# CHARGING SYSTEM

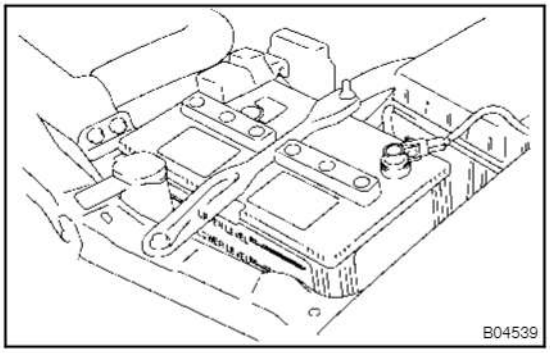
CH033–02

## PRECAUTION

1. **Check that the battery cables are connected to the correct terminals.**
2. **Disconnect the battery cables when the battery is given a quick charge.**
3. **Do not perform tests with a high voltage insulation resistance tester.**
4. **Never disconnect the battery while the engine is running.**

CH034–03

# ON–VEHICLE INSPECTION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## 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). Check the charging system.

Except Maintenance–Free Battery:

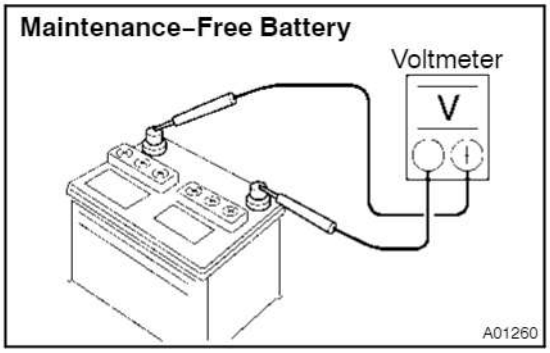
If under the lower level, add distilled water.


## 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)**

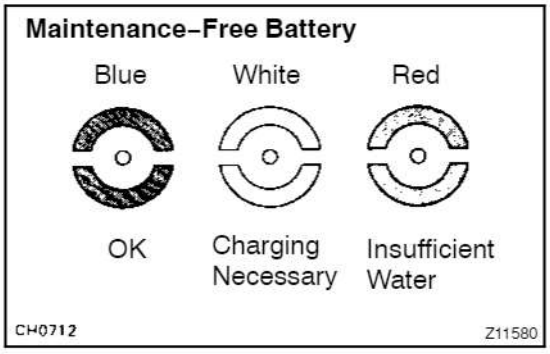
If the specific gravity is less than specification, charge the battery.




## 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.

HINT:

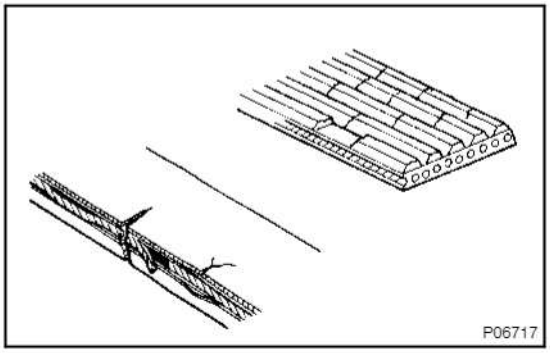
Check the indicator as shown in the illustration.

## 4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

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

If the terminals are corroded, clean the terminals.

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




**5. INSPECT DRIVE BELT**

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

If any defect has been found, replace the drive belt.

HINT:

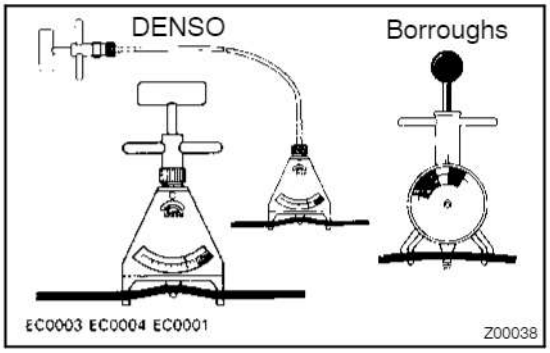
Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

(b) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

**Drive belt deflection:**
**New belt 11 – 15 mm (0.43 – 0.59 in.)**
**Used belt 15 – 20 mm (0.59 – 0.79 in)**

If necessary, adjust the drive belt deflection.

**Reference**



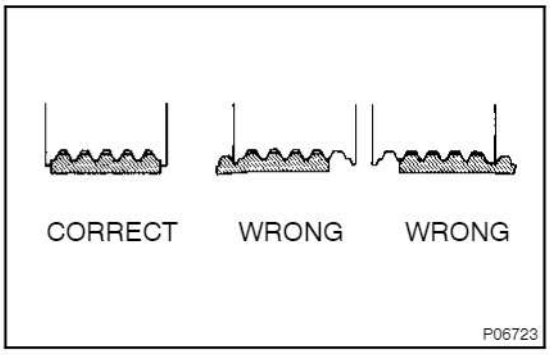

(c) Using a belt tension gauge, measure the belt tension.

**Belt tension gauge:**
**Denso BTG–20 (95506–00020)**
**Borroughs No. BT–33–73F**
**Drive belt tension:**
**New belt 310 – 510 N (33 – 57 kgf)**
**Used belt 148 – 345 N (15 – 35 kgf)**

If the belt tension is not as specified, adjust it.

HINT:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.




**6. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES**

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

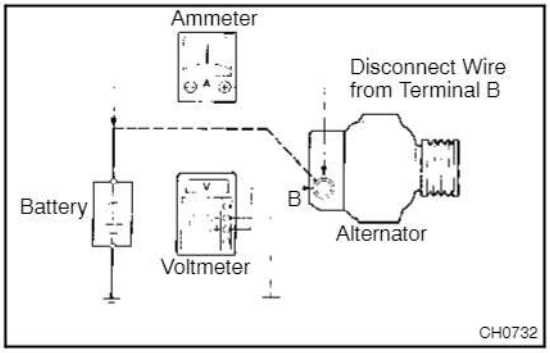
(b) Check that there is no abnormal noise from the alternator while the engine is running.

**7. INSPECT DISCHARGE WARNING LIGHT CIRCUIT**

(a) Turn the ignition switch "ON". Check that the discharge warning light comes on.

(b) Start the engine. Check that the light goes off.

If the light does not operate as specified, troubleshoot the discharge warning light circuit.



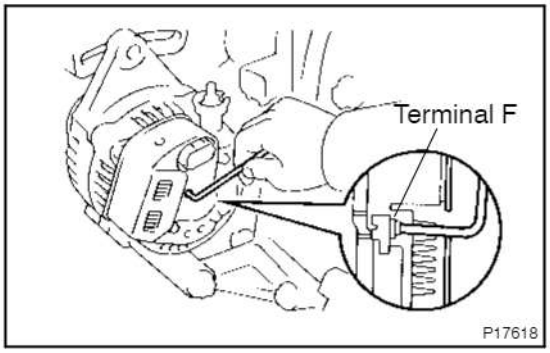

### 8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

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 (–) lead of the ammeter.
- Connect the positive (+) lead of the ammeter to terminal B of the generator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- Ground the negative (–) lead of the voltmeter.

(b) Check the charging circuit as follows:
With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.
**Standard amperage:**
**10 A or less**
**Standard voltage:**
**14.0 – 15.0 V at 25°C (77°F)**




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

If the voltmeter reading is less than the standard voltage, check the voltage regulator and generator as follows:
- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.
- If the voltmeter reading is more than the standard voltage, replace the IC regulator.
- If the voltmeter reading is less than the standard voltage, check the alternator.

### 9. 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.

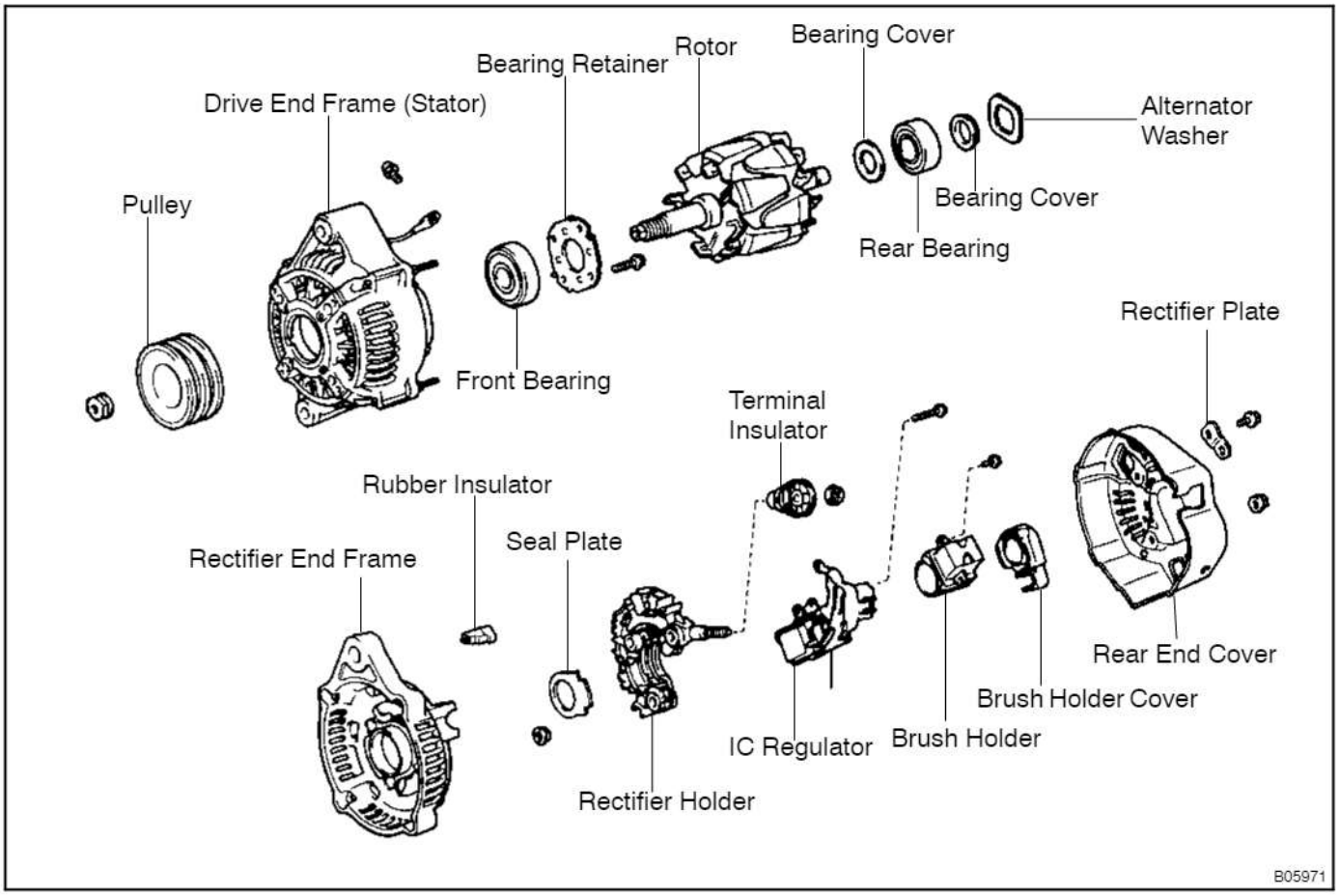
HINT:

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

# ALTERNATOR

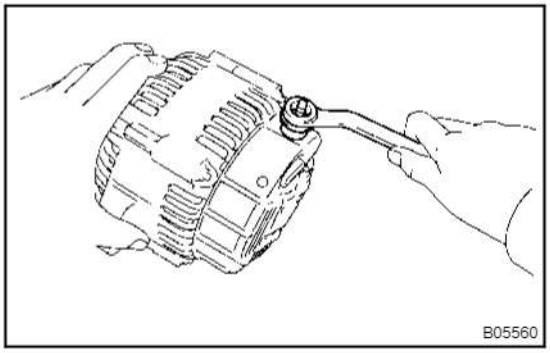
## COMPONENTS

CH06R-02



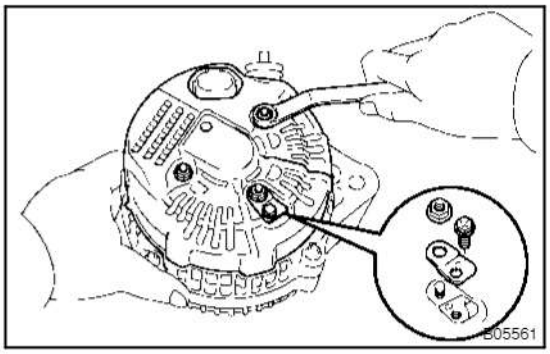
CH0AI–01

# DISASSEMBLY

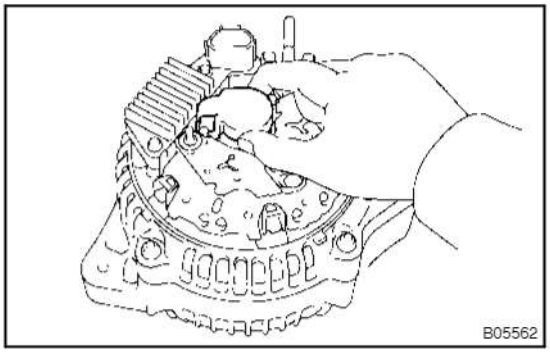



**1. REMOVE REAR END COVER**

(a) Remove the nut and terminal insulator.

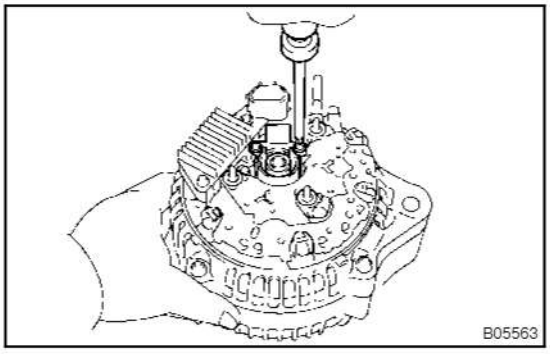



(b) Remove the 3 nuts and rear end cover.

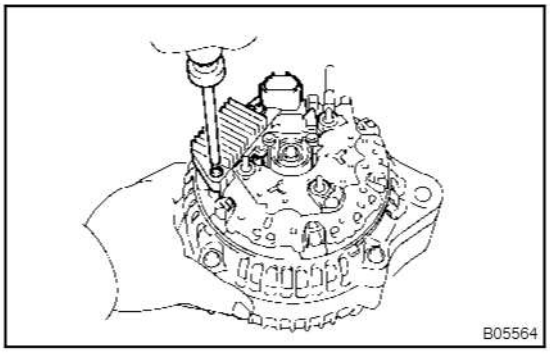



**2. REMOVE BRUSH HOLDER AND IC REGULATOR**

(a) Remove the 5 screws, brush holder and IC regulator.

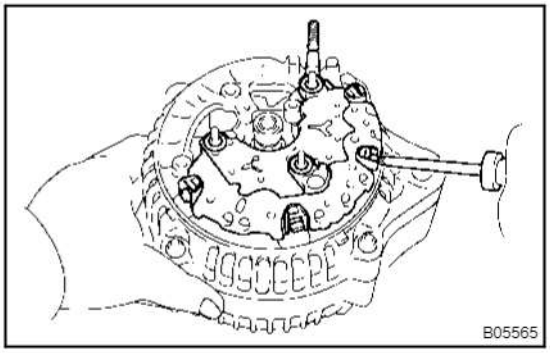



(b) Remove the brush holder cover from the brush holder.



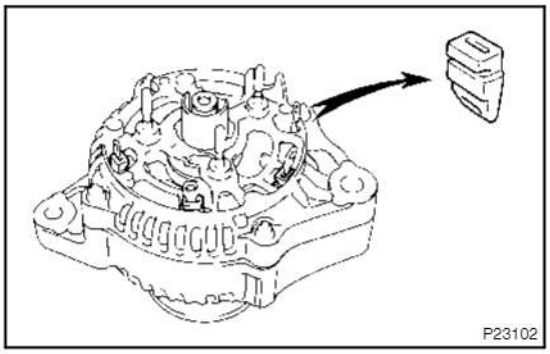

**3. REMOVE IC REGULATOR**

Remove the 3 screws and IC regulator.

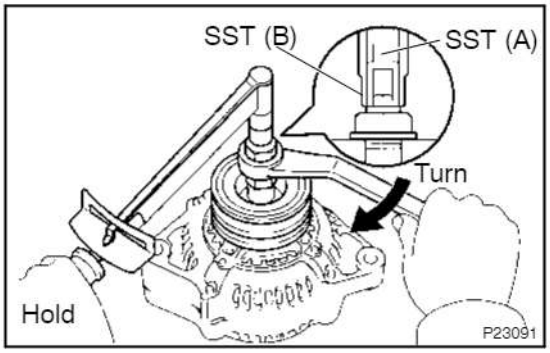



**4. REMOVE RECTIFIER HOLDER**

(a) Remove the 4 screws and rectifier holder.



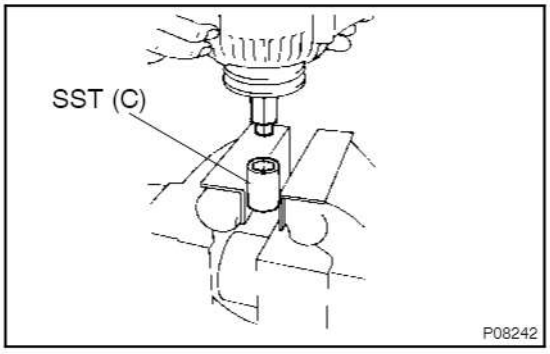

(b) Remove the 4 rubber insulators.




**5. REMOVE PULLEY**

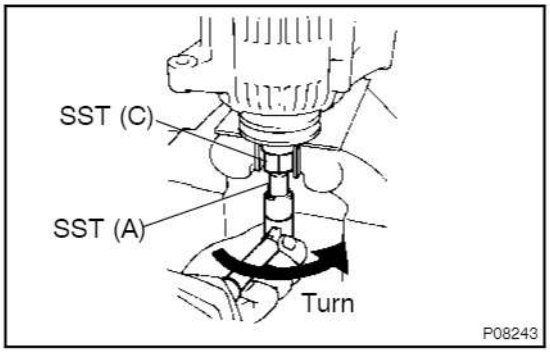
(a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
**Torque: 39 N·m (400 N·m, 29 ft·lbf)**

(b) Check that SST (A) is secured to the rotor shaft.




(c) Mount SST (C) in a vise.

(d) Install the generator to SST (C).




(e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

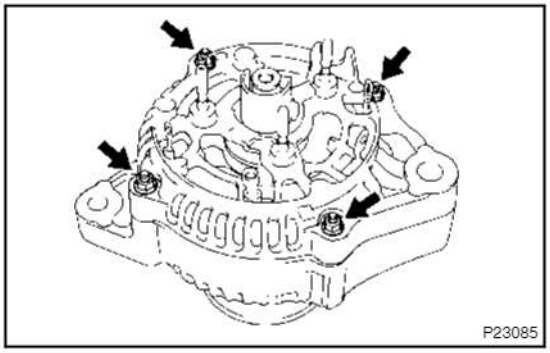
**NOTICE:**

**To prevent damage to the rotor shaft, do not loosen the pulley nut more than one–half of a turn.**

(f) Remove the generator from SST (C).

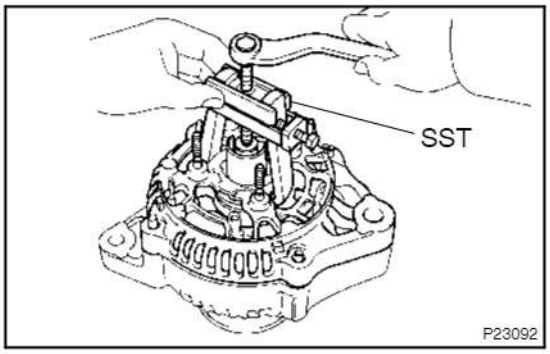
(g) Turn SST (B) and remove SST (A and B).

(h) Remove the pulley nut and pulley.

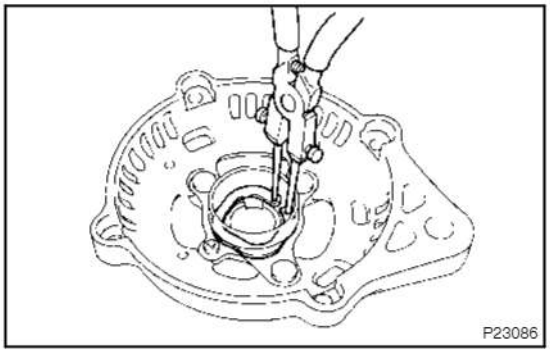



**6. REMOVE RECTIFIER END FRAME**

(a) Remove the 4 nuts.




(b) Using SST, remove the rectifier end frame.
SST 09286–46011




(c) Using snap ring pliers, remove the alternator washer from the rectifier end frame.

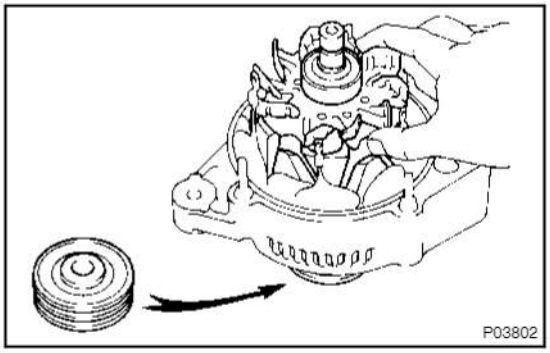
**7. REMOVE ROTOR FROM DRIVE END FRAME**

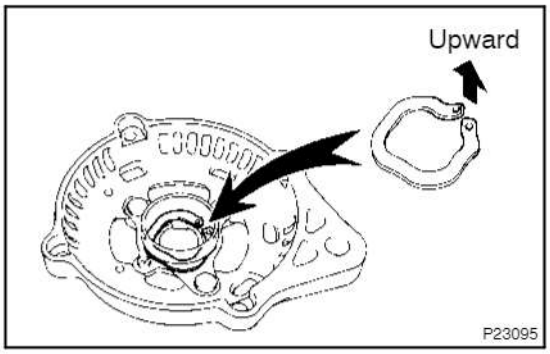
CH0AJ–01

# REASSEMBLY

**1. PLACE RECTIFIER END FRAME ON PULLEY**

**2. INSTALL ROTOR TO DRIVE END FRAME**



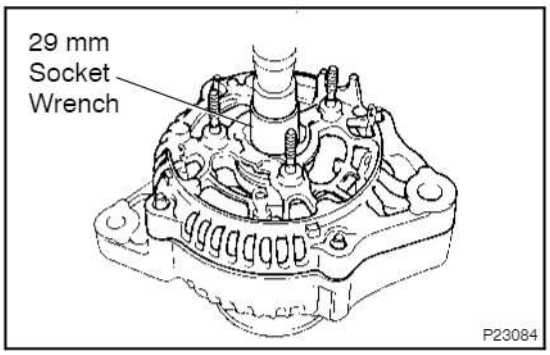




**3. INSTALL RECTIFIER END FRAME**

(a) Install the generator washer to the rectifier end frame.

**NOTICE:**

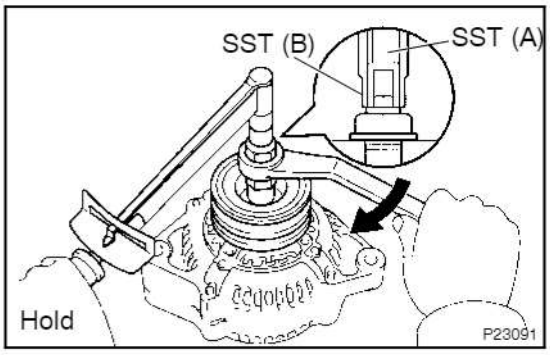
**Be careful of the generator washer installation direction.**




(b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

(c) Install the 4 nuts.

**Torque: 4.5 N·m (46 kgf·cm, 40 in.·lbf)**




**4. INSTALL PULLEY**

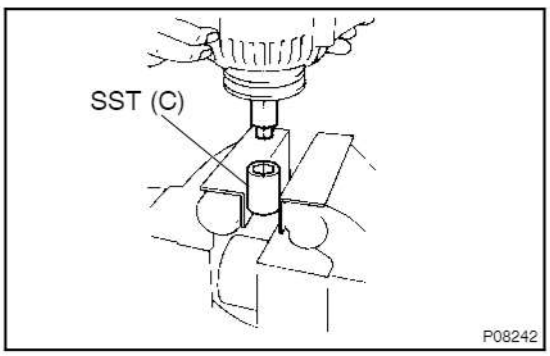
(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

(b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820–63010

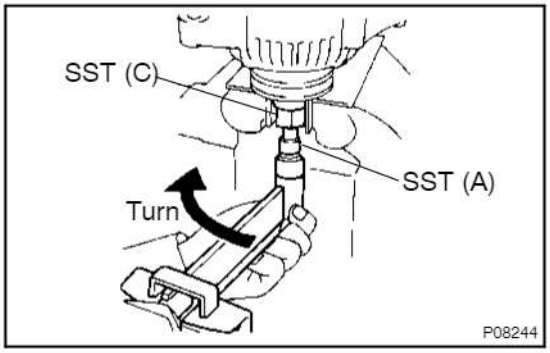
**Torque: 39 N·m (400 kgf·cm, 29 in.·lbf)**

(c) Check that SST (A) is secured to the pulley shaft.

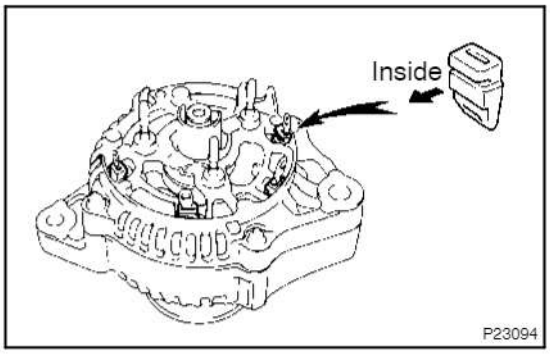



(d) Mount SST (C) in a vise.

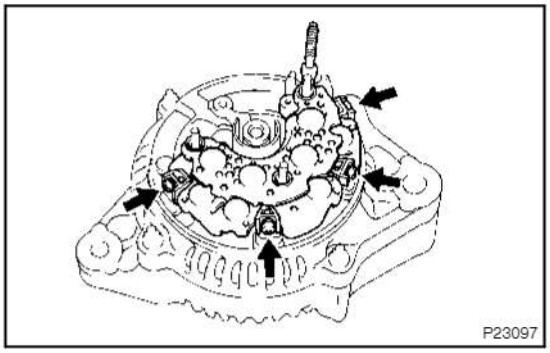
(e) Install the generator to SST (C).



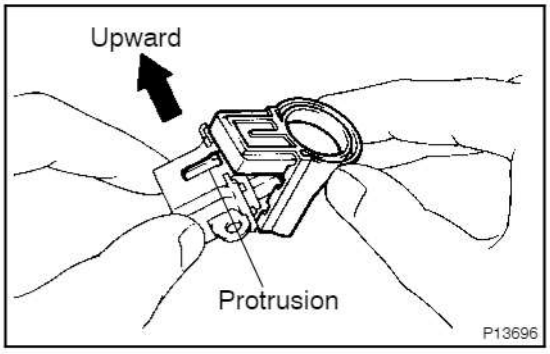

(f) To torque the pulley nut turn SST (A) in the direction shown in the illustration.
**Torque: 110 N·m (1,125 kgf·cm, 81 in.·lbf)**
(g) Remove the generator from SST (C).
(h) Turn SST (B), and remove SST (A and B).



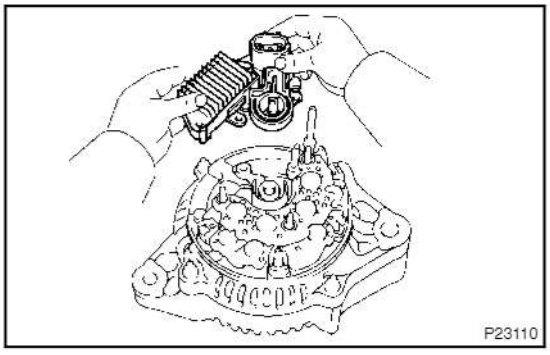

**5. INSTALL RECTIFIER HOLDER**
(a) Install the 4 rubber insulators on the lead wires.
**NOTICE:**
**Be careful of the rubber insulators installation direction.**



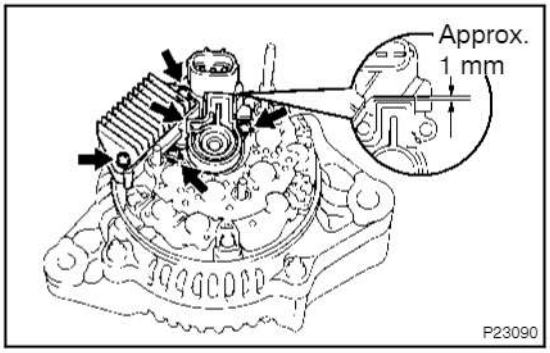

(b) Install the rectifier holder with the 4 screws.
**Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)**



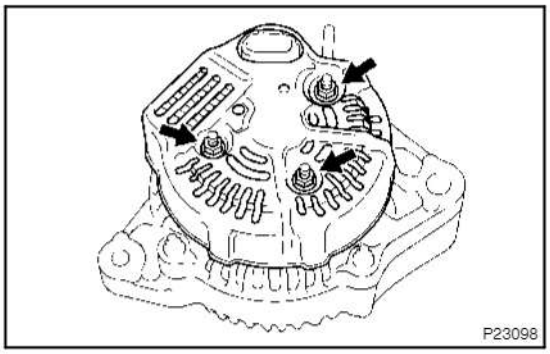

**6. INSTALL IC REGULATOR AND BRUSH HOLDER**
(a) Install the brush holder cover to the brush holder.
**NOTICE:**
**Be careful of the holder installation direction.**




(b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.

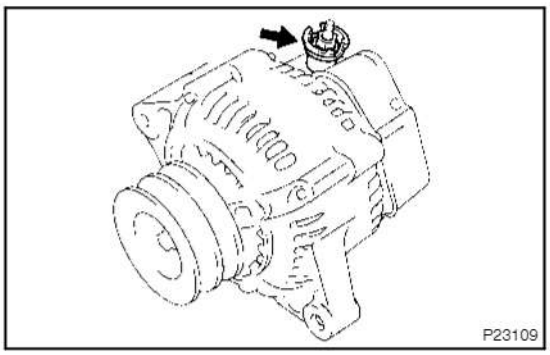



(c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and IC regulator.
(d) Fit the brush holder cover.

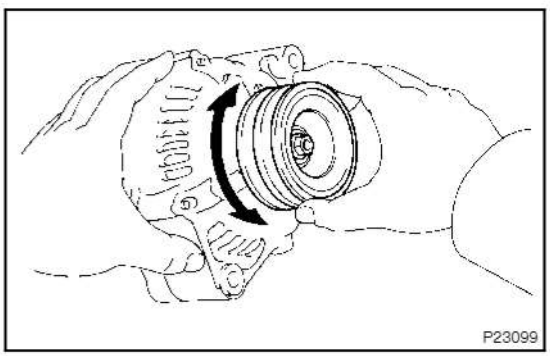



**7. INSTALL REAR END COVER**

(a) Instal the end cover together with the rectifier plate. Hand tighten the bolt first for positioning the plate. Tighten the 3 nuts and retighten the bolt.
**Torque: 4.4 N·m (45 kgf·cm, 39 in.·lbf)**




(b) Install the terminal insulator with the nut.
**Torque: 4.1 N·m (42 kgf·cm, 36 in.·lbf)**




**8. CHECK THAT ROTOR ROTATES SMOOTHLY**

# COOLANT

## INSPECTION

CO0RR-02

HINT:

Check the coolant level when the engine is cold.

**1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR**

The engine coolant level should be between the "LOW" and "FULL" lines at normal temperature (20°C (68°F)).

If low, check for leaks and add engine coolant up to the "FULL" line.

**2. CHECK ENGINE COOLANT QUALITY**

(a) Remove the radiator cap.

**CAUTION:**

**To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**

(b) There should not be any excessive deposits of rust or scale around the radiator cap or radiator filter hole, and the coolant should be free from oil.

If excessively dirty, clean the coolant passages and replace the coolant.

(c) Reinstall the radiator cap.

# COOLANT

## REPLACEMENT

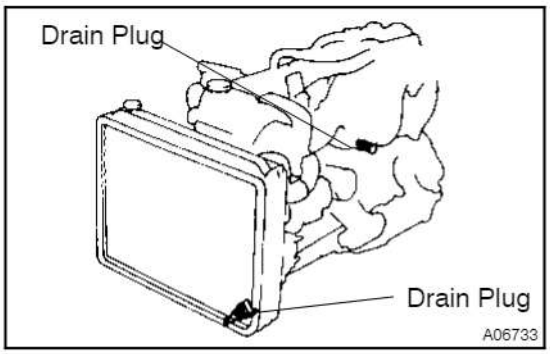
CO0RS–01

### 1. DRAIN ENGINE COOLANT

(a) Remove the radiator cap.

**CAUTION:**

**To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**




(b) Loosen the 2 drain plugs on the engine and radiator, and drain the coolant.

(c) Close the 2 drain plugs.

**Torque: 29.0 N·m (300 kgf·cm, 22 ft·lbf) for engine**

### 2. REFILL WITH ENGINE COOLANT

(a) slowly fill the system with coolant.

- Use a good brand of ethylene– glycol base coolant and mix it according to the manufacturer's directions.
- Using coolant which includes more than50 % ethylene–glycol (but not more than 70 %) is recommended.

**NOTICE:**

- **Do not use an alcohol type coolant.**
- **the coolant should be mixed with demineralized water or distilled water.**

**Capacity:**

**G.C.C. countries:**

**M/T: 13.9 liters (14.7 US qts, 12.2 Imp. qts)**

**A/T: 13.5 liters (14.2 US qts, 11.9 Imp. qts)**

**Others:**

**M/T:**

**w/ rear heater: 14.3 liters (15.1 US qts, 12.6 Imp. qts)**

**w/o rear heater: 13.8 liters (14.6 US qts, 12.1 Imp. qts)**

**A/T:**

**w/ rear heater: 13.9 liters (14.7 US qts, 12.2 Imp. qts)**

**w/o rear heater: 13.4 liters (14.2 US qts, 11.8 Imp. qts)**

(b) Install the radiator cap.

(c) Bleed the cooling system.

(1) Start the engine, and open the heater water valve.

(2) Maintain the engine speed at 2,000 – 2,500 rpm, and warm up the engine.

(d) Stop the engine, and wait until the engine coolant cools down.

(e) Refill the radiator reservoir with coolant until it reaches the "FULL" line.

### 3. CHECK FOR ENGINE COOLANT LEAKS

# RADIATOR

CO0RT-01

## ON–VEHICLE CLEANING

Using water or a steam cleaner, remove any mud and dirt from the radiator core.

**NOTICE:**

**If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. (i.e. Maintain a distance between the cleaner nozzle and radiator core.)**

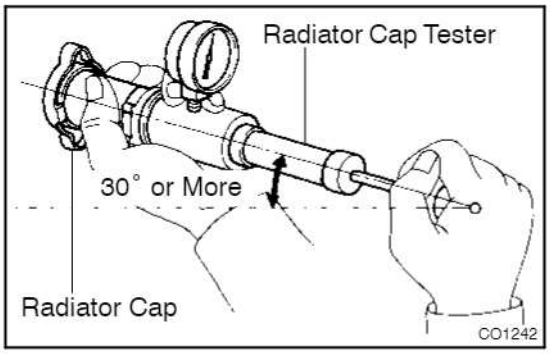
CO0RU–01

# ON–VEHICLE INSPECTION

## 1. REMOVE RADIATOR CAP

**CAUTION:**

**To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**




## 2. INSPECT RADIATOR CAP

**NOTICE:**

- **If the radiator cap has contaminations, always rinse it with water.**
- **When performing steps (a) and (b) below, keep the radiator cap tester at an angle of over 30° above the horizontal.**

(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the vacuum valve.

**Pump speed: 1 push/(3 seconds or more)**

**NOTICE:**

**Push the pump at a constant speed.**

If air is not coming from the vacuum valve, replace the radiator cap.

(b) Pump the tester and measure the relief valve opening pressure.

**Pump speed: 1 push within 1 second**

**NOTICE:**

**This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.**

**Standard opening pressure:**

**93 – 123 kPa (0.95 – 1.25 kgf/cm$^2$, 13.5 – 17.8 psi)**

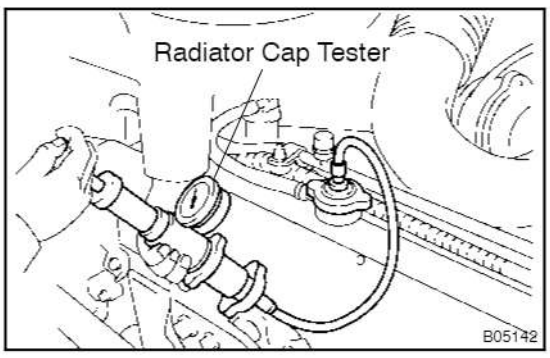
**Minimum opening pressure:**

**78 kPa (0.8 kgf/cm$^2$, 11.4 psi)**

HINT:

Use the tester's maximum reading as the opening pressure.

If the opening pressure is less than minimum, replace the radiator cap.




## 3. INSPECT COOLING SYSTEM FOR LEAKS

(a) Fill the radiator with coolant, and attach a radiator cap tester to the radiator.

(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm$^2$, 17.1 psi), and check that the pressure does not drop.

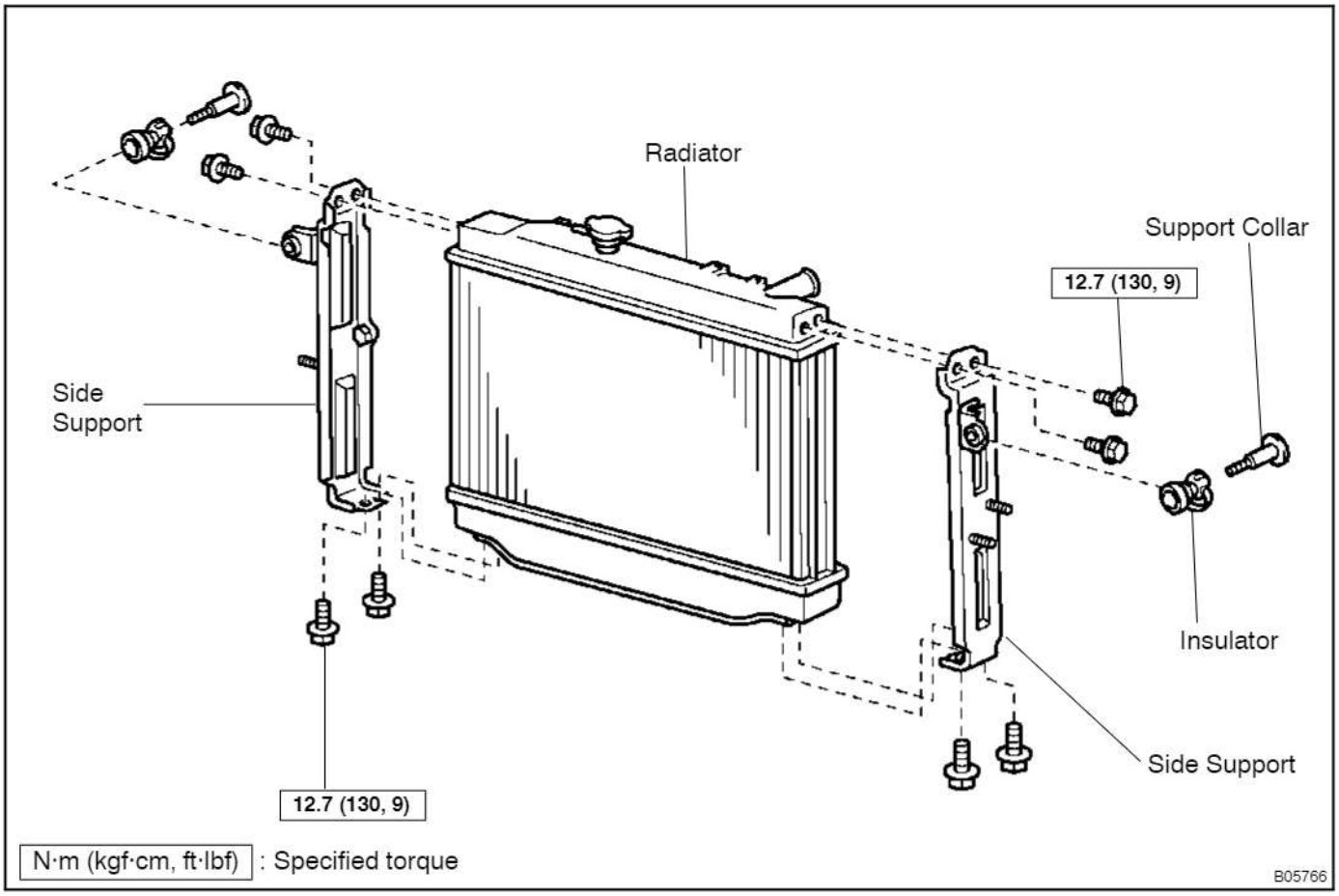
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

## 4. REINSTALL RADIATOR CAP

# RADIATOR

## COMPONENTS

CO0RV-02

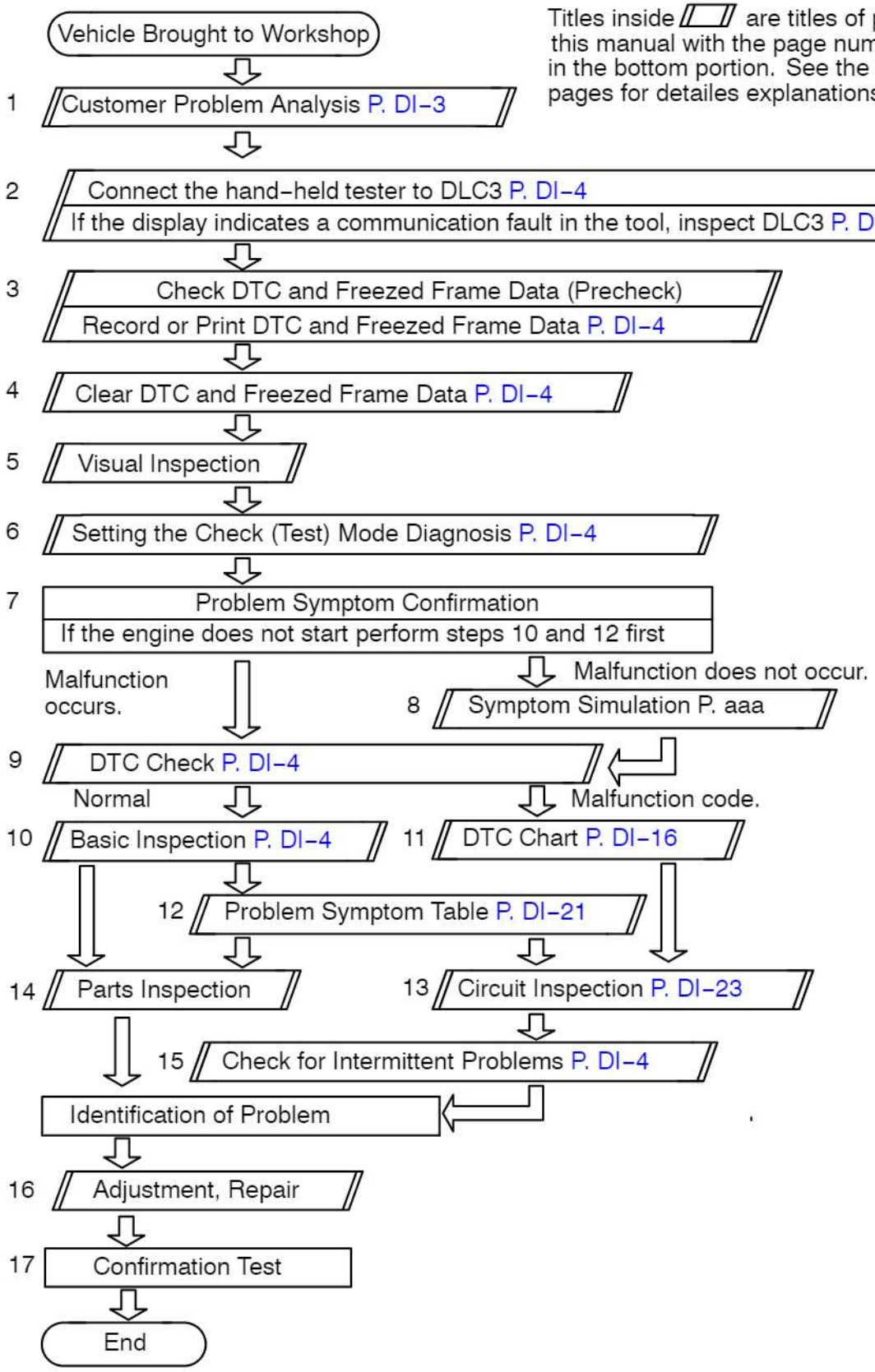


# ENGINE

## HOW TO PROCEED WITH TROUBLESHOOTING

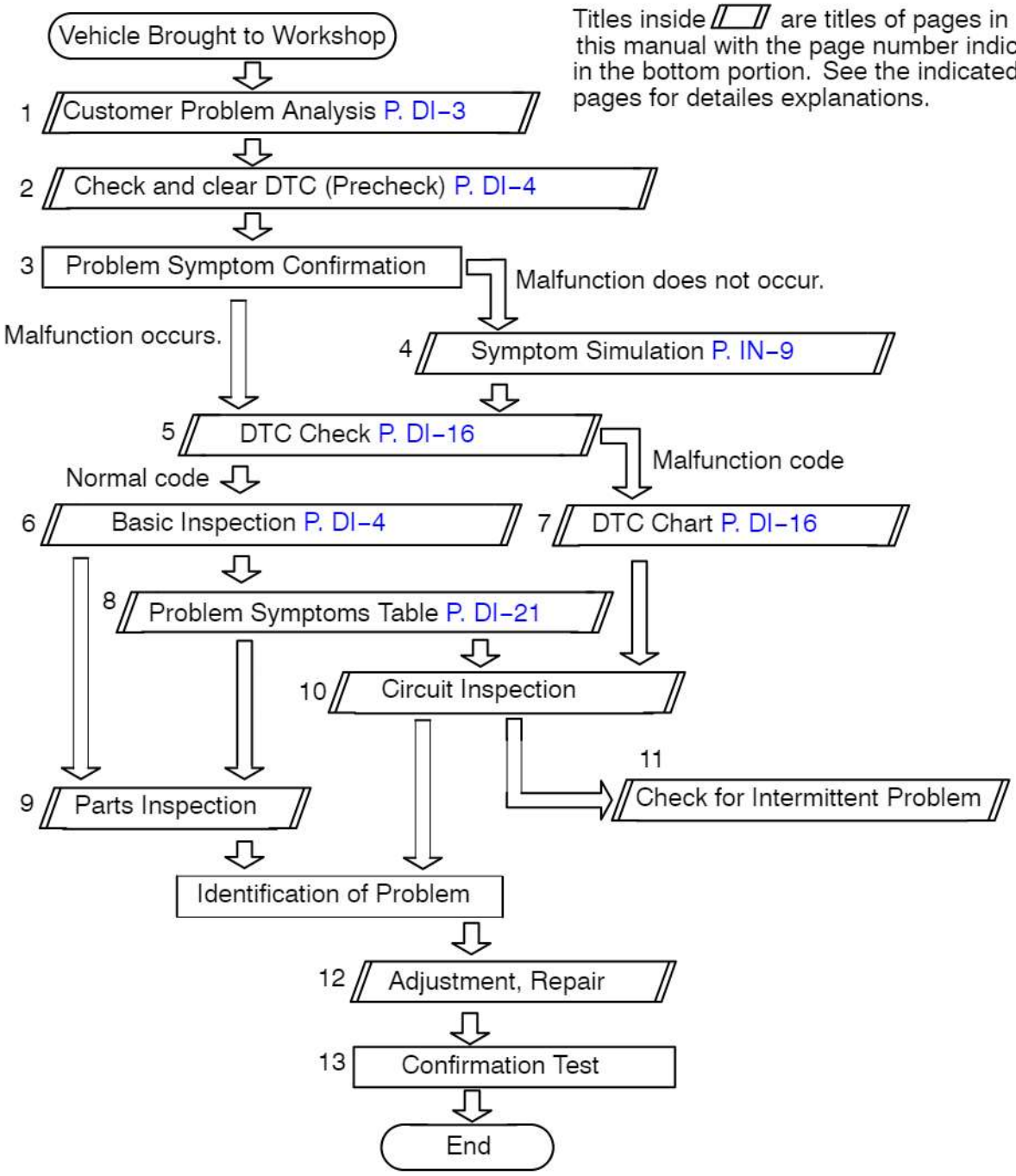
DI1I4–07

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




Titles inside ▱ are titles of pages in this manual with the page number indicated in the bottom portion. See the indicated pages for detailes explanations.

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



DI1I5-02

# 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<br>☐ Other _____ |
| ☐ Poor Idling | ☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High ( rpm) ☐ Low ( rpm)<br>☐ Rough idling ☐ Other _____ |
| ☐ Poor Driveability | ☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-fire) ☐ Surging<br>☐ Knocking ☐ Other _____ |
| ☐ Engine Stall | ☐ Soon after starting ☐ After accelerator pedal depressed<br>☐ After accelerator pedal released ☐ During A/C operation<br>☐ Shifting from N to D ☐ Other _____ |
| ☐ Others | |

| | |
|---|---|
| Dates Problem Occurred | |
| Problem Frequency | ☐ Constant ☐ Sometimes ( times per day/month) ☐ Once only<br>☐ Other _____ |

**Condition When Problem Occurs**

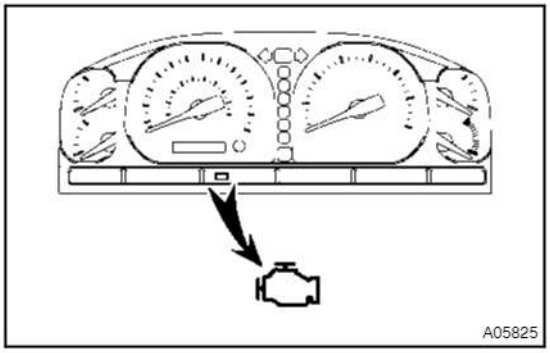
| | |
|---|---|
| Weather | ☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____ |
| Outdoor Temperature | ☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. ____ °F/____ °C) |
| Place | ☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill<br>☐ Rough road ☐ Other _____ |
| Engine Temp. | ☐ Cold ☐ Warming up ☐ After Warming up ☐ Any temp. ☐ Other _____ |
| Engine Operation | ☐ Starting ☐ Just after starting ( min.) ☐ Idling ☐ Racing<br>☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration<br>☐ A/C switch ON/OFF ☐ Other _____ |

| | | | |
|---|---|---|---|
| Condition of check engine warning light (CHK ENG) | | ☐ Remains on | ☐ Sometimes light up ☐ Does not light up |
| DTC Inspection | Normal mode (Precheck) | ☐ Normal | ☐ Malfunction code(s) (code )<br>☐ Freezed frame data ( ) |
| | Check Mode | ☐ Normal | ☐ Malfunction code(s) (code )<br>☐ Freezed frame data ( ) |

DI31A–03

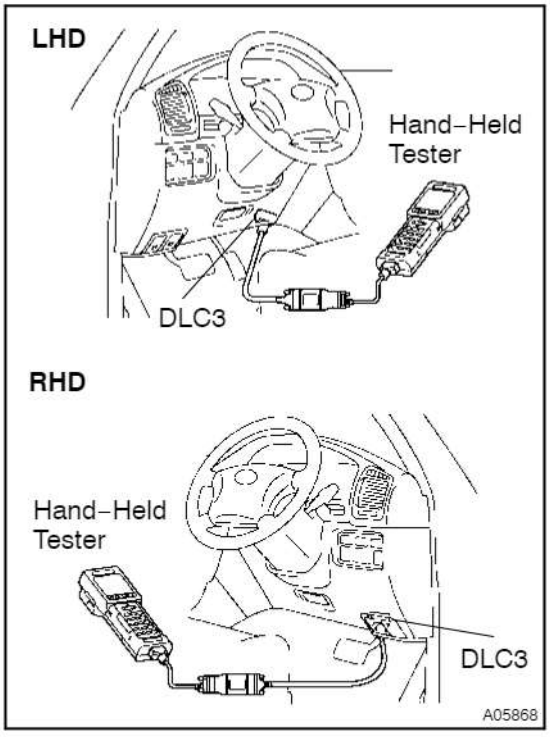
# PRE–CHECK

## 1. DIAGNOSIS SYSTEM



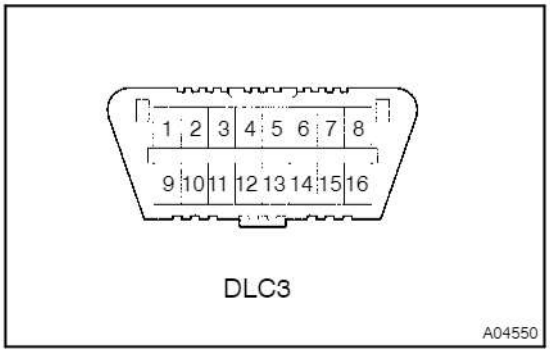

(a) Description

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand–held tester to the vehicle, and read off various data output from the vehicle's ECU.
- The vehicle's on–board computer lights up the 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 the check engine warning light lighting up when a malfunction is detected, the applicable Diagnosis Trouble Code (DTC) are recorded in the ECU memory. (See page DI–16) If the malfunction has been repaired, the check engine warning light goes off automatically but the DTCs remain recorded in the ECU memory.




- To check the DTCs, connect the hand–held tester to Data Link Connector 3 (DLC3) on the vehicle. or read the number of blinks of the check engine warning light 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 hand–held tester 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 ECU to check (test) mode using hand–held tester when troubleshooting, the technician can cause the check engine warning light (CHK ENG) to light up for a malfunction that is only detected once or momentarily. (Hand–held tester only)
(See step 3.)

- * 2 trip detection logic
  When a logic malfunction is fist detected, the malfunction is temporarily stored in the ECU memory. If the same malfunction is detected again during the second drive test, this second detection cases the check engine warning light (CHK ENG) to light up. The 2 trip repeats the same mode for 2 times. (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 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.

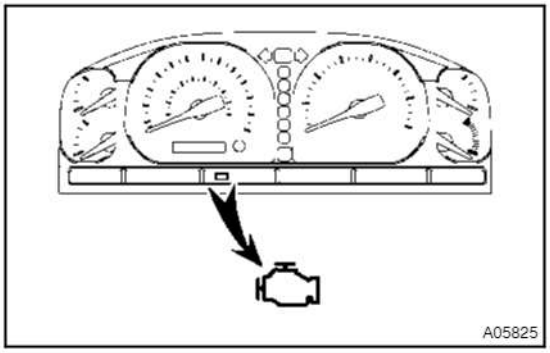



(b) Check the DLC3.
The vehicle's ECU uses the ISO 14230 for communication. The terminal arrangement of DLC3 complies with SAE J1962 and matches the ISO 14230 format.

| 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 is 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.




**2. INSPECT DIAGNOSIS (Normal Mode)**

(a) Check the check engine warning light.

(1) The check engine warning light (CHK ENG) comes on when the ignition switch is turned ON and the engine is not running.

HINT:

If the check engine warning light (CHK ENG) does not light up, troubleshoot the combination meter.

(2) When the engine is started, the check engine warning light should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system.

(b) 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.**

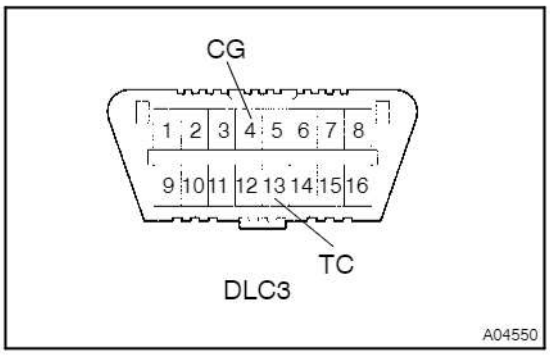
(1) Prepare the hand–held tester.

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

(3) Turn the ignition switch ON and switch 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,s instruction book.)

(5) See page DI–16 to confirm the details of the DTCs.

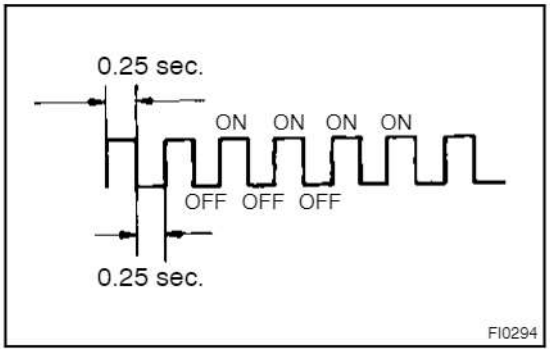



(c) If you have no hand–held tester, perform the following step (1) to (6).

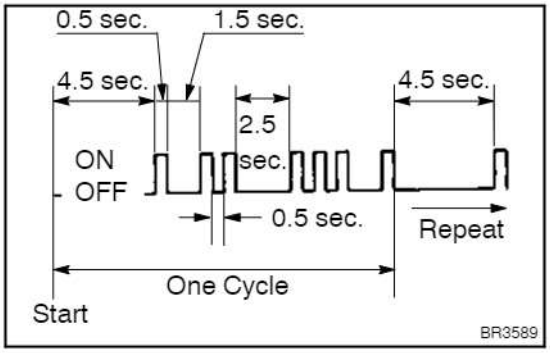
(1) Turn the ignition switch ON.

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

SST 09843–18040




(3) Read the DTC from the check engine warning light (CHK ENG).




(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.
(5) Check the details of the malfunction using the DTC chart on page DI–16.
(6) 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 cords, indication will begin from the smaller numbered cord and continue in order to the larger.

**NOTICE:**
**When simulating symptoms without a hand–held tester to check the DTCs, use normal mode. For codes on the DTCs 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 check engine warning light lights up and the DTCs are recorded in the ECU.**

(d) Clear the DTC.
The following actions will erase the DTCs and freezed frame data.
- Operating the hand–held tester to erase the codes. (See the hand–held tester's instruction book for operating instructions.)
- Disconnecting the battery terminals or EFI fuse.

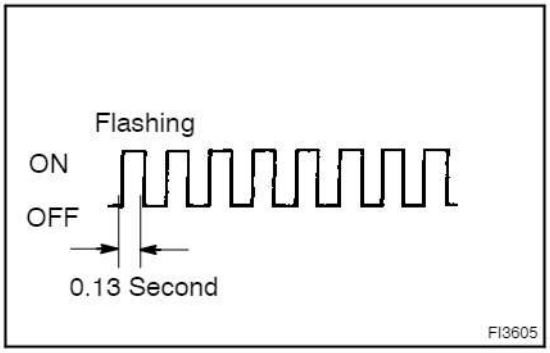
**NOTICE:**
**If the hand–held tester switches the ECU from normal mode to check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check mode, the DTCs and freezed frame data will be erased.**

### 3. INSPECT DIAGNOSIS (Check (Test) Mode)

Hand–held tester only:
Compared to the normal mode, the check 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 DLC3 in the fuse box of the instrument panel.
(5) Turn the ignition switch ON and switch the push the hand–held tester ON.




(6) Switch the hand–held tester normal mode to check (test) mode. (Check that the check engine warning light (CHK ENG) flashes.)

**NOTICE:**

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

(7) Start the engine. (The check engine warning light (CHK ENG) goes out after the engine start.)

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

**NOTICE:**

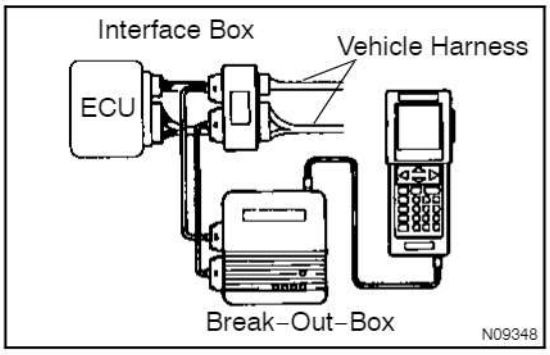
**Leave the ignition switch ON until you have checked the DTC, etc.**

(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 DTCs, inspect the applicable circuit.




(b) Using break–out–box and hand–held tester

(1) Hook up the break–out–box and hand–held tester to the vehicle.

(2) Read the ECU input/output values following the prompts on the tester screen.

HINT:

Hand–held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.

Please refer to the hand–held tester/break–out–box operator,s manual for further details.

## 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 |
|---|---|---|
| P0105/31 | Ignition timing fixed at 5° BTDC | Returned to normal condition |
| P0110/24 | Intake air temp. is fixed at 20°C (68°F) | Returned to normal condition |
| P0115/22 | Water temp. is fixed at 80°(176°F) | Returned to normal condition |
| P0120/41 | VTA is fixed at 0° | The following condition must be repeated at least 2 times consecutively<br>When closed throttle position switch is ON:<br>VTA ≧ 0.1 V and ≦ 0.95 V |
| P0330/55 | Max. timing retardation | Ignition switch OFF |
| P1300/14<br>P1310/15<br>P1320/14 | Fuel cut | IGF signal is detected for 6 consecutive ignitions |

## 5. CHECK FOR INTERMITTENT PROBLEMS

HAND–HELD TESTER only:

By putting the vehicle's 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 DTC (See step 2.).
(2) Set the check (test) mode (See step 3.).
(3) Perform a simulation test (See page IN–9).
(4) Check the connector and terminal (See page IN–19).
(5) Check the visual check and contact pressure (See page IN–19).
(6) Handle the connector (See page IN–19).

## 6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out 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–21.**

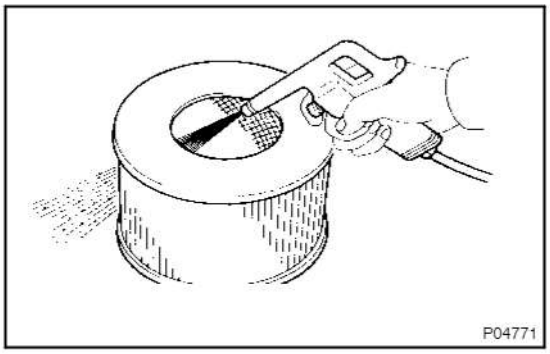
**YES**

| | |
|---|---|
| 3 | **Does engine start ?** |

**NO** → **Go to step 7.**

**YES**

| | |
|---|---|
| 4 | **Check air filter.** |

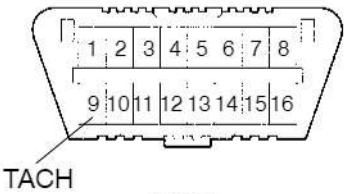



**PREPARATION:**
Remove the air filter.
**CHECK:**
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the filter.

**NG** → **Repair or replace**

**OK**

| 5 | **Check engine idle speed.** |
|---|---|




DLC3

A04550

**PREPARATION:**

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

**NOTICE:**

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

**CHECK:**

Check the idle speed.

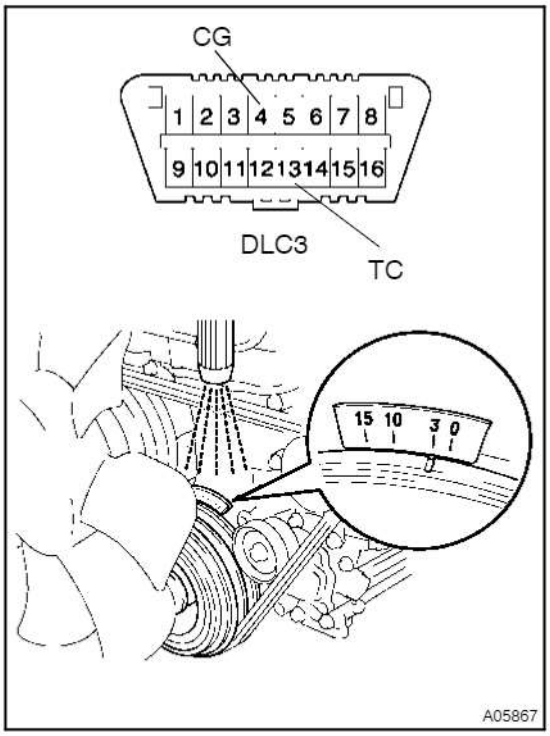
**OK:**

**Idle speed: 600 – 700 rpm**

| NG | **Proceed to problem symptoms table on page DI–21.** |
|---|---|

OK

| 6 | Check ignition timing. |
|---|---|




**PREPARATION:**

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into the "N" position.
(e) Keep the engine speed at idle.
(f) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843–18040
(g) Using a timing light, connect the tester to the No.1 high–tension cord.

**CHECK:**

Check ignition timing.

**OK:**

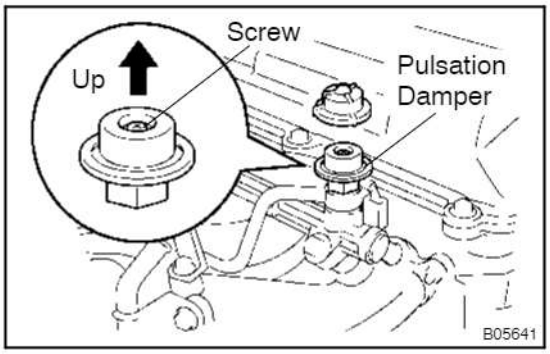
**Ignition timing: 3° BTDC at idle**

**NG** → **Proceed to page IG–1 and continue to troubleshoot.**

**OK**

**Proceed to problem symptoms table on page DI–21.**

| 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 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 page EM–3 and continue to troubleshoot.**

**OK**

| | |
|---|---|
| 8 | **Check for spark.** |

**PREPARATION:**

(a) Disconnect the high–tension cord from spark plug.
(b) Remove the spark plug.
(c) Install the spark plug to high–tension cord.
(d) Disconnect the injector connectors.
(e) Hold the end about 12.5 mm (0.5 in.) from the ground.

**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 page IG–1 and continue to troubleshoot.**

**OK**

**Proceed to problem symptoms table on page DI–21.**

### 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* |
|---|---|---|
| CALC LOAD | Calculator Load:<br>Current intake air volume as a proportion of max. intake air volume | Idling: 17.7 ~ 47.4 %<br>Racing without load (2,500 rpm): 13.8 ~ 41.5 % |
| WATER 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 % |
| ENGINE SPD | Engine Speed | Idling: 600 ~ 700 rpm |
| VEHICLE SPD | Vehicle Speed | Vehicle stopped: 0 km/h (0 mph) |
| IGN ADVANCE | Ignition Advance:<br>Ignition Timing of Cylinder No. 1 | Idling: BTDC 0 ~ 13° |
| INTAKE AIR | Intake Air Temp. Sensor Value | Equivalent to ambient temp. |

*: 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*1 |
|---|---|---|
| PIM | Absolute Pressure inside Intake Manifold | Idling: 18 ~ 48 kPa<br>Racing without load (2,500 rpm):<br>14 ~ 42 kPa |
| THROTTLE POS | Voltage Output of Throttle Position Sensor<br>Calculated as a percentage:<br>0 V → 0 %, 5 V → 100 % | Throttle fully closed: 7 ~ 11 %<br>Throttle fully open: 65 ~ 75 % |
| INJECTOR | Fuel injection time for cylinder No.1 | Idling: 2.7 ~ 4.7 ms |
| ISC DUTY RATIO | Idle Speed Control Valve Duty Ratio<br>Opening ratio rotary solenoid type ISC valve | Idling: 25 ~ 50 % |
| STARTER SIG | Starter Signal | Cranking: ON |
| A/C SIG | A/C Switch Signal | A/C ON: ON |
| STOP LIGHT SW | Stop Light Switch Signal | Stop light switch ON: ON |
| NSW*2 | Neutral Start Switch Signal | P or N position: ON |

*1: 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.

