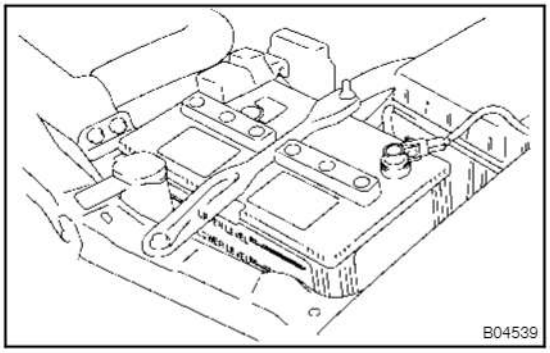

B04539

CHARGING SYSTEM

CH0JX–01

ON–VEHICLE INSPECTION

1. CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

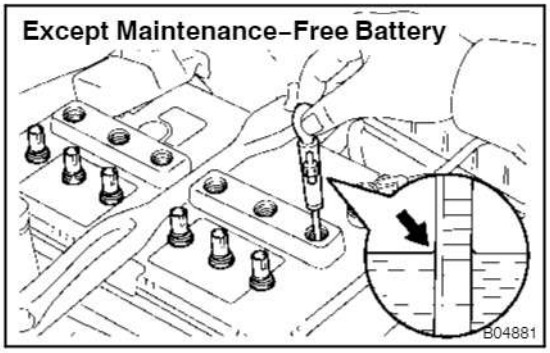
Maintenance–Free Battery:

If under the lower level, replace the battery (or add distilled water if possible). and check the charging system.

Except Maintenance–Free Battery:

If under the lower level, add distilled water.

Except Maintenance–Free Battery


B04881

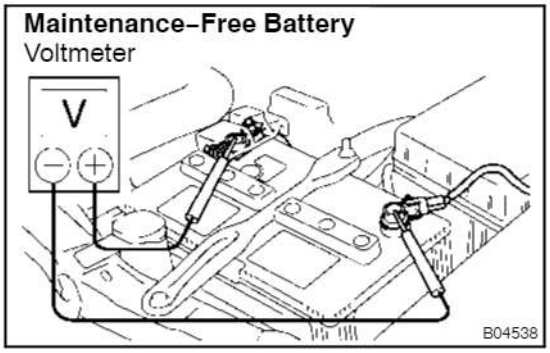
2. Except Maintenance–Free Battery: CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

Standard specific gravity:
1.25 – 1.29 at 20°C (68°F)

If the specific gravity is less than specification, charge the battery.

Maintenance–Free Battery
Voltmeter



B04538

3. Maintenance–Free Battery: CHECK BATTERY VOLTAGE

(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

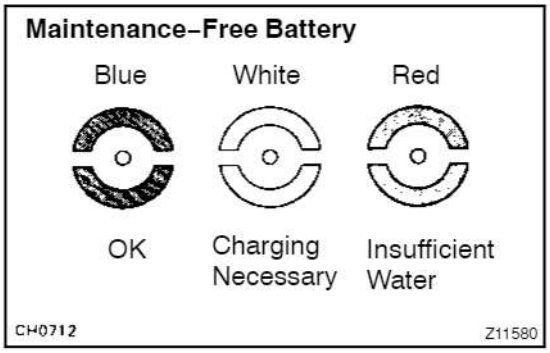
(b) Turn the ignition switch OFF and turn off the electrical systems.

(c) Measure the battery voltage between the negative (–) and positive (+) terminals of the battery.

Standard voltage:
12.5 – 12.9 V at 20°C (68°F)

If the voltage is less than specification, charge the battery.

Maintenance–Free Battery



HINT:

Check the indicator as shown in the illustration.

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

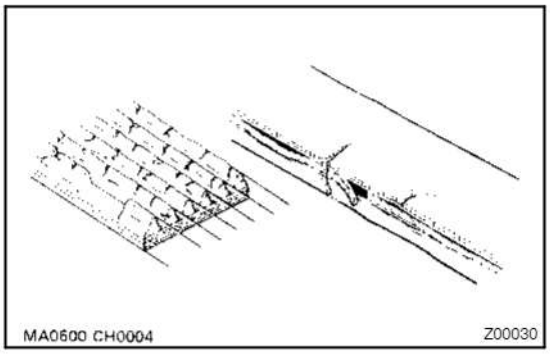
(a) Check that the battery terminals are not loose or corroded.

(b) Check the fusible link and fuses for continuity.

5. INSPECT DRIVE BELT

HINT:

A belt tensioner is used, so checking the belt tension is not necessary.

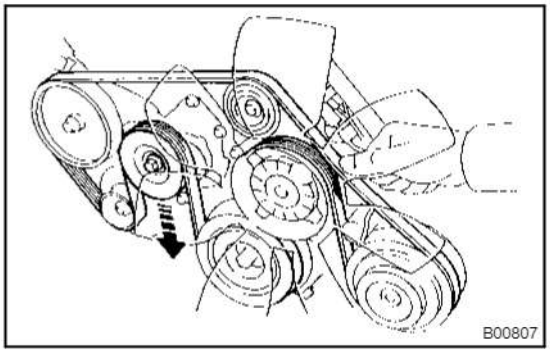


(a) Visually check the drive belt for excessive wear, frayed cords etc.

If necessary, replace the drive belt.

HINT:

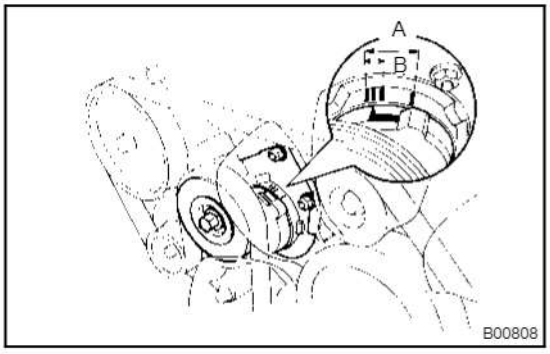
- Cracks on the rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.
- The drive belt tension can be released by turning the belt tensioner counterclockwise. The pulley bolt for the belt tensioner has a left–hand thread.



(b) Check the belt tensioner operation.

- Check that the belt tensioner moves downward when the drive belt is pressed down at the points indicated in the illustration with approx. 98 N (10 kgf, 22.0 lbf) of force.
- Check the alignment of the belt tensioner pulley to make sure the drive belt has not slipped off the pulley.

If necessary, replace the belt tensioner.

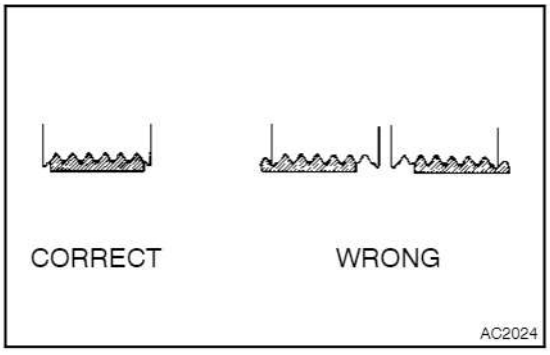


- Check that the arrow mark on the belt tensioner falls within area A of the scale.

If it is outside area A, replace the drive belt.

HINT:

- When a new belt is installed, it should lie within area B. If not, the drive belt is not correct.



- After installing a belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.

6. REMOVE ENGINE UNDER COVER NO.1

7. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

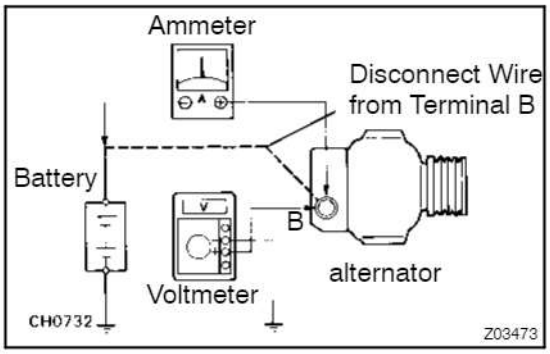
(a) Check that the wiring is in good condition.

(b) Check that there is no abnormal noise from the alternator while the engine is running.

8. CHECK CHARGE WARNING LIGHT CIRCUIT

(a) Warm up the engine and then turn it off.
(b) Switch off all accessories.
(c) Turn the ignition switch ON, and check that the charge warning light is lit.
(d) Start the engine, and check that the light goes off.

If the light does not go off as specified, troubleshoot the charge light circuit.



9. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT:
If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:
- Disconnect the wire from terminal B of the alternator, and connect it to the negative (–) tester probe of the ammeter.
- Connect the positive (+) tester probe of the ammeter to terminal B of the alternator.
- Connect the positive (+) tester probe of the voltmeter to terminal B of the alternator.
- Ground the negative (–) tester probe of the voltmeter.

(b) Check the charging circuit as follows:
With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.
Standard amperage:
10 A or less
Standard voltage:
13.2 – 14.8 V

If the voltmeter reading is more than standard voltage, replace the IC regulator.

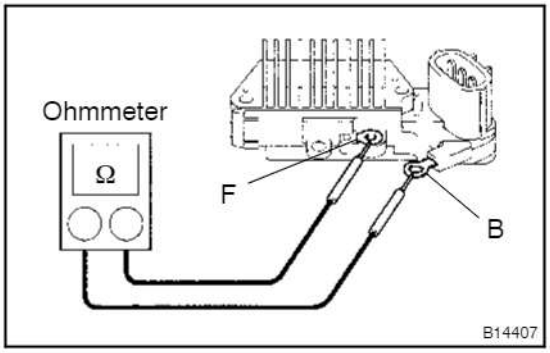
10. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at HI.
(b) Check the reading on the ammeter.
Standard amperage:
30 A or more

If the ammeter reading is less than the standard amperage, repair the alternator.

HINT:
If the battery is fully charged, the indication will sometimes be less than standard amperage.

11. REINSTALL ENGINE UNDER COVER NO.1



ALTERNATOR

INSPECTION

CH0JY–01

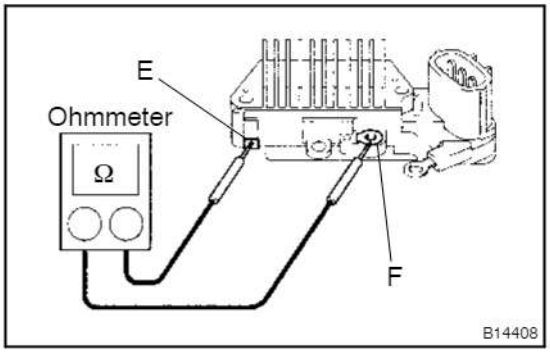
1. INSPECT VOLTAGE REGULATOR

(a) Using an ohmmeter, check the continuity between terminals F and B.

Standard:

When the positive and negative poles between terminals F and B are exchanged, there is continuity in one way but no continuity in another way.

If the continuity is not as specified, replace the voltage regulator.

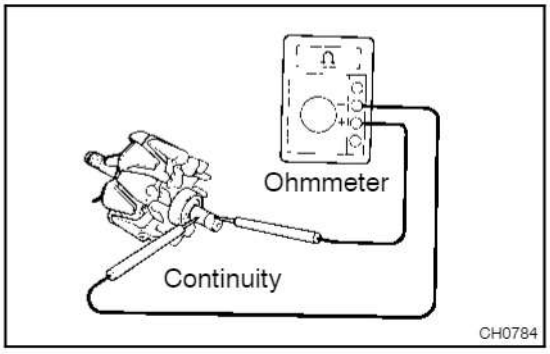


(b) Using an ohmmeter, check the continuity between terminals F and E.

Standard:

When the positive and negative poles between terminals F and E are exchanged, there is continuity in one way but no continuity in another way.

If the continuity is not as specified, replace the voltage regulator.



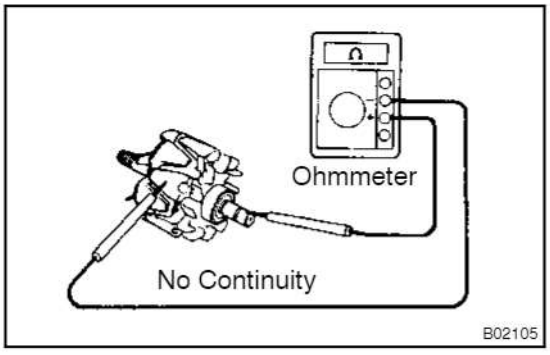
2. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance:

2.1 – 2.5 Ω at 20°C (68°F)

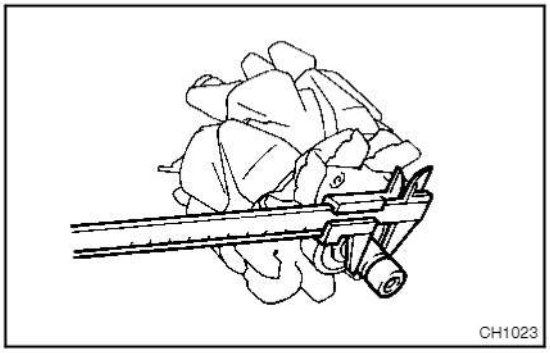
If there is no continuity, replace the rotor.



3. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

If there is continuity, replace the rotor.



4. INSPECT SLIP RINGS

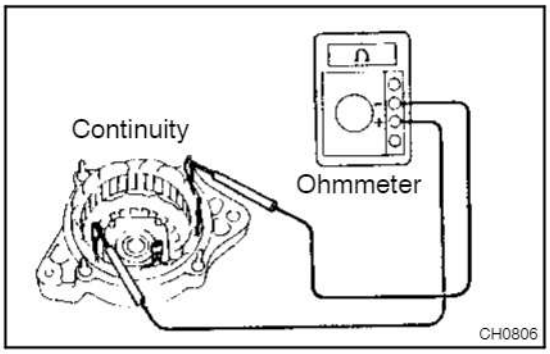
(a) Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

(b) Using vernier calipers, measure the slip ring diameter.

Standard diameter:
14.2 – 14.4 mm (0.559 – 0.567 in.)
Minimum diameter:
12.8 mm (0.504 in.)

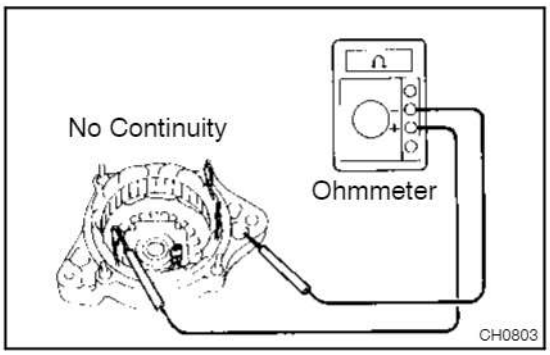
If the diameter is less than minimum, replace the rotor.



5. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

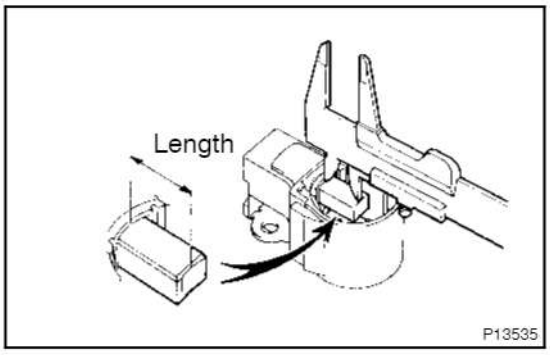
If there is no continuity, replace the drive end frame assembly.



6. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

If there is continuity, replace the drive end frame assembly.

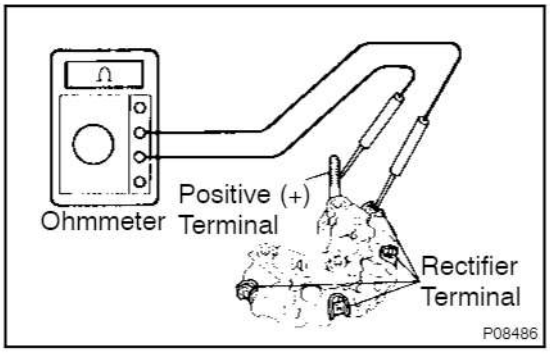


7. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

Standard exposed length:
10.5 mm (0.413 in.)
Minimum exposed length:
1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brush holder.



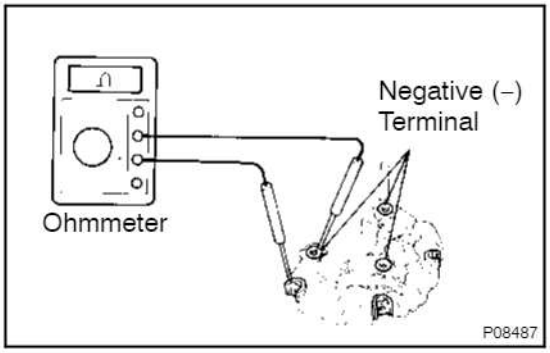
8. INSPECT POSITIVE RECTIFIER

(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



9. INSPECT NEGATIVE RECTIFIER

(a) Using an ohmmeter, connect one tester probe to each negative (–) terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

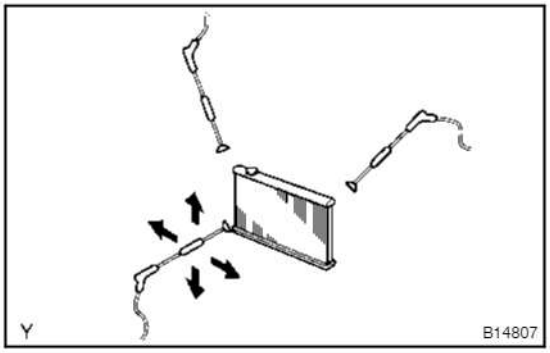
(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.

10. INSPECT FRONT AND REAR BEARING

Check that the bearing is not rough or worn.

If necessary, replace the bearing.



RADIATOR

CO1B0–01

ON–VEHICLE CLEANING

INSPECT FINS FOR BLOCKAGE

If fins are clogged, wash them with water or a steam cleaner and dry with compressed air.

NOTICE:

- **If the distance between the steam cleaner and the core is too close, there is a possibility of damaging the fin, so keep the following injection distance.**

Injection Pressure	Injection Distance
2,942 – 4,903 kpa (30 – 50 kg/cm^2, 427 –711 psi)	300 mm (11.811 in)
4,903 – 7,845 kpa (50 – 80 kg/cm^2, 711 – 1,138 psi)	500 mm (19.685 in)

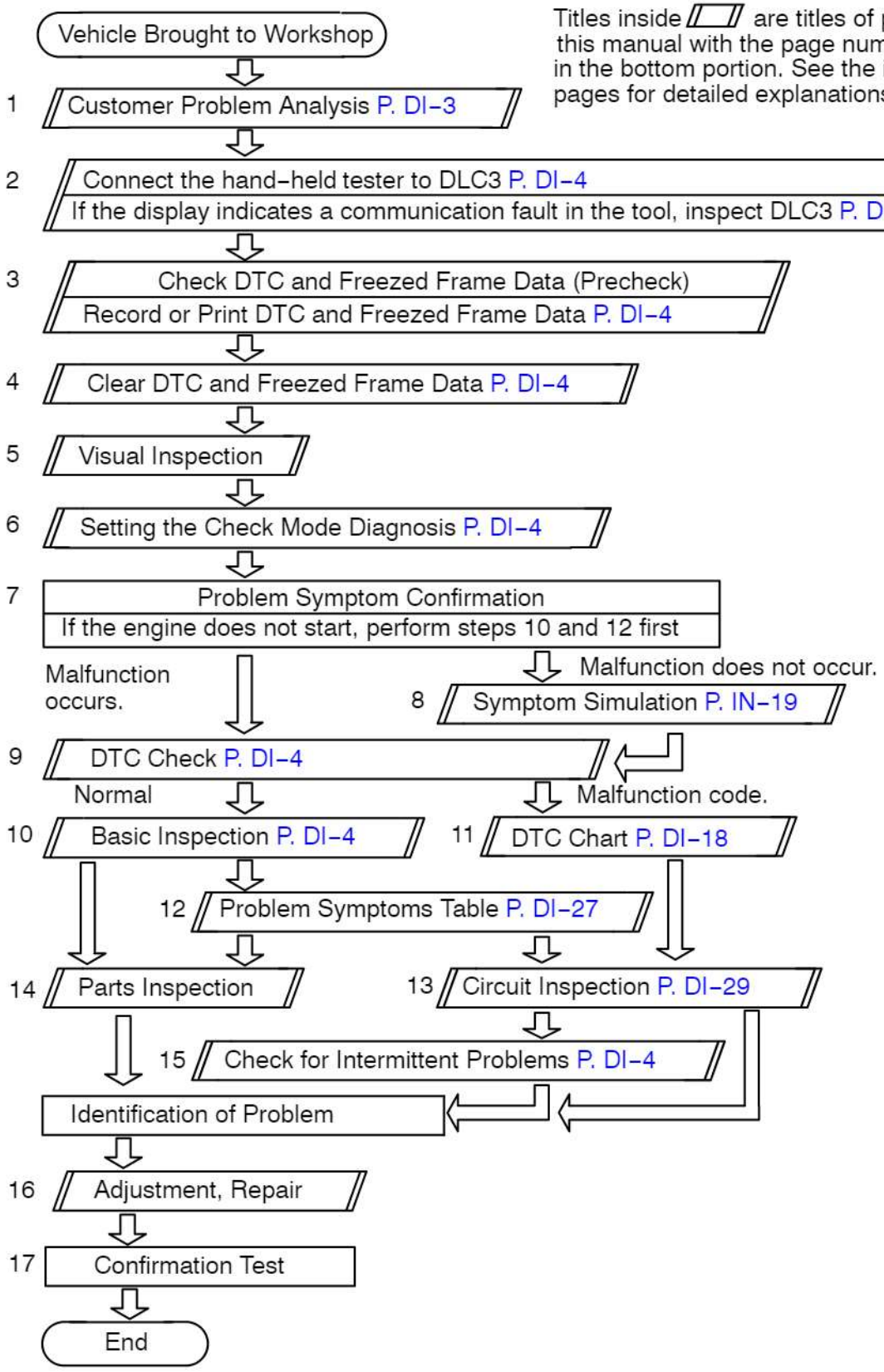
- **If the fins are bent, straighten them with a screwdriver or pliers.**
- **Never apply water directly onto the electronic components.**

ENGINE

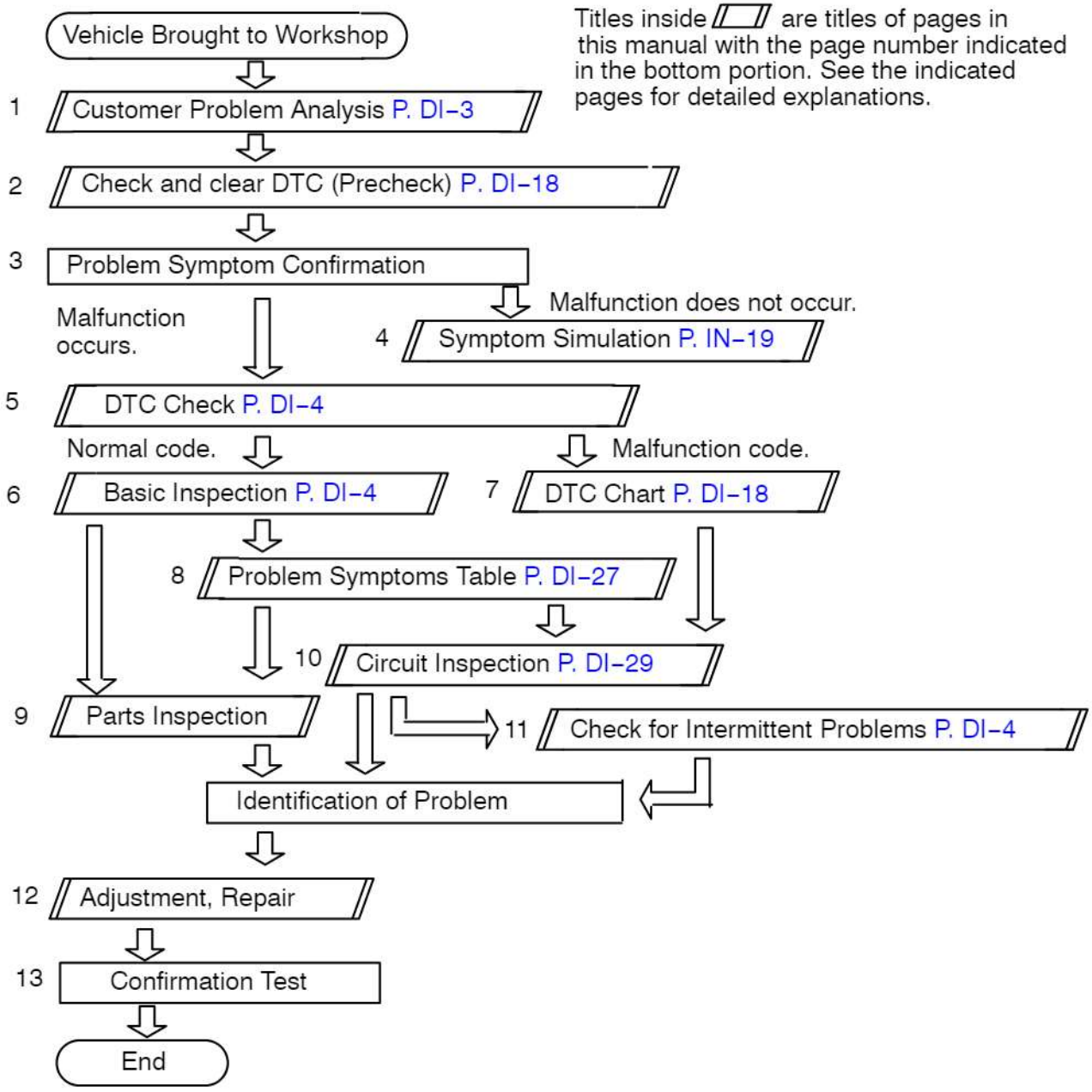
DI3OP–02

HOW TO PROCEED WITH TROUBLESHOOTING

When using hand–held tester, Troubleshoot in accordance with the procedure on the following page.



When not using hand–held tester, Troubleshoot in accordance with the procedure on the following page.



DI3OQ–01

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name _____

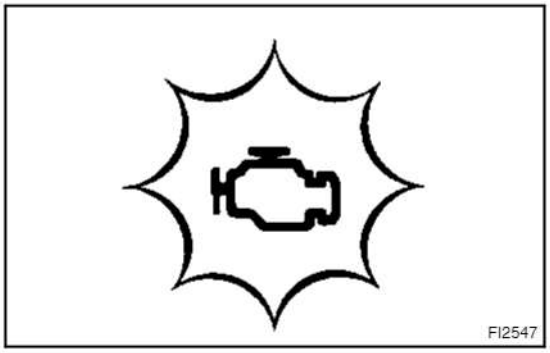
Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
Date Vehicle Brought in		Engine Model	
License No.		Odometer Reading	km miles

Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____
	☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging ☐ Knocking ☐ Other _____
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____
	☐ Others	

Dates Problem Occurred		
Problem Frequency		☐ Constant ☐ Sometimes (times per day/month) ☐ Once only ☐ Other _____
Condition When Problem Occurs	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. ____ °F/____ °C)
	Place	☐ Highway ☐ Suburbs ☐ Inner city ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
	Engine Temp.	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temp. ☐ Other _____
	Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

DTC Inspection	Normal Mode (Precheck)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Check (test) Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )

DI9MF–01

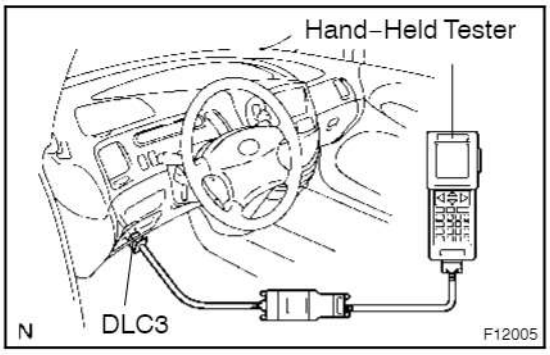

FI2547

PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description for Euro–OBD (European spec.)

- When troubleshooting Euro–OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect the vehicle to the OBD scan tool complying with ISO 15031–4 or hand–held tester, and read off various data output from the vehicle's engine ECU.
- Euro–OBD regulations require that the vehicle's on–board computer lights up the check engine warning light on the instrument panel when the computer detects a malfunction in the emission control system / components or in the power train control components which affect vehicle emissions, or a malfunction in the computer. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTC) prescribed by ISO 15031–4 are recorded in the engine ECU memory (See page DI–18). If the malfunction does not reoccur in 3 consecutive trips, the check engine warning light goes off automatically but the DTCs remain recorded in the engine ECU memory.

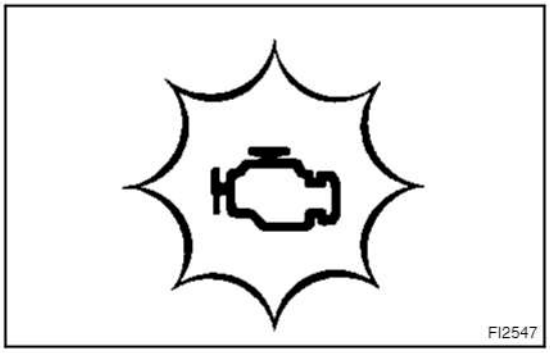


- To check the DTCs, connect the OBD scan tool or hand–held tester to Data Link Connector 3 (DLC3) on the vehicle. The OBD scan tool or hand–held tester also enables you to erase the DTCs and check freezed frame data and various forms of engine data. (For operating instructions, see the OBD scan tool's instruction book.)
  DTCs include ISO controlled codes and manufacturer controlled codes. ISO controlled codes must be set as prescribed by the ISO, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page DI–18).

- The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the engine ECU to the check mode when troubleshooting, the technician can cause the check engine warning light to light up for a malfunction that is only detected once or momentarily (hand–held tester only). (See step 2)
- *2 trip detection logic: When a malfunction is 1st detected, the malfunction is temporarily stored in the engine ECU memory. (1st trip) If the same malfunction is detected again during the second drive test, this 2nd detection causes the check engine warning light to light up. (2nd trip)
  (However, the IG switch must be turned OFF between the 1st trip and the 2nd trip.)
- Freeze frame data:
  Freeze frame data records the engine condition when a misfire (DTCs P0300/93 – P0304/93) or fuel trim malfunction (DTCs P0171/25) or other malfunction (first malfunction only), is detected.
  Because freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
- Priorities for troubleshooting:
  If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these should be followed.

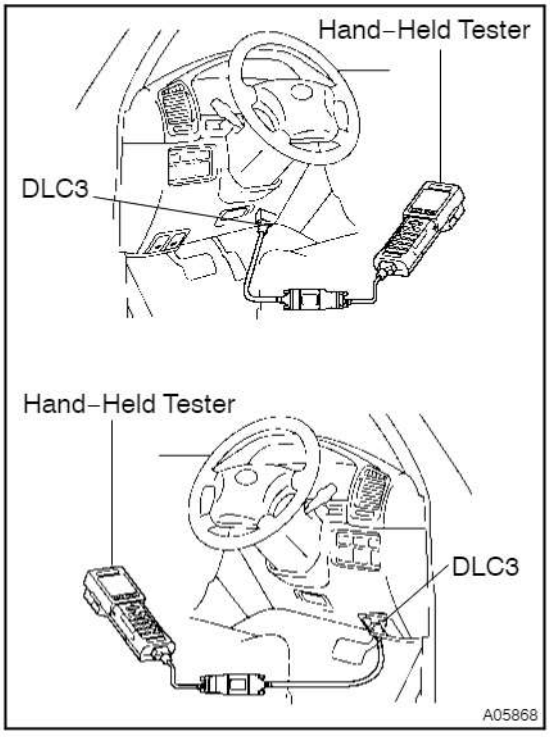
If no instructions are given, troubleshoot according to the following priorities.

(1) DTCs other than fuel trim malfunction (DTCs P0171/25) and misfire (DTCs P0300/93 – P0304/93).
(2) Fuel trim malfunction (DTCs P0171/25).
(3) Misfire (DTCs P0300/93 – P0304/93).



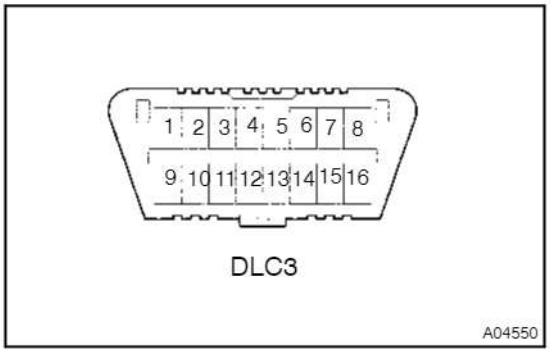
(b) Description for M–OBD (Except European spec.)

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect to the vehicle the hand–held tester, and read off various data output from the vehicle's engine ECU.
- The vehicle's on–board computer lights up check engine warning light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to an indication of the CHK ENG lighting up when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTC) recorded in the engine ECU memory (See page DI–18). If the malfunction has been repaired, the CHK ENG goes off automatially but the DTCs remain recorded in the engine ECU memory.



- To check the DTCs, connect the hand–held tester to Data Link Connector 3 (DLC3) on the vehicle or read the diagnostic trouble code which is indicated on the multi information display when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and check freezed frame data and various forms of engine data. (For operating instructions, see the instruction book.)
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check (test) mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the engine ECU to check (test) mode using hand–held tester when troubleshooting, the technician can cause the CHK ENG light up for a malfunction that is only detected once or momentarily. (Hand–held tester only) (See step 2)
- *2 trip detection logic: When a logic malfunction is first detected, the malfunction is temporarily stored in the engine ECU memory. If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG light up. The 2 trip repeats the same mode a 2nd time (However, the IG switch must be turned OFF between the 1st trip and 2nd trip.).

