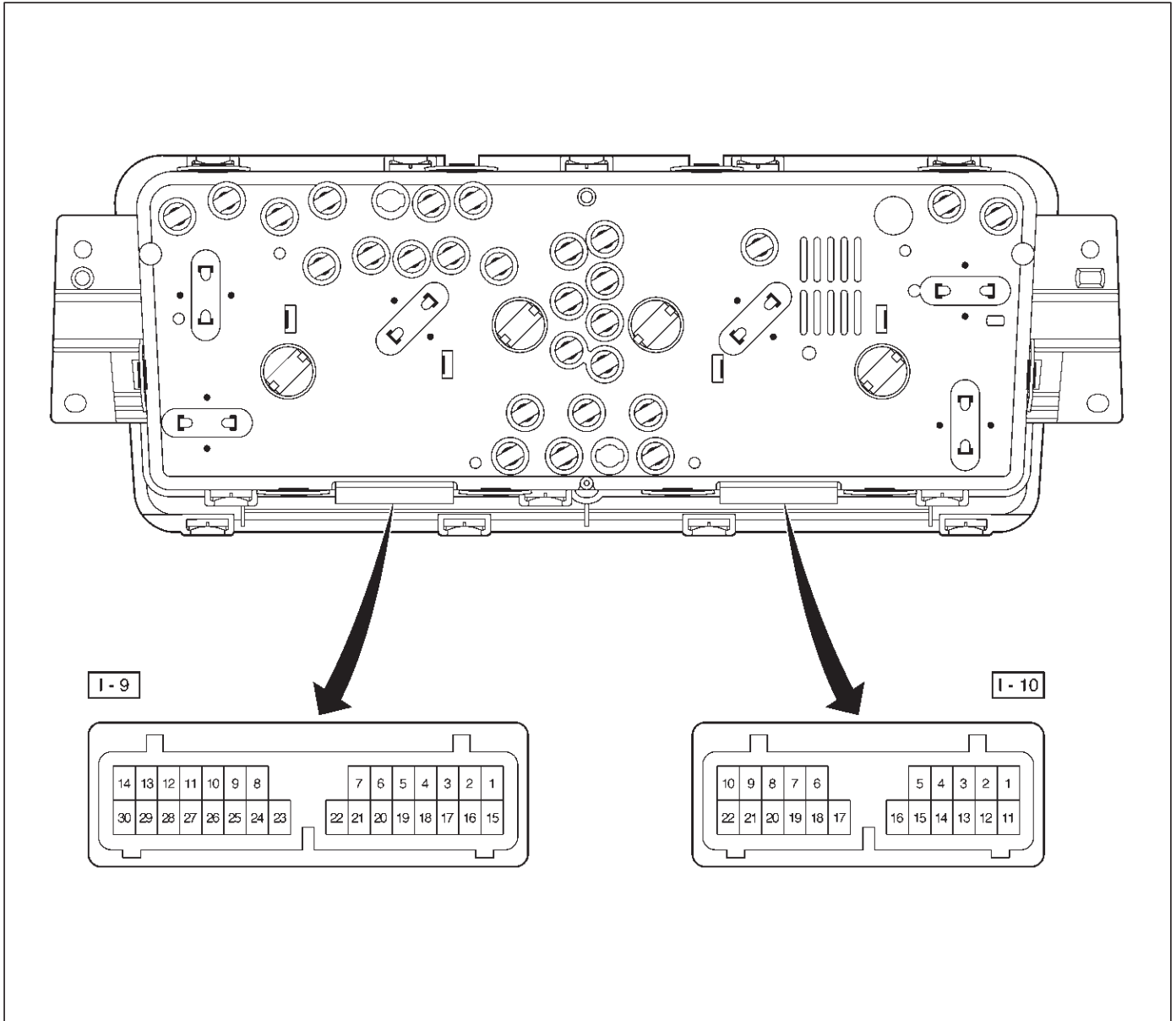
825RW232

Legend

- (9) LCD Light
- (10) Illumination Light

- (11) Illumination Light
- (12) Illumination Light
- (13) Illumination Light

Table for Meter/Gauge Connector Terminal Connections
Meter Assembly-Gasoline W/O TOD-1



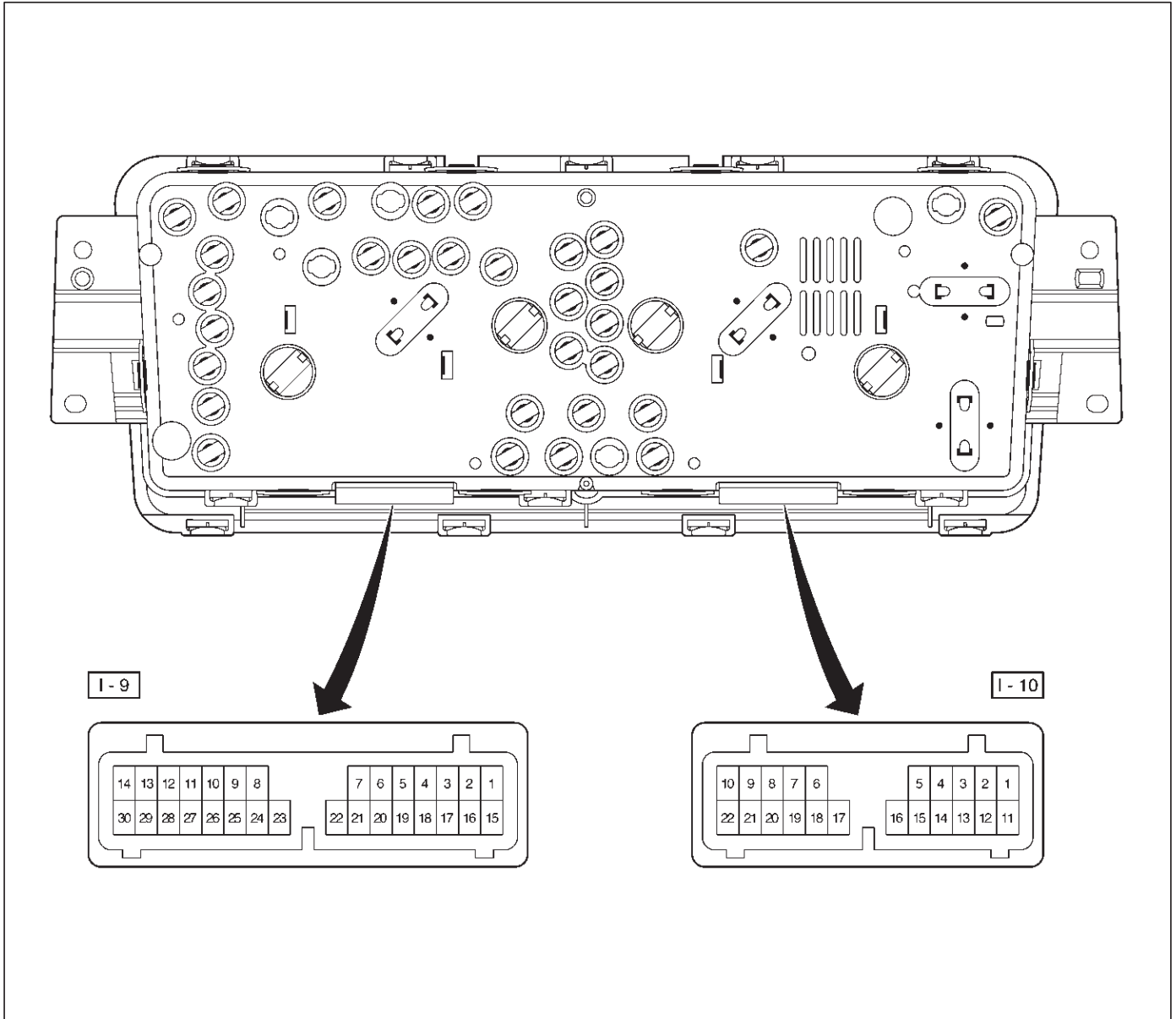
Meter Assembly—Gasoline W/O TOD-2

Connector No. I-9	
Terminal	Function
1	A/T oil temp warning light
2	Seat belt warning light
3	Check trans warning light
4	Brake warning light
5	Check engine warning light
6	Charge warning light
7	Cigarette lighter illumination light
8	Illumination controller
9	Tachometer
10	D position (A/T)
11	—
12	A/T shift indicator control unit
13	—
14	2 position (A/T)
15	Starter switch
16	Cruise set indicator light
17	Cruise main indicator light
18	4WD indicator light
19	Ground (Gauge)
20	—
21	Winter drive indicator light
22	Oil pressure warning light
23	—
24	Air bag warning light
25	Power drive indicator light
26	—
27	—
28	Turn signal indicator light (Left)
29	—
30	Ground

Connector No. I-10	
Terminal	Function
1	Turn signal indicator light (Right)
2	L position (A/T)
3	R position (A/T)
4	Engine coolant temperature gauge
5	Speedometer
6	—
7	—
8	Battery (+)
9	—
10	Rear fog light
11	P position (A/T)
12	N position (A/T)
13	3 position (A/T)
14	High-beam indicator light (-)
15	High-beam indicator light (+)
16	ABS indicator light
17	—
18	Fuel warning light
19	Oil pressure gauge
20	Fuel gauge
21	—
22	—

8E-10 METER AND GAUGE

Meter Assembly–Gasoline W/TOD-1



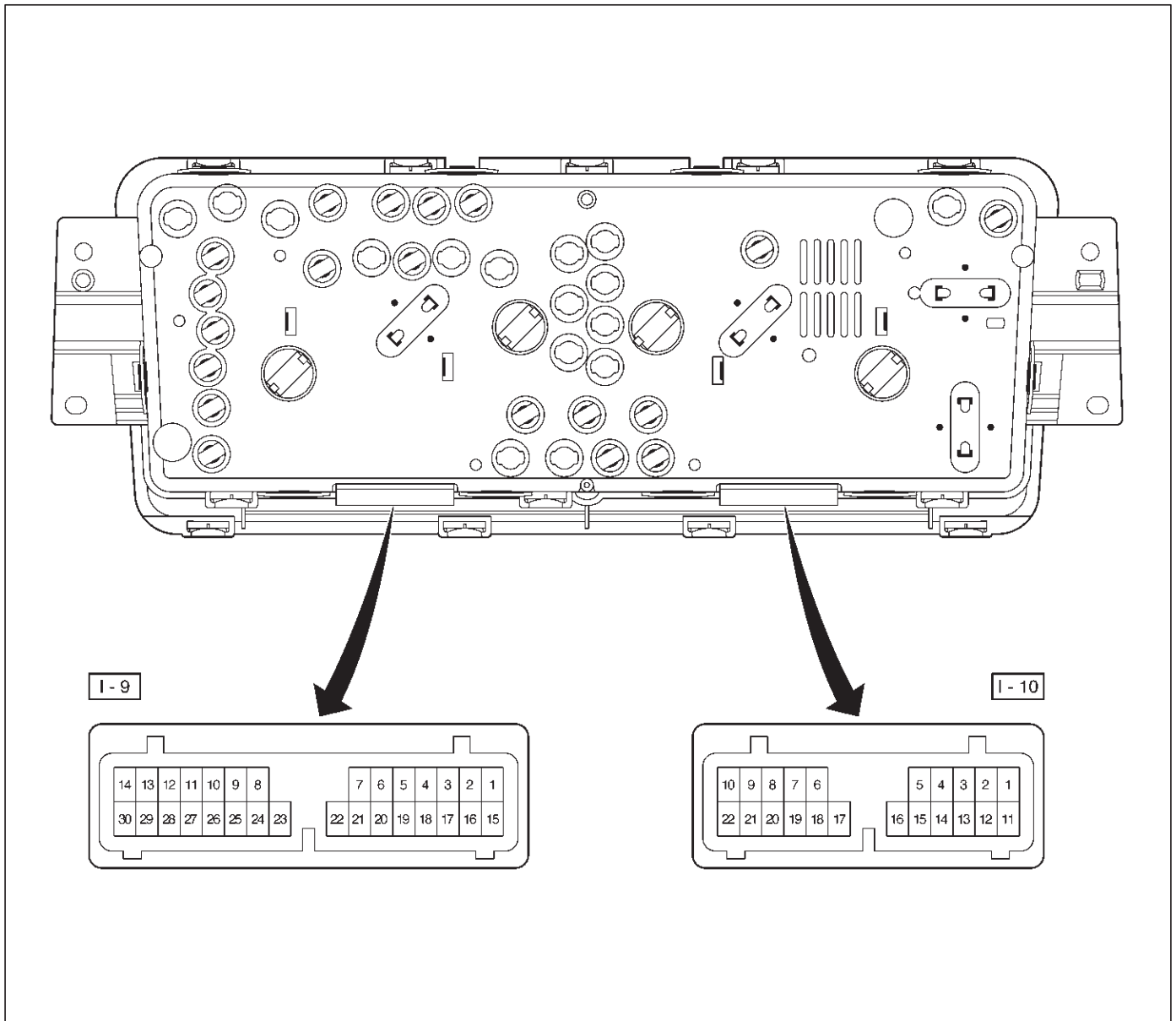
Meter Assembly—Gasoline W/TOD-2

Connector No. I-9	
Terminal	Function
1	—
2	Air bag warning light
3	A/T oil temp warning light
4	Charge warning light
5	Check engine warning light
6	Check trans warning light
7	Brake warning light
8	—
9	Tachometer
10	—
11	Turn signal indicator light (Left)
12	A/T shift indicator control unit
13	2 position (A/T)
14	D position (A/T)
15	Rear (TOD)
16	Auto (TOD)
17	Check (TOD)
18	Cruise set indicator light
19	Cruise main indicator light
20	Oil pressure warning light
21	Front "1" (TOD)
22	Front "2" (TOD)
23	Front "3" (TOD)
24	Cigarette lighter illumination light
25	Illumination controller
26	Starter switch
27	—
28	Winter drive indicator light
29	Power drive indicator light
30	—

Connector No. I-10	
Terminal	Function
1	Turn signal indicator light (Right)
2	L position (A/T)
3	R position (A/T)
4	Check engine warning light
5	Speedometer
6	—
7	—
8	Battery (+)
9	Engine coolant temperature gauge
10	Ground
11	P position (A/T)
12	N position (A/T)
13	3 position (A/T)
14	High beam indicator light (-)
15	High beam indicator light (+)
16	ABS indicator light
17	—
18	Fuel warning light
19	—
20	Fuel gauge
21	Ground (Gauge)
22	—

8E-12 METER AND GAUGE

Meter Assembly–Diesel–1



Meter Assembly–Diesel–2

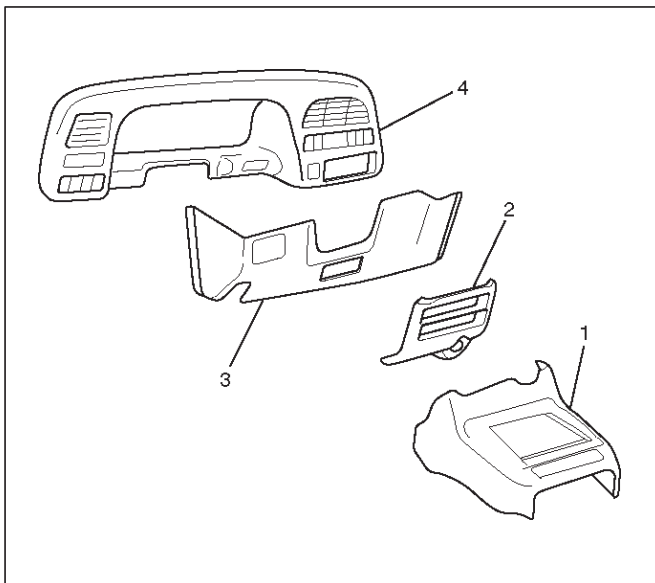
Connector No. I-9	
Terminal	Function
1	—
2	Seat belt warning light
3	—
4	Brake warning light
5	—
6	Charge warning light
7	Cigarette lighter illumination light
8	Illumination controller
9	Tachometer
10	—
11	—
12	—
13	—
14	—
15	Starter switch
16	—
17	—
18	4WD indicator light
19	Ground (Gauge)
20	—
21	—
22	Oil pressure warning light
23	Water sedimenter
24	Air bag warning light
25	—
26	Glow indicator light
27	—
28	Turn signal indicator light (Left)
29	—
30	Ground

Connector No. I-10	
Terminal	Function
1	Turn signal indicator light (Right)
2	—
3	—
4	Engine coolant temperature gauge
5	Speedometer
6	—
7	—
8	Battery (+)
9	—
10	—
11	—
12	—
13	—
14	High-beam indicator light (-)
15	High-beam indicator light (+)
16	ABS indicator light
17	—
18	Fuel warning light
19	Oil pressure gauge
20	Fuel gauge
21	—
22	—

8E-14 METER AND GAUGE

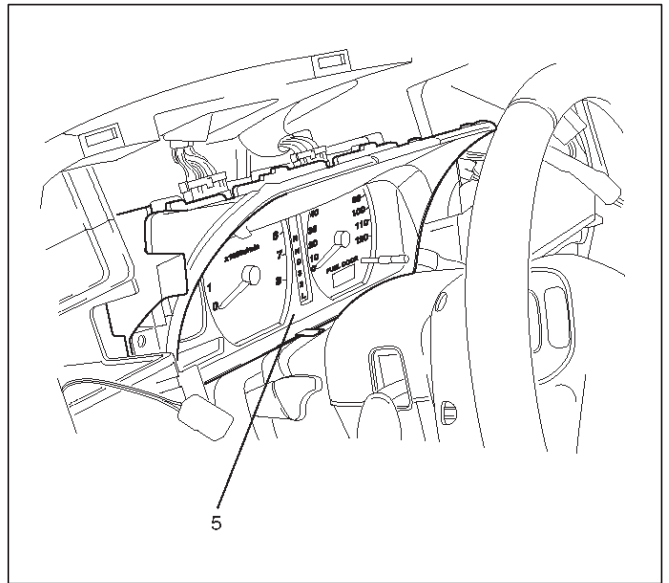
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover(3).
Refer to the Instrument Panel Assembly in Body Structure section.



740RS004

5. Remove four fixing screws and disconnect the meter connectors to remove the meter assembly(5).



825RW031

CAUTION: The removed meter assembly should be placed upright or with its face side up.

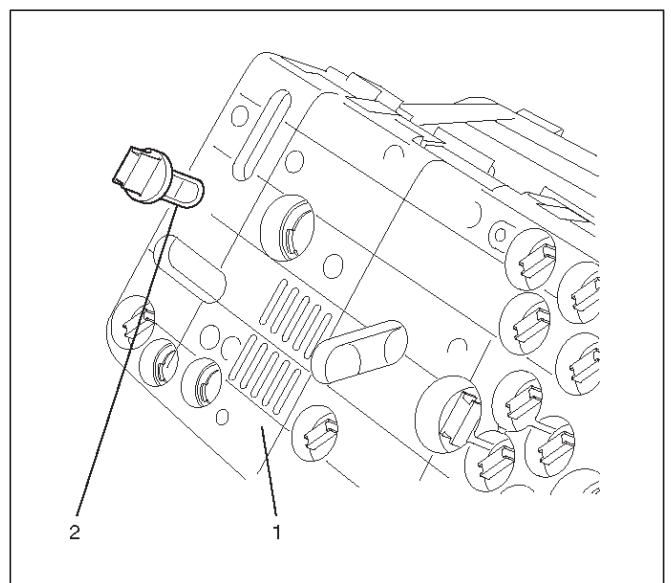
Installation

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

Warning Light Bulb, Indicator Light Bulb, Illumination Light Bulb, A/T Indicator Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter assembly(1).
Refer to the Meter Assembly removal steps in this section.
3. Hold the bulb socket by hand and rotate it counterclockwise to remove the socket & bulb(2) from the meter body.



825RW032

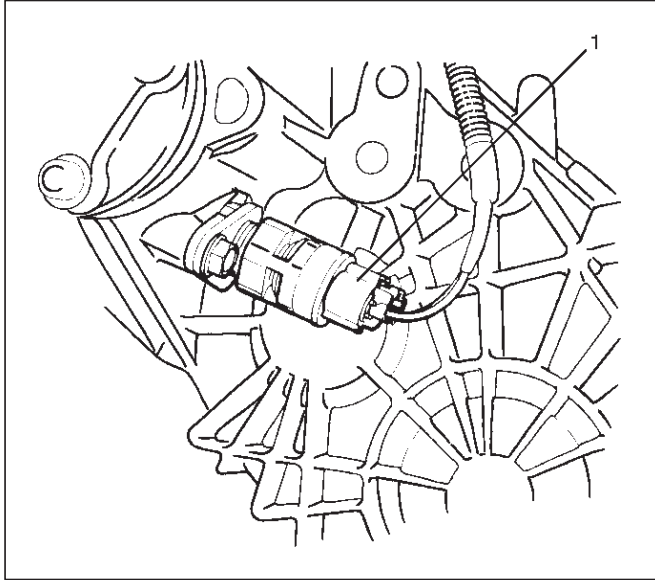
Installation

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

Vehicle Speed Sensor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector, remove the vehicle speed sensor body by rotating it and then remove the vehicle speed sensor(1).



826RS009

Installation

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

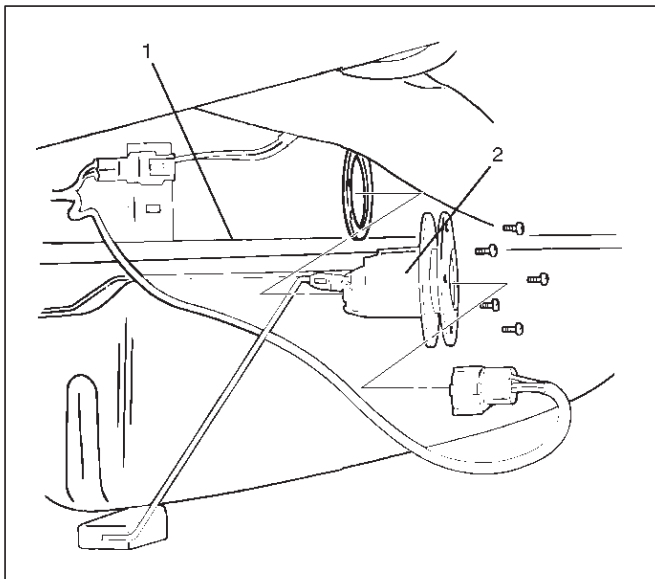
1. Tighten the vehicle speed sensor to the specified torque.

Torque: 27 N·m (2.8 kg·m/20 lb ft)

Fuel Tank Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the fuel tank(1).
Refer to the Fuel Tank removal steps in Engine section
3. Disconnect the connectors, remove five screws and then remove the fuel tank unit(2).



140RS006

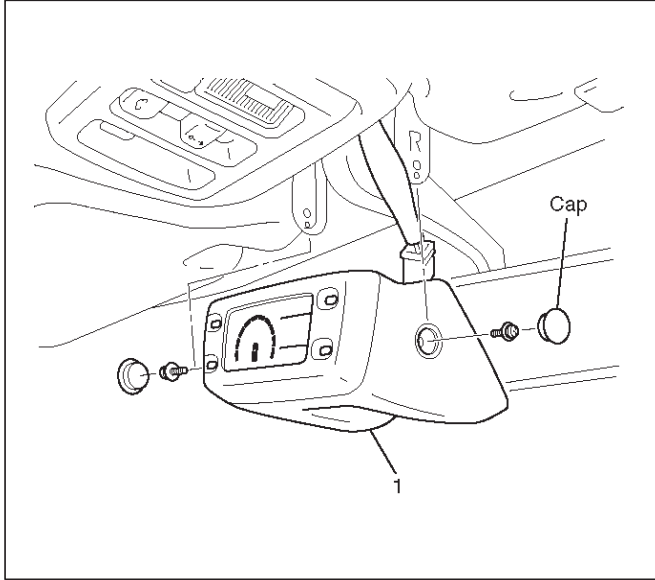
Installation

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

Multi Meter

Removal

1. Disconnect the battery ground cable.
2. Remove two caps, two screws and disconnect the connector to remove the multi meter(1).



821RW036

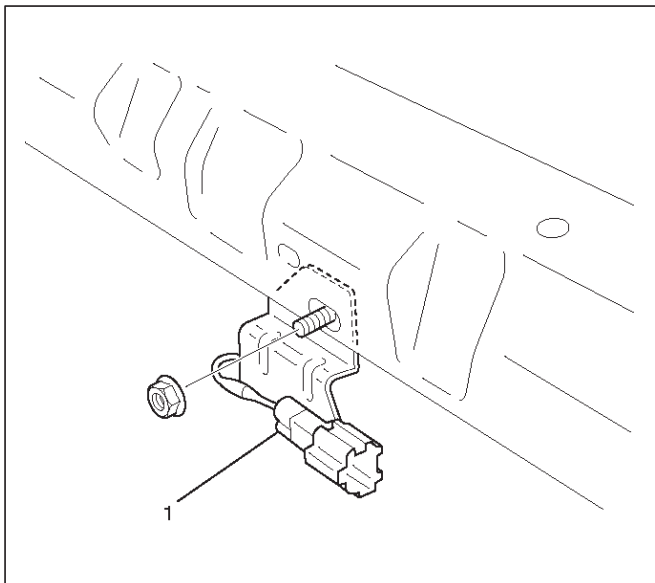
Installation

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

Ambient Sensor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector and remove the nut to remove the ambient sensor(1).



821RW035

Installation

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

Main Data and Specifications**Torque Specifications**

Application	N·m	kg·m	Lb Ft	Lb In
Vehicle Speed Sensor Fixing	27	2.8	20	—

MEMO

BODY AND ACCESSORIES

BODY STRUCTURE

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Service Precaution

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

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

Frame

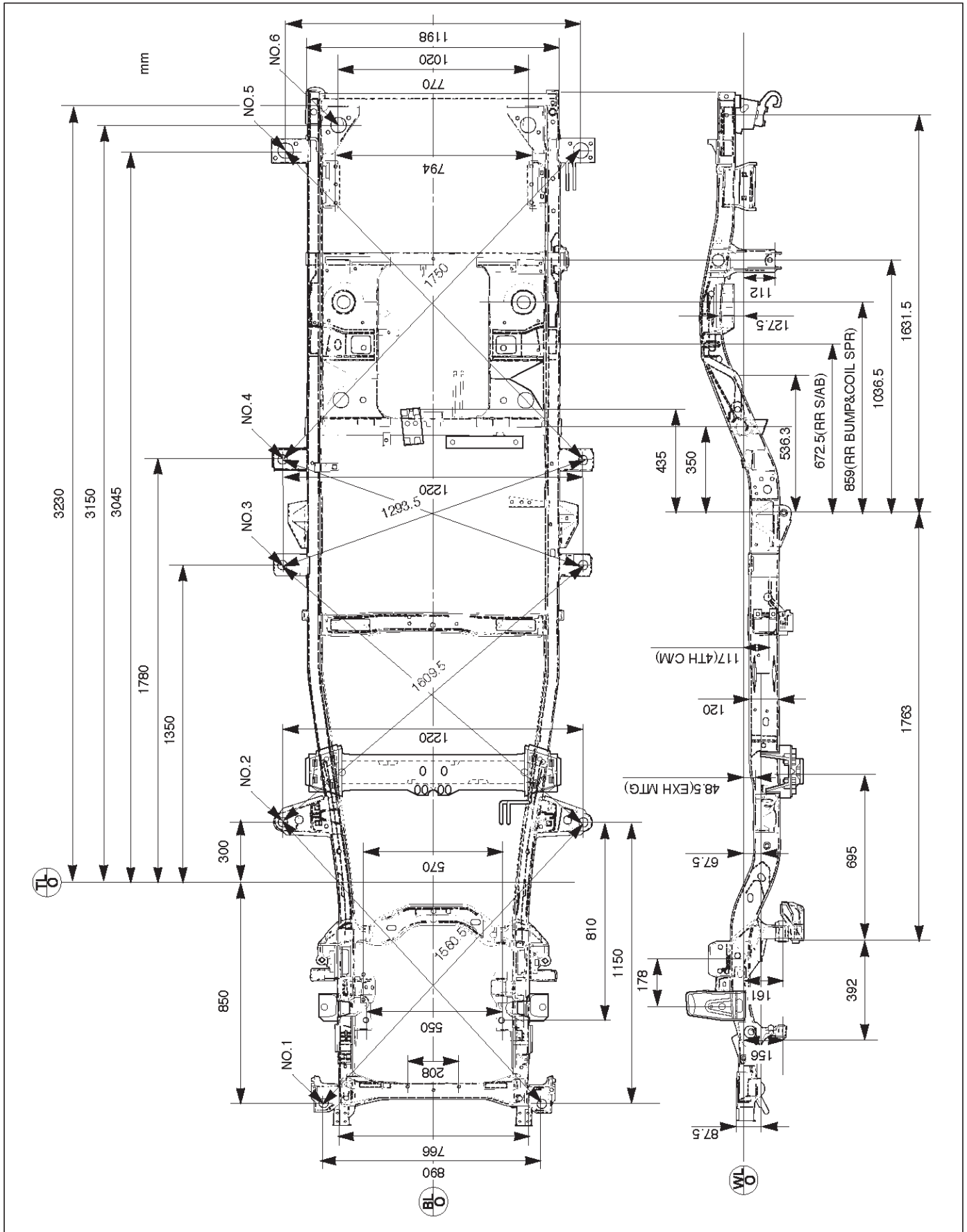
General Description

Proper frame alignment is important to assure normal vehicle life and performance of many other parts of the

vehicle. If the vehicle has been involved in a fire, collision or has been overloaded, it is necessary to check the frame alignment.

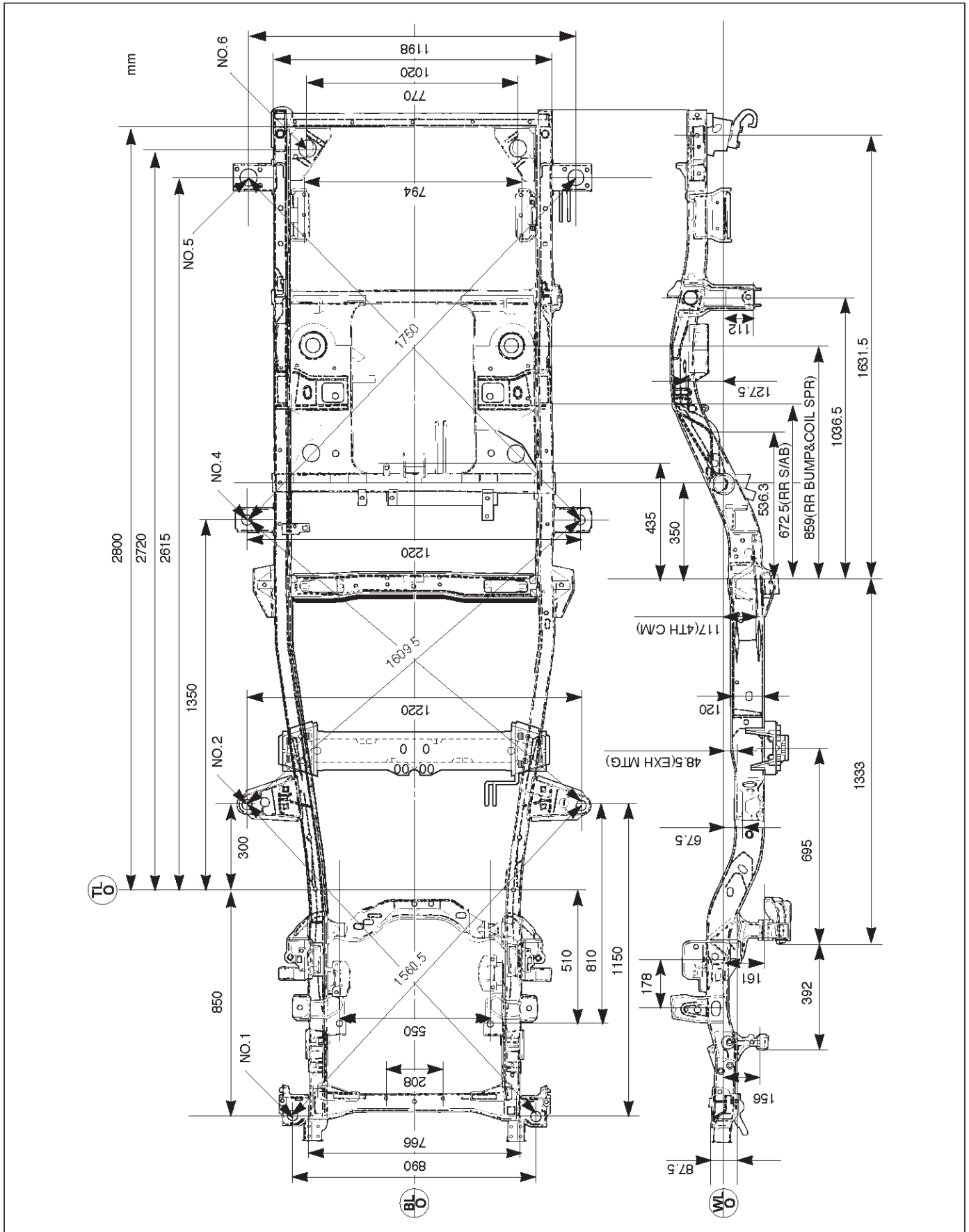
Frame Dimensions (L W B)

This illustration is based on the gasoline engine and A/T model.



Frame Dimensions (S W B)

This illustration is based on the gasoline engine and A/T model.



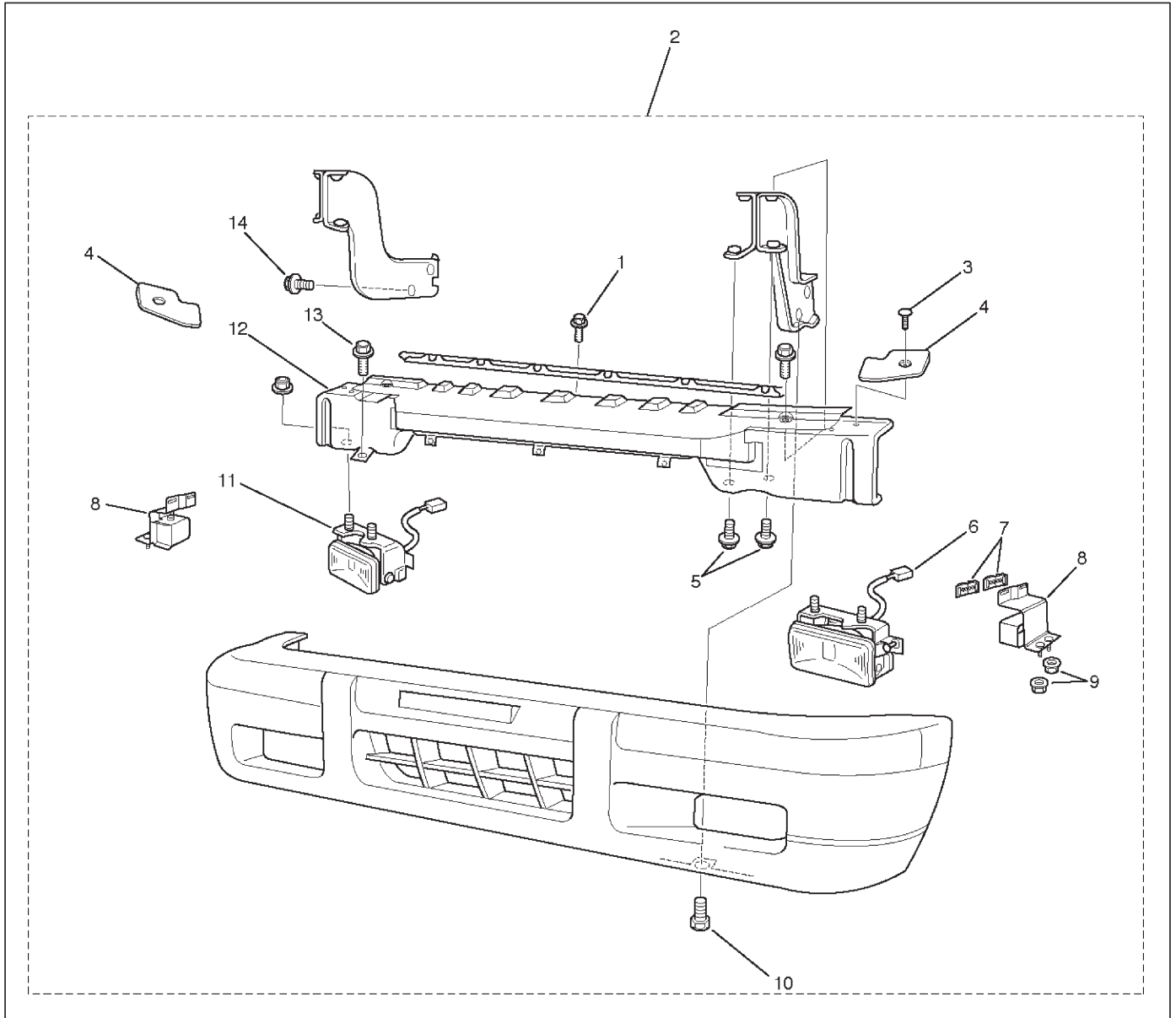
General Description

This section describes how to remove and install front and rear bumpers. Each bumper is installed with two fixing bolts used on either side to fasten the backbar to the

frame, a slider is used to fasten the bumper fascia to the fender panel. The bumpers can be removed by taking them out forward or backward after removing the two fixing bolts on either side.

Front Bumper

Parts Location



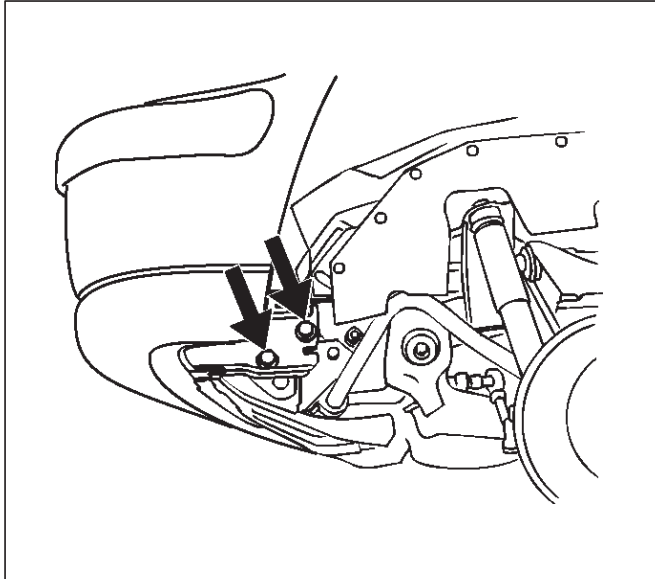
601RW015

Legend

- | | |
|-------------------------------------|------------------------------------|
| (1) Front Bumper Retainer Bolt | (8) Front Bumper Slider |
| (2) Front Bumper Assembly | (9) Front Bumper Slider Fixing Nut |
| (3) Support Fixing Clip | (10) Bumper Fascia Lower Bolt |
| (4) Bumper Spacer Support | (11) Front Fog Light Assembly |
| (5) Back Bar Fixing Bolt | (12) Reinforce Assembly |
| (6) Front Fog Light Connector | (13) Reinforce Lower Bolt |
| (7) Front Bumper Slider Fixing Clip | (14) Front Bumper Fixing Bolt |

Removal

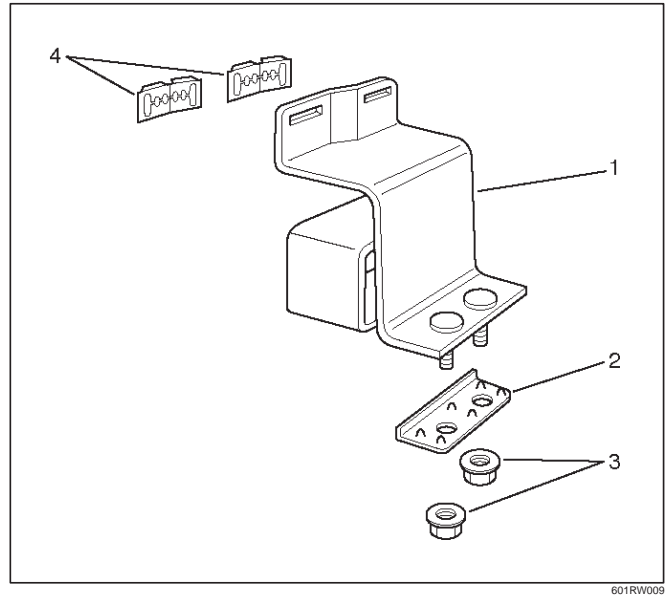
1. Disconnect battery ground cable.
2. Remove front fog light connector.
3. Remove front bumper assembly fixing bolt.
 - Remove the two bolts from both sides of the front bumper.



601RW010

4. Remove front bumper assembly.
5. Remove bumper fascia lower bolts.
6. Remove front bumper retainer.
7. Remove reinforce lower bolts.
 - Loosen the five bolts and release claws.
8. Remove reinforce assembly.

9. Remove backbar fixing bolts.
 - Remove the four bolts at each backbar.
10. Remove front fog light assembly.
11. Remove the front bumper slider(1).
 - Remove the two clips(4) and the two nuts(3), and release the claw from the washer(2).



601RW009

Installation

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

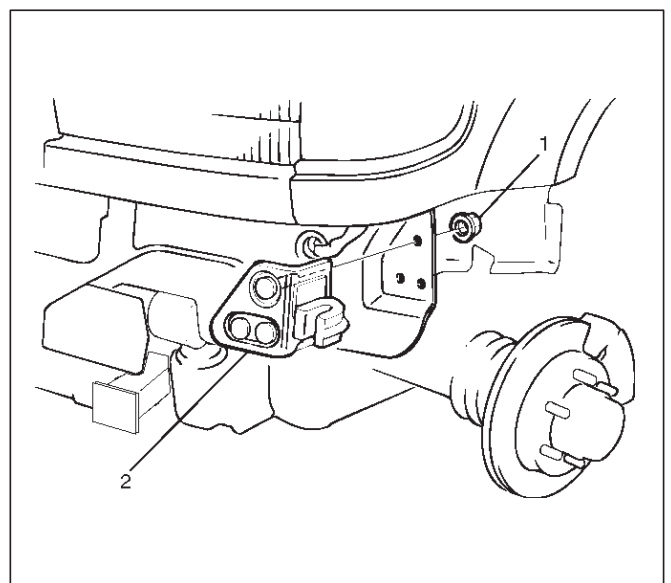
1. Tighten the front bumper assembly fixing bolts to the specified torque.

Torque: 132 N•m (13.5kg-m/98 lb ft)

Front Bumper Slider Bracket

Removal

1. Disconnect battery ground cable.
2. Remove the Front bumper.
 - Refer to Front Bumper in this section.
3. Remove the three nuts(1) and draw out the slider bracket(2).



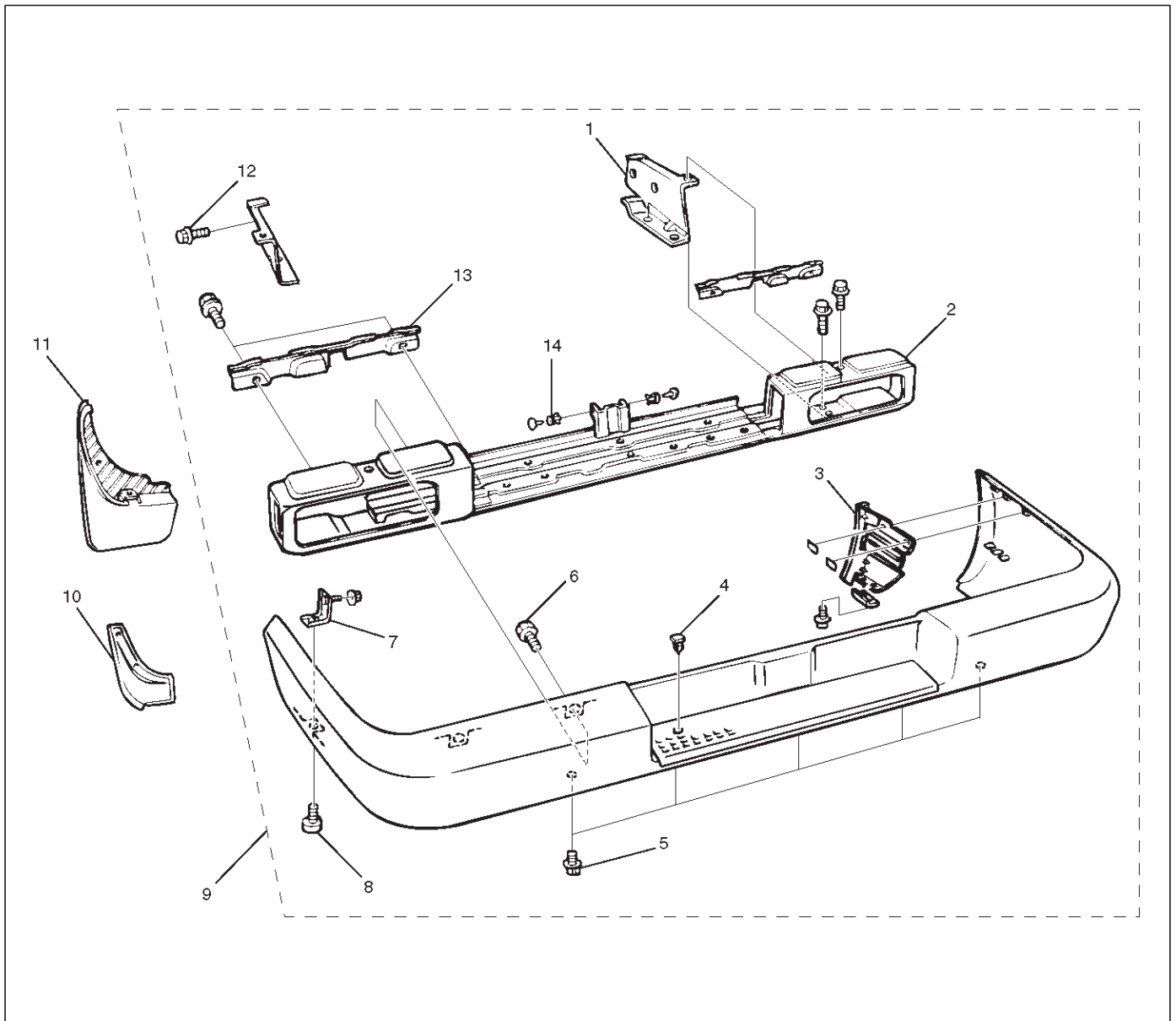
601RW005

Installation

To install, follow the removal steps in reverse order.

Rear Bumper

Parts Location



690RW001

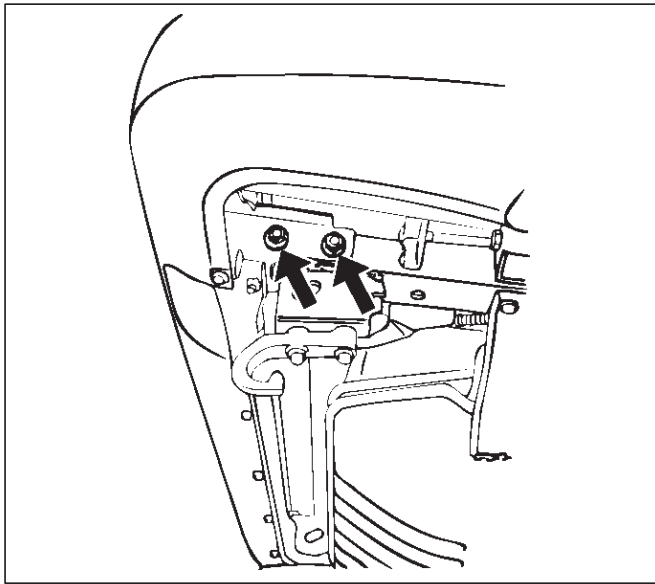
Legend

- | | |
|---------------------------------|--|
| (1) Back Bars | (8) Rear Bumper Fascia Bracket Screws |
| (2) Reinforce Assembly | (9) Rear Bumper Assembly |
| (3) Rear Bumper Slider Brackets | (10) Rear Bumper Side Covers |
| (4) Rear Step Clips | (11) Mud Flaps |
| (5) Reinforce Lower Screws | (12) Rear Bumper Assembly Fixing Bolts |
| (6) Reinforce Upper Bolts | (13) Rear Bumper Retainers |
| (7) Rear Bumper Fascia Brackets | (14) Clips |

Removal

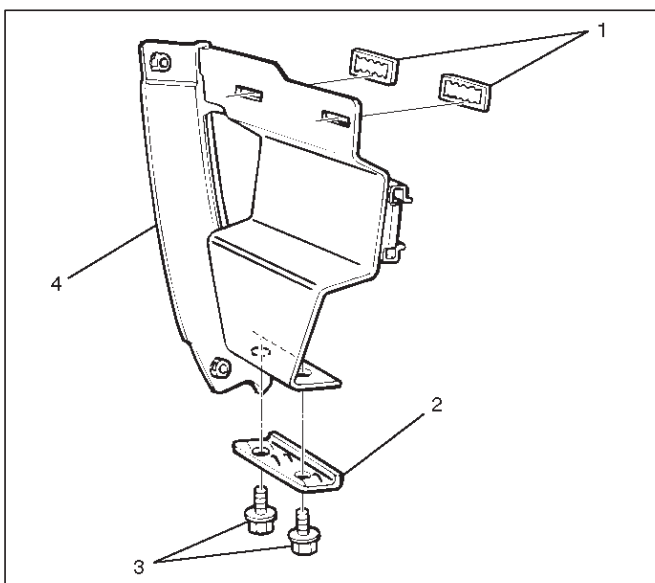
1. Remove rear bumper side covers.
 - Remove three screws.
2. Remove mud flaps.
3. Remove bumper fascia bracket screws.

4. Remove rear bumper assembly fixing bolts.
 - Remove two bolts from each side.



690RW002

5. Remove rear bumper assembly.
6. Remove rear bumper retainers.
7. Remove reinforce upper bolts.
 - Remove the rear bumper retainer from each side, and then remove two upper bolts.
8. Remove reinforce lower screws.
9. Remove clips.
10. Remove rear step clips.
11. Remove reinforce assembly.
 - Pull out both ends of the bumper fascia and take out the reinforce assembly.
12. Remove backbars.
 - Remove the three bolts from each backbar.
13. Remove rear bumper slider brackets(4).
 - Remove the two clips(1) and two screws(3), and then remove claw caught in the washer(2).



690RS003

14. Remove bumper fascia brackets.
 - Remove the fixing nut on the back side of the fender panel.

Installation

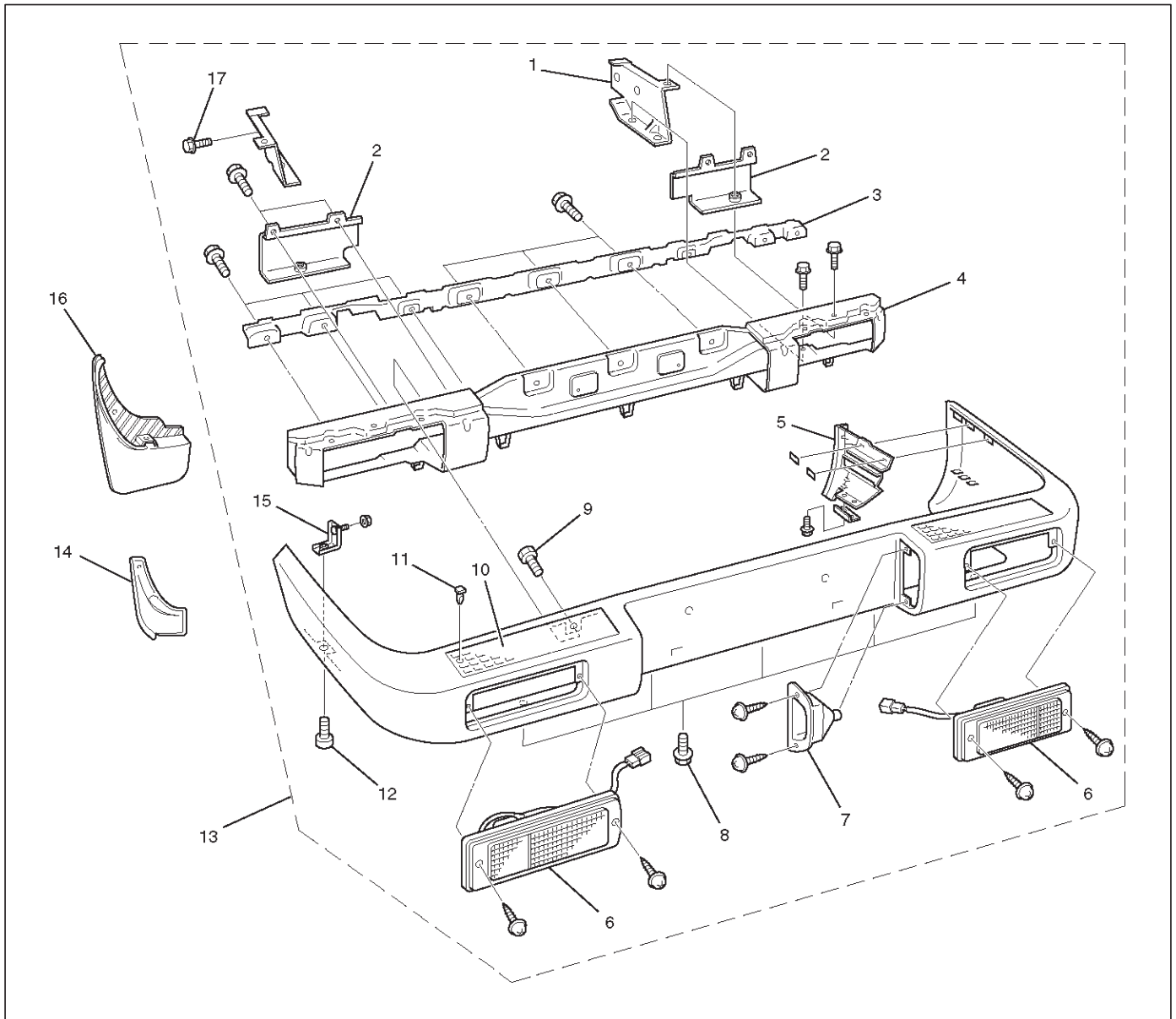
To install, follow the removal steps in reverse order noting the following points:

1. Tighten the rear bumper assembly fixing bolts to the specified torque.

Torque: 132 N•m (13.5kg-m/98 lb ft)

2. Apply chassis grease to the slider and the slider bracket moving surface.

Parts Location (W/Rear Combination Light and License Light)



690RW010

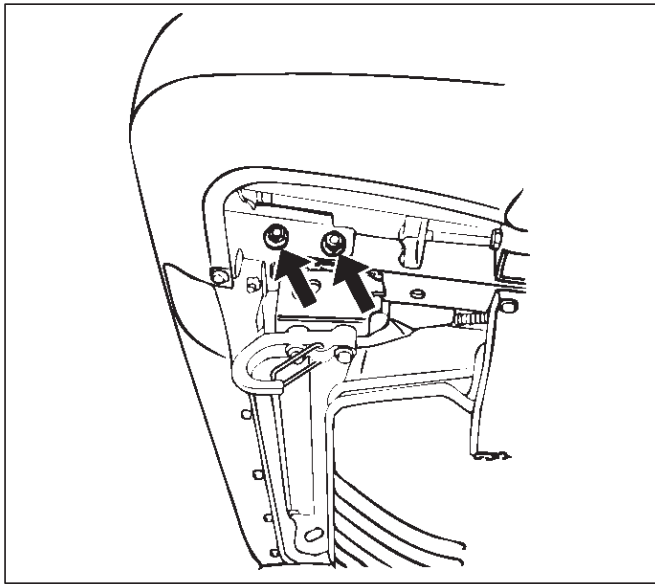
Legend

- | | |
|---------------------------------------|--|
| (1) Back Bar | (9) Reinforce Upper Bolts |
| (2) Rear Combination Light Back Plate | (10) Rear Step |
| (3) Rear Bumper Retainer | (11) Rear Step Clips |
| (4) Reinforce Assembly | (12) Rear Bumper Fascia Bracket Screws |
| (5) Rear Bumper Slider Brackets | (13) Rear Bumper Assembly |
| (6) Rear Combination Light Assembly | (14) Rear Bumper Side Covers |
| (7) License Light | (15) Rear Bumper Fascia Brackets |
| (8) Reinforce Lower Screws | (16) Mud Flaps |
| | (17) Rear Bumper Assembly Fixing Bolts |

Removal

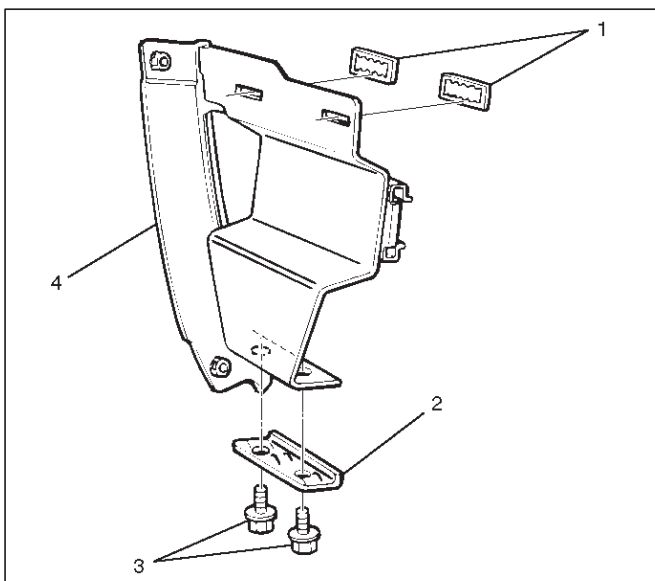
1. Disconnect battery ground cable.
2. Remove rear bumper side covers.
3. Remove mud flaps.
 - Remove three screws.
4. Remove rear bumper fascia bracket screws.

5. Remove rear bumper assembly fixing bolts.
 - Remove two bolts from each side.



690RW011

6. Remove rear bumper assembly.
7. Remove rear bumper retainers.
8. Remove rear combination light back plate.
9. Remove reinforce upper bolts.
 - Remove the rear bumper retainer from each side, and then remove two upper bolts.
10. Remove reinforce lower screws.
11. Remove rear step clips.
12. Remove rear step.
13. Remove reinforce assembly.
 - Pull out both ends of the bumper fascia and take out the reinforce assembly.
14. Remove backbars.
 - Remove the three bolts from each backbar.
15. Remove rear bumper slider brackets(4).
 - Remove the two clips(1) and two screws(3), and then remove claw caught in the washer(2).



690RS003

16. Remove bumper fascia brackets.
 - Remove the fixing nut on the back side of the fender panel.
17. Remove rear combination light assembly.
18. Remove license light.

Installation

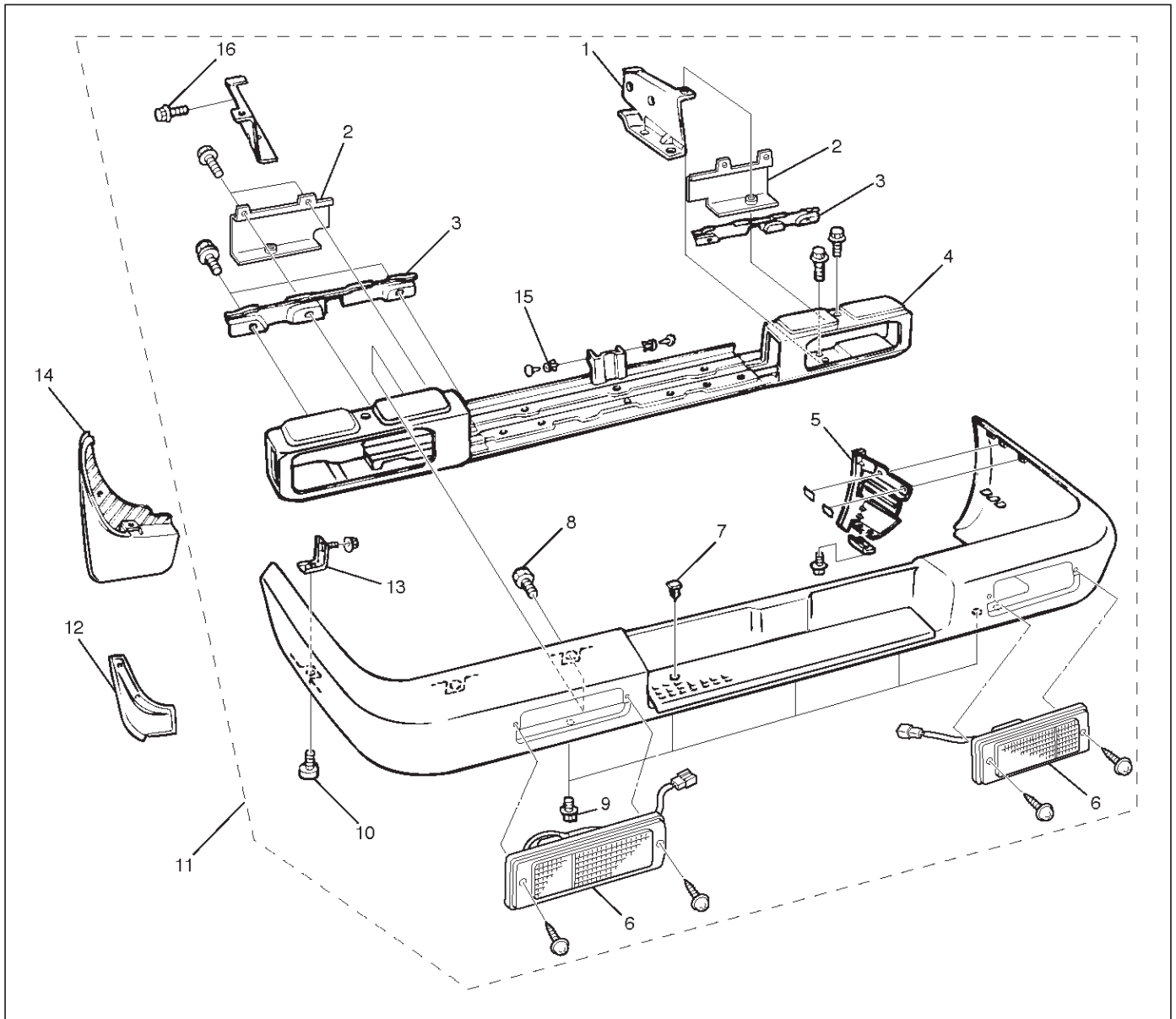
To install, follow the removal steps in reverse order noting the following points:

1. Tighten the rear bumper assembly fixing bolts to the specified torque.

Torque: 132 N•m (13.5kg-m/98 lb ft)

2. Apply chassis grease to the slider and the slider bracket moving surface.

Parts Location (W/Rear Combination Light)



690RW012

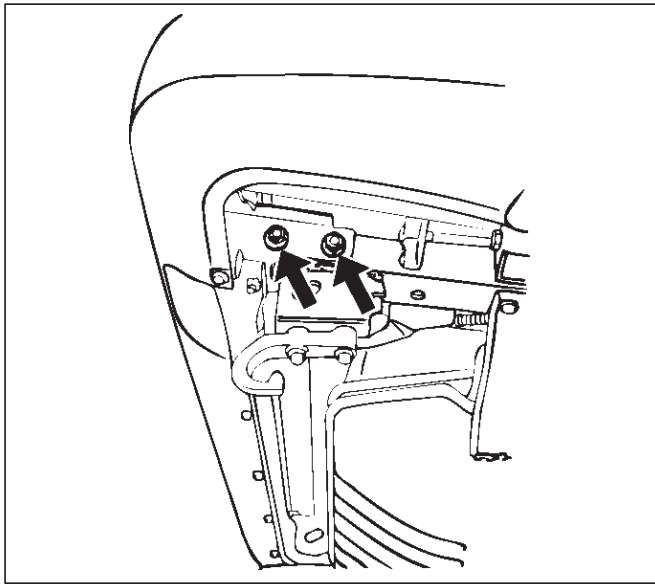
Legend

- | | |
|---------------------------------------|--|
| (1) Back Bar | (9) Reinforce Lower Screws |
| (2) Rear Combination Light Back Plate | (10) Rear Bumper Fascia Bracket Screws |
| (3) Rear Bumper Retainer | (11) Rear Bumper Assembly |
| (4) Reinforce Assembly | (12) Rear Bumper Side Covers |
| (5) Rear Bumper Slider Brackets | (13) Rear Bumper Fascia Brackets |
| (6) Rear Combination Light Assembly | (14) Mud Flaps |
| (7) Rear Step Clips | (15) Clips |
| (8) Reinforce Upper Bolts | (16) Rear Bumper Assembly Fixing Bolts |

Removal

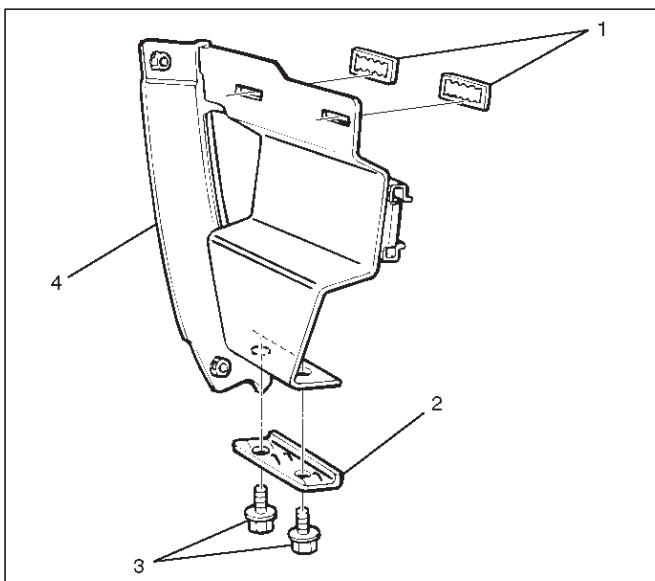
1. Disconnect battery ground cable.
2. Remove rear bumper side covers.
3. Remove mud flaps.
 - Remove three screws.
4. Remove rear bumper fascia bracket screws.

5. Remove rear bumper assembly fixing bolts.
 - Remove two bolts from each side.



690RW002

6. Remove rear bumper assembly.
7. Remove rear bumper retainers.
8. Remove rear combination light back plate.
9. Remove reinforce upper bolts.
 - Remove the rear bumper retainer from each side, and then remove two upper bolts.
10. Remove reinforce lower screws.
11. Remove clips.
12. Remove rear step clips.
13. Remove reinforce assembly.
 - Pull out both ends of the bumper fascia and take out the reinforce assembly.
14. Remove backbars.
 - Remove the three bolts from each backbar.
15. Remove rear bumper slider brackets(4).
 - Remove the two clips(1) and two screws(3), and then remove claw caught in the washer(2).



690RS003

16. Remove bumper fascia brackets.
 - Remove the fixing nut on the back side of the fender panel.
17. Remove rear combination light assembly.

Installation

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

1. Tighten the rear bumper assembly fixing bolts to the specified torque.

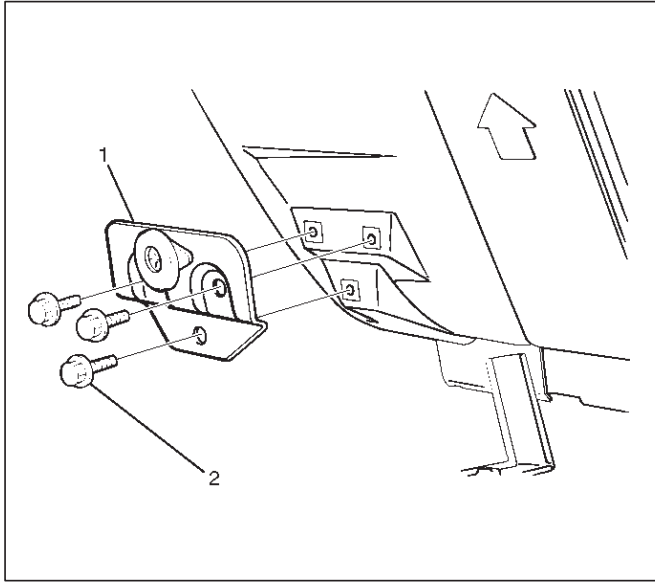
Torque: 132 N•m (13.5kg-m/98 lb ft)

2. Apply chassis grease to the slider and the slider bracket moving surface.

Rear Bumper Slider

Removal

1. Remove the rear bumper.
 - Refer to Rear Bumper removal in this section.
2. Remove the three bolts (2).
3. Remove rear bumper slider (1).



690RS004

Installation

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

1. Apply chassis grease to the slider and the slider bracket moving surface.

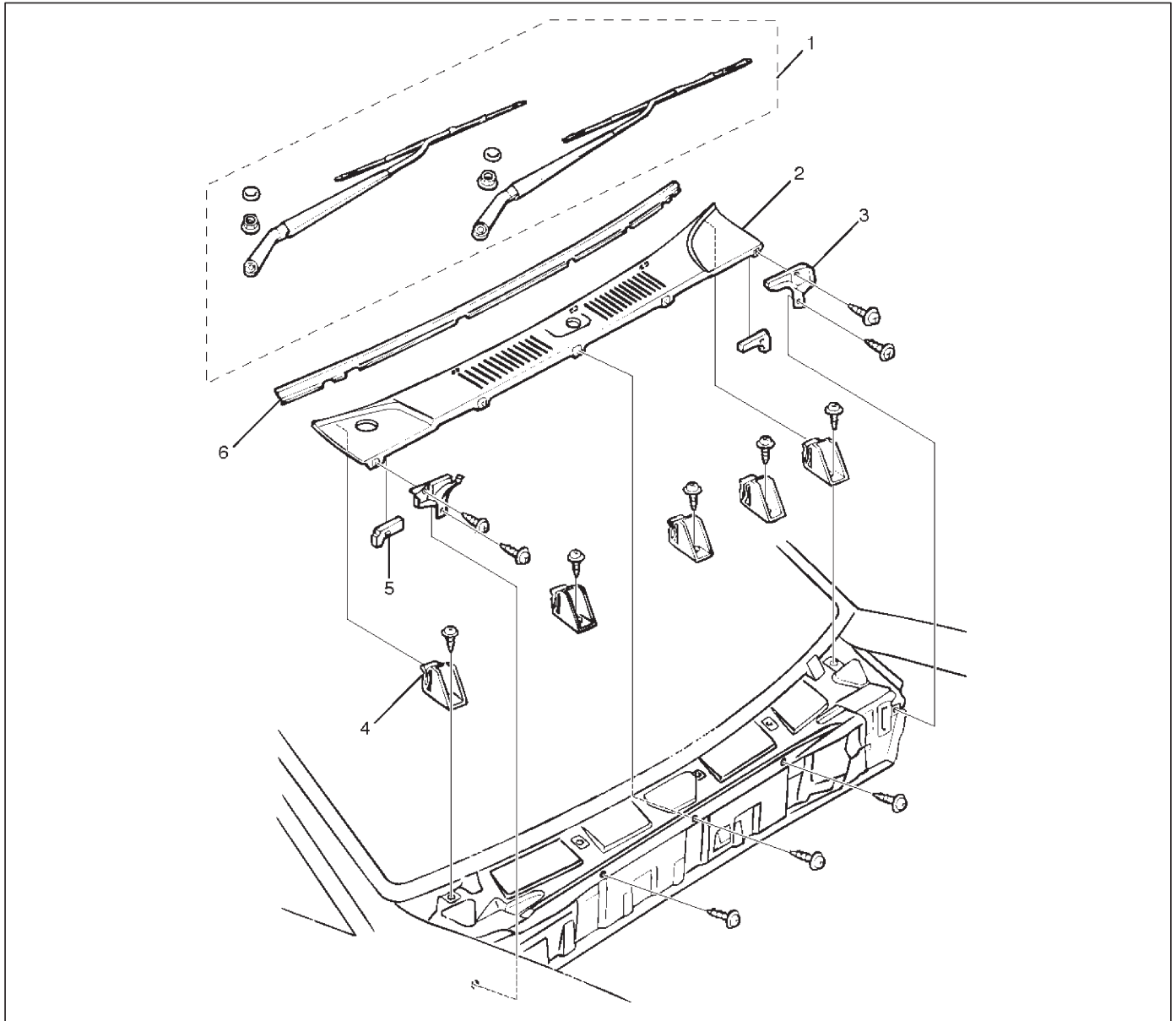
General Description

This section includes items of front end sheet metal that are attached by bolts, screws or clips and related accessory components.

Anti-corrosion materials have been applied to the interior surfaces of some metal panels to provide rust resistance. When servicing these panels, areas on which this material has been disturbed should be properly recoated with service-type anti-corrosion material.

Cowl Cover

Parts Location



Legend

- | | |
|-------------------------|--------------------------------|
| (1) Front Wiper Arms | (4) Cowl Cover Stoppers |
| (2) Cowl Cover | (5) Cowl Cover Seals |
| (3) Cowl Cover Brackets | (6) Front Window Lower Molding |

Removal

1. Open the hood.
2. Support the hood.
3. Remove front wiper arms.
 - Refer to Wiper/Washer System in this section.
4. Remove cowl cover brackets.
 - Disconnect two screws each side.

5. Remove cowl cover.
 - Disconnect three screws.
6. Remove cowl cover seals.
7. Remove front window lower molding.

8. Remove cowl cover stoppers.

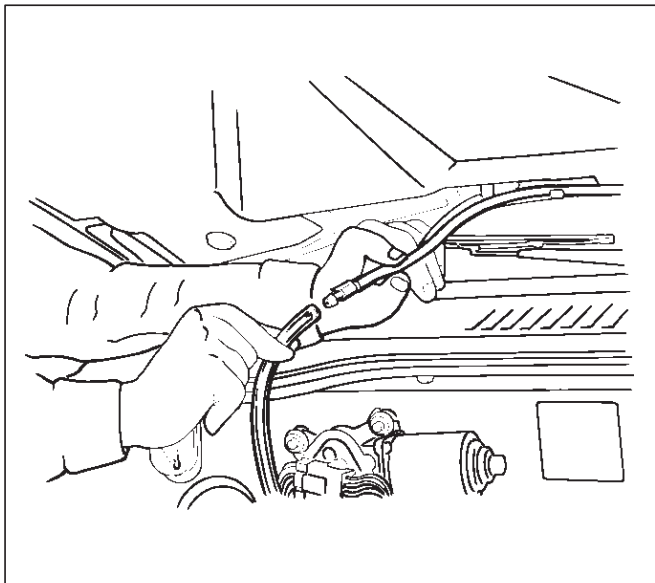
Installation

To install, follow the removal steps in reverse order.

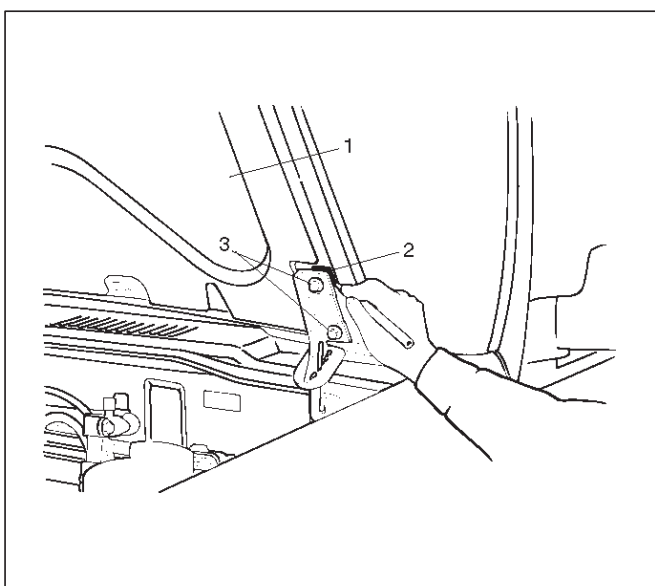
Engine Hood

Removal

1. Open the hood.
2. Support the hood.
3. Remove windshield washer nozzle tube.



4. Remove hood hinge bolts (3).
 - Before removing the hinges from the Engine hood (1), scribe a mark (2) showing location of the hinges to facilitate installation in the original position.



5. Remove engine hood.

Installation

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

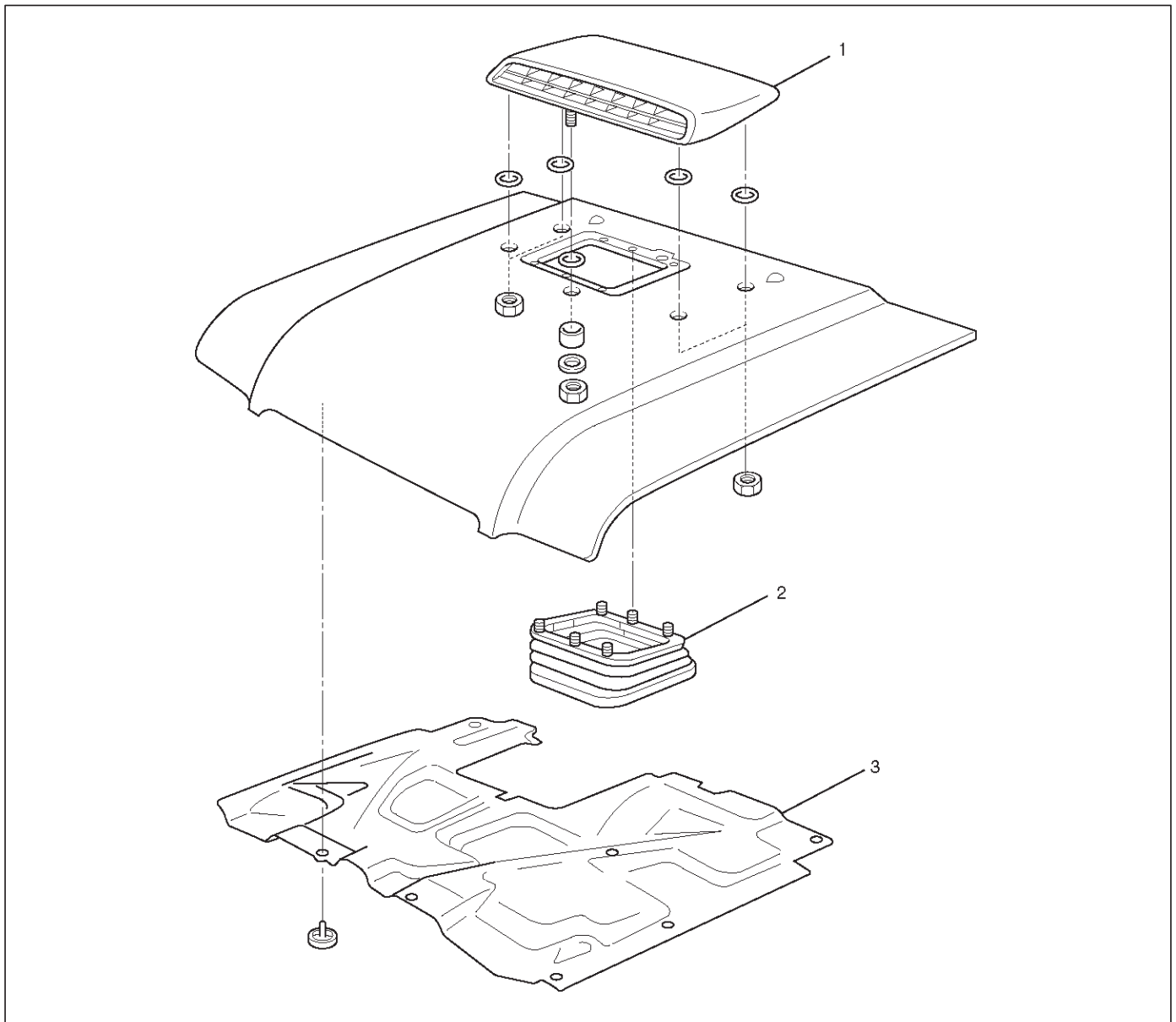
1. Tighten the engine hood fixing bolts to the specified torque.

Torque: 13 N•m (1.3kg-m/113 lb in)

2. Adjust the engine hood mounting gap with reference to Body Dimension in this section.
3. Check and see if the engine hood lock operates normally.

Air Bulge

Parts Location



610RW013

Legend

(1) Air Bulge

(2) Intercooler Seal

(3) Engine Hood Insulator

Removal

1. Remove engine food insulator.
 - Remove the sixteen clips.
2. Remove Intercooler seal.
 - Remove the six clips.
3. Remove air bulge.
 - Remove the six nuts.

1. Tighten the air bulge fixing nuts to the specified torque.

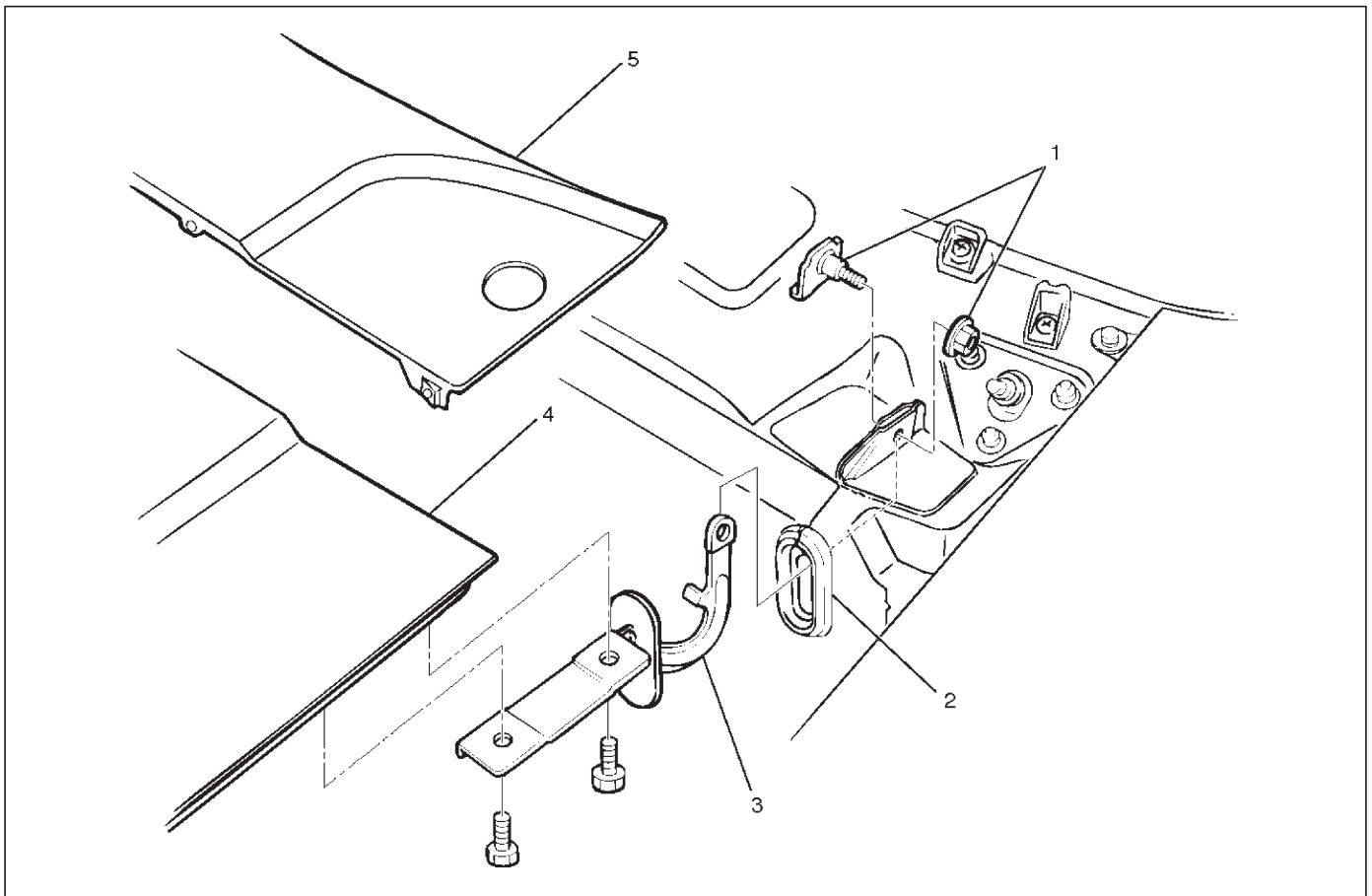
Torque 8 N•m (0.8kg-m/ 69 lb in)

Installation

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

Engine Hood Hinge

Parts Location



610RW012

Legend

- (1) Hinge Fixing Bolts And Nuts
- (2) Hood End Seal

- (3) Engine Hood Hinge
- (4) Engine Hood
- (5) Cowl Cover

Removal

1. Remove cowl cover.
 - Refer to Cowl Cover in this section.
2. Remove engine hood.
 - Refer to Engine Hood in this section.
3. Remove hinge fixing bolt and nut.
4. Remove engine hood hinge.
5. Remove hood end seal.

Installation

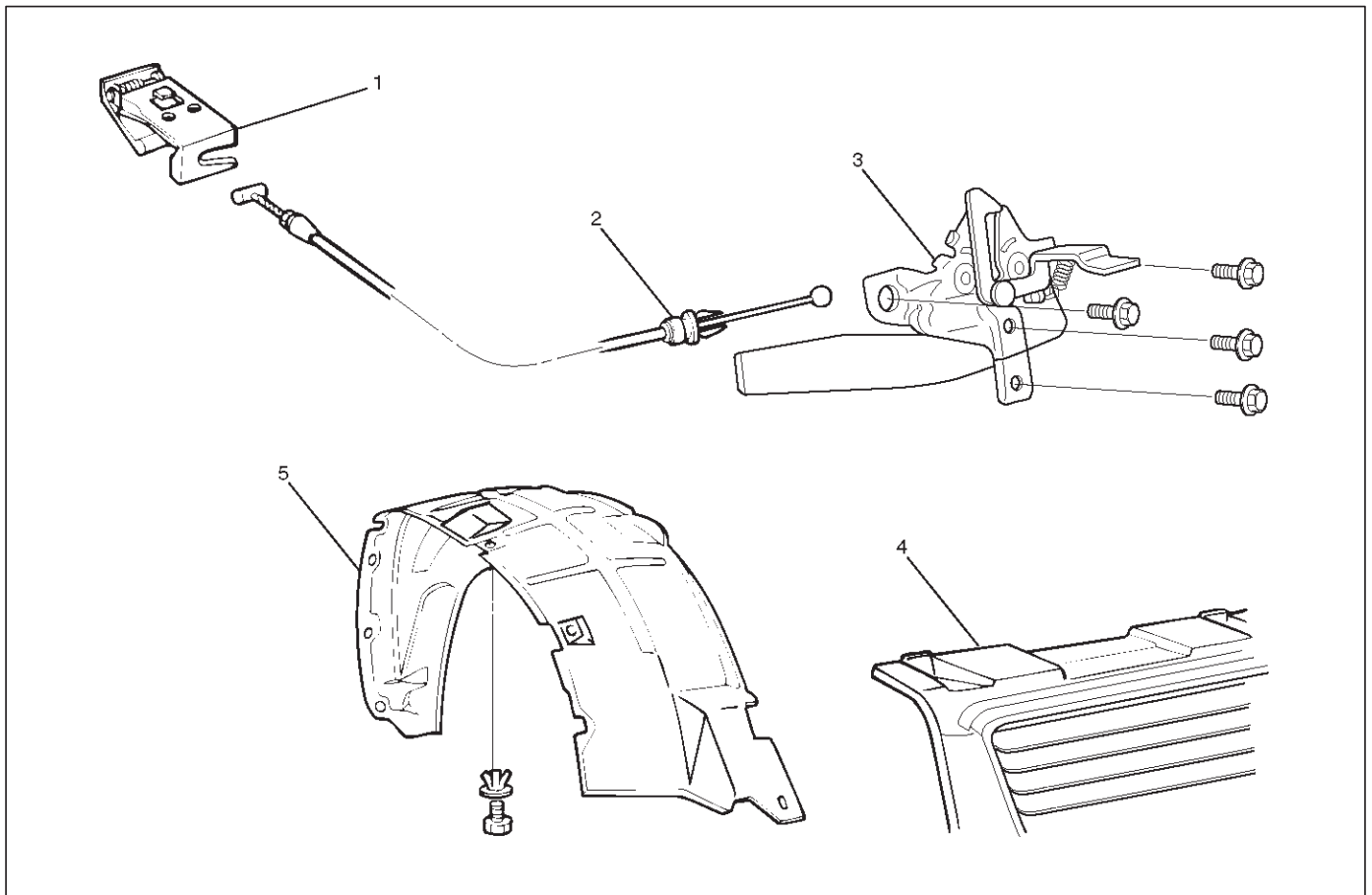
To install, follow the removal steps in reverse order noting the following points:

1. Tighten the hood hinge fixing bolt and nut to the specified torque.

Torque 13 N•m (1.3kg•m/113 lb in)

Engine Hood Lock

Parts Location



610RW011

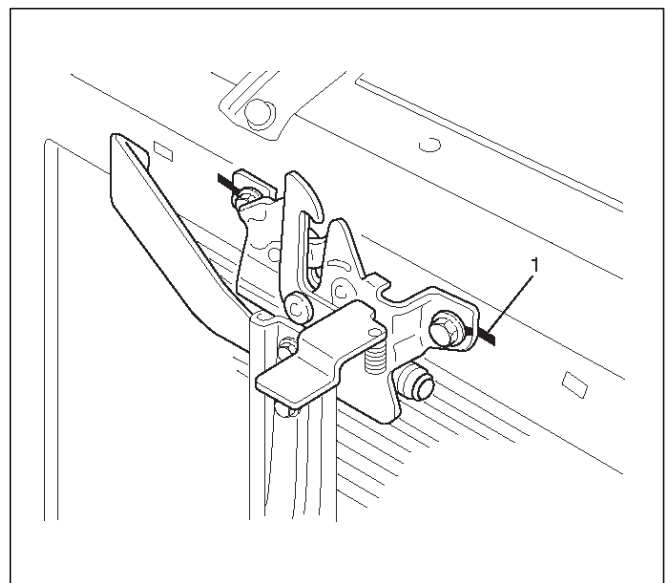
Legend

- (1) Hood Lock Control Lever
- (2) Control Cable

- (3) Engine Hood Lock Assembly
- (4) Radiator Grille
- (5) Inner Liner

Removal

1. Remove hood lock control lever.
2. Remove inner liner.
3. Remove control cable.
 - Remove the cable fixing clips from the body panel.
4. Remove radiator grille.
 - Refer to Radiator Grille And Front End Lower Panel in this section.
5. Remove engine hood lock assembly.
 - Apply setting marks (1) to the hood lock assembly and the body prior to removal.



610RW009

Installation

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

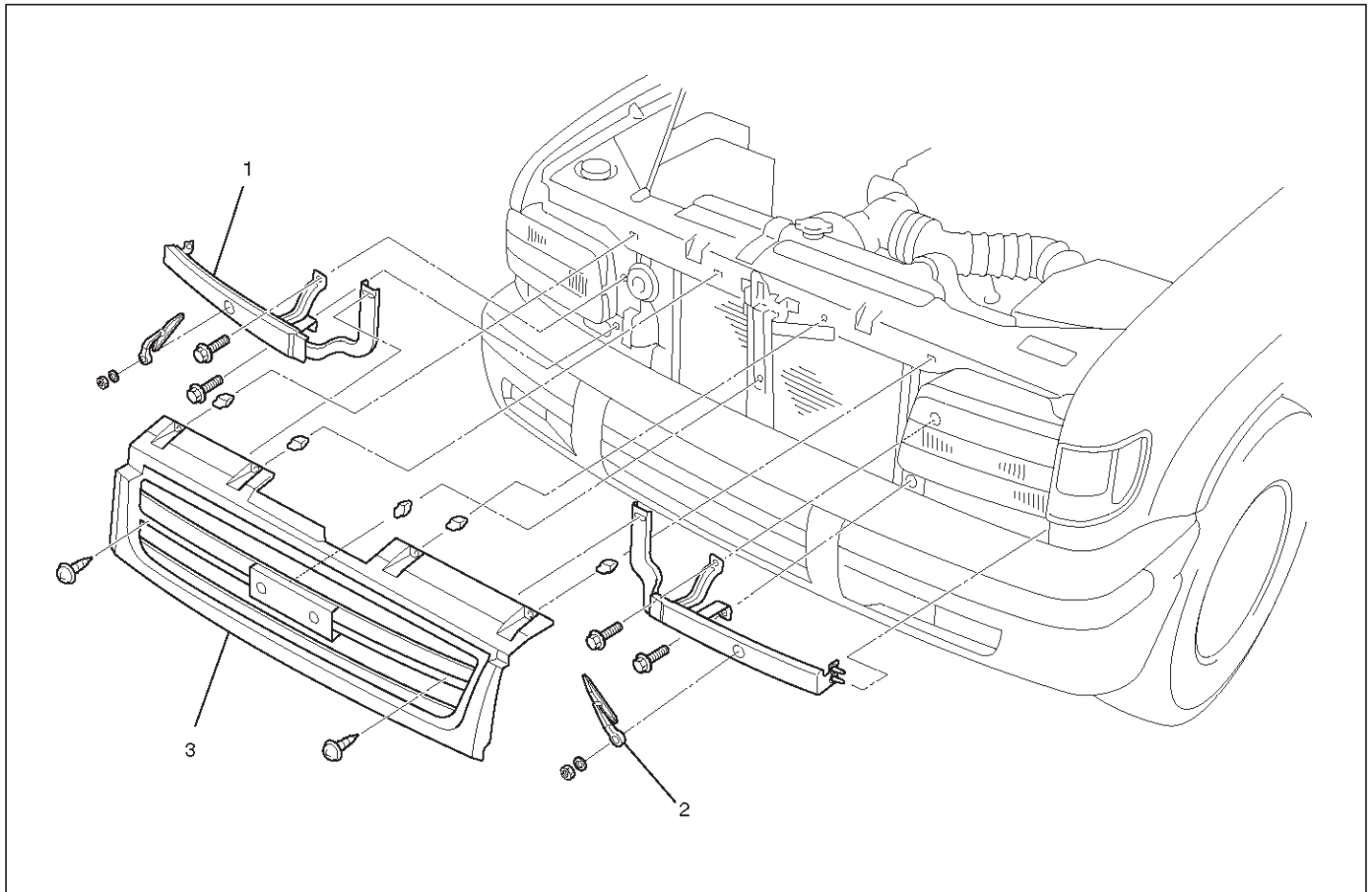
1. Reroute the control cable to its original position, and check and see if the lock assembly and control lever work normally.

2. Tighten the hood lock assembly fixing bolts to the specified torque.

Torque : 10 N•m (1.0kg-m/87 lb in)

Radiator Grille And Front End Lower Panel

Parts Location



603RW014

Legend

(1) Front End Lower Panel

(2) Head light Wiper

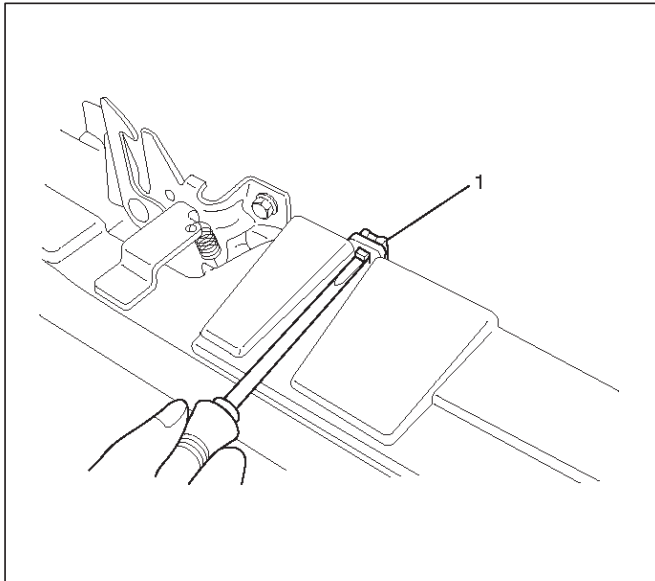
(3) Radiator Grille

Removal

1. Open the hood.
2. Support the hood.
3. Remove headlight wiper.
 - Refer to Wiper/Washer System in this section.

4. Remove radiator grille.

- Raise the clips (1) on the radiator grille and remove two screws.



603RW012

5. Remove front end lower panel.

- Remove two fixing bolts and remove the panel from the fender.

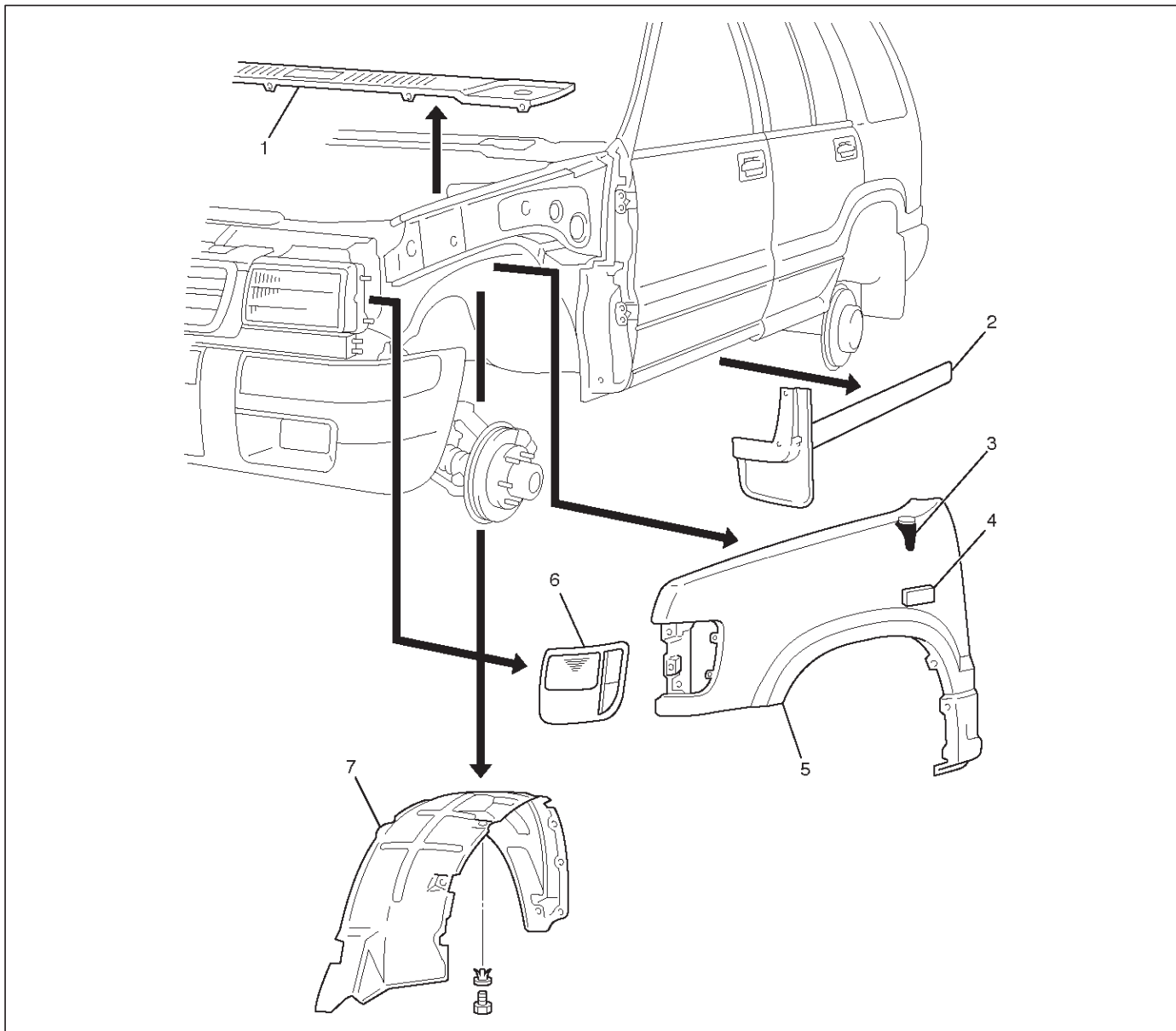
Installation

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

1. Install the radiator grille clips remaining on the body side in the radiator grille, and then install the radiator grille on the body.

Front Fender Panel

Parts Location



605RW008

Legend

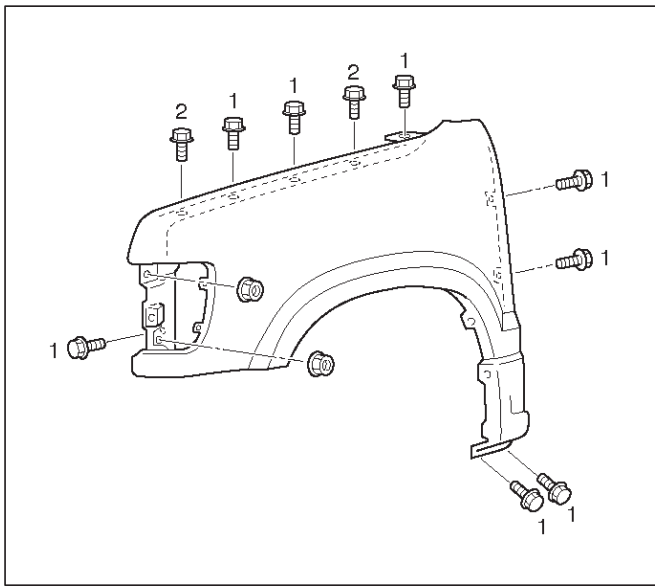
- | | |
|--------------------|-------------------------------------|
| (1) Cowl Cover | (4) Side Flasher Light |
| (2) Front Mud Flap | (5) Front Fender Panel |
| (3) Antenna Bezel | (6) Front Combination Lamp Assembly |
| | (7) Inner Liner |

Removal

1. Open the hood.
2. Support the hood.
3. Disconnect the battery ground cable.
4. Remove cowl cover.
 - Refer to Cowl Cover in this section.
5. Remove front combination lamp assembly.
 - Disconnect fixing screw and connector.
6. Remove front mud flap.
 - Disconnect three fixing screws and four clips.
7. Remove inner liner.
8. Remove antenna bezel.
 - Refer to Entertainment in this section.
9. Remove side flasher light.
 - Refer to Lighting System in this section.

10. Remove front fender panel.

- Disconnect ten fixing bolts and two nuts.



605RW001

Installation

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

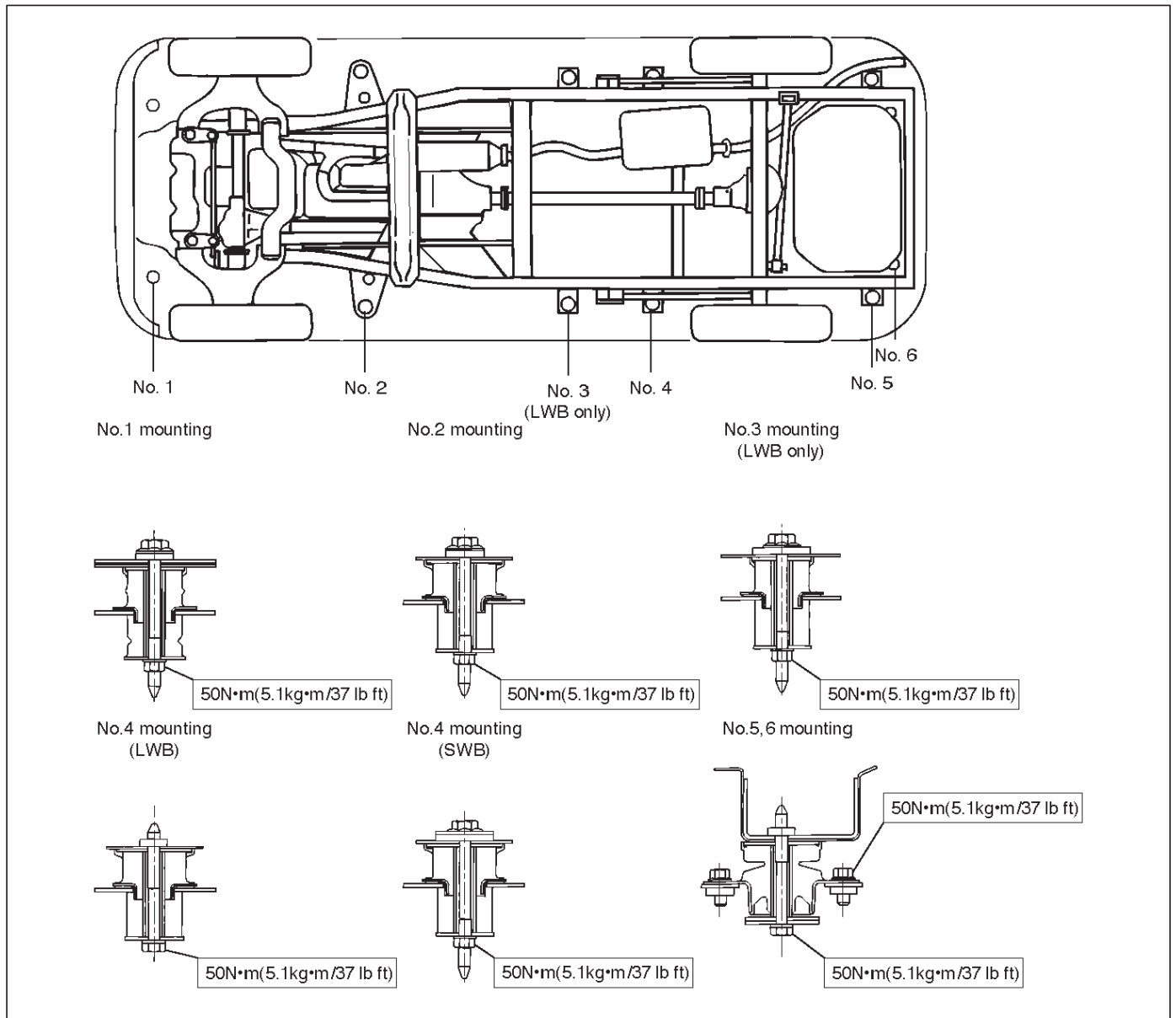
1. Tighten the front fender panel fixing bolts to the specified torque.

(1) Torque : 9 N•m (0.9kg-m/78 lb in)

(2) Torque : 7 N•m (0.7kg-m/61 lb in)

Body Mounting

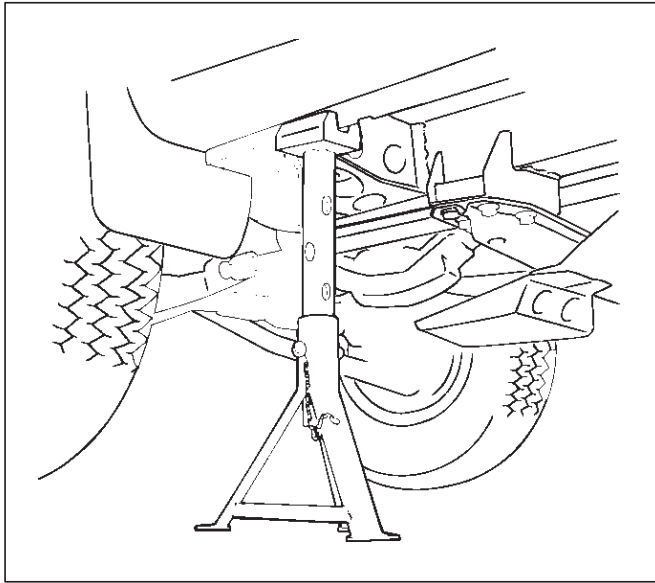
Parts Location



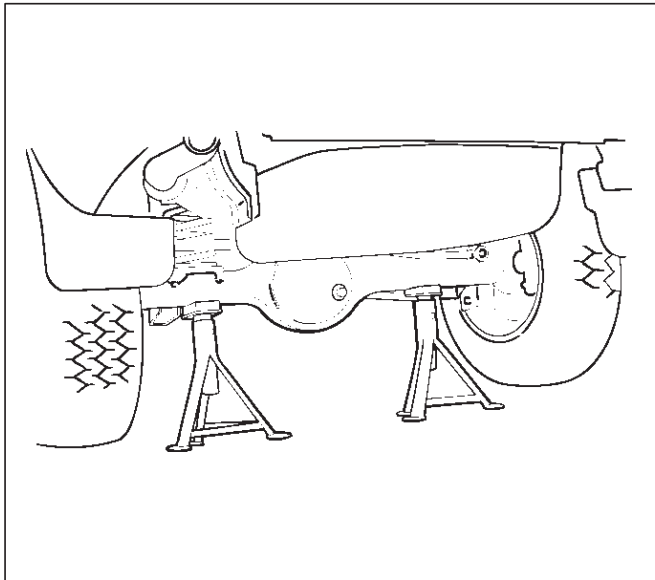
E02RW006

Removal (No.1 – No. 2)

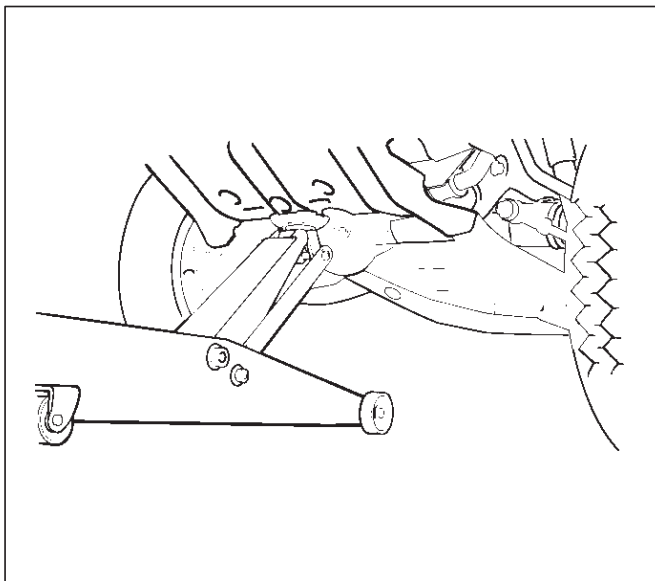
1. Remove the front bumper.
2. Jack up the vehicle by the frame.
3. Support the front side sill and rear axle with stands.
Further, support the front jack up point with a jack.



620RS001

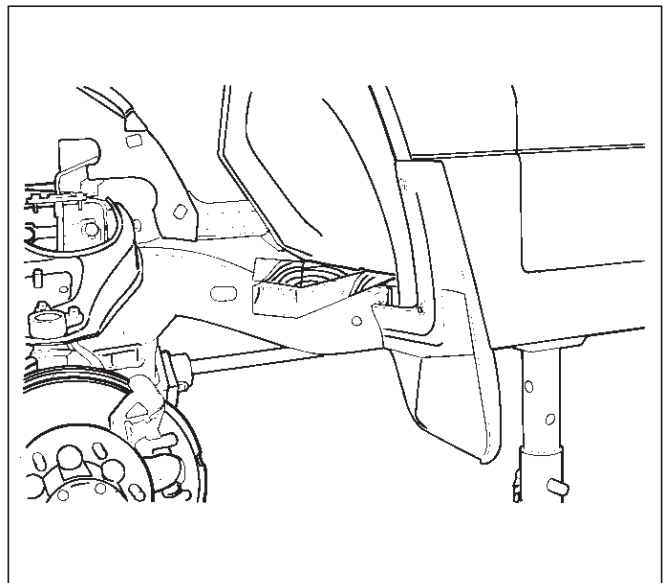


420RS001



545RS001

4. Remove the mounting bolts (No. 1-4) on either side.
 - No. 1 – Hold in check not to turn from the inside of the front fender.
 - No. 2 – Remove the front door sill plate and dash side trim panel, turn over the floor carpet and hold the bolt in check not to turn.
 - No. 3 (LWB only)– Remove the rear door sill plate and center pillar lower trim cover, turn over the floor carpet and hold the bolt in check not to turn.
 - No. 4 (SWB)– Remove the luggage side trim cover, turn over the floor carpet and hold the bolt in check not to turn.
 - No. 4 (LWB)– Remove the bolt from under the frame.
5. Loosen the mounting bolts (No. 5-6) on either side.
6. Remove the frame side mounting and washer.
7. Gently lower the jack supporting the front axle until the cab side mounting can be removed.
8. Remove the cab side mounting.
 - Be sure to use a splice bar around the mounting to be removed.



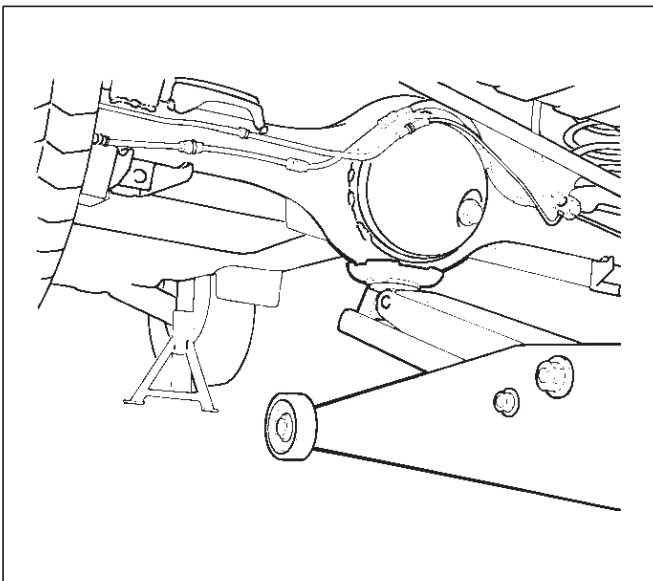
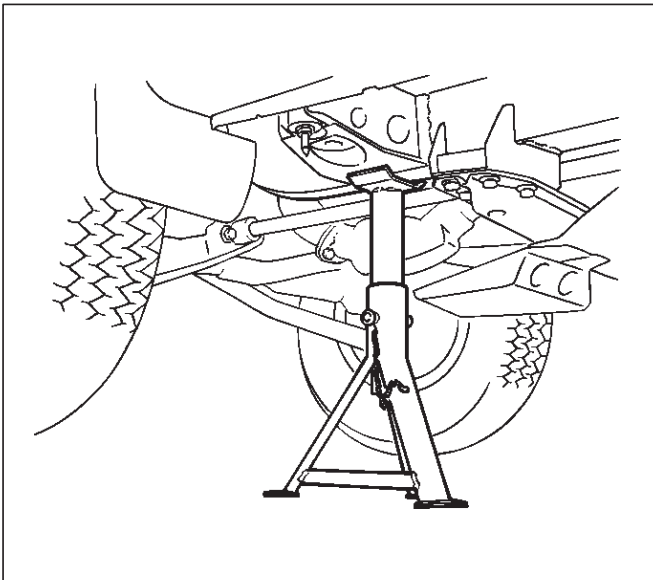
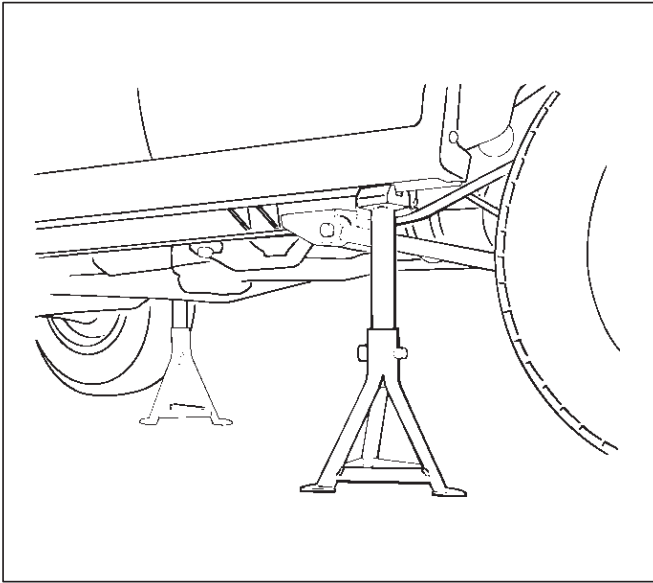
501RS001

Removal (No. 3 — No. 6)

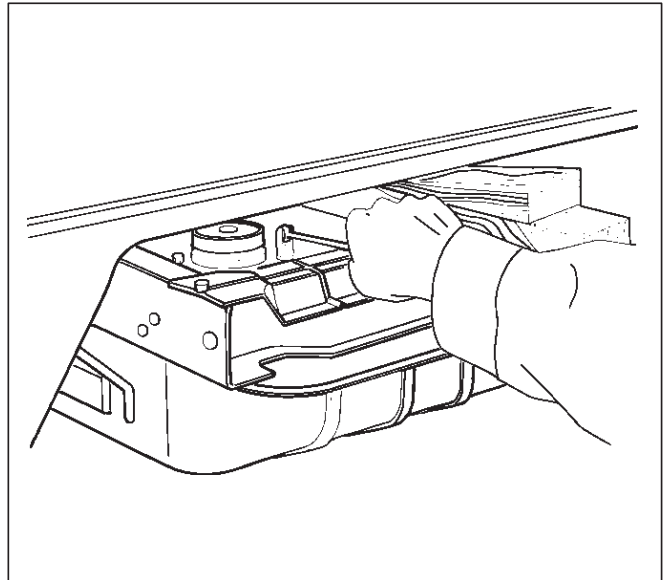
1. Remove the rear bumper.
2. Jack up the vehicle by the frame.

8F-26 BODY STRUCTURE

- Support the rear side sill and frame stands, and support the rear axle with a jack.



- Remove the mounting bolts (No. 3-6) on either side.
 - No. 3 (LWB only) — Remove the rear door sill plate and center pillar lower-trim cover, turn over the floor carpet and hold the bolt in check not to turn.
 - No. 4 (SWB) — Remove the luggage side trim cover, turn over the floor carpet and hold the bolt in check not to turn.
 - No. 4 (LWB) and No. 5 – 6
- Remove the frame side mounting and washer.
- Gently lower the jack supporting the rear axle until the cab side mounting can be removed.
- Remove the cab side mounting.
 - Be sure to use a splice bar around the mounting to be removed.
 - As for No. 5 and 6, remove the frame side bracket fixing bolts after lowering the frame gently.



Installation

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

- Tighten each mounting bolt to the specified torque.

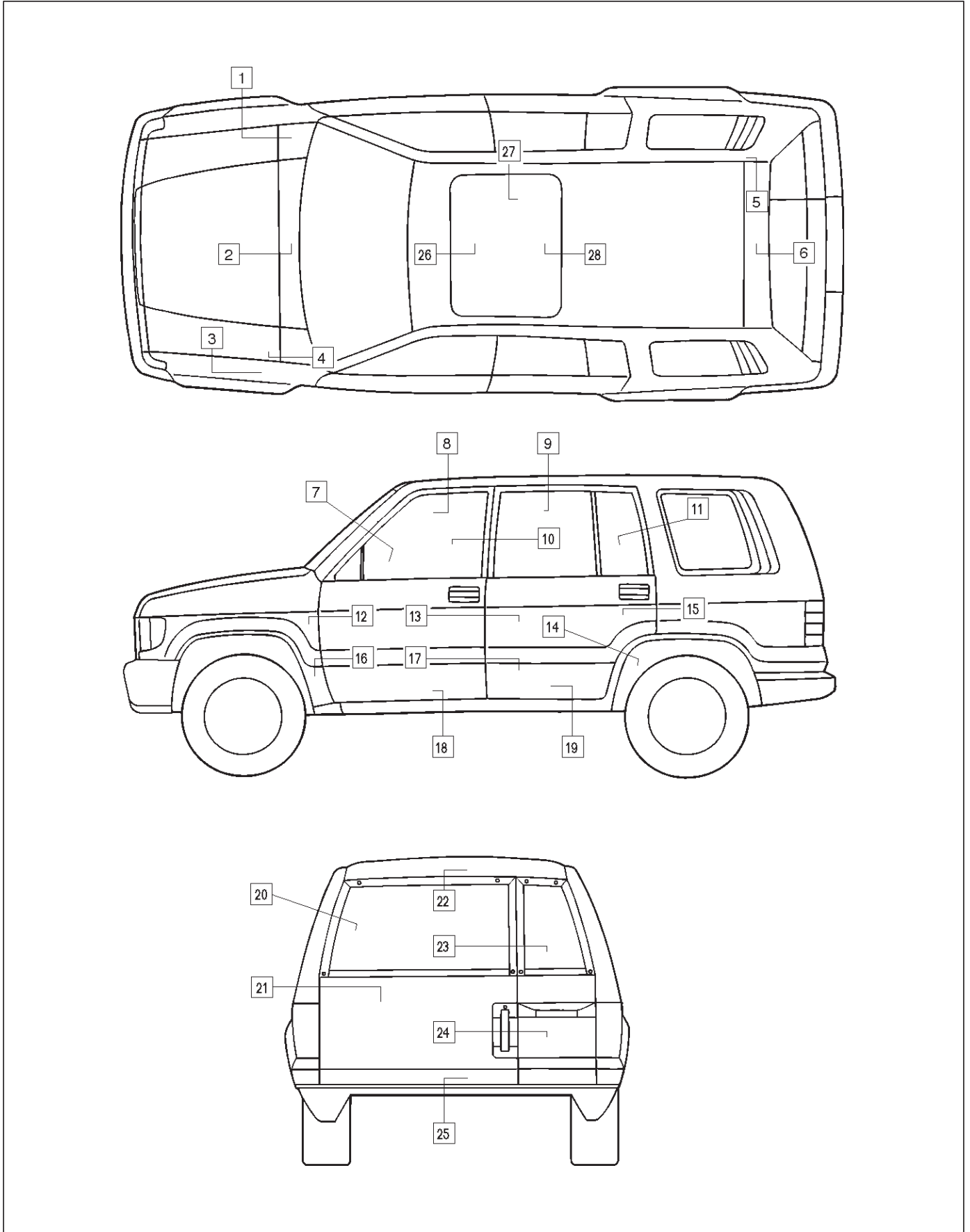
Torque : 50 N•m (5.1kg-m/37 lb ft)

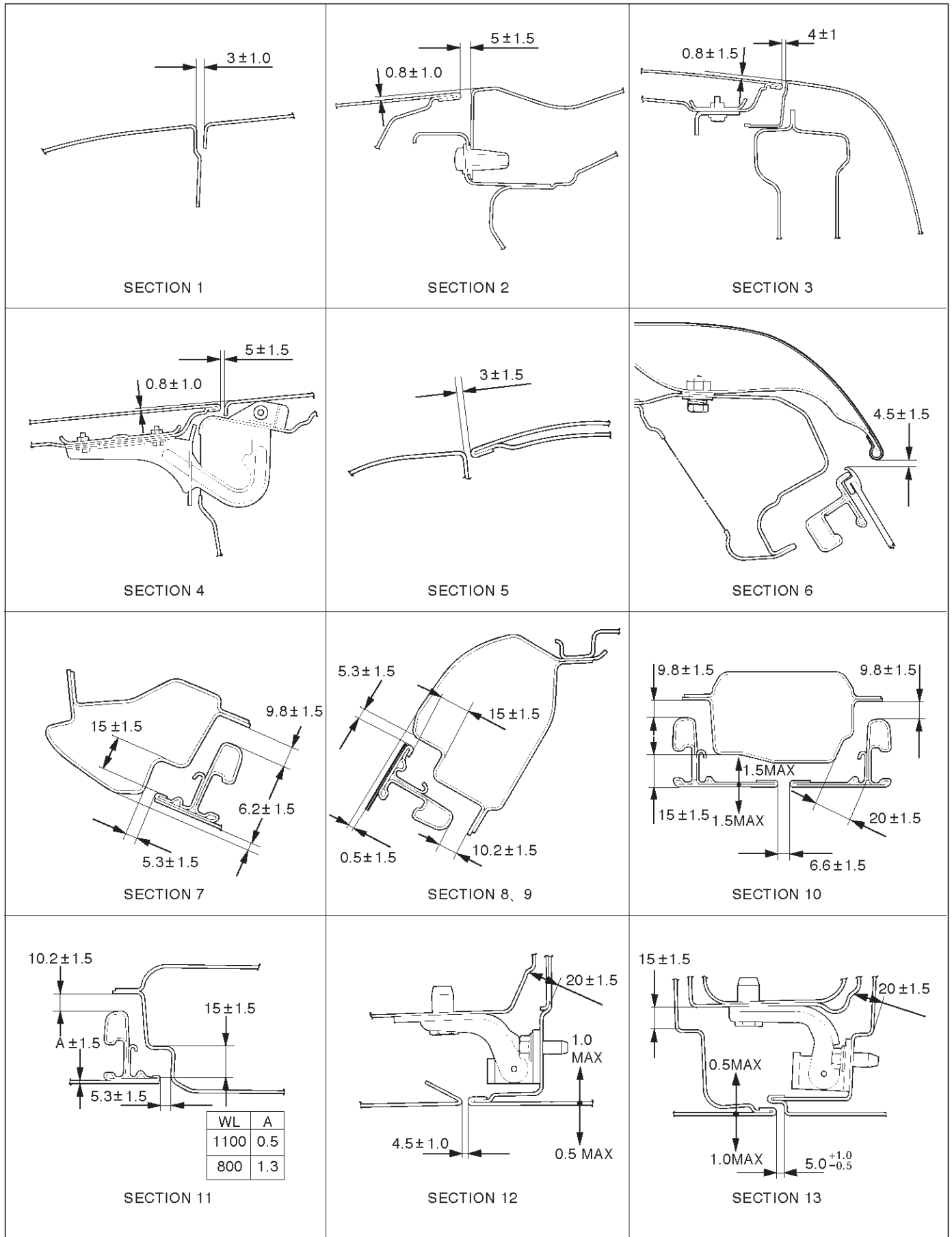
General Description

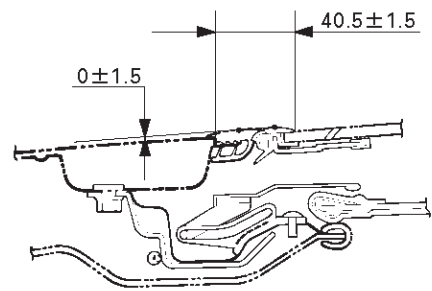
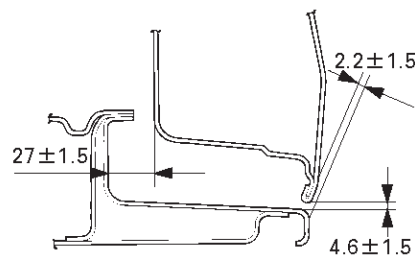
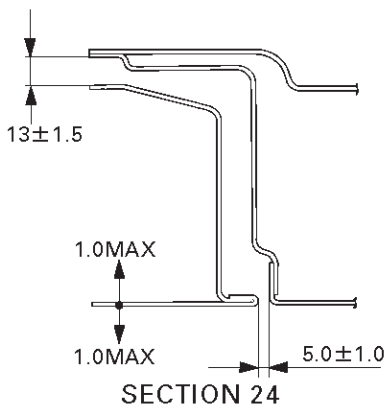
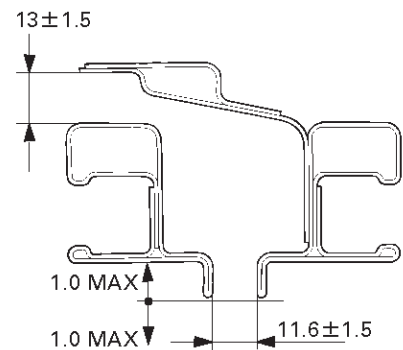
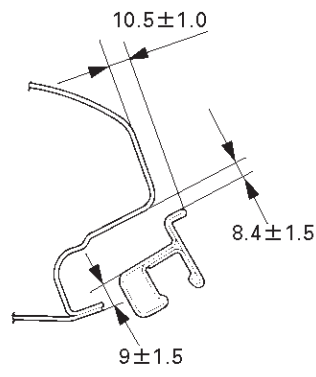
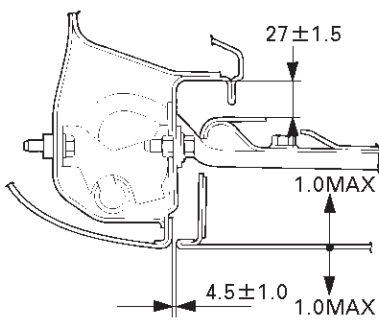
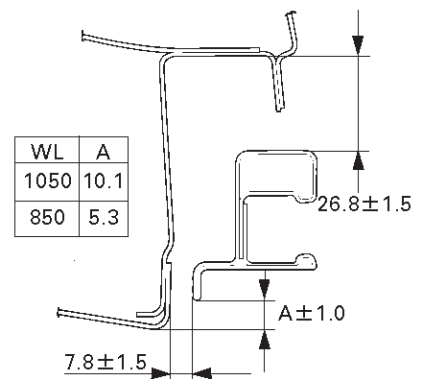
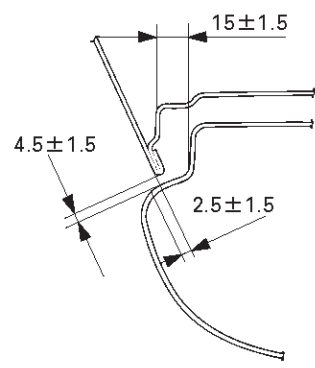
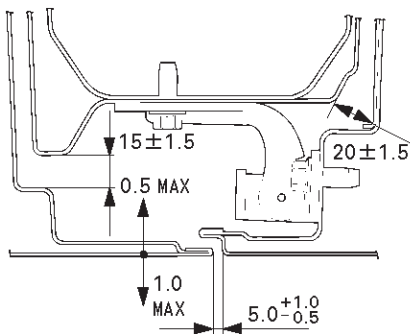
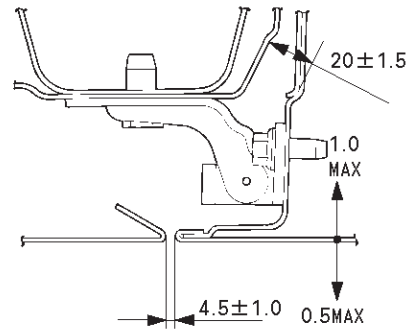
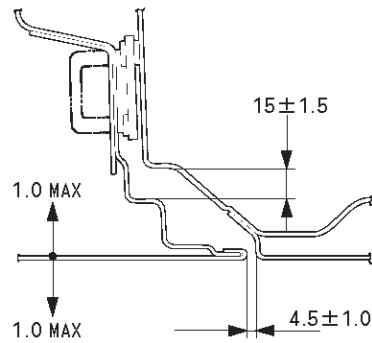
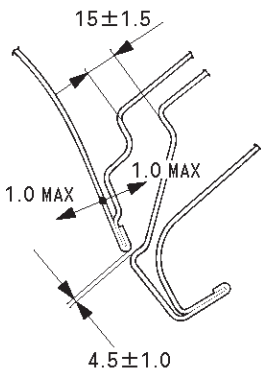
This section describes major items of the removal, installation and servicing procedures pertaining to the TROOPER body. Each servicing instruction is applicable to all models of the TROOPER, unless otherwise specifically mentioned. For those differing by specific models from the common procedures, they are detailed for each model.

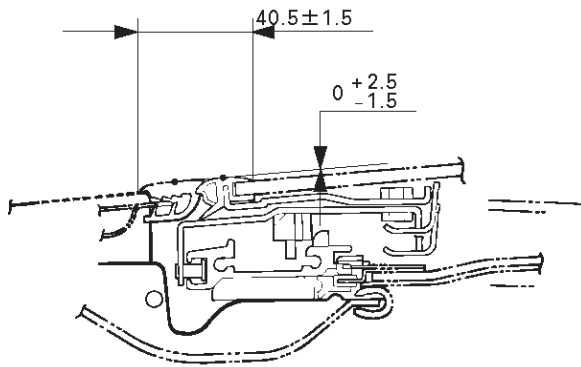
Body Dimension

Upper Body

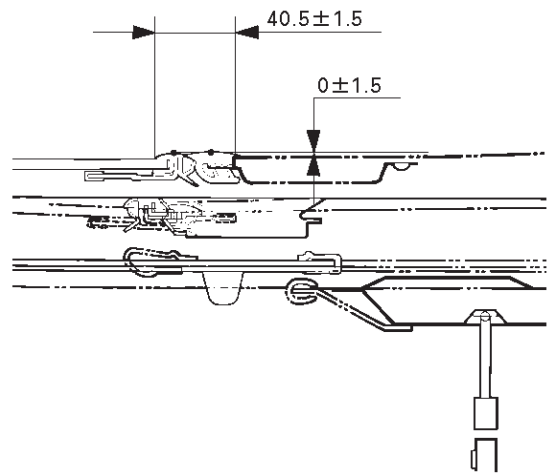








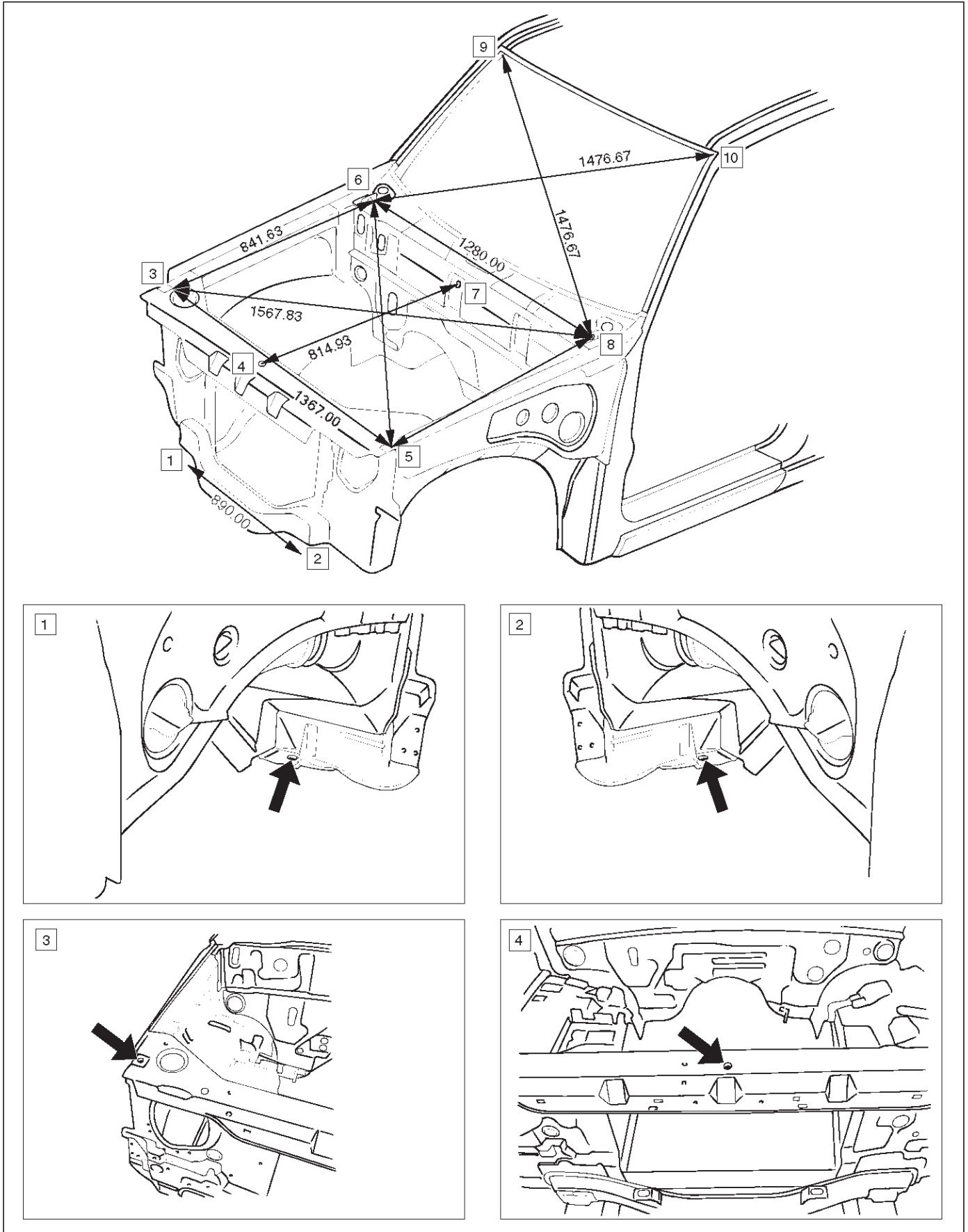
SECTION 27



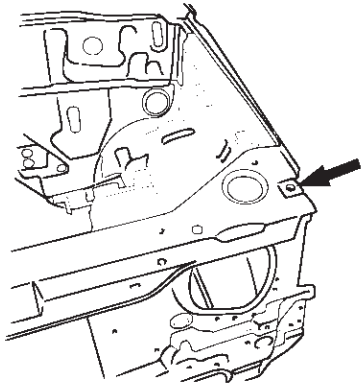
SECTION 28

8F-32 BODY STRUCTURE

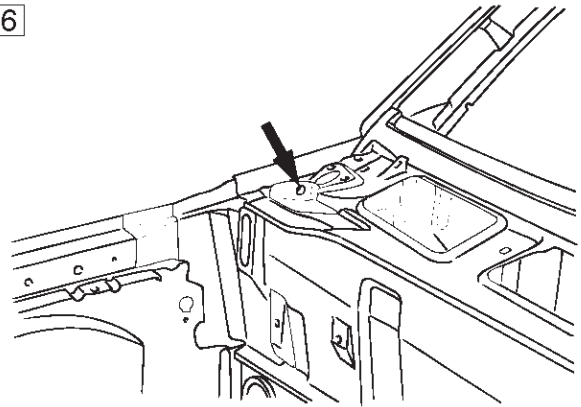
Front Section



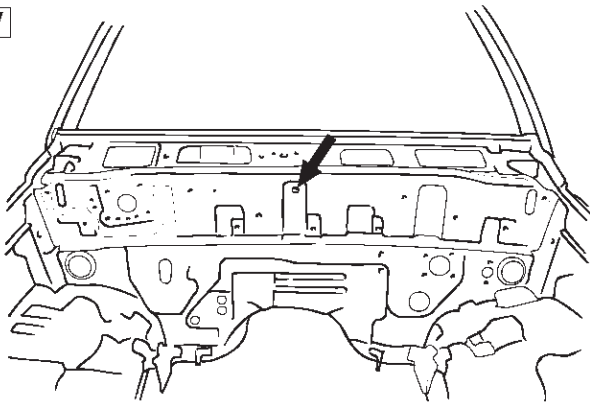
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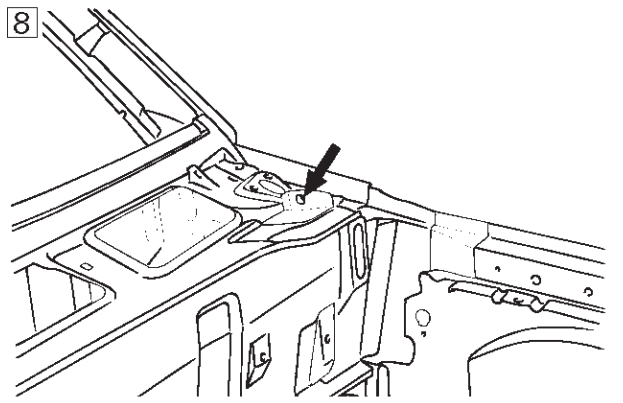
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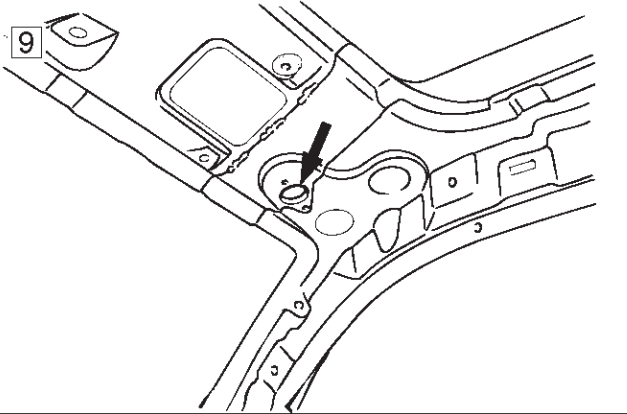
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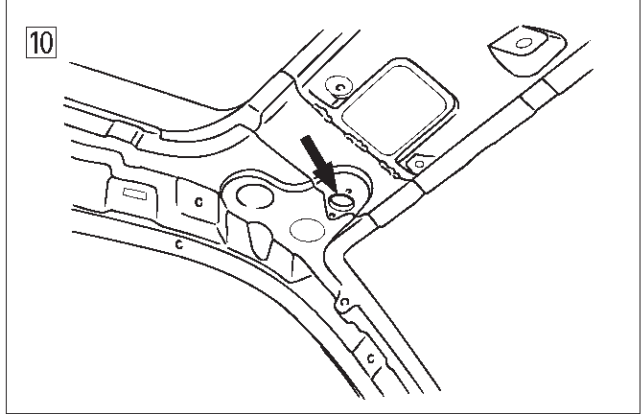
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9

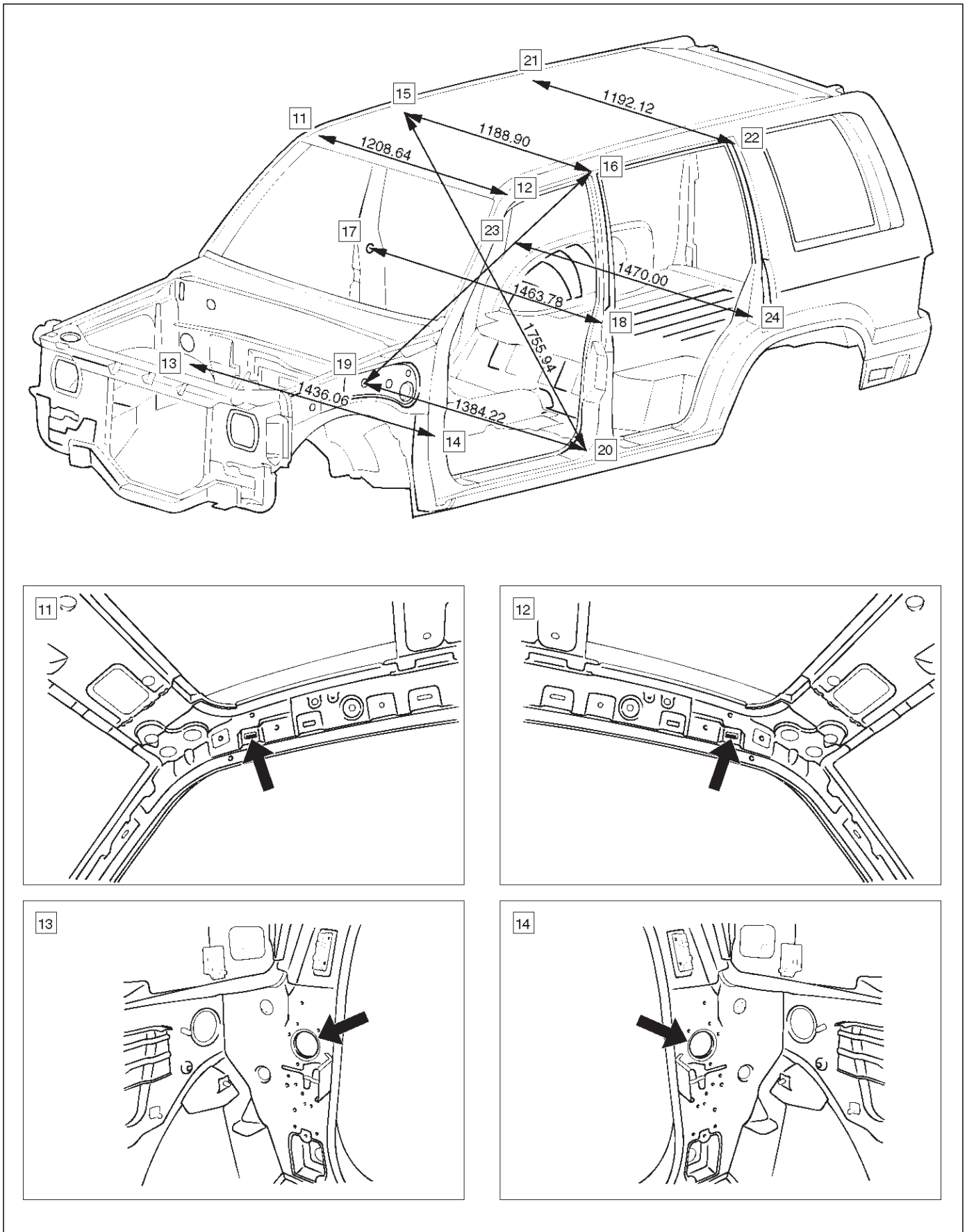


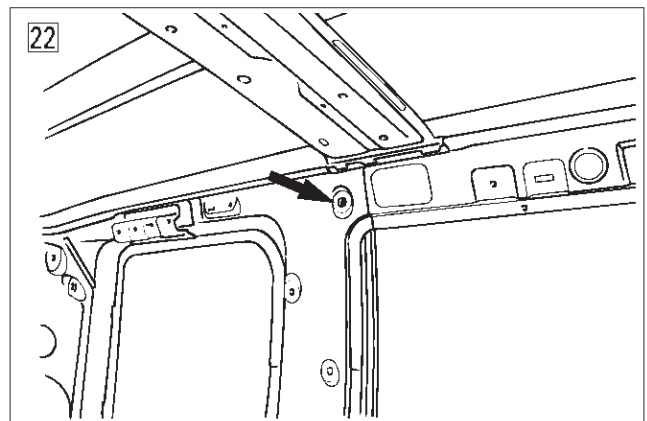
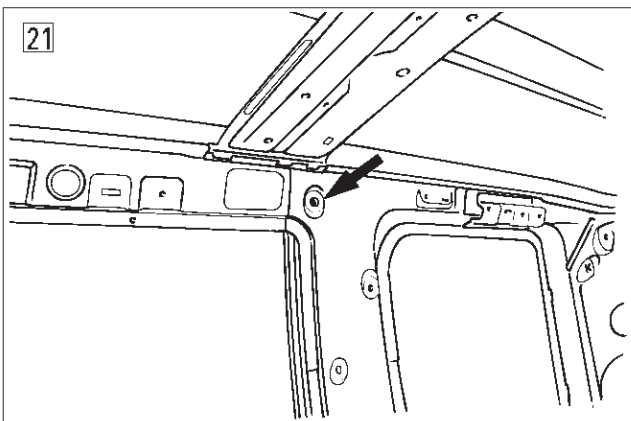
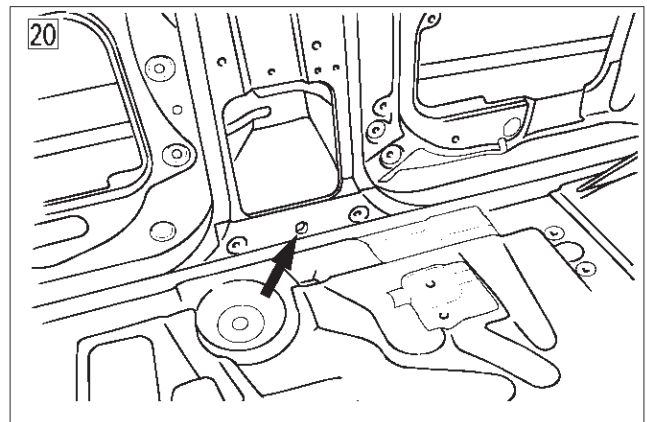
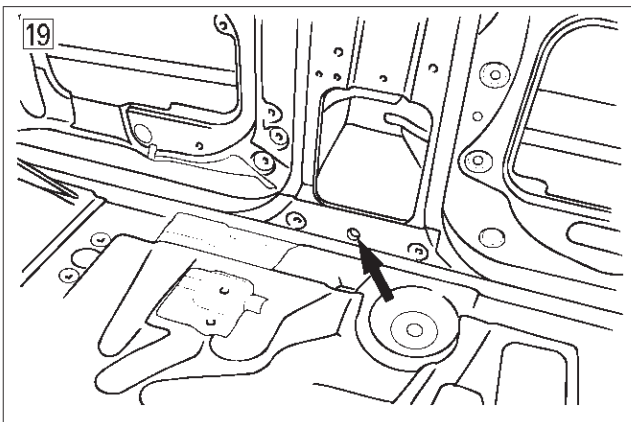
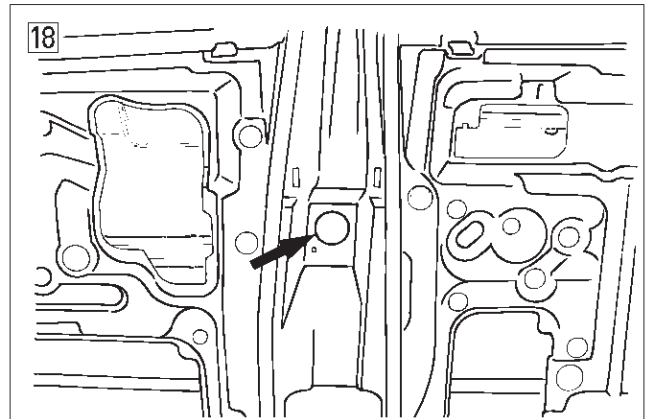
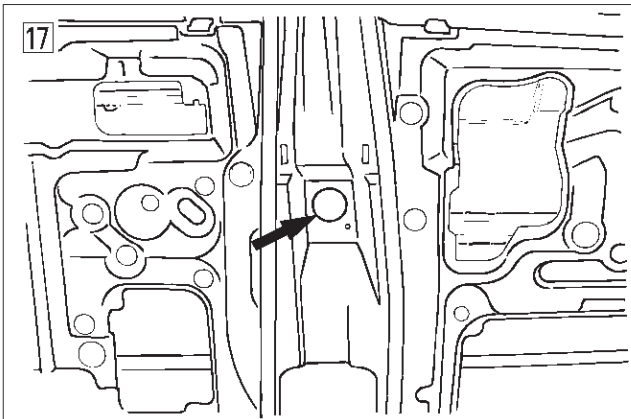
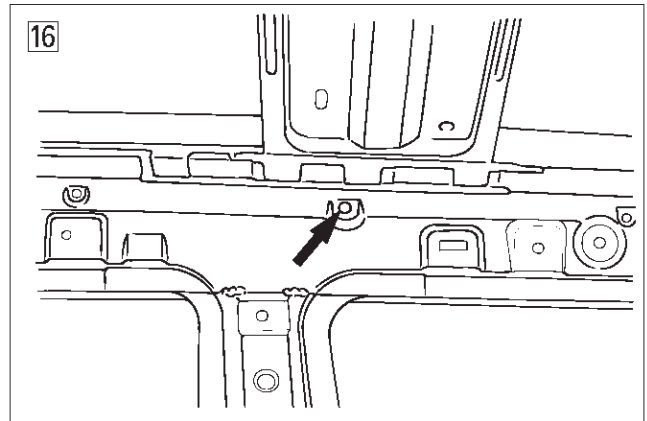
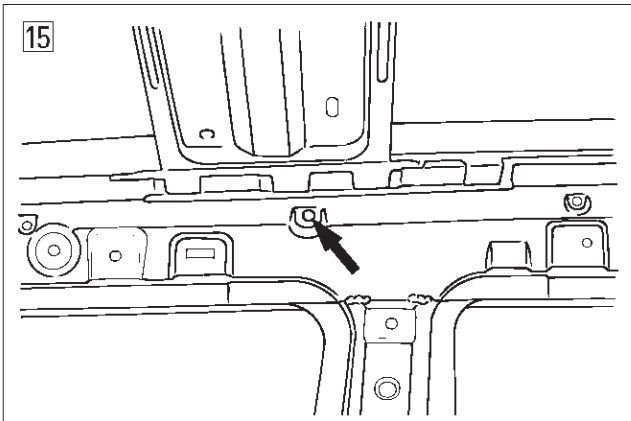
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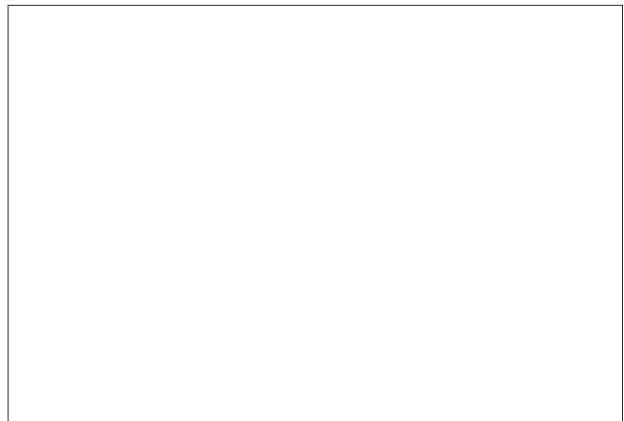
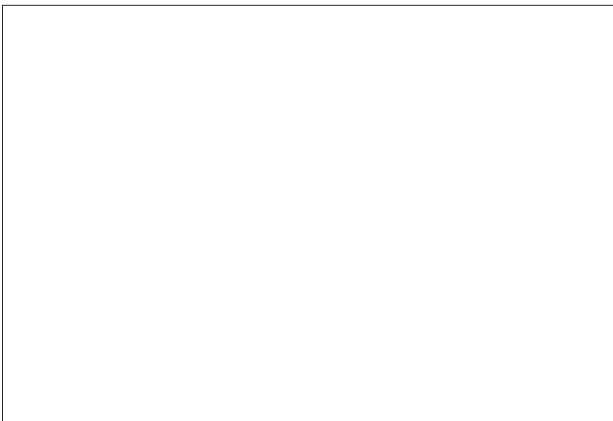
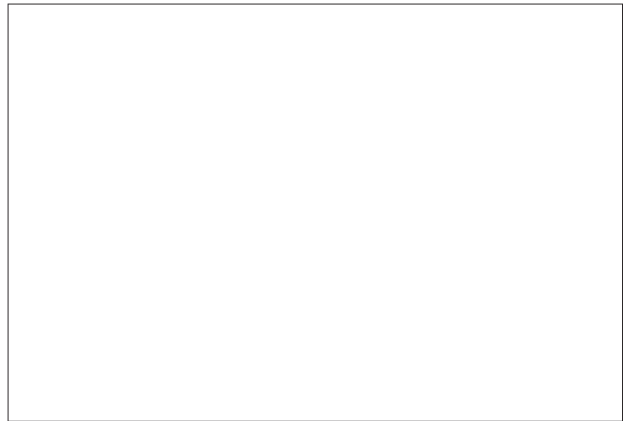
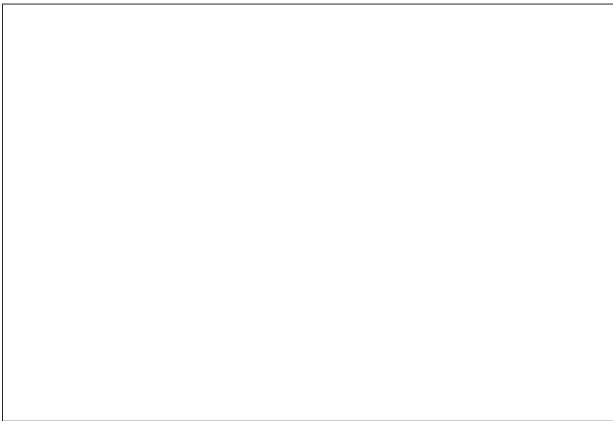
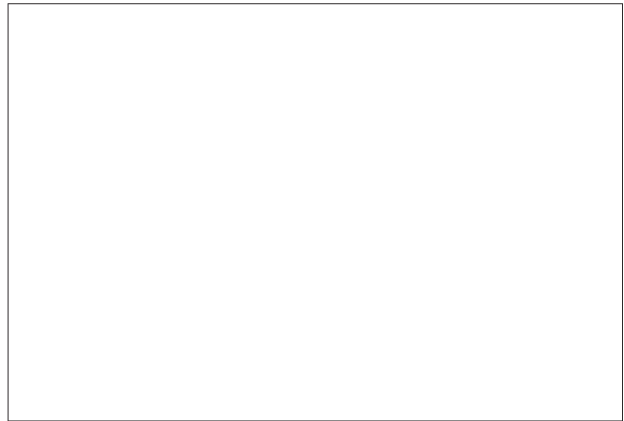
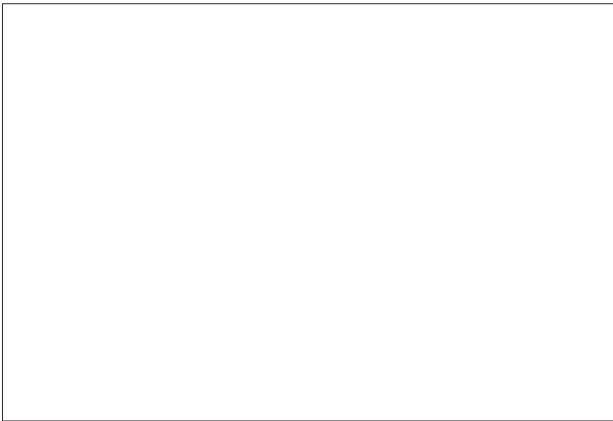
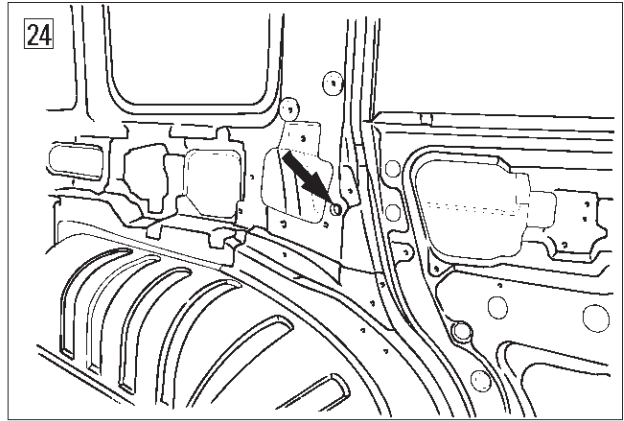
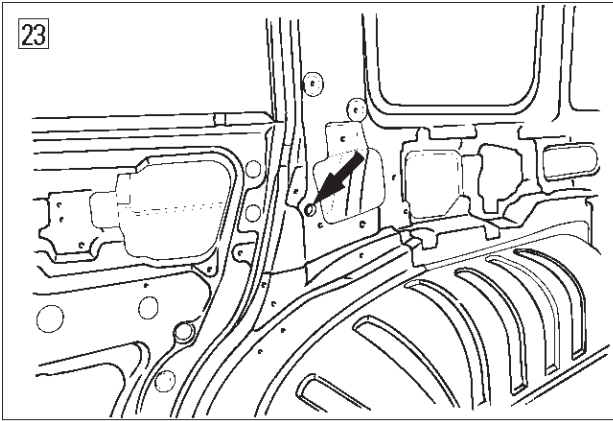


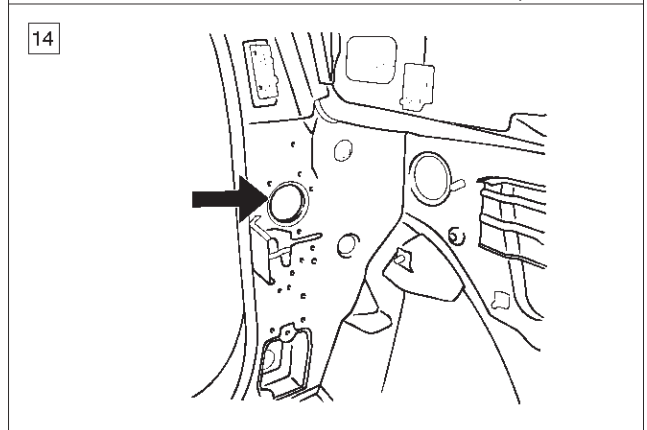
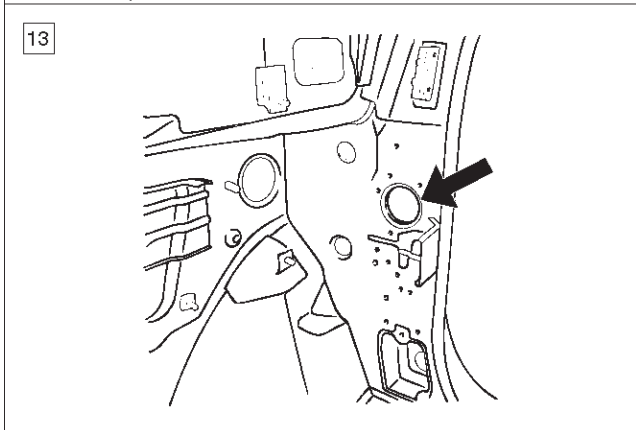
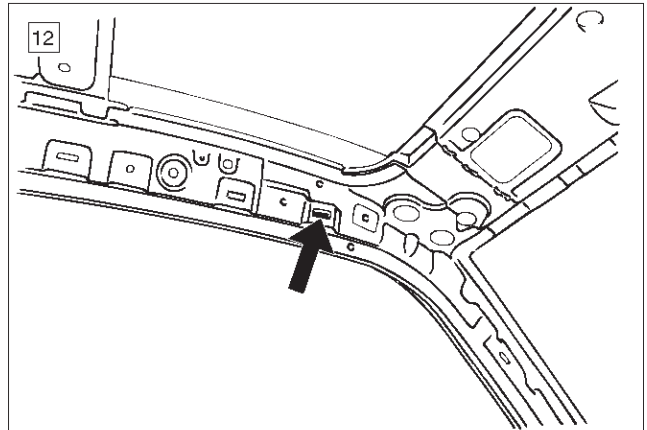
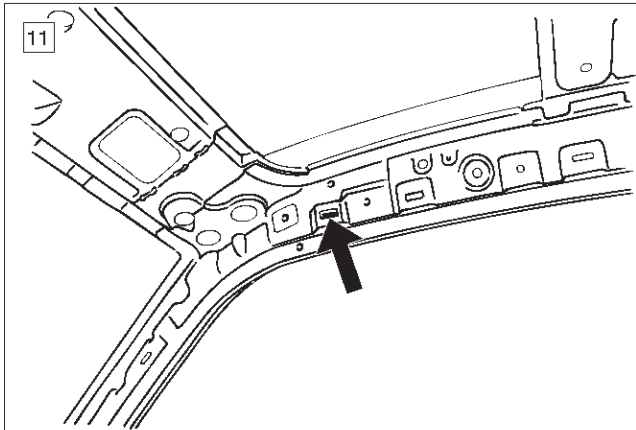
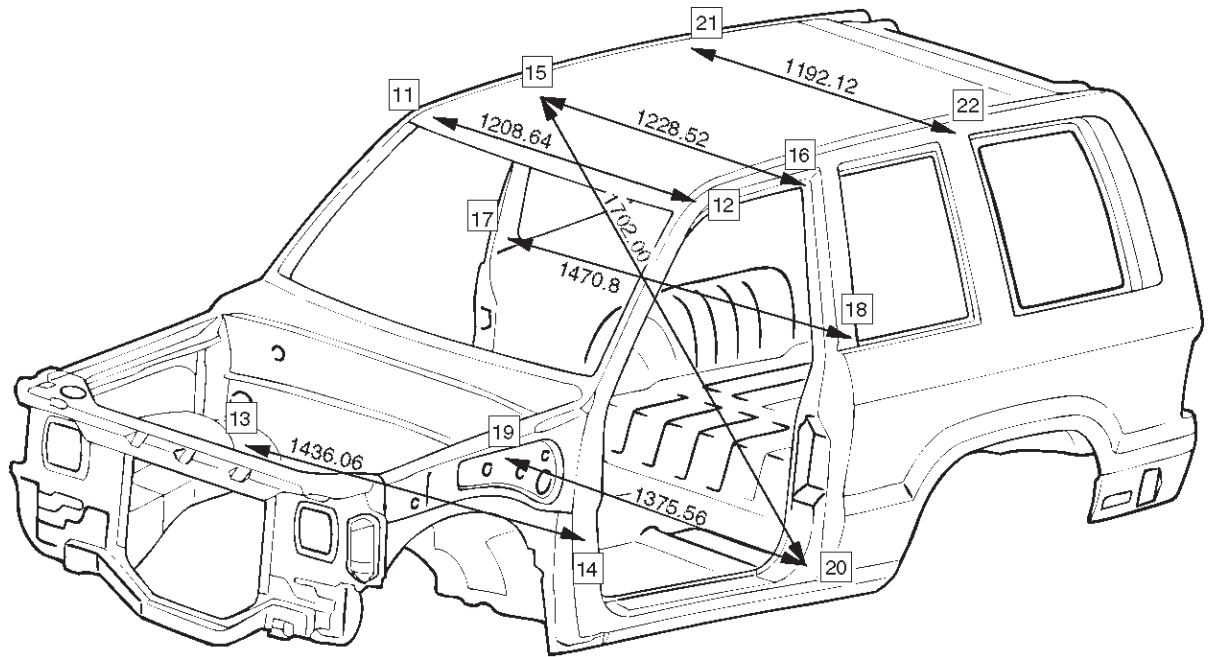
8F-34 BODY STRUCTURE

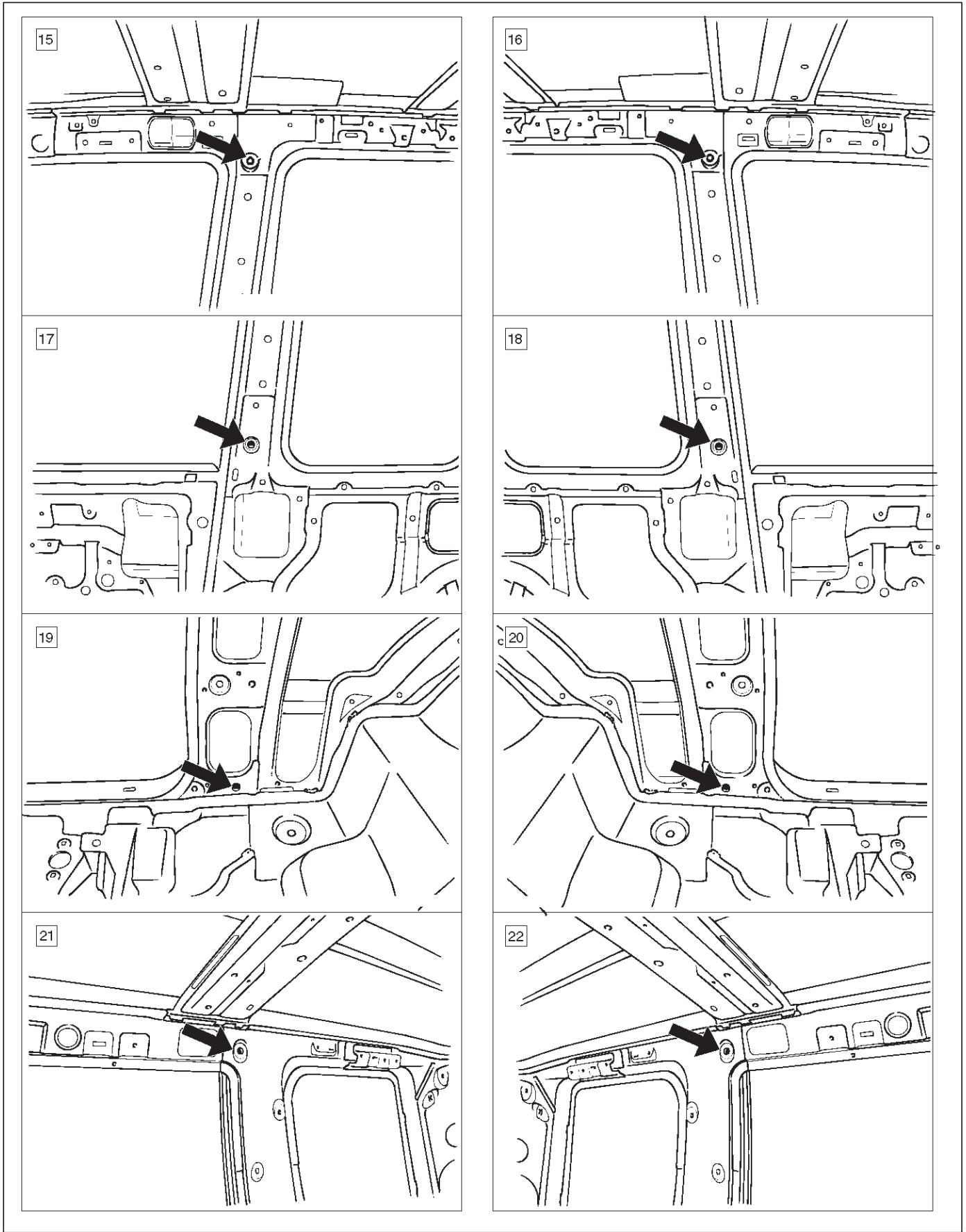
Room Section (LWB)



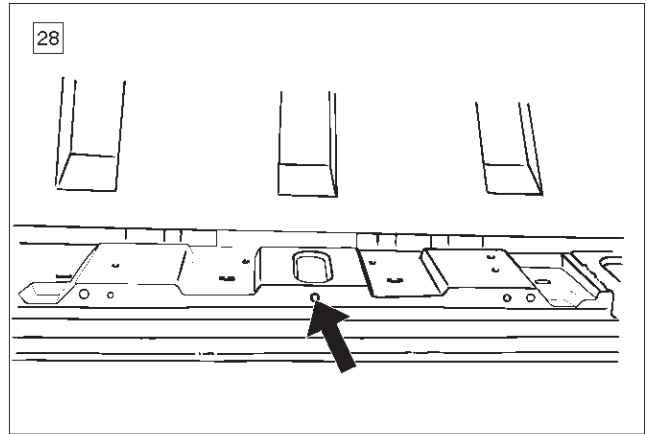
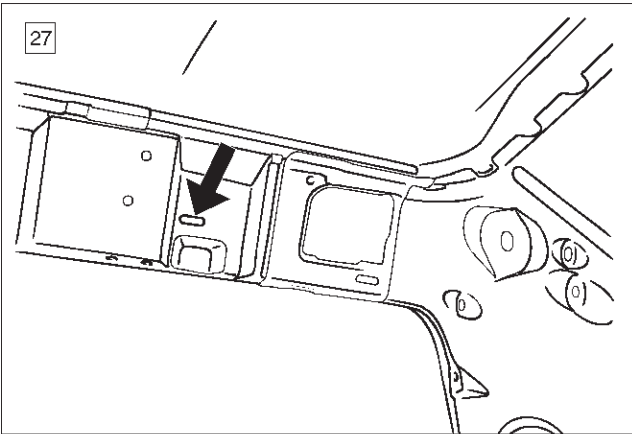
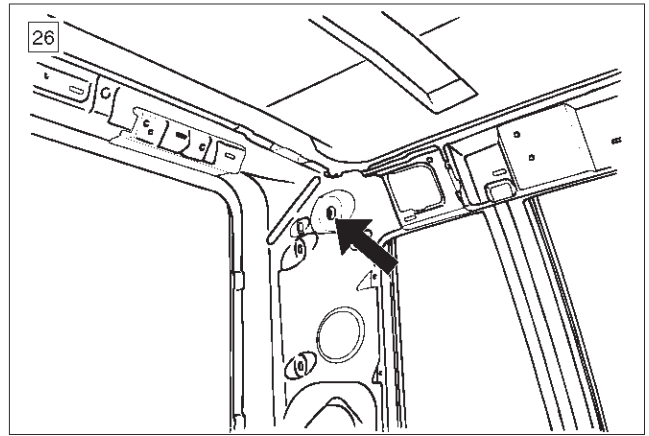
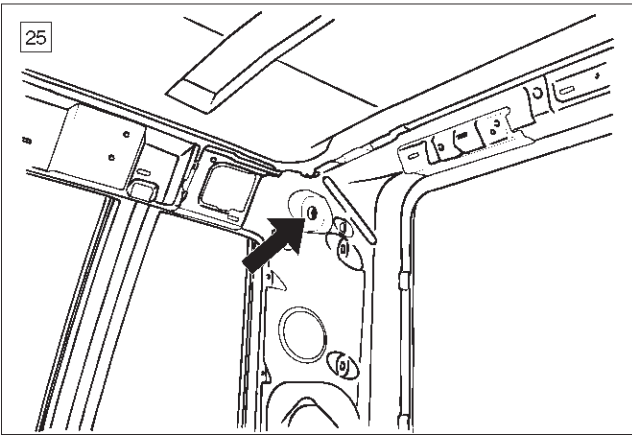
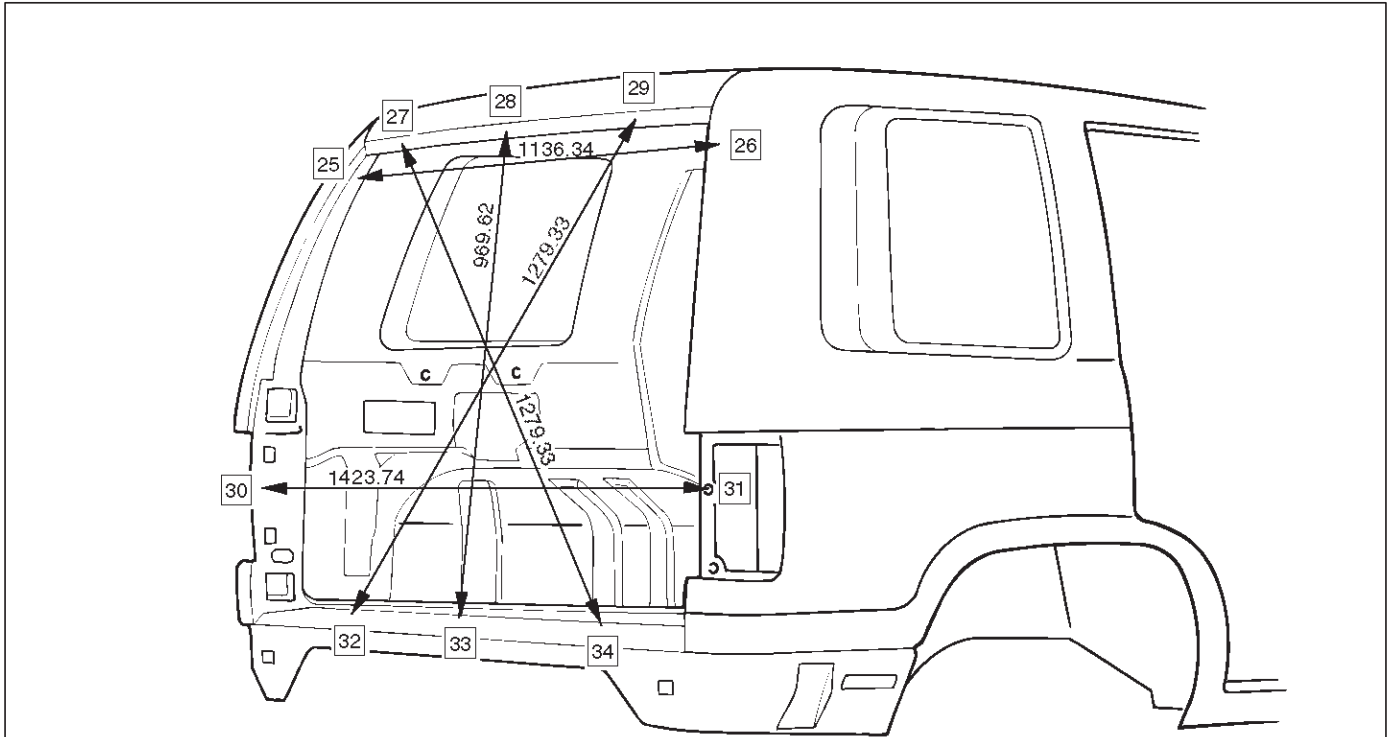


