# 1. General Description

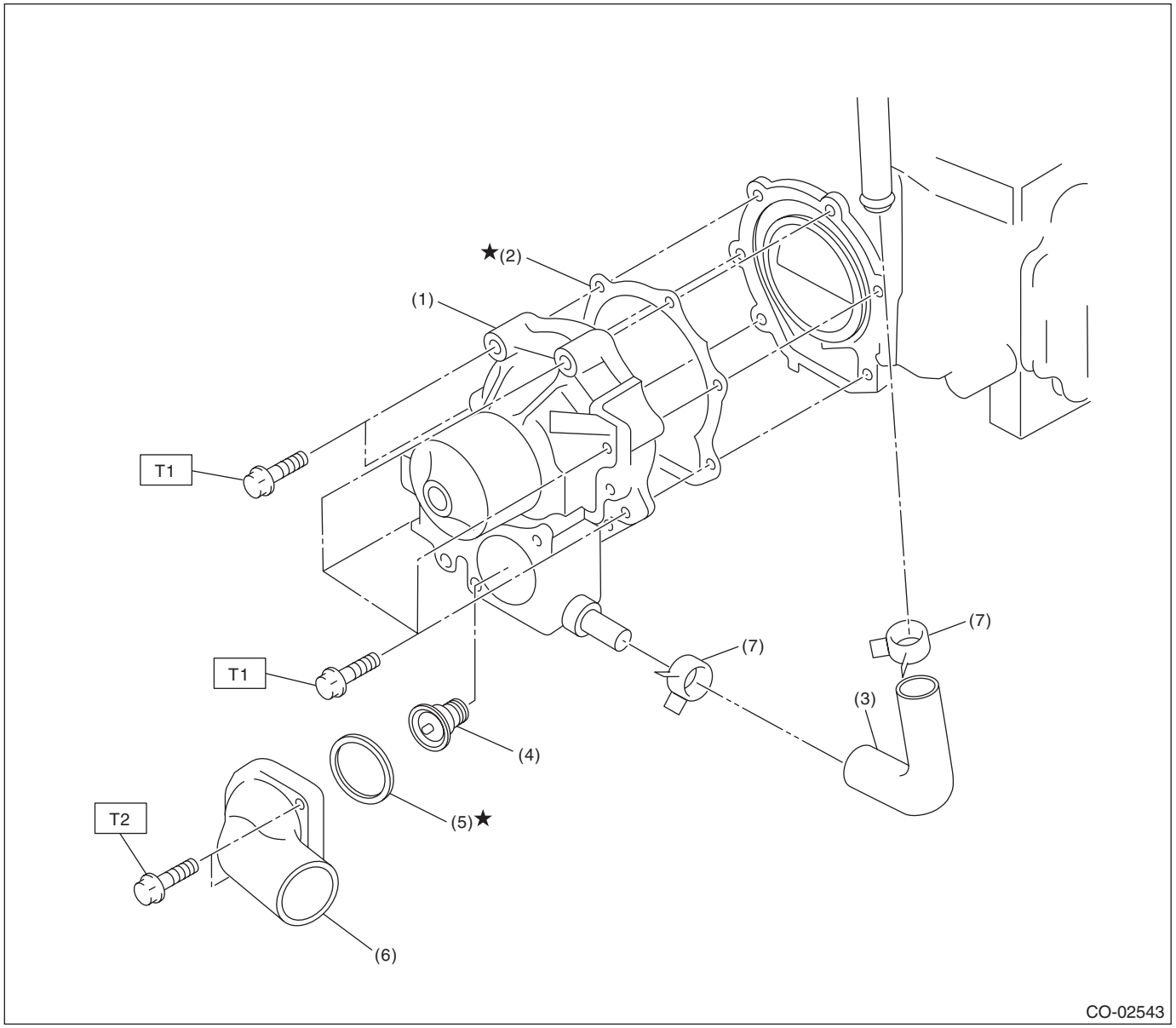
## A: SPECIFICATION

| | | | | |
|---|---|---|---|---|
| Cooling system | | | | Electric fan + Forced engine coolant circulation system |
| Total engine coolant capacity ℓ (US qt, Imp qt) | | | | AT model: Approx. 6.7 (7.1, 5.9) |
| | | | | MT model: Approx. 6.8 (7.2, 6.0) |
| Water pump | Type | | | Centrifugal impeller type |
| | Discharge performance | Discharge rate ℓ (US gal, Imp gal) /min. | | 200 (52.8, 44.0) |
| | | Pump speed — Discharge pressure | | 6,000 rpm — 225.4 kPa (23 mAq) |
| | | Engine coolant temperature | | 80°C (176°F) |
| | Impeller diameter mm (in) | | | 76 (2.99) |
| | Number of impeller vanes | | | 8 |
| | Pump pulley diameter mm (in) | | | 60 (2.36) |
| | Clearance between impeller and case mm (in) | | Standard | 0.5 — 1.5 (0.020 — 0.060) |
| Thermo-stat | Type | | | Wax pellet type |
| | Starting temperature to open | | | 80 — 84°C (176 — 183°F) |
| | Fully opens | | | 95°C (203°F) |
| | Valve lift mm (in) | | | 9.0 (0.354) or more |
| | Valve bore mm (in) | | | 35 (1.38) |
| Radiator fan | Motor input | Main fan | | 90 W |
| | | Sub fan | | 90 W |
| | Fan diameter / Blade | Main fan | | 300 mm (11.81 in)/4 |
| | | Sub fan | | 300 mm (11.81 in)/5 |
| Radiator | Type | | | Down flow, pressure type |
| | Core dimensions | Width × Height × Thickness mm (in) | | 687.4 × 340 × 16 (27.06 × 13.39 × 0.63) |
| | Pressure range in which cap valve is open kPa (kg/cm$^2$, psi) | Above | Standard | 93 — 123 (0.95 — 1.25, 14 — 18) |
| | | | Limit | 83 (0.85, 12) |
| | | Below | Standard | –1.0 to –4.9 or less (–0.01 — –0.05, –0.1 — –0.7) |
| | Fins | | | Corrugated fin type |
| Reservoir tank | Capacity ℓ (US qt, Imp qt) | | | 0.45 (0.48, 0.40) |

| | Recommended materials | Item number | Alternative |
|---|---|---|---|
| Coolant | SUBARU SUPER COOLANT (Concentrated type) | — | — |
| | SUBARU SUPER COOLANT (Diluted type) | K0670Y0001 | |
| Water for dilution | Distilled water | — | Soft water or tap water |
| Cooling system protective agent | Cooling system conditioner | SOA345001 | — |

# B: COMPONENT

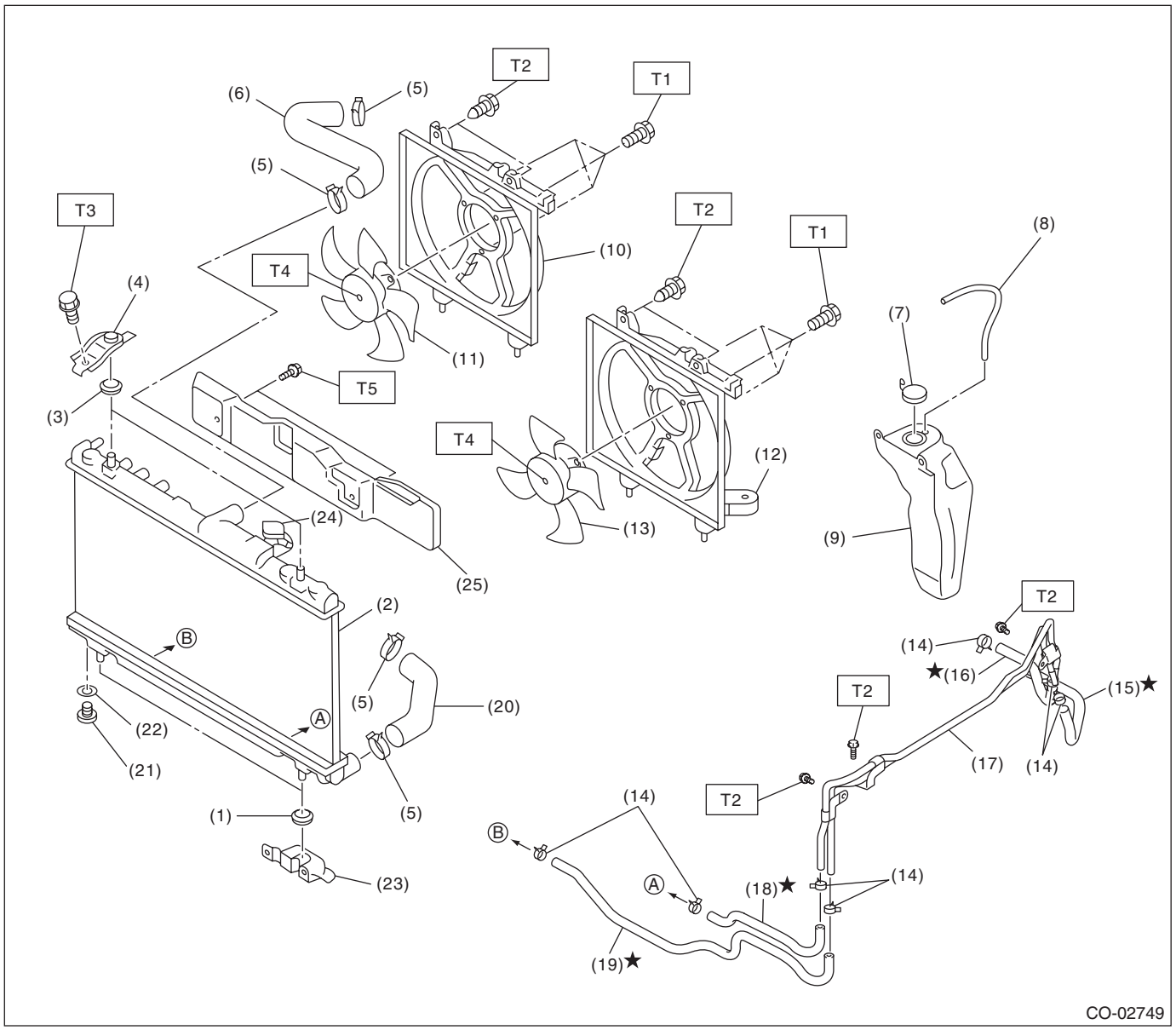
## 1. WATER PUMP




(1) Water pump ASSY
(2) Gasket
(3) Heater by-pass hose
(4) Thermostat
(5) Gasket
(6) Thermostat cover
(7) Clip

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: First 12 (1.2, 8.9)***
***Second 12 (1.2, 8.9)***
***T2: 12 (1.2, 8.9)***

## 2. RADIATOR & RADIATOR FAN




| | | | | | |
|---|---|---|---|---|---|
| (1) | Radiator lower cushion | (12) | Radiator main fan shroud | (23) | Radiator lower bracket |
| (2) | Radiator | (13) | Radiator main fan, main fan motor ASSY | (24) | Radiator cap |
| (3) | Radiator upper cushion | (14) | ATF hose clip (AT model) | (25) | Heat shield cover (AT model) |
| (4) | Radiator upper bracket | (15) | ATF hose A (AT model) | | |
| (5) | Clip | (16) | ATF hose B (AT model) | | |
| (6) | Radiator inlet hose | (17) | ATF pipe (AT model) | | |
| (7) | Engine coolant reservoir tank cap | (18) | ATF hose C (AT model) | | |
| (8) | Over flow hose | (19) | ATF hose D (AT model) | | |
| (9) | Engine coolant reservoir tank | (20) | Radiator outlet hose | | |
| (10) | Radiator sub fan shroud | (21) | Radiator drain plug | | |
| (11) | Radiator sub fan, sub fan motor ASSY | (22) | O-ring | | |

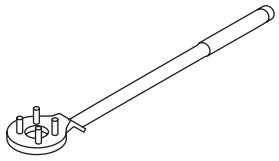
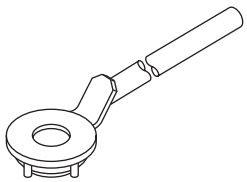
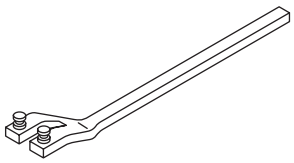
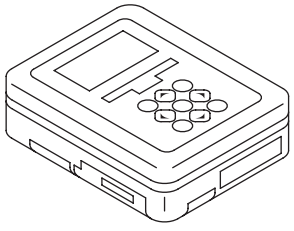
| *Tightening torque:N·m (kgf-m, ft-lb)* |
|---|
| ***T1: 5 (0.5, 3.7)*** |
| ***T2: 7.5 (0.8, 5.5)*** |
| ***T3: 12 (1.2, 8.9)*** |
| ***T4: 3.4 (0.3, 2.5)*** |
| ***T5: 3 (0.3, 2.2)*** |

## C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
• Follow all government and local regulations concerning disposal of refuse when disposing engine coolant.

# D: PREPARATION TOOL

## 1. SPECIAL TOOL

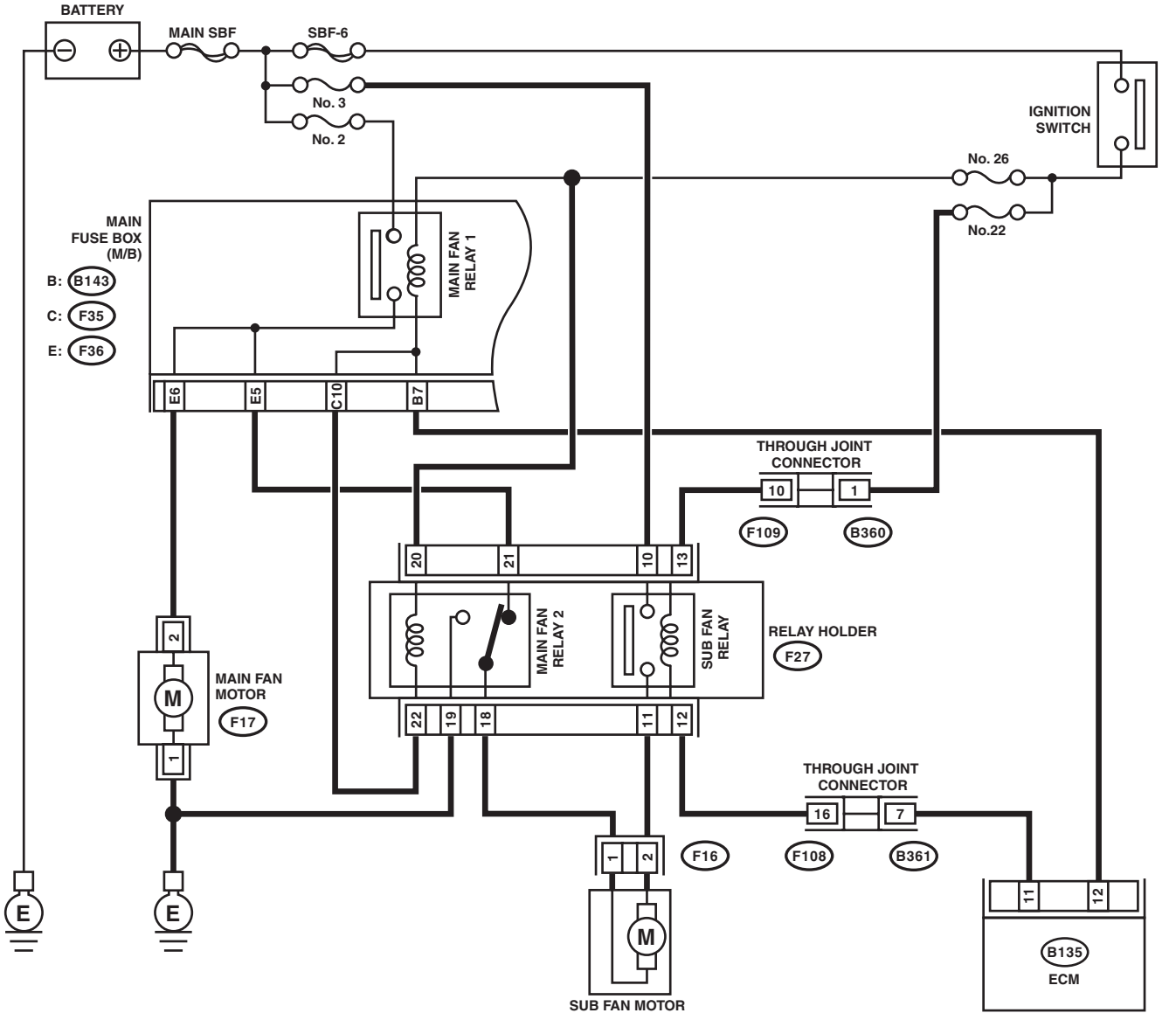
| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-499977100 | 499977100 | CRANK PULLEY WRENCH | Used for removing and installing the crank pulley. (MT model) |
|  ST-499977400 | 499977400 | CRANK PULLEY WRENCH | Used for removing and installing the crank pulley. (AT model) |
|  ST18231AA010 | 18231AA010 | CAM SPROCKET WRENCH | Used for removing and installing cam sprocket.<br>NOTE:<br>CAM SPROCKET WRENCH (499207100) can also be used. |
|  ST1B022XU0 | 1B022XU0 | SUBARU SELECT MONITOR III KIT | Used for troubleshooting the electrical system. |

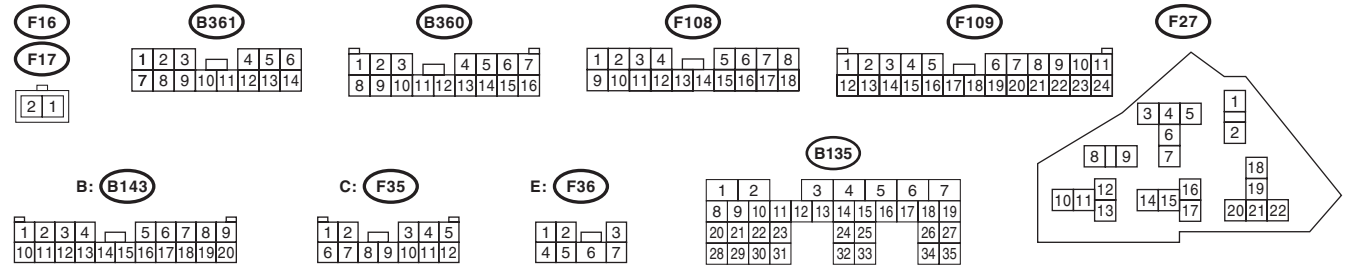
## 2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring resistance and voltage. |
| Radiator cap tester | Used for checking radiator and radiator cap. |

# 2. Radiator Fan System

## A: WIRING DIAGRAM




CO-02743

# B: INSPECTION

**Operating condition:**

| Vehicle speed | A/C compressor load | Engine coolant temperature | | |
|---|---|---|---|---|
| | | Increase: 95°C (203°F) or less<br>Decrease: 92°C (198°F) or less | Increase: 96 — 99°C (205 — 210°F)<br>Decrease: 93 — 94°C (199 — 201°F) | Increase: 100°C (212°F) or more<br>Decrease: 95°C (203°F) or more |
| | | Radiator fan operation | Radiator fan operation | Radiator fan operation |
| During acceleration:<br>19 km/h (12 MPH) or less<br>During deceleration:<br>10 km/h (6 MPH) or less | OFF | OFF | Low-Speed | High-Speed |
| | Low | Low-Speed | Low-Speed | High-Speed |
| | High | High-Speed | High-Speed | High-Speed |
| During acceleration:<br>20 — 69 km/h (12 — 43 MPH)<br>During deceleration:<br>11 — 64 km/h (7 — 40 MPH) | OFF | OFF | Low-Speed | High-Speed |
| | Low | High-Speed | High-Speed | High-Speed |
| | High | High-Speed | High-Speed | High-Speed |
| During acceleration: 70 — 134 km/h (43 — 83 MPH)<br>During deceleration: 65 — 129 km/h (40 — 80 MPH) | OFF | OFF | Low-Speed | High-Speed |
| | Low | OFF | Low-Speed | High-Speed |
| | High | Low-Speed | High-Speed | High-Speed |
| During acceleration: 135 km/h (84 MPH) or more<br>During deceleration: 130 km/h (81 MPH) or more | OFF | OFF | OFF | High-Speed |
| | Low | OFF | Low-Speed | High-Speed |
| | High | OFF | Low-Speed | High-Speed |

**DIAGNOSIS:**

Radiator main fan and radiator sub fans do not rotate under the above operating conditions.

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OPERATION OF RADIATOR FAN.**<br>1) Connect the delivery (test) mode connector.<br>2) Turn the ignition switch to ON.<br>3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay.<br>NOTE:<br>• When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.<br>• Subaru Select Monitor<br>Refer to “Compulsory Valve Operation Check Mode” for detailed procedures. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Do the radiator main fans and radiator sub fans rotate at low speed? | Go to step **2**. | Go to step **3**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK OPERATION OF RADIATOR FAN.**<br>1) Connect the delivery (test) mode connector.<br>2) Turn the ignition switch to ON.<br>3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay.<br>NOTE:<br>• When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.<br>• Subaru Select Monitor<br>Refer to "Compulsory Valve Operation Check Mode" for detailed procedures. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Do the radiator main fans and radiator sub fans rotate at high speed? | Radiator main fan system is normal. | Go to step **27**. |
| 3 | **CHECK POWER SUPPLY TO SUB FAN RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the sub fan relay from the relay holder.<br>3) Measure the voltage between the sub fan relay terminal and chassis ground.<br>***Connector & terminal***<br>***(F27) No. 10 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **4**. | Go to step **5**. |
| 4 | **CHECK POWER SUPPLY TO SUB FAN RELAY.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between the sub fan relay terminal and chassis ground.<br>***Connector & terminal***<br>***(F27) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **7**. | Go to step **6**. |
| 5 | **CHECK FUSE.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the fuse No. 3.<br>3) Check the condition of fuse. | Is the fuse blown out? | Replace the fuse. | Repair the power supply line. |
| 6 | **CHECK FUSE.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the fuse No. 22.<br>3) Check the condition of fuse. | Is the fuse blown out? | Replace the fuse. | Repair the power supply line. |
| 7 | **CHECK SUB FAN RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between sub fan relay terminals.<br>***Terminals***<br>***No. 10 — No. 11:*** | Is the resistance 1 MΩ or more? | Go to step **8**. | Replace the sub fan relay. <Ref. to AC-38, Relay and Fuse.> |
| 8 | **CHECK SUB FAN RELAY.**<br>1) Connect the battery to terminals No. 13 and No. 12 of the sub fan relay.<br>2) Measure the resistance between sub fan relay terminals.<br>***Terminals***<br>***No. 10 — No. 11:*** | Is the resistance less than 1 Ω? | Go to step **9**. | Replace the sub fan relay. <Ref. to AC-38, Relay and Fuse.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 9 | **CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.**<br>1) Disconnect the connector from the sub fan motor.<br>2) Measure the resistance of the harness between the sub fan relay terminal and sub fan motor connector.<br>***Connector & terminal***<br>***(F16) No. 2 — (F27) No. 11:*** | Is the resistance less than 1 Ω? | Go to step **10**. | Repair the open circuit of the harness between the sub fan relay terminal and sub fan motor connector. |
| 10 | **CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.**<br>1) Remove main fan relay 2 from the relay holder.<br>2) Measure the resistance of the harness between the sub fan motor connector and main fan relay 2 connector.<br>***Connector & terminal***<br>***(F16) No. 1 — (F27) No. 18:*** | Is the resistance less than 1 Ω? | Go to step **11**. | Repair the open circuit of the harness between the sub fan motor connector and main fan relay 2 connector. |
| 11 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of the sub fan motor connector. | Is there poor contact of sub fan motor connector? | Repair the poor contact of the sub fan motor connector. | Go to step **12**. |
| 12 | **CHECK SUB FAN MOTOR.**<br>Connect the battery positive (+) terminal to terminal No. 2 of the sub fan motor, and the ground (–) terminal to terminal No. 1. | Does the radiator sub fan rotate? | Go to step **13**. | Replace the sub fan motor. <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.> |
| 13 | **CHECK MAIN FAN RELAY 2.**<br>Measure the resistance of main fan relay 2.<br>***Terminals***<br>***No. 21 — No. 18:*** | Is the resistance less than 1 Ω? | Go to step **14**. | Replace the main fan relay 2. <Ref. to AC-38, Relay and Fuse.> |
| 14 | **CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.**<br>1) Disconnect the connector from the main fan motor.<br>2) Measure the resistance of the harness between the main fan relay 2 terminal and main fan motor connector.<br>***Connector & terminal***<br>***(F17) No. 2 — (F27) No. 21:*** | Is the resistance less than 1 Ω? | Go to step **15**. | Repair the open circuit of the harness between the main fan relay 2 terminal and main fan motor connector. |
| 15 | **CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.**<br>Measure the resistance between the main fan motor connector and chassis ground.<br>***Connector & terminal***<br>***(F17) No. 1 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **16**. | Repair the open circuit of the harness between main fan motor connector and chassis ground. |
| 16 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of the main fan motor connector. | Is there poor contact of the main fan motor connector? | Repair the poor contact of the main fan motor connector. | Go to step **17**. |
| 17 | **CHECK MAIN FAN MOTOR.**<br>Connect the battery positive (+) terminal to terminal No. 2 of the main fan motor, and the ground (–) terminal to terminal No. 1. | Does the radiator main fan rotate? | Go to step **18**. | Replace the main fan motor. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 18 | **CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.**<br>1) Disconnect the connector from ECM.<br>2) Measure the resistance between the sub fan relay terminal and ECM connector.<br>***Connector & terminal***<br>***(B135) No. 11 — (F27) No. 12:*** | Is the resistance less than 1 Ω? | Go to step **19**. | Repair the open circuit of harness between sub fan relay terminal and ECM. |
| 19 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Check the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).> |
| 20 | **CHECK MAIN FAN RELAY 1.**<br>1) Turn the ignition switch to OFF.<br>2) Remove main fan relay 1 from the main fuse box.<br>3) Measure the resistance at the main fan relay 1 switch. | Is the resistance 1 MΩ or more? | Go to step **21**. | Replace the main fan relay 1. <Ref. to AC-38, Relay and Fuse.> |
| 21 | **CHECK MAIN FAN RELAY 1.**<br>1) Connect the main fan relay 1 coil side terminal to the battery.<br>2) Measure the resistance between terminals at main fan relay 1 switch side. | Is the resistance less than 1 Ω? | Go to step **22**. | Replace the main fan relay 1. <Ref. to AC-38, Relay and Fuse.> |
| 22 | **CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.**<br>1) Disconnect the connector from the main fan motor.<br>2) Measure the resistance of the harness between the main fan relay 1 terminal and main fan motor connector.<br>***Connector & terminal***<br>***(F17) No. 2 — (F36) No. 6:*** | Is the resistance less than 1 Ω? | Go to step **23**. | Repair the open circuit of the harness between the main fan relay 1 terminal and main fan motor connector. |
| 23 | **CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.**<br>1) Disconnect the connector from ECM.<br>2) Measure the resistance between the main fan relay 1 terminal and ECM connector.<br>***Connector & terminal***<br>***(B135) No. 12 — (B143) No. 7:*** | Is the resistance less than 1 Ω? | Go to step **24**. | Repair the open circuit of the harness between main fan relay 1 terminal and ECM. |
| 24 | **CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.**<br>Measure the resistance between the main fan relay 2 terminal and ECM connector.<br>***Connector & terminal***<br>***(B135) No. 12 — (F27) No. 22:*** | Is the resistance less than 1 Ω? | Go to step **25**. | Repair the open circuit of the harness between main fan relay 2 terminal and ECM. |
| 25 | **CHECK FUSE.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the fuse No. 2 and 26.<br>3) Check the condition of fuse. | Is the fuse blown out? | Replace the fuse. | Go to step **26**. |
| 26 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Repair the power supply circuit to the main fuse box. |
| 27 | **CHECK OPERATION OF RADIATOR FAN.**<br>If the both radiator fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating. | Does the radiator sub fan rotate? | Go to step **20**. | Go to step **28**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 28 | **CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.**<br>1) Remove main fan relay 2 from the relay holder.<br>2) Measure the resistance between main fan relay 2 terminal and chassis ground.<br>***Connector & terminal***<br>***(F27) No. 19 — Chassis ground:*** | Is the resistance less than 1 Ω? | Go to step **29**. | Repair the open circuit of the harness between main fan relay 2 terminal and chassis ground. |
| 29 | **CHECK POWER SUPPLY TO MAIN FAN RELAY 2.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between main fan relay 2 terminal and chassis ground.<br>***Connector & terminal***<br>***(F27) No. 20 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **30**. | Repair the power supply line. |
| 30 | **CHECK MAIN FAN RELAY 2.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the main fan relay 2.<br>3) Measure the resistance of main fan relay 2.<br>***Terminals***<br>***(F27) No. 18 — (F27) No. 19:*** | Is the resistance 1 MΩ or more? | Go to step **31**. | Replace the main fan relay 2. <Ref. to AC-38, Relay and Fuse.> |
| 31 | **CHECK MAIN FAN RELAY 2.**<br>1) Connect the battery to terminals No. 20 and No. 22 of the main fan relay 2.<br>2) Measure the resistance of main fan relay 2.<br>***Terminals***<br>***(F27) No. 18 — (F27) No. 19:*** | Is the resistance less than 1 Ω? | Go to step **23**. | Replace the main fan relay 2. <Ref. to AC-38, Relay and Fuse.> |

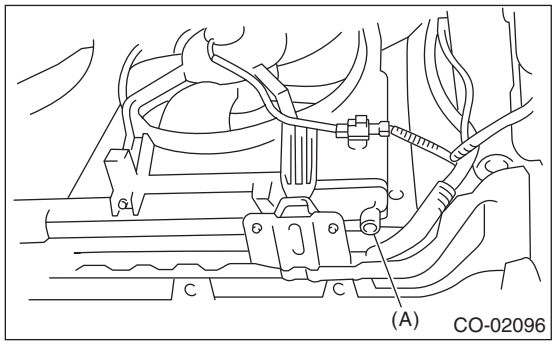
# 3. Engine Coolant

## A: REPLACEMENT

### 1. DRAINING OF ENGINE COOLANT

1) Lift up the vehicle.
2) Remove the under cover RH. <Ref. to EI-24, REMOVAL, Front Under Cover.>
3) Remove the drain plug (A) to drain engine coolant into container.

NOTE:
Remove the radiator cap so that engine coolant will drain faster.




4) Install the drain plug.
5) Install the under cover RH. <Ref. to EI-24, INSTALLATION, Front Under Cover.>

### 2. FILLING OF ENGINE COOLANT

1) Pour cooling system conditioner through the filler neck.

***Cooling system protective agent:***
***Refer to "SPECIFICATION" for cooling system protective agent. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>***

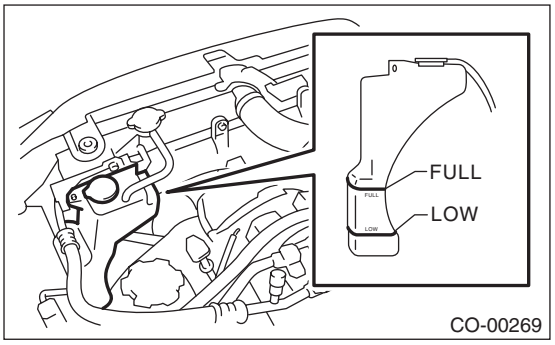
2) Pour engine coolant into the radiator up to the filler neck position.

***Recommended engine coolant:***
***Refer to "SPECIFICATION" for recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>***

***Engine coolant level:***
***Refer to "SPECIFICATION" for engine coolant level. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>***

***Engine coolant concentration:***
***Refer to "ADJUSTMENT" for the recommended engine coolant concentration. <Ref. to CO(H4SO)-14, ADJUSTMENT, Engine Coolant.>***

NOTE:
The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Always use SUBARU Super Coolant, since other coolant may cause corrosion.
3) Fill engine coolant into the reservoir tank up to "FULL" level.




4) Close the radiator cap and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)
5) Wait for one minute after the engine stops, and open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.
6) Perform the procedures 4) and 5) again.
7) Attach the radiator cap and reservoir tank cap properly.
8) Start the engine and operate the heater at maximum hot position and the blower speed setting to "LO".
9) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

NOTE:
Be careful with the engine coolant temperature gauge to prevent overheating.
10) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11) Open the radiator cap. If the engine coolant level drops, add engine coolant into the radiator up to the filler neck position and the reservoir tank to "FULL" level.
12) Attach the radiator cap correctly.
13) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard from the heater core, repeat the procedures from step 9).

# B: ADJUSTMENT

## 1. PROCEDURE TO ADJUST THE SUBARU SUPER COOLANT CONCENTRATION

**CAUTION:**
**Use the SUBARU Super Coolant with a 50 — 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.**
To adjust the concentration of SUBARU Super Coolant according to temperature, find the proper SUBARU Super Coolant concentration in the table, and add dilution water to the SUBARU Super Coolant (concentrated type) until it reaches the proper dilution.

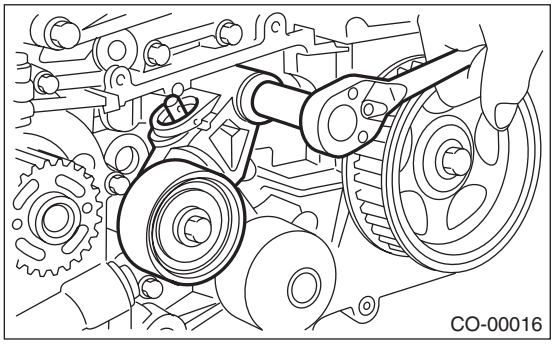
| Relationship of SUBARU Super Coolant concentration and freezing temperature | | | |
|---|---|---|---|
| SUBARU Super Coolant concentration | 50% | 55% | 60% |
| Freezing temperature | –36°C (–33°F) | –41°C (–42°F) | –50°C (–58°F) |

***Engine coolant and diluting water:***
***Refer to "SPECIFICATION" for recommended engine coolant and diluting water. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>***

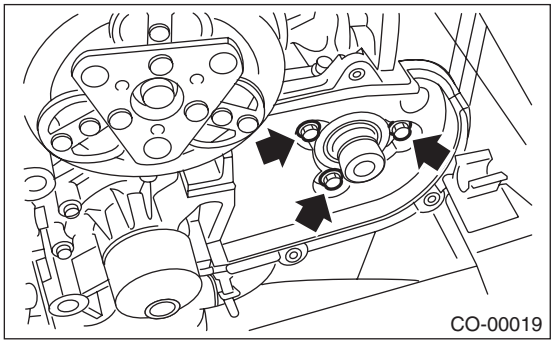
# 4. Water Pump

## A: REMOVAL

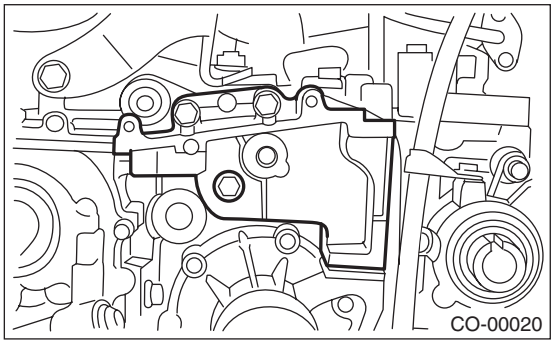
1) Remove the radiator. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
2) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-50, TIMING BELT, REMOVAL, Timing Belt.>
6) Remove the automatic belt tension adjuster.


CO-00016

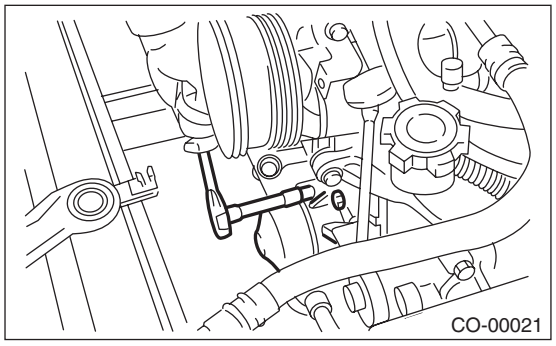
7) Remove the camshaft position sensor. <Ref. to FU(H4SO)-28, REMOVAL, Camshaft Position Sensor.>
8) Remove the cam sprocket LH. <Ref. to ME(H4SO)-55, REMOVAL, Cam Sprocket.>
9) Remove the belt cover LH No. 2.


CO-00019

10) Remove the tensioner bracket.


CO-00020

11) Disconnect the hose from water pump.
12) Remove the water pump.

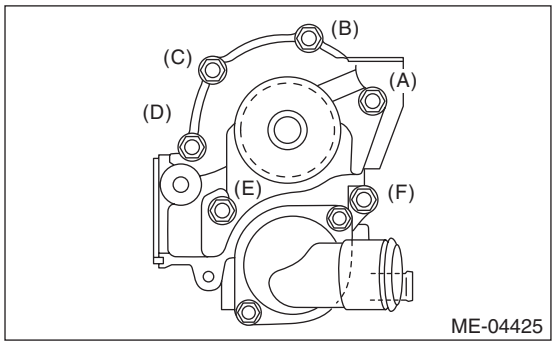

CO-00021

## B: INSTALLATION

1) Install the water pump onto cylinder block LH.

NOTE:
- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

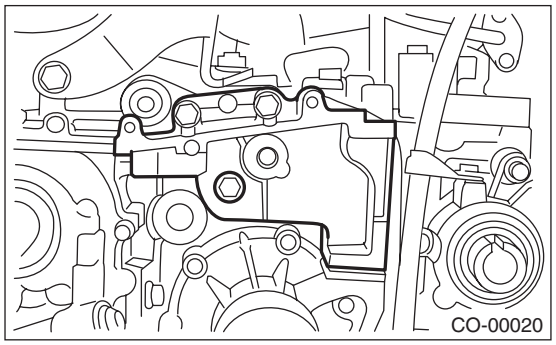
***Tightening torque:***
***1st***
***12 N·m (1.2 kgf-m, 8.9 ft-lb)***
***Second***
***12 N·m (1.2 kgf-m, 8.9 ft-lb)***



ME-04425

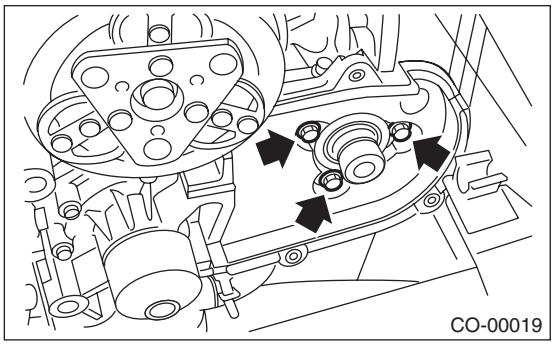
2) Install the hose to water pump.
3) Install the tensioner bracket.

***Tightening torque:***
***24.5 N·m (2.5 kgf-m, 18.1 ft-lb)***


CO-00020

4) Install the belt cover No. 2 LH.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***

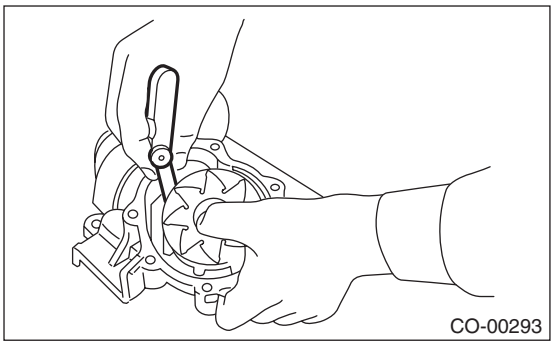



5) Install the cam sprocket LH. <Ref. to ME(H4SO)-55, INSTALLATION, Cam Sprocket.>
6) Install the camshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
7) Install an automatic belt tension adjuster with the tension rod held by a pin. <Ref. to ME(H4SO)-51, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
8) Install the timing belt. <Ref. to ME(H4SO)-52, TIMING BELT, INSTALLATION, Timing Belt.>
9) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
10) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
11) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>
12) Install the radiator. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>

## C: INSPECTION

1) Check the water pump bearing for smooth rotation.
2) Check the water pump pulley for abnormalities.
3) Make sure the impeller is not abnormally deformed or damaged.
4) Inspect the clearance between impeller and pump case.

***Clearance between impeller and pump case:***
***Standard***
***0.5 — 1.5 mm (0.020 — 0.060 in)***

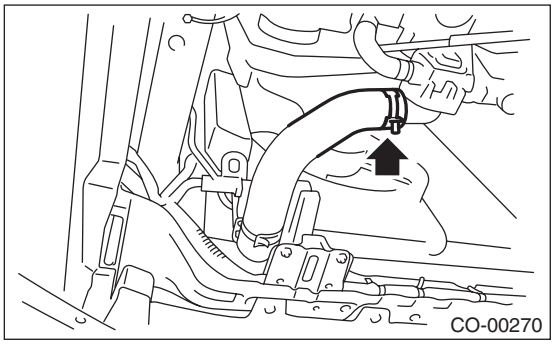



5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

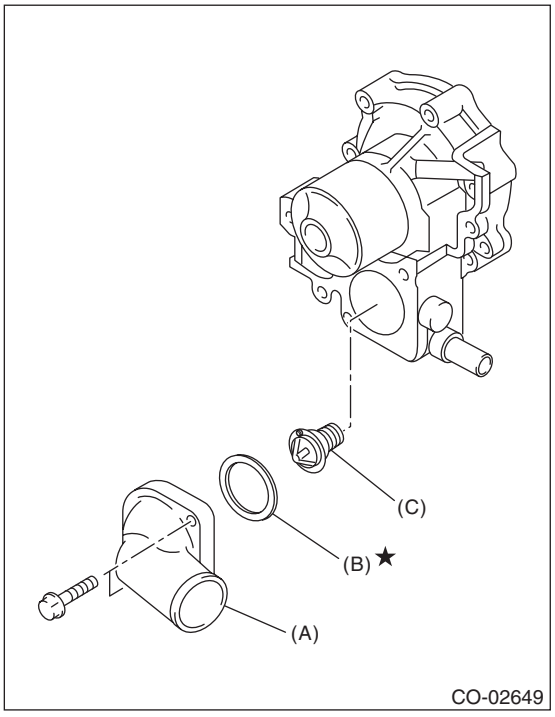
# 5. Thermostat

## A: REMOVAL

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the radiator outlet hose from thermostat cover.




5) Remove the thermostat cover, and then remove the gasket and thermostat.




(A) Thermostat cover
(B) Gasket
(C) Thermostat

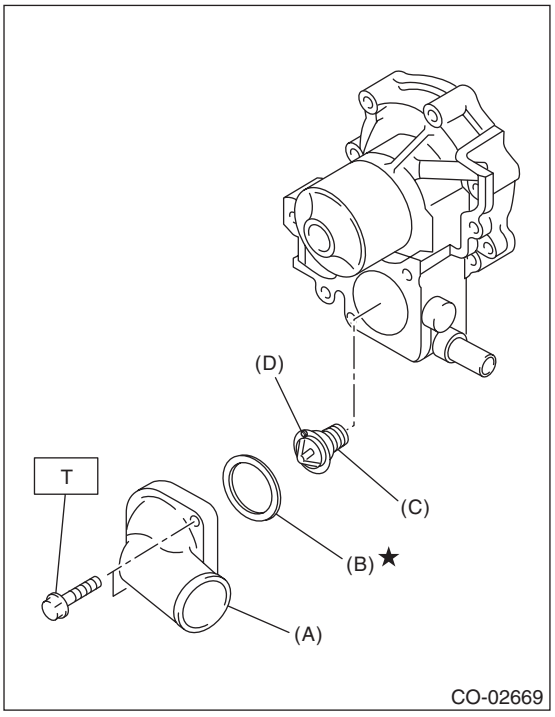
## B: INSTALLATION

1) Install a gasket to thermostat.

NOTE:
Use a new gasket.
2) Install the thermostat and thermostat cover.

NOTE:
Install with the jiggle pin facing upward.

***Tightening torque:***
***12 N·m (1.2 kgf-m, 8.9 ft-lb)***




(A) Thermostat cover
(B) Gasket
(C) Thermostat
(D) Jiggle pin

3) Connect the radiator outlet hose to thermostat cover.
4) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

## C: INSPECTION

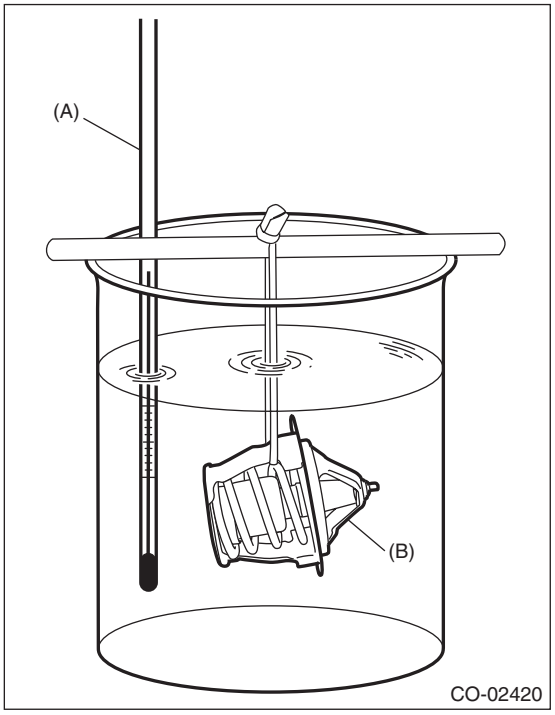
1) Check that the thermostat does not have deformation, cracks or damage.
2) Check that the thermostat valve closes completely at an ambient temperature.
3) Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened. Replace the thermostat if faulty.

NOTE:
• During the test, agitate the water for even temperature distribution.
• Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
• Hold the thermostat with a wire or the like to avoid contacting the container.

***Starting temperature to open:***
***80 — 84°C (176 — 183°F)***

***Full open temperature:***
***95°C (203°F)***

***Total valve lift:***
***9.0 mm (0.354 in) or more***



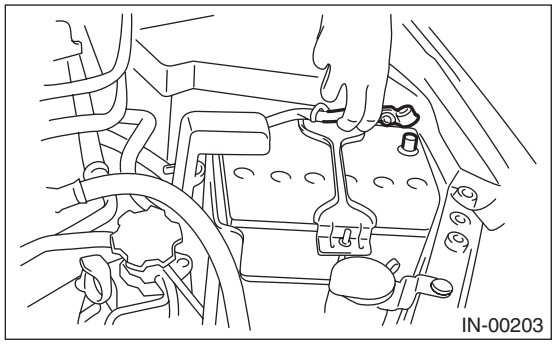

(A) Thermometer
(B) Thermostat

# 6. Radiator

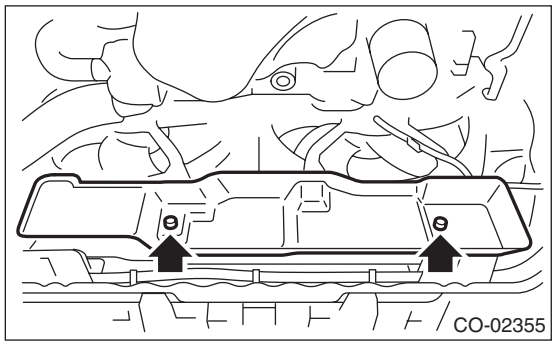
## A: REMOVAL

**CAUTION:**
**The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.**

1) Disconnect the ground cable from battery.

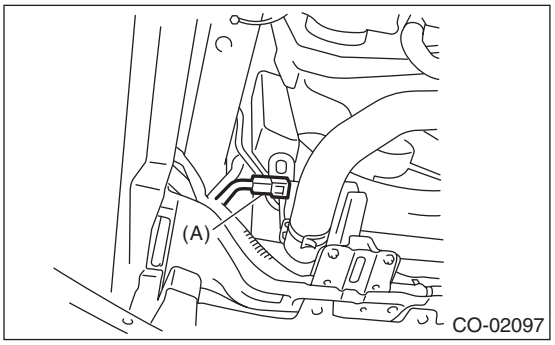


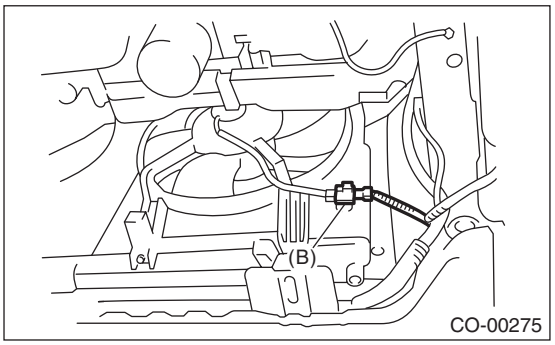

2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
4) Remove the heat shield cover from radiator. (AT model)



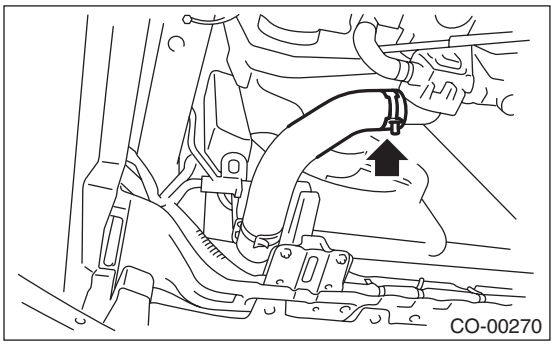

5) Drain engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

6) Disconnect the main fan motor assembly connector (A) and sub fan motor assembly connector (B).



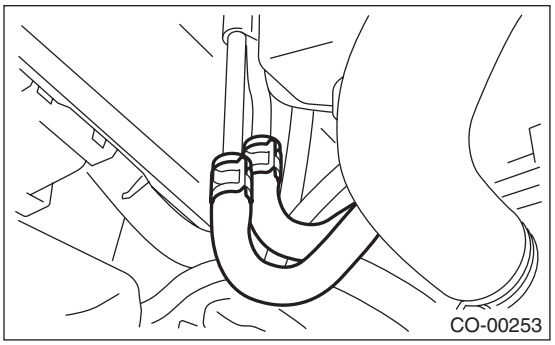




7) Disconnect the radiator outlet hose from thermostat cover.

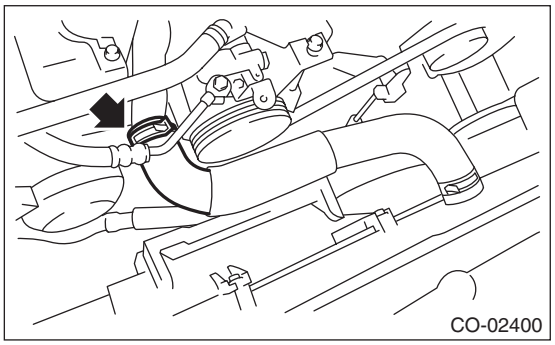



8) Disconnect the ATF cooler hoses from ATF pipes. (AT model)

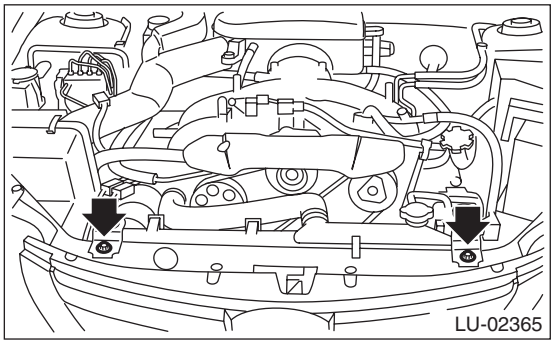
NOTE:
Plug the ATF pipe to prevent ATF from leaking.



9) Lower the vehicle.
10) Disconnect the over flow hose.
11) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>
12) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
13) Disconnect the radiator inlet hose from engine.


CO-02400

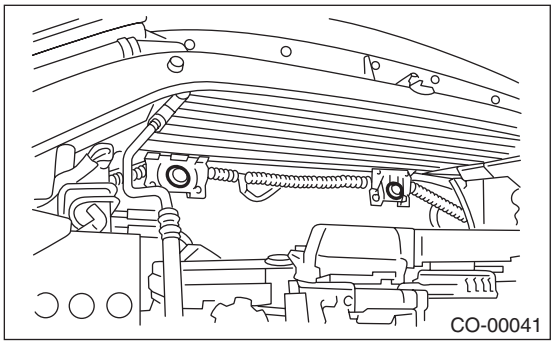
14) Remove the radiator upper brackets.


LU-02365

15) Lift the radiator up and remove the radiator from vehicle.

## B: INSTALLATION

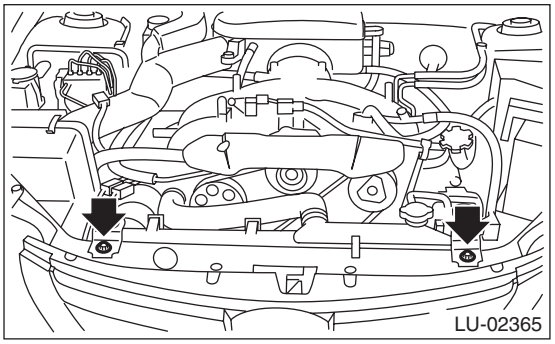
1) Attach the radiator lower cushion to the hole on the radiator lower bracket.


CO-00041

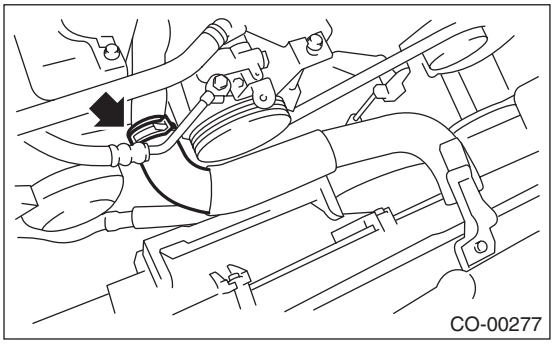
2) Install the radiator to vehicle.

NOTE:
Make pins on the lower side of radiator be fitted into the radiator lower cushions.
3) Install the radiator upper brackets.

***Tightening torque:***
***12 N·m (1.2 kgf-m, 8.9 ft-lb)***

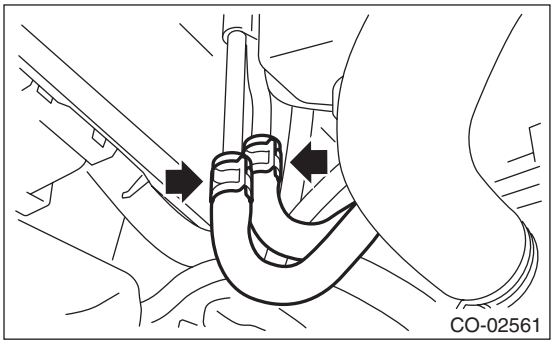

LU-02365

4) Connect the radiator inlet hose.

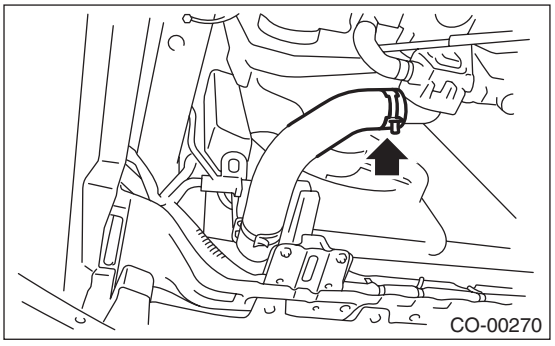

CO-00277

5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
6) Install the reservoir tank. <Ref. to CO(H4SO)-27, INSTALLATION, Reservoir Tank.>
7) Connect the over flow hose.
8) Lift up the vehicle.
9) Connect the ATF hoses. (AT model)

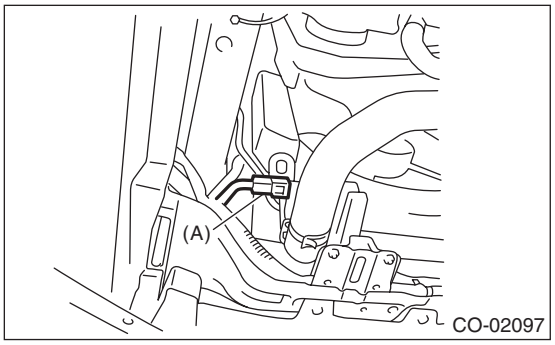
NOTE:
Use a new ATF hose.

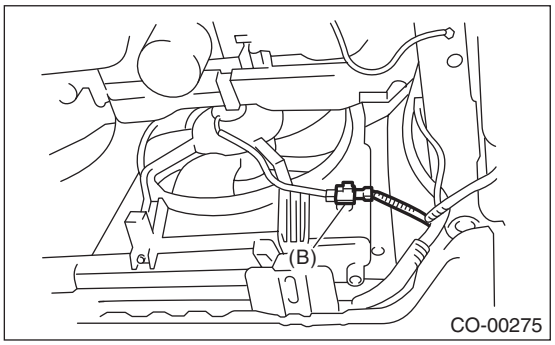

CO-02561

10) Connect the radiator outlet hose.


CO-00270

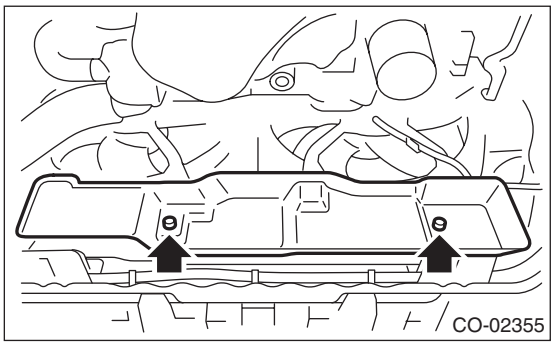
11) Connect the main fan motor assembly connector (A) and sub fan motor assembly connector (B).



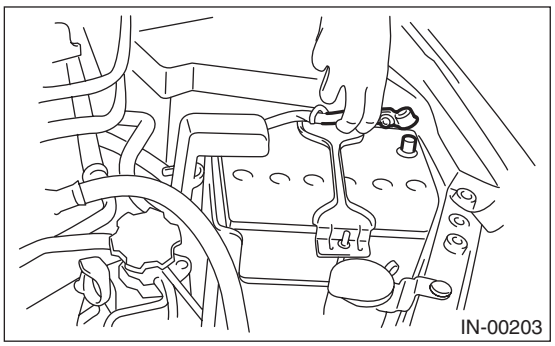




12) Install the heat shield cover. (AT model)

***Tightening torque:***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***



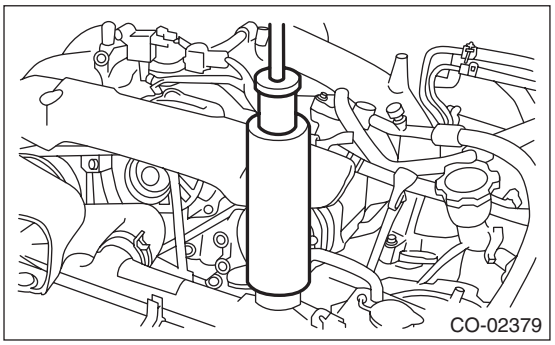

13) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
14) Lower the vehicle.
15) Connect the battery ground terminal.




16) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
17) Check the ATF level. (AT model) <Ref. to 4AT-26, INSPECTION, Automatic Transmission Fluid.>

## C: INSPECTION

1) Check that the radiator does not have deformation, cracks or damage.
2) Check that the hose has no cracks, damage or loose part.
3) Remove the radiator cap, fill the radiator with engine coolant, and then install the radiator cap tester to the filler neck of radiator.



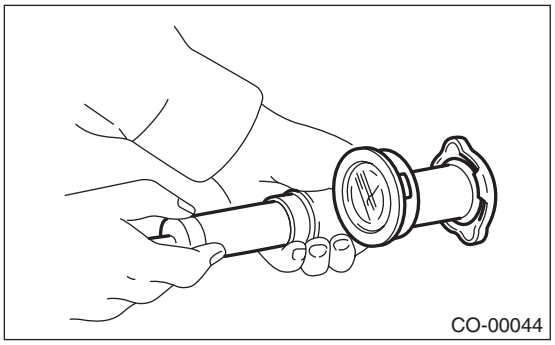

4) Apply a pressure of 157 kPa (1.6 kg/cm$^2$, 23 psi) to the radiator and check the following points:
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

**CAUTION:**
- **Engine should be turned off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful of engine coolant from spurting out when removing the radiator cap tester.**
- **Be careful not to deform the filler neck of radiator when installing and removing the radiator cap tester.**

# 7. Radiator Cap

## A: INSPECTION

1) Check that the radiator cap does not have deformation, cracks or damage.
2) Attach the radiator cap tester to radiator cap.




3) Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the cap if it is opened under a pressure less than the service limit value.

***Standard:***
***93 — 123 kPa (0.95 — 1.25 kg/cm$^2$, 14 — 18 psi)***

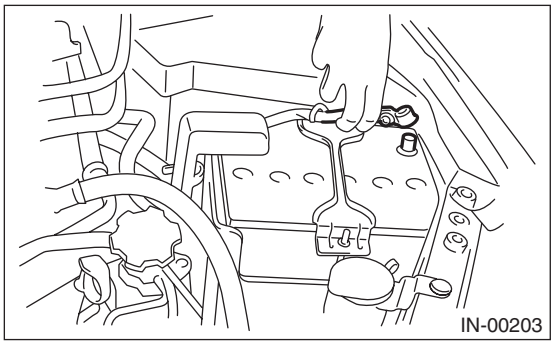
***Service limit:***
***83 kPa (0.85 kg/cm$^2$, 12 psi)***

**CAUTION:**
**Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.**

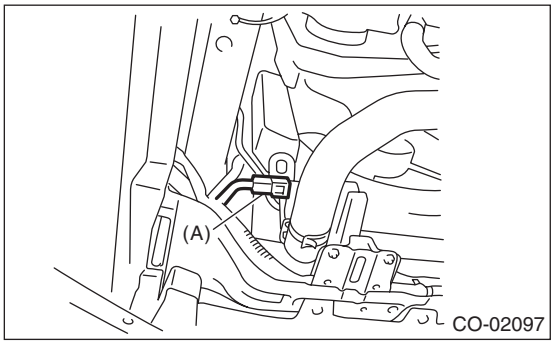
# 8. Radiator Main Fan and Fan Motor

## A: REMOVAL

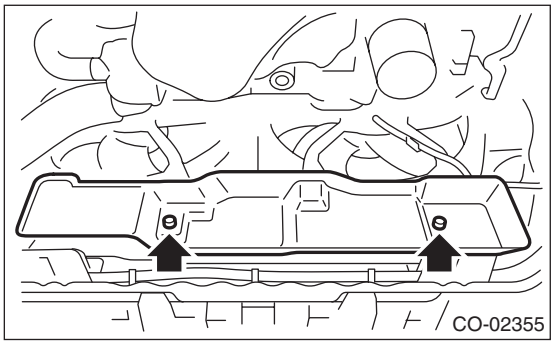
1) Disconnect the ground cable from battery.



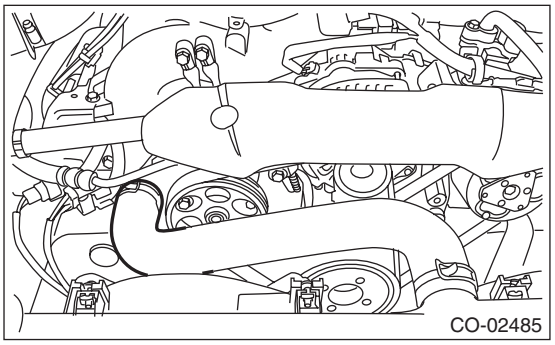

2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
4) Disconnect the connector (A) of the main fan motor assembly.



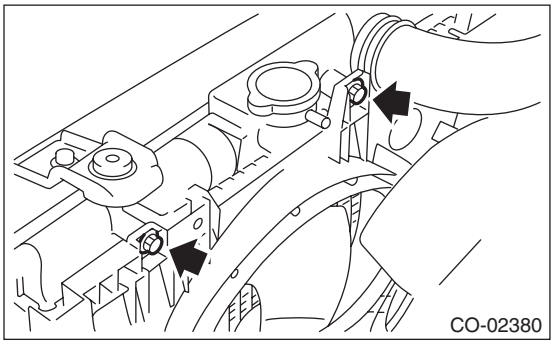

5) Remove the heat shield cover. (AT model)




6) Remove the ATF hose from the clip of the radiator main fan shroud. (AT model)
7) Lower the vehicle.
8) Drain approximately 2 ℓ of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
9) Disconnect the radiator inlet hose from engine side.




10) Disconnect the over flow hose.
11) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>
12) Remove the bolts which hold the radiator main fan shroud onto the radiator.



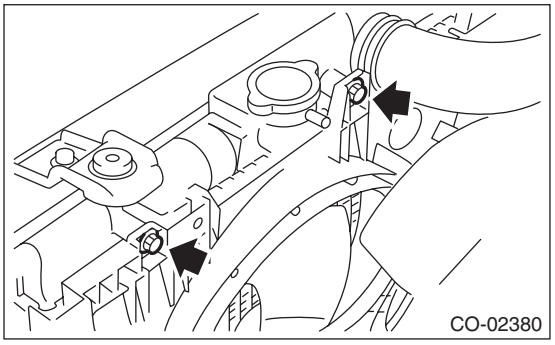

13) Remove the radiator main fan and fan motor from the vehicle.

## B: INSTALLATION

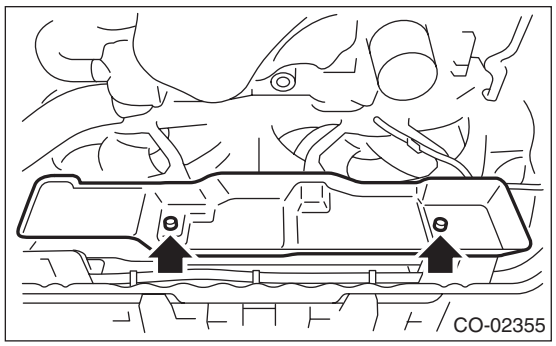
**CAUTION:**
**Check if the radiator hose and the over flow hose are properly connected.**
Install in the reverse order of removal.

NOTE:
If the installation of the radiator main fan and fan motor is difficult, attempt installation after loosening the bolts which hold the radiator sub fan shroud to the radiator.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***

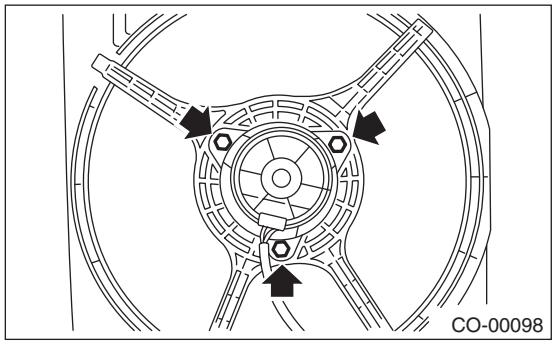


***Tightening torque:***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***




## C: DISASSEMBLY

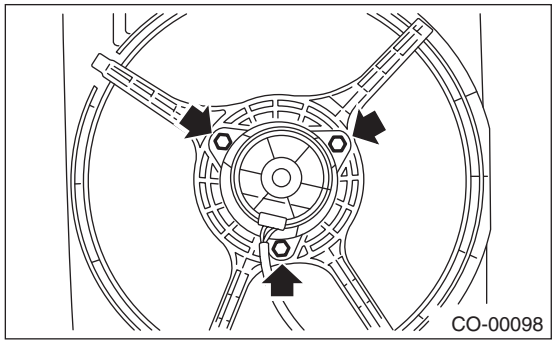
1) Remove the clip which holds the main fan motor assembly connector onto the radiator main fan shroud.
2) Remove the bolts which hold the main fan motor assembly onto the radiator main fan shroud.




## D: ASSEMBLY

Assemble in the reverse order of disassembly.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***



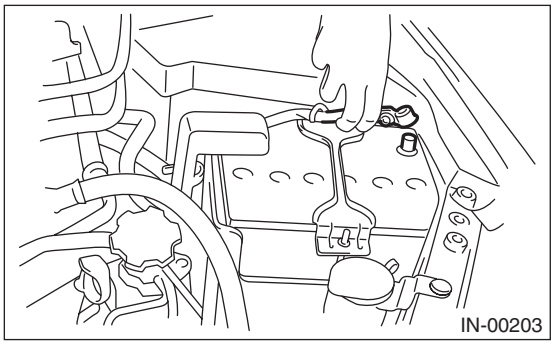

## E: INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor assembly do not have deformation, cracks or damage.

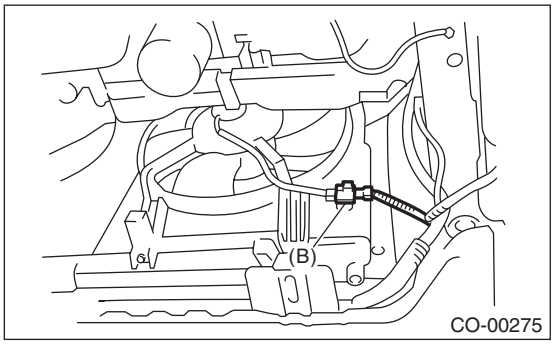
# 9. Radiator Sub Fan and Fan Motor

## A: REMOVAL

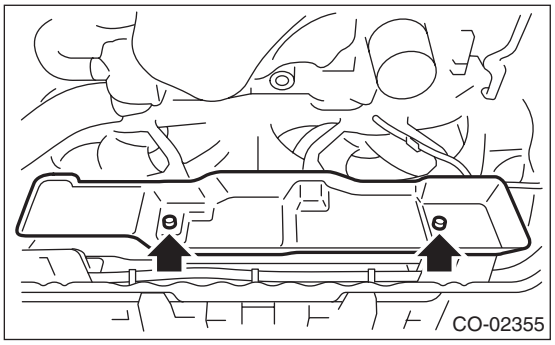
1) Disconnect the ground cable from battery.



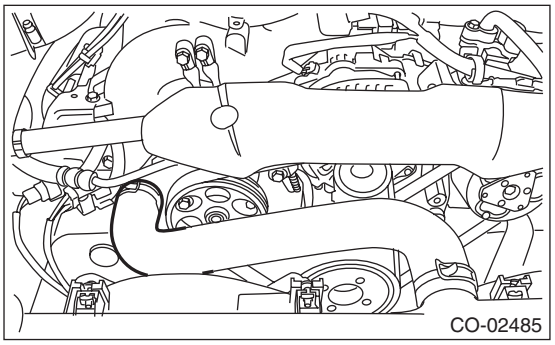

2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
4) Remove the connector (B) of sub fan motor assembly.



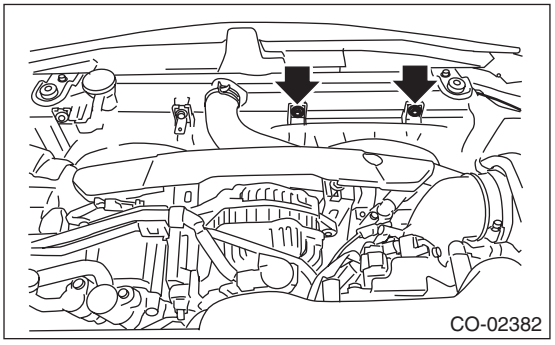

5) Remove the heat shield cover. (AT model)




6) Remove the ATF hose from the clip of the radiator sub fan shroud. (AT model)
7) Lower the vehicle.
8) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
9) Drain approximately 2 ℓ of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
10) Disconnect the radiator inlet hose from engine side.




11) Remove the bolts which hold the radiator sub fan shroud onto the radiator.

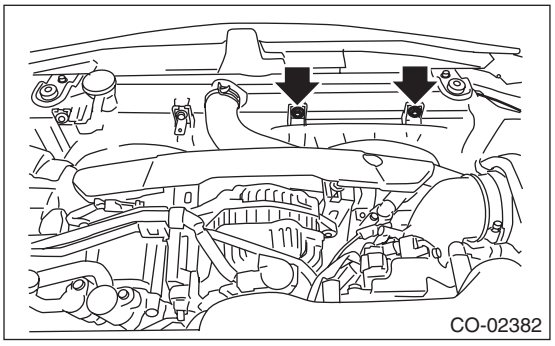



12) Remove the radiator sub fan and fan motor from vehicle.

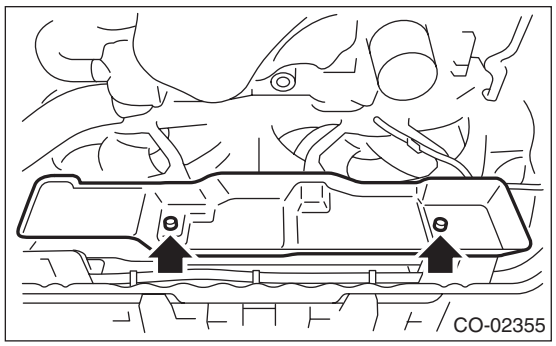
## B: INSTALLATION

**CAUTION:**
**Confirm that the radiator hose is securely connected.**
Install in the reverse order of removal.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***

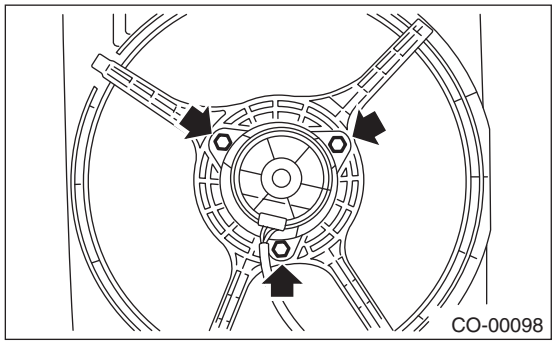


***Tightening torque:***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***




## C: DISASSEMBLY

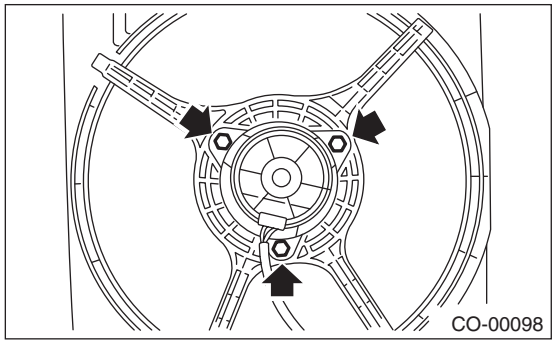
1) Remove the clip which holds the sub fan motor assembly connector onto the radiator sub fan shroud.
2) Remove the bolts which hold the sub fan motor assembly onto the radiator sub fan shroud.




## D: ASSEMBLY

Assemble in the reverse order of disassembly.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***



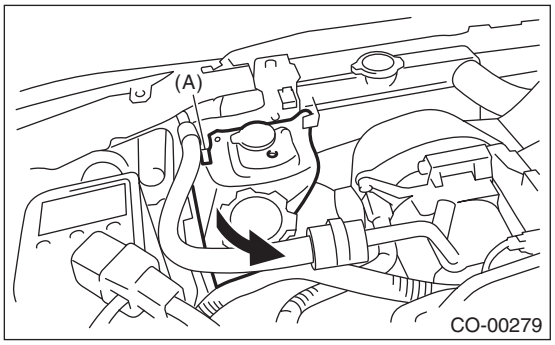

## E: INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor assembly do not have deformation, cracks or damage.

# 10.Reservoir Tank

## A: REMOVAL

1) Disconnect the over flow hose connected to the radiator filler neck.
2) Push in the hook (A), and pull the reserve tank in the direction of the arrow to remove.




## B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

1) Check that the reservoir tank does not have deformation, cracks or damage.
2) Make sure the over flow hoses are not cracked, damaged or loose.
3) Make sure the engine coolant level is between “FULL” and “LOW”.

# 11.Engine Cooling System Trouble in General

## A: INSPECTION

| Trouble | Possible cause | Corrective action |
|---|---|---|
| Over-heating | a. Insufficient engine coolant | Replenish engine coolant, inspect for leakage, and repair it if necessary. |
| | b. Loose timing belt | Repair or replace timing belt tensioner. |
| | c. Oil on timing belt | Replace. |
| | d. Malfunction of thermostat | Replace. |
| | e. Malfunction of water pump | Replace. |
| | f. Clogged engine coolant passage | Clean. |
| | g. Improper ignition timing | Inspect and repair ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> |
| | h. Clogged or leaking radiator | Clean, repair or replace. |
| | i. Defective radiator fan | Replace. |
| | j. Improper engine oil in engine coolant | Replace the engine coolant. If ineffective, check, repair or replace engine components. |
| | k. Air/fuel mixture ratio too lean | Inspect and repair the fuel injection system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> |
| | l. Excessive back pressure in exhaust system | Clean or replace. |
| | m. Insufficient clearance between piston and cylinder | Adjust or replace. |
| | n. Slipping clutch | Repair or replace. |
| | o. Dragging brake | Adjust. |
| | p. Defective radiator fan | Inspect the radiator fan relay, engine coolant temperature sensor or fan motor assembly and replace them. |
| Over-cooling | a. Ambient temperature extremely low | Partly cover radiator front area. |
| | b. Defective thermostat | Replace. |
| Engine coolant leaks | a. Loosened or damaged connecting units on hoses | Repair or replace. |
| | b. Leakage from water pump | Replace. |
| | c. Leakage from water pipe | Repair or replace. |
| | d. Leakage around cylinder head gasket | Retighten cylinder head bolts or replace cylinder head gasket. |
| | e. Damaged or cracked cylinder head and cylinder block | Repair or replace. |
| | f. Damaged or cracked thermostat cover | Repair or replace. |
| | g. Leakage from radiator | Repair or replace. |
| Noise | a. Timing belt problem | Replace. |
| | b. Defective radiator fan | Replace. |
| | c. Defective water pump bearing | Replace water pump. |
| | d. Defective water pump mechanical seal | Replace water pump. |

# LUBRICATION

# LU(H4SO)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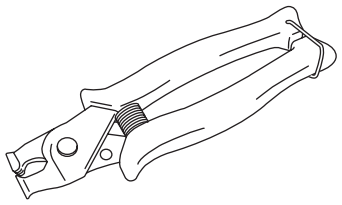
# 1. General Description

## A: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.

## B: PREPARATION TOOL

### 1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST18353AA000 | 18353AA000 | CLAMP PLIERS | • Used for removing and installing the PCV hose.<br>• This tool is made by the French company CAILLAU. (code) 54.0.000.205<br>To make it easier to obtain, it has been provided with a tool number. |

### 2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring resistance. |

# 2. Front Catalytic Converter

## A: REMOVAL

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>

## B: INSTALLATION

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

## C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Check for hole or rust.

# 3. Rear Catalytic Converter

## A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-9, REMOVAL, Center Exhaust Pipe.>

## B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-9, INSTALLATION, Center Exhaust Pipe.>

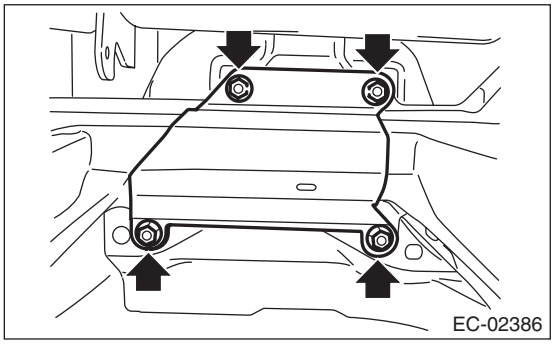
## C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Check for hole or rust.

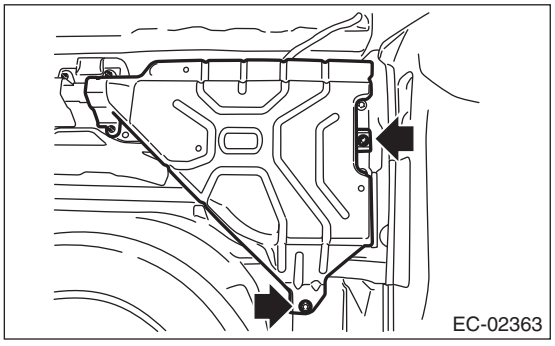
# 4. Canister

## A: REMOVAL

1) Open the trunk, and remove the trunk room mat. (4 door model)
2) Open the rear gate, and remove the luggage floor mat. (5 door model)
3) Tilt the rear seat backrest forward.
4) Remove the sub trunk box and spacers. (4 door model)
5) Remove the luggage floor box and spacers. (5 door model)
6) Remove the center canister cover.

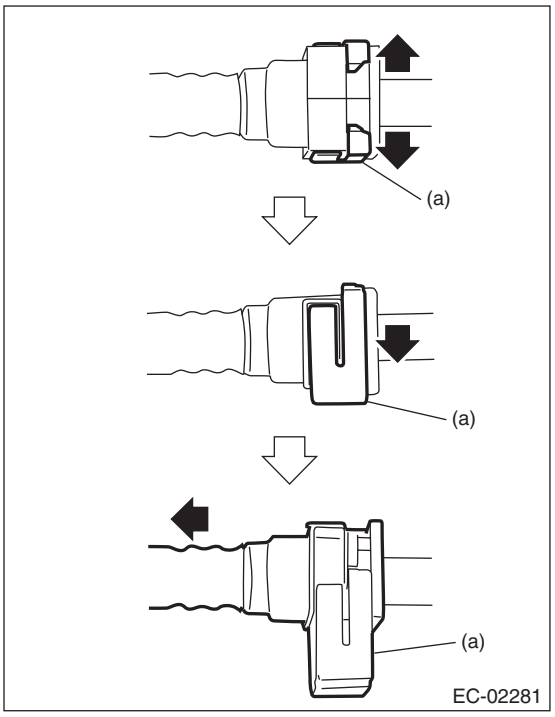



7) Remove the canister cover RH.

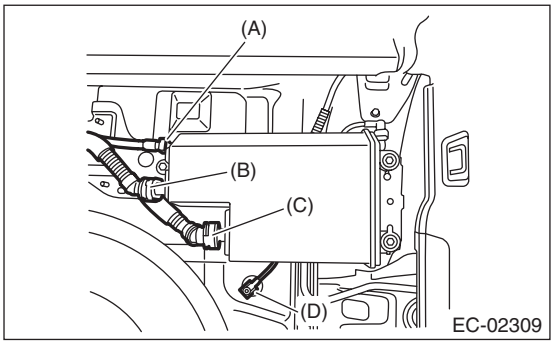



8) Disconnect the purge tube (A), vent tube (B), drain tube A (C) and PCV drain tube (D).

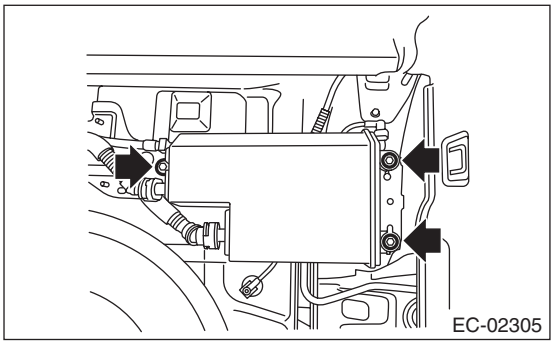
NOTE:
Disconnect the quick connector as shown in the figure.



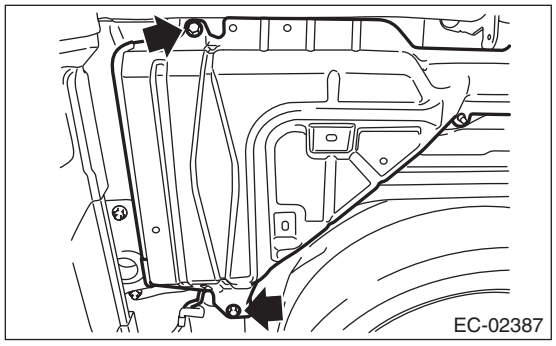

(a) Retainer




9) Remove the canister.

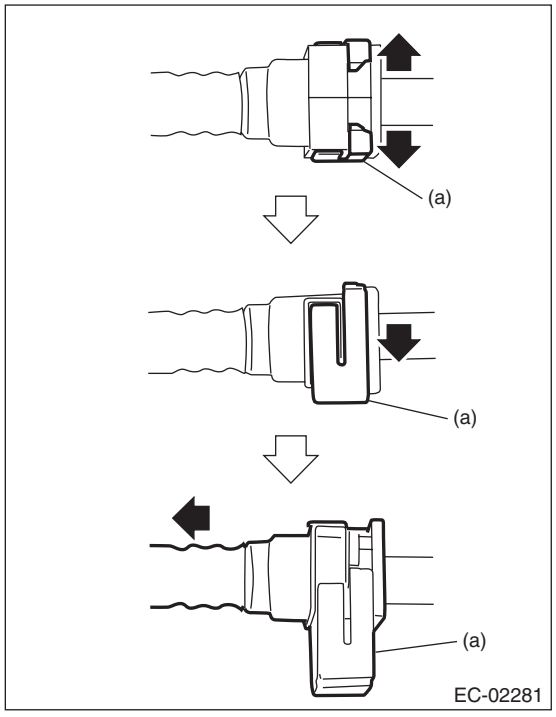


10) Remove the canister cover LH.

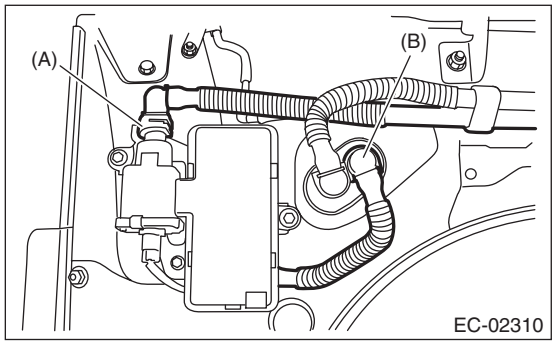



11) Disconnect drain tube A (A) and drain tube B (B).

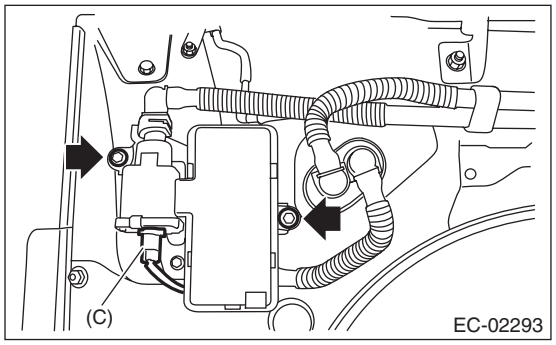
NOTE:
Disconnect the quick connector as shown in the figure.




(a) Retainer

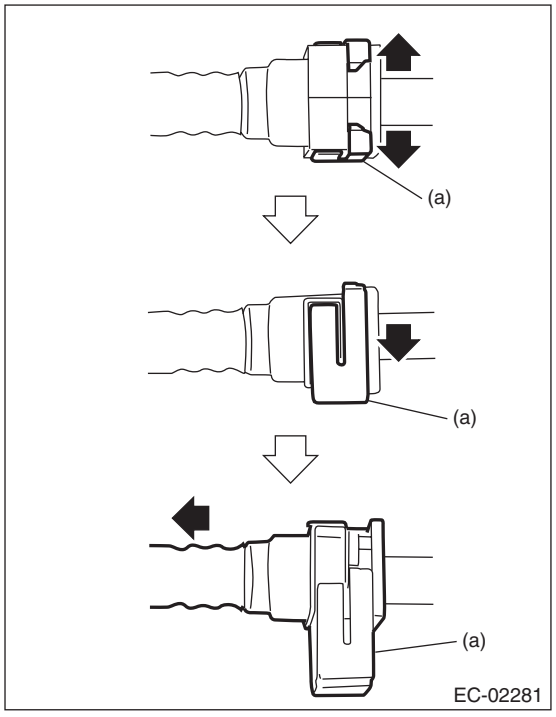



12) Disconnect connector (C) from the drain valve, and remove the drain valve.

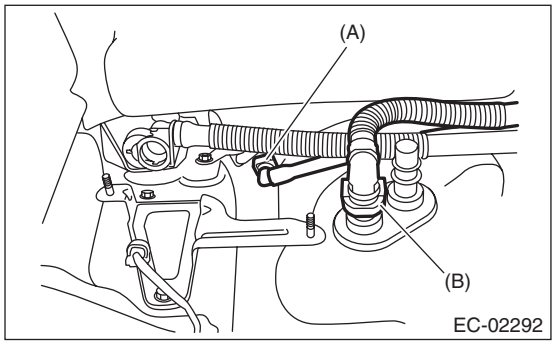



13) Disconnect purge tube (A) and vent tube (B).

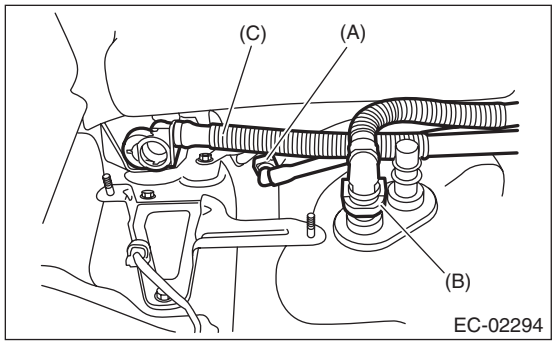
NOTE:
Disconnect the quick connector as shown in the figure.




(a) Retainer



14) Remove purge tube (A), vent tube (B), and drain tube A (C).




## B: INSTALLATION

Install in the reverse order of removal while being careful of the following.

• Connect the quick connector as shown in the figure.

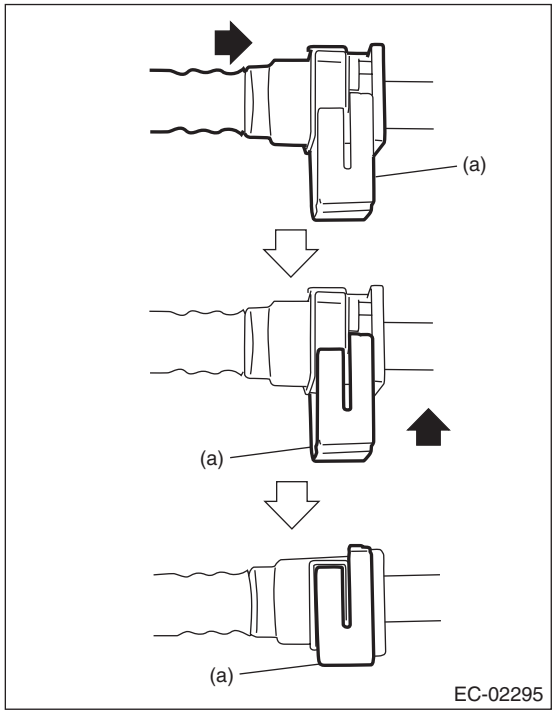
**CAUTION:**

**• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**

**• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.**

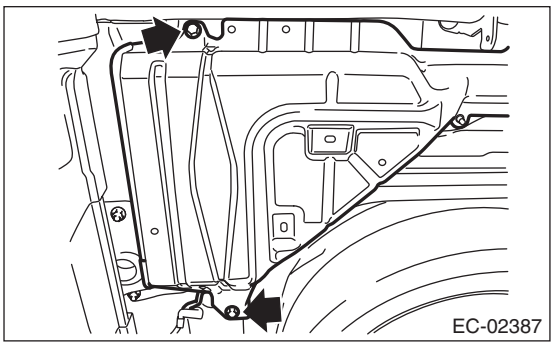
**• If it is not possible to perform the push lock operation of the retainer, recheck whether the pipe is securely inserted.**

**• Make sure that the quick connector is securely connected.**

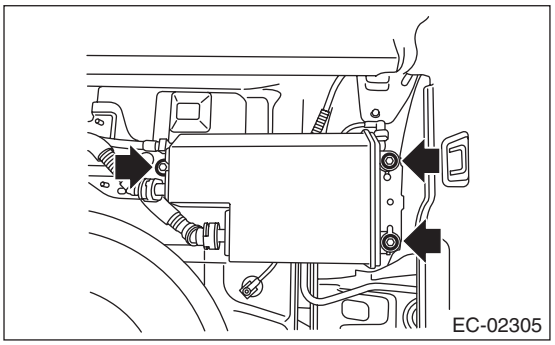



(a) Retainer

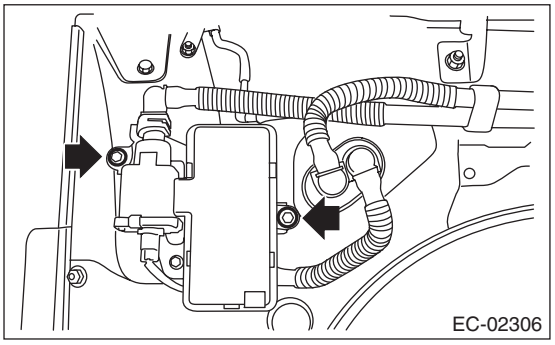
***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***



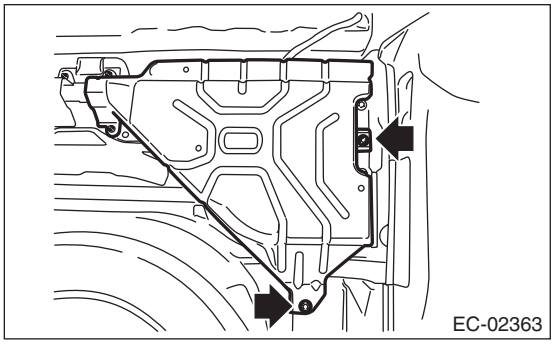

***Tightening torque:***
***8 N·m (0.8 kgf-m, 5.9 ft-lb)***

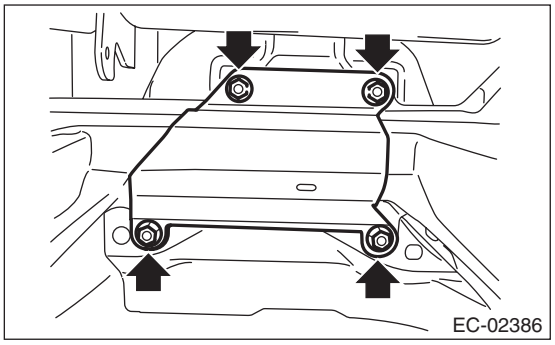



***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***



***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***



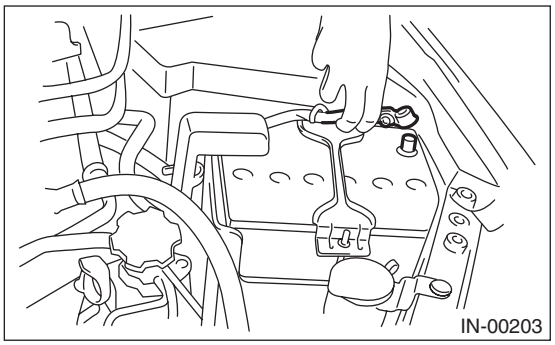

## C: INSPECTION

1) Check that the canister has no deformation, cracks or other damages.
2) Check that the tube has no cracks, damage or loose part.

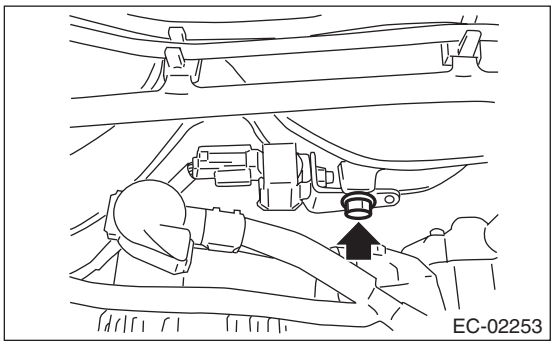
# 5. Purge Control Solenoid Valve

## A: REMOVAL

1) Disconnect the ground cable from battery.



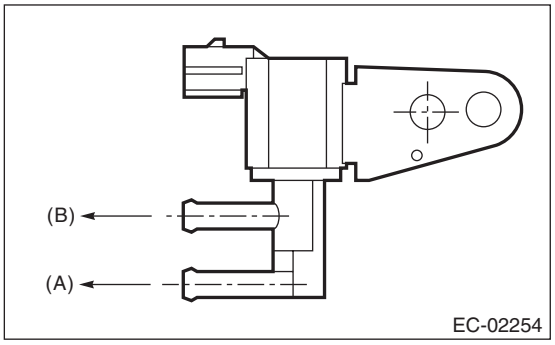

2) Disconnect the connector and evaporation hoses of purge control solenoid valve, and then remove the purge control solenoid valve.




## B: INSTALLATION

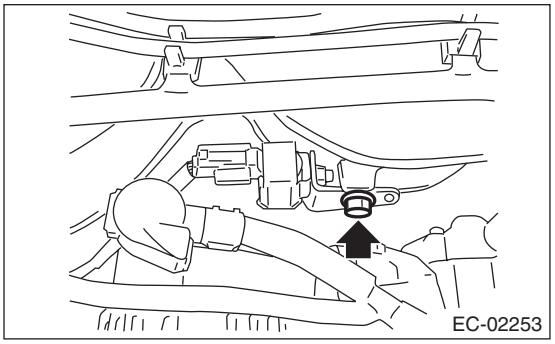
Install in the reverse order of removal.

NOTE:
Connect the evaporation hose as shown in the figure.




(A) To fuel pipe (intake manifold)
(B) To fuel pipe (evaporation line)

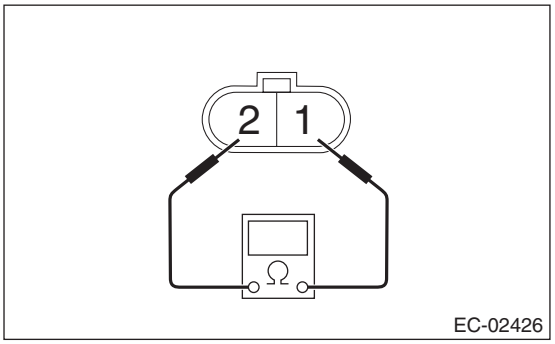
***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***




## C: INSPECTION

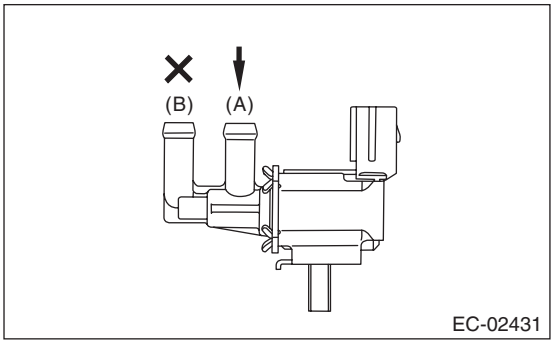
### 1. PURGE CONTROL SOLENOID VALVE

1) Check that the purge control solenoid valve has no deformation, cracks or other damages.
2) Measure the resistance between the purge control solenoid valve terminals.

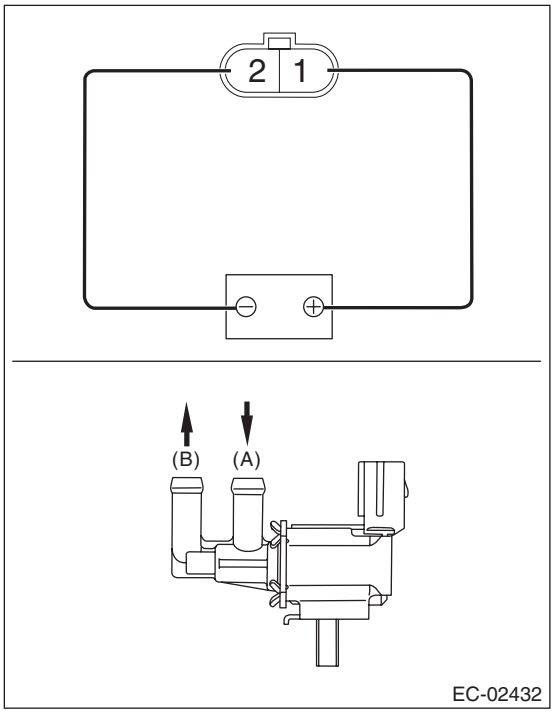



| Terminal No. | Standard |
|---|---|
| 1 and 2 | 24±3 Ω (20°C (68°F)) |

3) Check that air does not come out from (B) when air is blown into (A).



4) Connect the terminal No. 1 to the battery positive terminal and the terminal No. 2 to the battery negative terminal. Check that air is discharged from (B), when supplying air to (A).




## 2. OTHER INSPECTIONS

Check that the evaporation hose has no cracks, damage or loose part.

# 6. EGR Valve

## A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-36, REMOVAL, EGR Valve.>

## B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-36, INSTALLATION, EGR Valve.>

## C: INSPECTION

For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-36, INSPECTION, EGR Valve.>

# 7. Fuel Level Sensor

## A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Level Sensor.>

## B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-68, INSTALLATION, Fuel Level Sensor.>

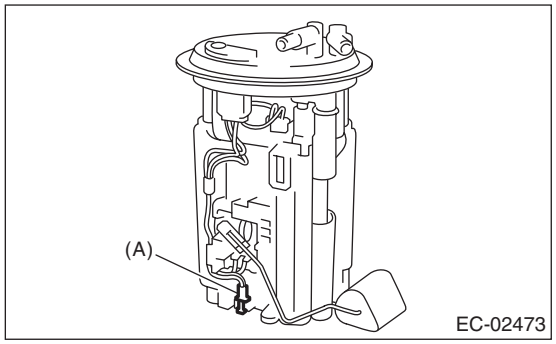
## C: INSPECTION

For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-68, INSPECTION, Fuel Level Sensor.>

# 8. Fuel Temperature Sensor

## A: REMOVAL

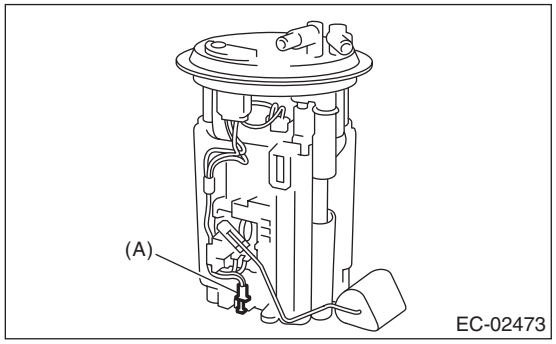
The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for removal procedure. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Level Sensor.>




(A) Fuel temperature sensor

## B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for installation procedure. <Ref. to FU(H4SO)-68, INSTALLATION, Fuel Level Sensor.>

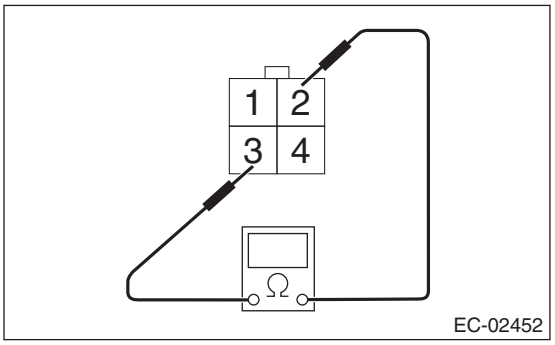



(A) Fuel temperature sensor

## C: INSPECTION

1) Check that the fuel temperature sensor has no deformation, cracks or other damages.
2) Check the resistance between the fuel temperature sensor terminals.

**CAUTION:**
**When inspecting the resistance, check the circuit tester specification and be careful not to turn on electricity 3 V or more to prevent damaging the fuel temperature sensor.**




| Temperature | Terminal No. | Standard |
|---|---|---|
| –10°C (14°F) | 2 and 3 | 11.21±0.69 kΩ (measured current 0.10 mA) |
| 20°C (68°F) | | 2.502±0.08 kΩ (measured current 0.10 mA) |
| 50°C (122°F) | | 0.7176±0.034 kΩ (measured current 0.10 mA) |

# 9. Fuel Sub Level Sensor

## A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-69, REMOVAL, Fuel Sub Level Sensor.>

## B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-70, INSTALLATION, Fuel Sub Level Sensor.>

## C: INSPECTION

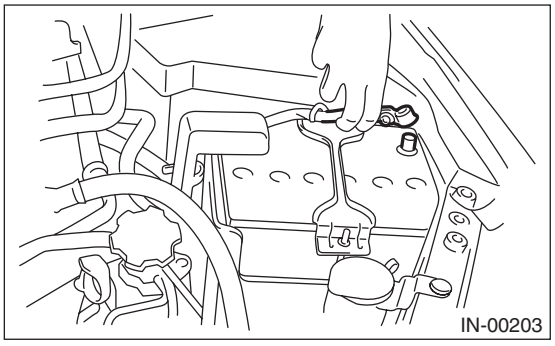
For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-70, INSPECTION, Fuel Sub Level Sensor.>

# 10.Fuel Tank Pressure Sensor

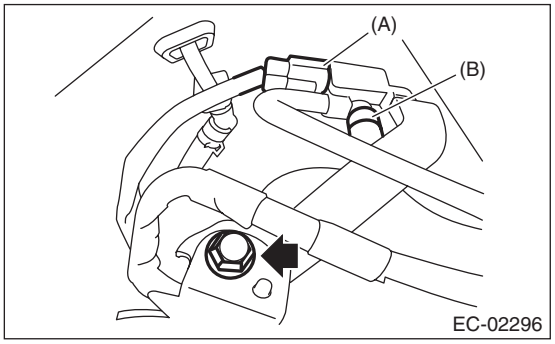
## A: REMOVAL

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

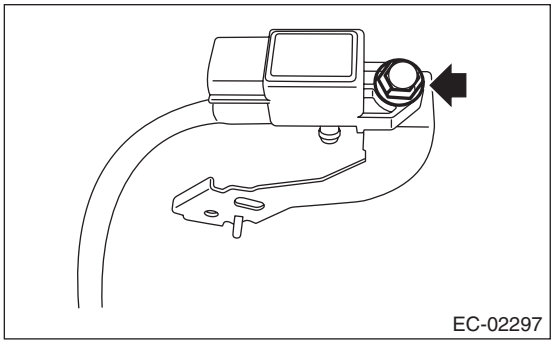
1) Disconnect the ground cable from battery.




2) Open the fuel filler lid and remove the fuel filler cap.
3) Lift up the vehicle.
4) Disconnect the connector from the fuel tank pressure sensor (A).
5) Disconnect the pressure hose from the fuel tank pressure sensor (B).
6) Remove the fuel tank pressure sensor along with the bracket.



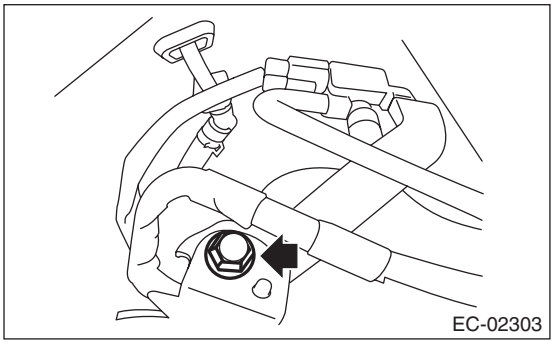

7) Remove the fuel tank pressure sensor from the bracket cover.

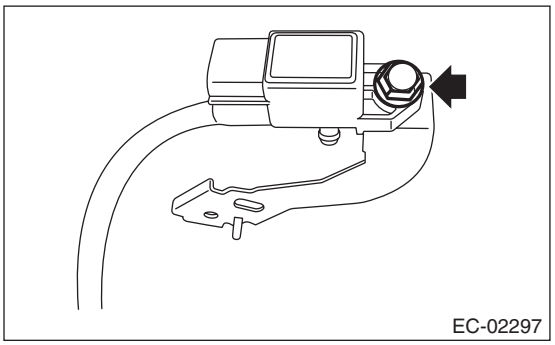



## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***7.35 N·m (0.7 kgf-m, 5.4 ft-lb)***



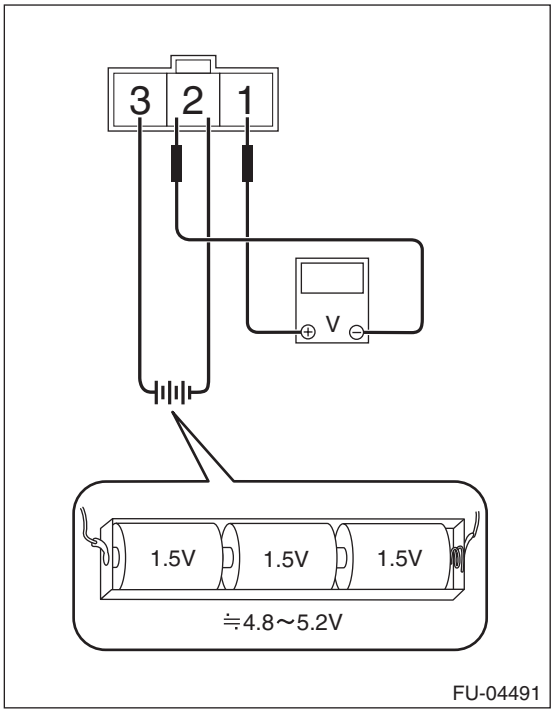




## C: INSPECTION

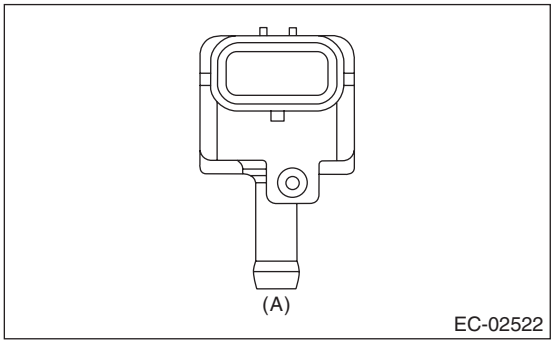
### 1. FUEL TANK PRESSURE SENSOR

1) Check that the fuel tank pressure sensor has no deformation, cracks or other damages.
2) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 2, circuit tester positive terminal to terminal No. 1 and the circuit tester negative terminal to terminal No. 2.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.




3) Connect the Mighty Vac to the pressure port (A) of fuel tank pressure sensor.




4) Check the voltage when generating vacuum and positive pressure using Mighty Vac.

**CAUTION:**
**Do not apply pressure out of the range of –10 — 20 kPa (–0.1 — 0.2 kgf/cm$^2$, –1.45 — 2.90 psi). Doing so may damage the fuel tank pressure sensor.**

| Pressure | Terminal No. | Standard |
|---|---|---|
| –6.666 kPa (–0.07 kgf/cm$^2$, –0.97 psi) | 1 (+) and 2 (–) | Approx. 0.5 V (when 25°C (77°F)) |
| –2.000 kPa (–0.02 kgf/cm$^2$, –0.29 psi) | | Approx. 1.9 V (when 25°C (77°F)) |
| 2.000 kPa (0.02 kgf/cm$^2$, 0.29 psi) | | Approx. 3.1 V (when 25°C (77°F)) |
| 6.666 kPa (0.07 kgf/cm$^2$, 0.97 psi) | | Approx. 4.5 V (when 25°C (77°F)) |

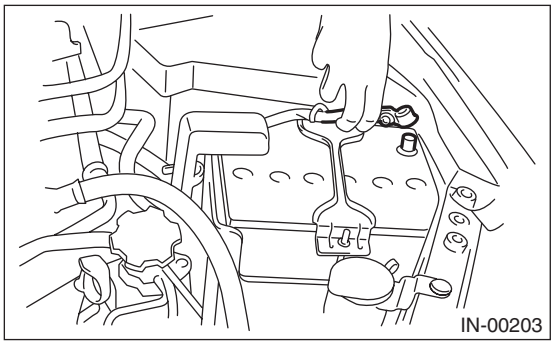
## 2. OTHER INSPECTIONS

Check that the hose has no cracks, damage or loose part.

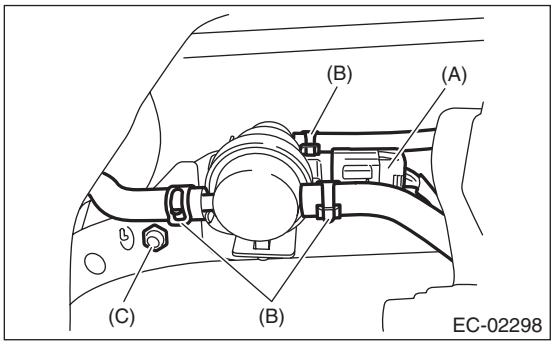
# 11.Pressure Control Solenoid Valve

## A: REMOVAL

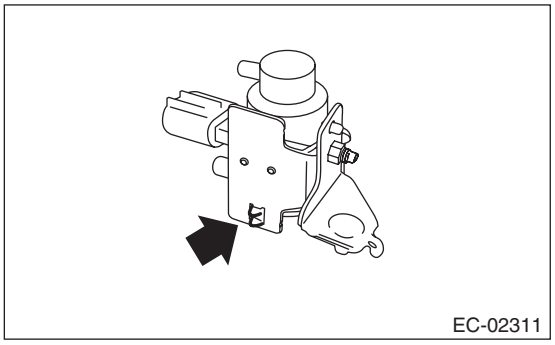
1) Disconnect the ground cable from battery.




2) Lift up the vehicle.
3) Disconnect connector (A) from the pressure control solenoid valve.
4) Disconnect the evaporation hose (B) from the pressure control solenoid valve.
5) Remove the nuts (C) which secure the bracket to the fuel tank.




6) Remove the pressure control solenoid valve and bracket as a unit.
7) Remove the pressure control solenoid valve from the bracket.




## B: INSTALLATION

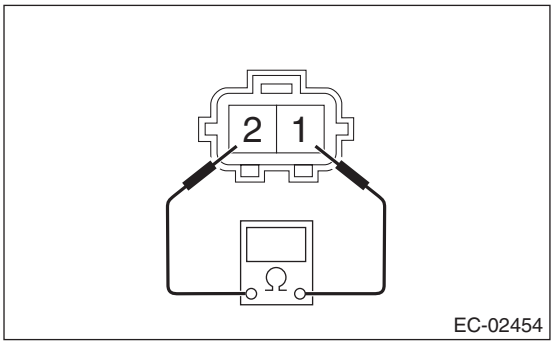
Install in the reverse order of removal.

***Tightening torque:***
***7.35 N·m (0.7 kgf-m, 5.4 ft-lb)***

## C: INSPECTION

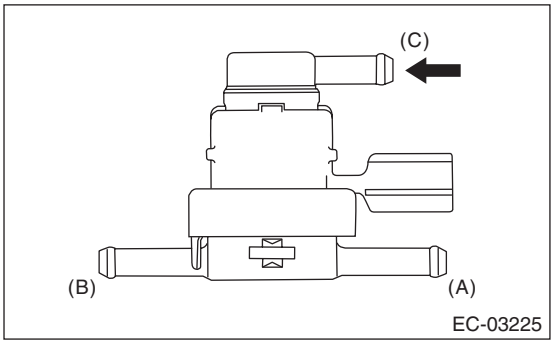
### 1. PRESSURE CONTROL SOLENOID VALVE

1) Check that the pressure control solenoid valve has no deformation, cracks or other damages.
2) Check the resistance between the pressure control solenoid valve terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | 20 — 30 Ω |

3) Connect the Mighty Vac to fuel tank side of the pressure control solenoid valve.




(A) Fuel tank side
(B) Canister side
(C) Barometric pressure

4) Using the Mighty Vac, generate the positive pressure. Check that the Mighty Vac gauge needle rises at the pressure (0.55 — 1.55 kPa (0.006 — 0.016 kgf/cm$^2$, 0.08 — 0.23 psi)) then lowers.
5) Using the Mighty Vac, generate the negative pressure. Check that the Mighty Vac gauge needle does not rise.

### 2. OTHER INSPECTIONS

Check that the evaporation hose has no cracks, damage or loose part.

# 12.Drain Filter

## A: SPECIFICATION

The drain valve is a non-disassembled part, so do not remove the drain filter from drain valve. Refer to “Canister” for removal and installation procedures. <Ref. to EC(H4SO)-5, REMOVAL, Canister.> <Ref. to EC(H4SO)-7, INSTALLATION, Canister.>

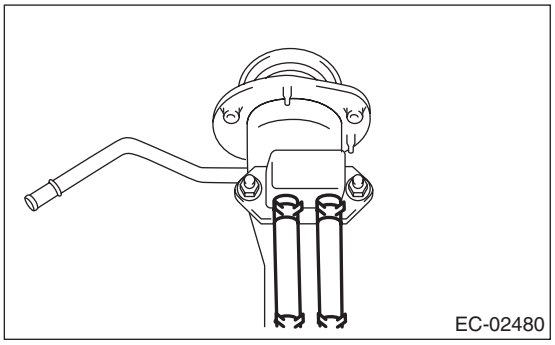
# 13.Shut Valve

## A: REMOVAL

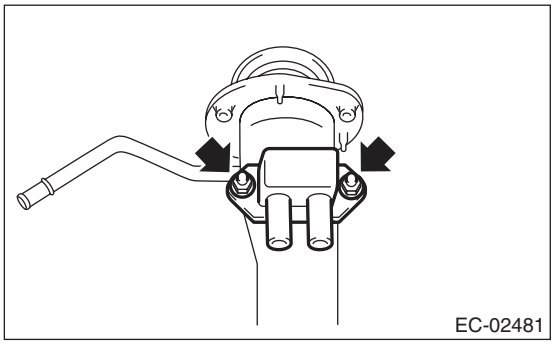
**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**

1) Remove the fuel filler pipe. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Filler Pipe.>
2) Disconnect the evaporation hose from the shut valve.



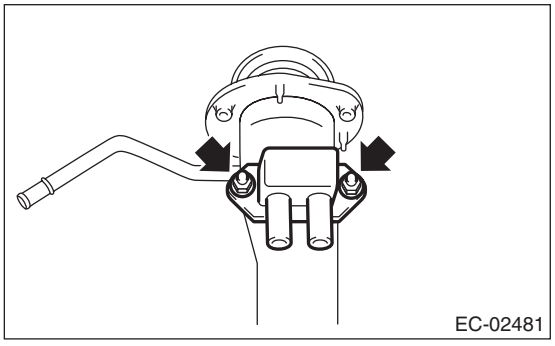

3) Remove the shut valve from the fuel filler pipe.




## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***4.5 N·m (0.5 kgf-m, 3.3 ft-lb)***




## C: INSPECTION

1) Check that the shut valve has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

# 14.Drain Valve

## A: REMOVAL

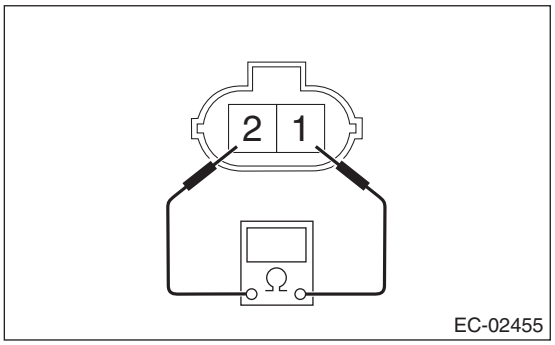
Refer to “Canister” for removal procedures. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>

## B: INSTALLATION

Refer to “Canister” for installation procedures. <Ref. to EC(H4SO)-7, INSTALLATION, Canister.>

## C: INSPECTION

Measure the resistance between drain valve terminals.

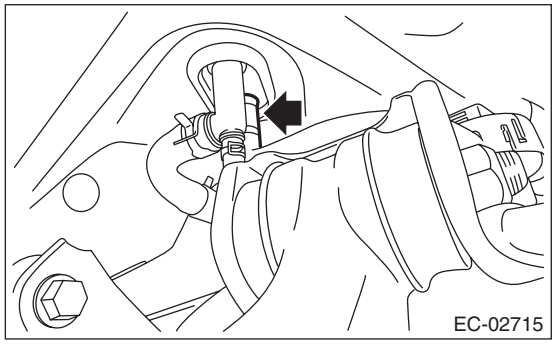



| Terminal No. | Standard |
|---|---|
| 1 and 2 | 20 — 30 Ω |

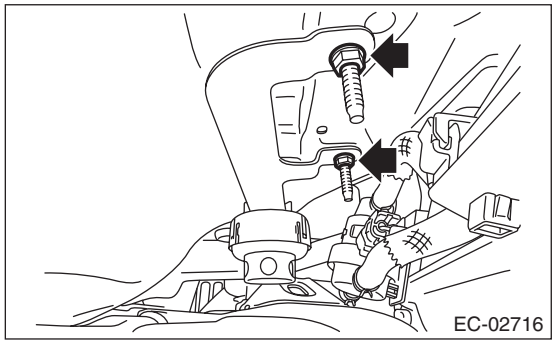
# 15.Drain Separator

## A: REMOVAL

1) Lift up the vehicle.
2) Remove the rear differential. <Ref. to DI-19, REMOVAL, Rear Differential.>
3) Disconnect the drain hose from the connector.



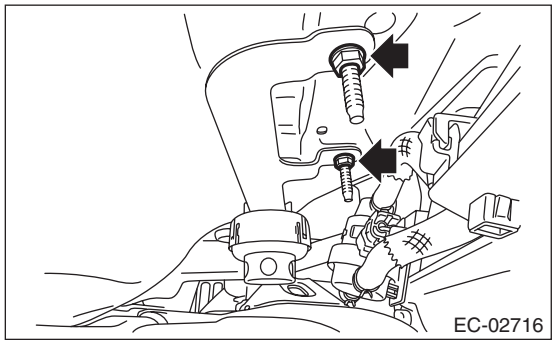

4) Remove the drain separator from the vehicle.



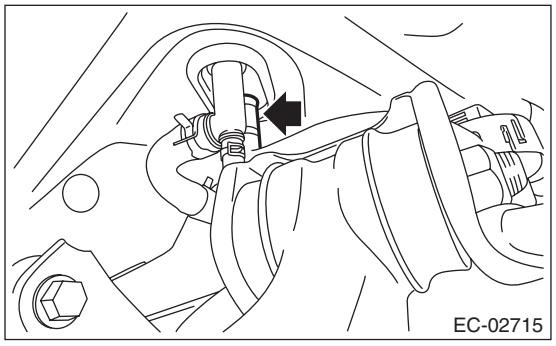

## B: INSTALLATION

1) Install the drain separator to the vehicle.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***



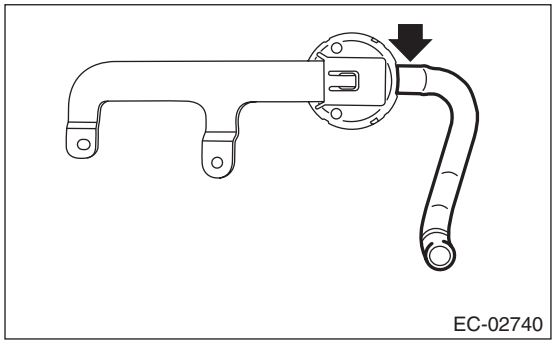

2) Connect the drain hose to the connector.



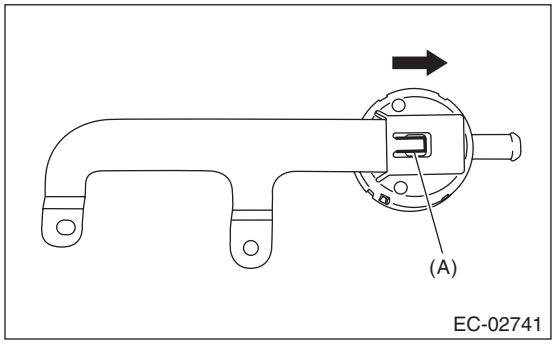

3) Install the rear differential. <Ref. to DI-21, INSTALLATION, Rear Differential.>

## C: DISASSEMBLY

1) Disconnect the drain hose from the drain separator.




2) Lift up the claw (A) of the drain separator and slide the drain separator in the direction of the arrow to remove the drain separator.




## D: ASSEMBLY

Assemble in the reverse order of disassembly.

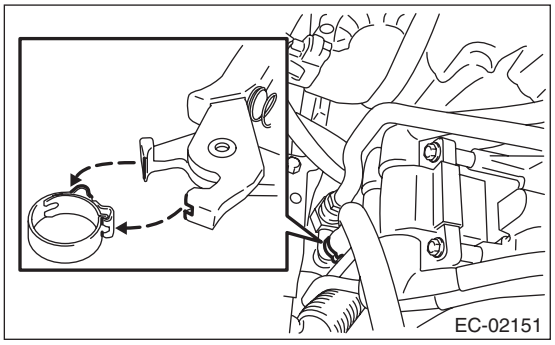
## E: INSPECTION

1) Check that the drain separator and drain separator bracket have no deformation, crack, or other damage.
2) Check that the drain hose has no crack, damage, or looseness.
3) Check that no foreign substances are clogged in the drain separator.

# 16.PCV Hose Assembly

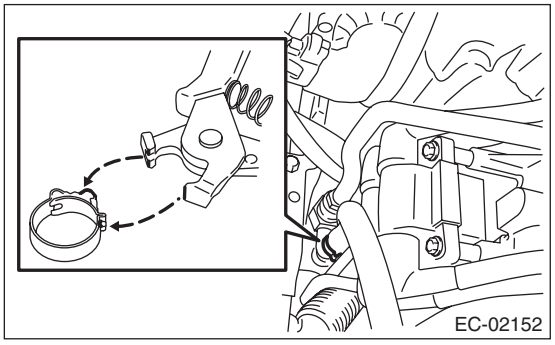
## A: REMOVAL

**CAUTION:**
**Do not remove unless the PCV hose, diagnostics connector and PCV valve are damaged.**
1) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
2) Fit the depression in the ST with the protrusion on the clamp to unlock.
3) Remove the PCV hose assembly.
ST 18353AA000 CLAMP PLIERS




## B: INSTALLATION

NOTE:
Replace the clamp with a new part.
1) Install the PCV hose assembly, then lock by fitting the ST on the clamp protrusion.
ST 18353AA000 CLAMP PLIERS

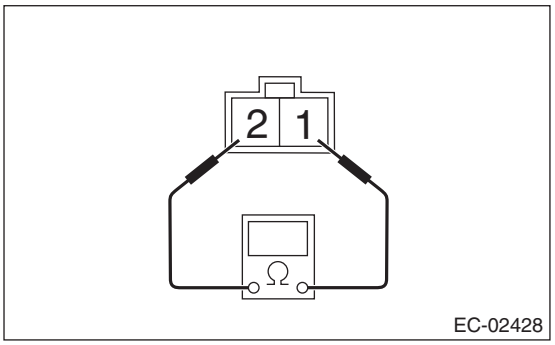



2) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

## C: INSPECTION

### 1. DIAGNOSIS CONNECTOR

1) Check that the diagnosis connector has no deformation, cracks and any other damage.
2) Check the resistance between the diagnosis connector terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | Less than 1 Ω |

### 2. OTHER INSPECTIONS

1) Check that the PCV connector has no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

# INTAKE (INDUCTION)

# *IN(H4SO)*


**Page**

1. General Description .....2
2. Air Cleaner Element .....4
3. Air Cleaner Case .....5
4. Air Intake Chamber .....7
5. Air Intake Duct .....8
6. Resonator Chamber .....9

# 1. Basic Diagnostic Procedure

## A: PROCEDURE

### 1. ENGINE

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ENGINE START FAILURE.**<br>1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to EN(H4SO)(diag)-4, CHECK, Check List for Interview.><br>2) Start the engine. | Does the engine start? | Go to step **2**. | Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4SO)(diag)-70, Diagnostics for Engine Starting Failure.> |
| 2 | **CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.** | Does the malfunction indicator light illuminate? | Go to step **3**. | Inspection using "General Diagnostic Table". <Ref. to EN(H4SO)(diag)-317, INSPECTION, General Diagnostic Table.> |
| 3 | **CHECK COMMUNICATION STATUS.**<br>1) Turn the ignition switch to OFF.<br>2) Connect the Subaru Select Monitor or general scan tool to the data link connector.<br>3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed procedures, refer to "Subaru Select Monitor". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Does Subaru select monitor or general scan tool communicate with vehicle normally? | Go to step **4**. | Inspection using "Diagnostics Procedure for Subaru Select Monitor Communication". <Ref. to EN(H4SO)(diag)-84, Diagnostic Procedure for Subaru Select Monitor Communication.> |
| 4 | **CHECK DTC.**<br>Read DTC using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>Refer to "Read Diagnostic Trouble Code" for detailed operation procedure. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is DTC displayed on Subaru Select Monitor or general scan tool? | Record the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).><br>Go to step **5**. | Repair the related parts.<br>NOTE:<br>If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H4SO)(diag)-60, Malfunction Indicator Light.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 5 | **CHECK FREEZE FRAME DATA.**<br>Check the freeze frame data using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed procedures, refer to "Subaru Select Monitor". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is freeze frame data displayed on Subaru Select Monitor or general scan tool? | Record the freeze frame data. Repair the faulty parts, and go on to the next. Go to step **6**. | Go to step **6**. |
| 6 | **PERFORM DIAGNOSIS.**<br>1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.><br>2) Perform the Inspection Mode or Drive Cycle. <Ref. to EN(H4SO)(diag)-43, Inspection Mode.> <Ref. to EN(H4SO)(diag)-48, Drive Cycle.> | Is DTC displayed on Subaru Select Monitor or general scan tool? | Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-93, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> | Finish the diagnosis. |

# 2. Check List for Interview

## A: CHECK

### 1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:
Use copies of this page for interviewing customers.

| | | | |
|---|---|---|---|
| Customer's name | | Engine No. | |
| Date of purchase | | Fuel type | |
| Date of repair | | Odometer reading | km |
| V.I.N. | | | miles |
| Weather | ❑ Fine<br>❑ Cloudy<br>❑ Rainy<br>❑ Snowy<br>❑ Various/Others: | | |
| Ambient air temperature | °C (°F) | | |
| | ❑ Hot<br>❑ Warm<br>❑ Cool<br>❑ Cold | | |
| Place | ❑ Highway<br>❑ Suburbs<br>❑ Inner city<br>❑ Uphill<br>❑ Downhill<br>❑ Rough road<br>❑ Others: | | |
| Engine temperature | ❑ Cold<br>❑ Warming-up<br>❑ After warming-up<br>❑ Any temperature<br>❑ Others: | | |
| Engine speed | rpm | | |
| Vehicle speed | km/h (MPH) | | |
| Driving conditions | ❑ Not affected<br>❑ At starting<br>❑ While idling<br>❑ At racing<br>❑ While accelerating<br>❑ While cruising<br>❑ While decelerating<br>❑ While turning (RH/LH) | | |
| Headlight | ❑ ON/❑ OFF | Rear defogger | ❑ ON/❑ OFF |
| Blower | ❑ ON/❑ OFF | Audio | ❑ ON/❑ OFF |
| A/C compressor | ❑ ON/❑ OFF | Rear entertainment system | ❑ ON/❑ OFF |
| Radiator fan | ❑ ON/❑ OFF | Car phone | ❑ ON/❑ OFF |
| Front wiper | ❑ ON/❑ OFF | Wireless device | ❑ ON/❑ OFF |
| Rear wiper | ❑ ON/❑ OFF | | |

## 2. CHECK LIST NO. 2

Check the following item about the vehicle's state when malfunction indicator light turns on.

NOTE:
Use copies of this page for interviewing customers.

| |
|---|
| a) Other warning lights or indicators illuminate. ❑ Yes / ❑ No |
| ❑ Low fuel warning light<br>❑ Charge warning light<br>❑ Engine coolant temperature warning light<br>❑ Oil pressure warning light<br>❑ ATF temperature warning light or SPORT indicator light<br>❑ Driver's control center differential indicator light<br>❑ ABS warning light<br>❑ VDC warning light<br>❑ Cruise indicator light<br>❑ SI-CRUISE warning light<br>❑ Immobilizer indicator light<br>❑ STEERING warning light<br>❑ Electric parking brake warning light<br>❑ Glow indicator light<br>❑ Sedimentor warning light<br>❑ Others: |
| b) Fuel level |
| • Lack of fuel: ❑ Yes / ❑ No<br>• Indicator position of fuel gauge:<br>• Experienced running out of fuel: ❑ Yes / ❑ No |
| c) Intentional connecting or disconnecting of harness connectors or spark plug cords: ❑ Yes / ❑ No |
| • What: |
| d) Intentional connecting or disconnecting of hoses: ❑ Yes / ❑ No |
| • What: |
| e) Installing of other parts except genuine parts: ❑ Yes / ❑ No |
| • What:<br>• Where: |
| f) Occurrence of noise: ❑ Yes / ❑ No |
| • From where:<br>• What kind: |
| g) Occurrence of smell: ❑ Yes / ❑ No |
| • From where:<br>• What kind: |
| h) Intrusion of water into engine compartment or passenger compartment: ❑ Yes / ❑ No |
| i) Troubles occurred |
| ❑ Engine does not start.<br>❑ Engine stalls during idling.<br>❑ Engine stalls while driving.<br>❑ Engine speed decreases.<br>❑ Engine speed does not decrease.<br>❑ Rough idling<br>❑ Poor acceleration<br>❑ Back fire<br>❑ After fire<br>❑ Does not shift.<br>❑ Excessive shift shock |

# 3. General Description

## A: CAUTION

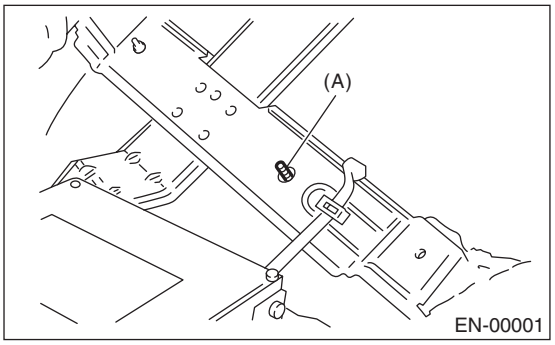
1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

**CAUTION:**
**• Do not use electrical test equipment on the airbag system circuits.**
**• Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.**

2) Never connect the battery in reverse polarity. Doing so will damage the ECM instantly, and other parts will also be damaged.
3) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.
4) Before disconnecting the connectors of each sensor and ECM, be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
5) When measuring the voltage or resistance of individual sensor or all electrical control modules, use a tapered pin with a diameter of less than 0.6 mm (0.024 in). Do not insert the pin 4 mm (0.16 in) or more into the part.

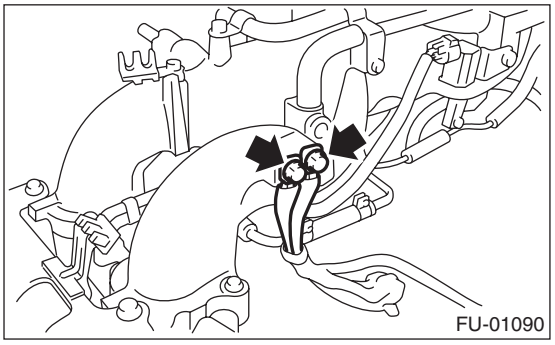
**CAUTION:**
**When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.**

NOTE:
When replacing the ECM of the models with Immobilizer, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the “PC application help for Subaru Select Monitor”.
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.
7) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.




(A) Stud bolt

8) Use the engine ground terminal or engine assembly for the grounding point to chassis when measuring the voltage and resistance in engine compartment.




9) Every engine control system related part is a precision part. Do not drop them.
10) Observe the following cautions when installing a radio in vehicle.

**CAUTION:**
**• The antenna must be kept as far apart as possible from control module. (ECM is installed under the passenger’s side floor mat.)**
**• The antenna feeder must be placed as far apart as possible from the ECM and engine control system harness.**
**• Carefully adjust the antenna for correct matching.**
**• When mounting a large power type radio, pay special attention to the three items mentioned above.**
**• Incorrect installation of the radio may affect the operation of ECM.**

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

12) Warning lights may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the VDC memory clear procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

## B: INSPECTION

Before performing diagnostics, check the following item which might affect engine problems.

### 1. BATTERY

1) Measure the battery voltage and specific gravity of the electrolyte.

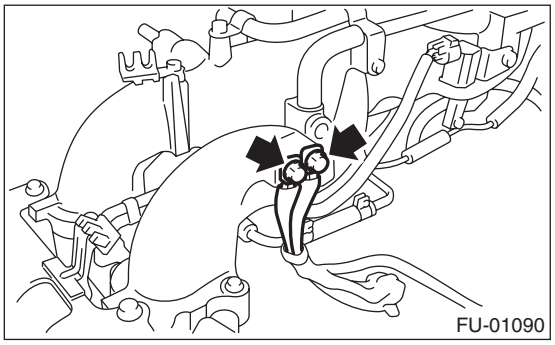
***Standard voltage: 12 V***

***Specific gravity: 1.260 or more***

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

### 2. ENGINE GROUND

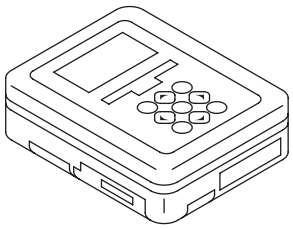
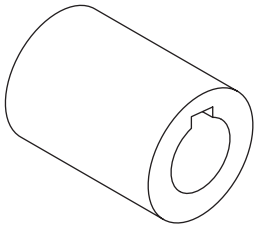
Check that the engine ground terminal has no contamination, corrosion or looseness and is properly connected to the engine.




## C: NOTE

• The on-board diagnostic (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
• Further, against such a failure of sensors as may disable the drive, the fail-safe function is provided to ensure the minimal drivability.
• The OBD system incorporated with the vehicles within this type of engine complies with OBD-II regulations. The OBD system monitors the components and the system malfunction listed in “Engine Section” which affects on emissions.
• When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
• The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer when it detects a malfunction.
• Freeze frame engine condition data are stored until the DTCs are cleared. However when such malfunctions as fuel trim fault and misfire are detected with the freeze frame engine condition data stored, they are rewritten into those related to the fuel trim fault and misfire.
• When the malfunction does not occur again for three consecutive driving cycles, malfunction indicator light is turned off, but DTC remains at on-board computer.
• When performing diagnosis, connect the Subaru Select Monitor or general scan tool to the vehicle.