*2: A/T only

DI1I7–07

# DIAGNOSTIC TROUBLE CODE CHART

## 1. 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* | Memory |
|---|---|---|---|---|
| P0105/31 (DI–23) | Vacuum Sensor Circuit Malfunction | • Open or short in vacuum sensor circuit<br>• Vacuum sensor<br>• Engine ECU | ○ | ○ |
| P0110/24 (DI–28) | Intake Air Temp. Circuit Malfunction | • Open or short in intake air temp. sensor circuit<br>• Intake air temp. sensor<br>• Engine ECU | – | ○ |
| P0115/22 (DI–35) | Water Temp. Circuit Malfunction | • Open or short in water temp. sensor circuit<br>• Water temp. sensor<br>• Engine ECU | ○ | ○ |
| P0120/41 (DI–41) | Throttle Position Sensor Circuit Malfunction | • Open or short in throttle position sensor circuit<br>• Throttle position sensor<br>• Engine ECU | – | ○ |
| P0325/52 (DI–47) | Knock Sensor 1 Circuit Malfunction | • Open or short in knock sensor 1 circuit<br>• Knock sensor 1 (looseness)<br>• Engine ECU | ○ | ○ |
| P0330/55 (DI–47) | Knock Sensor 2 Circuit Malfunction | • Open or short in knock sensor 2 circuit<br>• Knock sensor 2 (looseness)<br>• Engine ECU | ○ | ○ |
| P0335/12, 13 (DI–50) | Crankshaft Position Sensor Circuit Malfunction | • Open or short in crankshaft position sensor circuit<br>• Crankshaft position sensor<br>• Starter<br>• Engine ECU | ○ | ○ |
| P0340/12 (DI–53) | Camshaft Position Sensor Circuit Malfunction | • Open or short in camshaft position sensor circuit<br>• Camshaft position sensor<br>• Starter<br>• Engine ECU | ○ | ○ |
| P0500/42 (DI–56) | Vehicle Speed Sensor Circuit Malfunction | • Open or short in vehicle speed sensor circuit<br>• Vehicle speed sensor<br>• Combination meter<br>• Engine ECU | – | ○ |

*: ○ · · · Check engine warning light (CHK ENG) lights up

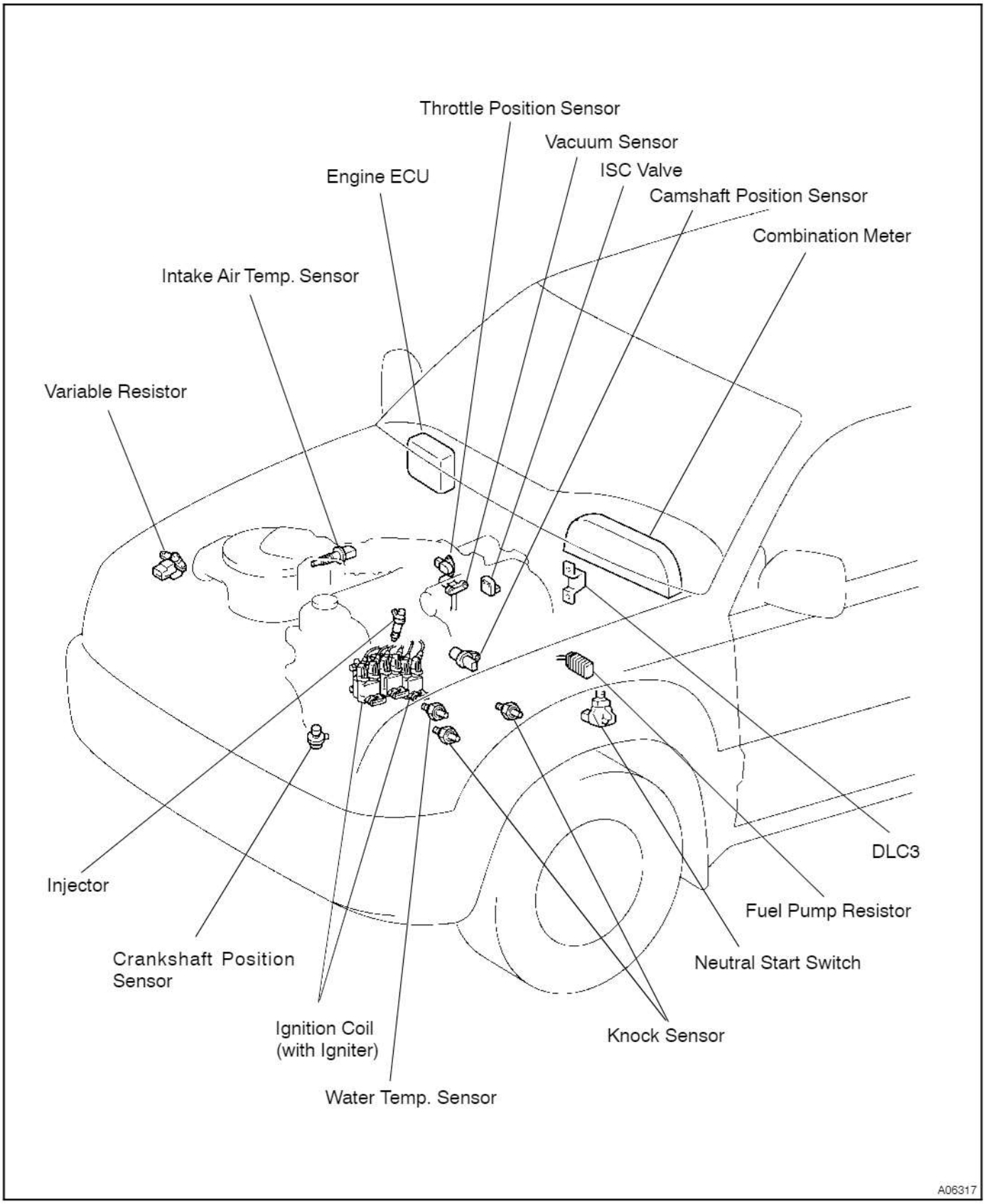
– · · · Check engine warning light (CHK ENG) does not lights up

| DTC No. (See Page) | Detection Item | Trouble Area | CHK ENG* | Memory |
|---|---|---|---|---|
| P0505/33 (DI–59) | Idle Control System Malfunction | • Open or short in ISC valve circuit<br>• ISC valve<br>• Engine ECU | ○ | ○ |
| P1200/78 (DI–65) | Fuel Pump Relay/ECU Circuit Malfunction | • Open or short in fuel pump relay<br>• Fuel pump relay<br>• Engine ECU | – | ○ |
| P1300/14 (DI–68) | Igniter Circuit Malfunction No.1 | • Open or short in IGF or IGT1 circuit from igniter to engine ECU<br>• Ignition coil No.1 (w/ Igniter)<br>• Engine ECU | ○ | ○ |
| P1310/15 (DI–68) | Igniter Circuit Malfunction No.2 | • Open or short in IGF or IGT2 circuit from igniter to engine ECU<br>• Ignition coil No.2 (w/ Igniter)<br>• Engine ECU | ○ | ○ |
| P1320/14 (DI–68) | Igniter Circuit Malfunction No.3 | • Open or short in IGF or IGT3 circuit from igniter to engine ECU<br>• Ignition coil No.3 (w/ Igniter)<br>• Engine ECU | ○ | ○ |
| P1335/13 (DI–74) | Crankshaft Position Sensor Circuit Malfunction (during idling) | • Open or short in crankshaft position sensor circuit<br>• Crankshaft position sensor<br>• Starter<br>• Engine ECU | – | ○ |

*: ○ · · · Check engine warning light (CHK ENG) lights up
– · · · Check engine warning light (CHK ENG) does not lights up

DI31B–03

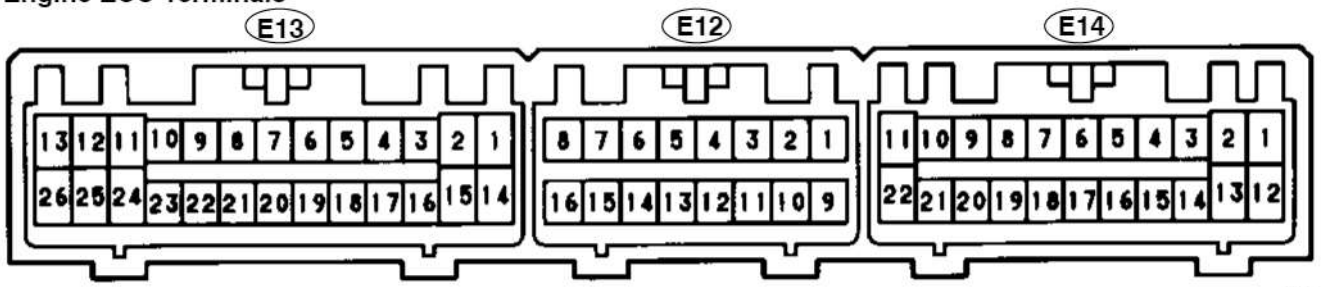
# PARTS LOCATION



DI1I8–07

# TERMINALS OF ECU

**Engine ECU Terminals**




| Symbols (Terminals No.) | Wiring Color | Condition | STD Voltage (V) |
|---|---|---|---|
| BATT (E14 – 1) – E1 (E13 – 14) | B–R ↔ BR | Always | 9 ~ 14 |
| + B (E14 – 12) – E1 (E13 – 14) | B–Y ↔ BR | IG switch ON | 9 ~ 14 |
| VC (E12 – 1) – E2 (E12 – 9) | L–R ↔ BR–W | IG switch ON | 4.5 ~ 5.5 |
| VTA (E12 – 11) – E2 (E12 – 9) | R–Y ↔ BR–W | IG switch ON<br>Throttle valve fully closed | 0.3 ~ 1.0 |
| | | IG switch ON<br>Throttle valve fully open | 3.2 ~ 4.9 |
| PIM (E12 – 2) – E2 (E12 – 9) | P–L ↔ BR–W | IG switch ON | 3.3 ~ 3.9 |
| | | Apply vacuum 26.7 kPa (200 mmHg, 7.9 in.Hg) | 2.5 ~ 3.1 |
| THA (E12 – 3) – E2 (E12 – 9) | Y–B ↔ BR–W | Idling, Intake air temp. 20°C (68°F) | 0.5 ~ 3.4 |
| THW (E12 – 4) – E2 (E12 – 9) | G–B ↔ BR–W | Idling, Engine coolant temp. 80°C (176°F) | 0.2 ~ 1.0 |
| STA (E14 – 11) – E1 (E13 – 14) | B–R ↔ BR | Cranking | 6.0 or more |
| #10 (E12 – 12) – E01 (E13 – 13) | Y ↔ W–B | IG switch ON | 9 ~ 14 |
| | | Idling | Pulse generation<br>(See page DI–75) |
| #20 (E12 – 11) – E01 (E13 – 13) | G ↔ W–B | IG switch ON | 9 ~ 14 |
| | | Idling | Pulse generation<br>(See page DI–75) |
| #30 (E12 – 25) – E01 (E13 – 13) | Y–B ↔ W–B | IG switch ON | 9 ~ 14 |
| | | Idling | Pulse generation<br>(See page DI–75) |
| IGT1 (E13 – 20) – E1 (E13 – 14) | B ↔ BR | Idling | Pulse generation<br>(See page DI–68) |
| IGT2 (E13 – 19) – E1 (E13 – 14) | R ↔ BR | Idling | Pulse generation<br>(See page DI–68) |
| IGT3 (E13 –1 8) – E1 (E13 – 14) | L ↔ BR | Idling | Pulse generation<br>(See page DI–68) |
| IGF1 (E13 – 3) – E1 (E13 – 14) | B–W ↔ BR | IG switch ON | Below 2.0 |
| | | Idling | Pulse generation<br>(See page DI–68) |
| SIL (E12 – 10) – E1 (E13 – 14) | V–W ↔ BR | During transmission | Pulse generation |
| TACH (E13 – 8) – E1 (E13 – 14) | B ↔ BR | Idling | Pulse generation |
| G2 (E13 – 5) – NE– (E13 – 17) | R ↔ G | Idling | Pulse generation<br>(See page DI–50) |

| Symbols (Terminals No.) | Wiring Color | Condition | STD Voltage (V) |
|---|---|---|---|
| NE+ (E13 – 4) – NE– (E13 – 17) | L ↔ G | Idling | Pulse generation (See page DI–50) |
| FC (E14 – 4) – E1 (E13 – 14) | B–W ↔ BR | IG switch ON | 9 ~ 14 |
| RSD (E13 – 10) – E1 (E13 – 14) | V ↔ BR | Idling | Pulse generation |
| KNK1 (E12 – 5) – E1 (E13 – 14) | B ↔ BR | Idling | Pulse generation (See page DI–47) |
| KNK2 (E12 – 13) – E1 (E13 – 14) | W ↔ BR | Idling | Pulse generation (See page DI–47) |
| NSW (E14 – 22) – E1 (E13 – 14) | 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 |
| SPD (E14 – 9) – E1 (E13 – 14) | V ↔ BR | IG switch ON (Rotate driving wheel slowly) | Pulse generation (See page DI–56) |
| TC (E12 – 8) – E1 (E13 – 14) | P–B ↔ BR | IG switch ON | 9 ~ 14 |
| W (E14 – 5) – E1 (E13 – 14) | W ↔ BR | Idling | 9 ~ 14 |
| | | IG switch ON | Below 3.0 |
| A/C (E14 – 10) – E1 (E13 – 14) | W–G ↔ BR | A/C switch ON | 9 ~ 14 |
| | | A/C switch OFF | Below 2.0 |
| ACT (E14 – 21) – E1 (E13 – 14) | L–B ↔ BR | Idling, A/C switch OFF | Below 2.0 |
| | | Idling, A/C switch ON | 9 ~ 14 |
| IMI (E12 – 12) – E1 (E13 – 14) | L–B ↔ BR | Idling | Pulse generation |
| IMO (E13 – 23) – E1 (E13 –14) | L–R ↔ BR | A few sec. after engine starting | Pulse generation |

DI1IA–07

# PROBLEM SYMPTOMS TABLE

When the malfunction code 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 tables and troubleshoot according to the numbered order given below.

| Symptom | Suspect Area | See page |
|---|---|---|
| Engine does not crank (Does not start) | 1. Starter | *1 |
| | 2. Starter relay | ST–1 |
| | 3. Neutral start switch circuit | DI–83 |
| No initial combustion (Does not start) | 1. ECU power source circuit | DI–88 |
| | 2. Igniter circuit | DI–68 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Injector circuit | DI–75 |
| No complete combustion (Does not start) | 1. Fuel pump control circuit | DI–65 |
| | 2. Igniter circuit | DI–68 |
| | 3. Injector circuit | DI–75 |
| Engine cranks normally (Difficult to start) | 1. Starter signal circuit | DI–79 |
| | 2. ISC valve circuit | DI–59 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Ignition coil (w/ igniter) | DI–68 |
| | 5. Spark plug | IG–1 |
| | 6. Compression | *2 |
| | 7. Injector circuit | DI–75 |
| Cold engine (Difficult to start) | 1.Starter signal circuit | DI–79 |
| | 2. ISC valve circuit | DI–59 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Injector circuit | DI–75 |
| | 5. Ignition coil (w/ igniter) | DI–68 |
| | 6. Spark plug | IG–1 |
| Hot engine (Difficult to start) | 1. Starter signal circuit | DI–79 |
| | 2. ISC valve circuit | DI–59 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Injector circuit | DI–75 |
| | 5. Ignition coil (w/ igniter) | DI–68 |
| | 6. Spark plug | IG–1 |
| Incorrect first idle (Poor idling) | 1. ISC valve circuit | DI–59 |
| High engine idle speed (Poor idling) | 1. ISC valve circuit | DI–59 |
| | 2. ECU power source circuit | DI–88 |
| | 3. Neutral start switch circuit | DI–83 |
| | 4. Back up power source circuit | DI–81 |
| Low engine idle speed (Poor idling) | 1. ISC valve circuit | DI–59 |
| | 2. Neutral start switch circuit | DI–83 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Injector circuit | DI–75 |
| | 5. Vacuum sensor circuit | DI–23 |
| | 6. Back up power source circuit | DI–81 |

*1: See Pub. No. RM436E
*2: See Pub. No. RM321E

| Symptom | Suspect Area | See page |
|---|---|---|
| Rough idling (Poor idling) | 1. ISC valve circuit | DI–59 |
| | 2. Vacuum sensor circuit | DI–23 |
| | 3. Injector circuit | DI–75 |
| | 4. Variable resistor circuit | DI–96 |
| | 5. Igniter circuit | DI–68 |
| | 6. Compression | * |
| | 7. Fuel pump control circuit | DI–65 |
| | 8. Back up power source circuit | DI–81 |
| Hunting (Poor idling) | 1. ISC valve circuit | DI–59 |
| | 2. Vacuum sensor circuit | DI–23 |
| | 3. ECU power source circuit | DI–88 |
| | 4. Fuel pump control circuit | DI–65 |
| Hesitation/Poor acceleration (Poor driveability) | 1. Vacuum sensor circuit | DI–23 |
| | 2. Injector circuit | DI–75 |
| | 3. Fuel pump control circuit | DI–65 |
| | 4. Variable resistor circuit | DI–96 |
| | 5. Igniter circuit | DI–68 |
| | 6. A/T faulty | – |
| Muffler explosion, after fire (Poor driveability) | 1. Ignition coil (w/ igniter) | DI–68 |
| | 2. Spark plug | IG–1 |
| | 3. Injector circuit | DI–75 |
| Surging (Poor driveability) | 1. Fuel pump control circuit | DI–65 |
| | 2. Variable resistor circuit | DI–96 |
| | 3. Spark plug | IG–1 |
| | 4. Injector circuit | DI–75 |
| Soon after starting (Engine stall) | 1. Fuel pump control circuit | DI–65 |
| | 2. Vacuum sensor circuit | DI–96 |
| | 3. ISC valve circuit | DI–59 |
| After accelerator pedal depressed (Engine stall) | 1. Vacuum sensor circuit | DI–23 |
| After accelerator pedal released (Engine stall) | 1. Injector circuit | DI–75 |
| | 2. ISC valve circuit | DI–59 |
| | 3. Engine ECU | IN–19 |
| During A/C operation (Engine stall) | 1. ISC valve circuit | DI–59 |
| | 2. A/C signal circuit | – |
| | 3. Engine ECU | IN–19 |
| When shifting N to D (Engine stall) | 1. Neutral start switch circuit | DI–83 |
| | 2. ISC valve circuit | DI–59 |

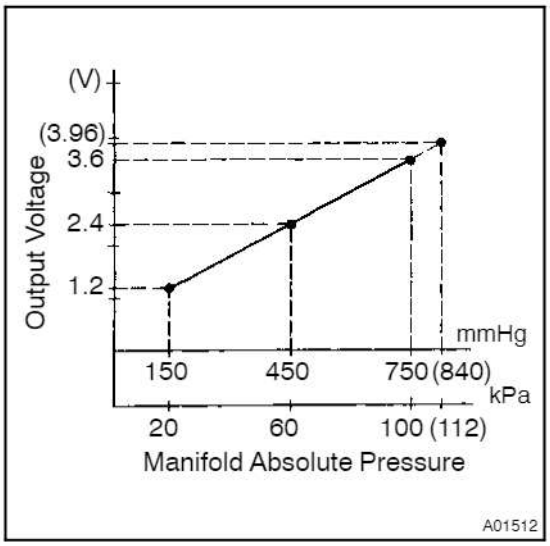
*: See Pub. No. RM321E

DI31C–03

# CIRCUIT INSPECTION

| DTC | P0105/31 | Vacuum Sensor Circuit |
|---|---|---|

## CIRCUIT DESCRIPTION



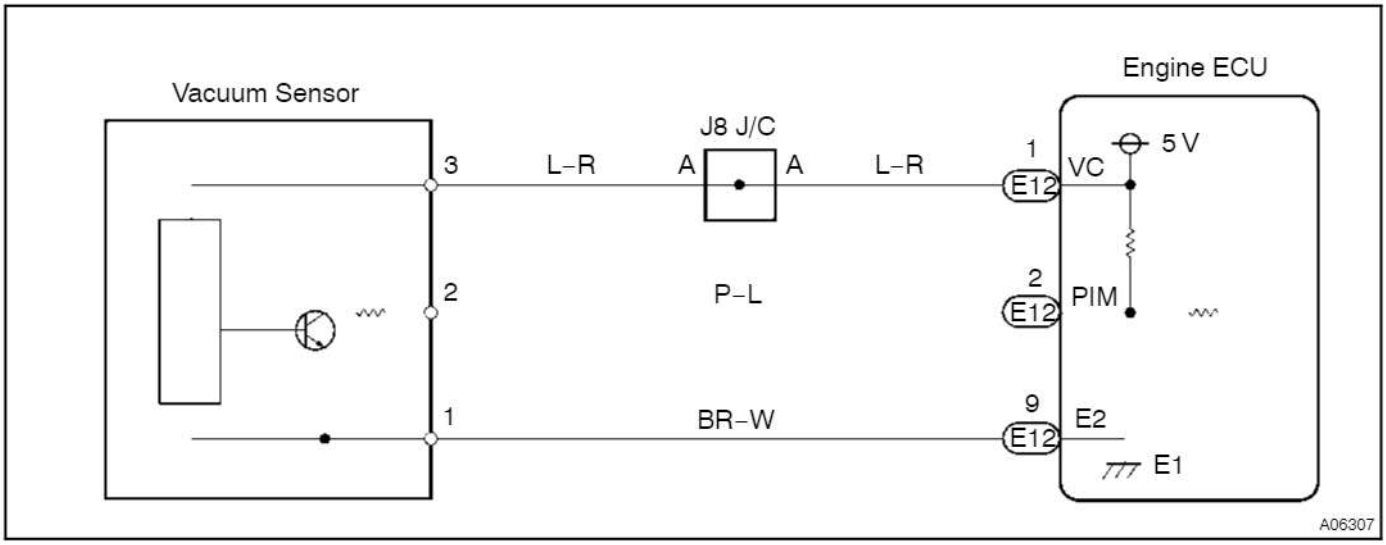

By a built–in sensor unit, the vacuum sensor detects the intake manifold pressure as a voltage. The engine ECU then determines the basic injection duration and basic ignition advance angle based on this voltage.
Since the vacuum sensor does not use the atmospheric pressure as a criterion, but senses the absolute pressure inside the intake manifold (the pressure in proportion to the preset absolute vacuum 0), it is not influenced by fluctuations in the atmospheric pressure due to high altitude and other factors. This permits it to control the air fuel ratio at the proper level under all conditions.

| DTC No. | DTC Detection condition | Trouble Area |
|---|---|---|
| P0105/31 | Open or short in vacuum sensor circuit for 0.5 sec. or more | • Open or short in vacuum sensor circuit<br>• Vacuum sensor<br>• Engine ECU |

If the engine ECU detects diagnostic trouble code "P0105/31", it operates the fail safe function, keeping the ignition timing and fuel injection volume constant and making it possible to drive the vehicle.
HINT:
After confirming DTC "P0105/31" use the hand–held tester to confirm the manifold absolute pressure from "CURRENT DATA".

| Manifold Absolute Pressure (kPa) | Malfunction |
|---|---|
| Approx. 0 | • PIM circuit short |
| 130 or more | • VC circuit open or short<br>• PIM circuit open<br>• E2 circuit open |

## WIRING DIAGRAM




## 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.
- If DTC "P0105/31" (Vacuum Sensor Circuit Malfunction), "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

### When using hand–held tester

| | |
|---|---|
| 1 | **Connect the hand–held tester, and read value of manifold absolute pressure.** |

**PREPARATION:**

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

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

**CHECK:**

Read value of manifold absolute pressure on the hand–held tester.

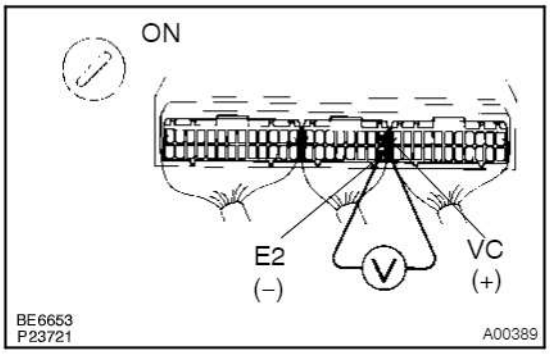
**OK:**

**Same as atmospheric pressure.**

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

**NG**

| 2 | Check voltage between terminals VC and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

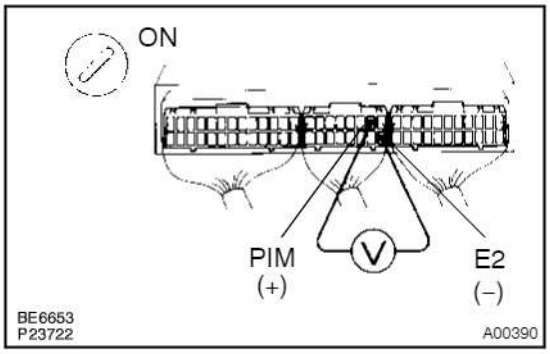
**CHECK:**
Measure voltage between terminals VC and E2 of engine ECU connector.

**OK:**
**Voltage: 4.5 – 5.5 V**

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

**OK**

| 3 | Check voltage between terminals PIM and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

**CHECK:**
Measure voltage between terminals PIM and E2 of engine ECU connector.

**OK:**
**Voltage: 3.3 – 3.9 V**

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

**NG**

| 4 | Check for open and short in harness and connector between vacuum sensor and engine ECU. |
|---|---|

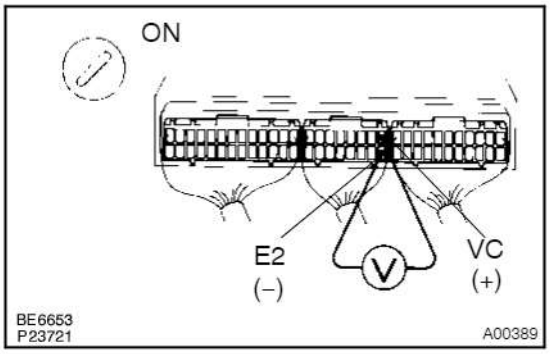
| NG | Repair and replace harness or connector. |
|---|---|

**OK**

**Replace vacuum sensor.**

## When not using hand–held tester

| 1 | Check voltage between terminals VC and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals VC and E2 of engine ECU connector.

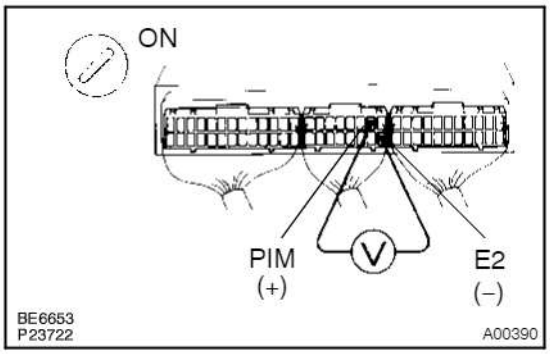
**OK:**

**Voltage: 4.5 – 5.5 V**

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

**OK**

| 2 | Check voltage between terminals PIM and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals PIM and E2 of engine ECU connector.

**OK:**

**Voltage: 3.3 – 3.9 V**

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

**NG**

| | |
|---|---|
| 3 | **Check for open and short in harness and connector between vacuum sensor and engine ECU.** |

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

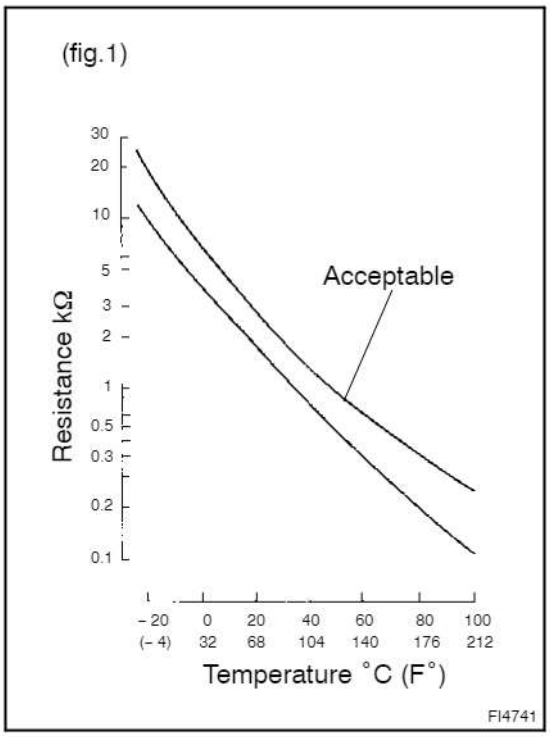
**OK**

**Replace vacuum sensor.**

DI31D–03

| DTC | P0110/24 | Intake Air Temp. Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION



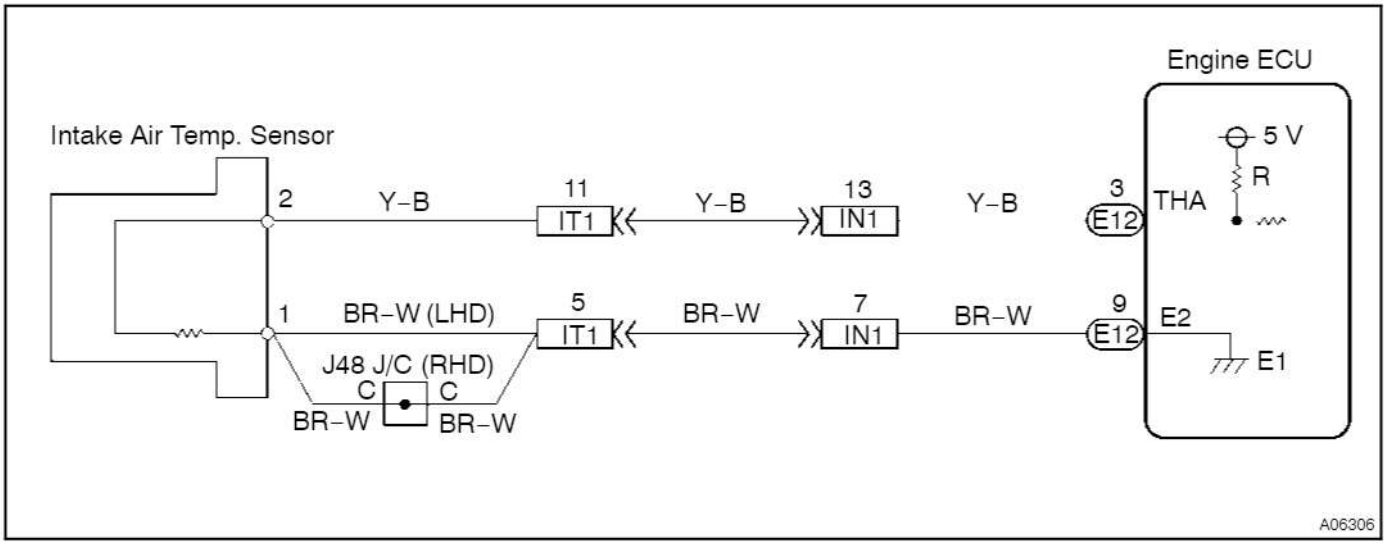

The intake air temp. sensor is mounted on the air cleaner cap and sensors the intake air temperature.
A thermistor built in the sensor changes the resistance value according to the intake air temp. The lower the intake air temp. the greater the thermistor resistance value, and the higher the intake air temp. the lower the thermistor resistance value (See fig.1).
The air intake temp. sensor is connected to the engine ECU (See below). The 5V power source voltage in the ECU is applied to the intake air temp. sensor from the terminal THA via a resistor R.
That is the resistor R and the intake air temp. sensor are connected in series. When the resistance value of the intake air temperature sensor changes in accordance with changes in the intake air temp. the potential at terminal THA also changes. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.
If the engine ECU detects the DTC "P0110/24", it operates the fail safe function in which the intake air temperature is assumed to be 20°C (68°F).

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0110/24 | Open or short in intake air temp. sensor circuit for 0.5 sec. or more | • Open or short in intake air temp. sensor circuit<br>• Intake air temp. sensor<br>• Engine ECU |

HINT:
After confirming DTC P0110/24 use the hand–held tester to confirm the intake air temperature from "CURRENT DATA".

| Temperature Displayed | Malfunction |
|---|---|
| – 40°C (– 40°F) | Open circuit |
| 140°C (284°F) or more | Short circuit |

## WIRING DIAGRAM




## 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.
- If DTC "P0105/31" (Vacuum Sensor Circuit Malfunction), "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

## When using hand–held tester

| | |
|---|---|
| 1 | **Connect the hand–held tester, and read value of intake air temperature.** |

**PREPARATION:**

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

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

**CHECK:**

Read temperature value on the hand–held tester.

**OK:**

**Same as actual intake air temperature**

HINT:

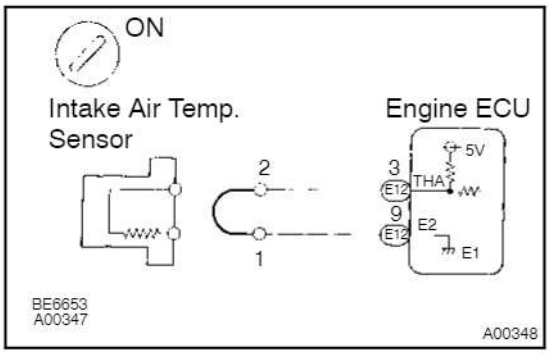
- If there is open circuit, hand–held tester indicates – 40°C (– 40°F).
- If there is short circuit, hand–held tester indicates 140°C (284°F) or more.

**NG** → **–40°C (–40°F) .... Go to step 2.**
**140°C (284°F) or more .... Go to step 4.**

**OK**

**Check for intermittent problem**
**(See gage DI–4).**

| | |
|---|---|
| 2 | **Check for open in harness or engine ECU.** |




**PREPARATION:**

(a) Disconnect the intake air temp. sensor connector.

(b) Connect the sensor wire harness terminals together.

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

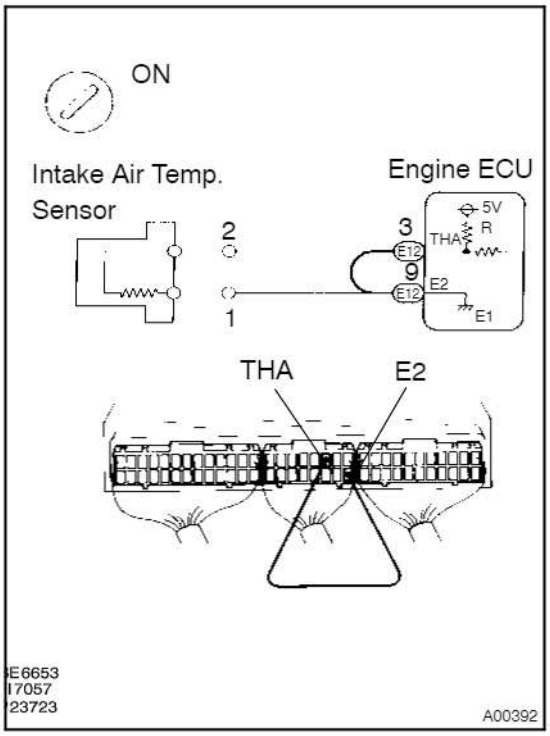
**OK:**

**Temperature value: 140°C (284°F) or more**

**OK** → **Confirm good connection at sensor. If OK, replace intake air temp. sensor.**

**NG**

| 3 | Check for open in harness or engine ECU. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Connect between terminals THA and E2 of engine ECU.

HINT:

Intake air temp. sensor connector is disconnected.

Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN–19).

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

**OK:**

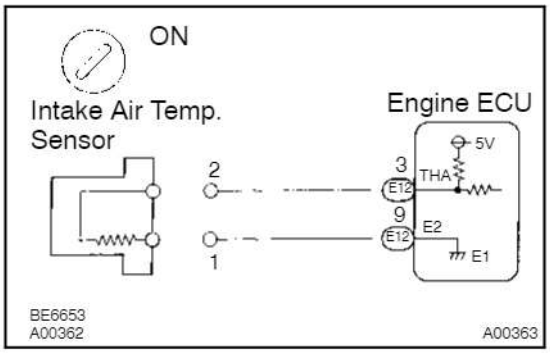
**Temperature value: 140°C (284°F) or more**

| OK | Open in harness between terminals E2 or THA repair or replace harness. |
|---|---|

**NG**

**Confirm good connection at engine ECU.
If OK, replace engine ECU.**

| 4 | Check for short in harness and engine ECU (See page IN–19). |
|---|---|




**PREPARATION:**

(a) Disconnect the intake air temp. sensor connector.

(b) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

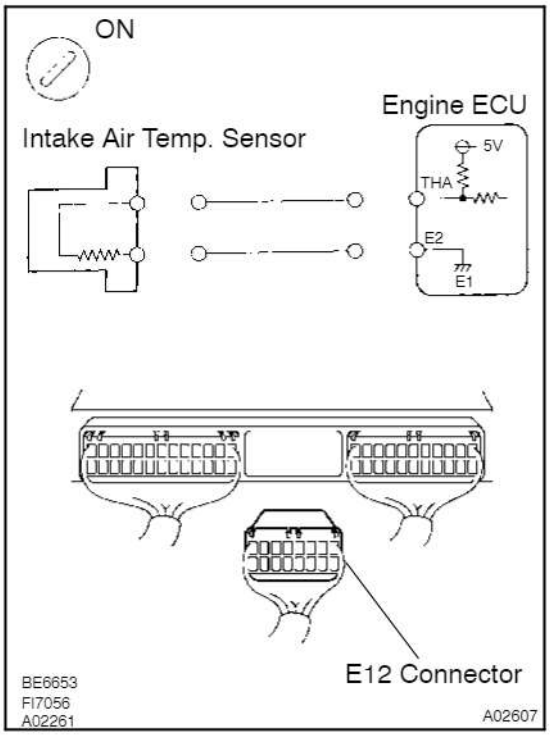
**OK:**

**Temperature value: – 40°C (– 40°F)**

| OK | Replace intake air temp. sensor. |
|---|---|

**NG**

| 5 | Check for short in harness or engine ECU. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Disconnect the E12 connector of engine ECU.

HINT:

Intake air temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

**OK:**

**Temperature value: – 40°C (– 40°F)**

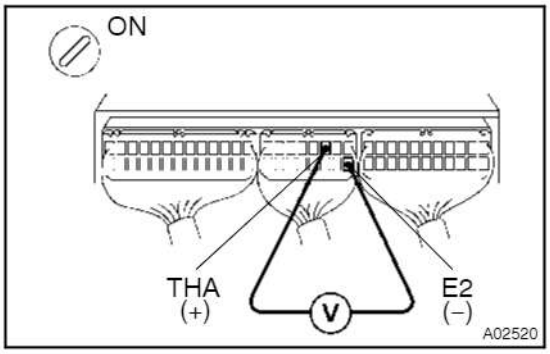
**OK** → **Repair or replace harness or connector.**

**NG**

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

## When not using hand–held tester

| 1 | Check voltage between terminals THA and E2 of engine ECU connecter |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals THA and E2 of engine ECU connector.

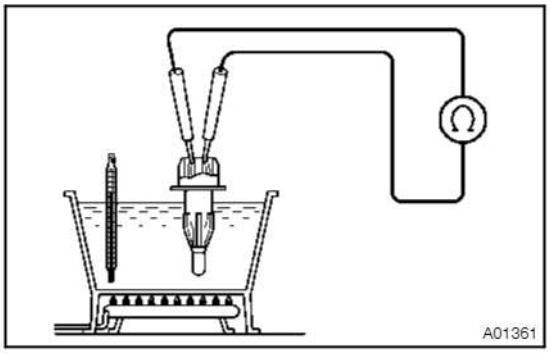
**OK:**

| Intake Air Temperature | Voltage |
|---|---|
| 20°C (68°F) | 0.5 – 3.4 V |
| 60°C (140°F) | 0.2 – 1.0 V |

| OK | Check for intermittent problem (See page DI–4). |
|---|---|

NG

| 2 | Check intake air temp. sensor. |
|---|---|




**PREPARATION:**

Disconnect the intake air temp. sensor connector.

**CHECK:**

Measure resistance between terminals.

**OK:**

**Resistance is within Acceptable Zone on chart.**

| Intake Air Temperature | Resistance |
|---|---|
| 20°C (68°F) | 2 – 3 kΩ |
| 80°C (176°F) | 0.2 – 0.4 kΩ |

| NG | Replace intake air temp. sensor. |
|---|---|

OK

| | |
|---|---|
| 3 | Check for open and short in harness and connector between engine ECU and intake air temp. sensor (See page IN–19). |

NG → Repair or replace harness or connector.

OK →

Check and replace engine ECU.

| DTC | P0115/22 | Water Temp. Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

A thermistor built into the water temp. 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 in the intake air temp. circuit malfunction shown on page DI–28.

If the engine ECU detects the DTC P0115/22, it operates the fail safe function in which the water temperature is assumed to be 80°C (176°F).

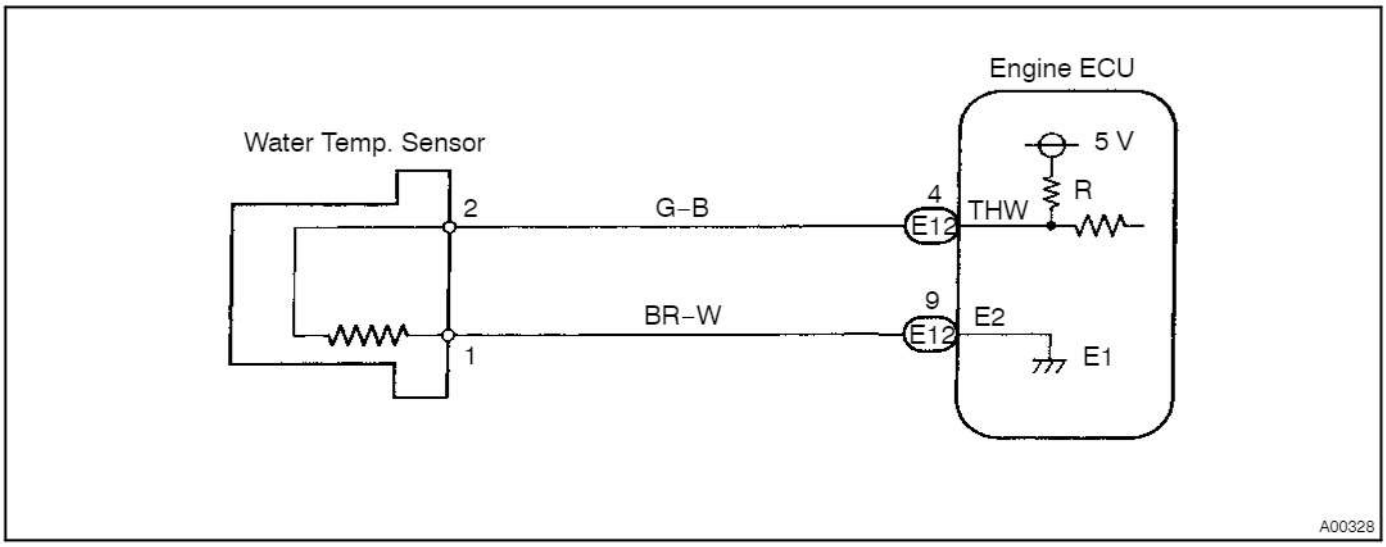
| DTC No. | DTC Detection Condition | Trouble Area |
|---|---|---|
| P0115/22 | Open or short in water temp. sensor circuit 0.5 sec. or more | • Open or short in water temp. sensor circuit<br>• Water temp. sensor<br>• Engine ECU |

HINT:

After confirming DTC P0115/22 use the hand–held tester to confirm the water temp. from CURRENT DATA.

| Temperature Displayed | Malfunction |
|---|---|
| – 40°C (– 40°F) | Open circuit |
| 140°C (284°F) or more | Short circuit |

## WIRING DIAGRAM




## 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.
- If DTC "P0105/31" (Vacuum Sensor Circuit Malfunction), "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

## When using hand–held tester

| | |
|---|---|
| 1 | **Connect the hand–held tester, and read value of water temperature.** |

**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 temperature value on the hand–held tester.

**OK:**

**Same as actual water temperature**

HINT:

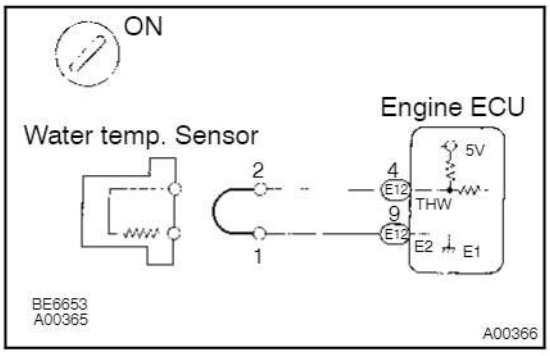
- If there is open circuit, hand–held tester indicates – 40°C (– 40°F).
- If there is short hand–held tester indicates 140°C (284°F) or more.

**NG** → **–40°C (–40°F) .... Go to step 2.**
**140°C (284°F) or more .... Go to step 4.**

**OK**

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

| | |
|---|---|
| 2 | **Check for open in harness or engine ECU.** |




**PREPARATION:**

(a) Disconnect the water temp. sensor connector.

(b) Connect sensor wire harness terminals together.

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

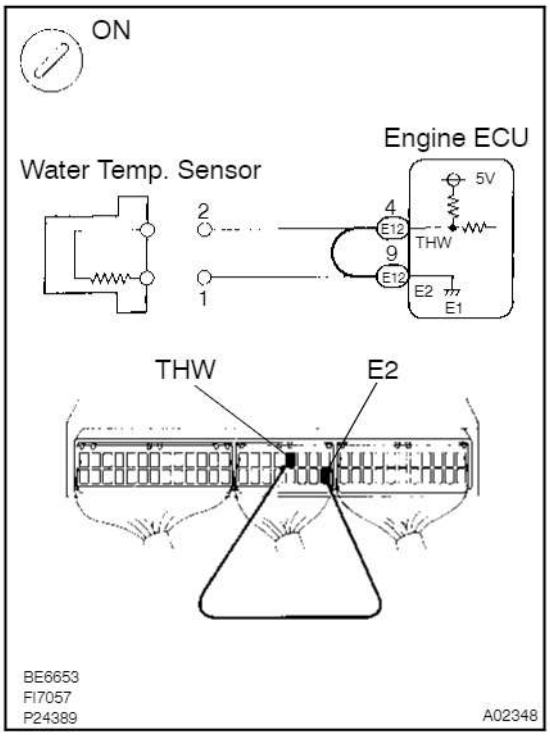
**OK:**

**Temperature value: 140°C (284°F) or more**

**OK** → **Confirm good connection at sensor. If OK, replace water temp. sensor.**

**NG**

| 3 | Check for open in harness or engine ECU. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Connect between terminals THW and E2 of engine ECU connector.

HINT:

Water temperature sensor connector is disconnected. Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN–19).

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

**OK:**

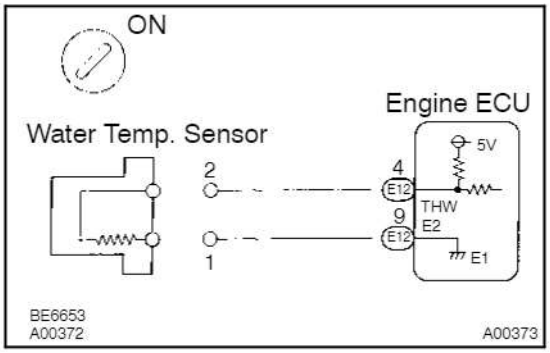
**Temperature value: 140°C (284°F) or more**

| OK | Open in harness between terminals E2 or THW, repair or replace harness. |
|---|---|

**NG**

**Confirm good connection at engine ECU.**
**If OK, replace engine ECU.**

| 4 | Check for short in harness or engine ECU. |
|---|---|




**PREPARATION:**

(a) Disconnect the water temp. sensor connector.

(b) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

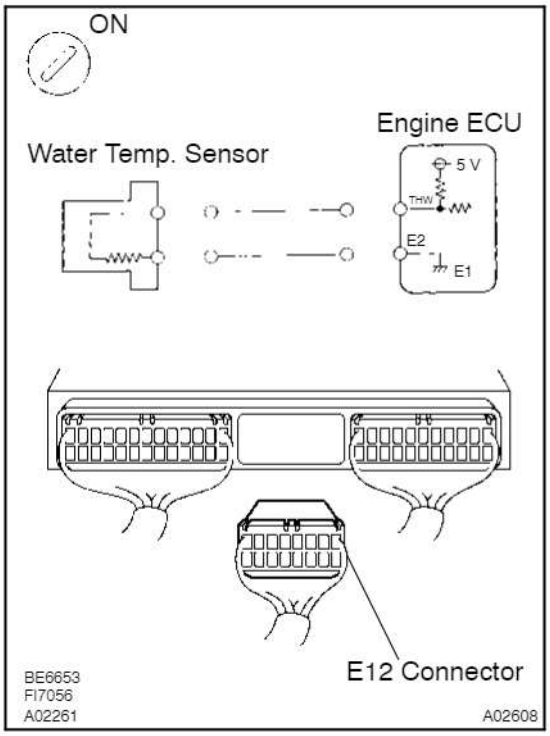
**OK:**

**Temperature value: – 40°C (– 40°F)**

| OK | Replace water temp. sensor. |
|---|---|

**NG**

| 5 | Check for short in harness or engine ECU. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Disconnect the E12 connector of engine ECU.

HINT:

Water temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

**CHECK:**

Read temperature value on the hand–held tester.

**OK:**

**Temperature value: – 40°C (– 40°F)**

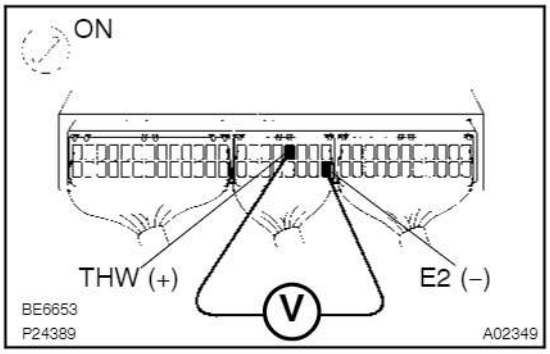
| OK | Repair or replace harness or connector. |
|---|---|

NG

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

## When not using hand–held tester

| 1 | Check voltage between terminals THW and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals THW and E2 of engine ECU connecter.

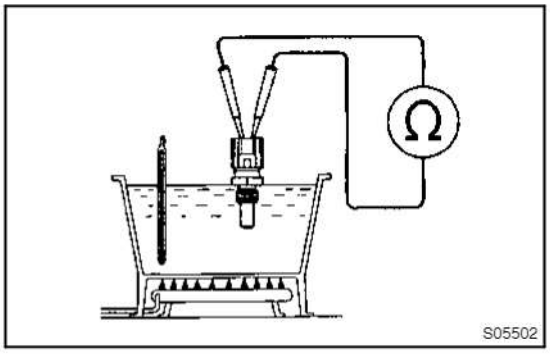
**OK:**

| Water Temperature | Voltage |
|---|---|
| 20°C (68°F) (Engine is cool) | 0.5 – 3.4 V |
| 80°C (176°F) (Engine is hot) | 0.2 – 1.0 V |

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

NG

| 2 | Check water temp. sensor. |
|---|---|




**PREPARATION:**

Disconnect the water temp. sensor connecter.

**CHECK:**

Measure resistance between terminals.

**OK:**

**Resistance is within Acceptable Zone on chart.**

| Water Temperature | Resistance |
|---|---|
| 20°C (68°F) (Engine is cool) | 2 – 3 kΩ |
| 80°C (176°F) (Engine is hot) | 0.2 – 0.4 kΩ |

| NG | Replace water temp. sensor. |
|---|---|

OK

| | |
|---|---|
| 3 | Check for open and short in harness and connector between engine ECU and water temp. sensor (See page IN–19). |

NG → Repair or replace harness or connector.

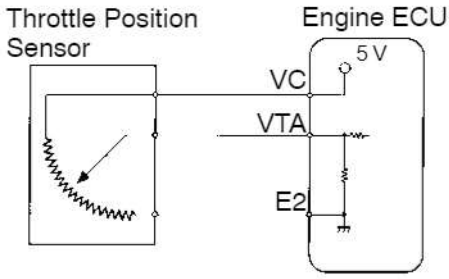
OK →

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

DI1IE–05

| DTC | P0120/41 | Throttle Position Sensor Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION



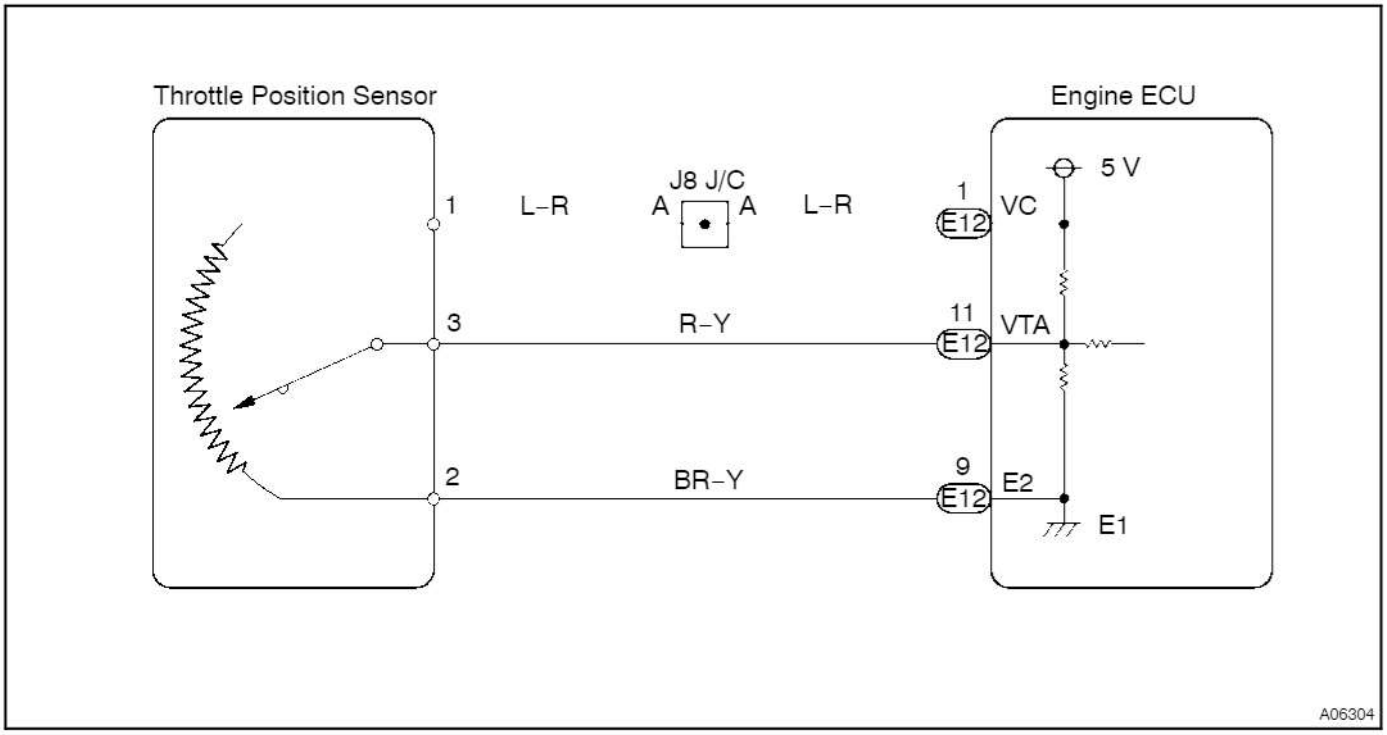

The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle.
When the throttle valve is fully closed, a voltage of approximately 0.3 ~ 0.8V is applied to terminal VTA of the engine ECU. The voltage applied to the terminals VTA of the engine ECU increases in proportion to the opening angle of the throttle valve and becomes approximately 3.2 ~ 4.9 V when the throttle valve is fully opened. The engine ECU judges the vehicle driving conditions from these signals input from terminal VTA, uses them as one of the conditions for deciding the air–fuel ratio correction, power increase correction and fuel–cut control etc..

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0120/41 | Open or short in throttle position sensor circuit for 0.5 sec. or more | • Open or short in throttle position sensor<br>• Throttle position senor<br>• Engine ECU |

HINT:
After confirming "DTC P0120/41" use the hand–held tester to confirm the throttle valve opening percentage and closed throttle position switch condition.

| Throttle valve opening position expressed as percentage | | Trouble Area |
|---|---|---|
| Throttle valve fully closed | Throttle valve fully open | |
| 0 % | 0 % | VC line open<br>VTA line open or short |
| Approx. 100 % | Approx. 100 % | E2 line open |

## WIRING DIAGRAM




## 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.
- If DTC "P0105/22" (Vacuum Sensor Circuit Malfunction), DTC "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

## When using hand–held tester

| | |
|---|---|
| 1 | **Connect the hand–held tester and read the throttle valve opening percentage.** |

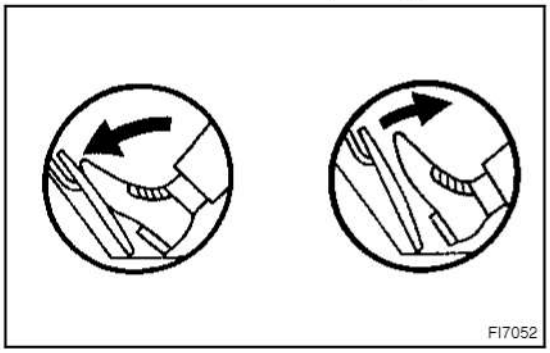
**PREPARATION:**

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

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

**CHECK:**

Read the throttle valve opening percentage.



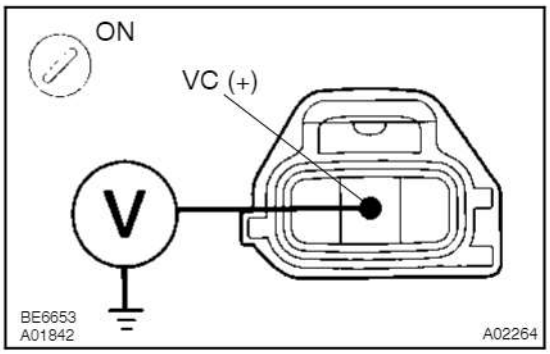

**OK:**

| Throttle valve | Throttle valve opening position expressed as percentage |
|---|---|
| Fully open | Approx. 70 % |
| Fully closed | Approx. 10 % |

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

NG

| | |
|---|---|
| 2 | **Check voltage between terminal VC of wire harness side connector and body ground.** |




**PREPARATION:**

(a) Disconnect the throttle position sensor connector.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminal VC of wire harness side connector and body ground.

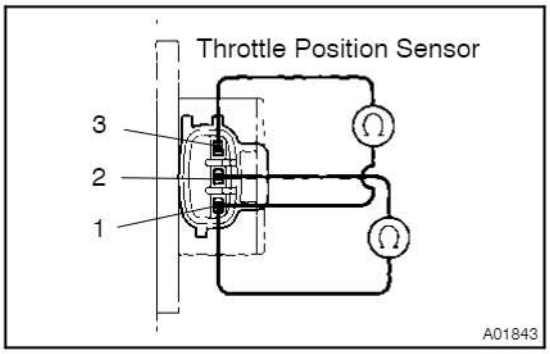
**OK:**

**Voltage 4.5 – 5.5 V**

NG → **Go to step 5.**

OK

| 3 | Check throttle position sensor. |
|---|---|



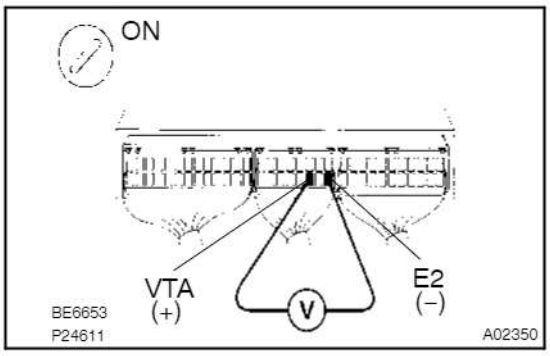

**PREPARATION:**
Disconnect the throttle position sensor connector.
**CHECK:**
Measure resistance between terminals 1, 3 and 2 of the throttle position sensor.
**OK:**

| Terminals | Throttle valve | Resistance |
|---|---|---|
| 1 – 2 | — | 2.5 – 5.9 kΩ |
| 1 – 3 | Fully closed | 0.2 – 5.7 kΩ |
| | Fully open | 2.0 – 10.2 kΩ |

NG → **Replace throttle position sensor.**

OK

| 4 | Check voltage between terminals VTA and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
**CHECK:**
Measure voltage between terminals VTA and E2 of engine ECU connector.
**OK:**

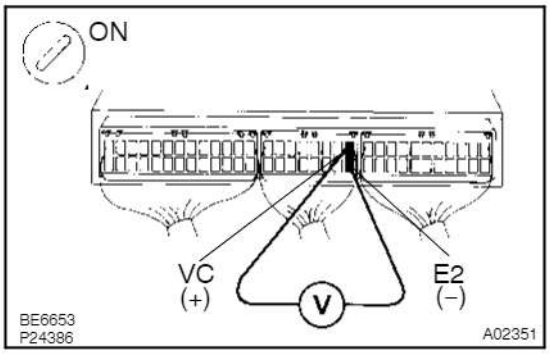
| Throttle valve | Voltage |
|---|---|
| Fully closed | 0.3 – 1.0 V |
| Fully open | 2.7 – 5.2 V |

NG → **Check for open and short in harness and connector between engine ECU and throttle position sensor (VTA line) (See page IN–19).**

OK

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

| 5 | Check voltage between terminals VC and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals VC and E2 of engine ECU connector.

**OK:**

**Voltage 4.5 – 5.5 V**

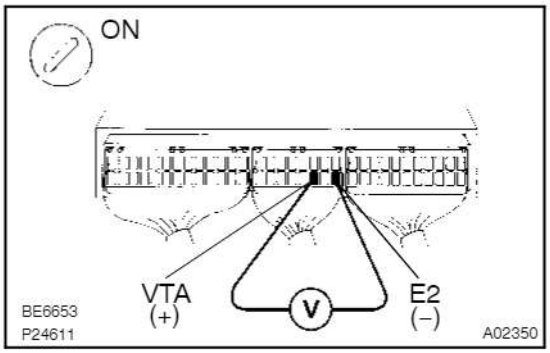
**NG** → **Check and replace engine ECU (See page IN–19).**

**OK**

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

## When not using hand–held tester

| 1 | Check voltage between terminals VTA and E2 of engine ECU. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals VTA and E2 of engine ECU.

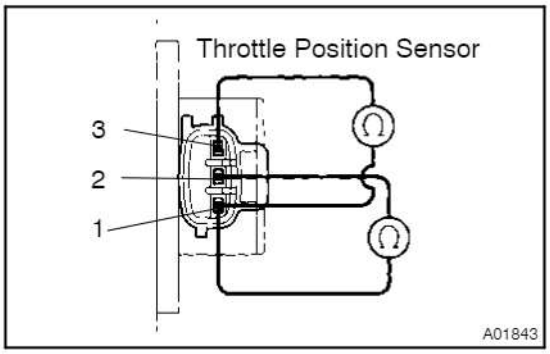
**OK:**

| Throttle valve | Voltage |
|---|---|
| Fully open | 0.3 – 1.0 V |
| Fully closed | 2.7 – 5.2 V |

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

**NG**

| 2 | Check throttle position sensor. |
|---|---|




**PREPARATION:**

Disconnect the throttle position sensor connector.

**CHECK:**

Measure resistance between terminals 1, 3 and 2 of throttle position sensor.

**OK:**

| Terminals | Throttle valve | Resistance |
|---|---|---|
| 1 – 2 | – | 2.5 – 5.9 kΩ |
| 2 – 3 | Fully closed | 0.2 – 5.7 kΩ |
| | Fully open | 2.0 – 10.2 kΩ |

NG → **Replace throttle position sensor.**

OK ↓

| 3 | Check for open and short in harness and connector between engine ECU and throttle position sensor (VC, VTA, E2 line) (See page IN–19). |
|---|---|

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

OK ↓

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

DI1IJ–04

| DTC | P0325/52 | Knock Sensor 1 Circuit Malfunction |
|---|---|---|

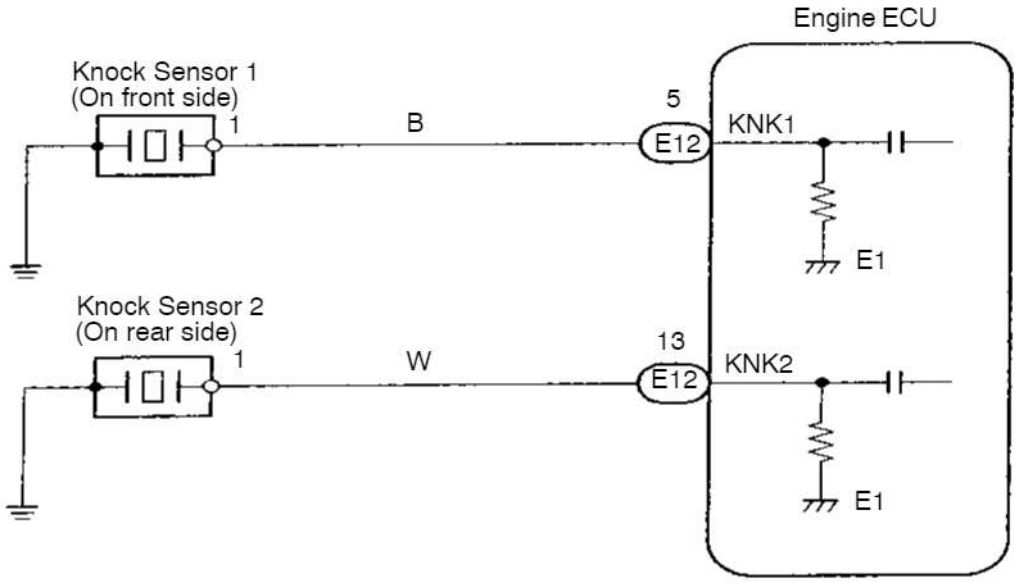
| DTC | P0330/55 | Knock Sensor 2 Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

Knock sensors are fitted to the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0325/52 | No knock sensor 1 signal to engine ECU with engine speed between 1,800 rpm and 5,200 rpm | • Open or short in knock sensor 1 circuit<br>• Knock sensor 1 (looseness)<br>• Engine ECU |
| P0330/55 | No knock sensor 2 signal to engine ECU with engine speed between 1,800 rpm and 5,200 rpm | • Open or short in knock sensor 2 circuit<br>• Knock sensor 2 (looseness)<br>• Engine ECU |

## WIRING DIAGRAM



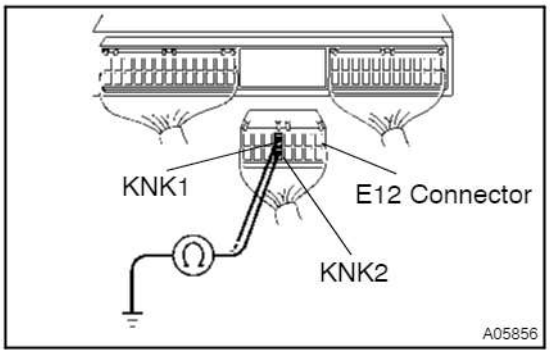

P22425

# 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.
- DTC P0325/52 is for the knock sensor circuit on the front side.
- DTC P0330/55 is for the knock sensor circuit on the rear side.

| 1 | **Check continuity between terminal KNK1, KNK2 of engine ECU connector and body ground.** |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.

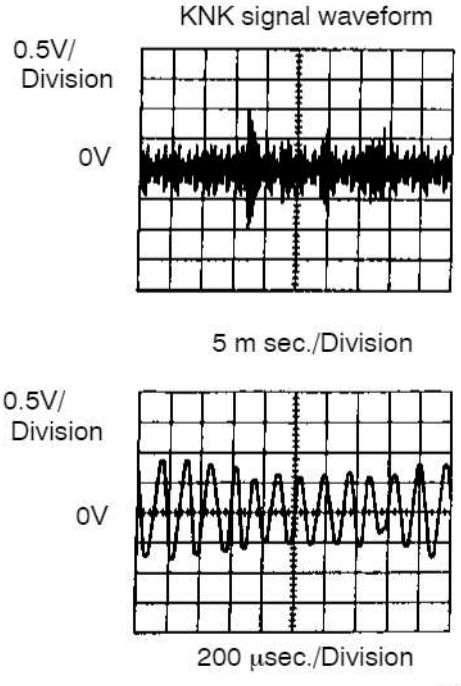
(b) Disconnect the E12 connector of engine ECU.

**CHECK:**

Measure resistance between terminal KNK1, KNK2 of engine ECU connector and body ground.

**OK:**

**Resistance: 1 MΩ or higher**




**Reference: INSPECTION USING OSCILLOSCOPE**

- With the engine racing (4,000 rpm) measure between terminal KNK1, KNK2 of engine ECU and body ground.

HINT:

The correct waveform is as shown.

- Spread the time on the horizontal axis, and confirm that period of the wave is 164 μ sec.
  (Normal mode vibration frequency of knock sensor: 6.1 kHz).

HINT:

If normal mode vibration frequency is not 6.1 kHz the sensor is malfunctioning.

| OK | **Go to step 3.** |
|---|---|

**NG**

| | |
|---|---|
| 2 | Check knock sensor. |

NG → Replace knock sensor.

OK

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

NG → Repair or replace harness or connector.

OK

| | |
|---|---|
| 4 | Does malfunction disappear when a good knock sensor is installed? |

YES → Replace knock sensor.

NO

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

DI1IK-06

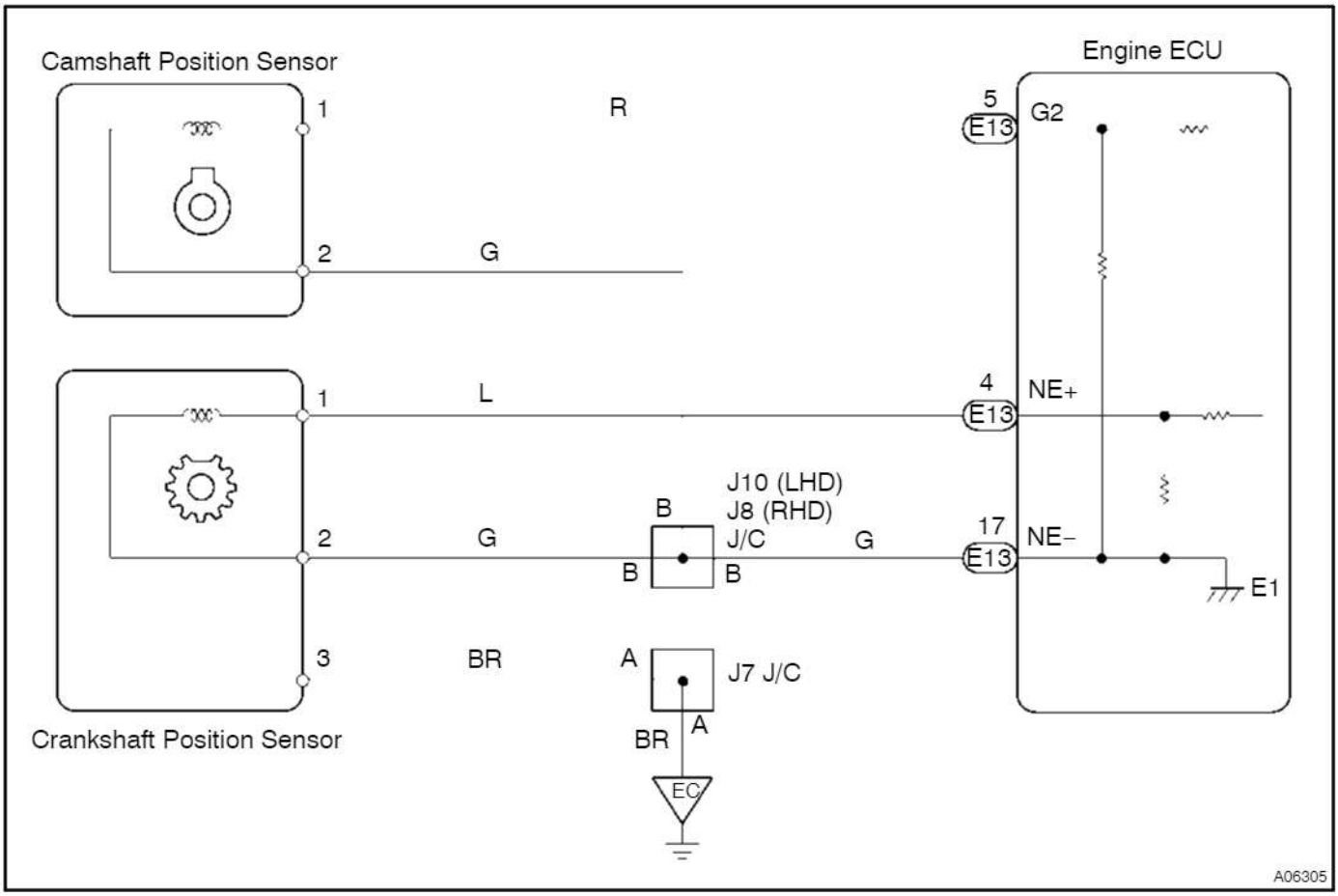
| DTC | P0335/12, 13 | Crankshaft Position Sensor Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

Crankshaft position sensor (NE signal) consist of a signal plate and pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals of every engine revolution. The engine ECU detects the standard crankshaft angle based on the G2 signals, and the actual crankshaft angle the engine speed by the NE signals.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0335/12, 13 | No crankshaft position sensor signal to engine ECU during cranking | • Open or short in crankshaft position sensor circuit<br>• Crankshaft position sensor<br>• Starter<br>• Engine ECU |
| | No crankshaft position sensor signal to engine ECU with engine speed 600 rpm or more | |

## WIRING DIAGRAM

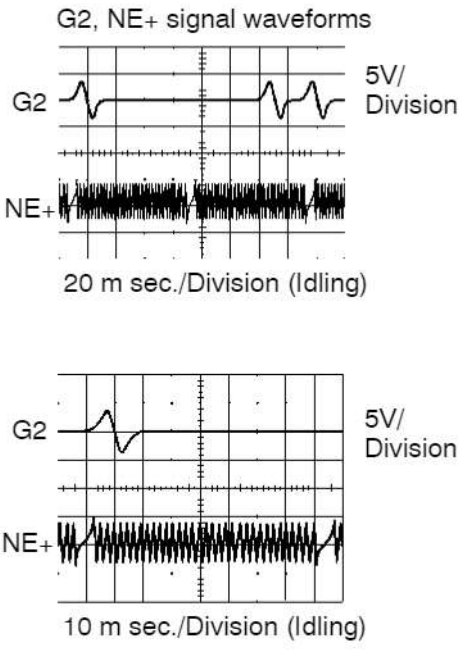


## INSPECTION PROCEDURE

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.
- Perform troubleshooting of DTC P0335/12,13 first. If no trouble is found, troubleshoot the following mechanical systems.

| | |
|---|---|
| 1 | **Check resistance of crankshaft position sensor (See page IG–1).** |




**Reference: INSPECTION USING OSCILLOSCOPE**

During cranking or idling, check between terminals G2 and NE–, NE+ and NE– of engine ECU.

HINT:

The correct waveforms are as shown.

NG → **Replace crankshaft position sensor.**

OK

| | |
|---|---|
| 2 | **Check for open and short in harness and connector between engine ECU and crankshaft position sensor (See page IN–19).** |

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

OK

| | |
|---|---|
| 3 | Inspect sensor installation and teeth of crankshaft timing pulley. |

NG → Tighten the sensor.
Replace crankshaft timing pulley.

OK →

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

| DTC | P0340/12 | Camshaft Position Sensor Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

Camshaft position sensor (G2 signal) consist of a signal plate and pick up coil. The G2 signal plate has one tooth on its outer circumference and is mounted on the camshaft.
When the camshafts rotate, the protrusion on the signal plate and the air gap on the pick up coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals for every engine revolution. The engine ECU detects the standard crankshaft angle based on the G+ signals and the actual crankshaft angle and the engine speed by the NE signals.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0340/12 | No camshaft position sensor signal to engine ECU during cranking | • Open or short in camshaft position sensor circuit<br>• Camshaft position sensor<br>• Starter<br>• Engine ECU |
| | No camshaft position sensor signal to engine ECU with engine speed 600 rpm or more | |

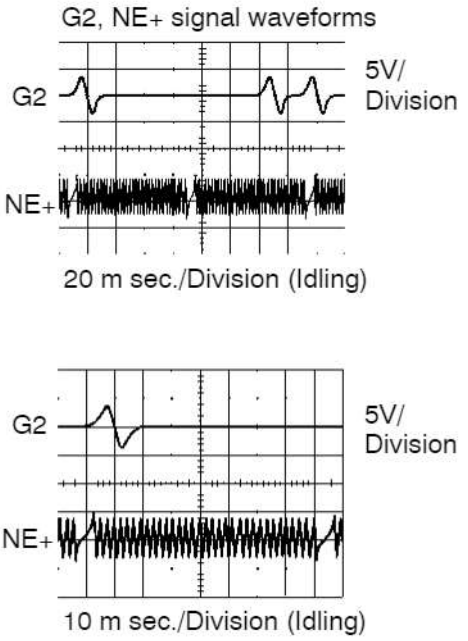
## WIRING DIAGRAM

Refer to DTC P0335/12, 13 (Crankshaft Position Sensor Circuit Malfunction) on page DI–50 for the WIRING DIAGRAM.

## 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 resistance of camshaft position sensor (See page IG–1).** |




**Reference: INSPECTION USING OSCILLOSCOPE**
During cranking or idling, check between terminals G2 and NE–, NE+ and NE– of engine ECU.
HINT:
The correct waveform are as shown.

NG → **Replace camshaft position sensor.**

OK

| | |
|---|---|
| 2 | **Check for open and short in harness and connector between engine ECU and camshaft position sensor (See page IN–19).** |

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

OK

| | |
|---|---|
| 3 | Inspect sensor installation. |

NG → Tighten the sensor.