- Freeze frame data:
  Freeze frame data records the engine condition when a malfunction , is detected.
  Because freeze frame data records the engine conditions (fuel system, calculator load, Water temperature, fuel trim,engine speed, vehicle speed, etc.) when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

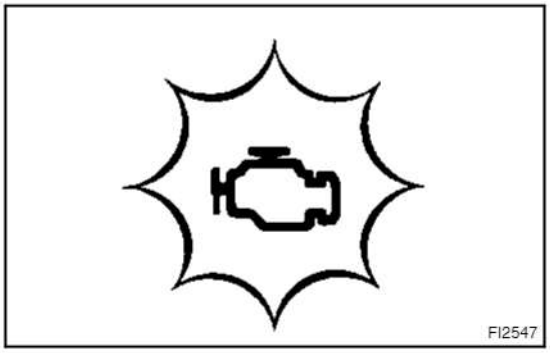


(c) Check the DLC3.
The vehicle's engine ECU uses ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) for communication. The terminal arrangement of DLC3 complies with ISO 15031–3 and matches the ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) format.

Terminal No.	Connection / Voltage or Resistance	Condition
7	Bus ⊕ Line / Pulse generation	During transmission
4	Chassis Ground ↔ Body Ground / 1 Ω or less	Always
16	Battery Positive ↔ Body Ground / 9 ~ 14 V	Always

HINT:
If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of the hand–held tester to DLC3, turned the ignition switch ON and operated the hand–held tester, there is a problem on the vehicle side or tool side.

- If communication is normal when the tool is connected to another vehicle, inspect DLC3 on the original vehicle.
- If communication is still not possible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.


FI2547

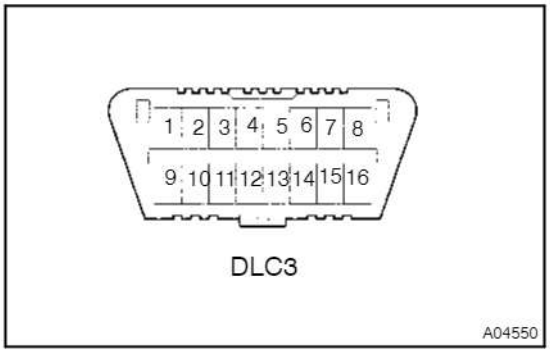
2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the DTC using hand–held tester.

NOTICE:

Hand–held tester only: When the diagnosis system is switched from normal mode to check (test) mode, it erases all DTCs and freezed frame data recorded in normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.

(1) Prepare the hand–held tester.
(2) Connect the hand–held tester to DLC3.
(3) Turn the ignition switch ON and push the hand–held tester main switch ON.
(4) Use the hand–held tester to check the DTCs and freezed frame data, note them down. (For operating instructions, see the hand–held tester instruction book.)
(5) See page DI–18 to confirm the details of the DTCs.



DLC3
A04550

(b) Check the DTC.
(1) Turn the ignition switch ON.
(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843–18040
(3) Read the DTC on the multiinformation display.

HINT:

- If a DTC is not indicated, check the TC terminal circuit (See page DI–24).
- If a code No.89 is indicated, read the number of blinks of the 2nd STRT indication (only for A/T)/ETCS indicator (only for M/T) to get the DTC for the electric throttle control system (ETCS).

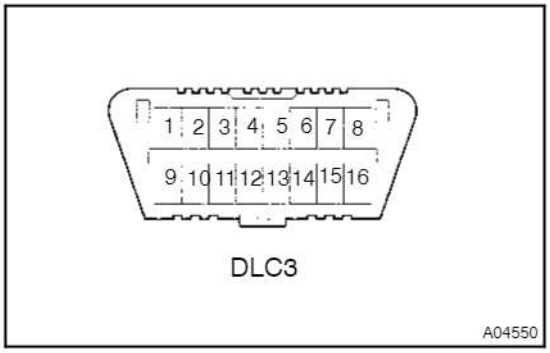
NOTICE:

When simulating symptoms with out a hand–held tester to check the DTCs, use normal mode. For code on the DTC chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the CHK ENG light up and the DTCs are recorded in the engine ECU.

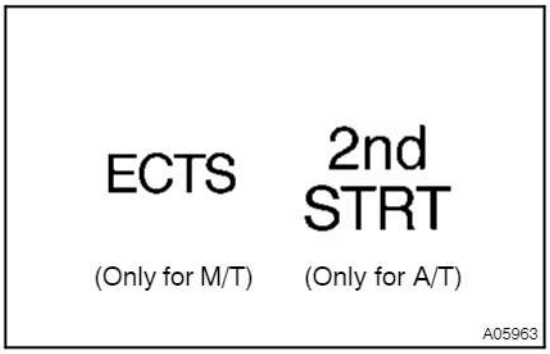
(c) Check the DTC for ETCS
(1) Turn ignition switch ON.

HINT:

If the 2nd STRT indicator (only for A/T)/ETCS indicator (only for M/T) does not light up, troubleshoot the combination meter (See page DI–23).



(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843–18040



(3) Read the diagnostic trouble code from 2nd STRT indicator (only for A/T)/ETCS indicator (only for M/T) on the combination meter.

HINT:
If a DTC is not output, check the TC terminal circuit (See page DI–24).

(4) Check details of the malfunction using the DTC chart on page DI–18.

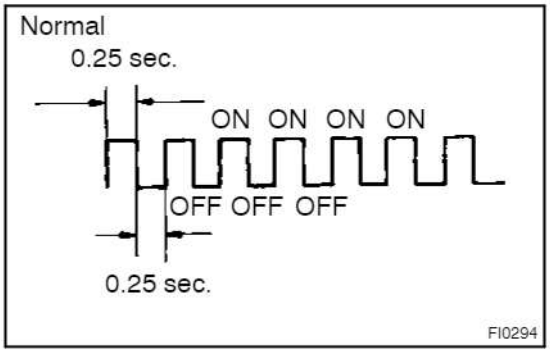
(5) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:
In the event of 2 or more malfunction codes, indication will begin from the smaller numbered code and continue in order to the lager.

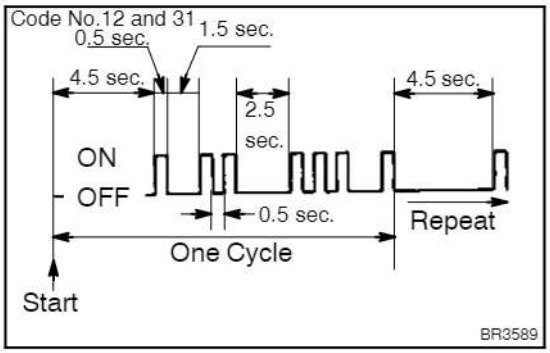
(d) Clear the DTC.
The DTCs and freezed frame data will be erased by either actions.

(1) Operating the hand–held tester to erase the codes. (See the hand–held tester's instruction book for operating instructions.)

(2) Disconnecting the battery terminals of EFI and THROTTLE fuses.



NOTICE:
If the hand–held tester switches the engine ECU from normal mode to check (test) mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check (test) mode, the DTCs and freezed frame data will be erased.



3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:
Hand–held tester only:
Compared to the normal mode, the check (test) mode has an increased sensitivity to detect malfunctions.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Check the DTC.

(1) Initial conditions

- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in "P" or "N" position.

- Air conditioning switched OFF.

(2) Turn the ignition switch OFF.
(3) Prepare the hand–held tester.
(4) Connect the hand–held tester to the DLC3.
(5) Turn the ignition switch ON and push the hand–held tester main switch ON.
(6) Switch the hand–held tester normal mode to check (test) mode.

NOTICE:
If the hand–held tester switches the engine ECU from normal mode to check (test) mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check (test) mode, the DTCs and freezed frame data will be erased.

(7) Start the engine.
(8) Simulate the conditions of the malfunction described by the customer.

NOTICE:
Leave the ignition switch ON until you have checked the DTCs, etc.

(9) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freezed frame data, etc.

HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode. so all DTCs, etc. are erased.

(10) After checking the DTC, inspect the applicable circuit.

4. FAIL–SAFE CHART

If any of the following codes is recorded, the engine ECU enters fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0100/31	Ignition timing fixed at 5° BTDC	Returned to normal condition
P0110/24	Intake air temperature is fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Water temperature is fixed at 80°C (176°F)	Returned to normal condition
P0135/21 P0141/21 P0155/28 P0161/28	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0325/52 P0330/53	Max. timing retardation	Ignition switch OFF
P1300/14 P1305/15 P1310/14 P1315/14 P1320/14 P1325/14 P1330/14 P1340/14	Fuel cut	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HAND–HELD TESTER only:

By putting the vehicle's engine ECU in check (test) mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(1) Clear the DTCs.
(2) Set the check (test) mode.
(3) Perform a simulation test (See page IN–9).
(4) Check the connector and terminal (See page IN–19).
(5) Handle the connector (See page IN–19).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be performed in the order for all possible circuits to be considered as the causes of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

1	**Is battery positive voltage 11 V or more when engine is stopped?**

NO → **Charge or replace battery.**

YES

2	**Is engine cranked?**

NO → **Proceed to problem symptoms table on page DI–27.**

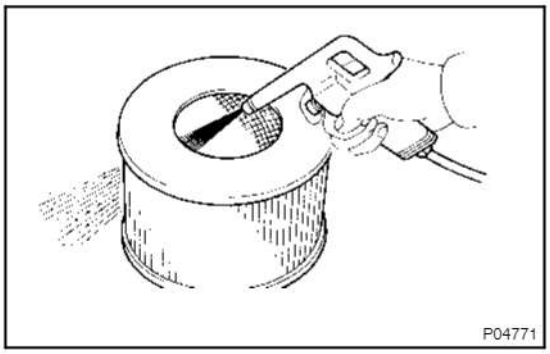
YES

3	**Does engine start?**

NO → **Go to step 7.**

YES

4	Check air filter.

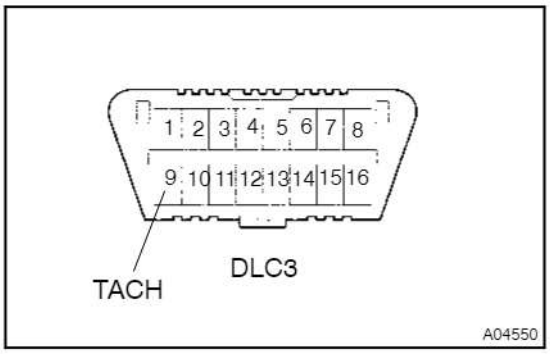


PREPARATION:
Remove the air filter.
CHECK:
Visual check that the air filter is not dirty or excessive oily.
HINT:
If necessary, clean the filter.

NG	Repair or replace

OK

5	Check idle speed.



PREPARATION:
(a) Warm up the engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into "N" position.
(e) Connect the hand–held tester to the DLC3 on the vehicle.
(f) If you have no hand–held tester, connect tachometer test prove to terminal 9 (TACH) of the DLC3.
SST 09843–18030

NOTICE:
As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your until before use.

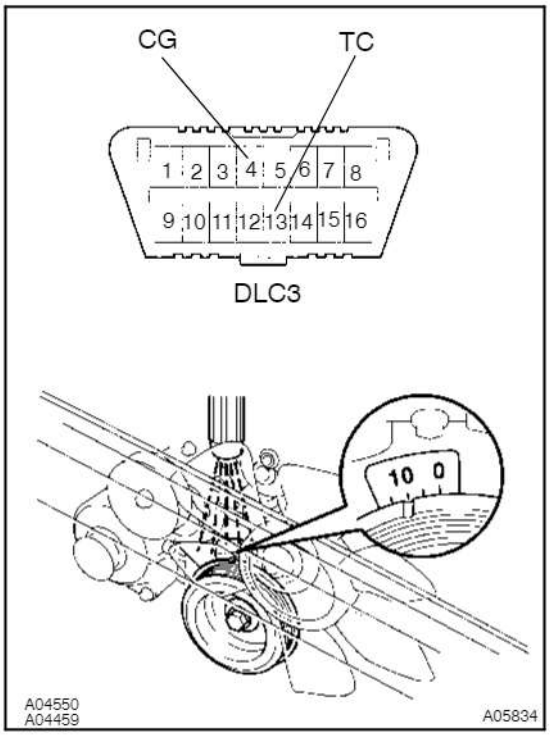
CHECK:
Check the idle speed.

OK:
Idle speed: 650 – 750 rpm

NG	Proceed to problem symptoms table on page DI–27.

OK

6	Check ignition timing.



PREPARATION:

(a) Warm up the engine to normal operating temperature.
(b) Shift transmission into "N" position.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18040
(e) Using a timing light, connect the tester to the ignition coil connector wire (See Pub. No. RM630E on page EM–11).

CHECK:

Check ignition timing.

OK:

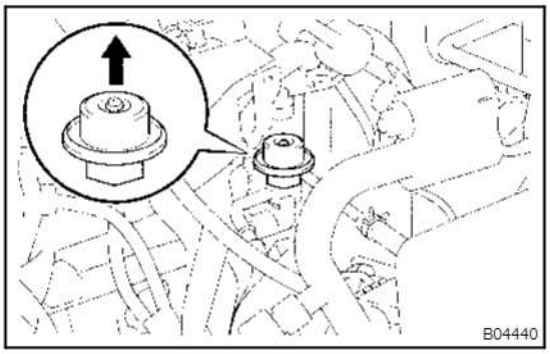
Ignition timing: 10° BTDC at idle

NG → **Proceed to Pub. No. RM630E on page IG–1 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–27.

7	**Check fuel pressure.**



PREPARATION:

(a) Be sure that enough fuel is in the tank.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the ignition switch ON and push hand–held tester main switch ON.
(d) Use ACTIVE TEST mode to operate the fuel pump.
(e) Please refer to the hand–held tester operator's manual for further details.
(f) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See Pub. No. RM630E on page FI–7).

CHECK:

Check that pulsation damper screw rises up when fuel pump operates.

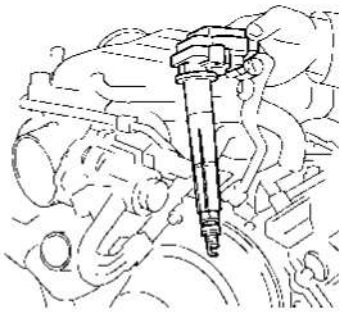
HINT:

At this time, you will hear a fuel flowing noise.

NG → **Proceed to Pub. No. RM630E on page and continue to troubleshoot.**

OK →

8	Check for spark.



PREPARATION:

(a) Remove the ignition coil from the spark plug.
(b) Remove the spark plug.
(c) Install the spark plug to the ignition coil.
(d) Disconnect the injector connector.
(e) Ground the spark plug.

CHECK:

Check if spark occurs while engine is being cranked.

NOTICE:

To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 ~ 10 seconds at a time.

NG → **Proceed to Pub. No. RM630E on page IG–1 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–27.

7. ENGINE OPERATING CONDITION

NOTICE:

The values given below for "Normal Condition" are representative values, so a vehicle may still be normal even if its value varies from those listed here. So do not decide whether a part is faulty or not solely according to the "Normal Condition" here.

Hand–held tester display	Measurement Item	Normal Condition*
FUEL SYS #1	Fuel System Bank 1 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
FUEL SYS #2	Fuel System Bank 2 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
CALC LOAD	Calculator Load: Current intake air volume as a proportion of max. intake air volume	Idling: 12.0 ~ 18.0 % Racing without load (2,500rpm): 11.0~ 17.0 %
COOLANT TEMP.	Water Temp. Sensor Value	After warming up: 80 ~ 95°C (176 ~ 203°F)
SHORT FT #1	Short–term Fuel Trim Bank 1	0 ± 20 %
LONG FT #1	Long–term Fuel Trim Bank 1	0 ± 20 %
SHORT FT #2	Short–term Fuel Trim Bank 2	0 ± 20 %
LONG FT #2	Long–term Fuel Trim Bank 2	0 ± 20 %

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

Hand–held tester display	Measurement Item	Normal Condition*
ENGINE SPD	Engine Speed	Idling: 650 ~ 750 rpm
VEHICLE SPD	Vehicle Speed	Vehicle stopped: 0 km/h (0 mph)
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No. 1	Idling: BTDC 5 ~ 15°
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to ambient temp.
AFM	Air Flow Rate Through Air Flow Meter	Idling: 4.5 ~ 5.5 gm/sec. Racing without load (2,500 rpm): 13.0 ~ 20.0 gm/sec.
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V → 0 %, 5 V → 100 %	Throttle fully closed: 8 ~ 20 % Throttle fully open: 64 ~ 96 %
O2S B1, S1	Voltage Output of Oxygen Sensor Bank 1, Sensor 1	Idling: 0.1 ~ 0.9 V
O2S B1, S2	Voltage Output of Oxygen Sensor Bank 1, Sensor 2	Driving (50 km/h, 31 mph): 0.1 ~ 0.9 V
O2S B2, S1	Voltage Output of Oxygen Sensor Bank 2, Sensor 1	Idling: 0.1 ~ 0.9 V
O2S B2, S2	Voltage Output of Oxygen Sensor Bank 2, Sensor 2	Driving (50 km/h, 31 mph): 0.1 ~ 0.9 V
O2FT B1, S1	Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1)	0 ± 20 %
O2FT B2, S1	Oxygen Sensor Fuel Trim Bank 2, Sensor 1 (Same as SHORT FT #2)	0 ± 20 %
INJECTOR	Fuel injection time for cylinder No.1	Idling: 2.1 ~ 3.9 ms
STARTER SIG	Starter Signal	Cranking: ON
A/C SIG	A/C Switch Signal	A/C ON: ON
PNP SW	Park/Neutral Position Switch Signal	P or N position: ON
CTP	Closed Throttle Position	Throttle fully closed: ON
STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
FUEL PUMP	Fuel Pump Signal	Idling: ON
EVAP (PURGE) VSV	EVAP VSV Signal	VSV operating: ON

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

Hand–held tester display	Measurement Item	Normal Condition*
THROTTLE POS #2	Throttle position sensor No.2 output voltage	Throttle fully closed: 2.0 ~ 2.9 V Throttle fully open: 4.7 ~ 5.1 V
ACCEL POS	Accelerator pedal position sensor No.1 output voltage	Accelerator pedal released: 0.3 ~ 0.9 V Accelerator pedal depressed: 3.2 ~ 4.8 V
ACCEL POS #2	Accelerator pedal position sensor No.2 output voltage	Accelerator pedal released: 1.8 ~ 2.7 V Accelerator pedal depressed: 4.7 ~ 5.1 V
THROTTLE TARGET POS	Target position of throttle valve	Idling: 0.4 ~ 1.1 V
THROTTLE OPEN DUTY	Throttle motor opening duty ratio	Throttle fully closed: 0 % When accelerator pedal is depressed, duty ratio is increased
THROTTLE CLOSE DUTY	Throttle motor closed duty ratio	Throttle fully closed: 0 – 40% When accelerator pedal is quick released, duty ratio is increased
THROTTLE MOTOR CTL	Whether or not throttle motor control is permitted	Idling: ON
THROTTLE CLUTCH CTL	Whether or not magnetic clutch control is permitted	Idling: ON
+BM	Whether or not electric throttle control system power is inputted	Idling: ON
ACCEL IDL	Whether or not accelerator pedal position sensor is detecting idle	Idling: ON
THROTTLE IDL	Whether or not throttle position sensor is detecting idle	Idling: ON
FAIL #1	Whether or not fail safe function is executed	ETCS is failed: ON
FAIL #2	Whether or not fail safe function is executed	ETCS is failed: ON
THROTTLE LEAN VALUE	Throttle fully closed learning value	0.4 ~ 0.8 V
ACCEL LEAN VALUE	Accelerator fully closed learning value	0.4 ~ 0.8 V
THROTTLE MOTOR	Throttle motor control current	Idling: 0 ~ 3.0 A
ETCS MAG CLUTCH	Magnetic clutch control current	0.8 ~ 1.0 A
TOTAL FT B1	Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1	Idling: 0.5 ~ 1.4
TOTAL FT B2	Total Fuel Trim Bank 2: Average value for fuel trim system of bank 2	Idling: 0.5 ~ 1.4
O2 LR B1, S1	Oxygen Sensor Lean Rich Bank 1, Sensor 1 Response time for oxygen sensor output to switch from lean to rich	Idling after warming up: 0 ~ 1,000 msec.
O2 LR B2, S1	Oxygen Sensor Lean Rich Bank 2, Sensor 1 Response time for oxygen sensor output to switch from lean to rich	Idling after warming up: 0 ~ 1,000 msec.
O2 RL B1, S1	Oxygen Sensor Rich Lean Bank 1, Sensor 1 Response time for oxygen sensor output to switch from rich to lean	Idling after warming up: 0 ~ 1,000 msec.
O2 RL B2, S1	Oxygen Sensor Rich Lean Bank 1, Sensor 1 Response time for oxygen sensor output to switch from rich to lean	Idling after warming up: 0 ~ 1,000 msec.

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

DI3OS–02

DIAGNOSTIC TROUBLE CODE CHART

1. ENGINE TROUBLE CODES

HINT:

Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in check mode, check the circuit for that code listed in the table below. For details of each code, turn to the page referred to under the "See Page" for the respective "DTC No." in the DTC chart.

DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
P0100/31 (★)	Air Flow Circuit Malfunction	• Open or short in air flow meter circuit • Air flow meter • Engine ECU	○	○
P0110/24 (★)	Intake Air Temp. Circuit Malfunction	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (inside air flow meter) • Engine ECU	–	○
P0115/22 (★)	Water Temp. Circuit Malfunction	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU	○	○
P0116/22 (DI–29)	Water Temp. Circuit Range/Performance Problem	• Water temp. sensor • Cooling System	○	○
P0120/41 (★)	Throttle Position Sensor Circuit Malfunction	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU	○	○
P0121/41 (★)	Throttle Position Sensor Circuit Range/Performance Problem	• Throttle position sensor • Engine ECU	○	○
P0125/91 *4 (DI–30)	Insufficient Coolant Temp. for Closed Loop Fuel Control	• Air induction system • Fuel pressure • Injector injection • Gas leakage on exhaust system • Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Oxygen sensor (bank 1 sensor 1)	○	○
P0130/21 *2 (★)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Oxygen sensor • Fuel trim malfunction	–	○
P0133/21 *3 (DI–36)	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Open or short in oxygen sensor circuit • Oxygen sensor • Air induction system • Fuel pressure • Injector • Engine ECU	○	○
P0135/21 *2 (DI–40)	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • Engine ECU	–	○
P0136/27 *2 (★)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Oxygen sensor	–	○

P0153/28 *3 (DI–36)	Oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1)	• Open or short in oxygen sensor circuit • Oxygen sensor • Air induction system • Fuel pressure • Injector • Engine ECU	○	○
P0141/21 *2 (DI–40)	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	• Same as DTC No. P0135/21	–	○
P0150/28 *2 (★)	Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 1)	• Same as DTC No. P0130/21	–	○
P0155/28 *2 (DI–40)	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	• Same as DTC No. P0135/21	–	○
P0156/29 *2 (★)	Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 2)	• Same as DTC No. P0136/27	–	○
P0161/28 *2 (DI–40)	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)	• Same as DTC No. P0135/21	–	○
P0171/25 *2 (DI–42)	Fuel Trim System too Lean (Air–Fuel Ratio Lean Malfunction, Bank 1)	• Air intake (hose loose) • Fuel line pressure • Injector blockage • Oxygen sensor malfunction • Air flow meter • Water temp. sensor	–	○
P0172/26 *3 (DI–42)	System too Rich (Air–Fuel Ratio Rich Malfunction, Bank 1)	• Injector leak, blockage • Air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in oxygen sensor (bank 1 sensor 1) circuit • Open sensor (bank 1 sensor1)	○	○
P0174/25 *2 (DI–42)	Fuel Trim System too Rich (Air–Fuel Ratio Lean Malfunction, Bank 2)	• Air intake (hose loose) • Fuel line pressure • Injector blockage • Oxygen sensor malfunction • Air flow meter • Water temp. sensor	–	○
P0175/26 *3 (DI–42)	System too Rich (Air–Fuel Ratio Rich Malfunction, Bank 2)	• Injector leak, blockage • Air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in oxygen sensor (bank 2 sensor 1) circuit • Oxygen sensor (bank 2 sensor 1)	○	○

P0300/93 *3 (DI–48)	Random/Multiple Cylinder Misfire Detected	• Open or short engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Vacuum sensor • Water temp. sensor • Compression pressure • Valve clearance • Valve timing • Engine ECU	○	○
P0301/93 *3 (DI–48)	Cylinder 1 Misfire Detected			
P0302/93 *3 (DI–48)	Cylinder 2 Misfire Detected			
P0303/93 *3 (DI–48)	Cylinder 3 Misfire Detected			
P0304/93 *3 (DI–48)	Cylinder 4 Misfire Detected			
P0305/93 *3 (DI–48)	Cylinder 5 Misfire Detected			
P0306/93 *3 (DI–48)	Cylinder 6 Misfire Detected			
P0307/93 *3 (DI–48)	Cylinder 7 Misfire Detected			
P0308/93 *3 (DI–48)	Cylinder 8 Misfire Detected			
P0325/52 (★)	Knock Sensor 1 Circuit Malfunction (Bank 1)	• Open or short in knock sensor 1 circuit • Knock sensor 1 (looseness) • Engine ECU	○	○
P0330/55 (★)	Knock Sensor 2 Circuit Malfunction (Bank 2)	• Open or short in knock sensor 2 circuit • Knock sensor 2 (looseness) • Engine ECU	○	○
P0335/12, 13 (★)	Crankshaft Position Sensor Circuit Malfunction	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU	○	○
P0340/12 (★)	Camshaft Position Sensor Circuit Malfunction	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Starter • Engine ECU	○	○
P0420/94 *3 (DI–54)	Catalyst System Efficiency Below Threshold (Bank 1)	• Gas leakage on exhaust system • Oxygen sensor • Three–way catalytic converter	○	○
P0430/94 *3 (DI–54)	Catalyst System Efficiency Below Threshold (Bank 2)	• Same as DTC No. P0420/94	○	○
P0443/94 *3 (DI–57)	Evaporative Emission Control System Purge Control Vent Control Malfunction	• Open or short in VSV circuit for EVAP • VSV for EVAP • Engine ECU	○	○
P0500/42 (★)	Vehicle Speed Sensor Malfunction	• Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Combination meter • Engine ECU	–	○
P0505/33 *3 (DI–60)	Idle Control System Malfunction	• Air induction system • Electric throttle control system	○	○
P1120/19 (★)	Accelerator Pedal Position Sensor Circuit Malfunction	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU	○	○

P1121/19 (★)	Accelerator Pedal Position Sensor Range/Performance Problem	• Accelerator pedal position sensor • Engine ECU	○	○
P1125/89 *5 (★)	Throttle Control Motor Circuit Malfunction	• Open or short in throttle control motor circuit • Throttle control motor • Engine ECU	○	○
P1126/89 *5 (★)	Magnetic Clutch Circuit Malfunction	• Open or short in magnetic clutch circuit • Magnetic clutch • Engine ECU	○	○
P1127/89 *5 (★)	ETCS Actuator Power Source Circuit Malfunction	• Open in ETCS power source circuit • Engine ECU	○	○
P1128/89 *5 (★)	Throttle Control Motor Lock Malfunction	• Throttle control motor • Throttle body • Engine ECU	○	○
P1129/89 *5 (★)	Electric Throttle Control System Malfunction	• Electric throttle control system • Engine ECU	○	○
P1200/78 (★)	Fuel Pump Relay/ECU Circuit Malfunction (Except Europe)	• Open or short in fuel pump relay • Fuel pump relay • Engine ECU	–	○
P1300/14 (★)	Igniter Circuit Malfunction (No.1)	• Open or short in IGF1 or IGT1 circuit from No.1 ignition coil with igniter to engine ECU • No.1 ignition coil with igniter • Engine ECU	○	○
P1305/15 (★)	Igniter Circuit Malfunction (No.2)	• Open or short in IGF2 or IGT2 circuit from No.2 ignition coil with igniter to engine ECU • No.2 ignition coil with igniter • Engine ECU	○	○
P1310/14 (★)	Igniter Circuit Malfunction (No.3)	• Open or short in IGF2 or IGT3 circuit from No.3 ignition coil with igniter to engine ECU • No.3 ignition coil with igniter • Engine ECU	○	○
P1315/14 (★)	Igniter Circuit Malfunction (No.4)	• Open or short in IGF1 or IGT4 circuit from No.4 ignition coil with igniter to engine ECU • No.4 ignition coil with igniter • Engine ECU	○	○
P1320/14 (★)	Igniter Circuit Malfunction (No.5)	• Open or short in IGF2 or IGT5 circuit from No.5 ignition coil with igniter to engine ECU • No.5 ignition coil with igniter • Engine ECU	○	○
P1325/14 (★)	Igniter Circuit Malfunction (No.6)	• Open or short in IGF1 or IGT6 circuit from No.6 ignition coil with igniter to engine ECU • No.6 ignition coil with igniter • Engine ECU	○	○
P1330/14 (★)	Igniter Circuit Malfunction (No.7)	• Open or short in IGF1 or IGT7 circuit from No.7 ignition coil with igniter to engine ECU • No.7 ignition coil with igniter • Engine ECU	○	○
P1335/13 (★)	Crankshaft Position Sensor Circuit Malfunction (during engine running)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU	–	○

P1340/14 (★)	Igniter Circuit Malfunction (No.8)	• Open or short in IGF2 or IGT8 circuit from No.8 ignition coil with igniter to engine ECU • No.8 ignition coil with igniter • Engine ECU	○	○
P1520/95 *3 (DI–61)	Stop Light Switch Signal Malfunction	• Short in stop light switch signal circuit • Stop light switch • Engine ECU	○	○
P1565/32 (★)	Short in Cruise Control Switch Circuit	• Cruise control switch • Harness or connector between ECM and cruise control switch circuit • ECM	○	○
P1566/54	Input Signal Circuit	• ECM	○	○
P1600/96 *3 (DI–64)	Engine ECU BATT Malfunction	• Open in back up power source circuit • Engine ECU	–	○
P1633/89 *5 (★)	ECU Malfunction (ETCS Circuit)	• Engine ECU	○	○
P1780/97 (DI–66)	Neutral Start Switch Malfunction	• Short in neutral start switch circuit • Neutral start switch • Engine ECU	○	○

*1: ○ ... Check engine warning light (CHK ENG) light up
– ... Check engine warning light (CHK ENG) does not light up
*2: Only for Europe, Turkey, Russia, Saudi Arabia
*3: Only for Europe
*4: Only for Europe, Turkey
*5: If the DTC No.89 is indicated on the instrument panel, read the DTC for ETCS, from 2nd STRT indicator (only for A/T)/ ETCS indicator (only for M/T) to get detail of the DTC No.89. If use the hand–held tester, the detail DTC for ETCS are displayed by the hand–held tester
★: See Pub. No. RM630E

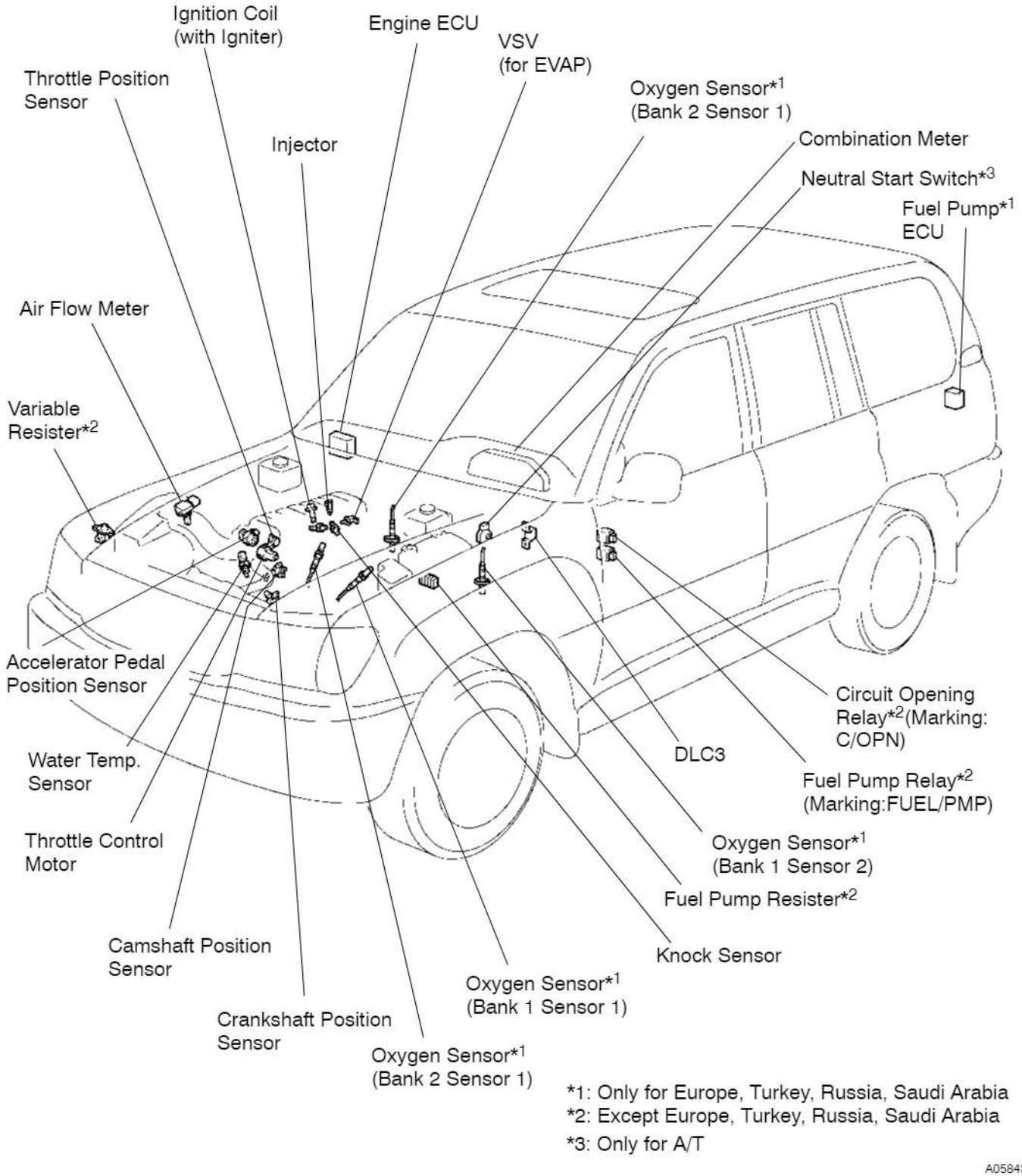
2. ETCS TROUBLE CODES (When not use hand–held tester)

DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
21 (★)	Throttle Control Motor Circuit Malfunction	• Same as DTC No. P1125/89	○	○
22 (★)	Magnetic Clutch Circuit Malfunction	• Same as DTC No. P1126/89	○	○
23 (★)	ETCS Actuator Power Source Circuit Malfunction	• Same as DTC No. P1127/89	○	○
31 (★)	Throttle Control Motor Lock Malfunction	• Same as DTC No. P1128/89	○	○
32 (★)	Electric Throttle Control System Malfunction	• Same as DTC No. P1129/89	○	○
33 (★)	ECU Malfunction (ETCS)	• Same as DTC No. P1633/89	○	○

*1: ○ ... Check engine warning light (CHK ENG) light up
★: See Pub. No. RM630E

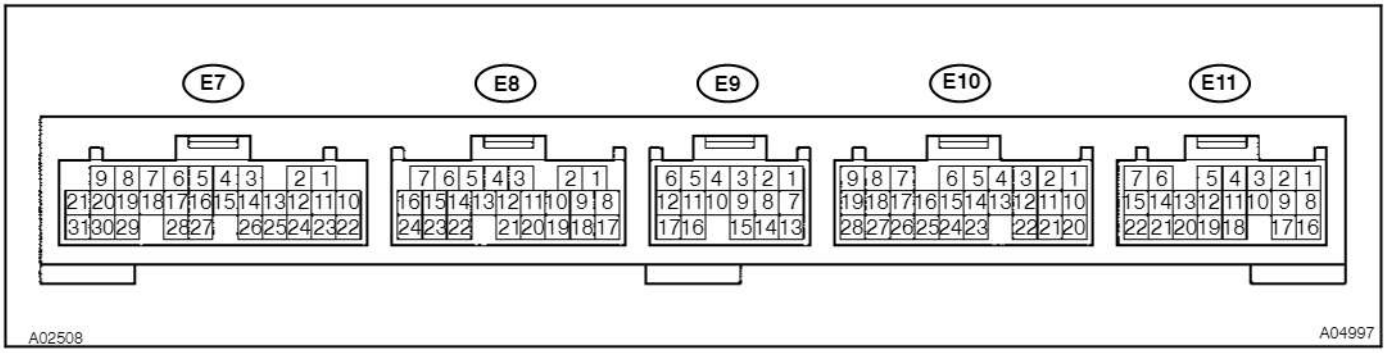
DI3OT-02

PARTS LOCATION



DI3OU–03

TERMINALS OF ECU



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E11–1) – E1 (E8–17)	B–R ↔ BR	Always	9 – 14
+BM (E11–7) – E1 (E8–17)	Y–B ↔ BR		
IGSW (E11–9) – E1 (E8–17)	B–R ↔ BR	IG switch ON	9 – 14
+B (E11–16) – E1 (E8–17)	B–Y ↔ BR		
+B1 (E11–8) – E1 (E8–17)	B–Y ↔ BR		
MREL (E11–5)*3 – E1 (E8–17) MREL (E11–10)*4 – E1 (E8–17)	B–W ↔ BR	IG switch ON	9 – 14
VC (E8–2) – E2 (E8–18)	L–R ↔ BR–W	IG switch ON	4.5 – 5.5
VG (E8–10) – EVG (E8–19)	L–Y ↔ G–W	Idling, P or N position, A/C switch OFF	0.5 – 3.0
THA (E8–22) – E2 (E8–18)	Y–B ↔ BR–W	Idling, Intake air temp. 20°C (68°F)	0.5 – 3.4
THW (E8–14) – E2 (E8–18)	G–B ↔ BR–W	Idling, Water temp. 80°C (176°F)	0.2 – 1.0
VTA (E8–13) – E2 (E8–18)	R–Y ↔ BR–W	IG switch ON Accelerator pedal released	0.4 – 1.0
		IG switch ON Accelerator pedal depressed	3.2 – 4.8
VTA2 (E8–20) – E2 (E8–18)	Y–B ↔ BR–W	IG switch ON Accelerator pedal released	2.0 – 2.9
		IG switch ON Accelerator pedal depressed	4.7 – 5.1
VPA (E8–21) – E2 (E8–18)	R ↔ BR–W	IG switch ON Accelerator pedal released	0.3 – 0.9
		IG switch ON Accelerator pedal depressed	3.2 – 4.8
VPA2 (E8–9) – E2 (E8–18)	R–B ↔ BR–W	IG switch ON Accelerator pedal released	1.8 – 2.7
		IG switch ON Accelerator pedal depressed	4.7 – 5.1
OXL1 (E8–12)*1 – E1 (E8–17) OXL1 (E8–12)*3 – E1 (E8–17) OXL2 (E10–18)*1 – E1 (E8–17) OXL2 (E10–16)*3 – E1 (E8–17) OXR1 (E8–11)*1 – E1 (E8–17) OXR1 (E8–11)*3 – E1 (E8–17) OXR2 (E10–27)*1 – 1 (E8–17) OXR2 (E10–15)*3 – 1 (E8–17)	B ↔ BR B ↔ BR B ↔ BR B ↔ BR W ↔ BR W ↔ BR W ↔ BR W ↔ BR	Maintain engine speed at 2,500 rpm for 2 minutes after warming up	Pulse generation (★)

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
HTL (E8–4)*1 – E1 (E8–17) HTL (E8–5)*3 – E1 (E8–17) HTL2 (E8–24)*3 – E1 (E8–17) HTL2 (E10–8)*2 – E1 (E8–17) HTR (E8–3) – E1 (E8–17) HTR2 (E10–7)*2 – E1 (E8–17) HTR2 (E10–23)*3 – E1 (E8–17)	R ↔ BR R ↔ BR L ↔ BR L ↔ BR Y ↔ BR R–B ↔ BR R–B ↔ BR	IG switch ON	9 – 14
#1 (E8–5) – E01 (E7–21) #2 (E8–6) – E01 (E7–21) #3 (E7–1) – E01 (E7–21) #4 (E7–2) – E01 (E7–21) #5 (E7–3) – E01 (E7–21) #6 (E7–4) – E01 (E7–21) #7 (E7–5) – E01 (E7–21) #8 (E7–6) – E01 (E7–21)	Y ↔ W–B B ↔ W–B L ↔ W–B R ↔ W–B G ↔ W–B R–L ↔ W–B W ↔ W–B B–W ↔ W–B	IG switch ON	9 – 14
		Idling	Pulse generation (★)
KNKL (E7–18) – E1 (E8–17)	B ↔ BR	Maintain engine speed at 4,000 rpm after warming up	Pulse generation (★)
KNKR (E7–17) – E1 (E8–17)	W ↔ BR		
G2 (E7–10)*3 – G– (E7–24)*3 G2 (E7–10)*4 – NE– (E7–22)*4	R ↔ G	Idling	Pulse generation (★)
NE+ (E7–23) – NE– (E7–22)	L ↔ G		
PRG (E8–7) – E1 (E8–17)	L–B ↔ BR	IG switch ON	9 – 14
SPD (E10–15)*2 – E1 (E8–17) SPD (E10–5)*3 – E1 (E8–17)	V ↔ BR	IG switch ON Rotate driving wheel slowly	Pulse generation (★)
CL+ (E7–29) – CL– (E7–24)*2 CL+ (E7–29) – CL– (E7–19)*3	G ↔ L	Idling	Pulse generation (★)
M+ (E7–8) – E1 (E8–17) M– (E7–7) – E1 (E8–17)	R ↔ BR W ↔ BR	Idling	Pulse generation (★)
DI (E11–4)*1 – E1 (E8–17)	G–R ↔ BR	IG switch ON	9 – 14
FPC (E11–5)*2 – E1 (E8–17) FPC (E11–6)*3 – E1 (E8–17)	G–W ↔ BR	IG switch ON	0 – 3.0
IGT1 (E7–11) – E1 (E8–17) IGT2 (E7–12) – E1 (E8–17) IGT3 (E7–13) – E1 (E8–17) IGT4 (E7–14) – E1 (E8–17) IGT5 (E7–15) – E1 (E8–17) IGT6 (E7–16) – E1 (E8–17) IGT7 (E7–25) – E1 (E8–17) IGT8 (E7–26) – E1 (E8–17)	B ↔ BR R ↔ BR L ↔ BR G ↔ BR Y ↔ BR B–Y ↔ BR B–L ↔ BR L–B ↔ BR	Idling	Pulse generation (★)
IGF1 (E7–27) – E1 (E8–17) IGF2 (E7–28) – E1 (E8–17)	B–W ↔ BR	IG switch ON	4.5 – 5.5
		Idling	Pulse generation (★)
STP (E11–15)*3 – E1 (E8–17) STP (E10–6)*4 – E1 (E8–17)	G–W ↔ BR	Brake pedal is depressed	7.5 – 14
		Brake pedal is released	Below 1.5
STA (E10–7)*3 – E1 (E8–17) STA (E10–17)*4 – E1 (E8–17)	B–R ↔ BR	Shift lever position P or N position, ignition switch START	6.0 or more
NSW (E11–2)*3, *5 – E1 (E8–17) NSW (E10–20)*4,*5 – E1 (E8–17)	B–W ↔ BR	IG switch ON Other shift position in "P" ,"N" position	9 – 14
		IG switch ON Shift position in "P" ,"N" position	0 – 3.0
W (E10–23)*3 – E1 (E8–17) W (E11–6)*4 – E1 (E8–17)	W ↔ BR	Idling	9 – 14
		IG switch ON	Below 3.0

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
ACT (E11–22)*3 – E1 (E8–17) ACT (E10–13)*4 – E1 (E8–17)	L–B ↔ BR	A/C switch OFF	Below 3.0
		A/C switch ON at idling	9 – 14
AC1 (E11–21)*3 – E1 (E8–17) A/C (E10–25)*4 – E1 (E8–17)	W–G ↔ BR	A/C switch ON at idling	Below 3.0
		A/C switch OFF	7.5 – 14
ST1– (E11–10) – E1 (E8–17)	R–G ↔ BR	IG switch ON, Brake pedal is depressed	Below 1.5
		IG switch ON, Brake pedal is released	7.5 – 14
SIL (E11–17)*3 – E1 (E8–17) SIL (E11–11)*4 – E1 (E8–17)	V–W ↔ BR	During transmission	Pulse generation
ELS (E10–12) – E1 (E8–17)	G–W ↔ BR	Taillight switch ON, Defogger switch ON	7.5 – 14
		Taillight switch OFF, Defogger switch OFF	0 – 1.5
TACH (E10–4)*3 – E1 (E8–17) TACH (E10–16)*4 – E1 (E8–17)	B ↔ BR	Idling	Pulse generation
KSW (E11–11)*3 – E1 (E8–17) KSW (E11–20)*4 – E1 (E8–17)	R–B ↔ BR	At the time of inserting the key	Below 1.5
		In the condition without the key inserted	4 – 5
RXCK (E11–13) – E1 (E8–17)	V–G ↔ BR	At the time of inserting the key	Pulse generation
CODE (E11–14)*3 – E1 (E8–17) CODE (E11–12)*4 – E1 (E8–17)	L–B ↔ BR	At the time of inserting the key	Pulse generation
TXCT (E11–12)*3 – E1 (E8–17) TXCT (E11–14)*4 – E1 (E8–17)	R–Y ↔ BR	At the time of inserting the key	Pulse generation

*1: Only for Europe, Turkey, Russia, Saudi Arabia
*2: Only for Russia, Saudi Arabia
*3: Only for Europe, Turkey
*4: Except Europe, Turkey
*5: A/T
*6: M/T
★: See Pub. No. RM630E

DI3OV–02

PROBLEM SYMPTOMS TABLE

When the malfunction is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, proceed to this problem symptoms table and troubleshoot according to the numbered order given below.

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter	*5
	2. Starter relay	*5
	3. Neutral start switch circuit*1	*4
	4. Body ECU	*4
No initial combustion (Does not start)	1. Engine ECU power source circuit	*5
	2. Ignition coil with igniter	*5
	3. Fuel pump control circuit	*5
	4. Fuel control switch*2	*5
	5. Injector circuit	
No complete combustion (Does not start)	1. Fuel pump control circuit	*5
	2. Ignition coil with igniter	*5
	3. Injector circuit	*5
Engine cranks normally (Difficult to start)	1. Starter signal circuit	*5
	2. Fuel pump control circuit	*5
	3. Ignition coil with igniter	*5
	4. Spark plug	*5
	5. Compression	*5
	6. Injector circuit	*5
Cold engine (Difficult to start)	1. Starter signal circuit	*5
	2. Fuel pump control circuit	*5
	3. Injector circuit	*5
	4. Ignition coil with igniter	*5
	5. Spark plug	*5
Hot engine (Difficult to start)	1. Starter signal circuit	*5
	2. Fuel pump control circuit	*5
	3. Injector circuit	*5
	4. Ignition coil	*5
	5. Spark plug	*5
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit)	*4
	2. Engine ECU power source circuit	*5
	3. Neutral start switch circuit*1	*4
	4. Back up power source circuit	*5
Low engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit)	*4
	2. Neutral start switch circuit*1	*4
	3. Fuel pump control circuit	*5
	4. Injector circuit	*5
	5. Back up power source circuit	*5
Rough idling (Poor idling)	1. Injector circuit	*5
	2. Variable resistor circuit*3	*5
	3. Ignition coil with igniter	*5
	4. Compression	*5
	5. Fuel pump control circuit	*5
	6. Back up power source circuit	*5
Hunting (Poor idling)	1. Engine ECU power source circuit	*5
	2. Fuel pump control circuit	*5

Hesitation/Poor acceleration (Poor driveability)	1. Injector circuit 2. Fuel pump control circuit 3. Variable resistor circuit*3 4. Ignition coil with igniter 5. A/T faulty*1	*5 *5 *5 *5 *4
Muffler explosion, after fire (Poor driveability)	1. Ignition coil 2. Spark plug 3. Injector circuit 4. Variable resistor circuit*3	*5 *5 *5 *5
Surging (Poor driveability)	1. Fuel pump control circuit 2. Variable resistor circuit*3 3. Spark plug 4. Injector circuit	*5 *5 *5 *5
Engine stall (Soon after starting)	1. Fuel pump control circuit 2. Air flow meter circuit	*5 *5
Engine stall (After accelerator pedal depressed)	1. Air flow meter circuit	*5
Engine stall (After accelerator pedal released)	1. Air flow meter circuit 2. Engine ECU	*5 IN–19
Engine stall (During A/C operation)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU	*4 IN–19
Engine stall (When shifting N to D)	1. Neutral start switch circuit*1	*4

*1: Only for A/T
*2: Only for Europe
*3: w/o TWC
*4: See Pub. No. RM616E
*5: See Pub. No. RM630E

DI6TR–09

CIRCUIT INSPECTION

DTC	P0116/22	Engine Coolant Temp. Circuit Range/ Performance Problem

CIRCUIT DESCRIPTION

A thermistor built in the water temperature sensor changes the resistance value according to the water temperature. The structure of the sensor and connection to the engine ECU is the same as the ones of the air temperature sensor.

DTC No.	DTC Detecting Condition	Trouble Area
P0116/22	When THW ≧ 35 °C (95 °F) and < 60 °C (140 °F), and THA- ≧ –6.7 °C (20 °F), and when starting engine, conditions (a) and (b) continue: (2 trip detection logic) (a) Vehicle speed is changing (Not stable) (b) THW change is lower than 3 °C (5.4 °F) from THW since when starting engine	• Engine coolant temp. sensor • Cooling system

INSPECTION PROCEDURE

HINT:

- If DTC "P0115/22" (Engine Coolant Temp. Circuit Malfunction) and "P0116/22" (Engine Coolant Temp. Circuit Range/Performance Problem) are output simultaneously, engine coolant temp. sensor circuit may be open. Perform troubleshooting of DTC P0115/22 first.
- Read freeze frame data using a hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	Are there any other codes (besides DTC P0116/22) being output?

YES → Go to relevant DTC chart.

NO

2	Check thermostat (See Pub. No. RM630E on page CO–11).

NG → Replace thermostat.

OK

Replace engine coolant temp. sensor.

DI9NF–01

DTC	P0125/91	Insufficient Coolant Temp. for Closed Loop Fuel Control

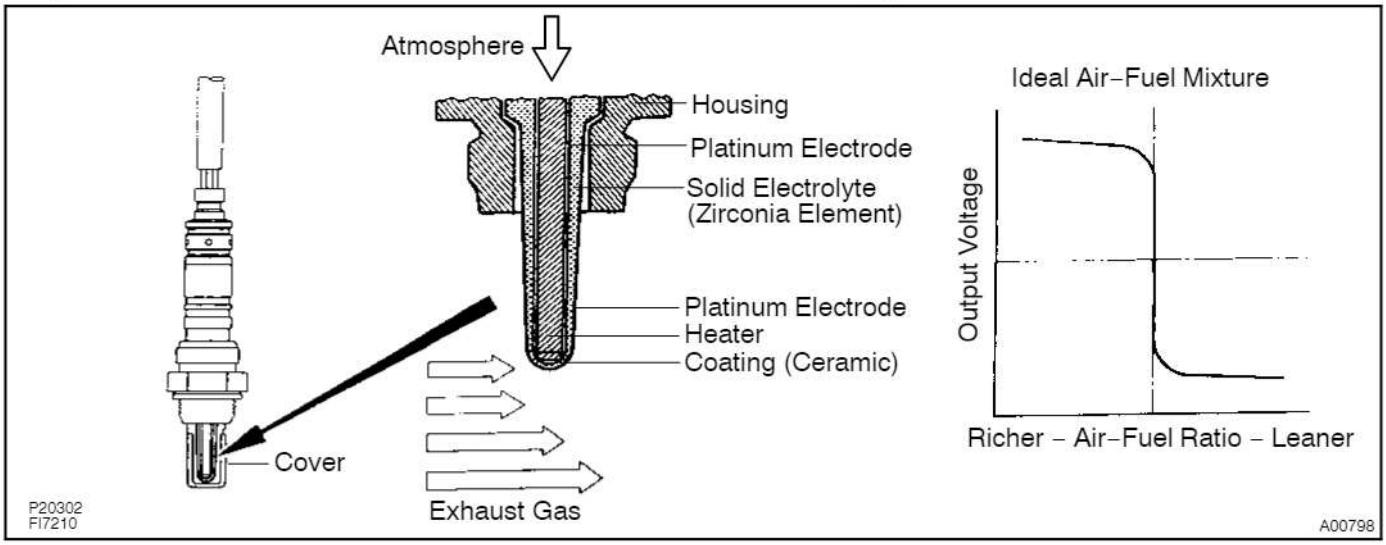
CIRCUIT DESCRIPTION

To obtain a high purification rate of the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used. For the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.

The oxygen sensor (bank 1, 2 sensor 1) is characterized that its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This character is used to detect the oxygen concentration in the exhaust gas and provide the engine ECU with feedback to control the air–fuel ratio.

When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust gas increases and the oxygen sensor informs the engine ECU of the LEAN condition (small electromotive force: < 0.45 V).

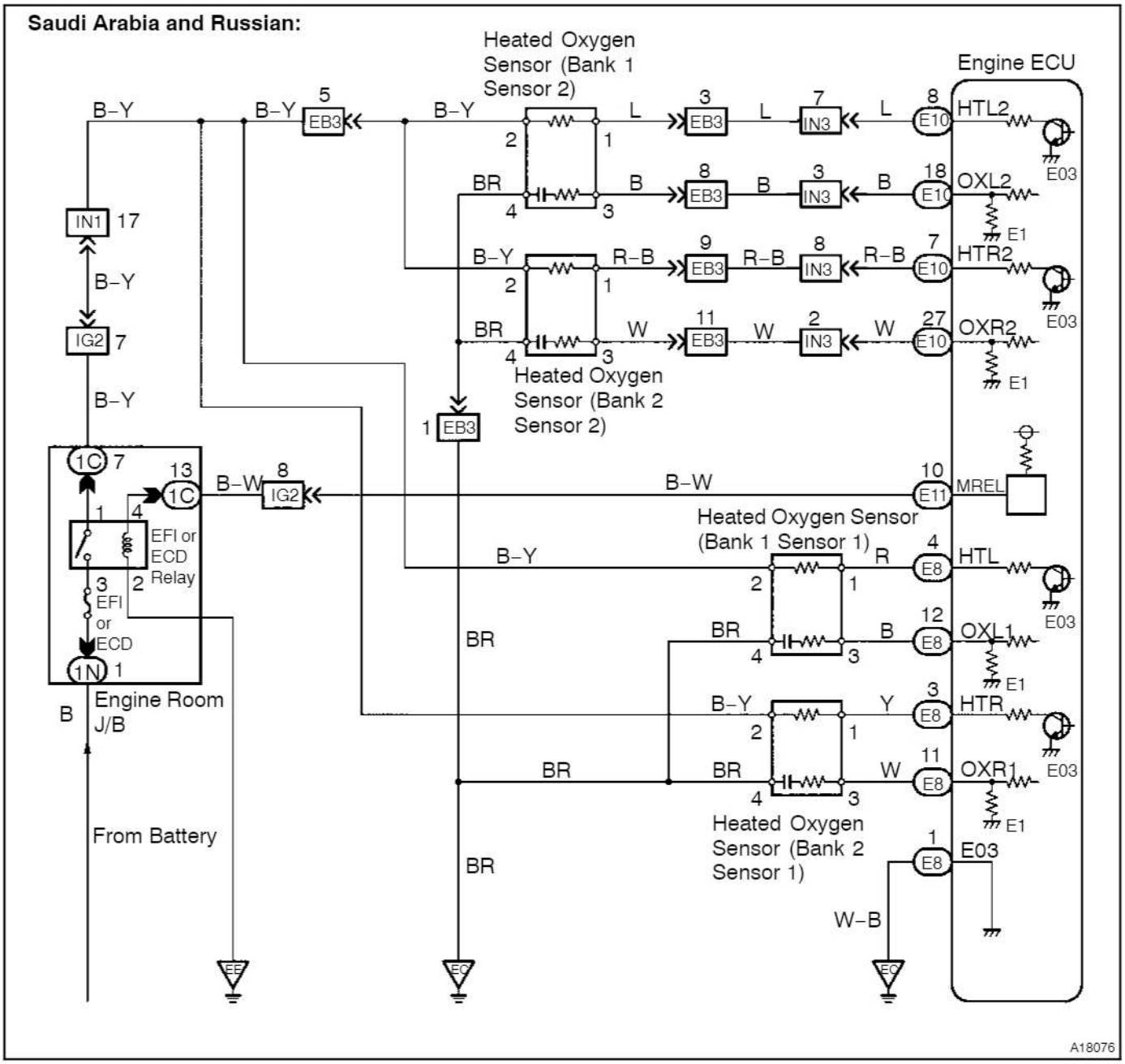
When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio, the oxygen concentration in the exhaust gas is reduced and the oxygen sensor informs the engine ECU of the RICH condition (large electromotive force: > 0.45 V). The engine ECU judges by the electromotive force from the oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the engine ECU is unable to perform accurate air–fuel ratio control. The oxygen sensors include a heater which heats the zirconia element. The heater is controlled by the engine ECU. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater to heat the sensor for accurate oxygen concentration detection.



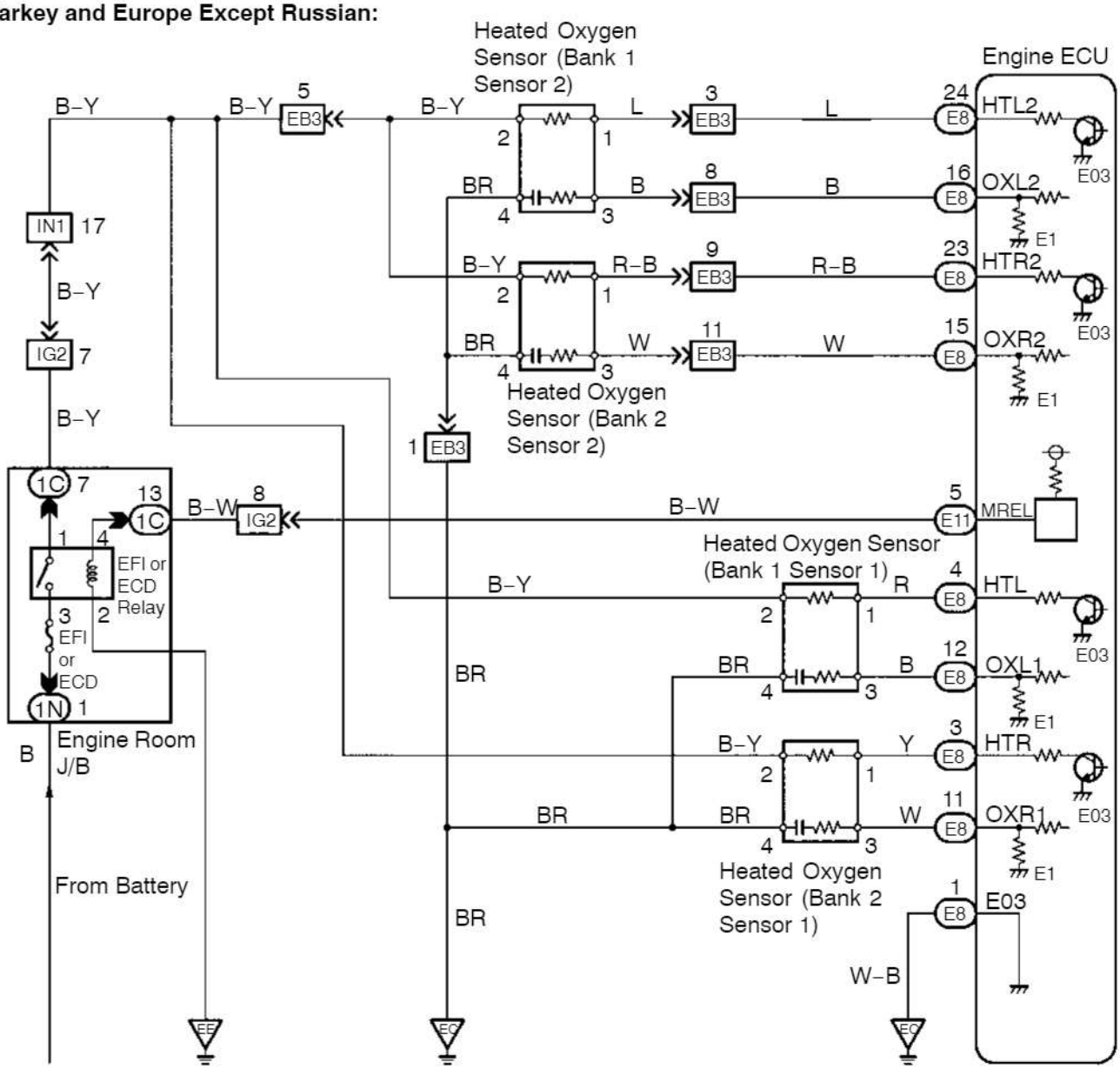
DTC No.	DTC Detection Condition	Trouble Area
P0125	After engine is warmed up, oxygen sensors (bank 1, 2 sensor 1) does not output RICH (≧0.45 V) even once when conditions (a), (b), (c) and (d) continue for at least 90 sec.: (a) Engine speed: 1,400 rpm or more (b) Vehicle speed: 40 – 100 km/h (25 – 62 mph) (c) Throttle valve does not fully closed (d) 180 sec. or more after starting engine	• Open or short in oxygen sensor (bank 1, 2 sensor 1) circuit • Oxygen sensor (bank 1, 2 sensor 1) • Air induction system • Fuel pressure • Injector • Gas leakage on exhaust system • Engine ECU

HINT:
After confirming DTC P0125/91, use the hand–held tester to confirm voltage output of oxygen sensor (bank 1, 2 sensor 1) from the CURRENT DATA. If the output voltage of the oxygen sensor is less than 0.1 V, the oxygen sensor circuit may be open or short.

WIRING DIAGRAM



Tarkey and Europe Except Russian:



INSPECTION PROCEDURE

HINT:

- If the vehicle runs out of fuel, the air–fuel ratio is LEAN and DTC P0125 is recorded. The CHK ENG (MIL) then comes on.
- Read freeze frame data using the hand–held tester, as freeze frame data records the engine conditions when the malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0125) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO

2	**Connect hand–held tester, and read value for output voltage of oxygen sensor (bank 1, 2 sensor 1).**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Warm up the engine to the normal operating temperature (above 75°C (167°F)).

CHECK:

Read the output voltage of the oxygen sensors when the engine is suddenly raced.

HINT:

Perform quick racing to 4,000 rpm 3 times using the accelerator pedal.

OK:

Oxygen sensor output a RICH signal (0.45 V or more) at least once.

OK → **Go to step 9.**

NG

3	**Check for open and short in harness and connector between engine ECU and oxygen sensor (bank 1, 2 sensor 1) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

4	Check whether misfire has occurred or not by monitoring DTC and data list.

NG → Perform troubleshooting for misfire (See page DI–27).

OK

5	Check air induction system (See Pub. No. RM630E on page FI–1).

NG → Repair or replace.

OK

6	Check fuel pressure (See Pub. No. RM630E on page FI–1).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK

7	Check injector injection (See Pub. No. RM630E on page FI–29).

NG → Replace injector.

OK

8	Check gas leakage on exhaust system.

NG → Repair or replace.

OK →

Replace oxygen sensor (bank 1, 2 sensor 1).

9	Perform confirmed driving pattern (See page DI–54).

GO →

10	Is there DTC P0125 being output again?

YES → Check and replace engine ECU (See page IN–19).

NO →

11	Did vehicle run out of fuel in past?

NO → Check for intermittent problems (See page DI–4).

YES →

DTC P0125 is caused by shortage of fuel.

DI563–13

DTC	P0133/21	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)

DTC	P0153/28	Oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–30.

DTC No.	DTC Detecting Condition	Trouble Area
P0133/21 P0153/28	Response time for oxygen sensor's voltage output to change from rich to lean, or from lean to rich, is 1.1 sec. or more during idling after engine is warmed up (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • Air induction system • Fuel pressure • Injector • Engine ECU

HINT:

- Bank 1 refers to bank that includes cylinder No.1.
- Bank 2 refers to bank that does not include cylinder No.1.
- Sensor 1 refers to the sensor closer to the engine body.

WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–30.

INSPECTION PROCEDURE

When using hand–held tester:

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0133 or P0153) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO

2	**Check output voltage of oxygen sensor during idling.**

PREPARATION:

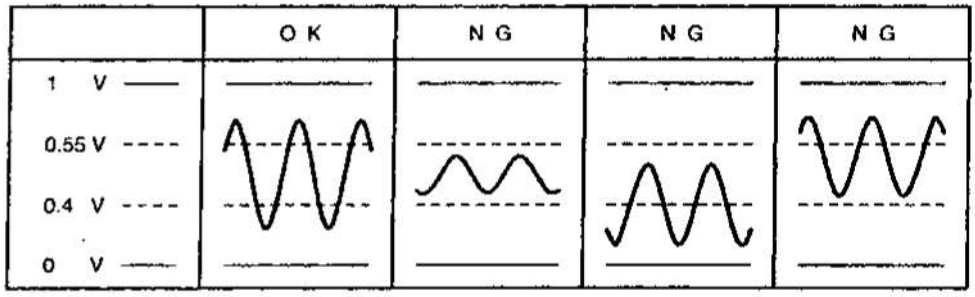
Warm up the oxygen sensor with the engine speed at 2,500 rpm for approx. 90 sec.

CHECK:

Use the hand–held tester to read the output voltage of the oxygen sensor during idling.

OK:

Oxygen sensor output voltage:
Alternates repeatedly between less than 0.4 V and more than 0.55 V (See the following table).



OK → **Go to step 7**

NG

3	**Check for open and short in harness and connector between engine ECU and oxygen sensor (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

4	**Check air induction system (See Pub. No. RM630E on page FI–1).**

NG → **Repair or replace.**

OK

5	Check fuel pressure (See Pub. No. RM630E on page FI–1).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E on page FI–1).

OK

6	Check injector injection (See Pub. No. RM630E on page FI–29).

NG → Replace injector.

OK

Replace oxygen sensor.

7	Perform confirmation driving pattern (See page DI–54).

GO

8	Is there DTC P0133 or P0153 being output again?

NO → Check for intermittent problems (See page DI–4).

YES

Check and replace engine ECU (See page IN–19).

When not using hand–held tester:

1	Are there any other codes (besides code 21 or 28) being output?

YES → Go to relevant DTC chart (See page DI–18).

NO →

Replace oxygen sensor.

DTC	P0135/21	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

DTC	P0141/21	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

DTC	P0155/28	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)

DTC	P0161/28	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–30.