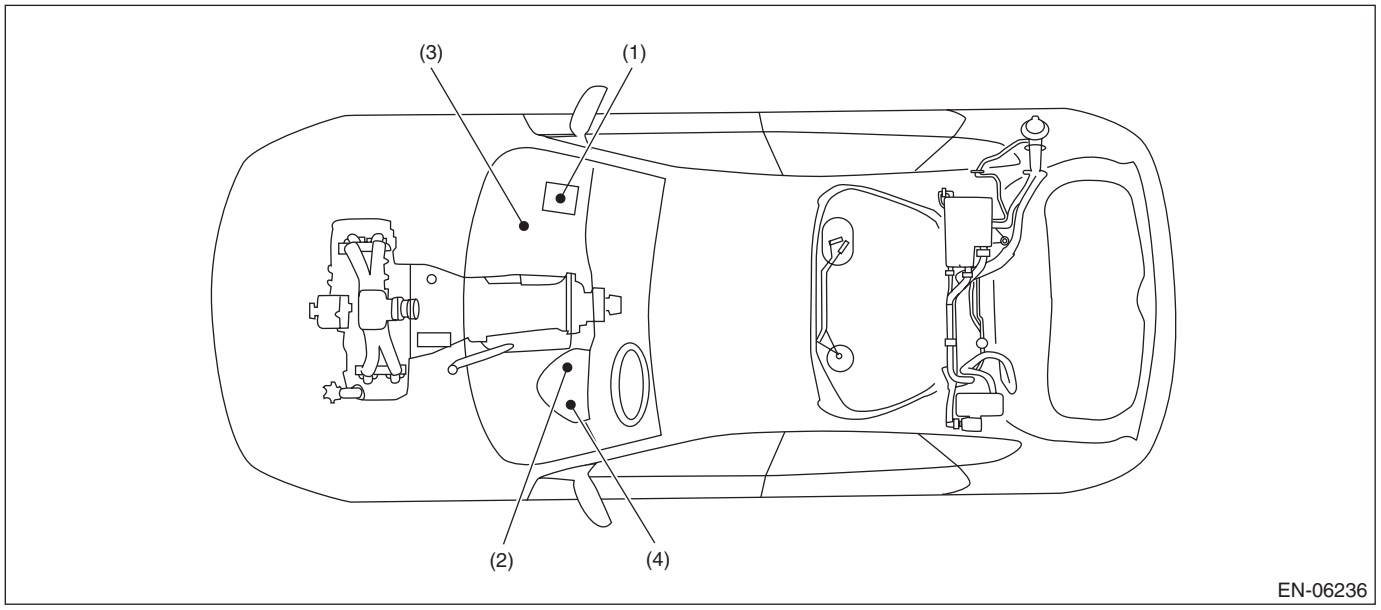
## D: PREPARATION TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST1B022XU0 | 1B022XU0 | SUBARU SELECT MONITOR III KIT | Used for troubleshooting the electrical system. |
|  ST-499987500 | 499987500 | CRANKSHAFT SOCKET | Used for rotating crankshaft. |

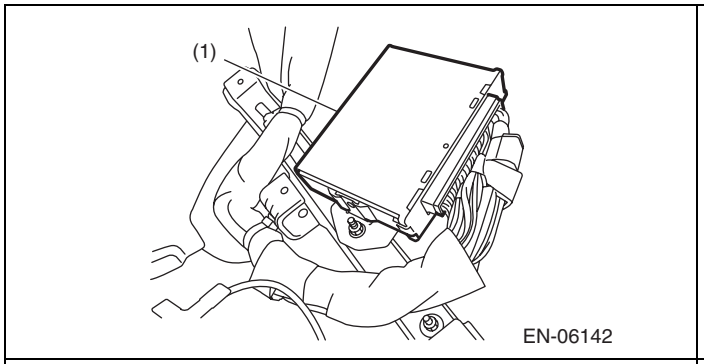
# 4. Electrical Component Location

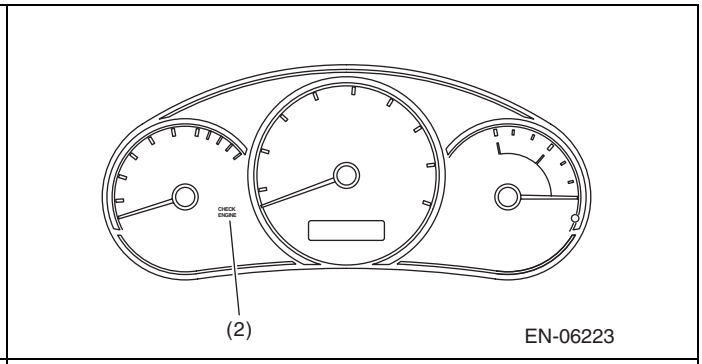
## A: LOCATION

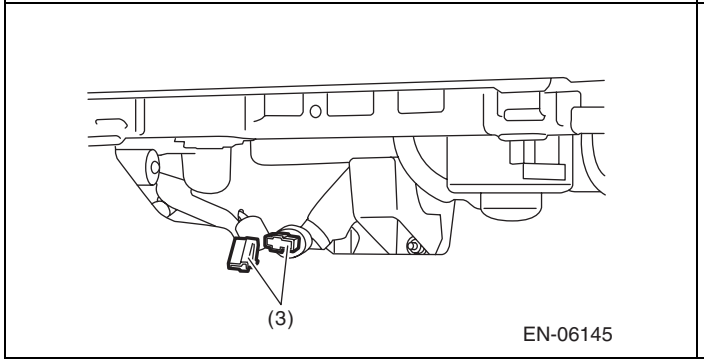
### 1. CONTROL MODULE

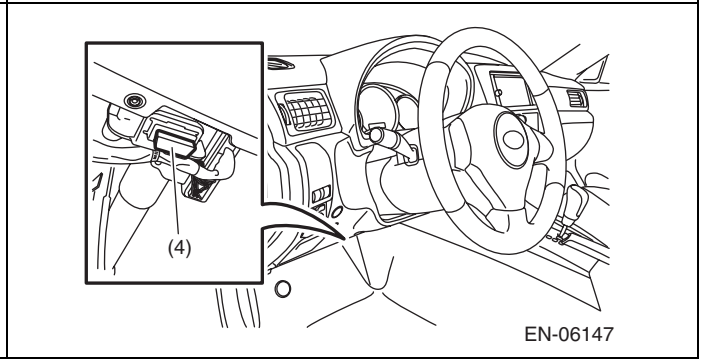



(1) Engine control module (ECM)
(2) Malfunction indicator light
(3) Delivery (test) mode connector
(4) Data link connector

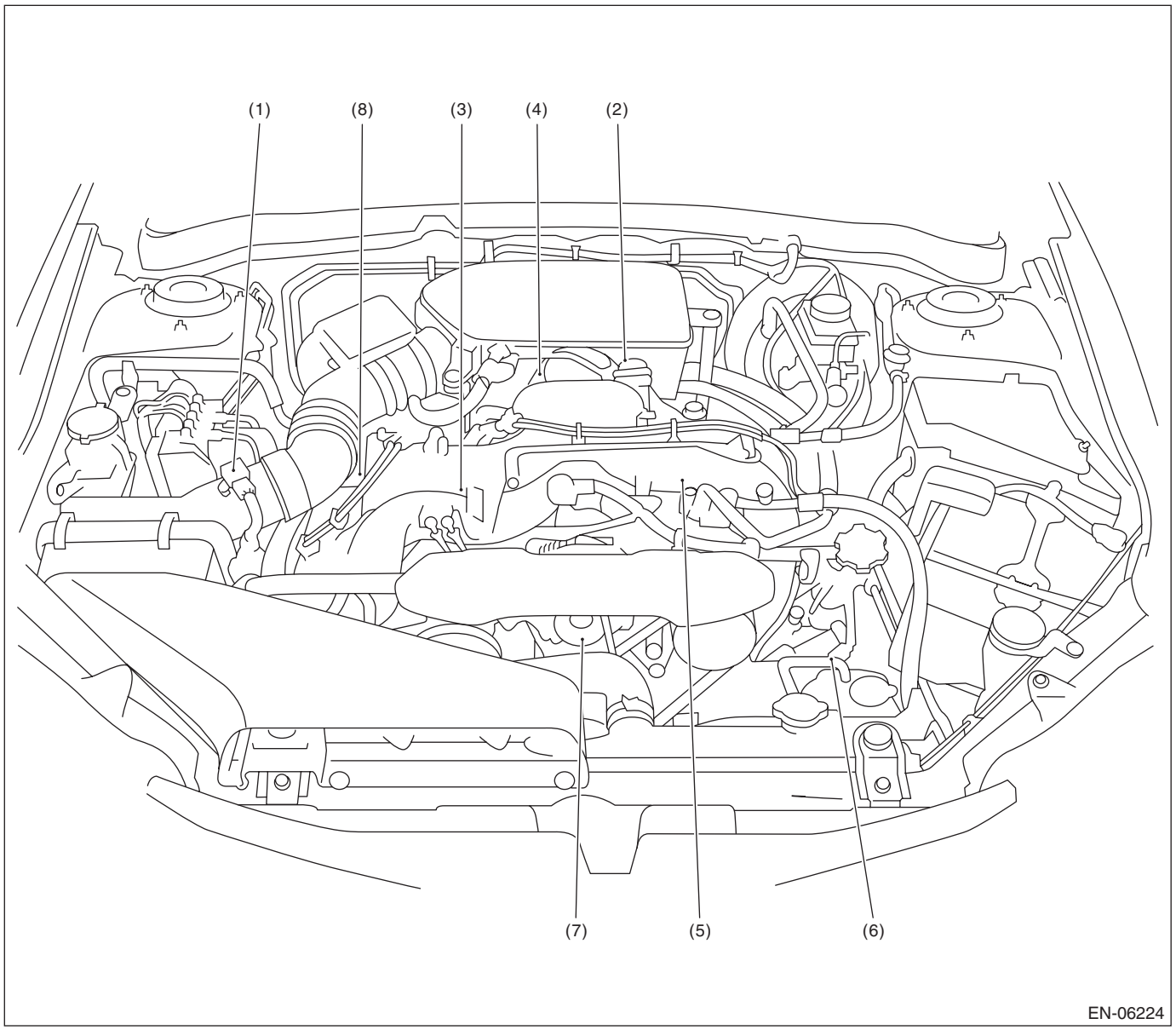


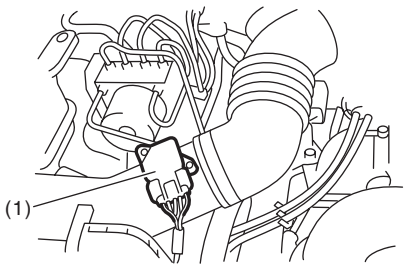



## 2. SENSOR




(1) Mass air flow and intake air temperature sensor
(2) Manifold absolute pressure sensor
(3) Engine coolant temperature sensor
(4) Electronic throttle control
(5) Knock sensor
(6) Camshaft position sensor
(7) Crankshaft position sensor
(8) Oil temperature sensor



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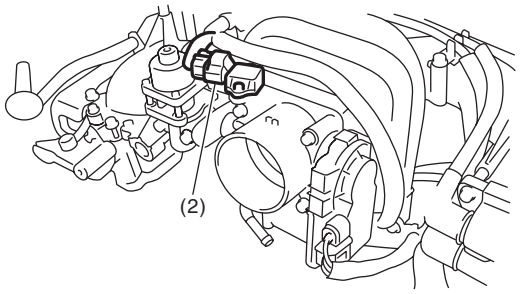

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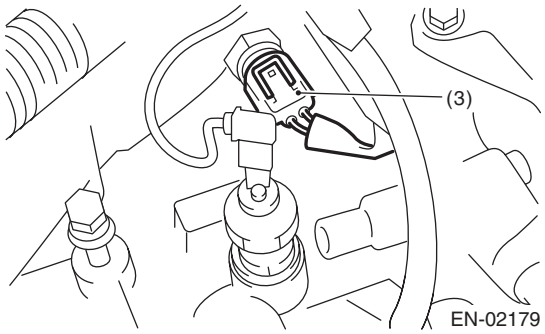

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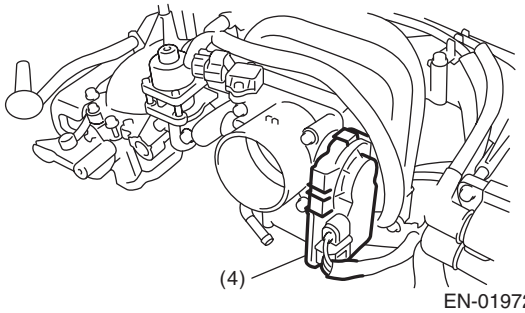

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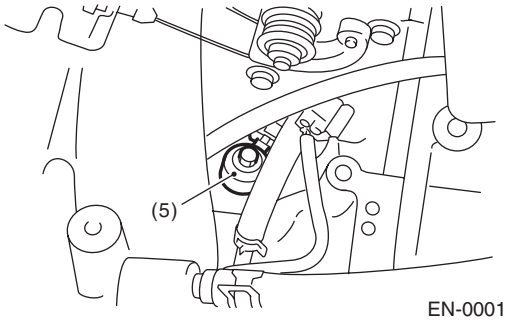
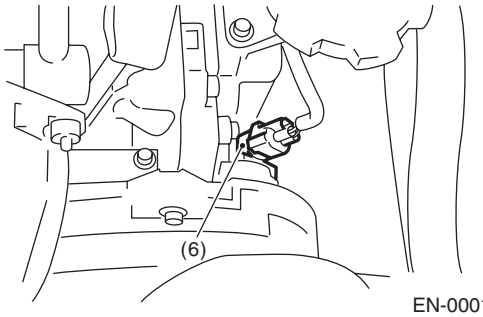
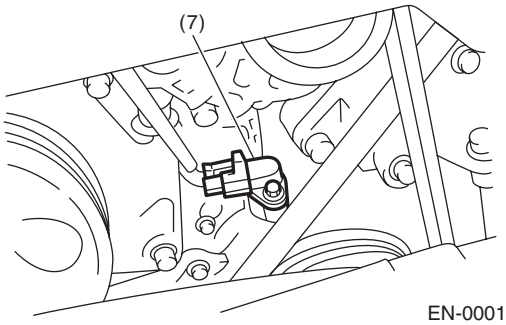


EN-00010



EN-00011



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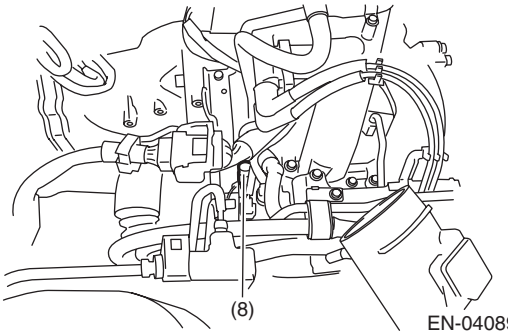

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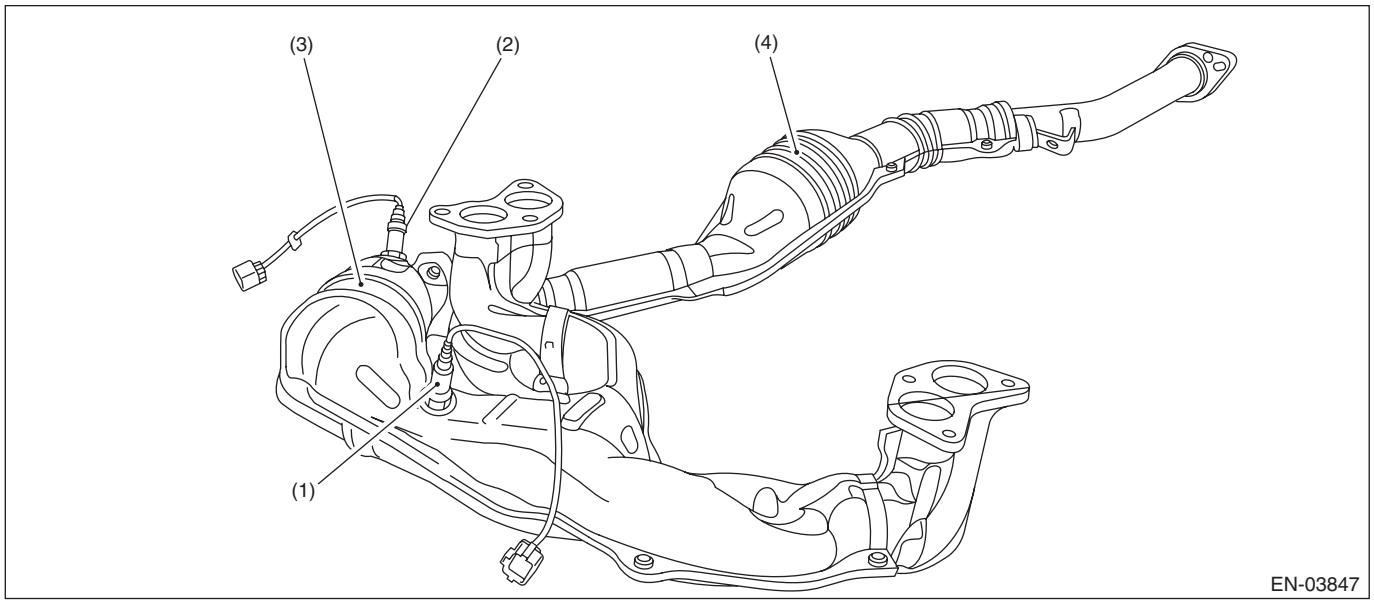
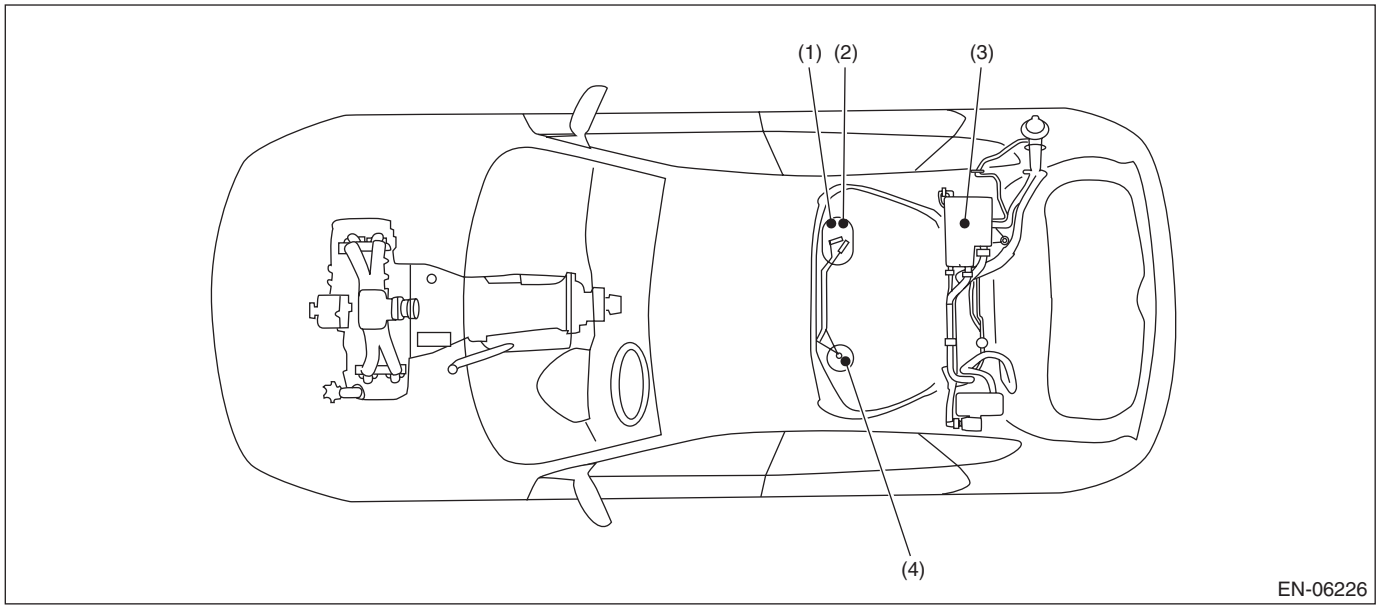
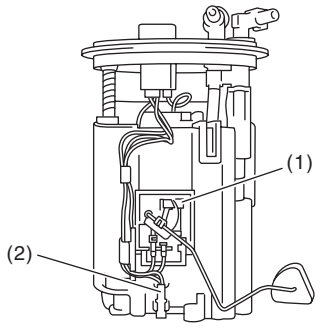


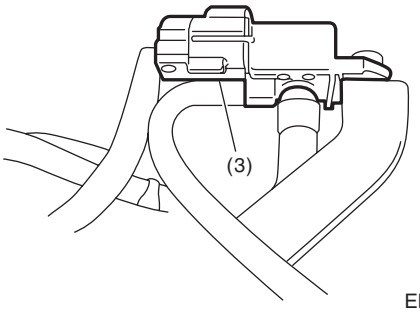

(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Front catalytic converter
(4) Rear catalytic converter




(1) Fuel level sensor
(2) Fuel temperature sensor
(3) Fuel tank pressure sensor
(4) Fuel sub level sensor



EN-05725



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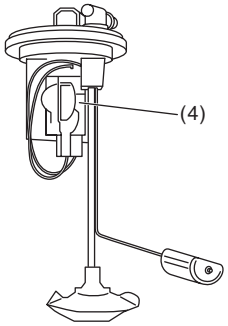
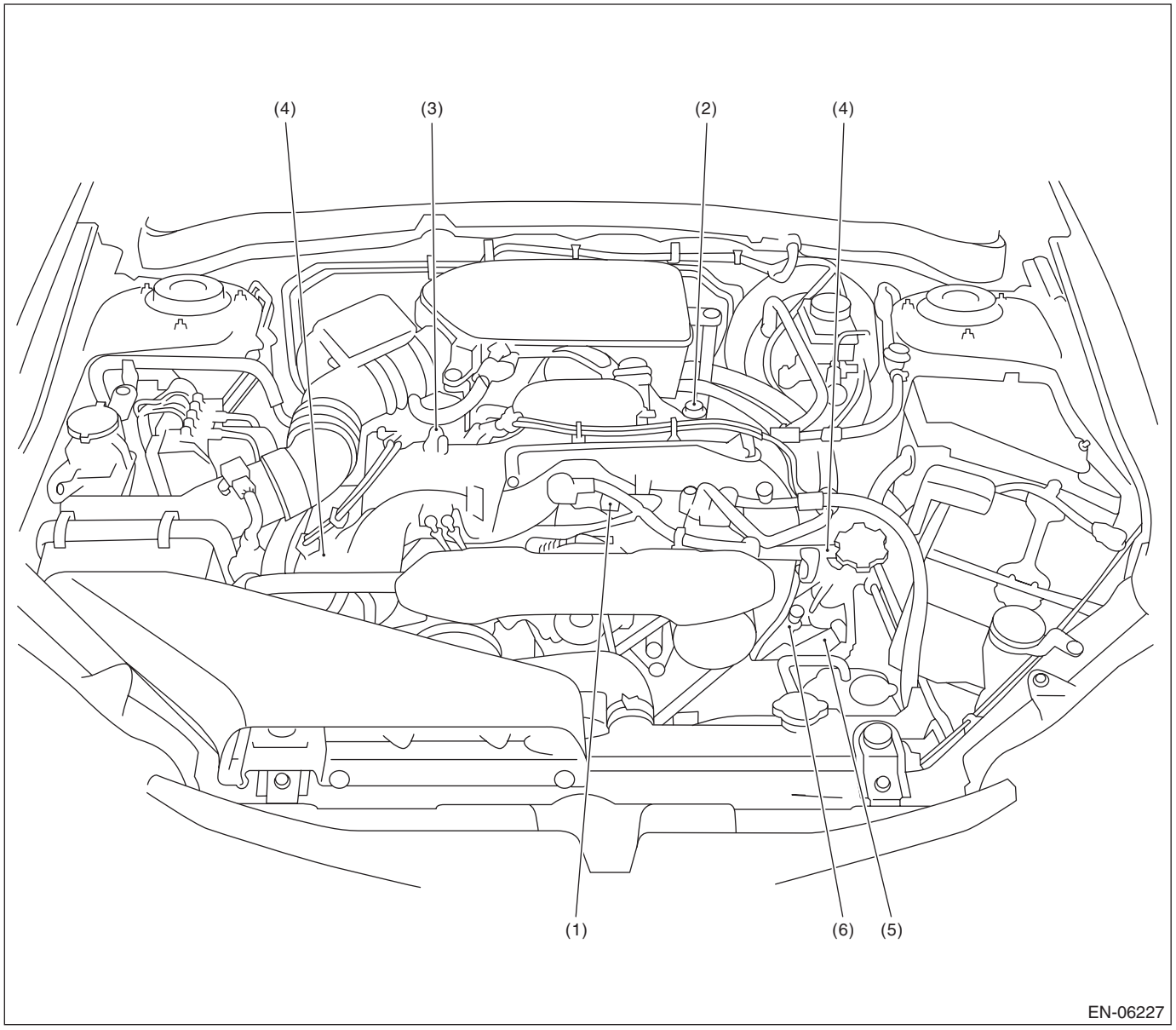
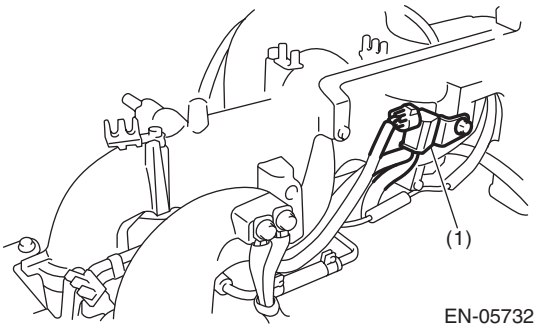


EN-03132

## 3. SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS




(1) Purge control solenoid valve
(2) EGR valve
(3) Ignition coil and ignitor ASSY
(4) Fuel injector
(5) Oil switching solenoid valve
(6) Variable valve lift diagnosis oil pressure switch



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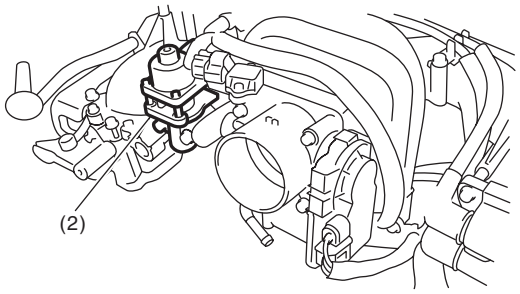

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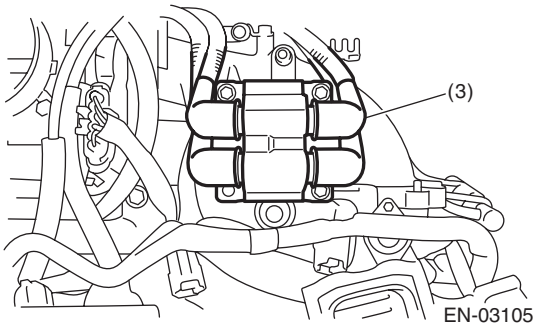
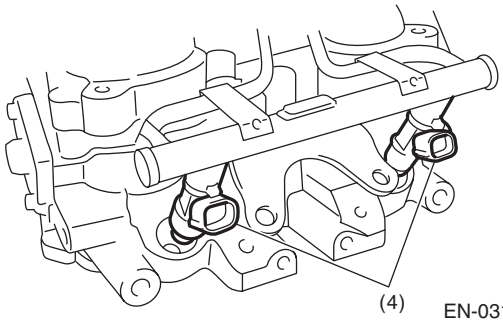


EN-03105



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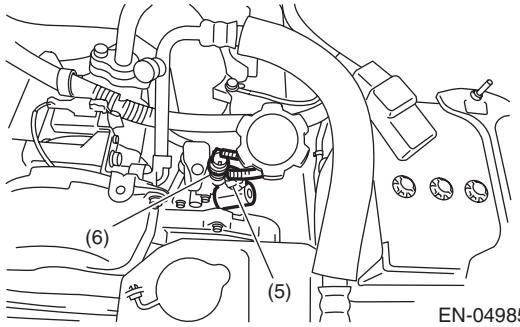

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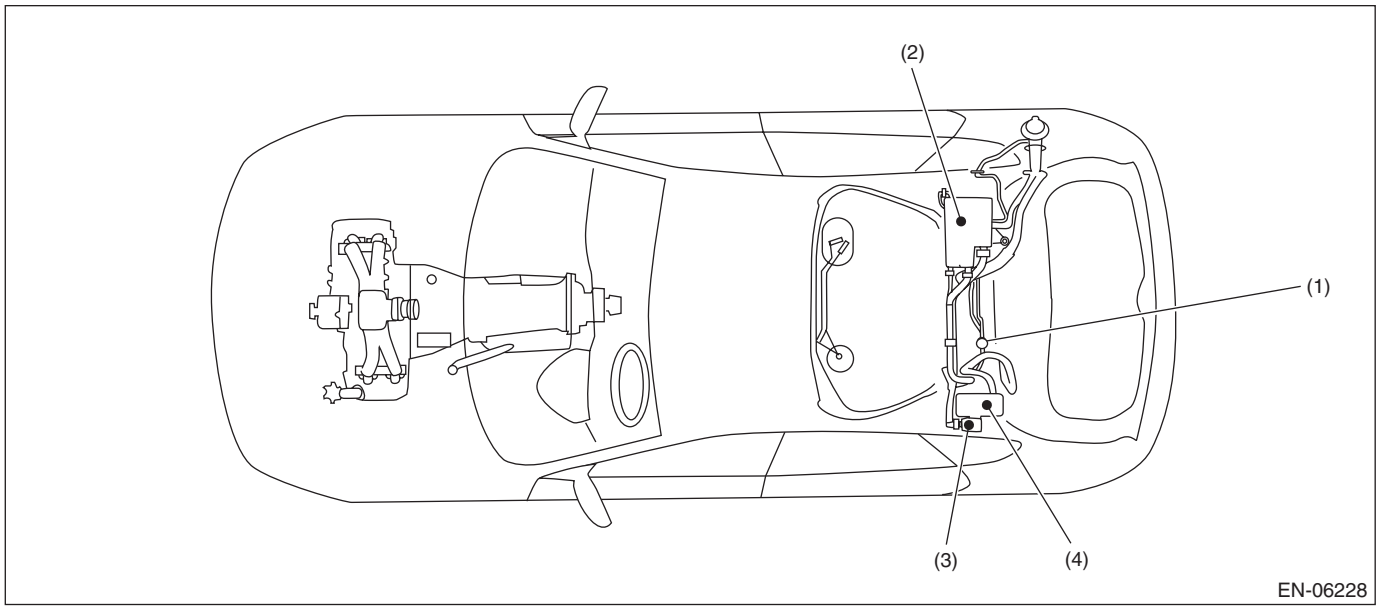
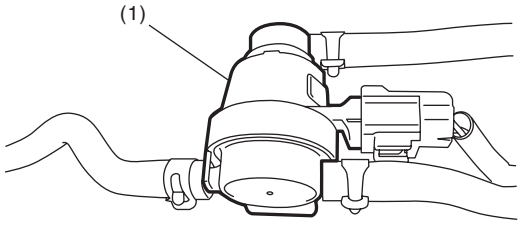
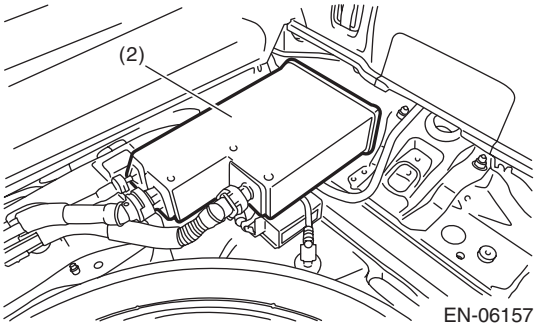
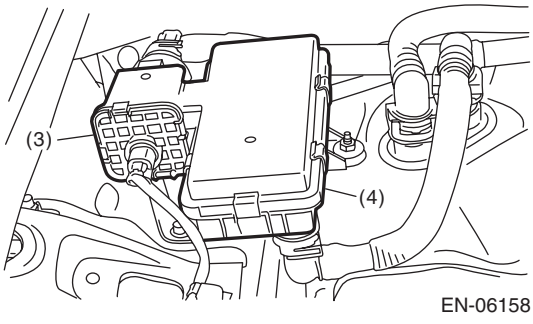
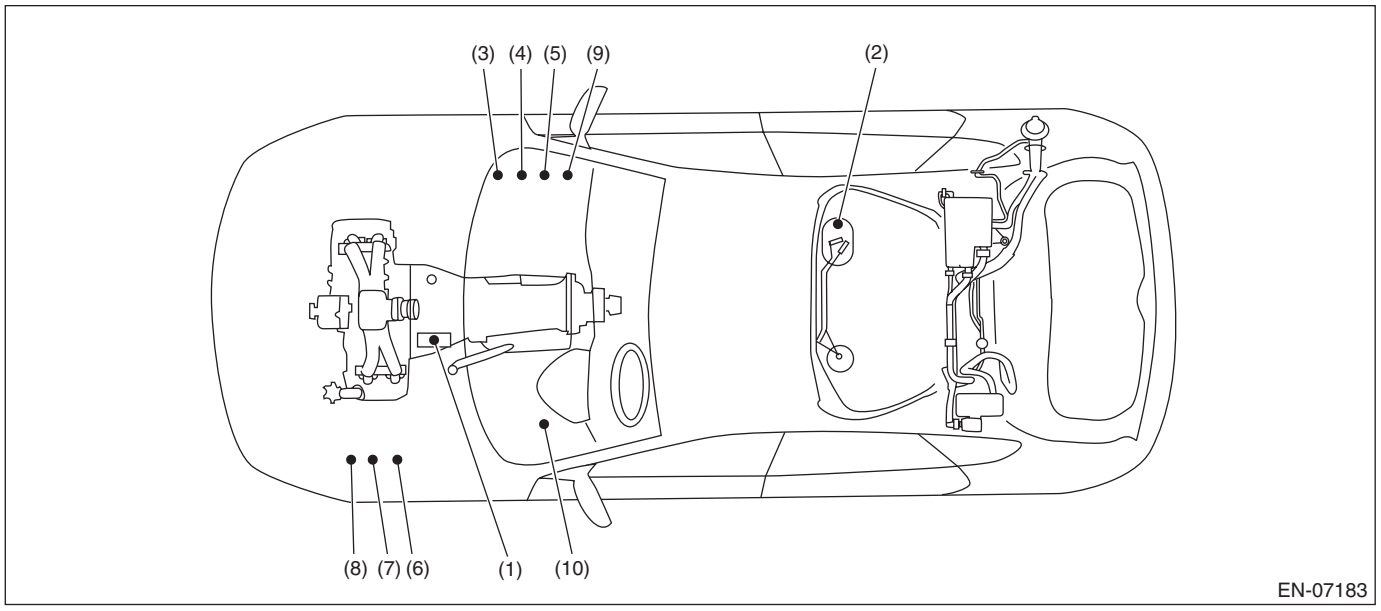



(1) Pressure control solenoid valve
(2) Canister
(3) Drain valve
(4) Drain filter

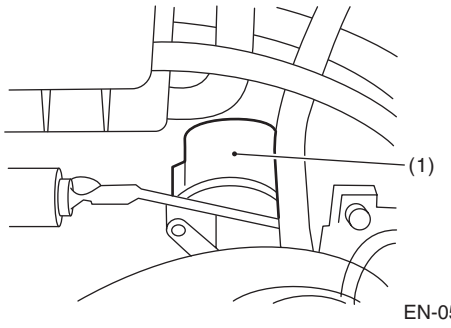


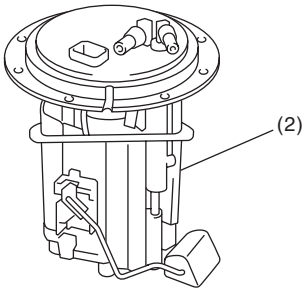



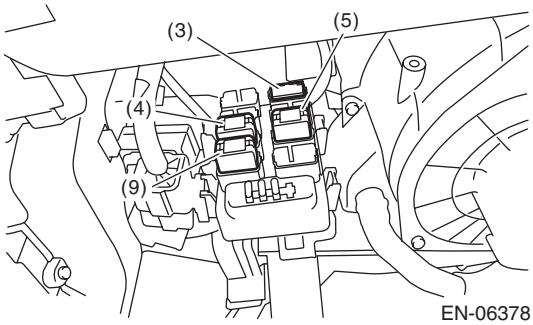



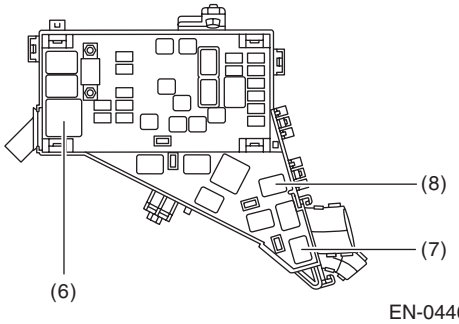


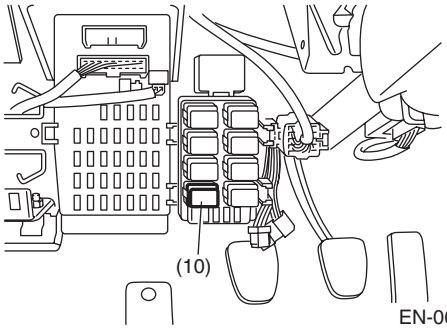

(1) Starter
(2) Fuel pump
(3) Main relay
(4) Fuel pump relay
(5) Electronic throttle control relay
(6) Radiator main fan relay 1
(7) Radiator sub fan relay
(8) Radiator main fan relay 2
(9) A/F, oxygen sensor relay
(10) Starter relay



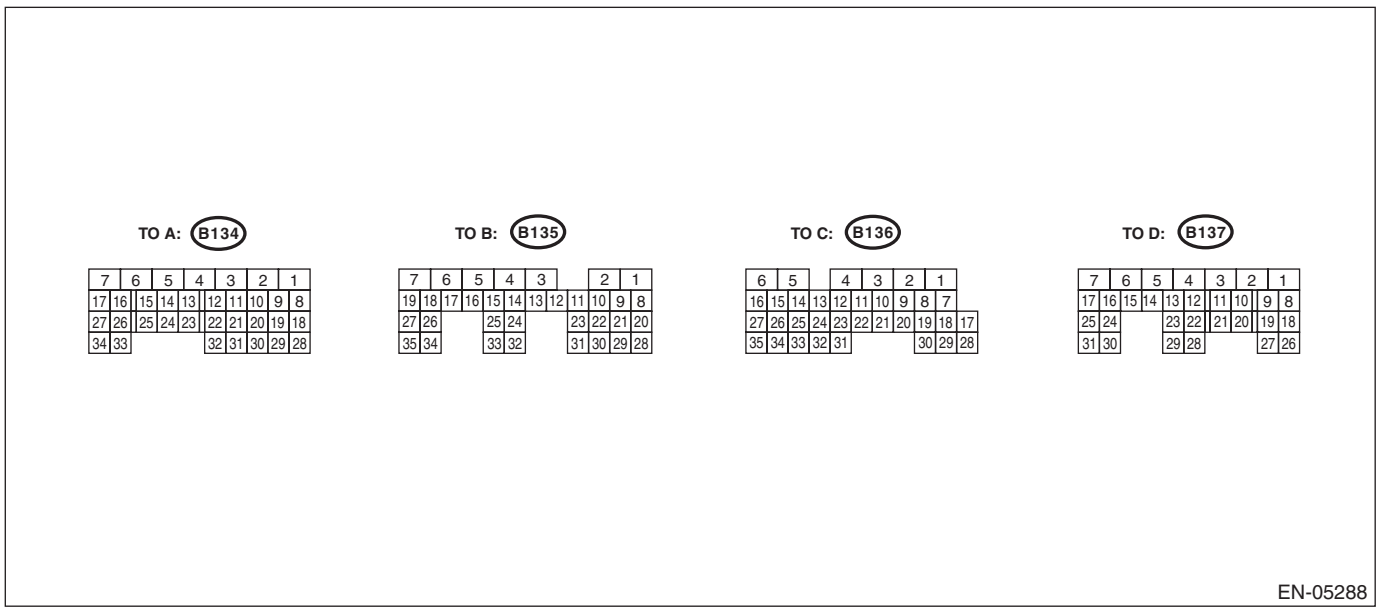



# 5. Engine Control Module (ECM) I/O Signal

## A: ELECTRICAL SPECIFICATION




| Contents | | Connector No. | Terminal No. | Signal (V) | | Note |
|---|---|---|---|---|---|---|
| | | | | Ignition SW ON (engine OFF) | Engine ON (idling) | |
| Crankshaft position sensor | Signal (+) | B137 | 17 | 0 | –7 — +7 | Waveform |
| | Signal (–) | B137 | 25 | 0 | 0 | — |
| | Shield | B137 | 31 | 0 | 0 | — |
| Camshaft position sensor | Signal (+) | B137 | 24 | 0 | –7 — +7 | Waveform |
| | Signal (–) | B137 | 30 | 0 | 0 | — |
| | Shield | B137 | 31 | 0 | 0 | — |
| Electronic throttle control | Main | B134 | 18 | Approx. 0.7 | Approx. 0.6 — 0.7 (After engine is warmed up.) | Fully closed: Approx. 0.6<br>Fully open: Approx. 4.0 |
| | Sub | B134 | 28 | Approx. 1.6 | Approx. 1.5 — 1.6 (After engine is warmed up.) | Fully closed: Approx. 1.5<br>Fully open: Approx. 4.2 |
| | Power supply | B134 | 19 | 5 | 5 | — |
| | Ground (sensor) | B134 | 29 | 0 | 0 | — |
| Electronic throttle control motor (+) | | B134 | 2 | Duty waveform | Duty waveform | Drive frequency: 500 Hz |
| Electronic throttle control motor (–) | | B134 | 1 | Duty waveform | Duty waveform | Drive frequency: 500 Hz |
| Electronic throttle control motor power supply | | B135 | 7 | 10 — 13 | 12 — 14 | — |
| Electronic throttle control motor relay | | B135 | 17 | ON: 0<br>OFF: 10 — 13 | ON: 0<br>OFF: 12 — 14 | When ignition switch is turned to ON: ON |

# Engine Control Module (ECM) I/O Signal

| Contents | | Connector No. | Terminal No. | Signal (V) | | Note |
|---|---|---|---|---|---|---|
| | | | | Ignition SW ON (engine OFF) | Engine ON (idling) | |
| Accelerator pedal position sensor | Main sensor signal | B135 | 23 | Fully closed: 1.0<br>Fully opened: 3.5 | Fully closed: 1.0<br>Fully opened: 3.5 | — |
| | Main power supply | B135 | 21 | 5 | 5 | — |
| | Ground (Main sensor) | B135 | 29 | 0 | 0 | — |
| | Sub sensor signal | B135 | 31 | Fully closed: 1.0<br>Fully opened: 3.5 | Fully closed: 1.0<br>Fully opened: 3.5 | — |
| | Sub power supply | B135 | 22 | 5 | 5 | — |
| | Ground (Sub sensor) | B135 | 30 | 0 | 0 | — |
| Rear oxygen sensor | Signal | B136 | 20 | 0 | 0 — 0.9 | — |
| | Shield | B136 | 9 | 0 | 0 | — |
| Front oxygen (A/F) sensor heater | Signal 1 | B136 | 6 | 10 — 13 | 1 — 14 | Duty waveform |
| | Signal 2 | B136 | 5 | 10 — 13 | 1 — 14 | Duty waveform |
| Rear oxygen sensor heater signal | | B135 | 6 | 10 — 13 | 1 — 14 | Duty waveform |
| Engine coolant temperature sensor | | B137 | 22 | 1.0 — 1.4 | 1.0 — 1.4 | After engine is warmed up. |
| Starter switch | | B136 | 16 | 0 | 0 | AT model<br>Cranking: 8 — 14<br>MT model<br>Cranking with the clutch pedal pressed: 8 — 14 |
| Starter relay control | | B135 | 26 | ON: 0.5 or less<br>OFF: 10 — 13 | ON: 0.5 or less<br>OFF: 12 — 14 | — |
| Ignition switch | | B136 | 30 | 10 — 13 | 12 — 14 | — |
| Neutral position switch | | B136 | 35 | ON: 0<br>OFF: 12±0.5 | | AT model: Switch is ON when select lever is shifted into “P” range or “N” range.<br>MT model: Switch is ON when the shift lever is in neutral. |
| Delivery (test) mode switch | | B136 | 34 | 10 — 13 | 13 — 14 | When connector connected: 0 |
| Knock sensor | Signal | B137 | 2 | 2.5 | 2.5 | — |
| | Shield | B137 | 8 | 0 | 0 | — |
| Back-up power supply | | B136 | 2 | 10 — 13 | 12 — 14 | Ignition switch “OFF”: 10 — 13 |
| Control module power supply | | B137 | 7 | 10 — 13 | 12 — 14 | — |
| | | B136 | 1 | 10 — 13 | 12 — 14 | — |
| Ignition control | #1, #2 | B134 | 21 | 0 | 0 or 5 | Waveform |
| | #3, #4 | B134 | 22 | 0 | 0 or 5 | Waveform |
| Fuel injector | #1 | B134 | 10 | 10 — 13 | 1 — 14 | Waveform |
| | #2 | B134 | 11 | 10 — 13 | 1 — 14 | Waveform |
| | #3 | B134 | 12 | 10 — 13 | 1 — 14 | Waveform |
| | #4 | B134 | 13 | 10 — 13 | 1 — 14 | Waveform |
| Fuel pump relay control | | B136 | 33 | ON: 0.5 or less<br>OFF: 10 — 13 | ON: 0.5 or less<br>OFF: 12 — 14 | — |

# Engine Control Module (ECM) I/O Signal

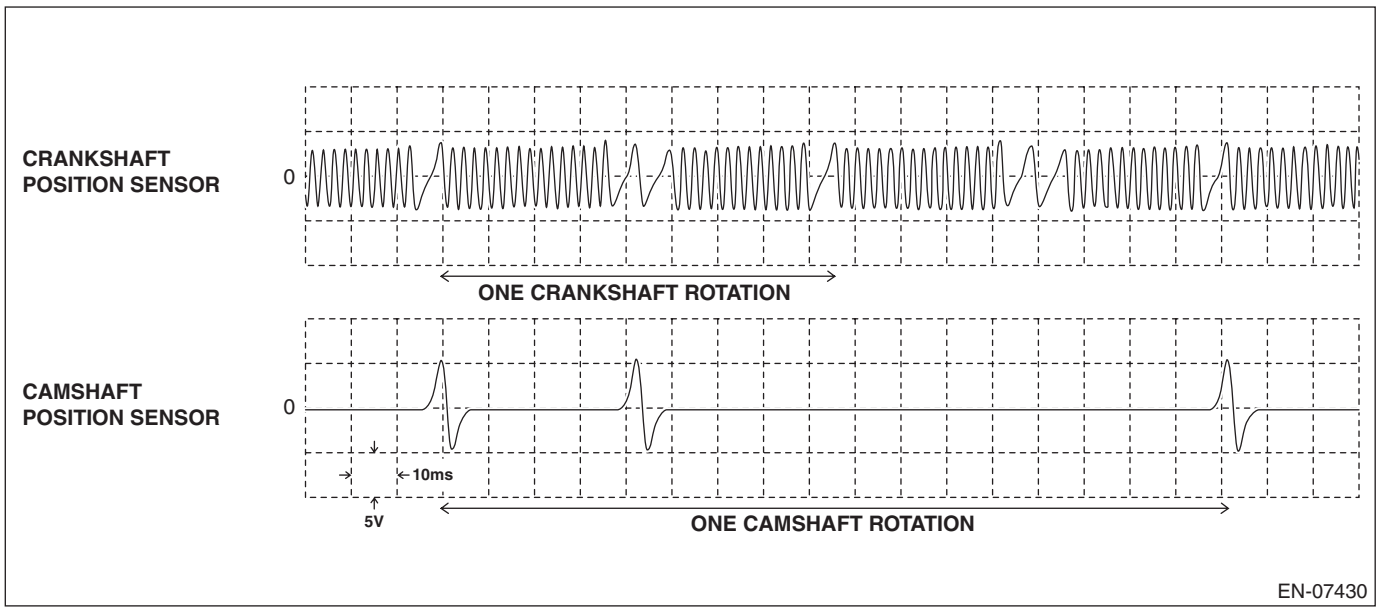
| Contents | | Connector No. | Terminal No. | Signal (V) | | Note |
|---|---|---|---|---|---|---|
| | | | | Ignition SW ON (engine OFF) | Engine ON (idling) | |
| A/C relay control | | B135 | 35 | ON: 0.5 or less<br>OFF: 10 — 13 | ON: 0.5 or less<br>OFF: 12 — 14 | — |
| Main fan relay control | | B135 | 12 | ON: 0.5 or less<br>OFF: 10 — 13 | ON: 0.5 or less<br>OFF: 12 — 14 | — |
| Sub fan relay control | | B135 | 11 | ON: 0.5 or less<br>OFF: 10 — 13 | ON: 0.5 or less<br>OFF: 12 — 14 | — |
| Self-shutoff control | | B135 | 13 | 0.5 or less | 0.5 or less | — |
| Malfunction indicator light | | B135 | 33 | — | — | Light “ON”: 1 or less<br>Light “OFF”: 10 — 14 |
| Engine speed output | | B135 | 15 | — | 0 — 13 or more | Waveform |
| Oil temperature sensor signal | | B137 | 21 | 1.0 — 1.4 | 1.0 — 1.4 | After engine is warmed up. |
| Purge control solenoid valve | | B137 | 6 | ON: 1 or less<br>OFF: 10 — 13 | ON: 1 or less<br>OFF: 12 — 14 | Duty waveform |
| EGR valve | Signal 1 | B134 | 8 | 0 or 10 — 13 | 0 or 12 — 14 | Waveform |
| | Signal 2 | B134 | 9 | 0 or 10 — 13 | 0 or 12 — 14 | Waveform |
| | Signal 3 | B134 | 20 | 0 or 10 — 13 | 0 or 12 — 14 | Waveform |
| | Signal 4 | B134 | 30 | 0 or 10 — 13 | 0 or 12 — 14 | Waveform |
| Power steering oil pressure switch | | B137 | 28 | ON: 1 or less<br>OFF: 10 — 13 | ON: 1 or less<br>OFF: 12 — 14 | — |
| Blower motor relay | | B135 | 19 | ON: 0<br>OFF: 10 — 13 | ON: 0<br>OFF: 12 — 14 | Manual A/C |
| A/C pressure switch | | B136 | 7 | ON: 0<br>OFF: 10 — 13 | ON: 0<br>OFF: 12 — 14 | — |
| A/C switch | | B136 | 29 | ON: 10 — 13<br>OFF: 0 | ON: 12 — 14<br>OFF: 0 | — |
| Oil switching solenoid valve RH | Signal (+) | B134 | 7 | 0 | Duty waveform | Drive frequency: 300 Hz |
| | Signal (–) | B134 | 15 | 0 | 0 | — |
| Oil switching solenoid valve LH | Signal (+) | B134 | 5 | 0 | Duty waveform | Drive frequency: 300 Hz |
| | Signal (–) | B134 | 14 | 0 | 0 | — |
| Variable valve lift diagnosis oil pressure switch RH | | B137 | 14 | 0 | 0 | — |
| Variable valve lift diagnosis oil pressure switch LH | | B137 | 13 | 0 | 0 | — |
| Front oxygen (A/F) sensor | Signal (+) | B136 | 19 | — | 2.7 — 2.9 | — |
| | Signal (–) | B136 | 18 | — | 2.35 — 2.25 | — |
| | Shield | B136 | 9 | 0 | 0 | — |
| Manifold absolute pressure sensor | | B137 | 20 | 3.4 — 3.8 | 1.4 — 1.8 | — |
| Air flow sensor | Signal | B136 | 22 | — | 0.3 — 4.5 | — |
| | Shield | B136 | 10 | 0 | 0 | — |
| | Ground | B136 | 11 | 0 | 0 | — |
| Intake air temperature sensor signal | | B136 | 31 | 0.3 — 4.6 | 0.3 — 4.6 | — |
| Immobilizer communication 1 | | B135 | 25 | 1 or less ←→ 4 or more | 1 or less ←→ 4 or more | — |
| Immobilizer communication 2 | | B135 | 24 | 1 or less ←→ 4 or more | 1 or less ←→ 4 or more | — |
| SSM communication | | B135 | 14 | 1 or less ←→ 4 or more | 1 or less ←→ 4 or more | — |

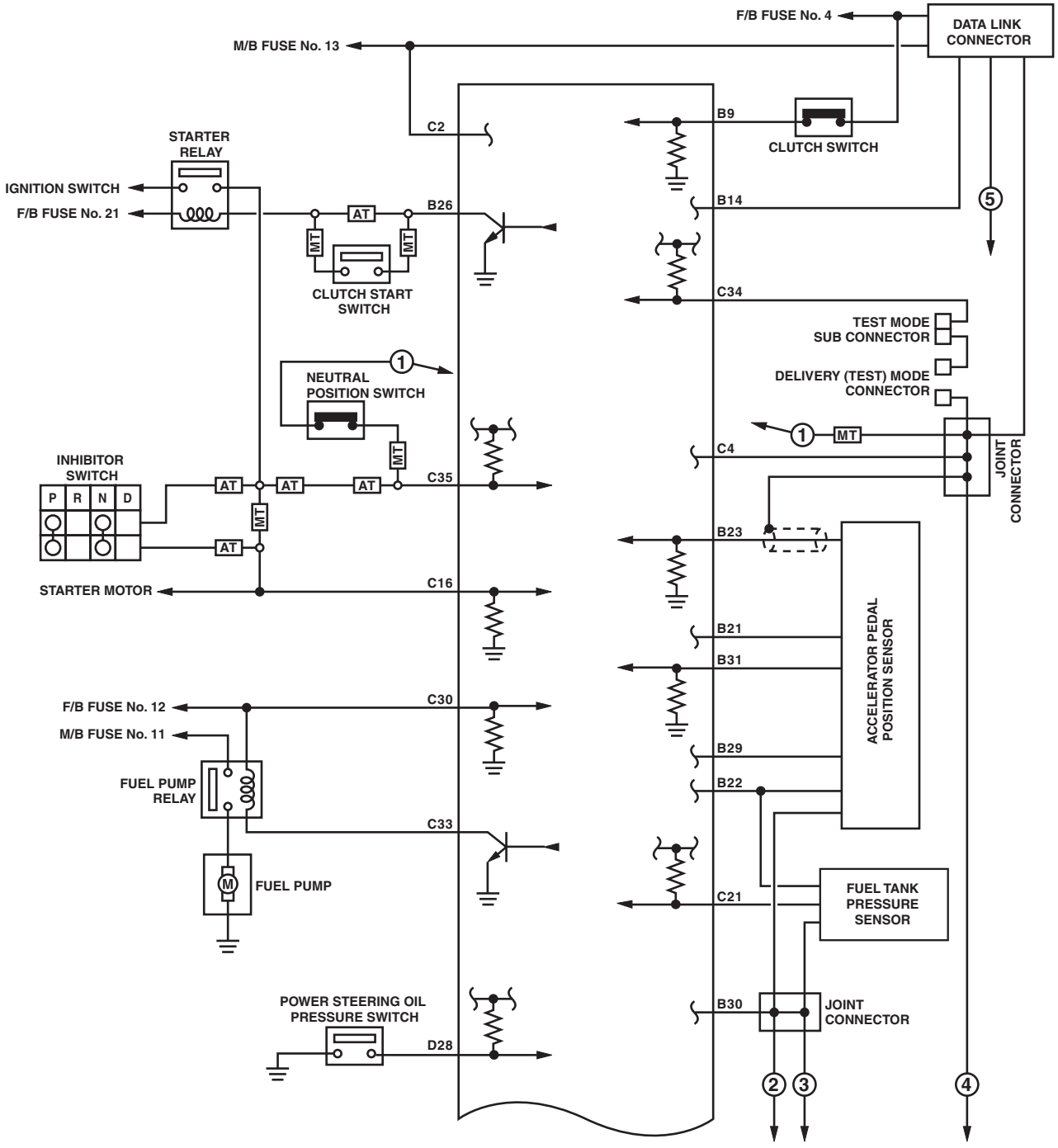
# Engine Control Module (ECM) I/O Signal

| Contents | | Connector No. | Terminal No. | Signal (V) | | Note |
|---|---|---|---|---|---|---|
| | | | | Ignition SW ON (engine OFF) | Engine ON (idling) | |
| Sensor power supply | | B134 | 19 | 5 | 5 | — |
| | | B135 | 22 | 5 | 5 | — |
| Ground | Sensor | B134 | 29 | 0 | 0 | — |
| | | B135 | 30 | 0 | 0 | — |
| | Engine 1 | B134 | 6 | 0 | 0 | — |
| | Engine 2 | B134 | 4 | 0 | 0 | — |
| | Engine 3 | B134 | 3 | 0 | 0 | — |
| | Engine 4 | B137 | 1 | 0 | 0 | — |
| | Engine 5 | B137 | 3 | 0 | 0 | — |
| | Body | B136 | 4 | 0 | 0 | — |
| Clutch switch | | B135 | 9 | When clutch pedal is depressed: 0<br>When clutch pedal is released: 10 — 13 | When clutch pedal is depressed: 0<br>When clutch pedal is released: 12 — 14 | — |
| Brake switch 1 (brake switch) | | B136 | 15 | When brake pedal is depressed: 0<br>When brake pedal is released: 10 — 13 | When brake pedal is depressed: 0<br>When brake pedal is released: 12 — 14 | — |
| Brake switch 2 (stop light switch) | | B136 | 3 | When brake pedal is depressed: 10 — 13<br>When brake pedal is released: 0 | When brake pedal is depressed: 12 — 14<br>When brake pedal is released: 0 | — |
| Cruise control main switch | | B136 | 13 | ON: 0<br>OFF: 5 | ON: 0<br>OFF: 5 | — |
| Cruise control command switch | | B136 | 12 | When operating nothing: 3.5 — 4.5<br>When operating RES/ACC: 2.5 — 3.5<br>When operating SET/COAST: 0.5 — 1.5<br>When operating CANCEL: 0 — 0.5 | When operating nothing: 3.5 — 4.5<br>When operating RES/ACC: 2.5 — 3.5<br>When operating SET/COAST: 0.5 — 1.5<br>When operating CANCEL: 0 — 0.5 | — |
| Blow-by leak diagnosis | | B137 | 12 | 0 | 0 | — |
| Fuel temperature sensor | | B136 | 23 | 2.5 — 3.8 | 2.5 — 3.8 | Ambient temperature: 25°C (77°F) |
| Fuel tank pressure sensor | | B136 | 21 | 2.3 — 2.7 | 2.3 — 2.7 | Value after removing fuel filler cap and installing again |
| Pressure control solenoid valve | | B135 | 3 | ON: 1 or less<br>OFF: 10 — 13 | ON: 1 or less<br>OFF: 12 — 14 | — |
| Drain valve | | B135 | 4 | ON: 1 or less<br>OFF: 10 — 13 | ON: 1 or less<br>OFF: 12 — 14 | — |
| CAN communication | (Hi) | B136 | 17 | 2.5 — 3.5 | 2.5 — 3.5 | Waveform |
| | (Lo) | B136 | 28 | 1.5 — 2.5 | 1.5 — 2.5 | Waveform |

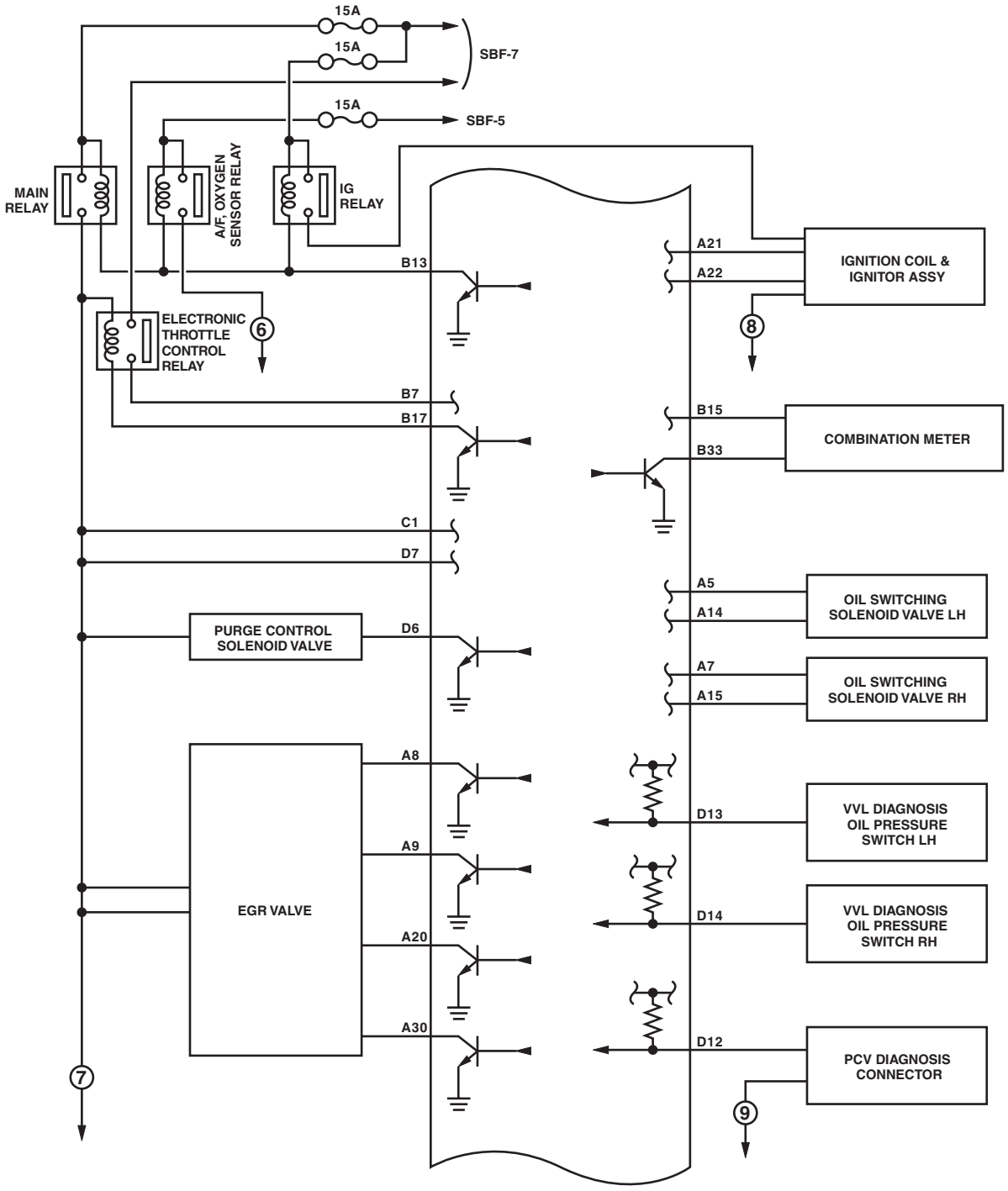
**Input/output name:**
- Crankshaft position sensor
- Camshaft position sensor

**Measuring condition:**
- After warming-up
- At idling

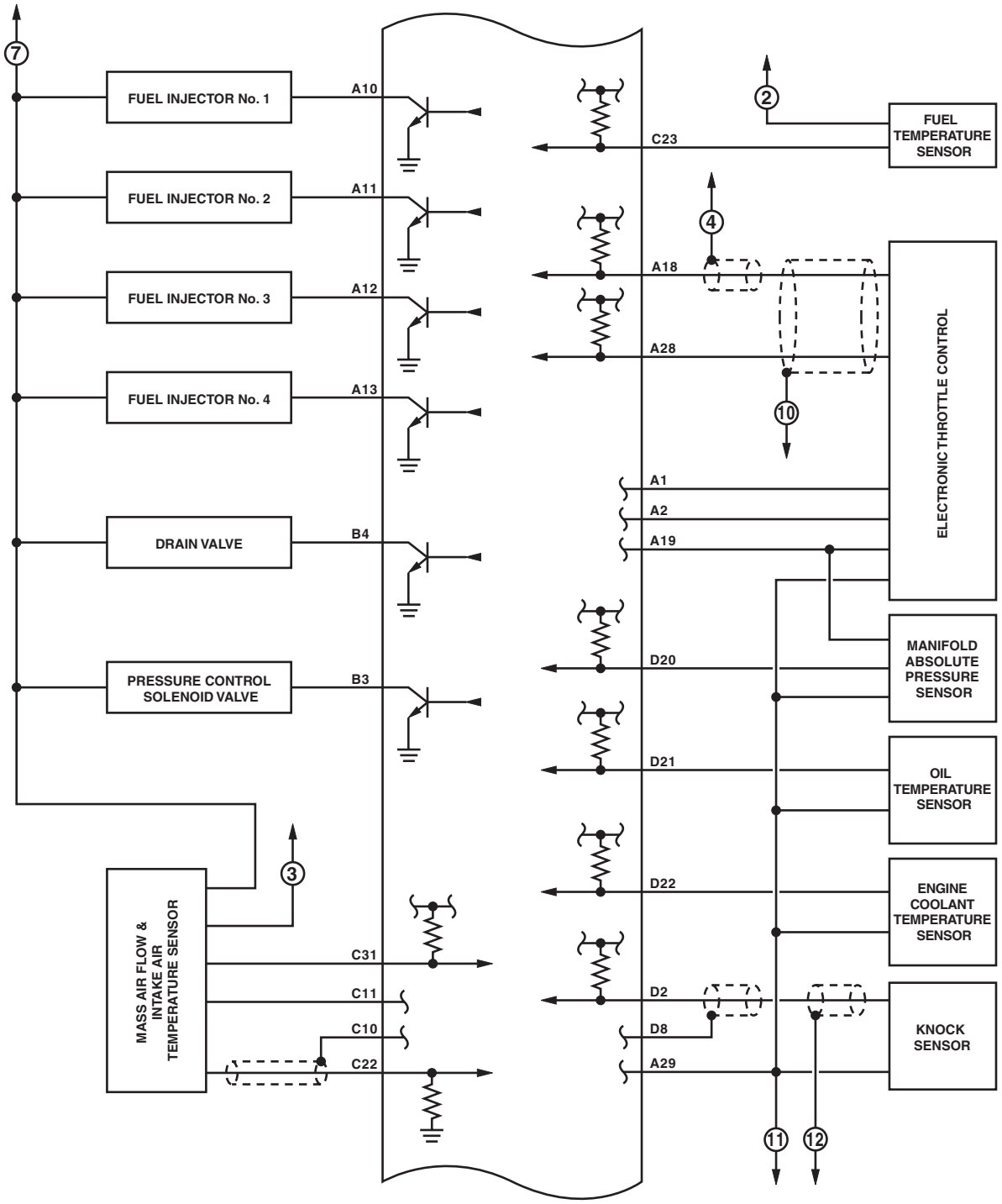



F/B FUSE No. 4
DATA LINK CONNECTOR
M/B FUSE No. 13
C2
B9
CLUTCH SWITCH
STARTER RELAY
IGNITION SWITCH
F/B FUSE No. 21
AT
B26
MT
B14
5
CLUTCH START SWITCH
C34
TEST MODE SUB CONNECTOR
DELIVERY (TEST) MODE CONNECTOR
1
NEUTRAL POSITION SWITCH
MT
C4
JOINT CONNECTOR
INHIBITOR SWITCH
P R N D
C35
B23
ACCELERATOR PEDAL POSITION SENSOR
STARTER MOTOR
C16
B21
B31
F/B FUSE No. 12
C30
M/B FUSE No. 11
B29
B22
FUEL PUMP RELAY
C33
FUEL PUMP
C21
FUEL TANK PRESSURE SENSOR
POWER STEERING OIL PRESSURE SWITCH
D28
B30
JOINT CONNECTOR
2
3
4

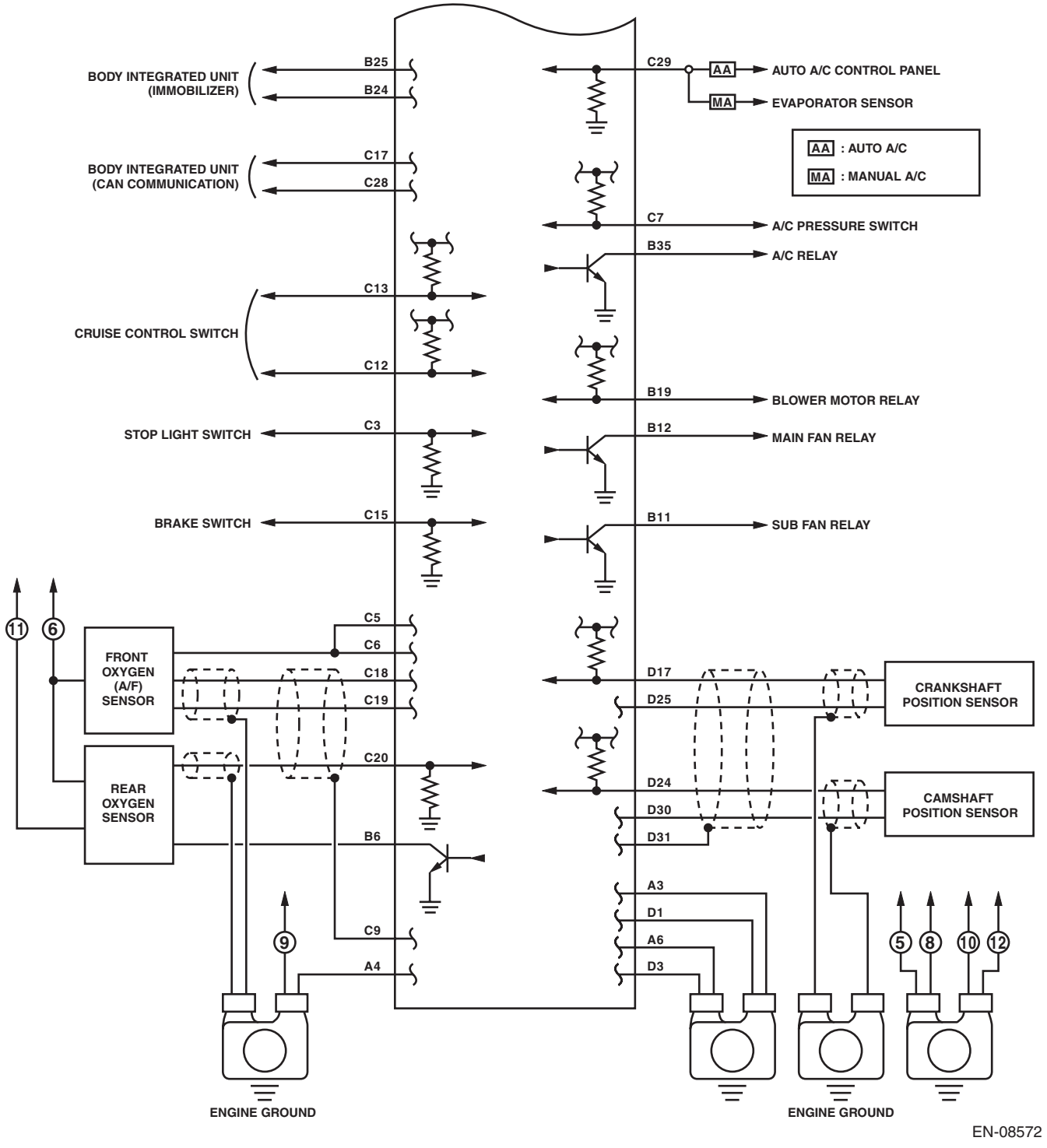
EN-08569


15A
15A
SBF-7
15A
SBF-5
MAIN RELAY
A/F, OXYGEN SENSOR RELAY
IG RELAY
ELECTRONIC THROTTLE CONTROL RELAY
6
B13
B7
B17
C1
D7
PURGE CONTROL SOLENOID VALVE
D6
EGR VALVE
A8
A9
A20
A30
7
A21
A22
IGNITION COIL & IGNITOR ASSY
8
B15
B33
COMBINATION METER
A5
A14
OIL SWITCHING SOLENOID VALVE LH
A7
A15
OIL SWITCHING SOLENOID VALVE RH
D13
VVL DIAGNOSIS OIL PRESSURE SWITCH LH
D14
VVL DIAGNOSIS OIL PRESSURE SWITCH RH
D12
PCV DIAGNOSIS CONNECTOR
9

EN-08570


7
FUEL INJECTOR No. 1
A10
FUEL INJECTOR No. 2
A11
FUEL INJECTOR No. 3
A12
FUEL INJECTOR No. 4
A13
DRAIN VALVE
B4
PRESSURE CONTROL SOLENOID VALVE
B3
3
MASS AIR FLOW & INTAKE AIR TEMPERATURE SENSOR
C31
C11
C10
C22
2
C23
FUEL TEMPERATURE SENSOR
4
A18
A28
10
A1
A2
A19
ELECTRONIC THROTTLE CONTROL
D20
MANIFOLD ABSOLUTE PRESSURE SENSOR
D21
OIL TEMPERATURE SENSOR
D22
ENGINE COOLANT TEMPERATURE SENSOR
D2
D8
A29
KNOCK SENSOR
11
12

EN-08571


BODY INTEGRATED UNIT (IMMOBILIZER)
B25
B24
BODY INTEGRATED UNIT (CAN COMMUNICATION)
C17
C28
CRUISE CONTROL SWITCH
C13
C12
STOP LIGHT SWITCH
C3
BRAKE SWITCH
C15
11
6
FRONT OXYGEN (A/F) SENSOR
REAR OXYGEN SENSOR
C5
C6
C18
C19
C20
B6
9
C9
A4
ENGINE GROUND
C29
AA
AUTO A/C CONTROL PANEL
MA
EVAPORATOR SENSOR
AA : AUTO A/C
MA : MANUAL A/C
C7
A/C PRESSURE SWITCH
B35
A/C RELAY
B19
BLOWER MOTOR RELAY
B12
MAIN FAN RELAY
B11
SUB FAN RELAY
D17
D25
CRANKSHAFT POSITION SENSOR
D24
D30
D31
CAMSHAFT POSITION SENSOR
A3
D1
A6
D3
5
8
10
12
ENGINE GROUND

EN-08572

# 6. Engine Condition Data

## A: ELECTRICAL SPECIFICATION

| Content | Specifications |
|---|---|
| Engine load | 17.6 — 40.5 (%): Idling |
| | 14.7 — 29.8 (%): 2,500 rpm racing |

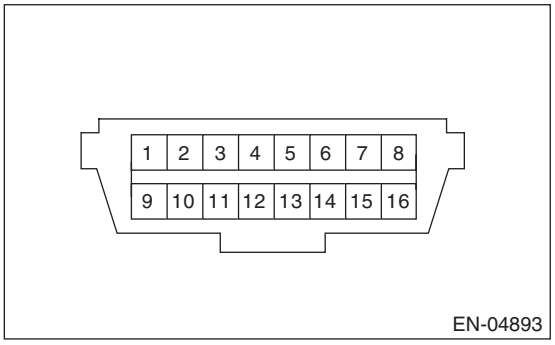
Measuring condition:
- After engine is warmed up.
- Set the select lever in “P” range or “N” range, or the shift lever in neutral.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

# 7. Data Link Connector

## A: NOTE

This connector is used for Subaru Select Monitor.

**CAUTION:**
**Do not connect any scan tools other than Subaru Select Monitor or general scan tool because the circuit for Subaru Select Monitor may be damaged.**



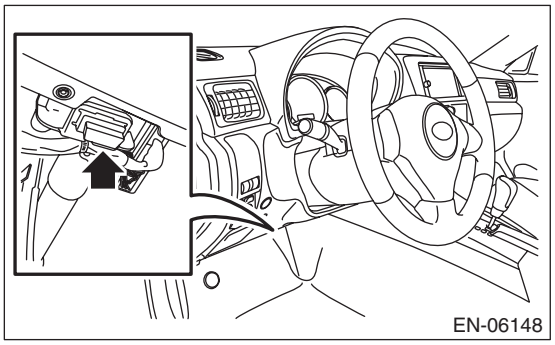

| Terminal No. | Content | Terminal No. | Content |
|---|---|---|---|
| 1 | Blank | 9 | Blank |
| 2 | Blank | 10 | Blank |
| 3 | Blank | 11 | Blank |
| 4 | Ground | 12 | Blank |
| 5 | Ground | 13 | Blank |
| 6 | CAN communication (Hi) | 14 | CAN communication (Lo) |
| 7 | Subaru Select Monitor signal | 15 | Blank |
| 8 | Blank | 16 | Power supply |

# 8. General Scan Tool

## A: OPERATION

### 1. HOW TO USE GENERAL SCAN TOOL

1) Prepare a scan tool (general scan tool) required by SAE J1978.
2) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).




3) Using the general scan tool, call up each data. General scan tool functions consist of:
   (1) MODE $01: Current powertrain diagnostic data
   (2) MODE $02: Powertrain freeze frame data
   (3) MODE $03: Emission-related powertrain DTC
   (4) MODE $04: Clear/Reset emission-related diagnostic information
   (5) MODE $06: Request on-board monitoring test results for intermittently monitored systems
   (6) MODE $07: Request on-board monitoring test results for continuously monitored systems
   (7) MODE $09: Request vehicle information
4) Read out the data according to repair procedures. (For detailed operation procedure, refer to the general scan tool operation manual.)

NOTE:
For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

## 2. MODE $01: (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.

A list of the support data and PID (Parameter Identification) codes are shown in the following table.

| PID | Data | Unit of measure |
|---|---|---|
| $01 | Number of emission-related powertrain DTC, and malfunction indicator light status and diagnosis support information | — |
| $03 | Fuel system control status | — |
| $04 | Calculated engine load value | % |
| $05 | Engine coolant temperature | °C |
| $06 | Short term fuel trim | % |
| $07 | Long term fuel trim | % |
| $0B | Intake manifold absolute pressure | kPa |
| $0C | Engine speed | rpm |
| $0D | Vehicle speed | MPH |
| $0E | Ignition timing advance | ° |
| $0F | Intake air amount | °C |
| $10 | Intake air amount | g/s |
| $11 | Throttle valve opening angle | % |
| $13 | Air fuel ratio sensor | — |
| $15 | Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2) | V and % |
| $1C | Supporting OBD system | — |
| $1F | Elapsed time after starting the engine | sec |
| $21 | Travel distance after the malfunction indicator light illuminates | miles |
| $24 | A/F value and A/F sensor output voltage (Bank 1 Sensor 1) | — and V |
| $2C | Target EGR | % |
| $2D | EGR deviation | % |
| $2E | Evaporative purge | % |
| $2F | Fuel level | % |
| $30 | Number of warm ups after DTC clear | — |
| $31 | Travel distance after DTC clear | miles |
| $32 | Fuel tank pressure | Pa |
| $33 | Barometric pressure | kPa |
| $34 | A/F value and A/F sensor current (Bank 1 Sensor 1) | — and mA |
| $3C | Catalyst temperature #1 | °C |
| $41 | Diagnostic monitor of each drive cycle | — |
| $42 | ECM power voltage | V |
| $43 | Absolute load | % |
| $44 | A/F target lambda | — |
| $45 | Relative throttle opening angle | % |
| $46 | Ambient temperature | °C |
| $47 | Absolute throttle opening angle 2 | % |
| $49 | Absolute accelerator opening angle 1 | % |
| $4A | Absolute accelerator opening angle 2 | % |
| $4C | Target throttle opening angle | % |
| $4D | Engine operating time while malfunction indicator lit | min |
| $4E | Elapsed time after DTC clear | min |
| $51 | Fuel used | — |
| $5A | Relative accelerator opening angle | % |
| $65 | Neutral status | — |

NOTE:
Refer to general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE $01).

### 3. MODE $02 (POWERTRAIN FREEZE FRAME DATA)

Refer to data denoting the operating condition when trouble is detected by on-board diagnosis system. A list of the support data and PID (Parameter Identification) codes are shown in the following table.

| PID | Data | Unit of measure |
|---|---|---|
| $02 | DTC that caused the freeze frame data storage required by CARB | — |
| $03 | Fuel system control status | — |
| $04 | Calculated engine load value | % |
| $05 | Engine coolant temperature | °C |
| $06 | Short term fuel trim (Bank 1 Sensor 1) | % |
| $07 | Long term fuel trim (Bank 1 Sensor 1) | % |
| $0B | Intake manifold absolute pressure | kPa |
| $0C | Engine speed | rpm |
| $0D | Vehicle speed | MPH |
| $0E | Ignition timing advance | ° |
| $0F | Intake air amount | °C |
| $10 | Intake air amount | g/s |
| $11 | Throttle valve opening angle | % |
| $13 | Air fuel ratio sensor | — |
| $15 | Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2) | V and % |
| $1C | Supporting OBD system | — |
| $1F | Elapsed time after starting the engine | sec |
| $2C | Target EGR | % |
| $2D | EGR deviation | % |
| $2E | Evaporative purge | % |
| $2F | Fuel level | % |
| $32 | Fuel tank pressure | Pa |
| $33 | Barometric pressure | kPa |
| $42 | ECM power voltage | V |
| $43 | Absolute load | % |
| $44 | A/F target lambda | — |
| $45 | Relative throttle opening angle | % |
| $46 | Ambient temperature | °C |
| $47 | Absolute throttle opening angle 2 | % |
| $49 | Absolute accelerator opening angle 1 | % |
| $4A | Absolute accelerator opening angle 2 | % |
| $4C | Target throttle opening angle | % |
| $65 | Neutral status | — |

NOTE:
Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE $02).

### 4. MODE $03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

### 5. MODE $04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refer to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

NOTE:
Refer to general scan tool manufacturer's instruction manual to clear the emission-related diagnostic information (MODE $04).

## 6. MODE $06

Refer to test value of troubleshooting and data of test limit indicated on the support data bit sequence table. A list of the support data is shown in the following table.

| OBDMID | TID | SID | Diagnostic item |
|---|---|---|---|
| $01 | $81 | $0A | A/F sensor continuity failure (Bank 1 Sensor 1) |
| | $82 | $8D | |
| | $83 | $14 | |
| | $84 | $1E | A/F sensor range failure (Bank 1 Sensor 1) |
| | $85 | $1E | |
| | $86 | $20 | A/F sensor response failure (Bank 1 Sensor 1) |
| $02 | $87 | $0B | Oxygen sensor circuit failure (Bank 1 Sensor 2) |
| | $88 | $0B | |
| | $07 | $0B | Oxygen sensor drop failure (Bank 1 Sensor 2) |
| | $08 | $0B | |
| | $A5 | $0B | |
| | $05 | $10 | Oxygen sensor response failure (Bank 1 Sensor 2) |
| | $06 | $10 | |
| $21 | $89 | $20 | Catalyst deterioration diagnosis (Bank 1) |
| $31 | $8A | $FD | EGR system diagnosis |
| $39 | $93 | $FE | Evaporative emission control system (Cap off) |
| $3B | $94 | $FE | Evaporative emission control system (0.04 inch leak) |
| | $95 | $FE | |
| $3C | $96 | $FE | Evaporative emission control system (0.02 inch leak) |
| | $97 | $FE | |
| $3D | $98 | $FE | Evaporative emission control system (Purge flow) |
| $41 | $99 | $24 | A/F sensor heater failure (Bank 1 Sensor 1) |
| | $9A | $24 | |
| | $9B | $14 | A/F sensor heater characteristics failure (Bank 1 Sensor 1) |
| $42 | $9C | $24 | Oxygen sensor heater failure (Bank 1 Sensor 1) |
| | $9D | $24 | |
| $A1 | $0B | $24 | Misfire monitoring (All cylinders) |
| | $0C | $24 | |
| $A2 | $0B | $24 | Misfire monitoring (#1 cylinder) |
| | $0C | $24 | |
| $A3 | $0B | $24 | Misfire monitoring (#2 cylinder) |
| | $0C | $24 | |
| $A4 | $0B | $24 | Misfire monitoring (#3 cylinder) |
| | $0C | $24 | |
| $A5 | $0B | $24 | Misfire monitoring (#4 cylinder) |
| | $0C | $24 | |

## 7. MODE $07

Refer to the data of DTC (pending code) for troubleshooting result about emission in the first time.

## 8. MODE $09

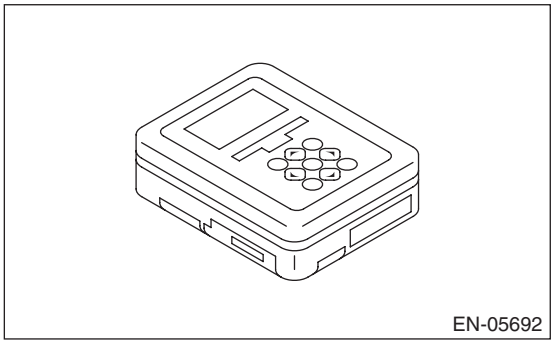
Refer to data of vehicle specification (V.I.N., calibration ID, diagnosis frequency etc.).

# 9. Subaru Select Monitor

## A: OPERATION

### 1. HOW TO USE SUBARU SELECT MONITOR

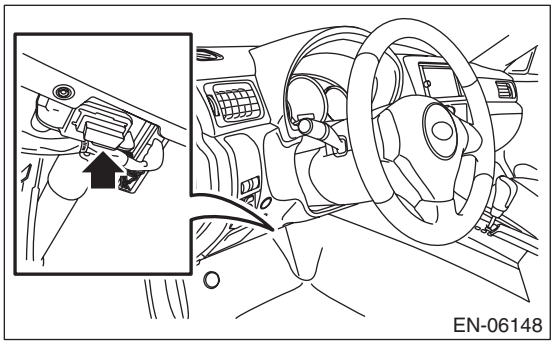
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.
4) Connect the diagnosis cable to SDI.
5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**
**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**


EN-06148

6) Start the PC.
7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
8) Call up DTC and data, then record them.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

## 2. READ CURRENT DATA FOR ENGINE (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Current Data Display & Save}.
5) On «Current Data Display & Save» display, select {Normal sampling}.
6) Using the scroll key, scroll the display screen up or down until the desired data is shown.

• A list of the support data is shown in the following table.

| Content | Display | Unit of measure | Note (at idling) |
|---|---|---|---|
| Engine load | Engine Load | % | 21.0% |
| Engine coolant temperature signal | Coolant Temp. | °C or °F | 85°C or 185°F or more (after warm-up) |
| A/F correction #1 | A/F Correction #1 | % | –0.8% |
| A/F learning #1 | A/F Learning #1 | % | 0.0% |
| Intake manifold absolute pressure | Mani. Absolute Pressure | mmHg, kPa, inHg or psig | 200 — 300 mmHg, 26.7 — 40 kPa, 7.8 — 11.8 inHg or 3.8 — 5.8 psig |
| Engine speed signal | Engine Speed | rpm | 700 rpm (Agree with the tachometer indication) |
| Meter vehicle speed signal | Vehicle Speed | km/h or MPH | 0 km/h or 0 MPH (at parking) |
| Ignition timing signal | Ignition Timing | deg | 14 — 16 deg |
| Intake air temperature signal | Intake Air Temp. | °C or °F | (Ambient air temperature) |
| Intake air amount | Mass Air Flow | g/s or lb/m | 2.5 g/s or 0.33 lb/m |
| Throttle opening angle signal | Throttle Opening Angle | % | 2.0% |
| Rear oxygen sensor voltage | Rear O2 Sensor | V | 0.1 — 0.7 V |
| Battery voltage | Battery Voltage | V | 12 — 14 V |
| Mass air flow voltage | Air Flow Sensor Voltage | V | 1.26 V |
| Injection 1 pulse width | Fuel Injection #1 Pulse | ms | 2.82 ms |
| Atmospheric pressure signal | Atmosphere Pressure | mmHg, kPa, inHg or psig | (Atmospheric pressure) |
| Intake manifold relative pressure | Mani. Relative Pressure | mmHg, kPa, inHg or psig | (Air intake absolute pressure – Atmospheric pressure) |
| Learned ignition timing | Learned Ignition Timing | deg | 0 deg |
| Acceleration opening angle signal | Accel. Opening Angle | % | 0.0% |
| Fuel temperature signal | Fuel Temp. | °C or °F | +20°C or +68°F |
| Purge control solenoid duty ratio | CPC Valve Duty Ratio | % | 0 — 3% |
| Number of EGR steps | No. of EGR steps | STEP | 0 STEP |
| A/F sensor current value 1 | A/F Sensor #1 Current | mA | –0.2 — 0.2 mA |
| A/F sensor resistance value 1 | A/F Sensor #1 Resistance | Ω | 32 Ω |
| A/F sensor output lambda 1 | A/F Sensor #1 | — | 1.0 |
| A/F correction #3 | A/F Correction #3 | % | 0.3% |
| A/F learning #3 | A/F Learning #3 | % | 0.00% |
| Throttle motor duty | Throttle Motor Duty | % | –15% |
| Throttle motor voltage | Throttle Motor Voltage | V | (Battery voltage) |
| Sub throttle sensor voltage | Sub-Throttle Sensor | V | 1.52 V |
| Main throttle sensor voltage | Main-Throttle Sensor | V | 0.66 V |
| Sub accelerator sensor voltage | Sub-Accelerator Sensor | V | 0.68 V |
| Main acceleration sensor voltage | Main-Accelerator Sensor | V | 0.68 V |
| Memory vehicle speed | Memorized Cruise Speed | km/h or MPH | 0 km/h or 0 MPH |
| Fuel level sensor signal | Fuel level resistance | Ω | 2 — 96 Ω |
| Engine oil temperature | Oil Temperature | °C | ≥ 85°C (after warm-up) |
| Oil switching solenoid valve duty R | OSV Duty R | % | 16.9% |

| Content | Display | Unit of measure | Note (at idling) |
|---|---|---|---|
| Oil switching solenoid valve duty L | OSV Duty L | % | 16.9% |
| Oil switching solenoid valve current R | OSV Current R | mA | 192 mA |
| Oil switching solenoid valve current L | OSV Current L | mA | 192 mA |
| Variable valve lift lift mode | VVL Lift Mode | — | 1 |
| #1 cylinder roughness monitor | Roughness Monitor #1 | — | 0 |
| #2 cylinder roughness monitor | Roughness Monitor #2 | — | 0 |
| #3 cylinder roughness monitor | Roughness Monitor #3 | — | 0 |
| #4 cylinder roughness monitor | Roughness Monitor #4 | — | 0 |
| Knock sensor correction | Knocking Correction | deg | 0.0 deg |
| Fuel tank pressure signal | Fuel Tank Pressure | mmHg, kPa, inHg or psig | +7.7 mmHg, +1.1 kPa, +0.31 inHg or +0.15 psig |
| AT vehicle ID signal | AT Vehicle ID Signal | — | ON/OFF |
| D-check require Flag | D-check Require Flag | — | OFF |
| Delivery (test) mode terminal | Delivery Mode Connector (Test Mode Connector) | — | OFF |
| Neutral position switch signal | Neutral Position Switch | — | ON |
| Soft idle switch signal | Idle Switch Signal | — | ON |
| Ignition switch signal | Ignition Switch | — | ON |
| Power steering switch signal | P/S Switch | — | OFF (when OFF) |
| Air conditioning switch signal | A/C Switch | — | OFF (when OFF) |
| Starter switch signal | Starter Switch | — | OFF |
| Rear oxygen monitor | Rear O2 Rich Signal | — | Rich/Lean |
| Knocking signal | Knocking Signal | — | OFF |
| Crankshaft position sensor signal | Crankshaft Position Sig. | — | ON |
| Camshaft position sensor signal | Camshaft Position Sig. | — | ON |
| Rear defogger switch signal | Rear Defogger SW | — | OFF (when OFF) |
| Blower fan switch signal | Blower Fan SW | — | OFF (when OFF) |
| Light switch signal | Light Switch | — | OFF (when OFF) |
| A/C middle pressure switch signal | A/C Mid Pressure Switch | — | OFF (when OFF) |
| Air conditioner compressor relay output signal | A/C Compressor Signal | — | OFF (when OFF) |
| Radiator fan relay 1 signal | Radiator Fan Relay #1 | — | OFF (when OFF) |
| Radiator fan relay 2 signal | Radiator Fan Relay #2 | — | OFF (when OFF) |
| Fuel pump relay signal | Fuel Pump Relay | — | ON output |
| PCV hose assembly diagnosis signal | Blow-by leak Connector | — | Connected |
| Pressure control solenoid valve signal | PCV Solenoid Valve | — | OFF output |
| Drain valve signal | Vent. Solenoid Valve | — | OFF output |
| Variable valve lift diagnosis oil pressure switch signal 1 | Eng. Oil Press. SW 1 | — | ON |
| Variable valve lift diagnosis oil pressure switch signal 2 | Eng. Oil Press. SW 2 | — | ON |
| AT coordinate retard angle demand signal | Retard Signal from AT | — | OFF |
| AT coordinate fuel cut demand signal | Fuel Cut signal from AT | — | OFF |
| AT coordinate permission signal | Torque permission signal | — | Allowed (prohibited on MT vehicles) |
| Electronic throttle control motor relay signal | ETC Motor Relay | — | ON |
| Clutch switch signal | Clutch Switch | — | OFF (when OFF) |
| Stop light switch signal | Stop Light Switch | — | OFF (when OFF) |
| SET/COAST switch signal | SET/COAST Switch | — | OFF (when OFF) |
| RES/ACC switch signal | RESUME/ACCEL Switch | — | OFF (when OFF) |
| Brake switch signal* | Brake Switch | — | OFF (when OFF) |
| Main switch signal | Main Switch | — | OFF (when OFF) |

| Content | Display | Unit of measure | Note (at idling) |
|---|---|---|---|
| Cruise control cancel switch signal | CC Cancel SW | — | OFF (when OFF) |
| Malfunction indicator light signal | MIL On Flag | — | OFF (when unlit) |

NOTE:
- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- *: For models without cruise control, the brake switch signal does not change.

## 3. READ CURRENT DATA FOR ENGINE (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Current Data Display & Save}.
6) On «Current Data Display & Save» display, select {All data display}.
7) Using the scroll key, scroll the display screen up or down until the desired data is shown.

• A list of the support data is shown in the following table.

| Content | Display | Note (at idling) | Unit of measure |
|---|---|---|---|
| Number of diagnosis code | Number of Diag. Code: | 0 | — |
| Condition of malfunction indicator light | MI(MIL) | OFF | — |
| Monitoring test of misfire | Misfire monitoring (Supp) | YES | — |
| Monitoring test of misfire | Misfire monitoring (Rdy) | YES | — |
| Monitoring test of fuel system | Fuel system monitoring (Supp) | YES | — |
| Monitoring test of fuel system | Fuel system monitoring (Rdy) | YES | — |
| Monitoring test of comprehensive component | Component monitoring (Supp) | YES | — |
| Monitoring test of comprehensive component | Component monitoring (Rdy) | YES | — |
| Test of catalyst | Catalyst Diagnosis (Supp) | YES | — |
| Test of catalyst | Catalyst Diagnosis (Rdy) | NO | — |
| Test of heating-type catalyst | Heated catalyst (Supp) | NO | — |
| Test of heating-type catalyst | Heated catalyst (Rdy) | N/A | — |
| Test of evaporative emission purge control system | Evaporative purge system (Supp) | YES | — |
| Test of evaporative emission purge control system | Evaporative purge system (Rdy) | NO | — |
| Secondary air system test | Secondary air system (Supp) | NO | — |
| Secondary air system test | Secondary air system (Rdy) | N/A | — |
| Test of air conditioning system refrigerant | A/C system refrigerant (Supp) | NO | — |
| Test of air conditioning system refrigerant | A/C system refrigerant (Rdy) | N/A | — |
| Test of oxygen sensor | Oxygen sensor (Supp) | YES | — |
| Test of oxygen sensor | Oxygen sensor (Rdy) | NO | — |
| Test of oxygen sensor heater | O2 Heater Diagnosis (Supp) | YES | — |
| Test of oxygen sensor heater | O2 Heater Diagnosis (Rdy) | NO | — |
| Test of EGR system | EGR system (Supp) | YES | — |
| Test of EGR system | EGR system (Rdy) | NO | — |
| Air fuel ratio control system for bank 1 | Fuel system for Bank 1 | Cl_normal | — |
| Engine load data | Calculated load value | 23.0 | % |
| Engine coolant temperature signal | Coolant Temp. | 92 | °C |
| Short term fuel trim by front oxygen (A/F) sensor (Bank 1) | Short term fuel trim B1 | –0.8 | % |
| Long term fuel trim by front oxygen (A/F) sensor (Bank 1) | Long term fuel trim B1 | 0.0 | % |
| Intake manifold absolute pressure signal | Mani. Absolute Pressure | 211 | mmHg |

| Content | Display | Note (at idling) | Unit of measure |
|---|---|---|---|
| Engine speed signal | Engine Speed | 700 | rpm |
| Vehicle speed signal | Vehicle Speed | 0 | km/h |
| #1 Cylinder ignition timing | Ignition timing #1 | 16.0 | ° |
| Intake air temperature signal | Intake Air Temp. | 36 | °C |
| Amount of intake air | Mass Air Flow | 2.7 | g/s |
| Throttle position signal | Throttle Opening Angle | 13 | % |
| Oxygen sensor (Bank 1 Sensor 2) | Oxygen sensor #12 | 0.7 | V |
| A/F correction (Bank 1 Sensor 2) | A/F correction #12 | 0.0 | % |
| On-board diagnostic system | OBD system | OBD/OBD2 | — |
| Front oxygen (A/F) sensor (Bank 1 Sensor 1) | Oxygen sensor #11 | Support | — |
| Oxygen sensor (Bank 1 Sensor 2) | Oxygen sensor #12 | Support | — |
| Time elapsed after engine start | Time Since Engine Start | — | sec |
| Travel distance after the malfunction indicator light illuminates | Lighted MI lamp history | — | km |
| A/F lambda signal (Bank 1 Sensor 1) | A/F Sensor #11 | 1.001 | — |
| A/F sensor output signal (Bank 1 Sensor 1) | A/F Sensor #11 | 2.79 | V |
| Target EGR | Target EGR | — | % |
| EGR error | EGR error | — | % |
| Evaporative purge | Commanded Evap Purge | 0 | % |
| Fuel level signal | Fuel Level | — | % |
| Number of warm ups after DTC clear | Number of warm-upsr | — | — |
| Travel distance after DTC clear | Meter since DTC cleared | — | km |
| Fuel tank pressure signal | Fuel Tank Pressure | 8.8 | mmHg |
| Atmospheric pressure signal | Atmosphere Pressure | Barometric pressure | mmHg |
| A/F lambda signal (Bank 1 Sensor 1) | A/F Sensor #11 | 1.001 | — |
| A/F sensor current (Bank 1 Sensor 1) | A/F Sensor #11 | 0.00 | mA |
| Catalytic temperature #1 | Catalytic Temperature #11 | — | °C |
| Monitoring test of misfire | Misfire monitoring (Enable) | YES | — |
| Monitoring test of misfire | Misfire monitoring (Comp) | NO | — |
| Monitoring test of fuel system | Fuel system monitoring (Enable) | YES | — |
| Monitoring test of fuel system | Fuel system monitoring (Comp) | NO | — |
| Monitoring test of comprehensive component | Component monitoring (Enable) | YES | — |
| Monitoring test of comprehensive component | Component monitoring (Comp) | NO | — |
| Test of catalyst | Catalyst Diagnosis (Enable) | YES | — |
| Test of catalyst | Catalyst Diagnosis (Comp) | NO | — |
| Test of heating-type catalyst | Heated catalyst (Enable) | N/A | — |
| Test of heating-type catalyst | Heated catalyst (Comp) | N/A | — |
| Test of evaporative emission purge control system | Evaporative purge system (Enable) | YES | — |
| Test of evaporative emission purge control system | Evaporative purge system (Comp) | NO | — |
| Secondary air system test | Secondary air system (Enable) | N/A | — |

| Content | Display | Note (at idling) | Unit of measure |
|---|---|---|---|
| Secondary air system test | Secondary air system (Comp) | N/A | — |
| Test of air conditioning system refrigerant | A/C system refrigerant (Enable) | N/A | — |
| Test of air conditioning system refrigerant | A/C system refrigerant (Comp) | N/A | — |
| Test of oxygen sensor | Oxygen sensor (Enable) | YES | — |
| Test of oxygen sensor | Oxygen sensor (Comp) | NO | — |
| Test of oxygen sensor heater | O2 Heater Diagnosis (Enable) | YES | — |
| Test of oxygen sensor heater | O2 Heater Diagnosis (Comp) | NO | — |
| Test of EGR system | EGR system (Enable) | YES | — |
| Test of EGR system | EGR system (Comp) | NO | — |
| ECM power voltage | Control module voltage | 13.789 | V |
| Absolute load | Absolute Load Value | 22 | % |
| A/F ratio target lambda | Target Equivalence Ratio | 0.976 | — |
| Relative throttle opening angle | Relative Throttle Pos. | 2 | % |
| Ambient temperature | Ambient Temperature | Ambient air temperature | °C |
| Absolute throttle opening angle 2 | Absolute Throttle Pos.#2 | 32 | % |
| Absolute accelerator opening angle 1 | Accelerator Pedal Pos.#1 | 13 | % |
| Absolute accelerator opening angle 2 | Accelerator Pedal Pos.#2 | 13 | % |
| Target throttle opening angle | Target Throt. Act. Cont. | 0 | % |
| Engine operating time while malfunction indicator lit | Time while MIL lighted | — | min |
| Time elapsed after DTC clear | Time since DTC cleared | — | min |
| Fuel used | Type of fuel | GAS | — |
| Relative accelerator opening angle | Relative Accelera. Pos. | 0 | % |
| Neutral status | AT drive status/MT gear status | NEUT | — |

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

## 4. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Freeze Frame Data Display}.

- A list of the support data is shown in the following table.

| Contents | Display | Unit of measure |
|---|---|---|
| Freeze frame data DTC code | Freeze frame data | — |
| Air fuel ratio control system for bank 1 | Fuel system for Bank 1 | — |
| Engine load data | Calculated load value | % |
| Engine coolant temperature signal | Coolant Temp. | °C or °F |
| Short term fuel trim by front oxygen (A/F) sensor | Short term fuel trim B1 | % |
| Long term fuel trim by front oxygen (A/F) sensor | Long term fuel trim B1 | % |
| Intake manifold absolute pressure signal | Mani. Absolute Pressure | mmHg, kPa, inHg or psig |
| Engine speed signal | Engine Speed | rpm |
| Vehicle speed signal | Vehicle Speed | km/h or MPH |
| Ignition timing advance for #1 cylinder | Ignition timing #1 | ° |
| Intake air temperature signal | Intake Air Temp. | °C or °F |
| Amount of intake air | Mass Air Flow | g/s or lb/m |
| Throttle position signal | Throttle Opening Angle | % |
| Oxygen sensor (Bank 1 Sensor 2) | Oxygen sensor #12 | V |
| A/F correction (Bank 1 Sensor 2) | Short term fuel trim #12 | % |
| On-board diagnostic system | OBD system | — |
| Front oxygen (A/F) sensor (Bank 1 Sensor 1) | Oxygen sensor #11 | — |
| Oxygen sensor (Bank 1 Sensor 2) | Oxygen sensor #12 | — |
| Time elapsed after engine start | Time Since Engine Start | sec |
| Target EGR | Commanded EGR | % |
| EGR deviation | EGR Error | % |
| Evaporative purge | Commanded Evap Purge | % |
| Fuel level signal | Fuel level | % |
| Fuel tank pressure signal | Fuel Tank Pressure | mmHg, kPa, inHg or psig |
| Barometric pressure | Atmosphere Pressure | mmHg, kPa, inHg or psig |
| ECM power voltage | Control module voltage | V |
| Absolute load | Absolute Load Value | % |
| A/F ratio target lambda | Target Equivalence Ratio | — |
| Relative throttle opening angle | Relative Throttle Pos. | % |
| Ambient temperature | Ambient Temperature | °C or °F |
| Absolute throttle opening angle 2 | Absolute Throttle Pos.#2 | % |
| Absolute accelerator opening angle 1 | Accelerator Pedal Pos.#1 | % |
| Absolute accelerator opening angle 2 | Accelerator Pedal Pos.#2 | % |
| Target throttle opening angle | Target Throt. Act. Cont. | % |
| Neutral status | AT drive status/MT gear status | — |

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

## 5. V.I.N REGISTRATION

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Entry VIN}.
5) Perform the procedures shown on the display screen.

# 10.Read Diagnostic Trouble Code (DTC)

## A: OPERATION

### 1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Diagnostic Code(s) Display}.
5) On «Diagnostic Code(s) Display» display, select {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

NOTE:
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

### 2. SUBARU SELECT MONITOR (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Diagnostic Code(s) Display}.
6) Make sure DTC is shown on the screen.

NOTE:
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

### 3. GENERAL SCAN TOOL

Refer to data denoting emission-related powertrain DTC.
For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

NOTE:
Refer to general scan tool manufacturer’s instruction manual to access powertrain DTC (MODE $03).

# 11.Inspection Mode

## A: PROCEDURE

Perform the diagnosis shown in the following DTC table.
When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer to the item on the drive cycle. <Ref. to EN(H4SO)(diag)-48, Drive Cycle.>

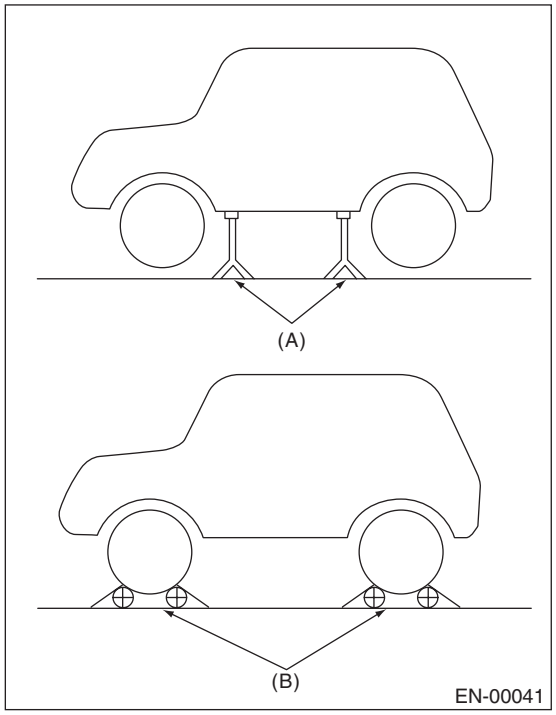
| DTC | Item | Condition |
|---|---|---|
| P0031 | HO2S Heater Control Circuit Low (Bank 1 Sensor 1) | — |
| P0032 | HO2S Heater Control Circuit High (Bank 1 Sensor 1) | — |
| P0037 | HO2S Heater Control Circuit Low (Bank 1 Sensor 2) | — |
| P0038 | HO2S Heater Control Circuit High (Bank 1 Sensor 2) | — |
| P0077 | Intake Valve Control Solenoid Circuit High (Bank 1) | — |
| P0083 | Intake Valve Control Solenoid Circuit High (Bank 2) | — |
| P0102 | Mass or Volume Air Flow Circuit Low Input | — |
| P0103 | Mass or Volume Air Flow Circuit High Input | — |
| P0107 | Manifold Absolute Pressure/Barometric Pressure Circuit Low Input | — |
| P0108 | Manifold Absolute Pressure/Barometric Pressure Circuit High Input | — |
| P0112 | Intake Air Temperature Sensor 1 Circuit Low | — |
| P0113 | Intake Air Temperature Sensor 1 Circuit High | — |
| P0117 | Engine Coolant Temperature Circuit Low | — |
| P0118 | Engine Coolant Temperature Circuit High | — |
| P0122 | Throttle/Pedal Position Sensor/Switch “A” Circuit Low | — |
| P0123 | Throttle/Pedal Position Sensor/Switch “A” Circuit High | — |
| P0131 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) | — |
| P0132 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) | — |
| P0137 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) | — |
| P0138 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) | — |
| P0140 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) | — |
| P0182 | Fuel Temperature Sensor “A” Circuit Low Input | — |
| P0183 | Fuel Temperature Sensor “A” Circuit High Input | — |
| P0197 | Engine Oil Temperature Sensor Low | — |
| P0198 | Engine Oil Temperature Sensor High | — |
| P0222 | Throttle/Pedal Position Sensor/Switch “B” Circuit Low | — |
| P0223 | Throttle/Pedal Position Sensor/Switch “B” Circuit High | — |
| P0327 | Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor) | — |
| P0328 | Knock Sensor 1 Circuit High (Bank 1 or Single Sensor) | — |
| P0335 | Crankshaft Position Sensor “A” Circuit | — |
| P0336 | Crankshaft Position Sensor “A” Circuit Range/Performance | — |
| P0340 | Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor) | — |
| P0341 | Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor) | — |
| P0447 | Evaporative Emission Control System Vent Control Circuit Open | — |
| P0448 | Evaporative Emission Control System Vent Control Circuit Shorted | — |
| P0452 | Evaporative Emission Control System Pressure Sensor Low Input | — |
| P0453 | Evaporative Emission Control System Pressure Sensor High Input | — |
| P0458 | Evaporative Emission System Purge Control Valve Circuit Low | — |
| P0462 | Fuel Level Sensor “A” Circuit Low | — |
| P0463 | Fuel Level Sensor “A” Circuit High | — |
| P0500 | Vehicle Speed Sensor “A” | — |
| P0512 | Starter Request Circuit | — |
| P0513 | Incorrect Immobilizer Key | — |

| DTC | Item | Condition |
|---|---|---|
| P0604 | Internal Control Module Random Access Memory (RAM) Error | — |
| P0605 | Internal Control Module Read Only Memory (ROM) Error | — |
| P0607 | Throttle Control System Circuit Range/Performance | — |
| P0638 | Throttle Actuator Control Range/Performance (Bank 1) | — |
| P0700 | Transmission Control System (MIL Request) | — |
| P0851 | Park/Neutral Switch Input Circuit Low | — |
| P0852 | Park/Neutral Switch Input Circuit High | — |
| P1152 | O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1) | — |
| P1153 | O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1) | — |
| P1160 | Return Spring Failure | — |
| P1400 | Fuel Tank Pressure Control Solenoid Valve Circuit Low | — |
| P1420 | Fuel Tank Pressure Control Sol. Valve Circuit High | — |
| P1491 | Positive Crankcase Ventilation (Blow-by) Function Problem | — |
| P1518 | Starter Switch Circuit Low Input | — |
| P1560 | Back-Up Voltage Circuit Malfunction | — |
| P1570 | Antenna | — |
| P1571 | Reference Code Incompatibility | — |
| P1572 | IMM Circuit Failure | — |
| P1574 | Key Communication Failure | — |
| P1576 | EGI Control Module EEPROM | — |
| P1577 | IMM Control Module EEPROM | — |
| P1578 | Meter Failure | — |
| P2101 | Throttle Actuator Control Motor Circuit Range/Performance | — |
| P2102 | Throttle Actuator Control Motor Circuit Low | — |
| P2103 | Throttle Actuator Control Motor Circuit High | — |
| P2109 | Throttle/Pedal Position Sensor “A” Minimum Stop Performance | — |
| P2122 | Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input | — |
| P2123 | Throttle/Pedal Position Sensor/Switch “D” Circuit High Input | — |
| P2127 | Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input | — |
| P2128 | Throttle/Pedal Position Sensor/Switch “E” Circuit High Input | — |
| P2135 | Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation | — |
| P2138 | Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation | — |
| P2227 | Atmospheric Pressure Sensor Range/Performance | — |
| P2228 | Barometric Pressure Circuit Low | — |
| P2229 | Barometric Pressure Circuit High | — |
| U0073 | CAN Failure, Bus “OFF” Detection | — |
| U0101 | CAN (TCU) Data not Loaded | — |
| U0122 | CAN (VDC) Data not Loaded | — |
| U0140 | CAN (BCU) Data not Loaded | — |
| U0402 | CAN (TCU) Data Abnormal | — |
| U0416 | CAN (VDC) Data Abnormal | — |
| U0422 | CAN (BCU) Data Abnormal | — |

## 1. PREPARATION FOR THE INSPECTION MODE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

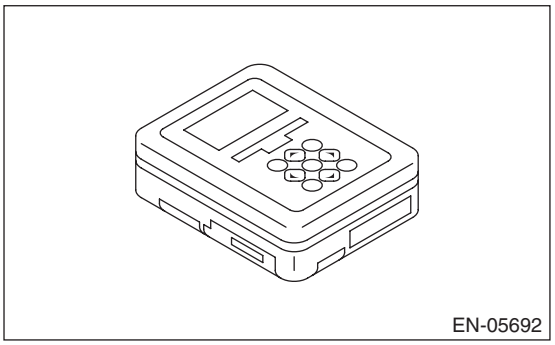
**WARNING:**
**• Before lifting up the vehicle, ensure parking brake is applied.**
**• Do not use a pantograph jack in place of a rigid rack.**
**• Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.**
**• Before rotating the wheels, make sure that there is no one in front of the vehicle. Besides while the wheels are rotating, make sure that no one approaches the vehicle front side.**
**• Make sure that there is nothing around the wheels. For AWD model, pay special attention to all four wheels.**
**• While servicing, do not depress or release the clutch pedal or accelerator pedal quickly regardless of the engine speed. Quick operation may cause the vehicle to drop off the free roller.**
**• To prevent the vehicle from slipping due to vibration, do not place anything between rigid rack and the vehicle.**




(A) Rigid rack
(B) Free roller

## 2. SUBARU SELECT MONITOR

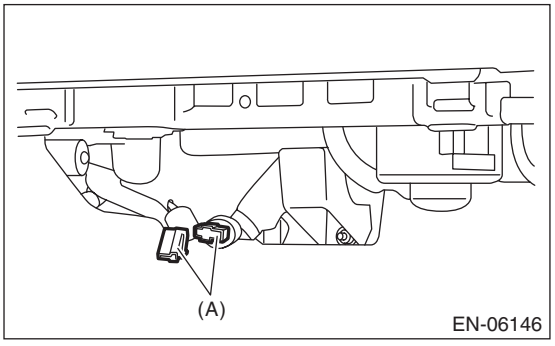
1) Check that no DTC remains after clearing memory. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
2) Warm up the engine.
3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>




4) Prepare PC with Subaru Select Monitor installed.
5) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

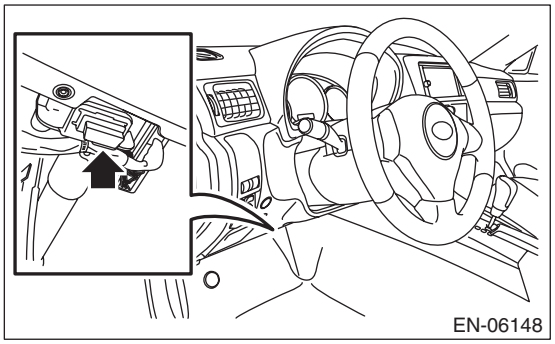
NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to SDI.
7) Connect the delivery (test) mode connector (A) located under the glove box.



8) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**
**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

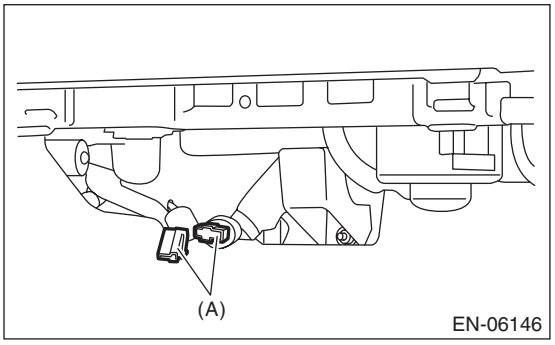



9) Start the PC.
10) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
11) On «Main Menu» display, select {Each System Check}.
12) On «System Selection Menu» display, select {Engine Control System}.
13) Click the [OK] button after the information of engine type has been displayed.
14) On «Engine Diagnosis» display, select {Dealer Check Mode Procedure}.
15) When the «Perform Inspection (Dealer Check) Mode?» is shown on the screen, click the [Next] button.
16) Perform subsequent procedures as instructed on the display screen.
• If trouble still remains in the memory, the corresponding DTC appears on the display screen.

NOTE:
• For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".
• For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".
<Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>
• Release the parking brake.
• The speed difference between front and rear wheels may light the ABS warning light, but this does not indicate a malfunction. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

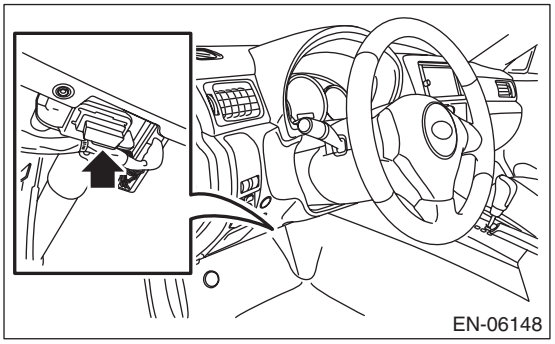
## 3. GENERAL SCAN TOOL

1) Check that no DTC remains after clearing memory. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
2) Warm up the engine.
3) Connect the delivery (test) mode connector (A) located under the glove box.




4) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**
**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**




5) Start the engine.

NOTE:
• Ensure the selector lever is placed in "P" range before starting. (AT model)
• Depress the clutch pedal when starting engine. (MT model)
6) Turn the neutral position switch to ON using select lever or shift lever.
7) Depress the brake pedal to turn the brake switch ON. (AT model)
8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.

9) Place the select lever or shift lever in D position (AT model) or 1st gear (MT model) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
- For AWD model, release the parking brake.
- The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunctions. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

10) Using the general scan tool, check for DTC and record the result(s).

NOTE:
- For detailed operation procedures, refer to the general scan tool operation manual.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.

<Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).>

# 12.Drive Cycle

## A: PROCEDURE

It is necessary to perform the drive cycle listed below if DTC is not found in the Inspection Mode. It is possible to complete diagnosis of the DTC by performing the indicated drive cycle. After the repair for the DTC, perform a necessary drive cycle and make sure the function recovers and the DTC is recorded.

### 1. PREPARATION FOR DRIVE CYCLE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) After performing the diagnostics and Clear Memory Mode, check that no DTC remains. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
3) Check the delivery (test) mode connector is disconnected.

NOTE:
• Perform the drive cycle after warming up the engine except when the engine coolant temperature at engine start is specified.
• Perform the drive cycle twice if the DTC in the list is marked with *. After completing the first drive cycle, stop the engine and perform second diagnosis in same condition.

## 2. DRIVE CYCLE A

| DTC | Item | Condition |
|---|---|---|
| *P0125 | Insufficient Coolant Temperature for Closed Loop Fuel Control | Engine coolant temperature at engine start is less than 20°C (68°F). |
| *P0126 | Insufficient Engine Coolant Temperature for Stable Operation | — |
| *P0128 | Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature) | — |
| *P0133 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) | — |
| *P0141 | O2 Sensor Heater Circuit (Bank 1 Sensor 2) | — |
| *P0171 | System Too Lean (Bank 1) | Complete diagnosis with drive cycle B or C as well. |
| *P0172 | System Too Rich (Bank 1) | Complete diagnosis with drive cycle B or C as well. |
| *P0196 | Engine Oil Temperature Sensor Circuit Range/Performance | — |
| *P0301 | Cylinder 1 Misfire Detected | Complete diagnosis with drive cycle B or C as well. |
| *P0302 | Cylinder 2 Misfire Detected | Complete diagnosis with drive cycle B or C as well. |
| *P0303 | Cylinder 3 Misfire Detected | Complete diagnosis with drive cycle B or C as well. |
| *P0304 | Cylinder 4 Misfire Detected | Complete diagnosis with drive cycle B or C as well. |
| *P0420 | Catalyst System Efficiency Below Threshold (Bank 1) | — |
| *P0442 | Evaporative Emission Control System Leak Detected (Small Leak) | Engine coolant temperature at engine start is less than 30°C (86°F). |
| *P0451 | Evaporative Emission Control System Pressure Sensor | — |
| *P0456 | Evaporative Emission Control System Leak Detected (Very Small Leak) | Engine coolant temperature at engine start is less than 30°C (86°F). |
| *P0457 | Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off) | Engine coolant temperature at engine start is less than 30°C (86°F). |
| *P0459 | Evaporative Emission System Purge Control Valve Circuit High | — |
| P1443 | Vent Control Solenoid Valve Function Problem | — |
| *P2096 | Post Catalyst Fuel Trim System Too Lean (Bank 1) | Complete diagnosis with drive cycle B or C as well. |
| *P2097 | Post Catalyst Fuel Trim System Too Rich (Bank 1) | Complete diagnosis with drive cycle B or C as well. |

**Diagnostic procedure:**
1) Drive for 20 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
2) Stop the vehicle and idle for one minute.

## 3. DRIVE CYCLE B

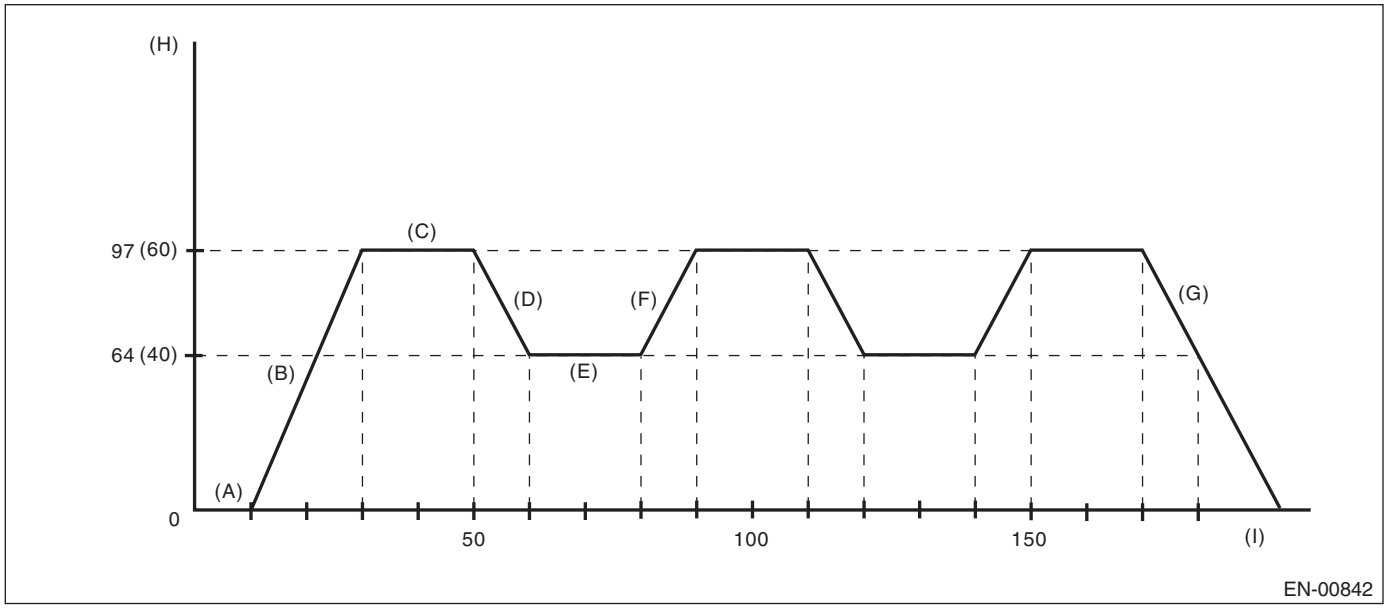
| DTC | Item | Condition |
|---|---|---|
| *P0171 | System Too Lean (Bank 1) | Complete diagnosis with drive cycle A or C as well. |
| *P0172 | System Too Rich (Bank 1) | Complete diagnosis with drive cycle A or C as well. |
| *P0301 | Cylinder 1 Misfire Detected | Complete diagnosis with drive cycle A or C as well. |
| *P0302 | Cylinder 2 Misfire Detected | Complete diagnosis with drive cycle A or C as well. |
| *P0303 | Cylinder 3 Misfire Detected | Complete diagnosis with drive cycle A or C as well. |
| *P0304 | Cylinder 4 Misfire Detected | Complete diagnosis with drive cycle A or C as well. |
| *P0464 | Fuel Level Sensor Circuit Intermittent | — |
| *P0506 | Idle Air Control System RPM Lower Than Expected | — |
| *P0507 | Idle Air Control System RPM Higher Than Expected | — |
| *P2096 | Post Catalyst Fuel Trim System Too Lean (Bank 1) | Complete diagnosis with drive cycle A or C as well. |
| *P2097 | Post Catalyst Fuel Trim System Too Rich (Bank 1) | Complete diagnosis with drive cycle A or C as well. |
| *P219A | Bank 1 Air-Fuel Ratio Imbalance | Complete diagnosis with drive cycle C as well. |

**Diagnostic procedure:**
1) Drive at 10 km/h (6 MPH) or more.
2) Stop the vehicle and idle for ten minutes.

## 4. DRIVE CYCLE C

| DTC | Item | Condition |
|---|---|---|
| P0026 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 1) | — |
| P0028 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 2) | — |
| *P0030 | HO2S Heater Control Circuit (Bank 1 Sensor 1) | — |
| *P0068 | MAP/MAF - Throttle Position Correlation | — |
| P0076 | Intake Valve Control Solenoid Circuit Low (Bank 1) | — |
| P0082 | Intake Valve Control Solenoid Circuit Low (Bank 2) | — |
| *P0101 | Mass or Volume Air Flow Circuit Range/Performance | — |
| P0134 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) | — |
| *P0139 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 2) | — |
| *P0171 | System Too Lean (Bank 1) | Complete diagnosis with drive cycle A or B as well. |
| *P0172 | System Too Rich (Bank 1) | Complete diagnosis with drive cycle A or B as well. |
| *P0301 | Cylinder 1 Misfire Detected | Complete diagnosis with drive cycle A or B as well. |
| *P0302 | Cylinder 2 Misfire Detected | Complete diagnosis with drive cycle A or B as well. |
| *P0303 | Cylinder 3 Misfire Detected | Complete diagnosis with drive cycle A or B as well. |
| *P0304 | Cylinder 4 Misfire Detected | Complete diagnosis with drive cycle A or B as well. |
| *P0400 | Exhaust Gas Recirculation Flow | — |
| P1492 | EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input) | — |
| P1493 | EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input) | — |
| P1494 | EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input) | — |
| P1495 | EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input) | — |
| P1496 | EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input) | — |
| P1497 | EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input) | — |
| P1498 | EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input) | — |
| P1499 | EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input) | — |
| *P2096 | Post Catalyst Fuel Trim System Too Lean (Bank 1) | Complete diagnosis with drive cycle A or B as well. |
| *P2097 | Post Catalyst Fuel Trim System Too Rich (Bank 1) | Complete diagnosis with drive cycle A or B as well. |
| *P219A | Bank 1 Air-Fuel Ratio Imbalance | Complete diagnosis with drive cycle B as well. |

**Diagnostic procedure:**
Drive according to the drive pattern described below.




| | | | | | |
|---|---|---|---|---|---|
| (A) | Idle the engine for 10 seconds or more. | (D) | Decelerate with fully closed throttle to 64 km/h (40 MPH) or less. | (G) | Stop the vehicle with throttle fully closed. |
| (B) | Accelerate to 97 km/h (60 MPH) or more within 20 seconds. | (E) | Drive for 20 seconds or more at 64 km/h (40 MPH) or less. | (H) | Vehicle speed km/h (MPH) |
| (C) | Drive for 20 seconds or more at 97 km/h (60 MPH) or more. | (F) | Accelerate to 97 km/h (60 MPH) or more within 10 seconds. | (I) | Sec. |

## 5. DRIVE CYCLE D

| DTC | Item | Condition |
|---|---|---|
| *P0181 | Fuel Temperature Sensor “A” Circuit Range/Performance | — |

NOTE:
In drive cycle D, one drive cycle will be established when both the drift diagnosis and stuck diagnosis have completed.
**Diagnostic procedure:**

**DRIFT DIAGNOSIS**

1) Make sure of the items below before starting the engine.
- Engine coolant temperature is less than 30°C (86°F).
- Remaining fuel is 10 ℓ (2.6 US gal, 2.2 Imp gal) or more.
- Battery voltage is 10.9 V or more.

2) Idle the engine until engine coolant temperature is at least 10°C (18°F) higher than it was when engine started.
3) After the engine has reached the state of procedure 2), idle the engine for another 5 minutes or more.

**STUCK DIAGNOSIS**

1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
3) Drive for approximately 50 ℓ (13.2 US gal, 11 Imp gal) of fuel.

NOTE:
- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals during stuck diagnosis. (Data will be cleared by disconnecting the battery terminals.)

## 6. DRIVE CYCLE E

| DTC | Item | Condition |
|---|---|---|
| *P0461 | Fuel Level Sensor “A” Circuit Range/Performance | — |

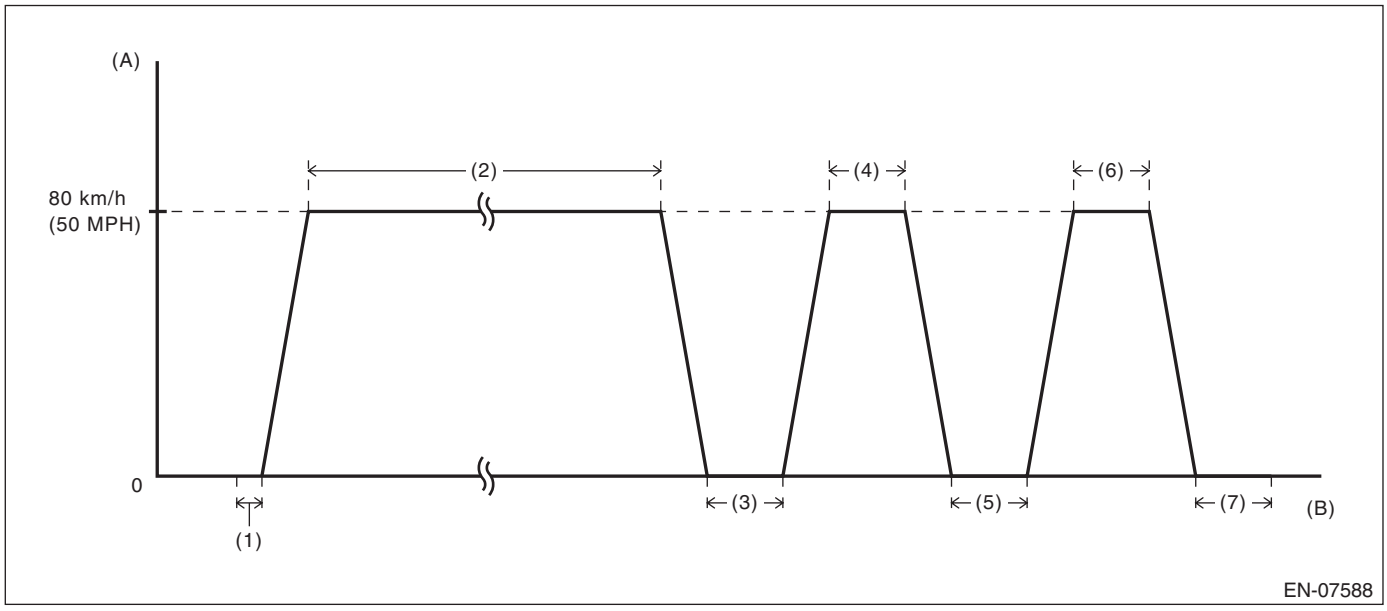
**Diagnostic procedure:**
1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
3) Drive for approximately 30 ℓ (7.9 US gal, 6.6 Imp gal) of fuel.

NOTE:
• It is acceptable to drive the vehicle intermittently.
• Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

## 7. DRIVE CYCLE F

| DTC | Item | Condition |
|---|---|---|
| *P0111 | Intake Air Temperature Sensor 1 Circuit Range/Performance | — |

**Diagnostic procedure:**
1) Make sure that the engine coolant temperature is less than 30°C (86°F).
2) Drive according to the drive pattern described below.




(A) Vehicle speed
(B) Elapsed time
(1) Idle the engine for 10 seconds or more after engine start.
(2) Drive for 8 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
(3) Stop the vehicle and idle for 30 seconds or more.
(4) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(5) Stop the vehicle and idle for 30 seconds or more.
(6) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(7) Stop the vehicle and idle for 30 seconds.

NOTE:
• There is no given transition time between idling and cruising.
• Driving at constant speed only on a downhill causes smaller engine load and may result in failure to obtain a right diagnostic result.
• When the engine stops while performing drive cycle F, perform it again from the state of procedure 1).

## 8. DRIVE CYCLE H

| DTC | Item | Condition |
|---|---|---|
| *P050A | Cold Start Idle Air Control System Performance | — |
| *P050B | Cold Start Ignition Timing Performance | — |

1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>
2) With the ignition switch ON, read the engine coolant temperature, intake air temperature and fuel temperature. <Ref. to EN(H4SO)(diag)-34, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
3) If the values from step 2) satisfy the following two conditions, idle the engine for one minute.

***Condition:***
***|Engine coolant temperature — Intake air temperature| ≤ 5°C (41°F)***
***|Engine coolant temperature — Fuel temperature| ≤ 2°C (36°F)***

NOTE:
- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
- For AT models, hold the select lever to “P” range or “N” range at idling, and for MT models, the shift lever in the neutral position at idling.

# 13.Clear Memory Mode

## A: OPERATION

### 1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Clearing Memory}.
5) When the “Clear Memory?” is shown on the screen, click the [YES] button.
6) When “Done” and “Turn off the ignition switch.” are shown on the display screen, turn the ignition switch to OFF.

NOTE:
• Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 2. SUBARU SELECT MONITOR (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Clear Diagnostic Code(s)}.
6) When the “Clear Diagnostic Code?” is shown on the screen, click the [Yes] button.
7) When “Done” and “Turn off the ignition switch.” are shown on the display screen, turn the ignition switch to OFF.

NOTE:
• Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 3. GENERAL SCAN TOOL

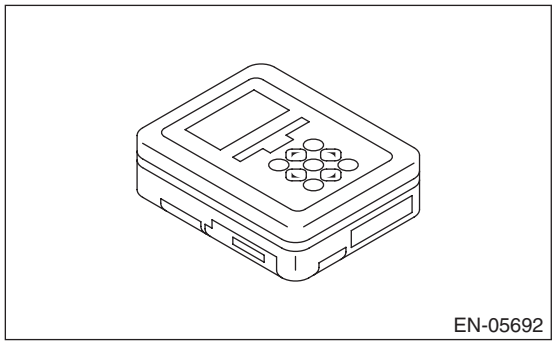
For clear memory procedures using the general scan tool, refer to “General Scan Tool Instruction Manual”.

NOTE:
Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

# 14. Compulsory Valve Operation Check Mode

## A: OPERATION

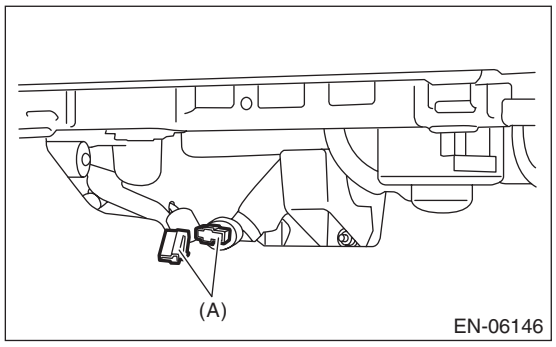
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

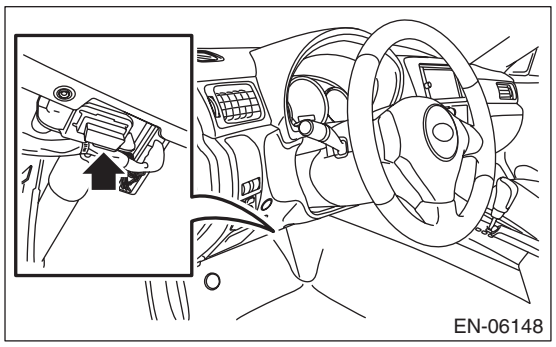
4) Connect the diagnosis cable to SDI.
5) Connect the delivery (test) mode connector (A) located under the glove box.



EN-06146

6) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**
**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**


EN-06148

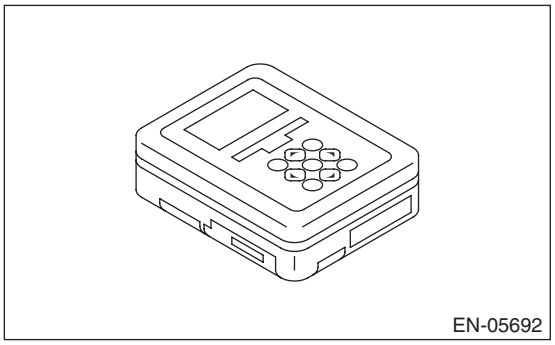
7) Start the PC.
8) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
9) On «Main Menu» display, select {Each System Check}.
10) On «System Selection Menu» display, select {Engine Control System}.
11) Click the [OK] button after the information of engine type has been displayed.
12) On «Engine Diagnosis» display, select {System Operation Check Mode}.
13) On «System Operation Check Mode» display, select {Actuator ON/OFF Operation}.
14) Select the actuator to be forcibly driven on the «Actuator ON/OFF Operation» display and click the [Next] button.
15) Clicking the [Finished] button completes the compulsory drive mode of actuator. The display will then return to the «Actuator ON/OFF Operation» screen.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

# 15. System Operation Check Mode

## A: OPERATION

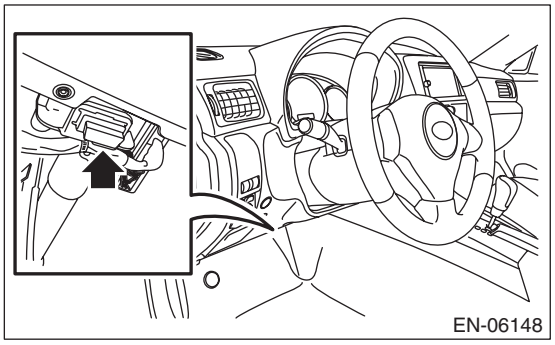
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.
4) Connect the diagnosis cable to SDI.
5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**
**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**


EN-06148

6) Start the PC.
7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
8) On «Main Menu» display, select {Each System Check}.
9) On «System Selection Menu» display, select {Engine Control System}.
10) Click the [OK] button after the information of engine type has been displayed.
11) On «Engine Diagnosis» display, select {System Operation Check Mode}.
12) The following items are displayed on the monitor.

| Display |
|---|
| Actuator ON/OFF Operation |
| Immobilizer System |
| Fuel Pump Control |
| Idling Ignition Timing Fixed |
| IDLE SPEED CONTROL |
| Injector Control |
| EGR VALVE CONTROL |

### 1. FUEL PUMP CONTROL (OFF DRIVE)

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>.**
1) On «System Operation Check Mode» display, select {Fuel Pump Control}.
2) On «Fuel Pump Control» display, select {OFF Drive}.
3) On «Start the Engine» display, start the engine and click the [OK] button.
4) On «OFF Drive» display, click the [Execution] button and execute the OFF drive.
5) Click the [Cancel] button to stop the OFF drive.
6) Click the [F12 Exit] button to end the OFF drive. The screen will return to the «Fuel Pump Control» screen.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

### 2. FUEL PUMP CONTROL (ON/OFF DRIVE)

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**
1) On «System Operation Check Mode» display, select {Fuel Pump Control}.
2) On «Fuel Pump Control» display, select {ON/OFF Dr.}.
3) On «Turn Ignition Switch ON with Engine OFF» display, turn the ignition switch to ON and click the [OK] button.
4) On «ON/OFF Dr.» display, click the [Execution] button and execute the ON/OFF drive.
5) Click the [Cancel] button to stop the ON/OFF drive.

6) Click the [F12 Exit] button to end the ON/OFF drive. The screen will return to the «Fuel Pump Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 3. IDLING IGNITION TIMING FIXED

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**
1) On «System Operation Check Mode» display, select {Fixed Idle Ignition Timing}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) On «Fixed Idle Ignition Timing» display, click the [Execution] button and execute the idling ignition timing fixed.
4) Click the [Cancel] button to stop the idling ignition timing fixed.
5) Click the [F12 Exit] button to end the idle ignition timing fixed. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 4. IDLE SPEED CONTROL

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**
1) On «System Operation Check Mode» display, select {Idle Speed Control}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) In the «Idle Speed Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in a range between 500 rpm — 2,000 rpm, in increments of 50 rpm. However, the engine speed that can actually be controlled will vary depending on the vehicle.
4) Click the [Cancel] button to stop the idle speed control.
5) Click the [F12 Exit] button to end the idle speed control. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 5. INJECTOR CONTROL (INJECTION STOP MODE)

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**
1) On «System Operation Check Mode» display, select {Injector Control}.
2) On «Injector Control» display, select {Injection Stop Mode}.
3) On «Injection Stop Mode» display, select the fuel injector to be stopped.
4) On «Start the Engine» display, start the engine and click the [OK] button.
5) On «Fuel Injector #» display, click the [Execution] button and execute the injection stop mode.
6) Click the [Cancel] button to stop the injection stop mode.
7) Click the [F12 Exit] button to return the «Injection Stop Mode» display screen.
8) On the «Injection Stop Mode» display, click the [Return] button to end the «Injection Stop Mode». The screen will return to the «Injector Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

### 6. INJECTOR CONTROL. (INJECTION QUANTITY CONTROL)

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**
1) On «System Operation Check Mode» display, select {Injector Control}.
2) On «Injector Control» display, select {Injection Quantity Control}.
3) On «Start the Engine» display, start the engine and click the [OK] button.
4) In the «Injection Quantity Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in a range between 0 — 20%, in increments of 1%.
5) Click the [Cancel] button to stop the injection quantity control.
6) Click the [F12 Exit] button to end the injection quantity control. The screen will return to the «Injector Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

## 7. EGR VALVE CONTROL

**CAUTION:**
**After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>**

1) On «System Operation Check Mode» display, select {EGR Valve Control}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) In the «EGR Valve Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in increments of 1 STEP. However, the STEP number that can actually be controlled will vary depending on the vehicle.
4) Click the [Cancel] button to stop the EGR valve control.
5) Click the [F12 Exit] button to end the EGR valve control. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

# 16.Malfunction Indicator Light

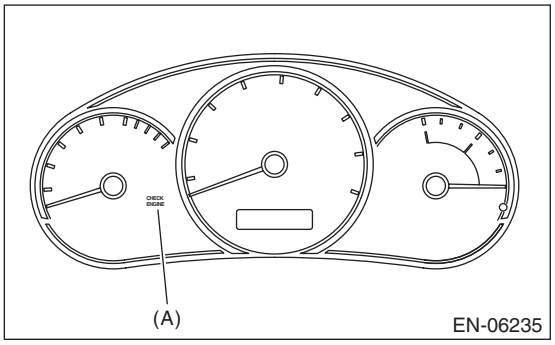
## A: PROCEDURE

| |
|---|
| 1. Activation of malfunction indicator light <Ref. to EN(H4SO)(diag)-61, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.> |
| ↓ |
| 2. Malfunction indicator light does not come on <Ref. to EN(H4SO)(diag)-63, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.> |
| ↓ |
| 3. Malfunction indicator light does not go off <Ref. to EN(H4SO)(diag)-65, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.> |
| ↓ |
| 4. Malfunction indicator light does not blink <Ref. to EN(H4SO)(diag)-66, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.> |
| ↓ |
| 5. Malfunction indicator light remains blinking <Ref. to EN(H4SO)(diag)-68, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.> |

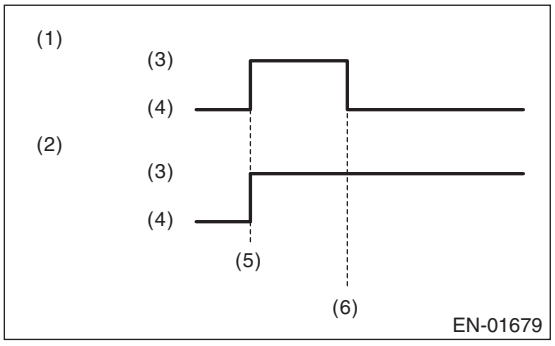
## B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

NOTE:
If the malfunction indicator light does not illuminate, perform diagnostics of the malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4SO)(diag)-63, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

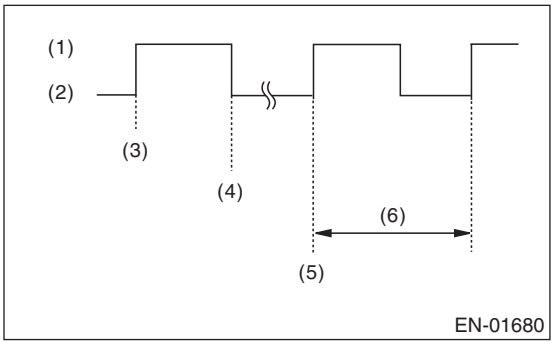



2) After starting the engine, the malfunction indicator light goes out. If it does not go off, any of the engine and emission control system has malfunction.



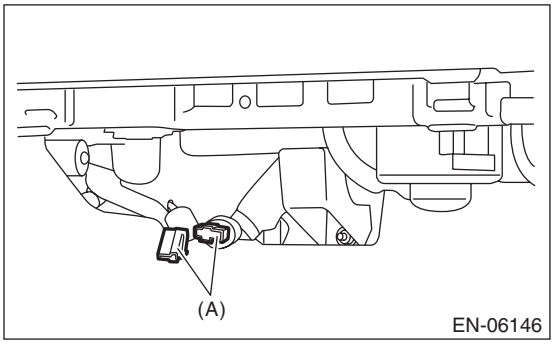

(1) No faulty
(2) Trouble occurs
(3) ON
(4) OFF
(5) Ignition switch ON
(6) Engine start

3) If the diagnostic system detects a misfire which could damage the catalyst, the malfunction indicator light will blink at a cycle of 1 Hz.



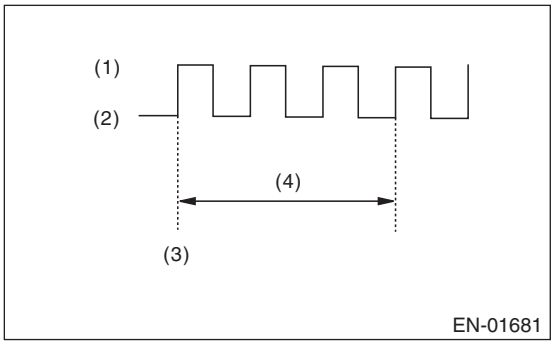

(1) ON
(2) OFF
(3) Ignition switch ON
(4) Engine start
(5) Misfire start
(6) 1 second

4) Turn the ignition switch to OFF, and connect the delivery (test) mode connector (A) located under the glove box.




(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.
(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

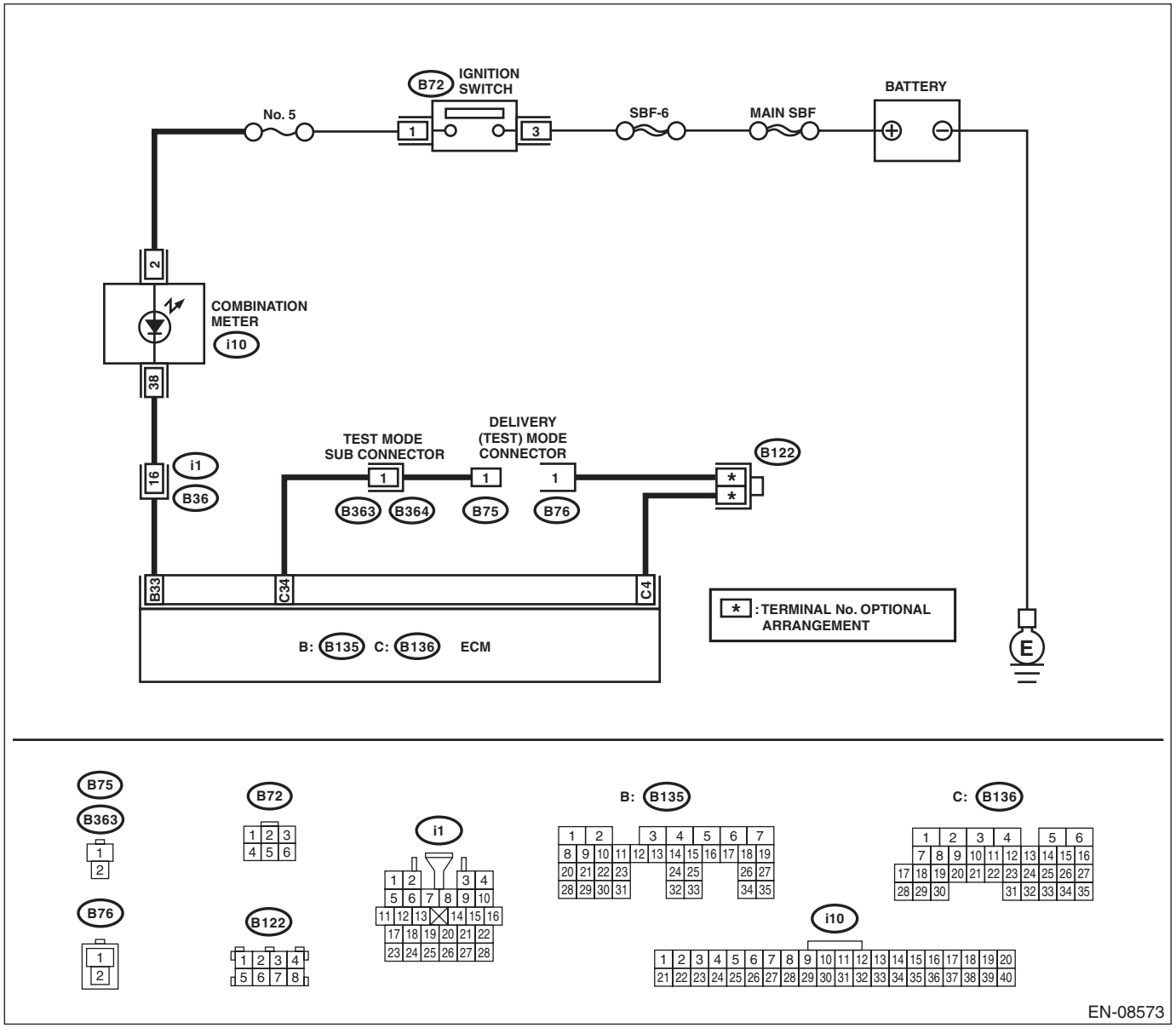
(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.




(1) ON
(2) OFF
(3) Ignition switch ON
(4) 1 second

## C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

**DIAGNOSIS:**
The malfunction indicator light circuit is open or shorted.
**TROUBLE SYMPTOM:**
When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not illuminate.
**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM connector and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 33 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **5**. | Go to step **2**. |

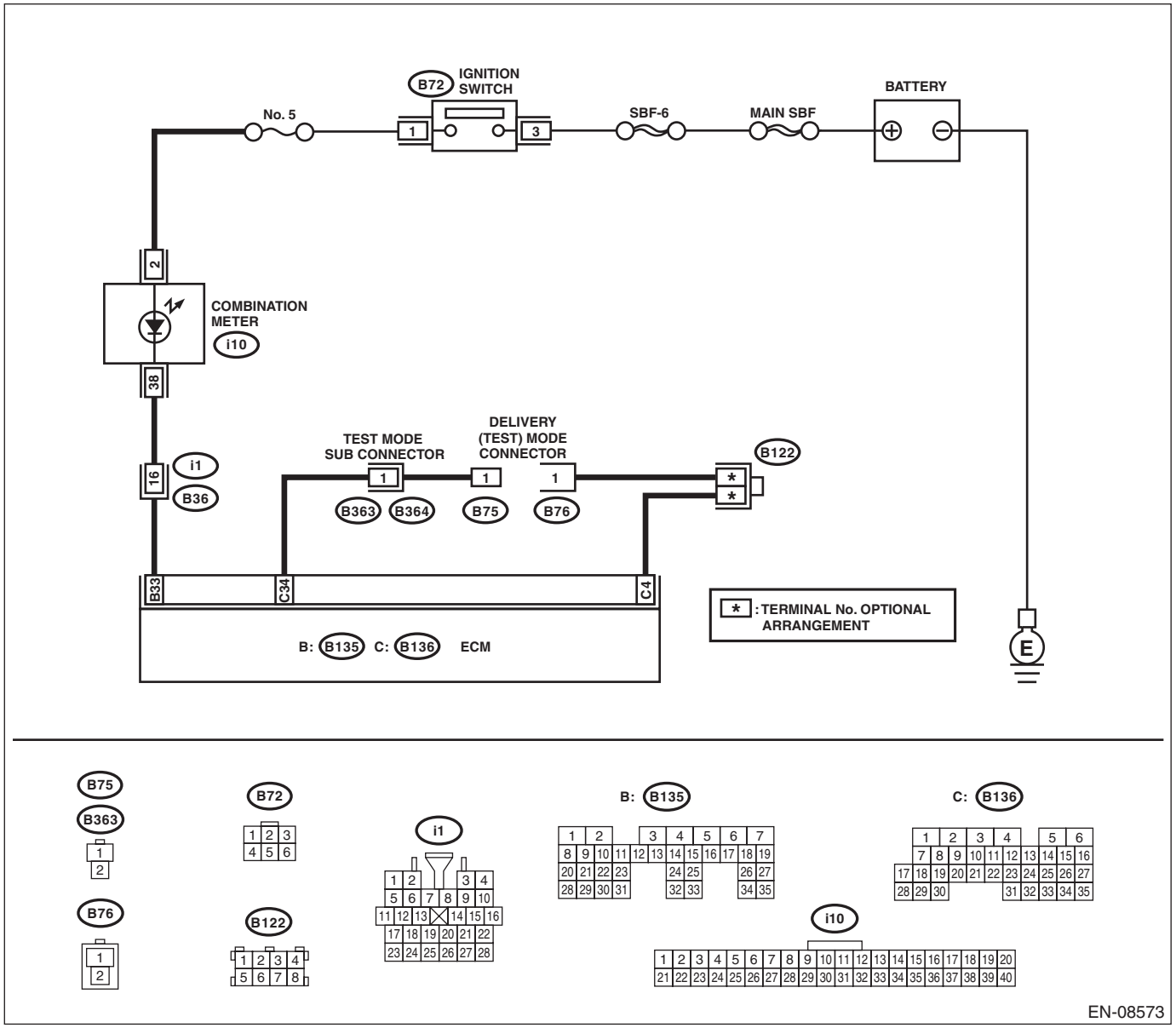
| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the combination meter. <Ref. to IDI-14, Combination Meter.><br>3) Disconnect the connector from ECM and combination meter.<br>4) Measure the resistance of harness between ECM and combination meter connector.<br>***Connector & terminal***<br>***(B135) No. 33 — (i10) No. 38:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and combination meter connector<br>• Poor contact of coupling connector |
| 3 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of combination meter connector. | Is there poor contact of combination meter connector? | Repair the poor contact of combination meter connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between combination meter connector and chassis ground.<br>***Connector & terminal***<br>***(i10) No. 2 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Replace the meter case assembly of combination meter. <Ref. to IDI-14, Combination Meter.> | Check the following item and repair if necessary.<br>NOTE:<br>• Blown out of fuse (No. 5)<br>• Open circuit or short circuit to ground in harness of power supply circuit |
| 5 | **CHECK FOR POOR CONTACT.**<br>Check for poor connection by shaking or pulling ECM connector and harness. | Does the malfunction indicator light illuminate? | Repair the poor contact of ECM connector. | Go to step **6**. |
| 6 | **CHECK ECM CONNECTOR.**<br>Check the connection of ECM connector. | Is the ECM connector correctly connected? | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> | Repair the connection of ECM connector. |

## D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

**DIAGNOSIS:**
The malfunction indicator light circuit is shorted.

**TROUBLE SYMPTOM:**
Although malfunction indicator light comes on when the engine runs, DTC is not shown on the Subaru Select Monitor display.

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Turn the ignition switch to ON. | Does the malfunction indicator light illuminate? | Repair the short circuit of harness between ECM and combination meter connector. | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

## E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

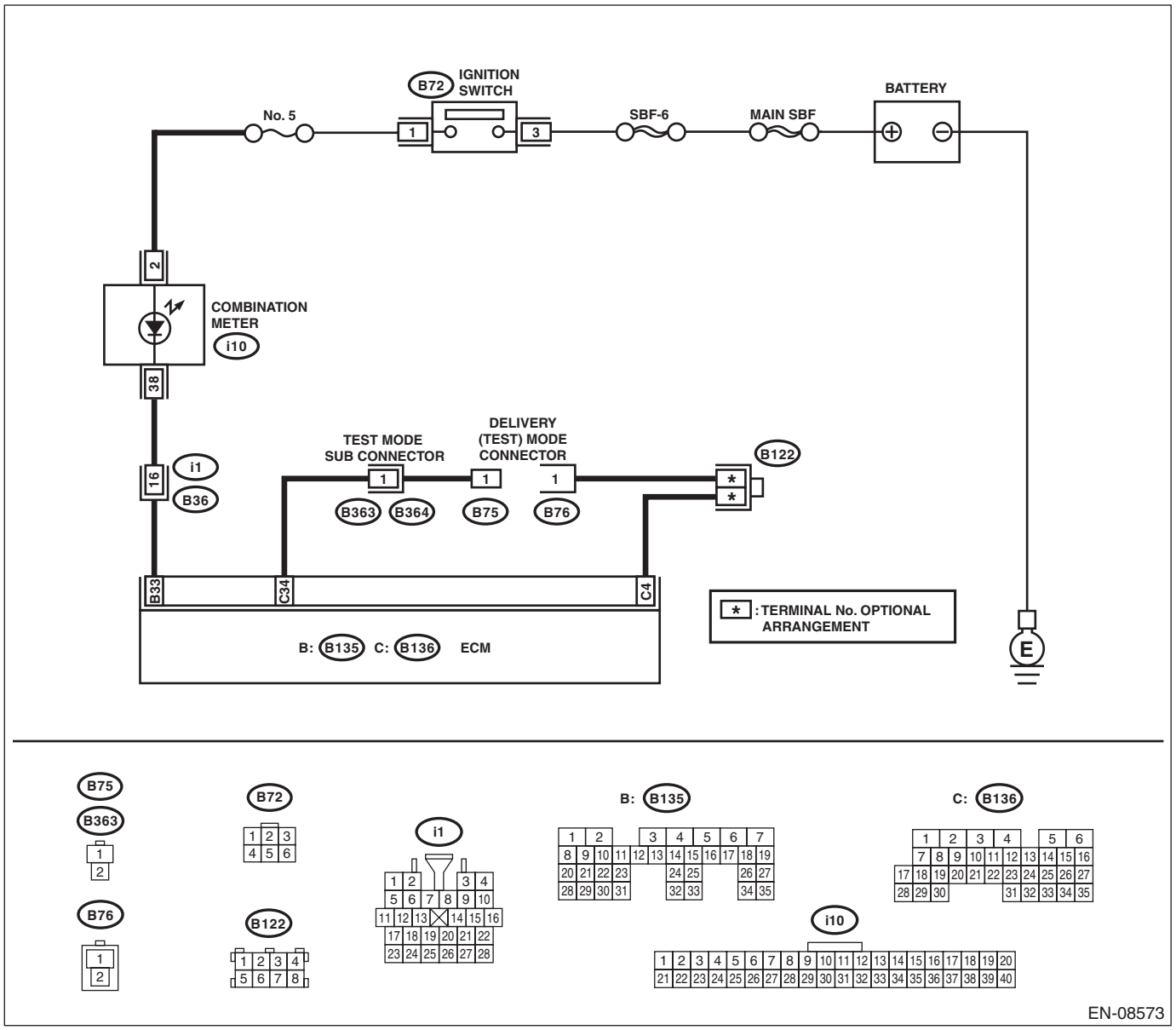
**DIAGNOSIS:**

- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

**TROUBLE SYMPTOM:**

Malfunction indicator light does not blink during Inspection Mode.