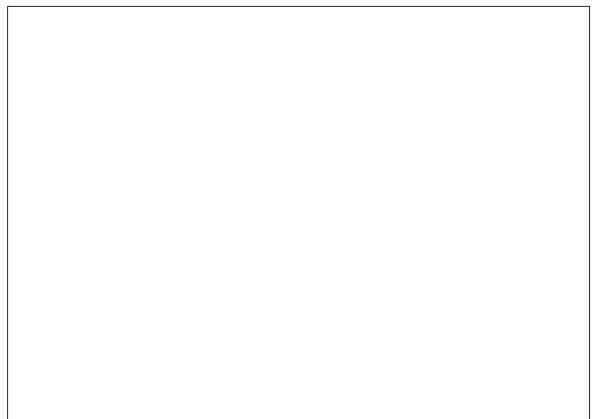
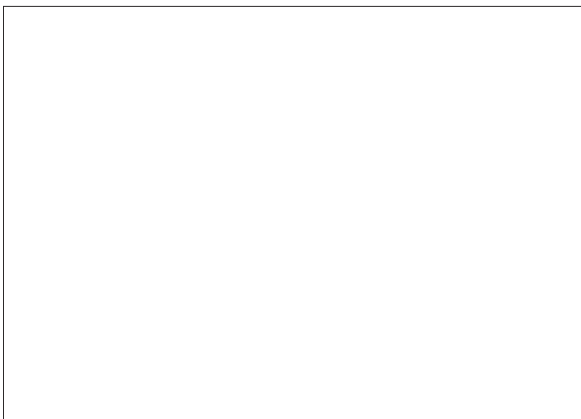
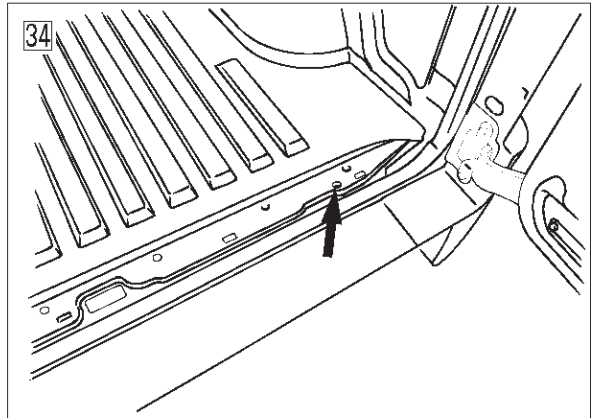
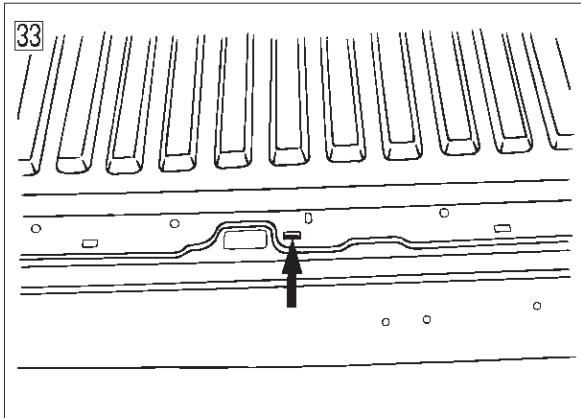
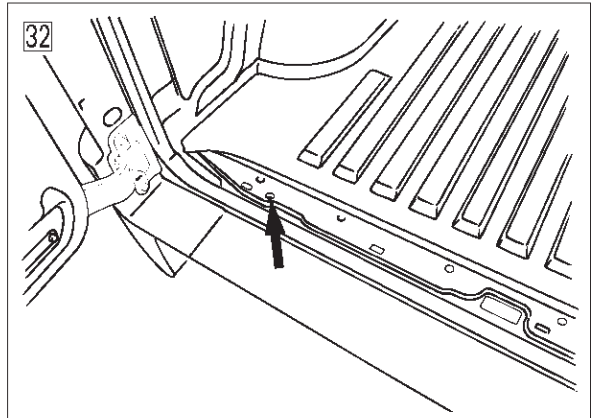
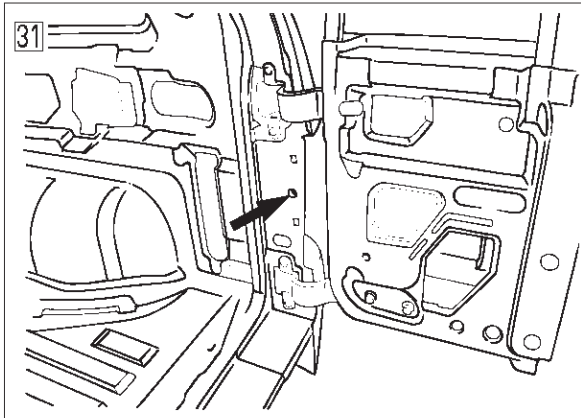
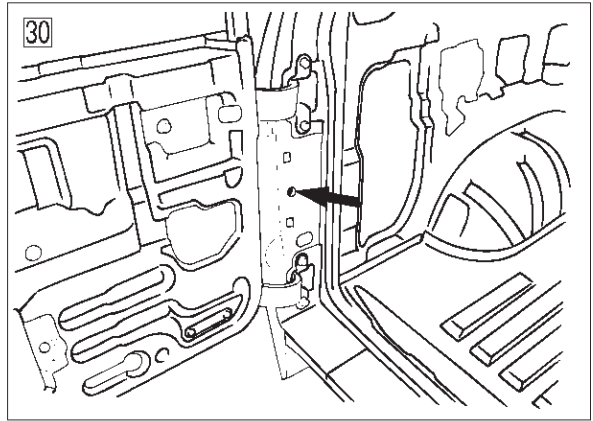
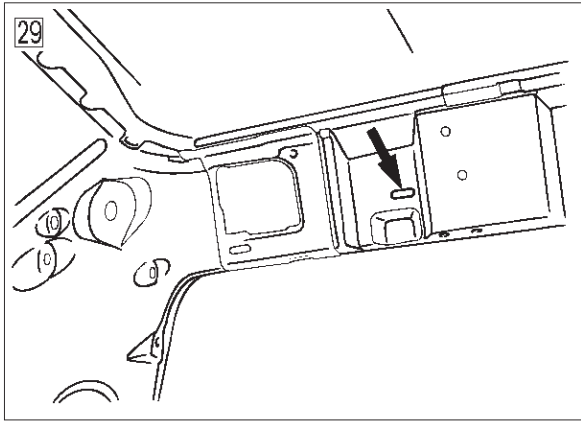




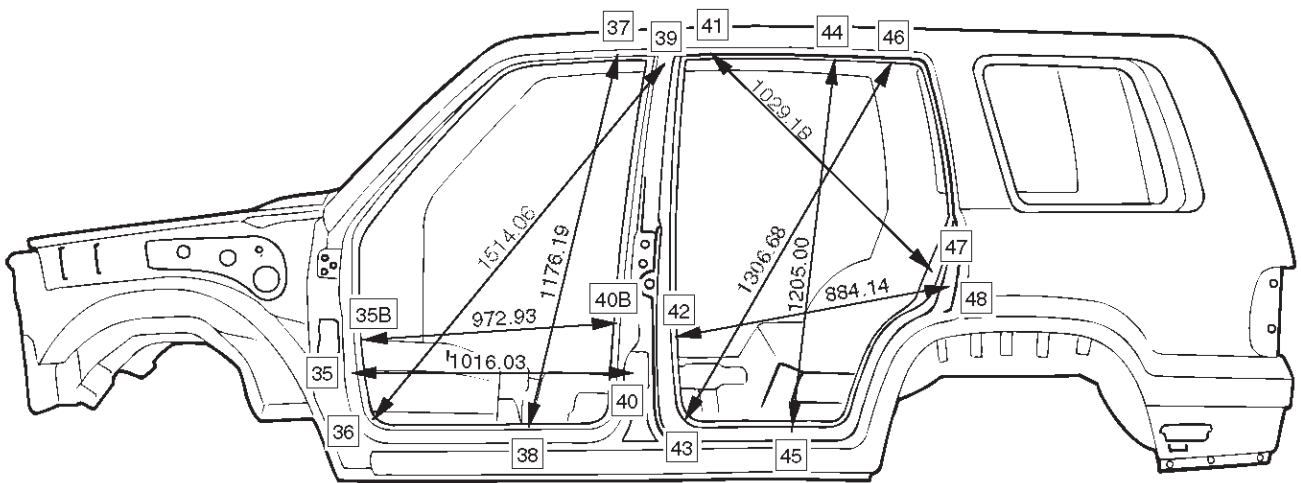


Rear Section

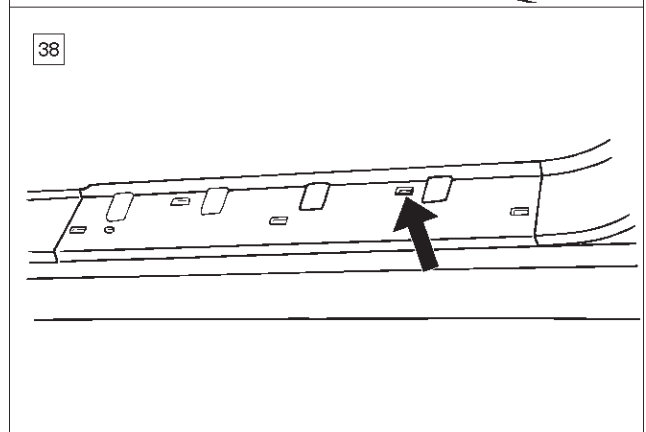
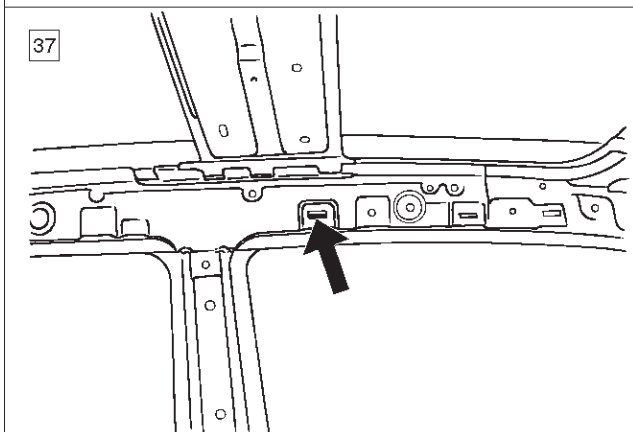
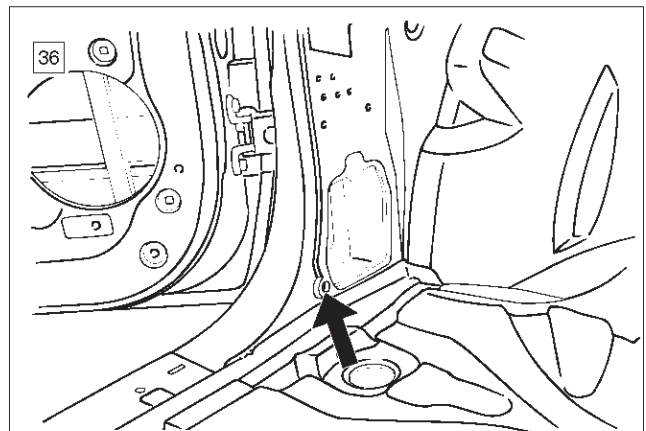
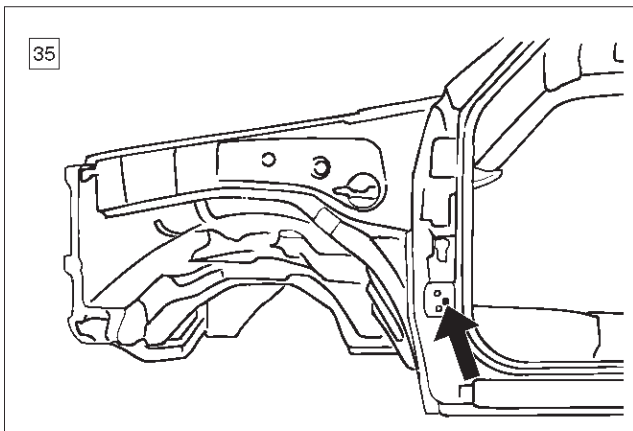


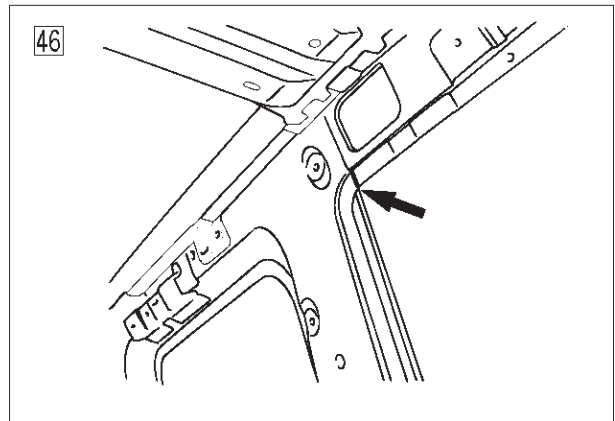
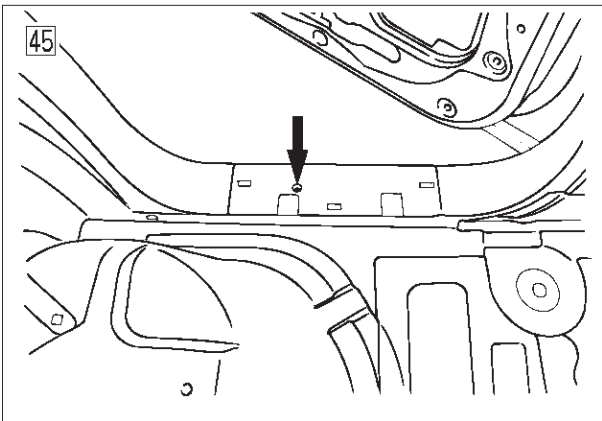
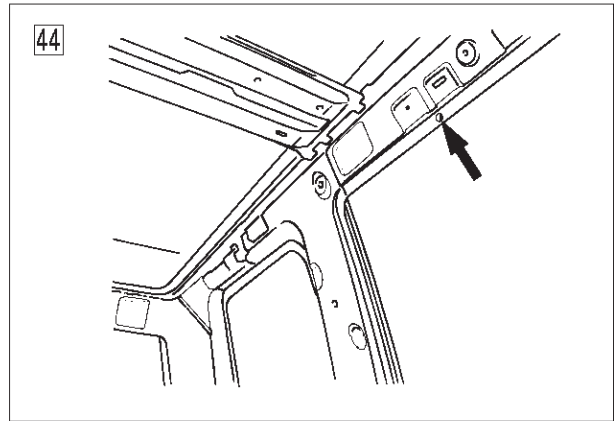
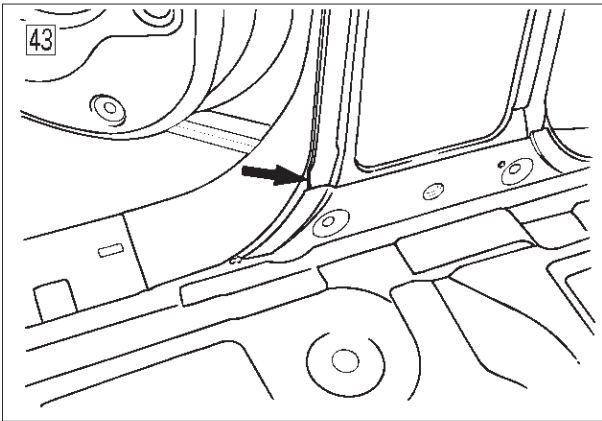
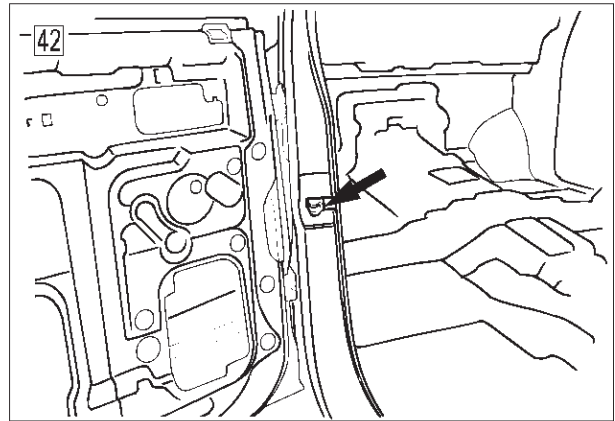
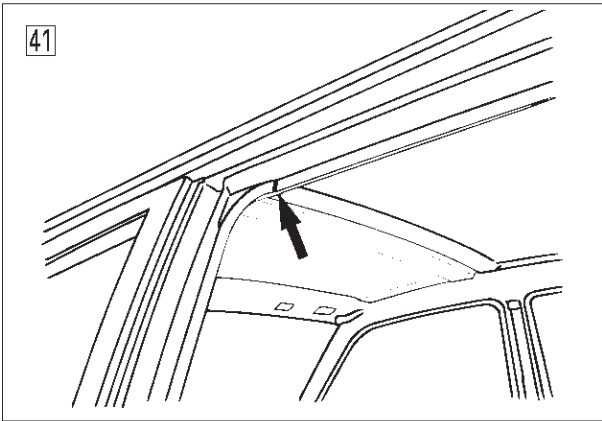
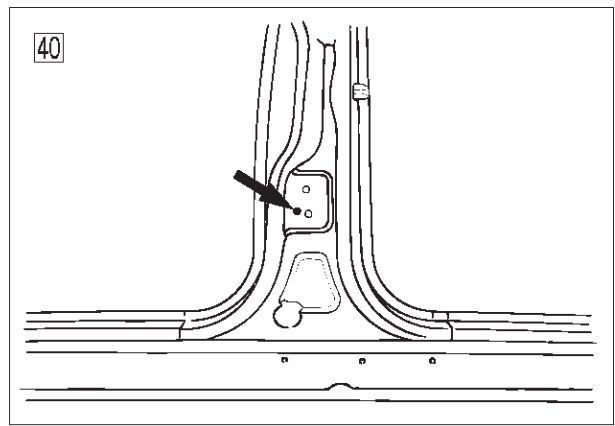
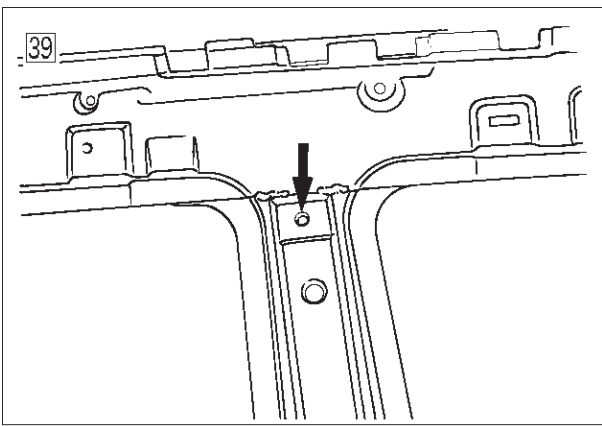


Side Body

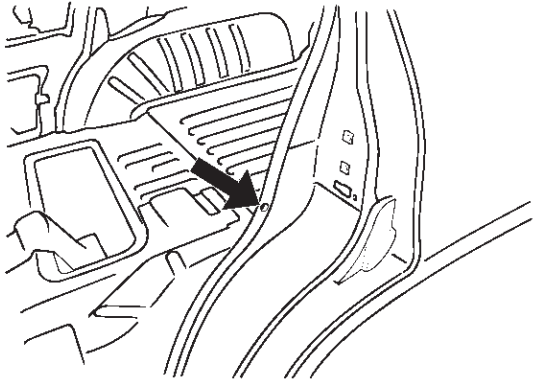


* 35B ~ 40B : Short Wheel Base Only

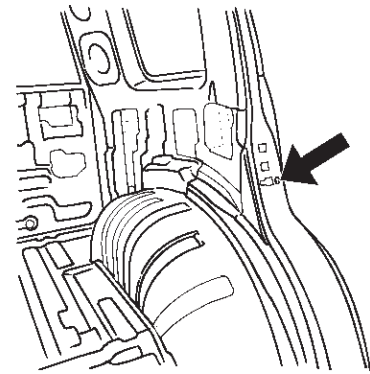




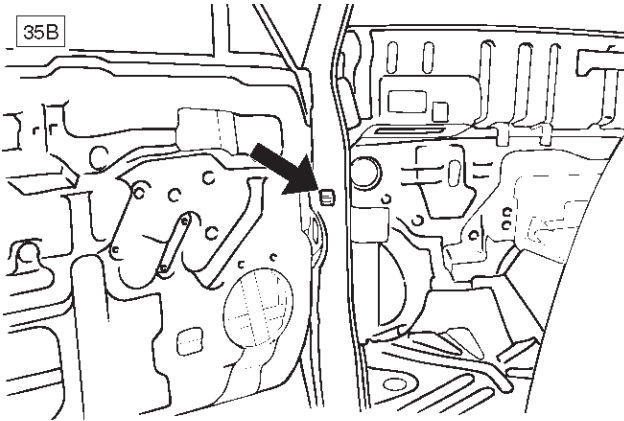
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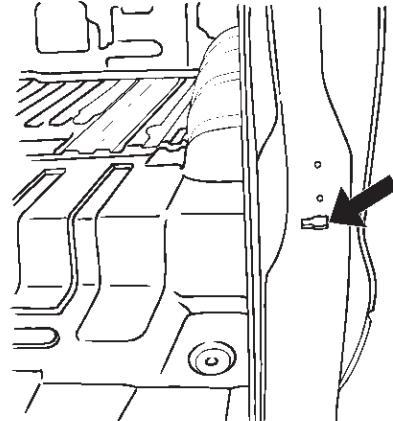
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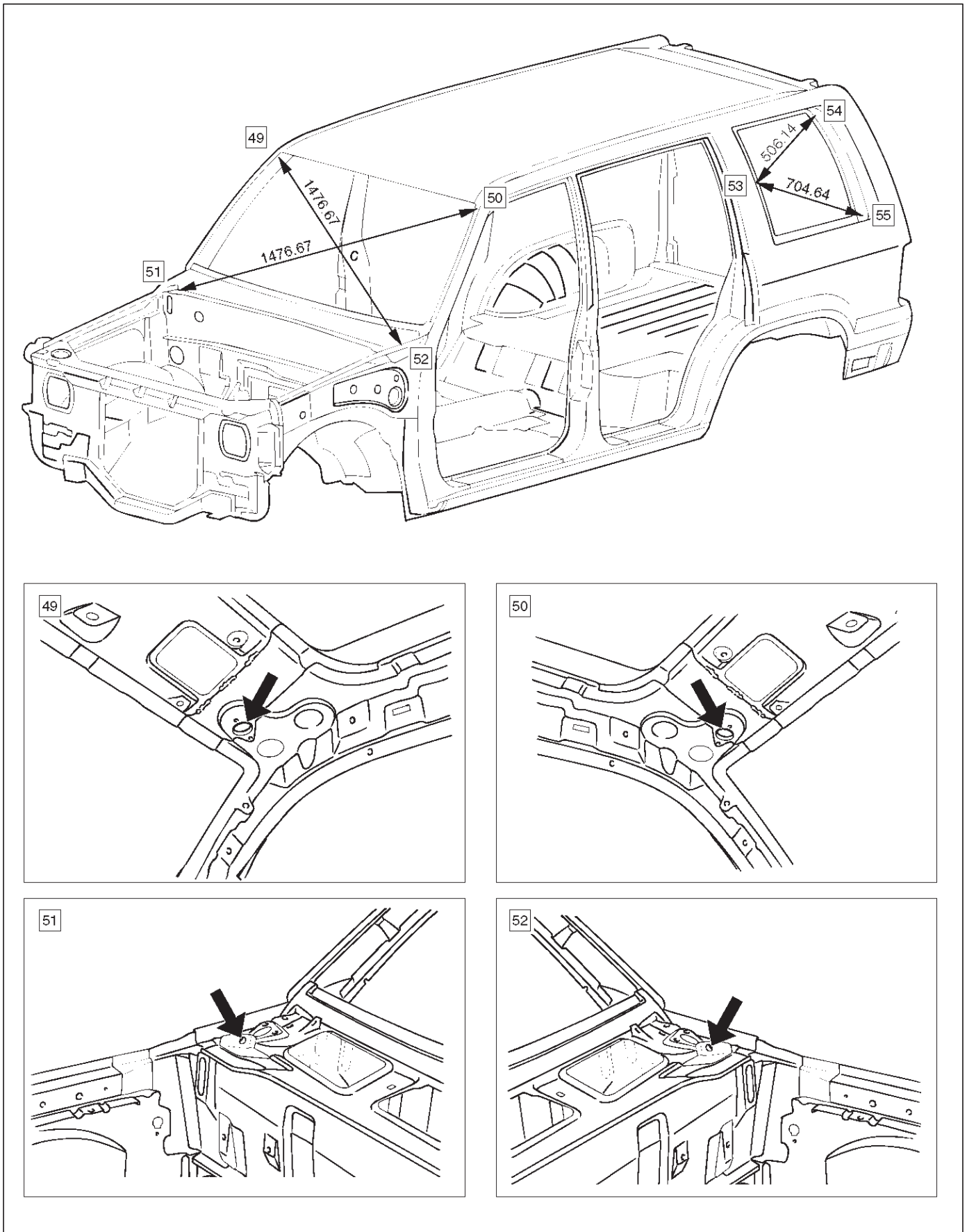
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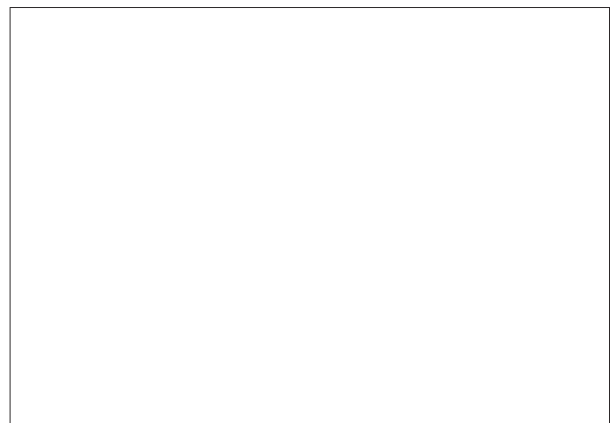
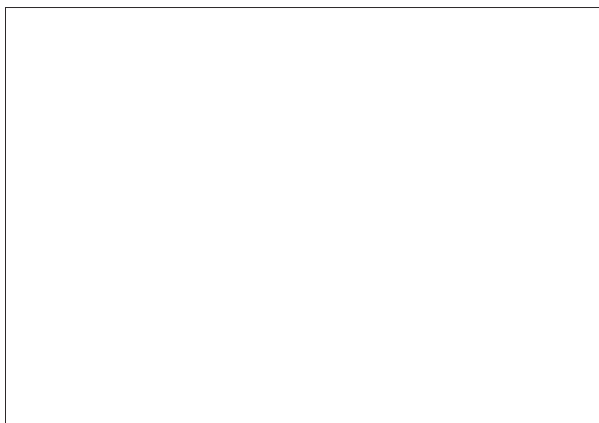
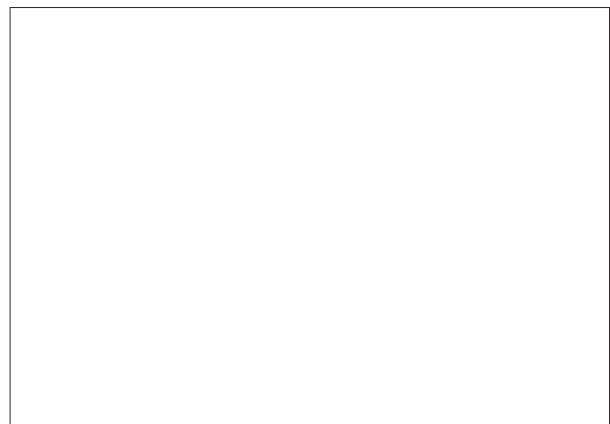
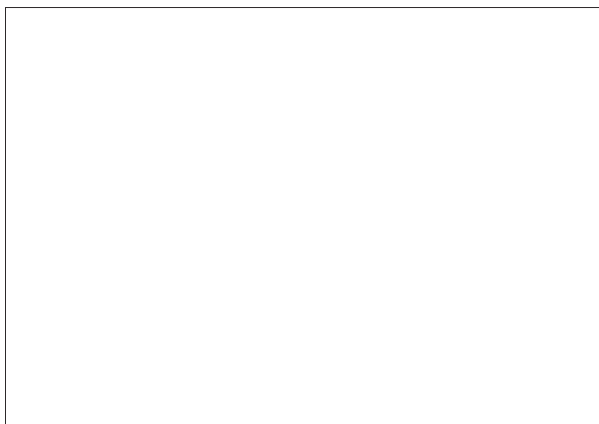
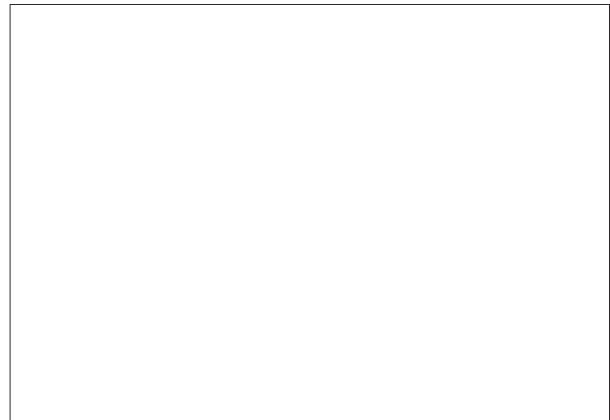
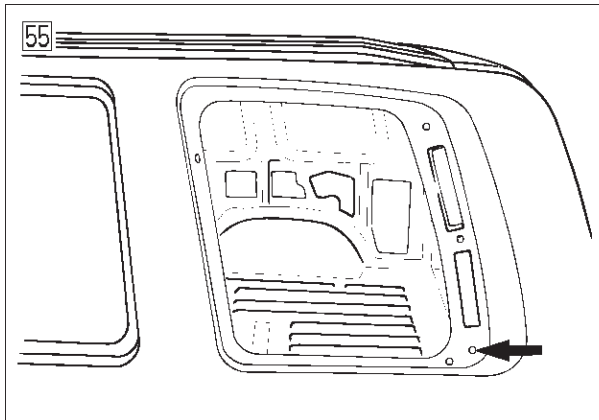
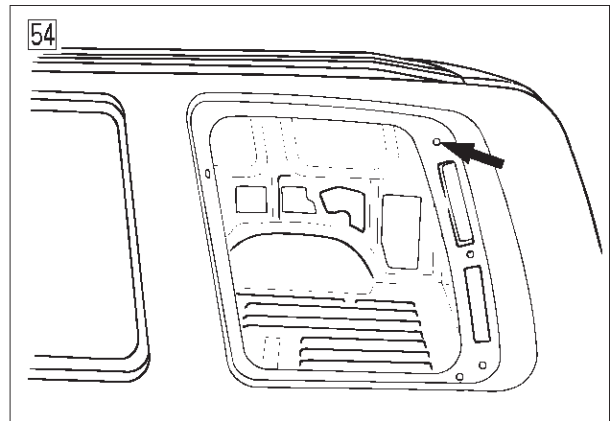
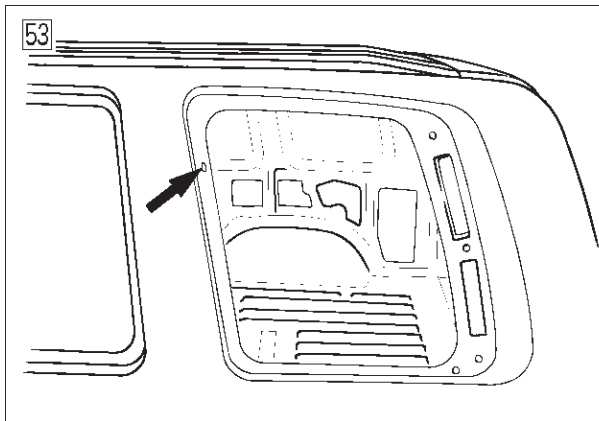


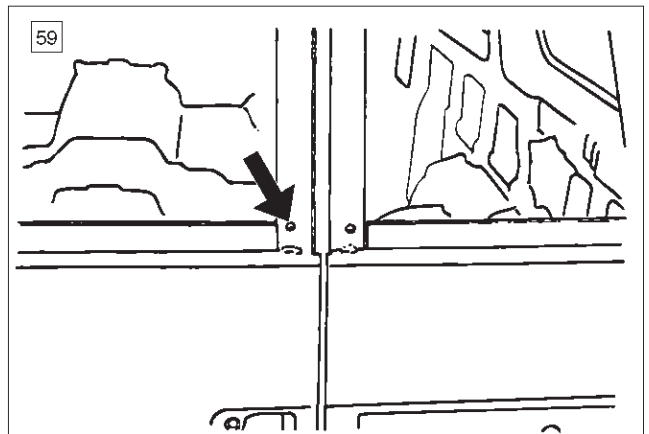
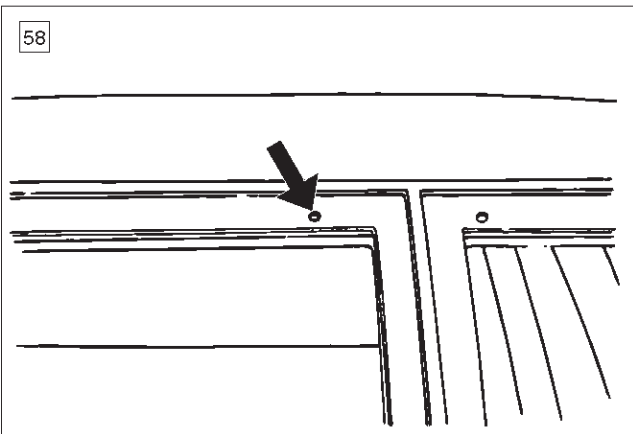
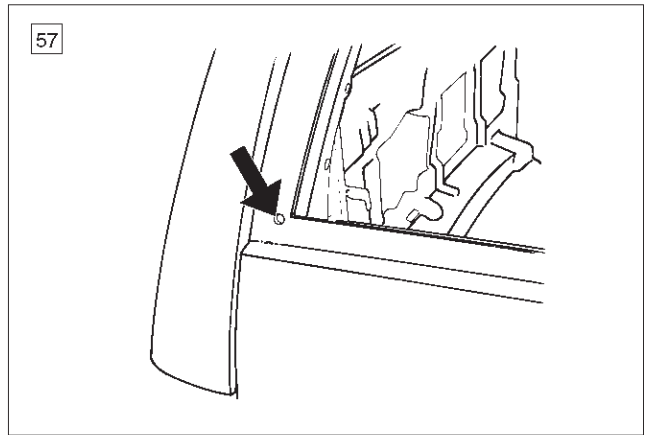
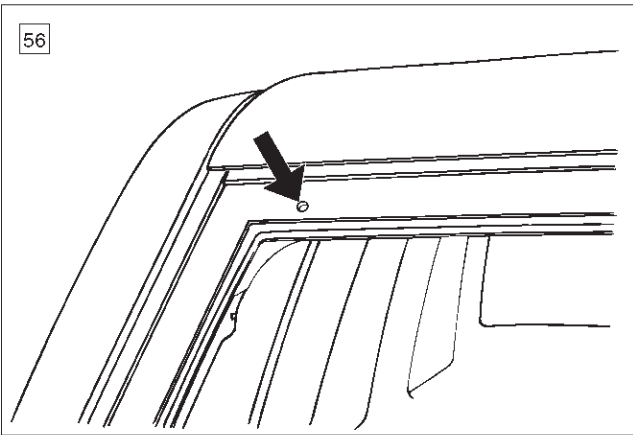
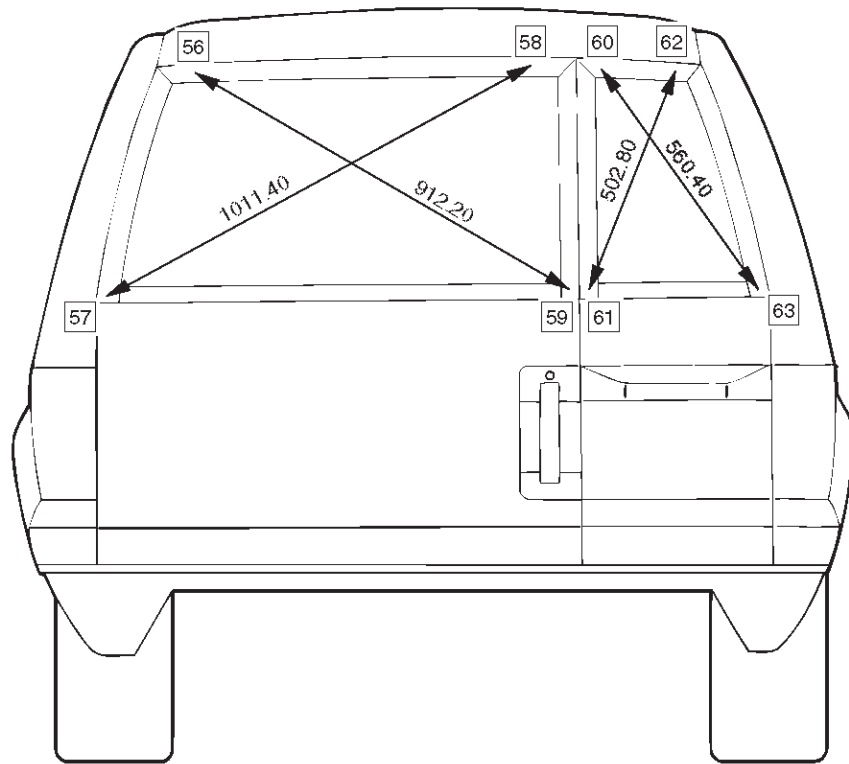
40B

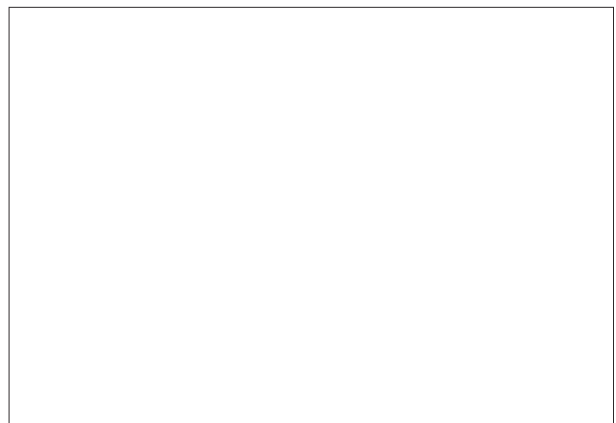
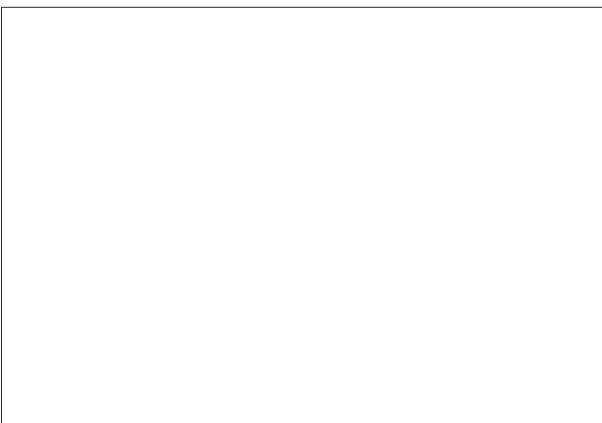
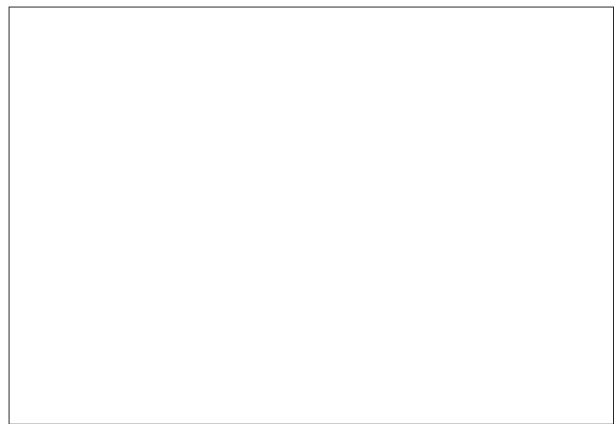
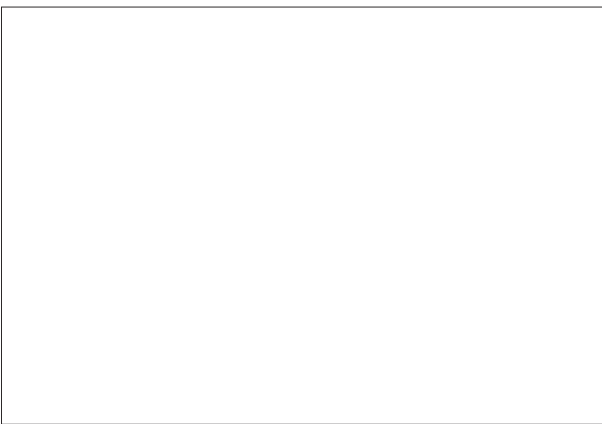
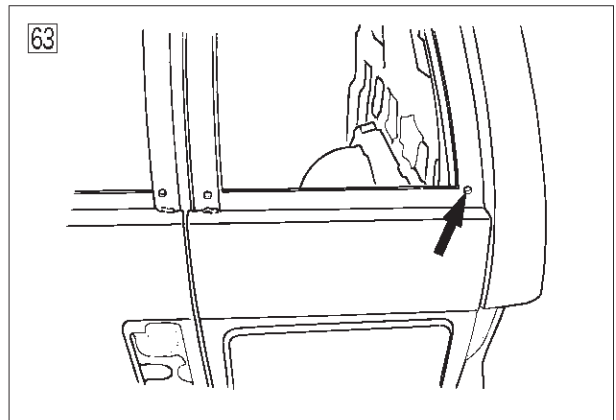
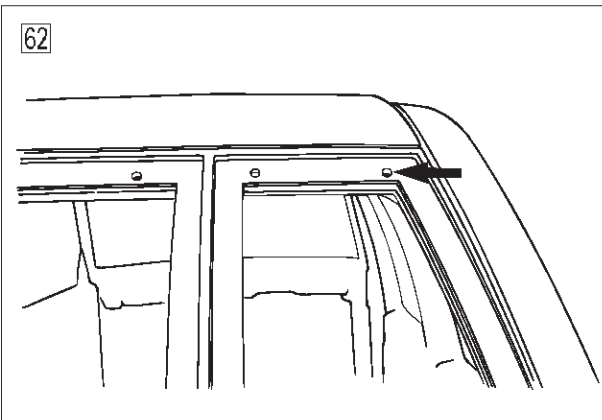
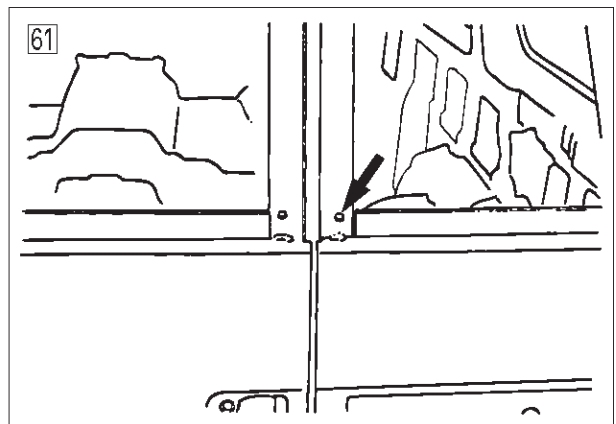
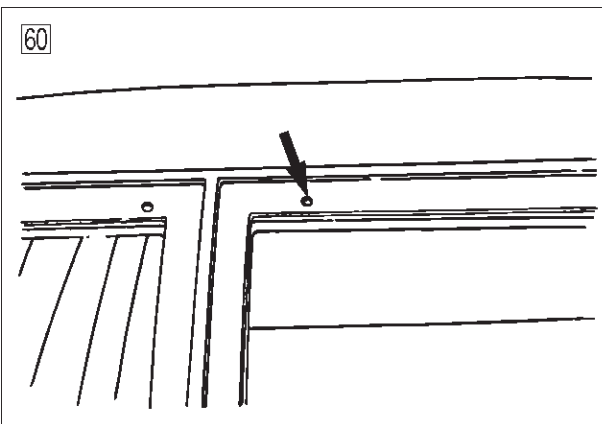


Window Glass





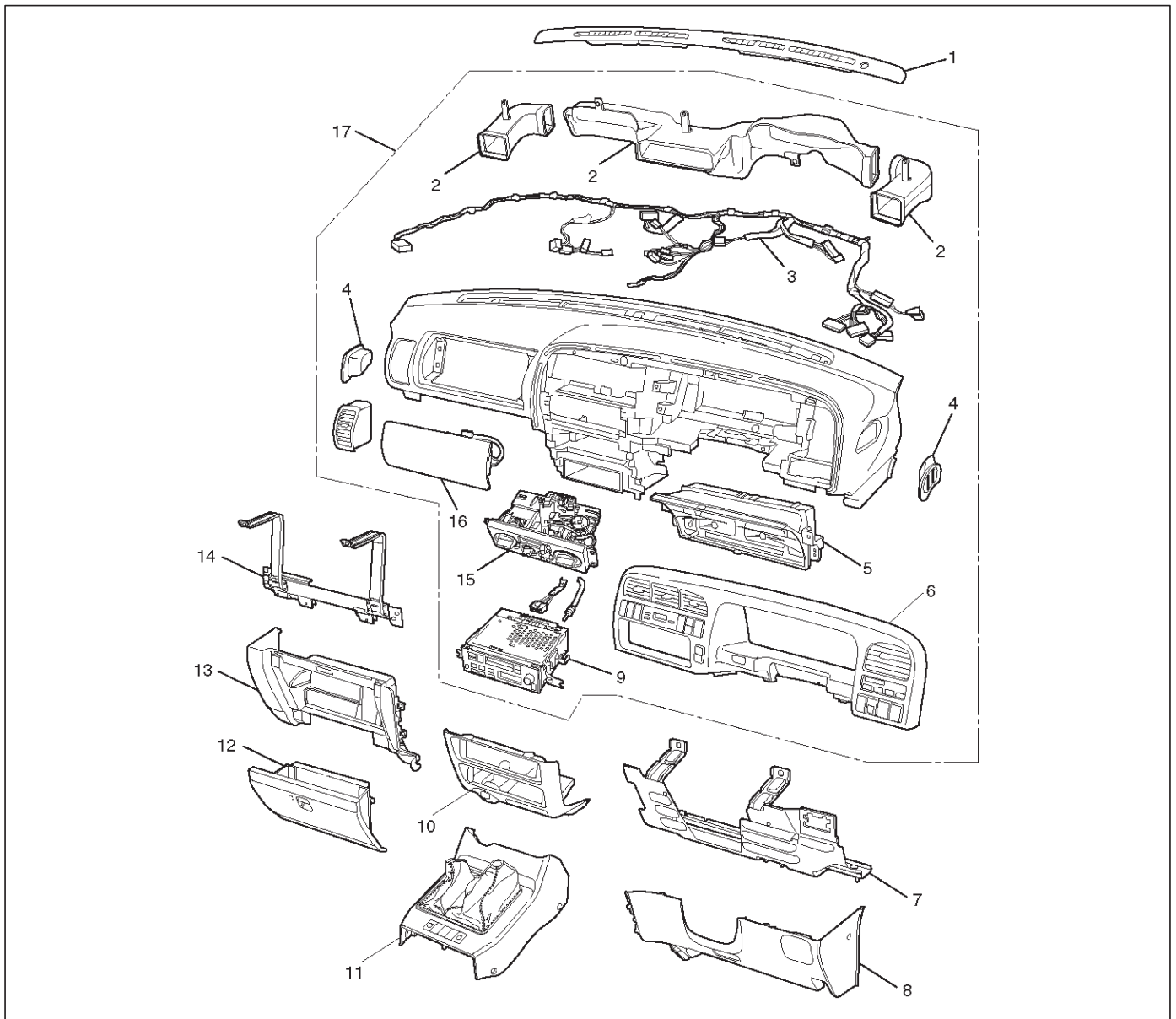




Instrument Panel Assembly

Parts Location

This illustration is based on RHD and W/SRS.



740RW123

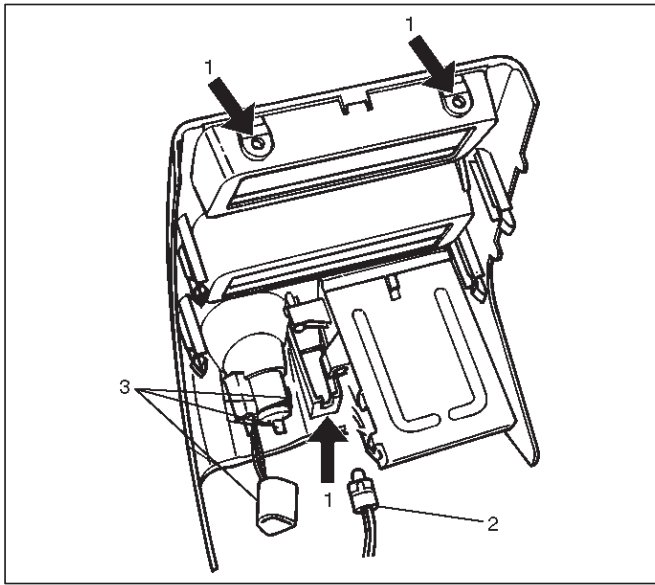
Legend

- | | |
|--|--|
| (1) Front Defroster Grille | (10) Lower Cluster Assembly |
| (2) Vent Duct Assembly | (11) Front Console Assembly |
| (3) Instrument Harness Assembly | (12) Glove Box |
| (4) Side Defroster Grille | (13) Instrument Panel Passenger Lower Cover Assembly |
| (5) Meter Assembly | (14) Passenger Knee Bolster Reinforcement Assembly |
| (6) Instrument Panel Cluster Assembly | (15) Control Lever Assembly |
| (7) Driver Knee Bolster Assembly (W/SRS) | (16) Passenger Inflator Module (W/SRS) |
| (8) Instrument Panel Driver Lower Cover Assembly | (17) Instrument Panel Assembly |
| (9) Radio Assembly | |

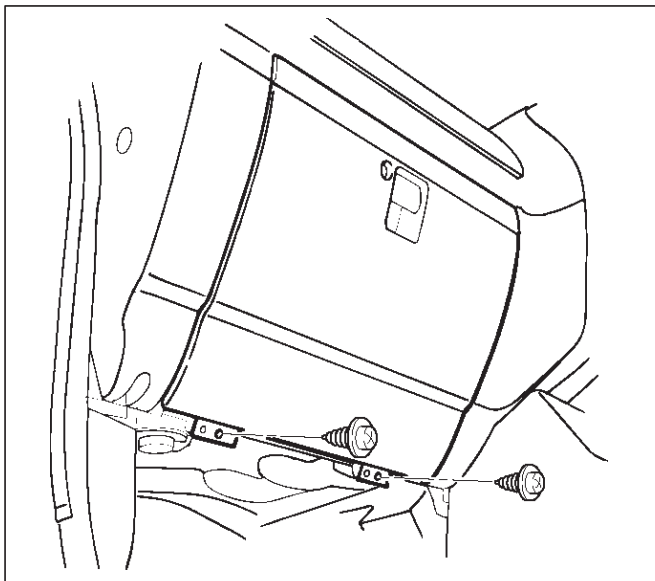
Removal

CAUTION: For precautions on installation or removal of SRS—air bag system, refer to Supplemental Restraint System (SRS) — AIR BAG in Restraint section.

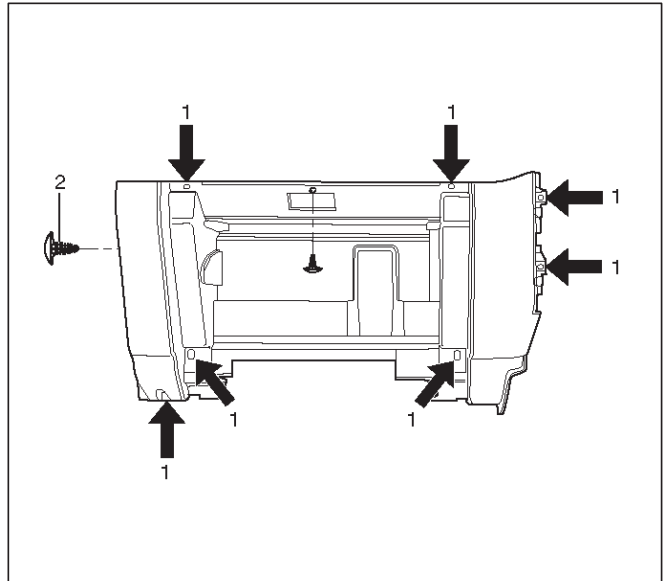
1. Disconnect the battery ground cable.
2. Remove front console assembly.
 - Remove the 4 fixing screws and disconnect the switch connectors.
3. Remove lower cluster assembly.
 - Remove the 3 fixing screws (1) in order to disconnect the cigarette lighter (3) and the illumination (2) connectors.



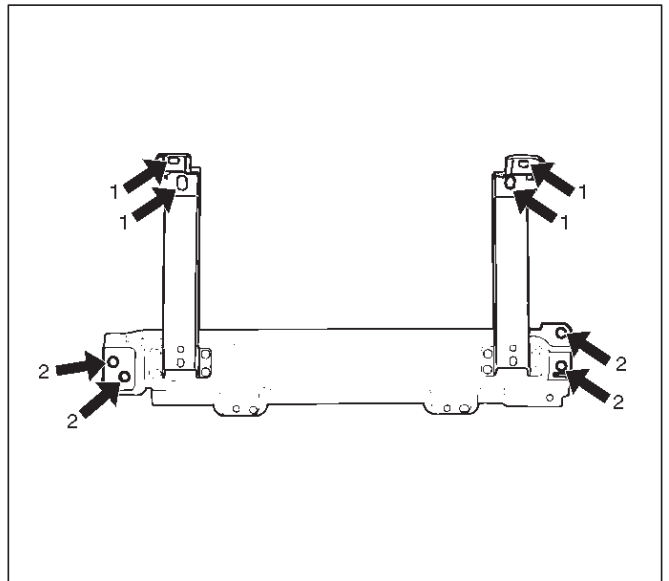
4. Remove glove box.
 - Remove the 2 fixing screws.



5. Remove instrument panel passenger lower cover assembly.
 - Remove the 7 fixing screws (1) and 1 clip (2).



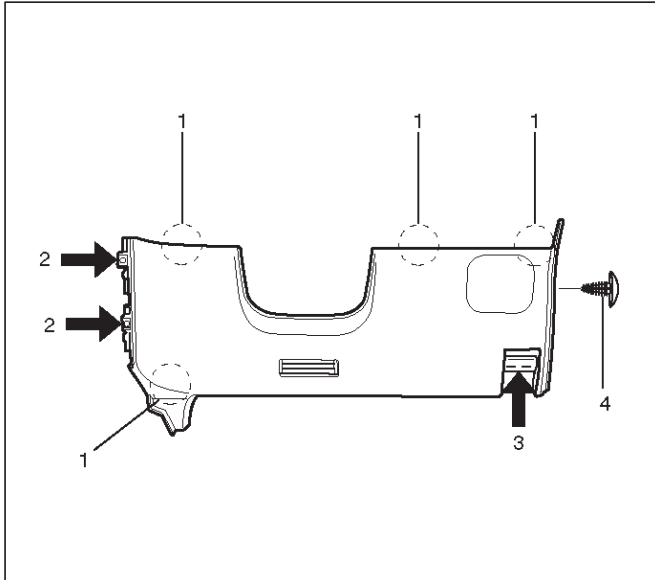
6. Remove passenger knee bolster reinforcement assembly.
 - Remove the 4 fixing bolts (2) and 4 nuts (1).



8F-50 BODY STRUCTURE

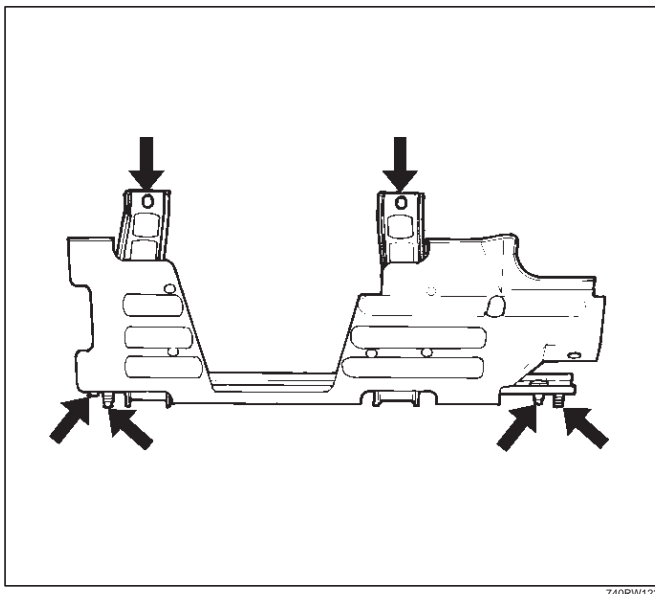
7. Remove instrument panel driver lower cover assembly.

- Remove the engine hood opener fixing screws.
- Remove the 2 fixing screws (2), 1 fixing bolt (3), and 1 clip (4). Pull out the fasteners at the 4 positions (1).



8. Remove driver knee bolster assembly (W/SRS).

- Remove the 6 fixing nuts.



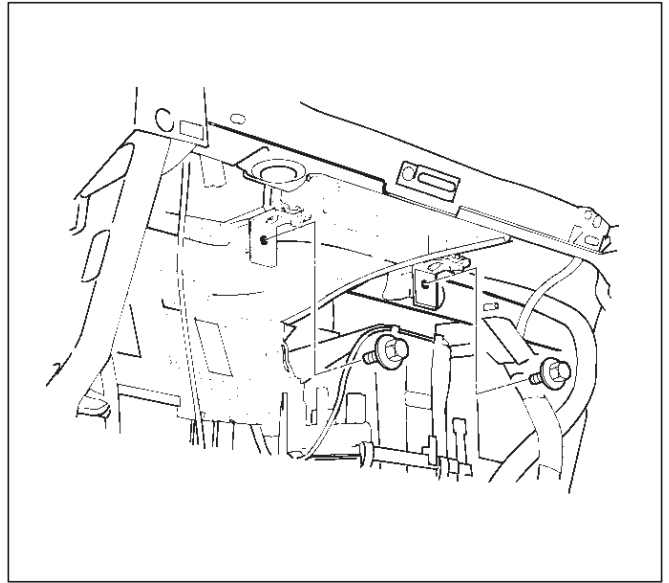
9. Remove front defroster grille.

- Pry 8 claws on the front side toward you side (room side) and raise the grille upward.

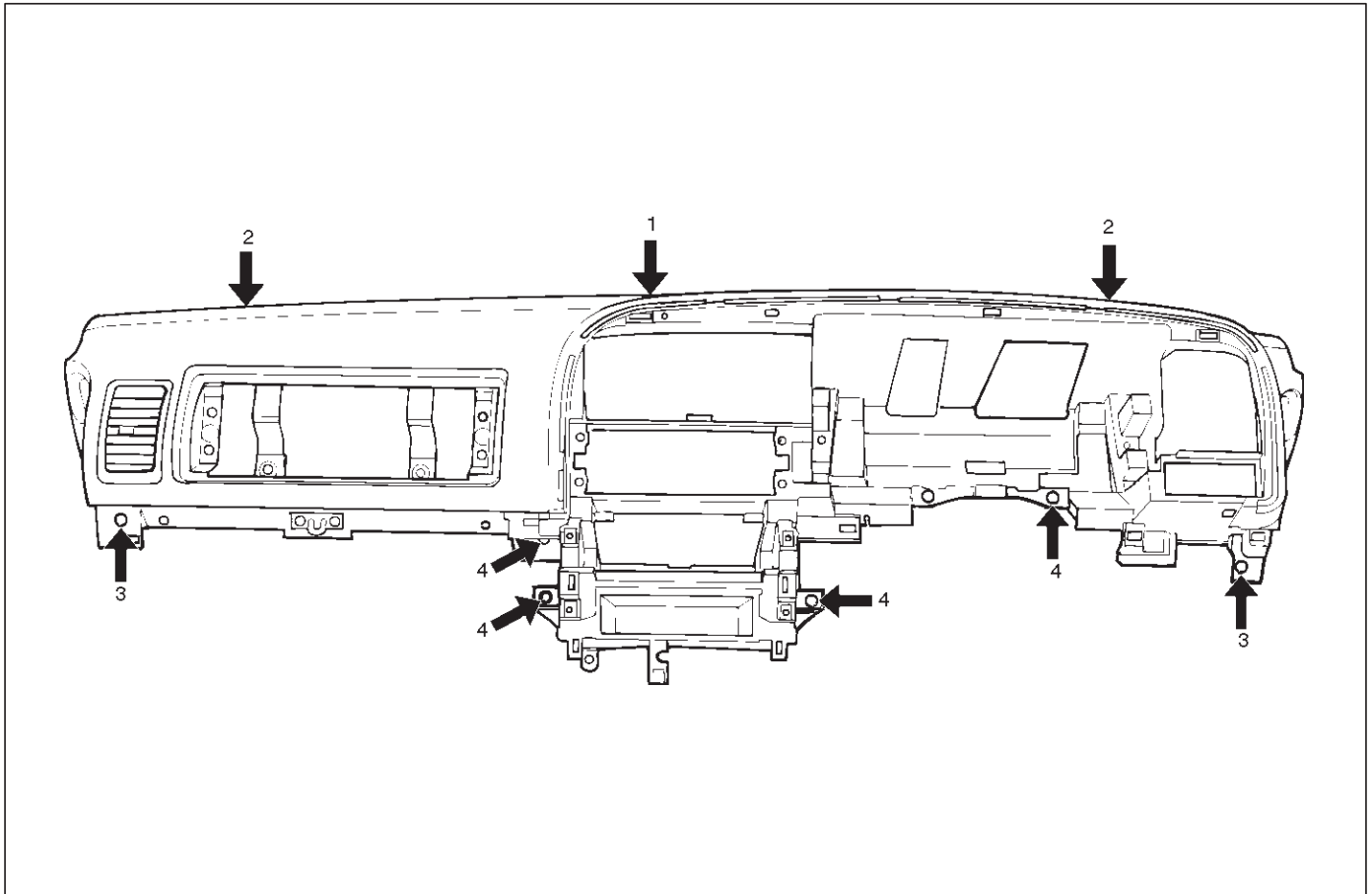
10. Remove instrument panel assembly.

- Remove the 2 fixing bolts on the SRS adjust bracket and the cross beam under the passenger inflator module (W/SRS).

CAUTION: For precautions on installation or removal of SRS — air bag system, refer to Supplemental Restraint System (SRS) — AIR BAG in Restraint section.



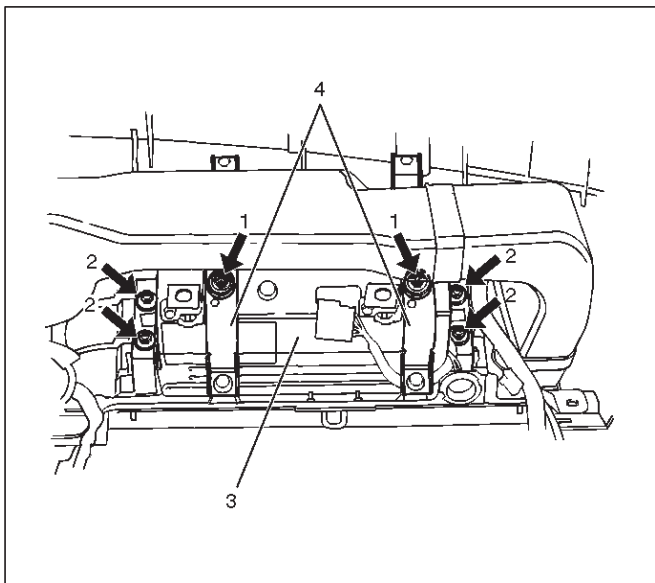
- Disconnect the 3 air conditioner control cables on the unit side.
- Remove the instrument harness connectors (5 connectors on the drivers side and 3 connectors on the passenger side), the passenger inflator module connector, the radio antenna cable plug, and the ground cable fixing bolt on the center bracket.
- Remove the 4 bolts (4) and the 2 nuts (3) under the instrument panel assembly, and the upper left and the upper right bolts (2) and the center nut (1).



740RW106

11. Remove passenger inflator module (W/SRS).

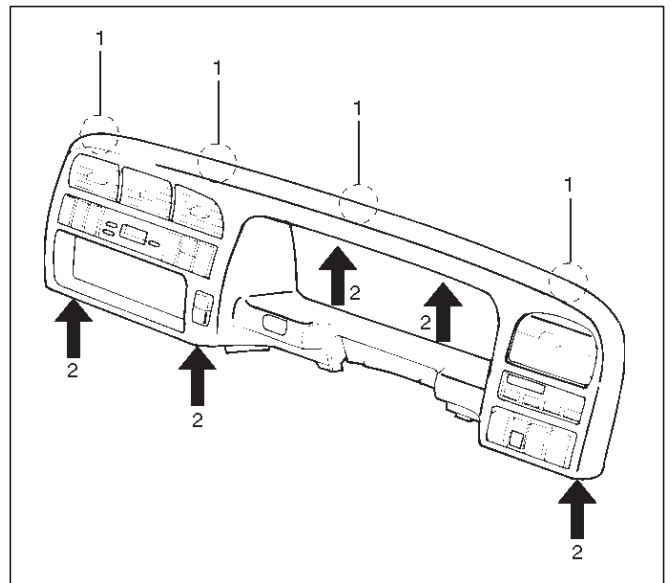
- From the back of the instrument panel, remove the 4 fixing nuts (2) on the passenger inflator module (3) and the 2 fixing nuts (1) and washers on the support bracket (4), then disengage the 2 clips in order to remove the passenger inflator module.



827RW032

12. Remove instrument panel cluster assembly.

- Remove the 5 fixing screws (2) and pull the main unit toward you and remove the clips at the 4 positions (1). Disconnect the switch connectors.

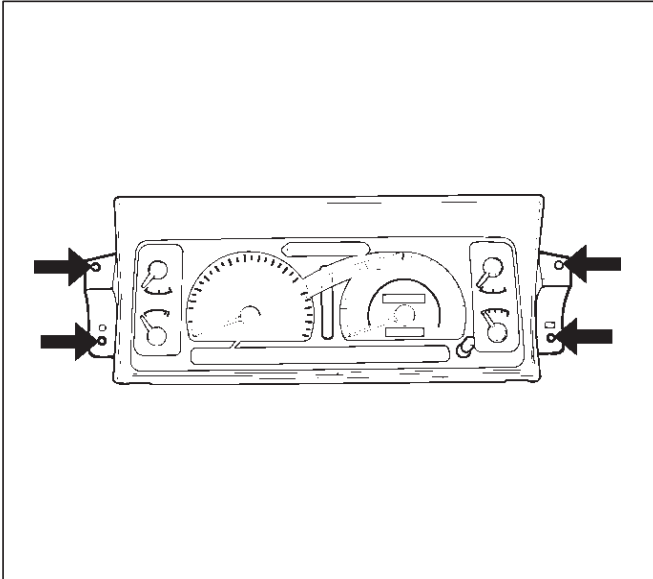


740RW107

8F-52 BODY STRUCTURE

13. Remove meter assembly.

- Remove the 4 meter assembly fixing screws and disconnect the meter harness connectors.



821RS034

14. Remove control lever assembly.

- Refer to HVAC System in HVAC section.

15. Remove radio assembly.

- Remove 2 fixing screws.

16. Remove vent duct assembly.

- Remove 5 fixing screws.

17. Remove instrument harness assembly.

- Remove the 4 fixing screws, fasteners at the 4 positions and the clips at the 7 positions.

18. Remove side defroster grille.

NOTE: For the order of removal steps in which each items contained in the instrument panel assembly are removed individually, refer to the chart.

Installation

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

Order Of Removal/Installation Steps For Each Item

Removal Item	Removal Procedure	Removal Step
Front console assembly	Shift knob (M/T), Power & Winter SW (A/T), Transfer knob, Seat heater/Miller SW conn. and 4 screws	1, 2
Lower cluster assembly	3 screws, Ciger lighter conn. and Ashtray illumination conn.	1-3
Glove box	2 screws	4
Instrument panel passenger lower cover	7 screws and 1 clip	1-5
Passenger knee bolster reinforcement	4 nuts and 4 bolts	1-6
Instrument panel driver lower cover	Engine hood opening fixing screw, 2 screws, 1 bolt, 1 clip and fasteners at 4 positions	1-3, 7
Driver knee bolster	6 nuts	1-3, 7, 8
Front defroster grille	Claws at 8 positions	9
Instrument panel assembly	2 bolts (SRS adjust bracket~ cross beam), A/C control cable (Unit side at 3 position), Instrument harness connector (Driver side 5 position, assist side 3 position), SRS module conn., Radio antenna jack, Earth cable, 9 bolts and 3 nuts	1-10
Passenger inflator module	4 nuts (SRS module~Instrument panel), 2 nuts 0 and 2 washers (SRS module~support bracket) and 2 clips	1-6, 11
Instrument panel cluster	5 Screws, fastener at 4 position and each SW conn.	1-3, 7, 12
Meter assembly	4 screws and connectors	1-3, 7, 12, 13
A/C control panel assembly	4 screws and connectors	1-3, 7, 12, 14
Radio assembly	2 screws	1-3, 15
Vent duct assembly	5 screws	1-10, 16
Instrument harness assembly	4 screws, fasteners at 4 position, and clips at 7 position	1-10, 17
Side defroster grille		18

M/T = Manual Transmission

A/T = Automatic Transmission

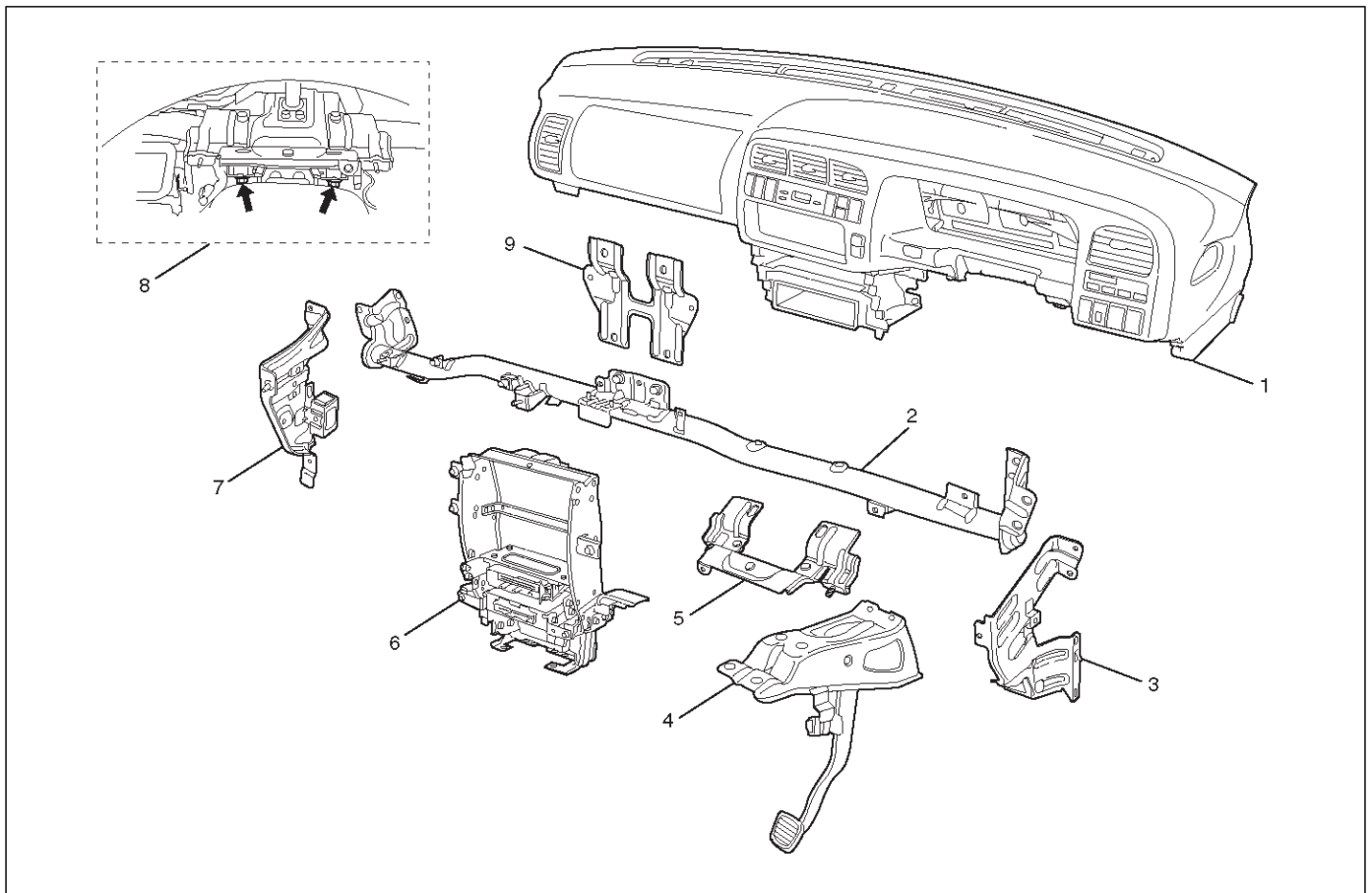
SRS = Supplemental Restraint System

A/C = Air Conditioning

Cross Beam Assembly

Parts Location

This illustration es based on RHD and W/SRS



740RW100

Legend

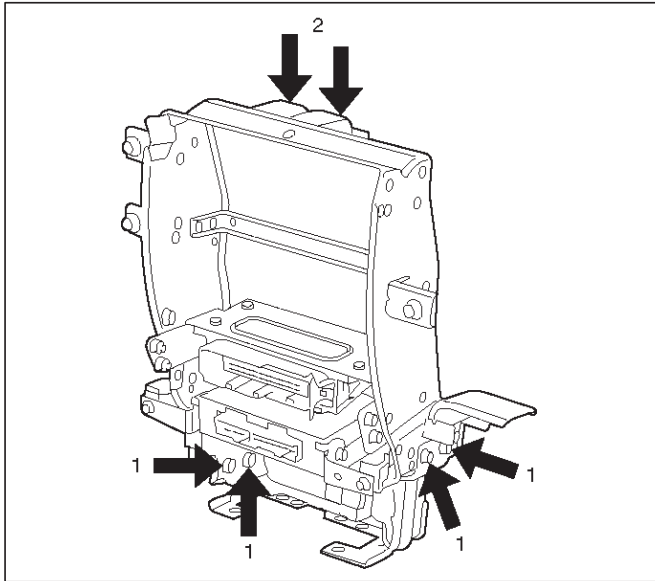
- | | |
|---|--|
| (1) Instrument Panel Assembly | (5) Steering Support Bracket Assembly |
| (2) Cross Beam Assembly | (6) Instrument Panel Center Bracket |
| (3) Side Support Bracket Assembly (RH) | (7) Side Support Bracket Assembly (LH) |
| (4) Brake Pedal Mounting Bracket Assembly | (8) Steering Column Fixing Bolts |
| | (9) Cross Beam Center Bracket |

Removal

1. Disconnect battery ground cable.
2. Remove instrument panel assembly.
 - Refer to Instrument Panel Assembly in this section.
3. Remove side support bracket assembly (LH/RH).
 - Remove the 4 fixing bolts on both sides.
4. Remove cross beam center bracket
 - Remove 2 fixing nuts.
5. Remove instrument panel center bracket.
 - Disconnect the PCM and EBCM connector.
 - Remove the DERM (SRS) with 3 fixing nuts.

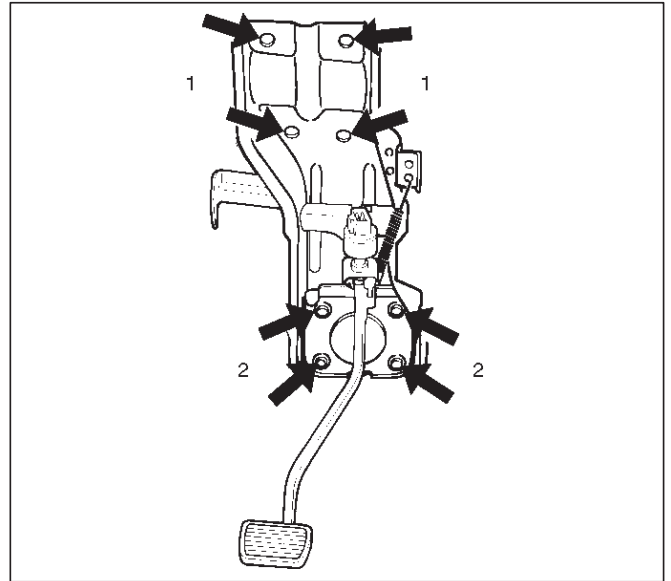
CAUTION: For precautions on installation or removal of SRS — air bag system, refer to Supplemental Restraint System (SRS) — AIR BAG in Restraint section.

- Remove the 2 fixing nuts (upper) and the 4 fixing bolts (lower).



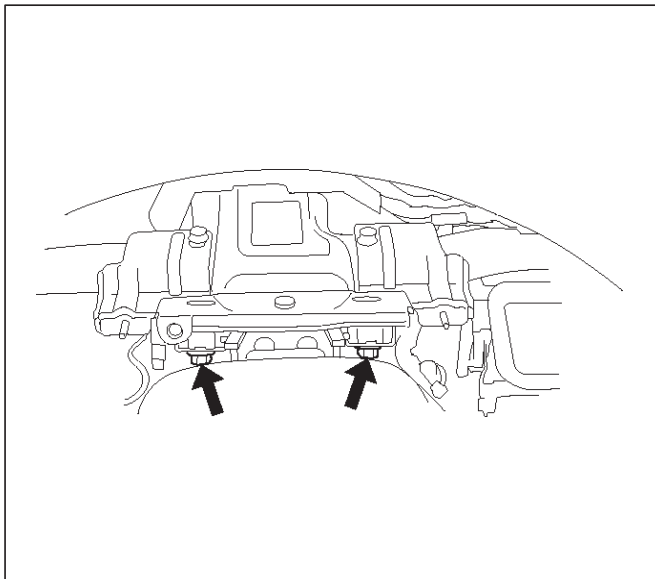
740RW101

6. Remove steering column fixing bolts.
- Remove 2 fixing bolts.



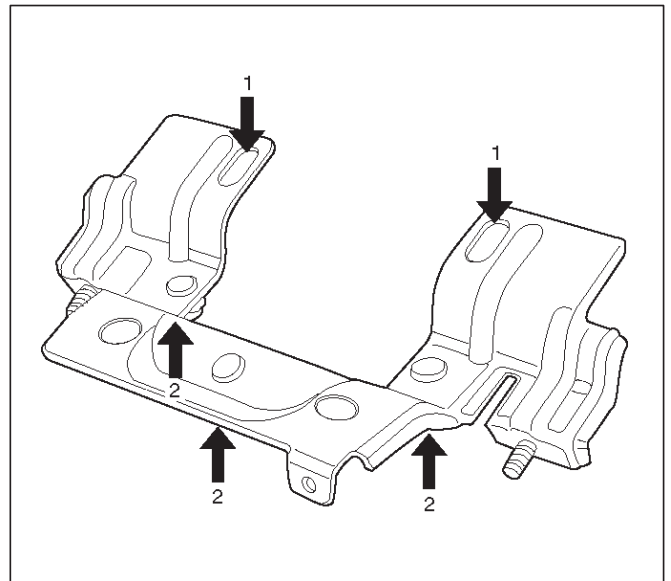
310RW14

8. Remove steering support bracket assembly.
- Remove the 2 fixing bolts (upper side) (1) and the 3 fixing nuts (lower side) (2).



431RW007

7. Remove brake pedal mounting bracket assembly.
- Disconnect the 2 brake pedal mounting bracket assembly fixing nuts, and remove the antitheft controller.
 - Disconnect the brake pedal link and the brake switch, and remove the 4 fixing bolts and the nuts on the bracket.



740RW102

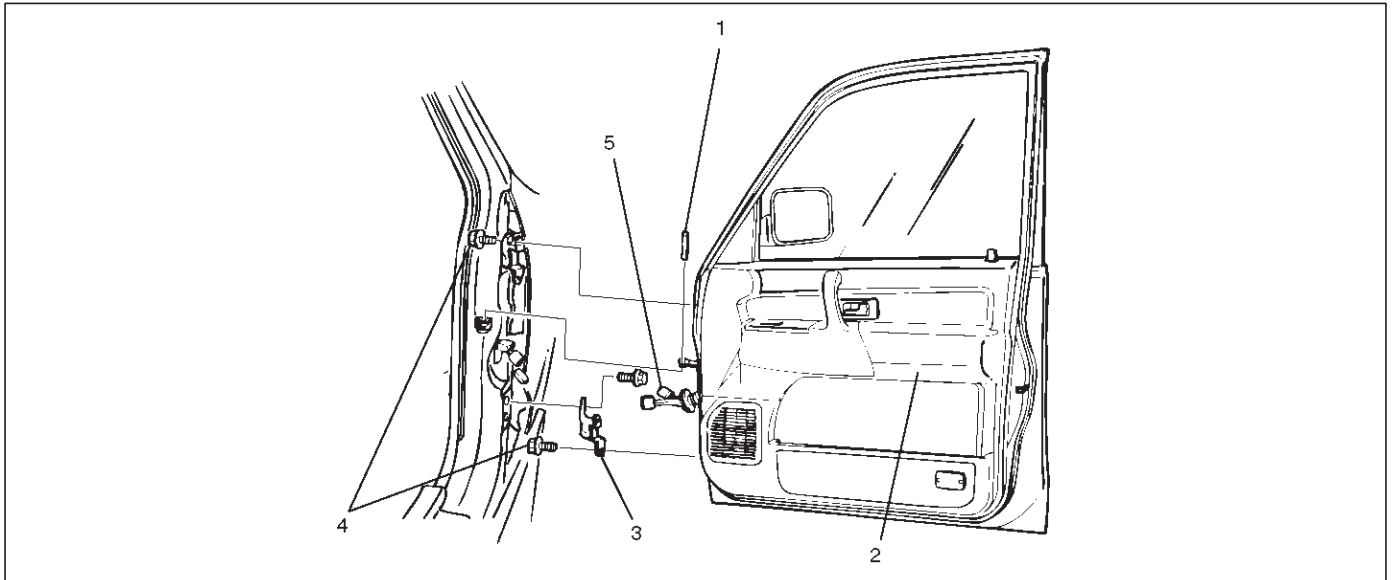
9. Remove cross beam assembly.
- Disconnect the harness clips from the crossbeam assembly, and remove 2 fixing bolts on both sides and 2 fixing nuts in the center.

Installation

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

Front Door Assembly

Parts Location



630RS001

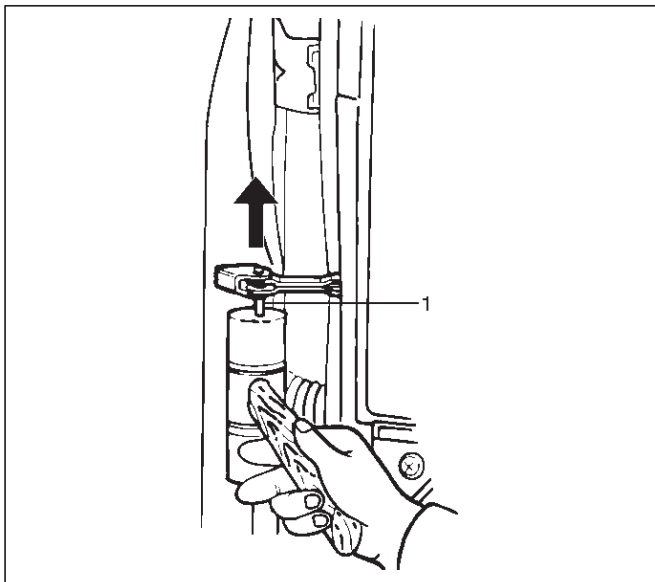
Legend

- (1) Door Check Arm Pin
- (2) Front Door Assembly

- (3) Door Hinge Assembly
- (4) Hinge Bolt
- (5) Door Harness Connection

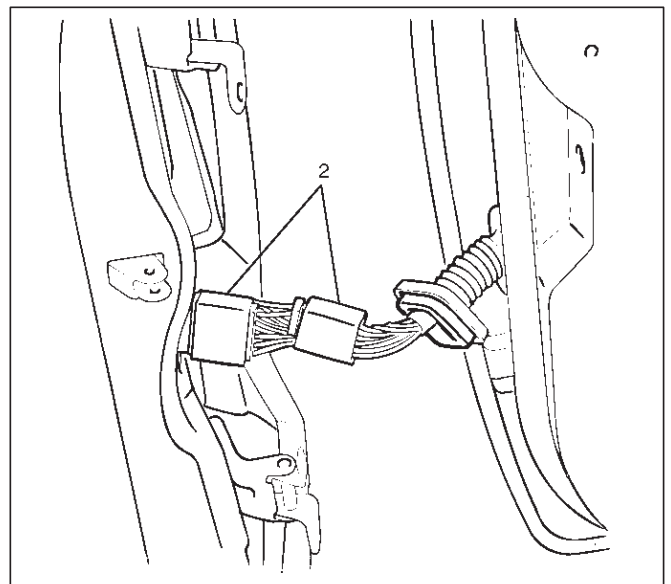
Removal

1. Disconnect the battery ground cable.
2. Remove door check arm pin (1).



630RS002

3. Remove hinge bolt.
 - Align the hinge bolt to the door side hinge and put a marker on it.
4. Remove door harness connection (2).
 - Pull the door harness grommet out in order to disconnect the harness connection.



810RS001

5. Remove front door assembly.

Installation

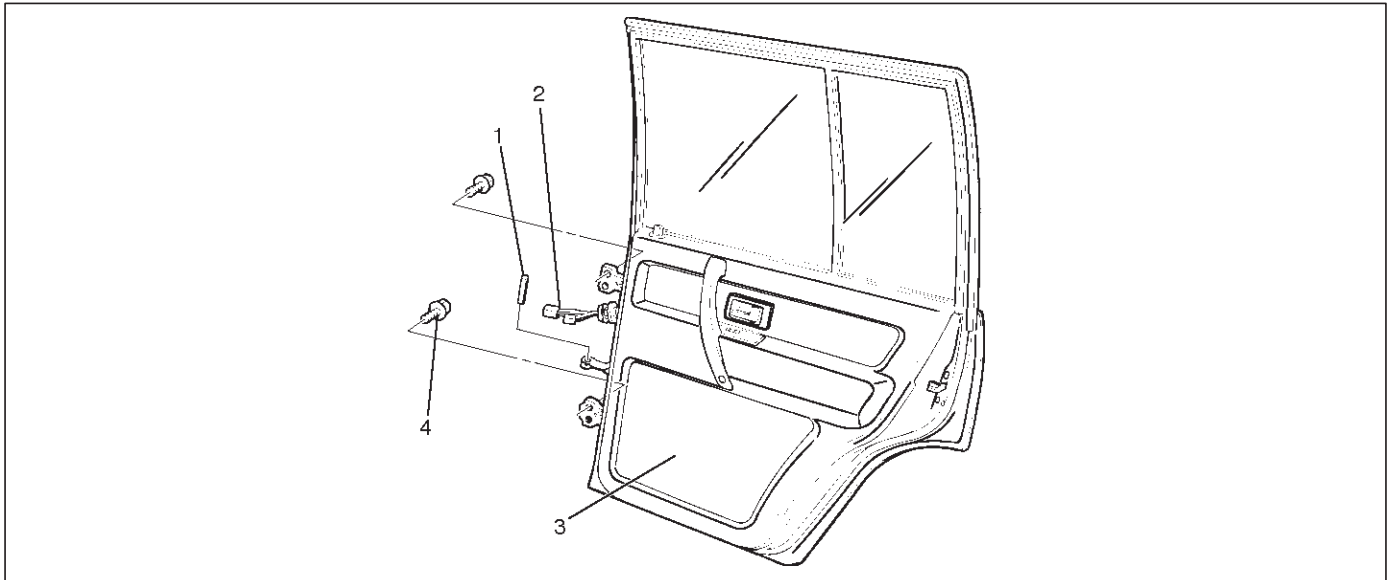
To install, follow the removal steps in the reverse order, noting the following points:

1. Align the door fitting to the body by referring to Body Dimensions in this section.
2. Tighten the door hinge bolts to the specified torque.

Torque : 34 N•m (3.5kg-m/25 lb ft)
3. Apply chassis grease to the door check arm pin and the door hinge moving surface.

Rear Door Assembly

Parts Location



650RW007

Legend

- (1) Door Check Arm Pin
- (2) Door Harness Connection

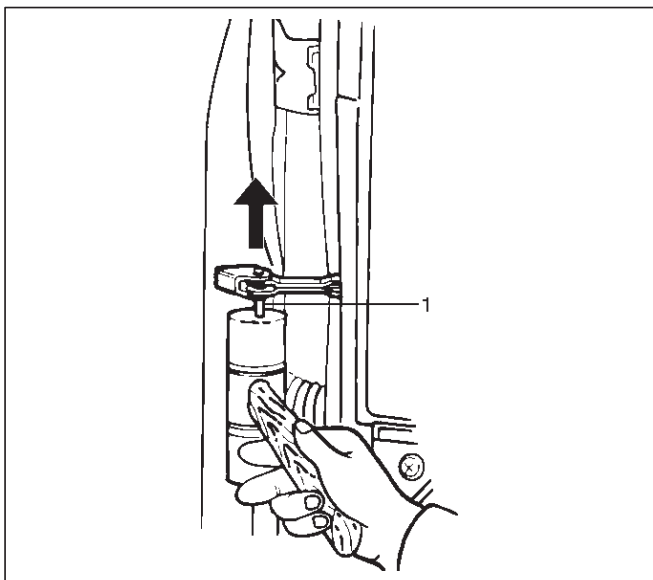
- (3) Rear Door Assembly
- (4) Hinge Bolt

Removal

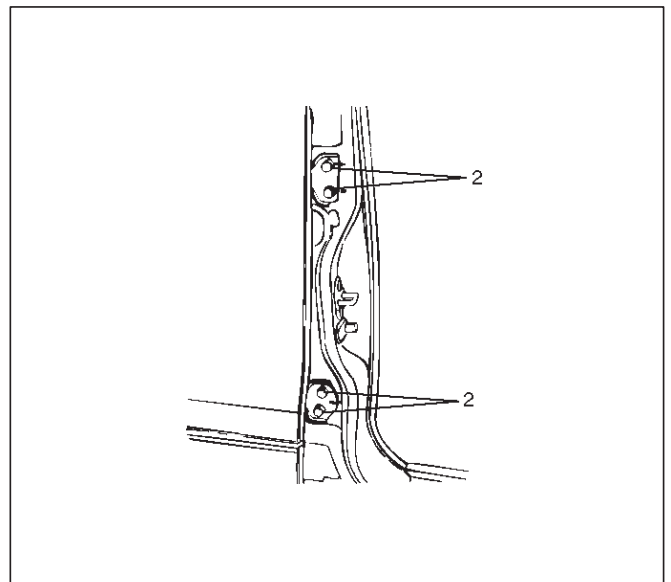
1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove door check arm pin (1).

4. Remove hinge bolt.

- Open the front door and remove the body side hinge bolts (2).



630RS002

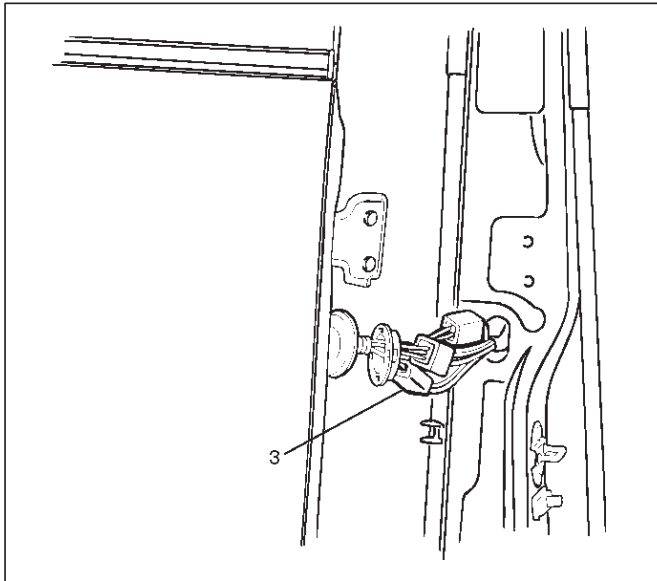


650RS002

8F-58 BODY STRUCTURE

5. Remove door harness connection (3).

- Pull the door harness grommet out in order to disconnect the door harness connection.



810RS002

6. Remove door assembly

Installation

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

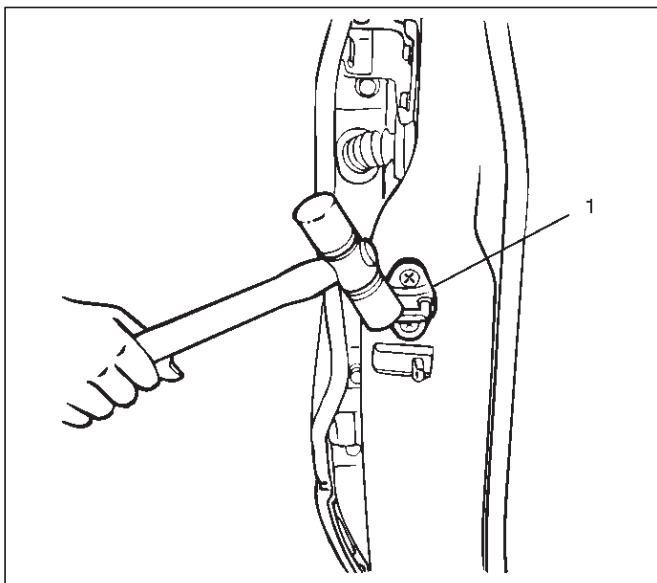
1. Align the door fitting to the body by refer to Body Dimensions in this section.
2. Tighten the door hinge bolts to the specified torque.

Torque : 34 N•m (3.5kg-m/25 lb ft)

3. Apply chassis grease to the check arm pin and the door hinge moving surface.

Door Strikers

Adjustment



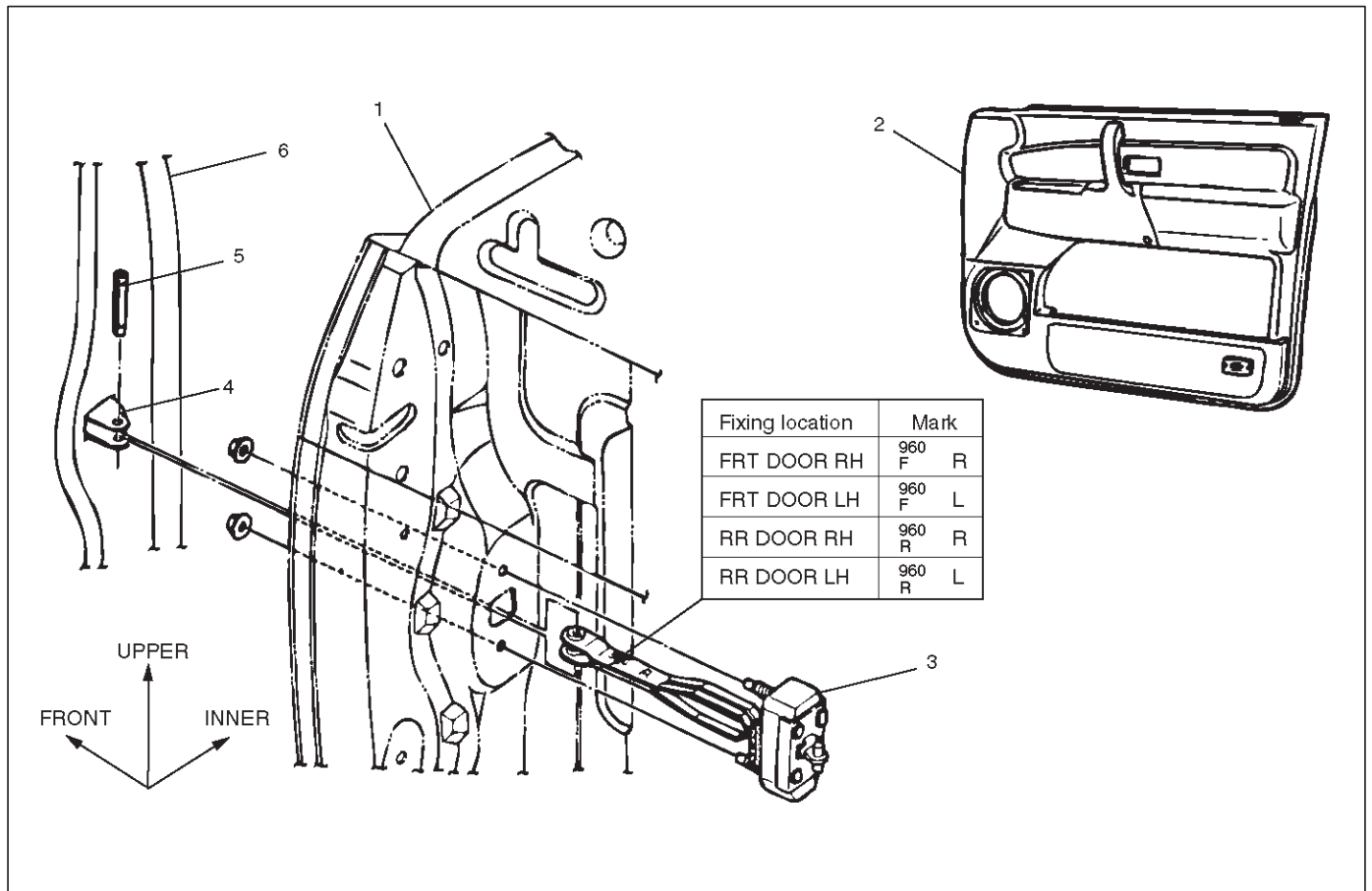
632RS001

1. Loosen the striker (1) screws.
2. Tap with a plastic hammer to align.
3. Tighten the striker screws.

Torque : 15 N•m (1.5kg-m/11 lb ft)

Door Check Arm Assembly (Front & Rear)

Parts Location



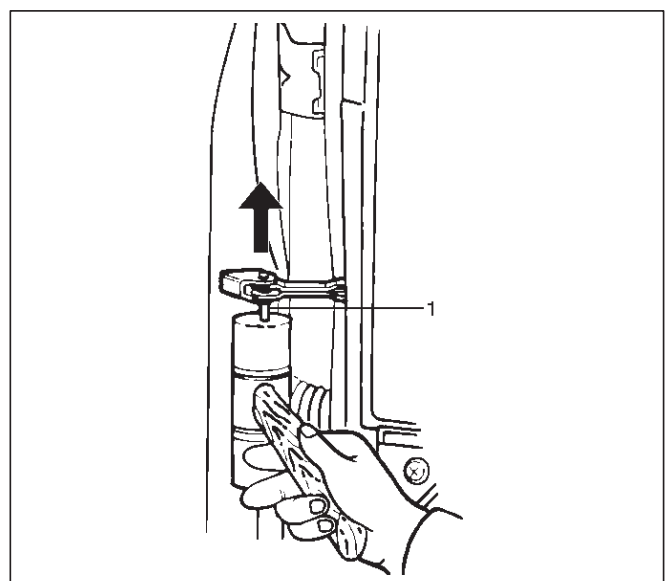
630RS002

Legend

- (1) Front or Rear Door
- (2) Door Trim Panel
- (3) Check Arm Assembly
- (4) Check Arm Pin Bracket
- (5) Check Arm Pin
- (6) Front or Center Pillar

Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
 - Refer to Exterior / Interior Trim in this section.
3. Remove check arm pin (1).



630RS002

8F-60 BODY STRUCTURE

4. Remove check arm assembly.
 - Carefully peel off the water proof sheet as much as necessary, for check arm removal.

Installation

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

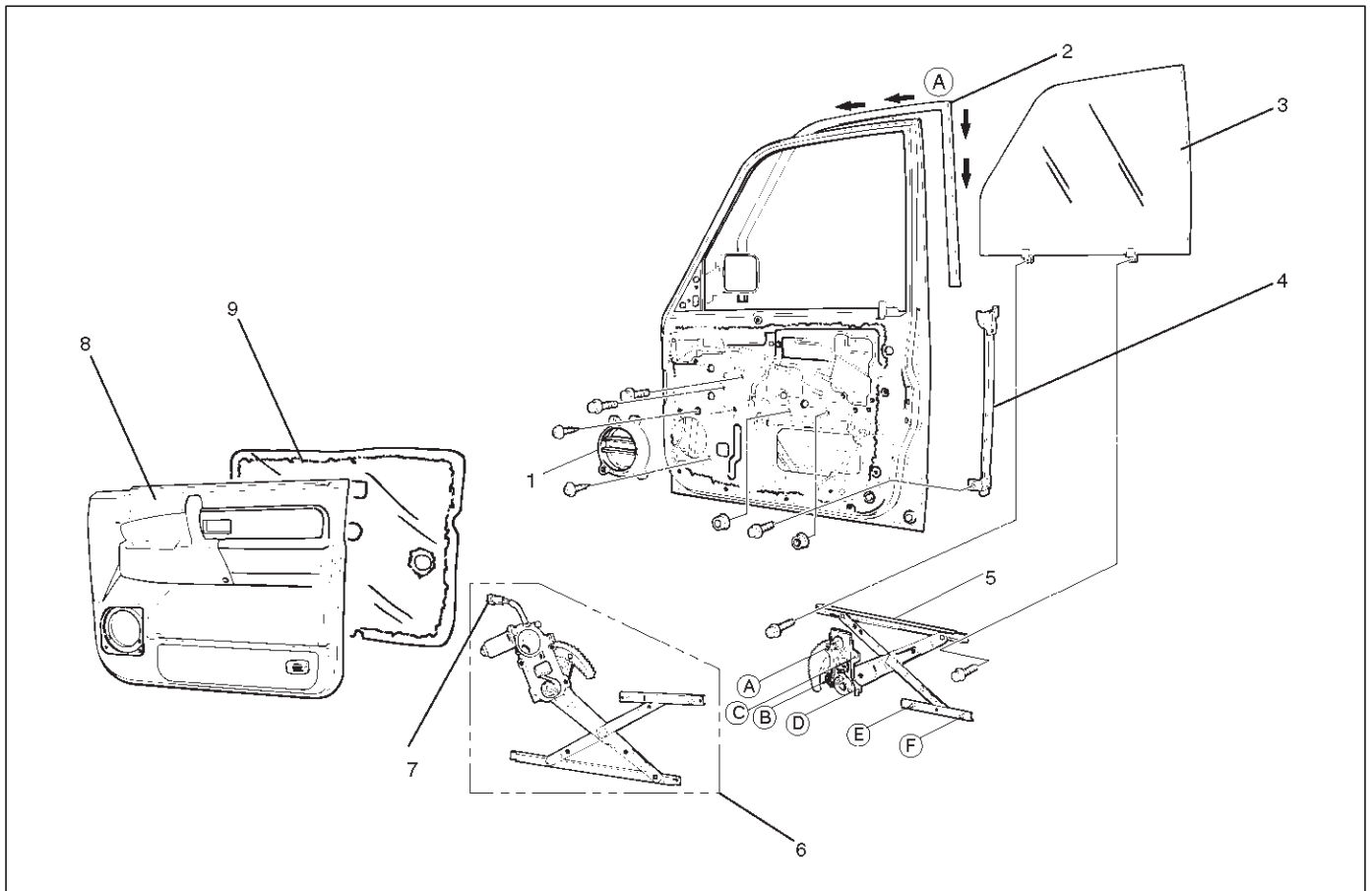
1. When installing the check arm assembly, note its marking to ensure using the appropriate part.
2. Tighten the check arm fixing nuts to the specified torque.

Torque : 13 N•m (1.3kg-m/113 lb in)

3. Apply chassis grease to the check arm pin moving surface.

Front Window Regulator, Glass And Glass Run

Parts Location



631RS002

Legend

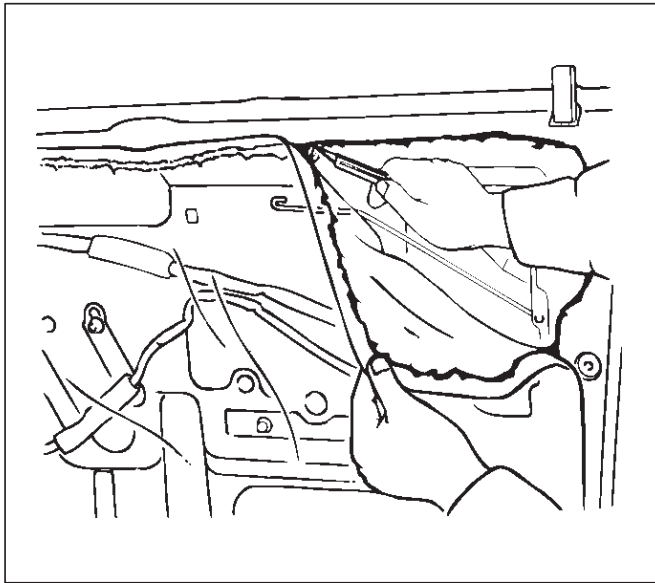
- | | |
|---------------------|--|
| (1) Speaker Box | (5) Window Regulator |
| (2) Glass Run | (6) Window Regulator with Power Window |
| (3) Glass | (7) Window Regulator Motor Connector |
| (4) Rear Guide Rail | (8) Door Trim Panel |
| | (9) Waterproof Sheet |

Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
 - Refer to Exterior / Interior Trim in this section.
3. Remove speaker box.

4. Remove waterproof sheet.

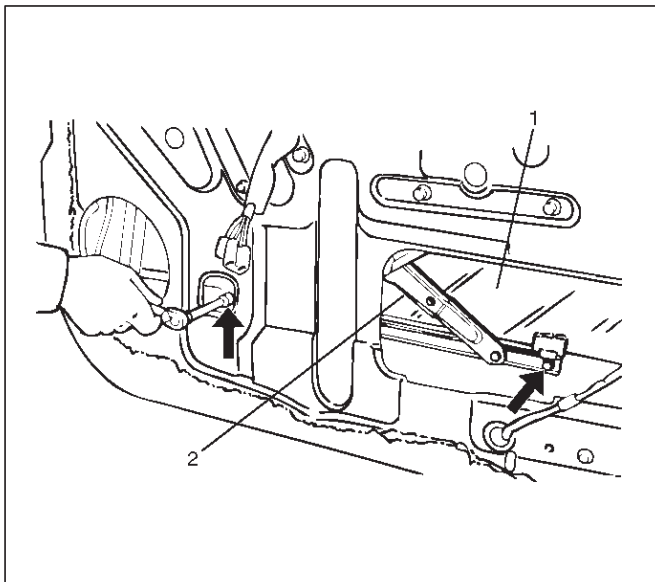
- Take notice of the door harness and the grommet, peel the waterproof sheet off the door panel carefully.



631RS003

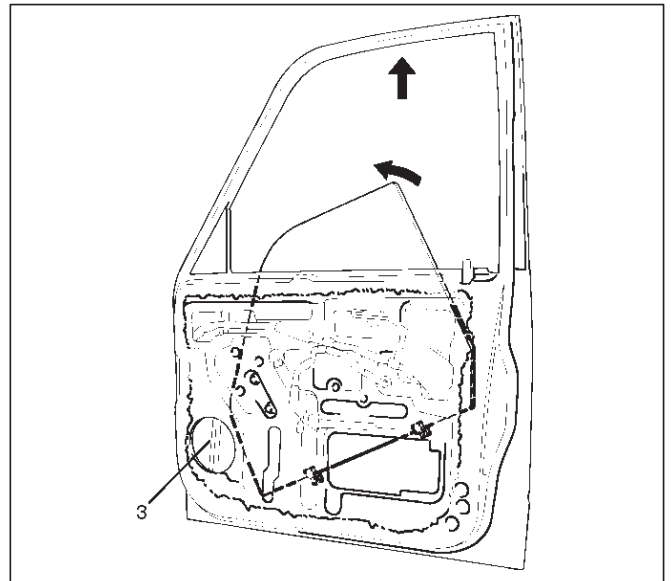
5. Remove glass.

- Bring the glass (1) down to the position where the fixing bolts can be seen.
- Remove the glass fixing bolts from the window regulator (2) and lower the front side of the glass.



631RS004

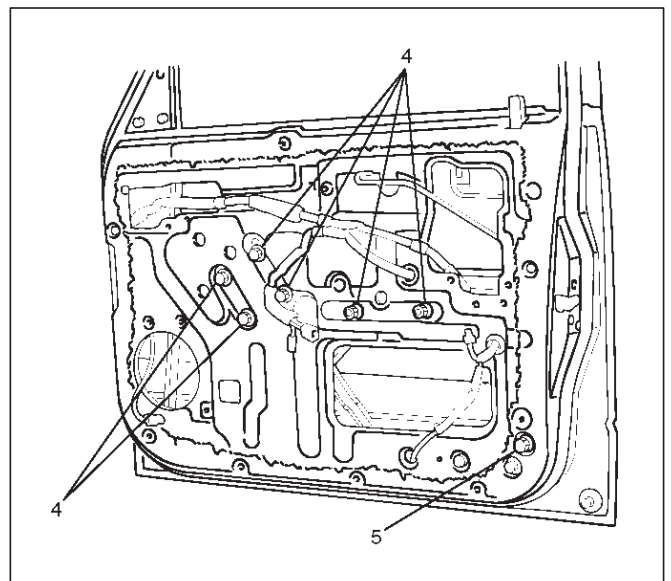
- When the front side of the glass comes off the glass run (3), turn the glass inside out and pull it up from its rear side.



631RS005

6. Remove window regulator.

- Remove the window regulator fixing bolts (4) and the rear guide rail fixing bolt (5).
- Disconnect the window regulator motor harness connector, if equipped with power windows.

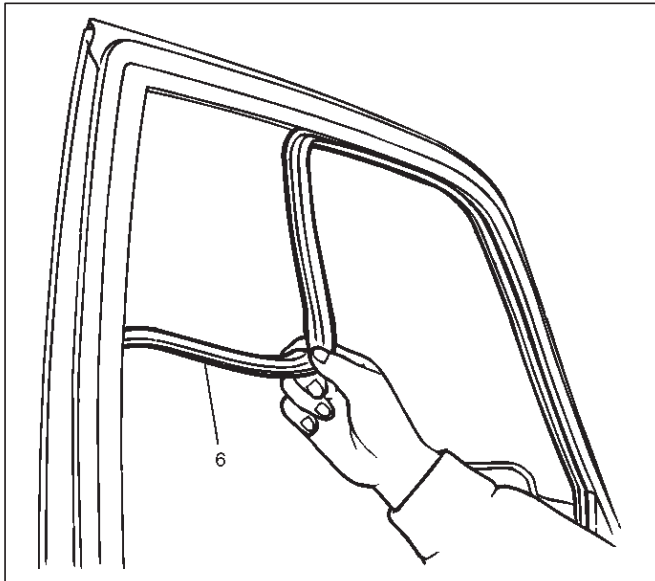


631RS006

8F-62 BODY STRUCTURE

7. Remove glass run.

- Pull the glass run (6) out from the door frame groove.



631RS007

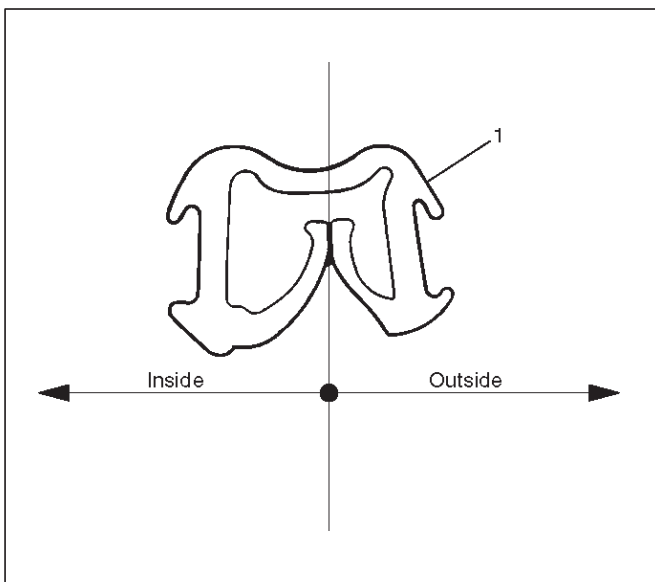
8. Remove rear guide rail.

4. Check to see if the window regulator operates smoothly and the glass opens and closes properly. Install the waterproof sheet with no clearance between the door panel and the waterproof sheet.

Installation

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

1. Apply soap and water to the door frame groove. Insert the glass run (1) to the door frame from the A corner in the arrow-marked directions.
Install the glass run with its wider end pointed to the inside of the vehicle.



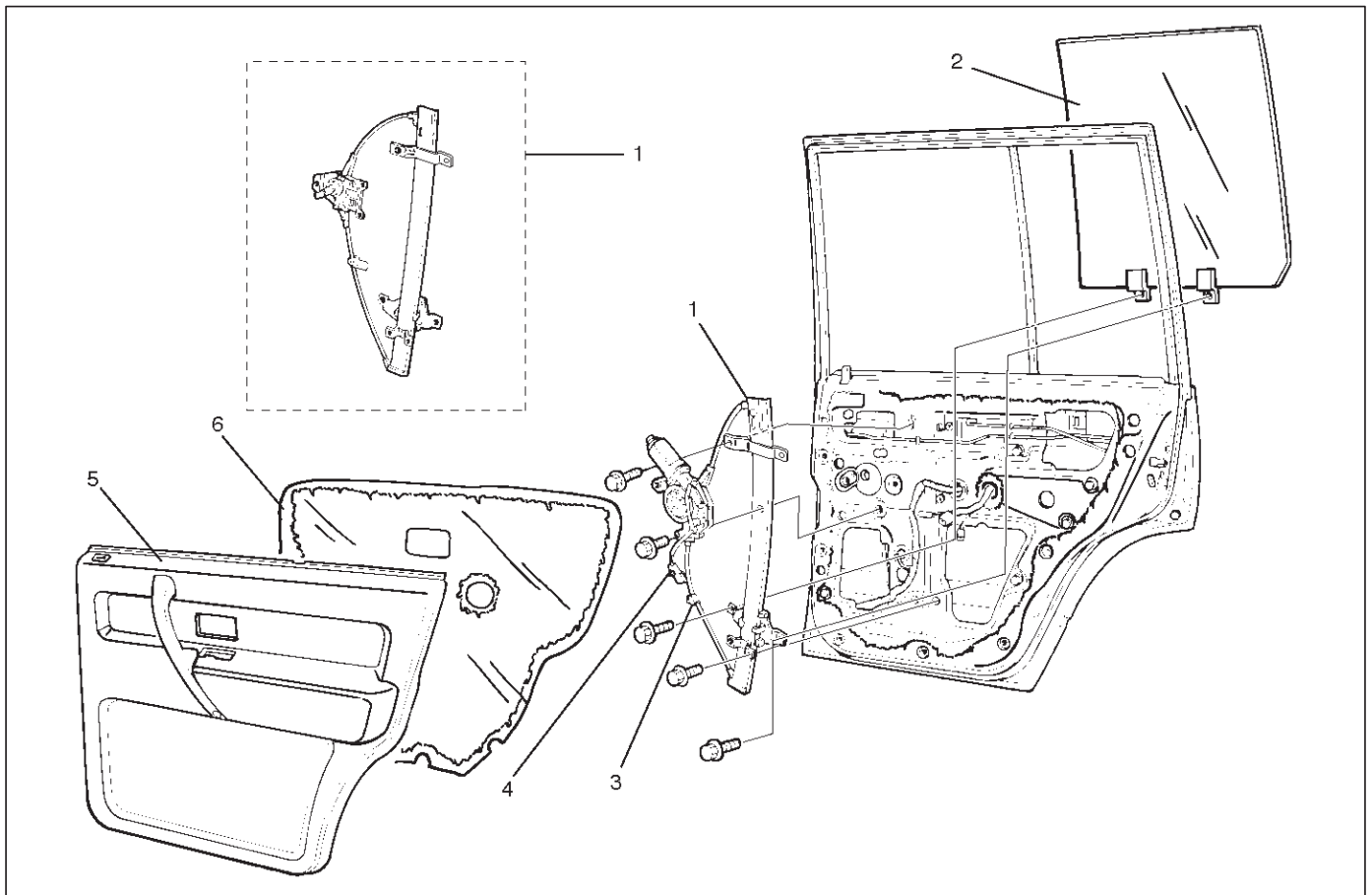
A10RS023

2. Set the glass into the door panel with the front side of the glass lowered and insert the rear side of the glass into the glass run (1). Then insert the front side of the glass into the glass run in order to install the glass to the glass run while raising it up along the glass run.
3. Tighten the window regulator and the glass fixing bolts and nuts to the specified torque.

Torque : 8 N•m (0.8kg-m/69 lb in)

Rear Window Regulator And Glass

Parts Location



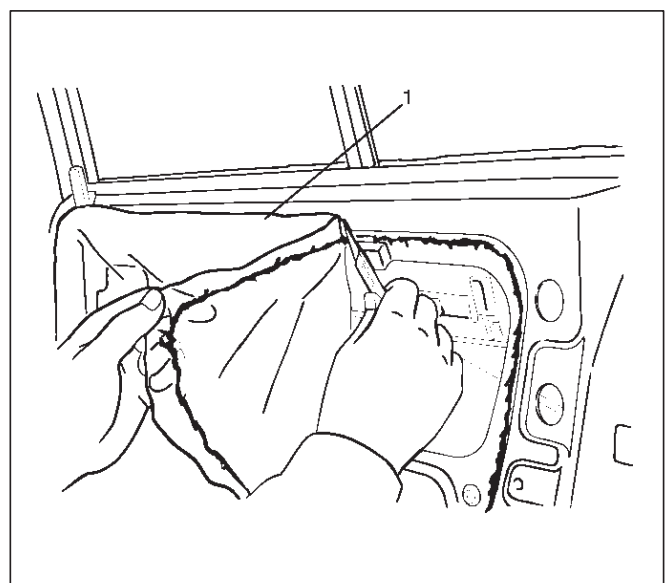
651RW018

Legend

- | | |
|-----------------------|--------------------------------------|
| (1) Window Regulator | (4) Window Regulator Motor Connector |
| (2) Glass | (5) Door Trim Panel |
| (3) Cable Fixing Clip | (6) Waterproof Sheet |

Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
 - Refer to Door Trim Panel (Rear) removal procedure in this section.
3. Remove waterproof sheet (1).
 - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.

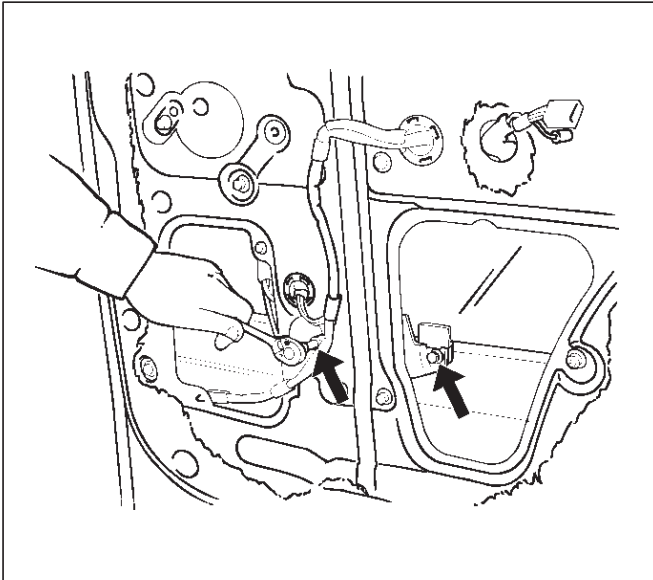


651RS002

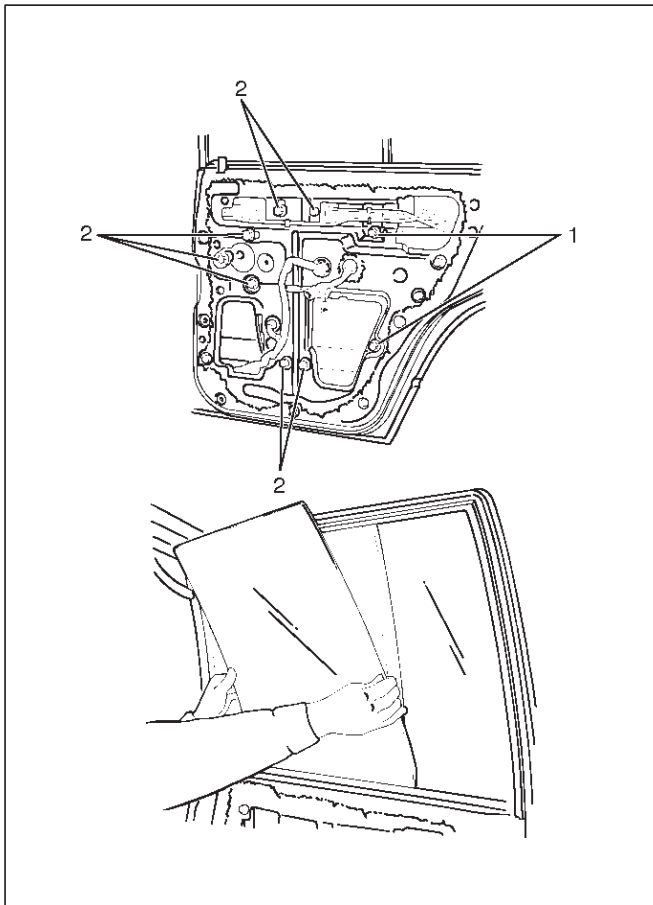
8F-64 BODY STRUCTURE

4. Remove glass.

- Bring the glass down to the position where the bolt can be seen.
- Remove the sash division 2 fixing bolts (1) and then remove the glass fixing bolt to remove the glass upwards.



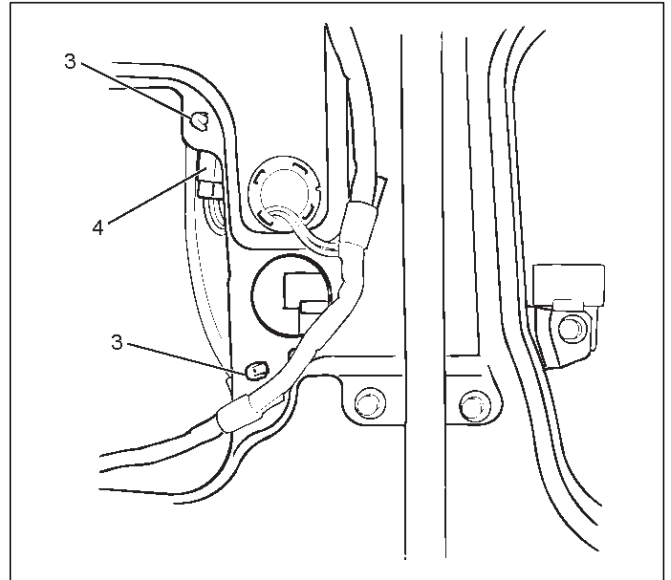
651RS003



651RW010

5. Remove window regulator.

- Disconnect the regulator motor connector (4) and remove the window regulator cable fixing clip (3) from the door panel, if model is equipped with power windows.
- Remove the window regulator 7 fixing bolts (2) and pull the regulator out from the lower hole of the door panel.



651RW011

Installation

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

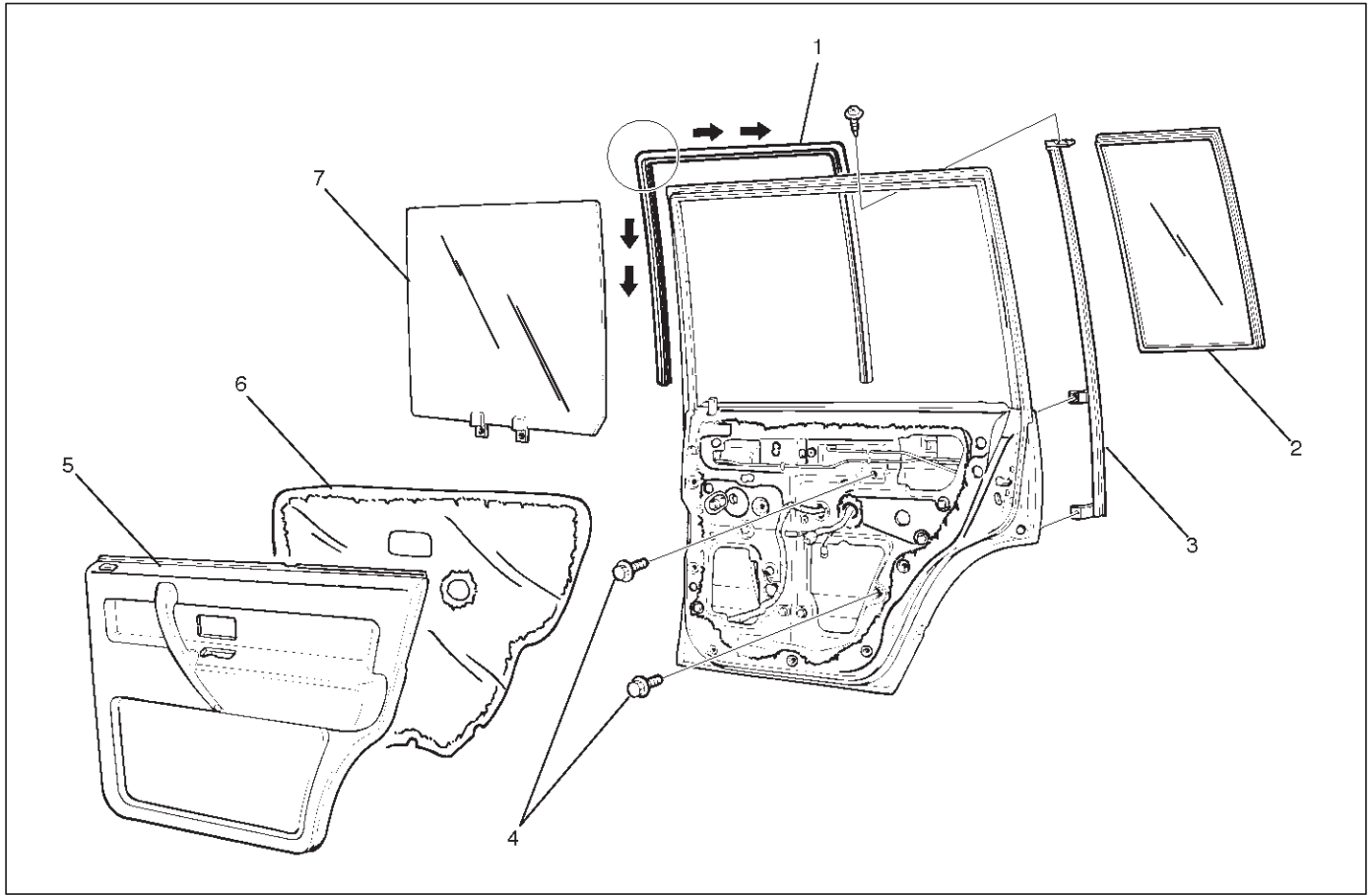
1. Tighten the window regulator and the glass fixing bolts to the specified torque.

Torque : 8 N•m (0.8kg-m/69 lb in)

2. Install the waterproof sheet with no clearance between the door panel and the waterproof sheet.

Rear Door Fixed Glass And Glass Run

Parts Location



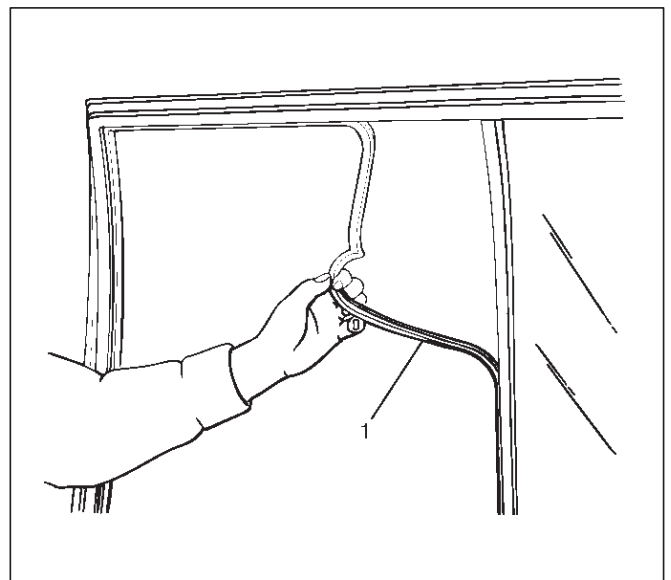
651RW019

Legend

- | | |
|----------------------|--------------------------------|
| (1) Glass Run | (4) Sash Division Fixing Bolts |
| (2) Rear Fixed Glass | (5) Door Trim Panel |
| (3) Sash Division | (6) Waterproof Sheet |
| | (7) Glass |

Removal

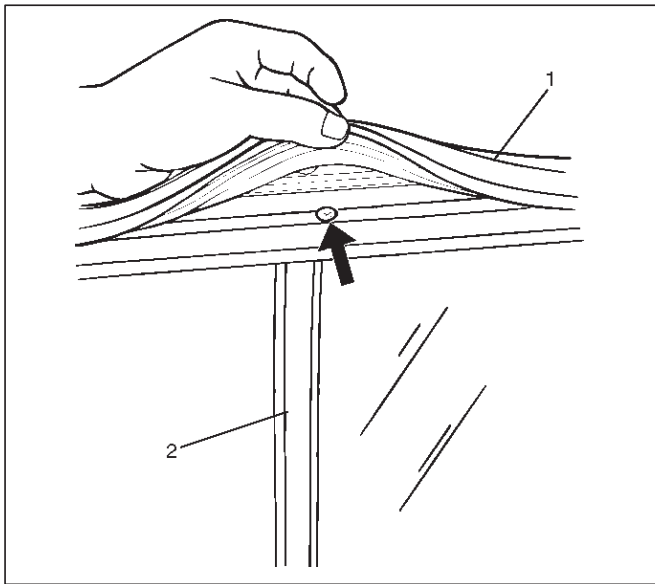
1. Disconnect the battery ground cable.
2. Remove door trim panel.
3. Remove waterproof sheet.
4. Remove glass.
 - Refer to Window Regulator and Glass removal procedure in this section.
5. Remove glass run.
 - Pull the glass run (1) out from the door frame.



651RS007

8F-66 BODY STRUCTURE

6. Remove sash division (2).



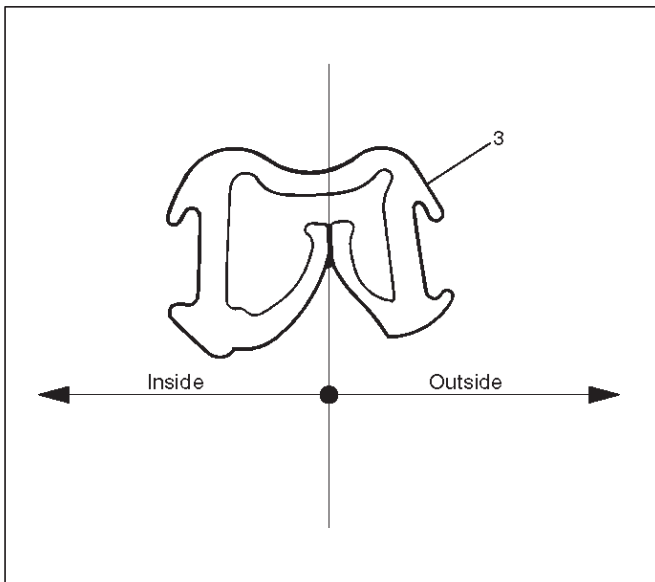
651RS008

7. Remove door fixed glass.

Installation

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

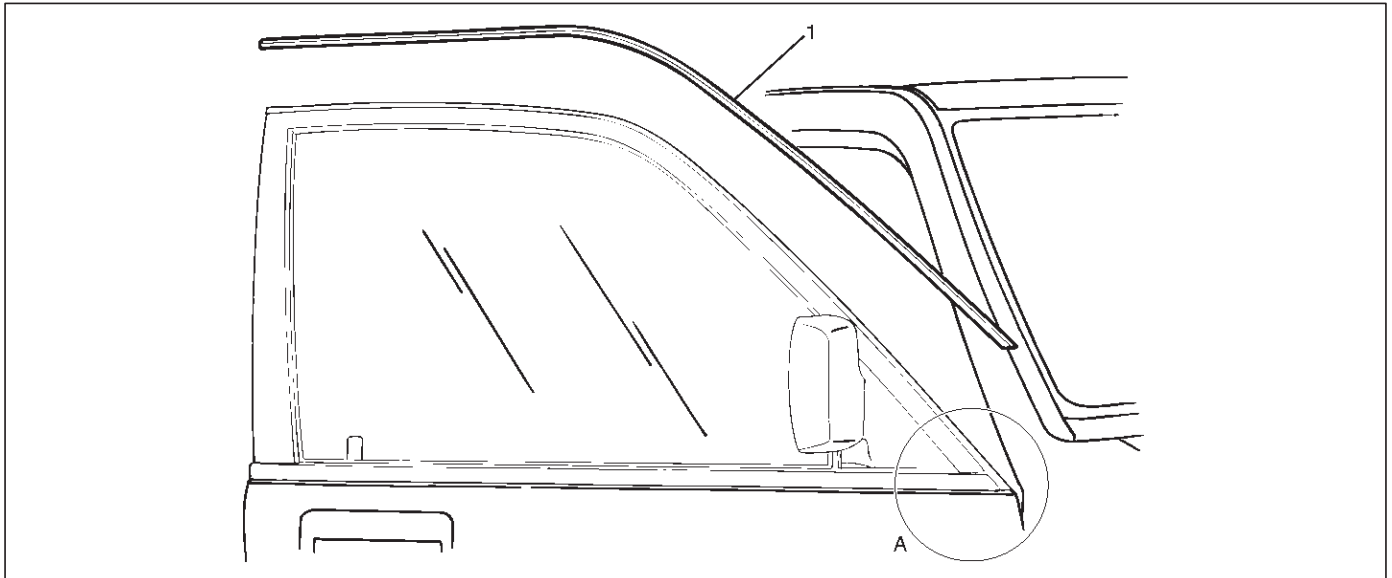
1. Apply soap and water to the fixed glass.
2. Apply soap and water to the door groove and insert the glass run (3) to the frame from the corner in the arrow-marked directions.
3. Be sure to install the glass run with its end pointed to the inside of the vehicle.



A10RW019

Front Door Sash Moulding

Parts Location



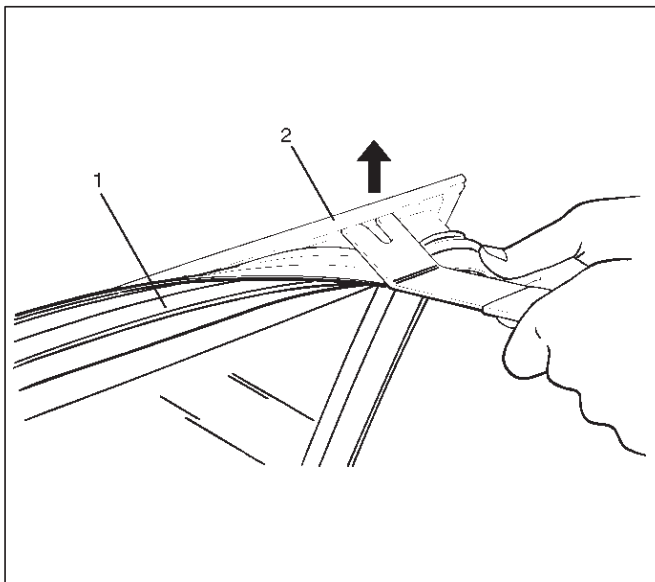
645RS001

Legend

- (1) Front Door Sash Moulding

Removal

1. Remove front door slash moulding.
 - To avoid the weatherstrip (1) and pry the door sash moulding (2) out from the door panel.



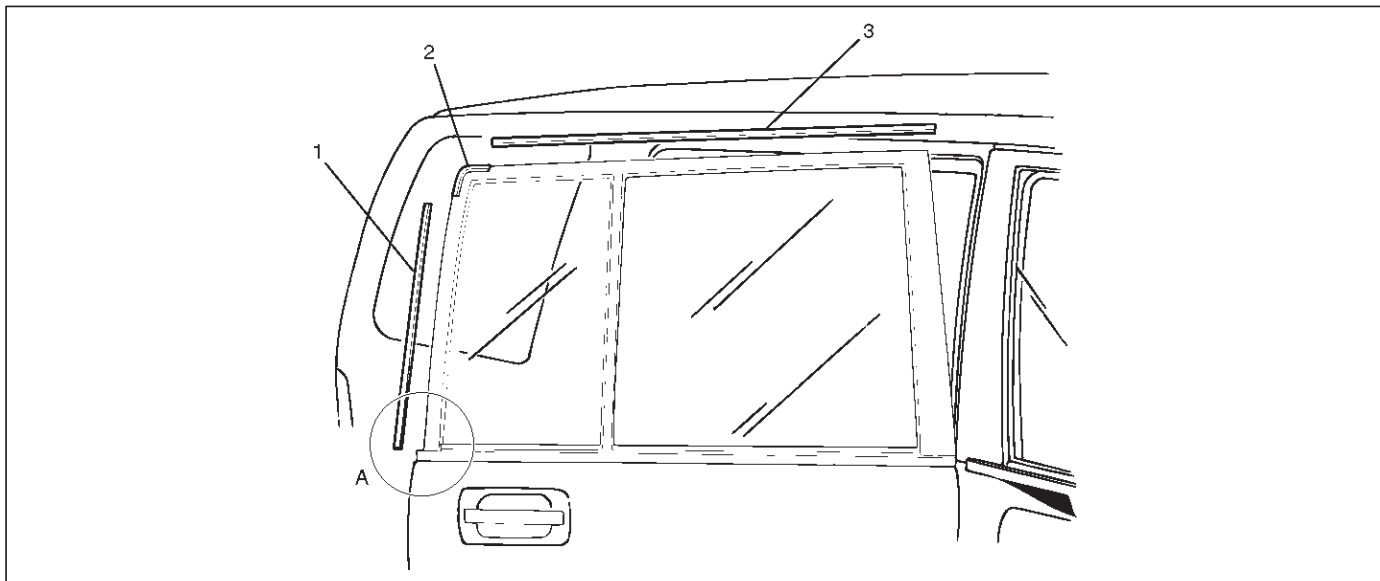
645RS002

Installation

1. Install the front door sash moulding.
 - Assemble the edge portion (A portion) of the moulding so that the clearance between the moulding and the waist seal becomes 1 mm (0.04 in).

Rear Door Moulding

Parts Location



645RS003

Legend

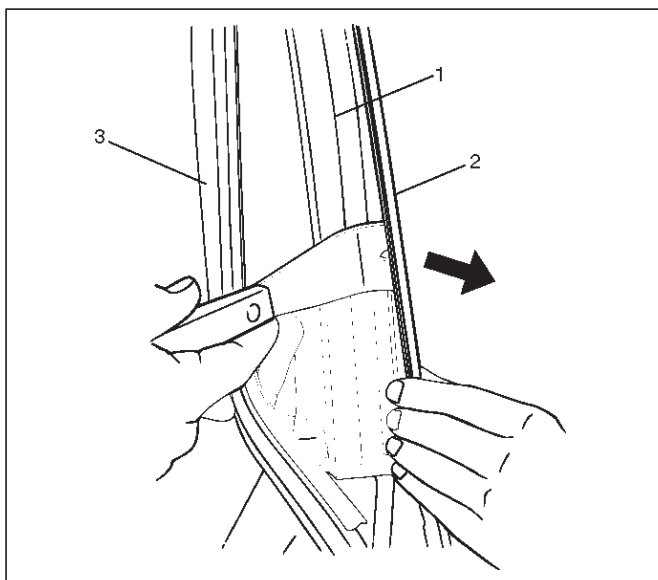
(1) Rear Door Side Moulding

(2) Rear Door Corner Moulding

(3) Rear Door Upper Moulding

Removal

1. Disconnect the battery ground cable.
2. Remove rear door side moulding.
3. Remove rear door upper moulding.
4. Remove rear door corner moulding.
 - Avoiding the weatherstrip (3), pry the moulding (2) out from the door frame (1).



645RS004

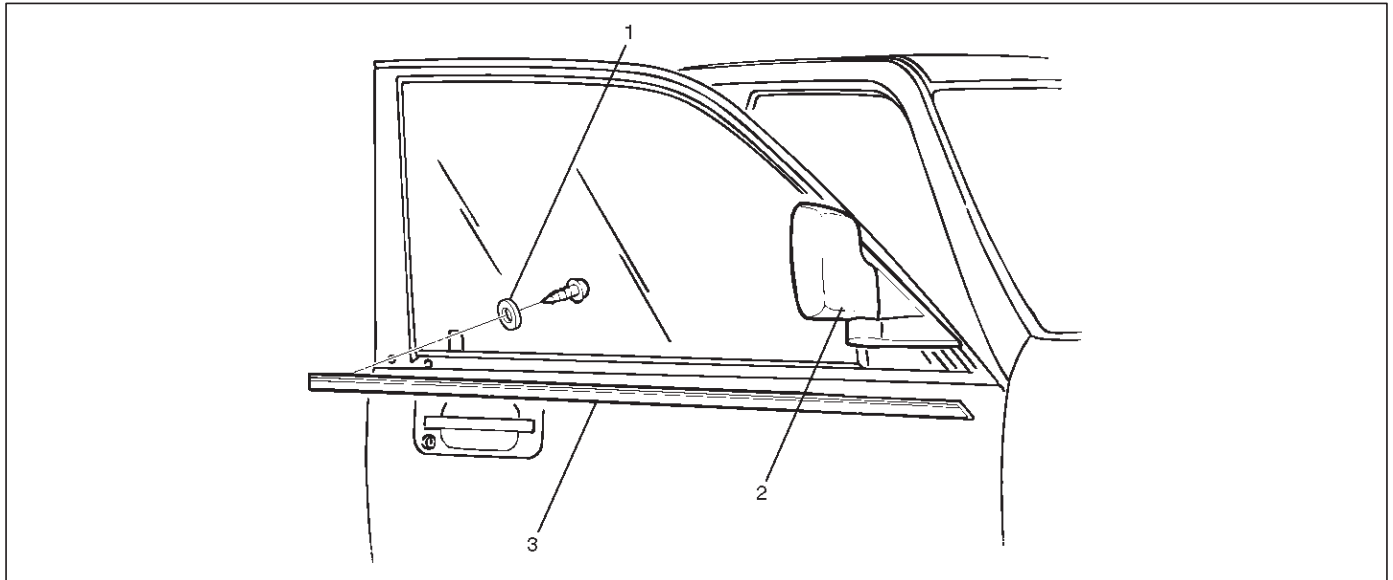
Installation

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

1. Install each moulding with no clearance between each piece of moulding.
2. Assemble the edge portion (A portion) of the moulding so that the clearance between the rear side moulding and the waist seal is 1 mm (0.04 in).

Front Door Waist Seal

Parts Location



631RS009

Legend

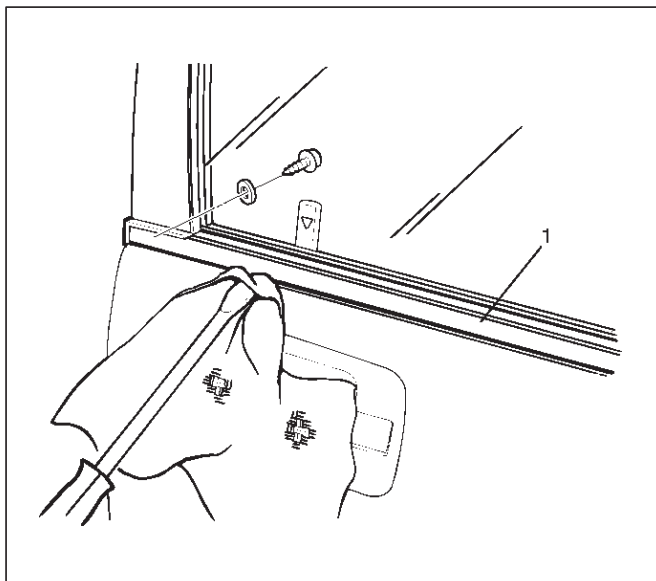
(1) Nylon Washer

(2) Door Mirror

(3) Front Door Waist Seal

Removal

1. Disconnect the battery ground cable.
2. Remove door mirror.
 - Refer to Exterior / Interior Trim in this section.
3. Remove front door waist seal.
 - Remove the fixing screw and pull out the waist seal (1) from the door frame while prying it up.



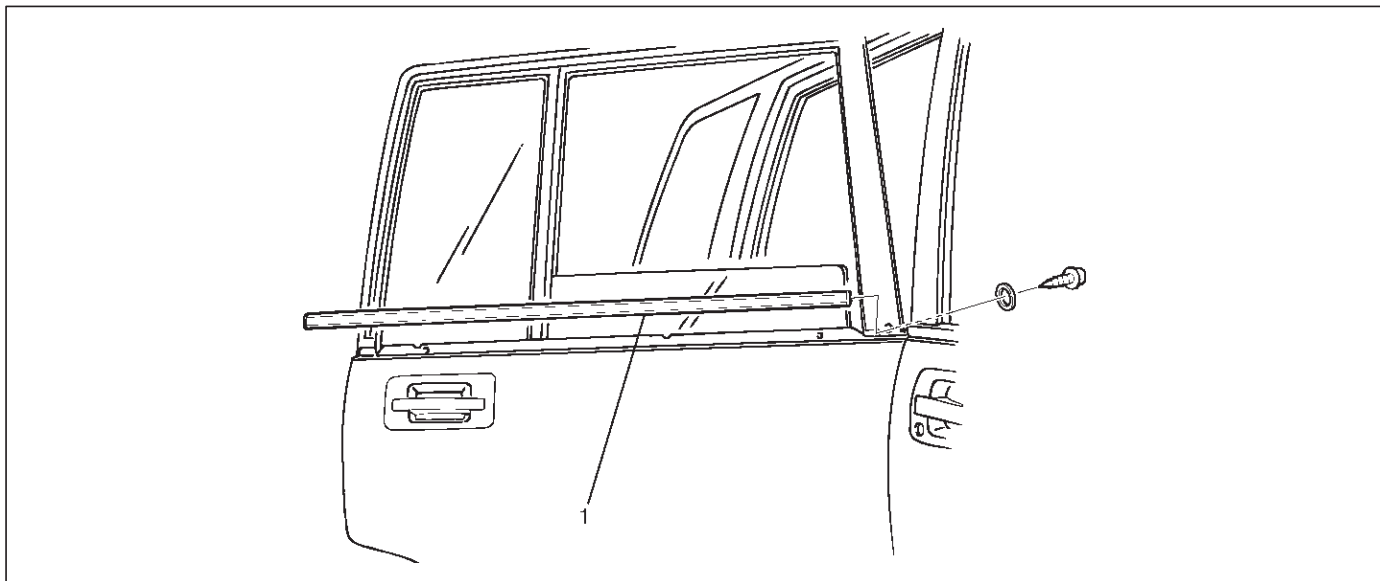
631RS010

Installation

1. Install the front door waist seal.
 - Apply soap and water to the inside of the waist seal and align the screw hole of the waist seal to the door panel hole, and gently tap the seal with a rubber hammer. Be sure not to tap the seal hard. This may result in deforming the seal.
2. Install the door mirror.

Rear Door Waist Seal

Parts Location



651RW013

Legend

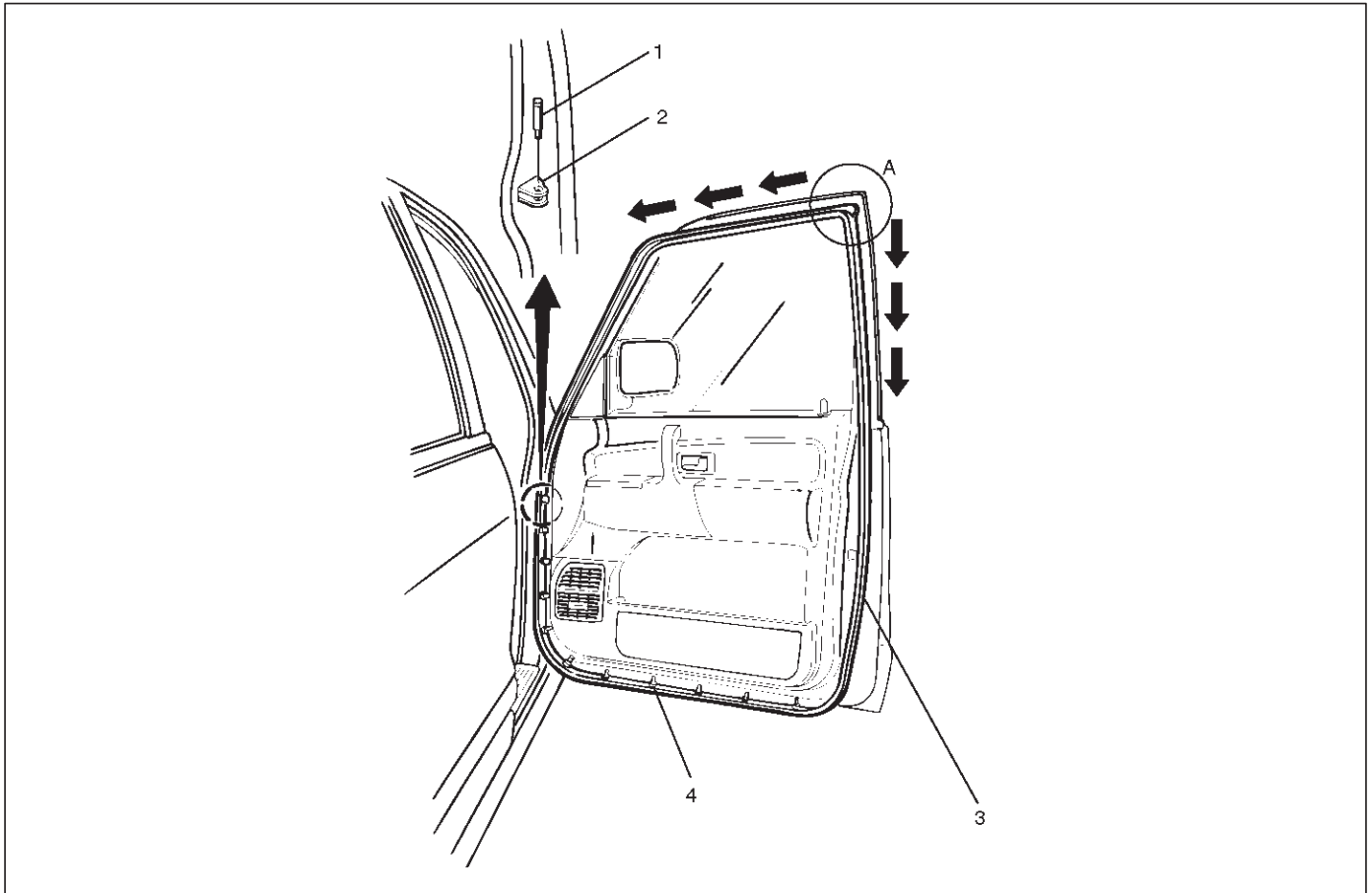
- (1) Rear Door Waist Seal

Removal and Installation

Refer to Front Door Waist Seal in this section.

Front Door Weatherstrip

Parts Location



631RS008

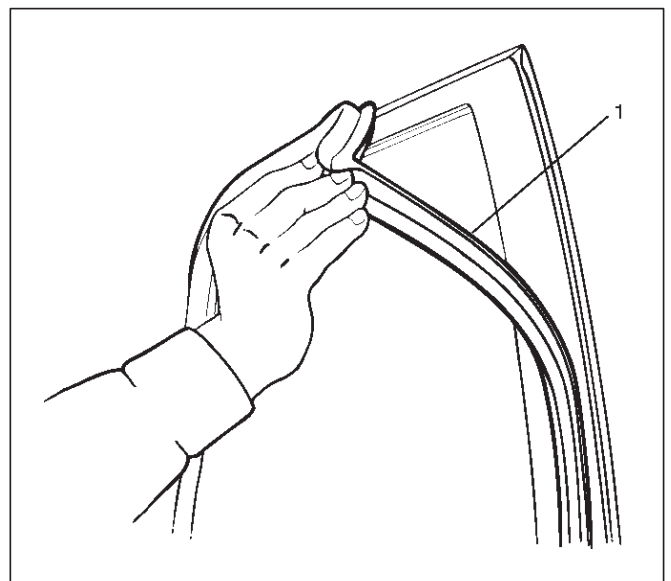
Legend

- (1) Check Arm Pin
- (2) Bracket

- (3) Weather Strip
- (4) Clip

Removal

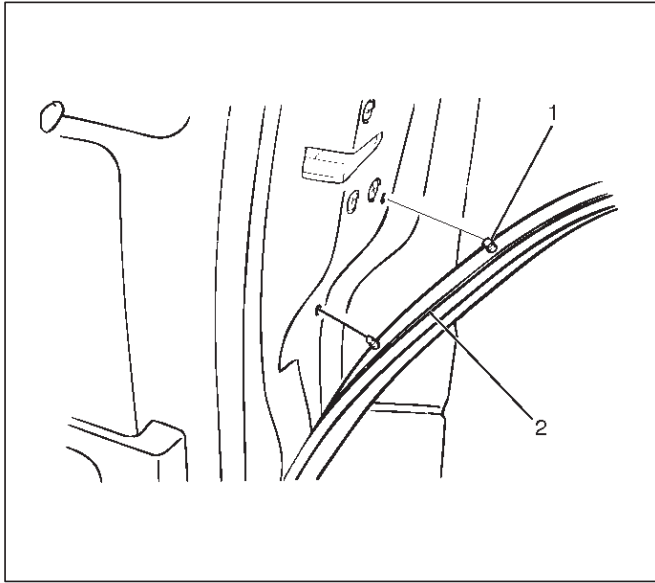
1. Remove check arm pin.
2. Remove front door weatherstrip.
 - Pull the weatherstrip (1) out from the door frame.



631RS011

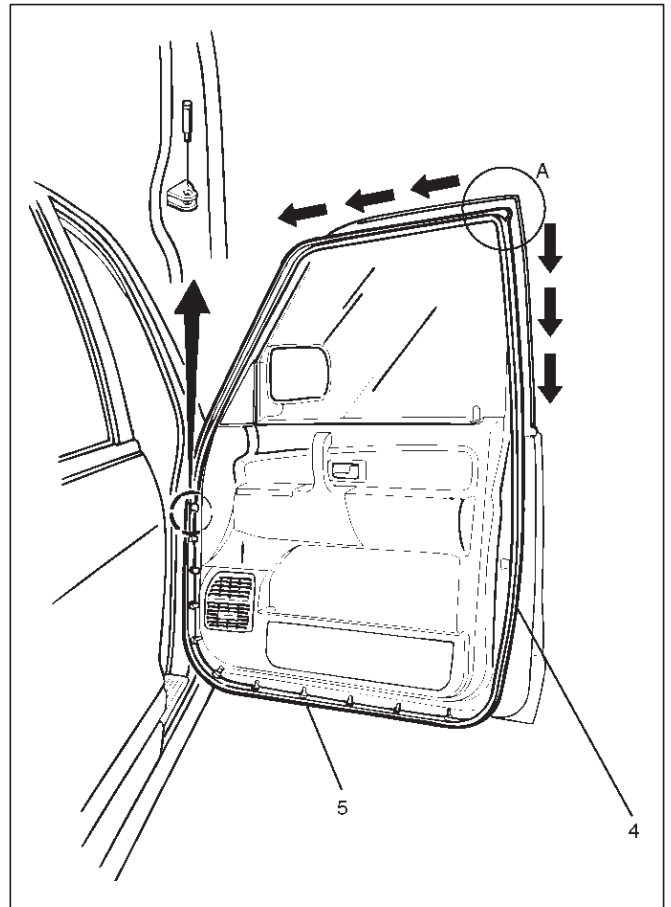
8F-72 BODY STRUCTURE

- Carefully remove the weatherstrip (2) from the door panel.



631RW003

- After positioning the weatherstrip (4) corner, insert the weatherstrip into the door frame groove from A point in the arrow-marked direction.



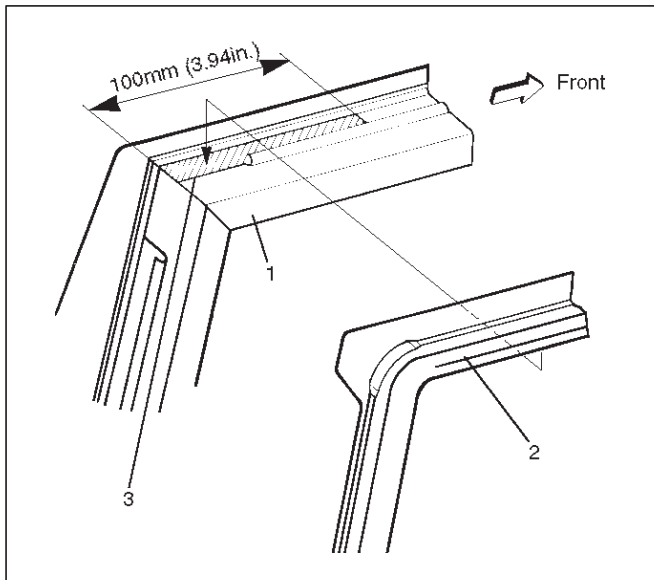
631RW009

- Insert the weatherstrip clip (5) into the door panel up to its base.
2. Install the check arm pin.

Installation

1. Install the front door weatherstrip.

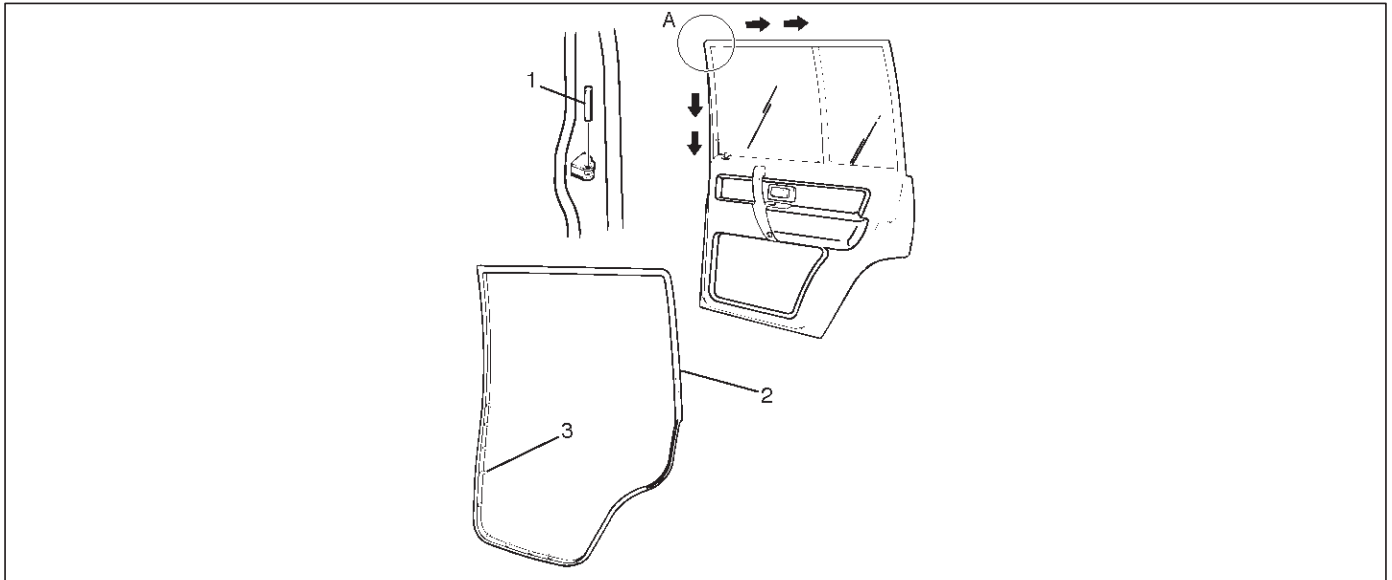
- Apply soapy water to the door frame groove.
- Apply the sealing adhesive (3) to the upper A portion of the door frame (1) and press it for installation after assembling the weatherstrip (2).



631RS013

Rear Door Weatherstrip

Parts Location



655RW010

Legend

(1) Check Arm Pin

(2) Rear Door Weather Strip

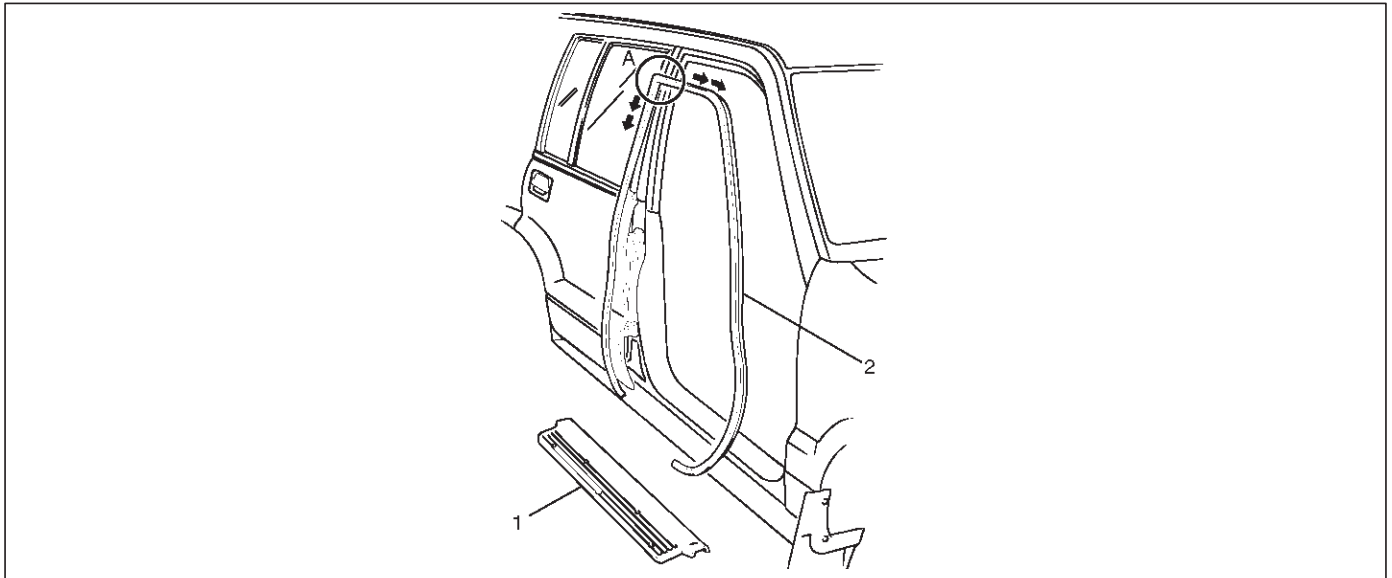
(3) Clip

Removal and Installation

Refer to Front Door Weatherstrip in this section.

Front Door Seal Finisher

Parts Location



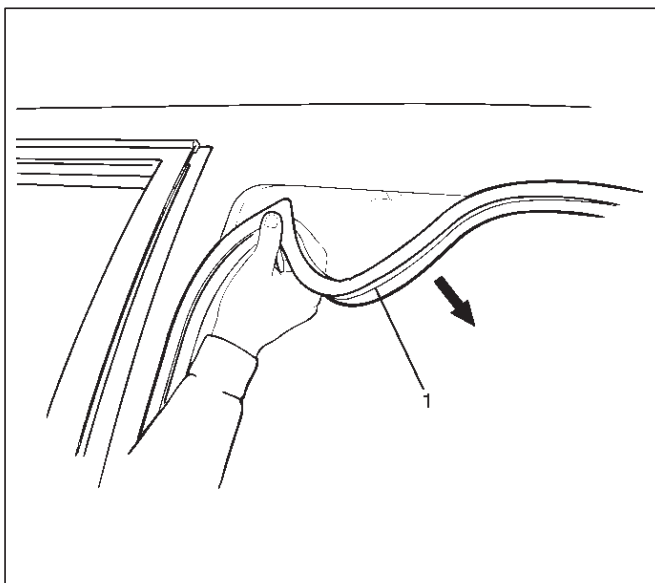
635RS002

Legend

- (1) Front Door Sill Plate
- (2) Front Door Seal Finisher

Removal

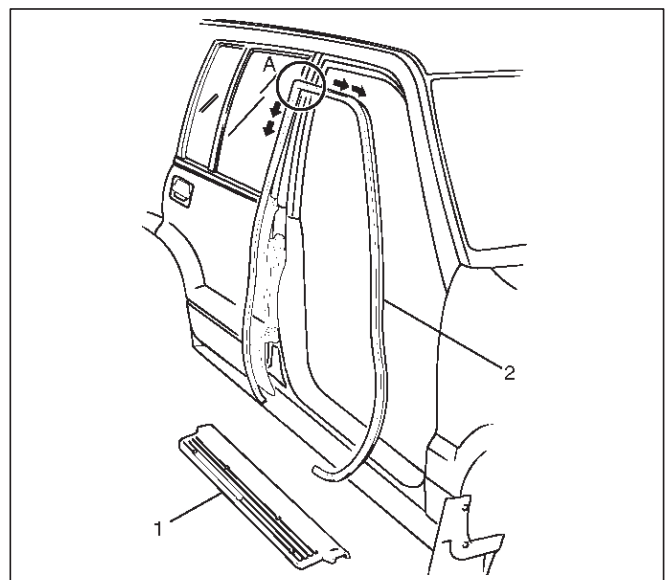
1. Disconnect the battery ground cable.
2. Remove front door sill plate.
3. Remove front door seal finisher (1).
 - Pull the finisher out from the body panel.



635RS003

Installation

1. Install the front door seal finisher (2).
 - Insert the finisher into the A corner and install the finisher in the arrow-marked directions.