DTC No.	DTC Detecting Condition	Trouble Area
P0135/21 P0141/21 P0155/28 P0161/28	Open or short in heater circuit of oxygen sensor 0.5 sec. or more	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • Engine ECU

HINT:

- Bank 1 refers to bank that includes cylinder No.1.
- Bank 2 refers to bank that does not include cylinder No.1.
- Sensor 1 refers to the sensor closer to the engine body.
- Sensor 2 refers to the sensor farther away from the engine body.

WIRING DIAGRAM

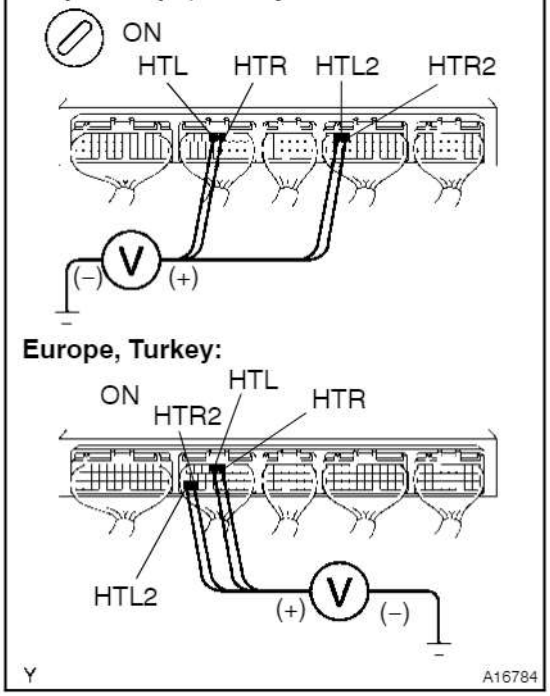
Refer to DTC P0125/91 on page DI–30.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	Check voltage between terminals HTR, HTR2, HTL, HTL2 of engine ECU connector and body ground.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals HTR, HTR2, HTL, HTL2 of the engine ECU connector and body ground.

HINT:

- Connect terminal HTR to bank 2 sensor 1.
- Connect terminal HTR2 to bank 2 sensor 2.
- Connect terminal HTL to bank 1 sensor 1.
- Connect terminal HTL2 to bank 1 sensor 2.

OK:

Voltage: 9 – 14 V

OK	Check and replace engine ECU (See page IN–19).

NG

2	Check resistance of oxygen sensor heater (See Pub. No. RM630E on page FI–71).

NG	Replace oxygen sensor.

OK

Check and repair harness or connector between main relay and oxygen sensor and engine ECU (See page IN–19).

DTC	P0171/25	Fuel Trim System too Lean (Air–Fuel Ratio Lean Malfunction, Bank 1)

DTC	P0172/26	System too Rich (A/F Rich Malfunction, Bank 1)

DTC	P0174/25	Fuel Trim System too Lean (Air–Fuel Ratio Lean Malfunction, Bank 2)

DTC	P0175/26	System too Rich (A/F Rich Malfunction, Bank 2)

CIRCUIT DESCRIPTION

Fuel trim refers to the feedback compensation value compared against the basic injection time. Fuel trim includes short–term fuel trim and long–term fuel trim.

Short–term fuel trim is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air–fuel ratio is RICH or LEAN compared to the ideal theoretical value, triggering a reduction in fuel volume if the air–fuel ratio is rich, and an increase in fuel volume if it is lean.

Long–term fuel trim is overall fuel compensation carried out long–term to compensate for continual deviation of the short–term fuel trim form the central value due to individual engine differences, wear over time and changes in the usage environment.

If both the short–term fuel trim and long–term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction.

DTC No.	DTC Detecting Condition	Trouble Area
P0171/25 P0174/25	When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the LEAN side (2 trip detection logic)	• Gas leakage on exhaust system • Air intake (hose loose) • Fuel line pressure • Injector blockage • Oxygen sensor (bank 1 sensor 1) malfunction • Air flow meter • Water temp. sensor
P0172/26 P0175/26	When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side (2 trip detection logic)	• Gas leakage on exhaust system • Fuel line pressure • Injector leak, blockage • Oxygen sensor (bank 2 sensor 1) malfunction • Air flow meter • Water temp. sensor

HINT:

- When DTC P0171 or P0174 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172 or P0175 is recorded, the actual air–fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air–fuel ratio is LEAN and DTC P0171/25 and DTC P0174/25 is recorded.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ± 25 %, the system is functioning normally.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Ask customer whether vehicles runs out of fuel.**

YES → **DTC P0171/25 was recorded because the vehicle runs out of fuel.**

NO

2	**Check air induction system (See Pub. No. RM630E on page FI–1).**

NG → **Repair or replace.**

OK

3	**Check for oxygen sensor (bank 1, 2 sensor 1) data.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Warm up the engine to normal operating temperature.

CHECK:

Read the oxygen sensor (bank 1, 2 sensor 1) output voltage and short–term fuel trim.

HINT:

Read the values for the same bank.

RESULT:

Pattern	Oxygen sensor output voltage	Short–term fuel trim
1	Lean condition (Changes at 0.55 V or less)	Changes at about +20 %
2	Rich condition (Changes at 0.35 V or more)	Changes at about –20 %
3	Except 1 and 2	

3 → **Check for oxygen sensor (bank 1, 2 sensor 1) (See Pub. No. RM630E on page DI–51).**

1, 2 ↓

4	**Check fuel pressure (See Pub. No. RM6330e on page FI–1).**

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E on page FI–1).**

OK ↓

5	**Check injector injection (See Pub. No. RM630E on page FI–29).**

NG → **Replace injector.**

OK ↓

6	Check air flow meter and water temp. sensor (See Pub. No. RM630E on page DI–27 and DI–39).

NG → Repair or replace.

OK

7	Check for spark and ignition (See Pub. No. RM630E on page IG–1).

NG → Repair or replace.

OK

8	Check gas leakage on exhaust system.

NG → Repair or replace.

OK

Check and replace engine ECU (See page IN–19).

When not using hand–held tester

1	Check air induction system (See Pub. No. RM6330e on page FI–1).

NG → Repair or replace.

OK

2	Check fuel pressure (See Pub. No. RM6330e on page FI–1).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E on page FI–1).

OK

3	Check injector injection (See Pub. No. RM630E on page FI–29).

NG → Replace injector.

OK

4	Check air flow meter (See Pub. No. RM630E on page DI–27).

NG → Repair or replace.

OK

5	Check water temp. sensor (See Pub. No. RM630E on page DI–39).

NG → Repair or replace.

OK

6	Check for spark and ignition (See Pub. No. RM630E on page IG–1).

NG → Repair or replace.

OK

7	Check gas leakage on exhaust system.

NG → Repair or replace.

OK

8	Does malfunction disappear when a good oxygen sensor installed?

YES → Repair oxygen sensor.

NO

Check and replace engine ECU (See page IN–19).

DI63Z–07

DTC	P0300/93	Random/Multiple Cylinder Misfire Detected
DTC	P0301/93	Cylinder 1 Misfire Detected
DTC	P0302/93	Cylinder 2 Misfire Detected
DTC	P0303/93	Cylinder 3 Misfire Detected
DTC	P0304/93	Cylinder 4 Misfire Detected
DTC	P0305/93	Cylinder 5 Misfire Detected
DTC	P0306/93	Cylinder 6 Misfire Detected
DTC	P0307/93	Cylinder 7 Misfire Detected
DTC	P0308/93	Cylinder 8 Misfire Detected

CIRCUIT DESCRIPTION

Misfire: The engine ECU uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder.

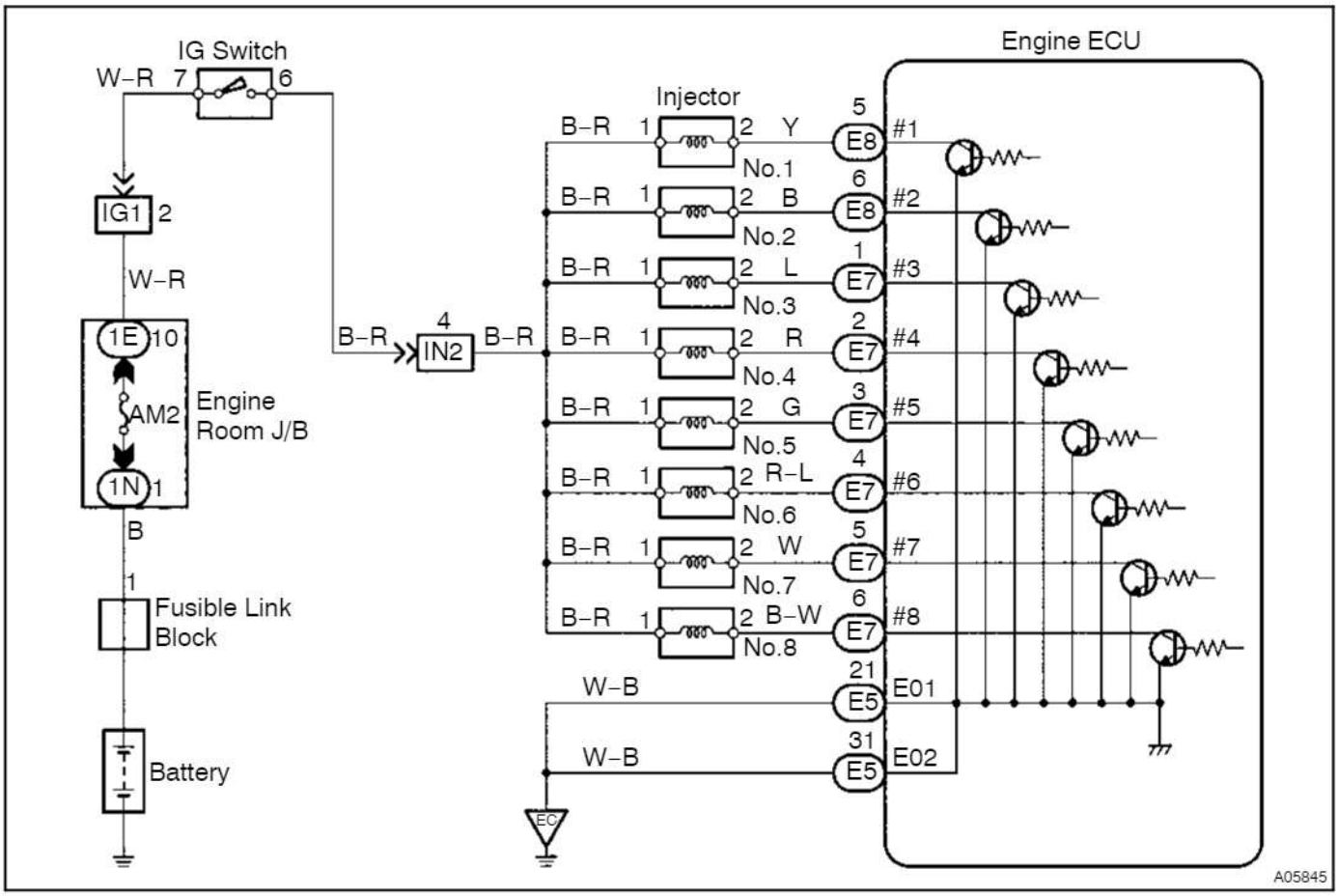
The engine ECU counts the number of times the engine speed change rate indicates that misfire has occurred. And when the misfire rate equals or exceeds the count indicating that the engine condition has deteriorated, the check engine warning light lights up.

If the misfire rate is high enough and the driving conditions will cause catalyst overheating, the check engine warning light blinks when misfiring occurs.

DTC No.	DTC Detecting Condition	Trouble Area
P0300/93	Misfiring of random cylinders is detected during any particular 200 or 1,000 revolutions 1 trip detection logic: check engine warning light to brink 2 trip detection logic: check engine warning light to light up	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Water temp. sensor • Compression pressure • Valve clearance • Valve timing • Engine ECU
P0301/93 P0302/93 P0303/93 P0304/93 P0305/93 P0306/93	For any particular 200 revolutions of engine, misfiring is detected which can cause catalyst overheating (This causes check engine warning light to blink)	
	For any particular 1,000 revolutions of engine, misfiring is detected which causes a deterioration in emissions (2 trip detection logic)	

HINT:
When codes for a misfiring cylinder is recorded repeatedly but no random misfire code is recorded, it indicates that the misfires were detected and recorded at different times.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Connect the hand–held tester to the DLC3.
(b) Record DTC and the freeze frame data.
(c) Use the hand–held tester to set to the Check (Test) Mode (See page DI–4).
(d) Drive the vehicle several times with the engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in the freeze frame data or MISFIRE RPM, MISFIRE LOAD in the data list.

If you have no hand–held tester, turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again.

HINT:

In order to memorize DTC of misfire, it is necessary to drive around MISFIRE RPM, MISFIRE LOAD in the data list for the following period of time.

Engine Speed	Time
Idling	3 minutes 30 seconds or more
1,000 rpm	3 minutes or more
2,000 rpm	1 minute 30 seconds or more
3,000 rpm	1 minute or more

(e) Check whether there is misfire or not by monitoring DTC and the freeze frame data. After that, record them.
(f) Turn the ignition switch OFF and wait at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If it is the case that DTC besides misfire is memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.
- When the vehicle is brought to the workshop and the misfire is not occurred, misfire can be confirmed by reproducing the condition of freeze frame data. Also, after finishing the repair, confirm that there is no misfire (See confirmation driving pattern).
- When either of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is besides the range of ± 20 %, there is a possibility that the air–fuel ratio is inclining either to RICH (–20 % or less) or LEAN (+20 % or more).
- When COOLANT TEMP in the freeze frame data is less than 80°C (176°F), there is a possibility of misfire only during warmed up.
- In the case that misfire cannot be reproduced, the reason may be because of the driving with lack of fuel, the use of improper fuel, a stain of the ignition plug, and etc.

1	**Check wire harness, connector and vacuum hose in engine room.**

CHECK:

(a) Check the connection conditions of wire harness and connector.
(b) Check the disconnection, piping and break of vacuum hose.

NG	**Repair or replace, then confirm that there is no misfire (See confirmation driving pattern).**

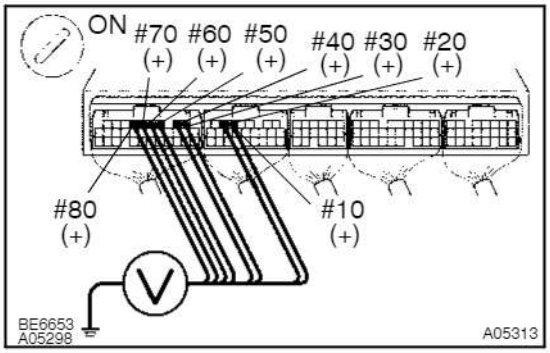
OK

2	**Check spark plug and spark of misfiring cylinder (See Pub. No. RM630E on page IG–1).**

NG → **Replace or check ignition system (See Pub. No. RM630E on page IG–1).**

OK

3	**Check voltage of engine ECU terminals for injector of failed cylinder.**



PREPARATION:

(a) Remove the engine ECU hood.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between applicable terminals #10 – #80 of the engine ECU connectors and body ground.

OK:

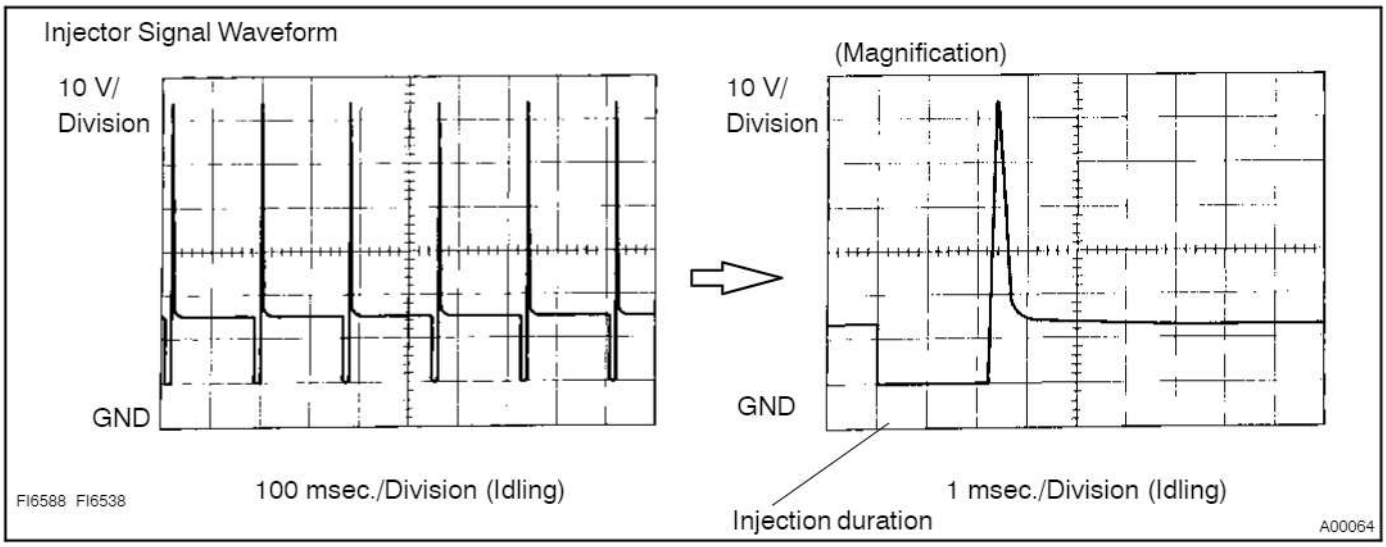
Voltage: 9 – 14 V

Reference: INSPECTION USING OSCILLOSCOPE

With the engine idling, check the waveform between terminals #10 – #80 and E01 of the engine ECU connectors.

HINT:

The correct waveform is as shown.



OK → Go to step 5.

NG

4	Check resistance of injector of misfiring cylinder (See Pub. No. RM630E on page FI–24).

NG → Replace injector.

OK

Check for open and short in harness and connector between injector and engine ECU (See page IN–19).

5	Check fuel pressure (See Pub. No. RM630E on page FI–1).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E on page FI–1).

OK

6	Check injector injection (See Pub. No. RM630E on page FI–29).

NG → Replace injector.

OK

7	Check air flow meter and water temp. sensor (See Pub. No. RM630E on page DI–27 and DI–39).

NG → Repair or replace.

OK →

Check compression pressure (See Pub. No. RM630E on page EM–5), valve clearance (See Pub. No. RM630E on page EM–6) and valve timing (See Pub. No. RM630E on page EM–14).

DTC	P0420/94	Catalyst System Efficiency Below Threshold (Bank 1)

DTC	P0430/94	Catalyst System Efficiency Below Threshold (Bank 2)

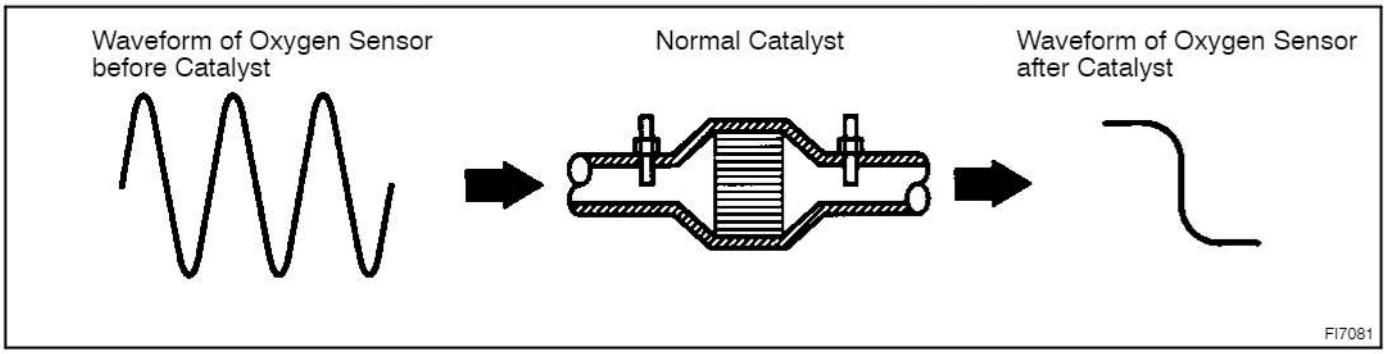
CIRCUIT DESCRIPTION

The engine ECU compares the waveform of the oxygen sensor located before the catalyst with the waveform of the oxygen sensor located after the catalyst to determine whether or not catalyst performance has deteriorated.

Air–fuel ratio feedback compensation keeps the waveform of the oxygen sensor before the catalyst repeatedly changing back and forth from rich to lean.

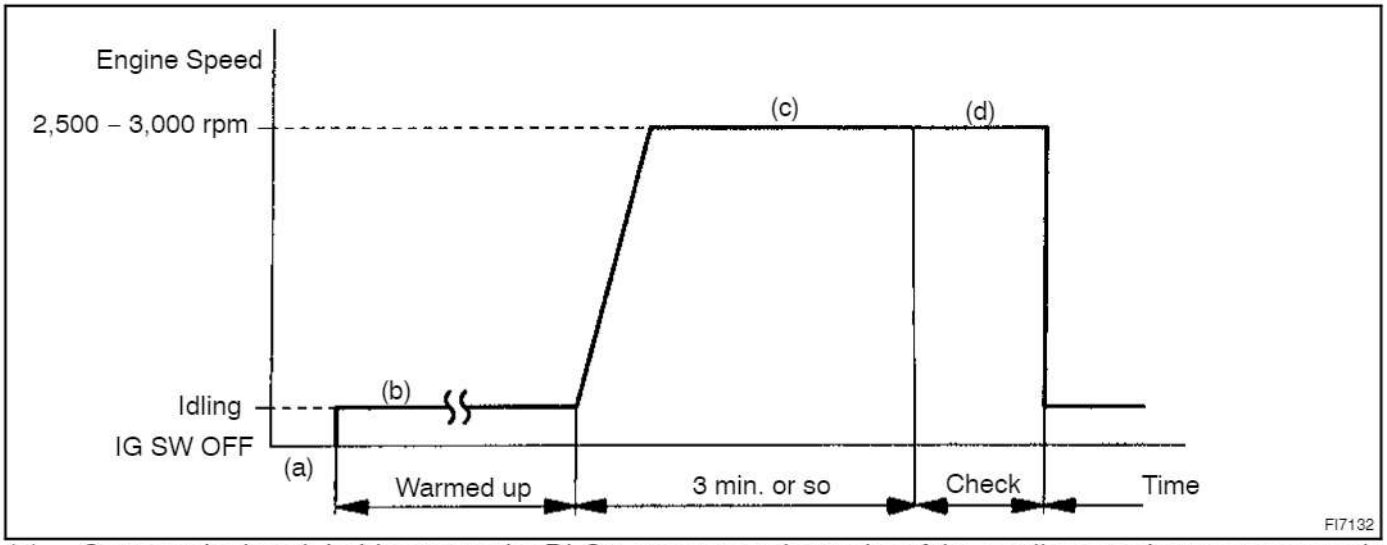
If the catalyst is functioning normally, the waveform of the oxygen sensor after the catalyst switches back and forth between rich and lean much more slowly than the waveform of the oxygen sensor before the catalyst.

But when both waveform change at a similar rate, it indicates that catalyst performance has deteriorated.

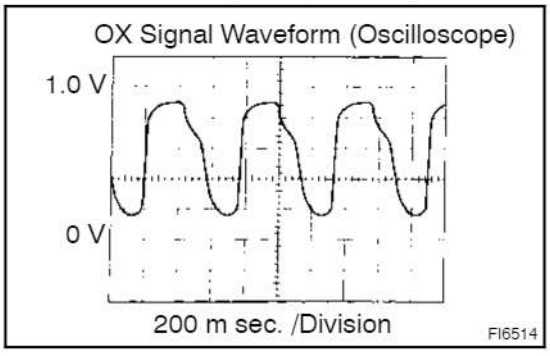


DTC No.	DTC Detecting Condition	Trouble Area
P0420/94 P0430/94	After the engine and the catalyst are warmed up, and while the vehicle is driven within the set vehicle and engine speed range, the waveforms of the A/F sensors (bank1, 2 sensor 1) and oxygen sensors (bank 1, 2 sensor 2) have the same amplitude (2 trip detection logic)	• Three–way catalytic converter • Open or short in oxygen sensor (bank1, 2 sensor2) circuit • Oxygen sensor (bank1, 2 sensor2)

CONFIRMATION ENGINE RACING PATTERN



(a) Connect the hand–held tester to the DLC3, or connect the probe of the oscilloscope between terminals OXL1, OXL2, OXR1, OXR2 and E1 of the engine ECU.
(b) Start engine and warm it up with all accessories switched OFF until water temp. is stable.
(c) Race the engine at 2,500 – 3,000 rpm for about 3 min.
(d) After confirming that the waveforms of the oxygen sensor (bank 1, 2 sensor 1 (OXL1, OXR1)), oscillate around 0.5 V during feedback to the engine ECU, check the waveform of the oxygen sensor, bank 1, 2 sensor 2 (OXL2, OXR2).



HINT:
If there is a malfunction in the system, the waveform of the oxygen sensor (bank 1, 2 sensor 2 (OXL1, OXL2)), is almost the same as that of the oxygen sensor (bank 1, 2 sensor 1 (OXL2, OXR2)), on the left.
There are some cases where, even though a malfunction exists, the check engine warning light may either light up or not light up.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using a hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0420/94, P0430/94) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO

2	Check gas leakage on exhaust system.

NG → Repair or replace.

OK

3	Check oxygen sensor (bank 1, 2 sensor 1) (See Pub. No. RM630E on page DI–51).

NG → Repair or replace.

OK

4	Check oxygen sensor (bank 1, 2 sensor 2) (See Pub. No. RM630E on page DI–59).

NG → Repair or replace.

OK

Replace three–way catalytic converter.

DTC	P0443/94	Evaporative Emission Control System Purge Control Vent Control Malfunction

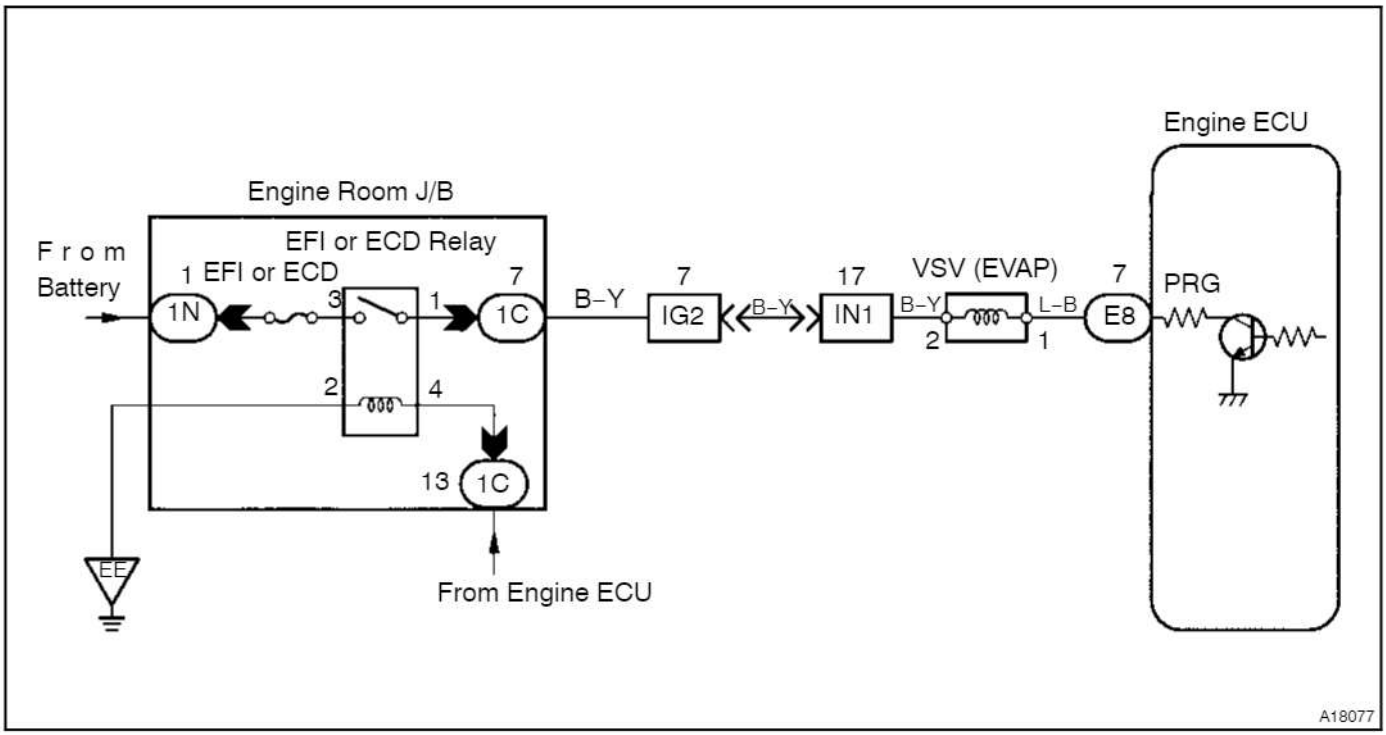
CIRCUIT DESCRIPTION

To reduce HC emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

The engine ECU changes the duty signal to the VSV for the EVAP so that the intake quantity of HC emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is wamed up.

DTC No.	DTC Detection Condition	Trouble Area
P0443/94	Proper response to engine ECU command does not occur	• Open or short in VSV circuit for EVAP • VSV for EVAP • Engine ECU

WIRING DIAGRAM



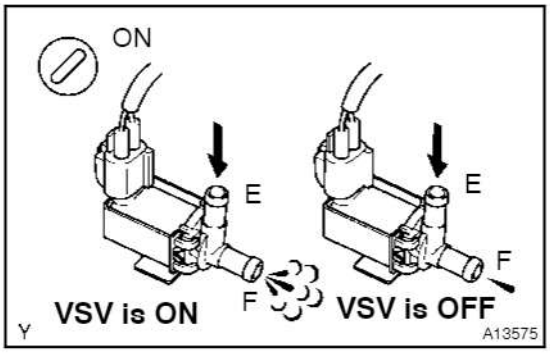
INSPECTION PROCEDURE

When using hand–held tester:

HINT:

Read freeze frame data using a hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Connect hand–held tester and check operation of VSV for EVAP.**



PREPARATION:

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch and push the hand–held tester main switch ON.
(c) Select the ACTIVE TEST mode on the hand–held tester.

CHECK:

Check the operation of the VSV when the VSV is operated by the hand–held tester.

OK:

VSV is ON:
Air from port E flows out through port F.
VSV is OFF:
Air from port E flows out with hardly through port F.

OK	**Check for intermittent problems (See page DI–4).**

NG

2	**Check VSV for EVAP (See Pub. No. RM630E on page FI–62).**

NG	**Replace VSV for EVAP.**

OK

3	**Check for open and short in harness and connector between EFI main relay (Marking: EFI) and engine ECU (See page IN–19).**

NG	**Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

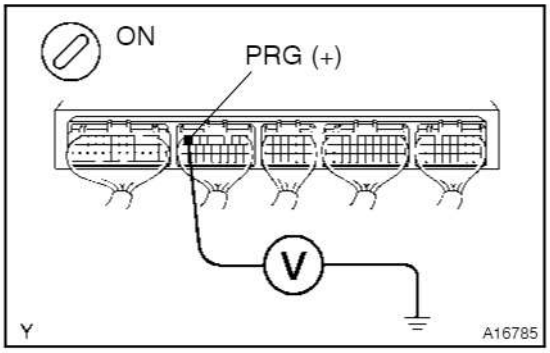
When not using hand–held tester:

1	**Check VSV for EVAP (See Pub. No. RM630E on page FI–62).**

NG → **Replace VSV for EVAP.**

OK

2	**Check voltage between terminal PRG of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the engine room ECU cover.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal PRG of the engine ECU connector and body ground.

OK:

Voltage: 9 – 14 V

NG → **Check for open and short in harness and connector between EFI main relay (Marking: EFI) and engine ECU (See page IN–19).**

OK

Check and replace engine ECU (See page IN–19).

DI2F2–09

DTC	P0505/33	Idle Control System Malfunction

CIRCUIT DESCRIPTION

The idle speed is controlled by the Electric Throttle Control System (ETCS).
ETCS is composed of the throttle motor to operate the throttle valve, the magnetic clutch to connect the throttle motor with the throttle valve, the throttle position sensor to detect the opening angle of the throttle valve, the accelerator pedal position sensor to detect the accelerator pedal position, the engine ECU to control the ETCS and the one valve type throttle body.
The engine ECU controls the throttle motor to make the throttle valve opening angle properly for the target idle speed.

DTC No.	DTC Detecting Condition	Trouble Area
P0505/33	Idle speed continues to vary greatly from target speed (2 trip detection logic)	• Air induction system • Electric throttle control system

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel was ratio lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides P0505/33) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO

2	**Check air induction system (See Pub. No. RM630E on page FI–1).**

NG → **Repair or replace.**

OK

Check electric throttle control system (See Pub. No. RM630E on page FI–40).