**WIRING DIAGRAM:**

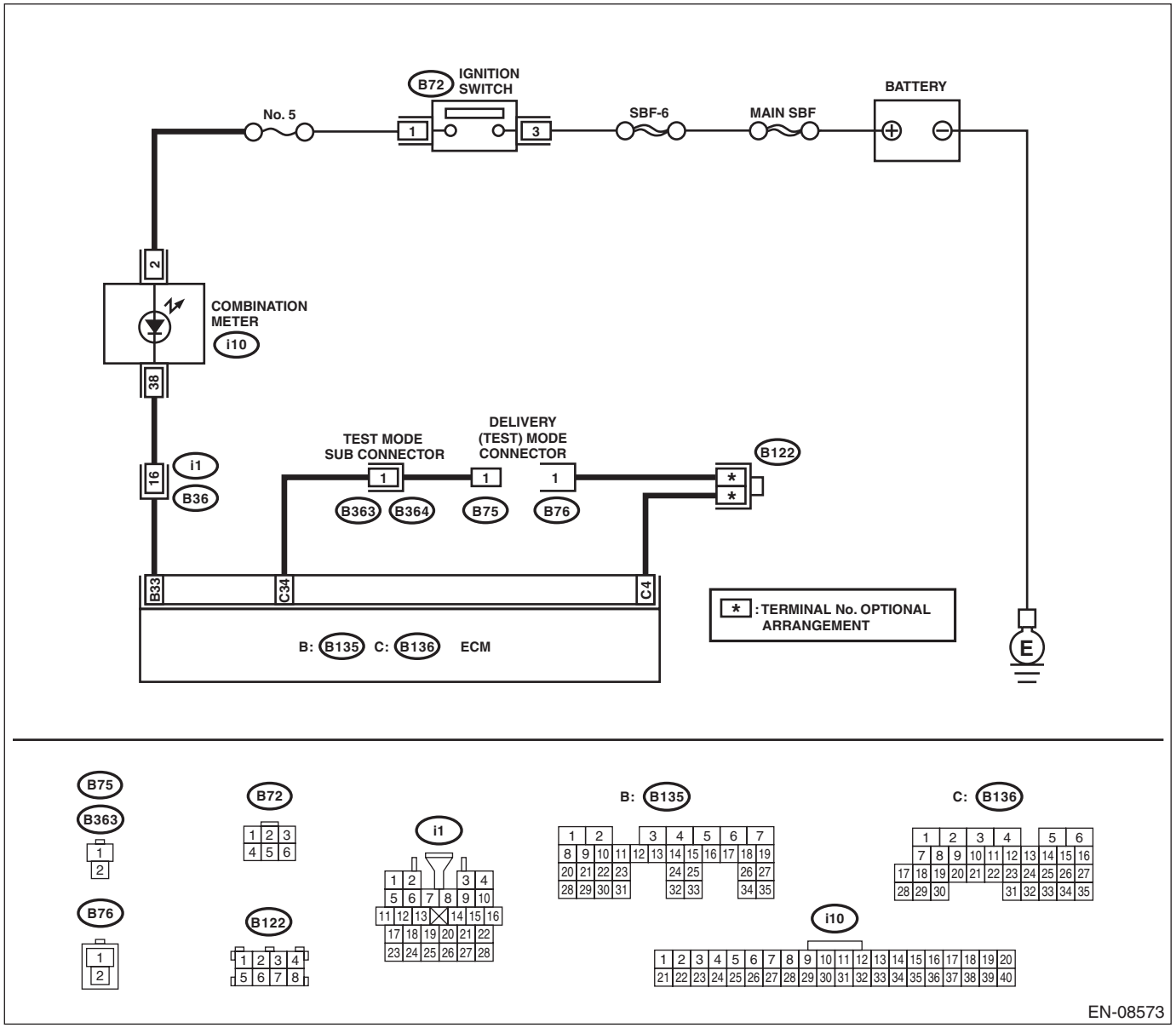



EN-08573

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.**<br>1) Turn the ignition switch to OFF.<br>2) Check the delivery (test) mode connector is disconnected.<br>3) Turn the ignition switch to ON. (engine OFF) | Does the malfunction indicator light illuminate? | Go to step **2**. | Repair the malfunction indicator light circuit. <Ref. to EN(H4SO)(diag)-63, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.> |
| 2 | **CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Turn the ignition switch to ON. | Does the malfunction indicator light illuminate? | Repair the ground short circuit of harness between ECM and combination meter connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Connect the delivery (test) mode connector.<br>3) Measure the resistance of harness between ECM connectors.<br>***Connector & terminal***<br>***(B136) No. 34 — (B136) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM connector<br>• Poor contact of each connector between ECM connector. |
| 4 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

## F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

**DIAGNOSIS:**
The delivery (test) mode connector circuit is shorted.
**TROUBLE SYMPTOM:**
Malfunction indicator light blinks when delivery (test) mode connector is not connected.
**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK DELIVERY (TEST) MODE CONNECTOR.**<br>1) Check the delivery (test) mode connector is disconnected.<br>2) Turn the ignition switch to ON. | Does the malfunction indicator light blink? | Go to step **2**. | System is normal.<br>NOTE:<br>Malfunction indicator light blinks when delivery (test) mode connector is connected. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 34 — Chassis ground:*** | Is the resistance less than 5 Ω? | Repair the short circuit to ground in harness between ECM and delivery (test) mode connector. | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

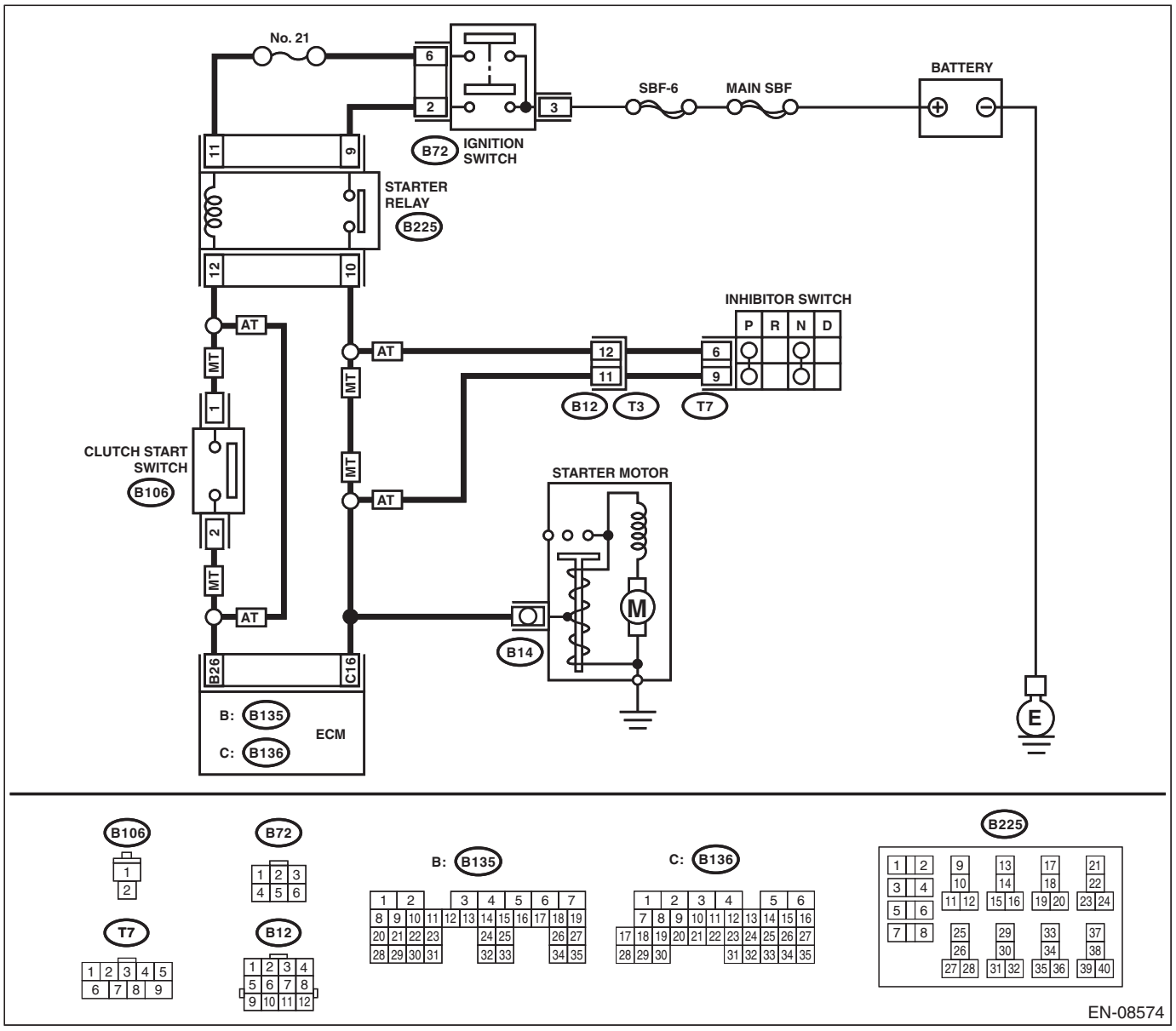
# 17.Diagnostics for Engine Starting Failure

## A: PROCEDURE

| |
|---|
| 1. Check of the fuel amount |
| ↓ |
| 2. Inspection of starter motor circuit <Ref. to EN(H4SO)(diag)-71, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.> |
| ↓ |
| 3. Inspection of ECM power supply and ground line <Ref. to EN(H4SO)(diag)-75, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.> |
| ↓ |
| 4. Inspection of ignition control system <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> |
| ↓ |
| 5. Inspection of fuel pump circuit <Ref. to EN(H4SO)(diag)-79, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.> |
| ↓ |
| 6. Inspection of fuel injector circuit <Ref. to EN(H4SO)(diag)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.> |

## B: STARTER MOTOR CIRCUIT

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, Inspection Mode.>.**
**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK BATTERY.**<br>Check the battery voltage. | Is the voltage 12 V or more? | Go to step **2**. | Charge or replace the battery. |
| 2 | **CHECK OPERATION OF STARTER MOTOR.** | Does the starter motor operate? | Go to step **3**. | Go to step **4**. |

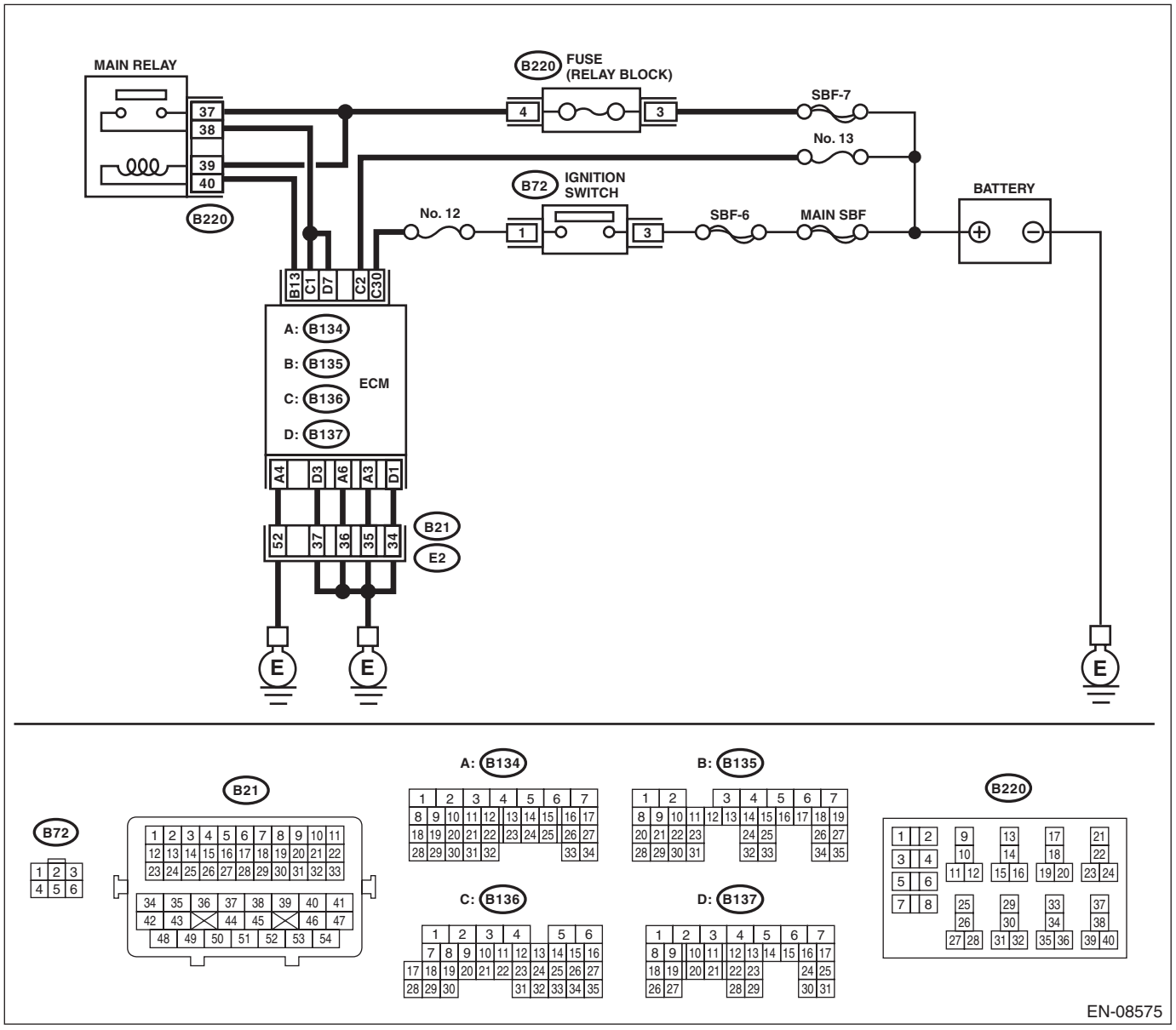
| Step | | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK DTC.** | Is DTC displayed? <Ref. to EN(H4SO)(diag)-42, OPERATION, Read Diagnostic Trouble Code (DTC).> | Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | The circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 4 | **CHECK INPUT SIGNAL FOR STARTER MOTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from starter motor.<br>3) Turn the ignition switch to START.<br>4) Measure the voltage between the starter motor connector and the engine ground.<br>***Connector & terminal***<br>***(B14) No. 1 (+) — Engine ground (–):***<br>NOTE:<br>• For AT model, place the select lever in "P" range or "N" range.<br>• For MT model, depress the clutch pedal. | Is the voltage 10 V or more? | Check the starter motor. <Ref. to SC(H4SO)-7, Starter.> | Go to step **5**. |
| 5 | **CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ignition switch.<br>3) Measure the power supply voltage between ignition switch connector and chassis ground.<br>***Connector & terminal***<br>***(B72) No. 3 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **6**. | Repair the power supply circuit. |
| 6 | **CHECK IGNITION SWITCH.**<br>Measure the resistance between ignition switch terminals after turning the ignition switch to START position.<br>***Terminals***<br>***No. 3 — No. 2:***<br>***No. 3 — No. 6:*** | Is the resistance less than 1 Ω? | Go to step **7**. | Replace the ignition switch. <Ref. to SL-41, REPLACEMENT, Ignition Key Lock.> |
| 7 | **CHECK INPUT VOLTAGE OF STARTER RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the starter relay.<br>3) Connect the connector to ignition switch.<br>4) Measure the voltage between starter relay connector and chassis ground after turning the ignition switch to START position.<br>***Connector & terminal***<br>***(B225) No. 9 (+) — Chassis ground (–):***<br>***(B225) No. 11 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **8**. | Check the following item and repair if necessary.<br>• Blown out of fuse<br>• Open or short circuit to ground in harness between starter relay and ignition switch connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 8 | **CHECK STARTER RELAY.**<br>1) Connect the battery to starter relay terminals No. 11 and No. 12.<br>2) Measure the resistance between starter relay terminals.<br>***Terminals***<br>***No. 9 — No. 10:*** | Is the resistance less than 1 Ω? | Go to step **9**. | Replace the starter relay. <Ref. to EN(H4SO)(diag)-9, Electrical Component Location.> |
| 9 | **CHECK TRANSMISSION TYPE.** | Is the transmission type AT? | Go to step **10**. | Go to step **14**. |
| 10 | **CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between ECM and starter relay connector.<br>***Connector & terminal***<br>***(B135) No. 26 — (B225) No. 12:*** | Is the resistance less than 1 Ω? | Go to step **11**. | Repair the open circuit of harness between ECM and starter relay connector. |
| 11 | **CHECK HARNESS BETWEEN STARTER RELAY AND INHIBITOR SWITCH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from inhibitor switch.<br>3) Measure the resistance of harness between starter relay connector and inhibitor relay connector.<br>***Connector & terminal***<br>***(B225) No. 10 — (T7) No. 6:*** | Is the resistance less than 1 Ω? | Go to step **12**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between starter relay connector and inhibitor switch connector<br>• Poor contact of coupling connector |
| 12 | **CHECK HARNESS BETWEEN INHIBITOR SWITCH AND STARTER MOTOR.**<br>Measure the resistance of harness between the inhibitor switch connector and starter motor.<br>***Connector & terminal***<br>***(T7) No. 9 — (B14) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **13**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between inhibitor switch connector and starter motor<br>• Poor contact of coupling connector |
| 13 | **CHECK INHIBITOR SWITCH.**<br>1) Place the select lever in “P” range and “N” range.<br>2) Measure the resistance between inhibitor switch terminals.<br>***Terminals***<br>***No. 6 — No. 9:*** | Is the resistance less than 1 Ω? | Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4SO)(diag)-75, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.> | Replace the inhibitor switch. <Ref. to 4AT-45, Inhibitor Switch.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 14 | **CHECK HARNESS BETWEEN STARTER RELAY AND CLUTCH START SWITCH.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from clutch start switch.<br>3) Install the starter relay.<br>4) Turn the ignition switch to START.<br>5) Measure the voltage between the clutch start switch connector and chassis ground.<br>***Connector & terminal***<br>***(B106) No. 1 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **15**. | Repair the open circuit in harness between starter relay connector and clutch start switch connector. |
| 15 | **CHECK CLUTCH START SWITCH.**<br>Measure the resistance between clutch start switch terminals while depressing the clutch pedal.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Go to step **16**. | Replace the clutch start switch. <Ref. to CL-25, Clutch Switch.> |
| 16 | **CHECK HARNESS BETWEEN ECM AND CLUTCH START SWITCH.**<br>Measure the resistance of harness between ECM and clutch start switch connector.<br>***Connector & terminal***<br>***(B135) No. 26 — (B106) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **17**. | Repair the open circuit of harness between ECM and clutch start switch connector. |
| 17 | **CHECK HARNESS BETWEEN STARTER RELAY AND STARTER MOTOR.**<br>Measure the resistance of harness between starter relay connector and starter motor.<br>***Connector & terminal***<br>***(B225) No. 10 — (B14) No. 1:*** | Is the resistance less than 1 Ω? | Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4SO)(diag)-75, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.> | Repair the open circuit of the harness between starter relay connector and starter motor. |

## C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**
**WIRING DIAGRAM:**

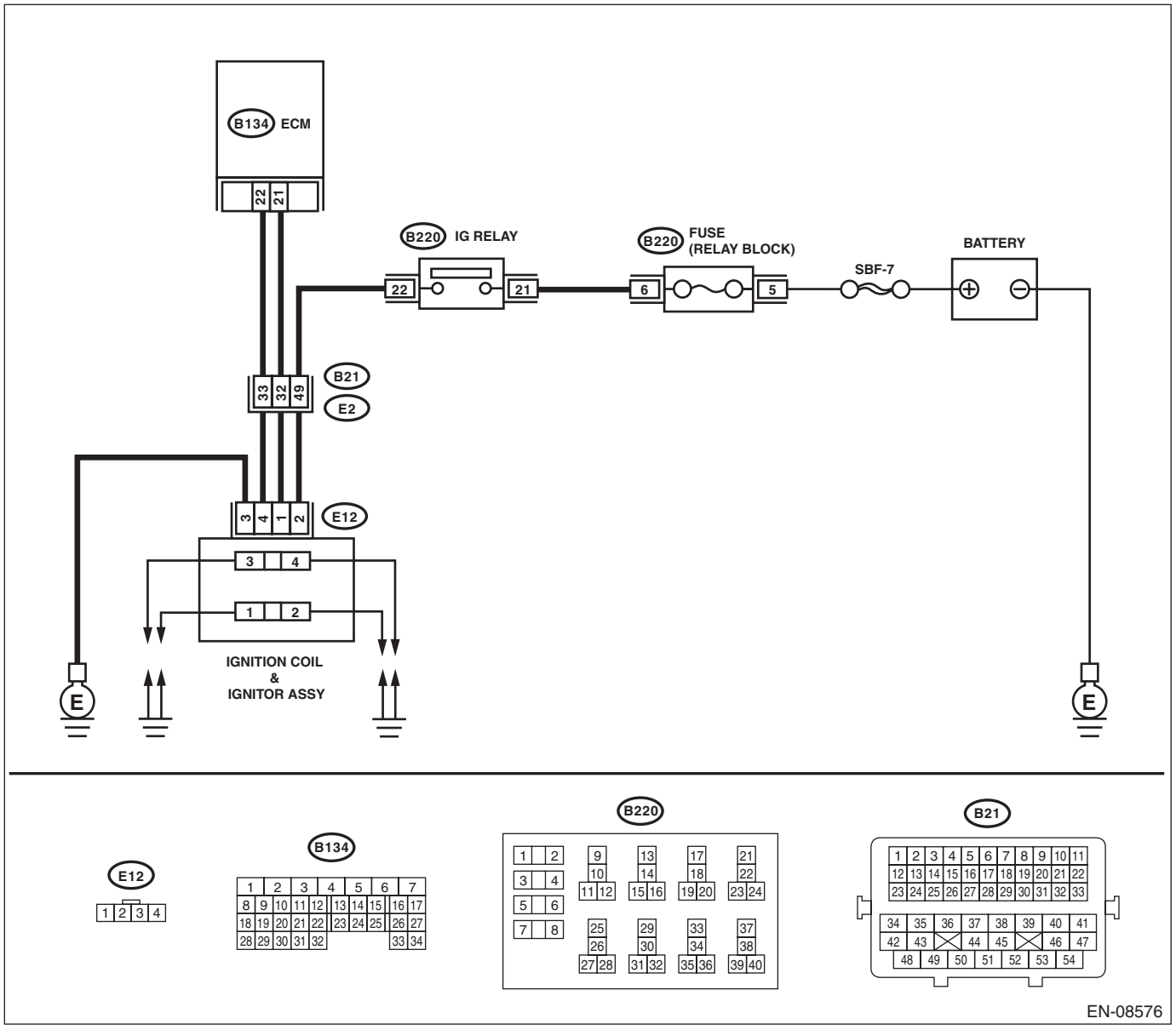



| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK MAIN RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the main relay.<br>3) Connect the battery to main relay terminals No. 39 and No. 40.<br>4) Measure the resistance between main relay terminals.<br>***Terminals***<br>***No. 37 — No. 38:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Replace the main relay. <Ref. to FU(H4SO)-47, Main Relay.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK GROUND CIRCUIT FOR ECM.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM connector and engine ground terminal.<br>• Poor contact of coupling connector |
| 3 | **CHECK INPUT VOLTAGE OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 2 (+) — Chassis ground (–):***<br>***(B136) No. 30 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **4**. | Repair the open or ground short circuit of harness of power supply circuit. |
| 4 | **CHECK INPUT VOLTAGE OF MAIN RELAY.**<br>Measure the voltage between main relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 37 (+) — Chassis ground (–):***<br>***(B220) No. 39 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **5**. | Repair the open or ground short circuit of harness of power supply circuit. |
| 5 | **CHECK INPUT VOLTAGE OF ECM.**<br>1) Turn the ignition switch to OFF.<br>2) Install the main relay.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **6**. | Repair the open circuit in harness between ECM and main relay connector. |
| 6 | **CHECK INPUT VOLTAGE OF ECM.**<br>1) Turn the ignition switch to OFF.<br>2) Connect the connector to ECM.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 1 (+) — Chassis ground (–):***<br>***(B137) No. 7 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Check ignition control system. <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and main relay connector<br>• Poor contact of main relay connector<br>• Poor contact of ECM connector |

## D: IGNITION CONTROL SYSTEM

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, Inspection Mode.>.**
**WIRING DIAGRAM:**

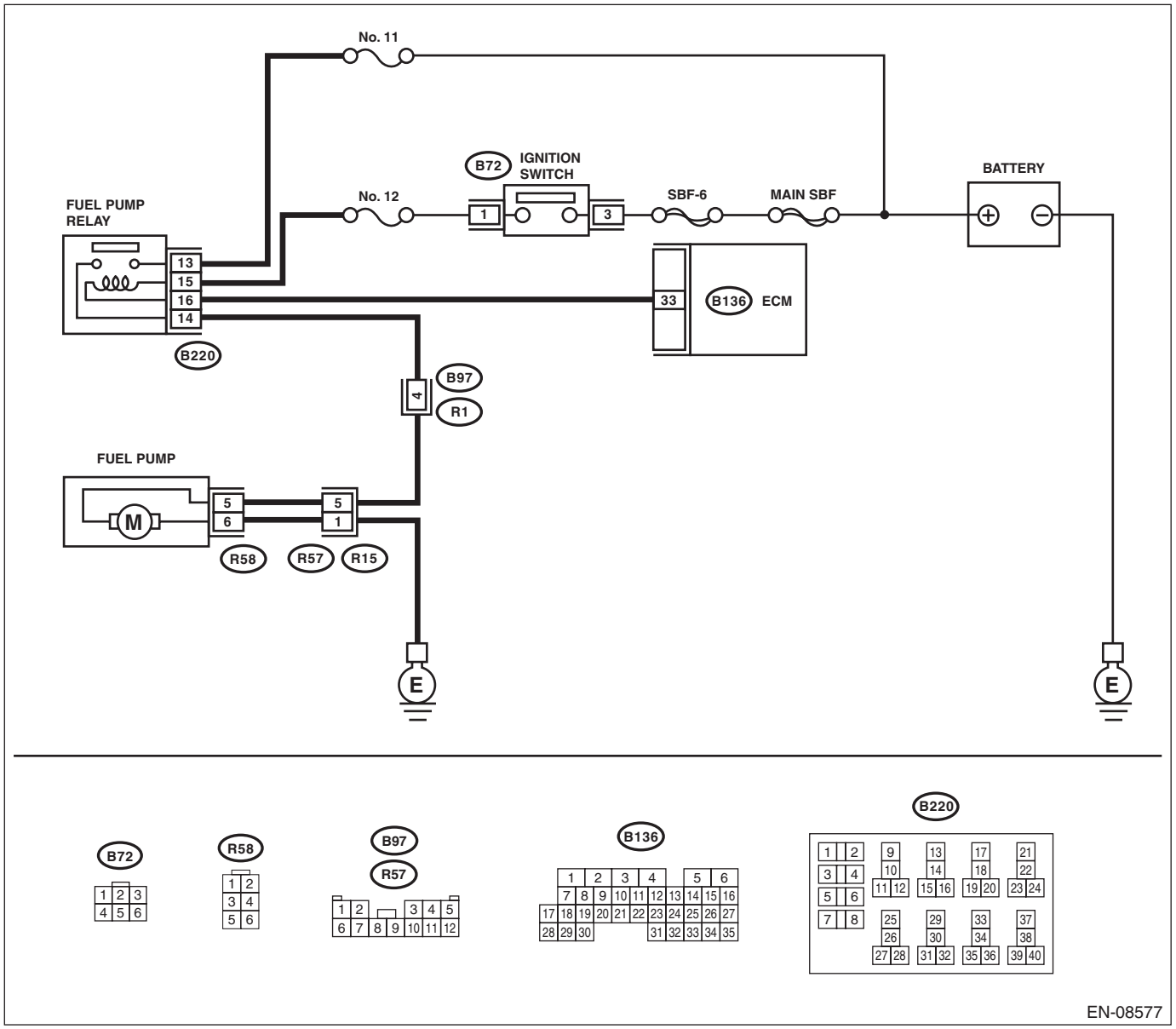



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK IGNITION SYSTEM FOR SPARKS.**<br>1) Remove the plug cord cap from each spark plug.<br>2) Install a new spark plug on plug cord cap.<br>**CAUTION:**<br>**Do not remove the spark plug from engine.**<br>3) Contact the spark plug thread portion to engine.<br>4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder. | Does spark occur at each cylinder? | Check fuel pump system. <Ref. to EN(H4SO)(diag)-79, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.> | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL AND IGNITOR ASSEMBLY.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the ignition coil & ignitor assembly.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ignition coil and ignitor assembly connector and engine ground.<br>***Connector & terminal***<br>***(E12) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ignition coil and ignitor assembly and IG relay connector<br>• Poor contact of coupling connector<br>• Blown out of fuse |
| 3 | **CHECK IGNITION COIL AND IGNITOR ASSEMBLY GROUND CIRCUIT.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between the ignition coil and ignitor assembly connector, and engine ground.<br>***Connector & terminal***<br>***(E12) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **4**. | Repair the open circuit in harness between ignitor assembly connector and engine ground. |
| 4 | **CHECK IGNITION COIL AND IGNITOR ASSEMBLY.**<br>1) Remove the spark plug cords.<br>2) Measure the resistance between spark plug cord contact portions to check secondary coil.<br>***Terminals***<br>***No. 1 — No. 2:***<br>***No. 3 — No. 4:*** | Is the resistance between 10 and 15 kΩ? | Go to step **5**. | Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.> |
| 5 | **CHECK INPUT SIGNAL FOR IGNITION COIL AND IGNITOR ASSEMBLY.**<br>1) Connect the connector to the Ignition coil and ignitor assembly.<br>2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil and ignitor assembly connector and engine ground.<br>***Connector & terminal***<br>***(E12) No. 1 (+) — Engine ground (–):***<br>***(E12) No. 4 (+) — Engine ground (–):*** | Does the voltage vary 10 V or more? | Go to step **6**. | Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.> |
| 6 | **CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and ignition coil & igniter assembly.<br>3) Measure the resistance of harness between ECM and ignition coil and ignitor assembly connector.<br>***Connector & terminal***<br>***(B134) No. 21 — (E12) No. 1:***<br>***(B134) No. 22 — (E12) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **7**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and ignition coil and ignitor assembly connector<br>• Poor contact of coupling connector |
| 7 | **CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.**<br>Measure the resistance of harness between ECM and engine ground.<br>***Connector & terminal:***<br>***(B134) No. 21 — Engine ground:***<br>***(B134) No. 22 — Engine ground:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of ECM connector. | Repair the ground short circuit of harness between ECM and ignition coil and ignitor assembly connector. |

# E: FUEL PUMP CIRCUIT

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**
**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OPERATING SOUND OF FUEL PUMP.**<br>Check if the fuel pump operates for two seconds when turning the ignition switch to ON.<br>NOTE:<br>Fuel pump operation can be executed using the Subaru Select Monitor.<br>For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the fuel pump emit operating sound? | Check the fuel injector circuit. <Ref. to EN(H4SO)(diag)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.> | Go to step **2**. |

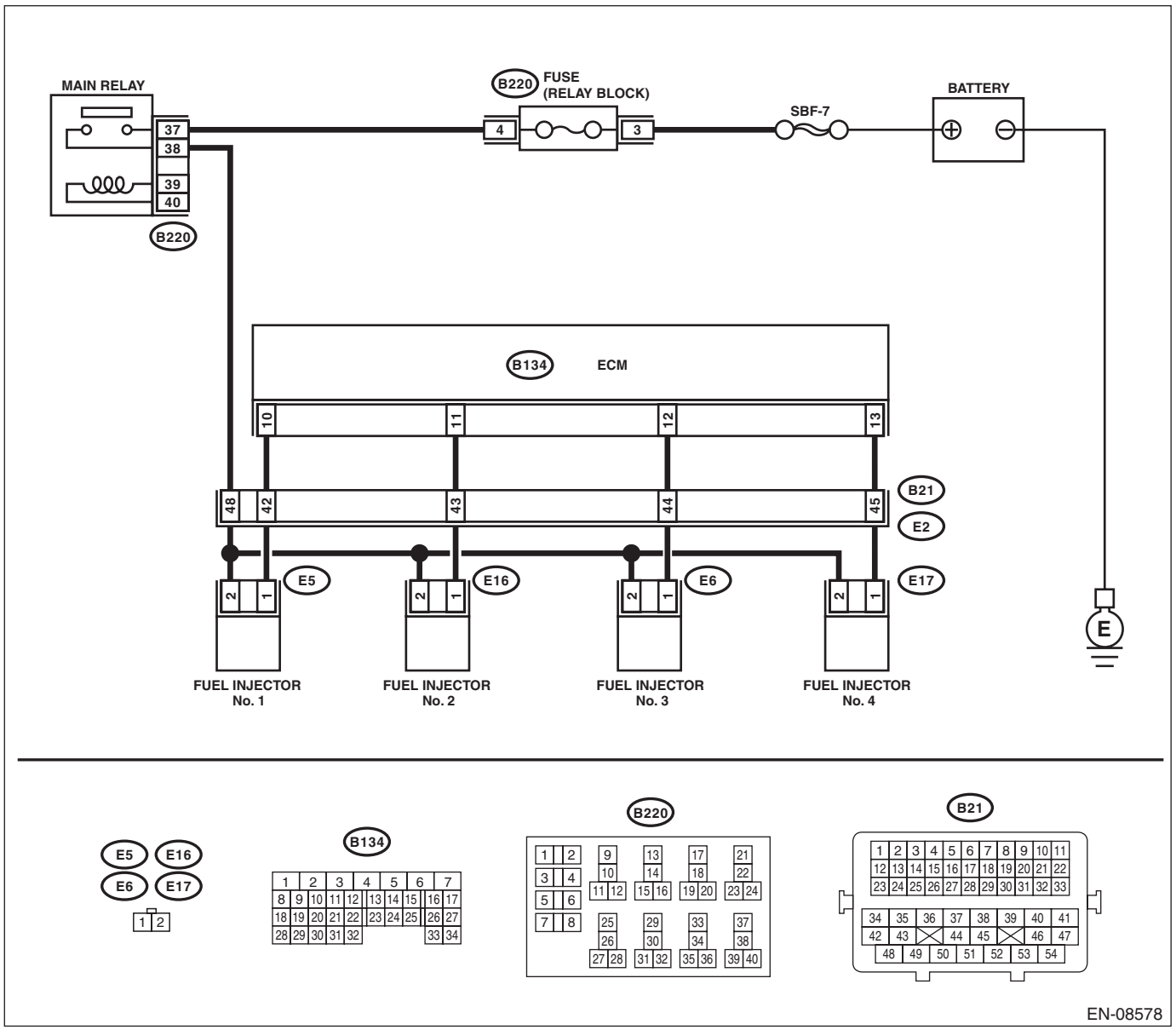
| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK GROUND CIRCUIT OF FUEL PUMP.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the fuel pump access hole lid.<br>3) Disconnect the connector from fuel pump.<br>4) Measure the resistance of harness between fuel pump and chassis ground.<br>***Connector & terminal***<br>***(R58) No. 6 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between fuel pump connector and chassis grounding terminal<br>• Poor contact of coupling connector |
| 3 | **CHECK POWER SUPPLY TO FUEL PUMP.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground.<br>***Connector & terminal***<br>***(R58) No. 5 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Replace the fuel pump. <Ref. to FU(H4SO)-66, Fuel Pump.> | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between fuel pump connector and fuel pump relay connector.<br>***Connector & terminal***<br>***(R58) No. 5 — (B220) No. 14:*** | Is the resistance less than 1 Ω? | Go to step **5**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between fuel pump connector and fuel pump relay connector<br>• Poor contact of coupling connector |
| 5 | **CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.**<br>Measure the resistance of harness between fuel pump connector and fuel pump relay connector.<br>***Connector & terminal***<br>***(R58) No. 5 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **6**. | Repair the short circuit of harness between fuel pump connector and fuel pump relay connector. |
| 6 | **CHECK FUEL PUMP RELAY.**<br>1) Remove the fuel pump relay.<br>2) Connect the battery to fuel pump relay terminals No. 15 and No. 16.<br>3) Measure the resistance between fuel pump relay terminals.<br>***Terminals***<br>***No. 13 — No. 14:*** | Is the resistance less than 1 Ω? | Go to step **7**. | Replace the fuel pump relay. <Ref. to FU(H4SO)-49, Fuel Pump Relay.> |
| 7 | **CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and fuel pump relay connector.<br>***Connector & terminal***<br>***(B136) No. 33 — (B220) No. 16:*** | Is the resistance less than 1 Ω? | Go to step **8**. | Repair the open circuit of harness between ECM and fuel pump relay connector. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 8 | **CHECK POWER SUPPLY OF FUEL PUMP RELAY.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between fuel pump relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 13 (+) — Chassis ground (–):***<br>***(B220) No. 15 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of ECM connector. | Repair the open or ground short circuit of harness of power supply circuit. |

## F: FUEL INJECTOR CIRCUIT

**CAUTION:**
- **Check or repair only faulty parts.**
- **After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



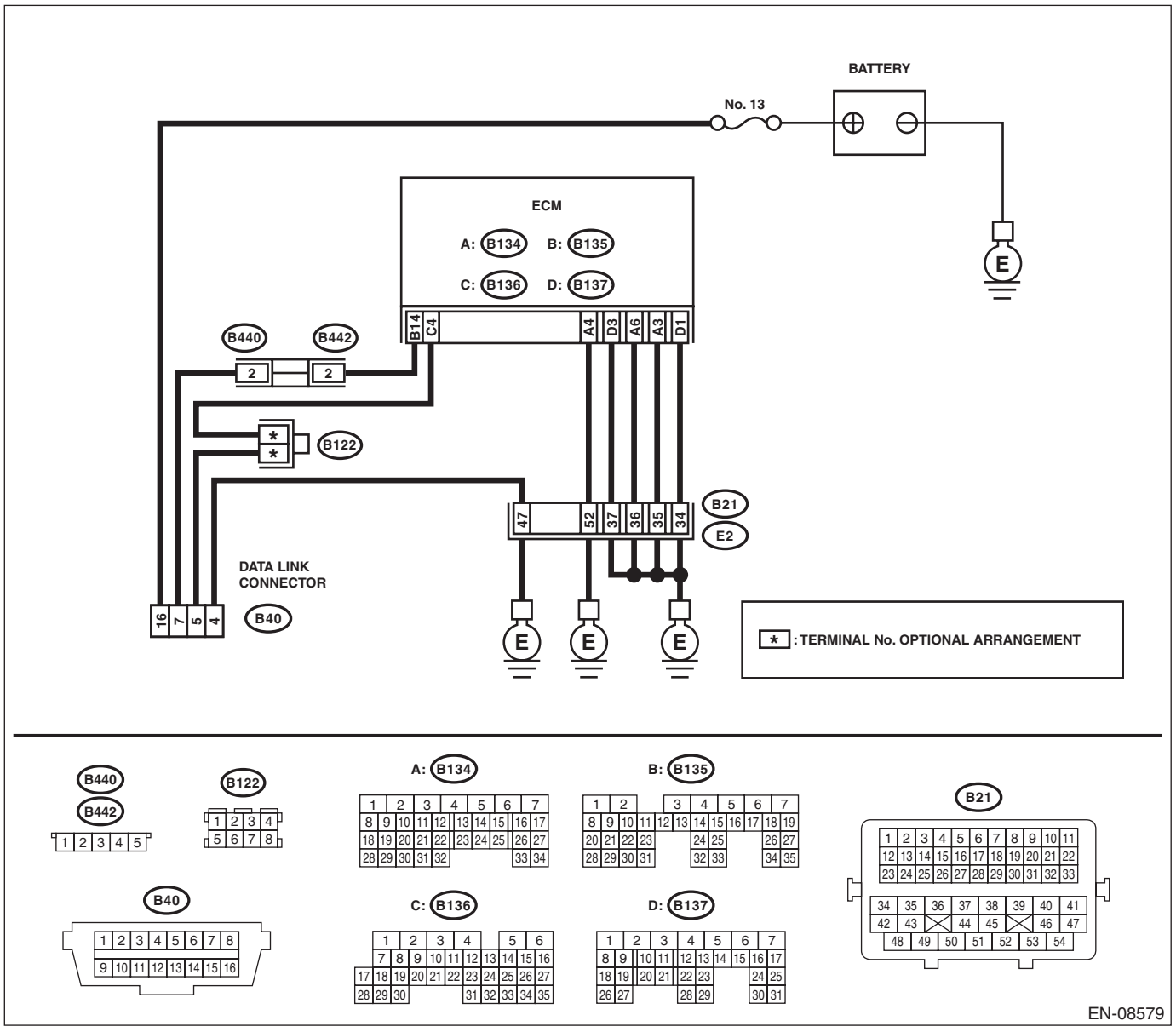

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OPERATION OF EACH FUEL INJECTOR.**<br>While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector to listen to sounds for this check. | Does the fuel pump emit operating sound? | Check the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.> | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK POWER SUPPLY TO EACH FUEL INJECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector.<br>3) Turn the ignition switch to ON.<br>4) Measure the power supply voltage between fuel injector terminal and engine ground.<br>***Connector & terminal***<br>***#1 (E5) No. 2 (+) — Engine ground (–):***<br>***#2 (E16) No. 2 (+) — Engine ground (–):***<br>***#3 (E6) No. 2 (+) — Engine ground (–):***<br>***#4 (E17) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between main relay connector and fuel injector connector<br>• Poor contact of main relay connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between ECM and fuel injector connector.<br>***Connector & terminal***<br>***#1 (B134) No. 10 — (E5) No. 1:***<br>***#2 (B134) No. 11 — (E16) No. 1:***<br>***#3 (B134) No. 12 — (E6) No. 1:***<br>***#4 (B134) No. 13 — (E17) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and fuel injector connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***#1 (B134) No. 10 — Chassis ground:***<br>***#2 (B134) No. 11 — Chassis ground:***<br>***#3 (B134) No. 12 — Chassis ground:***<br>***#4 (B134) No. 13 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the short circuit to ground in harness between ECM and fuel injector connector. |
| 5 | **CHECK EACH FUEL INJECTOR.**<br>Measure the resistance between each fuel injector terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Go to step **6**. | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> |
| 6 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Inspection using “General Diagnostic Table”. <Ref. to EN(H4SO)(diag)-317, INSPECTION, General Diagnostic Table.> |

# 18.Diagnostic Procedure for Subaru Select Monitor Communication

## A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

**DIAGNOSIS:**
Open or short circuit in data link connector
**TROUBLE SYMPTOM:**
Subaru Select Monitor communication failure
**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK POWER SUPPLY CIRCUIT.**<br>Connect the SDI (Subaru Diagnosis Interface) or general scan tool to data link connector. | Does SDI or general scan tool turn ON? | Go to step **4**. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK POWER SUPPLY CIRCUIT.**<br>Measure the voltage between data link connector and chassis ground.<br>***Connector & terminal***<br>***(B40) No. 16 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the power supply circuit.<br>NOTE:<br>In this case, repair the following item:<br>• Open or ground short circuit of harness between battery and data link connector<br>• Blown out of fuse (M/B No. 13) |
| 3 | **CHECK HARNESS BETWEEN DATA LINK CONNECTOR AND CHASSIS GROUND.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between data link connector and chassis ground.<br>***Connector & terminal***<br>***(B40) No. 4 — Chassis ground:***<br>***(B40) No. 5 — Chassis ground:*** | Is the resistance less than 5 Ω? | Repair the poor contact of data link connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and data link connector<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of joint connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.**<br>1) Disconnect the connector from ECM, TCM, VDC CM, airbag CM and body integrated unit.<br>**CAUTION:**<br>**When disconnecting the connector from airbag CM, always follow the precautions on AB section. <Ref. to AB-5, CAUTION, General Description.>**<br>2) Measure the resistance of harness between ECM and data link connector.<br>***Connector & terminal***<br>***(B135) No. 14 — (B40) No. 7:*** | Is the resistance less than 1 Ω? | Go to step **5**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and data link connector<br>• Poor contact of joint connector |
| 5 | **CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.**<br>Measure the resistance between data link connector and chassis ground.<br>***Connector & terminal***<br>***(B40) No. 7 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of the ECM or data link connector. | Repair the ground short circuit of harness between ECM and data link connector. |

# 19.List of Diagnostic Trouble Code (DTC)

## A: LIST

| DTC | Item | Note |
|---|---|---|
| P0026 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 1) | <Ref. to EN(H4SO)(diag)-93, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0028 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 2) | <Ref. to EN(H4SO)(diag)-95, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0030 | HO2S Heater Control Circuit (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-97, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0031 | HO2S Heater Control Circuit Low (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-99, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0032 | HO2S Heater Control Circuit High (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-101, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0037 | HO2S Heater Control Circuit Low (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-103, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0038 | HO2S Heater Control Circuit High (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-105, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0068 | MAP/MAF - Throttle Position Correlation | <Ref. to EN(H4SO)(diag)-107, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0076 | Intake Valve Control Solenoid Circuit Low (Bank 1) | <Ref. to EN(H4SO)(diag)-108, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0077 | Intake Valve Control Solenoid Circuit High (Bank 1) | <Ref. to EN(H4SO)(diag)-110, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0082 | Intake Valve Control Solenoid Circuit Low (Bank 2) | <Ref. to EN(H4SO)(diag)-112, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0083 | Intake Valve Control Solenoid Circuit High (Bank 2) | <Ref. to EN(H4SO)(diag)-114, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0101 | Mass or Volume Air Flow Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-116, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0102 | Mass or Volume Air Flow Circuit Low Input | <Ref. to EN(H4SO)(diag)-117, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0103 | Mass or Volume Air Flow Circuit High Input | <Ref. to EN(H4SO)(diag)-119, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0107 | Manifold Absolute Pressure/Barometric Pressure Circuit Low Input | <Ref. to EN(H4SO)(diag)-121, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0108 | Manifold Absolute Pressure/Barometric Pressure Circuit High Input | <Ref. to EN(H4SO)(diag)-123, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P0111 | Intake Air Temperature Sensor 1 Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-125, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0112 | Intake Air Temperature Sensor 1 Circuit Low | <Ref. to EN(H4SO)(diag)-126, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0113 | Intake Air Temperature Sensor 1 Circuit High | <Ref. to EN(H4SO)(diag)-128, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0117 | Engine Coolant Temperature Circuit Low | <Ref. to EN(H4SO)(diag)-130, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0118 | Engine Coolant Temperature Circuit High | <Ref. to EN(H4SO)(diag)-132, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0122 | Throttle/Pedal Position Sensor/Switch “A” Circuit Low | <Ref. to EN(H4SO)(diag)-134, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0123 | Throttle/Pedal Position Sensor/Switch “A” Circuit High | <Ref. to EN(H4SO)(diag)-136, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0125 | Insufficient Coolant Temperature for Closed Loop Fuel Control | <Ref. to EN(H4SO)(diag)-138, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0126 | Insufficient Engine Coolant Temperature for Stable Operation | <Ref. to EN(H4SO)(diag)-139, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0128 | Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature) | <Ref. to EN(H4SO)(diag)-140, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0131 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-141, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0132 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-143, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0133 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-145, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0134 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) | <Ref. to EN(H4SO)(diag)-146, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0137 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-148, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0138 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-150, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0139 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-152, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0140 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-154, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P0141 | O2 Sensor Heater Circuit (Bank 1 Sensor 2) | <Ref. to EN(H4SO)(diag)-156, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0171 | System Too Lean (Bank 1) | <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0172 | System Too Rich (Bank 1) | <Ref. to EN(H4SO)(diag)-157, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0181 | Fuel Temperature Sensor “A” Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-159, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0182 | Fuel Temperature Sensor “A” Circuit Low Input | <Ref. to EN(H4SO)(diag)-160, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0183 | Fuel Temperature Sensor “A” Circuit High Input | <Ref. to EN(H4SO)(diag)-162, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0196 | Engine Oil Temperature Sensor Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-164, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0197 | Engine Oil Temperature Sensor Low | <Ref. to EN(H4SO)(diag)-165, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0198 | Engine Oil Temperature Sensor High | <Ref. to EN(H4SO)(diag)-167, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0222 | Throttle/Pedal Position Sensor/Switch “B” Circuit Low | <Ref. to EN(H4SO)(diag)-169, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0223 | Throttle/Pedal Position Sensor/Switch “B” Circuit High | <Ref. to EN(H4SO)(diag)-171, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0301 | Cylinder 1 Misfire Detected | <Ref. to EN(H4SO)(diag)-173, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0302 | Cylinder 2 Misfire Detected | <Ref. to EN(H4SO)(diag)-173, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0303 | Cylinder 3 Misfire Detected | <Ref. to EN(H4SO)(diag)-173, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0304 | Cylinder 4 Misfire Detected | <Ref. to EN(H4SO)(diag)-174, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0327 | Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor) | <Ref. to EN(H4SO)(diag)-180, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0328 | Knock Sensor 1 Circuit High (Bank 1 or Single Sensor) | <Ref. to EN(H4SO)(diag)-182, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0335 | Crankshaft Position Sensor “A” Circuit | <Ref. to EN(H4SO)(diag)-184, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0336 | Crankshaft Position Sensor “A” Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-186, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0340 | Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor) | <Ref. to EN(H4SO)(diag)-187, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0341 | Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor) | <Ref. to EN(H4SO)(diag)-189, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P0400 | Exhaust Gas Recirculation Flow | <Ref. to EN(H4SO)(diag)-191, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0420 | Catalyst System Efficiency Below Threshold (Bank 1) | <Ref. to EN(H4SO)(diag)-192, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0442 | Evaporative Emission Control System Leak Detected (Small Leak) | <Ref. to EN(H4SO)(diag)-196, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0447 | Evaporative Emission Control System Vent Control Circuit Open | <Ref. to EN(H4SO)(diag)-198, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0448 | Evaporative Emission Control System Vent Control Circuit Shorted | <Ref. to EN(H4SO)(diag)-200, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0451 | Evaporative Emission Control System Pressure Sensor | <Ref. to EN(H4SO)(diag)-202, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0452 | Evaporative Emission Control System Pressure Sensor Low Input | <Ref. to EN(H4SO)(diag)-203, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0453 | Evaporative Emission Control System Pressure Sensor High Input | <Ref. to EN(H4SO)(diag)-205, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0456 | Evaporative Emission Control System Leak Detected (Very Small Leak) | <Ref. to EN(H4SO)(diag)-209, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0457 | Evaporative Emission Control System Leak Detected (Fuel Cap Loose/ Off) | <Ref. to EN(H4SO)(diag)-211, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0458 | Evaporative Emission System Purge Control Valve Circuit Low | <Ref. to EN(H4SO)(diag)-213, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0459 | Evaporative Emission System Purge Control Valve Circuit High | <Ref. to EN(H4SO)(diag)-215, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0461 | Fuel Level Sensor “A” Circuit Range/ Performance | <Ref. to EN(H4SO)(diag)-217, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0462 | Fuel Level Sensor “A” Circuit Low | <Ref. to EN(H4SO)(diag)-217, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0463 | Fuel Level Sensor “A” Circuit High | <Ref. to EN(H4SO)(diag)-218, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0464 | Fuel Level Sensor Circuit Intermittent | <Ref. to EN(H4SO)(diag)-219, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0500 | Vehicle Speed Sensor “A” | <Ref. to EN(H4SO)(diag)-220, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0506 | Idle Air Control System RPM Lower Than Expected | <Ref. to EN(H4SO)(diag)-221, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0507 | Idle Air Control System RPM Higher Than Expected | <Ref. to EN(H4SO)(diag)-222, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P050A | Cold Start Idle Air Control System Performance | <Ref. to EN(H4SO)(diag)-223, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P050B | Cold Start Ignition Timing Performance | <Ref. to EN(H4SO)(diag)-232, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0512 | Starter Request Circuit | <Ref. to EN(H4SO)(diag)-233, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0513 | Incorrect Immobilizer Key | <Ref. to IM(diag)-15, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0604 | Internal Control Module Random Access Memory (RAM) Error | <Ref. to EN(H4SO)(diag)-235, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0605 | Internal Control Module Read Only Memory (ROM) Error | <Ref. to EN(H4SO)(diag)-235, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0607 | Throttle Control System Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-236, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0638 | Throttle Actuator Control Range/Performance (Bank 1) | <Ref. to EN(H4SO)(diag)-237, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0700 | Transmission Control System (MIL Request) | <Ref. to EN(H4SO)(diag)-237, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0851 | Park/Neutral Switch Input Circuit Low (AT Model) | <Ref. to EN(H4SO)(diag)-238, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0851 | Neutral Switch Input Circuit Low (MT Model) | <Ref. to EN(H4SO)(diag)-240, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0852 | Park/Neutral Switch Input Circuit High (AT Model) | <Ref. to EN(H4SO)(diag)-242, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P0852 | Neutral Switch Input Circuit High (MT Model) | <Ref. to EN(H4SO)(diag)-244, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1152 | O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1) | <Ref. to EN(H4SO)(diag)-246, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1153 | O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1) | <Ref. to EN(H4SO)(diag)-248, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1160 | Return Spring Failure | <Ref. to EN(H4SO)(diag)-249, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1400 | Fuel Tank Pressure Control Solenoid Valve Circuit Low | <Ref. to EN(H4SO)(diag)-250, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1420 | Fuel Tank Pressure Control Sol. Valve Circuit High | <Ref. to EN(H4SO)(diag)-252, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1443 | Vent Control Solenoid Valve Function Problem | <Ref. to EN(H4SO)(diag)-254, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1491 | Positive Crankcase Ventilation (Blow-by) Function Problem | <Ref. to EN(H4SO)(diag)-255, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1492 | EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P1493 | EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1494 | EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1495 | EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1496 | EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1497 | EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input) | <Ref. to EN(H4SO)(diag)-257, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1498 | EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input) | <Ref. to EN(H4SO)(diag)-258, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1499 | EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input) | <Ref. to EN(H4SO)(diag)-261, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1518 | Starter Switch Circuit Low Input | <Ref. to EN(H4SO)(diag)-264, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1560 | Back-Up Voltage Circuit Malfunction | <Ref. to EN(H4SO)(diag)-266, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1570 | Antenna | <Ref. to IM(diag)-16, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1571 | Reference Code Incompatibility | <Ref. to IM(diag)-18, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1572 | IMM Circuit Failure | <Ref. to IM(diag)-19, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1574 | Key Communication Failure | <Ref. to IM(diag)-21, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1576 | EGI Control Module EEPROM | <Ref. to IM(diag)-22, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1577 | IMM Control Module EEPROM | <Ref. to IM(diag)-23, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P1578 | Meter Failure | <Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2096 | Post Catalyst Fuel Trim System Too Lean (Bank 1) | <Ref. to EN(H4SO)(diag)-268, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2097 | Post Catalyst Fuel Trim System Too Rich (Bank 1) | <Ref. to EN(H4SO)(diag)-274, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2101 | Throttle Actuator Control Motor Circuit Range/Performance | <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2102 | Throttle Actuator Control Motor Circuit Low | <Ref. to EN(H4SO)(diag)-285, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2103 | Throttle Actuator Control Motor Circuit High | <Ref. to EN(H4SO)(diag)-287, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| DTC | Item | Note |
|---|---|---|
| P2109 | Throttle/Pedal Position Sensor “A” Minimum Stop Performance | <Ref. to EN(H4SO)(diag)-288, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2122 | Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input | <Ref. to EN(H4SO)(diag)-289, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2123 | Throttle/Pedal Position Sensor/Switch “D” Circuit High Input | <Ref. to EN(H4SO)(diag)-291, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2127 | Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input | <Ref. to EN(H4SO)(diag)-293, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2128 | Throttle/Pedal Position Sensor/Switch “E” Circuit High Input | <Ref. to EN(H4SO)(diag)-295, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2135 | Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation | <Ref. to EN(H4SO)(diag)-297, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2138 | Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation | <Ref. to EN(H4SO)(diag)-300, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P219A | Bank 1 Air-Fuel Ratio Imbalance | <Ref. to EN(H4SO)(diag)-302, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2227 | Atmospheric Pressure Sensor Range/ Performance | <Ref. to EN(H4SO)(diag)-314, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2228 | Barometric Pressure Circuit Low | <Ref. to EN(H4SO)(diag)-315, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| P2229 | Barometric Pressure Circuit High | <Ref. to EN(H4SO)(diag)-316, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0073 | CAN Failure, Bus “OFF” Detection | <Ref. to EN(H4SO)(diag)-316, DTC U0073 CAN FAILURE, BUS ‘OFF’ DETECTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0101 | CAN (TCU) Data not Loaded | <Ref. to EN(H4SO)(diag)-316, DTC U0101 CAN (TCU) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0122 | CAN (VDC) Data not Loaded | <Ref. to EN(H4SO)(diag)-316, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0140 | CAN (BCU) Data not Loaded | <Ref. to EN(H4SO)(diag)-316, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0402 | CAN (TCU) Data Abnormal | <Ref. to EN(H4SO)(diag)-316, DTC U0402 CAN (TCU) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0416 | CAN (VDC) Data Abnormal | <Ref. to EN(H4SO)(diag)-316, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| U0422 | CAN (BCU) Data Abnormal | <Ref. to EN(H4SO)(diag)-316, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

# 20.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-9, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

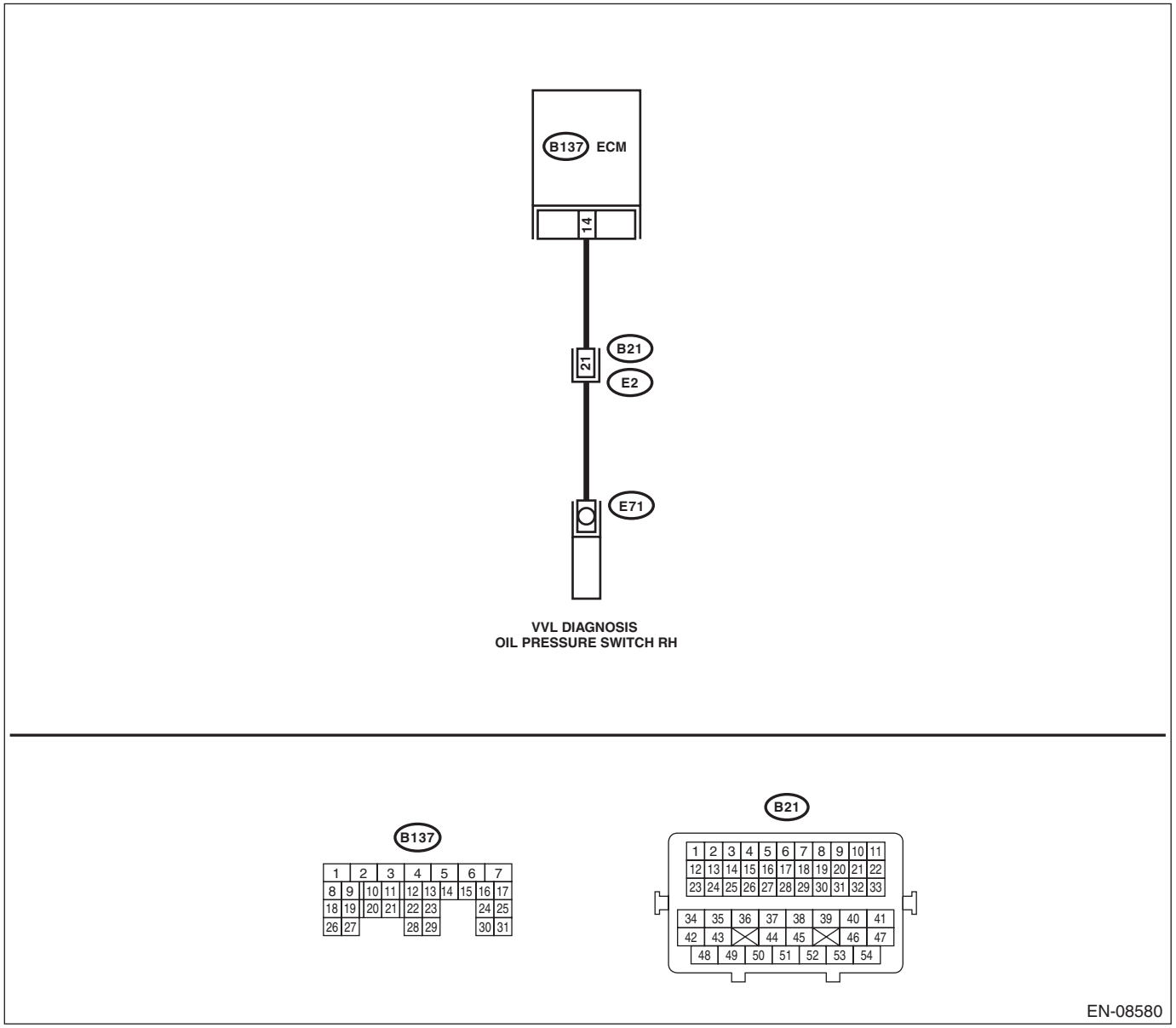
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.**<br>1) Warm up the engine.<br>2) Turn the ignition switch to OFF.<br>3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure RH switch.<br>4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch RH connector.<br>***Connector & terminal***<br>***(B137) No. 14 — (E71) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.**<br>Measure the resistance between the variable valve lift diagnosis oil pressure switch RH connector and engine ground.<br>***Connector & terminal***<br>***(E71) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector. |
| 3 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between the variable valve lift diagnosis oil pressure switch RH connector and engine ground.<br>***Connector & terminal***<br>***(E71) No. 1 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power supply in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector. | Go to step **4**. |
| 4 | **CHECK DTC.**<br>1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.><br>2) After idling the engine, check the DTC. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).> | Is DTC displayed? | Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> After replacement, go to the next step. Go to step **5**. | End. |
| 5 | **CHECK DTC.**<br>1) Perform the Clear Memory Mode.<br>2) After idling the engine, check the DTC.<br>NOTE:<br>For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.> | Is DTC displayed? | Check for oil routing. | End. |

## B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-11, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

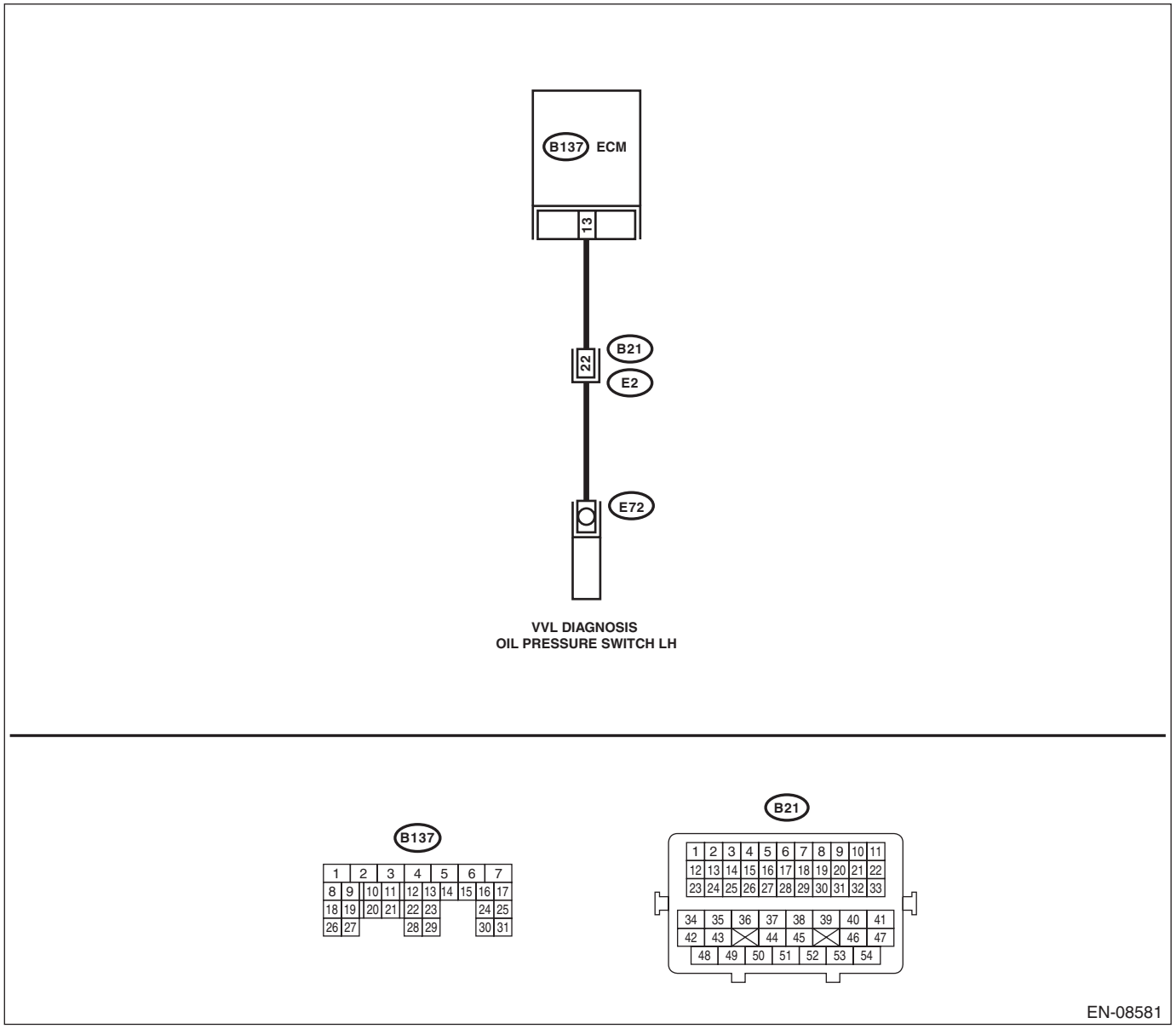
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.**<br>1) Warm up the engine.<br>2) Turn the ignition switch to OFF.<br>3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch LH.<br>4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch LH connector.<br>***Connector & terminal***<br>***(B137) No. 13 — (E72) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.**<br>Measure the resistance between the variable valve lift diagnosis oil pressure switch LH connector and engine ground.<br>***Connector & terminal***<br>***(E72) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector. |
| 3 | **CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between the variable valve lift diagnosis oil pressure switch LH connector and engine ground.<br>***Connector & terminal***<br>***(E72) No. 1 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power supply in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector. | Go to step **4**. |
| 4 | **CHECK DTC.**<br>1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.><br>2) After idling the engine, check the DTC. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).> | Is DTC displayed? | Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> After replacement, go to the next step. Go to step **5**. | End. |
| 5 | **CHECK DTC.**<br>1) Perform the Clear Memory Mode.<br>2) After idling the engine, check the DTC.<br>NOTE:<br>For detailed procedures, refer to "Clear Memory Mode". <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.> | Is DTC displayed? | Check for oil routing. | End. |

## C: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

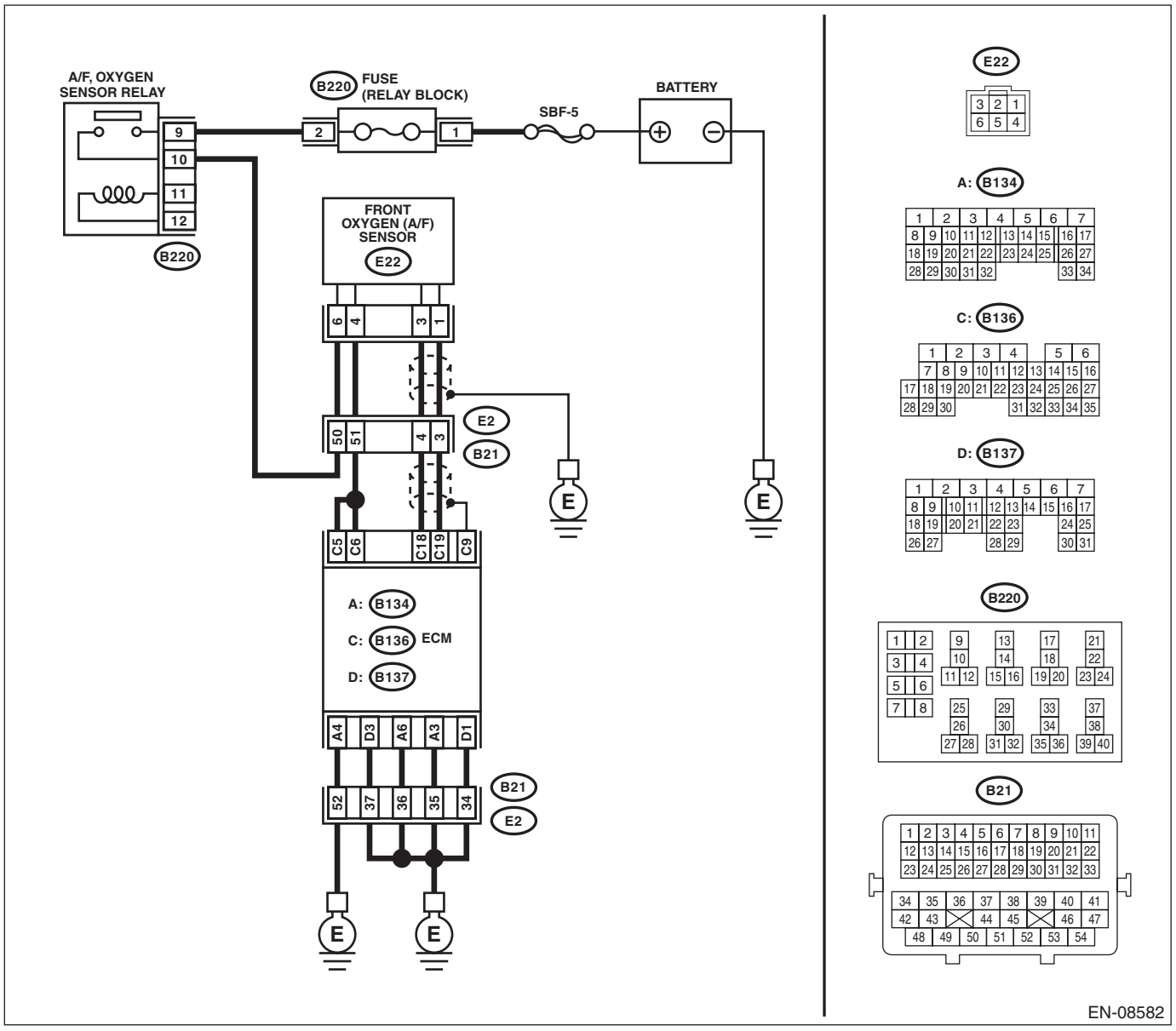
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-12, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Start and warm up the engine.<br>2) Turn the ignition switch to OFF.<br>3) Disconnect the connectors from ECM and front oxygen (A/F) sensor.<br>4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 5 — (E22) No. 4:***<br>***(B136) No. 6 — (E22) No. 4:***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 2 | **CHECK FRONT OXYGEN (A/F) SENSOR.**<br>Measure the resistance between front oxygen (A/F) sensor terminals.<br>***Terminals***<br>***No. 6 — No. 4:*** | Is the resistance 2 — 3 Ω? | Go to step **3**. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |
| 3 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and front oxygen (A/F) sensor connector. | Is there poor contact of ECM or front oxygen (A/F) sensor connector? | Repair the poor contact of ECM or front oxygen (A/F) sensor connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

# D: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

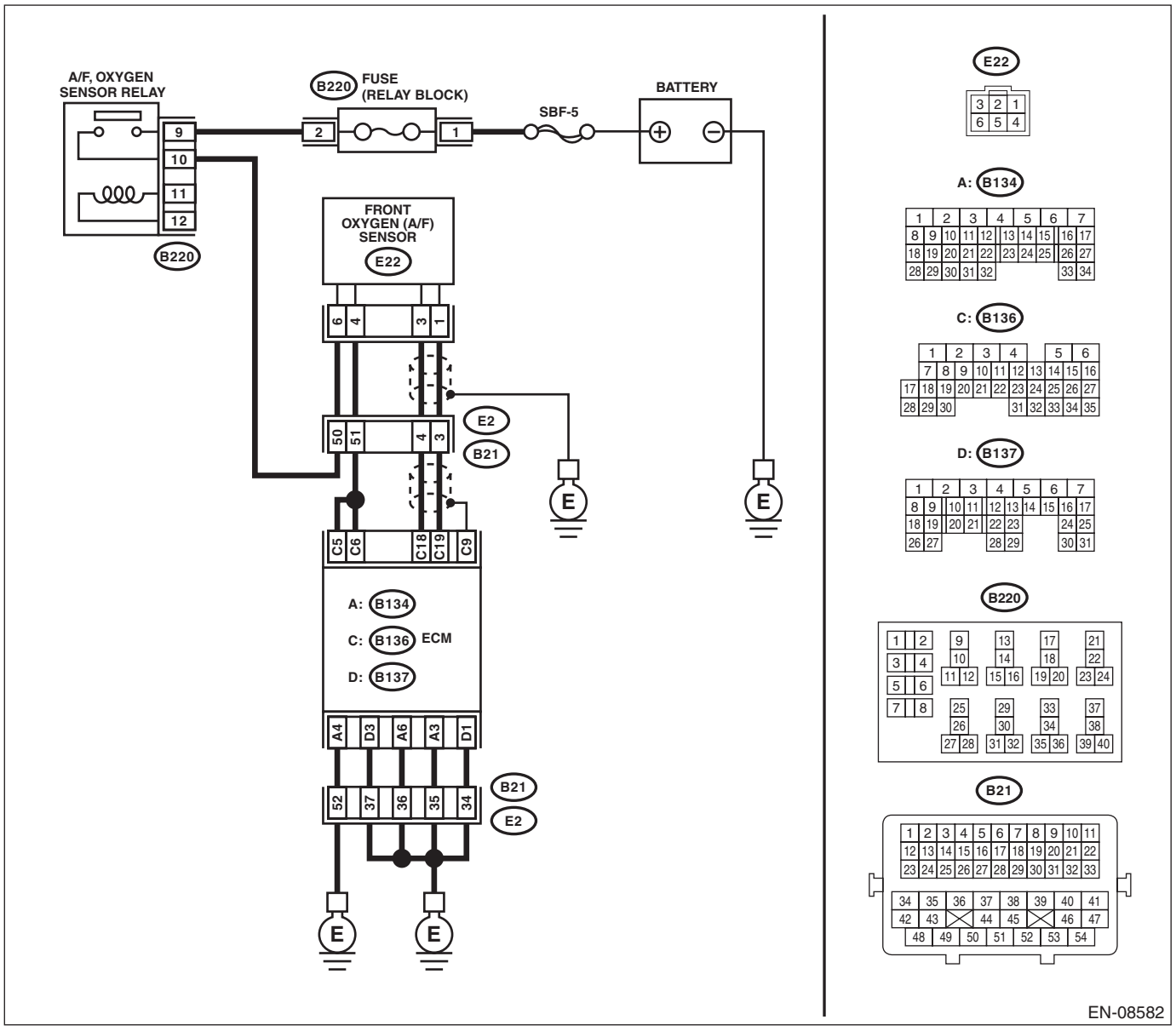
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-14, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from front oxygen (A/F) sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground.<br>***Connector & terminal***<br>***(E22) No. 6 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Repair the power supply line.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between A/F, oxygen sensor relay connector and front oxygen (A/F) sensor connector<br>• Poor contact of A/F, oxygen sensor relay connector<br>• Poor contact of coupling connector<br>• Malfunction of A/F, oxygen sensor relay |
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 5 — (E22) No. 4:***<br>***(B136) No. 6 — (E22) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 3 | **CHECK GROUND CIRCUIT FOR ECM.**<br>Measure the resistance of harness between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |
| 4 | **CHECK FRONT OXYGEN (A/F) SENSOR.**<br>Measure the resistance between front oxygen (A/F) sensor terminals.<br>***Terminals***<br>***No. 6 — No. 4:*** | Is the resistance 2 — 3 Ω? | Repair the poor contact of ECM connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

# E: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

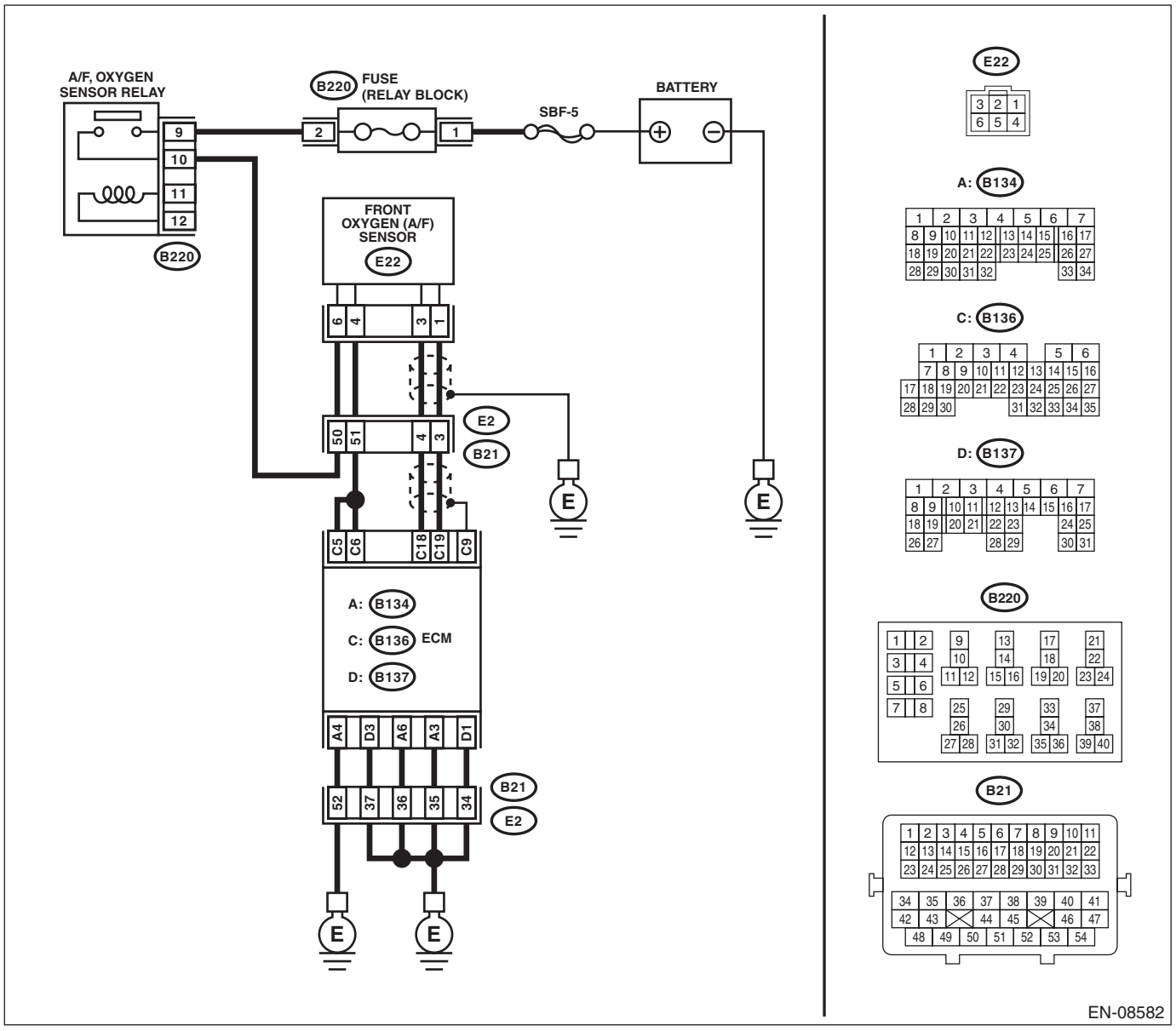
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-16, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 5 (+) — Chassis ground (–):***<br>***(B136) No. 6 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. | Go to step **2**. |
| 2 | **CHECK GROUND CIRCUIT FOR ECM.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Repair the poor contact of ECM connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |

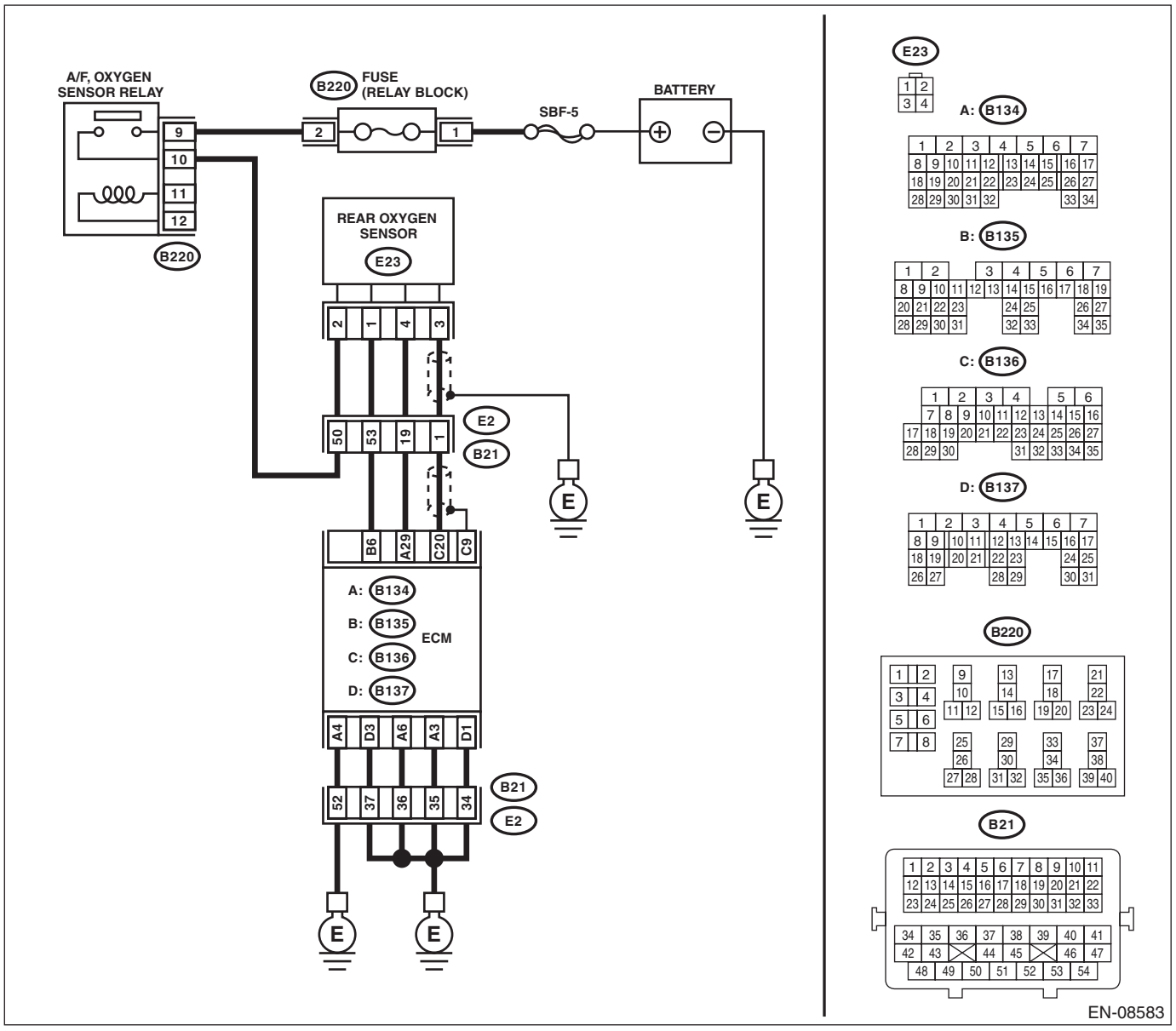
# F: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-18, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from rear oxygen sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between rear oxygen sensor connector and engine ground.<br>***Connector & terminal***<br>***(E23) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Repair the power supply line. Or replace the main relay.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between A/F, oxygen sensor relay connector and rear oxygen sensor connector<br>• Poor contact of A/F, oxygen sensor relay connector<br>• Poor contact of coupling connector<br>• Malfunction of A/F, oxygen sensor relay |
| 2 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM and oxygen sensor connector.<br>***Connector & terminal***<br>***(B135) No. 6 — (E23) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 3 | **CHECK GROUND CIRCUIT FOR ECM.**<br>Measure the resistance of harness between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |
| 4 | **CHECK REAR OXYGEN SENSOR.**<br>Measure the resistance between rear oxygen sensor terminals.<br>***Terminals***<br>***No. 2 — No. 1:*** | Is the resistance 5 — 7 Ω? | Repair the poor contact of ECM connector. | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> |

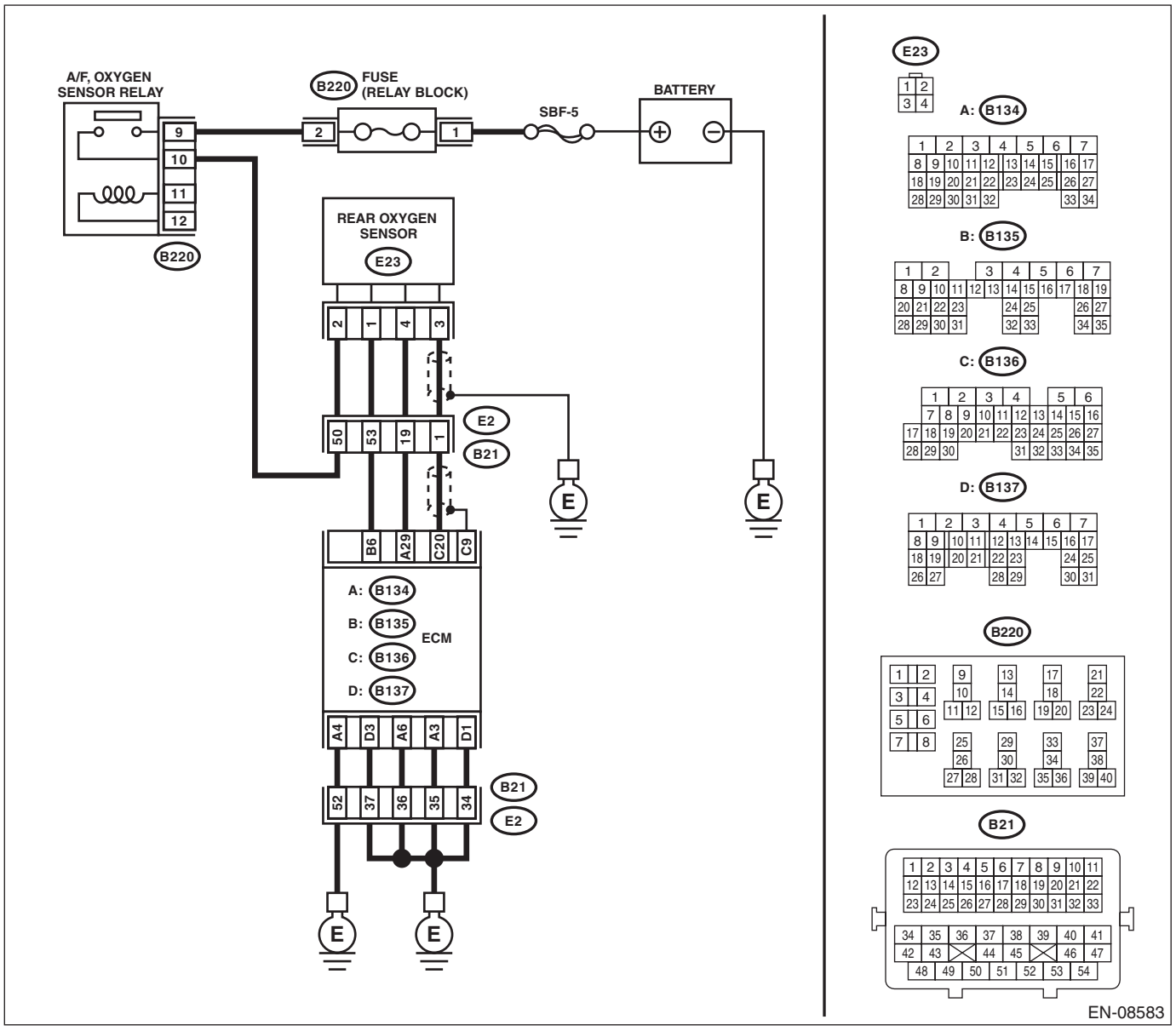
## G: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-20, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 6 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector. | Go to step **2**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK GROUND CIRCUIT FOR ECM.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Repair the poor contact of ECM connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |

## H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-22, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **2**. |
| 2 | **CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the "General Scan Tool Instruction Manual". | Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) during idling? | Go to step **3**. | Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.> |
| 3 | **CHECK THROTTLE OPENING ANGLE.**<br>Read the data of throttle position signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the "General Scan Tool Instruction Manual". | Is the measured value less than 5% when throttle is fully closed? | Go to step **4**. | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |
| 4 | **CHECK THROTTLE OPENING ANGLE.** | Is the measured value 85% or more when throttle is fully open? | Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.> | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |

# I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-24, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

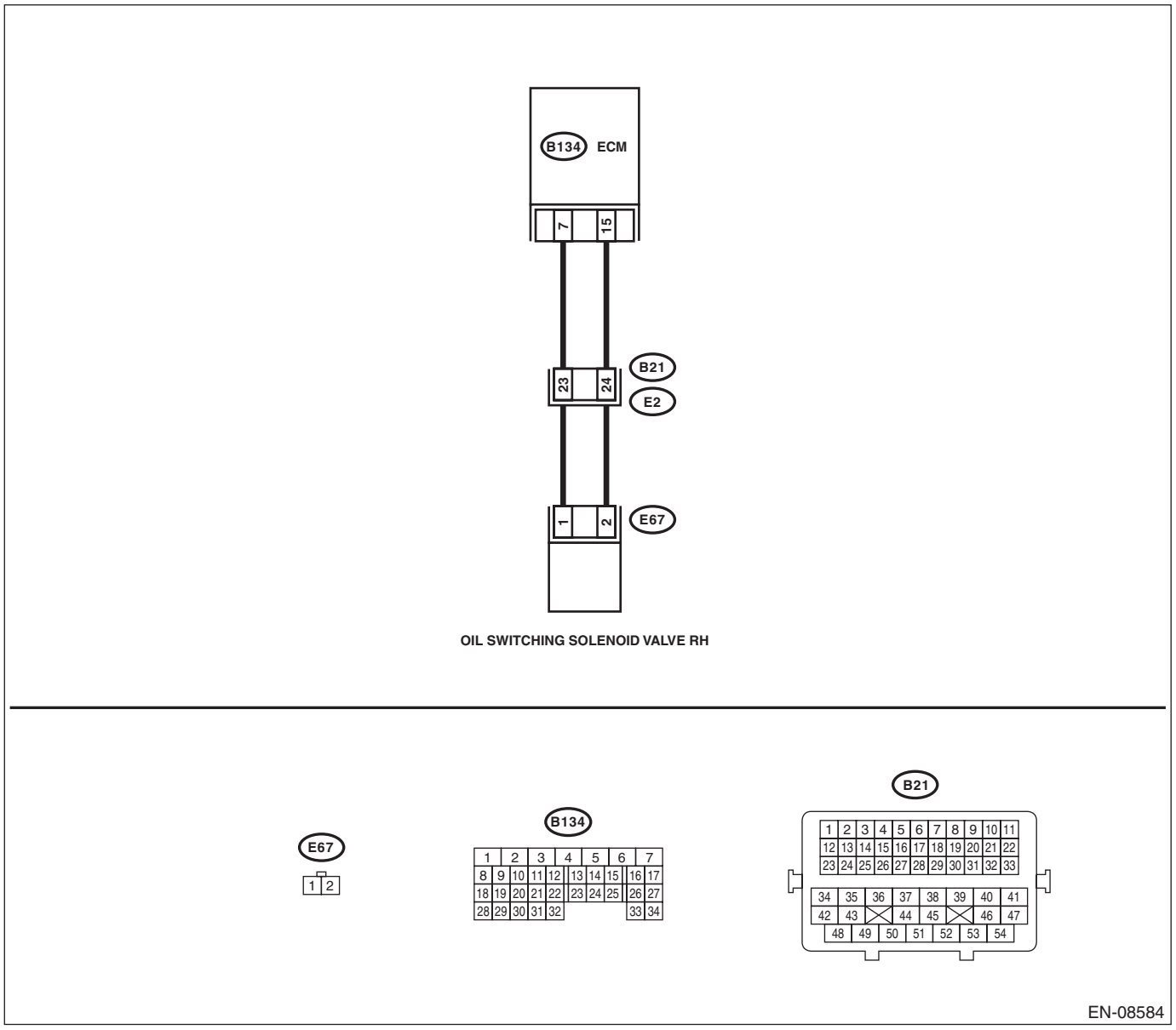
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and oil switching solenoid valve RH.<br>3) Measure the resistance of harness between ECM and oil switching solenoid valve RH connector.<br>***Connector & terminal***<br>***(B134) No. 7 — (E67) No. 1:***<br>***(B134) No. 15 — (E67) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and oil switching solenoid valve RH connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 7 — Chassis ground:***<br>***(B134) No. 15 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the short circuit to ground in harness between ECM and oil switching solenoid valve RH connector. |
| 3 | **CHECK OIL SWITCHING SOLENOID VALVE RH.**<br>Measure the resistance between oil switching solenoid valve RH terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 6 — 12 Ω? | Repair the poor contact of ECM and oil switching solenoid valve RH connector. | Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> |

## J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-25, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

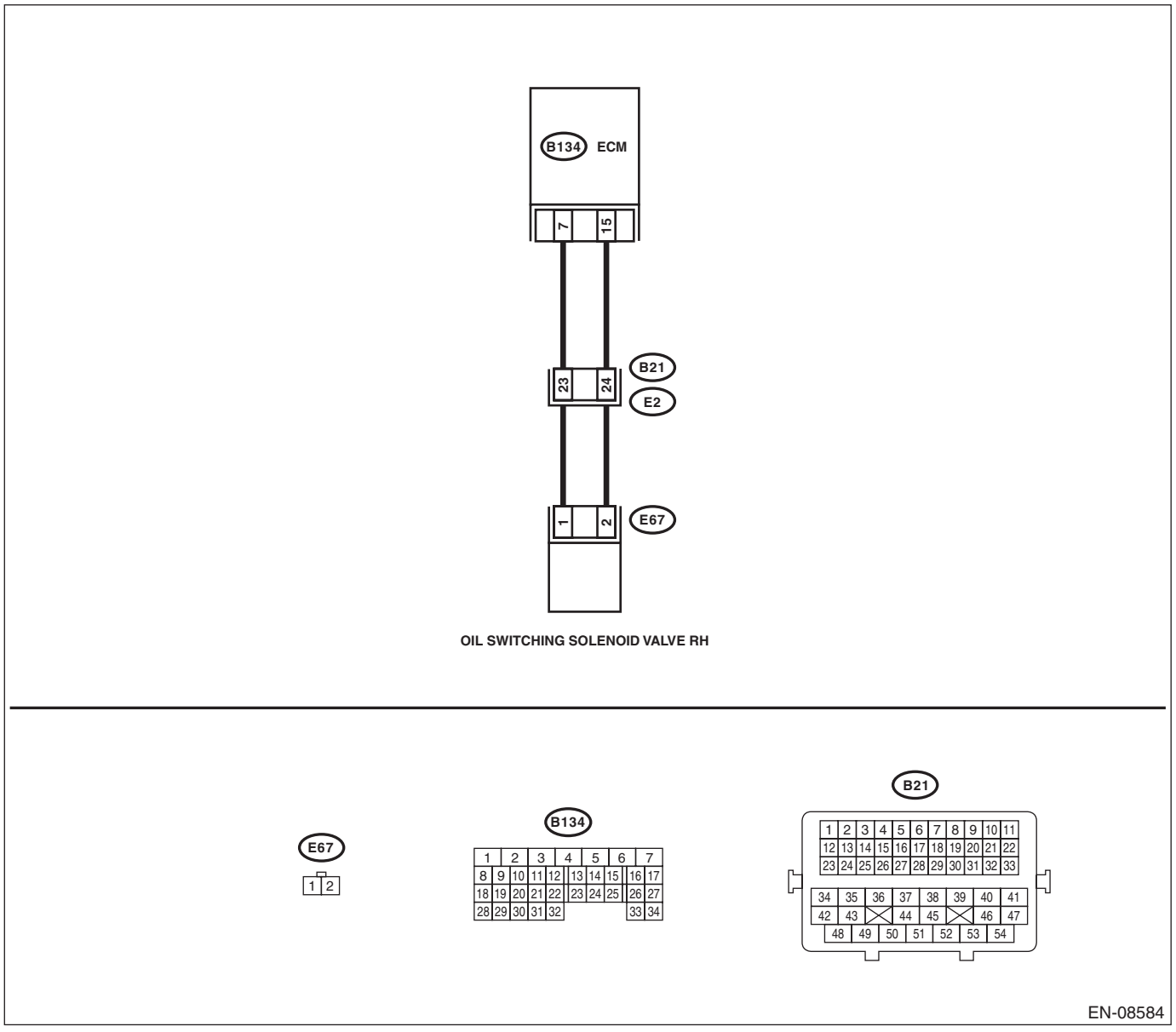
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and oil switching solenoid valve RH.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 7 (+) — Chassis ground (–):***<br>***(B134) No. 15 (+) — Chassis ground (–):*** | Is the voltage less than 1 V? | Go to step **2**. | Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector. |
| 2 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.**<br>Measure the resistance of harness between ECM and oil switching solenoid valve RH connector.<br>***Connector & terminal***<br>***(B134) No. 7 — (E67) No. 1:***<br>***(B134) No. 15 — (E67) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and oil switching solenoid valve RH connector<br>• Poor contact of coupling connector |
| 3 | **CHECK OIL SWITCHING SOLENOID VALVE RH.**<br>Measure the resistance between oil switching solenoid valve RH terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 6 — 12 Ω? | Repair the poor contact of ECM and oil switching solenoid valve RH connector. | Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> |

## K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-25, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

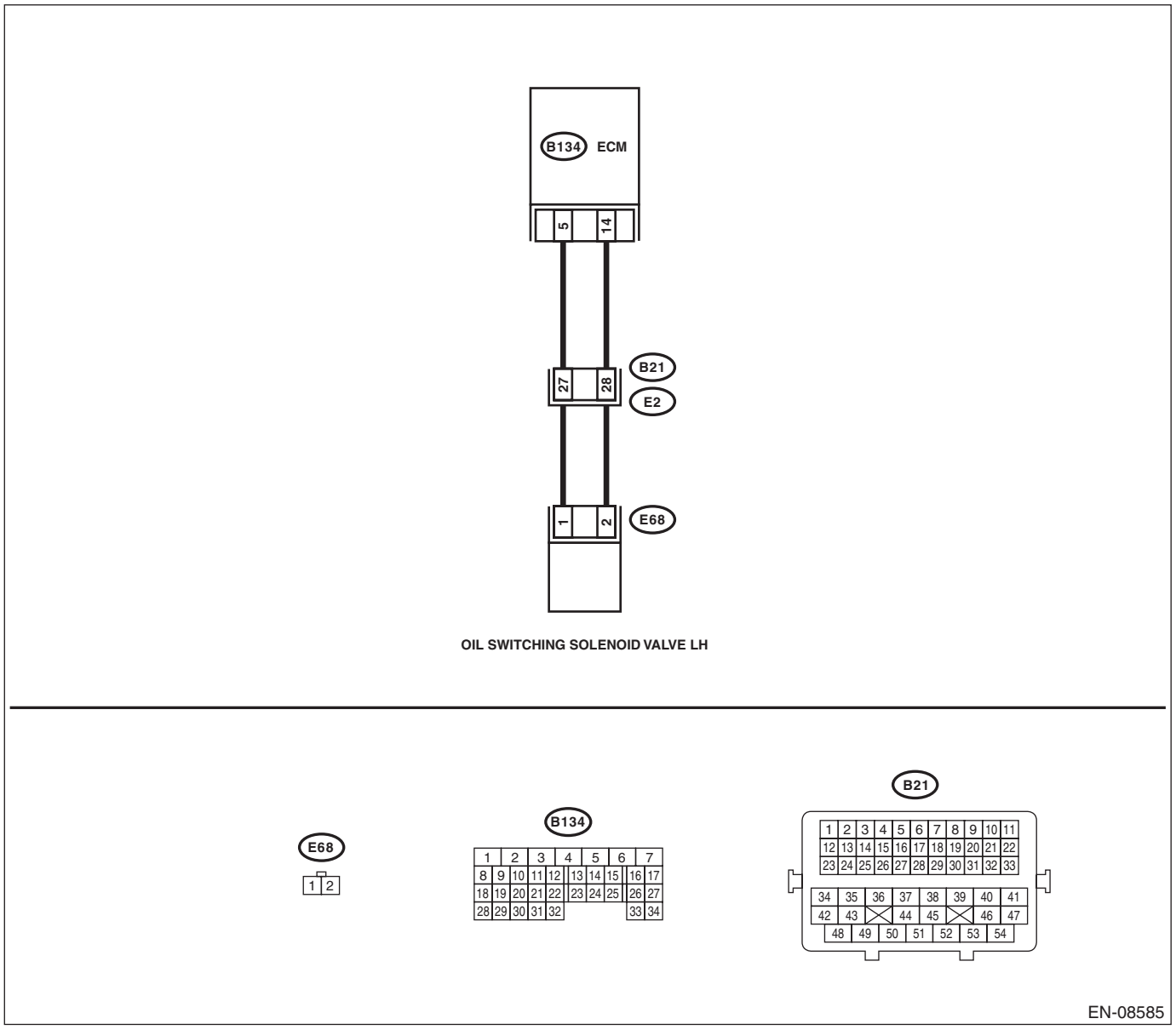
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and oil switching solenoid valve LH.<br>3) Measure the resistance between ECM and oil switching solenoid valve LH connector.<br>***Connector & terminal***<br>***(B134) No. 5 — (E68) No. 1:***<br>***(B134) No. 14 — (E68) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and oil switching solenoid valve LH connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 5 — Chassis ground:***<br>***(B134) No. 14 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the short circuit to ground in harness between ECM and oil switching solenoid valve LH connector. |
| 3 | **CHECK OIL SWITCHING SOLENOID VALVE LH.**<br>Measure the resistance between oil switching solenoid valve LH terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 6 — 12 Ω? | Repair the poor contact of ECM and oil switching solenoid valve LH connector. | Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> |

## L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-25, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

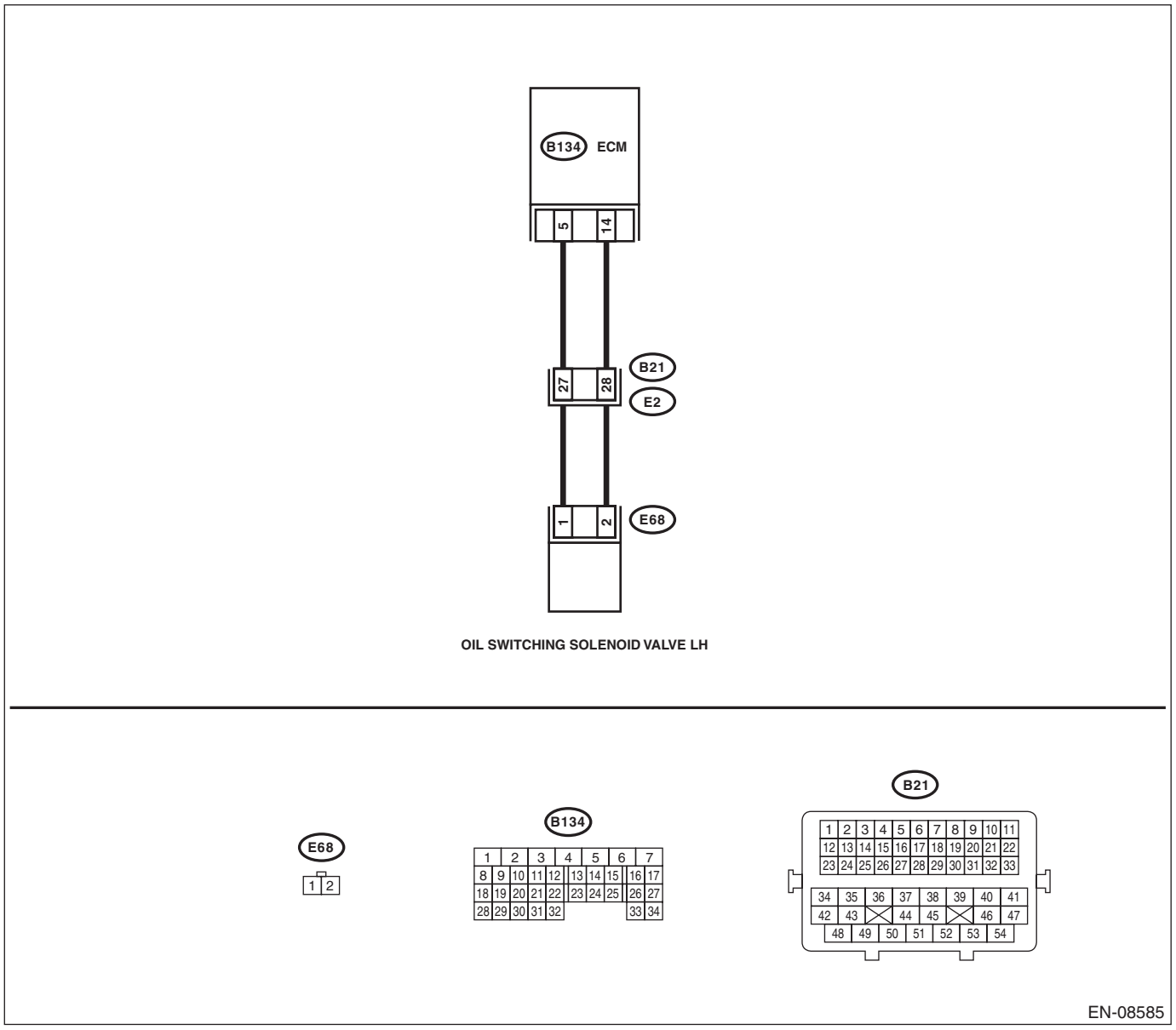
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and oil switching solenoid valve LH.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 5 (+) — Chassis ground (–):***<br>***(B134) No. 14 (+) — Chassis ground (–):*** | Is the voltage less than 1 V? | Go to step **2**. | Repair the short circuit to power supply in harness between ECM and oil switching solenoid valve LH connector. |
| 2 | **CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.**<br>Measure the resistance between ECM and oil switching solenoid valve LH connector.<br>***Connector & terminal***<br>***(B134) No. 5 — (E68) No. 1:***<br>***(B134) No. 14 — (E68) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and oil switching solenoid valve LH connector<br>• Poor contact of coupling connector |
| 3 | **CHECK OIL SWITCHING SOLENOID VALVE LH.**<br>Measure the resistance between oil switching solenoid valve LH terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 6 — 12 Ω? | Repair the poor contact of ECM and oil switching solenoid valve LH connector. | Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-95, Oil Switching Solenoid Valve.> |

## M: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-26, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

## N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

**DTC DETECTING CONDITION:**

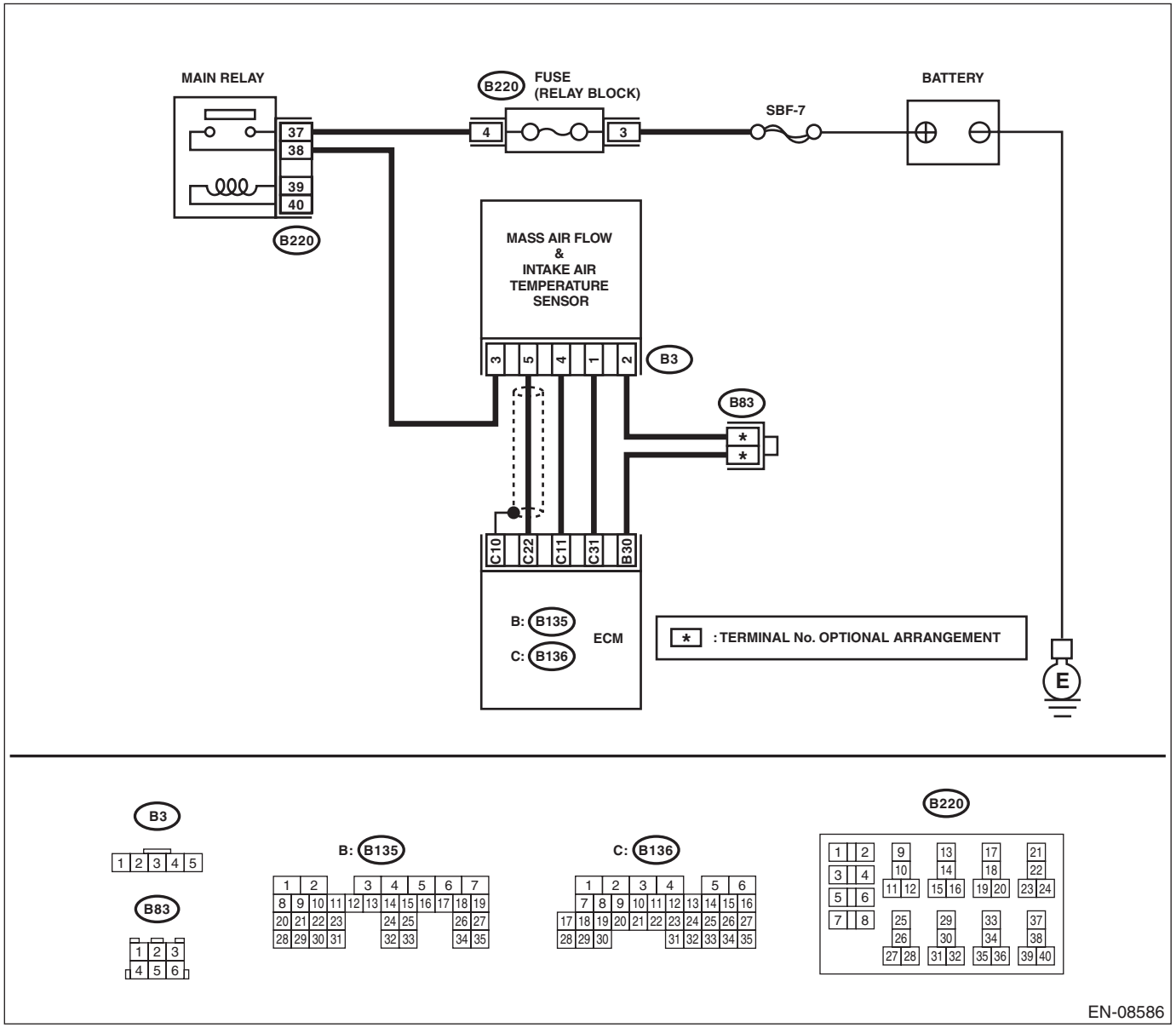
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-28, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of air flow sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage less than 0.2 V? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the mass air flow and intake air temperature sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground.<br>***Connector & terminal***<br>***(B3) No. 3 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between main relay and mass air flow and intake air temperature sensor connector<br>• Poor contact of main relay connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector.<br>***Connector & terminal***<br>***(B136) No. 22 — (B3) No. 5:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the open circuit in harness between ECM and the mass air flow and intake air temperature sensor connector. |
| 4 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 22 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the short circuit to ground in harness between ECM and mass air flow and intake air temperature sensor connector. |
| 5 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and mass air flow and intake air temperature sensor connector. | Is there poor contact of ECM or mass air flow and intake air temperature sensor connector? | Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

## O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

**DTC DETECTING CONDITION:**

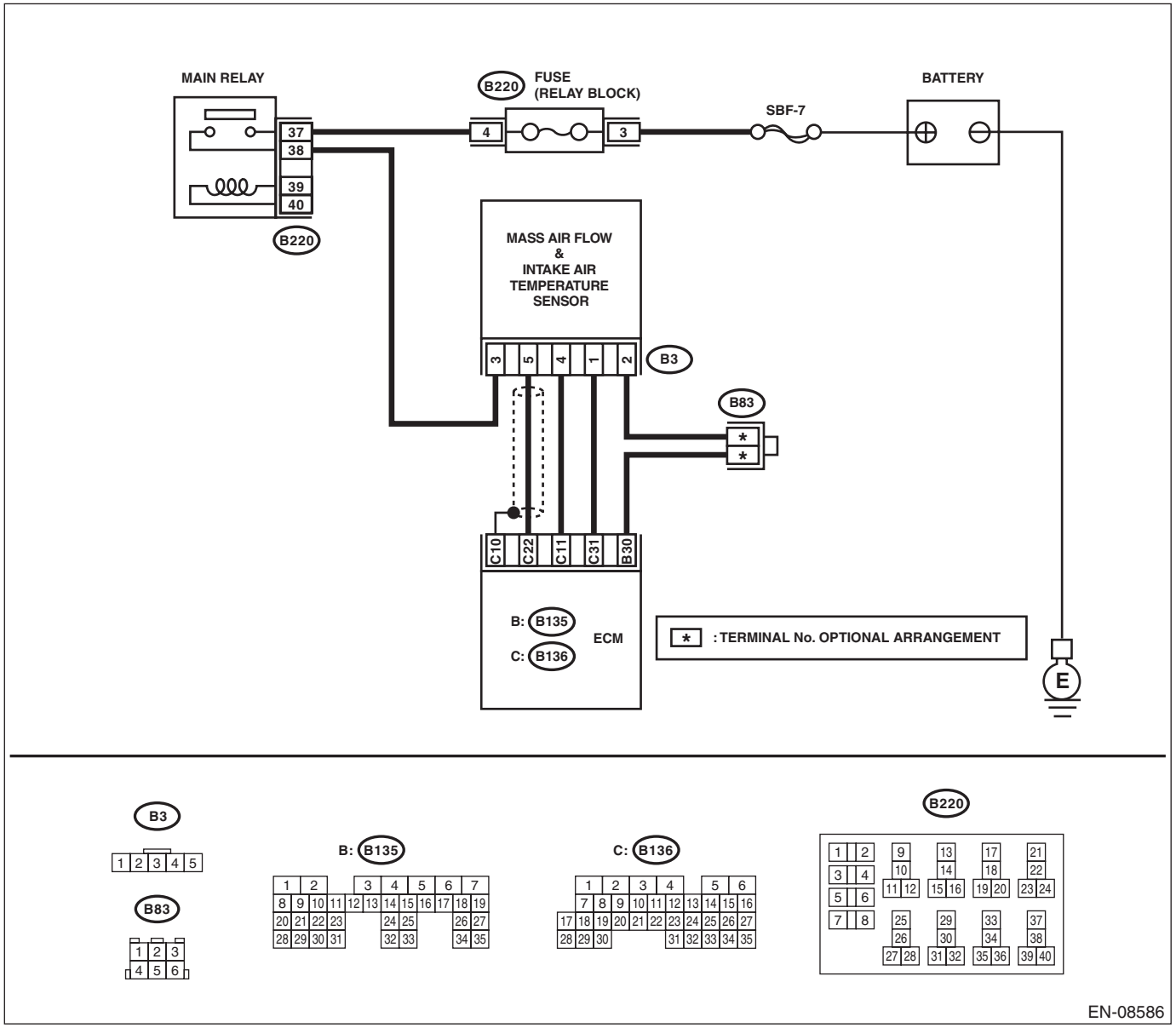
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-29, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of air flow sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 5 V or more? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the mass air flow and intake air temperature sensor.<br>3) Start the engine.<br>4) Read the data of air flow sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 5 V or more? | Repair the short circuit of harness to power supply between ECM and mass air flow and intake air temperature sensor connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between mass air flow and intake air temperature sensor connector and engine ground.<br>***Connector & terminal***<br>***(B3) No. 4 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and mass air flow and intake air temperature sensor connector<br>• Poor contact of ECM connector |
| 4 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of mass air flow and intake air temperature sensor connector. | Is there poor contact of mass air flow and intake air temperature sensor connector? | Repair the poor contact of mass air flow and intake air temperature sensor connector. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

# P: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

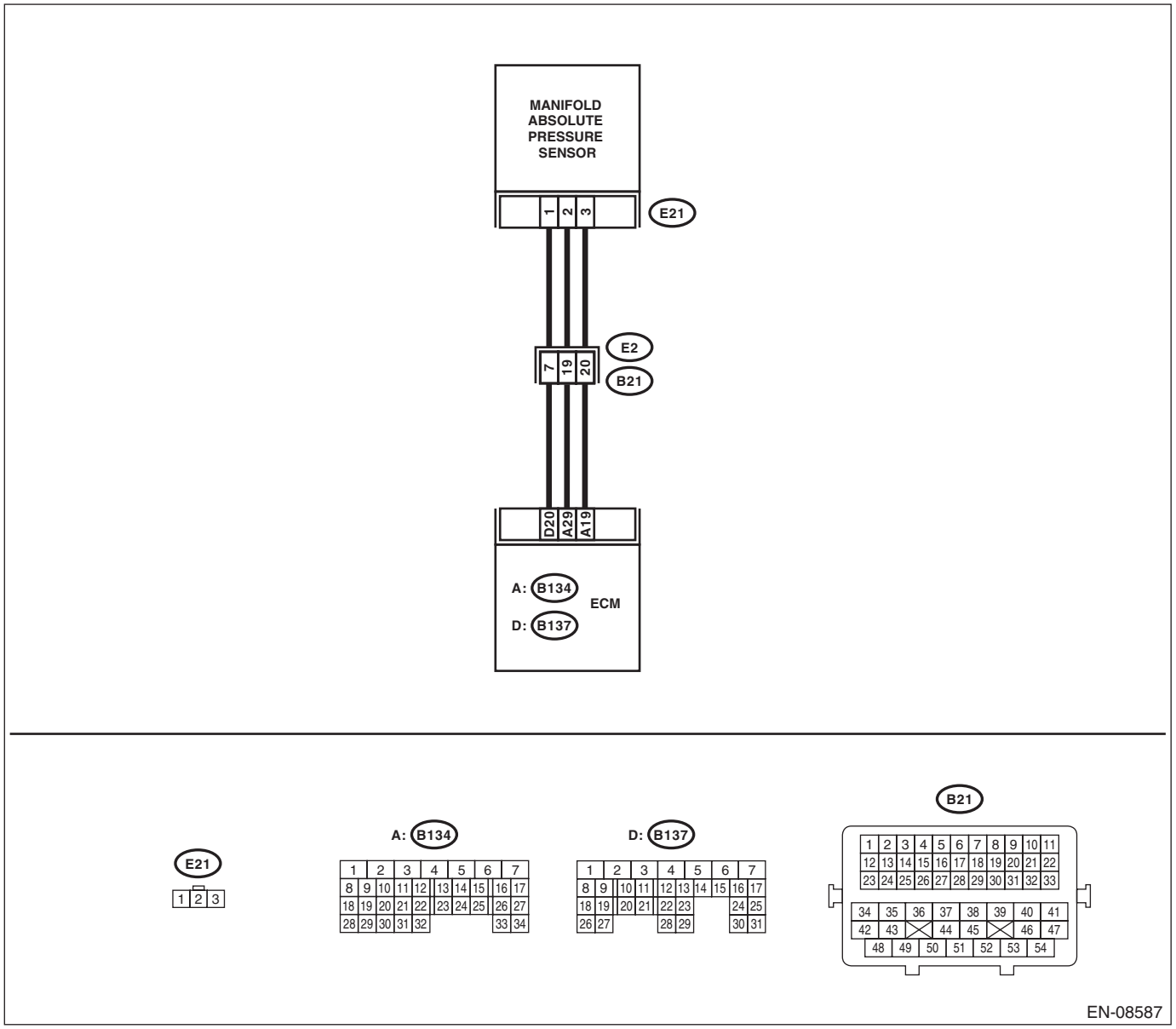
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-30, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK POWER SUPPLY OF MANIFOLD ABSOLUTE PRESSURE SENSOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from manifold absolute pressure sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between manifold absolute pressure sensor connector and engine ground.<br>***Connector & terminal***<br>***(E21) No. 3 (+) — Engine ground (–):*** | Is the voltage 4.5 V or more? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and manifold absolute pressure sensor connector.<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector.<br>***Connector & terminal***<br>***(B137) No. 20 — (E21) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and manifold absolute pressure sensor connector.<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 20 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair ground short circuit of harness between ECM and manifold absolute pressure sensor connector. |
| 5 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and manifold absolute pressure sensor connector. | Is there poor contact of ECM or manifold absolute pressure sensor connector? | Repair the poor contact of ECM or manifold absolute pressure sensor connector. | Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.> |

## Q: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

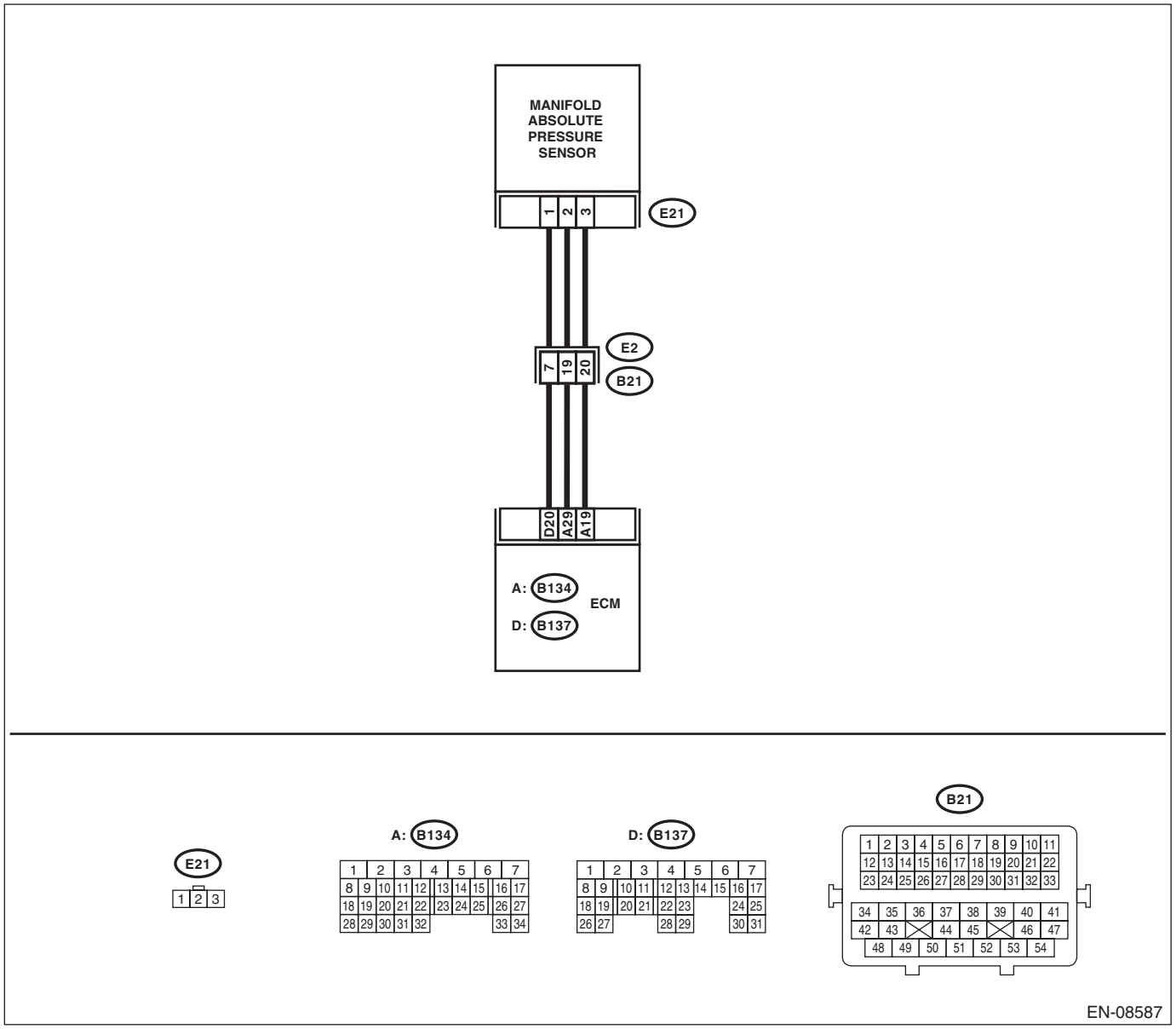
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-31, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from manifold absolute pressure sensor.<br>3) Start the engine.<br>4) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more? | Repair the short circuit to power in harness between ECM and manifold absolute pressure sensor connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground.<br>***Connector & terminal***<br>***(E21) No. 2 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and manifold absolute pressure sensor connector.<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 4 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of manifold absolute pressure sensor connector. | Is there poor contact of manifold absolute pressure sensor connector? | Repair the poor contact of manifold absolute pressure sensor connector. | Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.> |

## R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-32, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ENGINE COOLANT TEMPERATURE.**<br>1) Start the engine and warm up completely.<br>2) Measure the engine coolant temperature using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> | Check for DTC P0125. <Ref. to EN(H4SO)(diag)-138, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

# S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-35, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

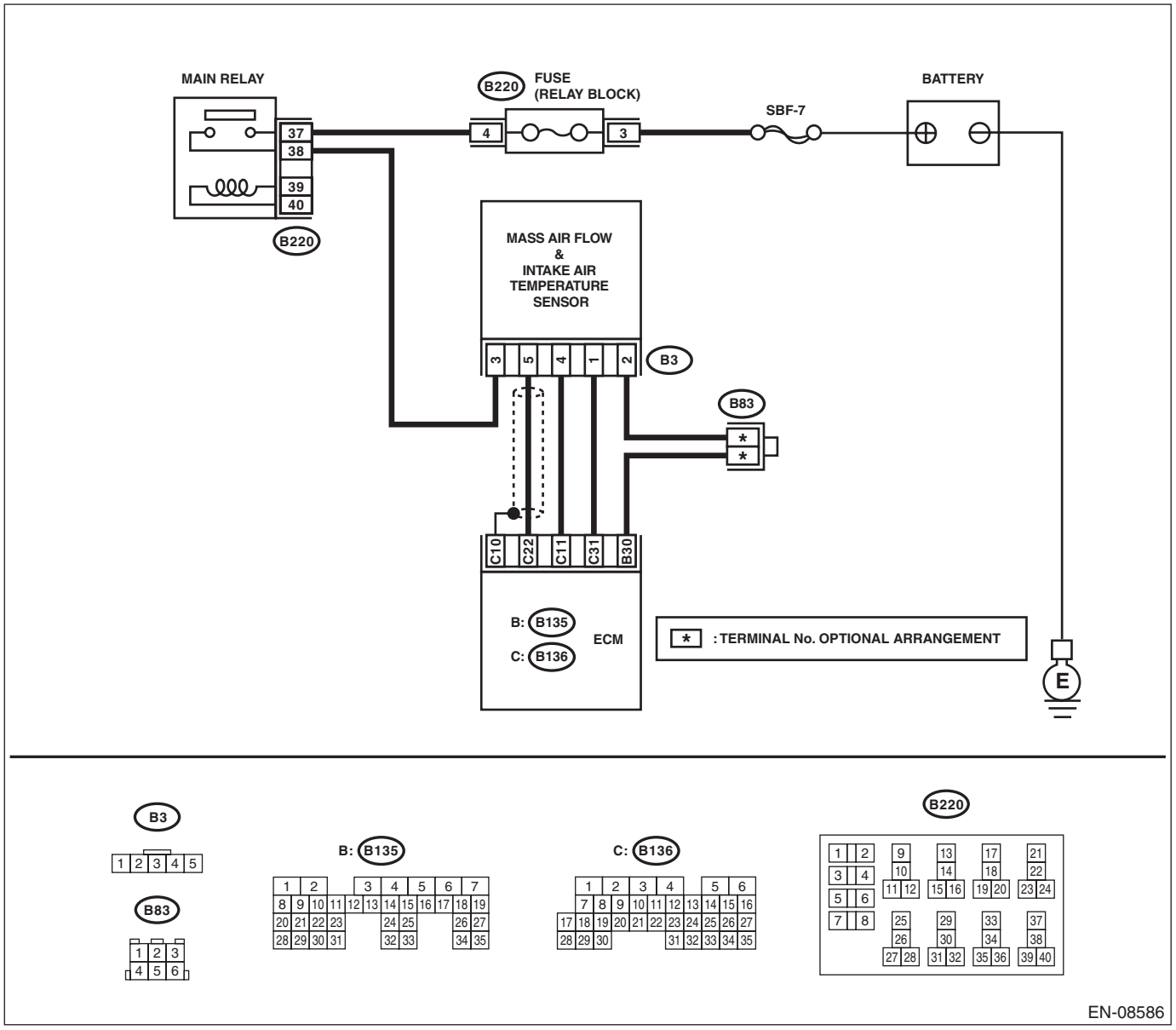
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the intake air temperature 120°C (248°F) or more? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 31 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> | Repair the short circuit to ground in harness between ECM and mass air flow and intake air temperature sensor connector. |

# T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

**DTC DETECTING CONDITION:**

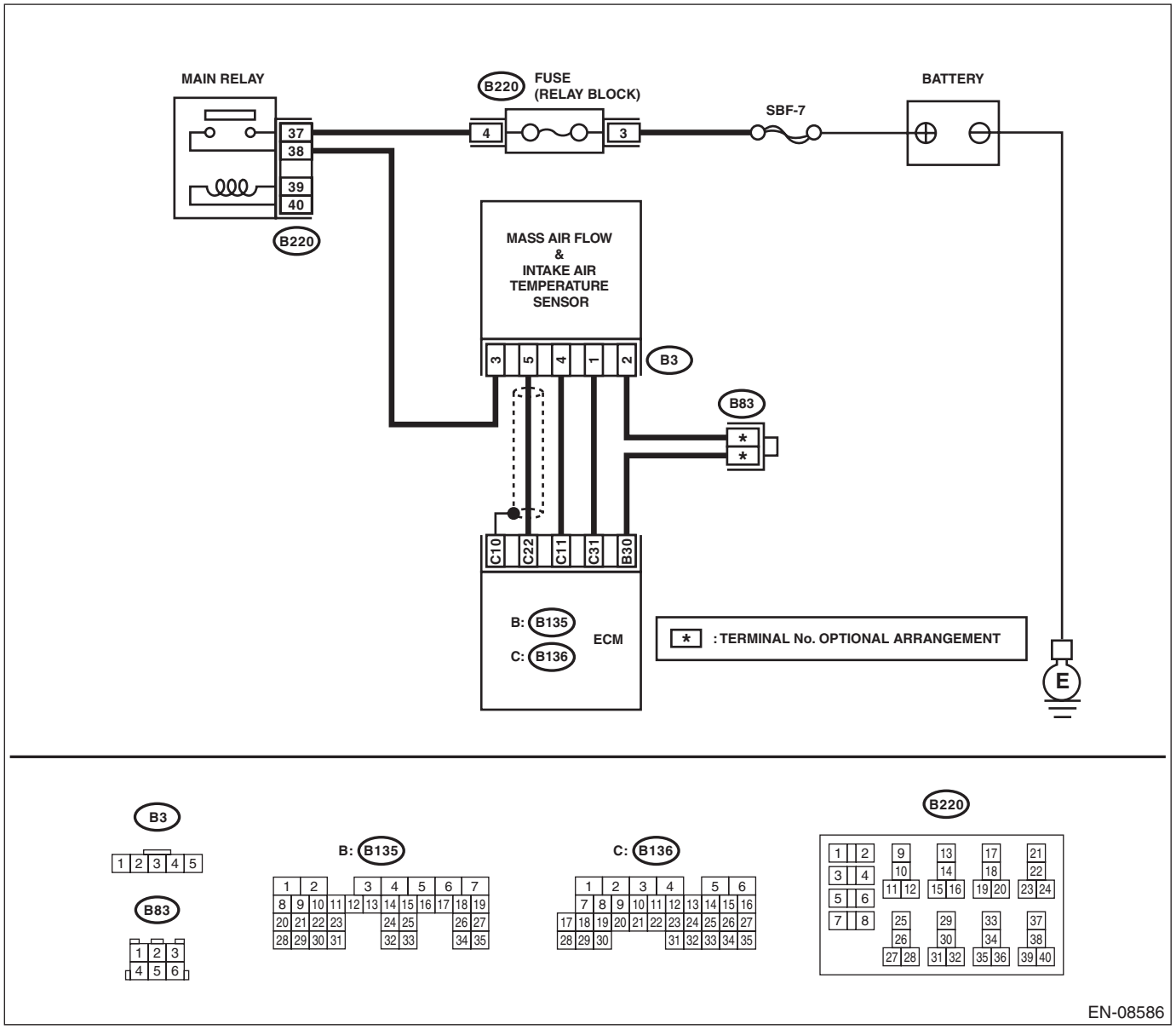
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-36, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**

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| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the intake air temperature less than –40°C (–40°F)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and mass air flow and intake air temperature sensor connector. | Is there poor contact of ECM or mass air flow and intake air temperature sensor connector? | Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor.<br>3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector.<br>***Connector & terminal***<br>***(B136) No. 31 — (B3) No. 1:***<br>***(B135) No. 30 — (B3) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and mass air flow and intake air temperature sensor connector<br>• Poor contact of joint connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 31 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit of harness to power supply between ECM and mass air flow and intake air temperature sensor connector. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

# U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

**DTC DETECTING CONDITION:**

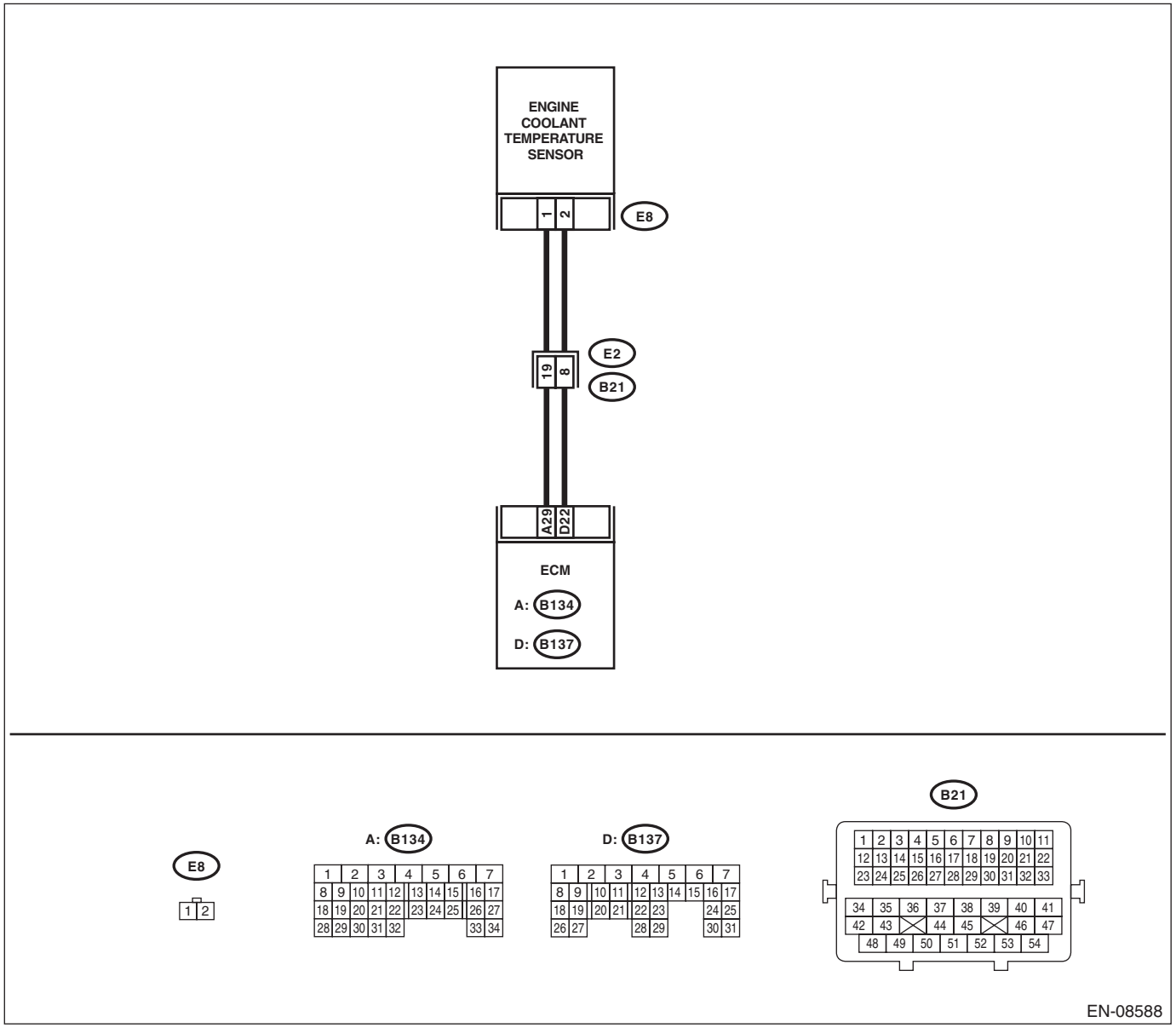
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-37, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 150°C (302°F) or higher? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and engine coolant temperature sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 22 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> | Repair short circuit in harness to ground between ECM and engine coolant temperature sensor connector. |

## V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

**DTC DETECTING CONDITION:**

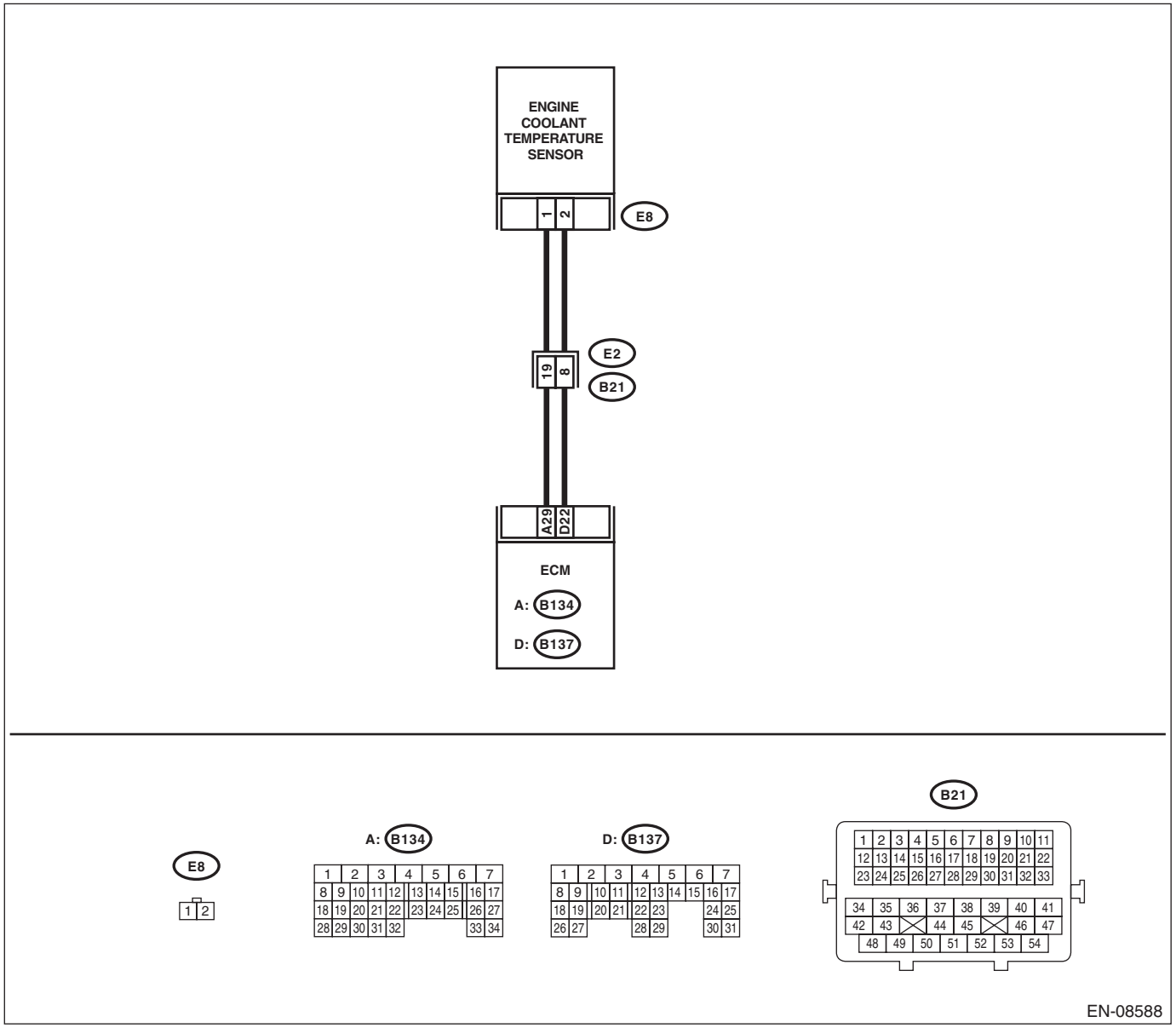
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-38, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature less than –40°C (–40°F)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and engine coolant temperature sensor connector. | Is there poor contact of ECM or engine coolant temperature sensor connector? | Repair the poor contact of ECM or engine coolant temperature sensor connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and engine coolant temperature sensor.<br>3) Measure the resistance of harness between ECM and engine coolant temperature sensor connector.<br>***Connector & terminal***<br>***(B137) No. 22 — (E8) No. 2:***<br>***(B134) No. 29 — (E8) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and engine coolant temperature sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 22 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and engine coolant temperature sensor connector. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |

## W: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-39, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

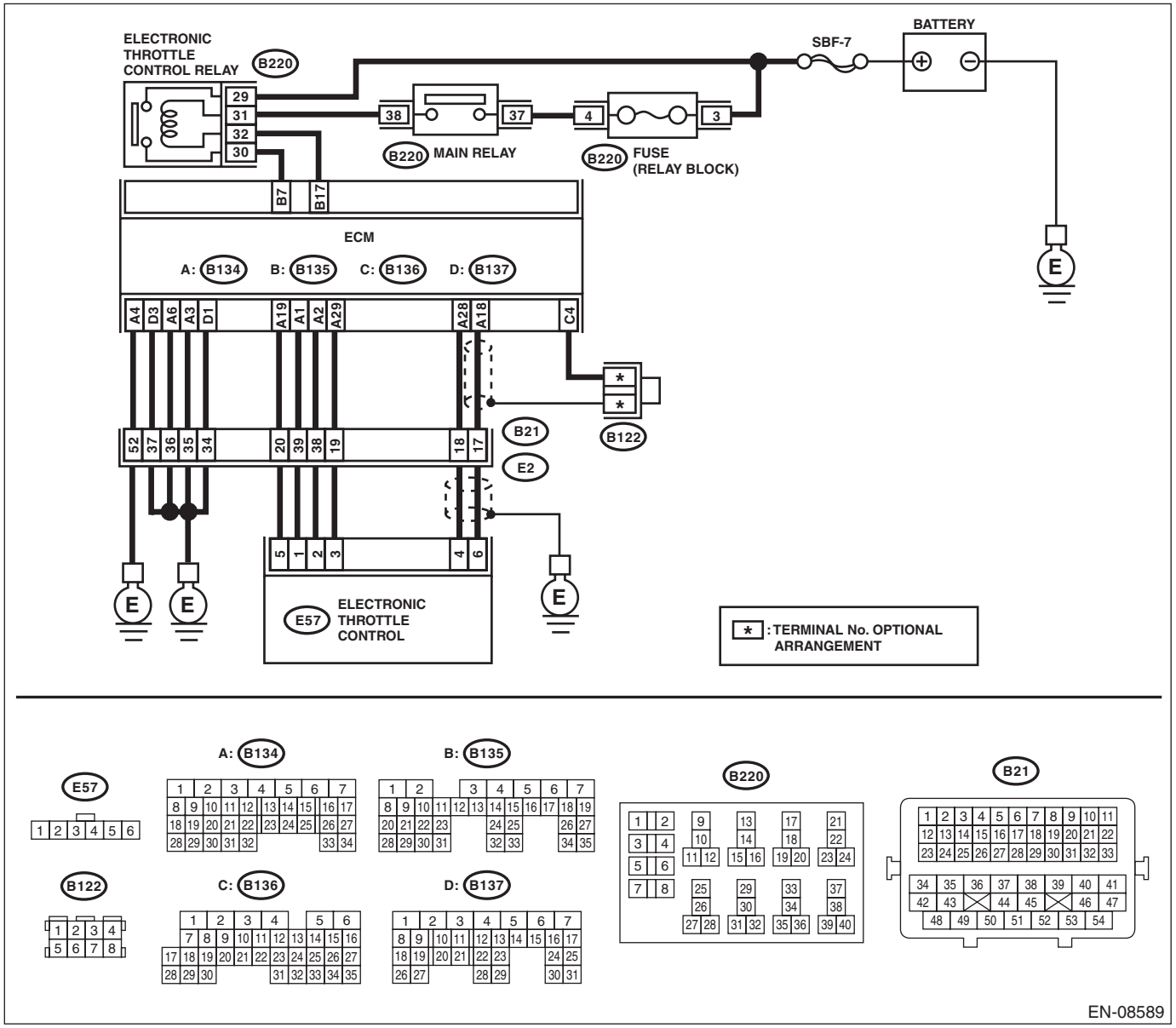
**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 19 — Chassis ground:***<br>***(B134) No. 18 — Chassis ground:***<br>***(B134) No. 18 — (B136) No. 4:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 2 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 — Engine ground:*** | Is the resistance 1 MΩ or more? | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

# X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-40, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

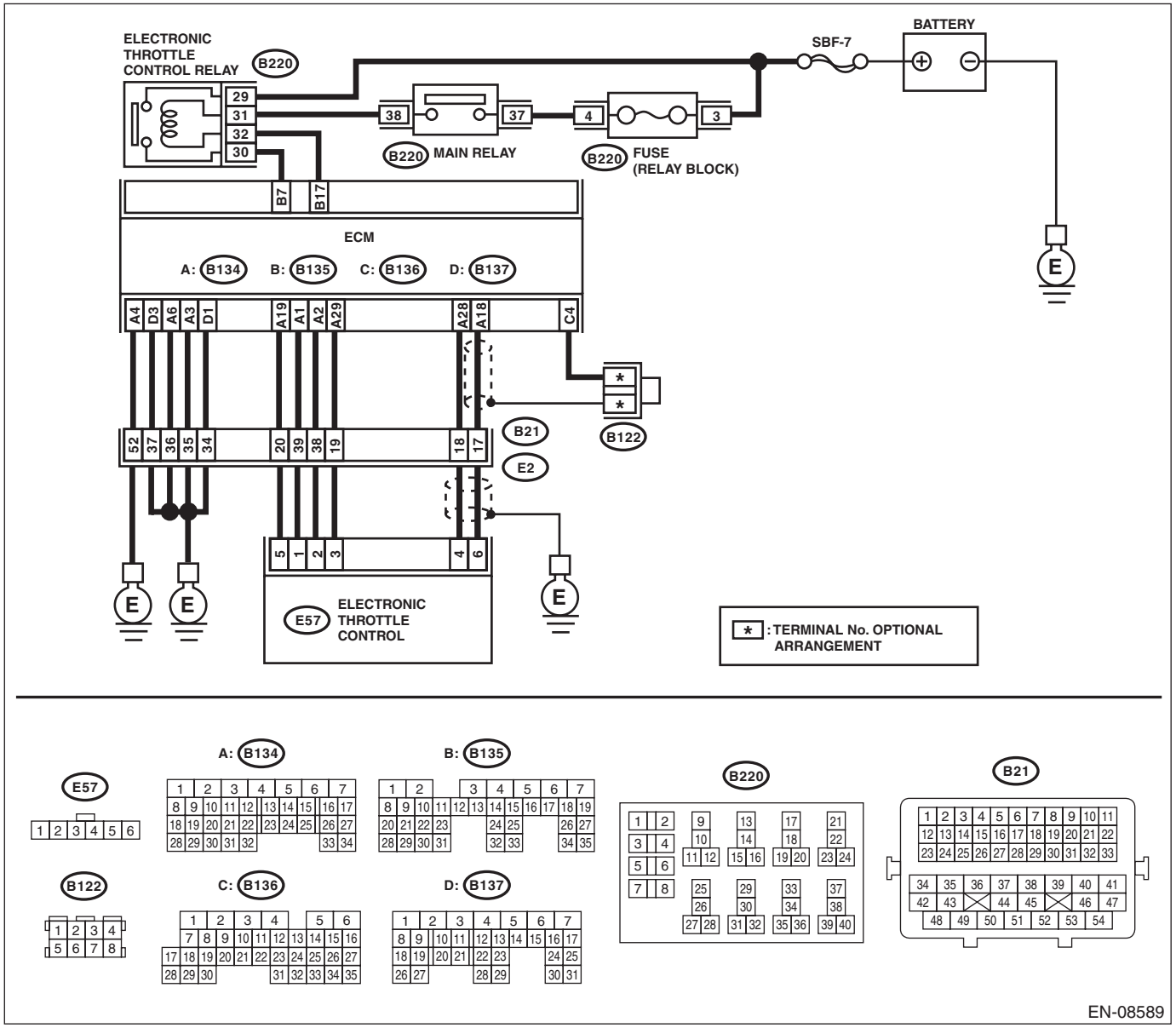
**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**

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| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 18 — (E57) No. 6:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B134) No. 19 — (B134) No. 18:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.> | Repair the short circuit to power in harness between ECM and electronic throttle control connector. |