OK →

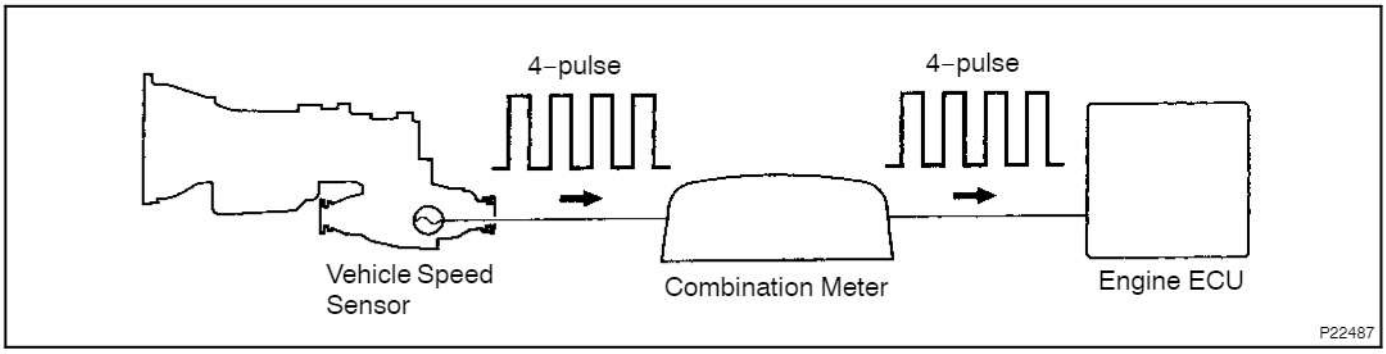
Check and replace engine ECU (See page IN–19).

DI1IM–07

| DTC | P0500/42 | Vehicle Speed Sensor Malfunction |
|---|---|---|

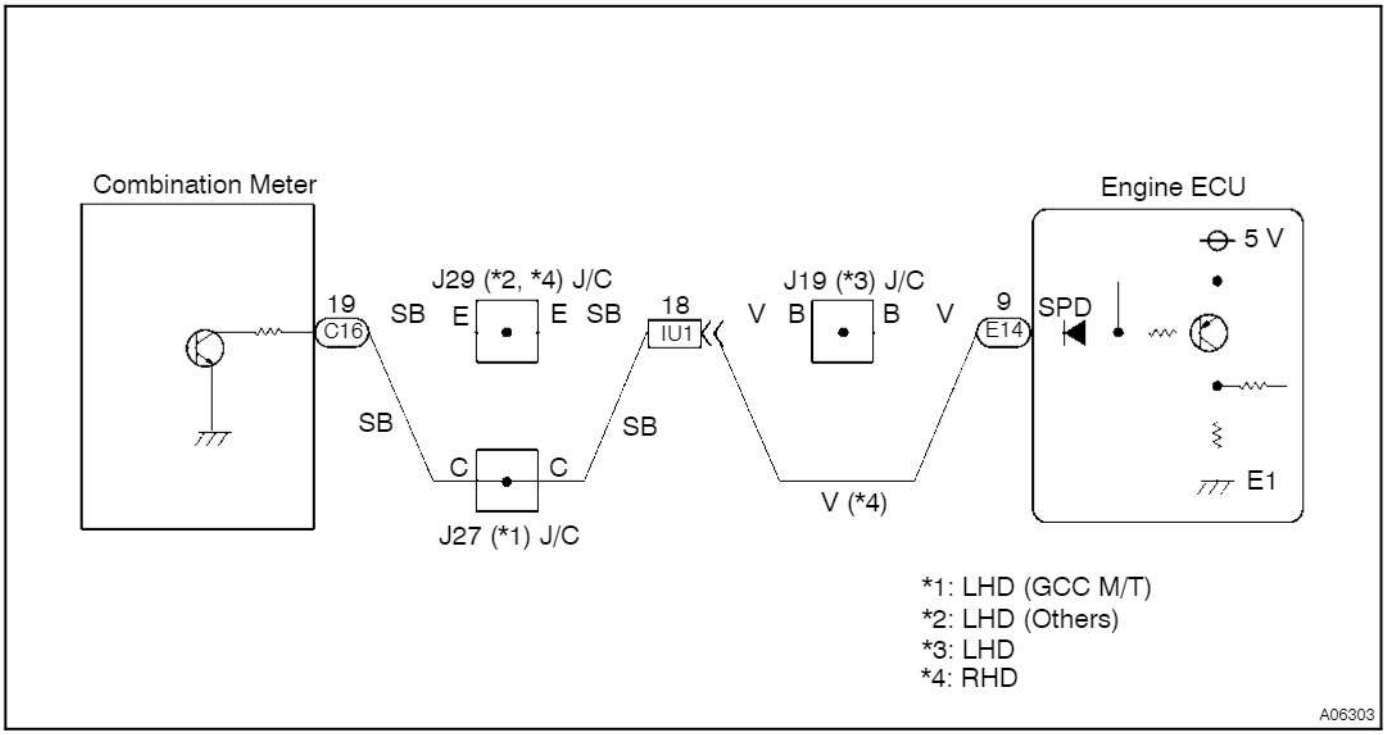
## CIRCUIT DESCRIPTION

The No.1 vehicle speed sensor outputs a 4–pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the engine ECU. The engine ECU determines the vehicle speed based on the frequency of these pulse signals.




| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0500/42 | No vehicle speed sensor signal to engine ECU under conditions (a) and (b):<br>(a) Neutral start switch is OFF<br>(b) Vehicle is being driven | • Open or short in vehicle speed sensor circuit<br>• Vehicle speed sensor<br>• Combination meter<br>• Engine ECU |

## WIRING DIAGRAM



## 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.

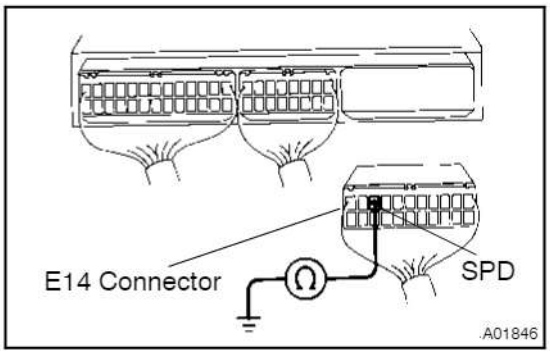
| | |
|---|---|
| 1 | **Check operation of speedometer.** |

**CHECK:**
Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor is operating normally if the speedometer display is normal.

**NG** → **Check speedometer circuit.**

**OK**

| | |
|---|---|
| 2 | **Check for short in harness and connector between terminal SPD of engine ECU and body ground.** |




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Disconnect the E14 engine ECU connector.

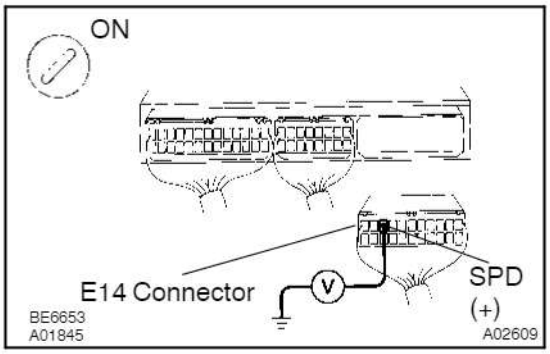
**CHECK:**
Check continuity between terminal SPD of engine ECU and body ground.

**OK:**
**No continuity (1MΩ. or higher)**

**NG** → **Check and repair harness or connector.**

**OK**

| 3 | Check voltage between terminal SPD of engine ECU and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Disconnect the E14 engine ECU connector.
(c) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminal SPD of engine ECU and body ground.

**OK:**

**Voltage: 9 – 14 V**

NG → **Check for open in harness and connector between combination meter and engine ECU (See page IN–19).**

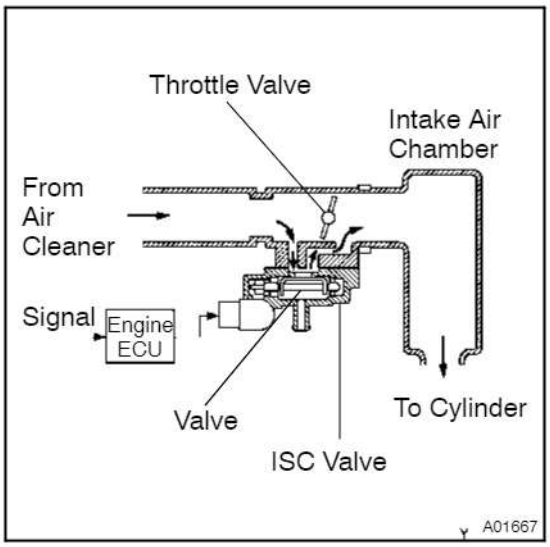
OK →

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

DI31F–02

| DTC | P0505/33 | Idle Control System Malfunction |
|---|---|---|

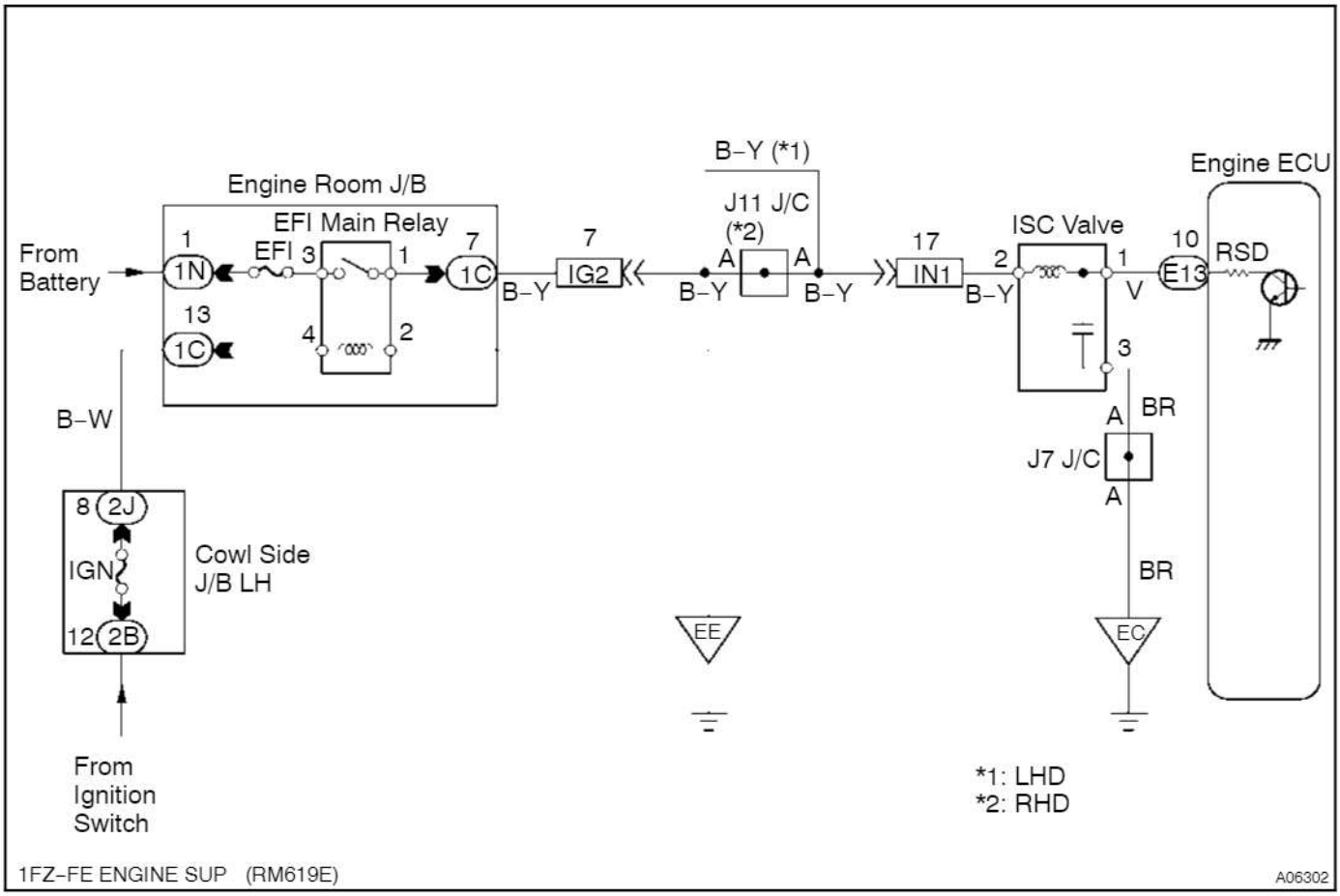
## CIRCUIT DESCRIPTION




The rotary solenoid type ISC valve is located in front of the intake air chamber and intake air bypassing the throttle valve is directed to the ISC valve through a passage.
In this way the intake air volume bypassing the throttle valve is regulated, controlling the engine speed.
The engine ECU operates only the ISC valve to perform idle–up and provide feedback for the target idling speed.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P0505/33 | Open or short in ISC valve circuit. | • Open or short in ISC valve circuit<br>• ISC valve<br>• Engine ECU |

## WIRING DIAGRAM



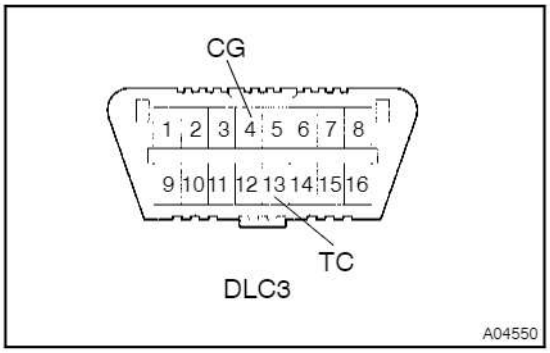
## INSPECTION PROCEDURE

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 | **Check engine idle speed.** |




**PREPARATION:**

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into "N" or neutral position.
(e) Connect hand–held tester to DLC3 on the vehicle.
(f) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18040

**CHECK:**

Check the difference of engine speed between the ones less than 5 sec. and more than 5 sec. after connecting terminals 13 (TC) and 4 (CG) of the DLC3.

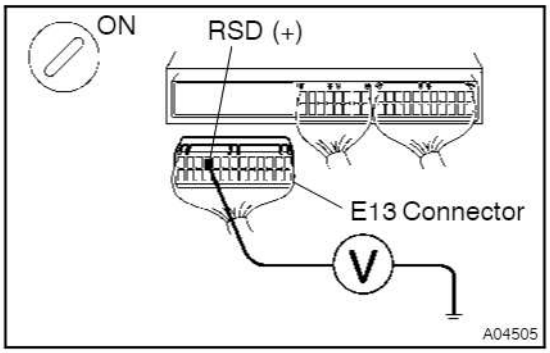
**OK:**

**Difference of engine speed: More than 100 rpm**

**OK** → **Proceed to next circuit inspection shown on problem symptom table (See page DI–21).**

**NG**

| 2 | Check voltage between terminal RSD of engine ECU connector and body ground. |
|---|---|




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Disconnect the E13 connector of engine ECU.
(c) Turn the ignition switch ON.

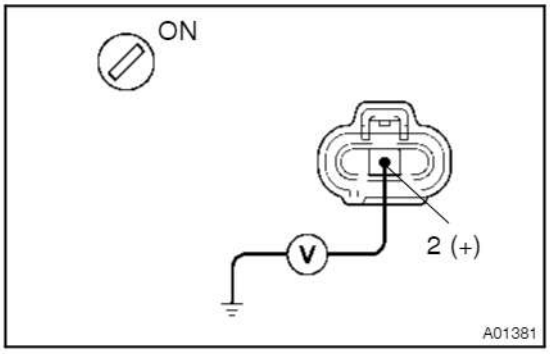
**CHECK:**
Measure voltage between terminal RSD of engine ECU connector and body ground.

**OK:**
**Voltage: 9 – 14 V**

| OK | Go to step 5. |
|---|---|

NG

| 3 | Check voltage between terminal of ISC valve connector and body ground. |
|---|---|




**PREPARATION:**
(a) Disconnect the ISC valve connector.
(b) Turn the ignition switch ON.

**CHECK:**
Measure voltage between terminal 2 of ISC valve connector and body ground.

**OK:**
**Voltage: 9 – 14 V**

| NG | Check for open and short in harness and connector between ISC valve and engine room J/B. |
|---|---|

OK

| | |
|---|---|
| 4 | Check for open and short in harness and connector in RSD circuit. |

NG → Repair or replace.

OK →

Replace ISC valve.

| | |
|---|---|
| 5 | Check for open and short in harness and connector between terminal 3 of ISC valve connector and body ground. |

NG → Repair or replace.

OK →

| | |
|---|---|
| 6 | Check operation of the ISC valve (See page FI–42). |

NG → Replace ISC valve.

OK →

| | |
|---|---|
| 7 | Check the blockage of ISC valve and the passage to bypass the throttle valve. |

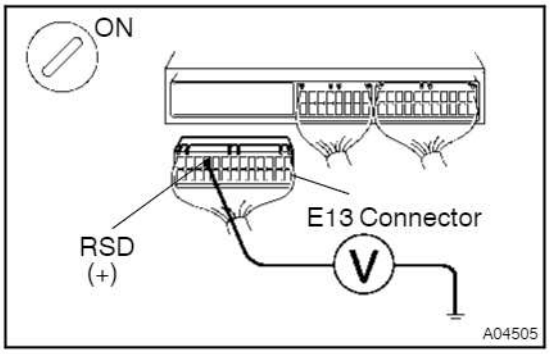
NG → Repair or replace ISC valve and throttle body.

OK →

Proceed to next circuit inspection shown on problem symptom table (See page DI–21).

## When not using hand–held tester

| 1 | Check voltage between terminal RSD of engine ECU and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Disconnect the E13 connector of engine ECU.
(c) Turn the ignition switch ON.

**CHECK:**

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

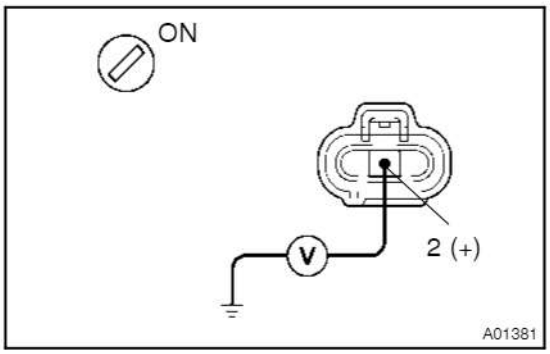
**OK:**

**Voltage: 9 – 14 V**

| OK | Go to step 4. |
|---|---|

NG

| 2 | Check voltage between terminal of ISC valve connector and body ground. |
|---|---|




**PREPARATION:**

(a) Disconnect the ISC valve connector.
(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminal 2 of ISC valve connector and body ground.

**OK:**

**Voltage: 9 – 14 V**

| NG | Check for open and short in harness and connector between ISC valve and engine room J/B. |
|---|---|

OK

| | |
|---|---|
| 3 | Check for open and short in harness and connector in RSD circuit. |

NG → Repair or replace.

OK →

Replace ISC valve.

| | |
|---|---|
| 4 | Check for open and short in harness and connector between terminal 3 of ISC valve connector and body ground. |

NG → Repair or replace.

OK →

| | |
|---|---|
| 5 | Check operation of the ISC valve (See page FI–42). |

NG → Replace ISC valve.

OK →

| | |
|---|---|
| 6 | Check the blockage of ISC valve and the passage to bypass the throttle valve. |

NG → Repair or replace ISC valve and throttle body.

OK →

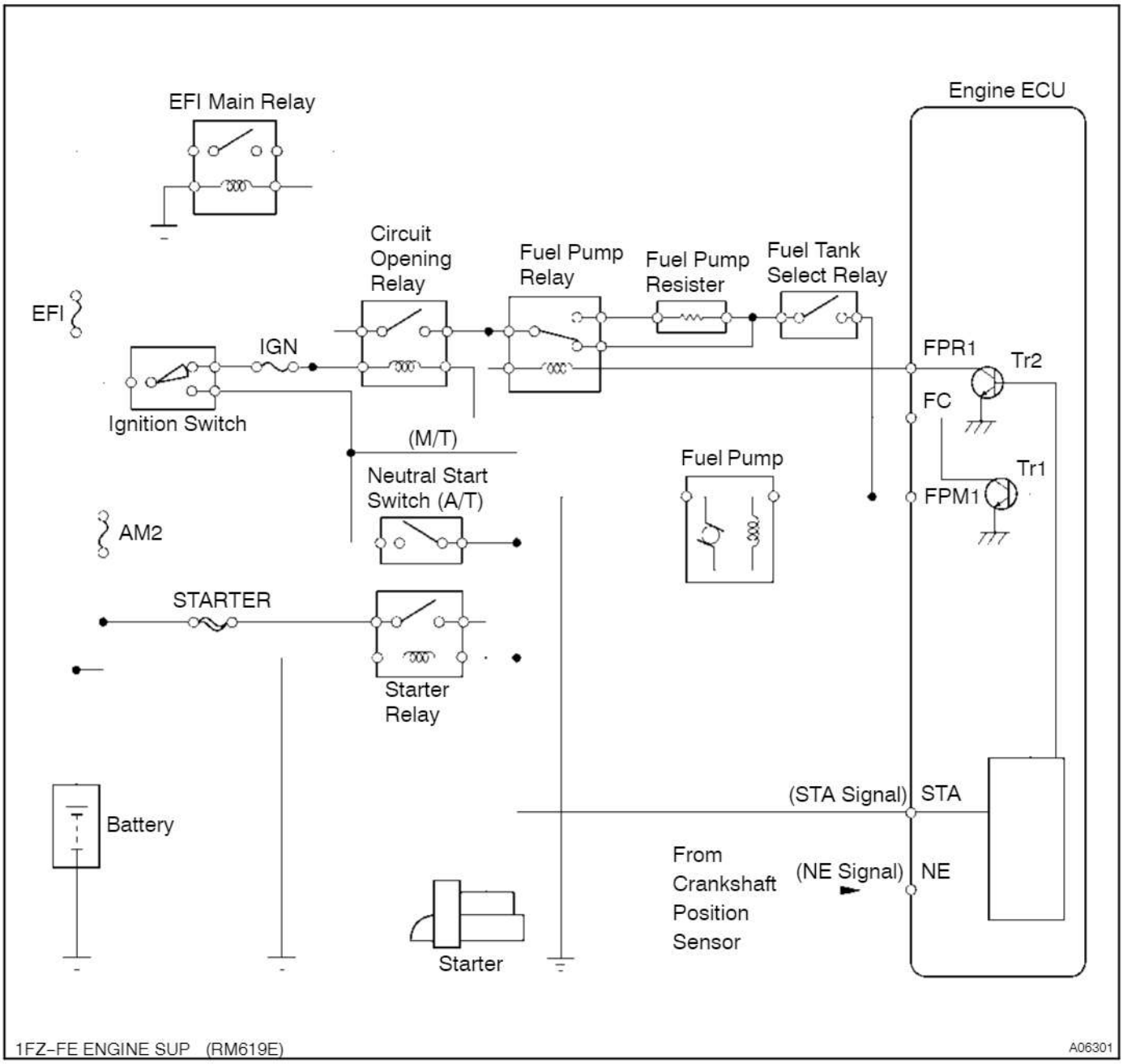
Proceed to next circuit inspection shown on problem symptom table (See page DI–21).

DI3M8–02

| DTC | P1200/78 | Fuel Pump Relay/ECU Circuit Malfunction |
|---|---|---|

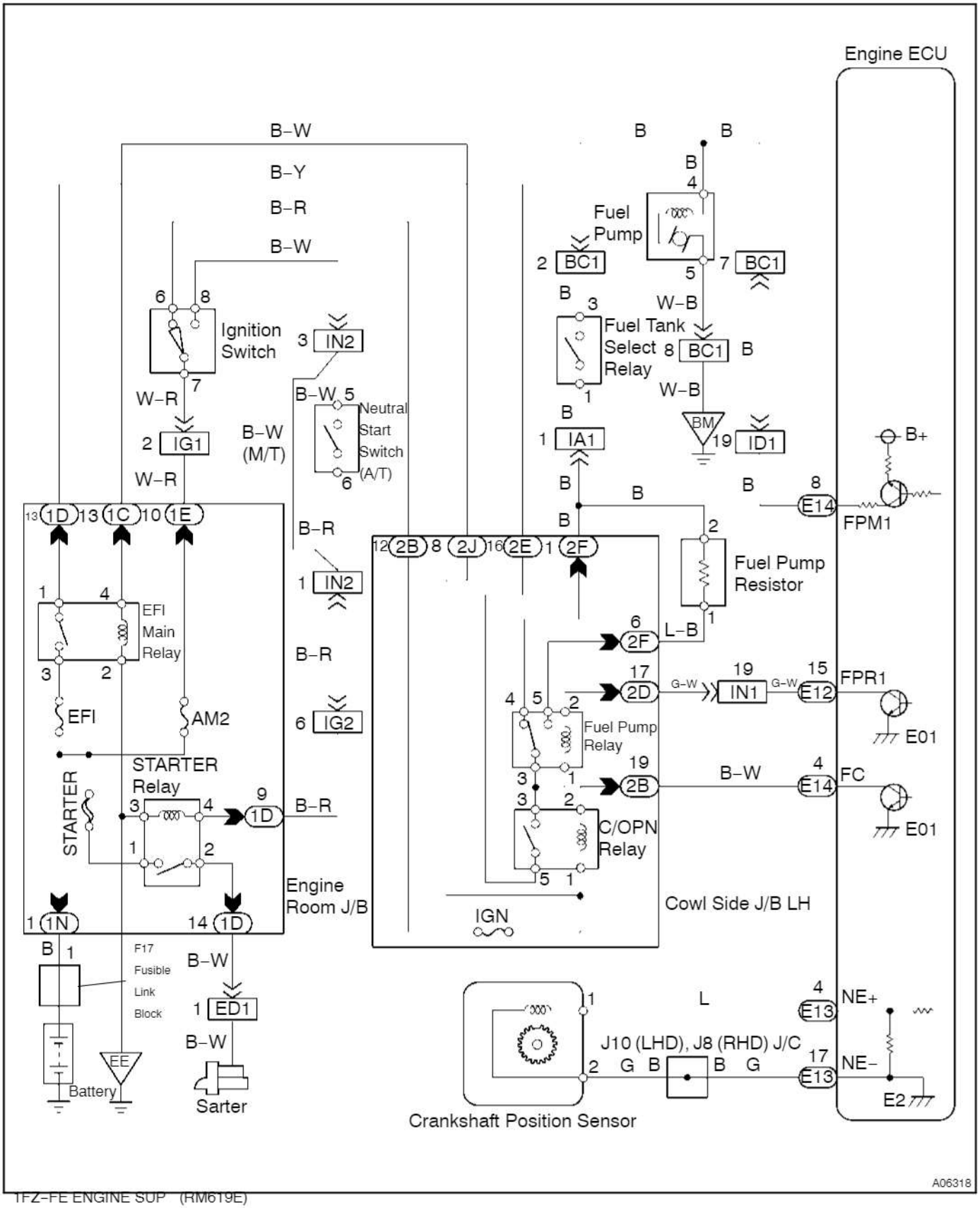
## CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil and also current flows to terminal STA of the engine ECU (STA signal).
When the STA signal and NE signal are input to the engine ECU, Tr1 is turned ON, current flows to coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates. While the NE signal is generated (engine running), the engine ECU keeps Tr1 ON (circuit opening relay ON) and the fuel pump also keeps operating. The fuel pump speed is controlled at two levels (high speed or low speed) by the condition of the engine (starting, light load, heavy load). When the engine starts (STA ON), Tr2 in the engine ECU is OFF, so the fuel pump relay closes and battery voltage is applied directly to the fuel pump. Fuel pump operates at high speed. After the engine starts during idling or light loads, since Tr2 goes ON, power is supplied to the fuel pump via the fuel pump resistor. Fuel pump operates at low speed.



| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P1200/78 | Open or short in fuel pump relay circuit | • Open or short in fuel pump relay circuit<br>• Fuel pump relay<br>• Engine ECU |

## WIRING DIAGRAM

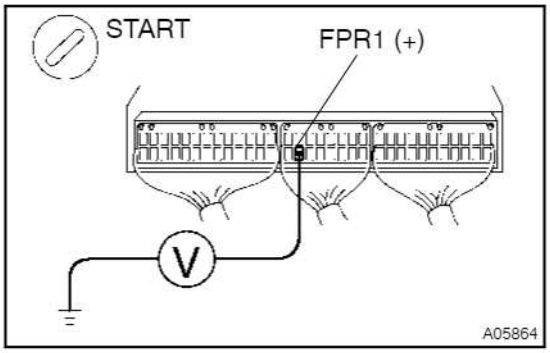


HINT:
This diagnostic chart is based on premise that engine is started. If the engine is not started, proceed to problem symptoms table on DI–21.

## 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 terminal FPR1 of engine ECU and body ground.** |
|---|---|




**PREPARATION:**
(a) Remove the glove compartment door.
(b) Start the engine.

**CHECK:**
Measure voltage between terminal FPR1 of the engine ECU connector and body ground while racing engine.

**OK:**

| Time after engine started | Voltage |
|---|---|
| Less than 60 seconds | 9 ~ 14 V |
| 60 seconds or more | 0 ~ 3 V |

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

NG

| 2 | **Check operation of fuel pump relay (Marking: FUEL/PMP) (See page FI–46).** |
|---|---|

NG → **Replace fuel pump relay.**

OK

**Repair or replace harness or connector between fuel pump relay and engine ECU.**

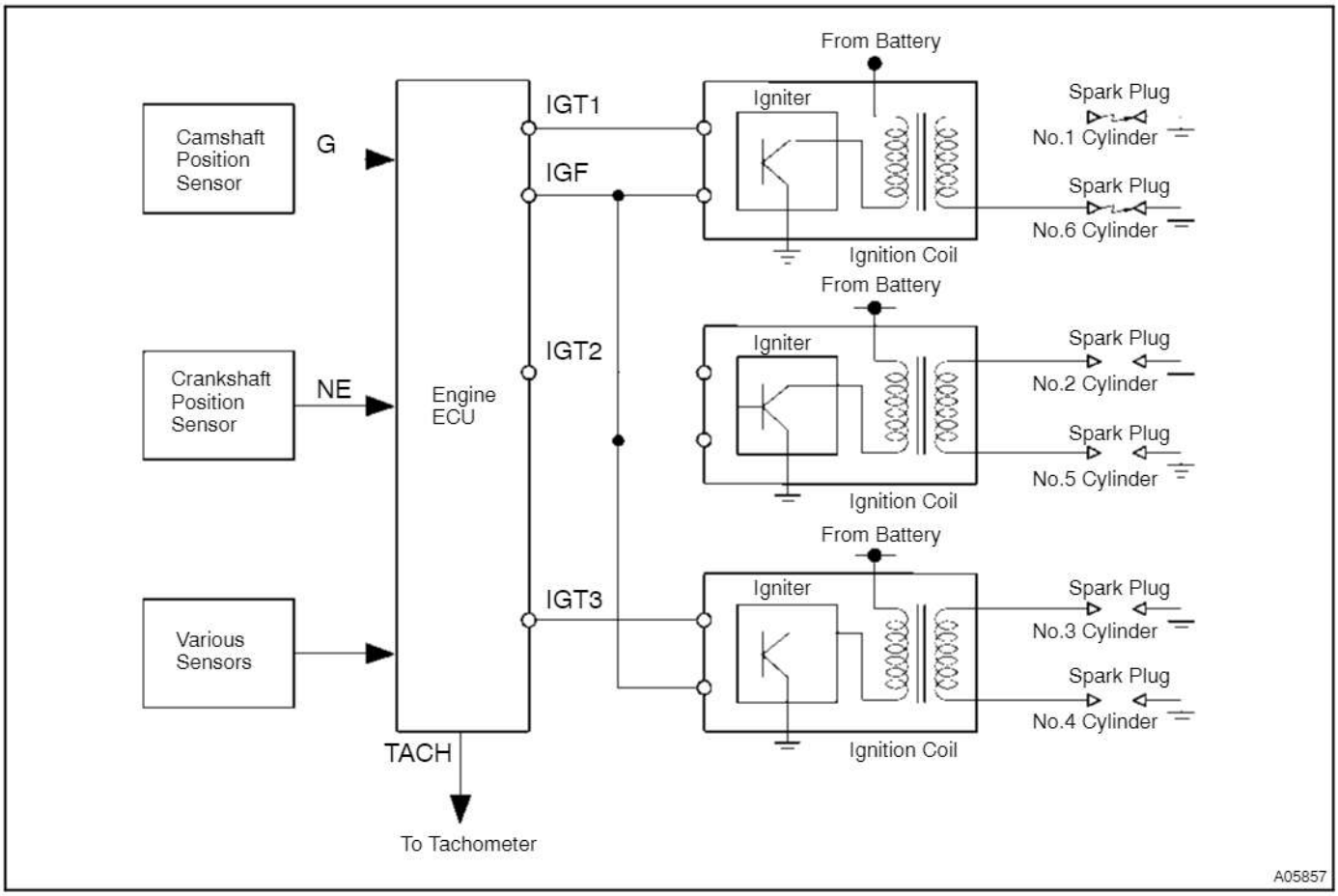
| DTC | P1300/14 | Igniter Circuit Malfunction No.1 |
|---|---|---|

| DTC | P1310/15 | Igniter Circuit Malfunction No.2 |
|---|---|---|

| DTC | P1320/14 | Igniter Circuit Malfunction No.3 |
|---|---|---|

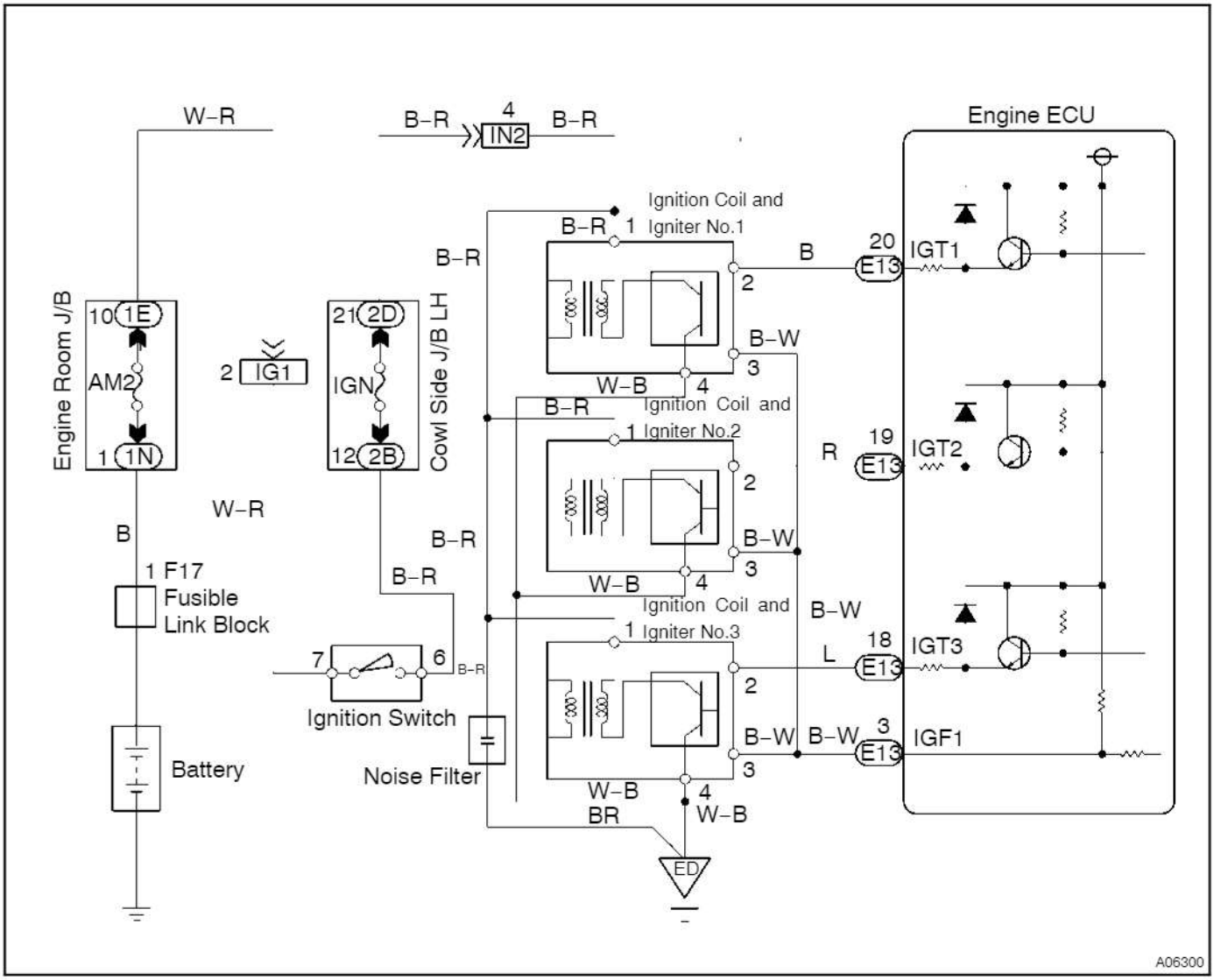
## CIRCUIT DESCRIPTION

A DIS (Direct Ignition System) has been adopted. The DIS improves the ignition timing accuracy, reduces high–voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor.
The DIS is a 2–cylinder simultaneous ignition system which ignites 2 cylinders simultaneously with 1 ignition coil. In the 2–cylinder simultaneous ignition system, each of the 2 spark plugs is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to the 2 spark plugs. The sparks of the 2 spark plugs pass simultaneously from the center electrode to the ground electrode.
The engine ECU determines ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil in the ignition coil is supplied simultaneously to the 2 spark plugs via the high–tension cords that are connected to the both ends of the secondary coil. At the same time, the igniter also sends an ignition confirmation signal (IGF) as a fail–safe measure to the engine ECU.



| DTC No | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P1300/14 | No IGF signal to engine ECU for 6 consecutive IGT1 signals during engine running | • Open or short in IGF or IGT1 circuit from ignition coil to engine ECU.<br>• Ignition coil No.1 (w/ Igniter)<br>• Engine ECU |
| P1310/15 | No IGF signal to engine ECU for 6 consecutive IGT2 signals during engine running | • Open or short in IGF or IGT2 circuit from ignition coil to engine ECU.<br>• Ignition coil No.2 (w/ Igniter)<br>• Engine ECU |
| P1320/14 | No IGF signal to engine ECU for 6 consecutive IGT3 signals during engine running | • Open or short in IGF or IGT3 circuit from ignition coil to engine ECU.<br>• Ignition coil No.3 (w/ Igniter)<br>• Engine ECU |

## WIRING DIAGRAM



## INSPECTION PROCEDURE

HINT:

- Read freed 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.
- DTC P1300/14 is for the ignition circuit of No.1 and No.6 cylinders.
- DTC P1310/15 is for the ignition circuit of No.2 and No.5 cylinders.
- DTC P1320/14 is for the ignition circuit of No.3 and No.4 cylinders.

| | |
|---|---|
| 1 | **Check spark plug and spark (See page IG–1).** |

**NG** → **Go to step 4.**

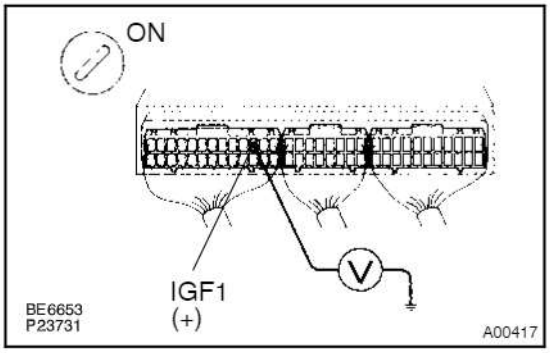
**OK**

| | |
|---|---|
| 2 | **Check for open and short in harness and connector in IGF1 signal circuit between engine ECU and ignition coil No.1, No.2 No.3 (See page IN–19).** |

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

**OK**

| | |
|---|---|
| 3 | **Disconnect ignition coil No.1, No.2, No.3 connectors and check voltage between terminal IGF1 of engine ECU connector and body ground.** |




**PREPARATION:**

(a) Disconnect the ignition coil No.1, No.2, No.3 connectors.
(b) Remove the glove compartment door.
(c) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminal IGF1 of engine ECU connector and body ground.

**OK:**

**Voltage: 4.5 – 5.5 V**

**OK** → **Replace ignition coil No.1, No.2, No.3.**

**NG**

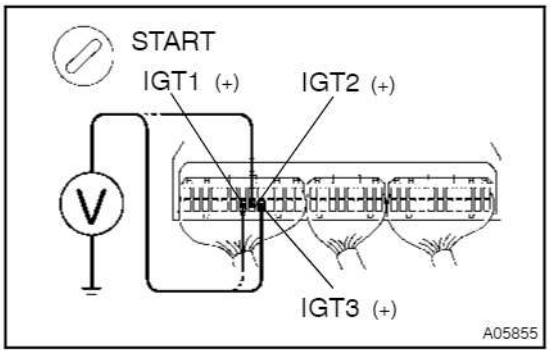
**Check and replace engine ECU (See page IN–19).**

| | |
|---|---|
| 4 | **Check for open and short in harness and connector in IGT1, 2, 3 signal circuit between engine ECU and ignition coil No.1, No.2, No.3 (See page IN–19).** |

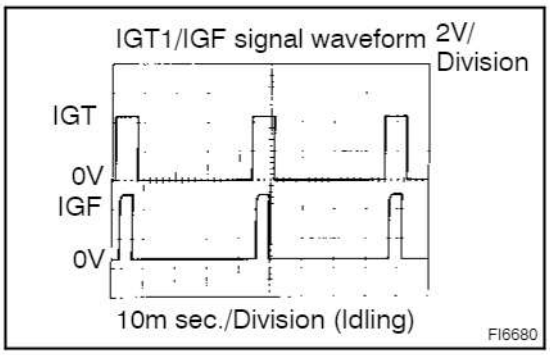
**NG** → **Repair or replace harness or connector.**

**OK**

| | |
|---|---|
| 5 | **Check voltage between terminals IGT1, 2, 3 of engine ECU connector and body ground.** |




**PREPARATION:**
Remove the grove compartment door.
**CHECK:**
Measure voltage between terminals IGT1, 2, 3 of engine ECU connector and body ground when engine is cranked.
**OK:**
**Voltage: More than 0.1 V and less than 4.5 V**

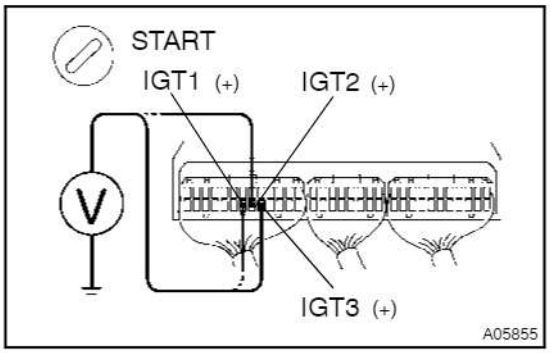



**Reference: INSPECTION USING OSCILLOSCOPE**
During idling, check waveform between terminals IGT1, 2, 3 and E1 of engine ECU.
HINT:
The correct waveform are as shown.
IGT2, IGT3 signal waveform is same as the IGT1 signal waveform.

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

**OK**

| 6 | **Disconnect ignition coil No.1, No.2, No.3 connector and check voltage between terminals IGT1, 2, 3 of engine ECU connector and body ground.** |
|---|---|




**PREPARATION:**

(a) Disconnect the ignition coil No.1, No.2, No.3 connectors.

(b) Remove the glove compartment door.

**CHECK:**

Measure voltage between terminals IGT1, 2, 3 of engine ECU connector and body ground when engine is cranked.

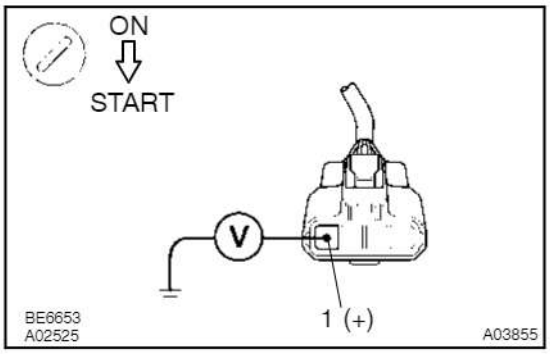
**OK:**

**Voltage: More than 0.1 V and less than 4.5 V**

| NG | **Replace ignition coil No.1, No.2, No.3.** |
|---|---|

OK

| 7 | **Check ignition coil No.1, No.2, No.3 power source circuit.** |
|---|---|




**PREPARATION:**

Disconnect the ignition coil No.1, No.2, No.3 connectors.

**CHECK:**

Measure voltage between terminal 1 of ignition coil (w/ ignitor) connector and body ground, when ignition switch is turned to "ON" and "START" position.

**OK:**

**Voltage: 9 – 14 V**

| NG | **Repair ignition coil No.1, No.2, No.3 power source circuit.** |
|---|---|

OK

| 8 | **Check for open and short in harness and connector between ignition switch and ignition coil No.1, No.2, No.3 (See page IN–19).** |
|---|---|

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

OK

| | |
|---|---|
| 9 | Check EFI main relay (Marking: EFI) (See page FI–44). |

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

OK

Replace ignition coil No.1, No.2, ,No.3.

DI1IP–06

| DTC | P1335/13 | Crankshaft Position Sensor Circuit Malfunction (during engine running) |
|---|---|---|

## CIRCUIT DESCRIPTION

Refer to DTC P0335/12,13 (Crankshaft Position Sensor Circuit Malfunction) on page DI–50.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| P1335/13 | No crankshaft position sensor signal to engine ECU with engine speed 1,000 rpm or more | • Open or short in crankshaft position sensor circuit<br>• Crankshaft position sensor<br>• Starter<br>• Engine ECU |

## WIRING DIAGRAM

Refer to DTC P0335/12,13 (Crankshaft Position Sensor Circuit Malfunction) on page DI–50 for the WIRING DIAGRAM.

## INSPECTION PROCEDURE

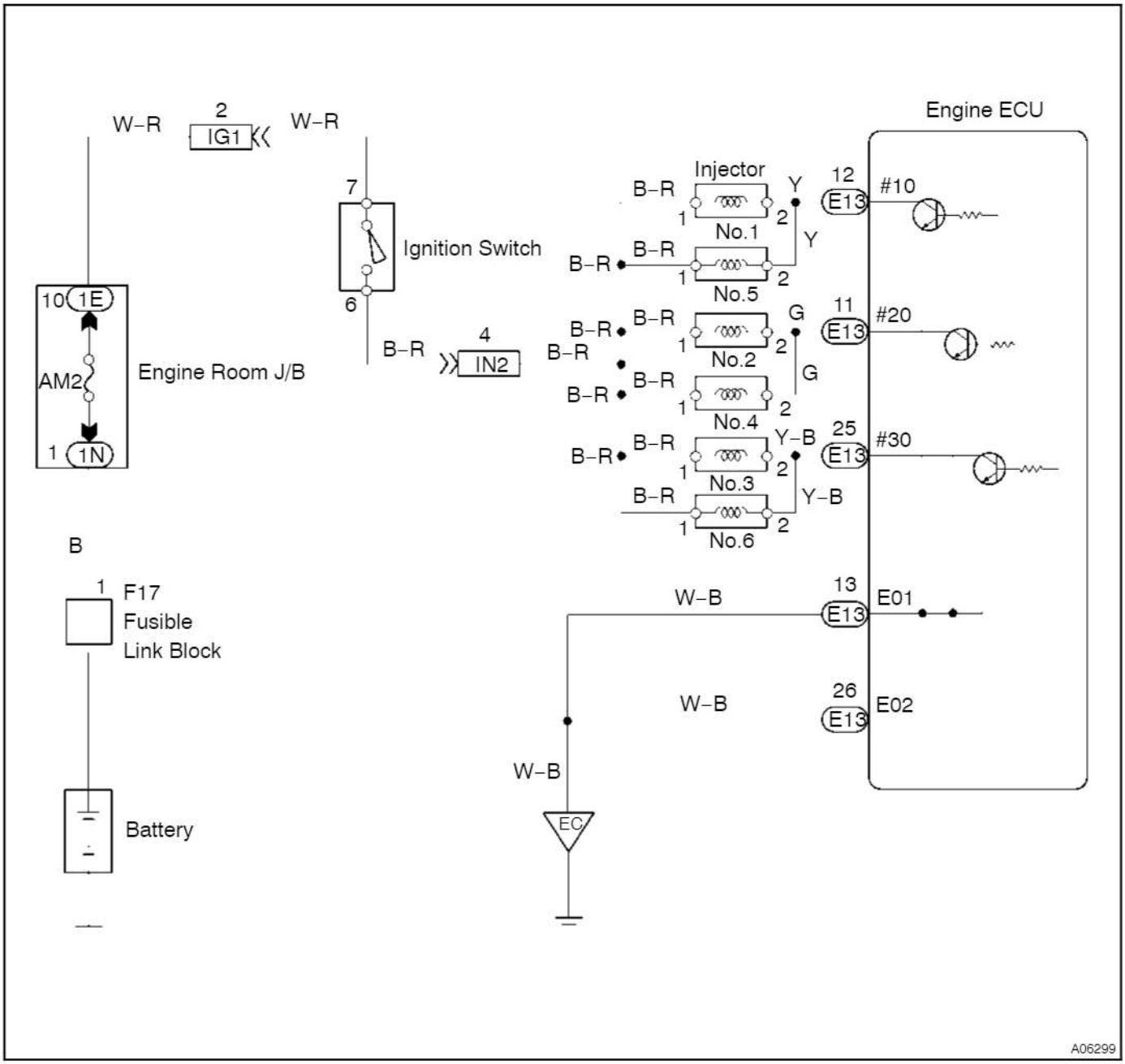
Refer to DTC P0335/12,13 (Crankshaft Position Sensor Circuit Malfunction) on page DI–50 for the INSPECTION PROCEDURE.

# Injector Circuit

## CIRCUIT DESCRIPTION

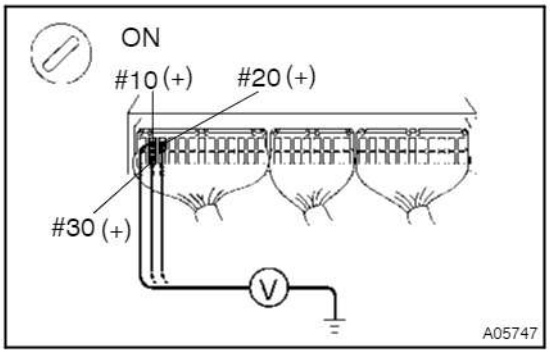
The injectors are located in the intake manifold. They inject fuel into the cylinders based on the signals from the engine ECU.

## WIRING DIAGRAM



## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check voltage between terminals #10 ~ 30 of engine ECU and body ground.** |




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals #10 ~ 30 of engine ECU and body ground.

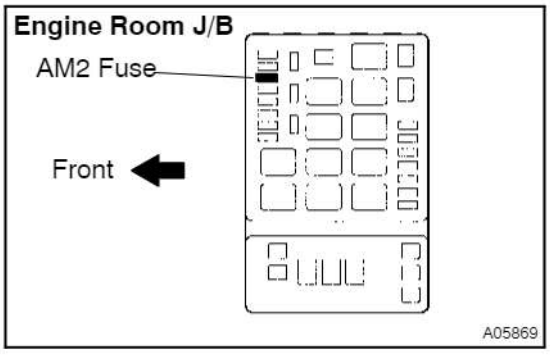
**OK:**

**Voltage: 9 – 14 V**

| | |
|---|---|
| OK | **Go to step 4.** |

NG

| | |
|---|---|
| 2 | **Check AM2 fuse.** |




**PREPARATION:**

Remove AM2 fuse from engine room J/B.

**CHECK:**

Check continuity of AM2 fuse.

**OK:**

**Continuity**

| | |
|---|---|
| NG | **Check for short in the harness and all the components connected to AM2 fuse.** |

OK

| | |
|---|---|
| 3 | Check resistance of injectors (See page FI–21). |

NG → Replace injector.

OK →

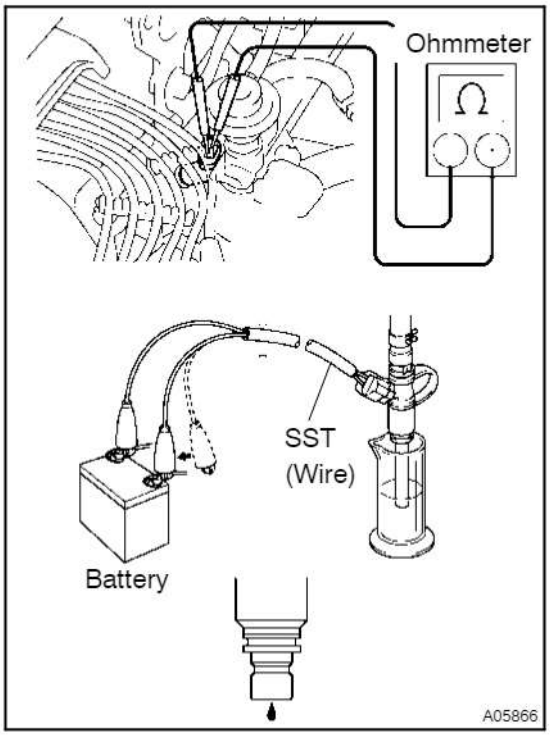
Check and repair harness and connector between engine ECU and battery.

| | |
|---|---|
| 4 | Check for open in harness and connector between terminal E01, E02 of engine ECU connector and body ground (See page IN–19). |

NG → Repair or replace harness or connector.

OK →

| 5 | Check injectors. |
|---|---|




**PREPARATION:**
Disconnect the injector connectors.
**CHECK:**
Measure resistance of injectors.
**OK:**
**Resistance: 13.4 – 14.2 Ω at 20°C (68°F)**
**CHECK:**
Check injection volume of injectors.
**OK:**
**Injection volume:**
**71 – 86 $cm^3$ (4.3 – 5.2 cu in.)/15 sec.**
**Difference between each injector:**
**Less than 13 $cm^3$ (0.8 cu in.)**
**Leakage: One drop or less per minute**

**NG** → **Replace injector(s).**

**OK**

**Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

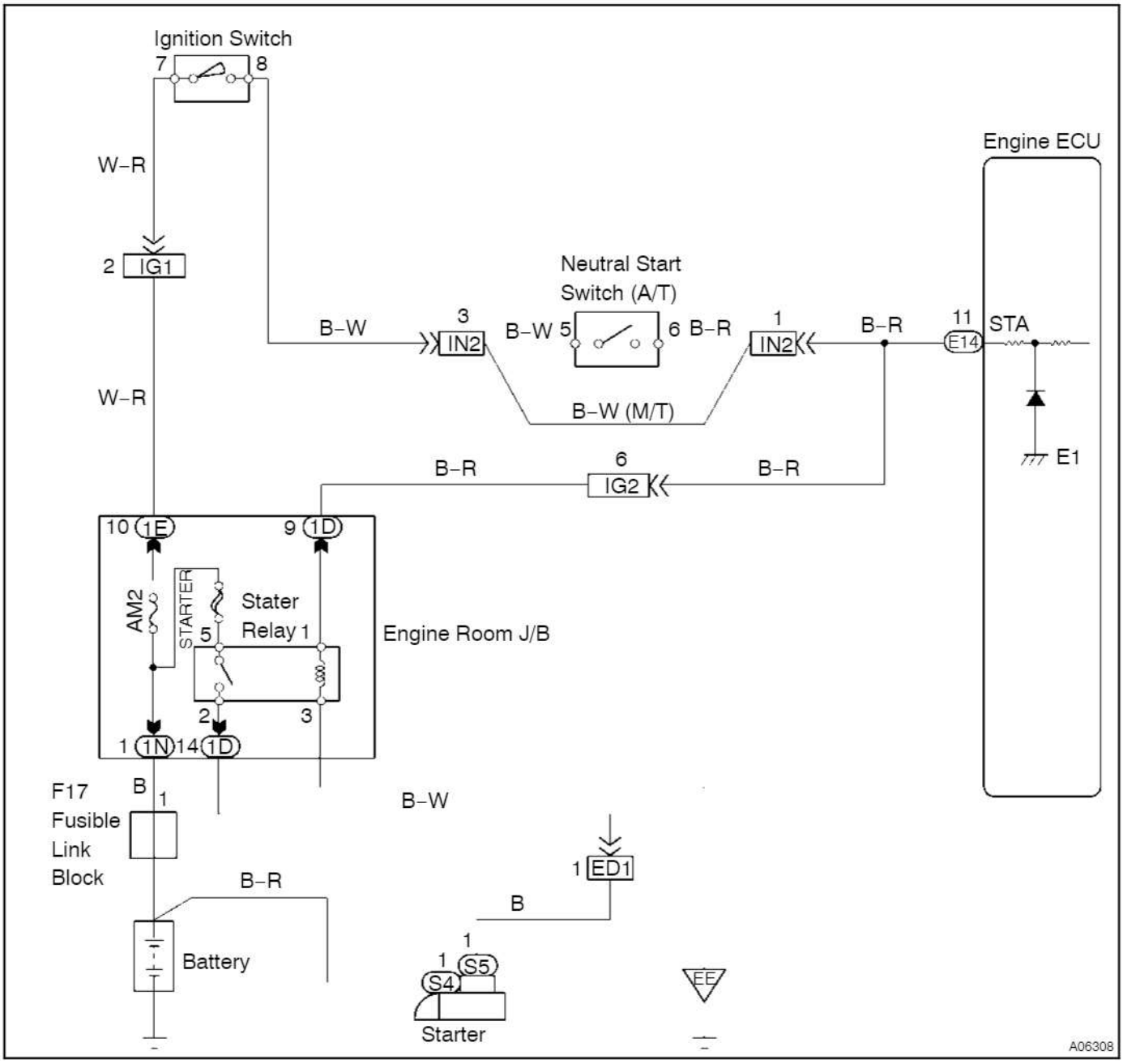
DI31G–04

# 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 voltage is applied to terminal STA of the engine ECU. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after–start injection control.

## WIRING DIAGRAM

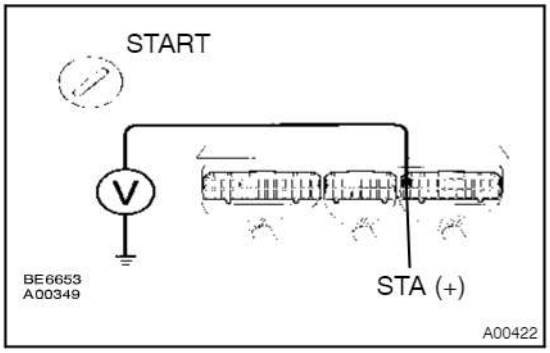


## INSPECTION PROCEDURE

HINT:
This diagnostic chart is based on the premise that engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table (See page DI–21).

| | |
|---|---|
| 1 | **Check the starter signal.** |

**Using hand–held tester:**
**PREPARATION:**
(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and hand–held tester main switch ON.
**CHECK:**
Read the starter signal on the hand–held tester during cranking.
**OK:**
**Starter signal: ON**




**When not using hand–held tester:**
**PREPARATION:**
Remove the glove compartment door.
**CHECK:**
Measure voltage between terminal STA of engine ECU connector and body ground during cranking.
**OK:**
**Voltage: 6.0 V or more**

**OK** → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

**NG**

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

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

**OK**

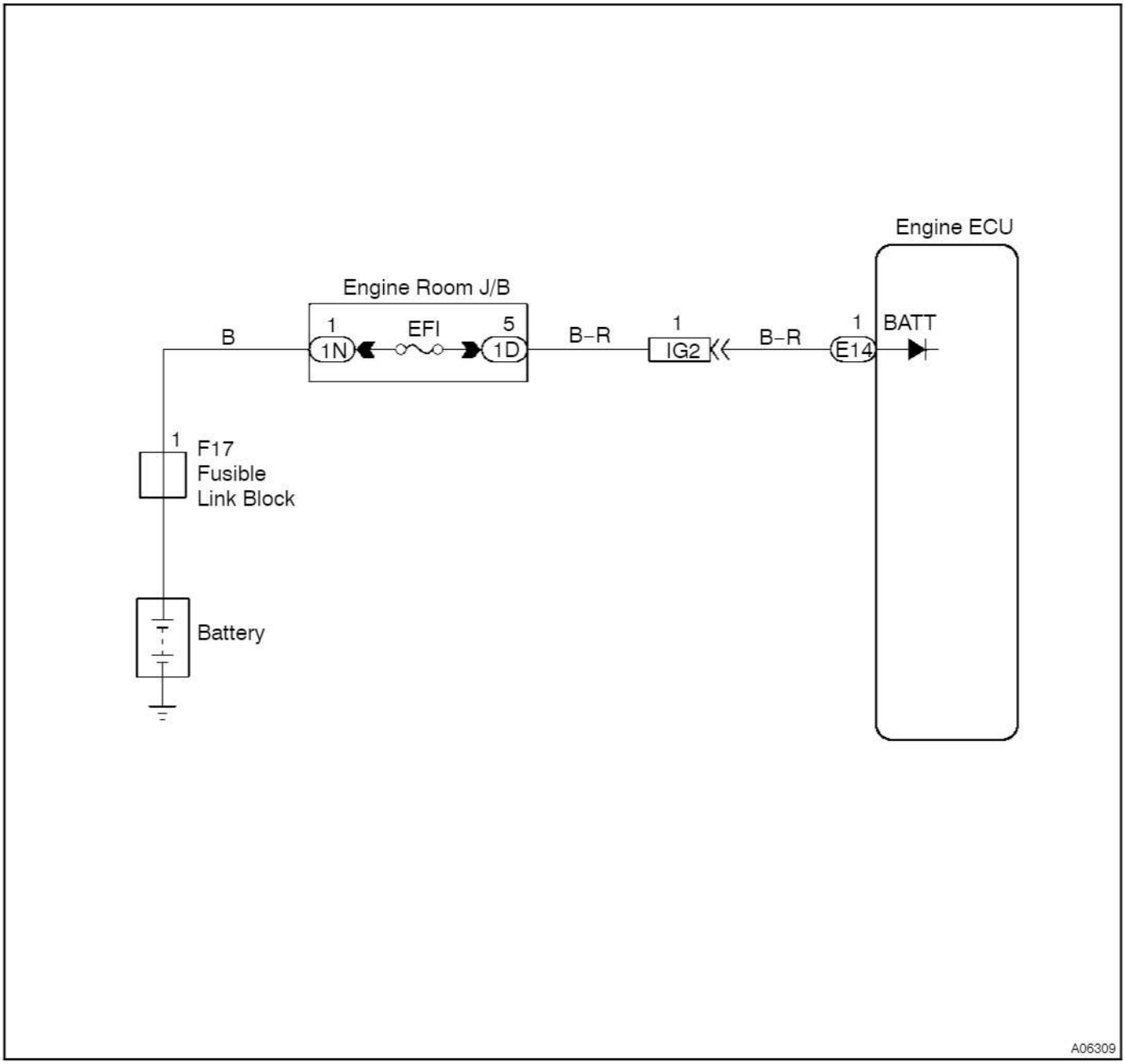
**Check and replace engine ECU (See page IN–19).**

# Back Up Power Source Circuit

## CIRCUIT DESCRIPTION

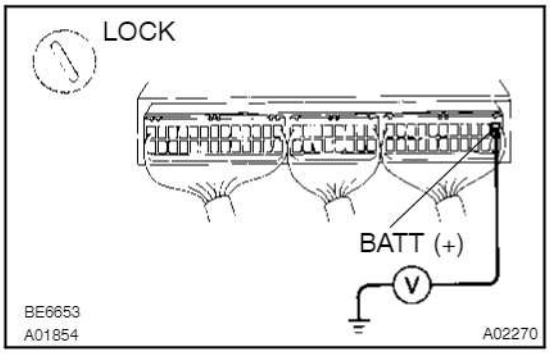
Battery voltage is supplied to terminal BATT of the engine ECU even when the ignition switch is OFF for use by the DTC memory and air–fuel ratio adaptive control value memory, etc.

## WIRING DIAGRAM



## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check voltage between terminal BATT of engine ECU connector and body ground** |

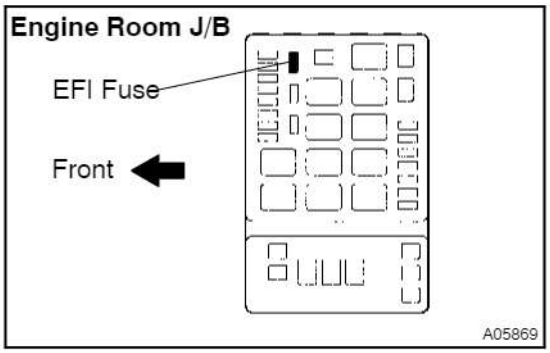



**PREPARATION:**
Remove the glove compartment door.
**CHECK:**
Measure voltage between terminal BATT of engine ECU connector and body ground.
**OK:**
**Voltage: 9 – 14 V**

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

NG

| | |
|---|---|
| 2 | **Check EFI fuse.** |




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

| | |
|---|---|
| NG | **Check for short in all the harness and components connected to EFI fuse.** |

OK

**Check and repair harness or connector between battery, EFI fuse and engine ECU.**

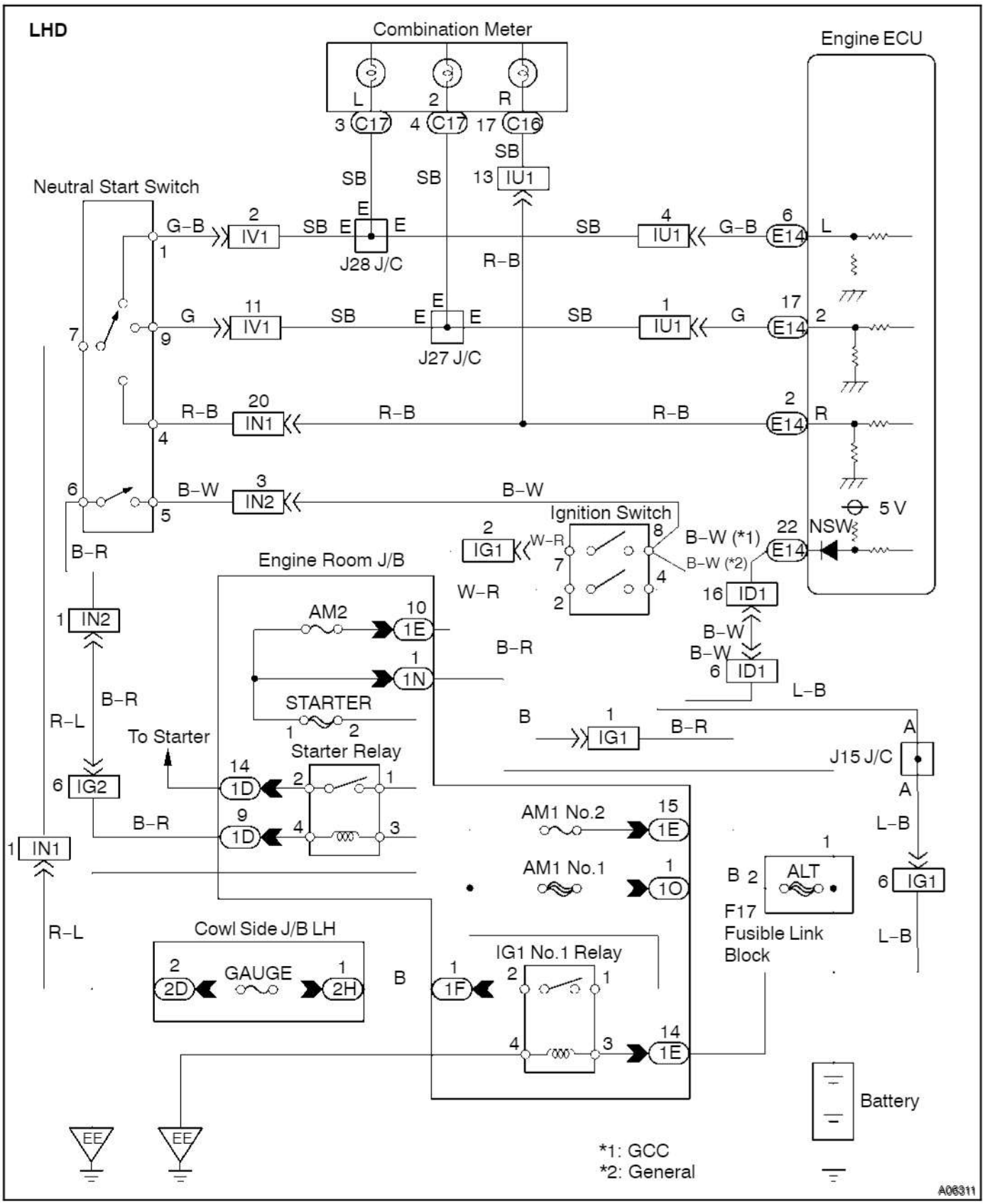
DI3QE–01

# Neutral Start Switch Circuit

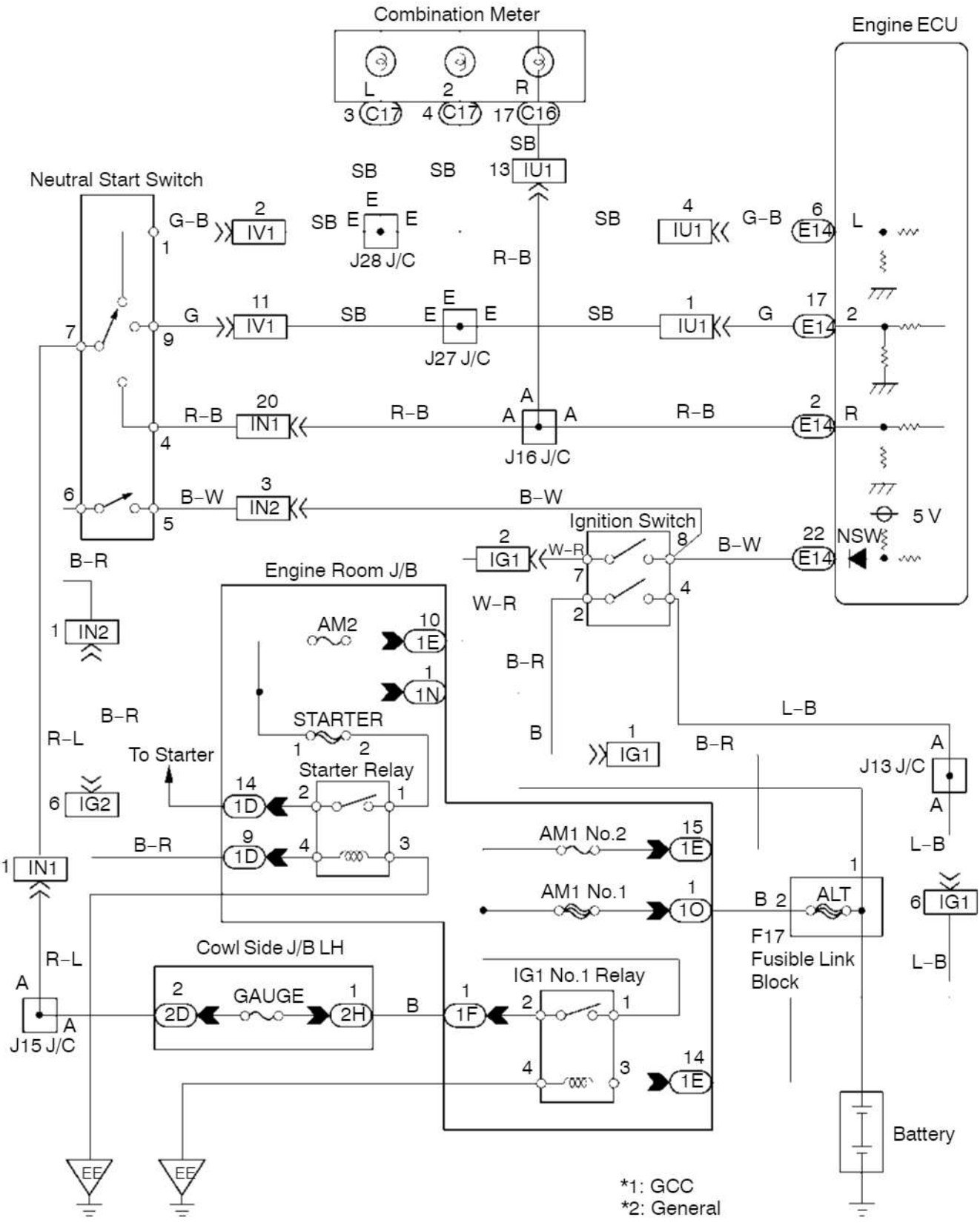
## CIRCUIT DESCRIPTION

The neutral start switch goes on when the shift lever is in the N or P shift position. When it goes on terminal NSW of the engine ECU is grounded to body ground via the starter relay thus the terminal NSW voltage becomes 0V. When the shift lever is in the D, 2, L or R position, the neutral start switch goes off, so the voltage of engine ECU terminal NSW becomes battery voltage, the voltage of the engine ECU internal power source. If the shift lever is moved from the N position to the D position, this signal is used for air–fuel ratio correction and for idle speed control (estimated control), etc.

# WIRING DIAGRAM



**RHD**



## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check R , 2, L and NSW signals.** |

**When using hand–held tester:**

**PREPARATION:**

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

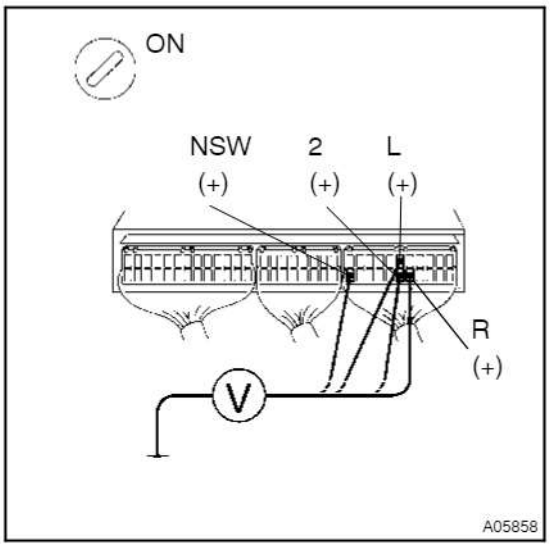
(b) Turn the ignition switch ON and hand–held tester main switch ON.