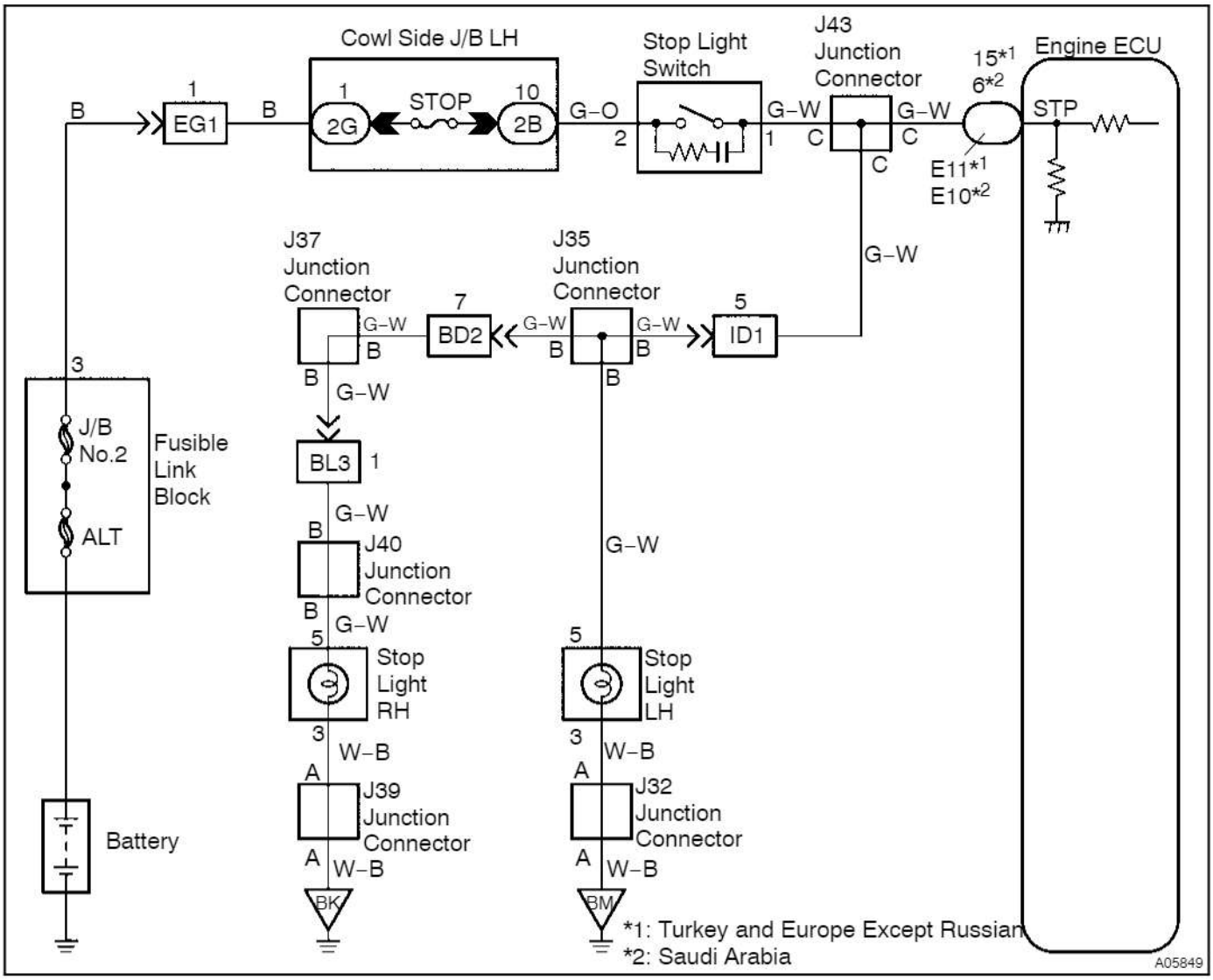
DTC	P1520/95	Stop Light Switch Signal Malfunction (Only for A/T)

CIRCUIT DESCRIPTION

This signal is used to detect when the brakes have been applied. The STP signal voltage is the same as the voltage supplied to the stop lights.
The STP signal is used mainly to control the fuel cut–off engine speed (The fuel cut–off engine speed is reduced slightly when the vehicle is braking.).

DTC No.	DTC Detecting Condition	Trouble Area
P1520/95	The stop light switch does not turn off even once the vehicle is driven (2 trip detection logic)	• Short in stop light switch signal circuit • Stop light switch • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using a hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Check operation of stop light.**

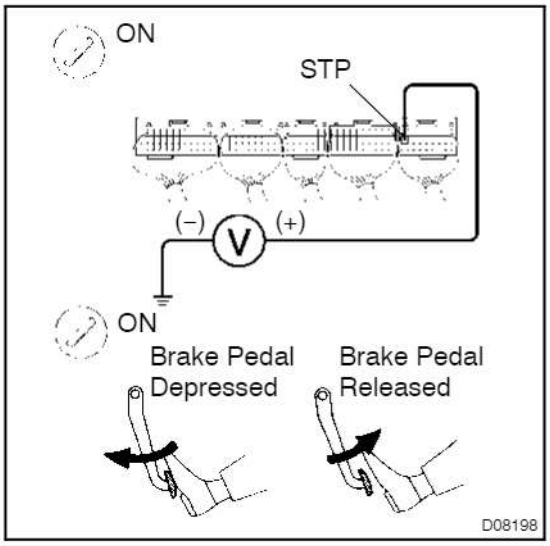
CHECK:

Check if the stop lights go on and off normally when the brake pedal is operated and released.

NG → **Check and repair stop light circuit.**

OK

2	**Check STP signal.**



When using hand–held tester:

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

CHECK:

Read the STP signal on the hand–held tester.

OK:

Brake Pedal	STP Signal
Depressed	ON
Released	OFF

When not using hand–held tester:

PREPARATION:

Turn the ignition switch ON.

CHECK:

Check the voltage between terminal STP of the engine ECU connector and body ground.

OK:

Brake Pedal	Voltage
Depressed	7.5 – 14 V
Released	Below 1.5 V

OK → **Check for intermittent problems (See page DI–4).**

NG

3	Check harness and connector between engine ECU and stop light switch (See page IN–19).

NG → Repair or replace harness or connector.

OK →

Check and replace engine ECU (See page IN–19).

DI7JD–05

DTC	P1600/96	ECM BATT Malfunction

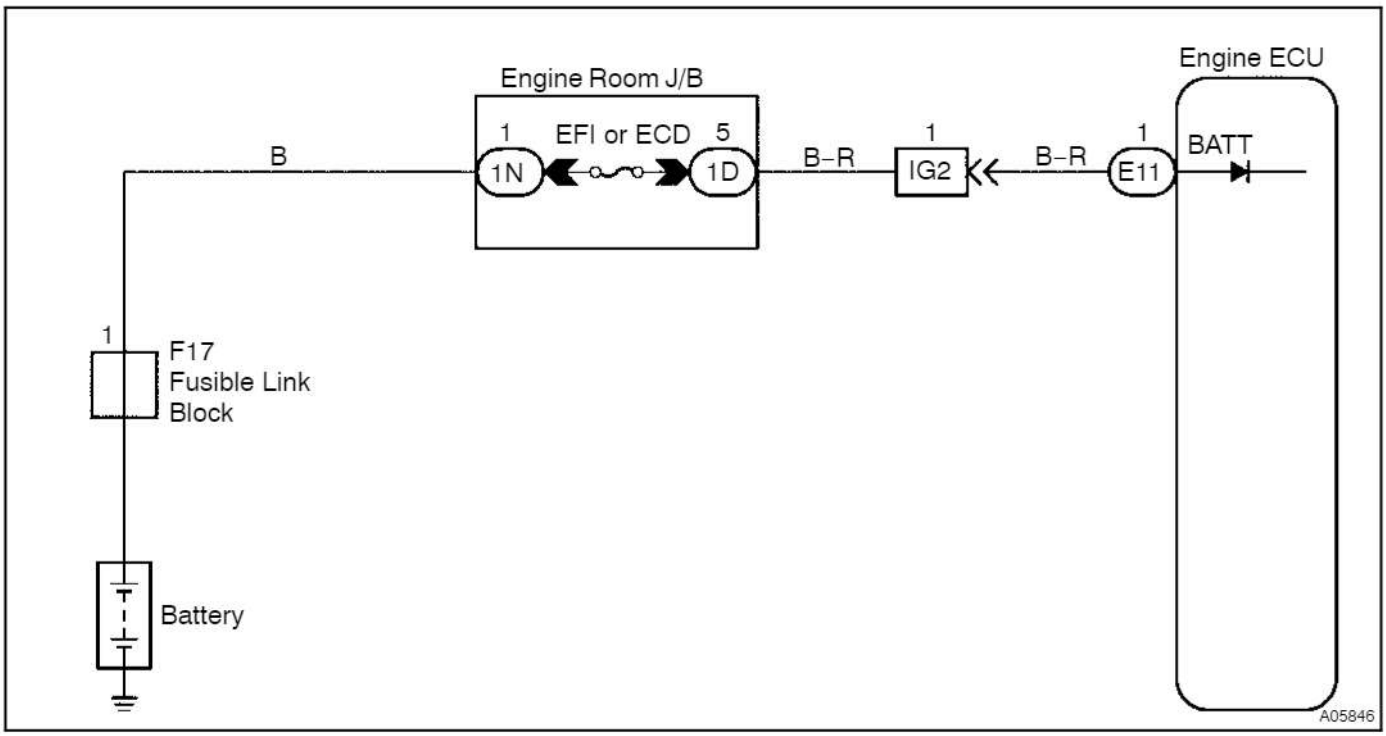
CIRCUIT DESCRIPTION

Battery positive voltage is supplied to terminal BATT of the engine ECU even when the ignition switch is OFF for use by the DTC memory and air–fuel ratio adaptive control value memory, etc.

DTC No.	DTC Detecting Condition	Trouble Area
P1600/96	Open in back up power source circuit	• Open in back up power source circuit • Engine ECU

HINT:
If DTC P1600/96 appear, the engine ECU does not store another DTC.

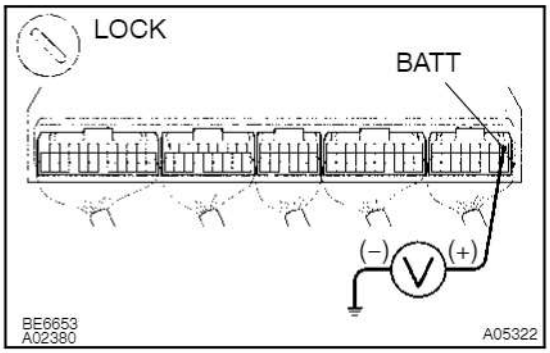
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because free frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	Check voltage between terminal BATT of engine ECU connector and body ground.

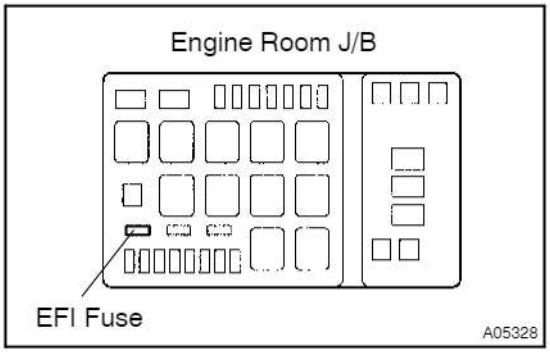


PREPARATION:
Remove the engine room ECU cover.
CHECK:
Measure voltage between terminal BATT of the engine ECU connector and body ground.
OK:
Voltage: 9 – 14 V

OK	Check and replace engine ECU (See page IN–19).

NG

2	Check EFI fuse.



PREPARATION:
Remove the EFI fuse from the engine room R/B.
CHECK:
Check continuity of EFI fuse.
OK:
Continuity

NG	Check for short in all harness and components connected to EFI fuse.

OK

Check and repair harness or connector between battery, EFI fuse and engine ECU (See page IN–19).

DI3C3–05

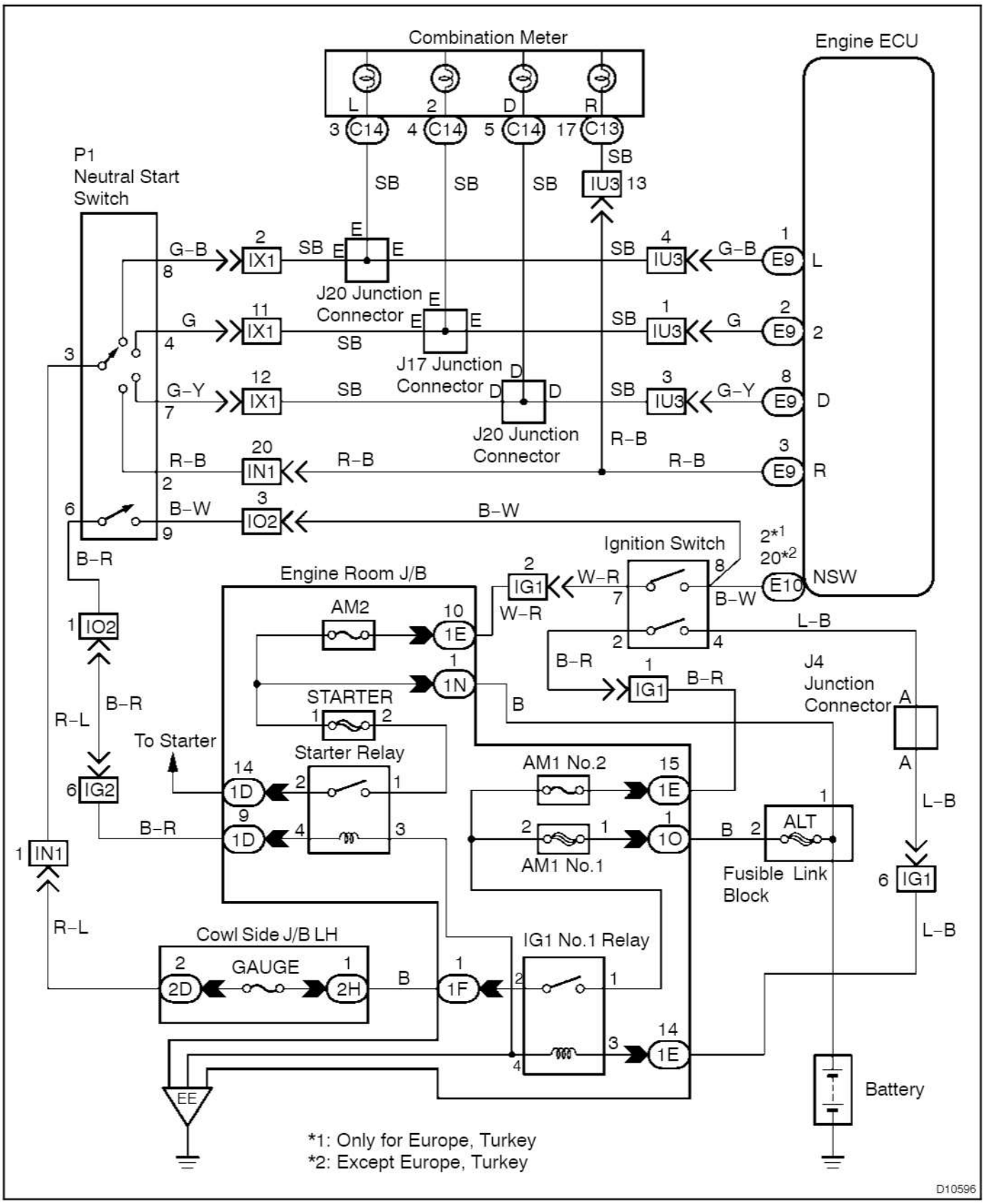
DTC	P1780/97	Neutral Start Switch Malfunction

CIRCUIT DESCRIPTION

The neutral start switch detects the shift lever position and sends signals to the engine ECU.
The engine ECU receives signals (NSW, R, D, 2 and L) from the neutral start switch. When the signal is not sent to the engine ECU from the neutral start switch, the engine ECU judges that the shift lever is in D range.

DTC No.	DTC Detection Condition	Trouble Area
P1780/97	2 or more switches are ON simultaneously for N, 2 and L positions. (2–trip detection logic)	• Short in neutral start switch circuit • Neutral start switch • Engine ECU
	When driving under conditions (a) and (b) for 30 seconds or more, the neutral start switch is ON (N position). (2–trip detection logic) (a) Vehicle speed: 70 km/h (44 mph) or more (b) Engine speed: 1,500 – 2,500 rpm	

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Read PNP, REVERSE, 2ND and LOW signals.**

When using hand–held tester:

PREPARATION:

(a) Connect a hand–held tester to the DLC3.

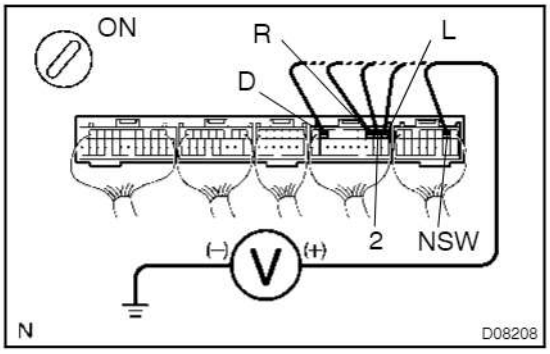
(b) Turn the ignition switch ON and hand–held tester main switch ON.

CHECK:

Shift lever into the P, R, D, N, 2 and L ranges, and read the PNP, REVERSE, 2ND and LOW signals on the hand–held tester.

OK:

Shift position	Signal
2	2ND OFF → ON
L	LOW OFF → ON
R	REVERSE OFF → ON
P,N	PNP SW OFF → ON



When not using hand–held tester:

PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure voltage between terminals NSW, R, D, 2 and L of engine ECU and body ground when the shift lever is shifted to the following ranges.

OK:

Position	NSW–Body ground	R–Body ground	D–Body ground	2–Body ground	L–Body ground
P,N	0 V	0 V	0 V	0 V	0 V
R	9 – 14 V*	7.5 – 14 V*	0 V	0 V	0 V
D	9 – 14 V	0 V	7.5 – 14 V	0 V	0 V
2	9 – 14 V	0 V	0 V	7.5 – 14 V	0 V
L	9 – 14 V	0 V	0 V	0 V	7.5 – 14 V

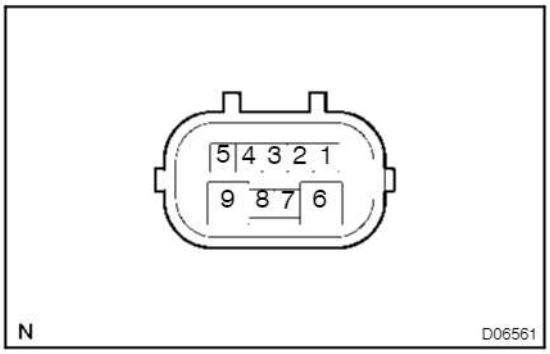
HINT:

The voltage will drop slightly due to lighting up the back up light.

OK → **Check and replace the engine ECU (See page IN–19).**

NG

2	Check neutral start switch.



PREPARATION:

Remove the neutral start switch connector.

CHECK:

Check continuity between each terminal shown below when the shift lever is moved to each range.

OK:

Shift Position	Terminal No. to continuity	
P	6 – 9	1 – 3
R	2 – 3	–
N	6 – 9	3 – 5
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

NG → **Replace the neutral start switch.**

OK →

Repair or replace harness and connector between battery and neutral start switch, neutral start switch and engine ECU (See page IN–19).

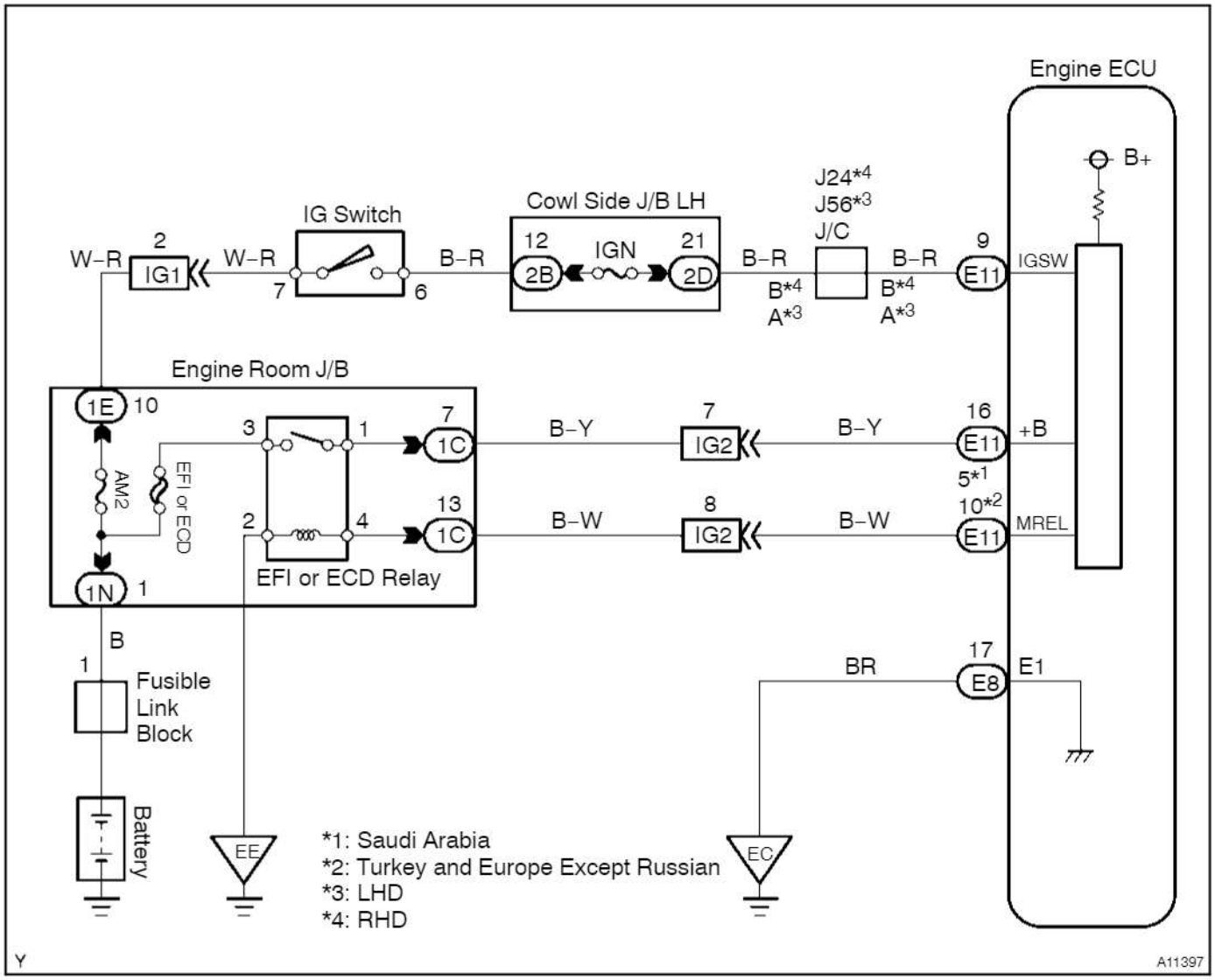
DI3FM–02

Engine ECU Power Source Circuit

CIRCUIT DESCRIPTION

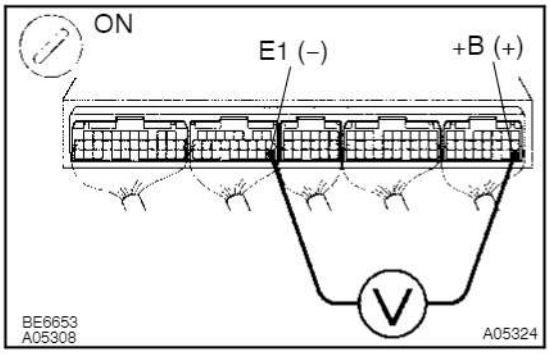
When the ignition switch is turned ON, battery positive voltage is applied to the terminal IGSW of the engine ECU and the EFI main relay (Making: EFI) control circuit in the engine ECU sends a signal to the terminal MREL of the engine ECU switching on the EFI main relay.
This signal causes current to flow to the coil, closing the contacts of the EFI main relay and supplying power to the terminals +B of the engine ECU.
If the ignition switch is turned off, the engine ECU continues to switch on the EFI main relay for a maximum of 2 seconds for the initial setting of the throttle body.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check voltage between terminals +B and E1 of engine ECU connector.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals +B and E1 of the engine ECU connector.

OK:

Voltage: 9 – 14 V

OK	**Proceed to next circuit inspection shown on Problem symptoms table (See page DI–27).**

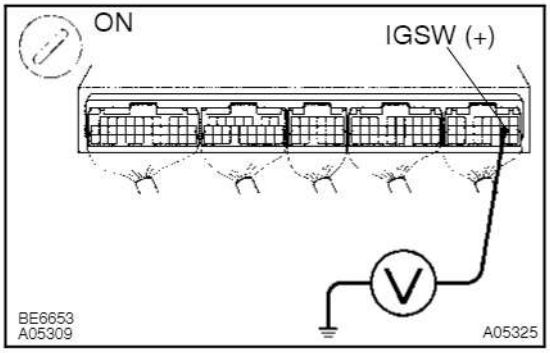
NG

2	**Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–19).**

NG	**Repair or replace harness or connector.**

OK

3	**Check voltage between terminal IGSW of engine ECU connector and body ground.**



PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure voltage between terminal IGSW of the engine ECU and body ground.

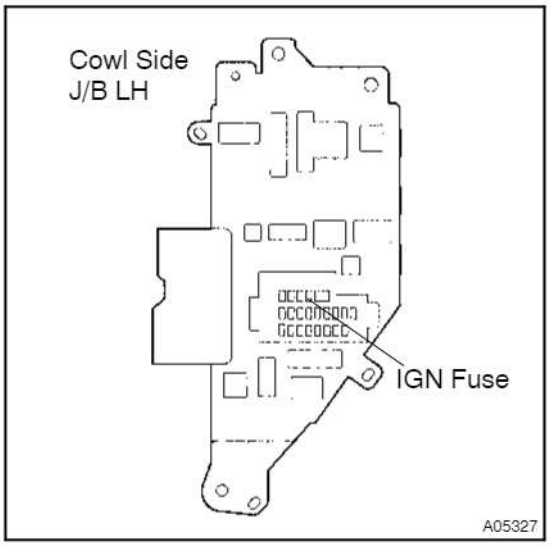
OK:

Voltage: 9 – 14 V

OK	**Go to step 6.**

NG

4	Check IGN fuse.



PREPARATION:
Remove the IGN fuse from the cowl side J/B LH.
CHECK:
Check continuity of the IGN fuse.
OK:
Continuity

NG → **Check for short in all harness and components connected to IGN fuse.**

OK ↓

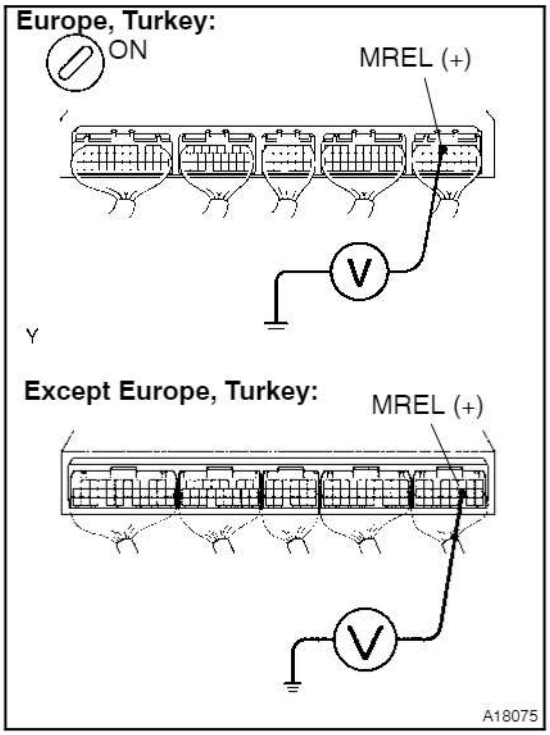
5	Check ignition switch.

NG → **Replace ignition switch.**

OK ↓

Check and repair harness and connector between battery and ignition switch, ignition switch and engine ECU.

6	Check voltage between terminal MREL of engine ECU connector and body ground.



PREPARATION:
Turn the ignition switch ON.
CHECK:
Measure voltage between terminal MREL of the engine ECU connector and body ground.
OK:
Voltage: 9 – 14 V

NG → **Check and replace engine ECU (See page IN–19).**

OK

7	Check EFI fuse of engine room J/B (See Pub. No. RM630E on page DI–129).

NG → **Check for short in all harness and components connected to EFI fuse.**

OK

8	Check EFI main relay (Marking: EFI) (See Pub. No. RM630E on page FI–52).

NG → **Replace EFI main relay (Marking: EFI).**

OK

9	Check for open and short in harness and connector between terminal MREL of engine ECU and body ground (See page IN–19).

NG → Repair and replace harness or connector.

OK →

Check and repair harness or connector between EFI fuse and battery.

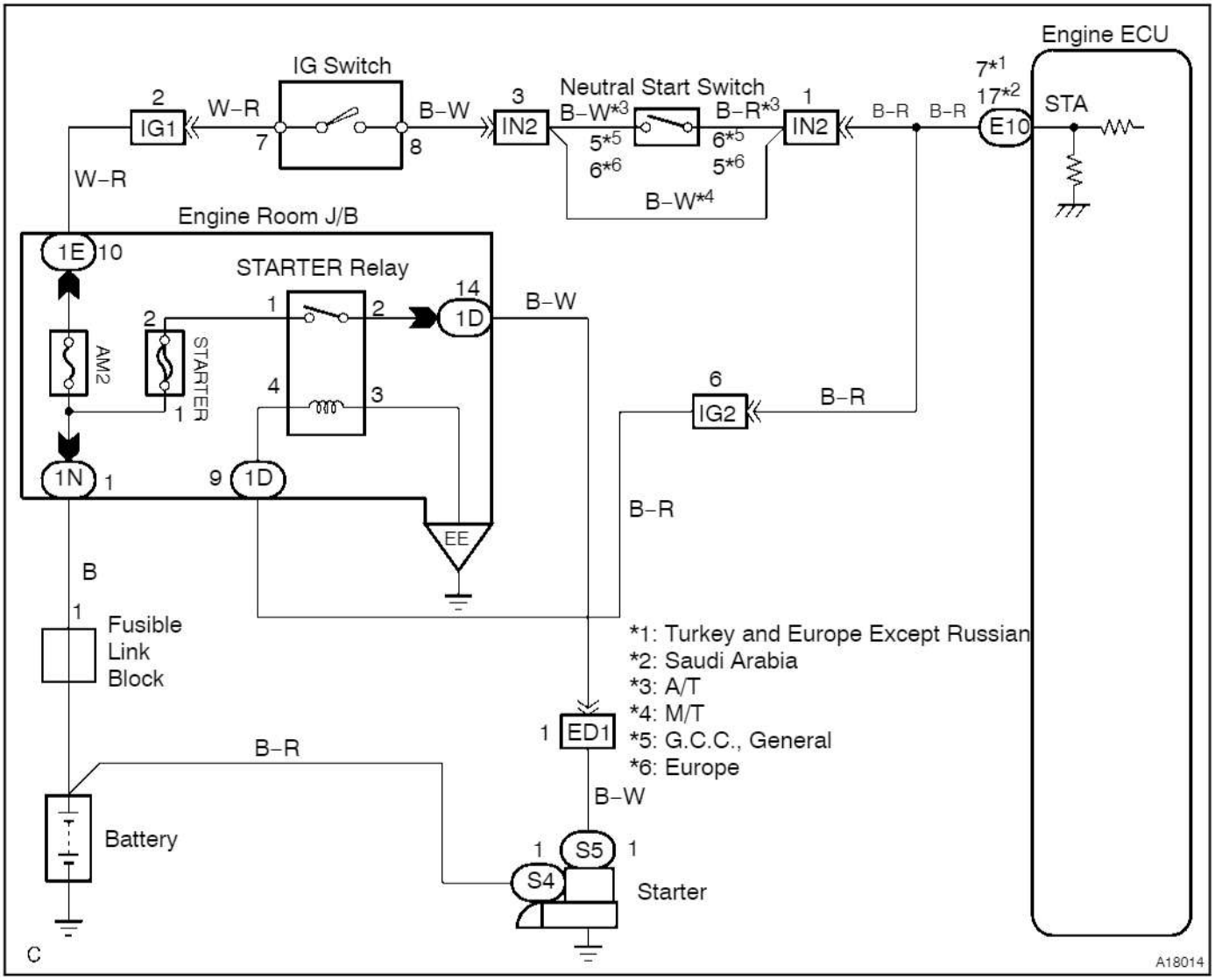
DI3PL–02

Starter Signal Circuit

CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the engine ECU. The starter signal id mainly used to increase the fuel injection volume for the starting injection control and after–start injection control.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table on page DI–27.

When using hand–held tester

1	**Connect hand–held tester and check STA signal.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

CHECK:

Read STA signal on the hand–held tester while starter operates.

OK:

Ignition Switch Position	ON	START
STA signal	OFF	ON

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–27).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking: STARTER) (See page IN–19).**

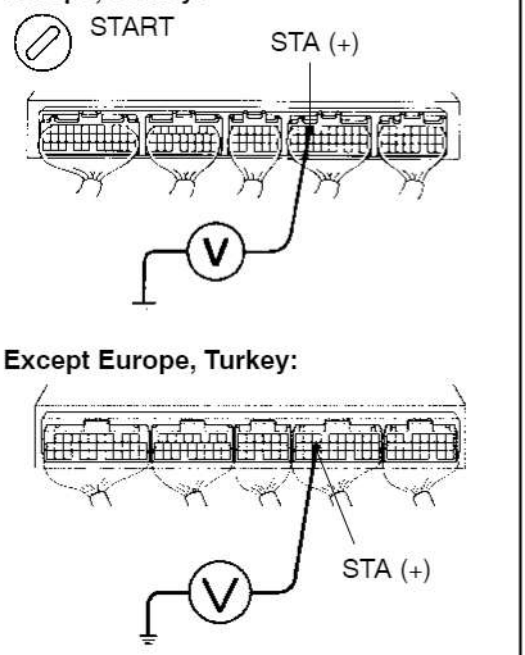
NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

When not using hand–held tester

1	**Check voltage between terminal STA of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch START.

CHECK:

Measure voltage between terminal STA of the engine ECU connector and body ground, during engine cranking.