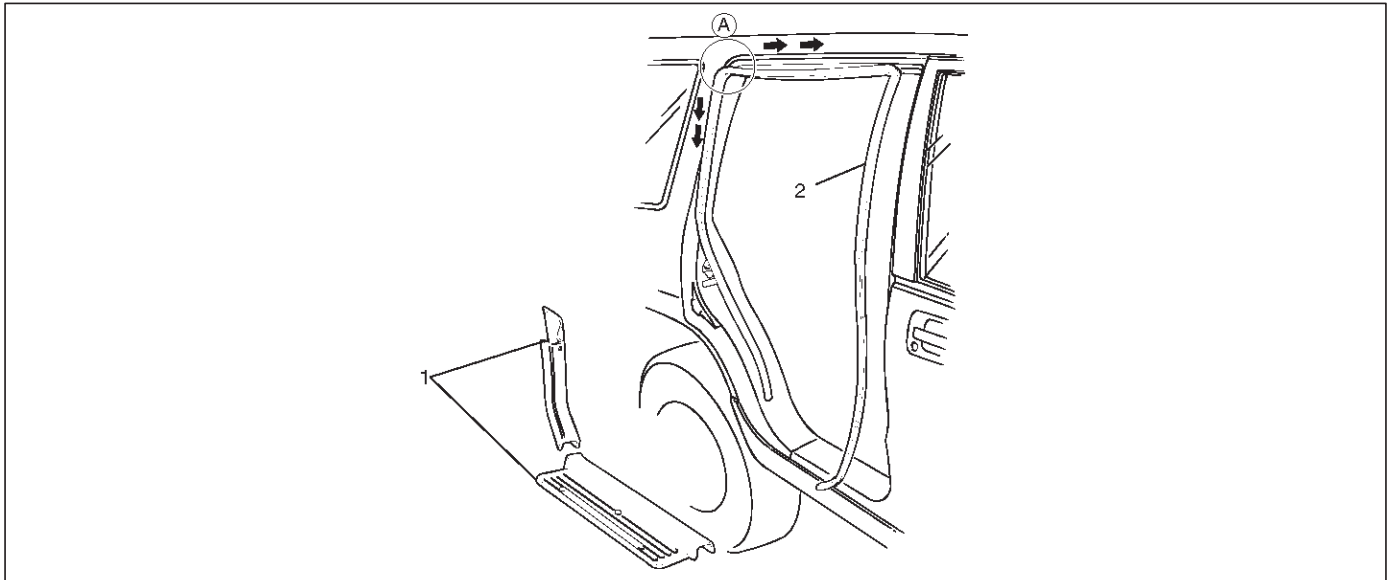


635RS002

2. Install the front door sill plate (1).
 - Take care not to allow the sill plate to distort or twist the finisher.

Rear Door Seal Finisher

Parts Location



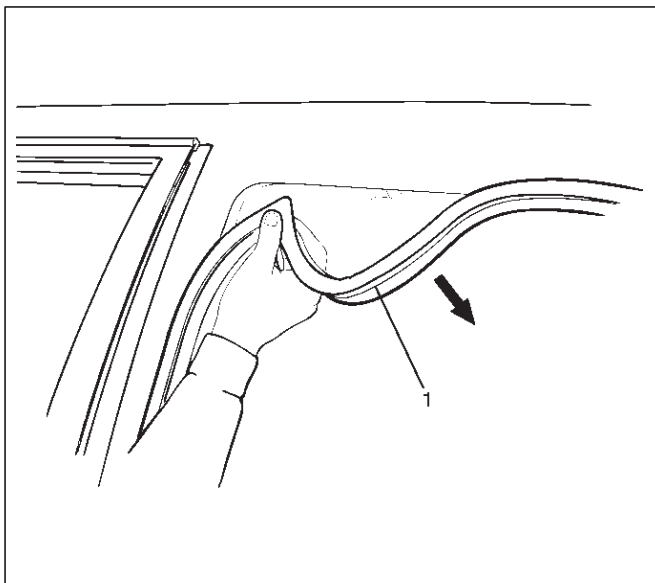
655RS002

Legend

- (1) Rear Door Sill Plate and Luggage Side Lower Cover
- (2) Rear Door Seal Finisher

Removal

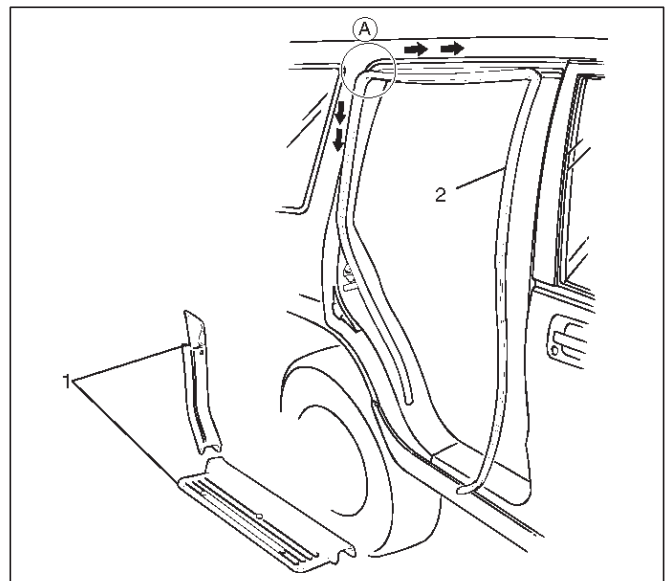
1. Disconnect the battery ground cable.
2. Remove rear door sill plate and the luggage side lower cover.
3. Remove rear door seal finisher (1).
 - Pull the rear door seal finisher (1) out from the body panel.



635RS003

Installation

1. Install the rear door seal finisher (2).
 - Insert the rear door seal finisher (2) into the A corner and install the finisher in the arrow-marked directions.

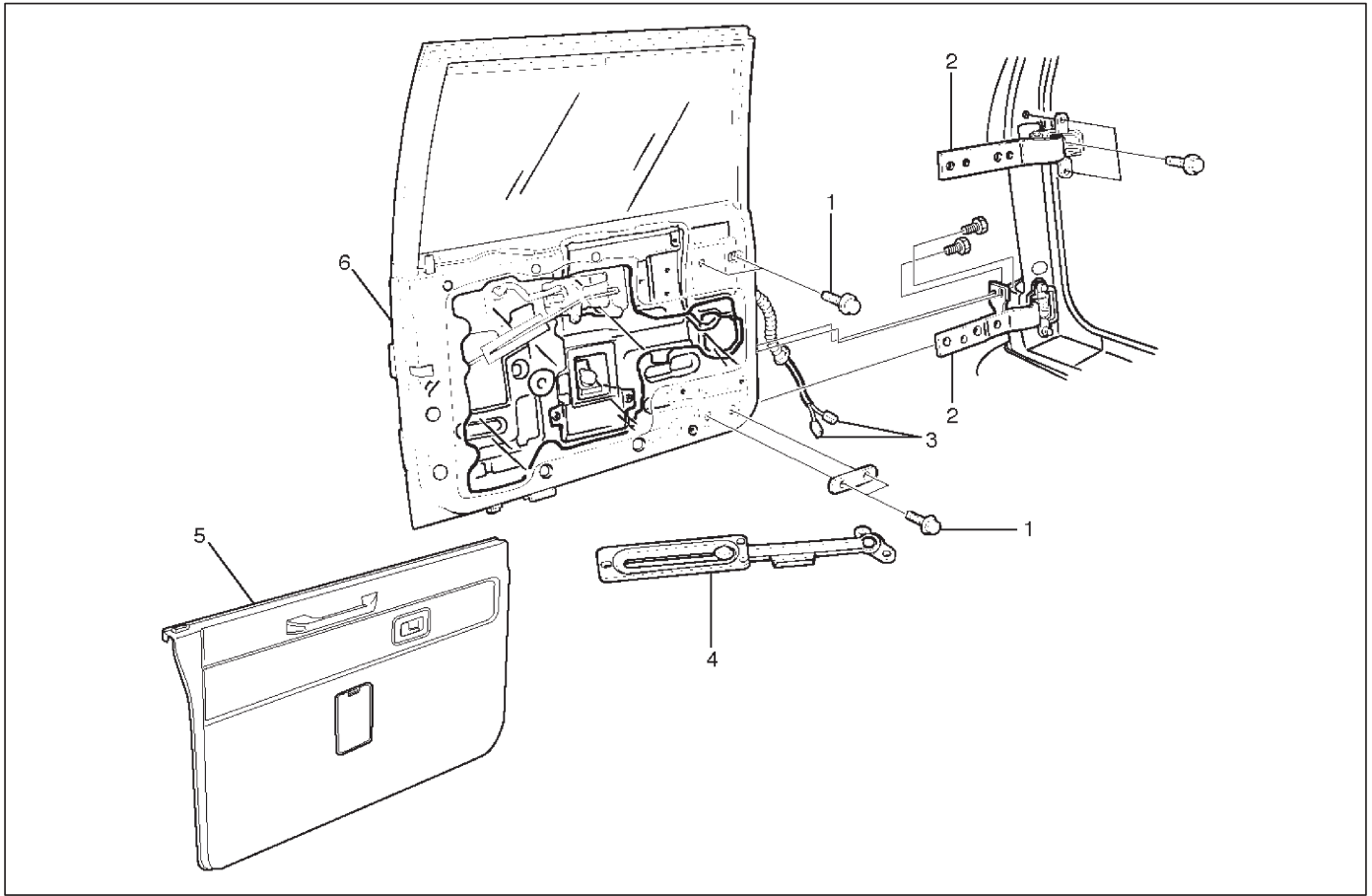


655RS002

2. Install the rear door sill plate and luggage side lower cover.
 - Be careful not to allow the sill plate and the cover to distort or twist the finisher.

Tailgate Assembly (LH)

Parts Location



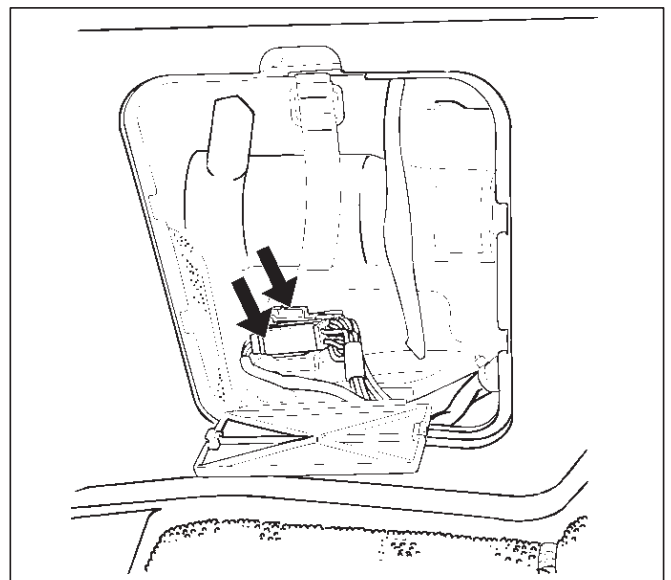
681RW008

Legend

- | | |
|---------------------------------|-------------------------------|
| (1) Tailgate Fixing Bolt | (4) Tailgate Stopper Assembly |
| (2) Tailgate Hinge | (5) Tailgate Trim Panel (LH) |
| (3) Tailgate Harness Connection | (6) Tailgate Assembly (LH) |

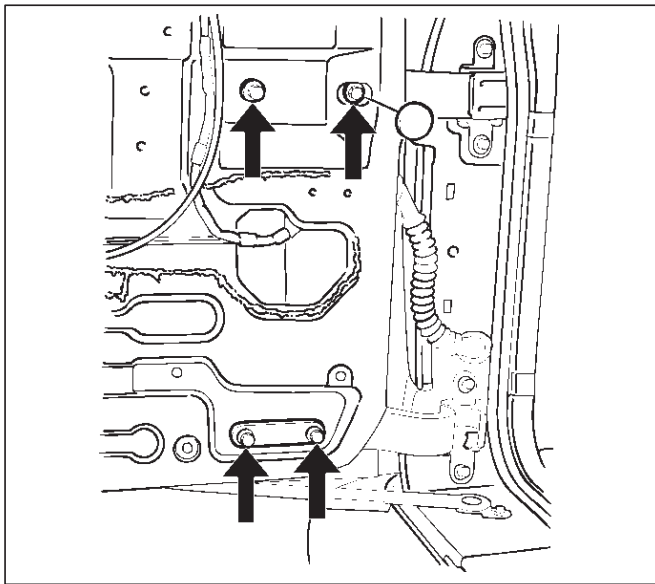
Removal

1. Disconnect the battery ground cable.
2. Remove tailgate trim panel (LH).
 - Refer to Exterior / Interior Trim in this section.
3. Remove tailgate stopper assembly
4. Remove tailgate harness connection.
 - Open the luggage trim panel lid and disconnect the tailgate harness connection.



810RS008

5. Remove tailgate fixing bolts.

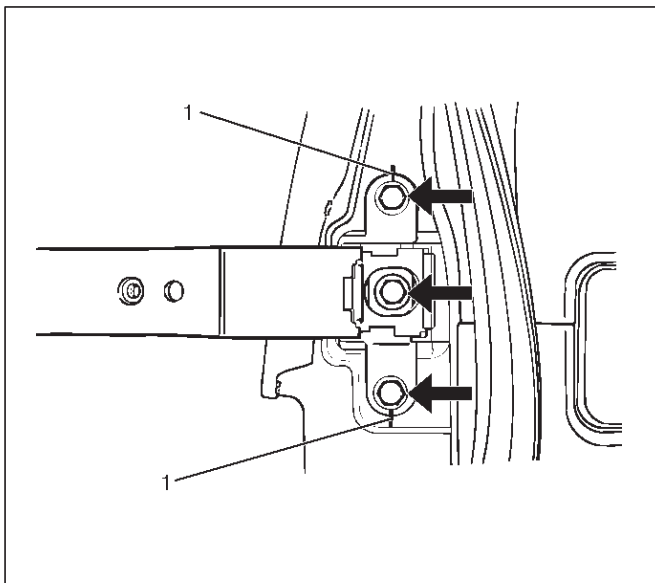


681RS002

6. Remove tailgate assembly (LH).

7. Remove tailgate hinge.

- Apply a setting mark (1) on the body side hinge and remove the hinge fixing bolts.



681RW007

Installation

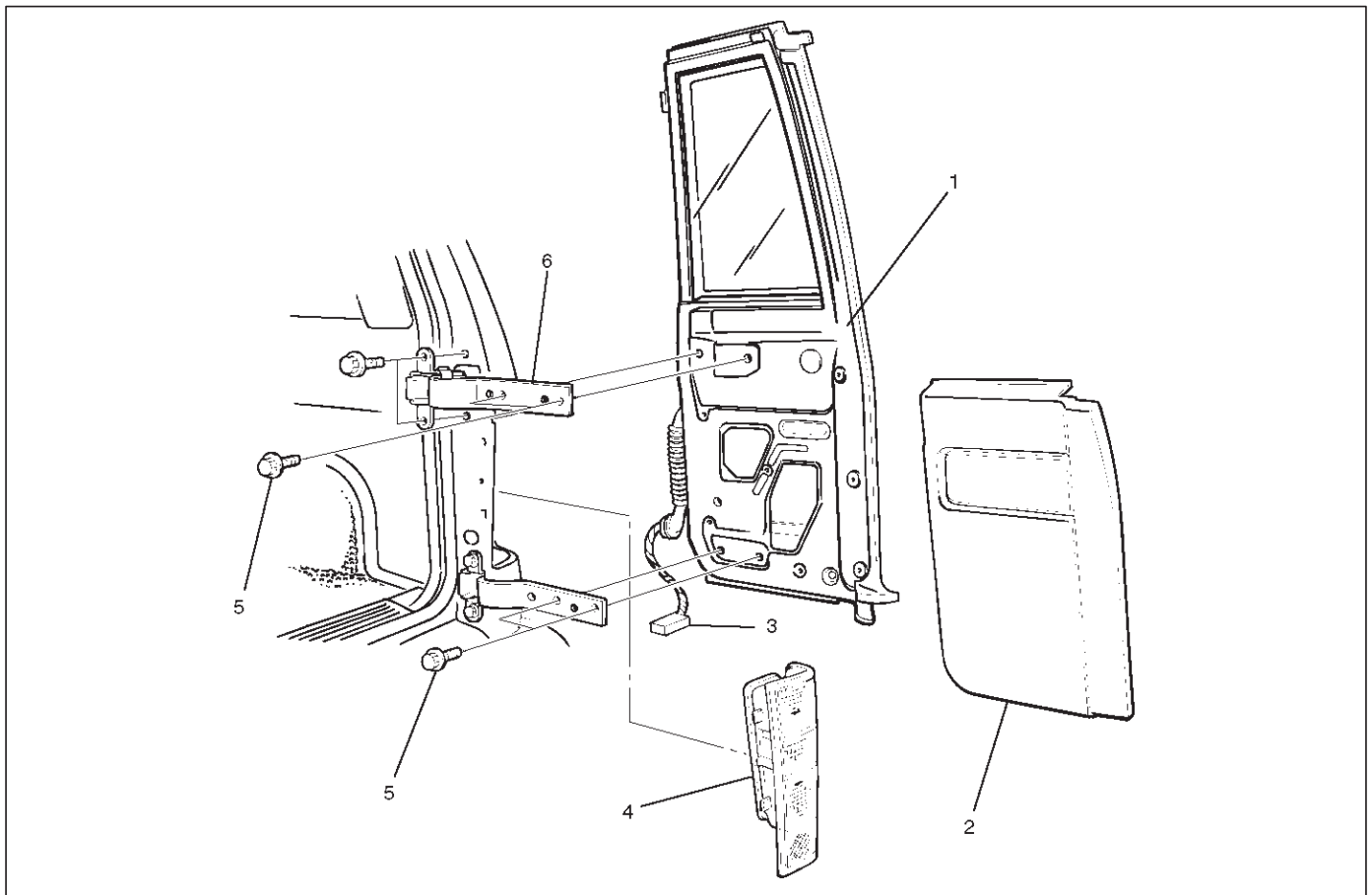
To install, follow the removal steps in the reverse order, noting the following points.

1. Apply chassis grease to the tailgate hinge and the tailgate stopper moving surface.
2. Align the tailgate fitting to the body by referring to Body Dimension in this section.
3. Tighten the hinge bolts to the specified torque.

Torque : 34 N•m (3.5kg-m/25 lb ft)

Tailgate Assembly (RH)

Parts Location



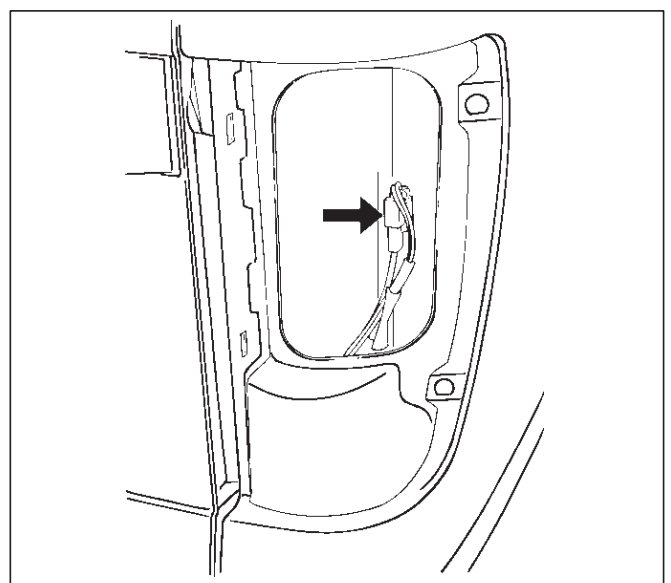
810RS004

Legend

- | | |
|---------------------------------|---------------------------------|
| (1) Tailgate Assembly (RH) | (4) Rear Combination Light (RH) |
| (2) Tailgate Trim Panel (RH) | (5) Tailgate Fixing Bolt |
| (3) Tailgate Harness Connection | (6) Tailgate Hinge |

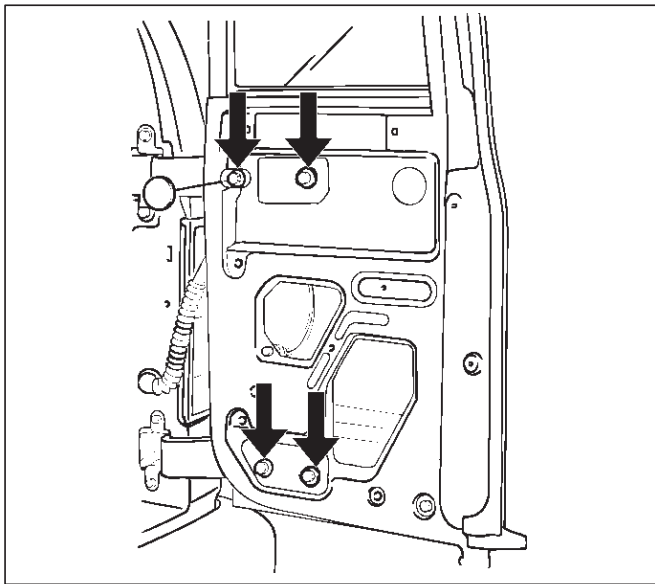
Removal

1. Disconnect the battery ground cable.
2. Remove rear combination light (RH).
3. Remove tailgate trim panel (RH).
 - Refer to Exterior / Interior Trim in this section.
4. Remove tailgate harness connection.
 - Disconnect the tailgate harness connection.



810RS004

5. Remove tailgate fixing bolt.

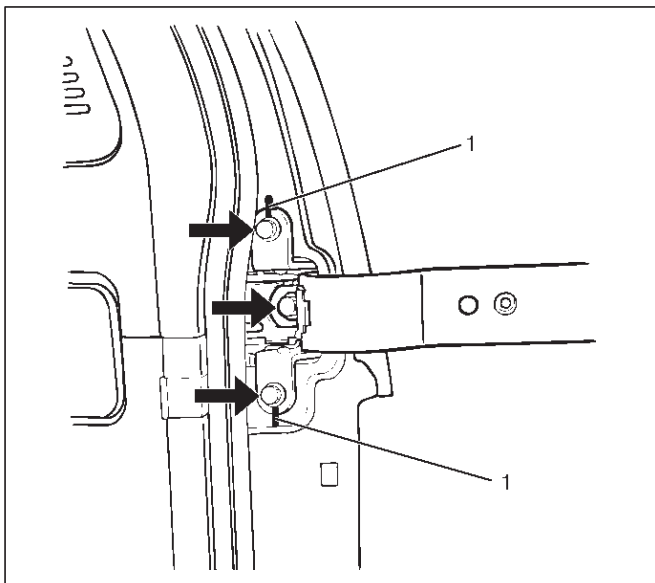


681RS005

6. Remove tailgate assembly (RH).

7. Remove tailgate hinge.

- Apply a setting mark (1) on the body side hinge and remove the hinge fixing bolts.



681RW006

Installation

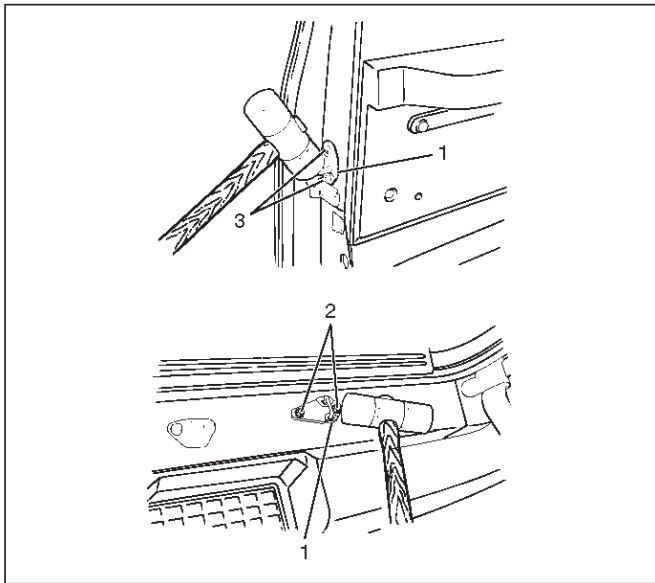
To install, follow the removal steps in the reverse order, noting the following point.

1. Apply chassis grease to the tailgate hinge moving surface.
2. Align the tailgate fitting to the body. Refer to Body Dimension in this section.
3. Tighten the hinge bolts to the specified torque.

Torque : 34 N•m (3.5kg-m/25 lb ft)

Tailgate Strikers

Adjustment



683RW012

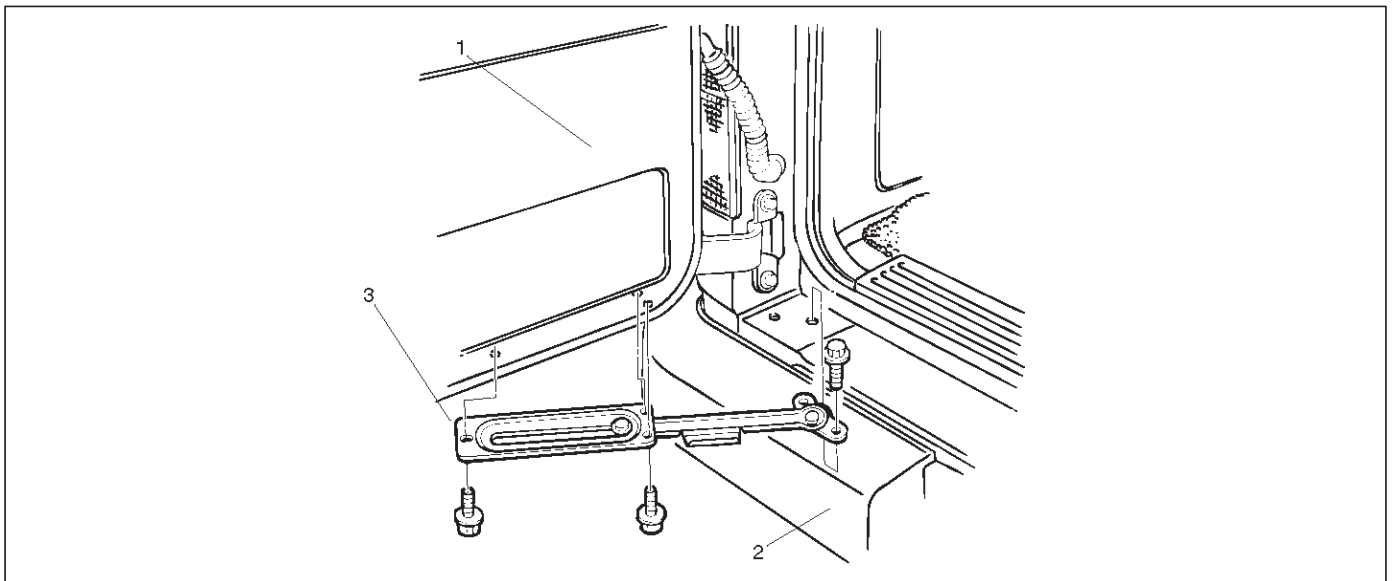
1. Loosen the striker screws (3) (or bolts (2)).
2. Tap the striker (1) with a plastic hammer to align.
3. Tighten the striker screws (3) (or bolts (2)).

Screw Torque : 15 N•m (1.5kg-m/11 lb ft)

Bolt Torque : 12 N•m (1.2kg-m/104 lb in)

Tailgate Stopper Assembly

Parts Location



683RS010

Legend

(1) Tailgate

(2) Rear Bumper

(3) Tailgate Stopper Assembly

Removal

1. Remove tailgate stopper assembly.

2. Apply chassis grease to the stopper moving surface.

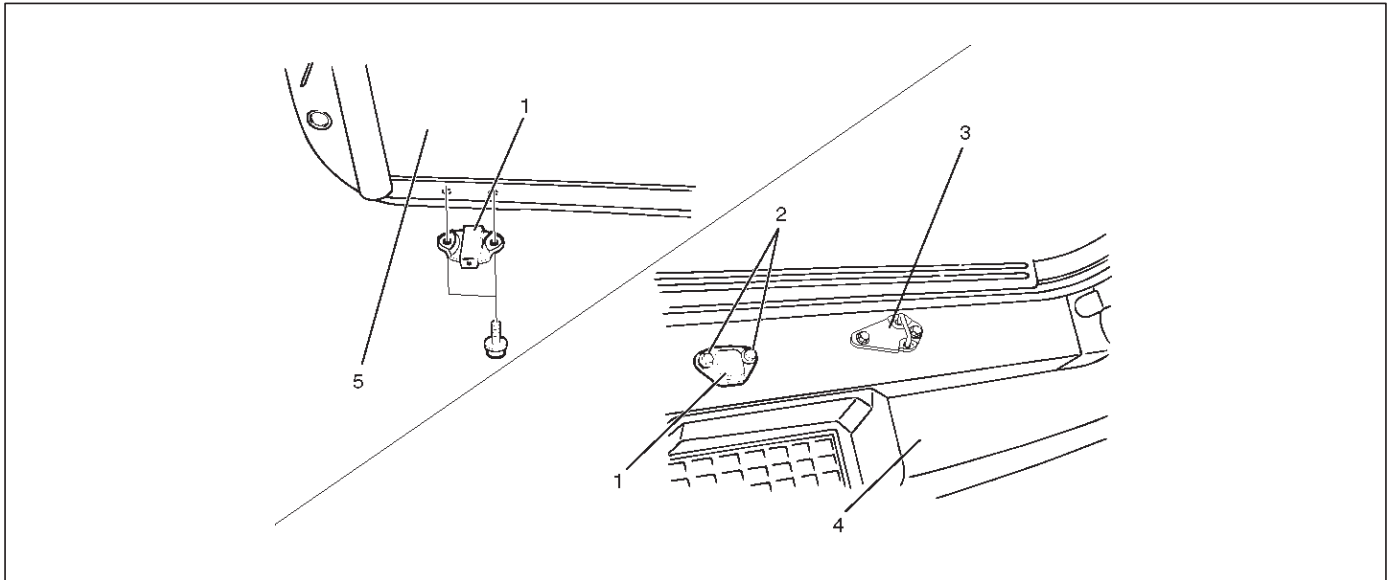
Installation

1. Install the tailgate stopper assembly.
 - Tighten the fixing bolts to the specified torque.

Torque : 12 N•m (1.2kg-m/104 lb in)

Tailgate Dove-Tail

Parts Location



683RW011

Legend

- | | |
|-----------------|----------------------|
| (1) Dove-Tail | (3) Tailgate Striker |
| (2) Fixing Bolt | (4) Rear Bumper |
| | (5) Tailgate (LH) |

Removal

1. Remove tailgate dove-tail.

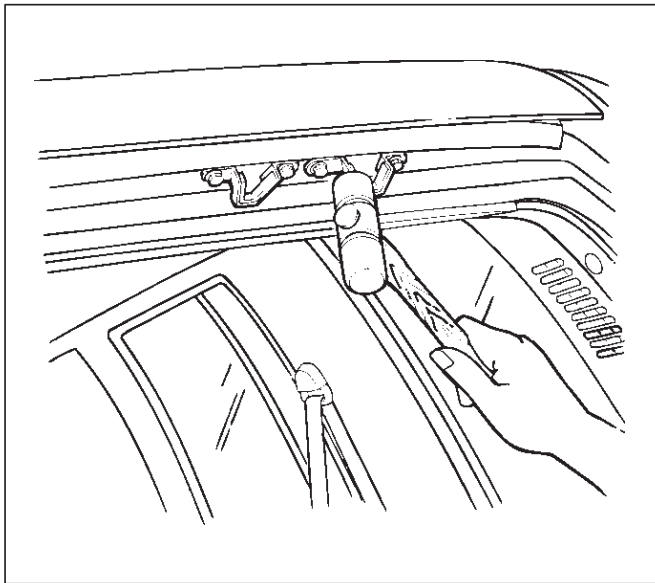
Installation

1. Install the tailgate dove-tail
 - Apply chassis grease to the dove-tail (A) moving surface.
 - Tighten the fixing bolts to the specified torque.

Torque : 12 N•m (1.2kg-m/104 lb in)

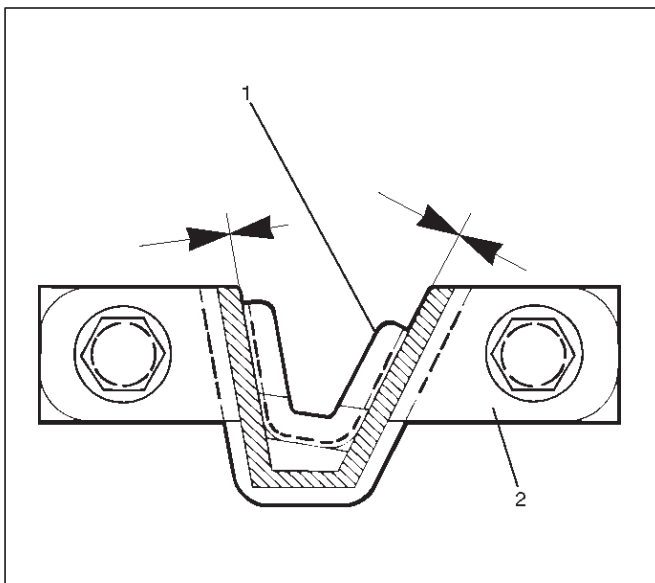
Tailgate Dove-Tail Striker

Adjustment



683RS012

1. Loosen the striker bolts.
2. Tap with a plastic hammer to align.
 - Gaps between Dove-Tail Striker (2) and bracket (1) are 0 mm (No clearance).

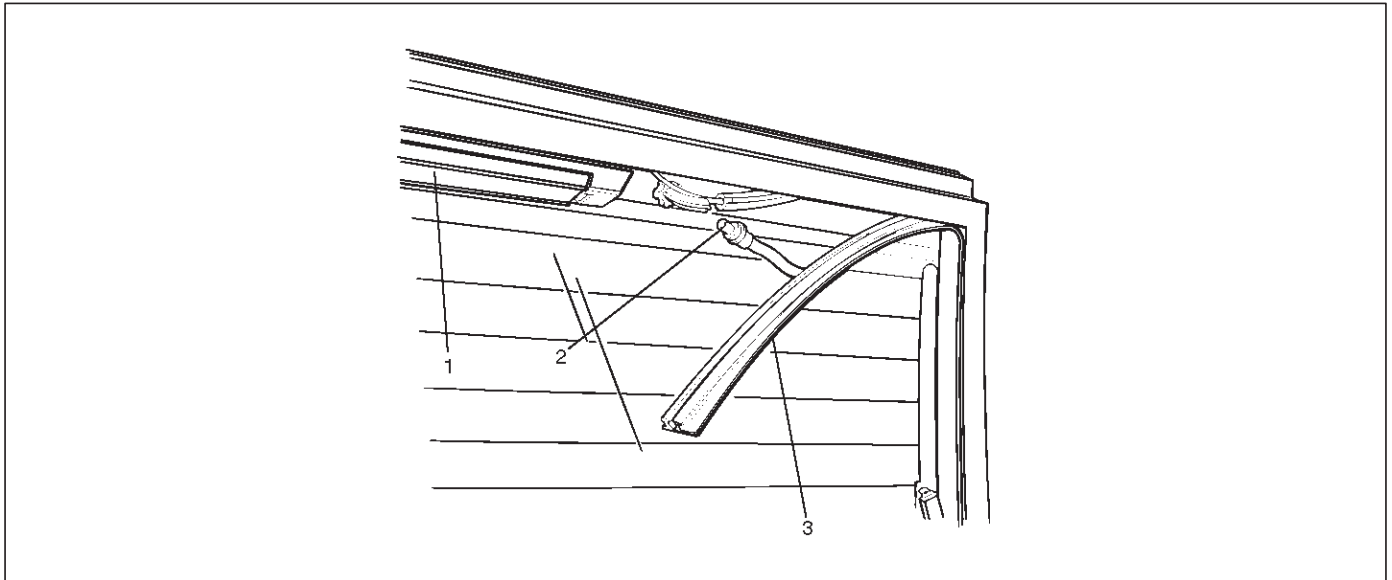


683RS013

3. Tighten striker bolts.
Torque : 12 N•m (1.2kg-m/104 lb in)

Tailgate Frame Cover (LH)

Parts Location



684RW001

Legend

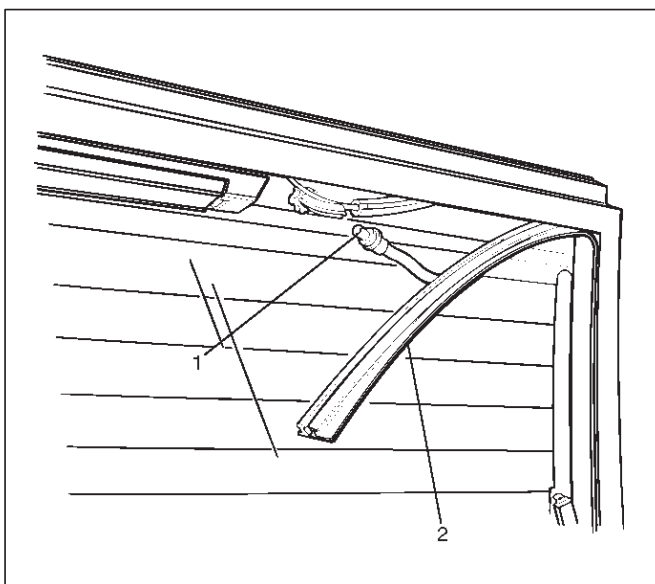
(1) High Mount Stop Light

(2) Washer Tube

(3) Tailgate Frame Cover

Removal

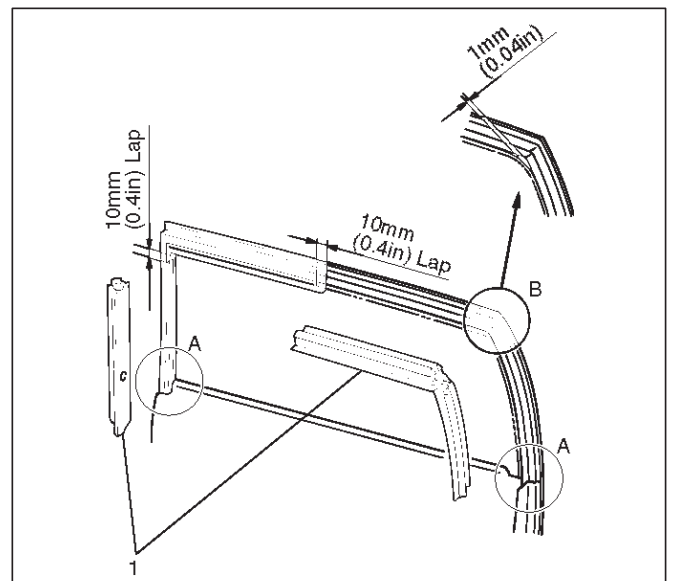
1. Disconnect the battery ground cable.
2. Remove tailgate frame cover.
 - Pull the tailgate frame cover (2) out.
 - Disconnect the washer tube (1) at the nozzle and pull the washer tube out from the frame cover (2).
 - Disconnect the rear defogger and pull the harness from the cover.



684RW002

Installation

1. Install the tailgate frame cover (1).
 - Hit the lower A edge portion of the cover to the tailgate flange.
 - Clearance between the frame cover and the tailgate panel (B portion) is 1 mm (0.04 in).

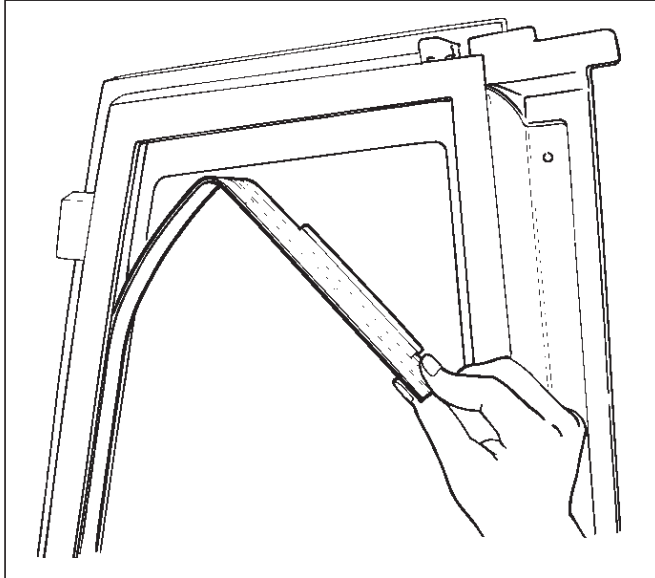


684RS008

Tailgate Frame Cover (RH)

Removal

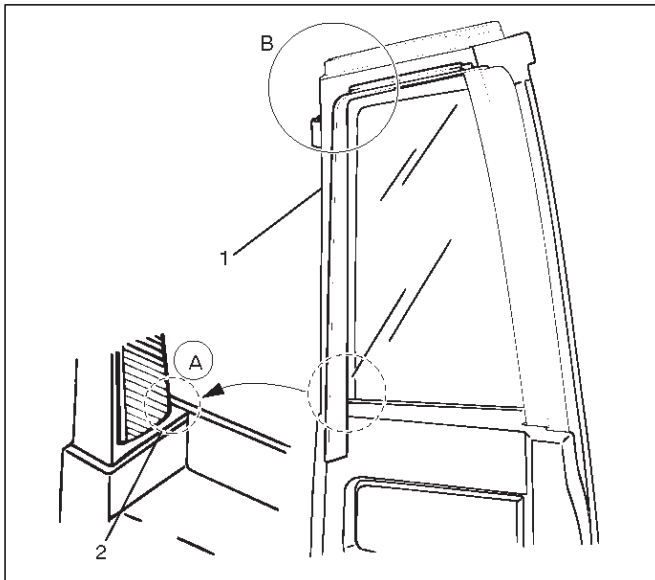
1. Remove tailgate frame cover (RH).
 - Pull the frame cover out from the tailgate frame.



684RS011

Installation

1. Install the tailgate frame cover.
 - Hit the lower A edge portion (2) of the tailgate frame cover (1).

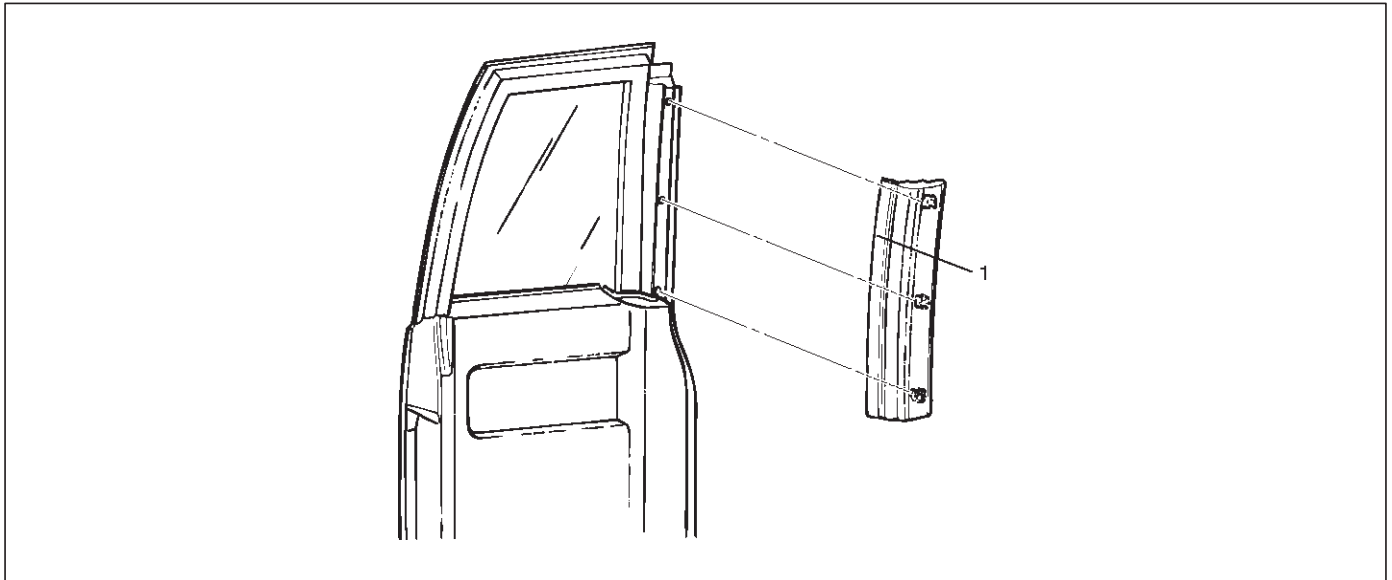


684RS010

- Clearance between the frame cover and the tailgate panel (B portion) is 1 mm (0.04 in).

Tailgate Sash Trim Cover

Parts Location



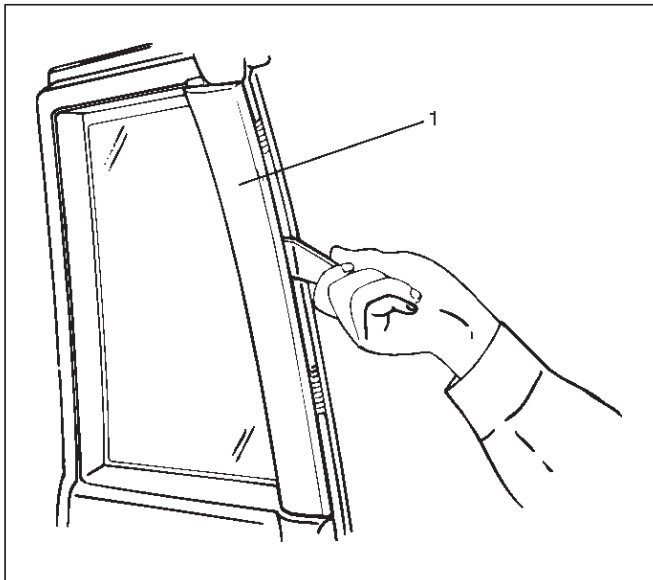
684RS012

Legend

- (1) Tailgate Sash Trim Cover

Removal

1. Remove tailgate sash trim cover (1).
 - Pry the tailgate trim cover retainers free from the tailgate panel.



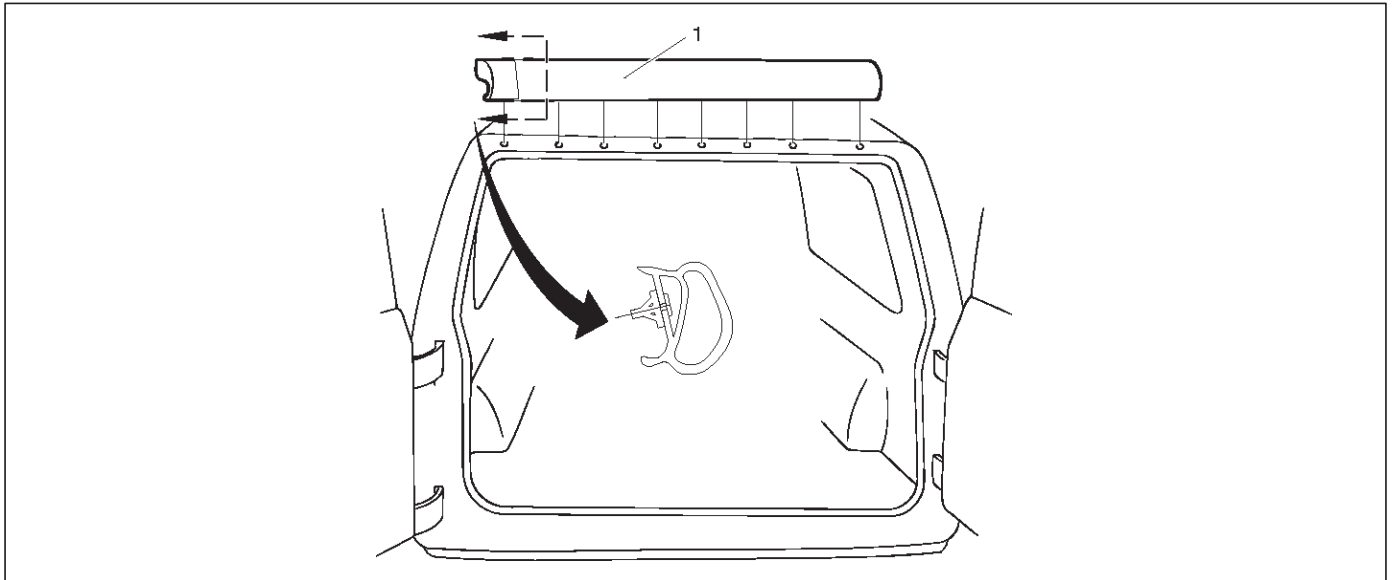
684RS013

Installation

1. Install the tailgate sash trim cover (1).
 - Insert the trim cover retainers into the tailgate hole securely so that there are no gaps between them.

Tailgate Outer Weatherstrip

Parts Location



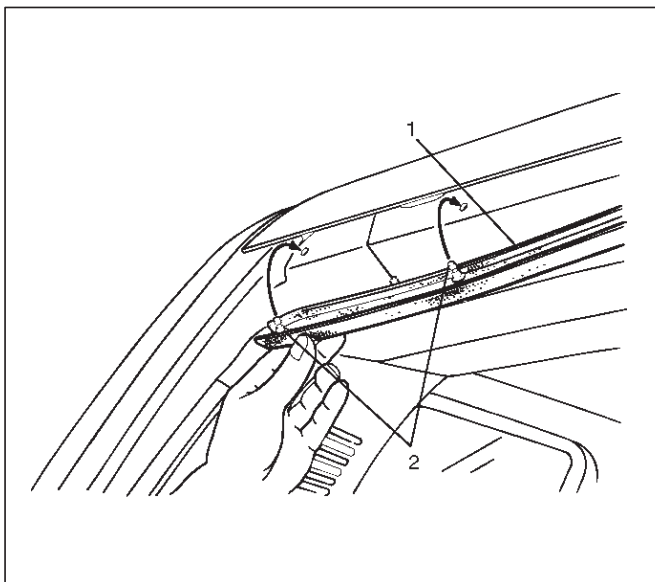
682RW001

Legend

- (1) Tailgate Outer Weatherstrip

Removal

1. Disconnect the battery ground cable.
2. Remove tailgate outer weatherstrip (1).
 - Pry the tailgate outer weatherstrip clips (2) free from the body panel.



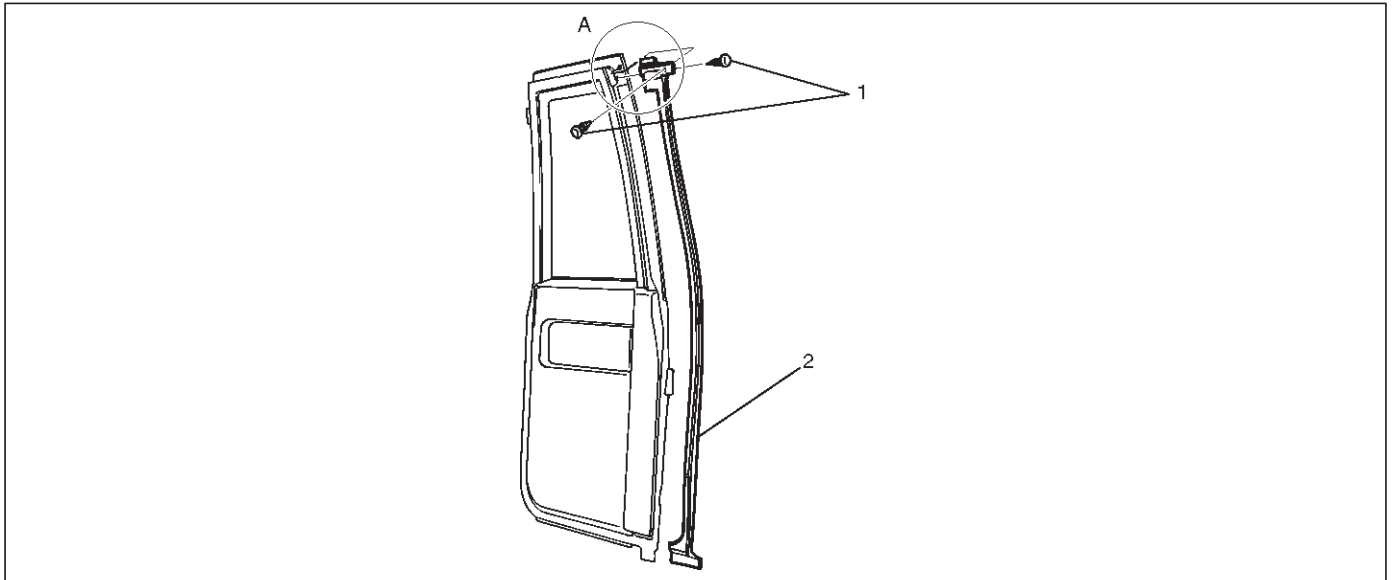
682RS002

Installation

1. Install the tailgate weatherstrip.
 - Insert the tailgate outer weatherstrip clip into the body panel hole securely in order to install the tailgate outer weatherstrip with the gap between the body panel and the weatherstrip.

Tailgate Center Weatherstrip

Parts Location



682RS003

Legend

- (1) Clip
- (2) Tailgate Center Weatherstrip

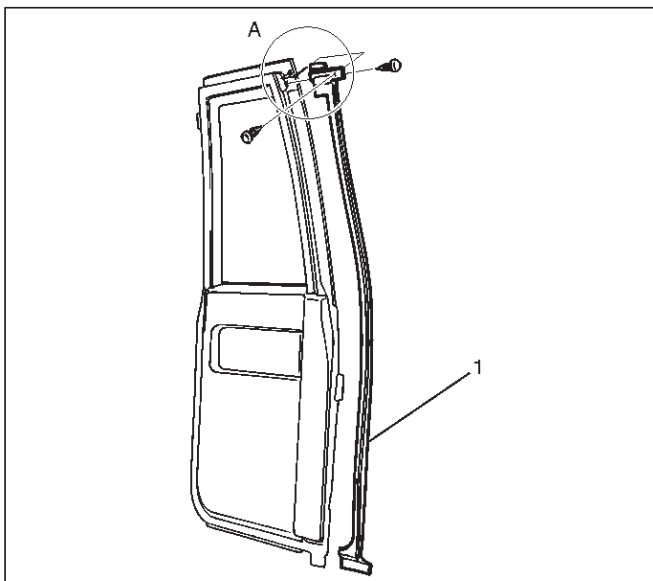
Removal

1. Remove tailgate center weatherstrip.
 - Remove the fixing clips in order to pull the tailgate center weatherstrip out from the tailgate panel.

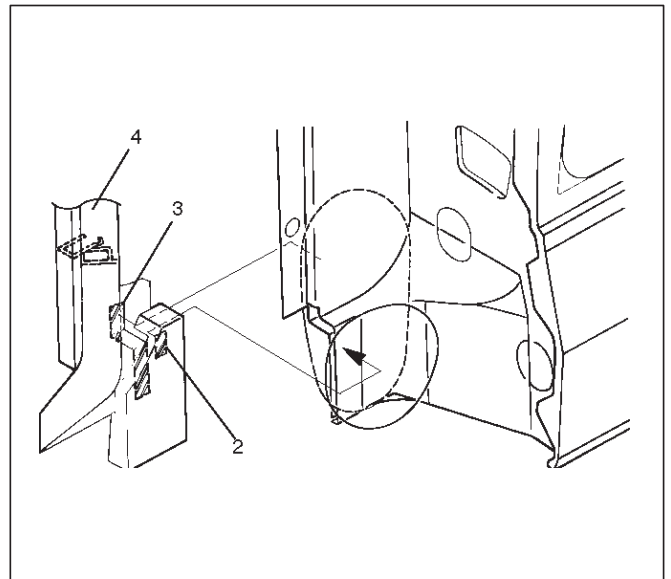
- Affix new adhesive tape and the butyl seal to the weatherstrip (lower side) in order to install the tailgate center weatherstrip to the tailgate panel with no gap between them.

Installation

1. Install the tailgate center weatherstrip (1).
 - Start assembling at the A portion.



682RW006

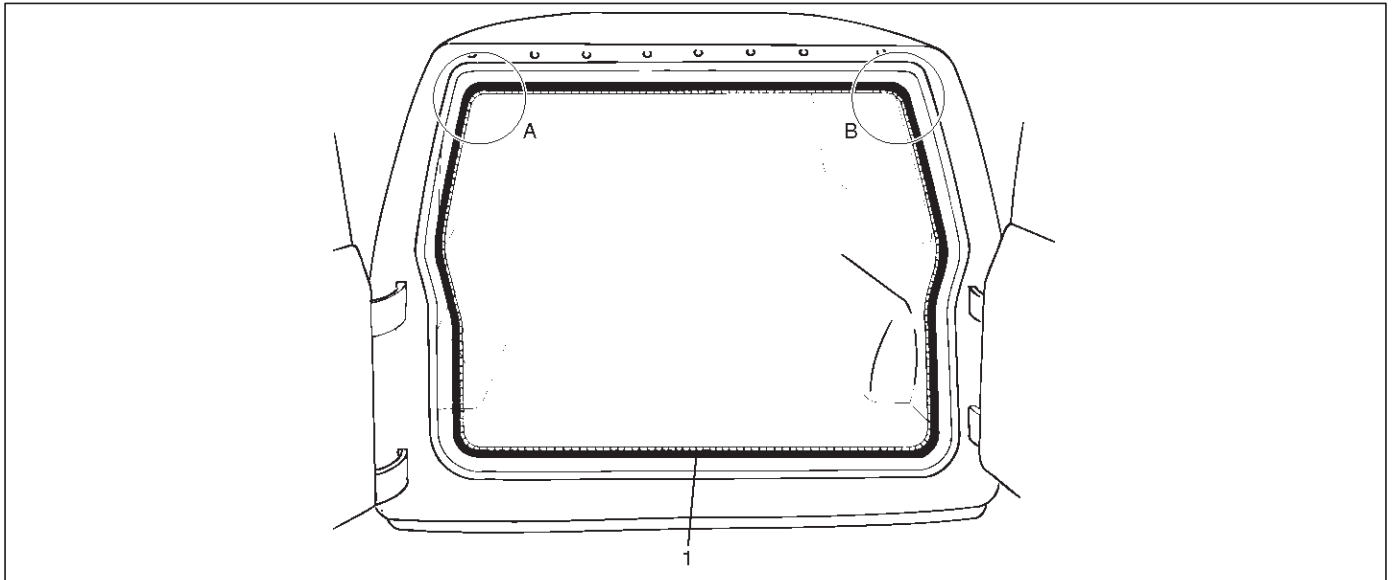


682RS004

- Clean the tailgate center weatherstrip (4) adhesive tape (2) and the butyl seal (3) fitting position of the tailgate panel.

Tailgate Main Weatherstrip

Parts Location



682RS005

Legend

- (1) Tailgate Main Weatherstrip
-

Removal

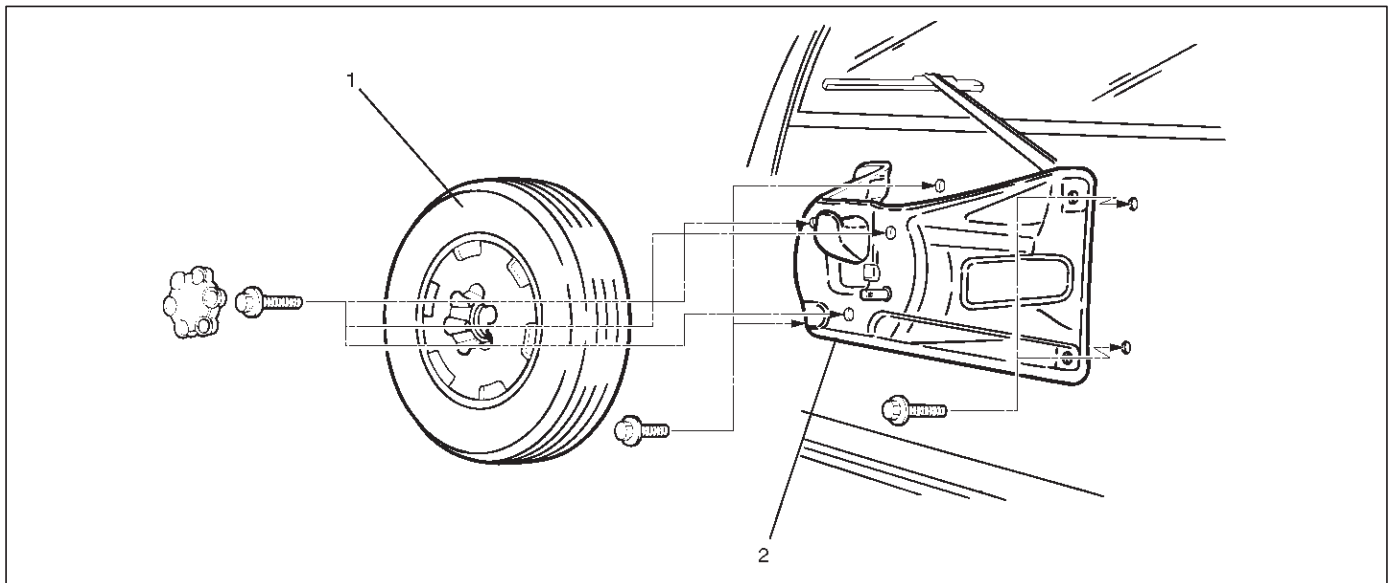
1. Remove tailgate main weatherstrip.
 - Pull the tailgate main weatherstrip out from the body panel.

Installation

1. Install the tailgate main weatherstrip.
 - Align the A and B positions to the corners of the body panel. Install the tailgate main weatherstrip to the body panel by gently tapping with a plastic hammer. There should be not clearance between the body panel the tailgate main weatherstrip.

Spare Tire Carrier

Parts Location



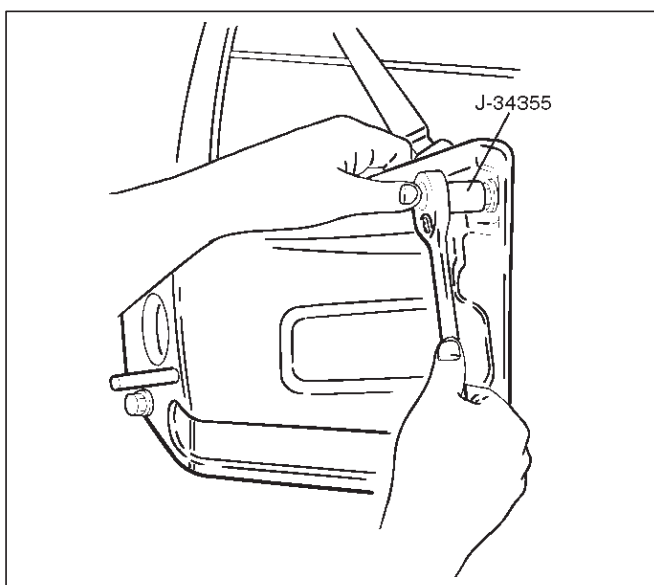
530RS001

Legend

- (1) Spare Tire
- (2) Spare Tire Carrier

Removal

1. Remove spare tire.
2. Remove spare tire carrier.
 - Remove the special bolts by using special tool (If so equipped).
 - Spare tire carrier bolt wrench 5-8840-2095-0 (J-34355).



530RS002

Installation

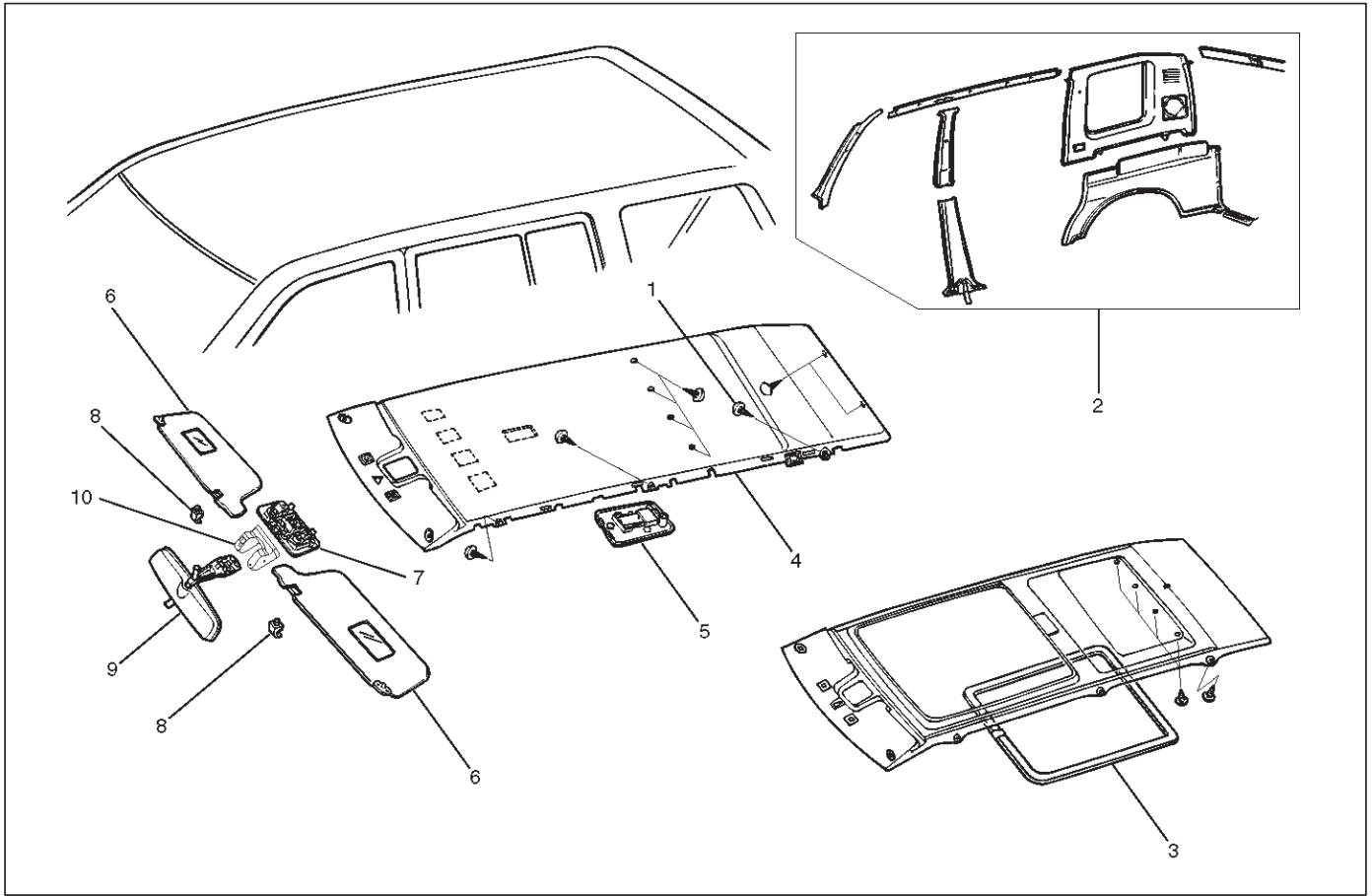
1. Install the spare tire carrier.
 - Tighten the carrier fixing bolts to the specified torque.

Torque : 31 N•m (3.2kg-m/23 lb ft)
2. Install the spare tire.
 - Tighten the spare tire fixing bolts to the specified torque.

Torque : 118 N•m (12.0kg-m/87 lb ft)

Headlining

Parts Location



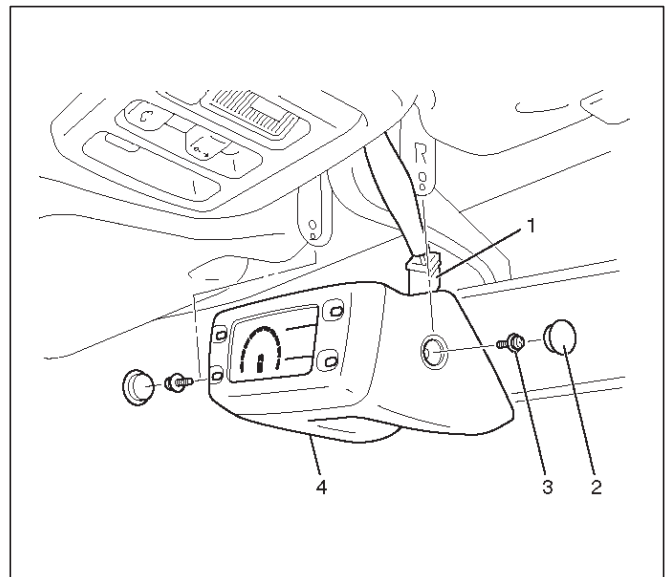
666RW003

Legend

- | | |
|------------------------------------|----------------------|
| (1) Clip | (6) Sunvisors |
| (2) Interior Trim Panels | (7) Map Light |
| (3) Sun Roof Finisher (W/Sun Roof) | (8) Sunvisor Holder |
| (4) Headlining | (9) Rear View Mirror |
| (5) Dome Light | (10) Multi Meter |

Removal

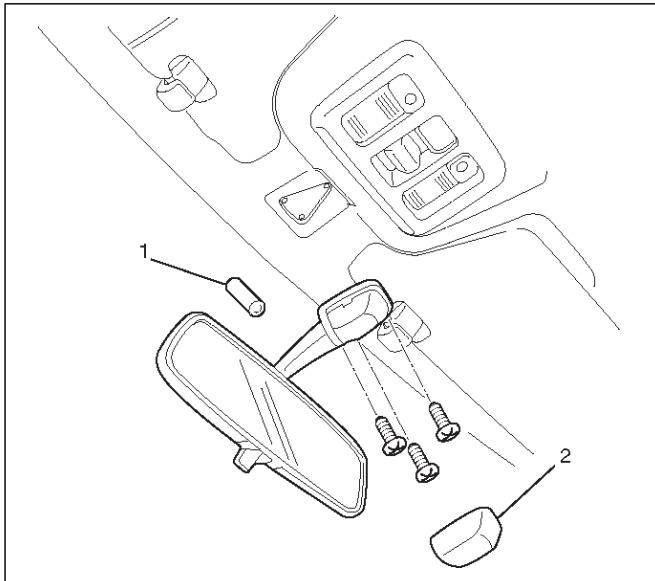
1. Disconnect the battery ground cable.
2. Remove interior trim panels.
 - Refer to Exterior / Interior Trim in this section.
3. Remove dome light.
 - Remove the dome light lens and the fixing screws.
 - Disconnect the dome light connectors.
4. Remove multi meter (4) (If so equipped).
 - Remove two caps (2), two screws (3) and disconnect the connector (1).



821RW241

5. Remove rear view mirror.

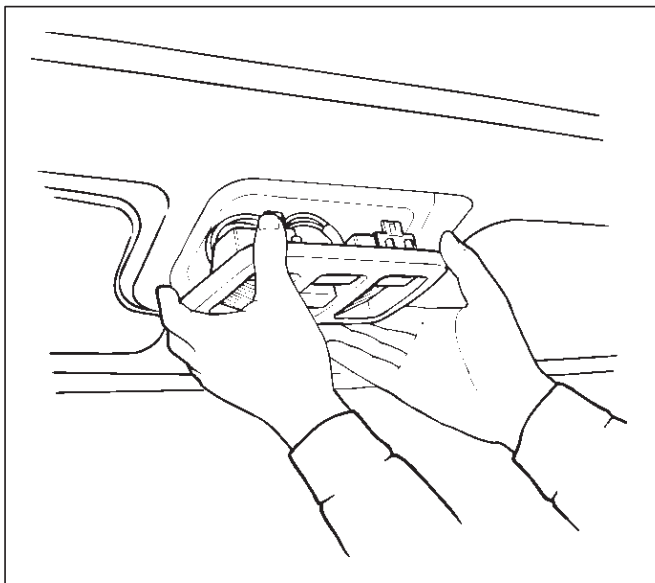
- Remove the rubber stopper (1).
- Pry off the mirror stay cover (2) and remove 3 screws.



720RW004

6. Remove map light/sun roof switch.

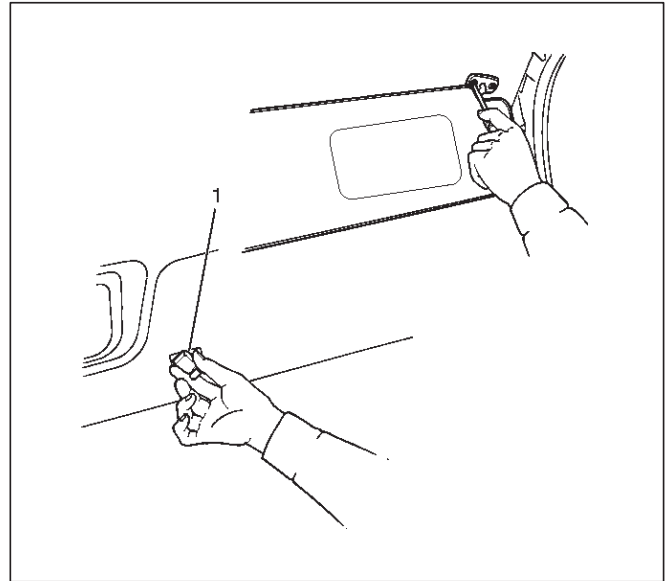
- Pry the map light clip free from the map light/sun roof switch bracket and disconnect the connector.



809RS001

7. Remove sunvisors.

- Remove the fixing screw and turn the sunvisor holder (1) to remove it.
- Disconnect the vanity mirror illumination connector.



743RW006

8. Remove sun roof finisher (W/Sun roof).

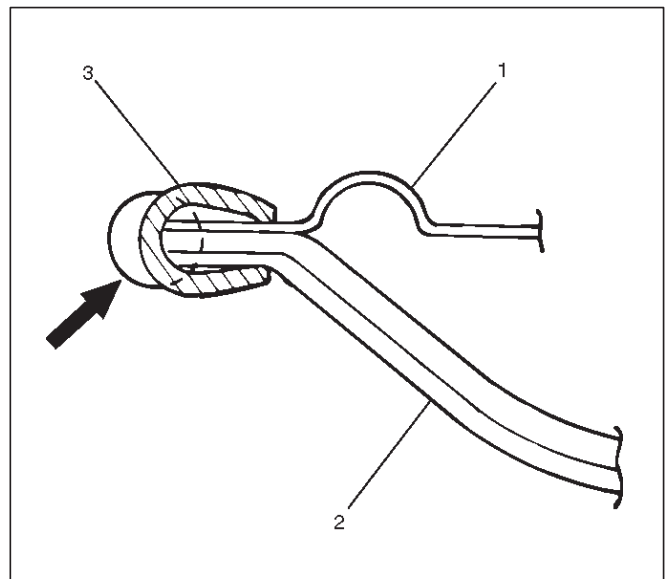
9. Remove headlining.

- Remove the headlining fixing clips.

Installation

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

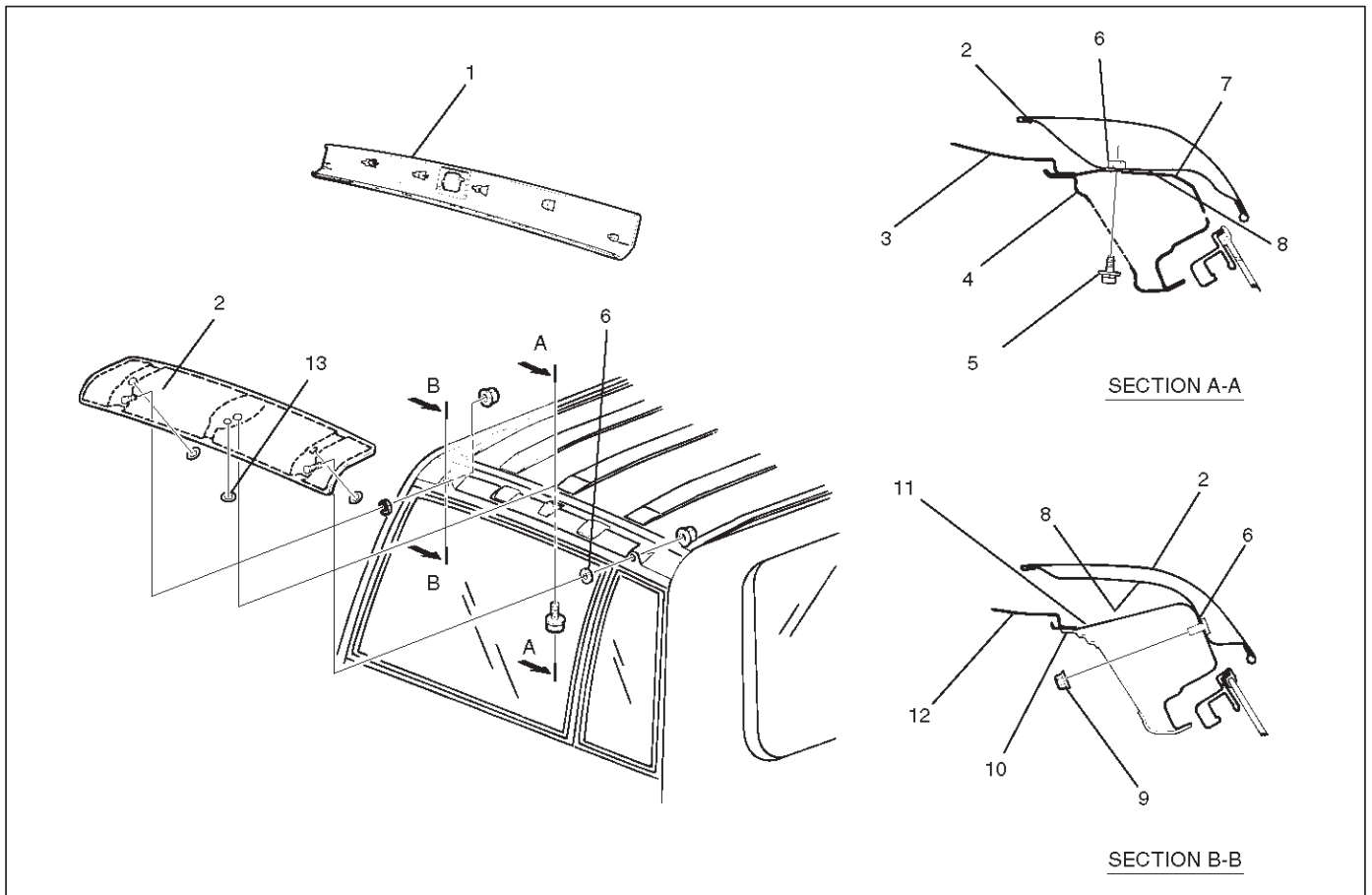
1. Install the headlining so that the fixing clips will not come off.
2. To install the sun roof finisher (3), first fit in at one place with the head lining (2) close to the sun roof frame complete (1), then install the entire finisher tightly by hitting it with a plastic hammer, not allowing it to move up.



666RS001

Rear Air Deflector

Parts Location



667RW001

Legend

- | | |
|--------------------------|--------------------------------------|
| (1) Rear Roof Trim Cover | (7) Rear Outer Roof Panel |
| (2) Rear Air Deflector | (8) Grommet |
| (3) Roof Rail | (9) Fixing Nut |
| (4) Rear Inner Roof Rail | (10) Rear Pillar Upper Reinforcement |
| (5) Fixing Bolt | (11) Rear Outer Roof Rail |
| (6) Nylon Washer | (12) Roof Panel |
| | (13) Grommet |

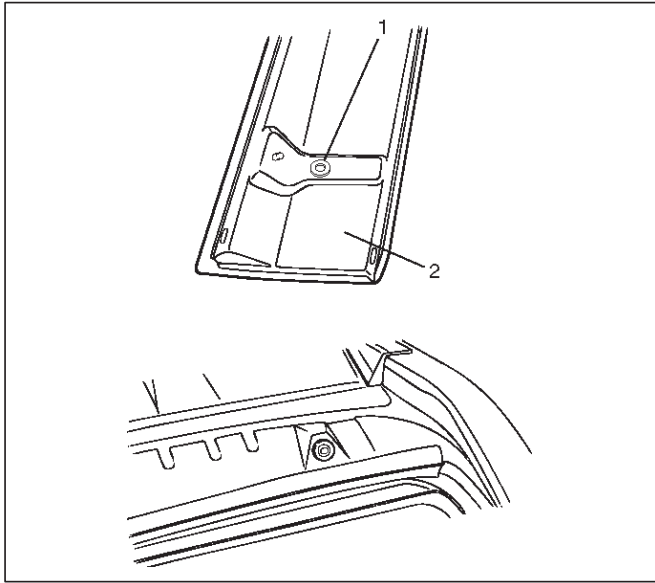
Removal

1. Disconnect the battery ground cable
2. Remove rear roof trim cover.
 - Refer to Exterior / Interior Trim in this section.
3. Remove rear air deflector.
 - Take notice of the grommet and the nylon washer.

Installation

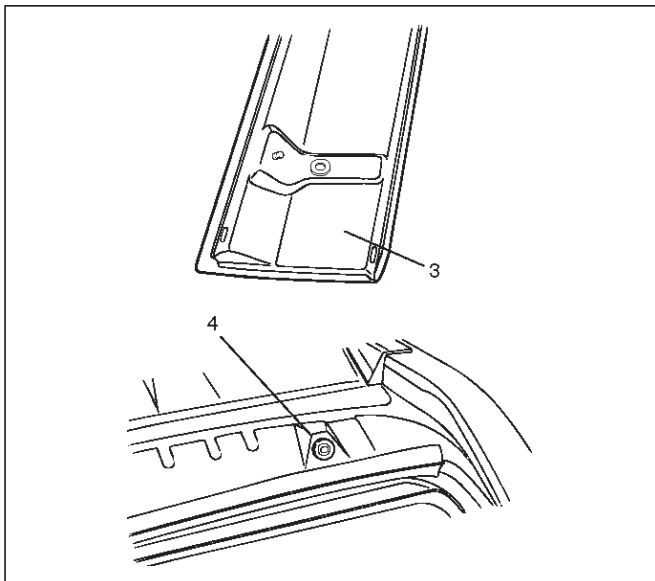
To install, follow the removal steps in the reverse order, noting the following points.

1. Install the grommet (1) to the air deflector (2) drain hole.



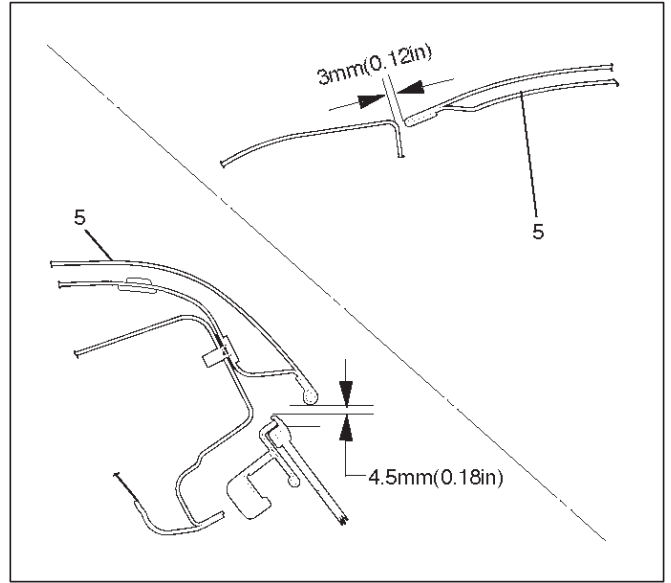
667RW002

2. Use a new nylon washer (4). Peel off the adhesive tape of the washer to install the nylon washer to the air deflector (3).



667RW004

3. Install the air deflector (5) to the roof by referring to the specified values shown in the illustration.



667RW003

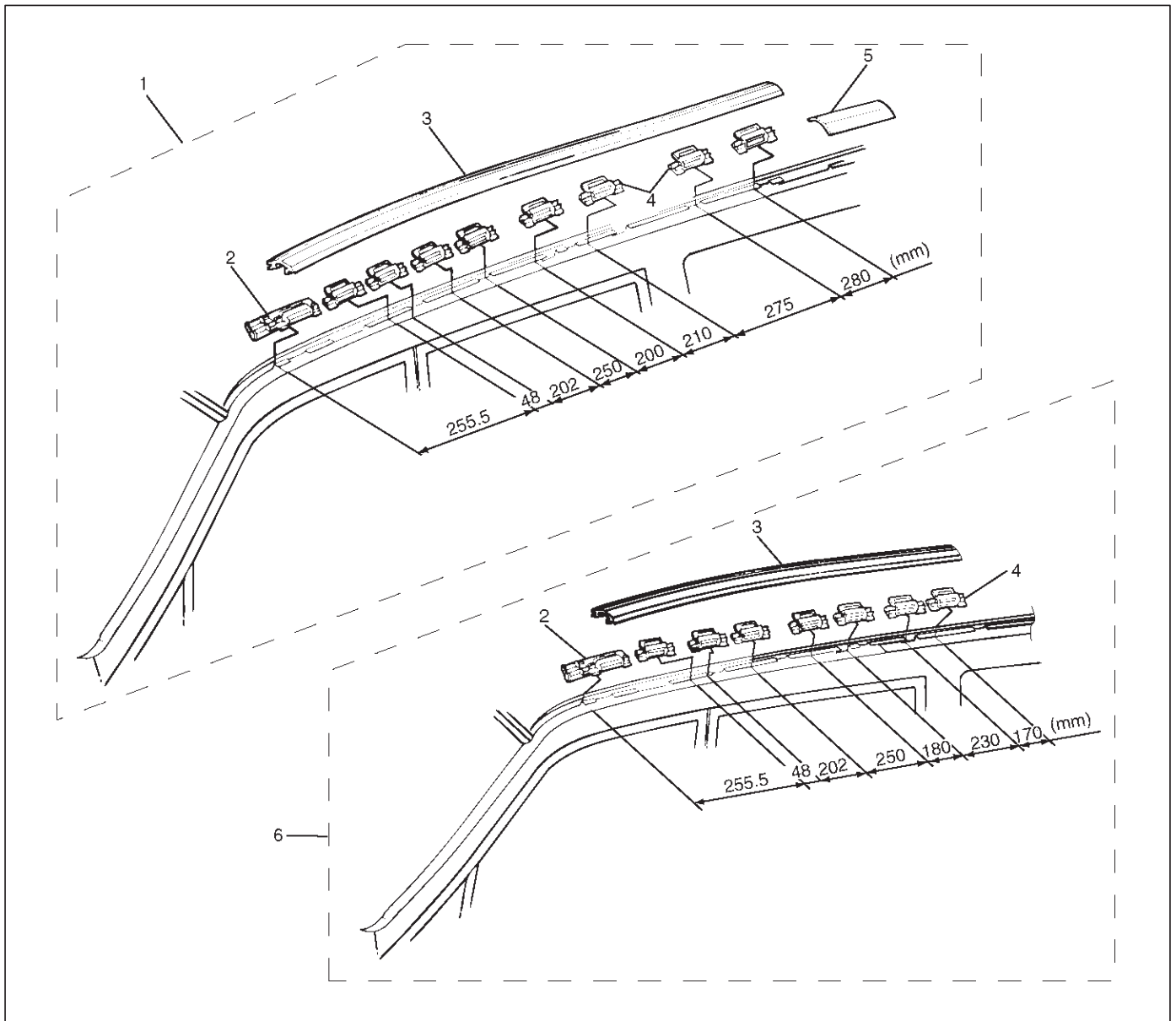
4. Tighten the deflector fixing to the specified torque.

Bolt Torque : 6 N•m (0.6kg-m/52 lb in)

Nut Torque : 8 N•m (0.8kg-m/69 lb in)

Roof Moulding

Parts Location



645RW009

Legend

- | | |
|---|------------------------|
| (1) L-W-B | (4) Moulding Roof Clip |
| (2) Windshield Side Moulding Upper Clip | (5) Roof End Moulding |
| (3) Roof Mounting | (6) S-W-B |

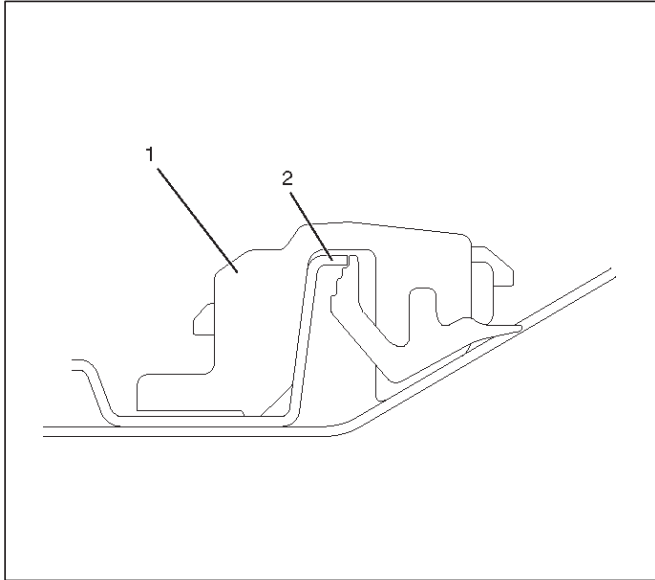
Removal

1. Disconnect the battery ground cable.
2. Remove roof moulding.
3. Remove roof end moulding.
 - Remove the sealing adhesive and the adhesive tape of the roof end moulding from the panel using a knife or scraper while you peel them off.
4. Remove moulding roof clips.

Installation

1. Install the moulding roof clips (1).

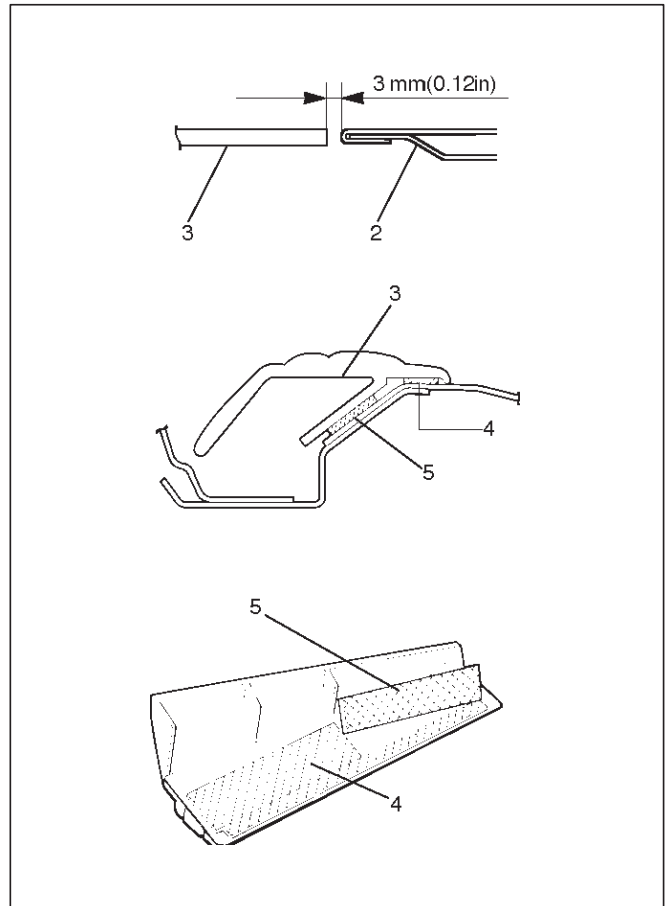
- Install the clips on roof panel flange (2) to refer the illustration.



645RW003

2. Install the roof end moulding (3).

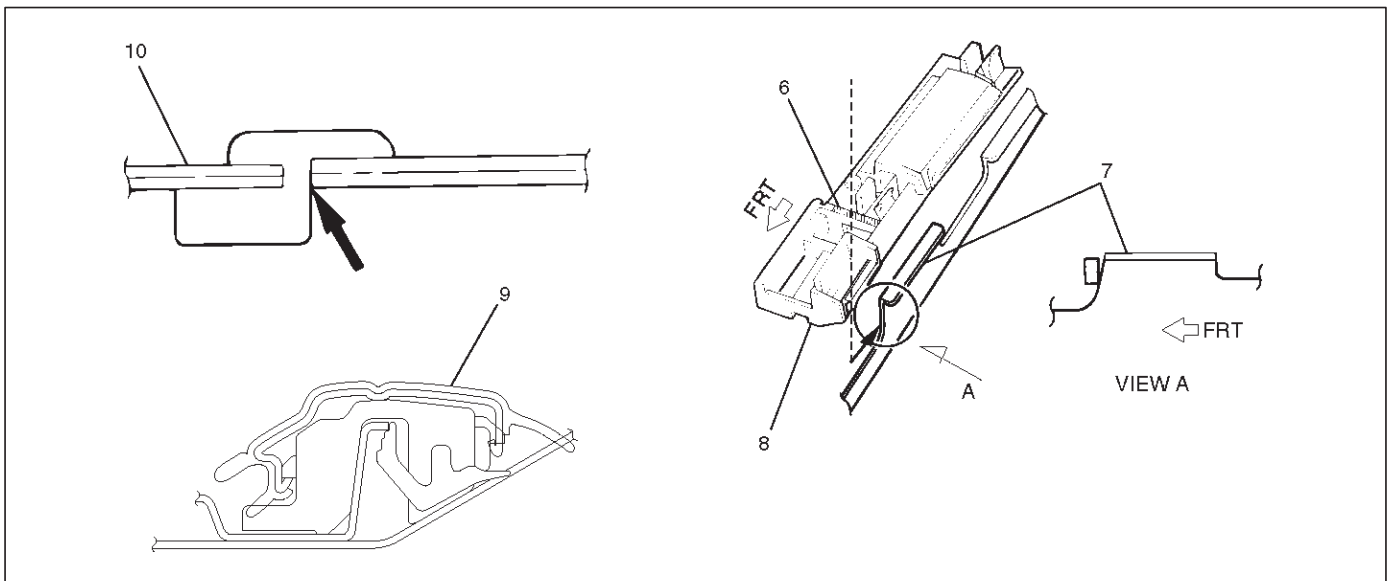
- Clean the body panel where the roof end moulding is installed.
- Install the roof end moulding and the rear air deflector (2) so that the installation clearance between them is within the specified values. Securely fix it with the adhesive tape (4) and sealing adhesive (5).



645RW001

3. Install the roof moulding (9).

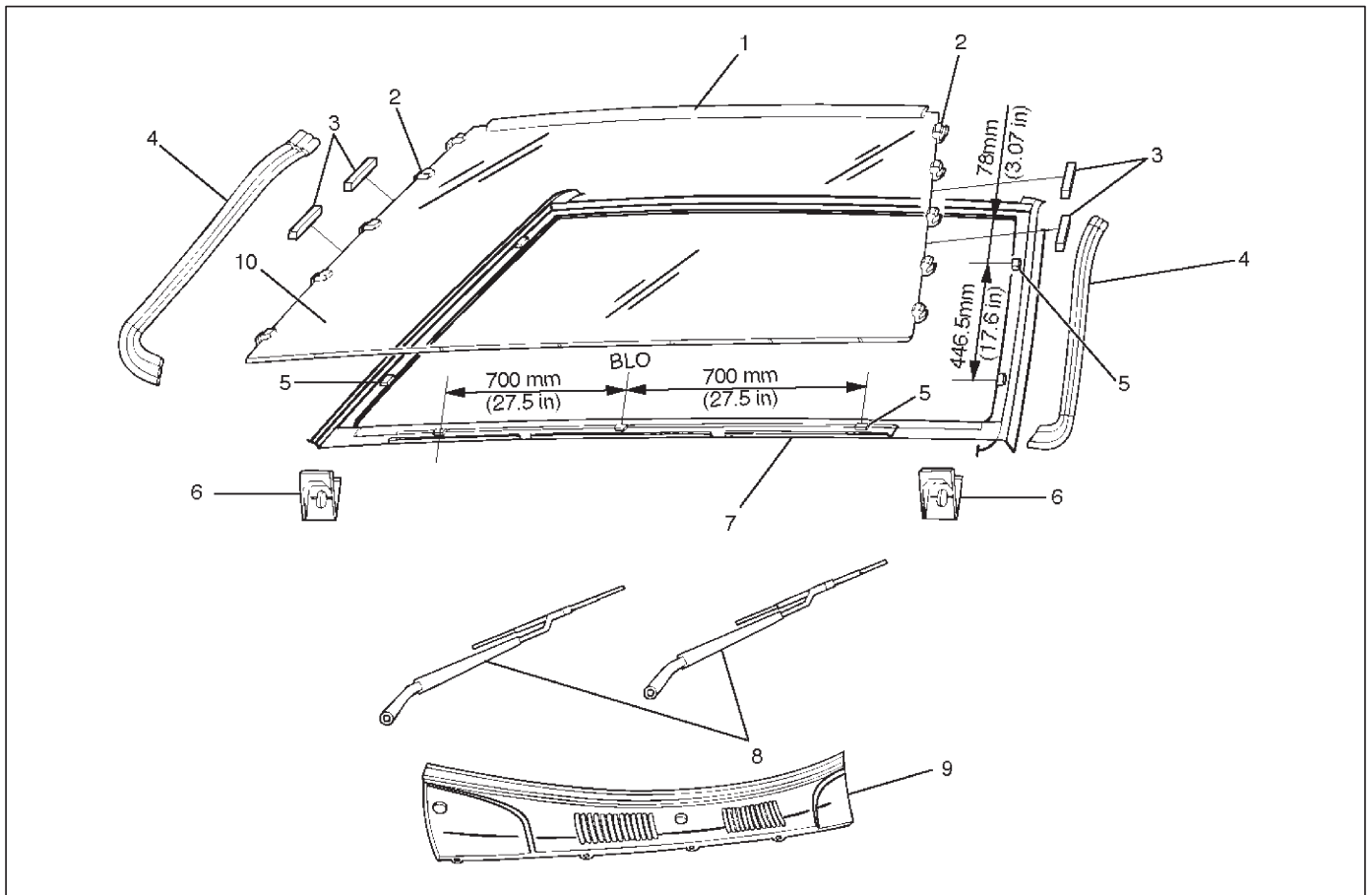
- Assemble the windshield side moulding upper clip (8) to the roof panel with the clip positioning rib (6) (oblique lines portion) attached to the roof panel flange (7). Assemble the roof moulding (9) while you attach the front edge portion of the roof moulding to the windshield side moulding (10).



645RW005

Windshield

Parts Location



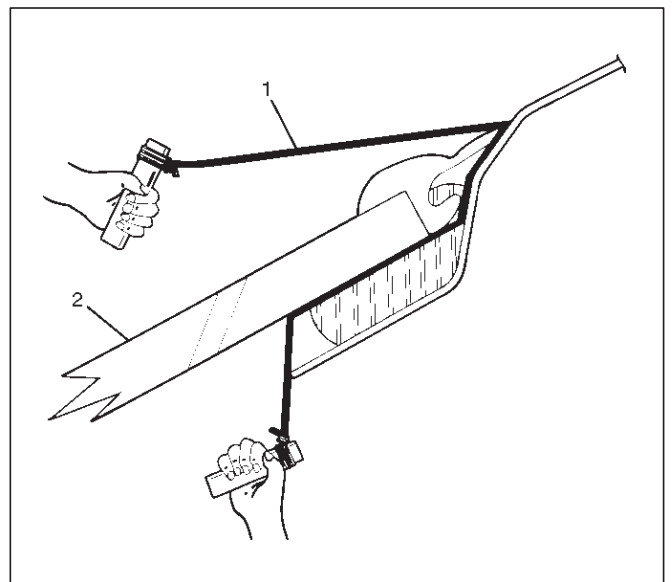
607RW006

Legend

- | | |
|-------------------------------|----------------------------|
| (1) Windshield Upper Moulding | (6) Windshield Support |
| (2) Moulding Clip | (7) Cowl Upper Rail Flange |
| (3) Windshield Side Seal | (8) Windshield Wiper |
| (4) Windshield Side Moulding | (9) Front Cowl Cover |
| (5) Spacer | (10) Windshield |

Removal

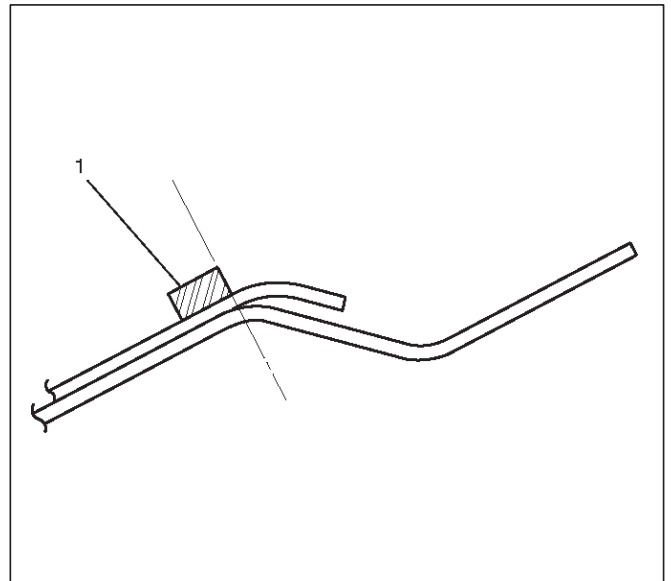
1. Disconnect the battery ground cable.
2. Remove windshield wiper.
 - Refer to Wiper/Washer System section.
3. Remove front cowl cover.
 - Refer to Cowl Cover removal steps in this section.
4. Remove windshield side moulding.
 - Pull the moulding out from the windshield side moulding clip.
5. Remove windshield support.
6. Remove windshield side seal.
7. Remove windshield (2).
 - Use a knife to cut through part of the adhesive caulking material.
 - Secure one end of a piece of steel piano wire (1) (0.02 inches in diameter) to a piece of wood that can serve as a handle.



607RS002

- Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the windshield glass.
 - Secure the other end of the piano wire to another piece of wood.
 - With the aid of an assistant, carefully move the piano wire with a sawing motion to cut through the adhesive caulking material around the entire circumference of the windshield glass.
 - Clean the remaining adhesive caulking material from the area of the body which holds the windshield.
8. Remove windshield upper moulding.
- Taking notice of the adhesive tape, and peel the moulding off the windshield upper portion.
9. Remove moulding clip.
10. Remove spacer.

- When installing the spacers, align the lower side spacer to the R stop of the body panel and the side spacer to the end of the body panel. Be sure to always use a new spacer.

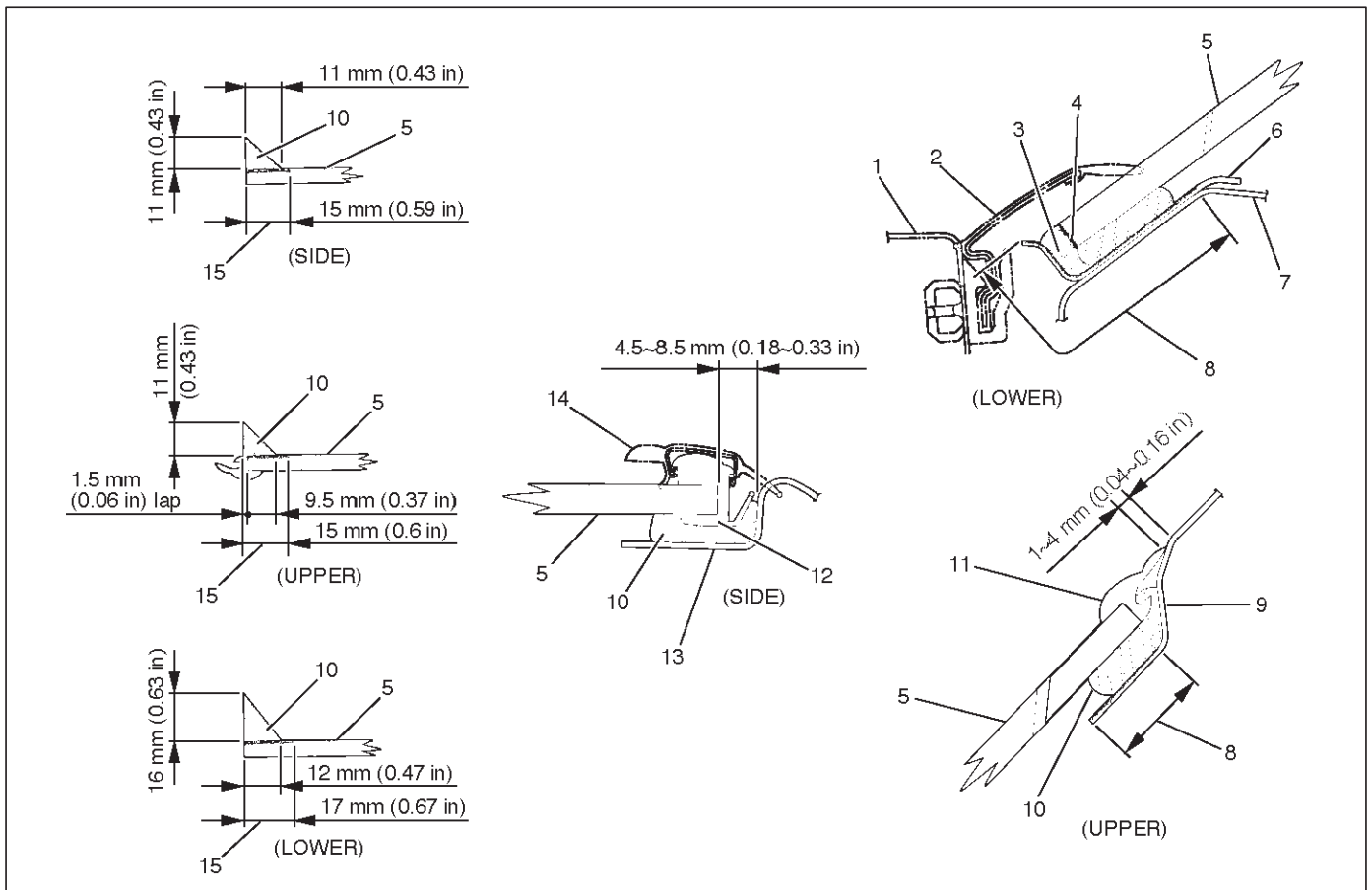


607RS003

- Be absolutely sure to apply glass primer and body primer to the body panel as shown in the illustration.

Installation

1. Install the spacer (1).
- Clean the bonding surfaces of both the windshield and the body panel.



607RW005

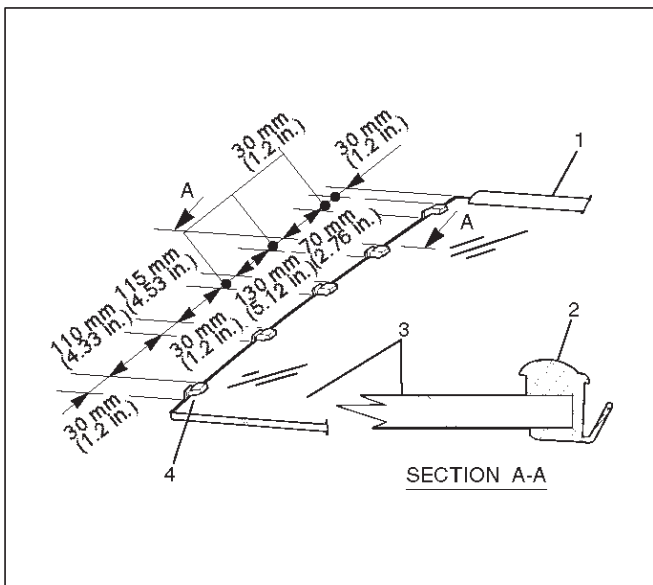
8F-98 BODY STRUCTURE

Legend

- | | |
|---|--------------------------------|
| (1) Front Cowl Cover | (7) Cowl Upper Panel |
| (2) Windshield Lower Moulding | (8) Body Primer |
| (3) The portion of the cowl upper rail flange where sealing adhesive is additionally filled | (9) Roof Panel |
| (4) Apply primer to the glass and portion where sealing adhesive is additionally filled | (10) Sealing Adhesive |
| (5) Windshield | (11) Windshield Upper Moulding |
| (6) Cowl Upper Rail | (12) Moulding Clip |
| | (13) Front Pillar Outer Panel |
| | (14) Windshield Side Moulding |
| | (15) Sealing Adhesive |

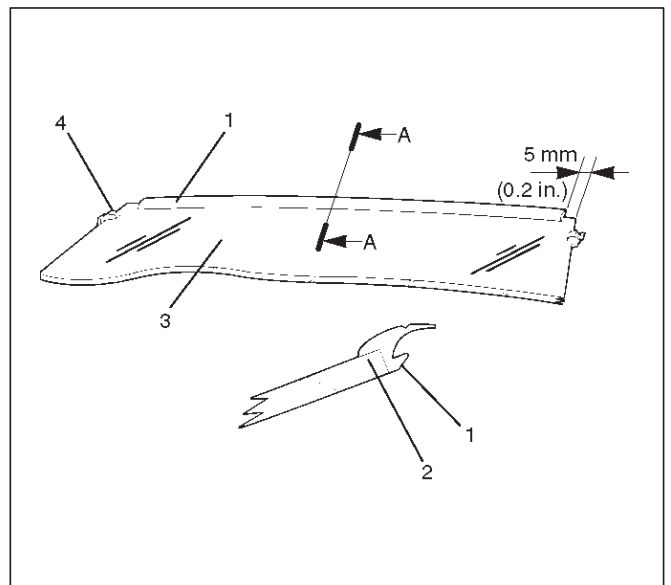
2. Install the moulding clip (2).

- Install new moulding clips to the fixed position of the windshield (3).
- Always use new moulding clips (4).

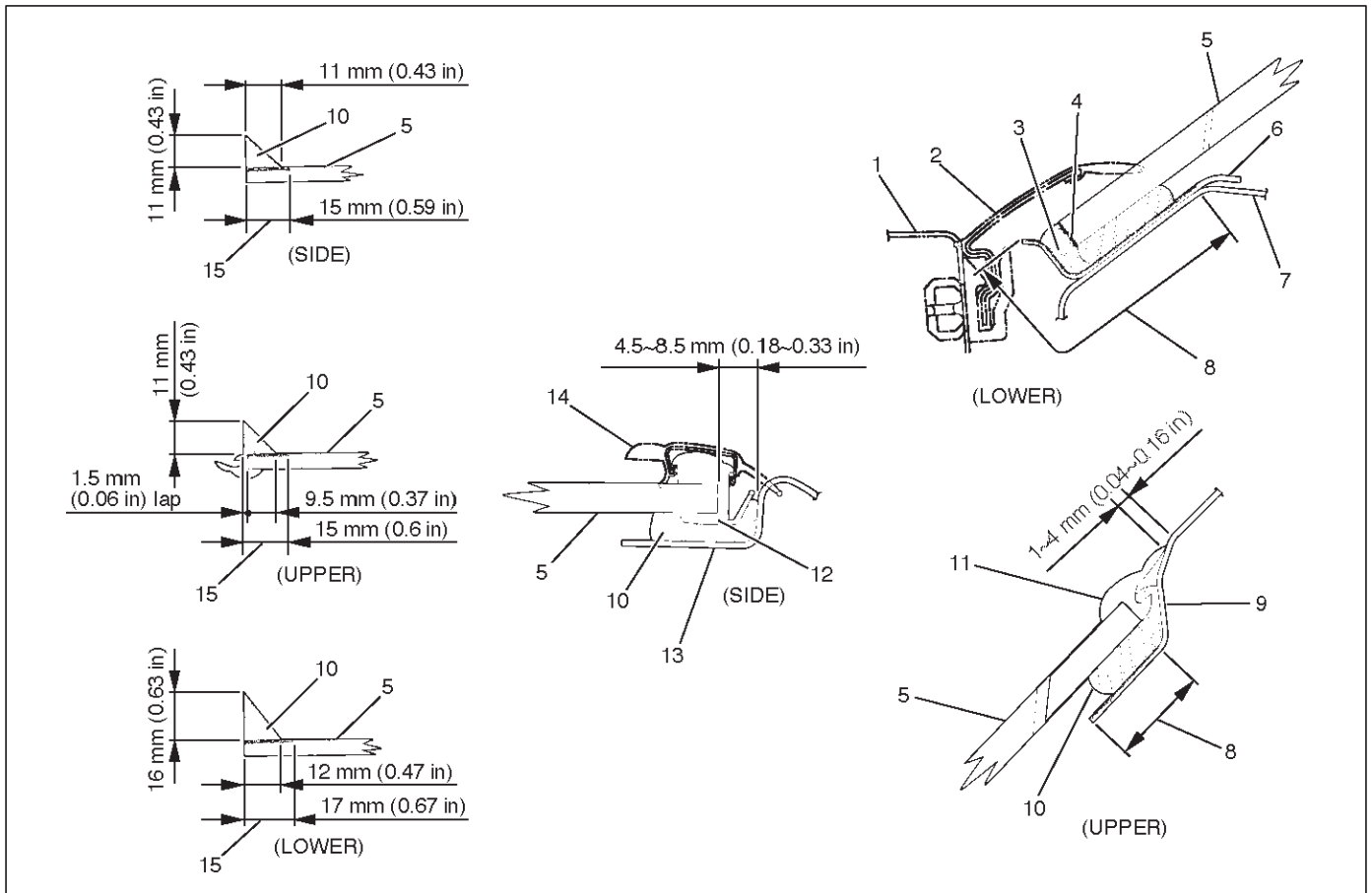


3. Install the windshield upper moulding (1).

- Peel off the adhesive tape (2) and install the moulding to the fixed position of the windshield (3).
- Always use new upper moulding (1).



4. Install the windshield.



607RW005

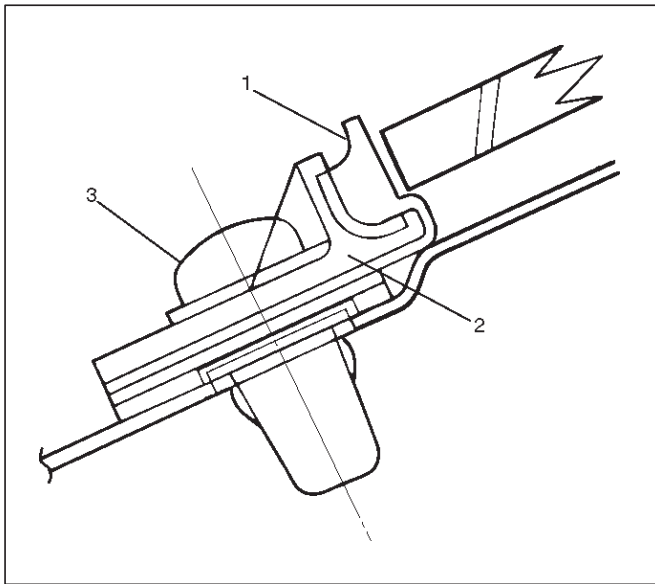
Legend

- | | |
|---|--------------------------------|
| (1) Front Cowl Cover | (7) Cowl Upper Panel |
| (2) Windshield Lower Moulding | (8) Body Primer |
| (3) The portion of the cowl upper rail flange where sealing adhesive is additionally filled | (9) Roof Panel |
| (4) Apply primer to the glass and portion where sealing adhesive is additionally filled | (10) Sealing Adhesive |
| (5) Windshield | (11) Windshield Upper Moulding |
| (6) Cowl Upper Rail | (12) Moulding Clip |
| | (13) Front Pillar Outer Panel |
| | (14) Windshield Side Moulding |
| | (15) Sealing Adhesive |

5. Install the windshield side seal.

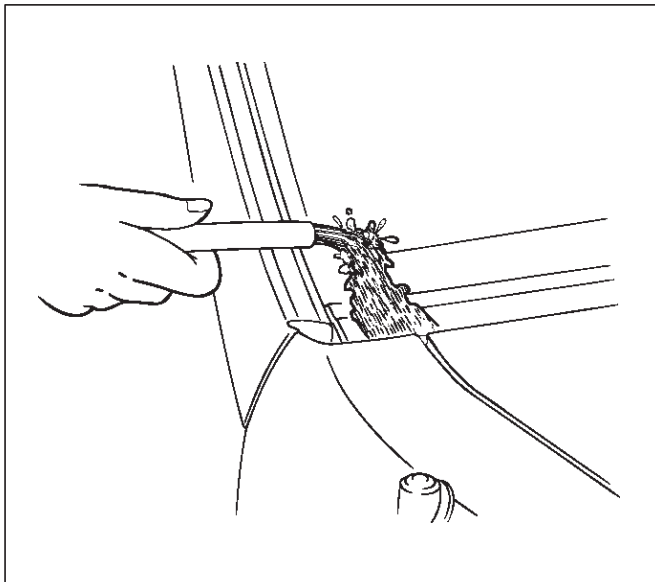
8F-100 BODY STRUCTURE

6. Install the windshield support (2).



631RS014

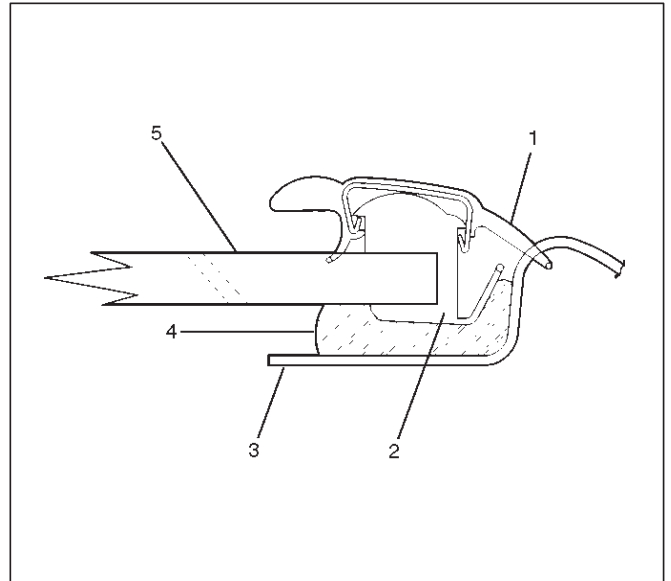
- Apply a sealing adhesive to the circumference of the windshield.
- Apply the sealing adhesive to the frange portion of the cowl upper rail.
- Adjust the gap clearance of the windshield.
- Install the windshield to the body panel by applying pressure to the windshield.
- Cure the adhesive at a temperature of 20~30°C (68~86°F) for 24 hours.
- Check that the windshield does not leak water.



607RS007

7. Install the windshield side moulding.

- Insert the windshield (5) side moulding (1) into the moulding clip (2).

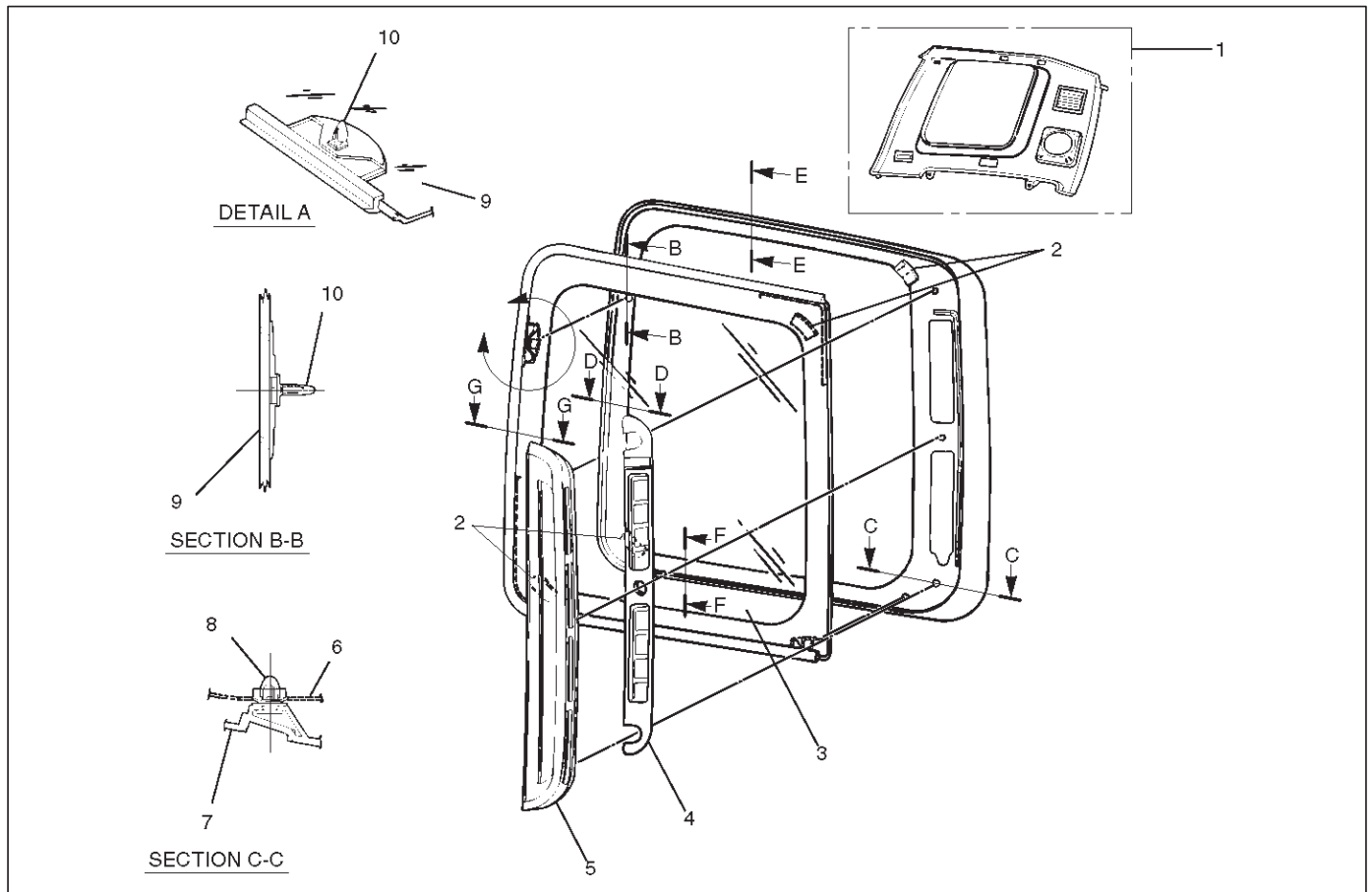


607RS008

- Take care not to damage the side moulding when you install it.
8. Install the front cowl cover.
9. Install the windshield wiper.

Rear Quarter Side Glass

Parts Location



641RS005

Legend

- | | |
|-----------------------------------|-----------------------------|
| (1) Rear Quarter Upper Trim Panel | (6) Side Outer Panel |
| (2) Fastener | (7) Ventilation Assembly |
| (3) Rear Quarter Side Glass | (8) Ventilation Fixing Clip |
| (4) Valve Assembly | (9) Rear Quarter Side |
| (5) Ventilation Assembly | (10) Glass Fixing Clip |

Removal

1. Disconnect the battery ground cable.
2. Remove rear quarter upper trim panel.
 - Refer to Exterior / Interior Trim in this section.
3. Remove ventilation assembly.
4. Remove valve assembly.
 - Refer to Exterior / Interior Trim in this section.
5. Remove rear quarter side glass.
 - Refer to Windshield removal procedure in this section.

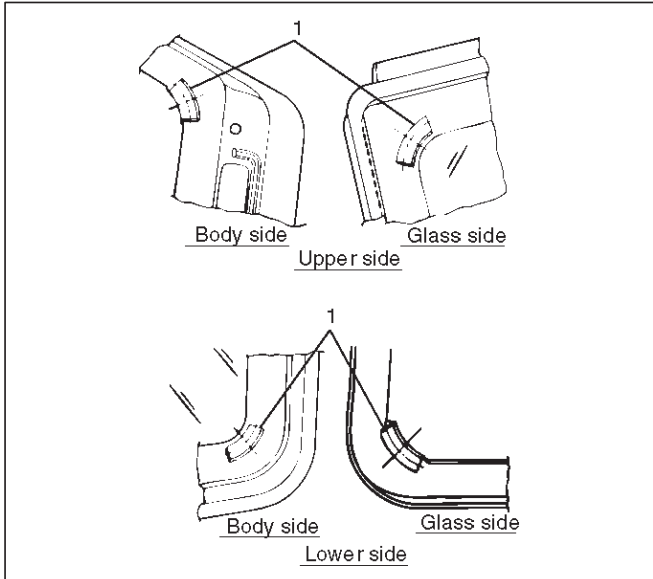
8F-102 BODY STRUCTURE

Installation

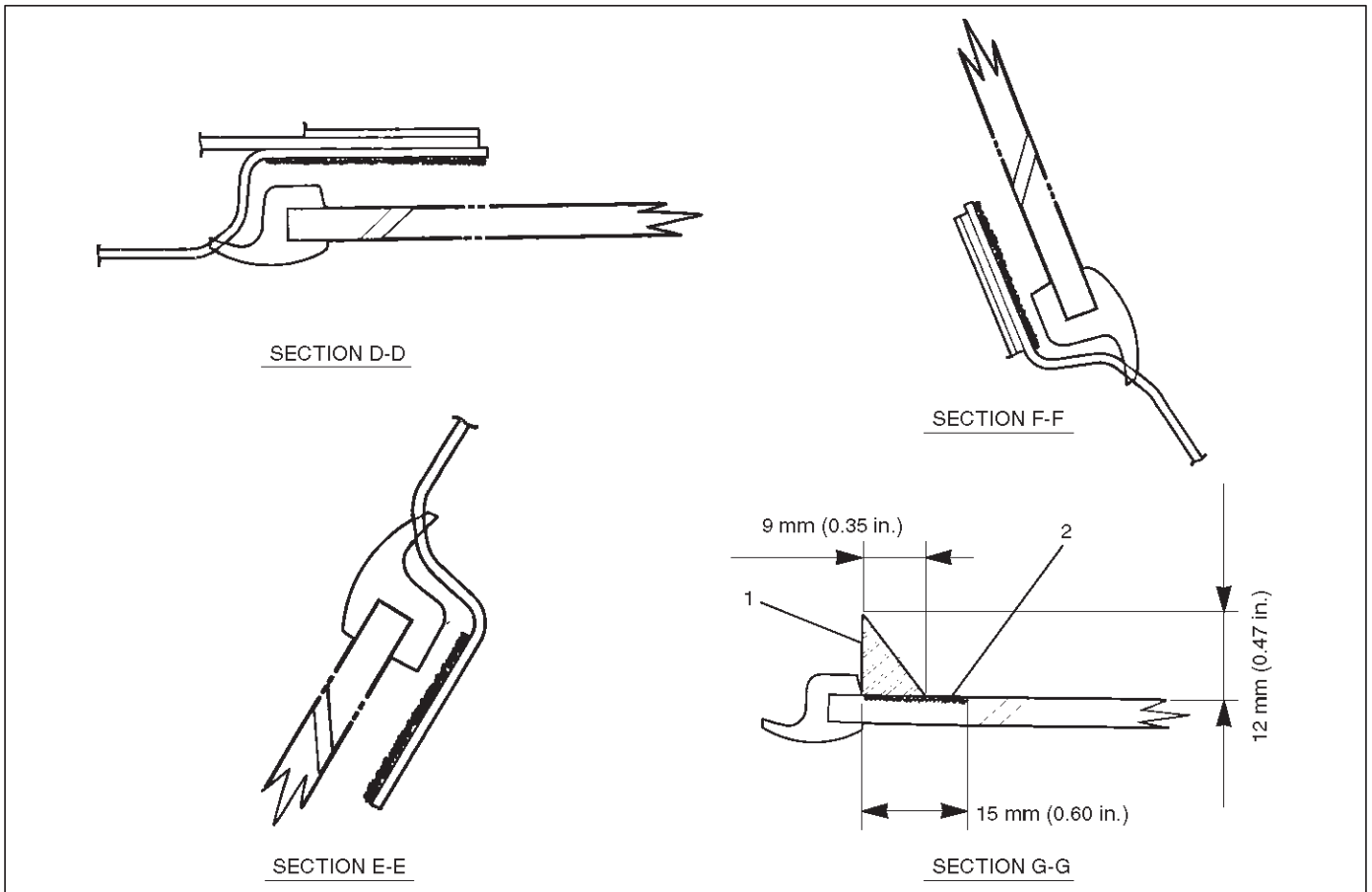
1. Install the rear quarter side glass.

- Clean the bonding surfaces of both the glass and the body panel.
- Install the fasteners (1) to the fixed positions of the glass and the body panel.

- Always use new fasteners.
- Be absolutely sure to apply glass primer (2) to the side glass.
- Apply a sealing adhesive (1) to the glass circumference.

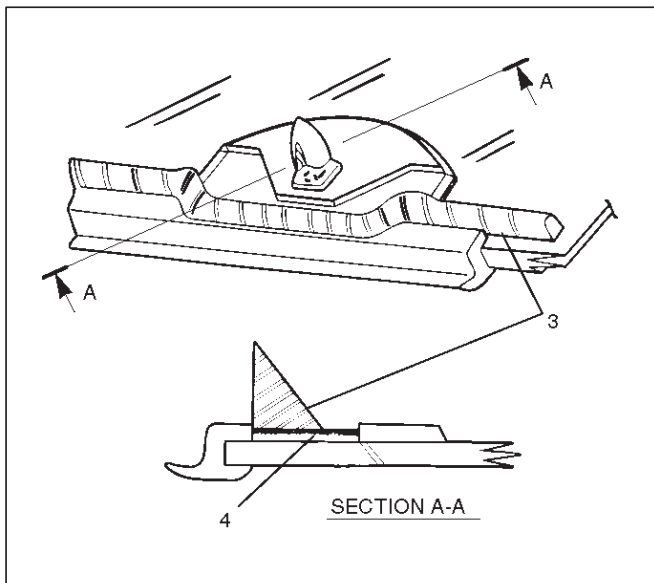


641RS006



641RS007

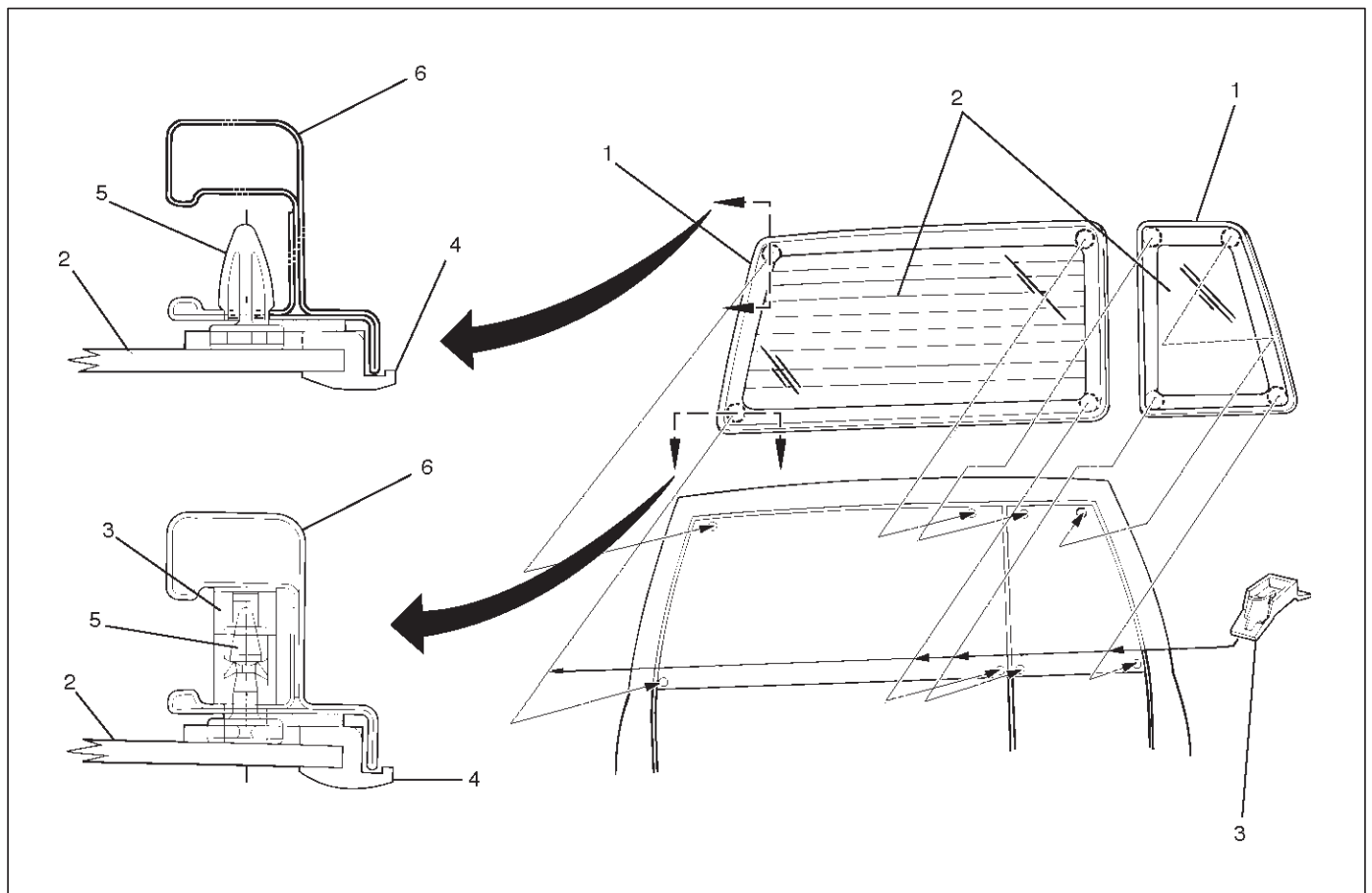
- Apply PVC primer (4) to the A clip portion.



- Insert the fixing clip on the side glass into the body panel.
 - Push the side glass against the body panel and bond them.
 - Cure the adhesive at a temperature of 20~30°C (68~86°F) for 24 hours.
 - Check that the rear quarter side glass does not leak water.
2. Install the valve assembly.
 3. Install the ventilation assembly.
 4. Install the rear quarter upper trim panel.

Tailgate Glass

Parts Location



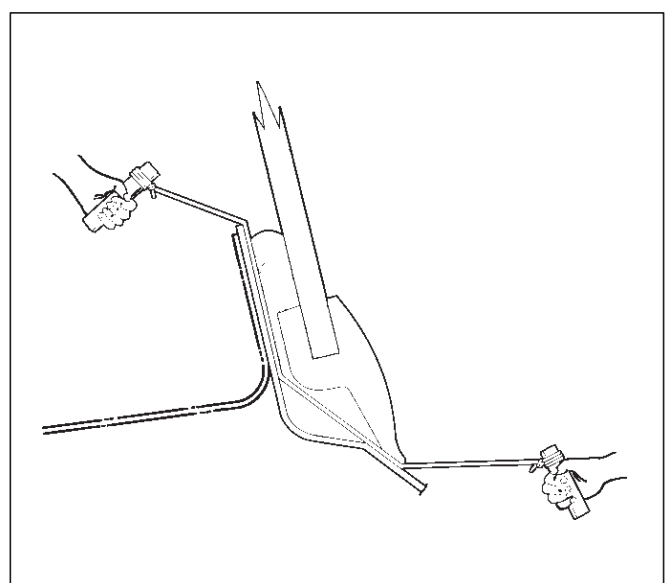
682RW008

Legend

- | | |
|-----------------------------|--------------------|
| (1) Tailgate Glass Moulding | (4) Glass Moulding |
| (2) Tailgate Glass | (5) Clip |
| (3) Tailgate Glass Clip | (6) Body Panel |

Removal

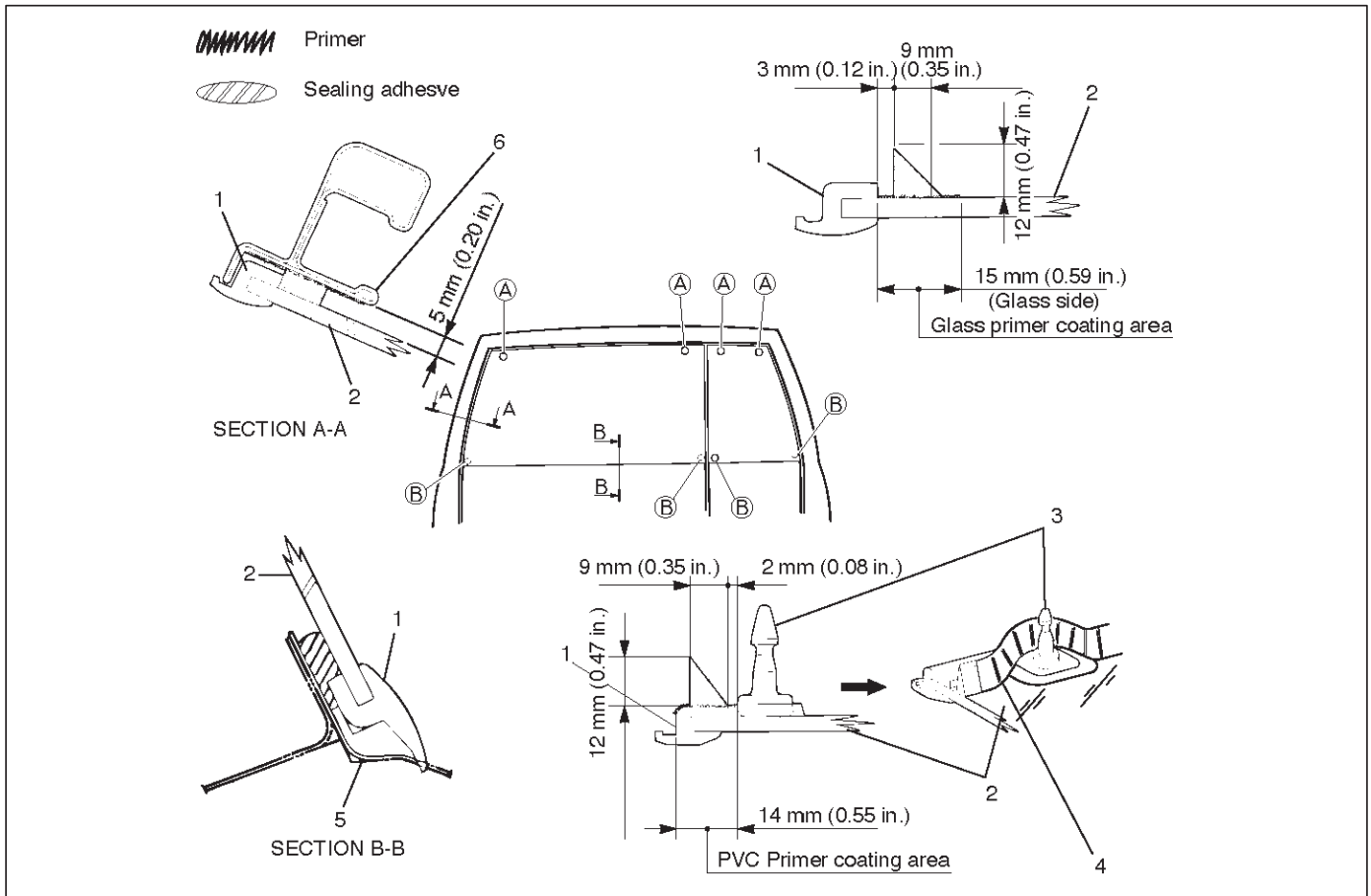
1. Remove battery ground cable.
2. Remove tailgate trim panel.
3. Remove tailgate sash trim cover (RH only).
 - Remove the tailgate frame cover. Refer to Exterior / Interior Trim in this section
4. Remove tailgate glass.
 - Refer to Windshield removal procedure in this section.



682RS007

5. Remove tailgate glass clip.

Installation



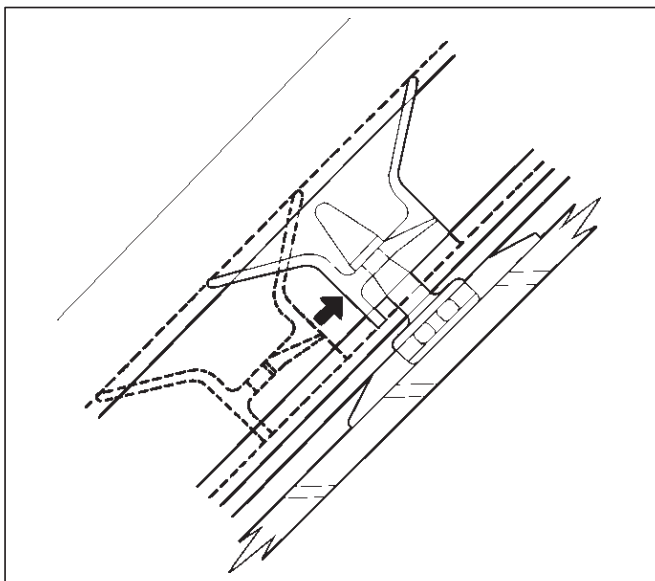
682RW009

Legend

- (1) Glass Moulding
- (2) Tailgate Glass
- (3) Clip

- (4) Sealing Adhesive
- (5) Body Panel
- (6) Tailgate Frame

1. Install the tailgate glass clip.



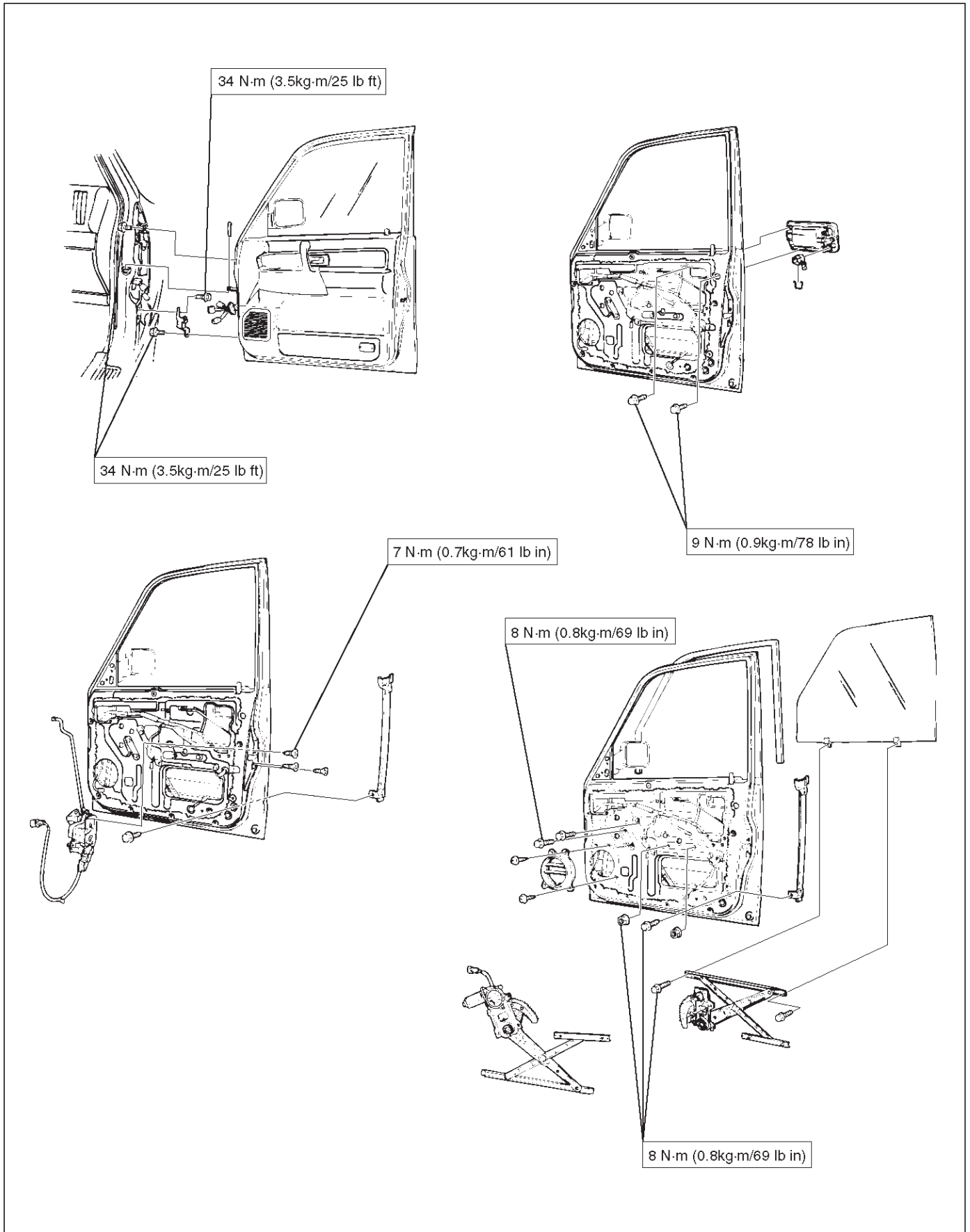
682RS008

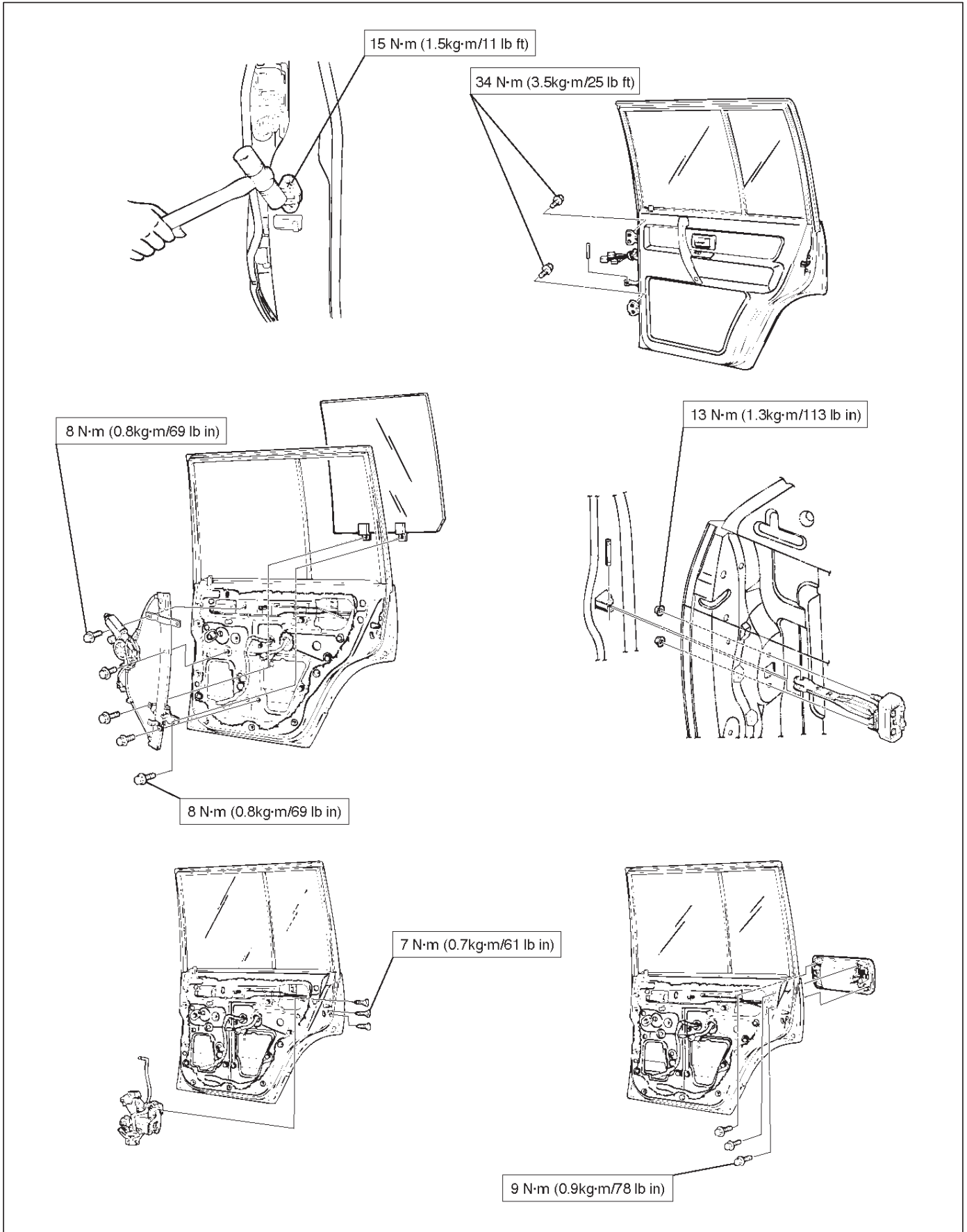
2. Install the tailgate glass (2).

- Clean the bonding surfaces of both the tailgate glass and the tailgate panel.
- Be absolutely sure to apply glass primer to the tailgate glass and PCV primer to the glass moulding (1).
- Apply a sealing adhesive to the circumference of the tailgate glass as shown.
- Insert the clip of the tailgate glass A portion into the tailgate panel hole to position the glass.
- Install the new tailgate glass clip to the clip of the tailgate glass B portion while sliding it, and bond the glass to the tailgate panel by applying pressure. Always use new tailgate glass clips.
- Cure the bonding at a temperature of 20~30°C (68~86°F) for 24 hours.
- Check that the tailgate glass does not leak water.

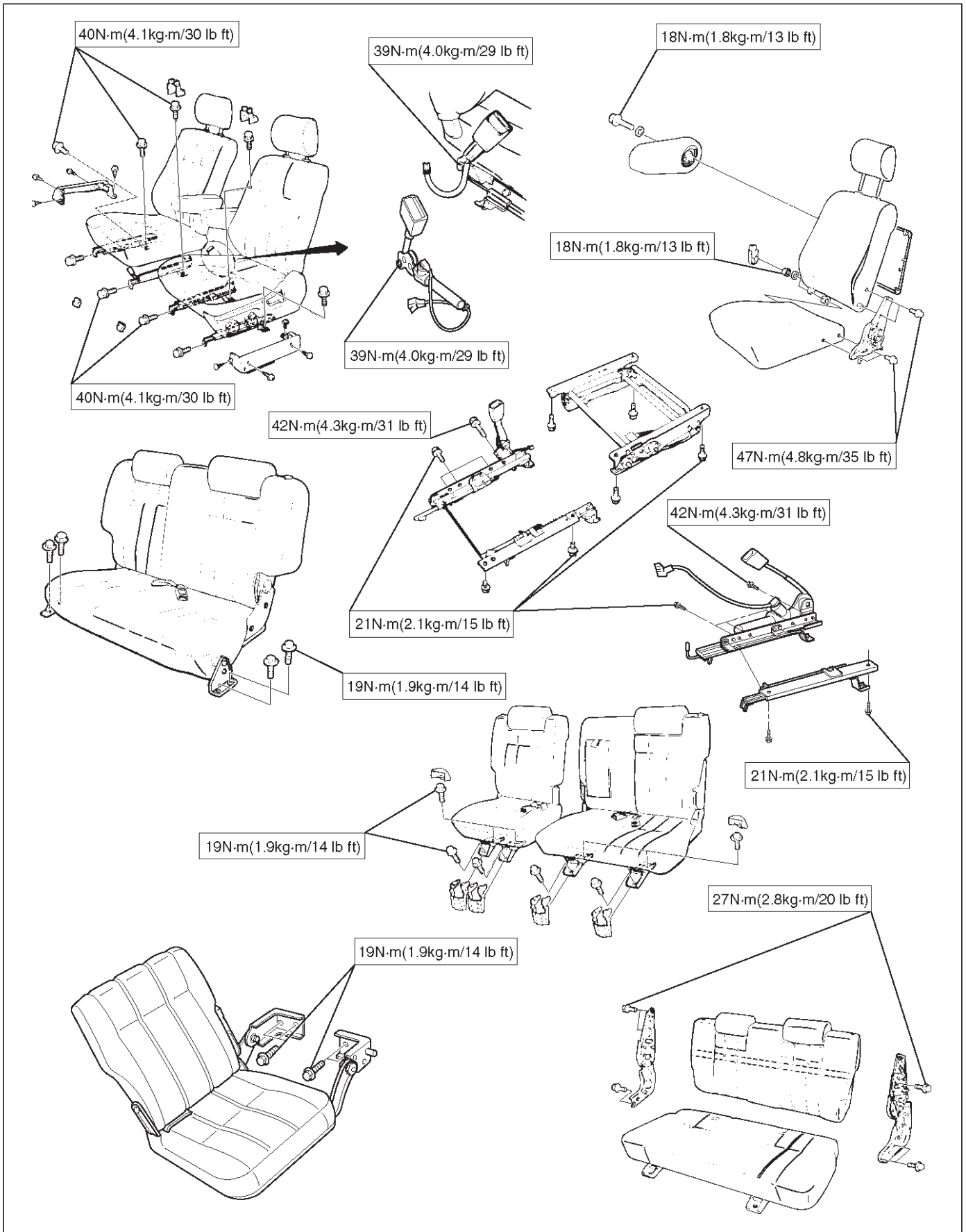
Main Data and Specifications

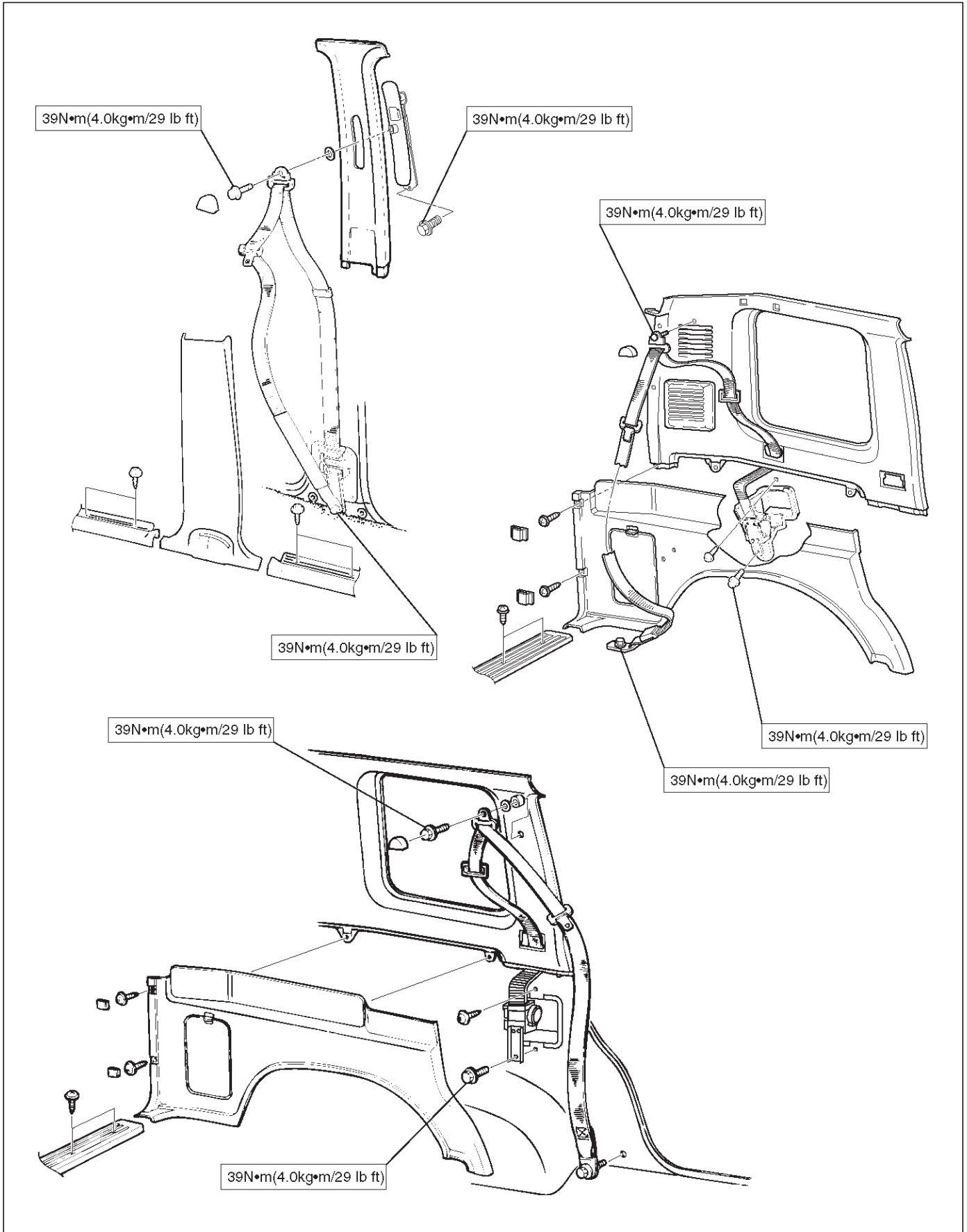
Torque Specifications



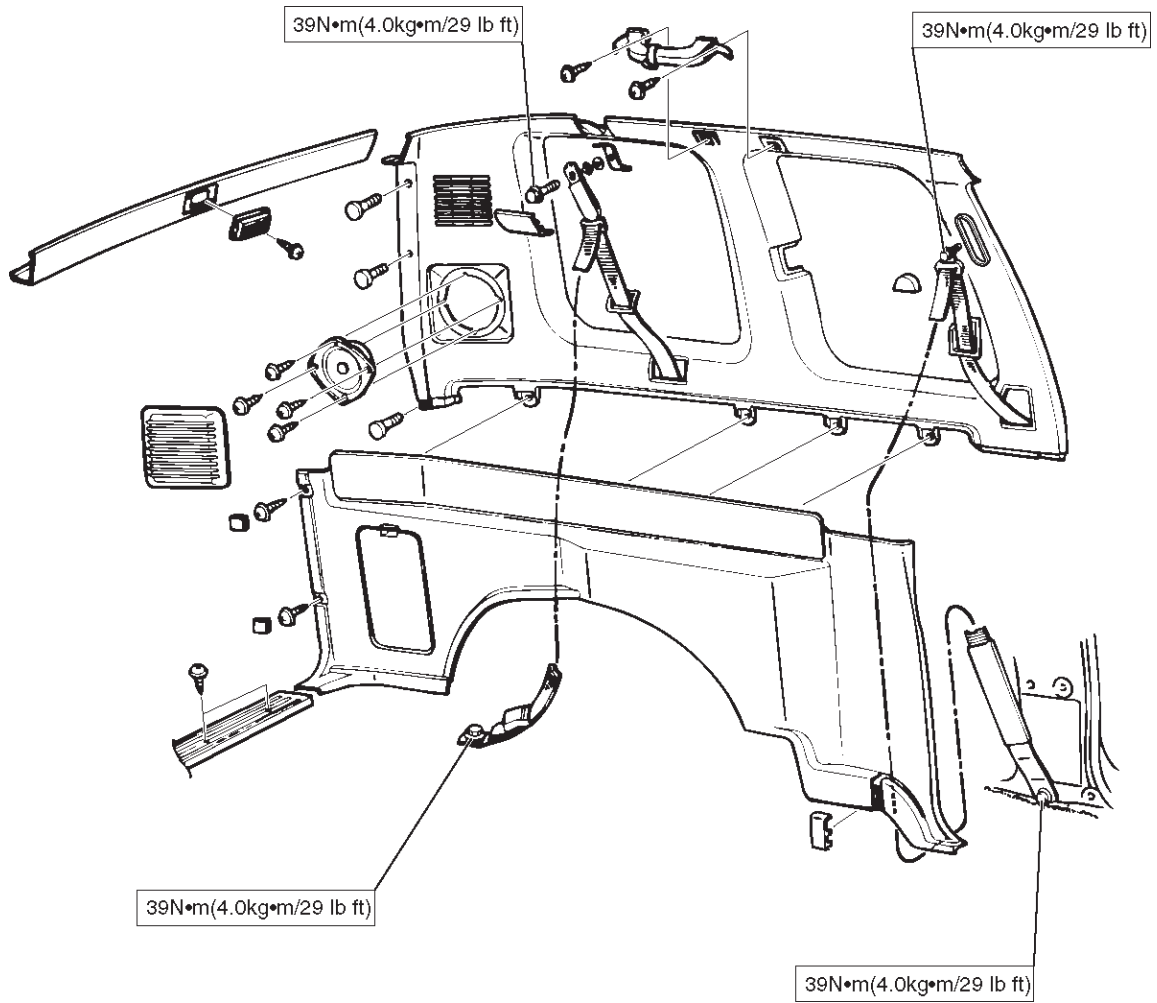


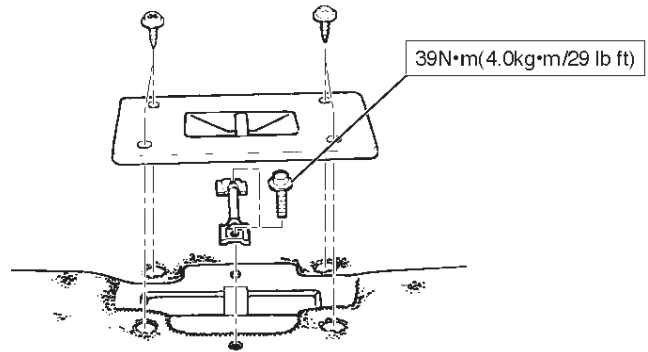
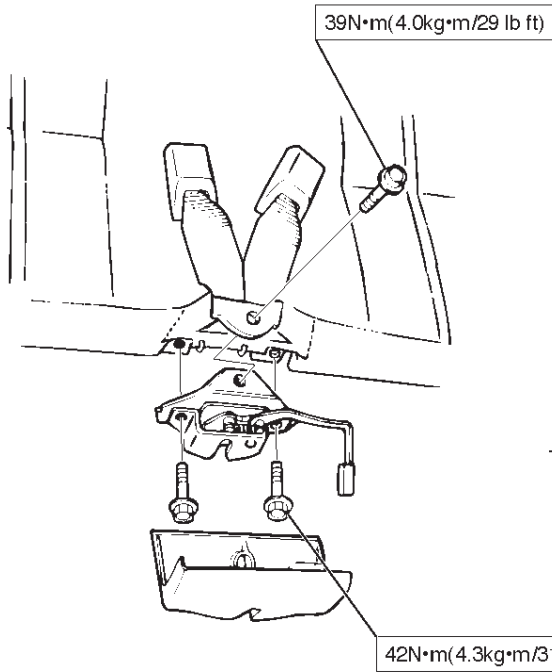
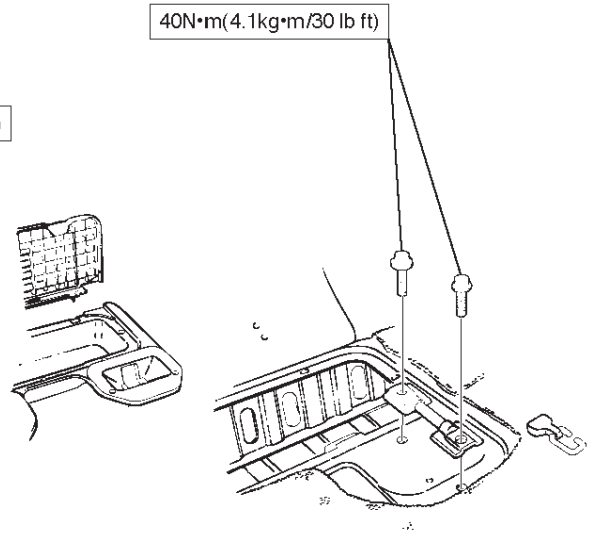
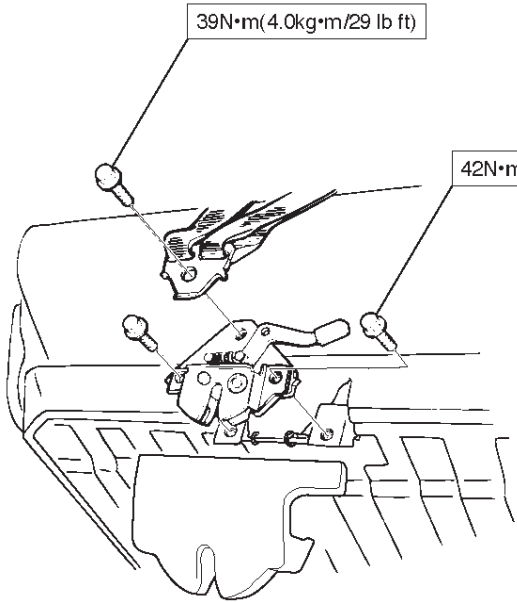
8F-108 BODY STRUCTURE



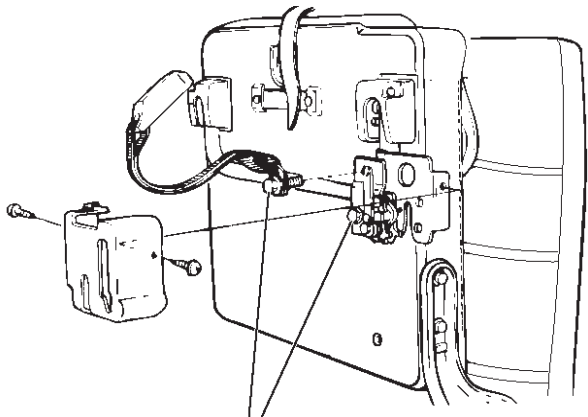


8F-110 BODY STRUCTURE

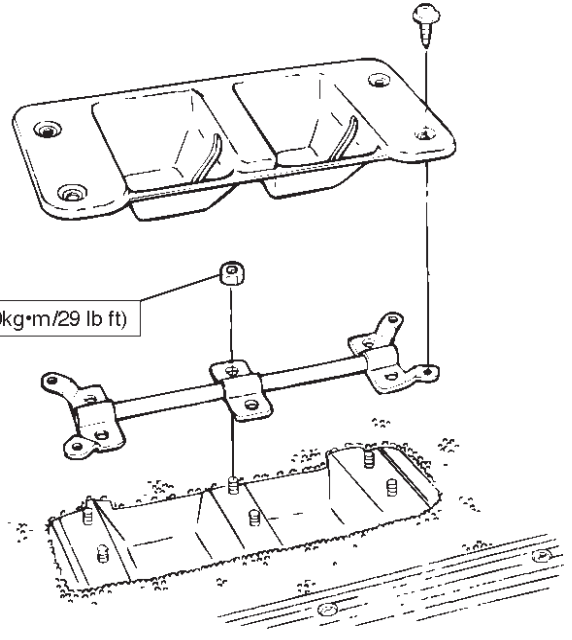




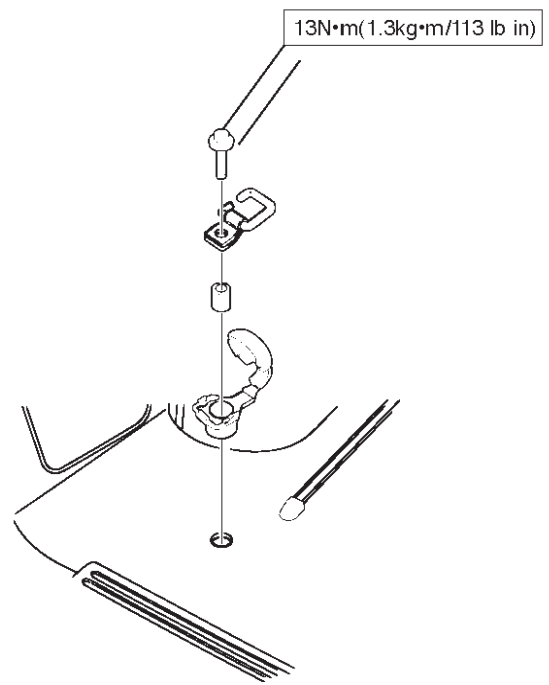
8F-112 BODY STRUCTURE



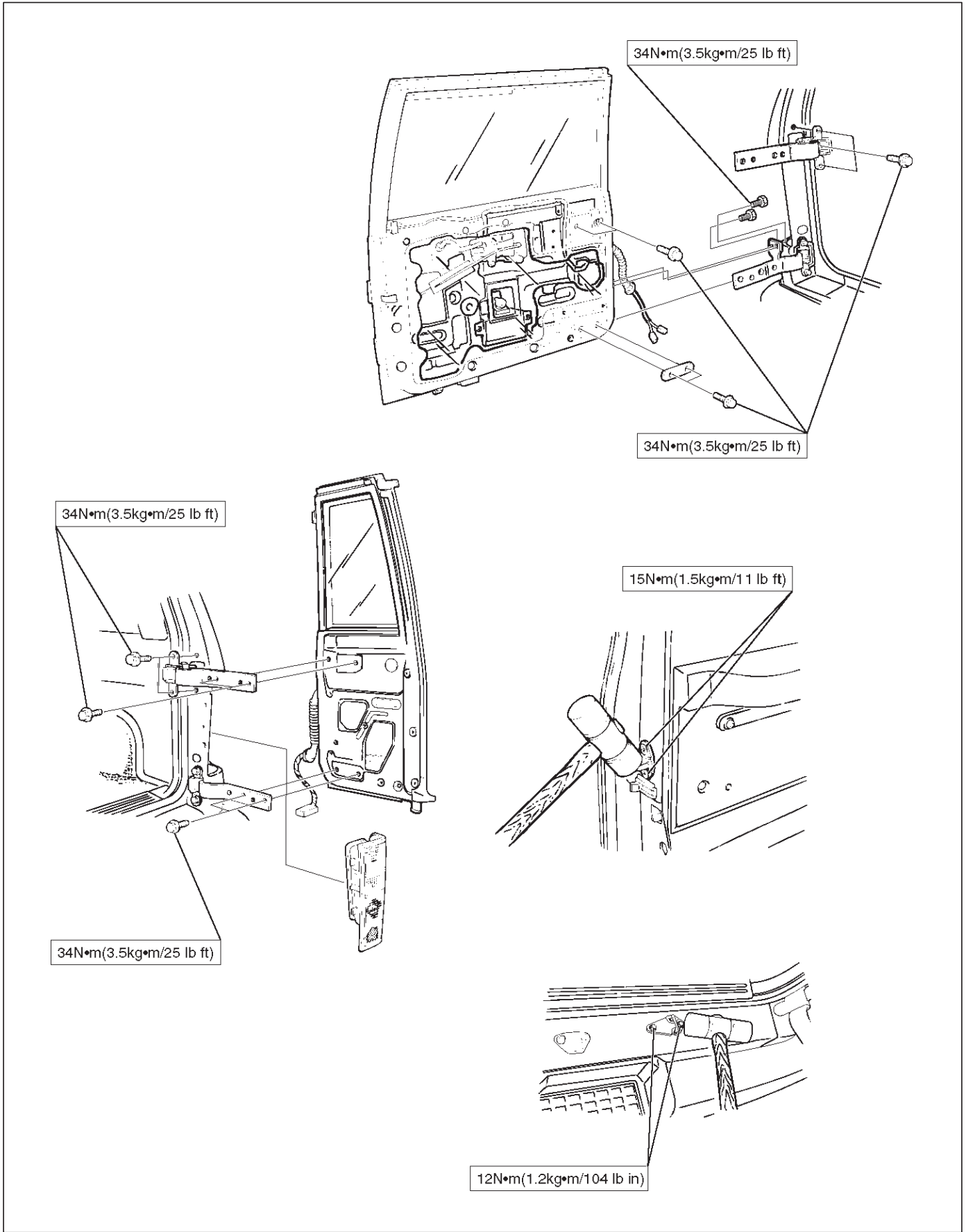
$39\text{N}\cdot\text{m}$ (4.0kg·m/29 lb ft)



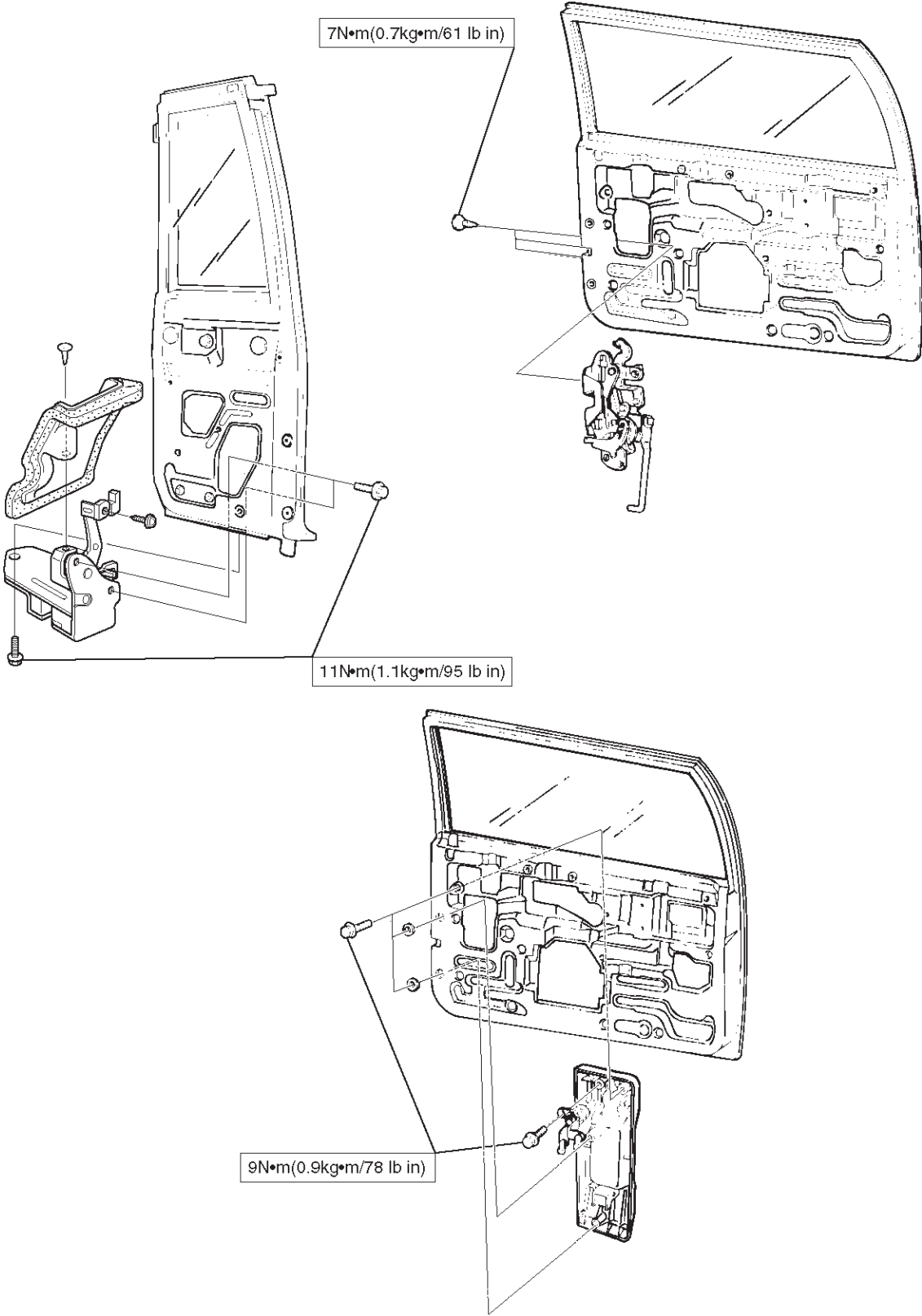
$39\text{N}\cdot\text{m}$ (4.0kg·m/29 lb ft)

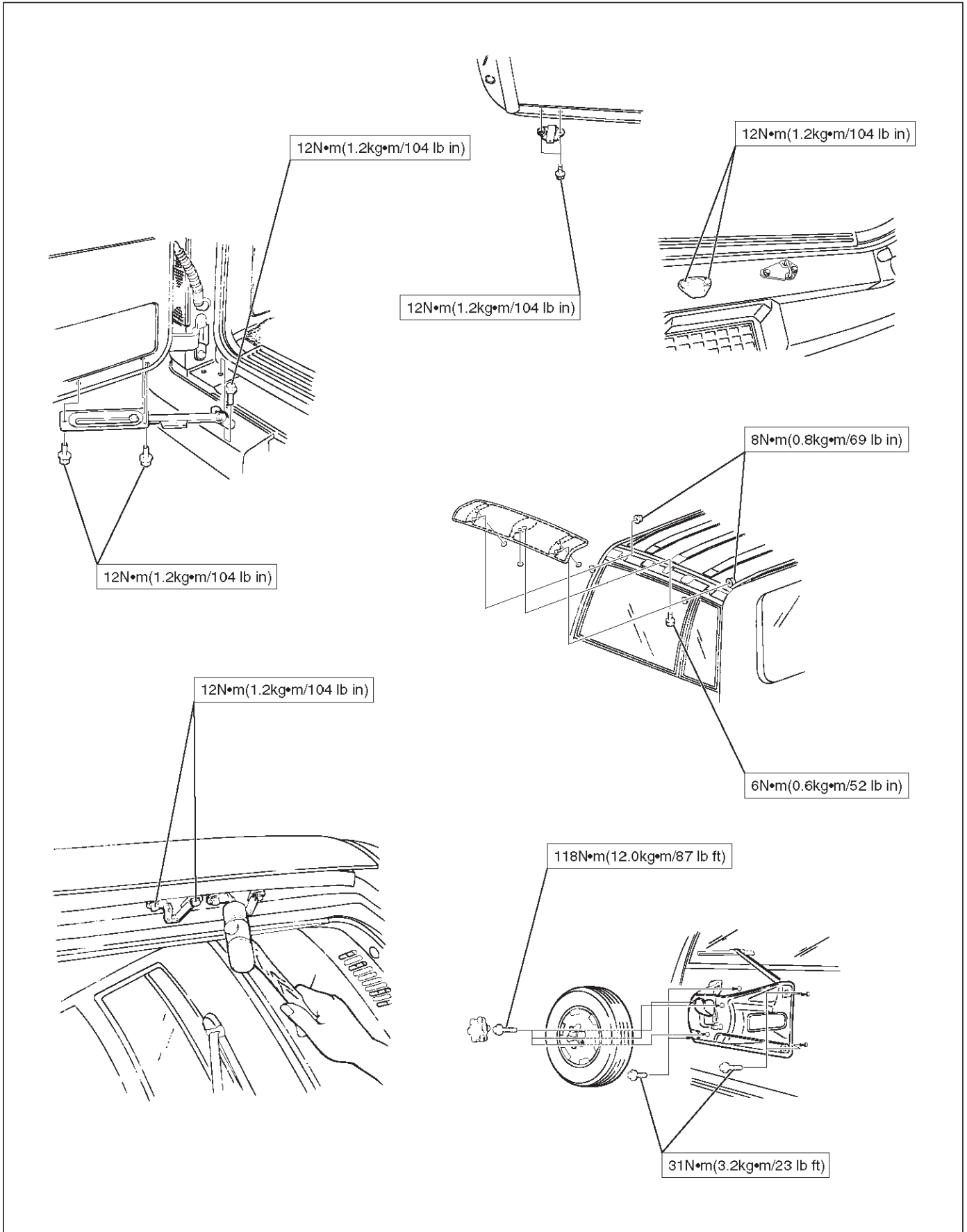


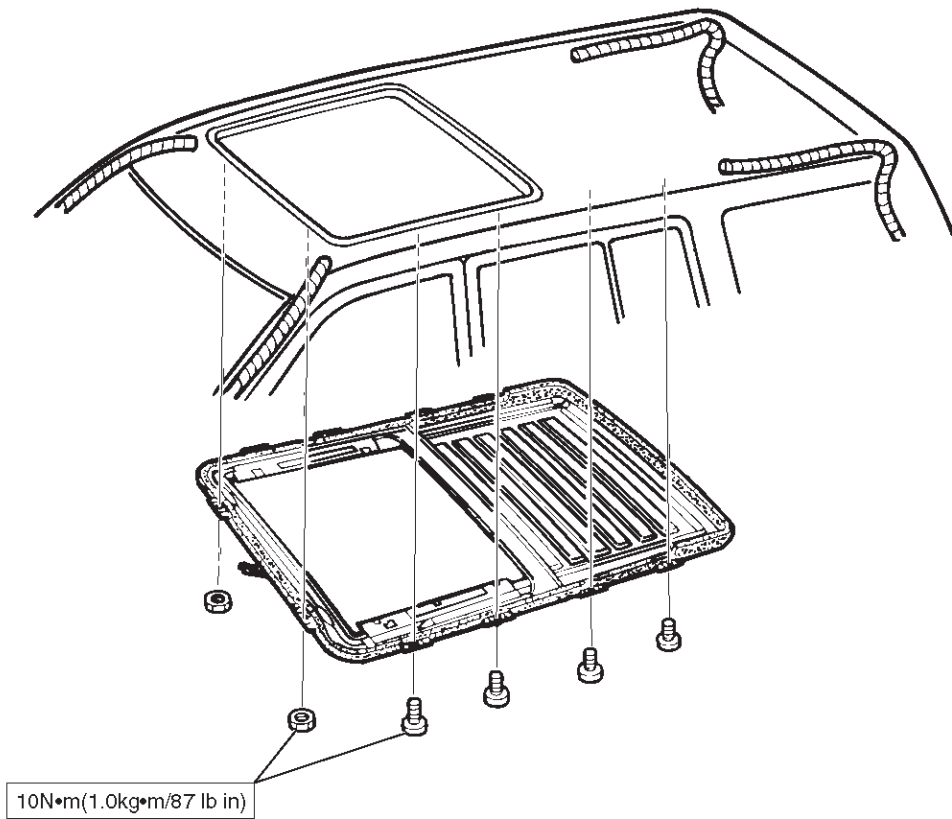
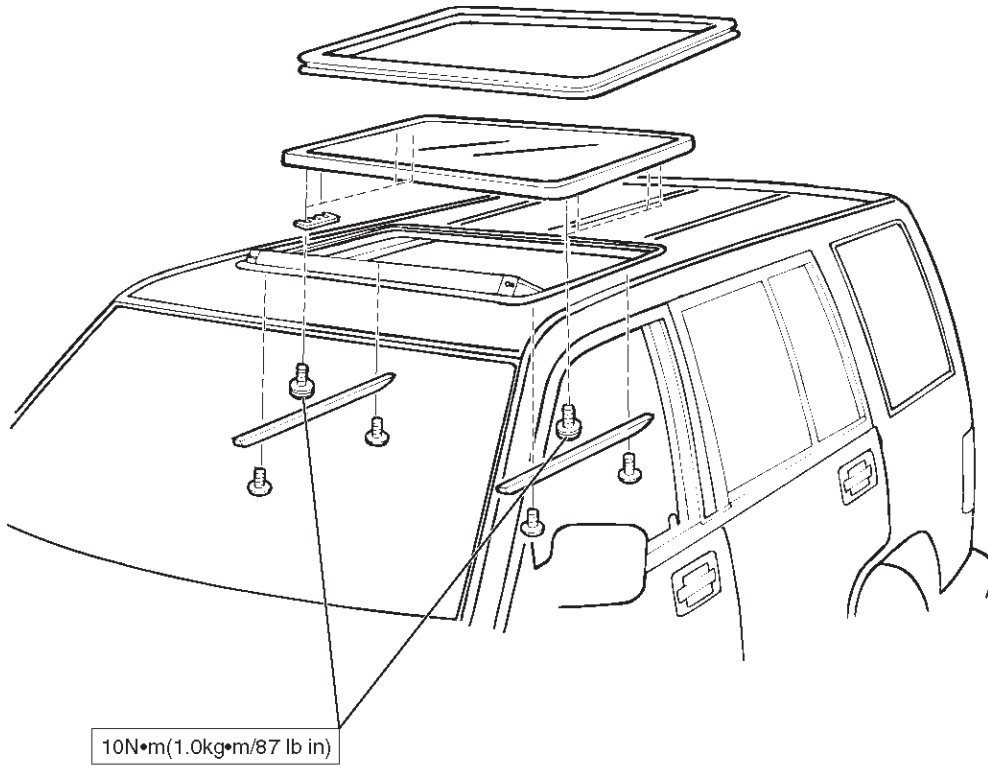
$13\text{N}\cdot\text{m}$ (1.3kg·m/113 lb in)



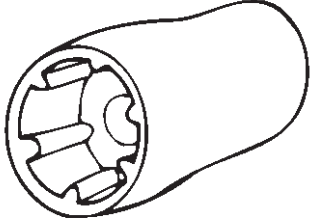
8F-114 BODY STRUCTURE







Special Tools

ILLUSTRATION	TOOL NO. TOOL NAME
 <p style="text-align: right; font-size: small;">901RW111</p>	<p style="text-align: center;">5-8840-2095-0 (J-34355) Spare Tire Carrier Bolt Wrench</p>

BODY AND ACCESSORIES

SEATS

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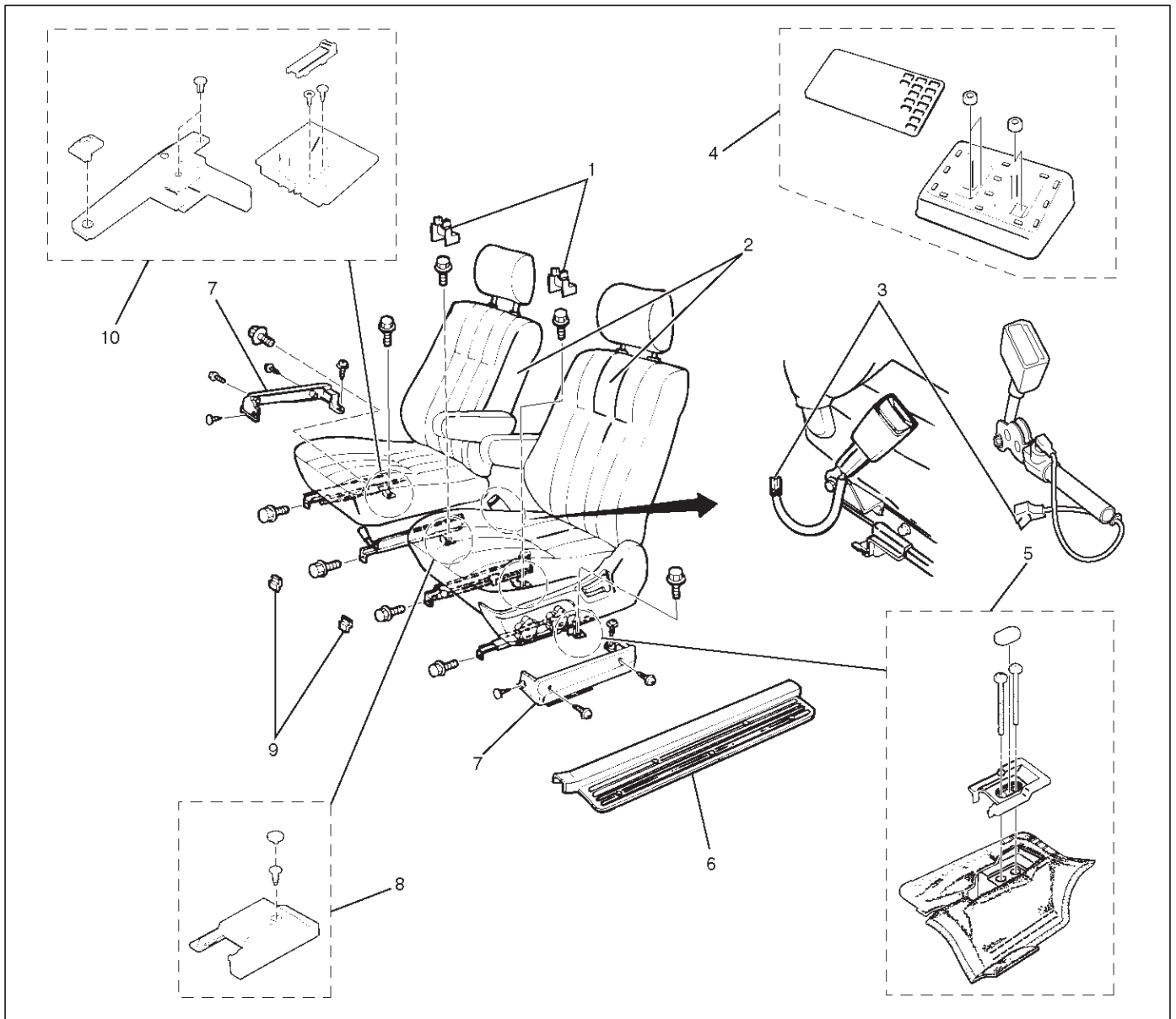
Service Precaution

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

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

Front Seat Assembly

Front Seat Assembly and Associated Parts



750RX016

Legend

- | | |
|---|---|
| (1) Rear Cover | (5) Seat Rail Cover (S-W-B) |
| (2) Front Seat Assembly | (6) Door Sill Plate |
| (3) Seat Belt Warning Connector/Pretensioner
Harness Connector | (7) Riser Cover (L-W-B) |
| (4) Rear Seat Foot Rest (L-W-B) | (8) Seat Slide Cover (S-W-B) |
| | (9) Front Cover |
| | (10) Seat Rail Cover and Hole Cover (S-W-B) |

Removal

1. Disconnect the battery ground cable.
2. Remove the front cover.
3. Remove the rear cover.
 - Remove the cover fixing screw from the rear inner cover, if this model is equipped with the power seats.
4. Remove the door sill plate.
5. Remove the rear seat foot rest.
 - Refer to the Rear Seat Foot Rest in this section.
6. Remove the riser cover.
7. Remove the seat belt warning connector (Driver's side only) or pretensioner harness connector.
8. Remove the front seat assembly.
 - Disconnect the power seat connector, if this model is equipped with the power seats.