**CHECK:**

Shift the shift lever to the P, R, N, 2, or L positions, and read the NSW, R, 2 and L signals on the hand–held tester.

**OK:**

| Shift position | Signal |
|---|---|
| P, N | NSW OFF → ON |
| R | R OFF → ON |
| 2 | 2 OFF → ON |
| L | L OFF → ON |




**When not using hand–held tester:**

**PREPARATION:**

Turn the ignition switch ON.

**CHECK:**

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

**OK:**

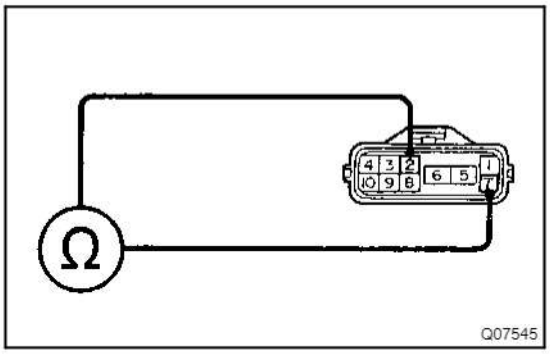
| Position | R–Body ground | NSW–Body ground | 2–Body ground | L–Body ground |
|---|---|---|---|---|
| P, N | 0 V | Below 1 V | Below 1 V | Below 1 V |
| R | 7.5 – 14 V* | 7.5 – 14 V* | Below 1 V | Below 1 V |
| D | Below 1 V | 7.5 – 14 V | Below 1 V | Below 1 V |
| 2 | Below 1 V | 7.5 – 14 V | 7.5 – 14 V | Below 1 V |
| L | Below 1 V | 7.5 – 14 V | Below 1 V | 7.5 – 14 V |

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

**OK** → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

**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 shifted to each position.

**OK:**

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

NG → **Replace neutral start switch.**

OK ↓

| 3 | Check harness and connector between battery and neutral start switch, neutral start switch and engine ECU (See page IN–19). |
|---|---|

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

OK ↓

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

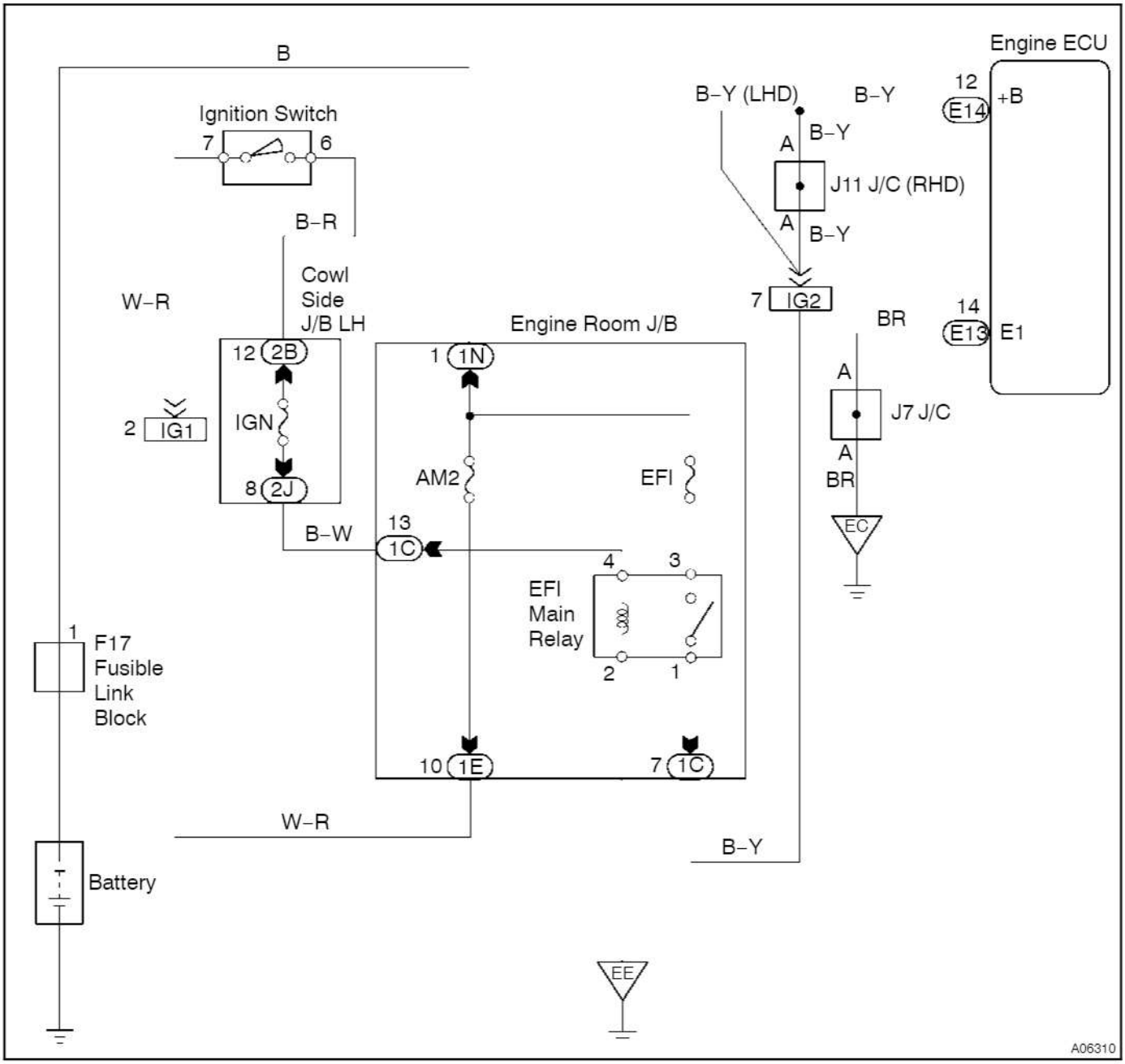
DI1U–05

# ECU Power Source Circuit

## CIRCUIT DESCRIPTION

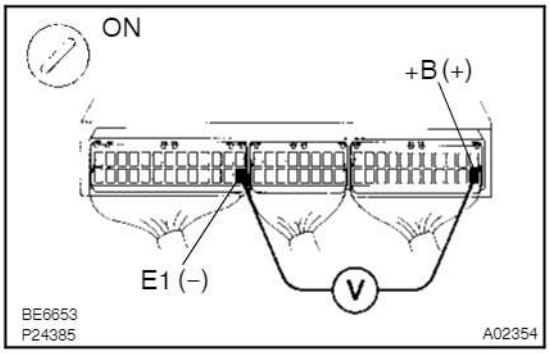
When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the EFI main relay and supplying power to the terminal +B of the engine ECU.

## 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 engine ECU connector.

**OK:**

**Voltage: 9 – 14 V**

**OK** → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

**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 EFI main relay (Marking: EFI) (See page FI–44).** |

**NG** → **Replace EFI main relay.**

**OK**

| | |
|---|---|
| 4 | **Check EFI fuse (See page DI–81, step2).** |

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

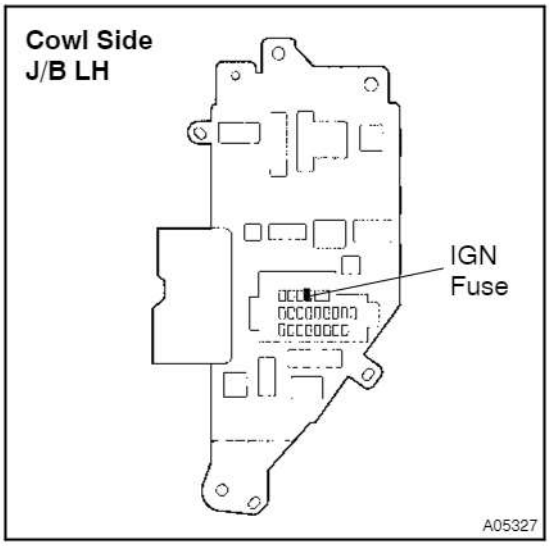
**OK**

| | |
|---|---|
| 5 | **Check for open in harness and connector between EFI main relay and battery, EFI main relay and engine ECU (See page IN–19).** |

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

**OK**

| | |
|---|---|
| 6 | **Check IGN fuse.** |




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

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

**OK**

| | |
|---|---|
| 7 | Check ignition switch. |

NG → Replace ignition switch.

OK

Check for open in harness and connector between IG switch and main relay, main relay and body ground (See page IN–19).

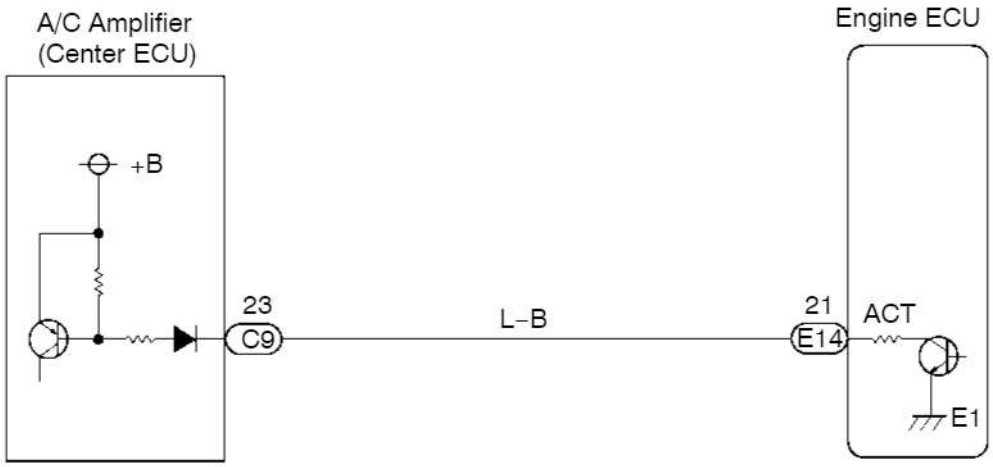
DI2IF-05

# A/C Cut Control Circuit

## CIRCUIT DESCRIPTION

This circuit cuts air conditioning operation during vehicle acceleration in order to increase acceleration performance. During acceleration with the vehicle speed at 25 km/h (16 mph) or less, engine speed at 1,600 rpm or less and throttle valve opening angle at 60° or more, the A/C magnet switch is turned OFF for several seconds.

## WIRING DIAGRAM




A05395

# INSPECTION PROCEDURE

## When using hand–held tester

| | |
|---|---|
| 1 | **Connect the hand–held tester and check operation of air conditioning cut control.** |

**PREPARATION:**

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and hand–held tester main switch ON.
(c) Start the engine and conditioning switch ON.

HINT:

A/C magnet clutch is turned ON.

(d) Select the ACTIVE TEST mode on the hand–held tester.

**CHECK:**

Check operation of A/C magnet clutch cut when air conditioning cut control is operated by the hand–held tester.

**OK:**

**A/C magnet clutch is turned OFF.**

**OK** → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

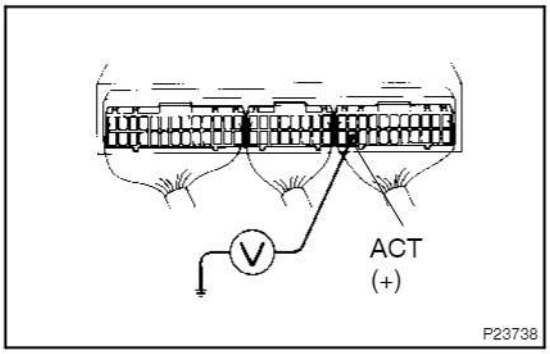
**NG**

| | |
|---|---|
| 2 | **Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19).** |

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

**OK**

| | |
|---|---|
| 3 | **Check voltage between terminal ACT of engine engine ECU and body ground.** |




**PREPARATION:**

(a) Remove the glove compartment door.

(b) Start the engine.

**CHECK:**

Measure voltage between terminal ACT of engine ECU connector and body ground when A/C switch is turned to ON and OFF.

**OK:**

| A/C switch condition | Voltage |
|---|---|
| ON | 9 – 14 V |
| OFF | Below 2.0 V |

**NG** → **Check and replace A/C amplifier.**

**OK**

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

## When not using hand–held tester

| | |
|---|---|
| 1 | **Check voltage between terminal ACT of engine ECU and body ground (See same page, step 3).** |

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

**NG**

| | |
|---|---|
| 2 | Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19). |

NG → Repair or replace harness or connector.

OK →

Check and replace A/C amplifier.

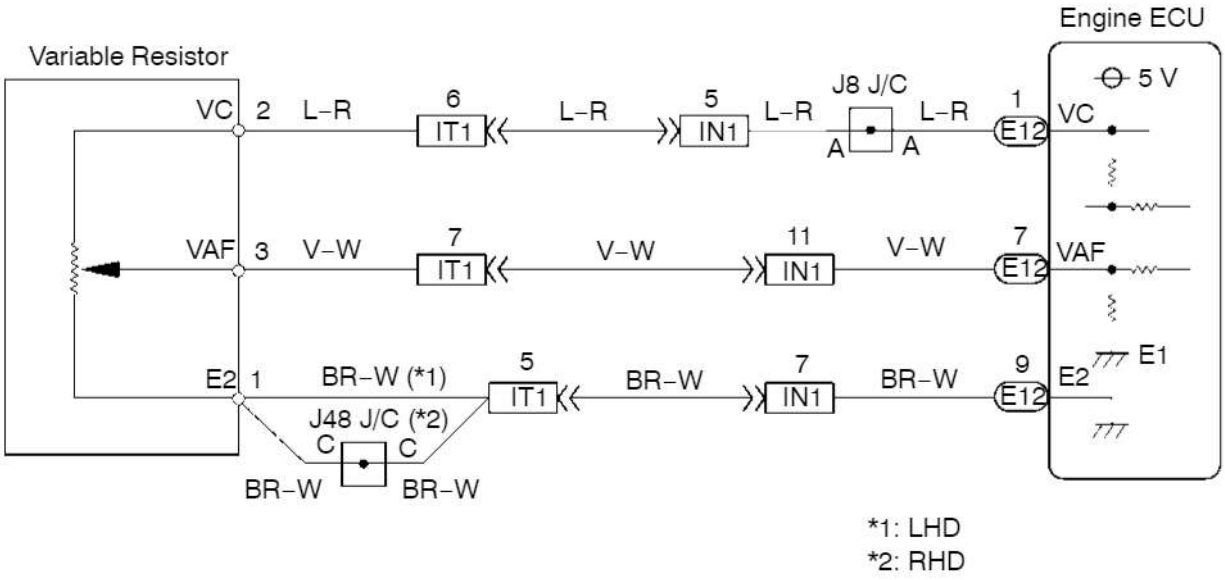
DI14V–03

# Variable Resistor Circuit

## CIRCUIT DESCRIPTION

This resistor is used to change the air–fuel ratio of the air–fuel mixture.
The idle mixture is adjusted using this resistor.
Turning the idle mixture adjusting screw clockwise moves the contacts inside the resistor, raising terminal VAF voltage. Conversely, turning the screw counterclockwise lowers the terminal VAF voltage.
When the terminal VAF voltage rises, the engine ECU increases the injection volume slightly, making the air–fuel mixture a little richer.

## WIRING DIAGRAM

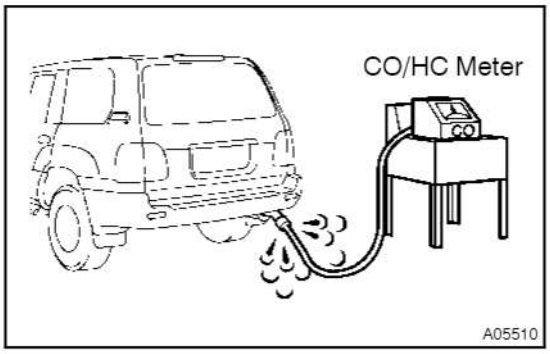


## INSPECTION PROCEDURE

**NOTICE:**

**Always use a CO meter when adjusting the idle mixture. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.**

| | |
|---|---|
| 1 | **Check CO concentration.** |




**PREPARATION:**

(a) Warm up engine to normal operating temperature.
(b) All accessories switched OFF.
(c) All vacuum lines properly connected.
(d) Transmission in "N" position.
(e) Connect the tachometer.
(f) Ignition timing check correctly.
(g) Idle speed check correctly.
(h) Check that the CO meter is properly calibrated.
(i) Race the engine at 2,500 rpm about 2 minutes.

**CHECK:**

Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe. Measure the concentration with 1 – 3 minutes after racing the engine to allow the the concentration to stabilize.

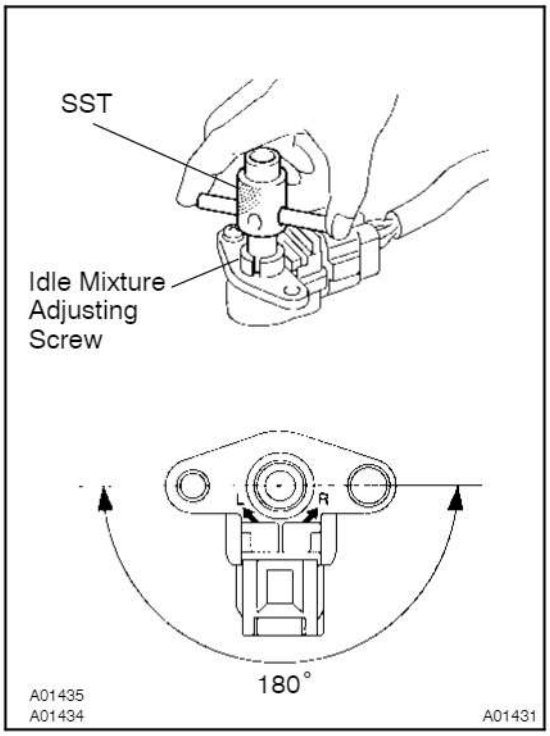
**OK:**

**Idle CO concentration: 1.0 – 2.0 %**

OK → **CO concentration is normal. Proceed to next circuit inspection shown problem symptom tables (See page DI–21).**

NG

| 2 | Adjust CO concentration. |
|---|---|




**PREPARATION:**

Same condition as step 1 of this chart.

**CHECK:**

Using SST, adjust the mixture by turning the idle mixture adjusting screw in the variable resistor.

SST 09243–00020

**RESULT:**

| | |
|---|---|
| OK | CO concentration: 1.0 – 2.0 % |
| NG type I | Change in CO concentration |
| NG type II | No change in CO concentration |

HINT:

Always check idle speed after turning the idle mixture adjusting screw. If it is incorrect, readjust idle speed.

Adjustable range of the idle mixture adjust to turn this screw is 180 degrees. Do not turn this screw more than it.

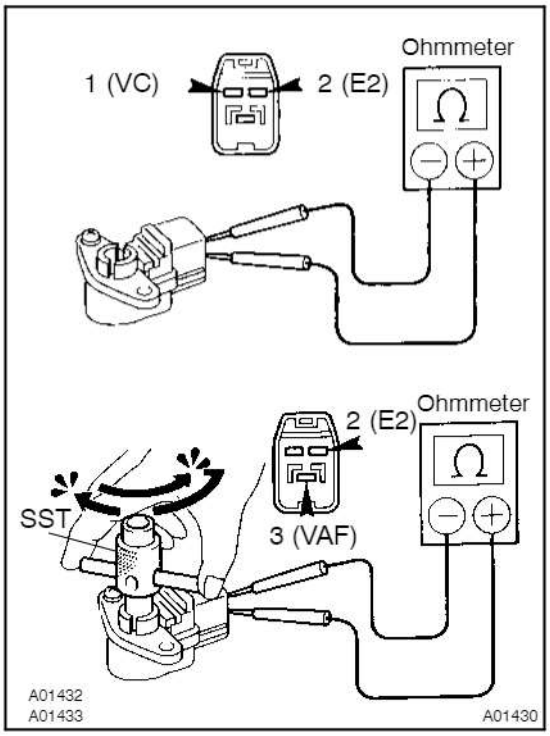
**Type I** → **See page EM–1 and go on troubleshooting.**

**Type II** → **Go to step 3.**

**OK**

**Adjustment is complete.**

| 3 | Check resistance of variable resistor. |
|---|---|




**Check Resistance Between 1 and 2:**

**PREPARATION:**

Disconnect the variable resistor connector.

**CHECK:**

Measure resistance between terminals 1 and 2 of the variable resistor.

**OK:**

**Resistance: 4 – 6 kΩ**

**Check Resistance Between 2 and 3:**

**CHECK:**

Measure resistance between terminals 2 and 3 when turning the idle mixture adjusting screw fully clockwise and counter-clockwise using SST.

SST 09243–00020

**OK:**

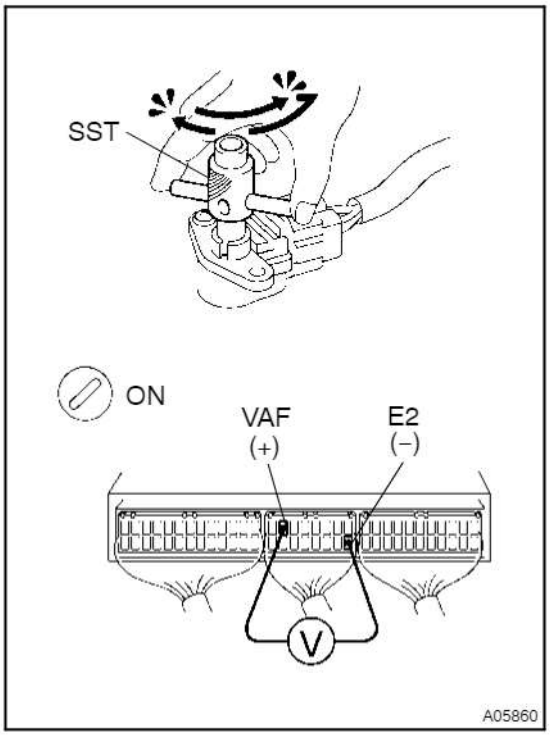
**Resistance:**

**Change from about 5 kΩ to 0 kΩ accordingly**

NG → **Replace variable resister.**

OK

| 4 | Check voltage between terminals VAF and E2 of engine ECU connector. |
|---|---|




**PREPARATION:**

(a) Reconnect the variable resistor connector.
(b) Remove the console box.
(c) Turn the ignition switch ON.

**CHECK:**

Measure voltage between terminals VAF and E2 of engine ECU connector while slowly turning the idle mixture adjusting screw first fully counterclockwise, and then fully clockwise, using SST.

SST 09243–00020

**OK:**

**Voltage changes smoothly from 0 V to about 5 V; i.e., does not suddenly jump up to 5 V or down to 0 V.**

| OK | Check and replace engine ECU. |
|---|---|

NG

| 5 | Check for open and short in harness and connector between variable resistor and engine ECU (See page IN–19). |
|---|---|

| NG | Repair or replace harness or connector. |
|---|---|

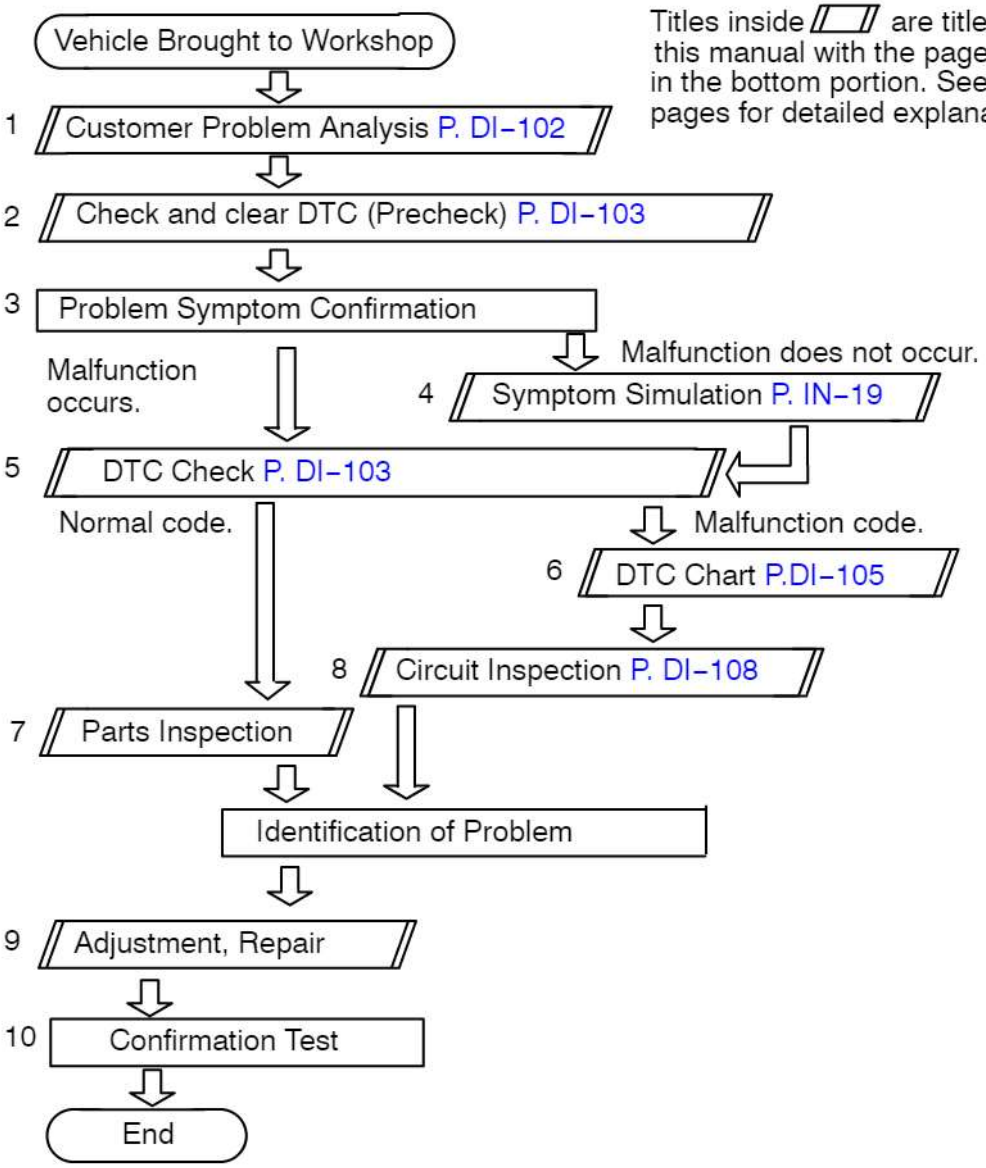
NG

Check and replace engine ECU.

# SUB FUEL TANK SYSTEM

## HOW TO PROCEED WITH TROUBLESHOOTING

DISM7–02




Titles inside ▱ are titles of pages in this manual with the page number indicated in the bottom portion. See the indicated pages for detailed explanations.

DI3M8–01

# CUSTOMER PROBLEM ANALYSIS CHECK

**SUB FUEL TANK 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<br>miles |

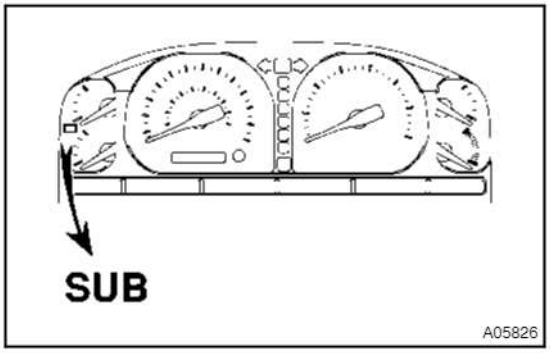
| | | |
|---|---|---|
| Problem Symptoms | ☐ Fuel Tank Changeover Switch is OFF | ☐ Main fuel pump does not operate<br>☐ Main fuel pump and sub fuel pump operate simultaneously<br>☐ Sub fuel pump operate |
| | ☐ Fuel Tank Changeover Switch is ON | ☐ Sub fuel pump does not operate<br>☐ Main fuel pump and sub fuel pump operate simultaneously<br>☐ Main fuel pump operate |
| | ☐ Others _____ | |

| | |
|---|---|
| Dates Problem Occurred | |
| Problem Frequency | ☐ Constant ☐ Sometimes ( times per day/month) ☐ Once only<br>☐ Other _____ |

| | |
|---|---|
| DTC Inspection | ☐ Normal ☐ Malfunction code(s) (code ) |

DI3M9–02

# PRE–CHECK




## 1. DIAGNOSIS SYSTEM

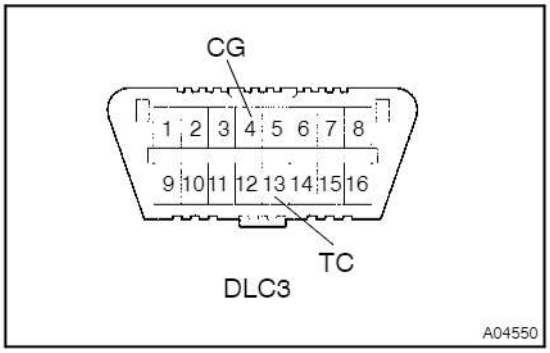
(a) Check the indicator.

(1) Turn the ignition switch ON.

(2) Check that the sub fuel tank indicator lights come on immediately.

HINT:

- When the fuel tank changeover switch is pressed to side, the sub fuel tank indicator light continues to light up.
- When the sub fuel tank indicator light flashes at 0.5 seconds intervals, if indicates that the ECU stores the malfunction codes in memory.




(b) Check the DTC

(1) Turn ignition switch ON.

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

SST 09843–18040

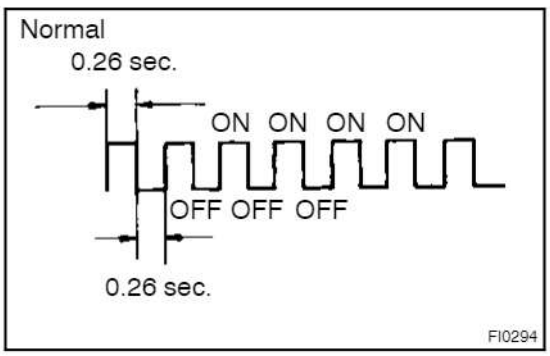
(3) Read the DTC output by sub fuel tank indicator.

HINT:

If a DTC is not indicated, check the TC terminal circuit (See page DI–107).

(4) Check details of the malfunction using the DTC chart on page DI–105.

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



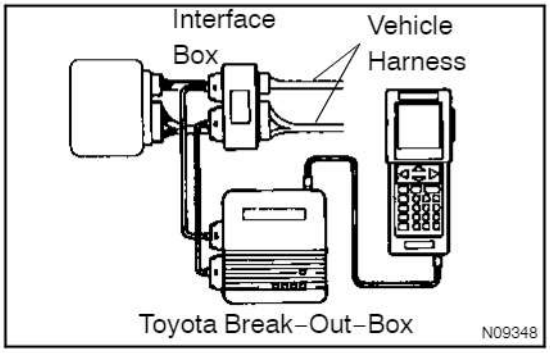

HINT:

If the even of 2 or more malfunction codes, indication will begin from the smaller numbered code and continue in order to the lager.

(c) Clear the DTC.

(1) After completing repairs, the DTC retained in memory can be cleared by removing the EFI fuse for 10 seconds or more, with the ignition switch OFF.

(2) Check that the normal code is displayed after connecting the fuse.




(d) Engine ECU Terminal Values Measurement Using Break–Out–Box and Hand–Held Tester

(1) Hook up the break–out–box and hand–held tester to the vehicle.

(2) Read the engine ECU input/output values by following the prompts on the tester screen.

HINT:

- Hand–held tester has a "Snapshot" function.
  This records the measured values and is effective in the diagnosis of intermittent problems.
- Please refer to the hand–held tester/break–out–box operator's manual for further details.

DI5MA–02

# DIAGNOSTIC TROUBLE CODE CHART

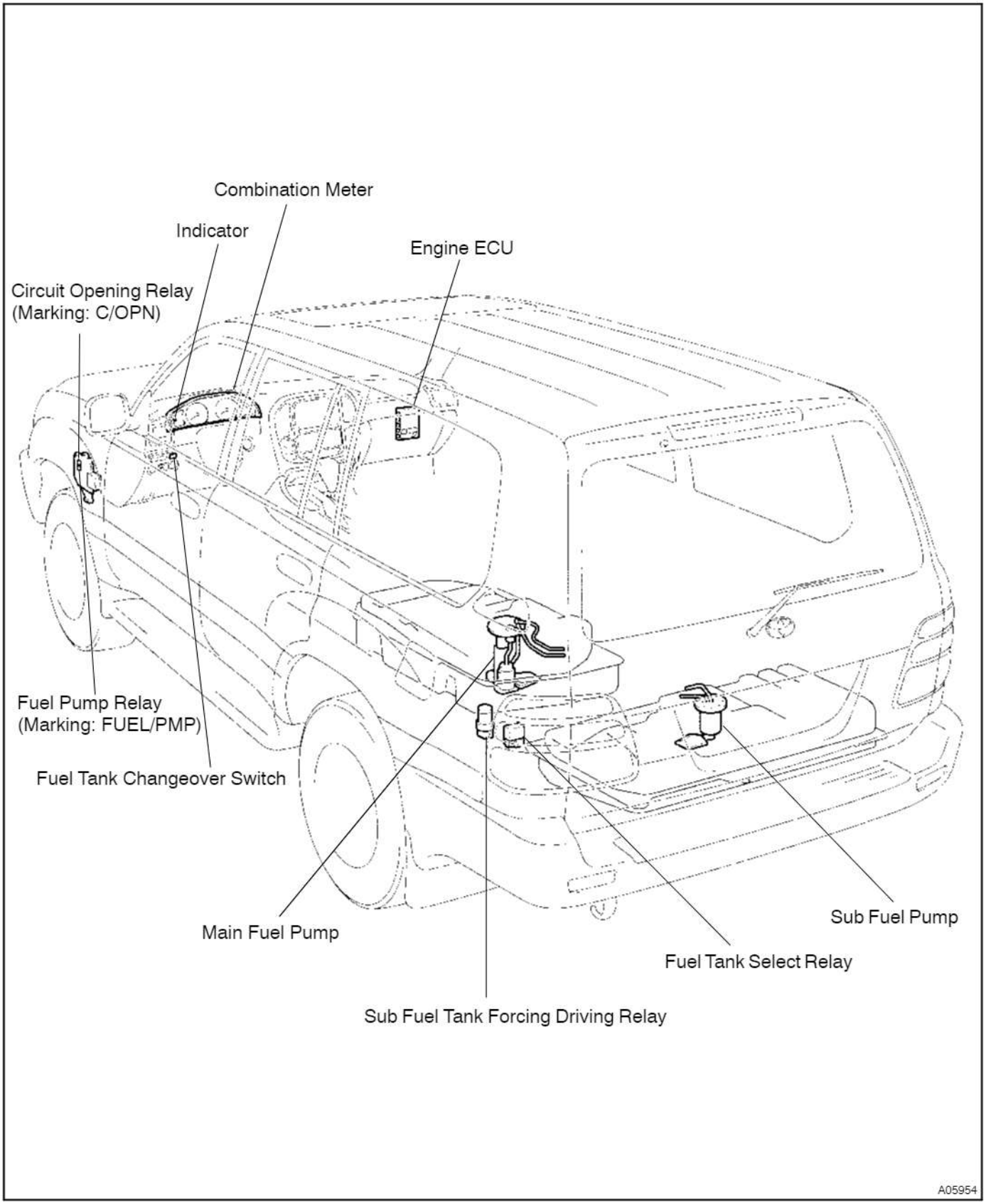
HINT:

If a malfunction code is displayed during the DTC check, 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 |
|---|---|---|
| 11 (DI–108) | Main Fuel Pump Circuit Malfunction (Fuel Tank Changeover Switch OFF) | • Open or short in main fuel pump circuit<br>• Main fuel pump<br>• Fuel tank select relay<br>• Fuel pump relay<br>• Circuit opening relay |
| 12 (DI–116) | Fuel Tank Select Relay Malfunction | • Fuel tank select relay<br>• Open or short in main fuel pump circuit<br>• Main fuel pump<br>• Fuel pump relay<br>• Circuit opening relay<br>• Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |
| 22 (DI–120) | Both Fuel Pump Simultaneous Operation Malfunction (Fuel Tank Changeover Switch OFF) | • Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |
| 31 (DI–122) | Sub Fuel Pump Circuit Malfunction | • Open or short in sub fuel pump circuit<br>• Sub fuel pump<br>• Fuel tank select relay<br>• Fuel pump relay<br>• Circuit opening relay |
| 41 (DI–125) | Fuel Tank Select Relay Circuit Malfunction (Fuel Tank Changeover Switch ON) | • Open or short in fuel tank select relay circuit<br>• Fuel tank select relay<br>• Open or short in sub fuel pump circuit<br>• Sub fuel pump<br>• Short in main fuel pump circuit (+B short) |
| 42 (DI–128) | Both Fuel Pump Simultaneous Operation Malfunction (Fuel Tank Changeover Switch ON) | • Short in main fuel pump circuit (+B short)<br>• Open or short in fuel tank select relay circuit<br>• Fuel tank select relay<br>• Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |

DI3MB–02

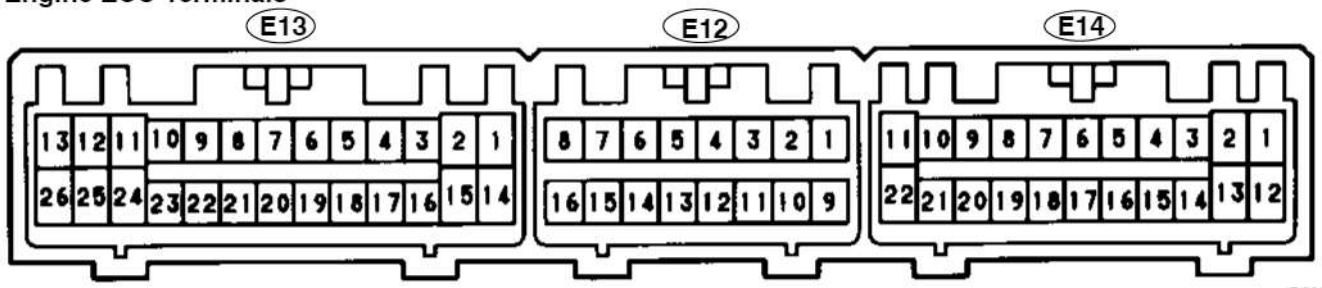
# PARTS LOCATION



DI3MC–02

# TERMINALS OF ECU

**Engine ECU Terminals**




| Symbols (Terminals No.) | Wiring Color | Condition | STD Voltage (V) |
|---|---|---|---|
| FPMS (E14–7) – E1 (E13–14) | L–W ↔ BR | IG switch ON<br>Fuel tank changeover switch OFF | 0 – 3.0 V |
| | | IG switch ON<br>Fuel tank changeover switch ON | 9 – 14 V |
| FPM1 (E14–8) – E1 (E13–14) | B ↔ BR | Idling<br>Fuel tank changeover switch OFF | 9 – 14 V |
| | | Idling<br>Fuel tank changeover switch ON | 0 – 3.0 V |
| FPM2 (E14–19) – E1 (E13–14) | B–O ↔ BR | Idling<br>Fuel tank changeover switch OFF | 0 – 3.0 V |
| | | Idling<br>Fuel tank changeover switch ON | 9 – 14 V |
| FPR1 (E12–15) – E01 (E13–13) | G–W ↔ W–B | IG switch ON | 9 – 14 V |
| FPR2 (E14–15) – E01 (E13–13) | L ↔ W–B | 4.0 seconds or more after starting the engine | 9 – 14 V |
| | | Sarting the engine<br>Water temperature is 60°C (140°F) or more | 9 – 14 V |
| | | 1 second or more and 4 seconds or less after starting the engine<br>Water temperature is 60°C (140°F) or less | 3 – 3.0 V |
| FC (E14–4) – E01 (E13–13) | B–W ↔ W–B | IG switch ON | 9 – 14 V |
| FPLD (E14–14) – E01 (E13–13) | O ↔ W–B | Idling<br>Fuel tank changeover switch OFF | 9 – 14 V |
| | | Idling<br>Fuel tank changeover switch ON | 0 – 3.0 V |

DI5MD–04

# CIRCUIT INSPECTION

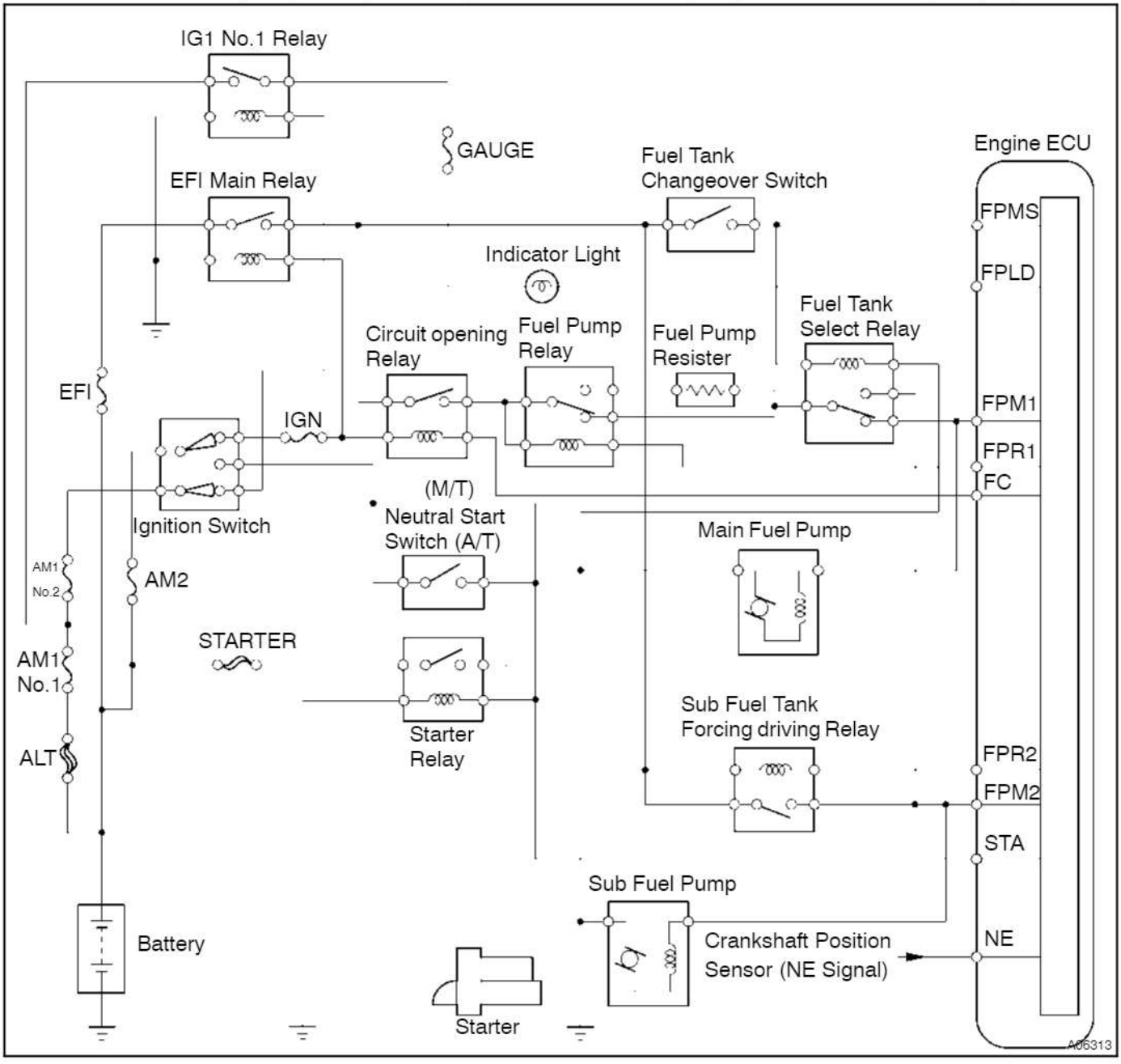
| DTC | 11 | Main Fuel Pump Circuit Malfunction (Fuel Tank Changeover Switch OFF) |
|---|---|---|

## CIRCUIT DESCRIPTION

When the STA signal and NE signal are input to the engine ECU, Tr1 is turned ON, current flows to coil of the circuit opening relay, relay switches on, power is supplied to the fuel pump via a pump select relay and the fuel pump operates.

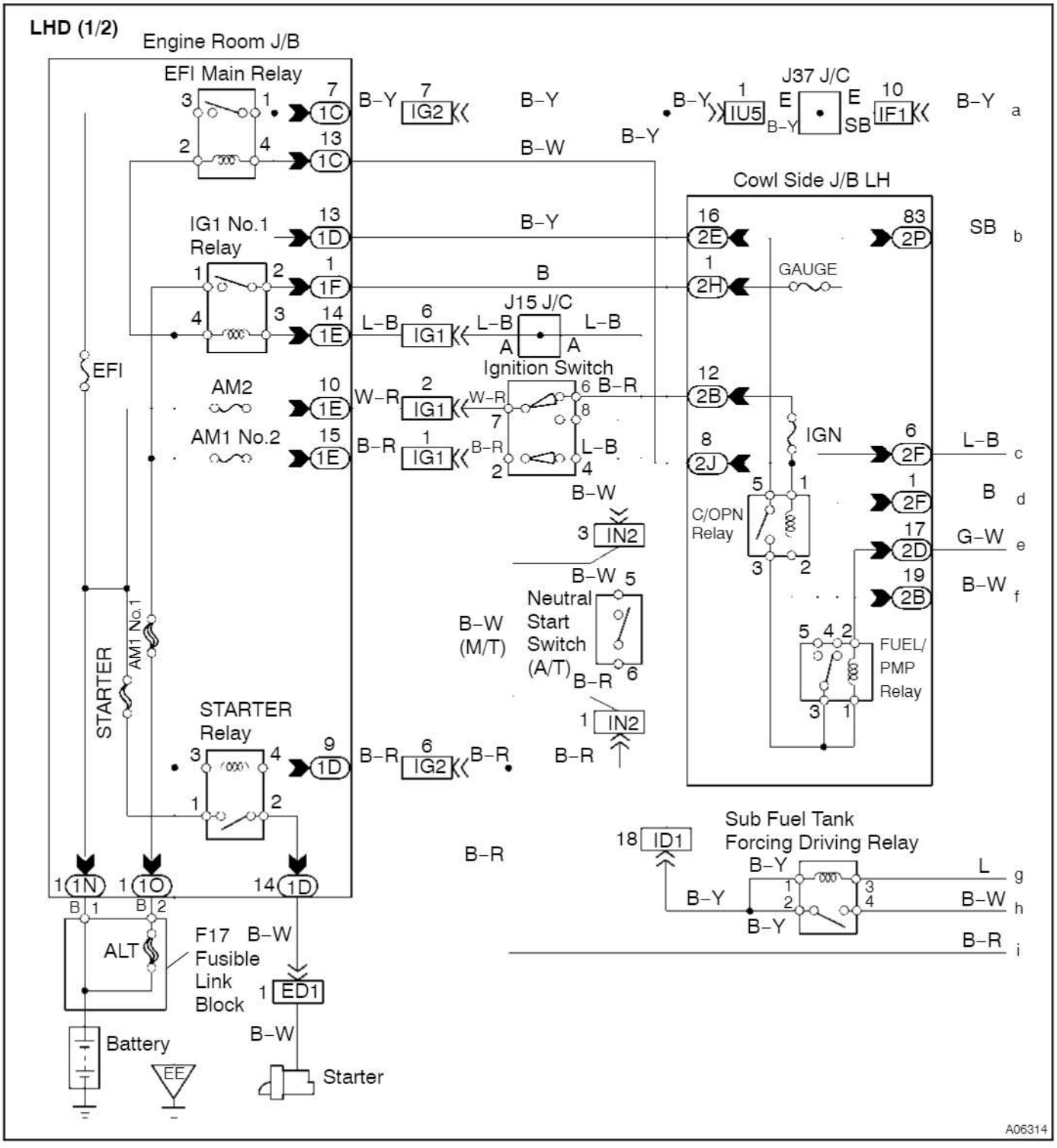
When the fuel tank changeover switch is OFF, the pump select relay point contacts with the main fuel pump side, power is supplied to the main fuel pump and the main fuel pump operates.

When the fuel tank changeover switch is ON, current flows to coil of the pump select relay, relay point contacts with the sub fuel pump side, power supplied to the sub fuel pump and the sub fuel pump operates.

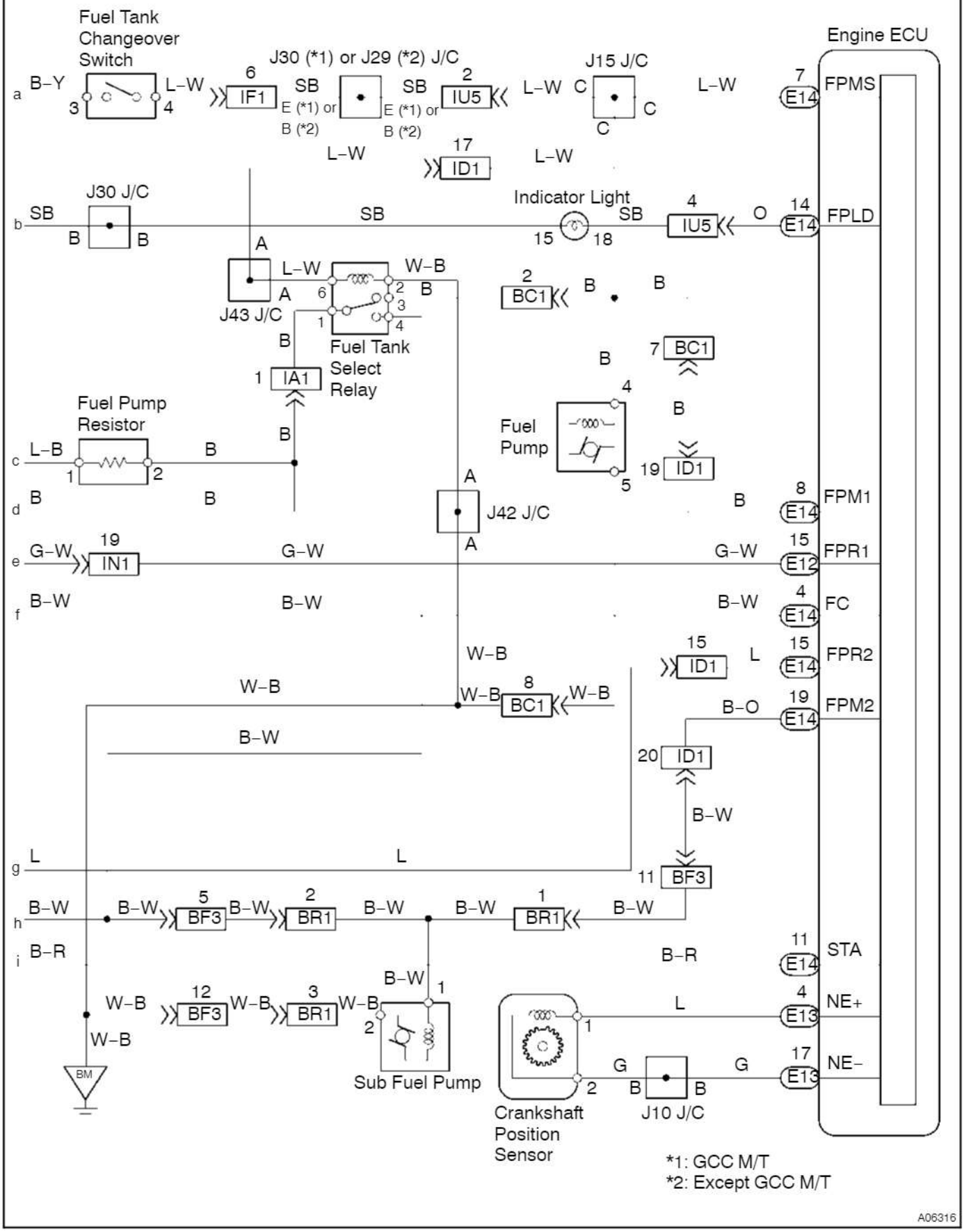


| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| 11 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch OFF<br>(Voltage of FPMS terminal is low)<br>(b) Voltage of FPM1 terminal is low<br>(c) Voltage of FPM2 terminal is low | • Open or short in main fuel pump circuit<br>• Main fuel pump<br>• Fuel tank select relay<br>• Fuel pump relay<br>• Circuit opening relay |

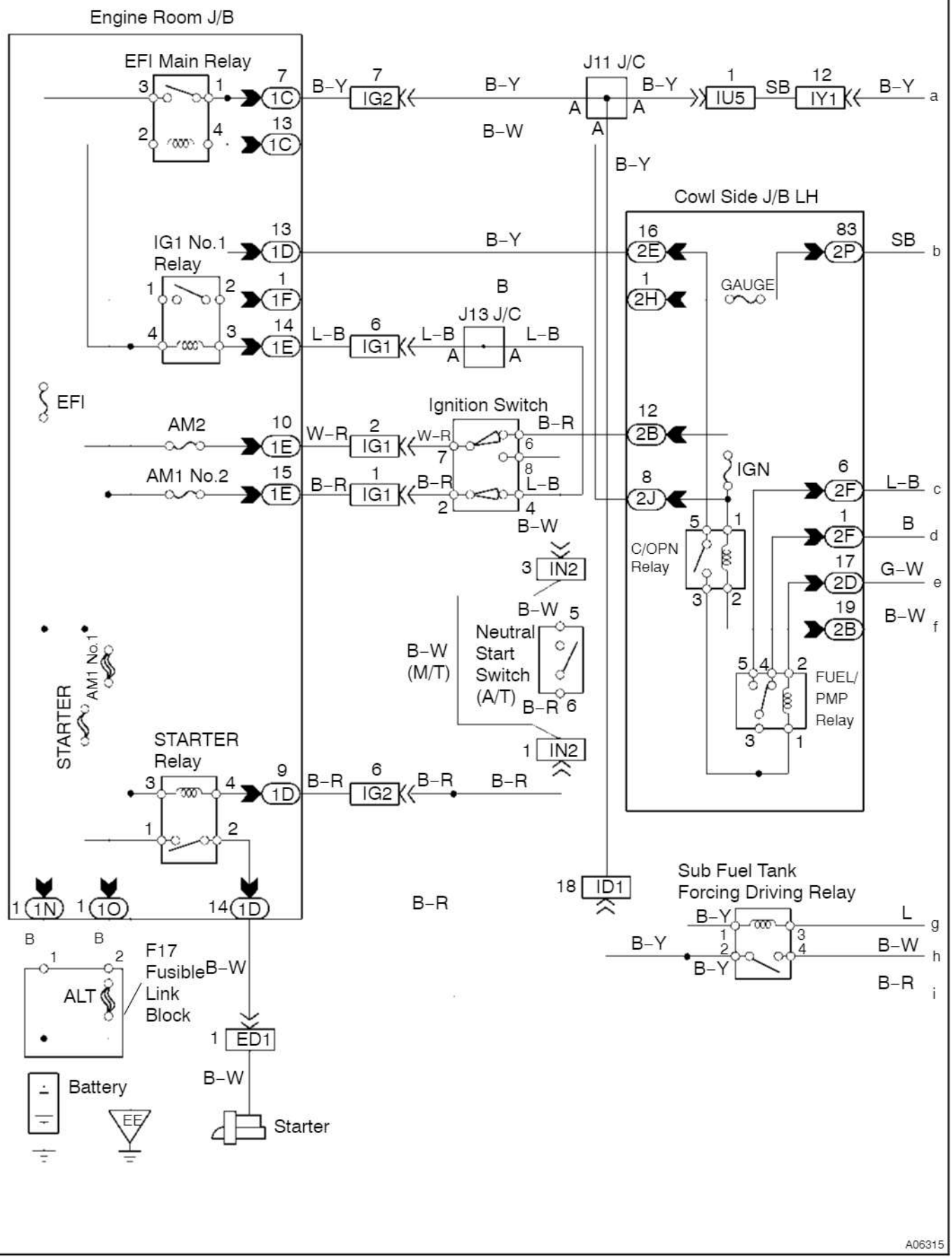
## WIRING DIAGRAM



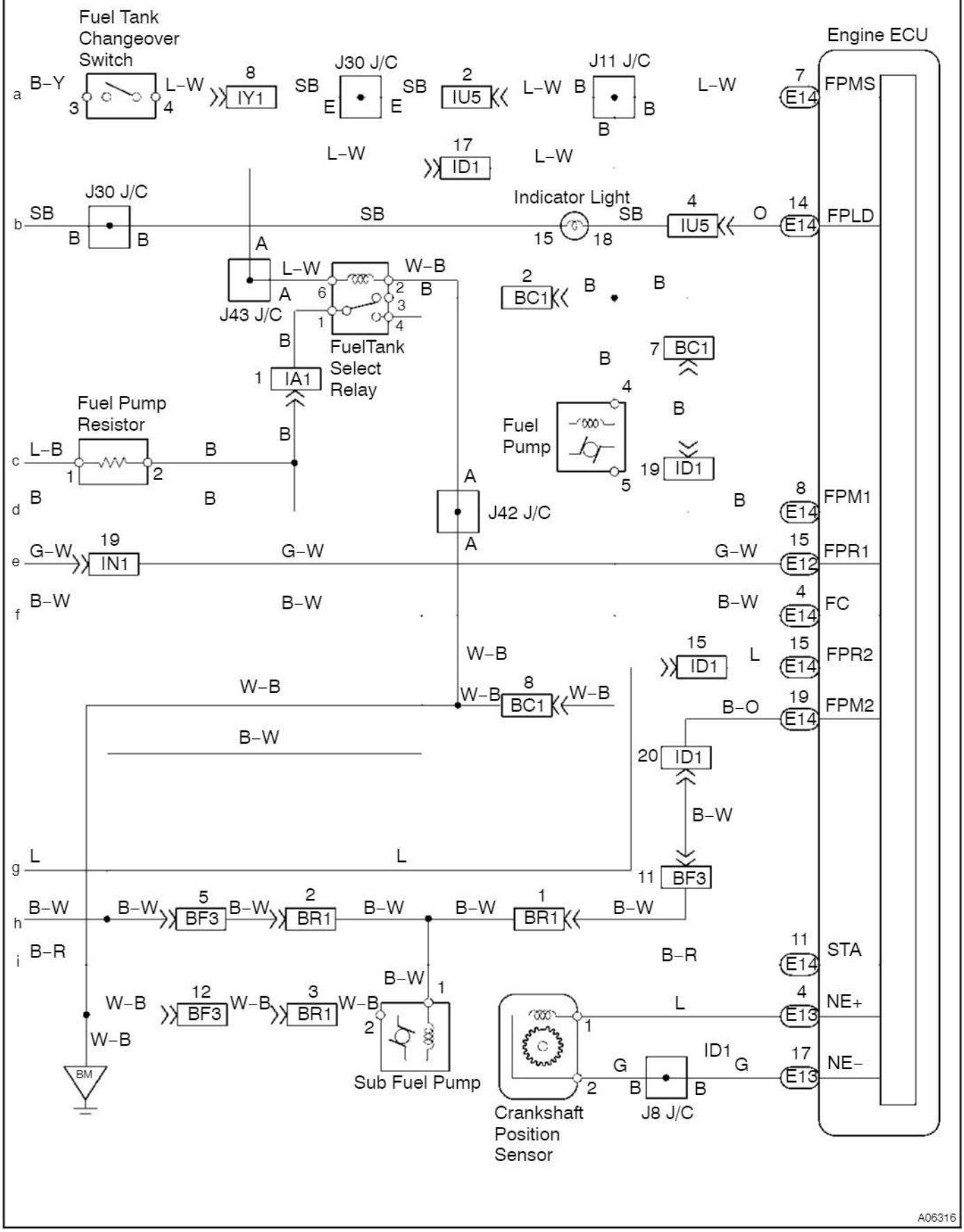
**LHD (2/2)**



**RHD (1/2)**

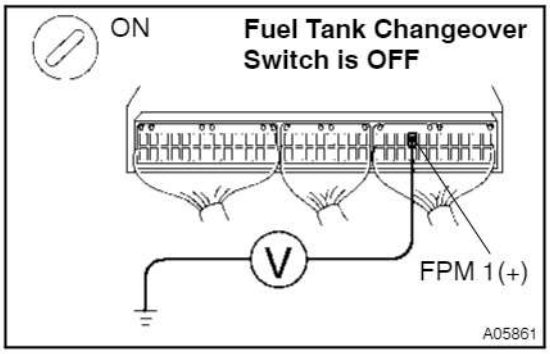


**RHD (2/2)**



## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check voltage between terminal FPM1 of engine ECU connector and body ground.** |




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
(c) Fuel tank changeover switch is OFF.

**CHECK:**

Measure voltage between terminal FPM1 of engine ECU connector and body ground.

**OK:**

**Voltage: 9 – 14 V**

| | |
|---|---|
| OK | **Go to step 5.** |

NG

| | |
|---|---|
| 2 | **Check fuel tank select relay (See page FI–49).** |

| | |
|---|---|
| NG | **Replace fuel tank select relay.** |

OK

| | |
|---|---|
| 3 | **Check fuel pump relay (Marking: FUEL/PMP) (See page FI–46).** |

| | |
|---|---|
| NG | **Replace fuel pump relay.** |

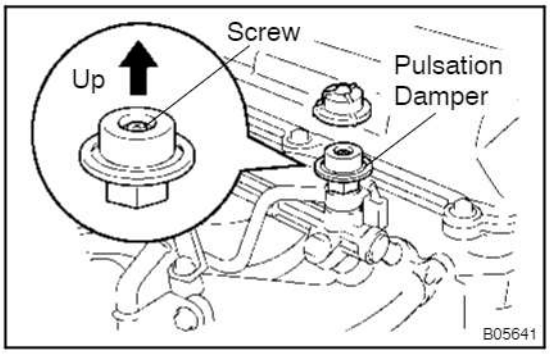
OK

| | |
|---|---|
| 4 | **Check circuit opening relay (Marking: C/OPN) (See page FI–45).** |

| | |
|---|---|
| NG | **Replace circuit opening relay.** |

OK

| | |
|---|---|
| 5 | **Check operation of main fuel pump.** |




**PREPARATION:**

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Fuel tank changeover switch is OFF.
(d) Select the ACTIVE TEST mode.

**CHECK:**

Check the main fuel pump operation, when it is operated by hand–held tester.

**OK:**

**Here a main fuel pump operation noise**

HINT:

If you have no hand–held tester, and then go to step 6.

| | |
|---|---|
| OK | **Go to step 8.** |

NG

| | |
|---|---|
| 6 | **Check main fuel pump (See page FI–7).** |

| | |
|---|---|
| NG | **Replace main fuel pump.** |

OK

| | |
|---|---|
| 7 | **Check for open or short in harness and connector between main fuel pump and fuel tank select relay, fuel tank select relay and fuel pump relay, fuel pump relay and circuit opening relay (See page IN–19).** |

| | |
|---|---|
| NG | **Repair or replace.** |

OK

| | |
|---|---|
| 8 | Check for open and short in harness and connector between fuel tank select relay and engine ECU (See page IN–19). |

NG → Repair or replace harness and connector.

OK →

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

DI3ME–03

| DTC | 12 | Fuel Tank Select Relay Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| 12 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch OFF (Voltage of FPMS terminal is low)<br>(b) Voltage of FPM1 terminal is low<br>(c) Voltage of FPM2 terminal is high | • Fuel tank select relay<br>• Open or short in main fuel pump circuit<br>• Main fuel pump<br>• Fuel pump relay<br>• Circuit opening relay<br>• Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |

## WIRING DIAGRAM

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

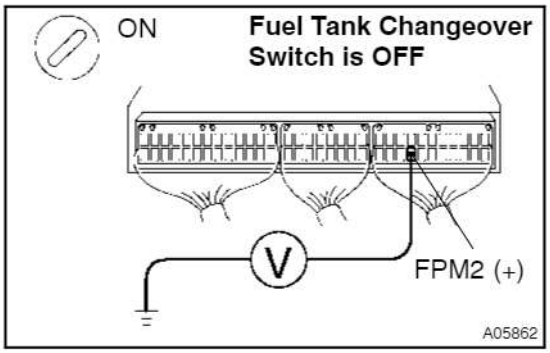
## INSPECTION PROCEDURE

| 1 | Check fuel tank select relay (See page FI–49). |
|---|---|

NG → Replace fuel tank select relay.

OK

| 2 | Check voltage between terminal FPM2 of engine ECU connector and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
(c) Fuel tank changeover switch is OFF.

**CHECK:**

Measure voltage between terminal FPM2 of engine ECU connector and body ground, turn the ignition switch ON after 4 seconds or more.

**OK:**

**Voltage: 0 – 3.0 V**

OK → Go to step 5.

NG

| | |
|---|---|
| 3 | Check sub fuel tank forcing driving relay (See page FI–52). |

NG → Replace sub fuel tank forcing driving relay, and then go to step 5.

OK

| | |
|---|---|
| 4 | Check for short in harness and connector between sub fuel tank forcing driving relay and engine ECU (See page IN–19). |

NG → Repair or replace harness and connector, and then go to step 5.

OK

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

| | |
|---|---|
| 5 | Check voltage between terminal FPM1 of engine ECU connector and body ground (See page DI–108, step 1). |

OK → Go to step 8.

NG

| | |
|---|---|
| 6 | Check fuel pump relay (Marking: FUEL/PMP) (See page FI–46). |

NG → Replace fuel pump relay.

OK

| | |
|---|---|
| 7 | **Check circuit opening relay (Marking: C/OPN) (See page FI–45).** |

**NG** → **Replace circuit opening relay.**

**OK**

| | |
|---|---|
| 8 | **Check operation of main fuel pump (See page DI–108, step 5).** |

HINT:
If you have no hand–held tester, and then go to step 9.

**OK** → **Go to step 11.**

**NG**

| | |
|---|---|
| 9 | **Check main fuel pump (See page FI–7).** |

**NG** → **Replace main fuel pump.**

**OK**

| | |
|---|---|
| 10 | **Check for open or short in harness and connector between main fuel pump and fuel tank select relay, fuel tank select relay and fuel pump relay, fuel pump relay and circuit opening relay (See page IN–19).** |

**NG** → **Repair or replace.**

**OK**

| | |
|---|---|
| 11 | Check for open and short in harness and connector between fuel tank select relay and engine ECU (See page IN–19). |

NG → Repair or replace harness and connector.

OK →

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

DI3MF–03

| DTC | 22 | Both Fuel Pump Simultaneous Operation Malfunction (*) |
|---|---|---|

***: Fuel Tank Changeover Switch OFF**

## CIRCUIT DESCRIPTION

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

| DTC No. | DTC Detecting Item | Trouble Area |
|---|---|---|
| 22 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch OFF (Voltage of FPMS terminal is low)<br>(b) Voltage of FPM1 terminal is high<br>(c) Voltage of FPM2 terminal is high | • Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |

## WIRING DIAGRAM

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check voltage between terminal FPM2 of engine ECU connector and body ground (See page DI–116, step 2).** |

**OK** → **Repair and replace harness and connector.**

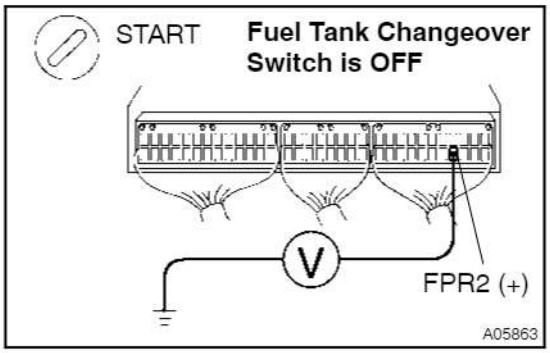
**NG**

| | |
|---|---|
| 2 | **Check sub fuel tank forcing driving relay (See page FI–52).** |

**NG** → **Replace sub fuel tank forcing driving relay.**

**OK**

| 3 | Check voltage between terminal FPR2 of engine ECU connector and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch to START.
(c) Fuel tank changeover switch is OFF.

**CHECK:**

Measure voltage between terminal FPR2 of engine ECU connector and body ground, 4 seconds or more after starting the engine.

**OK:**

**Voltage: 9 – 14 V**

| NG | Go to step 4. |
|---|---|

OK

**Check and repair harness and connector between sub fuel pump and sub fuel tank forcing driving relay (+B short circuit) (See page IN–19).**

| 4 | Check for short in harness and connector between sub fuel tank forcing driving relay and engine ECU (See page IN–19). |
|---|---|

| NG | Repair or replace. |
|---|---|

OK

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

DI3MG–03

| DTC | 31 | Sub Fuel Pump Circuit Malfunction |
|---|---|---|

## CIRCUIT DESCRIPTION

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

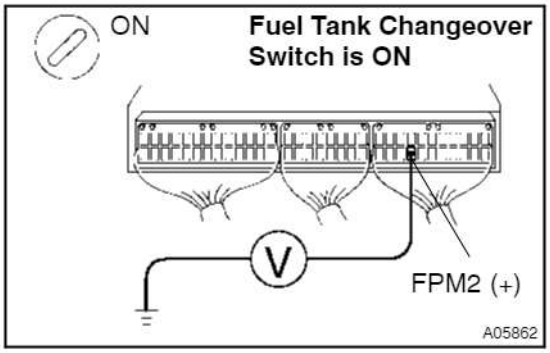
| DTC No. | DTC Detecting Item | Trouble Area |
|---|---|---|
| 31 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch ON<br>(Voltage of FPMS terminal is high)<br>(b) Voltage of FPM1 terminal is low<br>(c) Voltage of FPM2 terminal is low | • Open or short in sub fuel pump circuit<br>• Sub fuel pump<br>• Fuel tank select relay<br>• Fuel pump relay<br>• Circuit opening relay |

## WIRING DIAGRAM

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

## INSPECTION PROCEDURE

| 1 | Check voltage between terminal FPM2 of engine ECU connector and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
(c) Push the fuel tank changeover switch ON.

**CHECK:**

Measure voltage between terminal FPM2 of engine ECU connector and body ground, turn the ignition switch ON after 4 seconds or more.

**OK:**

**Voltage: 9 – 14 V**

| OK | Go to step 5. |
|---|---|

NG

| 2 | Check fuel tank select relay (See page FI–49). |
|---|---|

| NG | Replace fuel tank select relay. |
|---|---|

OK

| | |
|---|---|
| 3 | **Check fuel pump relay (Marking: FUEL/PMP) (See page FI–46).** |

**NG** → **Replace fuel pump relay.**

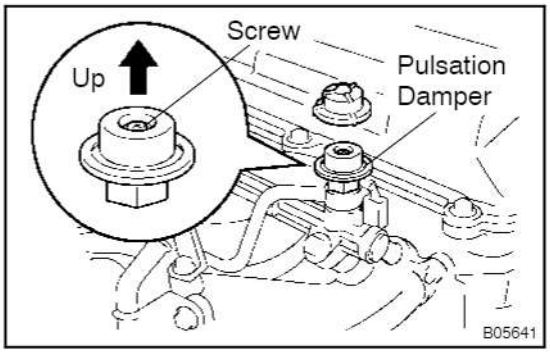
**OK**

| | |
|---|---|
| 4 | **Check circuit opening relay (Marking: C/OPN) (See page FI–45).** |

**NG** → **Replace circuit opening relay.**

**OK**

| | |
|---|---|
| 5 | **Check operation of sub fuel pump.** |




**PREPARATION:**
(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Push the fuel tank changeover switch ON.
(d) Select the ACTIVE TEST mode.

**CHECK:**
Check the sub fuel pump operation, when it is operated by hand–held tester.

**OK:**
**Here a sub fuel pump operation noise**

HINT:
If you have no hand–held tester, and then go to step 6.

**OK** → **Go to step 7.**

**NG**

| | |
|---|---|
| 6 | **Check sub fuel pump (See page FI–16).** |

**NG** → **Replace sub fuel pump.**

**OK**

| | |
|---|---|
| 7 | Check for open or short in harness and connector between sub fuel pump and fuel tank select relay, fuel tank select relay and fuel pump relay, fuel pump relay and circuit opening relay (See page IN–19). |

NG → Repair or replace.

OK

| | |
|---|---|
| 8 | Check for open and short in harness and connector between fuel tank select relay and engine ECU (See page IN–19). |

NG → Repair or replace harness and connector.

OK

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

DI3MH–03

| DTC | 41 | Fuel Tank Select Relay Circuit Malfunction (Fuel Tank Changeover Switch ON) |
|---|---|---|

## CIRCUIT DESCRIPTION

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

| DTC No. | DTC Detecting Condition | Trouble Area |
|---|---|---|
| 41 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch ON<br>(Voltage of FPMS terminal is high)<br>(b) Voltage of FPM1 terminal is high<br>(c) Voltage of FPM2 terminal is low | • Open or short in fuel tank select relay circuit<br>• Fuel tank select relay<br>• Open or short in sub fuel pump circuit<br>• Sub fuel pump<br>• Short in main fuel pump circuit (+B short) |

## WIRING DIAGRAM

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

## INSPECTION PROCEDURE

| | |
|---|---|
| 1 | **Check fuel tank select relay (See page FI–49).** |

**NG** → **Replace fuel tank select relay.**

**OK**

| | |
|---|---|
| 2 | **Check voltage between terminal FPM2 of engine ECU connector and body ground (See page DI–122, step 1).** |

**OK** → **Go to step 4.**

**NG**

| | |
|---|---|
| 3 | **Check for open and short in harness and connector between fuel tank changeover switch and fuel tank select relay, fuel tank select relay and body ground (See page IN–19).** |

**NG** → **Repair or replace harness and connector, and then go to step 8.**

**OK**

| | |
|---|---|
| 4 | **Check operation of sub fuel pump (See page DI–122, step 5).** |

HINT:
If you have no hand–held tester, and then go to step 5.