OK:

Voltage: 6 V or more

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–27).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking: STARTER) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

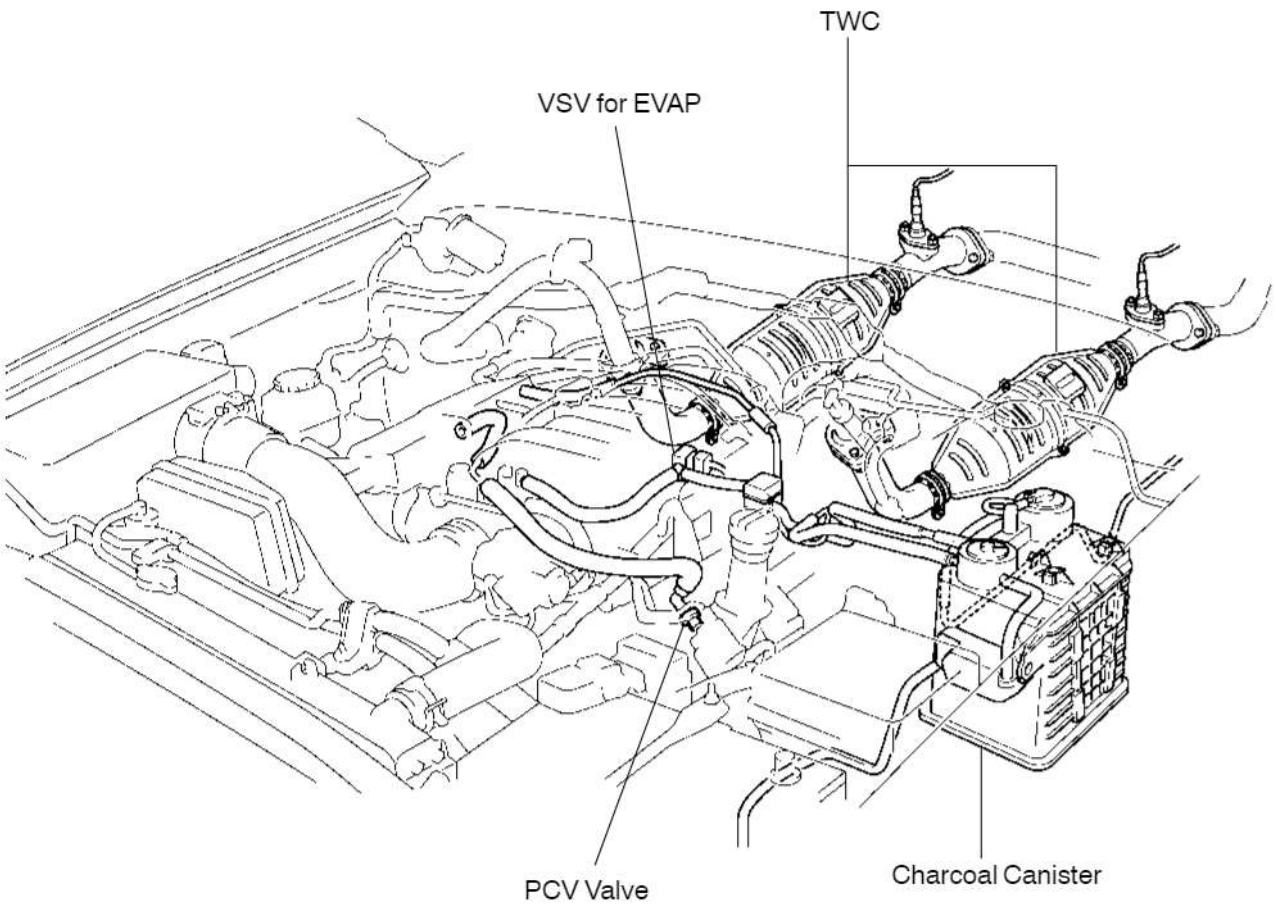
Check and replace engine ECU (See page IN–19).

PARTS LAYOUT AND SCHEMATIC DRAWING

LOCATION

EC0KX-01

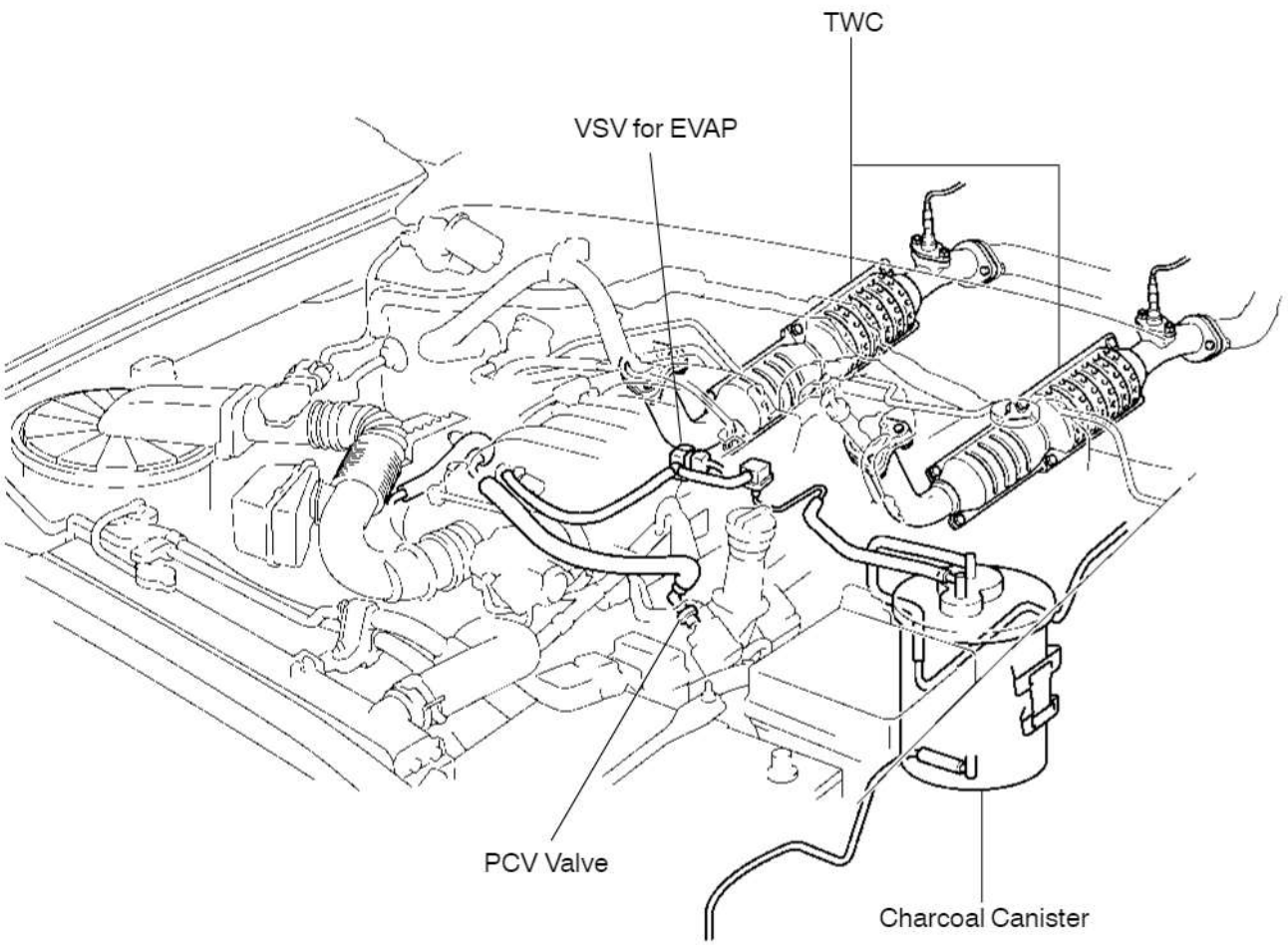
Europe



Y

B12574

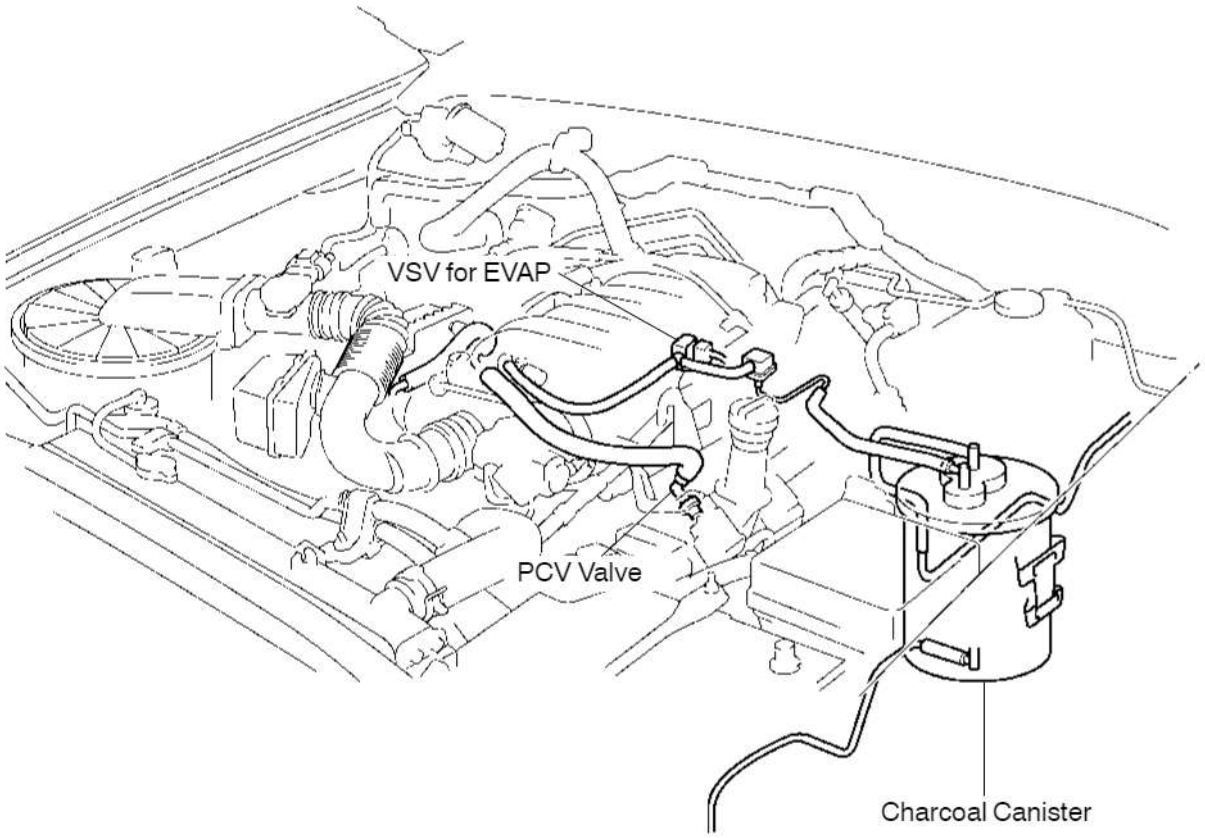
Saudi Arabia



Y

B12575

Except Europe and Saudi Arabia

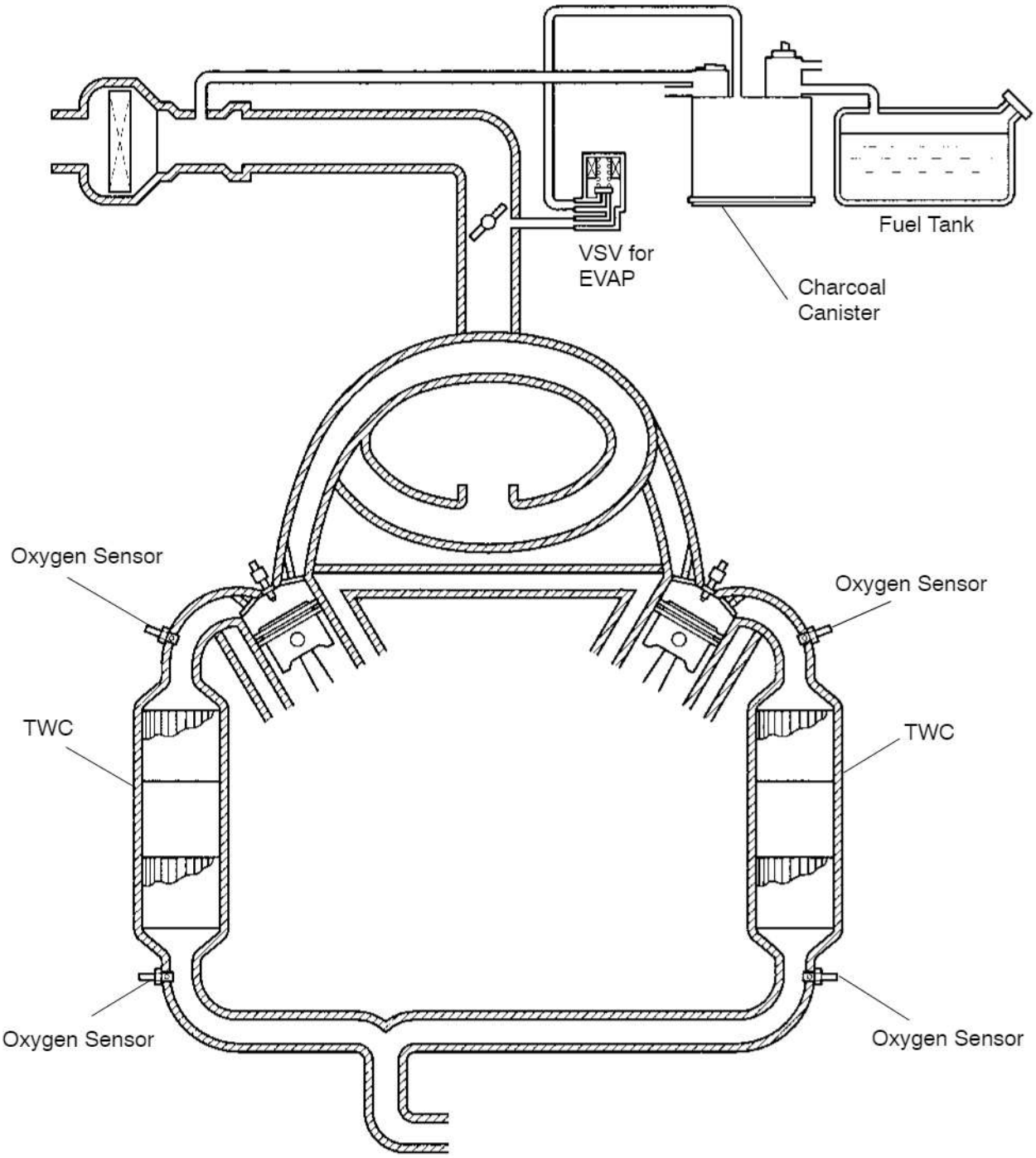


B05692

EC0KY–01

DRAWING

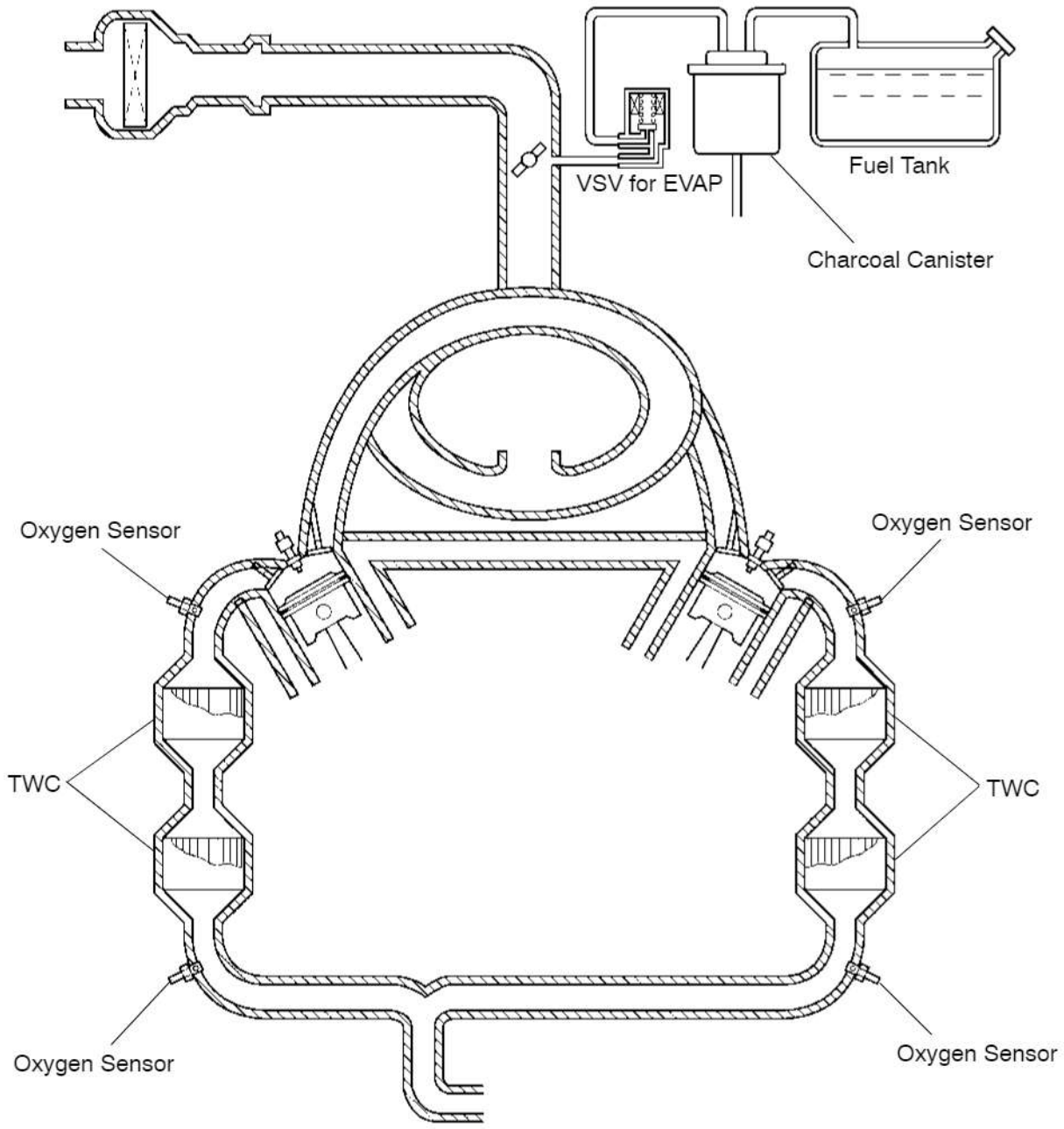
Europe



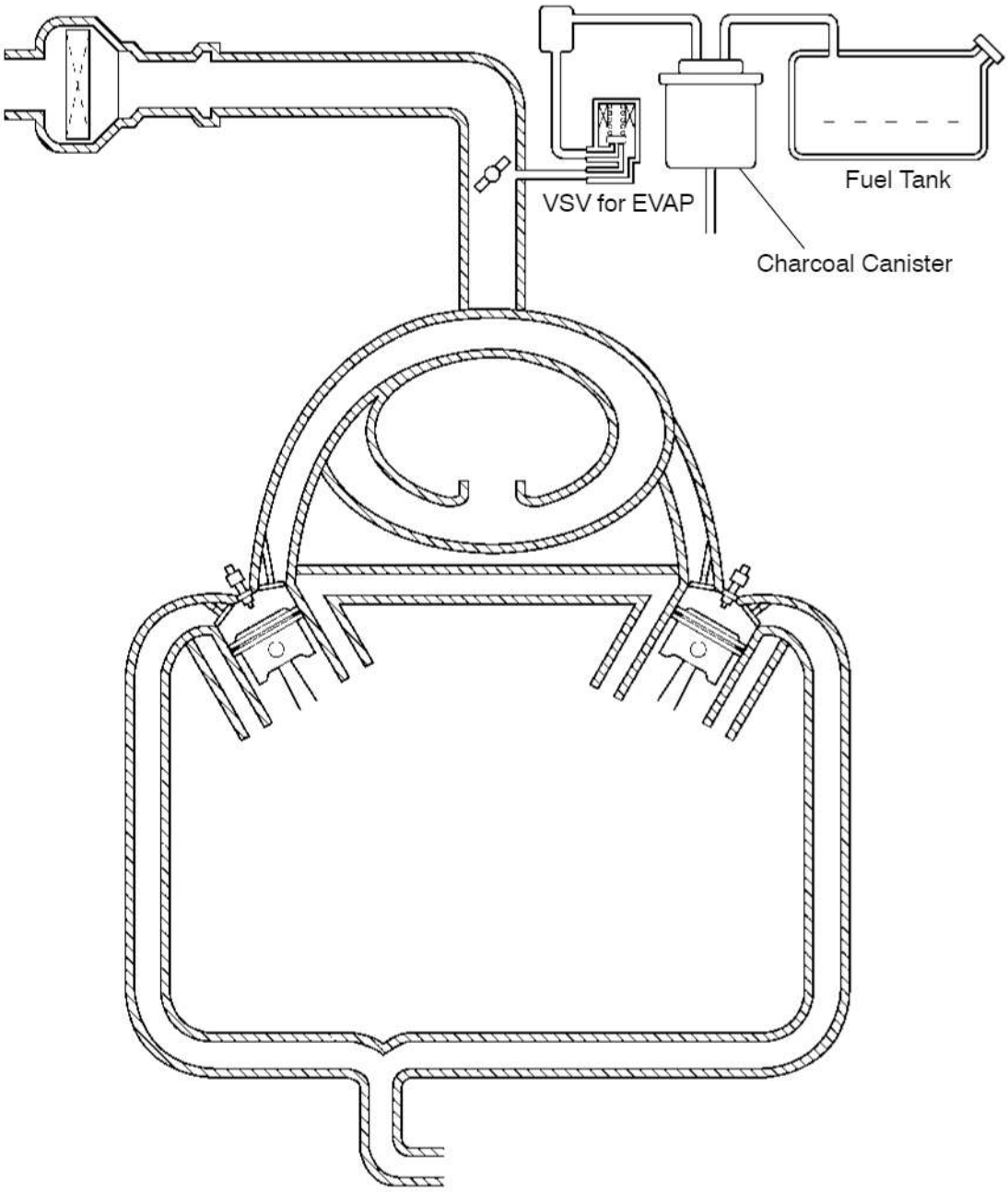
P

B15379

Saudi Arabia



Except Europe and Saudi Arabia



EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM (Europe)

EC0KZ-01

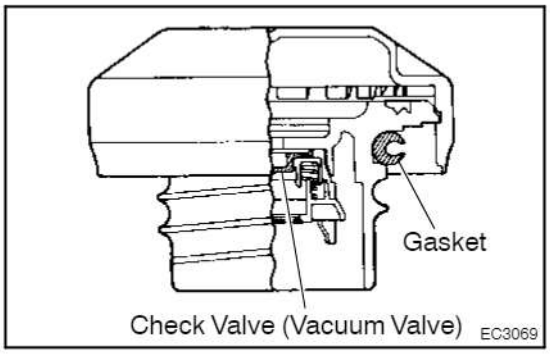
INSPECTION

1. VISUALLY INSPECT LINES AND CONNECTIONS

Look for loose connections, sharp bends or damage.

2. VISUALLY INSPECT FUEL TANK

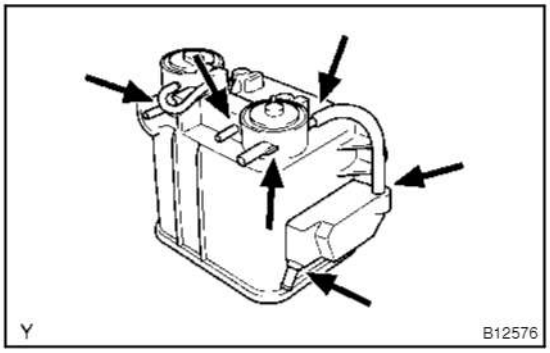
Look for deformation, cracks or fuel leakage.



3. VISUALLY INSPECT FUEL TANK CAP

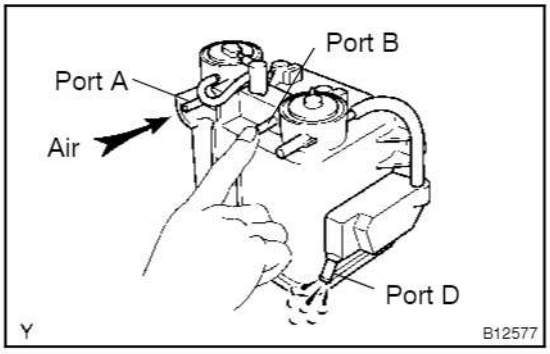
Check if the cap and/or gasket are deformed or damaged.
If necessary, repair or replace the cap.

4. REMOVE CHARCOAL CANISTER



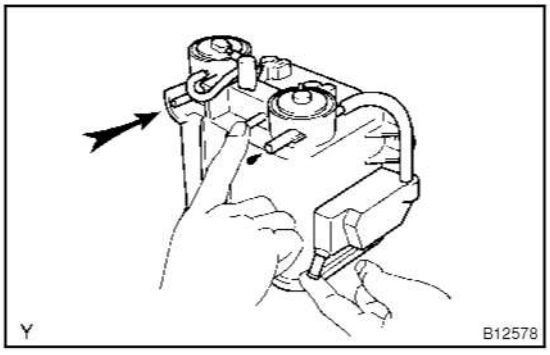
5. INSPECT CHARCOAL CANISTER

(a) Visually check the charcoal canister for cracks or damage.

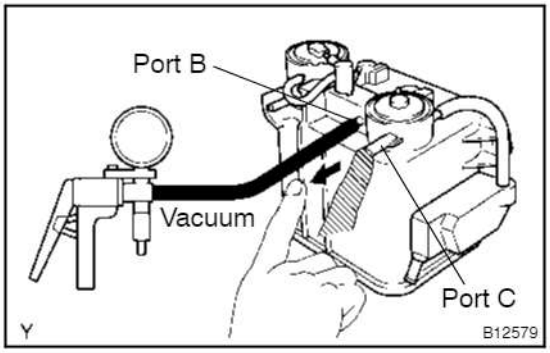


(b) Inspect the charcoal canister operation.

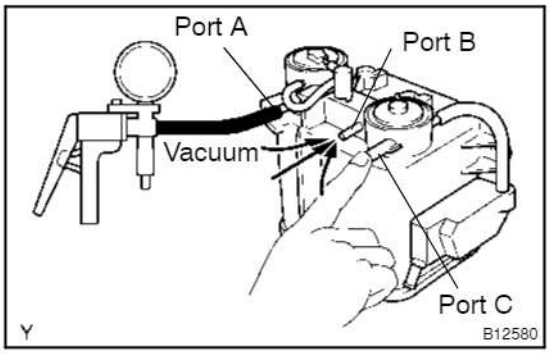
(1) While holding the port B closed, blow air (1.76 kPa (18 gf/cm^2, 0.26 psi)) into the port A and check that air flows from the port D.



(2) While holding the ports B and D closed, blow air (1.76 kPa (18 gf/cm^2, 0.26 psi)) into the port A and check that air does not flows from the port D.



(3) Apply vacuum (3.43 kPa (26 gf/cm^2, 1.01 psi)) to port B, check that the vacuum does not decrease when port C is closed, and check that the vacuum decreases when port C is released.



(4) While holding the port C closed, apply vacuum (1.32 kPa (10 mmHg, 0.39 in.Hg)) to the port A and check that air flows into the port B.

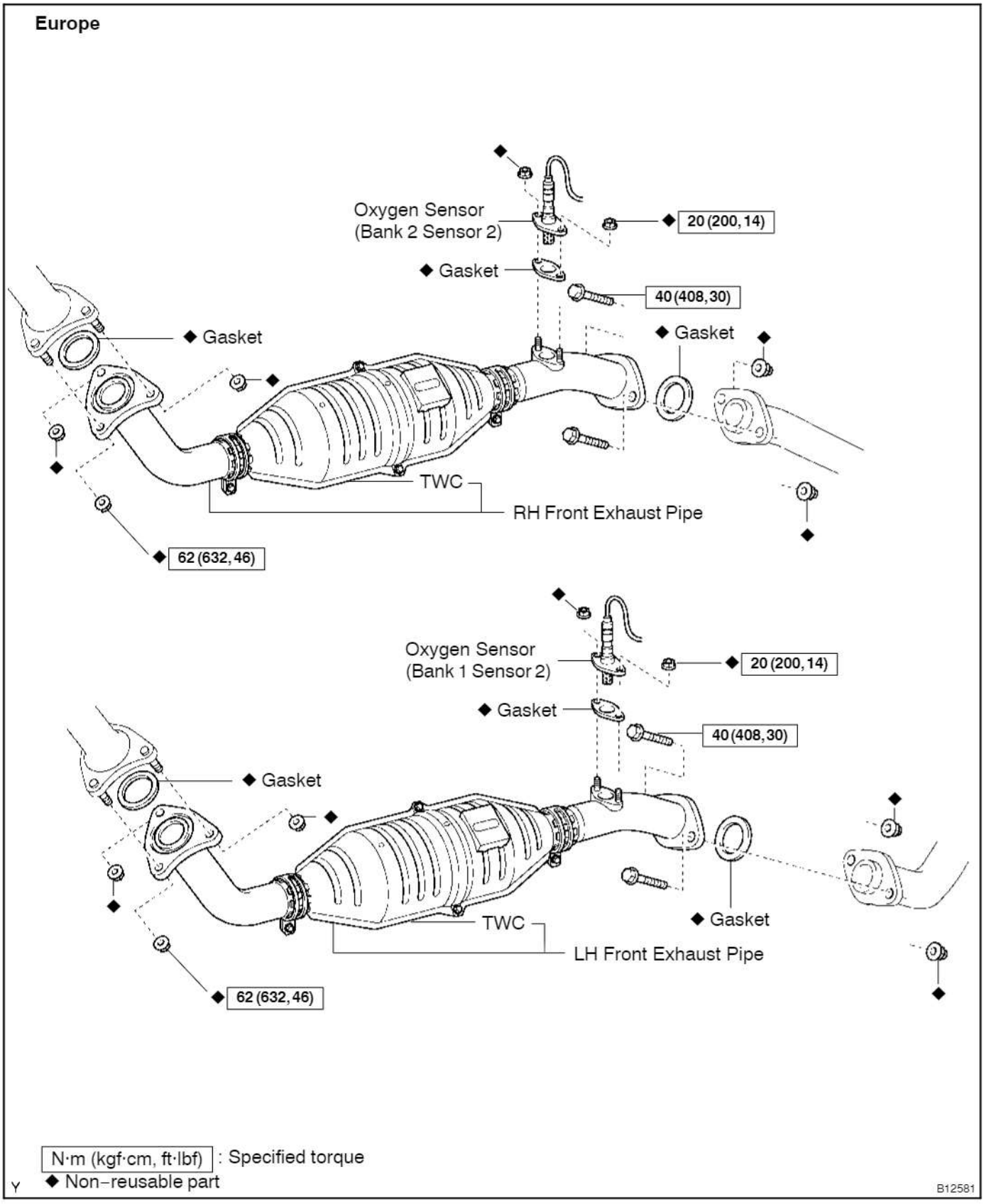
If operation is not as specified, replace the charcoal canister.

6. **REINSTALL CHARCOAL CANISTER**
   Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
7. **INSPECT VSV FOR EVAP (See Pub. No. RM630E on page FI–61)**

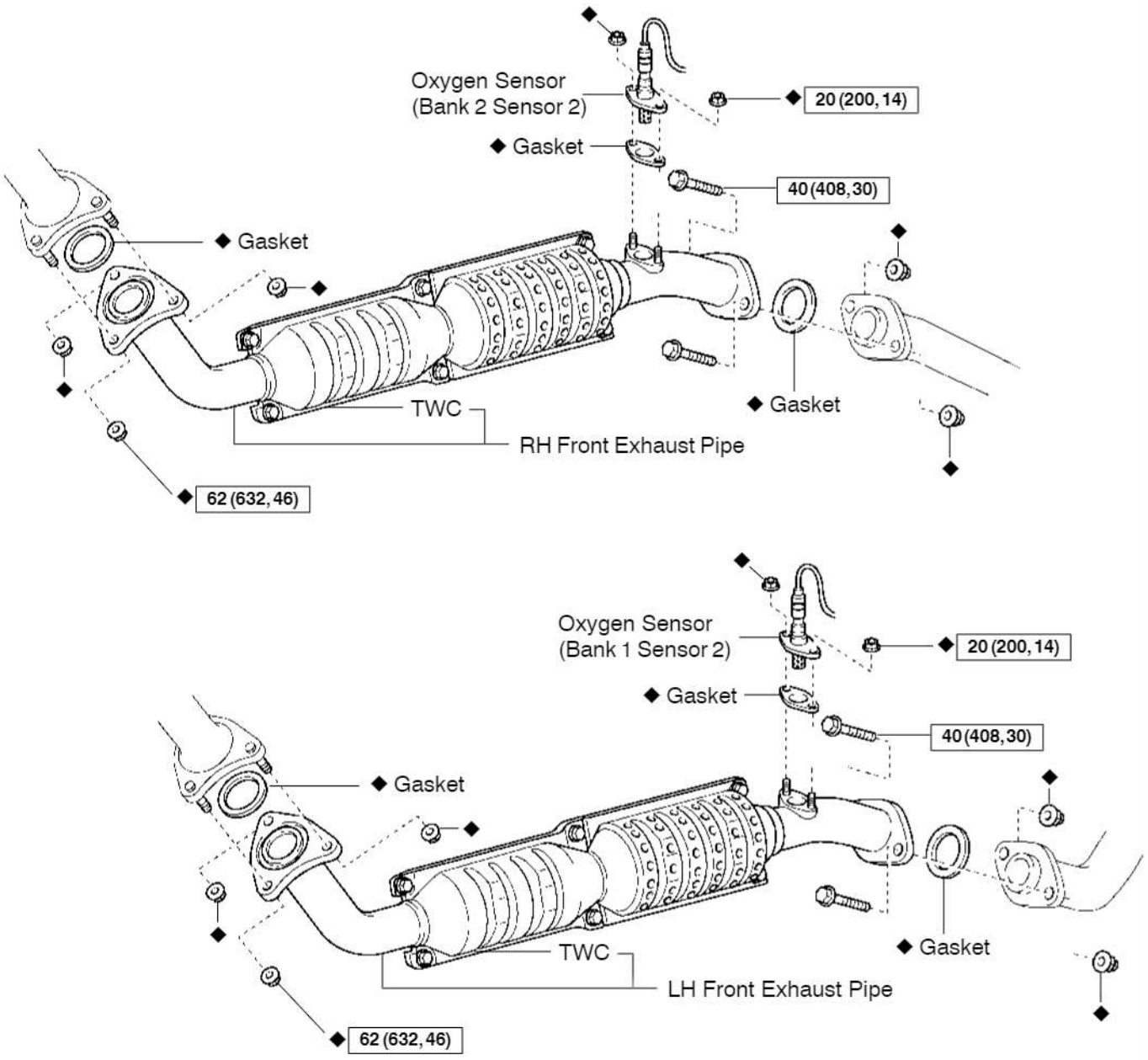
THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

EC0L0–01

COMPONENTS



Saudi Arabia



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

B03194

EC096–01

INSPECTION

1. CHECK EXHAUST PIPE ASSEMBLY

(a) Check the connections for looseness or damage.