## Y: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-41, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

Engine does not return to idle.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK TIRE SIZE.** | Is the tire size as specified and the same size as three other wheels? | Go to step **2**. | Replace the tire. |
| 2 | **CHECK ENGINE COOLANT.**<br>Check the following items:<br>• Amount of engine coolant<br>• Engine coolant freeze<br>• Contamination of engine coolant | Is the engine coolant normal? | Go to step **3**. | Fill or replace the engine coolant. <Ref. to CO(H4SO)-13, REPLACEMENT, Engine Coolant.> |
| 3 | **CHECK THERMOSTAT.** | Does the thermostat remain opened? | Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.> | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |

## Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-43, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Disconnect the connectors from the engine coolant temperature sensor.<br>2) Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed up.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed up? | Repair the poor contact of ECM connector. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |

## AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-45, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

Thermostat remains open.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ENGINE COOLANT.** | Is the amount of engine coolant normal? | Go to step **2**. | Supply engine coolant. <Ref. to CO(H4SO)-13, Engine Coolant.> |
| 2 | **CHECK RADIATOR FAN.**<br>1) Start the engine.<br>2) Check the radiator fan operation. | Does the radiator fan continuously rotate for 3 minutes or more during idling? | Repair radiator fan circuit. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.> | Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.> |

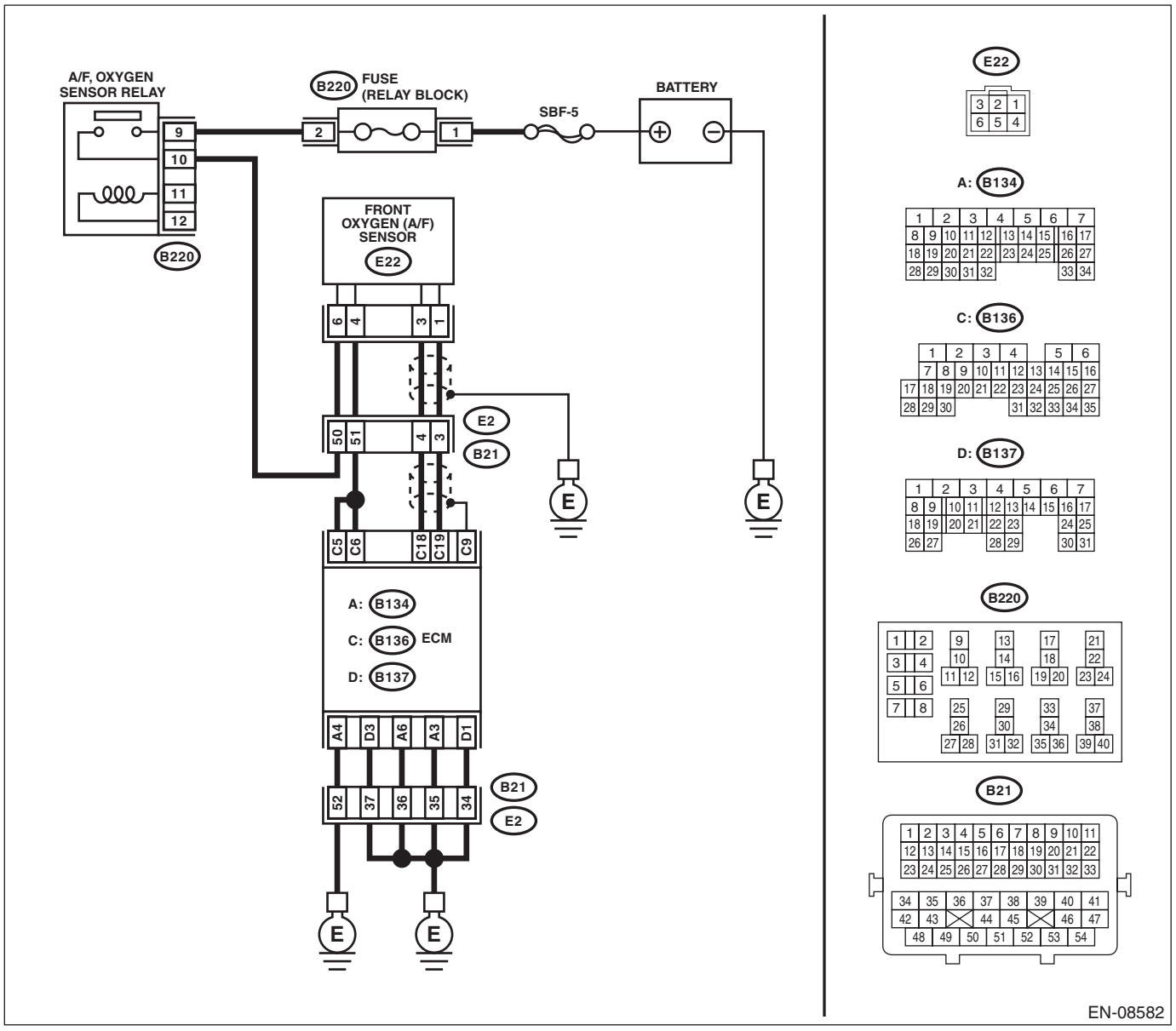
## AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-47, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 18 — Chassis ground:***<br>***(B136) No. 19 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector. |
| 3 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of the front oxygen (A/F) sensor connector. | Is there poor contact of front oxygen (A/F) sensor connector? | Repair the poor contact of front oxygen (A/F) sensor connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

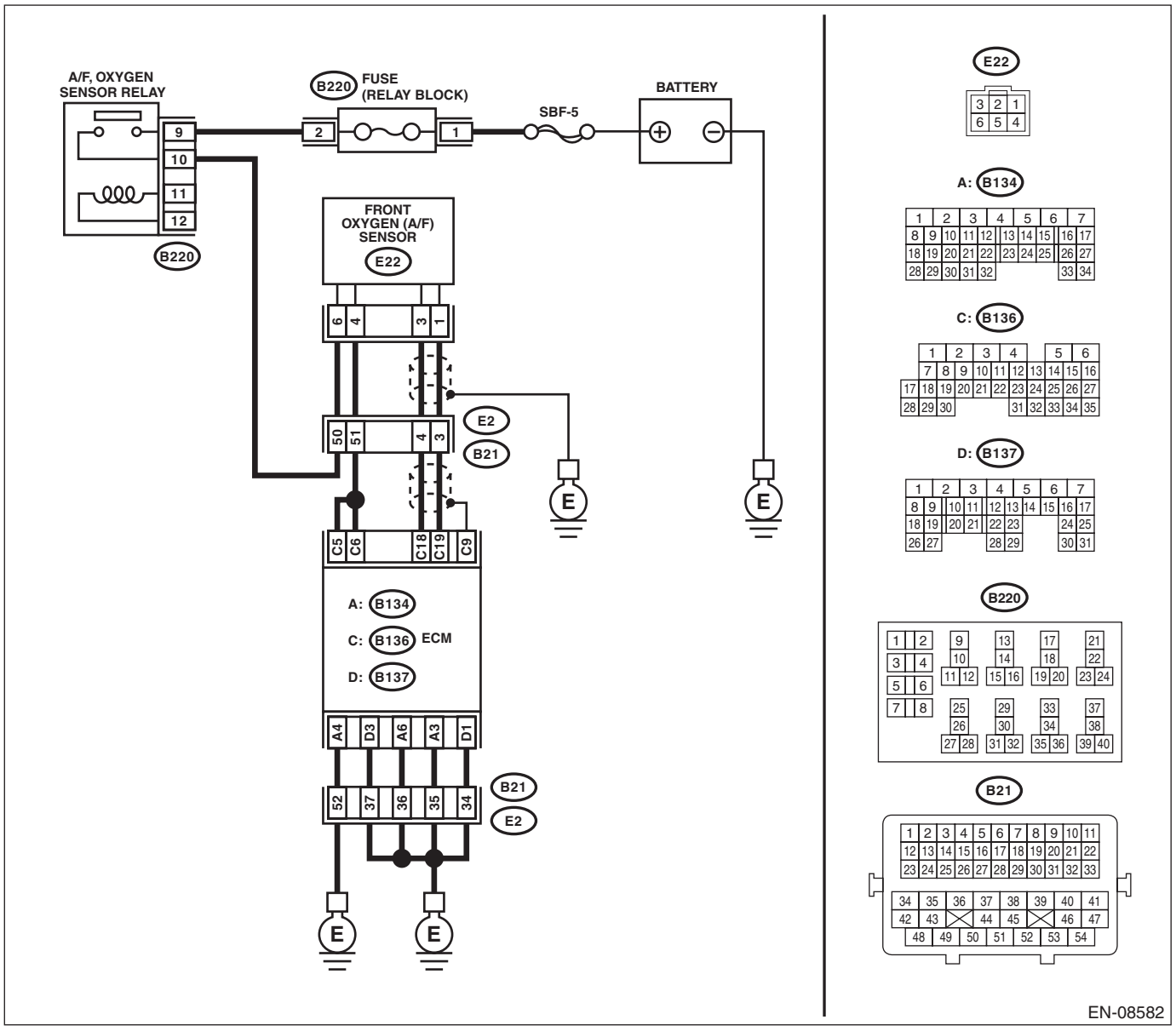
# AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-49, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from front oxygen (A/F) sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 18 (+) — Chassis ground (–):***<br>***(B136) No. 19 (+) — Chassis ground (–):*** | Is the voltage 8 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

# AD:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-51, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK EXHAUST SYSTEM.**<br>NOTE:<br>Check the following items.<br>• Loose installation of front portion of exhaust pipe onto cylinder heads<br>• Loose connection between front exhaust pipe and front catalytic converter<br>• Damage of exhaust pipe resulting in a hole | Is there any fault in exhaust system? | Repair the exhaust system. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

# AE:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

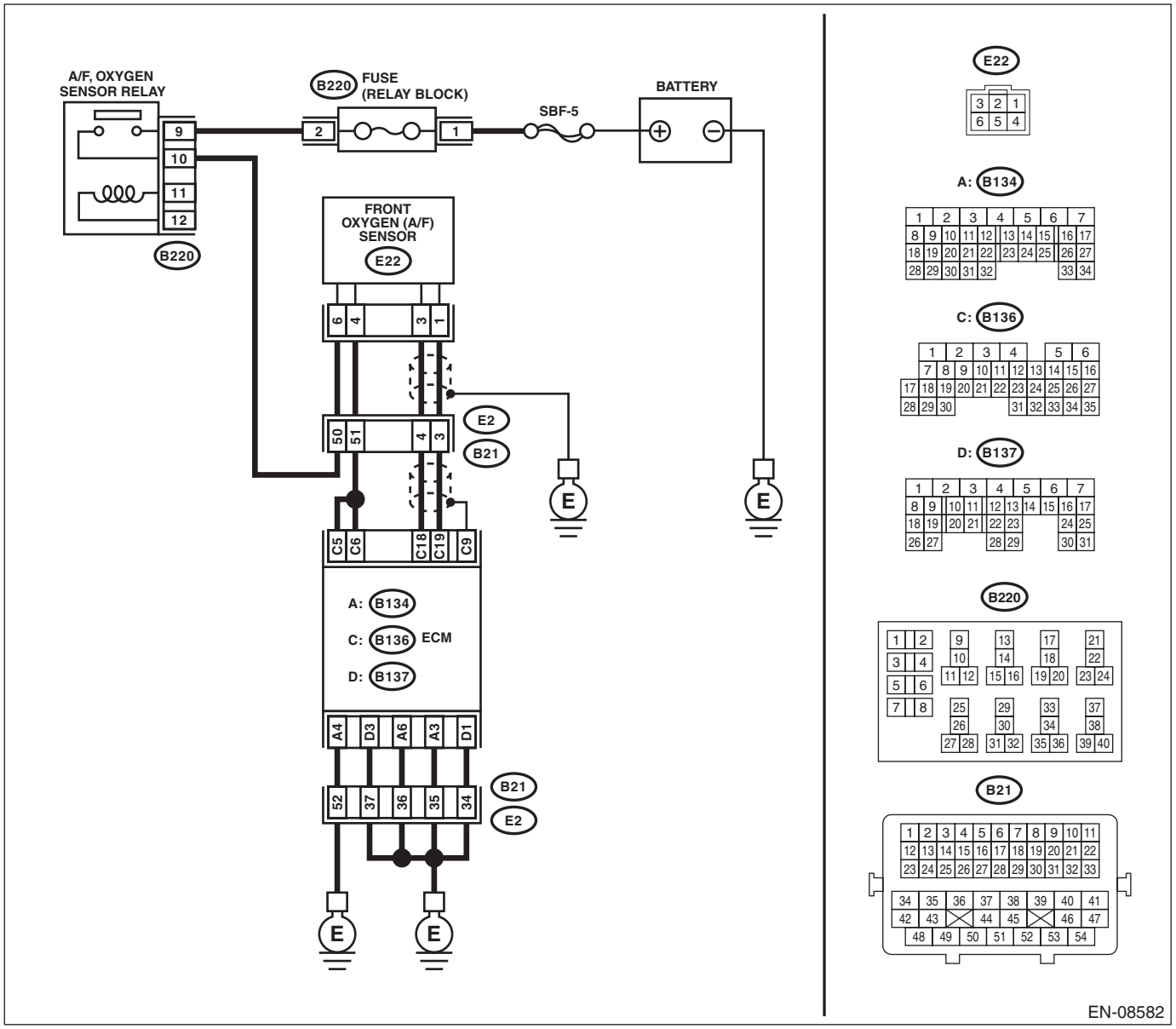
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-54, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector.<br>3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and front oxygen (A/F) sensor connector. | Is there poor contact of ECM or front oxygen (A/F) sensor connector? | Repair the poor contact of ECM or front oxygen (A/F) sensor connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

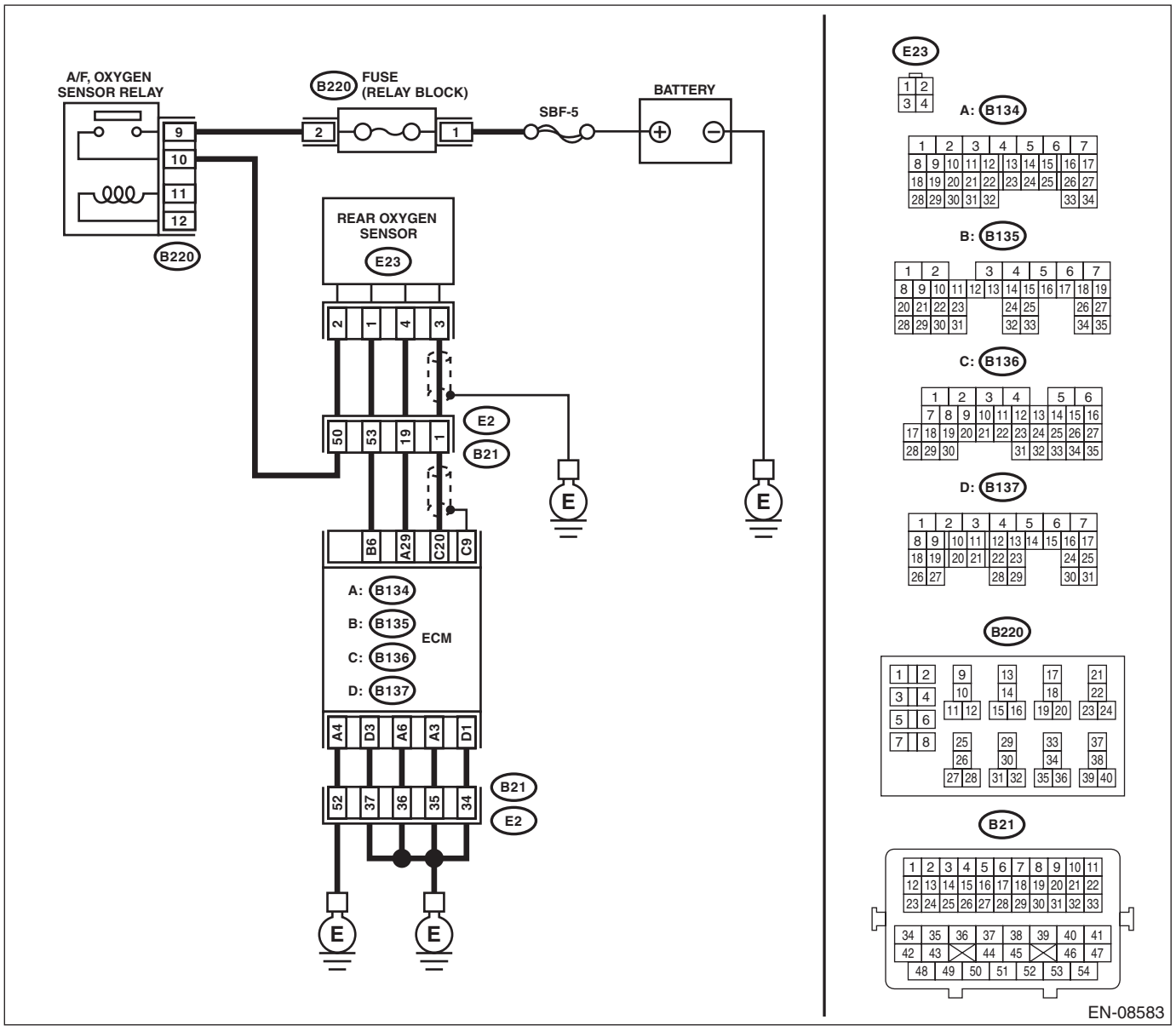
# AF:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-56, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 490 mV or more? | Go to step **5**. | Go to step **2**. |
| 2 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B134) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector<br>• Poor contact of ECM connector |
| 5 | **CHECK EXHAUST SYSTEM.**<br>Check exhaust system parts.<br>NOTE:<br>Check the following items.<br>• Looseness and improper fitting of exhaust system parts<br>• Damage (crack, hole etc.) of parts<br>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor | Is there any fault in exhaust system? | Repair or replace faulty parts. | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> |

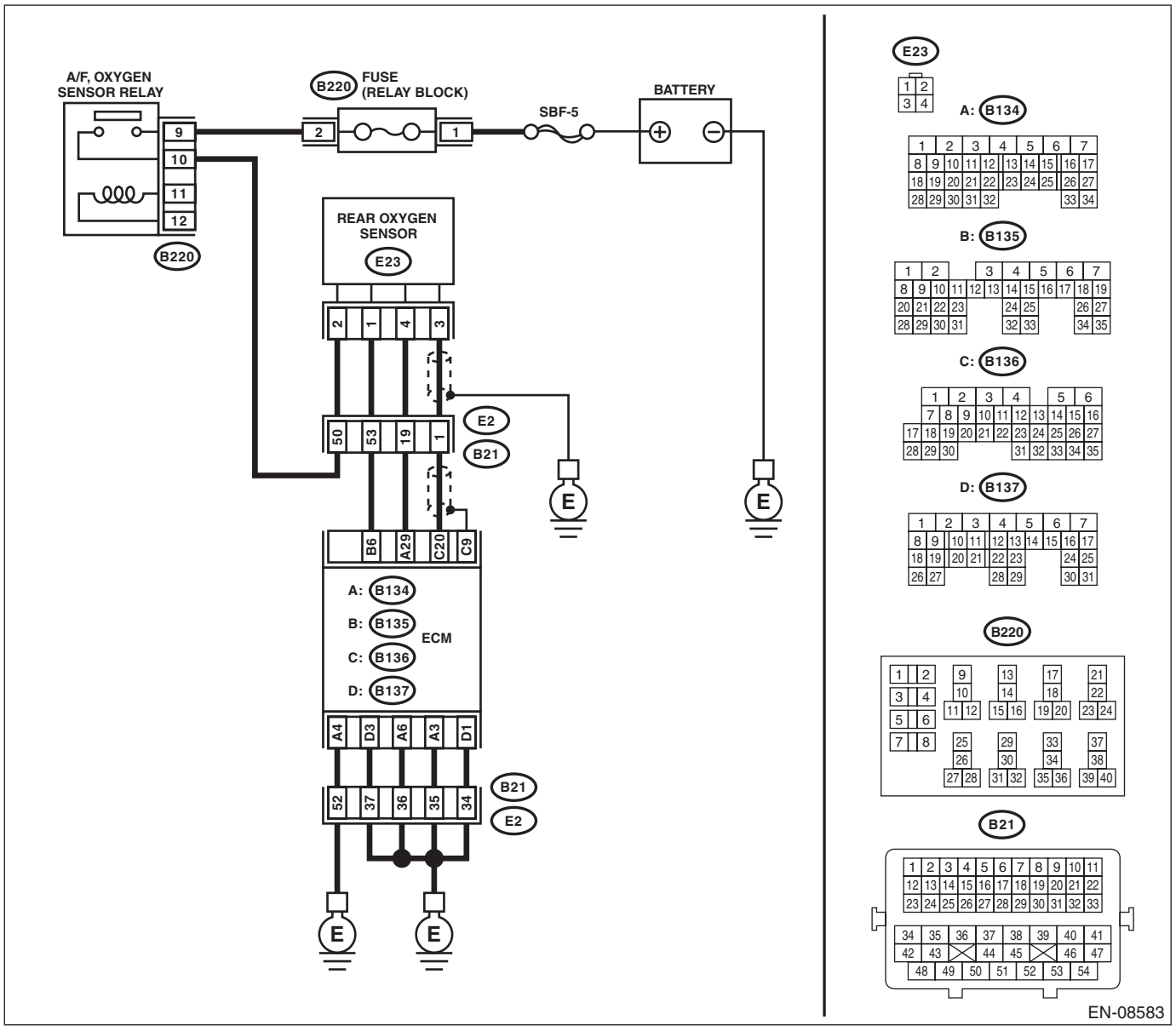
# AG:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-58, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 250 mV or less? | Go to step **5**. | Go to step **2**. |
| 2 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B134) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector<br>• Poor contact of ECM connector |
| 5 | **CHECK EXHAUST SYSTEM.**<br>Check exhaust system parts.<br>NOTE:<br>Check the following items.<br>• Looseness and improper fitting of exhaust system parts<br>• Damage (crack, hole etc.) of parts<br>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor | Is there any fault in exhaust system? | Repair or replace faulty parts. | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> |

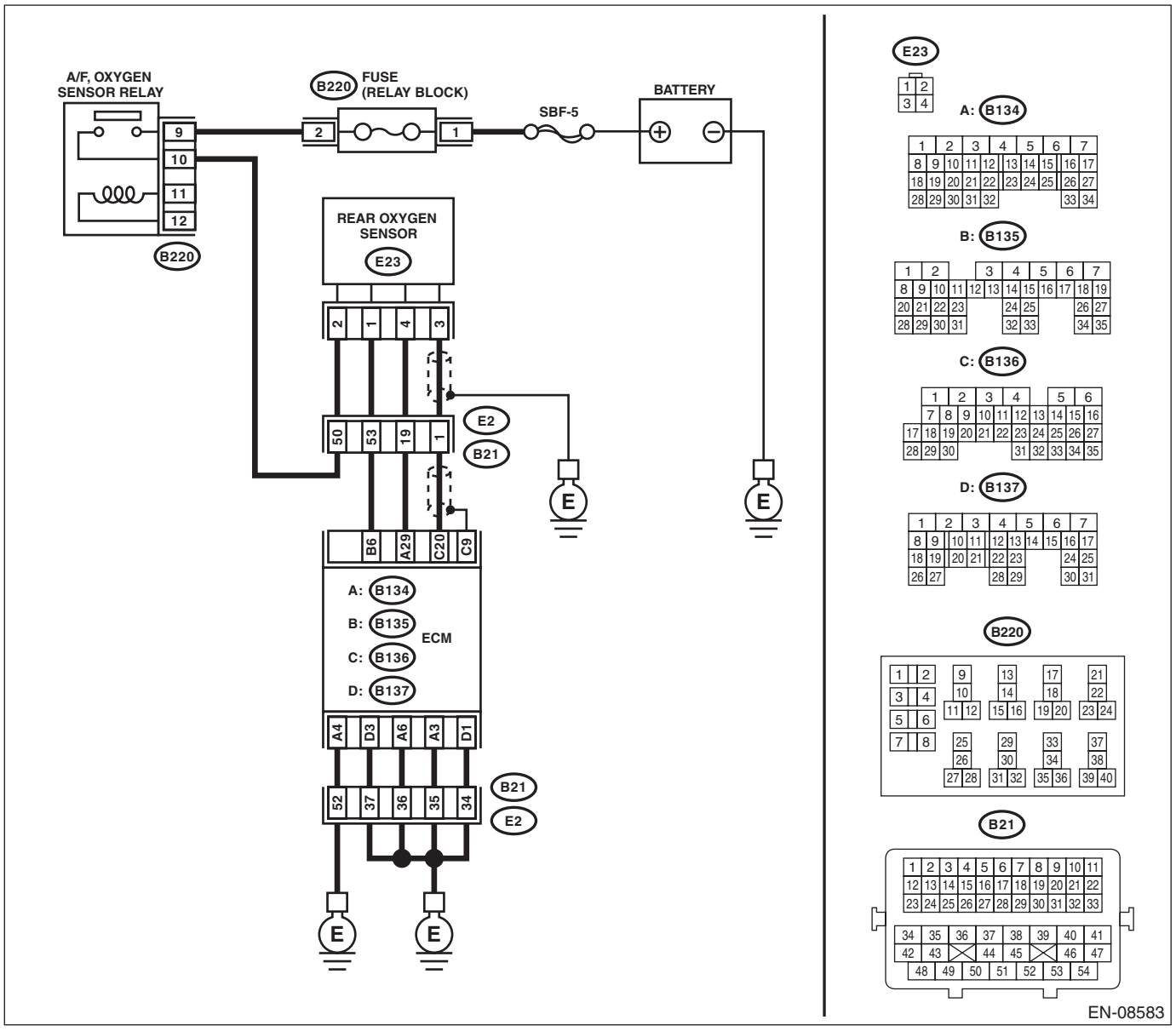
# AH:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-59, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>Measure the resistance between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit of harness between ECM and rear oxygen sensor connector. |
| 3 | **CHECK REAR OXYGEN SENSOR.**<br>Measure the resistance between rear oxygen sensor terminals.<br>***Terminals***<br>***No. 3 — No. 4*** | Is the resistance less than 1 Ω? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |

# AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2)

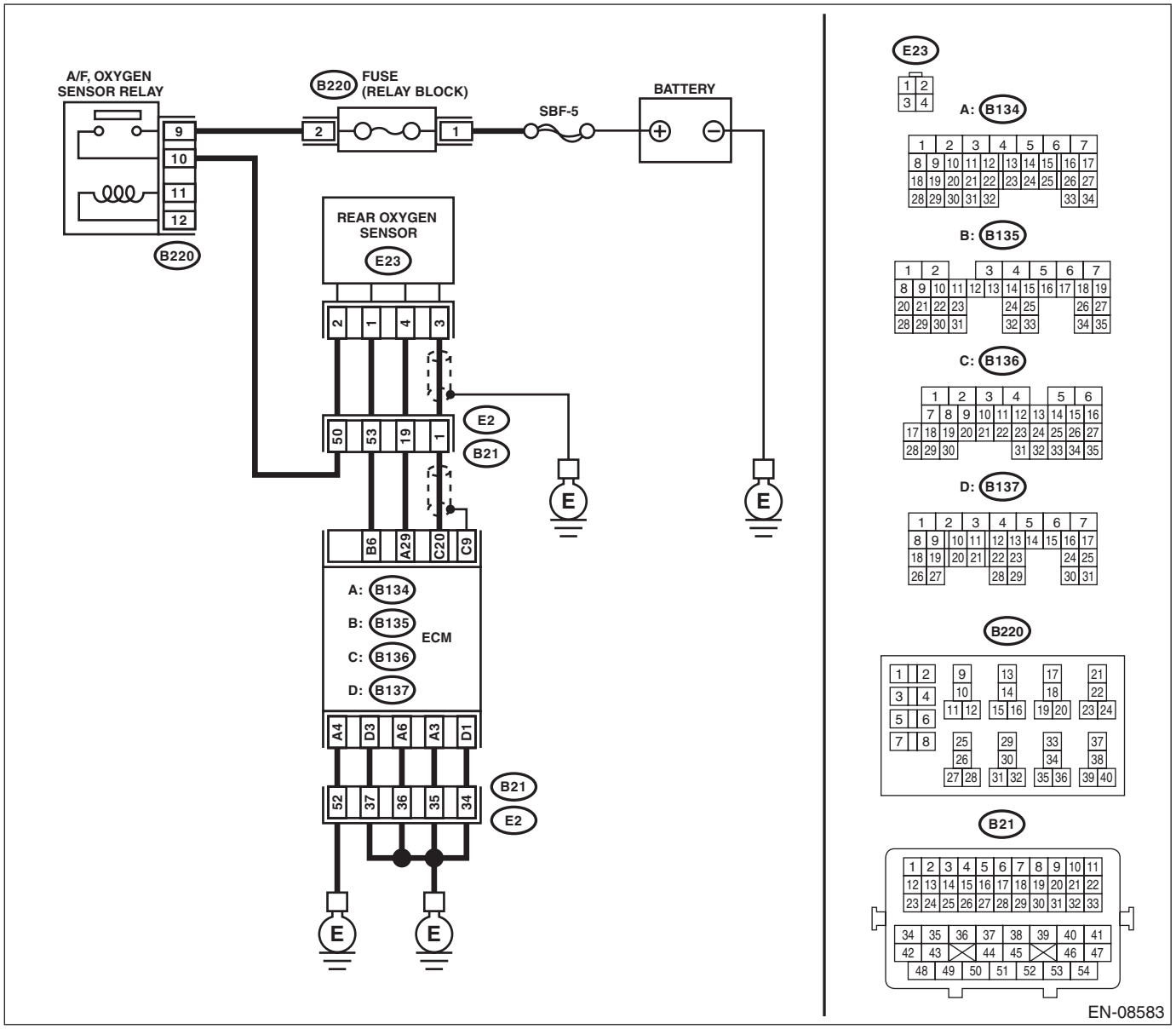
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-67, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 490 mV or more? | Go to step **6**. | Go to step **2**. |
| 2 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 250 mV or less? | Go to step **6**. | Go to step **3**. |
| 3 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B134) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **5**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 5 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector<br>• Poor contact of ECM connector |
| 6 | **CHECK EXHAUST SYSTEM.**<br>Check exhaust system parts.<br>NOTE:<br>Check the following items.<br>• Looseness and improper fitting of exhaust system parts<br>• Damage (crack, hole etc.) of parts<br>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor | Is there any fault in exhaust system? | Repair or replace faulty parts. | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> |

## AJ:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

Refer to DTC P0037 for diagnostic procedure. <Ref. to EN(H4SO)(diag)-103, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AK:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4SO)(diag)-157, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AL:DTC P0172 SYSTEM TOO RICH (BANK 1)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-72, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK EXHAUST SYSTEM.** | Are there holes or loose bolts on exhaust system? | Repair the exhaust system. | Go to step **2**. |
| 2 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **3**. |
| 3 | **CHECK FUEL PRESSURE.**<br>**WARNING:**<br>**Place "NO OPEN FLAMES" signs near the working area.**<br>**CAUTION:**<br>**Be careful not to spill fuel.**<br>Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.><br>**CAUTION:**<br>**Release fuel pressure before removing the fuel pressure gauge.** | Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm$^2$, 49 — 58 psi)? | Go to step **4**. | Repair the following item.<br>Fuel pressure is too high:<br>• Clogged fuel line or bent hose<br>Fuel pressure is too low:<br>• Improper fuel pump discharge<br>• Clogged fuel line |
| 4 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Start the engine and warm up completely.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Go to step **5**. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 5 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)? | Go to step **6**. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |
| 6 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Open the front hood.<br>6) Measure the ambient temperature.<br>7) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)? | Repair the poor contact of ECM connector. | Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

## AM:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-73, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.> |

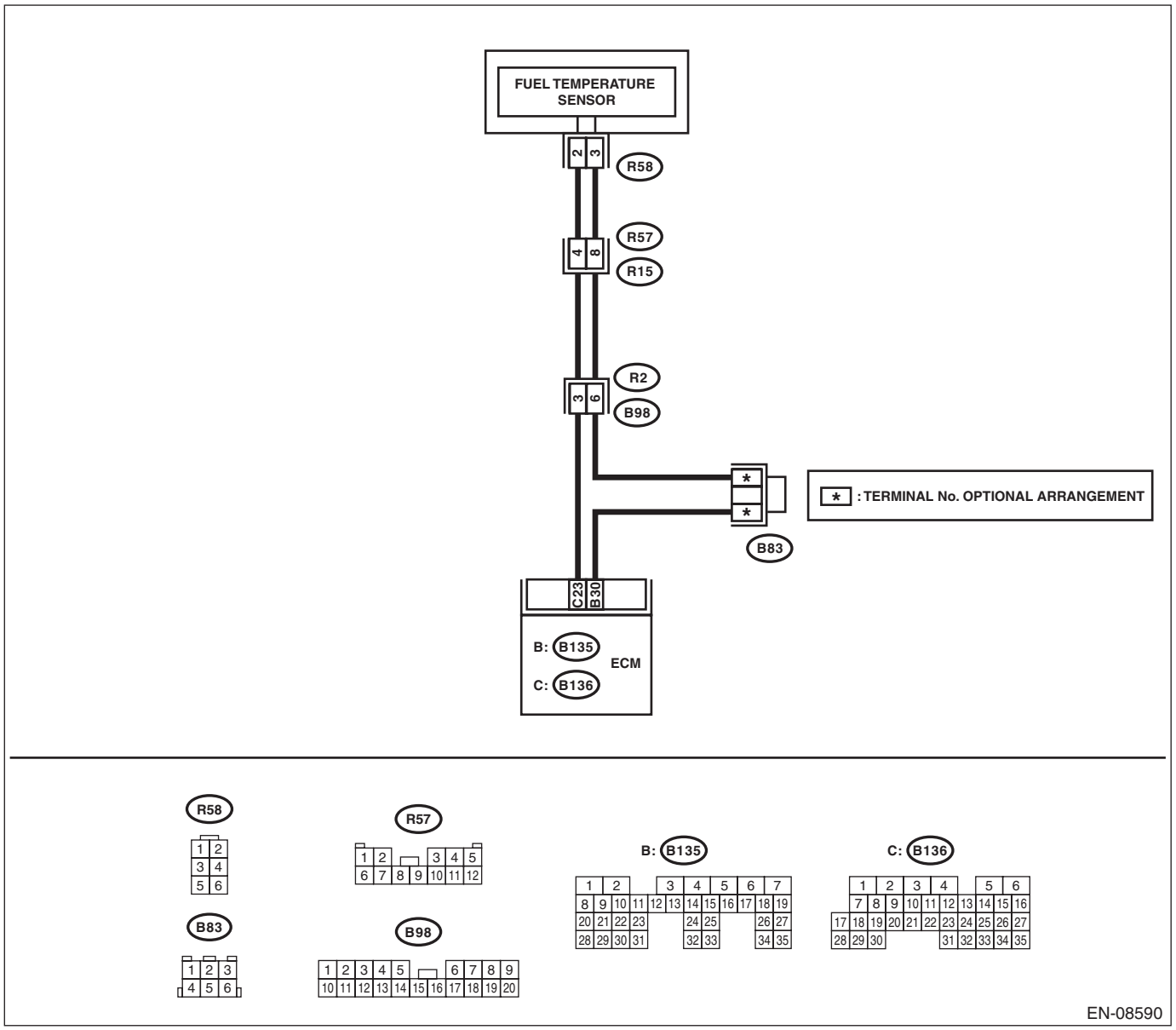
# AN:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-76, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.<br>NOTE:<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the temperature 120°C (248°F) or higher? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and fuel temperature sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 23 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.> | Repair the ground short circuit of harness between ECM and fuel pump connector. |

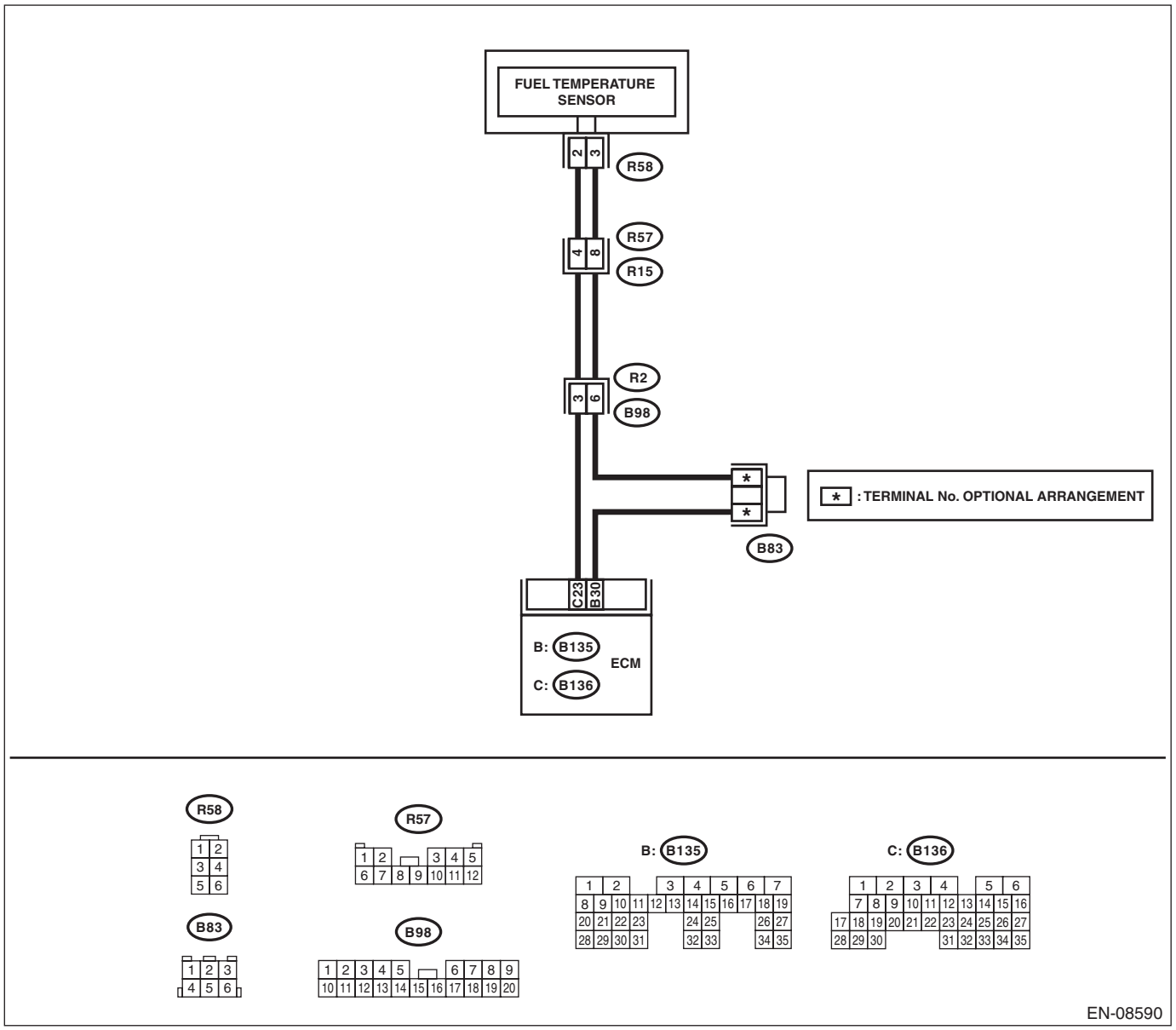
# AO:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-77, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.<br>NOTE:<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the temperature less than –40°C (–40°F)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Repair any poor contact between the ECM and fuel temperature sensor connectors. | Is there poor contact of the ECM or fuel temperature sensor connectors? | Repair any poor contact between the ECM and fuel temperature sensor connectors. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and fuel temperature sensor.<br>3) Measure the resistance of the harness between the ECM and fuel temperature sensor connector.<br>***Connector & terminal***<br>***(B136) No. 23 — (R58) No. 2:***<br>***(B135) No. 30 — (R58) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and fuel temperature sensor connector<br>• Poor contact of coupling connector<br>• Poor contact of joint connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 23 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in the harness between the ECM and fuel temperature sensor connector. | Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.> |

## AP:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-78, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**
- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the oil temperature sensor. <Ref. to FU(H4SO)-41, Oil Temperature Sensor.> |

## AQ:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

DTC DETECTING CONDITION:

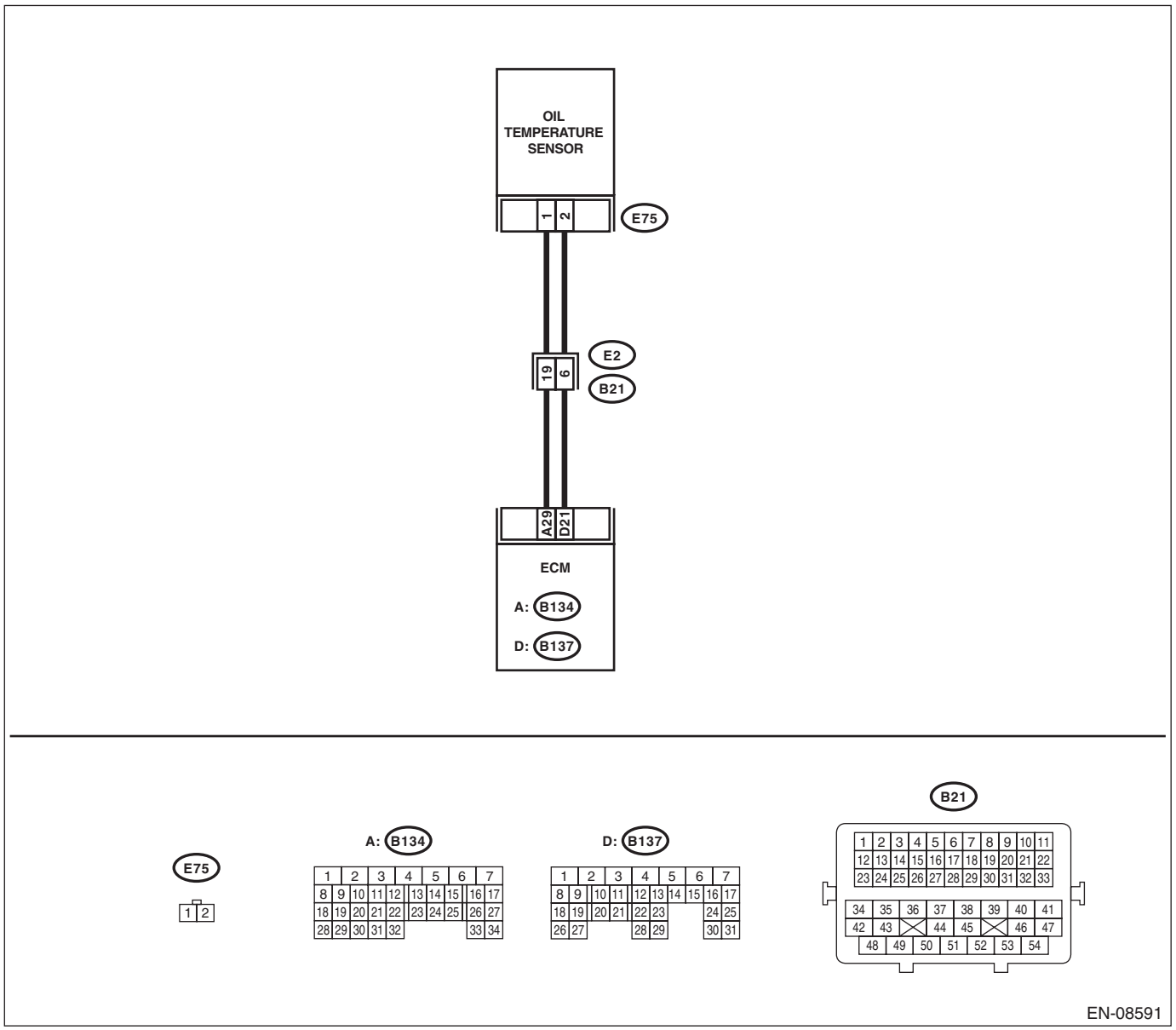
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-80, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the oil temperature 215°C (419°F) or more? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and oil temperature sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 21 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the oil temperature sensor. <Ref. to FU(H4SO)-41, Oil Temperature Sensor.> | Repair the short circuit to ground in harness between ECM and oil temperature sensor connector. |

## AR:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

**DTC DETECTING CONDITION:**

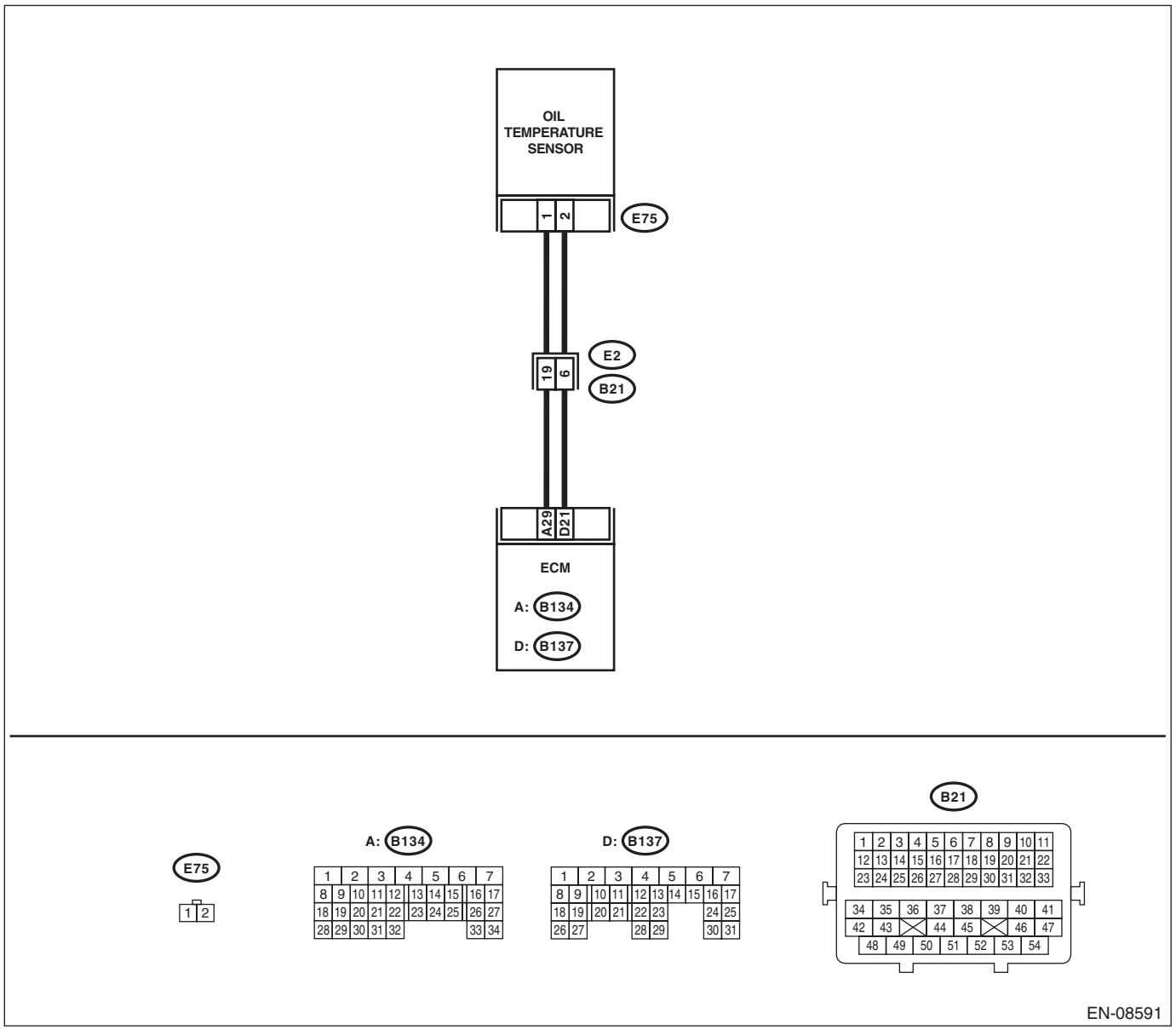
- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-81, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the oil temperature less than –40°C (–40°F)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and oil temperature sensor connector. | Is there poor contact of ECM or oil temperature sensor connector? | Repair the poor contact of ECM or the oil temperature sensor connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and oil temperature sensor.<br>3) Measure the resistance of the harness between ECM and oil temperature sensor connector.<br>***Connector & terminal***<br>***(B137) No. 21 — (E75) No. 2:***<br>***(B134) No. 29 — (E75) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and oil temperature sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 21 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power supply in harness between ECM and oil temperature sensor connector. | Replace the oil temperature sensor. <Ref. to FU(H4SO)-41, Oil Temperature Sensor.> |

# AS:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-82, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

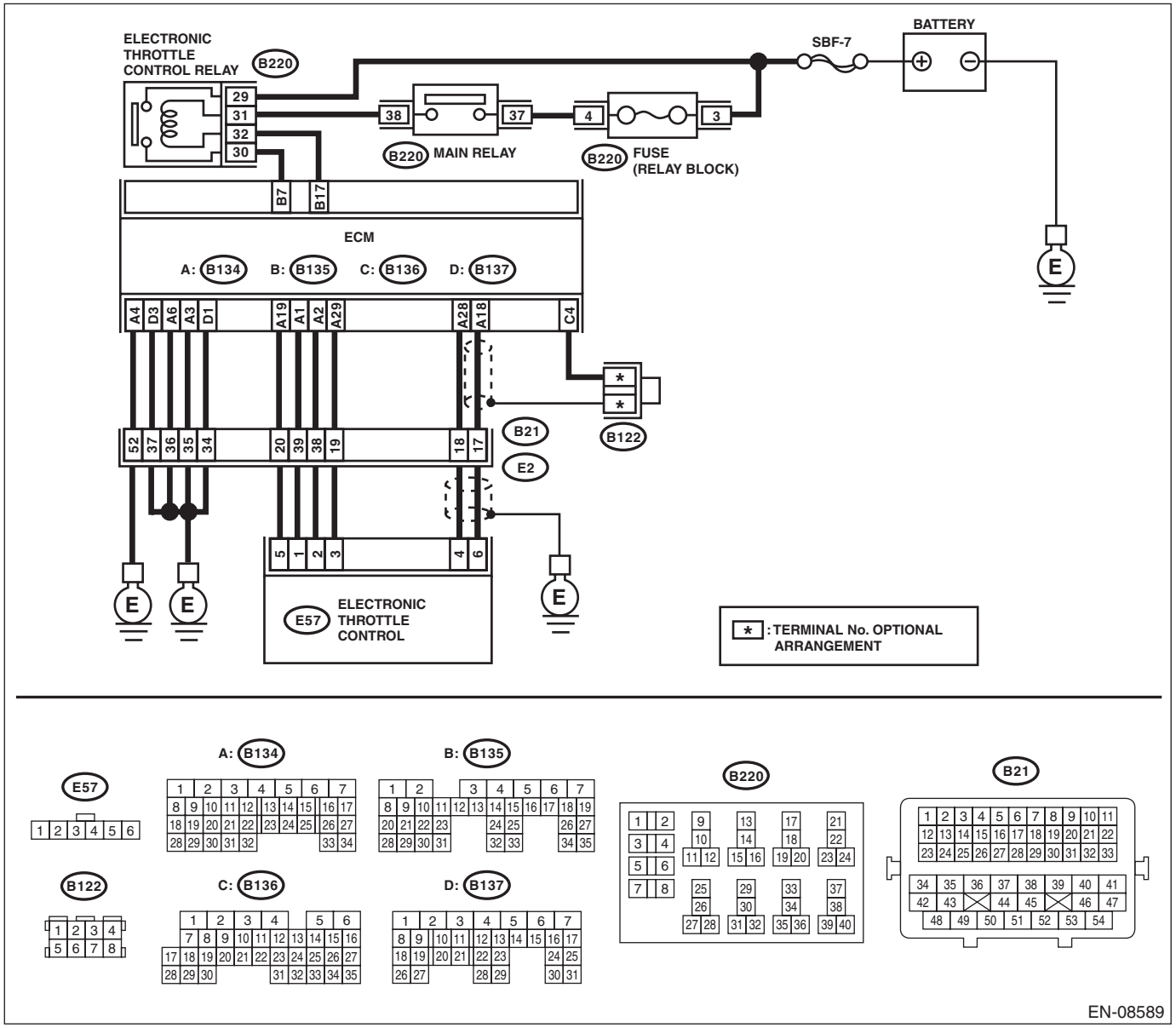
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine stalls.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




EN-08589

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 19 — Chassis ground:***<br>***(B134) No. 28 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 2 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 4 — Engine ground:*** | Is the resistance 1 MΩ or more? | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

# AT:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-83, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

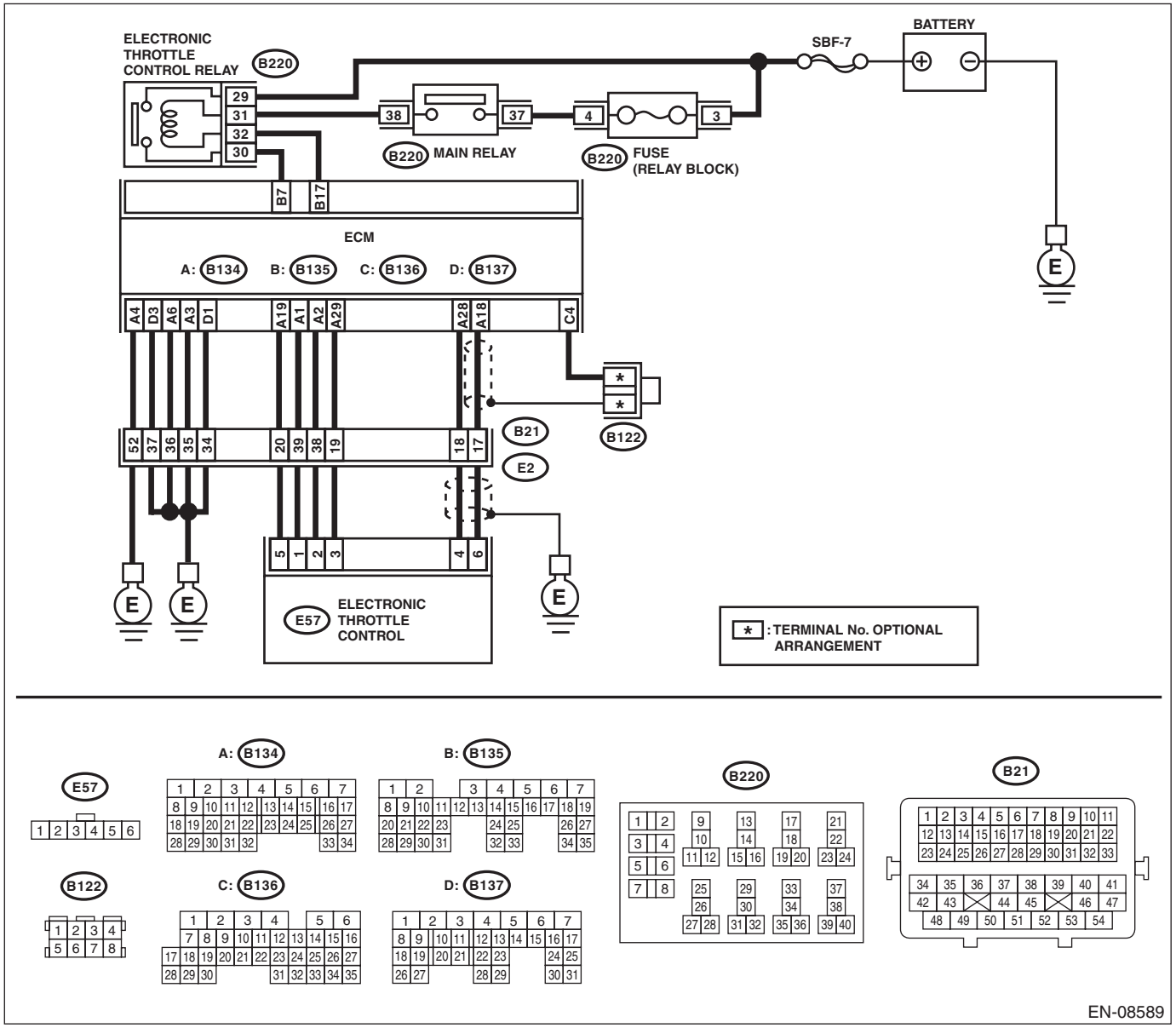
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine stalls.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**







EN-08589

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 28 — (E57) No. 4:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 4 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B134) No. 19 — (B134) No. 28:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.> | Repair the short circuit to power in harness between ECM and electronic throttle control connector. |

## AU:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-174, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AV:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-174, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AW:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-174, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AX:DTC P0304 CYLINDER 4 MISFIRE DETECTED

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-89, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

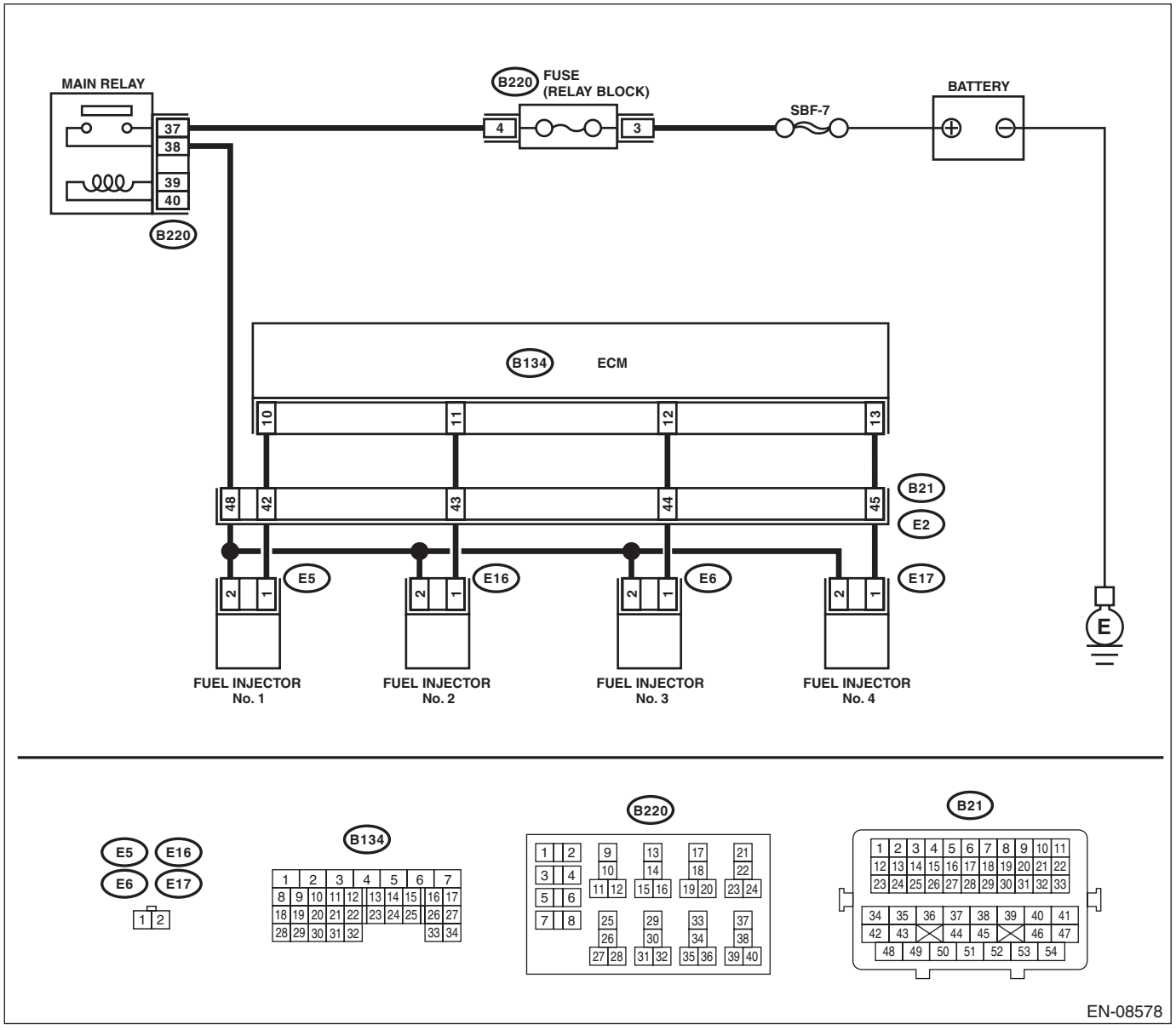
**TROUBLE SYMPTOM:**

- Engine stalls.
- Improper idling
- Rough driving

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




EN-08578

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **6**. | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 1 — Engine ground:***<br>***#2 (E16) No. 1 — Engine ground:***<br>***#3 (E6) No. 1 — Engine ground:***<br>***#4 (E17) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the short circuit to ground in harness between ECM and fuel injector connector. |
| 3 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>Measure the resistance of harness between ECM and fuel injector on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 — (E5) No. 1:***<br>***#2 (B134) No. 11 — (E16) No. 1:***<br>***#3 (B134) No. 12 — (E6) No. 1:***<br>***#4 (B134) No. 13 — (E17) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and fuel injector connector<br>• Poor contact of coupling connector |
| 4 | **CHECK FUEL INJECTOR.**<br>Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Go to step **5**. | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> |
| 5 | **CHECK POWER SUPPLY LINE.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between fuel injector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 2 (+) — Engine ground (–):***<br>***#2 (E16) No. 2 (+) — Engine ground (–):***<br>***#3 (E6) No. 2 (+) — Engine ground (–):***<br>***#4 (E17) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of all connectors in fuel injector circuit. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders<br>• Poor contact of coupling connector<br>• Poor contact of main relay connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in harness between ECM and fuel injector connector. | Go to step **7**. |
| 7 | **CHECK FUEL INJECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> | Go to step **8**. |
| 8 | **CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.** | Is the camshaft position sensor or crankshaft position sensor loosely installed? | Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> | Go to step **9**. |
| 9 | **CHECK CRANK SPROCKET.**<br>Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.> | Is the crank sprocket rusted or does it have broken teeth? | Replace the crank sprocket. <Ref. to ME(H4SO)-56, Crank Sprocket.> | Go to step **10**. |
| 10 | **CHECK INSTALLATION CONDITION OF TIMING BELT.**<br>Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block.<br>ST 499987500 CRANKSHAFT SOCKET | Is the timing belt dislocated from its proper position? | Repair the installation condition of timing belt. <Ref. to ME(H4SO)-50, Timing Belt.> | Go to step **11**. |
| 11 | **CHECK FUEL LEVEL.** | Is the fuel meter indication higher than the “Lower” level? | Go to step **12**. | Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **12**. |
| 12 | **CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.**<br>1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.><br>2) Start the engine, and drive the vehicle 10 minutes or more. | Does the malfunction indicator light illuminate or blink? | Go to step **14**. | Go to step **13**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 13 | **CHECK CAUSE OF MISFIRE.** | Was the cause of misfire identified when the engine is running? | Finish diagnostics operation, if the engine has no abnormality. | Repair the poor contact of connector.<br>NOTE:<br>In this case, repair the following item:<br>• Poor contact of ignition coil connector<br>• Poor contact of fuel injector connector on faulty cylinders<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 14 | **CHECK AIR INTAKE SYSTEM.** | Is there any fault in air intake system? | Repair the air intake system.<br>NOTE:<br>Check the following items.<br>• Are there air leaks or air suction caused by loose or dislocated nuts and bolts?<br>• Are there cracks or any disconnection of hoses? | Go to step **15**. |
| 15 | **CHECK MISFIRE SYMPTOM.**<br>1) Turn the ignition switch to ON.<br>2) Check for DTC. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).> | Does the Subaru Select Monitor or general scan tool indicate only one DTC? | Go to step **20**. | Go to step **16**. |
| 16 | **CHECK DTC.** | Is DTC P0301 and P0302 displayed on the Subaru Select Monitor or general scan tool? | Go to step **21**. | Go to step **17**. |
| 17 | **CHECK DTC.** | Is DTC P0303 and P0304 displayed on the Subaru Select Monitor or general scan tool? | Go to step **22**. | Go to step **18**. |
| 18 | **CHECK DTC.** | Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool? | Go to step **23**. | Go to step **19**. |
| 19 | **CHECK DTC.** | Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool? | Go to step **24**. | Go to step **25**. |
| 20 | **ONLY ONE CYLINDER.** | Is there any fault in the cylinder? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Spark plug cord<br>• Fuel injector<br>• Compression ratio | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 21 | GROUP OF #1 AND #2 CYLINDERS. | Are there any faults in #1 and #2 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>• Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Ignition coil<br>• Compression ratio<br>• If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 22 | GROUP OF #3 AND #4 CYLINDERS. | Are there any faults in #3 and #4 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>• Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Ignition coil<br>• Compression ratio<br>• If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 23 | GROUP OF #1 AND #3 CYLINDERS. | Are there any faults in #1 and #3 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio<br>• Skipping timing belt teeth | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 24 | GROUP OF #2 AND #4 CYLINDERS. | Are there any faults in #2 and #4 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio<br>• Skipping timing belt teeth | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 25 | CYLINDER AT RANDOM. | Is the engine idle rough? | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio |

## AY:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-90, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

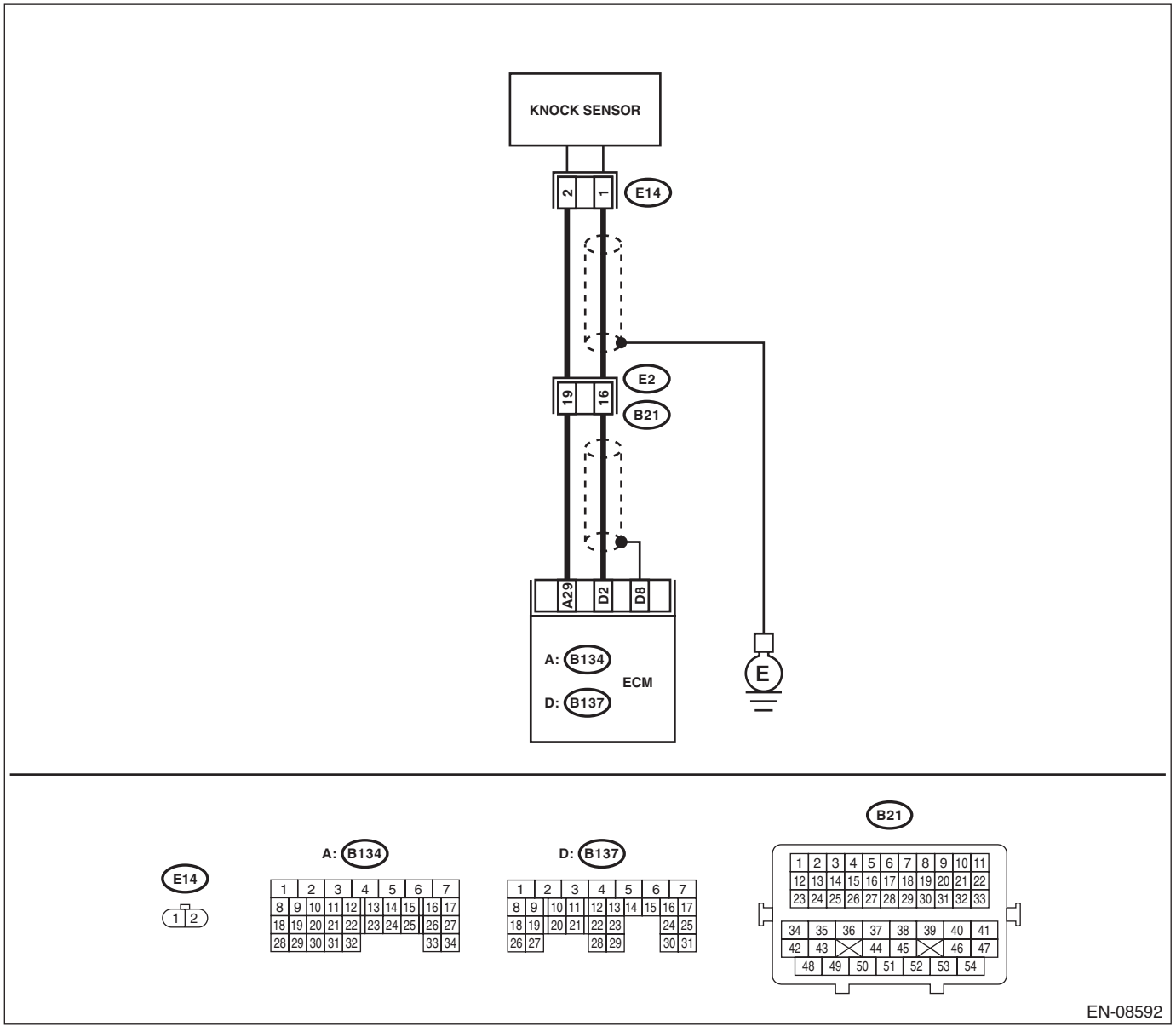
**TROUBLE SYMPTOM:**

- Poor driving performance
- Knocking occurs.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B137) No. 2 — (B134) No. 29:*** | Is the resistance 600 kΩ or more? | Go to step **2**. | Repair the poor contact of ECM connector. |
| 2 | **CHECK KNOCK SENSOR.**<br>1) Disconnect the connector from knock sensor.<br>2) Measure the resistance between knock sensor terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 600 kΩ or more? | Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and knock sensor connector<br>• Poor contact of knock sensor connector<br>• Poor contact of coupling connector |

# AZ:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-92, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

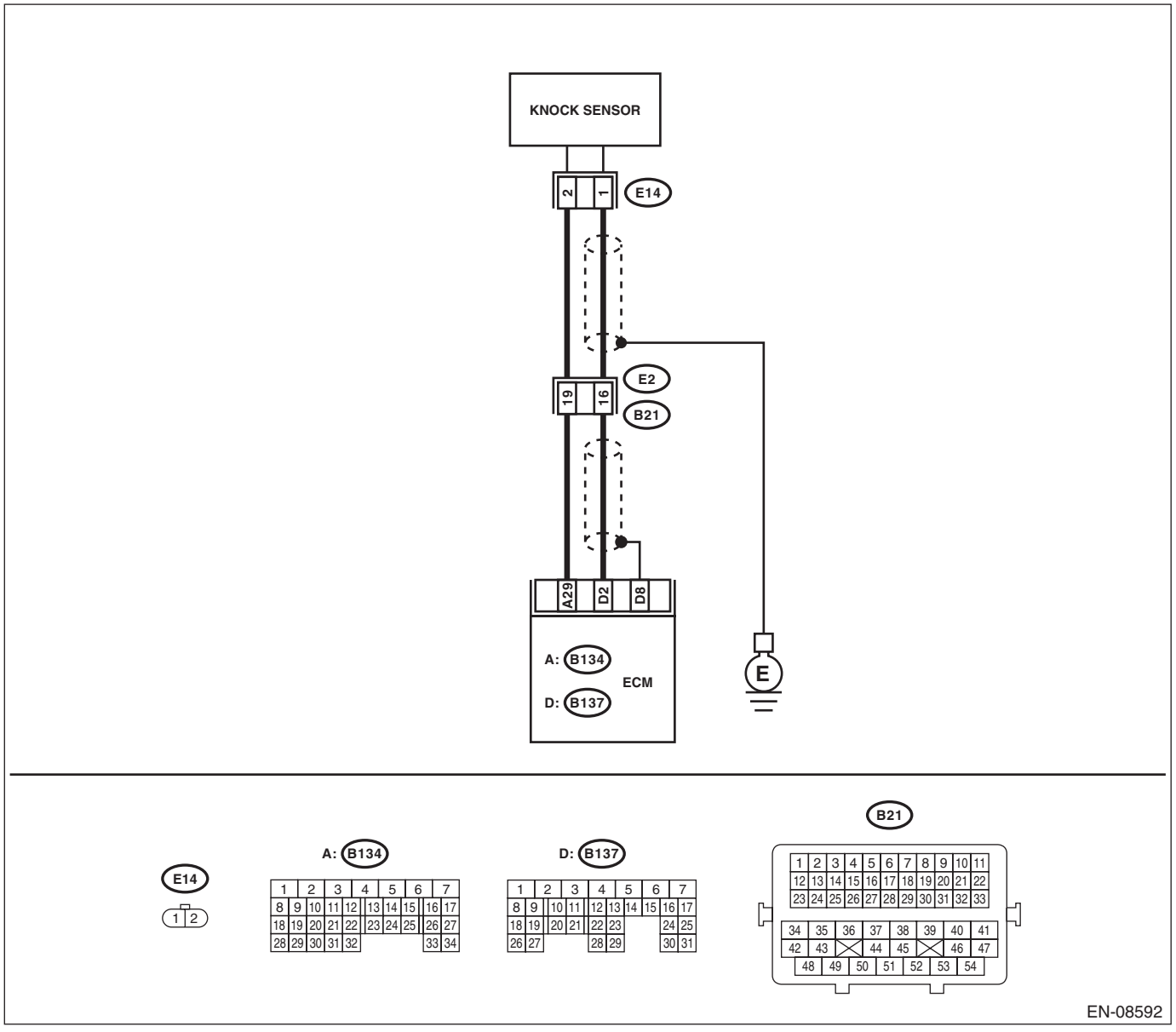
**TROUBLE SYMPTOM:**

- Poor driving performance
- Knocking occurs.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B137) No. 2 — (B134) No. 29:*** | Is the resistance less than 500 kΩ? | Go to step **2**. | Go to step **3**. |
| 2 | **CHECK KNOCK SENSOR.**<br>1) Disconnect the connector from knock sensor.<br>2) Measure the resistance between knock sensor terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 500 kΩ? | Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.> | Repair the short circuit to ground in harness between ECM and knock sensor connector.<br>NOTE:<br>The harness between both connectors are shielded. Remove the shield and repair the short circuit of harness. |
| 3 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 2 (+) — Chassis ground (–):*** | Is the voltage 2 V or more? | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. | Repair the poor contact of ECM connector. |

## BA:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-94, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

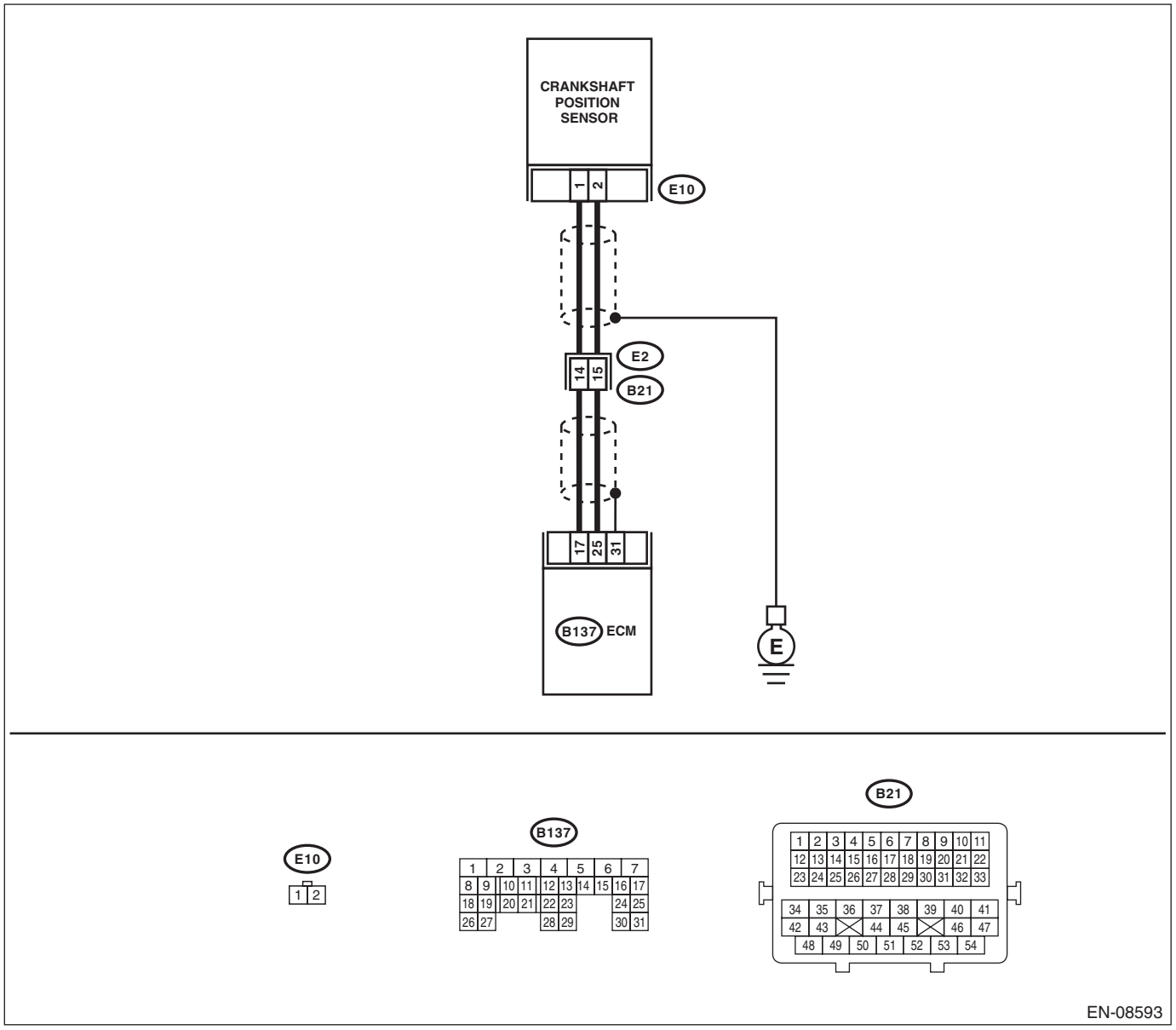
**TROUBLE SYMPTOM:**

- Engine stalls.
- Failure of engine to start

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK INSTALLATION CONDITION OF CRANKSHAFT POSITION SENSOR.** | Is the crankshaft position sensor installation bolt tightened securely? | Go to step **2**. | Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> |
| 2 | **CHECK CRANKSHAFT POSITION SENSOR.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the crankshaft position sensor.<br>3) Measure the resistance between terminals of crankshaft position sensor.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance between 1 and 4 kΩ? | Go to step **3**. | Replace the crankshaft position sensor. <Ref. to FU(H4SO)-26, Crankshaft Position Sensor.> |
| 3 | **CHECK HARNESS BETWEEN ECM AND CRANKSHAFT POSITION SENSOR CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and crankshaft position sensor connector.<br>***Connector & terminal***<br>***(B137) No. 17 — (E10) No. 1:***<br>***(B137) No. 25 — (E10) No. 2:*** | Is the resistance less than 1 Ω? | Repair the poor contact of ECM and crankshaft position sensor connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and crankshaft position sensor connector<br>• Poor contact of coupling connector |

## BB:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-96, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Engine stalls.
- Failure of engine to start

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.**<br>Turn the ignition switch to OFF. | Is the crankshaft position sensor installation bolt tightened securely? | Go to step **2**. | Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> |
| 2 | **CHECK CRANK SPROCKET.**<br>Remove the timing belt cover. | Are crank sprocket teeth cracked or damaged? | Replace the crank sprocket. <Ref. to ME(H4SO)-56, Crank Sprocket.> | Go to step **3**. |
| 3 | **CHECK INSTALLATION CONDITION OF TIMING BELT.**<br>Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block.<br>ST 499987500 CRANKSHAFT SOCKET | Is the timing belt dislocated from its proper position? | Repair the installation condition of timing belt. <Ref. to ME(H4SO)-50, Timing Belt.> | Replace the crankshaft position sensor. <Ref. to FU(H4SO)-26, Crankshaft Position Sensor.> |

## BC:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-98, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

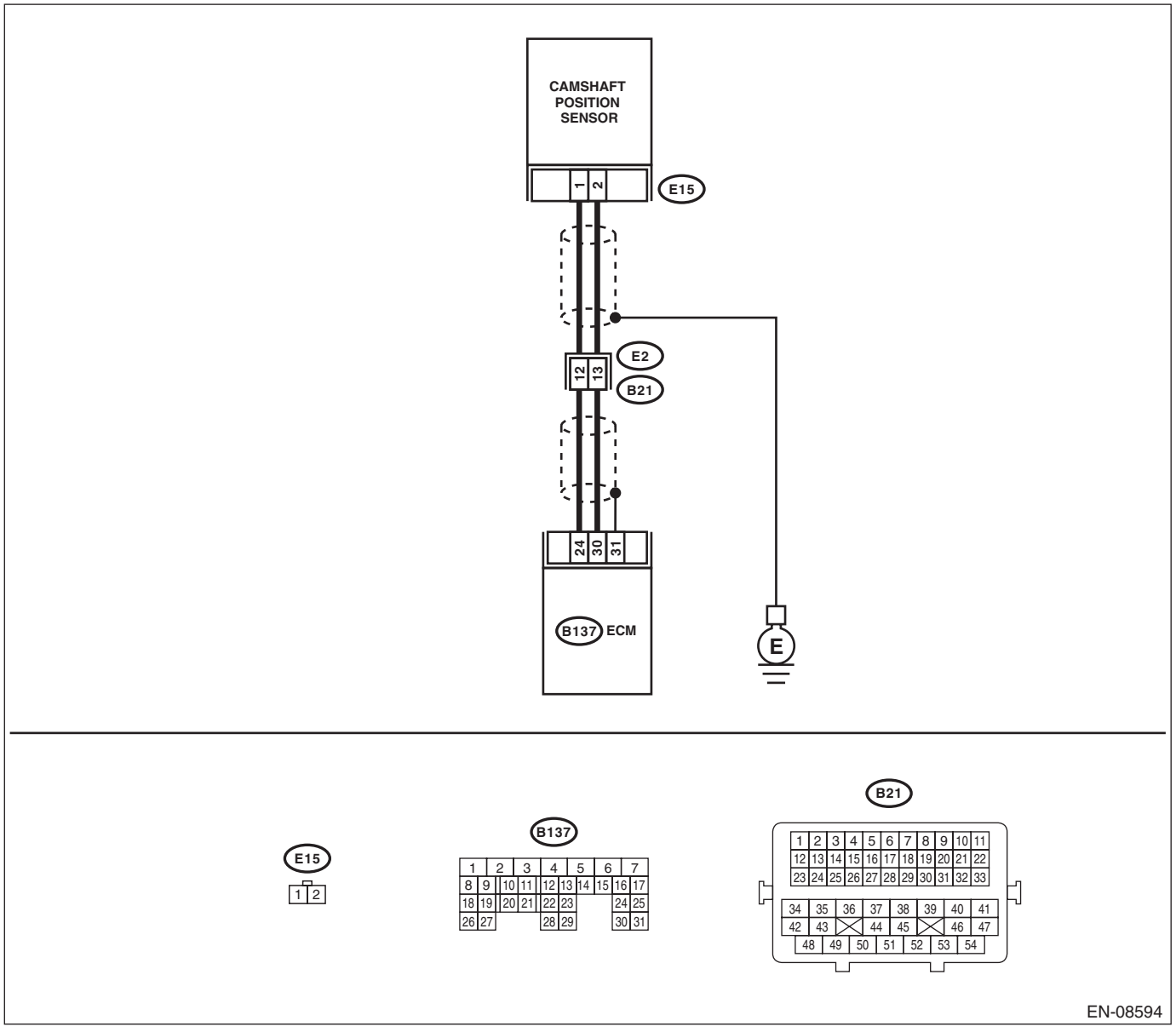
**TROUBLE SYMPTOM:**

- Engine stalls.
- Failure of engine to start

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and camshaft position sensor.<br>3) Measure the resistance of harness between ECM and camshaft position sensor connector.<br>***Connector & terminal***<br>***(B137) No. 24 — (E15) No. 1:***<br>***(B137) No. 30 — (E15) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and camshaft position sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.**<br>Measure the resistance between camshaft position sensor connector and engine ground.<br>***Connector & terminal***<br>***(E15) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair short circuit to ground in harness between ECM and camshaft position sensor connector.<br>NOTE:<br>The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit. |
| 3 | **CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.** | Is the camshaft position sensor installation bolt tightened securely? | Go to step **4**. | Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> |
| 4 | **CHECK CAMSHAFT POSITION SENSOR.**<br>1) Remove the camshaft position sensor.<br>2) Measure the resistance between terminals of camshaft position sensor.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance between 1 and 4 kΩ? | Repair the poor contact of ECM or camshaft position sensor connector. | Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.> |

## BD:DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-100, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

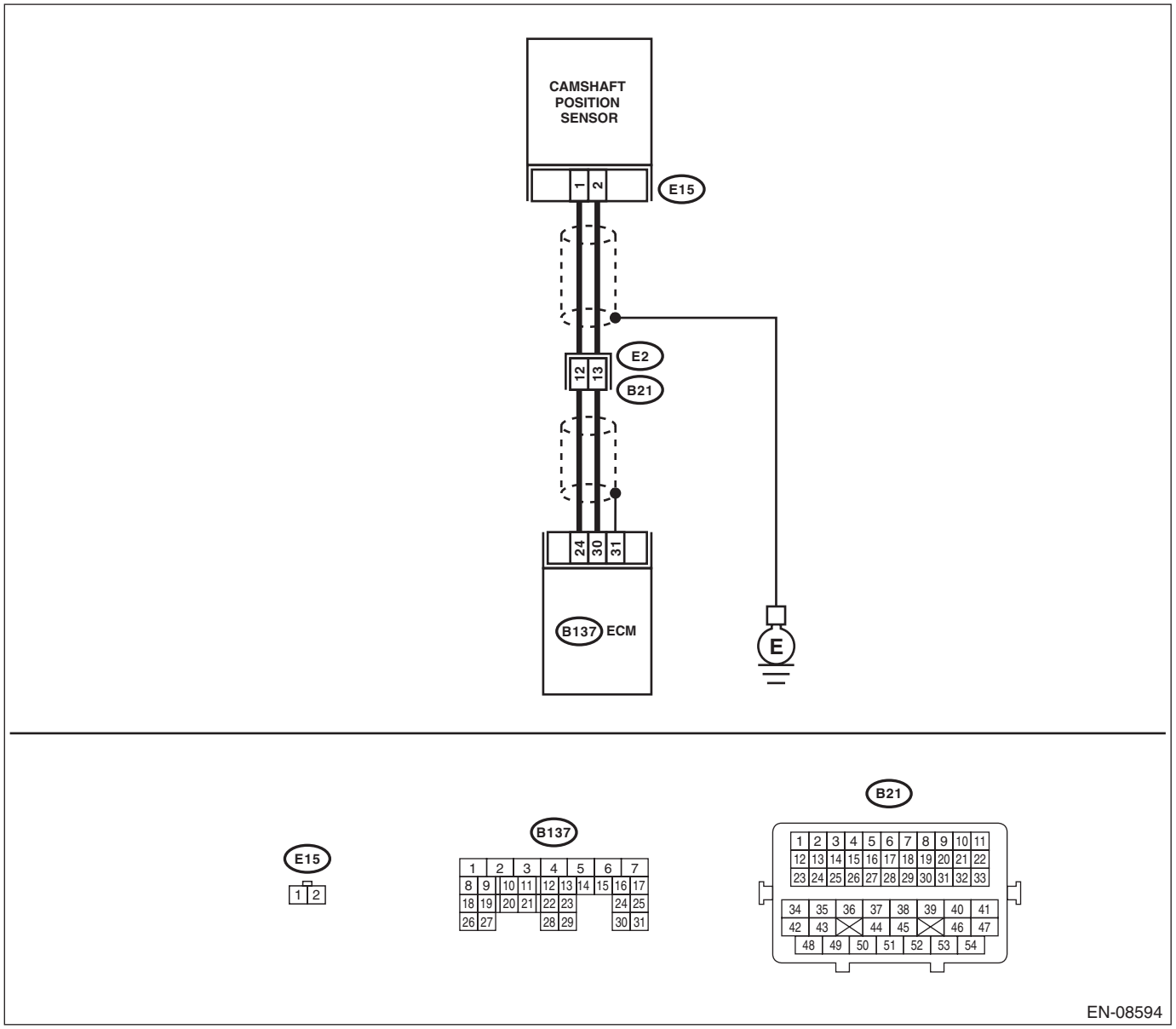
**TROUBLE SYMPTOM:**

- Engine stalls.
- Failure of engine to start

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




EN-08594

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and camshaft position sensor.<br>3) Measure the resistance of harness between ECM and camshaft position sensor connector.<br>***Connector & terminal***<br>***(B137) No. 24 — (E15) No. 1:***<br>***(B137) No. 30 — (E15) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and camshaft position sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.**<br>Measure the resistance between camshaft position sensor connector and engine ground.<br>***Connector & terminal***<br>***(E15) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair short circuit to ground in harness between ECM and camshaft position sensor connector.<br>NOTE:<br>The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit. |
| 3 | **CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.** | Is the camshaft position sensor installation bolt tightened securely? | Go to step **4**. | Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> |
| 4 | **CHECK CAMSHAFT POSITION SENSOR.**<br>1) Remove the camshaft position sensor.<br>2) Measure the resistance between terminals of camshaft position sensor.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance between 1 and 4 kΩ? | Go to step **5**. | Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.> |
| 5 | **CHECK CAM SPROCKET.**<br>Remove the timing belt cover. <Ref. to ME(H4SO)-49, Timing Belt Cover.> | Are cam sprocket teeth cracked or damaged? | Replace the cam sprocket. <Ref. to ME(H4SO)-55, Cam Sprocket.> | Go to step **6**. |
| 6 | **CHECK INSTALLATION CONDITION OF TIMING BELT.**<br>Turn the crankshaft using the ST, and align the alignment mark on the cam sprocket with the alignment mark on the timing belt cover LH.<br>ST 499987500 CRANKSHAFT SOCKET | Is the timing belt dislocated from its proper position? | Repair the installation condition of timing belt. <Ref. to ME(H4SO)-50, Timing Belt.> | Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.> |

## BE:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-102, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Movement performance problem when engine is low speed.
- Improper idling
- Movement performance problem

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Start the engine.<br>2) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 53.3 kPa (400 mmHg, 15.75 inHg) or more? | Make sure that the EGR valve, manifold absolute pressure sensor and throttle body are installed securely. | Go to step **2**. |
| 2 | **CHECK EGR VALVE.**<br>Remove the EGR valve. | Are there any holes, clogged lines or foreign matters in the EGR system? | Repair the EGR system. | Replace the EGR valve. <Ref. to FU(H4SO)-36, EGR Valve.> |

# BF:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-105, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

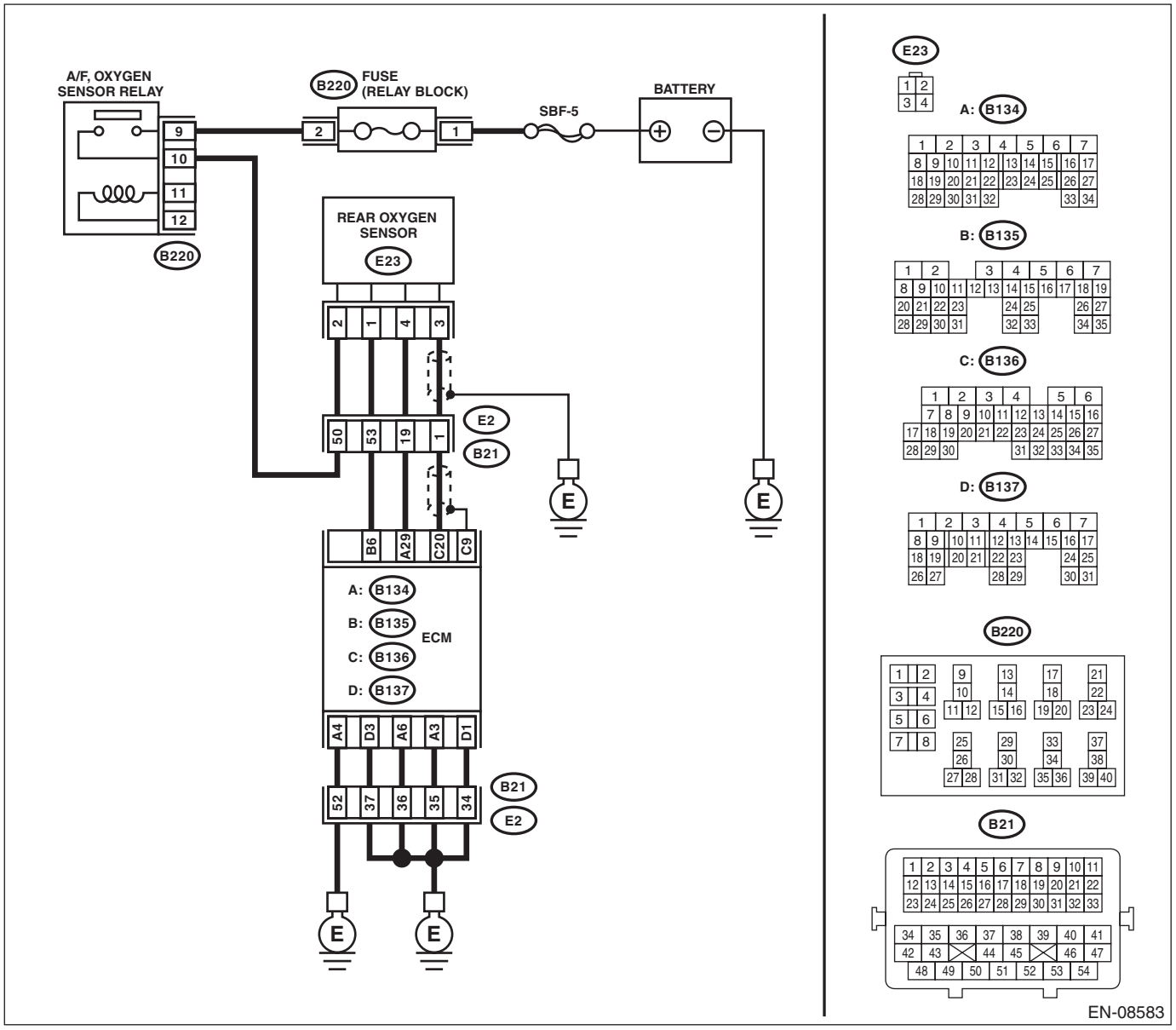
**TROUBLE SYMPTOM:**

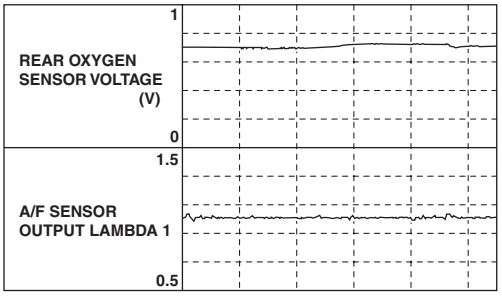
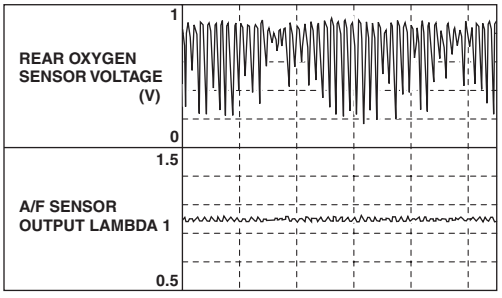
- Engine stalls.
- Idle mixture is out of specifications.

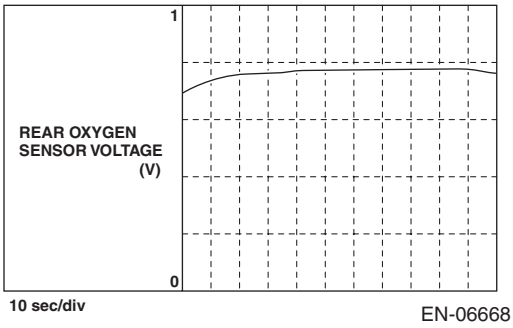
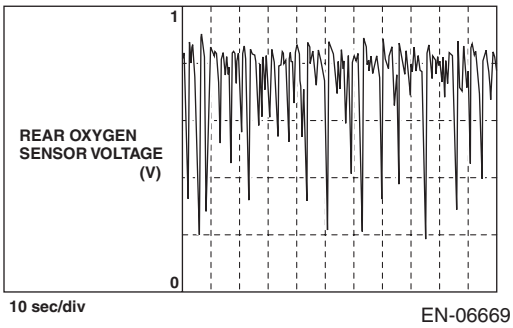
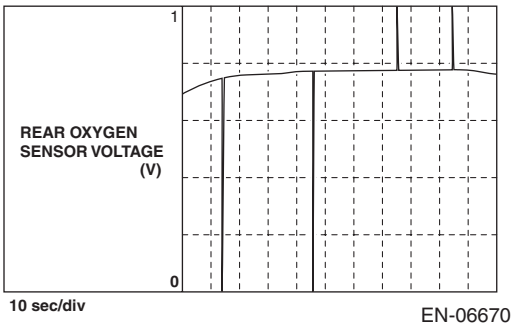
**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK EXHAUST SYSTEM.**<br>Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes.<br>NOTE:<br>Check the following positions.<br>• Between cylinder head and front exhaust pipe<br>• Between front exhaust pipe and front catalytic converter<br>• Between front catalytic converter and rear catalytic converter<br>• Loose or improperly attached front oxygen (A/F) sensor or rear oxygen sensor | Is there any fault in exhaust system? | Repair or replace the exhaust system. <Ref. to EX(H4SO)-2, General Description.> | Go to step **2**. |
| 2 | **CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).**<br>1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH).<br>2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data.<br>• At normal condition<br>  <br><br>EN-06666<br>• At abnormal condition (numerous inversion)<br>  <br><br>EN-06667 | Is a normal waveform displayed? | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. | Go to step **3**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).**<br>1) Run the engine at idle.<br>2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data.<br>• At normal condition<br>  <br><br>EN-06668<br>• At abnormal condition 1 (numerous inversion)<br>  <br><br>EN-06669<br>• At abnormal condition 2 (noise input)<br>  <br><br>EN-06670 | Is a normal waveform displayed? | Go to step **4**. | • The waveform is displayed at abnormal condition 1: Go to step **4**.<br>• The waveform is displayed at abnormal condition 2: Go to step **5**. |
| 4 | **CHECK CATALYTIC CONVERTER.** | Is the catalytic converter damaged? | Replace the catalytic converter. <Ref. to EC(H4SO)-3, Front Catalytic Converter.> | Go to step **5**. |
| 5 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **6**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B134) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **7**. | Repair the harness and connector.<br>NOTE:<br>Repair the following locations.<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 7 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Go to step **8**. | Repair the harness and connector.<br>NOTE:<br>Repair the following locations.<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 8 | **CHECK REAR OXYGEN SENSOR SHIELD.**<br>1) Turn the ignition switch to OFF.<br>2) Expose the rear oxygen sensor connector body side harness sensor shield.<br>3) Measure the resistance between sensor shield and chassis ground. | Is the resistance less than 1 Ω? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the open circuit of rear oxygen sensor harness. |

# BG:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-107, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FUEL FILLER CAP.**<br>1) Turn the ignition switch to OFF.<br>2) Check the fuel filler cap.<br>NOTE:<br>The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening. | Is the fuel filler cap tightened securely? | Go to step **2**. | Tighten fuel filler cap securely. |
| 2 | **CHECK FUEL FILLER CAP.** | Is the fuel filler cap genuine? | Go to step **3**. | Replace with a genuine fuel filler cap. |
| 3 | **CHECK FUEL FILLER PIPE GASKET.** | Is there any damage to the seal between fuel filler cap and fuel filler pipe? | Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-62, Fuel Filler Pipe.> | Go to step **4**. |
| 4 | **CHECK DRAIN VALVE OPERATION.**<br>1) Connect the delivery (test) mode connector.<br>2) Turn the ignition switch to ON.<br>3) Perform operation check for the drain valve using the Subaru Select Monitor.<br>NOTE:<br>The drain valve can be operated using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the drain valve operate? | Go to step **5**. | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> |
| 5 | **CHECK OPERATION OF PURGE CONTROL SOLENOID VALVE.**<br>Perform operation check for the purge control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the purge control solenoid valve operate? | Go to step **6**. | Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK OPERATION OF PRESSURE CONTROL SOLENOID VALVE.**<br>Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the pressure control solenoid valve operate? | Go to step **7**. | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |
| 7 | **CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the delivery (test) mode connector. | Is there any hole of more than 1.0 mm (0.04 in) dia. on evaporation line? | Repair or replace the evaporation line. <Ref. to FU(H4SO)-77, Fuel Delivery and Evaporation Lines.> | Go to step **8**. |
| 8 | **CHECK CANISTER.** | Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it? | Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.> | Go to step **9**. |
| 9 | **CHECK FUEL TANK.**<br>Remove the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Is the fuel tank damaged or is there any hole of more than 1.0 mm (0.04 in) dia. in it? | Repair or replace the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Go to step **10**. |
| 10 | **CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.** | Is there any hole of more than 1.0 mm (0.04 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system? | Repair or replace the hoses or pipes. | Repair the poor contact of ECM connector. |

# BH:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

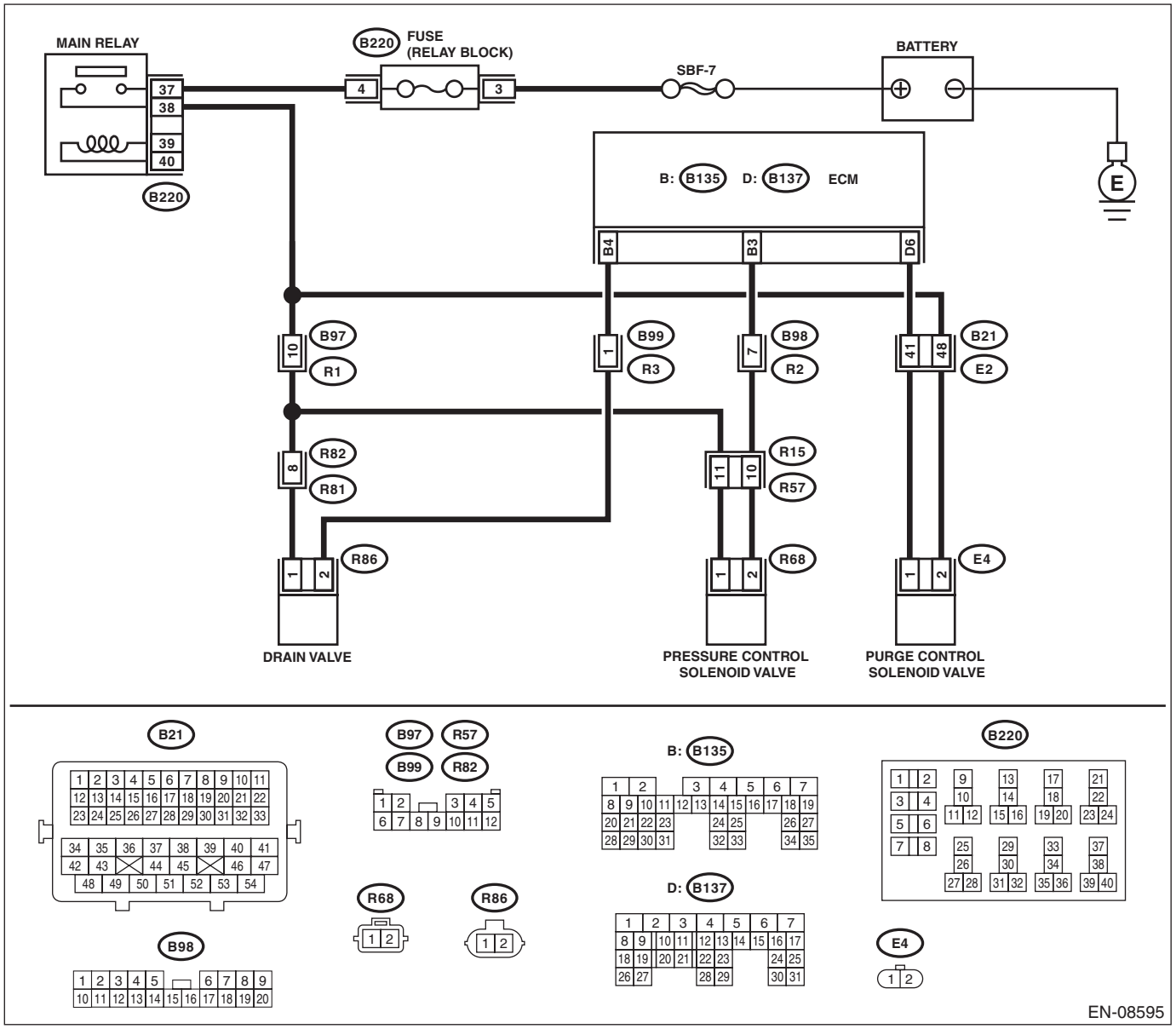
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-123, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 4 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Go to step **3**. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause. |
| 3 | **CHECK POWER SUPPLY TO DRAIN VALVE.**<br>Measure the voltage between drain valve connector and chassis ground.<br>***Connector & terminal***<br>***(R86) No. 1 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **4**. | Repair the power supply circuit. |
| 4 | **CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and drain valve.<br>3) Measure the resistance between the drain valve connector and chassis ground.<br>***Connector & terminal***<br>***(R86) No. 2 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and drain valve connector. |
| 5 | **CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.**<br>Measure the resistance of harness between ECM and drain valve connector.<br>***Connector & terminal***<br>***(B135) No. 4 — (R86) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **6**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and drain valve connector<br>• Poor contact of coupling connector |
| 6 | **CHECK DRAIN VALVE.**<br>Measure the resistance between drain valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 10 — 100 Ω? | Repair the poor contact of drain valve connector. | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> |

# BI: DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

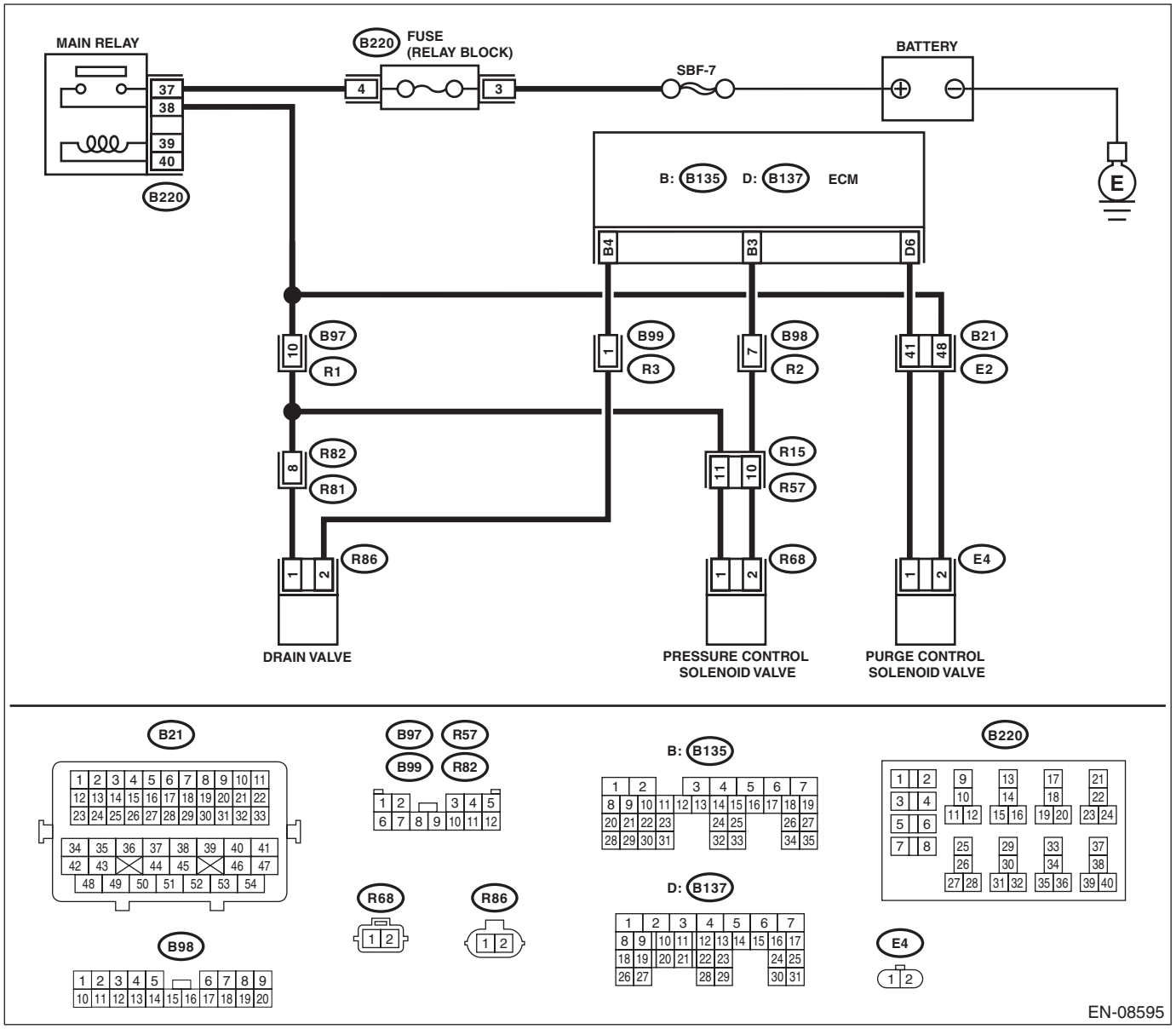
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-125, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and drain valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 4 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and drain valve connector. | Go to step **2**. |
| 2 | **CHECK DRAIN VALVE.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between drain valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> | Repair the poor contact of ECM connector. |

## BJ:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-127, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FUEL FILLER CAP.**<br>1) Turn the ignition switch to OFF.<br>2) Open the fuel flap. | Is the fuel filler cap tightened securely? | Go to step **2**. | Tighten fuel filler cap securely. |
| 2 | **CHECK PRESSURE/VACUUM LINE.**<br>NOTE:<br>Check the following items.<br>• Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank<br>• Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank | Is there any fault in pressure/vacuum line? | Repair or replace the hoses and pipes. | Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.> |

## BK:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

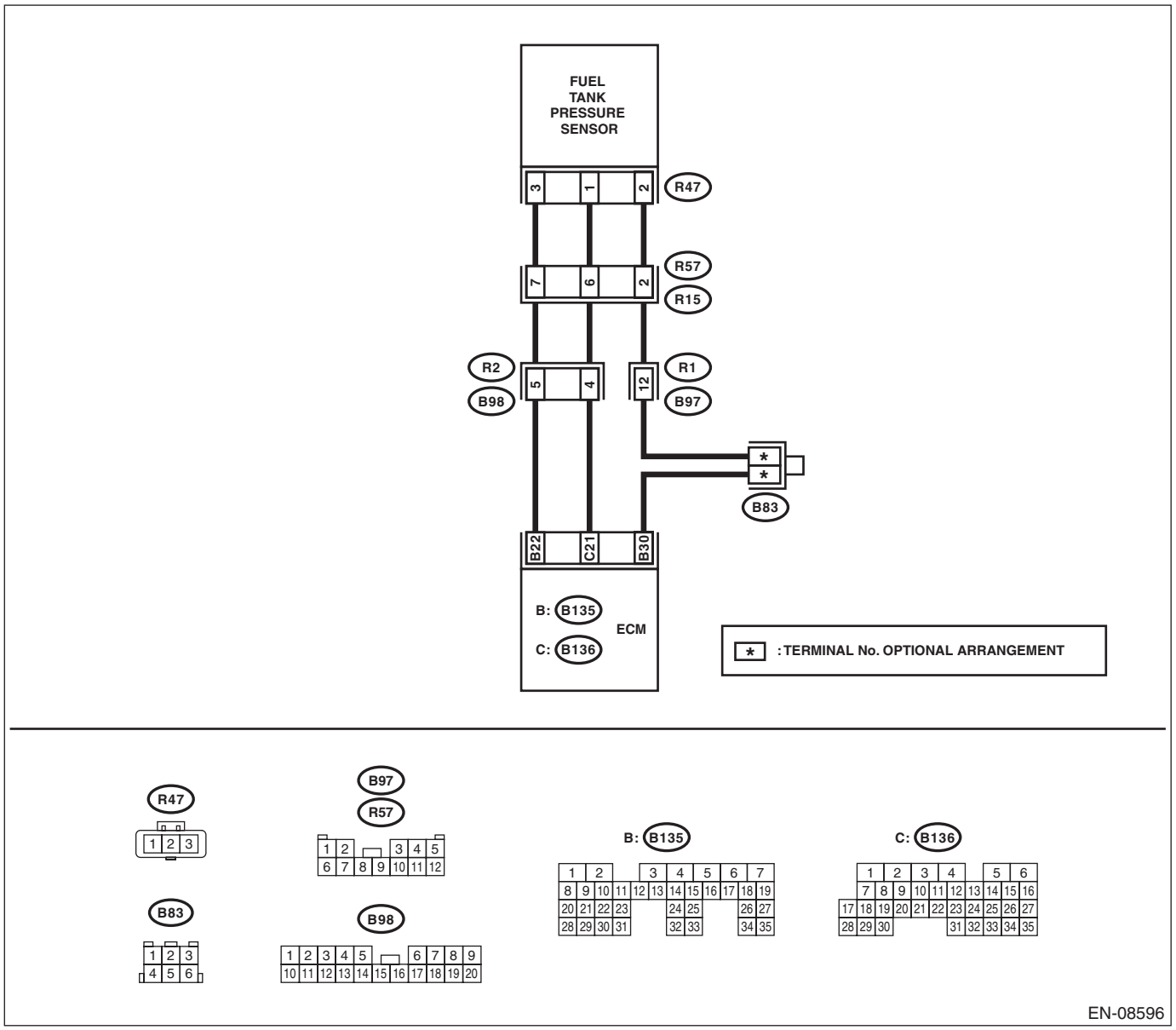
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-129, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK CURRENT DATA.**<br>1) Turn the ignition switch to ON.<br>2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value less than –7.45 kPa (–55.9 mmHg, –2.2 inHg)? | Go to step **2**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 2 | **CHECK FUEL TANK PRESSURE SENSOR POWER SUPPLY.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the fuel tank pressure sensor.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between the fuel tank pressure sensor connector and chassis ground.<br>***Connector & terminal***<br>***(R47) No. 3 (+) — Chassis ground (–):*** | Is the voltage 4.5 V or more? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and fuel tank pressure sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance of harness between the ECM and fuel tank pressure sensor connector.<br>***Connector & terminal***<br>***(B136) No. 21 — (R47) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and fuel tank pressure sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 21 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and fuel tank pressure sensor connector. |
| 5 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact between the ECM and fuel tank pressure sensor connector. | Is there poor contact of the ECM or fuel tank pressure sensor connector? | Repair the poor contact of the ECM or fuel tank pressure sensor connector. | Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.> |

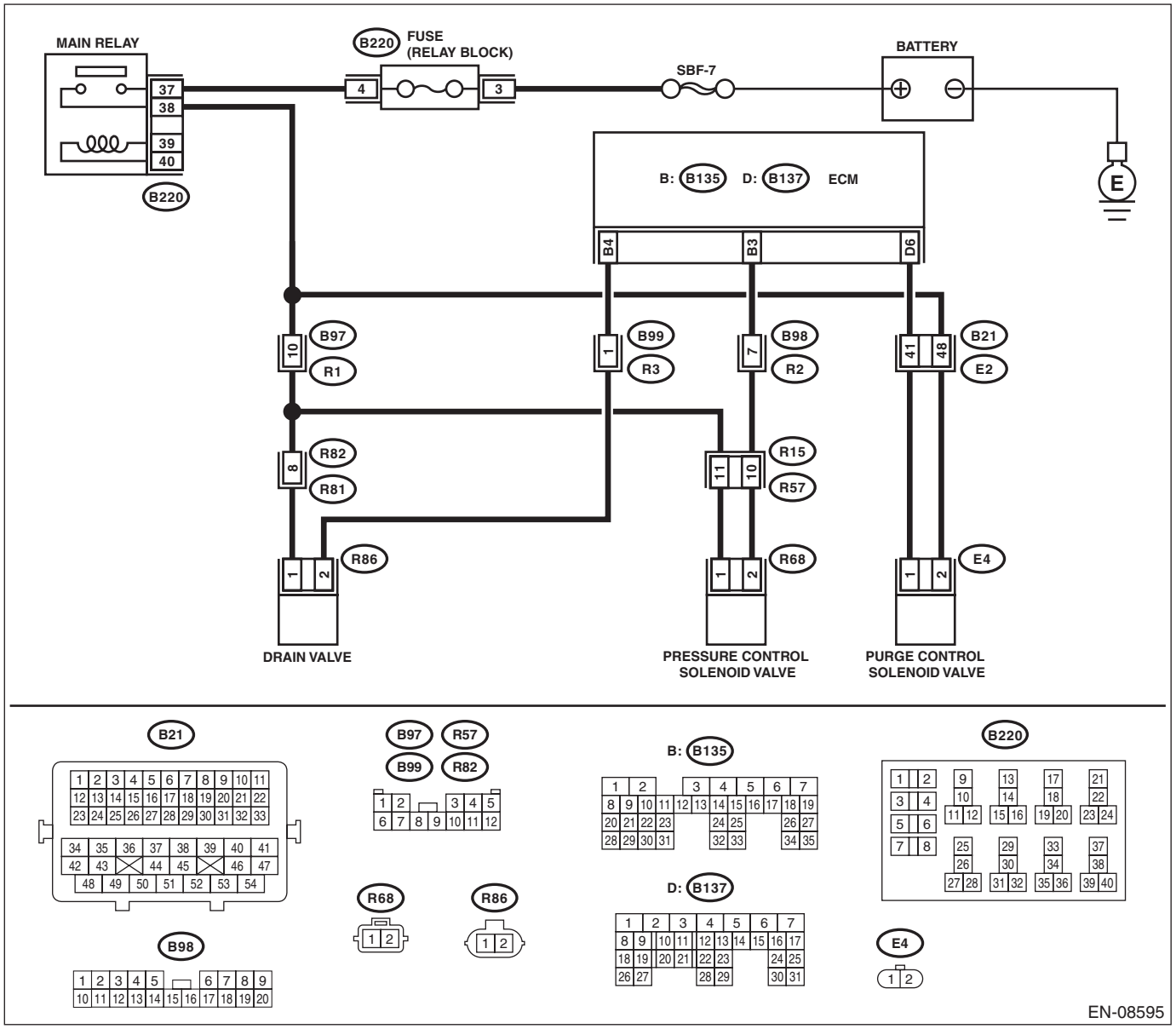
# BL:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

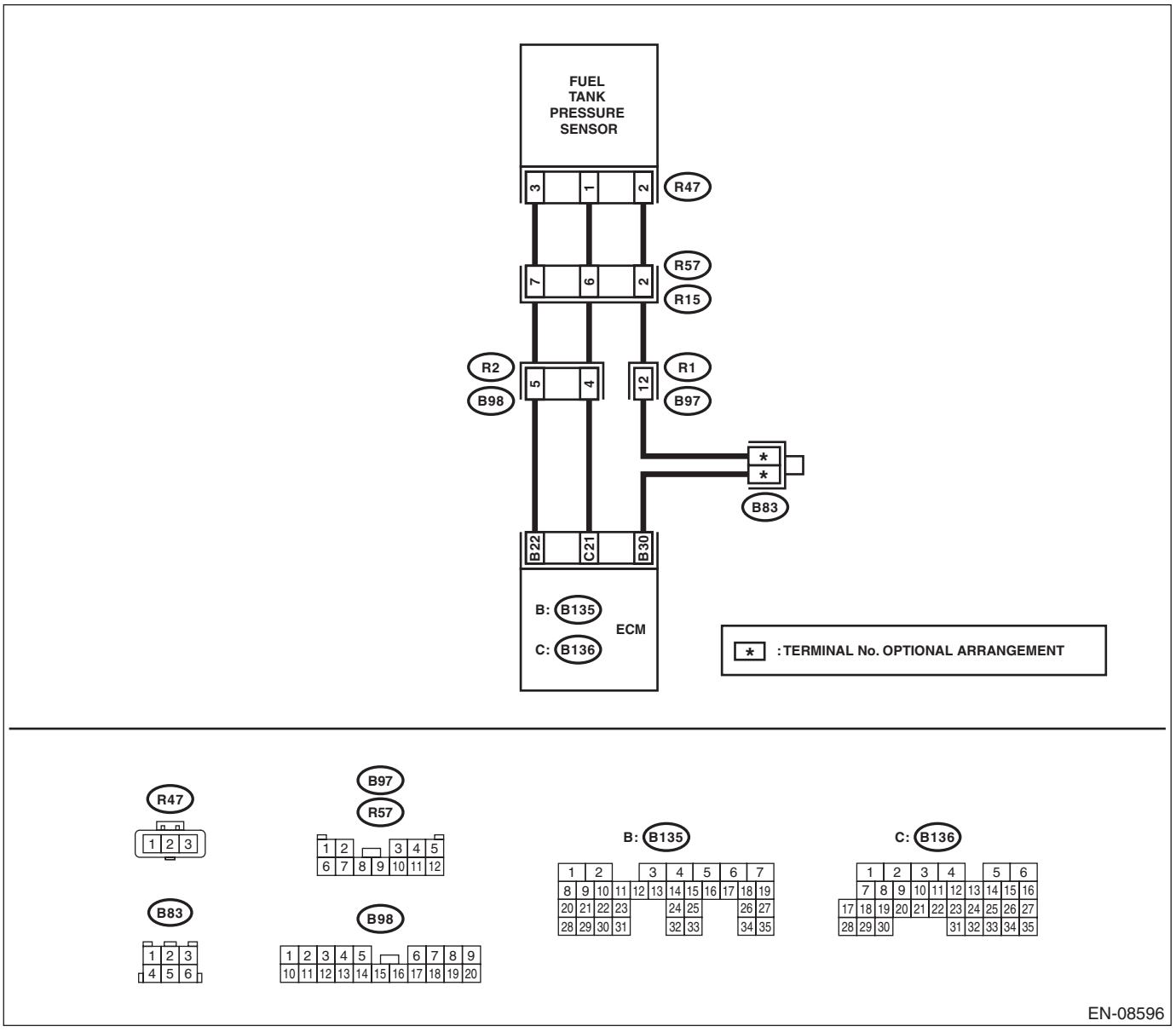
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-131, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**






| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK PRESSURE CONTROL SOLENOID VALVE AND EVAPORATION HOSE.**<br>Check the pressure control solenoid valve and the evaporation hose. <Ref. to EC(H4SO)-17, INSPECTION, Pressure Control Solenoid Valve.> | Is the pressure control solenoid valve and the evaporation hose normal? | Go to step **2**. | Replace the pressure control solenoid valve or the evaporation hose. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |
| 2 | **CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the ECM and pressure control solenoid valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 3 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector. | Go to step **3**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK PRESSURE CONTROL SOLENOID VALVE.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between pressure control solenoid valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 20 — 30 Ω? | Go to step **4**. | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |
| 4 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Go to step **5**. |
| 5 | **CHECK CURRENT DATA.**<br>1) Turn the ignition switch to ON.<br>2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more? | Go to step **6**. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |
| 6 | **CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the fuel tank pressure sensor.<br>3) Turn the ignition switch to ON.<br>4) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more? | Repair the short circuit to power in the harness between ECM and fuel tank pressure sensor connector. | Go to step **7**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 7 | **CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance of harness between fuel tank pressure sensor connector and engine ground.<br>***Connector & terminal***<br>***(R47) No. 2 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **8**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and fuel tank pressure sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector<br>• Poor contact of joint connector |
| 8 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of the fuel tank pressure sensor connector. | Is there poor contact of fuel tank pressure sensor connector? | Repair the poor contact of fuel tank pressure sensor connector. | Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.> |

# BM:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-132, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Fuel odor
- There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FUEL FILLER CAP.**<br>1) Turn the ignition switch to OFF.<br>2) Check the fuel filler cap.<br>NOTE:<br>The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening. | Is the fuel filler cap tightened securely? | Go to step **2**. | Tighten fuel filler cap securely. |
| 2 | **CHECK FUEL FILLER CAP.** | Is the fuel filler cap genuine? | Go to step **3**. | Replace with a genuine fuel filler cap. |
| 3 | **CHECK FUEL FILLER PIPE GASKET.** | Is there any damage to the seal between fuel filler cap and fuel filler pipe? | Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-62, Fuel Filler Pipe.> | Go to step **4**. |
| 4 | **CHECK DRAIN VALVE OPERATION.**<br>1) Connect the delivery (test) mode connector.<br>2) Turn the ignition switch to ON.<br>3) Perform operation check for the drain valve using the Subaru Select Monitor.<br>NOTE:<br>Drain valve can be operated using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the drain valve operate? | Go to step **5**. | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> |
| 5 | **CHECK OPERATION OF PURGE CONTROL SOLENOID VALVE.**<br>Perform operation check for the purge control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the purge control solenoid valve operate? | Go to step **6**. | Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK OPERATION OF PRESSURE CONTROL SOLENOID VALVE.**<br>Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the pressure control solenoid valve operate? | Go to step **7**. | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |
| 7 | **CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.**<br>1) Turn the ignition switch to OFF.<br>2) Check the delivery (test) mode connector is disconnected. | Is there any hole of more than 0.5 mm (0.020 in) dia. on evaporation line? | Repair or replace the evaporation line. <Ref. to FU(H4SO)-77, Fuel Delivery and Evaporation Lines.> | Go to step **8**. |
| 8 | **CHECK CANISTER.** | Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it? | Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.> | Go to step **9**. |
| 9 | **CHECK FUEL TANK.**<br>Remove the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Is the fuel tank damaged or is there any hole of more than 0.5 mm (0.020 in) dia. in it? | Repair or replace the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Go to step **10**. |
| 10 | **CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.** | Is there any hole of more than 0.5 mm (0.020 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system? | Repair or replace the hoses or pipes. | Repair the poor contact of ECM connector. |

## BN:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-132, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Fuel odor
- Fuel filler cap loose or lost

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FUEL FILLER CAP.**<br>1) Turn the ignition switch to OFF.<br>2) Check the fuel filler cap.<br>NOTE:<br>The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening. | Is the fuel filler cap tightened securely? | Go to step **2**. | Tighten fuel filler cap securely. |
| 2 | **CHECK FUEL FILLER CAP.** | Is the fuel filler cap genuine? | Go to step **3**. | Replace with a genuine fuel filler cap. |
| 3 | **CHECK FUEL FILLER PIPE GASKET.** | Is there any damage to the seal between fuel filler cap and fuel filler pipe? | Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-62, Fuel Filler Pipe.> | Go to step **4**. |
| 4 | **CHECK DRAIN VALVE OPERATION.**<br>1) Connect the delivery (test) mode connector.<br>2) Turn the ignition switch to ON.<br>3) Perform operation check for the drain valve using the Subaru Select Monitor.<br>NOTE:<br>Drain valve can be operated using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the drain valve operate? | Go to step **5**. | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> |
| 5 | **CHECK OPERATION OF PURGE CONTROL SOLENOID VALVE.**<br>Perform operation check for the purge control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the purge control solenoid valve operate? | Go to step **6**. | Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK OPERATION OF PRESSURE CONTROL SOLENOID VALVE.**<br>Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor.<br>NOTE:<br>The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the pressure control solenoid valve operate? | Go to step **7**. | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |
| 7 | **CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.**<br>1) Turn the ignition switch to OFF.<br>2) Check the delivery (test) mode connector is disconnected. | Is there any disconnection, damage or clogging on the evaporation line? | Repair or replace the evaporation line. <Ref. to FU(H4SO)-77, Fuel Delivery and Evaporation Lines.> | Go to step **8**. |
| 8 | **CHECK CANISTER.** | Is the canister damaged? | Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.> | Go to step **9**. |
| 9 | **CHECK FUEL TANK.**<br>Remove the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Is the fuel tank damaged? | Repair or replace the fuel tank. <Ref. to FU(H4SO)-55, Fuel Tank.> | Go to step **10**. |
| 10 | **CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.** | Are there holes, cracks, clogging, or disconnections, misconnection of hoses or pipes in evaporative emission control system? | Repair or replace the hoses or pipes. | Repair the poor contact of ECM connector. |

# BO:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-133, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

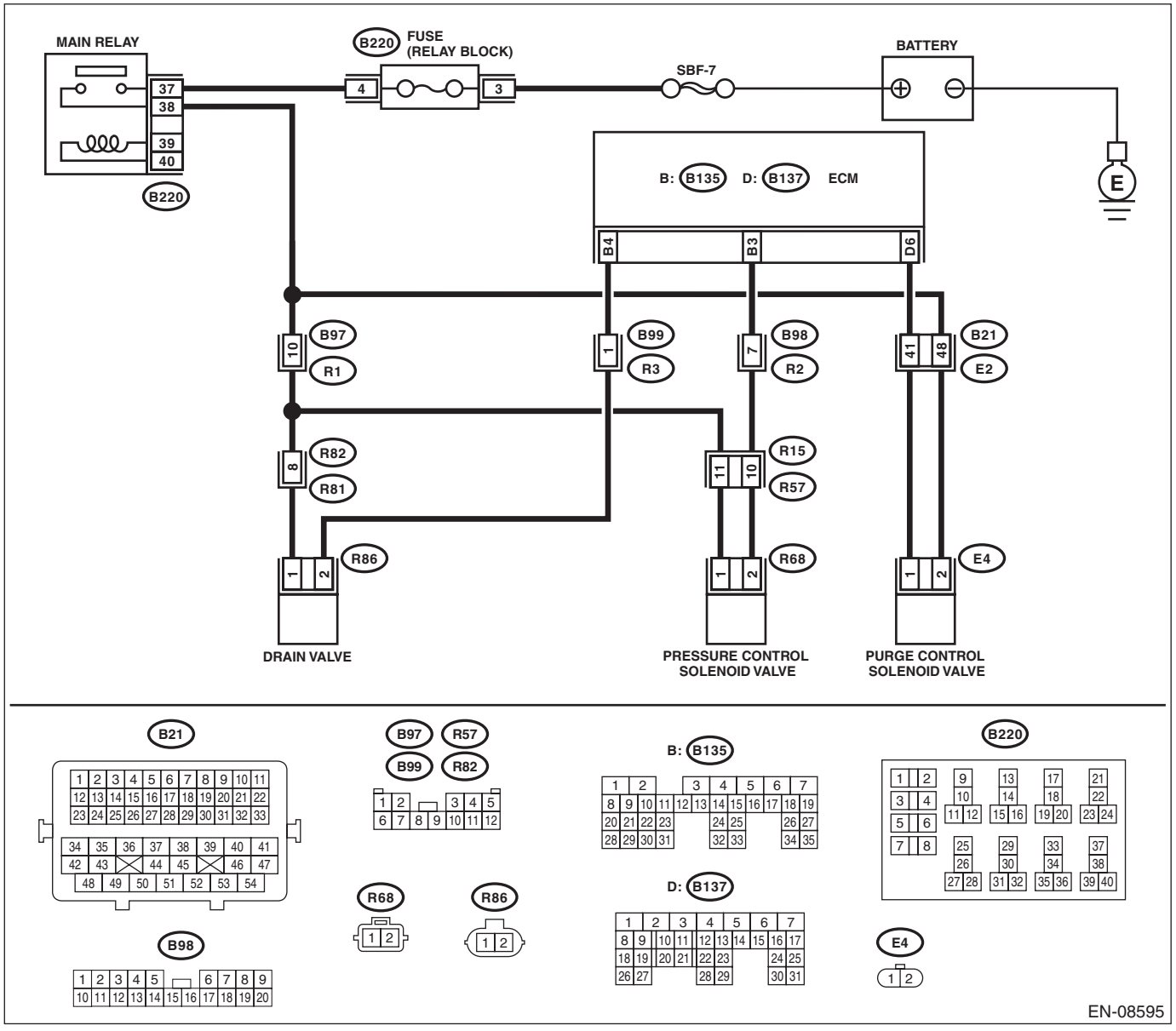
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 6 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Go to step **3**. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause. |
| 3 | **CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.**<br>Measure the voltage between purge control solenoid valve connector and engine ground.<br>***Connector & terminal***<br>***(E4) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **4**. | Repair the power supply circuit. |
| 4 | **CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and purge control solenoid valve.<br>3) Measure the resistance between the purge control solenoid valve connector and engine ground.<br>***Connector & terminal***<br>***(E4) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and purge control solenoid valve connector. |
| 5 | **CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.**<br>Measure the resistance of harness between ECM and purge control solenoid valve.<br>***Connector & terminal***<br>***(B137) No. 6 — (E4) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **6**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and purge control solenoid valve connector<br>• Poor contact of coupling connector |
| 6 | **CHECK PURGE CONTROL SOLENOID VALVE.**<br>1) Remove the purge control solenoid valve.<br>2) Measure the resistance between purge control solenoid valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 10 — 100 Ω? | Repair the poor contact of purge control solenoid valve connector. | Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.> |

# BP:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-135, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

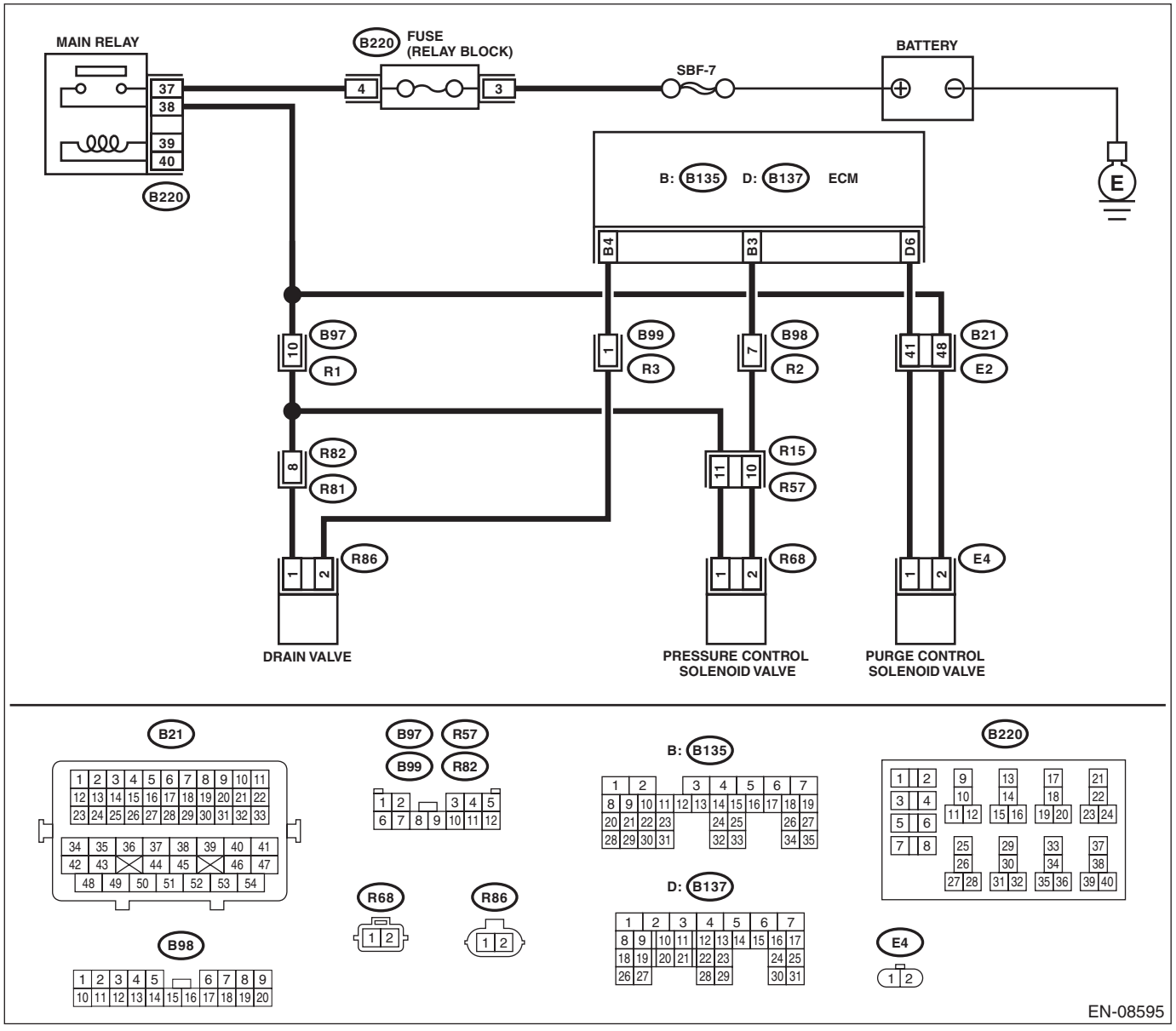
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and purge control solenoid valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 6 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and purge control solenoid valve connector. | Go to step **2**. |
| 2 | **CHECK PURGE CONTROL SOLENOID VALVE.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between purge control solenoid valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.> | Repair the poor contact of ECM connector. |

## BQ:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-137, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H4SO)-68, Fuel Level Sensor.> <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.> |

## BR:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

NOTE:
For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4SO)(diag)-218, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## BS:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-141, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is DTC P0462 or P0463 displayed on the Subaru Select Monitor? | Check the combination meter. <Ref. to IDI-7, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.> | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |

## BT:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-143, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is DTC P0464 displayed on the display? | Check the combination meter. <Ref. to IDI-7, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.> | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |

## BU:DTC P0500 VEHICLE SPEED SENSOR “A”

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-146, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK DTC OF VDC.**<br>Check DTC of VDC. | Is DTC of VDC displayed? | Perform the diagnosis according to DTC. <Ref. to VDC(diag)-35, List of Diagnostic Trouble Code (DTC).> | Repair the poor contact of ECM connector. |

## BV:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-147, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Hard to start the engine.
- Engine does not start.
- Improper idling
- Engine stalls.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK AIR CLEANER ELEMENT.**<br>1) Turn the ignition switch to OFF.<br>2) Check the air cleaner element. | Is there excessive clogging on air cleaner element? | Replace the air cleaner element. <Ref. to IN(H4SO)-4, Air Cleaner Element.> | Go to step **3**. |
| 3 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>1) Remove the electronic throttle control. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.><br>2) Check the electronic throttle control. | Are foreign matter found inside electronic throttle control? | Remove foreign matter from electronic throttle control. | Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

## BW:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-148, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

Engine keeps running at higher speed than specified idle speed.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK AIR INTAKE SYSTEM.**<br>1) Start and idle the engine.<br>2) Check the following items.<br>• Loose installation of intake manifold and throttle body<br>• Cracks of intake manifold gasket and throttle body gasket<br>• Disconnection of vacuum hoses | Is there any fault in air intake system? | Repair air suction and leaks. | Go to step **3**. |
| 3 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the electronic throttle control. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.><br>3) Check the electronic throttle control. | Are foreign matter found inside electronic throttle control? | Remove foreign matter from electronic throttle control. | Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

## BX:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

**DTC DETECTING CONDITION:**

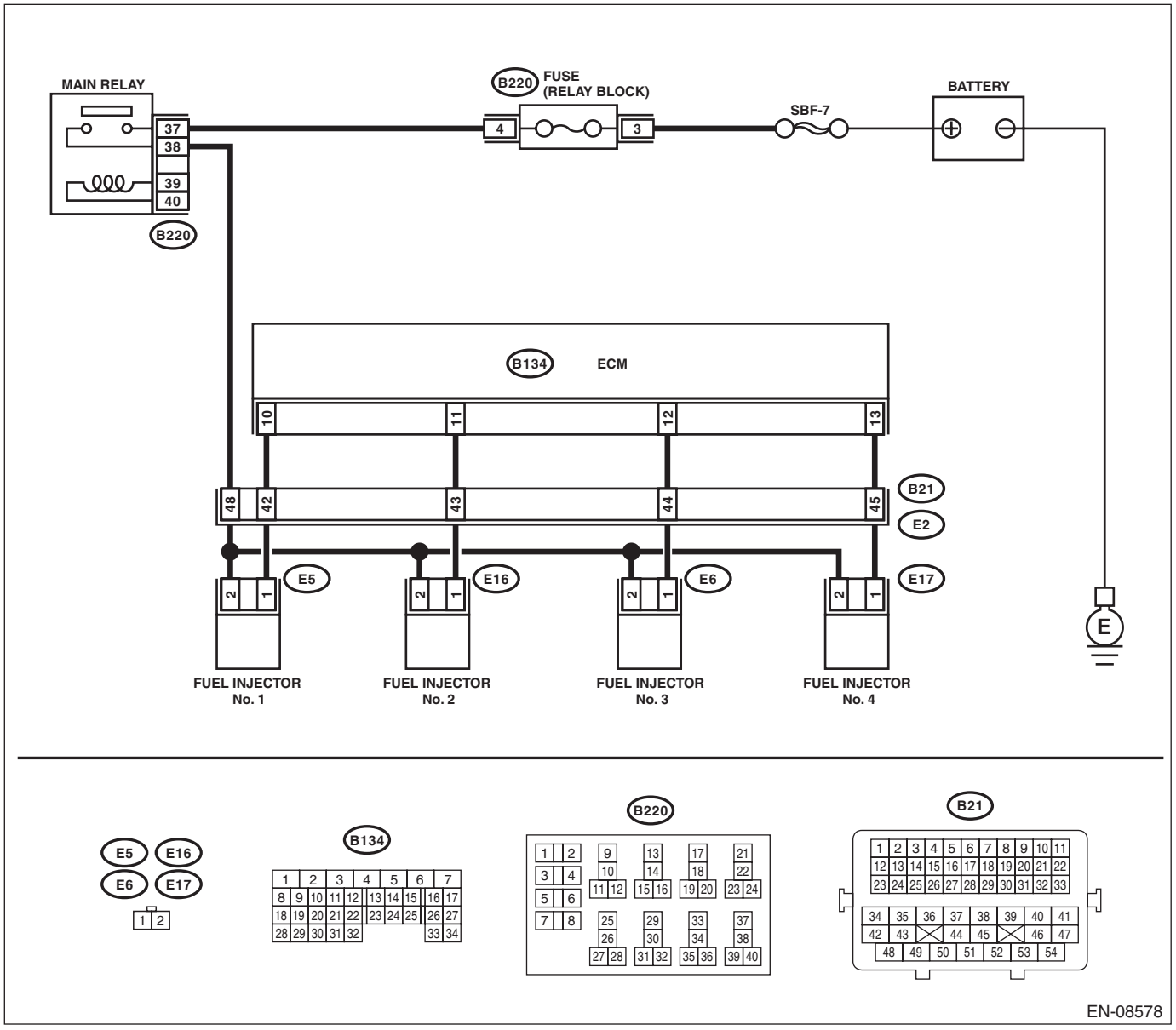
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-149, 0, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

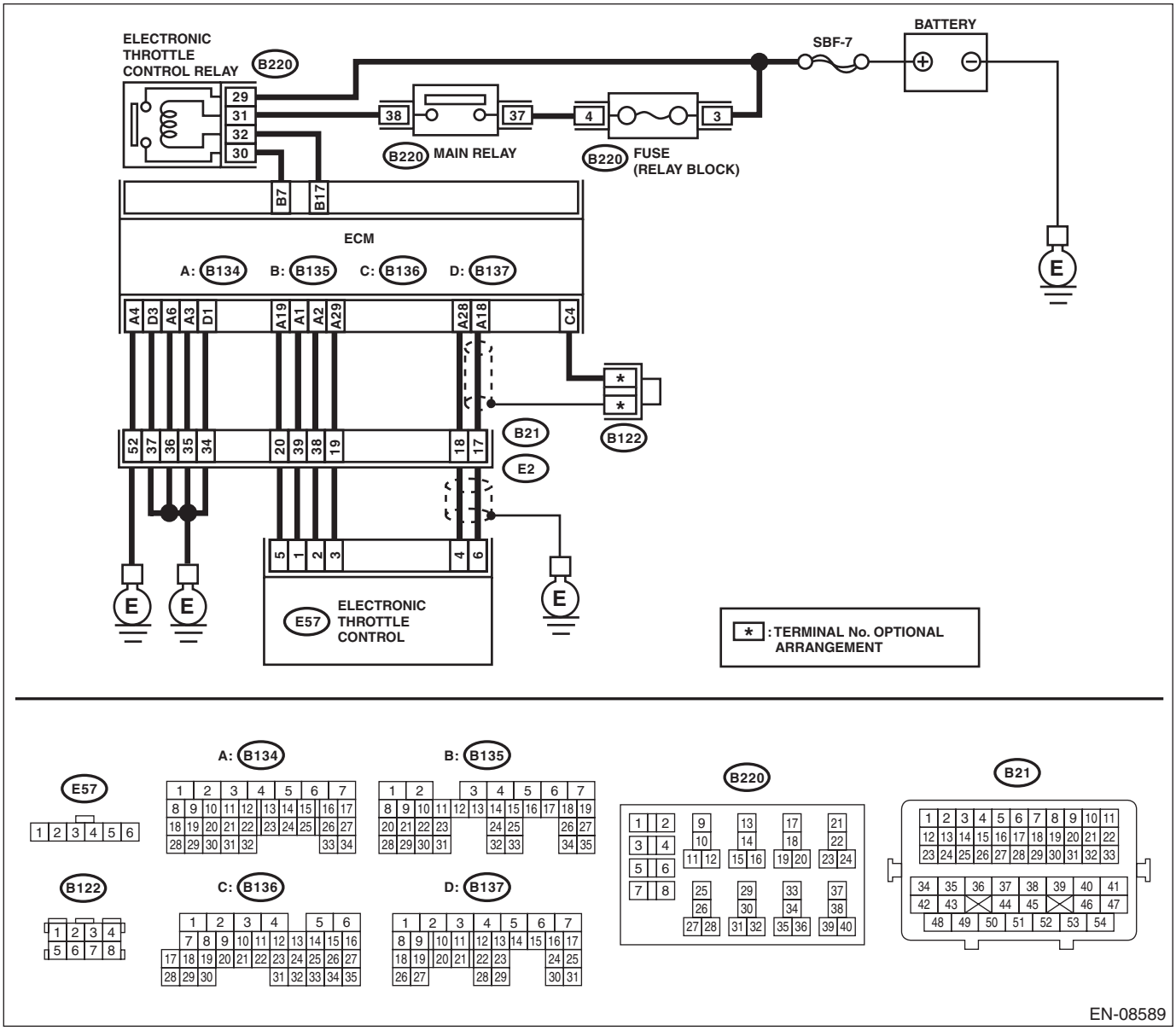
- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




EN-08578




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK ENGINE OIL.** | Is there a proper amount of engine oil? | Go to step **3**. | Replace engine oil. <Ref. to LU(H4SO)-9, REPLACEMENT, Engine Oil.> |
| 3 | **CHECK EXHAUST SYSTEM.** | Are there holes or loose bolts on exhaust system? | Repair the exhaust system. | Go to step **4**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 4 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **5**. |
| 5 | **CHECK FUEL PRESSURE.**<br>**WARNING:**<br>**Place "NO OPEN FLAMES" signs near the working area.**<br>**CAUTION:**<br>**Be careful not to spill fuel.**<br>Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.><br>**CAUTION:**<br>**Release fuel pressure before removing the fuel pressure gauge.** | Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm$^2$, 49 — 58 psi)? | Go to step **6**. | Repair the following item.<br>Fuel pressure is too high:<br>• Clogged fuel line or bent hose<br>Fuel pressure is too low:<br>• Improper fuel pump discharge<br>• Clogged fuel line |
| 6 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Start the engine and warm up completely.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Go to step **7**. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |
| 7 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)? | Go to step **8**. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 8 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Open the front hood.<br>6) Measure the ambient temperature.<br>7) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)? | Go to step **9**. | Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |
| 9 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **14**. | Go to step **10**. |
| 10 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 1 — Engine ground:***<br>***#2 (E16) No. 1 — Engine ground:***<br>***#3 (E6) No. 1 — Engine ground:***<br>***#4 (E17) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **11**. | Repair the short circuit to ground in harness between ECM and fuel injector connector. |
| 11 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>Measure the resistance of harness between ECM and fuel injector connector on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 — (E5) No. 1:***<br>***#2 (B134) No. 11 — (E16) No. 1:***<br>***#3 (B134) No. 12 — (E6) No. 1:***<br>***#4 (B134) No. 13 — (E17) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **12**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and fuel injector connector<br>• Poor contact of coupling connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 12 | **CHECK FUEL INJECTOR.**<br>Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Go to step **13**. | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> |
| 13 | **CHECK POWER SUPPLY LINE.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between fuel injector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 2 (+) — Engine ground (–):***<br>***#2 (E16) No. 2 (+) — Engine ground (–):***<br>***#3 (E6) No. 2 (+) — Engine ground (–):***<br>***#4 (E17) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of all connectors in fuel injector circuit. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders<br>• Poor contact of coupling connector<br>• Poor contact of main relay connector |
| 14 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between the ECM and fuel injector. | Go to step **15**. |
| 15 | **CHECK FUEL INJECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> | Go to step **16**. |
| 16 | **CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.** | Is the camshaft position sensor or crankshaft position sensor loosely installed? | Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> | Go to step **17**. |
| 17 | **CHECK CRANK SPROCKET.**<br>Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.> | Is the crank sprocket rusted or does it have broken teeth? | Replace the crank sprocket. <Ref. to ME(H4SO)-56, Crank Sprocket.> | Go to step **18**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 18 | **CHECK INSTALLATION CONDITION OF TIMING BELT.**<br>Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block.<br>ST 499987500 CRANKSHAFT SOCKET | Is the timing belt dislocated from its proper position? | Repair the installation condition of timing belt. <Ref. to ME(H4SO)-50, Timing Belt.> | Go to step **19**. |
| 19 | **CHECK ELECTRONIC THROTTLE CONTROL RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the electronic throttle control relay.<br>3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay.<br>4) Measure the resistance between electronic throttle control relay terminals.<br>***Terminals***<br>***No. 29 — No. 30:*** | Is the resistance less than 1 Ω? | Go to step **20**. | Replace the electronic throttle control relay. <Ref. to FU(H4SO)-51, Electronic Throttle Control Relay.> |
| 20 | **CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.**<br>Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 29 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **21**. | Repair the open or ground short circuit of power supply circuit. |
| 21 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector. | Go to step **22**. |
| 22 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 — Chassis ground:***<br>***(B220) No. 30 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **23**. | Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector. |
| 23 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>Measure the resistance between ECM and electronic throttle control relay connector.<br>***Connector & terminal***<br>***(B135) No. 17 — (B220) No. 32:***<br>***(B135) No. 7 — (B220) No. 30:*** | Is the resistance less than 1 Ω? | Go to step **24**. | Repair the open circuit in harness between ECM and electronic throttle control relay connector. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 24 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 19 — Chassis ground:***<br>***(B134) No. 18 — Chassis ground:***<br>***(B134) No. 18 — (B136) No. 4:***<br>***(B134) No. 28 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **25**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 25 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 — Engine ground:***<br>***(E57) No. 4 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **26**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |
| 26 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 18 — (E57) No. 6:***<br>***(B134) No. 28 — (E57) No. 4:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **27**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 27 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **28**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 28 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 (+) — Engine ground (–):***<br>***(E57) No. 4 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **29**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 29 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B134) No. 19 — (B134) No. 18:***<br>***(B134) No. 19 — (B134) No. 28:*** | Is the resistance 1 MΩ or more? | Go to step **30**. | Repair the short circuit to power in harness between ECM and electronic throttle control connector. |
| 30 | **CHECK SENSOR OUTPUT.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Read the data of main throttle sensor signal using Subaru Select Monitor.<br>NOTE:<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the voltage 0.81 — 0.87 V? | Go to step **31**. | Repair the poor contact of electronic throttle control connector.<br>Replace the electronic throttle control if defective.<br><Ref. to FU(H4SO)-14, Throttle Body.> |
| 31 | **CHECK SENSOR OUTPUT.**<br>Read the data of sub throttle sensor signal using Subaru Select Monitor.<br>NOTE:<br>Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the voltage 1.64 — 1.70 V? | Go to step **32**. | Repair the poor contact of electronic throttle control connector.<br>Replace the electronic throttle control if defective.<br><Ref. to FU(H4SO)-14, Throttle Body.> |
| 32 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 2 — (E57) No. 2:***<br>***(B134) No. 1 — (E57) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **33**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 33 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 2 (+) — Engine ground (–):***<br>***(E57) No. 1 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **34**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 34 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 2 — Engine ground:***<br>***(E57) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **35**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 35 | **CHECK HARNESS BETWEEN ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>Measure the resistance between electronic throttle control connectors.<br>***Connector & terminal***<br>***(E57) No. 2 — (E57) No. 1:*** | Is the resistance 1 MΩ or more? | Go to step **36**. | Repair the short circuit of harness between ECM and electronic throttle control connector. |
| 36 | **CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **37**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |
| 37 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>Measure the resistance between electronic throttle control terminals.<br>***Terminals***<br>***No. 2 — No. 1:*** | Is the resistance 50 Ω or less? | Go to step **38**. | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |
| 38 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>Move the throttle valve to the fully open and fully closed positions with fingers.<br>Check that the valve returns to the specified position when releasing fingers. | Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position | Repair the poor contact of ECM connector. | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |

## BY:DTC P050B COLD START IGNITION TIMING PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P050A. <Ref. to EN(H4SO)(diag)-223, 0, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## BZ:DTC P0512 STARTER REQUEST CIRCUIT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-152, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

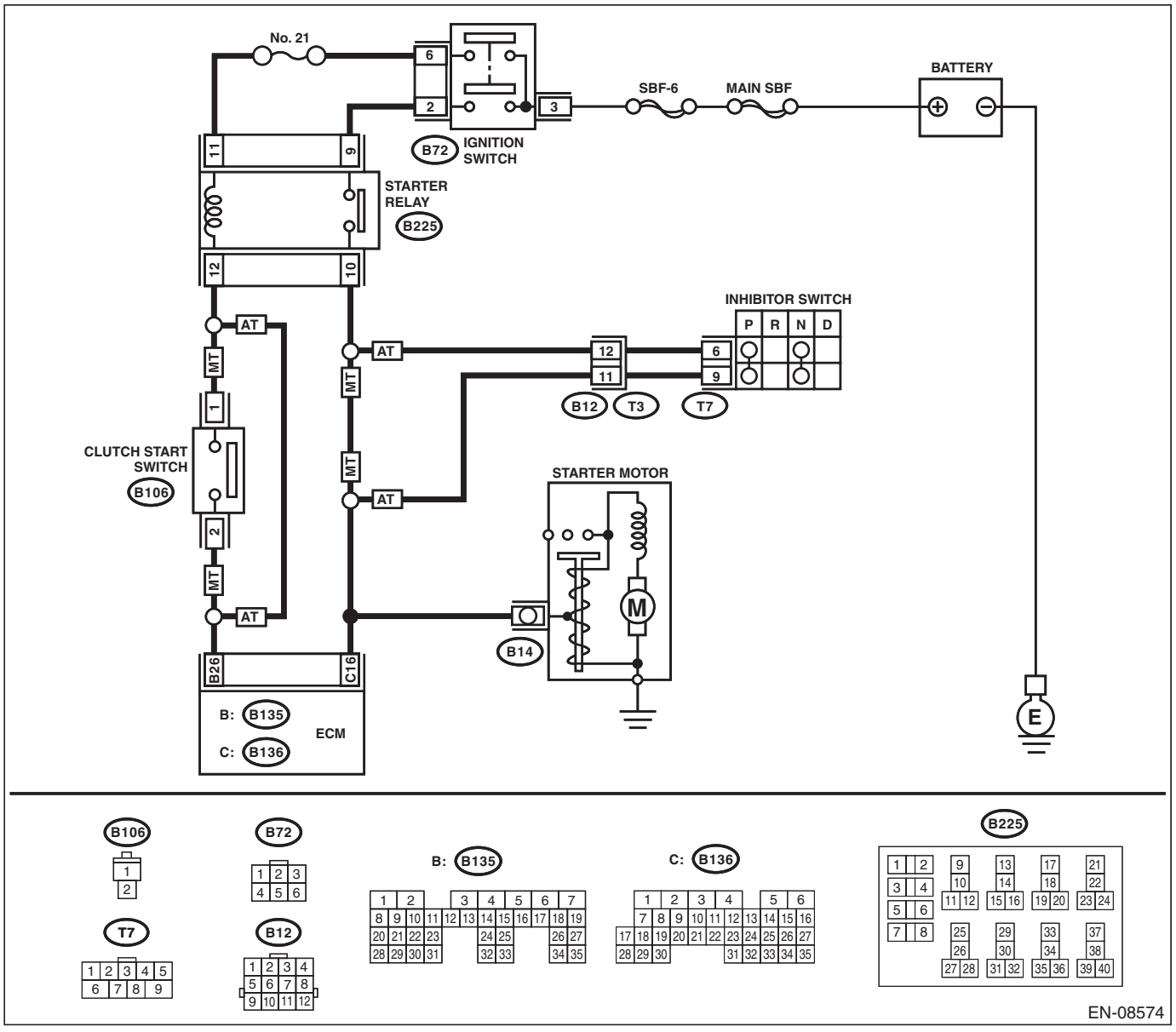
**TROUBLE SYMPTOM:**

Failure of engine to start

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 16 (+) — Chassis ground (–):***<br>NOTE:<br>For AT model, place the select lever in “P” range or “N” range. | Is the voltage 10 V or more? | Repair the short circuit to power supply in harness between ECM and starter relay connector. | Repair the poor contact of ECM connector. |

## CA:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-154, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

- Engine does not start.
- Engine stalls.