Installation

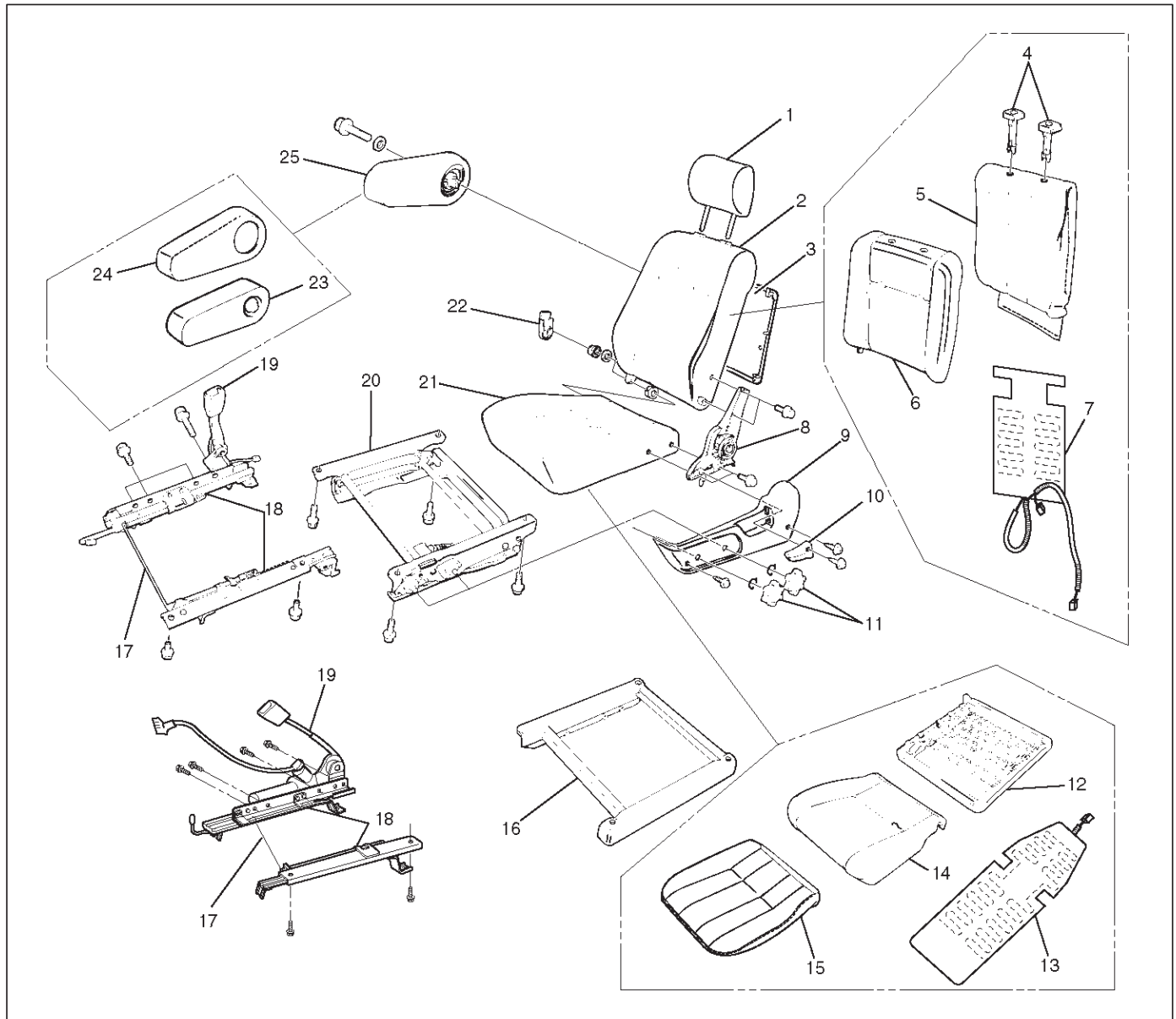
To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the front seat assembly fixing bolts to the specified torque.

Torque: 40 N·m (4.1 kg·m/30 lb ft)

2. Install the longest bolt to the rear inner side fixing location, if this model is equipped with power seats.

Disassembled View (Long Wheel Base)



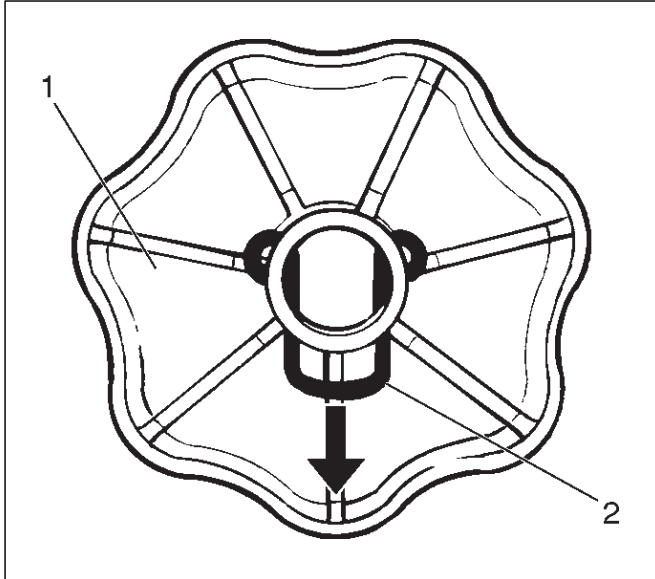
750RX017

Legend

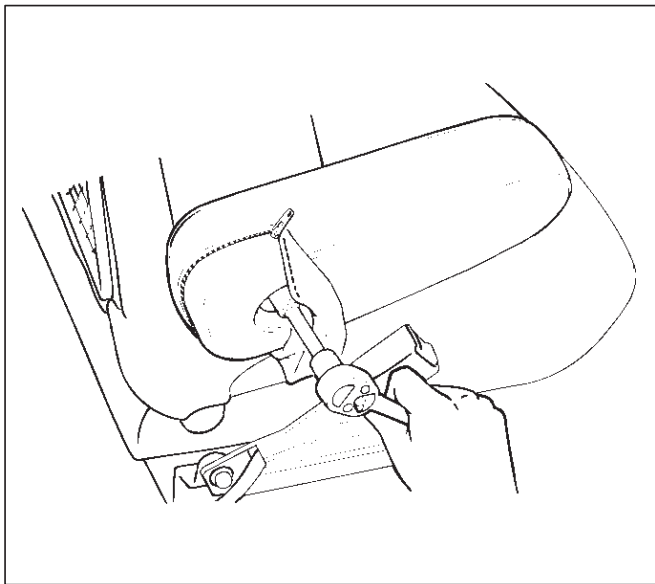
- | | |
|-------------------------------|---|
| (1) Head Rest | (13) Seat Heater Assembly |
| (2) Seat Back Assembly | (14) Pad Assembly |
| (3) Back Board Assembly | (15) Trim Cover |
| (4) Guide Holder | (16) Spacer (W/O Height Adjuster) |
| (5) Trim Cover | (17) Release Wire |
| (6) Pad & Frame Assembly | (18) Seat Adjuster/Seat Adjuster (W/Pretensioner) |
| (7) Seat Heater Assembly | (19) Seat Belt Buckle Assembly |
| (8) Reclining Device | (20) Height Adjuster |
| (9) Slide Cover | (21) Seat Cushion Assembly |
| (10) Reclining Knob | (22) Hinge Cover |
| (11) Dial (W/Height Adjuster) | (23) Pad & Frame Assembly |
| (12) Frame Assembly | (24) Trim Cover |
| | (25) Armrest Assembly |

Disassembly

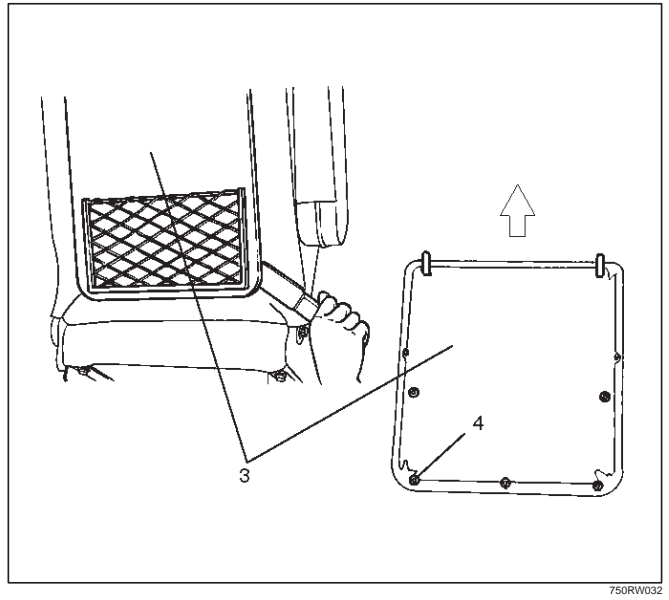
1. Remove the head rest.
2. Remove the reclining knob.
3. Remove the dial(1) (W/height adjuster).
 - Remove the side cover fixing screws and the dial lock spring(2).



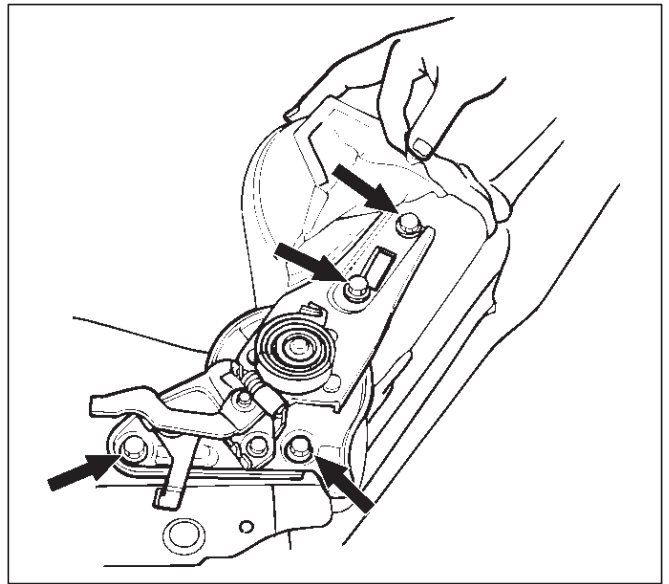
4. Remove the side cover.
5. Remove the armrest assembly.
 - Open the armrest fastener and remove the armrest fixing bolt.



6. Remove the trim cover.
7. Remove the pad and frame assembly.
8. Remove the hinge cover.
9. Remove the back board assembly(3).
 - Pull out the back board while prying the clip (4) of the back board free from the seat back assembly.

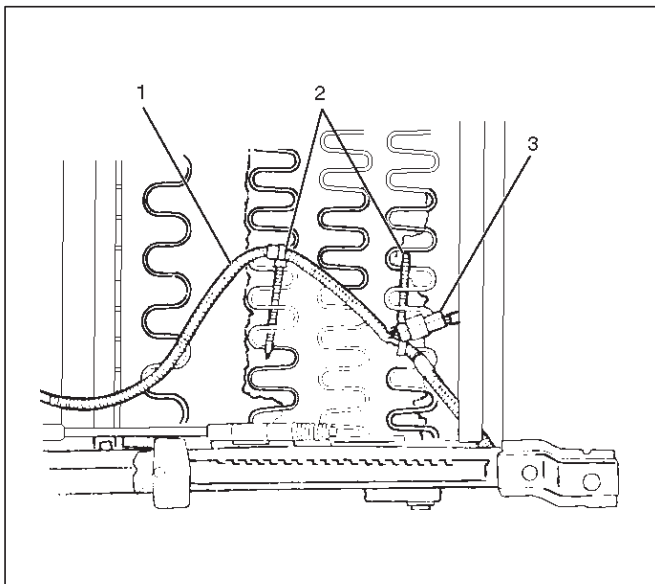


10. Remove the reclining device.
 - Turn up the seat back trim cover in order to remove the reclining device fixing bolts.



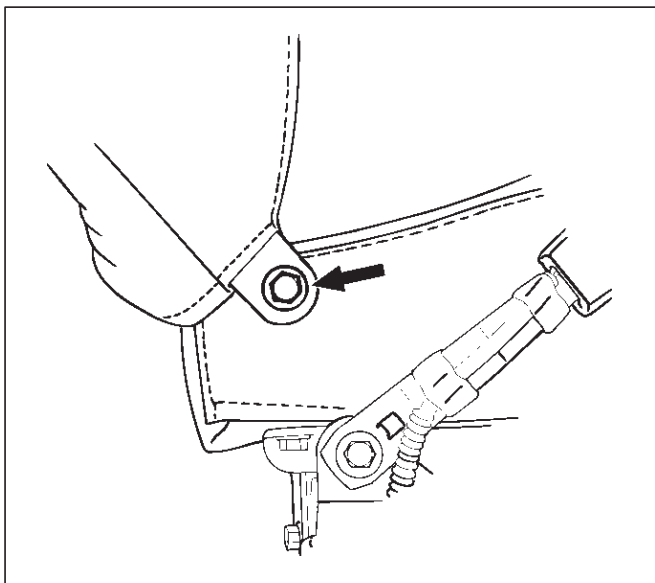
11. Remove the seat back assembly.

- Remove the clips (2) from the seat heater harness (1), and separate the seat heater connector (3) (models with the seat heater).



750RW029

- Remove the seat back assembly fixing nut on the opposite side of the reclining device.



750RS007

12. Remove the guide holder.

- Pull the guide holder out by holding the bottom end of it from the seat back assembly.

13. Remove the trim cover.

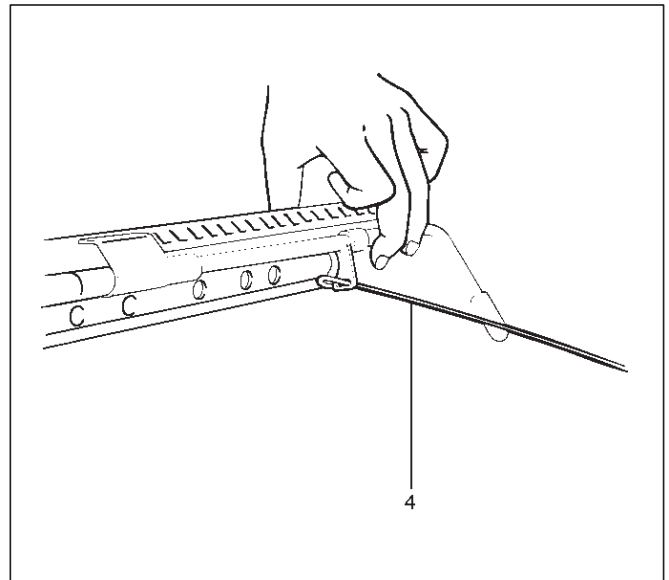
- Remove the trim cover hog rings from the back side of the seat back.
- With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.

14. Remove the pad and frame assembly.

15. Remove the seat heater assembly.

16. Remove the seat adjuster.

- Disconnect the release wire(4) and remove the fixing bolts.



750RW006

- Remove the seat belt buckle assembly.

17. Remove the height adjuster.

18. Remove the spacer (W/O height adjuster).

19. Remove the seat cushion assembly.

20. Remove the trim cover.

- Remove the trim cover hog rings from the back side of the seat cushion assembly.
- With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.

21. Remove the frame assembly.

22. Remove the pad assembly.

23. Remove the seat heater assembly.

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following point.

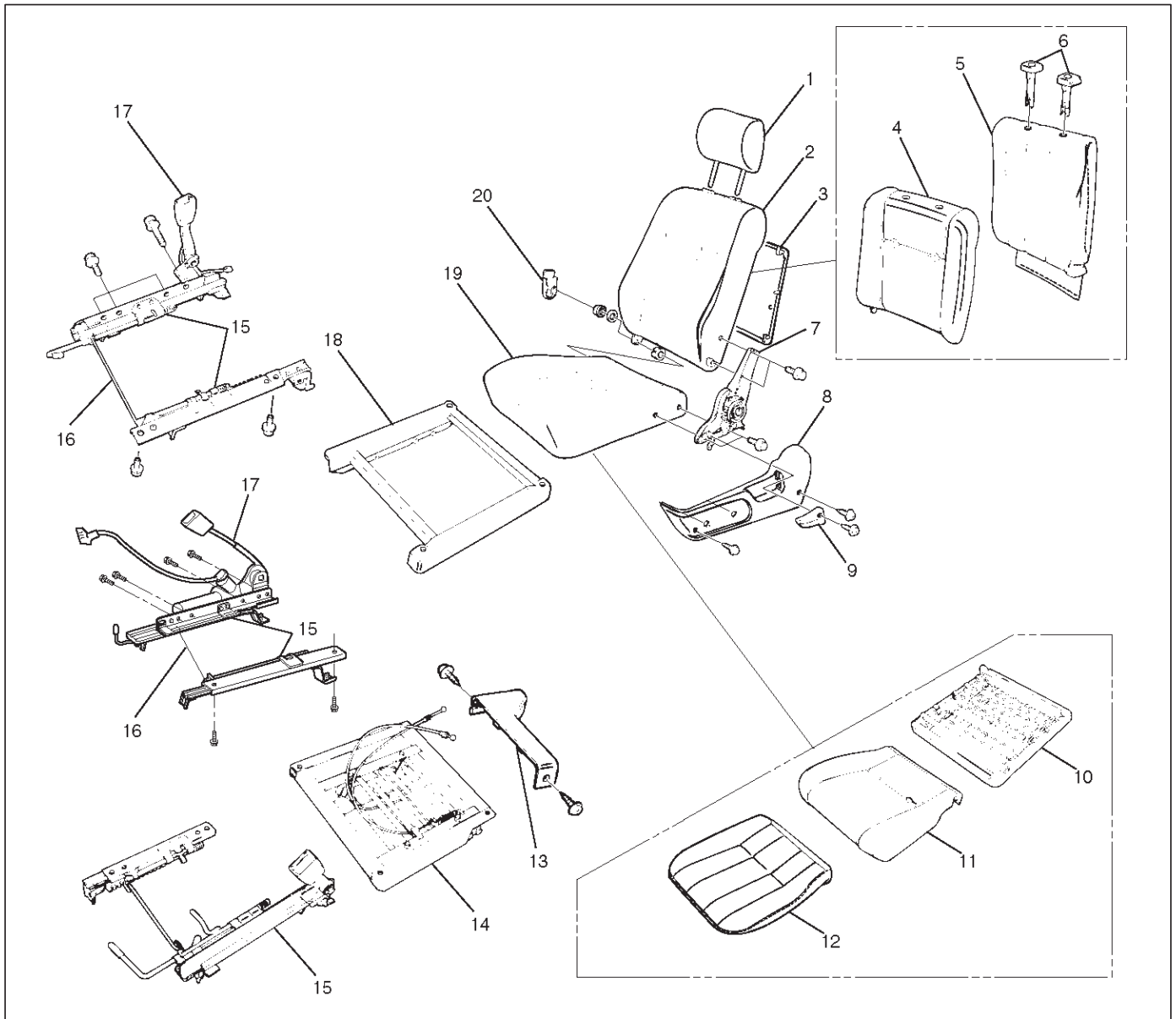
1. Tighten the armrest assembly fixing bolts to the specified torque.

Torque: 18 N·m (1.8 kg·m/13 lb ft)

2. Tighten the reclining device fixing bolts to the specified torque.

Torque: 47 N·m (4.8kg·m/35 lb ft)

Disassembled View (Short Wheel Base)



750RX018

Legend

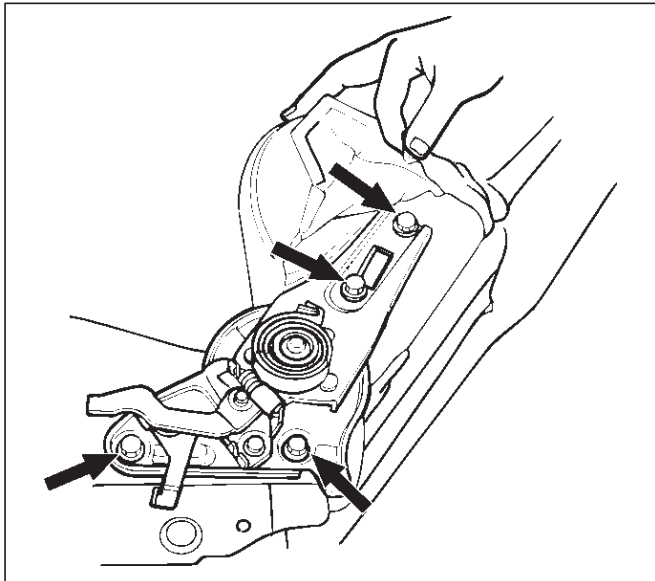
- | | |
|--------------------------|---|
| (1) Head Rest | (11) Pad Assembly |
| (2) Seat Back Assembly | (12) Trim Cover |
| (3) Back Board Assembly | (13) Walk-in Cover |
| (4) Pad & Frame Assembly | (14) Walk-in Assembly |
| (5) Trim Cover | (15) Seat Adjuster/Seat Adjuster (W/Pretensioner) |
| (6) Guide Holder | (16) Release Wire |
| (7) Reclining Device | (17) Seat Belt Buckle Assembly |
| (8) Slide Cover | (18) Spacer |
| (9) Reclining Knob | (19) Seat Cushion Assembly |
| (10) Frame Assembly | (20) Hinge Cover |

Disassembly

1. Remove the head rest.
2. Remove the reclining knob.
3. Remove the side cover.
4. Remove the hinge cover.
5. Remove the back board assembly.
 - Pull out the back board while prying the clip of the back board free from the seat back assembly.

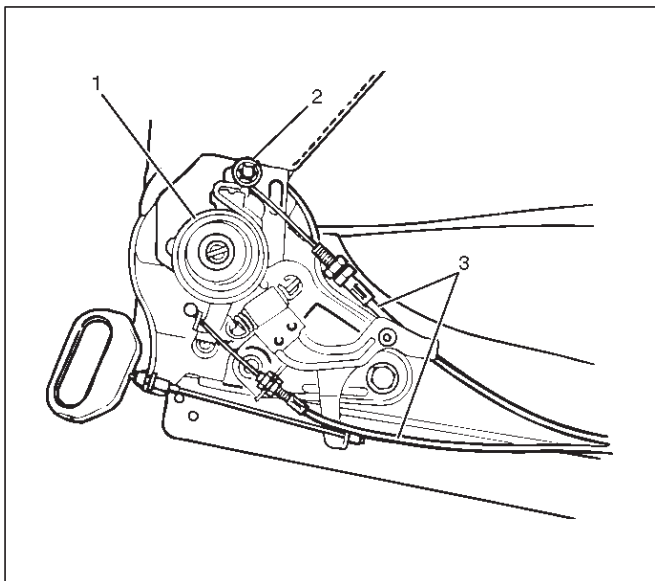
6. Remove the reclining device.

- Trun up the seat back trim cover in order to remove the reclining device fixing bolts.



750RS006

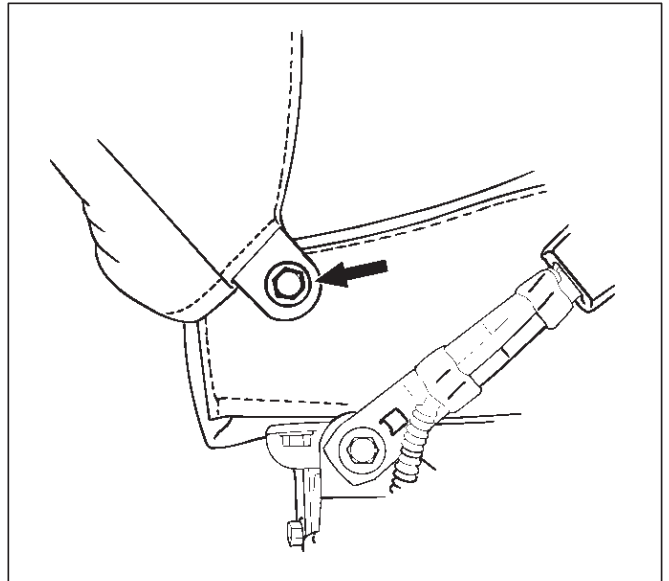
- Remove the push nut (2) and disconnect walk-in cable (3) from reclining device (1).



750RW034

7. Remove the seat back assembly.

- Remove the seat back assembly fixing nut on the opposite side of the reclining device.



750RS007

8. Remove the guide holder.

- Pull the guide holder out by holding the bottom end of it from the seat back assembly.

9. Remove the trim cover.

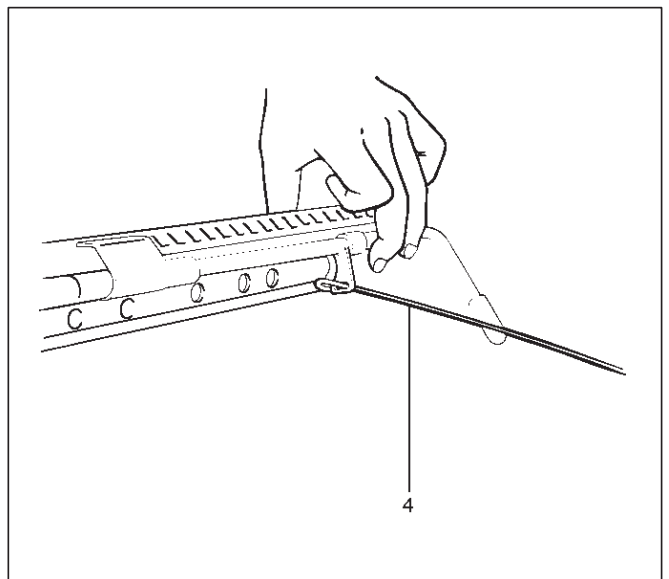
- Remove the trim cover hog rings from the back side of the seat back.
- With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.

10. Remove the pad and frame assembly.

11. Remove the walk-in cover.

12. Remove the seat adjuster.

- Disconnect the release wire (4) and remove the fixing bolts.



750RW006

- Remove the seat belt buckle assembly.

8G-8 SEATS

13. Remove the walk-in assembly (passenger side).
14. Remove the spacer (driver side).
15. Remove the seat cushion assembly.
16. Remove the trim cover.
 - Remove the trim cover hog rings from the back side of the seat cushion assembly.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
17. Remove the frame assembly.
18. Remove the pad assembly.

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the armrest assembly fixing bolts to the specified torque.

Torque: 18 N·m (1.8 kg·m/13 lb ft)

2. Tighten the reclining device fixing bolts to the specified torque.

Torque: 47 N·m (4.8kg·m/35 lb ft)

Power Seat Assembly

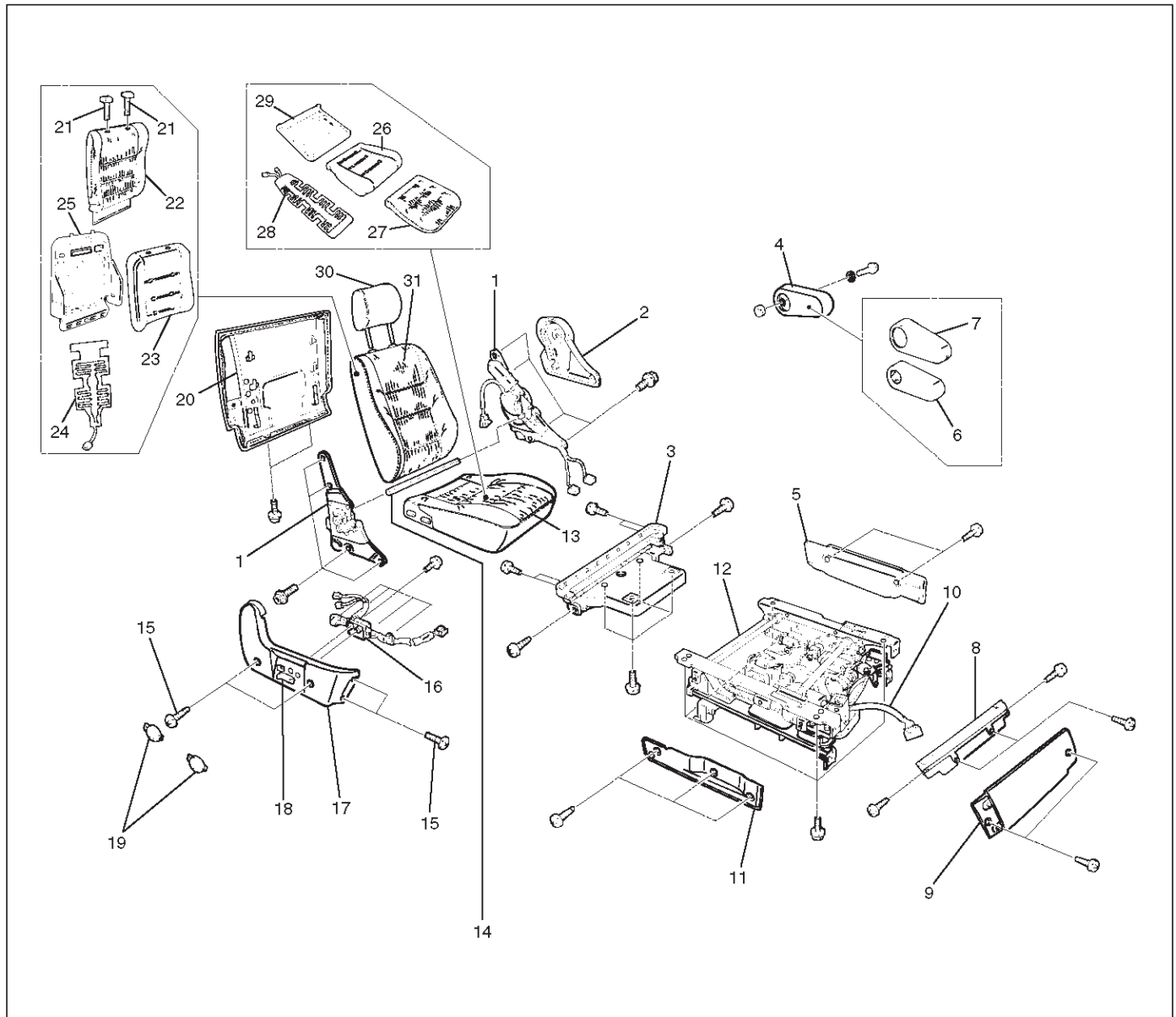
General Description

The circuit consists of the power seat switch, front tilt motor (driver's seat only), rear tilt motor (driver's seat only), slide motor and the recliner motor.

The power seat switch has a tilt & slide switch and a recliner switch.

The motor built in the seat can be actuated by operating these switches to move the seat to desired position, independent of the position of the starter switch.

Disassembled View



Legend

- | | |
|--------------------------|--------------------------------|
| (1) Reclining Device | (12) Adjuster Assembly |
| (2) Inner Cover | (13) Seat Cushion Assembly |
| (3) Rear Cover | (14) Connecting Shaft |
| (4) Armrest Assembly | (15) Outer Cover Fixing Screws |
| (5) Inner Lower Cover | (16) Switch Assembly |
| (6) Pad & Frame Assembly | (17) Outer Cover |
| (7) Trim Cover | (18) Switch Knob |
| (8) Front Lower Cover | (19) Outer Cover Cap |
| (9) Front Cover | (20) Back Board Assembly |
| (10) Power Seat Harness | (21) Guide Holder |
| (11) Outer Lower Cover | (22) Trim Cover |
| | (23) Pad Assembly |

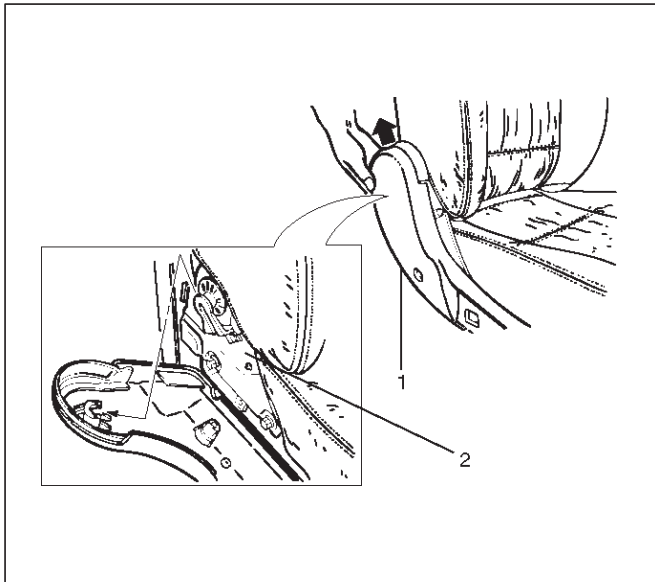
8G-10 SEATS

- (24) Seat Heater
- (25) Frame Assembly
- (26) Pad Assembly
- (27) Trim Cover

- (28) Seat Heater
- (29) Frame Assembly
- (30) Head Rest
- (31) Seat Back Assembly

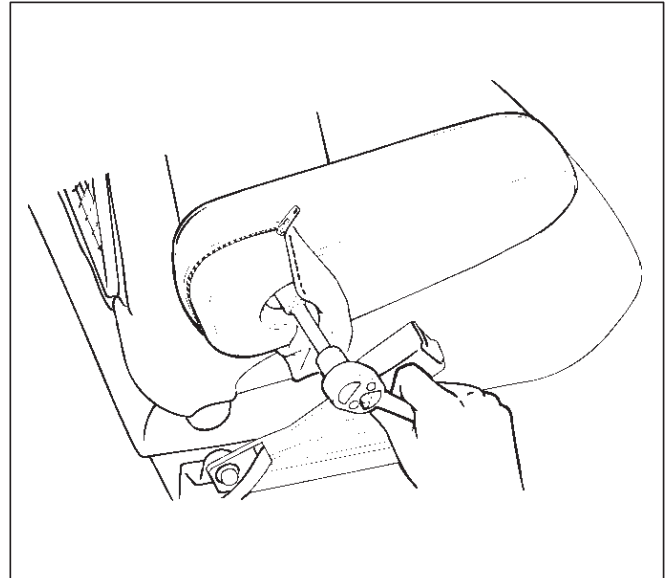
Disassembly

1. Disconnect the battery ground cable.
2. Remove the head rest.
3. Remove the switch knob.
 - Pull the switch knob out.
4. Remove the outer cover cap.
5. Remove the outer cover fixing screws.
 - Pull up the outer cover(1) to remove the cover from the reclining device(2).



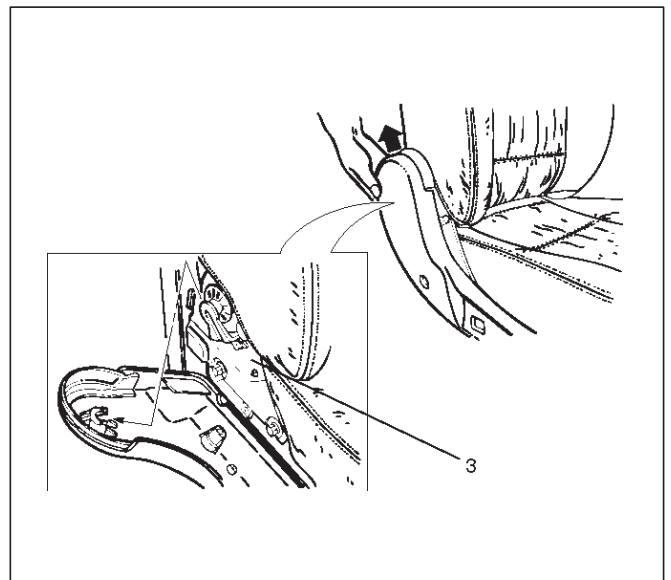
750RS012

6. Remove the front cover.
7. Remove the front lower cover.
8. Remove the rear cover.
9. Remove the outer cover.
 - Disconnect the switch connectors and remove the harness fixing clips.
10. Remove the switch assembly.
 - Remove the switch fixing screws from the outer cover.
11. Remove the armrest assembly.
 - Open the armrest fastener and remove the fixing bolt.



750RS004

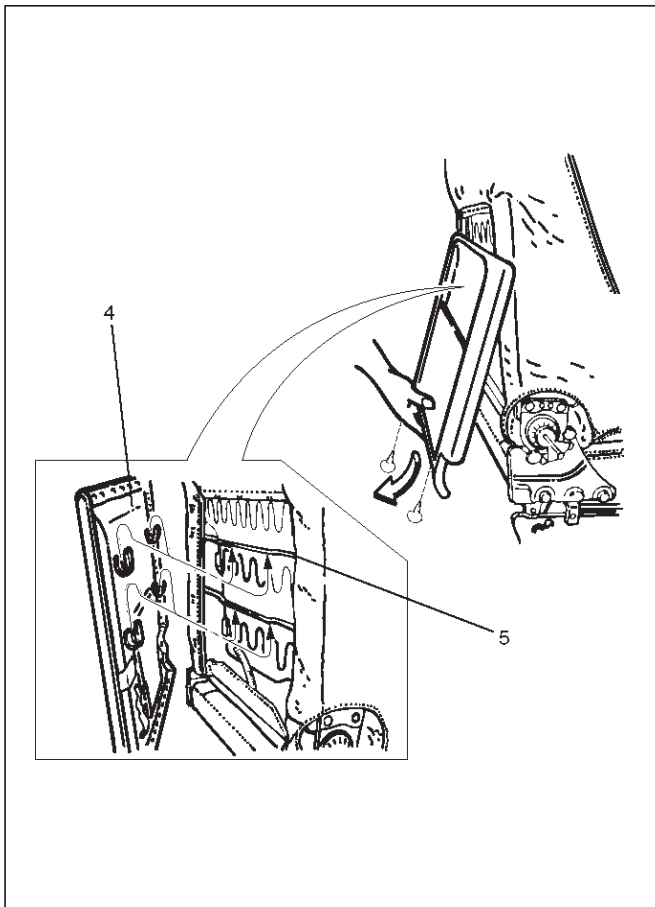
12. Remove the trim cover.
13. Remove the pad & frame assembly.
14. Remove the inner cover.
 - Remove the cover fixing screw.
 - Pull up the inner cover to remove the cover from the reclining device(3).



750RW007

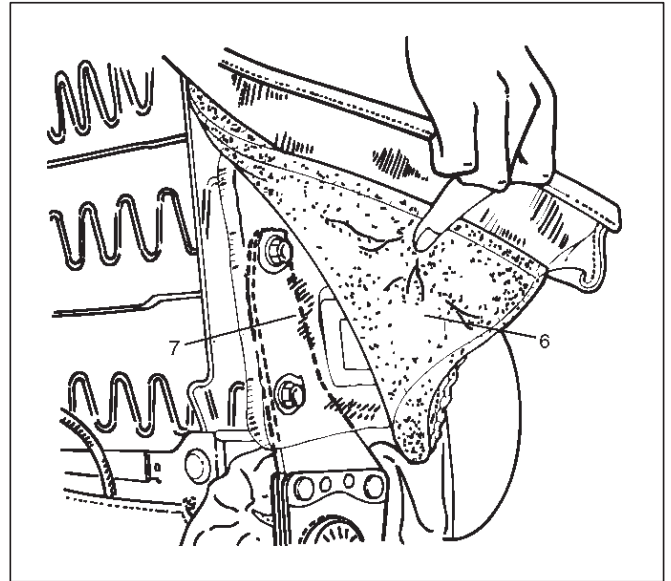
15. Remove the back board assembly(4).

- Remove the board fixing screws.
- Pull the back board downward and remove the board from the seat back frame(5).



16. Remove the reclining device(7).

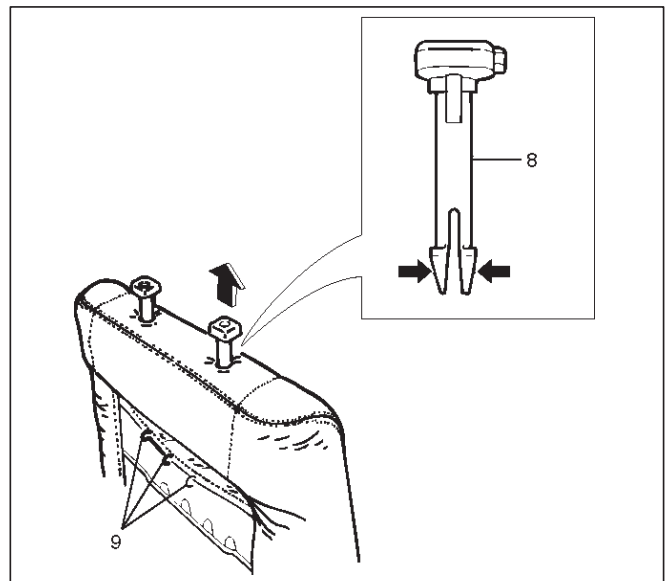
- Remove the device lower side fixing bolt in order to separate the seat back from the seat cushion.
- Disconnect the seat heater connector.
- Remove the trim cover(6) hog rings from the backside of the seat back assembly.
- Turn up the seat back trim cover to remove the reclining device upper side fixing bolt.
- Disconnect the connecting shaft and the reclining device connectors.



17. Remove the seat back assembly.

18. Remove the guide holder(8).

- Remove the trim cover fixing hog rings(9) from the backside of the seat back assembly.
- Hold the tip end of the guide holder and pull the holder out from the seat back assembly.



19. Remove the trim cover.

- Remove the trim cover hog rings from the backside of the seat back.
- With close attention paid to the hog rings and the wire which connect the trim cover and pad & frame assembly, remove the trim cover while turning it up.

20. Remove the seat heater.

21. Remove the pad assembly.

22. Remove the frame assembly.

23. Remove the outer lower cover.

24. Remove the inner lower cover.

25. Remove the adjuster assembly.

- Disconnect the connectors and remove the fixing bolts.

8G-12 SEATS

- Remove the power seat harness from the adjuster assembly.
26. Remove the seat cushion assembly.
 27. Remove the trim cover.
 - Remove the trim cover hog rings from the backside of the seat cushion assembly.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad & frame assembly, remove the trim cover while turning it up.

28. Remove the seat heater.
29. Remove the frame assembly.
30. Remove the pad assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the fixing bolts to the specified torque.
 - Refer to the Torque Specifications in this section.

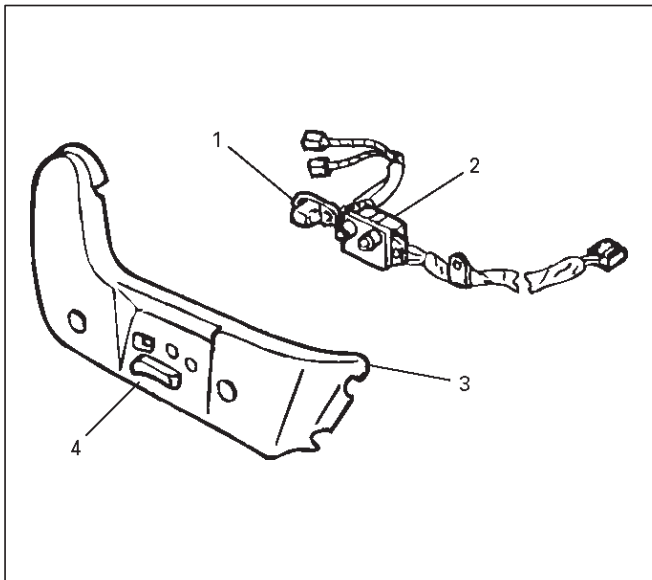
Power Seat Switch

Removal

1. Remove the side cover(3).
 - Refer to the Power Seat Assembly disassembly steps in this section.
2. Remove the tilt & slide switch lever(4).
 - Hold the switch lever with your fingers and pull it toward you.
3. Remove the tilt & slide switch(2).
 - Remove two screws.
4. Remove the recliner switch(1).
 - Remove two screws.

Installation

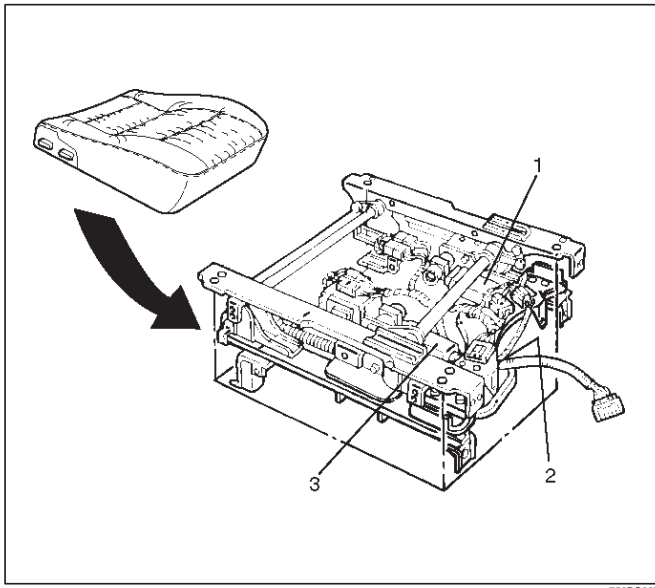
To install, follow the removal steps in the reverse order.



750RS025

Front Tilt Motor / Rear Tilt Motor / Slide Motor / Recliner Motor

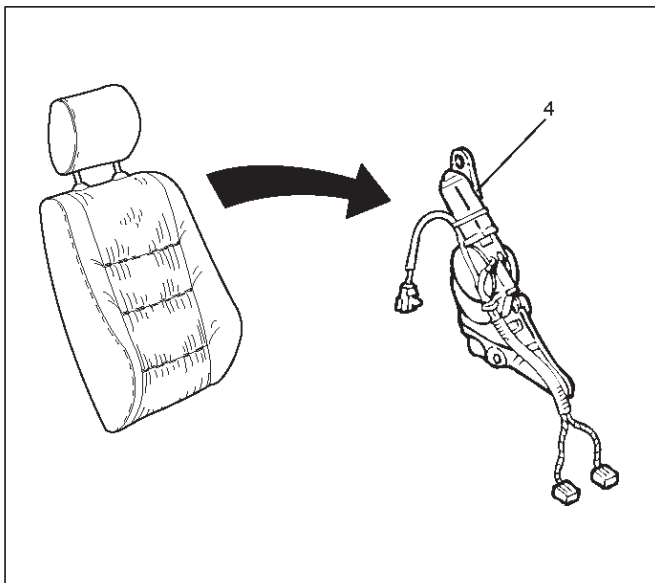
Parts Location



750RS027

Legend

- (1) Tilt Motor
- (2) Slide Motor
- (3) Tilt Motor



750RS028

Legend

- (4) Recliner Motor

Removal and Installation

Refer to the Power Seat Assembly disassembly and reassembly steps in this section.

Seat Heater System

General Description

The circuit consists of the starter switch, seat heater switch and the heat unit.

The seat heater is provided in driver's and front passenger seats (as option).

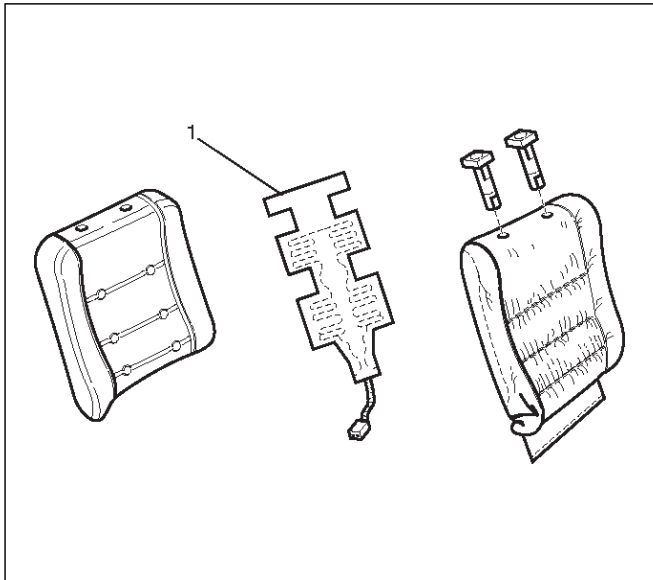
When the seat heater switch is ON, the seat heat built in the seat back and cushion is switched on to warm the seats.

To prevent the seats from being overheated, the circuit is fitted with a thermostat.

Seat Heater Switch Removal and Installation

Refer to the Seat Heater Switch removal and installation steps in Lighting System section.

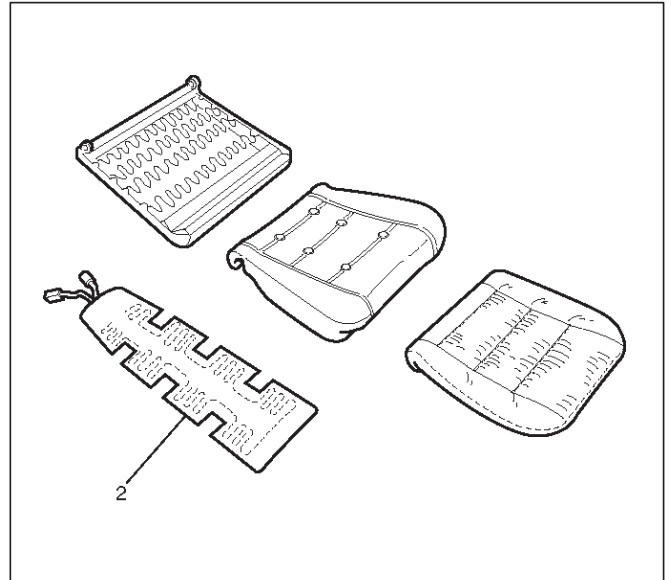
Heat Unit Parts Location



750RS018

Legend

(1) Heat Unit (Seat Back Side)



750RS019

Legend

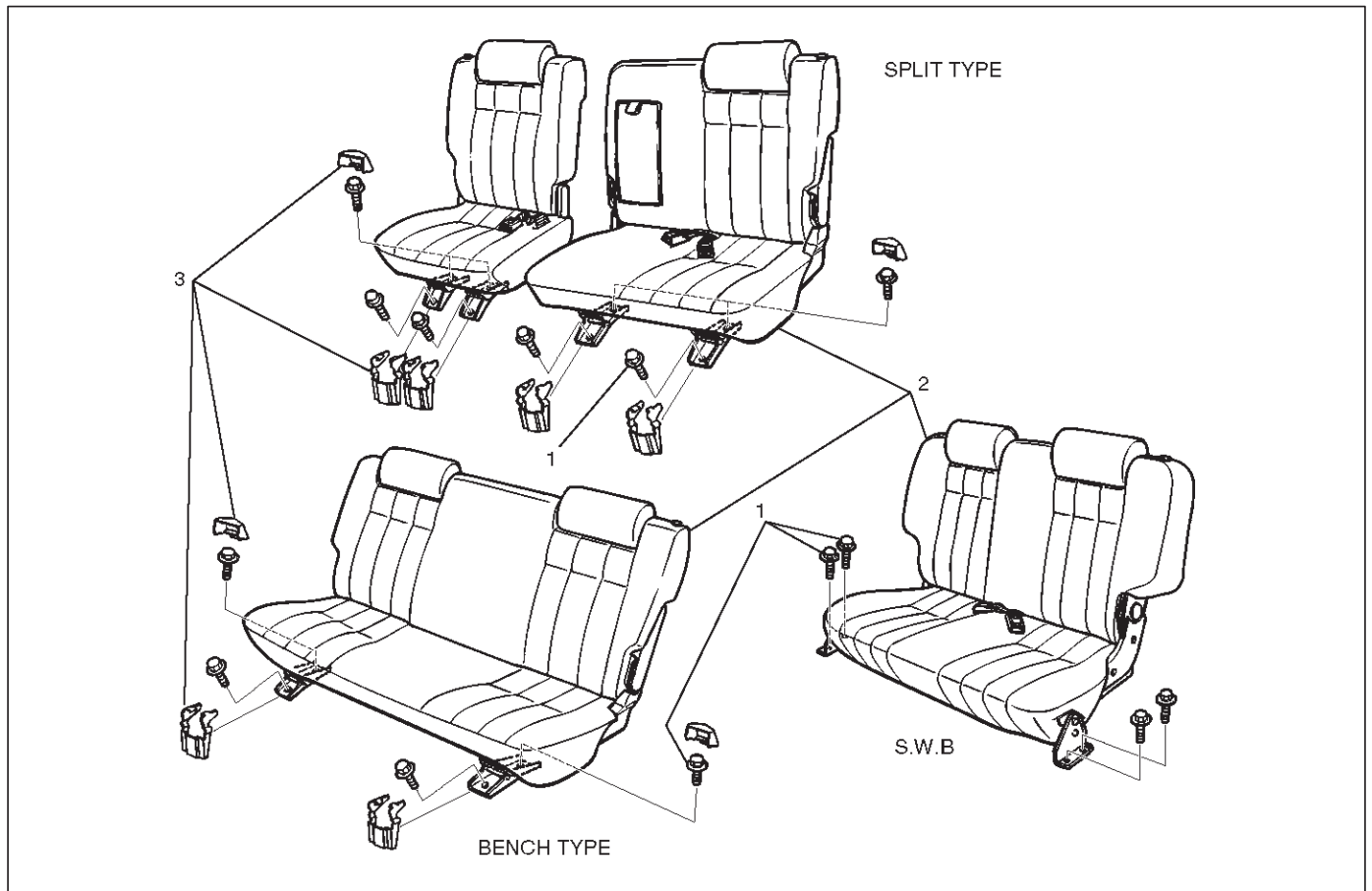
(2) Heat Unit (Seat Cushion Side)

Heat Unit Removal and Installation

Refer to the Power Seat Assembly disassembly and reassembly steps in this section.

Rear Seat Assembly

Rear Seat Assembly and Associated Parts



755RW031

Legend

(1) Fixing Bolts

(2) Rear Seat Assembly

(3) Mounting Bracket Cover

Removal

1. Unlock the rear seat(1) lock to remove it.
2. Remove the mounting bracket cover.
3. Remove the fixing bolts.

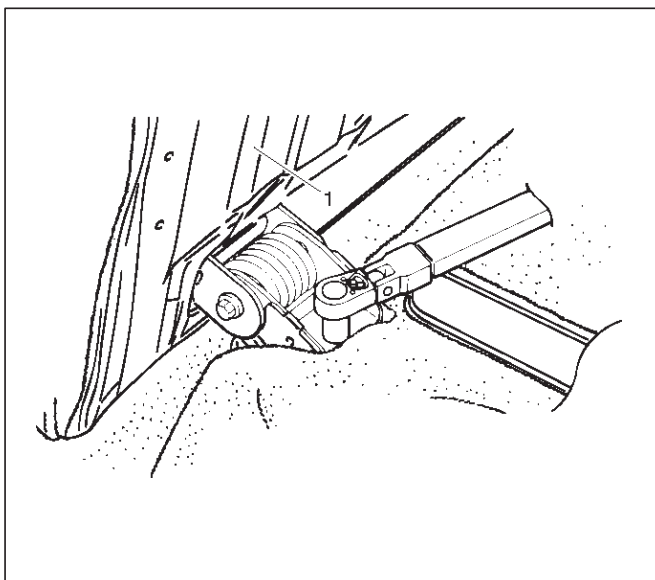
4. Remove the rear seat assembly.

Installation

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

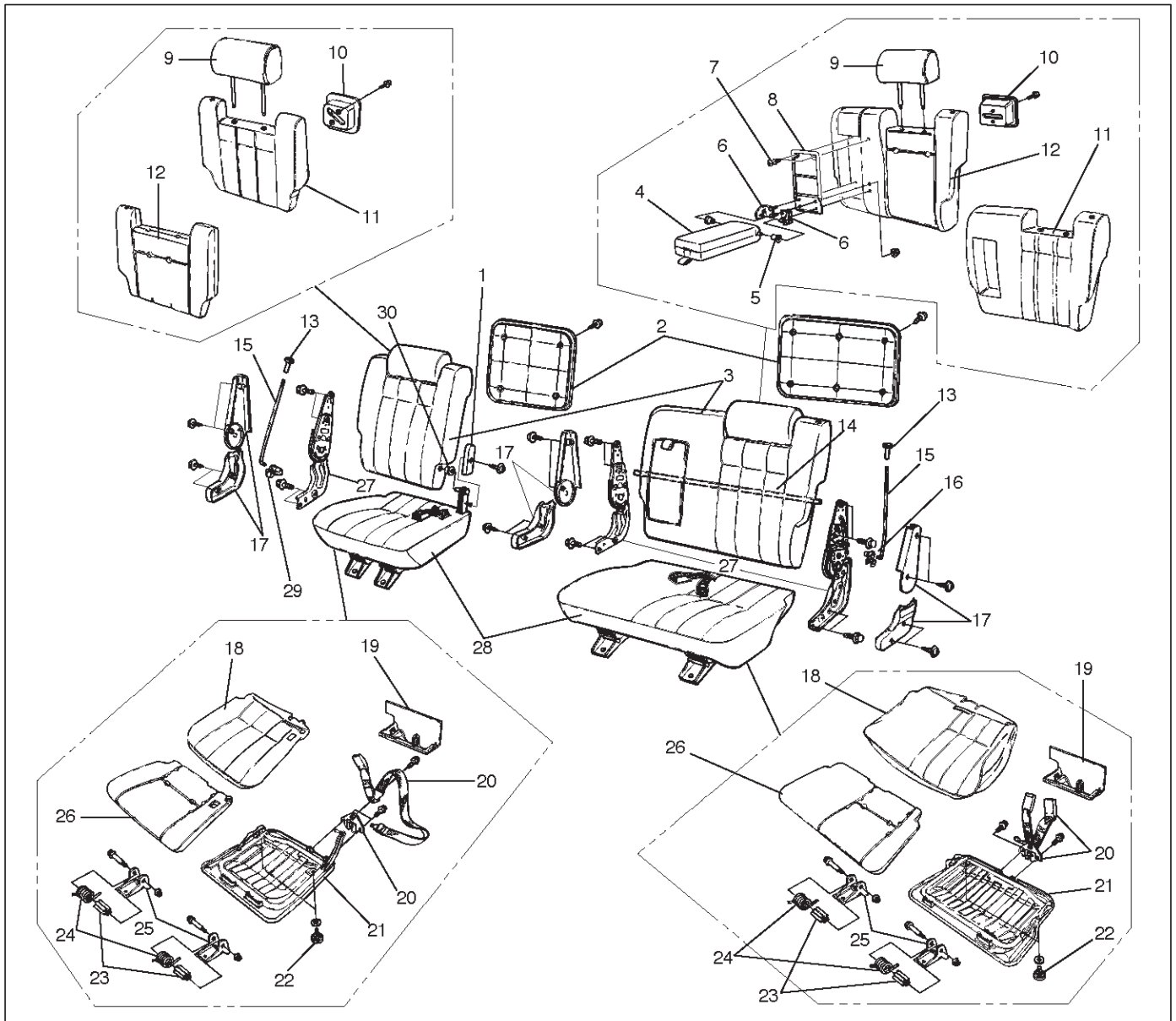
1. Tighten the rear seat fixing bolts to the specified torque.

Torque: 19 N·m (1.9kg·m/14 lb ft)



755RS002

Disassembled View (Split Type)



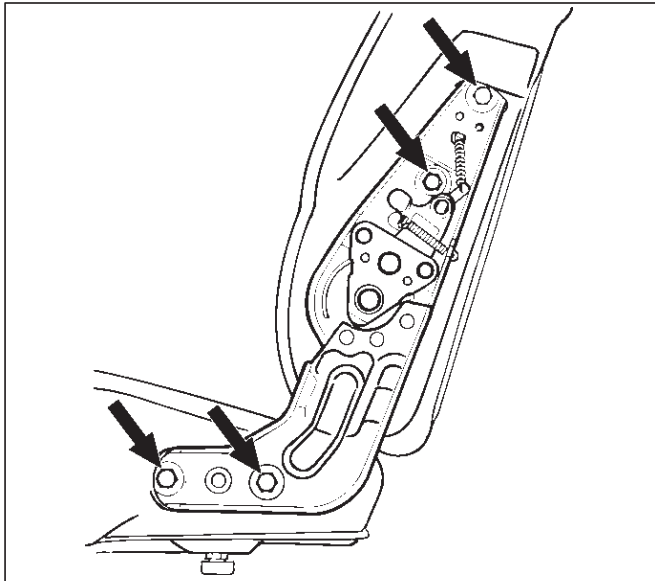
755RW056

Legend

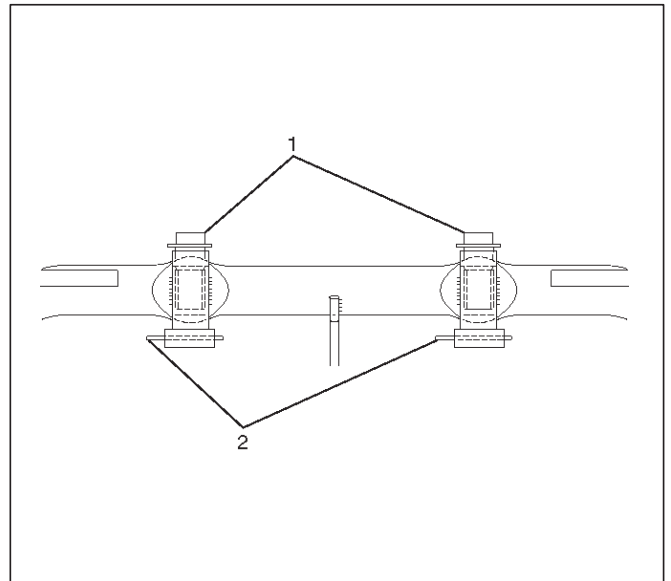
- | | |
|---------------------------|--|
| (1) Free Hinge Cover | (16) Linkage Bush |
| (2) Back Board | (17) Device Cover |
| (3) Seat Back Assembly | (18) Trim Cover |
| (4) Armrest Assembly | (19) Seat Lock Cover |
| (5) Bush | (20) Rear Seat Belt Buckle and Lock Assembly |
| (6) Armrest Set Bracket | (21) Frame Assembly |
| (7) Clip | (22) Stopper Rubber |
| (8) Armrest Board | (23) Spring Collar |
| (9) Pillow Assembly | (24) Return Spring |
| (10) Band Hook Cover | (25) Mounting Bracket |
| (11) Trim Cover | (26) Pad Assembly |
| (12) Pad & Frame Assembly | (27) Reclining Device |
| (13) Release Knob | (28) Seat Cushion Assembly |
| (14) Connecting Shaft | (29) Linkage Bush |
| (15) Release Rod | (30) Bush |

Disassembly (Split Type)

1. Remove the back board.
 - Remove the clips and the back board.
2. Remove the device cover.
3. Remove the release knob.
 - Turn the knob counterclockwise to remove it.
4. Remove the release rod.
 - Disconnect the rod from the linkage bush.
5. Remove the reclining device.



6. Remove the connecting shaft.
7. Remove the seat back assembly.
8. Remove the pillow assembly.
 - Turn up the seat back trim cover and slit the pad from the back around to the place where the lock spring(2) of the guide bush(1) is.
 Then insert a finger through the slit and pull out the pillow while you are pressing down on the lock spring.



9. Remove the band hook cover.
10. Remove the armrest assembly.
 - Turn up the seat back trim cover and remove the fixing nuts.
11. Remove the armrest set bracket.
12. Remove the armrest board.
13. Remove the trim cover.
 - Remove the trim cover fixing hog rings from the backside of the seat back.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
14. Remove the pad & frame assembly.
15. Remove the seat cushion assembly.
16. Remove the seat lock cover.
17. Remove the rear seat belt buckle and lock assembly.
18. Remove the mounting bracket.
19. Remove the return spring.
20. Remove the spring collar.
21. Remove the trim cover.
 - Remove the hog rings and pull the trim cover out from the frame assembly groove.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad & frame assembly, remove the trim cover while turning it up.
22. Remove the frame assembly.
23. Remove the pad assembly.
24. Remove the stopper rubber.

Reassembly (Split Type)

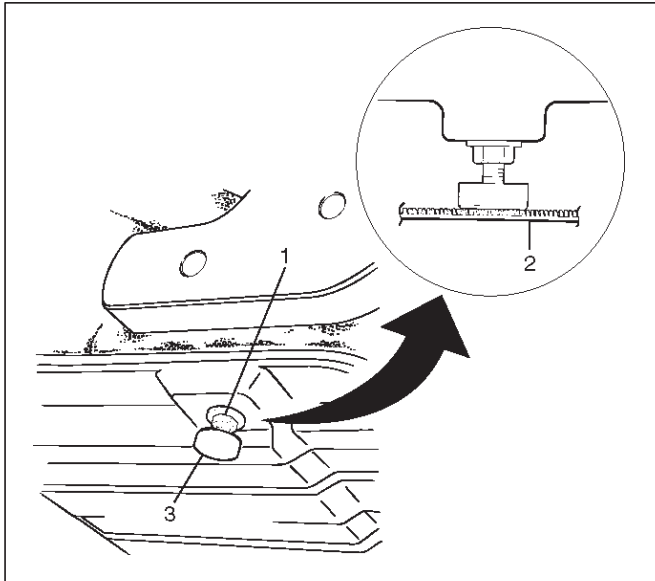
To reassemble, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the reclining device fixing bolts to the specified torque.

Torque: 27 N·m (2.8kg·m/20 lb ft)

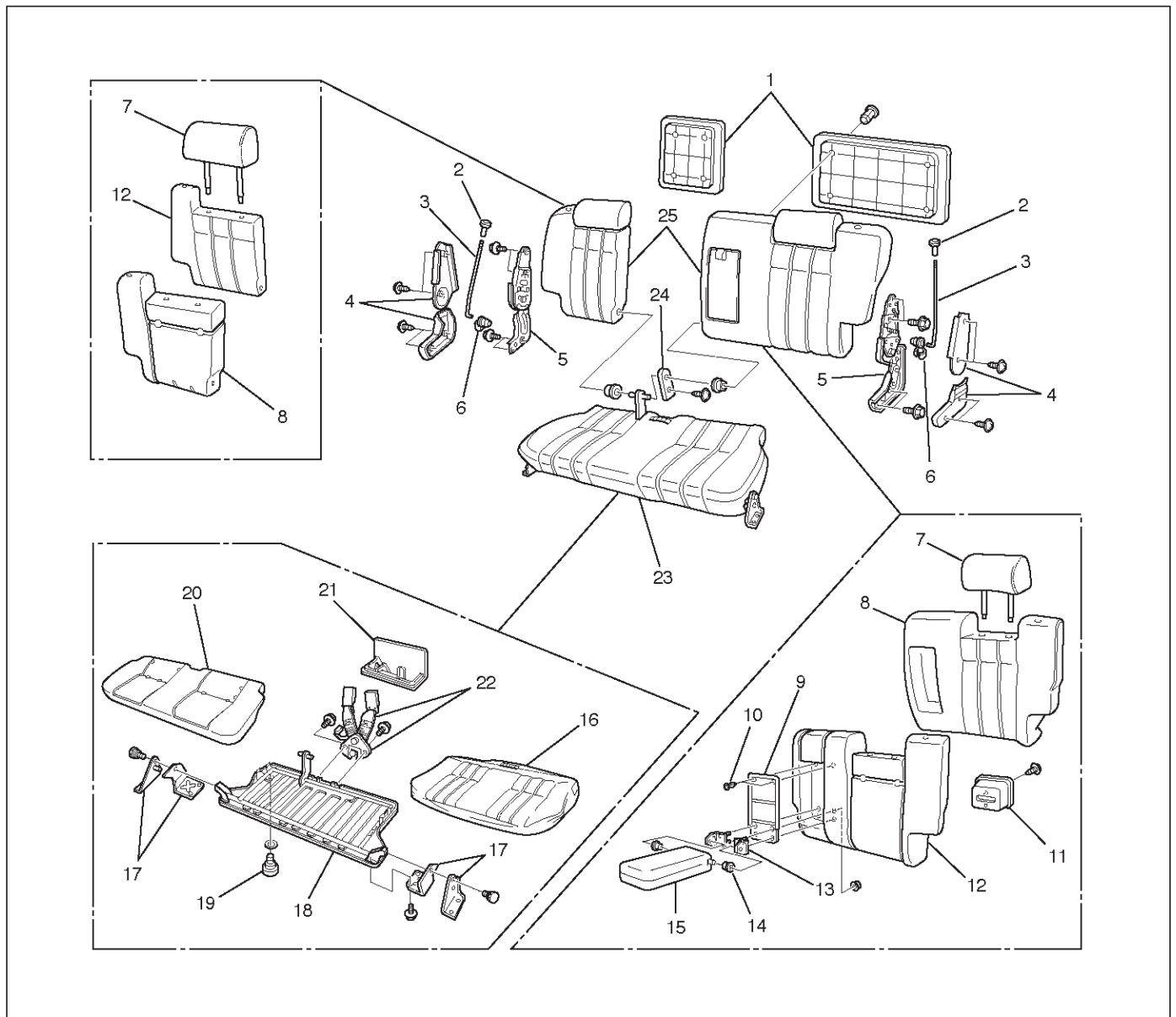
2. Loosen the rubber stopper lock nut(1). Adjust the stopper(3) so there is no clearance between the bottom of the stopper and the carpet(2) while you make sure the rear seat is firmly locked.

Then tighten the lock nut securely.



759RS005

Disassembled View (Short Wheel Base)



755RW036

Legend

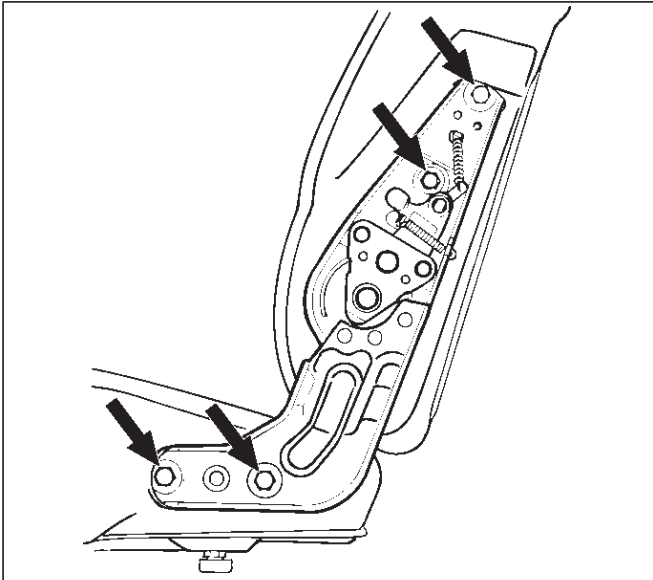
- | | |
|--------------------------|--|
| (1) Back Board | (13) Armrest Set Bracket |
| (2) Release Knob | (14) Bush |
| (3) Release Rod | (15) Armrest Assembly |
| (4) Device Cover | (16) Trim Cover |
| (5) Reclining Device | (17) Mounting Bracket |
| (6) Linkage Bush | (18) Frame Assembly |
| (7) Pillow Assembly | (19) Stopper Rubber |
| (8) Pad & Frame Assembly | (20) Pad Assembly |
| (9) Armrest Board | (21) Seat Lock Cover |
| (10) Clip | (22) Rear seat Belt Buckle and Lock Assembly |
| (11) Band Hook Cover | (23) Seat Cushion Assembly |
| (12) Trim Cover | (24) Free Hinge Cover |
| | (25) Seat Back Assembly |

Disassembly

1. Remove the back board.
 - Remove the clips and the back board.
2. Remove the device cover.
3. Remove the release knob.
 - Turn the knob counterclockwise to remove it.

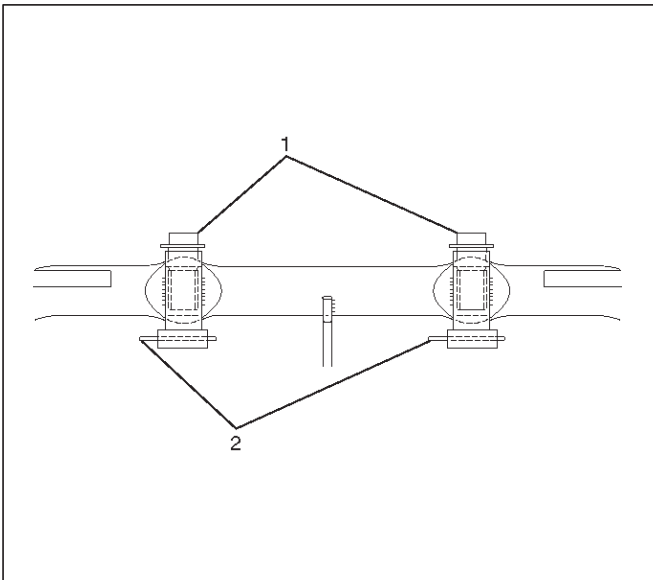
8G-20 SEATS

4. Remove the release rod.
 - Disconnect the rod from the linkage bush.
5. Remove the reclining device.



755RS004

6. Remove the seat back assembly.
7. Remove the pillow assembly.
 - Turn up the seat back trim cover and slit the pad from the back around to the place where the lock spring(2) of the guide bush(1) is.
 Then insert a finger through the slit and pull out the pillow while you are pressing down on the lock spring.



755RS017

8. Remove the band hook cover.
9. Remove the armrest assembly.
 - Turn up the seat back trim cover and remove the fixing nuts.
10. Remove the armrest set bracket.
11. Remove the armrest board.
12. Remove the trim cover.
 - Remove the trim cover fixing hog rings from the backside of the seat back.

- With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.

13. Remove the pad & frame assembly.
14. Remove the free hinge cover.
15. Remove the seat cushion assembly.
16. Remove the seat lock cover.
17. Remove the rear seat belt buckle and lock assembly.
18. Remove the mounting bracket.
19. Remove the trim cover.
 - Remove the hog rings and pull the trim cover out from the frame assembly groove.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad & frame assembly, remove the trim cover while turning it up.
20. Remove the frame assembly.
21. Remove the pad assembly.
22. Remove the stopper rubber.

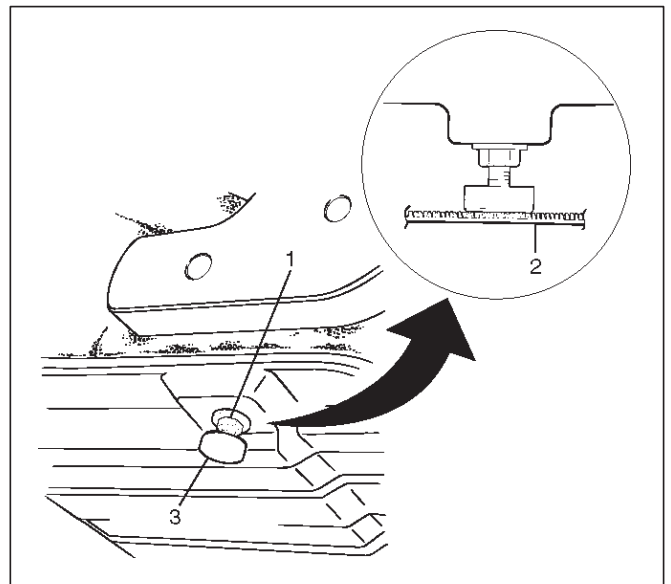
Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the reclining device fixing bolts to the specified torque.

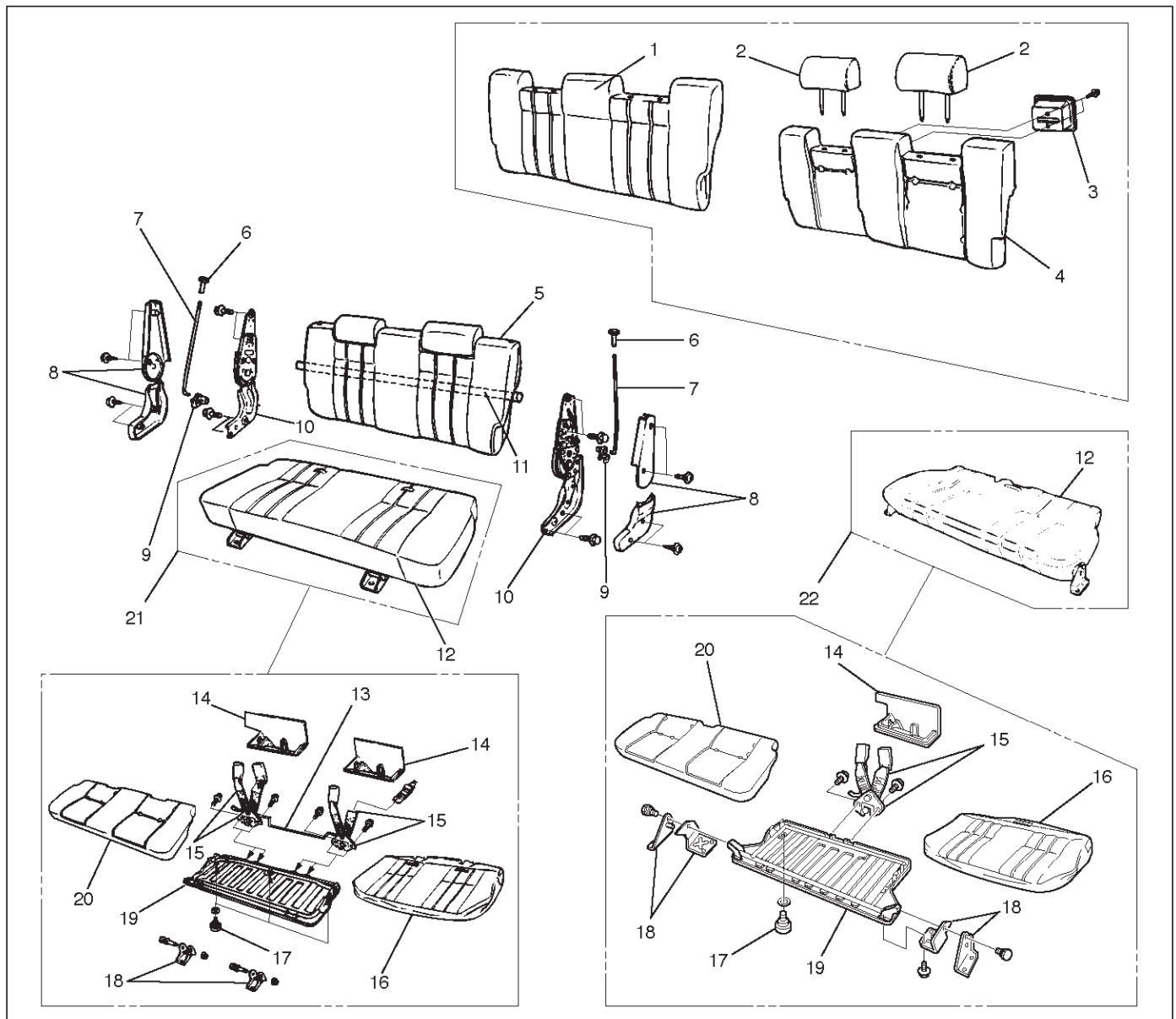
Torque: 27 N·m (2.8kg·m/20 lb ft)

2. Loosen the rubber stopper lock nut(1). Adjust the stopper(3) so there is no clearance between the bottom of the stopper and the carpet(2) while you make sure the rear seat is firmly locked. Then tighten the lock nut securely.



755RS005

Disassembled View (Bench Type)



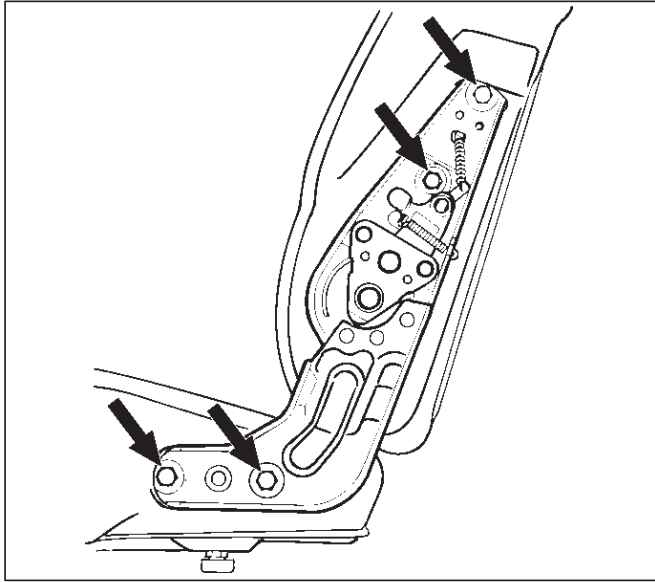
755RW033

Legend

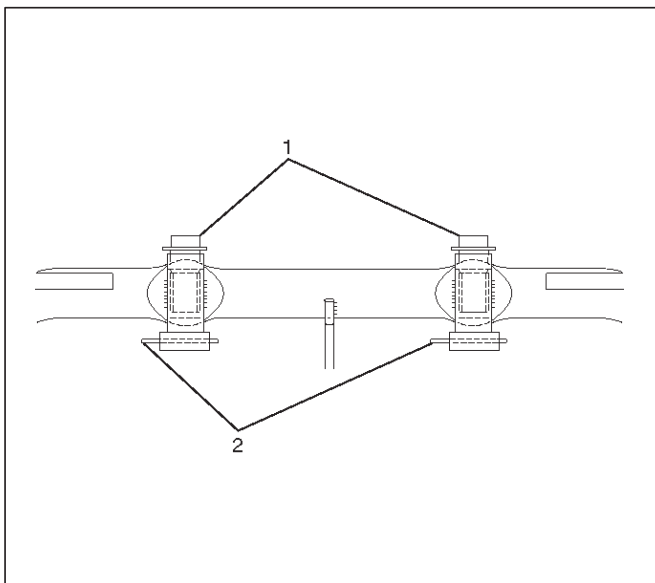
- | | |
|--------------------------|--|
| (1) Trim Cover | (12) Seat Cushion Assembly |
| (2) Pillow Assembly | (13) Connecting Link |
| (3) Band Hook Cover | (14) Seat Lock Cover |
| (4) Pad & Frame Assembly | (15) Rear Seat Belt Buckle and Lock Assembly |
| (5) Seat Back Assembly | (16) Trim Cover |
| (6) Release Knob | (17) Stopper Rubber |
| (7) Release Rod | (18) Mounting Bracket |
| (8) Device Cover | (19) Frame Assembly |
| (9) Linkage Bush | (20) Pad Assembly |
| (10) Reclining Device | (21) L-W-B |
| (11) Connecting Shaft | (22) S-W-B |

Disassembly (Bench Type)

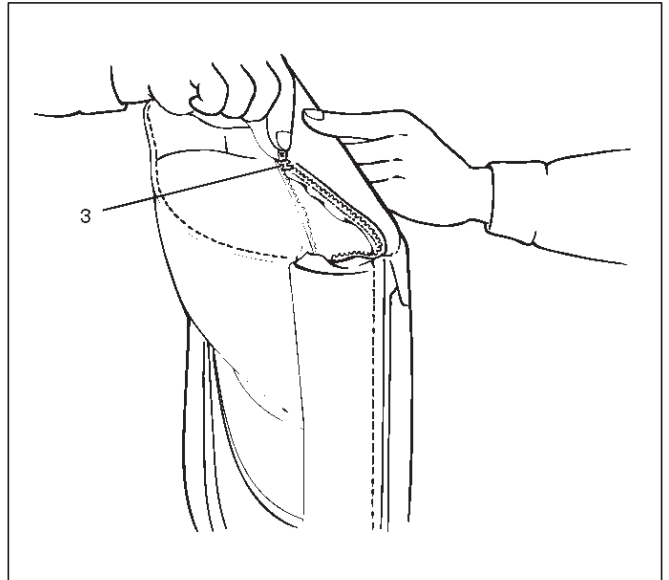
1. Remove the device cover.
2. Remove the release knob.
 - Turn the knob to the counterclockwise to remove it.
3. Remove the release rod.
 - Disconnect the rod from the linkage bush.
4. Remove the reclining device.



5. Remove the connecting shaft.
6. Remove the seat back assembly.
7. Remove the band hook cover.
8. Remove the pillow assembly.
 - Refer to the Disassembly (Split Type) in this section.



9. Remove the trim cover.
 - Open the fastener(3), and with close attention paid to the hog rings and wire which connect the trim cover and the pad and frame assembly, remove the trim cover as you turn it up.



10. Remove the pad & frame assembly.
11. Remove the seat cushion assembly.
12. Remove the seat lock cover.
13. Remove the rear seat belt buckle and lock assembly.
14. Remove the mounting bracket.
15. Remove the trim cover.
 - Remove the hog rings and pull the trim cover out from the frame assembly groove.
 - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
16. Remove the frame assembly.
17. Remove the pad assembly.
18. Remove the stopper rubber.

Reassembly (Bench Type)

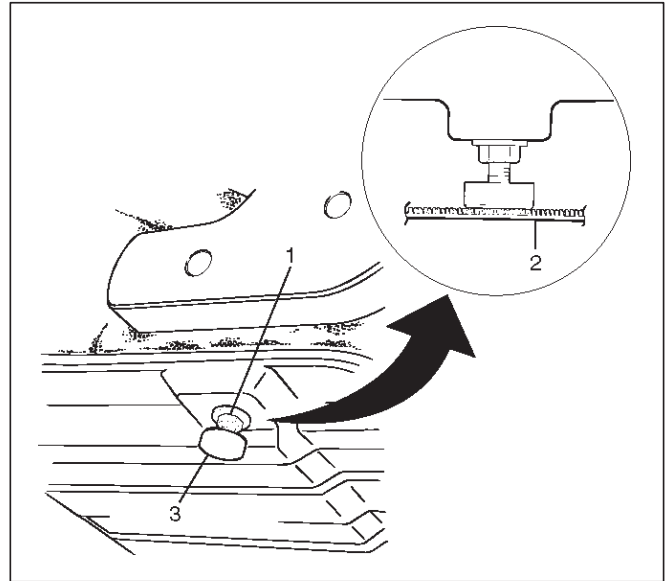
To reassemble, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the reclining device fixing bolts to the specified torque.

Torque: 27 N·m (2.8kg·m/20 lb ft)

2. Loosen the rubber stopper lock nut(1) and adjust the stopper rubber(3) so there is no clearance between the bottom of the stopper and the carpet(2), while ensuring the rear seat is firmly locked.

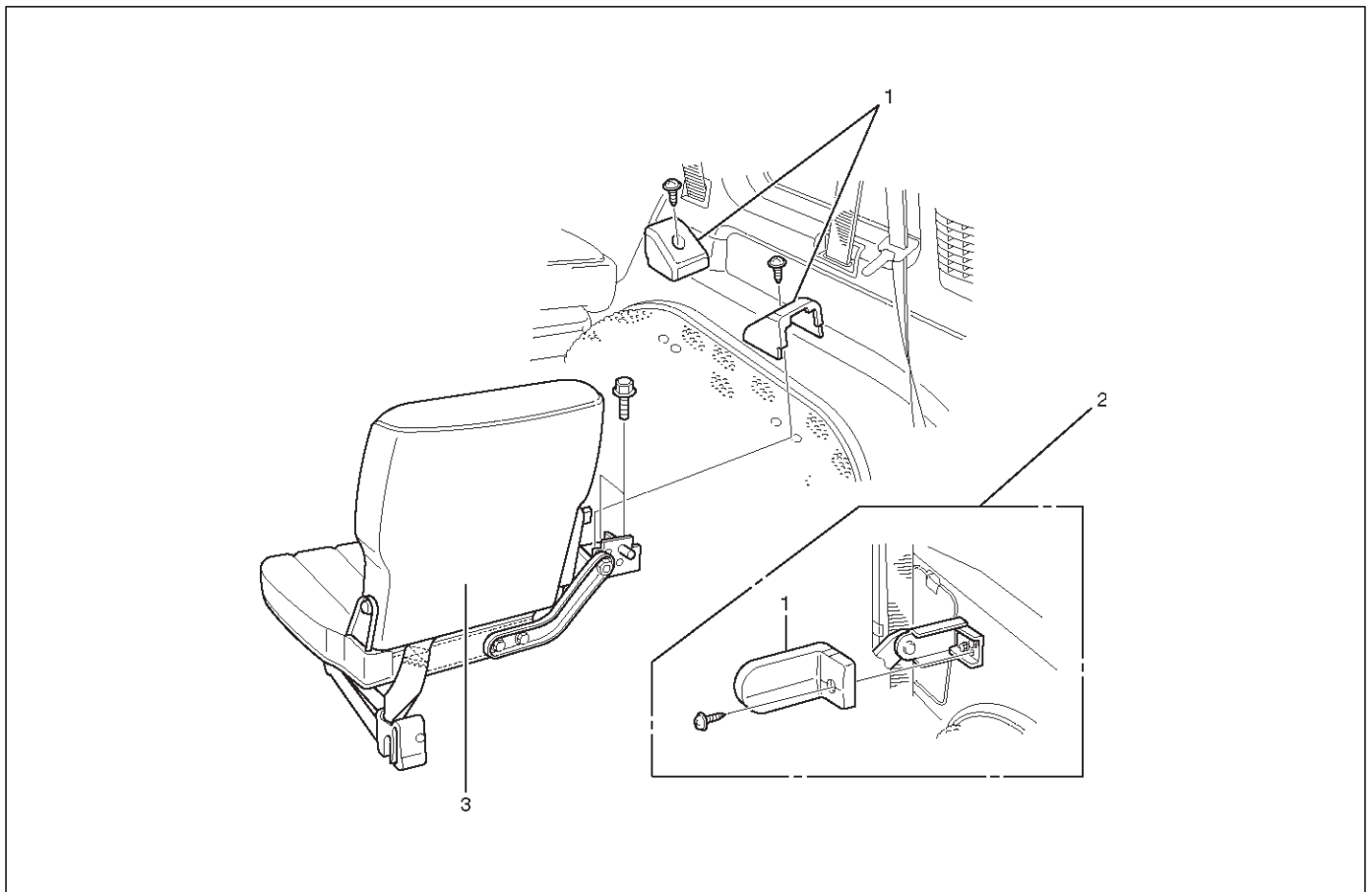
Tighten the lock nut securely.



755RS005

Third Seat Assembly

Parts Location



755RW034

Legend

(1) Cover

(2) Rear Side of LH

(3) Third Seat Assembly

Removal

1. Disconnect the battery ground cable.

2. Remove the cover.
3. Remove the third seat assembly.

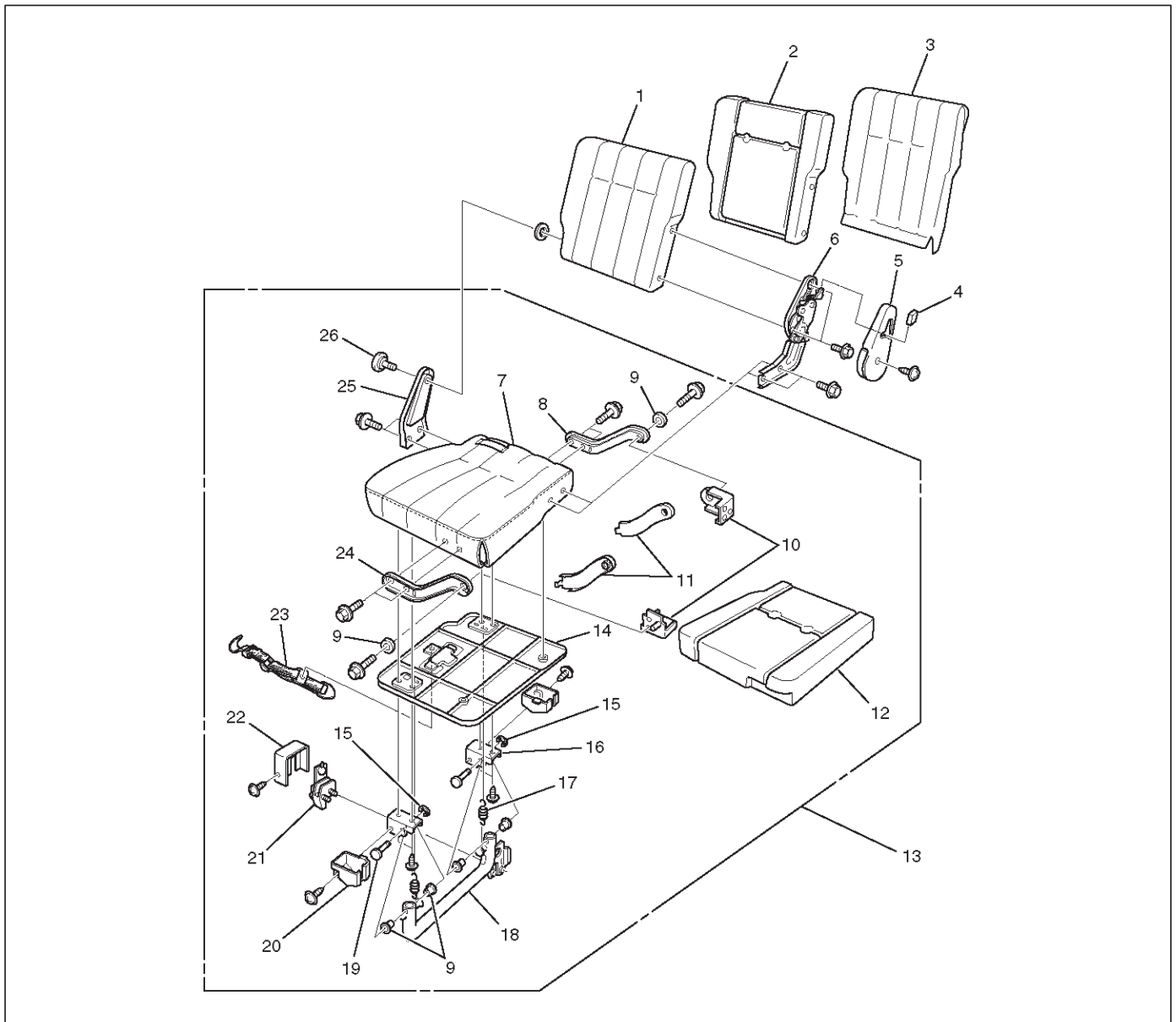
Installation

To reassemble, follow the disassembly steps in the reverse order, noting the following point.

Disassembled View

1. Tighten the reclining device fixing bolts to the specified torque.

Torque: 19 N·m (1.9kg·m/14 lb ft)



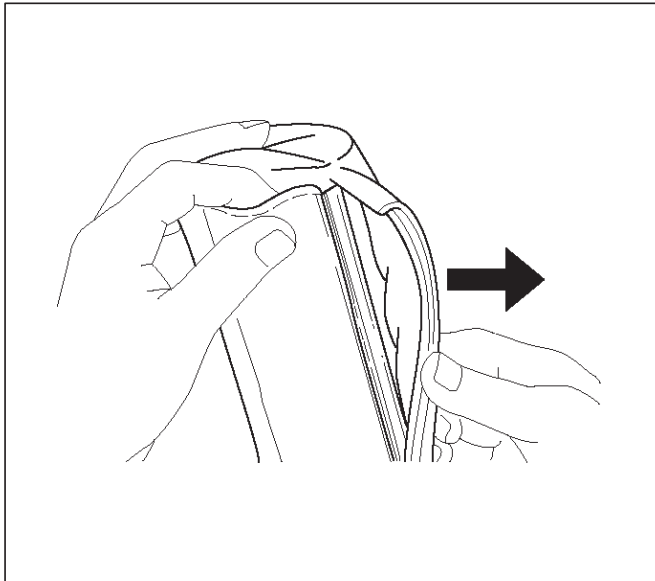
75SRW035

Legend

- | | |
|----------------------------|--------------------------|
| (1) Seat Back Assembly | (14) Board Assembly |
| (2) Pad & Frame Assembly | (15) E-Ring |
| (3) Trim Cover | (16) Cam Bracket |
| (4) Hinge Knob | (17) Tension Spring |
| (5) Hinge Cover | (18) Leg Pipe Assembly |
| (6) Hinge Assembly | (19) Hing Pin |
| (7) Trim Cover | (20) Lock Cover |
| (8) Arm Bracket | (21) Floor Lock Assembly |
| (9) Bush | (22) Lock Cover |
| (10) Bracket | (23) Band Assembly |
| (11) Arm Bracket Cover | (24) Arm Bracket |
| (12) Pad & Frame Assembly | (25) Free Hinge |
| (13) Seat Cushion Assembly | (26) Free Hinge Bolt |

Disassembly

1. Remove the hinge knob.
 - Pull the knob out from hinge assembly.
2. Remove the hinge cover.
3. Remove the hinge assembly.
4. Remove the free hinge bolt.
5. Remove the seat back assembly.
6. Remove the trim cover.
 - Turn up the trim cover from under the seat back while taking notice of the hog ring and wire.



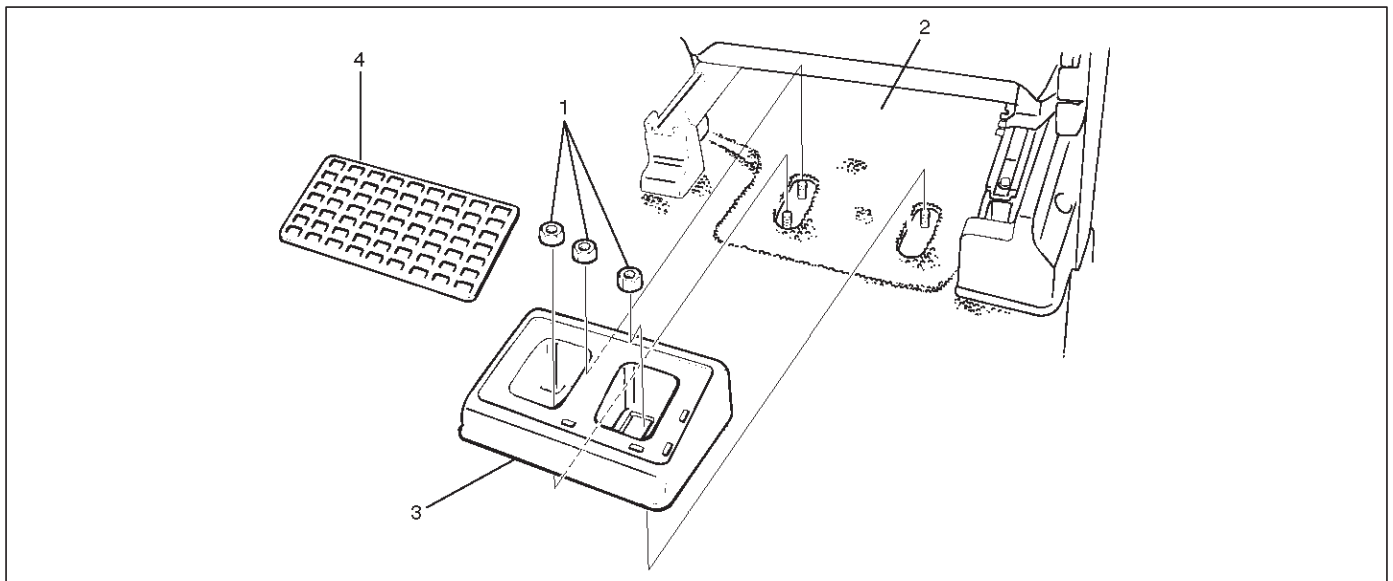
7. Remove the pad & frame assembly.
8. Remove the seat cushion assembly.
9. Remove the free hinge.
10. Remove the lock cover.
11. Remove the floor lock assembly.
12. Remove the leg cover.
13. Remove the leg pipe assembly.
 - Remove the E-ring and pull the hinge pin from cam bracket.
14. Remove the cam bracket.
15. Remove the tension spring.
16. Remove the band assembly.
17. Remove the board assembly.
18. Remove trim cover.
 - Remove the hog ring from back side seat cushion.
 - Turn up the trim cover from under the seat back while taking notice of the hog ring.
19. Remove the arm bracket.
20. Remove the arm bracket cover.
21. Remove the pad & frame assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order.

Rear Seat Foot Rest

Rear Seat Foot Rest and Associated Parts

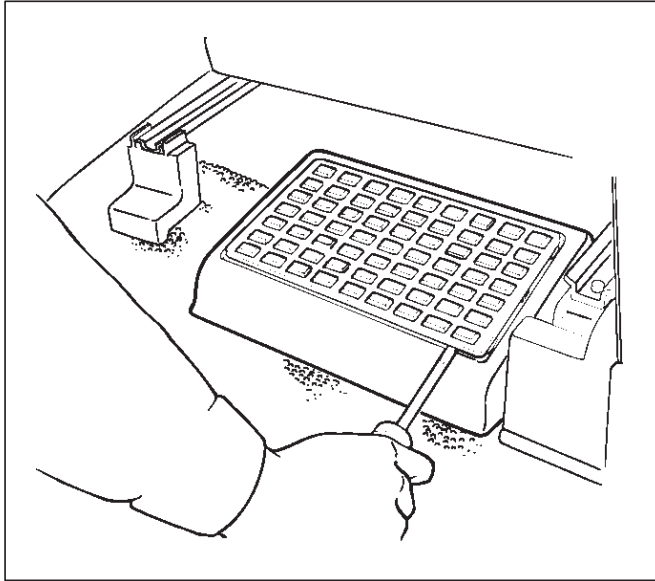


Legend

- | | |
|----------------|-------------------------|
| (1) Fixing Nut | (3) Rear Seat Foot Rest |
| (2) Front Seat | (4) Foot Rest Pad |

Removal

1. Remove the foot rest pad.



676RS002

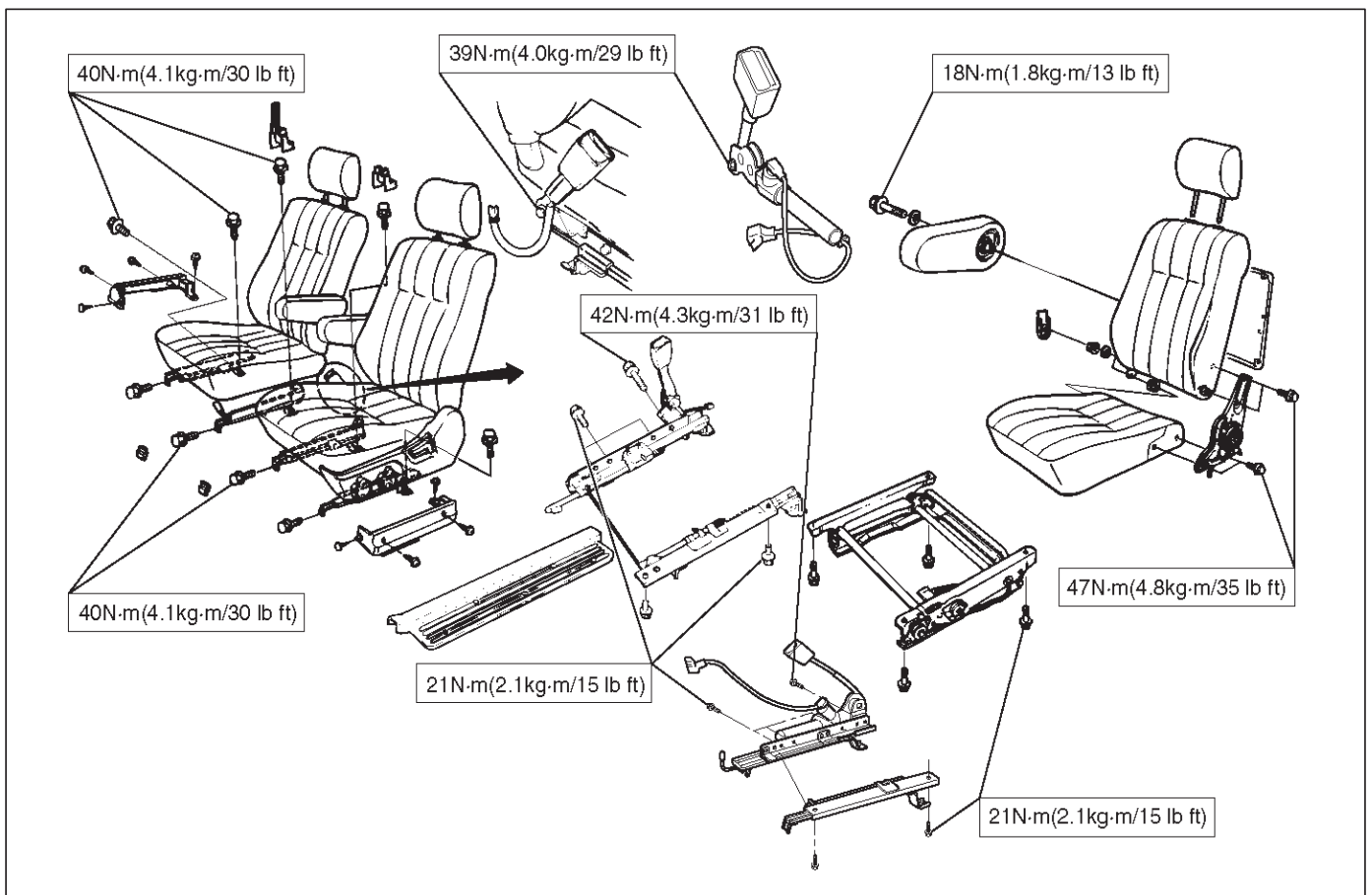
2. Remove the fixing nuts.
3. Remove the rear seat foot rest.

Installation

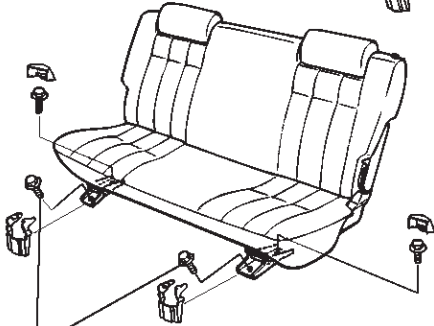
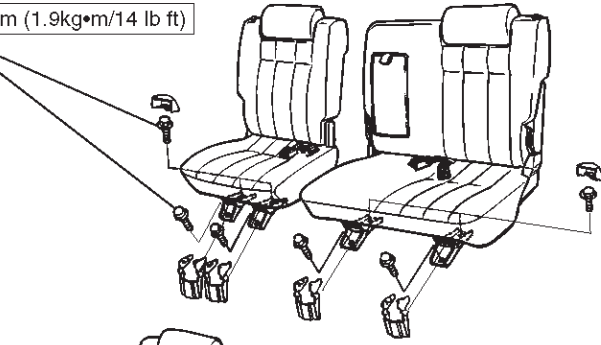
To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specifications

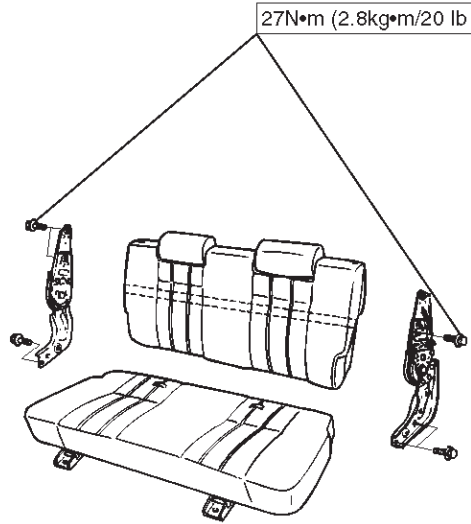


19N•m (1.9kg•m/14 lb ft)



19N•m (1.9kg•m/14 lb ft)

27N•m (2.8kg•m/20 lb ft)



BODY AND ACCESSORIES

SECURITY AND LOCKS

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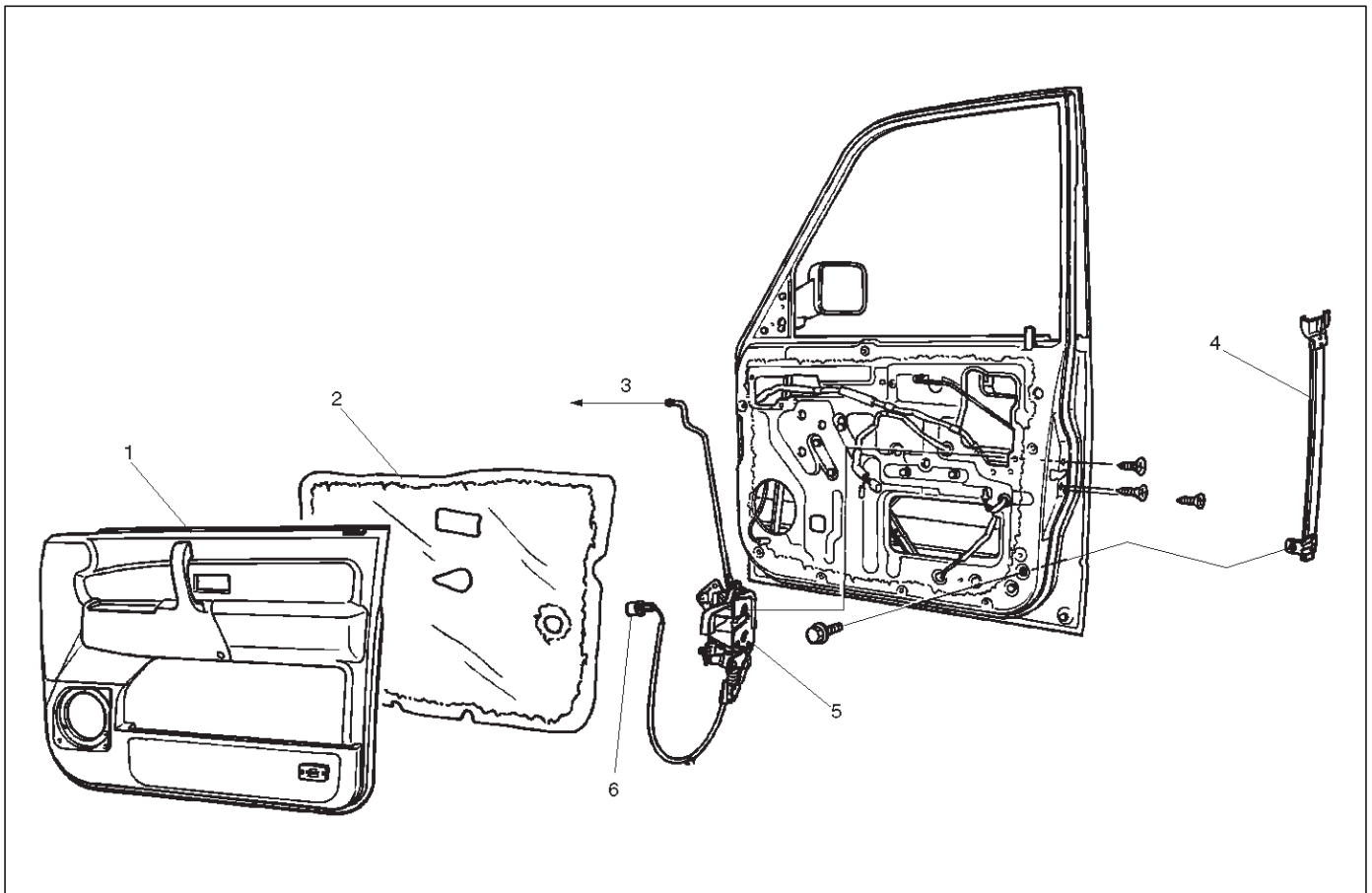
Service Precaution

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

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

Front Door Lock Assembly

Front Door Lock Assembly and Associated Parts



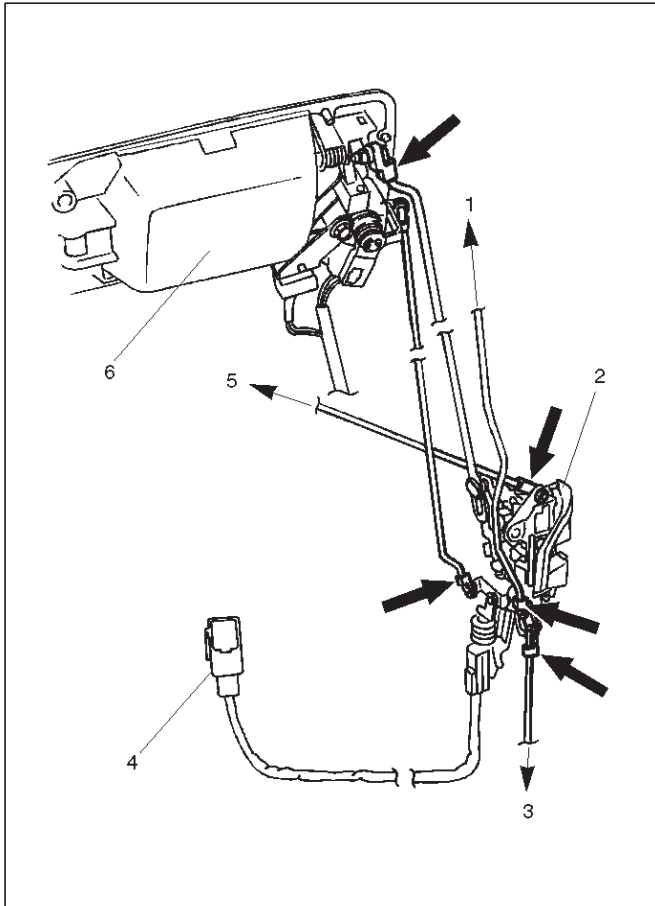
Legend

- | | |
|-----------------------|--|
| (1) Door Trim Panel | (4) Rear Guide Rail |
| (2) Waterproof Sheet | (5) Door Lock Assembly |
| (3) To Outside Handle | (6) Door Lock Switch Connector (W/Power Door Lock) |

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
Refer to the Window Regulator removal procedure in Body Structure section.

4. Raise the glass up to the uppermost position, and then remove the rear guide rail.
5. Disconnect the door lock switch connector (w/power door lock) and locking links (arrow marks positions), then remove the door lock assembly fixing screws and door lock assembly.



632RS004

Legend

- (1) To Inside Lock Knob
- (2) Door Lock Assembly
- (3) To Actuator
- (4) Door Lock Switch Connector
- (5) To Inside Handle
- (6) Outside Handle

Installation

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

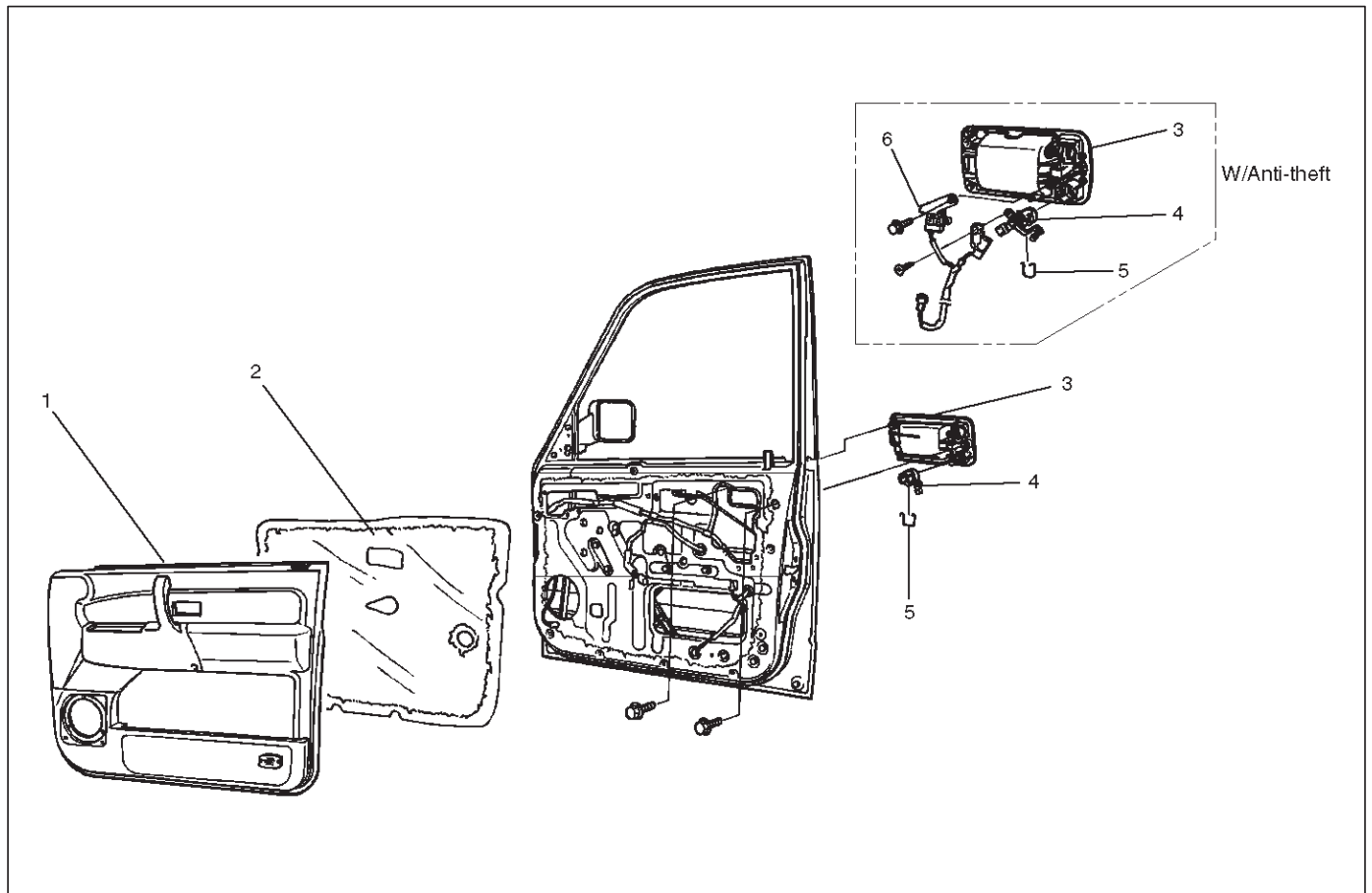
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

Torque: 7 N·m (0.7kg·m/61 lb in)

3. Check that the door lock operates smoothly.

Front Outside Handle and Door Lock Cylinder

Front Outside Handle, Door Lock Cylinder and Associated Parts



632RS006

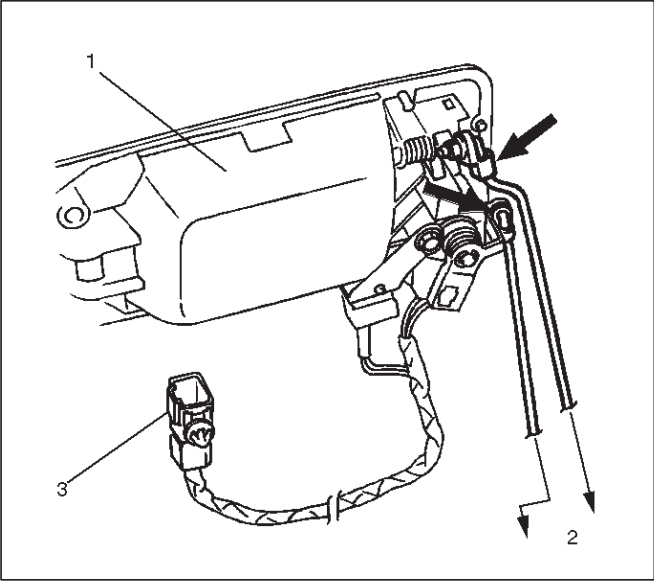
Legend

- | | |
|----------------------|-------------------------------|
| (1) Door Trim Panel | (4) Door Lock Cylinder |
| (2) Waterproof Sheet | (5) Clip |
| (3) Outside Handle | (6) Key Switch (W/Anti-Theft) |

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
Refer to the Window Regulator removal procedure in Body Structure section.

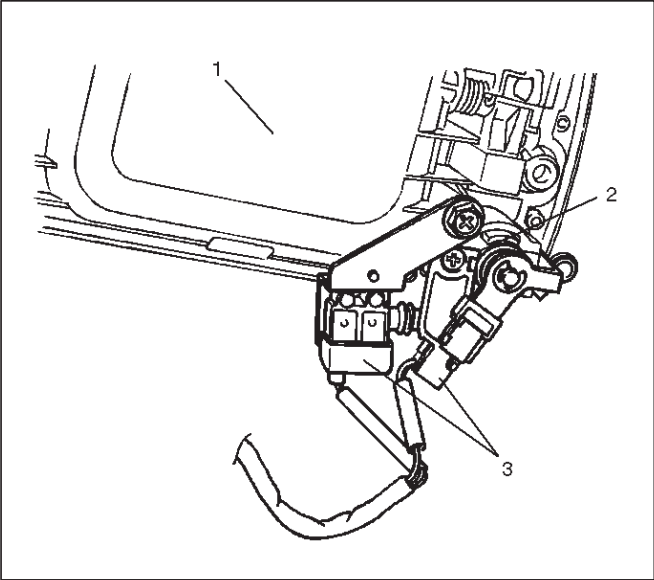
4. Disconnect the locking links (arrow marks positions) and key switch connector (w/anti-theft) to remove the outside handle.



Legend

- (1) Outside Handle
- (2) To Door Lock Assembly
- (3) Key Switch Connector (W/Anti-Theft)

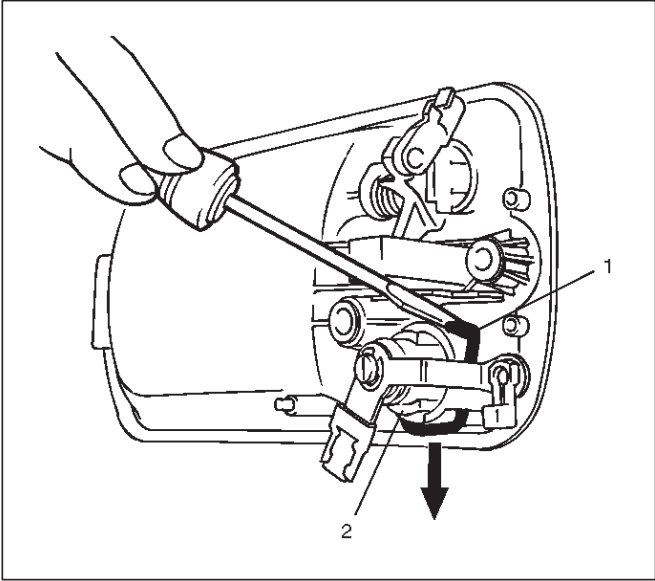
5. Remove the key Switch.



Legend

- (1) Outside Handle
- (2) Lock Cylinder
- (3) Key Switch

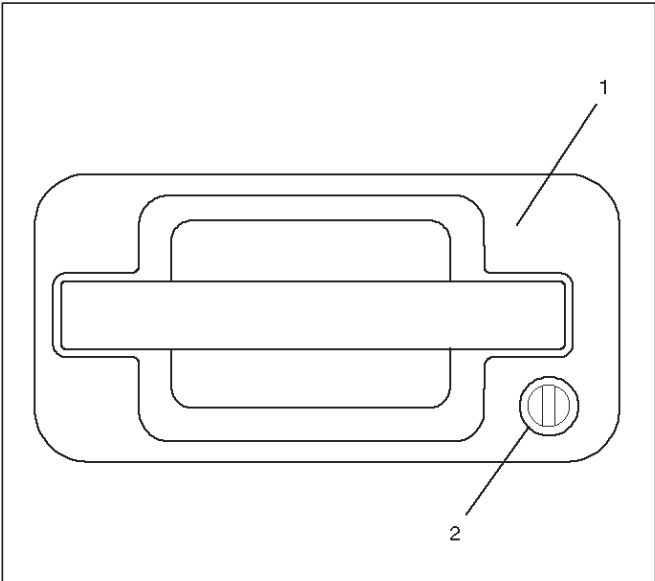
6. Remove the fixing clip(1) to remove the door lock cylinder(2).



Installation

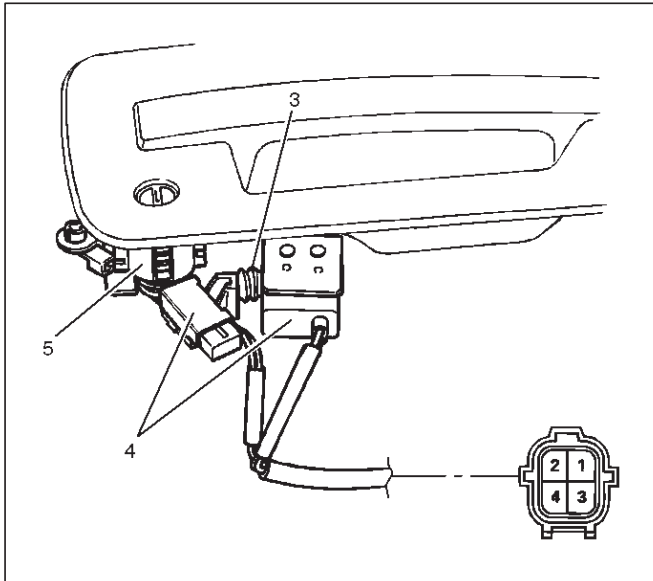
To install, follow the removal steps in the reverse order, noting the following points.

- 1. Be sure to install the door lock cylinder(2) at a right angle to the outside handle(1).



8H-6 SECURITY AND LOCKS

2. For the anti-theft system, be sure to install the push rod(3) of key switch while pressing it to the door lock cylinder(5) so that there is no continuity between the key switch(4) side connector terminal No. D6-2 and D6-4 (No. D16-2 and D16-4: passenger side).



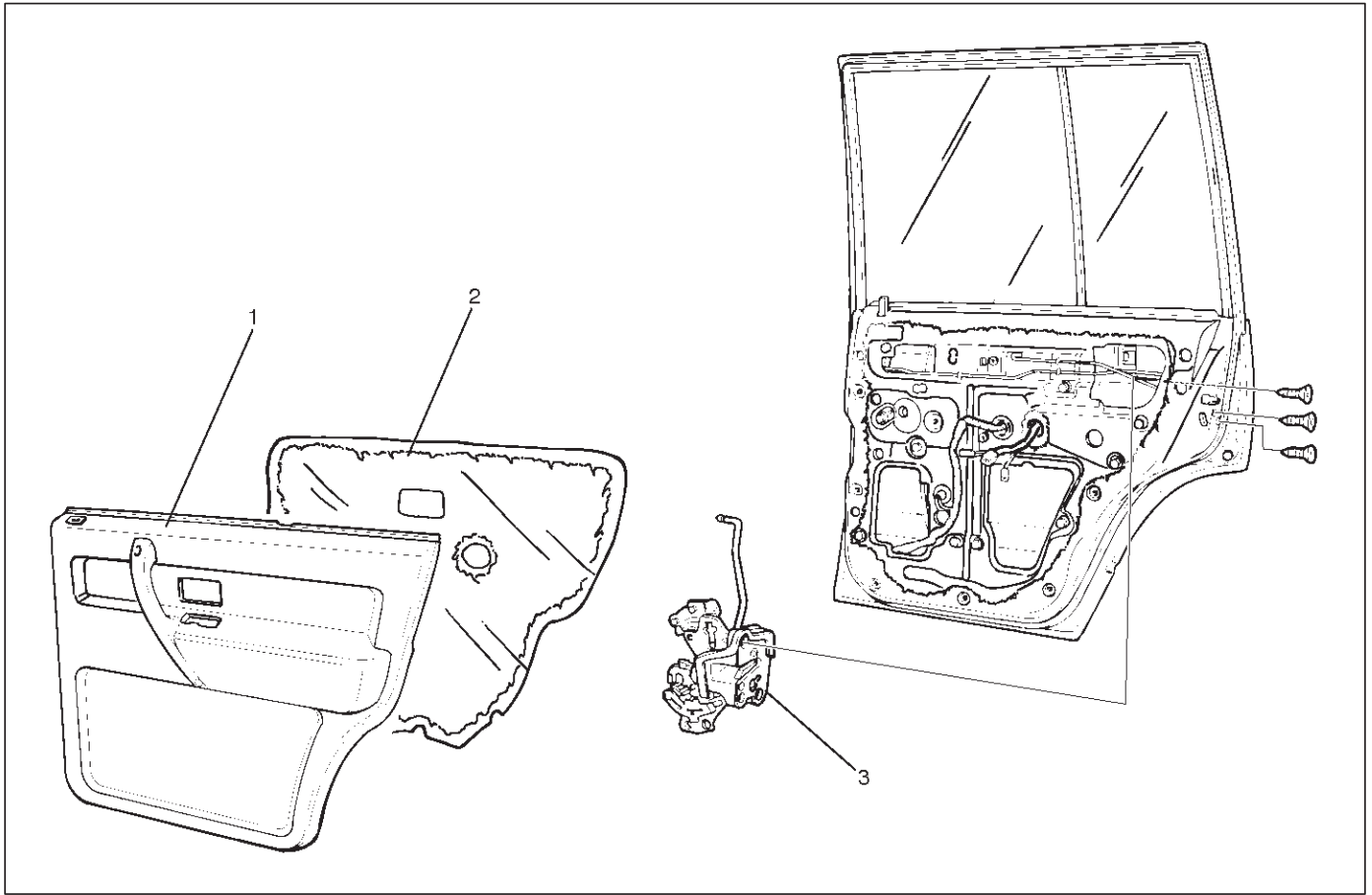
3. Tighten the outside handle and key switch fixing bolts to the specified torque.

Torque: 9 N·m (0.9kg·m/78 lb in)

4. Check for smooth outside handle and lock cylinder operation.

Rear Door Lock Assembly

Rear Door Lock Assembly and Associated Parts



652RW004

Legend

(1) Door Trim Panel

(2) Waterproof Sheet

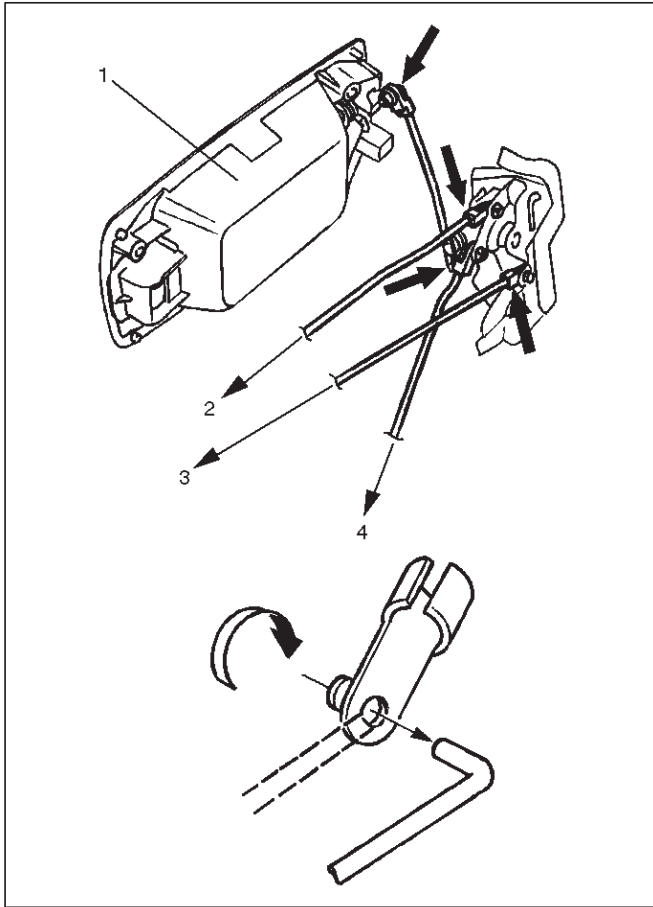
(3) Door Lock Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
Refer to the Window Regulator removal procedure in Body Structure section.

8H-8 SECURITY AND LOCKS

4. Disconnect the locking links (arrow marks positions) and remove the fixing screws to remove the door lock assembly.



Legend

- (1) Outside Handle
- (2) To Inside Lock Knob
- (3) To Inside Handle
- (4) To Actuator

Installation

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

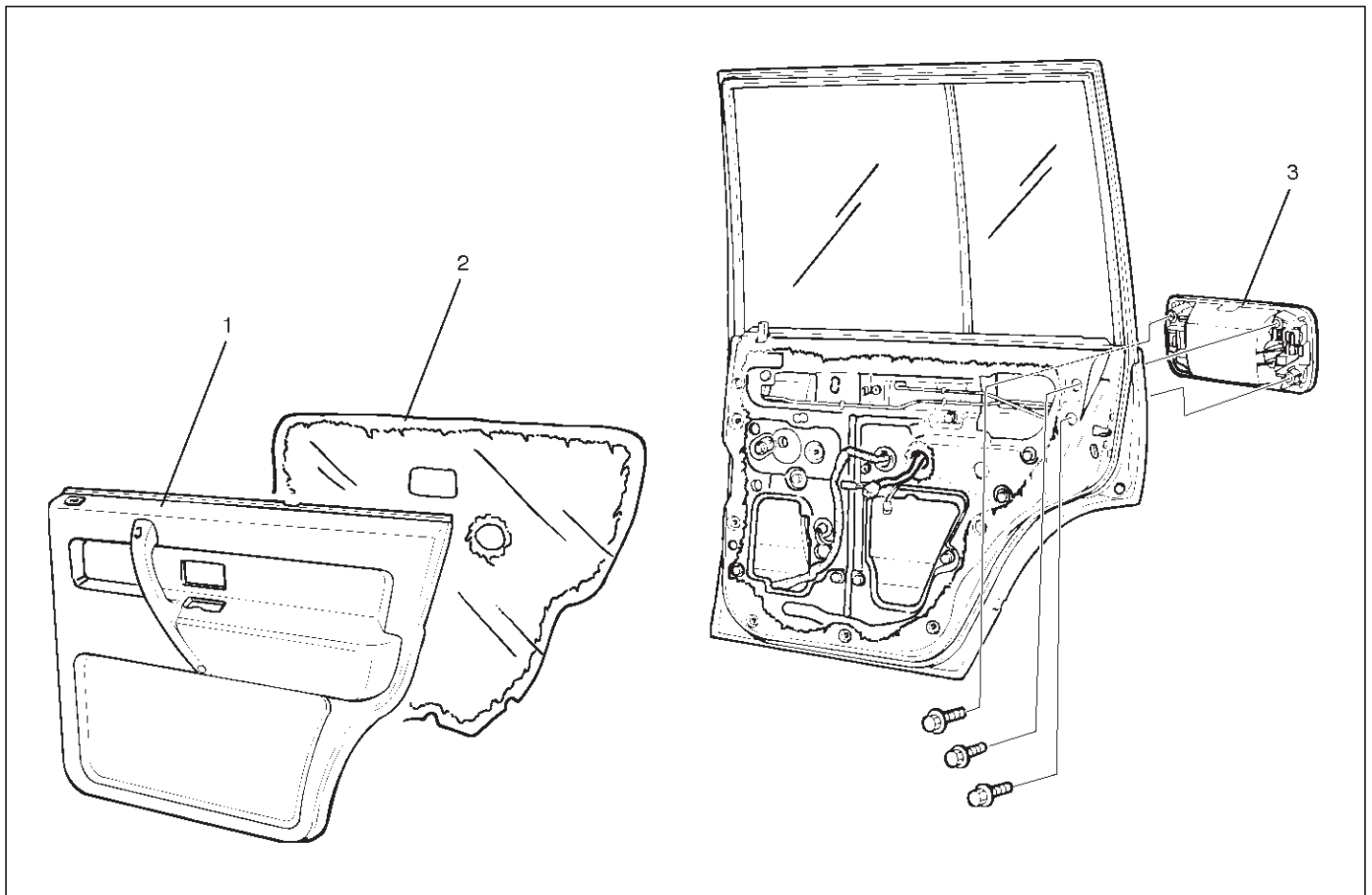
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

Torque: 7 N·m (0.7kg·m/61 lb in)

3. Check that the door lock operates smoothly.

Rear Outside Handle

Rear Outside Handle and Associated Parts



652RW003

Legend

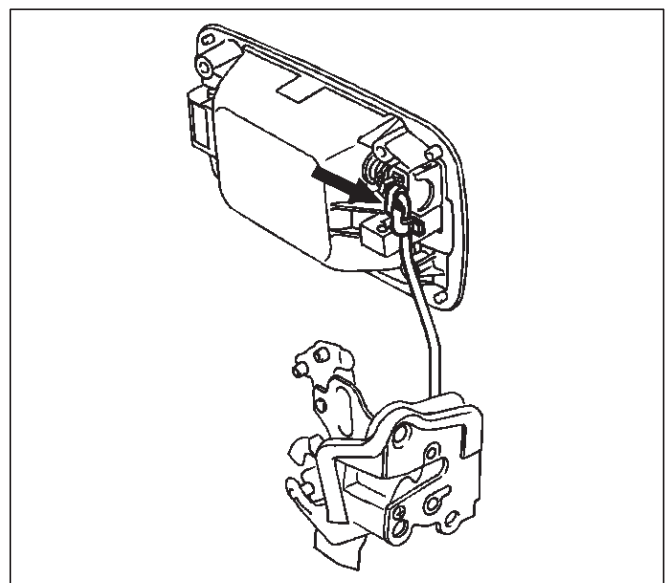
(1) Door Trim Panel

(2) Waterproof Sheet

(3) Outside Handle

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
Refer to the Window Regulator removal procedure in Body Structure section.
4. Disconnect the locking link (arrow mark position) and remove three fixing bolts to remove the outside handle.



652RS003

8H-10 SECURITY AND LOCKS

Installation

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

1. Tighten the outside handle fixing bolts to the specified torque.

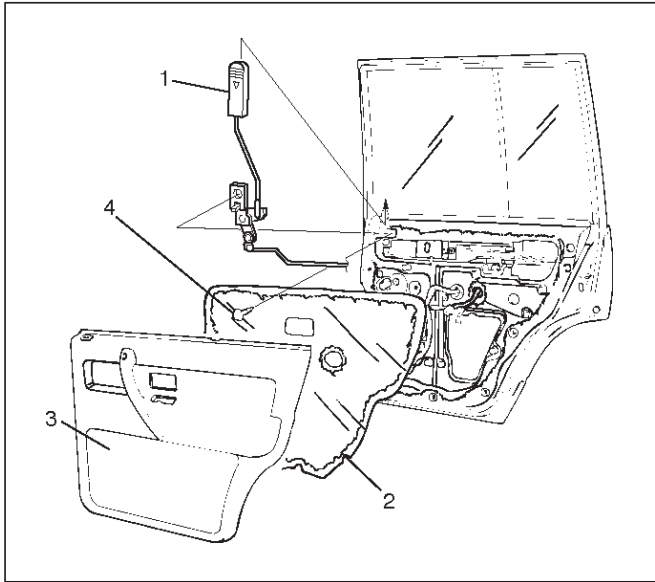
Torque: 9 N·m (0.9kg·m/78 lb in)

2. Check that the outside handle operates smoothly.

Rear Door Inside Lock Knob Link

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel(3).
3. Remove the waterproof sheet(2).
Refer to the Window Regulator removal procedure in Body Structure section.
4. Remove the fixing screw(4) and disconnect the locking link at the door lock assembly to remove the rear door inside lock knob link(1).



655RW009

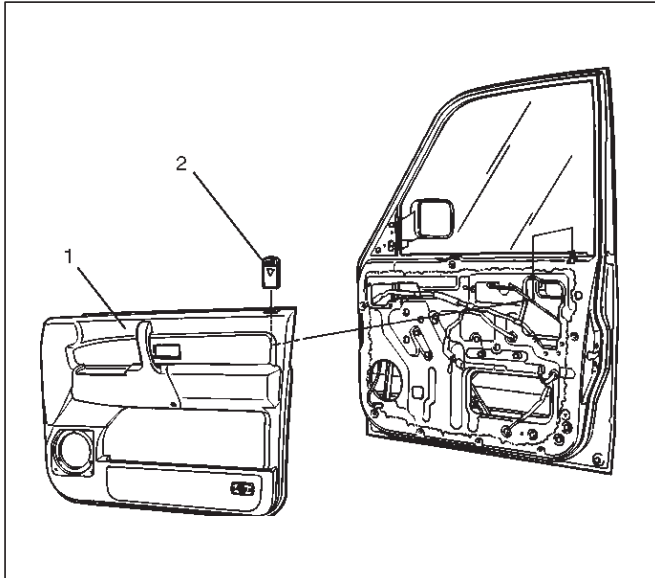
Installation

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

Door Inside Lock Knob

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel(1).
Refer to the Door Trim Panel removal procedure in Exterior/Interior Trim section.
3. Turn the door inside lock knob counterclockwise and then remove the door inside lock knob (2).



632RS011

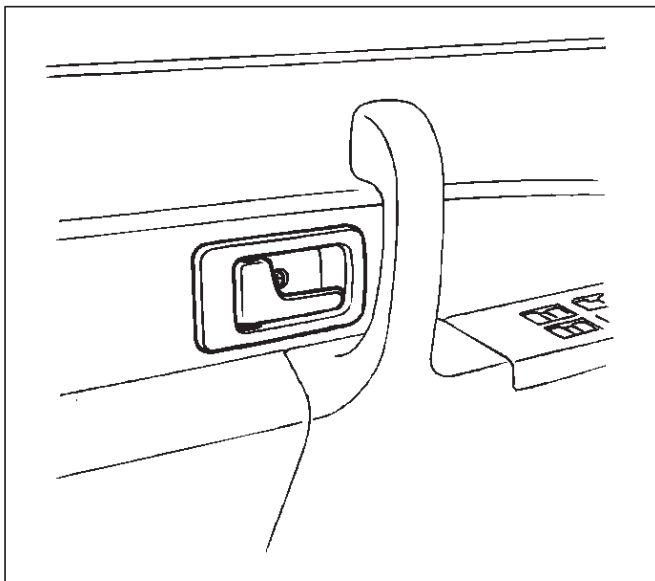
Installation

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

Door Inside Handle

Removal and Installation

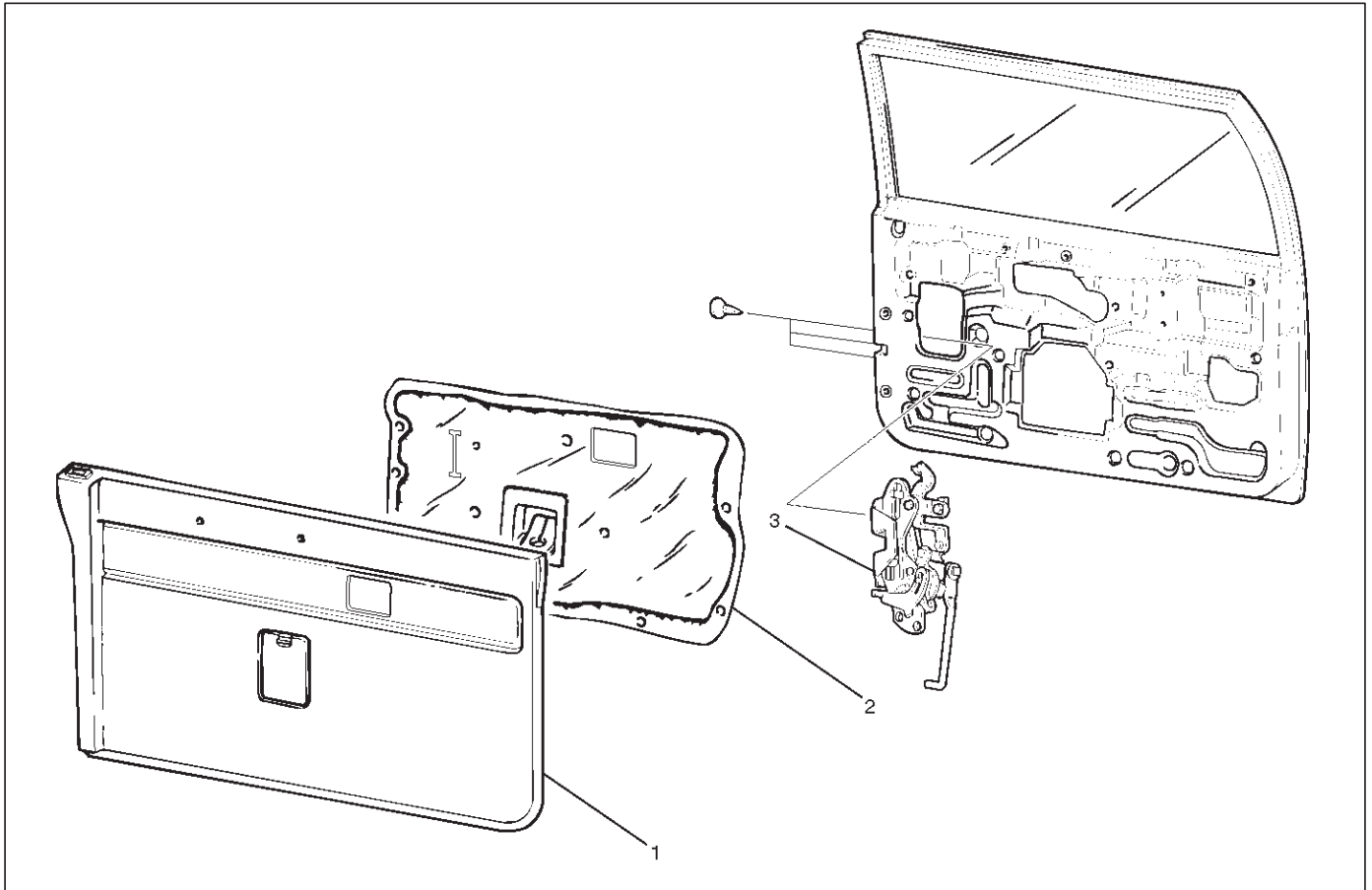
Refer to the Door Trim Panel removal and installation procedures in Exterior/Interior Trim section.



635RS008

Tailgate Lock Assembly (LH)

Tailgate Lock Assembly (LH) and Associated Parts



684RW006

Legend

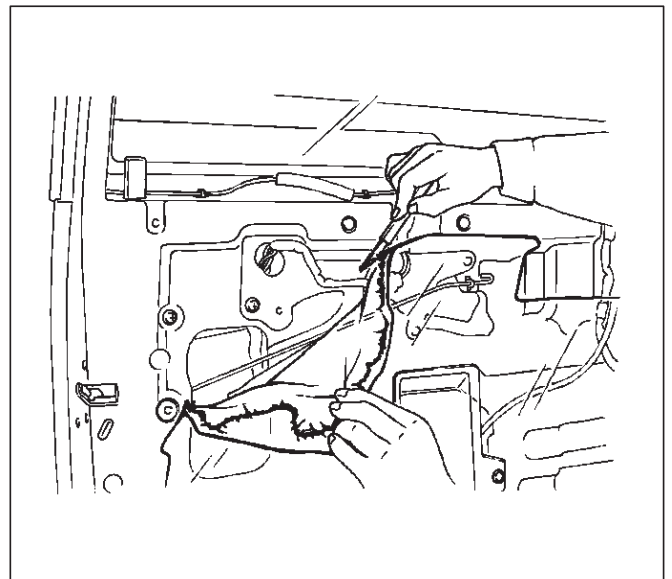
(1) Tailgate Trim Panel(LH)

(2) Waterproof Sheet

(3) Tailgate Lock Assembly

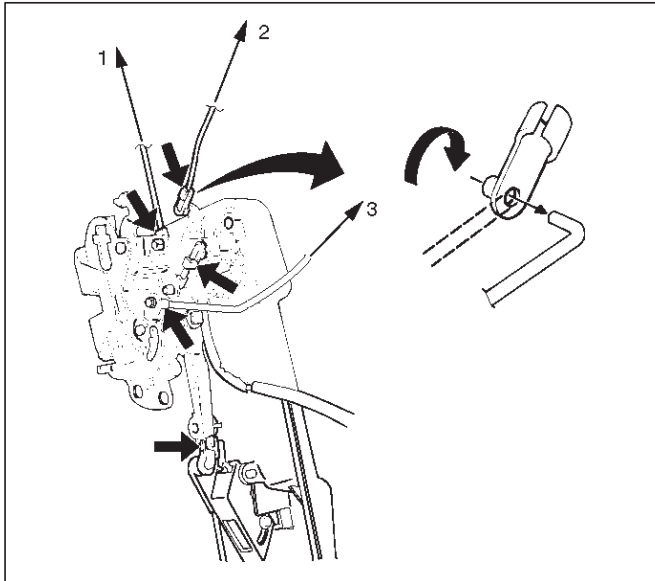
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (LH).
Refer to the Tailgate Trim Panel (LH) removal procedure in Exterior/Interior Trim section.
3. Taking notice of the tailgate harness, peel the waterproof sheet off the tailgate panel carefully and then remove the waterproof sheet.



684RS005

4. Disconnect the locking links (arrow marks positions), remove three fixing screws and then remove the tailgate lock assembly (LH).



Legend

- (1) To Inside Lock Knob
- (2) To Actuator
- (3) To Inside Handle

Installation

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

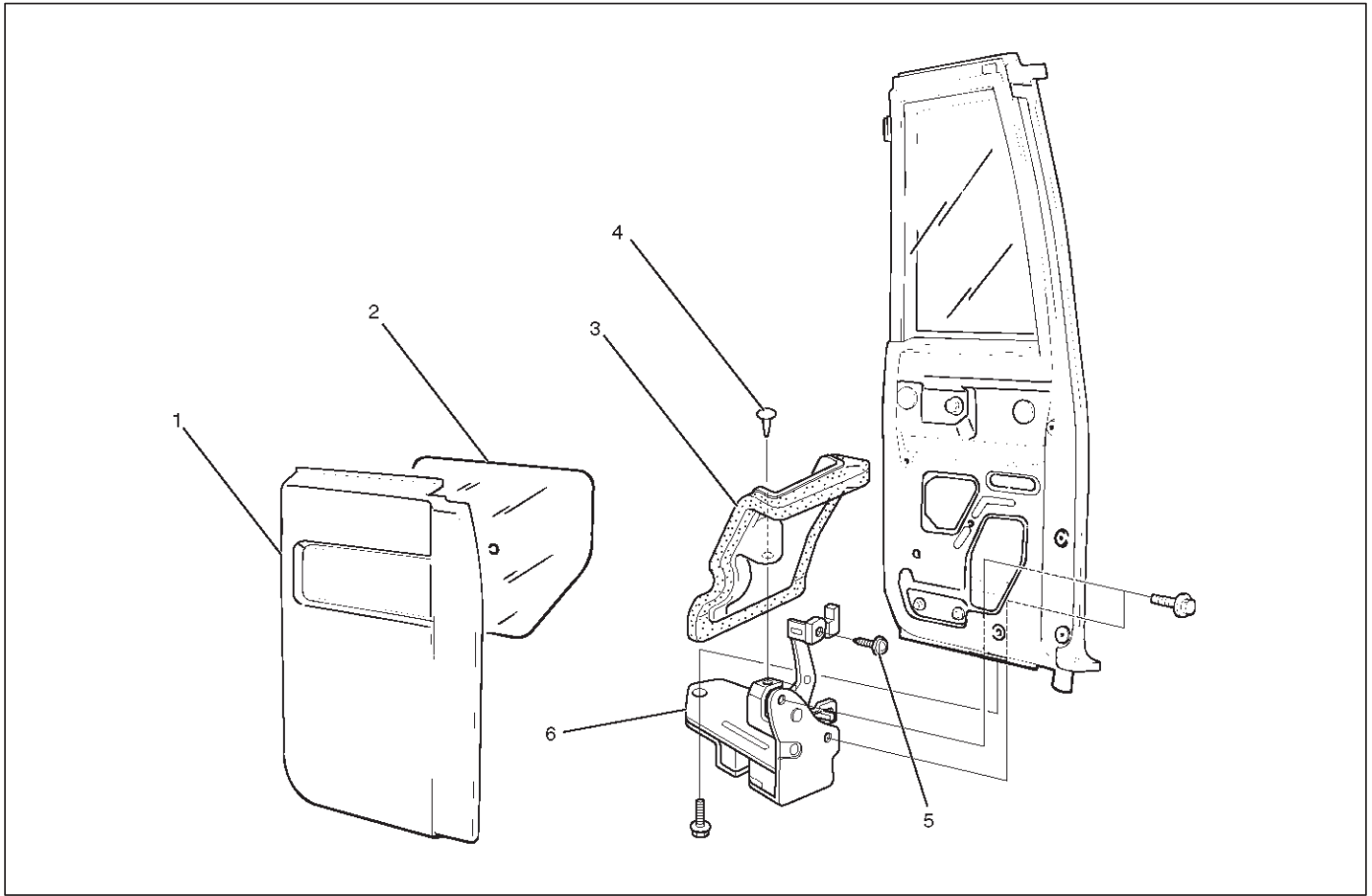
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the tailgate lock assembly fixing screws to the specified torque.

Torque: 7 N·m (0.7kg·m/61 lb in)

3. Check that the tailgate lock operates correctly after installing it.

Tailgate Lock Assembly (RH)

Tailgate Lock Assembly (RH) and Associated Parts



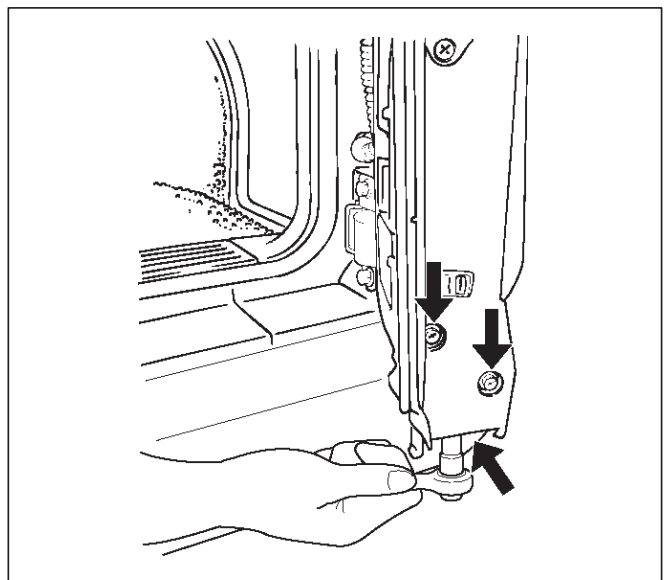
684RW006

Legend

- | | |
|------------------------------|---------------------------------|
| (1) Tailgate Trim Panel (RH) | (4) Clip |
| (2) Waterproof Sheet | (5) Screw |
| (3) Tailgate Lock Seal | (6) Tailgate Lock Assembly (RH) |

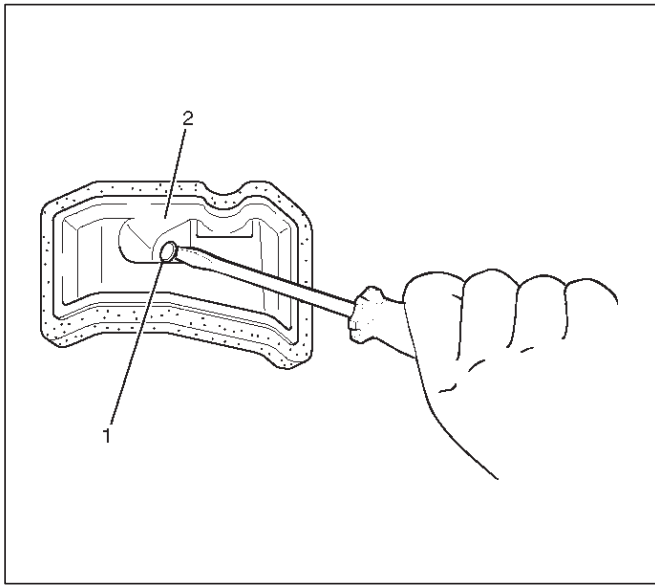
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (RH).
Refer to the Tailgate Trim Panel (RH) removal procedure in Exterior/Interior Trim section.
3. Peel the waterproof sheet off the tailgate panel carefully and then remove the waterproof sheet.
4. Remove three fixing bolts and then remove the tailgate lock assembly (RH).



683RW006

- Remove the tailgate lock seal fixing clip(1) and then remove the tailgate lock seal(2).



683RW008

Installation

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

- Apply chassis grease to the lock assembly and striker moving surface.
- Tighten the tailgate lock assembly fixing bolts to the specified torque.

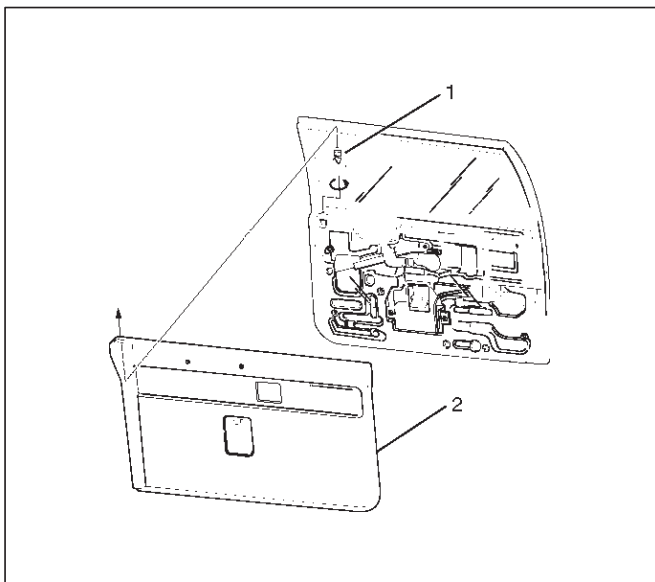
Torque: 11 N·m (1.1kg·m/95 lb in)

- Check that the tailgate lock operates correctly after installing it.

Tailgate Inside Lock Knob

Removal

- Disconnect the battery ground cable.
- Remove the tailgate trim panel (LH)(2).
Refer to the Tailgate Trim Panel (LH) removal procedure in Exterior/Interior Trim section.
- Take care of cushion to turn the lock knob counterclockwise and then remove the tailgate inside lock knob(1).