**OK** → **Go to step 7.**

**NG**

| | |
|---|---|
| 5 | **Check sub fuel pump (See page FI–16).** |

**NG** → **Replace sub fuel pump, and then go to step 8.**

**OK**

| | |
|---|---|
| 6 | **Check for open or short in harness and connector between sub fuel pump and fuel tank select relay (See page IN–19).** |

**NG** → **Repair or replace, and then go to step 8.**

**OK**

| | |
|---|---|
| 7 | **Check for open and short in harness and connector between fuel tank select relay and engine ECU, sub fuel tank forcing driving relay and engine ECU (See page IN–19).** |

**NG** → **Repair or replace, and then go to step 8.**

**OK**

| | |
|---|---|
| 8 | Check for short in harness and connector between main fuel pump and fuel tank select relay (+B short circuit) (See page IN–19). |

NG → Repair or replace harness and connector.

OK →

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

| DTC | 42 | Both Fuel Pump Simultaneous Operation Malfunction (*) |
|---|---|---|

***: Fuel Tank Changeover Switch ON**

## CIRCUIT DESCRIPTION

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

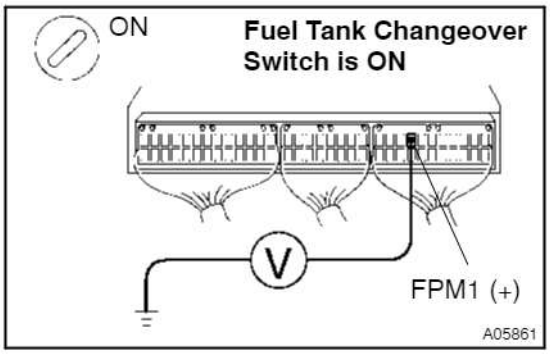
| DTC No. | DTC Detecting Item | Trouble Area |
|---|---|---|
| 42 | Conditions (a), (b) and (c) continue:<br>(a) Fuel tank changeover switch ON (Voltage of FPMS terminal is high)<br>(b) Voltage of FPM1 terminal is high<br>(c) Voltage of FPM2 terminal is high | • Short in main fuel pump circuit (+B short)<br>• Open or short in fuel tank select relay circuit<br>• Fuel tank select relay<br>• Short in sub fuel tank forcing driving relay circuit<br>• Sub fuel tank forcing driving relay<br>• Short in sub fuel pump circuit (+B short) |

## WIRING DIAGRAM

Refer to DTC 11 (Main Fuel Pump Circuit Malfunction) on page DI–108.

## INSPECTION PROCEDURE

| 1 | **Check voltage between terminal FPM1 of engine ECU connector and body ground.** |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
(c) Push the fuel tank changeover switch ON.

**CHECK:**

Measure voltage between terminal FPM1 of engine ECU and body ground, turn the ignition switch ON after 4 seconds or more.

**OK:**

**Voltage: 0 – 3.0 V**

| OK | **Go to step 4.** |
|---|---|

**NG**

| | |
|---|---|
| 2 | Check fuel tank select relay (See page FI–49). |

NG → Replace fuel tank select relay, and then go to step 4.

OK

| | |
|---|---|
| 3 | Check for open and short in harness and connector between fuel tank change-over switch and fuel tank select relay, fuel tank select relay and body ground (See page IN–19). |

NG → Repair or replace harness and connector, and then go to step 4.

OK

| | |
|---|---|
| 4 | Check for short in harness and connector between fuel tank select relay and engine ECU, fuel tank select relay and main fuel pump (+B short circuit) (See page IN–19). |

NG → Repair or replace harness and connector.

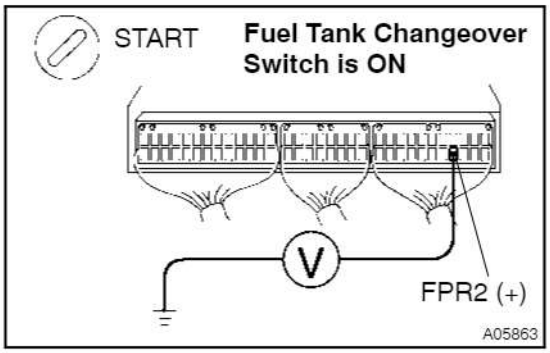
OK

| | |
|---|---|
| 5 | Check sub fuel tank forcing driving relay (See page FI–52). |

NG → Replace sub fuel tank forcing driving relay.

OK

| 6 | Check voltage between terminal FPR2 of engine ECU connector and body ground. |
|---|---|




**PREPARATION:**

(a) Remove the glove compartment door.
(b) Turn the ignition switch to START.
(c) Push the fuel tank changeover switch ON.

**CHECK:**

Measure voltage between terminal FPR2 of engine ECU connector and body ground, 4 seconds or more after starting the engine.

**OK:**

**Voltage: 9 – 14 V**

**NG** → **Go to step 7.**

**OK**

**Check and repair harness and connector between sub fuel pump and sub fuel tank forcing driving relay (+B short circuit) (See page IN–19).**

| 7 | Check for short in harness and connector between sub fuel tank forcing driving relay and engine ECU (See page IN–19). |
|---|---|

**NG** → **Repair or replace.**

**OK**

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

# EMISSION CONTROL SYSTEM

EC09M–01

## PURPOSE

The emission control systems are installed to reduce the amount of HC exhausted from the engine to prevent the atmospheric release of blow–by gas–containing HC (1) and evaporated fuel containing HC being released from the fuel tank (2).

The function of each system is shown in these table.

| System | Abbreviation | Function |
|---|---|---|
| (1) Positive Crankcase Ventilation | PCV | Reduces blow–by gas (HC) |
| (2) Evaporative Emission Control | EVAP | Reduces evaporated HC |
| (3) Electronic fuel injection * | EFI | Injects a precisely timing, optimum amount of fuel for reduce exhaust emissions. |

Remark: * For inspection and repair of the EFI system, refer to the FI section in this manual.

# EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

EC09L–01

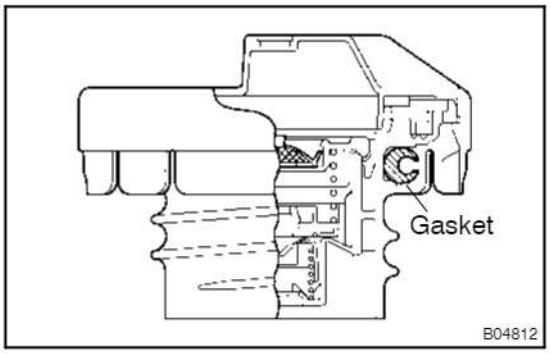
## INSPECTION

**1. VISUALLY INSPECT LINES AND CONNECTIONS**

Look for loosen connections, sharp bends or damage.

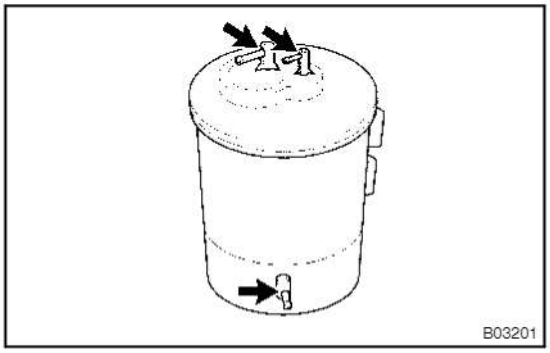
**2. VISUALLY INSPECT FUEL TANK**

Look for deformation, cracks or fuel leakage.




**3. VISUALLY INSPECT FUEL TANK CAP**

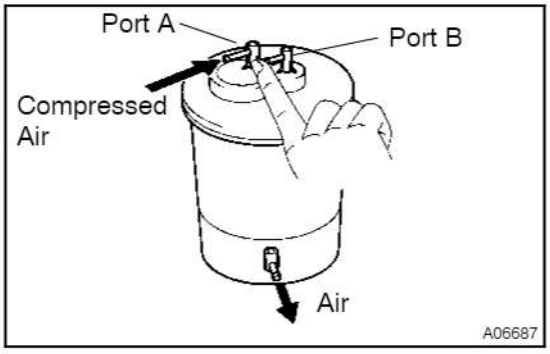
Check if the cap and/or gasket are deformed or damaged.
If necessary, repair or replace the cap.




**4. REMOVE CHARCOAL CANISTER**

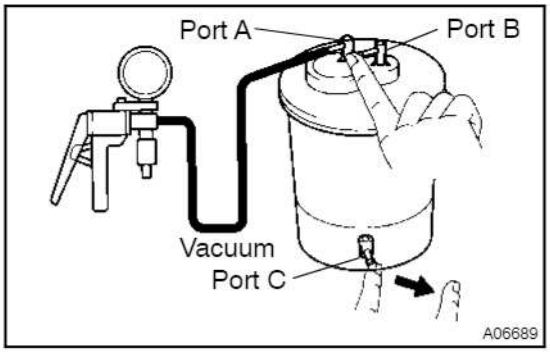
**5. VISUALLY INSPECT CHARCOAL CANISTER**

Look for cracks or damage.




**6. CHECK FOR CLOGGED FILTER, AND STUCK CHECK VALVE**

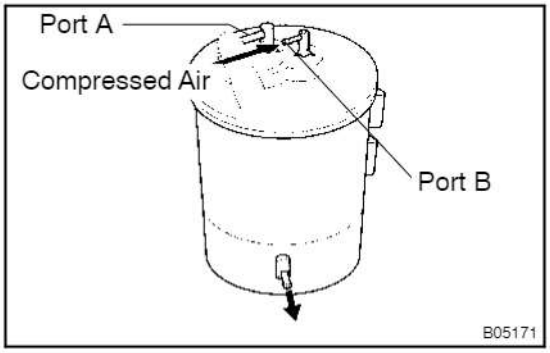
(a) Using low pressure compressed air (4.71 kPa (48 gf/cm$^2$, 0.68 psi)), when port B closed,blow into port A and check that air flows from the port C.




(b) Apply vacuum (1.96 kPa (20 gf/cm$^2$, 0.28 psi)) to port A, check that the vacuum does not decrease when port B and C are closed, and check that the vacuum decreases when port C is released.

(c) Apply vacuum (9.32 kPa (51 gf/cm$^2$, 1.37 psi)) to port B, check that the vacuum does not decrease when port A and C are closed, and check that the vacuum decreases when port C is released.

If a problem is found, replace the charcoal canister.




**7. CLEAN FILTER IN CANISTER**

Clean the filter by blowing 294 kPa (3 kgf/cm$^2$, 43 psi) of compressed air into port B while holding port A closed.

**NOTICE:**

- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

**8. REINSTALL CHARCOAL CANISTER**

# CO

## INSPECTION

EM0TE–02

HINT:
This check is used only to determine whether or not the idle CO complies with regulations.

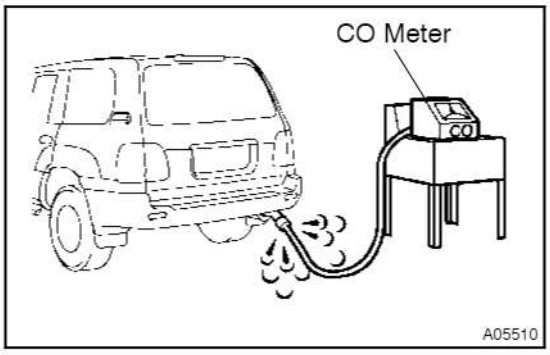
**1. INITIAL CONDITIONS**

(a) Engine at normal operating temperature.
(b) Air cleaner installed.
(c) All pipes and hoses of air induction system connected.
(d) All accessories switched OFF.
(e) All vacuum lines properly connected.
(f) EFI system wiring connectors fully plugged.
(g) Ignition timing set correctly .
(h) Transmission in neutral range.
(i) Tachometer in neutral position.
(j) Tachometer and CO meter calibrated by hand.

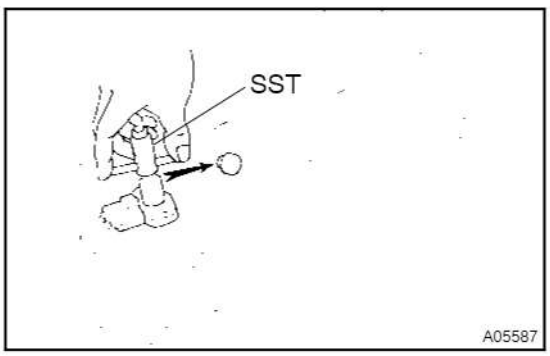
**2. CHECK AND ADJUST CO CONCENTRATION AT IDLE**

**NOTICE:**
**Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. if a CO meter is not available, Do NOT ATTEMPT TO ADJUST IDLE MIXTURE**

(a) Race the engine at 2,500 rpm for approx.180 seconds.

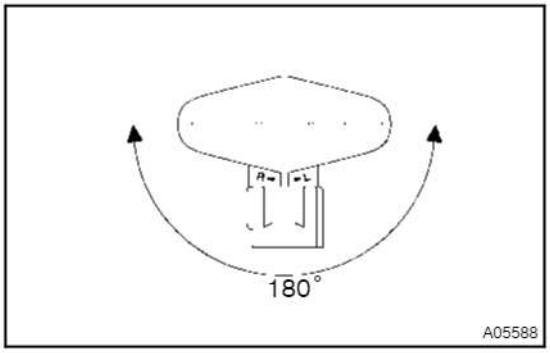



(b) Insert a tester probe at least 40 cm (1.3ft) into the tailpipe.
(c) Wait at least 1 minute before measuring to allow the concentration to stabilize. Complete the measuring with 3 minutes.
**Idle CO concentration: 1.5 ± 0.5 %**




If the CO concentration dose not conform to regulations, adjust by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resister with SST.

SST 09243–00020




HINT:

The idle mixture adjusting screw can be tightened through on angle of 180°.

- If the CO concentration is within specification, this adjustments is complete.
- If the CO concentration can not be corrected by idle mixture adjustment, see the table below for other possible causes.

# IGNITION TIMING

EM0VR–01

## INSPECTION

**1. WARM UP ENGINE**

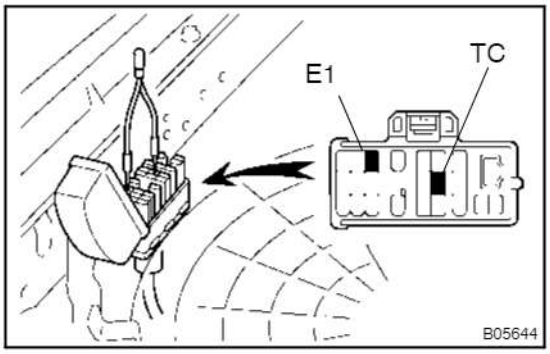
Allow the engine to warm up to normal operating temperature.

**2. CONNECT TIMING LIGHT TO ENGINE**

Connect the tester probe of a timing light to the No.1 high–tension cord for No.4 cylinder.

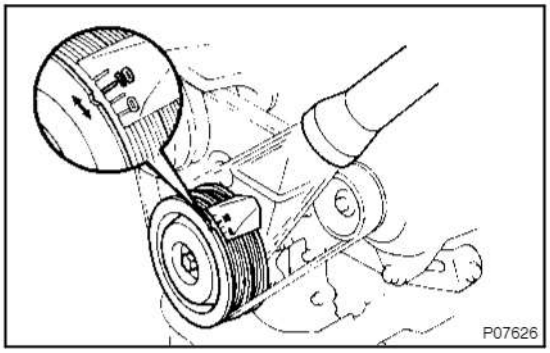
**3. CHECK IDLE SPEED**

**(See page EM–4)**




**4. INSPECT IGNITION TIMING**

(a) Using SST, connect terminals TC and CG of the DLC1.
SST 09843–18020




(b) Using a timing light, check the ignition timing.
**Ignition timing:**
**3° BTDC @ idle**
**(Transmission in neutral position)**

(c) Remove the SST from the check connector.
SST 09843–18020

**5. FURTHER CHECK IGNITION TIMING**

**Ignition timing:**
**0 – 13° BTDC @ idle**
**(Transmission in neutral position)**

HINT:
The timing mark moves in a range between 20° and 46°.

**6. DISCONNECT TIMING LIGHT FROM ENGINE**

# IDLE SPEED

EM0VS–01

## INSPECTION

**1. INITIAL CONDITIONS**

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected

HINT:

All vacuum hoses should be properly connected.

(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position
(i) Air conditioning switched OFF

**2. CONNECT TACHOMETER**

**(See page EM–3)**

**3. INSPECT IDLE SPEED**

(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(b) Check the idle speed.

**Idle speed: 700 ± 50 rpm**

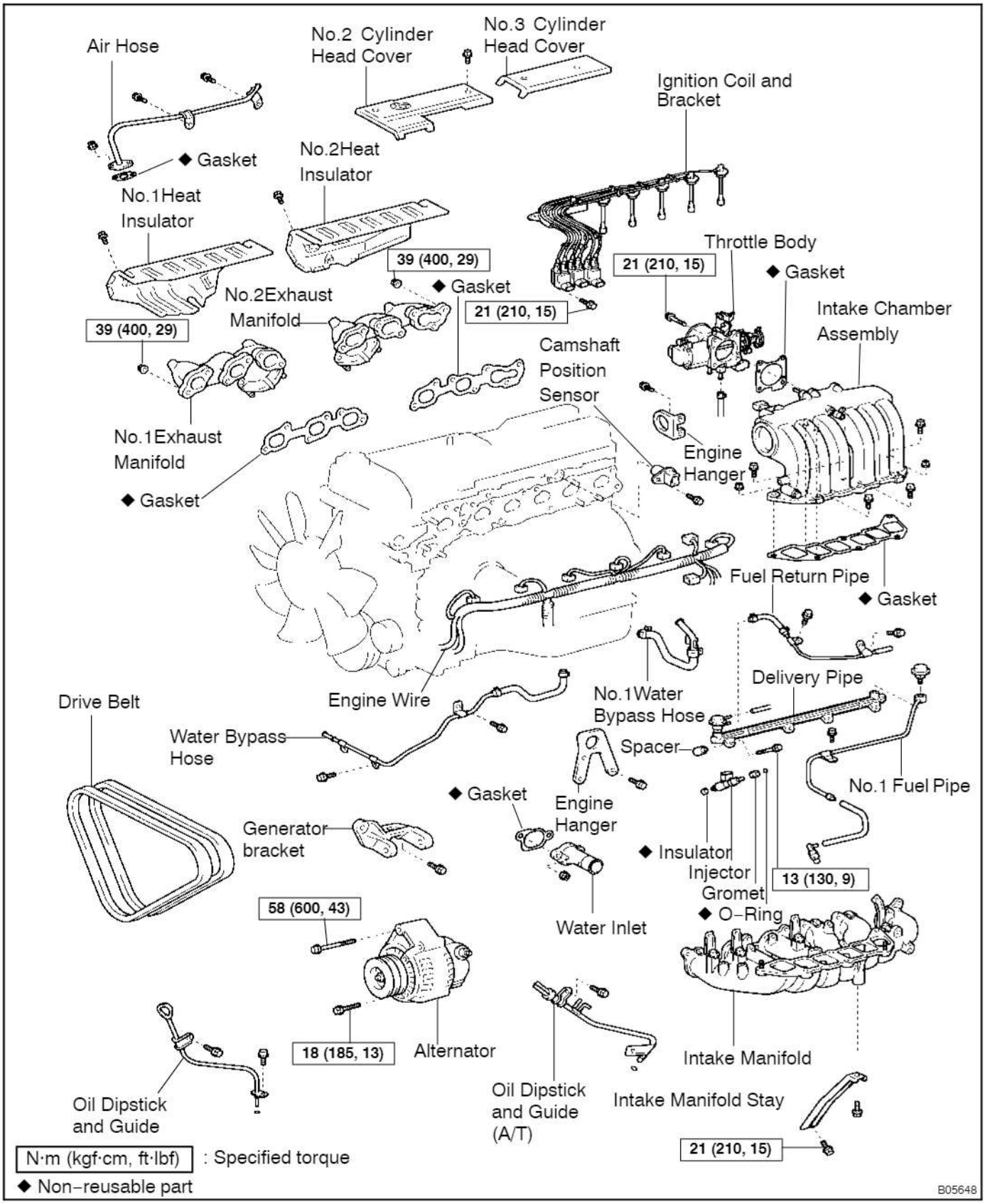
If the idle speed is not as specified, check the air intake system.

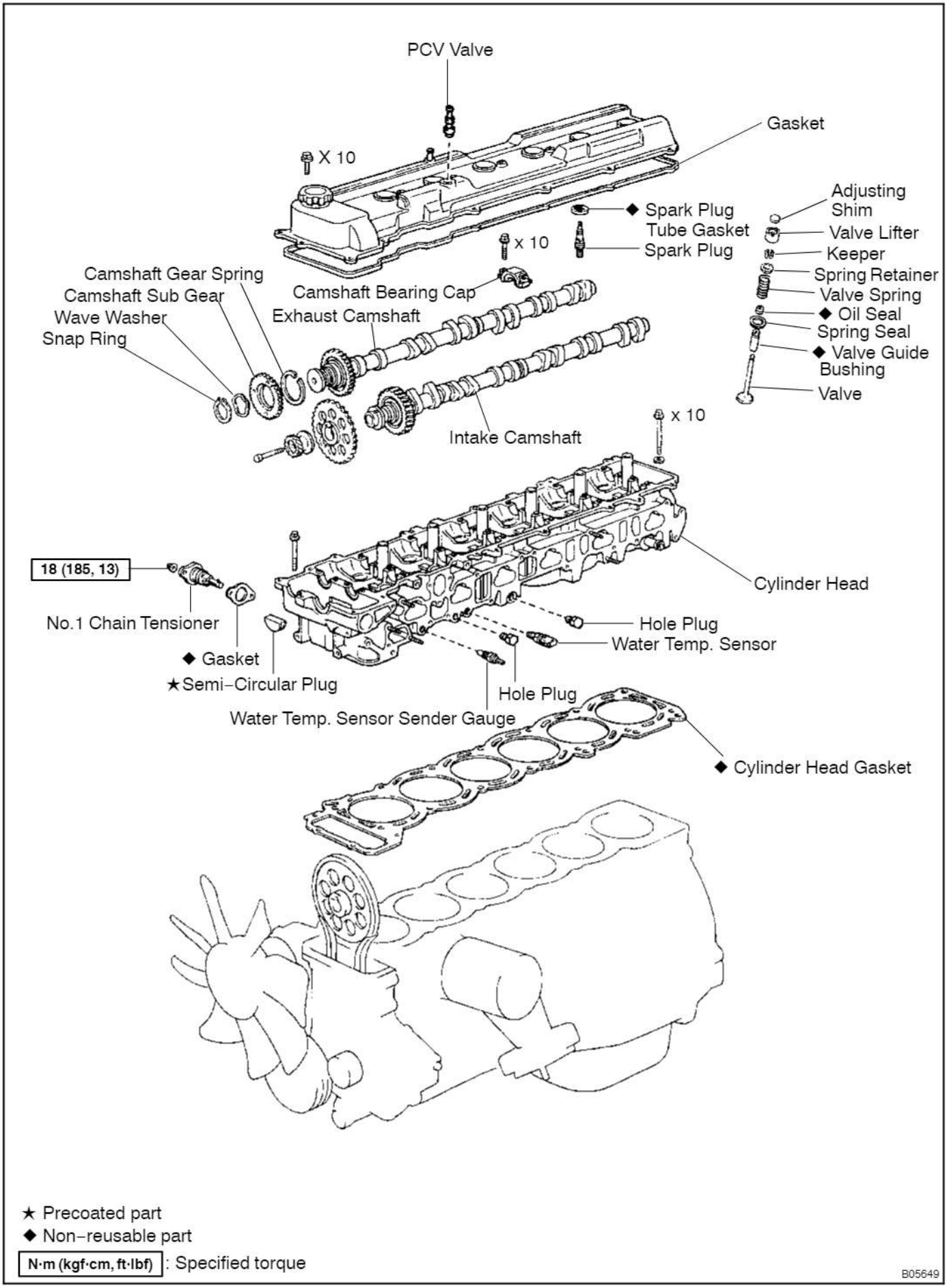
**4. DISCONNECT TACHOMETER**

# CYLINDER HEAD

## COMPONENTS

EM0VT–03





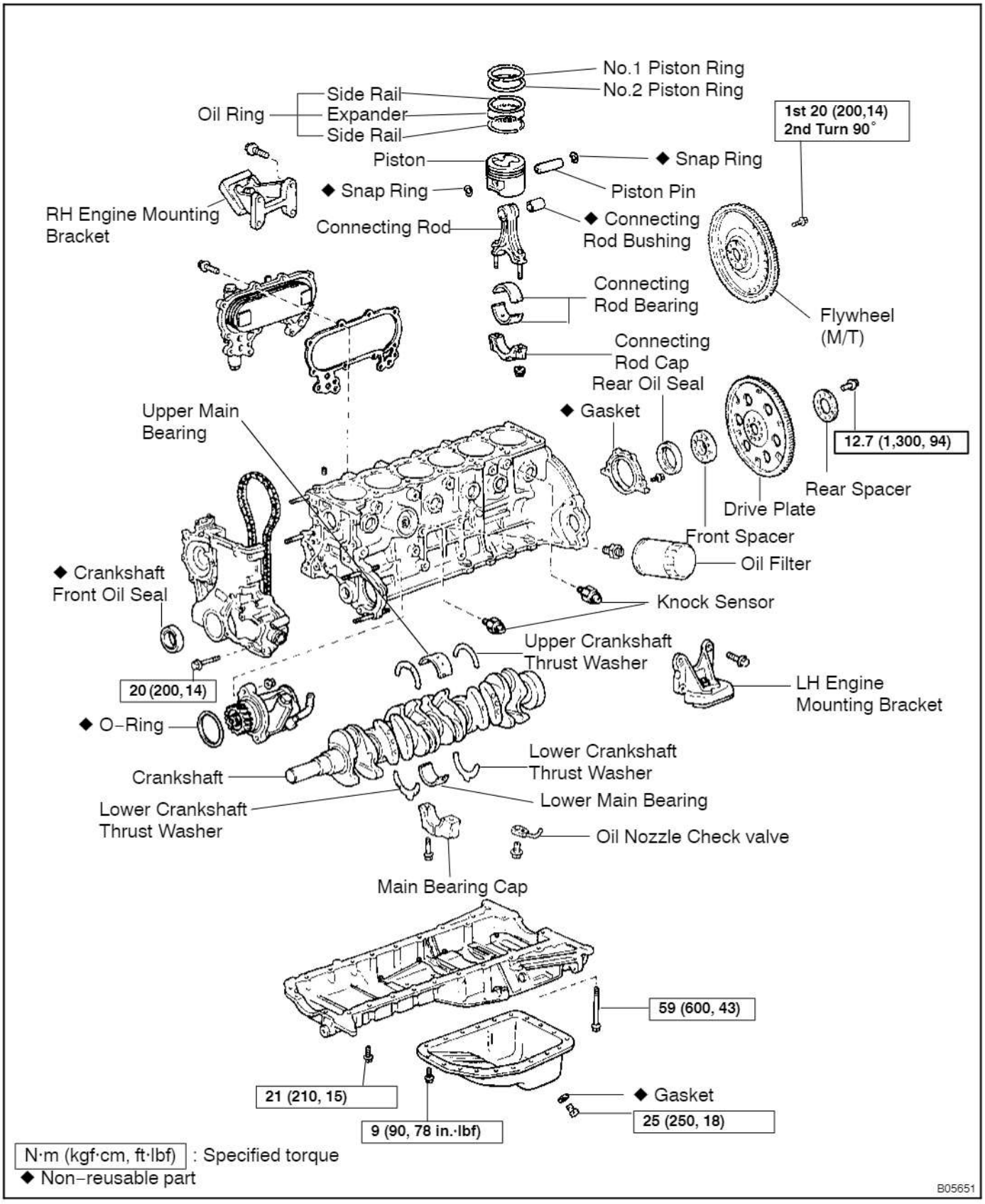

★ Precoated part
◆ Non–reusable part
N·m (kgf·cm, ft·lbf) : Specified torque

B05649

# CYLINDER BLOCK

## COMPONENTS

EM0VX–01



# EFI SYSTEM

FIOHF-03

## PRECAUTION

**1. BEFORE WORKING ON FUEL SYSTEM, DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

HINT:

Any diagnostic trouble code retained by the computer will be erased when the negative (–) terminal cable is removed from the battery.

Therefore, if necessary, read the diagnosis before removing the negative (–) terminal cable from the battery.

**2. DO NOT SMOKE OR WORK NEAR AN OPEN FLAME WHEN WORKING ON THE FUEL SYSTEM**

**3. KEEP GASOLINE AWAY FROM RUBBER OR LEATHER PARTS**

**4. MAINTENANCE PRECAUTIONS**

(a) In event of engine misfire, these precautions should be taken.
  (1) Check proper connection to battery terminals, etc.
  (2) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
  (3) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

(b) Precautions when handling the oxygen sensor.
  (1) Do not allow oxygen sensor to drop or hit against an object.
  (2) Do not allow the sensor to come into contact with water.

**5. IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)**

If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

**6. AIR INDUCTION SYSTEM**

(a) Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.

(b) Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

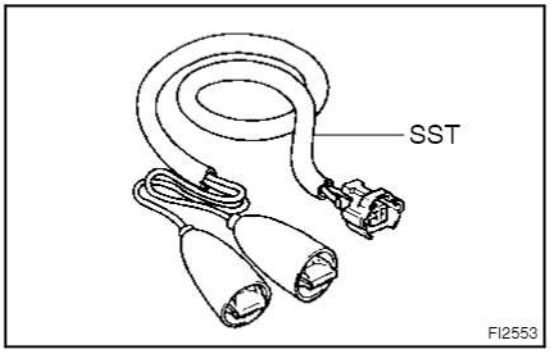
**7. ELECTRONIC CONTROL SYSTEM**

(a) Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (–) terminal cable from the battery.

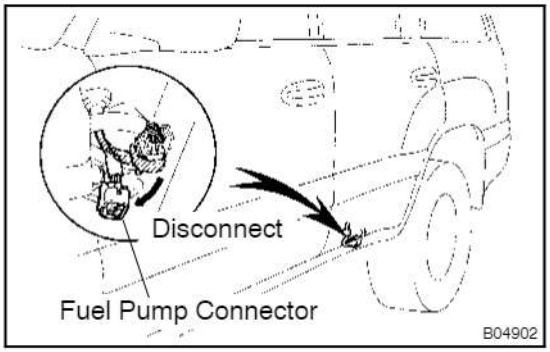
HINT:

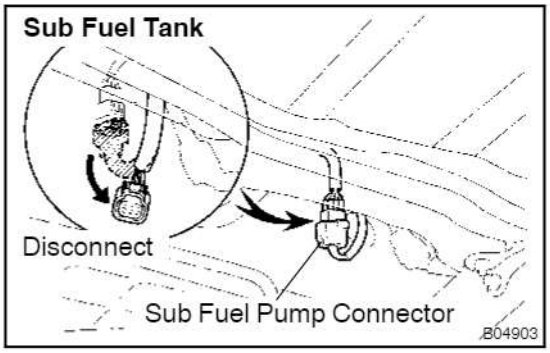
Always check the diagnostic trouble code before disconnecting the negative (–) terminal cable from the battery.

(b) When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
(c) Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
(d) Be careful during troubleshooting as there are numerous transistor circuit, and even slight terminal contact can cause further troubles.
(e) Do not open the ECU cover.
(f) When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
(g) Parts should be replaced as an assembly.
(h) Care should be taken when pulling out and inserting wiring connectors.
  (1) Release the lock and pull out the connector, pulling on the connectors.
  (2) Fully insert the connector and check that it is locked.



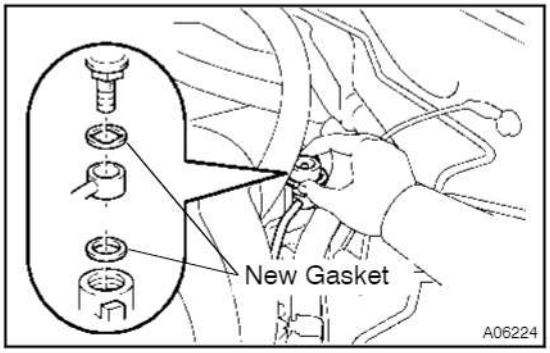

(i) Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070



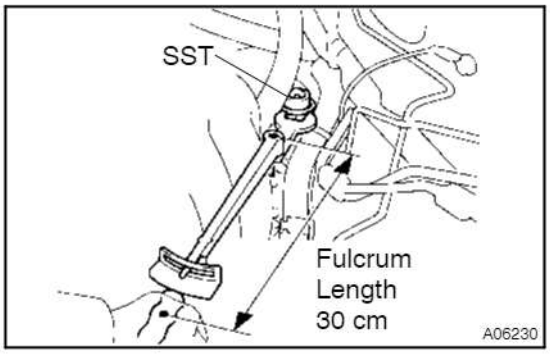




**8. FUEL SYSTEM**

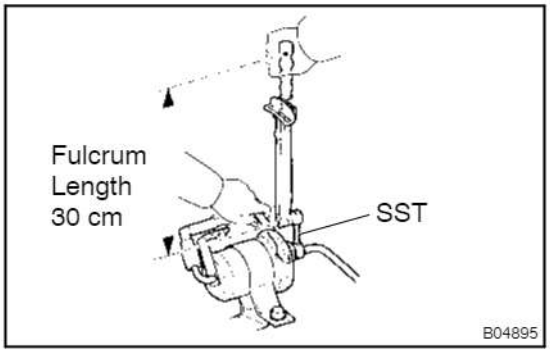
(a) When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so observe these procedures:
  (1) Disconnect the fuel pump connector.
  (2) Start the engine. After the engine has stopped on its own, turn the ignition switch OFF.
  (3) Put a container under the connection.
  (4) Slowly loosen the connection.
  (5) Disconnect the connection.
  (6) Plug the connection with a rubber plug.
  (7) Reconnect the fuel pump connector.



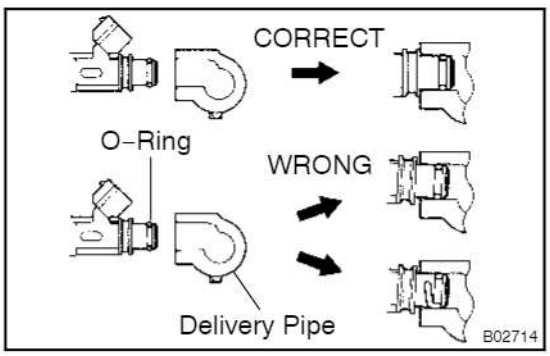

(b) When connecting the union bolt (fuel pressure pulsation damper) on the high pressure pipe union, observe these procedures:
(1) Always use 2 new gaskets.
(2) Tighten the union bolt by hand.



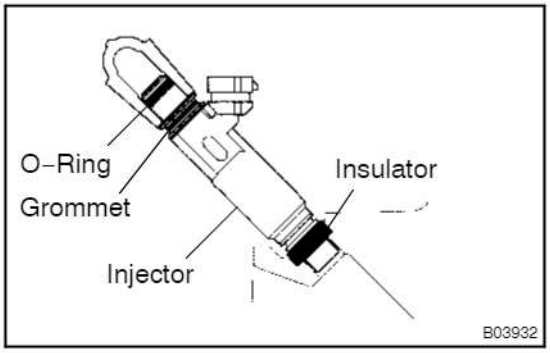

(3) Using SST, tighten the union bolt to the specified torque.
SST 09612–24014 (09617–24011)
**Torque:**
**34 N·m (345 kgf·cm, 25 ft·lbf) for use with SST**
**38 N·m (380 kgf·cm, 28 ft·lbf)**
HINT:
Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).




(c) When connecting the flare nut on the high pressure pipe union, observe these procedures:
(1) Apply a light coat of engine oil to the flare nut, and tighten the flare nut by hand.
(2) Using SST, tighten the flare nut to the specified torque.
SST 09631–22020
**NOTICE:**
**Do not rotate the fuel filter outlet, when tightening the flare nut.**
**Torque:**
**34 N·m (345 kgf·cm, 25 ft·lbf) for use with SST**
**38 N·m (380 kgf·cm, 28 ft·lbf)**
HINT:
Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

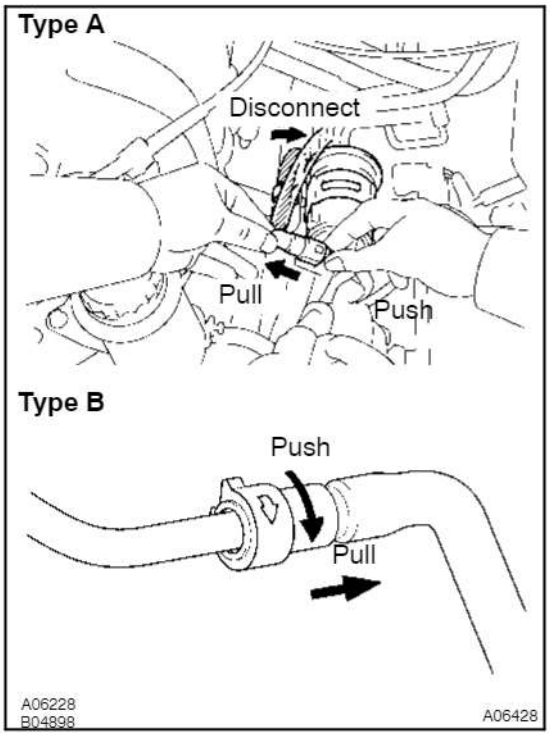


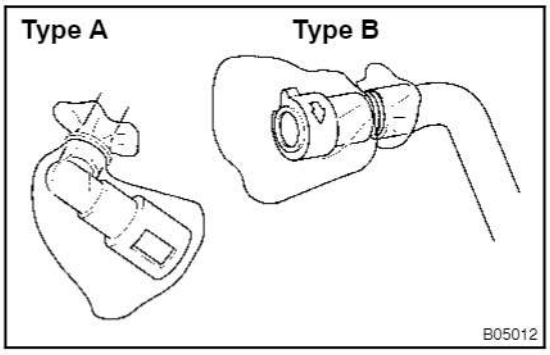

(d) Observe these precautions when removing and installing the injectors.
(1) Never reuse the O–ring.
(2) When placing a new O–ring on the injector, take care not to damage it in any way.
(3) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear or brake oil.



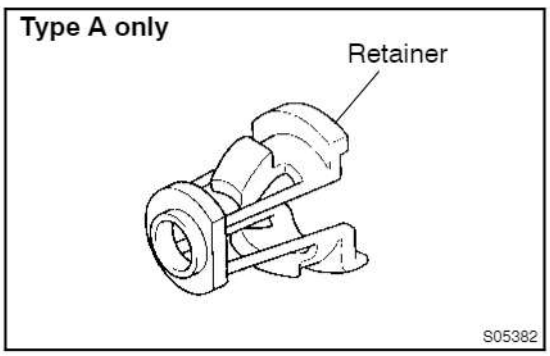

(e) Install the injector to the delivery pipe and lower intake manifold as shown in the illustration.
Before installing the injector, must apply spindle oil or gasoline on the place where a delivery pipe or an intake manifold touches an O–ring of the injector.

(f) Observe these precautions when disconnecting the fuel tube connector (quick type):
(1) Check if there is any dirt like mud on the pipe and around the connector before disconnecting them and clean the dirt away.
(2) Be sure to disconnect with hands.
(3) Type A:
When the connector and the pipe are stuck, pinch the retainer between the hands, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.
Type B:
When the connector and the pipe are stuck, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.
(4) Inspect if there is any dirt or the likes on the seal surface of the disconnected pipe and clean it away.

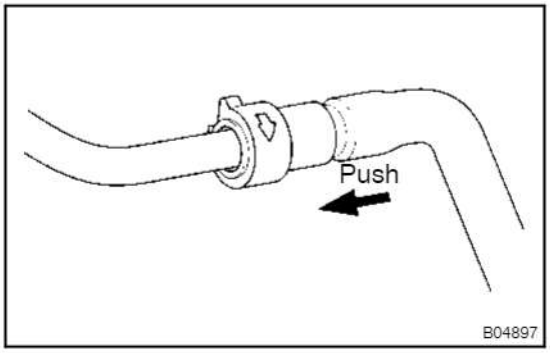


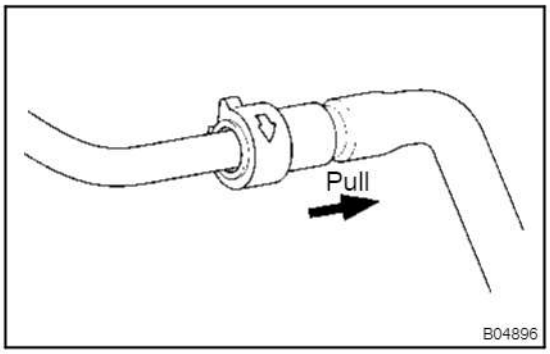

(5) Prevent the disconnected pipe and connector from damaging and mixing foreign objects by covering them with a vinyl bag.




(g) Observe these precautions when connecting the fuel tube connector (quick type):
(1) Do not reuse the retainer removed from the pipe.
(2) Must use hands without using tools when to remove the retainer from the pipe.
(3) Check if there is any damage or foreign objects on the connected part of the pipe.

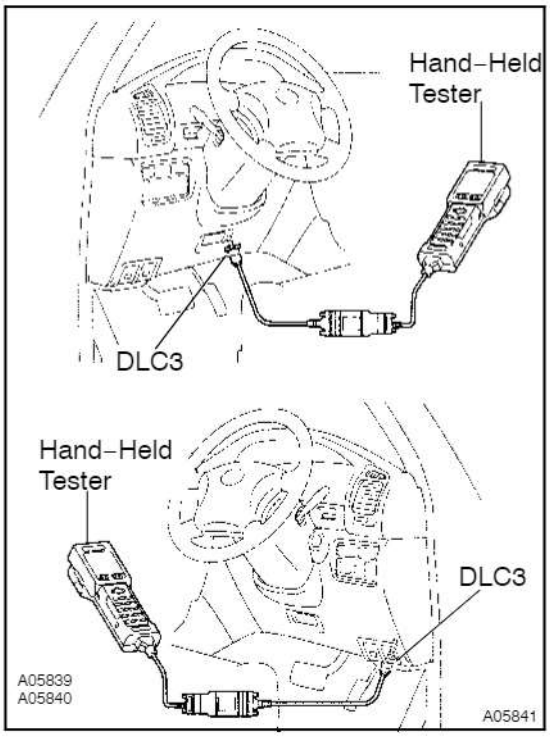



(4) Match the axis of the connector with axis of the pipe, and push in the connector until the connector makes a "click" sound. In case that the connections is tight, apply little amount of new engine oil on the tip of the pipe.




(5) After having finished the connection, check if the pipe and the connector are securely connected by pulling them.
(6) Check if there is any fuel leakage.

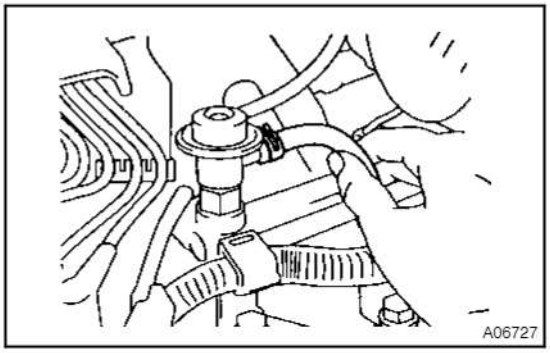
(h) Observe these precautions when handling nylon tube.
(1) Pay attention not to turn the connected part of the nylon tube and the quick connector with force when connecting them.
(2) Pay attention not to kink the nylon tube.
(3) Do not remove the EPDM protector on the outside of the nylon tube.
(4) Must not close the piping with the nylon tube by bending it.




(i) Check that there are no fuel leaks after doing maintenance anywhere on the fuel system.
(1) Connect a hand–held tester to the DLC3.
(2) Turn the ignition switch ON and push the hand–held tester main switch ON.

**NOTICE:**
**Do not start the engine.**

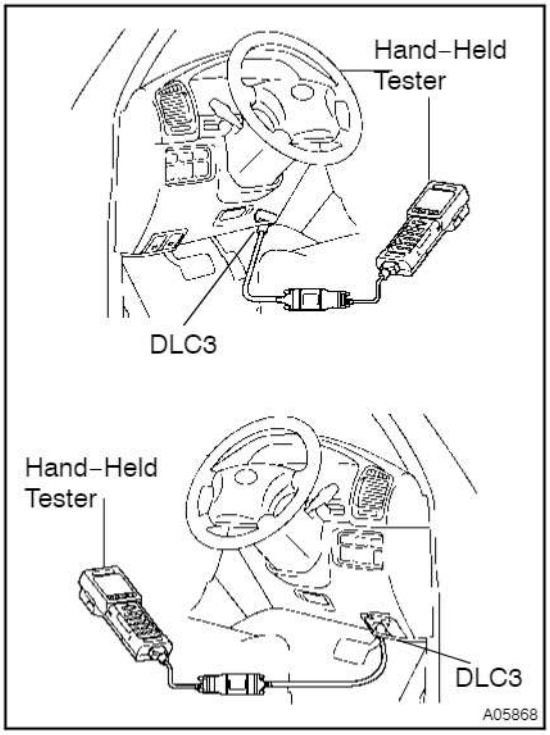
(3) Select the ACTIVE TEST mode on the hand–held tester.
(4) Please refer to the hand–held tester operator's manual for further details.
(5) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector. (See page FI–7)




(6) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (4 kgf/cm$^2$, 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

**NOTICE:**
**Always pinch the hose. Avoid bending as it may cause the hose to crack.**

(7) Turn the ignition switch OFF.
(8) Disconnect the hand–held tester from the DLC3.




# FUEL PUMP

FI0IF–02

## ON–VEHICLE INSPECTION

**1. CHECK FUEL PUMP OPERATION**

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

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

**NOTICE:**

**Do not start the engine.**

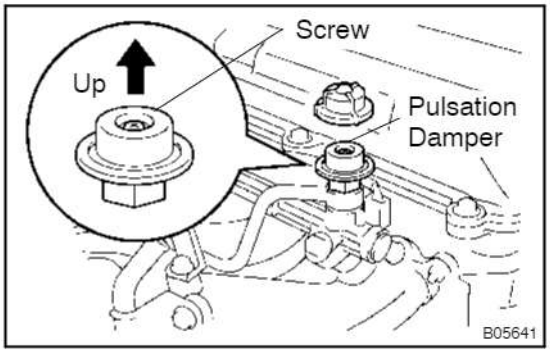
(c) Select the ACTIVE TEST mode on the hand–held tester.

(d) Please refer to the hand–held tester operator's manual for further details.

(e) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector. (See step 3)

(f) Disconnect the fuel return hose from the clamp on the V–bank cover.

(g) Remove the 2 bolts, nuts and V–bank cover.




(h) Check that the pulsation damper screw rises up when the fuel pump operates.

If operation is not as specified, check these parts:

- Fusible link
- Fuses
- EFI main relay
- Fuel pump
- Engine ECU
- Wiring connections

(i) Turn the ignition switch OFF.

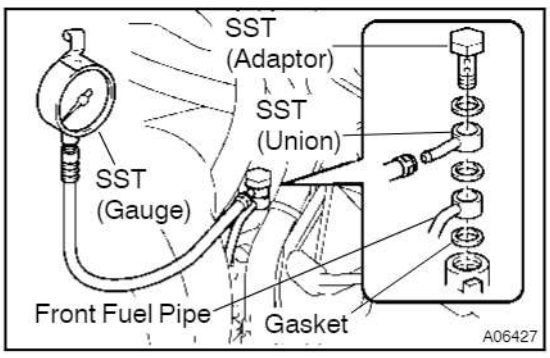
(j) Disconnect the hand–held tester from the DLC3.

**2. CHECK FUEL PRESSURE**

(a) Check the battery positive voltage is above 12 V.

(b) Disconnect the negative (–) terminal cable from the battery.

(c) Remove the front fuel pipe from the LH delivery pipe. (See page FI–23)




(d) Install the front fuel pipe and SST (pressure gauge) to the delivery pipe with 3 lower gaskets and SST (adaptor).
SST 09268–45012 (09268–41190, 90405–06167)
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

(e) Wipe off any splattered gasoline.

(f) Reconnect the negative (–) terminal cable to the battery.

(g) Connect a hand–held tester to the DLC3.
(See step 1 in check fuel pump operation (a) to (e))

(h) Measure the fuel pressure.

**Fuel pressure:**
**265 – 304 kPa (2.7 – 3.1 kgf/cm$^2$, 38 – 44 psi)**

If pressure is high, replace the fuel pressure regulator.
If pressure is low, check these parts:

- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator

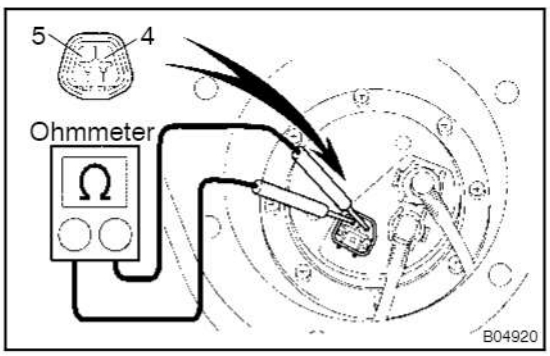
(i) Disconnect the hand–held tester from the DLC3.
(j) Start the engine.
(k) Measure the fuel pressure at idle.
**Fuel pressure:**
**265 – 304 kPa (2.7 – 3.1 kgf/cm$^2$, 38 – 44 psi)**
(l) Measure the fuel pressure at idle.
**Fuel pressure:**
**196 – 235 kPa (2.0 – 2.4 kgf/cm$^2$, 28 – 34 psi)**
(m) Stop the engine.
(n) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.
**Fuel pressure: 147 kPa (1.5 kgf/cm$^2$, 21 psi) or more**

If pressure is not as specified, check the fuel pump, pressure regulator and/or injectors.

(o) After checking fuel pressure, disconnect the negative (–) terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.
SST 09268–45012
(p) Reinstall the front fuel pipe to the LH delivery pipe. (See page FI–28)
(q) Reconnect the negative (–) terminal cable to the battery.
(r) Check for fuel leaks. (See page FI–1)

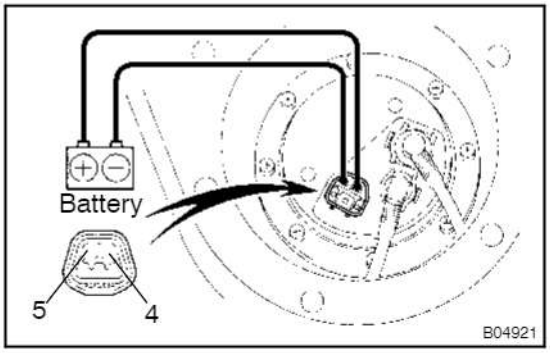
**3. INSPECT FUEL PUMP**

(a) Remove the No.1 rear seats.
(b) Remove the 2 rear door scuff plates, step plates and rear seat lock covers.
(c) Pull off the front and rear floor carpets.
(d) Remove the 2 screws and rear floor service hole cover.
(e) Disconnect the fuel pump & sender gauge connector.




(f) Using an ohmmeter, measure the resistance between terminals 4 and 5.
**Resistance: 0.2 – 3.0 Ω at 20°C (68°F)**

If the resistance is not as specified, replace the fuel pump and/or lead wire.




(g) Inspect the fuel pump operation.
Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (–) lead to terminal 5. Check that the fuel pump operates.

**NOTICE:**

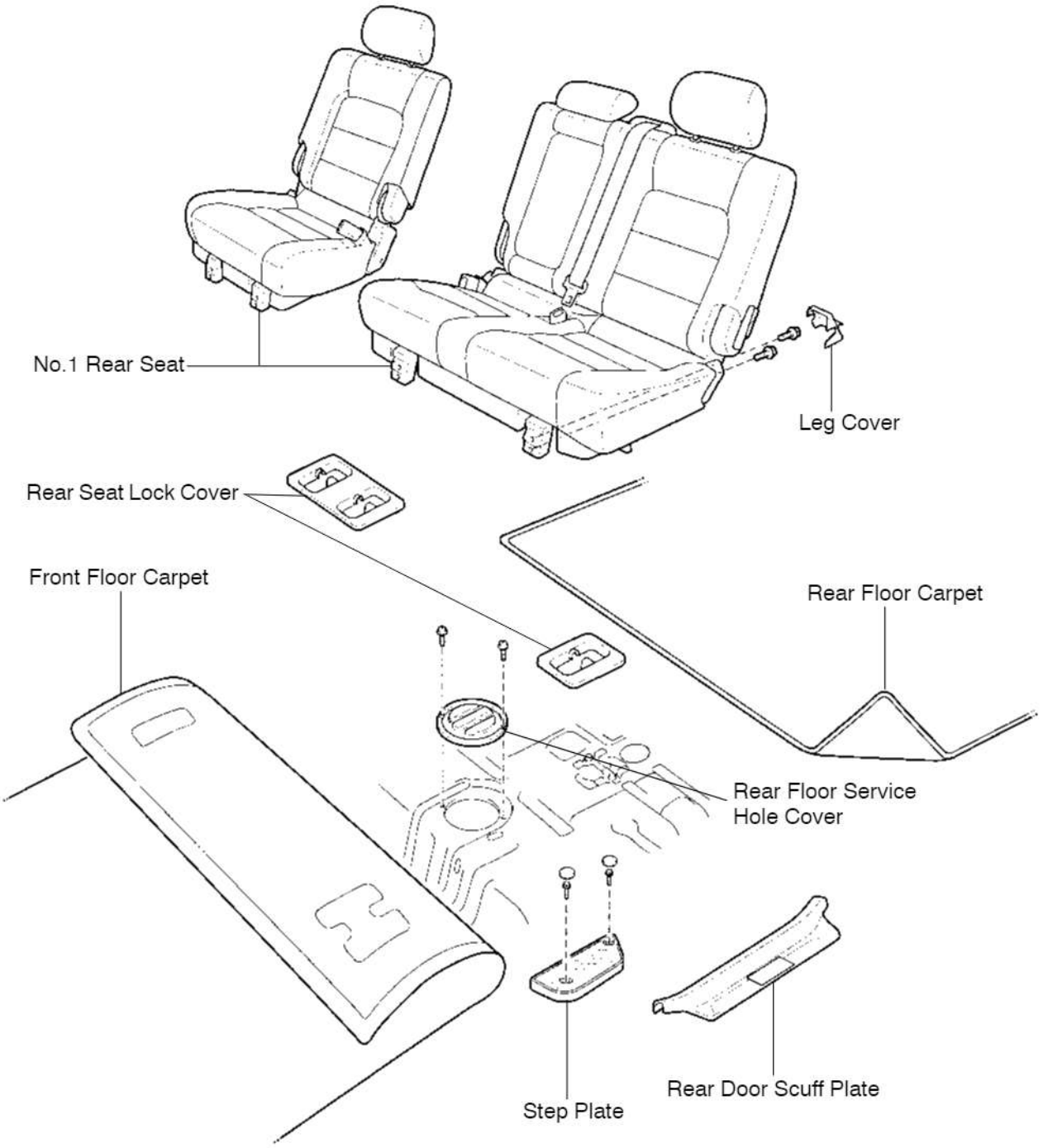
- **These tests must be done quickly (within 10 seconds) to prevent the coil burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always do the switching at the battery side.**

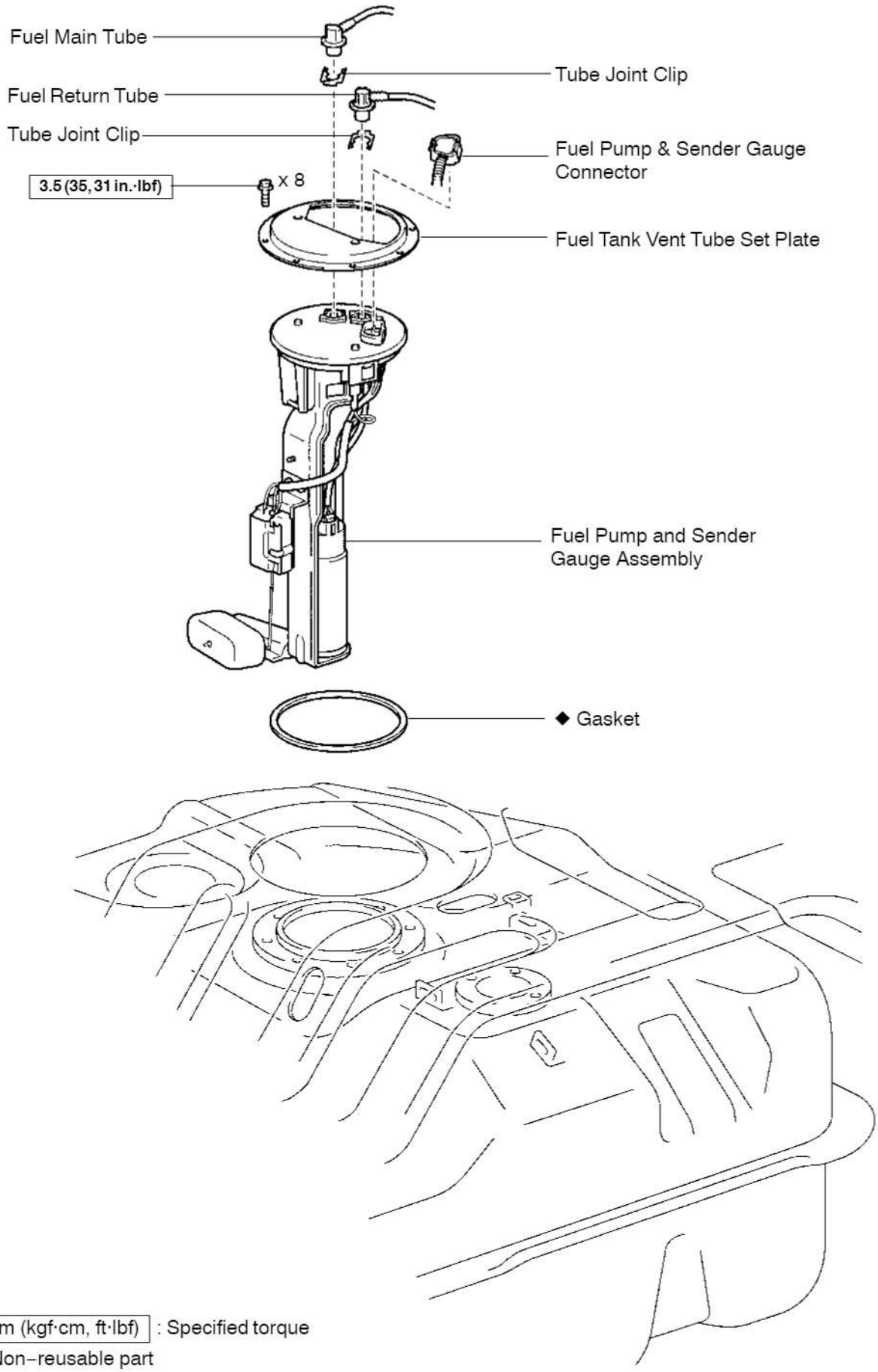
If operation is not as specified, replace the fuel pump and/or lead wire.

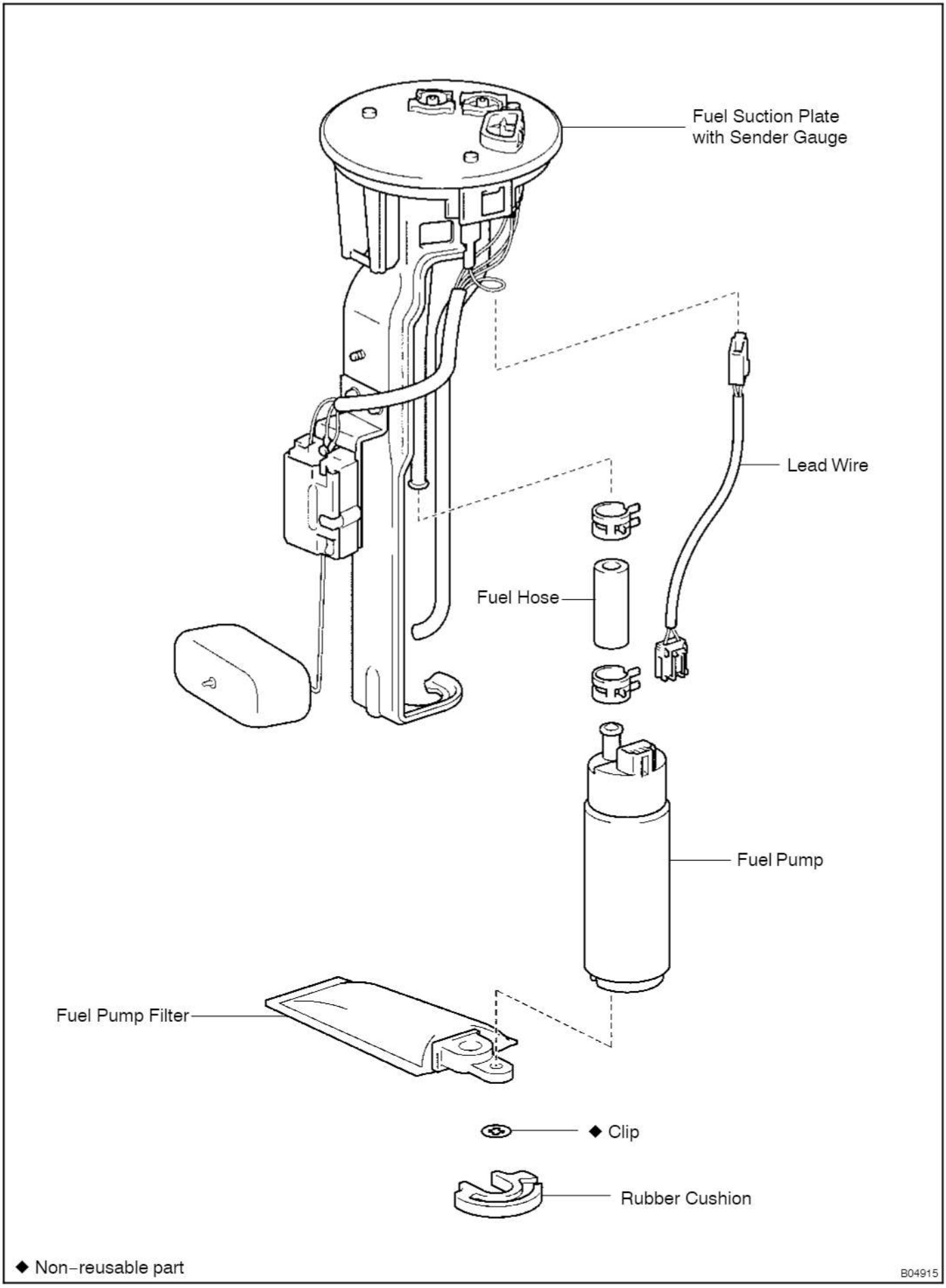
(h) Reconnect the fuel pump & sender gauge connector.
(i) Reinstall the rear floor service hole cover with the 2 screws.
(j) Reinstall the front and rear floor carpets.
(k) Remove the 2 rear door scuff plates, step plates and rear sear lock covers.
(l) Reinstall the No.1 rear seats.

FI0IG-01

# COMPONENTS







FI0IH–01

# REMOVAL

**CAUTION:**

**Do not smoke or work near an open frame when working the fuel pump.**

1. **REMOVE NO.1 REAR SEATS**
2. **REMOVE REAR DOOR SCUFF PLATES, STEP PLATES AND REAR SEAT LOCK COVERS**
3. **REMOVE FLOOR SERVICE HOLE COVER**

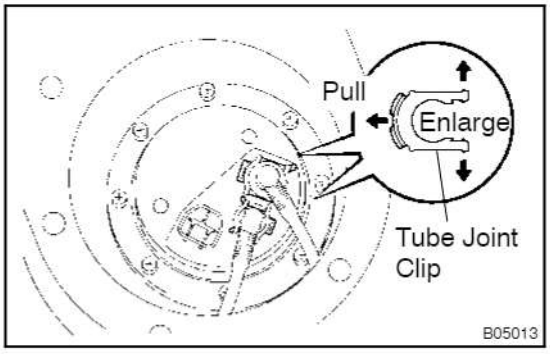
(a) Take off the front and rear floor carpets.

(b) Remove the 2 screws and service hole cover.

4. **DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**
5. **DISCONNECT FUEL MAIN TUBE AND RETURN TUBE (FUEL TUBE CONNECTORS) FROM FUEL SUCTION PLATE**

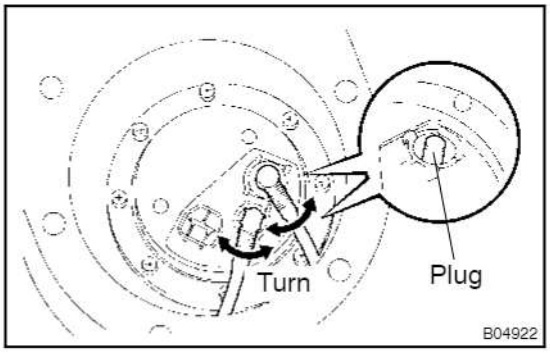
**CAUTION:**

- **Perform disconnecting operation of the fuel tube connector (quick type) after observing precaution.** **(See page FI–1)**
- **As there is retained pressure in the fuel line, prevent it from splashing inside the vehicle compartment.**
- **As the quick connector seals tube and suction plate through O–rings, perform the operation while taking sufficient care not to damage the contact surface or let the foreign matter stick on it.**
- **Be sure to perform the disconnection with your hands. Do not use tools.**
- **Do not bend or turn the nylon tube forcefully.**




(a) Before operation, remove the foreign matter or dirt stick to the tube joint clips and clean them.

(b) Enlarge the tip of the clips with your finger and pull them out for disconnection.



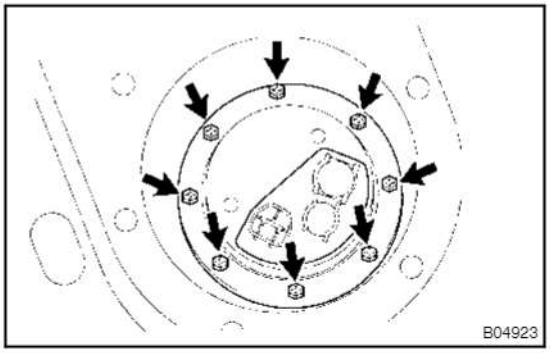

(c) Pull out the fuel main tube and return tube.

If the nylon tube and suction plate stick together, ease the connection by turning the nylon tube with your hand and pull it out for disconnection.

**NOTICE:**

**Plug the port of the fuel suction plate with a clean rubber cap.**

(d) After disconnection, protect the connector with a vinyl bag.




**6. REMOVE FUEL PUMP AND SENDER GAUGE ASSEMBLY FROM FUEL TANK**

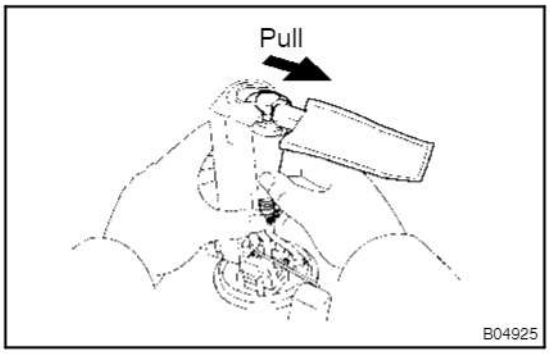
(a) Remove the 8 bolts.

(b) Pull out the fuel pump and sender gauge assembly.

**NOTICE:**

- **Do not damage the fuel pump filter.**
- **Be careful that the arm of the sender gauge should not bent.**

(c) Remove the gasket from the fuel section plate.



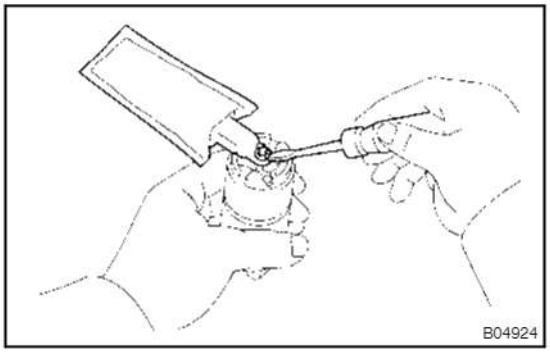

**7. REMOVE LEAD WIRE FROM FUEL PUMP**

**8. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**

(a) Pull out the lower side of the fuel pump from the pump bracket.

(b) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

(c) Remove the rubber cushion from the fuel pump.



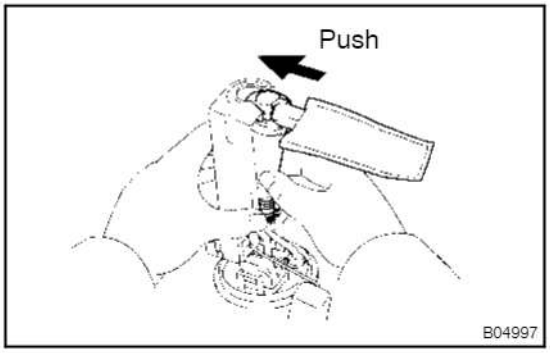

**9. REMOVE FUEL PUMP FILTER FROM FUEL PUMP**

(a) Using a small screwdriver, remove the clip.

(b) Pull out the pump filter.

FI0II–01

# INSTALLATION



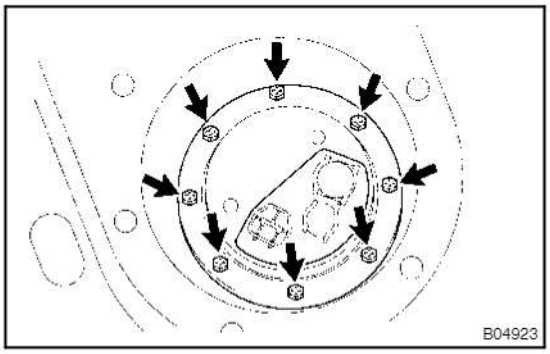

**1. INSTALL FUEL PUMP FILTER TO FUEL PUMP**

Install the pump filter with a new clip.

**2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET**

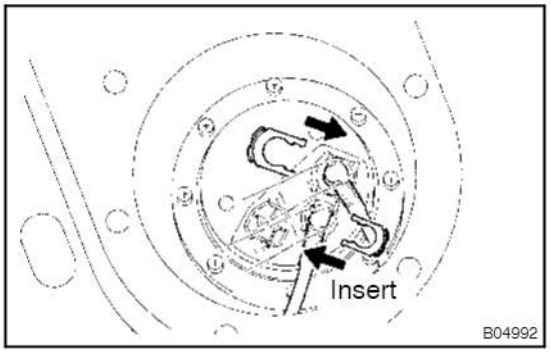
(a) Install the rubber cushion to the fuel pump.
(b) Connect the fuel hose to the outlet port of the fuel pump.
(c) Install the fuel pump by pushing the lower side of the fuel pump.

**3. INSTALL LEAD WIRE TO FUEL PUMP**



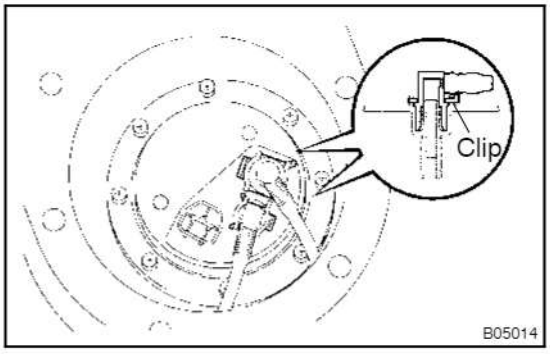

**4. INSTALL FUEL PUMP AND SENDER GAUGE ASSEMBLY TO FUEL TANK**

(a) Install a new gasket to the fuel suction plate.
(b) Insert the fuel pump and sender gauge assembly into the fuel tank.
(c) Install the fuel tank vent tube set plate with the 8 bolts.
**Torque: 3.5 N·m (35 kgf·cm, 31 in.·lbf)**




**5. CONNECT FUEL MAIN TUBE AND RETURN TUBE (FUEL TUBE CONNECTORS) TO FUEL SUCTION PLATE**

(a) Before installing the tube connectors, check to see the connection between the nylon tube and suction plate for the presence of foreign matters.
(b) Attach the fuel tube connectors to the ports of the fuel suction plate and insert the clips until you hear a click.




(c) After connection, pull out the clips to check to see that they are installed securely.

**6. CONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**

**7. CHECK FOR FUEL LEAKS** (See page FI–1)

**8. INSTALL FLOOR SERVICE HOLE COVER**

(a) Install the service hole cover with the 2 screws.
(b) Cover the rear and front floor carpets.