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause. |

## CB:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

NOTE:
For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4SO)(diag)-236, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# CC:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-156, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

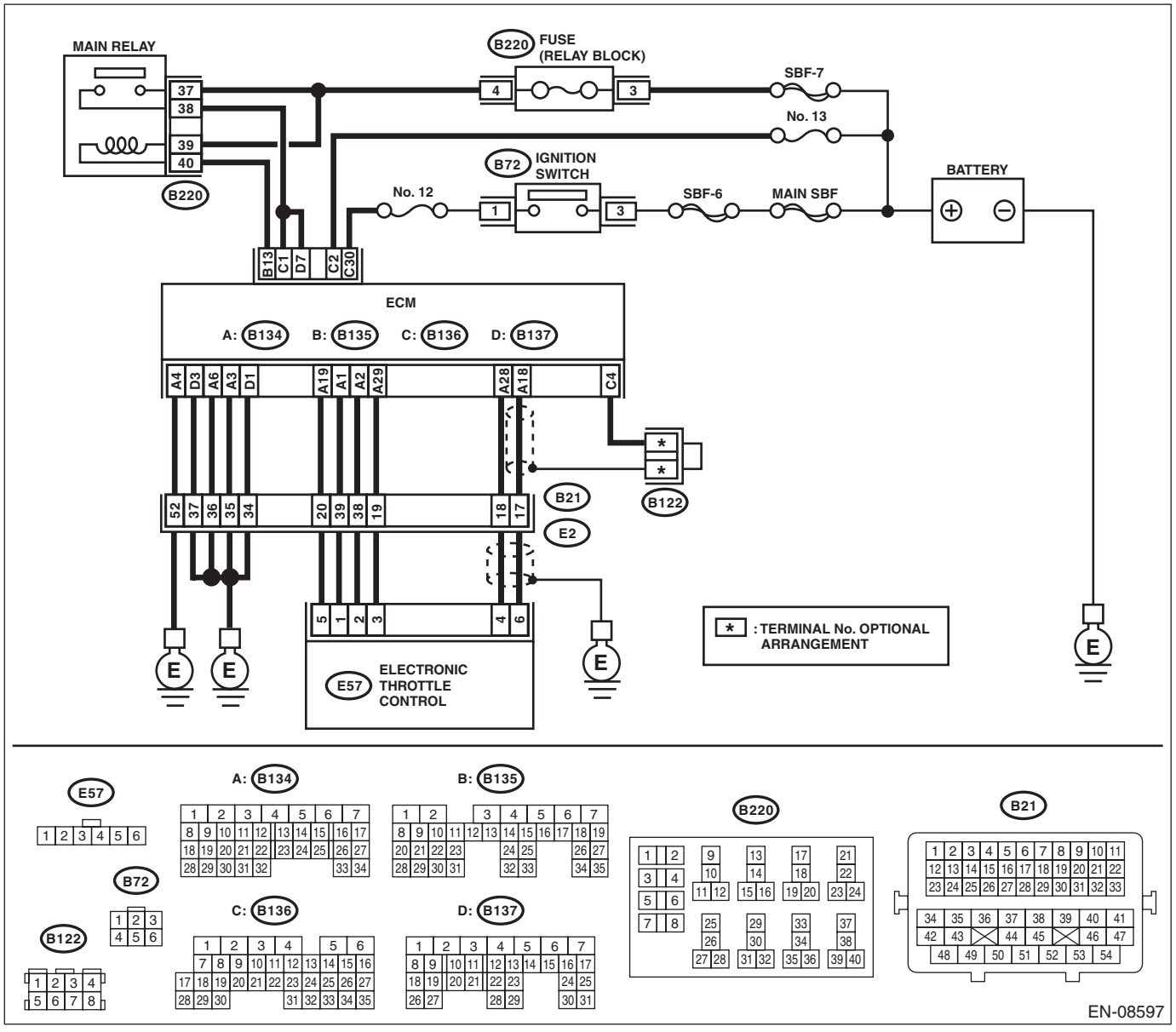
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK INPUT VOLTAGE OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 1 (+) — Chassis ground (–):***<br>***(B137) No. 7 (+) — Chassis ground (–):*** | Is the voltage 10 — 13 V? | Go to step **2**. | Repair the open or ground short circuit of power supply circuit. |
| 2 | **CHECK INPUT VOLTAGE OF ECM.**<br>1) Start the engine.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 1 (+) — Chassis ground (–):***<br>***(B137) No. 7 (+) — Chassis ground (–):*** | Is the voltage 13 — 15 V? | Go to step **3**. | Repair the open or ground short circuit of power supply circuit. |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 19 — (E57) No. 5:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 4 | **CHECK ECM GROUND HARNESS.**<br>Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 (+) — Chassis ground (–):***<br>***(B134) No. 4 (+) — Chassis ground (–):***<br>***(B134) No. 6 (+) — Chassis ground (–):***<br>***(B137) No. 1 (+) — Chassis ground (–):***<br>***(B137) No. 3 (+) — Chassis ground (–):*** | Is the voltage less than 1 V? | Repair the poor contact of ECM connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in ground circuit<br>• Further tightening of the engine ground terminal<br>• Poor contact of coupling connector |

## CD:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CE:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

NOTE:
For the diagnostic procedure, refer to AT section. <Ref. to 4AT(diag)-2, Basic Diagnostic Procedure.>

## CF:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-161, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

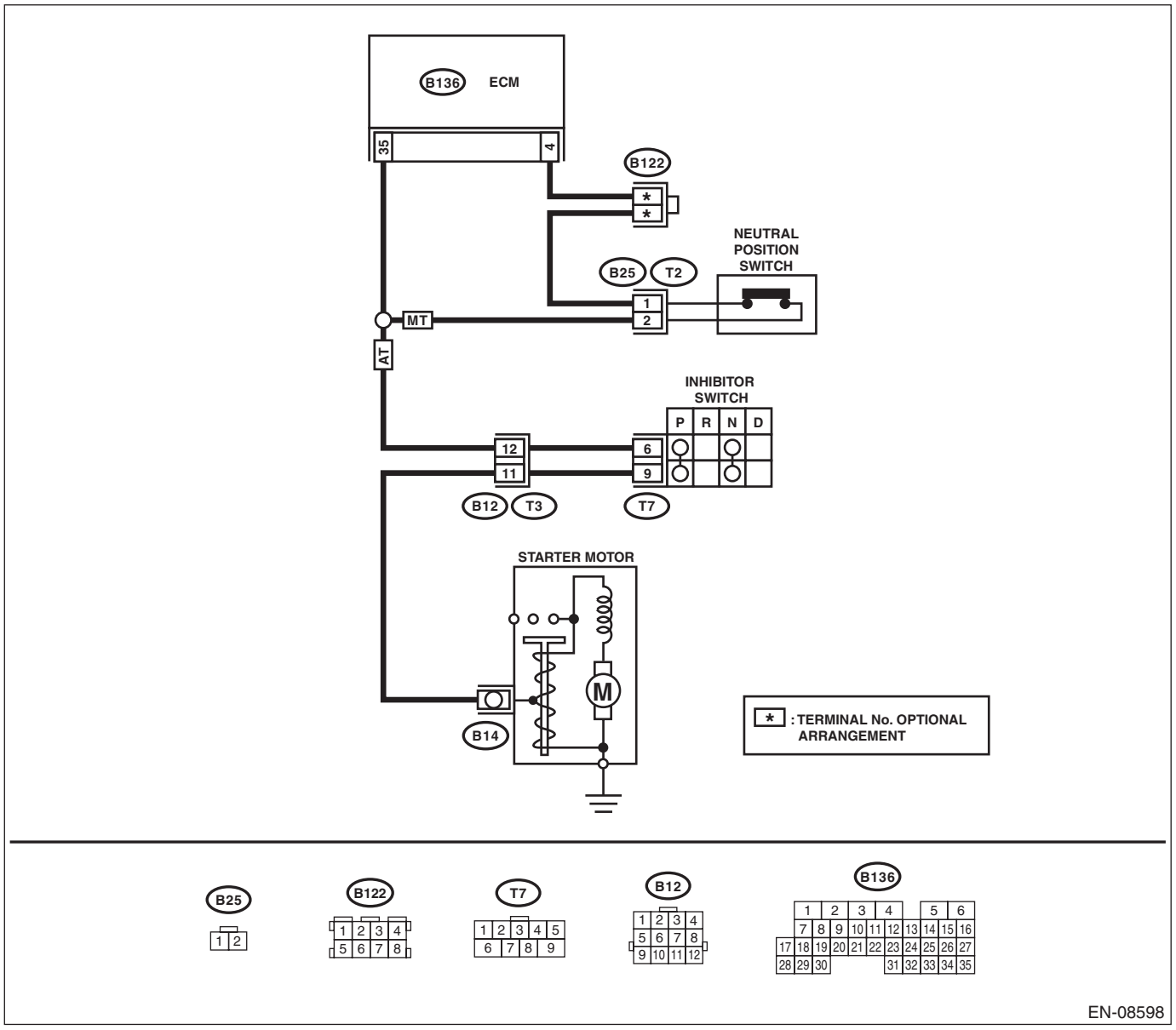
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK SELECT CABLE.** | Is there any fault in select cable? | Repair or adjust the select cable. <Ref. to CS-24, Select Cable.> | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Place the select lever in other than "P" range and "N" range.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 35 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of ECM connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and transmission harness connector (T3).<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 35 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **4**. | Repair the ground short circuit of harness between ECM and transmission harness connector. |
| 4 | **CHECK TRANSMISSION HARNESS CONNECTOR.**<br>1) Disconnect the connector from inhibitor switch.<br>2) Measure the resistance between transmission harness connector and engine ground.<br>***Connector & terminal***<br>***(T3) No. 12 — Engine ground:*** | Is the resistance 1 MΩ or more? | Replace the inhibitor switch. <Ref. to 4AT-45, Inhibitor Switch.> | Repair short circuit to ground in harness between transmission harness connector and inhibitor switch connector. |

## CG:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-162, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

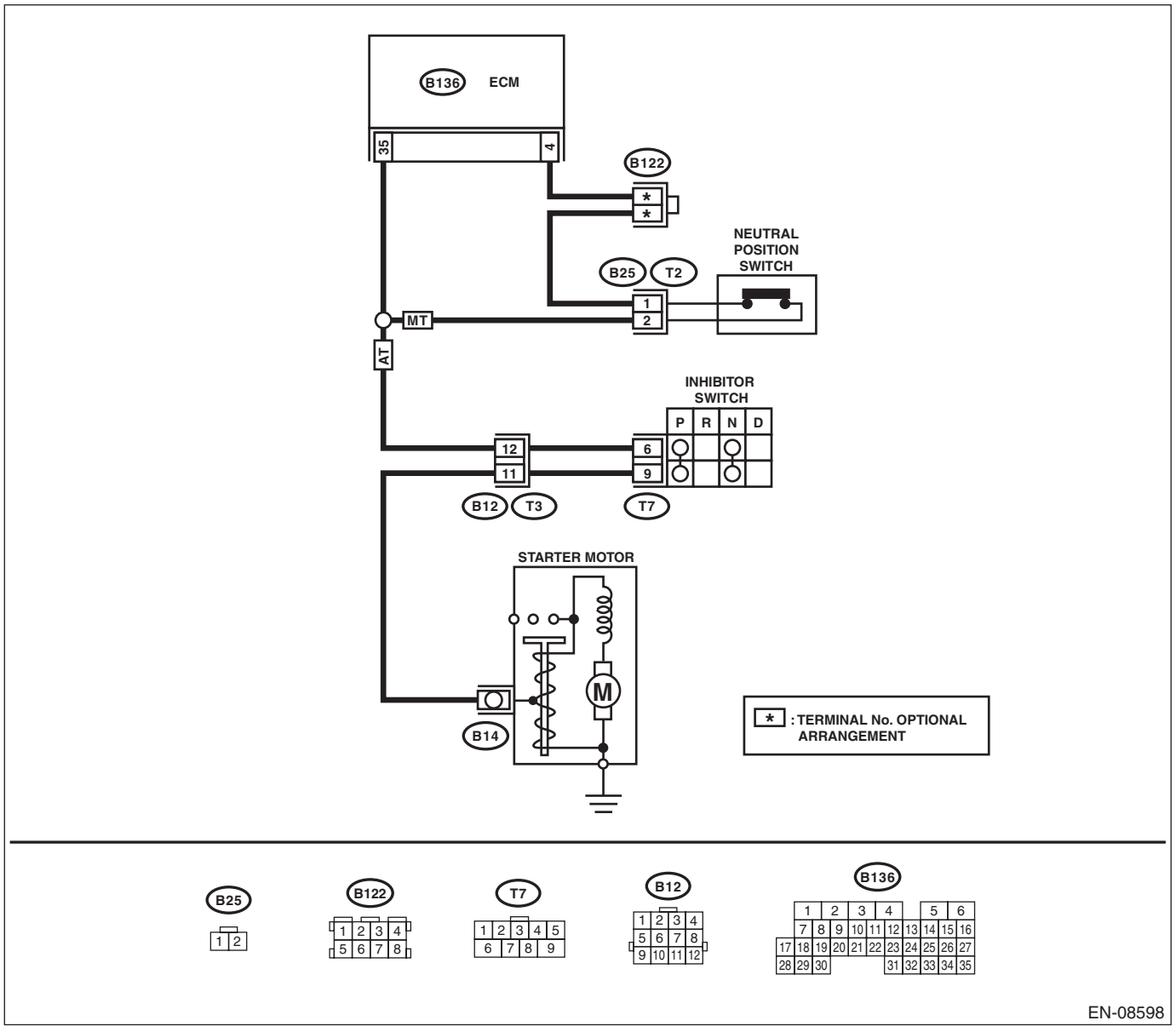
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Place the shift lever in a position other than neutral.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 35 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of ECM connector. | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and neutral position switch.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 35 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the neutral position switch. <Ref. to 5MT-33, Switches and Harness.> | Repair the short circuit to ground harness between ECM and neutral position switch connector. |

# CH:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-163, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

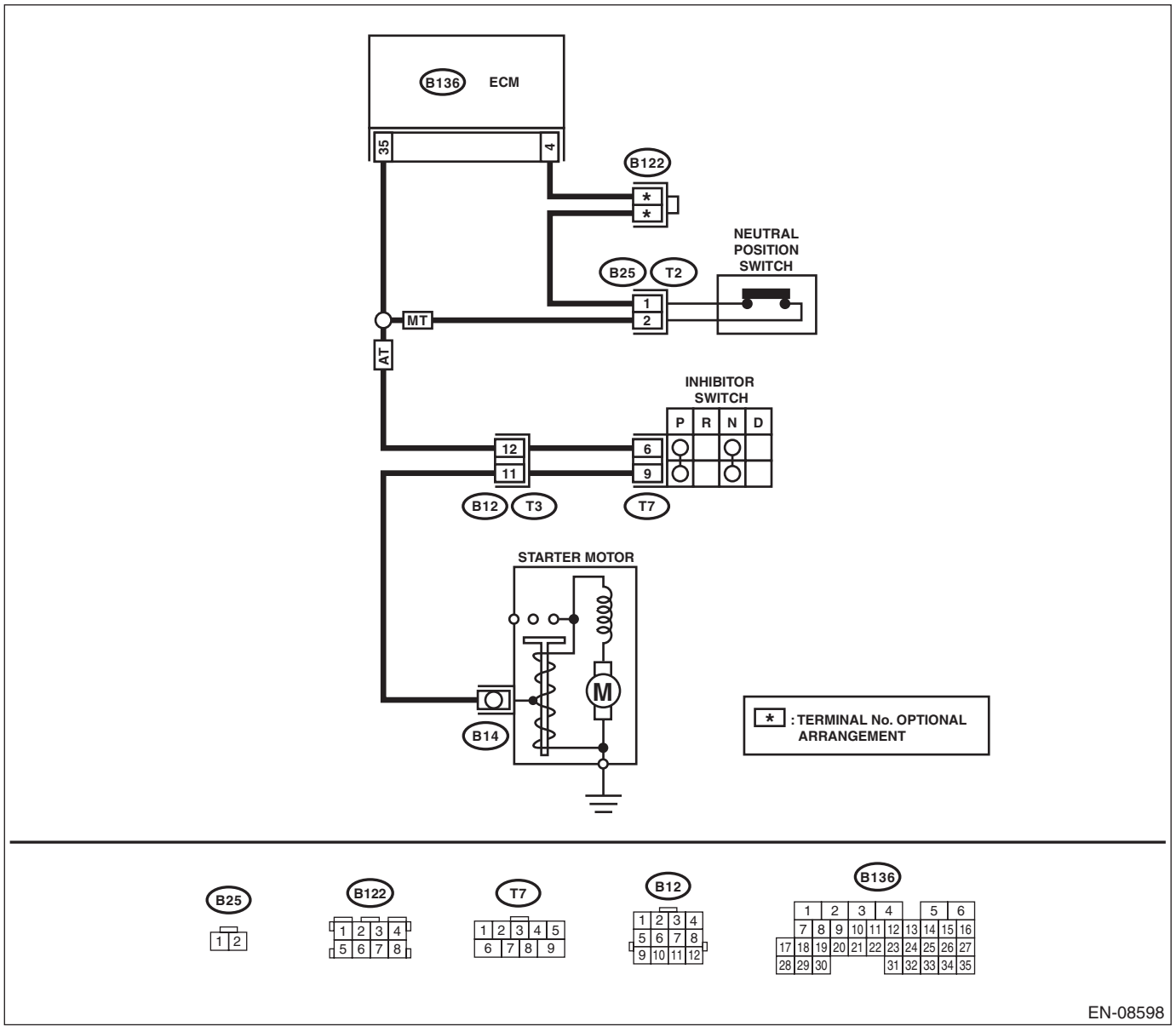
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




EN-08598

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK SELECT CABLE.** | Is there any fault in select cable? | Repair or adjust the select cable. <Ref. to CS-24, Select Cable.> | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground with select lever at "P" range and "N" range.<br>***Connector & terminal***<br>***(B136) No. 35 (+) — Chassis ground (–):*** | Is the voltage less than 1 V? | Repair the poor contact of ECM connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and inhibitor switch.<br>3) Measure the resistance of harness between ECM and inhibitor switch connector.<br>***Connector & terminal***<br>***(B136) No. 35 — (T7) No. 6:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and inhibitor switch connector<br>• Poor contact of coupling connector |
| 4 | **CHECK INHIBITOR SWITCH GROUND LINE.**<br>Measure the resistance of harness between inhibitor switch connector and engine ground.<br>***Connector & terminal***<br>***(T7) No. 9 — Engine ground:*** | Is the resistance less than 5 Ω? | Replace the inhibitor switch. <Ref. to 4AT-45, Inhibitor Switch.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between inhibitor switch connector and starter motor ground line<br>• Poor contact of coupling connector<br>• Poor contact of starter motor connector<br>• Poor contact of starter motor ground<br>• Starter motor |

## CI: DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-164, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

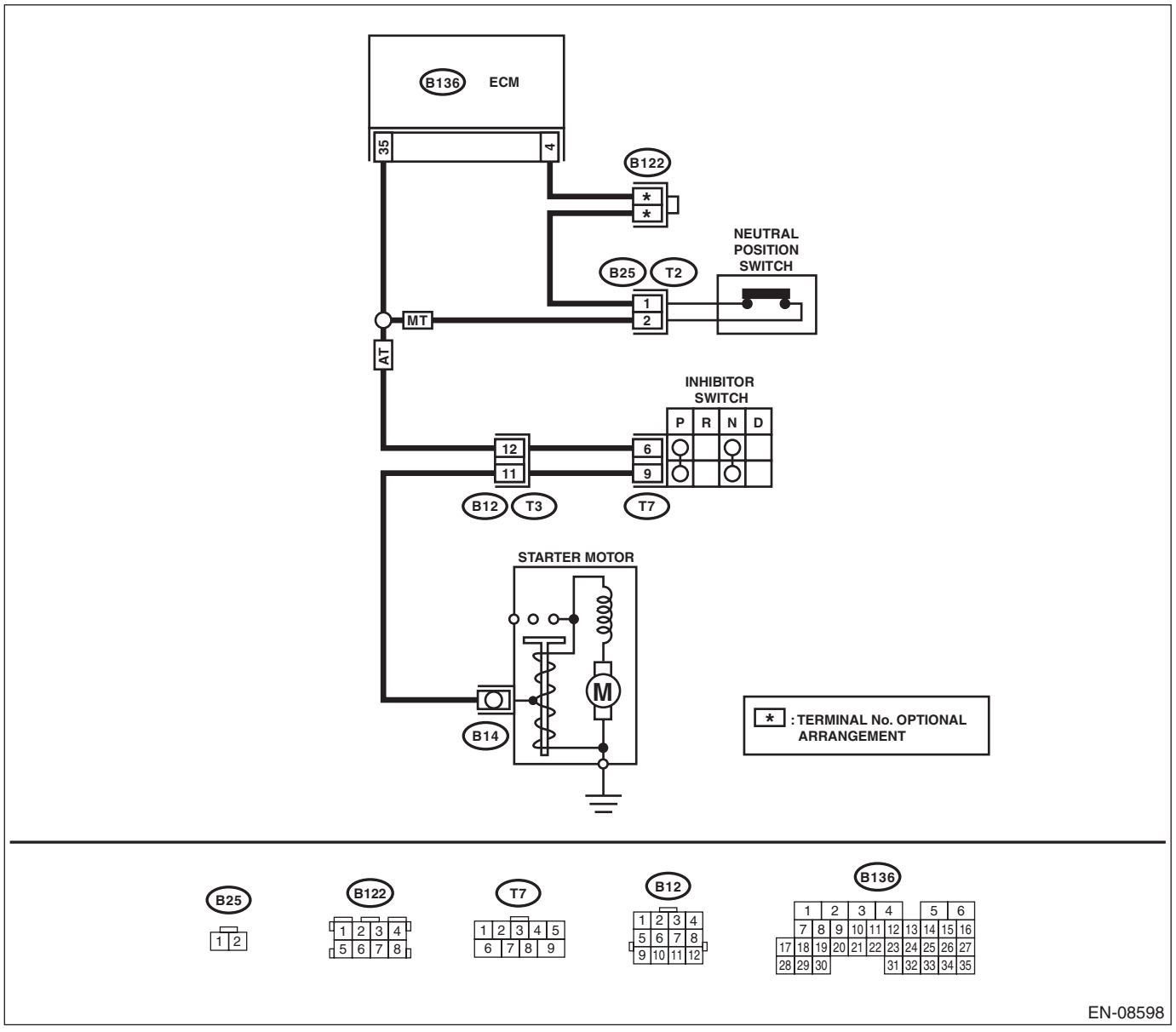
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Place the shift lever in neutral.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 35 (+) — Chassis ground (–):*** | Is the voltage less than 1 V? | Repair the poor contact of ECM connector. | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and neutral position switch.<br>3) Measure the resistance of harness between ECM and neutral position switch connector.<br>***Connector & terminal***<br>***(B136) No. 35 — (B25) No. 2:***<br>***(B136) No. 4 — (B25) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and neutral position switch connector<br>• Poor contact of coupling connector |
| 3 | **CHECK NEUTRAL POSITION SWITCH.**<br>1) Place the shift lever in neutral.<br>2) Measure the resistance between neutral position switch terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Repair the poor contact of neutral position switch connector. | Replace the neutral position switch. <Ref. to 5MT-33, Switches and Harness.> |

# CJ:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

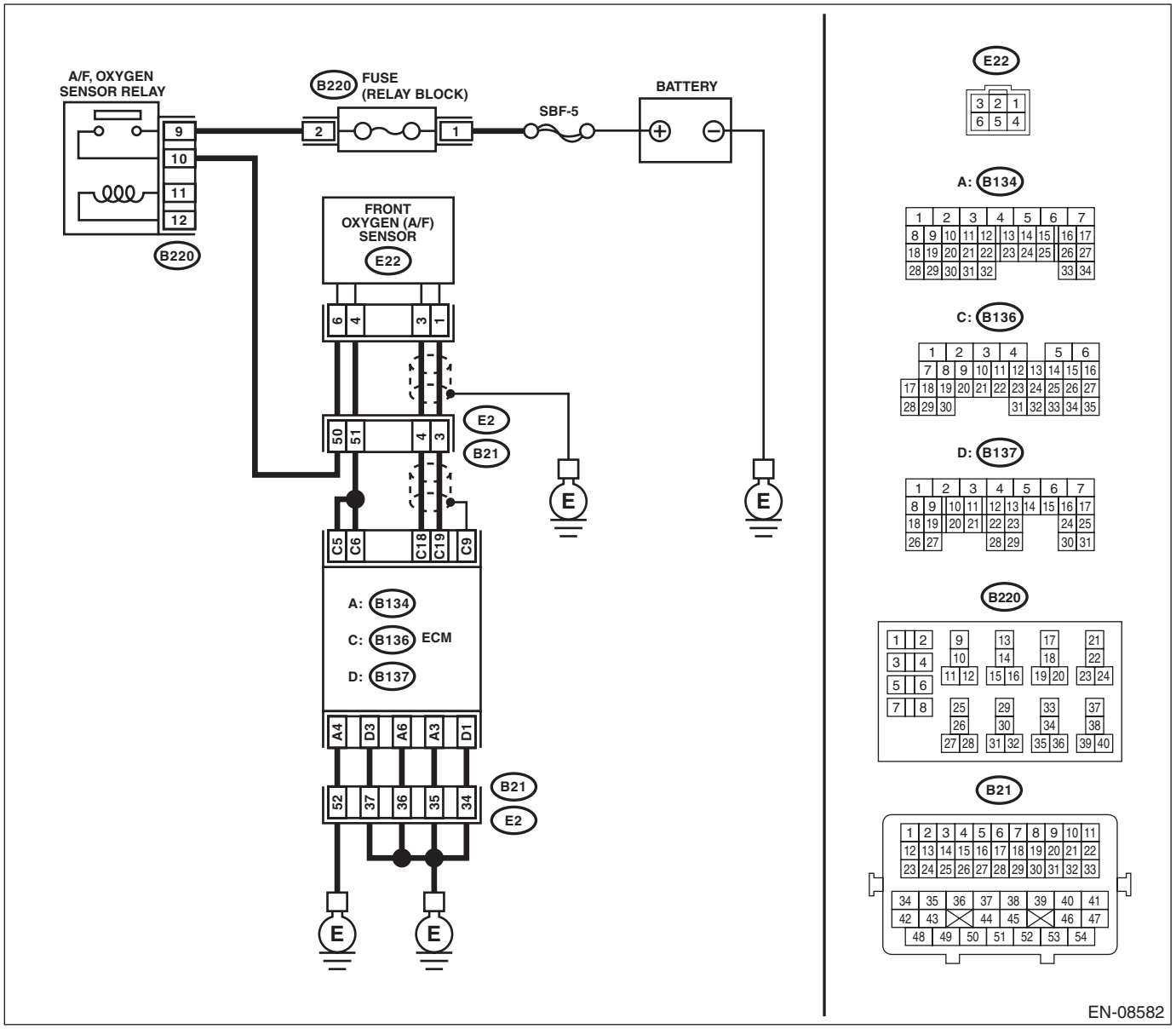
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-165, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor.<br>3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 3 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of the front oxygen (A/F) sensor connector. | Is there poor contact of front oxygen (A/F) sensor connector? | Repair the poor contact of front oxygen (A/F) sensor connector. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |

## CK:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

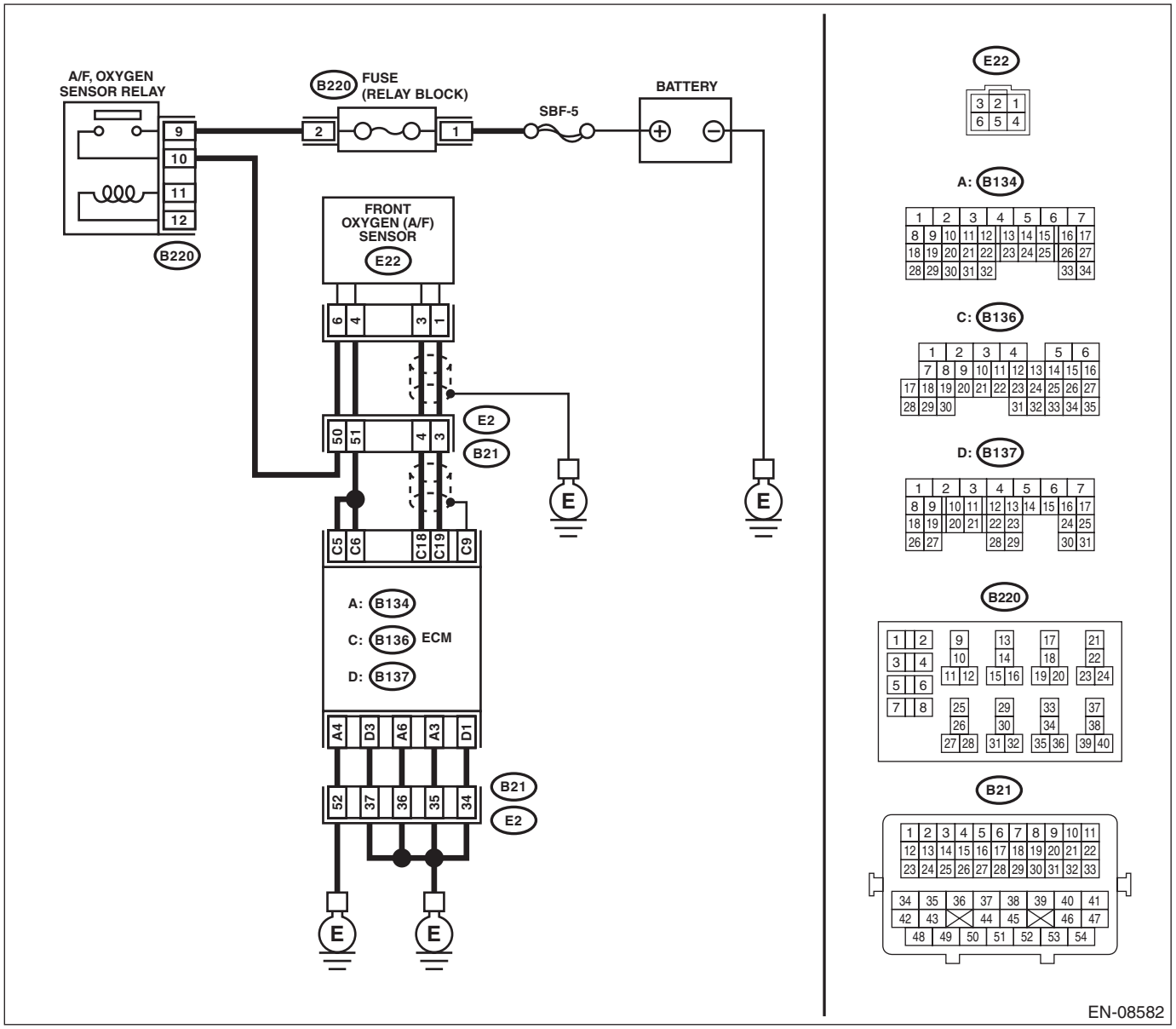
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-167, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 — Chassis ground:***<br>***(B136) No. 18 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector. |
| 3 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 (+) — Chassis ground (–):*** | Is the voltage 4.5 V or more? | Go to step **5**. | Go to step **4**. |
| 4 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 18 (+) — Chassis ground (–):*** | Is the voltage 4.95 V or more? | Go to step **5**. | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> |
| 5 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 (+) — Chassis ground (–):***<br>***(B136) No. 18 (+) — Chassis ground (–):*** | Is the voltage 8 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> | Repair the poor contact of ECM connector. |

## CL:DTC P1160 RETURN SPRING FAILURE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CM:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

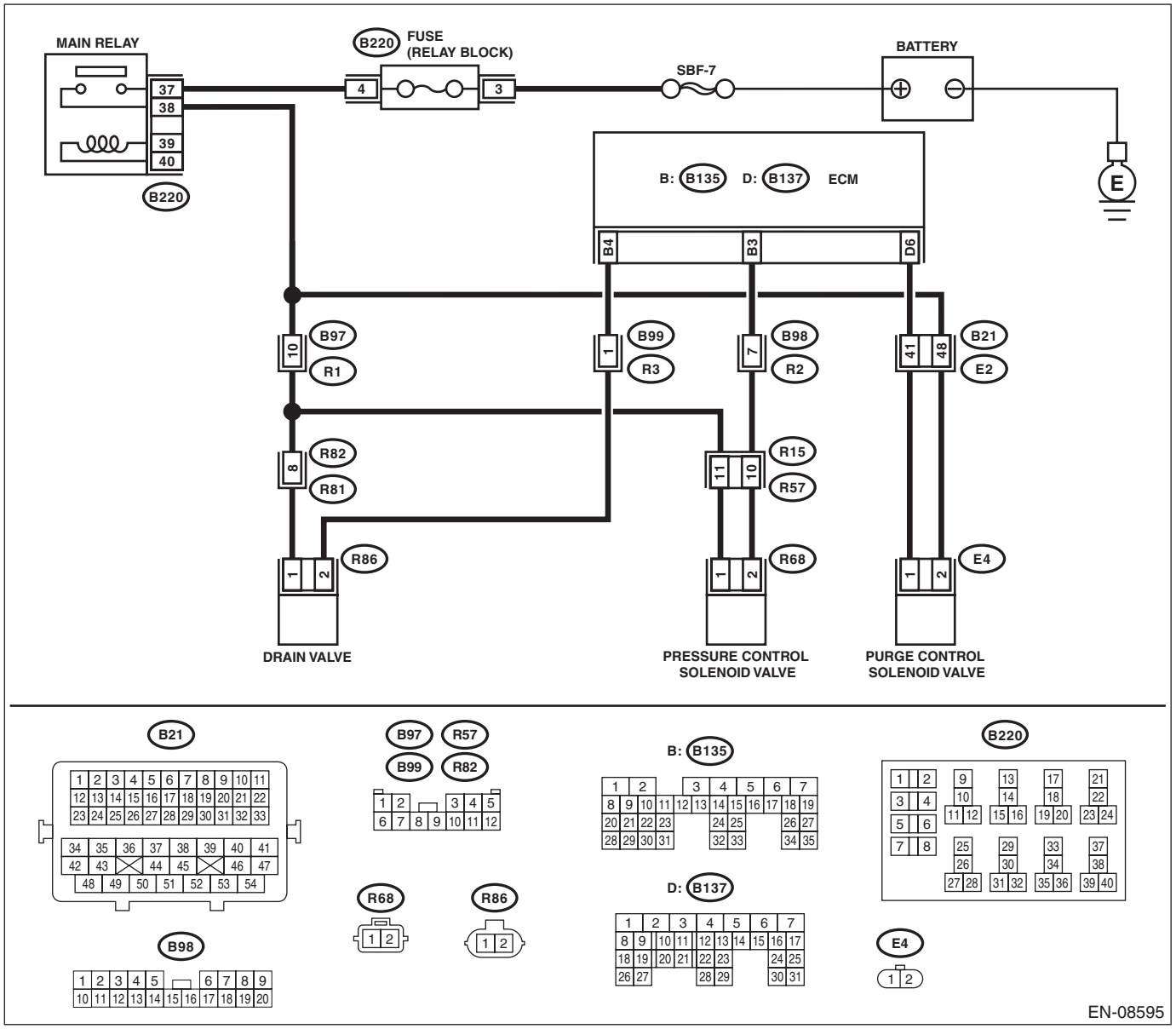
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-171, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 3 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Go to step **3**. |
| 2 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM connector. | Is there poor contact of ECM connector? | Repair the poor contact of ECM connector. | Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.<br>NOTE:<br>In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause. |
| 3 | **CHECK POWER SUPPLY TO THE PRESSURE CONTROL SOLENOID VALVE.**<br>Measure the voltage between pressure control solenoid valve and chassis ground.<br>***Connector & terminal***<br>***(R68) No. 1 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **4**. | Repair the power supply circuit. |
| 4 | **CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the ECM and pressure control solenoid valve.<br>3) Measure the resistance between pressure control solenoid valve and chassis ground.<br>***Connector & terminal***<br>***(R68) No. 2 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and pressure control solenoid valve connector. |
| 5 | **CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.**<br>Measure the resistance of harness between ECM and pressure control solenoid valve connector.<br>***Connector & terminal***<br>***(B135) No. 3 — (R68) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **6**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and pressure control solenoid valve connector<br>• Poor contact of coupling connector |
| 6 | **CHECK PRESSURE CONTROL SOLENOID VALVE.**<br>Measure the resistance between pressure control solenoid valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 10 — 100 Ω? | Repair the poor contact of pressure control solenoid valve connector. | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> |

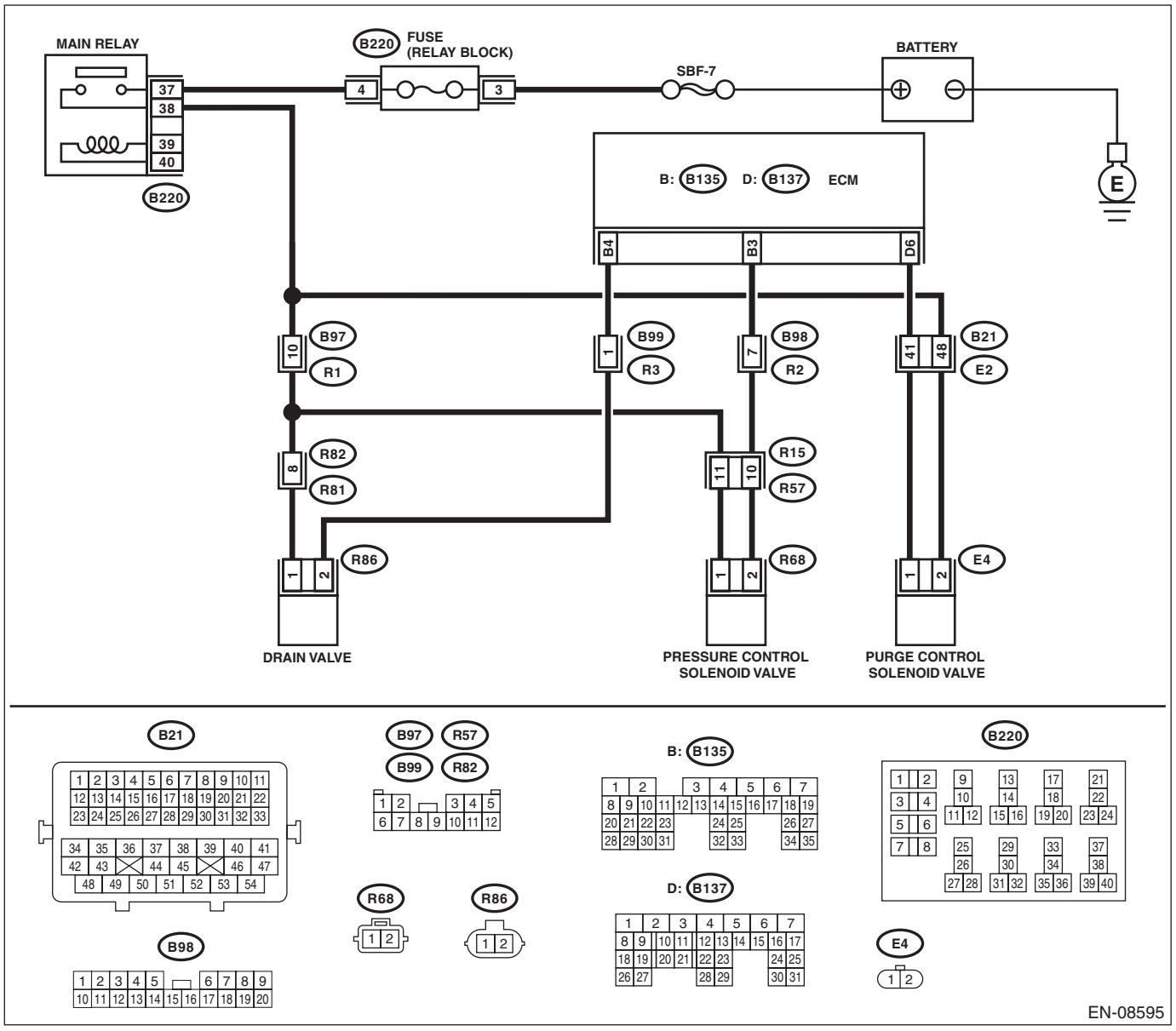
# CN:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-173, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from the ECM and pressure control solenoid valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 3 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector. | Go to step **2**. |
| 2 | **CHECK PRESSURE CONTROL SOLENOID VALVE.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between pressure control solenoid valve terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-17, Pressure Control Solenoid Valve.> | Repair the poor contact of ECM connector. |

# CO:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-175, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**TROUBLE SYMPTOM:**

Improper fuel supply

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK DRAIN HOSE.**<br>Check the drain hose for clogging. | Is there clogging in the drain hose? | Replace the drain hose. | Go to step **3**. |
| 3 | **CHECK DRAIN VALVE OPERATION.**<br>1) Turn the ignition switch to OFF.<br>2) Connect the delivery (test) mode connector.<br>3) Turn the ignition switch to ON.<br>4) Operate the drain valve.<br>NOTE:<br>Drain valve can be operated using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-56, Compulsory Valve Operation Check Mode.> | Does the drain valve operate? | Repair the poor contact of ECM connector. | Replace the drain valve. <Ref. to EC(H4SO)-20, Drain Valve.> |

## CP:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-177, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

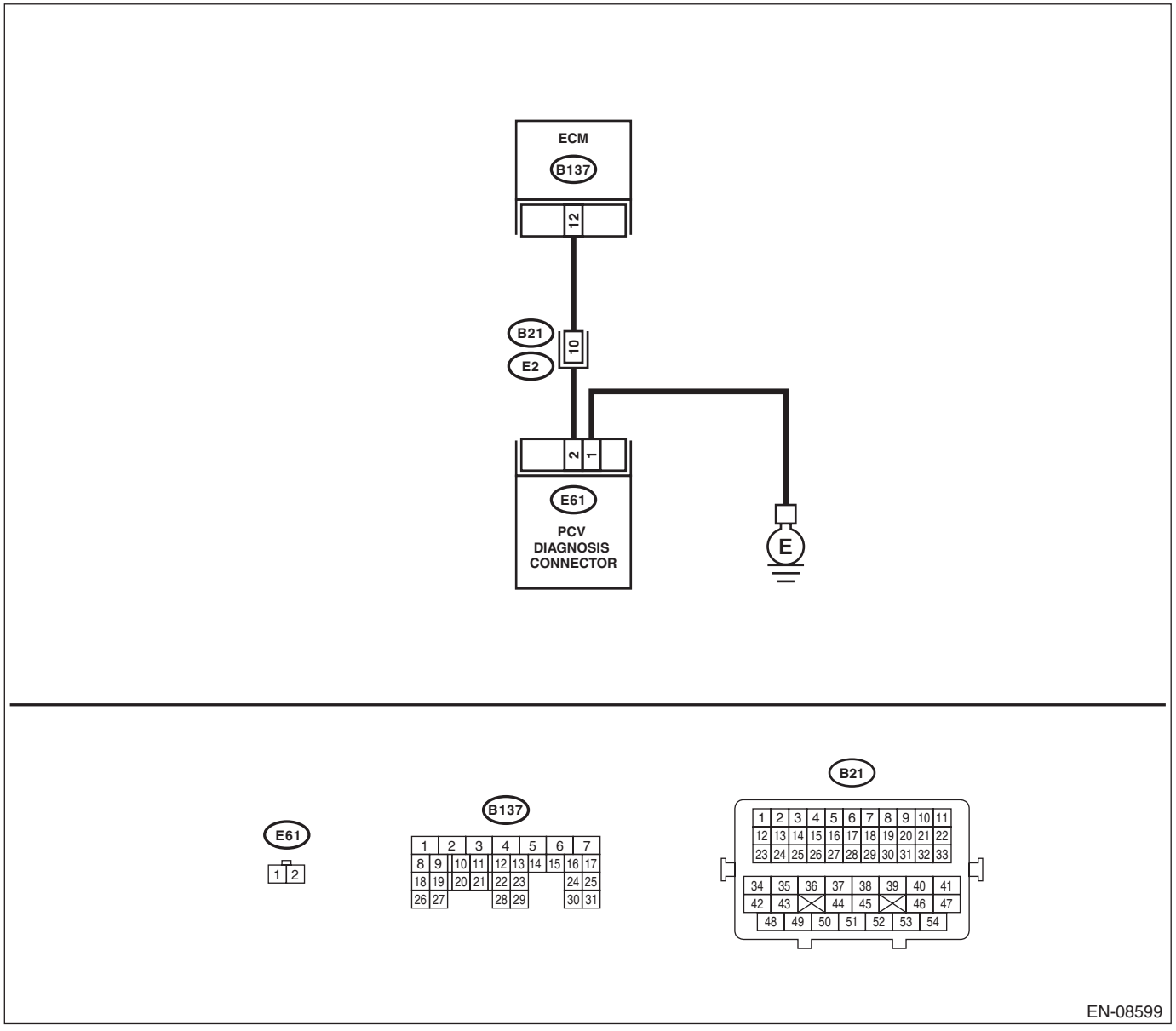
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK BLOW-BY HOSE.**<br>Check the blow-by hose condition. | Is there any disconnection or crack in blow-by hose? | Repair or replace the blow-by hose. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from the ECM and PCV hose assembly.<br>3) Measure the resistance of harness between ECM and PCV hose assembly connector.<br>***Connector & terminal***<br>***(B137) No. 12 — (E61) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and PCV hose assembly connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.**<br>Measure the resistance between PCV hose assembly connector and chassis ground.<br>***Connector & terminal***<br>***(B137) No. 12 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **4**. | Repair the short circuit to ground in harness between ECM and PCV hose assembly connector. |
| 4 | **CHECK GROUND CIRCUIT OF PCV HOSE ASSEMBLY.**<br>Measure the resistance of harness between PCV hose assembly connector and engine ground.<br>***Connector & terminal***<br>***(E61) No. 1 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **5**. | Repair the open circuit of harness between PCV hose assembly and engine ground. |
| 5 | **CHECK PCV HOSE ASSEMBLY.**<br>Measure the resistance between the PCV hose assembly terminals.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance less than 1 Ω? | Repair the poor contact of ECM and PCV hose assembly connector. | Replace the PCV hose assembly. <Ref. to EC(H4SO)-22, PCV Hose Assembly.> |

## CQ:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-258, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CR:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-261, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CS:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-258, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CT:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-261, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CU:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-258, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CV:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-261, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CW:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-179, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

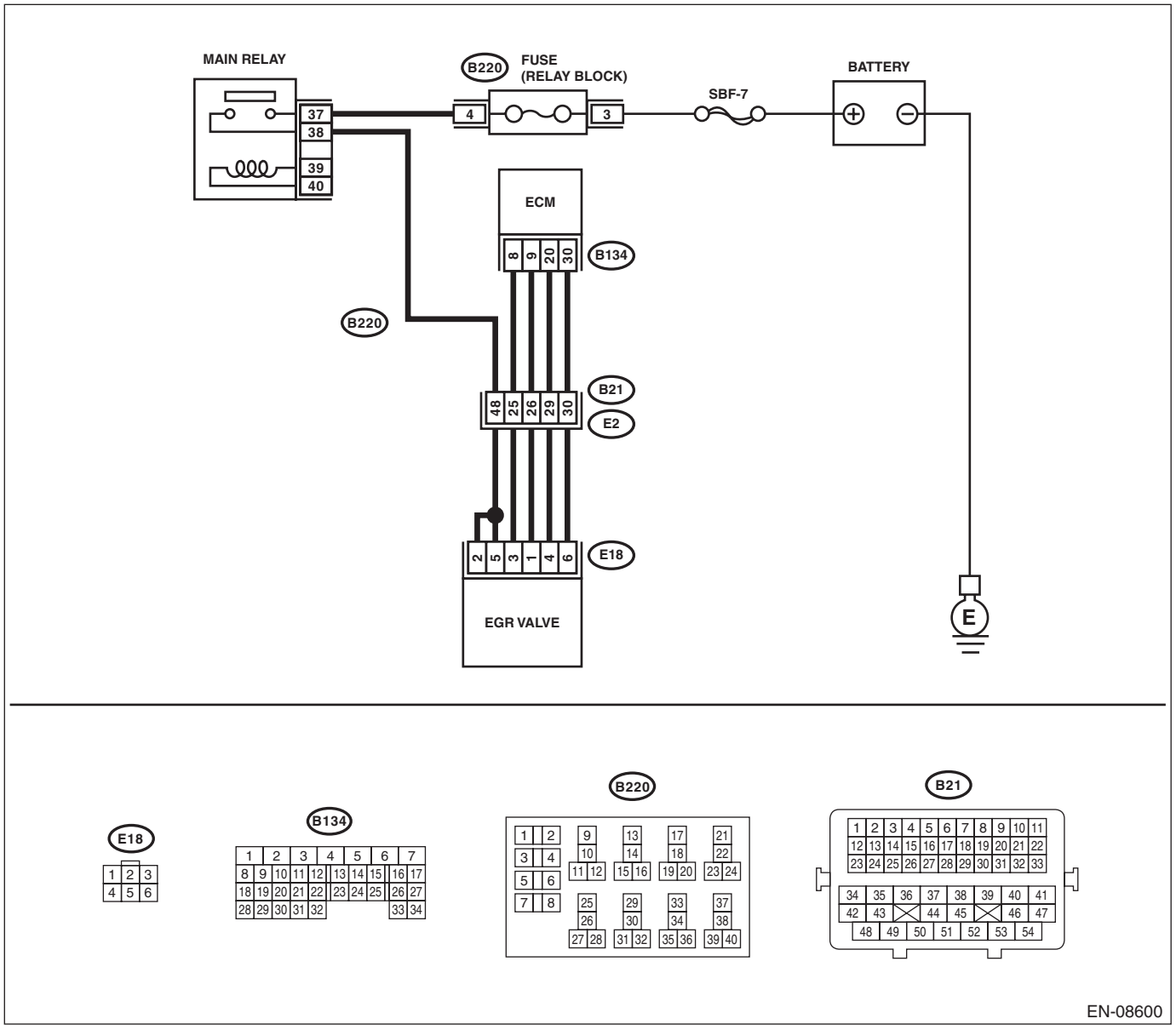
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine breathing

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK POWER SUPPLY TO EGR VALVE.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from EGR valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between EGR valve connector and engine ground.<br>***Connector & terminal***<br>***(E18) No. 2 (+) — Engine ground (–):***<br>***(E18) No. 5 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between EGR valve and main relay connector<br>• Poor contact of coupling connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM and EGR valve connector.<br>***Connector & terminal***<br>***DTC P1492; (B134) No. 8 — (E18) No. 3:***<br>***DTC P1494; (B134) No. 9 — (E18) No. 1:***<br>***DTC P1496; (B134) No. 20 — (E18) No. 4:***<br>***DTC P1498; (B134) No. 30 — (E18) No. 6:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and EGR valve connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***DTC P1492; (B134) No. 8 — Chassis ground:***<br>***DTC P1494; (B134) No. 9 — Chassis ground:***<br>***DTC P1496; (B134) No. 20 — Chassis ground:***<br>***DTC P1498; (B134) No. 30 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **4**. | Repair the ground short in harness between ECM and EGR valve connector. |
| 4 | **CHECK FOR POOR CONTACT.**<br>Check for poor contact of ECM and EGR valve connector. | Is there poor contact of ECM or EGR valve connector? | Repair the poor contact of ECM or EGR valve connector. | Replace the EGR valve. <Ref. to FU(H4SO)-36, EGR Valve.> |

## CX:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-181, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-183, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

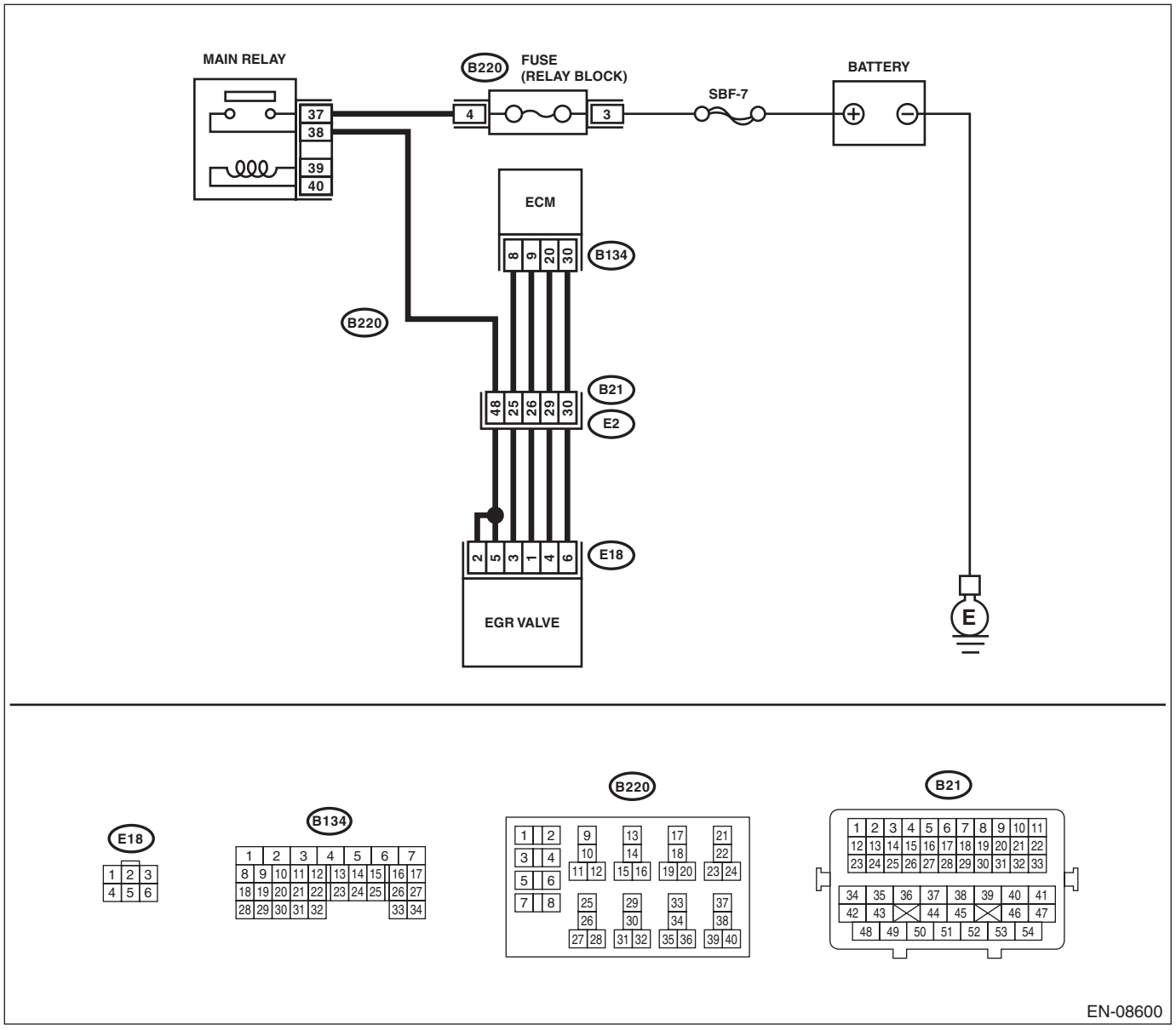
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine breathing

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and EGR valve.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***DTC P1493; (B134) No. 8 (+) — Chassis ground (–):***<br>***DTC P1495; (B134) No. 9 (+) — Chassis ground (–):***<br>***DTC P1497; (B134) No. 20 (+) — Chassis ground (–):***<br>***DTC P1499; (B134) No. 30 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power supply in harness between ECM and EGR valve connector. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK EGR VALVE.**<br>Measure the resistance between EGR valve terminals.<br>***Terminals***<br>***DTC P1493; No. 2 — No. 3:***<br>***DTC P1493; No. 5 — No. 3:***<br>***DTC P1495; No. 2 — No. 1:***<br>***DTC P1495; No. 5 — No. 1:***<br>***DTC P1497; No. 2 — No. 4:***<br>***DTC P1497; No. 5 — No. 4:***<br>***DTC P1499; No. 2 — No. 6:***<br>***DTC P1499; No. 5 — No. 6:*** | Is the resistance 20 Ω or more? | Repair the poor contact of ECM connector. | Replace the EGR valve. <Ref. to FU(H4SO)-36, EGR Valve.> |

# CY:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

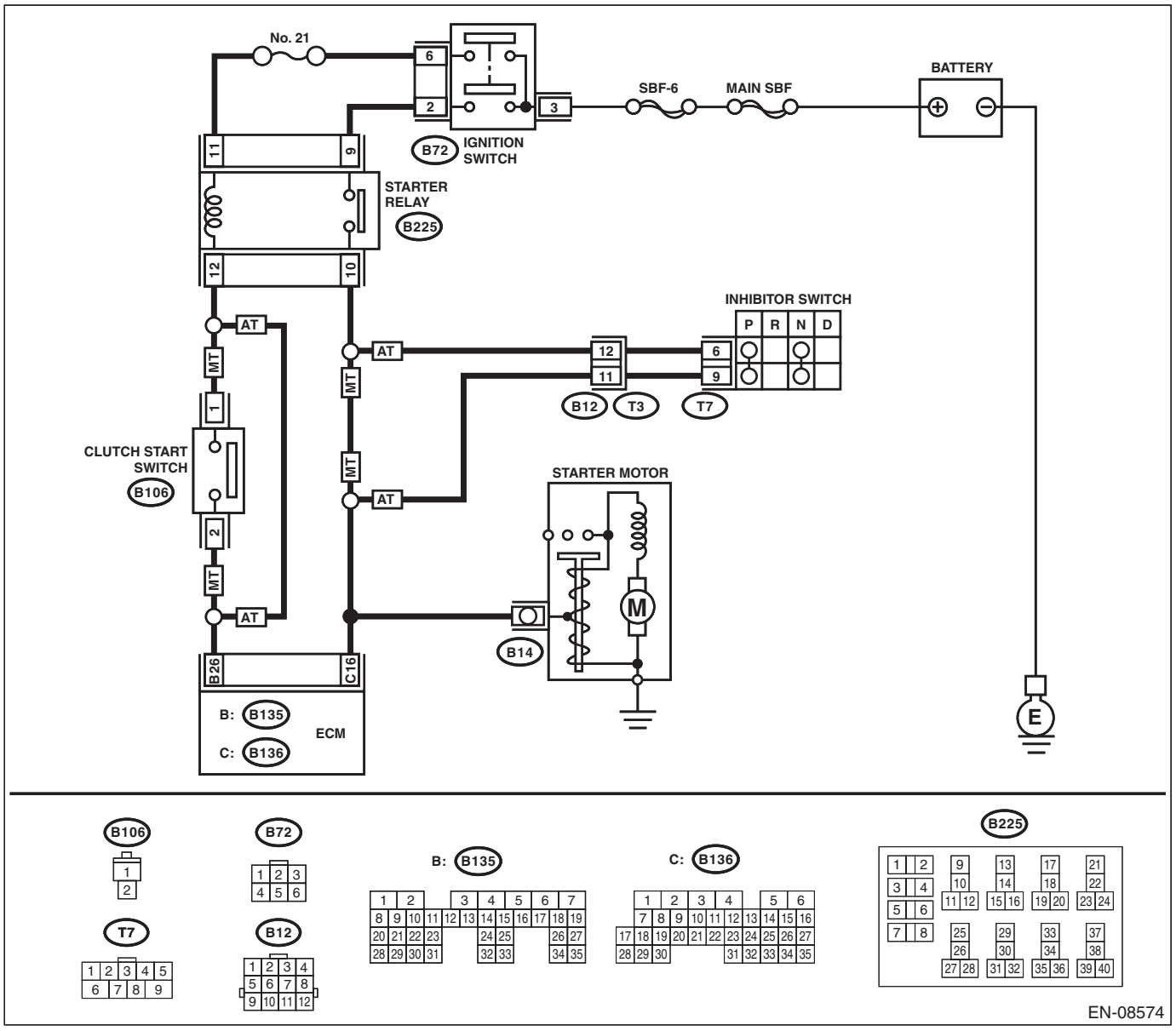
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-184, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the starter relay.<br>3) Disconnect the connectors from ECM and starter motor.<br>4) Measure the resistance of harness between ECM and starter relay connector.<br>***Connector & terminal***<br>***(B136) No. 16 — (B225) No. 10:***<br>NOTE:<br>For AT model, place the select lever in "P" range or "N" range. | Is the resistance less than 1 Ω? | Go to step **3**. | NOTE:<br>Check the following item and repair or replace if necessary.<br>• Open circuit of harness between ECM and starter relay connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 16 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of ECM connector. | Repair the short circuit to ground in harness between ECM and starter relay connector. |

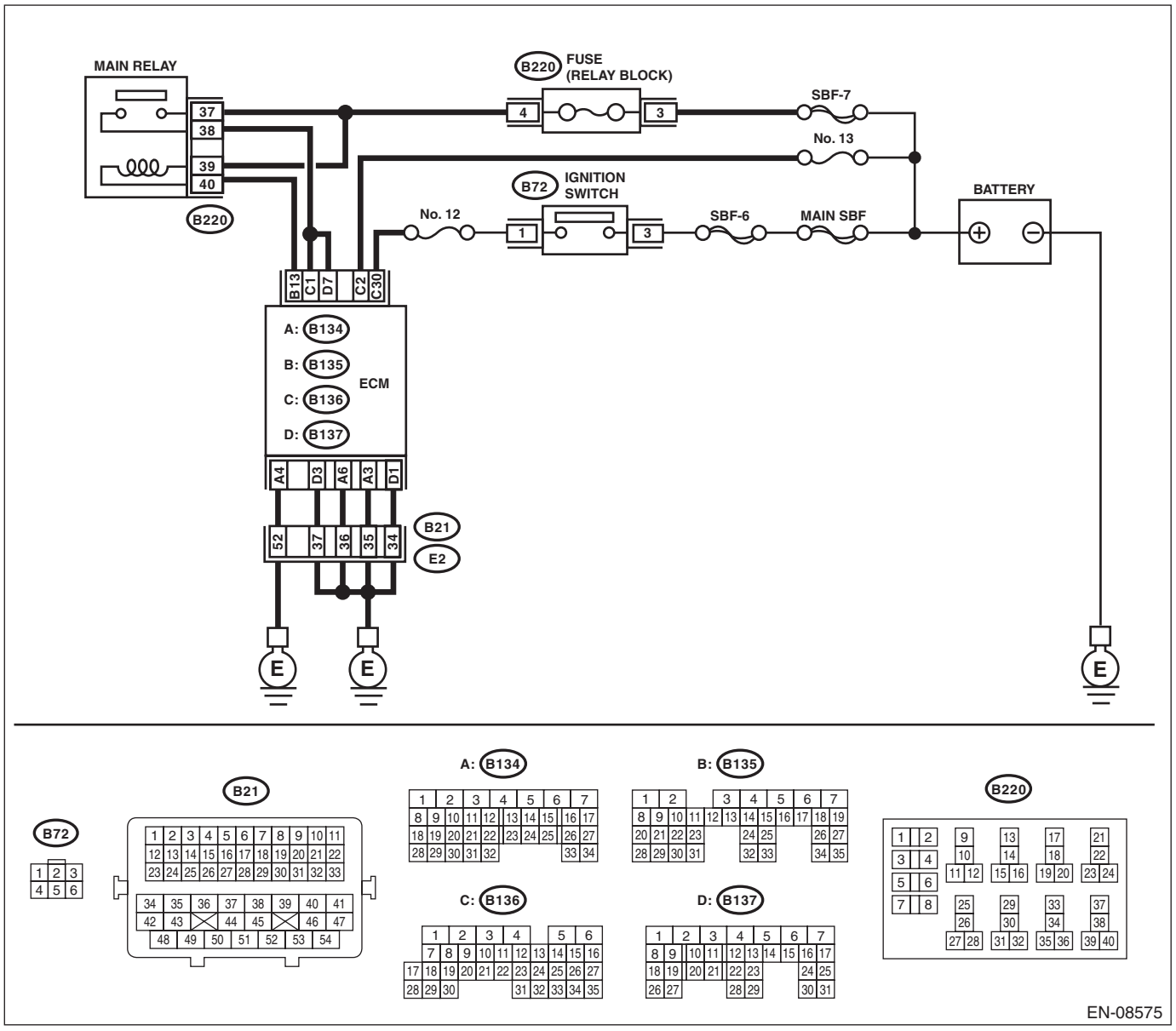
## CZ:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-185, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK INPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 2 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of ECM connector. | Go to step **2**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 2 | **CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 2 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the ground short circuit of harness between ECM and battery terminal. |
| 3 | **CHECK FUSE NO. 13 (MAIN FUSE BOX).** | Is the fuse blown out? | Replace the fuse. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and battery<br>• Poor contact of ECM connector<br>• Poor contact of battery terminal |

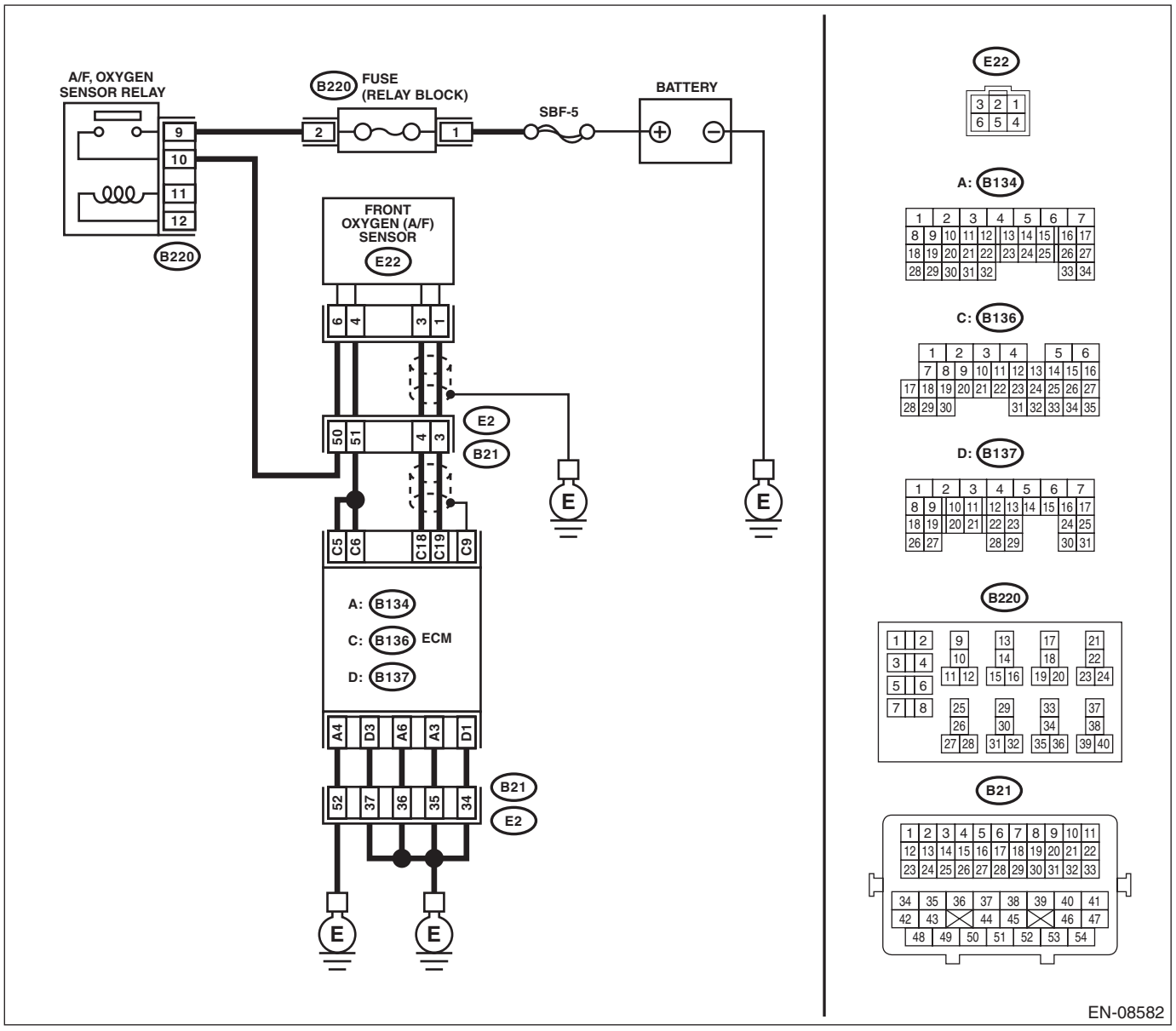
# DA:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

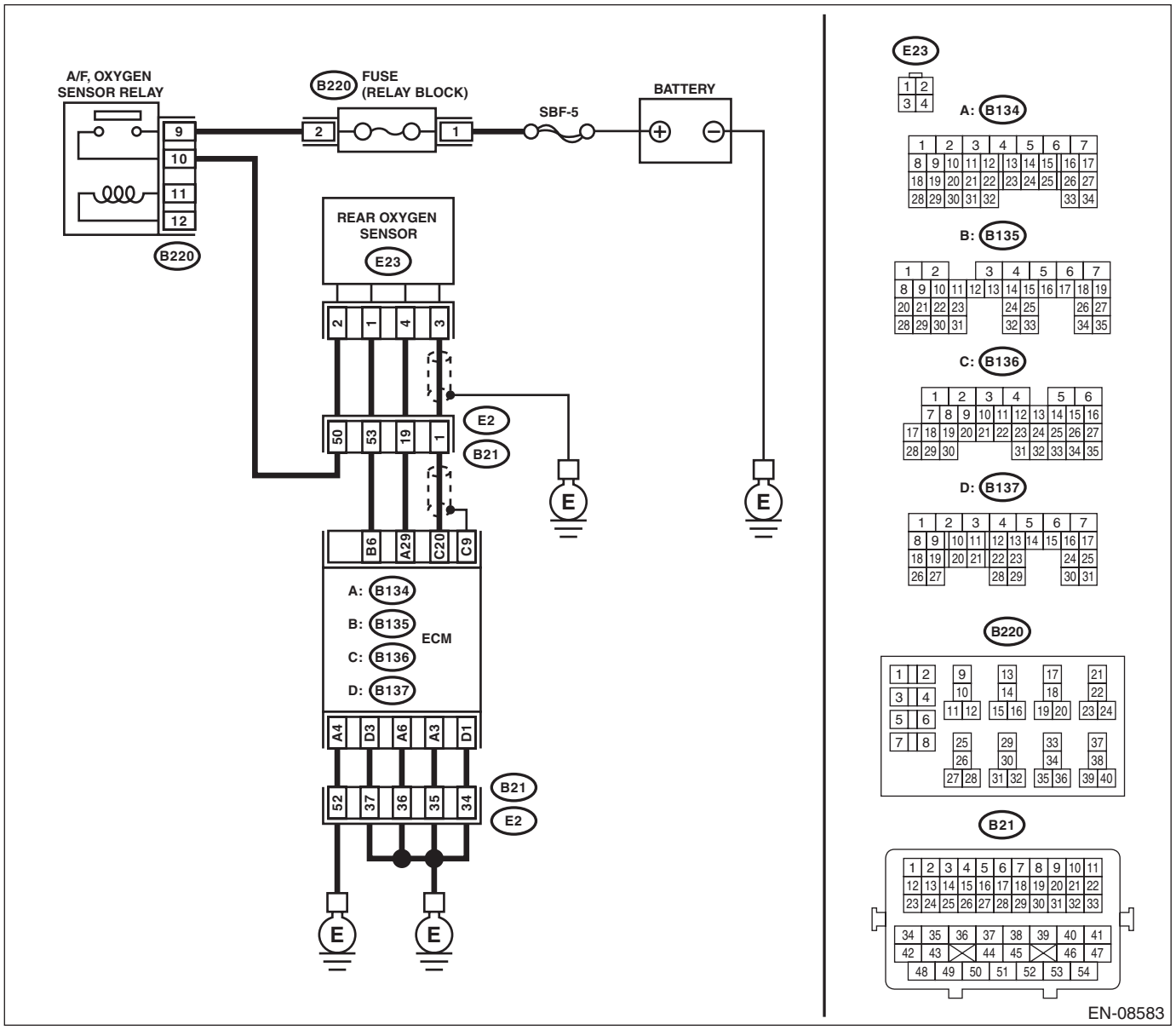
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-187, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**






| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **3**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor.<br>3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 — Chassis ground:***<br>***(B136) No. 18 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector. |
| 5 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):*** | Is the voltage 4.5 V or more? | Go to step **7**. | Go to step **6**. |
| 6 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 4.95 V or more? | Go to step **7**. | Go to step **8**. |
| 7 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 8 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> | Repair the poor contact of ECM connector. |
| 8 | **CHECK EXHAUST SYSTEM.** | Are there holes or loose bolts on exhaust system? | Repair the exhaust system. | Go to step **9**. |
| 9 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **10**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 10 | **CHECK FUEL PRESSURE.**<br>**WARNING:**<br>**Place "NO OPEN FLAMES" signs near the working area.**<br>**CAUTION:**<br>**Be careful not to spill fuel.**<br>1) Connect the front oxygen (A/F) sensor connector.<br>2) Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.><br>**CAUTION:**<br>**Release fuel pressure before removing the fuel pressure gauge.** | Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm$^2$, 49 — 58 psi)? | Go to step **11**. | Repair the following item.<br>Fuel pressure is too high:<br>• Clogged fuel line or bent hose<br>Fuel pressure is too low:<br>• Improper fuel pump discharge<br>• Clogged fuel line |
| 11 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Start the engine and warm up completely.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Go to step **12**. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |
| 12 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)? | Go to step **13**. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 13 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Open the front hood.<br>6) Measure the ambient temperature.<br>7) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)? | Go to step **14**. | Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |
| 14 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 490 mV or more? | Go to step **15**. | Go to step **16**. |
| 15 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 250 mV or less? | Go to step **17**. | Go to step **16**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 16 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **18**. |
| 17 | **CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is a voltage of 250 mV or less maintained for 5 minutes or more? | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> | Go to step **18**. |
| 18 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B135) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **19**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 19 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |

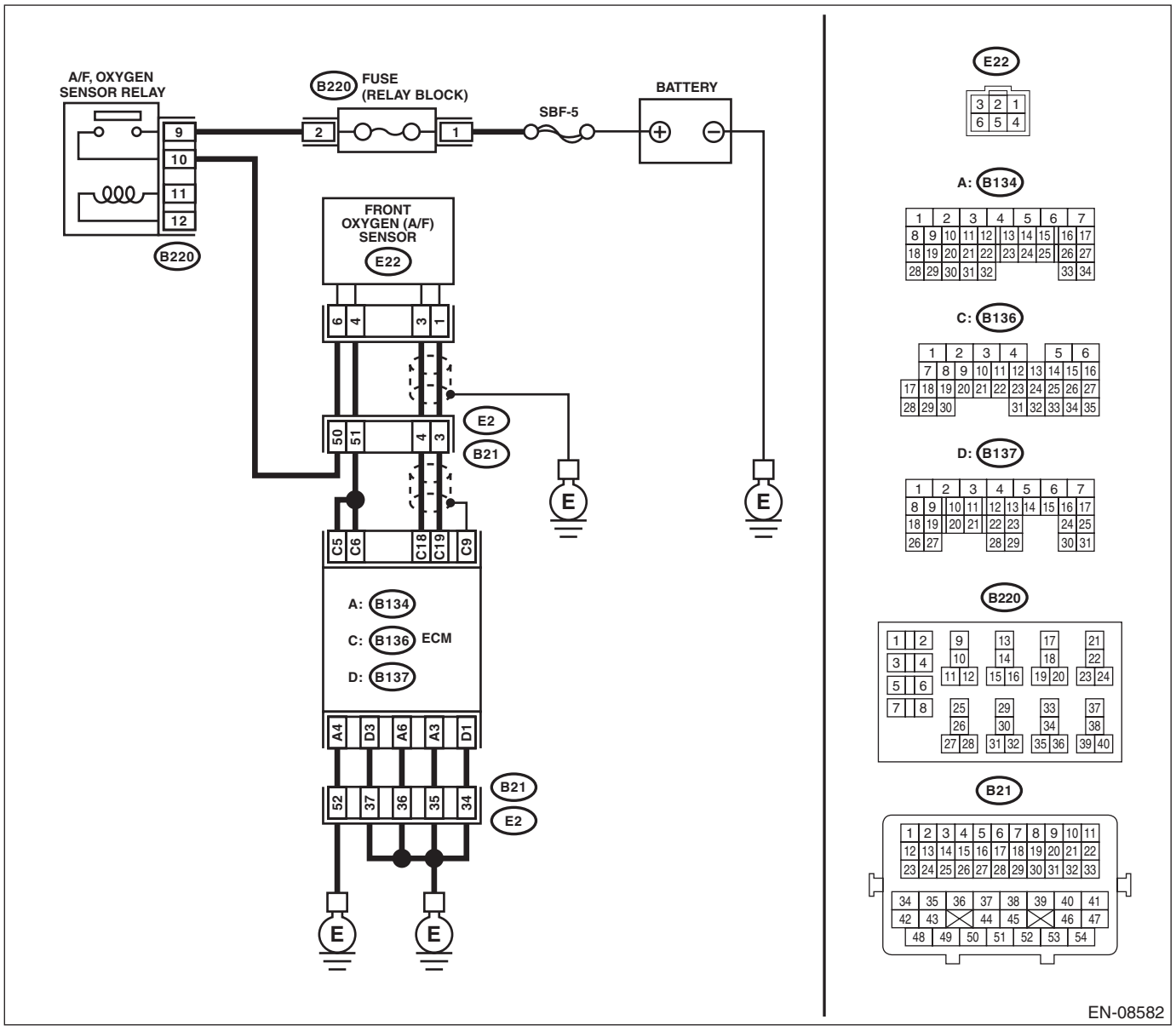
# DB:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

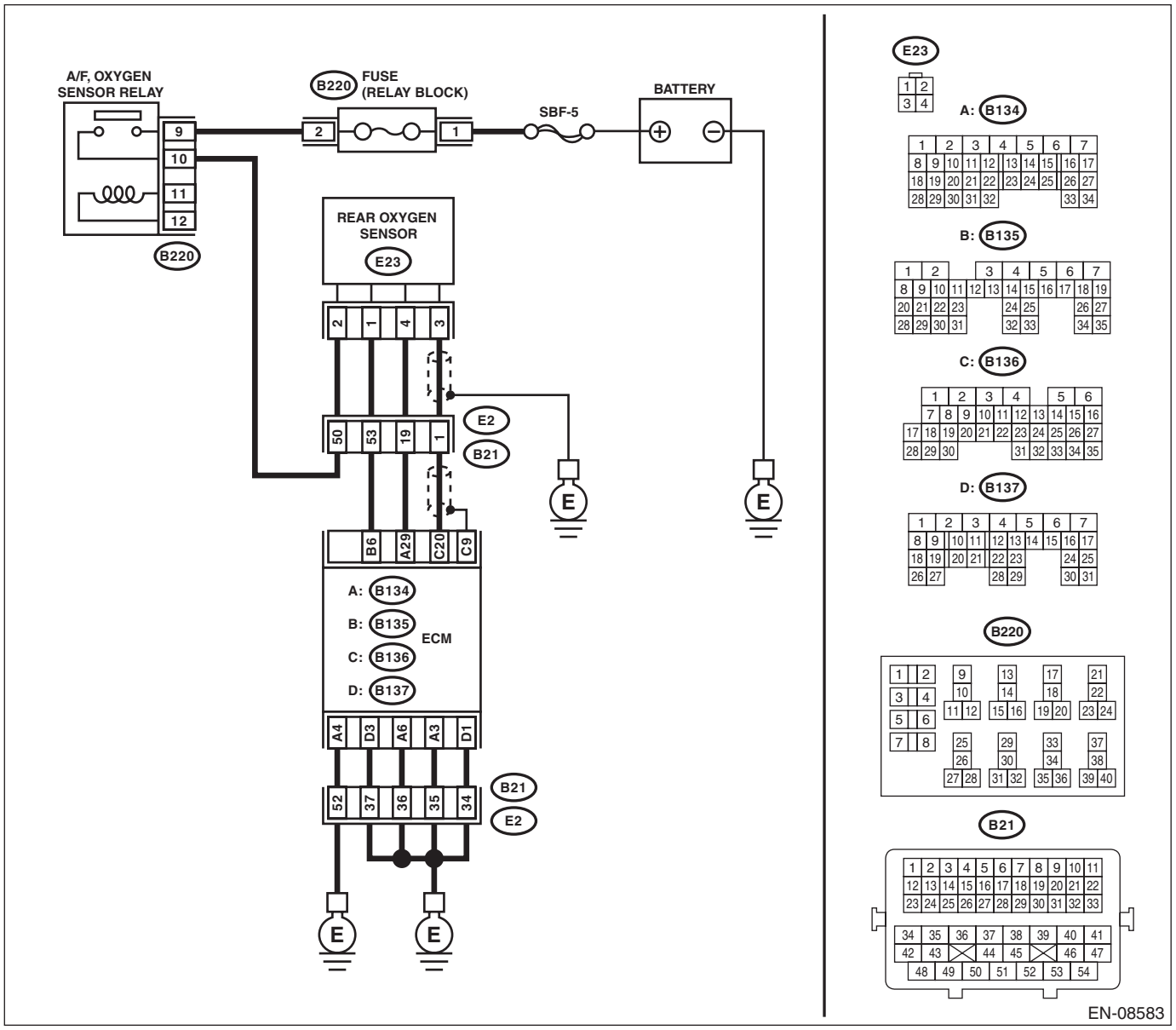
**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-189, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**






| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Go to step **2**. |
| 2 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **3**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor.<br>3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 — Chassis ground:***<br>***(B136) No. 18 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector. |
| 5 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):*** | Is the voltage 4.5 V or more? | Go to step **7**. | Go to step **6**. |
| 6 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 4.95 V or more? | Go to step **7**. | Go to step **8**. |
| 7 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 8 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> | Repair the poor contact of ECM connector. |
| 8 | **CHECK EXHAUST SYSTEM.** | Are there holes or loose bolts on exhaust system? | Repair the exhaust system. | Go to step **9**. |
| 9 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **10**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 10 | **CHECK FUEL PRESSURE.**<br>**WARNING:**<br>**Place "NO OPEN FLAMES" signs near the working area.**<br>**CAUTION:**<br>**Be careful not to spill fuel.**<br>1) Connect the front oxygen (A/F) sensor connector.<br>2) Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.><br>**CAUTION:**<br>**Release fuel pressure before removing the fuel pressure gauge.** | Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm$^2$, 49 — 58 psi)? | Go to step **11**. | Repair the following item.<br>Fuel pressure is too high:<br>• Clogged fuel line or bent hose<br>Fuel pressure is too low:<br>• Improper fuel pump discharge<br>• Clogged fuel line |
| 11 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Start the engine and warm up completely.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Go to step **12**. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |
| 12 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)? | Go to step **13**. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 13 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Open the front hood.<br>6) Measure the ambient temperature.<br>7) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)? | Go to step **14**. | Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |
| 14 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 490 mV or more? | Go to step **15**. | Go to step **16**. |
| 15 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 250 mV or less? | Go to step **17**. | Go to step **16**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 16 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **18**. |
| 17 | **CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is a voltage of 0.8 V or more maintained for 5 minutes or more? | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> | Go to step **18**. |
| 18 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B134) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **19**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 19 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |

# DC:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-191, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

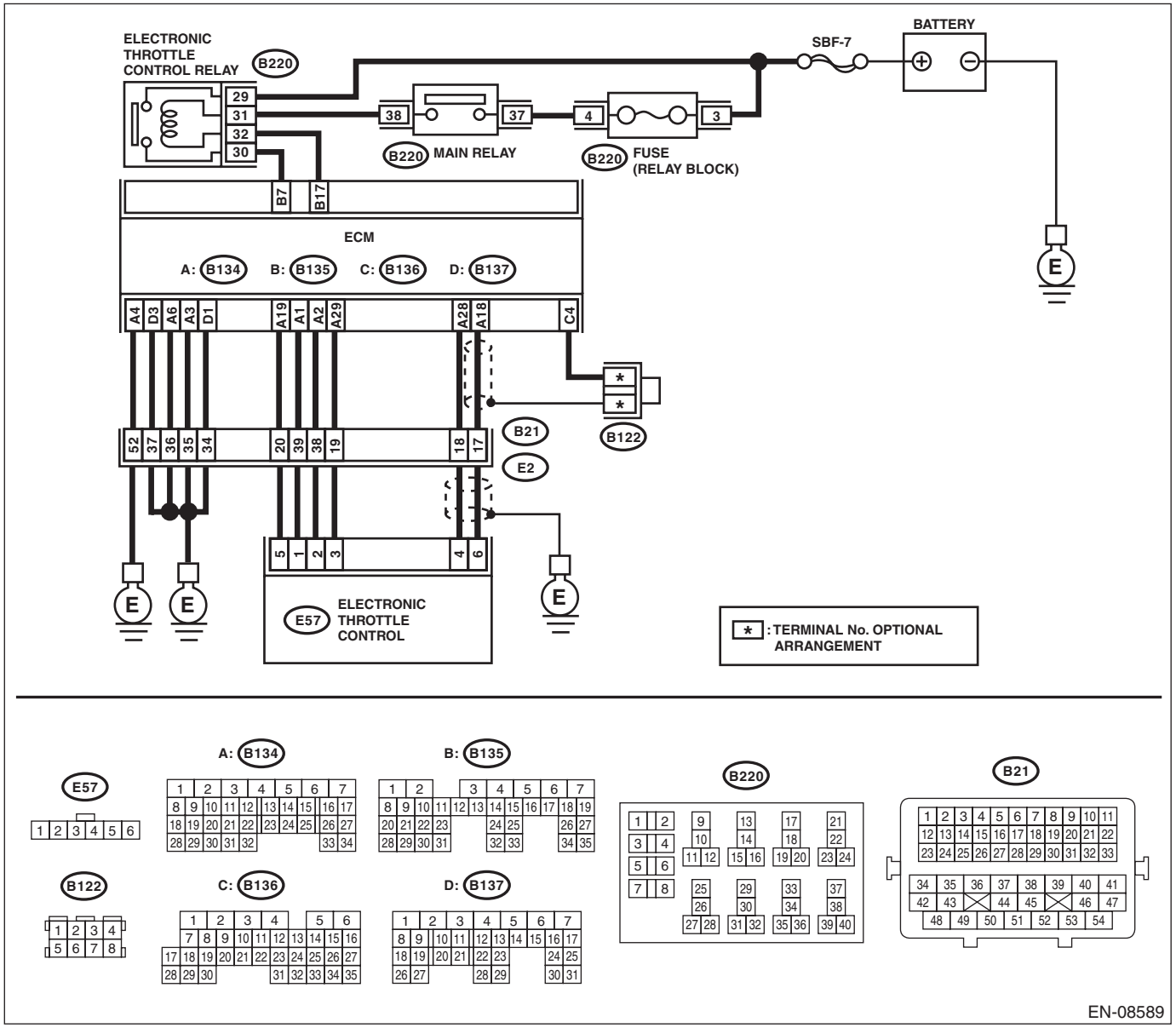
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine stalls.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ELECTRONIC THROTTLE CONTROL RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the electronic throttle control relay.<br>3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay.<br>4) Measure the resistance between electronic throttle control relay terminals.<br>***Terminals***<br>***No. 29 — No. 30:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Replace the electronic throttle control relay. <Ref. to FU(H4SO)-51, Electronic Throttle Control Relay.> |
| 2 | **CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.**<br>Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 29 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the open or ground short circuit of power supply circuit. |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 — Chassis ground:***<br>***(B220) No. 30 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector. |
| 5 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>Measure the resistance between ECM and electronic throttle control relay connector.<br>***Connector & terminal***<br>***(B135) No. 17 — (B220) No. 32:***<br>***(B135) No. 7 — (B220) No. 30:*** | Is the resistance less than 1 Ω? | Go to step **6**. | Repair the open circuit in harness between ECM and electronic throttle control relay connector. |
| 6 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from electronic throttle control.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 19 — Chassis ground:***<br>***(B134) No. 18 — Chassis ground:***<br>***(B134) No. 18 — (B136) No. 6:***<br>***(B134) No. 28 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **7**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 7 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 — Engine ground:***<br>***(E57) No. 4 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **8**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |
| 8 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 18 — (E57) No. 6:***<br>***(B134) No. 28 — (E57) No. 4:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **9**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 9 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **10**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 10 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 (+) — Engine ground (–):***<br>***(E57) No. 4 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **11**. |
| 11 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B134) No. 19 — (B134) No. 18:***<br>***(B134) No. 19 — (B134) No. 28:*** | Is the resistance 1 MΩ or more? | Go to step **12**. | Repair the short circuit to power in harness between ECM and electronic throttle control connector. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 12 | **CHECK SENSOR OUTPUT.**<br>1) Connect all connectors.<br>2) Turn the ignition switch to ON.<br>3) Read the data of main throttle sensor signal using Subaru Select Monitor.<br>NOTE:<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the voltage 0.81 — 0.87 V? | Go to step **13**. | Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.> |
| 13 | **CHECK SENSOR OUTPUT.**<br>Read the data of sub throttle sensor signal using Subaru Select Monitor.<br>NOTE:<br>Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.> | Is the voltage 1.64 — 1.70 V? | Go to step **14**. | Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.> |
| 14 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 2 — (E57) No. 2:***<br>***(B134) No. 1 — (E57) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **15**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 15 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 2 (+) — Engine ground (–):***<br>***(E57) No. 1 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **16**. |
| 16 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 2 — Engine ground:***<br>***(E57) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **17**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 17 | **CHECK ELECTRONIC THROTTLE CONTROL CONNECTOR HARNESS.**<br>Measure the resistance between electronic throttle control connectors.<br>***Connector & terminal***<br>***(E57) No. 2 — (E57) No. 1:*** | Is the resistance 1 MΩ or more? | Go to step **18**. | Repair the short circuit of harness between ECM and electronic throttle control connector. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 18 | **CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 3 — Chassis ground:***<br>***(B134) No. 4 — Chassis ground:***<br>***(B134) No. 6 — Chassis ground:***<br>***(B137) No. 1 — Chassis ground:***<br>***(B137) No. 3 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **19**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of coupling connector |
| 19 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>Measure the resistance between electronic throttle control terminals.<br>***Terminals***<br>***No. 2 — No. 1:*** | Is the resistance 50 Ω or less? | Go to step **20**. | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |
| 20 | **CHECK ELECTRONIC THROTTLE CONTROL.**<br>Move the throttle valve to the fully open and fully closed positions with fingers.<br>Check that the valve returns to the specified position when releasing fingers. | Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position | Repair the poor contact of ECM connector. | Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.> |

# DD:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-192, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

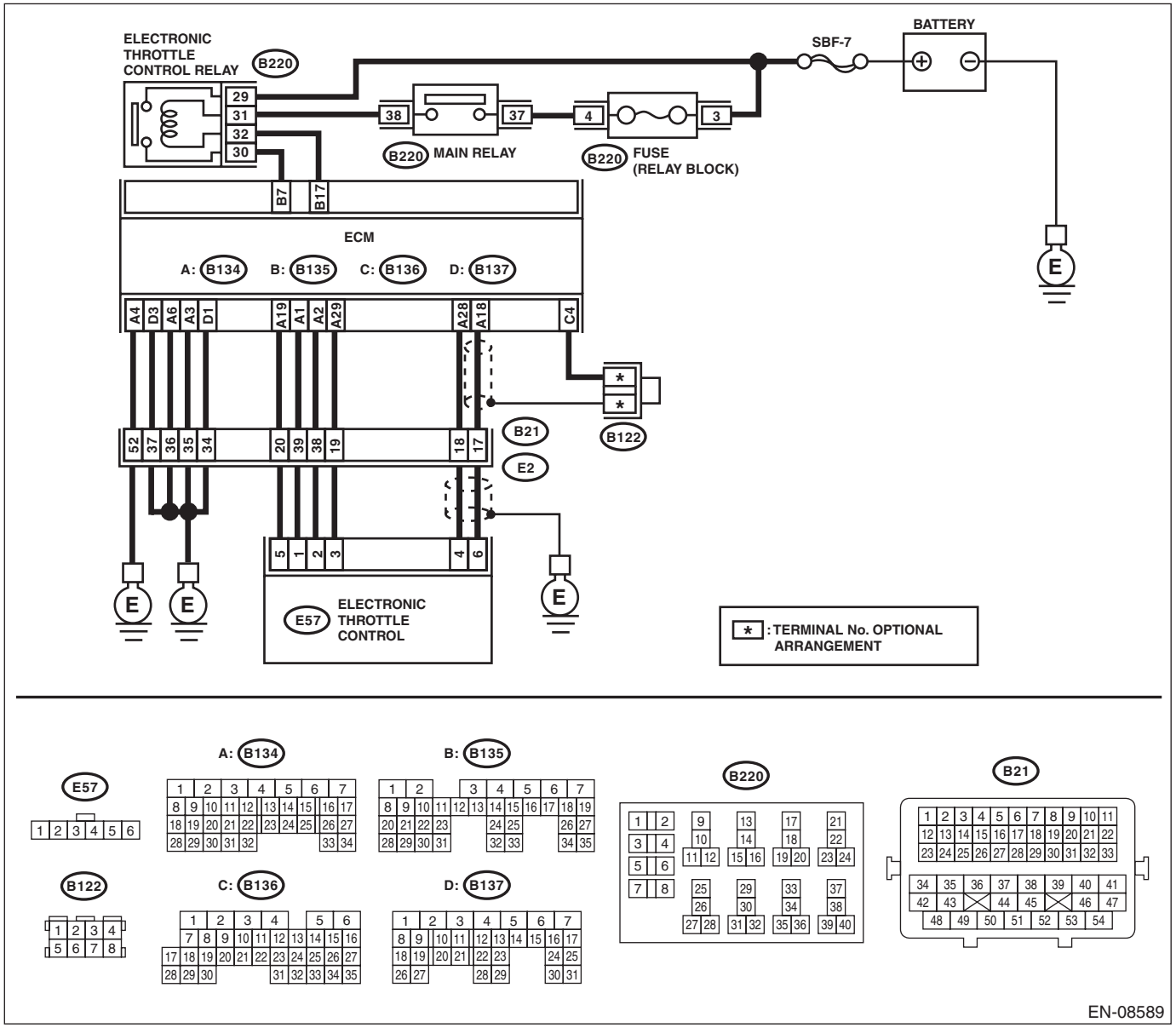
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance
- Engine stalls.

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ELECTRONIC THROTTLE CONTROL RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the electronic throttle control relay.<br>3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay.<br>4) Measure the resistance between electronic throttle control relay terminals.<br>***Terminals***<br>***No. 29 — No. 30:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Replace the electronic throttle control relay. <Ref. to FU(H4SO)-51, Electronic Throttle Control Relay.> |
| 2 | **CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.**<br>Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 29 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **3**. | Repair the open or ground short circuit of power supply circuit. |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 32 — Chassis ground:***<br>***(B220) No. 30 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **5**. | Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector. |
| 5 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>Measure the resistance between ECM and electronic throttle control relay connector.<br>***Connector & terminal***<br>***(B135) No. 17 — (B220) No. 32:***<br>***(B135) No. 7 — (B220) No. 30:*** | Is the resistance less than 1 Ω? | Repair the poor contact of ECM connector. | Repair the open circuit in harness between ECM and electronic throttle control relay connector. |

# DE:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

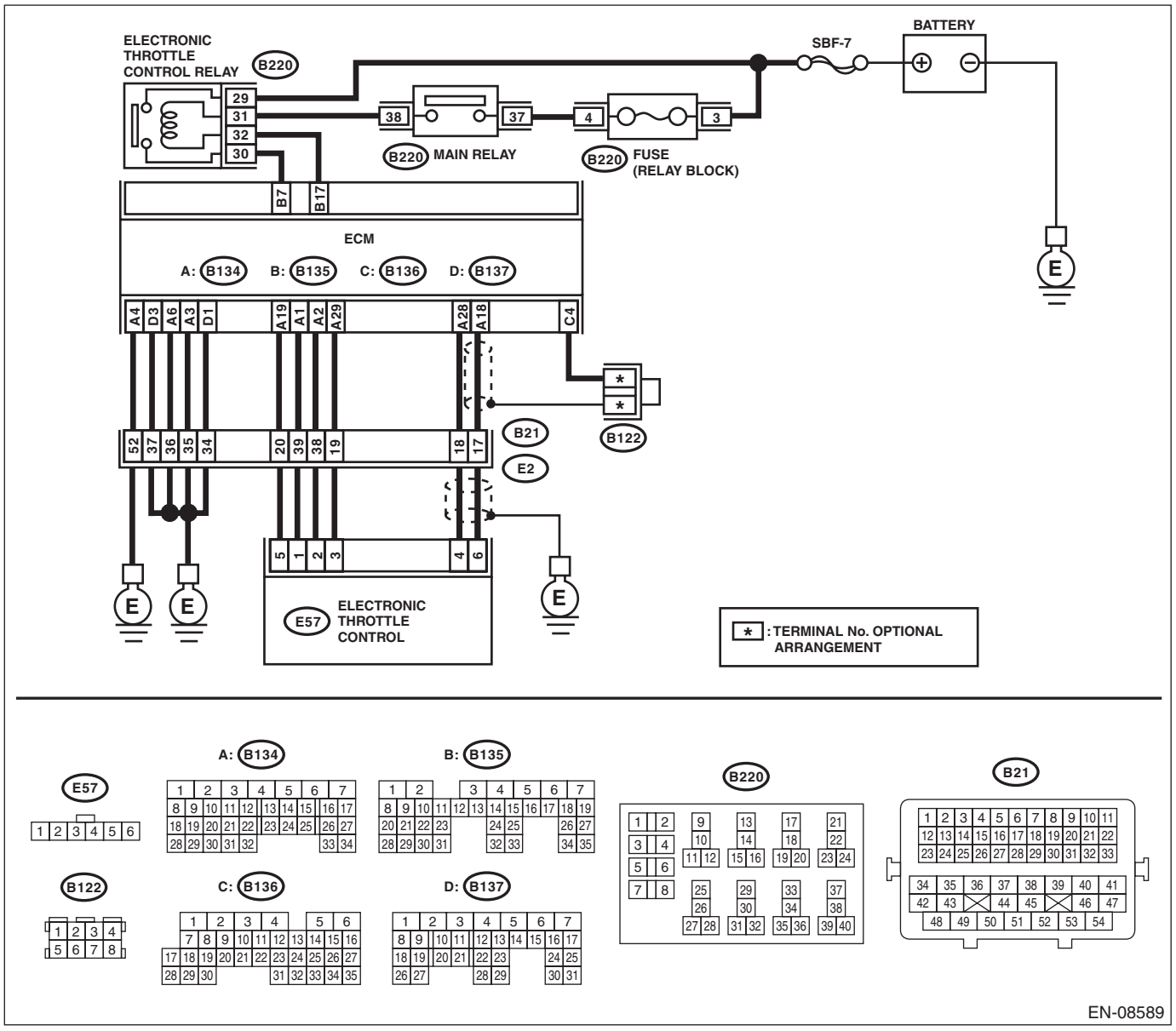
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-193, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ELECTRONIC THROTTLE CONTROL RELAY.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the electronic throttle control relay.<br>3) Measure the resistance between electronic throttle control relay terminals.<br>***Terminals***<br>***No. 29 — No. 30:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Replace the electronic throttle control relay. <Ref. to FU(H4SO)-51, Electronic Throttle Control Relay.> |
| 2 | **CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control relay connector and chassis ground.<br>***Connector & terminal***<br>***(B220) No. 30 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector. | Go to step **3**. |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 17 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of ECM connector. | Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector. |

## DF:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-280, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# DG:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-195, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

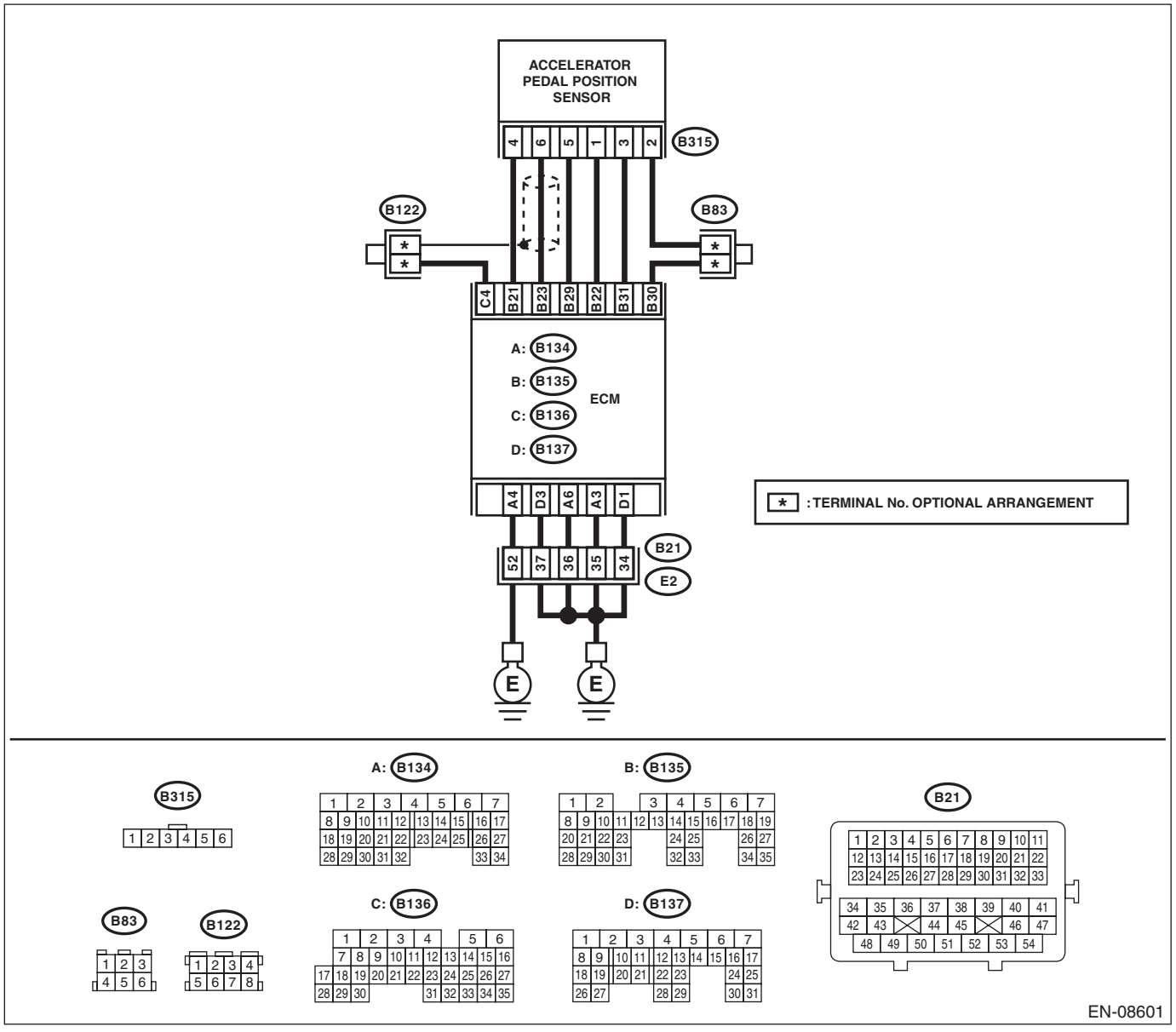
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and accelerator pedal position sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 21 — Chassis ground:***<br>***(B135) No. 23 — Chassis ground:***<br>***(B135) No. 23 — (B136) No. 4:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. |
| 2 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 6 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.> | Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

# DH:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-197, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

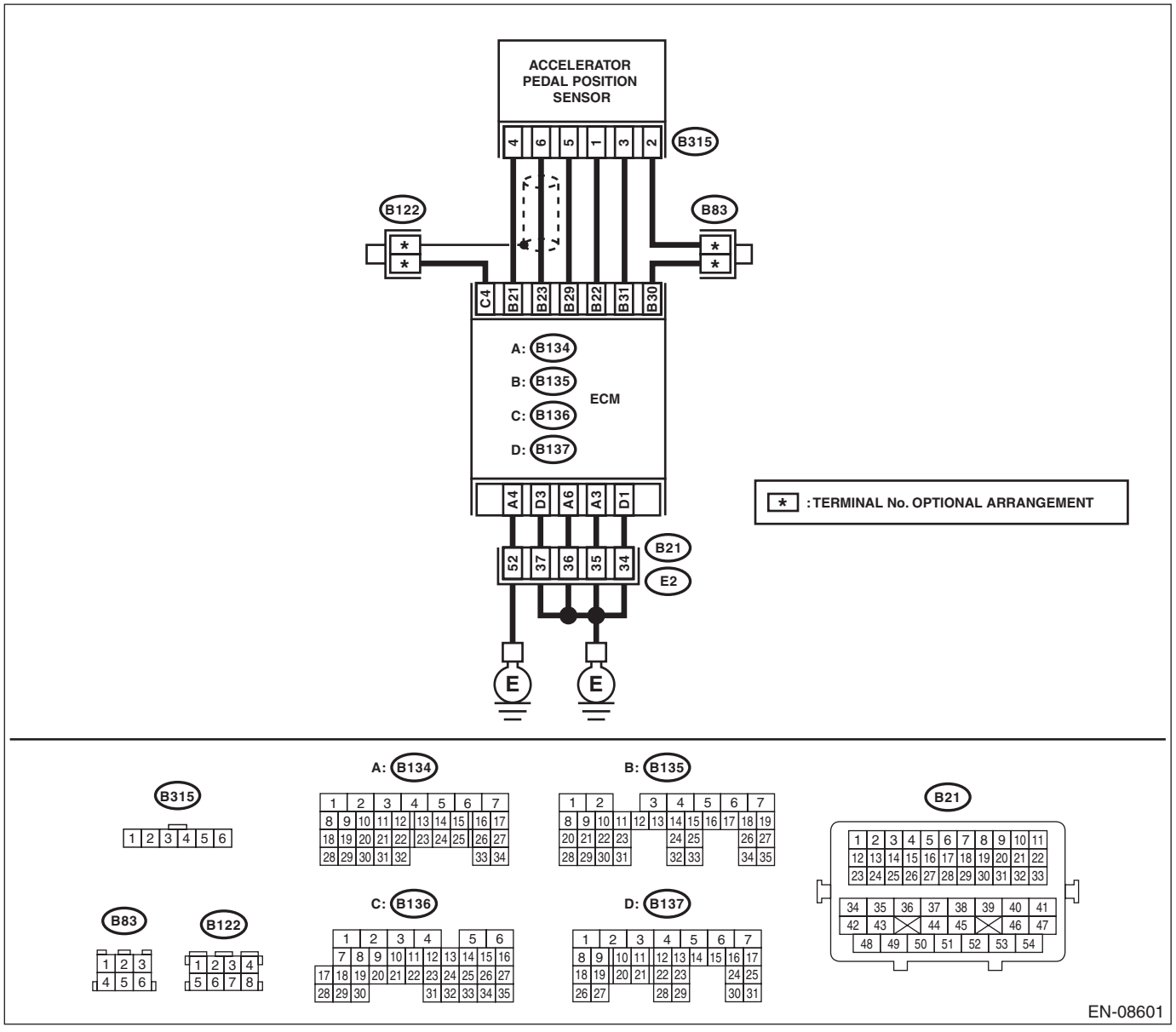
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and accelerator pedal position sensor.<br>3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.<br>***Connector & terminal***<br>***(B135) No. 23 — (B315) No. 6:***<br>***(B135) No. 29 — (B315) No. 5:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the open circuit in harness between ECM and accelerator pedal position sensor connector. |
| 2 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 5 — Chassis ground:*** | Is the resistance less than 5 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 6 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B135) No. 21 — (B135) No. 23:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-4, Accelerator Pedal.> | Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector. |

# DI: DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-199, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

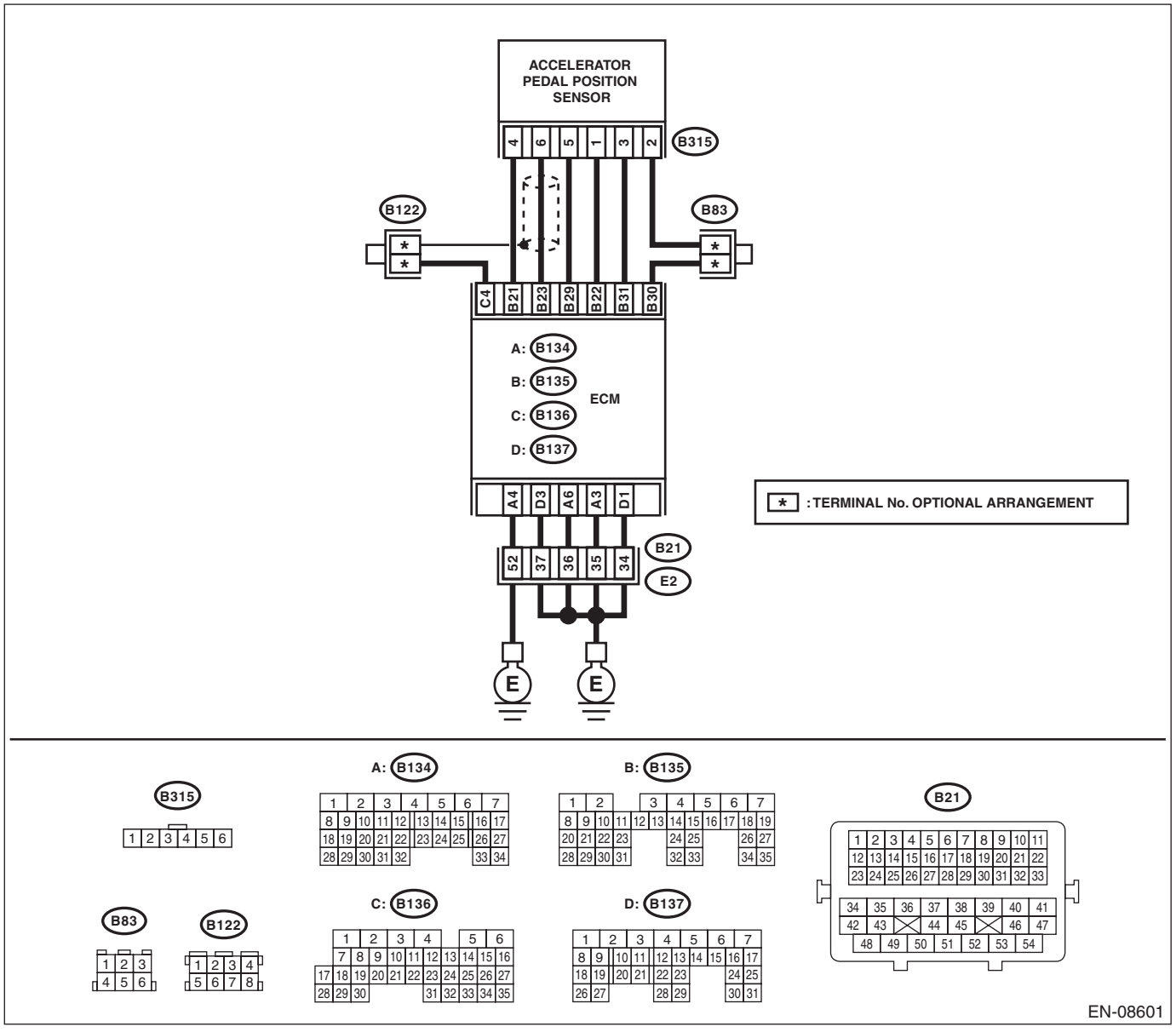
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and accelerator pedal position sensor.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B135) No. 22 — Chassis ground:***<br>***(B135) No. 31 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. |
| 2 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 3 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.> | Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |

# DJ:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-201, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

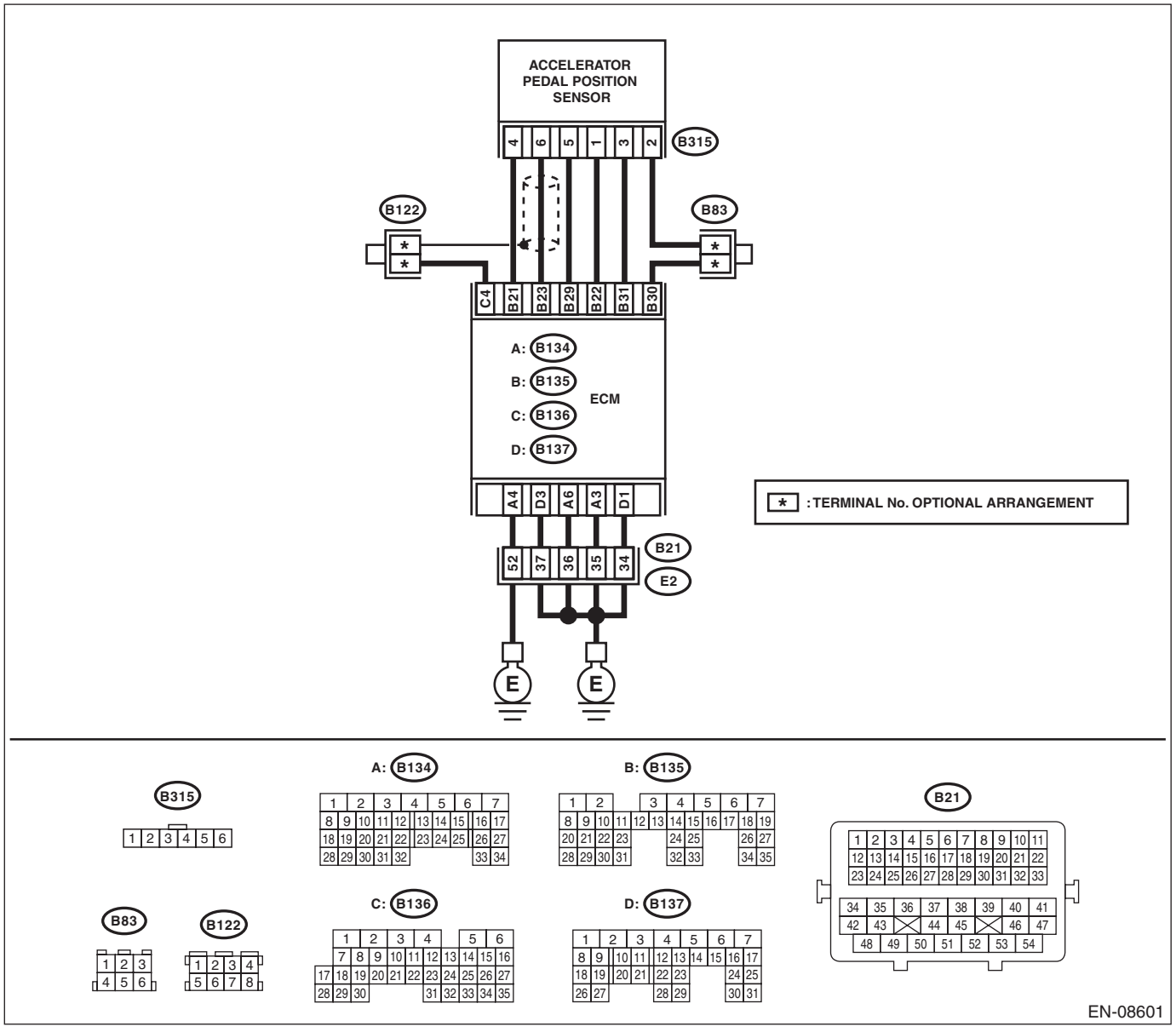
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and accelerator pedal position sensor.<br>3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.<br>***Connector & terminal***<br>***(B135) No. 31 — (B315) No. 3:***<br>***(B135) No. 30 — (B315) No. 2:*** | Is the resistance less than 1 Ω? | Go to step **2**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and accelerator pedal position sensor connector<br>• Poor contact of joint connector |
| 2 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 2 — Chassis ground:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 3 (+) — Chassis ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector. | Go to step **4**. |
| 4 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B135) No. 22 — (B135) No. 31:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-4, Accelerator Pedal.> | Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector. |

# DK:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-203, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

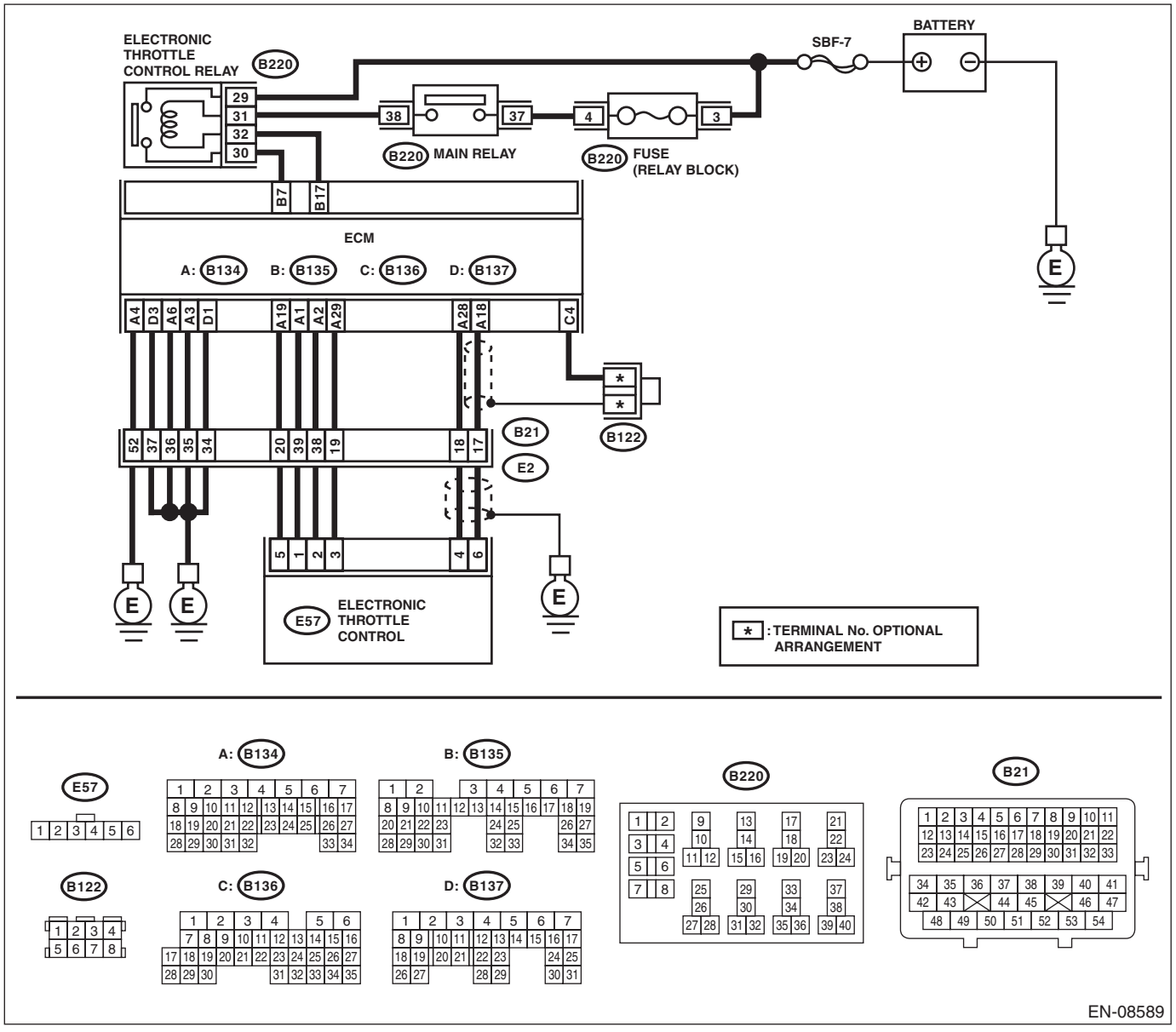
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and electronic throttle control.<br>3) Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B134) No. 19 — Chassis ground:***<br>***(B134) No. 18 — Chassis ground:***<br>***(B134) No. 18 — (B136) No. 4:***<br>***(B134) No. 28 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **2**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. |
| 2 | **CHECK SHORT CIRCUIT INSIDE THE ECM.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 — Engine ground:***<br>***(E57) No. 4 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **3**. | Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> |
| 3 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Disconnect the connectors from ECM.<br>2) Measure the resistance of harness between ECM and electronic throttle control connector.<br>***Connector & terminal***<br>***(B134) No. 18 — (E57) No. 6:***<br>***(B134) No. 28 — (E57) No. 4:***<br>***(B134) No. 29 — (E57) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **4**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and electronic throttle control connector<br>• Poor contact of coupling connector |
| 4 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Measure the resistance between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 3 — Engine ground:*** | Is the resistance less than 5 Ω? | Go to step **5**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 5 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between electronic throttle control connector and engine ground.<br>***Connector & terminal***<br>***(E57) No. 6 (+) — Engine ground (–):***<br>***(E57) No. 4 (+) — Engine ground (–):*** | Is the voltage 5 V or more? | Repair the short circuit to power in harness between ECM and electronic throttle control connector. | Go to step **6**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 6 | **CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM.<br>3) Measure the resistance between ECM connectors.<br>***Connector & terminal***<br>***(B134) No. 19 — (B134) No. 18:***<br>***(B134) No. 19 — (B134) No. 28:*** | Is the resistance 1 MΩ or more? | Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.> | Repair the short circuit to power in harness between ECM and electronic throttle control connector. |

# DL:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-205, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

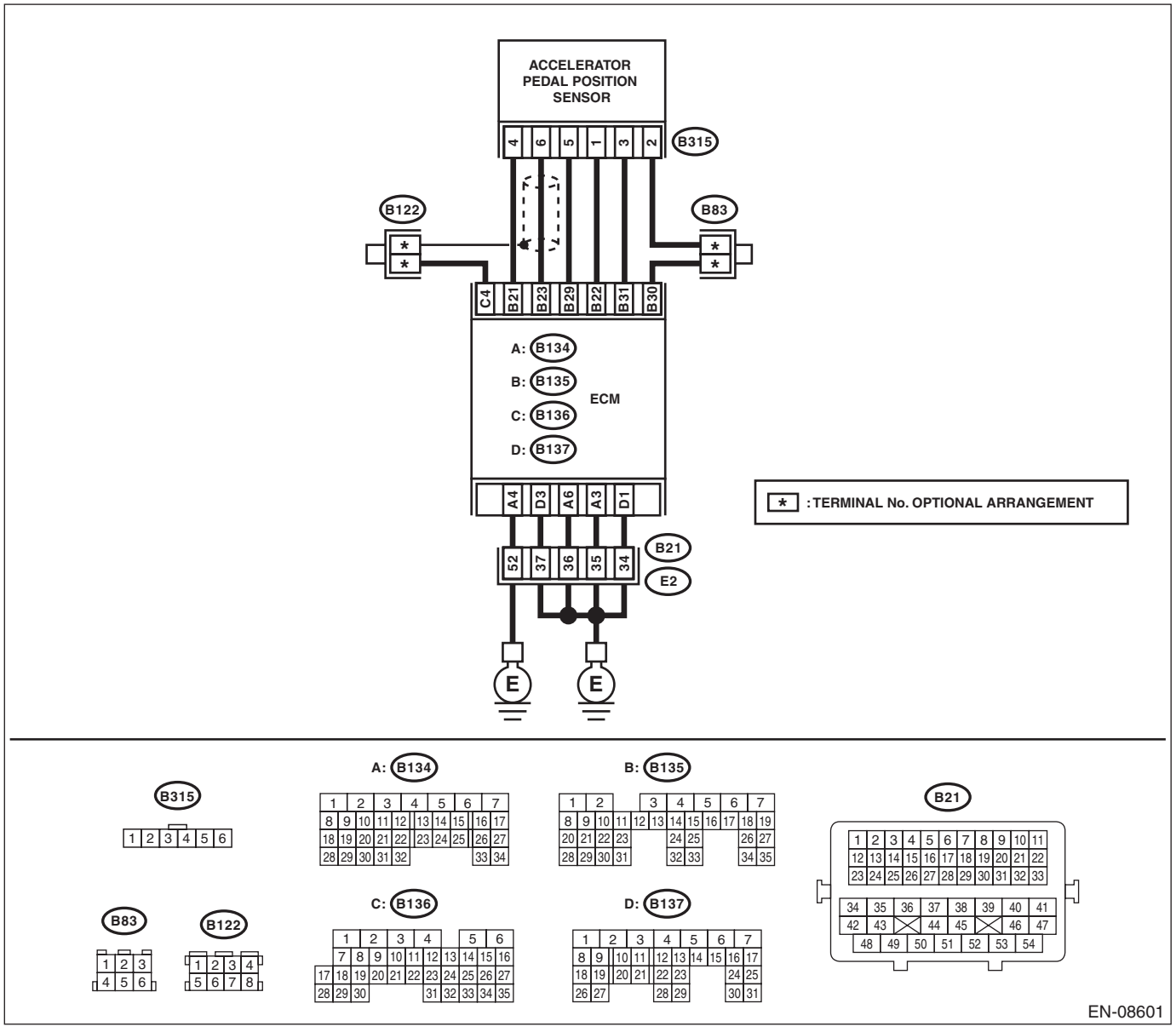
**TROUBLE SYMPTOM:**

- Improper idling
- Poor driving performance

**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**



| | Step | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground.<br>***Connector & terminal***<br>***Main accelerator pedal position sensor signal***<br>***(B135) No. 23 (+) — Chassis ground (–):***<br>***Sub accelerator pedal position sensor signal***<br>***(B135) No. 31 (+) — Chassis ground (–):*** | Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V? | Go to step **3**. | Go to step **2**. |
| 2 | **CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.**<br>1) Measure the voltage between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 6 (+) — Chassis ground (–):***<br>***(B315) No. 3 (+) — Chassis ground (–):*** | Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V? | Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.> | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and accelerator pedal position sensor connector<br>• Short circuit to ground in harness between ECM and accelerator pedal position sensor connector |
| 3 | **CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.**<br>Measure the resistance of harness between accelerator pedal position sensor connector and chassis ground.<br>***Connector & terminal***<br>***(B315) No. 5 — Chassis ground:***<br>***(B315) No. 2 — Chassis ground:*** | Is the resistance less than 5 Ω? | Repair the poor contact of ECM connector. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and accelerator pedal position sensor connector<br>• Open circuit of harness between ECM and engine ground<br>• Poor contact of ECM connector<br>• Poor contact of joint connector |

# DM:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-207, 0, Diagnostic Trouble Code (DTC) Detecting Criteria.>

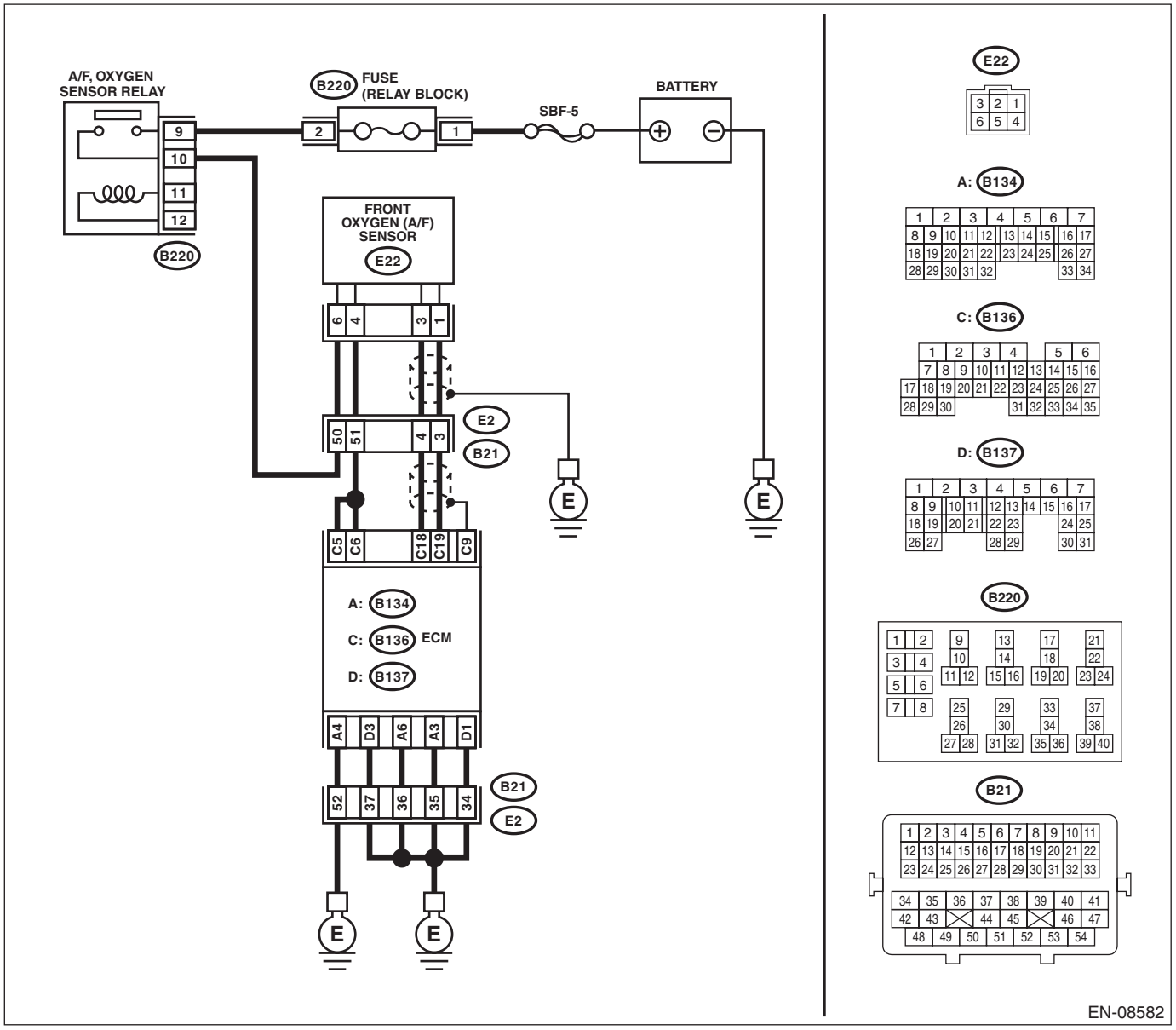
**TROUBLE SYMPTOM:**

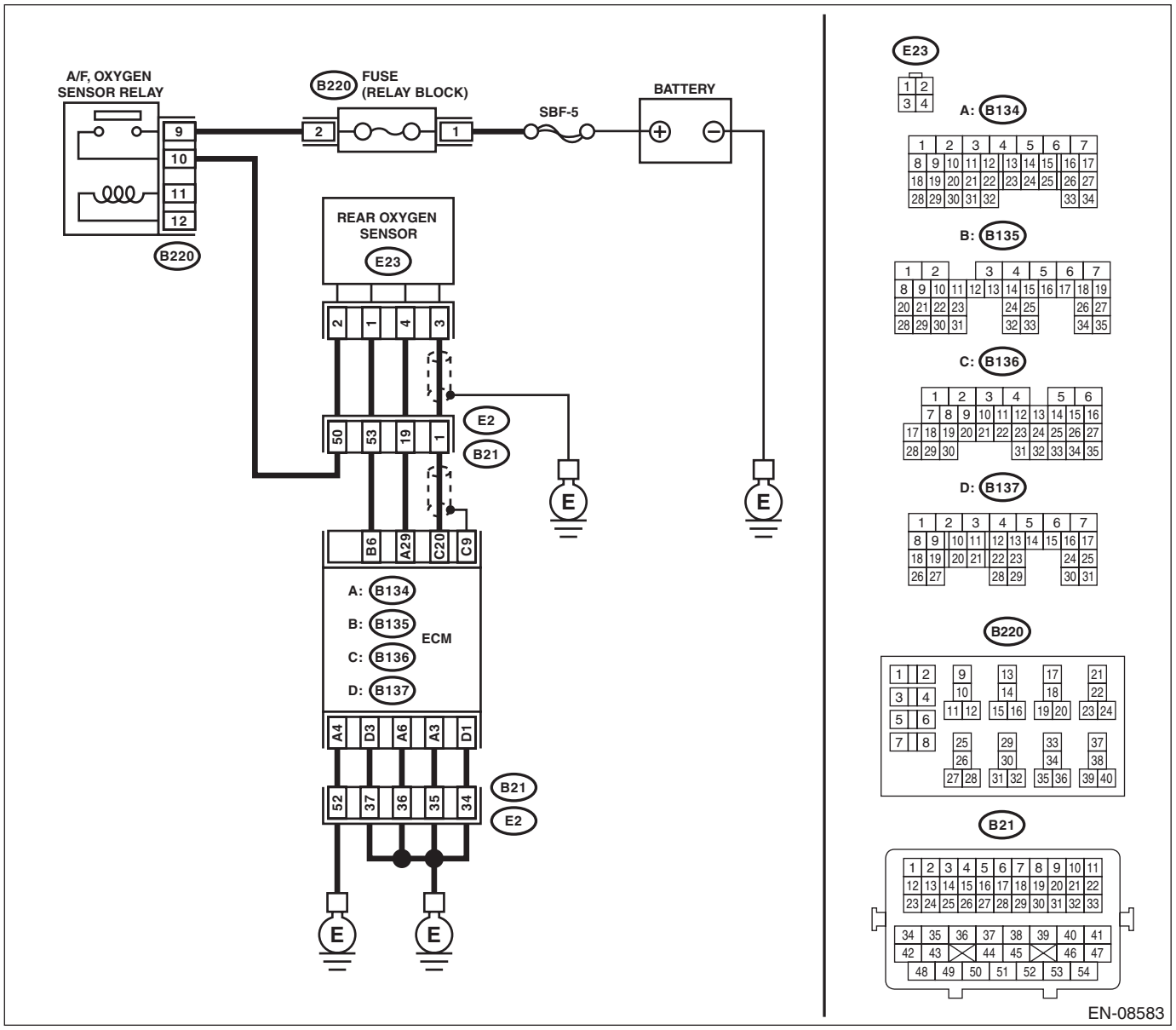
- Engine stalls.
- Improper idling

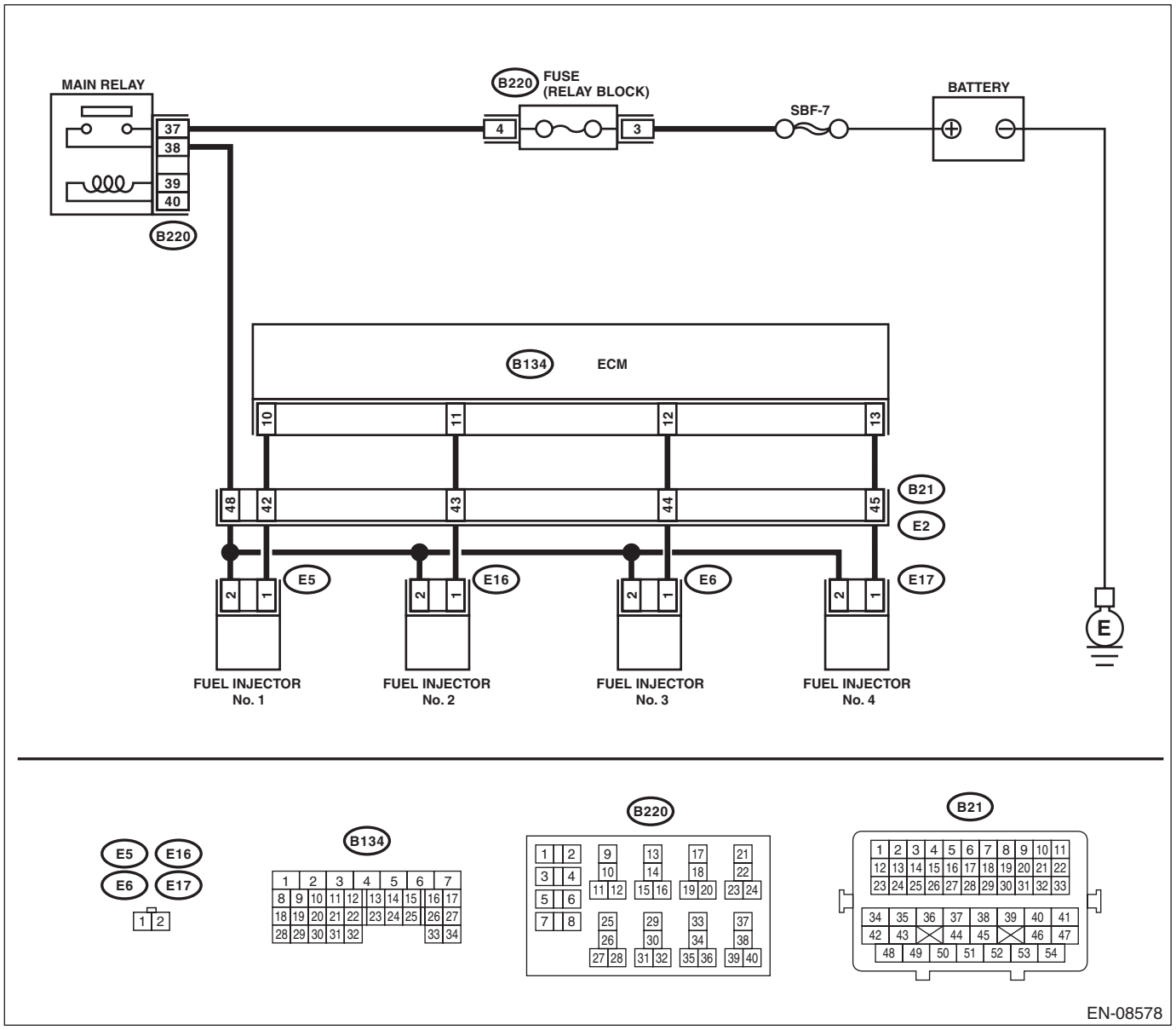
**CAUTION:**

**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

**WIRING DIAGRAM:**




A/F, OXYGEN SENSOR RELAY
B220
FUSE (RELAY BLOCK)
BATTERY
SBF-5
REAR OXYGEN SENSOR
E23
E2
B21
A: B134
B: B135
C: B136
D: B137
ECM
E
EN-08583




| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **2**. |
| 2 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connectors from ECM and front oxygen (A/F) sensor.<br>3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.<br>***Connector & terminal***<br>***(B136) No. 19 — (E22) No. 1:***<br>***(B136) No. 18 — (E22) No. 3:*** | Is the resistance less than 1 Ω? | Go to step **3**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector<br>• Poor contact of coupling connector |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 3 | **CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.**<br>Measure the resistance between ECM and chassis ground.<br>***Connector & terminal***<br>***(B136) No. 19 — Chassis ground:***<br>***(B136) No. 18 — Chassis ground:*** | Is the resistance 1 MΩ or more? | Go to step **4**. | Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector. |
| 4 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):*** | Is the voltage 4.5 V or more? | Go to step **6**. | Go to step **5**. |
| 5 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 4.95 V or more? | Go to step **6**. | Go to step **7**. |
| 6 | **CHECK OUTPUT SIGNAL FOR ECM.**<br>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E22) No. 1 (+) — Chassis ground (–):***<br>***(E22) No. 3 (+) — Chassis ground (–):*** | Is the voltage 8 V or more? | Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).> | Repair the poor contact of ECM connector. |
| 7 | **CHECK EXHAUST SYSTEM.** | Are there holes or loose bolts on exhaust system? | Repair the exhaust system. | Go to step **8**. |
| 8 | **CHECK AIR INTAKE SYSTEM.** | Are there holes, loose bolts or disconnection of hose on air intake system? | Repair the air intake system. | Go to step **9**. |
| 9 | **CHECK FUEL PRESSURE.**<br>**WARNING:**<br>**Place "NO OPEN FLAMES" signs near the working area.**<br>**CAUTION:**<br>**Be careful not to spill fuel.**<br>1) Connect the front oxygen (A/F) sensor connector.<br>2) Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.><br>**CAUTION:**<br>**Release fuel pressure before removing the fuel pressure gauge.** | Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm$^2$, 49 — 58 psi)? | Go to step **10**. | Repair the following item.<br>Fuel pressure is too high:<br>• Clogged fuel line or bent hose<br>Fuel pressure is too low:<br>• Improper fuel pump discharge<br>• Clogged fuel line |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 10 | **CHECK ENGINE COOLANT TEMPERATURE SENSOR.**<br>1) Start the engine and warm up completely.<br>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the engine coolant temperature 75°C (167°F) or higher? | Go to step **11**. | Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.> |
| 11 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)? | Go to step **12**. | Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 12 | **CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.**<br>1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F).<br>2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position.<br>3) Turn the A/C switch to OFF.<br>4) Turn all the accessory switches to OFF.<br>5) Open the front hood.<br>6) Measure the ambient temperature.<br>7) Read the data of the mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)? | Go to step **13**. | Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-35, Mass Air Flow and Intake Air Temperature Sensor.> |
| 13 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 490 mV or more? | Go to step **14**. | Go to step **15**. |
| 14 | **CHECK REAR OXYGEN SENSOR DATA.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Depress the clutch pedal. (MT model)<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is the voltage 250 mV or less? | Go to step **16**. | Go to step **15**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 15 | **CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.** | Has water entered the connector? | Completely remove any water inside. | Go to step **17**. |
| 16 | **CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.**<br>1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more.<br>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.<br>NOTE:<br>• Subaru Select Monitor<br>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-33, Subaru Select Monitor.><br>• General scan tool<br>For detailed operation procedures, refer to the general scan tool operation manual. | Is a voltage of 250 mV or less maintained for 5 minutes or more? | Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-42, Front Oxygen (A/F) Sensor.> | Go to step **17**. |
| 17 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from ECM and rear oxygen sensor.<br>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.<br>***Connector & terminal***<br>***(B136) No. 20 — (E23) No. 3:***<br>***(B135) No. 29 — (E23) No. 4:*** | Is the resistance less than 1 Ω? | Go to step **18**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and rear oxygen sensor connector<br>• Poor contact of coupling connector |
| 18 | **CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.**<br>1) Connect the connector to ECM.<br>2) Turn the ignition switch to ON.<br>3) Measure the voltage between rear oxygen sensor connector and chassis ground.<br>***Connector & terminal***<br>***(E23) No. 3 (+) — Chassis ground (–):*** | Is the voltage 0.2 — 0.5 V? | Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.> | Go to step **19**. |
| 19 | **CHECK OUTPUT SIGNAL OF ECM.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Go to step **24**. | Go to step **20**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 20 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 1 — Engine ground:***<br>***#2 (E16) No. 1 — Engine ground:***<br>***#3 (E6) No. 1 — Engine ground:***<br>***#4 (E17) No. 1 — Engine ground:*** | Is the resistance 1 MΩ or more? | Go to step **21**. | Repair the short circuit to ground in harness between ECM and fuel injector connector. |
| 21 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>Measure the resistance of harness between ECM and fuel injector on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 — (E5) No. 1:***<br>***#2 (B134) No. 11 — (E16) No. 1:***<br>***#3 (B134) No. 12 — (E6) No. 1:***<br>***#4 (B134) No. 13 — (E17) No. 1:*** | Is the resistance less than 1 Ω? | Go to step **22**. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between ECM and fuel injector connector<br>• Poor contact of coupling connector |
| 22 | **CHECK FUEL INJECTOR.**<br>Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Go to step **23**. | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> |
| 23 | **CHECK POWER SUPPLY LINE.**<br>1) Turn the ignition switch to ON.<br>2) Measure the voltage between fuel injector and engine ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (E5) No. 2 (+) — Engine ground (–):***<br>***#2 (E16) No. 2 (+) — Engine ground (–):***<br>***#3 (E6) No. 2 (+) — Engine ground (–):***<br>***#4 (E17) No. 2 (+) — Engine ground (–):*** | Is the voltage 10 V or more? | Repair the poor contact of all connectors in fuel injector circuit. | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders<br>• Poor contact of coupling connector<br>• Poor contact of main relay connector |
| 24 | **CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from fuel injector on faulty cylinders.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage between ECM and chassis ground on faulty cylinders.<br>***Connector & terminal***<br>***#1 (B134) No. 10 (+) — Chassis ground (–):***<br>***#2 (B134) No. 11 (+) — Chassis ground (–):***<br>***#3 (B134) No. 12 (+) — Chassis ground (–):***<br>***#4 (B134) No. 13 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Repair the short circuit to power in harness between ECM and fuel injector connector. | Go to step **25**. |

| | Step | Check | Yes | No |
|---|---|---|---|---|
| 25 | **CHECK FUEL INJECTOR.**<br>1) Turn the ignition switch to OFF.<br>2) Measure the resistance between fuel injector terminals on faulty cylinder.<br>***Terminals***<br>***No. 1 — No. 2:*** | Is the resistance 5 — 20 Ω? | Replace the faulty fuel injector. <Ref. to FU(H4SO)-37, Fuel Injector.> | Go to step **26**. |
| 26 | **CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.** | Is the camshaft position sensor or crankshaft position sensor loosely installed? | Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> | Go to step **27**. |
| 27 | **CHECK CRANK SPROCKET.**<br>Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.> | Is the crank sprocket rusted or does it have broken teeth? | Replace the crank sprocket. <Ref. to ME(H4SO)-56, Crank Sprocket.> | Go to step **28**. |
| 28 | **CHECK INSTALLATION CONDITION OF TIMING BELT.**<br>Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block.<br>ST 499987500 CRANKSHAFT SOCKET | Is the timing belt dislocated from its proper position? | Repair the installation condition of timing belt. <Ref. to ME(H4SO)-50, Timing Belt.> | Go to step **29**. |
| 29 | **CHECK FUEL LEVEL.** | Is the fuel meter indication higher than the “Lower” level? | Go to step **30**. | Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **30**. |
| 30 | **CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.**<br>1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4SO)(diag)-55, Clear Memory Mode.><br>2) Start the engine, and drive the vehicle 10 minutes or more. | Does the malfunction indicator light illuminate or blink? | Go to step **32**. | Go to step **31**. |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 31 | **CHECK CAUSE OF MISFIRE.** | Was the cause of misfire identified when the engine is running? | Finish diagnostics operation, if the engine has no abnormality. | Repair the poor contact of connector.<br>NOTE:<br>In this case, repair the following item:<br>• Poor contact of ignition coil connector<br>• Poor contact of fuel injector connector on faulty cylinders<br>• Poor contact of ECM connector<br>• Poor contact of coupling connector |
| 32 | **CHECK AIR INTAKE SYSTEM.** | Is there any fault in air intake system? | Repair the air intake system.<br>NOTE:<br>Check the following items.<br>• Are there air leaks or air suction caused by loose or dislocated nuts and bolts?<br>• Are there cracks or any disconnection of hoses? | Go to step **33**. |
| 33 | **CHECK MISFIRE SYMPTOM.**<br>1) Turn the ignition switch to ON.<br>2) Check for DTC. <Ref. to EN(H4SO)(diag)-42, Read Diagnostic Trouble Code (DTC).> | Does the Subaru Select Monitor or general scan tool indicate only one DTC? | Go to step **38**. | Go to step **34**. |
| 34 | **CHECK DTC.** | Is DTC P0301 and P0302 displayed on the Subaru Select Monitor or general scan tool? | Go to step **39**. | Go to step **35**. |
| 35 | **CHECK DTC.** | Is DTC P0303 and P0304 displayed on the Subaru Select Monitor or general scan tool? | Go to step **40**. | Go to step **36**. |
| 36 | **CHECK DTC.** | Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool? | Go to step **41**. | Go to step **37**. |
| 37 | **CHECK DTC.** | Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool? | Go to step **42**. | Go to step **43**. |
| 38 | **ONLY ONE CYLINDER.** | Is there any fault in the cylinder? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Spark plug cord<br>• Fuel injector<br>• Compression ratio | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 39 | GROUP OF #1 AND #2 CYLINDERS. | Are there any faults in #1 and #2 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>• Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Ignition coil<br>• Compression ratio<br>• If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 40 | GROUP OF #3 AND #4 CYLINDERS. | Are there any faults in #3 and #4 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>• Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Ignition coil<br>• Compression ratio<br>• If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)(diag)-77, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 41 | GROUP OF #1 AND #3 CYLINDERS. | Are there any faults in #1 and #3 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio<br>• Skipping timing belt teeth | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 42 | GROUP OF #2 AND #4 CYLINDERS. | Are there any faults in #2 and #4 cylinders? | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio<br>• Skipping timing belt teeth | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> |
| 43 | CYLINDER AT RANDOM. | Is the engine idle rough? | Go to DTC P0171. <Ref. to EN(H4SO)(diag)-156, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> | Repair or replace faulty parts.<br>NOTE:<br>Check the following items.<br>• Spark plug<br>• Fuel injector<br>• Compression ratio |

# DN:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-210, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).><br>NOTE:<br>The barometric pressure sensor is built into the ECM. |

# DO:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-211, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).><br>NOTE:<br>The barometric pressure sensor is built into the ECM. |

## DP:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-212, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**
**After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.>.**

| Step | Check | Yes | No |
|---|---|---|---|
| 1 **CHECK FOR ANY OTHER DTC ON DISPLAY.** | Is any other DTC displayed? | Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-86, List of Diagnostic Trouble Code (DTC).> | Replace the ECM. <Ref. to FU(H4SO)-46, Engine Control Module (ECM).><br>NOTE:<br>The barometric pressure sensor is built into the ECM. |

## DQ:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DR:DTC U0101 CAN (TCU) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DS:DTC U0122 CAN (VDC) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DT:DTC U0140 CAN (BCU) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DU:DTC U0402 CAN (TCU) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DV:DTC U0416 CAN (VDC) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## DW:DTC U0422 CAN (BCU) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# 21.General Diagnostic Table

## A: INSPECTION

### 1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(H4SO)-101, Engine Trouble in General.>

| Symptoms | Problem parts |
|---|---|
| 1. Engine stalls during idling. | 1) Manifold absolute pressure sensor<br>2) Mass air flow and intake air temperature sensor<br>3) Ignition parts (*1)<br>4) Engine coolant temperature sensor (*2)<br>5) Crankshaft position sensor (*3)<br>6) Camshaft position sensor (*3)<br>7) Fuel injection parts (*4)<br>8) Electronic throttle control |
| 2. Rough idling | 1) Manifold absolute pressure sensor<br>2) Mass air flow and intake air temperature sensor<br>3) Engine coolant temperature sensor (*2)<br>4) Ignition parts (*1)<br>5) Air intake system (*5)<br>6) Fuel injection parts (*4)<br>7) Electronic throttle control<br>8) Crankshaft position sensor (*3)<br>9) Camshaft position sensor (*3)<br>10) Oxygen sensor<br>11) Fuel pump and fuel pump relay<br>12) EGR valve<br>13) Oil switching solenoid valve |
| 3. Engine does not return to idle. | 1) Engine coolant temperature sensor<br>2) Electronic throttle control<br>3) Manifold absolute pressure sensor<br>4) Mass air flow and intake air temperature sensor<br>5) EGR valve<br>6) Accelerator pedal position sensor<br>7) Oil temperature sensor |
| 4. Poor acceleration | 1) Manifold absolute pressure sensor<br>2) Mass air flow and intake air temperature sensor<br>3) Electronic throttle control<br>4) Fuel injection parts (*4)<br>5) Fuel pump and fuel pump relay<br>6) Engine coolant temperature sensor (*2)<br>7) Crankshaft position sensor (*3)<br>8) Camshaft position sensor (*3)<br>9) A/C switch and A/C relay<br>10) Engine torque control signal circuit<br>11) Ignition parts (*1)<br>12) EGR valve<br>13) Accelerator pedal position sensor<br>14) Oil temperature sensor<br>15) Oil switching solenoid valve |

| Symptoms | Problem parts |
|---|---|
| 5. Engine stalls, hesitates, or sputters at acceleration. | 1) Manifold absolute pressure sensor<br>2) Mass air flow and intake air temperature sensor<br>3) Engine coolant temperature sensor (*2)<br>4) Crankshaft position sensor (*3)<br>5) Camshaft position sensor (*3)<br>6) Purge control solenoid valve<br>7) Fuel injection parts (*4)<br>8) Electronic throttle control<br>9) Fuel pump and fuel pump relay<br>10) EGR valve |
| 6. Surging | 1) Mass air flow and intake air temperature sensor<br>2) Manifold absolute pressure sensor<br>3) Engine coolant temperature sensor (*2)<br>4) Crankshaft position sensor (*3)<br>5) Camshaft position sensor (*3)<br>6) Fuel injection parts (*4)<br>7) Electronic throttle control<br>8) Fuel pump and fuel pump relay<br>9) EGR valve |
| 7. Spark knock | 1) Mass air flow and intake air temperature sensor<br>2) Manifold absolute pressure sensor<br>3) Engine coolant temperature sensor<br>4) Knock sensor<br>5) Fuel injection parts (*4)<br>6) Fuel pump and fuel pump relay<br>7) EGR valve<br>8) Oil switching solenoid valve |
| 8. After burning in exhaust system | 1) Mass air flow and intake air temperature sensor<br>2) Manifold absolute pressure sensor<br>3) Engine coolant temperature sensor (*2)<br>4) Fuel injection parts (*4)<br>5) Fuel pump and fuel pump relay |

*1: Check ignition coil and ignitor assembly and spark plug.
*2: Indicate the symptom occurring only in cold temperatures.
*3: Ensure the secure installation.
*4: Check fuel injector, fuel pressure regulator and fuel filter.
*5: Inspect air leak in air intake system.