(b) Check the clamps for weakness, cracks or damage.

2. INSPECT TWC

Check for dents or damage.

If any part of protector is damaged or dented to the extent that it contacts the TWC, repair or replace it.

3. INSPECT HEAT INSULATOR

(a) Check the heat insulator for damage.

(b) Check for adequate clearance between the TWC and heat insulator.

HOW TO USE THIS MANUAL

IN001–08

GENERAL INFORMATION

1. INDEX

An INDEX is provided on the first page of each section to guide you to the item to be repaired. To assist you in finding your way through the manual, the Section Title and major heading are given at the top of every page.

2. GENERAL DESCRIPTION

At the beginning of each section, a General Description is given that pertains to all repair operations contained in that section.

Read these precautions before starting any repair task.

3. TROUBLESHOOTING

TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause. The fundamentals of how to proceed with troubleshooting are described on page IN–8.

Be sure to read this before performing troubleshooting.

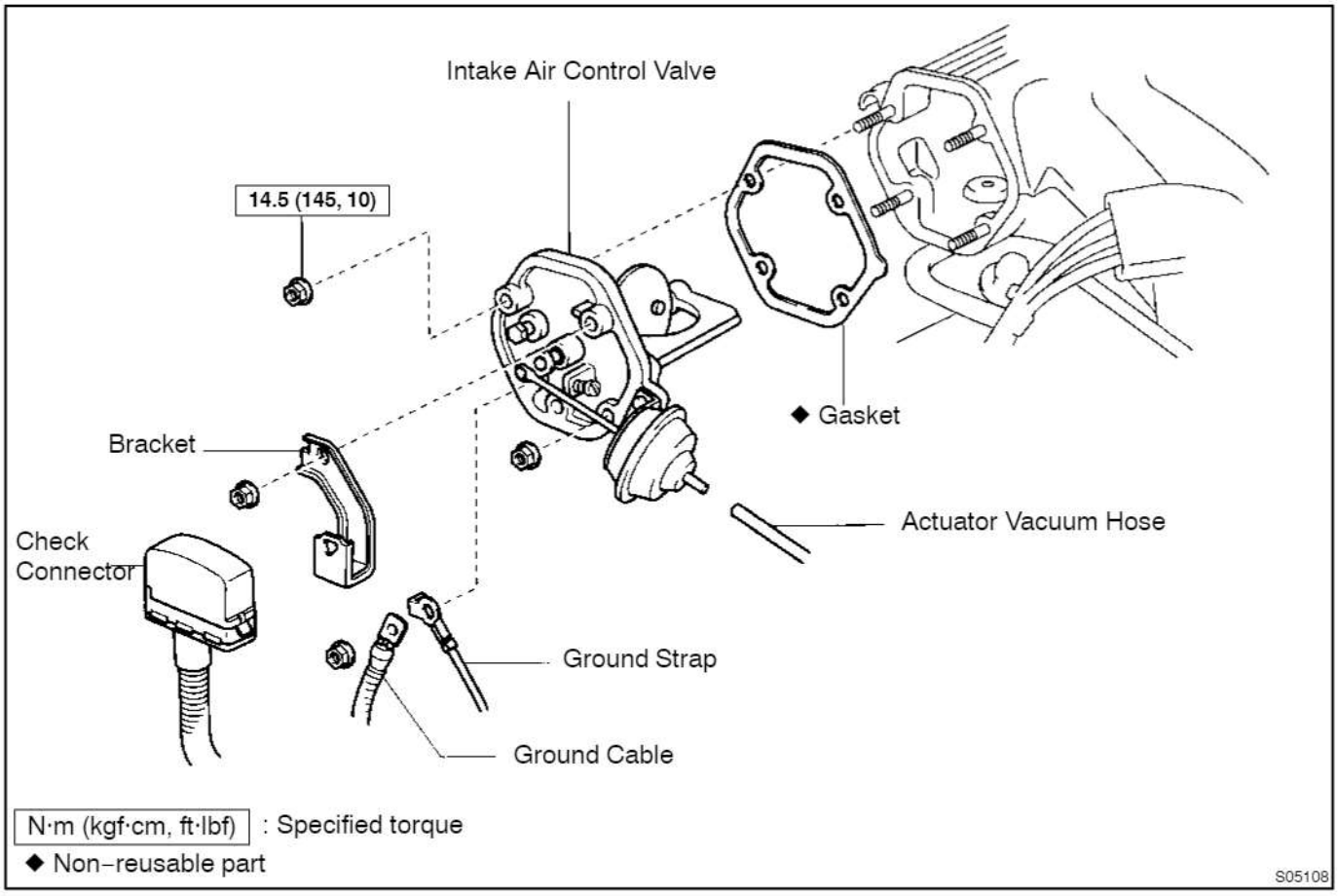
4. PREPARATION

Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

5. REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

Example:



The procedures are presented in a step–by–step format:

- The illustration shows what to do and where to do it.
- The task heading tells what to do.
- The detailed text tells how to perform the task and gives other information such as specifications and warnings.

Example:

Task heading : what to do

21. CHECK PISTON STROKE OF OVERDRIVE BRAKE

(a) Place SST and a dial indicator onto the overdrive brake Piston as shown in the illustration.

SST 09350–30020 (09350–06120)

Set part No. *Component part No.*

Detailed text : how to do task

(b) Measure the stroke applying and releasing the compressed air (392 — 785 kPa, 4 — 8 kgf/cm^2 or 57 — 114 psi) as shown in the illustration.

Piston stroke: 1.40 — 1.70 mm (0.0551 — 0.0669 in.)

Specification

This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

6. REFERENCES

References have been kept to a minimum. However, when they are required you are given the page to refer to.

7. SPECIFICATIONS

Specifications are presented in bold type throughout the text where needed. You never have to leave the procedure to look up your specifications. They are also found in Service Specifications section for quick reference.

8. CAUTIONS, NOTICES, HINTS:

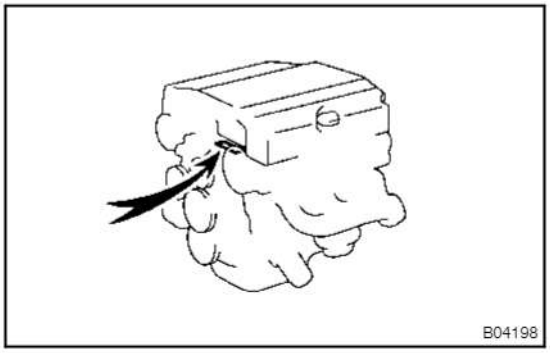
- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide additional information to help you perform the repair efficiently.

9. SI UNIT

The UNITS given in this manual are primarily expressed according to the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the English System.

Example:

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

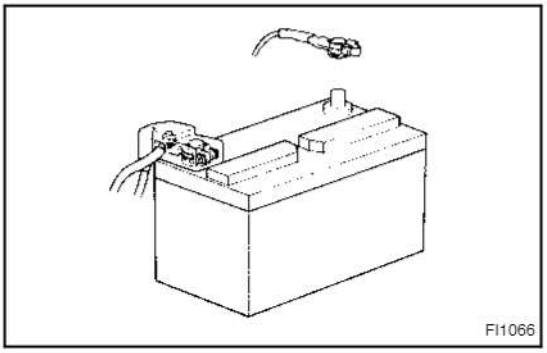


IDENTIFICATION INFORMATION

IN00Q-06

ENGINE SERIAL NUMBER

The engine serial number is stamped on the engine block as shown.


FI1066

REPAIR INSTRUCTIONS

IN0BX-01

GENERAL INFORMATION

BASIC REPAIR HINT

(a) Use fender, seat and floor covers to keep the vehicle clean and prevent damage.

(b) During disassembly, keep parts in the appropriate order to facilitate reassembly.

(c) Observe the following:

(1) Before performing electrical work, disconnect the negative (–) terminal cable from the battery.

(2) If it is necessary to disconnect the battery for inspection or repair, always disconnect the negative (–) terminal cable which is grounded to the vehicle body.

(3) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.

(4) Clean the battery terminals and cable ends with a clean shop rag. Do not scrape them with a file or other abrasive objects.

(5) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.

(6) Be sure the cover for the positive (+) terminal is properly in place.

(d) Check hose and wiring connectors to make sure that they are secure and correct.

(e) Non–reusable parts

(1) Always replace cotter pins, gaskets, O–rings and oil seals etc. with new ones.

(2) Non–reusable parts are indicated in the component illustrations by the "◆" symbol.

(f) Precoated parts

Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

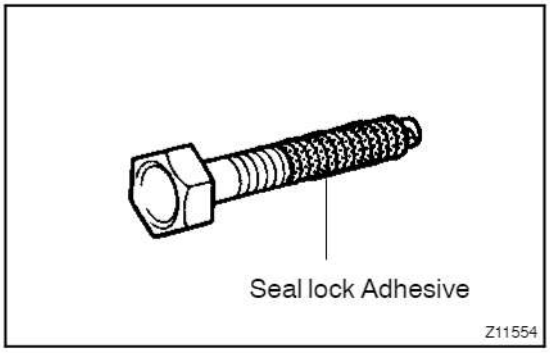
(1) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

(2) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.

(3) Precoated parts are indicated in the component illustrations by the "★" symbol.

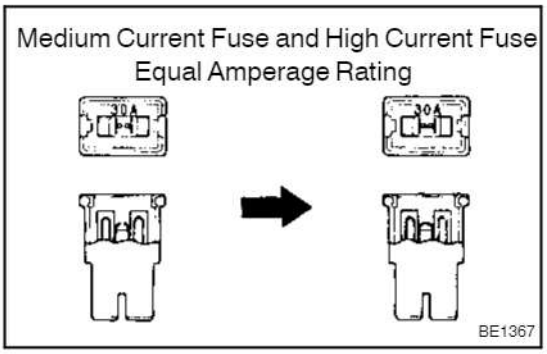
(g) When necessary, use a sealer on gaskets to prevent leaks.

(h) Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.

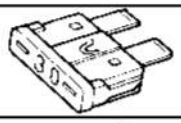
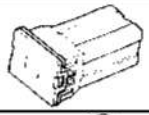
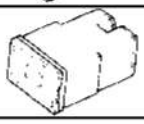
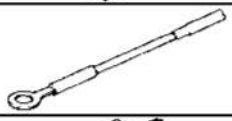
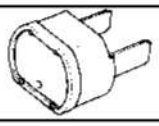
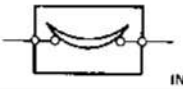


Z11554

(i) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in section PP (Preparation) in this manual.



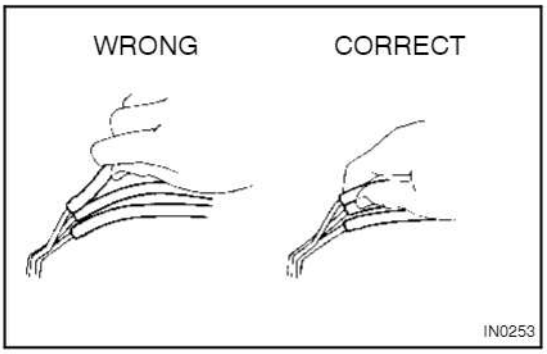
(j) When replacing fuses, be sure the new fuse has the correct amperage rating. DO NOT exceed the rating or use one with a lower rating.

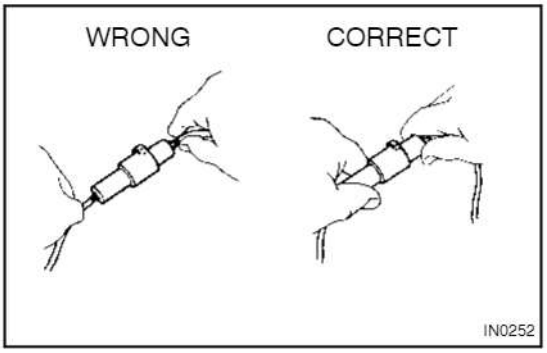
Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M–FUSE
 BE5596	 IN0367	HIGH CURRENT FUSE	H–FUSE
 BE5597	 IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

V00076

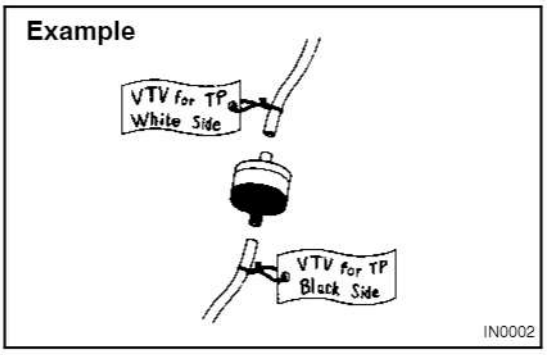
(k) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.
   (1) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.
   (2) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

(l) Observe the following precautions to avoid damage to the following parts:
(1) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)





(2) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
(3) To pull apart electrical connectors, pull on the connector itself, not the wires.
(4) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
(5) When steam cleaning an engine, protect the electronic components, air filter and emissions–related components from water.
(6) Never use an impact wrench to remove or install temperature switches or temperature sensors.
(7) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
(8) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step–down adapter instead. Once the hose has been stretched, it may leak.



(m) Tag hoses before disconnecting them:
(1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
(2) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.
(n) Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

FOR ALL OF VEHICLES

PRECAUTION

IN00R–01

1. FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

CAUTION:

If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

(a) Use only unleaded gasoline

(b) Avoid prolonged idling
Avoid running the engine at idle speed for more than 20 minutes.

(c) Avoid spark jump test
(1) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
(2) While testing, never race the engine.

(d) Avoid prolonged engine compression measurement
Engine compression tests must be done as rapidly as possible.

(e) Do not run engine when fuel tank is nearly empty
This may cause the engine to misfire and create an extra load on the converter.

(f) Avoid coasting with ignition turned off and prolonged braking

(g) Do not dispose of used catalyst along with parts contaminated with gasoline or oil

2. IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

For vehicles with mobile communication systems such as two–way radios and cellular telephones, observe the following precautions.

(1) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.
(2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronics systems. For details about ECU and sensors locations, refer to the section on the applicable component.
(3) Do not wind the antenna feeder together with the other wiring. As much as possible, also avoid running the antenna feeder parallel with other wire harnesses.
(4) Confirm that the antenna and feeder are correctly adjusted.
(5) Do not install powerful mobile communications system.

3. FOR USING HAND–HELD TESTER

CAUTION:

Observe the following for safety reasons:

- **Before using the hand–held tester, the hand–held tester's operator manual should be read throughly.**
- **Be sure to route all cables securely when driving with the hand–held tester connected to the vehicle. (i.e. Keep cables away from feet, pedals, steering wheel and shift lever.)**
- **Two persons are required when test driving with the hand–held tester, one person to drive the vehicle and one person to operate the hand–held tester.**

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

IN005-36

GENERAL INFORMATION

A large number of ECU controlled systems are used in the LAND CRUISER (Station Wagon). In general, the ECU controlled system is considered to be a very intricate system requiring a high level of technical knowledge and expert skill to troubleshoot. However, the fact is that if you proceed to inspect the circuits one by one, troubleshooting of these systems is not complex. If you have adequate understanding of the system and a basic knowledge of electricity, accurate diagnosis and necessary repair can be performed to locate and fix the problem. This manual is designed through emphasis of the above standpoint to help service technicians perform accurate and effective troubleshooting, and is compiled for the following major ECU controlled systems:

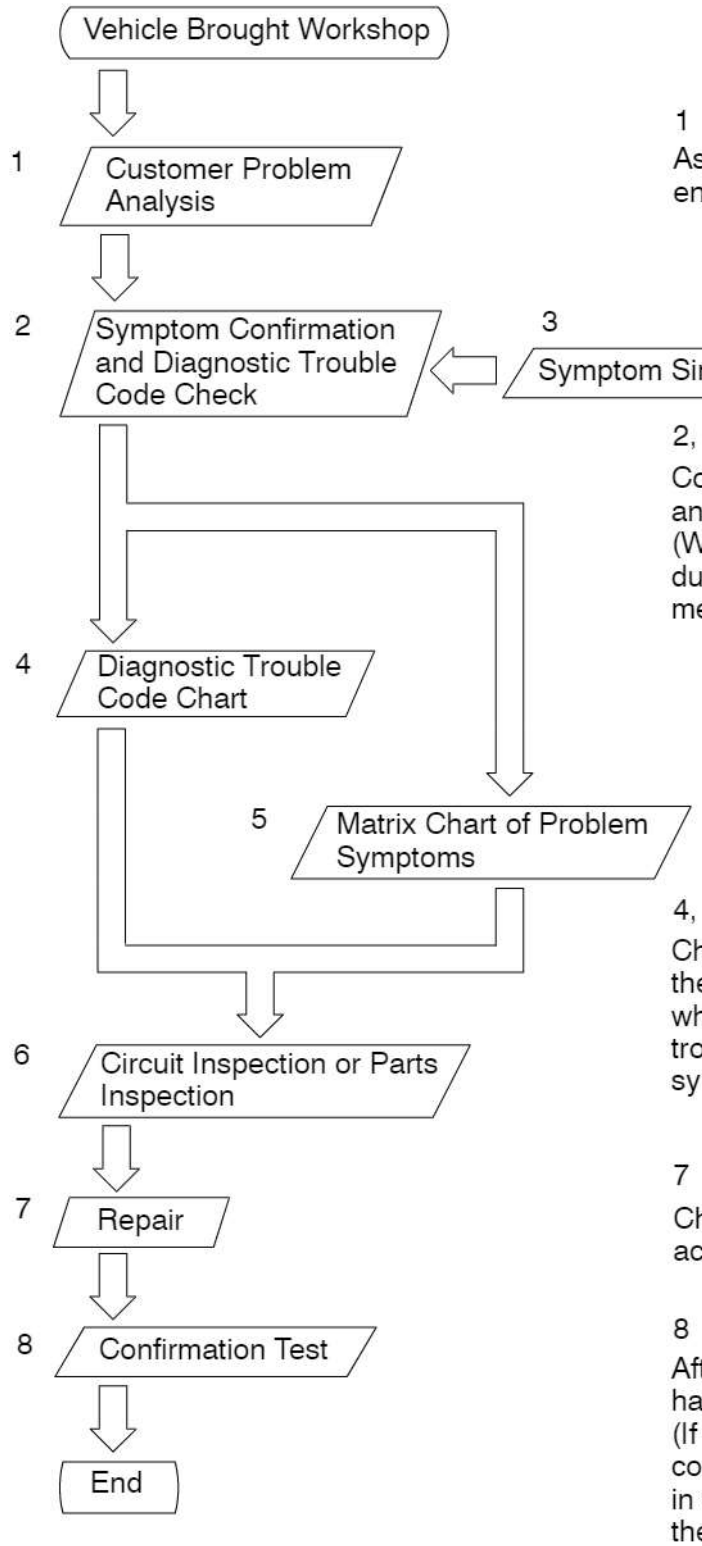
System	Page
1. Engine	DI–1

The troubleshooting procedure and how to make use of it are described on the following pages.

IN006-39

HOW TO PROCEED WITH TROUBLESHOOTING

Carry out troubleshooting in accordance with the procedure on the following page. Here, only the basic procedure is shown. Details are provided in each section, showing the most effective methods for each circuit. Confirm the troubleshooting procedures first for the relevant circuit before beginning troubleshooting of that circuit.



1

Ask the customer about the conditions and the environment when the problem occurred.

2, 3

Confirm the symptoms and the problem conditions, and check the diagnostic trouble codes.
(When the problem symptoms do not appear during confirmation, use the symptom simulation method described later on.)

4, 5, 6

Check the results obtain in Step 2, then confirm the inspection procedure for the system or the part which should be checked using the diagnostic trouble code chart or the matrix chart of problem symptoms.

7

Check and repair the affected system or part in accordance with the instructions in Step 6.

8

After completing repairs, confirm that the problem has been eliminated.
(If the problem is not reproduced, perform the confirmation test under the same conditions and in the same environment as when it occurred for the first time.)

1. CUSTOMER PROBLEM ANALYSIS

In troubleshooting, the problem symptoms must be confirmed accurately and all preconceptions must be cleared away in order to give an accurate judgment. To ascertain just what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.

Important Point in the Problem Analysis:

The following 5 items are important points in the problem analysis. Past problems which are thought to be unrelated and the repair history, etc. may also help in some cases, so as much information as possible should be gathered and its relationship with the problem symptoms should be correctly ascertained for reference in troubleshooting. A customer problem analysis table is provided in the troubleshooting section for each system for your use.

Important Points in the Customer Problem Analysis

- What ––––– Vehicle model, system name
- When ––––– Date, time, occurrence frequency
- Where ––––– Road conditions
- Under what conditions? ––––– Running conditions, driving conditions, weather conditions
- How did it happen? ––––– Problem symptoms

(Sample) Engine control system check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet Inspector's Name

Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
Data Vehicle Brought in		Engine Model	
License No.		Odometer Reading	km miles

Problem Symptoms		
	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____
	☐ Poor Drive ability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging ☐ Knocking ☐ Other _____
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____
	☐ Others	

onstant ☐ Sometimes (times per day/month)

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the LAND CRUISER (Station Wagon) fulfills various functions. The first function is the Diagnostic Trouble Code Check in which a malfunction in the signal circuits to the ECU is stored in code in the ECU memory at the time of occurrence, to be output by the technician during troubleshooting. Another function is the Input Signal Check which checks if the signals from various switches are sent to the ECU correctly.

By using these check functions, the problem areas can be narrowed down quickly and troubleshooting can be performed effectively. Diagnostic functions are incorporated in the following systems in the LAND CRUISER (Station Wagon).

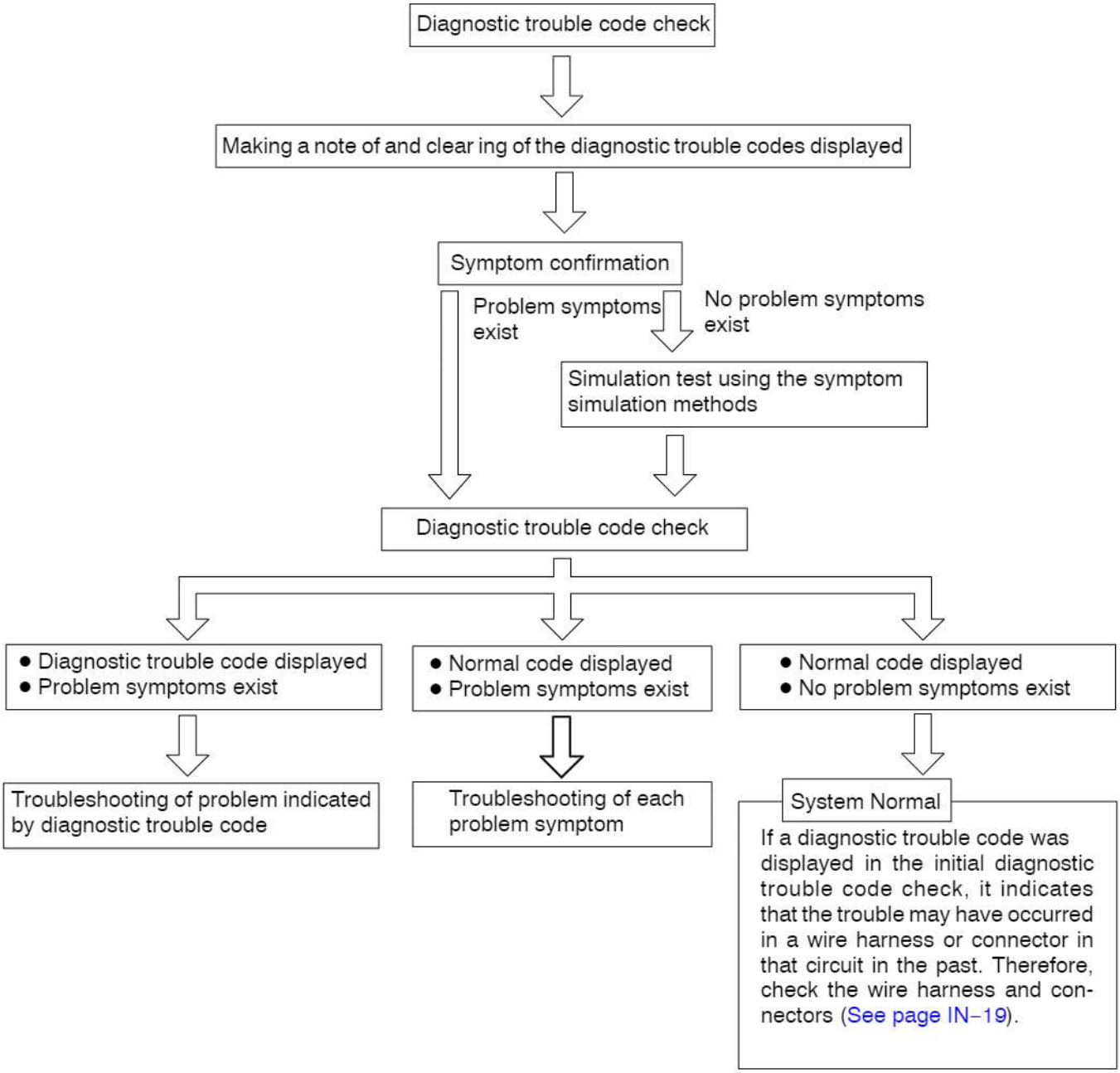
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	○ (with Check Mode)	○	Diagnostic Test Mode

In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated by the diagnostic trouble code is directly related to the problem symptom or not. For this reason, the diagnostic trouble codes should be checked before and after the symptom confirmation to determine the current conditions, as shown in the table below. If this is not done, it may, depending on the case, result in unnecessary troubleshooting for normally operating systems, thus making it more difficult to locate the problem, or in repairs not pertinent to the problem. Therefore, always follow the procedure in correct order and perform the diagnostic trouble code check.

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

Diagnostic Trouble Code Check (Make a note of and then clear)	Confirmation of Symptoms	Diagnostic Trouble Code Check	Problem Condition
Diagnostic Trouble Code Display	Problem symptoms exist	Same diagnostic trouble code is displayed	Problem is still occurring in the diagnostic circuit
		Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit. (The diagnostic trouble code displayed first is either for a past problem or it is a secondary problem.)
	No problem symptoms exist		The problem occurred in the diagnostic circuit in the past.
Normal Code Display	Problem symptoms exist	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit.
	No problem symptoms exist	Normal code is displayed	The problem occurred in a place other than in the diagnostic circuit in the past.

Taking into account the above points, a flow chart showing how to proceed with troubleshooting using the diagnostic trouble code check is shown below. This flow chart shows how to utilize the diagnostic trouble code check effectively, then by carefully checking the results, indicates how to proceed either to diagnostic trouble code troubleshooting or to troubleshooting of problem symptoms.

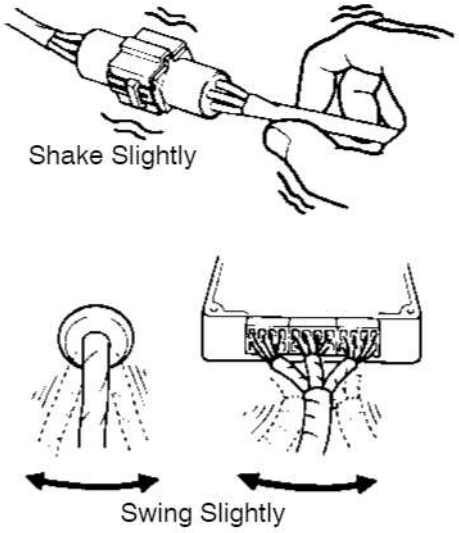
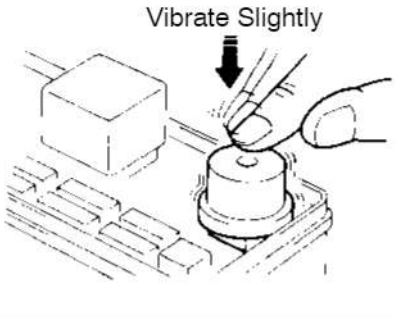


3. SYMPTOM SIMULATION

The most difficult case in troubleshooting is when there are no problem symptoms occurring. In such cases, a thorough customer problem analysis must be carried out, then simulate the same or similar conditions and environment in which the problem occurred in the customer's vehicle. No matter how much experience a technician has, or how skilled he may be, if he proceeds to troubleshoot without confirming the problem symptoms he will tend to overlook something important in the repair operation and make a wrong guess somewhere, which will only lead to a standstill. For example, for a problem which only occurs when the engine is cold, or for a problem which occurs due to vibration caused by the road during driving, etc., the problem can never be determined so long as the symptoms are confirmed with the engine hot condition or the vehicle at a standstill. Since vibration, heat or water penetration (moisture) are likely causes for problems which are difficult to reproduce, the symptom simulation tests introduced here are effective measures in that the external causes are applied to the vehicle in a stopped condition.

Important Points in the Symptom Simulation Test:

In the symptom simulation test, the problem symptoms should of course be confirmed, but the problem area or parts must also be found out. To do this, narrow down the possible problem circuits according to the symptoms before starting this test and connect a tester beforehand. After that, carry out the symptom simulation test, judging whether the circuit being tested is defective or normal and also confirming the problem symptoms at the same time. Refer to the matrix chart of problem symptoms for each system to narrow down the possible causes of the symptom.

1	**VIBRATION METHOD: When vibration seems to be the major cause.**
CONNECTORS Slightly shake the connector vertically and horizontally. **WIRE HARNESS** Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.	
PARTS AND SENSOR Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs. HINT: Applying strong vibration to relays may result in open relays.	

V07268

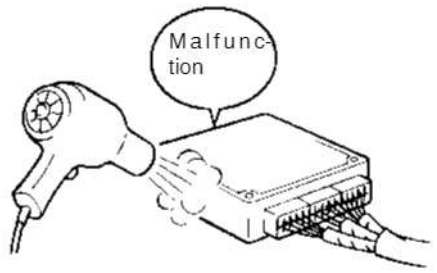
2	**HEAT METHOD: When the problem seems to occur when the suspect area is heated.**

Heat the component that is the likely cause of the malfunction with a hair dryer or similar object. Check to see if the malfunction occurs.

NOTICE:

(1) Do not heat to more than 60°C (140°F). (Temperature limit that no damage is done to the component.)

(2) Do not apply heat directly to parts in the ECU.



FI2334

3	**WATER SPRINKLING METHOD: When the malfunction seems to occur on a rainy day or in a high–humidity condition.**

Sprinkle water onto the vehicle and check to see if the malfunction occurs.

NOTICE:

(1) Never sprinkle water directly into the engine compartment, but indirectly change the temperature and humidity by applying water spray onto the radiator front surface.

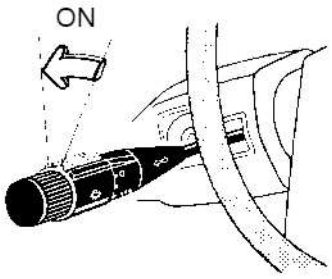
(2) Never apply water directly onto the electronic components.

(Service hint)
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.

FI6649

4	**OTHER: When a malfunction seems to occur when electrical load is excessive.**

Turn on all electrical loads including the heater blower, head lights, rear window defogger, etc. and check to see if the malfunction occurs.



FI2336

V07469

4. DIAGNOSTIC TROUBLE CODE CHART

The inspection procedure is shown in the table below. This table permits efficient and accurate troubleshooting using the diagnostic trouble codes displayed in the diagnostic trouble code check. Proceed with troubleshooting in accordance with the inspection procedure given in the diagnostic chart corresponding to the diagnostic trouble codes displayed. The engine diagnostic trouble code chart is shown below as an example.

- DTC No.
  Indicates the diagnostic trouble code.
- Page or Instructions
  Indicates the page where the inspection procedure for each circuit is to be found, or gives instructions for checking and repairs.

- Trouble Area
  Indicates the suspect area of the problem.

- Detection Item
  Indicates the system of the problem or contents of the problem.

DTC CHART (SAE Controlled)

HINT: Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in check mode, check the circuit for that code listed in the table below. For details of each code, turn to the page referred to under the "See page" for the respective "DTC No." in the DTC chart.