**9. INSTALL REAR DOOR SCUFF PLATES, STEP PLATES AND REAR SEAT LOCK COVERS**

**10. INSTALL NO.1 REAR SEATS**

# SUB FUEL PUMP

FI0HN–01

## ON–VEHICLE INSPECTION

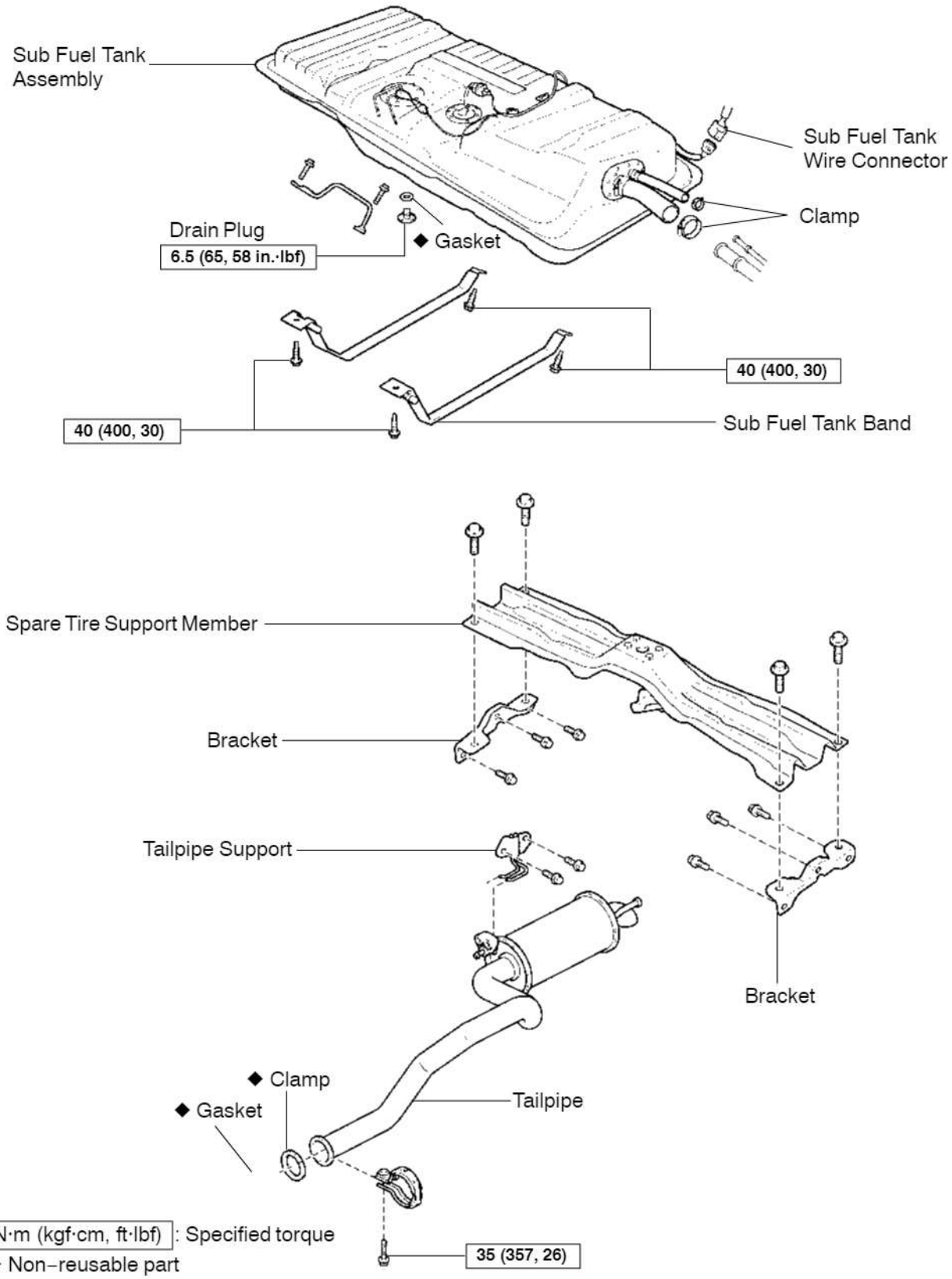
**CHECK SUB FUEL PUMP OPERATION AND FUEL PRESSURE (See page FI–16)**

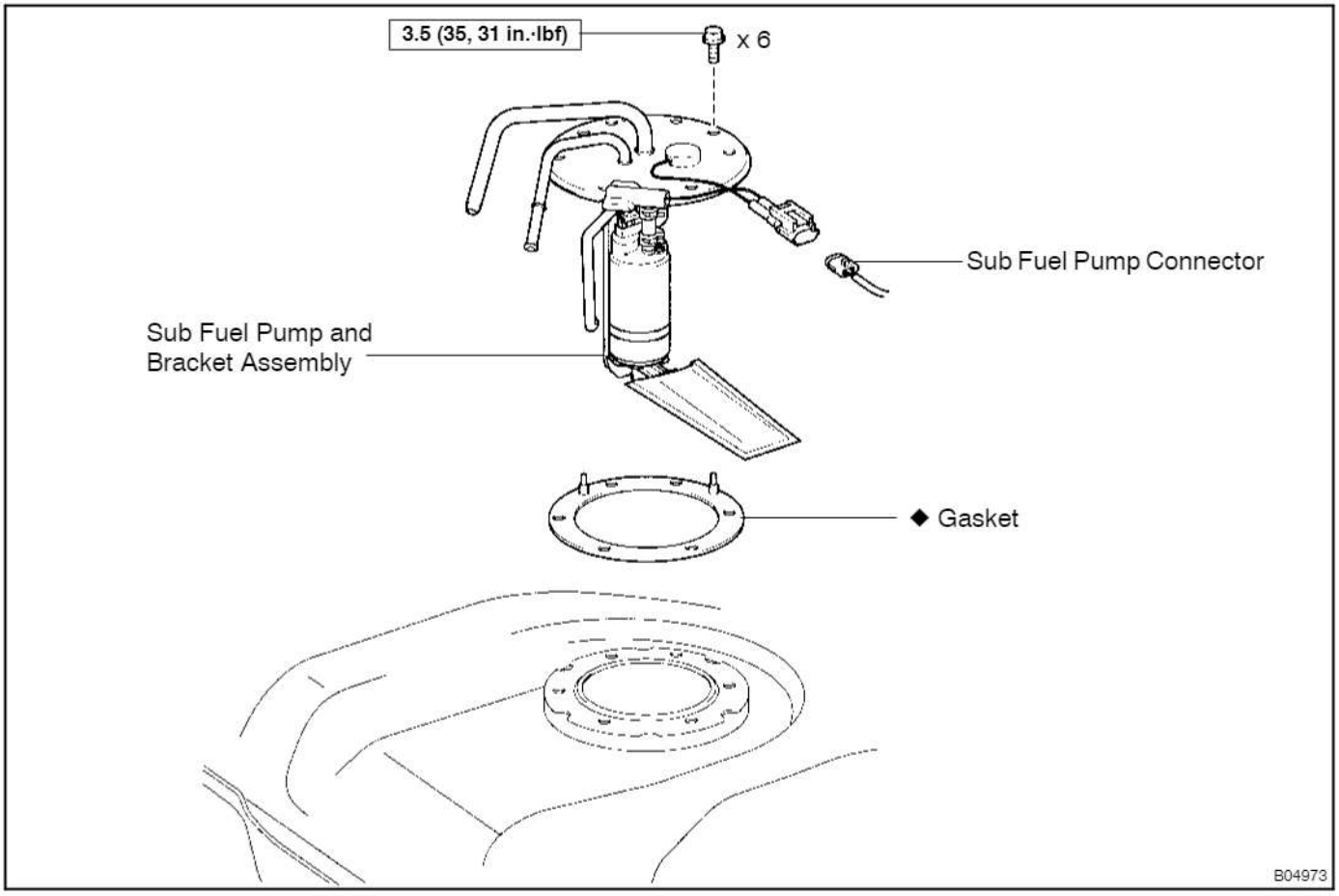
**NOTICE:**

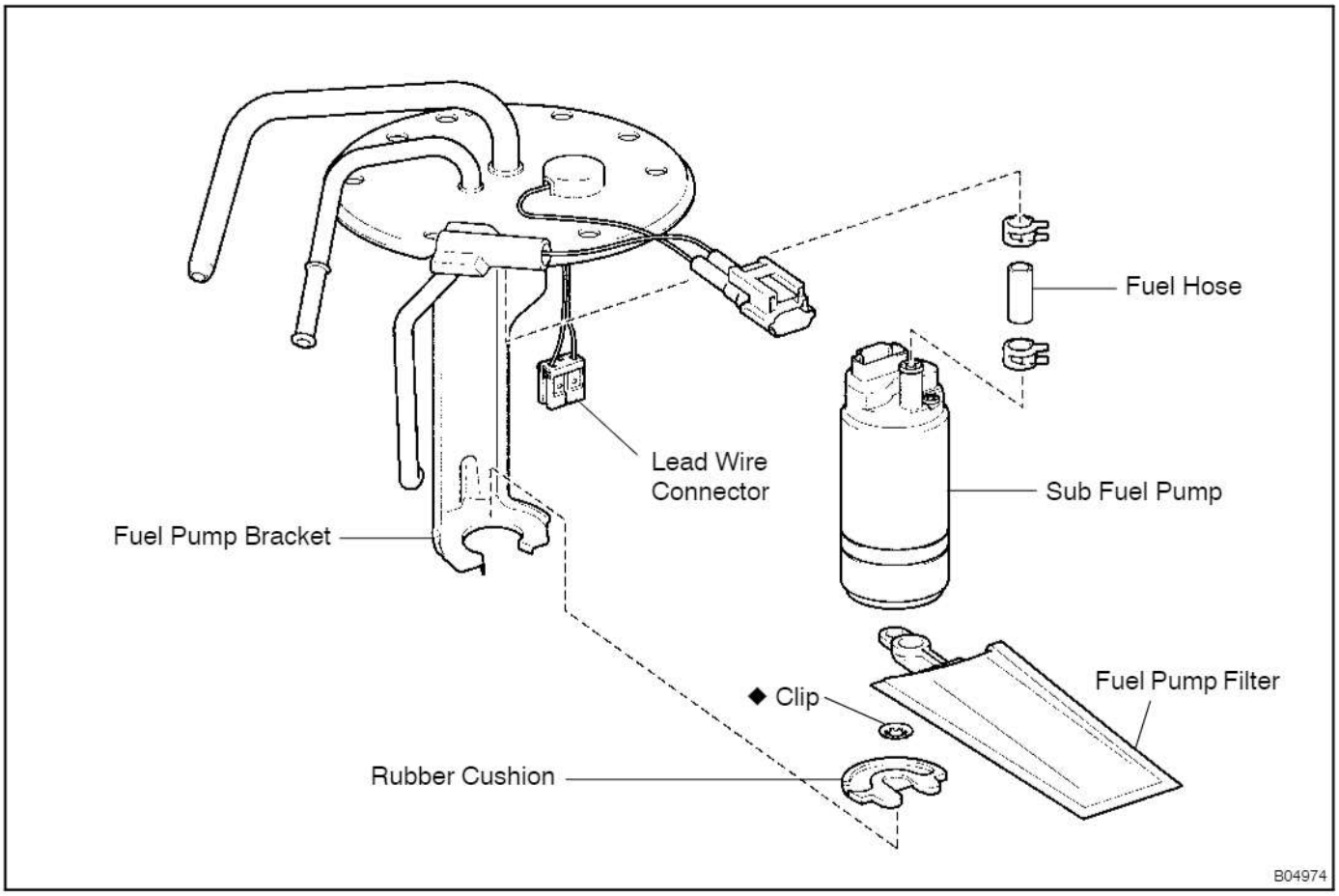
**Push the fuel tank changeover switch ON.**

FI0HK-01

# COMPONENTS

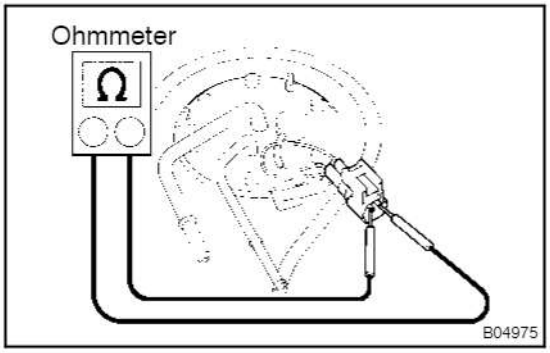




FI0HL-01

# REMOVAL




**CAUTION:**

**Do not smoke or work near an open flame when working on the fuel pump.**

**1. REMOVE SUB FUEL TANK FROM VEHICLE**

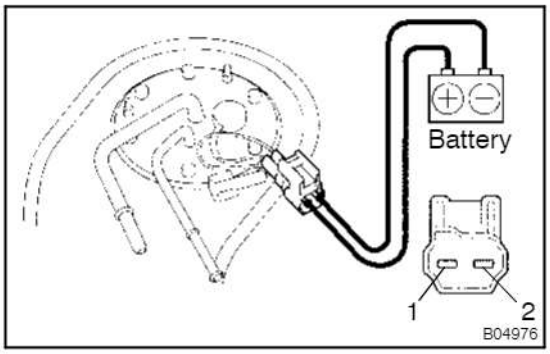
**2. DISCONNECT SUB FUEL PUMP CONNECTOR**

**3. INSPECT SUB FUEL PUMP RESISTANCE**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance: 0.2 – 3.0 Ω at 20°C (68°F)**

If the resistance is not as specified, replace the sub fuel pump.




**4. INSPECT SUB FUEL PUMP OPERATION**

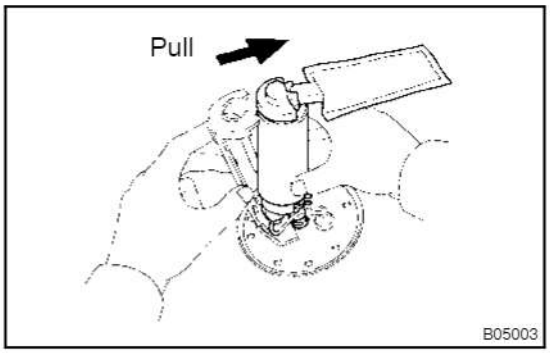
Connect a tester lead from terminal 1 of the connector to the positive (+) terminal of the battery: connect another tester lead from terminal 2 of the connector to the negative (–) terminal of the battery.

**NOTICE:**

- **These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always connect or disconnect at the battery.**

If operation is not as specified, replace the sub fuel pump.

**5. REMOVE SUB FUEL PUMP AND BRACKET ASSEMBLY FROM SUB FUEL TANK**



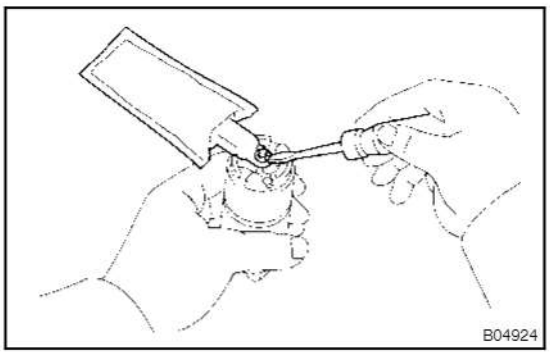

**6. REMOVE SUB FUEL PUMP FROM PUMP BRACKET**

(a) Disconnect the lead wire connector from the sub fuel pump.

(b) Pull out the lower side of the sub fuel pump from the pump bracket.

(c) Disconnect the fuel hose from the sub fuel pump, and remove the sub fuel pump.

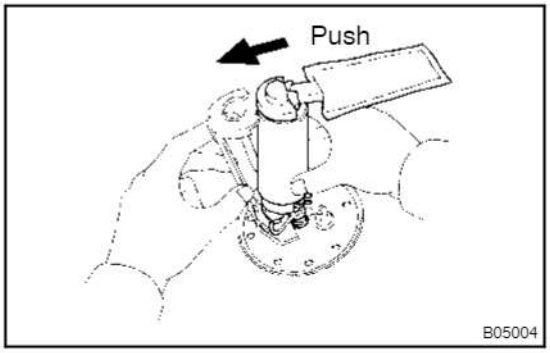
(d) Remove the rubber cushion from the sub fuel pump.




**7. REMOVE FUEL PUMP FILTER FROM SUB FUEL PUMP**

(a) Using a small screwdriver, remove the clip.

(b) Pull out the pump filter.




FI0HM–01

# INSTALLATION

**1. INSTALL FUEL PUMP FILTER TO SUB FUEL PUMP**

Install the pump filter with a new clip.

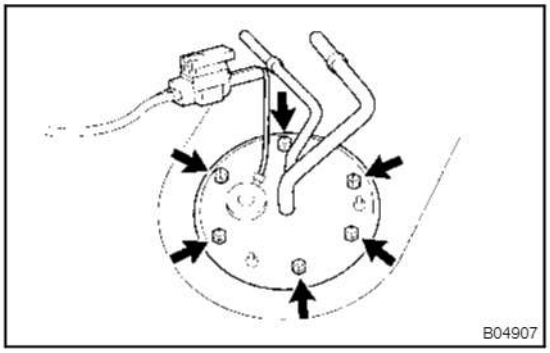
**2. INSTALL SUB FUEL PUMP TO FUEL PUMP BRACKET**

(a) Install the rubber cushion to the sub fuel pump.

(b) Connect the fuel hose to the outlet port of the sub fuel pump.

(c) Install the sub fuel pump by pushing the lower side of the sub fuel pump.

(d) Connect the lead wire connector to the sub fuel pump.




**3. INSTALL SUB FUEL PUMP AND BRACKET ASSEMBLY**

(a) Install a new gasket to the fuel pump bracket.

(b) Attach the sub fuel pump and bracket assembly to the sub fuel tank.

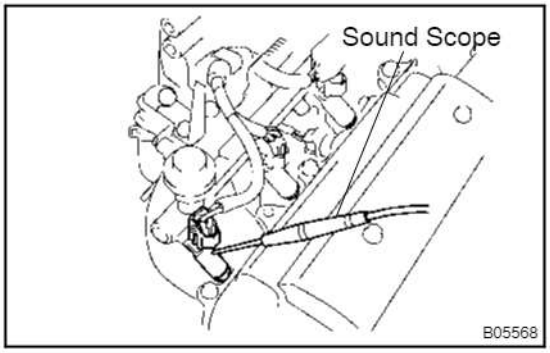
(c) Install the fuel pump bracket with the 6 bolts.

**Torque: 3.5 N·m (35 kgf·cm, 31 in.·lbf)**

**4. CONNECT SUB FUEL PUMP CONNECTOR**

**5. INSTALL SUB FUEL TANK TO VEHICLE**

**6. CHECK FOR FUEL LEAKS** (See page FI – 1)




# INJECTOR

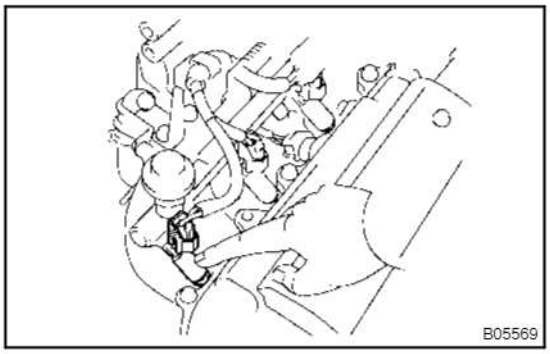
FI0HO-01

## ON–VEHICLE INSPECTION

### 1. INSPECT INJECTOR OPERATION

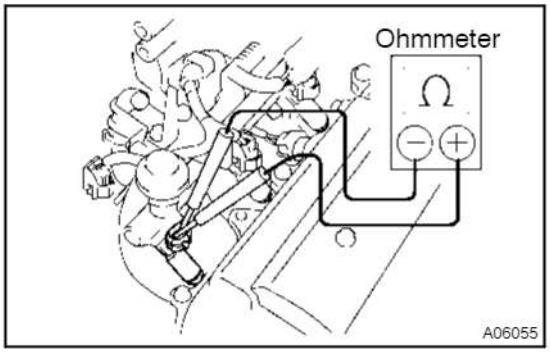
Check operation sound from each injector.

(1) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine speed.




(2) If you have no sound scope, you can check the injector transmission operation with your finger.

If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECU.




### 2. INSPECT INJECTOR RESISTANCE

(a) Disconnect the injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

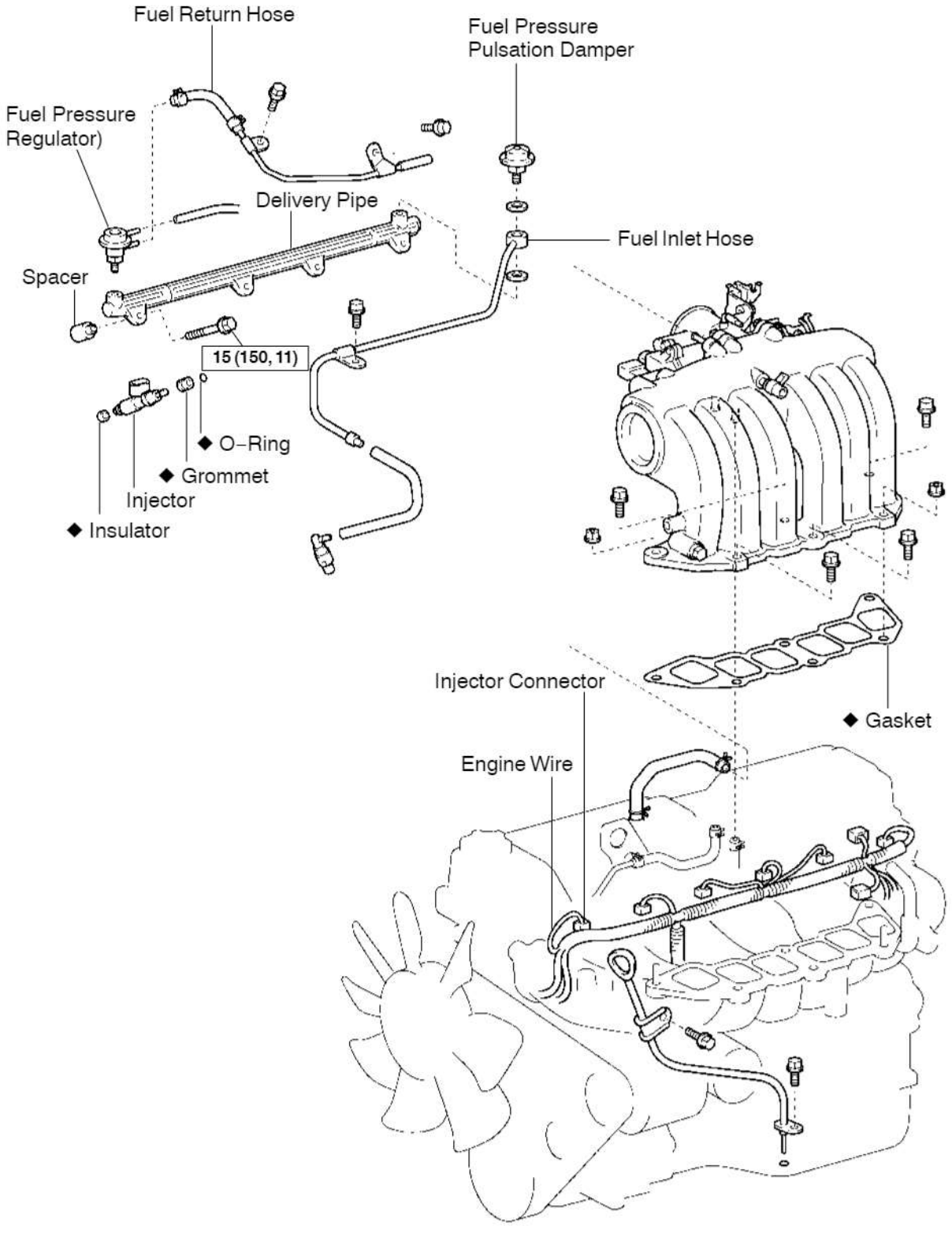
**Resistance: 13.4 – 14.2 Ω at 20°C (68°F)**

If the resistance is not as specified, replace the injector.

(c) Reconnect the injector connector.

FI0HP–01

# COMPONENTS




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

B05631

FI0HQ-01

# REMOVAL

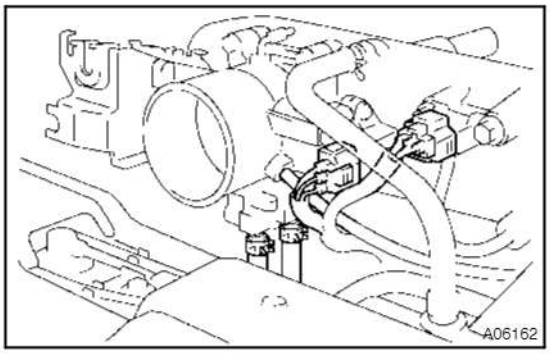
**1. DRAIN ENGINE COOLANT**

**2. REMOVE AIR CLEANER CAP AND HOSE**

**3. DISCONNECT CONTROL CABLES FROM THROTTLE BODY**

Disconnect these cables:

- Accelerator cable
- A/T:
  Throttle cable

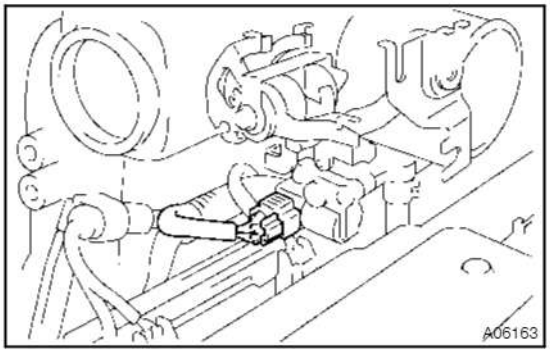



**4. REMOVE INTAKE MANIFOLD ASSEMBLY**

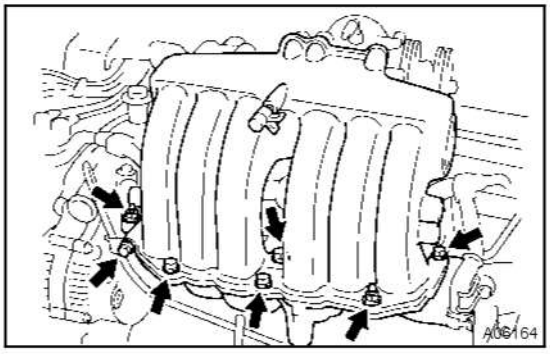
(a) Disconnect these connectors:
- Throttle position sensor connector
- Water bypass hose (from water bypass pipe)
- Water bypass hose (from water outlet)

(b) Disconnect the vacuum hose from the throttle body.

(c) Disconnect the air hose for the fuel pressure regulator from the throttle body.



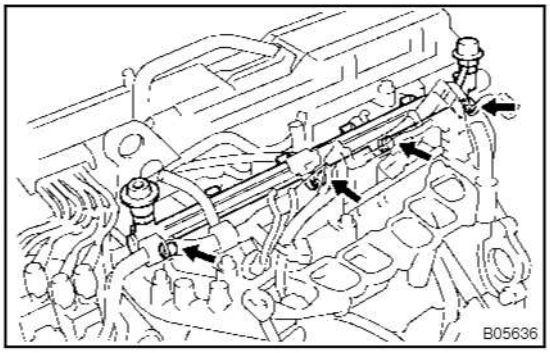

(d) Disconnect ISC valve connector




(e) Remove the 5 bolts, 2 nuts, intake manifold NO 1 and gasket.

**5. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR**

**6. DISCONNECT INJECTOR CONNECTORS**




**7. REMOVE DELIVERY PIPE AND INJECTORS**

(a) Disconnect the 6 injector connectors.

(b) Remove the 4 bolts holding the delivery pipe to the cylinder head.

(c) Disconnect the delivery pipe from the 6 injectors.

(d) Pull out the 6 injectors.

**NOTICE:**

- **Be careful not to drop the injectors when removing the delivery pipes.**

- **Pay attention to put any hung load on the injector to and from the side direction.**

(e) Remove the 6 insulators and 4 spacers from the cylinder head.

(f) Remove the O–ring and grommet from each injector.

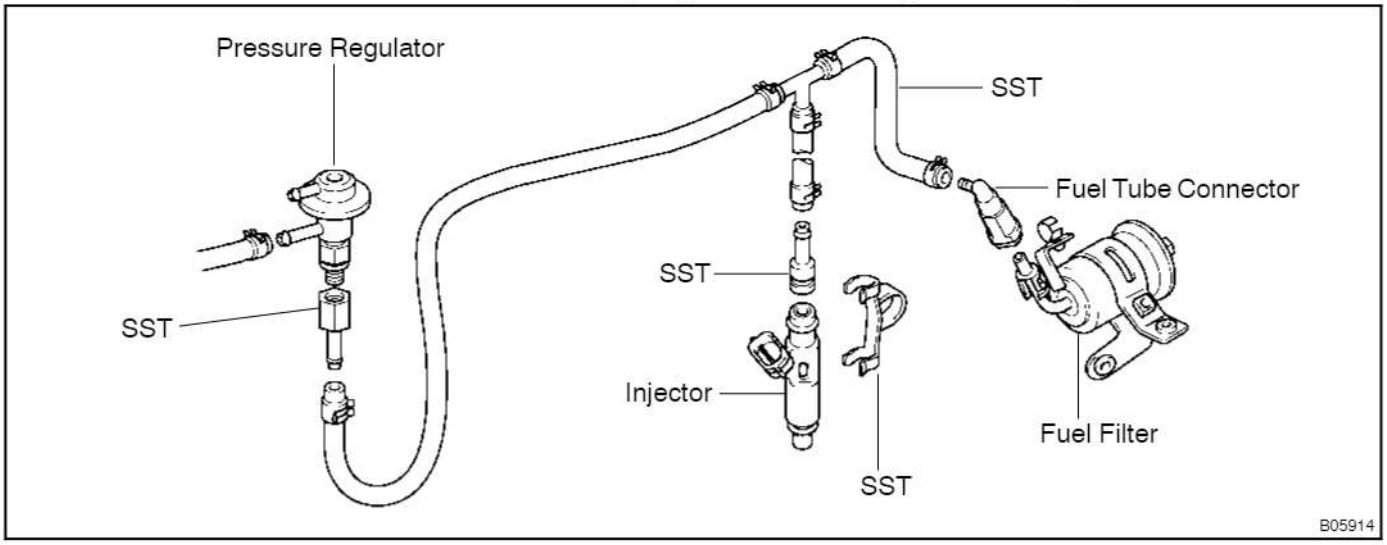
FI0HR–01

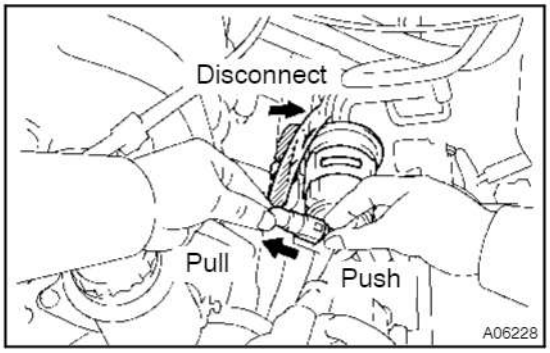
# INSPECTION

## 1. INSPECT INJECTOR INJECTION

**CAUTION:**

**Keep injector clean of sparks during the test.**

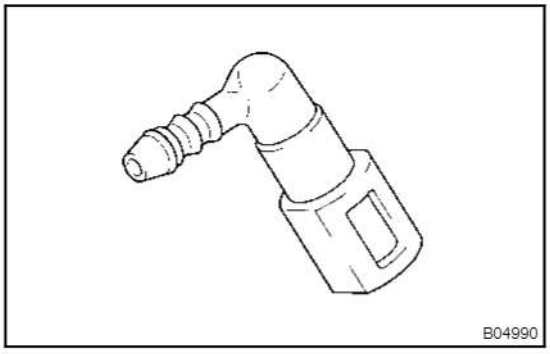


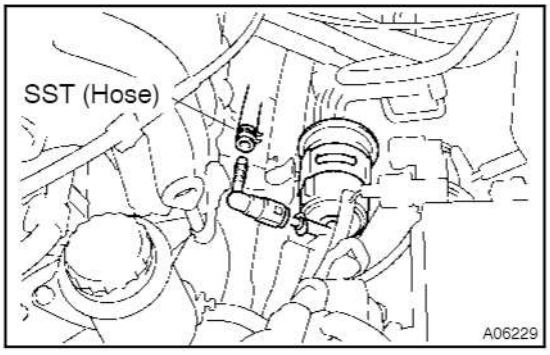

(a) Disconnect the fuel inlet hose (fuel tube connector) from the fuel filter.

**CAUTION:**

- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent it from splashing inside the engine compartment.**




(b) Purchase the new fuel main hose and take out the fuel tube connector from its hose.
Part No. 23271–50150



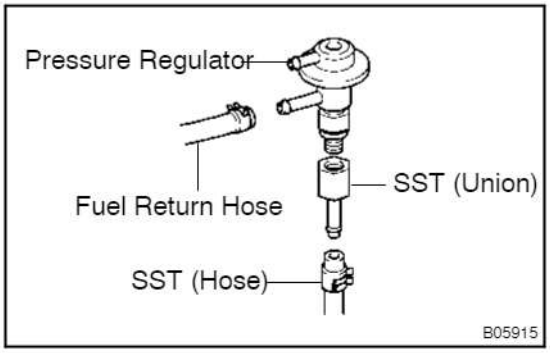

(c) Connect SST (hose) and fuel tube connector to the fuel filter outlet.
SST 09268–41047

**CAUTION:**

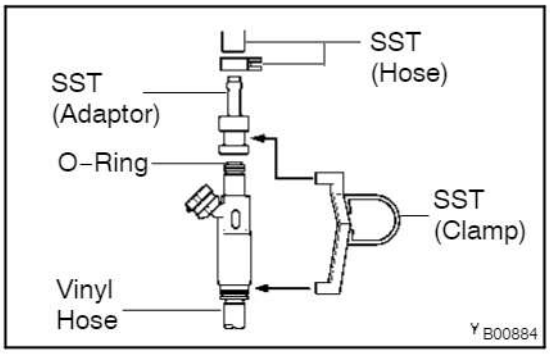
**Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.**

HINT:

Use the vehicle's fuel filter.

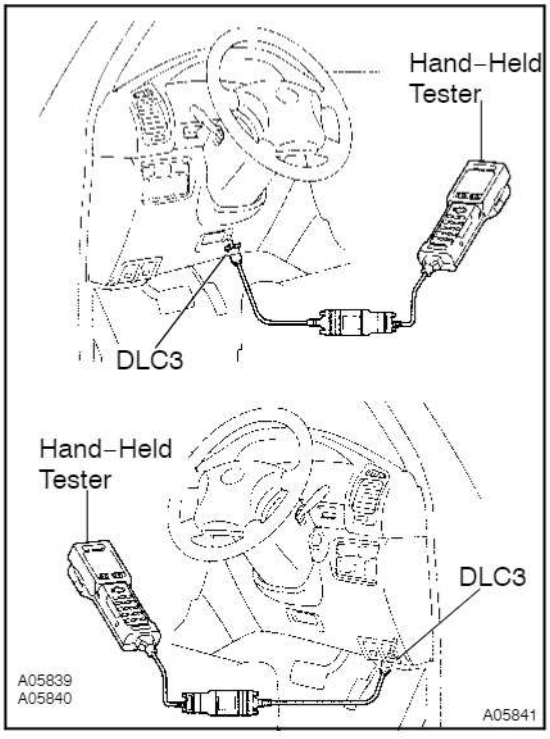



(d) Remove the pressure regulator from the delivery pipe.
(e) Install the O–ring to the fuel inlet of the pressure regulator.
(f) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.
SST 09268–41045 (09268–41090)
**Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)**
(g) Connect the fuel return hose to the fuel outlet of the pressure regulator.




(h) Install the O–ring to the injector.
(i) Connect SST (adaptor and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045
(j) Put the injector into the graduated cylinder.

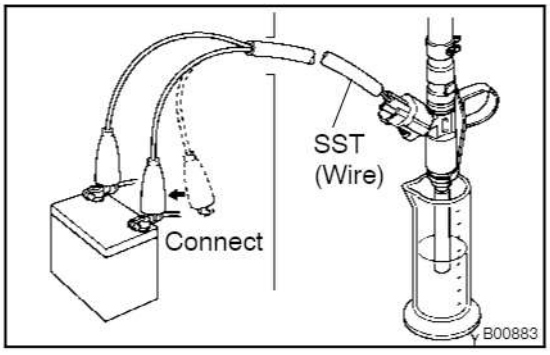
**CAUTION:**
**Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.**




(k) Connect a hand–held tester to the DLC3.
(l) Connect the battery negative (–) cable to the battery.
(m) Turn the ignition switch ON, and push the hand–held tester main switch ON.

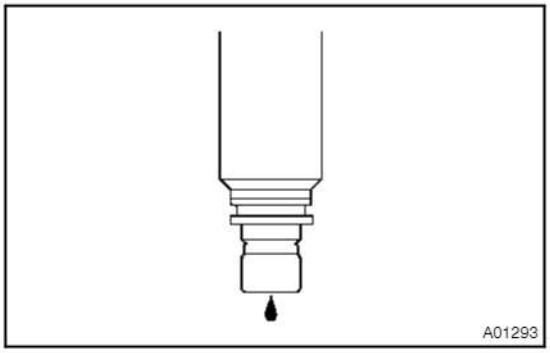
**NOTICE:**
**Do not start the engine.**

(n) Select the ACTIVE TEST mode on the hand–held tester.
(o) Please refer to the hand–held tester operator's manual for further details.
(p) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector. (See page FI–7)




(q) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
**Volume: 71 – 86 $cm^3$ (4.7 – 5.5 cu in.) per 15 seconds**
**Difference between each injector:**
**13 $cm^3$ (0.8 cu in.) or less**

If the injection volume is not as specified, replace the injector.




**2. INSPECT LEAKAGE**

(a) In the condition above, disconnect the tester probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
**Fuel drop: 1 drop or less per 12 minutes**

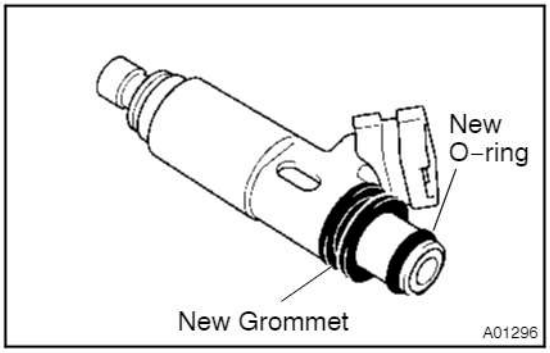
(b) Turn the ignition switch OFF.
(c) Disconnect the negative (–) terminal cable from the battery.
(d) Remove the SST and fuel tube connector.
SST 09268–41047, 09842–30070
(e) Disconnect the hand–held tester from the DLC3.
(f) Reconnect the fuel inlet pipe (fuel tube connector) to the fuel filter.

**CAUTION:**
**Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.**

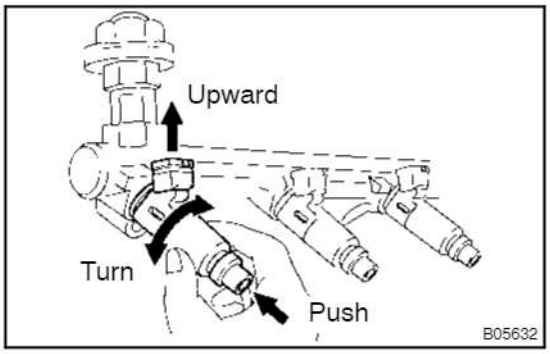
FI0HS–01

# INSTALLATION

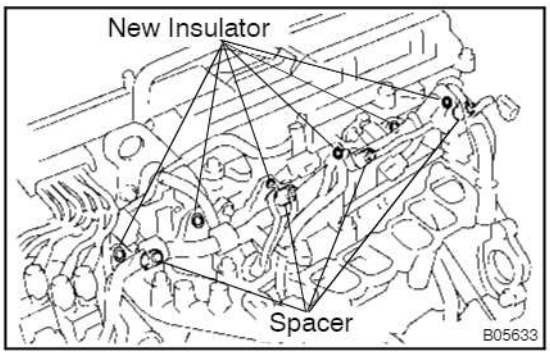
## 1. INSTALL INJECTORS AND DELIVERY PIPE



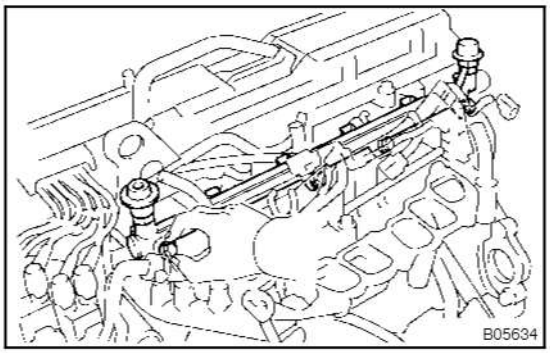

(a) Install a new grommet to the injector.
(b) Apply a light coat of gasoline to a new O–ring and install it to the injector.



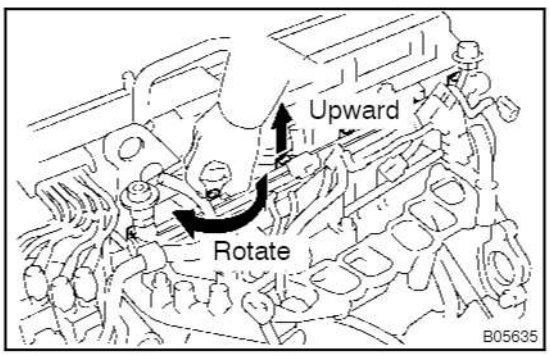

(c) While turning the injector left and right, install it to the delivery pipe. Install the 6 injectors.
(d) Position the injector connector upward.




(e) Place 6 new insulators and the 4 spacers in position on the intake manifold.




(f) Place the 6 injectors and delivery pipe assembly in position on the intake manifold.
(g) Temporarily install the 4 bolts holding the delivery pipe to the intake manifold.

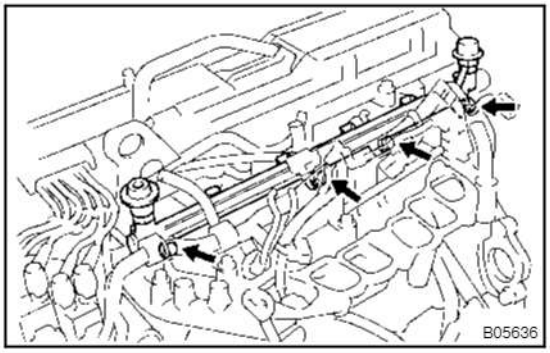



(h) Check that the injectors rotate smoothly.

HINT:

If the injectors do not rotate smoothly, the probable cause is in correct installation of the O–rings. Replace the O–rings.

(i) Position the injector connector upward.




(j) Tighten the 4 bolts holding the delivery pipe to the intake manifold.
**Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)**

**2. CONNECT INJECTOR CONNECTORS**

**3. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR**

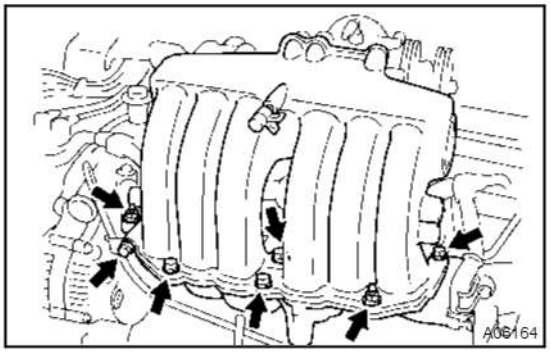
**4. CONNECT FUEL INLET HOSE TO DELIVERY PIPE**

Connect the inlet hose with 2 new gaskets and the union bolt.
**Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**

**5. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR**

**6. INSTALL PCV HOSES**

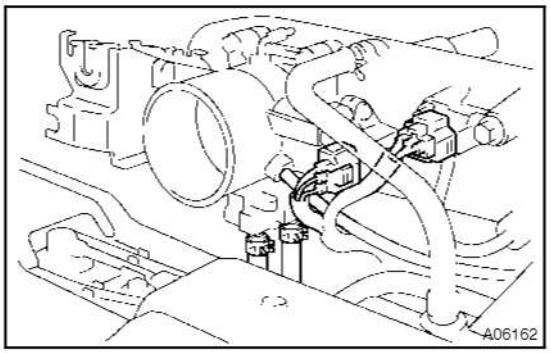
HINT:
Install the thinner PCV hose so that the white paint mark on it faces upward and toward the cylinder head cover side.




**7. INSTALL INTAKE MANIFOLD ASSEMBLY**

(a) Install a new gasket and the intake manifold and delivery pipe assembly with the 4 bolts and 2 nuts.
**Torque: 28 N·m (280 kgf·cm, 21 ft·lbf)**

(b) Install oil revel gage with the bolt.

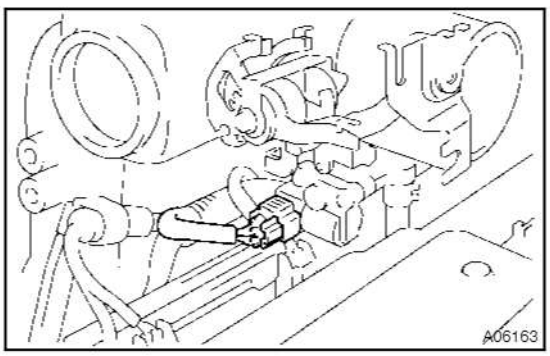



(c) Install a new gasket and the throttle body with the 3 bolts.
**Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)**

(d) Connect the air hose for the fuel pressure regulator to the throttle body.

(e) Connect these connectors:

- Throttle position sensor connector




- ISC valve connector

**8. CONNECT CONTROL CABLES TO THROTTLE BODY**

Connect these cables:

- Accelerator cable
- A/T:
  Throttle cable

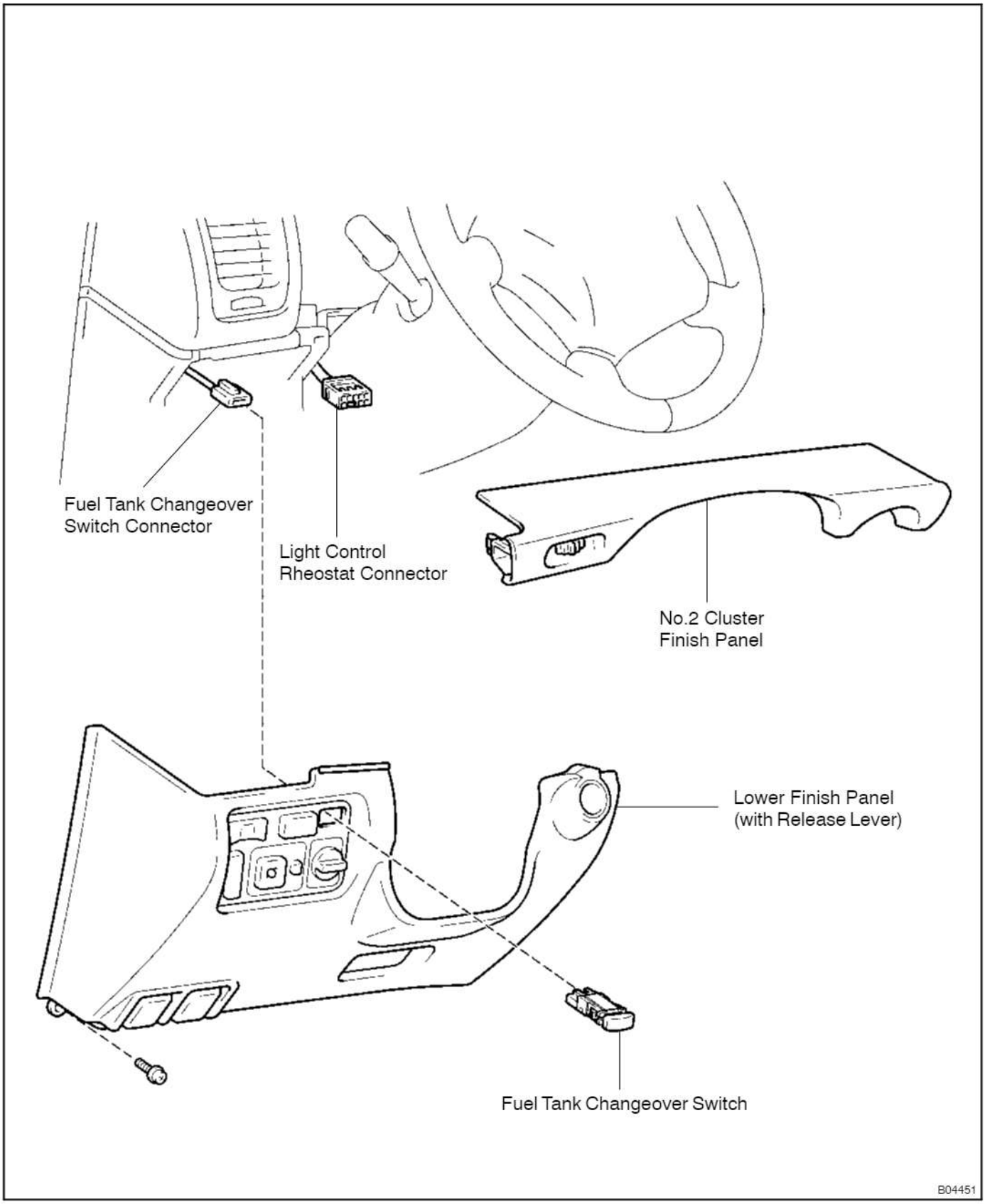
**9. INSTALL AIR CLEANER CAP AND HOSE**

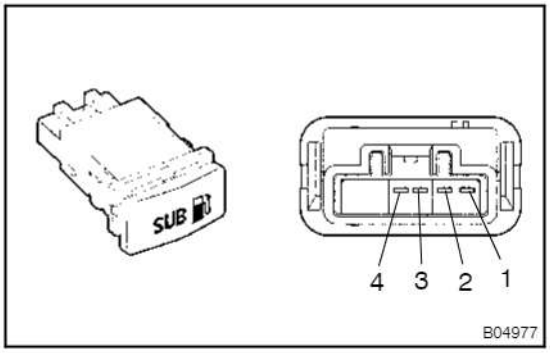
**10. FILL WITH ENGINE COOLANT**

# FUEL TANK CHANGEOVER SWITCH

## COMPONENTS

FI0IC–01






FI0ID–01

# INSPECTION

## 1. REMOVE FUEL TANK CHANGEOVER SWITCH

## 2. INSPECT CHANGEOVER SWITCH CONTINUITY

| Switch position | Tester connection | Specified condition |
|---|---|---|
| OFF | 3 – 4 | No continuity |
| ON | 3 – 4 | Continuity |
| Illumination circuit | 1 – 2 | Continuity |

If continuity is not as specified, replace the switch.

## 3. REINSTALL FUEL TANK CHANGEOVER SWITCH

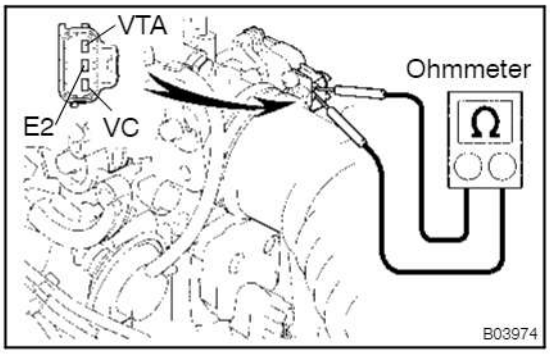
# THROTTLE BODY

FI0IK–01

## ON–VEHICLE INSPECTION

### 1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.



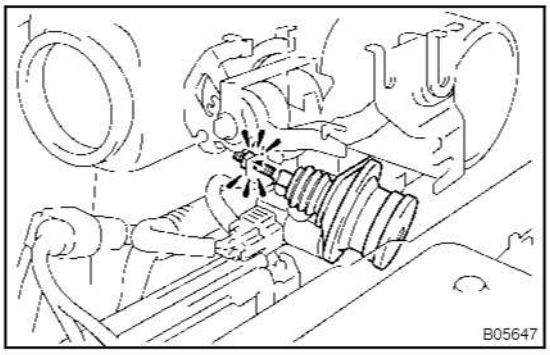

### 2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

(b) Using an ohmmeter, measure the resistance between each terminal.

| Clearance between lever and stop screw | Between terminals | Resistance |
|---|---|---|
| 0 mm (0 in.) | VTA – E2 | 0.2 – 5.7 kΩ |
| Throttle valve fully open | VTA – E2 | 2.0 – 10.2 kΩ |
| – | VC – E2 | 2.5 – 5.9 kΩ |

(c) Reconnect the sensor connector.




### 3. INSPECT DASHPOT (DP)

(a) Allow the engine to warm up to normal operating temperature.

(b) Check the idle speed.

**Idle speed:**
**650 – 750 rpm**

(c) Maintain engine speed at 2,500 rpm or more.

(d) Hold the DP rod.

(e) Release the throttle valve.

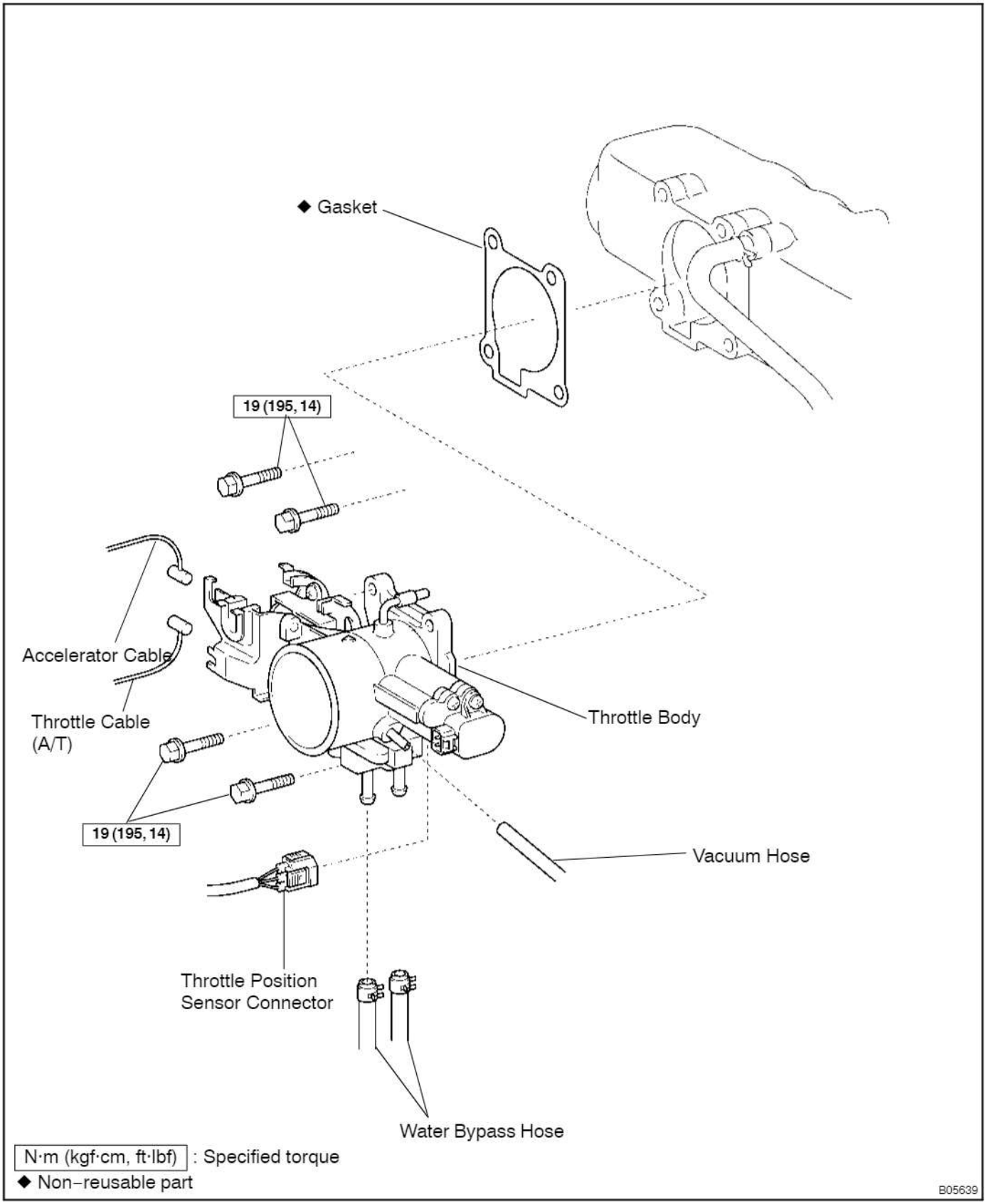
(f) Check the DP is set.

**DP setting speed:**
**1,800 – 2,200 rpm**

(g) If not as specified, adjust with the DP adjusting screw.

FI05T–03

# COMPONENTS




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

B05639

FI0HU-02

# REMOVAL

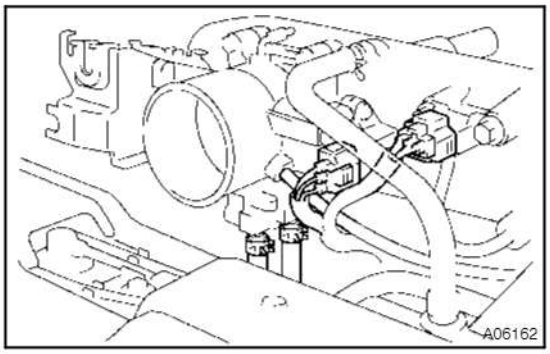
**1. DRAIN ENGINE COOLANT**

**2. REMOVE AIR CLEANER CAP AND HOSE**

**3. DISCONNECT CONTROL CABLES FROM THROTTLE BODY**

Disconnect these cables:

- Accelerator cable
- A/T:
  Throttle cable

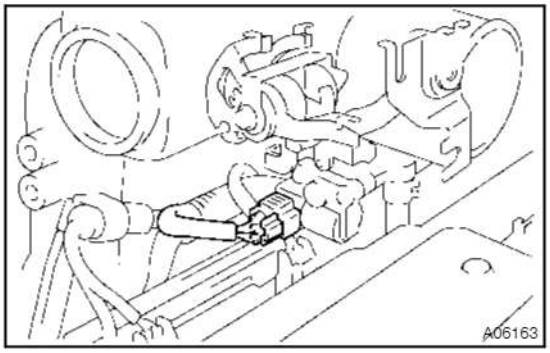



**4. REMOVE THROTTLE BODY**

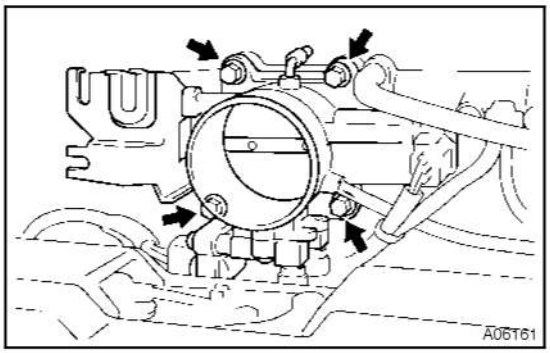
(a) Disconnect these connectors:
- Throttle position sensor connector
- Water bypass hose (from water bypass pipe)
- Water bypass hose (from water outlet)

(b) Disconnect the vacuum hose from the throttle body.

(c) Disconnect the air hose for the fuel pressure regulator from the throttle body.




(d) Disconnect ISC valve connector



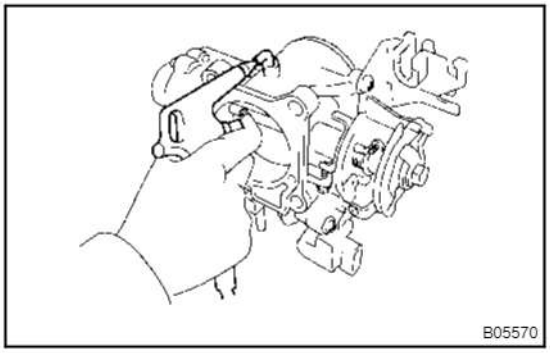

(e) Remove the 4 bolts.

(f) Disconnect the throttle body from the intake manifold.

(g) Remove the gasket.

FI0HV–02

# INSPECTION



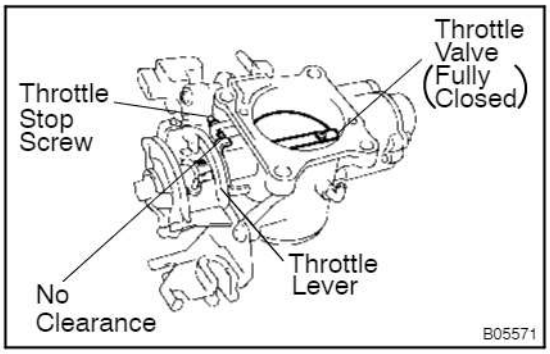

## 1. CLEAN THROTTLE BODY

(a) Using a soft brush and carburetor cleaner, clean the cast parts.

(b) Using compressed air, clean all the passages and apertures.

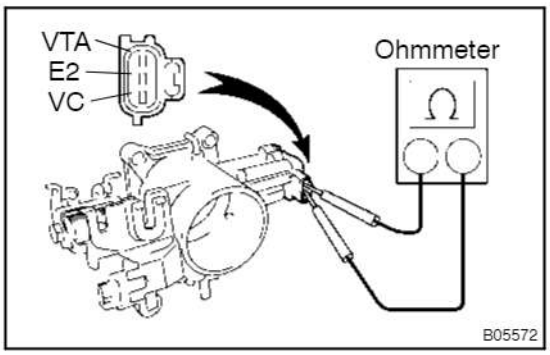
**NOTICE:**

**To prevent deterioration, do not clean the throttle position sensor.**




## 2. INSPECT THROTTLE VALVE

Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.




## 3. INSPECT THROTTLE POSITION SENSOR

Using an ohmmeter, measure the resistance between each terminal.

| Throttle valve condition | Between terminals | Resistance |
|---|---|---|
| Fully closed | VTA – E2 | 0.2 – 5.7 kΩ |
| Fully open | VTA – E2 | 2.0 – 10.2 kΩ |
| – | VC – E2 | 2.5 – 5.9 kΩ |

FI0HW–02

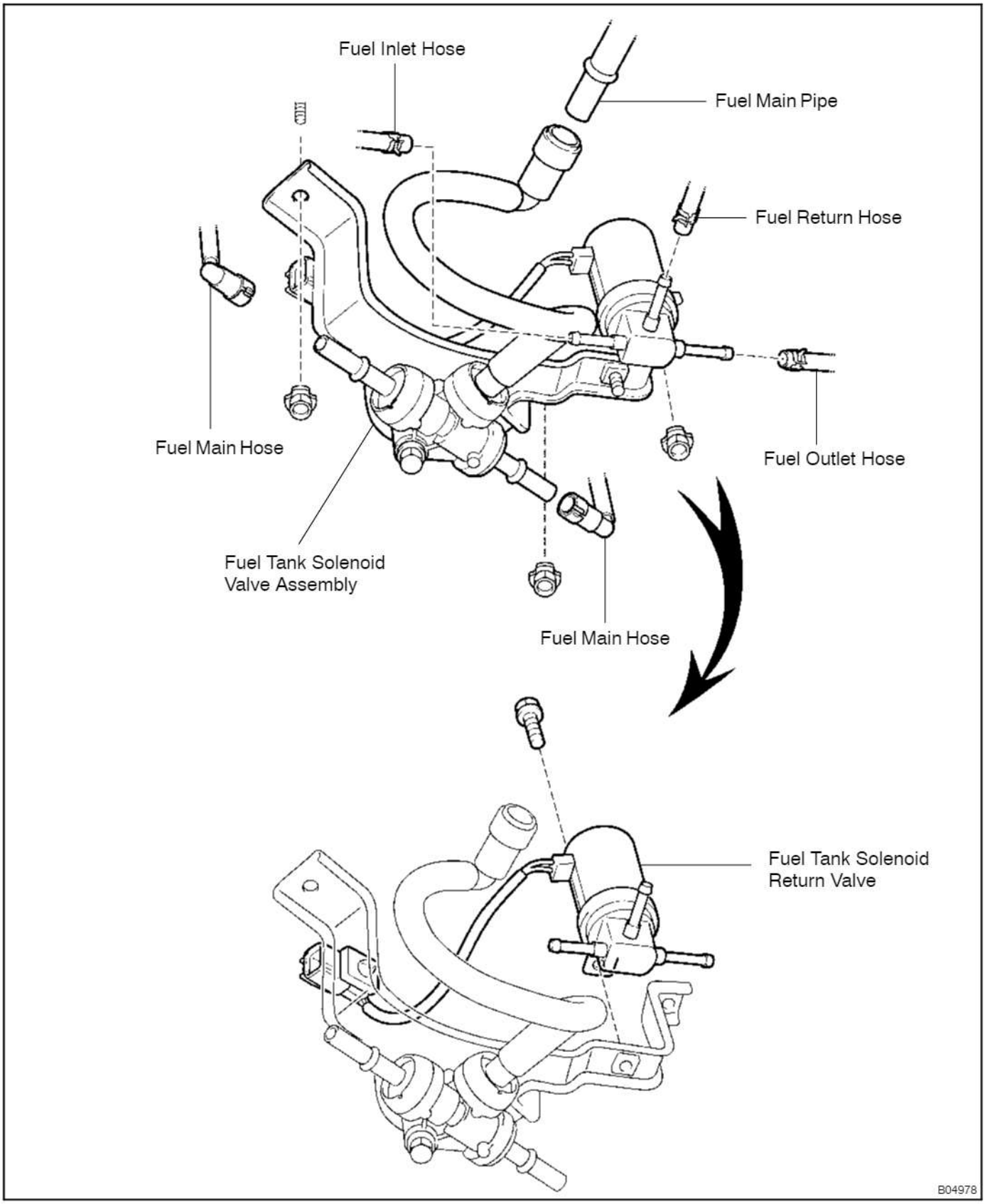
# INSTALLATION

**Installation is in the reverse order of removal.(See page FI–34)**

# FUEL TANK SOLENOID RETURN VALVE

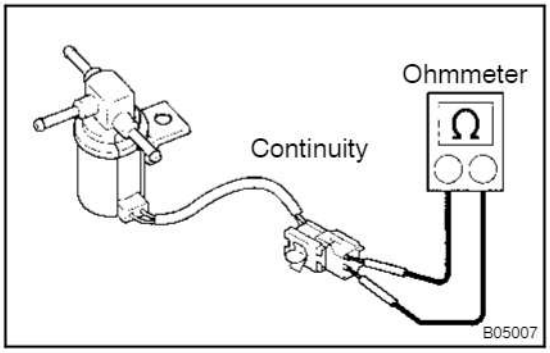
## COMPONENTS

FI0IA–01



FI0IB-01

# INSPECTION




**1. REMOVE FUEL TANK SOLENOID VALVE ASSEMBLY FROM VEHICLE**

**2. REMOVE FUEL TANK SOLENOID RETURN VALVE**

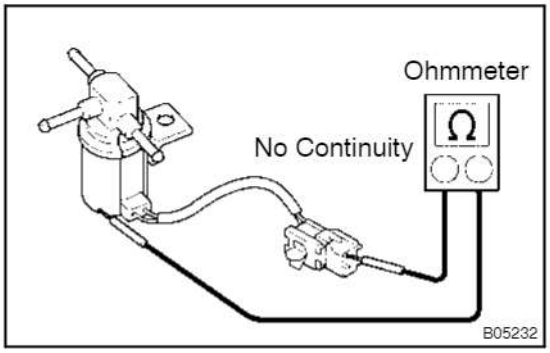
**3. INSPECT FUEL TANK SOLENOID RETURN VALVE**

(a) Inspect the valve for open circuit.

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

**Resistance: 33 – 39 Ω at 20°C (68°F)**

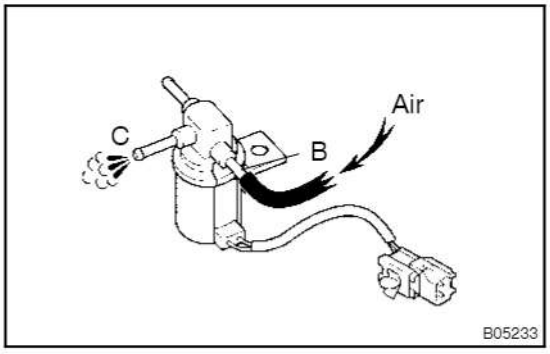
If there is no continuity, replace the valve.




(b) Inspect the valve for ground.

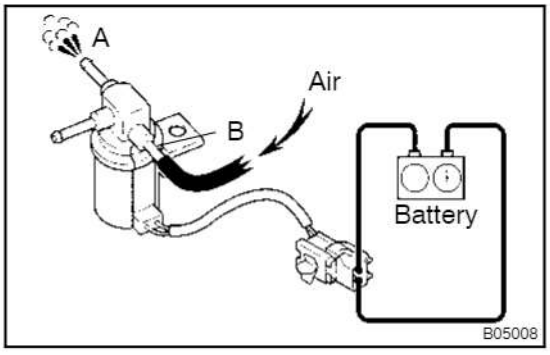
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the valve.




(c) Inspect the valve operation.

(1) Check that air flows from ports B to C.




(2) Apply battery positive voltage across the terminals.

(3) Check that air flows from ports B to A.

If operation is not as specified, replace the valve.

**4. REINSTALL FUEL TANK SOLENOID RETURN VALVE**

**5. REINSTALL FUEL TANK SOLENOID VALVE ASSEMBLY TO VEHICLE**

# IDLE SPEED CONTROL (ISC) VALVE

FI0I3–02

## ON–VEHICLE INSPECTION

### INSPECT ISC VALVE OPERATION

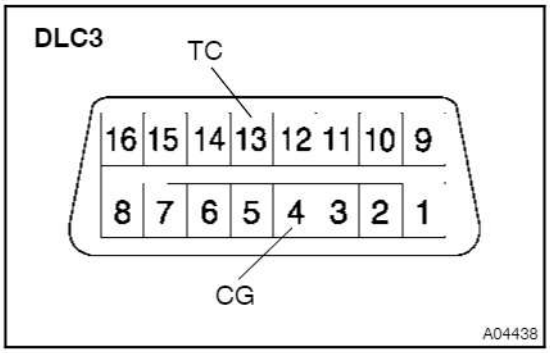
(a) Initial conditions:
- Engine at normal operating temperature
- Idle speed check correctly
- Transmission in neutral position

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

(c) After engine speed are kept at 1,000 – 1,500 rpm for 5 seconds, check that they return to idle speed.

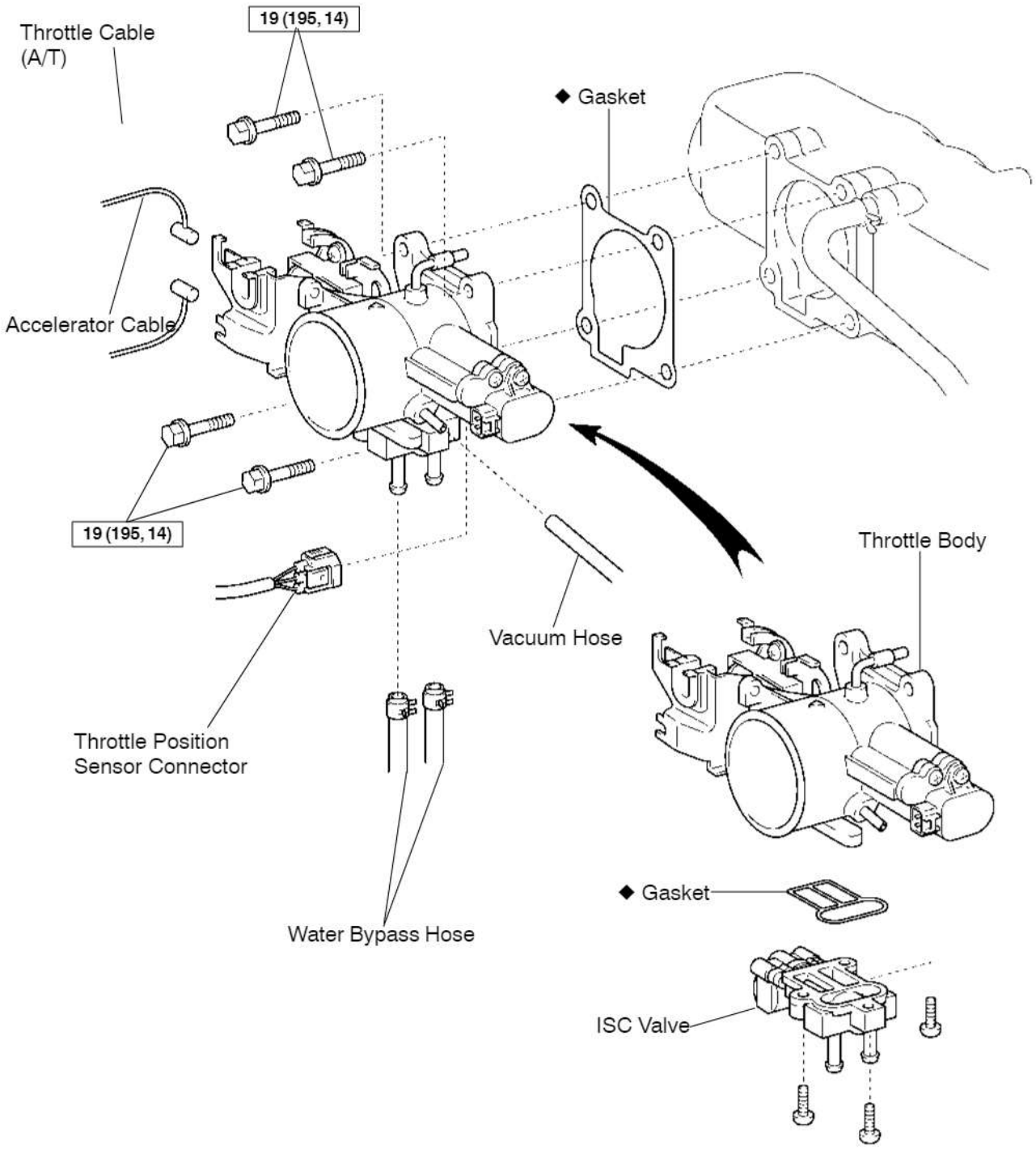
If the engine speed operation is not as specified, check the ISC valve, wiring and ECU.