# GENERAL DESCRIPTION

# *GD(H4SO)*

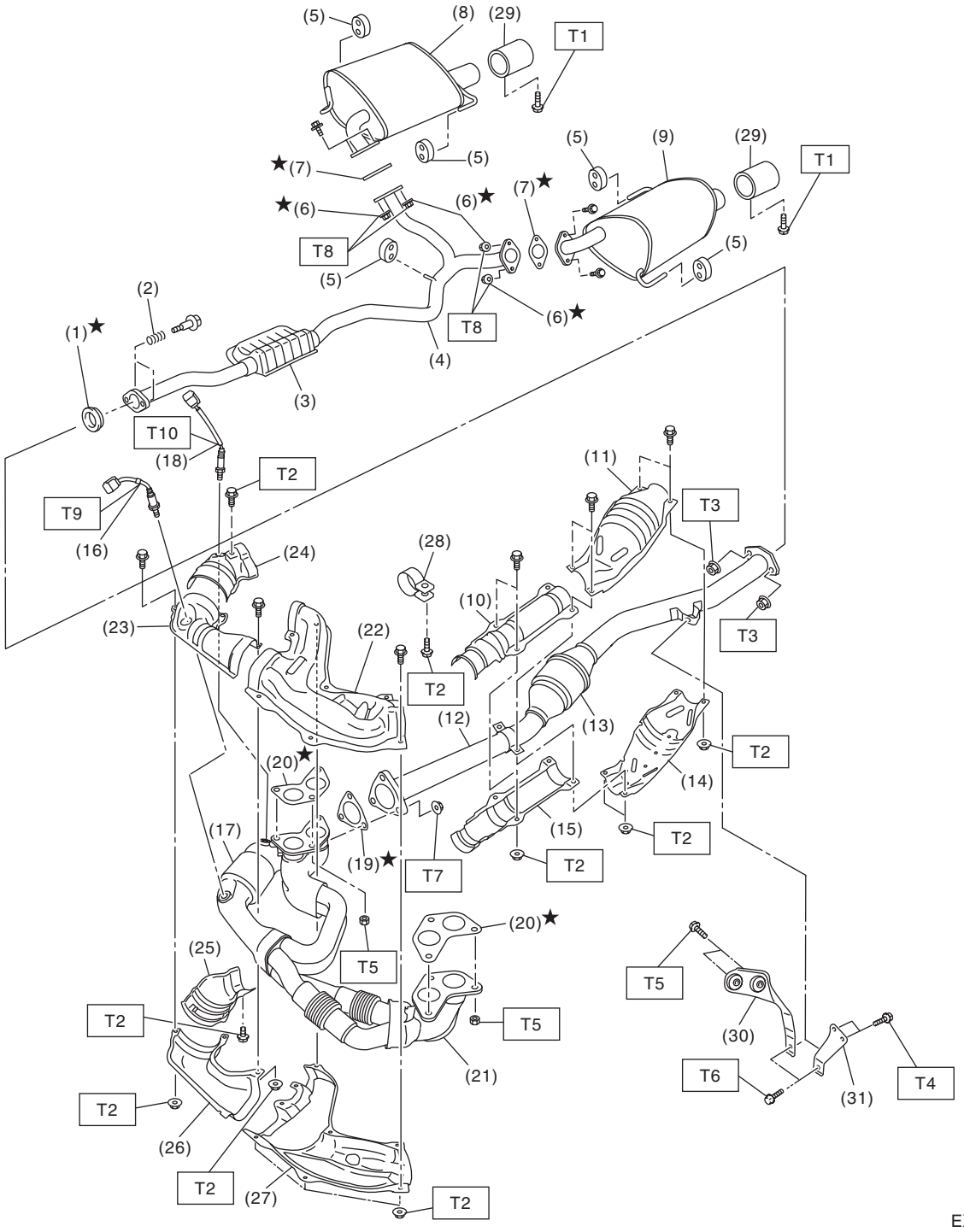

Page

1. List of Diagnostic Trouble Code (DTC) .....2
2. Diagnostic Trouble Code (DTC) Detecting Criteria .....9

# 1. General Description

## A: COMPONENT

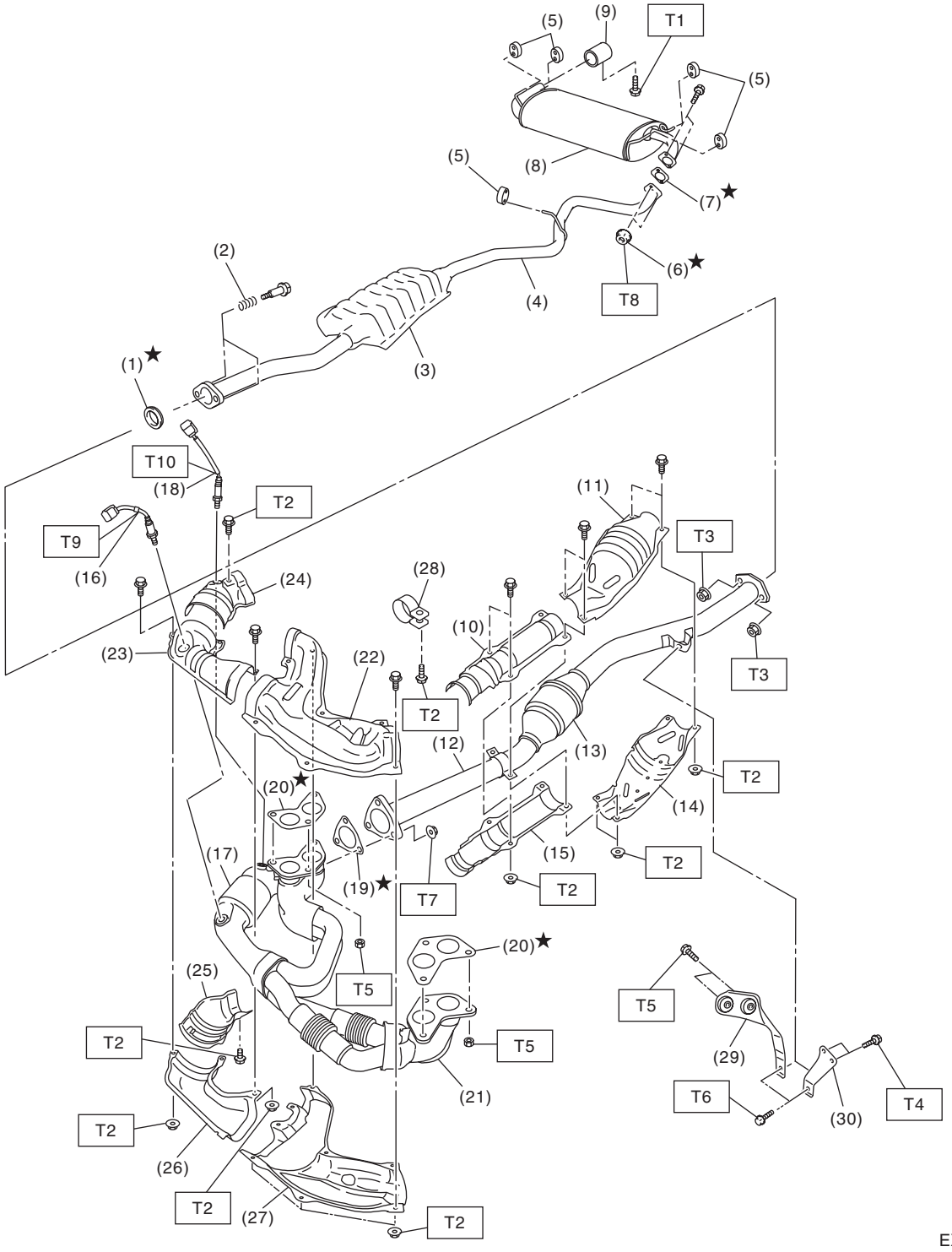
- 4 door model



(1) Gasket
(2) Spring
(3) Chamber
(4) Rear exhaust pipe
(5) Cushion rubber
(6) Self-locking nut
(7) Gasket
(8) Muffler RH
(9) Muffler LH
(10) Center exhaust pipe front upper cover
(11) Rear catalytic converter upper cover
(12) Center exhaust pipe
(13) Rear catalytic converter
(14) Rear catalytic converter lower cover
(15) Center exhaust pipe front lower cover
(16) Front oxygen (A/F) sensor
(17) Front catalytic converter
(18) Rear oxygen sensor
(19) Gasket
(20) Gasket
(21) Front exhaust pipe
(22) Front exhaust pipe upper cover LH
(23) Front exhaust pipe upper cover RH
(24) Front catalytic converter upper cover
(25) Front catalytic converter lower cover
(26) Front exhaust pipe lower cover RH
(27) Front exhaust pipe lower cover LH
(28) Band
(29) Muffler cutter (Models with muffler cutter)
(30) Hanger bracket (MT model)
(31) Hanger bracket (AT model)

| *Tightening torque:N·m (kgf-m, ft-lb)* | |
|---|---|
| *T1:* | *7.5 (0.8, 5.5)* |
| *T2:* | *13 (1.3, 9.6)* |
| *T3:* | *18 (1.8, 13.3)* |
| *T4:* | *23 (2.3, 17.0)* |
| *T5:* | *30 (3.1, 22.1)* |
| *T6:* | *35 (3.6, 25.8)* |
| *T7:* | *40 (4.1, 29.5)* |
| *T8:* | *48 (4.9, 35.4)* |
| *T9:* | *<Ref. to FU(H4SO)-42, INSTALLATION, Front Oxygen (A/F) Sensor.>* |
| *T10:* | *<Ref. to FU(H4SO)-44, INSTALLATION, Rear Oxygen Sensor.>* |

- 5 door model


(5)
(9)
T1
(5)
(5)
(8)
(7)★
(2)
(6)★
(4)
T8
(3)
(1)★
T10
(18)
T2
(11)
T9
T3
(16)
(24)
(28)
(10)
(23)
(22)
T3
T2
(12)
(13)
T2
(20)★
(14)
(17)
(15)
T2
(19)★
T7
T2
(20)★
(25)
T5
T5
T2
T5
(29)
(21)
T6
T4
T2
(30)
(26)
T2
(27)
T2
EX-02702

(1) Gasket
(2) Spring
(3) Chamber
(4) Rear exhaust pipe
(5) Cushion rubber
(6) Self-locking nut
(7) Gasket
(8) Muffler
(9) Muffler cutter (Models with muffler cutter)
(10) Center exhaust pipe front upper cover
(11) Rear catalytic converter upper cover
(12) Center exhaust pipe
(13) Rear catalytic converter
(14) Rear catalytic converter lower cover
(15) Center exhaust pipe front lower cover
(16) Front oxygen (A/F) sensor
(17) Front catalytic converter
(18) Rear oxygen sensor
(19) Gasket
(20) Gasket
(21) Front exhaust pipe
(22) Front exhaust pipe upper cover LH
(23) Front exhaust pipe upper cover RH
(24) Front catalytic converter upper cover
(25) Front catalytic converter lower cover
(26) Front exhaust pipe lower cover RH
(27) Front exhaust pipe lower cover LH
(28) Band
(29) Hanger bracket (MT model)
(30) Hanger bracket (AT model)

***Tightening torque:N·m (kgf-m, ft-lb)***

| | |
|---|---|
| ***T1:*** | ***7.5 (0.8, 5.5)*** |
| ***T2:*** | ***13 (1.3, 9.6)*** |
| ***T3:*** | ***18 (1.8, 13.3)*** |
| ***T4:*** | ***23 (2.3, 17.0)*** |
| ***T5:*** | ***30 (3.1, 22.1)*** |
| ***T6:*** | ***35 (3.6, 25.8)*** |
| ***T7:*** | ***40 (4.1, 29.5)*** |
| ***T8:*** | ***48 (4.9, 35.4)*** |
| ***T9:*** | ***<Ref. to FU(H4SO)-42, INSTALLATION, Front Oxygen (A/F) Sensor.>*** |
| ***T10:*** | ***<Ref. to FU(H4SO)-44, INSTALLATION, Rear Oxygen Sensor.>*** |

## B: CAUTION

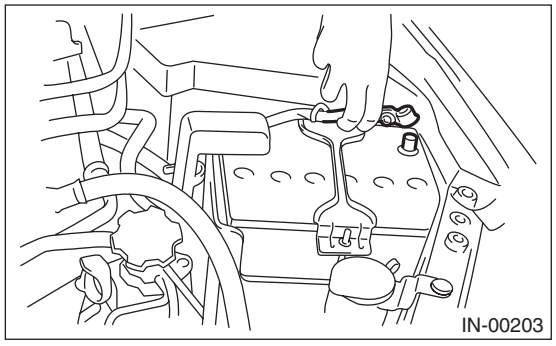
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

# 2. Front Exhaust Pipe

## A: REMOVAL

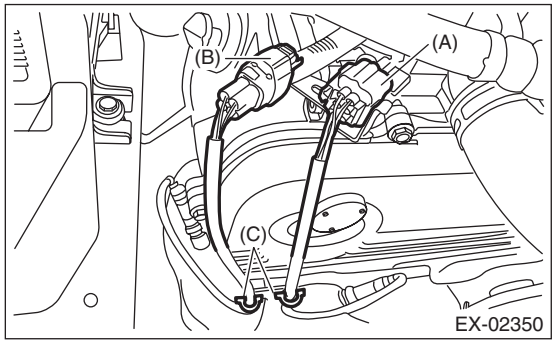
**CAUTION:**
**Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.**

1) Disconnect the ground cable from battery.




2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

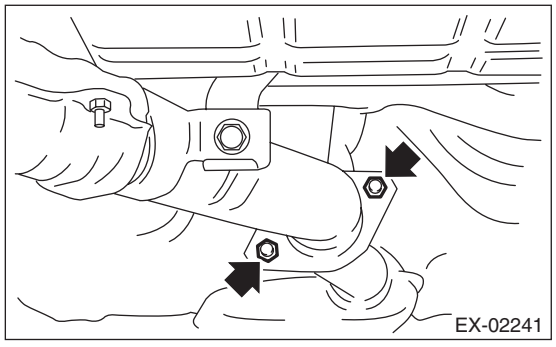
3) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.




4) Lift up the vehicle.

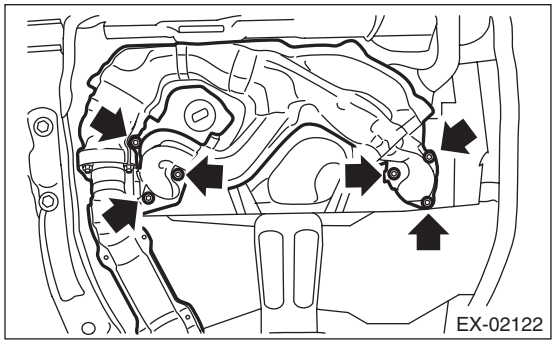
5) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>

6) Remove the rear exhaust pipe from center exhaust pipe.

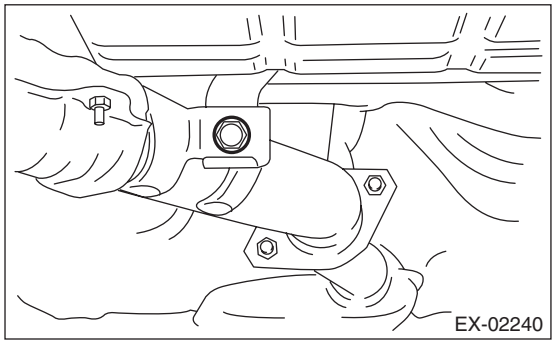



7) Remove the nuts which hold front exhaust pipe onto cylinder heads.

**CAUTION:**
**Be careful not to drop the front exhaust pipe and center exhaust pipe assembly.**



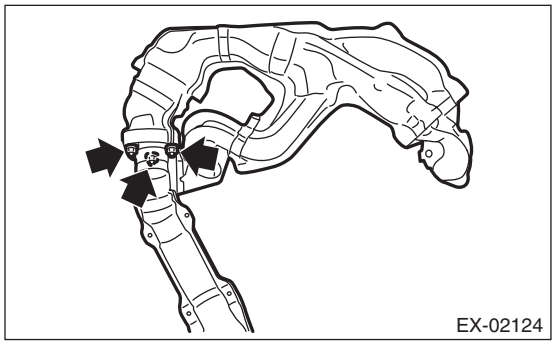

8) Remove the bolt which holds center exhaust pipe to hanger bracket.




9) Remove the front exhaust pipe and center exhaust pipe from vehicle as a unit.

**CAUTION:**
**• The front exhaust pipe and center exhaust pipe assembly are very heavy. Be careful not to drop the exhaust pipes when removing.**
**• After removing the front exhaust pipe and center exhaust pipe assembly, do not pull the rear exhaust pipe with excessive force.**

10) Remove the center exhaust pipe from front exhaust pipe.



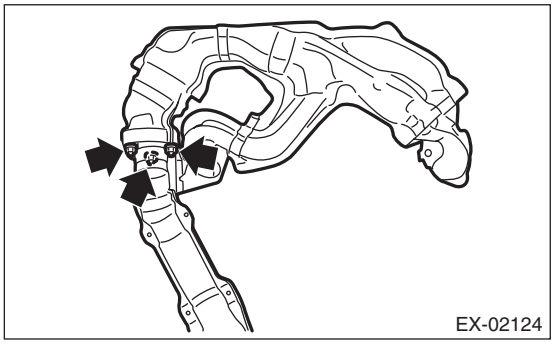

11) Remove the front oxygen (A/F) sensor and rear oxygen sensor from front exhaust pipe. <Ref. to FU(H4SO)-42, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-44, REMOVAL, Rear Oxygen Sensor.>

## B: INSTALLATION

1) Install the front oxygen (A/F) sensor and rear oxygen sensor to the front exhaust pipe. <Ref. to FU(H4SO)-42, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-44, INSTALLATION, Rear Oxygen Sensor.>
2) Install the center exhaust pipe to front exhaust pipe.

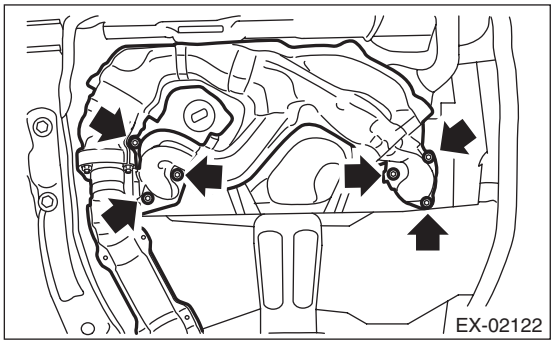
NOTE:
Use a new gasket.

***Tightening torque:***
***40 N·m (4.1 kgf-m, 29.5 ft-lb)***




3) Install the front exhaust pipe and center exhaust pipe as a unit to the vehicle.

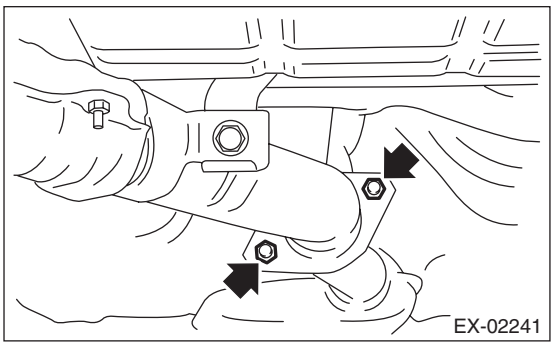
NOTE:
Use a new gasket.
4) Temporarily tighten the nuts which hold front exhaust pipe to cylinder heads.




5) Install the rear exhaust pipe to center exhaust pipe.

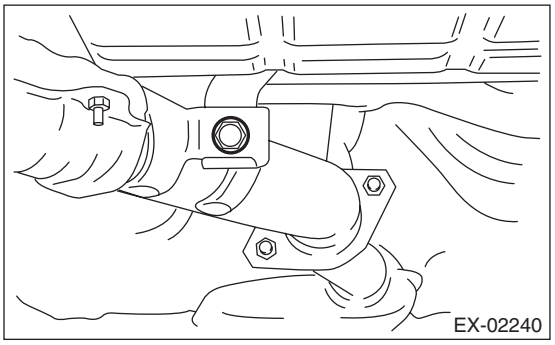
NOTE:
Use a new gasket.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***



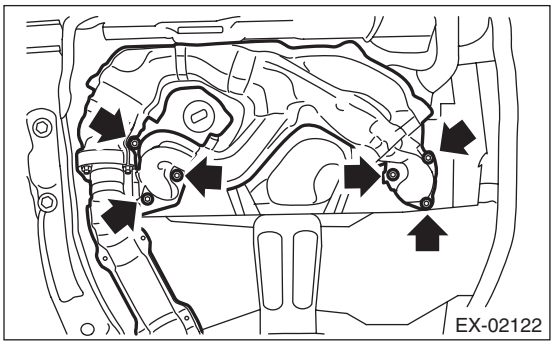

6) Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

***Tightening torque:***
***35 N·m (3.6 kgf-m, 25.8 ft-lb)***



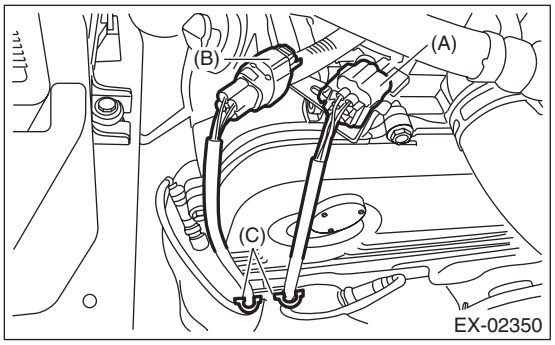

7) Tighten the nuts which hold front exhaust pipe to cylinder heads.

***Tightening torque:***
***30 N·m (3.1 kgf-m, 22.1 ft-lb)***

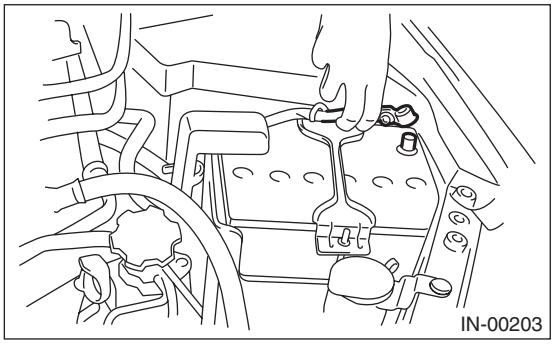



8) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
9) Lower the vehicle.

10) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B), and fasten the harness with the clip (C).




11) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
12) Connect the battery ground terminal.




## C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

# 3. Center Exhaust Pipe

## A: REMOVAL

After removing the center exhaust pipe and front exhaust pipe as a unit, separate them. Refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>

## B: INSTALLATION

Install the center exhaust pipe and front exhaust pipe as one unit. Refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

## C: INSPECTION

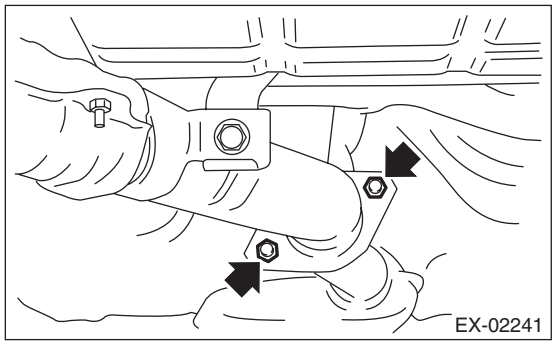
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

# 4. Rear Exhaust Pipe

## A: REMOVAL

**CAUTION:**
**Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.**

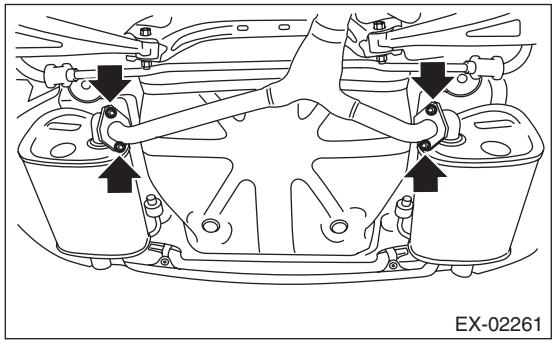
1) Lift up the vehicle.
2) Remove the center exhaust pipe from rear exhaust pipe.



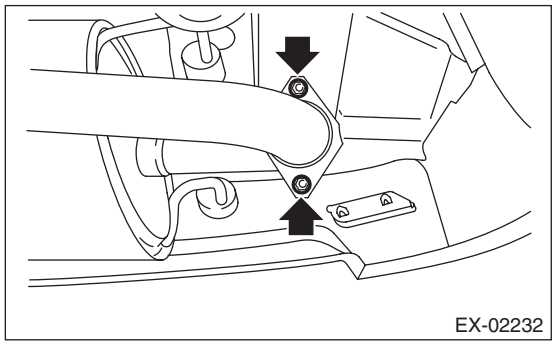

3) Remove the muffler from rear exhaust pipe.

**CAUTION:**
**Be careful not to drop the rear exhaust pipe.**

- 4 door model

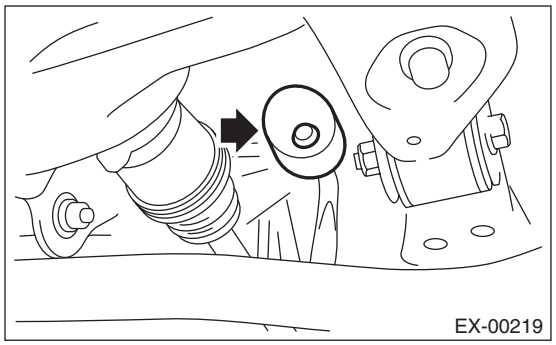



- 5 door model




4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
5) Remove the rear exhaust pipe from the cushion rubber.

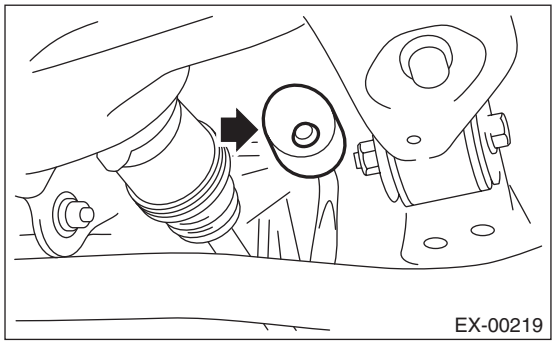
**CAUTION:**
**Be careful not to let the muffler contact the rear bumper.**




## B: INSTALLATION

1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
2) Install the rear exhaust pipe to cushion rubber.

NOTE:
After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

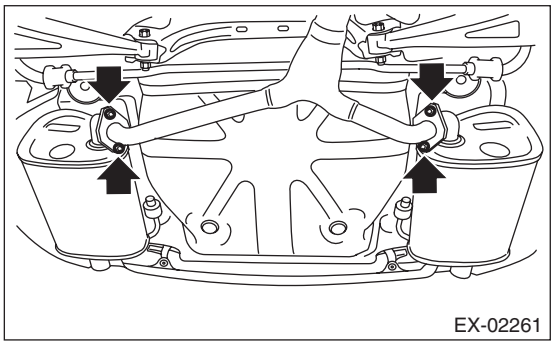


3) Install the rear exhaust pipe to the muffler.

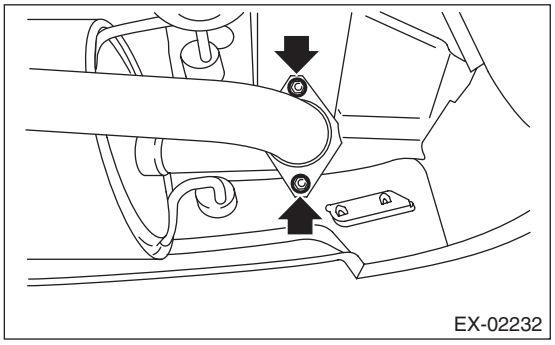
NOTE:
Use a new gasket and self-locking nut.

***Tightening torque:***
***48 N·m (4.9 kgf-m, 35.4 ft-lb)***

- 4 door model



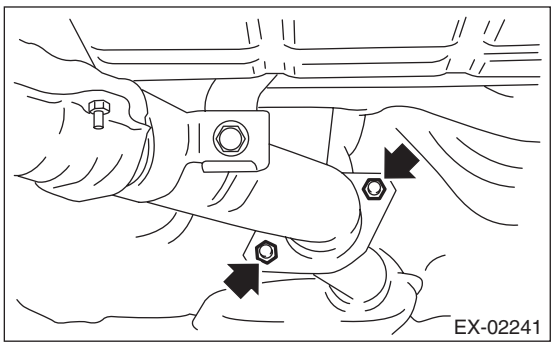

- 5 door model




4) Install the center exhaust pipe to rear exhaust pipe.

NOTE:
Use a new gasket.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***




5) Lower the vehicle.

## C: INSPECTION

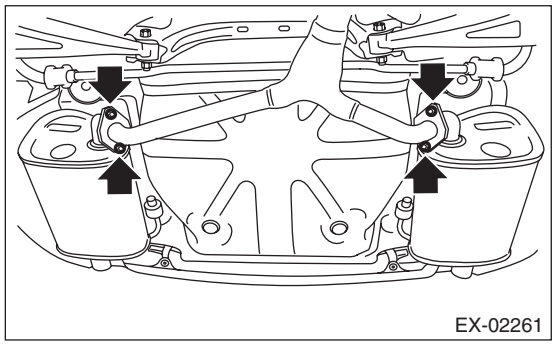
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

# 5. Muffler

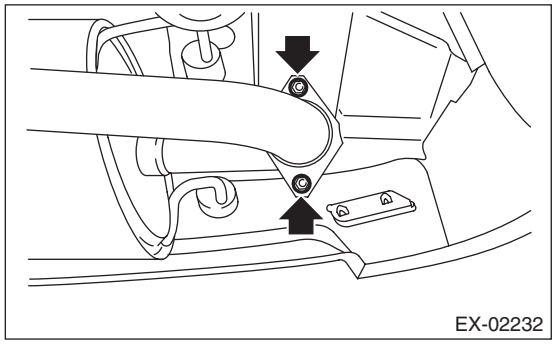
## A: REMOVAL

**CAUTION:**
**Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.**

1) Lift up the vehicle.
2) Remove the rear exhaust pipe from the muffler.
- 4 door model



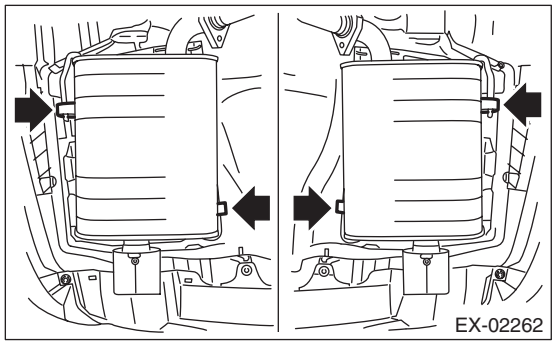

- 5 door model



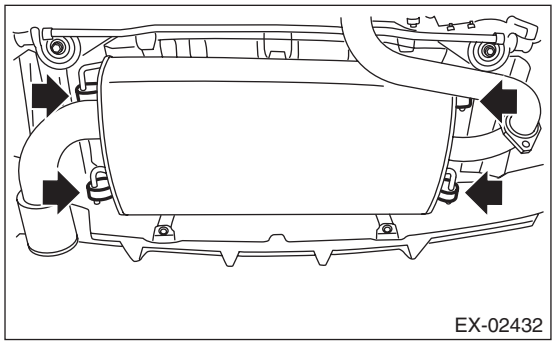

3) Apply a coat of spray type lubricant to the mating area of cushion rubber.
4) Remove the muffler from the cushion rubber.

**CAUTION:**
**Be careful not to drop the muffler during removal.**

- 4 door model




- 5 door model



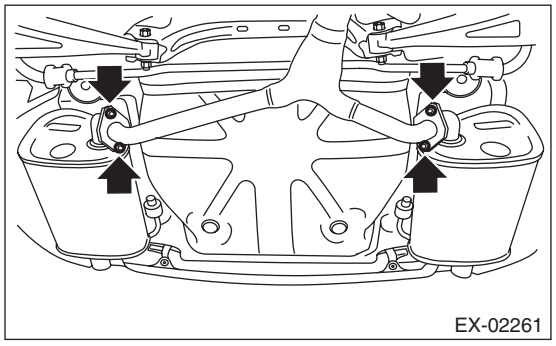

## B: INSTALLATION

Install in the reverse order of removal.

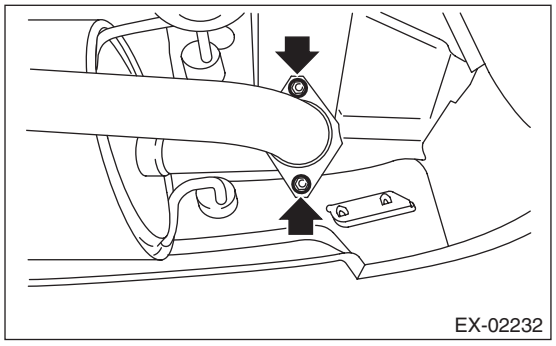
NOTE:
- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

***Tightening torque:***
***48 N·m (4.9 kgf-m, 35.4 ft-lb)***

- 4 DOOR MODEL




- 5 DOOR MODEL




## C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

# COOLING

# CO(H4SO)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3. Engine Coolant .....13
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5. Thermostat .....17
6. Radiator .....19
7. Radiator Cap .....22
8. Radiator Main Fan and Fan Motor .....23
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10. Reservoir Tank .....27
11. Engine Cooling System Trouble in General .....28

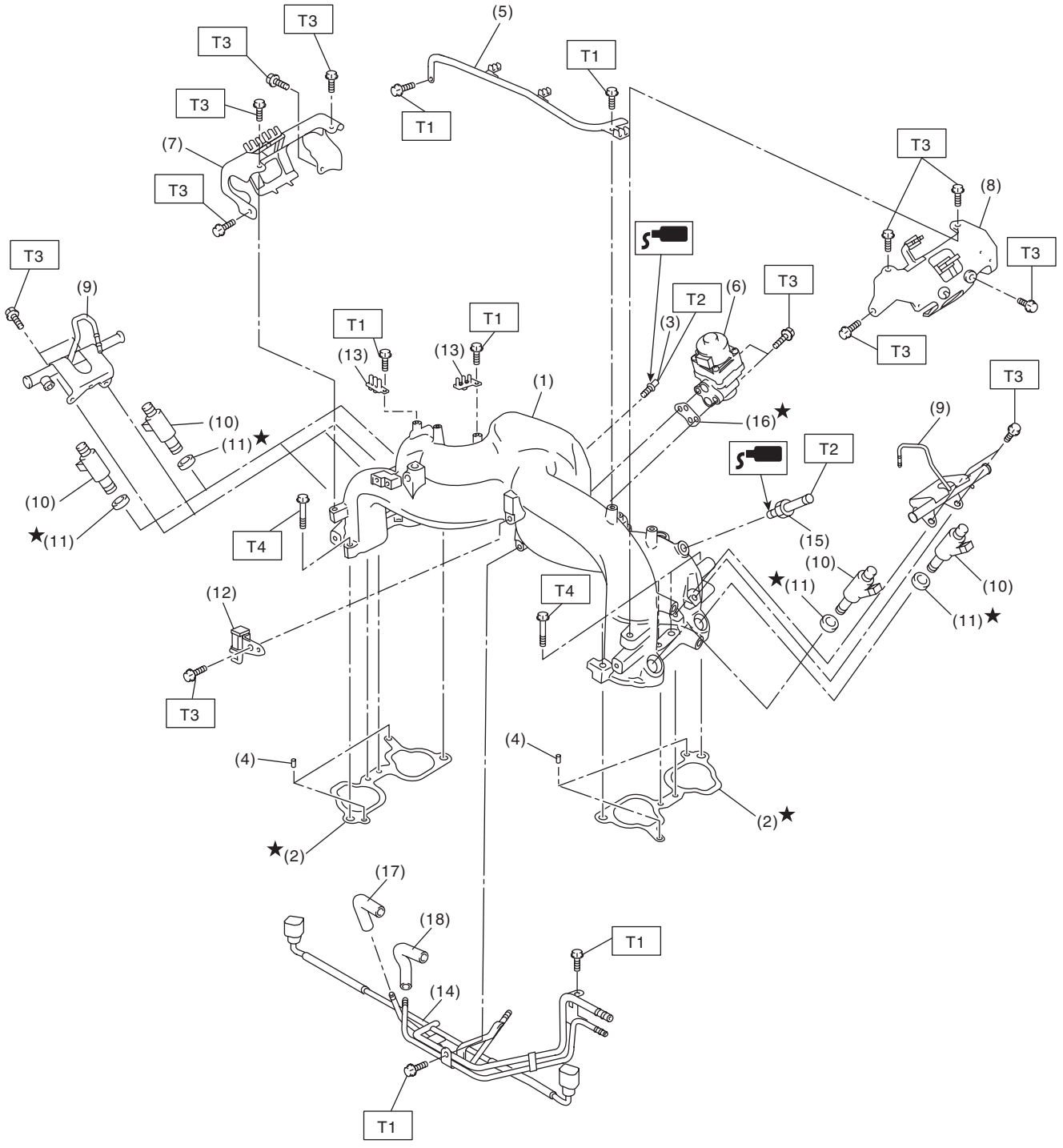
# 1. General Description

## A: SPECIFICATION

| | | |
|---|---|---|
| Fuel tank | Capacity | 64 ℓ (16.9 US gal, 14.1 Imp gal) |
| | Location | Under rear seat |
| Fuel pump | Type | Impeller |
| | Shutoff discharge pressure | 550 — 850 kPa (5.6 — 8.7 kg/cm$^2$, 79.7 — 123.2 psi) |
| | Discharge rate | 125 ℓ (33 US gal, 27.5 Imp gal)/h or more<br>[12 V at 300 kPa (3.06 kg/cm$^2$, 43.5 psi)] |
| Fuel filter | | In-tank type |

# B: COMPONENT

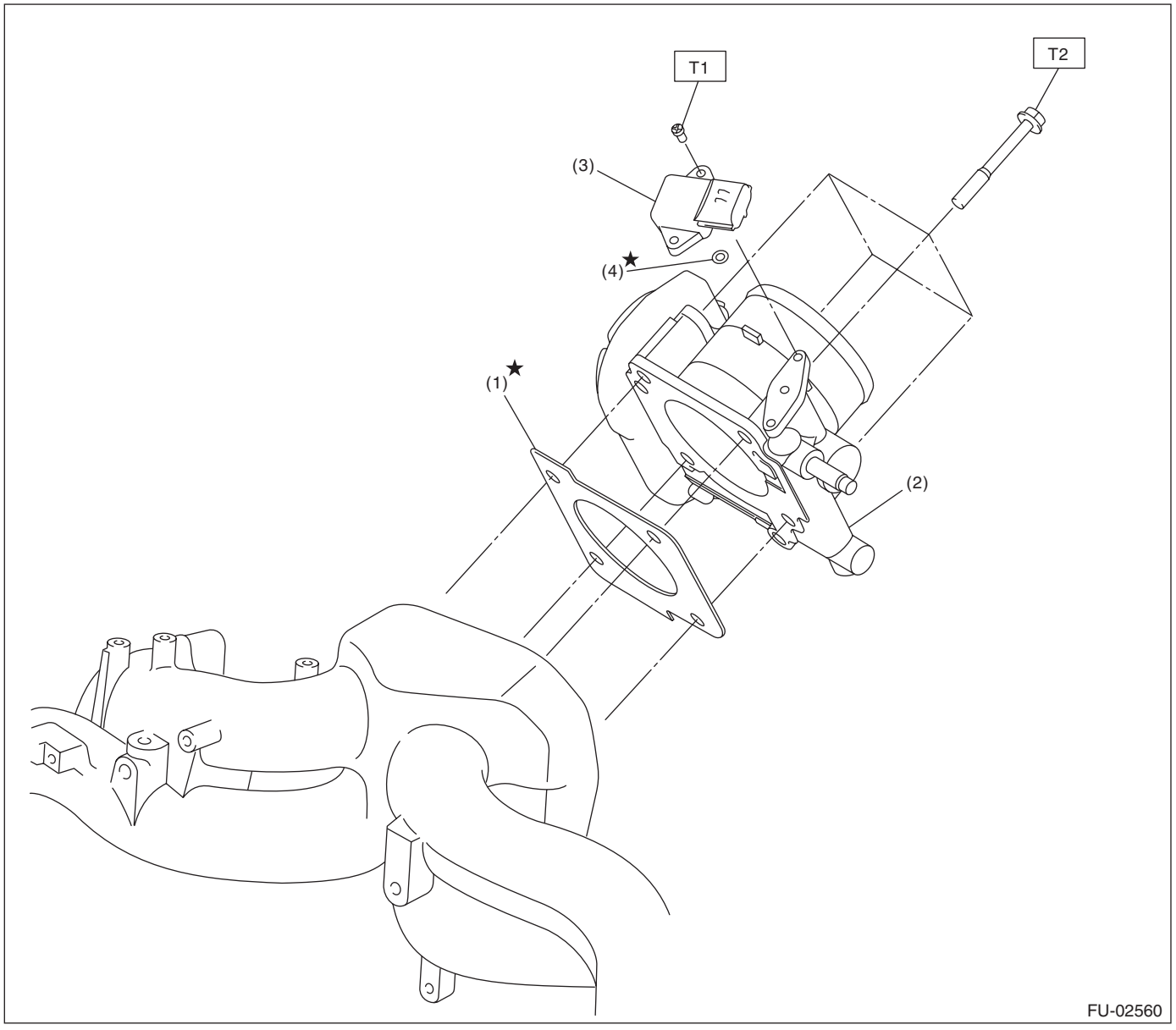
## 1. INTAKE MANIFOLD



(1) Intake manifold
(2) Gasket
(3) Nipple
(4) Guide pin
(5) Plug cord stay
(6) EGR valve
(7) Fuel pipe protector RH
(8) Fuel pipe protector LH
(9) Fuel injector pipe
(10) Fuel injector
(11) O-ring
(12) Purge control solenoid valve
(13) Plug cord holder
(14) Fuel pipe ASSY
(15) Nipple
(16) Gasket
(17) Evaporation hose (A)
(18) Evaporation hose (B)

***Tightening torque: N·m (kgf-m, ft-lb)***
***T1: 6.4 (0.7, 4.7)***
***T2: 17 (1.7, 12.5)***
***T3: 19 (1.9, 14.0)***
***T4: 25 (2.5, 18.4)***

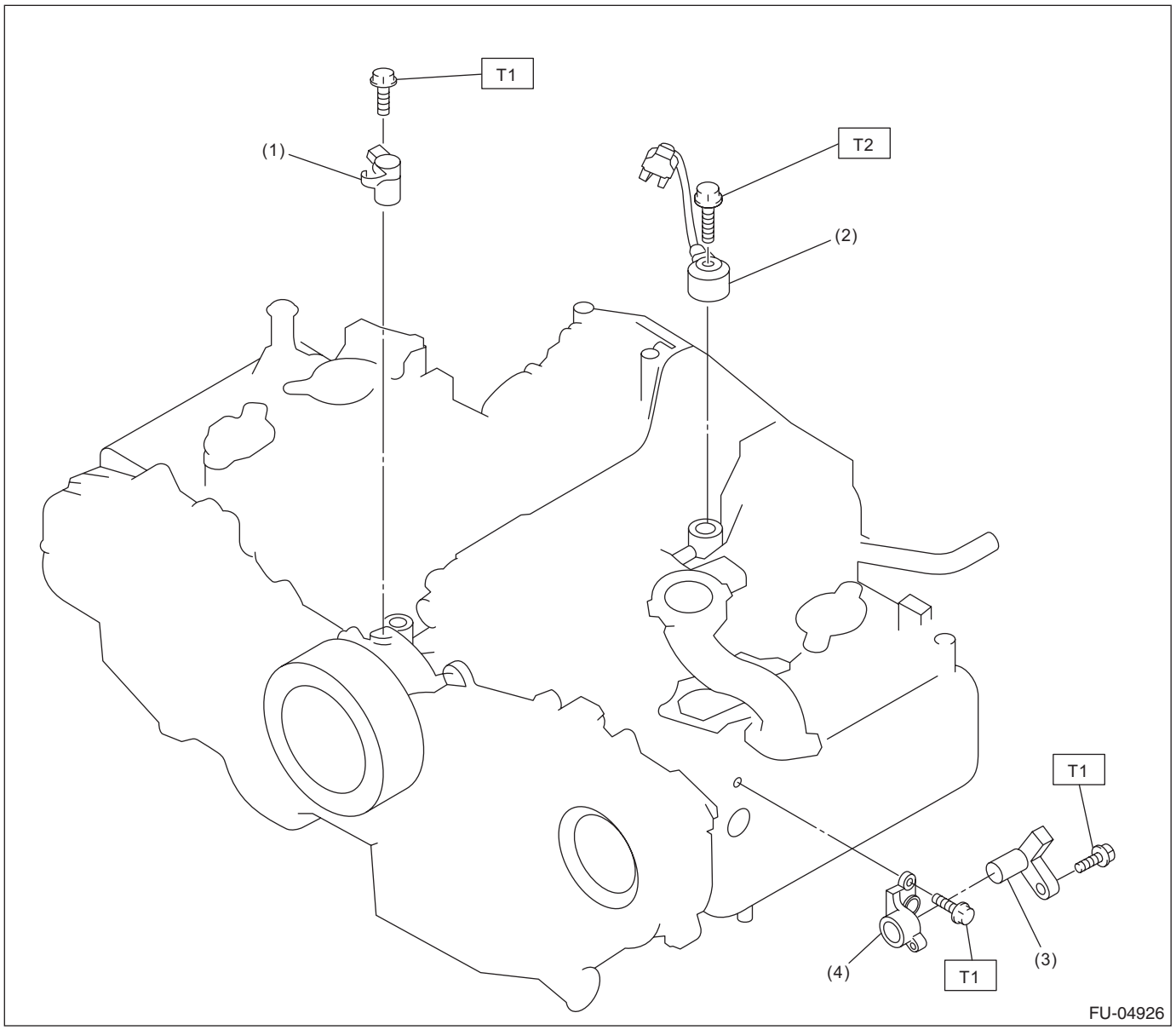
## 2. AIR INTAKE SYSTEM




(1) Gasket
(2) Throttle body
(3) Manifold absolute pressure sensor
(4) O-ring

***Tightening torque: N·m (kgf-m, ft-lb)***
***T1: 2 (0.2, 1.5)***
***T2: 8 (0.8, 5.9)***

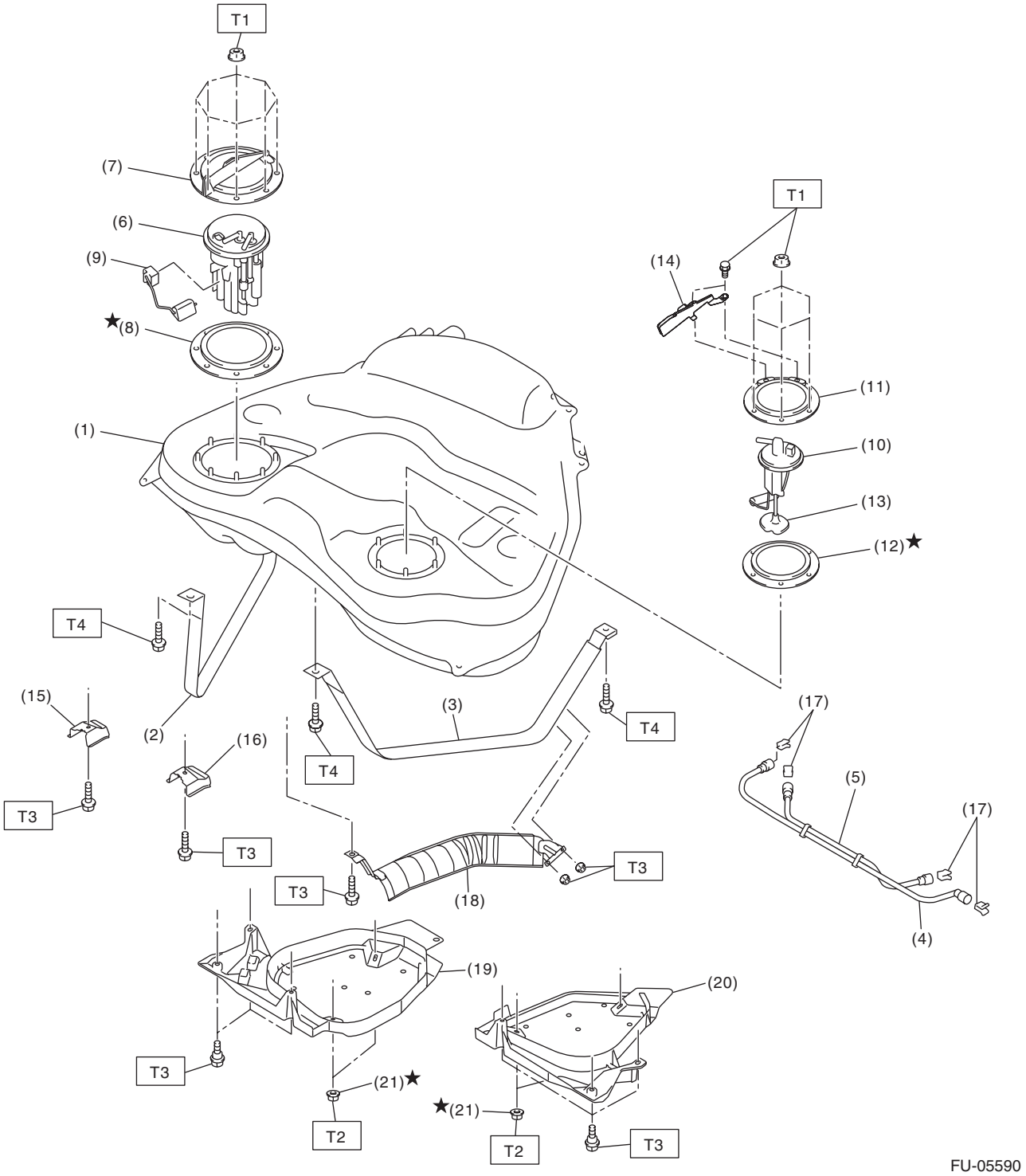
## 3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS




(1) Crankshaft position sensor
(2) Knock sensor
(3) Camshaft position sensor
(4) Camshaft position sensor support

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 6.4 (0.7, 4.7)***
***T2: 24 (2.4, 17.7)***

## 4. FUEL TANK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T1
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(12)★
T4
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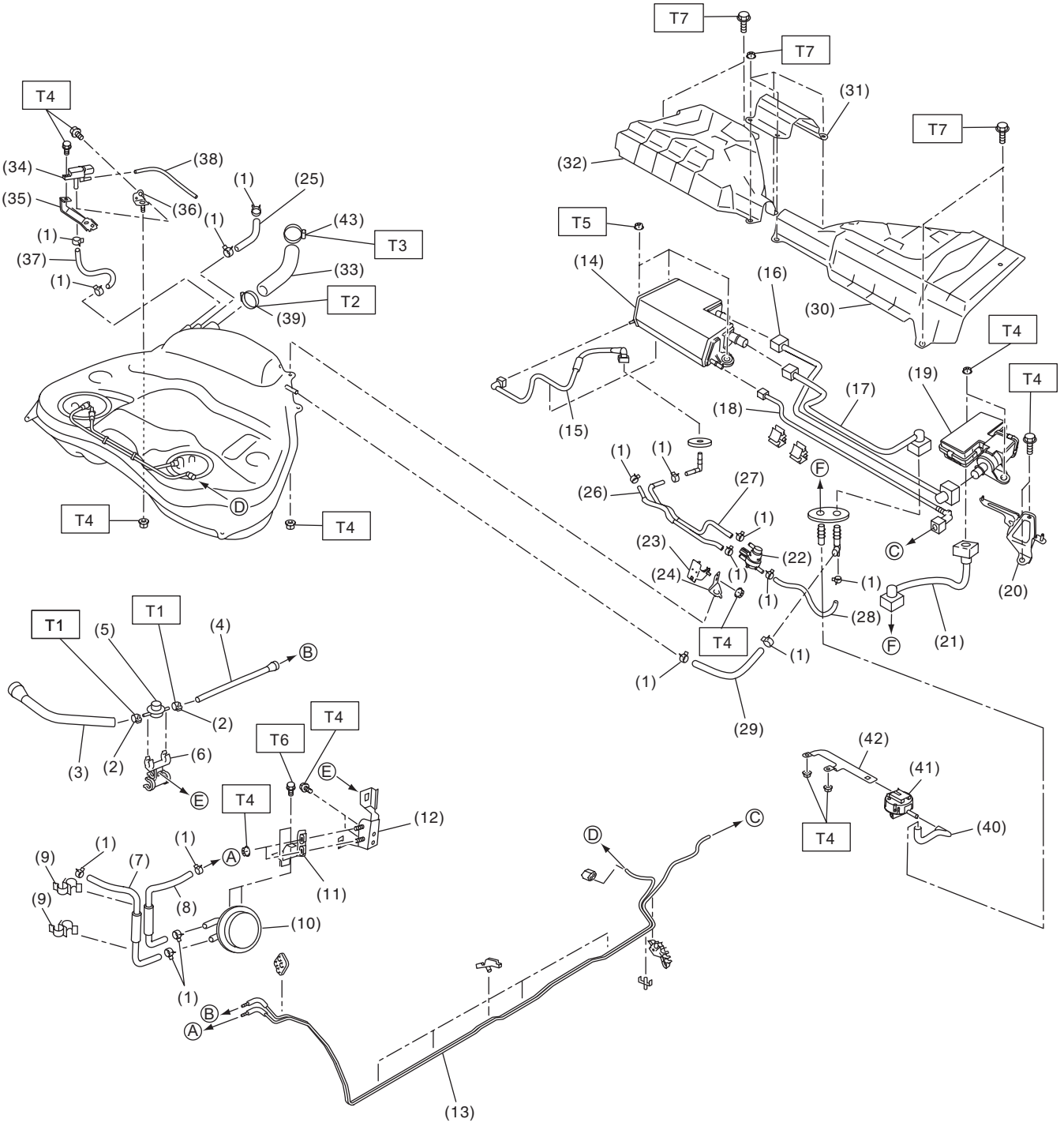
(18)
(4)
(19)
(20)
T3
(21)★
T2
★(21)
T2
T3
FU-05590

(1) Fuel tank
(2) Fuel tank band RH
(3) Fuel tank band LH
(4) Delivery tube
(5) Jet pump tube
(6) Fuel pump ASSY
(7) Fuel pump upper plate
(8) Fuel pump gasket
(9) Fuel level sensor
(10) Fuel sub level sensor
(11) Fuel sub level sensor upper plate
(12) Fuel sub level sensor gasket
(13) Fuel sub level sensor filter
(14) Fuel sub level sensor protector
(15) Stopper RH
(16) Stopper LH
(17) Retainer
(18) Heat shield cover
(19) Fuel tank protector RH
(20) Fuel tank protector LH
(21) Self-locking nut

***Tightening torque:N·m (kgf-m, ft-lb)***

***T1: 4.4 (0.4, 3.2)***
***T2: 9 (0.9, 6.6)***
***T3: 18 (1.8, 13.3)***
***T4: 33 (3.4, 24.3)***

## 5. FUEL LINE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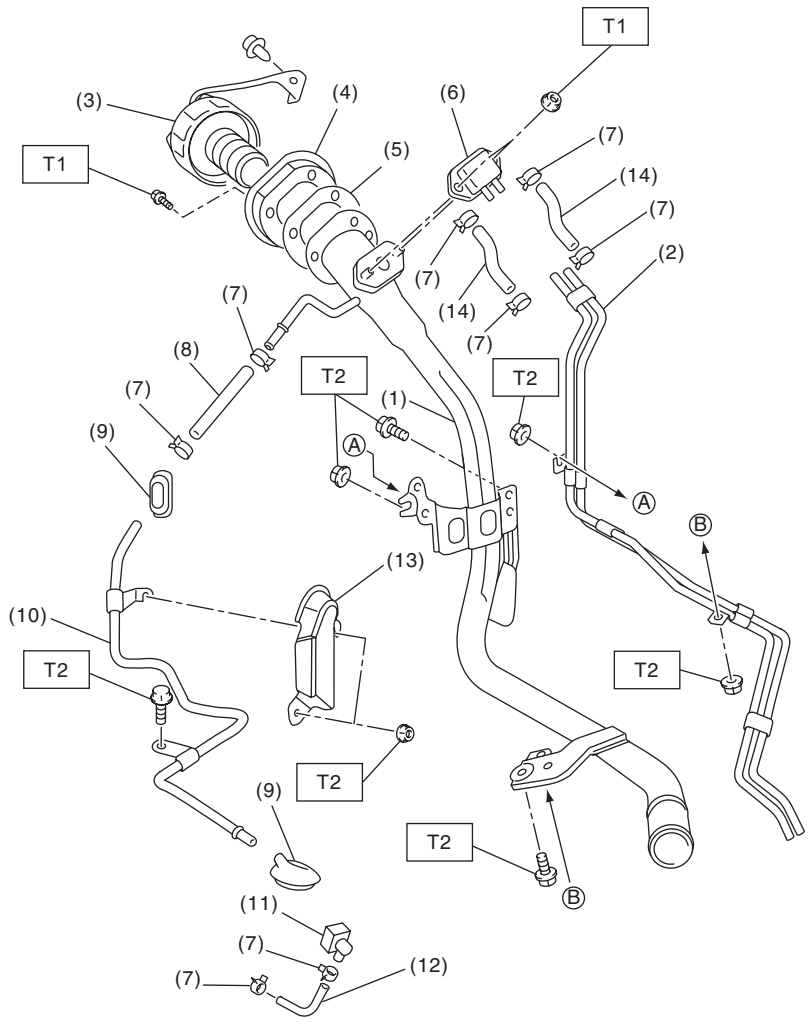
(41)
(42)
(43)
A
B
C
D
E
F
FU-05599

(1) Clip
(2) Clamp
(3) Fuel delivery hose A
(4) Fuel delivery hose B
(5) Fuel damper
(6) Fuel damper holder
(7) Evaporation hose A
(8) Evaporation hose B
(9) Clamp
(10) Purge damper
(11) Purge damper bracket
(12) Damper bracket
(13) Fuel pipe ASSY
(14) Canister
(15) PCV drain tube
(16) Drain tube A
(17) Vent tube
(18) Purge tube
(19) Drain valve
(20) Drain valve bracket
(21) Drain tube B
(22) Pressure control solenoid valve
(23) Pressure control solenoid valve bracket A
(24) Pressure control solenoid valve bracket B
(25) Evaporation hose A
(26) Evaporation hose B
(27) Evaporation hose C
(28) Evaporation hose D
(29) Evaporation hose E
(30) Canister cover LH
(31) Center canister cover
(32) Canister cover RH
(33) Fuel filler hose
(34) Fuel tank pressure sensor
(35) Fuel tank pressure sensor bracket A
(36) Fuel tank pressure sensor bracket B
(37) Pressure hose
(38) Vacuum hose
(39) Clamp
(40) Canister drain hose ASSY
(41) Drain separator
(42) Drain separator bracket
(43) Clamp

***Tightening torque:N·m (kgf-m, ft-lb)***

| | |
|---|---|
| ***T1:*** | ***1.25 (0.1, 0.9)*** |
| ***T2:*** | ***2 (0.2, 1.5)*** |
| ***T3:*** | ***2.5 (0.3, 1.8)*** |
| ***T4:*** | ***7.5 (0.8, 5.5)*** |
| ***T5:*** | ***8 (0.8, 5.9)*** |
| ***T6:*** | ***13 (1.3, 9.6)*** |
| ***T7:*** | ***18 (1.8, 13.3)*** |

## 6. FUEL FILLER PIPE

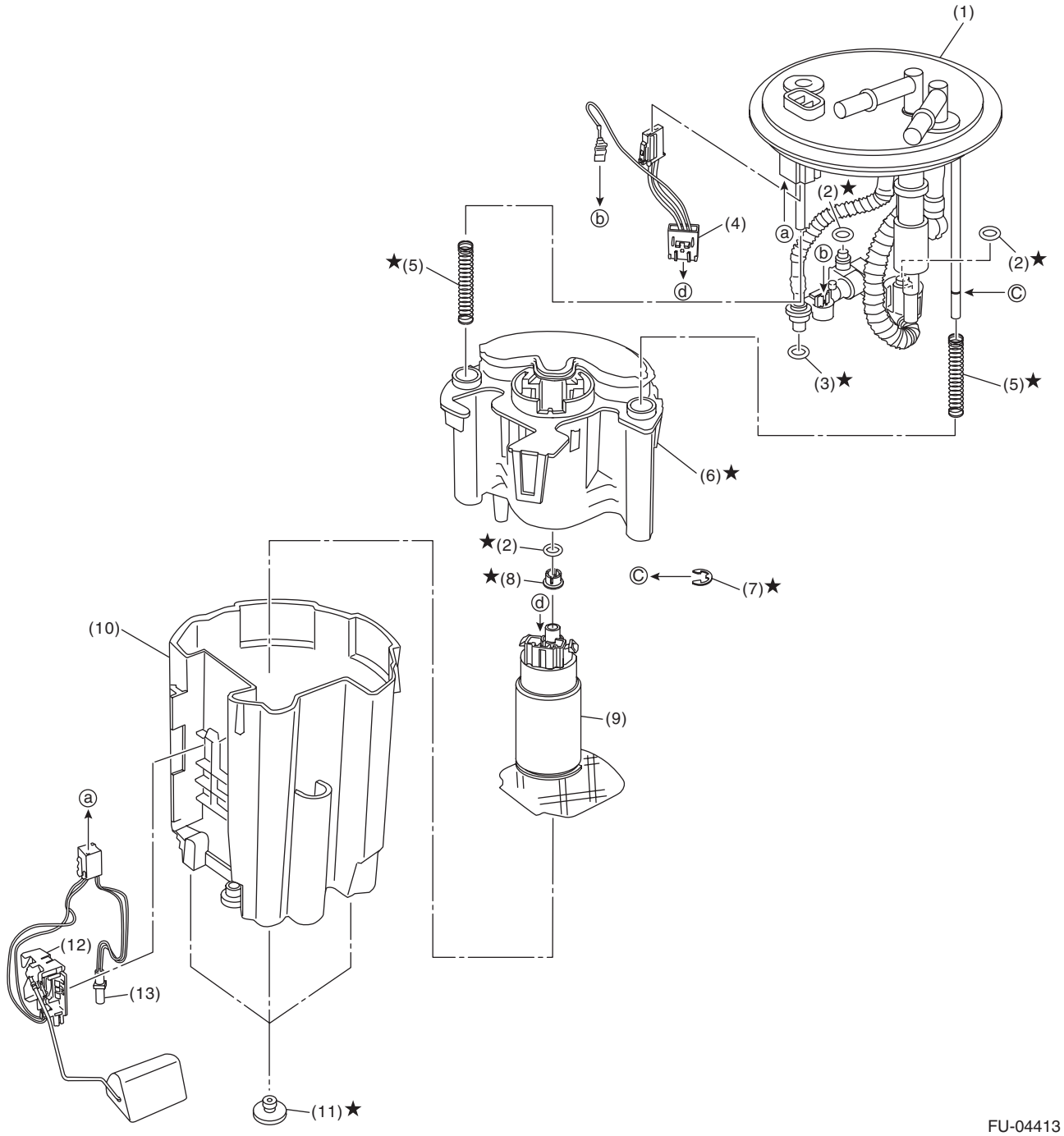



FU-04295

(1) Fuel filler pipe ASSY
(2) Evaporation pipe A
(3) Fuel filler cap
(4) Filler ring
(5) Filler pipe gasket
(6) Shut valve
(7) Clip
(8) Evaporation hose A
(9) Grommet
(10) Evaporation pipe B
(11) Quick connector
(12) Evaporation hose B
(13) Evaporation pipe protector
(14) Evaporation hose C

***Tightening torque: N·m (kgf-m, ft-lb)***
***T1: 4.4 (0.4, 3.2)***
***T2: 7.5 (0.8, 5.5)***

## 7. FUEL PUMP



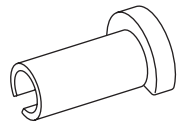
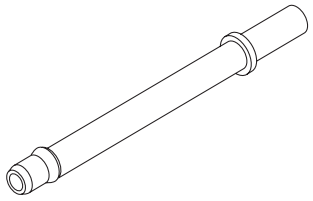
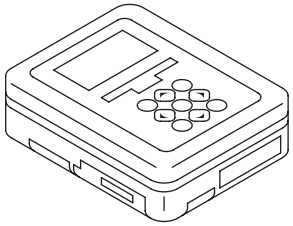

| | | | | | |
|---|---|---|---|---|---|
| (1) | Sub tank bracket ASSY | (6) | Fuel filter | (11) | Cushion |
| (2) | O-ring | (7) | Clip | (12) | Fuel level sensor |
| (3) | O-ring | (8) | Spacer | (13) | Fuel temperature sensor |
| (4) | Fuel pump harness | (9) | Pump ASSY | | |
| (5) | Spring | (10) | Sub tank | | |

## C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

## D: PREPARATION TOOL

### 1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST42099AE000 | 42099AE000 | QUICK CONNECTOR RELEASE | Used for removing the quick connector. |
|  ST18471AA000 | 18471AA000 | FUEL PIPE ADAPTER | Used for draining fuel. |
|  ST1B022XU0 | 1B022XU0 | SUBARU SELECT MONITOR III KIT | Used for draining fuel and each inspection. |

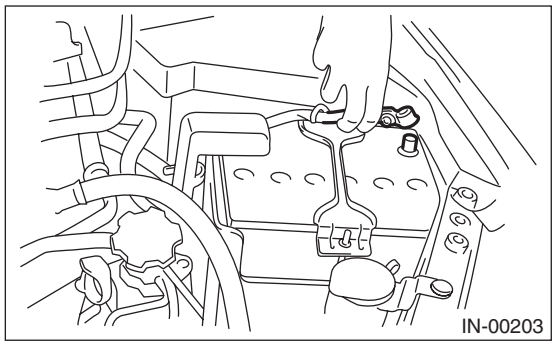
## 2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring resistance and voltage. |
| Oscilloscope | Used for inspecting the waveform of each sensor. |

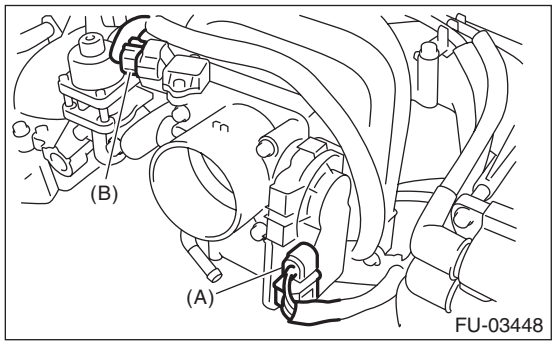
# 2. Throttle Body

## A: REMOVAL

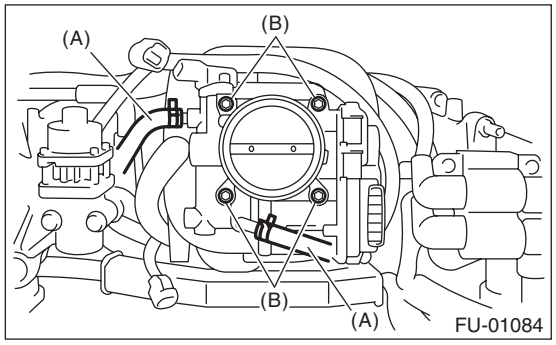
1) Disconnect the ground cable from battery.




2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
4) Drain approximately 3.0 ℓ (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
6) Disconnect the throttle position sensor connector (A) and manifold absolute pressure sensor connector (B).




7) Disconnect the engine coolant hoses (A) from throttle body.
8) Remove the bolts (B) which secure the throttle body to the intake manifold, and remove the throttle body.




## B: INSTALLATION

Install in the reverse order of removal.

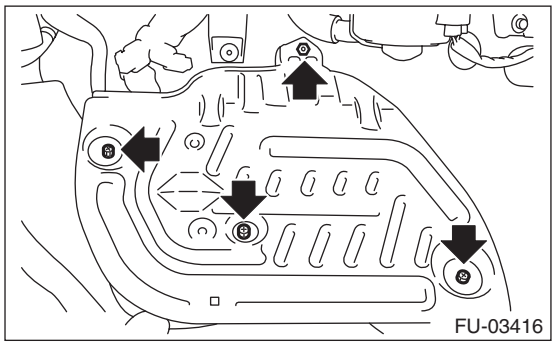
NOTE:
Use a new gasket.

***Tightening torque:***
***8 N·m (0.8 kgf-m, 5.9 ft-lb)***

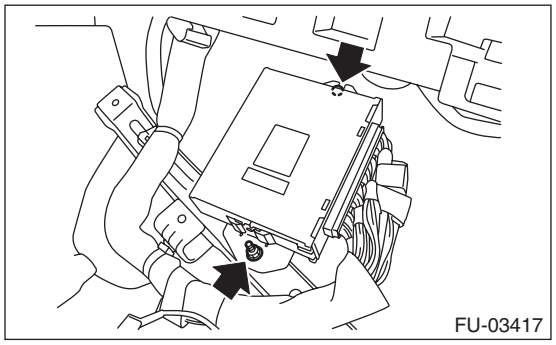
## C: INSPECTION

### 1. THROTTLE SENSOR (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-53, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

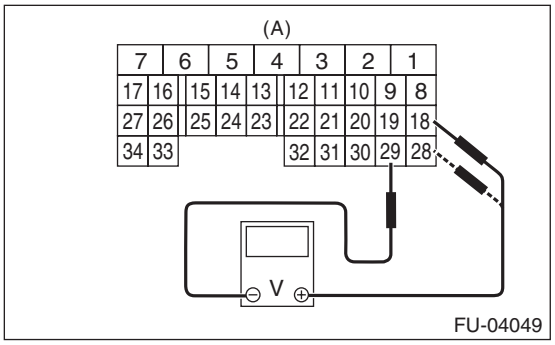



4) Remove the nuts and bolts which hold the ECM to the bracket.




5) Turn the ignition switch to ON. (engine OFF)

6) Measure the voltage between ECM connector terminals.




(A) To ECM connector

| Throttle sensor | Accelerator pedal | Terminal No. | Standard |
|---|---|---|---|
| Main | Not depressed (Full closed) | 18 (+) and 29 (–) | Approx. 0.6 V |
| | Depressed (Full opened) | | Approx. 4.0 V |
| Sub | Not depressed (Full closed) | 28 (+) and 29 (–) | Approx. 1.5 V |
| | Depressed (Full opened) | | Approx. 4.2 V |

## 2. THROTTLE SENSOR (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the throttle opening angle signal and voltage of throttle sensor using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-34, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

| Throttle sensor | Throttle opening angle signal | Standard |
|---|---|---|
| Main | 0.0 % | Approx. 0.6 V |
| | 100.0 % | Approx. 4.0 V |
| Sub | 0.0 % | Approx. 1.5 V |
| | 100.0 % | Approx. 4.2 V |

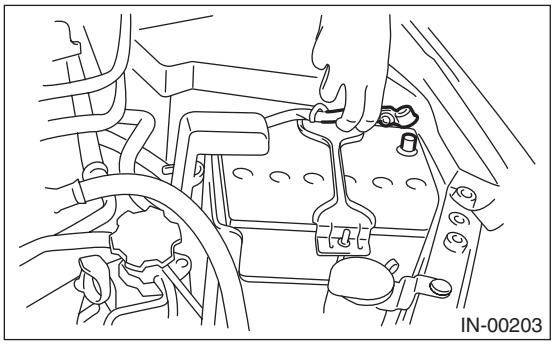
## 3. OTHER INSPECTIONS

1) Check that the throttle body has no deformation, cracks or other damages.
2) Check that the engine coolant hose has no cracks, damage or loose part.

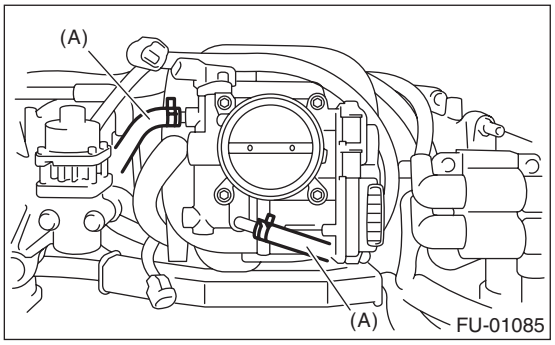
# 3. Intake Manifold

## A: REMOVAL

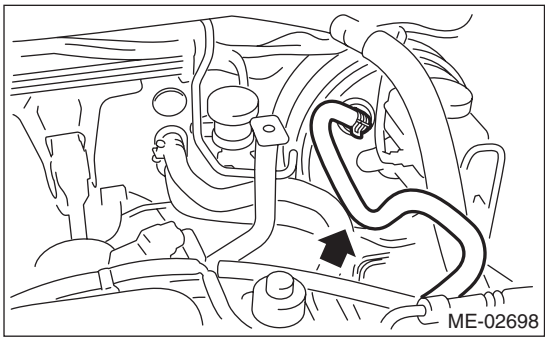
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



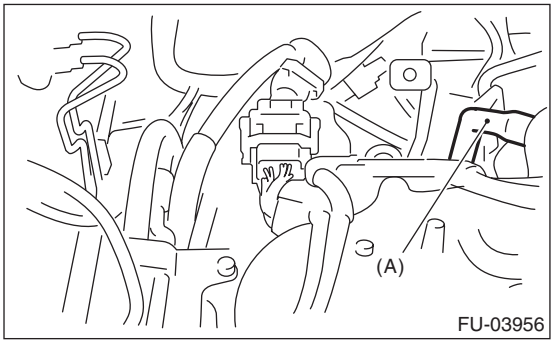

3) Open the fuel filler lid and remove the fuel filler cap.
4) Lift up the vehicle.
5) Remove the under cover RH. <Ref. to EI-24, REMOVAL, Front Under Cover.>
6) Drain approximately 3.0 ℓ (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
7) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
8) Remove the air intake chamber and intake boot. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
9) Remove the generator. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>
10) Disconnect the spark plug cord from the spark plug.
11) Disconnect the engine coolant hoses (A) from throttle body.



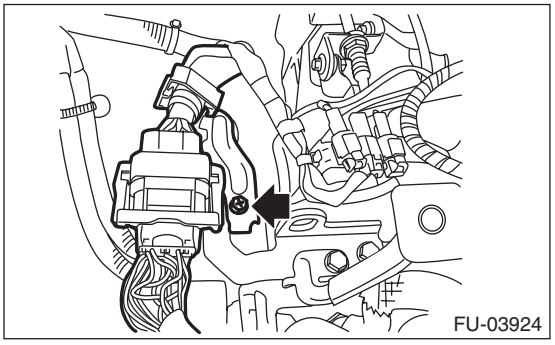

12) Disconnect the brake booster vacuum hose.



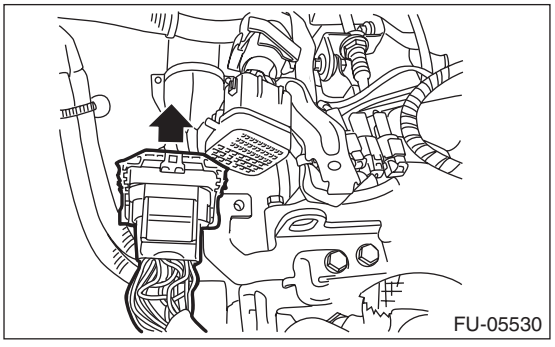

13) Disconnect the PCV hose (A) from intake manifold.



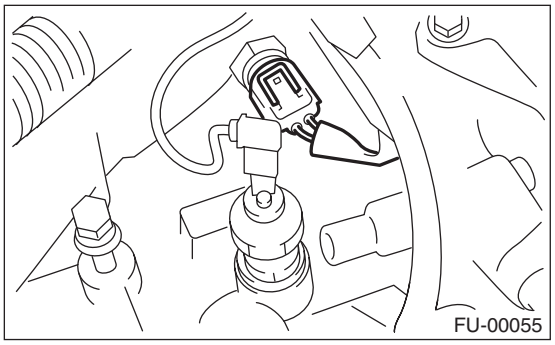

14) Remove the bolt, and disconnect the bulkhead harness connector from the engine harness connector and rear engine hanger.



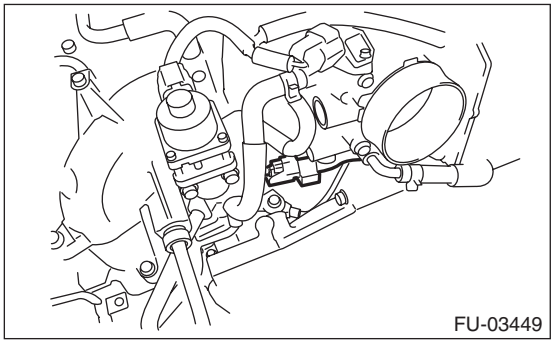

15) Slide the engine harness connector in the direction of the arrow and remove it from the rear engine hanger.



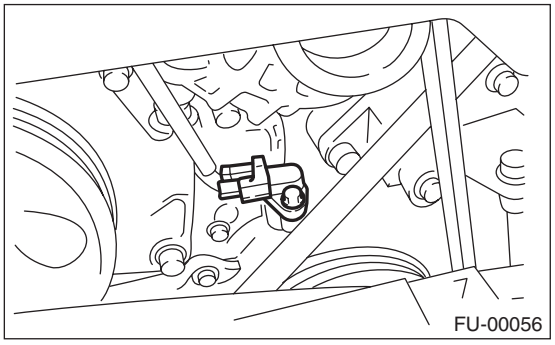
16) Disconnect the connectors from the engine coolant temperature sensor.



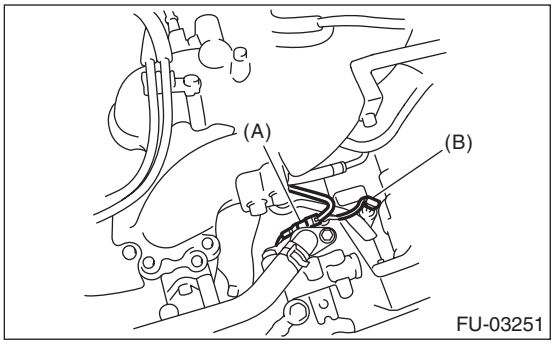

17) Disconnect the knock sensor connector.



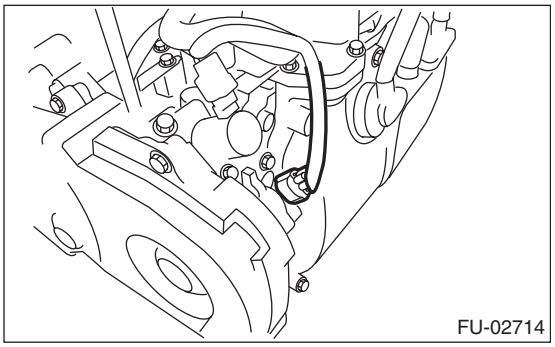

18) Disconnect the connector from crankshaft position sensor.



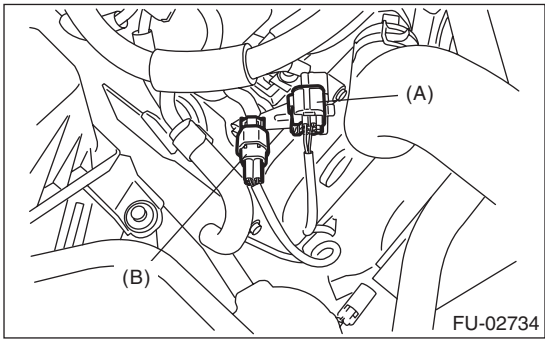

19) Disconnect the connector from power steering pump switch (A).
20) Disconnect the connector from the oil pressure switch (B).




21) Disconnect the connector from camshaft position sensor.

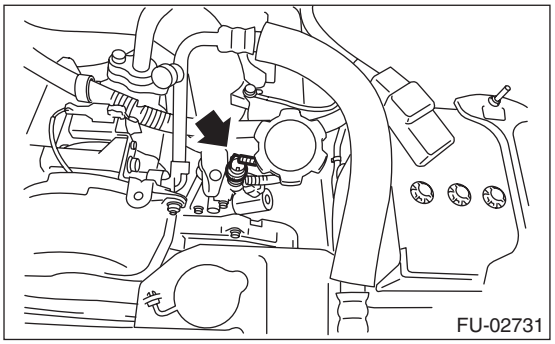



22) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).

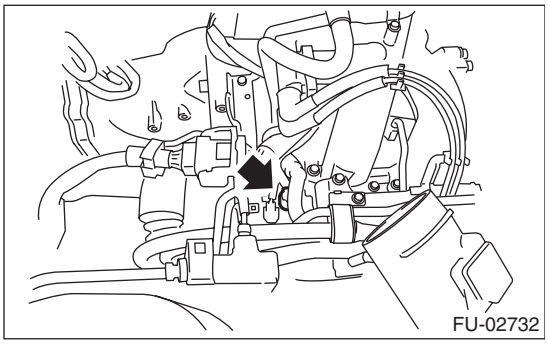



23) Disconnect the connector from the oil switching solenoid valve.
24) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.

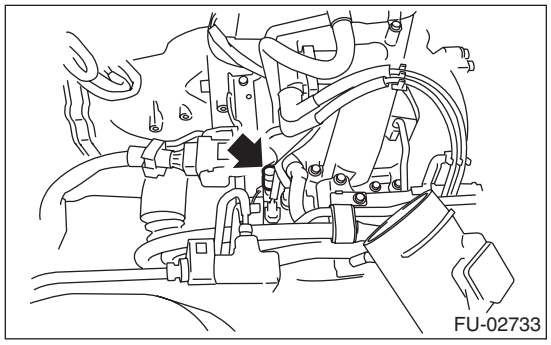
- LH side



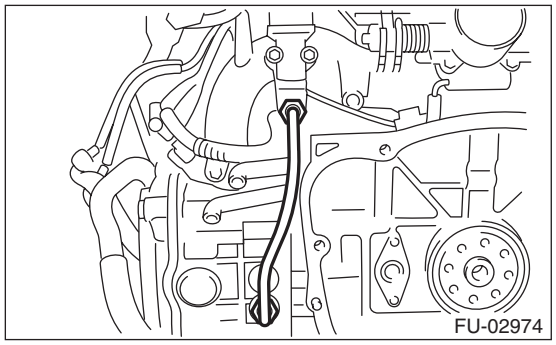

- RH side



25) Disconnect the connector from oil temperature sensor.




26) Remove the EGR pipe from intake manifold.



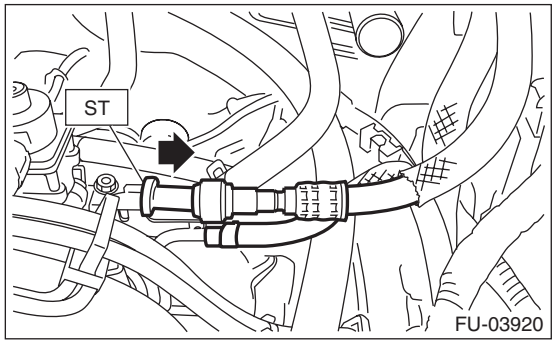

27) Disconnect the fuel delivery hose and evaporation hose from fuel pipe.

(1) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

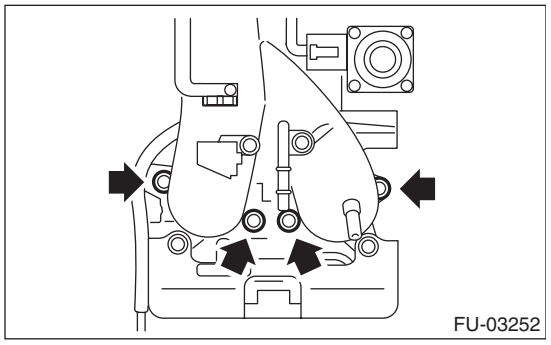
ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Remove the clip and disconnect the evaporation hose from the fuel pipe.

**CAUTION:**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**




28) Remove the intake manifold from cylinder head.

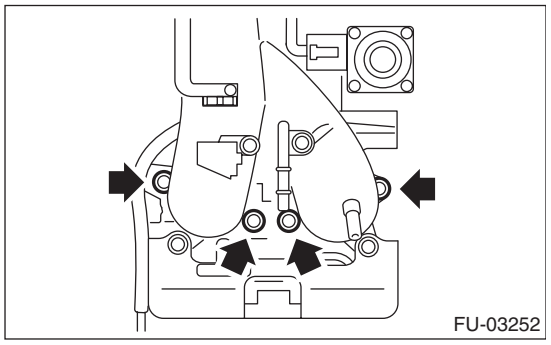



## B: INSTALLATION

1) Install the intake manifold onto cylinder heads.

NOTE:
Use a new gasket.

***Tightening torque:***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***

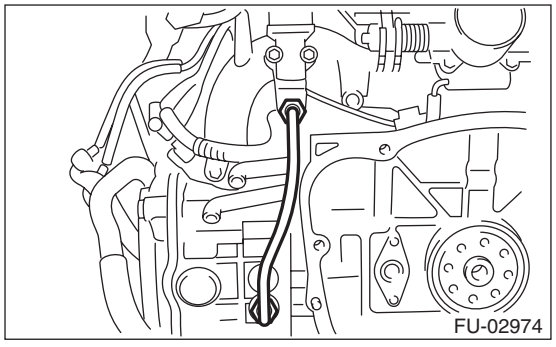



2) Connect the fuel delivery hose and evaporation hose to the fuel pipe. <Ref. to FU(H4SO)-79, INSTALLATION, Fuel Delivery and Evaporation Lines.>

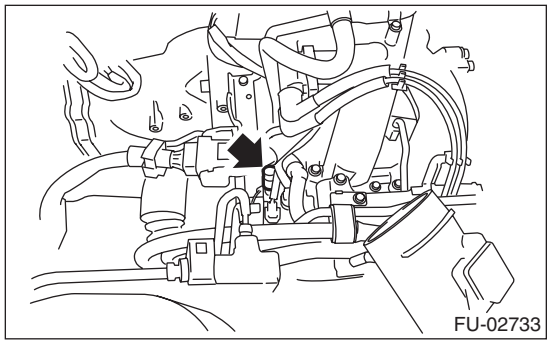
NOTE:
If fuel hoses or clamps are damaged, replace them with new parts.

3) Install the EGR pipe to intake manifold.

***Tightening torque:***
***34 N·m (3.5 kgf-m, 25.1 ft-lb)***

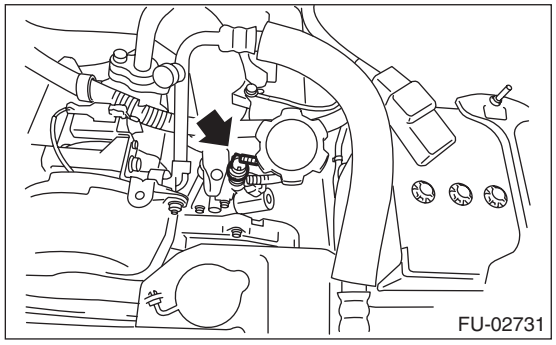


4) Connect the connector to the oil temperature sensor.

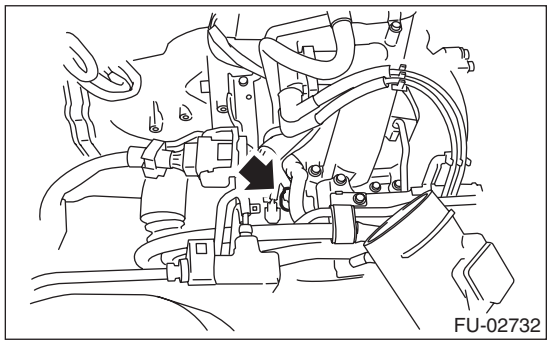



5) Connect the connector to the variable valve lift diagnosis oil pressure switch.

- LH side

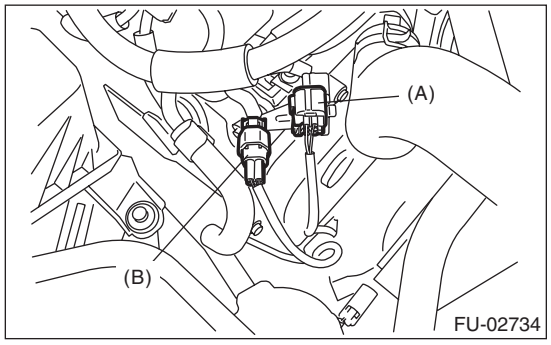



- RH side

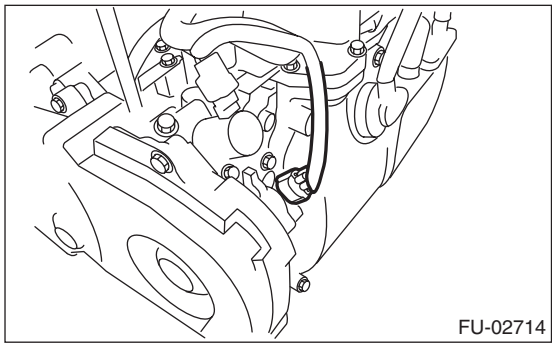



6) Connect the connector to oil switching solenoid valve.

7) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).

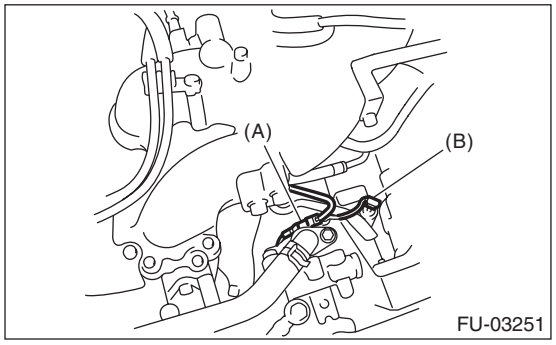



8) Connect the connectors to camshaft position sensor.

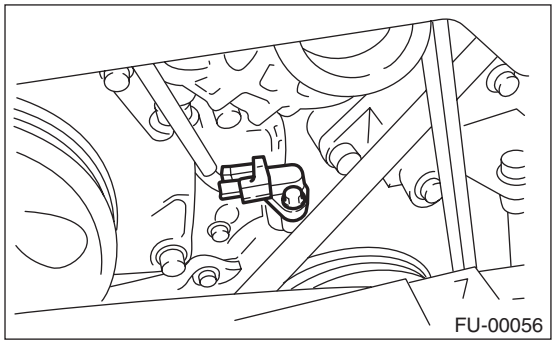



9) Connect the connector to the power steering pump switch (A).

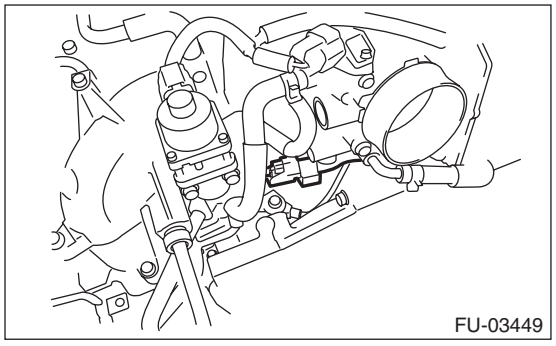
10) Connect the connector to the oil pressure switch (B).



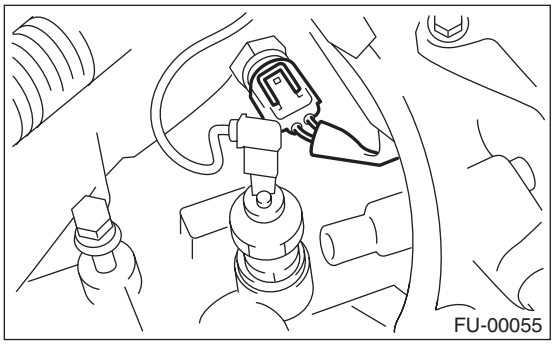

11) Connect the connector to crankshaft position sensor.



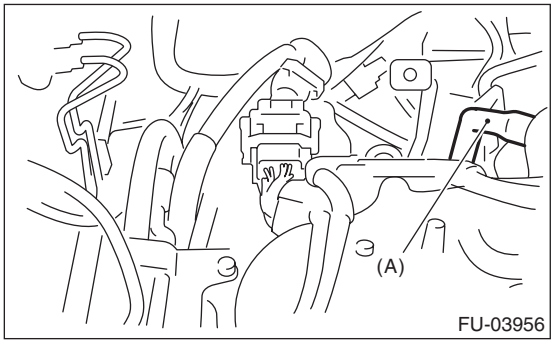

12) Connect the knock sensor connector.



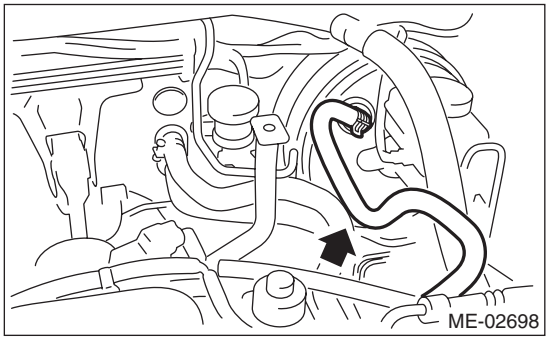
13) Connect the connector to engine coolant temperature sensor.




14) Connect the PCV hose (A) to intake manifold.

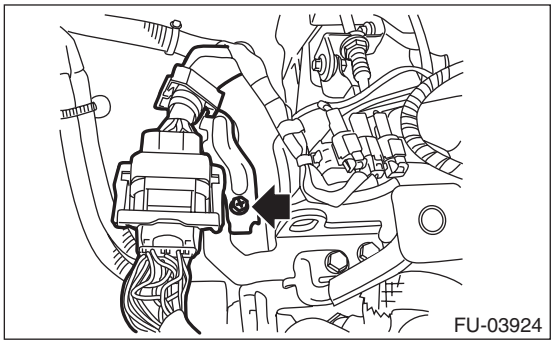



15) Connect the brake booster hose.

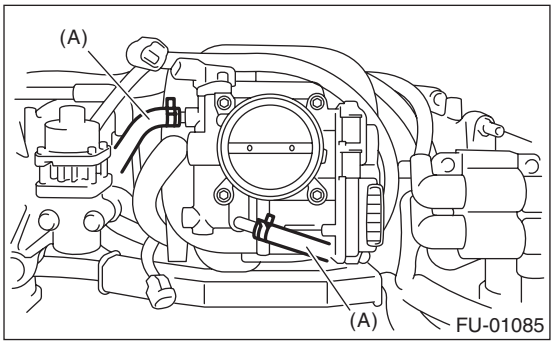



16) Connect the engine harness connector to the bulkhead harness connector and fasten to the rear engine hanger with bolt.

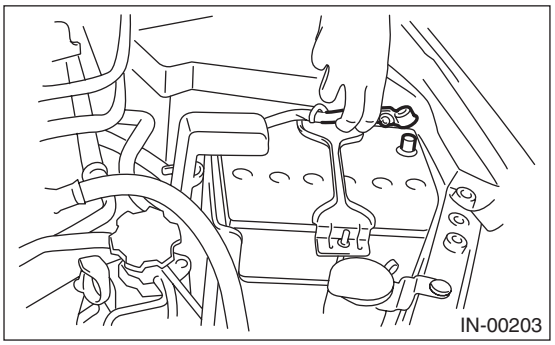
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




17) Connect the engine coolant hose (A) to throttle body.



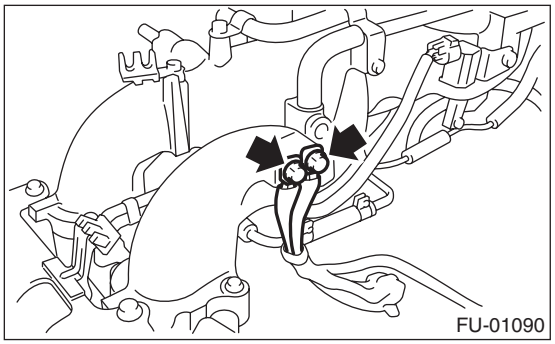

18) Connect the spark plug cords to spark plugs.
19) Install the generator. <Ref. to SC(H4SO)-16, INSTALLATION, Generator.>
20) Install the air intake chamber and intake boot. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
21) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
22) Connect the battery ground terminal.



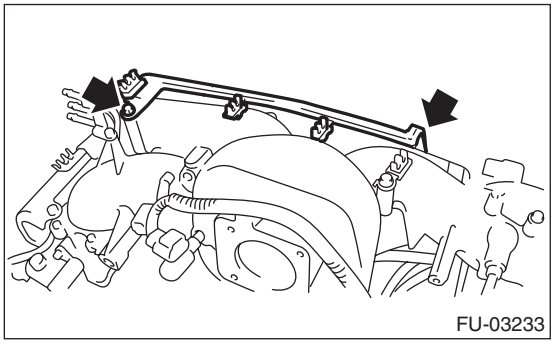

23) Lift up the vehicle.
24) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
25) Lower the vehicle.
26) Fill engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

## C: DISASSEMBLY

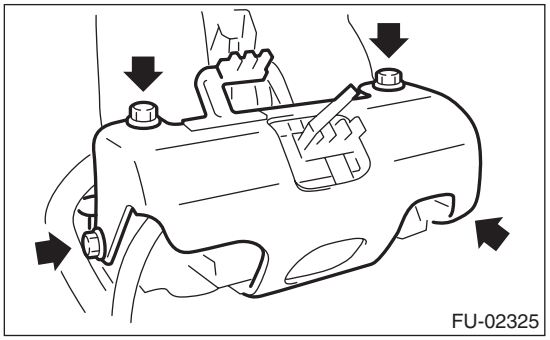
1) Disconnect the engine ground terminal from the intake manifold.



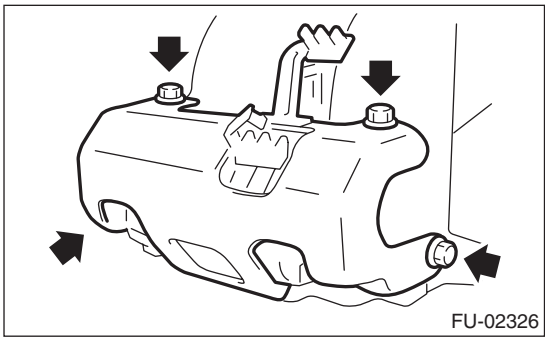

2) Remove the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, REMOVAL, Ignition Coil and Ignitor Assembly.>
3) Remove the throttle body. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.>
4) Remove the EGR valve. <Ref. to FU(H4SO)-36, REMOVAL, EGR Valve.>
5) Remove the plug cord stay.



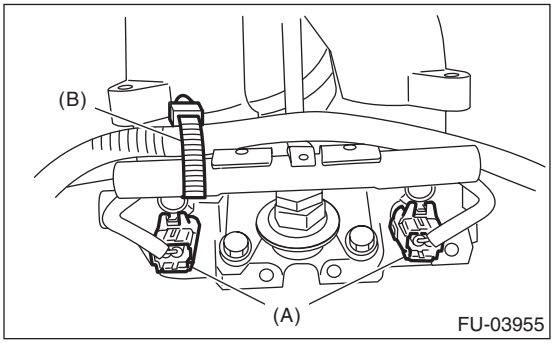

6) Remove the fuel pipe protector LH.



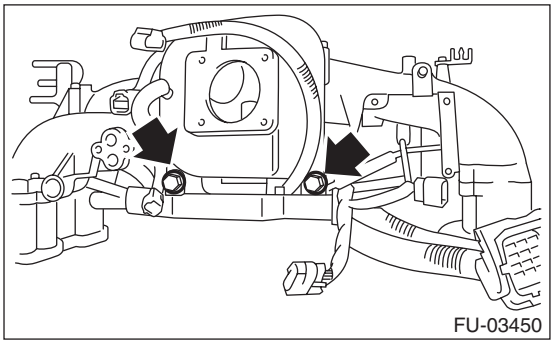

7) Remove the fuel pipe protector RH.



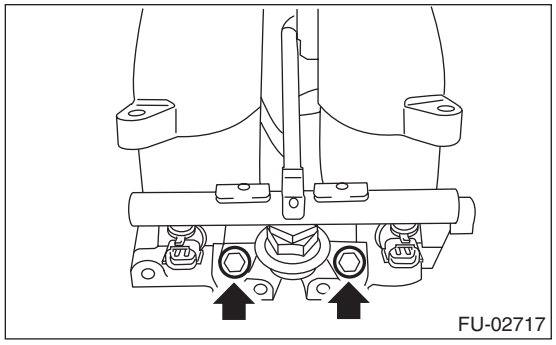

8) Remove the harness band (B) which holds the engine harness to the fuel injector pipe, and disconnect connectors (A) from the fuel injector.



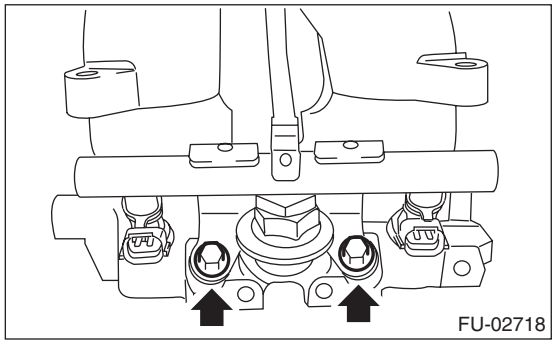

9) Remove the purge control solenoid valve. <Ref. to EC(H4SO)-9, REMOVAL, Purge Control Solenoid Valve.>
10) Remove the bolts holding the engine harness to the intake manifold, and remove the engine harness.

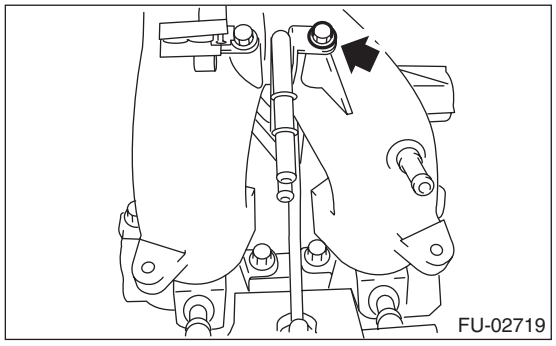


11) Remove the bolts which hold fuel injector pipe on the intake manifold as shown in the figure.
- RH side

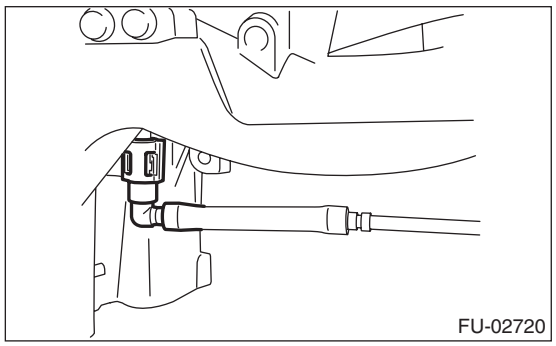



- LH side

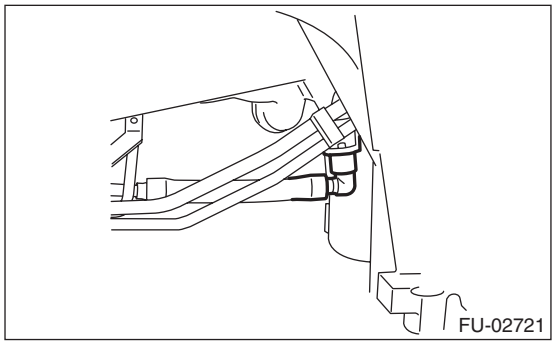


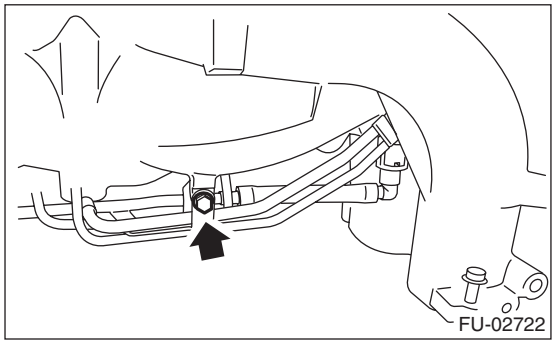

12) Remove the fuel injectors from the fuel injector pipe.
13) Disconnect the quick connector which hold the fuel injector pipe RH to the fuel pipe.




14) Disconnect the quick connector which hold the fuel injector pipe LH to the fuel pipe.




15) Remove the fuel injector pipe RH and LH.
16) Remove the bolts which hold fuel pipe onto intake manifold.




17) Remove the fuel pipe from intake manifold.

## D: ASSEMBLY

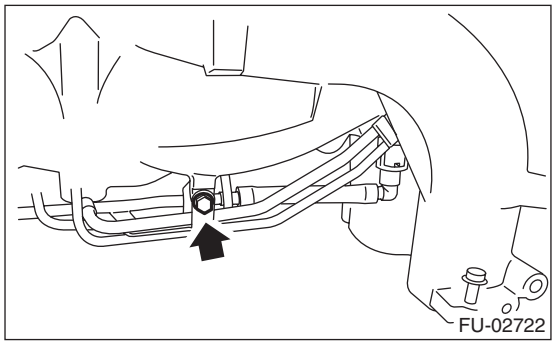
NOTE:
When assembling the nipple, apply liquid gasket.

***Liquid gasket:***
***THREE BOND 1105 (Part No. 004403010) or equivalent***

***Tightening torque:***
***17 N·m (1.7 kgf-m, 12.5 ft-lb)***

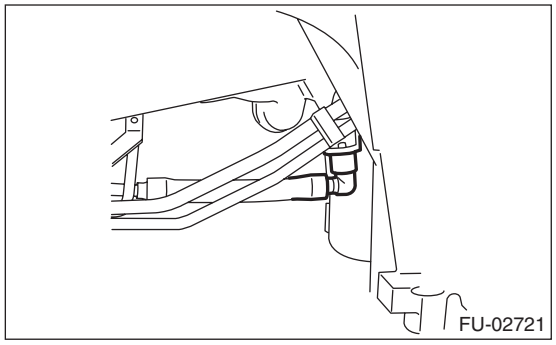
1) Secure the fuel pipe to intake manifold with bolts.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***



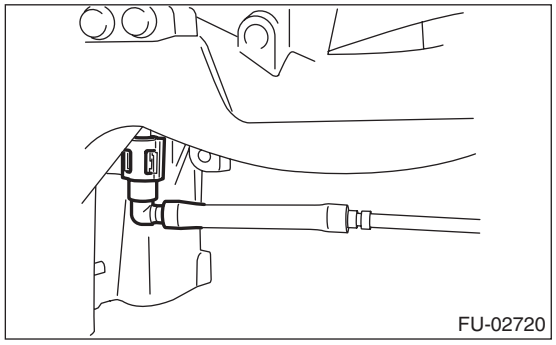
2) Connect the fuel pipe LH to the fuel pipe.

NOTE:
Connect the quick connector securely.




3) Connect the fuel pipe RH to the fuel pipe.

NOTE:
Connect the quick connector securely.



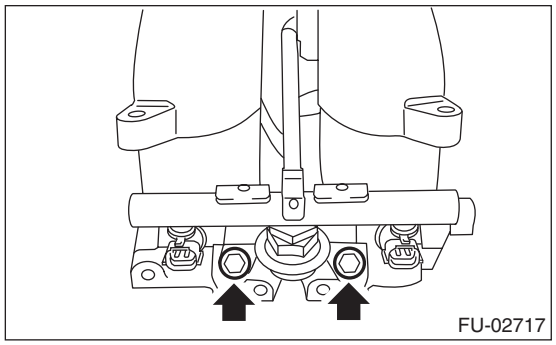

4) Install the fuel injector.

NOTE:
Use new O-rings.

5) Secure the fuel injector pipe to intake manifold with bolts.

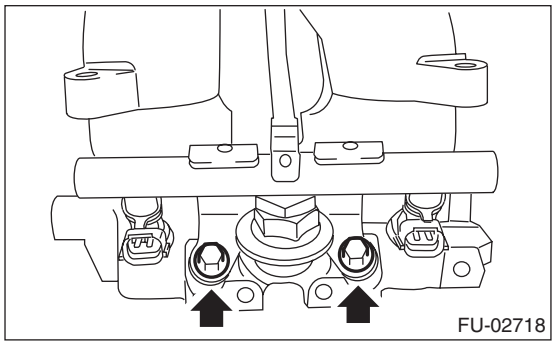
- RH side

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***

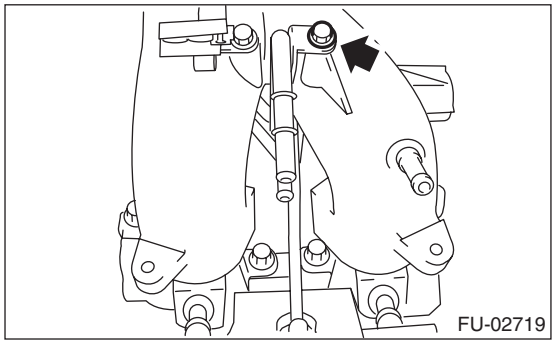



- LH side

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***



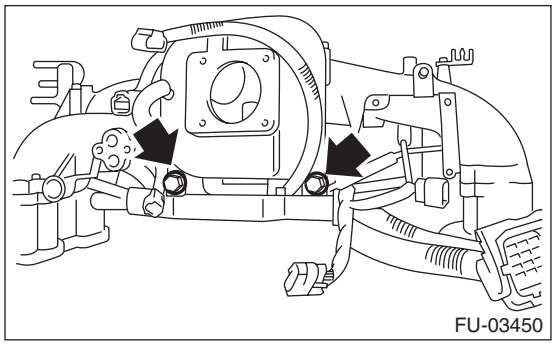

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




6) Install the engine harness to the intake manifold.

7) Secure the engine harness to intake manifold with bolts.

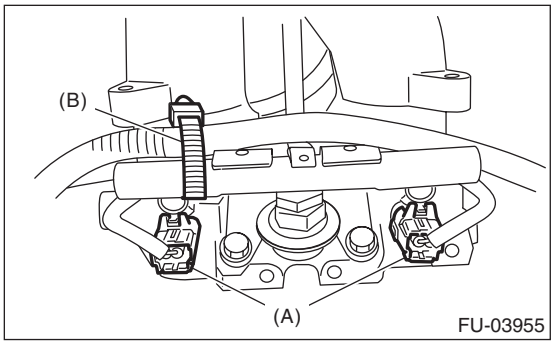
***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***




8) Install the purge control solenoid valve. <Ref. to EC(H4SO)-9, INSTALLATION, Purge Control Solenoid Valve.>

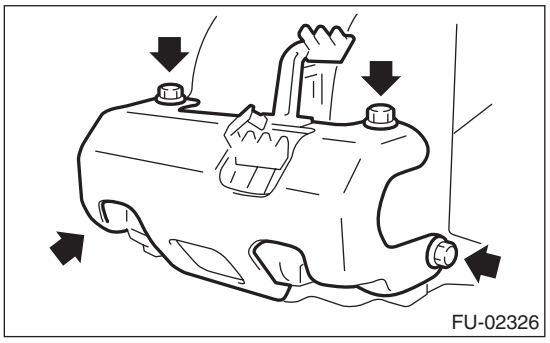
9) Connect the connectors (A) to fuel injector.

10) Hold the engine harness to fuel injector pipe by harness band (B).



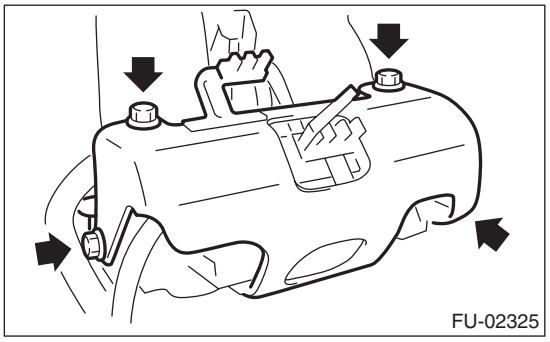

11) Install the fuel pipe protector RH.

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***



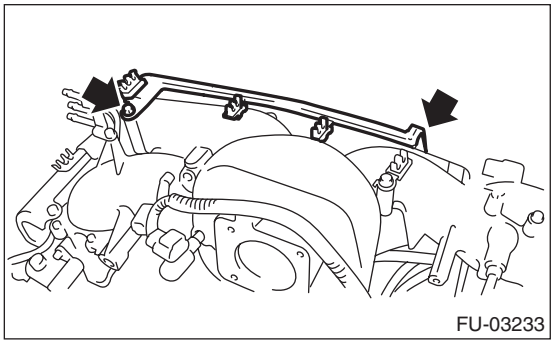

12) Install the fuel pipe protector LH.

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***



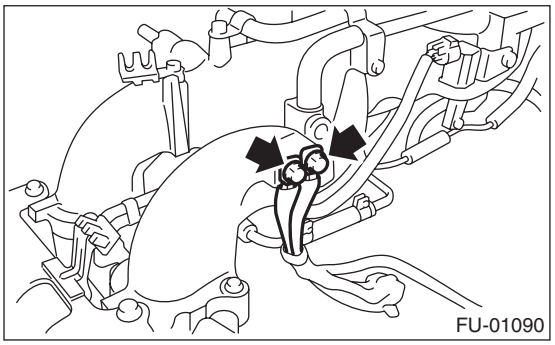

13) Install the plug cord stay.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




14) Install the EGR valve. <Ref. to FU(H4SO)-36, INSTALLATION, EGR Valve.>
15) Install the throttle body to the intake manifold. <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>
16) Install the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, INSTALLATION, Ignition Coil and Ignitor Assembly.>
17) Install the engine ground terminal to intake manifold.

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***



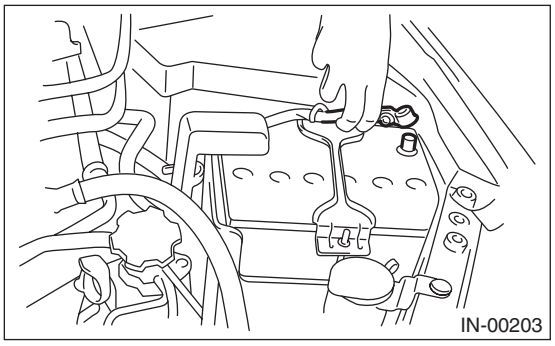

## E: INSPECTION

1) Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
2) Check that the hose has no cracks, damage or loose part.

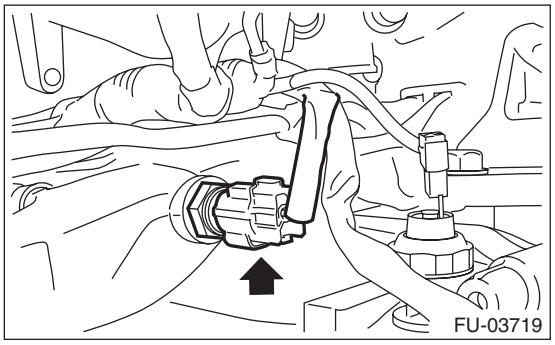
# 4. Engine Coolant Temperature Sensor

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Remove the generator. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>
3) Drain engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connector from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.




## B: INSTALLATION

Install in the reverse order of removal.

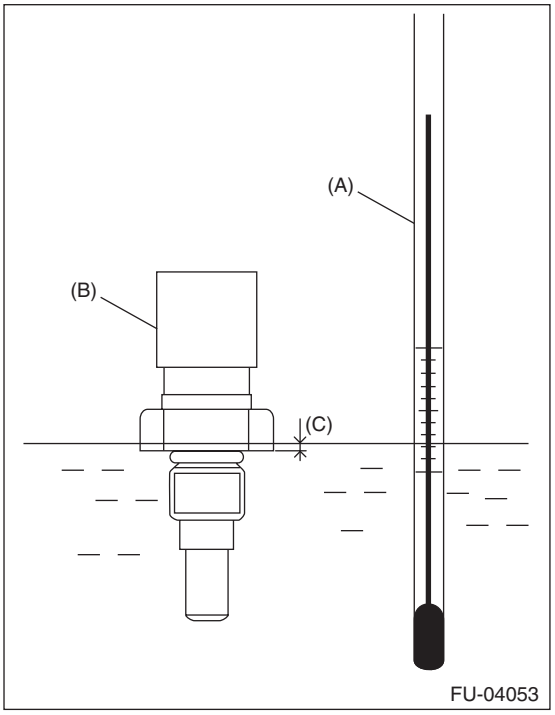
NOTE:
Use a new gasket.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***

## C: INSPECTION

1) Check that the engine coolant temperature sensor has no deformation, cracks or other damages.
2) Immerse the engine coolant temperature sensor and a thermometer in water.

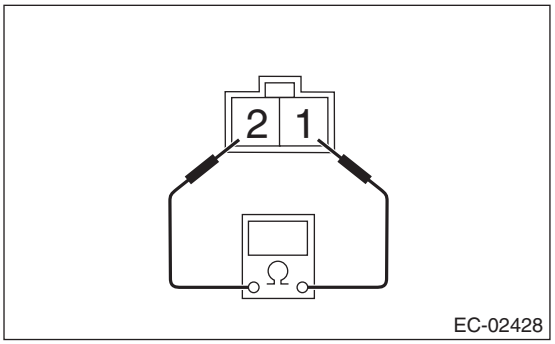
**CAUTION:**
**Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.**




(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: To approx. $^1/_3$

3) Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

NOTE:
Agitate the water for even temperature distribution.

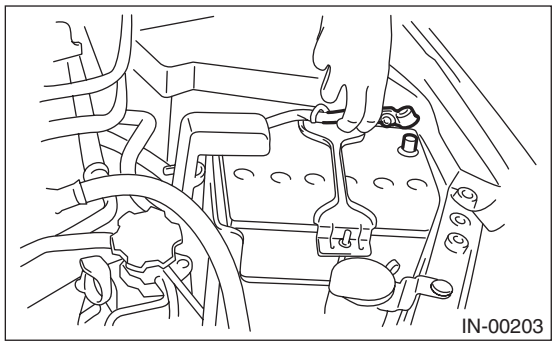



| Water temperature | Terminal No. | Standard |
|---|---|---|
| 20°C (68°F) | 1 and 2 | 2.45±0.2 kΩ |
| 80°C (176°F) | | 0.318±0.013 kΩ |

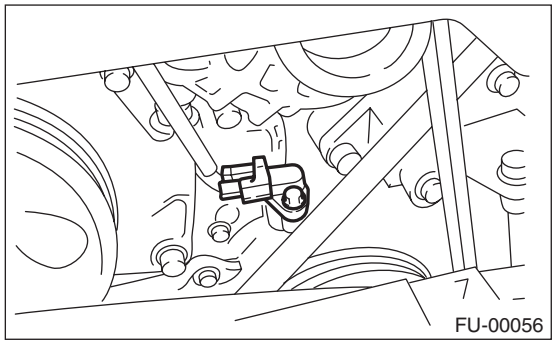
# 5. Crankshaft Position Sensor

## A: REMOVAL

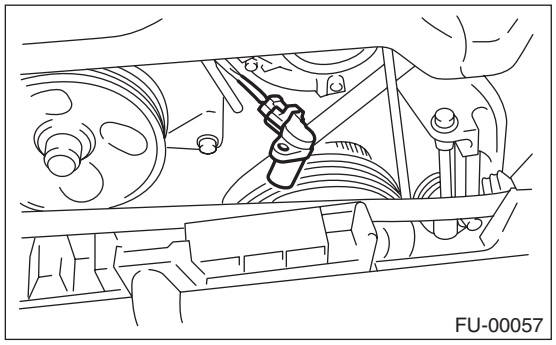
1) Disconnect the ground cable from battery.




2) Remove the bolt which secures crankshaft position sensor to oil pump.



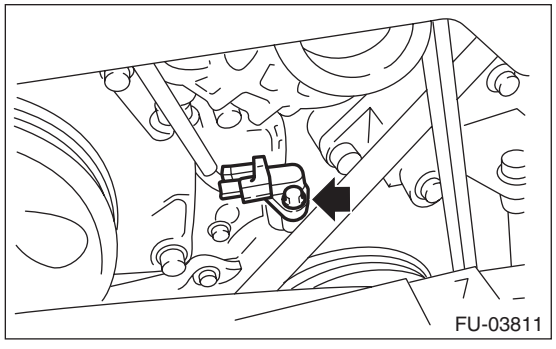

3) Remove the crankshaft position sensor, and then disconnect the connector from it.




## B: INSTALLATION

Install in the reverse order of removal.

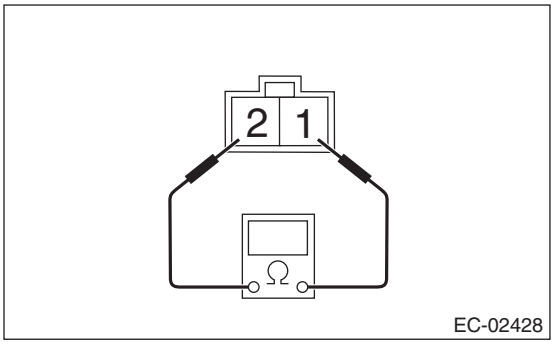
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




## C: INSPECTION

### 1. CRANKSHAFT POSITION SENSOR (METHOD WITH CIRCUIT TESTER)

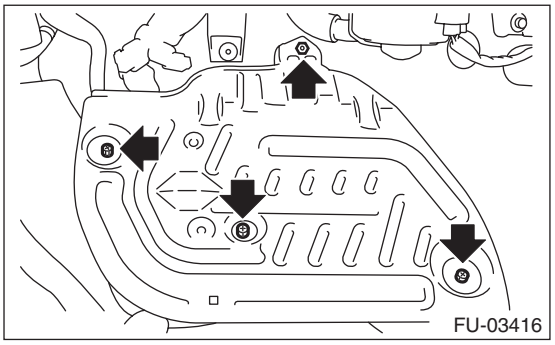
1) Measure the resistance between crankshaft position sensor terminals.



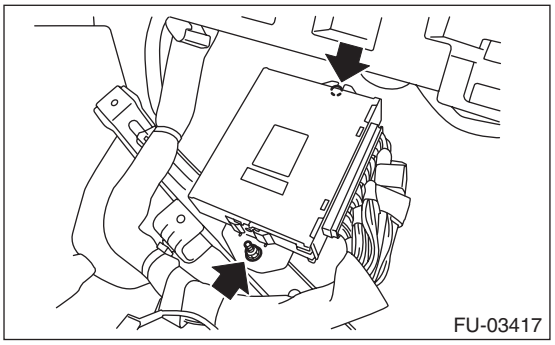

| Terminal No. | Standard |
|---|---|
| 1 and 2 | 2.04±0.204 kΩ |

### 2. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

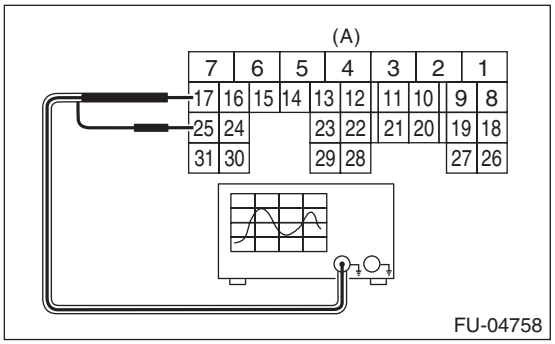
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-53, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.




5) Remove the nuts and bolts which hold the ECM to the bracket.



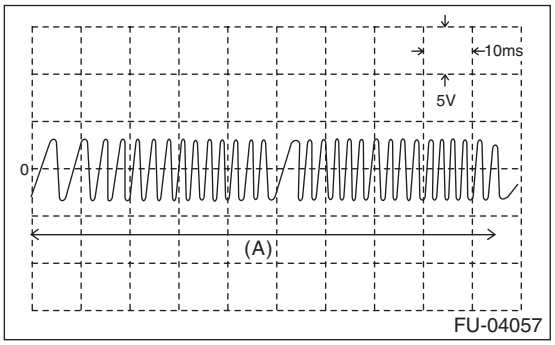
6) Connect the probe to ECM connector.




(A) To ECM connector

| Terminal No. | Probe |
|---|---|
| 17 | + |
| 25 | – |

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.




(A) One crankshaft rotation

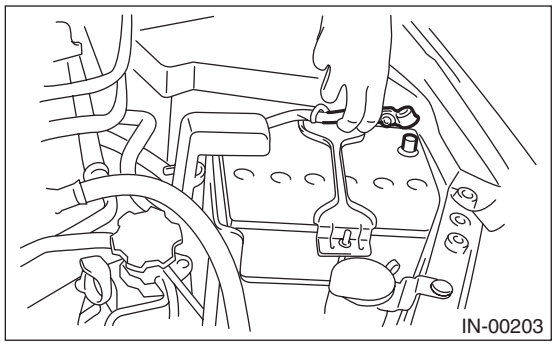
## 3. OTHER INSPECTIONS

Check that the crankshaft position sensor has no deformation, cracks or other damages.

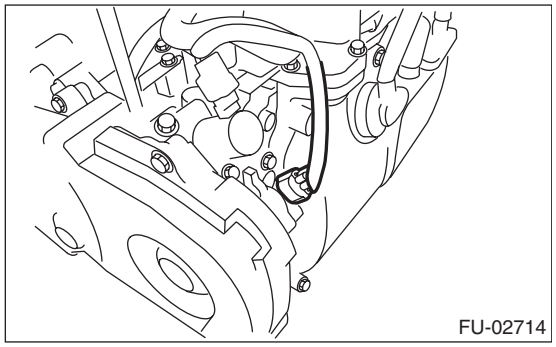
# 6. Camshaft Position Sensor

## A: REMOVAL

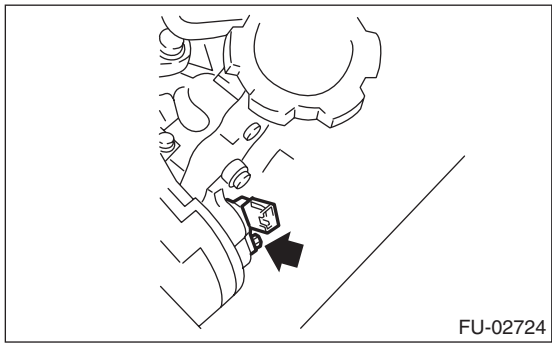
1) Disconnect the ground cable from battery.



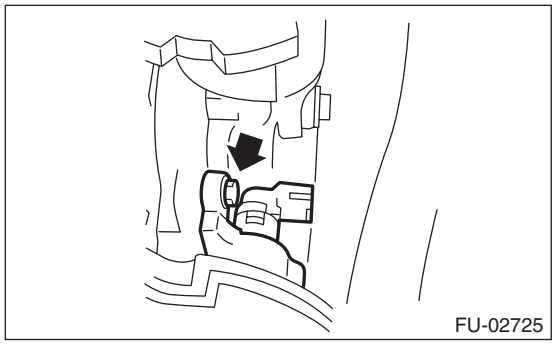

2) Disconnect the connector from camshaft position sensor.




3) Remove the bolt which secures camshaft position sensor to camshaft position sensor support.

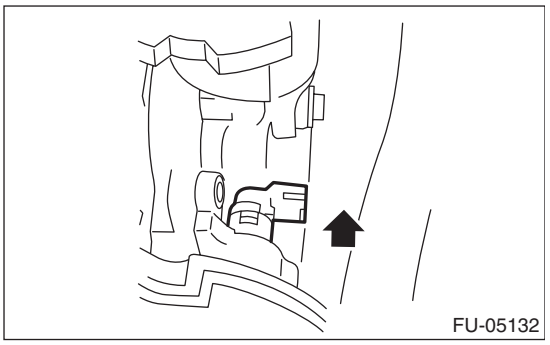



4) Remove the bolt which secures camshaft position sensor support to camshaft cap LH.

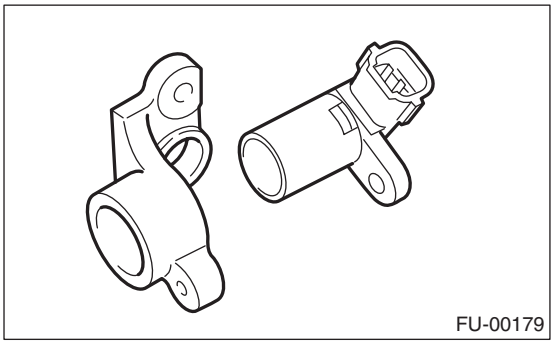



5) Remove the camshaft position sensor and the camshaft position sensor support as a unit.

NOTE:
Slide in the arrowed direction until the camshaft position sensor contacts the rocker cover LH.




6) Remove the camshaft position sensor from the camshaft position sensor support.




## B: INSTALLATION

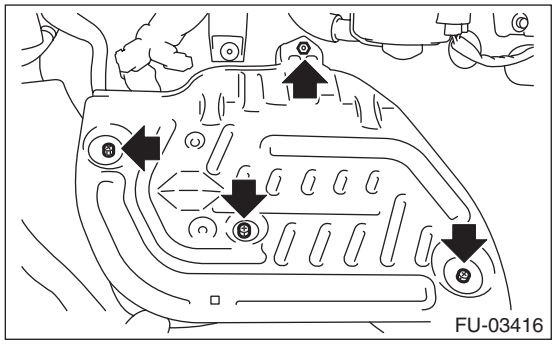
Install in the reverse order of removal.

***Tightening torque:***
***Camshaft position sensor support***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***Camshaft position sensor***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

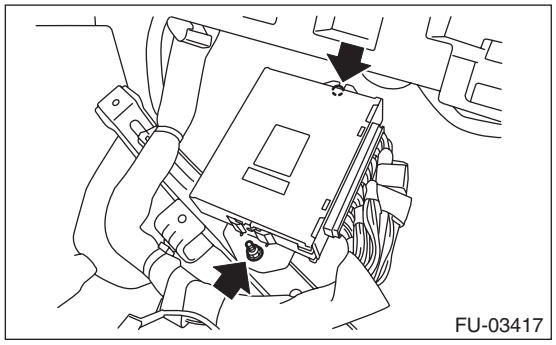
## C: INSPECTION

### 1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

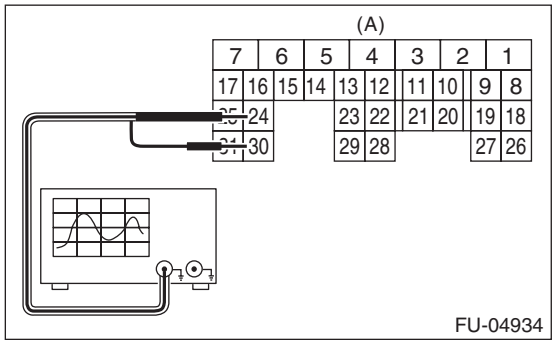
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-53, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.




5) Remove the nuts and bolts which hold the ECM to the bracket.



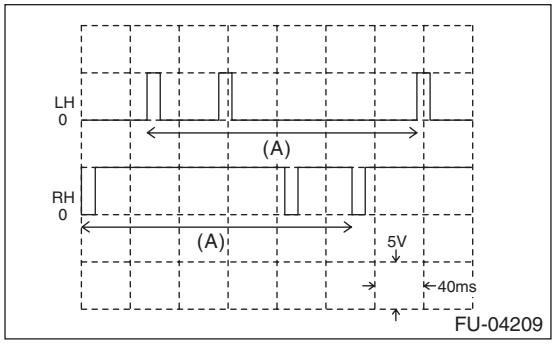

6) Connect the probe to ECM connector.




(A) To ECM connector

| Terminal No. | Probe |
|---|---|
| 24 | + |
| 30 | – |

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.




(A) One camshaft rotation

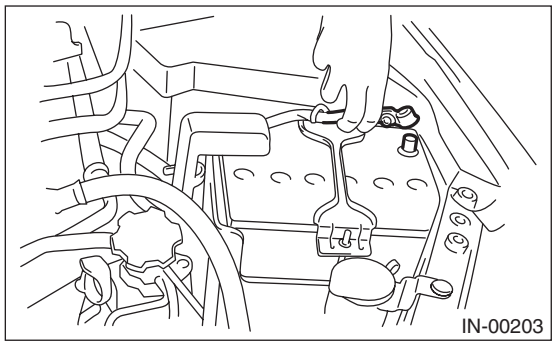
### 2. OTHER INSPECTIONS

Check that the camshaft position sensor has no deformation, cracks or other damages.

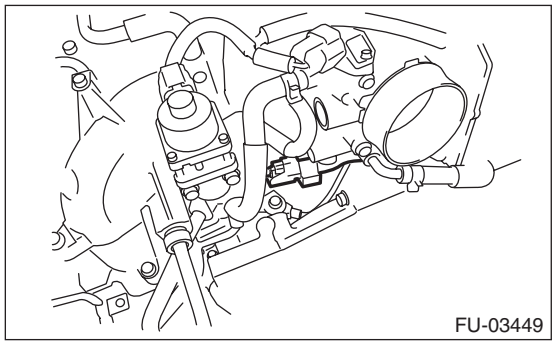
# 7. Knock Sensor

## A: REMOVAL

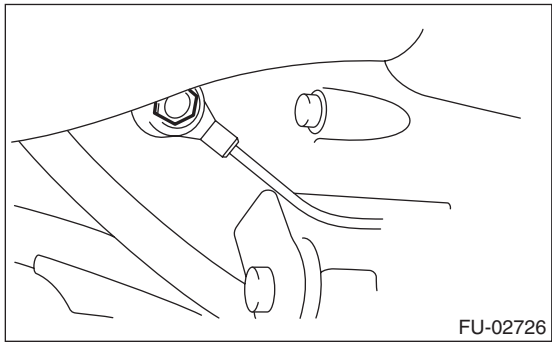
1) Disconnect the ground cable from battery.




2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Disconnect the knock sensor connector.




4) Remove the knock sensor from cylinder block.

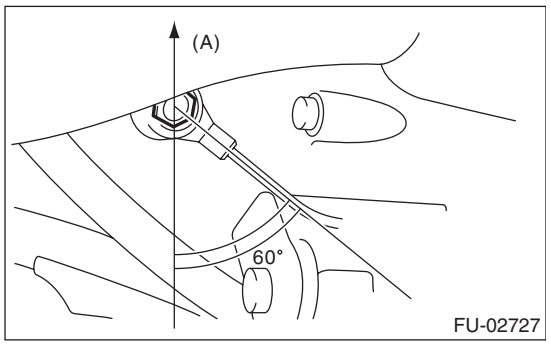



## B: INSTALLATION

1) Install the knock sensor to the cylinder block.

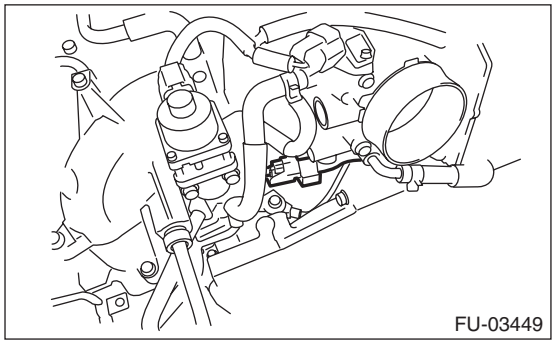
NOTE:
Extraction area of knock sensor cord must be positioned at a 60° angle relative to the engine rear.

***Tightening torque:***
***24 N·m (2.4 kgf-m, 17.7 ft-lb)***

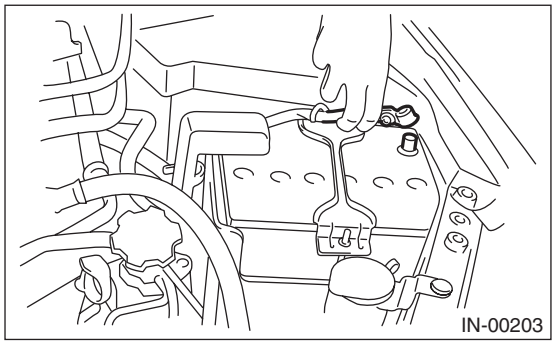



(A) Front side of vehicle

2) Connect the knock sensor connector.

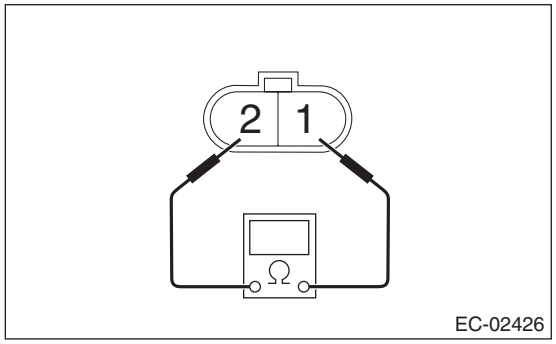



3) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
4) Connect the battery ground terminal.