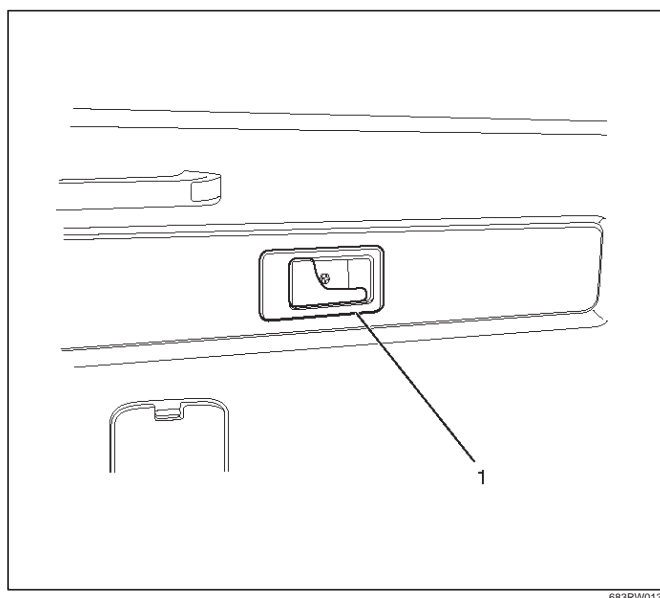
683RW014

Installation

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

Tailgate Inside Handle

Parts Location



683RW013

Legend

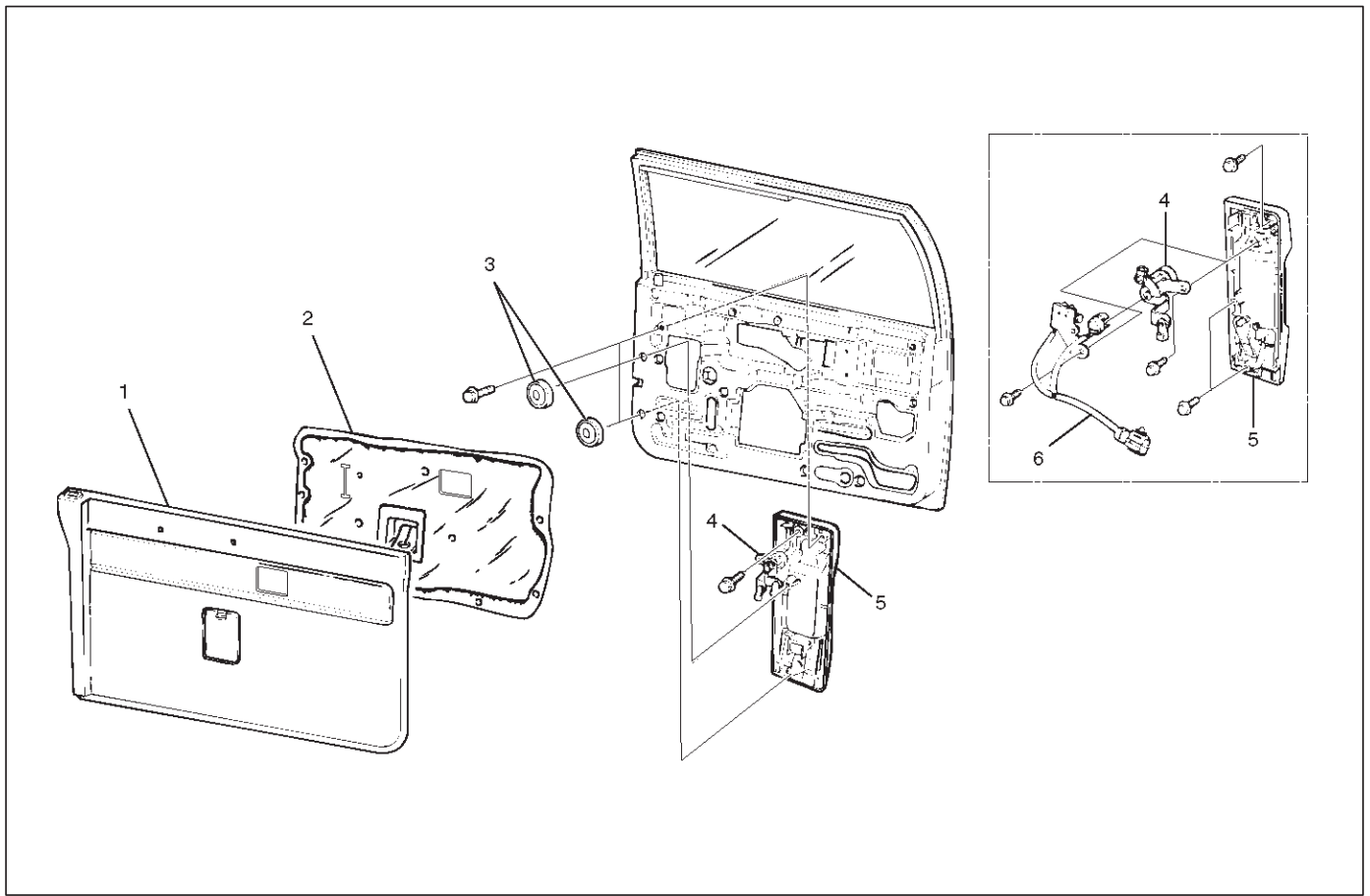
- (1) Tailgate Inside Handle

Removal and Installation

- Refer to the Tailgate Trim Panel (LH) removal procedure in Exterior/Interior Trim section.

Tailgate Outside Handle and/or Tailgate Lock Cylinder

Tailgate Outside Handle and/or Tailgate Lock Cylinder and Associated Parts



684RW007

Legend

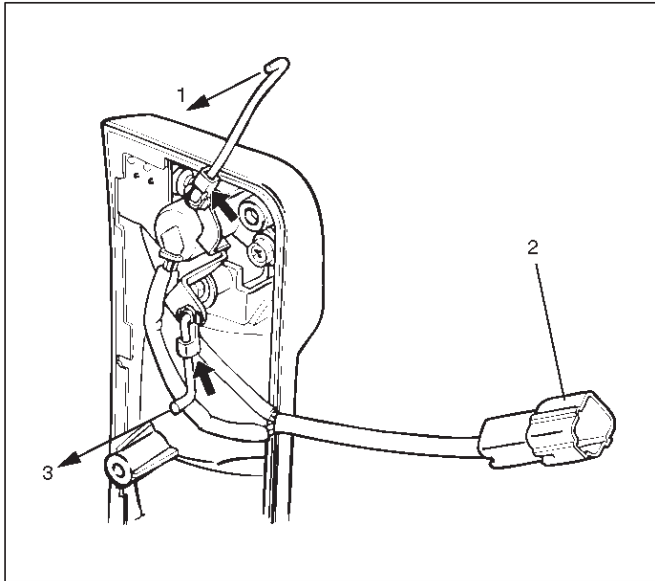
- | | |
|------------------------------|-------------------------------|
| (1) Tailgate Trim Panel (LH) | (4) Tailgate Lock Cylinder |
| (2) Waterproof Sheet | (5) Tailgate Outside Handle |
| (3) Grommet | (6) Key Switch (W/Anti-Theft) |

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel.
3. Remove the waterproof sheet.
Refer to the Tailgate Lock Assembly (LH) in this section.
4. Remove the grommet.

8H-18 SECURITY AND LOCKS

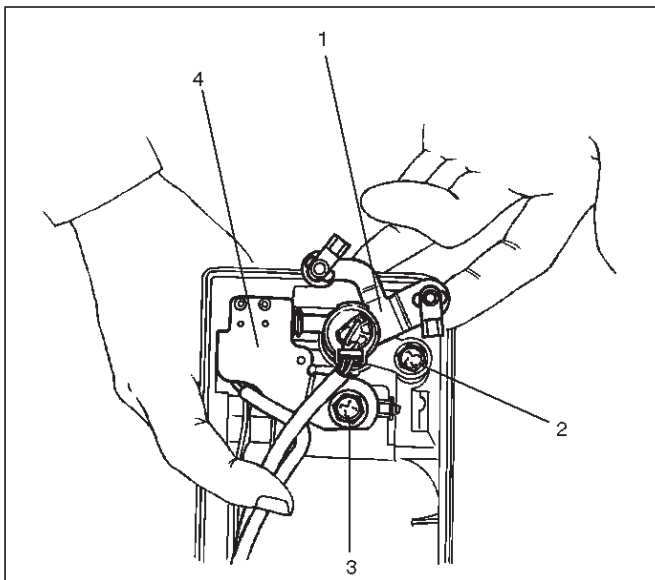
5. Disconnect the locking links (arrow marks positions), key switch connector (w/anti-theft) and remove three fixing bolts to remove the tailgate outside handle.



Legend

- (1) To Actuator
- (2) Key Switch Connector (W/Anti-Theft)
- (3) To Lock Assembly

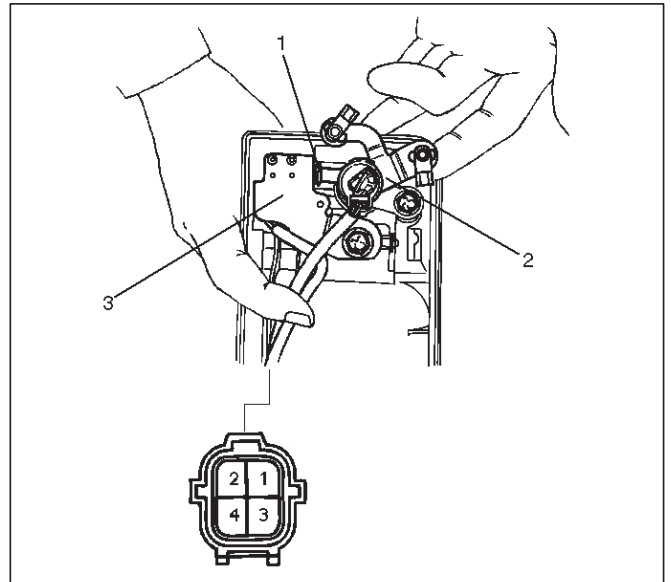
6. Remove the key switch fixing bolt(3) to remove the key switch (w/anti-theft) (4) from the tailgate lock cylinder (1).
And remove the tailgate lock cylinder fixing bolt(2) to remove the tailgate lock cylinder.



Installation

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

1. For the anti-theft system, install the push rod(1) of the key switch(3) to the key cylinder(2) while pressing it so that there is not continuity between the key switch side connector terminals No. G5-2 and G5-4 as shown in the figure.



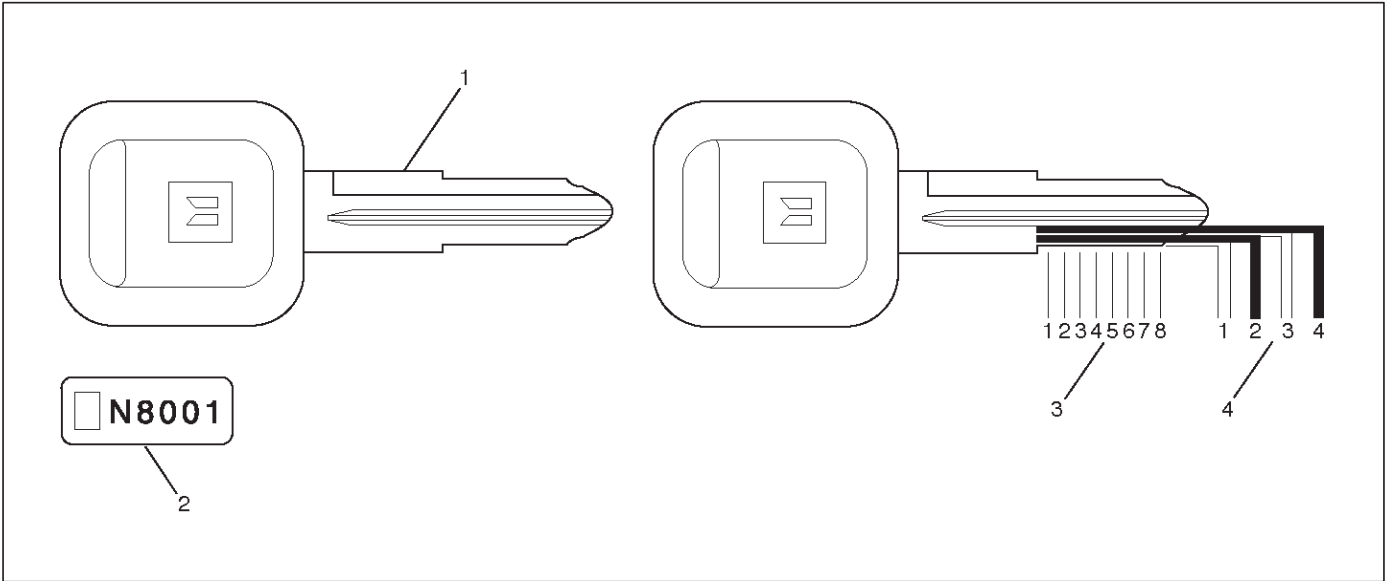
2. Tighten the outside handle and key cylinder fixing bolts to the specified torque.

Torque: 9 N·m (0.9kg·m/78 lb in)

3. Check that the outside handle and key cylinder operate correctly after installing them.

Key

Key Coding



Legend

- (1) Key (Actual Size)
- (2) Key Code Tag

- (3) Position
- (4) Level

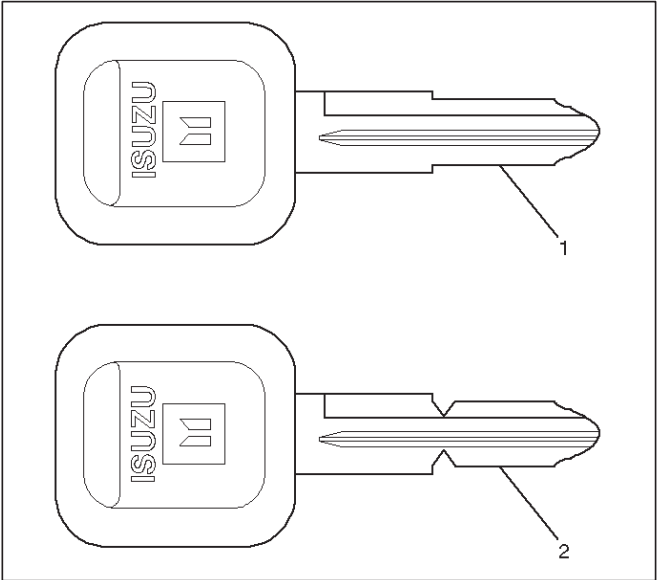
One key is used for the ignition, door, and tailgate lock cylinders. The keys are cut on both edges to make them reversible.

Key identification is obtained from the five character key code stamped on the key code tag. From this key code, the key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).

If key codes are not available from records or tags, the key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.

If the original key is available, the key code cutting combination can be determined by laying the key on the diagram shown in the figure.

Key Styles



Legend

- (1) Blank Key Style "A"
- (2) Blank Key Style "B"

The keys come in styles A or B depending on the key code cutting combination. When the first position in the combination is a 1, 2 or 3, Style A is used. When the first position is a 4, Style B (factory pre-cut key) is used.

Power Door Lock System

General Description

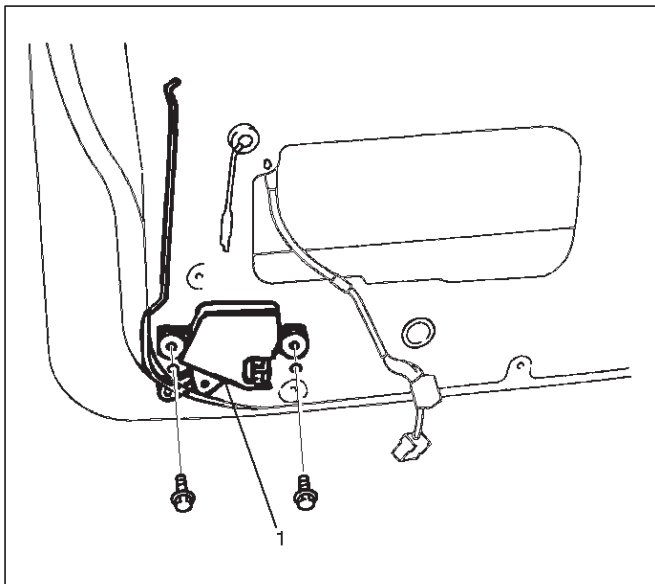
The circuit consists of the door lock (& power window) switch, door lock actuator for the front and rear door, tailgate lock actuator and the door lock key switch. The front door lock switch –LH is always provided with battery voltage.

The key or the inside lock button on the both driver's and the front passenger's door can activate the lock mechanism of all the doors (including the tailgate).

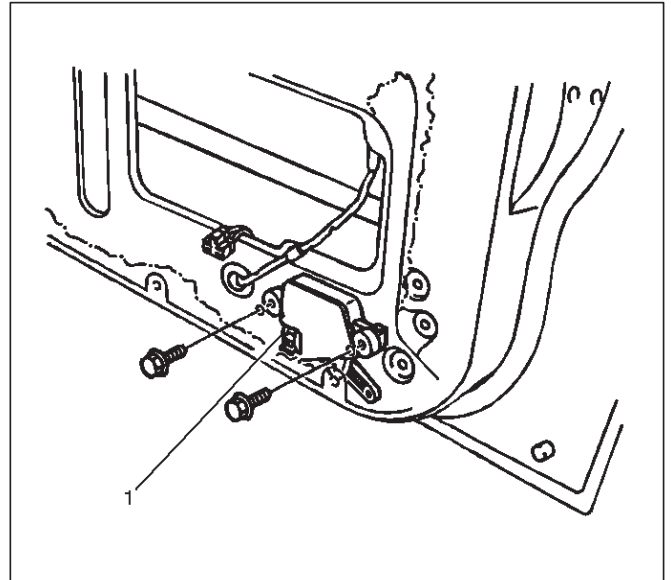
When the driver's door lock switch or the front passenger's door lock switch is turned on, current flows for about one second to the door lock actuator of each door connected in parallel with the front door lock (& power window) switch –LH to activate the actuator to lock and unlock the doors.

Front Door Lock Actuator Removal

1. Refer to the Front Door Lock Assembly removal procedure in this section.
2. Remove the door lock actuator(1).



632RS021



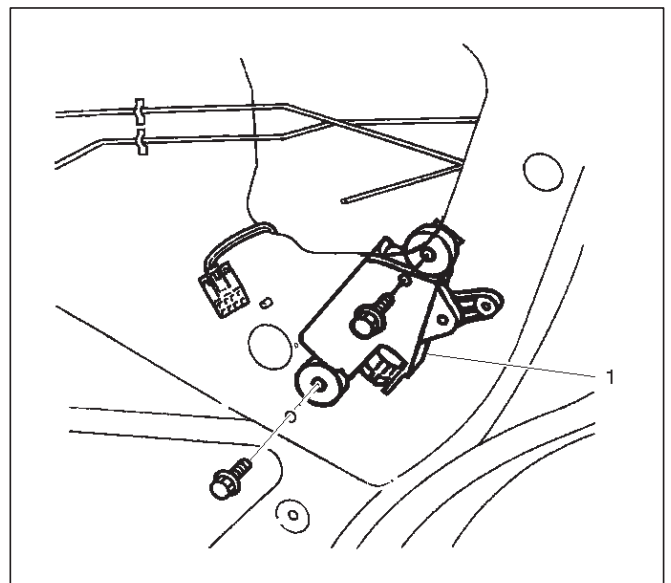
632RS020

Front Door Lock Actuator Installation

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

Rear Door Lock Actuator Removal

1. Refer to the Rear Door Lock Assembly removal procedure in this section.
2. Removal the door lock actuator(1).



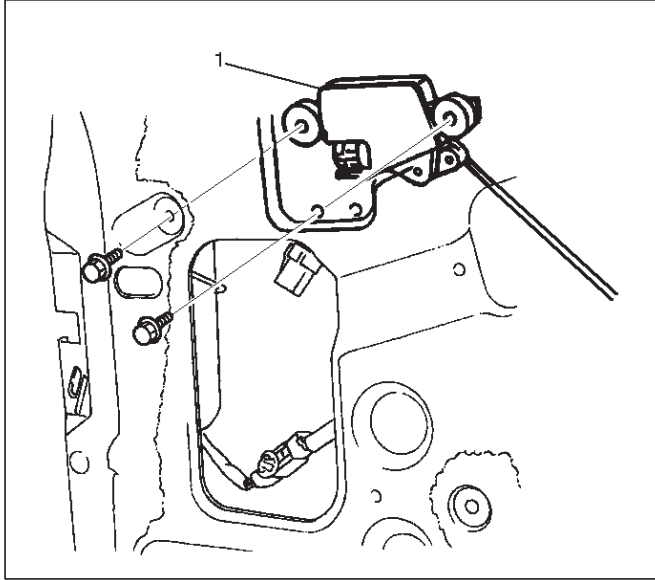
632RS019

Rear Door Lock Actuator Installation

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

Tailgate Lock Actuator Removal

1. Refer to the Tailgate Lock Assembly removal procedure in this section.
2. Remove the tailgate lock actuator(1).



Tailgate Lock Actuator Installation

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

Anti-theft System

General Description

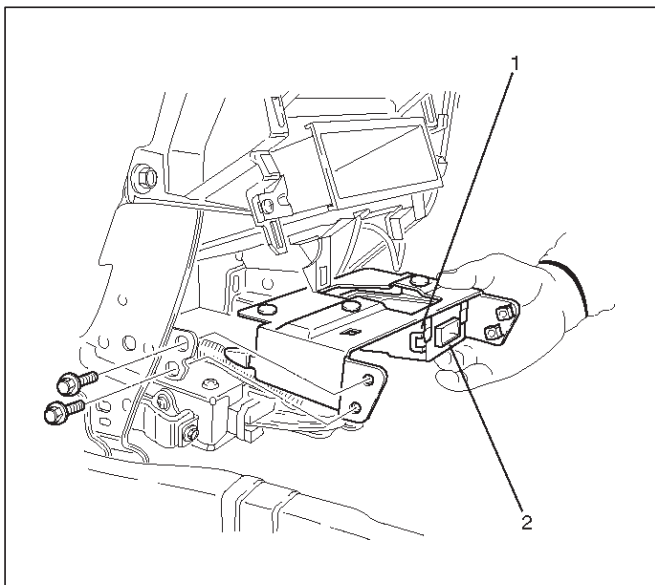
The circuit consists of the starter switch, anti-theft & keyless entry control unit, anti-theft horn, front door and tailgate key switch (detect and tamper switch), door lock (& power window) switch, door lock actuator for each door, engine hood switch, clutch start switch (M/T), ANTI-THEFT indicator light and mode switch (A/T).

The system operates as follows: After locking the starter switch and removing the starter key (this sets the alarm), if the door is unlocked in any way other than with the proper key, the headlights start flashing, the horn sounds, and the starter circuit is disabled. (However, the engine hood and all the doors must be locked and closed.)

Once the system has been placed in the warning or alarm condition, it can be released only when the starter switch is shifted from "OFF" to "ACC" by the starter key, or when the lock of the front door or the tailgate is released (to activate the detect switch) by the starter key.

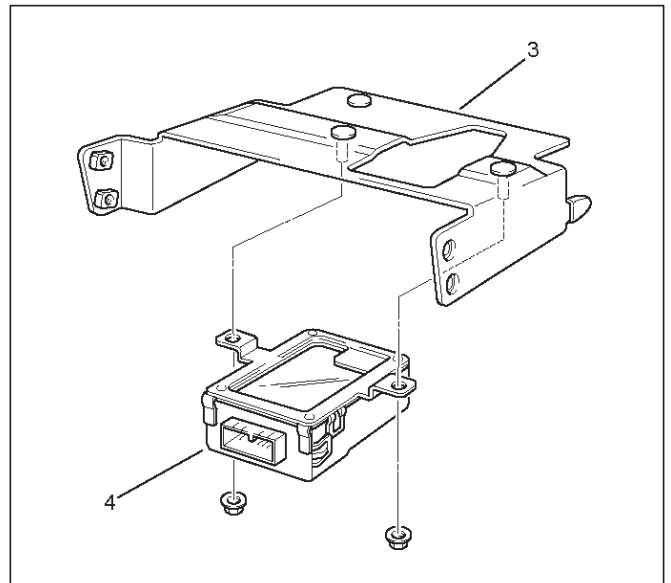
Anti-theft & Keyless Entry Control Unit Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
 - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly.
 - Refer to the Instrument Panel Assembly in Body Structure section.
4. Disconnect the connector(2).
5. Remove four screws to remove the anti-theft & keyless entry control unit with bracket(1).



825RW029

6. Remove two nuts from the anti-theft & keyless entry control unit with bracket(3) to remove the anti-theft & keyless entry controller(4).



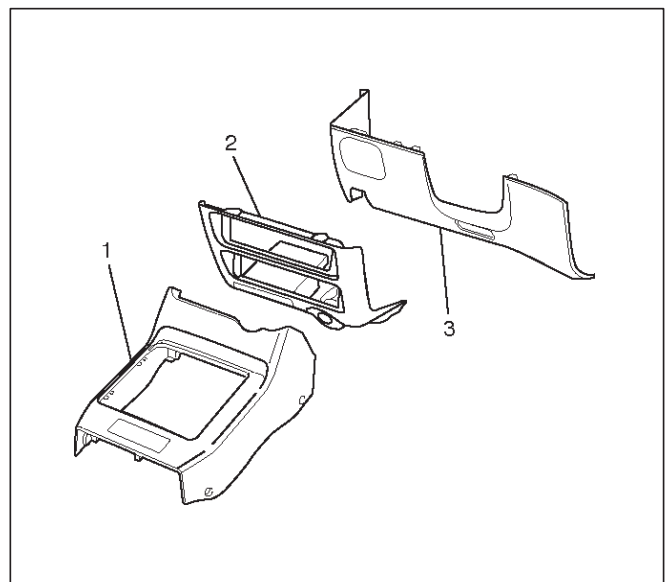
825RW028

Anti-theft & Keyless Entry Control Unit Installation

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

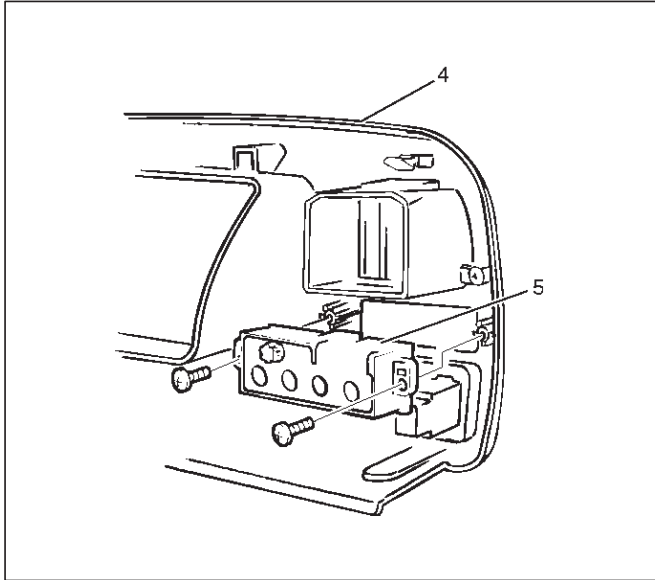
Anti-theft Indicator Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4). Refer to the Instrument Panel Assembly in Body Structure section.
6. Remove two screws and then remove the anti-theft indicator(5).



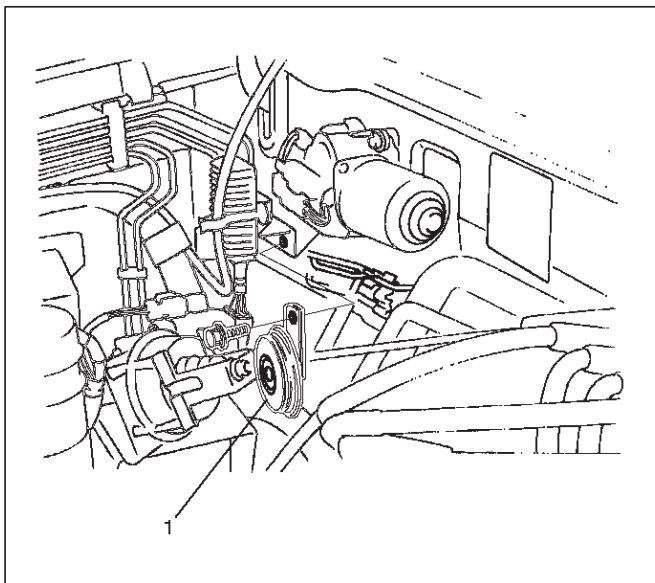
821RW032

Anti-theft Indicator Installation

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

Anti-theft Horn Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector and remove the fixing bolt to remove the anti-theft horn(1).



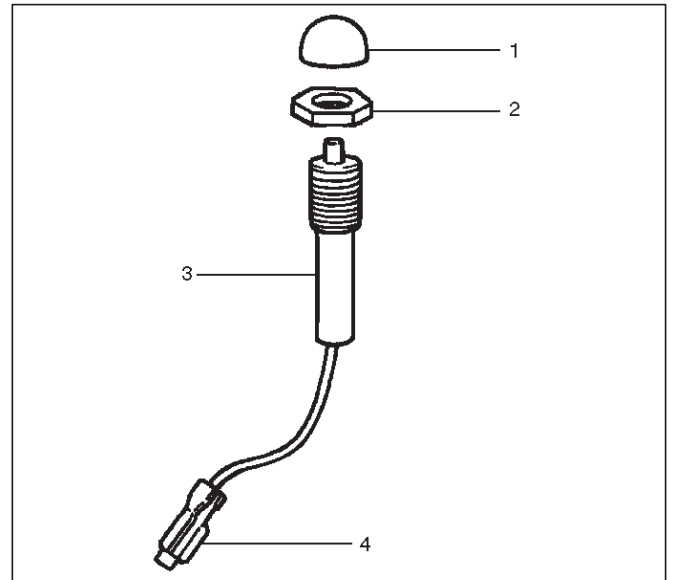
828RS007

Anti-Theft Horn Installation

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

Engine Hood Switch Removal

1. Disconnect the battery ground cable.
2. Remove the cap(1).
3. Remove the lock nut(2).
4. Disconnect the connector(4).
5. Remove the engine hood switch(3).



828RS011

Engine Hood Switch Installation

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

Keyless Entry System

ID Code Registration

There are four kinds of ID codes which can be registered, for which these three modes, ID code new registration, ID code additional registration and ID code check, are available.

ID Code New Registration

This procedure erases all registered ID codes and registers a new received ID code instead.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off five times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Go to Step 6	—
6	Operate the lock or unlock button of transmitter within twenty seconds after step 5. Is the action complete?	Go to Step 7	Finished
7	The control unit makes lock/unlock response once with interval of one second as ID temporary registration. Is the response complete?	Go to Step 8	—
8	Operate the lock or unlock button of transmitter within twenty seconds after step 7. Is the action complete?	Go to Step 9	Finished
9	The control unit compares temporary registered ID code with receiving ID code Is temporary registered ID code the same as receiving ID code?	Go to Step 10	Go to Step 11
10	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—
11	The control unit erases all registered ID codes and registers new ID code. Is the registration complete?	Go to Step 12	Go to Step 13

Step	Action	Yes	No
12	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
13	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

ID Code Additional Registration

This procedure additionally registers a new received ID code with holding registered ID codes. When total number of registered ID codes and newly registered ID code exceeds four, they are erased in order of older one.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off three times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response two times with interval of one second. Is the response complete?	Go to Step 6	—
6	Operate the lock or unlock button of transmitter within twenty seconds after step 5. Is the action complete?	Go to Step 7	Finished
7	The control unit makes lock/unlock response two times with interval of one second as ID temporary registration. Is the response complete?	Go to Step 8	—
8	Operate the lock or unlock transmitter within twenty seconds after step 7. Is the action complete?	Go to Step 9	Finished
9	The control unit compares temporary registered ID code with receiving ID code Is temporary registered ID code the same as receiving ID code?	Go to Step 10	Go to Step 11
10	The control unit makes lock/unlock response with interval of one second. Is the response complete?	Finished	—
11	The control unit registers new ID code. Is the registration complete?	Go to Step 12	Go to Step 13

8H-26 SECURITY AND LOCKS

Step	Action	Yes	No
12	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
13	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

ID Code Check

This procedure checks how many kinds of ID code are registered.

Step	Action	Yes	No
1	1. Open the driver's side door. 2. Turn the starter switch off. Is the action complete?	Go to Step 2	—
2	Turn the starter switch to ACC position and then off three times within five seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished
4	1. Turn the starter switch to ACC position and then off. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	The control unit makes lock/unlock response twice as many the number of registered ID code with interval of two seconds. (In case of no registered code, the response is made ten times.) Is the response complete?	Finished	—

Answer Back (Anti-theft Horn Operation) Change Mode

Anti-theft horn, as an answer back function for the transmitter operation, changes from available into unavailable or from unavailable into available by this procedure.

Step	Action	Yes	No
1	Open the driver's side door. Is the action complete?	Go to Step 2	—
2	Lock the door and then unlock it three times within ten seconds after step 1. Is the action complete within five seconds?	Go to Step 3	Finished
3	Close the door and then open it two times within ten seconds after step 2. Is the action complete within ten seconds?	Go to Step 4	Finished

Step	Action	Yes	No
4	1. Lock the door and unlock it three times. 2. Close the door and then open it. NOTE: This step must be performed within ten seconds after step 3. Is the action complete?	Go to Step 5	Finished
5	Answer back mode changes. Is this step complete?	Go to Step 6	Go to Step 7
6	The control unit makes lock/unlock response once with interval of one second. Is the response complete?	Finished	—
7	The control unit makes lock/unlock response three times with interval of one second. Is the response complete?	Finished	—

Anti-theft & Keyless Entry Control Unit/Transmitter Replacement

Anti-theft & Keyless Entry Control Unit Replacement

1. Remove and install the control unit.
 - Refer to Anti-theft & Keyless Entry Control Unit Removal and Installation in this section.
2. Register ID code.
 - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Replacement

1. Prepare a new transmitter.
2. Register ID code.
 - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Battery Replacement

1. Remove a screw to remove the cover.
2. Remove the batteries.
3. Set the new batteries into the transmitter.
4. Install the cover to the transmitter.
5. Check that the keyless entry system works normally.

8H-28 SECURITY AND LOCKS

Main Data and Specifications

Torque Specifications

Application	N·m	Kg·m	Lb Ft	Lb In
Front Door Lock Assembly Fixing Screws	7	0.7	—	61
Front Outside Handle and Key Switch Fixing Bolts	9	0.9	—	78
Rear Door Lock Assembly Fixing Screws	7	0.7	—	61
Rear Outside Handle Fixing Bolts	9	0.9	—	78
Tailgate Lock Assembly (LH) Fixing Screws	7	0.7	—	61
Tailgate Lock Assembly (RH) Fixing Bolts	11	1.1	—	95
Tailgate Outside Handle and Key Cylinder Fixing Bolts	9	0.9	—	78

BODY AND ACCESSORIES

SUN ROOF/CONVERTIBLE TOP

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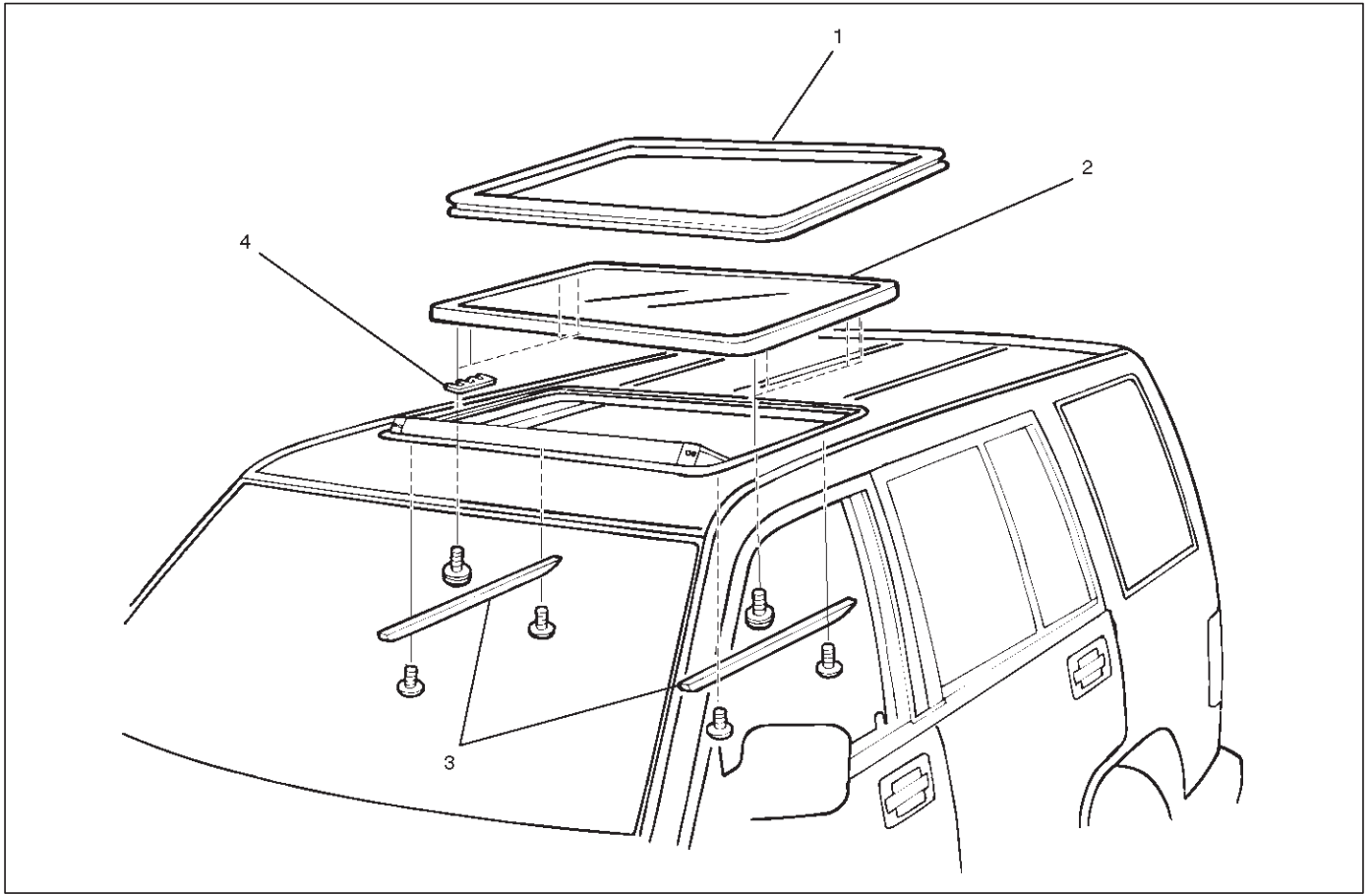
Service Precaution

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

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

Sun Roof Glass

Sun Roof Glass and Associated Parts



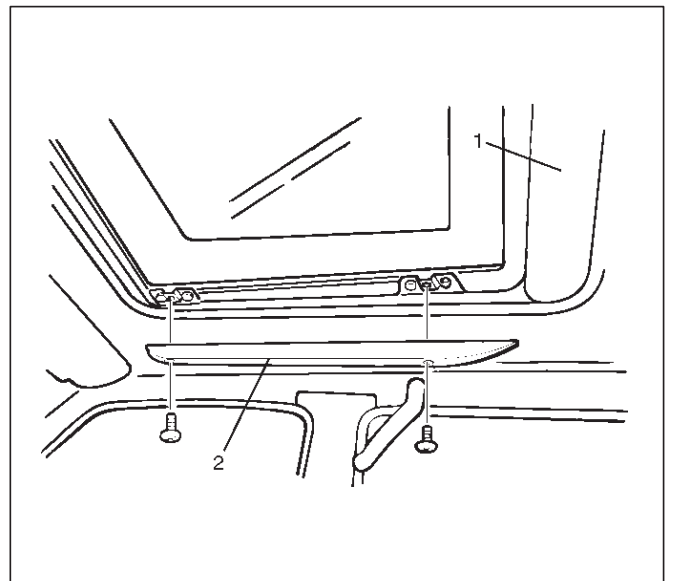
665RS002

Legend

- (1) Sun Roof Weatherstrip
- (2) Sun Roof Glass
- (3) Decoration Cover
- (4) Sun Roof Shim

Removal

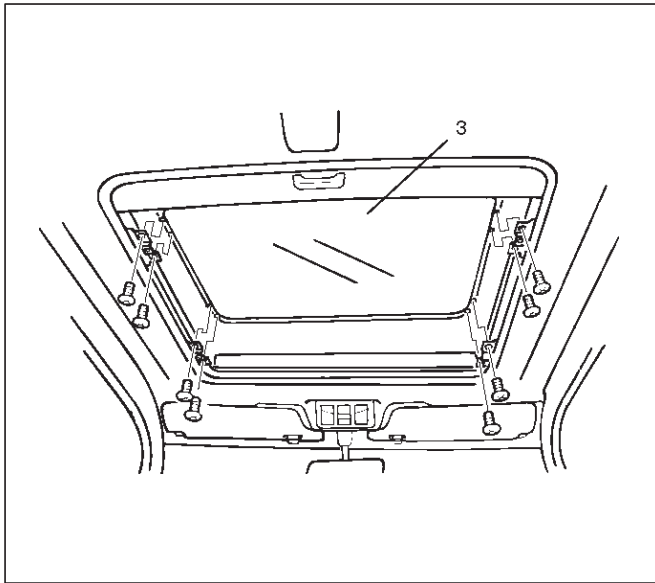
1. Open the sun roof and pull the sun roof weatherstrip out from the roof panel.
2. Disconnect the battery ground cable.
3. Close the sun roof and open the sunshade(1). Then, remove the decoration cover fixing screws and decoration cover(2).



665RS003

- Remove eight sun roof glass fixing screws to remove the sun roof glass(3).

NOTE: If shims are used between the sun roof set plate and the glass, note the number of shims used.



665RS004

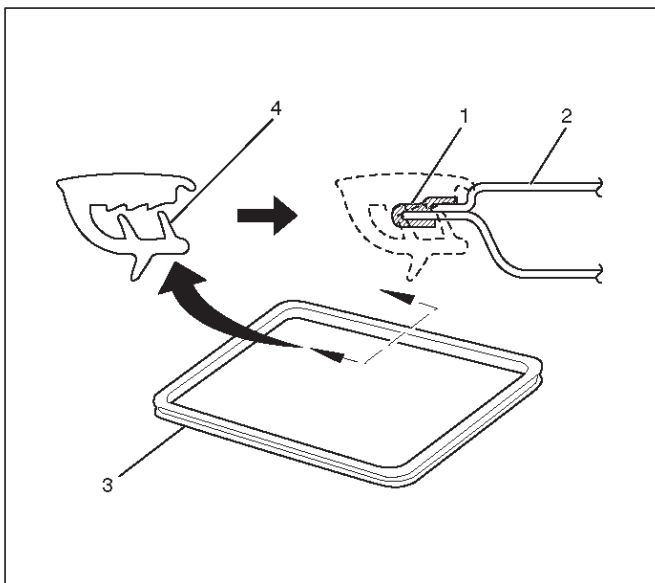
- Open and shut the sun roof four to five times to position correctly the sun roof weatherstrip and the glass in the longitudinal and latitudinal setting positions.
- Insert the original shims between the sun roof set plate and the glass.
- Tighten the sun roof glass fixing screws to the specified torque.

Torque: 10 N·m (1.0 kg·m/87 lb in)

- After the sun roof glass is installed, check the roof panel and sun roof glass for vertical install position. If out of standard, adjust with shim.
For the installation standard, refer to the Body Dimension in Body Structure section.
- Install the decoration cover.

Installation

- Clean the body panel of the weatherstrip fixing portion.
- If the protective film(1) of the body panel is peel, it cannot be reused.
Install the new protective film around the body panel(2).
- Install the new weatherstrip(3).
Always replace with a new one.
- Be sure to install the sun roof weatherstrip so that the white marking location(4) of the weatherstrip is on the front side of the vehicle.



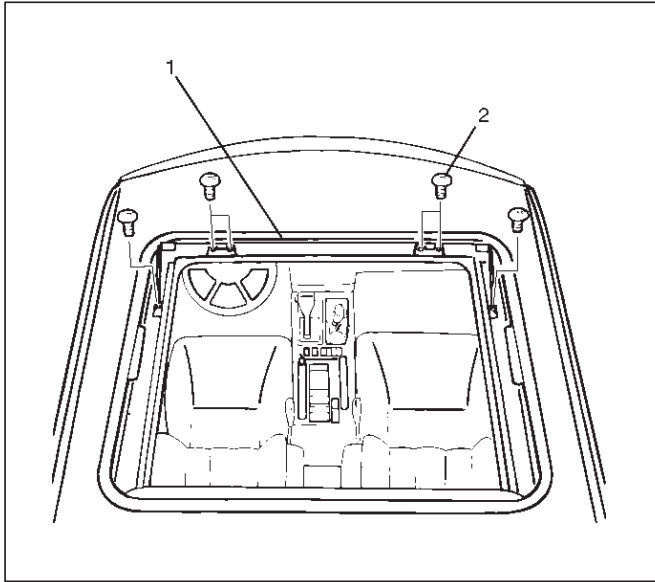
665RW016

- Temporary install the glass to the sun roof frame.

Sun Roof Deflector

Removal

1. Open the sun roof.
2. Remove the fixing screws(2) to remove the sun roof deflector(1).



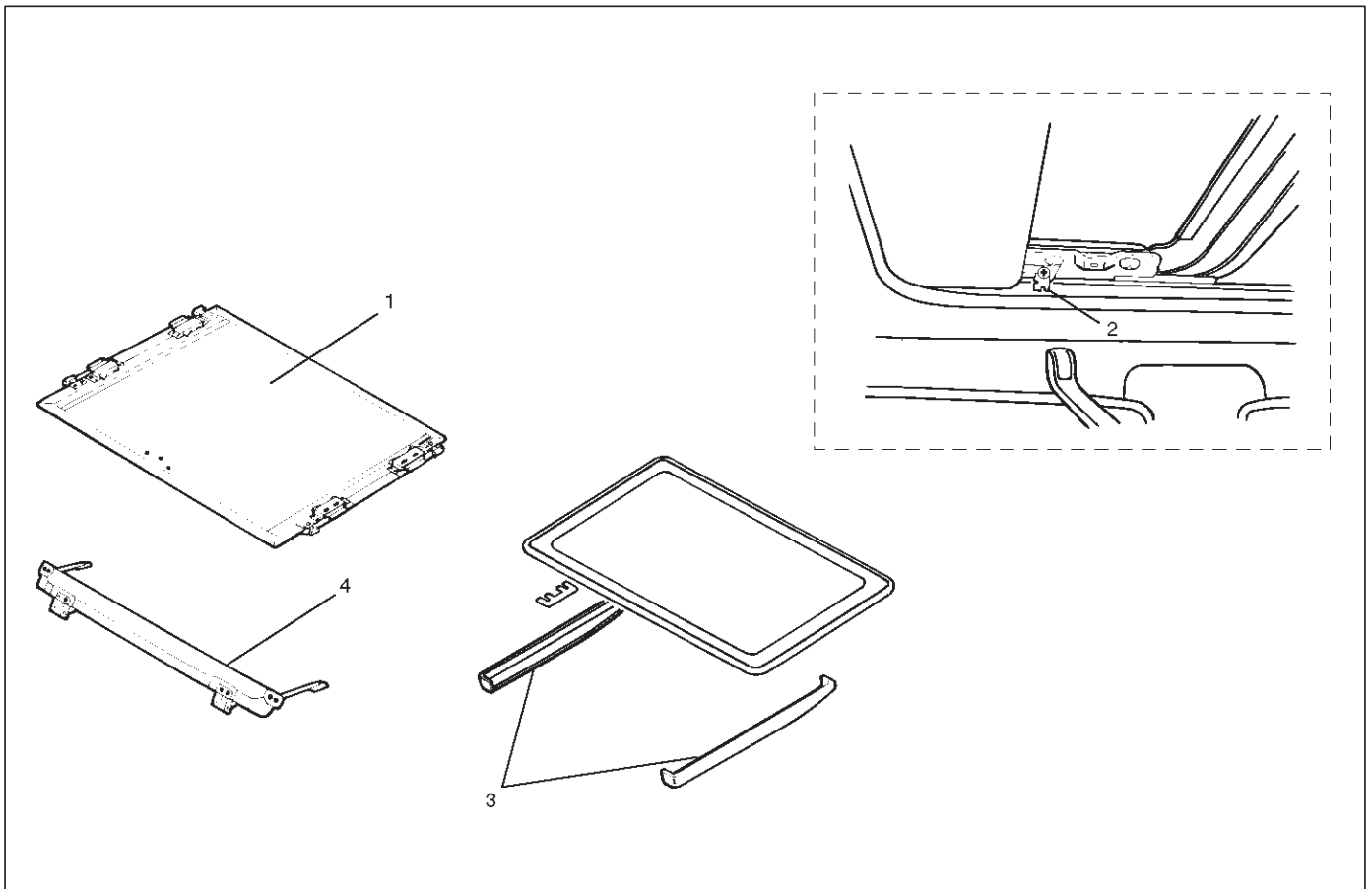
665RS006

Installation

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

Sunshade

Disassembled View



665RS007

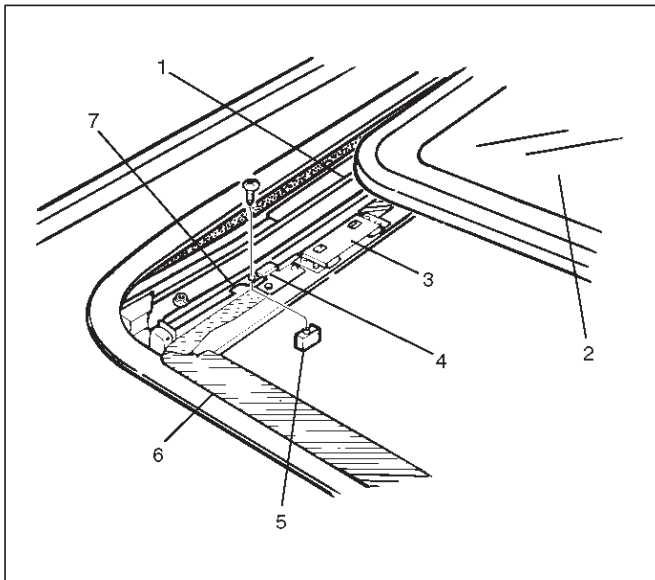
Legend

- (1) Sunshade
- (2) Sunshade Stopper

- (3) Decoration Cover
- (4) Sun Roof Deflector

Removal

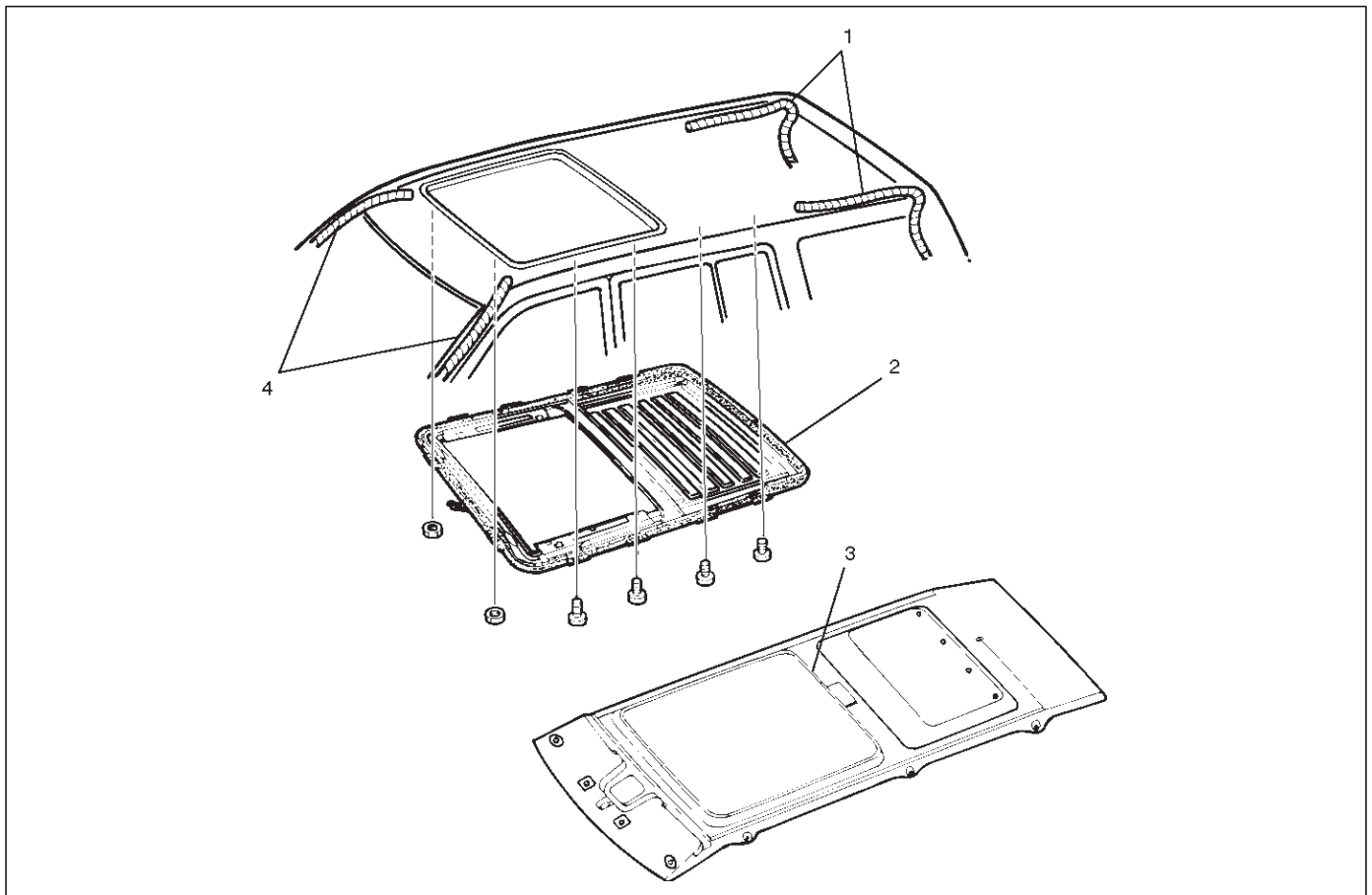
1. Remove the decoration cover.
2. Open the sun roof half position, remove the sunshade stopper screw and pull out the sunshade(6) until its front side protrudes a little from the sun roof glass(2) to remove the sunshade stopper.
3. Remove the sun roof deflector.
 - Refer to the Sun Roof Deflector in this section.
4. Open the sun roof completely.
5. Remove the sunshade guide rail stopper(5), and pull out the sunshade up to the rail edge.
6. Remove the guide pin(4) in the sunshade through the notch(7) of guide rail(1) and then draw the sunshade out of the roof by pushing inward the retaining clips(3) on both sides.

**Installation**

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

Sun Roof Frame Complete Assembly

Sun Roof Frame Complete Assembly and Associated Parts



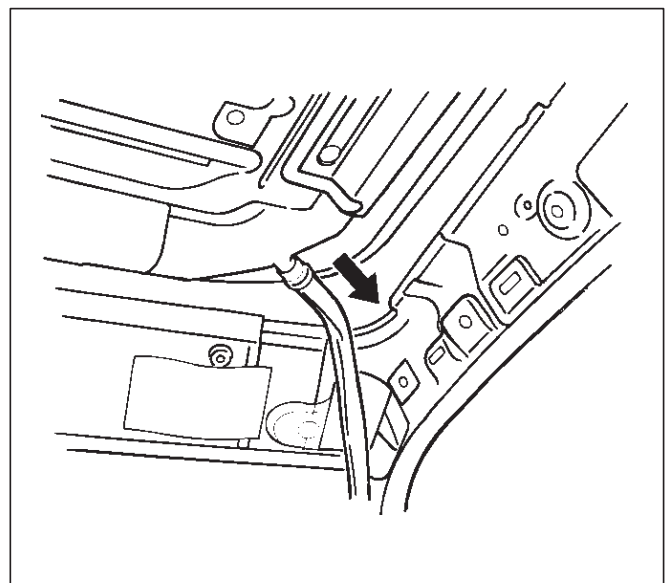
665RS009

Legend

- | | |
|--------------------------------------|-------------------------|
| (1) Sun Roof Drain Hose | (3) Headlining |
| (2) Sun Roof Frame Complete Assembly | (4) Sun Roof Drain Hose |

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
 - Refer to the Headlining removal steps in Body Structure section.
3. Disconnect the sun roof drain hose at the sun roof frame side as shown in the figure.



665RS010

4. Disconnect the sun roof harness connection.

- Remove two sun roof frame complete assembly fixing nuts (front side) and four fixing bolts (each side) from the frame complete, and then remove the sun roof frame complete assembly.

NOTE: Be sure to remove the frame complete while supporting it.

- After installing the frame complete, loosen the sun roof glass fixing nuts and adjust the sun roof glass setting position.

- Refer to the Sun Roof Glass installation steps in this section.

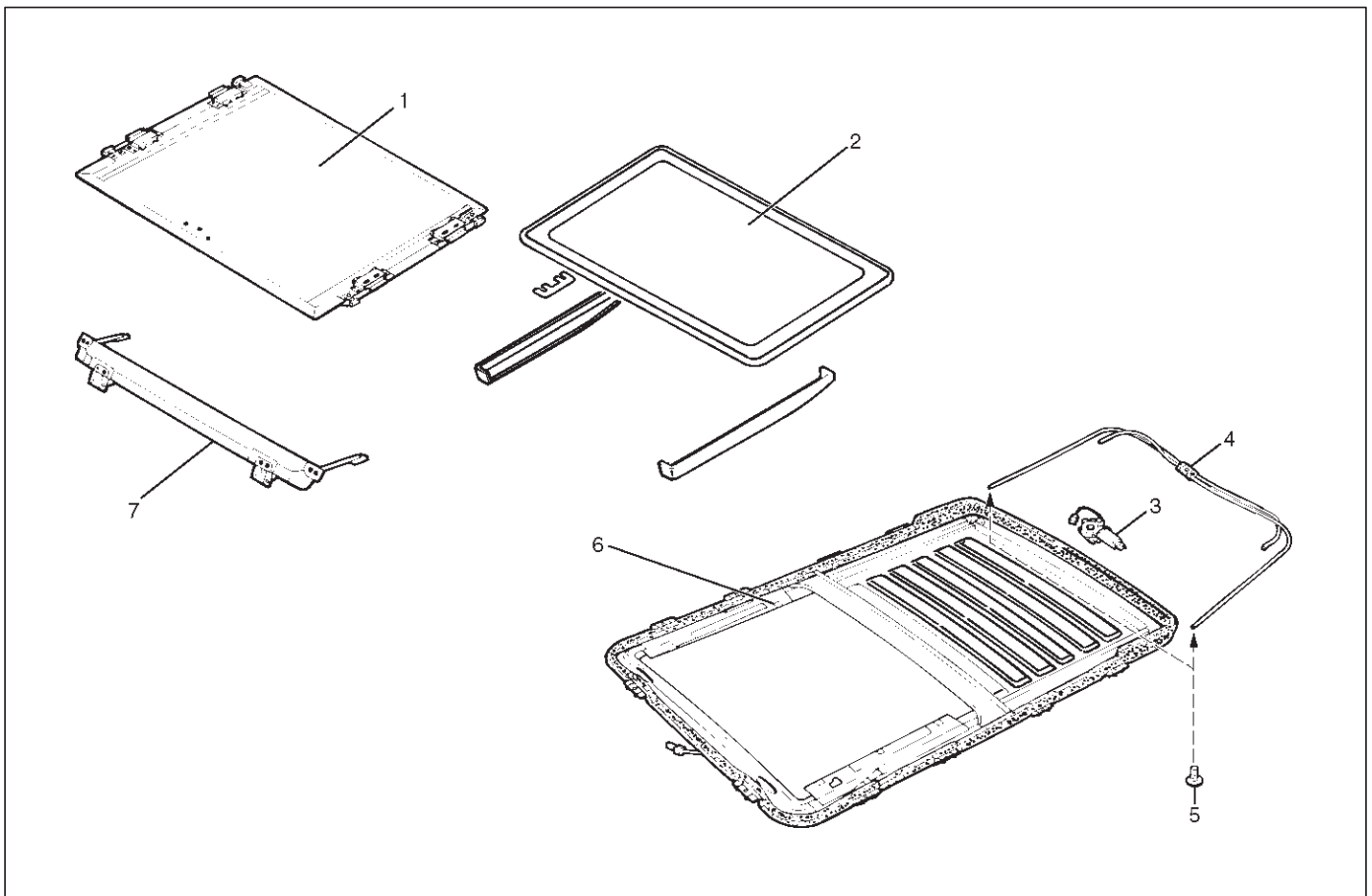
- Install the sun roof drain hose.
- Install the headlining.

Installation

- Tighten the sun roof frame complete assembly fixing bolts and nuts to the specified torque.

Torque: 10 N·m(1.0 kg·m/87 lb in)

Disassembled View



Legend

- (1) Sunshade
- (2) Sun Roof Glass
- (3) Sun Roof Motor

- (4) Sun Roof Drive Unit Assembly
- (5) Outer Tube Fixing Screw
- (6) Sun Roof Frame Assembly
- (7) Sun Roof Deflector

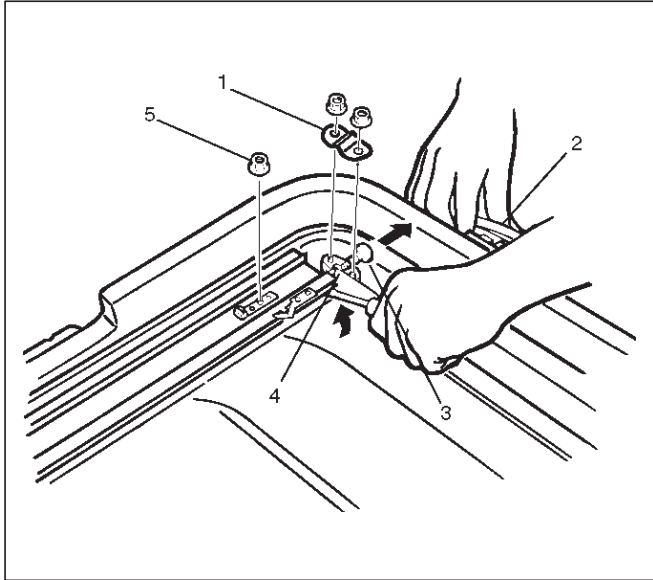
Disassembly

- Open the sun roof.
- Remove the sun roof deflector fixing screws and then remove the sun roof deflector.
- Remove the sunshade.
 - Refer to the Sunshade in this section.
- Close the sun roof, remove the decoration cover and the fixing screws and then remove the sun roof glass.

- If the shims are used between the sun roof set plate and the glass, note the number of the shims.
- Disconnect the sun roof motor connector, remove the sun roof fixing nuts and screws, and then remove the sun roof motor.

8I-8 SUN ROOF/CONVERTIBLE TOP

7. Remove the cable outer tube(2) fixing screws.
8. Remove the cable outer tube fixing clamps(1) and guide rail fixing nuts(5).
9. Prying the guide rail a little with a screwdriver, draw the outer tube out of the grommet(3).
 - At this time, the inner cable(4) remains on the frame assembly.
10. Remove the sun roof frame assembly.

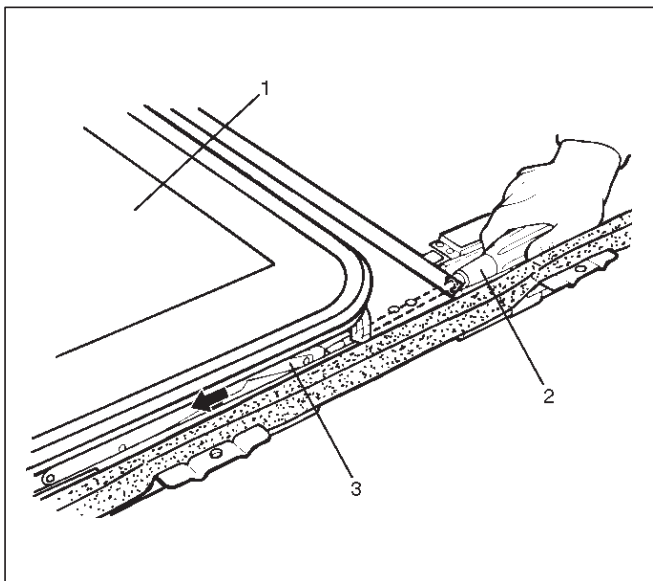


665RS012

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following points.

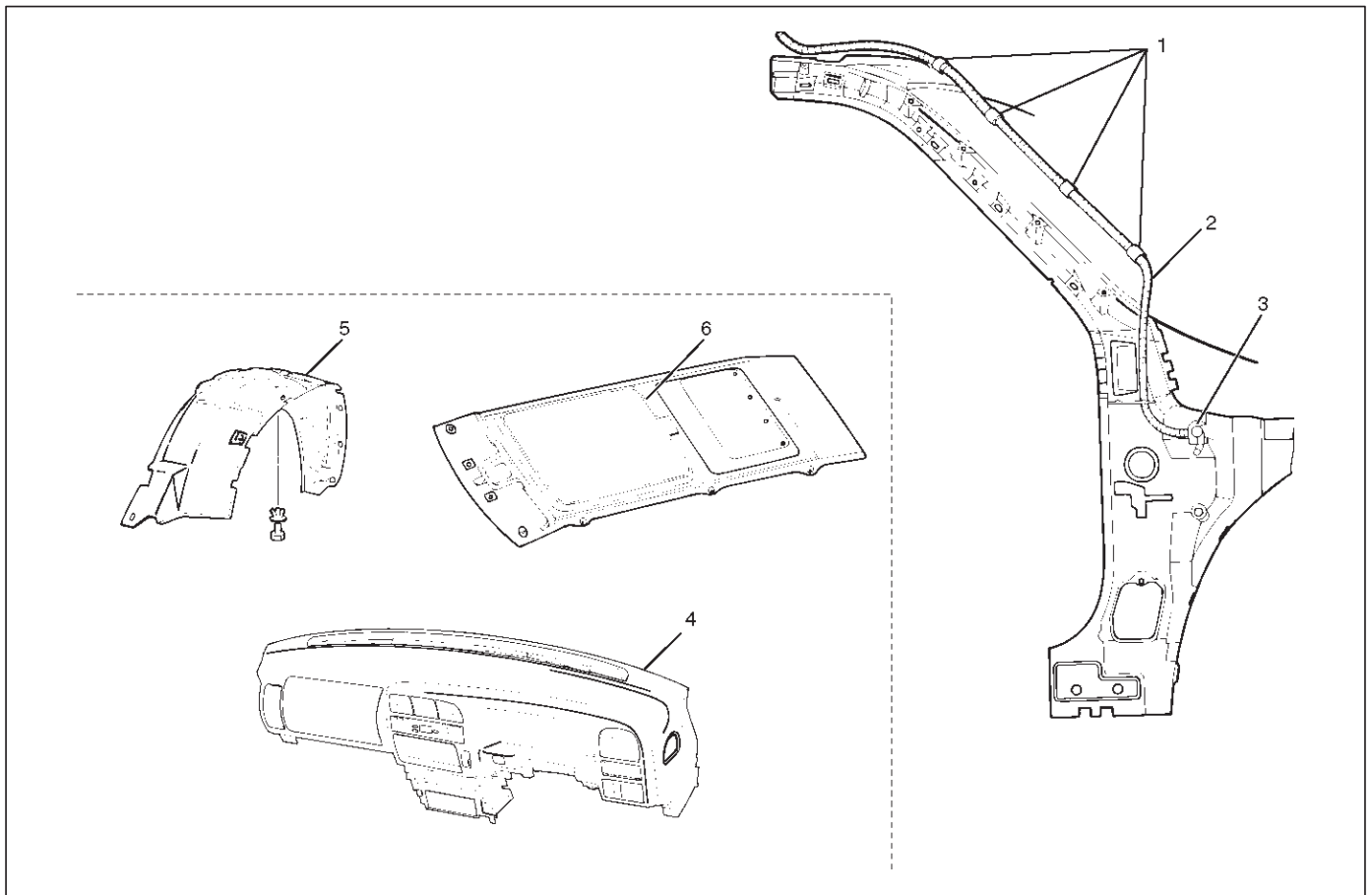
1. When installing the motor or drive unit, set the sun roof set plate in the full closed position by pushing the link(3) portion using the screwdriver(2).
2. When installing the sun roof glass(1) to the sun roof set plate, insert the original shims in the same position before removing the sun roof glass.



665RS013

Sun Roof Drain Hose (Front Side)

Sun Roof Drain Hose (Front Side) and Associated Parts



665RW017

Legend

- | | |
|-------------------------|-------------------------------|
| (1) Clip | (4) Instrument Panel Assembly |
| (2) Sun Roof Drain Hose | (5) Front Inner Liner |
| (3) Grommet | (6) Headlining |

Removal

1. Disconnect the battery ground cable.
2. Remove the front inner liner.
3. Remove the headlining.
 - Refer to the Headlining removal steps in Body Structure section.
4. Remove the instrument panel assembly.
 - Refer to the Instrument Panel Assembly removal steps in Body Structure section.
5. Disconnect the drain hose at the frame complete side.
6. Apply the soap and water to the body panel grommet.
7. Pass the string from the sun roof frame side through the drain port side, and remove the drain hose from the hose fixing clips. Taking care not to allow the body panel grommet to be removed together with the hose, pull the drain hose only to the inside of the vehicle. (The string should be kept as it is.)

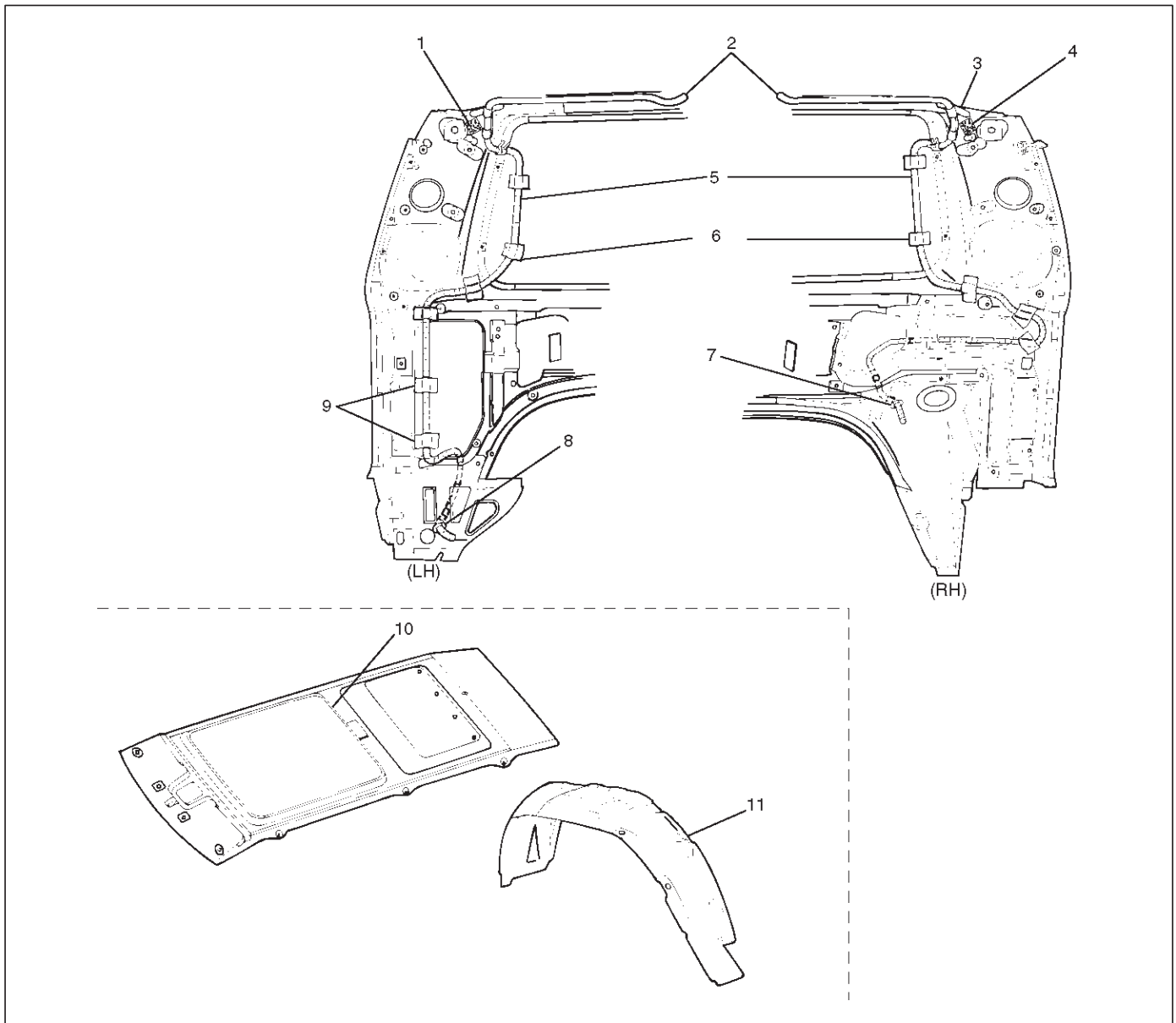
Installation

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

1. Apply the soap and water to the body panel grommet.
2. Install the drain hose from inside of the vehicle by utilizing, as a guide, the string passed during removal step.
3. The body panel grommet must not be twisted or caught in during installation.
4. Complete routing, avoiding extreme bends or curves.
5. After routing, install the trim with care not to allow the drain hose to be caught in.
6. Test the drain condition.
7. The protrusion of drain hose from the body panel must be within 50 mm (2.0 in). If it exceeds 50 mm (2.0 in) after correct routing, cut the leading edge so that the protrusion is within 50 mm (2.0 in).

Sun Roof Drain Hose (Rear Side)

Sun Roof Drain Hose (Rear Side) and Associated Parts



665RS015

Legend

- | | |
|-------------------------|------------------------------|
| (1) Soft Tape | (6) Tape |
| (2) Pipe | (7) Grommet |
| (3) Clip | (8) Grommet |
| (4) Soft Tape | (9) Clip |
| (5) Sun Roof Drain Hose | (10) Headlining |
| | (11) Rear Fender Inner Liner |

Removal

1. Disconnect the battery ground cable.
2. Remove the rear fender inner liner.
3. Remove the headlining.
 - Refer to the Headlining removal steps in Body Structure section.
4. Disconnect the drain hose at the frame complete side.

5. Apply the soap and water to the body panel grommet.
6. Remove the hose fixing tapes and clips.
7. Pull the drain hose to the inside of the vehicle.

Installation

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

1. Apply the soap and water to the body panel grommet.

2. Insert the drain hose from inside of vehicle, restore routing, and fix with new soft tape and clip.

If the grommet is removed during removal of drain hose, insert the grommet into drain hose from outside of the vehicle, and install on the body panel, avoiding any twisting.

3. After installing the drain hose, install the trim while taking care not to crush the drain hose.

Also, care should be taken not to allow the drain hose connected to the pipe to be caught in.

4. Test the drain condition.

5. The protrusion of the drain hose from the body panel must be within 50 mm (2.0 in). If it exceeds 50 mm (2.0 in) after correct routing, cut the leading edge so that the protrusion is within 50 mm (2.0 in).

Sun Roof Switch

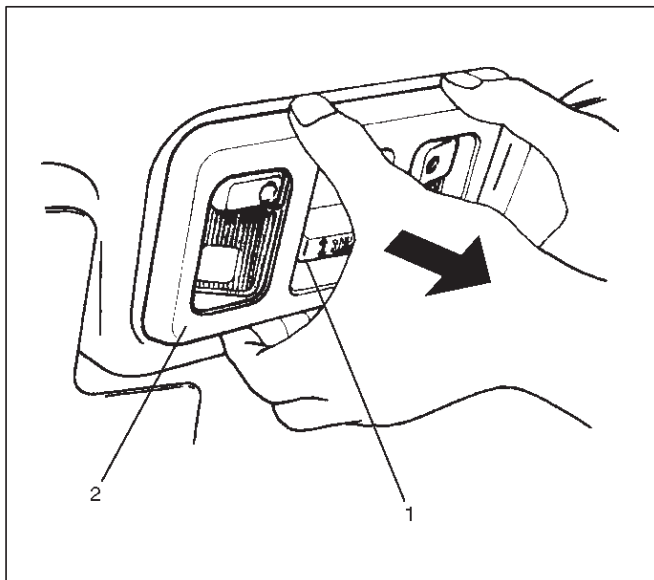
General Description

Sun roof operation can be controlled by pushing continuously the sun roof switch to activate the sun roof control unit and sun roof motor.

While the switch is being pushed to the "OPEN" side, the sun roof stops about 165 mm (6.5 in) before fully open position. Push the switch again to the "OPEN" side to open it fully. When the switch is being continuously pushed to the "CLOSE" side, the sun roof stops about 180 mm (7.1 in) short of the fully closed position and remains in this state. Push the switch again to the "CLOSE" side to close it completely.

Removal

1. Disconnect the battery ground cable.
2. Pull down the switch housing(2) and disconnect the sun roof switch and map light connectors to remove the sun roof switch(1).



809RS002

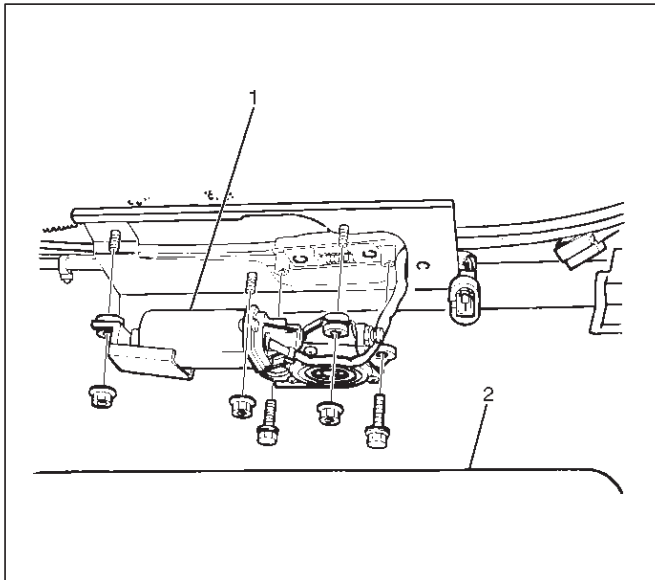
Installation

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

Sun Roof Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining(2).
 - Refer to the Headlining removal steps in Body Structure section.
3. Disconnect the connector, and remove three nuts and two screws to remove the sun roof motor(1).



665RS027

Installation

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

Main Data and Specifications

Torque Specifications

Application	N-m	kg-m	lb ft	lb in
Sun Roof Frame Complete Assembly Fixing Bolts	10	1.0	—	87
Sun Roof Glass Fixing Screws	10	1.0	—	87

BODY AND ACCESSORIES

EXTERIOR / INTERIOR TRIM

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Service Precaution

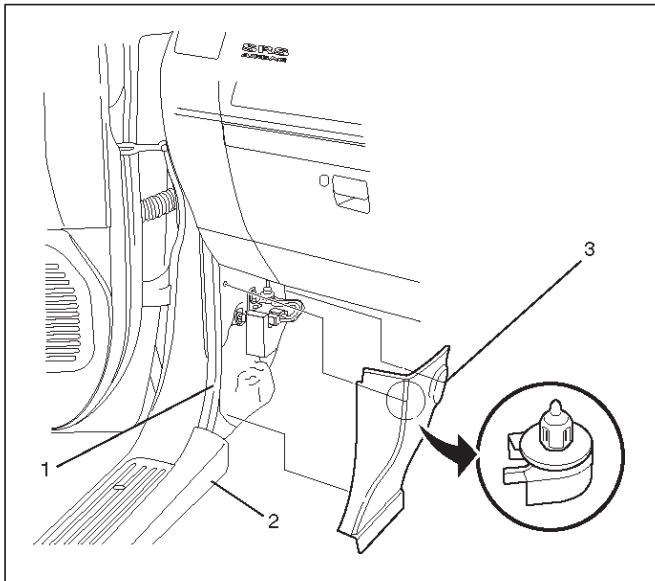
WARNING: IF SO EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM (SRS), REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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Dash Side Trim Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the Front door sill plate(2).
3. Remove the Dash side trim panel(3).
 - Turn up the door inner seal(1) of the body panel to remove the clips of the trim panel.
 - Take care not to damage the harness and the controller on the back of the trim panel.



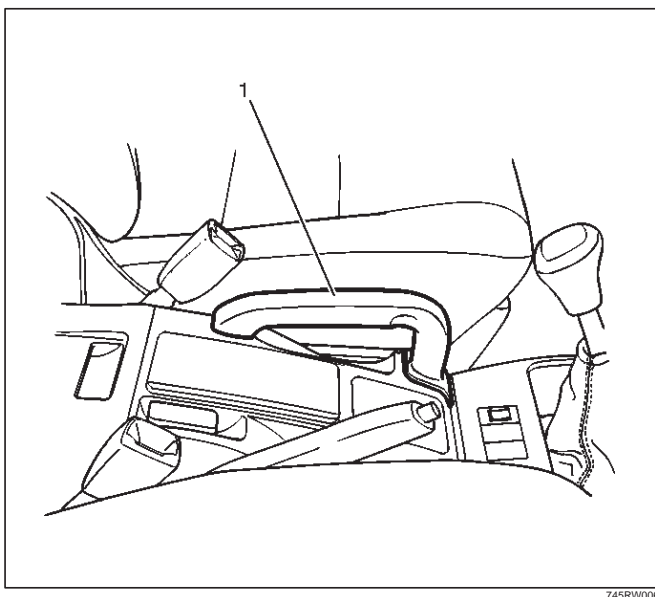
Installation

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

1. Lap the door inner seal over the trim panel to install them securely to the body panel.

Assist Grip

Parts Location



Legend

- (1) Assist Grip

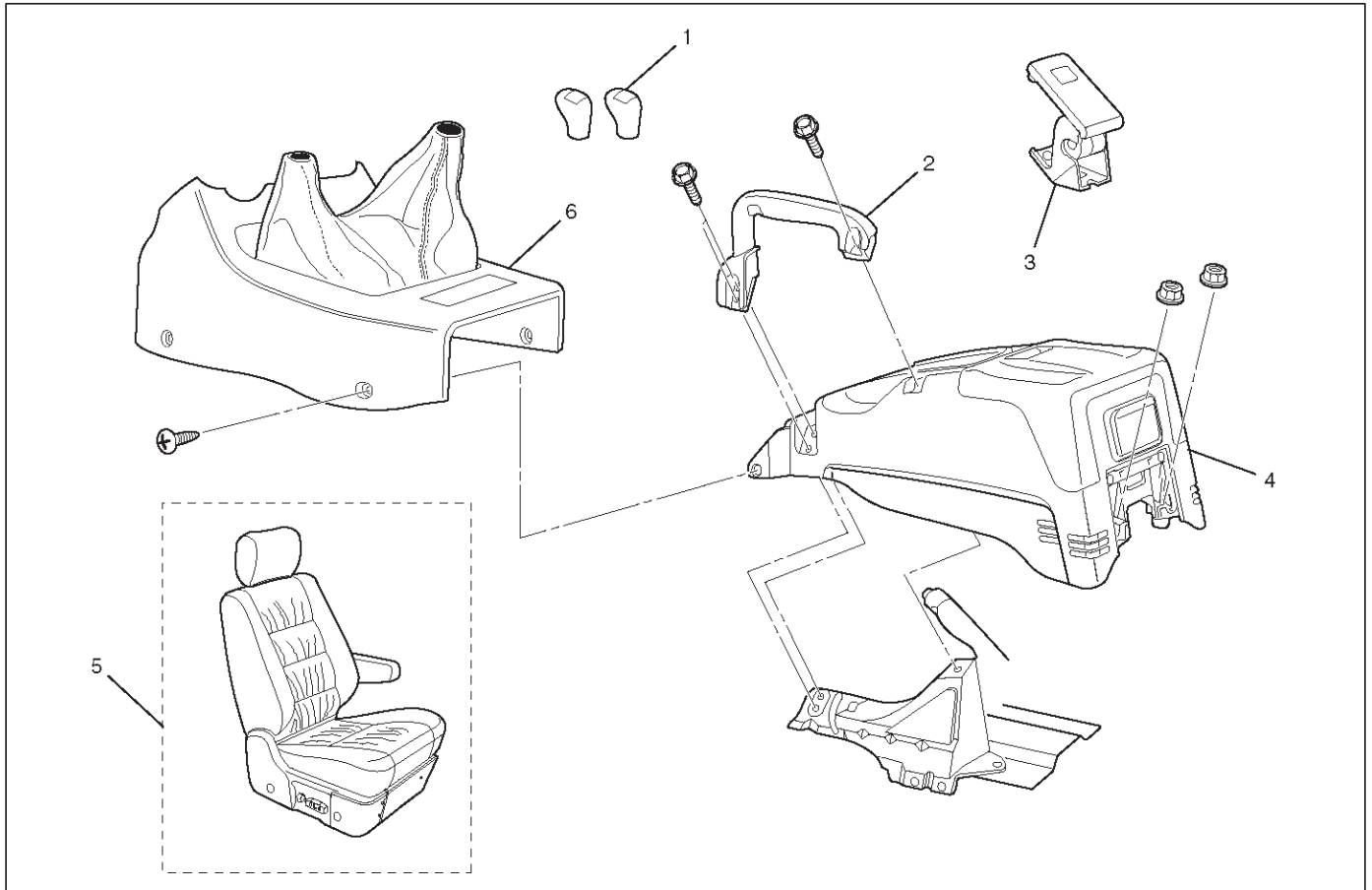
Removal and Installation

- Refer to the Consoles removal and installation steps in this section.

Consoles

Consoles and Associated Parts

This illustration is based on RHD



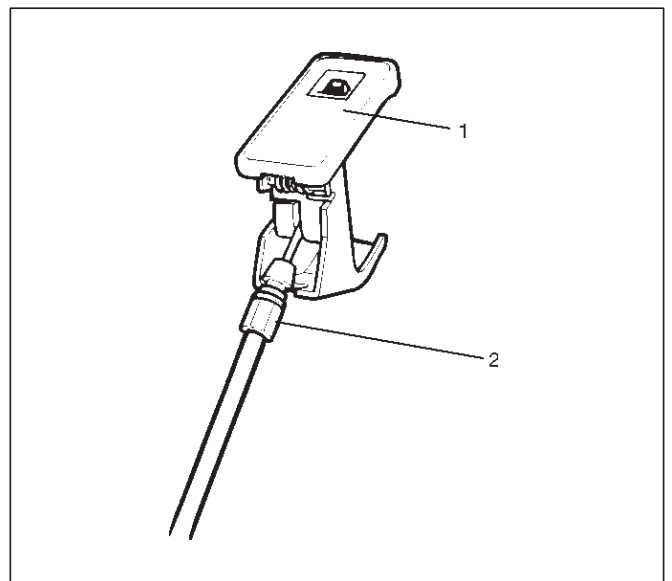
745RW009

Legend

- | | |
|--|------------------------------|
| (1) Shift Knob (M/T) / Transfer Knob (A/T) | (4) Center Console Assembly |
| (2) Assist Grip | (5) Front Seat Assembly (RH) |
| (3) Fuel Filler Lid Opener | (6) Front Console Assembly |

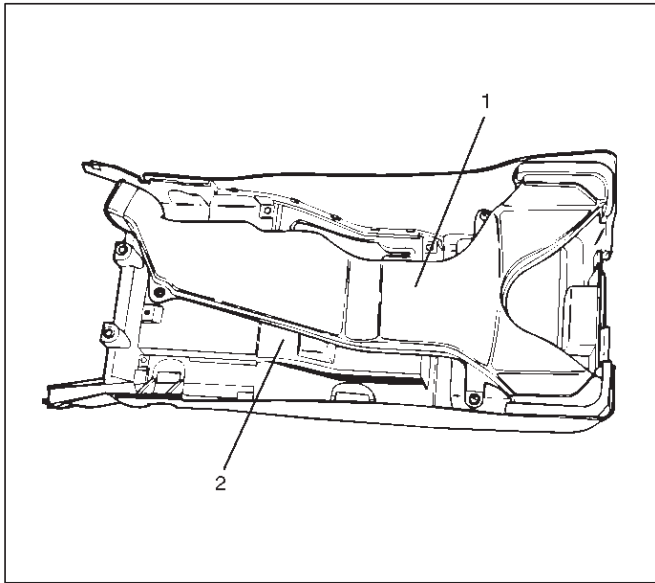
Removal

1. Disconnect the battery ground cable.
2. Remove the shift knob (M/T) / transfer knob (A/T).
3. Remove the front console assembly.
 - Remove four fixing screws and disconnect the switch connectors.
4. Remove the front seat assembly(RH).
 - Refer to the Front Seat Assembly removal steps in Seats section.
5. Remove the assist grip.
 - Remove three bolts.
6. Remove the fuel filler lid opener.
 - Remove the fuel filter lid opener(1) and disconnect the cable(2).



686RW007

7. Remove the center console assembly(2).
- Remove two fixing screws on the front side.
Open the rear cover, remove two nuts, then the center console assembly.
 - Remove the rear heater duct(1) from the center console.



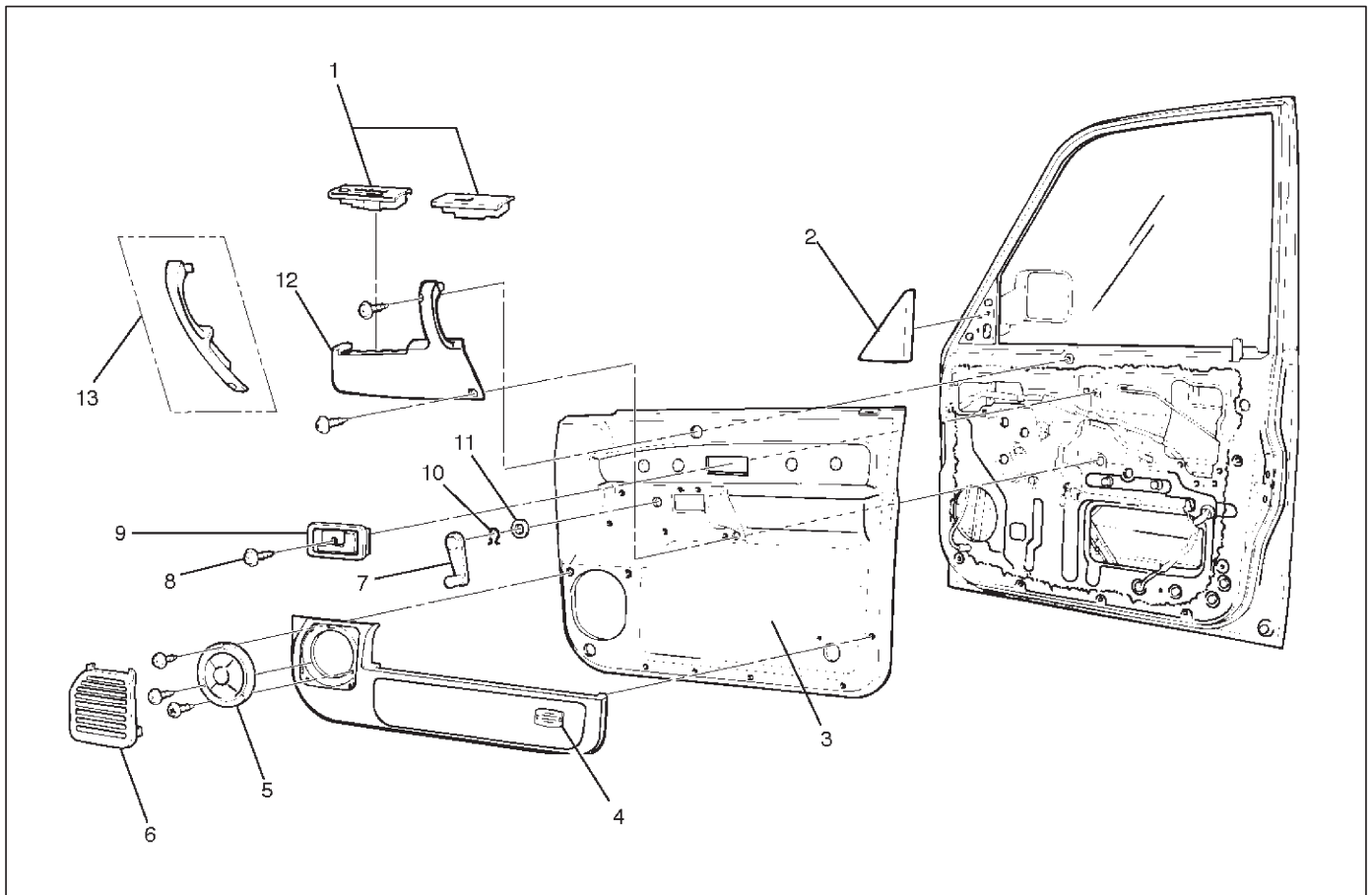
745RS005

Installation

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

Front Door Trim Panel

Front Door Trim Panel and Associated Parts



635RW011

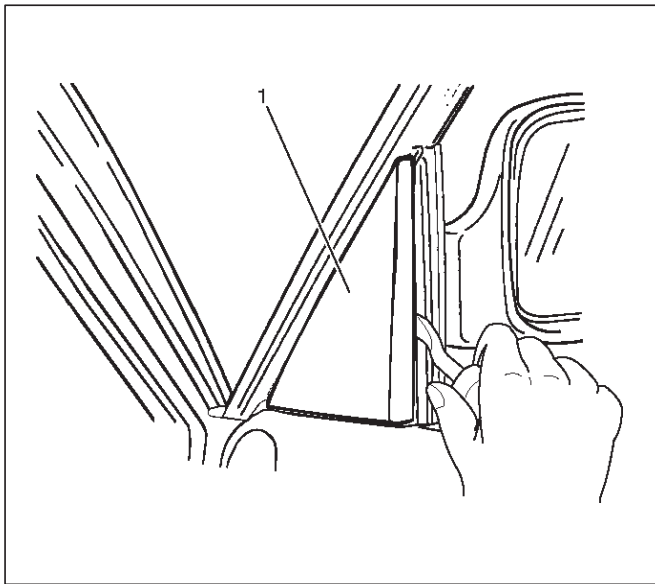
Legend

- | | |
|-------------------------|--|
| (1) Power Window Switch | (7) Regulator Handle |
| (2) Door Mirror Cover | (8) Inside Handle Fixing Screw |
| (3) Door Trim Panel | (9) Inside Handle |
| (4) Courtesy Light | (10) Hook |
| (5) Front Speaker | (11) Washer |
| (6) Speaker Cover | (12) Inside Pull Handle |
| | (13) Inside Pull Handle (W/O Power Window) |

Removal

1. Disconnect the battery ground cable.

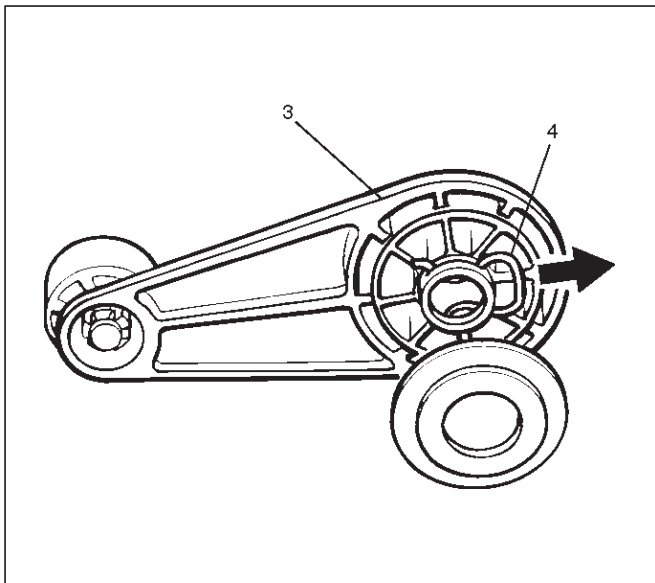
2. Remove the door mirror cover (1).



720RW011

3. Remove the regulator handle(3).

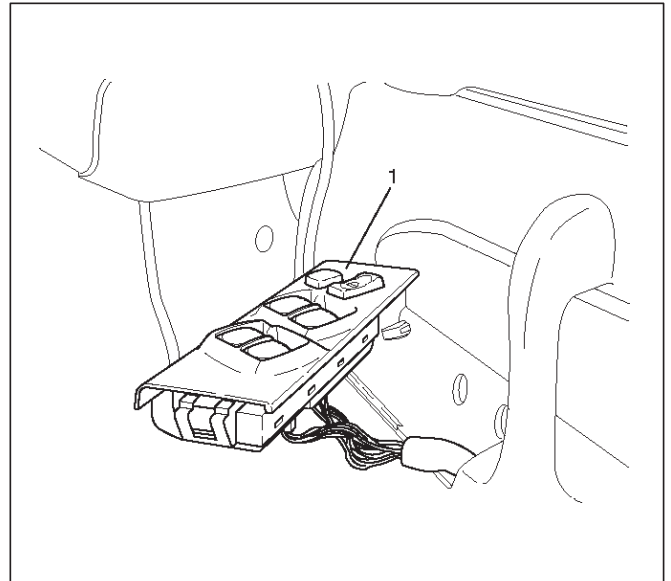
- Pull the hook(4) out and remove the regulator handle.



631RW001

4. Remove the power window switch(1).

- Pry the power window switch out and disconnect the switch connector.



825RW174

5. Remove the speaker cover.

6. Remove the front speaker.

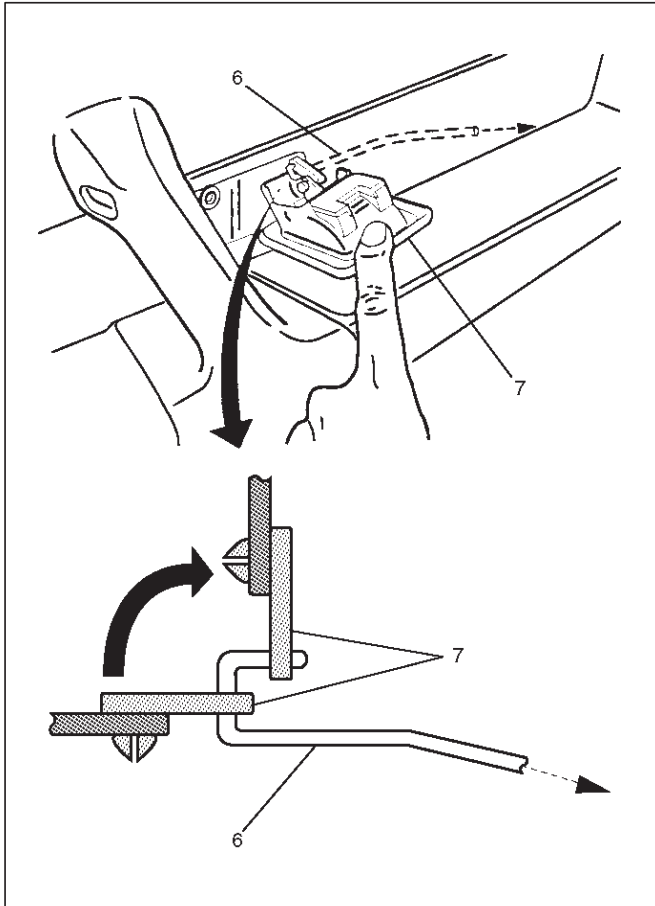
- Remove the front speaker fixing screws in order to disconnect the speaker connector.

7. Remove the inside handle fixing screw.

- Remove the screw that fixes the inside handle(7), slide the inside handle to the position illustrated, and leave it there for the moment.

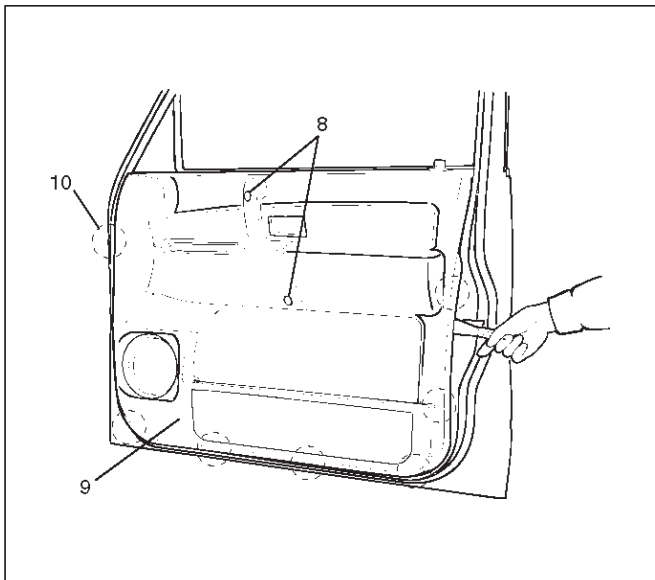
CAUTION: Take care not to impose excessive force on the inside handle link(6), lest this link is elongated, which could make it impossible to operate the door with the inside handle.

8J-8 EXTERIOR/INTERIOR TRIM

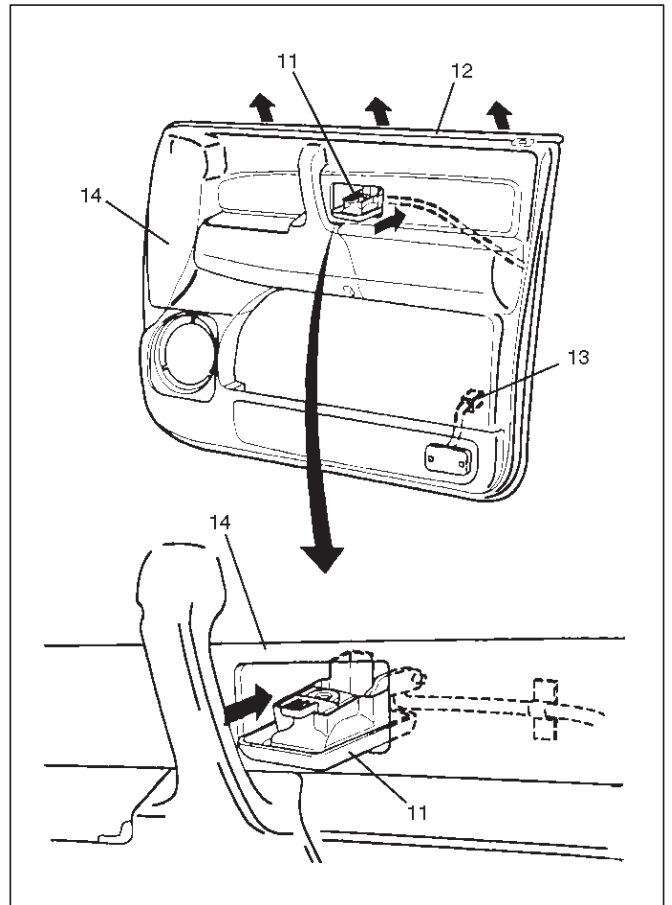


8. Remove the door trim panel(9).

- Remove two fixing screws(8) in order to take off seven clips(10) from the door panel.



- Disconnect the courtesy light connector(13) to lift the door trim panel(14) and unlock the engagement of the waist seal(12) section. Then, pass the inside handle(11) through the mounting hole of the trim panel, and detach the trim panel.

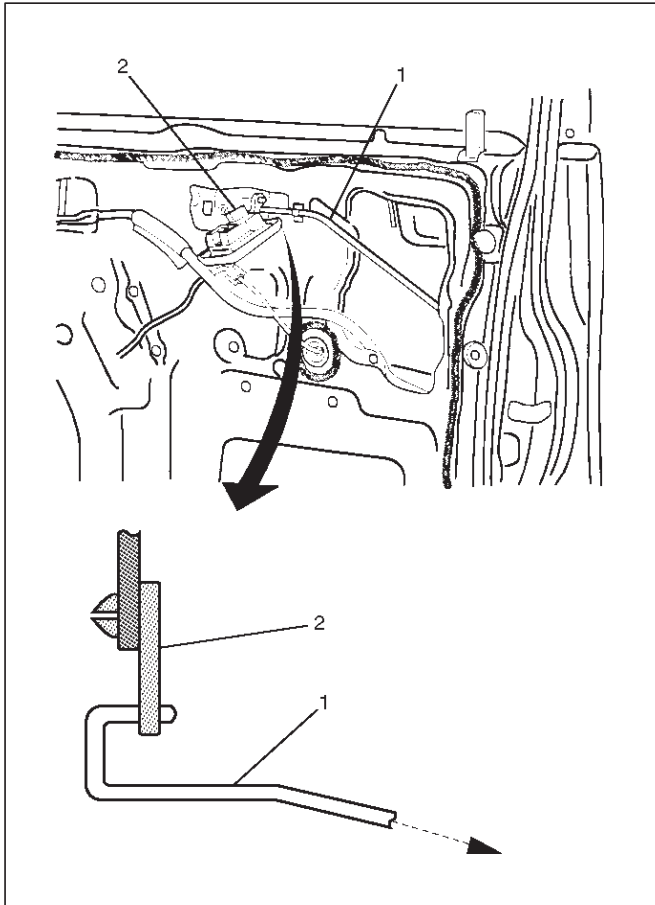


9. Remove the inside handle.

Installation

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

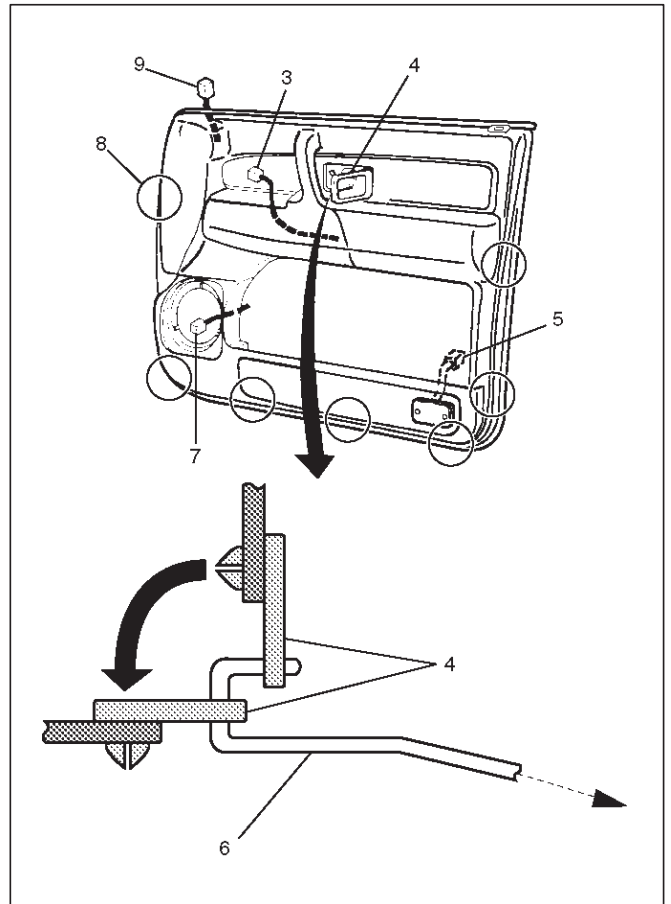
1. When installing the inside handle(2), assemble it temporarily to the inside handle link(1).



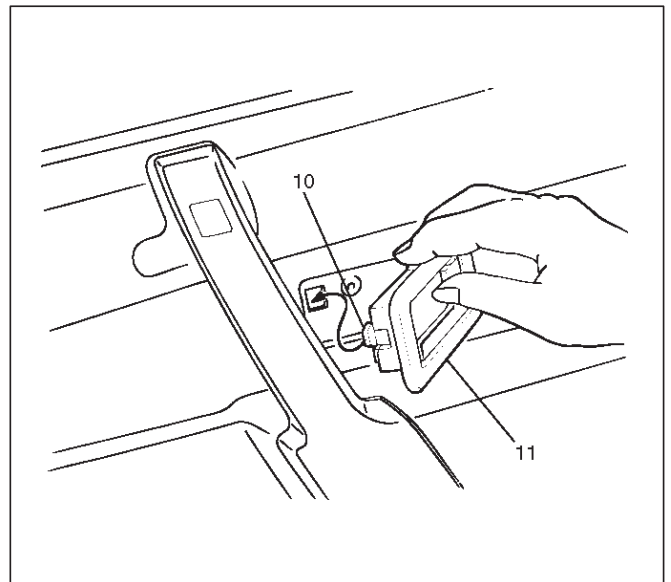
2. Pass the inside handle(4) through the mounting hole of the trim panel and assemble the trim panel.

Engage seven clips(8) into the door panel. Also, connect the courtesy light connector(5) and leave the connectors of the speaker(7), tweeter(9) and power window(3) drawn out to their prescribed positions, so that they will not be caught.

Then, put the inside handle(4) to the normal position of the inside handle link(6).

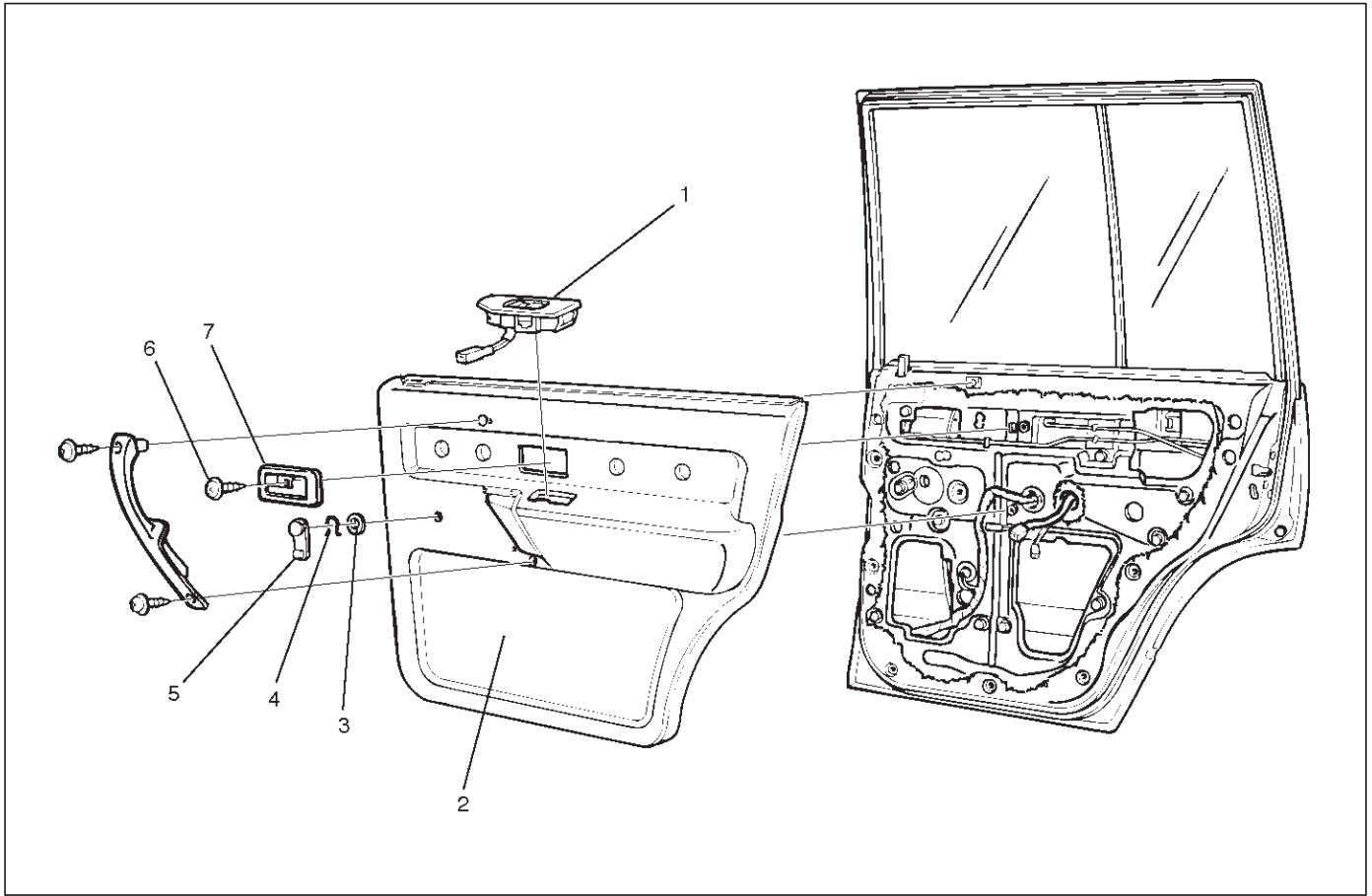


3. Fit the claw(10) of the inside handle(11) securely into the hole of the door panel and fix the inside handle with the screw.



Rear Door Trim Panel

Rear Door Trim Panel and Associated Parts



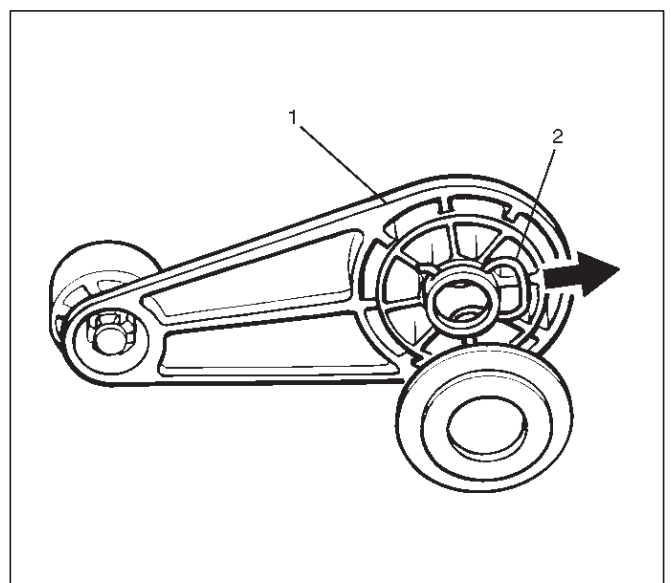
655RW006

Legend

- | | |
|-------------------------|--------------------------------|
| (1) Power Window Switch | (4) Clip |
| (2) Door Trim Panel | (5) Regulator Handle |
| (3) Washer | (6) Inside Handle Fixing Screw |
| | (7) Inside Handle |

Removal

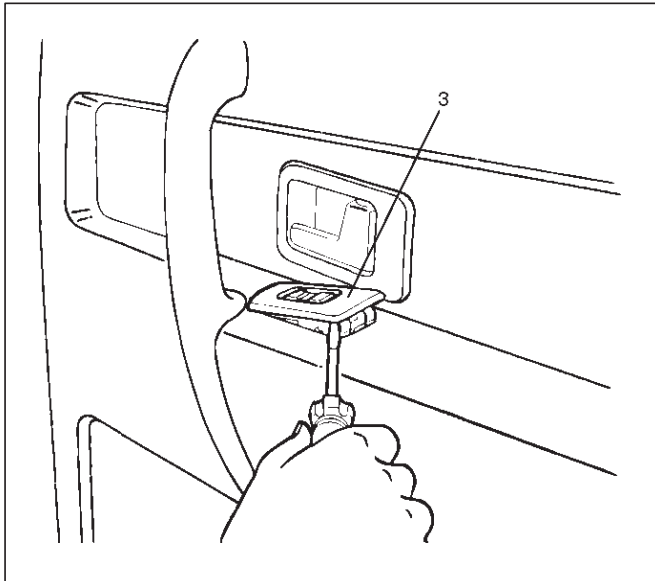
1. Disconnect the battery ground cable.
2. Remove the regulator handle(1).
 - Pull the hook(2) out and remove the regulator handle.



631RW002

3. Remove the power window switch(3).

- Pry the power window switch out and disconnect the switch connector.

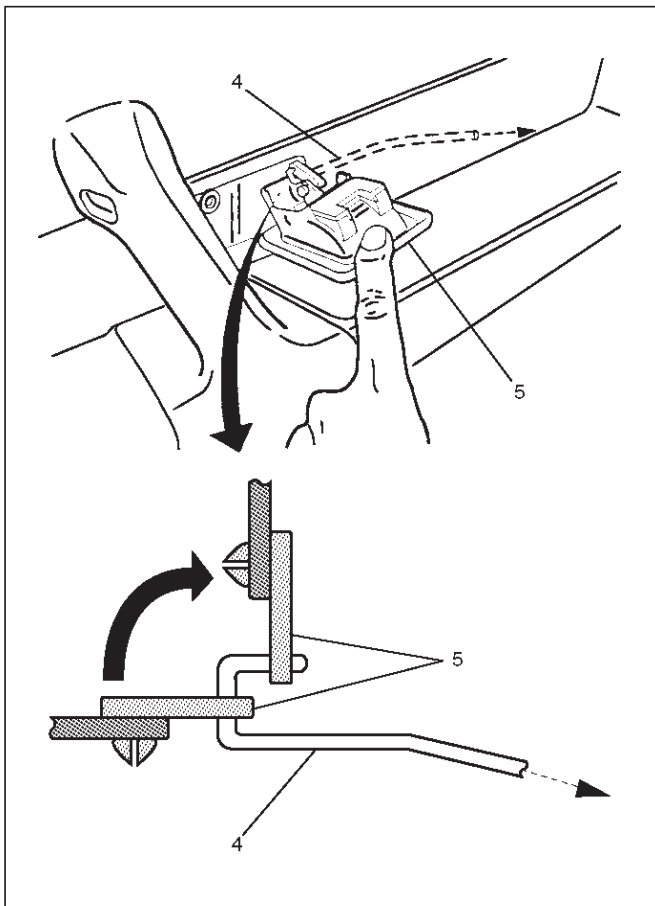


825RS084

4. Remove the inside handle fixing screw.

- Remove the screw that fixes the inside handle(5), slide the inside handle to the position illustrated, and leave it there for the moment.

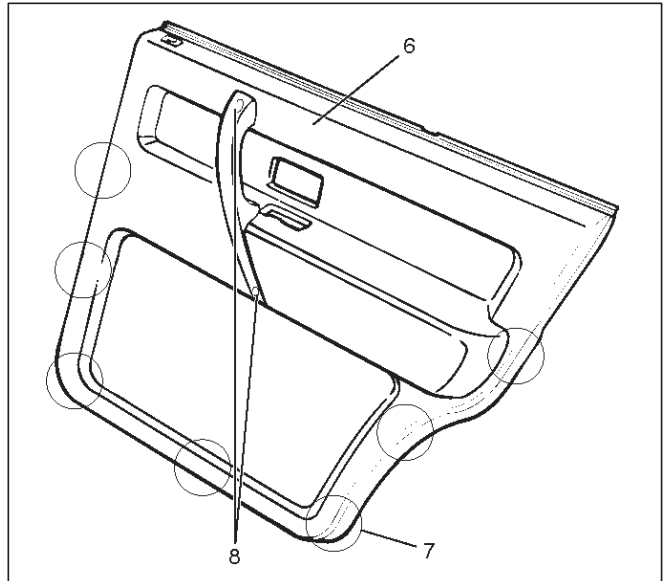
CAUTION: Take care not to impose excessive force on the inside handle link(4), lest this link be elongated, which could make it impossible to operate the door with the inside handle.



632RW002

5. Remove the door trim panel(6).

- Remove two fixing screws(8) to take off seven clips(7) from the door panel.



655RW007

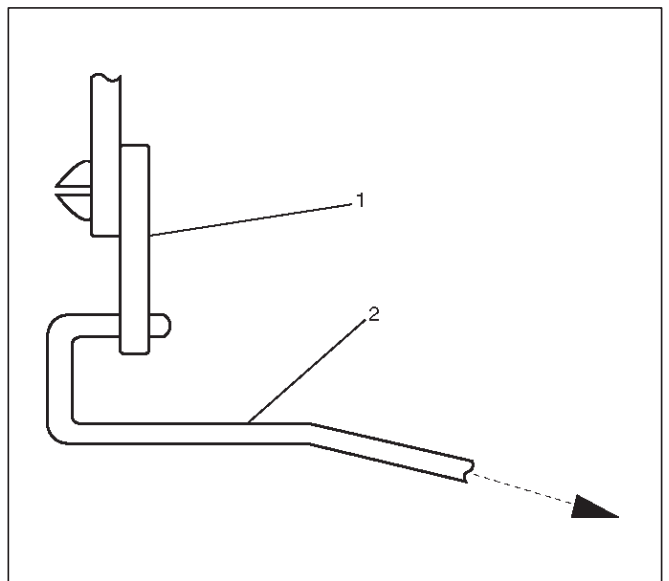
- Lift the trim panel and unlock the engagement of the waist seal section. Then, pass the inside lever through the mounting hole of the trim panel, and detach the trim panel.

6. Remove the inside handle.

Installation

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

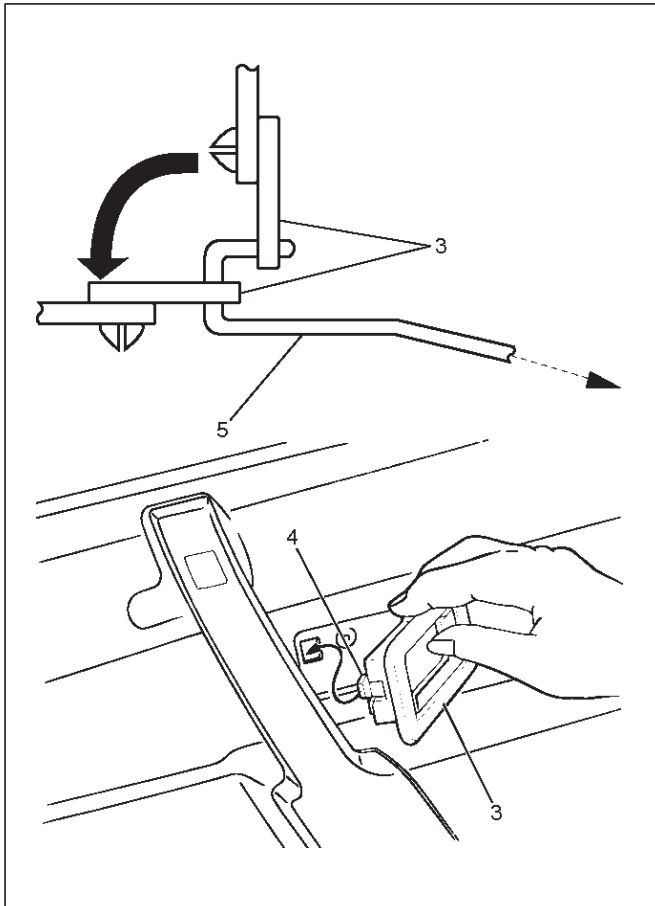
1. When installing the inside handle(1), assemble temporarily to the inside handle link(2).



652RS006

8J-12 EXTERIOR/INTERIOR TRIM

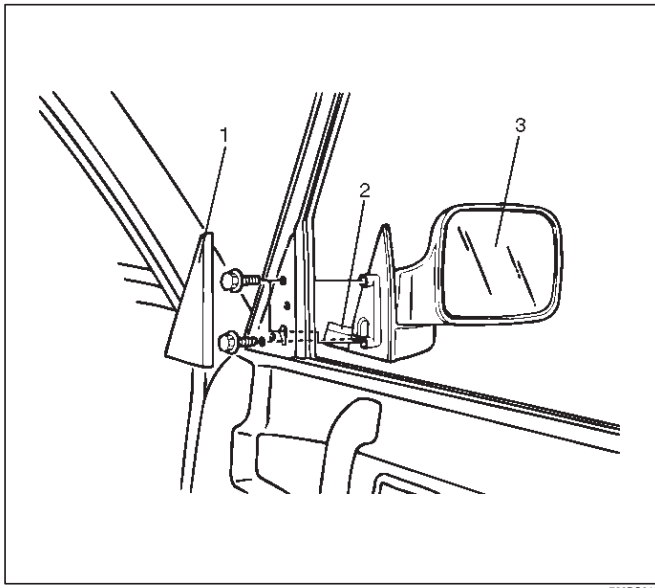
2. Pass the inside handle through the mounting hole of the trim panel. Assemble the trim panel. Engage securely seven clips into the door panel. Also, leave the connector of the power window drawn out to its prescribed position, so that it will not caught.
3. Put back the inside handle(3) to the original position of the link(5). Fit the claw(4) of the inside handle securely into the hole of the door panel. Fix the handle with the screw.



632RW011

Door Mirror

Door Mirror and Associated Parts



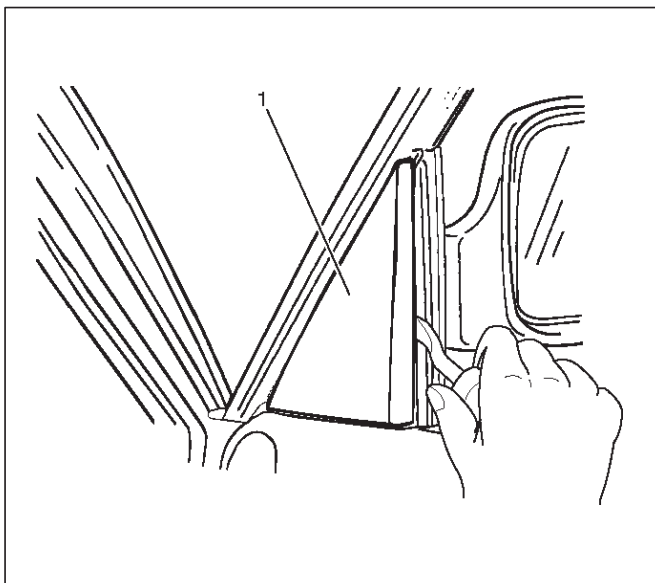
720RS012

Legend

- (1) Door Mirror Cover
- (2) Door Mirror Connector
- (3) Door Mirror

Removal

1. Disconnect the battery ground cable.
2. Remove the door mirror cover(1).



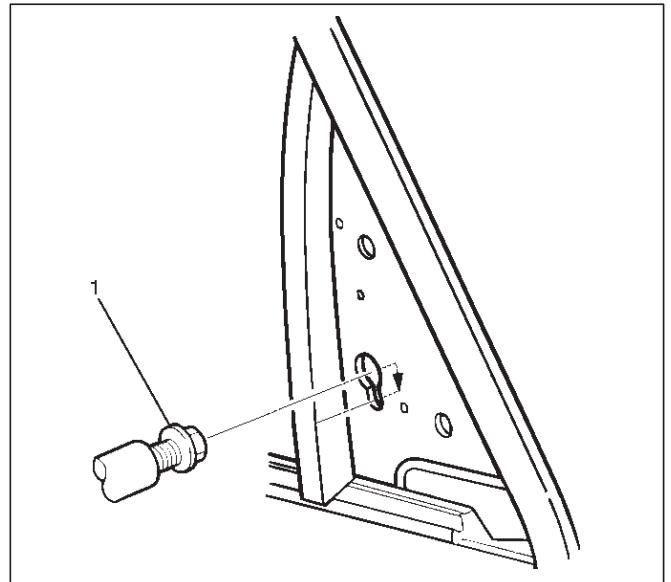
720RW011

3. Remove the door mirror connector.
4. Remove the door mirror.

Installation

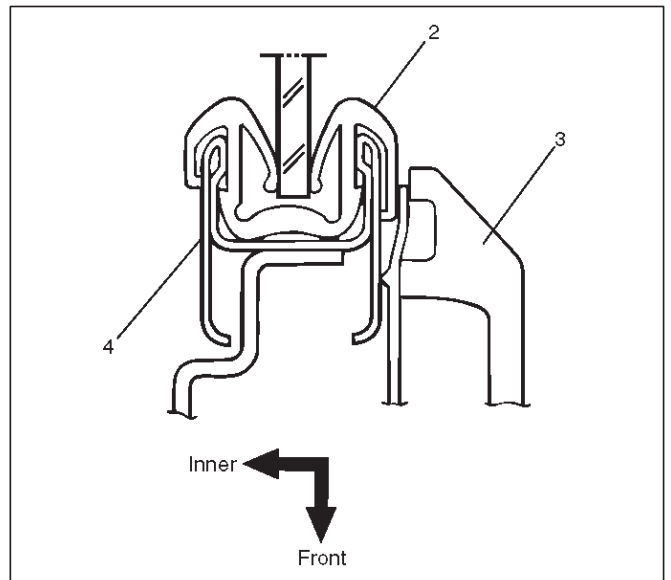
To install, follow the removal steps in the reverse order, noting the following points.

1. When you install the door mirror, install the bolt(1) to the mirror temporarily, hook the bolt to the door side hole and tighten the bolt from the inside.



720RS001

2. When installing the door mirror, hold the glass run lip(2) between the door mirror base(3) and the center sash(4).



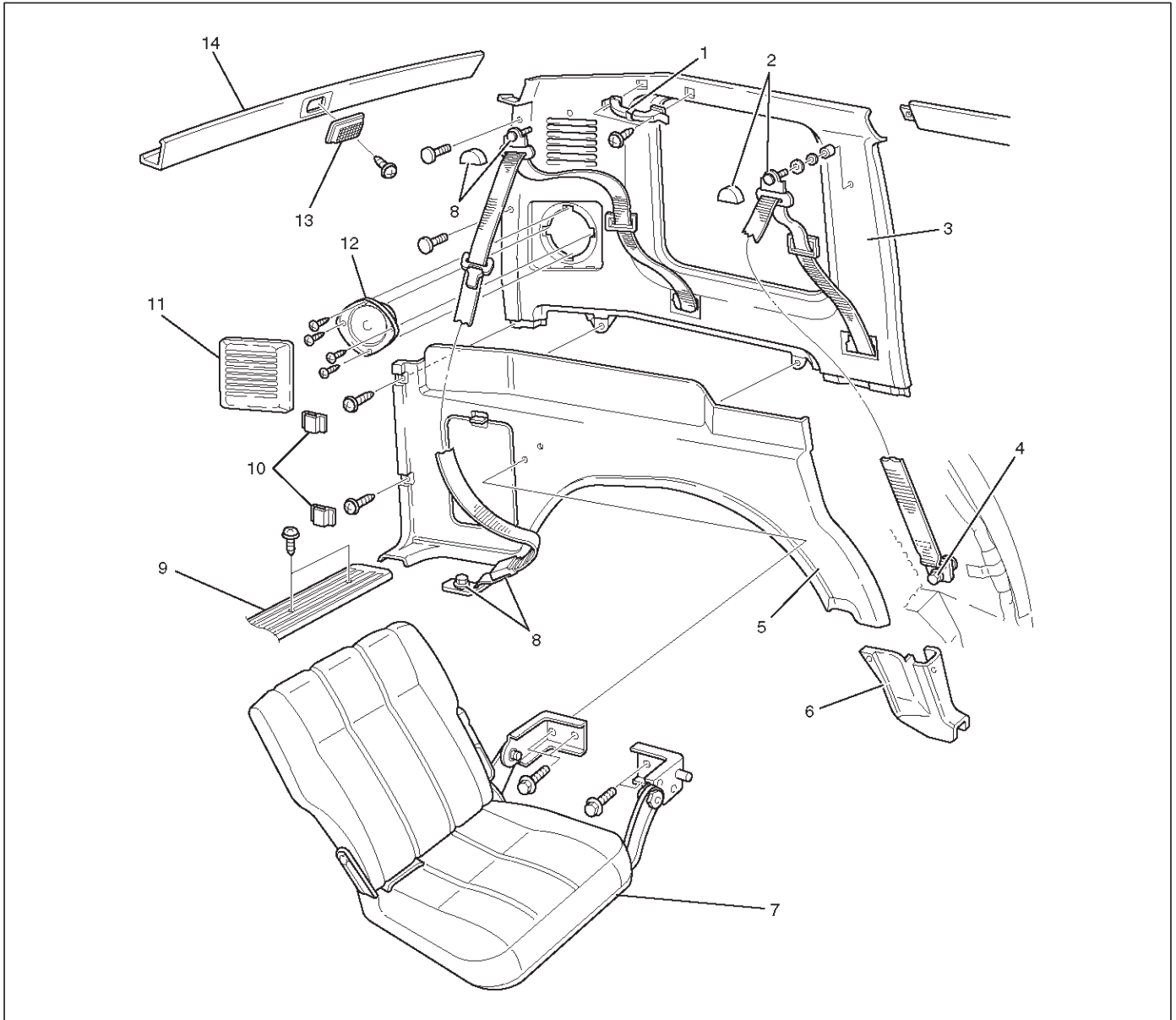
A10RS001

3. Tighten the door mirror fixing bolts to the specified torque.

Torque: 8 N·m (0.8kg·m/69 lb in)

Luggage Side and Quarter Upper Trim Cover (Long Wheel Base)

Luggage Side, Quarter Upper Trim Cover and Associated Parts



760RW017

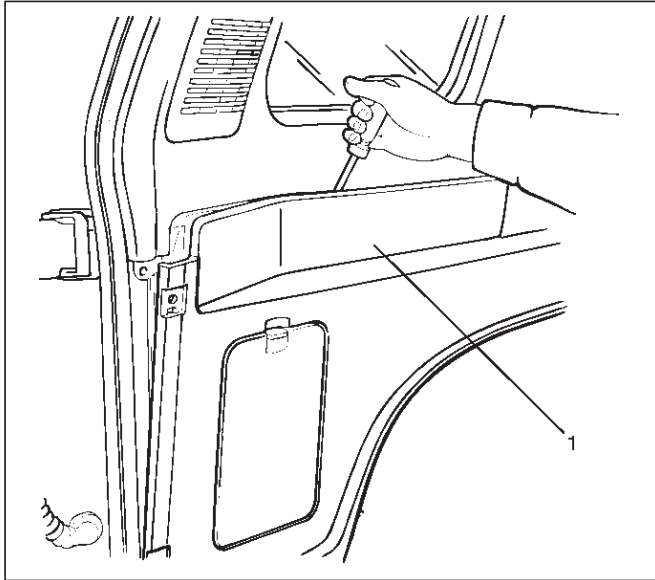
Legend

- | | |
|--|---|
| (1) Assist Grip | (8) Third Seat Belt Anchor Bolt Cover and Anchor Bolt |
| (2) Rear Seat Belt Anchor Bolt Cover and Anchor Bolt | (9) Rear End Floor Trim Cover |
| (3) Quarter Upper Trim Cover | (10) Luggage Side Cap |
| (4) Anchor Bolt | (11) Speaker Grille |
| (5) Luggage Side Trim Cover | (12) Rear Speaker |
| (6) Luggage Side Lower Cover | (13) Luggage Room Light |
| (7) Third Seat Assembly and seat Bracket | (14) Rear Roof Trim Cover |

Removal

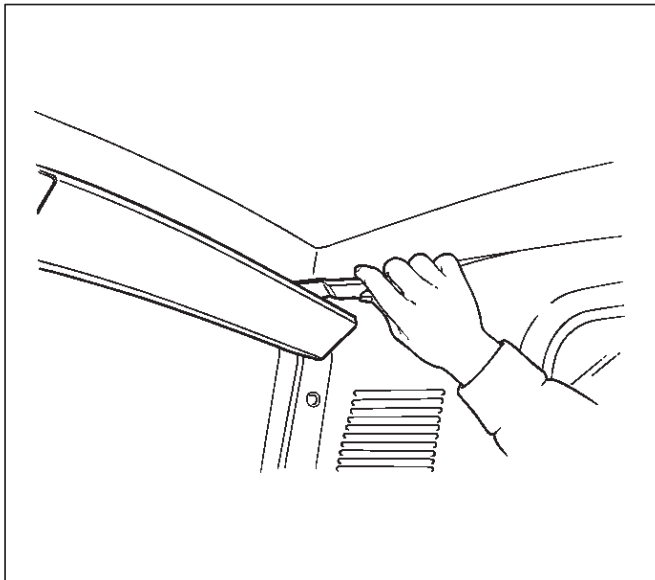
1. Disconnect the battery ground cable.
2. Remove the third seat assembly and seat bracket.
3. Remove the rear end floor trim cover.
4. Remove the luggage side cap.

5. Remove the luggage side lower cover.
6. Remove the luggage side trim cover (1).
 - Remove the rear side fixing screws and pry the trim cover retainers free from the body panel and the upper trim cover.



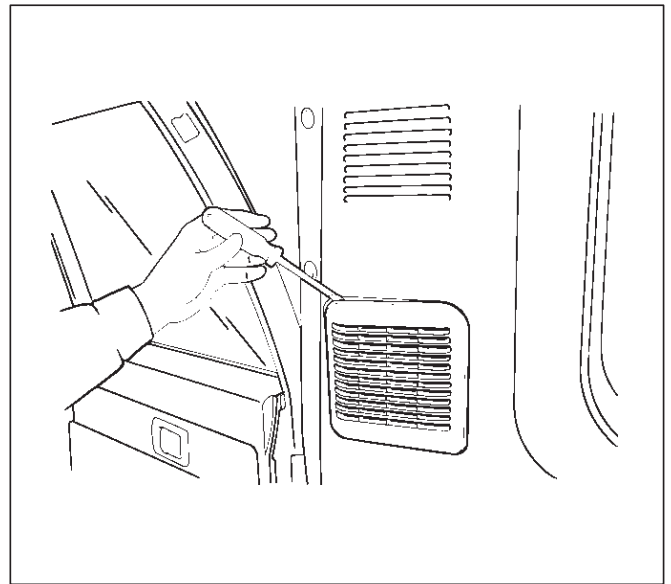
687RS002

7. Remove the luggage room light.
 - Remove the luggage room light lens and the fixing screws.
 - Disconnect the luggage room light connector.
8. Remove the rear roof trim cover.
 - Pry the trim cover retainers free from the body panel.



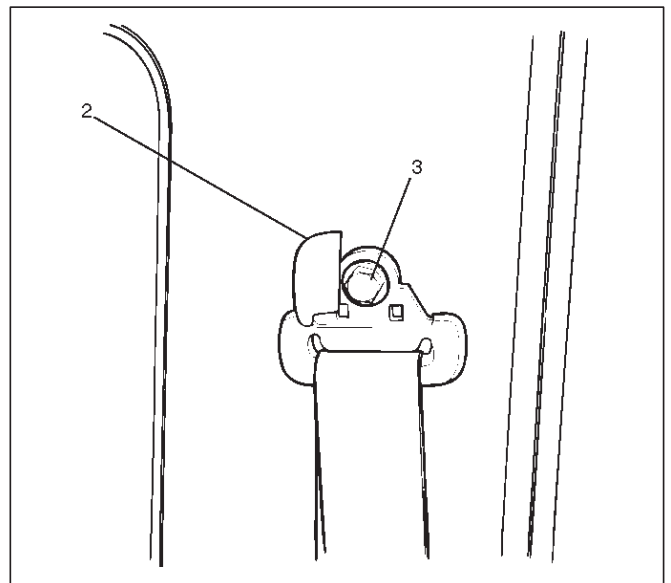
666RS001

9. Remove the speaker grille.



687RS003

10. Remove the rear speaker.
 - Remove the rear speaker fixing screws and disconnect the connector.
11. Remove the rear seat belt anchor bolt cover (2) and the anchor bolt (3).



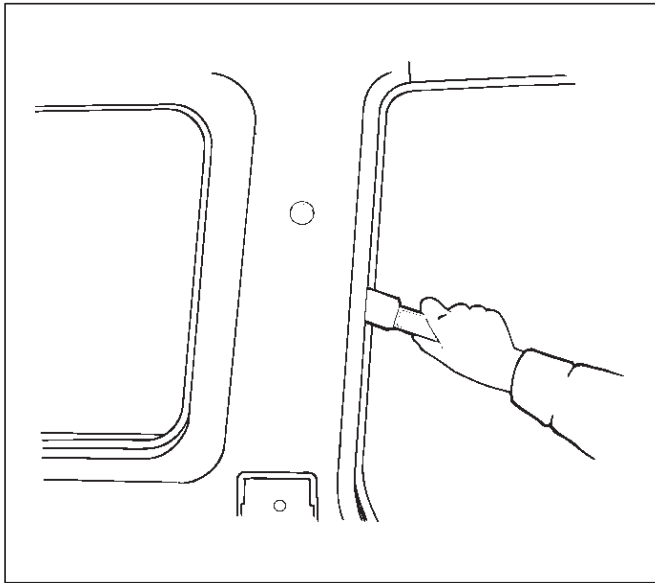
760RW005

12. Remove the third seat belt anchor bolt cover and anchor bolt.
 - Refer to the Third Seat Belt removal procedure in Seat Belt System section.
13. Remove the assist grip.

8J-16 EXTERIOR/INTERIOR TRIM

14. Remove the quarter upper trim cover.

- Remove the rear side clips of the trim cover and pry the quarter upper trim cover retainers free from the body panel.



687RS004

Installation

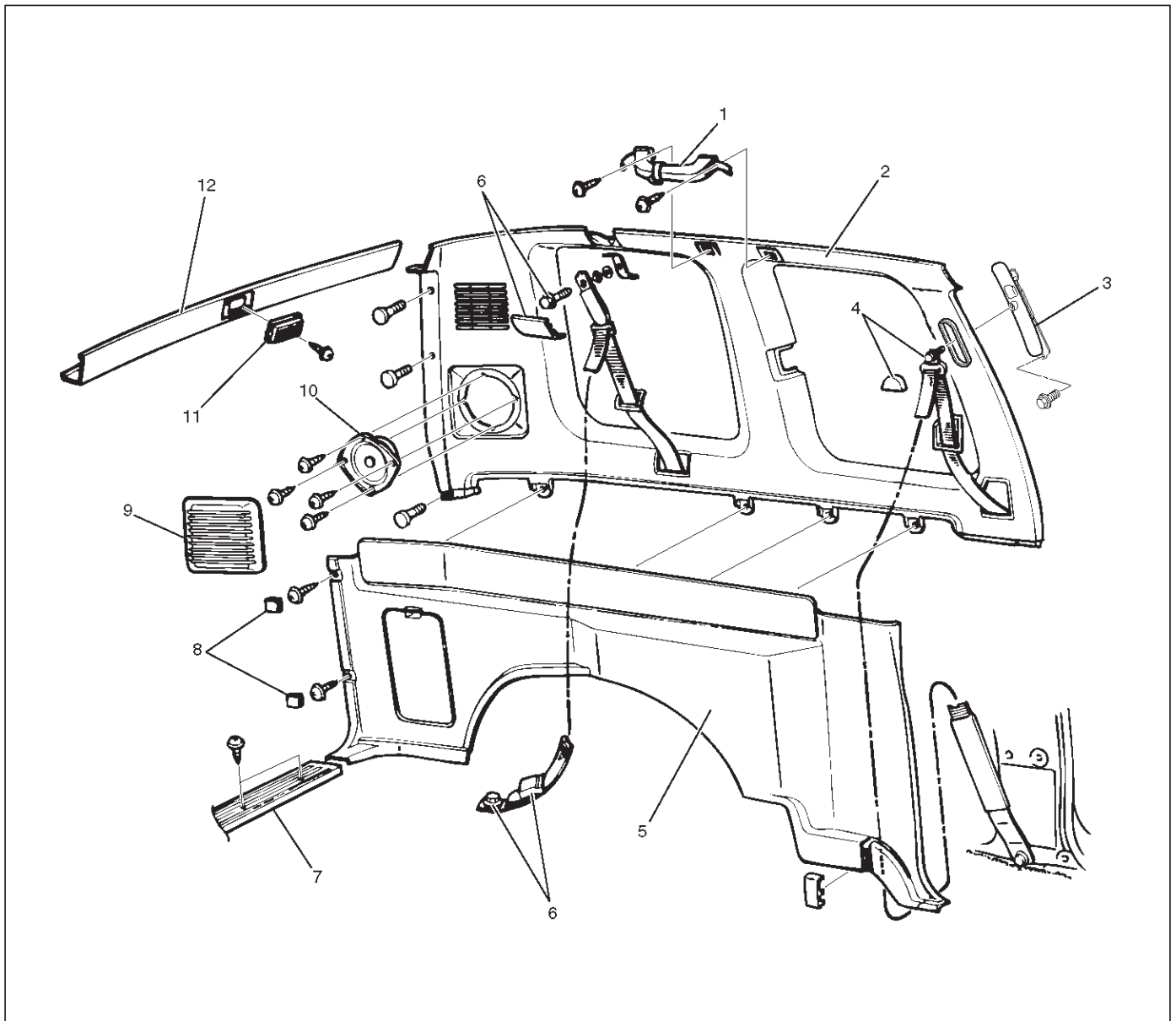
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the seat belt anchor bolt to the specified torque.

Torque: 39 N·m (4.0kg·m/29 lb ft)

Luggage Side and Quarter Upper Trim Cover (Short Wheel Base)

Luggage Side, Quarter Upper Trim Cover and Associated Parts



760RW021

Legend

- | | |
|---|-------------------------------|
| (1) Rear Assist Grip | (7) Rear End Floor Trim Cover |
| (2) Quarter Upper Trim Cover | (8) Luggage Side Cap |
| (3) Seat belt adjust Shoulder Anchor Plate | (9) Speaker Grill |
| (4) Front Seat Belt Anchor Bolt Cover and Anchor Bolt | (10) Rear Speaker |
| (5) Luggage Side Trim Cover | (11) Luggage Room Light |
| (6) Rear Seat Belt Anchor Bolt Cover and Anchor Bolt | (12) Rear Roof Trim Cover |

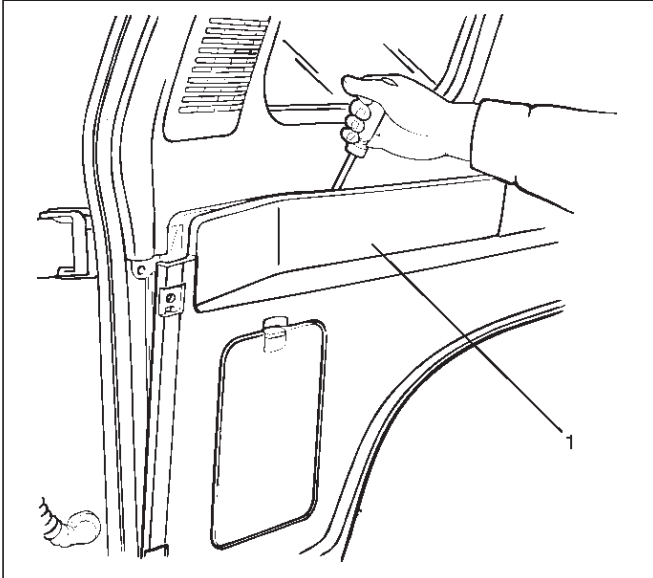
Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side cap.

8J-18 EXTERIOR/INTERIOR TRIM

4. Remove the luggage side trim cover (1).

- Remove the rear side fixing screws and pry the trim cover retainers free from the body panel and the upper trim cover.
- Remove the cover by pulling the front seat belt out of the slit on the lower side of the trim cover.

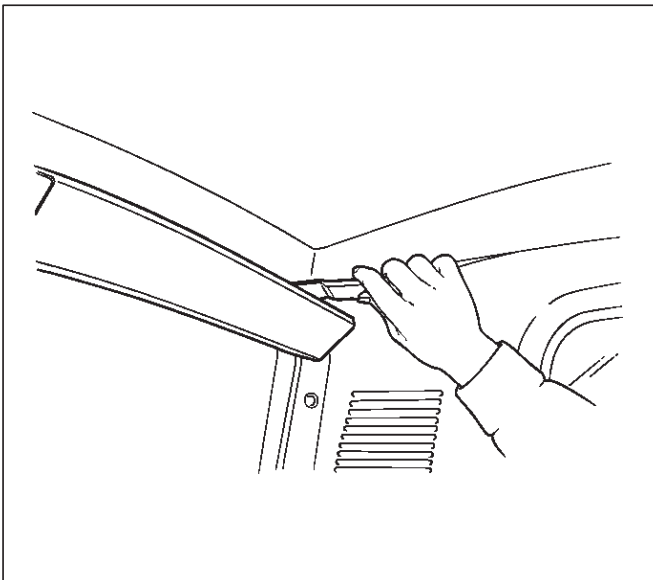


5. Remove the luggage room light.

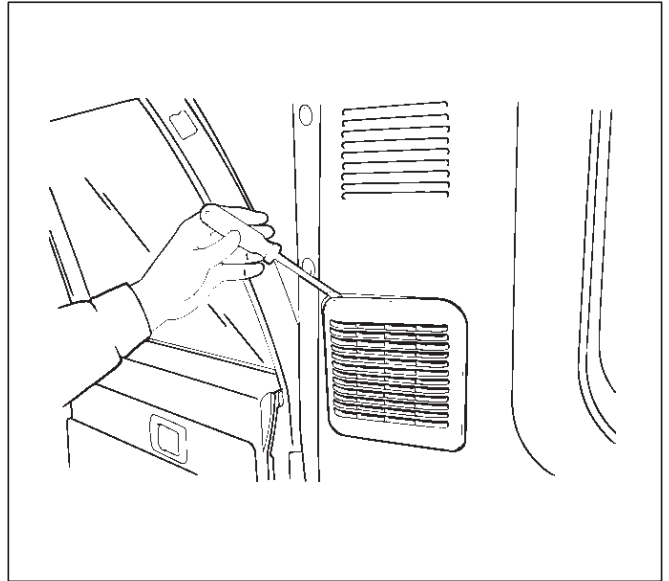
- Remove the luggage room light lens and the fixing screws.
- Disconnect the luggage room light connector.

6. Remove the rear roof trim cover.

- Pry the trim cover retainers free from the body panel.



7. Remove the speaker grille.

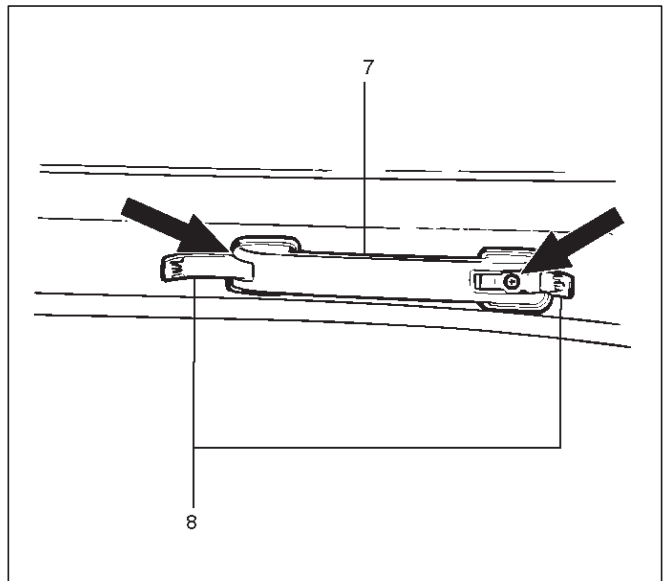


8. Remove the rear speaker.

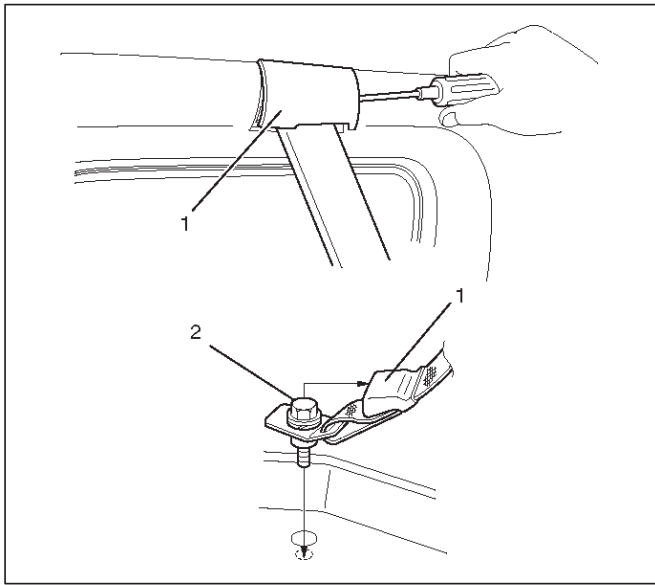
- Remove the rear speaker fixing screws and disconnect the connector.

9. Remove the rear assist grip (7).

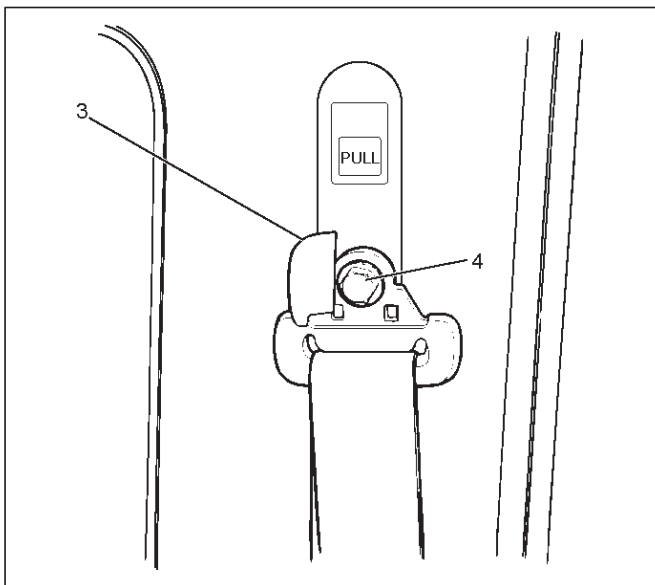
- Open the both side of the assist grip cover (8) and remove two fixing screws.



10. Remove the rear seat belt anchor bolt cover (1) and the anchor bolt (2).

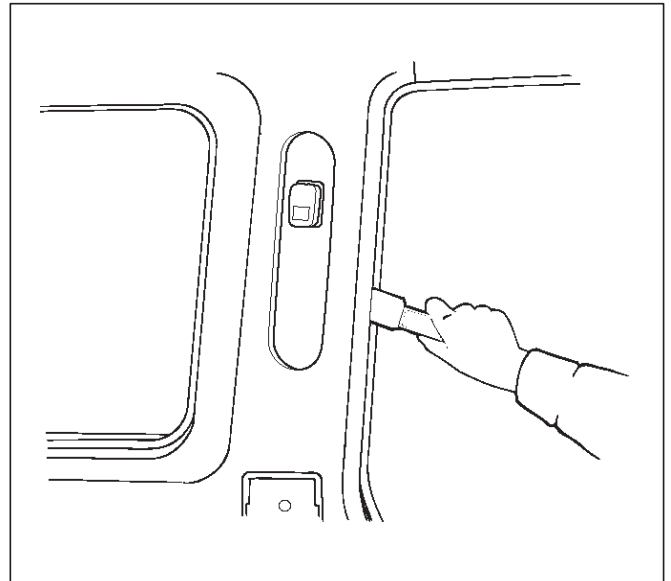


11. Remove the front seat belt anchor bolt cover (3) and the anchor bolt (4).



12. Remove the quarter upper trim cover.

- Remove the rear side clips of the trim cover and pry the quarter upper trim cover retainers free from the body panel.



13. Remove the seat belt adjust shoulder anchor plate.

Installation

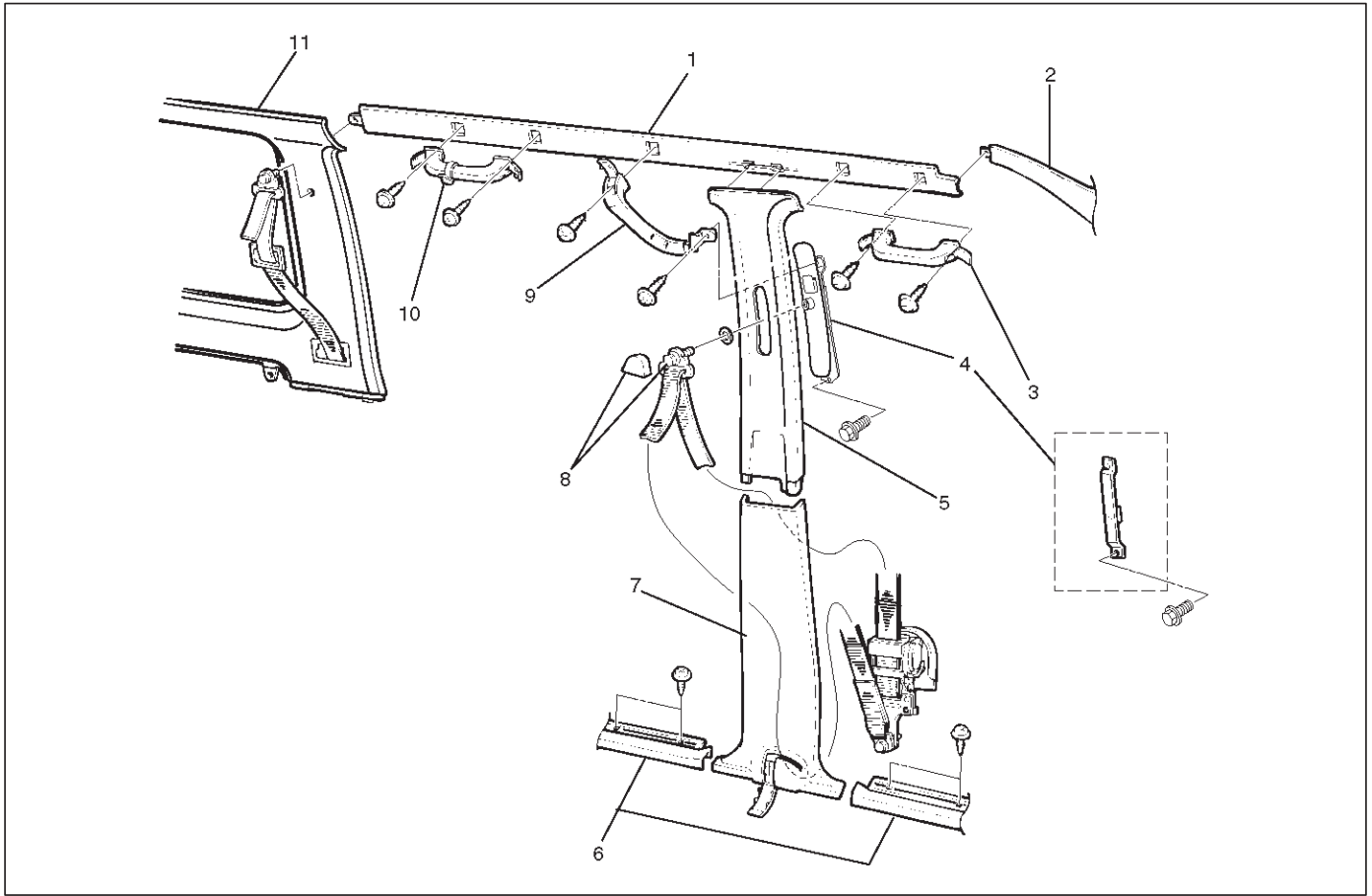
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0kg·m/29 lb ft)

Center Pillar and Roof Side Trim Cover (Long Wheel Base)

Center Pillar, Roof Side Trim Cover and Associated Parts



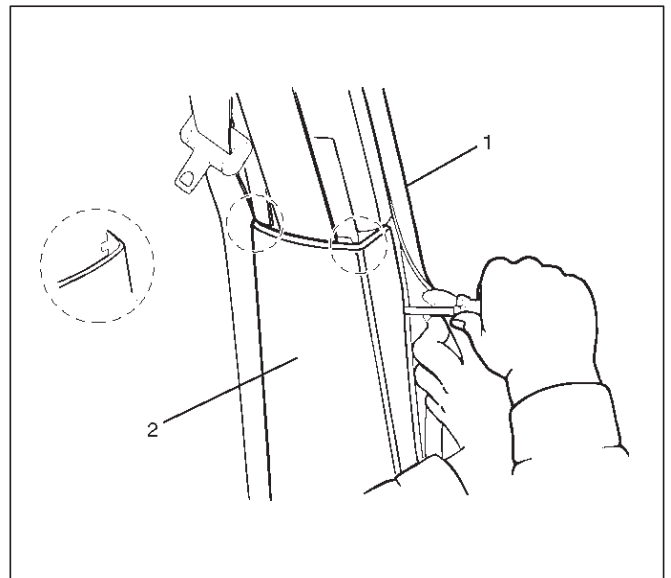
643RW007

Legend

- | | |
|--|--|
| (1) Roof Side Trim Cover | (6) Door Sill Plate (Front and Rear) |
| (2) Front Pillar Trim Cover | (7) Center Pillar Lower Trim Cover |
| (3) Assist Grip (Passenger Seat Side) | (8) Front Seat Anchor Bolt Cover and Anchor Bolt |
| (4) Adjust Shoulder Anchor Assembly/Seat Belt Anchor Plate | (9) Center Pillar Assist Grip |
| (5) Center Pillar Upper Trim Plate | (10) Assist Grip |
| | (11) Rear Quarter Upper Trim Cover |

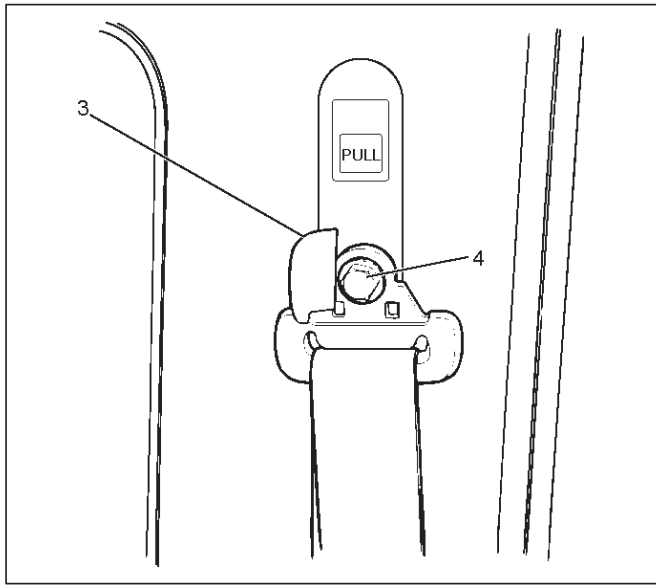
Removal

1. Disconnect the battery ground cable.
2. Remove the door sill plate (front and rear).
3. Remove the center pillar lower trim cover (2).
 - Turn up the finisher (1) and pry the trim cover retainers free from the body panel, then slide the trim cover downward.



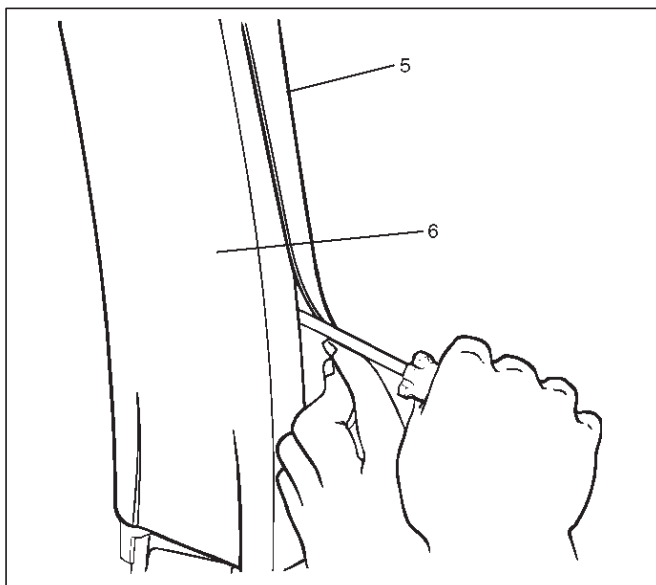
643RS003

4. Remove the front seat belt anchor bolt cover (3) and the anchor bolt (4).



760RW006

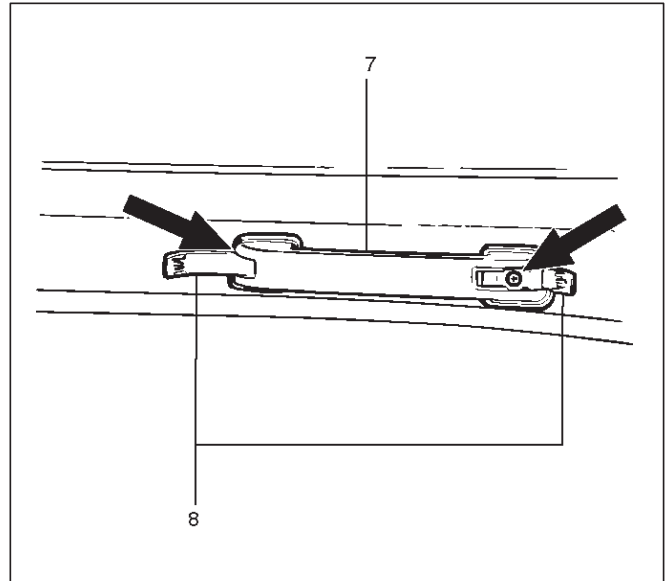
5. Remove the center pillar upper trim cover (6).
- Turn up the finisher (5) and pry the trim cover retainers free from the body panel.



643RS004

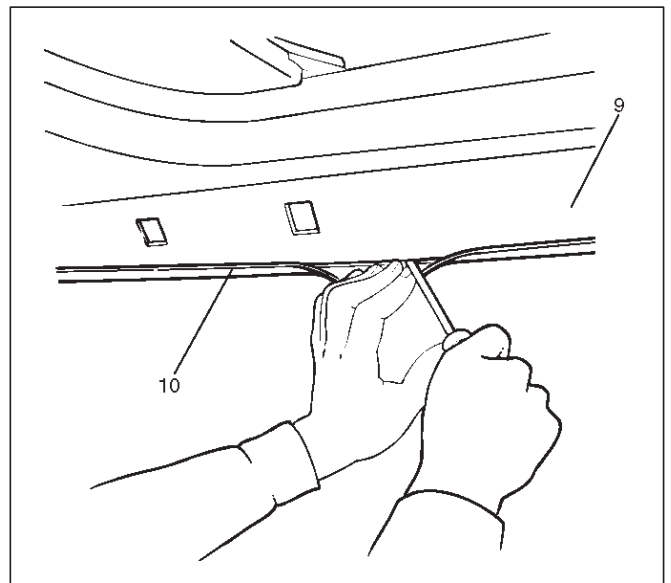
6. Remove the center pillar assist grip.
7. Remove the seat belt anchor plate/adjuster shoulder anchor assembly.

8. Remove the assist grip (7).
- Open the both side of the assist grip cover (8) and remove two fixing screws.



743RW004

9. Remove the roof side trim cover (9).
- Turn up the finisher (10) and pry the trim cover retainers free from the body panel.



643RS005

Installation

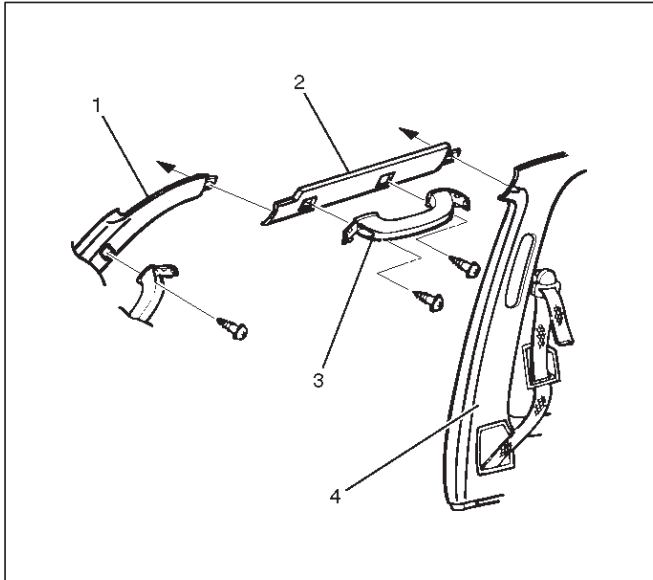
To install, follow the removal steps in the reverse order, noting the following point.

1. Install the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0kg·m/29 lb ft)

Roof Side Trim Cover (Short Wheel Base)

Roof Side Trim Cover and Associated Parts



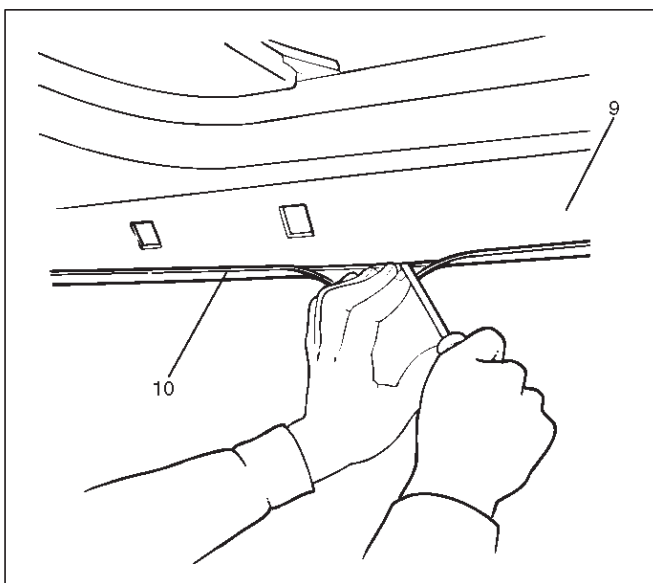
643RW006

Legend

- (1) Front Pillar Trim Cover
- (2) Roof Side Trim Cover
- (3) Assist Grip (Passenger Seat Side)
- (4) Rear Quarter Upper Trim Cover

Removal

1. Remove the assist grip.
2. Remove the roof side trim cover (9).
 - Turn up the finisher (10) and pry the trim cover retainers free from the body panel.



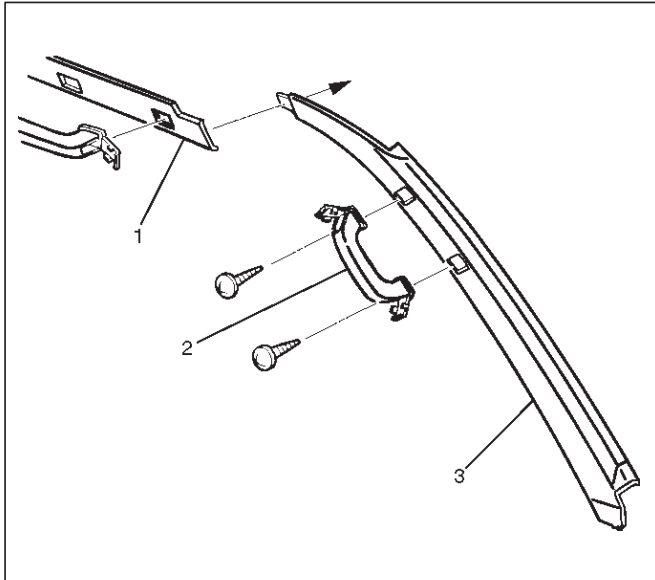
643RS005

Installation

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

Front Pillar Trim Cover

Front Pillar Trim Cover and Associated Parts



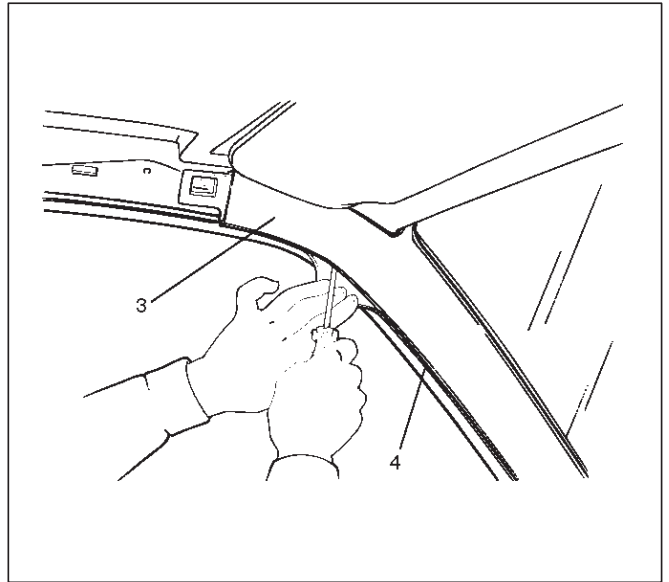
743RS003

Legend

- (1) Roof Side Trim Panel
- (2) Assist Grip
- (3) Front Pillar Trim Panel

2. Remove the front pillar trim cover (3).

- Turn up the finisher (4) and pry the trim cover retainers free from the body panel.



635RW001

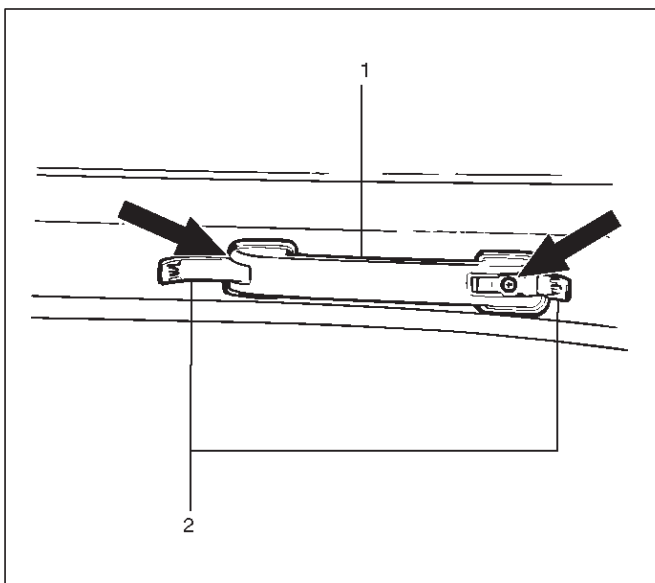
Installation

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

Removal

1. Remove the front pillar assist grip(1).

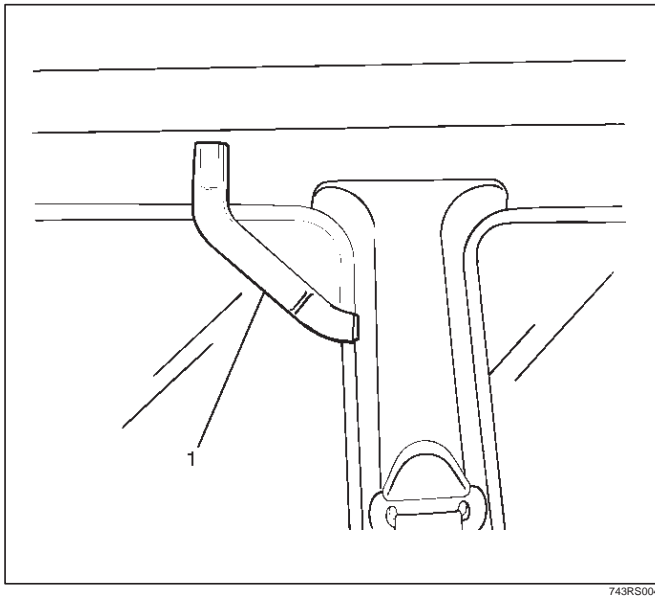
- Open the both sides of the assist grip cover (2) and remove the fixing screws and the front pillar assist grip.