(d) Remove the SST.
SST 09843–18040



FI0I4–01

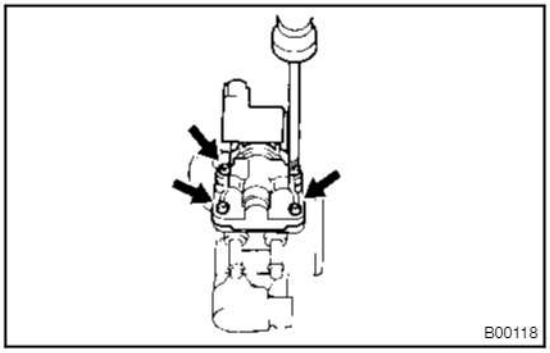
# COMPONENTS




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

B05640

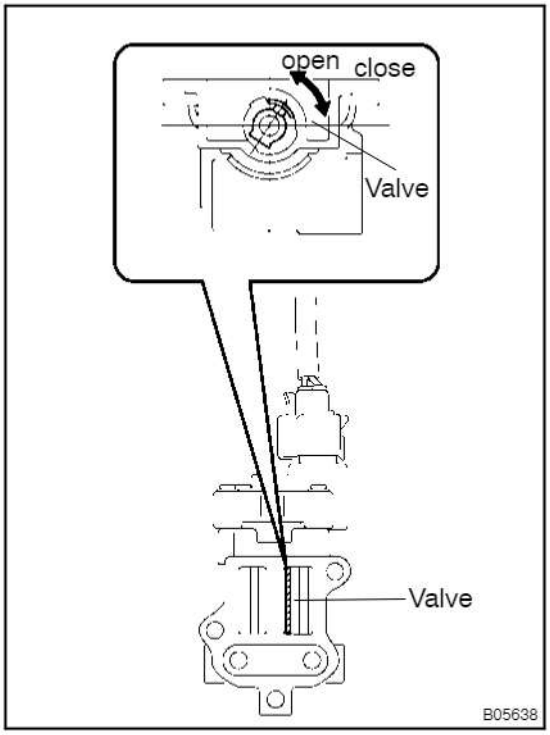
FI0I5–01




# REMOVAL

1. **REMOVE THROTTLE BODY**
   **(See page FI–34)**
2. **REMOVE IAC VALVE**

Remove the 4 screws, IAC valve and gasket.




FI0I6–01

# INSPECTION

## INSPECT ISC VALVE OPERATION

(a) Check that the ISC valve is halfly opened.
(b) Connect the ISC valve connector to the ISC valve.
(c) Turn the ignition switch ON.
(d) Check that the ISC valve moves in 0.5 seconds by order of fully open, fully close and halfly open.

If operation is not as specified, replace the ISC valve.

(e) Turn the ignition switch OFF.
(f) Disconnect the ISC valve connector from the ISC valve.

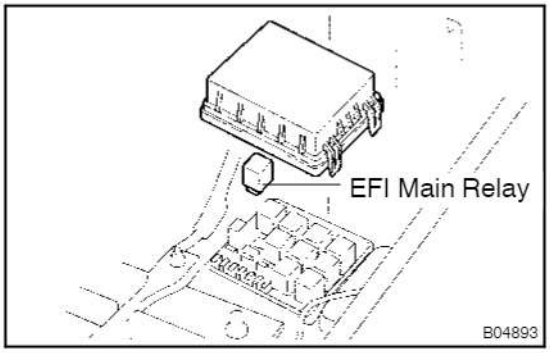
FI0I7–01

# INSTALLATION

**Installation is in reverse order of removal (See page FI–41).**

HINT:

Install the IAC valve with a new gasket.

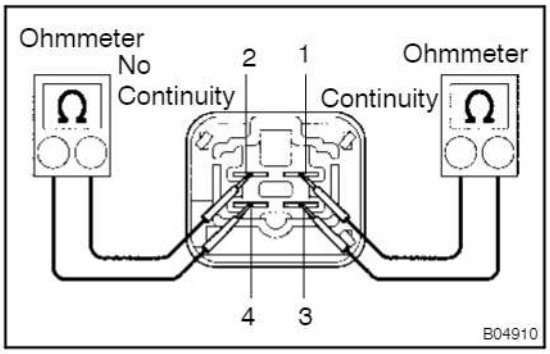



# EFI MAIN RELAY

FI0HZ-01

## INSPECTION

1. **REMOVE RELAY BOX COVER**
2. **REMOVE EFI MAIN RELAY (Marking: EFI)**




3. **INSPECT EFI MAIN RELAY**

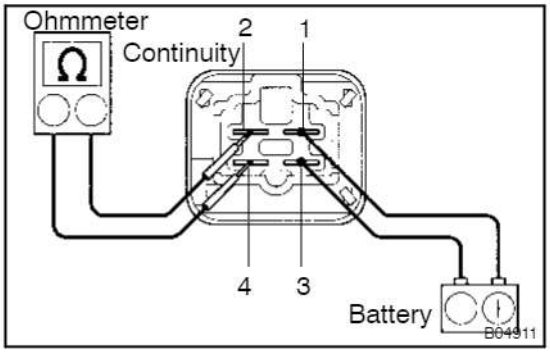
(a) Inspect the relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 2 and 4.

If there is continuity, replace the relay.



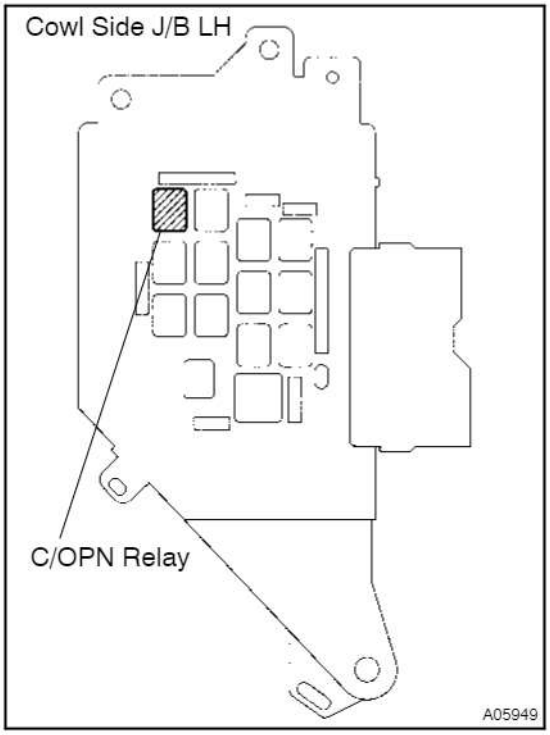

(b) Inspect the relay operation.

(1) Apply battery positive voltage across terminals 1 and 3.

(2) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If there is no continuity, replace the relay.

4. **REINSTALL EFI MAIN RELAY**
5. **REINSTALL RELAY BOX COVER**

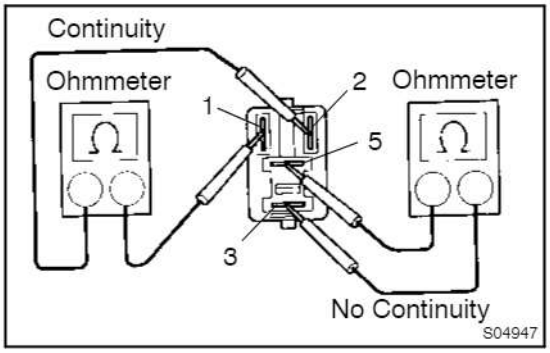



# CIRCUIT OPENING RELAY

FI0I0–01

## INSPECTION

**1. REMOVE CIRCUIT OPENING RELAY (Marking: C/OPN)**




**2. INSPECT CIRCUIT OPENING RELAY**

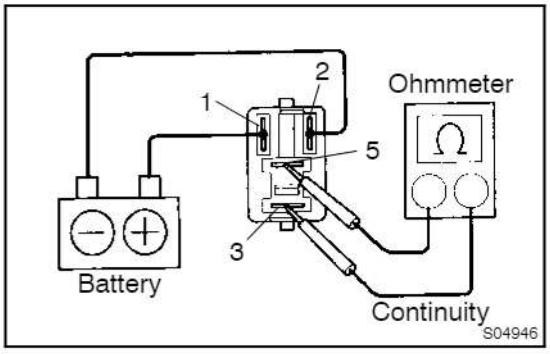
(a) Inspect the relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



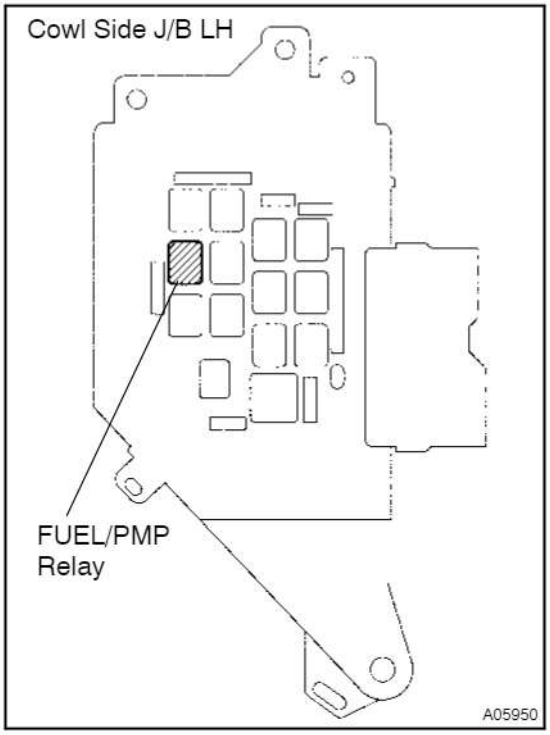

(b) Inspect the relay operation.

(1) Apply battery positive voltage across terminals 1 and 2.

(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

**3. REINSTALL CIRCUIT OPENING RELAY**

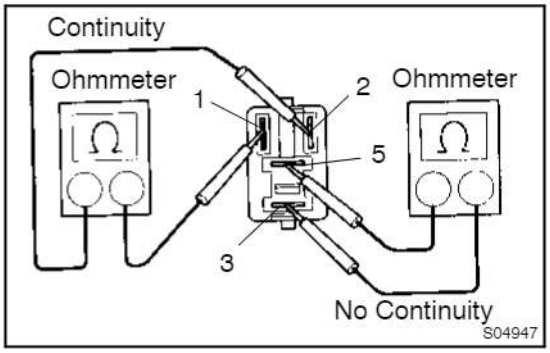



# FUEL PUMP RELAY

FI0IE–01

## INSPECTION

**1. REMOVE FUEL PUMP RELAY (Marking: FUEL/PMP)**




**2. INSPECT FUEL PUMP RELAY**

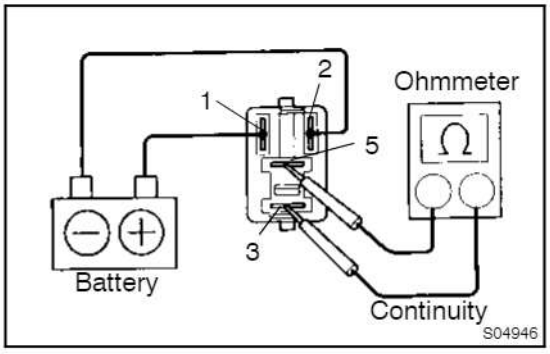
(a) Inspect the relay continuity.

(1) Using an ohmmeter. check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.




(b) Inspect the relay operation.

(1) Apply battery positive voltage across terminals 1 and 2.

(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

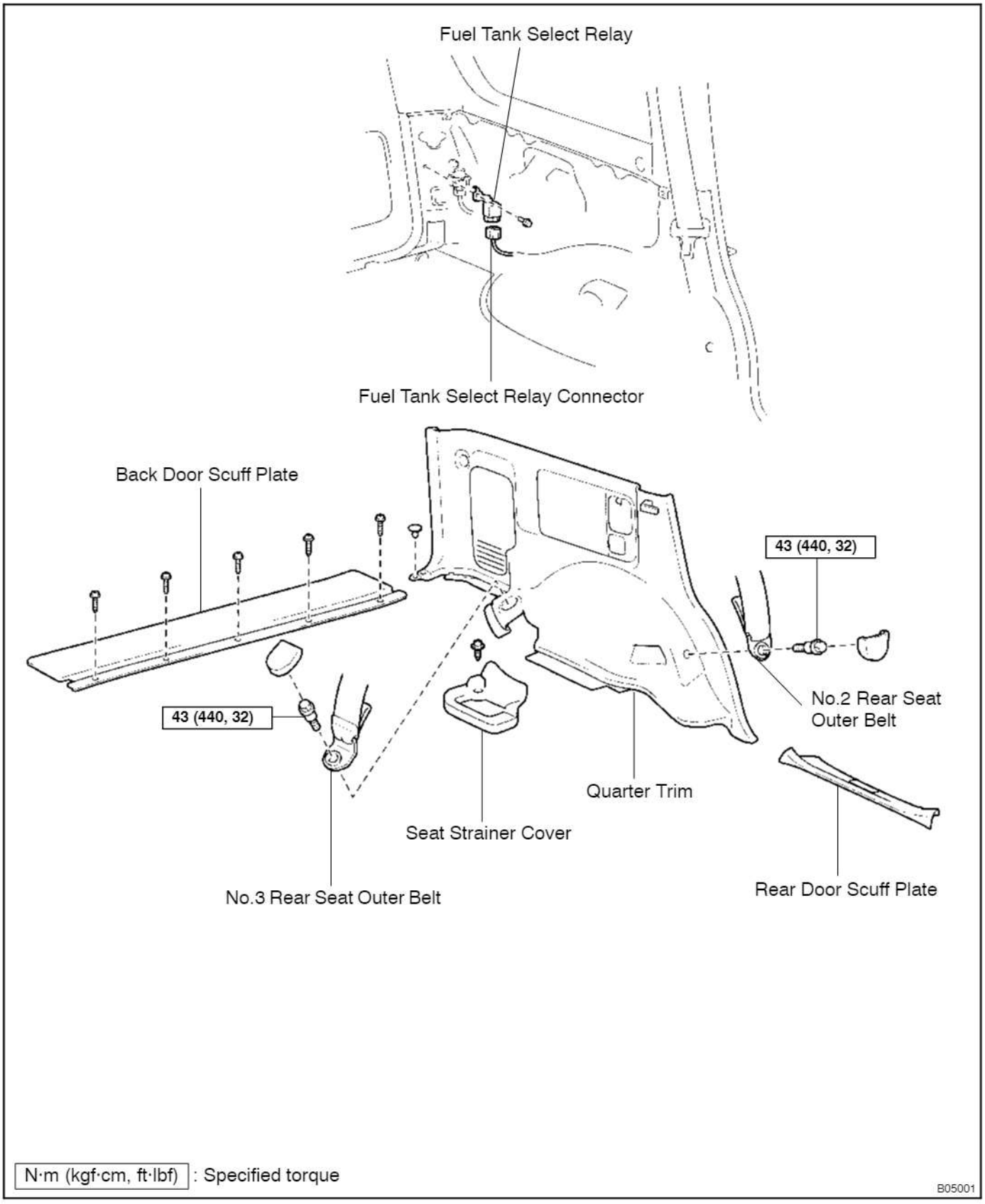
If operation is not as specified, replace the relay.

**3. REINSTALL FUEL PUMP RELAY**

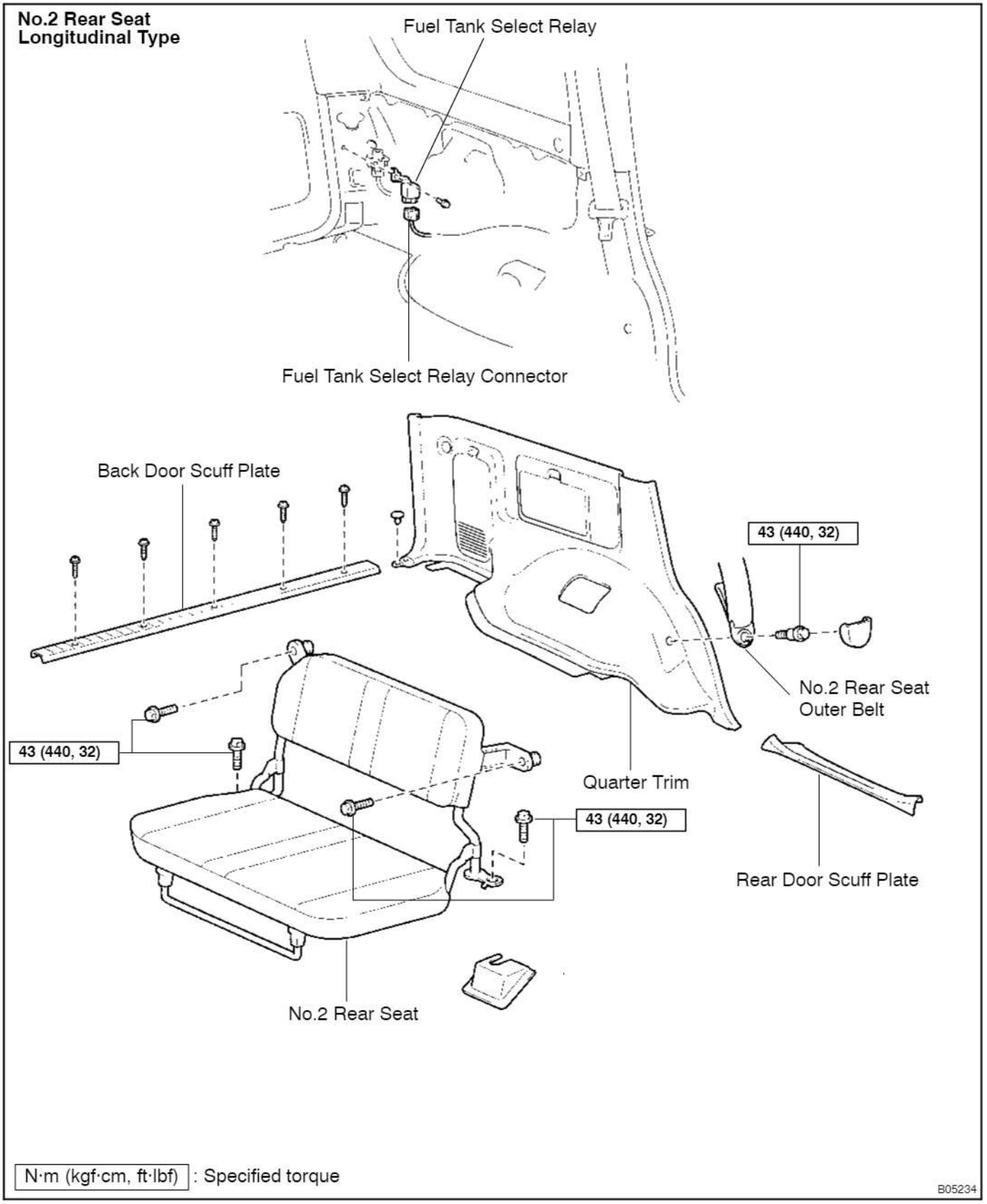
# FUEL TANK SELECT RELAY

## COMPONENTS

FI0HX-02

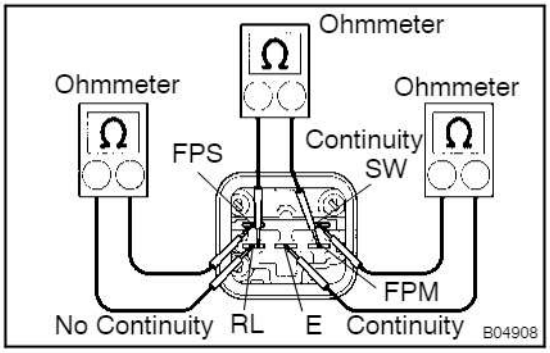


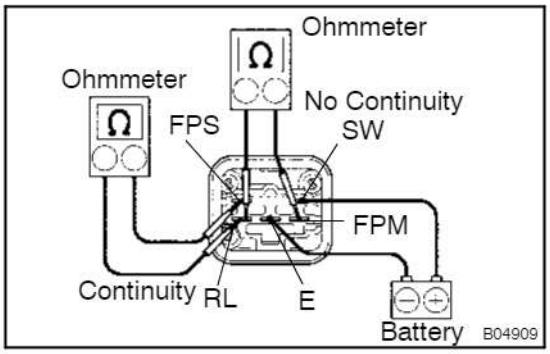
**No.2 Rear Seat Longitudinal Type**




N·m (kgf·cm, ft·lbf) : Specified torque

B05234




FI0HY-02

# INSPECTION

**1. REMOVE FUEL TANK SELECT RELAY**

**2. INSPECT FUEL TANK SELECT RELAY**

(a) Inspect the relay continuity.

(1) Using an ohmmeter. check that there is continuity between terminals SW and E.

(2) Check that there is continuity between terminals RL and FPM.

If there is no continuity, replace the relay.

(3) Check that thee is no continuity between terminals RL and FPS.

If there is continuity, replace the relay.

(b) Inspect the relay operation.

(1) Apply battery positive voltage across terminals SW and E.

(2) Using an ohmmeter, check that there is no continuity between the RL and FPM.

If there is continuity, replace the relay.

(3) Check that there is continuity between terminals RL and FPS.

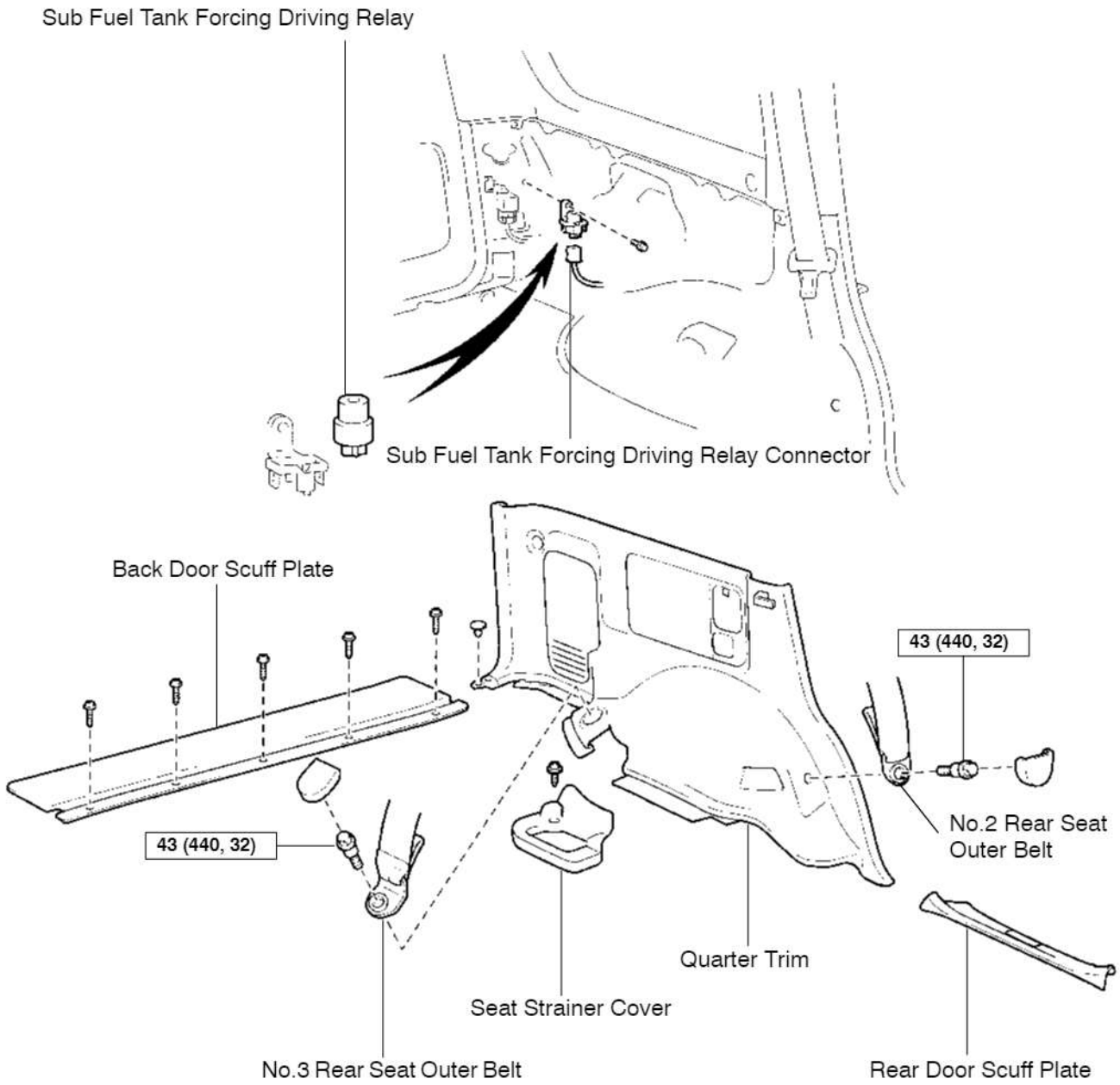
If there is no continuity, replace the relay.

**3. REINSTALL FUEL TANK SELECT RELAY**

# SUB FUEL TANK FORCING DRIVING RELAY

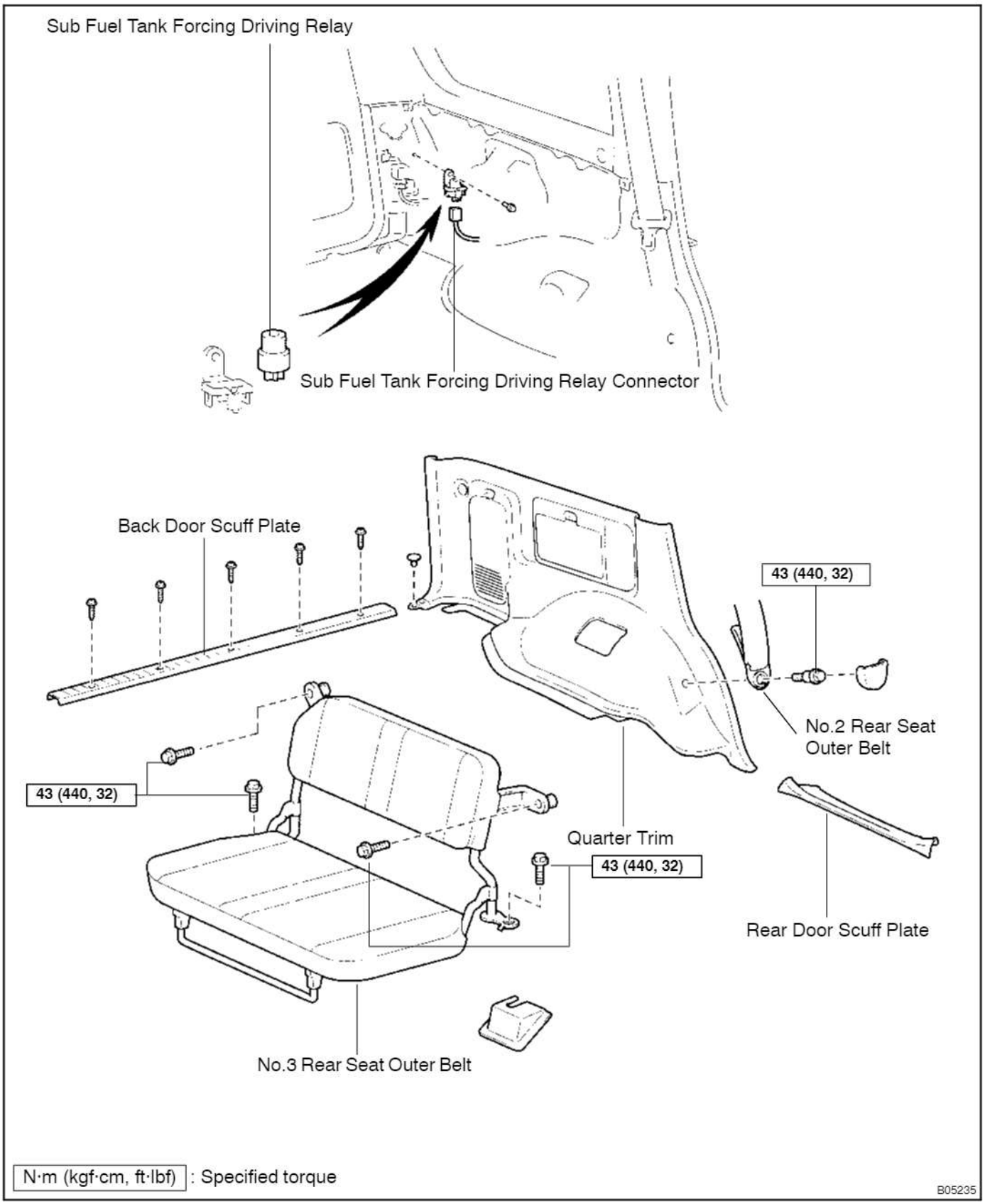
## COMPONENTS

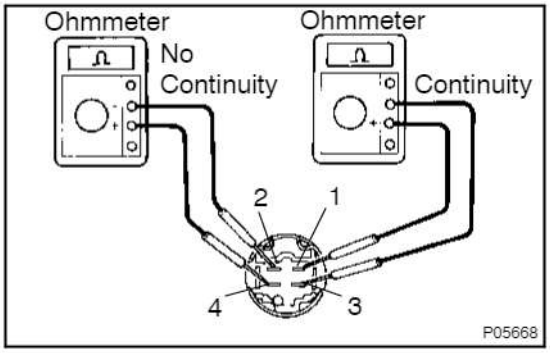
FI0I1–02

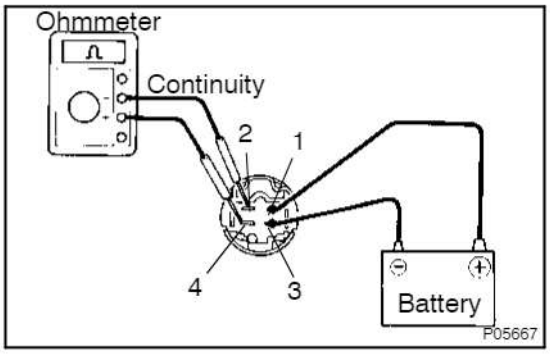



N·m (kgf·cm, ft·lbf) : Specified torque

B05002






FI0I2-03

# INSPECTION

**1. REMOVE SUB FUEL TANK FORCING DRIVING RELAY**

**2. INSPECT SUB FUEL TANK FORCING DRIVING RELAY**

(a) Inspect the relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 2 and 4.

If there is continuity, replace the relay.

(b) Inspect the relay operation.

(1) Apply battery positive voltage across terminals 1 and 3.

(2) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

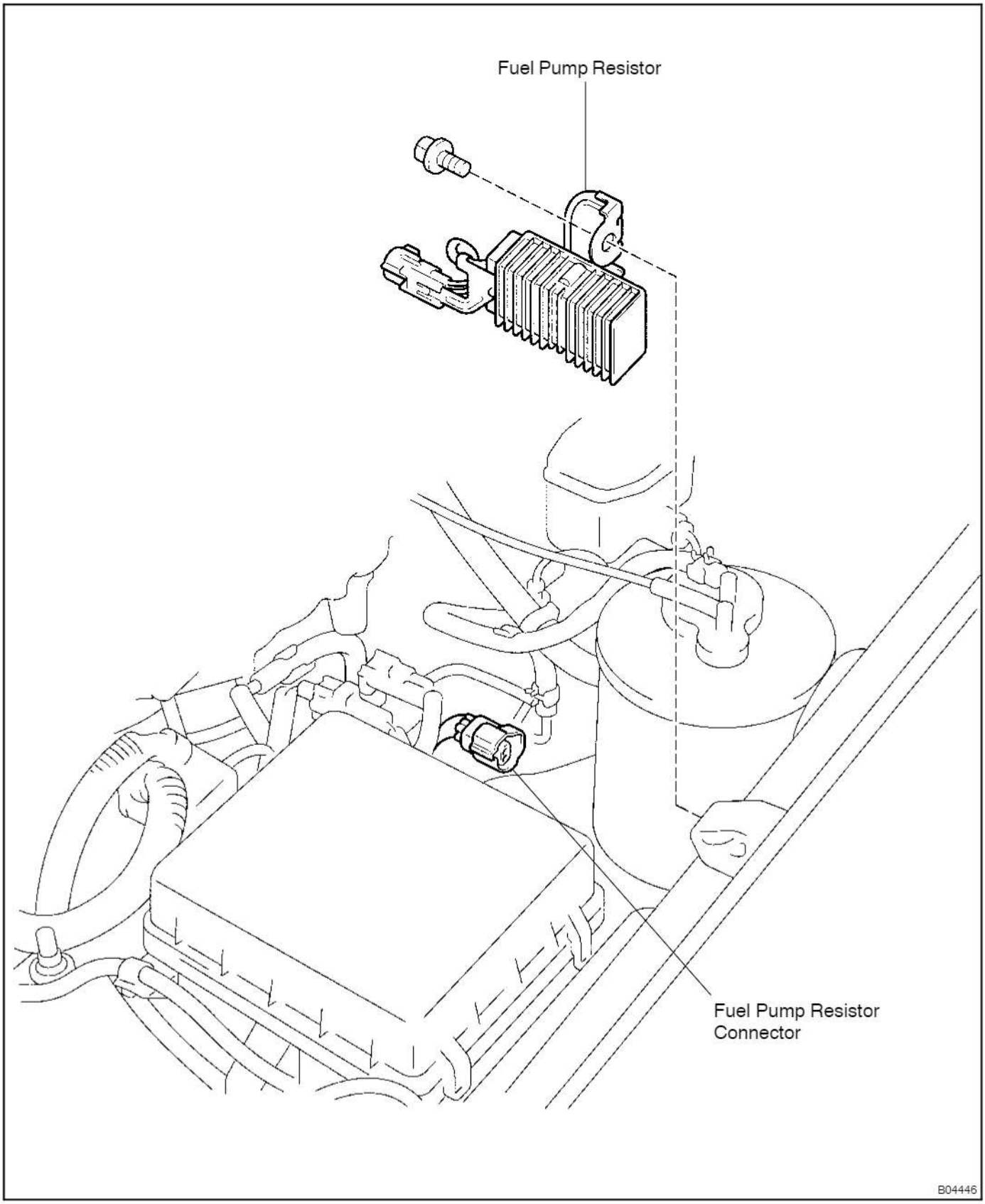
If there is no continuity, replace the relay.

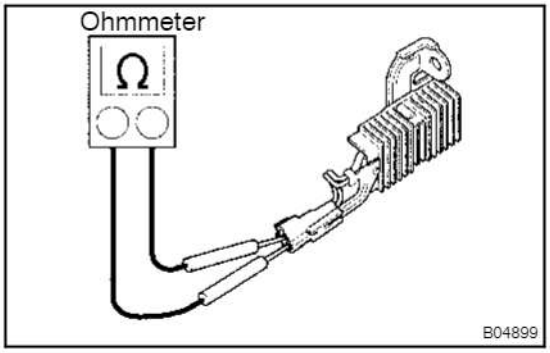
**3. REINSTALL SUB FUEL TANK FORCING DRIVING RELAY**

# FUEL PUMP RESISTOR

## COMPONENTS

FI0EA–03






FI0EB-03

# INSPECTION

**1. REMOVE FUEL PUMP RESISTOR**

**2. INSPECT FUEL PUMP RESISTOR**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

**0.71 – 0.75 Ω at 20°C (68°F)**

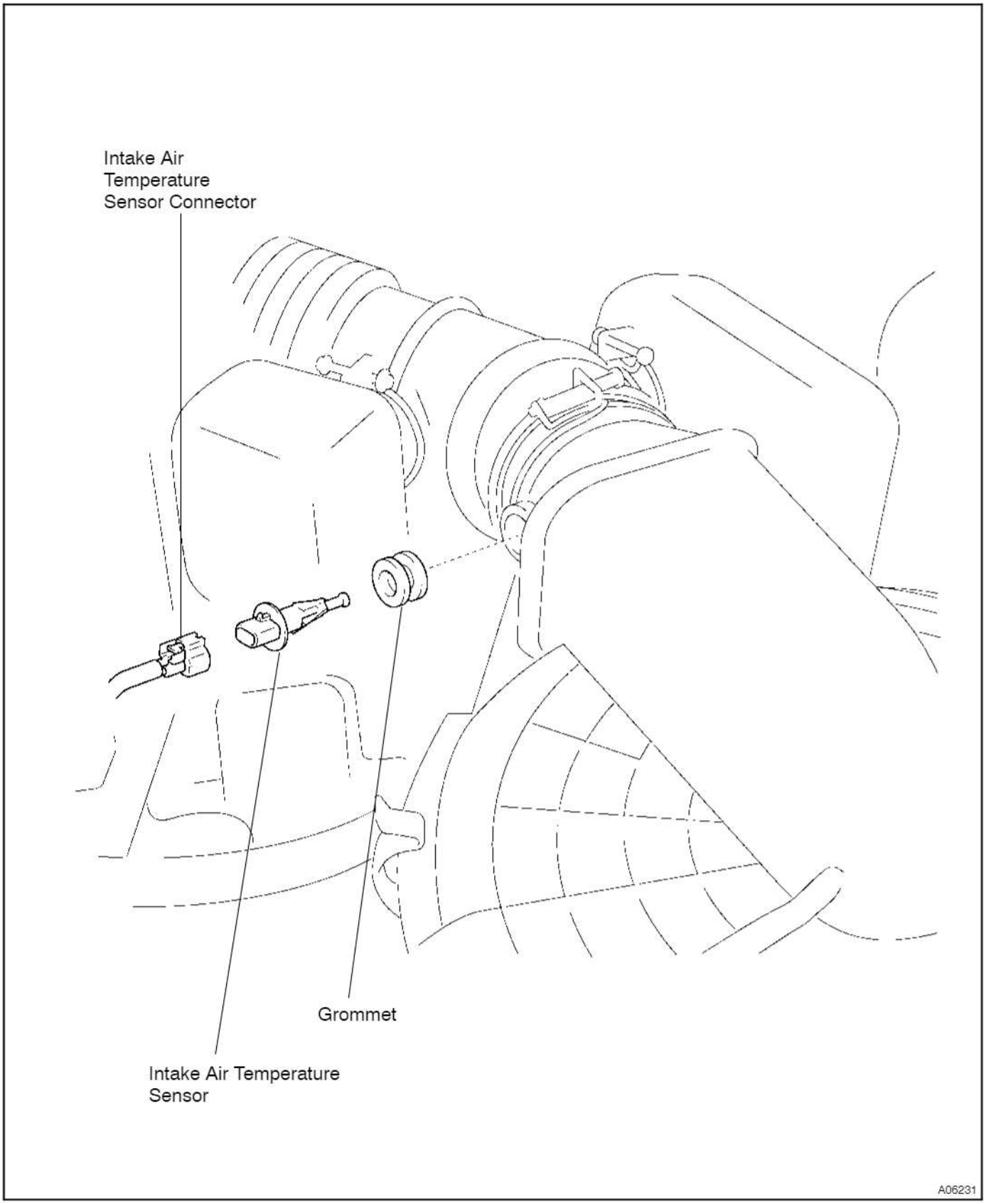
If the resistance is not as specified, replace the resistor.

**3. REINSTALL FUEL PUMP RESISTOR**

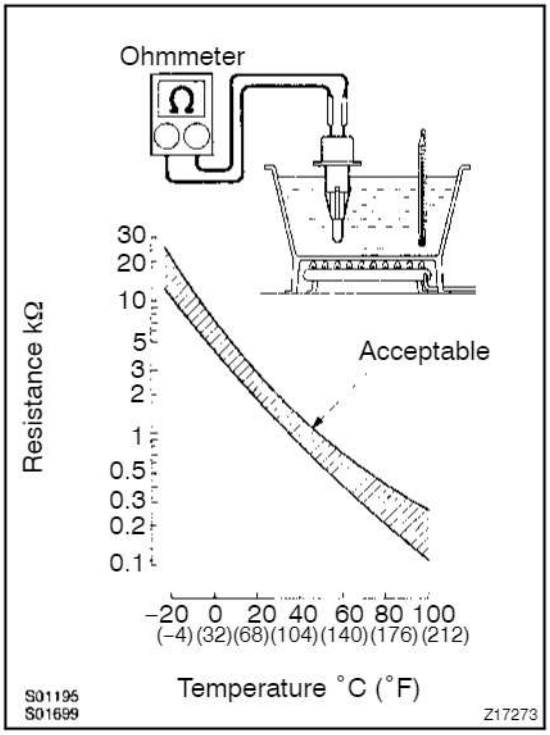
# INTAKE AIR TEMPERATURE SENSOR

## COMPONENTS

FI050–02



FI051–02




# INSPECTION

**1. REMOVE INTAKE AIR TEMPERATURE SENSOR**

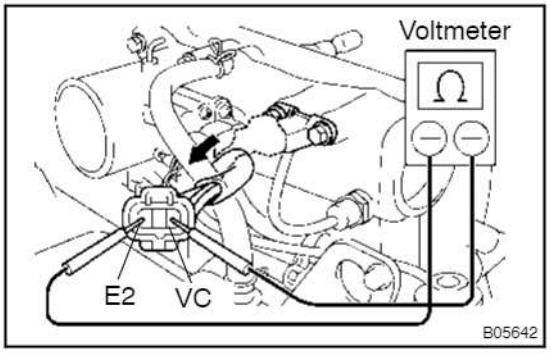
**2. INSPECT INTAKE AIR TEMPERATURE SENSOR**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance: Refer to the graph**

If the resistance is not as specified, replace the sensor.

**3. REINSTALL INTAKE AIR TEMPERATURE SENSOR**




# VACUUM SENSOR

FI00E-06

## INSPECTION

**1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR**

(a) Disconnect the vacuum sensor connector.

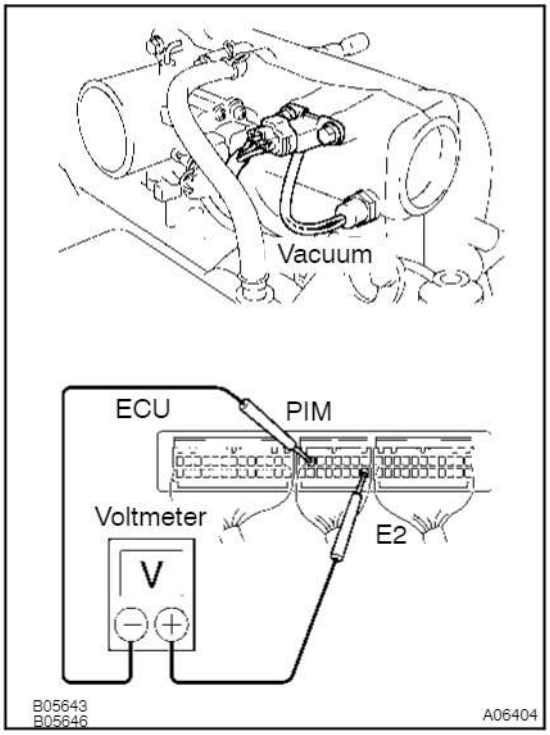
(b) Turn the ignition switch ON.

(c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.

**Voltage: 4.5 – 5.5 V**

(d) Turn the ignition switch OFF.

(e) Reconnect the vacuum sensor connector.




**2. INSPECT POWER OUTPUT OF VACUUM SENSOR**

(a) Turn the ignition switch ON.

(b) Disconnect the vacuum hose from the vacuum sensor.

(c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage under ambient atmospheric pressure.

(d) Apply vacuum to the vacuum sensor in 13.3 kPa 100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

(e) Measure the voltage drop from step (c) above for each segment.

**Voltage drop:**

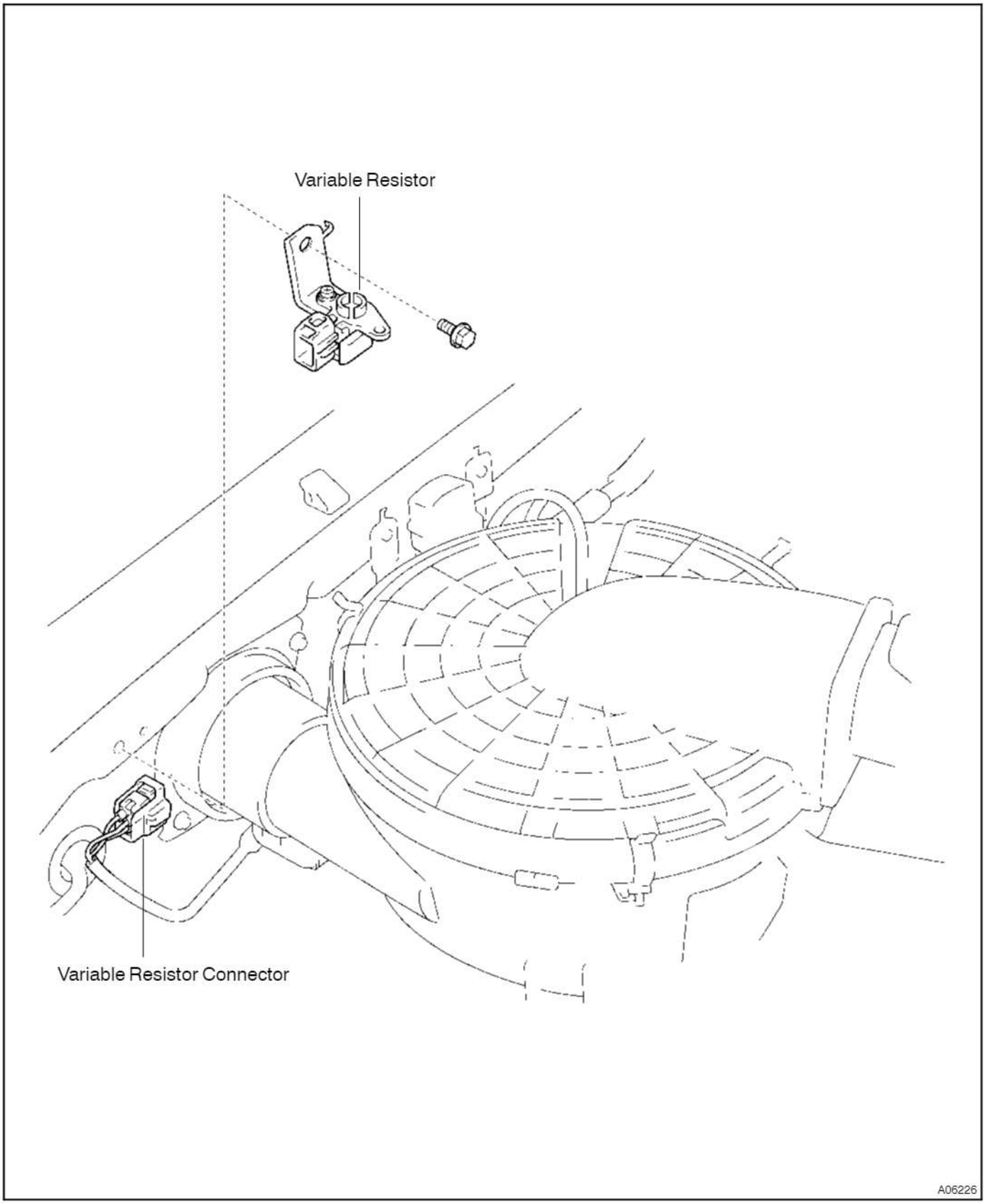
| Applied Vacuum kPa (mmHg, in.Hg) | 13.3 (100, 3.94) | 26.7 (200, 7.87) | 40.0 (300, 11.81) | 53.5 (400, 15.75) | 66.7 (500, 19.69) |
|---|---|---|---|---|---|
| Voltage drop V | 0.3 – 0.5 | 0.7 – 0.9 | 1.1 – 1.3 | 1.5 – 1.7 | 1.9 – 2.1 |

(f) Reconnect the vacuum hose to the vacuum sensor.

# VARIABLE RESISTOR

## COMPONENTS

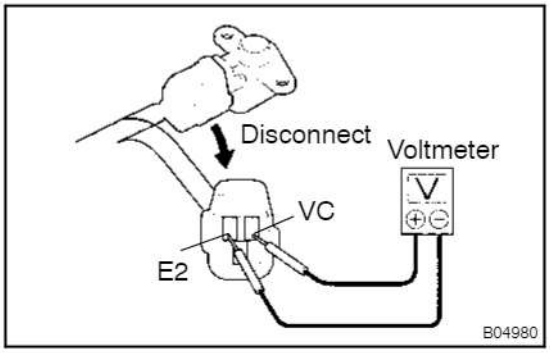
FI0I8–01



FI0I9–01

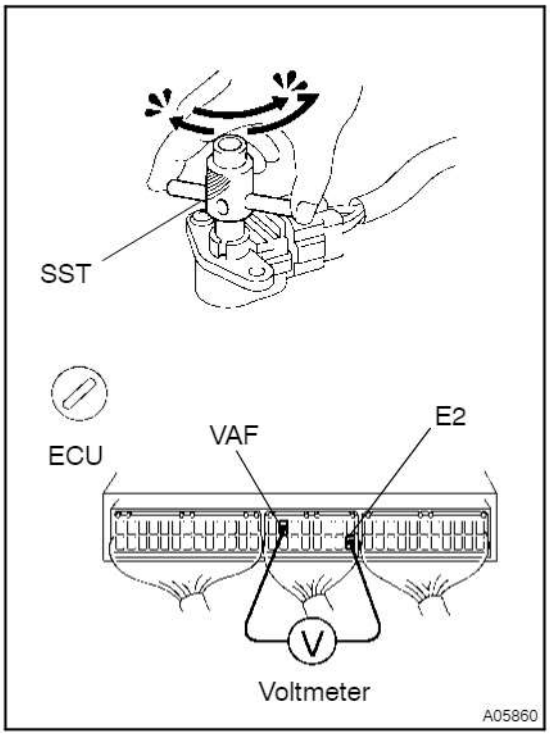
# INSPECTION

## 1. INSPECT POWER SOURCE VOLTAGE OF VARIABLE RESISTOR




(a) Disconnect the variable resistor connector.
(b) Turn the ignition switch ON.
(c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.
**Voltage: 4.5 – 5.5 V**
(d) Reconnect the variable resistor connector.

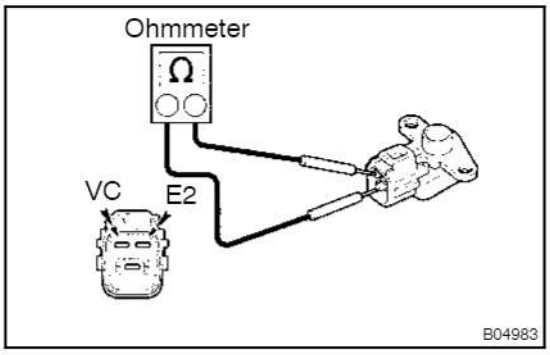
## 2. INSPECT POWER OUTPUT OF VARIABLE RESISTOR



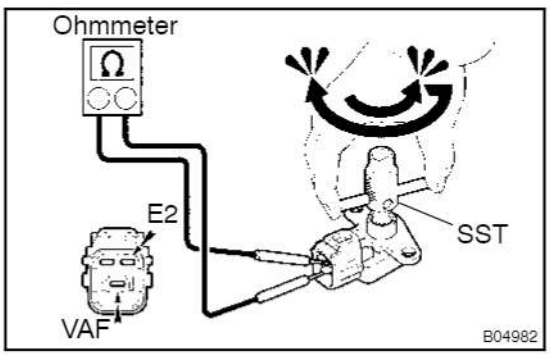

(a) Turn the ignition switch ON.
(b) Connect a voltmeter to terminals VAF and E2 of the engine ECU, and measure the voltage while slowly turning the idle mixture adjusting screw first fully counter–clockwise, and then fully clockwise using SST.
SST 09243–00020
(c) Check that voltage changes smoothly from 0 V to approx. 5 V.

HINT:
There is no sudden jump up to 5 V or down to 0 V.

## 3. INSPECT RESISTANCE OF VARIABLE RESISTOR




(a) Disconnect the variable resistor connector.
(b) Using an ohmmeter, measure the resistance between terminals VC and E2 of the variable resistor.
**Resistance: 4 – 6 kΩ**

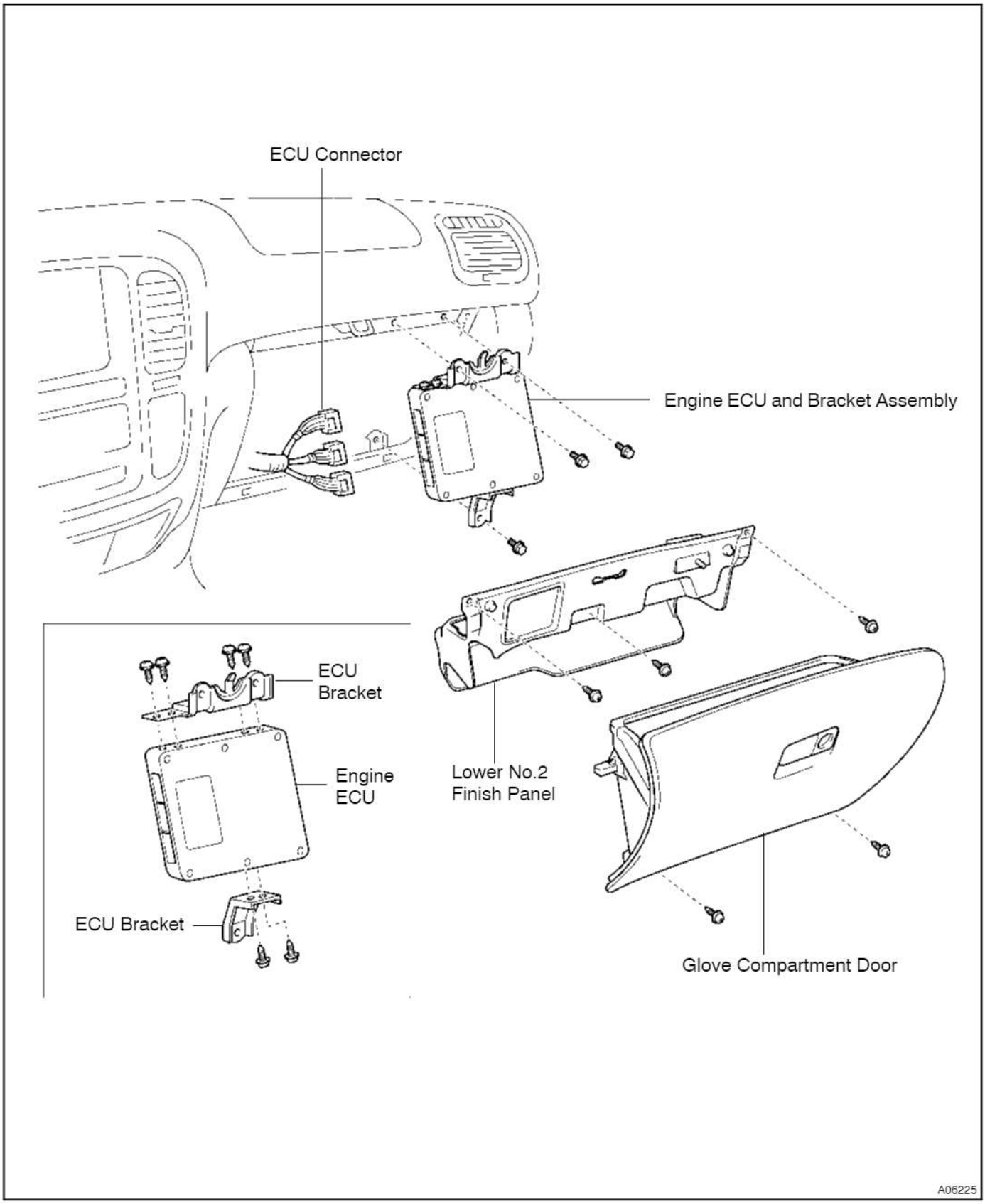



(c) Using SST, turn the idle mixture adjusting screw fully counterclockwise.
SST 09243–00020
(d) Connect the ohmmeter to terminals VAF and E2 of the variable resistor, and turn the idle mixture adjusting screw fully clockwise and check that the resistance value changes from approx. 5 kΩ to 0 Ω accordingly.
(e) Reconnect the variable resistor connector.

# ENGINE ECU

## COMPONENTS

SF0Q0-05



SF0Q1–05

# INSPECTION

1. REMOVE ENGINE ECU
2. INSPECT ENGINE ECU (See page DI–19)
3. REINSTALL ENGINE ECU

# FUEL CUT RPM

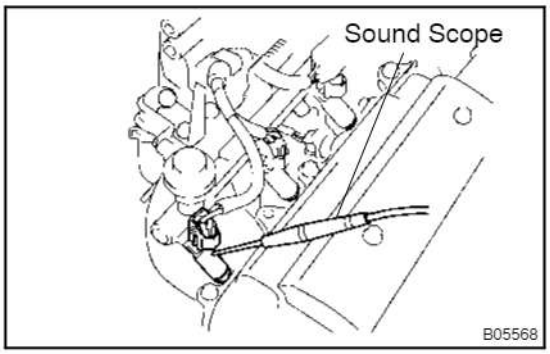
SF0YV-01

## INSPECTION

**1. WARM UP ENGINE**

Allow the engine to warm up to normal operating temperature.

**2. CONNECT TACHOMETER, HAND–HELD TESTER OR OBDII SCAN TOOL (See page EM–3)**




**3. INSPECT FUEL CUTOFF RPM OPERATION**

(a) Increase the engine speed to at 2,500 rpm or more.
(b) Check for injector operating noise.
(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT:

- The vehicle should be stopped.
- Measure with the A/C OFF.

**Fuel return speed: 1,800 rpm**

**4. DISCONNECT TOYOTA HAND–HELD TESTER OR OBDII SCAN TOOL**

# IGNITION SYSTEM

IG0CO-02

## ON–VEHICLE INSPECTION

**NOTICE:**

**"Cold" and "Hot" in these sentences express the temperature of the coils themselves. "Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).**

### 1. INSPECT IGNITERS AND SPARK TEST

Check that the spark occurs.

(1) Disconnect the high–tension cord from the spark plug.
(2) Remove the spark plug.
(3) Install the spark plug to the high–tension cord.
(4) Ground the spark plug.
(5) See if spark occurs while engine is being cranked.

**NOTICE:**

**To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 5 – 10 seconds at time.**

If the spark does not occur, do the test as next page:

**SPARK TEST**

↓ NO

**CHECK CONNECTION OF IGNITION COIL WITH IGNITER CONNECTORS** → BAD → Connect securely.

↓ OK

**CHECK RESISTANCE OF HIGH–TENSION CORDS (See step 2)**
**Maximum resistance: 25 kΩ per cord** → BAD → Replace cord(s).

↓ OK

**CHECK POWER SUPPLY TO IGNITION COILS WITH IGNITERS**
1. Turn ignition switch to ON.
2. Check that there is battery positive voltage at ignition coil positive (+) terminal.

→ BAD → Check wiring between ignition switch to ignition coils with igniters.

↓ OK

**CHECK RESISTANCE OF IGNITION COILS (See step 4)**

| Resistance: | Cold | Hot |
|---|---|---|
| Secondary | 9.7 – 16.7 kΩ | 12.4 – 19.6 kΩ |

→ BAD → Replace ignition coil(s) with igniter(s).

↓ OK

**CHECK RESISTANCE OF SENSORS (See steps 5 and 6)**

| Resistance: | Cold | Hot |
|---|---|---|
| Camshaft position sensor | 835 – 1,400 Ω | 1,060 – 1,645 Ω |
| Crankshaft position sensor | 1,630 – 2,740 Ω | 2,065 – 3,225 Ω |

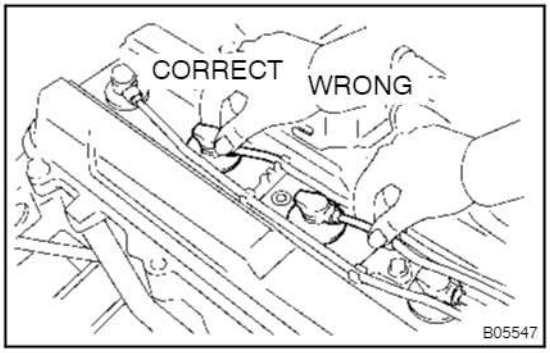
→ BAD → Replace sensor(s)

↓ OK

**CHECK IGT SIGNAL FROM ECU (See page DI–68)** → BAD → Check wiring between ECU and igniters, and then try another ECU.

↓ OK

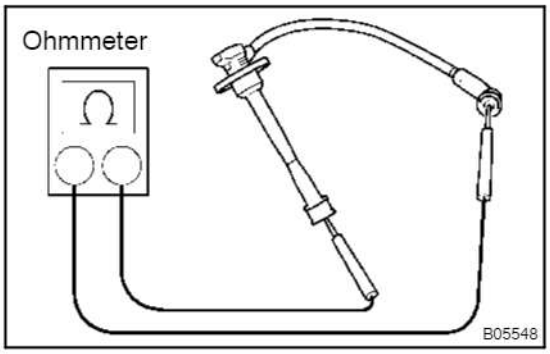
**TRY ANOTHER IGNITION COILS WITH IGNITER**




**2. INSPECT HIGH–TENSION CORDS**

(a) Remove the high–tension cords.
Disconnect the high–tension cords at the rubber boot. Do not pull on the high–tension cords.

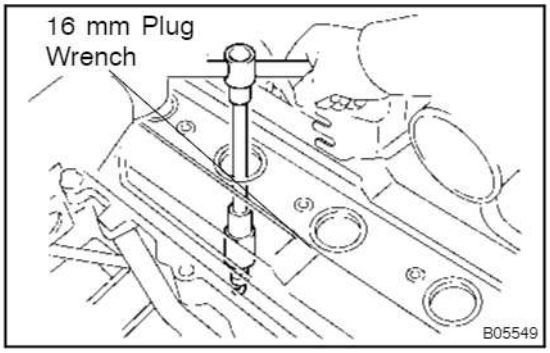
**NOTICE:**
**Pulling on or bending the cords may damage the conductor inside.**




(b) Using an ohmmeter, measure the high–tension cord resistance.
**Maximum resistance: 25 kΩ per cord**

If the resistance is greater than maximum, check the terminals. If necessary, replace the high–tension cord.

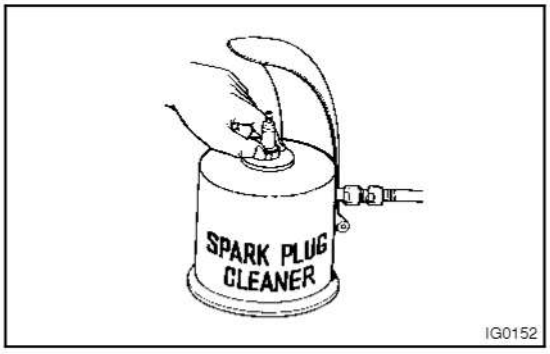
(c) Reinstall the high–tension cords.



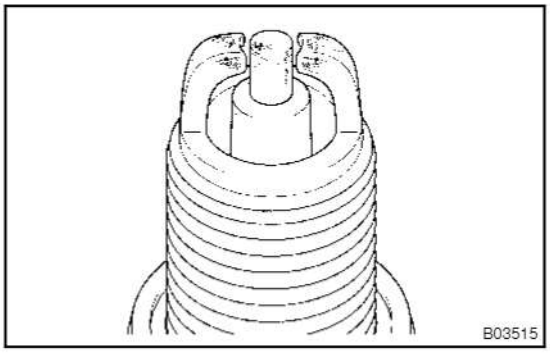

**3. INSPECT SPARK PLUGS**

(a) Disconnect the high–tension cords from the spark plugs.

(b) Using a 16 mm plug wrench, remove the 4 spark plugs.



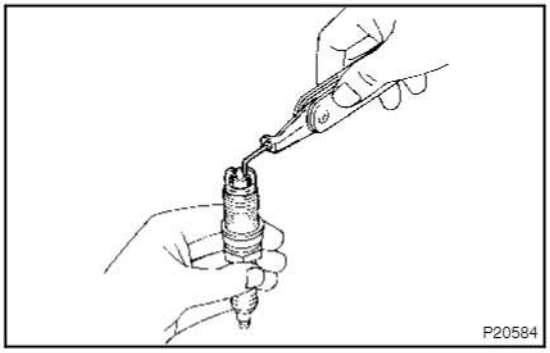

(c) Using a spark plug cleaner or wire brush, clean the spark plug.




(d) Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the spark plug.

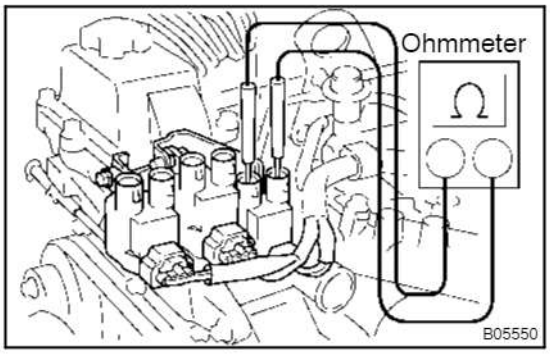
**Recommended spark plug:**
**DENSO made: K16TR11**
**NGK made: BKR5EKB11**




(e) Inspect the electrode gaps.
Carefully bend the outer electrode to obtain the correct electrode gap.
**Electrode gap: 1.1 mm (0.043 in.)**

(f) Using a 16 mm plug wrench, install the 4 spark plugs.
**Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)**

(g) Reconnect the high–tension cords from the spark plugs.




**4. INSPECT IGNITION COILS WITH IGNITERS**

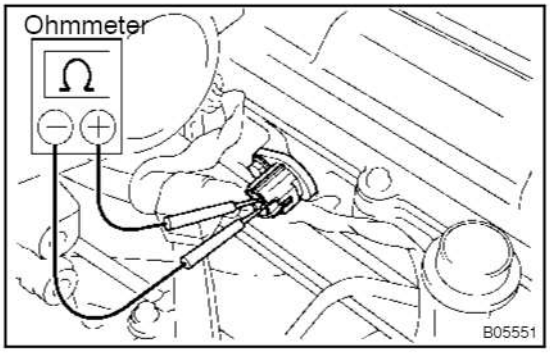
(a) Disconnect the high–tension cords from the ignition coils.

(b) Inspect the secondary coil resistance.
Using an ohmmeter, measure the resistance between the high–tension terminals.
**Secondary coil resistance:**
**Cold: 9.7 – 16.7 kΩ**
**Hot: 12.4 – 19.6 kΩ**

If the resistance is not as specified, replace the ignition coil.

(c) Reconnect the high–tension cords to the ignition coils.

(d) Inspect the igniters. (See procedure spark test)



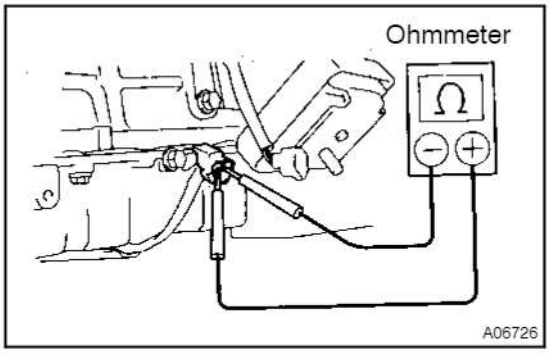

**5. INSPECT CAMSHAFT POSITION SENSOR**

(a) Disconnect the camshaft position sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals.
**Resistance:**
**Cold: 835 – 1,400 Ω**
**Hot: 1,060 – 1,645 Ω**

If the resistance is not as specified, replace the sensor.

(c) Reconnect the camshaft position sensor connector.




**6. INSPECT CRANKSHAFT POSITION SENSOR**

(a) Disconnect the crankshaft position sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals.
**Resistance:**
**Cold: 1,630 – 2,740 Ω**
**Hot: 2,065 – 3,225 Ω**

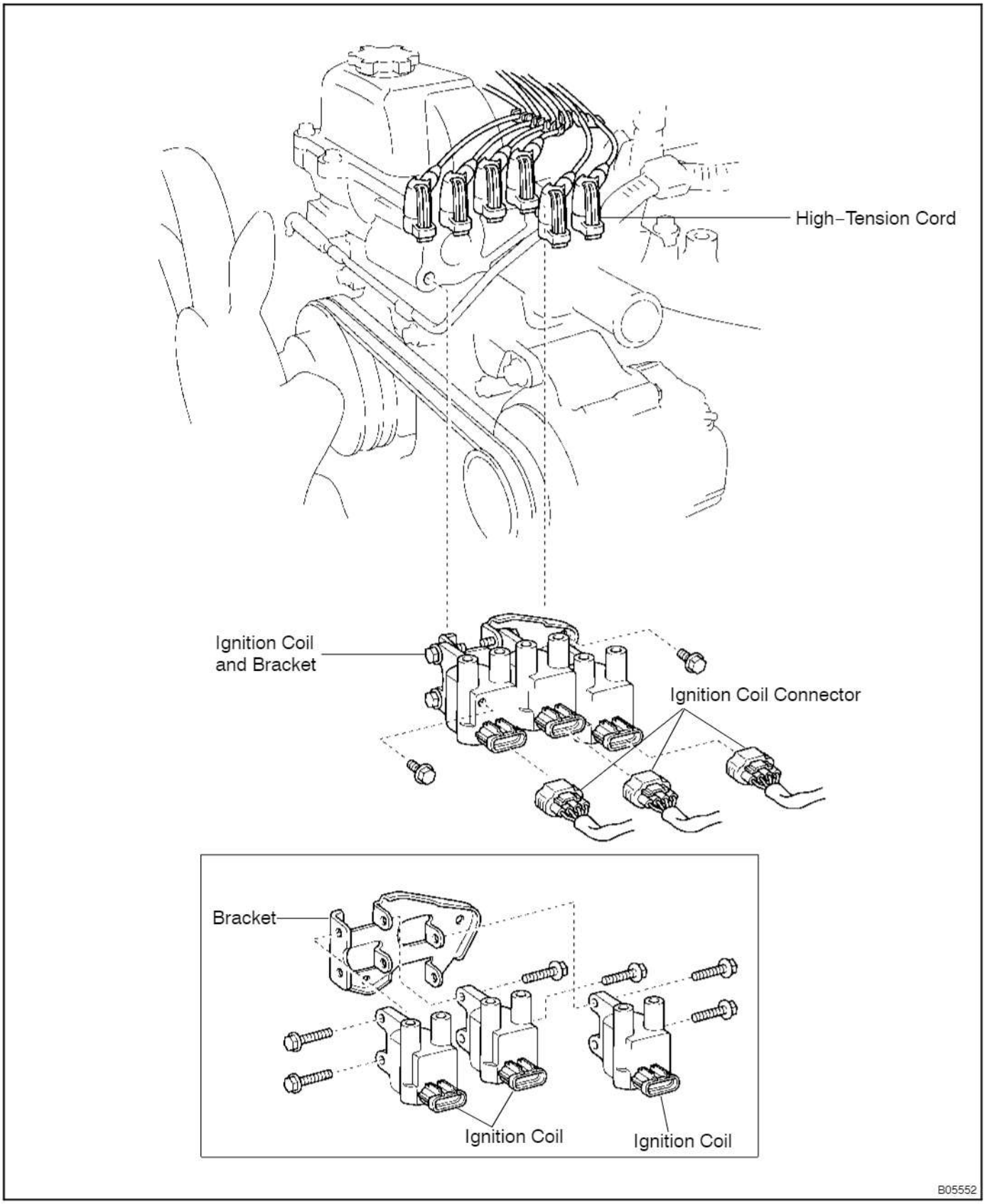
If the resistance is not as specified, replace the sensor.

(c) Reconnect the crankshaft position sensor connector.