## C: INSPECTION

1) Check that the knock sensor has no deformation, cracks or other damages.
2) Measure the resistance between knock sensor terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | 560±28 kΩ |

# 8. Throttle Position Sensor

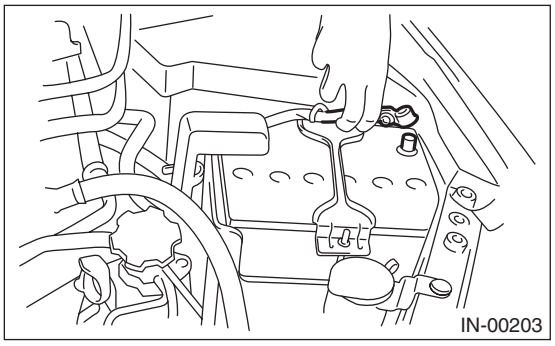
## A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.
Refer to “Throttle Body” for removal and installation procedure. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>

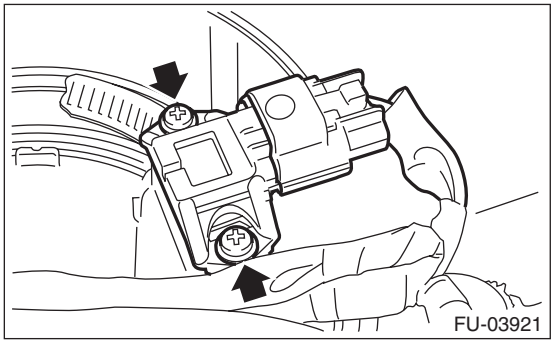
# 9. Manifold Absolute Pressure Sensor

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Disconnect the connector from the manifold absolute pressure sensor and remove the manifold absolute pressure sensor from throttle body.




## B: INSTALLATION

Install in the reverse order of removal.

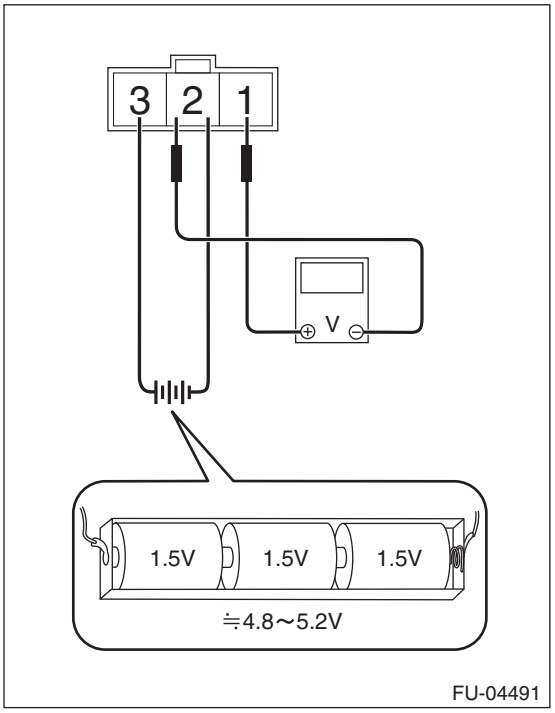
NOTE:
Use new O-rings.

***Tightening torque:***
***2 N·m (0.2 kgf-m, 1.5 ft-lb)***

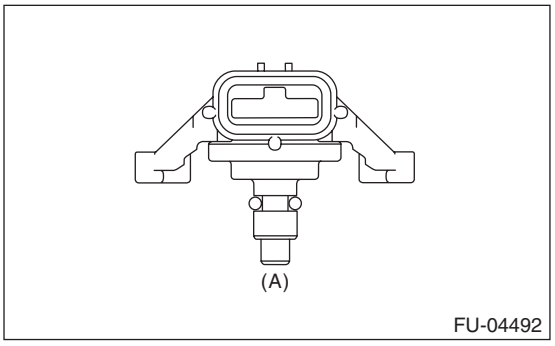
## C: INSPECTION

1) Check that the manifold absolute pressure sensor has no deformation, cracks or other damages.
2) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 2, circuit tester ground terminal to terminal No. 2 and the circuit tester positive terminal to terminal No. 1.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.




3) Connect the Mighty Vac to the pressure port (A) of manifold absolute pressure sensor.



4) Check the voltage when generating vacuum and positive pressure using Mighty Vac.

**CAUTION:**
**Do not apply vacuum of less than –88 kPa (–0.9 kgf/cm$^2$, –12.8 psi). Doing so may damage the manifold absolute pressure sensor.**

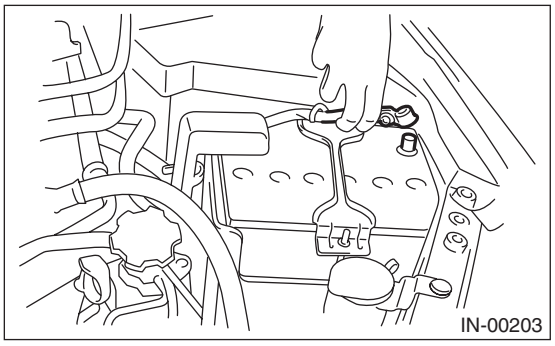
NOTE:
When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3). When positive pressure occurs, on the other hand, the voltage will rise.

| Pressure | Terminal No. | Standard |
|---|---|---|
| –88 kPa (–0.9 kgf/cm$^2$, –12.8 psi) | 2 (+) and 1 (–) | Approx. 1 V (when 25°C (77°F)) |
| –35 kPa (–0.4 kgf/cm$^2$, –5.1 psi) | | Approx. 2.6 V (when 25°C (77°F)) |
| 19 kPa (–0.2 kgf/cm$^2$, 2.8 psi) | | Approx. 4.2 V (when 25°C (77°F)) |

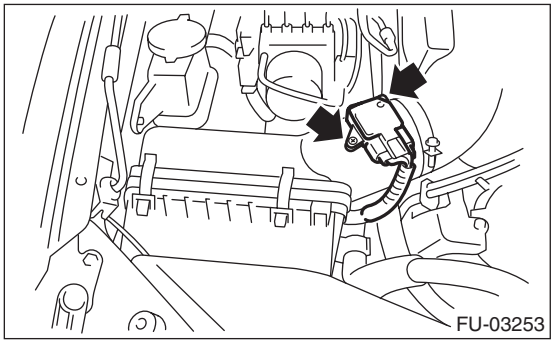
# 10.Mass Air Flow and Intake Air Temperature Sensor

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Disconnect the connector from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.




## B: INSTALLATION

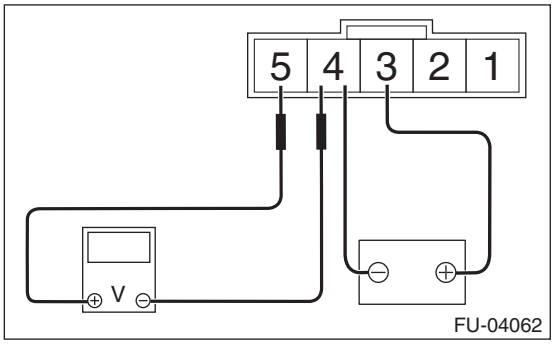
Install in the reverse order of removal.

***Tightening torque:***
***1 N·m (0.1 kgf-m, 0.7 ft-lb)***

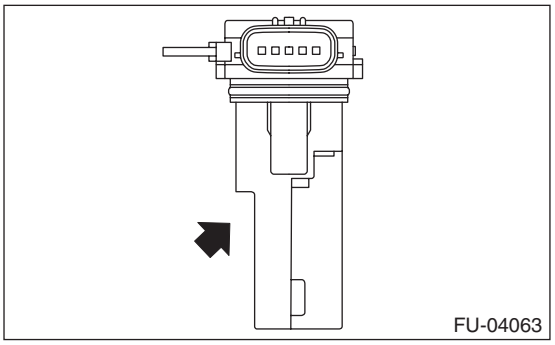
## C: INSPECTION

### 1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, the circuit tester positive terminal to terminal No. 5 and the circuit tester ground terminal to terminal No. 4.

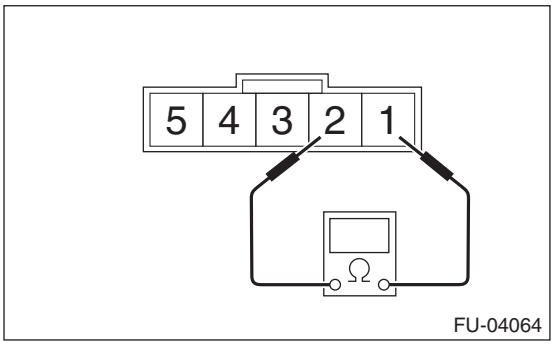



2) Check that the voltage changes when air is blown to the mass air flow sensor unit from arrow direction.




### 2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.




| Temperature | Terminal No. | Standard |
|---|---|---|
| –20°C (–4°F) | 1 and 2 | 16.0 ±2.4 kΩ |
| 20°C (68°F) | | 2.45 ±0.24 kΩ |
| 60°C (140°F) | | 0.580 ±0.087 kΩ |

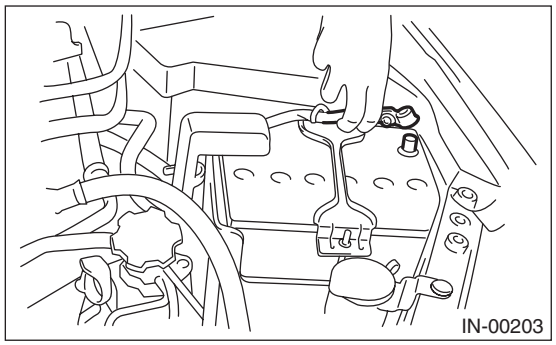
### 3. OTHER INSPECTIONS

1) Check that the mass air flow and intake air temperature sensor has no deformation, cracks or other damages.
2) Check that the mass air flow and intake air temperature sensor has no dirt.

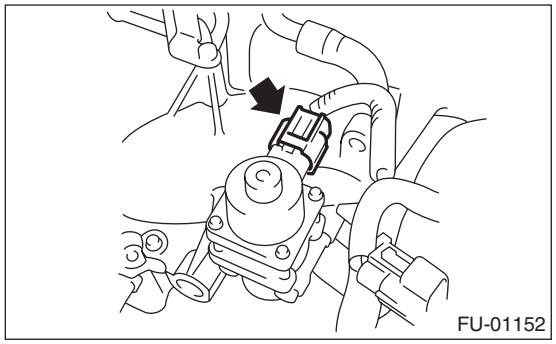
# 11.EGR Valve

## A: REMOVAL

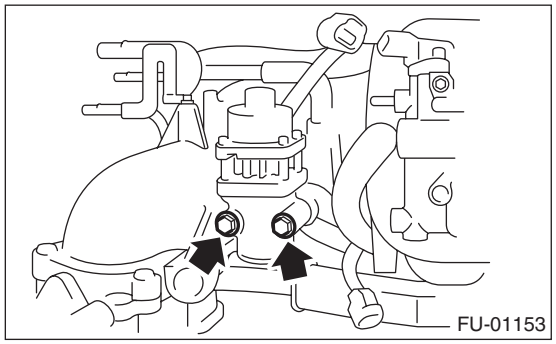
1) Disconnect the ground cable from battery.




2) Disconnect the connector from EGR valve.




3) Remove the EGR valve from intake manifold.




## B: INSTALLATION

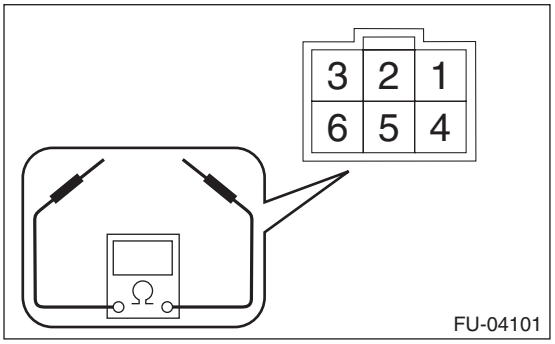
Install in the reverse order of removal.

NOTE:
Use a new gasket.

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***

## C: INSPECTION

1) Check that the EGR valve has no deformation, cracks or other damages.
2) Measure the resistance between EGR valve terminals.



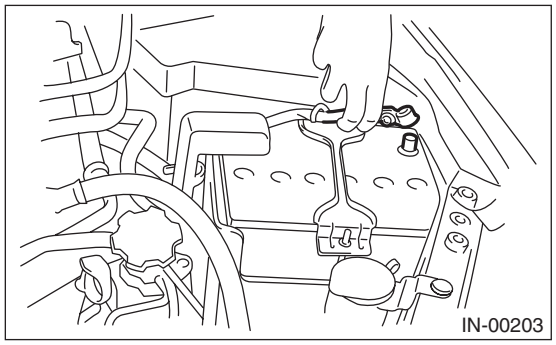

| Terminal No. | Standard |
|---|---|
| 2 and 1 | 22±2 Ω |
| 2 and 3 | 22±2 Ω |
| 5 and 4 | 22±2 Ω |
| 5 and 6 | 22±2 Ω |

# 12.Fuel Injector

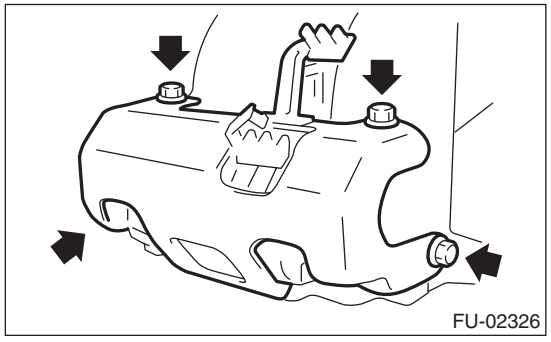
## A: REMOVAL

### 1. RH SIDE

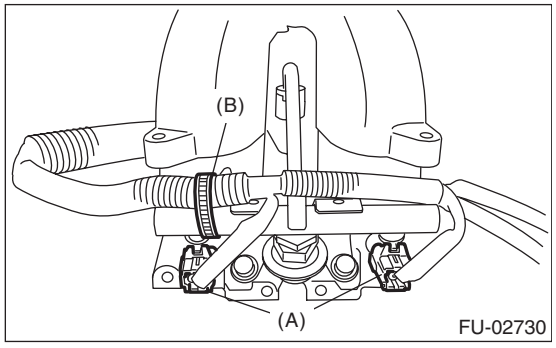
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



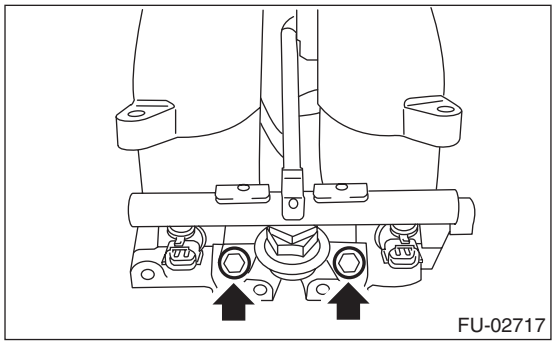

3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake boot.
5) Remove the spark plug cords from spark plugs (#1 and #3 cylinders).
6) Remove the fuel pipe protector RH.




7) Remove the harness band (B) which holds the engine harness to the fuel injector pipe, and disconnect the connectors (A) from fuel injector.



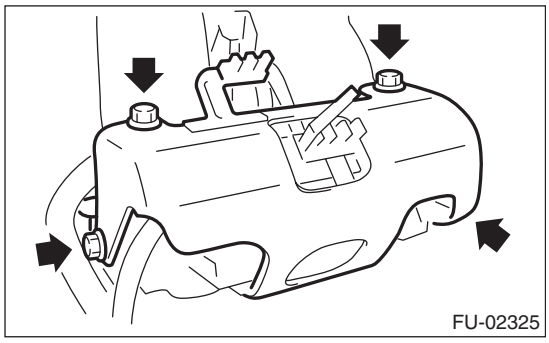

8) Remove the bolts which hold fuel injector pipe onto intake manifold.



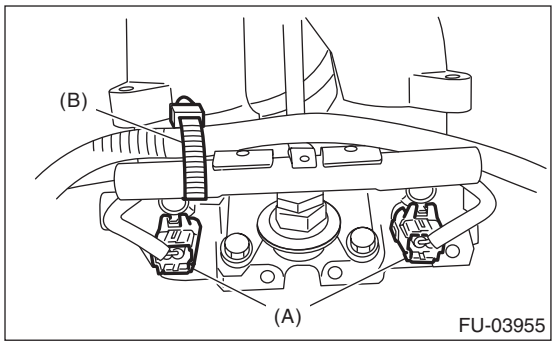

9) Remove the fuel injector while lifting up the fuel injector pipe.

### 2. LH SIDE

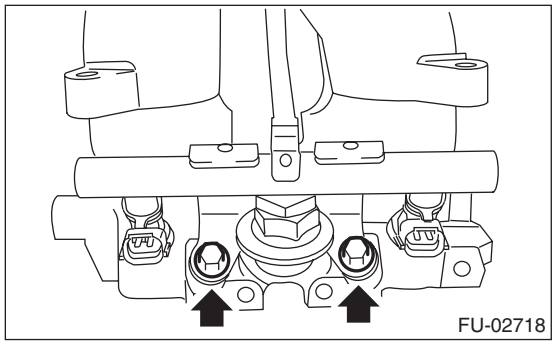
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the spark plug cords from spark plugs (#2 and #4 cylinders).
5) Remove the fuel pipe protector LH.

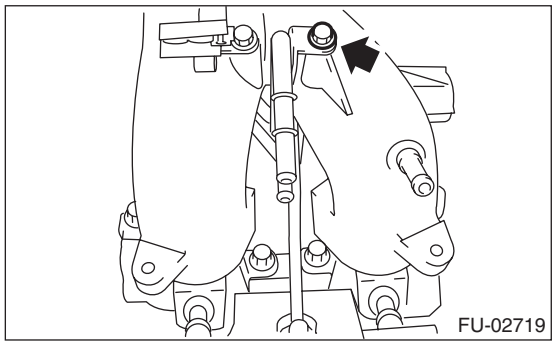



6) Remove the harness band (B) which holds the engine harness to the fuel injector pipe, and disconnect the connectors (A) from fuel injector.



7) Remove the bolts which hold fuel injector pipe onto intake manifold.



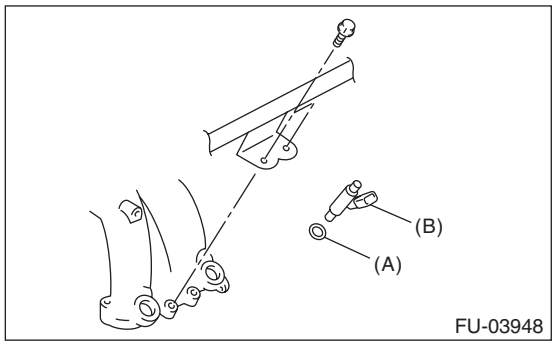

8) Remove the fuel injector while lifting up the fuel injector pipe.

## B: INSTALLATION

### 1. RH SIDE

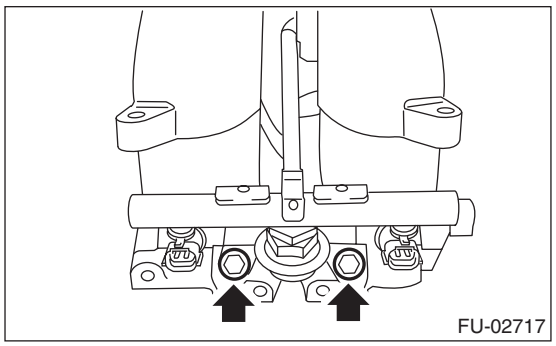
Install in the reverse order of removal.

NOTE:
Use new O-rings.

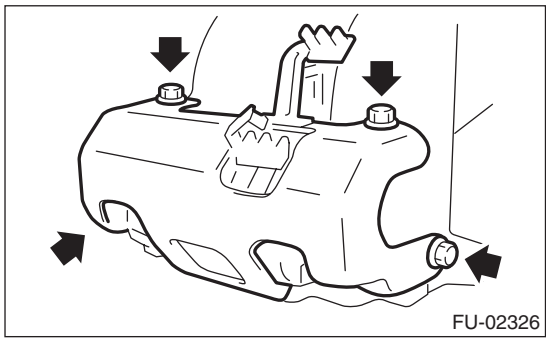



(A) O-ring
(B) Fuel injector

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***



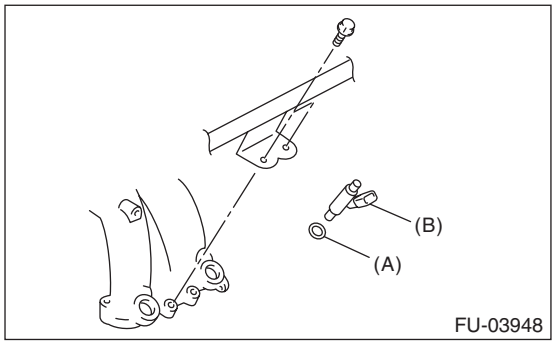

***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***




### 2. LH SIDE

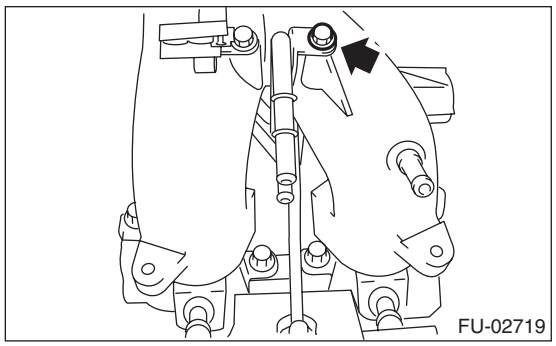
Install in the reverse order of removal.

NOTE:
Use new O-rings.

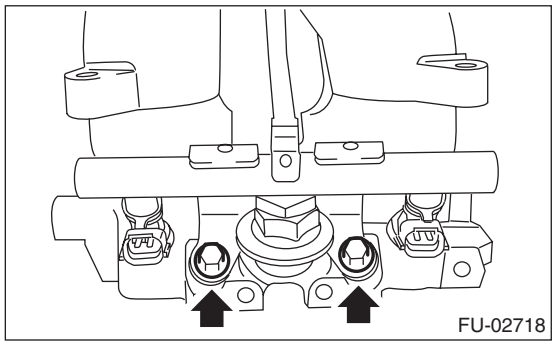



(A) O-ring
(B) Fuel injector

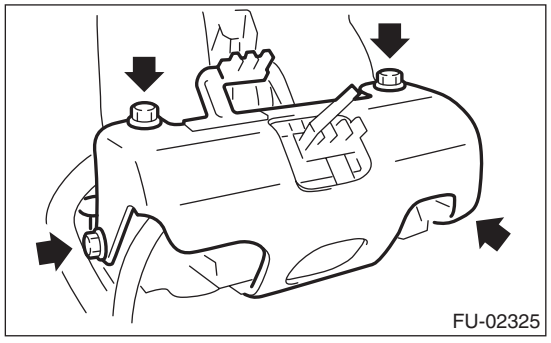
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***

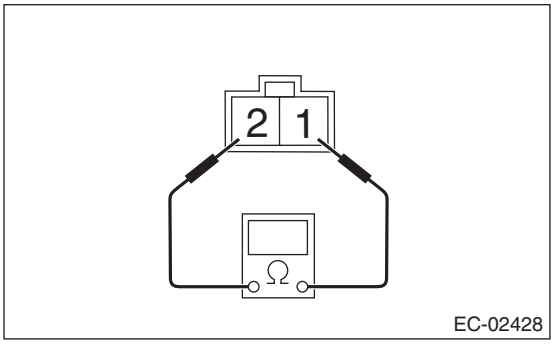



***Tightening torque:***
***19 N·m (1.9 kgf-m, 14.0 ft-lb)***




## C: INSPECTION

1) Check that the fuel injector has no deformation, cracks or other damages.
2) Measure the resistance between fuel injector terminals.

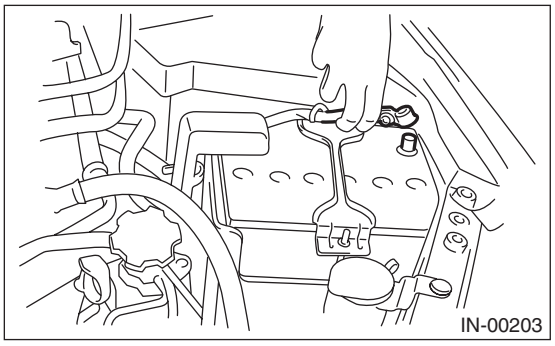



| Terminal No. | Standard |
|---|---|
| 1 and 2 | Approx. 12.0 Ω (when 20°C (68°F)) |

# 13. Variable Valve Lift Diagnosis Oil Pressure Switch

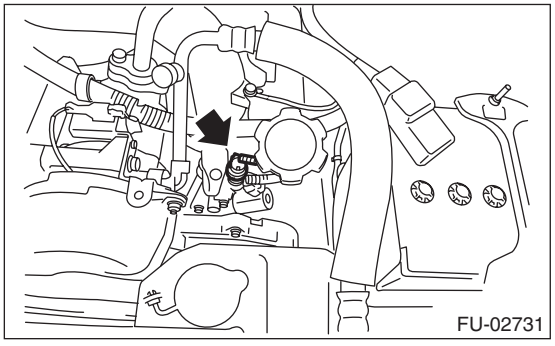
## A: REMOVAL

1) Disconnect the ground cable from battery.

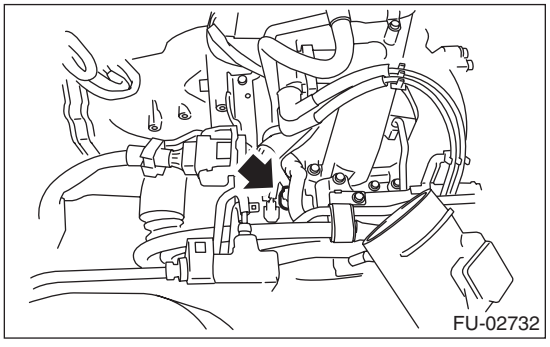



2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.
4) Remove the variable valve lift diagnosis oil pressure switch.

- LH side




- RH side




## B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Apply liquid gasket to the variable valve lift diagnosis oil pressure switch threads.

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***

***Tightening torque:***
***17 N·m (1.7 kgf-m, 12.5 ft-lb)***

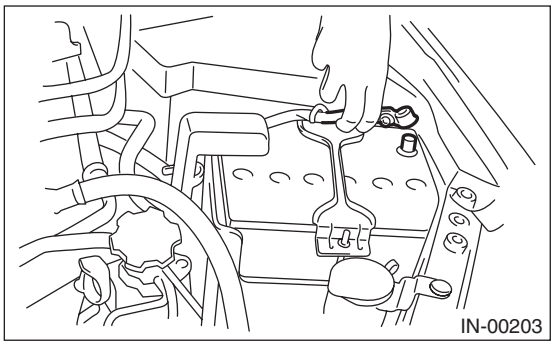
## C: INSPECTION

1) Check that the variable valve lift diagnosis oil pressure switch does not have deformation, cracks or damage.
2) Check the variable valve lift diagnosis oil pressure switch installation portion for oil leakage and oil seepage.

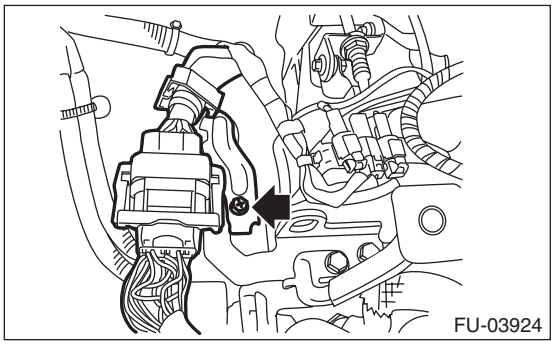
# 14.Oil Temperature Sensor

## A: REMOVAL

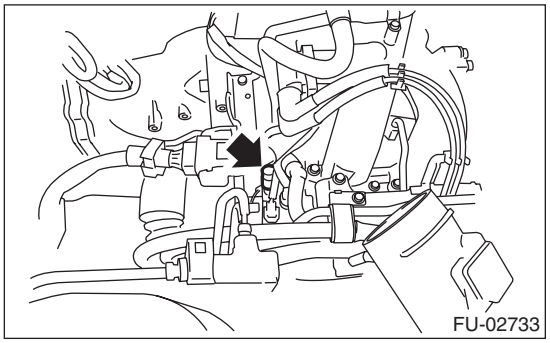
1) Disconnect the ground cable from battery.




2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Remove the bolt, and remove the engine harness connector from the bulkhead harness connector and rear engine hanger.




4) Disconnect the connector from oil temperature sensor.
5) Remove the oil temperature sensor.



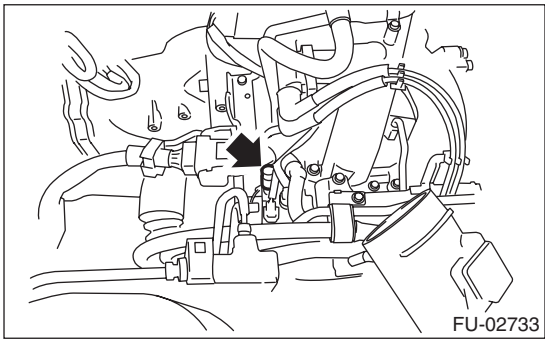

## B: INSTALLATION

Install in the reverse order of removal.

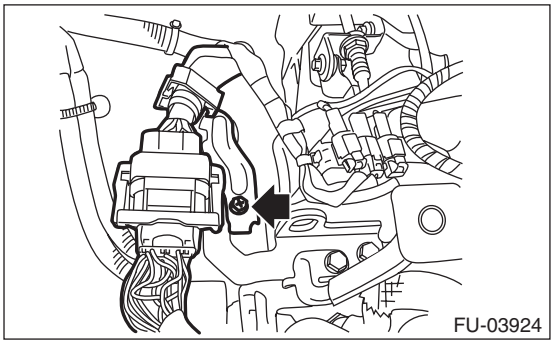
NOTE:
Apply liquid gasket to the oil temperature sensor threads.

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***

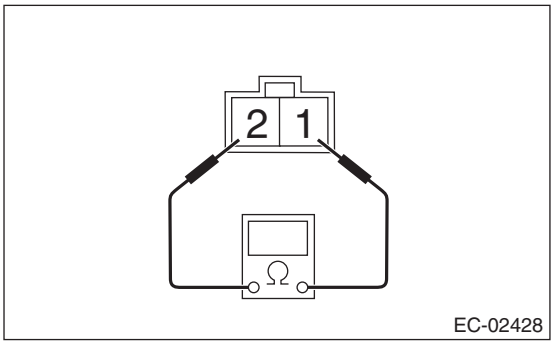



***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




## C: INSPECTION

1) Check that the oil temperature sensor has no deformation, cracks or other damages.
2) Check the resistance between the oil temperature sensor terminals.

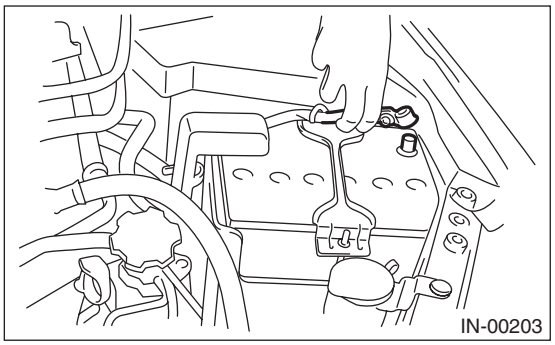



| Terminal No. | Standard |
|---|---|
| 1 and 2 | 2.45±0.2 (When 20°C (68°F)) |

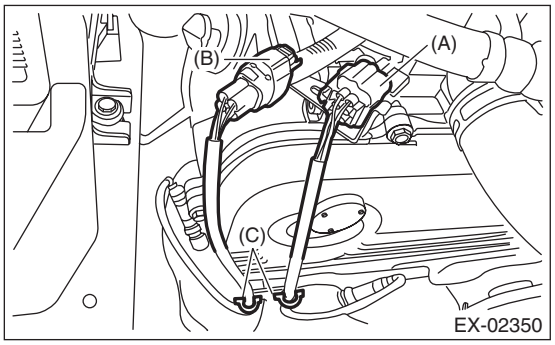
# 15.Front Oxygen (A/F) Sensor

## A: REMOVAL

1) Disconnect the ground cable from battery.



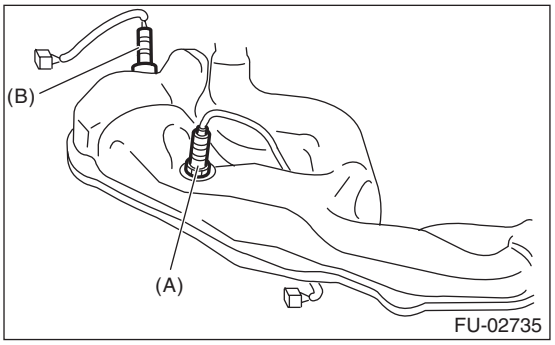

2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
3) Disconnect the front oxygen (A/F) sensor connector, and remove the clip holding the front oxygen (A/F) sensor harness.




(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
6) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
7) Remove the front oxygen (A/F) sensor.

**CAUTION:**
**When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.**




(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

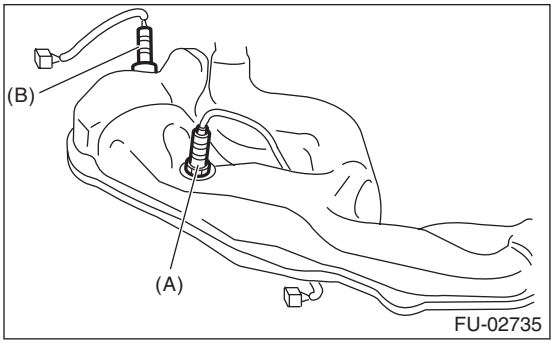
## B: INSTALLATION

**CAUTION:**
**If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.**
1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

**CAUTION:**
**Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.**

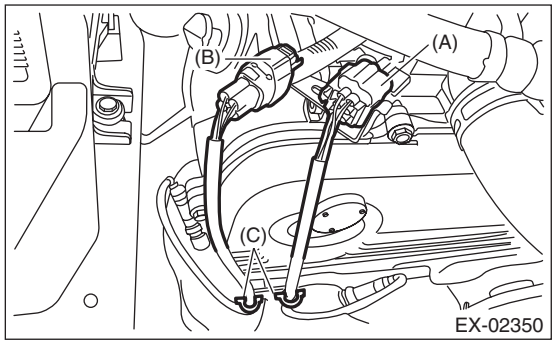
***Anti-seize compound:***
***NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent***
2) Install the front oxygen (A/F) sensor.

***Tightening torque:***
***21 N·m (2.1 kgf-m, 15.5 ft-lb)***



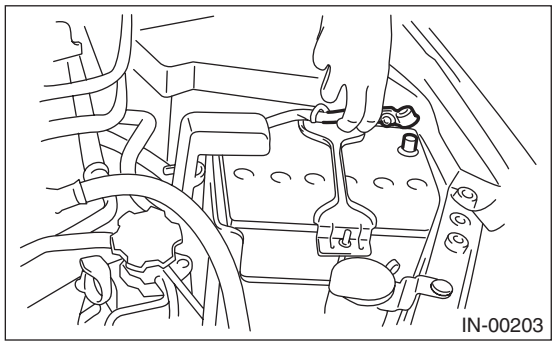

(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

3) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
4) Lower the vehicle.
5) Connect the front oxygen (A/F) sensor connector, and secure the front oxygen (A/F) sensor harness by using the clip.



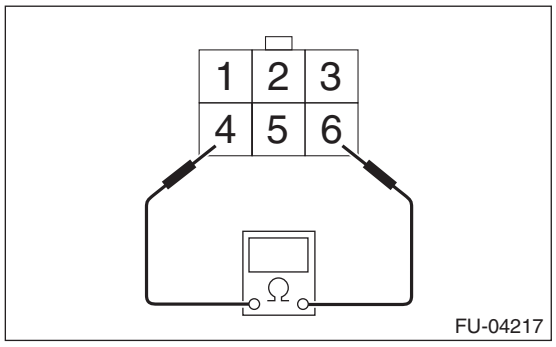

(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

6) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
7) Connect the battery ground terminal.




## C: INSPECTION

1) Check that the front oxygen (A/F) sensor has no deformation, cracks or other damages.
2) Measure the resistance between front oxygen (A/F) sensor terminals.

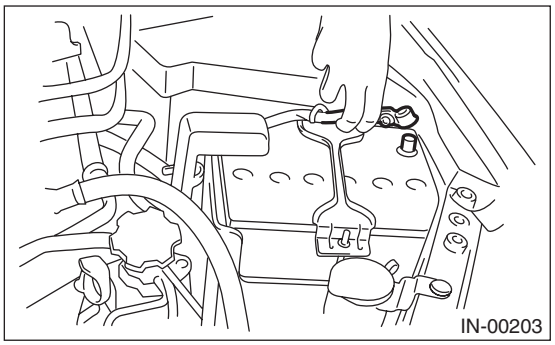



| Terminal No. | Standard |
|---|---|
| 4 and 6 | 2.4±0.24 Ω (20°C (68°F)) |

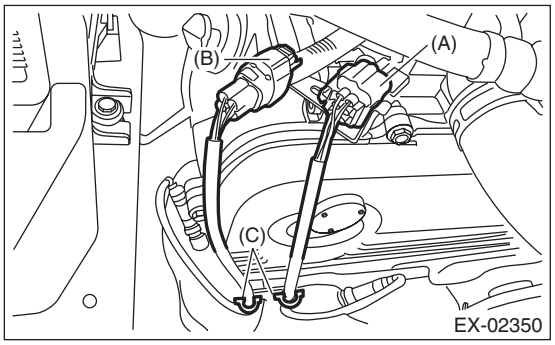
# 16.Rear Oxygen Sensor

## A: REMOVAL

1) Disconnect the ground cable from battery.



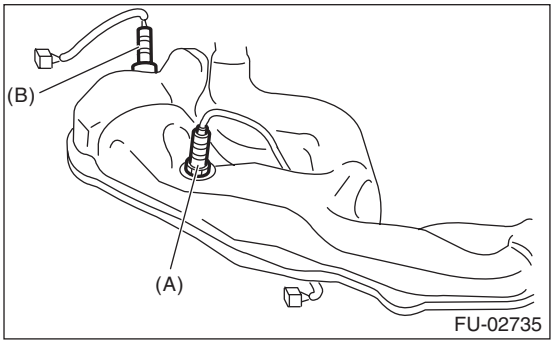

2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
3) Disconnect the rear oxygen sensor connector, and remove the clip holding the rear oxygen sensor harness.




(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
6) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
7) Remove the rear oxygen sensor.

**CAUTION:**
**When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.**




(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

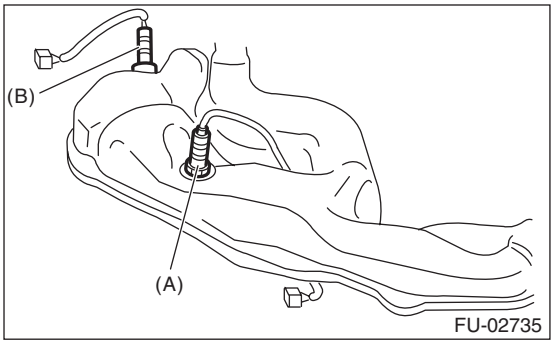
## B: INSTALLATION

**CAUTION:**
**If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.**
1) Before installing rear oxygen sensor, apply the anti-seize compound only to the threaded portion of rear oxygen sensor to make the next removal easier.

**CAUTION:**
**Never apply anti-seize compound to the protector of rear oxygen sensor.**

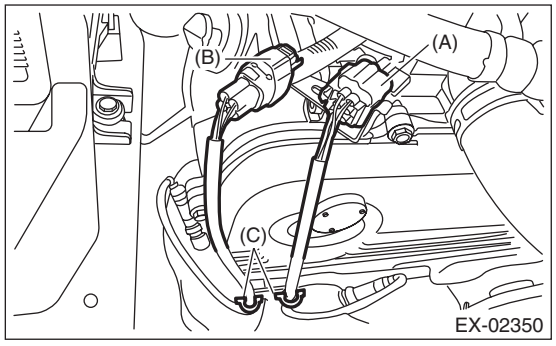
***Anti-seize compound:***
***NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent***
2) Install the rear oxygen sensor.

***Tightening torque:***
***21 N·m (2.1 kgf-m, 15.5 ft-lb)***



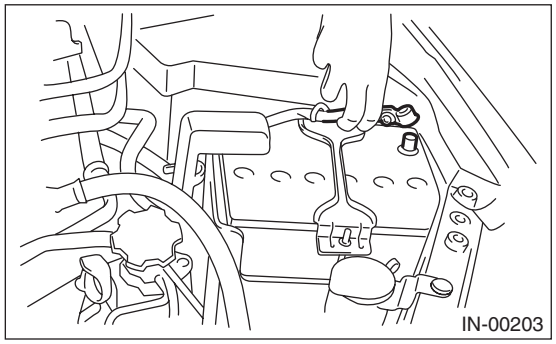

(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

3) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
4) Lower the vehicle.
5) Connect the rear oxygen sensor connector, and hold the rear oxygen sensor harness with the clip.



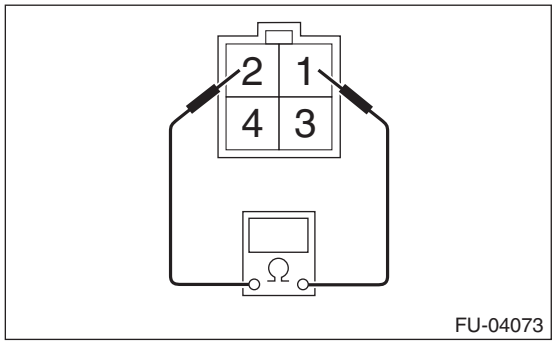

(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

6) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
7) Connect the battery ground terminal.




## C: INSPECTION

1) Check that the rear oxygen sensor has no deformation, cracks or other damages.
2) Measure the resistance between rear oxygen sensor terminals.

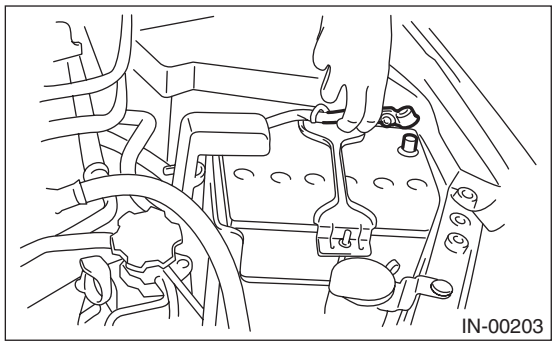



| Terminal No. | Standard |
|---|---|
| 1 and 2 | $5.6^{+1.7}_{-0.6}$ Ω (when 20°C (68°F)) |

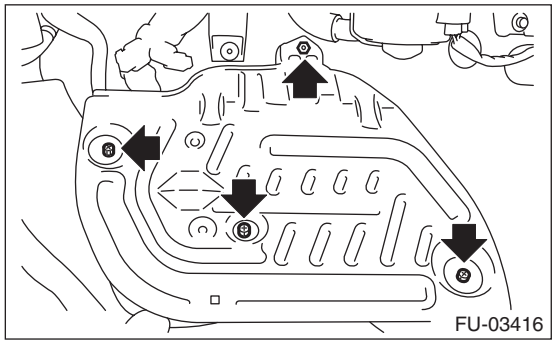
# 17.Engine Control Module (ECM)

## A: REMOVAL

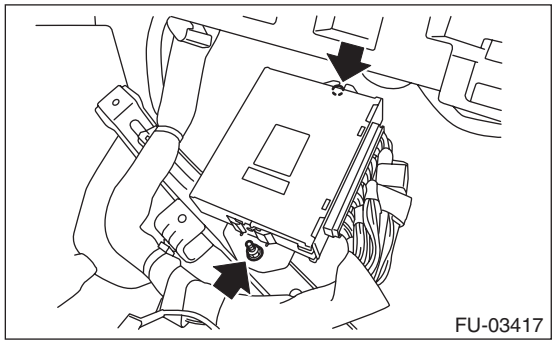
1) Disconnect the ground cable from battery.




2) Remove the lower inner trim of passenger's side. <Ref. to EI-53, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.




5) Remove the bolts and nuts which hold the ECM to the bracket.




6) Disconnect the ECM connectors, and take out the ECM.

## B: INSTALLATION

Install in the reverse order of removal.

**CAUTION:**
**• When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system. (Refer to "PC application help for Subaru Select Monitor".)**
**• When replacing the ECM or the bracket, replace both parts with the new ones.**
**• After attaching the bracket to the ECM, do not detach the bracket.**
**• If the bracket is attached to the ECM in the wrong direction, replace both parts with the new ones.**

NOTE:
When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***

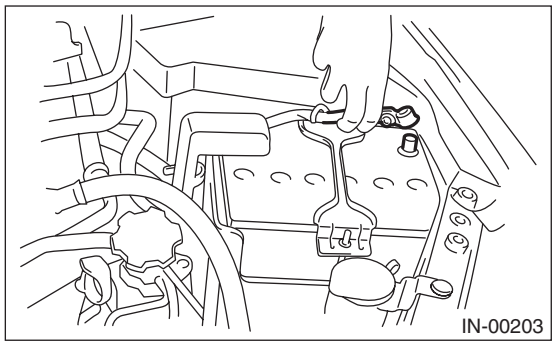
## C: INSPECTION

Check that the ECM has no deformation, cracks or other damages.

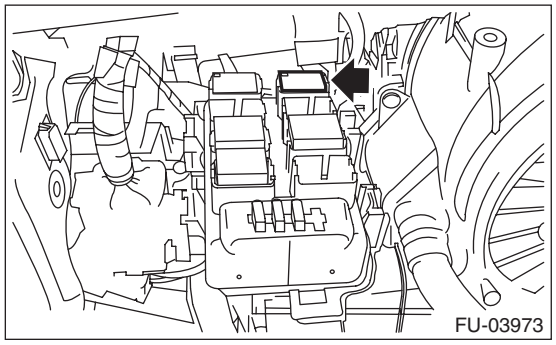
# 18.Main Relay

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Remove the main relay from the relay block on the back side of the glove box.

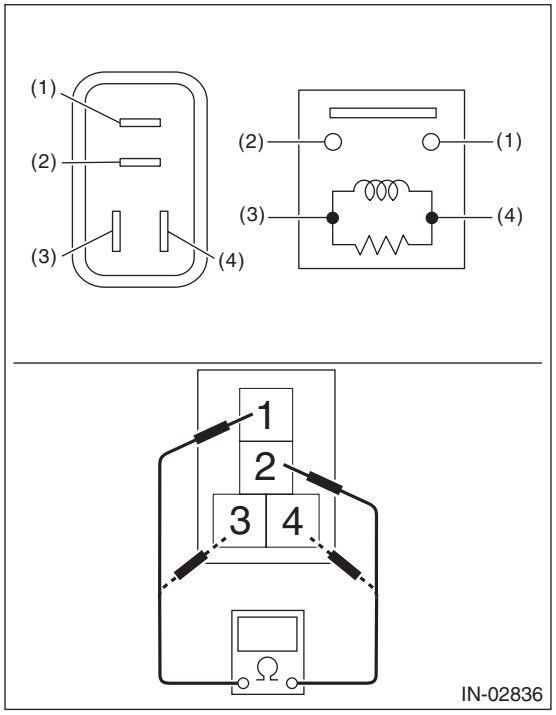



## B: INSTALLATION

Install in the reverse order of removal.

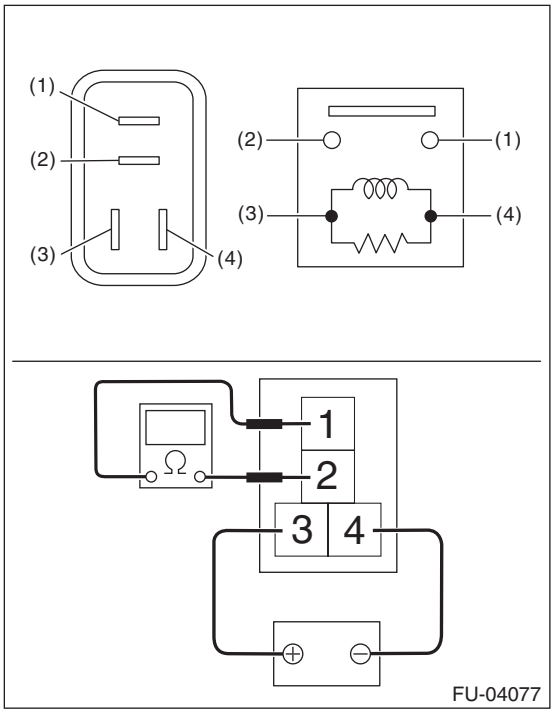
## C: INSPECTION

1) Check that the main relay has no deformation, cracks or other damages.
2) Measure the resistance between main relay terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | 1 MΩ or more |
| 3 and 4 | 130.4 — 230.8 Ω (When 20°C (68°F)) |

3) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and check the resistance between the main relay terminals.

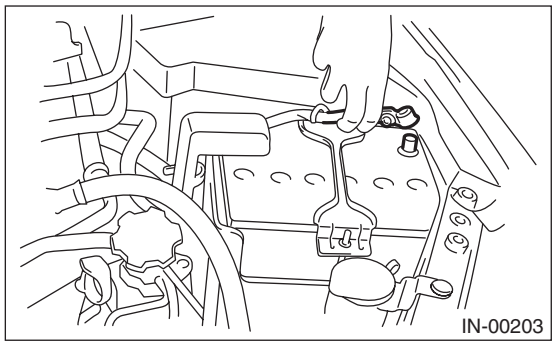



| Terminal No. | Standard |
|---|---|
| 1 and 2 | Less than 1 Ω |

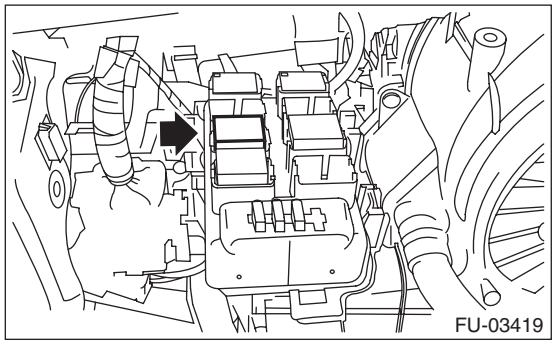
# 19.Fuel Pump Relay

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Remove the fuel pump relay from the relay block on the back side of the glove box.

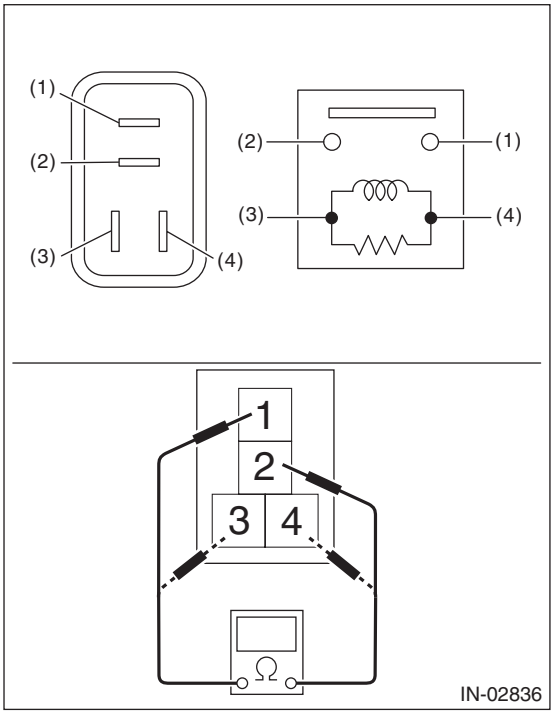



## B: INSTALLATION

Install in the reverse order of removal.

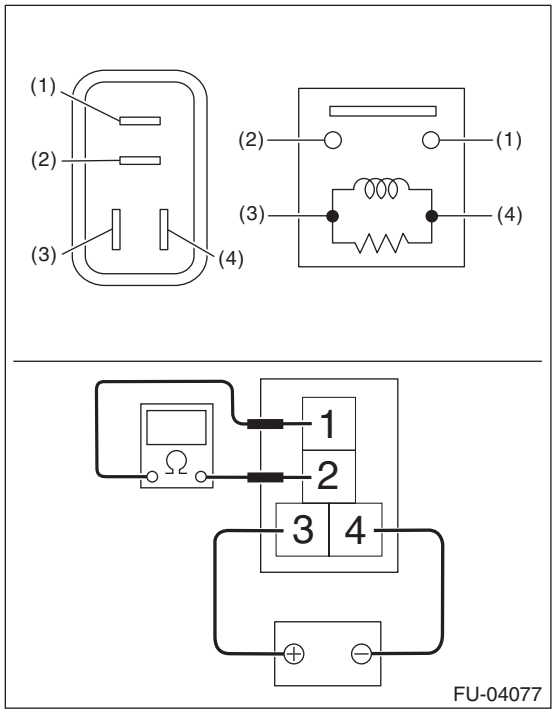
## C: INSPECTION

1) Check that the fuel pump relay has no deformation, cracks or other damages.
2) Measure the resistance between fuel pump relay terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | 1 MΩ or more |
| 3 and 4 | 93.8 — 136.4 Ω (When 20°C (68°F)) |

3) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and check the resistance between the fuel pump relay terminals.

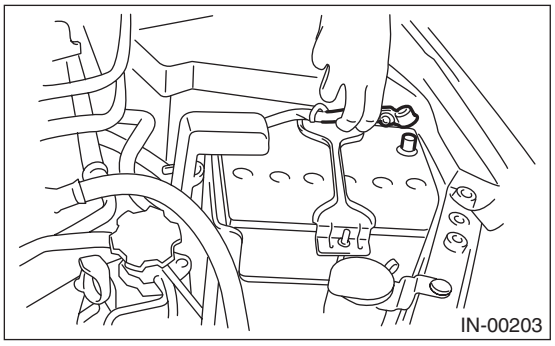



| Terminal No. | Standard |
|---|---|
| 1 and 2 | Less than 1 Ω |

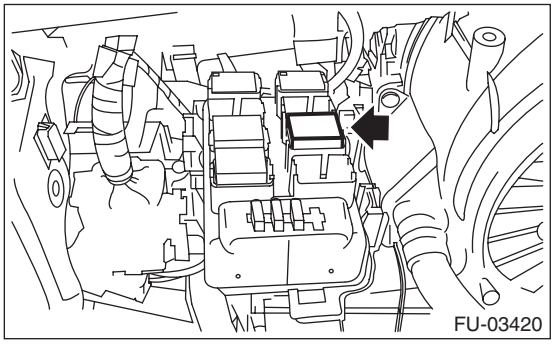
# 20. Electronic Throttle Control Relay

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Remove the electronic throttle control relay from the relay block on the back side of the glove box.

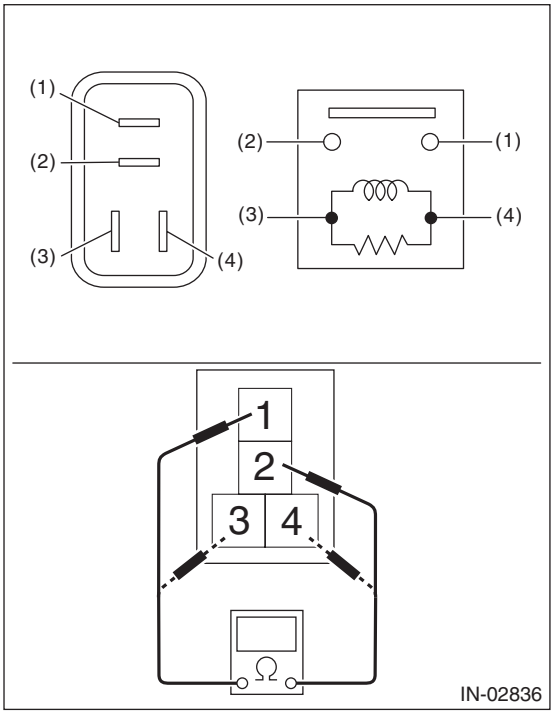



## B: INSTALLATION

Install in the reverse order of removal.

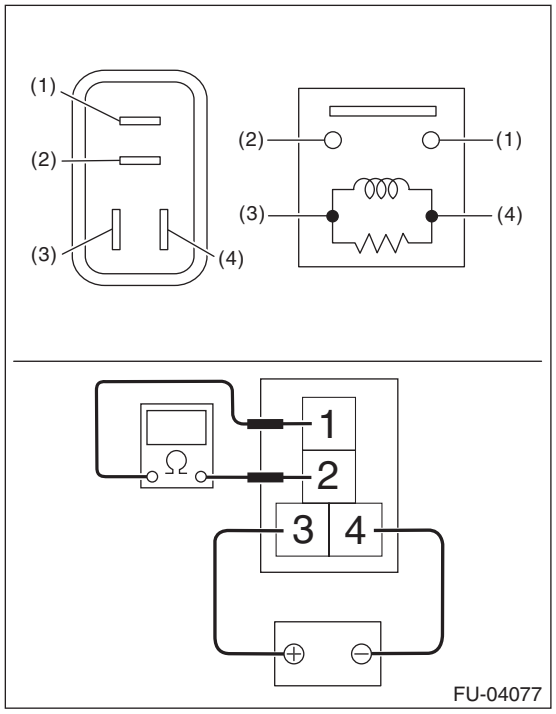
## C: INSPECTION

1) Check that the electronic throttle control relay has no deformation, cracks or other damages.
2) Measure the resistance between electronic throttle control relay terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | 1 MΩ or more |
| 3 and 4 | 93.8 — 136.4 Ω (When 20°C (68°F)) |

3) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and check the resistance between the electronic throttle control relay terminals.




| Terminal No. | Standard |
|---|---|
| 1 and 2 | Less than 1 Ω |

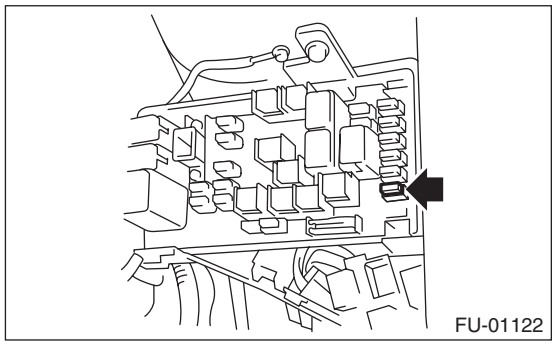
# 21.Fuel

## A: PROCEDURE

### 1. RELEASING OF FUEL PRESSURE

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**
1) Remove the fuse of fuel pump from main fuse box.




2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn the ignition switch to OFF.
5) Install the fuse of fuel pump to the main fuse box.

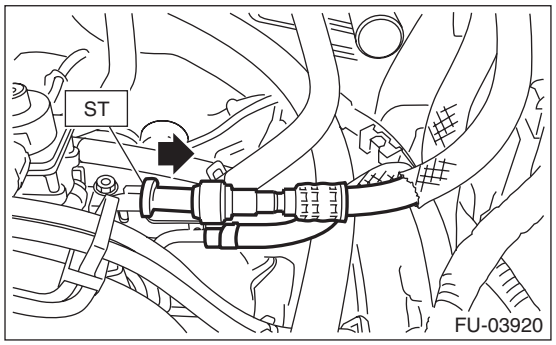
### 2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**

NOTE:
• If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose. <Ref. to FU(H4SO)-53, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
• Be careful not to let the battery run-out.
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.
ST 42099AE000 QUICK CONNECTOR RELEASE

**CAUTION:**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**




3) Connect ST to the fuel delivery hose.
ST 18471AA000 FUEL PIPE ADAPTER
4) Connect the gasoline proof hose to ST and put the end of the hose in the container.
5) Drive the fuel pump and drain the fuel using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-57, FUEL PUMP CONTROL (ON/OFF DRIVE), OPERATION, System Operation Check Mode.>

**CAUTION:**
**Be careful not to spill fuel.**
6) Install the related parts in the reverse order after draining the fuel.

### 3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

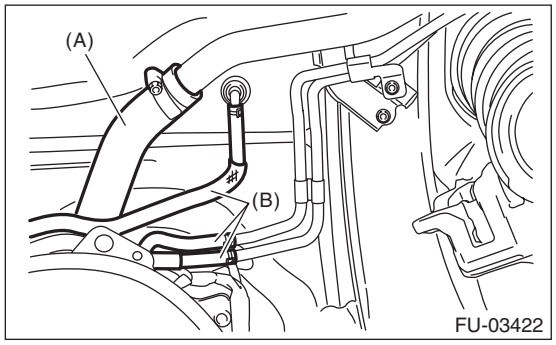
**• 4 door model**

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**• Be careful not to spill fuel.**
**• Fuel may remain in the fuel filler pipe. Draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.**

1) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>
3) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
4) Open the fuel filler lid and remove the fuel filler cap.
5) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
6) Disconnect the fuel filler hose (A) from the fuel filler pipe assembly.

**CAUTION:**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**




(A) Fuel filler hose
(B) Evaporation hose

7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

**CAUTION:**
**Be careful not to spill fuel.**
8) Install the related parts in the reverse order after draining the fuel.

***Tightening torque:***
***2.5 N·m (0.3 kgf-m, 1.8 ft-lb)***

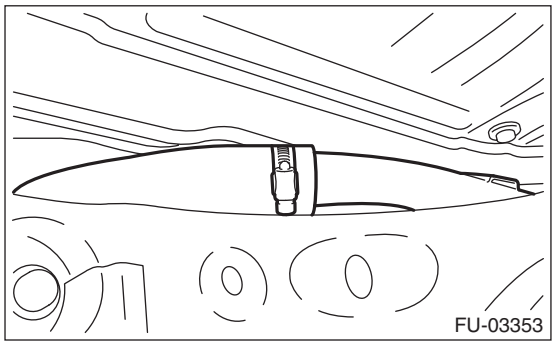
**• 5 door model**

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**• Be careful not to spill fuel.**
**• Fuel may remain in the fuel filler pipe. Draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.**

1) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
5) Disconnect the fuel filler hose from the fuel filler pipe assembly.

**CAUTION:**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**




6) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

**CAUTION:**
**Be careful not to spill fuel.**
7) Install the related parts in the reverse order after draining the fuel.

***Tightening torque:***
***2.5 N·m (0.3 kgf-m, 1.8 ft-lb)***

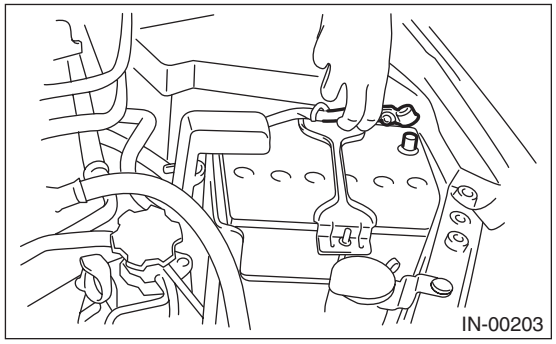
# 22.Fuel Tank

## A: REMOVAL

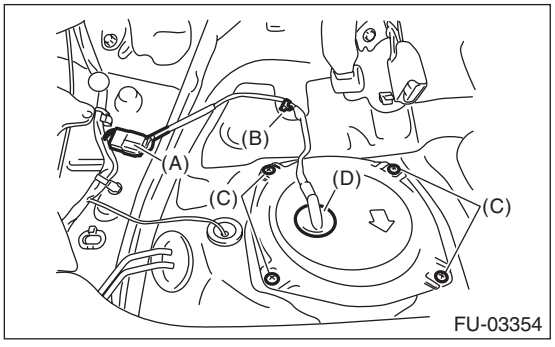
**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**

1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-53, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

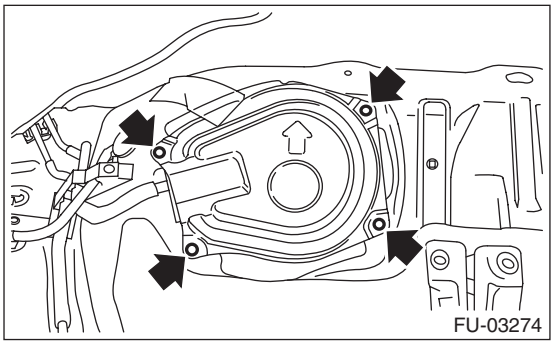

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover of fuel pump.
(1) Disconnect fuel pump connector (A), and remove clip (B).
(2) Remove the screw (C).
(3) Push the grommet (D) down and remove the service hole cover.

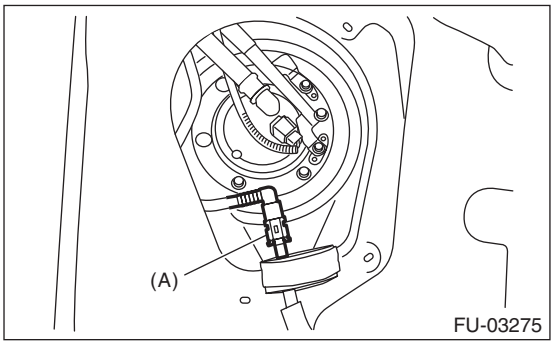


FU-03354

6) Remove the service hole cover of fuel sub level sensor.

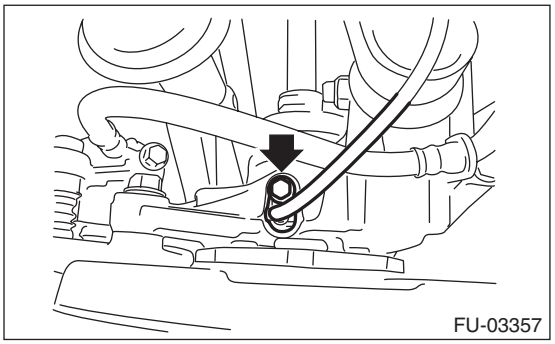

FU-03274

7) Disconnect the quick connector on the fuel delivery tube (A). <Ref. to FU(H4SO)-77, REMOVAL, Fuel Delivery and Evaporation Lines.>

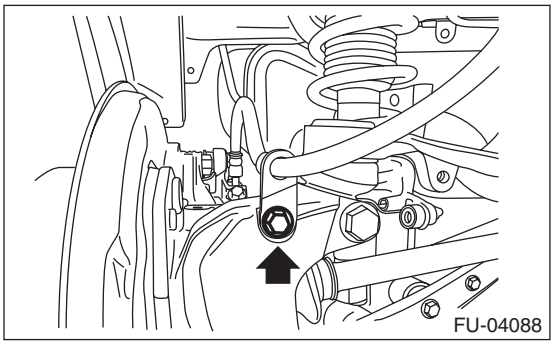


FU-03275

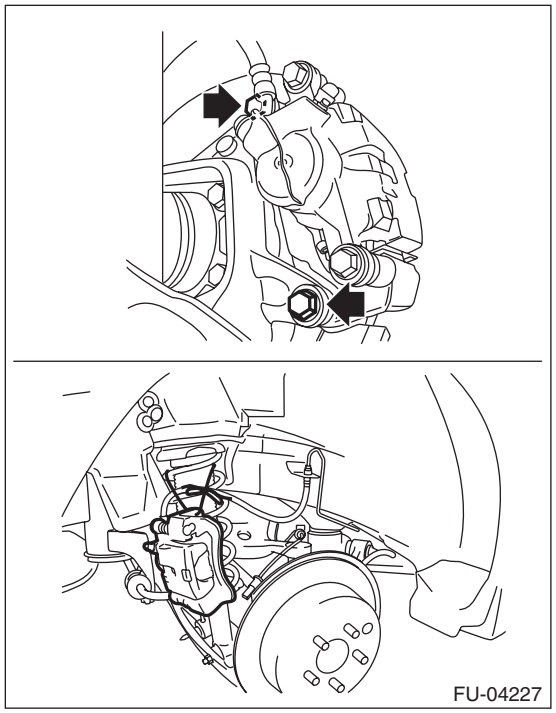
8) Remove the rear wheels.
9) Lift up the vehicle.
10) Remove the rear ABS wheel speed sensor from the rear housing.


FU-03357

11) Remove the rear brake hose bracket from rear housing.


FU-04088

12) Remove the rear disc brake assembly and tie it to the body side of the vehicle.



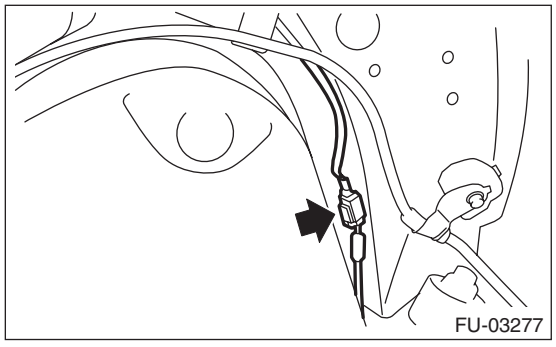

13) Remove the parking brake cable from parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

14) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>

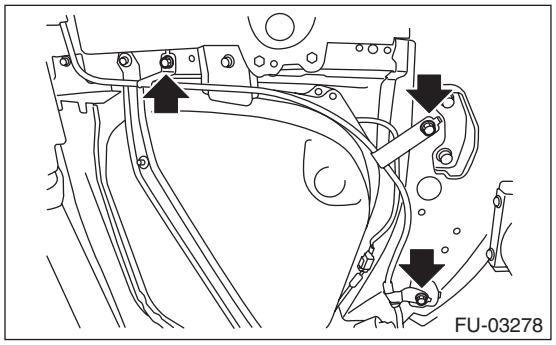
15) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

16) Remove the heat shield cover and fuel tank protector.

17) Disconnect the connector from the rear ABS wheel speed sensor.




18) Remove the parking brake cable clamp from the body.

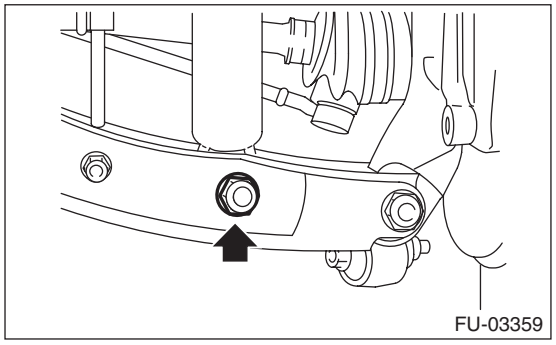



19) Remove the rear suspension assembly.

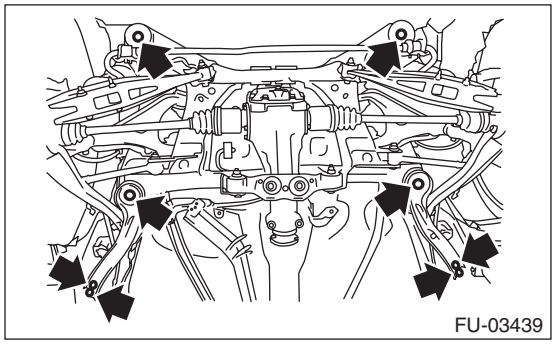
**WARNING:**
**A helper is required to perform this work.**

(1) Support the rear differential with the transmission jack.

(2) Remove the bolt and nut which secures rear shock absorber to rear suspension arm.

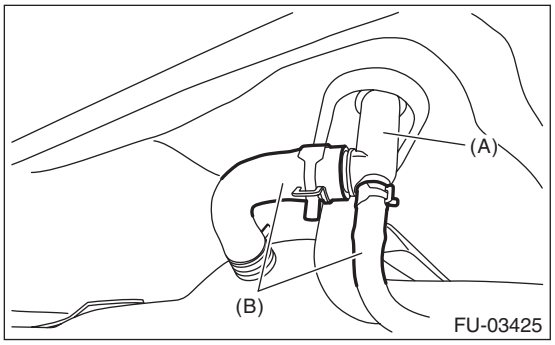



(3) Remove the bolts which secure the rear suspension assembly to the body.



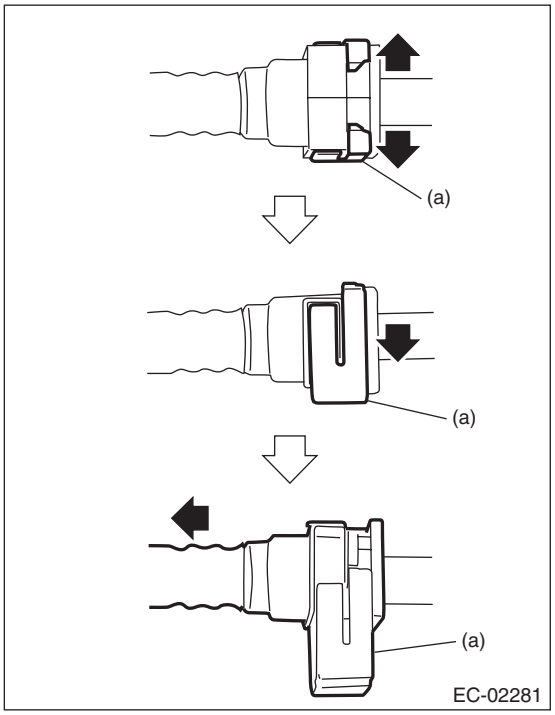

(4) Remove the rear suspension assembly.

20) Disconnect evaporation hose (B) from connector (A).

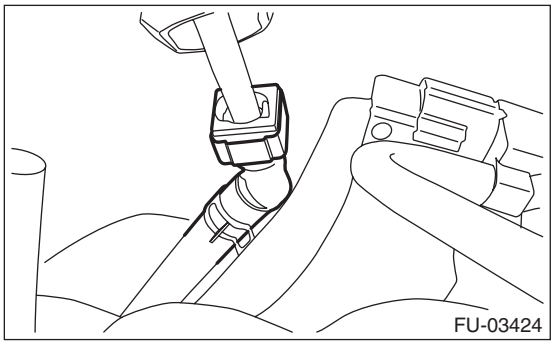



21) Disconnect the quick connector of the evaporation hose from the evaporation pipe.

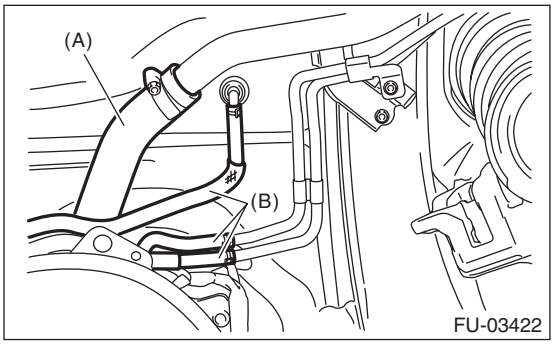
NOTE:
Disconnect the quick connector as shown in the figure.




(a) Retainer

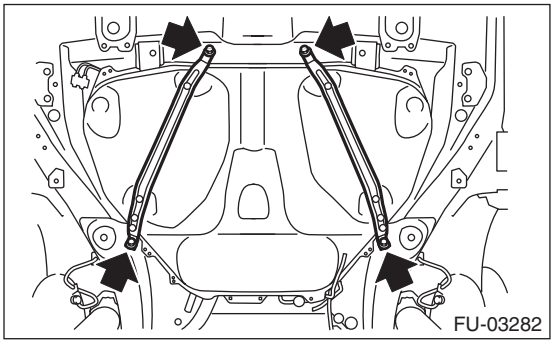



22) Disconnect the fuel filler hose (A) and evaporation hose (B).




23) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

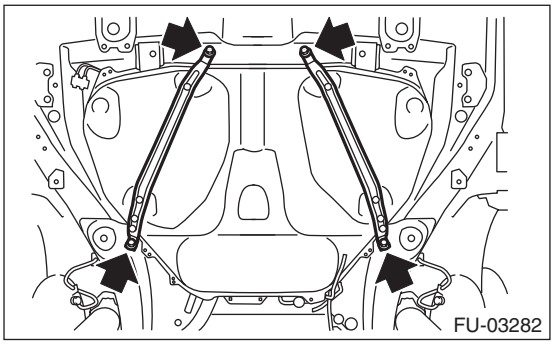
**WARNING:**
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank.**




## B: INSTALLATION

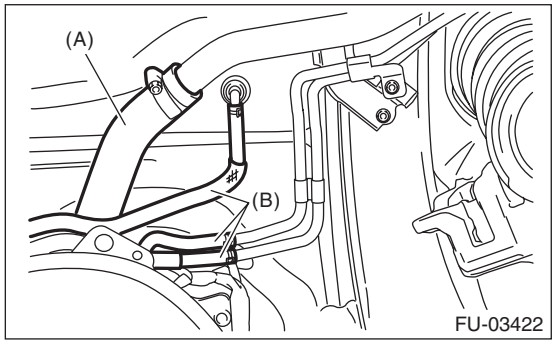
1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

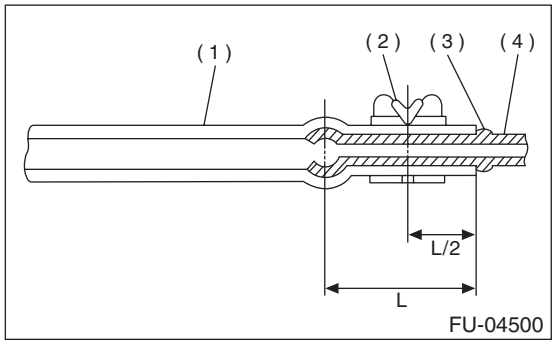
**WARNING:**
**A helper is required to perform this work.**



2) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

***Tightening torque:***
***2.5 N·m (0.3 kgf-m, 1.8 ft-lb)***

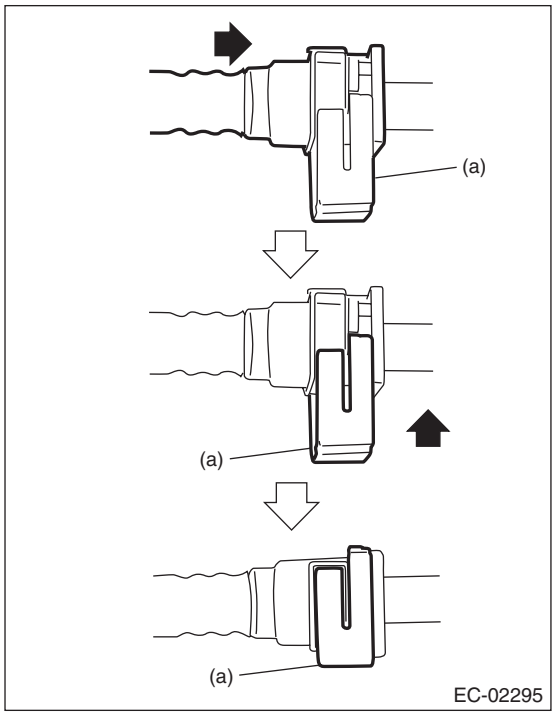


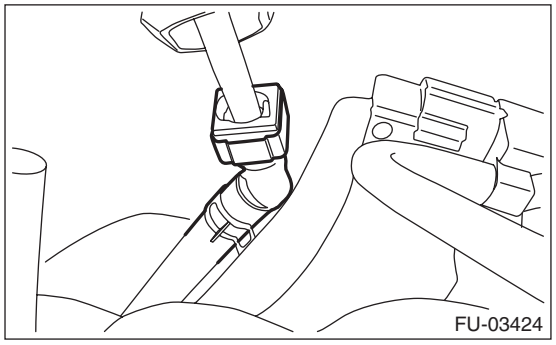

(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

3) Connect the quick connector of the evaporation hose to the evaporation pipe.

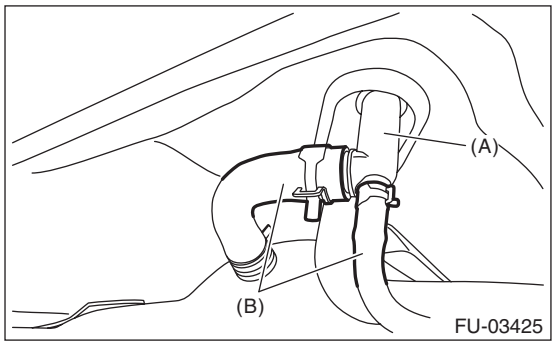
**CAUTION:**
**• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
**• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.**
**• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.**
**• Make sure that the quick connector is securely connected.**




(a) Retainer

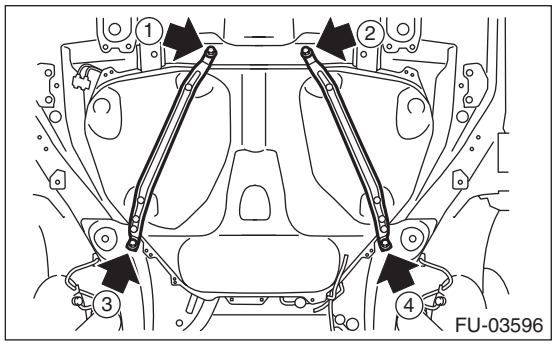



4) Connect evaporation hose (B) to connector (A).



5) Tighten the bolts of the fuel tank band in the order shown in the figure.

***Tightening torque:***
***33 N·m (3.4 kgf-m, 24.3 ft-lb)***

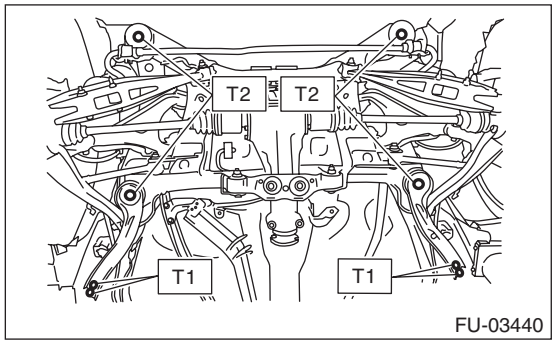



6) Install the rear suspension assembly.

**WARNING:**
**A helper is required to perform this work.**

(1) Support the rear differential with the transmission jack.
(2) Support the rear suspension assembly, and tighten the bolts which secure the rear suspension assembly to the body.

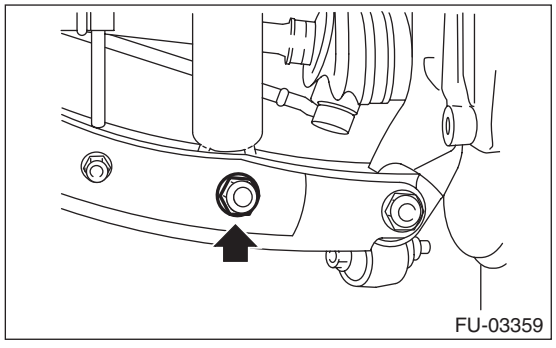
***Tightening torque:***
***T1: 70 N·m (7.1 kgf-m, 51.6 ft-lb)***
***T2: 145 N·m (14.8 kgf-m, 106.9 ft-lb)***




(3) Install the rear shock absorber to the rear suspension arm.

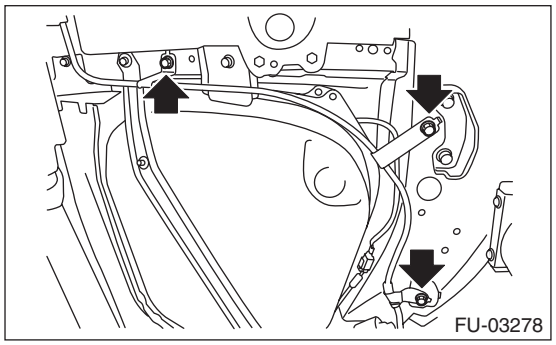
NOTE:
Use a new self-locking nut.

***Tightening torque:***
***120 N·m (12.2 kgf-m, 88.5 ft-lb)***

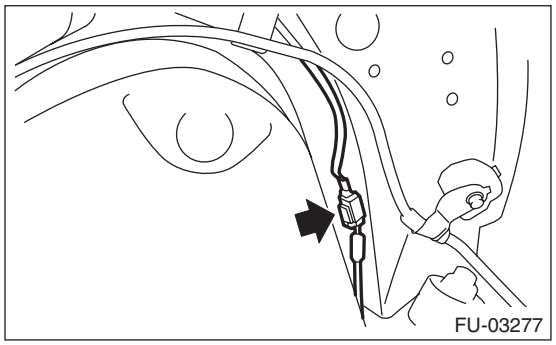



7) Install the parking brake cable clamp to the body.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***




8) Connect the connector to the rear ABS wheel speed sensor.




9) Install the heat shield cover.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***

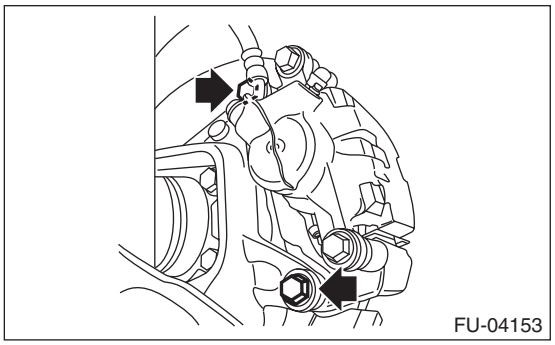
10) Install the fuel tank protector.

***Tightening torque:***
***Nut: 9 N·m (0.9 kgf-m, 6.6 ft-lb)***
***Bolt: 18 N·m (1.8 kgf-m, 13.3 ft-lb)***

11) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
12) Install the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, INSTALLATION, Muffler.>
13) Lower the vehicle.
14) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>

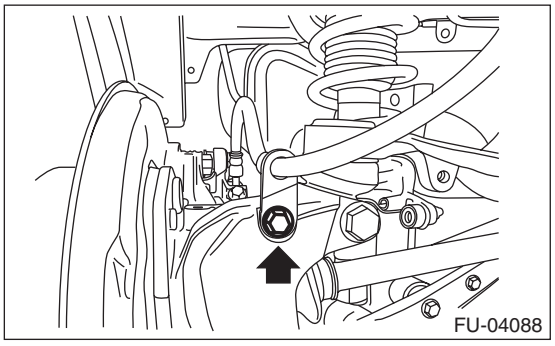
15) Install the rear disc brake assembly.

***Tightening torque:***
***66 N·m (6.7 kgf-m, 48.7 ft-lb)***



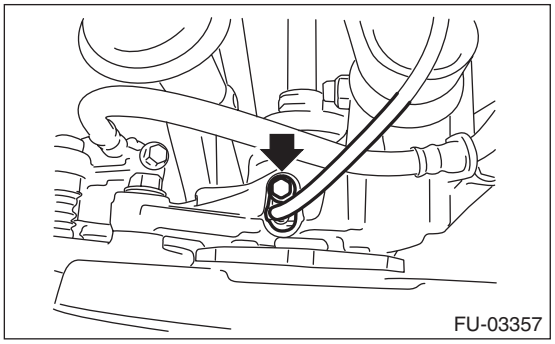

16) Install the rear brake hose bracket to the rear housing.

***Tightening torque:***
***33 N·m (3.4 kgf-m, 24.3 ft-lb)***




17) Attach the rear ABS wheel speed sensor to the rear housing.

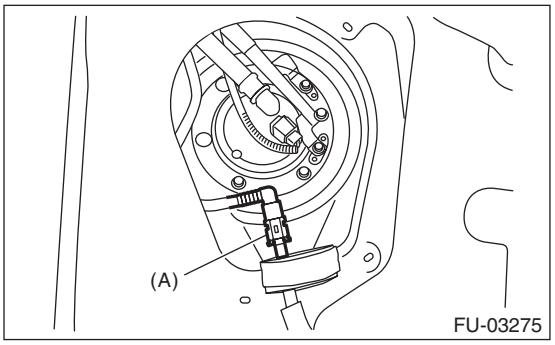
***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***



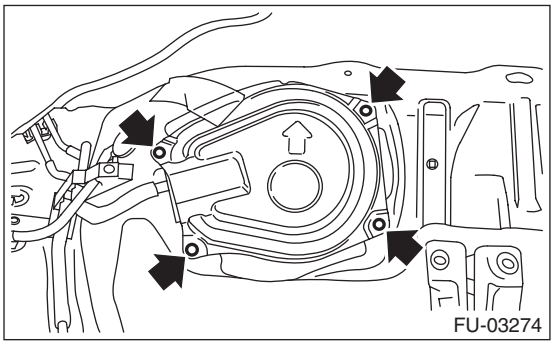

18) Install the rear wheels.

***Tightening torque:***
***100 N·m (10.2 kgf-m, 73.8 ft-lb)***

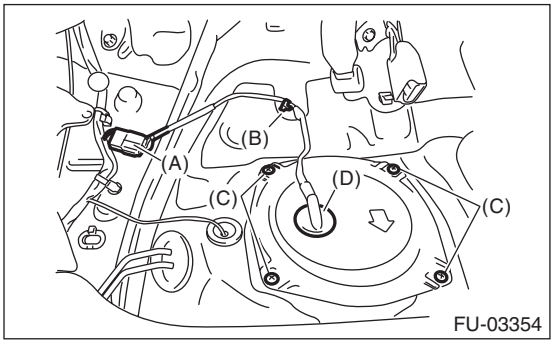
19) Connect the quick connector of the fuel delivery tube (A). <Ref. to FU(H4SO)-79, INSTALLATION, Fuel Delivery and Evaporation Lines.>




20) Install the service hole cover of fuel sub level sensor.

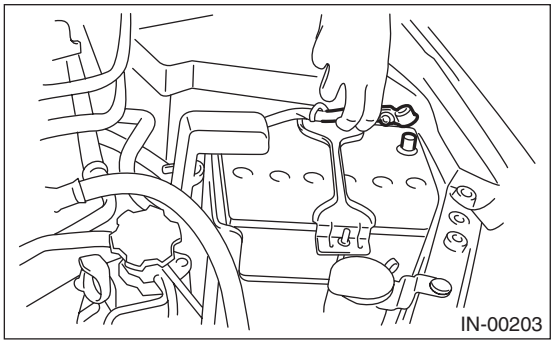



21) Attach the service hole cover of the fuel pump, and attach the connector and clip.




(A) Connector
(B) Clip
(C) Screw
(D) Grommet

22) Install the rear seat cushion. <Ref. to SE-14, INSTALLATION, Rear Seat.>
23) Connect the battery ground terminal.




24) Inspect the wheel alignment and adjust if necessary.

## C: INSPECTION

1) Check that the fuel tank and fuel pipe have no deformation, cracks and other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

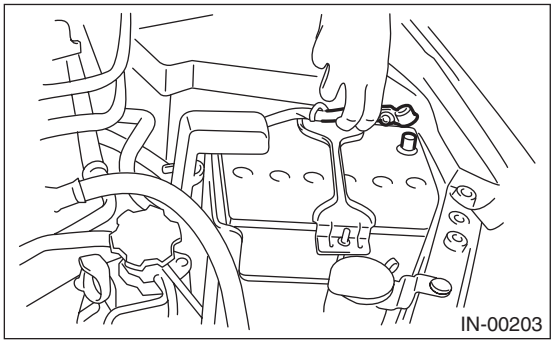
# 23.Fuel Filler Pipe

## A: REMOVAL

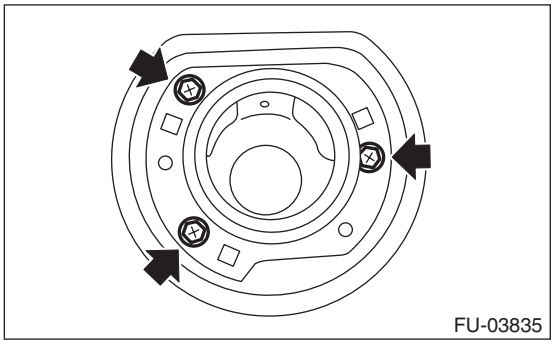
**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**

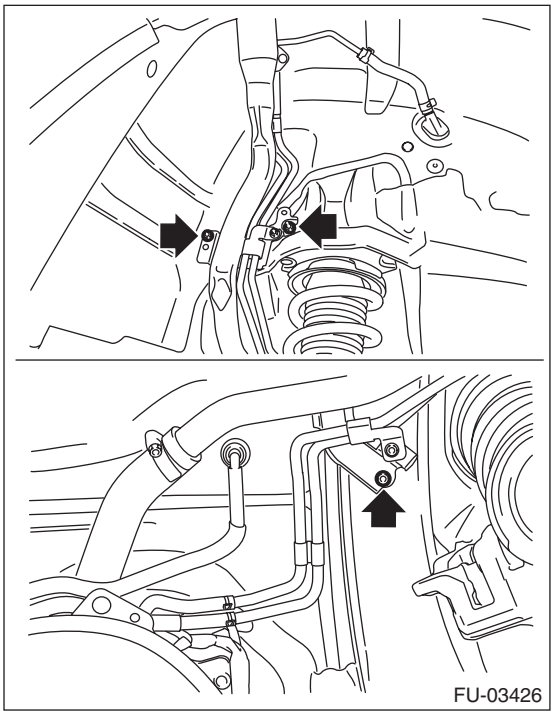
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-53, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



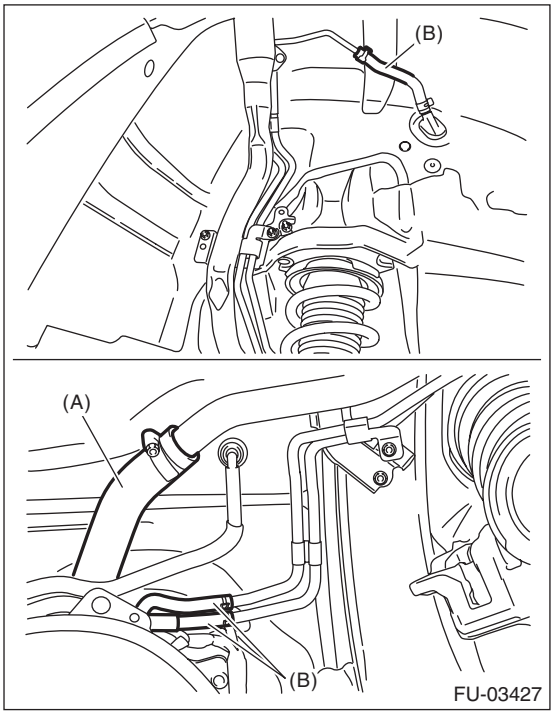

4) Open the fuel filler lid, and remove the filler cap.
5) Remove the screws which secure gasket.




6) Remove the rear wheel RH.
7) Lift up the vehicle.
8) Remove the rear mud guard RH. <Ref. to EI-26, REAR MUD GUARD, REMOVAL, Mud Guard.>
9) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
10) Remove the bolts and nuts which hold fuel filler pipe bracket on the body.




11) Disconnect the fuel filler hose (A) and evaporation hose (B).

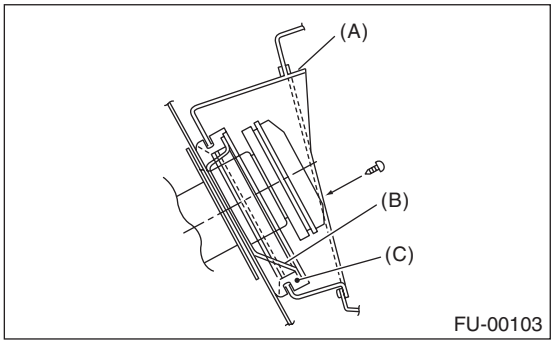



12) Remove the fuel filler pipe to the underside of the vehicle.

## B: INSTALLATION

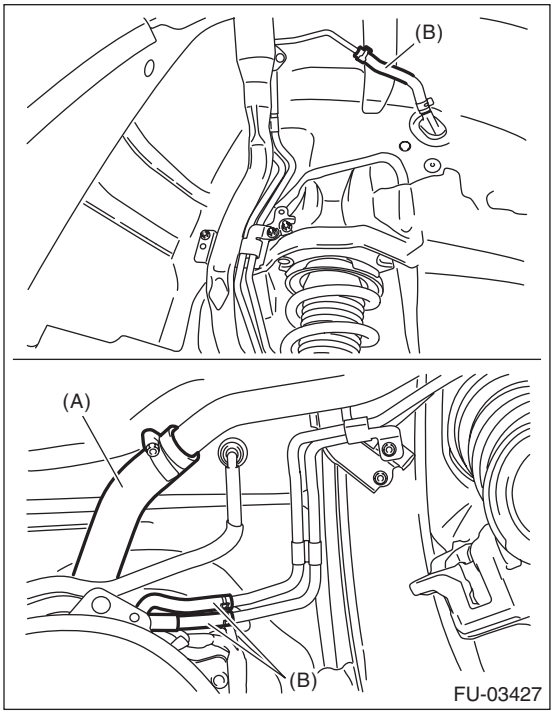
1) Open the fuel filler lid.
2) Set the fuel saucer (A) with rubber gasket (C), and insert the fuel filler pipe into hole from the inner side of apron.
3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

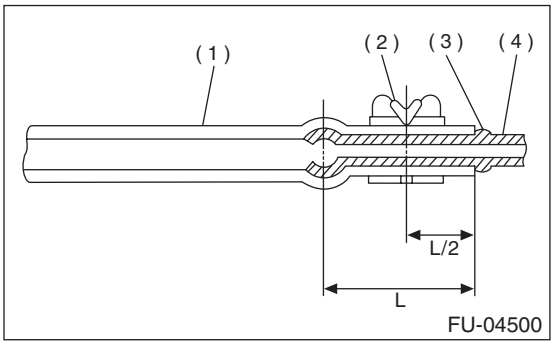
NOTE:
If the edges of rubber gasket are folded toward inside, straighten it with a flat tip screwdriver.




4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

***Tightening torque:***
***2.5 N·m (0.3 kgf-m, 1.8 ft-lb)***

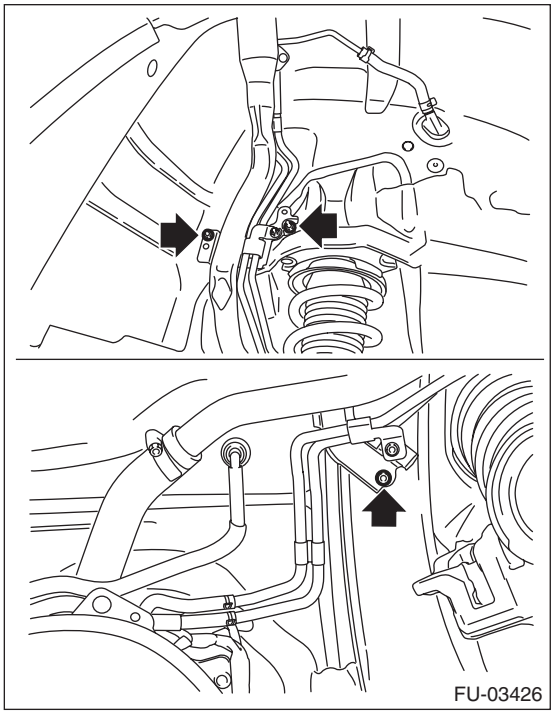



(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

5) Tighten the bolts and nuts which hold fuel filler pipe bracket on the body.

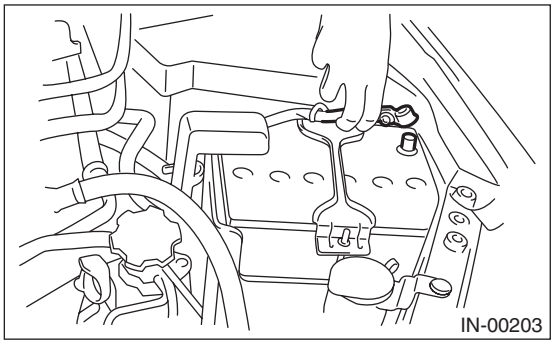
***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***




6) Install the rear sub frame. <Ref. to RS-18, INSTALLATION, Rear Sub Frame.>
7) Install the rear mud guard RH. <Ref. to EI-26, INSTALLATION, Mud Guard.>
8) Lower the vehicle.
9) Install the rear wheel RH.

***Tightening torque:***
***100 N·m (10.2 kgf-m, 73.8 ft-lb)***

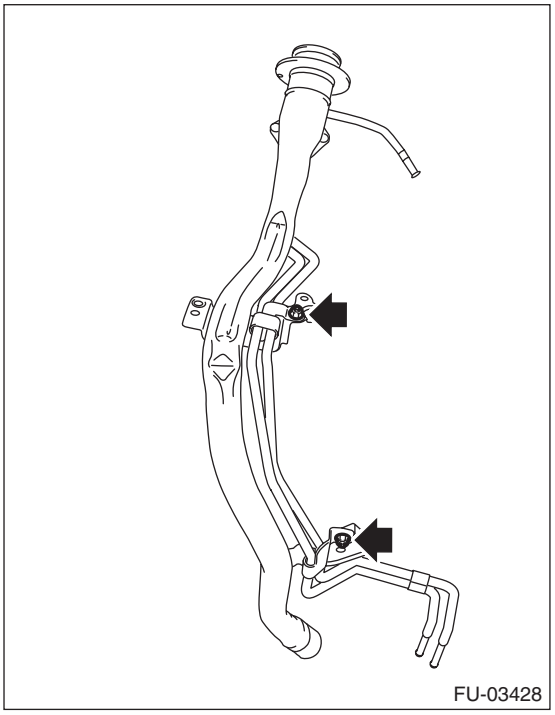
10) Connect the battery ground terminal.




11) Inspect the wheel alignment and adjust if necessary.

## C: DISASSEMBLY

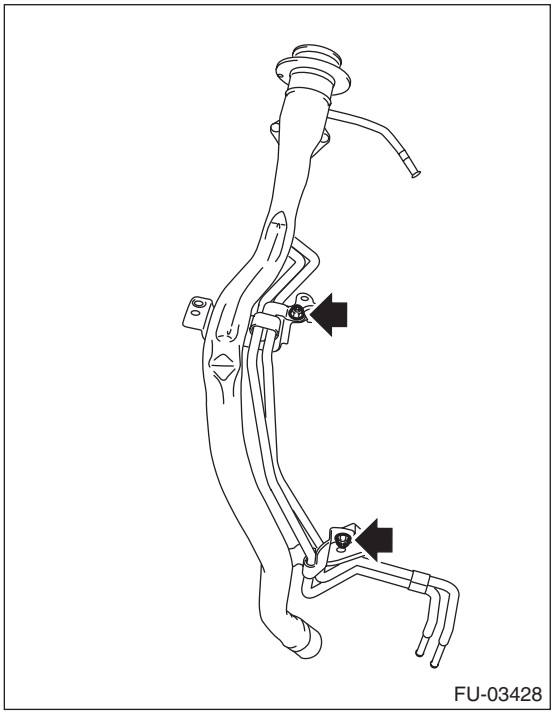
1) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-19, REMOVAL, Shut Valve.>
2) Remove the evaporation pipe from the fuel filler pipe.



## D: ASSEMBLY

1) Install the evaporation pipe to the fuel filler pipe.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***




2) Install the shut valve to the fuel filler pipe. <Ref. to EC(H4SO)-19, INSTALLATION, Shut Valve.>

## E: INSPECTION

1) Check that the fuel filler pipe assembly has no deformation, cracks or other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

# 24.Fuel Pump

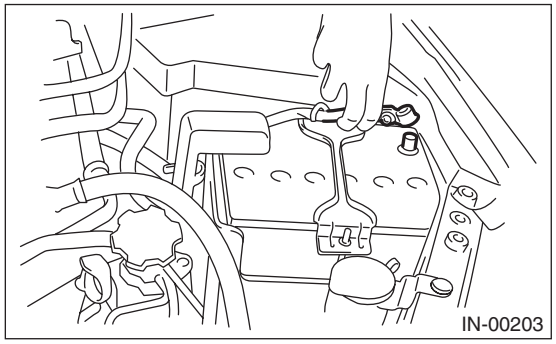
## A: REMOVAL

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

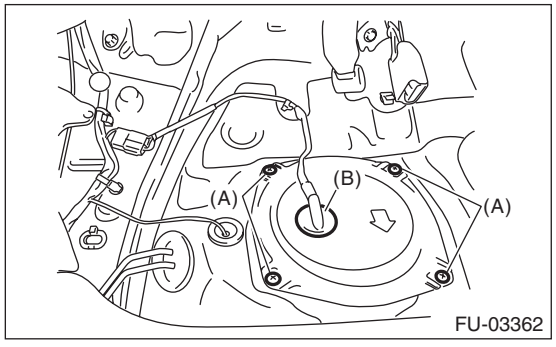
**CAUTION:**
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-53, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

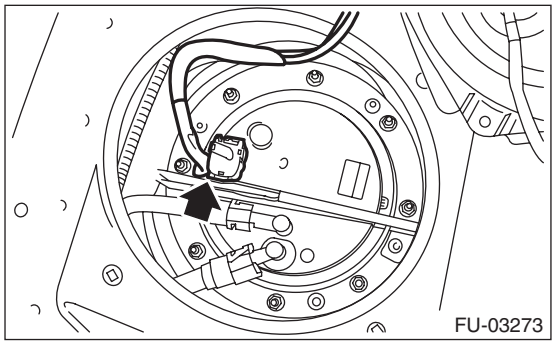

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover.
   (1) Remove the screws (A).
   (2) Push the grommet (B) down and remove service hole cover.

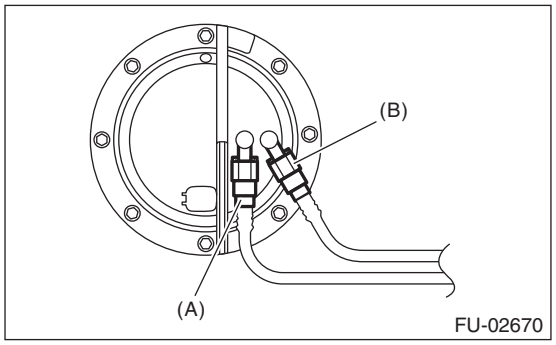


FU-03362

6) Disconnect the connector from fuel pump.

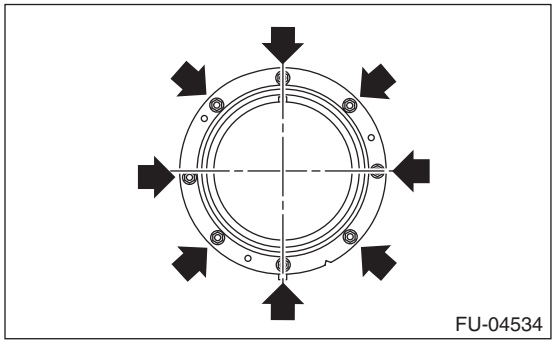

FU-03273

7) Disconnect the quick connector of fuel delivery tube (A) and jet pump tube (B). <Ref. to FU(H4SO)-77, REMOVAL, Fuel Delivery and Evaporation Lines.>



FU-02670

8) Remove the nuts which hold the fuel pump upper plate to the fuel tank.


FU-04534

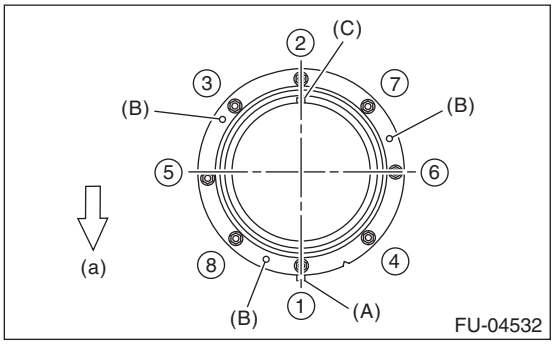
9) Remove the fuel pump assembly from the fuel tank.

## B: INSTALLATION

Install in the reverse order of removal while being careful of the following.
• Make sure the sealing portion is free from fuel or foreign matter before installation.
• Install with the protrusion (A) of gasket aimed at the front side of the vehicle.
• Insert the protrusion (B) of gasket into the upper plate. (3 places)
• Align the protrusion (C) of fuel pump assembly with the cutout on the upper plate.
• Tighten the nuts to the specified torque in the order as shown in the figure.

NOTE:
Use a new gasket.

***Tightening torque:***
***4.4 N·m (0.4 kgf-m, 3.2 ft-lb)***

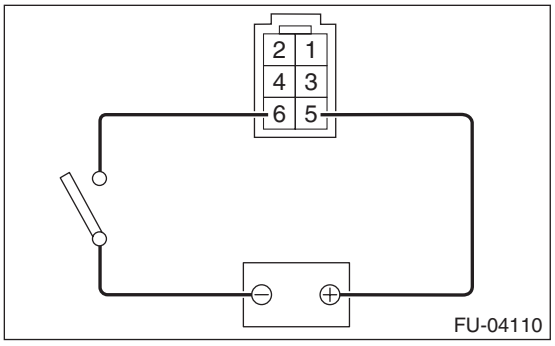



(a) Front side of vehicle

## C: INSPECTION

1) Check that the fuel pump has no deformation, cracks or other damages.
2) Connect terminal No. 5 to battery positive terminal and No. 6 terminal to the battery ground terminal, and inspect the fuel pump operation.

**WARNING:**
**• Wipe off fuel completely.**
**• Keep the battery as far apart from fuel pump as possible.**
**• Do not run the fuel pump for a long time under non-load condition.**



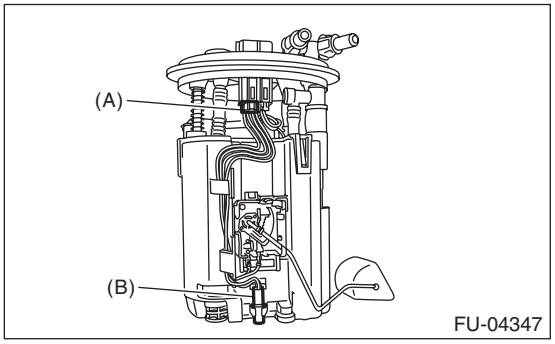
# 25.Fuel Level Sensor

## A: REMOVAL

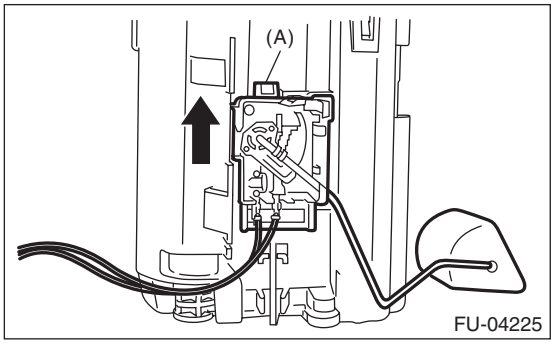
**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
The fuel level sensor is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Pump.>
2) Disconnect the fuel level sensor connector (A) from the sub tank bracket assembly.
3) Remove the fuel temperature sensor (B) from sub tank.




4) Slide the fuel level sensor in the direction of the arrow and remove the fuel level sensor by pressing the claw (A) of the fuel level sensor.



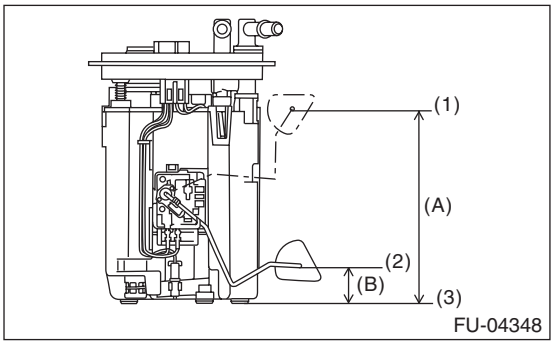

## B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

1) Check that the fuel level sensor has no damage.
2) Measure the fuel level sensor float position.

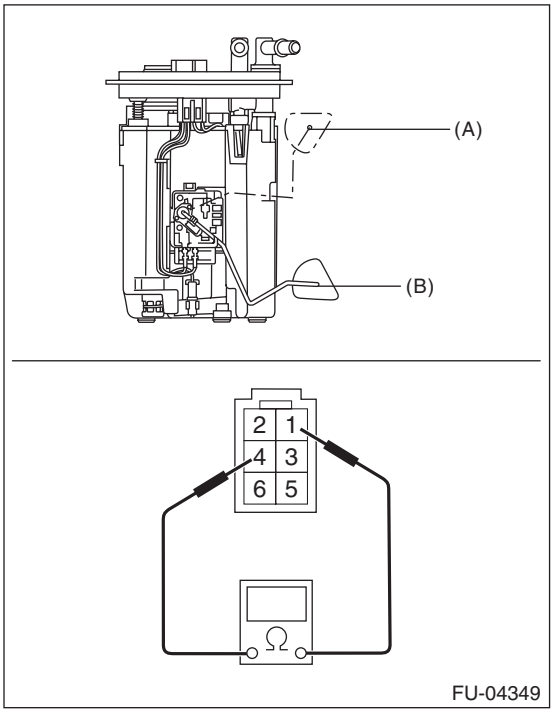
NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.




(1) FULL
(2) EMPTY
(3) Fuel tank seating surface

| Float position | Standard |
|---|---|
| FULL to Fuel tank seating surface (A) | 135 ±4 mm (5.315±0.157 in) |
| EMPTY to Fuel tank seating surface (B) | 23.7 ±4 mm (0.933±0.157 in) |

3) Measure the resistance between fuel level sensor terminals.




| Float position | Terminal No. | Standard |
|---|---|---|
| FULL (A) | 1 and 4 | 2.0±1.0 Ω |
| EMPTY (B) | | 31.9±1.0 Ω |

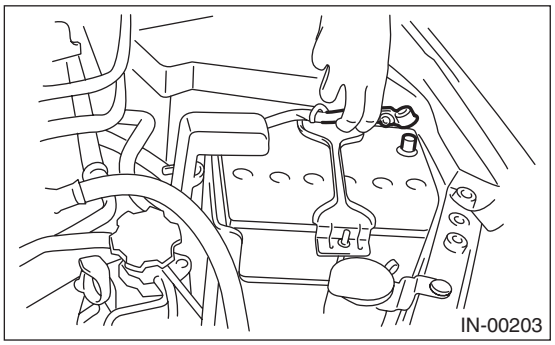
# 26.Fuel Sub Level Sensor

## A: REMOVAL

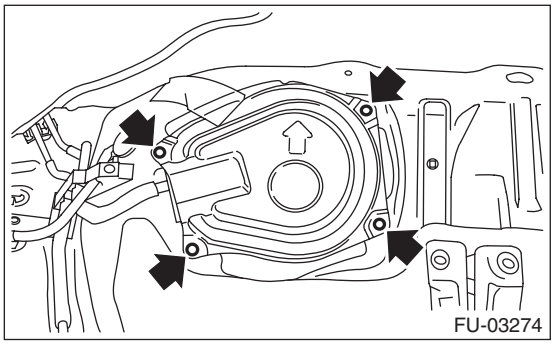
**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

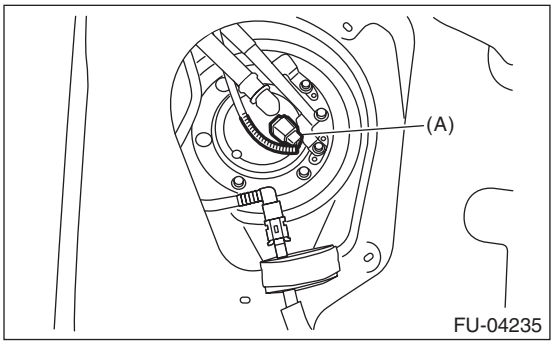
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-53, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.


IN-00203

4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover.

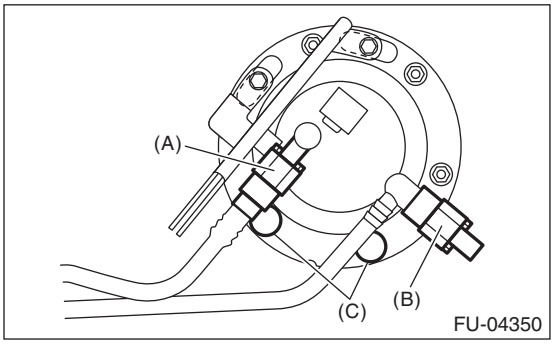

FU-03274

6) Disconnect connector (A) from fuel sub level sensor.



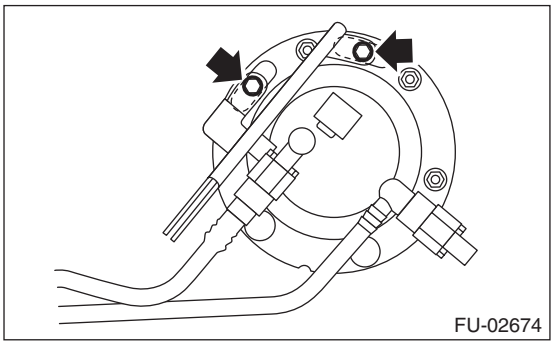
FU-04235

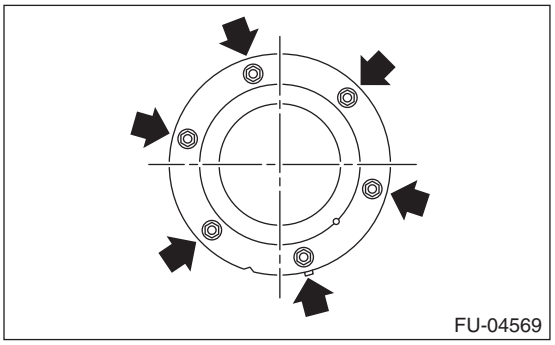
7) Disconnect the quick connector of fuel delivery tube (A) and jet pump tube (B). <Ref. to FU(H4SO)-77, REMOVAL, Fuel Delivery and Evaporation Lines.>
8) Remove the rubber cap (C) from the nut.



FU-04350

9) Remove the bolts and nuts which hold fuel sub level sensor protector and fuel sub level sensor upper plate to the fuel tank.


FU-02674


FU-04569

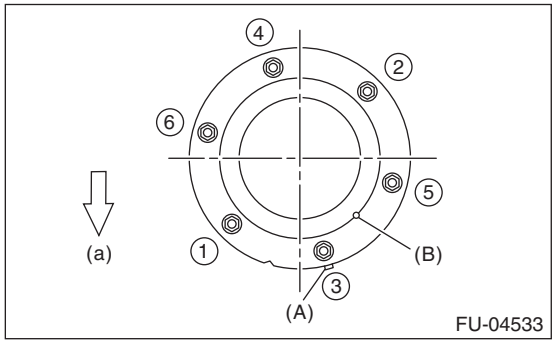
10) Remove the fuel sub level sensor.

## B: INSTALLATION

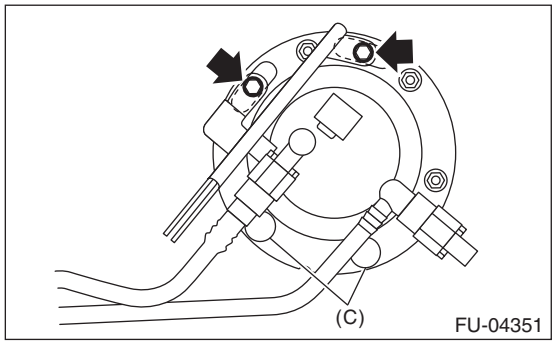
Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the following figure.
- Align protrusion (B) of the fuel sub level sensor to the cutout in the fuel sub level sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.
- After tightening, install the rubber cap (C) at the position shown in the figure.

NOTE:
- Use a new gasket.
- Do not forget to install rubber cap (C).

***Tightening torque:***
***4.4 N·m (0.4 kgf-m, 3.2 ft-lb)***

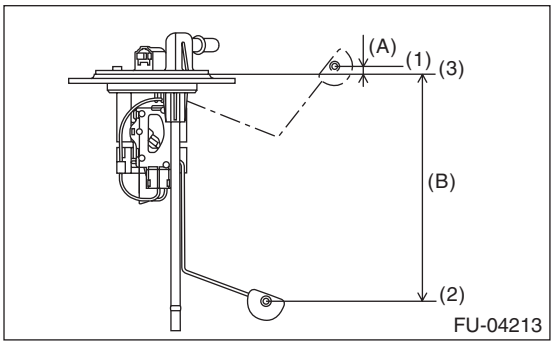



(a) Front side of vehicle




## C: INSPECTION

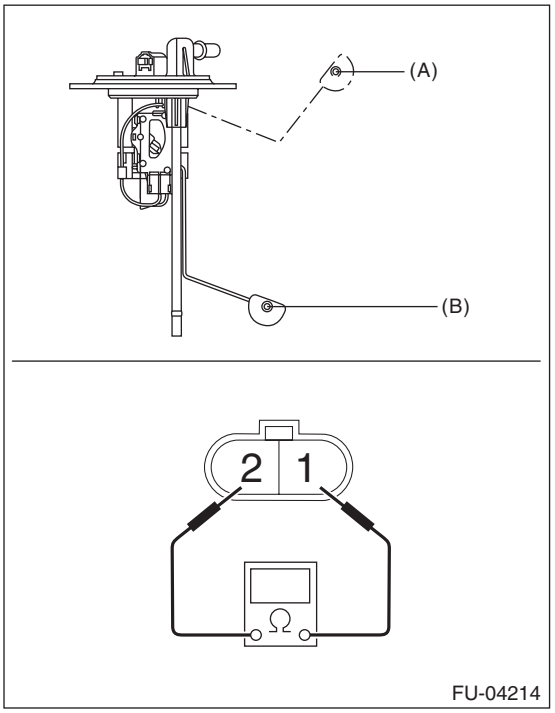
1) Check that the fuel sub level sensor has no damage.
2) Measure the fuel sub level sensor float position.




(1) FULL
(2) EMPTY
(3) Datum points

| Float position | Standard |
|---|---|
| FULL to Datum point (A) | 5.31 ±3.5 mm (0.209±0.138 in) |
| EMPTY to Datum point (B) | 160.6 ±3.5 mm (6.323±0.138 in) |

3) Measure the resistance between fuel sub level sensor terminals.




| Float position | Terminal No. | Standard |
|---|---|---|
| FULL (A) | 1 and 2 | 2.0±1.0 Ω |
| EMPTY (B) | | 62.1±1.0 Ω |

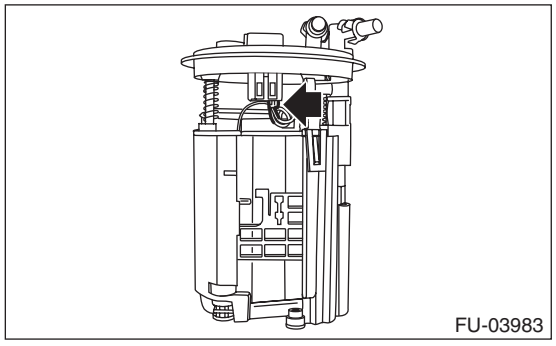
# 27.Fuel Filter

## A: REMOVAL

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**
- **Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.**

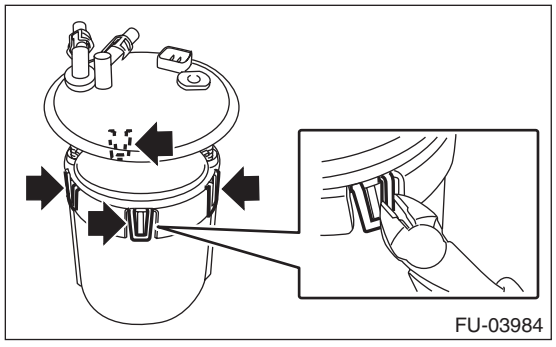
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor and fuel temperature sensor. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Level Sensor.>
3) Disconnect the pump assembly connector from sub tank bracket assembly.


FU-03983

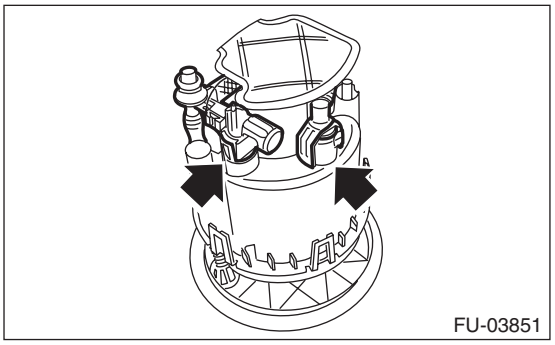
4) Cut off the tab holders connecting the sub tank bracket assembly and the sub tank in four locations, and separate the two.

**CAUTION:**
**Be careful not to damage the sub tank.**

NOTE:
If the O-ring is remaining on the sub tank, remove.

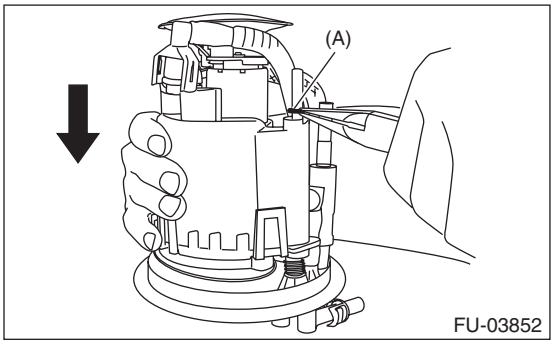

FU-03984

5) Disconnect two connectors of fuel delivery pipe from fuel filter assembly.


FU-03851

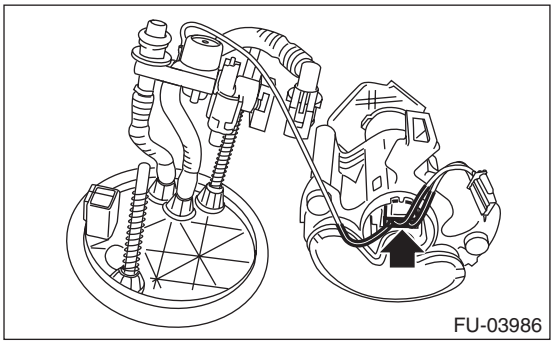
6) Push to compress the fuel filter assembly in the direction of the arrow, remove clip (A), and separate the sub tank bracket assembly and the fuel filter assembly.

**CAUTION:**
**When separating the sub tank bracket assembly and the fuel filter assembly, be careful not to damage the ground wire.**



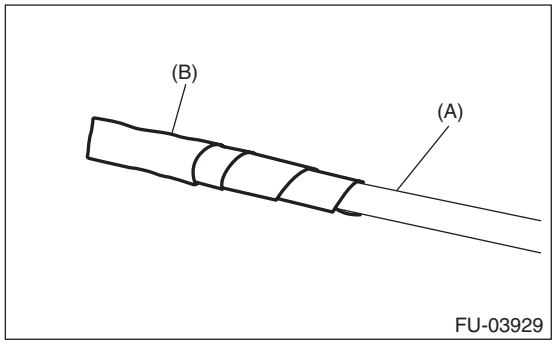
FU-03852

7) Disconnect the connector from the pump assembly.


FU-03986

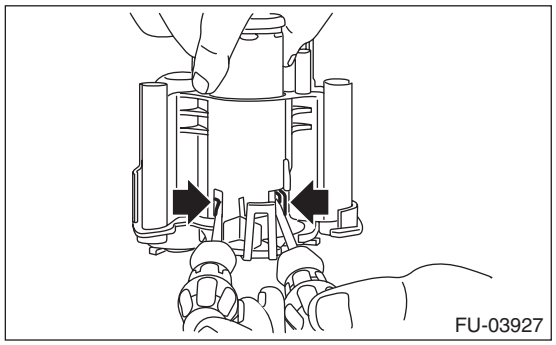
8) Lift the two tab holders connecting the pump assembly to the fuel filter using a flat tip screwdriver (with a shaft diameter of approx. 3 mm (0.12 in)), etc., and separate the fuel filter and pump assembly.

**CAUTION:**
**• To prevent damaging the tabs of the pump assembly, wrap the tip of flat tip screwdriver (A), etc. with tape (B).**




**• Be careful not to drop or apply any impact to the pump assembly.**

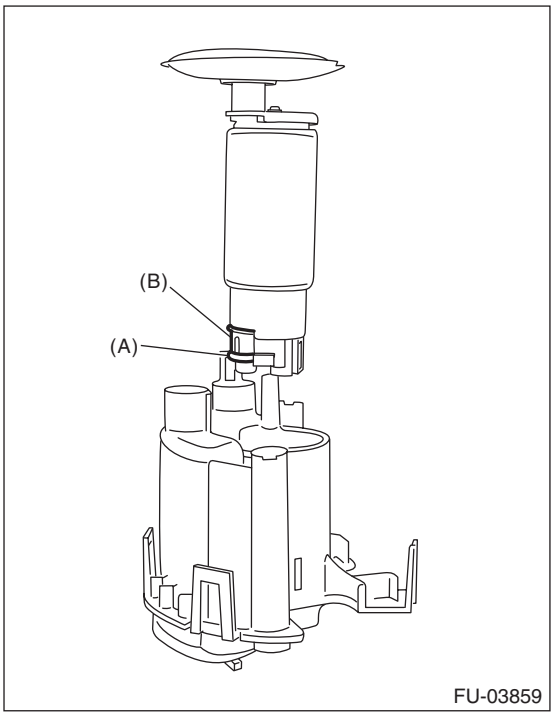
NOTE:
If the spacer and O-ring is remaining on the pump assembly, remove these.



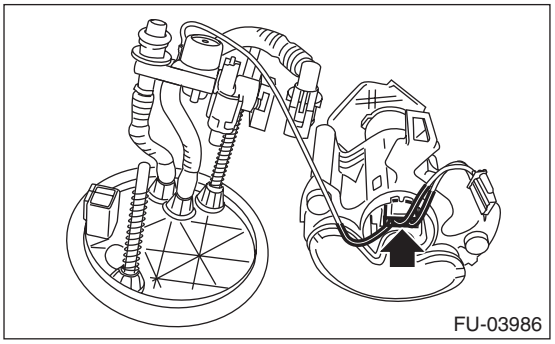

## B: INSTALLATION

1) Assemble O-ring (A) and spacer (B) to the pump assembly and attach the pump assembly to the fuel filter.

NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Use a new spacer.
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.

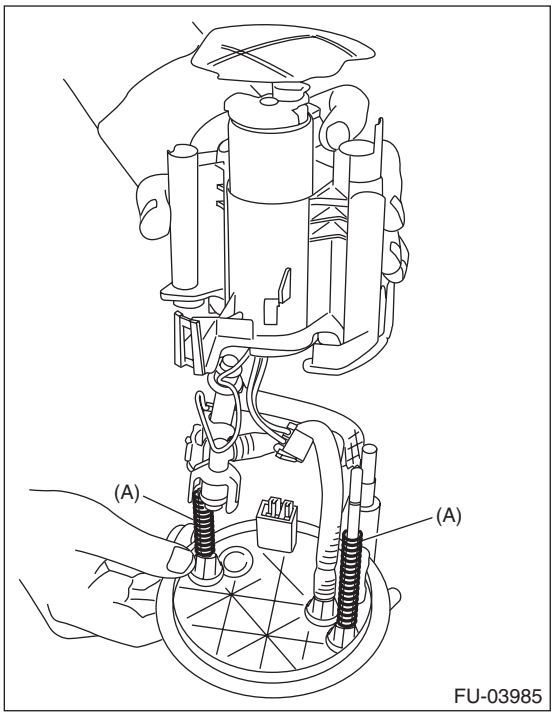



2) Connect the connector to the pump assembly.



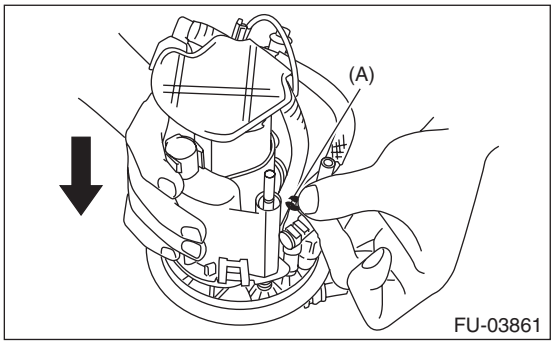
3) Attach spring (A) to the metal rod of the sub tank bracket assembly, and assemble the fuel filter assembly.

NOTE:
Use a new spring.




4) Push the fuel filter assembly in the direction of the arrow to compress, and attach clip (A).

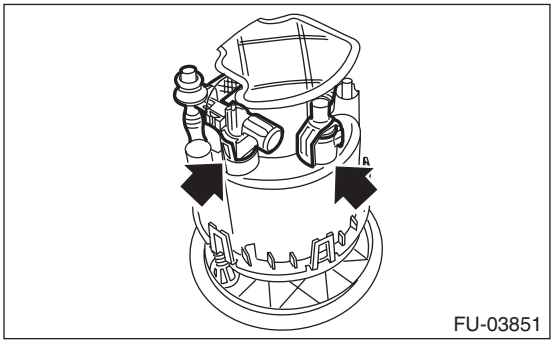
NOTE:
Use a new clip.




5) Connect the fuel piping connector to the fuel filter assembly.

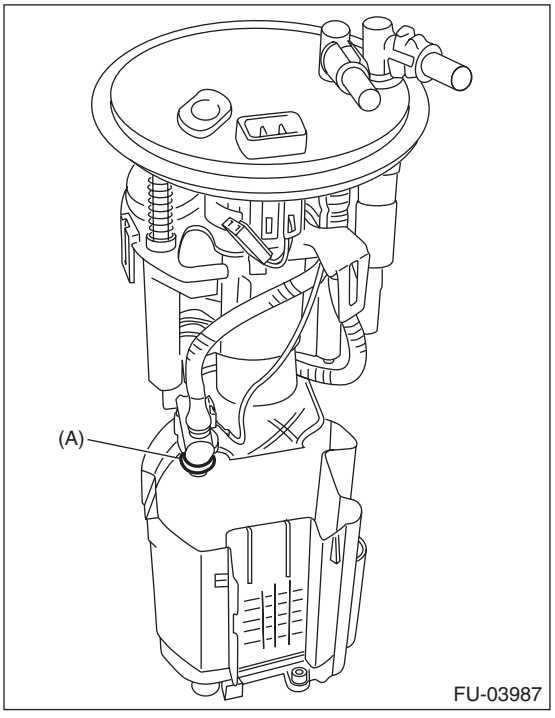
NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring.
- The O-rings of the black and white connectors are identified by a difference in diameter. Be careful not to confuse the two during assembly.

***O-ring inner diameter:***
***Black connector O-ring [Approx. 7 mm (0.28 in)]***
***White connector O-ring [Approx. 8 mm (0.31 in)]***

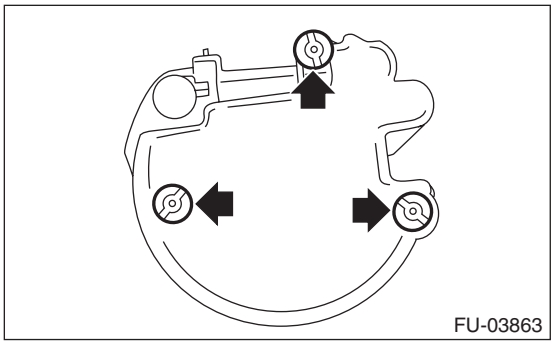



6) Attach the O-ring (A) to the fuel filter assembly, and attach the sub tank to the sub tank bracket assembly.

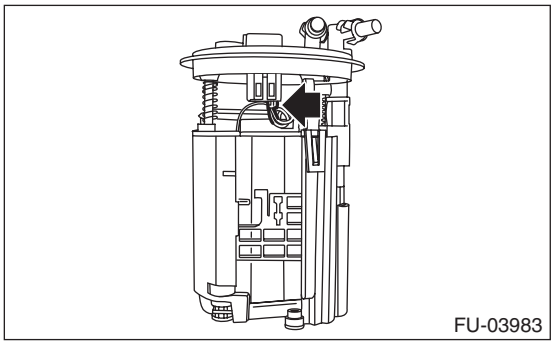
NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.



7) Replace the cushion on the rear face of the sub tank with a new cushion.




8) Connect the pump assembly connector to the sub tank bracket assembly.




9) Install the fuel level sensor and fuel temperature sensor. <Ref. to FU(H4SO)-68, INSTALLATION, Fuel Level Sensor.>
10) Inspect the fuel level sensor. <Ref. to FU(H4SO)-68, INSPECTION, Fuel Level Sensor.>
11) Install the fuel pump assembly. <Ref. to FU(H4SO)-67, INSTALLATION, Fuel Pump.>

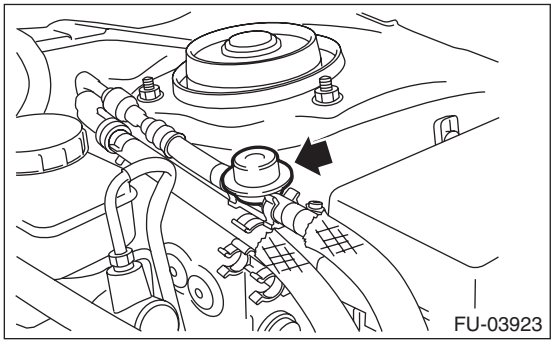
# 28.Fuel Damper

## A: REMOVAL

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the fuel delivery hose from the fuel damper, and remove the fuel damper.




## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***1.25 N·m (0.1 kgf-m, 0.9 ft-lb)***

## C: INSPECTION

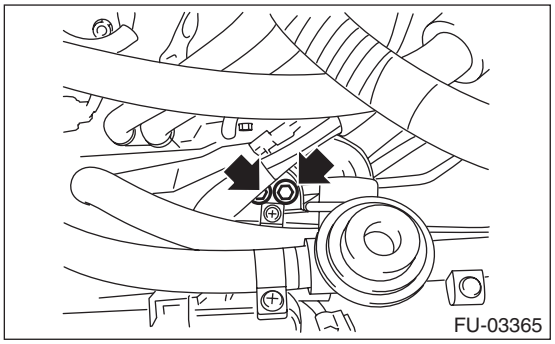
1) Check that the fuel damper has no deformation, cracks or other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

# 29.Purge Damper

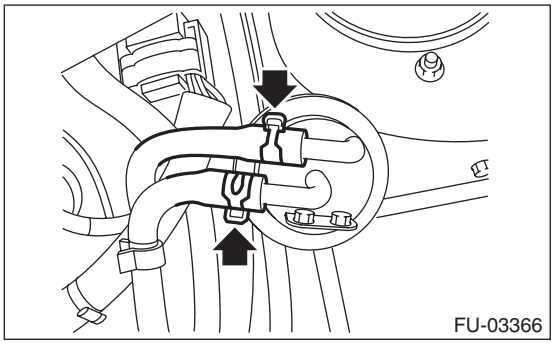
## A: REMOVAL

**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

1) Remove the bolts which secure the purge damper to the purge damper bracket.



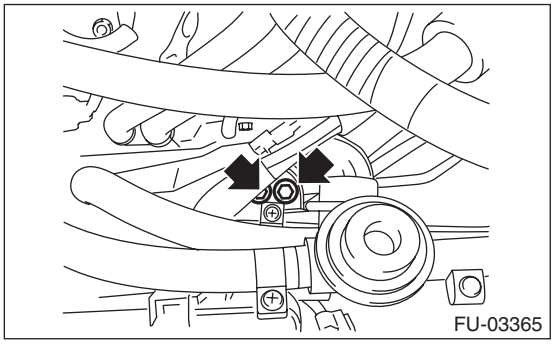

2) Disconnect the evaporation hose from the purge damper and remove the purge damper.




## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***13 N·m (1.3 kgf-m, 9.6 ft-lb)***

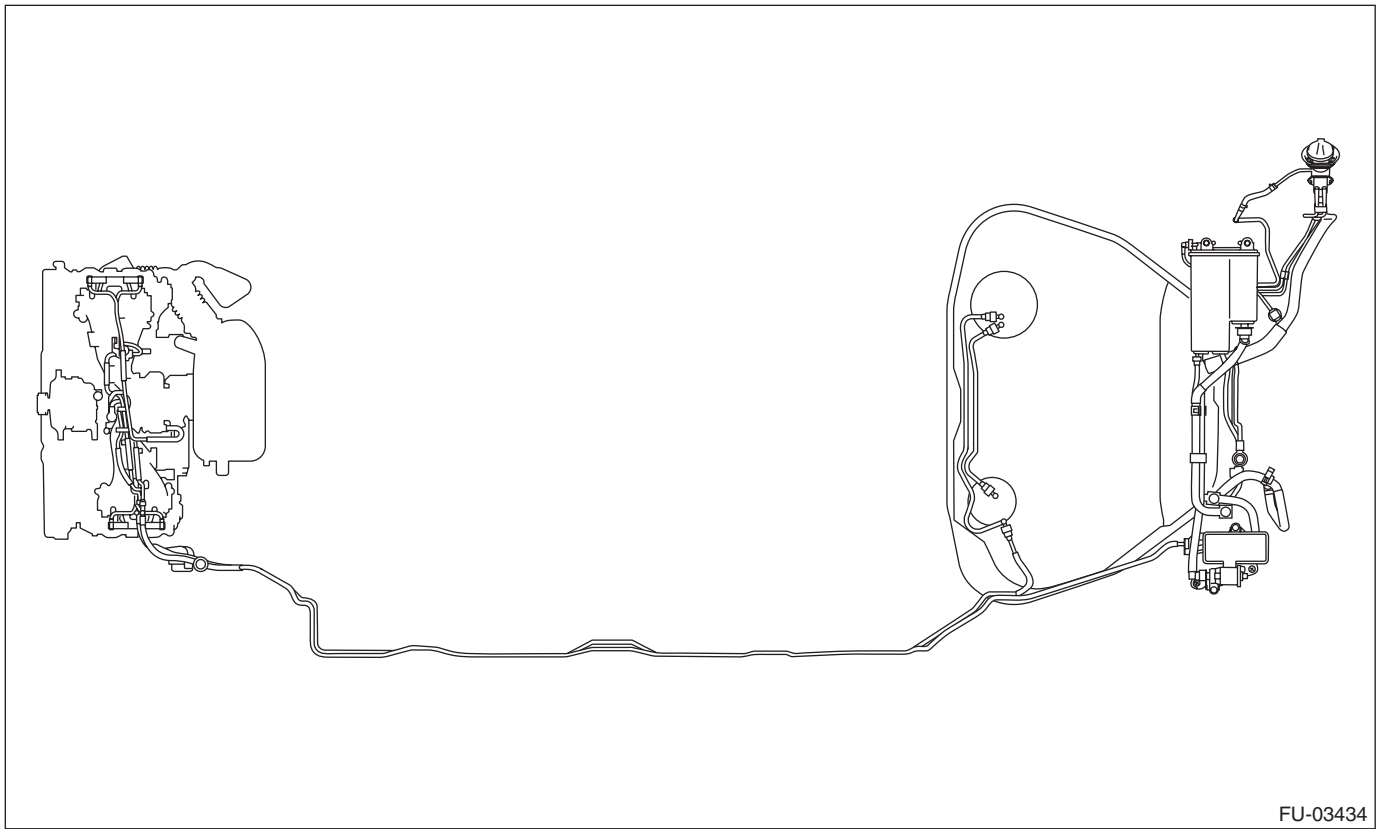



## C: INSPECTION

1) Check that the purge damper has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

# 30.Fuel Delivery and Evaporation Lines

## A: REMOVAL




**WARNING:**
**Place "NO OPEN FLAMES" signs near the working area.**

**CAUTION:**
**Be careful not to spill fuel.**

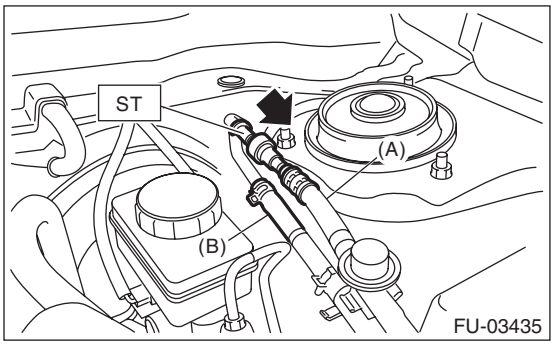
1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Remove the floor mat. <Ref. to EI-67, REMOVAL, Floor Mat.>
4) In the engine compartment, disconnect the fuel delivery hoses and evaporation hose.

**CAUTION:**
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.
(2) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

ST 42099AE000 QUICK CONNECTOR RELEASE

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.




(A) Fuel delivery hose
(B) Evaporation hose

5) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
6) Remove the fuel tank. <Ref. to FU(H4SO)-55, REMOVAL, Fuel Tank.>
7) Remove the fuel pipe assembly from vehicle.

8) Disconnect the quick connector, and remove the fuel delivery tube and jet pump tube from the fuel tank.

• When using ST

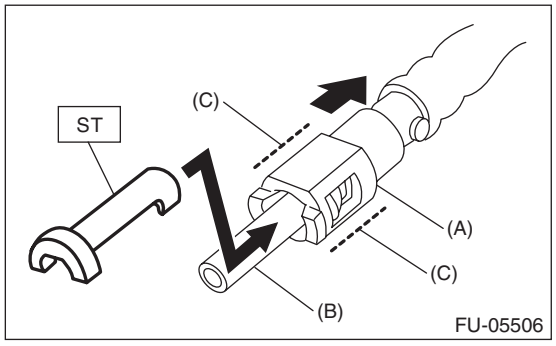
1. Attach ST to the pipe and push ST in the direction of arrow mark to disconnect the quick connector.

ST 42099AE000 QUICK CONNECTOR RELEASE

**CAUTION:**

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (C) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with ST pushed, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

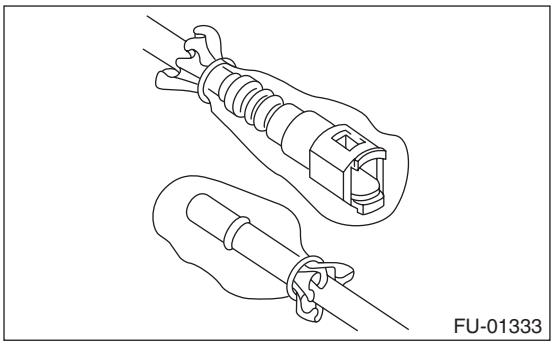
NOTE:
Clean the pipe and quick connector, if they are covered with dust.




(A) Quick connector
(B) Pipe
(C) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

**CAUTION:**
**When reusing the retainer, do not disconnect the retainer from the connector.**



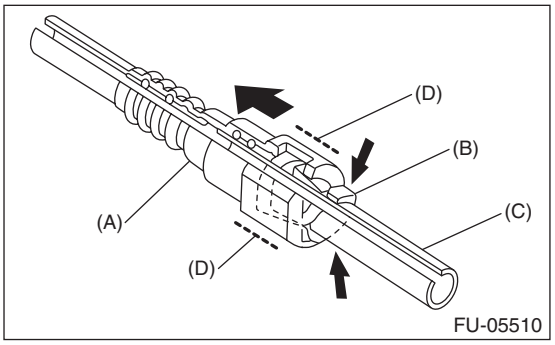

• When not using ST

1. Push the retainer in the direction of the arrow, disconnect the quick connector from pipe.

**CAUTION:**

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (D) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with the retainer pushed in the direction of the arrow, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

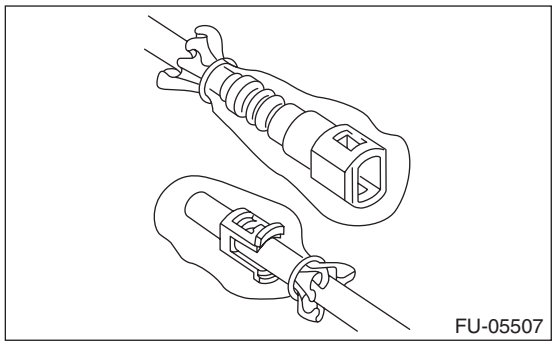
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



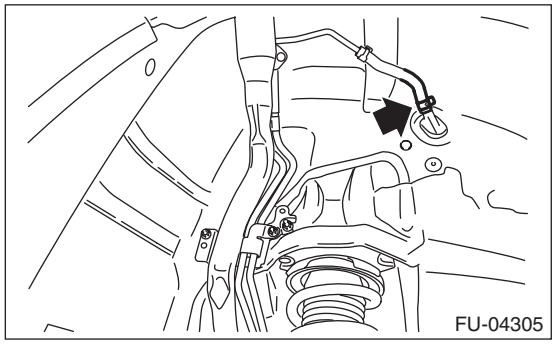

(A) Quick connector
(B) Retainer
(C) Pipe
(D) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

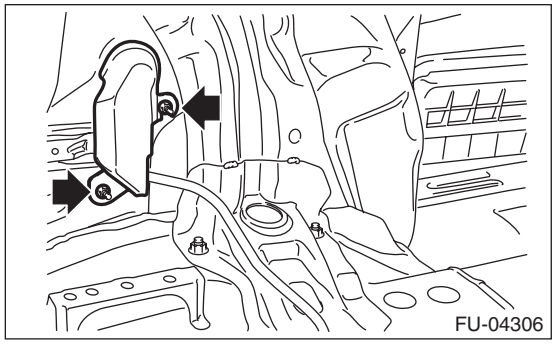
**CAUTION:**
**When reusing the retainer, do not disconnect the retainer from the pipe.**



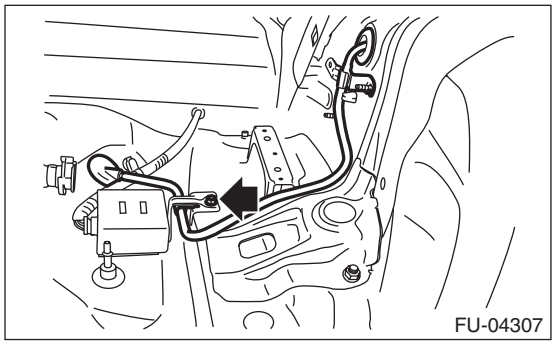

9) Remove the evaporation pipe.
(1) Remove the rear mud guard RH. <Ref. to EI-26, REMOVAL, Mud Guard.>
(2) Remove the evaporation hose.