743RW003

Center Pillar Assist Grip

Parts Location



743RS004

Legend

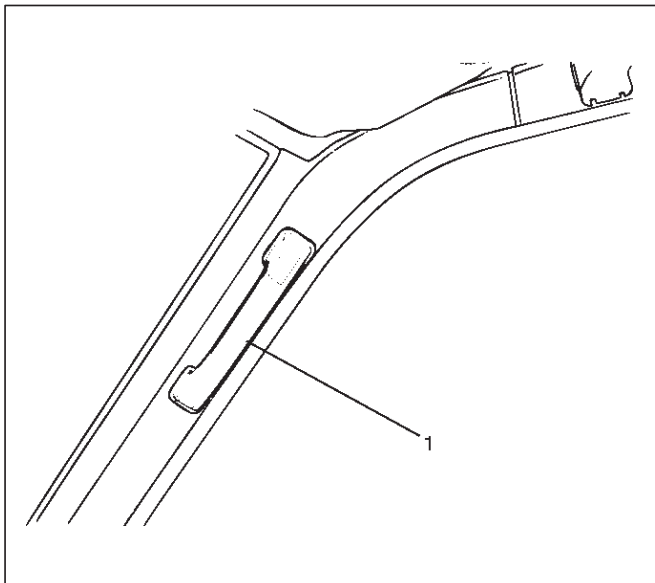
(1) Center Pillar Assist Grip

Removal and Installation

Refer to the Center Pillar and Roof Side Trim Cover in this section.

Assist Grip

Parts Location



743RS005

Legend

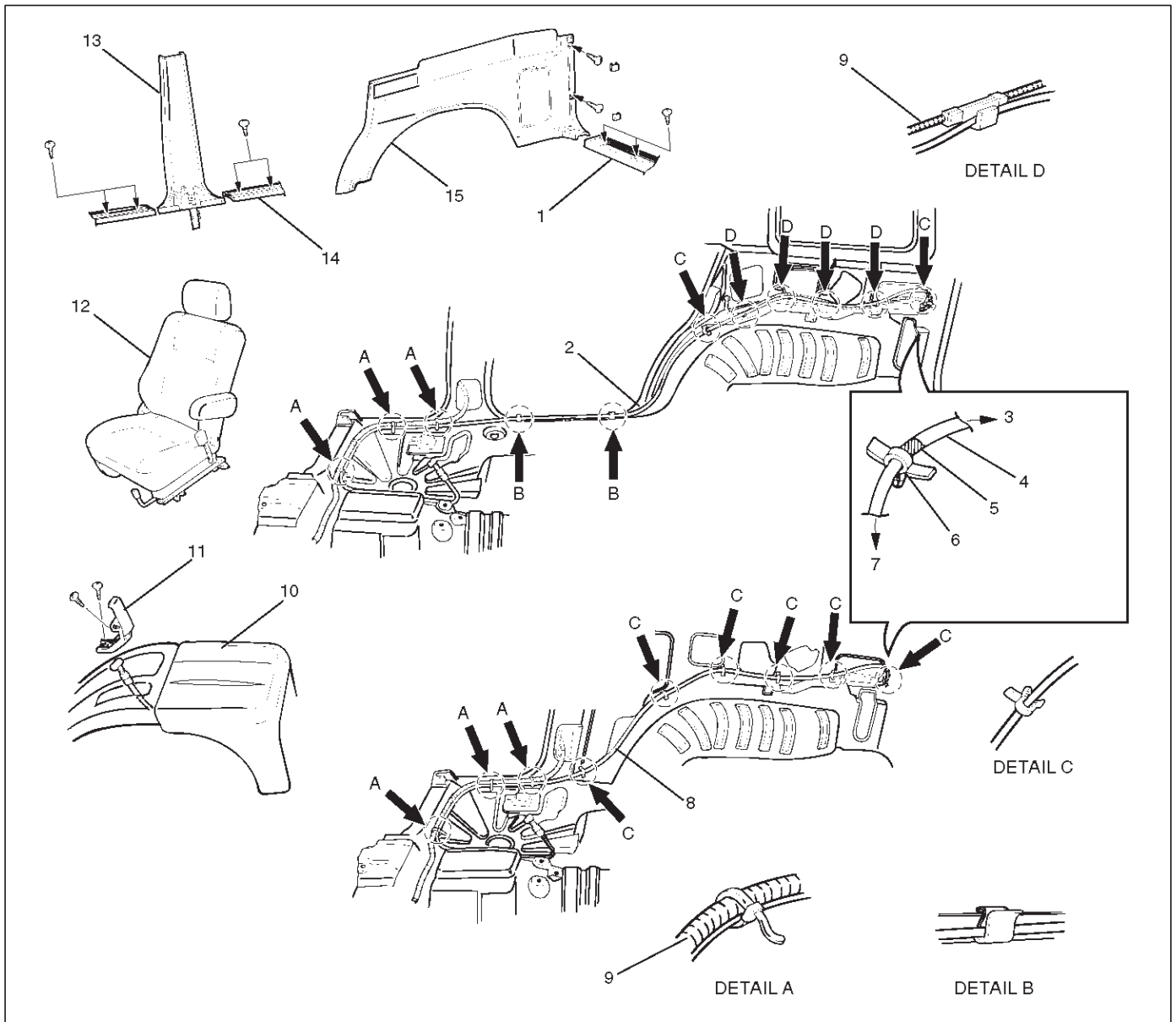
(1) Assist Grip

Removal and Installation

Refer to the Front Pillar Trim Cover in this section.

Fuel Filler Lid Opener Cable

Fuel Filler Lid Opener Cable and Associated Parts



Legend

- | | |
|--|--|
| (1) Rear End Floor Trim Cover | (8) Fuel Filler Lid Opener Cable (S-W-B) |
| (2) Fuel Filler Lid Opener Cable (L-W-B) | (9) Chassis Harness |
| (3) To Lever | (10) Center Console Assembly |
| (4) Cable | (11) Fuel Filler Lid Opener |
| (5) Marking | (12) Front Seat (RH) |
| (6) Clip | (13) Center Pillar Lower Trim Cover |
| (7) To Door | (14) Rear Door Sill Plate (RH) |
| | (15) Luggage Side Trim Panel (RH) |

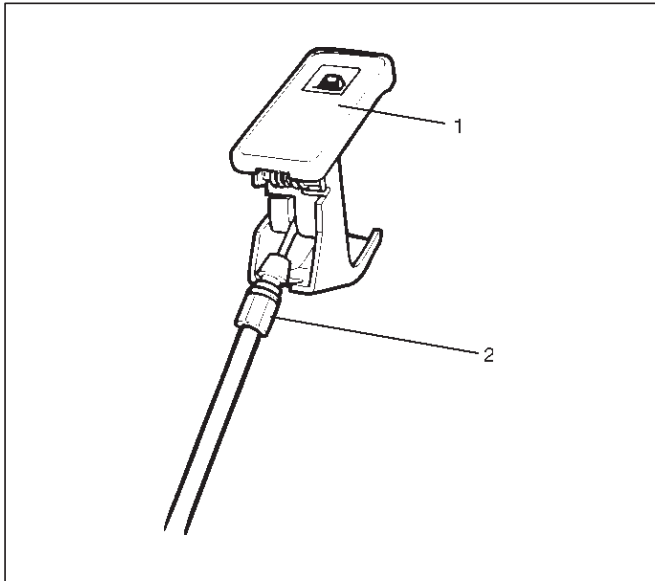
Removal

1. Disconnect the battery ground cable.
2. Remove the front seat (RH).
3. Remove the rear door sill plate (RH).
4. Remove the center pillar lower trim cover.
5. Remove the rear end floor trim panel.
6. Remove the luggage side trim panel (RH).
 - Refer to the Interior Trim Panels in this section.

8J-26 EXTERIOR/INTERIOR TRIM

7. Remove the fuel filler lid opener(1).

- Remove two opener fixing screws and disconnect the cable(2).



8. Remove the center console assembly.

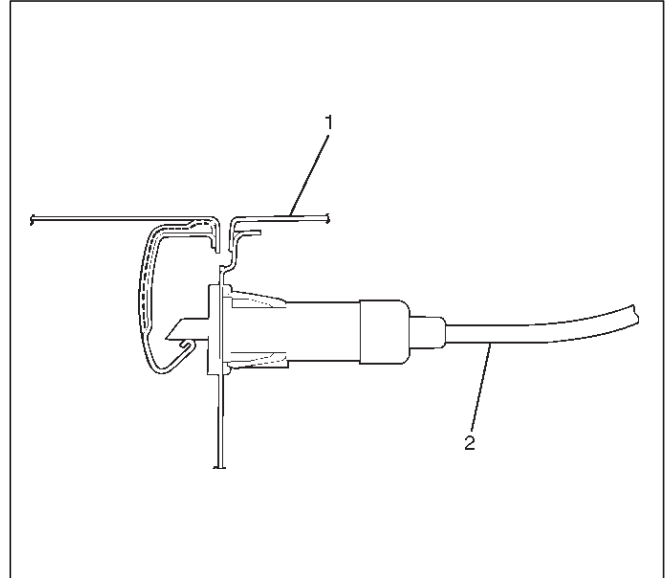
9. Remove the fuel filler lid opener cable.

- Roll up the floor carpet and remove the clips of the chassis harness and body panel to pull out the cable toward the fuel filler lid.

Installation

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

1. Insert the opener cable(2) into the body panel(1) securely.

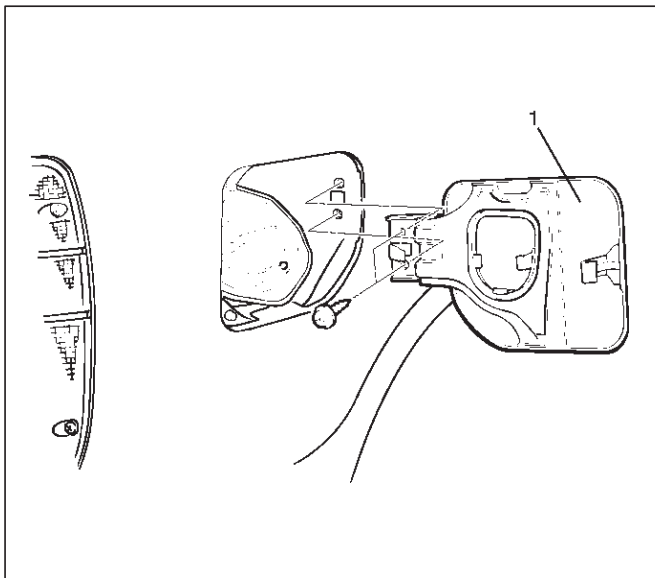


2. Install the cable and clips to its original position to the chassis harness and the body panel.

3. Check that the opener operates smoothly.

Fuel Filler Door

Parts Location



Legend

- (1) Fuel Filler Door

Removal

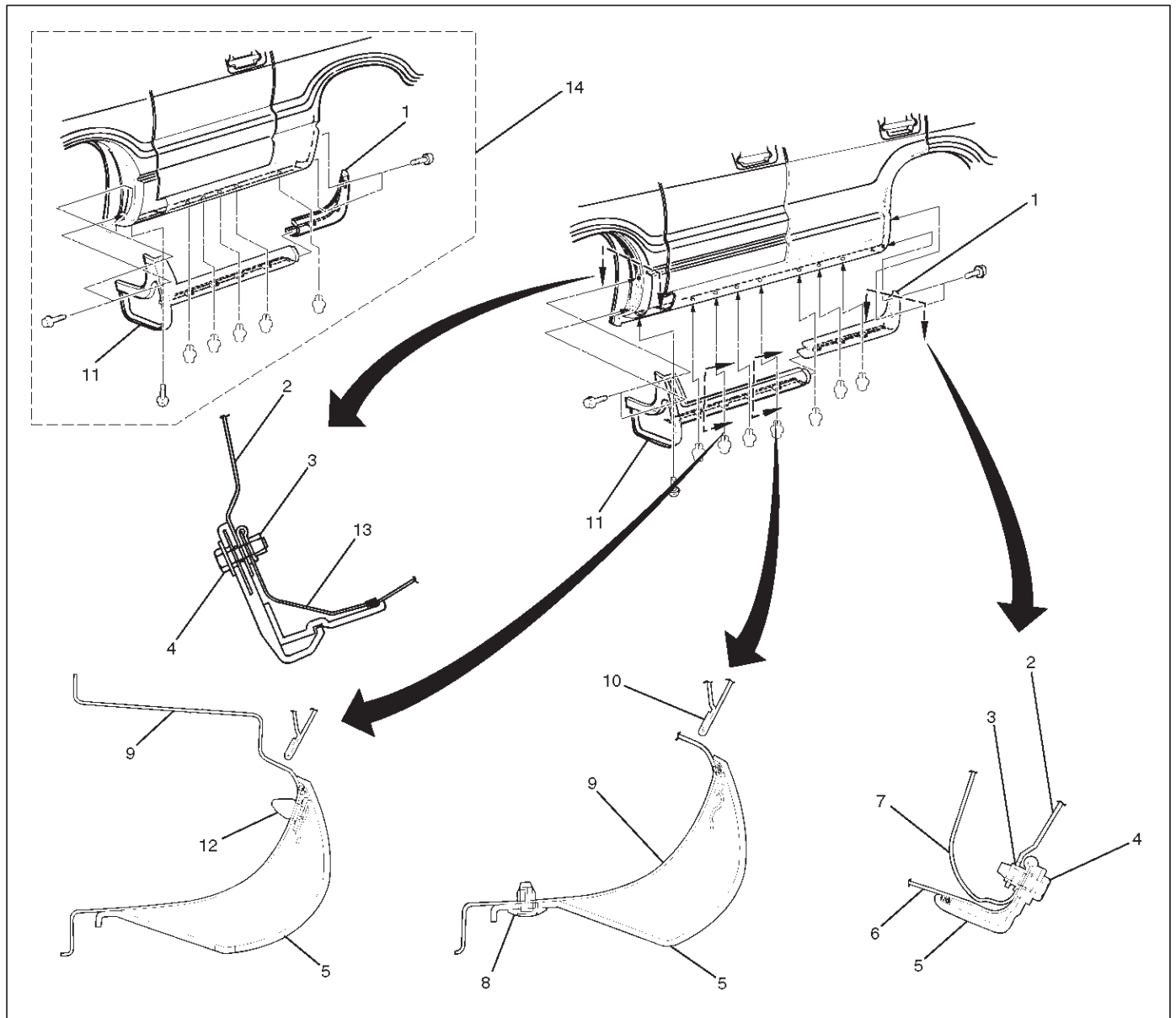
1. Remove the fuel filler door.

Installation

1. Install the fuel filler door.

Rocker Protector (Without Wheel Opening Extension)

Rocker Protector (Without Wheel Opening Extension) and Associated Parts



603RW015

Legend

- | | |
|-----------------------------|--------------------------------|
| (1) Rear Rocker Protector | (8) Fixing Clip |
| (2) Inner Liner | (9) Outer Rocker Panel |
| (3) Spare Nut | (10) Door Panel |
| (4) Fixing Screw | (11) Front Rocker Protector |
| (5) Rocker Protector | (12) Clip (W/Rocker Protector) |
| (6) Outer Side Panel | (13) Fender Panel |
| (7) Outer Wheel House Panel | (14) Short Wheel Base |

Removal

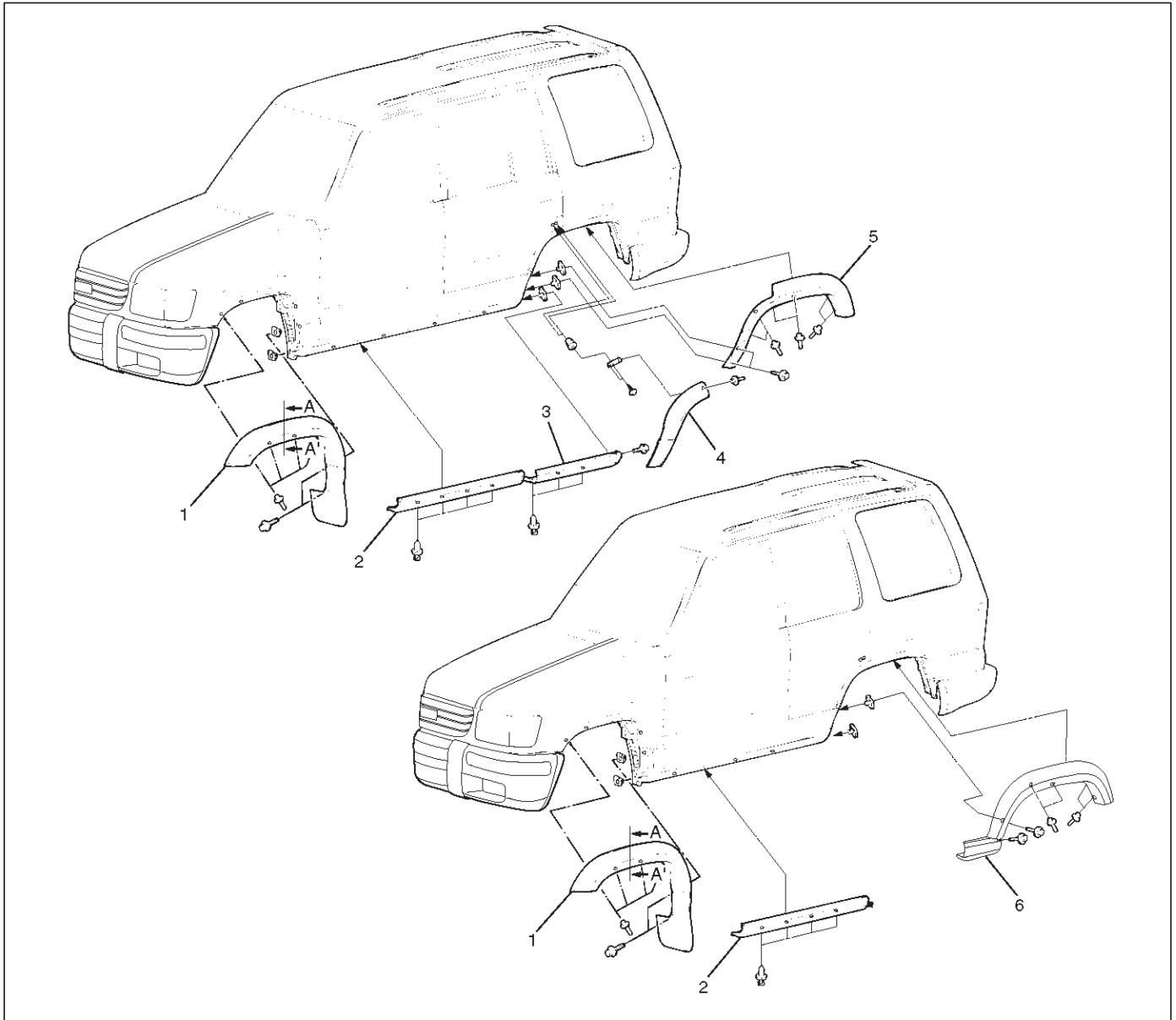
1. Remove the rear rocker protector.
2. Remove the front rocker protector.

Installation

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

Wheel Opening Extension and Rocker Protector Assembly

Wheel Opening Extension, Rocker Protector Assembly and Associated Parts



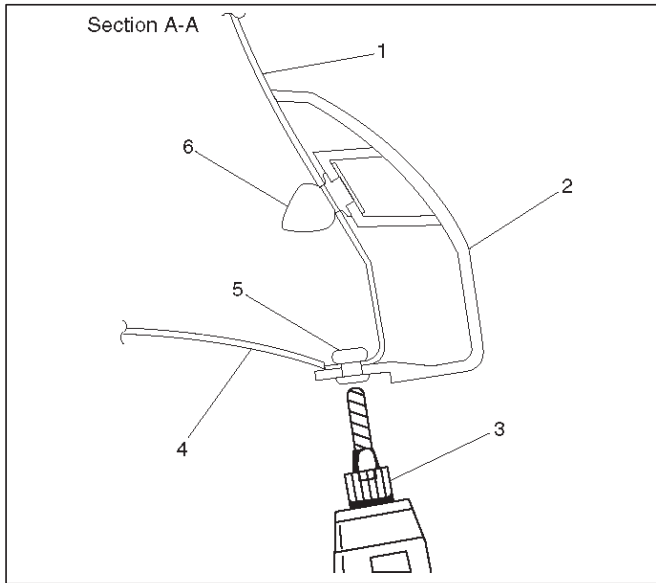
620RW005

Legend

- | | |
|---|--|
| (1) Front Wheel Opening Extension Assembly | (5) Rear Quarter Wheel Opening Extension Assembly (Only LWB) |
| (2) Front Rocker Protector Assembly | (6) Rear Wheel Opening Extension Assembly (Only SWB) |
| (3) Rear Rocker Protector Assembly (Only LWB) | |
| (4) Rear Door Wheel Opening Extension Assembly (Only LWB) | |

Removal

1. Remove the front wheel opening extension(2).
 - Let a 5mm drill(3) go through four blind rivets(5) to disengaged riveted portions. Remove two screws and disengage five clips (6), then remove the front wheel opening extension assembly.



Installation

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

1. Use a new 2-sided adhesive tape whenever installing each wheel opening extension assembly and rocker protector assembly. Using a white gasoline, clean the places in advance where a 2-sided adhesive tape is affixed. Also, install the clips, screws and blind rivets in the order specified as shown in the figure.

2. Remove the rear quarter wheel opening extension assembly (Only LWB).

- Let a 5mm drill go through six blind rivets to disengage riveted portions.

Disengage four clips, remove two screws, and remove the rear quarter wheel opening extension assembly.

3. Remove the rear wheel opening extension assembly (Only SWB).

- Let a 5mm drill go through four blind rivets to disengage riveted portions. Remove two screws, disengage eight clips, and remove the rear wheel opening extension assembly.

- Remove two fixing nuts (upper) and four fixing bolts (lower).

4. Remove the rear door wheel opening extension assembly (Only LWB).

- Let a 5mm drill go through a blind rivet to disengage riveted portions.

Disengage three clips, peel off the bonded portions with two double surface adhesive tape and the rear door wheel opening extension assembly.

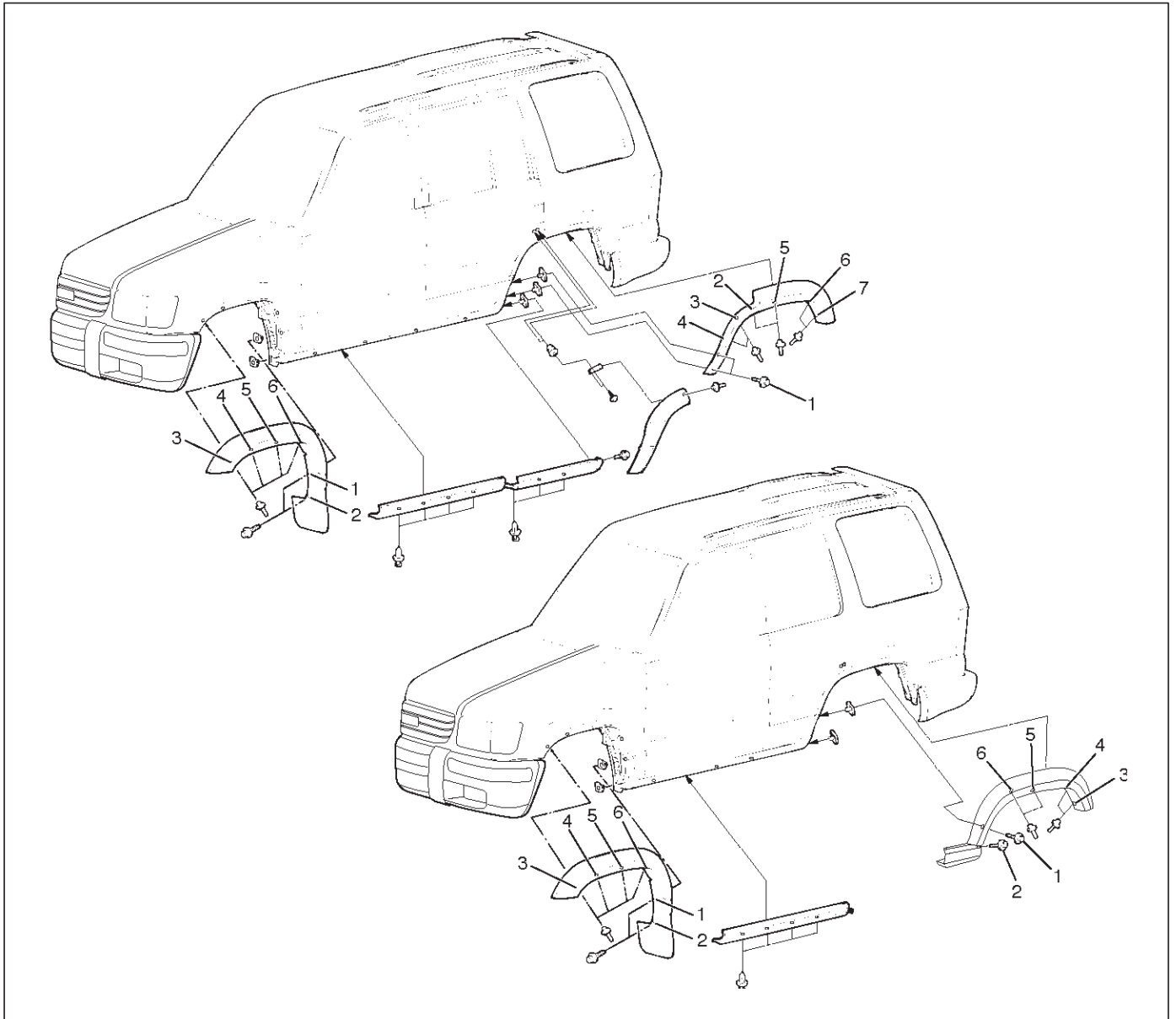
5. Remove the rear rocker protector assembly (Only LWB).

- Loosen and pull three clips, remove a rear screw, and remove the rear rocker protector assembly.

6. Remove the front rocker protector assembly.

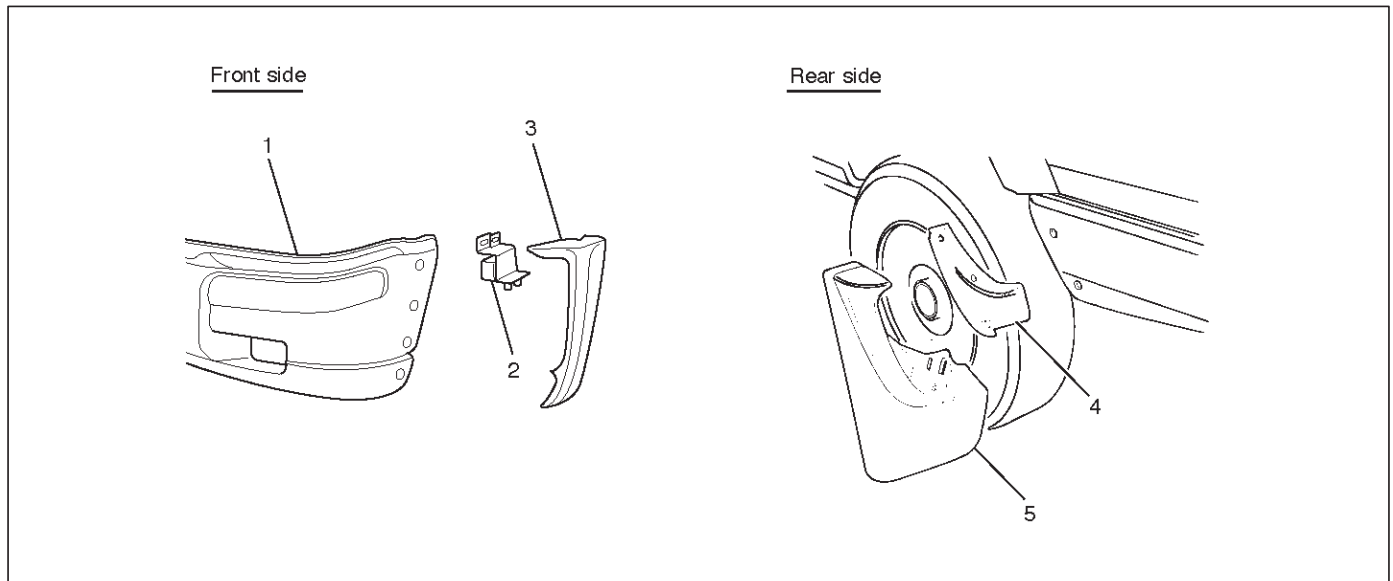
- Loosen and pull four clips, and remove the front rocker protector assembly.

8J-30 EXTERIOR/INTERIOR TRIM



Mud Flaps (With Wheel Opening Extension)

Mud Flaps (With Wheel Opening Extension) and Associated Parts



620RW003

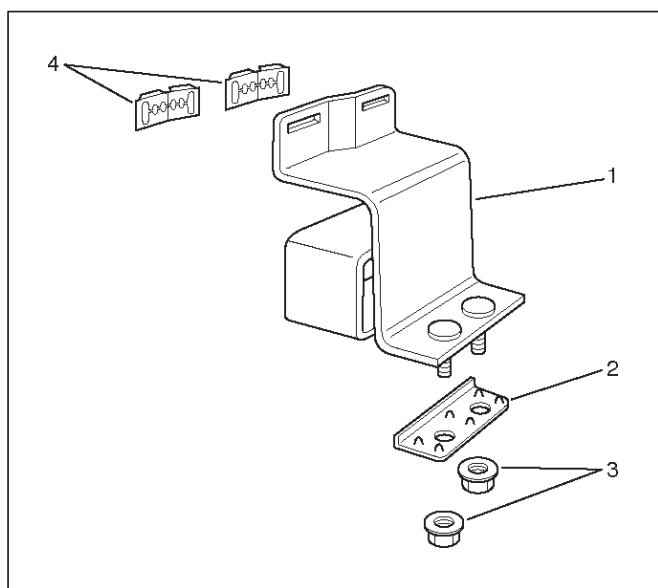
Legend

- | | |
|---------------------------|-----------------------|
| (1) Front Bumper Assembly | (3) Front Mud Flap |
| (2) Front Bumper Slider | (4) Bumper Side Cover |
| | (5) Rear Mud Flap |

Removal

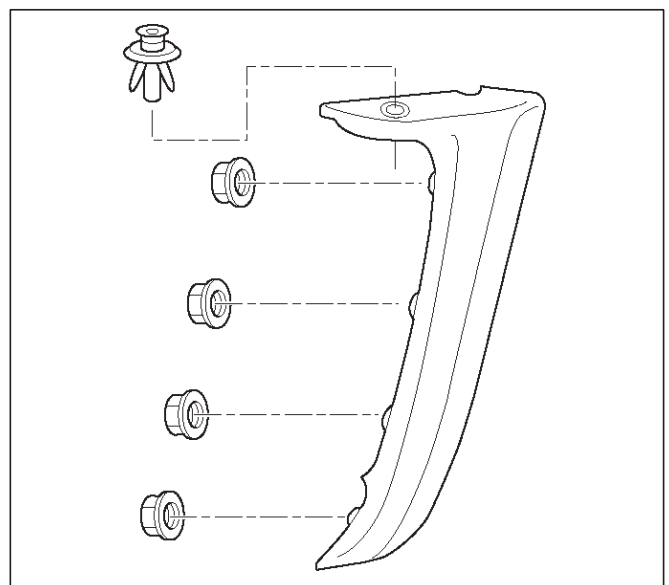
Front Side

1. Remove the front bumper assembly.
 - Disconnect the front fog light connector and remove two bolts from both sides of the front bumper.
2. Remove the front bumper slider(1).
 - Remove two clips(4) and two nuts(3), release the claw from the washer(2).



601RW009

3. Remove the front mud flap.
 - Remove four nuts and a clip.



601RW013

Rear Side

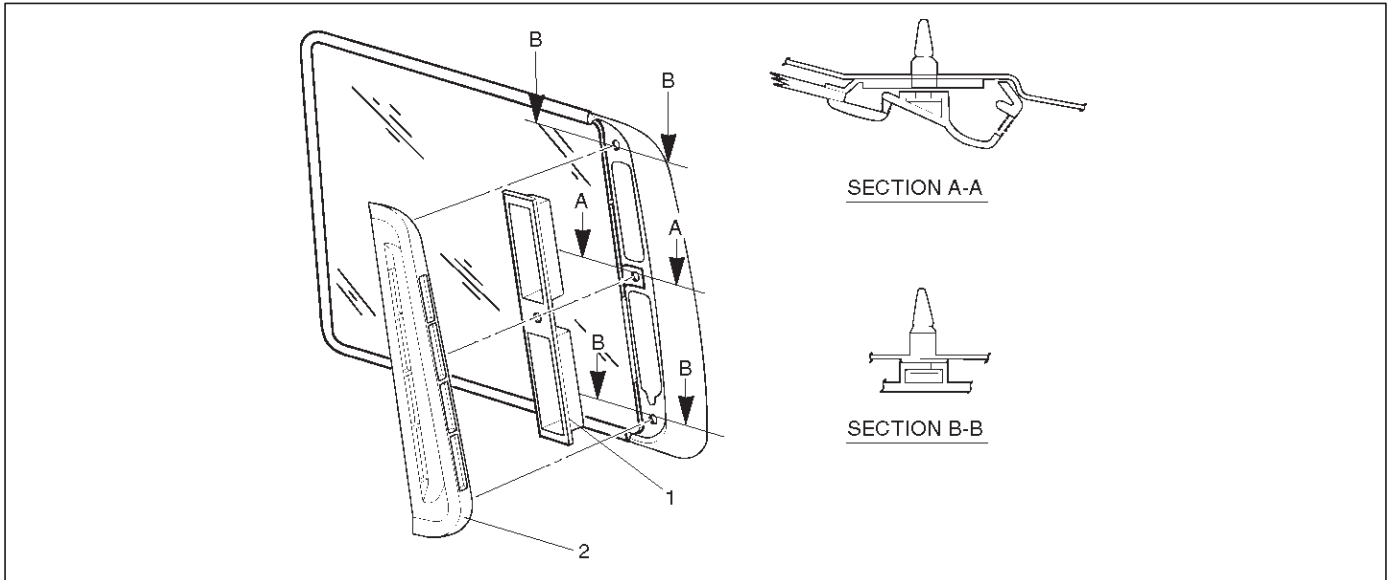
1. Remove the bumper side cover.
2. Remove the rear mud flap.
 - Remove four bolts and two nuts.

Installation

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

Ventilation Assembly

Ventilation Assembly and Associated Parts



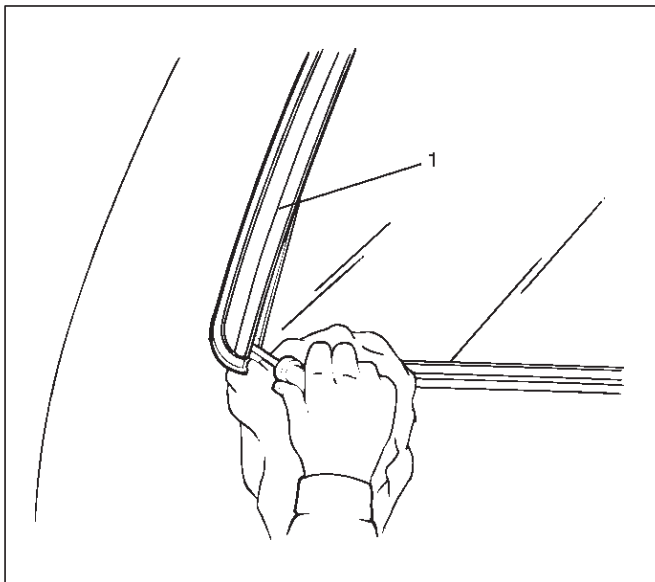
641RS001

Legend

- (1) Outlet Valve Assembly
- (2) Ventilation Assembly

Removal

1. Remove the ventilation assembly(1).
 - Pry the ventilation assembly retainers free from the body panel.



641RS002

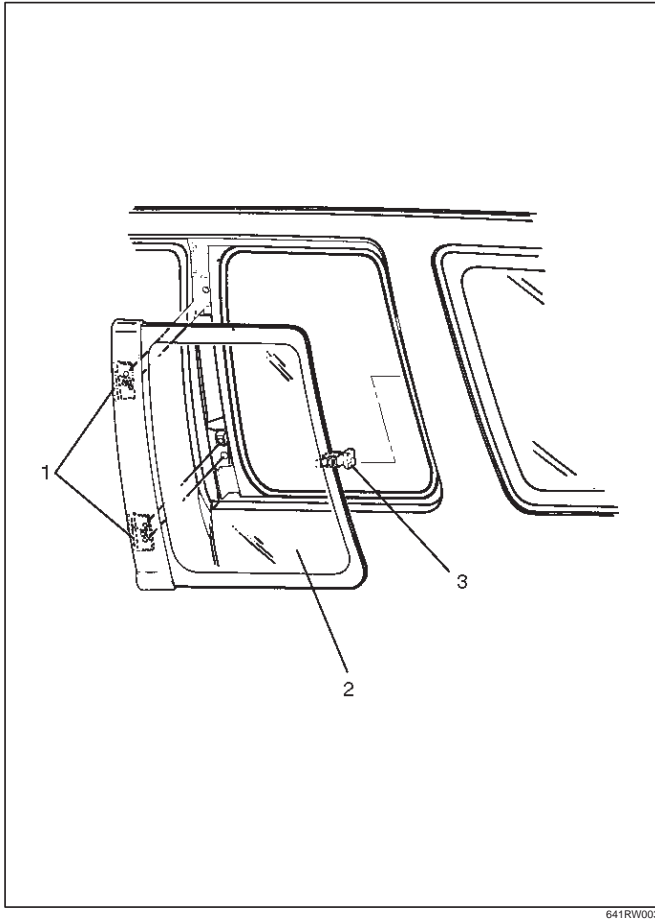
2. Remove the outlet valve assembly.

Installation

1. Install the outlet valve assembly.
 - Insert the upper and lower catches of the outlet valve into the body panel flange and fix them securely.
2. Install the ventilation assembly.
 - Fix the clips to the body panel securely so that the ventilation assembly will not come off the body panel.

Quarter Flipper Glass Assembly (S-W-B)

Quarter Flipper Glass Assembly and Associated Parts



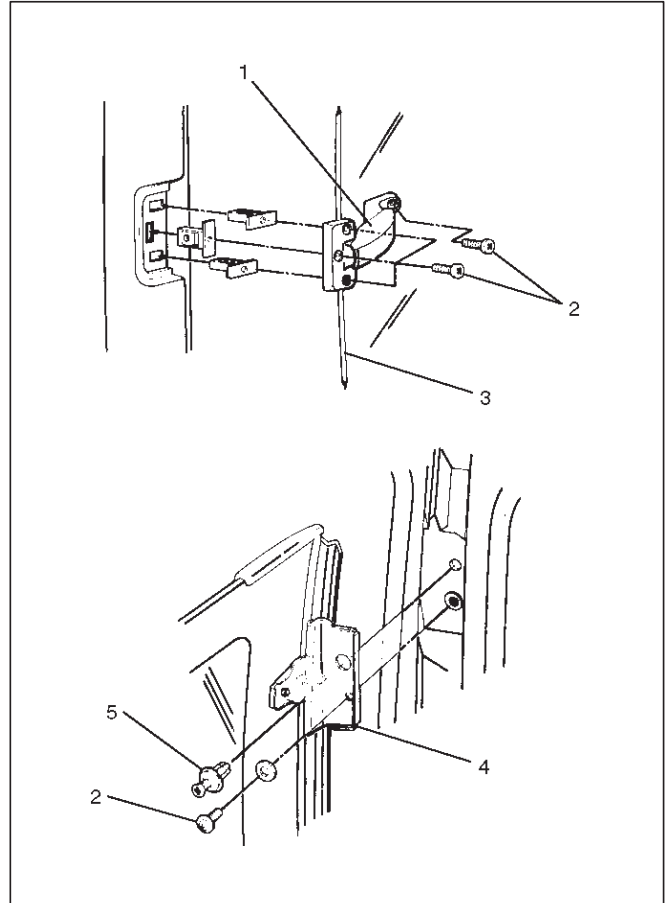
641RW003

Legend

- (1) Hinge Assembly
- (2) Quarter Flipper Glass Assembly
- (3) Fastener

Removal

1. Remove the quarter flipper glass assembly (3).
 - Remove the fixing screws (2) and rivet (5).
2. Remove the fastener (1).
3. Remove the hinge assembly (4).



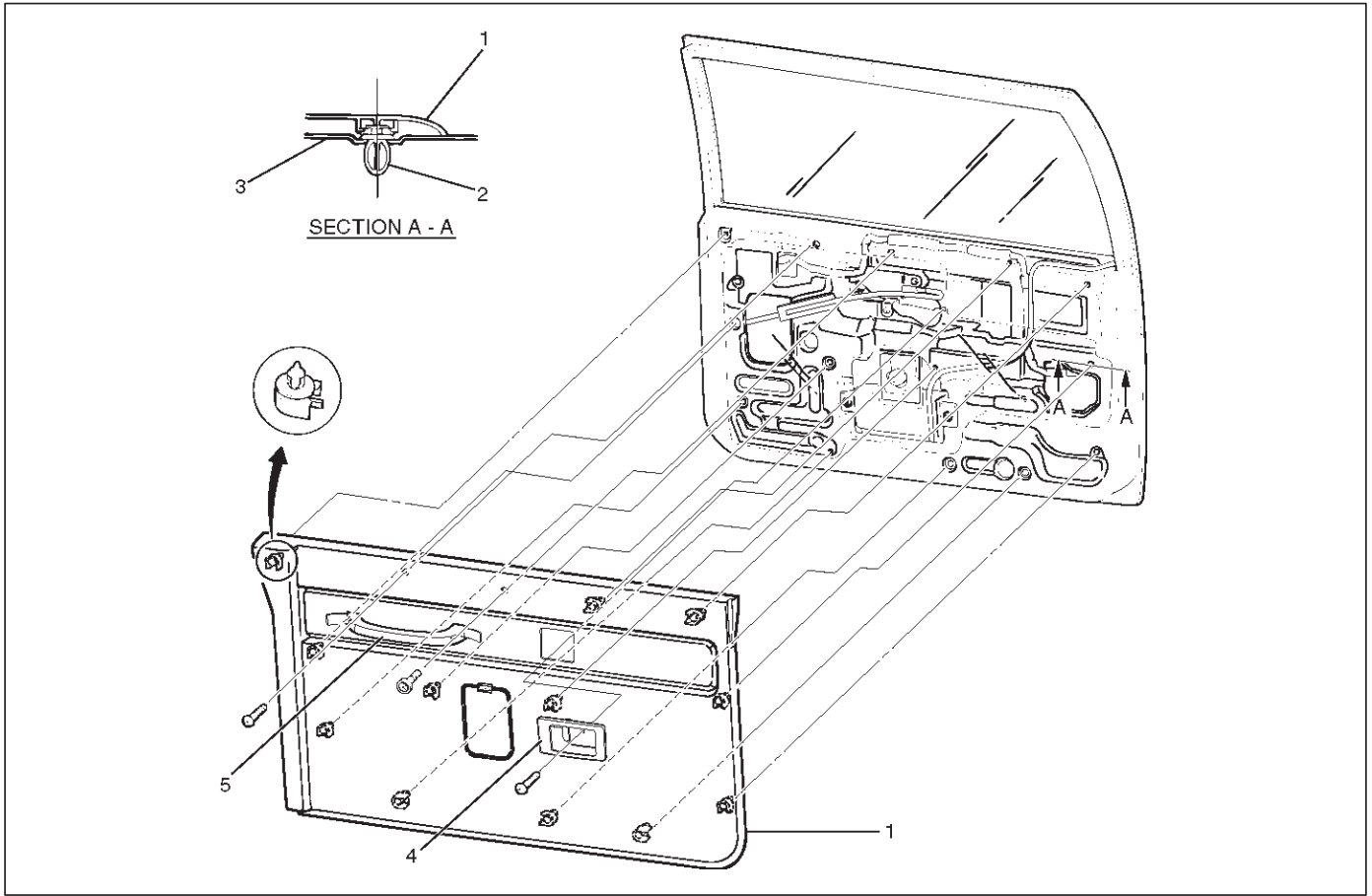
641RW002

Installation

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

Tailgate Trim Panel (LH)

Tailgate Trim Panel (LH) and Associated Parts



683RW017

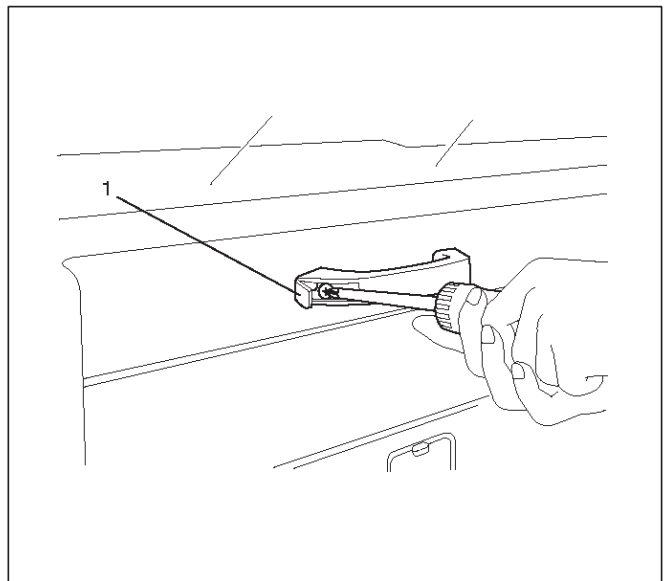
Legend

- (1) Tailgate Trim Panel (LH)
- (2) Clip

- (3) Tailgate Panel
- (4) Inside Handle
- (5) Tailgate Assist Grip

Removal

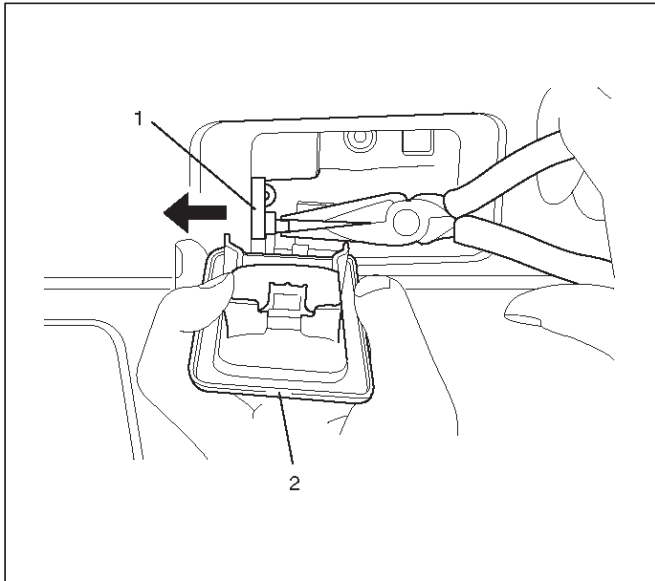
1. Disconnect the battery ground cable.
2. Remove the tailgate assist grip.
 - Open the assist covers (1) and remove two fixing screws.



683RW019

3. Remove the inside handle (2).

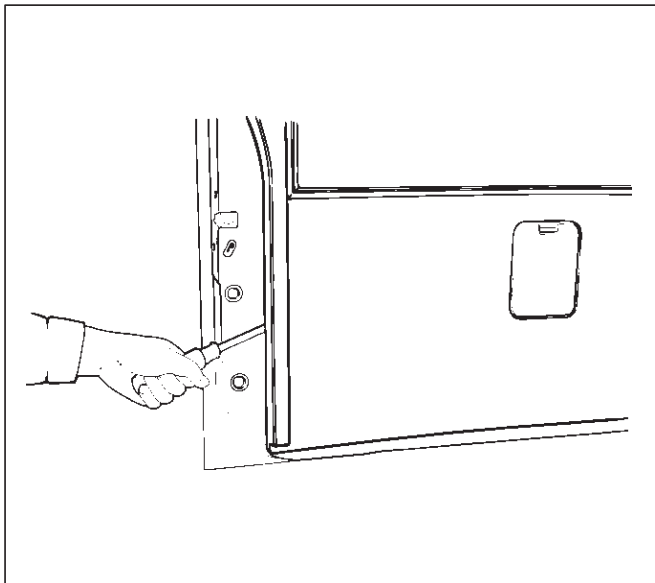
- Remove the fixing screw and disconnect the locking link (1).



683RW020

4. Remove the tailgate trim panel (LH).

- Pry the trim panel retainers free from the tailgate panel.

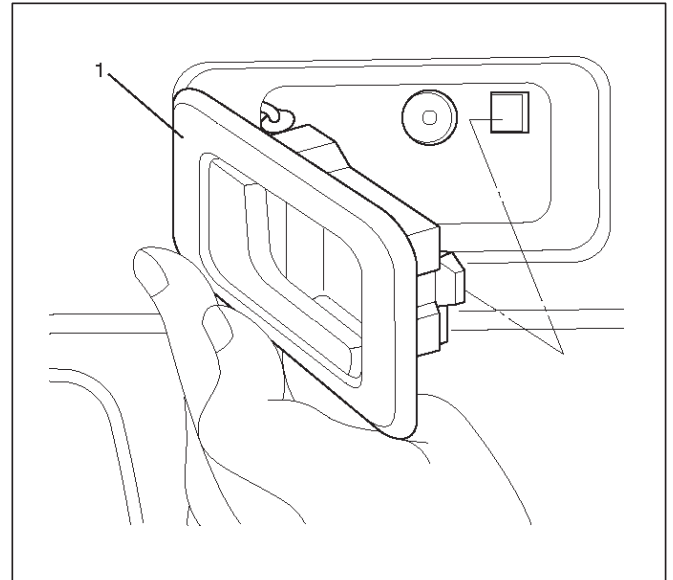


684RS001

Installation

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

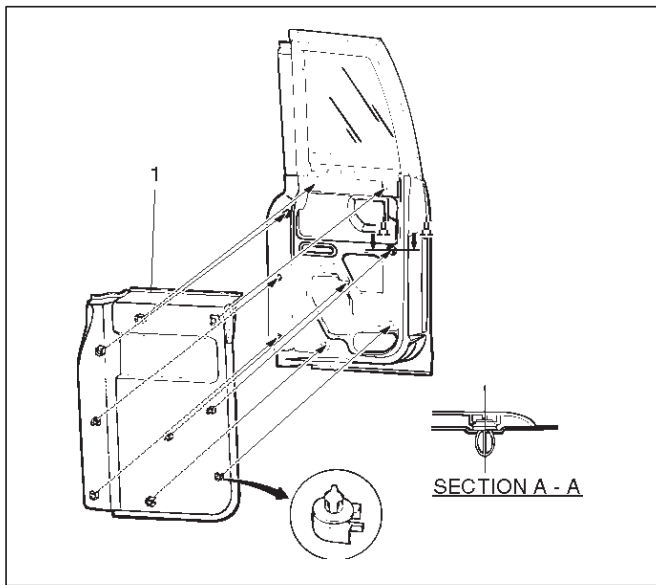
1. Install the inside handle (1), connect the link to the handle, insert the catch portion of the handle into the tailgate side hole securely and fix it with a screw.



683RW018

Tailgate Trim Panel (RH)

Parts Location



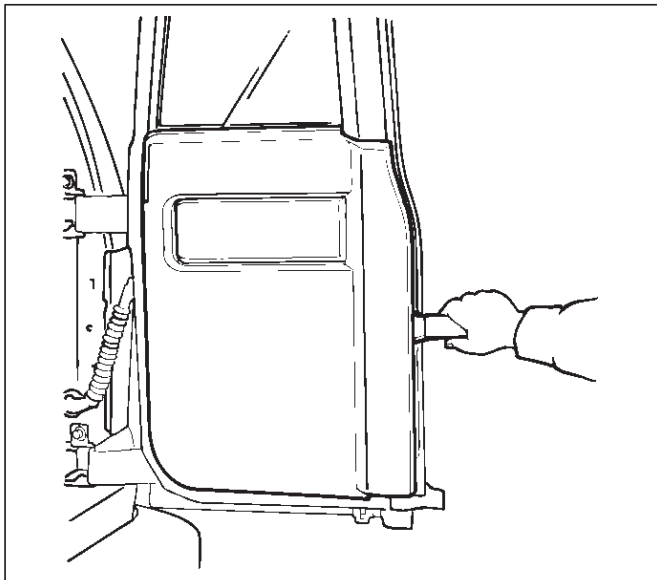
684RS002

Legend

- (1) Tailgate Trim Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (RH).
 - Pry trim panel retainer free from the tailgate panel.



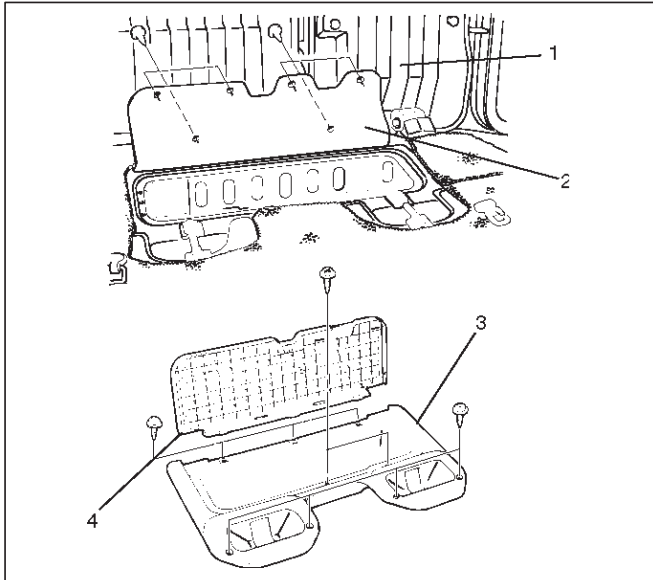
684RS003

Installation

1. Install the trim panel (RH).
 - Insert the retainer of the trim panel into the tailgate panel and fix it securely.

Luggage Floor Box

Luggage Floor Box and Associated Parts



643RS006

Legend

- (1) Rear Seat
- (2) Floor Carpet
- (3) Luggage Floor Box
- (4) Luggage Floor Box Cover

Remove

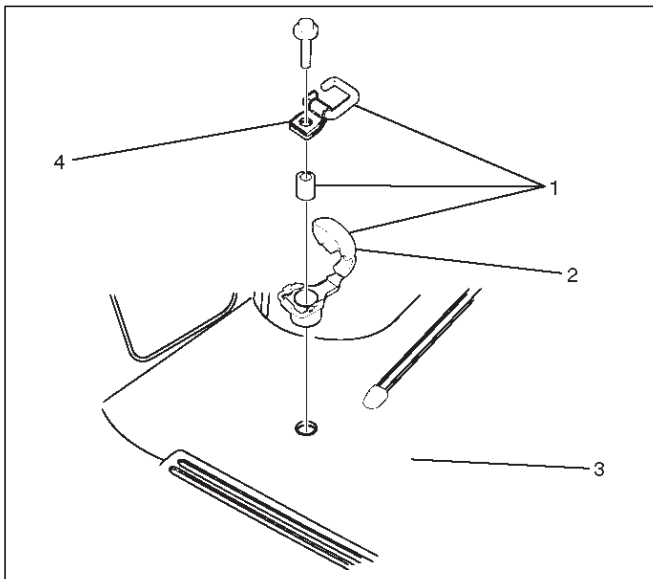
1. Fold the rear seat assembly to the front direction.
2. Remove the luggage floor box cover.
 - Remove the clips which connect the floor carpet and the luggage floor box cover.
3. Remove the luggage floor box.

Installation

1. Install the luggage floor box.
2. Install the luggage floor box cover.

Rope Hook Set

Rope Hook Set and Associated Parts



676RS003

Legend

- (1) Rope Hook Set
- (2) Cover
- (3) Luggage Floor Carpet
- (4) Hook

Removal

1. Remove the rope hook set.
 - Open the hook cover and hook fixing bolt.

Installation

1. Install the rope hook set.
 - Tighten the hook fixing bolt to the specified torque.
- Torque: 13 N·m (1.3kg·m/113 lb in)**

Power Door Mirror System

General Description

The circuit consists of the starter switch, door mirror control switch, folding switch, defogger switch and door mirrors on both sides.

The door mirror switch consists of the control switch, folding switch and defogger switch.

When the control switch is operated with the starter switch at either "ACC" or "ON" position, the motors incorporated in the door mirrors on both sides rotate to allow the horizontal and vertical adjustment of mirror angles.

The folding switch can be used to fold the mirror and return it to its original position.

When turning on the door mirror defogger switch with the starter switch at "ON" position, built-in heater in the mirror is activated to perform the defogger function.

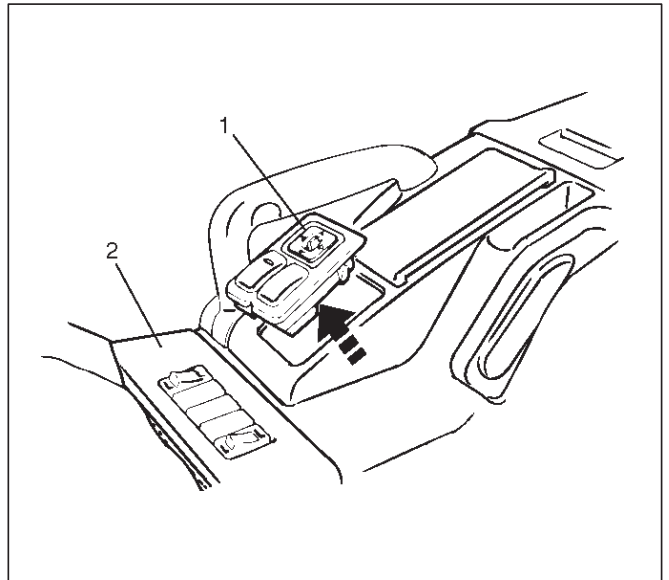
Door Mirror Switch Assembly (Control Switch, Folding Switch and Defogger Switch) Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(2).
 - Remove four screws.
 - Remove the transmission shift lever knob.
 - Remove the transfer shift lever knob.
 - Disconnect the seat heater switch connectors (if so equipped).
 - Disconnect the door mirror switch connectors.

- Disconnect the power & winter switch connectors. (A/T only)

3. Remove the door mirror switch assembly(1).

- Push the lock from the back side of the front console.



825RS005

Installation

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

1. Depress the switch with your fingers until it locks securely.

Power Door Mirror

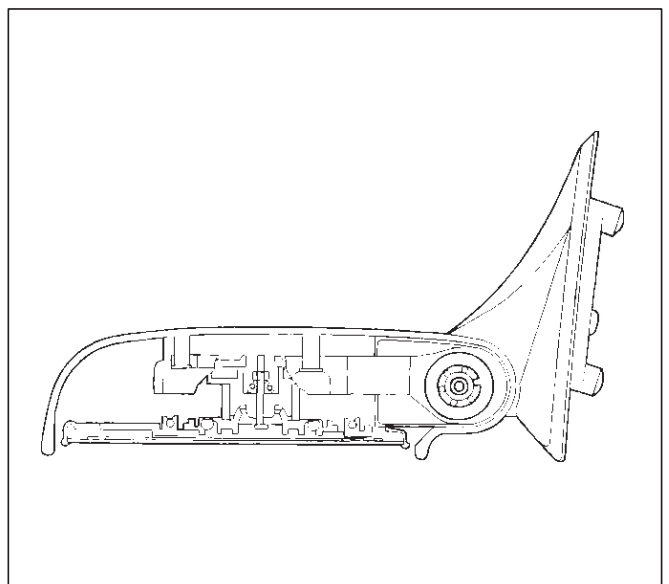
General Description

Mirrors contain two driving motors for the horizontal and vertical movement of the mirror and one motor for folding the mirror.

The movement of the mirror is controlled by the direction of current running through these motors.

The housing portion of the mirror is provided with the auto-stop mechanism which is interlocked with the motor for folding the mirror. When the mirror moves to the stop position (with the mirror folded or returned to its original position), the current to the motor is shut off.

When the mirror cannot operate due to some obstacle and the motor stops its rotation, the resistor prevents current overflow.



720RS004

Removal and Installation

Refer to the Door Mirror removal and installation steps in this section.

Power Window System

General Description

The circuit consists of the starter switch, (door lock &) power window switch for each of the front windows, power window switch for rear windows and power window motors.

When the starter switch is turned on, the battery voltage is applied to each of the power window switches through the circuit breaker and the power window relay on the circuit. The "Down" switch of the driver's power window switch has a built-in function which can be operated by just touching it.

Accordingly, the window will roll down automatically by just setting the switch to the "AUTO" position.

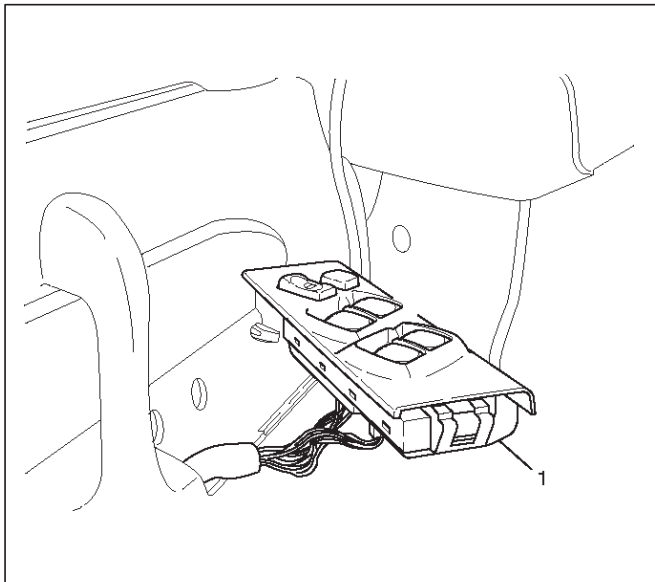
When the driver's power lock switch at the driver side is depressed, the power source to the passenger's power window switches are shut off. So, even if these switches are operated, the power window motor will not operate.

Power Window Switch Removal and Installation

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch(1).
 - Pull out the switch by pushing the spring with the tip of a screwdriver.
 - Disconnect two connectors.



826RS052

Installation

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

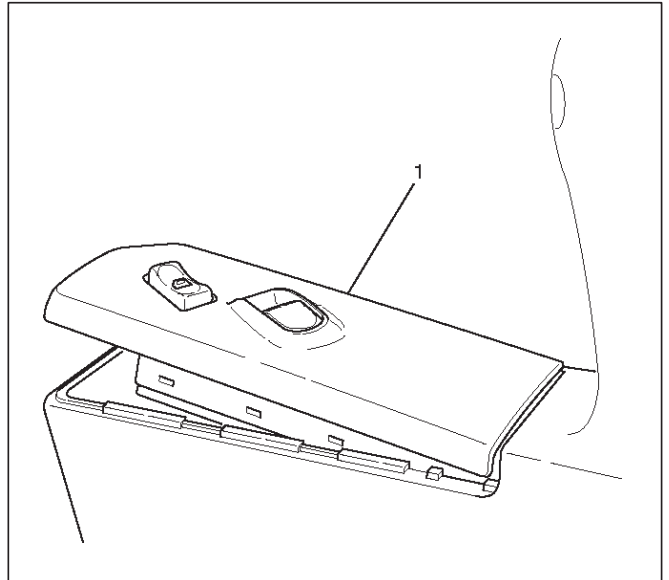
Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.

2. Remove the switch(1).

- Pull out the switch by pushing the spring with the tip of a screwdriver.
- Disconnect the connector.



825RW046

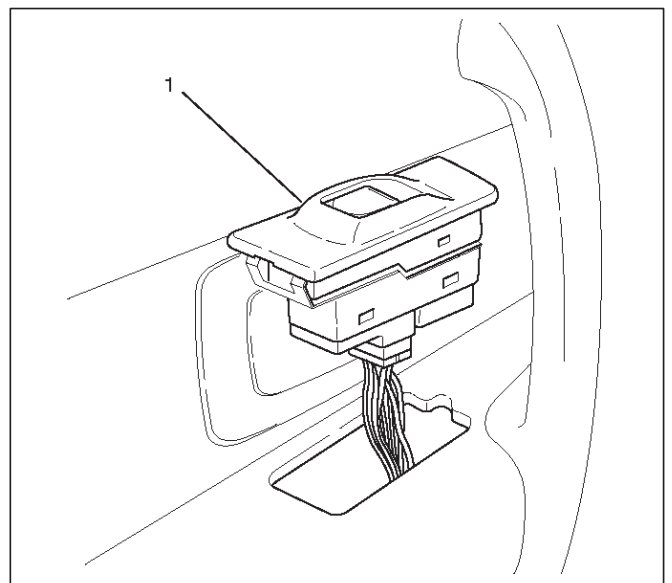
Installation

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

Rear-Left and Right Sides

Removal

1. Disconnect the battery ground cable.
2. Remove the switch(1).
 - Pull out the switch by pushing the spring with the tip of a screwdriver.
 - Disconnect the connector.



825RS057

Installation

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

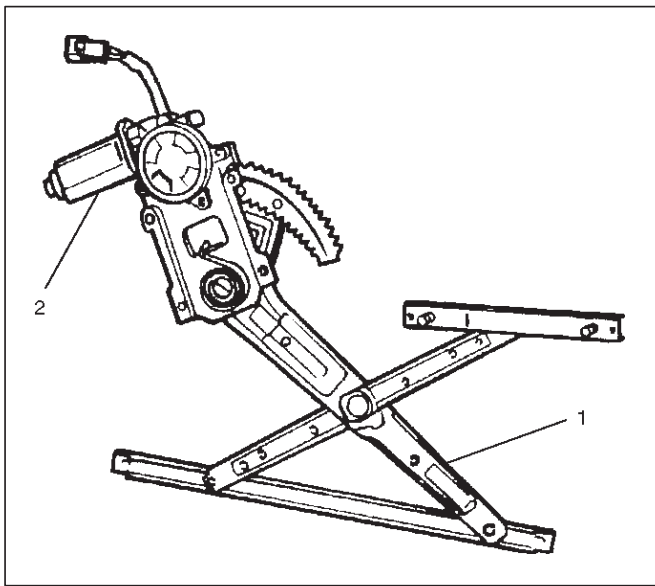
Power Window Motor Removal and Installation

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (1).
 - Refer to the Window Regulator and Glass removal steps in Body Structure section.
3. Remove the power window motor(2).
 - Remove three screws.

CAUTION: When removing the motor from the regulator(1), be careful not to get injured by the strong repellent force of the regulator spring.



Installation

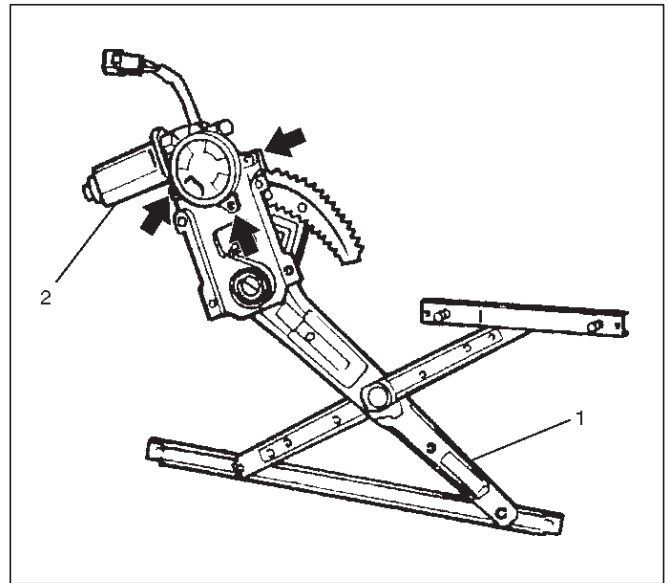
To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (1).
 - Refer to the Window Regulator and Glass removal steps in Body Structure section.
3. Remove the power window motor(2).
 - Remove three screws.

CAUTION: When removing the motor from the regulator(1), be careful not to get injured by the strong repellent force of the regulator spring.



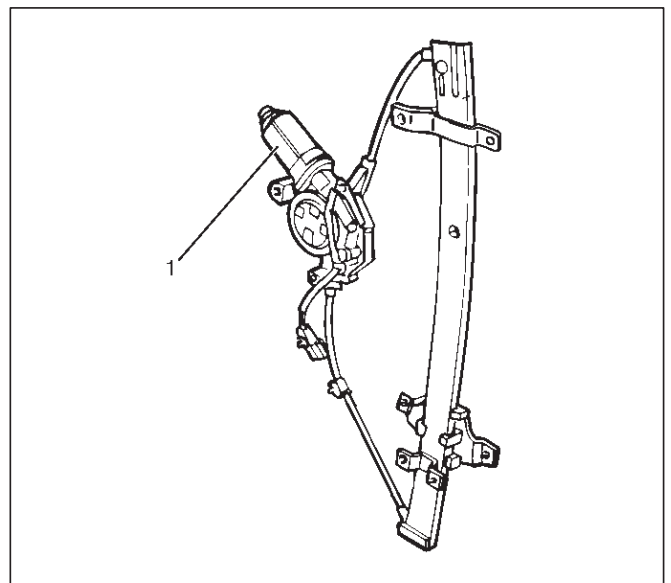
Installation

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

Rear-Left Side

Removal

1. Disconnect the battery ground cable.
2. Remove the rear window regulator assembly.
 - Refer to the Rear Window Regulator and Glass removal steps in Body Structure section.
3. Remove the power window motor(1).
 - Remove four screws.



Installation

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

Rear-Right Side

Removal and Installation

Refer to the Rear Power Window Motor-Left Side removal and installation steps in this section.

Main Data and Specifications**Torque Specifications**

Application	N·m	kg·m	lb ft	lb in
Door Mirror Fixing Bolts	8	0.8	—	69
Seat Belt Anchor Bolts	39	4.0	29	—
Hook Fixing Bolt	13	1.3	—	113

RESTRAINTS

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SEAT BELT SYSTEM

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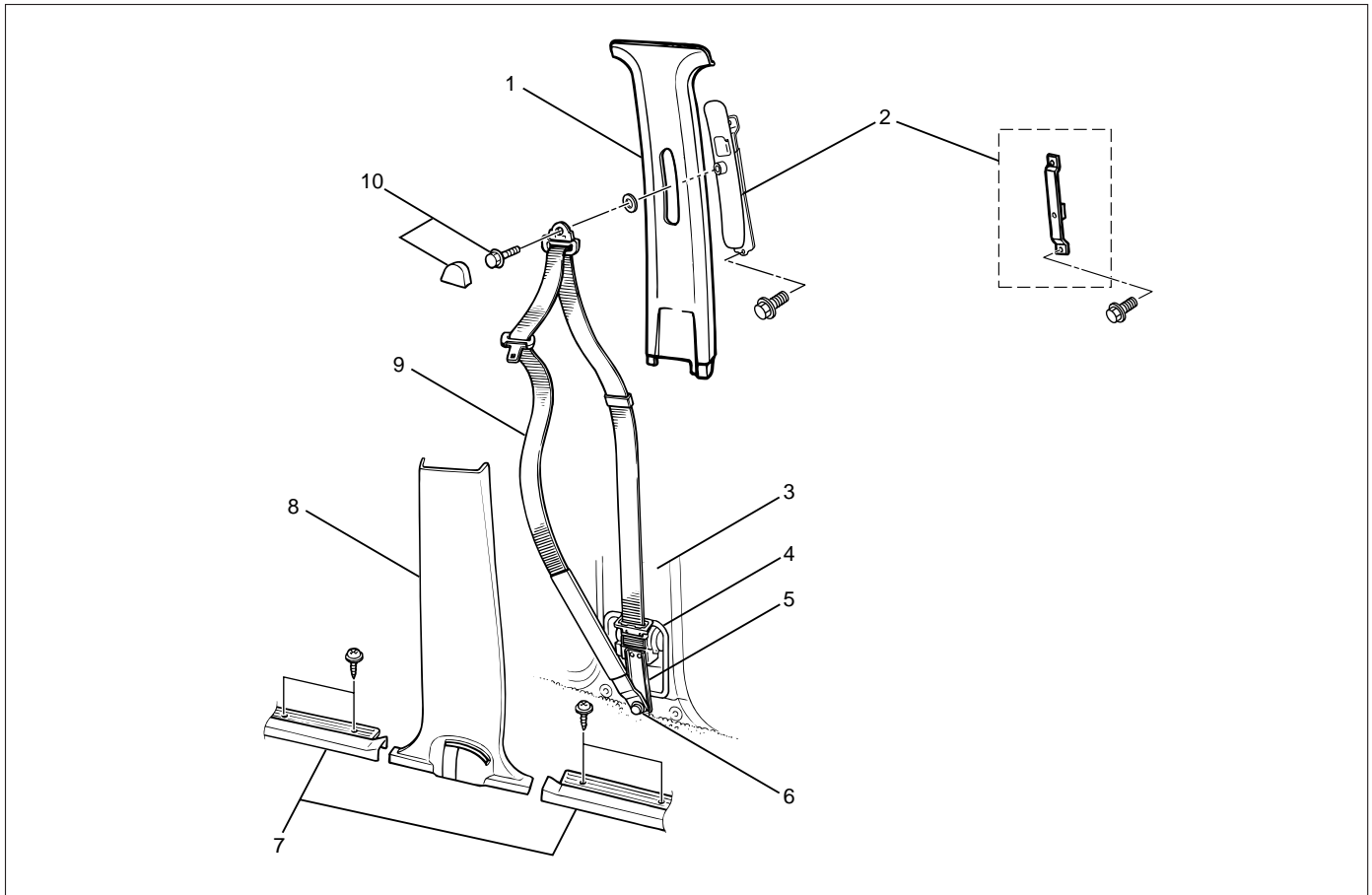
Service Precaution

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

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

Seat Belt

Front Seat Belt and Associated Parts (Long Wheel Base)



760RW022

Legend

- | | |
|--|--|
| (1) Center Pillar Upper Trim Cover | (6) Anchor Bolt (Lower) |
| (2) Adjust Shoulder Anchor Assembly/Seat Belt Anchor Plate | (7) Door Sill Plate (Front & Rear) |
| (3) Center Pillar | (8) Center Pillar Lower Trim Cover |
| (4) Dust Cover | (9) Front Seat Belt Assembly |
| (5) Retractor | (10) Front Seat Belt Anchor Bolt Cover and Anchor Bolt |

Removal

1. Disconnect the battery ground cable.
2. Remove the door sill plate (Front & Rear).
3. Remove the center pillar lower trim cover.
4. Remove the front seat belt anchor bolt cover and anchor bolt (Upper Side).
 - Refer to Center Pillar and Roof Side Trim Cover in Exterior/Interior Trim section.
5. Remove the seat belt lower anchor bolt and screw, and then remove the front seat belt.
6. Remove the adjust shoulder anchor assembly/seat belt anchor plate.
 - Refer to Center Pillar and Roof Side Trim Cover in Exterior/Interior Trim section.

Inspection

If any of the following abnormalities is found, replace on an assembly basis;

- Deform and malfunction of adjustable shoulder anchor/seat belt anchor plate.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
 - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
 - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
 - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

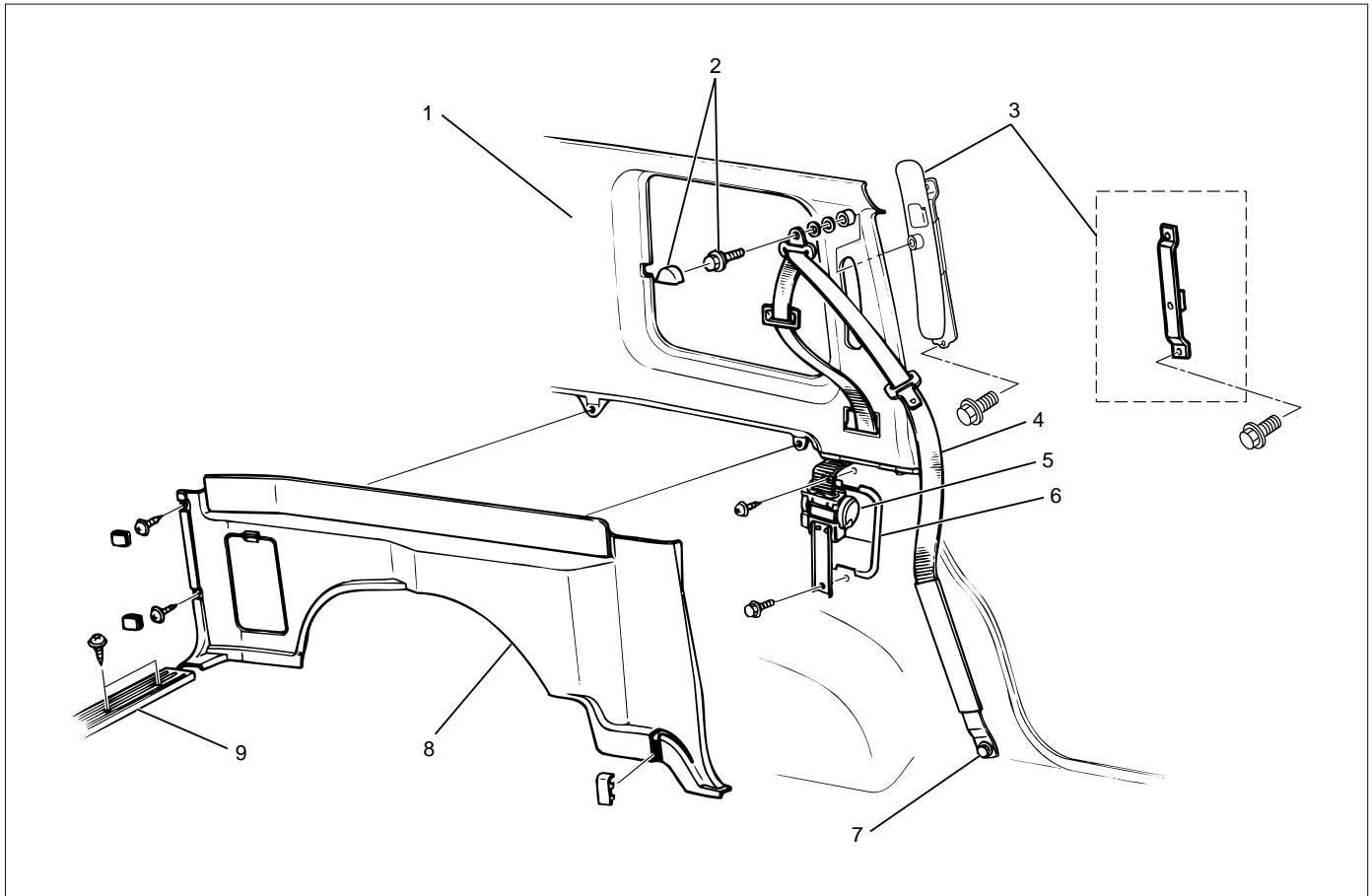
To install, follow the removal steps in the reverse order, noting the following points;

1. Pass the seat belt through the lower trim cover hole, and tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

2. After installing the trim cover to the body panel securely, close the lower trim cover.

Front Seat Belt and Associated Parts (Short Wheel Base)



760RW024

Legend

- | | |
|---|---|
| <p>(1) Quarter Upper Trim Cover</p> <p>(2) Front Seat Belt Anchor Bolt Cover and Anchor Bolt (Upper Side)</p> <p>(3) Adjust Shoulder Anchor Assembly/Seat Belt Anchor Plate</p> | <p>(4) Front Seat Belt Assembly</p> <p>(5) Retractor</p> <p>(6) Dust Cover</p> <p>(7) Anchor Bolt (Lower)</p> <p>(8) Luggage Side Trim Cover</p> <p>(9) Rear End Floor Trim Cover</p> |
|---|---|

Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side trim cover.
 - Refer to Luggage Side and Quarter Upper Trim Panel removal steps in Exterior/Interior Trim section.
4. Remove the front seat belt anchor bolt cover and anchor bolt (Upper Side).
5. Remove the seat belt lower anchor bolt and the retractor and then remove the front seat belt.
6. Remove the adjust shoulder anchor assembly/seat belt anchor plate.
 - Refer to Luggage Side and Quarter Upper Trim Cover remove steps in Exterior/Interior Trim section.

Inspection

If any of the following abnormalities is found, replace on an assembly basis;

- Deform and malfunction of adjustable shoulder anchor/seat belt anchor plate.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
 - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
 - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
 - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

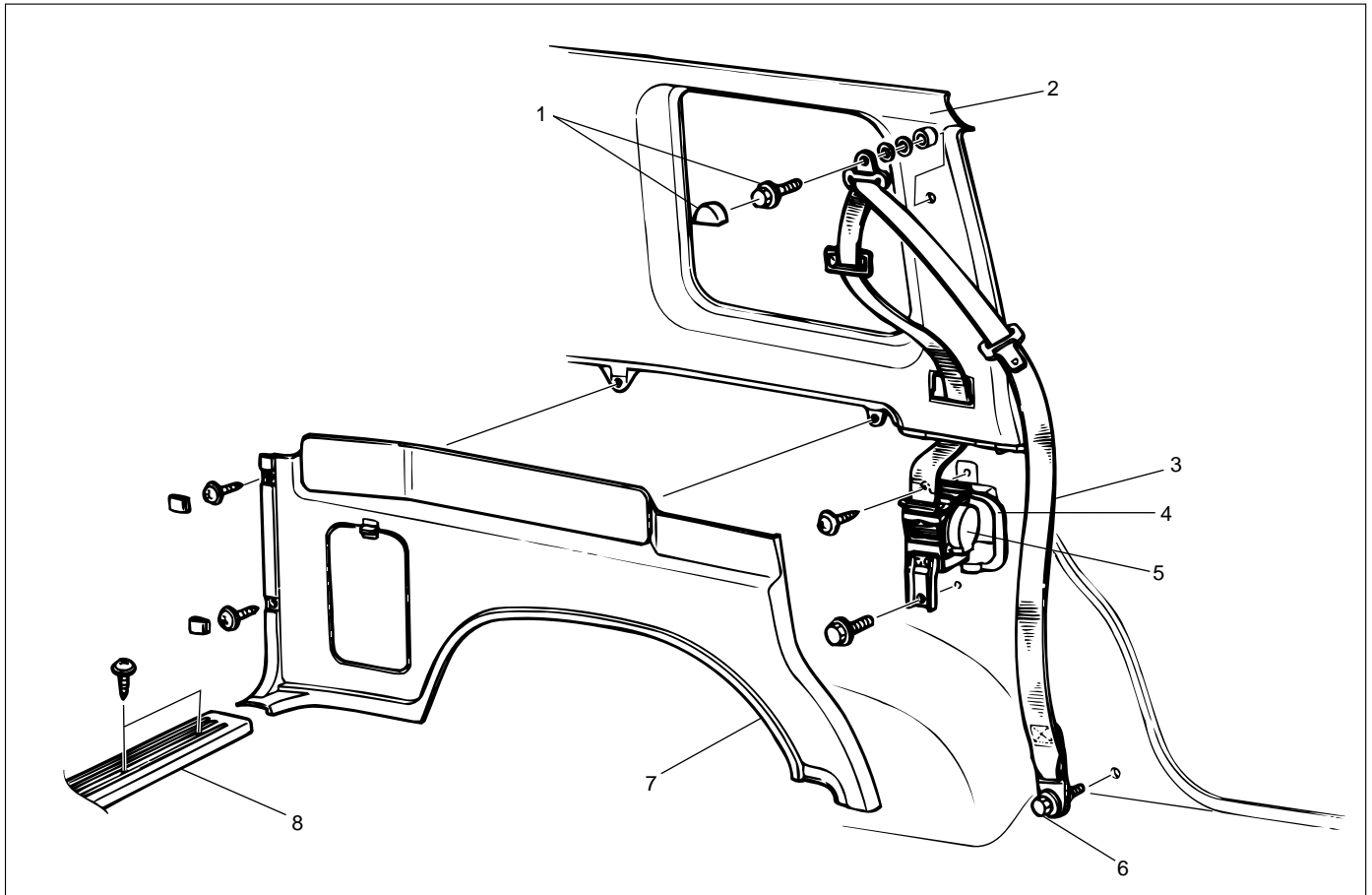
To install, follow the removal steps in the reverse order, noting the following points;

1. Pass the seat belt through the lower trim cover hole, and tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

2. After installing the trim cover to the body panel securely, close the lower trim cover.

Rear Seat Belt and Associated Parts (Long Wheel Base)



760RS006

Legend

- | | |
|---|-------------------------------|
| (1) Rear Seat Belt Anchor Bolt Cover and Anchor Bolt (Upper Side) | (4) Dust Cover |
| (2) Quarter Upper Trim Cover | (5) Retractor |
| (3) Rear Seat Belt Assembly | (6) Anchor Bolt (Lower Side) |
| | (7) Luggage Side Trim Cover |
| | (8) Rear End Floor Trim Cover |

Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side trim cover.
 - Refer to Luggage Side and Quarter Upper Trim Panel removal steps in Exterior/Interior Trim section.
4. Remove the rear seat belt anchor bolt cover and anchor bolt (Upper Side).
5. Remove the seat belt lower anchor bolt and remove the retractor from dust cover slit to remove the rear seat belt.

Inspection

If any of the following abnormalities is found, replace on an assembly basis;

- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
 - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
 - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
 - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

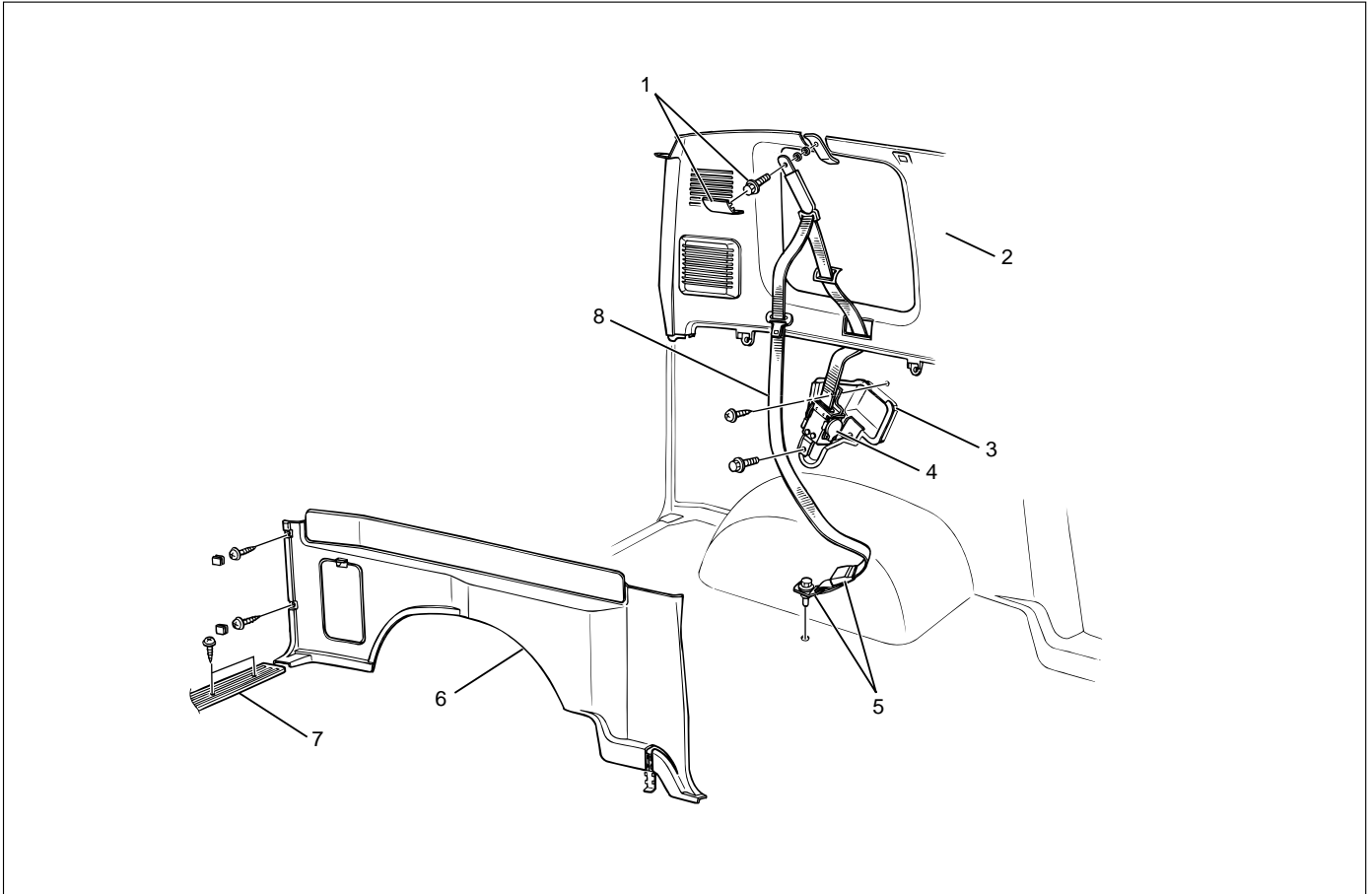
Installation

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

1. Tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

Rear Seat Belt and Associated Parts (Short Wheel Base)



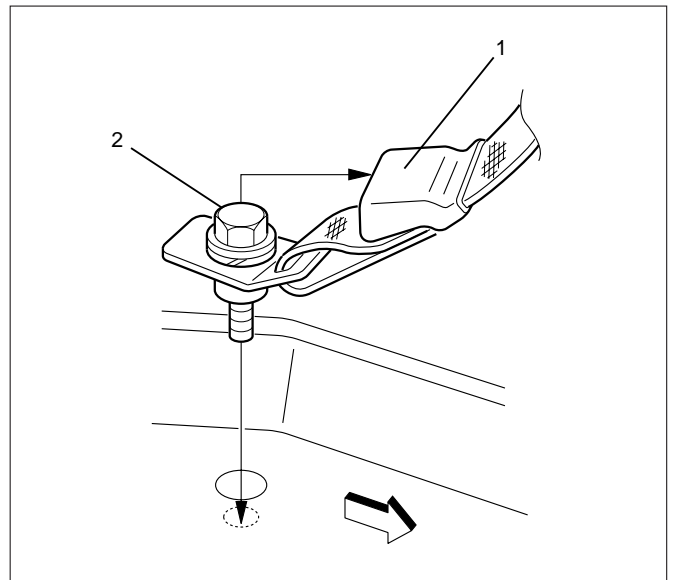
760RW025

Legend

- | | |
|--|--|
| (1) Rear Seat Belt Upper Anchor Bolt Cover and Anchor Bolt | (5) Rear Seat Belt Lower Anchor Bolt Cover and Anchor Bolt |
| (2) Quarter Upper Trim Cover | (6) Luggage Side Trim Cover |
| (3) Dust Cover | (7) Rear End Floor Trim Cover |
| (4) Retractor | (8) Rear Seat Belt Assembly |

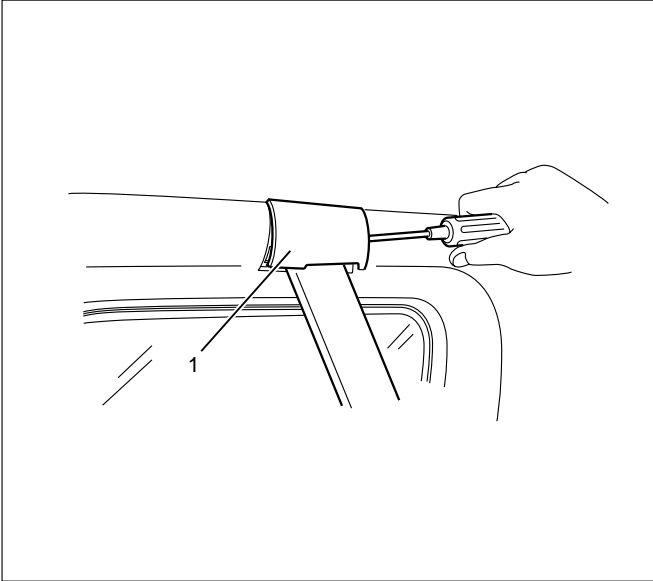
Removal

1. Disconnect the battery ground cable.
2. Remove the rear seat belt lower anchor bolt cover (1) and anchor bolt (2).



755RW038

3. Remove the rear end floor trim cover.
4. Remove the luggage side trim cover.
 - Refer to Luggage Side and Quarter Upper Trim Panel removal steps in Exterior/Interior Trim section.
5. Remove the rear seat belt upper anchor bolt cover (1) and anchor bolt.



755RW039

6. Remove the rear seat belt assembly.
 - Remove the seat belt lower anchor bolt and screw.
 - Remove the retractor from the dust cover slit.

Inspection

If any of the following abnormalities is found, replace on an assembly basis;

- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
 - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
 - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
 - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

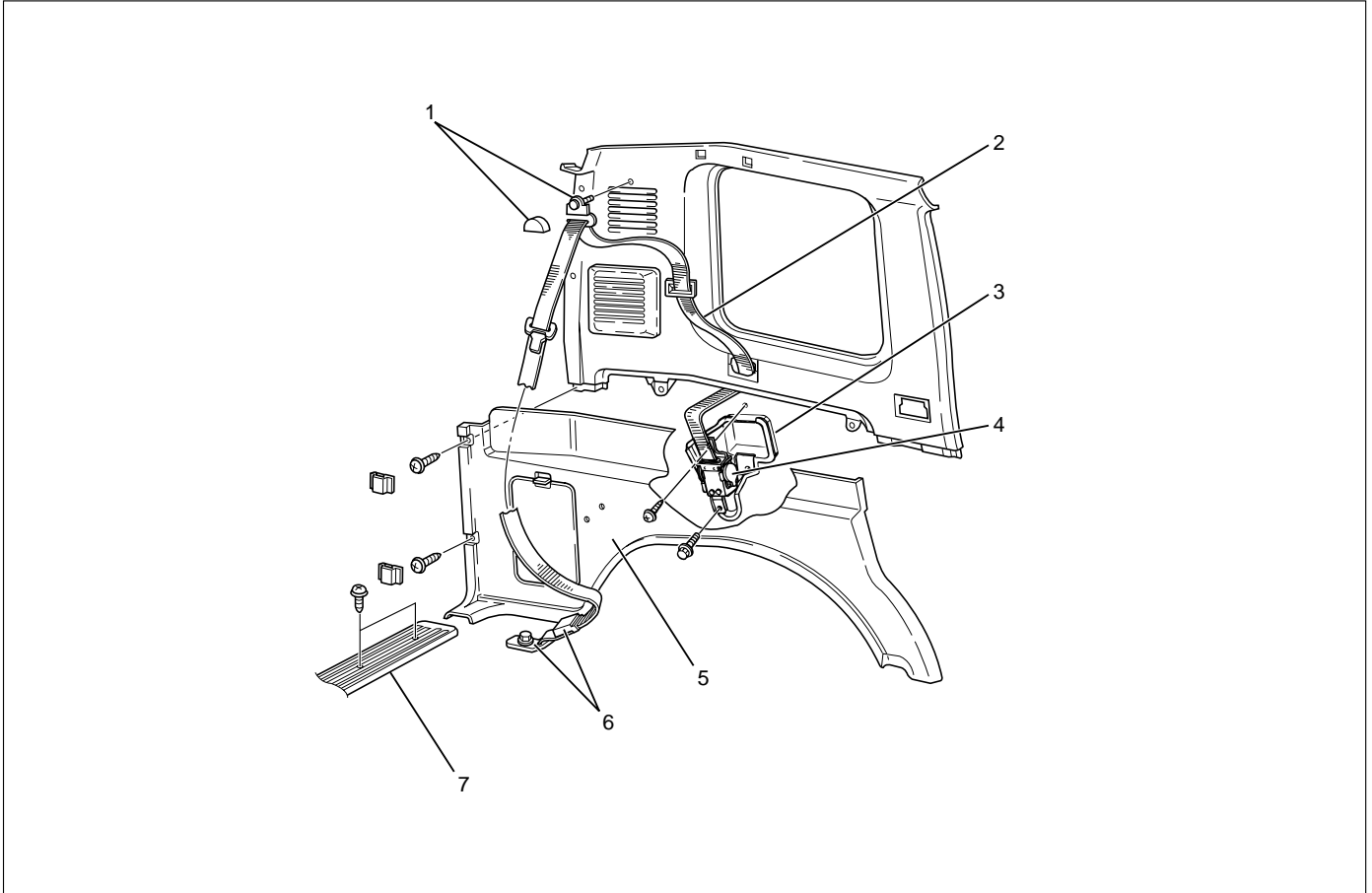
Installation

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

1. Be sure to install the lower side anchor plate straight horizontally, with mounting hole of the plate at the center.
2. Tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

Third Seat Belt and Associated Parts (Long Wheel Base)



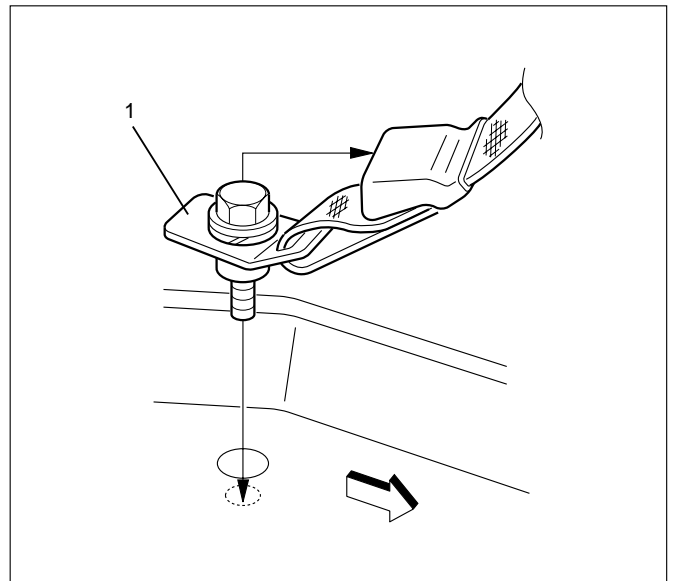
760RW027

Legend

- | | |
|---|--|
| <ul style="list-style-type: none"> (1) Third Seat Belt Upper Anchor Bolt Cover and Anchor Bolt (2) Third Seat Belt Assembly (3) Dust Cover | <ul style="list-style-type: none"> (4) Retractor (5) Luggage Side Trim Cover (6) Third Seat Belt Lower Anchor Bolt Cover and Anchor Bolt (7) Rear End Floor Trim Cover |
|---|--|

Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side trim cover.
 - Refer to Luggage Side and Quarter Upper Trim Panel removal steps in Exterior/Interior Trim section.
4. Remove the third seat belt anchor bolt cover and anchor bolt (Upper Side).
5. Remove the seat belt lower anchor bolt and remove the retractor from dust cover slit to remove the third seat belt.



755RW043

Inspection

If any of the following abnormalities is found, replace on an assembly basis;

- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
 - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
 - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.

CAUTION: Do not disassemble the retractor.

Installation

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

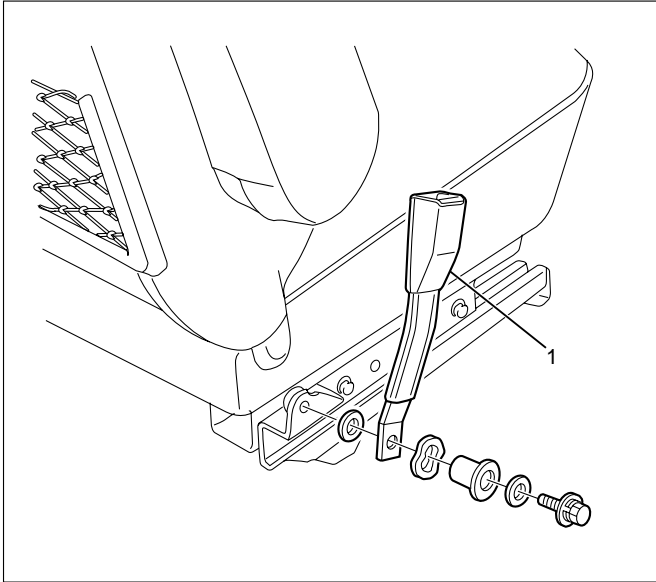
1. Be sure to install the lower side anchor plate (1) straight against the longitudinal direction of the vehicle with mounting hole of the plate at the center.
2. Tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

Front Seat Buckle Assembly

Removal

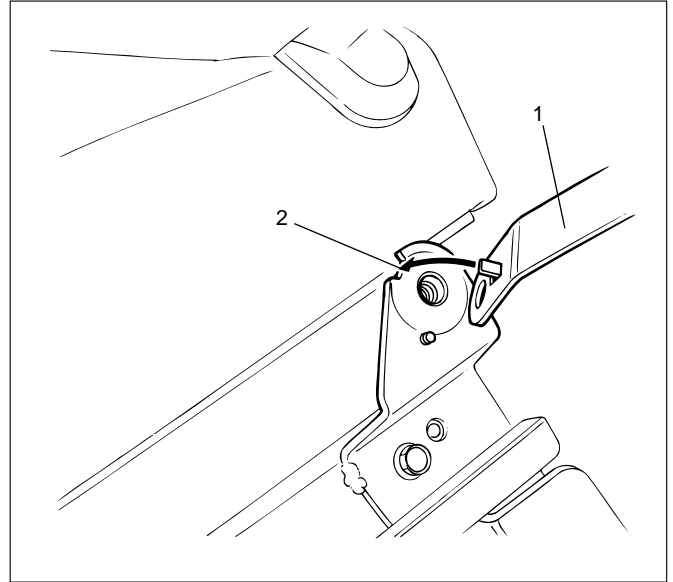
1. Disconnect the battery ground cable.
2. Disconnect the seat belt warning connector (if so equipped).
3. Remove the front seat buckle assembly(1).



Installation

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

1. Fix the buckle to the rotation – stop position(2) securely to install the front seat buckle assembly(1).

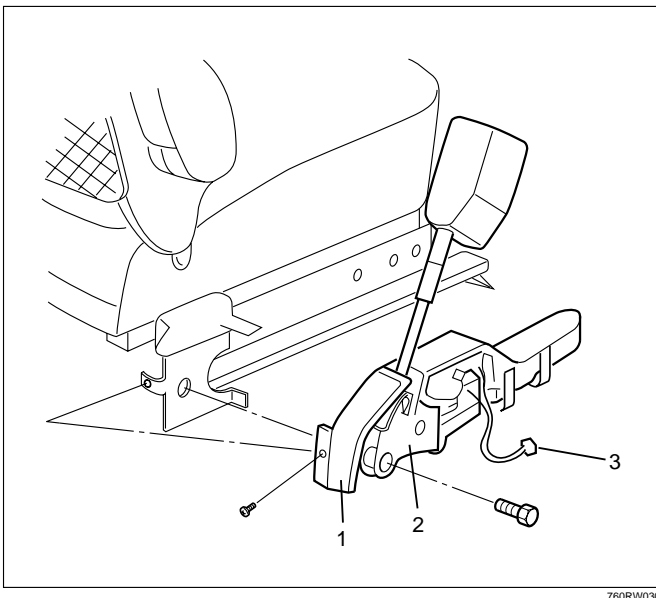


2. Tighten the buckle anchor bolt to the specified torque.
Torque: 39 N·m (4.0 kg·m/29 lb ft)

Front Seat Buckle Assembly (W/Pretensioner)

Removal

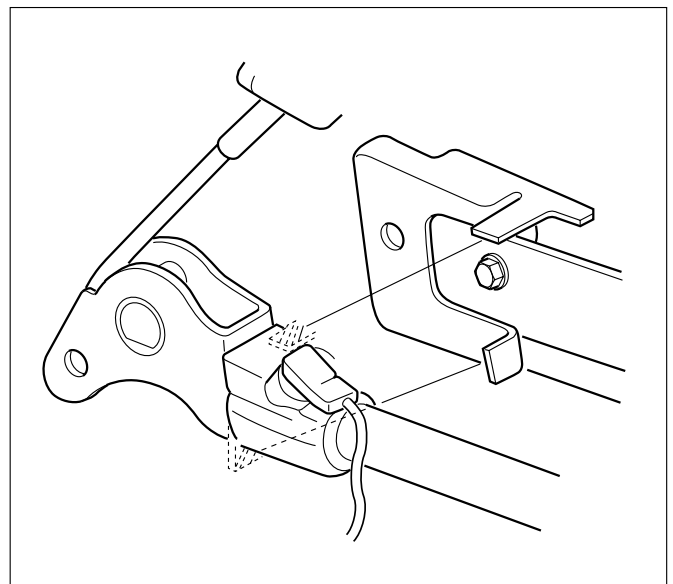
1. Disconnect the battery ground cable.
2. Disconnect the pretensioner harness connector(3).
3. Remove the pretensioner cover(1).
4. Remove the front seat buckle assembly(2).



Installation

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

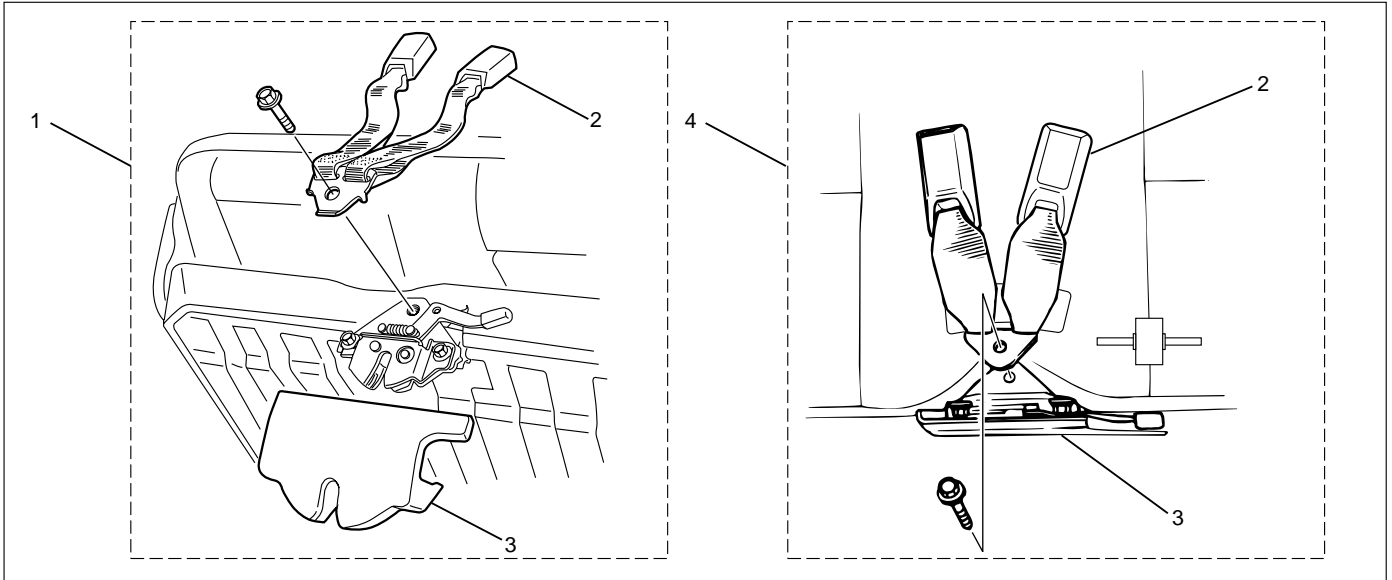
1. Fix the buckle to the rotation – stop position securely to install the front seat buckle assembly.
2. Connect the pretensioner harness connector.



3. Tighten the buckle anchor bolt to the specified torque.
Torque: 39 N·m (4.0 kg·m/29 lb ft)

Rear Center Seat Belt Buckle Assembly

Rear Center Seat Belt Buckle Assembly and Associated Parts



760RW026

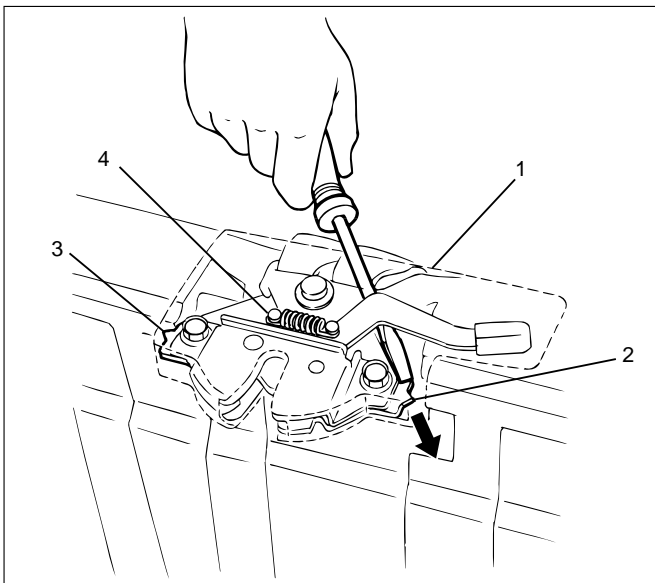
Legend

- (1) Long Wheel Base
- (2) Rear Seat Belt Buckle Assembly

- (3) Seat Lock Cover
- (4) Short Wheel Base

Removal

1. Remove the catch portions(2) & (3) of the seat lock assembly(4) from the cover, and then remove the seat lock cover(1).



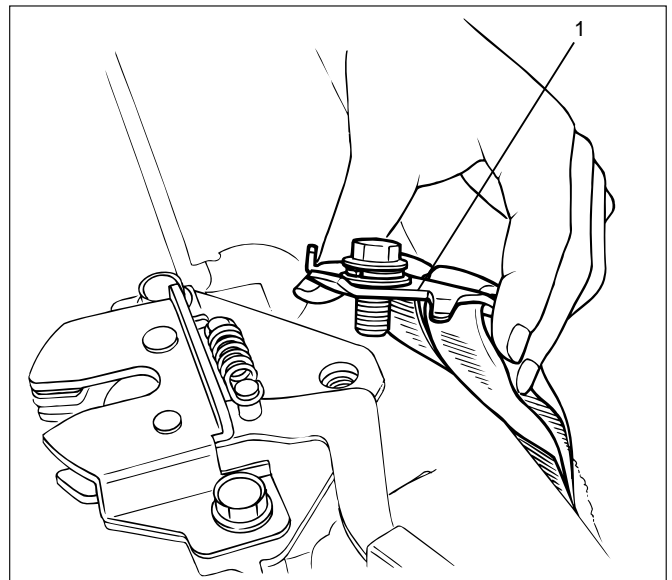
760RW016

2. Remove the rear seat buckle assembly.

Installation

1. Fix the rear seat belt buckle assembly(1) to the rotation stopper and tighten the anchor bolt to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

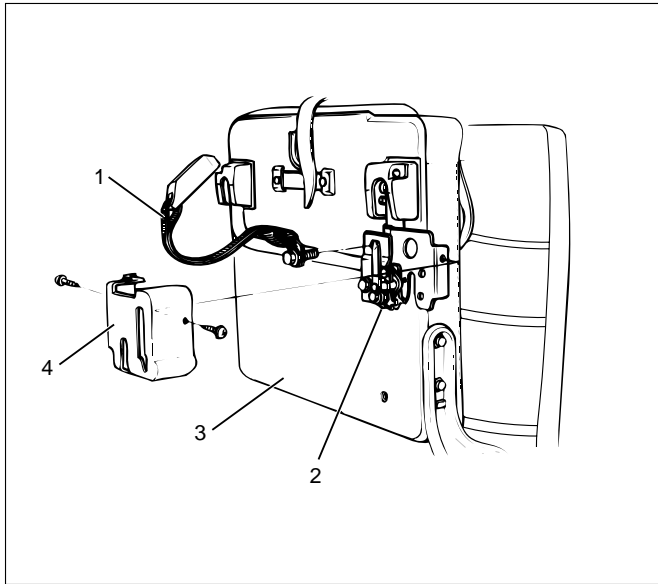


760RW013

2. Install the seat lock cover.

Third Seat Belt Buckle and Lock Assembly

Third Seat Belt Buckle and Lock Assembly and Associated Parts



755RW042

Legend

- (1) Third Seat Belt Buckle Assembly
- (2) Third Seat Lock Assembly
- (3) Third Seat
- (4) Seat Lock Cover

Removal

1. Disconnect the battery ground cable.
2. Remove seat lock cover.
3. Remove third seat belt buckle assembly.
4. Remove third seat lock assembly.

Installation

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

1. Tighten the lock assembly fixing bolts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

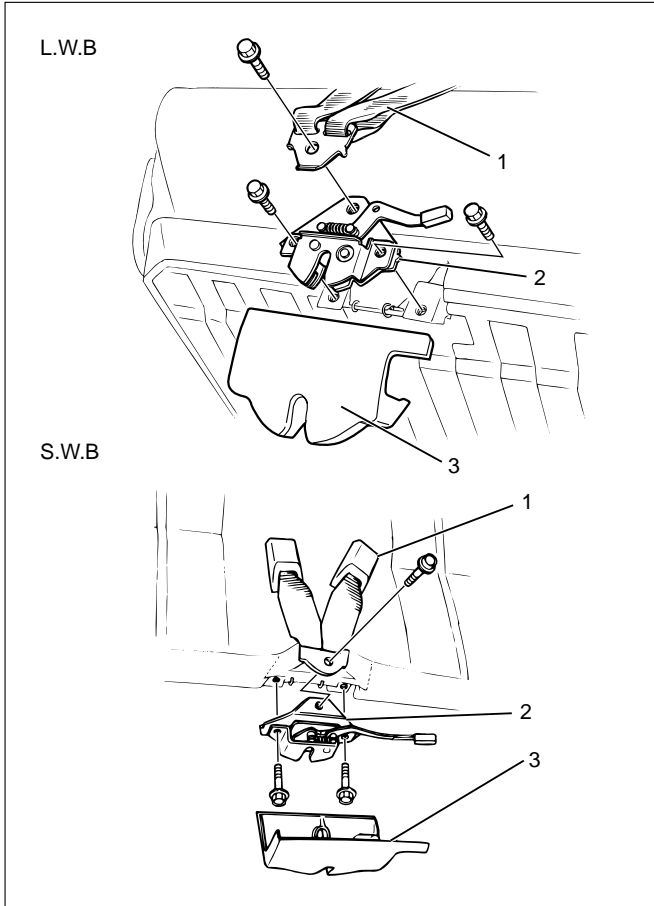
2. Tighten the buckle assembly fixing bolt to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

Rear Seat Lock Assembly

Removal

1. Remove the seat lock cover(3).
2. Remove the rear seat belt buckle assembly(1).
3. Remove the rear seat lock assembly(2).



755RW040

Installation

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

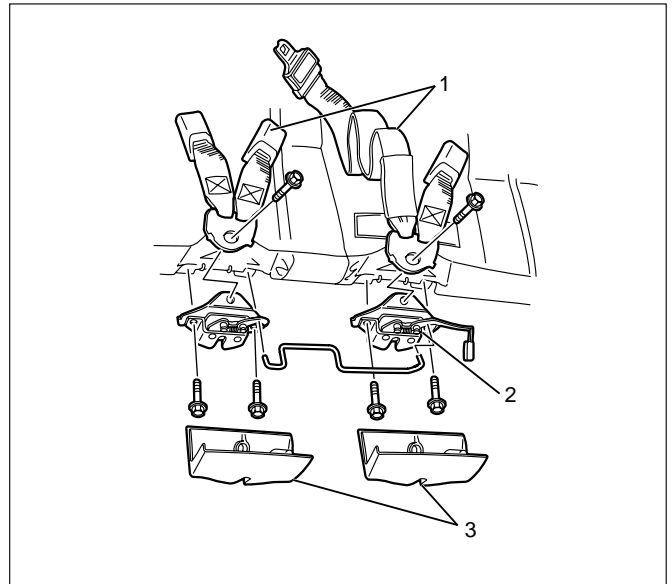
1. Tighten the seat lock fixing bolts to the specified torque.

Torque: 42 N·m (4.3 kg·m/31 lb ft)

Rear Seat Lock Assembly (Bench Type)

Removal

1. Remove the seat lock cover(3).
2. Remove the rear seat belt/buckle assembly(1).
3. Disconnect the link connecting the lock assemblies on the both sides, and then remove the rear seat lock assembly(2).



760RW003

Installation

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

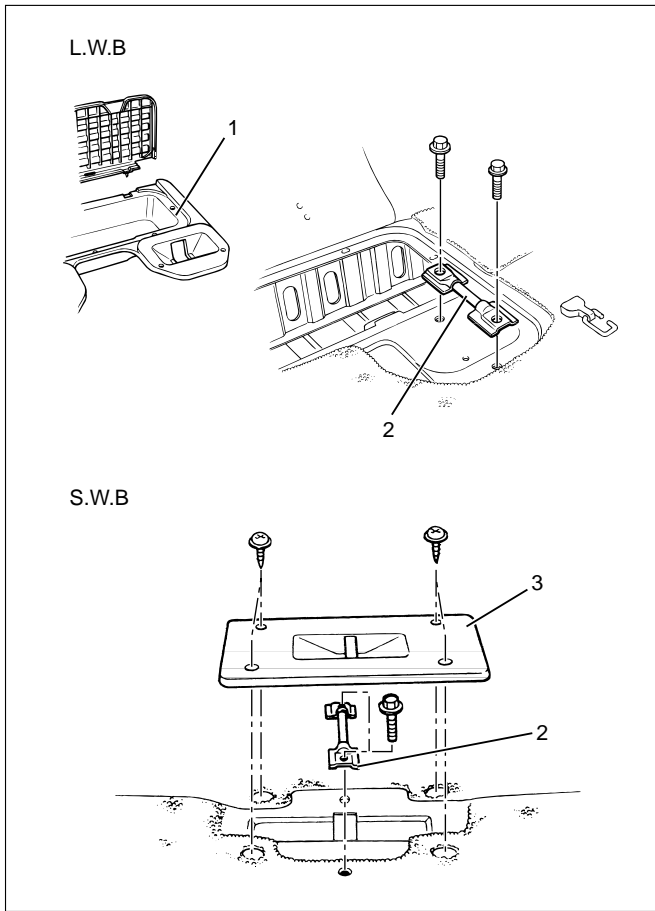
1. Tighten the seat lock fixing bolts to the specified torque.

Torque: 42 N·m (4.3 kg·m/31 lb ft)

Rear Seat Strikers

Removal

1. Fold the rear seat assembly to the front direction.
2. Remove the luggage floor box(1) (L-W-B).
Remove the striker cover(3) (S-W-B).
3. Remove the rear seat striker(2).



755RW045

Installation

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

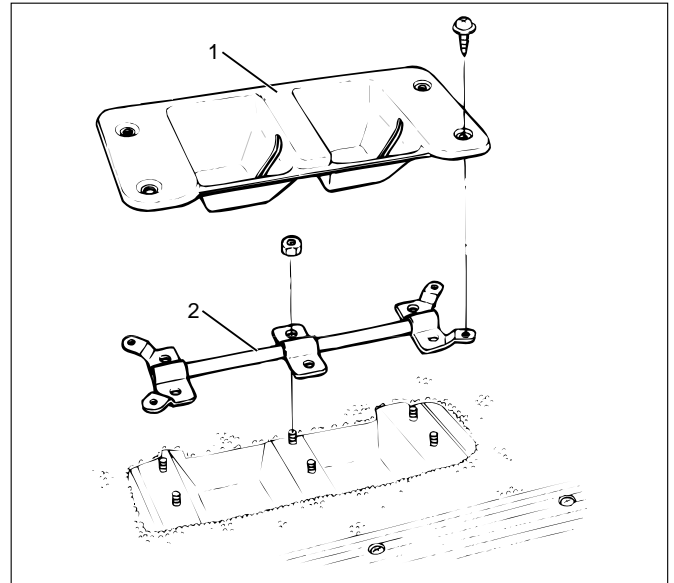
1. Tighten the striker fixing bolts to the specified torque.

Torque: 40 N·m (4.1 kg·m/30 lb ft)

Third Seat Striker

Removal

1. Disconnect the battery ground cable.
2. Remove the striker cover (1).
3. Remove the third seat striker (2).



755RW041

Installation

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

1. Tighten the striker fixing nuts to the specified torque.

Torque: 39 N·m (4.0 kg·m/29 lb ft)

Main Data and Specifications**Torque Specifications**

Application	N·m	kg·m	Lb Ft
Front Seat Belt Anchor Bolts	39	4.0	29
Rear Seat Belt Anchor Bolts	39	4.0	29
Front Seat Buckle Anchor Bolt	39	4.0	29
Rear Seat Buckle Anchor Bolt	39	4.0	29
Rear Seat Lock Fixing Bolts	42	4.3	31
Third Seat Belt Anchor Bolts	39	4.0	29
Third Seat Lock Fixing Bolts	39	4.0	29
Third Seat Buckle Anchor Bolt	39	4.0	29
Third Seat Striker Fixing Nuts	39	4.0	29
Rear Seat Striker Fixing Bolts	40	4.1	30

RESTRAINTS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

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Service Precaution

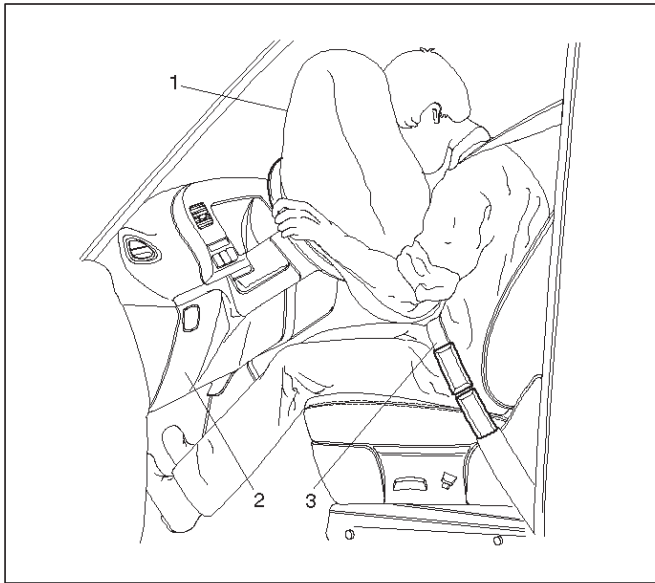
WARNING: IF SO EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM (SRS), REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING,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

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

General Description

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

Restraint Devices

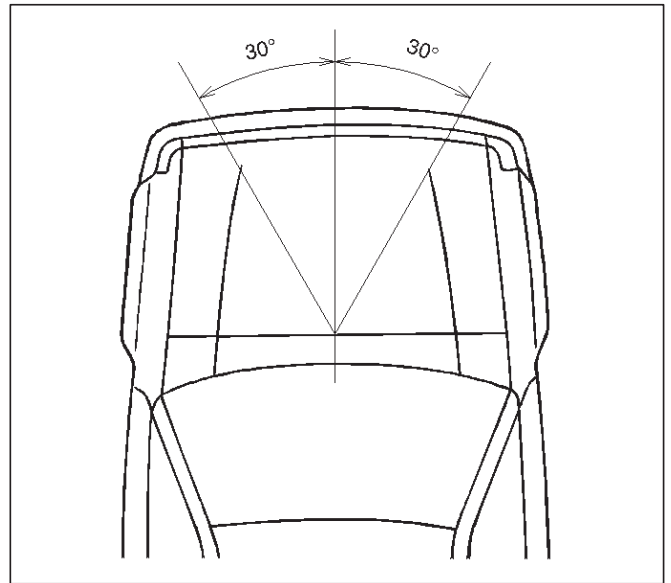


Legend

- (1) Deployed Air Bag
- (2) Knee Bolster
- (3) Seat Belt

The Supplemental Restraint System (SRS) helps supplement the protection offered by the driver and front passenger seat belts by deploying an air bag from the center of the steering wheel and from the top of the right side of the instrument panel.

The air bag deploys when the vehicle is involved in a frontal crash of sufficient force up to 30 degrees off the centerline of the vehicle. To further absorb the crash energy there is a knee bolster located beneath the instrument panel for both the driver and passenger, and the steering column is collapsible.

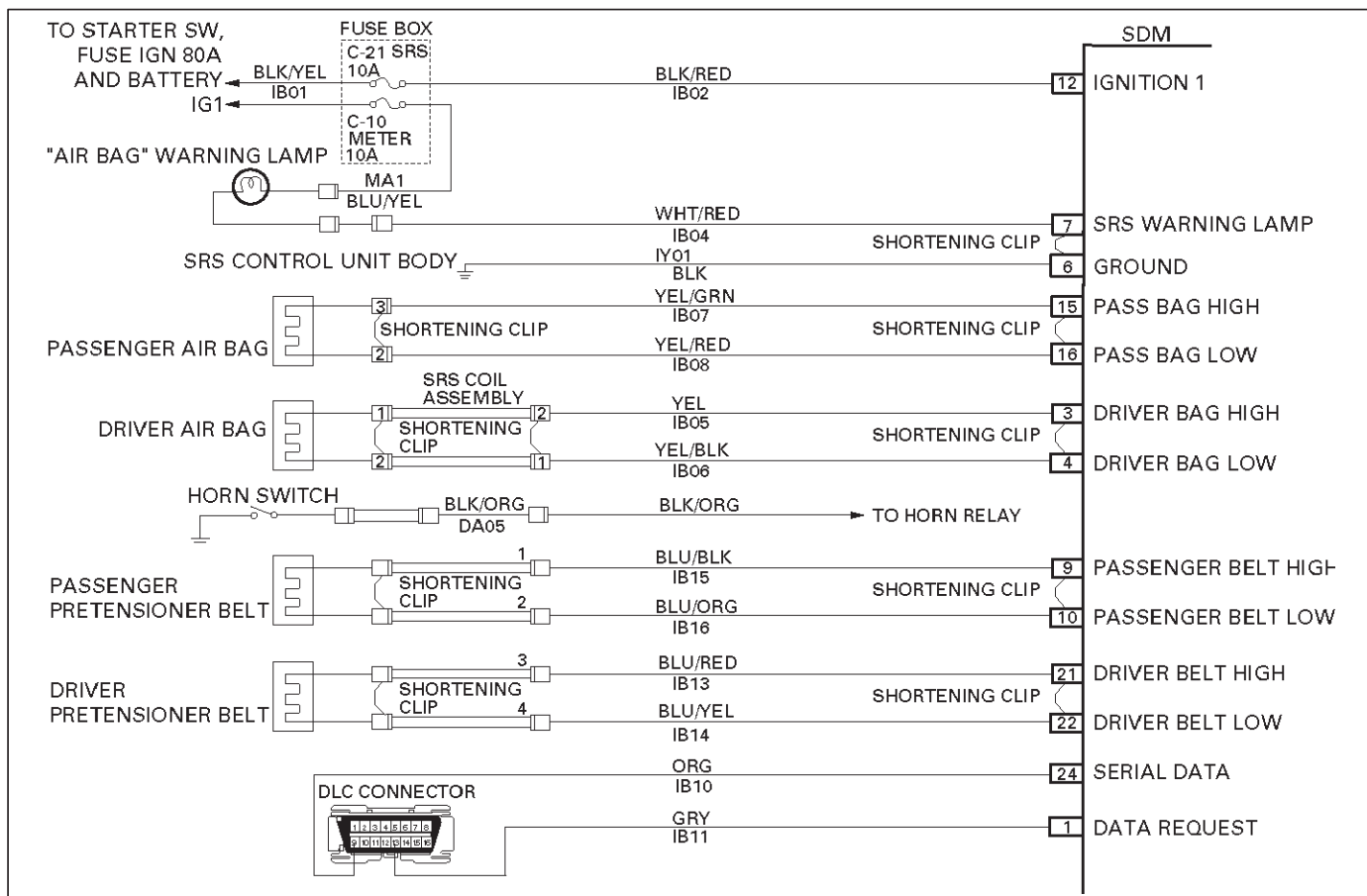


System Description

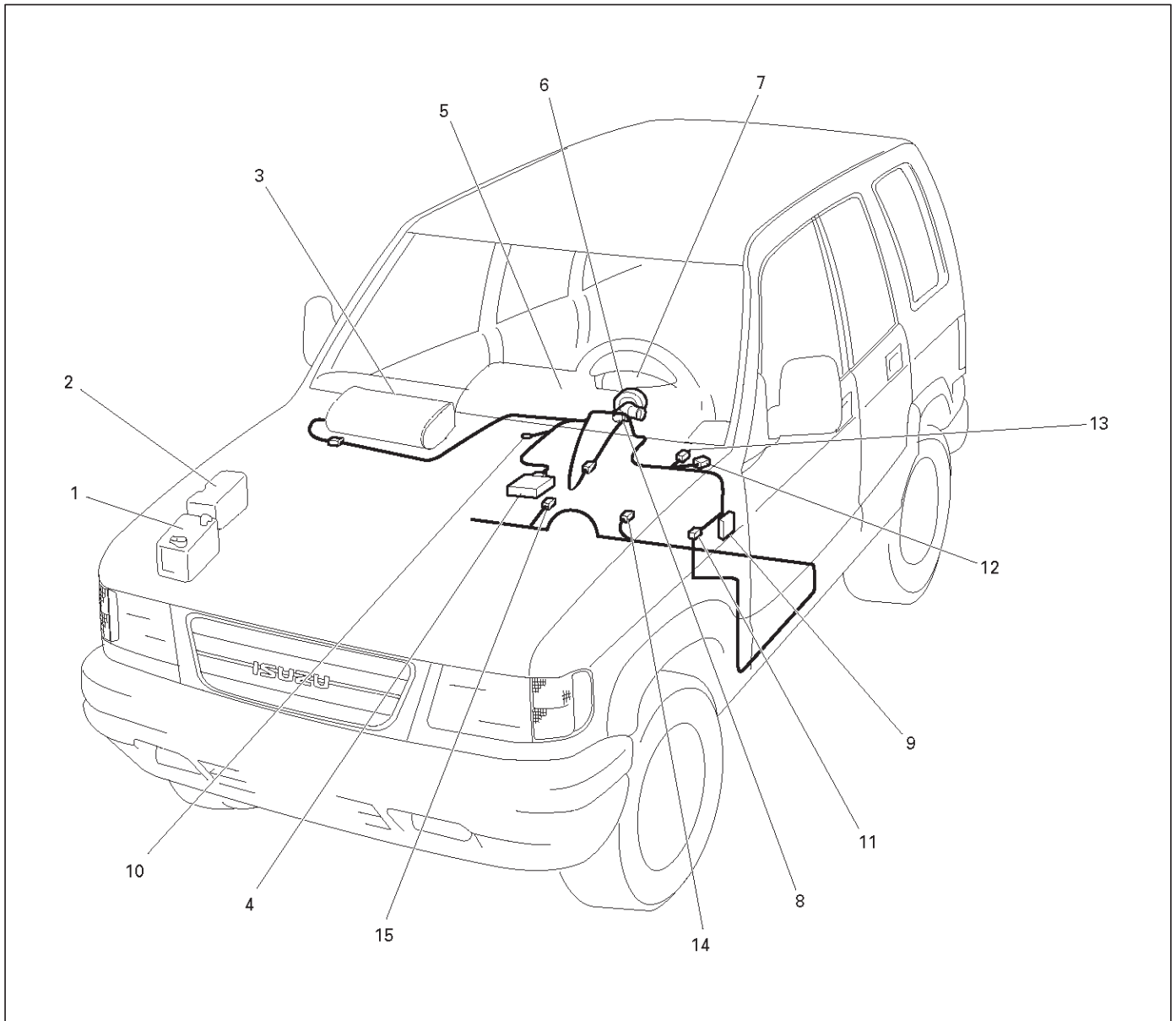
The SRS consists of the Sensing and Diagnostic Module (SDM), the driver air bag assembly, the SRS coil assembly, the passenger air bag assembly and the "AIR BAG" warning lamp in the instrument cluster. The SDM, SRS coil assembly (driver side only), driver air bag assembly, passenger air bag assembly and connector wire make up the deployment loops. The function of the deployment loops is to supply current through air bag assembly, which will cause deployment of the air bags in the event of a frontal crash of sufficient force, up to 30

degrees off the centerline of the vehicle. The air bag assemblies are only supplied enough current to deploy when the SDM detects vehicle velocity changes severe enough to warrant deployment.

The SDM contains a sensing device which converts vehicle velocity change to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags.



SRS Component And Wiring Location View



810RW298

Legend

- | | |
|--------------------------------|--|
| (1) Battery | (8) Starter Switch |
| (2) Relay & Fuse Box | (9) Fuse Box, C-21 |
| (3) Passenger Air Bag Assembly | (10) SRS Body Earth |
| (4) SDM | (11) Body Harness Connector |
| (5) Meter Assembly | (12) Instrument Harness Connector |
| (6) SRS Coil Assembly | (13) Engine Hanes Connector |
| (7) Driver Air Bag Assembly | (14) Pretensioner, LH (If so equipped) |
| | (15) Pretensioner, RH (If so equipped) |

Component Description

SDM (Sensing and Diagnostic Module)

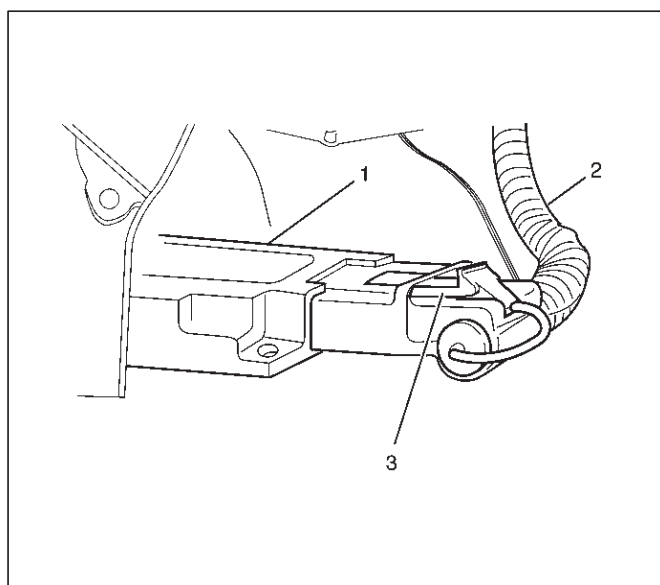
WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET

FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTED TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

The Sensing and Diagnostic Module (SDM) is designed to perform the following functions in the SRS:

1. Energy Reserve — The SDM maintains 24-Volt Loop Reserve (24VLR) energy supply to provide deployment energy when ignition voltage is lost in a frontal crash.
2. Frontal Crash Detection — The SDM monitors vehicle velocity changes to detect frontal crashes which are severe enough to warrant deployment.
3. Air Bag Deployment — When a frontal crash of sufficient force is detected, the SDM will cause enough current to flow through the air bag assembly to deploy the air bag.
4. Malfunction Detection — The SDM performs diagnostic monitoring of SRS electrical components and sets a diagnostic trouble code when a malfunction is detected.
5. Frontal Crash Recording — The SDM records information regarding SRS status during frontal crash.
6. Malfunction Diagnosis — The SDM displays SRS diagnostic trouble codes and system status information through the use of a scan tool.
7. Driver Notification — The SDM warns the vehicle driver of SRS malfunctions by controlling the “Air Bag” warning lamp.

The SDM is connected to the SRS wiring harness by a 24-pin connector. This harness connector uses a shorting clip across certain terminals in the contact area. This shorting clip connects the “AIR BAG” warning lamp to ground when the SDM harness connector is disconnected or CPA (Connector Position Assurance) is not inserted even if completely connected. This will cause the “AIR BAG” warning lamp to come “ON” steady whenever the ignition switch is at the ON or START positions with the SDM disconnected.



827RW044

Legend

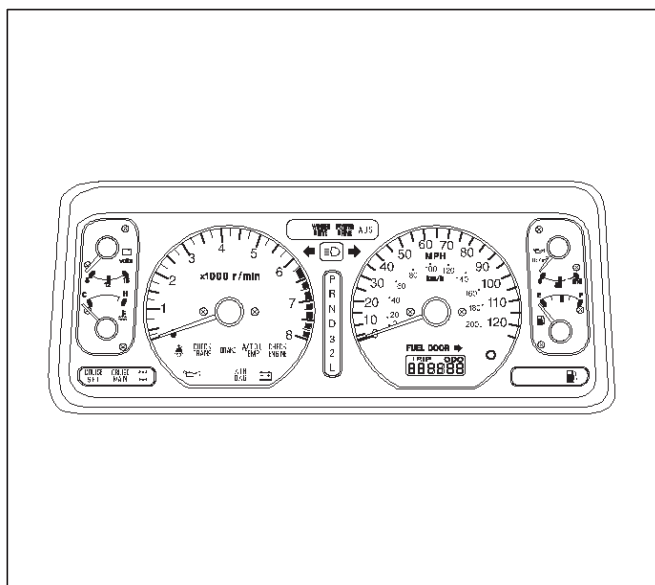
- (1) SDM
- (2) SRS Harness
- (3) Connector Position Assurance

“Air Bag” Warning Lamp

Ignition voltage is applied to the “AIR BAG” warning lamp when the ignition switch is at the ON or START positions. The SDM controls the lamp by providing ground with a lamp driver. The “AIR BAG” warning lamp is used in the SRS to do the following:

1. Verify lamp and SDM operation by turn on 3.5 seconds and then turns “OFF” when the ignition switch is first turned “ON”.
2. Warn the vehicle driver of SRS electrical system malfunctions which could potentially affect the operation of the SRS. These malfunctions could result in nondeployment in case of a frontal crash or deployment for conditions less severe than intended.

The “AIR BAG ” warning lamp is the key to driver notification of SRS malfunctions. For proper lamp operation, refer to the “SRS Diagnostic System Check” in this section.



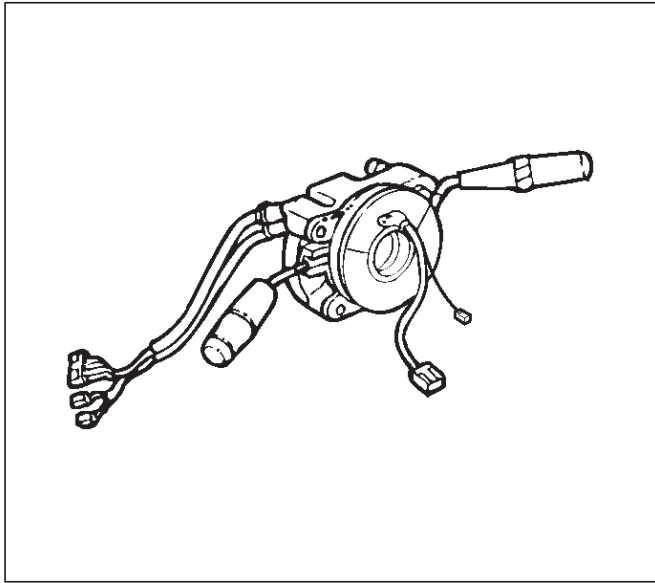
821RW037

SRS Coil Assembly

The SRS coil assembly consists of two current carrying coils. This is attached to the steering column and allow rotation of the steering wheel while maintaining continuous contact of the driver deployment loop to the driver air bag assembly.

There is a shorting clip on the yellow 2-pin connector near the base of steering column which connects the SRS coil to the SRS wiring harness.

The shorting clip shorts to the SRS coil and driver air bag assembly when the yellow 2-pin connector is disconnected. The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the steering column or other SRS components.



825RS017

Air Bag Assemblies

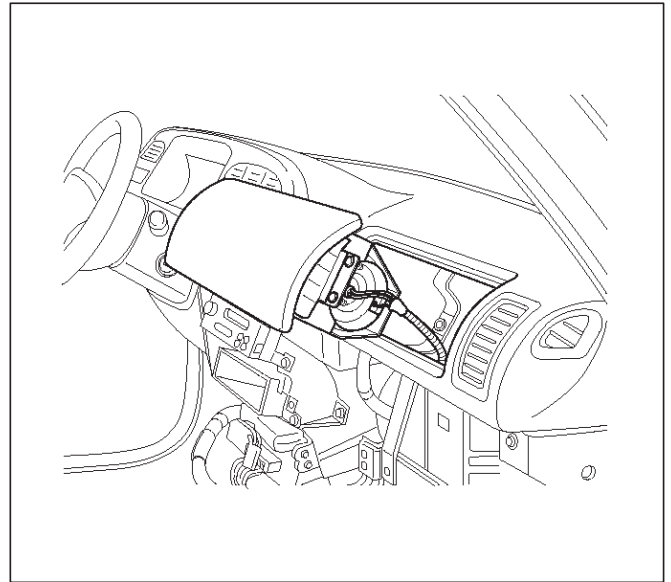
The air bag assembly consist of an inflatable air bag assembly and an inflator (a canister of gas-generating material and an initiating device). When the vehicle is in a frontal crash of sufficient force.

The SDM causes current flow through the deployment loops. Current passing through the inflator ignites the material in the air bag assembly. The gas produced from this reaction rapidly inflates the air bag assembly.

There is a shorting clip on the driver air bag assembly connector which connects the SRS coil assembly. The shorting clip shorts across the driver air bag assembly circuits when driver air bag assembly connector is disconnected.

The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the driver air bag assembly, the steering column or other SRS components.

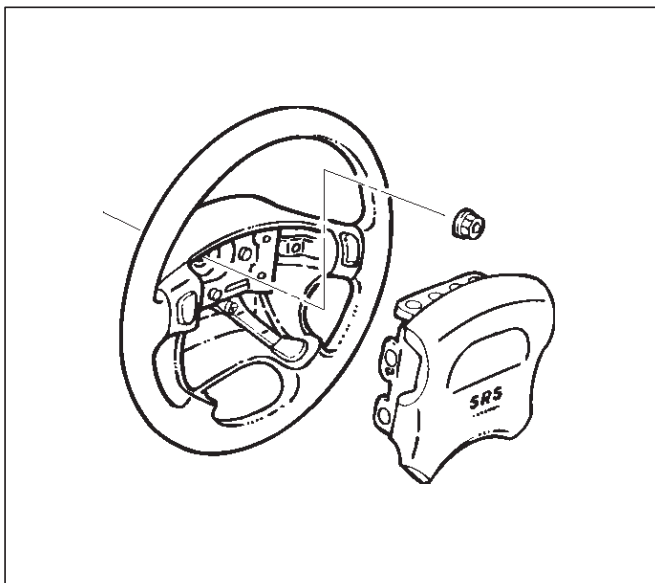
The shorting clip shorts across the passenger air bag assembly circuit when the passenger air bag assembly connector is disconnected. The circuit to the passenger air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the passenger air bag assembly, the instrument panel or other SRS components.



827RS001

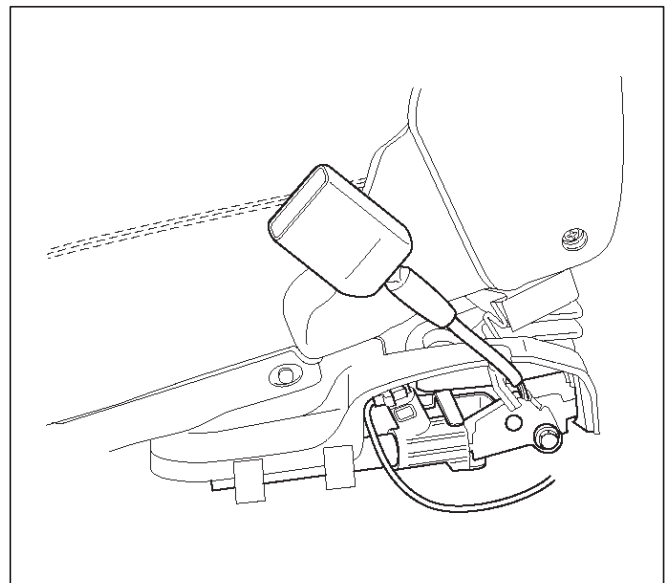
Seat Belt with Pretensioner (If so equipped)

The seat belt comprises a seat belt and a cylinder (a cylinder filled with powder and an ignition device). In cases of frontal collision which cause a shock exceeding a specified level, the controller lets current flow to the inflation circuit. The current ignites the cylinder of the seat belt, producing gas. The gas helps tighten the seat belt to restrain firmly the driver's upper half in his seat.



827RS008

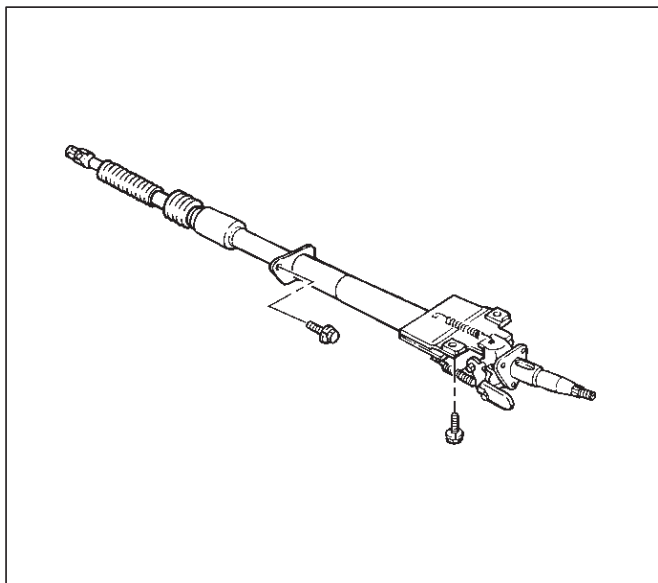
There is a shorting clip on the passenger air bag assembly connector which connects to the SRS harness.



760RW033

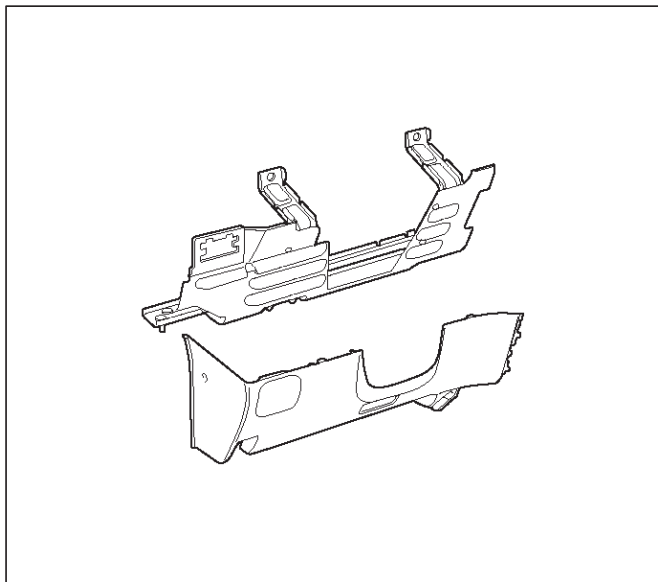
Steering Column

The steering column absorbs energy and is designed to compress in a frontal crash to decrease the chance of injury to the driver.



Knee Bolster

The knee bolsters are used to absorb energy to protect knees and control the forward movement of the vehicle's front seat occupants during a frontal crash, by limiting leg movement.



Definitions

Air Bag

An inflatable cloth cushion designed to deploy in certain frontal crashes. It supplements the protection offered by the seat belts by distributing the impact load more evenly over the vehicle occupant's head and torso.

Asynchronous

Performed in a nonperiodic fashion, (i.e., no defined time or interval).

B+

Battery voltage, (B+) The voltage available at the battery at the time of the indicated measurement. With the key "ON" and the engine not running, the system voltage will likely be between 12 and 12.5 volts. At idle, the voltage may be 14 to 16 volts. The voltage could be as low as 10 volts during engine cranking.

Bulb Check

The SDM will cause the "AIR BAG" warning lamp to turn on 3.5 seconds and then go "OFF" whenever the ignition switch transitions to the ON position from any other ignition switch position and no malfunctions are detected.

"Continuous Monitoring"

Tests performed by the SDM on the SRS every 100 milliseconds while "Ignition 1" voltage is in the normal operating voltage range at the SDM.

Data Link Connector (DLC)

Formerly "DLC" a connector which allows communication with an external computer, such as a scan tool.

Datum Line

A base line parallel to the plane of the underbody or frame from which all vertical measurements originate.

Deploy

To inflate the air bag.

Deployment Loops

The circuits which supply current to the air bag assemblies to deploy the air bag.

Diagnostic Trouble Code (DTC)

Formerly "Code", a numerical designator used by the SDM to indicate specific SRS malfunctions.

Driver Current Source

An output of the SDM which applies current into the driver air bag assembly circuit during the "Initiator Assembly Resistance Test".

Driver Air Bag Assembly

An assembly located in the steering wheel hub consisting of an inflatable bag, an inflator and an initiator.

EEPROM

Electrically Erasable Programmable Read Only Memory. Memory which retains its contents when power is removed from the SDM.

Ignition Cycle

The voltage at the SDM "Ignition 1" inputs, with ignition switch "ON", is within the normal operating voltage range for at least ten seconds before turning ignition switch "OFF".

Ignition 1

A battery voltage (B+) circuit which is only powered with the ignition switch in the ON, or START positions.

Initiator

The electrical component inside the air bag assembly which, when sufficient current flows, sets off the chemical reaction that inflates the air bag.

"Initiator Assembly Resistance Test"

Tests performed once each ignition cycle when no malfunctions are detected during "Turn-ON" or "Continuous Monitoring". This test checks for the correct SDM configuration for the vehicle, shorts to "Ignition 1" in

the deployment loops, high resistance or opens in the “Driver Side High”, “Driver Side Low”, “Passenger Side High” and “Passenger Side Low” circuits and measures the resistance of the inflator assembly consisting of 1) Initiators, 2) SRS coil assembly (driver side only), 3) Connectors and associated wiring.

Normal Operating Voltage Range

The voltage measured between the SDM “Ignition 1” terminals and “Ground” terminals is between 9 and 16 volts.

Passenger Current Source

An output of the SDM which applies current into the passenger air bag assembly circuit during the “Initiator Assembly Resistance Test”.

Passenger Air Bag Assembly

An assembly located in the right side of the instrument panel consisting of an inflatable bag, an inflator and an initiator.

Scan Tool

An external computer used to read diagnostic information from on-board computers via the data link connector.

SDM

Sensing and Diagnostic Module which provides reserve energy to the deployment loops, deploys the air bags when required and performs diagnostic monitoring of all SRS components.

Serial Data

Information representing the status of the SRS.

SRS

Supplemental Restraint System.

SRS Coil Assembly

An assembly of two current-carrying coils in the driver deployment loop that allows the rotation of the steering wheel while maintaining the continuous contact of the driver deployment loop to the driver air bag assembly.

SRS Wiring Harness

The wires and connectors that electrically connect the components in the SRS.

“Turn-ON”

Test which the SDM performs on the SRS once during each ignition cycle immediately after “Ignition 1” voltage is applied to the SDM and before “Continuous Monitoring”.

Diagnosis

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY-POWERED OR AC-POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED PROBE-TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

Diagnostic Trouble Codes

The “SRS Diagnostic System Check” must always be the starting point of any SRS diagnosis. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for SRS diagnostic trouble codes using the scan tool.

1. Current diagnostic trouble codes – Malfunctions that are presently being detected. Current diagnostic trouble codes are stored in RAM (Random Access Memory).
2. History diagnostic trouble codes – All malfunctions detected since the last time the history memory was cleared. History diagnostic trouble codes are stored in EEPROM.

Scan Tool Diagnostics

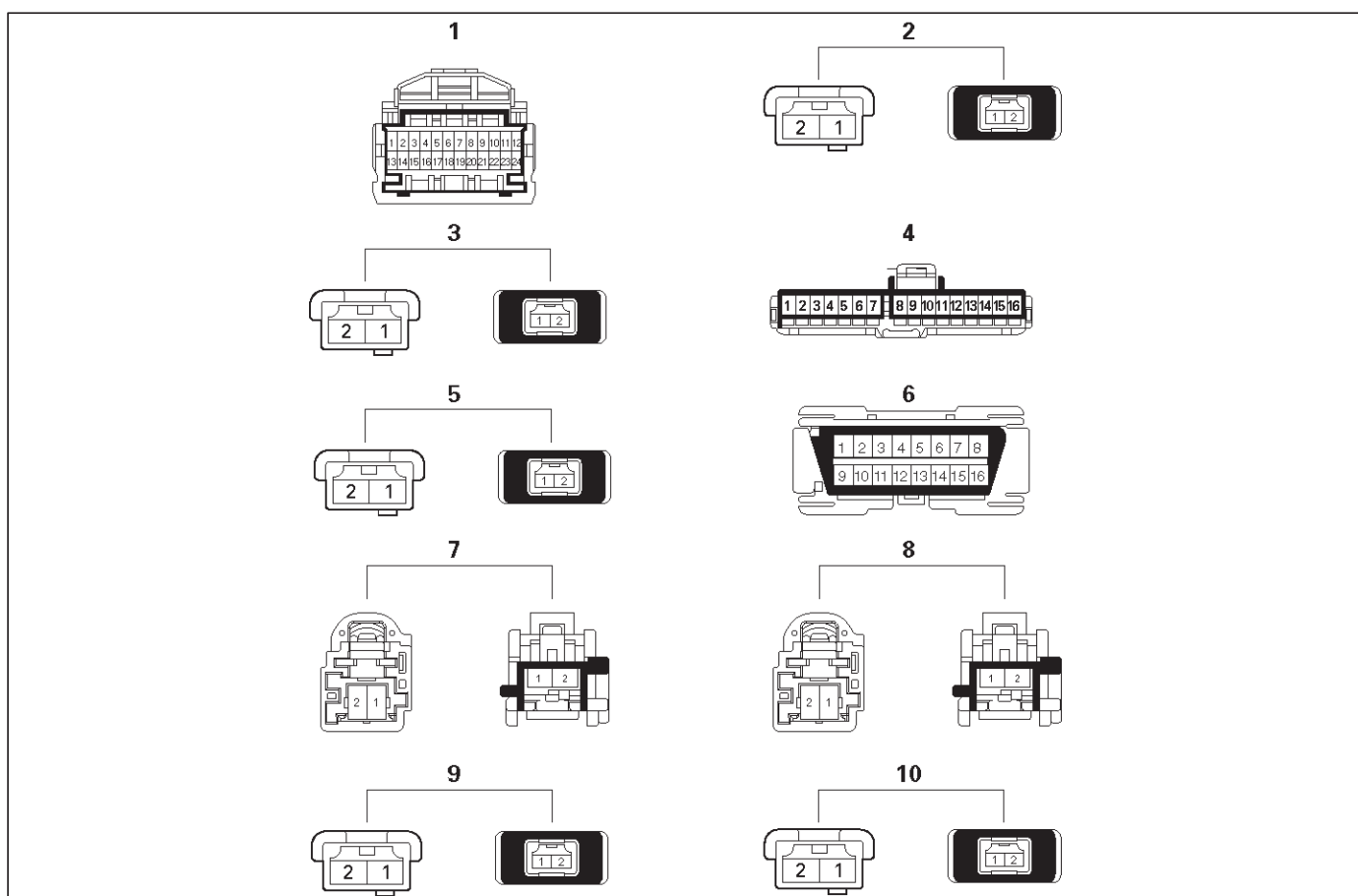
A scan tool is used to read current and history diagnostic trouble codes and to clear all diagnostic trouble codes after a repair is completed. The scan tool must be updated to communicate with the SRS through a replaceable cartridge before it can be used for SRS diagnostics. To use the scan tool, connect it to the data link connector and turn the ignition switch “ON”. The scan tool reads serial data from the SDM “Serial Data” line terminal “24” to the data link connector terminal “9”.

Use Of Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY-POWERED OR AC-POWERED VOLTMETER, OHMMETER, ETC, OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROBE-TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT. YOU SHOULD BE FAMILIAR WITH THE TOOLS LISTED IN THIS SECTION UNDER THE HANDLING SRS SPECIAL TOOLS.

You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as the Tech 2 Diagnostic Computer, SRS Driver/Passenger Load Tool 5-8840-2421-0, Connector Test Adapter Kit 5-8840-0385-0, and the DVM (Digital Multimeter) 5-8840-0285-0.

SRS Connector Body Face Views



D09RW016

Legend

- | | |
|--|---|
| <ul style="list-style-type: none"> (1) SDM (2) Driver Air Bag Assembly (3) Passenger Air Bag Assembly (4) "Air Bag" Warning Lamp (5) SRS Coil Assembly (6) DLC (7) Connector between Chassis Harness and Pretensioner Harness for Driver Seat Belt (If so equipped) | <ul style="list-style-type: none"> (8) Connector between Chassis Harness and Pretensioner Harness for Passenger Seat Belt (If so equipped) (9) Connector between Pretensioner Harness and driver side Pretensioner Seat Belt (If so equipped) (10) Connector between Pretensioner Harness and passenger side Pretensioner Seat Belt (If so equipped) |
|--|---|

Repairs And Inspections Required After An Accident

NOTE: If any SRS components are damaged, they must be replaced. If SRS component mounting points are damaged, they must be replaced.

- Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized dealer; they may be used for SRS repairs.
- Do not attempt to service the SDM, the SRS coil assembly, or the air bag assembly. Service of these items is by replacement only.
- Verify the part number of replacement air bag assembly.

CAUTION: Never use the air bag assembly from another vehicle. Use only the air bag assembly for Trooper.

CAUTION: Proper operation of the sensors and supplemental restraint system (SRS) requires that any repairs to the vehicle structure return it to the original production configuration. Deployment requires, at a minimum, replacement of the SDM, air bag assembly and dimensional inspection of the steering column. Any visible damage to the SDM mounting bracket (s) requires replacement, and the steering column must be dimensionally inspected, whether deployment occurred or not.

Accident With Deployment – Component Replacement And Inspections

Certain SRS components must be replaced or inspected for damage after a frontal crash involving air bag deployment. Those components are:

- Air bag assembly
- SDM

CAUTION: Refer to “SDM Replacement Guidelines” below for important information on SDM replacement in both deployment and non deployment crashes.

- SRS coil assembly — Inspect wiring and connector for any signs of scorching, melting, or damage due to excessive heat. Replace if damaged. Refer to section “SRS Coil Assembly” in this manual.

Accident With or Without Deployment – Component Inspection

Certain SRS system components and rotation parts must be inspected after any crash, whether the air bag deployed or not. Those components are:

- Steering column — Refer to Inspection Required “After an Accident” in this manual.
- Knee bolsters and mounting points — Inspect for any distortion, bending, cracking, or other damage.
- I/P steering column reinforcement plate — Inspect for any distortion, bending, cracking, or other damage.
- I/P braces — Inspect for any distortion, bending, cracking, or other damage.
- Seat belts and mounting points — Refer to “Seat Belts” in Section “Seat Belt” of this workshop manual.

SDM Replacement Guidelines

SDM replacement policy requires replacement of SDM, after crash involving air bag deployment when “SRS Warning Lamp” turn “ON”, “SRS Diagnosis” should be done according to Section “Restraint Control System.”

If accident without deployment air bag, it is not necessary replacement of SDM when do not indicate to replace the SDM by scan tool after SRS system check.

Wiring Damage

If any SRS wire harness is damaged, it should be replaced. Don't repair SRS harness. It is replace only.

SRS Connector (Plastic Body And Terminal Metal Pin) Damage

If any connector or terminal in the SRS wire harness (except pigtail) is damaged, it should be replaced.

SRS Wire Pigtail Damage

If the wiring pigtail (a wire or wires attached directly to the device, not by a connector) is damaged, the entire component (with pigtail) must be replaced. Examples of “pigtail” components are the driver air bag assembly, the passenger air bag assembly, and the SRS coil assembly.

On-Vehicle Service

Service Precaution

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned “OFF,” the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the “C-21” fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the “Disabling the SRS” procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to “LOCK” and remove key.

1. Remove SRS fuse C-21, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2-pin connector at the base of steering column.
3. Remove glove box assembly, refer to “Passenger Air Bag Assembly Replacement” in this manual.
4. Disconnect yellow 2-pin connector behind the glove box assembly.

CAUTION: With the “C-21” fuse removed and ignition switch “ON”, the “AIR BAG” warning lamp will be “ON”. This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

CAUTION: Never use the air bag assembly from another vehicle. Use only the air bag assembly for Trooper.

Turn ignition switch to “LOCK” and remove key.

1. Connect yellow 2-pin connector passenger air bag assembly.
2. Install glove box assembly. Refer to “Passenger air bag assembly replacement” in this manual.
3. Connect yellow 2-pin connector at the base of steering column.
4. Install “AIR BAG” fuse C-21 to left dash side lower fuse block or connect battery.

Turn ignition switch to “ON” and verify that the “AIR BAG” warning lamp turn on 3.5 seconds and then turns “OFF.” If it does not operate as described, perform the “SRS Diagnostic System Check” in this manual.

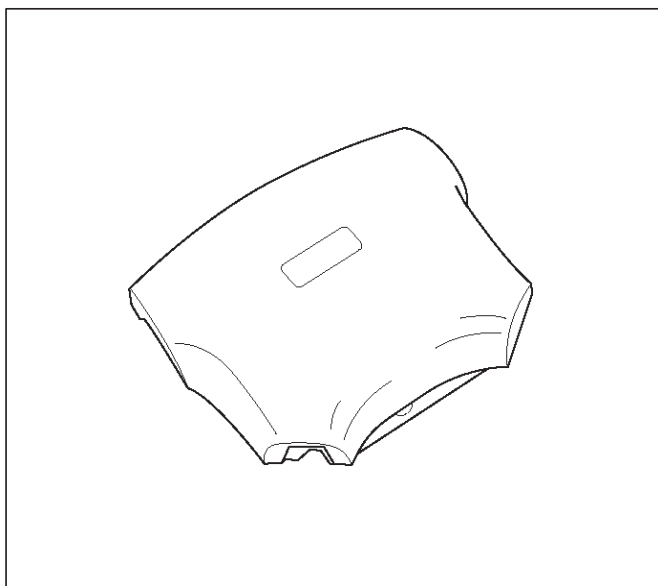
Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 93°C (200°F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the sensor pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" will verify proper "AIR BAG" warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.

Air Bag Assembly Handling / Shipping / Scrapping

Live (Undeployed) Air Bag Assembly

Special care is necessary when handling and storing a live (undeployed) air bag assembly. The rapid gas generation produced during deployment of the air bag could cause the air bag assembly, or an object in front of the air bag assembly, to be thrown through the air in the unlikely event of an accidental deployment.



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WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG OPENING IS POINTED AWAY FROM YOU. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. NEVER CARRY THE AIR BAG ASSEMBLY BY THE

WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE.

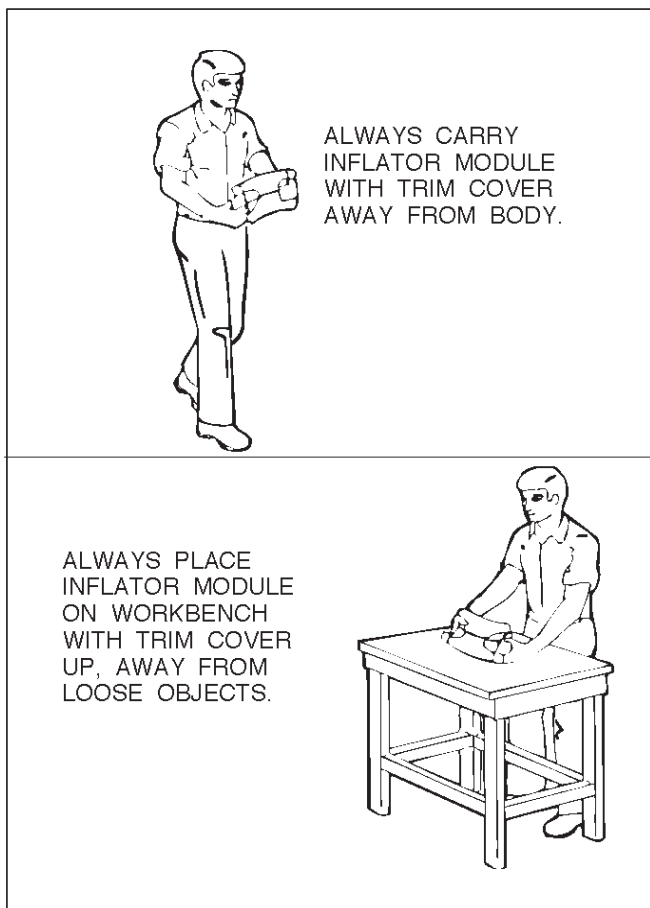
Pretensioner Seat Belt Handling / Shipping / Scrapping.

Live (undeployed) pretensioner seat belt.

Special care is necessary when handling and storing a live (undeployed) pretensioner seat belt.

The rapid gas generation produced during deployment of the pretensioner seat belt (could cause the pretensioner seat belt), or an object around of pretensioner seat belt, to be thrown through the air in the unlikely event of an accidental deployment.

WARNING: WHEN CARRYING A LIVE PRETENSIONER SEAT BELT, MAKE SURE THE PRETENSIONER SEAT BELT CYLINDER IS POINTED AWAY FROM YOU. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE PRETENSIONER SEAT BELT WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. NEVER CARRY THE PRETENSIONER SEAT BELT BY THE CYLINDER OR WIRES ON THE UNDERSIDE OF THE MODULE.



ALWAYS CARRY INFLATOR MODULE WITH TRIM COVER AWAY FROM BODY.

ALWAYS PLACE INFLATOR MODULE ON WORKBENCH WITH TRIM COVER UP, AWAY FROM LOOSE OBJECTS.

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Air Bag Assembly and/or Pretensioner Seat Belt Shipping Procedure For Live(Undeployed) Them.

Service personnel should refer to the Service Bulletins for proper SRS composition parts shipping procedures.

Deployed Air Bag Assembly (Driver Side)

"You should wear gloves and glasses. After the air bag assembly has been deployed, the surface of the air bag may contain solid particulate. This solid particulate consists primarily of by products of the chemical reaction, Potassium Chloride and copper metal dust. Compounds of Potassium Borate, Strontium Chloride, Copper Chloride, and Ammonium Chloride may be found in amounts of about 1% (each) of the total particulate."

Deployed Pretensioner Seat Belt.

You should wear gloves and safety glasses. After the pretensioner seat belt has been deployed, the surface of the pretensioner seat belt cylinder may heating up.

Air Bag Assembly and/or Pretensioner Seat Belt Scrapping Procedure.

During the cause of vehicle's useful life, certain situations may arise which will necessitate the disposal of a live air bag and/or pretensioner seat belt. (This information covers proper procedures for disposing of a live air bag assembly and/or pretensioner seat belt.)

Before a live air bag assembly can be disposed off, it must be deployed.

A live air bag assembly and/or pretensioner seat belt must not be disposed of through normal refuse channels.

WARNING: FAILURE TO FOLLOW PROPER SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. AN UNDEPLOYED AIR BAG ASSEMBLY MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF LOCAL LAW.

In situations which require deployment of a live air bag assembly, deployment may be accomplished inside or outside the vehicle. The method employed depends upon the final disposition of the particular vehicle, as noted in "Deployment Outside Vehicle" and "Deployment Inside Vehicle" in this section.

Cautions About Air Bag Deployment And Disposal

Failure to follow proper procedures could result in erroneous air bag deployment which may cause personal injury be sure to follow proper procedures.

1. Turn off (Lock) the ignition switch and disconnect the minus terminal of the battery, then start the work 15 or more sec later. (Air bag is designed to work by the back-up power source even if the battery power source is cut off at vehicle collision).
2. Be sure not to disassemble the air bag.
3. Do not give an impact to the air bag and bring the air bag close to magnet. (The air bag could deploy unexpectedly).

4. Place the air bag with its trim cover up.
5. Do not let the air bag deploy directly on the floor. (The air bag may be blown off 2 ~ 3 m (6.5 or 10 feet)).
6. Be sure to install the air bag firmly to a deployment tool (fixing tool).
7. Set a battery 10 m (33 feet) or more away from the air bag.
8. Before disconnecting air bag harness, ground the worker by touching the vehicle outer panel with bare hand.
9. When connecting or disconnecting the harness, do not work just in front of the air bag.
10. As deployment gives rise to big sound, warn the people around against it. Further, try to reduce the sound by covering the steering wheel or tires, and shut the vehicle windows in case of deployment inside the vehicle.
11. As deployment generates smoke, select a well ventilated place. (In case of deployment indoors, avoid deployment just under a fire alarm, smoke sensor, and fluorescent lamps).
12. Be careful not to inhale the smoke after deployment.
13. If part of the vehicle glass is damaged, cover the vehicle with a car cover to prevent the glass from braking at the time of deployment.
14. Do not touch the air bag immediately after deployment, since it remains hot for 30 minutes.
15. Do not water the air bag immediately after deployment.
16. Wear safety glasses and gloves throughout the work and wash the glasses and gloves after the work.
17. Do not reuse the removed air bag for another vehicle. (Deployment characteristic is different with vehicle types).

Deployment Outside Vehicle (Driver Air Bag Assembly)

Deployment outside the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which the vehicle will be returned to useful service after a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of a malfunctioning air bag assembly is, of course, subject to any required retention period.

For deployment of a live (undeployed) air bag assembly outside the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until a deployed air bag assembly is scrapped or until an undeployed air bag assembly is shipped. Before performing the procedures you should be familiar with servicing the SRS and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

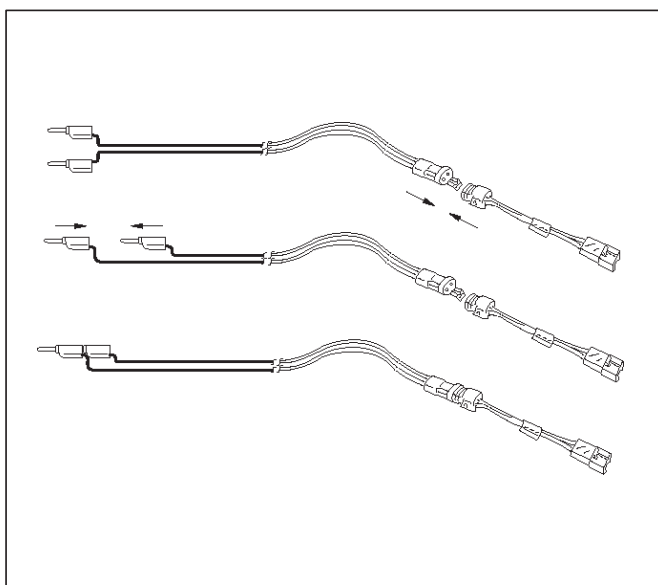
The following procedure requires use of 5-8840-2468-0 SRS deployment harness with appropriate pigtail adapter. Do not attempt procedure without 5-8840-2468-0 adapter.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT

HARNESSES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESSES TO THE DRIVER AIR BAG ASSEMBLY. DEPLOYMENT HARNESSES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to driver air bag assembly. Refer to "Deployment Outside Vehicle (Passenger Air Bag assembly)" in this section for information on passenger air bag assembly scrapping.

1. Turn ignition switch to "LOCK", remove key.
2. Inspect 5-8840-2468-0 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail adapter is damaged, discard and obtain a replacement.
3. Short the two SRS deployment harness leads together by fully seating one banana plug into the other. SRS deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.