# IGNITION COIL

## COMPONENTS

IG07N–03



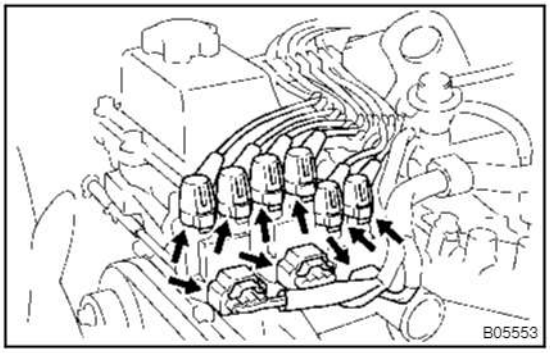

B05552

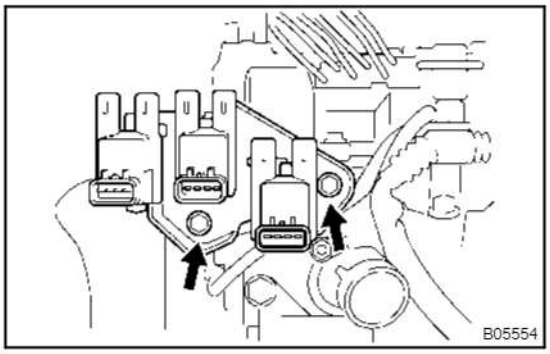
IG0CP–02

# REMOVAL

**1. DISCONNECT HIGH–TENSION CORDS FROM IGNITION COILS**

**2. DISCONNECT IGNITION COIL CONNECTORS FROM IGNITION COILS**

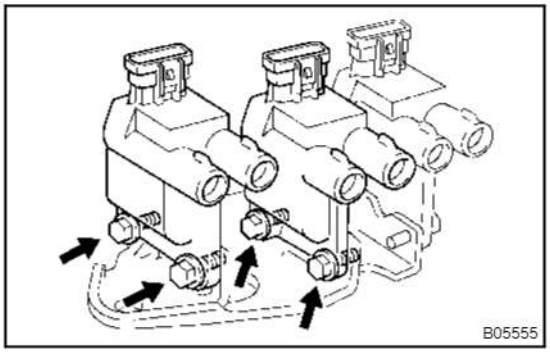



**3. REMOVE IGNITION COIL AND BRACKET ASSEMBLIES**

Remove the bolt and ignition coil and bracket assembly. Remove the 3 ignition coil and bracket assemblies.

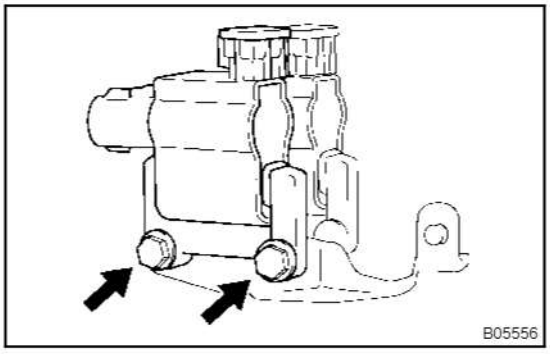
**Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)**




**4. REMOVE IGNITION COIL FROM BRACKET**

(a) Remove the 4 bolts and ignition coil.

**Torque: 9.8 N·m (100 kgf·cm, 85 in.·lbf)**




(b) Remove the 2 bolts and ignition coil.

**Torque: 9.8 N·m (100 kgf·cm, 85 in.·lbf)**

IG07F–03

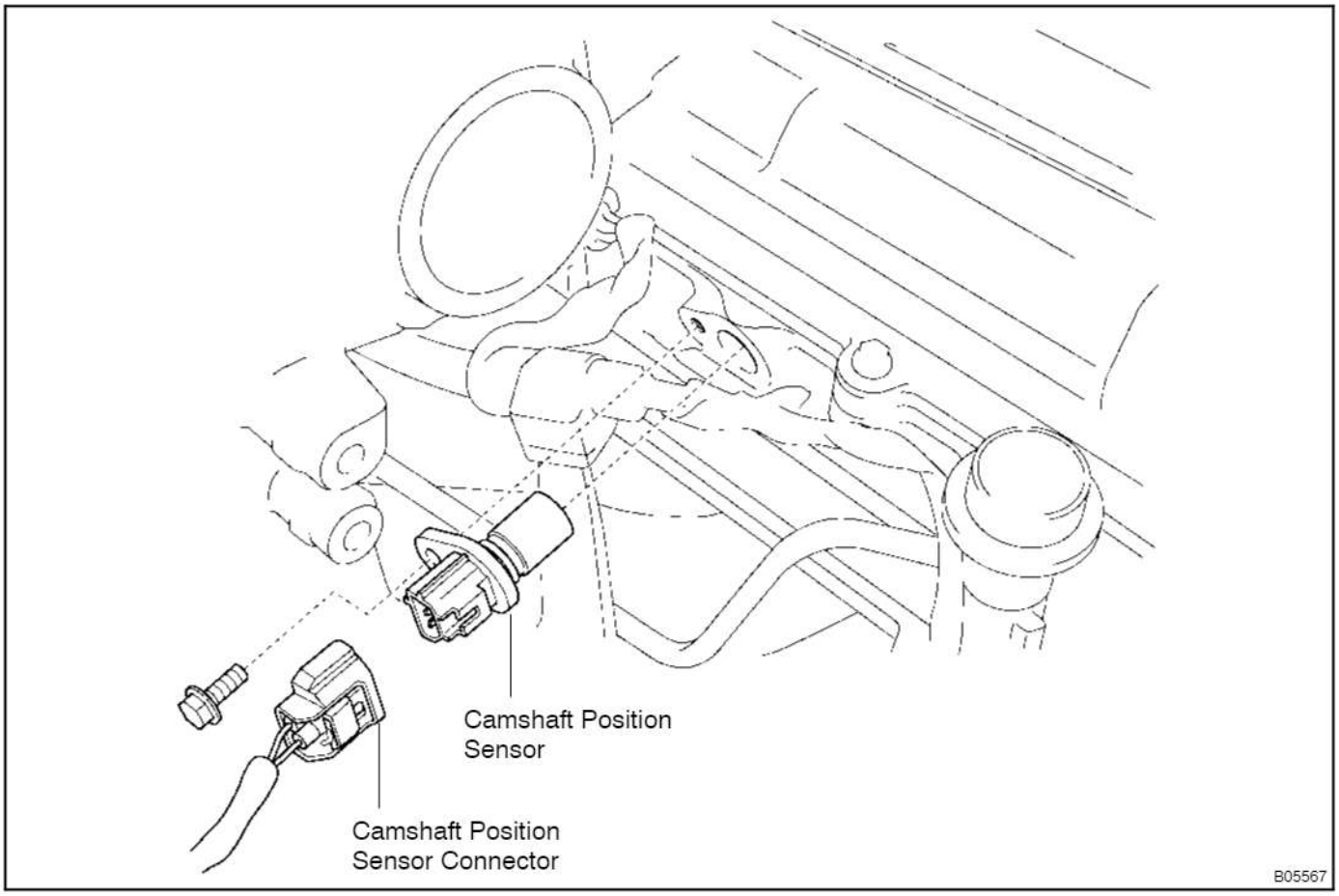
# INSTALLATION

**Installation is in the reverse order of removal (See page IG–5).**

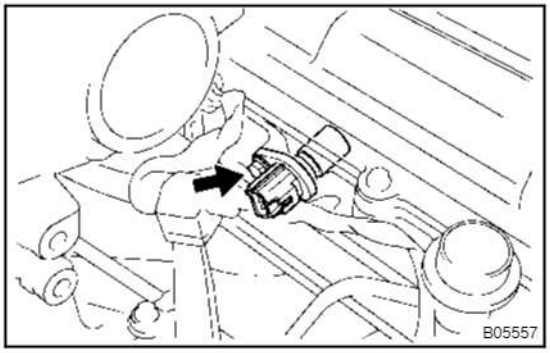
# CAMSHAFT POSITION SENSOR

IG07Q–03

## COMPONENTS



IG04G-05




# REMOVAL

## REMOVE CAMSHAFT POSITION SENSOR

(a) Disconnect the camshaft position sensor connector.

(b) Remove the bolt and camshaft position sensor.
**Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)**

IG04H–04

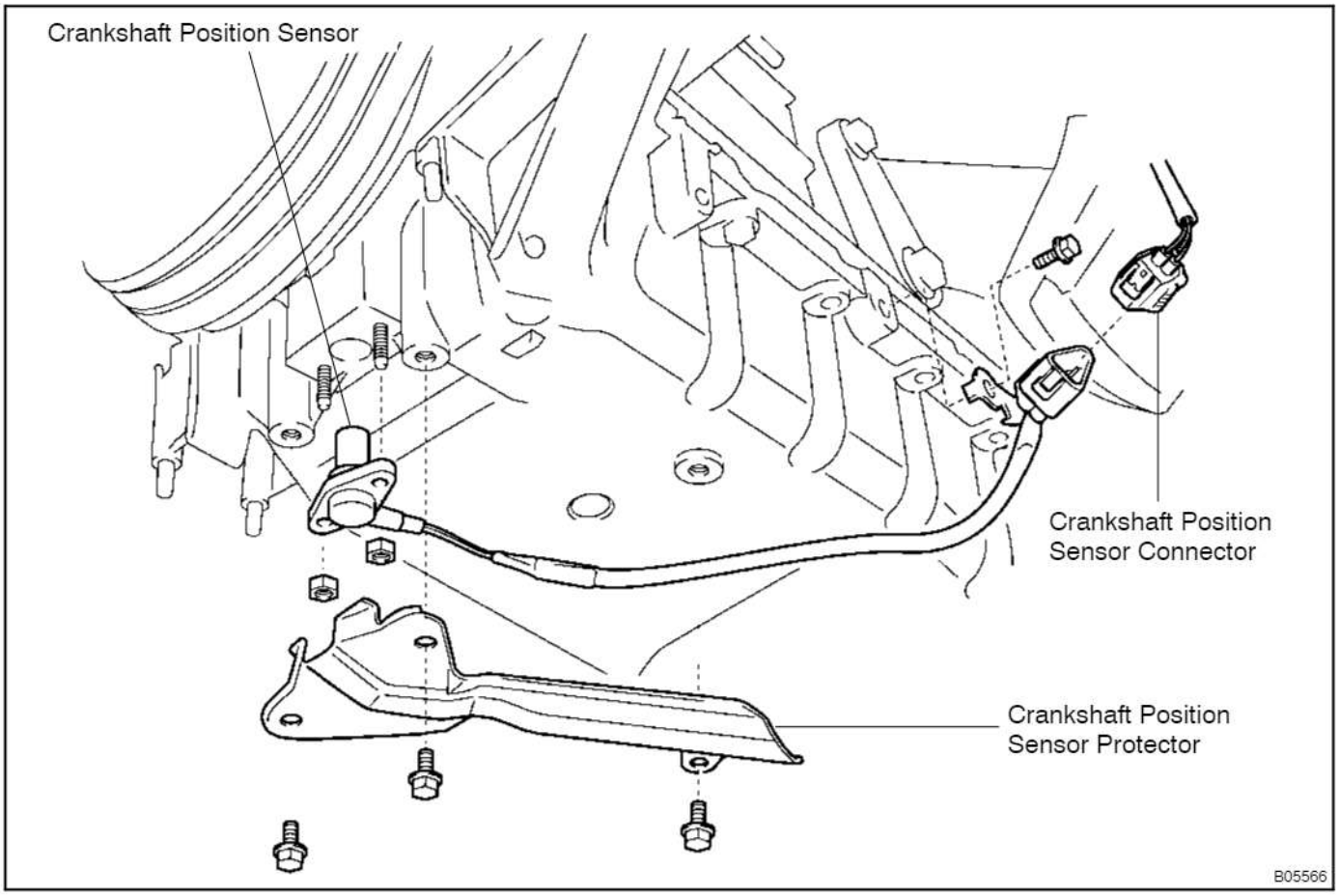
# INSTALLATION

**Installation is in the reverse order of removal (See page IG–8).**

# CRANKSHAFT POSITION SENSOR

## COMPONENTS

IG07R–03



IG07S–03

# REMOVAL

## REMOVE CRANKSHAFT POSITION SENSOR

(a) Disconnect the crankshaft position sensor connector.

(b) Remove the 3 bolts and crankshaft position sensor protector.
**Torque: 9.5 N·m (97 kgf·cm, 84 in.·lbf)**

(c) Remove the bolt and 2 nuts crankshaft position sensor.
**Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)**

IG07T–03

# INSTALLATION

**Installation is in the reverse order of removal (See page IG–11).**

# HOW TO USE THIS MANUAL

IN07Q–03

## 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 (Precautions) 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.

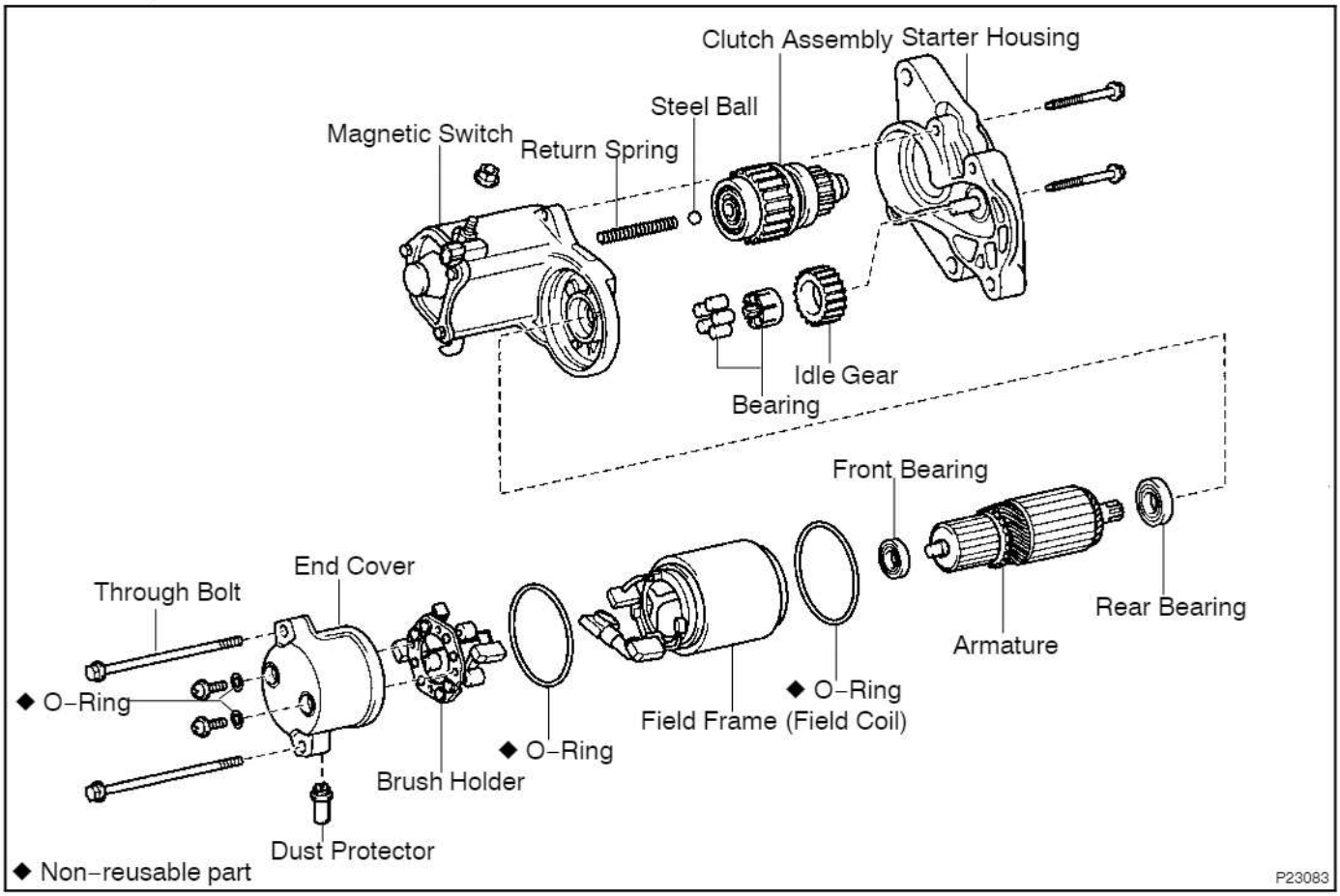
### 4. PREPARATION

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

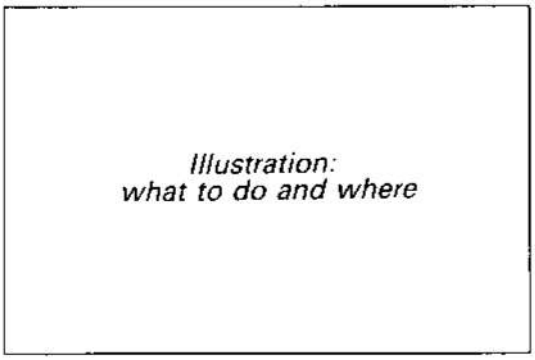
Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

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*

**6. INSTALL CRANKSHAFT PULLEY**

(a) Using SST, install the bolt.

SST 09213-54015 (90119-08126)

*Set part No.* *Component part No.*

*Detailed text: how to do task*

(b) Install the bolt.

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

*Specification*

V00801

This format provides the experienced 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.

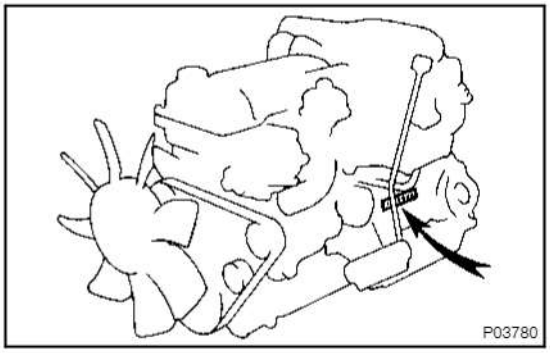
**8. CAUTIONS, NOTICES, HINTS:**

- 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 UNIT given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

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

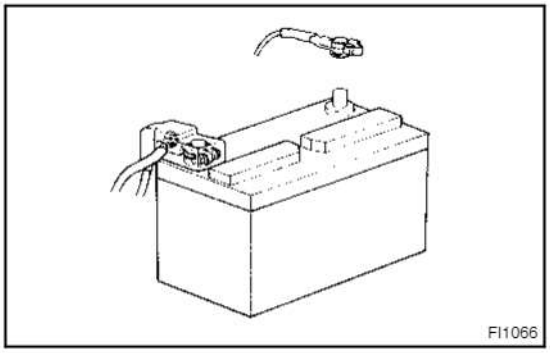



# IDENTIFICATION INFORMATION

IN07R-02

## ENGINE SERIAL NUMBER

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


FI1066

# REPAIR INSTRUCTIONS

IN07S–03

## 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) Installation and removal of battery terminal:

(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, first disconnect the negative (–) terminal cable.

(3) When disconnecting the terminal cable to prevent damage to 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 after loosening the nut, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.

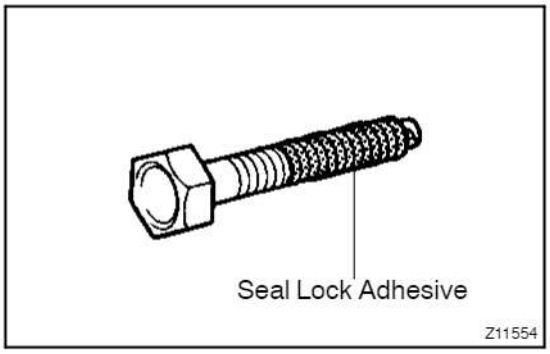
(6) Be sure the cover for the positive (+) terminal is properly in place.

(d) Check hose and wiring connectors to make sure that they are connected securely and correctly.

(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.



Z11554

(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.

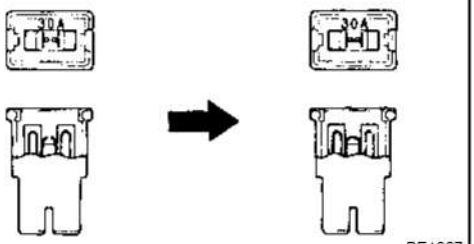
(3) Precoated parts are indicated in the component illustrations by the "★" symbol.

(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.

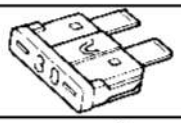
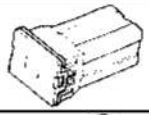
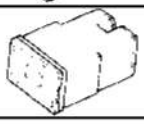
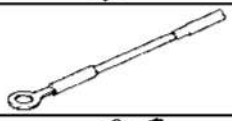
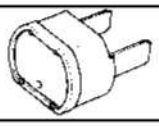
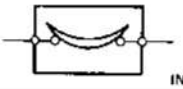
(i) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in Preparation section in this manual.

Medium Current Fuse and High Current Fuse Equal Amperage Rating




BE1367

(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 |

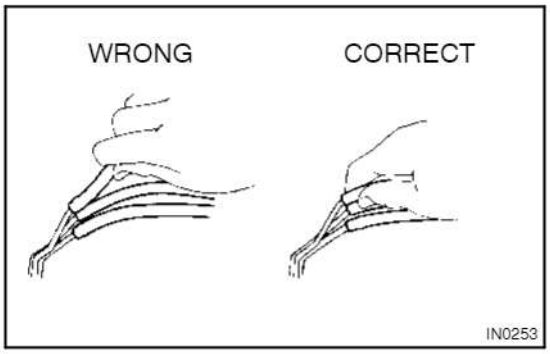
V00076

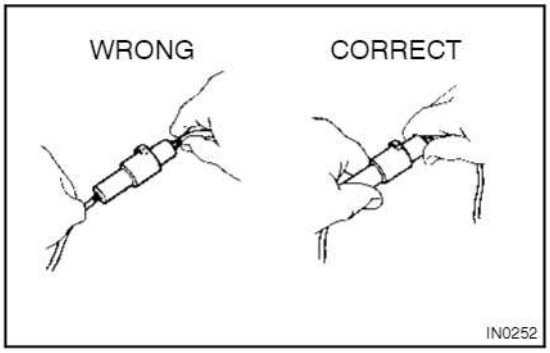
(k) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations

(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 to block them in order to ensure safety

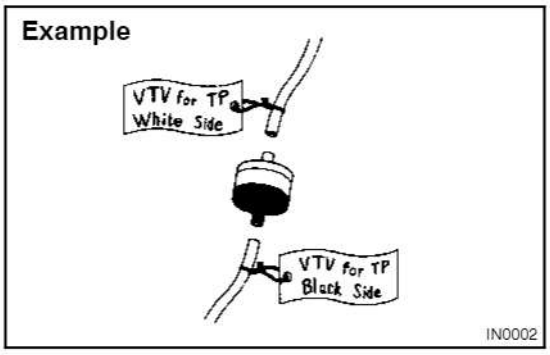
(2) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

(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 off 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 emission–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 for adjustment. Once the hose has been stretched, it may leak air.




(m) Installation and removal of vacuum hose:
(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) Bleeding of hydraulic brake booster system
(o) 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, measurement should be made when the engine has cooled down.

# FOR ALL OF VEHICLES

IN07T–02

## PRECAUTION

### 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

IN09D–03

## 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:

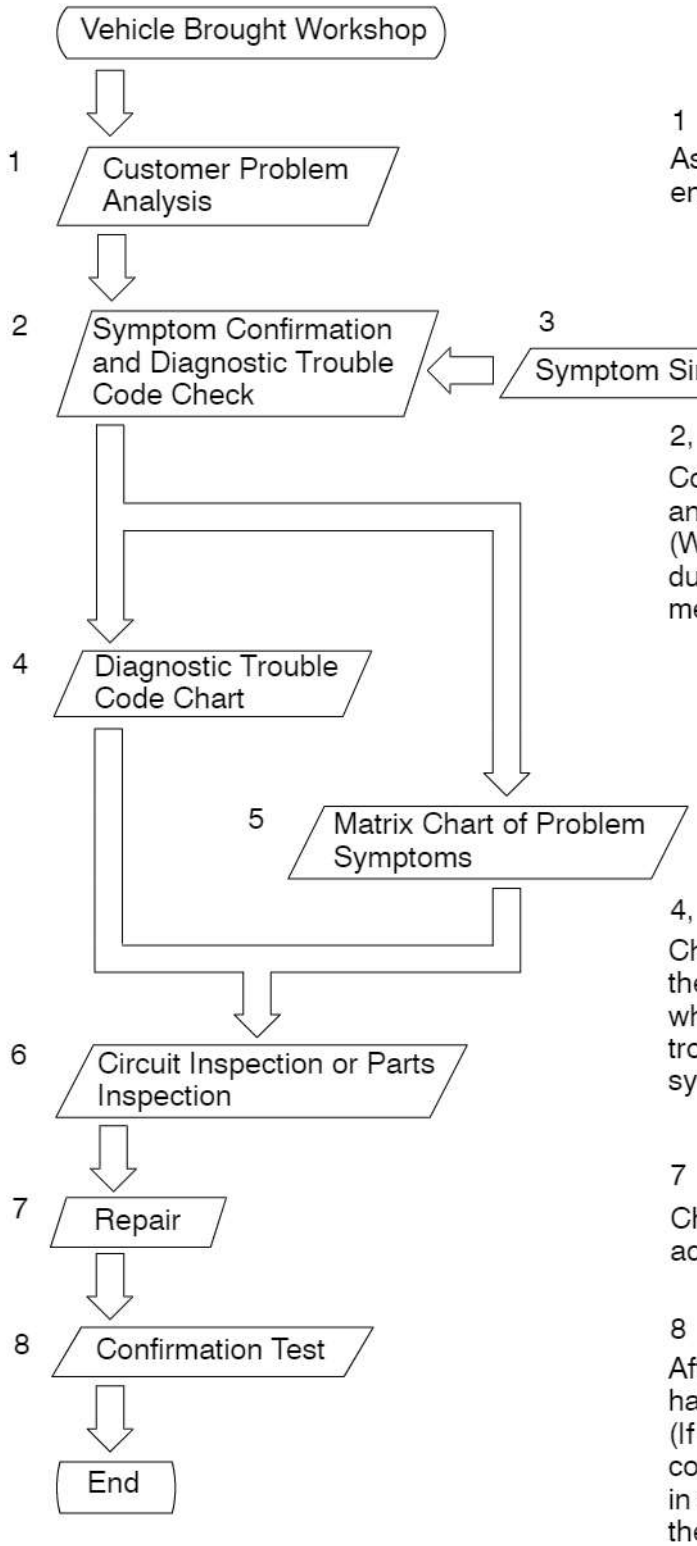
| System | Page |
|---|---|
| 1. Engine | DI–1 |
| 2. Sub Fuel Tank System | DI–101 |

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

IN09E–02

# 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<br>☐ Other _____ |
| | ☐ Poor Idling | ☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High ( rpm) ☐ Low ( rpm)<br>☐ Rough idling ☐ Other _____ |
| | ☐ Poor Drive ability | ☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging<br>☐ Knocking ☐ Other _____ |
| | ☐ Engine Stall | ☐ Soon after starting ☐ After accelerator pedal depressed<br>☐ After accelerator pedal released ☐ During A/C operation<br>☐ 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).

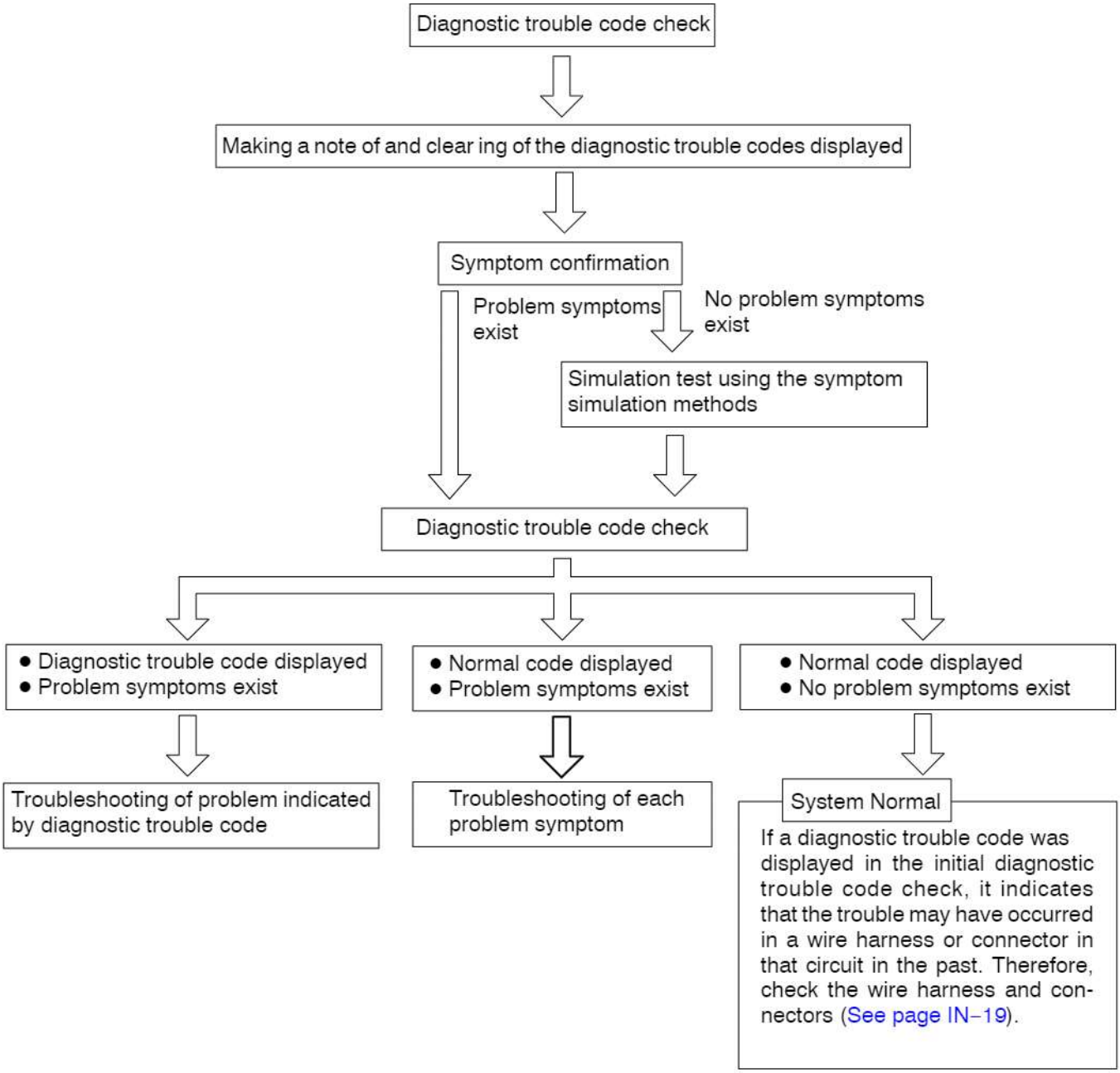
| System | Diagnostic Trouble Code Check | Input Signal Check (Sensor Check) | Other Diagnosis Function |
|---|---|---|---|
| Engine | ○ (with Check Mode) | ○ | Diagnostic Test Mode |
| Sub Fuel Tank System | ○ (with Test Mode) | ○ | |

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.

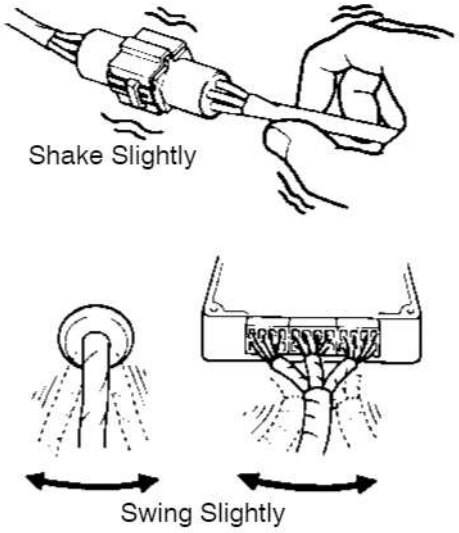
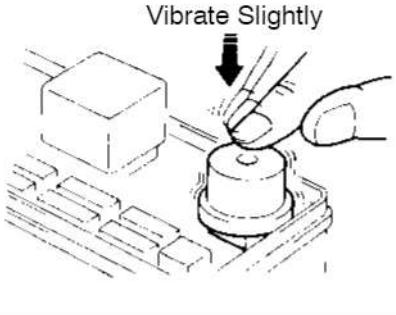


## 3. SYMPTOM SIMULATION

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**<br>Slightly shake the connector vertically and horizontally.<br><br>**WIRE HARNESS**<br>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**<br>Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs.<br><br>HINT: Applying strong vibration to relays may result in open relays. |  |

V07268

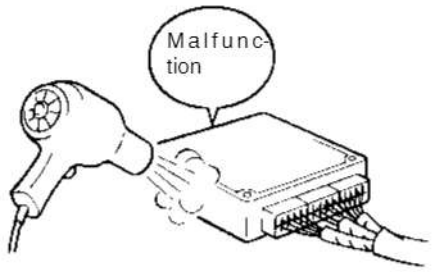
| 2 | **HEAT METHOD: When the problem seems to occur when the suspect area is heated.** |
|---|---|

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.**

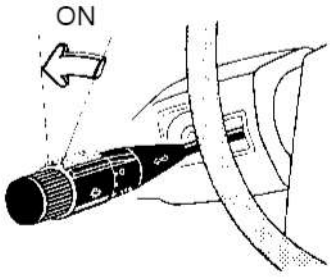
**(2) Never apply water directly onto the electronic components.**

(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

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## 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.

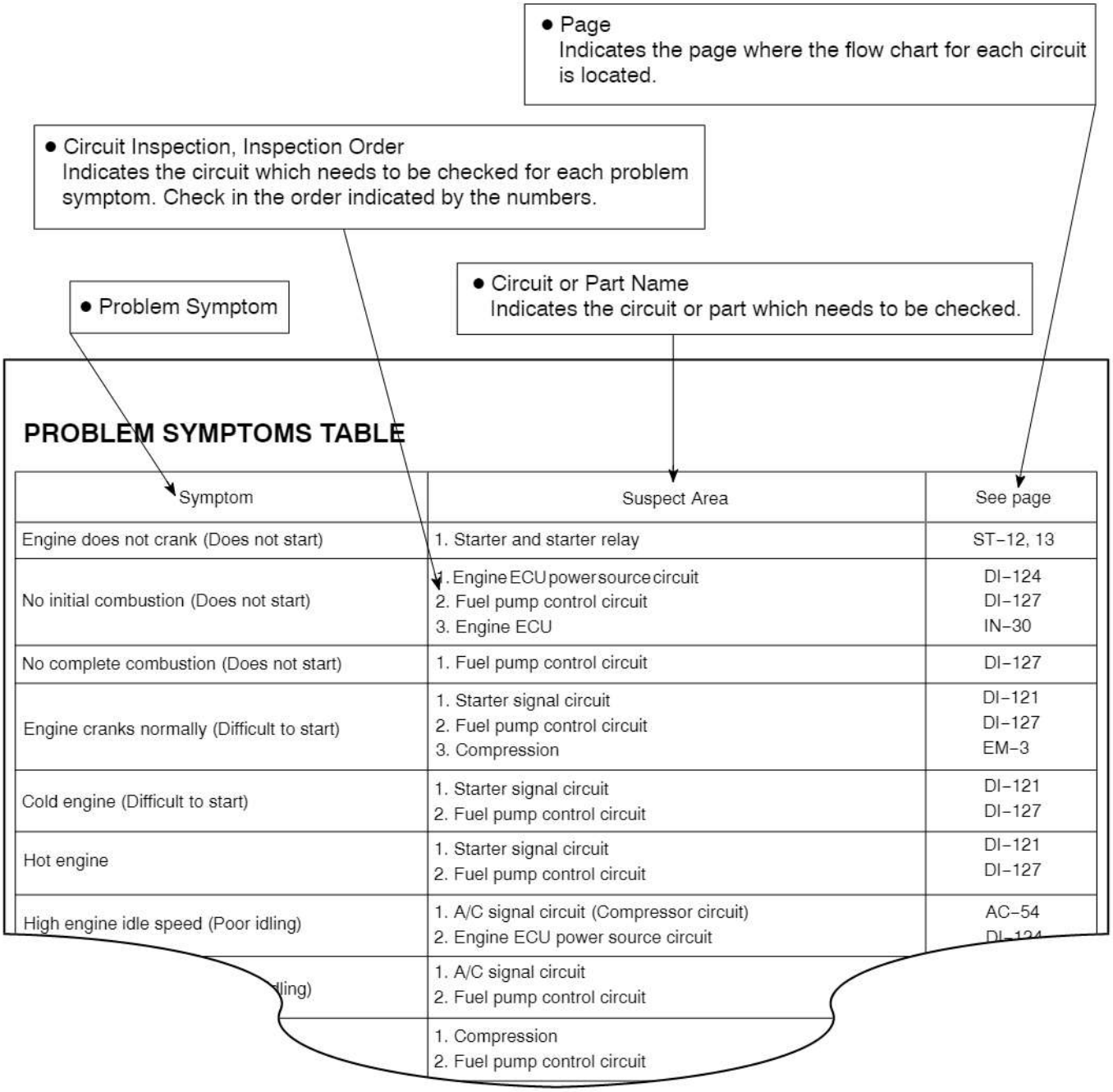
| DTC No. (See page) | Detection Item | Trouble Area | CHK ENG *1 | *Memory |
|---|---|---|---|---|
| P0105/31 (DI–12) | Vacuum Sensor Circuit Malfunction | • Open or short in vacuum sensor circuit<br>• Vacuum sensor<br>• Engine ECU | ○ | ○ |
| P0110/24 (DI–28) | Intake Air Temp. Circuit Malfunction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

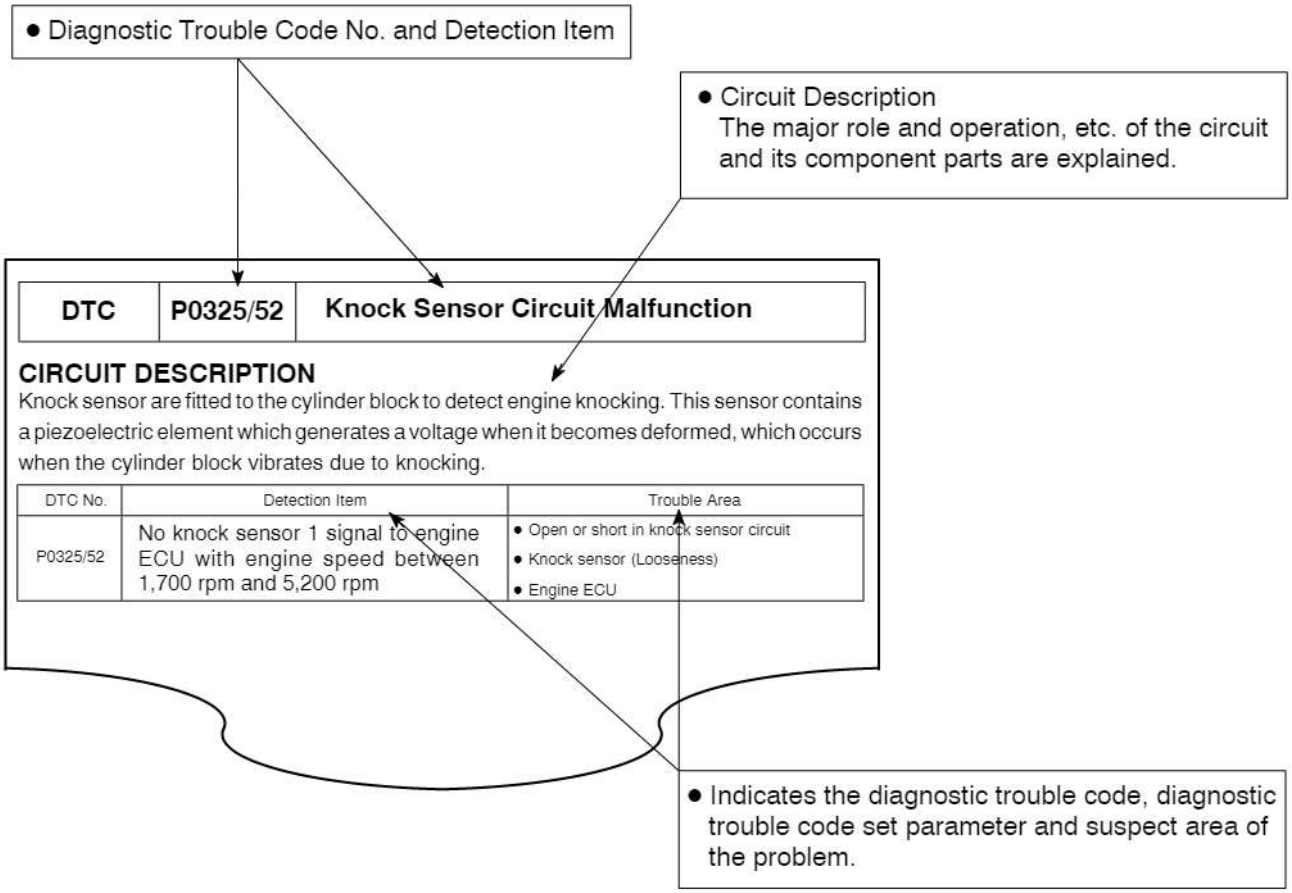


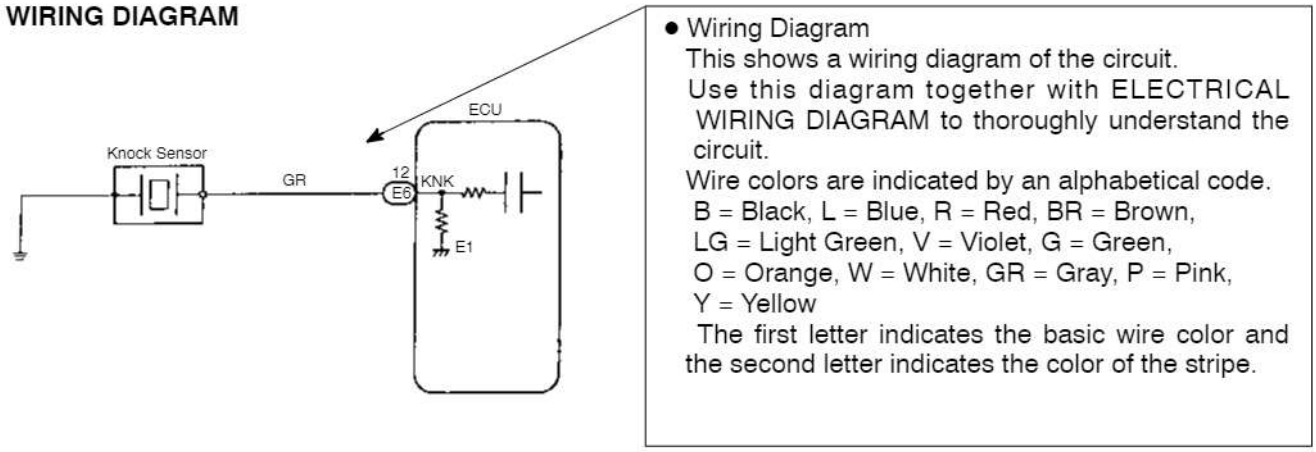

**PROBLEM SYMPTOMS TABLE**

| 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<br>2. Fuel pump control circuit<br>3. Engine ECU | DI–124<br>DI–127<br>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<br>2. Fuel pump control circuit<br>3. Compression | DI–121<br>DI–127<br>EM–3 |
| Cold engine (Difficult to start) | 1. Starter signal circuit<br>2. Fuel pump control circuit | DI–121<br>DI–127 |
| Hot engine | 1. Starter signal circuit<br>2. Fuel pump control circuit | DI–121<br>DI–127 |
| High engine idle speed (Poor idling) | 1. A/C signal circuit (Compressor circuit)<br>2. Engine ECU power source circuit | AC–54<br>DI–124 |
| dling) | 1. A/C signal circuit<br>2. Fuel pump control circuit | |
| | 1. Compression<br>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

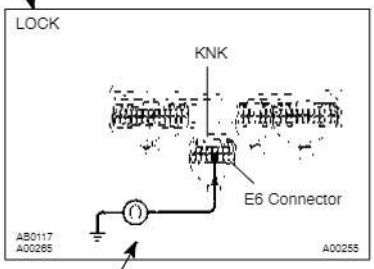
START
Ignition Switch START

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**

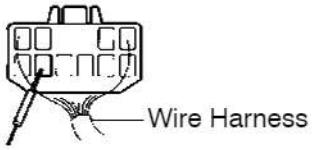
OK → **Go to step 3.**

NG

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

OK → **Replace knock sensor.**

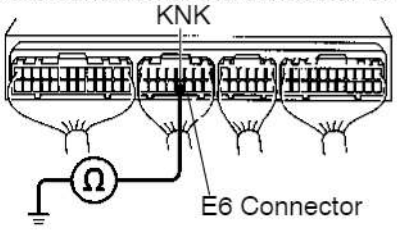
● Indicates the place to check the voltage or resistance.
● Indicates the connector position to checked, from the front or back side.



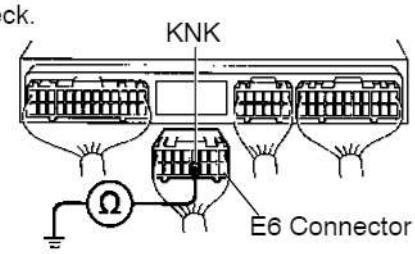

Check from the connector back side. (with harness)

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.

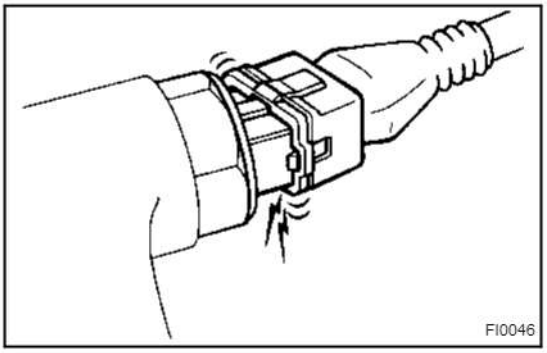


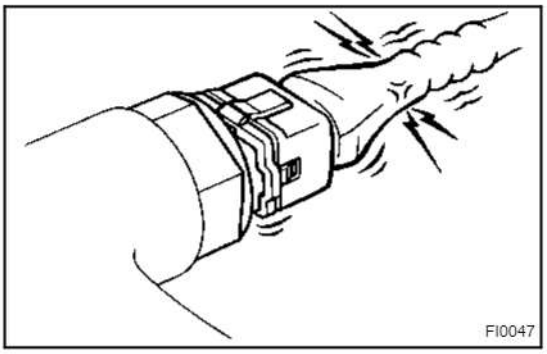

Connector being checked is connected.

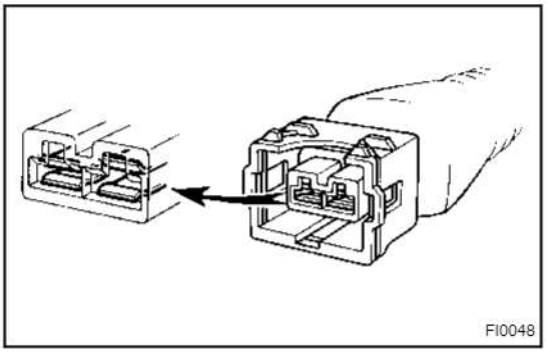



Connector being checked is disconnected.

V08425


FI0046


FI0047


FI0048

IN09F–02

# 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:

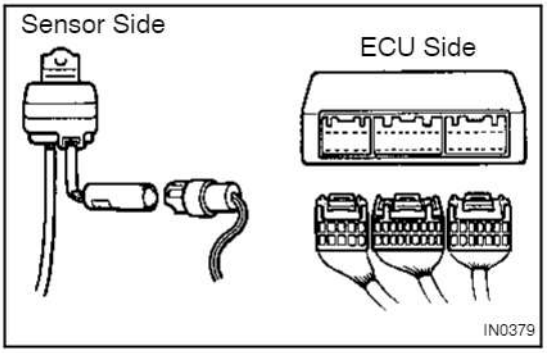
- It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
- Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the contact 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.

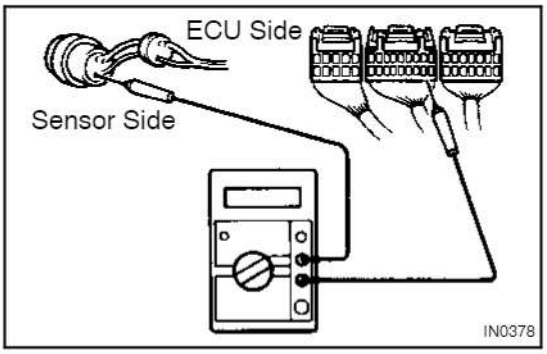
SHORT CIRCUIT:

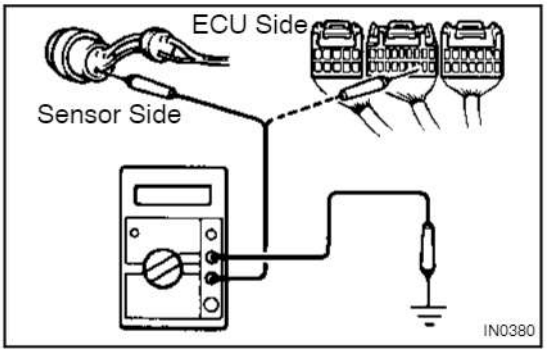
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.

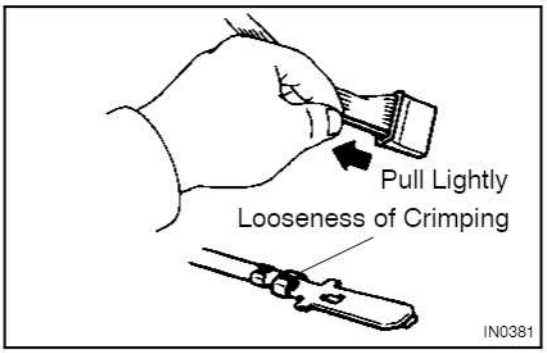
HINT:

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.

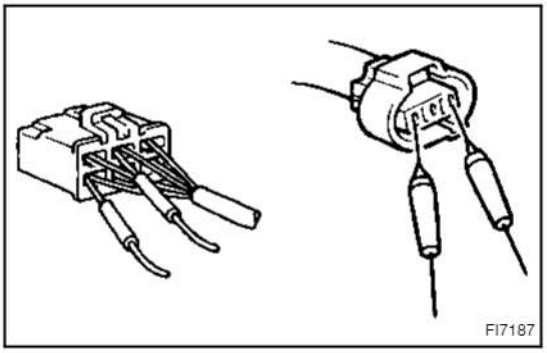
(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.

**NOTICE:**

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

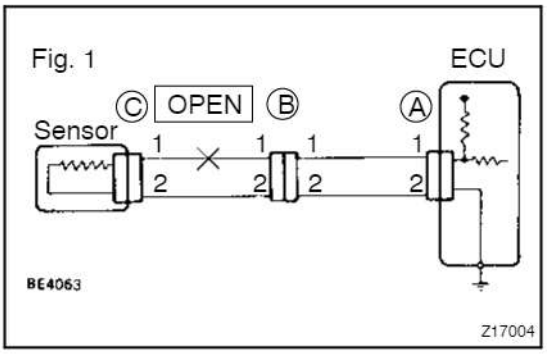
HINT:

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



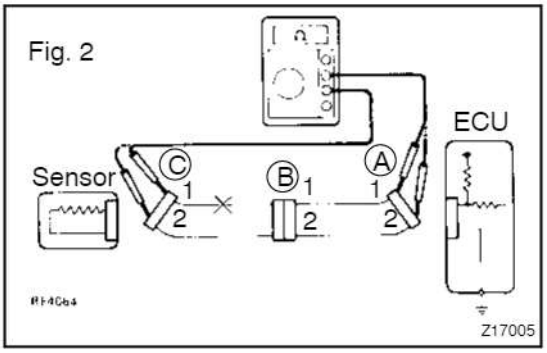

## 5. CONNECTOR HANDLING

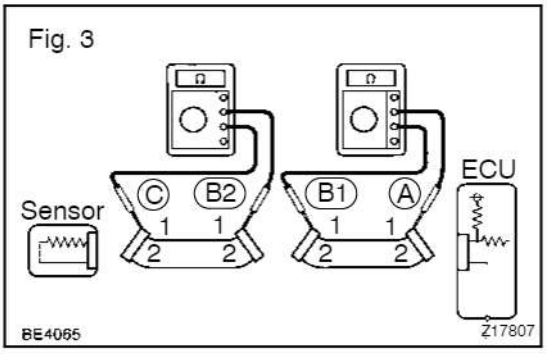
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.




## 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.



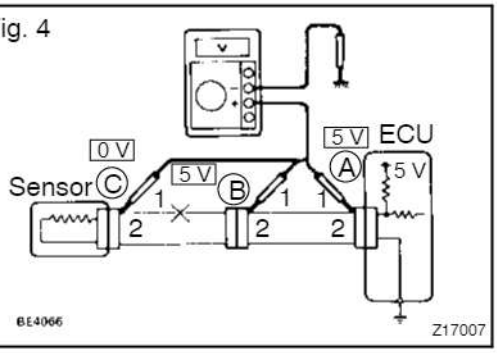




(a) Check the continuity.

(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.

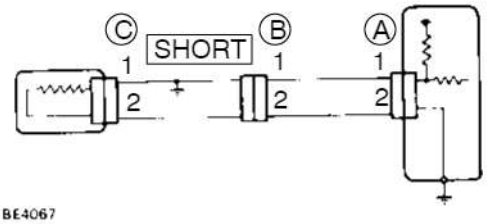
As shown in Fig. 4, with each connector still connected, measure the voltage between body ground and terminal 1 of connector "A" at the ECU 5 V output terminal, terminal 1 of connector "B", and terminal 1 of connector "C", in that order.

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".

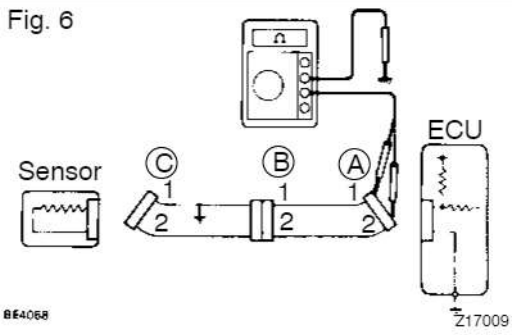
Fig. 5




## 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.

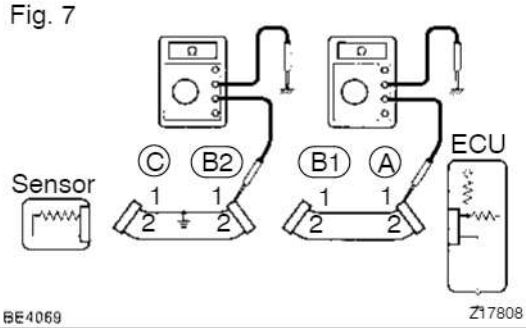
In the case of Fig. 6

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".

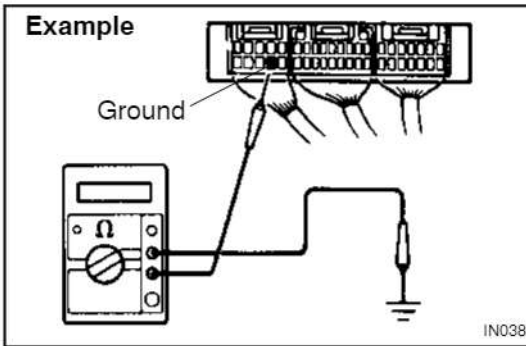
Fig. 7




(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".

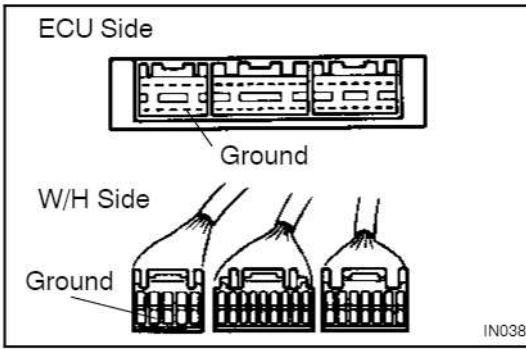
**8. CHECK AND REPLACE ECU**

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**



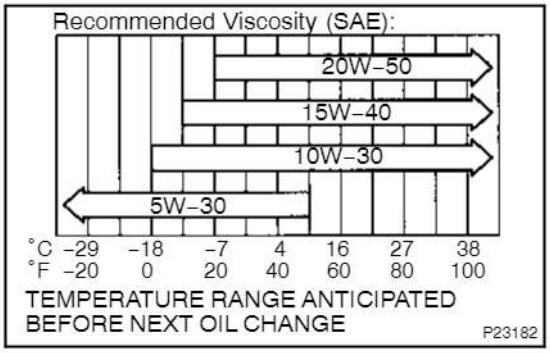

(2) Disconnect the ECU connector, check the ground terminals on the ECU side and the wire harness side for bend and check the contact pressure.

# TERMS

## ABBREVIATIONS USED IN THIS MANUAL

IN07U–02

| Abbreviations | Meaning |
|---|---|
| A/C | Air Conditioner |
| A/T | Automatic Transmission |
| BTDC | Before Top Dead Center |
| DLC3 | Data Link Connector 3 |
| ECU | Electronic Control Unit |
| EFI | Electronic Fuel Injection |
| EVAP | Evaporative Emission Control |
| FIPG | Formed In Place Gasket |
| FL | Fusible Link |
| MP | Multipurpose |
| M/T | Manual Transmission |
| IG | Ignition |
| ISC | Idle Speed Control |
| J/C | Junction Connector |
| J/B | Junction Block |
| LH | Left–Hand |
| LHD | Left–Hand Drive |
| O/S | Oversize |
| PCV | Positive Crankcase Ventilation |
| RH | Right–Hand |
| RHD | Right–Hand Drive |
| SSM | Special Service Materials |
| SST | Special Service Tools |
| SW | Switch |
| TDC | Top Dead Center |
| TEMP. | Temperature |
| VSV | Vacuum Switching valve |
| w/ | With |
| w/ o | Without |




# OIL AND FILTER

LU0F5–03

## INSPECTION

### 1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

**Oil grade:**

**API grade SH Energy–Conserving II or SJ, Energy–Conserving or ILSAC multigrade engine oil.**

**Recommended viscosity is as shown in the illustration.**

### 2. CHECK ENGINE OIL LEVEL

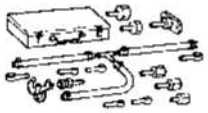
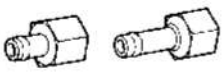
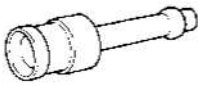
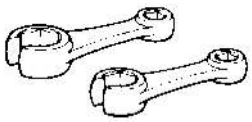
The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to "F" mark.

# ELECTRONIC FUEL INJECTION

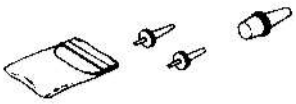
## SST (Special Service Tools)

FP1TZ–01

| | | | |
|---|---|---|---|
|  | 09268–41045 | Injection Measuring Tool Set<br><mk2> | |
|  | (09268–52010) | Injection Measuring Attachment<br><mk2> | |
|  | (09268–41110) | Adaptor | |
|  | (09268–41300) | Clamp | |
|  | 09268–45012 | EFI Fuel Pressure Gauge | |
|  | 09612–24014 | Steering Gear Housing Overhaul<br>Tool Set | |
|  | 09631–22020 | Power Steering Hose Nut<br>14 x 17 mm Wrench Set | Fuel line flare nut |
|  | 09816–30010 | Oil Pressure Switch Socket | Knock sensor |
|  | 09842–30070 | Wiring "F" EFI Inspection | |

PP0U4–04

# RECOMMENDED TOOLS

| | | | |
|---|---|---|---|
|  | 09082–00040 | TOYOTA Electrical Tester. | |
|  | 09258–00030 | Hose Plug Set . | Plug for vacuum hose, fuel hose etc. |

PP0NI–03

# EQUIPMENT

| | |
|---|---|
| Graduated cylinder | Injector |
| OBD II scan tool | |
| Sound scope | Injector |
| Torque wrench | |
| Vacuum gauge | |

# COOLING

## EQUIPMENT

PP1P1–02

| | |
|---|---|
| Radiator cap tester | |
| Torque wrench | |

PP1P2–02

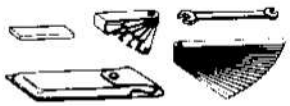
# COOLANT

| Item | | Capacity | Classification |
|---|---|---|---|
| Engine coolant | | | |
| Europe | | | |
| G.C.C countries | M/T | 13.9 liters (14.7 US qts, 12.2 Imp. qts) | Ethylene–glycol base |
| | A/T | 13.5 liters (14.2 US qts, 11.9 Imp. qts) | |
| Others | w/ Rear heater | | |
| | M/T | 14.3 liters (15.1 US qts, 12.6 Imp. qts) | |
| | A/T | 13.9 liters (14.7 US qts, 12.2 Imp. qts) | |
| | w/o Rear heater | | |
| | M/T | 13.8 liters (14.6 US qts, 12.1 Imp. qts) | |
| | A/T | 13.4 liters (14.2 US qts, 11.8 Imp. qts) | |

# IGNITION

## RECOMMENDED TOOLS

FP1OY–02

| | | | |
|---|---|---|---|
|  | 09082–00040 | TOYOTA Electrical Tester. | |
|  | 09200–00010 | Engine Adjust Kit . | |

PP1OZ–02

# EQUIPMENT

| | |
|---|---|
| Spark plug cleaner | |
| Torque wrench | |

# STARTING

## RECOMMENDED TOOLS

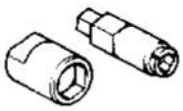
FP1B3–03

| | | |
|---|---|---|
|  | 09082–00040 TOYOTA Electrical Tester. | |

# CHARGING

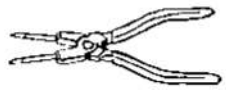
## SST (Special Service Tools)

PP1U0–01

| | | | |
|---|---|---|---|
|  | 09286–46011 | Injection Pump Spline Shaft Puller | Rectifier end frame |
|  | 09820–63010 | Alternator Pulley Set Nut Wrench Set | |

PP1U1–01

# RECOMMENDED TOOLS

| | | | |
|---|---|---|---|
|  | 09905–00013 | Snap Ring Pliers . | Generator washer |

PP1C9–02

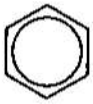
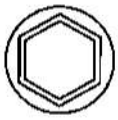
# EQUIPMENT

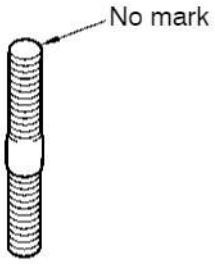
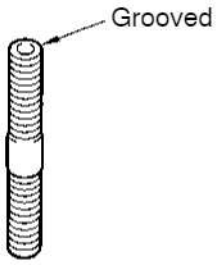
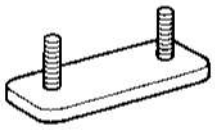
| | |
|---|---|
| Torque wrench | |
| Vernier calipers | Rotor (Slip ring), Brush |

# STANDARD BOLT

## HOW TO DETERMINE BOLT STRENGTH

SS0RQ–01

| | Mark | Class |
|---|---|---|
| Hexagon head bolt |  Bolt head No. 4– 5– 6– 7– 8– 9– 10– 11– | 4T 5T 6T 7T 8T 9T 10T 11T |
| |  No mark | 4T |
| Hexagon flange bolt w/ washer hexagon bolt |  No mark | 4T |
| Hexagon head bolt |  2 Protruding lines | 5T |
| Hexagon flange bolt w/ washer hexagon bolt |  2 Protruding lines | 6T |
| Hexagon head bolt |  3 Protruding lines | 7T |
| Hexagon head bolt |  4 Protruding lines | 8T |

| | Mark | Class |
|---|---|---|
| Hexagon flange bolt w/ washer hexagon bolt |  4 Protruding lines | 9T |
| Hexagon flange bolt w/ washer hexagon bolt |  5 Protruding lines | 10T |
| Hexagon flange bolt w/ washer hexagon bolt |  6 Protruding lines | 11T |
| Stud bolt |  No mark | 4T |
| |  Grooved | 6T |
| Welded bolt |  | 4T |

V06821

SSORR–01

# 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 | |

V00079

# ENGINE MECHANICAL

## TORQUE SPECIFICATION

SS0ZD-02

| Part tightened | | N·m | kgf·cm | ft·lbf |
|---|---|---|---|---|
| Spark plug x Cylinder head | | 20 | 200 | 14 |
| Throttle body x Intake manifold | | 21 | 210 | 15 |
| Intake manifold x Cylinder head | | 21 | 210 | 15 |
| Chain tensioner x Cylinder head | | 18 | 185 | 13 |
| Exhaust manifold x Cylinder head | | 39 | 400 | 29 |
| Heat insulator x Exhaust manifold | | 19 | 195 | 14 |
| Heater pipe x Cylinder head | | 20 | 200 | 14 |
| Delivery pipe x Intake manifold | | 13 | 135 | 11 |
| Fuel return pipe x Intake manifold | | 20 | 200 | 14 |
| Intake manifold stay x Intake manifold | | 19 | 195 | 14 |
| Intake manifold stay x Cylinder block | | 21 | 210 | 43 |
| Alternator bracket x Cylinder head | | 43 | 440 | 32 |
| Oil pan x Cylinder block | | 59 | 600 | 43 |
| Ignition coil bracket x Cylinder head | | 21 | 210 | 15 |
| Transmission x No.1 oil pan | | 72 | 730 | 43 |
| Flywheel x Crankshaft | (1st) | 20 | 200 | 14 |
| Flywheel x Crankshaft | (2nd) | 90° | 90° | 90° |

# ELECTRONIC FUEL INJECTION

## SERVICE DATA

SS0RV-02

| | | | |
|---|---|---|---|
| Fuel pressure regulator | Fuel pressure | at no vacuum | 392 kPa (4 kgf/cm$^2$, 57 psi) |
| Fuel pump | Resistance | at 20°C (68°F) | 0.2 – 3.0 Ω |
| Sub fuel pump | Resistance | at 20°C (68°F) | 0.2 – 3.0 Ω |
| Injector | Resistance | at 20°C (68°F) | 13.4 – 14.2 Ω |
| | | Injection volume | 71 – 86 cm$^3$ (4.7 – 5.5 cu in.) per 15 seconds |
| | | Difference between each cylinder | 13 cm$^3$ (0.8 cu in.) or less |
| | | Fuel leakage | 1 drop or less per 12 minutes |
| Throttle body | | Throttle body fully closed angle | 6° |
| | | Dash pot opener setting speed | 1,800 – 2,200 rpm |
| Throttle position sensor | Clearance between stop screw and lever | | |
| | 0 mm (0 in.) | VTA – E2 | 0.2 – 5.7 kΩ |
| | Throttle valve fully open | VTA – E2 | 2.0 – 10.2 kΩ |
| | – | VC – E2 | 2.5 – 5.9 kΩ |
| Intake air temperature sensor | Resistance | at –20°C (–4°F) | 10 – 20 kΩ |
| | | at 0°C (32°F) | 4 – 7 kΩ |
| | | at 20°C (68°F) | 2 – 3 kΩ |
| | | at 40°C (104°F) | 0.9 – 1.3 kΩ |
| | | at 60°C (140°F) | 0.4 – 0.7 kΩ |
| | | at 80°C (176°F) | 0.1 – 0.4 kΩ |
| Vacuum sensor | Power source voltage | | 4.5 – 5.5 V |
| Fuel pump resistor | Resistance | at 20°C (68°F) | 0.71 – 0.75 Ω |
| Variable resistor | Power source voltage | | 4.5 – 5.5 V |
| | Resistance | at 20°C (68°F) | 4 – 6 kΩ |
| Fuel cut rpm | Fuel return rpm | | 1,800 rpm |

SSORW–02

# TORQUE SPECIFICATION

| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Fuel line | 39 | 400 | 29 |
| No.1 rear seat x Body | 41 | 420 | 30 |
| Center exhaust pipe x Tailpipe | 35 | 357 | 26 |
| Sub fuel tank band x Body | 40 | 400 | 30 |
| Drain plug x Sub fuel tank | 6.5 | 65 | 58 in.·lbf |
| Fuel pressure regulator x Delivery pipe | 19 | 195 | 14 |
| Fuel return pipe x Fuel pressure regulator | 29 | 300 | 22 |
| Delivery pipe x Cylinder head | 13 | 130 | 9 |
| Fuel tank vent tube set plate x Fuel tank | 3.5 | 35 | 31 in.·lbf |
| Sub fuel pump and bracket assembly x Sub fuel tank | 3.5 | 35 | 31 in.·lbf |
| Front fuel pipe x Delivery pipe | 39 | 400 | 29 |
| Front fuel pipe x Lower intake manifold | 7.5 | 80 | 66 in.·lbf |
| Throttle body x Intake manifold | 19 | 195 | 14 |
| Water temperature sensor x Water outlet | 29.5 | 300 | 22 |
| Knock sensor x Cylinder block | 44 | 450 | 32 |
| No.2 rear seat x Body | 41 | 420 | 30 |
| No.2 rear seat outer belt x Body | 43 | 440 | 32 |

# COOLING

## SERVICE DATA

SS0WK–02

| | | | |
|---|---|---|---|
| Radiator cap | Relief valve opening pressure | STD | 93 – 123 kPa (0.95 – 1.25 kgf/cm$^2$, 10.7 – 14.9 psi) |
| | | Minimum | 78 kPa (0.6 kgf/cm$^2$, 8.5 psi) |

SS0WL–02

# TORQUE SPECIFICATION

| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Drain plug x Union on cylinder block | 29.0 | 300 | 22 |
| Radiator x Radiator side support | 12.7 | 130 | 9 |

# IGNITION

## SERVICE DATA

SS0WG–02

| | | | |
|---|---|---|---|
| High–tension cord | Resistance | Maximum | 25 kΩ per cord |
| Spark plug | Recommended spark plug | DENSO made | K16TR11 |
| | | NGK made | BKR5EKB11 |
| | Correct electrode gap for new spark plug | | 1.1 mm (0.043 in.) |
| Ignition coil | Secondary coil resistance | at cold | 9.7 – 16.7 kΩ |
| | | at hot | 12.4 – 19.6 kΩ |
| Camshaft position sensor | Resistance | at cold | 835 – 1,400 Ω |
| | | at hot | 1,060 – 1,645 Ω |
| Crankshaft position sensor | Resistance | at cold | 1,630 – 2,740 Ω |
| | | at hot | 2,065 – 3,225 Ω |

SS0WH–02

# TORQUE SPECIFICATION

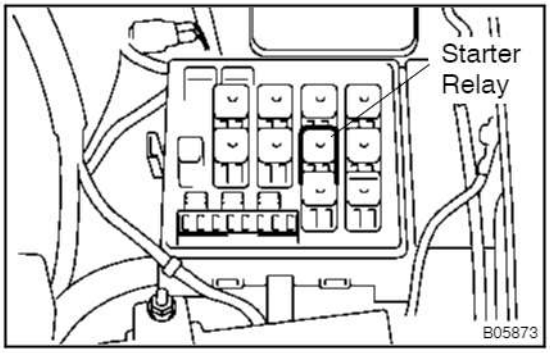
| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Spark plug x Cylinder head | 20 | 200 | 14 |
| Ignition coil bracket x Cylinder head | 18 | 185 | 13 |
| Ignition coil x Bracket | 9.8 | 100 | 85 in.·lbf |
| Camshaft position sensor x Cylinder head | 9.3 | 95 | 82 in.·lbf |
| Crankshaft position sensor x Oil pump | 9.3 | 95 | 82 in.·lbf |
| Crankshaft position sensor protector x Oil pump | 9.5 | 97 | 84 in.·lbf |

# CHARGING

## TORQUE SPECIFICATION

SS0P2–03

| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Bearing retainer x Drive end frame | 2.6 | 27 | 23 in.·lbf |
| Rectifier end frame x Drive end frame | 4.5 | 46 | 40 in.·lbf |
| Alternator pulley x Rotor | 110 | 1,125 | 81 |
| Rectifier x Rectifier holder | 2.9 | 30 | 26 in.·lbf |
| Rear end cover x Rectifier holder | 4.4 | 45 | 39 in.·lbf |
| Rectifier plate x Rectifier holder | 3.8 | 39 | 34 in.·lbf |
| Terminal insulator x Rectifier holder | 4.1 | 42 | 36 in.·lbf |



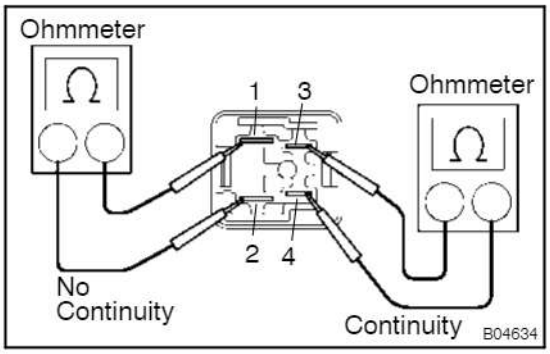

# STARTER RELAY

ST0AD-04

## INSPECTION

**1. REMOVE STARTER RELAY (Marking: "ST")**

Remove the relay box cover and starter relay.



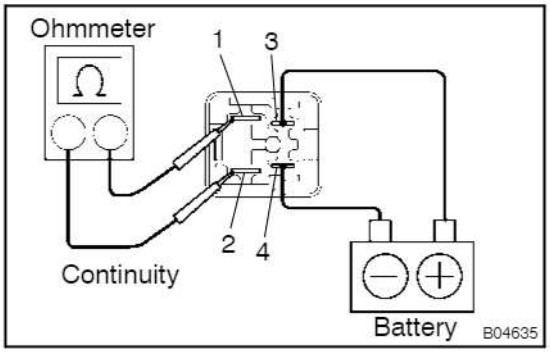

**2. INSPECT RELAY CONTINUITY**

(a) Using an ohmmeter, check that there is continuity between terminals 3 and 4.

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 1 and 2.

If there is continuity, replace the relay.




**3. INSPECT RELAY OPERATION**

(a) Apply battery voltage across terminals 3 and 4.

(b) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

**4. REINSTALL STARTER RELAY**