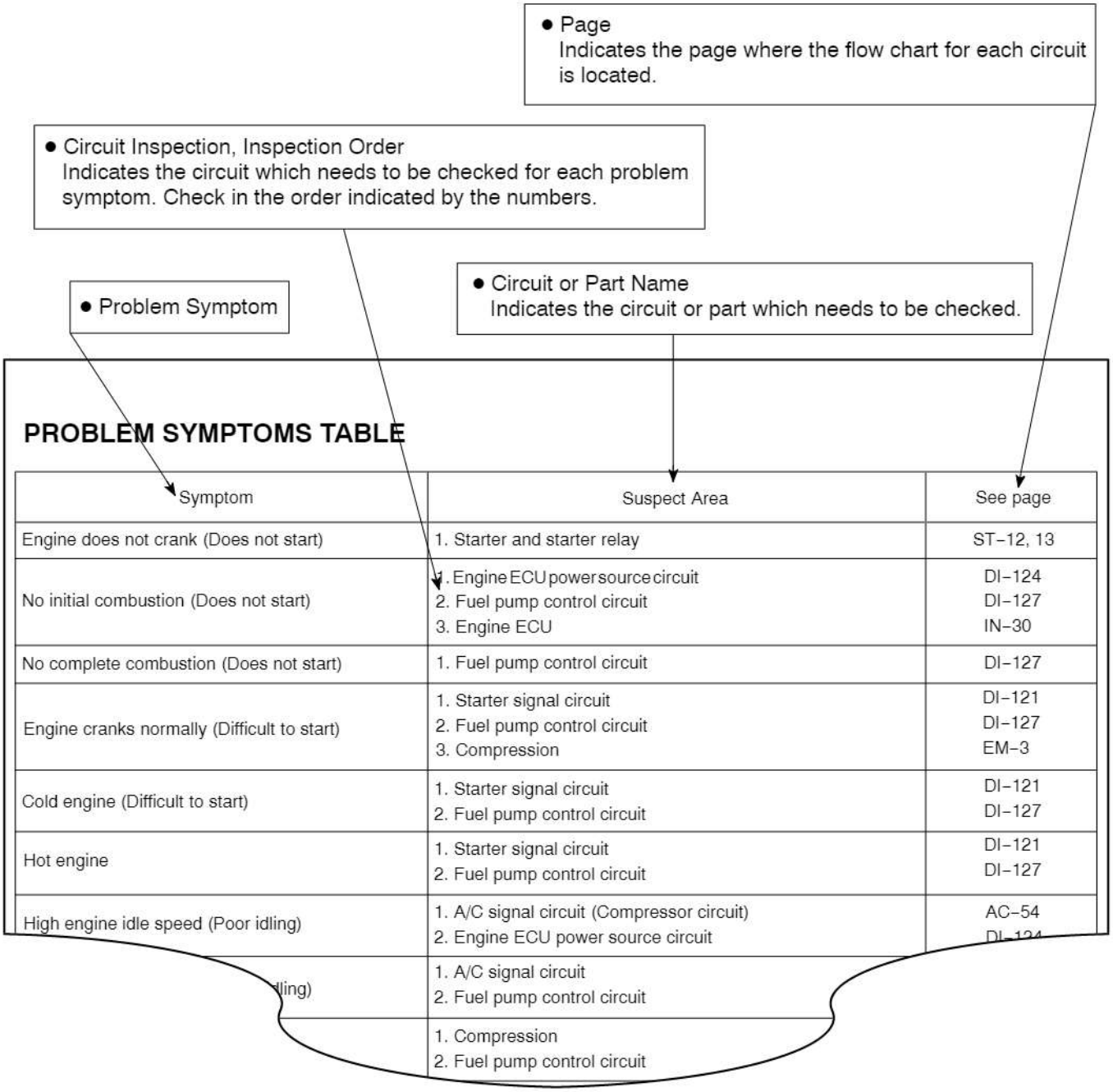
DTC No. (See page)	Detection Item	Trouble Area	CHK ENG *1	*Memory
P0105/31 (DI–12)	Vacuum Sensor Circuit Malfunction	• Open or short in vacuum sensor circuit • Vacuum sensor • Engine ECU	○	○
P0110/24 (DI–28)	Intake Air Temp. Circuit Malfunction	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • Engine ECU	–	○
P0115/22 (DI–31)	Water Temp. Circuit Malfunction	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU	○	○
P0120/41 (DI–32)	Throttle Position Sensor Circuit Malfunction	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU	–	○
		• Open or short in Oxygen sensor circuit • Oxygen sensor		

5. PROBLEM SYMPTOMS TABLE

The suspect circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshooting the problem when a "Normal" code is displayed in the diagnostic trouble code check but the problem is still occurring. Numbers in the table indicate the inspection order in which the circuits or parts should be checked.

HINT:

When the problem is not detected by the diagnostic system even though the problem symptom is present, it is considered that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a system other than the diagnostic system.

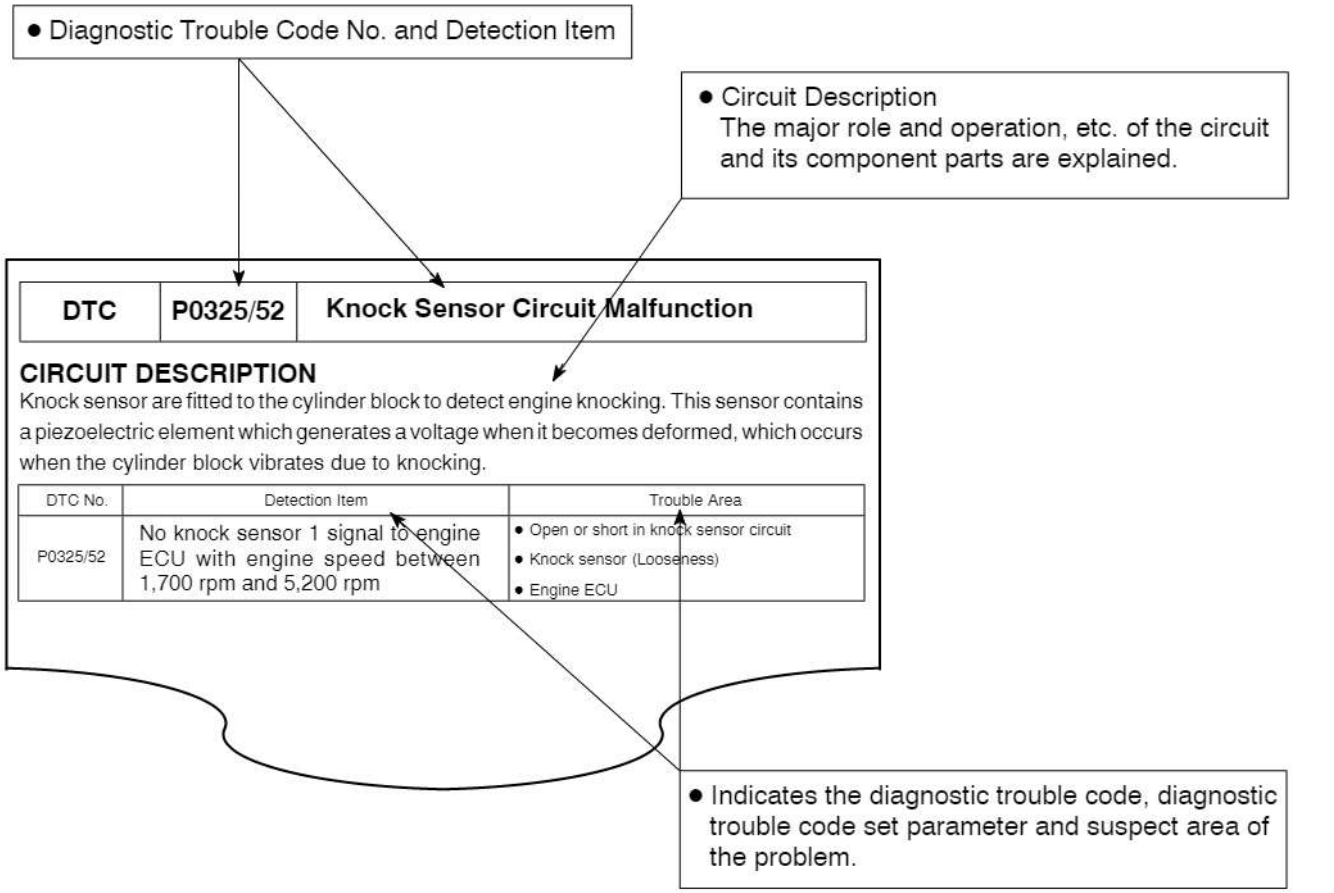


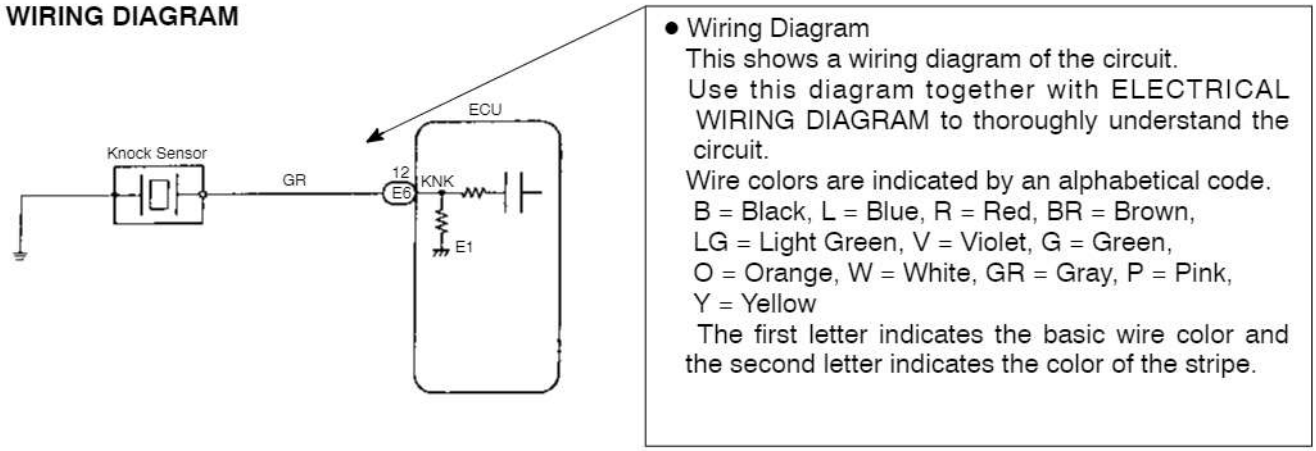
PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter and starter relay	ST–12, 13
No initial combustion (Does not start)	1. Engine ECU power source circuit 2. Fuel pump control circuit 3. Engine ECU	DI–124 DI–127 IN–30
No complete combustion (Does not start)	1. Fuel pump control circuit	DI–127
Engine cranks normally (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit 3. Compression	DI–121 DI–127 EM–3
Cold engine (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–127
Hot engine	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–127
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU power source circuit	AC–54 DI–124
dling)	1. A/C signal circuit 2. Fuel pump control circuit	
	1. Compression 2. Fuel pump control circuit	

6. CIRCUIT INSPECTION

How to read and use each page is shown below.





V08423

● Indicates the position of the ignition switch during the check.

LOCK
Ignition Switch LOCK (OFF)

ON
Ignition Switch ON

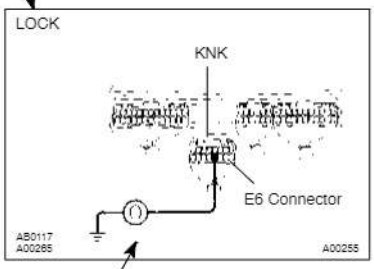
START
Ignition Switch START

ACC
Ignition Switch ACC

● Inspection Procedure
Use the inspection procedure to determine if the circuit is normal or abnormal, and , if it is abnormal, use it to determine whether the problem is located in the sensors, actuators, wire harness or ECU.

INSPECTION PROCEDURE

1	**Check continuity between terminal KNK of ECU connector and body ground.**



PREPARATION:
(a) Remove the glove compartment (See page FI–37).
(b) Disconnect the E6 connector of ECU.

CHECK:
Measure resistance between terminal KNK of ECU connector and body ground.

OK:
Resistance: 1 MΩ or higher

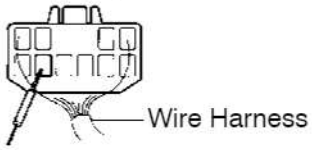
OK	**Go to step 3.**

NG

2	**Check knock sensor (See page FI–34).**

OK	**Replace knock sensor.**

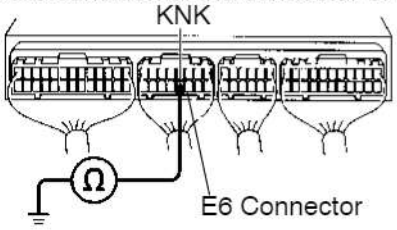
● Indicates the place to check the voltage or resistance.
● Indicates the connector position to checked, from the front or back side.



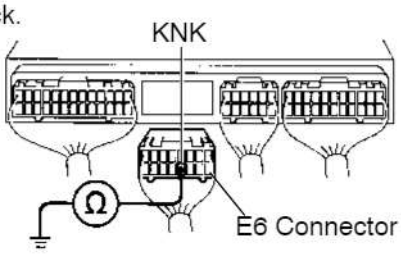
Check from the connector back side. (with harness)

Check from the connector front side. (without harness)
In this case, care must be taken not to bend the terminals.

● Indicates the condition of the connector of ECU during the check.

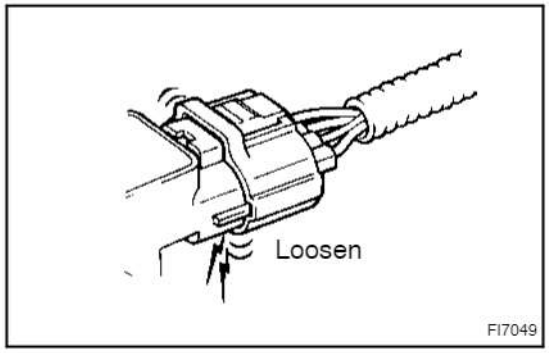


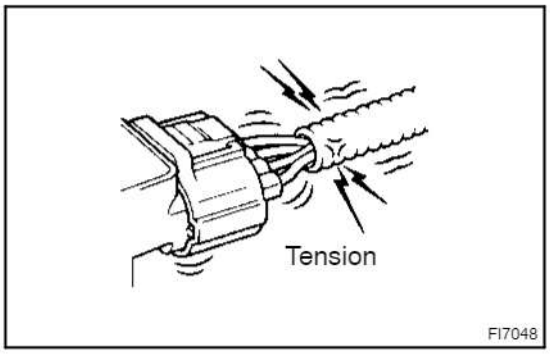
Connector being checked is connected.



Connector being checked is disconnected.

V08425





IN0BW–01

HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

1. CONNECTOR CONNECTION AND TERMINAL INSPECTION

- For troubleshooting, diagnostic trouble code charts or problem symptom charts are provided for each circuit with detailed inspection procedures on the following pages.

- When all the component parts, wire harnesses and connectors of each circuit except the ECU are found to be normal in troubleshooting, then it is determined that the problem is in the ECU. Accordingly, if diagnosis is performed without the problem symptoms occurring, the instruction will be to check and replace the ECU, even if the problem is not in the ECU. So always confirm that the problem symptoms are occurring, or proceed with inspection while using the symptom simulation method.
- The instructions "Check wire harness and connector" and "Check and replace ECU" which appear in the inspection procedure, are common and applicable to all diagnostic trouble codes. Follow the procedure outlined below whenever these instructions appear.

OPEN CIRCUIT:

This could be due to a disconnected wire harness, faulty contact in the connector, a connector terminal pulled out, etc.

HINT:

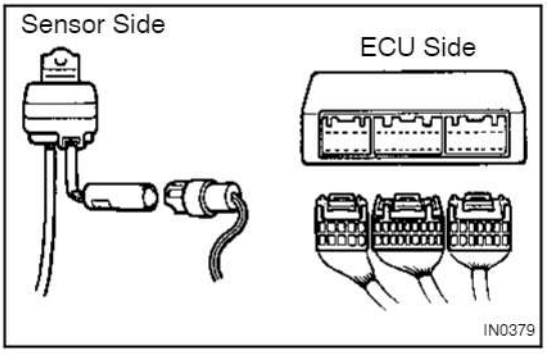
- It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
- Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the contact pressure between the male and female terminals of the connector. Simply disconnecting and reconnecting the connectors once changes the condition of the connection and may result in a return to normal operation. Therefore, in troubleshooting, if no abnormality is found in the wire harness and connector check, but the problem disappears after the check, then the cause is considered to be in the wire harness or connectors.

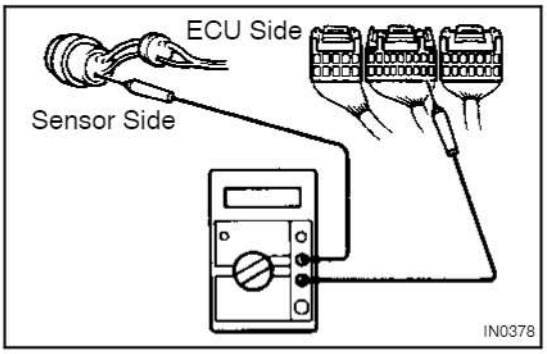
SHORT CIRCUIT:

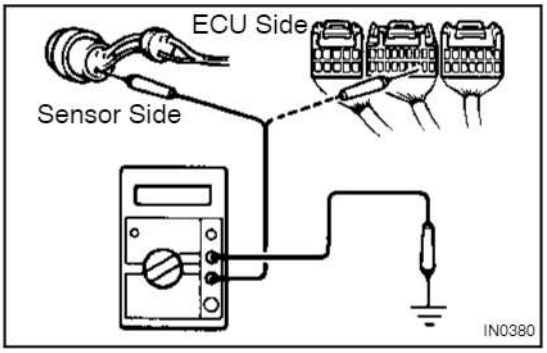
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.

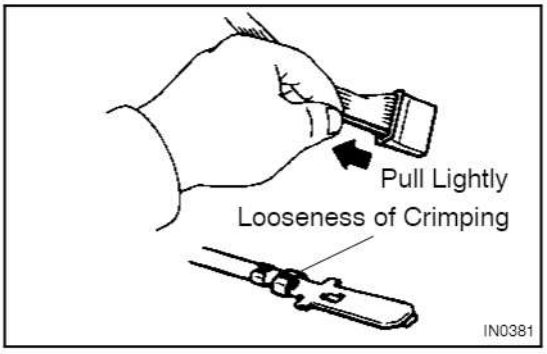
HINT:

When there is a short between the wire harness and body ground, check thoroughly whether the wire harness is caught in the body or is clamped properly.









2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

(a) Disconnect the connectors at both ECU and sensor sides.

(b) Measure the resistance between the applicable terminals of the connectors.

Resistance: 1 Ω or less

HINT:

- Measure the resistance while lightly shaking the wire harness vertically and horizontally.
- When tester probes are inserted into a connector, insert the probes from the back. For waterproof connectors in which the probes cannot be inserted from the back, be careful not to bend the terminals when inserting the tester probes.

3. RESISTANCE CHECK (SHORT CIRCUIT CHECK)

(a) Disconnect the connectors at both ends.

(b) Measure the resistance between the applicable terminals of the connectors and body ground. Be sure to carry out this check on the connectors on both ends.

Resistance: 1 MΩ or higher

HINT:

Measure the resistance while lightly shaking the wire harness vertically and horizontally.

4. VISUAL CHECK AND CONTACT PRESSURE CHECK

(a) Disconnect the connectors at both ends.

(b) Check for rust or foreign material, etc. in the terminals of the connectors.

(c) Check crimped portions for looseness or damage and check if the terminals are secured in lock portion.

HINT:

The terminals should not come out when pulled lightly.

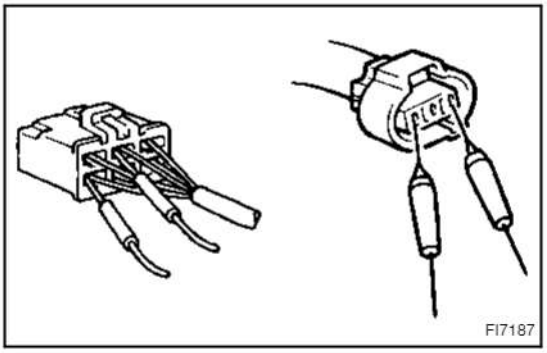
(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.

NOTICE:

When testing a gold–plated female terminal, always use a gold–plated male terminal.

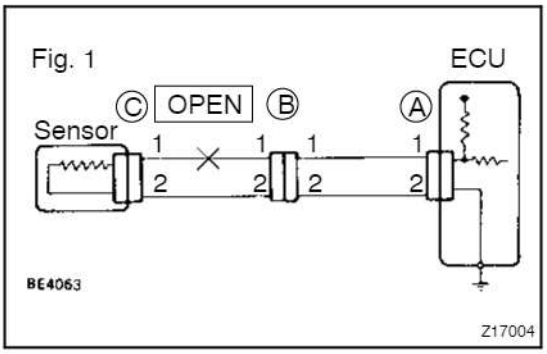
HINT:

When the test terminal is pulled out more easily than others, there may be poor contact in that section.



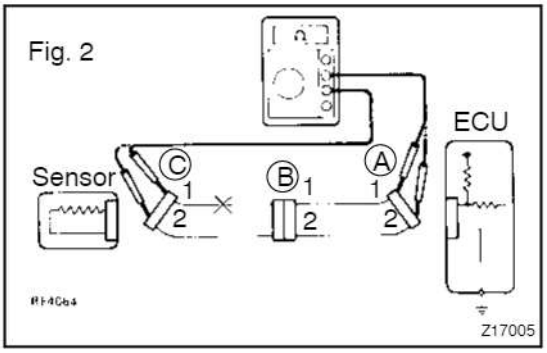
5. CONNECTOR HANDLING

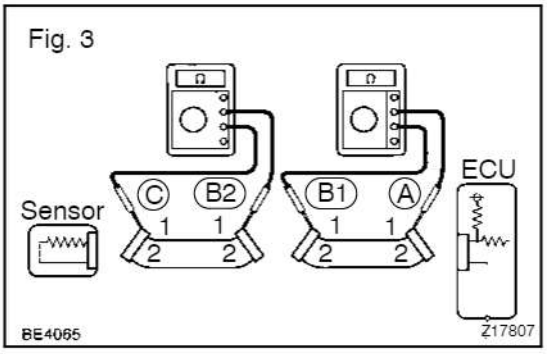
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.



6. CHECK OPEN CIRCUIT

For the open circuit in the wire harness in Fig. 1, perform "(a) Continuity Check" or "(b) Voltage Check" to locate the section.



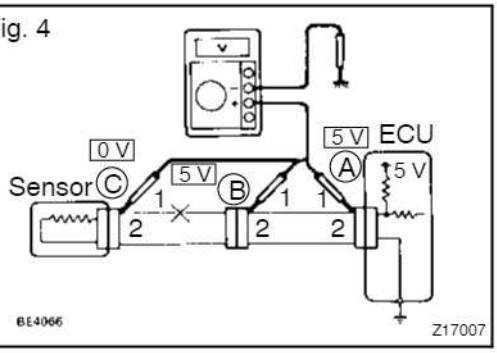


(a) Check the continuity.

(1) Disconnect connectors "A" and "C" and measure the resistance between them.
In the case of Fig. 2,
Between terminal 1 of connector "A" and terminal 1 of connector "C" → No continuity (open)
Between terminal 2 of connector "A" and terminal 2 of connector "C" → Continuity
Therefore, it is found out that there is an open circuit between terminal 1 of connector "A" and terminal 1 of connector "C".

(2) Disconnect connector "B" and measure the resistance between them.
In the case of Fig. 3,
Between terminal 1 of connector "A" and terminal 1 of connector "B1" → Continuity
Between terminal 1 of connector "B2" and terminal 1 of connector "C" → No continuity (open)
Therefore, it is found out that there is an open circuit between terminal 1 of connector "B2" and terminal 1 of connector "C".

Fig. 4



(b) Check the voltage.

In a circuit in which voltage is applied (to the ECU connector terminal), an open circuit can be checked for by conducting a voltage check.

As shown in Fig. 4, with each connector still connected, measure the voltage between body ground and terminal 1 of connector "A" at the ECU 5 V output terminal, terminal 1 of connector "B", and terminal 1 of connector "C", in that order.

If the results are:

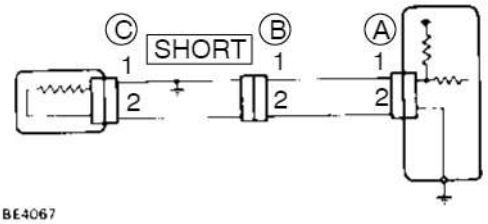
5 V: Between Terminal 1 of connector "A" and Body Ground

5 V: Between Terminal 1 of connector "B" and Body Ground

0 V: Between Terminal 1 of connector "C" and Body Ground

Then it is found out that there is an open circuit in the wire harness between terminal 1 of "B" and terminal 1 of "C".

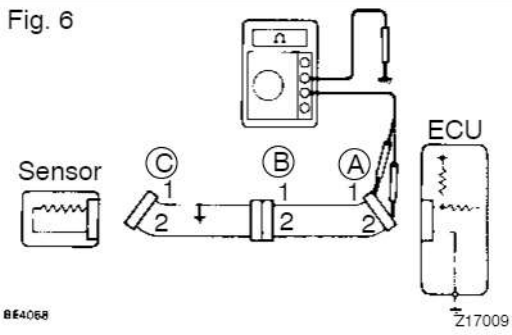
Fig. 5



7. CHECK SHORT CIRCUIT

If the wire harness is ground shorted as in Fig. 5, locate the section by conducting a "continuity check with ground".

Fig. 6



Check the continuity with ground.

(1) Disconnect connectors "A" and "C" and measure the resistance between terminal 1 and 2 of connector "A" and body ground.

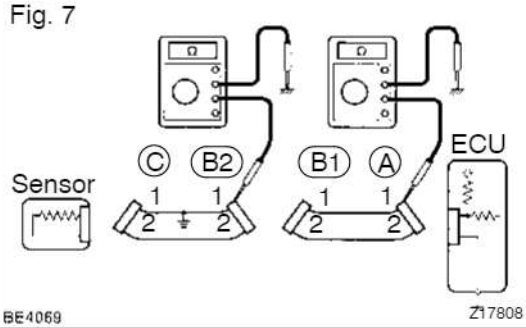
In the case of Fig. 6

Between terminal 1 of connector "A" and body ground → Continuity (short)

Between terminal 2 of connector "A" and body ground → No continuity

Therefore, it is found out that there is a short circuit between terminal 1 of connector "A" and terminal 1 of connector "C".

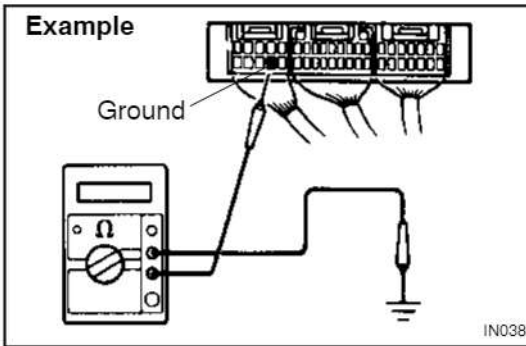
Fig. 7



(2) Disconnect connector "B" and measure the resistance between terminal 1 of connector "A" and body ground, and terminal 1 of connector "B2" and body ground.
In the case of Fig. 7
Between terminal 1 of connector "A" and body ground → No continuity
Between terminal 1 of connector "B2" and body ground → Continuity (short)
therefore, it is found out that there is a short circuit between terminal 1 of connector "B2" and terminal 1 of connector "C".

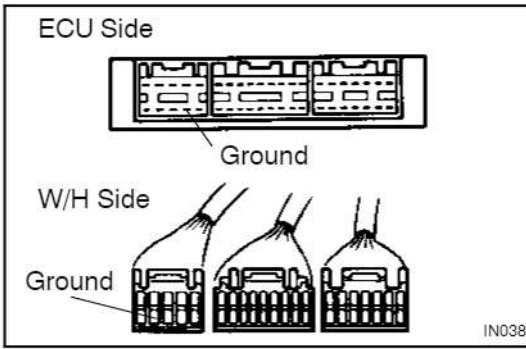
8. CHECK AND REPLACE ECU

First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty, so replace the ECU with a known good one and check if the symptoms appear.



(1) Measure the resistance between the ECU ground terminal and the body ground.

Resistance: 1 Ω or less



(2) Disconnect the ECU connector, check the ground terminals on the ECU side and the wire harness side for bend and check the contact pressure.

TERMS

ABBREVIATIONS USED IN THIS MANUAL

IN00S–06

Abbreviations	Meaning
A/C	Air Conditioner
A/T	Automatic Transmission
BTDC	Before Top Dead Center
DLC3	Data Link Connector 3
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EVAP	Evaporative Emission Control
FIPG	Formed In Place Gasket
FL	Fusible Link
IG	Ignition
J/B	Junction Block
LH	Left–Hand
LHD	Left–Hand Drive
M/T	Manual Transmission
O/S	Oversize
PCV	Positive Crankcase Ventilation
RH	Right–Hand
RHD	Right–Hand Drive
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TWC	Three–Way Catalyst
U/S	Undersize
VSV	Vacuum Switching Valve
w/	With
w/o	Without

EMISSION CONTROL

EQUIPMENT

PP1PW–01

MITYVAC (Hand–held vacuum pump)	

CHARGING

RECOMMENDED TOOLS

FP1B3–06

	09082–00040 TOYOTA Electrical Tester.	

PP154–04

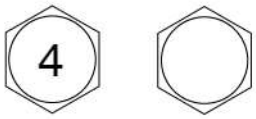
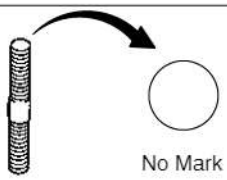
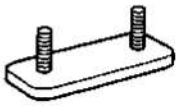
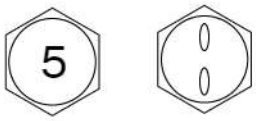
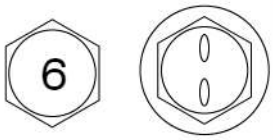
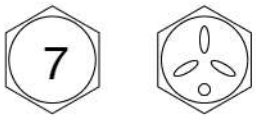
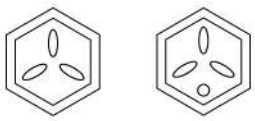
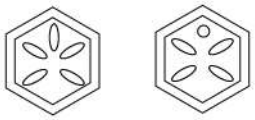
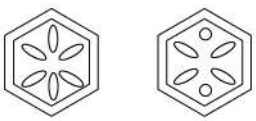
EQUIPMENT

Ammeter(A)	
Vernier calipers	Rotor (Slip ring)

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

SS0ZS–01

Bolt Type				Class
Hexagon Head Bolt		Stud Bolt	Weld Bolt	
Normal Recess Bolt	Deep Recess Bolt			
 No Mark	 No Mark	 No Mark		4T
				5T
 w/ Washer	 w/ Washer			6T
				7T
				8T
				9T
				10T
				11T

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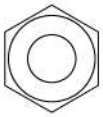
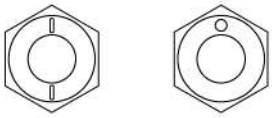
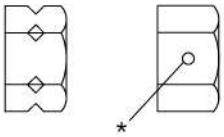
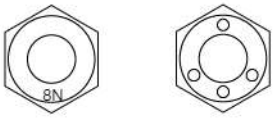
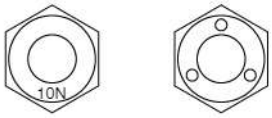
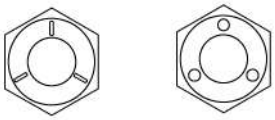
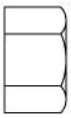
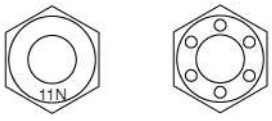
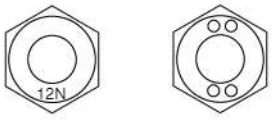
SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	–	–	–
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	–	–	–
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	–	–	–
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	–	–	–
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

SS0ZU-01

HOW TO DETERMINE NUT STRENGTH

Nut Type			Class
Present Standard Hexagon Nut	Old Standard Hexagon Nut		
	Cold Forging Nut	Cutting Processed Nut	
 No Mark			4N
 No Mark (w/ Washer)	 No Mark (w/ Washer)	 No Mark	5N (4T)
 6N			6N
		 *	7N (5T)
 8N			8N
 10N		 No Mark	10N (7T)
 11N			11N
 12N			12N

*: Nut with 1 or more marks on one side surface of the nut.

B06432

HINT:

Use the nut with the same number of the nut strength classification or the greater than the bolt strength classification number when tightening parts with a bolt and nut.

Example: Bolt = 4T

Nut = 4N or more

EMISSION CONTROL

TORQUE SPECIFICATION

SS0X1–01

Part tightened	N·m	kgf·cm	ft·lbf
Front exhaust pipe x Exhaust manifold	62	632	46
Front exhaust pipe x Center pipe	40	408	30
Oxygen sensor x Front exhaust pipe	20	200	14

CHARGING

SERVICE DATA

SS0T0-04

Battery	Specific gravity	at 20°C (68°F)	1.25 – 1.29
	Voltage	at 20°C (68°F)	12.5 – 12.9 V
Alternator	Rotor coil resistance	at 20°C (68°F)	2.1 – 2.5 Ω
	Slip ring diameter	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
		Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
		Minimum	1.5 mm (0.059 in.)
IC regulator	Regulating voltage		13.2 – 14.8 V