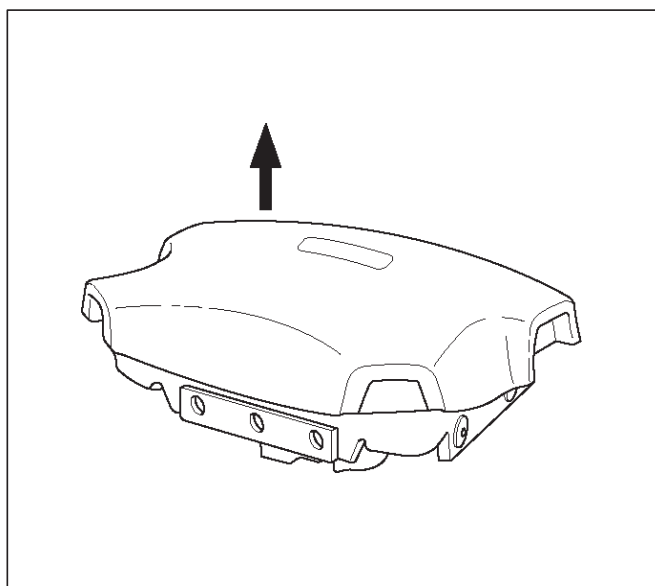


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4. Connect the appropriate pigtail adapter to the SRS deployment harness.
5. Remove the driver air bag assembly from vehicle. Refer to "Inflator Module Removal" in this manual.

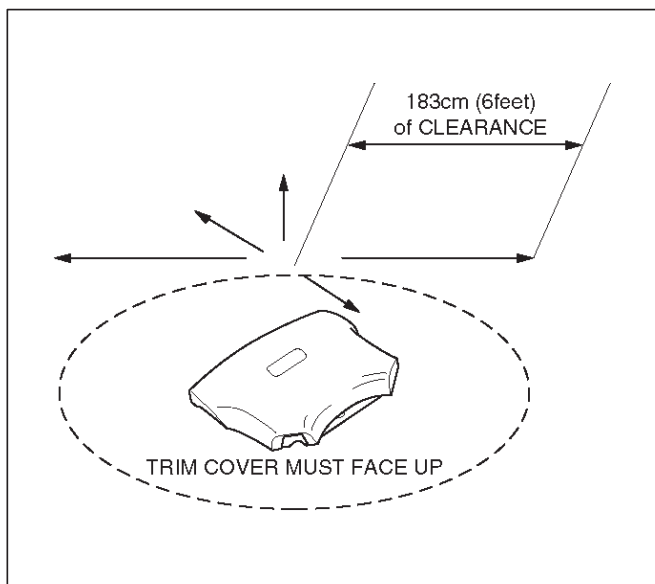
WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE AIR BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

6. Place the driver air bag assembly on a work bench or other surface away from all loose or flammable objects with its trim cover facing up, away from the surface.



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7. Clear a space on the ground about 183 cm (six feet) in clearance where the driver air bag assembly is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the deployment area.



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8. Place the driver air bag assembly, with its trim cover facing up, on the ground in the space just cleared.
9. Stretch the SRS deployment harness and pigtail adapter from the driver air bag assembly to its full length.

9J-14 SUPPLEMENTAL RESTRAINT SYSTEM

10. Place a power source near the shorted end of the SRS deployment harness. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
 11. Connect the driver air bag assembly to the pigtail adapter on the SRS deployment harness. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The driver air bag assembly will immediately deploy the air bag when a power source is connected to it.
- NOTE: Ensure that the pigtail adapter is firmly seated into the driver air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the driver air bag assembly connector functioning (shorted) and may result in nondeployment of the driver air bag assembly.
12. Verify that the area around the driver air bag assembly is clear of all people and loose or flammable objects.
 13. Verify that the driver air bag assembly is resting with its trim cover facing up.
 14. Notify all people in the immediate area that you intend to deploy the driver air bag. The deployment will be accompanied by a substantial noise which may startle the uninformed.
 15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the air bag deploys, the driver air bag assembly may jump about 3 m (ten feet) vertically. This is a normal reaction of the driver air bag to the force of the rapid gas expansion inside the air bag.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the driver air bag.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the driver air bag. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.

19. In the unlikely event that the driver air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the driver air bag assembly did deploy, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed driver air bag assembly. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This solid particulate consists primarily of by products of the chemical reaction, Potassium Chloride and copper metal dust. Compounds of Potassium Borate, Strontium Chloride, Copper Chloride, and Ammonium Chloride may be found in amounts of about 1 % (each) of the total particulate.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE INFLATOR MODULE TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY.

AFTER A DRIVER AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE DRIVER AIR BAG ASSEMBLY WILL BE VERY HOT. DO NOT TOUCH THE METAL AREAS OF THE DRIVER AIR BAG ASSEMBLY FOR ABOUT TEN MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED DRIVER AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG OR TRIM COVER.

21. Disconnect the pigtail adapter from the driver air bag assembly as soon after deployment as possible. This will prevent damage to the pigtail adapter or SRS deployment harness due to possible contact with the hot driver air bag assembly canister. The pigtail adapter can be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed driver air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the driver air bag assembly did not deploy after following these procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the driver air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE INFLATOR MODULE UNATTENDED ON A BENCH OR OTHER

SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

- Temporarily store the driver air bag assembly with its trim cover facing up, away from the surface upon which it rests.

Deployment Outside Vehicle (Passenger Air Bag Assembly)

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

Deployment out of the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of an air bag assembly is, of course, subject to any required retention period.

For deployment of a live air bag assembly out of the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until the deployed air bag assembly is scrapped. Before performing the procedures, you should be familiar with servicing the SRS system and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

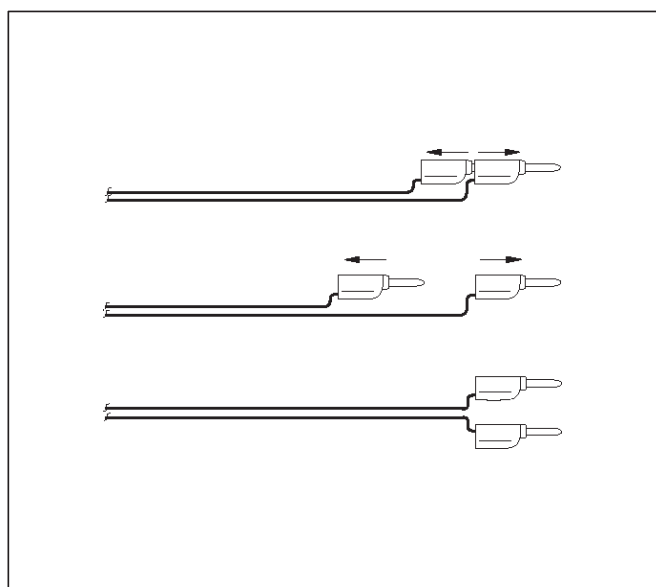
The following procedure requires use of 5-8840-2468-0 SRS Deployment Harness with the appropriate pigtail adapter. The procedure also requires the use of 5-8840-2420-0 Passenger Side SRS Module Deployment Fixture. Do not attempt this procedure without 5-8840-2468-0 and adapter, and 5-8840-2420-0.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR

SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

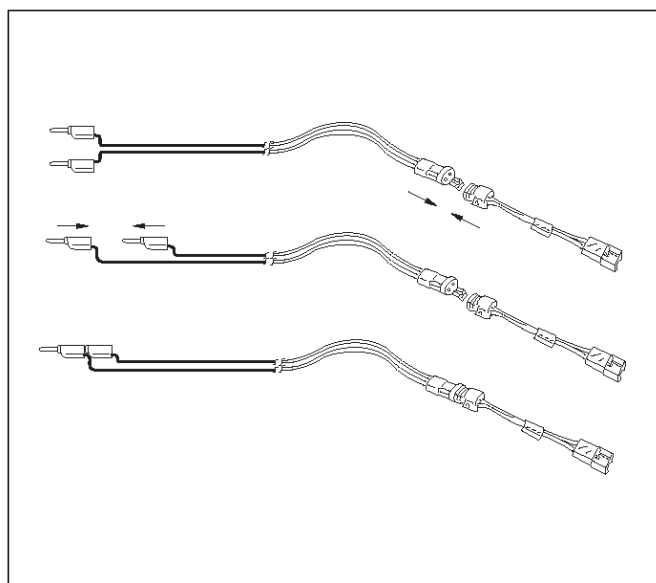
NOTE: This information applies only to passenger air bag assembly. Information for disposing of a live driver air bag assembly can be found in "Deployment Outside Vehicle" (Driver Air Bag Assembly) in this section.

- Turn ignition switch to "LOCK" remove key, and put on safety glasses.
- Inspect 5-8840-2468-0 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail is damaged, discard and obtain a replacement.
- Short the two SRS Deployment Harness leads together by fully seating one banana plug into the other. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.



827RS003

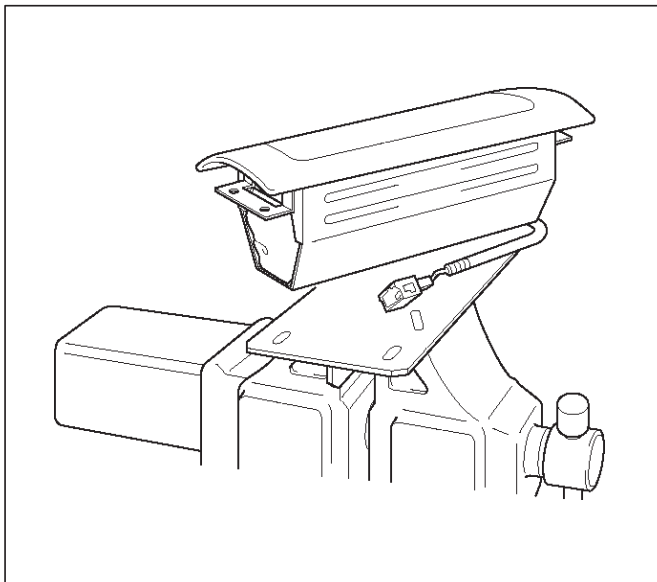
- Connect the appropriate pigtail adapter to the SRS Deployment Harness



827RS004

9J-16 SUPPLEMENTAL RESTRAINT SYSTEM

5. Remove passenger air bag assembly from vehicle. Refer to "Passenger Air Bag Assembly Removal" in this Section 9J-3.
6. Clear a space on the ground approximately 183 cm (six feet) in clearance where the fixture with attached air bag assembly is to be placed for deployment. A paved outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure that no loose or flammable objects are within the deployment area.
7. Place the 5-8840-2420-0 on the bench vice. This is necessary to provide sufficient stabilization of the fixture during deployment.
8. Attach the passenger air bag assembly in the 5-8840-2420-0. An air bag assembly must be mounted such that the bag will deploy upward. SECURELY HAND-TIGHTEN ALL FASTENERS PRIOR TO DEPLOYMENT.



901RW199

9. Stretch the SRS Deployment Harness and pigtail adapter from the air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. (Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.)
11. Connect the air bag assembly to the pigtail adapter on the SRS deployment harness. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in nondeployment of the air bag assembly.

12. Verify that the area around the passenger air bag assembly is clear of all people and loose or flammable objects.

13. Verify that the passenger air bag assembly is firmly and properly in 5-8840-2420-0.
14. Notify all people in the immediate area of your intention to deploy the passenger air bag assembly. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bag assembly.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the air bag assembly. Recommended application : 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the passenger air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the passenger air bag assembly deployed as intended, proceed with Steps 20 through 23.

20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE HOT. ALLOW THE AIR BAG ASSEMBLY TO

COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED INFLATOR MODULE NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY. AFTER AN AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE AIR BAG ASSEMBLY WILL BE HOT. DO NOT TOUCH THE METAL AREAS OF THE AIR BAG ASSEMBLY FOR ABOUT THIRTY MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG ITSELF.

21. Disconnect the pigtail adapter from the air bag assembly as soon after deployment as possible to avoid damage to the pigtail adapter or SRS deployment harness from contacting the hot air bag assembly canister. The pigtail adapter and SRS deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following the above procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

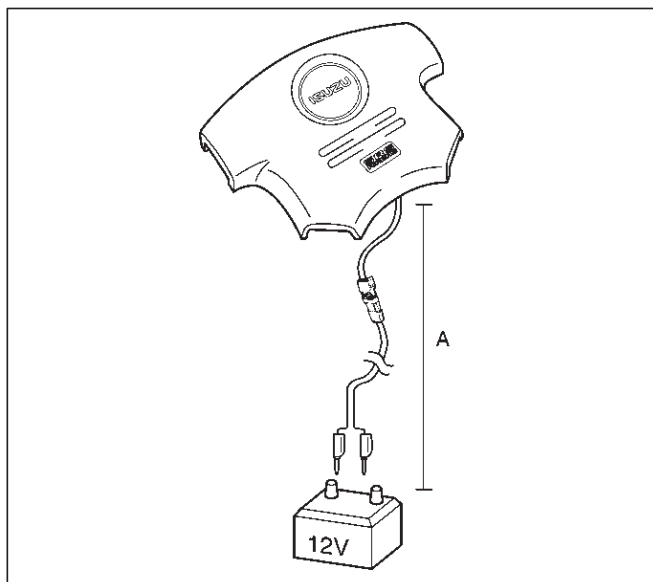
26. Temporarily store the air bag assembly with the bag facing up, away from the surface upon which it rests.

Deployment Outside Vehicle (Fixing Air Bag on Tire)

Read and understand the items of "CAUTIONS ABOUT AIR BAG DEPLOYMENT AND DISPOSAL PROCEDURES" and "Usage of Deployment Tool" for safe deployment of air bag.

1. Remove air bag assembly from vehicle. Refer to air bag assembly Removal "in this section".

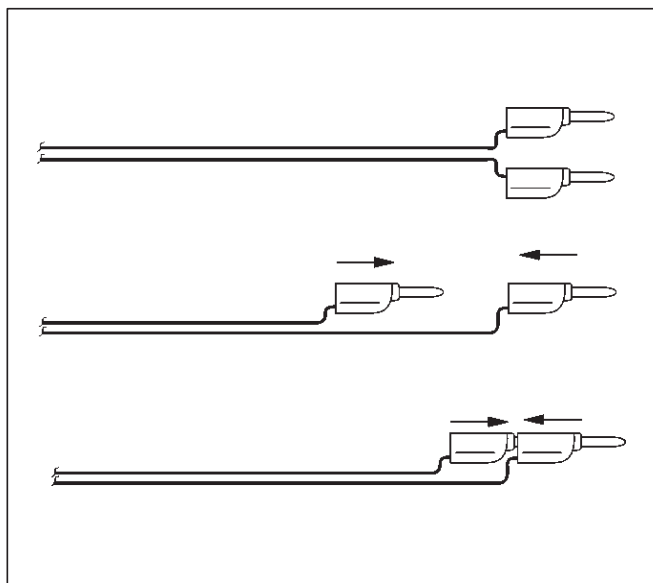
2. Inspect J-41434 Supplemental Restraint System (SRS) Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail is damaged, discard and obtain a replacement.
3. Extend double pole extension cord to a position far away 10 m (33 feet) from the air bag assembly.
4. Place a power source near the extended end of SRS air bag deployment harness. (Use of 12V battery is recommended).



Legend

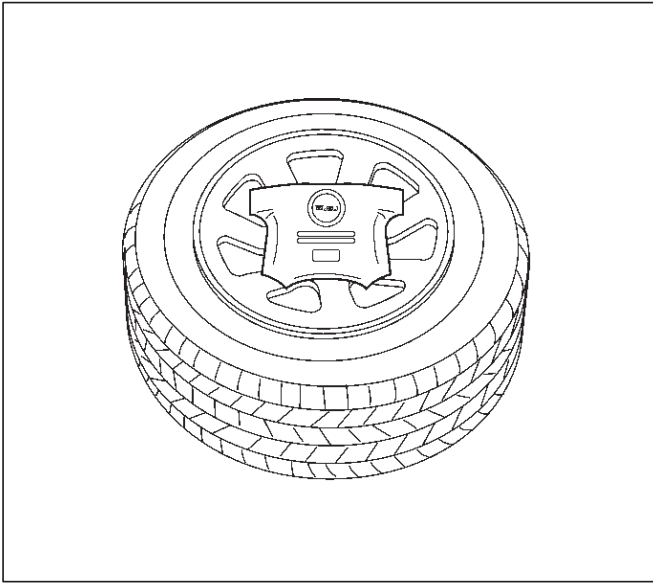
- (A) 10 m (33 feet) or more

5. Insert one of the banana plugs into the other banana plug to short the two SRS air bag deployment harness. Do not the harness to a power source until deployment.



9J-18 SUPPLEMENTAL RESTRAINT SYSTEM

6. Prepare four 15 inch or larger tires without wheel and two same size tires with wheels.



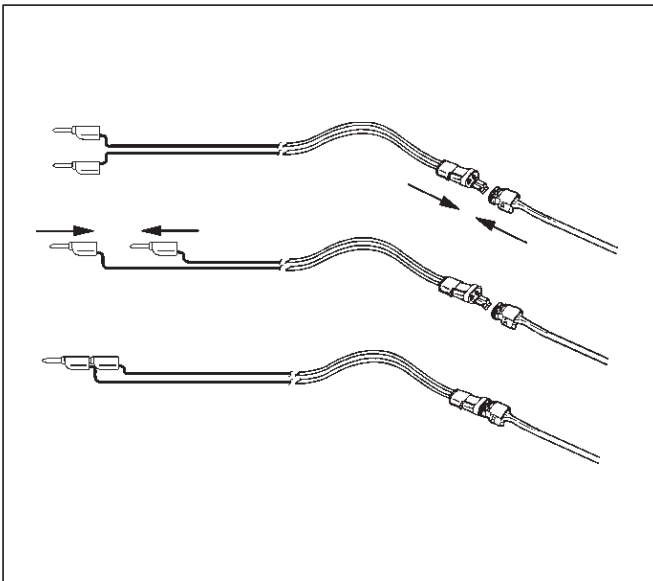
827RW056

7. How to fix Driver air bag.

1. Fix the air bag with its trim cover up on a tire with a wheel using an automobile use wire harness, (core size: 0.05 inch) or a wire trebly at two or more points.
2. Connect SRS air bag assembly to the double pole extension cord of the air bag deployment harness.

Do not connect the deployment harness to a power source until air bag deployment.
(If connected the SRS air bag assembly deploys immediately)

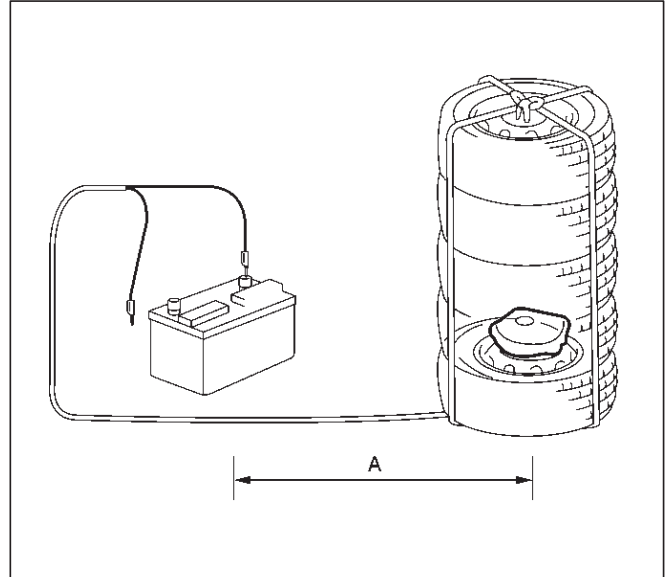
NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in non deployment of the air bag assembly.



827RW054

3. Place three tires without wheel on the tire on which air bag is fixed and a tire with a wheel on top.

Bind the five tires with a rope so that the tires may not collapse.



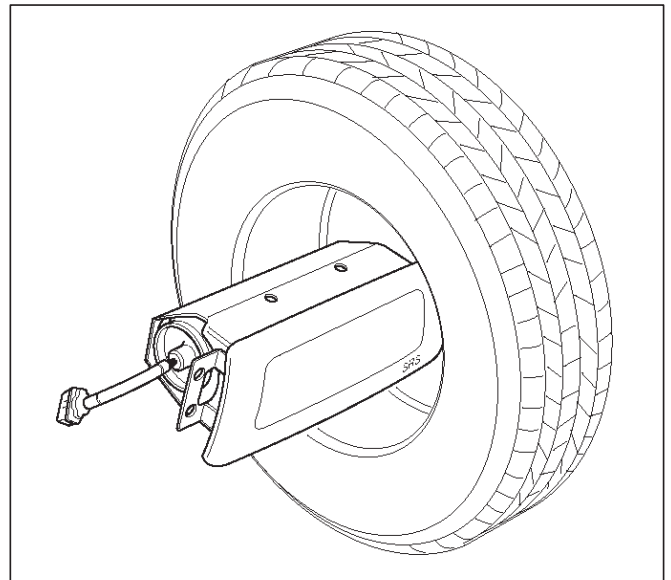
827RW053

Legend

- (A) 10 m (33 feet) or more

8. How to fix Passenger air bag.

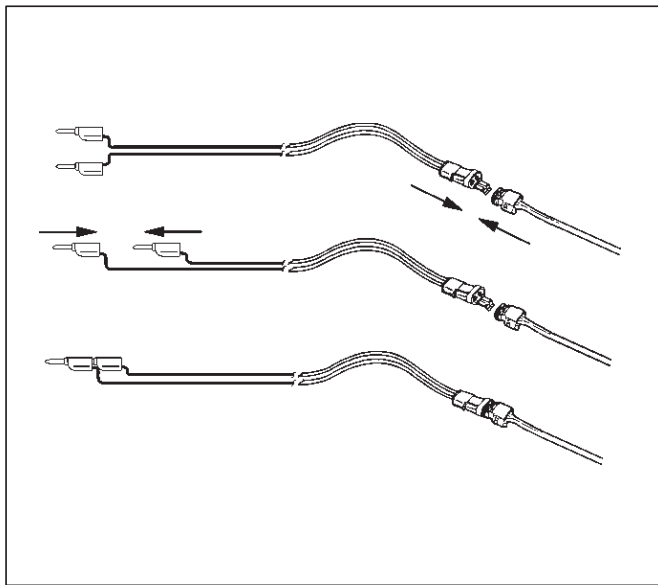
1. Fix the air bag with its trim cover side fixing the center of a tire without a wheel using an automobile use wire harness, (core size: 0.05 inch) or a wire trebly at two or more points.



901RX045

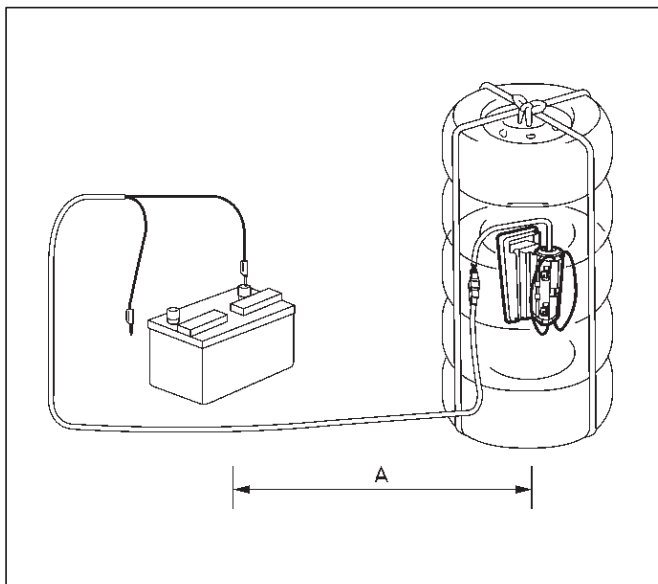
2. Connect Supplemental Restraint System (SRS) air bag assembly to the deployment harness double pole extension cord end. Be sure not to connect the deployment harness to a power source. (If connected the SRS air bag assembly deploys immediately).

NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in non deployment of the air bag assembly.



827RW054

- Put a tire without wheel on another, put the tire on which the air bag is fixing, put a tire without a wheel, and finally put a tire with a wheel on top. Bind the tires with a rope so that the tires pile may not collapse.



827RW050

Legend

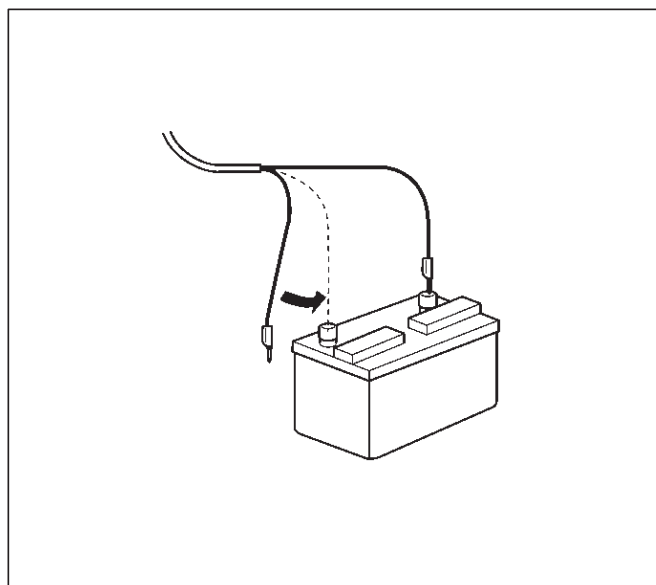
(A) 10 m (33 feet) or more

- Notify all people in the immediate area of your intention to deploy the passenger air bag assembly. The deployment will be accompanied by a substantial noise which may startle the uninformed.

WARNING: DEPLOYED HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED.

THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

- Connect the Supplemental Restraint System (SRS) deployment harness wires to the power source to immediately deploy the air bag assembly. Recommended application : 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.



827LW011

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED INFLATOR MODULE NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY. AFTER AN AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE AIR BAG ASSEMBLY WILL BE HOT. DO NOT TOUCH THE METAL AREAS OF THE AIR BAG ASSEMBLY FOR ABOUT THIRTY MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG IT SELF.

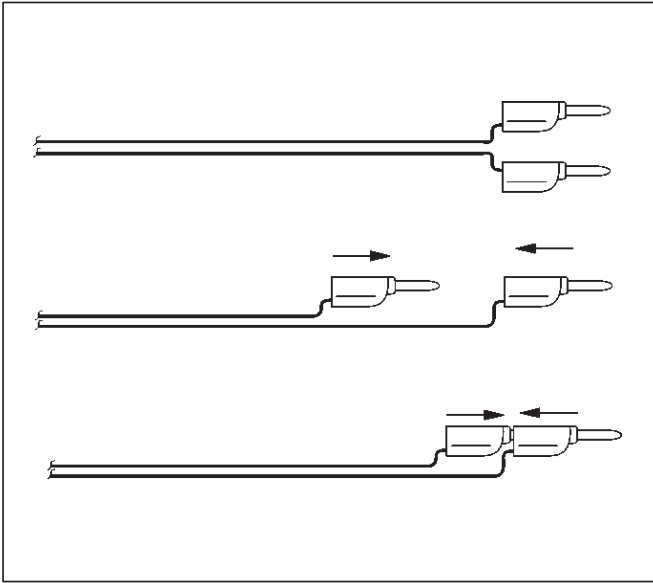
- Disconnect the pigtail adapter from the air bag assembly as soon after deployment as possible to avoid damage to the pigtail adapter or SRS deployment harness from contacting the hot air bag assembly canister. The pigtail adapter and SRS deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
- Dispose of the deployed air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.

9J-20 SUPPLEMENTAL RESTRAINT SYSTEM

13. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following the above procedures.

14. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.

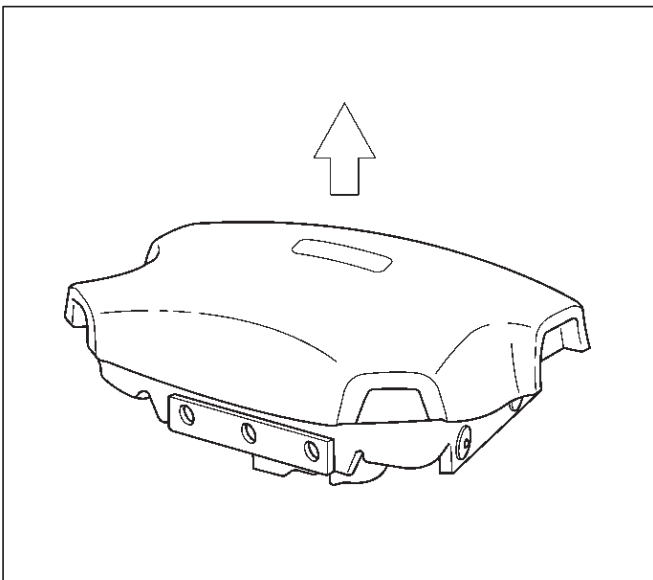


827RW055

15. Disconnect the pigtail adapter from the air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

16. Temporarily store the air bag assembly with the bag facing up, away from the surface upon which it rests.



066RW030

Deployment Inside Vehicle (Vehicle Scraping Procedure)

Deployment inside vehicle is proper when the vehicle is to be destroyed or salvaged for component parts. This includes, but is not limited to, the following situations:

1. The vehicle has completed its useful life.
2. The vehicle has been damaged beyond repair in a nondeployment type accident.
3. The vehicle has been stripped or damaged beyond repair in a theft.
4. The vehicle will be salvaged for component parts to be used on a vehicle with a different Vehicle Identification Number (VIN) as opposed to being rebuilt as same VIN. Never use SRS components from another vehicle.

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

1. Turn ignition switch to "LOCK," remove key and put on safety glasses.
2. Remove all loose objects from front seats.
3. Disconnect driver air bag assembly, yellow 2-pin connector located at the base of the steering column.
4. Cut the driver air bag assembly yellow 2-pin harness connector from the vehicle leaving at least 15 cm (six inches) of wire at the connector.
5. Strip 13 mm (1/2 inch) of insulation from yellow – green and yellow – black wire lead of the connector.
6. Cut two 900 cm (30 feet) deployment wires from 0.8 mm² (18 gauge) or thicker multi-strand wire. These wires will be used to fabricate the driver deployment harness.
7. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
8. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND BE NOT CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES

THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

9. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
10. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
11. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
12. Connect the deployment harness to the driver air bag assembly, yellow 2-pin connector at the base of the steering column. Route deployment harness out the driver side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED.

THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT.

CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE.

FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

13. Disconnect passenger air bag assembly, yellow 2-pin connector located behind glove box assembly.
14. Cut the passenger air bag assembly harness connector from the vehicle leaving at least 15 cm (six inches) of wire at the connector.
15. Strip 13 mm (1/2 inch) of insulation from blue-white and pink-blue wire lead of the connector.
16. Cut two 900 cm (30 feet) deployment wires from 0.8 mm² (18 gauge) or thicker multi-strand wire. These wires will be used to fabricate the passenger deployment harness.
17. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
18. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

19. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
20. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
21. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
22. Connect the deployment harness to the passenger air bag assembly, yellow 2-pin connector located behind the glove box assembly. Route deployment harness out the passenger side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

23. Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
24. Stretch the driver and passenger deployment harness to their full length.
25. Completely cover windshield area and front door window openings with a drop cloth, blanket or similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
26. Notify all people in the immediate area that you intend to deploy the air bags. The deployment will be accompanied by a substantial noise which may startle the uninformed.
27. Separate the two ends of the driver deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bags.

9J-22 SUPPLEMENTAL RESTRAINT SYSTEM

28. Connect the driver deployment harness wires to a power source to immediately deploy the driver air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
29. Separate the two ends of the passenger deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

30. Connect the passenger deployment harness wires to a power source to immediately deploy the passenger air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested. (Driver air bag assembly) Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After the air bag assembly has been deployed, the surface of the air bag may contain solid particulate. This solid particulate consists primarily of by products of the chemical reaction, Potassium Chloride and copper metal dust. Compounds of Potassium Borate, Strontium Chloride, Copper Chloride, and Ammonium Chloride may be found in amounts of about 1 % (each) of the total particulate.
(Passenger air bag assembly)

Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE HOT DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW

PROCEDURES COULD RESULT IN FIRE OR PERSONAL INJURY.

After an air bag assembly has been deployed, the metal canister and surrounding areas of the air bag assembly will be very hot. Do not touch the metal areas of the air bag assembly for about 30 minutes after deployment. If the deployed air bag assembly must be moved before it is cool, wear gloves and handle by the air bag or trim cover.

31. Short the driver deployment harness wires by twisting together one end from each. Repeat this procedure for the passenger deployment harness.
32. Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
33. Disconnect driver deployment harness and passenger deployment harness from vehicle and discard.
34. In the unlikely event that either or both of the air bag assemblies did not deploy after following these procedures, proceed immediately with Steps 36 through 37. If the air bag assembly deployed, proceed to step 35.
35. With both air bags deployed, the vehicle may be scrapped in the same manner as a non-SRS equipped vehicle.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following these procedures.

36. Remove the undeployed air bag assembly (s) from the vehicle. For driver air bag assembly refer to in the "Passenger Air Bag Assembly Removal" in this manual.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN PERSONAL INJURY.

37. Temporarily store the air bag assembly with the air bag opening facing up, away from the surface upon which it rests.

Deployed Air Bag Assembly Handling

Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue.

(Passenger air bag assembly)

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium

carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

(Driver air bag assembly)

After the air bag assembly has been deployed, the surface of the air bag may contain solid particulate. This solid particulate consists primarily of by products of the chemical reaction, Potassium Chloride and copper metal dust. Compounds of Potassium Borate, Strontium Chloride, Copper Chloride, and Ammonium Chloride may be found in amounts of about 1 % (each) of the total particulate.

Deployment Outside Vehicle (Pretensioner Seat Belt Assembly)

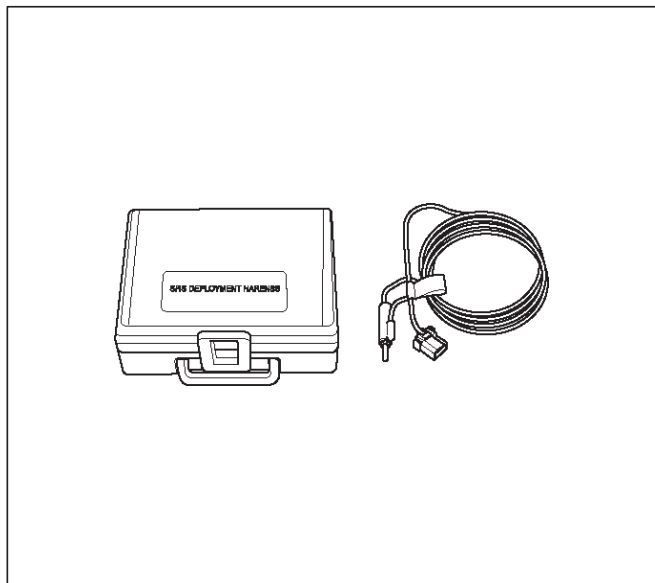
Deployment outside the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which the vehicle will be returned to useful service after a functionally or cosmetically deficient pretensioner seat belt assembly is replaced. Deployment and disposal of a malfunctioning pretensioner seat belt assembly is, of course, subject to any required retention period.

For deployment of a live (undeployed) pretensioner seat belt assembly outside the vehicle, the deployment procedure must be followed exactly. Always wear gloves and safety glasses during this deployment procedure until a deployed pretensioner seat belt assembly is scrapped or until an undeployed pretensioner seat belt assembly is shipped. Before performing the procedures you should be familiar with servicing the system and with proper handling of the pretensioner seat belt assembly. Procedures should be read fully before they are performed.

The following procedure requires use of SRS deployment harness with appropriate pigtail adapter. Do not attempt procedure without adapter.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE PRETENSIONER SEAT BELT ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT ASSEMBLY WILL IMMEDIATELY DEPLOY THE PRETENSIONER SEAT BELT WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR GLOVES AND SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

1. Turn ignition switch to "LOCK", remove key.
2. Remove the pretensioner seat belt assembly from vehicle. Refer to "Pretensioner Seat Belt Removal" in this manual.
3. Prepare SRS deployment harness.



901HV009

4. Short the two SRS deployment harness leads together by fully seating one banana plug into the other. SRS deployment harness shall remain shorted and not be connected to a power source until the pretensioner seat belt is to be deployed.
5. Place the pretensioner seat belt assembly on a work bench or other surface away from all loose or flammable objects.

WARNING: WHEN FIXING THE DEPLOYMENT DEVICE OF PRETENSIONER SEAT BELT, THE DEPLOYMENT DEVICE SHOULD BE FIXED AWAY FROM OTHER PERSON

6. Clear a space on the ground about 183 cm (six feet) in diameter where the pretensioner seat belt assembly is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the deployment area.
7. Stretch the SRS deployment harness and pigtail adapter from the pretensioner seat belt assembly to its full length.
8. Place a power source near the shorted end of the SRS deployment harness. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
9. Deployment harness shall remain shorted and not be connected to a power source until the pretensioner seat belt is to be deployed. The pretensioner seat belt assembly will immediately deploy the pretensioner seat belt when a power source is connected to it.
10. Verify that the area around the pretensioner seat belt assembly is clear of all people and loose or flammable objects.
11. Notify all people in the immediate area that you intend to deploy the driver air bag. The deployment will be accompanied by a substantial noise which may startle the uninformed.
12. Connect the pretensioner seat belt to the pigtail adapter on the SRS deployment harness.

9J-24 SUPPLEMENTAL RESTRAINT SYSTEM

NOTE: Ensure that the pigtail adapter is firmly seated into the pretensioner seat belt assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the pretensioner seat belt assembly connector functioning (shorted) and may result in nondeployment of the pretensioner seat belt assembly.

13. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the pretensioner seat belt deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the pretensioner seat belt.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT ASSEMBLY WILL IMMEDIATELY DEPLOY THE PRETENSIONER SEAT BELT WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE PRETENSIONER SEAT BELT ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

14. Connect the SRS deployment harness wires to the power source to immediately deploy the pretensioner seat belt. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
15. Disconnect the SRS deployment harness from the power source.
16. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
17. In the unlikely event that the pretensioner seat belt assembly did not deploy after following these procedures, proceed immediately with Steps 21 through 24. If the pretensioner seat belt assembly did deploy, proceed with Steps 15 through 20.
- 18.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED PRETENSIONER SEAT BELT ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE PRETENSIONER SEAT BELT ASSEMBLY WILL BE VERY HOT. ALLOW THE INFLATOR MODULE TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED PRETENSIONER SEAT BELT ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY.

AFTER A DRIVER PRETENSIONER SEAT BELT ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE DRIVER PRETENSIONER SEAT BELT ASSEMBLY WILL BE VERY HOT. DO NOT TOUCH THE METAL AREAS OF THE PRETENSIONER SEAT BELT ASSEMBLY FOR ABOUT TEN MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED PRETENSIONER

SEAT BELT ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE PRETENSIONER SEAT BELT OR TRIM COVER.

19. Disconnect the pigtail adapter from the pretensioner seat belt assembly as soon after deployment as possible. This will prevent damage to the pigtail adapter or SRS deployment harness due to possible contact with the hot pretensioner seat belt assembly canister. The pigtail adapter can be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
20. Dispose of the deployed pretensioner seat belt assembly through normal refuse channels after it has cooled for at least 30 minutes.
21. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the pretensioner seat belt assembly did not deploy after following these procedures.

22. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
23. Disconnect the pigtail adapter from the pretensioner seat belt assembly.
24. Remove the undeployed pretensioner seat belt from the special tool.

WARNING: WHEN STORING A LIVE PRETENSIONER SEAT BELT ASSEMBLY OR WHEN LEAVING A LIVE INFLATOR MODULE UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS PUT THE PRETENSIONER SEAT BELT HORIZONTAL PLACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE PRETENSIONER SEAT BELT TO SHRINK IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

25. Temporarily store the pretensioner seat belt assembly with its deployment device facing up, away from the surface upon which it rests.

Deployment Inside Vehicle (Pretensioner Seat Belt Vehicle Scrapping Procedure)

Deployment inside vehicle is proper when the vehicle is to be destroyed. This includes, but is not limited to, the following situations:

1. The vehicle has completed its useful life.
2. The vehicle has been damaged beyond repair in a nondeployment type accident.
3. The vehicle has been stripped or damaged beyond repair in a theft.

NOTE: The vehicle will be salvaged for component parts to be used on a vehicle with a different Vehicle Identification Number (VIN) as opposed to being rebuilt as same VIN. Never use pretensioner seat belt components from another vehicle.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES

TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE PRETENSIONER SEAT BELT ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT ASSEMBLY WILL IMMEDIATELY DEPLOY THE PRETENSIONER SEAT BELT WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

1. Turn ignition switch to "LOCK," remove key and put on safety glasses.
2. Remove all loose objects from front seats.
3. Disconnect pretensioner seat belt assembly, yellow 2-pin connector located at the base of the seat.
4. Prepare SRS deployment harness.
5. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
6. Deployment harness shall remain shorted and not be connected to a power source until the pretensioner seat belt is to be deployed.
7. Route deployment harness out the driver side of the vehicle.
8. Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
9. Stretch the SRS deployment harness to their full length.
10. Connect the deployment harness to the pretensioner seat belt assembly, yellow 2-pin connector at the base of the seat.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT ASSEMBLY WILL IMMEDIATELY DEPLOY THE PRETENSIONER SEAT BELT WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE PRETENSIONER SEAT BELT ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

11. Notify all people in the immediate area that you intend to deploy the pretensioner seat belt. The deployment will be accompanied by a substantial noise which may startle the uninformed.
12. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the pretensioner seat belt deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the pretensioner seat belt.

13. Connect the SRS deployment harness wires to a power source to immediately deploy the pretensioner seat belt assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT ASSEMBLY WILL IMMEDIATELY DEPLOY THE PRETENSIONER SEAT BELT WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES SHOULD ALWAYS BE THE FINAL STEP IN THE PRETENSIONER SEAT BELT ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

14. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
15. Disconnect the deployment harness to the pretensioner seat belt assembly, yellow 2-pin connector at the base of the seat.
16. In the unlikely event that the pretensioner seat belt assembly did not deploy after following these procedures, proceed immediately with Steps 18 through 19. If the pretensioner seat belt assembly deployed as intended, proceed with Steps 14 through 17.
17. With both air bags and pretensioner seat belt deployed, the vehicle may be scrapped in the same manner as a non-SRS equipped vehicle.

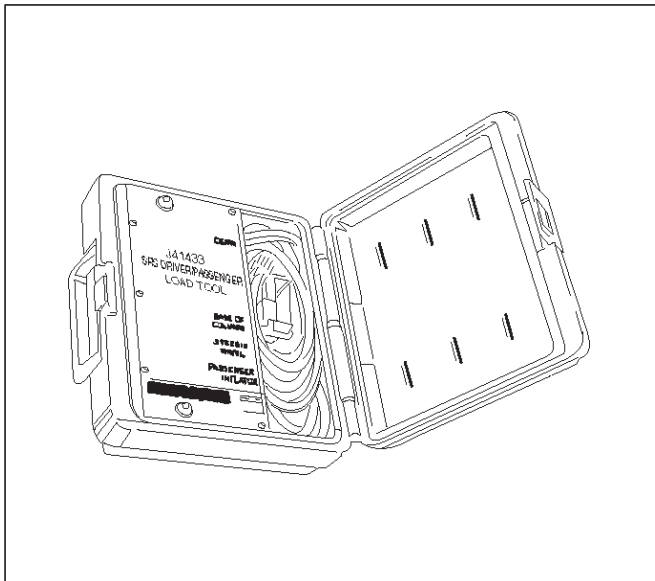
NOTE: The remaining steps are to be followed in the unlikely event that the pretensioner seat belt assembly did not deploy after following these procedures.

18. Remove the undeployed pretensioner seat belt assembly (s) from the vehicle. For pretensioner seat belt assembly refer to in the "Pretensioner Seat Belt Assembly Removal" in this manual.
19. Temporarily store the pretensioner seat belt assembly with the deployment device facing up, away from the surface upon which it rests.

Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY-POWERED OR AC-POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED PROBE-TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

5-8840-2421-0 SRS Driver/Passenger Load Tool



The SRS Driver/Passenger Load Tool 5-8840-2421-0 is used only when called for in this section. It is used as a diagnostic aid and safety device to prevent inadvertent air bag assembly deployment.

The load tool has three yellow connectors attached to its case.

The three small connectors are electrically functional and serve as resistive load substitutions.

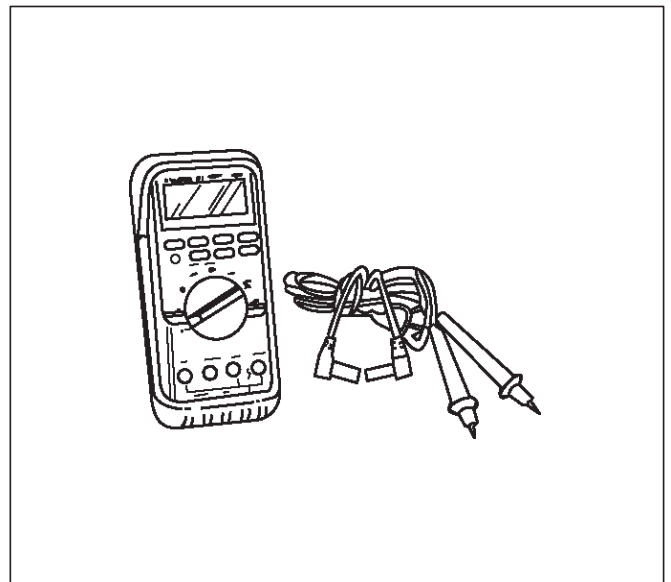
No more than two connectors are used at any time. One of the small connectors is used to substitute for the load of the driver air bag assembly when it is connected at the top of the column to the SRS coil assembly. Another small connector is used to substitute for the load of the driver air bag assembly and the SRS coil assembly when it is connected at the base of the column to the SRS wiring harness. The third small connector is used to substitute for the load of the passenger air bag assembly and pretensioner seat belt assembly when connected to the passenger air bag assembly and pretensioner seat belt assembly harness connector.

By substituting the resistance of the load tool when called for, a determination can be made as to whether an inflator circuit component is causing system malfunction and which component is causing the malfunction. The load

tool should be used only when specifically called for in the diagnostic procedures.

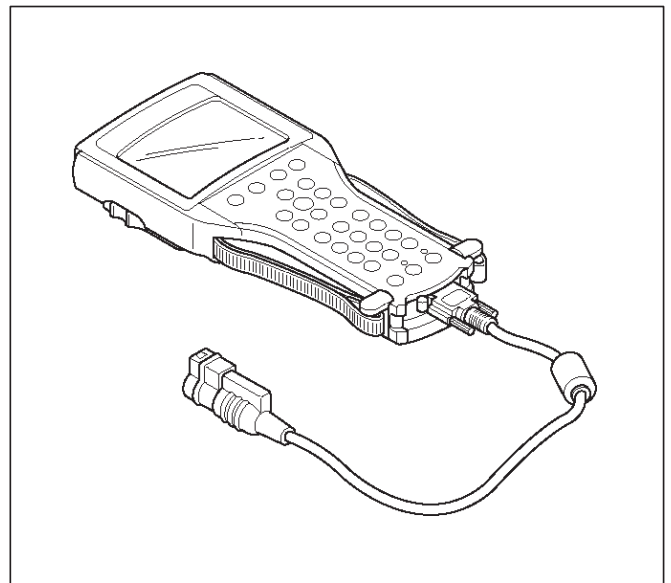
NOTE: If comand to use 5-8840-2421-0 load tool when repair the pretensioner seat belt, connect load tool connector to use for driver air bag and/or passenger air bag connector.

5-8840-0285-0 DVM



The 5-8840-0285-0 DVM is the preferred DVM for use in SRS diagnosis and repair. However, 5-8840-0366-0 may be used if 5-8840-0285-0 is not available. No other DVMs are approved for SRS diagnosis and repair.

Scan Tool



The Tech 2 is used to read and clear SRS Diagnostic Trouble Codes (DTCs). Refer to the Tech 2 Operators, Manual for specific information on how to use the Tech 2.

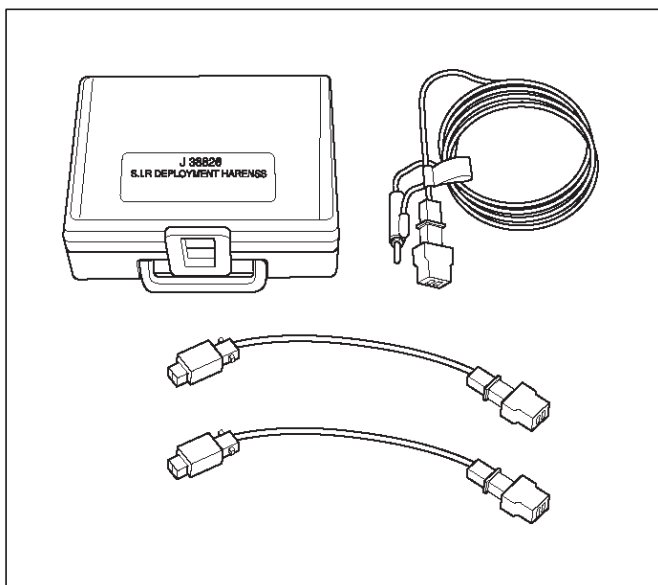
5-8840-0385-0 Connector Test Adapter Kit



901RS151

The 5-8840-0385-0 Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the appropriate adapter will ensure that no damage to the terminal will occur from the DVM probe, such as spreading or bending. The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.

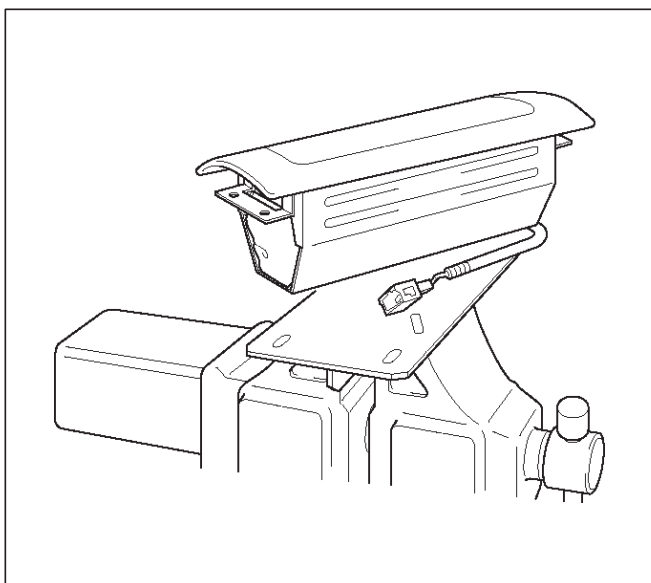
5-8840-2468-0 SRS Deployment Tool



901RW106

The 5-8840-2468-0 SRS Deployment Tool must be used for deployment of the undeployed air bag, and/or pretensioner seat belt.

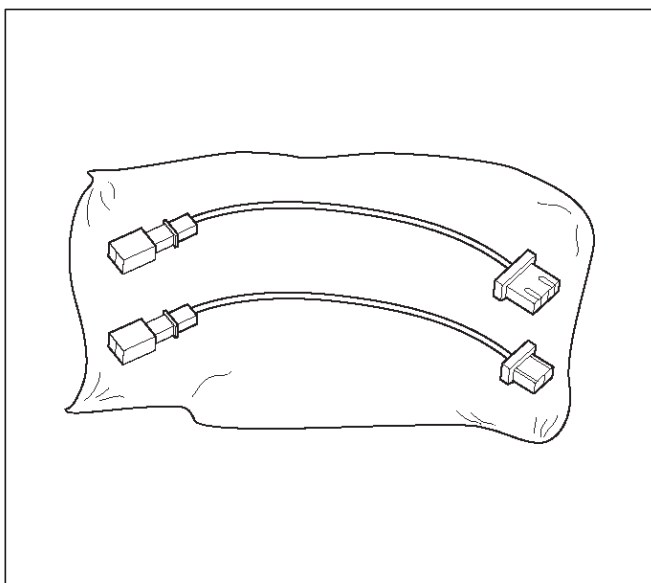
5-8840-2420-0 SRS Deployment Fixture



901RW199

The 5-8840-2420-0 SRS Deployment Fixture must be used for deployment of the undeployed passenger side air bag.

5-8840-2469-0 SRS Adapter for Load Tool.



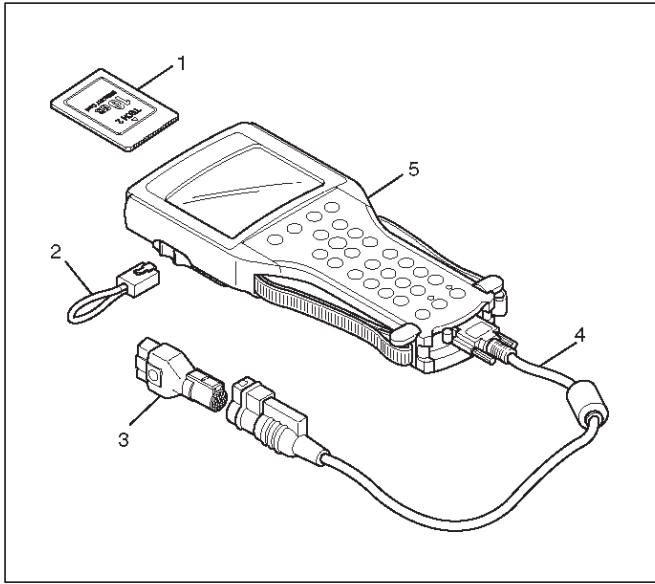
901RW107

The 5-8840-2469-0 SRS Adapter for Load Tool must be used with 5-8840-2421-0 SRS Driver/Passenger Load Tool.

9J-28 SUPPLEMENTAL RESTRAINT SYSTEM

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



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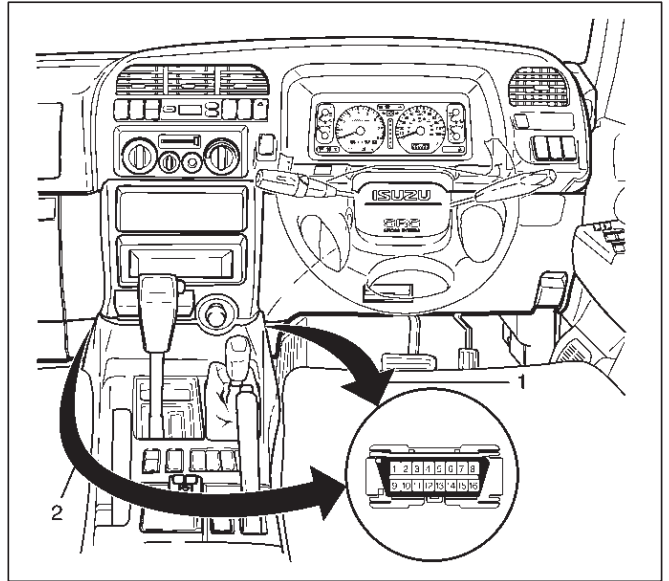
Legend

- (1) PCMCIA Card
- (2) RS 232 Loop Back Connector
- (3) SAE 16/19 Adaptor
- (4) DLC Cable
- (5) Tech-2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. Insert the Isuzu 98 System PCMCIA card (1) into the Tech 2 (5).
 2. Connect the SAE 16/19 adaptor (3) to the DLC cable (4).

3. Connect the DLC cable to the Tech 2 (5)
4. Make sure of the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adaptor to the vehicle ALDL/DLC connector.



060RW220

Legend

- (1) For RHD model
- (2) For LHD model

6. Turn on the vehicle ignition switch.
7. Verify the Tech 2 power up display.

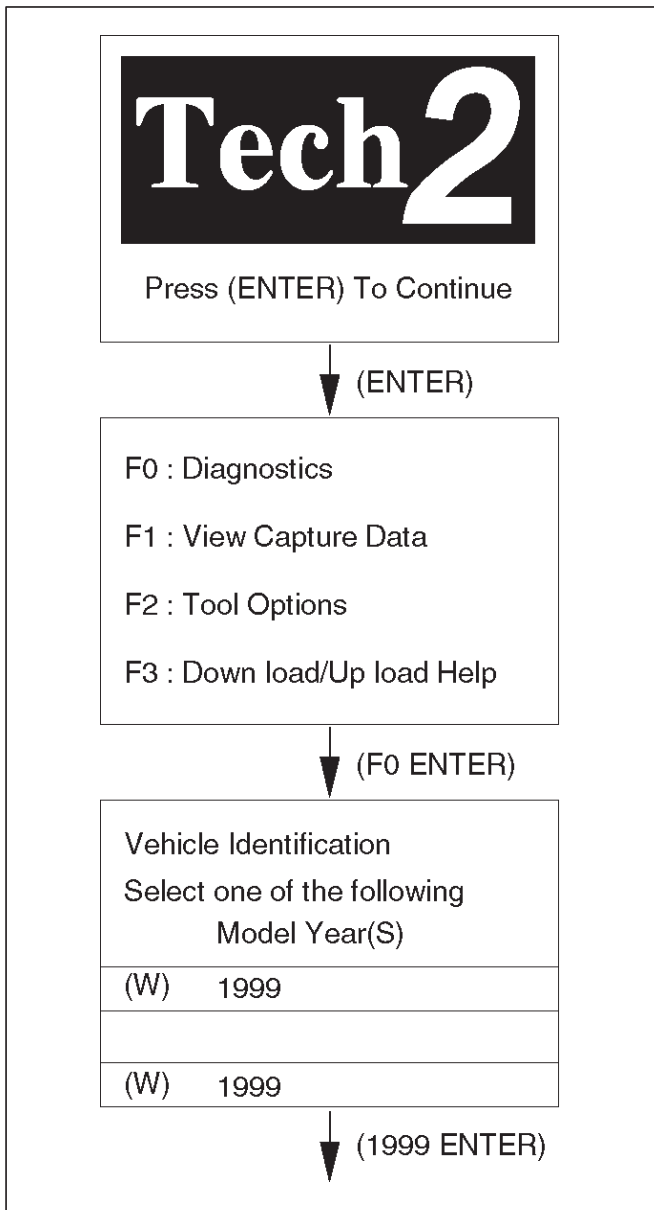


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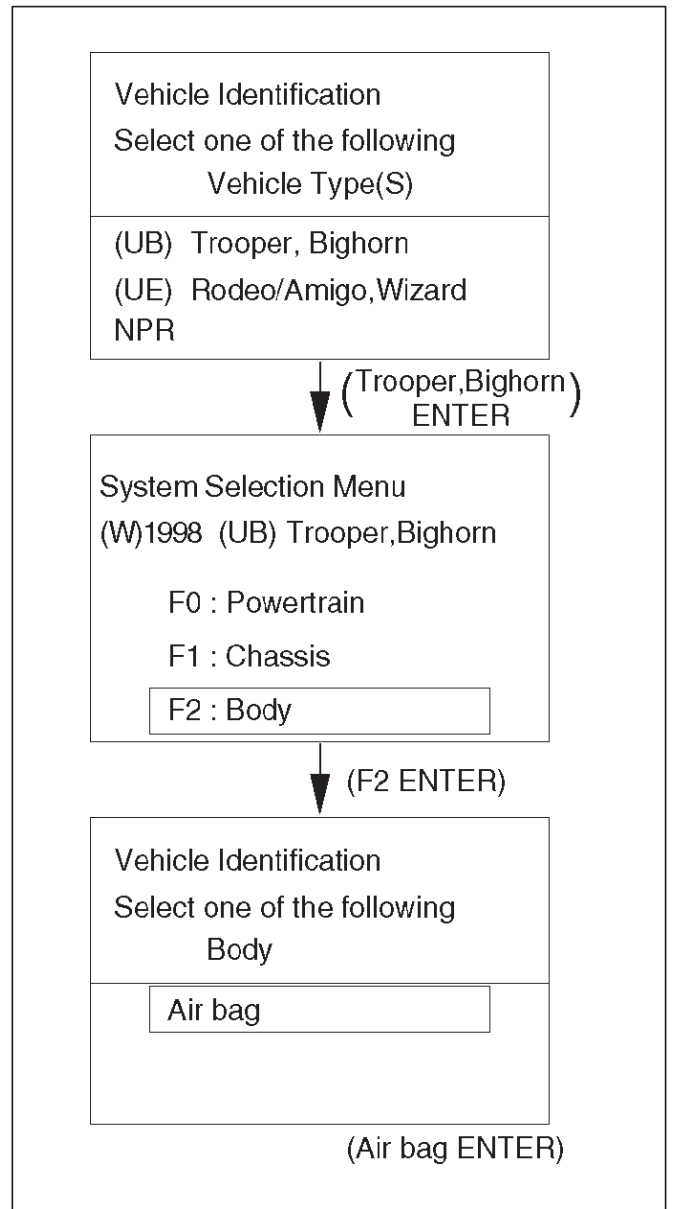
NOTE: The RS232 Loop back connector is only used to diagnosis Tech 2. Refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



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Service Precautions for SRS Component Service

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned “OFF,” the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the “C–21” fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the “Disabling the SRS” procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to “OFF” and turn the steering wheel so that the vehicle’s wheels are pointing straight ahead.

1. Remove SRS fuse “C–21” from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly; Refer to “Passenger air bag assembly replacement” in this section.
4. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.

CAUTION: With the “C–21” fuse removed and ignition switch “ON,” the “AIR BAG” warning lamp will be “ON.” This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

Turn ignition switch to “LOCK” and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.

2. Install glove box assembly. Refer to “Passenger Air Bag Assembly Replacement” in this section.
3. Connect yellow 2–pin connector at the base of the steering column.
4. Install “AIR BAG” fuse “C–21” to left dash side lower fuse block or connect battery.

Turn ignition switch to “ON” and verify that the “AIR BAG” warning lamp turn on 3.5 seconds and then turns “OFF.” If it does not operate as described, perform the “SRS Diagnostic System Check” in this section.

Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 93°C (200°F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the SDM pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The “SRS Diagnostic System Check” must be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” will verify proper “AIR BAG” warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacements.

Inspections Required After An Accident

CAUTION: Certain SRS components must be replaced after a frontal crash involving air bag deployment.

In all types of accidents regardless of “Air Bag” deployment, visually inspect all of the following components and replace as required:

- Driver air bag assembly
- Passenger air bag assembly
- Driver pretensioner assembly
- Passenger pretensioner assembly
- Steering wheel
- SRS coil assembly
- Steering column
- Knee bolster and instrument panel mounting attachments
- Driver seat and belt
- Passenger seat and belt
- SDM

SDM always should be checked according to “SDM Replacement Guidelines.”

CAUTION: Refer to “SDM Replacement Guidelines” below for important information on SDM replacement in both deployment and non-deployment crashes.

Inspect SRS coil assembly wiring and steering wheel for any sign of scorching, melting, or damage due to excessive heat. If coil assembly wire or steering wheel is damaged, replace them. The steering column and wheel must be dimensionally checked to determine if they are damaged. Refer to steering wheel of in this manual.

Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized Isuzu Retailer; they may be used for SRS repairs.

Do not attempt to repair the SDM, the SRS harness, the SRS coil assembly, the air bag assembly, the steering wheel, or the steering column. Service of these items is replacement only. Verify replacement part numbers.

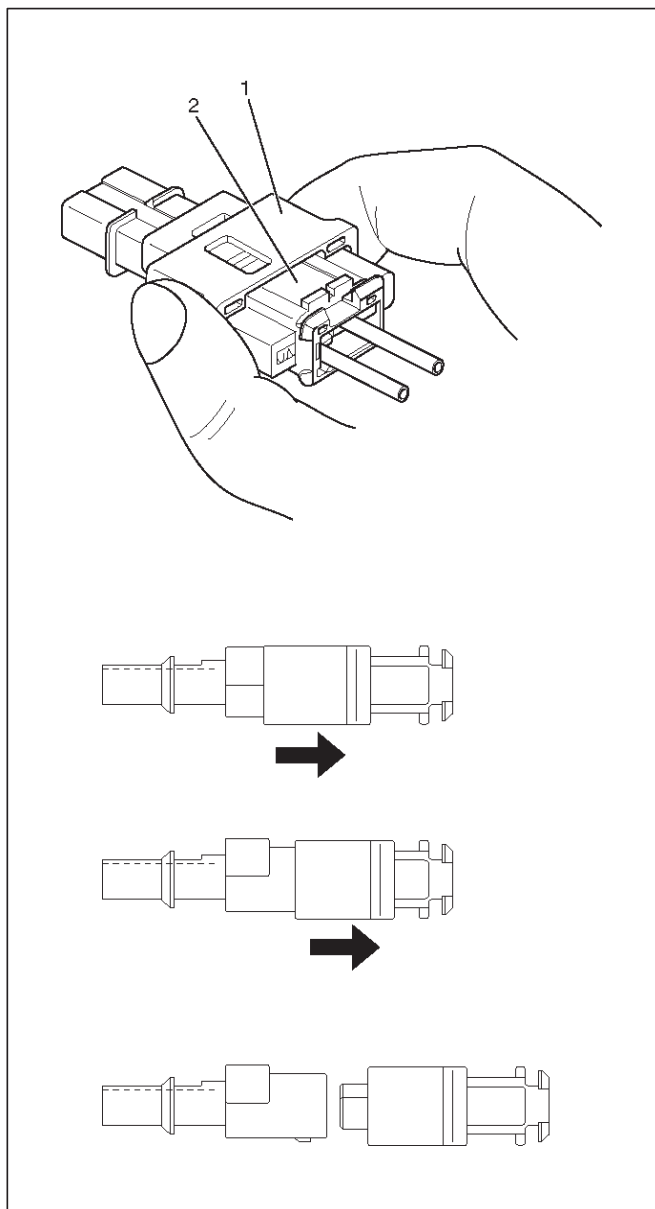
CAUTION: Proper operation of the SDM and supplemental restraint system (SRS) requires that any repairs to the vehicle structure return it to its original production configuration.

SRS Connectors

CAUTION: The special yellow color connectors are used for supplemental restraint system air bag circuit. When removing the cable harness, do not pull the cables otherwise, cable disconnection may occur. When connect the SRS connector, insert the connector completely. Imperfect locking may cause malfunction of SRS circuit.

Removal

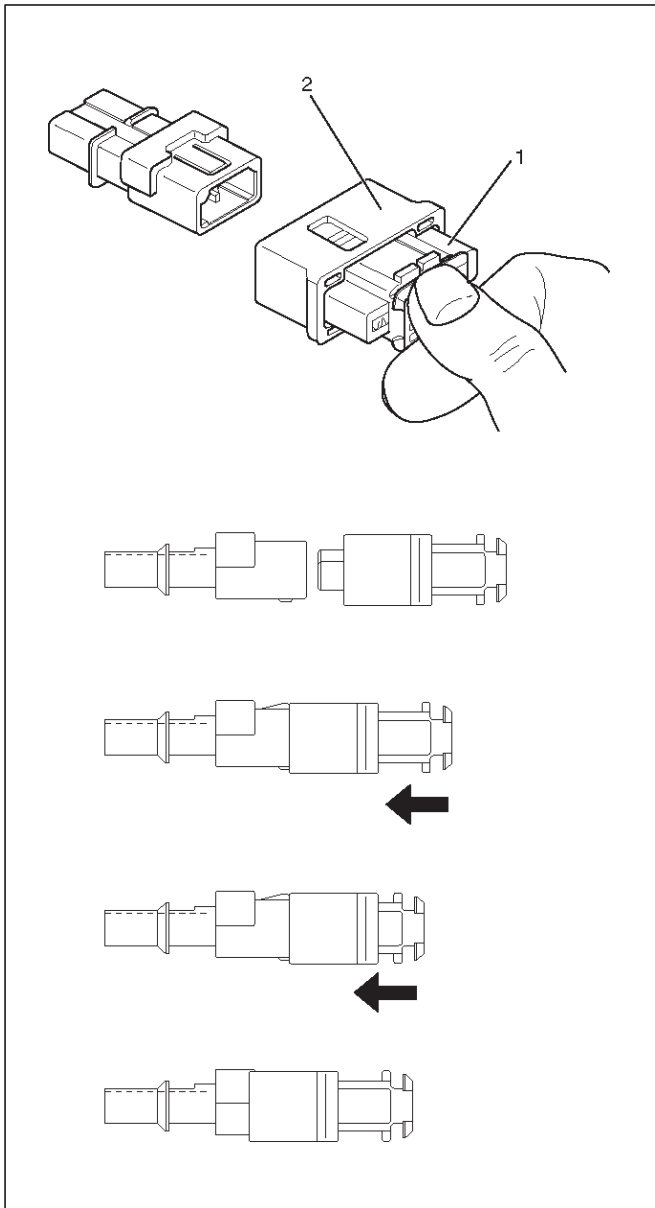
To remove the connector, hold the cover insulator (1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator (2).



9J-32 SUPPLEMENTAL RESTRAINT SYSTEM

Installation

To install the connector, hold the socket insulator (1) and insert it. The cover insulator slides and connector will be locked. Do not hold the cover insulator (2).



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Sensing And Diagnostic Module (SDM)

Service Precautions

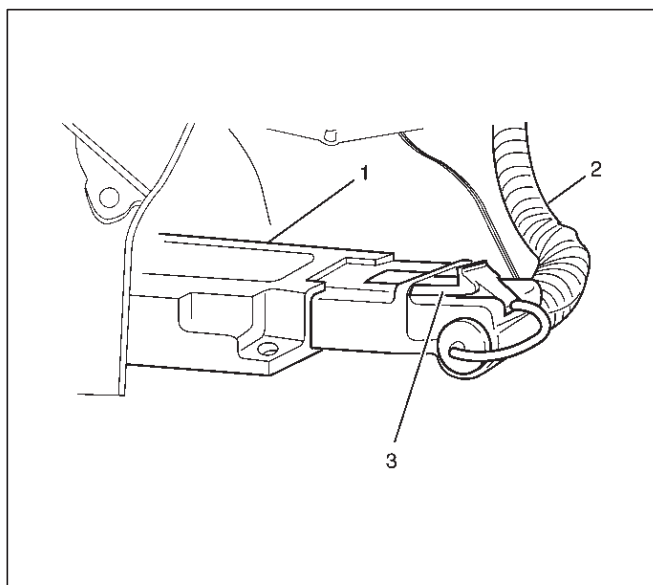
WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING SDM. NEVER STRIKE OR JAR SDM. UNDER SOME CIRCUMSTANCES, IT COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY OR IMPROPER OPERATION OF THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS). SDM MOUNTING BRACKET BOLTS MUST BE CAREFULLY TORQUED TO ASSURE PROPER OPERATION. NEVER POWER UP THE SRS WHEN SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

WARNING: PROPER OPERATION OF THE SENSING AND DIAGNOSTIC MODULE (SDM) REQUIRES THE SDM TO BE RIGIDLY ATTACHED TO THE VEHICLE STRUCTURE AND THAT THE ARROW ON THE SENSOR BE POINTING TOWARD THE FRONT OF THE VEHICLE.

SDM is specifically calibrated and is keyed to the SDM location SRS wiring harness. Caution should be used to ensure proper location of the SDM. The keying of the SDM to its location and wiring harness connectors should never be modified in the field.

Removal

1. Disable the SRS (Refer to "Disabling the SRS" in this section).
2. Remove the transmission knob (for M/T) and transfer lever knob.
3. Remove the front console assembly and disconnect wiring harness connector.
4. Pull CPA (Connector Position Assurance) out and push connector lock down to disconnect the SDM harness connector.
5. Remove the three SDM fixing bolts and remove SDM.



Legend

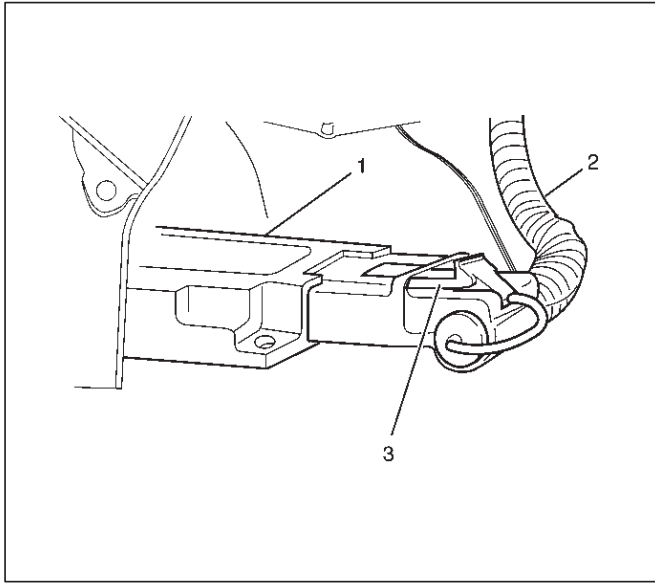
- (1) SDM
- (2) SRS Harness
- (3) Connector Position Assurance

Installation

1. Install the SDM on bracket and fixing bolts and tighten the fixing bolts to the specified torque.
Torque: 10 N·m (1.0 Kg·m/87 lb in)
2. Connect the SDM harness connector and after that, put CPA into connector.
3. Install the front console.
4. Install the transmission knob (for M/T) and transfer lever knob.

9J-34 SUPPLEMENTAL RESTRAINT SYSTEM

5. Enable the SRS (Refer to "Enabling the SRS" in this section).



827RW044

Legend

- (1) SDM
 - (2) SRS Harness
 - (3) Connector Position Assurance
-

Driver Air Bag Assembly

Service Precautions

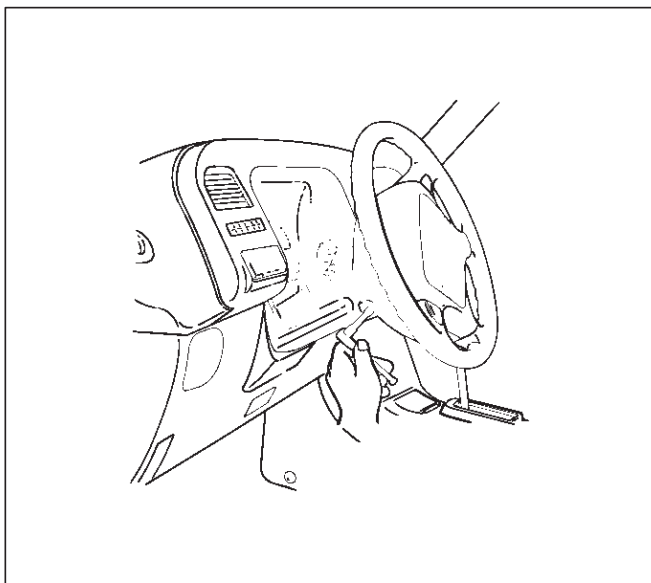
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

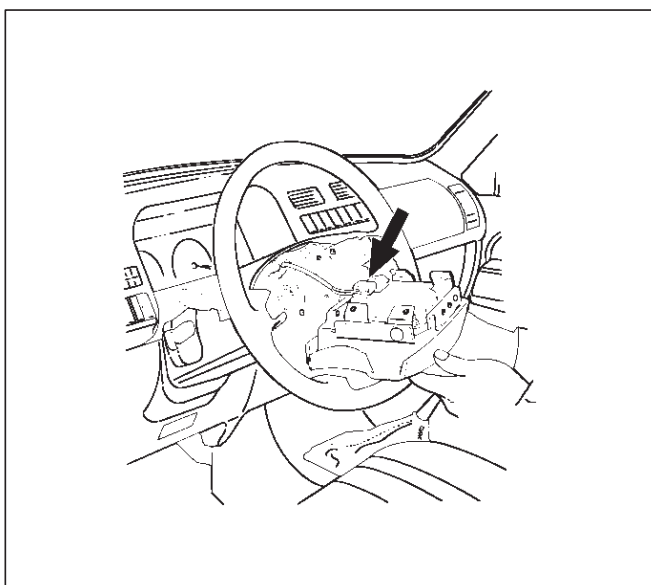
Removal

1. Disable the SRS (Refer to "Disabling the SRS" in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



827RT008

3. Disconnect the yellow 2-pin connector located behind the air bag assembly and remove air bag assembly. Refer to "SRS Connectors" in this section for removal and installation.

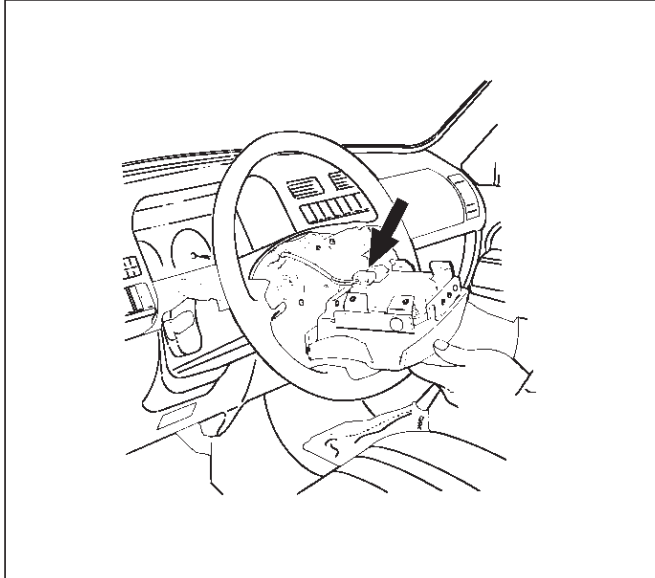


827RT009

Installation

1. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

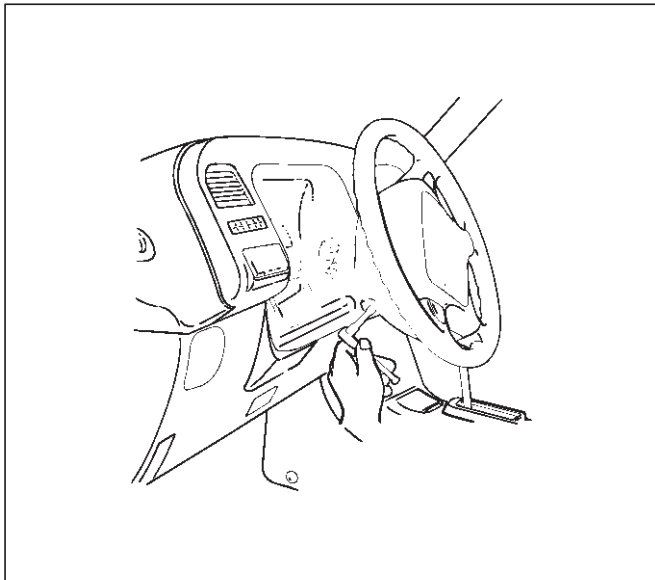


827R009

2. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8.8 N·m (0.9 Kg·m/78 lb in)

CAUTION: Never use the air bag assembly from another vehicle. Use only new air bag assembly proper to the Trooper which is being repaired.



827R008

3. Enable the SRS (Refer to "Enabling the SRS" in this section).

Steering Wheel

Service Precautions

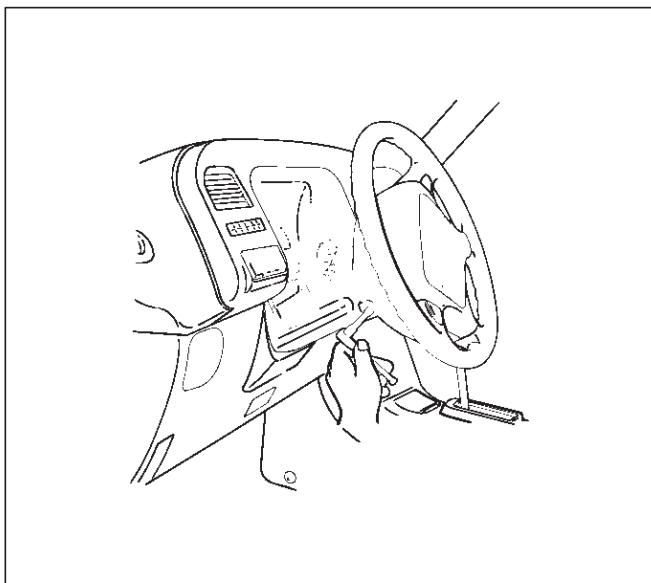
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

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NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

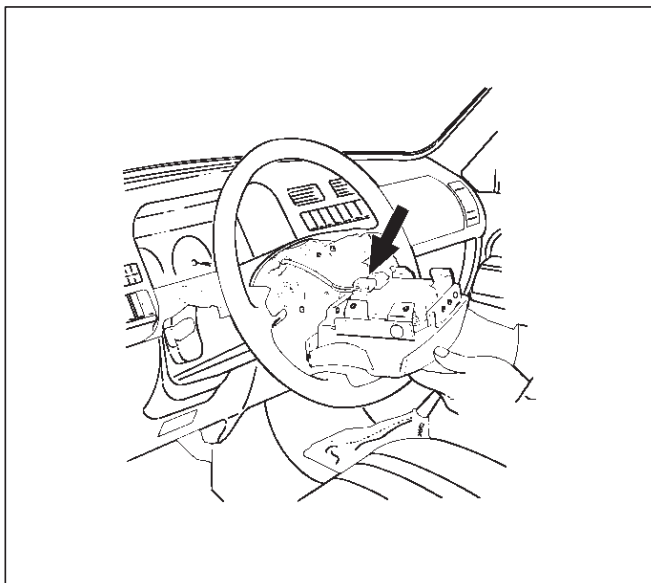
Removal

1. Disable the SRS (Refer to "Disabling the SRS" in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



827RT008

3. Disconnect the yellow 2-pin connector located behind the air bag assembly and remove air bag assembly. Refer to "SRS Connectors" in this section for removal and installation.
4. Disconnect horn lead.

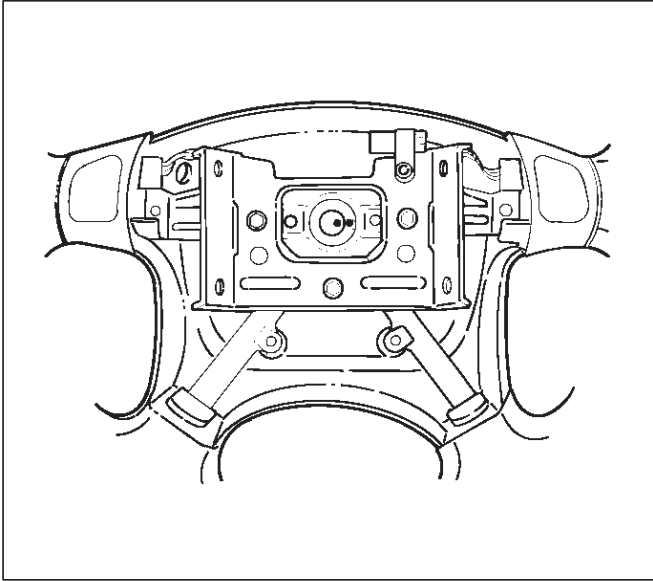


827RT009

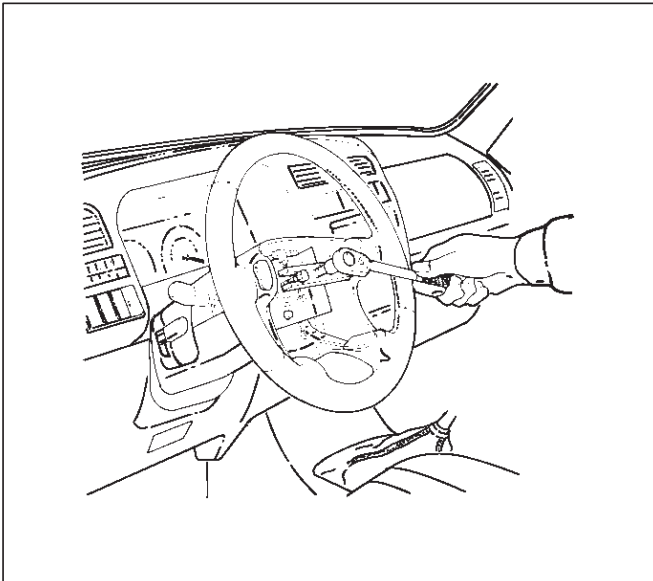
5. Remove steering wheel attachment nut.

9J-38 SUPPLEMENTAL RESTRAINT SYSTEM

6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



7. Move the tires to the straight ahead position before removing the steering wheel. Install steering wheel puller onto steering wheel and remove steering wheel with 5-8521-0016-0.

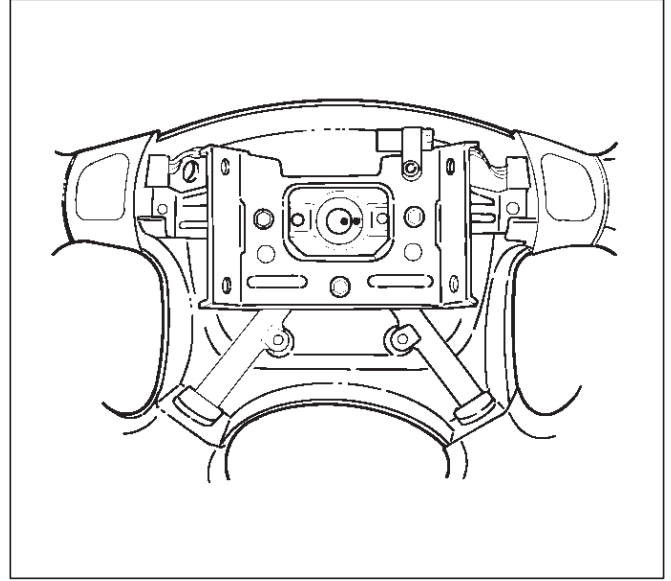


8. Feed wiring through the wheel and remove wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

Installation

1. Install the steering wheel and align the setting marks.

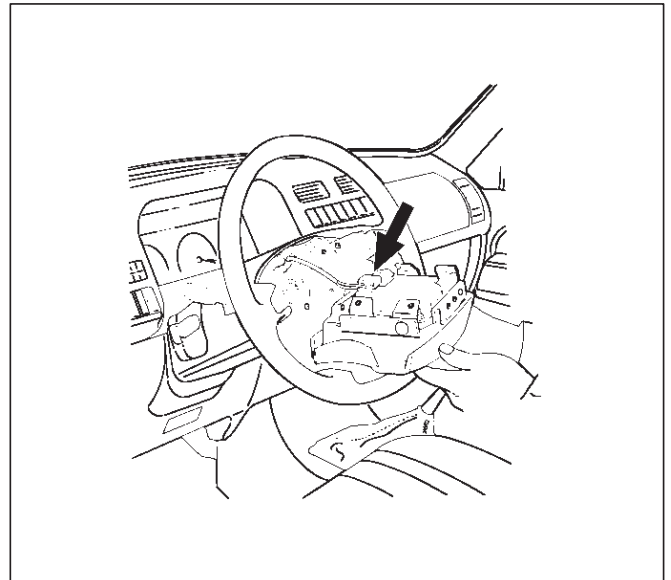


2. Tighten the steering wheel fixing nut to the specified torque.

Torque : 34 N-m (3.5 Kg-m/25 lb ft)

3. Connect horn lead.
4. Connect air bag to wiring harness connector.

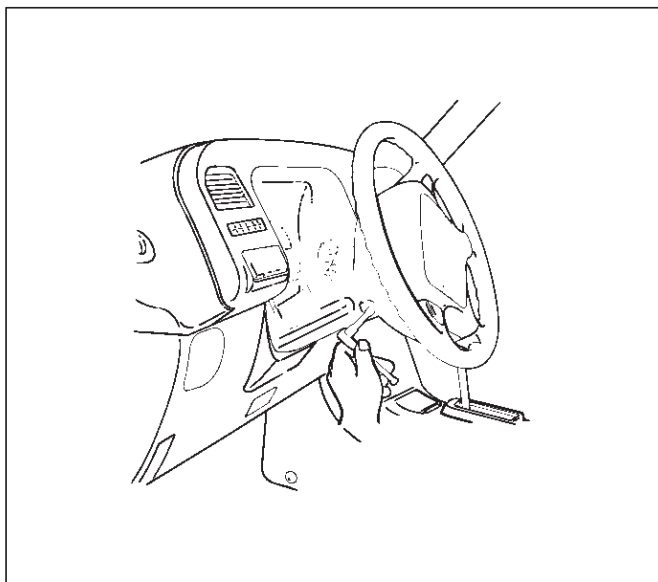
NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.



5. Install air bag into steering wheel and tighten bolts to specified sequence as show in figure.

Torque: 8.8 N·m (0.9 Kg·m/78 lb in)

CAUTION: Never use the air bag assembly from another vehicle. Use only new air bag assembly proper to the Trooper which is being repaired.



827R008

6. Enable the SRS (Refer to “Enabling the SRS” in this section).

SRS Coil Assembly

Service Precautions

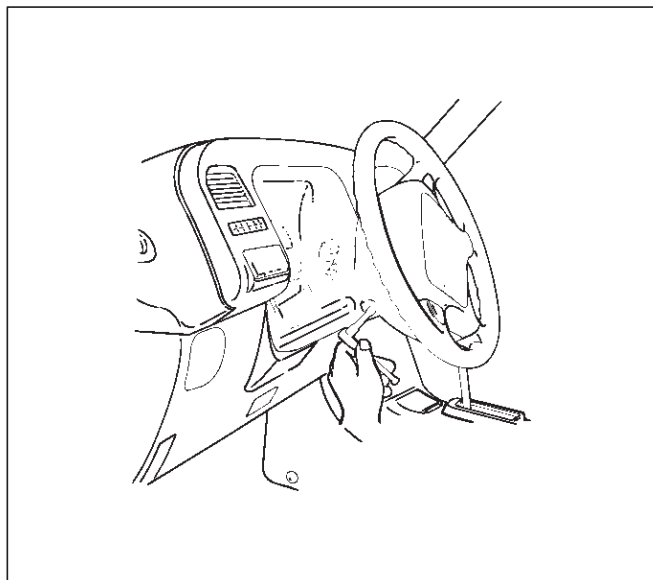
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NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS (Refer to “Disabling the SRS” in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.

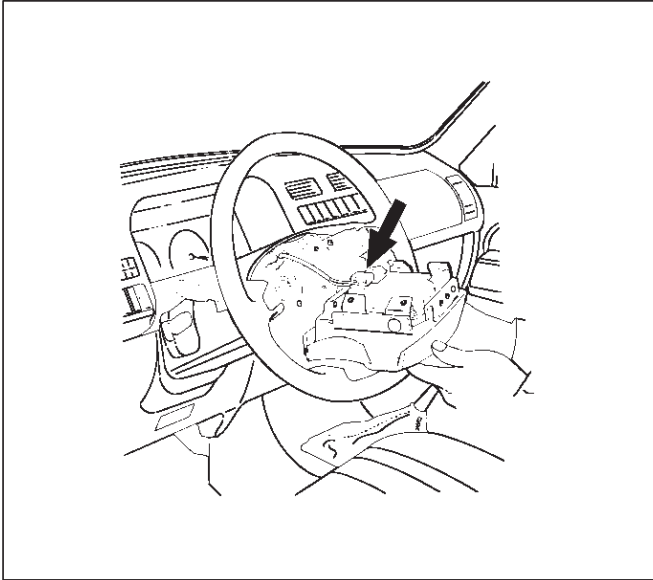


827R008

9J-40 SUPPLEMENTAL RESTRAINT SYSTEM

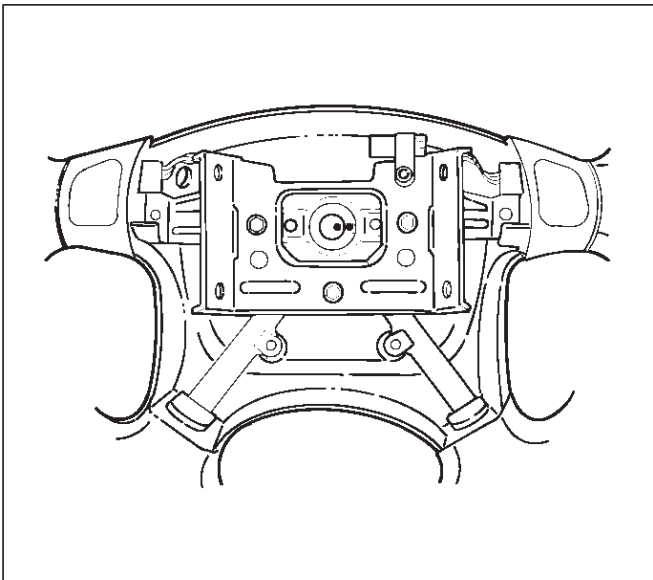
3. Disconnect the yellow 2-pin connector located behind the air bag assembly and remove air bag assembly. Refer to "SRS Connectors" in this section for removal and installation.

4. Disconnect horn lead connector.

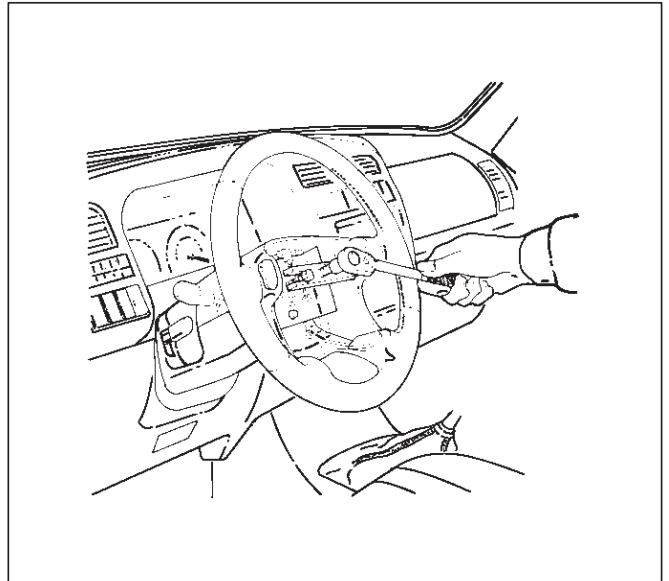


5. Remove the steering wheel attachment nut.

6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



7. Move the tires to the straight ahead position before removing the steering wheel and remove wheel with 5-8521-0016-0.



8. Feed wiring through the wheel and remove wheel.

9. Remove the steering lower cover and engine hood opening lever.

10. Remove the driver knee bolster assembly.

11. Remove the steering column cover.

12. Remove air conditioning lower duct.

13. Disconnect the 12-pin wiring harness connectors located at the base of steering column.

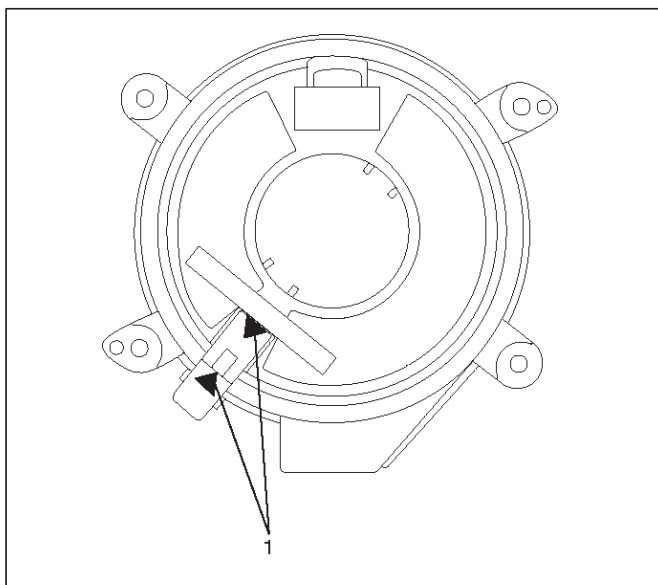
CAUTION: Never apply force to the steering wheel in the direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Remove the combination switch assembly with SRS coil.

Installation

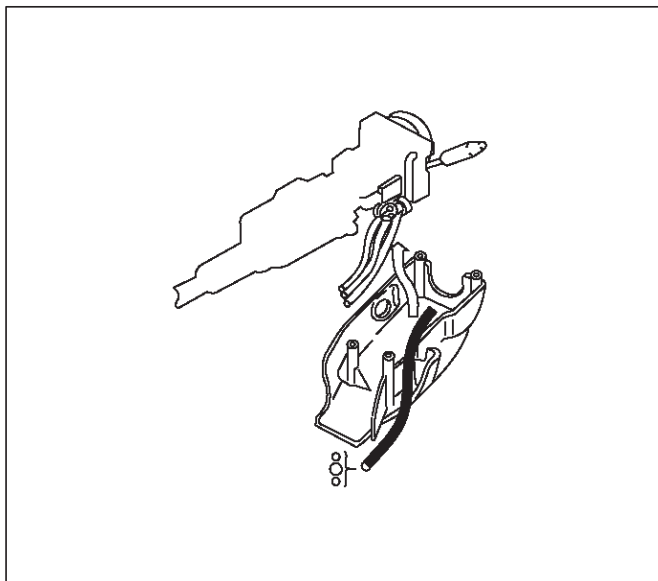
1. Install the combination switch assembly with SRS coil.
2. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark (1).

CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.

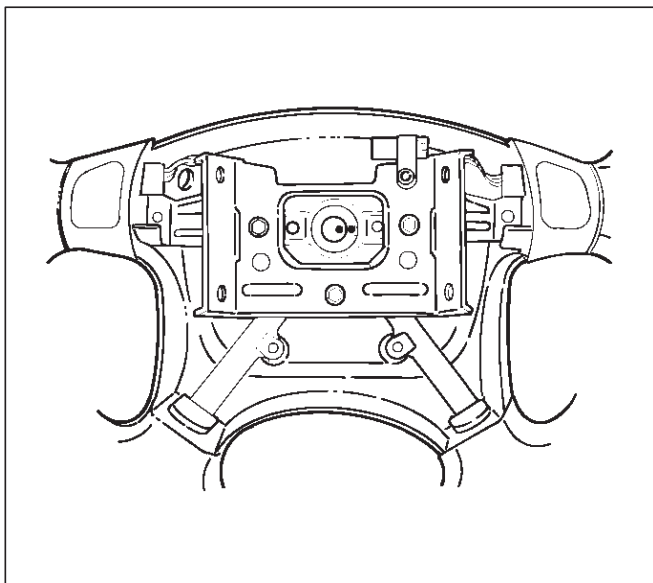


3. Connect the wiring harness connectors located at the base of steering column.
4. Install the air conditioning lower duct.
5. Install the steering column cover.

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harness starter switch, combination switch and SRS coil may not catch wiring.



6. Install the driver knee bolster assembly.
7. Install the steering lower cover and engine hood opening lever.
8. Install the steering wheel and align the setting marks.

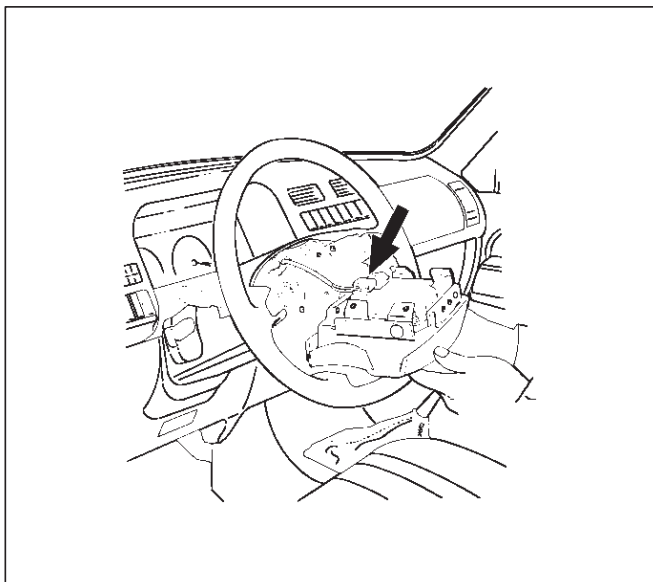


9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N-m (3.5 Kg-m/25 lb ft)

10. Connect horn lead.
11. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air to prevent lead wire from being pinches.



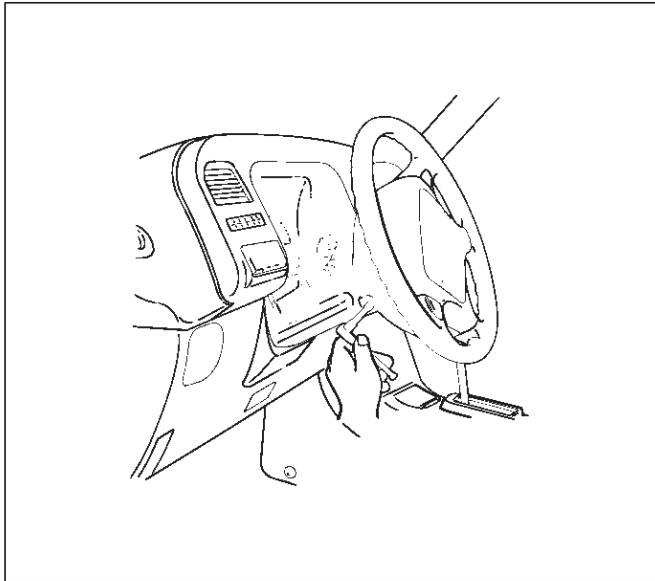
12. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8.8 N-m (0.9 Kg-m/78 lb in)

9J-42 SUPPLEMENTAL RESTRAINT SYSTEM

CAUTION: Never use the air bag assembly from another vehicle. Use only new air bag assembly proper to the Trooper which is being repaired.

13. Enable the SRS (Refer to "Enabling the SRS" in this section).



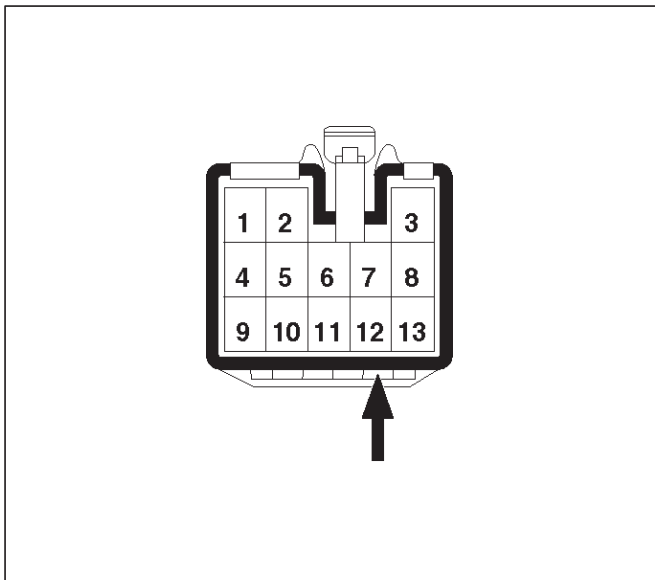
827RT008

SRS Coil Replacement Procedure

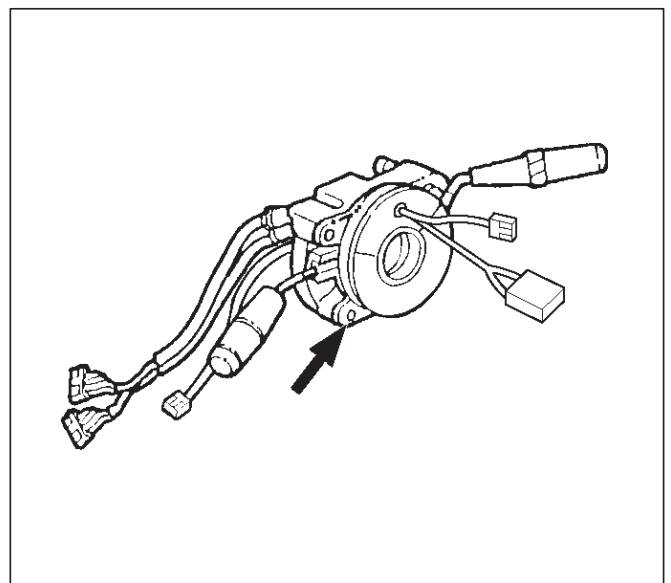
Removal

1. Same removal steps until step 13 of SRS Coil Assembly Removal.
2. Disconnect the horn terminal NO.12 from connector and remove the tape binding harness. (Refer to How to Disconnect the horn terminal in this section.)

3. Remove four bolts of SRS coil assembly and remove the SRS coil assembly from the combination switch.



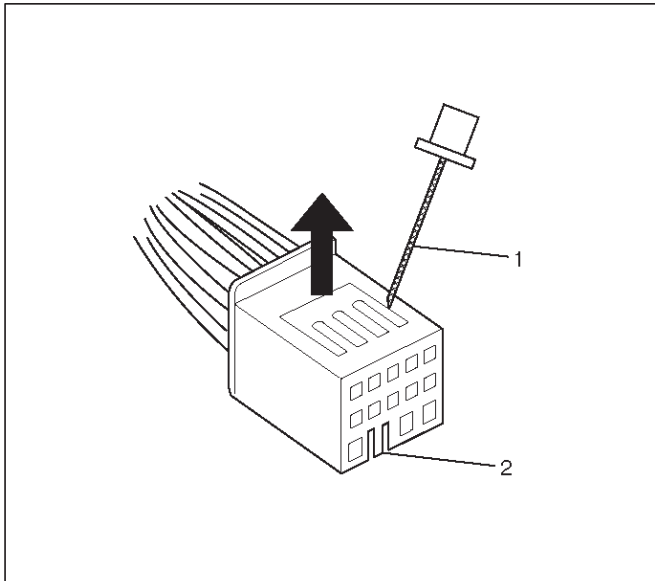
827RX029



825RX033

How to Disconnect the horn terminal

1. Lift the terminal lock plate from upper portion of connector with a minitenes screw driver (-) and release connector terminal lock.

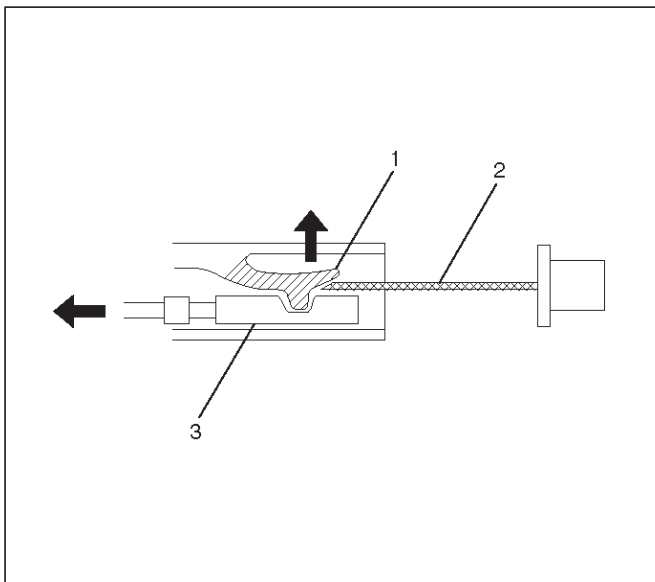


827RX045

Legend

- (1) Minitenes screw driver (-)
- (2) Connector lock knob

2. Pull out the terminal of lead wire coming to connector NO.12 while lifting the lock part with a minitenes screw driver (-).



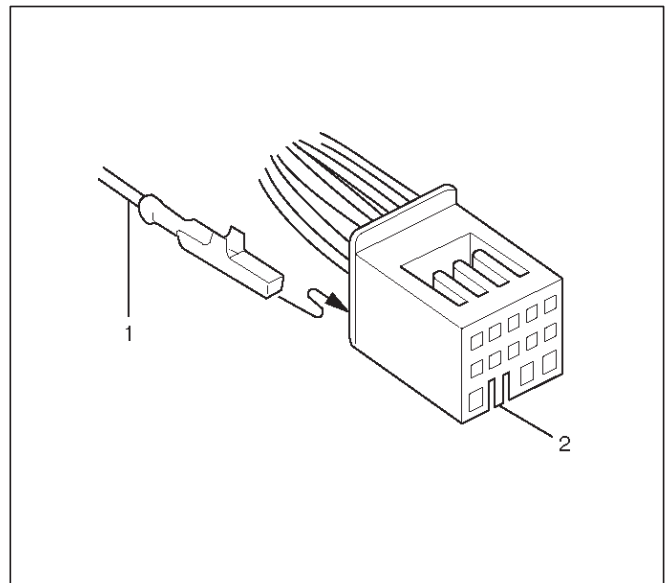
827RX046

Legend

- (1) Lock
- (2) Minitenes screw driver (-)
- (3) Terminal

How to Connect Horn Terminal

1. Insert horn terminal from behind black connector NO.12 until connector lock works.

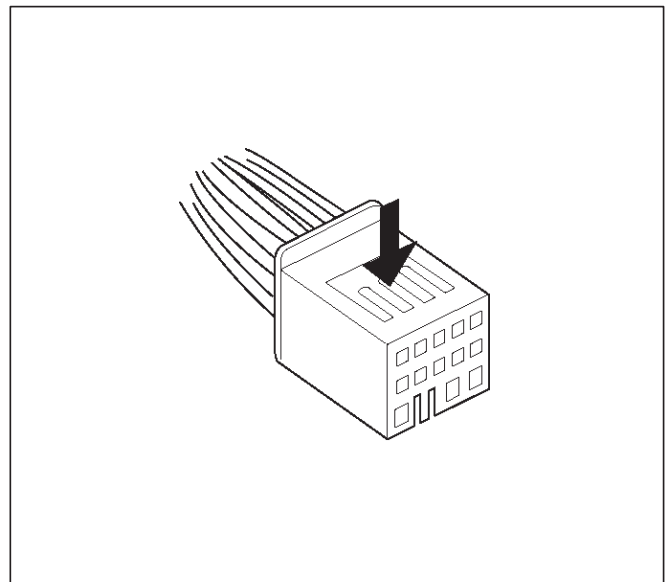


827RX047

Legend

- (1) Terminal
- (2) Connector lock knob

2. Push terminal lock plate into the connector for a duble lock.

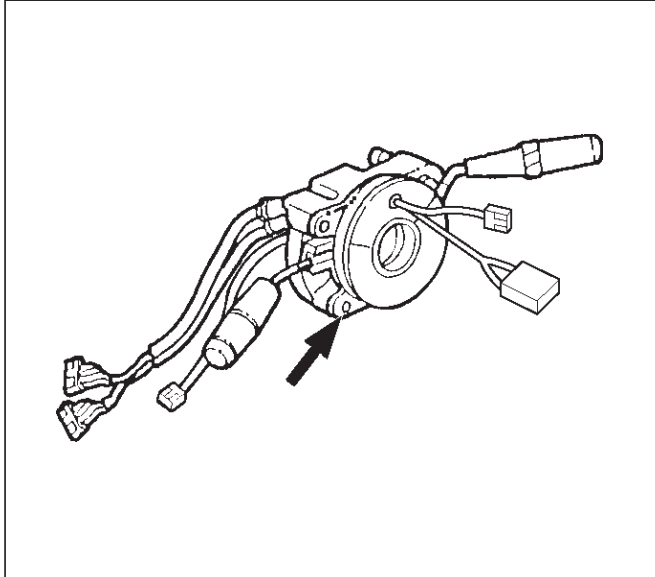


827RX048

Installation

1. Set cancel cam and SRS coil in position and install the SRS coil to combination switch by tightening the four bolts to a specified tightening torque with four bolts.

Torque: 0.5 N·m (0.05 kg·m/4 lb ft)



825RX033

2. Insert the horn terminal into the connector NO.12 and bind the combination switch harness and SRS coil harness with a tape. (Refer to How to Connect the Horn Terminal in this section.)
3. After installation steps above, same steps as SRS Coil Assembly installation step 2 to step 13.

Steering Column

Service Precautions

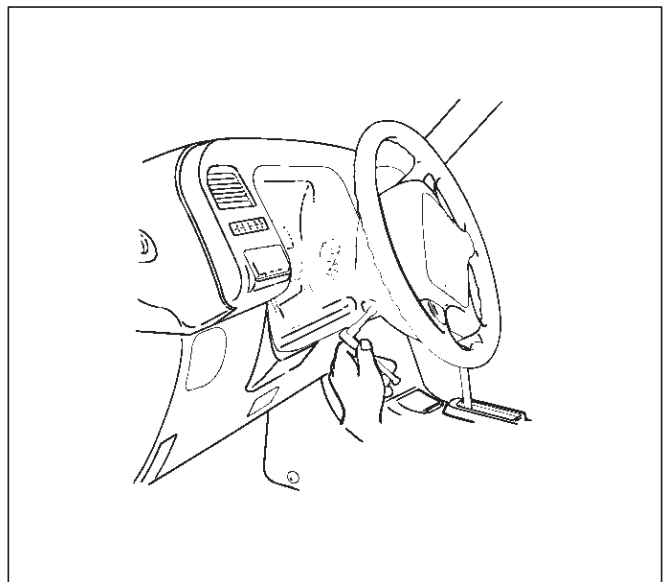
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NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

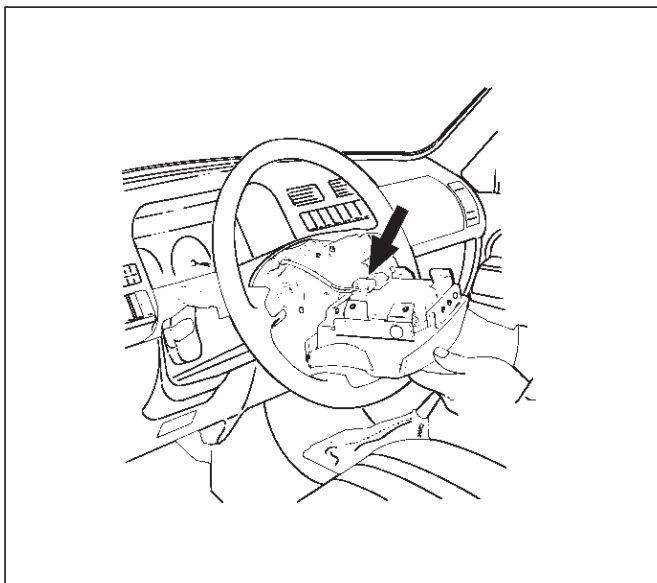
Removal

1. Disable the SRS (Refer to "Disabling the SRS" in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



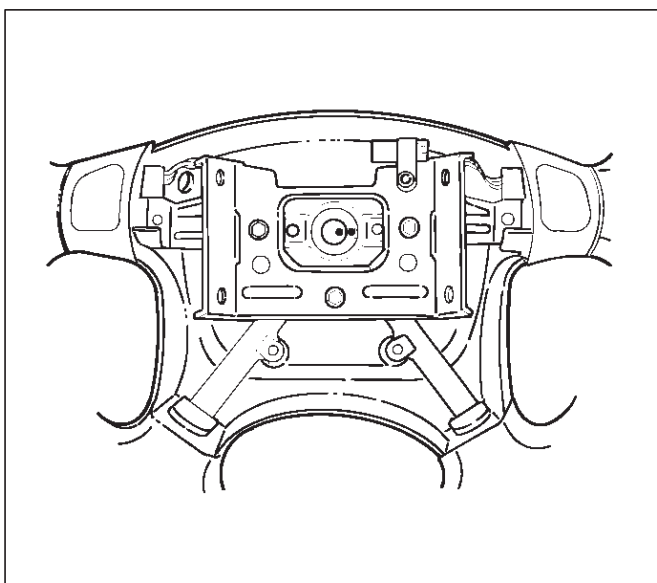
827RT008

3. Disconnect the yellow 2-pin connector located behind the air bag assembly and remove air bag assembly. Refer to "SRS Connectors" in this section for removal and installation.



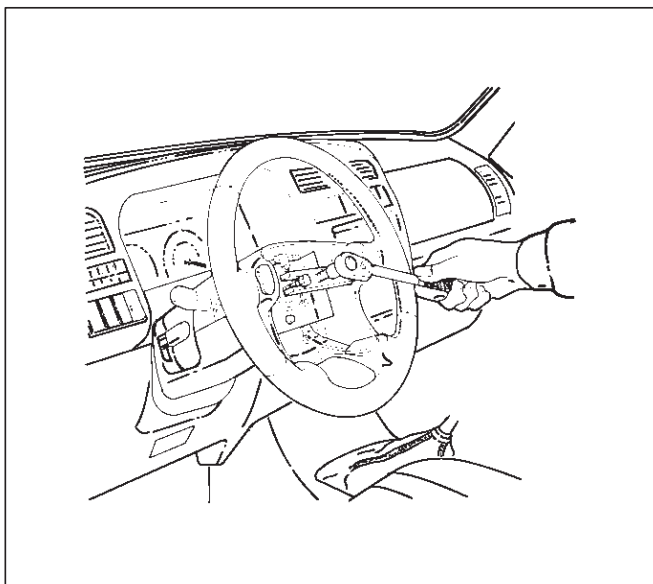
827RT009

4. Disconnect horn lead connector.
5. Remove the steering wheel attachment nut.
6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



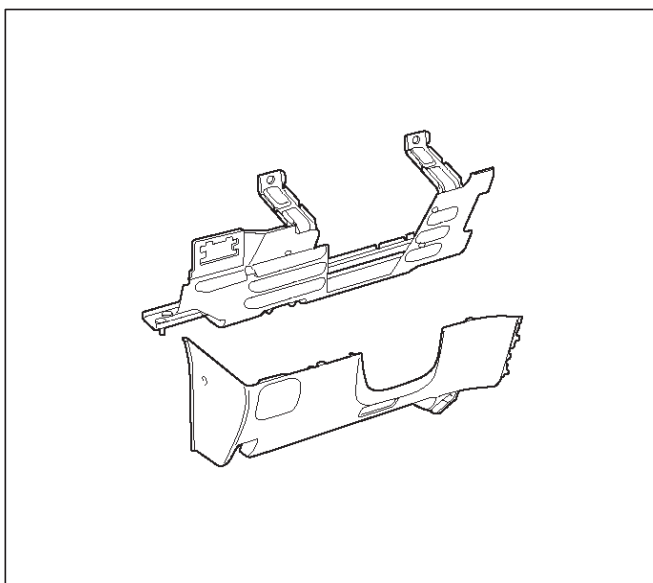
430RS004

7. Move the tires to the straight ahead position before removing the steering wheel and removing wheel with 5-8521-0016-0.



430RT009

8. Feed wiring through the wheel and remove wheel.
9. Remove the steering lower cover and engine hood opening lever.
10. Remove the driver knee bolster assembly.



740RT015

11. Remove the steering column cover.
12. Remove air conditioning lower duct.
13. Disconnect the wiring harness connectors located at the base of steering column.

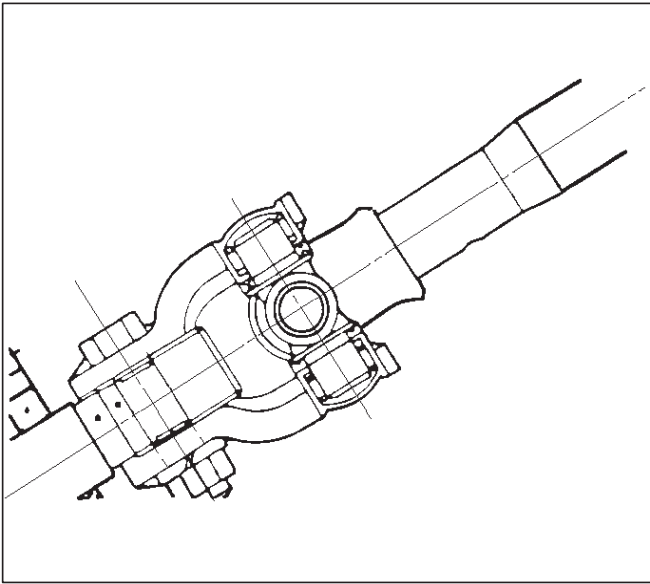
CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Remove the combination switch assembly with SRS coil.

9J-46 SUPPLEMENTAL RESTRAINT SYSTEM

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

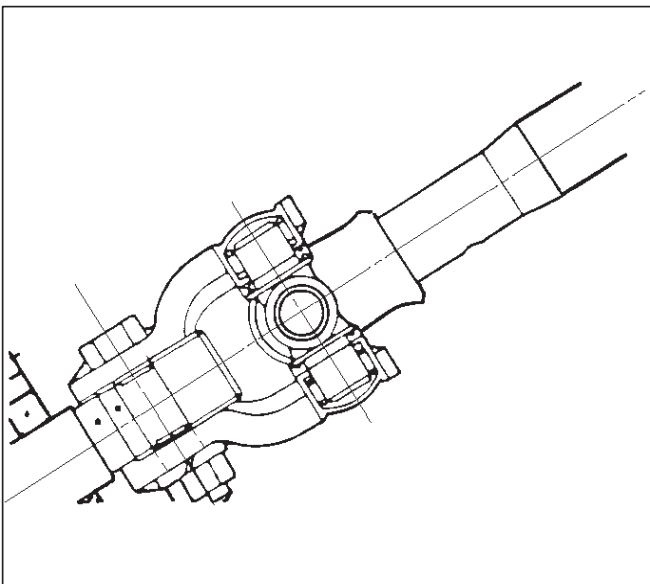
15. Remove the snap ring.
16. Remove the cushion rubber.
17. Disconnect shift lock cable (A/T only).
18. Disconnect the starter switch harness connector located base of steering column.
19. Remove steering lock cylinder assembly.
20. Apply a setting mark across the universal joint and steering shaft to reassemble the parts in their original position.



21. Remove steering column assembly.

Installation

1. Install the steering column assembly and align the setting marks on the universal joint and steering shaft made during removal.



2. Tighten the steering column fixing bolts (dash panel side) to the specified torque.

Torque: 19 N·m (1.9 Kg·m/14 lb ft)

3. Tighten the steering column fixing bolts (Pedal bracket) to the specified torque.

Torque: 17 N·m (1.7 Kg·m/13 lb ft)

4. Tighten the universal joint to the specified torque.

Torque: 25 N·m (2.6 Kg·m/18 lb ft)

5. Install steering lock cylinder assembly.

6. Connect shift lock cable (For A/T)

7. Install cushion rubber.

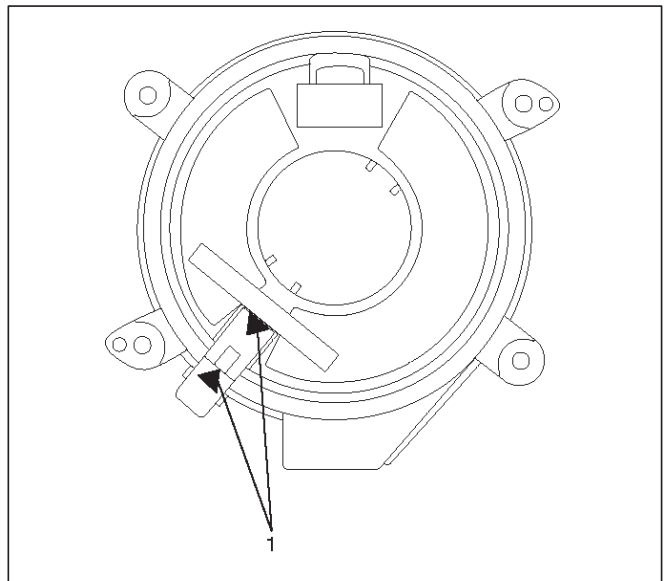
8. Install snap ring.

9. Install the combination switch assembly with SRS coil.

10. Connect the wiring harness connector located on the base of steering column.

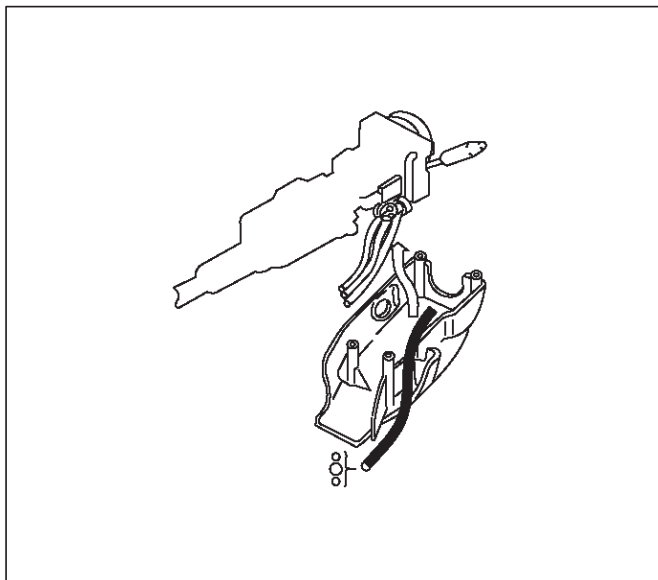
11. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark (1).

CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.

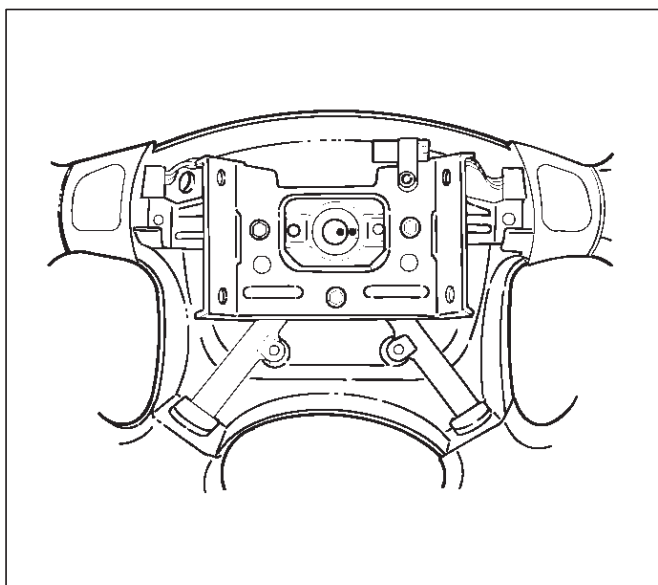


12. Install steering column cover.

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harness starter switch, combination switch and SRS coil may not catch wiring.



13. Install the steering wheel and align the setting marks.



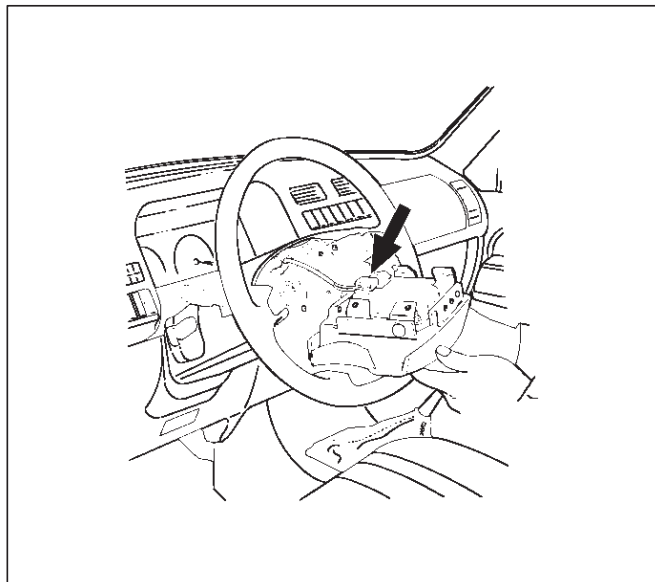
14. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N-m (3.5 Kg-m/25 lb ft)

15. Connect horn lead.

16. Connect air bag wiring harness connector.

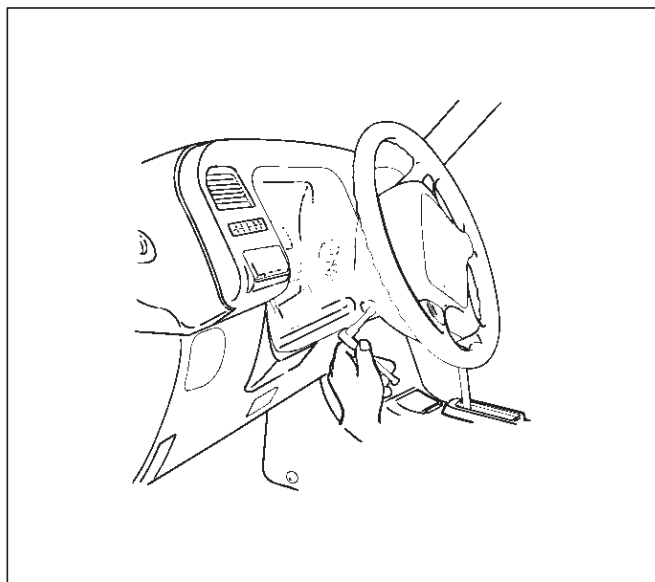
NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.



17. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8 N-m (0.8 Kg-m/69 lb in)

CAUTION: Never use the air bag assembly from another vehicle. Use only the air bag assembly proper to the Trooper which is being repaired.



18. Enable the SRS (Refer to "Enabling the SRS" in this section).

Passenger Air Bag Assembly

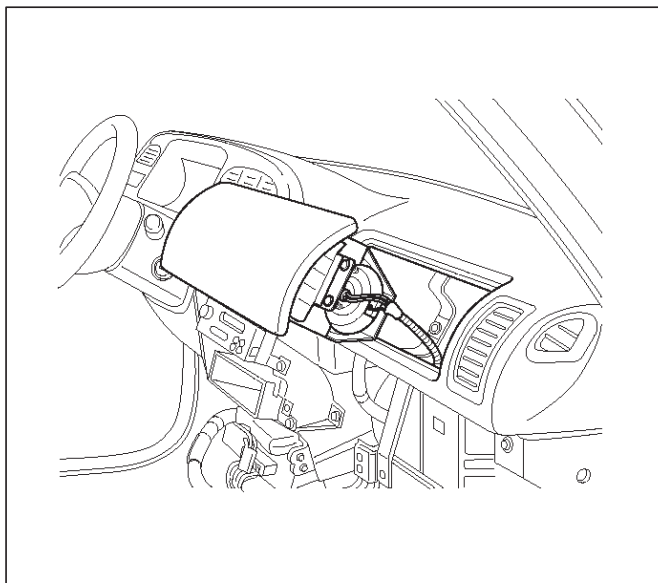
Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND RIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: IN THE EVENT DEPLOYMENT HAS OCCURRED, INSPECT COIL ASSEMBLY WIRE FOR ANY SIGNS OF SCORCHING, MELTING OR ANY OTHER DAMAGE DUE TO EXCESSIVE HEAT. IF THE COIL HAS BEEN DAMAGED, REPLACE IT.

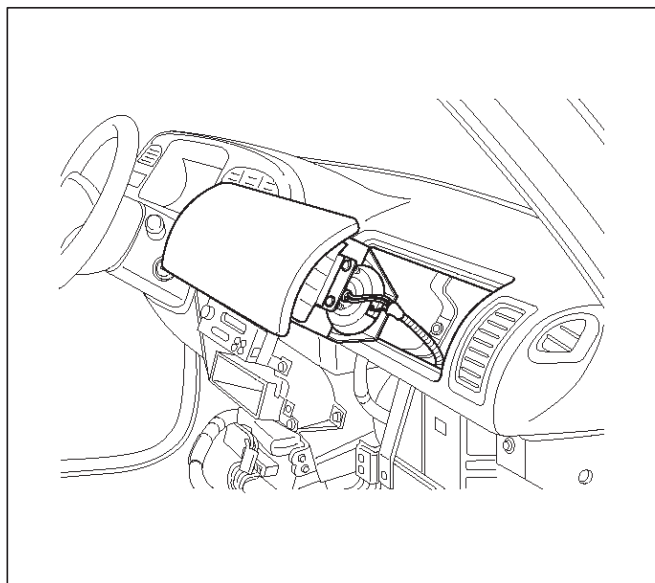
Removal



827RS001

1. Disable the SRS (Refer to "Disabling the SRS" in this section).
2. Remove gear control knob.
3. Remove front console assembly.
4. Remove rear console assembly and disconnect harness connector.
5. Remove ECM and SDM cover.
6. Remove glove box assembly with lid.
7. Remove glove box cover.
8. Remove instrument panel assist side lower cover.
9. Disconnect engine hood opener lever.
10. Remove instrument panel door side lower cover.
11. Remove lower cluster with ashtray.
12. Remove meter cluster assembly and disconnect harness connector.
13. Remove instrument panel lower center cover.
14. Disconnect passenger air bag assembly harness connector.
15. Remove air bag assembly fixing bolts and nuts.
16. Remove passenger air bag assembly.

Installation



827RS001

1. Install passenger air bag assembly.
2. Install air bag assembly fixing bolts, nuts and tighten to specified torque.

Torque: 6 N-m (0.6 Kg-m/52 lb in)

3. Connect air bag assembly harness connector.
4. Install instrument panel lower center cover.
5. Install meter cluster assembly and connect harness connector.
6. Install lower cluster with ashtray.
7. Install instrument panel door side lower cover.
8. Connect engine hood opener lever.
9. Install instrument panel assist side lower cover.

10. Install glove box cover.
11. Install glove box assembly with lid.
12. Install ECM and SDM cover.
13. Install rear console assembly and connect harness connector.
14. Install front console assembly.
15. Install gear control knob.
16. Enable the SRS (Refer to "Enabling the SRS" in this section).

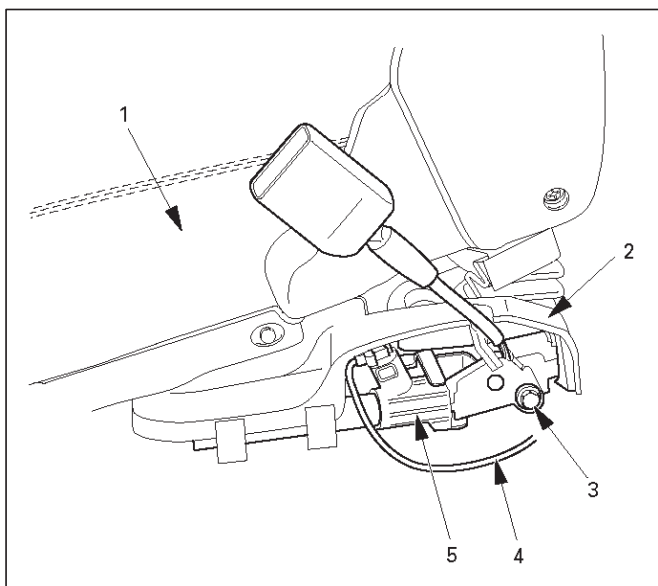
Pretensioner Seat Belt (If so equipped)

Service Precaution

WARNING: WHEN PERFORMING SERVICE ON OR AROUND THE PRETENSIONER SEAT BELT OR THE PRETENSIONER SEAT BELT WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE PRETENSIONER SEAT BELT. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE THE PRETENSIONER SEAT BELT DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED THE PRETENSIONER SEAT BELT REPAIR.

AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN PERFORMING THE PRETENSIONER SEAT BELT. WHEN DEPLOY A LIVE PRETENSIONER SEAT BELT AT OUTSIDE THE VEHICLE, DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE PRETENSIONER SEAT BELT IS TO BE DEPLOYED. THE PRETENSIONER SEAT BELT WILL IMMEDIATELY DEPLOY WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS SHOULD ALWAYS BE THE FINAL STEP IN THE PRETENSIONER SEAT BELT DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

Parts Location



760RW028

Legend

- (1) Seat
- (2) Pretensioner Cover
- (3) Bolt
- (4) Pretensioner Harness
- (5) Pretensioner

Removal

1. Turn ignition switch to "LOCK", remove key.
2. Remove the foot rest located behind the seat.
3. Remove the cover on seat slide.
4. Disconnect the 2-pin connector at the base of the seat.
5. Remove four fixing bolts the seat slide and remove seat.
6. Remove the pretensioner seat belt cover.
7. Remove the pretensioner seat belt assembly.

Installation

1. Install the pretensioner seat belt assembly.
2. Install the pretensioner seat belt cover.
3. Install the seat on seat slide and four fixing bolts.
4. Connect the yellow 2-pin connector at the base of the seat.
5. Install the cover on seat slide.
6. Install the foot rest located behind the seat.

9J-50 SUPPLEMENTAL RESTRAINT SYSTEM

Main Data and Specifications**Fastener Tightening Specification**

Application	N·m	Kg·m	Lb Ft	Lb In.
SDM	10	1.0	—	87
Driver air bag fixing bolt	8.8	0.9	—	78
Steering wheel fixing bolt	34	3.5	25	—
Steering column (dash panel side fixing bolts)	19	1.9	14	—
Steering column (Pedal bracket fixing bolt)	17	1.7	13	—
Steering column (Universal joint fixing bolt)	25	2.6	18	—
Passenger Air Bag fixing bolts and nuts	6	0.6	—	52

RESTRAINT CONTROL SYSTEM

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Service Precaution

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

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

Diagnostic Information

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

Diagnostic Procedures

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY-POWERED OR AC-POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED, PROBE-TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

The diagnostic procedures used in this section are designed to aid in finding and repairing SRS problems. Outlined below are the steps to find and repair SRS problems quickly and effectively. Failure to carefully follow these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

1. Perform The "SRS Diagnostic System Check".

The "SRS Diagnostic System Check" should always be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation and checks for SRS trouble codes using both "Flash Code" and "Scan Tool" Methods.

2. Refer To The Proper Diagnostic Chart As Directed By The "SRS Diagnostic System Check".

The "SRS Diagnostic System Check" will lead you to the correct chart to diagnose any SRS problems. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

3. Repeat The "SRS Diagnostic System Check" After Any Repair Or Diagnostic Procedures Have Been Performed.

Performing the "SRS Diagnostic System Check" after all repair or diagnostic procedures will assure that the repair has been made correctly and that no other conditions exist.

Diagnostic Codes

The Sensing and Diagnostic Module (SDM) maintains a history record of all diagnostic codes that have been

detected since the SRS codes were last cleared during service.

1. Active Codes — Faults that are presently detected this ignition cycle. Active codes are stored in RAM (Random Access Memory).
2. History Codes — All faults detected since the last time the history fault memory was cleared. History codes are stored in EEPROM. (Electrically Erasable Programmable Read only Memory)

How To Read Trouble Codes

All codes (Active and history) can be read (or cleared) by using a scan tool or equivalent.

If a PDT is not available, have the vehicle serviced by ISUZU dealer.

How To Clear Trouble Codes

Trouble codes can only be cleared by using a Scan Tool. If a "scan tool" is not available then inform the owner of the stored codes and suggest that the codes are cleared upon the next visit to an Isuzu dealership.

Scan Tool Diagnostics

A scan tool can be used to read current and history codes and to clear all history codes after a repair is complete. The scan tool must be updated to communicate with the SRS through a memory card or a manufacturer's update before it can be used for SRS diagnostics. To use the scan tool, connect it to the DLC connector and turn the ignition switch "ON". Then follow the manufacturer's directions for communication with the SRS. The scan tool reads serial data from the SDM "Serial Data" output (terminal 24) to the DLC connector (terminal 9).

Basic Knowledge Required

Before using this section of the Service Manual, there is some basic knowledge which will be required. Without this knowledge, you will have trouble using the diagnostic procedures in this section. Use care to prevent harm or unwanted deployment. Read all cautions in the service manual and on warning labels attached to SRS components.

Basic Electrical Circuits

You should understand the basic theory of electricity including series and parallel circuits, and understand the voltage drops across series resistors. You should know the meaning of voltage (volts), current (amps), and resistance (ohms). You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram.

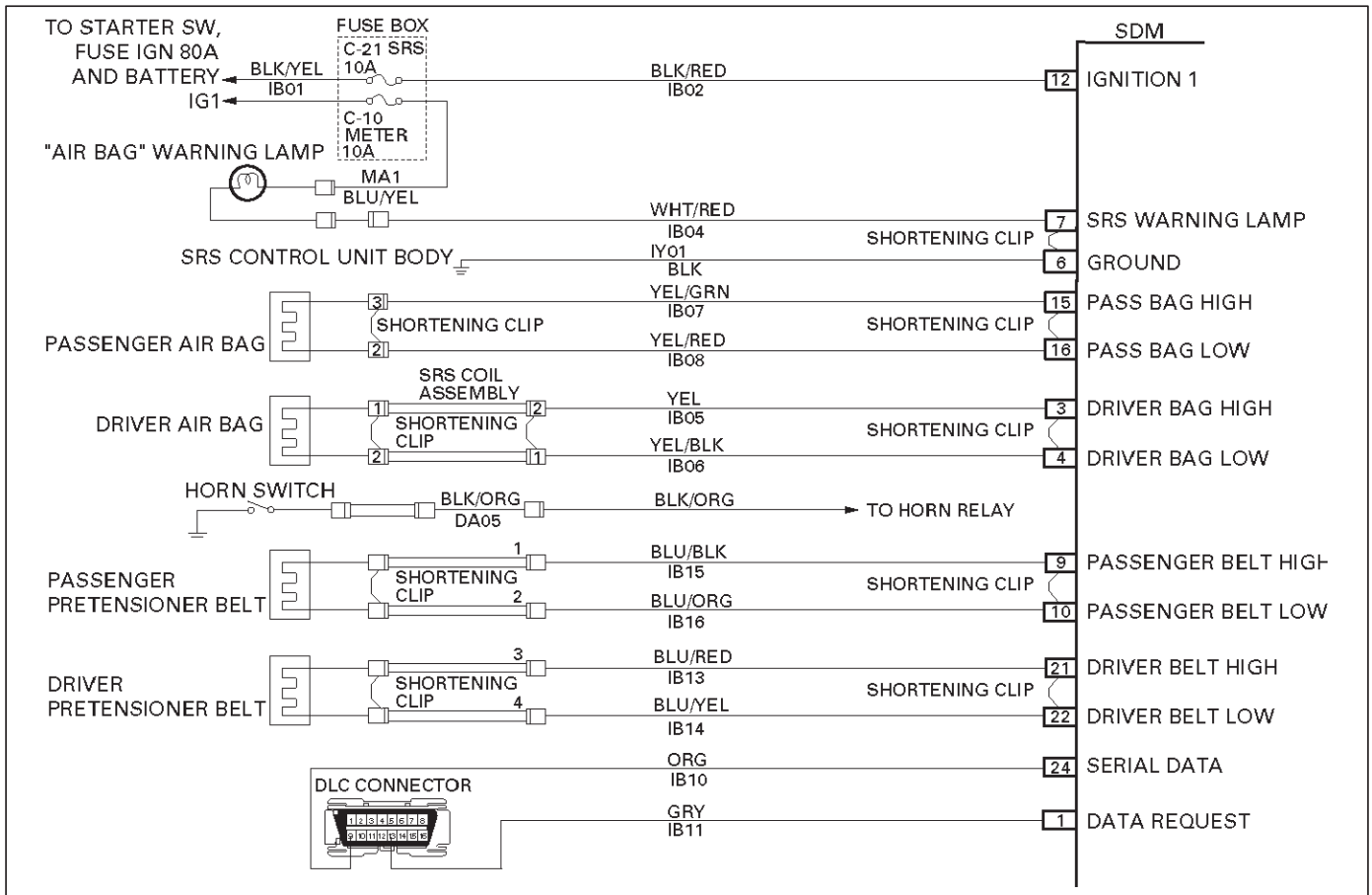
"Flash Code" Diagnostics

Flash code diagnostics can be used to read active codes and to determine if history codes are present but cannot be used to clear codes or read history codes. Flash code diagnostics is enabled by grounding by terminal 4 shorting to terminal 13 of the DLC connector with the ignition switch "ON". Grounding terminal 4 of the DLC connector pulls the "Diagnostics Request" input (Terminal 1) of the SDM low and signals the SDM to enter the flash code diagnostic display mode.

The SDM displays the trouble codes by flashing the warning lamp. Each code that is displayed will consist of a number of flashes which represents the tens digit, a 1.2 second pause, following by a number of flashes which represents the ones digit of the code. Each code is displayed one time before moving on to the next code. After all of the codes have been displayed, the entire code sequence will continually be repeated until ground is removed from terminal 4 of the DLC connector.

Two special codes exist when reading in the flash code mode (Flash Code 12 and Flash Code 13). "Flash Code 12" will always be the first code displayed when the flash code mode is enable Code 12 is not an indication of a SRS problem but an indication that the flash code mode has been enabled. If there are no active or history codes present, the SDM will display code 12 until ground is removed from the DLC connector at terminal 4. "flash Code 13" will be displayed if history codes are present. To read the history codes a scan tool must be used.

System Schematic



D09RW014

SRS Diagnostic System Check

The diagnostic procedures used in this section are designed to find and repair SRS malfunctions. To get the best results, it is important to use the diagnostic charts and follow the sequence listed below:

- A. Perform the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation, the ability of the SDM to communicate through the "Serial Data" line and whether SRS diagnostic trouble codes exist.
- B. Refer to the proper diagnostic chart as directed by the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.
- C. Repeat the "SRS Diagnostic System Check" after any repair or diagnostic procedures have been performed.

Performing the "SRS Diagnostic System Check" after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist

Circuit Description

When the ignition switch is first turned "ON", "Ignition 1" voltage is applied from the "C-21" fuse to the SDM at the "Ignition 1" input terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp turn on 3.5 seconds, while performing tests on the SRS.

Notes On System Check Chart:

1. The "AIR BAG" warning lamp should turn on 3.5 seconds after ignition is first turned "ON".
2. After the "AIR BAG" warning lamp turn on 3.5 seconds, it should turn "OFF"
3. This test checks for the proper operation of the "Serial Data" line. This test will also determine whether history diagnostic trouble codes are stored and, if so, identify them.
4. Improper operation of the "AIR BAG" warning lamp is indicated. This test differentiates a warning lamp stays "ON" condition from a warning lamp does not come "ON" condition.
5. This test checks for proper operation of the "Serial Data" line. This test will also identify the stored diagnostic trouble codes and whether they are current or history.

Diagnostic Aids:

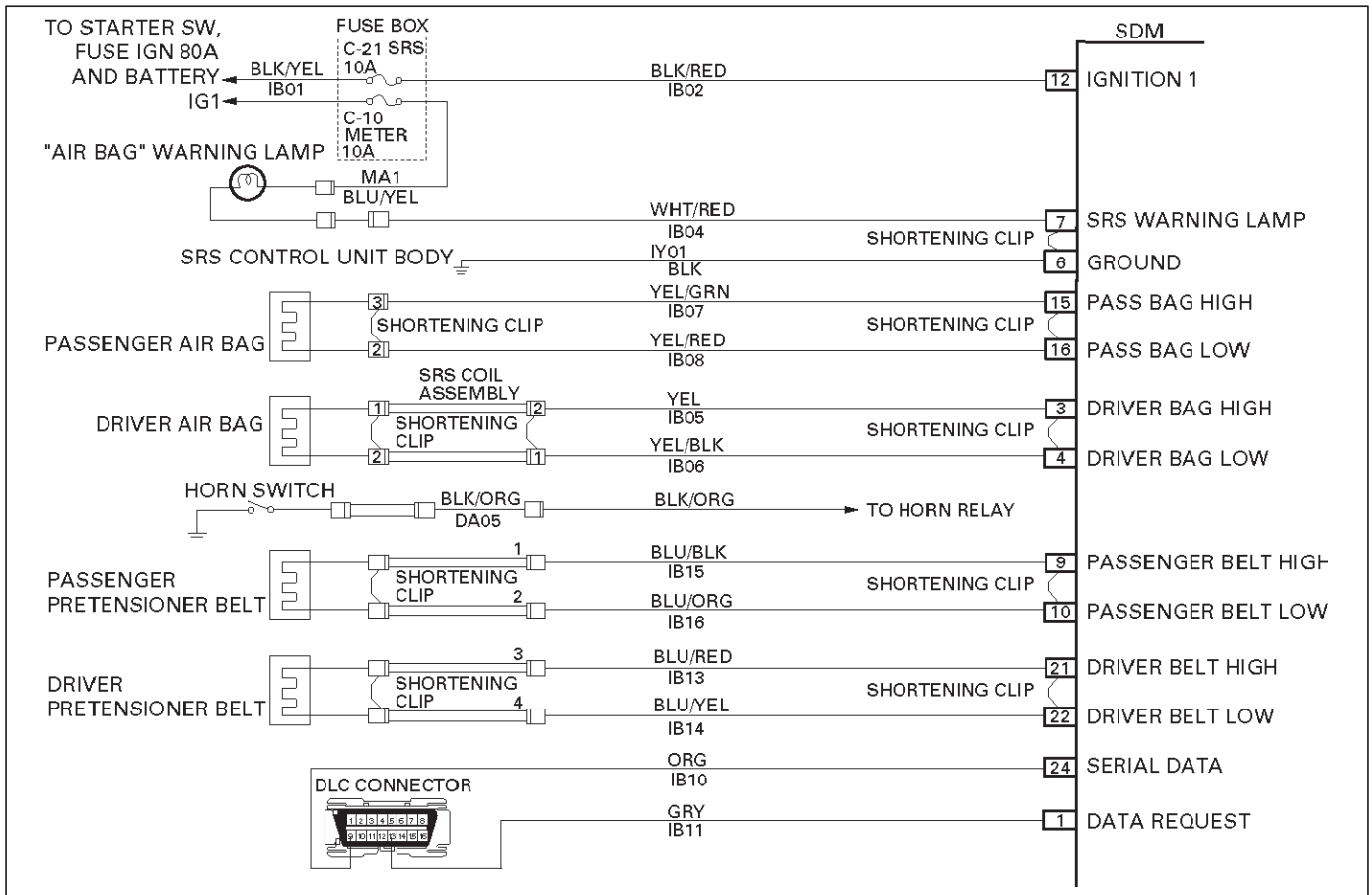
The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the

diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

SRS Diagnostic System Check

Step	Action	Yes	No
1	Note the "Air Bag" warning lamp as ignition switch is turned "ON." Does the "AIR BAG" warning lamp turn on 3.5 seconds?	Go to Step 2	Go to Step 3
2	Note the "AIR BAG" warning lamp after it turn on 3.5 seconds. Does the "AIR BAG" warning lamp go "OFF"?	Go to Step 4	Go to Step 5
3	Note the "AIR BAG" warning lamp as ignition switch is turned "ON". Does the "AIR BAG" warning lamp come "ON" steady?	Go to Chart B	Go to Chart C
4	1. Note the "AIR BAG" warning lamp as that ignition switch is turned "ON." Ignition switch "OFF." 2. Connect a scan tool to data link connector. 3. Follow direction given in the scan tool instruction manual. Ignition switch "ON." 4. Request the SRS diagnostic trouble code display, recode all history diagnostic trouble code(s). specify as such, on repair order Is (are) diagnostic trouble code(s) displayed?	Ignition switch "OFF" When DTC 71 is set, go to DTC 71 Chart For all other history codes refer to "Diagnostic Aids" For that specific DTC A history DTC indicates the malfunction has been repaired or is intermittent	SRS is functional and free of malfuncitons, no further diagnosis is required If scan tool indicated "NO DATA RECEIVED," refer to chassis electrical section8
5	1. Ignition switch "OFF." 2. Connect a scan tool to data link connector. 3. Follow directions as given in the scan tool instruction manual. 4. Ignition switch "ON." 5. Request the SRS diagnostic trouble code display, Recode all diagnostic trouble code(s), specifying as current or history on repair order. Is (are) diagnostic trouble code (s) displayed?	Ignition switch "OFF" When DTC 53 is set, go to DTC 53 chart When DTC 51 is set, go to DTC 51 chart When DTC 19 is set, go to DTC 19 chart When DTC 25 is set, go to DTC 25 chart Diagnose remaining current DTCs from lowest to highest When only history DTCs exist, refer to "Diagnostics Aids" for that specific DTC A history DTC indicates the malfunction has been repaired or is intermittent	If scan tool indicates "No Data Received," refer to chassis electrical section8

Chart A SDM Integrity Check



D09RW014

Circuit Description:

When the SDM recognizes "Ignition 1" voltage, applied to terminals "12", is greater than 9 volts, the "AIR BAG" warning lamp is turned on 3.5 seconds to verify operation. At this time the SDM performs "Turn-ON" tests followed by "Continuous Monitoring" tests. When a malfunction is detected, the SDM sets a current diagnostic trouble code and illuminates the "AIR BAG" warning lamp. The SDM will clear current diagnostic trouble codes and move them to a history file when the malfunction is no longer detected and/or the ignition switch is cycled, except for DTCs 19, 25, 51, 53 and 71. DTC 71 can only be cleared using a scan tool "Clear Codes" command. If DTCs 51, 53 are not indicated then DTC 71 is not existing. DTCs 51, 53 and 71 can not be cleared after a "Clear Codes" command is issued.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

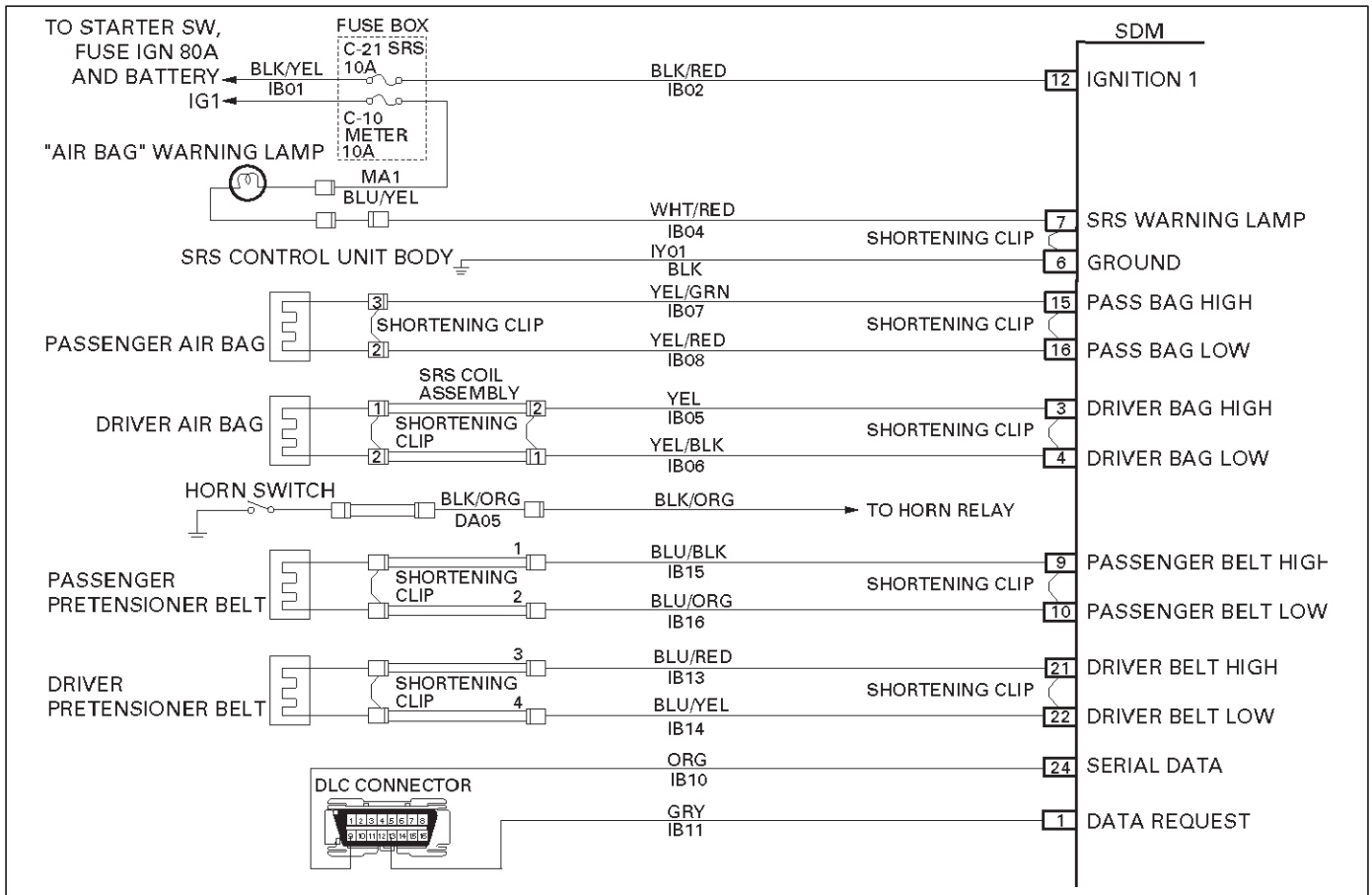
1. This test confirms a current malfunction. If no current malfunction is occurring (history DTC set) the "Diagnostic Aids" for the appropriate diagnostic trouble code should be referenced. The SDM should not be replaced for a history diagnostic trouble code.
2. This test checks for a malfunction introduced into the SRS during the diagnostic process. It is extremely unlikely that a malfunctioning SDM would cause a new malfunction to occur during the diagnostic process.
3. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, then and only then should the SDM be replaced.

Chart A SDM Integrity Check

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	<p>1. This chart assumes that the "SRS Diagnostic System Check" and either a symptom chart or a diagnostic trouble code chart diagnosis have been performed. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, and the symptom or DTC remains current, the following</p> <p>2. Diagnostic procedures must be performed to verify the need for SDM replacement.</p> <p>3. Ignition switch "OFF".</p> <p>4. Reconnect all SRS components, ensure all components are properly mounted.</p> <p>5. Ensure the ignition switch has been "OFF" for at least 15 seconds.</p> <p>6. Note "AIR BAG" warning lamp as ignition switch is turned "ON."</p> <p>Does warning lamp turn on 3.5 seconds then go "OFF"?</p>	<p>The symptom or DTC is no longer occurring</p> <p>Clear SRS diagnostic trouble codes</p> <p>Repeat "SRS Diagnostic System Check"</p>	<p>Go to Step 2</p>
2	<p>Using a scan tool request diagnostic trouble code display</p> <p>Is the same symptom or DTC occurring as was when the "SRS Diagnostic System Check" was first performed?</p>	<p>Go to Step 3</p>	<p>Ignition switch "OFF"</p> <p>Go to the appropriate chart for the indicated malfunction</p>
3	<p>1. Clear "SRS Diagnostic Trouble Codes".</p> <p>2. Ignition switch "OFF" for at least two minutes.</p> <p>3. Note "AIR BAG" warning lamp as ignition switch is turned "ON."</p> <p>Does warning lamp turn on 3.5 seconds then go "OFF"?</p>	<p>SRS is functional and free of malfunctions</p> <p>No further diagnosis is required</p> <p>Go to Step 4</p>	<p>Ignition switch "OFF"</p> <p>Replace SDM</p> <p>Go to Step 4</p>
4	<p>Reconnect all SRS components, ensure all components are properly mounted.</p> <p>Was this step finished?</p>	<p>Repeat the "SRS Diagnostic System Check"</p>	<p>Go to Step 4</p>

Chart B "AIR BAG" Warning Lamp Comes "ON" Steady



D09RW014

Circuit Description:

When the ignition switch is first turned "ON", "Ignition 1" voltage is applied from the "C-10" fuse to "AIR BAG", warning lamp which is connected to "SRS Warning Lamp", terminal "7". The "C-21" fuses apply system voltage to the "Ignition 1" inputs, terminals "12". The SDM responds by turning on the "AIR BAG" warning lamp 3.5 seconds. If "Ignition 1" is less than 9 volts, the "AIR BAG" warning lamp will come "ON" solid with no DTCs set.

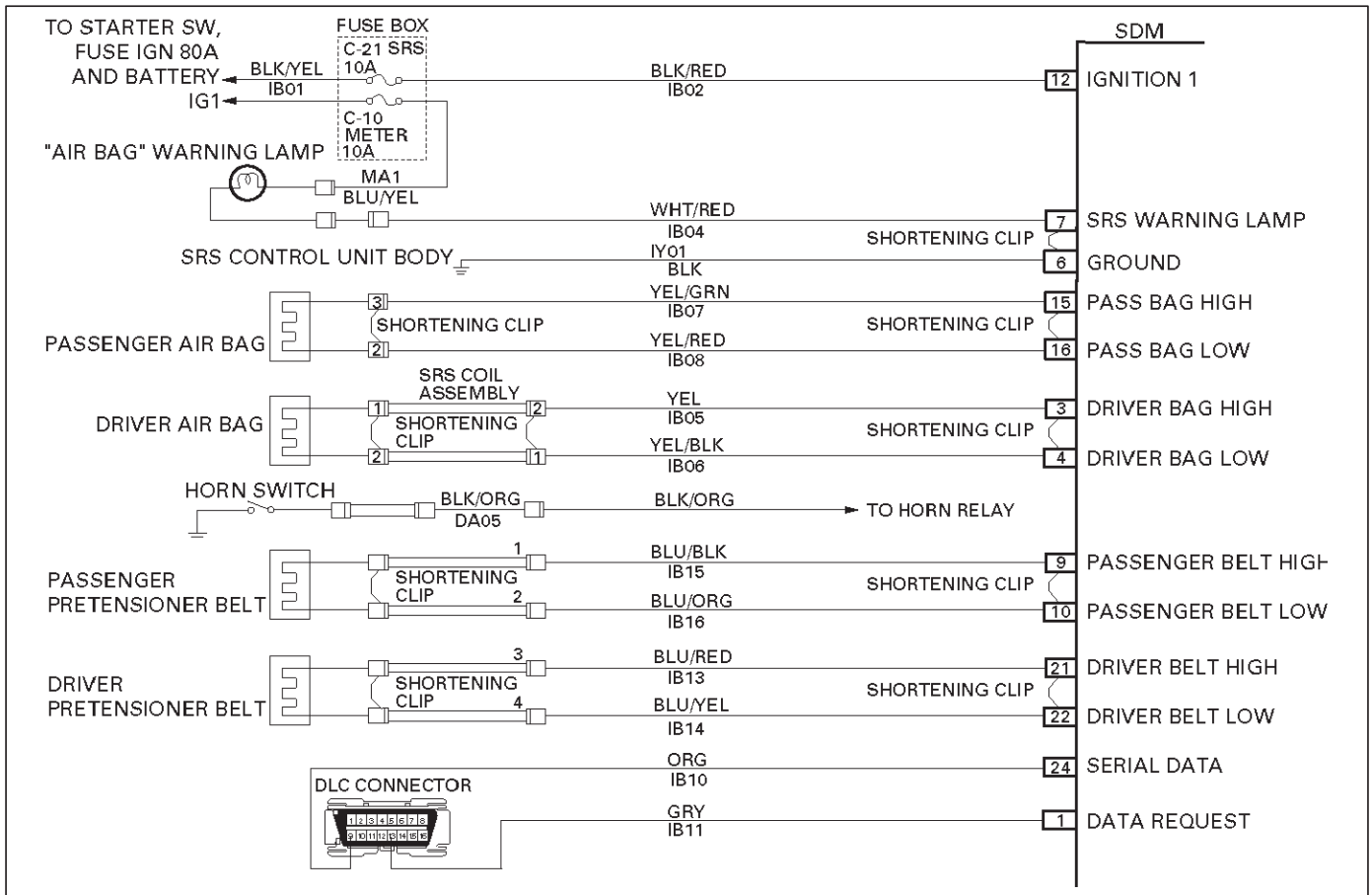
Chart Test Description:

1. Number(s) below refer to step number(s) on the diagnostic chart.
2. This test checks for an open in the "Ignition 1" circuit to the SDM.
3. This test checks for the voltage of "IGNITION 1".
4. This test determines whether the malfunction is a short to ground in IB04-WHT/RED.

Chart B “AIR BAG” warning lamp comes “ON” Steady

Step	Action	Yes	No
1	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Ignition switch “OFF.”</p> <p>3. Connect scan tool to data link connector, follow directions as given in the scan tool instruction MANUAL.</p> <p>4. Ignition switch “ON.”</p> <p>5. Request SRS diagnostic trouble code display.</p> <p>Dose scan tool indicate “No Data Received”?</p>	Go to Step 2	Go to Step 3
2	<p>1. Ignition switch “OFF.”</p> <p>2. Inspect SDM harness connector connection to SDM.</p> <p>Is it securely connected to the SDM?</p>	<p>Ignition switch “OFF”</p> <p>Replace SDM</p> <p>Go to Step 5</p>	<p>Connect SDM securely to de-activate shorting clip in SDM harness connector</p> <p>Go to Step 5</p>
3	<p>Using scan tool, request SRS data list.</p> <p>Is “ignition” less than 9 volts?</p>	Go to Step 4	<p>Ignition switch “OFF”</p> <p>Replace SDM</p> <p>Go to Step 5</p>
4	<p>1. Ignition switch “OFF.”</p> <p>2. Disconnect SRS coil and passenger air bag assemblies. yellow 2-pin connector located at base of steering column and behind the glove box assembly. Disconnect SDM.</p> <p>3. Disconnect the connector of “SRS Warning Lamp” of instrument cluster.</p> <p>4. Measure resistance from SDM harness connector terminal “7” to ground “6”.</p> <p>Does 5-8840-0285-0 display “OL” (Infinite)?</p>	Go to Chart A	<p>Replace SRS harness</p> <p>Go to Step 5</p>
5	<p>Reconnect all SRS components, ensure all components are properly mounted.</p> <p>Was this step finished?</p>	Repeat the “SRS Diagnostic System Check”	Go to Step 5

Chart C "AIR BAG" Warning Lamp Does Not Come "ON" Steady



D09RW014

Circuit Description:

When the ignition switch is first turned "ON", "Ignition 1" voltage is applied from the "C-10" fuse to the "AIR BAG" warning lamp which is connected to "SRS Warning Lamp", terminal "7". The "C-21" fuse apply system voltage to the "Ignition 1" inputs, terminals "12". The SDM responds by turning on the "AIR BAG" warning lamp 3.5 seconds. If "Ignition 1" is more than 16 volts, the "AIR BAG" warning lamp will be still "OFF" solid with no DTCs set.

Chart Test description:

Number(s) below refer to step number(s) on the diagnostic chart:

1. This test decides whether power is available to SDM warning lamp power feed circuit.

2. This test determines whether the voltage is present in the warning lamp circuit.
3. This test determines if the malfunction is in the instrument cluster.
4. This test checks for open in the warning lamp circuitry.
5. This test isolates the IB04-WHT/RED circuit and checks for a short in the IB04-WHT/RED circuit to B+.
8. This test checks for a short from the SDM warning lamp power feed circuit to ground.
9. This test determines whether the short to ground is due to a short in the wiring.

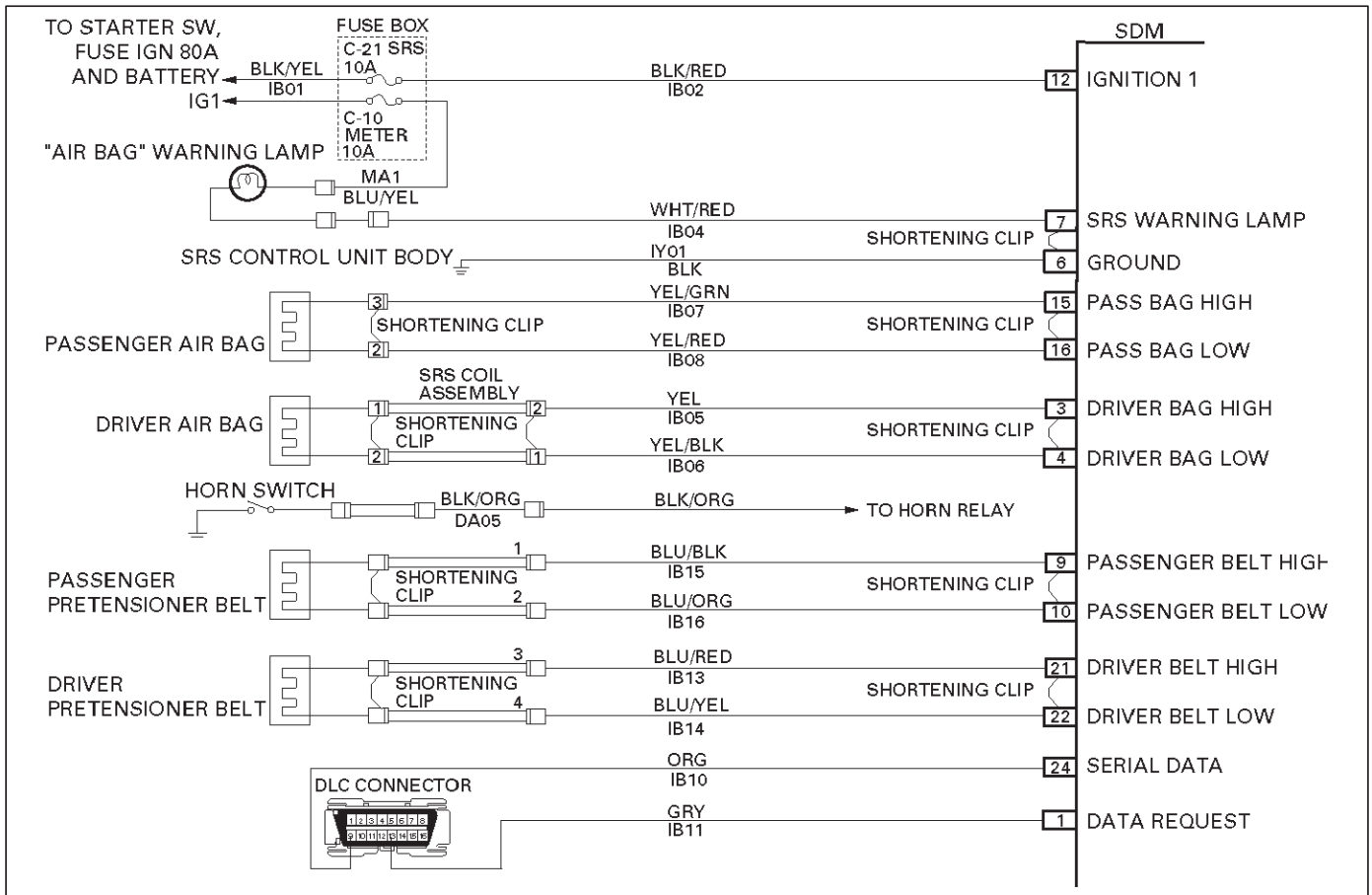
Chart C “AIR BAG” Warning Lamp Does Not Come “ON” Steady

Step	Action	Yes	No
1	<p>1. When measurements are requested in this chart, use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Ignition switch “OFF.”</p> <p>3. Remove and inspect “C-10” fuse (meter) to the “AIR BAG” warning lamp.</p> <p>Is fuse good?</p>	Go to Step 2	Go to Step 7
2	<p>1. Ignition switch “OFF.”</p> <p>2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2-pin connector located at base of steering column and behind the glove box assembly.</p> <p>3. Disconnect SDM.</p> <p>4. Ignition switch “ON.”</p> <p>5. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground).</p> <p>Is system voltage present on terminal “7”?</p>	Go to Step 4	Go to Step 3
3	<p>1. Ignition switch “OFF.”</p> <p>2. Remove instrument meter cluster.</p> <p>3. Check for proper connection to instrument cluster at IB04-WHT/RED terminal.</p> <p>4. If ok, then remove and inspect “AIR BAG” bulb.</p> <p>Is bulb good?</p>	Go to Step 5	<p>Replace bulb</p> <p>Go to Step 6</p>
4	<p>1. Ignition switch “OFF.”</p> <p>2. Disconnect instrument meter cluster harness connector.</p> <p>3. Ignition switch “ON.”</p> <p>4. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (GROUND).</p> <p>Is voltage 1 volt or less?</p>	Go to Chart A	<p>Replace SRS harness</p> <p>Go to Step 6</p>
5	<p>1. Install bulb.</p> <p>2. Measure resistance from instrument meter cluster harness connector IB04-WHT/RED terminal to SDM harness connector terminal “7”.</p> <p>Is resistance 5.0 ohms or less?</p>	<p>Service instrument meter cluster</p> <p>Install instrument meter cluster</p> <p>Go to Step 6</p>	<p>Replace SRS harness</p> <p>Go to Step 6</p>
6	<p>Reconnect all SRS components, ensure all components are properly mounted.</p> <p>Was this step finished?</p>	Repeat the “SRS Diagnostic System Check”	Go to Step 6
7	<p>Perform chart C.</p> <p>Was this step finished?</p>	Go to Step 8	Go to Step 1
8	<p>1. Replace “C-10” fuse.</p> <p>2. Ignition switch “ON” wait 10 Seconds then ignition switch “Off.”</p> <p>3. Remove and inspect “C-10” fuse.</p> <p>Is fuse good?</p>	<p>Install “C-10” fuse</p> <p>Go to Step 10</p>	Go to Step 9

9J1-12 RESTRAINT CONTROL SYSTEM**Chart C "AIR BAG" Warning Lamp Does Not Come "ON" Steady (Cont'd)**

Step	Action	Yes	No
9	<ol style="list-style-type: none">1. Disconnect SRS coil and passenger air bag assemblies. Yellow 2-pin connectors located at base of steering column and behind the glove box assembly.2. Disconnect SDM.3. Replace "C-10" fuse.4. Ignition switch "ON" wait 10 seconds.5. Ignition switch "OFF".6. Remove and inspection "C-10" fuse. Is fuse good?	Install "C-10" fuse Go to Chart A	Replace SRS harness Replace "C-10" fuse Go to Step 10
10	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 10

DTC 15 Passenger Deployment Loop Resistance High



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Bag Low" terminal "16" is grounded through a resistor and the passenger current source connected to "Passenger Bag High" terminal "15" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low" the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring IB07-YEL/GRN and IB08-YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring IB07-YEL/GRN and IB08-YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON",
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector.
4. This test checks for proper contact and/or corrosion of the yellow 2-pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the malfunction is due to high resistance in the wiring.

Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals "1" and "2", SDM terminal "15" and "16", or a poor wire to terminal connection in IB07-YEL/GRN and IB08-YEL/RED. This test for this diagnostic trouble code is only run while the "AIR BAG"

9J1-14 RESTRAINT CONTROL SYSTEM

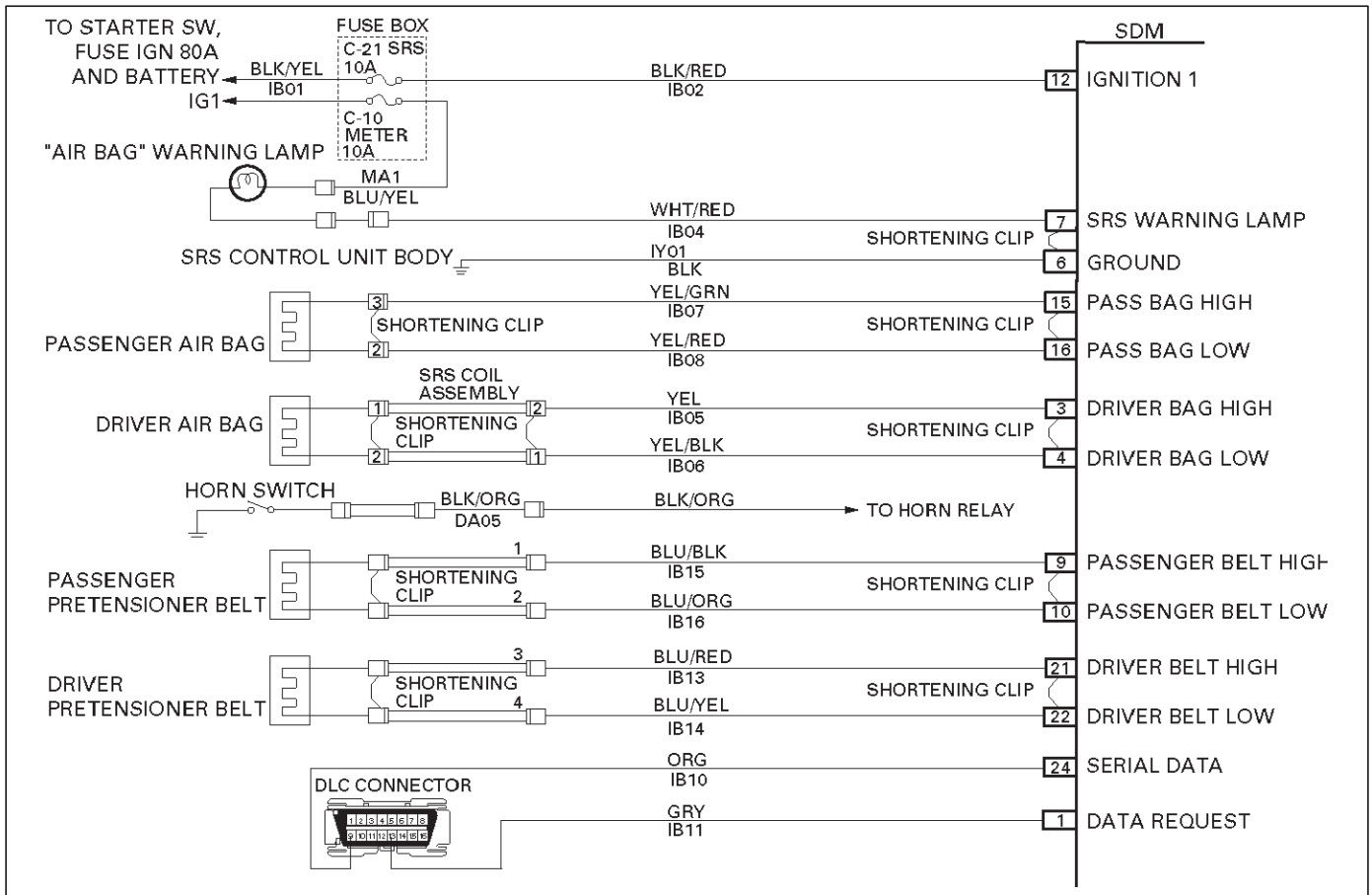
warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool "Clear Codes" command is issued and the malfunction is still

present, the DTC will not reappear until the next ignition cycle.

DTC 15 Passenger Deployment loop Resistance High

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" Performed?	Go to Step 2	Go to The "SRS Diagnostic System Check"
2	<ol style="list-style-type: none"> When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. Use scan tool data list function, read and record the passenger deployment loop resistance. <p>Is passenger resist. more than 2.9 ohms?</p>	Go to Step 3	Go to Chart A
3	<ol style="list-style-type: none"> Ignition switch "Off." Make sure the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly is seated properly. <p>Is the yellow 2-pin connector connected properly?</p>	Go to Step 4	Seat passenger Air Bag assembly yellow 2-pin connector properly Go to Step 7
4	<ol style="list-style-type: none"> Disconnect and inspect the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly. If ok, reconnect the passenger air bag assembly 2-pin connector. Ignition switch "ON." <p>Is DTC 15 current?</p>	Go to Step 5	Go to Step 7
5	<ol style="list-style-type: none"> Ignition switch "Off." Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connector located at the base of the steering column and behind the glove box assembly. Connect 5-8840-2421-0 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. Ignition switch "ON." <p>Is DTC 15 Current?</p>	Go to Step 6	Ignition switch "Off" Replace the passenger air bag assembly Go to Step 7
6	<ol style="list-style-type: none"> Ignition switch "Off." There has been an increase in the total circuit resistance of the passenger inflator deployment loop. Use the high resolution ohmmeter mode of the DVM while checking IB07-YEL/GRN and IB08-YEL/RED, and SDM connector terminal "15" and "16" to locate the root cause. <p>Was a fault found?</p>	Replace SRS harness Go to Step 7	Go to Chart A
7	<ol style="list-style-type: none"> Reconnect all components ensure all component are properly mounted. Clear diagnostic trouble codes. <p>Was This step finished?</p>	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 16 Passenger Deployment loop Resistance Low



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Bag Low" terminal "16" is grounded through a resistor and the passenger current source connected to "Passenger Bag High" terminal "15" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low", the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring IB07-YEL/GRN and IB08-YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring IB07-YEL/GRN and IB08-YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON",
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies connection of the yellow 2-pin connector.
4. This test checks for proper operation of the shorting clip in the yellow 2-pin connector.
5. The test checks for a malfunction passenger air bag assembly.
6. This test determines whether the malfunctioning is due to shortening in the wiring.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short between IB07-YEL/GRN and IB08-YEL/RED, or a malfunctioning shorting clip on the passenger air bag assembly which would require replacement of the air bag assembly. The test for this diagnostic trouble code is only run while "AIR BAG" warning lamp is performing the bulb

9J1-16 RESTRAINT CONTROL SYSTEM

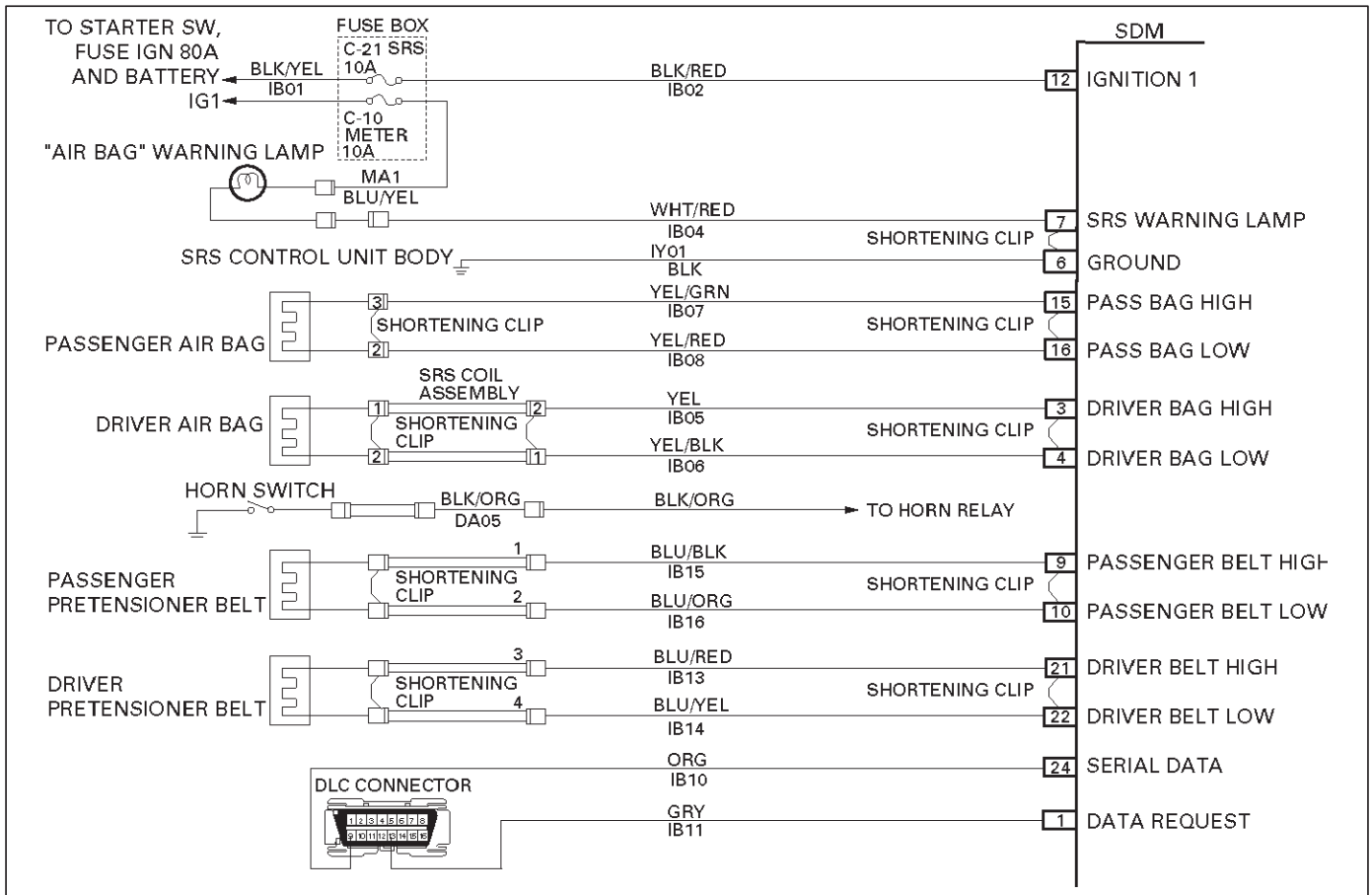
check, unless DTC 17 or DTC 26 is detected. When a scan tool "Clear Codes" command is issued and the

malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 16 Passenger Deployment loop Resistance Low

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	<ol style="list-style-type: none"> When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. Using scan tool data list function, read and record the passenger deployment loop resistance. <p>Is passenger resist. less than 1.4 ohms?</p>	Go to Step 3	Go to Chart A
3	<ol style="list-style-type: none"> Ignition switch "Off." Make sure the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly is seated properly. <p>Is the yellow 2-pin connector connected properly?</p>	Go to Step 4	<p>Seat passenger air bag assembly yellow 2-pin connector properly</p> <p>Go to Step 7</p>
4	<ol style="list-style-type: none"> Disconnect and inspect the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly. If ok, reconnect the passenger air bag assembly 2-pin connector. Ignition switch "ON." <p>Is DTC 16 Current?</p>	Go to Step 5	Go to Step 7
5	<ol style="list-style-type: none"> Ignition switch "Off." Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connector located at the base of the steering column and behind the glove box assembly. Connect 5-8840-2421-0 SRS driver/passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. Ignition switch "ON." <p>Is DTC 16 current?</p>	Go to Step 6	<p>Ignition switch "Off"</p> <p>Replace the passenger air bag assembly</p> <p>Go to Step 7</p>
6	<ol style="list-style-type: none"> Ignition switch "Off." There has been a decrease in the total circuit resistance of the passenger inflator deployment loop. Use the high resolution ohmmeter mode of the DVM while checking IB07-YEL/GRN and IB08-YEL/RED, and SDM connector terminal "15" and "16" to locate the root cause. <p>Was a fault found?</p>	<p>Replace SRS harness</p> <p>Go to Step 7</p>	Go to Chart A
7	<ol style="list-style-type: none"> Reconnect all components, ensure all component are properly mounted. Clear diagnostic trouble codes. <p>Was this step finished?</p>	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 17 Passenger Deployment Loop Open



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. During "Continuous Monitoring" diagnostics, a fixed amount of current is flowing in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low", the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring IB07-YEL/GRN AND IB08-YEL/RED, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Passenger Bag High" terminal "15" and "Passenger Bag Low" terminal "16" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Passenger Bag High" terminal "15" and "Passenger Bag Low" terminal "16" is below a specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector.
4. This test checks for proper contact and/or corrosion of the shorting clip in the yellow 2-pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the open in the wiring.

Diagnostic Aids:

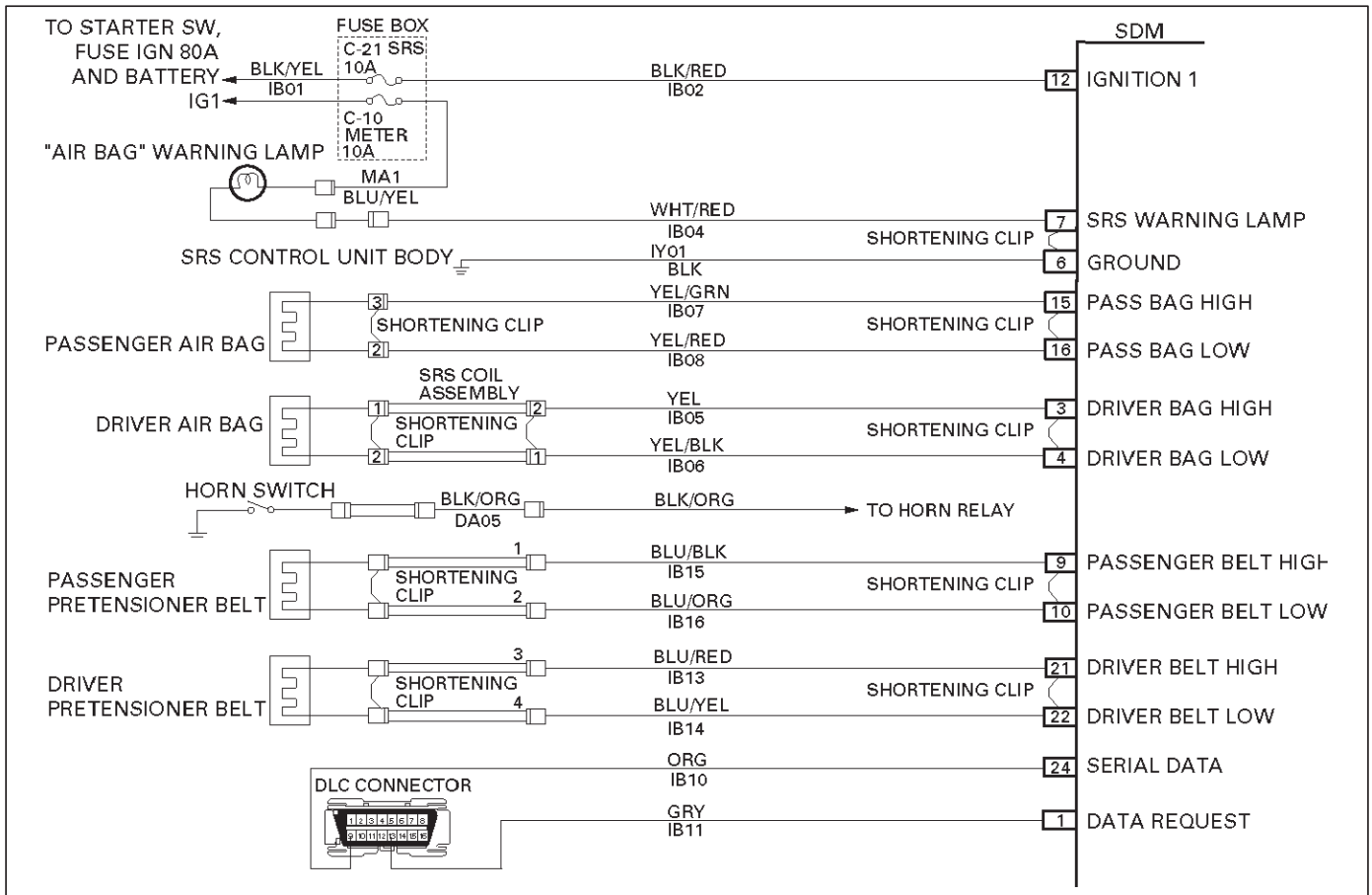
An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals "2" and "3", SDM terminals "15" and "16", or an open in IB07-YEL/GRN and IB08-YEL/RED.

9J1-18 RESTRAINT CONTROL SYSTEM

DTC 17 Passenger Deployment Loop Open

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Using scan tool data list function, read and record the passenger differential voltage. Is passenger VDIF 0.425 volts or more?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF". 2. Make sure the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly is seated properly. Is the yellow 2-pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2-pin connector properly Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2-pin connector located behind the glove box assembly. 2. If ok, reconnect the passenger air bag assembly 2-pin connector. 3. Ignition switch "ON". Is DTC 17 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch "Off." 2. Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connector located at the base of the steering column and behind the glove box assembly. 3. Connect 5-8840-2421-0 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch "ON." Is DTC 17 current?	Go to Step 6	Ignition switch "Off" Replace the passenger air bag assembly Go to Step 7
6	1. Ignition switch "Off." 2. There has been an open circuit resistance in the passenger deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB07-YEL/GRN and IB08-YEL/RED, and SDM connector terminal "15" and "16" to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 7

DTC 18 Passenger Deployment Loop Short To Ground



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltages at "Driver Bag Low" terminal "4" and "Passenger Bag Low" terminal "16" to detect short to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open. "Ignition 1" is within the normal operating voltage range. Once these conditions are met and the voltage at "Passenger Bag Low" is below a specified value, DTC 18 will set. This test is run once each ignition cycle and "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

This malfunction is no longer occurring and the ignition switch is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2-pin connector behind glove box assembly.
4. This test determines whether the malfunction is in IB07-YEL/GRN.
5. This test determines whether the malfunction is in IB08-YEL/RED.

Diagnostic Aids:

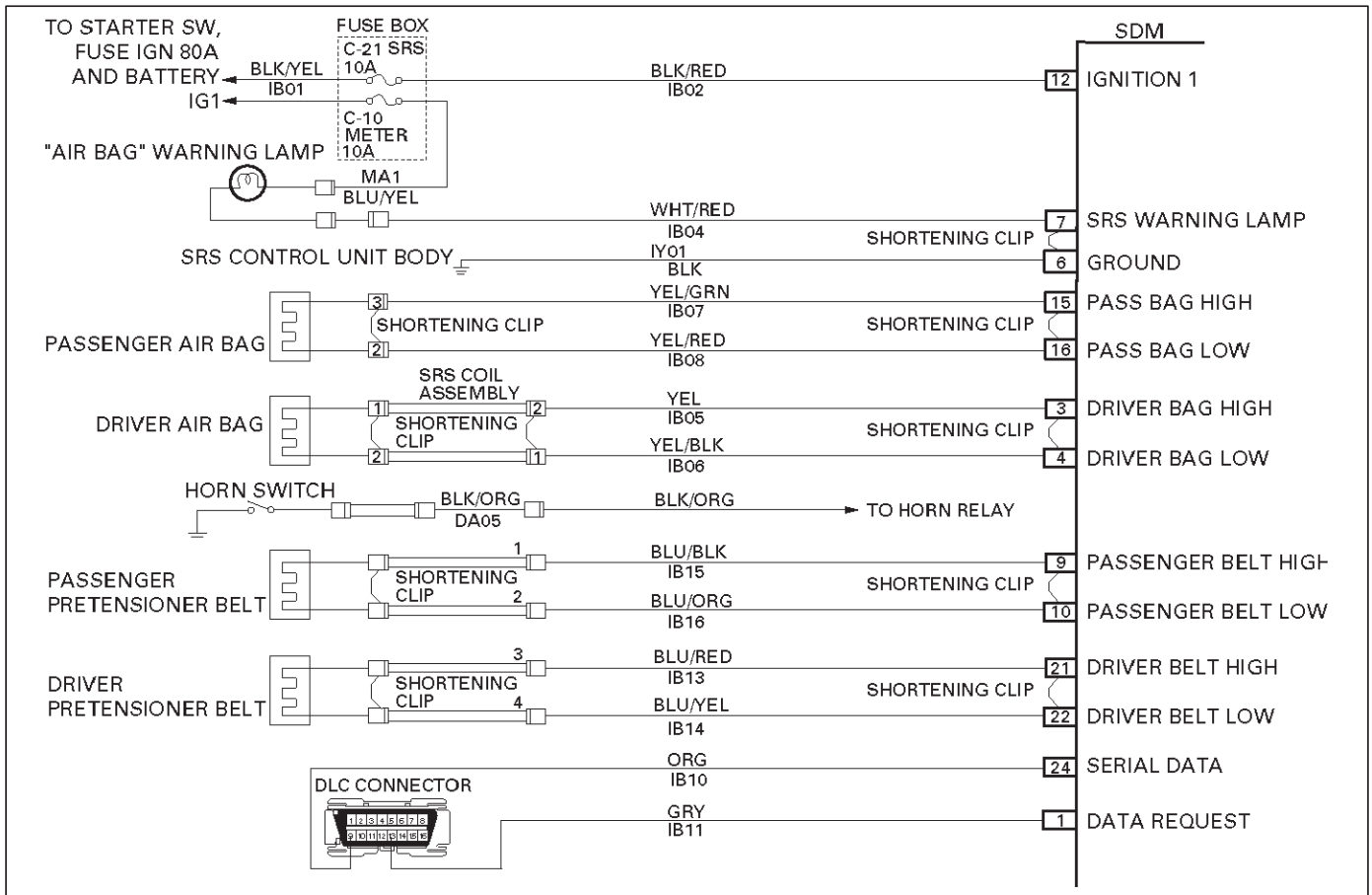
An intermittent condition is likely to be caused by a short to ground in the passenger air bag assembly circuit. Inspect IB07-YEL/GRN and IB08-YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced.

9J1-20 RESTRAINT CONTROL SYSTEM

DTC 18 Passenger Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Ignition switch "OFF."</p> <p>3. Connect scan tool data link connector. follow directions as given in the scan tool operator's MANUAL.</p> <p>4. Ignition switch "ON."</p> <p>5. Read passenger bag sense LO.</p> <p>Is passenger bag sense LO less than 1.5 volts?</p>	Go to Step 3	Go to Chart A
3	<p>1. Ignition switch "OFF."</p> <p>2. Disconnect passenger air bag assembly yellow 2-pin connector behind the glove box assembly.</p> <p>3. Leave driver air bag assembly connected.</p> <p>4. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to passenger air bag assembly harness connector.</p> <p>5. Ignition switch "ON."</p> <p>Is DTC 18 current?</p>	Go to Step 4	<p>Ignition switch "OFF"</p> <p>Replace passenger air bag assembly</p> <p>Go to Step 6</p>
4	<p>1. Ignition switch "OFF".</p> <p>2. Disconnect SRS driver / passenger load tool</p> <p>3. Measure resistance on SDM harness connector from terminal "15" to terminal "16" (ground).</p> <p>Does 5-8840-0285-0 display "OL" (Infinite)?</p>	Go to Step 5	<p>Replace SRS Harness</p> <p>Go to Step 6</p>
5	<p>Measure resistance on SDM harness connector from terminal "16" to terminal "6" (ground).</p> <p>Does 5-8840-0285-0 display "OL" (Infinite)?</p>	Go to Chart A	<p>Replace SRS Harness.</p> <p>Go to Step 6</p>
6	<p>1. Reconnect all components and ensure all component are properly mounted.</p> <p>2. Clear diagnostic trouble codes.</p> <p>Was this step finished?</p>	Go to the "SRS Diagnostic system Check"	Go to Step 6

DTC 19 Passenger Deployment Loop Short To B+



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltages at "Driver Bag Low" terminal "4" and "Passenger Bag Low" terminal "16" to detect short to B+ in the air bag assembly circuits.

DTC Will Set When:

"Ignition 1" is within the normal operating voltage range. Once these conditions are met and the voltage at "Passenger Bag Low" is above a specified value, DTC 19 will set. This test is run once each ignition cycle and "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 19 and also DTC 71.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2-pin connector behind glove box assembly.
4. This test determines whether the malfunction is in IB07-YEL/GRN.
5. This test determines whether the malfunction is in IB08-YEL/RED.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short to B+ in the passenger air bag assembly circuit. Inspect IB07-YEL/GRN and IB08-YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced. A careful inspection of IB07-YEL/GRN and IB08-YEL/RED, including the passenger air bag assembly pigtail is essential to ensure that the replacement SDM will not be damaged.

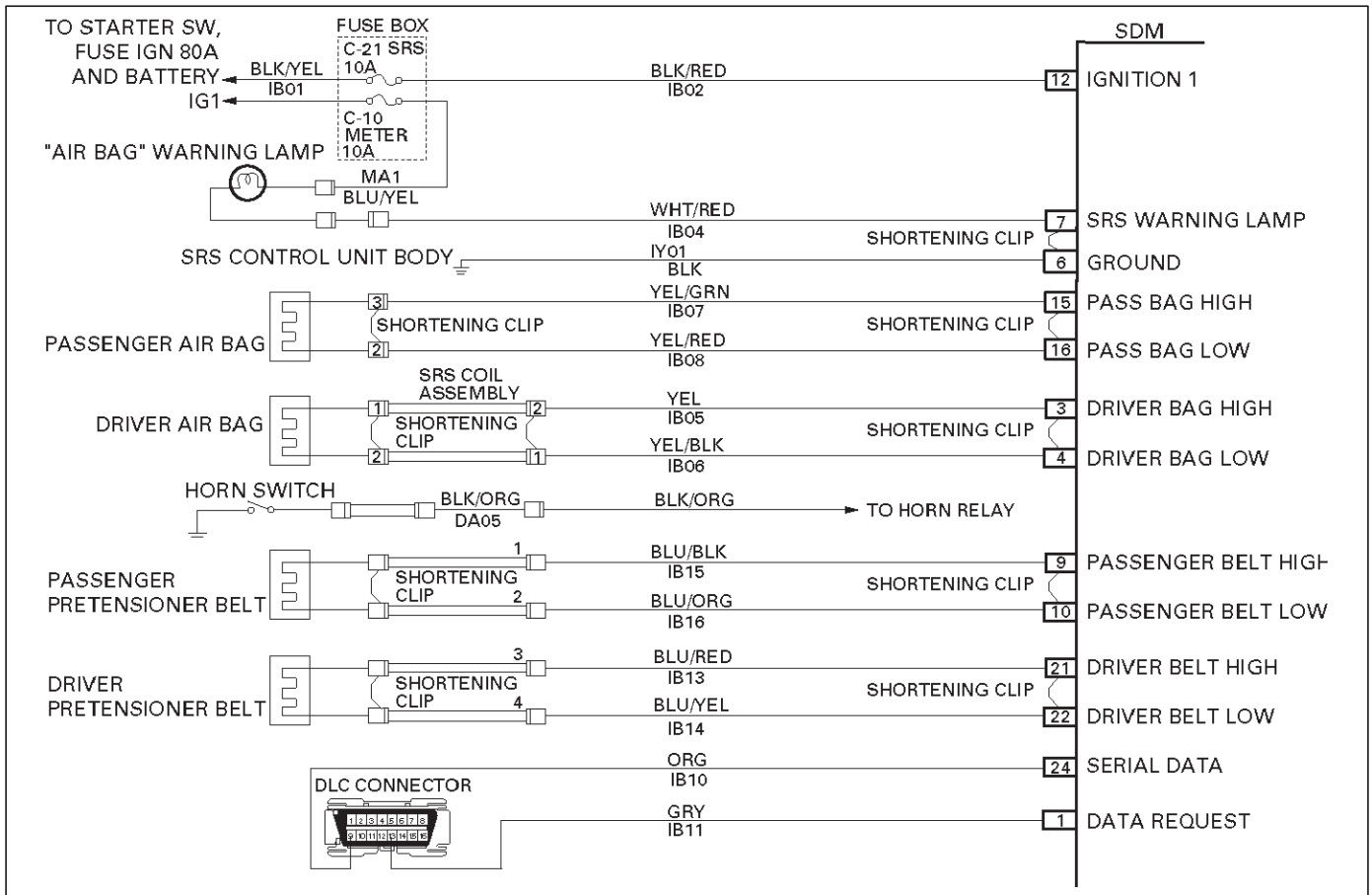
9J1-22 RESTRAINT CONTROL SYSTEM

DTC 19 Passenger Deployment Loop Short To B+

CAUTION: When DTC 19 has been set, it is necessary to replace the SDM. Setting DTC 19 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check" Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM With correct terminal adapter from 5-8840-0385-0. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger bag sense LO. Is passenger bag sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF". 2. Disconnect passenger air bag assembly yellow 2-pin connector behind the glove box assembly. 3. Leave driver air bag assembly connected. 4. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch "ON." Is passenger bag sense LO more than 3.5 volts?	Go to Step 4	Ignition switch "OFF" Replace passenger air bag assembly Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "15" to terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step 6.
5	Measure resistance on SDM harness connector from terminal "16" and terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Chart A	replace SRS harness Go to Step 6
6	1. Reconnect all components ensure all component are properly mounted. 2. Ignition switch "ON". Is passenger bag senslo less than 3.5 volts?	Ignition switch "OFF" Replace SDM Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 21 Driver Deployment Loop Resistance High



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test" "Driver Bag Low" terminal "4" is grounded through a current sink and the driver current source connected to "Driver Bag High" terminal "3" allows a known amount of current to flow. By monitoring the voltage difference between "Driver Bag High" and "Driver Bag Low", the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring IB05-YEL and IB06-YEL/BLK, and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring IB05-YEL and IB06-YEL/BLK, and connector terminal contact is above a specified value. This test run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON"
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 21.

DTC Will Clear When:

The ignition switch is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the 2-pin connector terminals at the base of steering column.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2-pin connector located at the base of the steering column.
6. This test determines whether the malfunction is due to high resistance in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

9J1-24 RESTRAINT CONTROL SYSTEM

Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at terminals "1" and "2" of the SRS coil 2-pin connector at the base of the steering column, terminal "1" and "2" of the driver air bag assembly 2-pin connector at the top of the steering column, SDM terminals "3" and "4" or a poor wire to terminal connection in IB05-YEL or

IB06-YEL/BLK. The test for this diagnostic trouble code is only run while the "AIR BAG" warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool "Clear Codes" command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

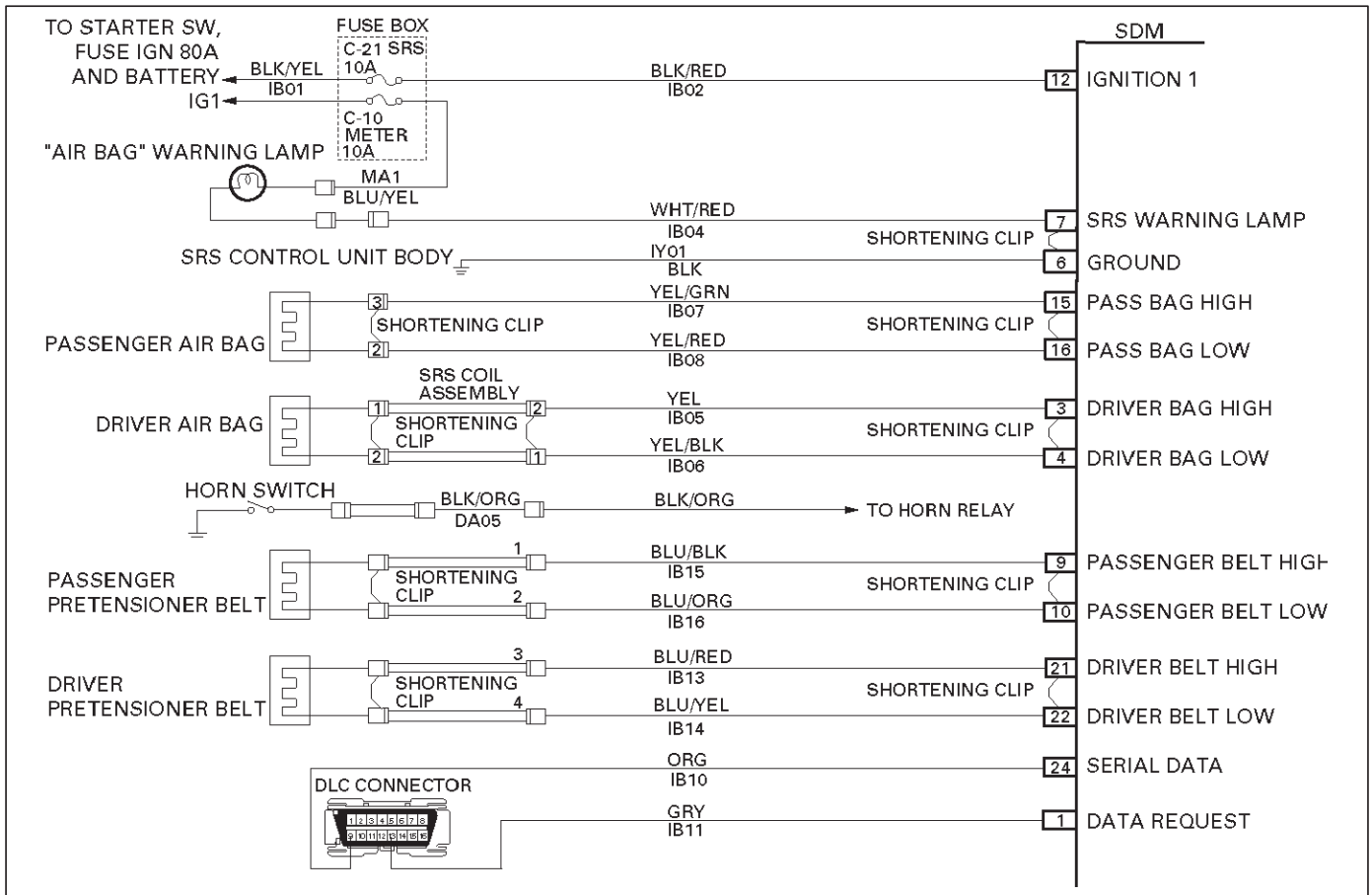
DTC 21 Driver Deployment Loop Resistance High

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check". Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver resistance more than 3.7 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Disconnect SRS coil assembly yellow 2-pin connector located at base of steering column is seated properly. Is the 2-pin connector connected properly?	Go to Step 4	Seat SRS coil assembly 2-pin connector properly Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2-Pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2-pin connector. 3. Ignition switch "ON." Is DTC 21 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch "OFF." 2. Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connector located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch "ON." Is DTC 21 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch "Off." 2. There has been a increase in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB05-YEL and IB06-YEL/BLK, and SDM connector terminal "3" and "4" to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A

DTC 21 Driver Deployment Loop Resistance High (Cont'd)

Step	Action	Yes	No
7	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 on the top of steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch "ON." Is DTC 21 current?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 8	Ignition switch "OFF" Replace driver air bag assembly Go to Step 8
8	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 8

DTC 22 Driver Deployment Loop Resistance Low



Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low” the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring IB05–YEL and IB06–YEL/BLK and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring IB05–YEL and IB06–YEL/BLK and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn-ON”
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 22.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the steering column.
4. This test checks for proper operation of the shorting clip in the yellow 2-pin connector.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2-pin connector located at the base of steering column.
6. This test determines whether the malfunction is due to shortening in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short between IB05–YEL or IB06–YEL/BLK or a

malfunctioning shorting clip on the driver air bag assembly or SRS coil assembly which would require replacement of the component. The test for this diagnostic trouble code is only run while the "AIR BAG" warning lamp is performing the bulb check, unless DTC

17 or DTC 26 is detected. When a scan tool "Clear Codes" command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

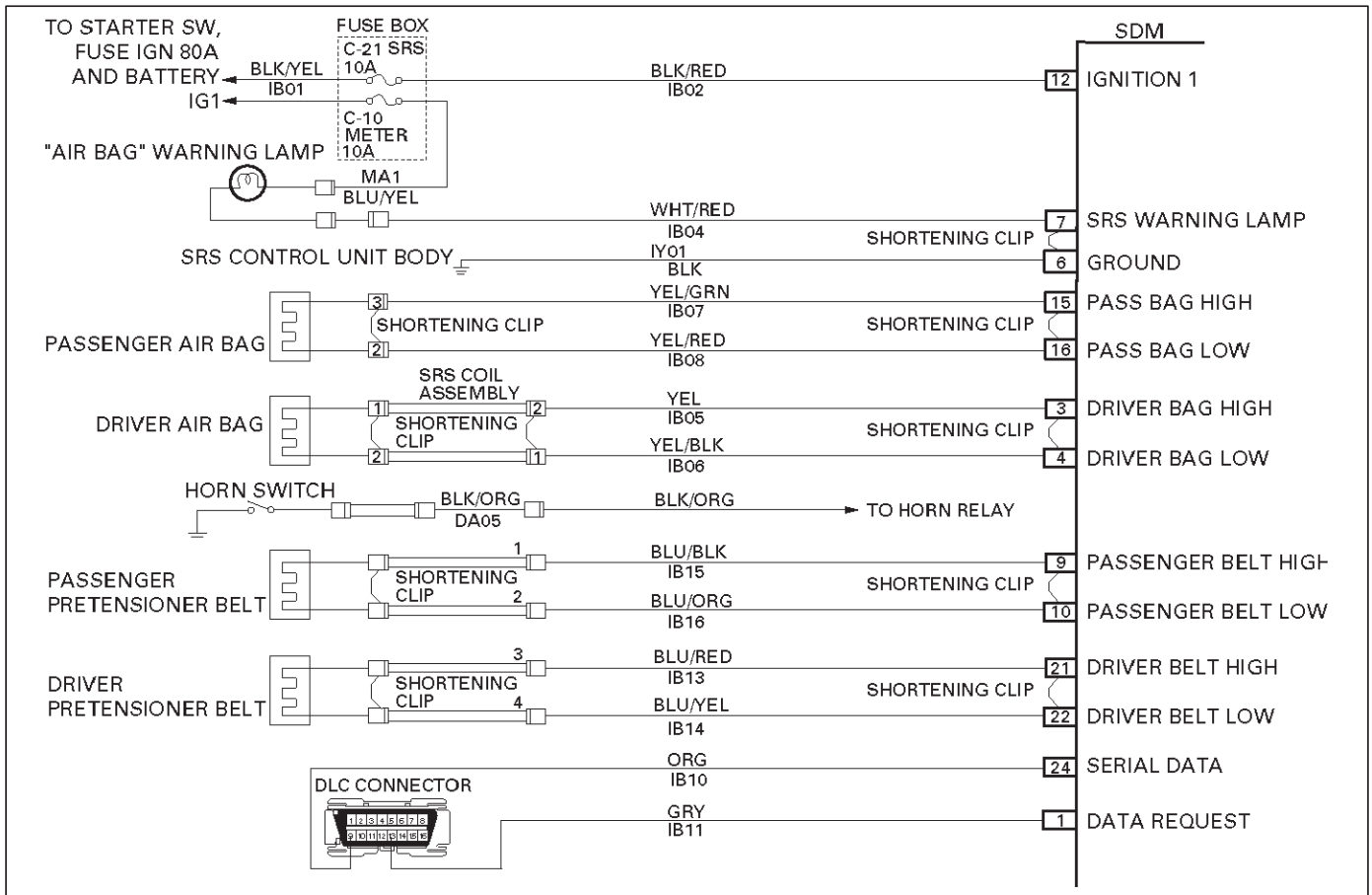
DTC 22 Driver Deployment Loop Resistance Low

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check." Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver deployment loop resistance less than 1.7 OHMS?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Make sure the SRS coil assembly yellow 2-pin connector located at the base of steering column is seated properly. Is the 2-pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2-pin connector properly Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2-pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2-pin connector. 3. Ignition switch "ON." Is DTC 22 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch "OFF." 2. Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connector located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch "ON." Is DTC 22 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch "OFF." 2. There has been a decrease in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB05-YEL and IB06-YEL/BLK, and SDM connector terminal "3" and "4" to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A

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Step	Action	Yes	No
7	<ol style="list-style-type: none">1. Ignition switch "OFF."2. Disconnect SRS driver / passenger load tool from driver air bag assembly harness connector.3. Connect SRS driver / passenger load tool 5-8840-2421-0 to the top of steering column 2-pin connector.4. Reconnect SRS coil assembly harness connector as the base of steering column.5. Ignition switch "ON." Is DTC 22 current?	Ignition switch "off" Replace SRS coil assembly Go to Step 8	Ignition switch "OFF" Replace driver air bag assembly Go to Step 8
8	<ol style="list-style-type: none">1. Reconnect all components, ensure all component are properly mounted.2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 8

DTC 24 Driver Deployment Loop Short To Ground



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltage at "Driver Bag Low" terminal "4" and "passenger Bag Low" terminal "16" to detect shorts to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open. "Ignition 1" is within the normal operating voltage range. This test is run once each ignition cycle and "Continuous Monitoring". Once these conditions are met and the voltage at "Driver Bag Low" is below a specified value, DTC 24 will set.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2-pin connector at the base of the steering column.
4. This test determines whether the malfunction is in IB05-YEL.
5. This test determines whether the malfunction is in IB06-YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

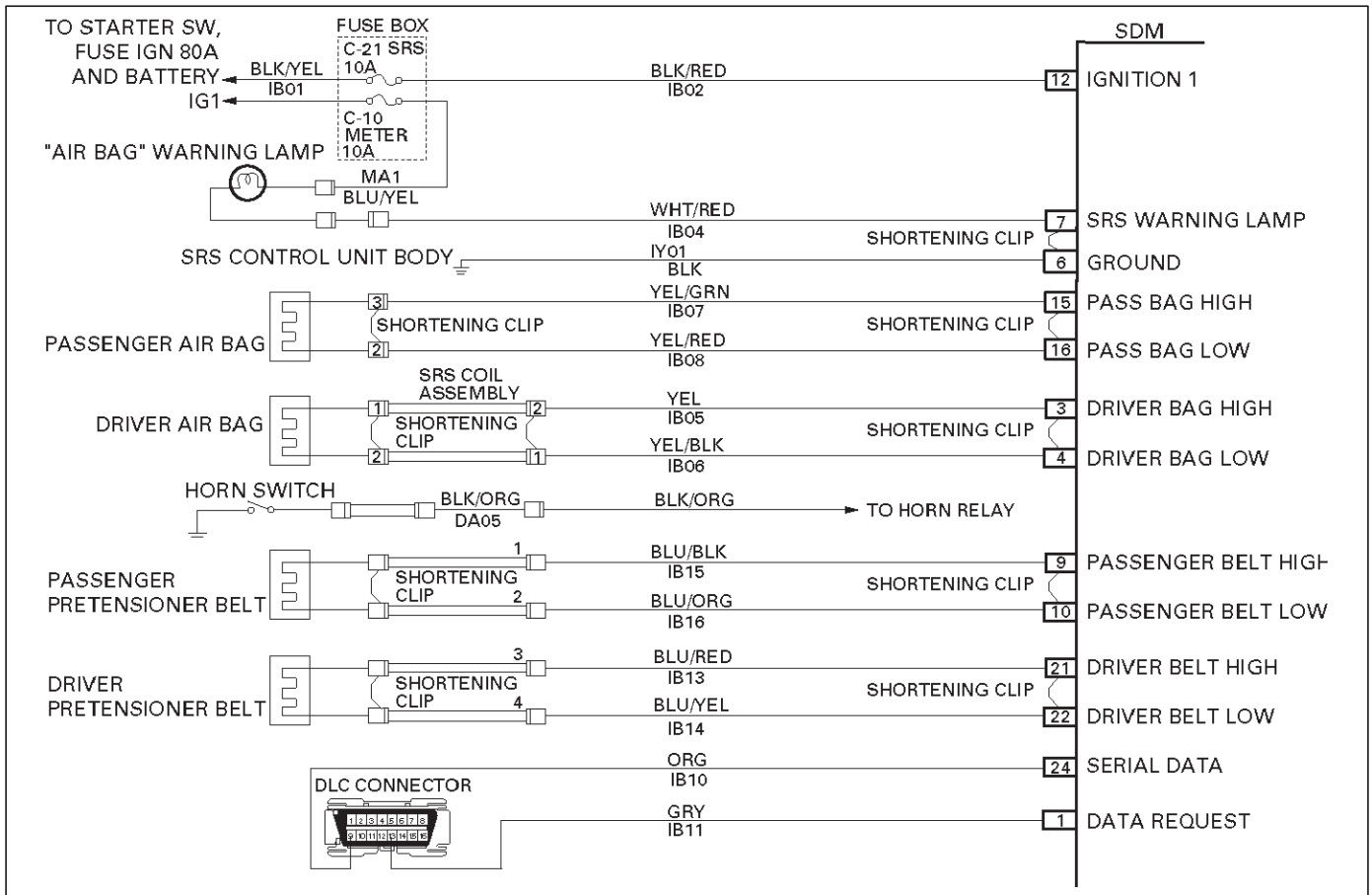
An intermittent condition is likely to be caused by a short to ground in the driver air bag assembly circuit. Inspect IB05-YEL and IB06-YEL/BLK carefully for cutting or chafing.

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DTC 24 Driver Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<ol style="list-style-type: none"> When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. Ignition switch "OFF." Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. Ignition switch "ON." Read driver bag sense LO. Is driver bag sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A
3	<ol style="list-style-type: none"> Ignition switch "OFF." Disconnect SRS coil assembly yellow 2-pin connector located at base of the steering column. leave passenger air bag assembly connected. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to SRS coil assembly harness connector. ignition switch "ON." Is DTC 24 current?	Go to Step 4	Go to Step 6
4	<ol style="list-style-type: none"> Ignition switch "OFF." Disconnect SDM. Disconnect SRS driver / passenger load tool. Measure resistance on SDM harness connector "3" to terminal "6" (ground). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step 7
5	Measure resistance on SDM harness connector from terminal "4" to terminal "6" (ground). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Chart A	Replace SRS harness Go to Step 7
6	<ol style="list-style-type: none"> Ignition switch "OFF." Disconnect SRS driver / passenger load tool 5-8840-2421-0 from SRS coil assembly harness connector. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter 5-8840-0385-0 to driver air bag assembly harness connector. located top of the steering column 2-pin connector. Reconnect SRS coil assembly harness connector as the base of steering column. Ignition switch "ON." Is DTC 24 current?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 7	Ignition switch "OFF" Replace driver air bag assembly Go to Step 7
7	<ol style="list-style-type: none"> Reconnect all components ensure all component are properly mounted. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 7

DTC 25 Driver Deployment Loop Short To B+



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltage at "Driver Bag Low" terminal "4" and "Passenger Bag Low" terminal "16" to detect shorts to B+ in the air bag assembly circuits.

DTC Will Set When:

"Ignition 1" is in the normal operating voltage range. This test is run once each ignition cycle and "Continuous monitoring". Once these conditions are met and the voltage at "Driver Bag Low" is above a specified value, DTC 25 will set.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 25 and also DTC 71

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the driver air bag assembly yellow 2-pin connector at the base of steering column.
4. This test determines whether the malfunction is in IB05-YEL.
5. This test determines whether the malfunction is in IB06-YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short to B+ in the driver air bag assembly circuit. Inspect IB05-YEL and IB06-YEL/BLK carefully for cutting or chafing. If the wiring pigtail of the driver air bag assembly and SRS coil assembly is damaged, the components must be replaced. A careful inspection of IB05-YEL and IB06-YEL/BLK, including the SRS coil assembly and driver air bag assembly is essential to ensure that the replacement SDM will not be damaged.

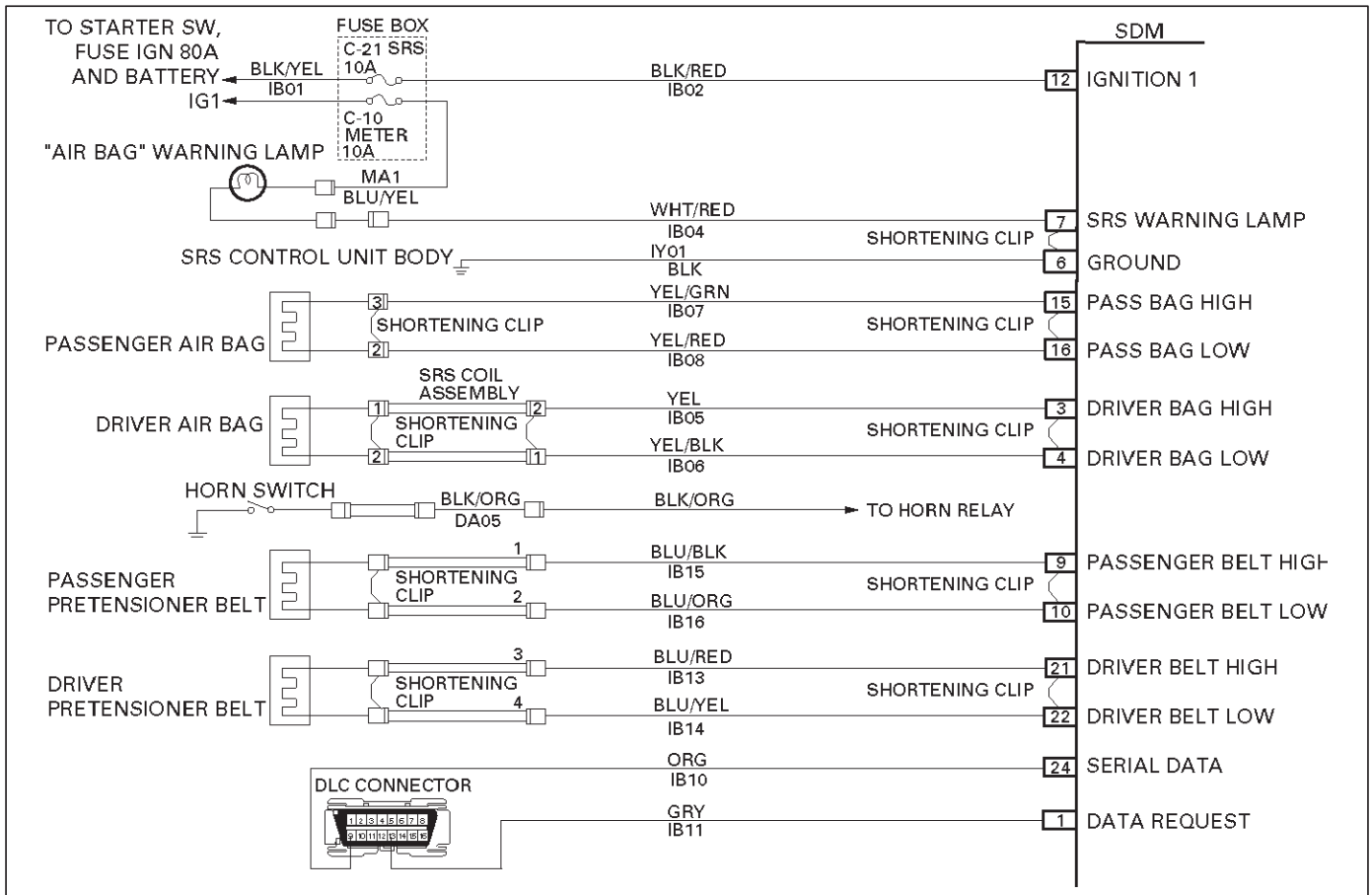
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DTC 25 Driver Deployment Loop Short To B+

CAUTION: When DTC 25 has been set, it is necessary to replace the SDM. Setting DTC 25 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to B+ condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<ol style="list-style-type: none"> 1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read driver bag sense LO . Is driver bag sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A
3	<ol style="list-style-type: none"> 1. Ignition switch "OFF." 2. Disconnect SRS coil assembly yellow 2-pin connector at the base of the steering column. Leave passenger air bag assembly connected. 3. Connect SRS driver /passenger load tool 5-8840-2421-0 and appropriate adapter to SRS coil assembly harness connector. 4. Ignition switch "ON." Is driver bag sense LO more than 3.5 volts?	Go to Step 4	Go to Step 6
4	<ol style="list-style-type: none"> 1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver /passenger load tool. 4. Measure resistance on SDM harness connector "3" to terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step 7
5	Measure resistance on SDM harness connector from terminal "4" to terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Chart A	Replace SRS harness Go to Step 7
6	<ol style="list-style-type: none"> 1. Ignition switch "OFF" 2. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter 5-8840-0385-0 to driver air bag assembly harness 2-pin connector located at top of the steering column. 3. Reconnect SRS coil assembly harness connector as the base of steering column. 4. Ignition switch "ON." Is driver bag sense LO more than 3.5 volts?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 7	Ignition switch "OFF" Replace driver air bag assembly Go to Step 7
7	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all component are properly mounted. 2. Ignition switch "ON." Is driver bag senslo less than 3.5 volts?	Ignition switch "OFF" Replace SDM Go to Step 8	Go to Chart A
8	<ol style="list-style-type: none"> 1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 8

DTC 26 Driver Deployment Loop Open



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. During "Continuous Monitoring" diagnostics, a fixed amount of current is following in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Driver Bag High" and "Driver Bag Low", the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring IB05-YEL and IB06-YEL/BLK, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Driver Bag High" terminal "3" and "Driver Bag Low" terminal "4" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Driver Bag High" terminal "3" and "Driver Bag Low" terminal "4" is below a

specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the yellow 2-pin connector at the base of the steering column.
5. This test isolates the malfunction to one side of the SRS coil assembly yellow 2-pin connector located at the base of steering column.
6. This test determines whether the open is in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

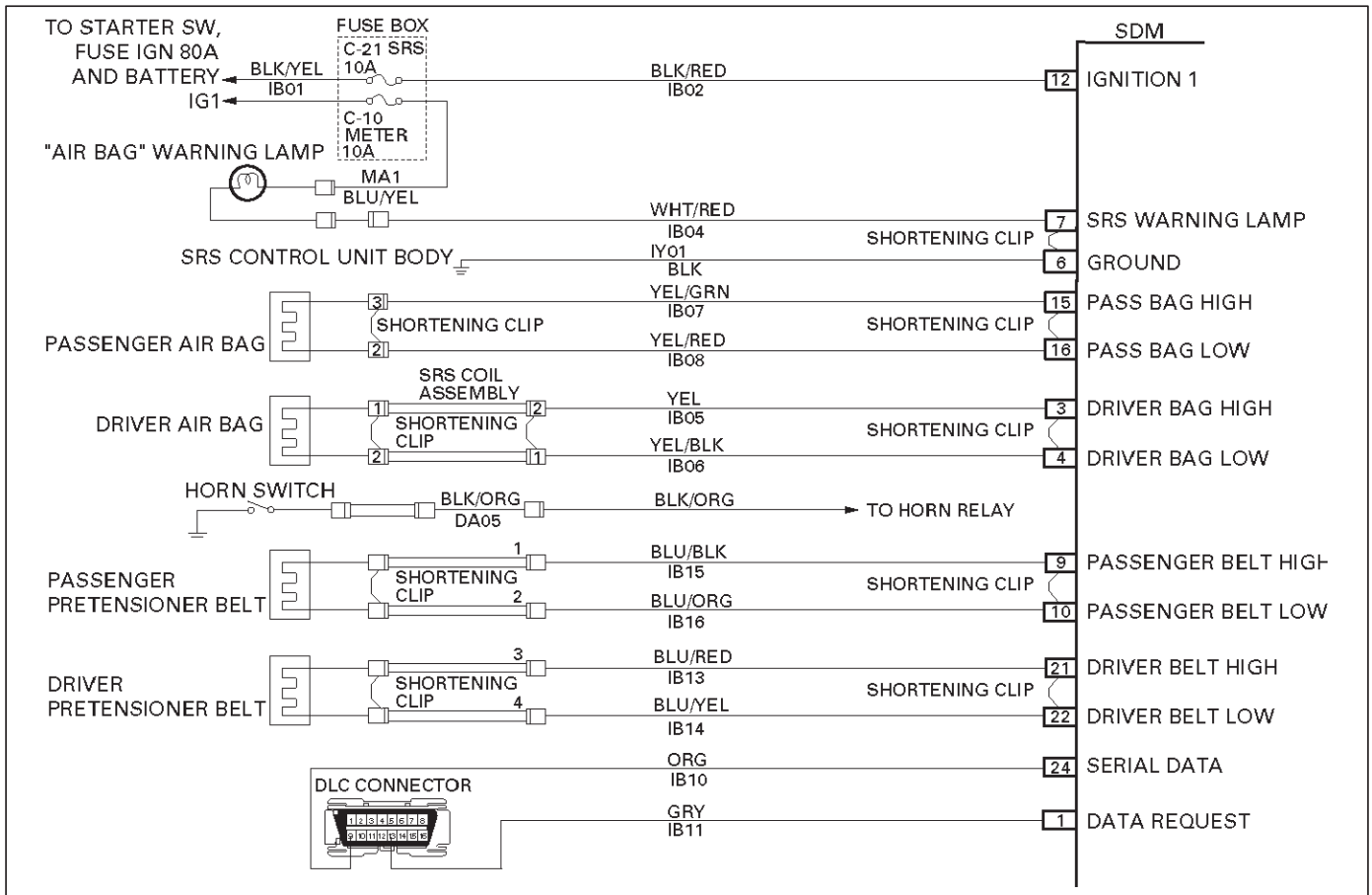
An intermittent condition is likely to be caused by a poor connection at the driver air bag assembly harness 2-pin connector terminals "1" and "2" at the top of the steering column, SRS coil assembly harness 2-pin connection terminals "1" and "2", SDM terminals "3" and "4", or an open in IB05-YEL and IB06-YEL/BLK.

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DTC 26 Driver Deployment Loop Open

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Use scan tool data list function, read and record the driver differential voltage. Is driver VDIF more than 4.25 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Make sure the SRS coil assembly yellow 2-pin connector located at the base of steering column is seated properly. Is the yellow 2-pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2-pin connector Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2-pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2-pin connector. 3. Ignition switch "ON." Is DTC 26 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch "OFF". 2. Disconnect SRS coil and passenger air bag assembly, yellow 2-pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver/passenger load tool 5-8840-2421-0 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch "ON." Is DTC 26 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch "OFF." 2. There has been an open circuit in the driver inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB05-YEL and IB06-YEL/BLK, and SDM connector terminal "3" and "4" to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A
7	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 on steering column 2-pin connector. 4. Reconnect SRS coil assembly harness connector at the base of steering column. 5. Ignition switch "ON." Is DTC 26 current?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 8	Ignition switch "OFF" Replace driver air bag assembly Go to Step 8
8	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 8

DTC 51 Air Bag Deployment Event Commanded



D09RW014

Circuit Description:

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags and causing DTC 51 to set.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp records "Crash Data", and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

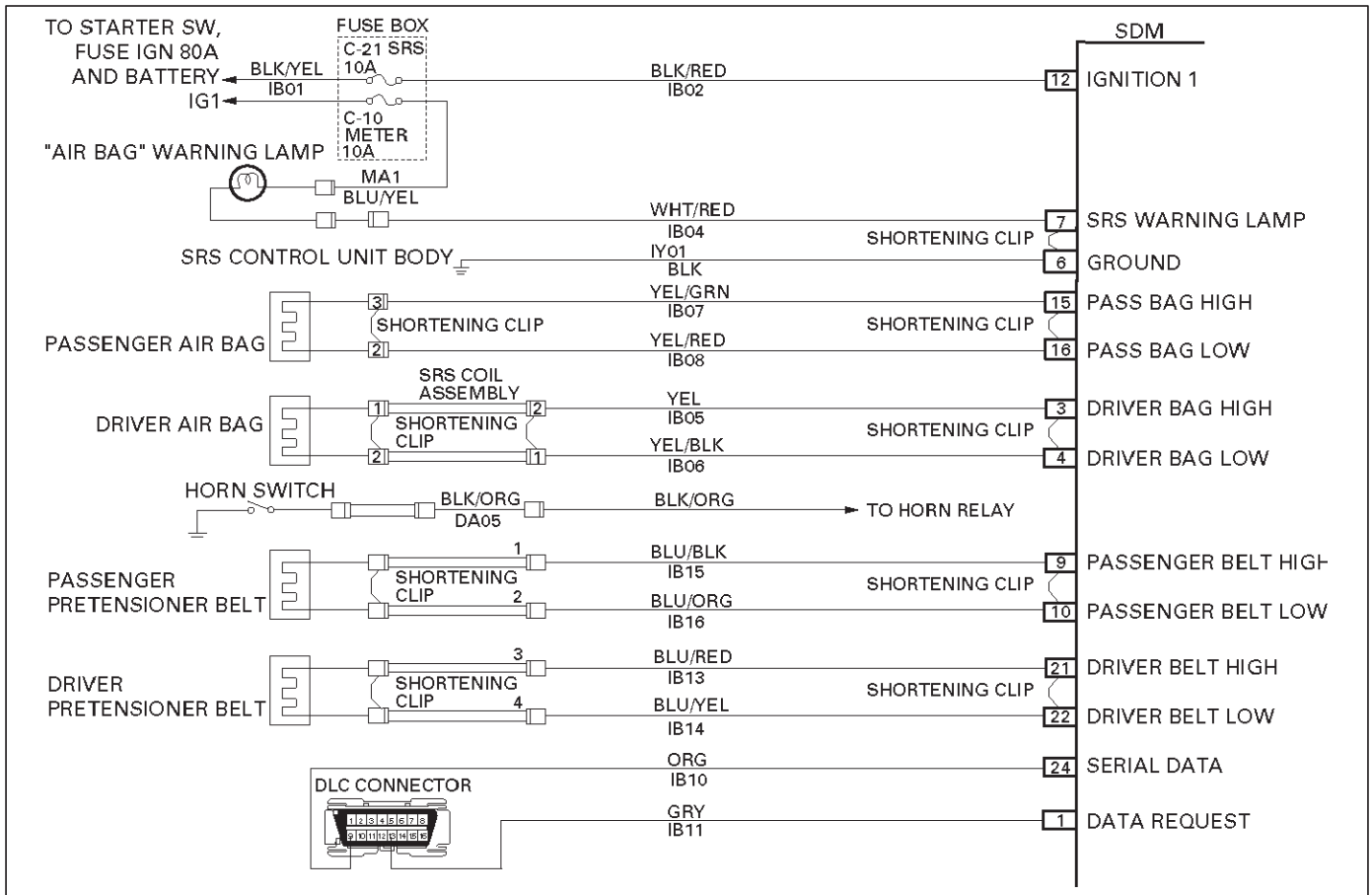
2. If air bag assembly (s) has not deployed, DTC 51 may have falsely set.
3. If DTC 51 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 51 Air Bag Deployment Event Commanded

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	Ignition switch "OFF." Have air bag assemblies deployed?	Replace components and perform inspections as directed in "repairs and inspections required after an accident" in this section Clear diagnostic trouble codes Repeat "SRS Diagnostic System Check"	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in "Repairs and Inspections Required After An Accident" in this section Clear diagnostic trouble codes Repeat "SRS Diagnostic System Check"	Ignition switch "OFF" Replace SDM Reconnect all SRS system components, ensure all components are properly mounted Repeat "SRS Diagnostic System Check"

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range



D09RW014

Circuit Description:

The SDM contains a sensing drive which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags. DTC 53 is set accompanying with DTC 51 when a deployment occurs while an air bag assembly circuit fault is present that could possibly result in a no deployment situation in one or both air bag assemblies.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags and an inflator circuit fault is present..

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp records "Crash Data", and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced. If DTC 53 is set, one or more DTCs will be set in addition to DTC 53. Malfunction(s) setting DTC(s) (other than DTC 71) must be repaired so that DTC(s) will not be set when a new SDM is installed.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

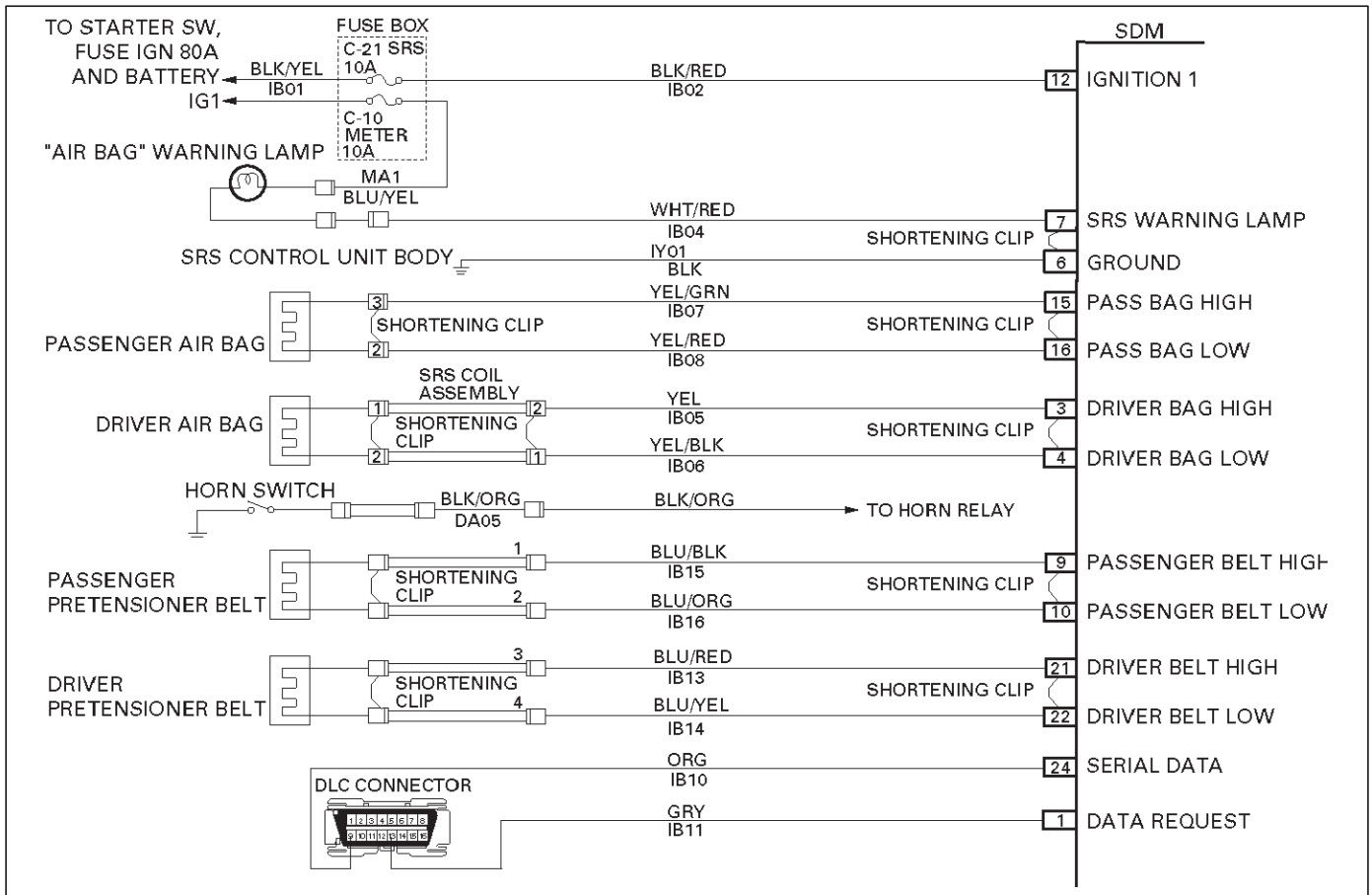
2. If air bag assembly have not deployed, DTC 53 may have falsely set.
3. If DTC 53 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 53 Deployment Commanded WITH Deployment Loop Fault Or Energy Reserves Out Of Range

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	Ignition switch "OFF." Have air bag assemblies deployed?	Replace components and perform inspections as directed in "Repairs And Inspections Required After An Accident" in this section Clear diagnostic trouble codes Repeat the "SRS Diagnostic System Check"	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in "Repairs And Inspections Required After An Accident" in this section Clear diagnostic trouble codes Repeat "SRS Diagnostic System Check"	Ignition switch "OFF" Replace SDM Reconnect all SRS system components, ensure all components are properly mounted Repeat the "SRS Diagnostic System Check"

DTC 61 Warning Lamp Circuit Failure



D09RW014

Circuit Description:

When the ignition switch is turned "ON", battery voltage is applied to the "AIR BAG" warning lamp and to the "Ignition 1" input terminal "12". The SDM responds by turning on the "AIR BAG" warning lamp 3.5 seconds. The SDM monitors the lamp driver output by comparing the output state at "SRS Warning Lamp" terminal "7" to the microprocessor commanded state. When "Ignition 1" is in the specified value, and the output state does not match the commanded state of the lamp driver for 500 milliseconds, DTC 61 is set.

DTC Will Set When:

"Ignition 1" voltage is in the specified value and the output state at the "SRS Warning Lamp" terminal does not match

the commanded state of the lamp driver for 500 milliseconds. This test is run every 100 milliseconds during "Continuous Monitoring" tests and once per each ignition cycle at the beginning.

Action Taken:

SDM attempts to turn "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

Diagnostic Aids:

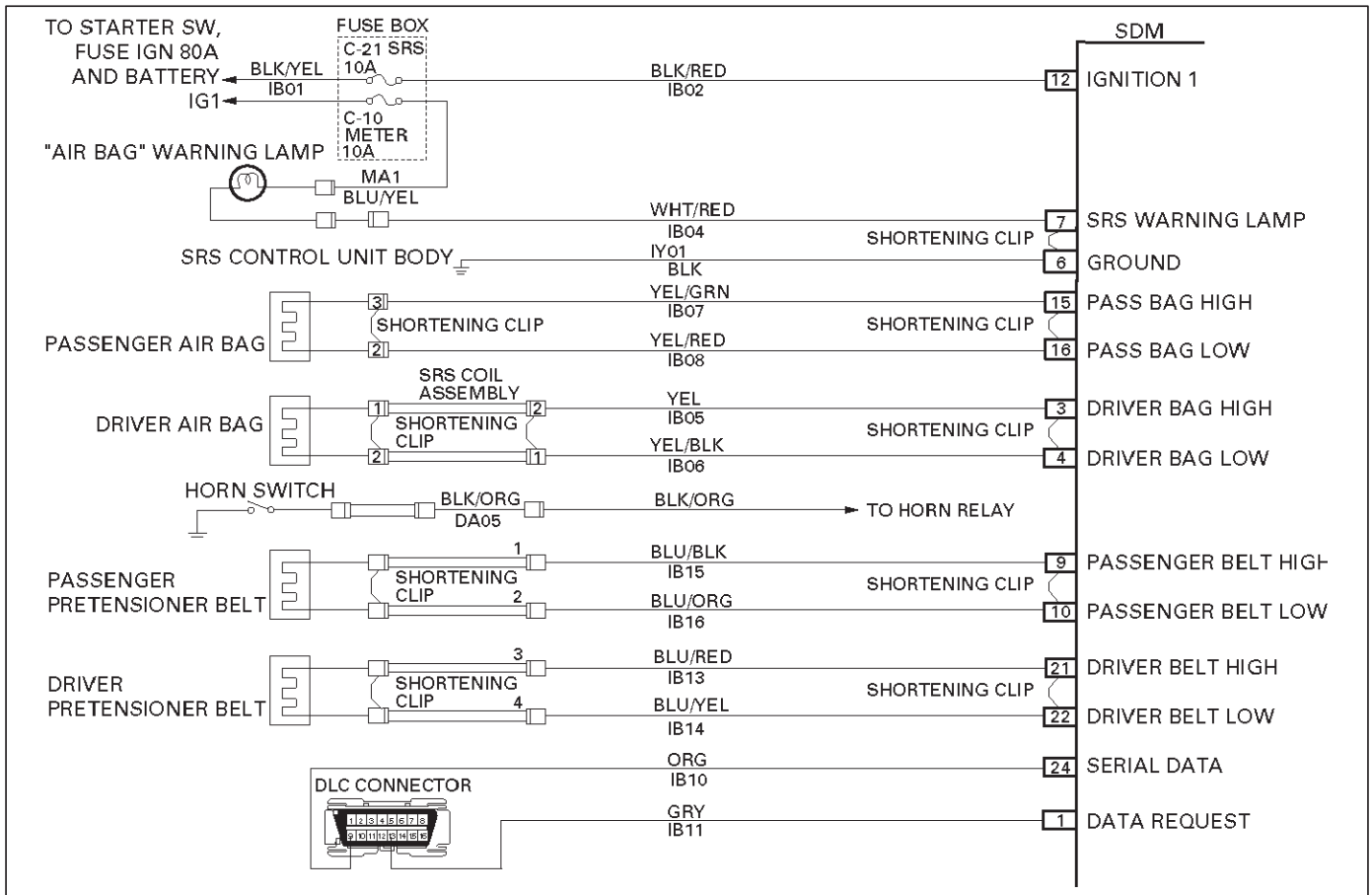
Refer to Charts B and C to diagnose warning lamp circuit malfunctions.

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DTC 61 Warning Lamp Circuit Failure

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<ol style="list-style-type: none">1. Malfunctions within the "AIR BAG" warning lamp circuitry will set this diagnostic trouble code.2. These malfunctions are addressed in the "SRS Diagnostic System Check" via Chart B and Chart C.3. Failure to properly perform the "SRS Diagnostic System Check" may result in misdiagnosis.4. Ignition switch "ON."5. Clear SRS diagnostic trouble codes. IS DTC 61 set?	Ignition switch "OFF" Go to Chart A	Repeat the "SRS Diagnostic System Check"

DTC 71 Internal SDM Fault



D09RW014

Circuit Description:

DTC 71 is an indication of a potential internal SDM malfunction and will set if any of the following conditions are detected:

- 1) Deployment or microprocessor energy reserve failure.
- 2) EEPROM failure.
- 3) ROM failure.
- 4) RAM failure.
- 5) Calibration check sum failure.
- 6) Deployment switch faults.
- 7) Accelerometer fault.
- 8) Arming sensor fault.
- 9) Diagnostic current faults.
- 10) DTC 19
- 11) DTC 25
- 12) DTC 51
- 13) DTC 53

DTC Will Set When:

Any of the above indicated malfunctions are detected by the SDM. The malfunctions described above are tested mainly during "Continuous Monitoring" and some ones run each ignition cycle.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

A scan tool "Clear Codes" commanded is received by the SDM. Some of the indicated malfunctions will only allow the "AIR BAG" warning lamp to go out.

But when DTC 19, 25, 51, 53 are also set, SDM is replaced.

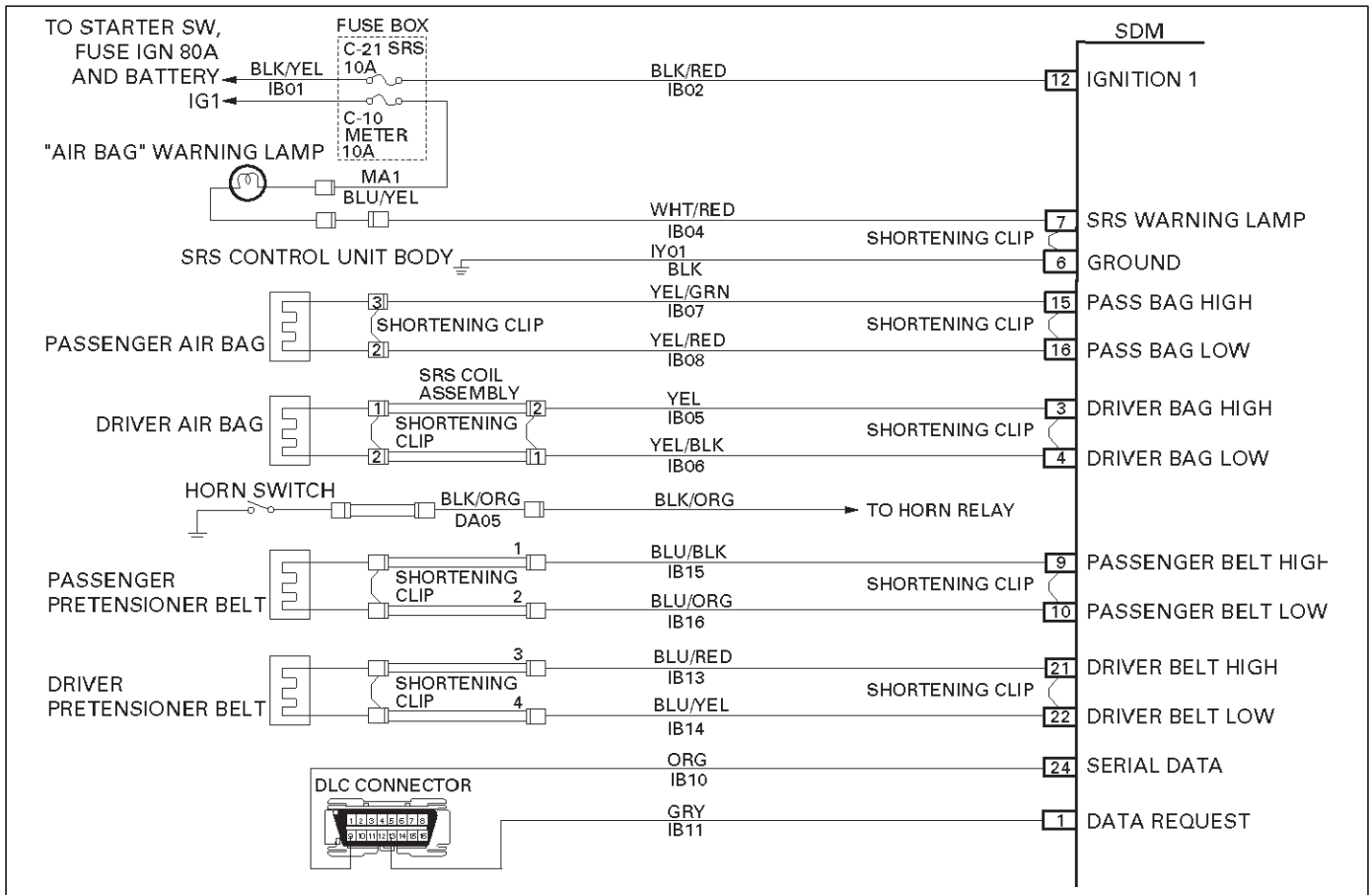
DTC 71 Internal SDM Fault

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

CAUTION: When DTC 19 or 25 has been set, it is necessary to replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 51 or 53 and DTC 71 will remain current. Ensure that the short to voltage condition DTC 19, 25 is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	Note SRS "Diagnostic System Check." IS DTC 19 OR 25 OR 51 OR 53 ALSO SET (CURRENT OR HISTORY)? (REFER TO NOTICE ABOVE.)	Go to DTC 19 if DTC 19 is set Go to DTC 25 if DTC 25 is set Go to DTC 51 if DTC 51 is set Go to DTC 53 if DTC 53 is set	Ignition switch "OFF" Replace SDM Repeat the "SRS Diagnostic System Check"

DTC 29 Passenger Pretensioner Loop Short To Ground



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltages at "Driver Belt Low" terminal "10" and "Passenger Belt Low" terminal "22" to detect short to ground in the pretensioner assembly circuits.

DTC Will Set When:

Neither of the air bag and the pretensioner belt are open. "Ignition 1" is within the normal operating range. Once these conditions are met and the voltage at "Passenger Belt Low" is below a specified value, DTC 29 will set. This test is run once each ignition cycle and "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

This malfunction is no longer occurring and the ignition switch is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the passenger pretensioner assembly yellow 2-pin connector at the base of the passenger seat.
4. This test determines whether the malfunction is in IB15-BLU/BLK.
5. This test determines whether the malfunction is in IB16-BLU/ORG.

Diagnostic Aids:

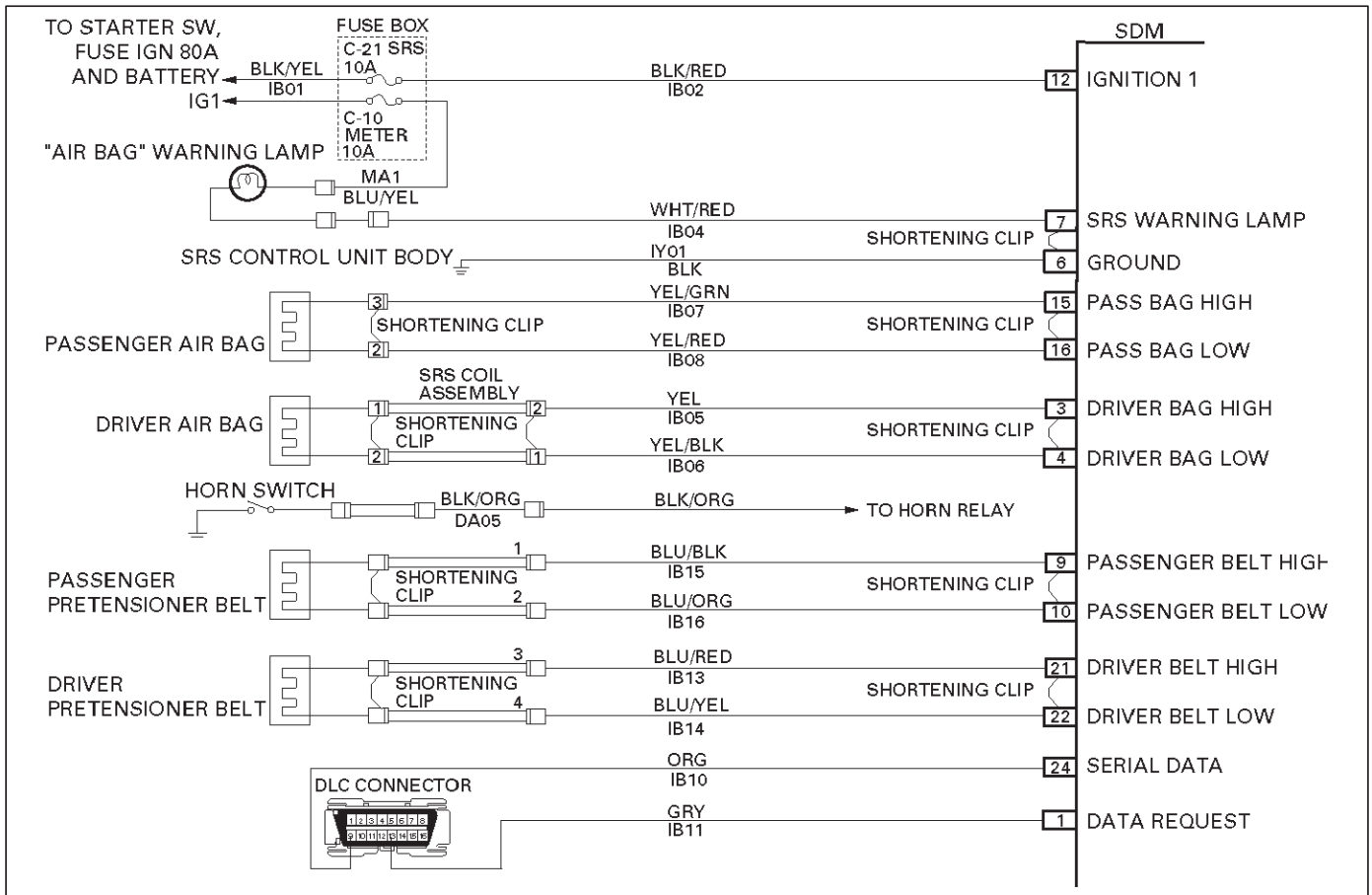
An intermittent condition is likely to be caused by a short to ground in the passenger pretensioner assembly circuit. Inspect IB15-BLU/BLK and IB16-BLU/ORG carefully for cutting or chafing. If the wiring pigtail of the passenger pretensioner assembly is damaged, the component must be replaced.

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DTC 29 Passenger Pretensioner Loop Short To Ground

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. follow directions as given in the scan tool operator's MANUAL. 4. Ignition switch "ON." 5. Read passenger sense LO. Is passenger sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Disconnect passenger pretensioner assembly yellow 2-pin connector at the base of the passenger seat. 3. Leave driver pretensioner assembly connected. 4. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to passenger pretensioner assembly harness connector. 5. Ignition switch "ON." Is DTC 29 current?	Go to Step 4	Ignition switch "OFF" Replace passenger pretensioner assembly Go to Step 6
4	1. Ignition switch "OFF". 2. Disconnect SRS driver / passenger load tool 3. Measure resistance on SDM harness connector from terminal "9" to terminal "6" (ground). Does 5-8840-0285-0 display "OL" (Infinite)?	Go to Step 5	Replace SRS harness or repair chassis harness Go to Step 6
5	Measure resistance on SDM harness connector from terminal "10" to terminal "6" (ground). Does 5-8840-0285-0 display "OL" (Infinite)?	Go to Chart A	Replace SRS harness or repair chassis harness Go to Step 6
6	1. Reconnect all components and ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic system Check"	Go to Step 6

DTC 31 Passenger Pretensioner Loop Resistance High



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Belt Low" terminal "10" is grounded through a resistor and the passenger current source connected to "Passenger Belt High" terminal "9" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Belt High" and "Passenger Belt Low" the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring IB15-BLU/BLK and IB16-BLU/ORG connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger pretensioner assembly, harness wiring IB15-BLU/BLK and IB16-BLU/ORG, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON",
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector.
4. This test checks for proper contact and/or corrosion of the yellow 2-pin connector terminals.
5. The test checks for a malfunctioning passenger pretensioner assembly.
6. This test determines whether the malfunction is due to high resistance in the wiring.

Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals "1" and "2", SDM terminal "9" and "10", or a poor wire to terminal connection in IB15-BLU/BLK and IB16-BLU/ORG. This test for this diagnostic trouble code is only run while the "AIR BAG"

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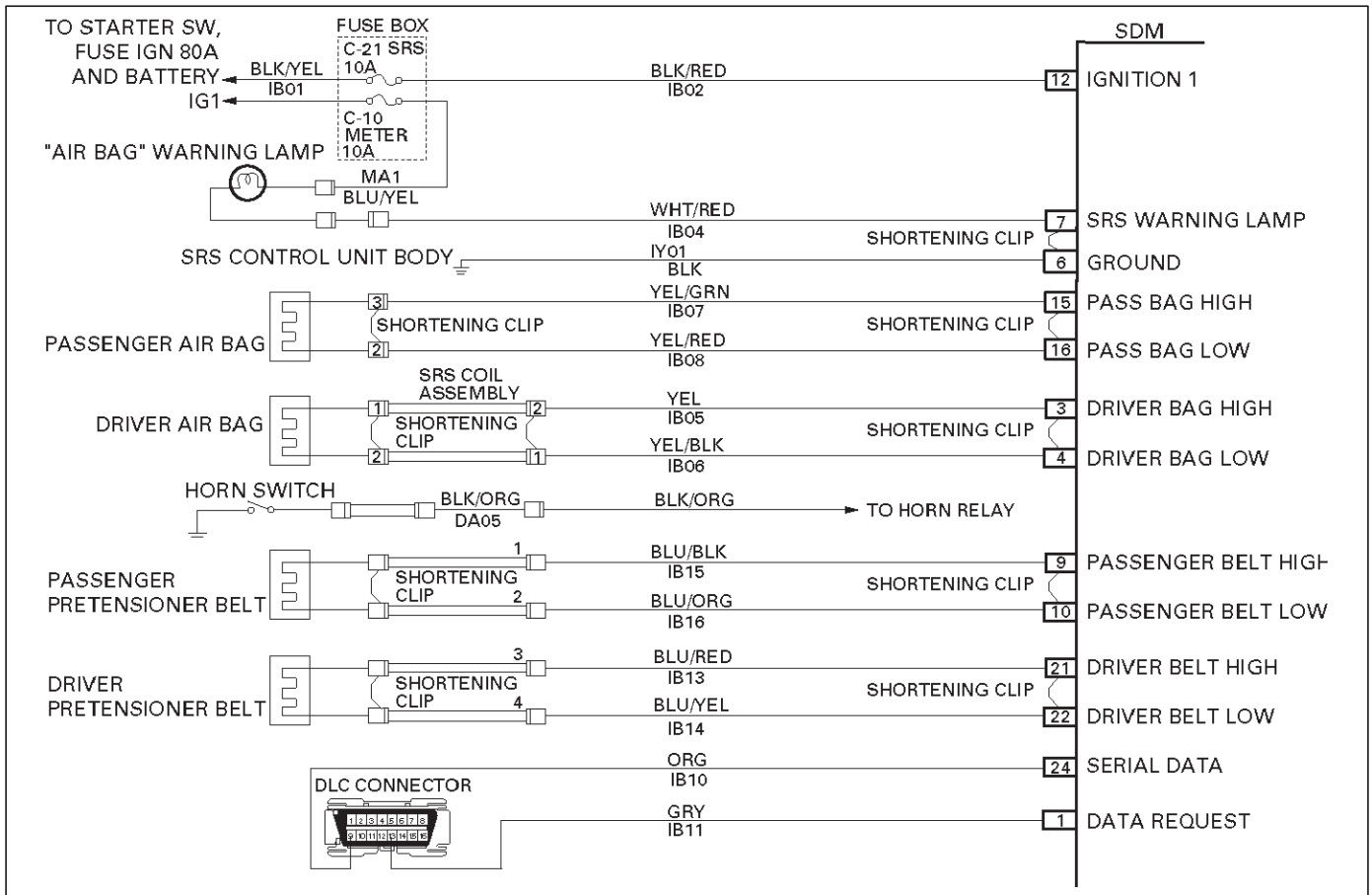
warning lamp is performing the bulb check. When a scan tool "Clear Codes" command is issued and the

malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 31 Passenger Pretensioner loop Resistance High

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" Performed?	Go to Step 2	Go to The "SRS Diagnostic System Check"
2	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Use scan tool data list function, read and record the passenger pretensioner loop resistance.</p> <p>Is passenger resist. more than 3.7 ohms?</p>	Go to Step 3	Go to Chart A
3	<p>1. Ignition switch "Off."</p> <p>2. Make sure the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat.</p> <p>Is the yellow 2-pin connector connected properly?</p>	Go to Step 4	Seat passenger pretensioner assembly yellow 2-pin connector properly Go to Step 7
4	<p>1. Disconnect and inspect the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat.</p> <p>2. If ok, reconnect the passenger pretensioner assembly 2-pin connector.</p> <p>3. Ignition switch "ON."</p> <p>Is DTC 31 current?</p>	Go to Step 5	Go to Step 7
5	<p>1. Ignition switch "Off."</p> <p>2. Disconnect passenger pretensioner assembly, yellow 2-pin connector located at the base of the passenger seat.</p> <p>3. Connect 5-8840-2421-0 SRS driver / passenger load tool and appropriate adapters to passenger pretensioner assembly harness connectors.</p> <p>4. Ignition switch "ON."</p> <p>Is DTC 31 Current?</p>	Go to Step 6	Ignition switch "Off" Replace the passenger pretensioner assembly Go to Step 7
6	<p>1. Ignition switch "Off."</p> <p>2. There has been an increase in the total circuit resistance of the passenger loop.</p> <p>3. Use the high resolution ohmmeter mode of the DVM while checking IB15-BLU/BLK and IB16-BLU/ORG, and SDM connector terminal "9" and "10" to locate the root cause.</p> <p>Was a fault found?</p>	Replace SRS harness or repair chassis harness Go to Step 7	Go to Chart A
7	<p>1. Reconnect all components ensure all component are properly mounted.</p> <p>2. Clear diagnostic trouble codes.</p> <p>Was This step finished?</p>	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 32 Passenger Pretensioner loop Resistance Low



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Belt Low" terminal "10" is grounded through a resistor and the passenger current source connected to "Passenger Belt High" terminal "9" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Belt High" and "Passenger Belt Low", the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring IB15-BLU/BLK and IB16-BLU/ORG connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring IB15-BLU/BLK and IB16-BLU/ORG, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON",
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies connection of the yellow 2-pin connector.
4. This test checks for proper operation of the shorting clip in the yellow 2-pin connector.
5. The test checks for a malfunction passenger pretensioner assembly.
6. This test determines whether the malfunctioning is due to shortening in the wiring.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short between IB15-BLU/BLK and IB16-BLU/ORG, or a malfunctioning shorting clip on the passenger pretensioner assembly which would require replacement of the pretensioner assembly. The test for this diagnostic trouble code is only run while "AIR BAG" warning lamp is

9J1-48 RESTRAINT CONTROL SYSTEM

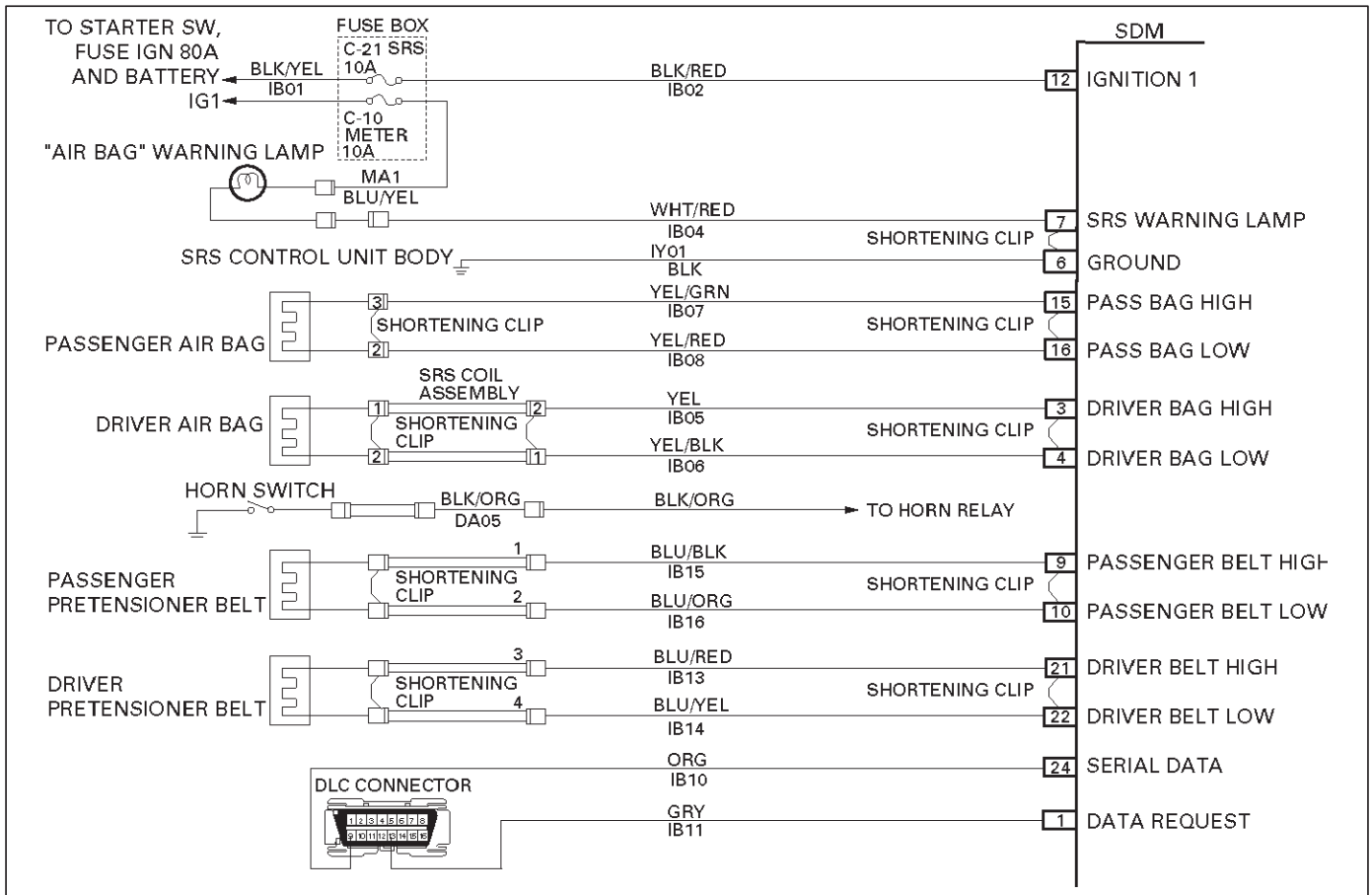
performing the bulb check. When a scan tool “Clear Codes” command is issued and the malfunction is still

present, the DTC will not reappear until the next ignition cycle.

DTC 32 Passenger Pretensioner loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Repeat the “SRS Diagnostic System Check”
2	<ol style="list-style-type: none"> When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. Using scan tool data list function, read and record the passenger pretensioner loop resistance. <p>Is passenger resist. less than 1.4 ohms?</p>	Go to Step 3	Go to Chart A
3	<ol style="list-style-type: none"> Ignition switch “Off.” Make sure the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat. <p>Is the yellow 2-pin connector connected properly?</p>	Go to Step 4	Seat passenger pretensioner assembly yellow 2-pin connector properly Go to Step 7
4	<ol style="list-style-type: none"> Disconnect and inspect the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat. If ok, reconnect the passenger pretensioner assembly 2-pin connector. Ignition switch “ON.” <p>Is DTC 32 Current?</p>	Go to Step 5	Go to Step 7
5	<ol style="list-style-type: none"> Ignition switch “Off.” Disconnect passenger pretensioner assembly, yellow 2-pin connector located at the base of the passenger seat. Connect 5-8840-2421-0 SRS driver/passenger load tool and appropriate adapters to passenger pretensioner assembly harness connectors. Ignition switch “ON.” <p>Is DTC 32 current?</p>	Go to Step 6	Ignition switch “Off” Replace the passenger pretensioner assembly Go to Step 7
6	<ol style="list-style-type: none"> Ignition switch “Off.” There has been a decrease in the total circuit resistance of the passenger pretensioner loop. Use the high resolution ohmmeter mode of the DVM while checking IB15-BLU/BLK and IB16-BLU/ORG, and SDM connector terminal “9” and “10” to locate the root cause. <p>Was a fault found?</p>	Replace SRS harness or repair chassis harness Go to Step 7	Go to Chart A
7	<ol style="list-style-type: none"> Reconnect all components, ensure all component are properly mounted. Clear diagnostic trouble codes. <p>Was this step finished?</p>	Repeat the “SRS Diagnostic System Check”	Go to Step 7

DTC 33 Passenger Pretensioner Loop Short To Voltage



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltages at "Driver Belt Low" terminal "10" and "Passenger Belt Low" terminal "22" to detect short to B+ in the pretensioner assembly circuits.

DTC Will Set When:

"Ignition 1" is within the normal operating voltage range. Once these conditions are met and the voltage at "Passenger pretensioner Low" is above a specified value, DTC 33 will set. This test is run once each ignition cycle and "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 33.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test isolates the malfunction to one side of the passenger pretensioner assembly yellow 2-pin connector at the base of the passenger seat.
4. This test determines whether the malfunction is in IB15-BLU/BLK.
5. This test determines whether the malfunction is in IB16-BLU/ORG.

Diagnostic Aids:

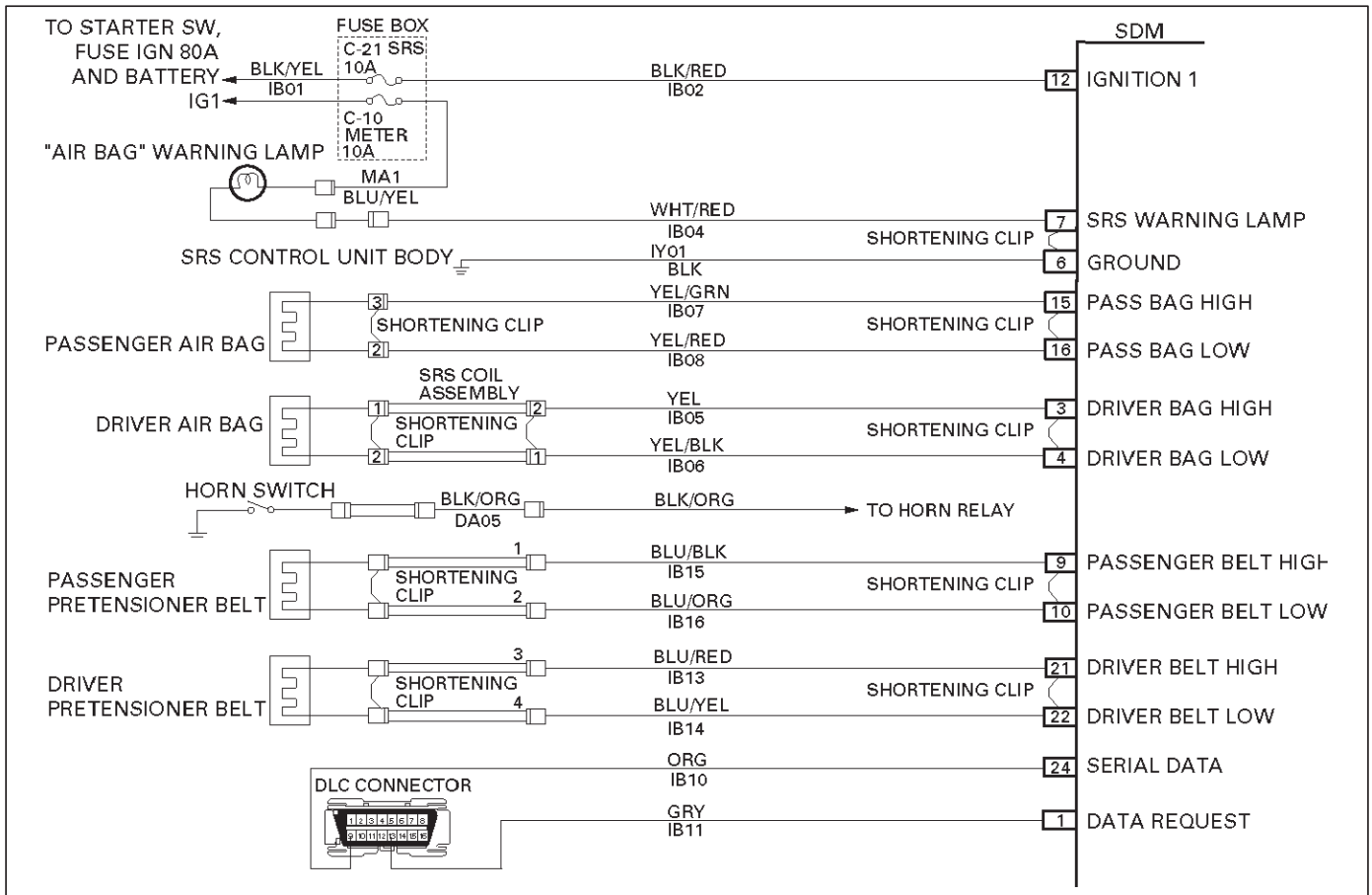
An intermittent condition is likely to be caused by a short to B+ in the passenger pretensioner assembly circuit. Inspect IB15-BLU/BLK and IB16-BLU/ORG carefully for cutting or chafing. If the wiring pigtail of the passenger pretensioner assembly is damaged, the component must be replaced. A careful inspection of IB15-BLU/BLK and IB16-BLU/ORG, including the passenger pretensioner assembly pigtail is essential to ensure that the replacement SDM will not be damaged.

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DTC 33 Passenger Pretensioner Loop Short To Voltage

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check" Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM With correct terminal adapter from 5-8840-0385-0. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger belt sense LO. Is passenger belt sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Disconnect passenger pretensioner assembly yellow 2-pin connector at the base of the passenger seat. 3. Leave driver pretensioner assembly connected. 4. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch "ON." Is DTC 33 current?	Go to Step 4	Ignition switch "OFF" Replace passenger pretensioner assembly Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool. 3. Measure resistance on SDM harness connector from terminal "9" to terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step 6.
5	Measure resistance on SDM harness connector from terminal "10" and terminal "12" (ignition). Does 5-8840-0285-0 display "OL" (infinite)?	Go to Chart A	Replace SRS harness Go to Step 6
6	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 6

DTC 34 Passenger Pretensioner Loop Open



Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. During "Continuous Monitoring" diagnostics, a fixed amount of current is flowing in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Passenger Belt High" and "Passenger Belt Low", the SDM calculates the combined resistance of the passenger pretensioner assembly, harness wiring IB15-BLU/BLK AND IB16-BLU/ORG, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Passenger pretensioner High" terminal "9" and "Passenger pretensioner Low" terminal "10" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Passenger Belt High" terminal "9" and "Passenger Belt Low" terminal "10" is

below a specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector.
4. This test checks for proper contact and/or corrosion of the shorting clip in the yellow 2-pin connector terminals.
5. The test checks for a malfunctioning passenger pretensioner assembly.
6. This test determines whether the open in the wiring.

Diagnostic Aids:

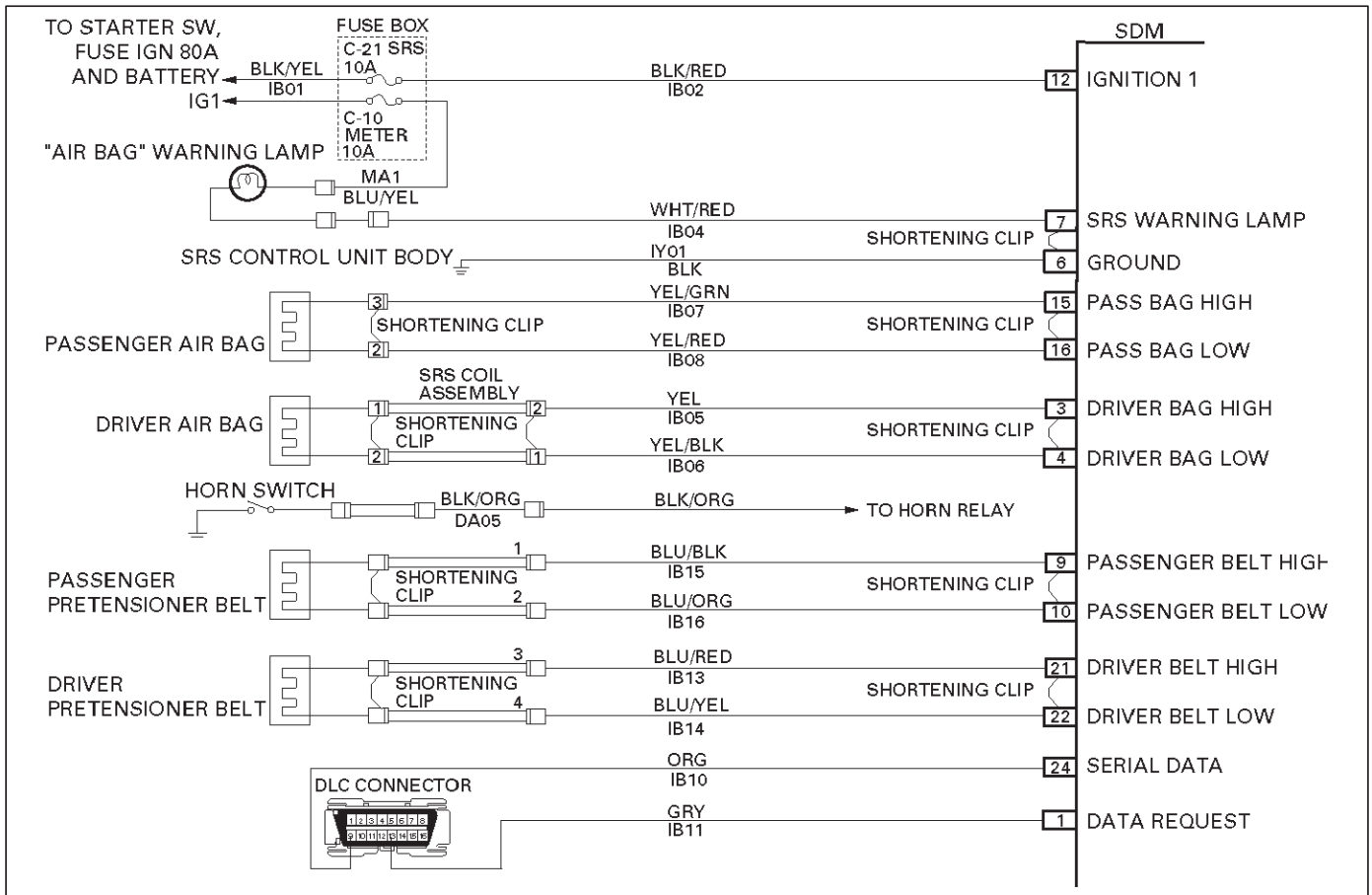
An intermittent condition is likely to be caused by a poor connection at the passenger pretensioner assembly harness connector terminals "1" and "2", SDM terminals "9" and "10", or an open in IB15-BLU/BLK and IB16-BLU/ORG.

9J1-52 RESTRAINT CONTROL SYSTEM

DTC 34 Passenger Pretensioner Loop Open

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Using scan tool data list function, read and record the passenger pretensioner differential voltage. Is passenger pretensioner VDIF 0.425 volts or more?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF". 2. Make sure the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat. Is the yellow 2-pin connector connected properly?	Go to Step 4	Seat passenger pretensioner assembly yellow 2-pin connector properly Go to Step 7
4	1. Disconnect and inspect the passenger pretensioner assembly yellow 2-pin connector located at the base of the passenger seat. 2. If ok, reconnect the passenger pretensioner assembly 2-pin connector. 3. Ignition switch "ON". Is DTC 34 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch "Off." 2. Disconnect the passenger pretensioner assembly, yellow 2-pin connector located at the base of the passenger seat. 3. Connect 5-8840-2421-0 SRS driver / passenger load tool and appropriate adapters to passenger pretensioner assembly harness connectors. 4. Ignition switch "ON." Is DTC 34 current?	Go to Step 6	Ignition switch "Off" Replace the passenger pretensioner assembly Go to Step 7
6	1. Ignition switch "Off." 2. There has been an open circuit resistance in the passenger pretensioner loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB15-BLU/BLK and IB16-BLU/ORG, and SDM connector terminal "9" and "10" to locate the root cause. Was a fault found?	Replace SRS harness or repair chassis harness Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 7

DTC 41 Driver Pretensioner Loop Resistance High



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test" "Driver Belt Low" terminal "22" is grounded through a current sink and the driver current source connected to "Driver Belt High" terminal "21" allows a known amount of current to flow. By monitoring the voltage difference between "Driver Belt High" and "Driver Belt Low", the SDM calculates the combined resistance of the driver pretensioner assembly, harness wiring IB13-BLU/RED and IB14-BLU/YEL, and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver pretensioner assembly, harness wiring IB13-BLU/RED and IB14-BLU/YEL, and connector terminal contact is above a specified value. This test run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON"
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 41.

DTC Will Clear When:

The ignition switch is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the driver seat.
4. This test checks for proper contact and/or corrosion of the 2-pin connector terminals at the base of the driver seat.
5. This test isolate the malfunction to one side of the pretensioner assembly yellow 2-pin connector located at the base of the driver seat.
6. This test determines whether the malfunction is due to high resistance in the wiring.

9J1-54 RESTRAINT CONTROL SYSTEM

Diagnostic Aids:

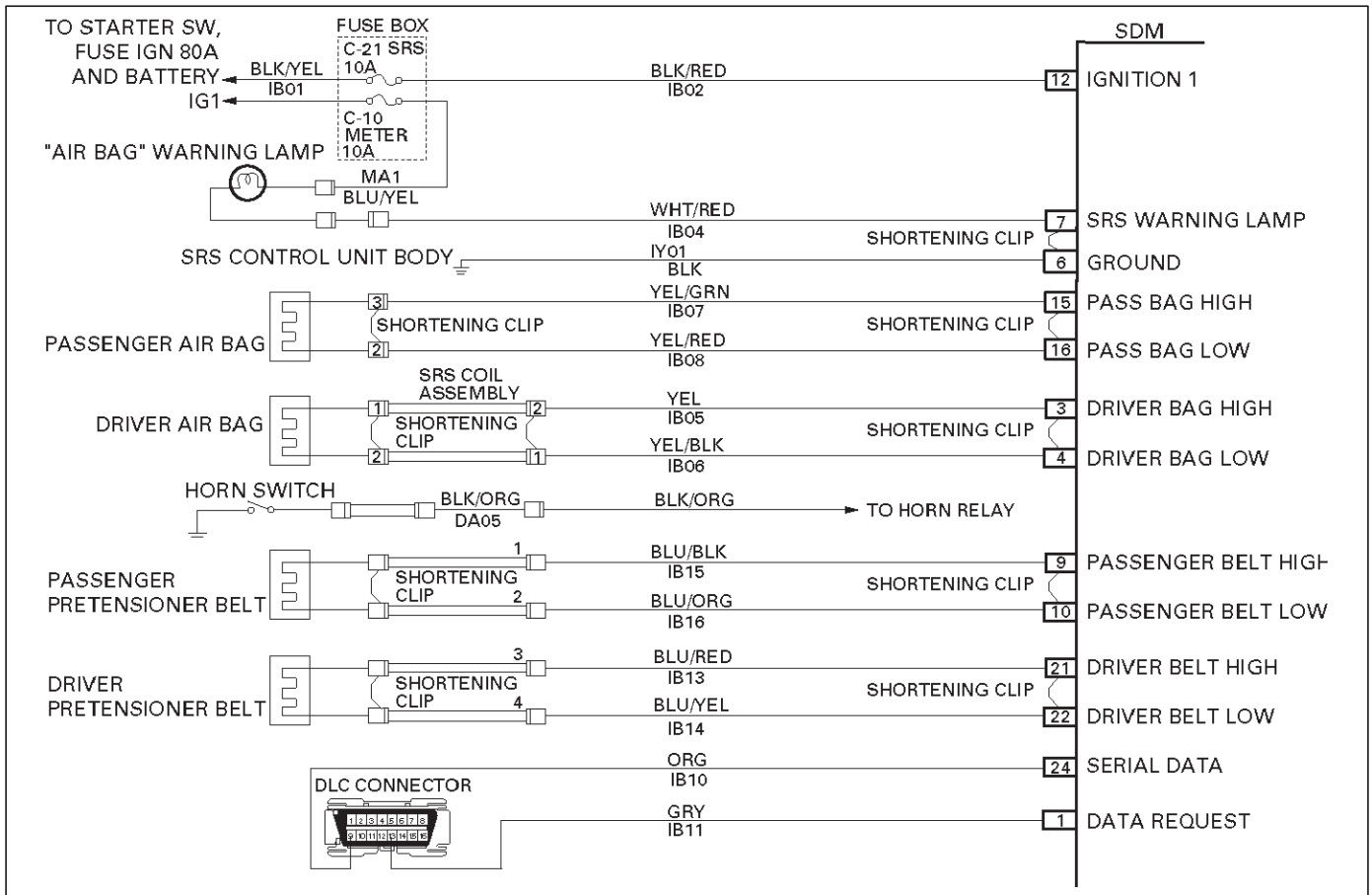
An intermittent condition is likely to be caused by a poor connection at terminals "3" and "4" of the driver pretensioner assembly 2-pin connector at the base of the driver seat. SDM terminals "21" and "22" or a poor wire to terminal connection in IB13-BLU/RED or

IB14-BLU/YEL. The test for this diagnostic trouble code is only run while the "AIR BAG" warning lamp is performing the bulb check. When a scan tool "Clear Codes" command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 41 Driver Pretensioner Loop Resistance High

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check". Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Use scan tool data list function, read and record the driver pretensioner loop resistance. Is driver resistance more than 3.7 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Disconnect driver pretensioner assembly yellow 2-pin connector located at base of the driver seat. Is the 2-pin connector connected properly?	Go to Step 4	Driver pretensioner assembly 2-pin connector properly Go to Step 7
4	1. Disconnect and inspect the driver pretensioner assembly yellow 2-Pin connector located base of the driver seat. 2. If ok, reconnect the driver pretensioner assembly yellow 2-pin connector. 3. Ignition switch "ON." Is DTC 41 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch "OFF." 2. Disconnect driver pretensioner assembly, yellow 2-pin connector located at the base of the driver seat. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to driver pretensioner assembly harness connectors. 4. Ignition switch "ON." Is DTC 41 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch "Off." 2. There has been a increase in the total circuit resistance of the driver pretensioner loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB13-BLU/RED and IB14-BLU/YEL, and SDM connector terminal "21" and "22" to locate the root cause. Was a fault found?	Replace SRS harness or repair chassis harness Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 42 Driver Pretensioner Loop Resistance Low



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test" "Driver Belt Low" terminal "22" is grounded through a current sink and the driver current source connected to "Driver Belt High" terminal "21" allows a known amount of current to flow. By monitoring the voltage difference between "Driver Belt High" and "Driver Belt Low" the SDM calculates the combined resistance of the driver pretensioner assembly, harness wiring IB13-BLU/RED and IB14-BLU/YEL and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver pretensioner assembly, harness wiring IB13-BLU/RED and IB14-BLU/YEL and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn-ON"
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 42.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the driver seat.
4. This test checks for proper operation of the shorting clip in the yellow 2-pin connector.
5. This test isolate the malfunction to one side of the pretensioner assembly yellow 2-pin connector located at the base of driver seat.
6. This test determines whether the malfunction is due to shortening in the wiring.

Diagnostic Aids:

An intermittent condition is likely to be caused by a short between IB13-BLU/RED or IB14-BLU/YEL or a malfunctioning shorting clip on the driver pretensioner assembly which would require replacement of the component. The test for this diagnostic trouble code is

9J1-56 RESTRAINT CONTROL SYSTEM

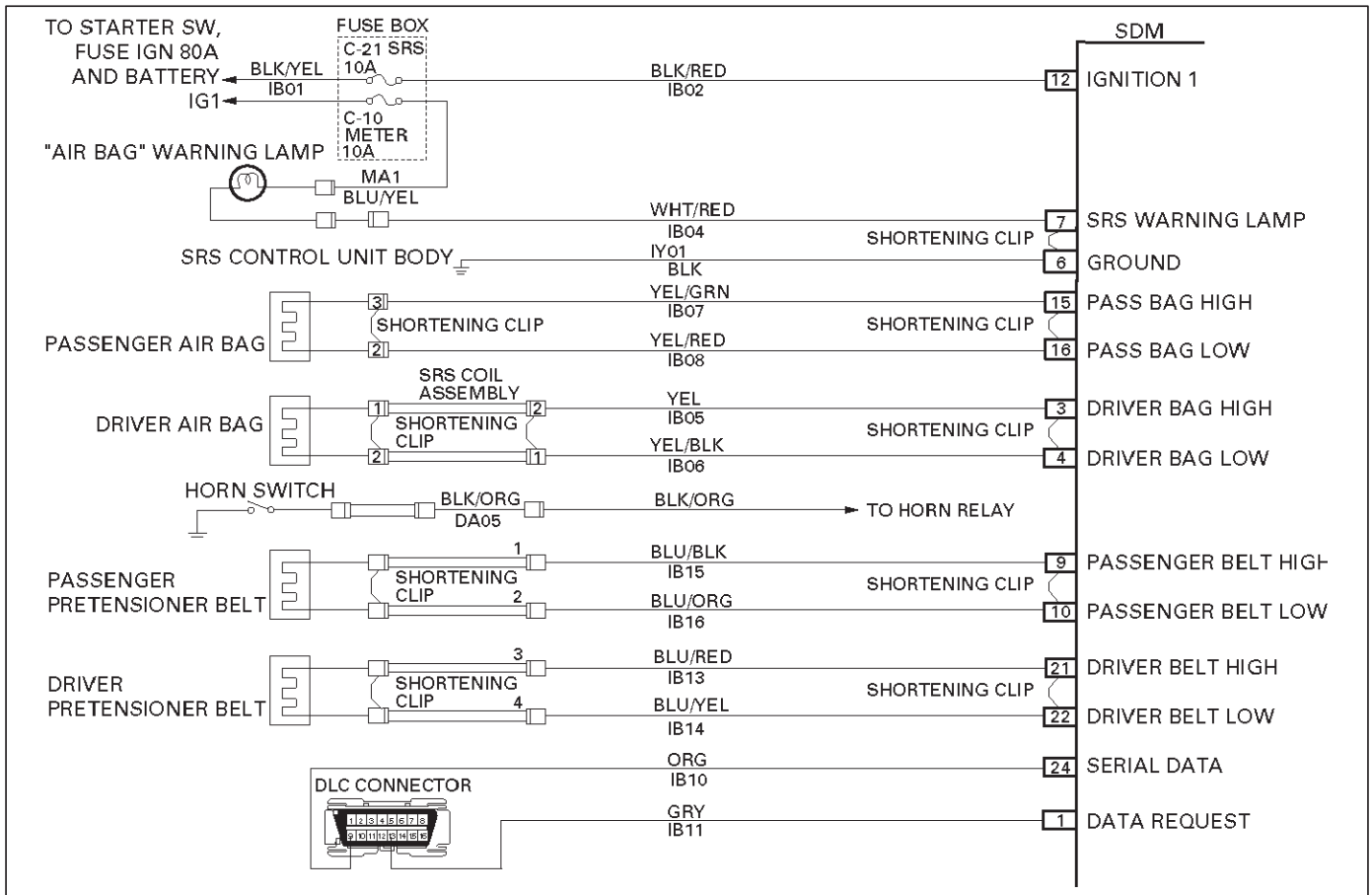
only run while the "AIR BAG" warning lamp is performing the bulb check. When a scan tool "Clear Codes"

command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 42 Driver Pretensioner Loop Resistance Low

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check." WAS THE "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. 2. Use scan tool data list function, read and record the driver pretensioner loop resistance. Is driver pretensioner loop resistance less than 1.4 OHMS?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Make sure the driver pretensioner assembly yellow 2-pin connector located at the base of the driver seat is connected properly. Is the 2-pin connector connected properly?	Go to Step 4	Seat driver pretensioner assembly 2-pin connector properly Go to Step 7
4	1. Disconnect and inspect the driver pretensioner assembly yellow 2-pin connector located base of the driver seat. 2. If ok, reconnect the driver pretensioner assembly yellow 2-pin connector. 3. Ignition switch "ON." Is DTC 42 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch "OFF." 2. Disconnect driver pretensioner assembly, yellow 2-pin connector located at the base of driver seat. 3. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to driver pretensioner assembly harness connectors. 4. Ignition switch "ON." Is DTC 42 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch "OFF." 2. There has been a decrease in the total circuit resistance of the driver pretensioner loop. 3. Use the high resolution ohmmeter mode of the DVM while checking IB13-BLU/RED and IB14-BLU/YEL, and SDM connector terminal "21" and "22" to locate the root cause. Was a fault found?	Replace SRS harness or repair chassis harness Go to Step 7	Go to Chart A
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 7

DTC 44 Driver Pretensioner Loop Open



Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. During "Continuous Monitoring" diagnostics, a fixed amount of current is following in the pretensioner loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Driver Belt High" and "Driver Belt Low", the SDM calculates the combined resistance of the driver pretensioner assembly, harness wiring IB13-BLU/RED and IB14-BLU/YEL, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Driver Belt High" terminal "21" and "Driver Belt Low" terminal "22" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Driver Belt High" terminal "21" and "Driver Belt Low" terminal "22" is below

a specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2-pin connector at the base of the driver seat.
4. This test checks for proper contact and/or corrosion of the yellow 2-pin connector at the base of the driver seat.
5. This test isolates the malfunction to one side of the driver pretensioner assembly yellow 2-pin connector located at the base of driver seat.
6. This test determines whether the open is in the wiring.

Diagnostic Aids:

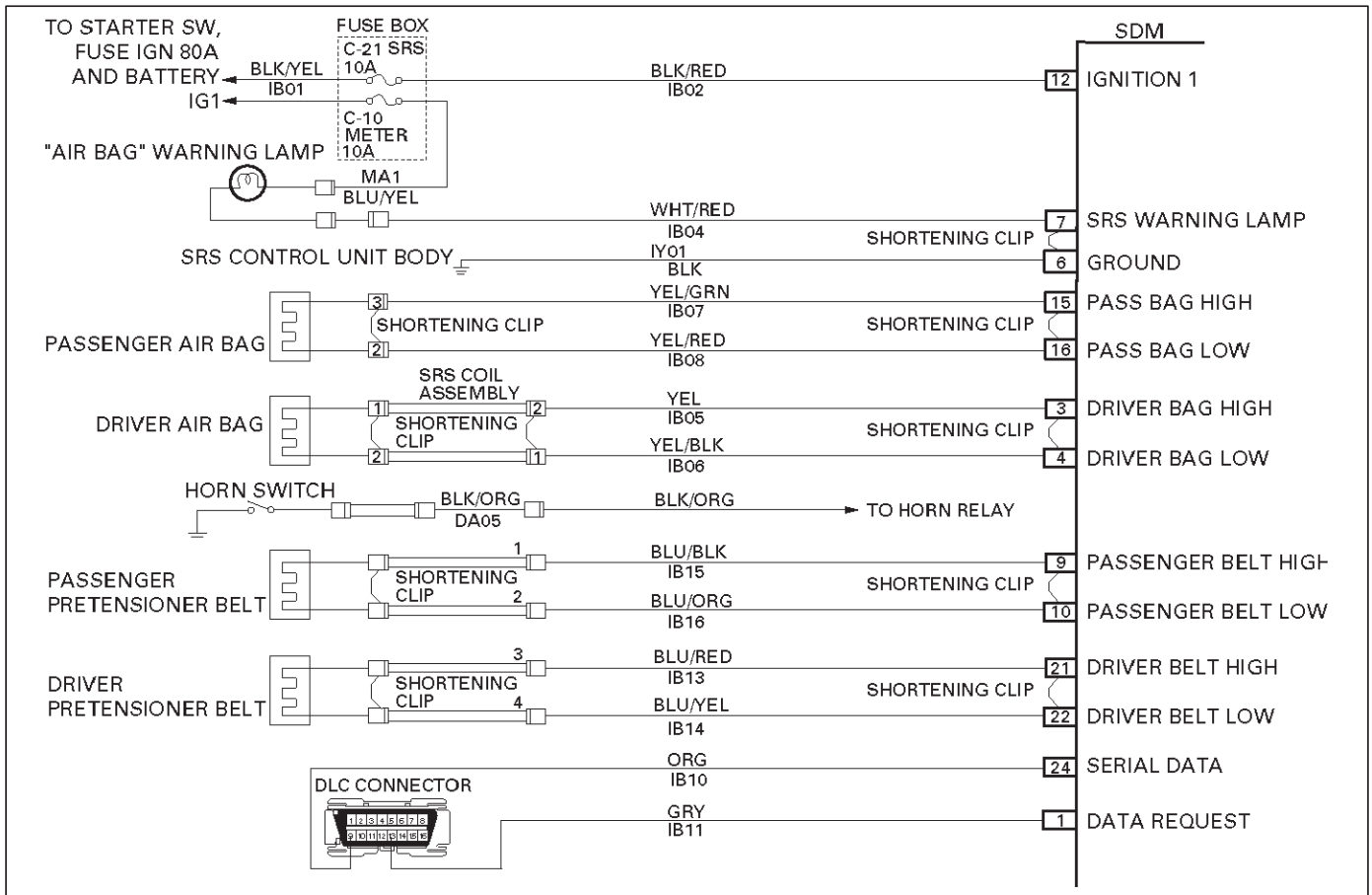
An intermittent condition is likely to be caused by a poor connection at the driver pretensioner assembly harness 2-pin connector terminals "3" and "4" at the top of the steering column, SDM terminals "21" and "22", or an open in IB13-BLU/RED and IB14-BLU/YEL.

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DTC 44 Driver Pretensioner Loop Open

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Use scan tool data list function, read and record the driver pretensioner circuit differential voltage.</p> <p>Is driver pretensioner VDIF more than 4.25 volts?</p>	Go to Step 3	Go to Chart A
3	<p>1. Ignition switch "OFF."</p> <p>2. Make sure the driver pretensioner assembly yellow 2-pin connector located at the base of the driver seat is seated properly.</p> <p>Is the yellow 2-pin connector connected properly?</p>	Go to Step 4	<p>Seat driver pretensioner assembly 2-pin connector</p> <p>Go to Step 7</p>
4	<p>1. Disconnect and inspect the driver pretensioner assembly yellow 2-pin connector located base of the driver seat.</p> <p>2. If ok, reconnect the driver pretensioner assembly yellow 2-pin connector.</p> <p>3. Ignition switch "ON."</p> <p>Is DTC 44 current?</p>	Go to Step 5	Go to Step 7
5	<p>1. Ignition switch "OFF".</p> <p>2. Disconnect driver pretensioner assembly, yellow 2-pin connectors located at the base of the driver seat.</p> <p>3. Connect SRS driver/passenger load tool 5-8840-2421-0 and appropriate adapter to driver pretensioner assembly harness connectors.</p> <p>4. Ignition switch "ON."</p> <p>Is DTC 44 current?</p>	Go to Step 6	Go to Step 7
6	<p>1. Ignition switch "OFF."</p> <p>2. There has been an open circuit in the driver pretensioner loop.</p> <p>3. Use the high resolution ohmmeter mode of the DVM while checking IB13-BLU/RED and IB14-BLU/YEL, and SDM connector terminal "21" and "22" to locate the root cause.</p> <p>Was a fault found?</p>	<p>Replace SRS harness or repair chassis harness</p> <p>Go to Step 7</p>	Go to Chart A
7	<p>1. Reconnect all components ensure all component are properly mounted.</p> <p>2. Clear diagnostic trouble codes.</p> <p>Was this step finished?</p>	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 45 Driver Pretensioner Loop Short To Ground



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltage at "Driver Belt Low" terminal "22" and "passenger Belt Low" terminal "10" to detect shorts to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the air bag and the pretensioner belt are open. "Ignition 1" is within the normal operating voltage range. This test is run once each ignition cycle and "Continuous Monitoring". Once these conditions are met and the voltage at "Driver Belt Low" is below a specified value, DTC 45 will set.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning
3. This test isolates the malfunction to one side of the driver pretensioner assembly yellow 2-pin connector at the base of the driver seat.
4. This test determines whether the malfunction is in IB13-BLU/RED.
5. This test determines whether the malfunction is in IB14-BLU/YEL.

Diagnostic Aids:

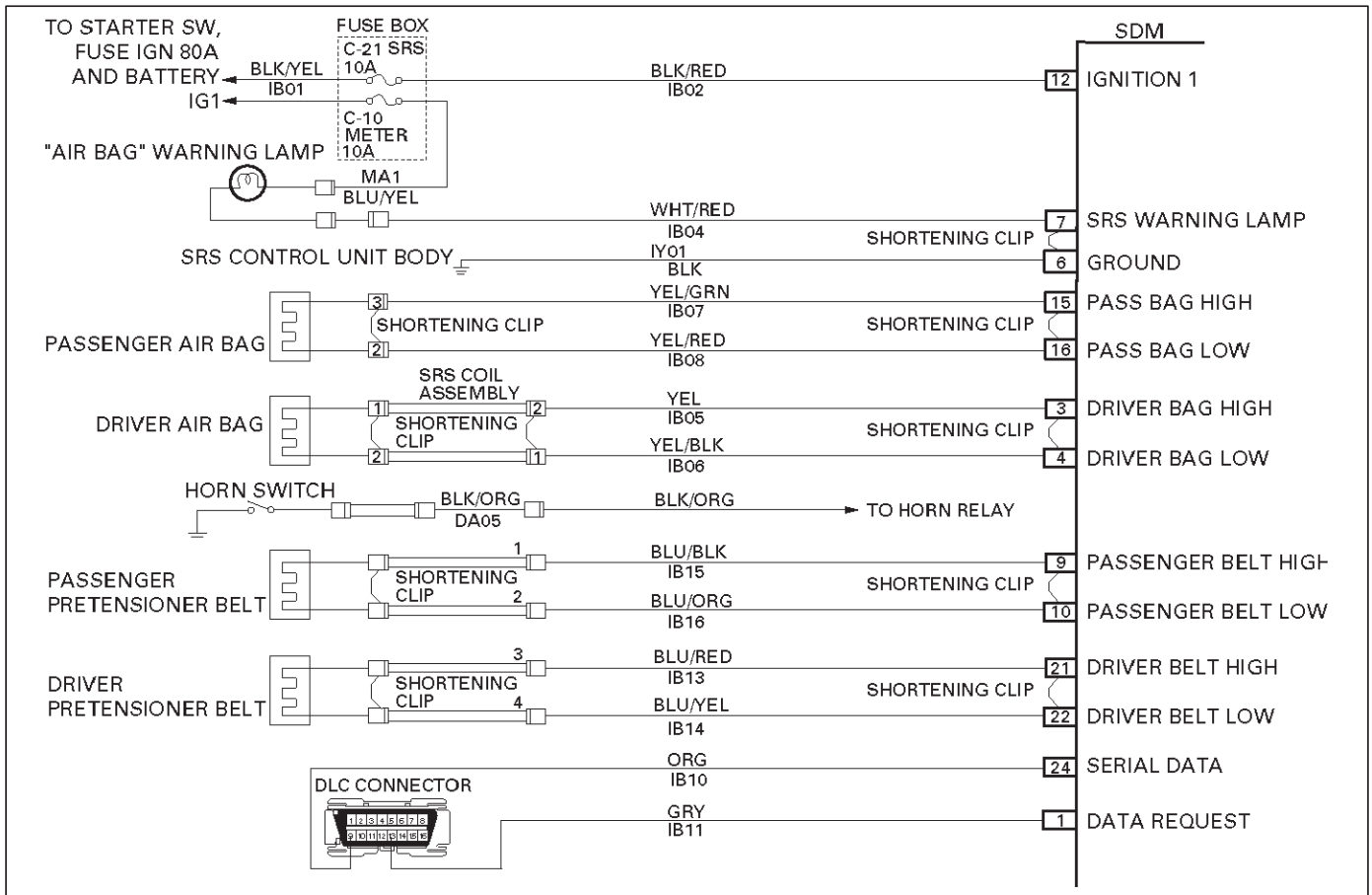
An intermittent condition is likely to be caused by a short to ground in the driver pretensioner assembly circuit. Inspect IB13-BLU/RED and IB14-BLU/YEL carefully for cutting or chafing.

9J1-60 RESTRAINT CONTROL SYSTEM

DTC 45 Driver Pretensioner Loop Short To Ground

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0.</p> <p>2. Ignition switch "OFF."</p> <p>3. Connect scan tool data link connector. follow directions as given in the scan tool operator's manual.</p> <p>4. Ignition switch "ON."</p> <p>5. Read driver belt sense LO.</p> <p>Is driver belt sense LO less than 1.5 volts?</p>	Go to Step 3	Go to Chart A
3	<p>1. Ignition switch "OFF."</p> <p>2. Disconnect driver pretensioner assembly yellow 2-pin connector located at base of the driver seat, leave passenger pretensioner assembly connected.</p> <p>3. Connect SRS driver / passenger load tool 5-8840-2421-0 and appropriate adapter to driver pretensioner assembly harness connector.</p> <p>4. Ignition switch "ON."</p> <p>Is DTC 45 current?</p>	Go to Step 4	Go to Step 6
4	<p>1. Ignition switch "OFF."</p> <p>2. Disconnect SDM.</p> <p>3. Disconnect SRS driver / passenger load tool.</p> <p>4. Measure resistance on SDM harness connector "21" to terminal "6" (ground).</p> <p>Does 5-8840-0285-0 display "OL" (infinite)?</p>	Go to Step 5	<p>Replace SRS harness or repair chassis harness</p> <p>Go to Step 6</p>
5	<p>Measure resistance on SDM harness connector from terminal "22" to terminal "6" (ground).</p> <p>Does 5-8840-0285-0 display "OL" (infinite)?</p>	Go to Chart A	<p>Replace SRS harness or repair chassis harness</p> <p>Go to Step 6</p>
6	<p>1. Reconnect all components ensure all component are properly mounted.</p> <p>2. Clear diagnostic trouble codes.</p> <p>Was this step finished?</p>	Go to the "SRS Diagnostic System Check"	Go to Step 6

DTC 46 Driver Pretensioner Loop Short To Voltage



D09RW014

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and pretensioner loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM monitors the voltage at "Driver Belt Low" terminal "22" and "Passenger Belt Low" terminal "10" to detect shorts to B+ in the pretensioner assembly circuits.

DTC Will Set When:

"Ignition 1" is in the normal operating voltage range. This test is run once each ignition cycle and "Continuous monitoring". Once these conditions are met and the voltage at "Driver Belt Low" is above a specified value, DTC 46 will set.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 46.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the driver pretensioner assembly yellow 2-pin connector at the base of the driver seat.
4. This test determines whether the malfunction is in IB13-BLU/RED.
5. This test determines whether the malfunction is in IB14-BLU/YEL.

Diagnostic Aids:

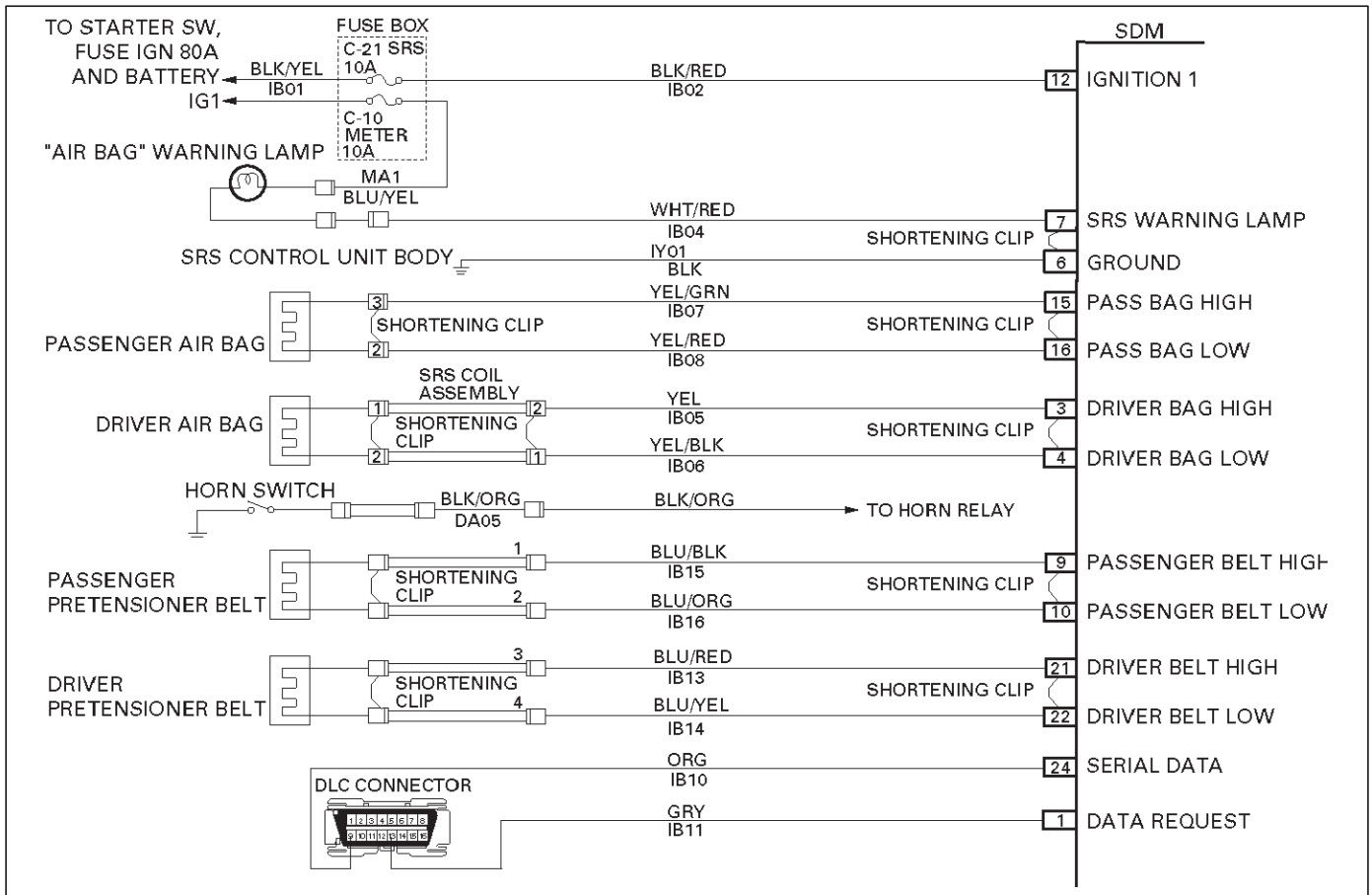
An intermittent condition is likely to be caused by a short to B+ in the driver pretensioner assembly circuit. Inspect IB13-BLU/RED and IB14-BLU/YEL carefully for cutting or chafing. If the wiring pigtail of the driver pretensioner assembly is damaged, the components must be replaced. A careful inspection of IB13-BLU/RED and IB14-BLU/YEL, including the driver pretensioner assembly is essential to ensure that the replacement SDM will not be damaged.

9J1-62 RESTRAINT CONTROL SYSTEM

DTC 46 Driver Pretensioner Loop Short To Ignition

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	<p>1. When measurements are requested in this chart use 5-8840-0285-0 DVM with correct terminal adapter from 5-8840-0385-0. Ignition switch "OFF." Connect scan tool data link connector. follow directions as given in the scan tool operator's manual.</p> <p>2. Ignition switch "ON." 3. Read driver belt sense LO .</p> <p>Is driver belt sense LO more than 3.5 volts?</p>	Go to Step 3	Go to Chart A
3	<p>1. Ignition switch "OFF." 2. Disconnect driver pretensioner assembly yellow 2-pin connector at the base of the driver seat, leave passenger pretensioner assembly connected. 3. Connect SRS driver /passenger load tool 5-8840-2421-0 and appropriate adapter to driver pretensioner assembly harness connector. 4. Ignition switch "ON."</p> <p>Is DTC 46 current?</p>	Go to Step 4	<p>Ignition switch "OFF" Replace driver pretensioner assembly Go to Step 6</p>
4	<p>1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver /passenger load tool. 4. Measure resistance on SDM harness connector "21" to terminal "12" (ignition).</p> <p>Does 5-8840-0285-0 display "OL" (infinite)?</p>	Go to Step 5	<p>Replace SRS harness or repair chassis harness Go to Step 6</p>
5	<p>Measure resistance on SDM harness connector from terminal "22" to terminal "12" (ignition).</p> <p>Does 5-8840-0285-0 display "OL" (infinite)?</p>	Go to Chart A	<p>Replace SRS harness or repair chassis harness Go to Step 6</p>
6	<p>1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes.</p> <p>Was this step finished?</p>	Go to the "SRS Diagnostic System Check"	Go to Step 6

DTC 52 Pretensioner Deployment Event Commanded



D09RW014

Circuit Description:

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the pretensioner assembly deploying the pretensioners and causing DTC 52 to set.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags and pretensioner seat belt.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp records "Crash Data", and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. If pretensioner assembly (s) has not deployed, DTC 52 may have falsely set.
3. If DTC 52 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 52 Deployment Event Commanded

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE PRETENSIONER WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE PRETENSIONER. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2.	Go to the "SRS Diagnostic System Check"
2	Ignition switch "OFF." Have pretensioner assemblies deployed?	Replace components and perform inspections as directed in "repairs and inspections required after an accident" in this section clear diagnostic trouble codes Repeat "SRS Diagnostic System Check"	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in "Repairs and Inspections Required After An Accident" in this section Clear diagnostic trouble codes Repeat "SRS Diagnostic System Check"	Ignition switch "OFF" Replace SDM Reconnect all SRS system components, ensure all components are properly mounted Repeat "SRS Diagnostic System Check"

CONTROL SYSTEM

CRUISE CONTROL SYSTEM

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Service Precaution

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

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

General Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch "AUTO CRUISE" is turned on with the vehicle in the running mode, the battery voltage is applied to the control unit. When a signal from the control switch is input to the control unit while the vehicle is in this state, the cruise control actuator is activated to operate the system. Also, while the system is operating, the "AUTO CRUISE" indicator light in the meter assembly lights up.

1. SET/COAST Switch Function

- 1. Set Function:** When the SET/COAST switch is pressed and released with the main switch on, the speed at which the vehicle is running at that moment is stored in the memory, and the vehicle automatically runs at the stored speed.
- 2. Coast-down Function:** When the SET/COAST switch is kept on while the vehicle is running, the vehicle decelerates during that time. The speed at which vehicle is running when the control switch is turned off is stored in the memory, and the vehicle automatically returns to the stored speed.
- 3. Tap-down Function:** When the SET/COAST switch is turned on and off instantaneously while the vehicle is running, the vehicle decelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the SET/COAST was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

10A-2 CRUISE CONTROL SYSTEM

2. RESUME/ACCEL Switch Function

1. **Resume Function:** When the RESUME/ACCEL switch is turned on/off after the system is temporarily deactivated by pressing the brake or clutch pedal while the vehicle is running, the vehicle resumes the speed stored before the system was released, and the vehicle automatically runs at the stored speed .
2. **Accelerate Function:** When the RESUME/ACCEL switch is kept on after the system is released completely, the vehicle accelerates its speed during that time. The vehicle speed at which the vehicle was running when the switch was turned off is stored in the memory, and the vehicle automatically returns to this speed.
3. **Tap-up Function:** When the RESUME/ACCEL switch is turned on and off instantaneously while the vehicle is running, the vehicle decelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the switch was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

3. CANCEL Function

1. **Temporary Cancellation:**
 - When the brake pedal is pressed.
 - When the clutch pedal is pressed. (M/T)
 - When the select lever is shifted to any position other than "D", "3", "2" or "L". (A/T)
 - When the cancel switch is operated.
 - When the vehicle speed exceeds about 20 km/h over the vehicle speed stored in the memory.
 - Turning the RESUME/ACCEL switch will return the vehicle to the speed stored in the cruise control memory.
2. **Complete Cancellation:**
 - When the starter switch or the main switch is turned off.
 - When the fail-safe function is activated.
 - When the vehicle speed is about 38.5 km/h.

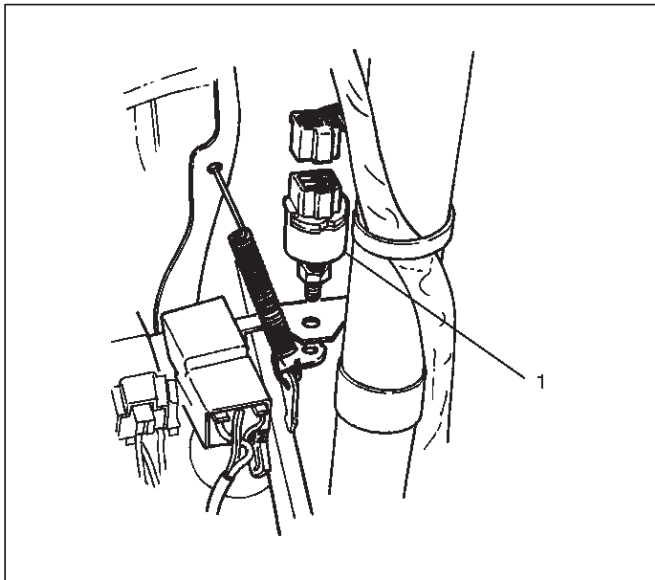
Diagnosis

Refer to the Cruise Control System Diagnosis in Wiring System section.

Brake Switch

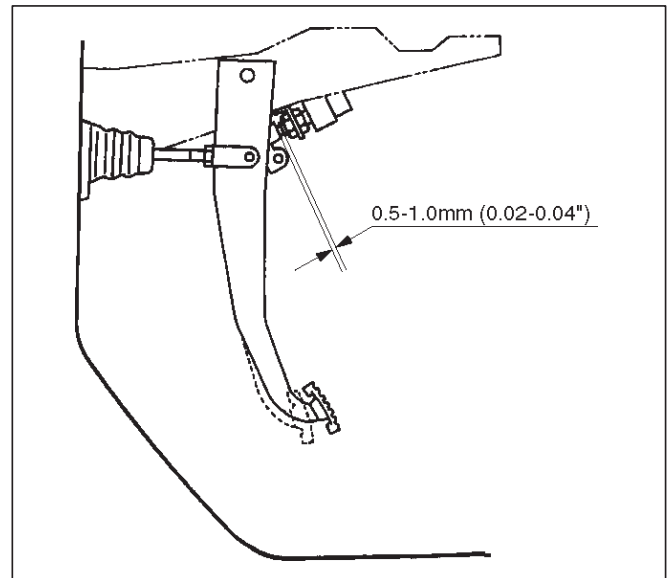
Removal

1. Disconnect the battery ground cable.
2. Remove the brake switch (1).
 - Disconnect the connector.
 - Loosen the lock nuts of the switch.
 - Remove the switch by turning it.



310RS004

2. Turn the switch clockwise until the tip of the threaded portion of the brake switch contacts the pedal arm.
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02-0.04 in.) as shown in the figure.



310RS003

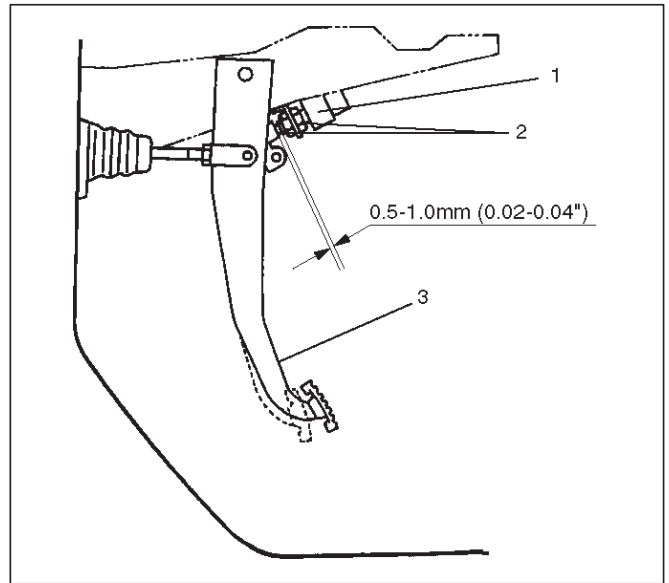
Installation

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

1. Check to see if the brake pedal has been returned by the return spring to the specified position.

Adjustment

1. Check to be sure that the brake pedal (3) has been completely returned by the return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (1) of the switch (2).
4. Turn the switch clockwise until the tip of screw portion of the brake pedal hits the pedal arm.
5. Turn the switch counterclockwise until the clearance between the tip of the screw portion and the pedal arm becomes 0.5 to 1.0 mm (0.02-0.04 in).
6. Tighten the lock nut.
7. Connect the switch connector.



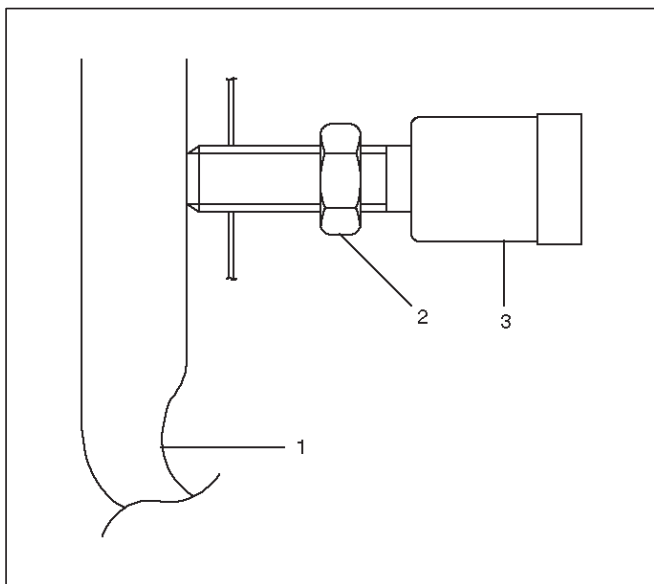
Clutch Switch

Removal and Installation

Refer to the Clutch Control removal and installation steps in Clutch section.

Adjustment

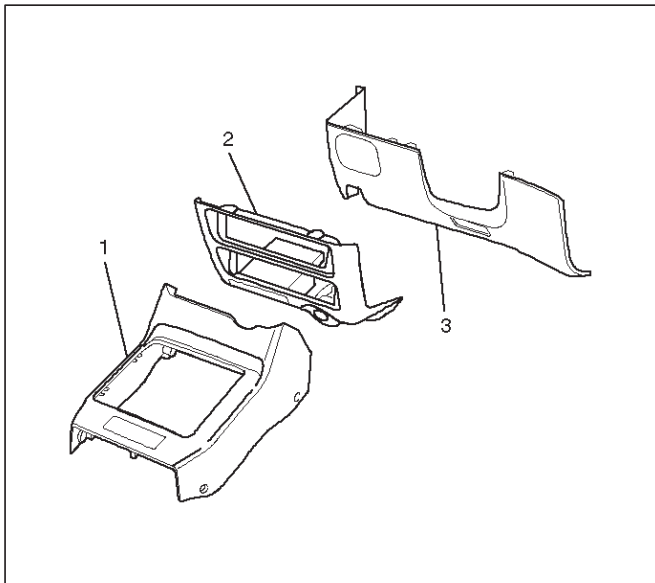
1. Check to be sure that the clutch pedal (1) has been completely returned by the return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (2) of the switch (3).
4. Push the switch by hand until the push rod cannot be seen from the tip portion of the switch.
5. Give the switch one reverse rotation.
6. Tighten the lock nut.
7. Connect the switch connector.



Starter Switch

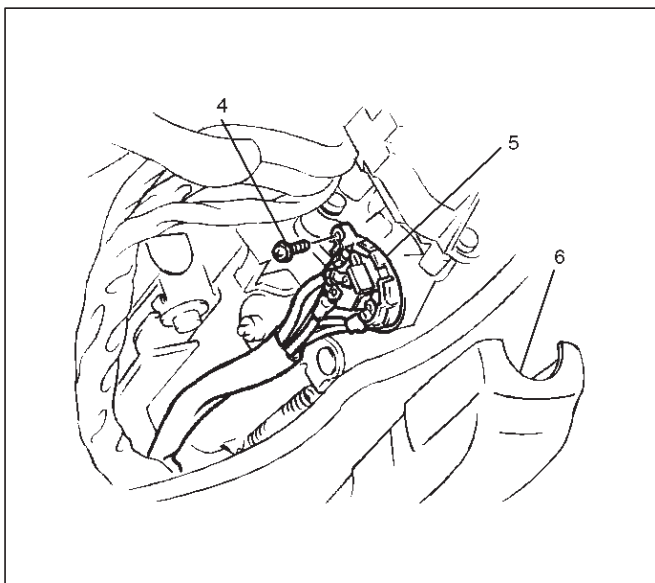
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1). Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2). Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3). Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove seven screws to remove the steering cowl (6).
6. Disconnect the connector, remove the screw (4) and then remove the starter switch (5).

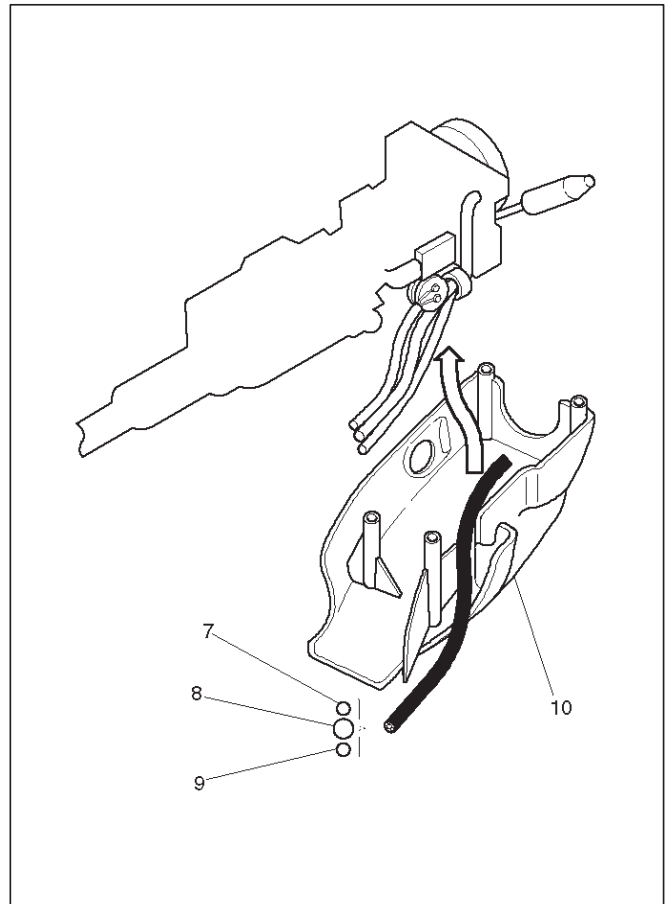


431RW005

Installation

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

1. When installing the steering cowl (10), be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness (7), the combination switch harness (8) and the inflator module harness (9) will not catch.

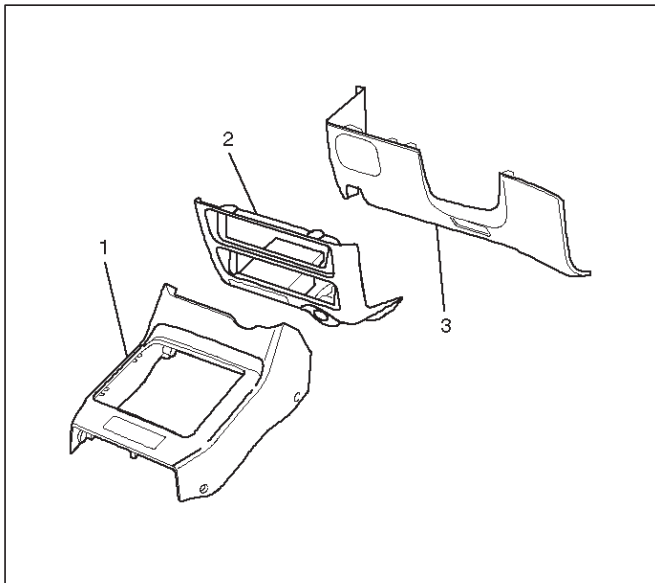


825RW058

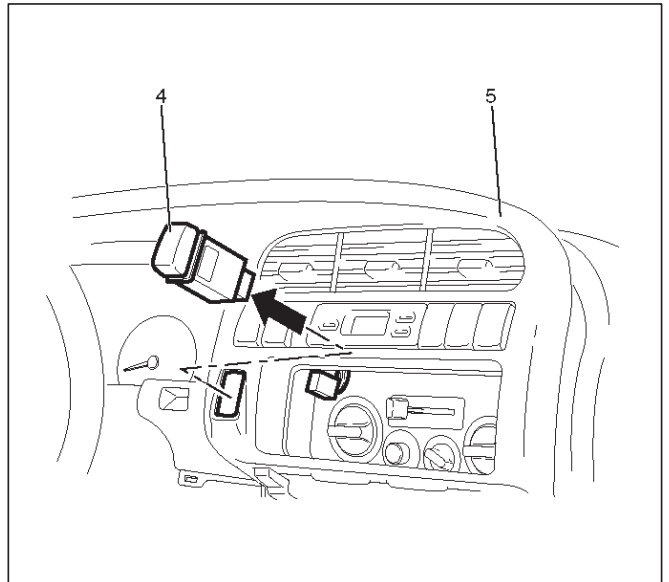
Cruise Control Main Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1). Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2). Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3). Refer to the Instrument Panel Assembly in Body Structure section.



5. Remove the instrument panel cluster assembly (5). Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the and push the lock from the side of the instrument panel cluster assembly to remove the cruise control main switch (4).



Installation

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

1. Push in the switch with your fingers until the switch is locked securely.

Cruise Control Switch (Combination Switch)

Removal and Installation

Refer to the Lighting Switch (Combination Switch) removal and installation steps of Lighting System in Body and Accessories section.

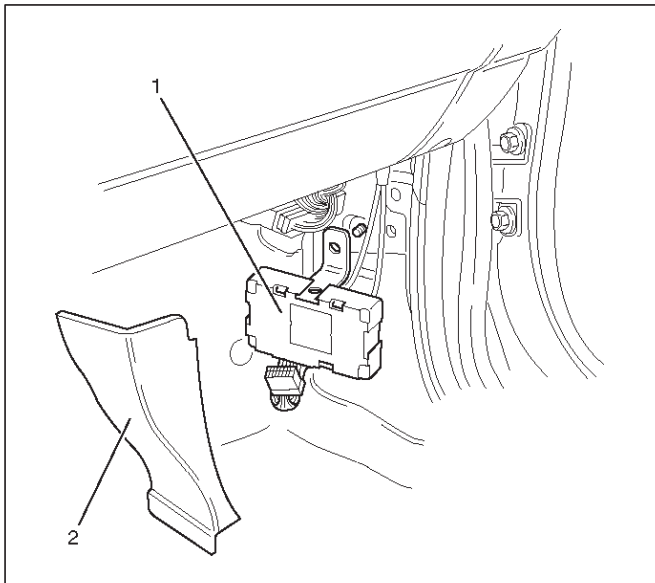
Cruise Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the dash side trim panel (RH)(2).
3. Disconnect the connector.
4. Remove a fixing nut to remove the cruise control unit (1).

Installation

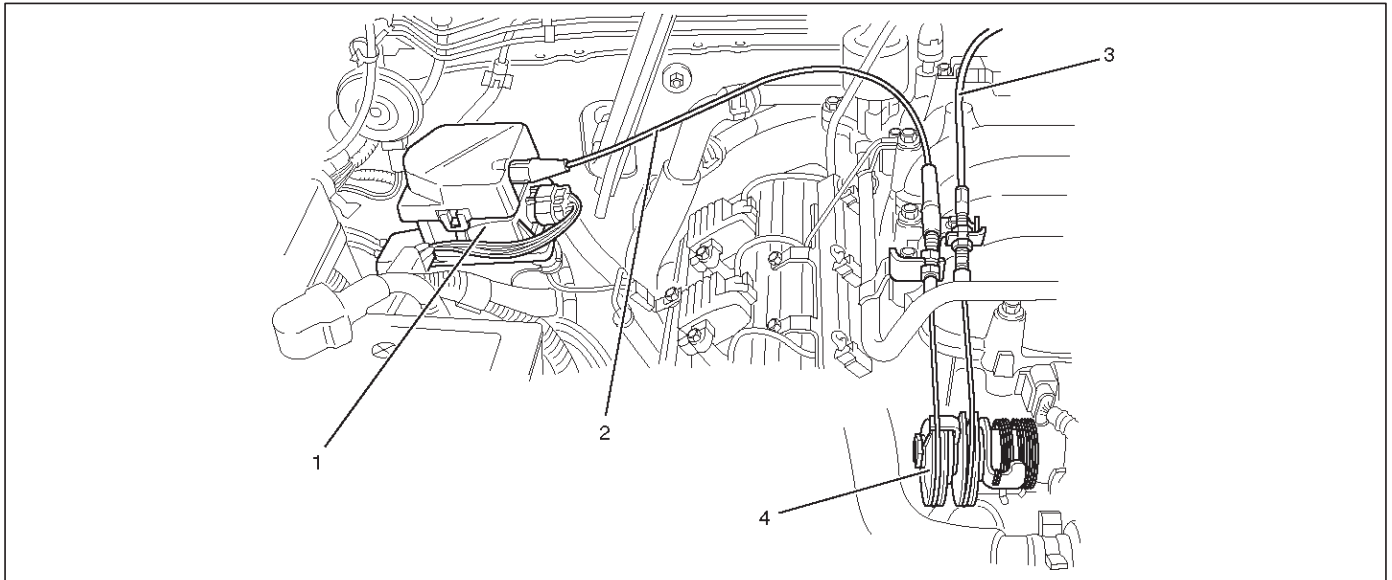
To install, follow the removal steps in the reverse order.



825RW050

Cruise Actuator

Actuator Cable Diagram (LHD)

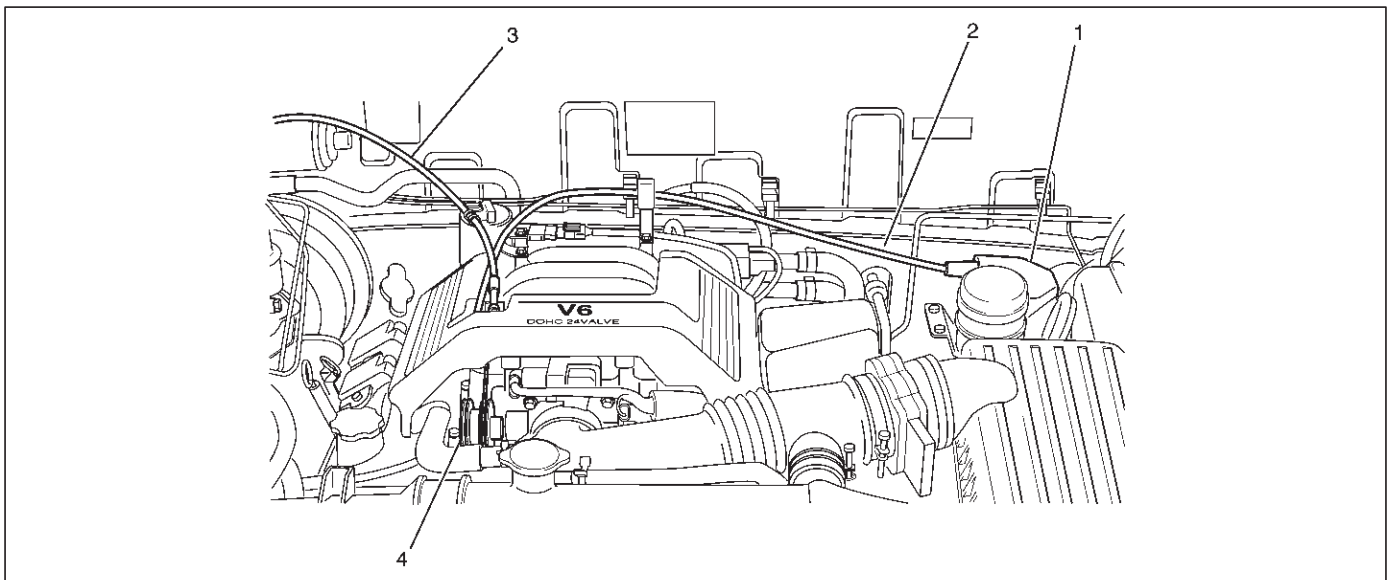


825RW051

Legend

- | | |
|------------------------------|------------------------------------|
| (1) Cruise Actuator Assembly | (3) Accel Control Cable |
| (2) Cruise Control Cable | (4) Cam Link (Cruise Control Side) |

Actuator Cable Diagram (RHD)



825RW221

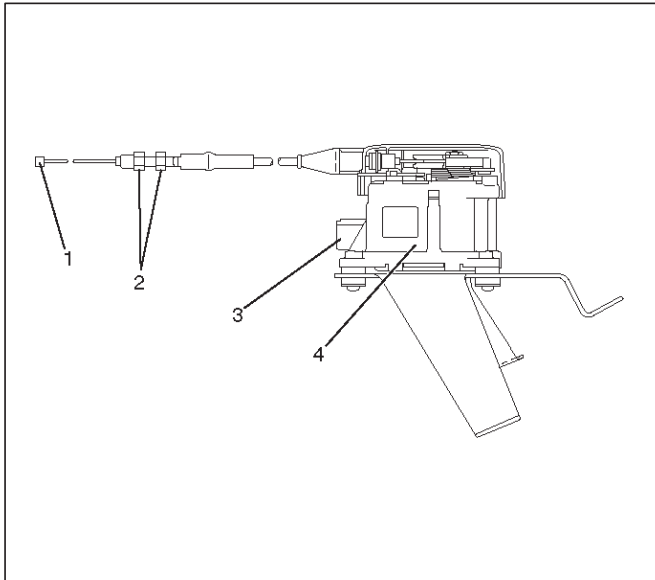
Legend

- | | |
|------------------------------|------------------------------------|
| (1) Cruise Actuator Assembly | (3) Accel Control Cable |
| (2) Cruise Control Cable | (4) Cam Link (Cruise Control Side) |

10A-8 CRUISE CONTROL SYSTEM

Removal

1. Disconnect the battery ground cable.
2. Remove the cruise actuator Assembly (4).
 - Disconnect the connector (3).
 - Remove the cable end (1) from the cam link (cruise control side).
 - Loosen two fixing nuts (2).
 - Remove three actuator fixing screws.



825RW049

Installation

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

1. Take care not to bend the cable excessively.

Mode Switch

Removal and Installation

Refer to the Mode Switch removal and installation steps in Automatic Transmission section.

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
0A	GENERAL INFORMATION
0B	MAINTENANCE AND LUBRICATION

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
1A	HEATING AND VENTILATION
1B	AIR CONDITIONING
1D	COMPRESSOR OVERHAUL

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
00	SERVICE INFORMATION
2A	FRONT END ALIGNMENT

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
3C	FRONT SUSPENSION
3D	REAR SUSPENSION; COIL SPRING
3E	WHEELS AND TIRES

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
4A1	DIFFERENTIAL (FRONT)
4A2A	DIFFERENTIAL (Rear 220mm)
4A2B	DIFFERENTIAL (REAR 244mm)
4B1	DRIVELINE CONTROL SYSTEM (SHIFT ON THE FLY)
4B2	DRIVELINE CONTROL SYSTEM (TOD)
4C	DRIVE SHAFT SYSTEM
4D1	TRANSFER CASE (STANDARD TYPE)
4D2	TRANSFER CASE (TOD)

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
5A	BRAKE CONTROL SYSTEM
5B	ANTI-LOCK BRAKE SYSTEM
5C	POWER ASSISTED BRAKE SYSTEM
5D	PARKING BRAKES

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

6VD1/6VE1

SECTION No.	CONTRNTS
6A	ENGINE MECHANICAL
6B	ENGINE COOLING
6C	ENGINE FUEL
6D1	ENGINE ELECTRICAL
6D2	IGNITION SYSTEM
6D3	STARTING AND CHARGING SYSTEM
6E	ENGINE DRIVEABILITY AND EMISSIONS
6F	ENGINE EXHAUST
6G	ENGINE LUBRICATION
6H	ENGINE SPEED CONTROL SYSTEM
6J	INDUCTION

4JG2

SECTION No.	CONTRNTS
00	SERVICE INFORMATION
6A	ENGINE MECHANICAL
6A2	4JG2-NA / 4JG2-TURBO ENGINE
6B	ENGINE COOLING
6C	FUEL SYSTEM
6D	ENGINE ELECTRICAL
6E	-
6F	EXHAUST
6G	-

4JX1

SECTION No.	CONTRNTS
6A	ENGINE MECHANICAL
6B	ENGINE COOLING
6C	ENGINE FUEL
6D	ENGINE ELECTRICAL
6E	ENGINE DRIVEABILITY AND EMISSIONS
6F	ENGINE EXHAUST
6G	ENGINE LUBRICATION
6H	ENGINE SPEED CONTROL
6J	INDUCTION

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
7A	AUTOMATIC TRANSMISSION (4L30-E)
7A	AUTOMATIC TRANSMISSION (AW30-40LE)
7A1	TRANSMISSION CONTROL SYSTEM (4L30-E)
7B	MANUAL TRANSMISSION (AR-5)
7B	MANUAL TRANSMISSION (MUA)
7C	CLUTCH

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
8A	LIGHTING SYSTEM
8B	WIPER / WASHER SYSTEM
8C	ENTERTAINMENT
8D	WIRING SYSTEM
8E	METER AND GAUGE
8F	BODY STRUCTURE
8G	SEATS
8H	SECURITY AND LOCKS
8I	SUN ROOF/CONVERTIBLE TOP
8J	EXTERIOR / INTERIOR TRIM

THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
9A	SEAT BELT SYSTEM
9J	SUPPLEMENTAL RESTRAINT SYSTEM
9J1	RESTRAINT CONTROL SYSTEM

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTRNTS
10A	CRUISE CONTROL SYSTEM

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THIS MALUAL INCLUDES THE FOLLOWING SECTIONS:

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Sec.-	IMMOBILIZER SYSTEM

SECTION 0A

GENERAL INFORMATION

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How To Use This Manual	0A- 3
Identification	0A- 6
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Service Precaution

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

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