(3) Remove the right side trunk side trim. (4 door model) <Ref. to EI-59, REMOVAL, Trunk Room Trim.>
(4) Remove the right side rear quarter trim. (5 door model) <Ref. to EI-56, REMOVAL, Rear Quarter Trim.>
(5) Remove the evaporation pipe protector.




(6) Remove the evaporation pipe from vehicle.

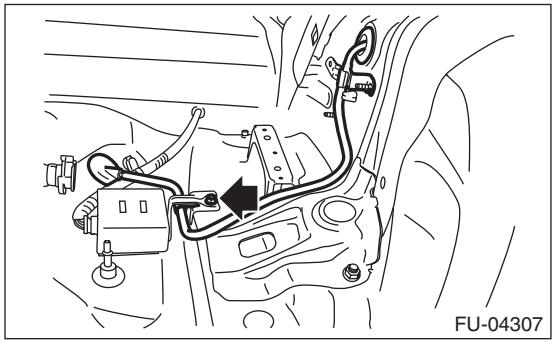



## B: INSTALLATION

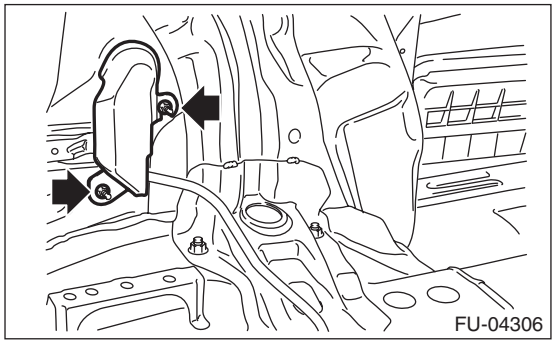
Install in the reverse order of removal while being careful of the following.

### 1. EVAPORATION PIPE INSTALLATION

1) Install the evaporation pipe to the vehicle.

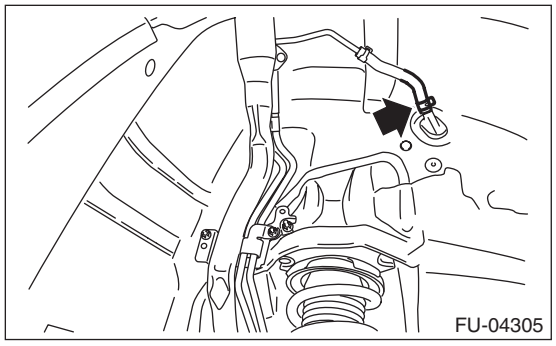



2) Install the evaporation pipe protector.




3) Install the right side trunk side trim. (4 door model) <Ref. to EI-59, INSTALLATION, Trunk Room Trim.>
4) Install the right side rear quarter trim. (5 door model) <Ref. to EI-57, INSTALLATION, Rear Quarter Trim.>

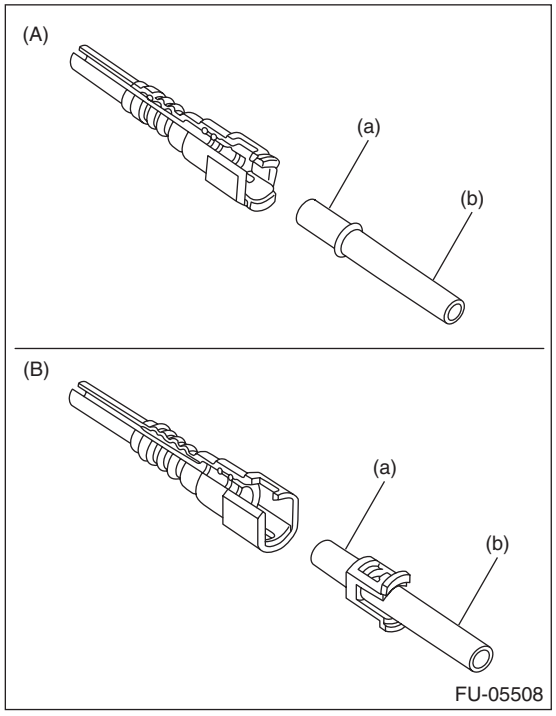
5) Install the evaporation hose.




6) Install the rear mud guard RH. <Ref. to EI-26, INSTALLATION, Mud Guard.>

## 2. CONNECTING THE FUEL LINE QUICK CONNECTOR

**CAUTION:**
**• Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.**

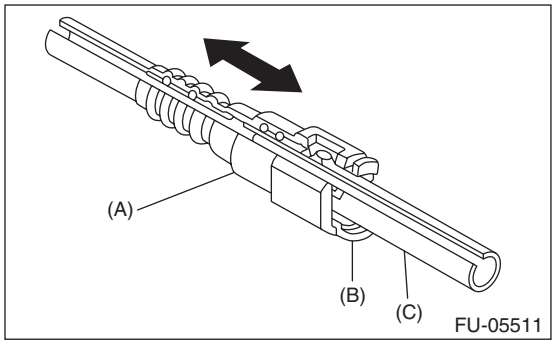



(A) When removed using ST
(B) When removed without using ST
(a) Seal surface
(b) Pipe

**• When reusing the retainer, make sure that neither scratches nor deformation exist on the retainer. If it is faulty, use a new part.**

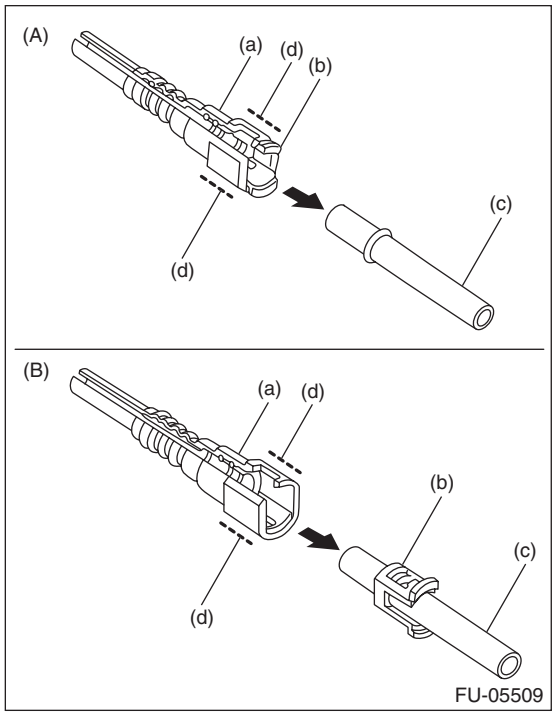
1) Connect the quick connector to pipe.

**CAUTION:**
**• Make sure that the quick connector is securely connected.**




(A) Quick connector
(B) Retainer
(C) Pipe

**• Make sure the two retainer pawls are engaged in their mating positions in the quick connector.**
**• Be sure to inspect tubes and their connections for any leakage of fuel.**
**• To connect the connector, hold (d) shown in the figure and push in axial direction.**
**• When connecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**




(A) When removed using ST
(B) When removed without using ST
(a) Quick connector
(b) Retainer
(c) Pipe
(d) Connector holding position

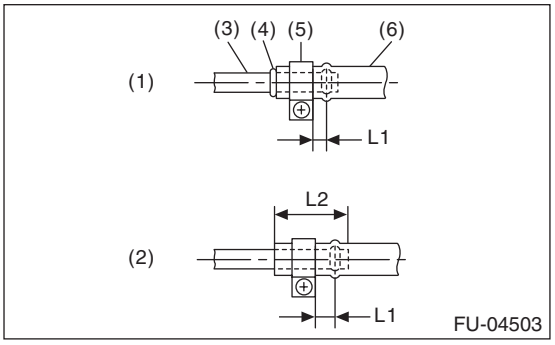
### 3. CONNECTING THE FUEL DELIVERY HOSE

Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

***L1: 2.5±1.5 mm (0.098±0.059 in)***

***L2: 22.5±2.5 mm (0.886±0.098 in)***

**CAUTION:**
**Be sure to inspect hoses and their connections for any leakage of fuel.**

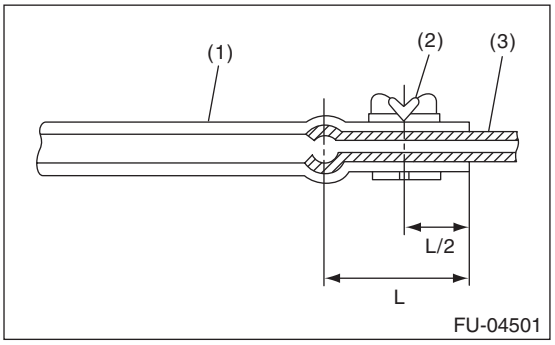



(1) When there is a spool or bump
(2) When there is no spool or bump
(3) Pipe
(4) Spool or bump
(5) Clamp
(6) Hose

### 4. EVAPORATION HOSE CONNECTION

Connect the evaporation hose to the pipe with an overlap of 15 to 20 mm (0.59 to 0.79 in).

***L = 17.5±2.5 mm (0.689±0.098 in)***




(1) Hose
(2) Clip
(3) Pipe

## C: INSPECTION

1) Check that the fuel pipe has no deformation, cracks or other damages.
2) Check that the hose and tube have no cracks, damage or loose part.

# 31.Fuel System Trouble in General

## A: INSPECTION

| Trouble | Possible cause | Corrective action |
|---|---|---|
| Insufficient fuel supply to injector | a. Fuel pump does not operate. | |
| | ❍ Defective terminal contact | Inspect contact, especially ground, and tighten it securely. |
| | ❍ Trouble in electromagnetic or electronic circuit parts | Replace the faulty parts. |
| | b. Decline of fuel pump function | Replace the fuel pump. |
| | c. Clogged fuel filter | Replace the fuel filter. Clean or replace the fuel tank if necessary. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| | e. Air is mixed in fuel system. | Check the fuel line connections, correct or replace the defective part. |
| | f. Damaged diaphragm of pressure regulator | Replace the pressure regulator. |
| Leakage or blow out of fuel | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Cracked fuel line pipe, hose or tube | Replace the fuel line pipe, hose or tube. |
| | c. Defective welded part of fuel tank | Replace the fuel tank. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| Gasoline smell inside of compartment | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Improper installation of rubber saucer | Correct or replace the rubber saucer. |
| | c. Defective canister | Replace the canister. |
| Defective fuel gauge | a. Defective operation of fuel level sensor | Replace the fuel level sensor. |
| | b. Defective operation of combination meter | Replace the combination meter. |
| Noise | a. Large operation noise or vibration of fuel pump | Replace the fuel pump. |

NOTE:
• When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
• In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
• When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
• Before using water removing agent, follow the cautions noted on the bottle.

# EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

# EC(H4SO)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# 1. List of Diagnostic Trouble Code (DTC)

## A: LIST

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| P0026 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 1) | <Ref. to GD(H4SO)-9, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0028 | Intake Valve Control Solenoid Circuit Range/Performance (Bank 2) | <Ref. to GD(H4SO)-11, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0030 | HO2S Heater Control Circuit (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-12, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0031 | HO2S Heater Control Circuit Low (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-14, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0032 | HO2S Heater Control Circuit High (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-16, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0037 | HO2S Heater Control Circuit Low (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-18, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0038 | HO2S Heater Control Circuit High (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-20, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0068 | MAP/MAF - Throttle Position Correlation | <Ref. to GD(H4SO)-22, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0076 | Intake Valve Control Solenoid Circuit Low (Bank 1) | <Ref. to GD(H4SO)-24, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0077 | Intake Valve Control Solenoid Circuit High (Bank 1) | <Ref. to GD(H4SO)-25, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0082 | Intake Valve Control Solenoid Circuit Low (Bank 2) | <Ref. to GD(H4SO)-25, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0083 | Intake Valve Control Solenoid Circuit High (Bank 2) | <Ref. to GD(H4SO)-25, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0101 | Mass or Volume Air Flow Circuit Range/Performance | <Ref. to GD(H4SO)-26, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0102 | Mass or Volume Air Flow Circuit Low Input | <Ref. to GD(H4SO)-28, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0103 | Mass or Volume Air Flow Circuit High Input | <Ref. to GD(H4SO)-29, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0107 | Manifold Absolute Pressure/Barometric Pressure Circuit Low Input | <Ref. to GD(H4SO)-30, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0108 | Manifold Absolute Pressure/Barometric Pressure Circuit High Input | <Ref. to GD(H4SO)-31, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0111 | Intake Air Temperature Sensor 1 Circuit Range/Performance | <Ref. to GD(H4SO)-32, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0112 | Intake Air Temperature Sensor 1 Circuit Low | <Ref. to GD(H4SO)-35, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0113 | Intake Air Temperature Sensor 1 Circuit High | <Ref. to GD(H4SO)-36, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0117 | Engine Coolant Temperature Circuit Low | <Ref. to GD(H4SO)-37, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

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| P0118 | Engine Coolant Temperature Circuit High | <Ref. to GD(H4SO)-38, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0122 | Throttle/Pedal Position Sensor/Switch “A” Circuit Low | <Ref. to GD(H4SO)-39, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0123 | Throttle/Pedal Position Sensor/Switch “A” Circuit High | <Ref. to GD(H4SO)-40, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0125 | Insufficient Coolant Temperature for Closed Loop Fuel Control | <Ref. to GD(H4SO)-41, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0126 | Insufficient Engine Coolant Temperature for Stable Operation | <Ref. to GD(H4SO)-43, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0128 | Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature) | <Ref. to GD(H4SO)-45, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0131 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-47, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0132 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-49, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0133 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-51, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0134 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) | <Ref. to GD(H4SO)-54, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0137 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-56, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0138 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-58, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0139 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-59, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0140 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-67, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0141 | O2 Sensor Heater Circuit (Bank 1 Sensor 2) | <Ref. to GD(H4SO)-69, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0171 | System Too Lean (Bank 1) | <Ref. to GD(H4SO)-71, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0172 | System Too Rich (Bank 1) | <Ref. to GD(H4SO)-72, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0181 | Fuel Temperature Sensor “A” Circuit Range/Performance | <Ref. to GD(H4SO)-73, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0182 | Fuel Temperature Sensor “A” Circuit Low Input | <Ref. to GD(H4SO)-76, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0183 | Fuel Temperature Sensor “A” Circuit High Input | <Ref. to GD(H4SO)-77, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0196 | Engine Oil Temperature Sensor Circuit Range/Performance | <Ref. to GD(H4SO)-78, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0197 | Engine Oil Temperature Sensor Low | <Ref. to GD(H4SO)-80, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

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|---|---|---|
| P0198 | Engine Oil Temperature Sensor High | <Ref. to GD(H4SO)-81, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0222 | Throttle/Pedal Position Sensor/Switch “B” Circuit Low | <Ref. to GD(H4SO)-82, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0223 | Throttle/Pedal Position Sensor/Switch “B” Circuit High | <Ref. to GD(H4SO)-83, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0301 | Cylinder 1 Misfire Detected | <Ref. to GD(H4SO)-84, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0302 | Cylinder 2 Misfire Detected | <Ref. to GD(H4SO)-89, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0303 | Cylinder 3 Misfire Detected | <Ref. to GD(H4SO)-89, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0304 | Cylinder 4 Misfire Detected | <Ref. to GD(H4SO)-89, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0327 | Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor) | <Ref. to GD(H4SO)-90, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0328 | Knock Sensor 1 Circuit High (Bank 1 or Single Sensor) | <Ref. to GD(H4SO)-92, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0335 | Crankshaft Position Sensor “A” Circuit | <Ref. to GD(H4SO)-94, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0336 | Crankshaft Position Sensor “A” Circuit Range/Performance | <Ref. to GD(H4SO)-96, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0340 | Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor) | <Ref. to GD(H4SO)-98, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0341 | Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor) | <Ref. to GD(H4SO)-100, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0400 | Exhaust Gas Recirculation Flow | <Ref. to GD(H4SO)-102, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0420 | Catalyst System Efficiency Below Threshold (Bank 1) | <Ref. to GD(H4SO)-105, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0442 | Evaporative Emission Control System Leak Detected (Small Leak) | <Ref. to GD(H4SO)-107, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0447 | Evaporative Emission Control System Vent Control Circuit Open | <Ref. to GD(H4SO)-123, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0448 | Evaporative Emission Control System Vent Control Circuit Shorted | <Ref. to GD(H4SO)-125, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0451 | Evaporative Emission Control System Pressure Sensor | <Ref. to GD(H4SO)-127, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0452 | Evaporative Emission Control System Pressure Sensor Low Input | <Ref. to GD(H4SO)-129, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0453 | Evaporative Emission Control System Pressure Sensor High Input | <Ref. to GD(H4SO)-131, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

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|---|---|---|
| P0456 | Evaporative Emission Control System Leak Detected (Very Small Leak) | <Ref. to GD(H4SO)-132, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0457 | Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off) | <Ref. to GD(H4SO)-132, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0458 | Evaporative Emission System Purge Control Valve Circuit Low | <Ref. to GD(H4SO)-133, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0459 | Evaporative Emission System Purge Control Valve Circuit High | <Ref. to GD(H4SO)-135, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0461 | Fuel Level Sensor “A” Circuit Range/Performance | <Ref. to GD(H4SO)-137, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0462 | Fuel Level Sensor “A” Circuit Low | <Ref. to GD(H4SO)-139, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0463 | Fuel Level Sensor “A” Circuit High | <Ref. to GD(H4SO)-141, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0464 | Fuel Level Sensor Circuit Intermittent | <Ref. to GD(H4SO)-143, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0500 | Vehicle Speed Sensor “A” | <Ref. to GD(H4SO)-146, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0506 | Idle Air Control System RPM Lower Than Expected | <Ref. to GD(H4SO)-147, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0507 | Idle Air Control System RPM Higher Than Expected | <Ref. to GD(H4SO)-148, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P050A | Cold Start Idle Air Control System Performance | <Ref. to GD(H4SO)-149, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P050B | Cold Start Ignition Timing Performance | <Ref. to GD(H4SO)-151, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0512 | Starter Request Circuit | <Ref. to GD(H4SO)-152, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0513 | Incorrect Immobilizer Key | <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0604 | Internal Control Module Random Access Memory (RAM) Error | <Ref. to GD(H4SO)-154, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0605 | Internal Control Module Read Only Memory (ROM) Error | <Ref. to GD(H4SO)-155, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0607 | Throttle Control System Circuit Range/Performance | <Ref. to GD(H4SO)-156, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0638 | Throttle Actuator Control Range/Performance (Bank 1) | <Ref. to GD(H4SO)-158, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0700 | Transmission Control System (MIL Request) | <Ref. to GD(H4SO)-160, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0851 | Park/Neutral Switch Input Circuit Low (AT Model) | <Ref. to GD(H4SO)-161, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0851 | Neutral Switch Input Circuit Low (MT Model) | <Ref. to GD(H4SO)-162, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.> |

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| P0852 | Park/Neutral Switch Input Circuit High (AT Model) | <Ref. to GD(H4SO)-163, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P0852 | Neutral Switch Input Circuit High (MT Model) | <Ref. to GD(H4SO)-164, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1152 | O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1) | <Ref. to GD(H4SO)-165, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1153 | O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1) | <Ref. to GD(H4SO)-167, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1160 | Return Spring Failure | <Ref. to GD(H4SO)-169, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1400 | Fuel Tank Pressure Control Solenoid Valve Circuit Low | <Ref. to GD(H4SO)-171, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1420 | Fuel Tank Pressure Control Sol. Valve Circuit High | <Ref. to GD(H4SO)-173, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1443 | Vent Control Solenoid Valve Function Problem | <Ref. to GD(H4SO)-175, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1491 | Positive Crankcase Ventilation (Blow-by) Function Problem | <Ref. to GD(H4SO)-177, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1492 | EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input) | <Ref. to GD(H4SO)-179, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1493 | EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input) | <Ref. to GD(H4SO)-181, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1494 | EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input) | <Ref. to GD(H4SO)-183, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1495 | EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input) | <Ref. to GD(H4SO)-183, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1496 | EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input) | <Ref. to GD(H4SO)-183, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1497 | EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input) | <Ref. to GD(H4SO)-183, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1498 | EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input) | <Ref. to GD(H4SO)-183, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1499 | EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input) | <Ref. to GD(H4SO)-183, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1518 | Starter Switch Circuit Low Input | <Ref. to GD(H4SO)-184, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1560 | Back-Up Voltage Circuit Malfunction | <Ref. to GD(H4SO)-185, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1570 | Antenna | <Ref. to GD(H4SO)-186, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1571 | Reference Code Incompatibility | <Ref. to GD(H4SO)-186, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

| DTC | Item | Index |
|---|---|---|
| P1572 | IMM Circuit Failure | <Ref. to GD(H4SO)-186, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1574 | Key Communication Failure | <Ref. to GD(H4SO)-186, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1576 | EGI Control Module EEPROM | <Ref. to GD(H4SO)-186, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1577 | IMM Control Module EEPROM | <Ref. to GD(H4SO)-186, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P1578 | Meter Failure | <Ref. to GD(H4SO)-186, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2096 | Post Catalyst Fuel Trim System Too Lean (Bank 1) | <Ref. to GD(H4SO)-187, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2097 | Post Catalyst Fuel Trim System Too Rich (Bank 1) | <Ref. to GD(H4SO)-189, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2101 | Throttle Actuator Control Motor Circuit Range/Performance | <Ref. to GD(H4SO)-191, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2102 | Throttle Actuator Control Motor Circuit Low | <Ref. to GD(H4SO)-192, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2103 | Throttle Actuator Control Motor Circuit High | <Ref. to GD(H4SO)-193, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2109 | Throttle/Pedal Position Sensor “A” Minimum Stop Performance | <Ref. to GD(H4SO)-194, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2122 | Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input | <Ref. to GD(H4SO)-195, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2123 | Throttle/Pedal Position Sensor/Switch “D” Circuit High Input | <Ref. to GD(H4SO)-197, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2127 | Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input | <Ref. to GD(H4SO)-199, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2128 | Throttle/Pedal Position Sensor/Switch “E” Circuit High Input | <Ref. to GD(H4SO)-201, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2135 | Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation | <Ref. to GD(H4SO)-203, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2138 | Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation | <Ref. to GD(H4SO)-205, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P219A | Bank 1 Air-Fuel Ratio Imbalance | <Ref. to GD(H4SO)-207, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2227 | Atmospheric Pressure Sensor Range/Performance | <Ref. to GD(H4SO)-210, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2228 | Barometric Pressure Circuit Low | <Ref. to GD(H4SO)-211, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| P2229 | Barometric Pressure Circuit High | <Ref. to GD(H4SO)-212, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0073 | CAN Failure, Bus “OFF” Detection | <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS ‘OFF’ DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0101 | CAN (TCU) Data not Loaded | <Ref. to GD(H4SO)-214, DTC U0101 CAN (TCU) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

| DTC | Item | Index |
|---|---|---|
| U0122 | CAN (VDC) Data not Loaded | <Ref. to GD(H4SO)-214, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0140 | CAN (BCU) Data not Loaded | <Ref. to GD(H4SO)-214, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0402 | CAN (TCU) Data Abnormal | <Ref. to GD(H4SO)-214, DTC U0402 CAN (TCU) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0416 | CAN (VDC) Data Abnormal | <Ref. to GD(H4SO)-214, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.> |
| U0422 | CAN (BCU) Data Abnormal | <Ref. to GD(H4SO)-214, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.> |

# 2. Diagnostic Trouble Code (DTC) Detecting Criteria

## A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Judge as NG with either Low NG or High NG.
A variable valve lift diagnosis oil pressure switch is installed for diagnosis. It is possible to determine whether the intake valve is in high mode (increase the amount of lift) or in low mode (suppressing the amount of lift) when the variable valve lift diagnosis oil pressure switch is turned ON or OFF.

- **Normal**

| Oil switching solenoid valve duty | Intake valve | Variable valve lift diagnosis oil pressure switch |
|---|---|---|
| Large | High mode | OFF |
| Minimum | Low mode | ON |

- **Low NG**

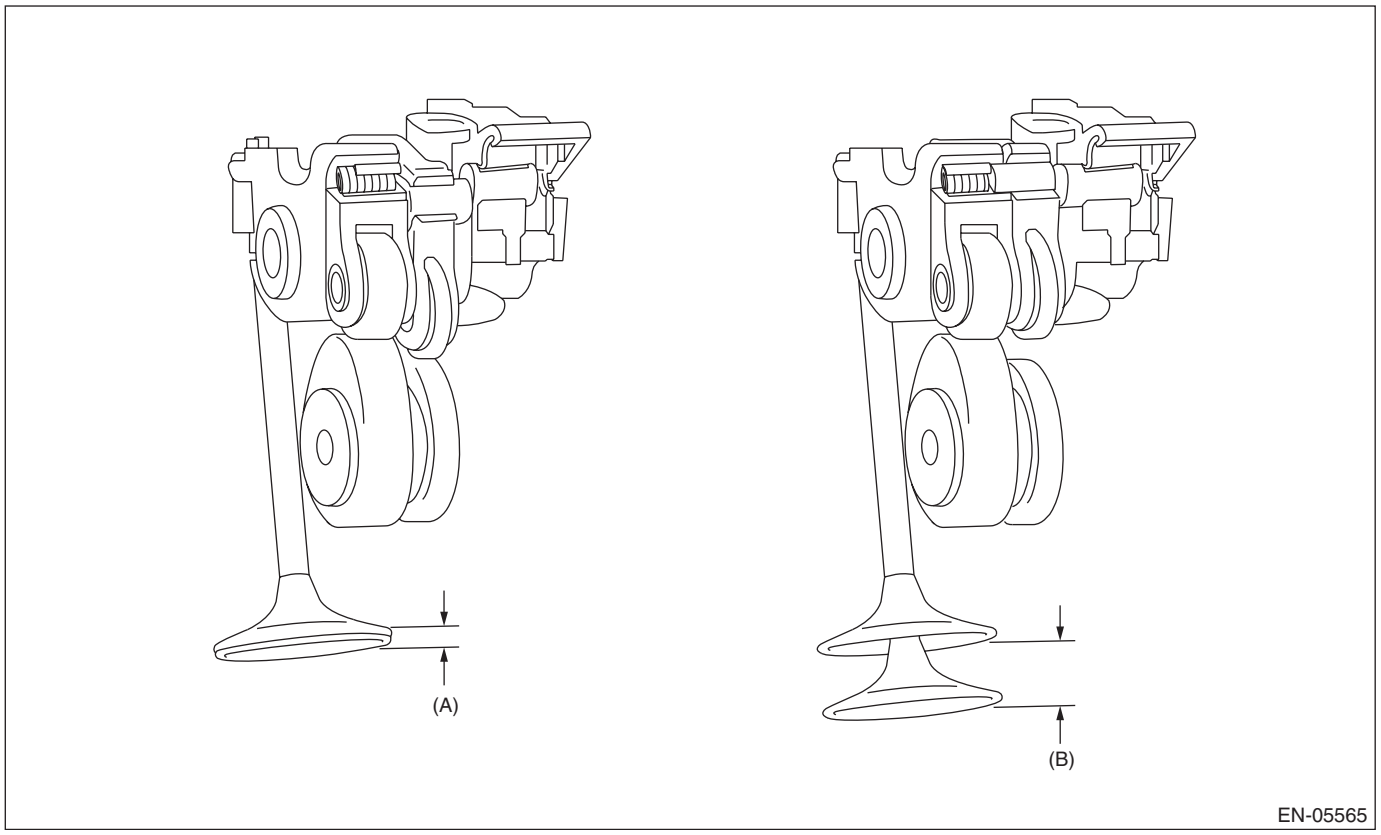
When the variable valve lift diagnosis oil pressure switch remains ON even though the intake valve tried to enter high mode (oil switching solenoid valve duty is large), this is judged as a Low NG.

- **High NG**

When the variable valve lift diagnosis oil pressure switch remains OFF even though the intake valve tried to enter low mode (oil switching solenoid valve duty is small), this is judged as a High NG.

## 2. COMPONENT DESCRIPTION

The variable valve lift system optimizes the intake valve lift by switching between the low lift cam and the high lift cam according to the engine speed. The amount of intake valve lift is varied by controlling the oil switching solenoid valve duty according to signals from the ECM.




(A) Low lift (B) High lift

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| After engine starting | ≥ 6000 ms |
| Engine oil temperature | ≥ 15 °C (59 °F) |
| Variable valve lift control | Operation |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 6 seconds after engine start while variable valve lift is being controlled

### 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Duty ratio | ≥ 62 % |
| Variable valve lift diagnosis oil pressure switch | ON |
| **High** | |
| Duty ratio | < 33 % |
| Variable valve lift diagnosis oil pressure switch | OFF |

**Time Needed for Diagnosis:**
Low side: 784 ms
High side: 3000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Duty ratio | ≥ 62 % |
| Variable valve lift diagnosis oil pressure switch | OFF |
| **High** | |
| Duty ratio | < 33 % |
| Variable valve lift diagnosis oil pressure switch | ON |

**Time Needed for Diagnosis:**
Low side: 208 ms
High side: 3000 ms

## B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

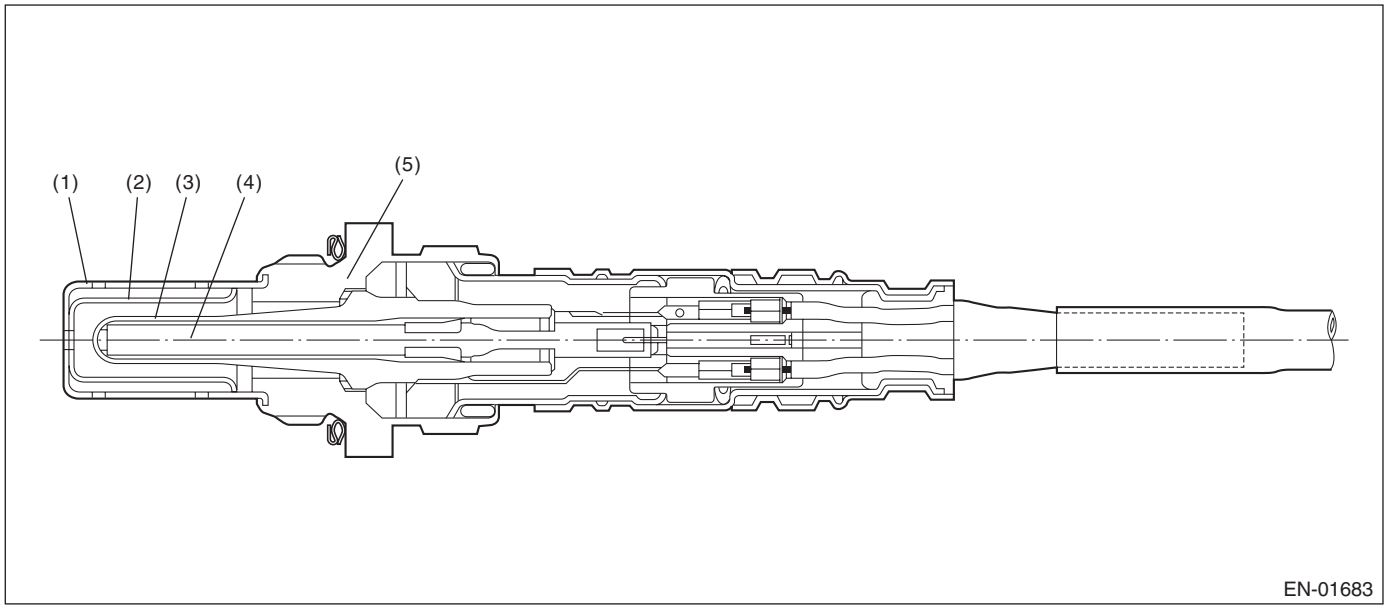
NOTE:
For the detection standard, refer to DTC P0026. <Ref. to GD(H4SO)-9, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# C: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.
Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

## 2. COMPONENT DESCRIPTION




(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Condition established time | ≥ 42000 ms |
| Battery voltage | ≥ 10.9 V |
| Heater current | Permitted |
| Control duty ≥ 35 % | Experienced |
| After fuel cut | ≥ 20000 ms |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms seconds or more have passed since the engine started.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Front oxygen (A/F) sensor impedance | > 50 Ω |

**Time Needed for Diagnosis:** 10000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Front oxygen (A/F) sensor impedance | ≤ 50 Ω |

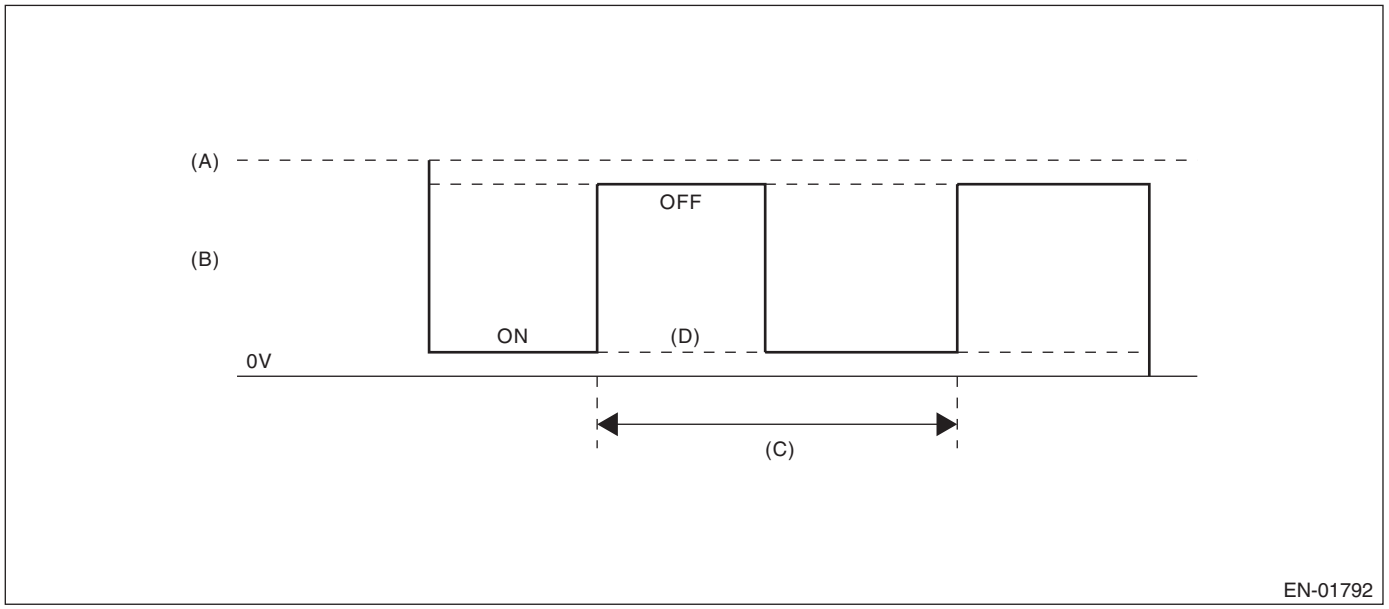
**Time Needed for Diagnosis:** 10000 ms

# D: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

## 2. COMPONENT DESCRIPTION




(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) Low error

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level<br>Front oxygen (A/F) sensor heater control duty | Low<br>< 87.5 % |

**Time Needed for Diagnosis:** 4 ms × 250 time(s)
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | High |

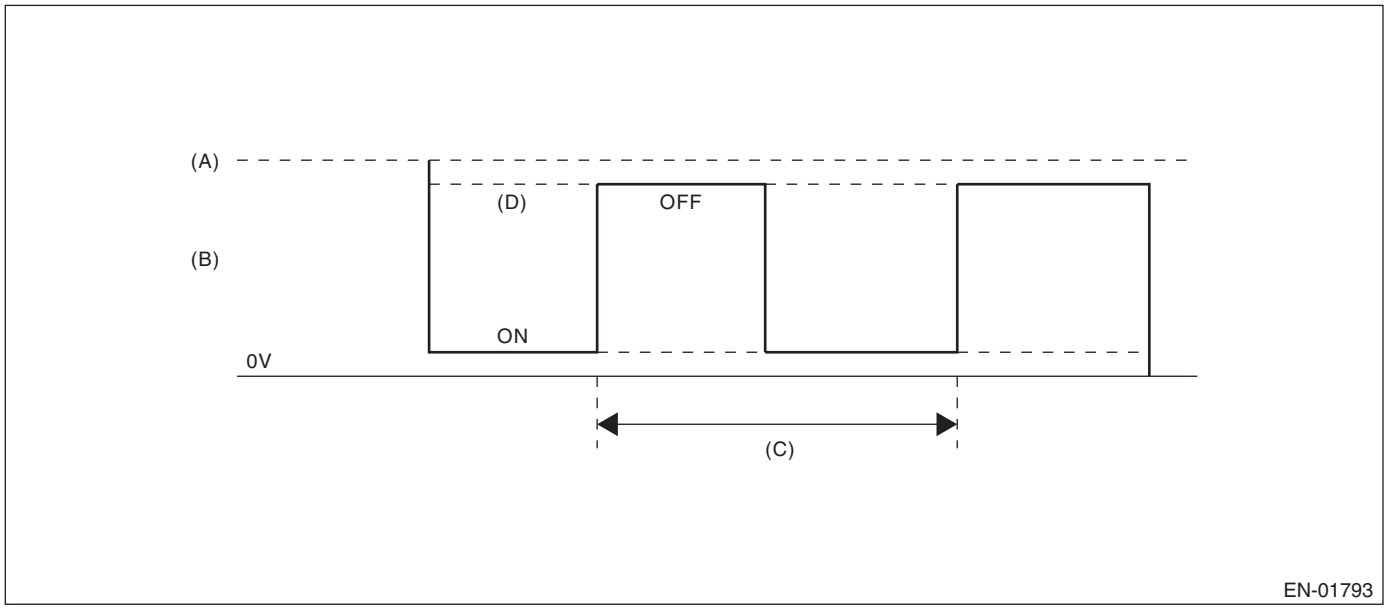
**Time Needed for Diagnosis:** Less than 1 second

# E: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

## 2. COMPONENT DESCRIPTION




(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) High error

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | High |
| Front oxygen (A/F) sensor heater control duty | ≥ 12.5 % |

**Time Needed for Diagnosis:** 4 ms × 500 time(s)
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | Low |

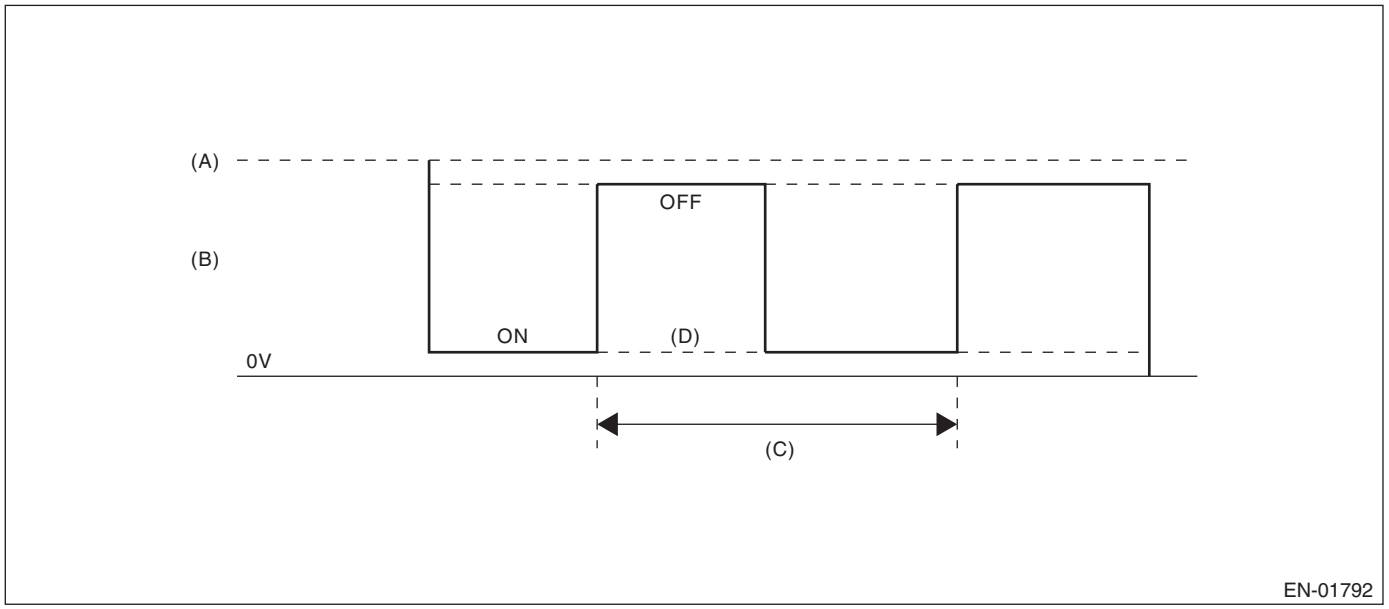
**Time Needed for Diagnosis:** Less than 1 second

# F: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

## 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

## 2. COMPONENT DESCRIPTION




(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycles)
(D) Low error

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after engine starting | ≥ 1 second |
| Engine speed | < 8000 rpm |

## 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | Low |
| Rear oxygen sensor heater control duty | < 75 % |

**Time Needed for Diagnosis:**8 ms × 1250 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | High |

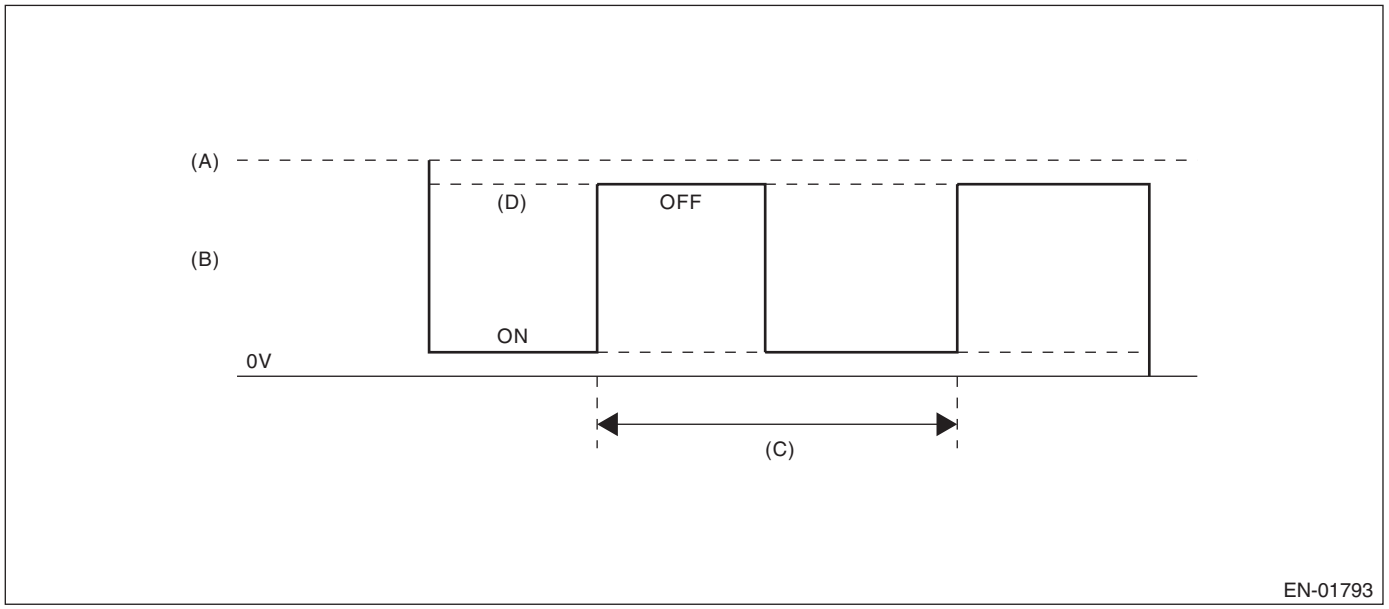
**Time Needed for Diagnosis:** Less than 1 second

# G: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

## 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

## 2. COMPONENT DESCRIPTION




(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycles)
(D) High error

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after engine starting | ≥ 1 second |
| Engine speed | < 8000 rpm |

## 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | High |
| Rear oxygen sensor heater control duty | ≥ 20 % |

**Time Needed for Diagnosis:**8 ms × 1250 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage level | Low |

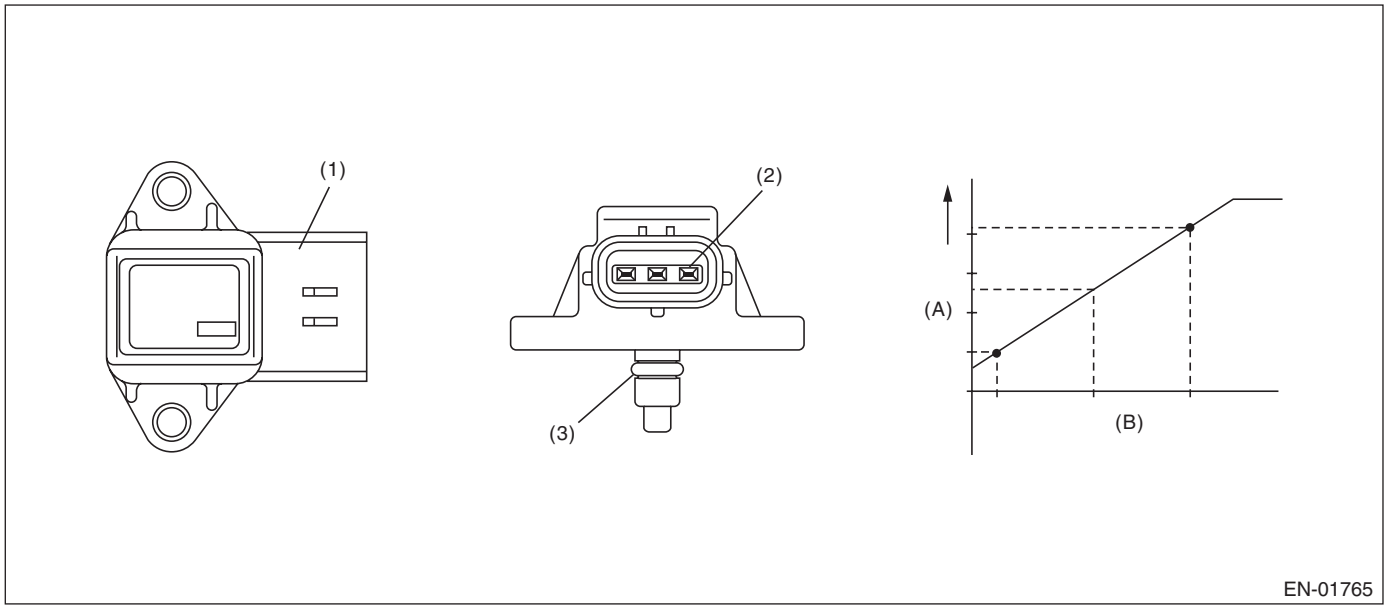
**Time Needed for Diagnosis:** Less than 1 second

# H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

## 1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.
Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

## 2. COMPONENT DESCRIPTION




(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine coolant temperature | ≥ 75 °C (167 °F) |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Engine speed | < 2500 rpm |
| Throttle position | ≥ 12 ° |
| Output voltage | < 1.63 V |
| Engine load | > 0.6 g/rev (0.02 oz/rev) |
| **High** | |
| Engine speed | 600 rpm — 900 rpm |
| Throttle position | < 2.44 ° |
| Output voltage | ≥ 3.4 V |
| Engine load | < 0.4 g/rev (0.01 oz/rev) |

**Time Needed for Diagnosis:**
Low side: 3000 ms
High side: 7000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG when both Low side and High side become OK.
If the duration of time while the following conditions are met is longer than the time indicated, judge as OK.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Engine speed | < 2500 rpm |
| Throttle position | ≥ 12 ° |
| Output voltage | ≥ 1.63 V |
| Engine load | > 0.6 g/rev (0.02 oz/rev) |
| **High** | |
| Engine speed | 600 rpm — 900 rpm |
| Throttle position | < 2.44 ° |
| Output voltage | < 3.4 V |
| Engine load | < 0.4 g/rev (0.01 oz/rev) |

**Time Needed for Diagnosis:**
Low side: Less than 1 second
High side: Less than 1 second

# I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the open circuit of the oil switching solenoid valve.
Judge as NG when the current is small even though the output duty is large.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duty ratio | ≥ 30 % |
| Control current | < 0.026 A |

**Time Needed for Diagnosis:** 2000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| \|Oil switching solenoid valve target current value – Oil switching solenoid valve current value\| | < 0.08 A |
| Target current | ≥ 0.11 A |

**Time Needed for Diagnosis:** 2000 ms

# J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect short circuits of the oil switching solenoid valve.
Judge as a short NG when the current is large even though the output duty is small.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duty ratio | < 7 % |
| Control current | ≥ 0.465 A |

**Time Needed for Diagnosis:** 2000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| \|Oil switching solenoid valve target current value – Oil switching solenoid valve current value\| | < 0.08 A |

**Time Needed for Diagnosis:** 2000 ms

# K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

## 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0076. <Ref. to GD(H4SO)-24, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

## 1. OUTLINE OF DIAGNOSIS

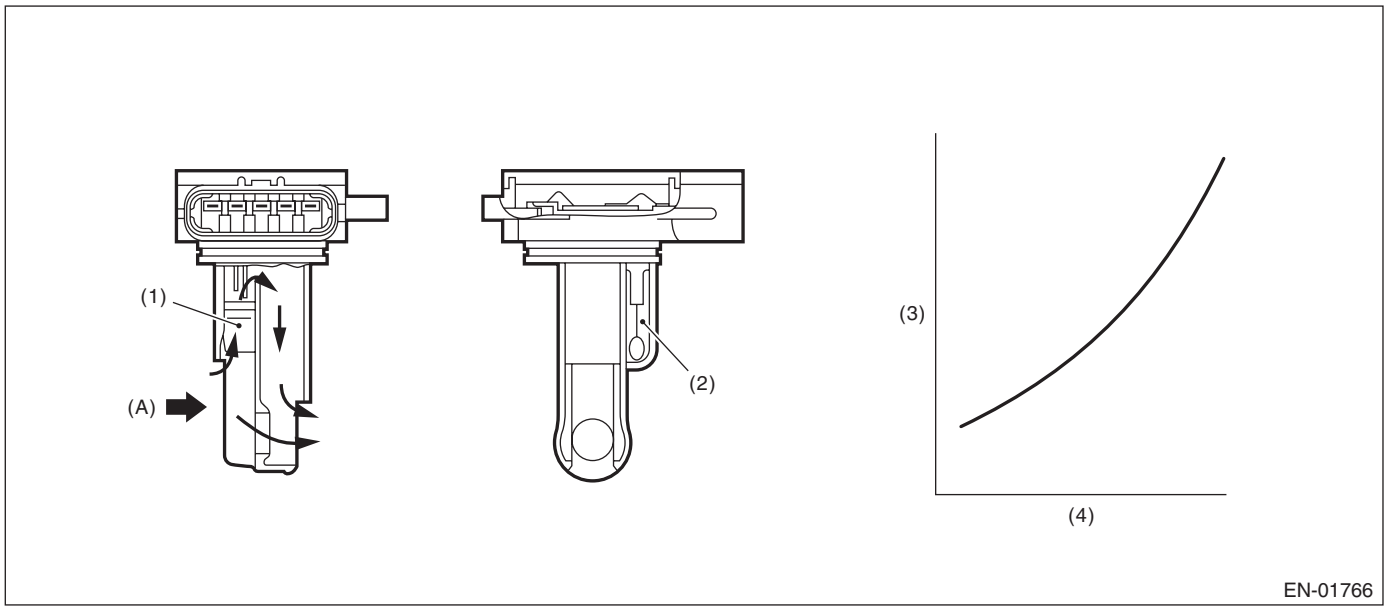
NOTE:
For the detection standard, refer to DTC P0077. <Ref. to GD(H4SO)-25, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# M: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.
Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine coolant temperature | ≥ 75 °C (167 °F) |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Output voltage | < 1.49 V |
| Engine speed | ≥ 2000 rpm |
| Throttle opening angle | ≥ 12 ° |
| Intake manifold pressure | ≥ 66.7 kPa (500 mmHg, 19.7 inHg) |
| **High (1)** | |
| Output voltage | ≥ 2.66 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 2.44 ° |
| Intake manifold pressure | < 40 kPa (300 mmHg, 11.8 inHg) |
| **High (2)** | |
| Output voltage | ≥ 1.45 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 2.44 ° |
| Intake manifold pressure | < 40 kPa (300 mmHg, 11.8 inHg) |
| Fuel system diagnosis | Rich side malfunction |

**Time Needed for Diagnosis**:
Low: 5000 ms
High: 10000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG when both Low side and High side become OK.
Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Low** | |
| Output voltage | ≥ 1.49 V |
| Engine speed | ≥ 2000 rpm |
| Throttle opening angle | ≥ 12 ° |
| Intake manifold pressure | ≥ 66.7 kPa (500 mmHg, 19.7 inHg) |
| **High** | |
| Output voltage | < 2.66 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 2.44 ° |
| Intake manifold pressure | < 40 kPa (300 mmHg, 11.8 inHg) |
| Fuel system diagnosis | Rich side normal |

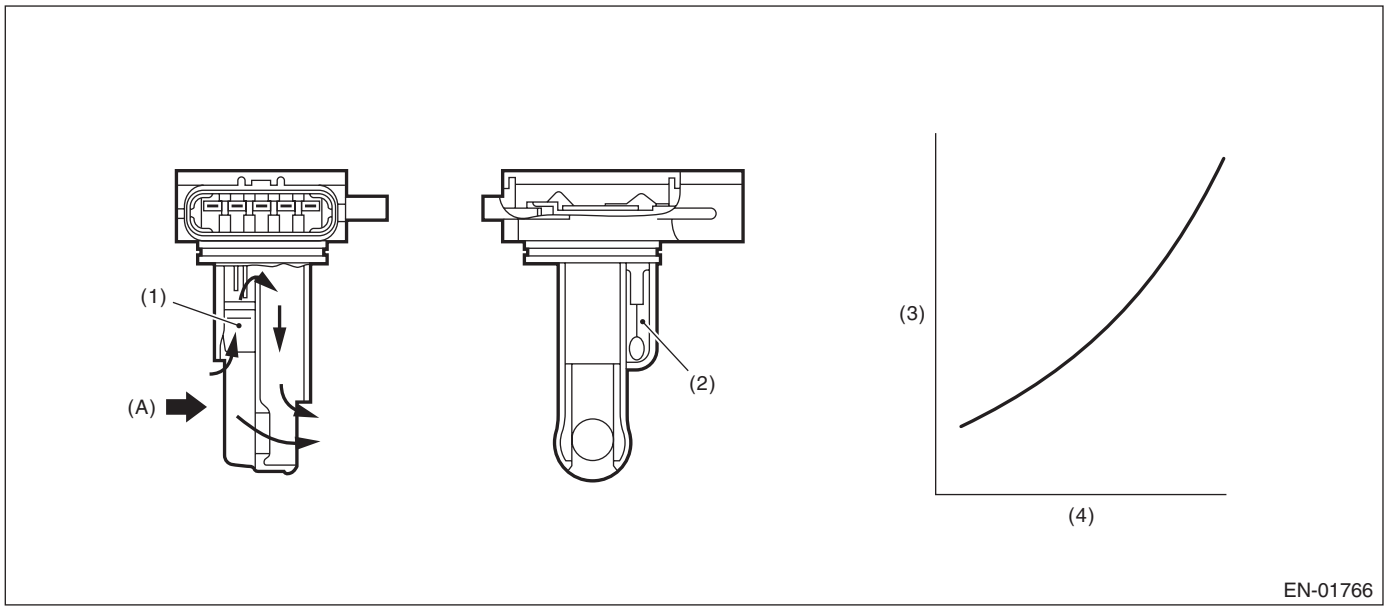
**Time Needed for Diagnosis**:
Low: Less than 1 second
High: Less than 1 second

# N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≤ 0.22 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | > 0.22 V |

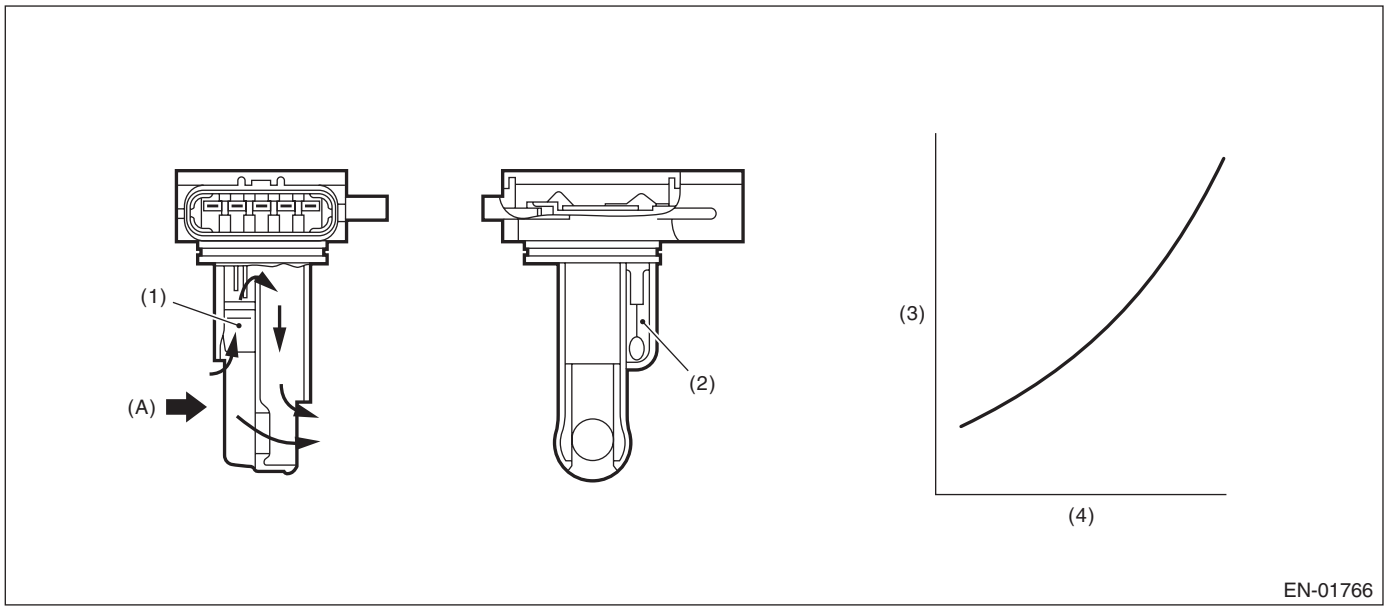
**Time Needed for Diagnosis:** Less than 1 second

# O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.1799 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.1799 V |

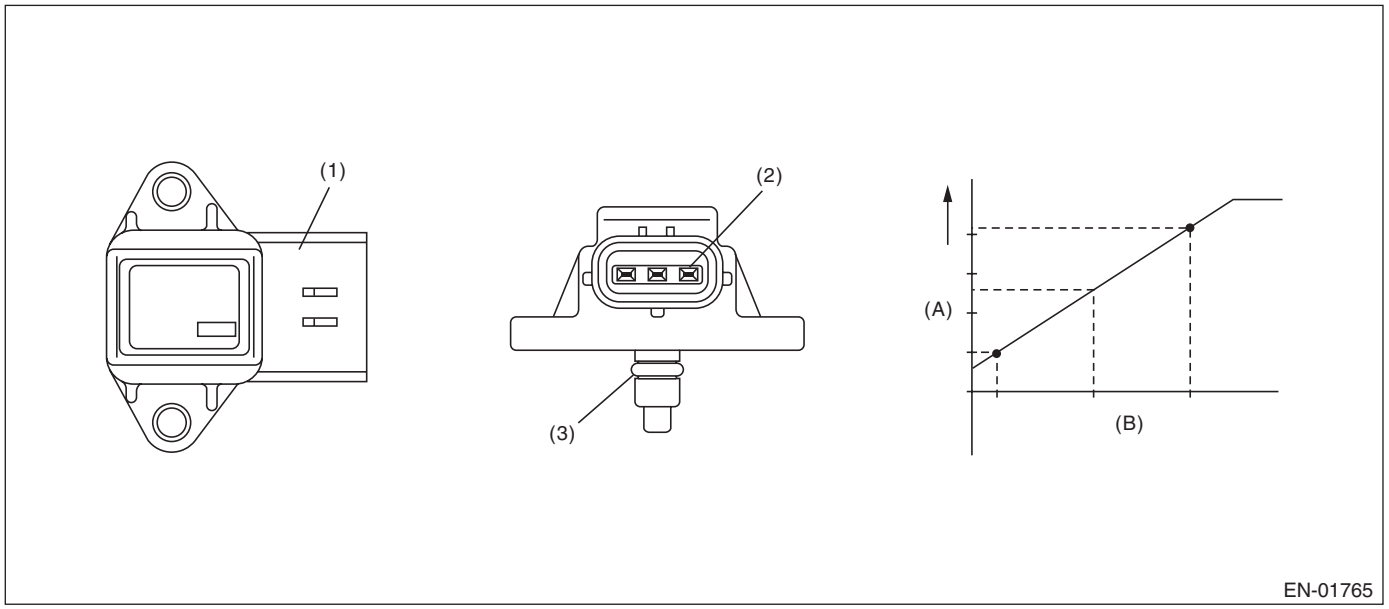
**Time Needed for Diagnosis:** Less than 1 second

# P: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≤ 0.573 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | > 0.573 V |

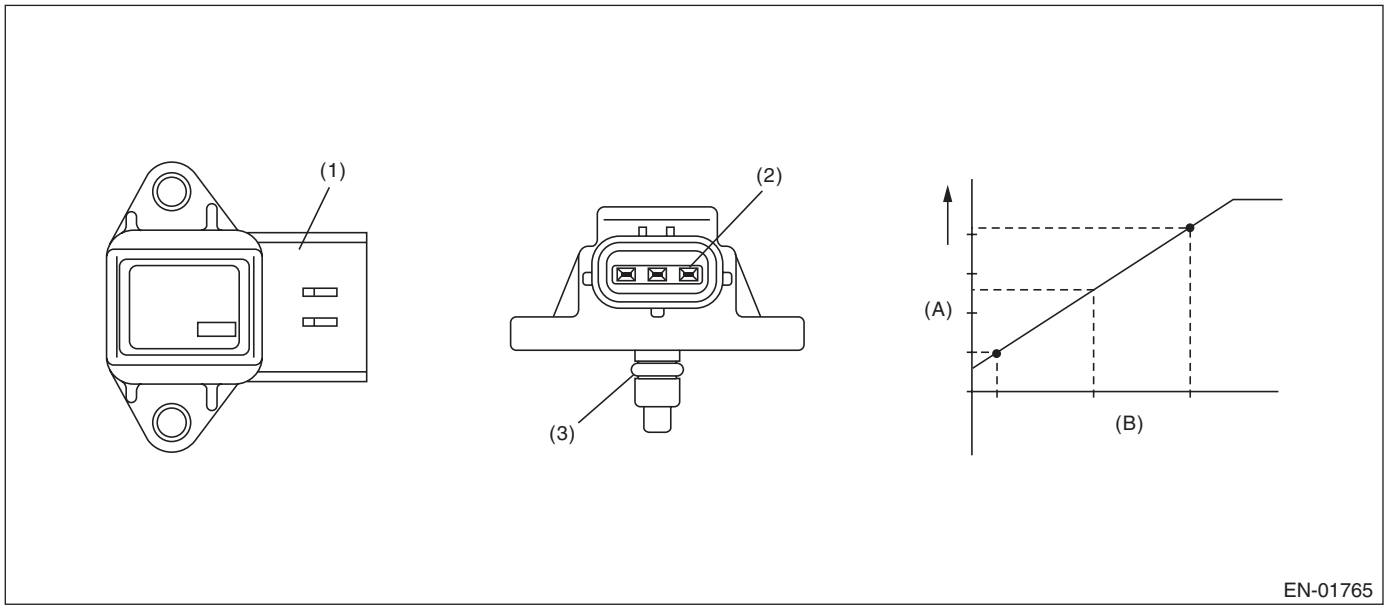
**Time Needed for Diagnosis:** Less than 1 second

# Q: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.388 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.388 V |

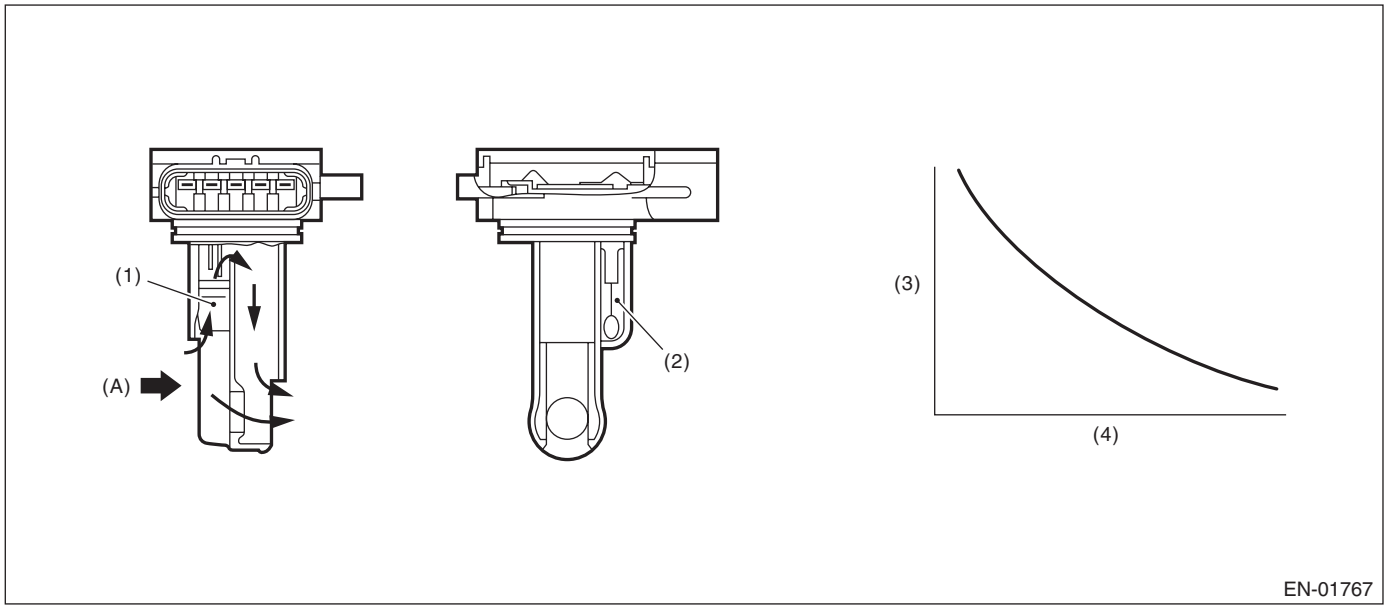
**Time Needed for Diagnosis:** Less than 1 second

# R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.
Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine coolant temperature at engine starting | < 35 °C (95 °F) |
| Battery voltage | ≥ 10.9 V |
| Continuous time when the vehicle speed is less than 140 km/h (87 MPH) | ≥ 600 s |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Intake air amount sum value | ≥ Value of Map 1 |
| Number of experiences under conditions below | ≥ 3 time(s) |
| • Continuous time when vehicle speed is less than 4 km/h (2.5 MPH) | ≥ Value of Map 2 |
| • Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more | ≥ 15 s |
| and | |
| Establishing time of 1, 2 | ≥ 15 s |
| 1. Intake air amount | ≥ 10 g/s (0.35 oz/s) |
| 2. Vehicle speed | ≥ 4 km/h (2.5 MPH) |

**Map 1**

| Engine coolant temperature °C (°F) | –20 (–4) | –10 (14) | 0 (32) | 10 (50) | 20 (68) |
|---|---|---|---|---|---|
| Intake air amount sum value (g (oz)/s) | 50000 (1763.5) | 7400 (261) | 6600 (232.78) | 5800 (204.57) | 5000 (176.35) |

**Map 2**

| Engine coolant temperature °C (°F) | –30 (–22) | 0 (32) | 10 (50) | 20 (68) |
|---|---|---|---|---|
| Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH) | 250 | 40 | 32 | 24 |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage difference between Max. and Min. | < 0.02 V(Equivalent to approximately 0.5°C (0.9°F) near 25°C) |

**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage difference between Max. and Min. | ≥ 0.02 V |

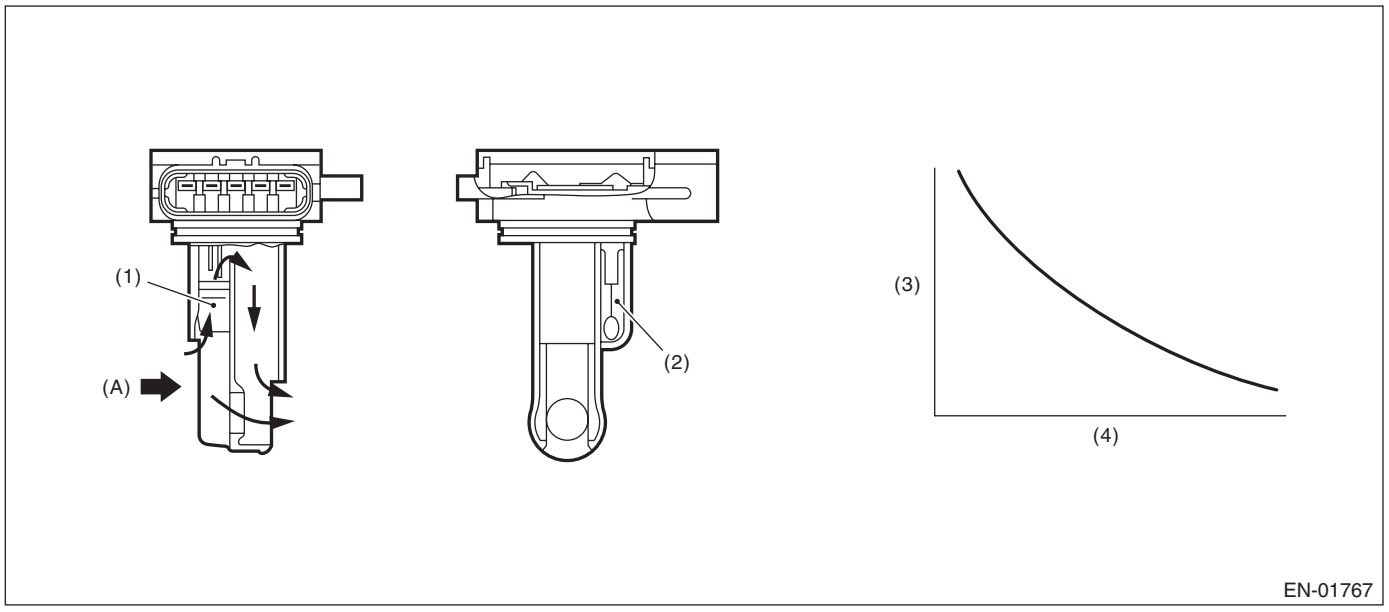
**Time Needed for Diagnosis:** Less than 1 second

# S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 0.231 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 0.231 V |

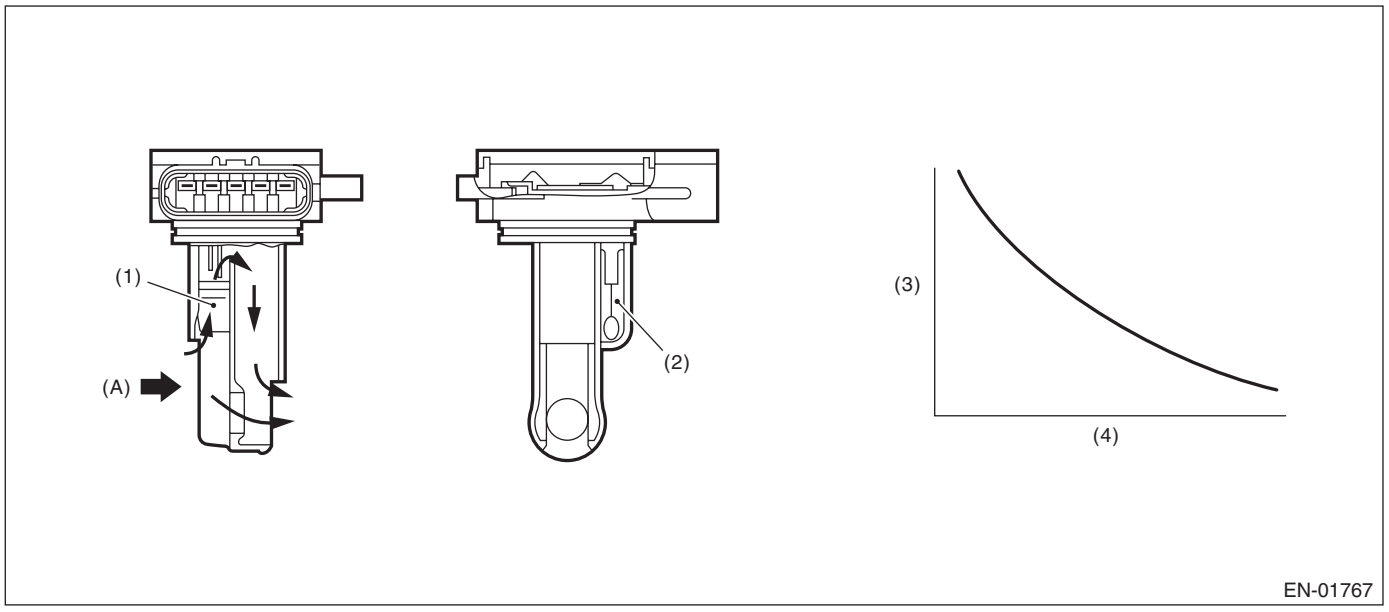
**Time Needed for Diagnosis:** Less than 1 second

# T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.716 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.716 V |

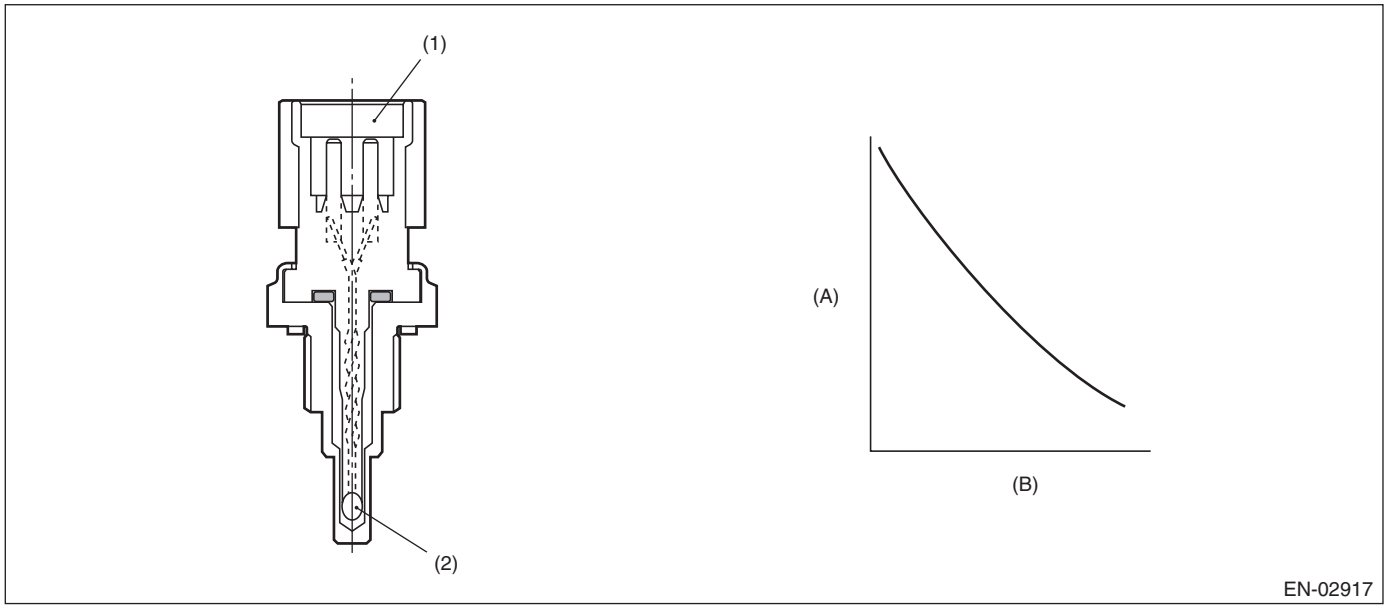
**Time Needed for Diagnosis:** Less than 1 second

# U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 0.265 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 0.265 V |

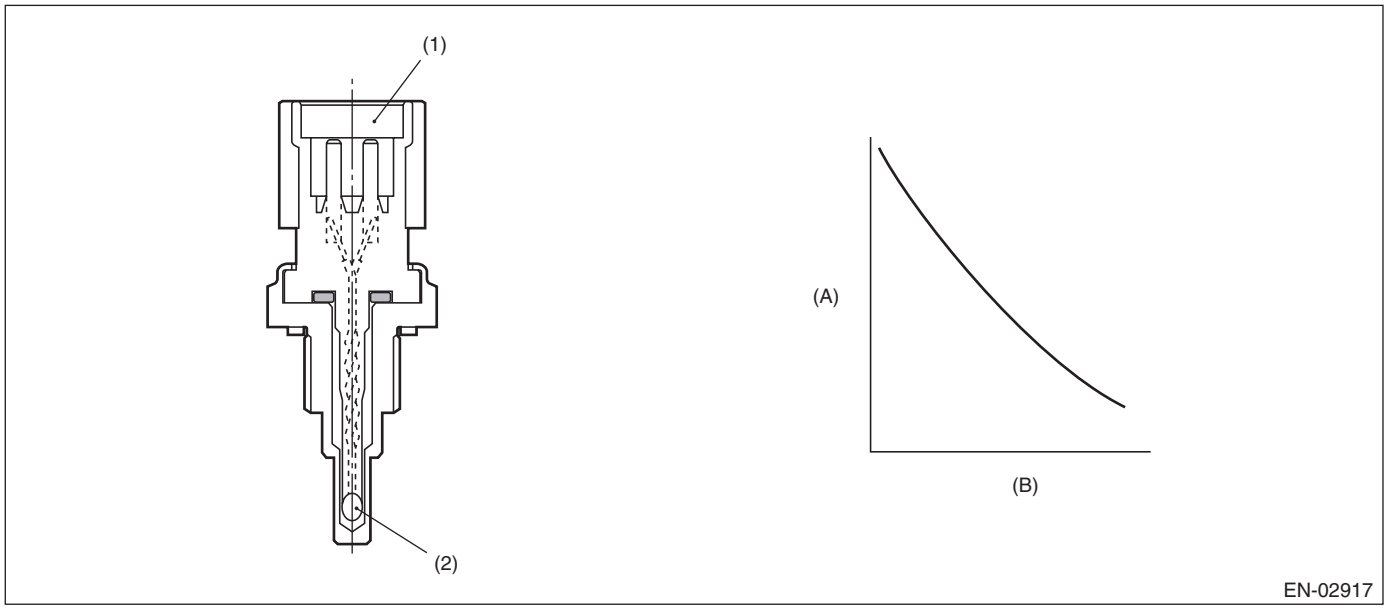
**Time Needed for Diagnosis:** Less than 1 second

# V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.716 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.716 V |

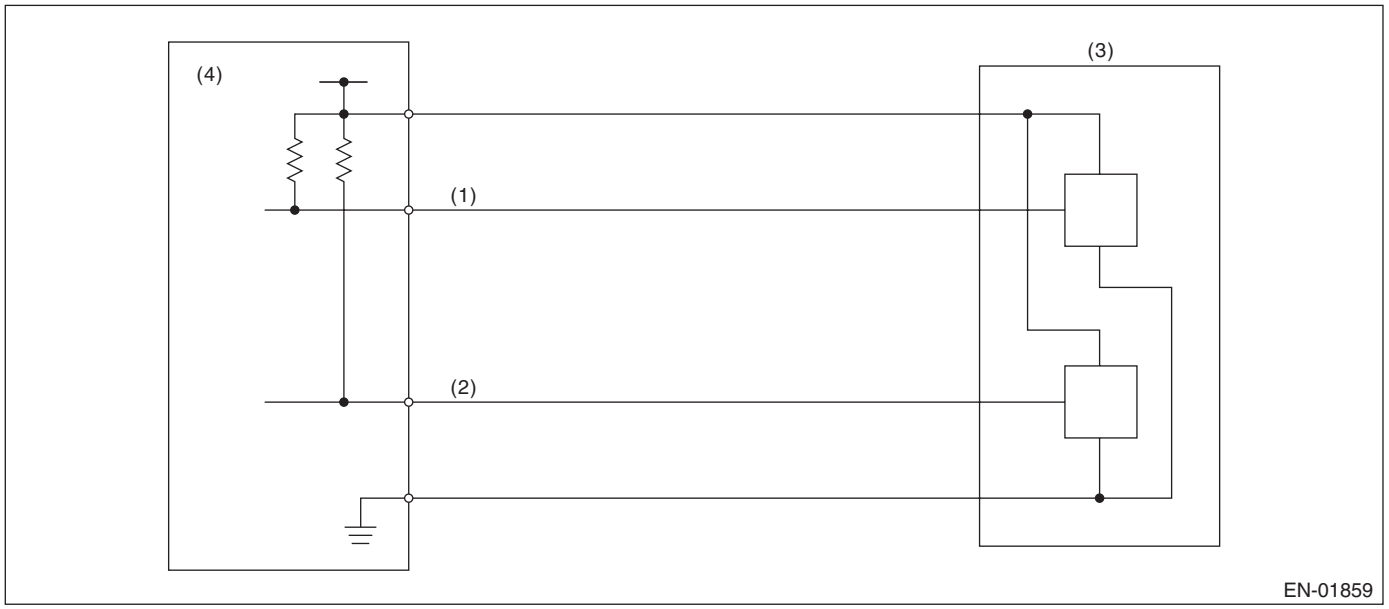
**Time Needed for Diagnosis:** Less than 1 second

# W: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | ≤ 0.217 V |

**Time Needed for Diagnosis**: 24 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | > 0.217 V |

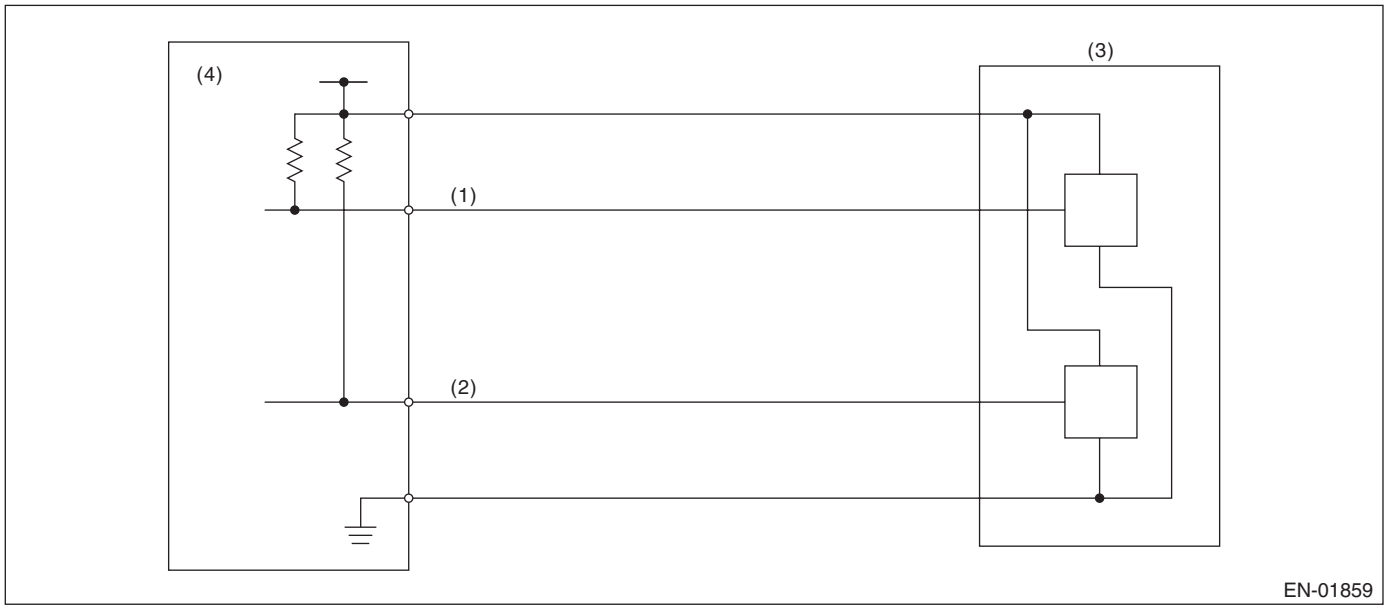
**Time Needed for Diagnosis**: 24 ms

# X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | ≥ 4.858 V |

**Time Needed for Diagnosis**: 24 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | < 4.858 V |

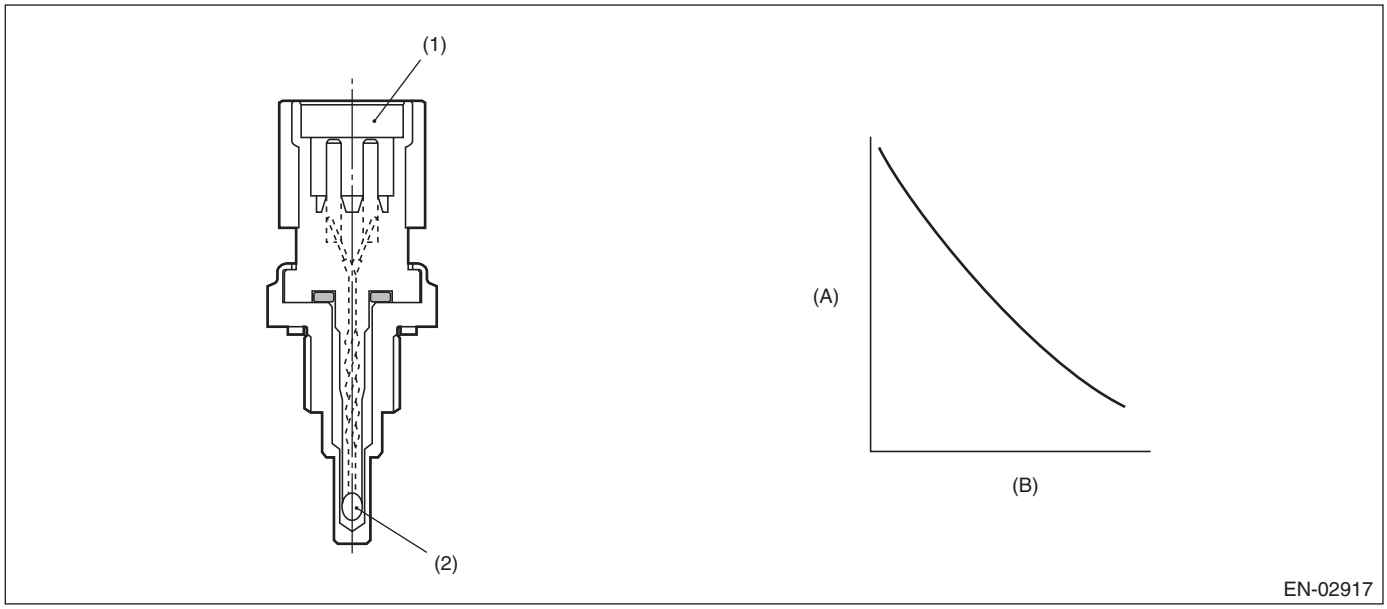
**Time Needed for Diagnosis**: 24 ms

# Y: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.
Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine speed | ≥ Value from Map |
| Battery voltage | ≥ 10.9 V |

**Map**

| Engine coolant temperature °C (°F) | –40 (–40) | –30 (–22) | –20 (–4) | –10 (14) | 0 (32) | 10 (50) | 20 (68) | 30 (86) |
|---|---|---|---|---|---|---|---|---|
| Engine speed rpm | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |

| Engine coolant temperature °C (°F) | 40 (104) | 50 (122) | 60 (140) | 70 (158) | 80 (176) | 90 (194) | 100 (212) | 110 (230) |
|---|---|---|---|---|---|---|---|---|
| Engine speed rpm | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG if the criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine coolant temperature | < 20 °C (68 °F) |
| Timer for diagnosis after engine start | ≥ Judgment value of timer after engine start |

Timer for diagnosis after engine start
a. Timer stop at fuel cut
b. During the driving conditions except a) above, timer counts up as follows.
64 ms + TWCNT ms (at 64 ms)
TWCNT is defined as follows,
TWCNT = 0 at idle switch ON,
TWCNT show on the following table at idle switch OFF.

| | | Vehicle speed km/h (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 (0) | 8 (5) | 16 (9.9) | 24 (14.9) | 32 (19.9) | 40 (24.9) | 48 (29.8) | 56 (34.8) |
| Temperature °C (°F) | –20 (–4) | 0 ms | 32.076 ms | 39.977 ms | 47.879 ms | 82.544 ms | 117.209 ms | 154.214 ms | 185.26 ms |
| | –10 (14) | 0 ms | 25.704 ms | 33.606 ms | 41.508 ms | 68.52 ms | 95.532 ms | 125.667 ms | 155.802 ms |
| | 0 (32) | 0 ms | 17.646 ms | 25.548 ms | 33.45 ms | 53.652 ms | 73.855 ms | 97.12 ms | 120.386 ms |
| | 10 (50) | 0 ms | 7.901 ms | 15.802 ms | 23.704 ms | 37.941 ms | 52.177 ms | 68.573 ms | 82.538 ms |
| | 20 (68) | 0 ms | 7.901 ms | 15.802 ms | 23.704 ms | 37.941 ms | 52.177 ms | 68.573 ms | 82.538 ms |

Judgment value of timer after engine starting
t = 573669 ms – 33924 ms × Ti
Ti : The lowest coolant temperature after engine start
**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine coolant temperature | ≥ 20 °C (68 °F) |

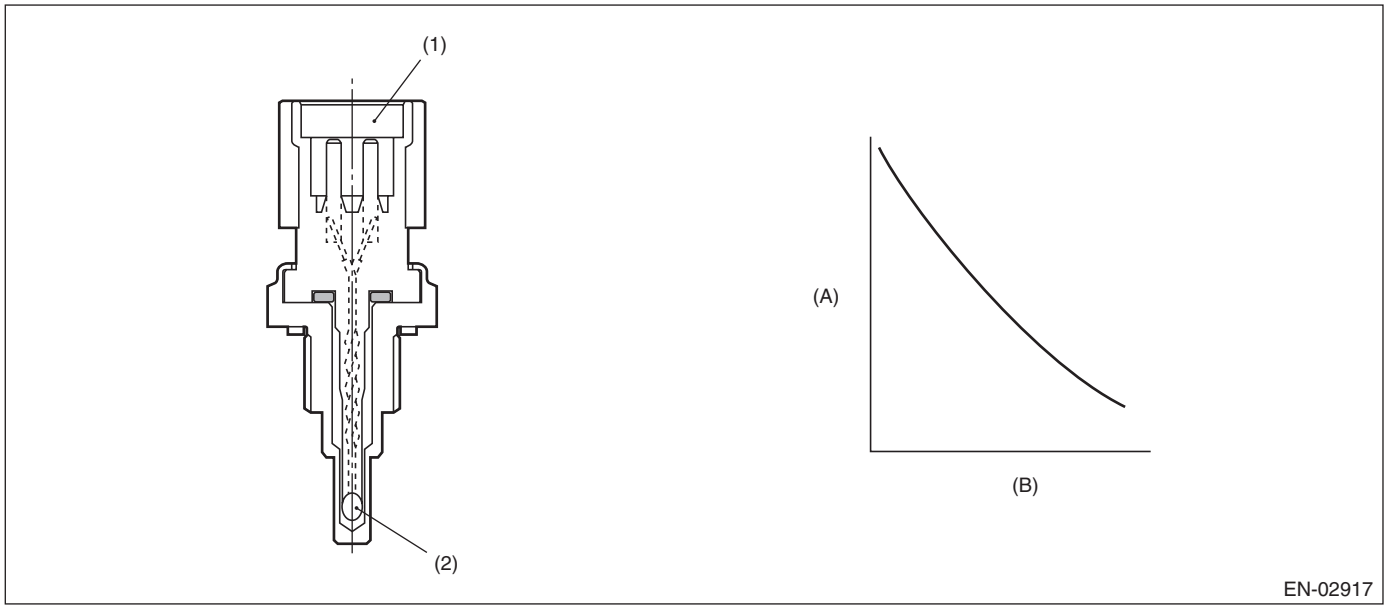
**Time Needed for Diagnosis:** Less than 1 second

# Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.
Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Refueling from the last engine stop till the current engine start | None |
| Fuel level | ≥ 15 ℓ (3.96 US gal, 3.3 Imp gal) |
| Engine coolant temperature at the last engine stop | ≥ 75 °C (167 °F) |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine coolant temperature at the last engine stop – Minimum engine coolant temperature after the engine start | < 2.5 °C (4.5°F) |
| Fuel temperature at the last engine stop – Fuel temperature | ≥ 5 °C (9°F) |
| Intake air temperature – Fuel temperature | < 2.5 °C (4.5°F) |
| Fuel temperature | < 35 °C (95 °F) |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine coolant temperature at the last engine stop – Minimum engine coolant temperature after the engine start | ≥ 2.5 °C (4.5°F) |

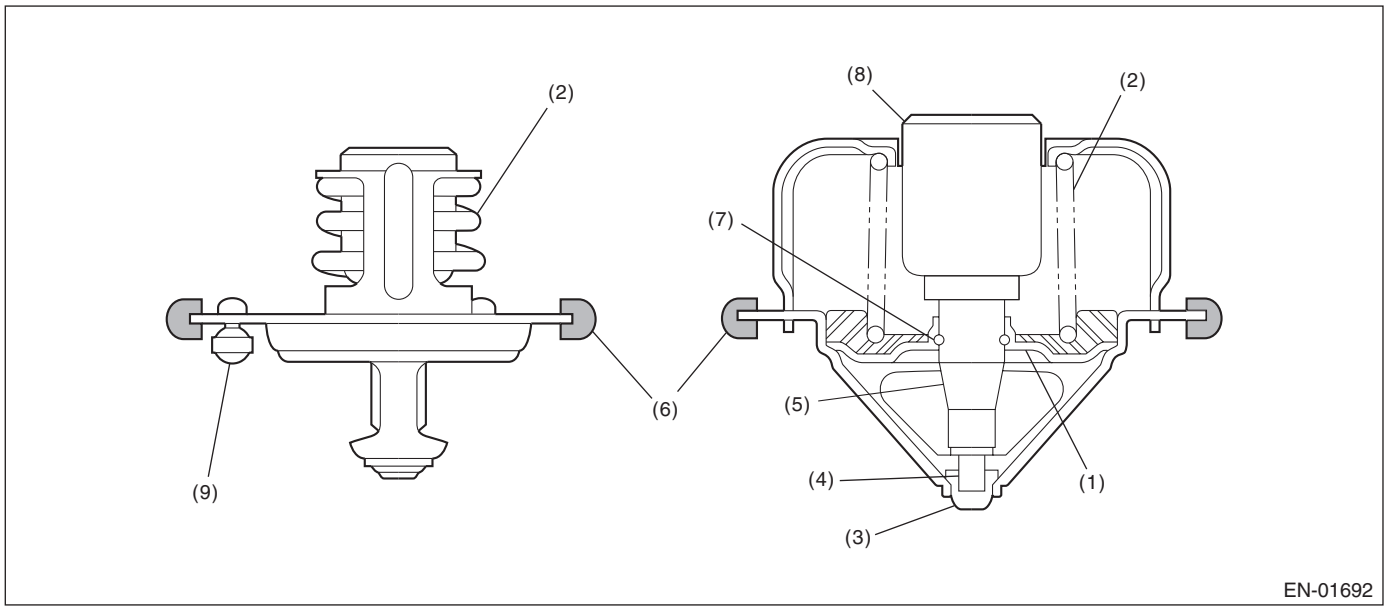
**Time Needed for Diagnosis:** Less than 1 second

# AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

## 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.
Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 75°C (167°F), and the difference is small, before judging NG.

## 2. COMPONENT DESCRIPTION




(1) Valve
(2) Spring
(3) Stopper
(4) Piston
(5) Guide
(6) Rubber seal
(7) Stop ring
(8) Wax element
(9) Jiggle valve

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Estimate ambient temperature | ≥ –7 °C (19.4 °F) |
| Thermostat malfunction diagnosis | Incomplete |
| Engine coolant temperature at engine starting | < 55 °C (131 °F) |
| Estimated coolant temperature | ≥ 75 °C (167 °F) |
| Engine coolant temperature | ≤ 75 °C (167 °F) |
| (Estimated – Measured) Engine coolant temperature | > 30 °C (54°F) |
| Vehicle speed | ≥ 30 km/h (18.6 MPH) |

**Time Needed for Diagnosis:**64 ms × 3 time(s) × 152 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Estimate ambient temperature | ≥ –7 °C (19.4 °F) |
| Thermostat malfunction diagnosis | Incomplete |
| Engine coolant temperature at engine starting | < 55 °C (131 °F) |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| (Estimated – Measured) Engine coolant temperature | ≤ 30 °C (54°F) |

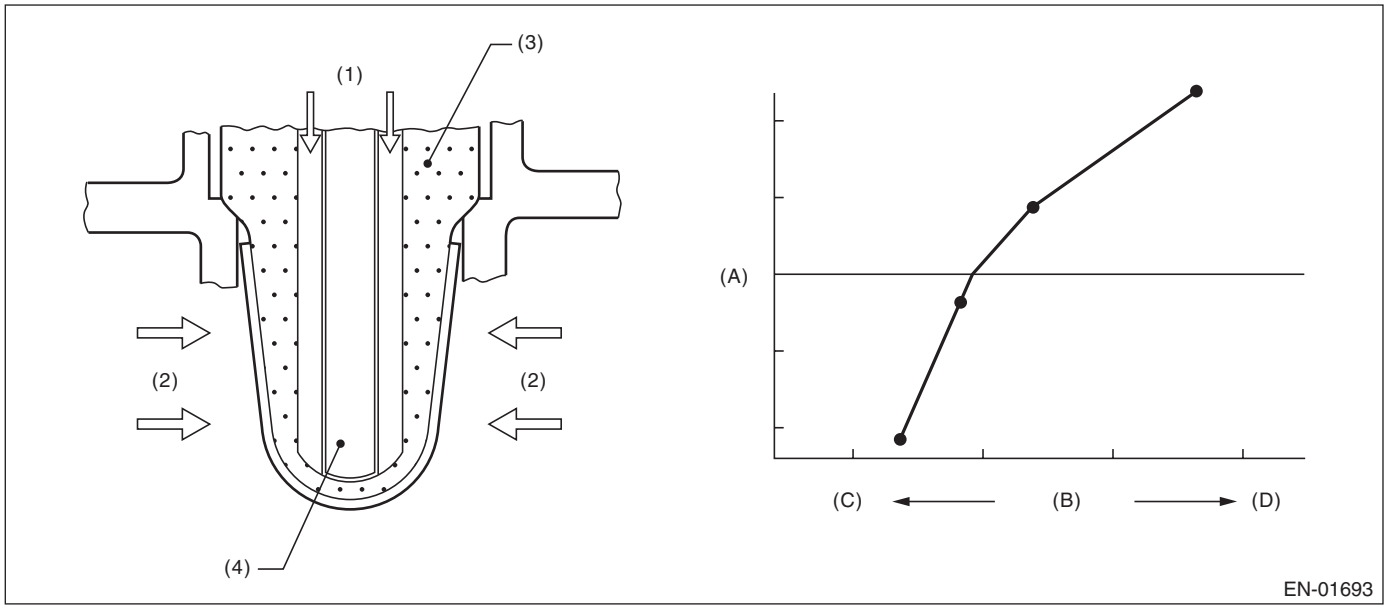
**Time Needed for Diagnosis**: Less than 1 second

# AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) $ZrO_2$
(4) Ceramic heater

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Input voltage (+) | < 1.128 V |
| or | |
| Input voltage (–) | < 0.23 V |
| or | |
| \|Input voltage (+) – Input voltage (–)\| | < 0.644 V |

**Time Needed for Diagnosis:**
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
|Input voltage (+) – Input voltage (–)|: 1000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Input voltage (+) | ≥ 1.128 V |
| Input voltage (–) | ≥ 0.23 V |
| \|Input voltage (+) – Input voltage (–)\| | ≥ 0.644 V |

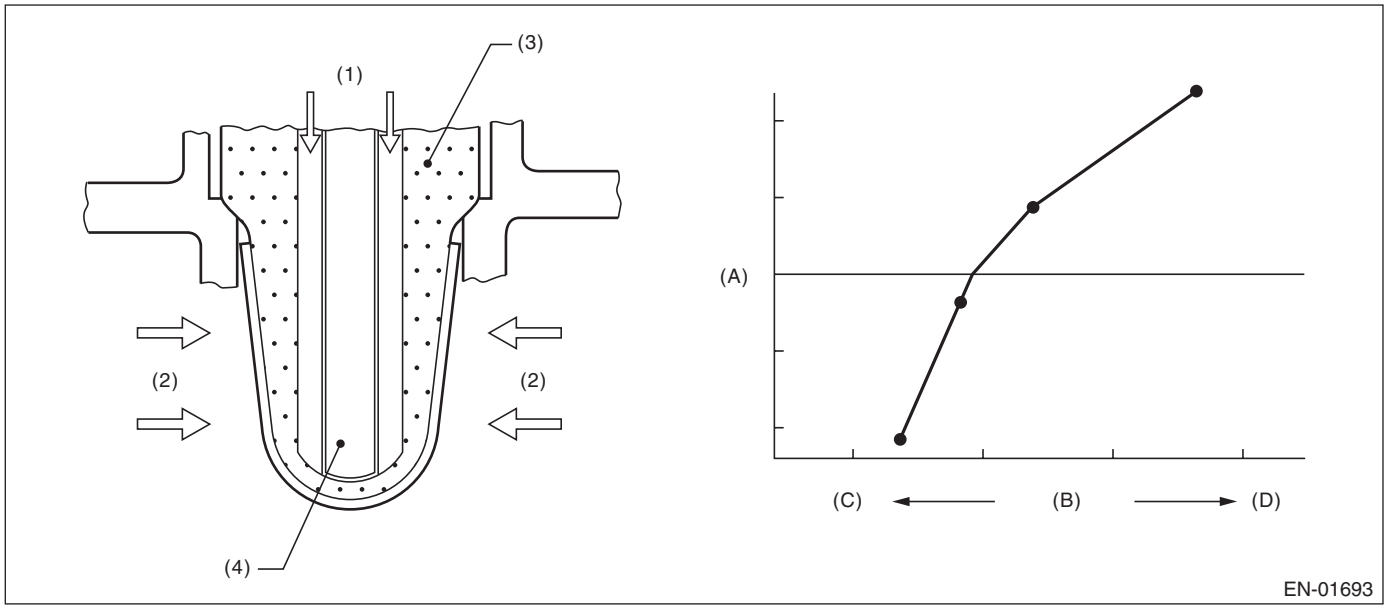
**Time Needed for Diagnosis:** Less than 1 second

# AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) $ZrO_2$
(4) Ceramic heater

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Input voltage (+) | > 3.589 V |
| or | |
| Input voltage (–) | > 3.541 V |

**Time Needed for Diagnosis:**
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

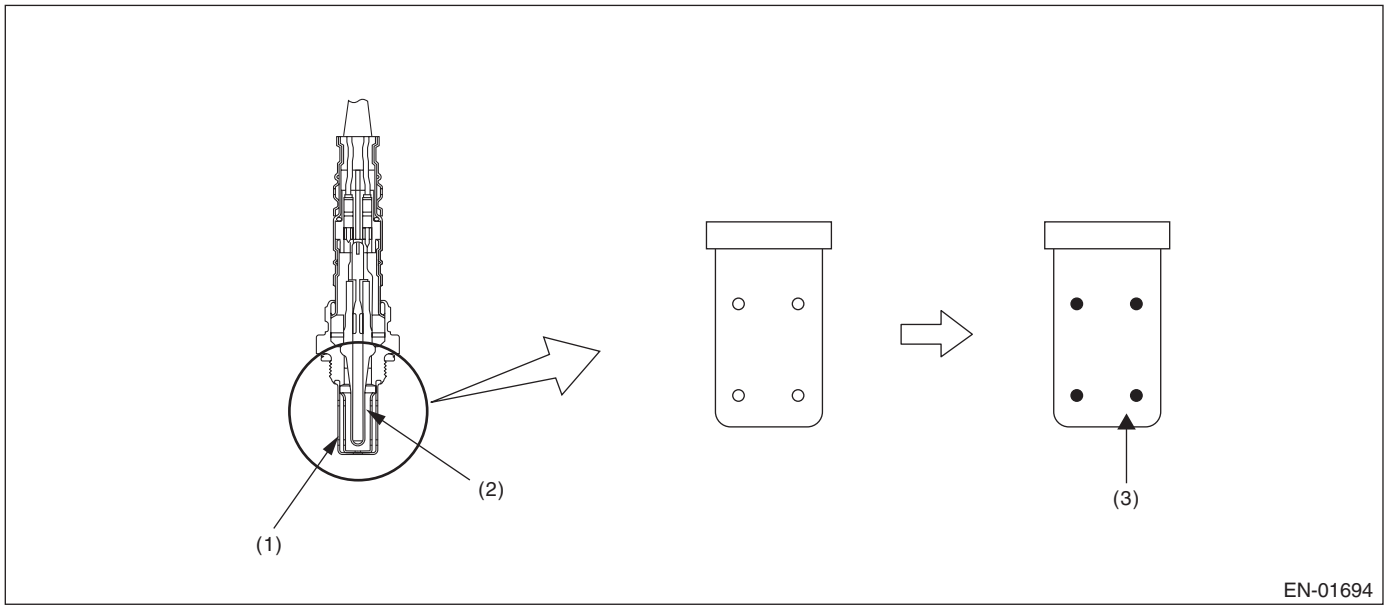
| Malfunction Criteria | Threshold Value |
|---|---|
| Input voltage (+) | ≤ 3.589 V |
| Input voltage (–) | ≤ 3.541 V |

**Time Needed for Diagnosis:** Less than 1 second

# AD:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

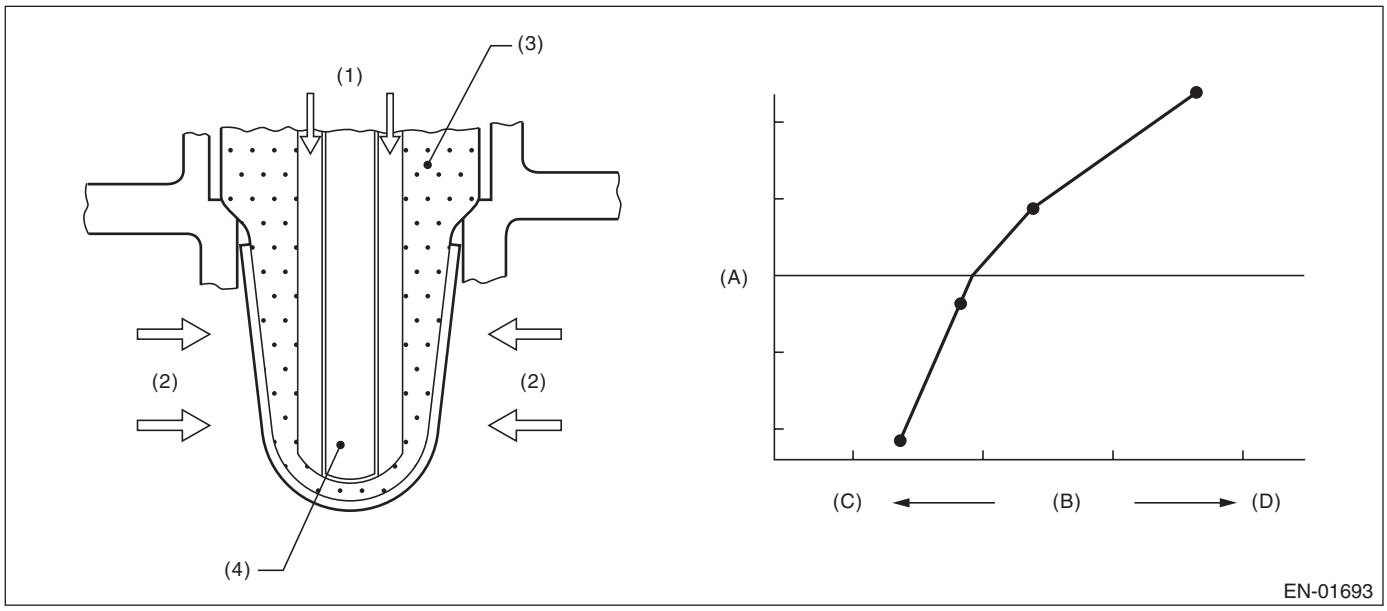
## 1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.
When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs.
Judge as NG when the actual movement in comparison to the ECM control amount is slow.




(1) Cover (2) Zirconia (3) Clogging

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(3) $ZrO_2$
(4) Ceramic heater
(2) Exhaust gas

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Time needed for all secondary parameters to be in enable conditions | ≥ 1024 ms |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | > 75 kPa (563 mmHg, 22.2 inHg) |
| Closed loop control with main feedback | Operation |
| Front oxygen (A/F) sensor impedance | 0 Ω — 50 Ω |
| Elapsed time after starting the engine | ≥ 120000 ms |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Engine speed | 1000 rpm — 3200 rpm |
| Vehicle speed | 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) |
| Amount of intake air | 10 g/s — 40 g/s (0.35 oz/s — 1.41 oz/s) |
| Engine load | < 0.02 g/rev (0 oz/rev) |
| Learning value of EVAP conc. during purge | < 0.2 |
| Total time of operating canister purge | ≥ 19.9 s |

## 4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

## 5. DIAGNOSTIC METHOD

Calculate faf difference every 32ms × 4 , and the λ value difference. 1640 time(s)Calculate the diagnosis value after calculating.

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| parafca = td2faf/td2lmd<br>where,<br>td2faf (N) = td2faf (n–1) + \|d2faf (n)\|<br>td2lmd (N) = td2lmd (n–1) + \|d2lmd (n)\|<br>add up to 32 ms × 4 × 1640 time(s).<br>d2faf (n) = (faf (n) – faf (n–1)) – (faf (n–1) – faf (n–2))<br>d2lmd (n) = (lmd (n) – lmd (n–1)) – (lmd (n–1) – lmd (n–2))<br>faf = main feedback compensation coefficient every 128 milliseconds<br>lmd = output lambda every 128 milliseconds | > 0.45 |

**Time Needed for Diagnosis:**32 ms × 4 × 1640 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| parafca = td2faf/td2lmd<br>where,<br>td2faf (N) = td2faf (n–1) + \|d2faf (n)\|<br>td2lmd (N) = td2lmd (n–1) + \|d2lmd (n)\|<br>add up to 32 ms × 4 × 1640 time(s).<br>d2faf (n) = (faf (n) – faf (n–1)) – (faf (n–1) – faf (n–2))<br>d2lmd (n) = (lmd (n) – lmd (n–1)) – (lmd (n–1) – lmd (n–2))<br>faf = main feedback compensation coefficient every 128 milliseconds<br>lmd = output lambda every 128 milliseconds | ≤ 0.45 |

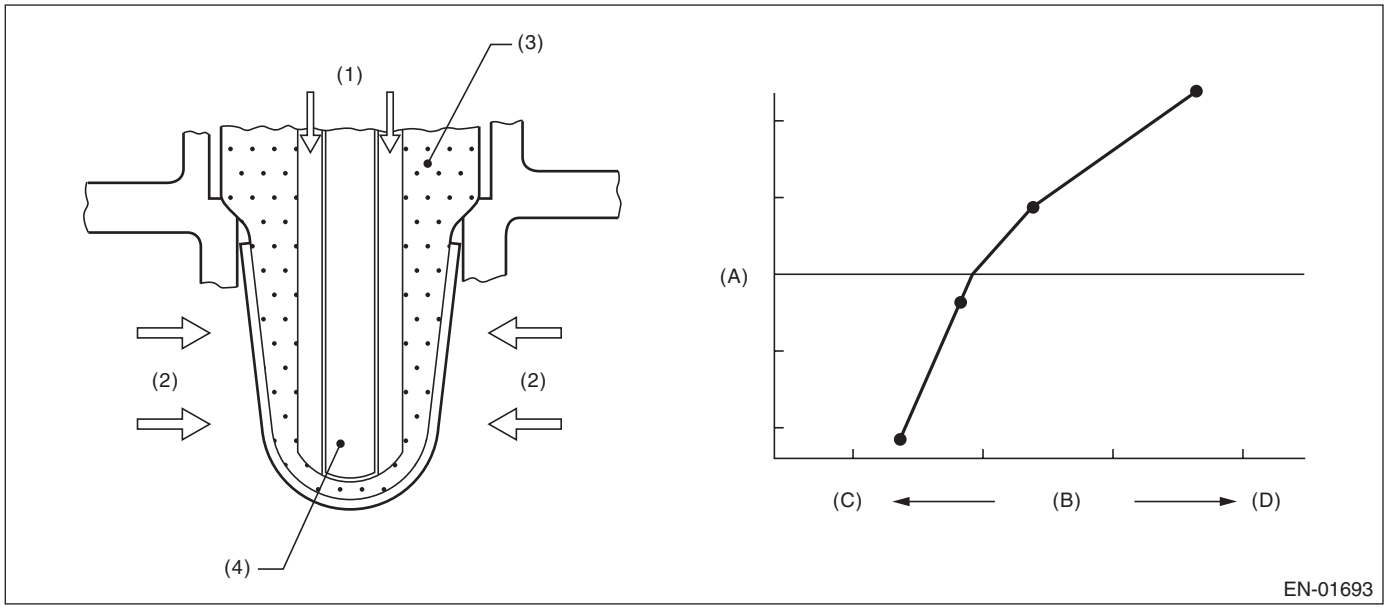
**Time Needed for Diagnosis:**32 ms × 4 × 1640 time(s)

# AE:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

## 1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.
Judge as NG when the impedance of the element is large.

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(3) $ZrO_2$
(4) Ceramic heater
(2) Exhaust gas

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Time of heater control duty at 70 % or more | ≥ 36000 ms |
| Front oxygen (A/F) sensor impedance. | > 500 Ω |

**Time Needed for Diagnosis:** 5000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Front oxygen (A/F) sensor impedance. | ≤ 500 Ω |

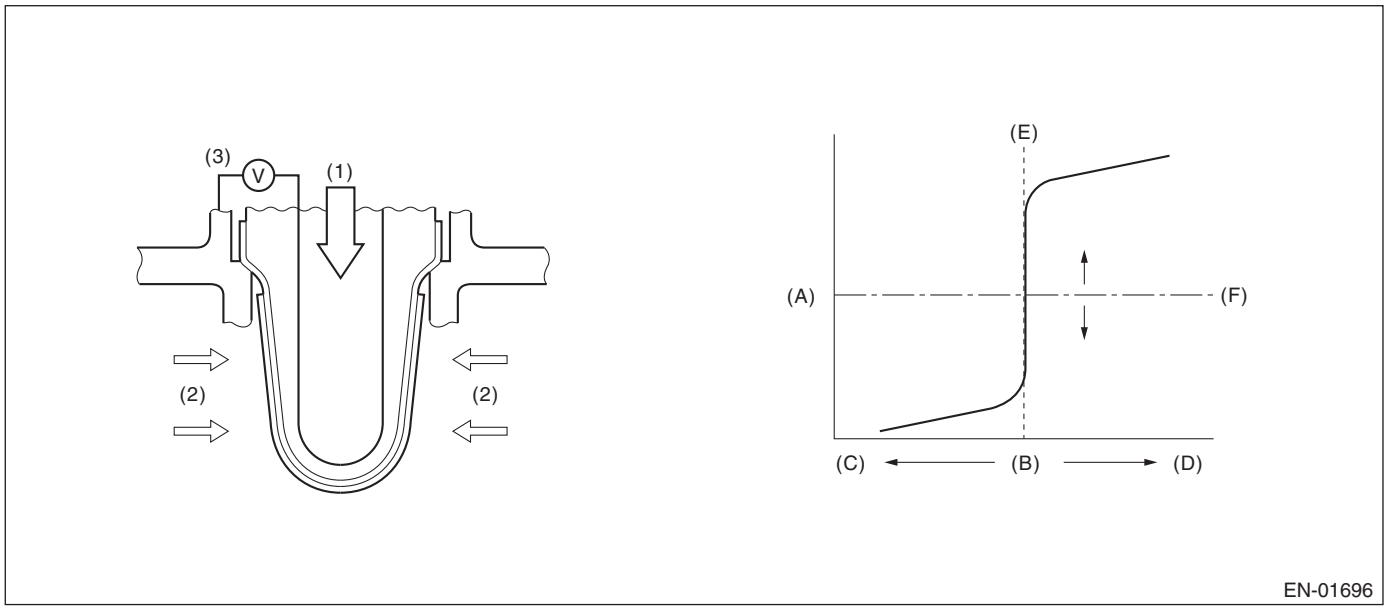
**Time Needed for Diagnosis:** Less than 1 second

# AF:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

## 1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Electromotive force | (B) | Air fuel ratio | (C) | Rich |
| (D) | Lean | (E) | Theoretical air fuel ratio | (F) | Comparative voltage |
| (1) | Atmosphere | (2) | Exhaust gas | (3) | Electromotive force |

## 3. ENABLE CONDITIONS

### Used for abnormality judgment

| Secondary Parameters | Enable Conditions |
|---|---|
| **High** | |
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| **Low (1)** | |
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Amount of intake air | ≥ 10 g/s (0.35 oz/s) |
| **Low (2)** | |
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Amount of intake air | < 10 g/s (0.35 oz/s) |
| Current continuation time of the rear oxygen sensor heater | ≥ 30000 ms |
| **Low (3)** | |
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Amount of intake air | < 10 g/s (0.35 oz/s) |
| Current continuation time of the rear oxygen sensor heater | ≥ 30000 ms |
| Fuel cut | Experienced |

### Used for normality judgment

| Secondary Parameters | Enable Conditions |
|---|---|
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 75 °C (167 °F) |

### 4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

### 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| **High**<br>Sensor output voltage | > 1.2 V | P0138 |
| **Low**<br>Sensor output voltage | < 0.03 V | P0137 |

**Time Needed for Diagnosis**

High: 2500 ms
Low (1): 20000 ms
Low (2): 40000 ms
Low (3): Value from Map

**Map**

| Fuel Cut Time (s) | 0 | 2000 | 10000 |
|---|---|---|---|
| Time needed for diagnosis (s) | 40000 | 40000 | 60000 |

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| **High**<br>Sensor output voltage | ≤ 1.2 V | P0138 |
| **Low**<br>Sensor output voltage | ≥ 0.03 V | P0137 |

**Time Needed for Diagnosis**

High: Less than 1 second
Low (1): Less than 1 second
Low (2): Less than 1 second
Low (3): Less than 1 second

## AG:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0137. <Ref. to GD(H4SO)-56, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# AH:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

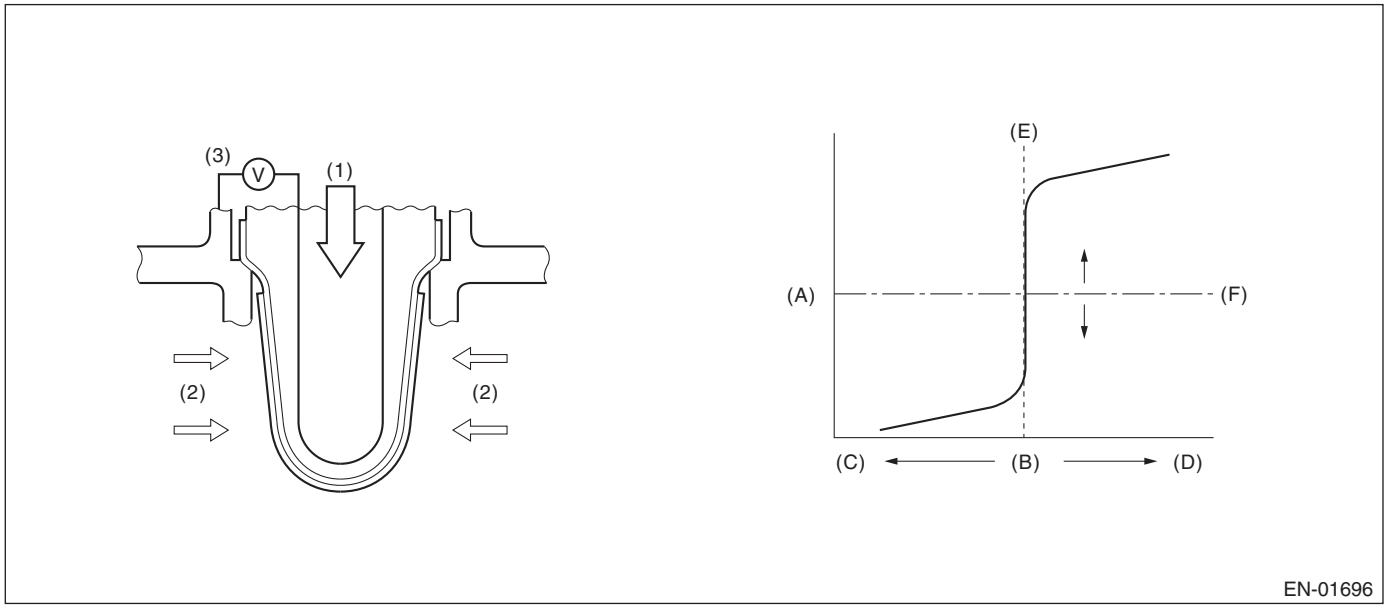
## 1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.
Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and judge as OK if both are OK.
[Rich → lean diagnosis response]
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK. Response time calculation is categorized in two by voltage difference.
   - Response time in small voltage difference: Intermediate
   - Response time in large voltage difference: Wide
2. Judge as NG when the oxygen sensor voltage is large (rich) even after deceleration fuel cut has occurred.
[Lean → rich diagnosis response]
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.
2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

**Diagnostic method**

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured response time is larger than the threshold value.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Electromotive force | (B) | Air fuel ratio | (C) | Rich |
| (D) | Lean | (E) | Theoretical air fuel ratio | (F) | Comparative voltage |
| (1) | Atmosphere | (2) | Exhaust gas | (3) | Electromotive force |

## 3. ENABLE CONDITIONS

Rich → lean diagnosis response

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| A/F main feedback control condition | Completed |
| Deceleration fuel cut time of 5000 ms or more (intermediate)<br>Deceleration fuel cut time of 5000 ms or more (wide) | Experienced |
| After fuel cut | ≥ 2000 ms (Intermediate)<br>≥ 2000 ms (Wide) |
| Estimated temperature of the rear oxygen sensor element | ≥ 500 °C (932 °F) (Intermediate)<br>≥ 500 °C (932 °F) (Wide) |
| Number of deceleration fuel cut | ≥ 1 time(s) |

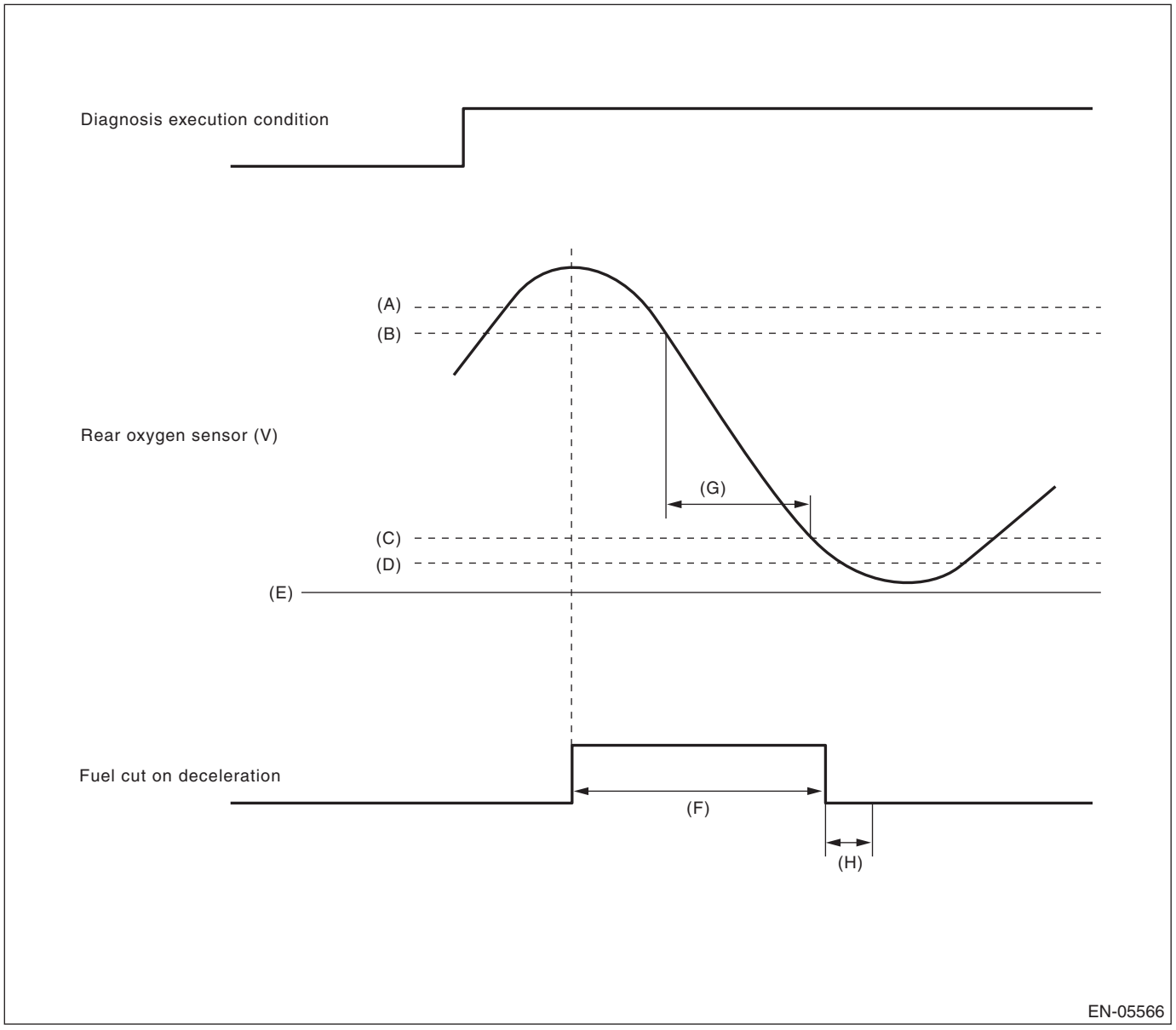
## 4. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

## 5. DIAGNOSTIC METHOD

- Intermediate

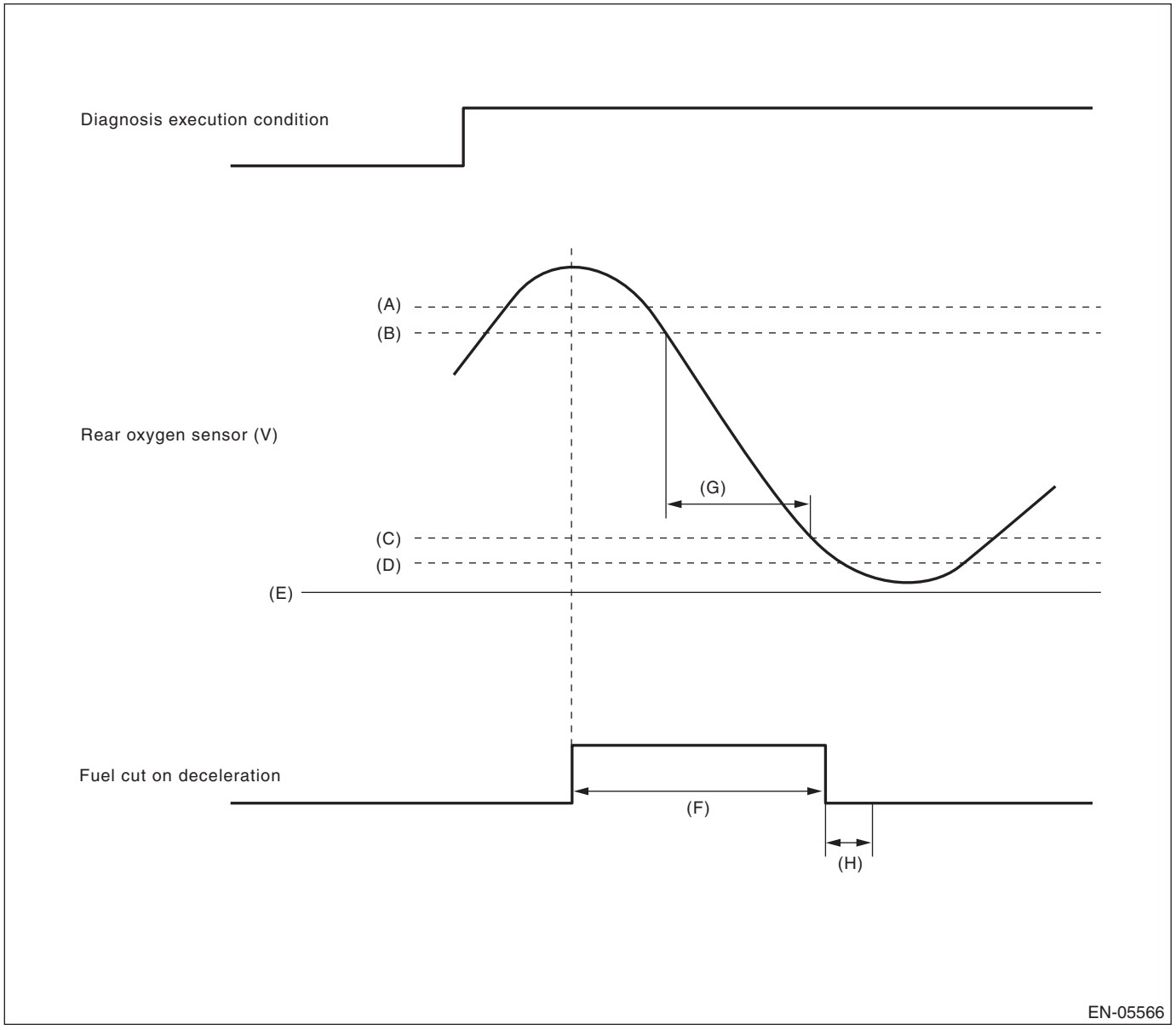
When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.




(A) 0.55 V
(B) 0.5 V
(C) 0.2 V
(D) 0.15 V
(E) 0 V
(F) More than 5000 ms
(G) Measure the response time.
(H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- Wide

When the oxygen sensor output voltage changes from 0.65 V (rich) to 0.05 V (lean), calculate the minimum response time for output change between 0.6 V and 0.1 V for the judgment criteria.




(A) 0.65 V
(B) 0.6 V
(C) 0.1 V
(D) 0.05 V
(E) 0 V
(F) More than 5000 ms
(G) Measure the response time.
(H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- **Abnormality Judgment**

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > threshold value → abnormal

NOTE:
Perform NG judgment only during fuel cut, when exhaust gas apparently changes from rich → lean. Even without deceleration fuel cut, judge as OK if the value is below the threshold.
2) Judge as NG when the oxygen sensor voltage at a deceleration fuel cut is large.
Judge as NG when oxygen sensor voltage is large even after a long period of deceleration fuel cut has completed.

**Judgment value (intermediate)**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from rich (0.5 V $O_2$ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V | > 491 ms |
| or | |
| Longest time over 0.55 V | ≥ 2000 ms |

**Judgment value (Wide)**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from rich (0.6 V $O_2$ output) to lean (0.1 V) when voltage reduces from 0.65 V to 0.05 V | > Value from Map |
| or | |
| Longest time over 0.65 V | ≥ 2000 ms |

**Map**

| Estimated temperature of rear oxygen sensor element when fuel cut starts °C (°F) | 0 (32) | 450 (842) | 500 (932) | 1000 (1832) |
|---|---|---|---|---|
| Longest time in rich status after fuel cut (ms) | 2000 | 2000 | 2000 | 2000 |

**Time Needed for Diagnosis:** 1 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

• **Normality Judgment**

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.
Response time (diagnosis value) ≤ threshold value → normal
2) Do not judge as a normal condition.
Judge as OK and clear the NG if the following conditions are established.

**Judgment value (intermediate)**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from rich (0.5 V $O_2$ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V | ≤ 491 ms |

**Judgment value (Wide)**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from rich (0.6 V $O_2$ output) to lean (0.1 V) when voltage reduces from 0.65 V to 0.05 V | ≤ 2000 ms |

**Time Needed for Diagnosis:** 1 time(s)

## 6. ENABLE CONDITIONS

Lean → rich response diagnosis

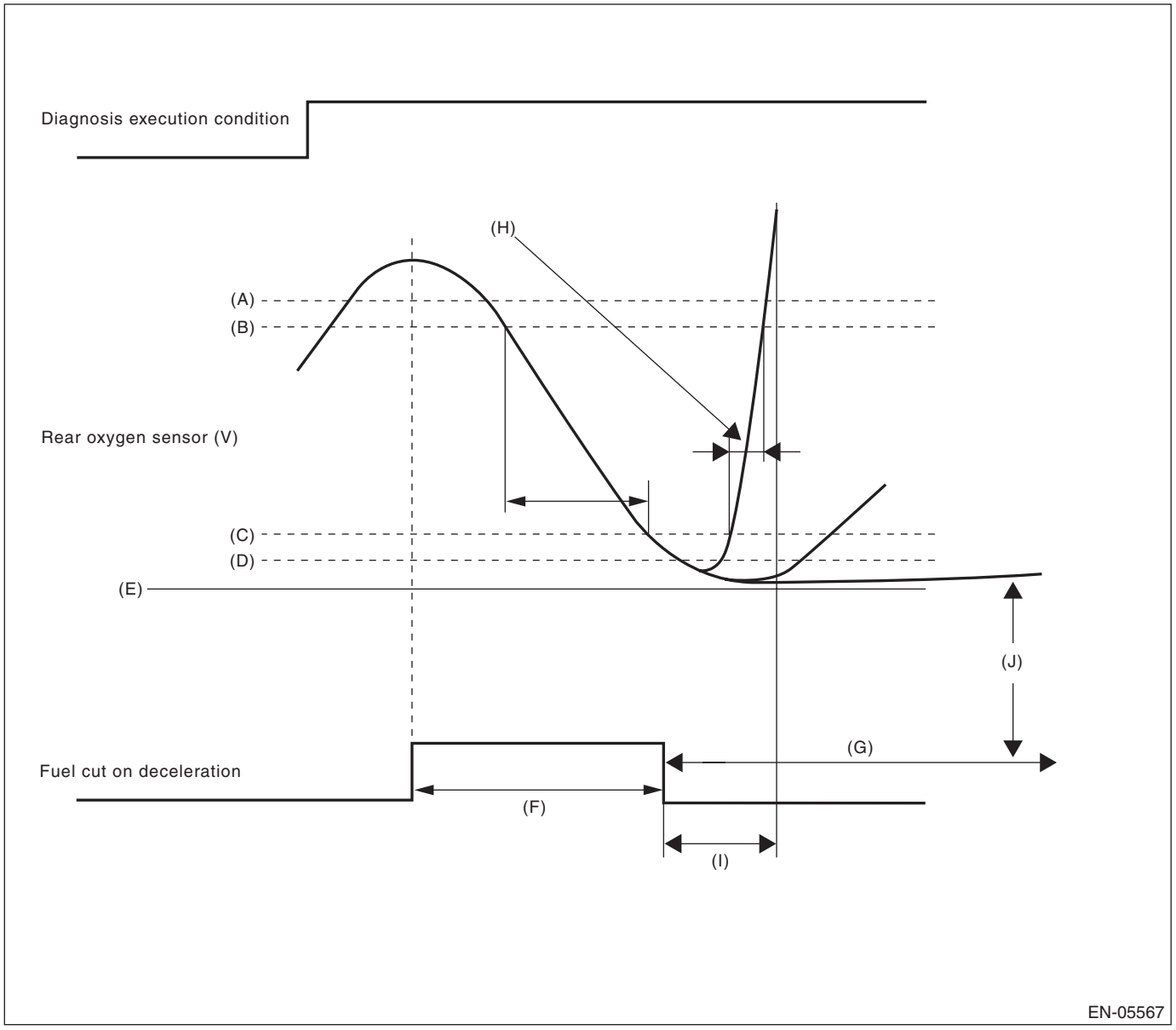
| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| A/F main feedback control condition | Completed |
| Deceleration fuel cut time is 6000 ms or more. | Experienced |
| After fuel cut | ≥ 2000 ms |
| Number of deceleration fuel cut | ≥ 1 time(s) |

## 7. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

## 8. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.




(A) 0.55 V
(B) 0.5 V
(C) 0.3 V
(D) 0.25 V
(E) 0 V
(F) More than 5 seconds
(G) More than 120000 ms
(H) Measure the response time (diagnostic value).
(I) Execute the malfunction judgment in 4000 ms from the recovery of fuel cut on deceleration.
(J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration.

**• Abnormality Judgment**

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > threshold value → abnormal
2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from lean (0.3 V $O_2$ output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V | > 4000 ms |
| or | |
| Longest time under 0.25 V | ≥ 120000 ms |

**Time Needed for Diagnosis:** 1 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.
Response time (diagnosis value) ≤ threshold value → normal
2) Do not judge as a normal condition.
Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Shortest time change from lean (0.3 V $O_2$ output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V | ≤ 4000 ms |

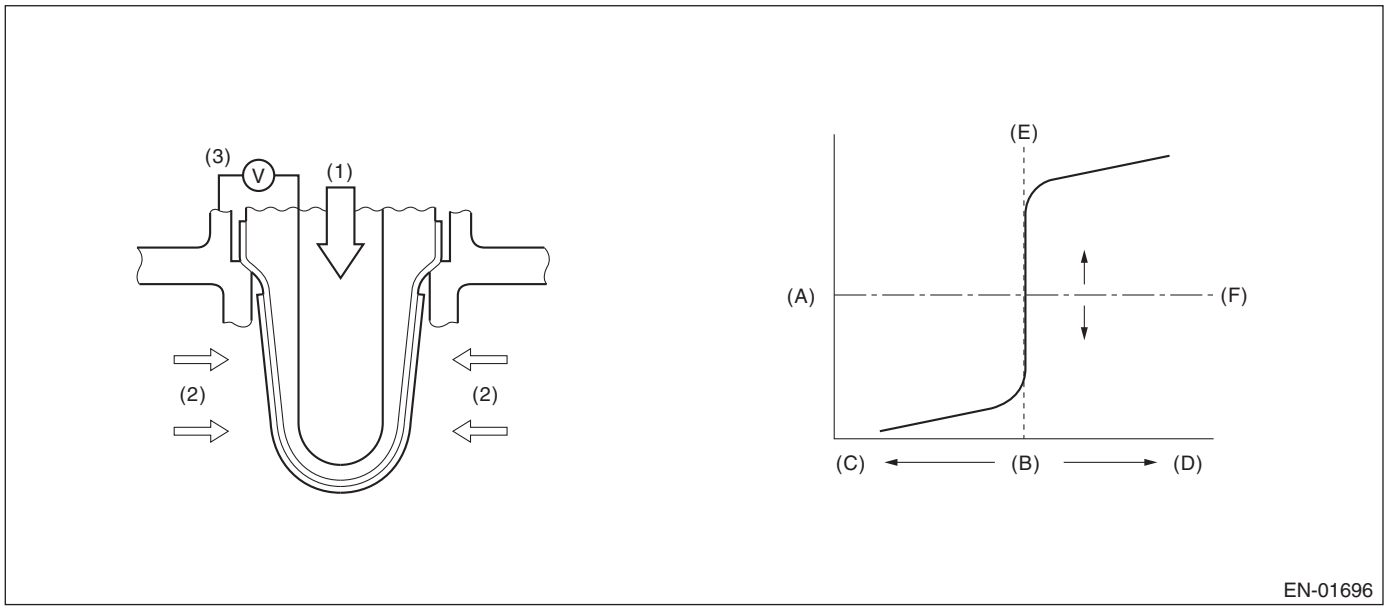
**Time Needed for Diagnosis:** 1 time(s)

# AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2)

## 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Electromotive force | (B) | Air fuel ratio | (C) | Rich |
| (D) | Lean | (E) | Theoretical air fuel ratio | (F) | Comparative voltage |
| (1) | Atmosphere | (2) | Exhaust gas | (3) | Electromotive force |

## 3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

| Secondary Parameters | Enable Conditions |
|---|---|
| Closed loop control at the rear oxygen sensor | In operation |
| Target output voltage of rear oxygen sensor | ≥ 0.55 V + 0.05 V |
| Amount of intake air | ≥ 10 g/s (0.35 oz/s) |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Deceleration fuel cut of 5000 ms or more. | Experienced |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Minimum output voltage | > 0.15 V |
| or | |
| Maximum output voltage | < 0.55 V |

**Time Needed for Diagnosis:** 200000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Diagnosis of the rear oxygen sensor voltage low side | Incomplete |
| Minimum output voltage | ≤ 0.15 V |
| Maximum output voltage | ≥ 0.55 V |

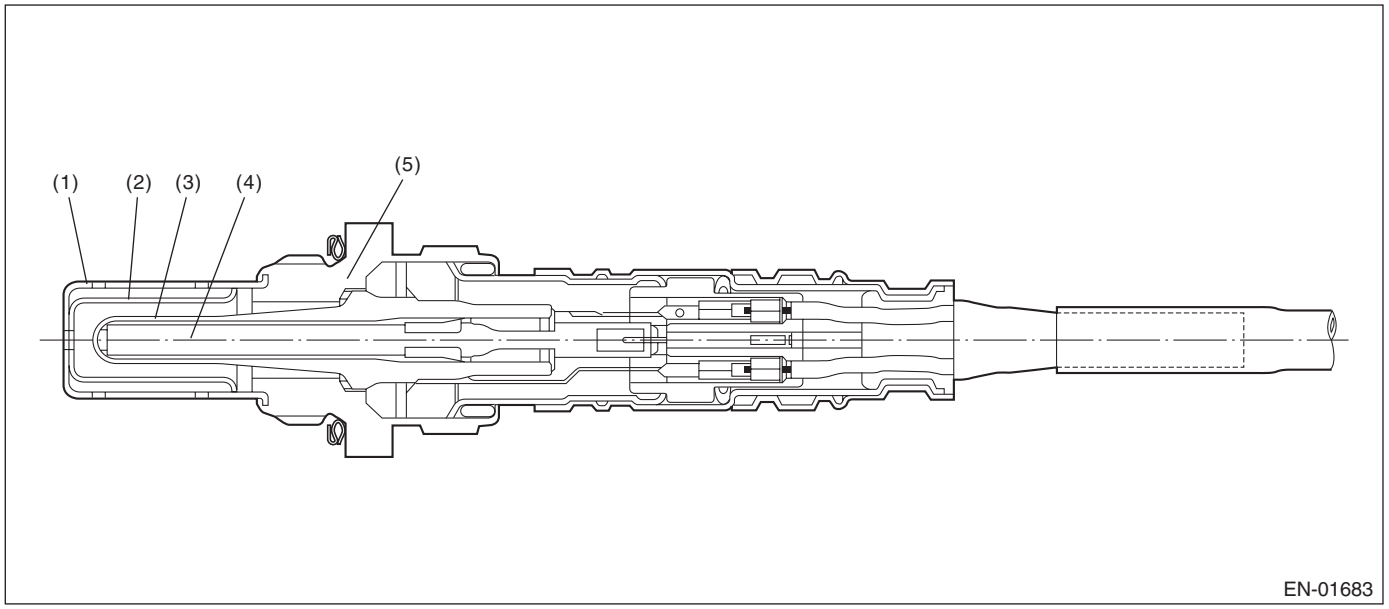
**Time Needed for Diagnosis:** Less than 1 second

# AJ:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

## 1. OUTLINE OF DIAGNOSIS

Detect malfunction of the rear oxygen sensor heater.
Judge as NG if it is determined that the rear oxygen sensor impedance is large by observing the engine conditions.

## 2. COMPONENT DESCRIPTION




(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1000 ms |
| Engine coolant temperature | ≥ 200 °C (392 °F) |
| A/F sensor element impedance | ≤ 50 Ω |
| A/F sensor heater control duty | ≤ 75 % |
| Rear oxygen sensor heater control duty | < 70 % |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 1000 ms seconds or more have passed since the engine started.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output terminal for heater characteristics failure detection | Low |

**Time Needed for Diagnosis:**4 ms × 2500 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output terminal for heater characteristics failure detection | High |

**Time Needed for Diagnosis:**4 ms × 2500 time(s)

# AK:DTC P0171 SYSTEM TOO LEAN (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

**Diagnostic method**

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| A/F main learning system | In operation |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Engine load change | < 0.02 g/rev (0 oz/rev) |
| Engine load | ≥ Value of Map 1 |

**Map 1**

| Engine speed (rpm) | Idling | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 |
|---|---|---|---|---|---|---|---|---|---|---|
| Measured value (g(oz)/rev) | na | 0.208 (0.01) | 0.201 (0.01) | 0.185 (0.01) | 0.183 (0.01) | 0.193 (0.01) | 0.206 (0.01) | 0.206 (0.01) | 0.225 (0.01) | 0.245 (0.01) |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 5 time(s) or more, judge that there is a fault in the fuel system.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| fsobd = (sglmd – tglmda) + faf + flaf<br>In this case: sglmd = measured lambda<br>tglmda = target lambda<br>faf = main feedback compensation coefficient (every 64 ms)<br>flaf = main feedback learning compensation coefficient | ≥ Value of Map 2 |

**Map 2**

| Amount of air (g (oz)/s) | 0 (0) | 3.2 (0.11) | 6.4 (0.23) | 9.6 (0.34) | 12.8 (0.45) | 16 (0.56) | 19.2 (0.68) |
|---|---|---|---|---|---|---|---|
| fsobdL1 (%) | 1.4 | 1.4 | 1.332 | 1.265 | 1.265 | 1.265 | 1.265 |

**Time Needed for Diagnosis:** 10 s × 5 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| fsobd = (sglmd – tglmda) + faf + flaf | < 1.2 |

**Time Needed for Diagnosis:** 10 s

# AL:DTC P0172 SYSTEM TOO RICH (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

**Diagnostic method**

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| A/F main learning system | In operation |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Engine load change | ≤ 0.02 g/rev (0 oz/rev) |
| Learning value of EVAP conc. | < 0.15 |
| Cumulative time of canister purge after engine start | ≥ 20 s |
| Continuous period after canister purge starting | ≥ 29884 ms |
| Engine load | ≥ Value of Map 1 |

**Map 1**

| Engine speed (rpm) | Idling | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 |
|---|---|---|---|---|---|---|---|---|---|---|
| Measured value (g(oz)/rev) | na | 0.208 (0.01) | 0.201 (0.01) | 0.185 (0.01) | 0.183 (0.01) | 0.193 (0.01) | 0.206 (0.01) | 0.206 (0.01) | 0.225 (0.01) | 0.245 (0.01) |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 5 time(s) or more, judge that there is a fault in the fuel system.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| fsobd = (sglmd – tglmda) + faf + flaf<br>In this case: sglmd = measured lambda<br>tglmda = target lambda<br>faf = main feedback compensation coefficient (every 64 ms)<br>flaf = main feedback learning compensation coefficient | < Value of Map 2 |

**Map 2**

| Amount of air (g (oz)/s) | 0 (0) | 3.2 (0.11) | 6.4 (0.23) | 9.6 (0.34) | 12.8 (0.45) | 16 (0.56) | 19.2 (0.68) |
|---|---|---|---|---|---|---|---|
| fsobdL1 (%) | 0.6 | 0.6 | 0.668 | 0.735 | 0.735 | 0.735 | 0.735 |

**Time Needed for Diagnosis:** 10 s × 5 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK when the malfunction criteria below continues for 10 seconds.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| fsobd = (sglmd – tglmda) + faf + flaf | ≥ 0.8 |

**Time Needed for Diagnosis:** 10 s

# AM:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect faults in the fuel temperature sensor output properties.
Diagnosis is performed in two methods (drift diagnosis and stuck diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

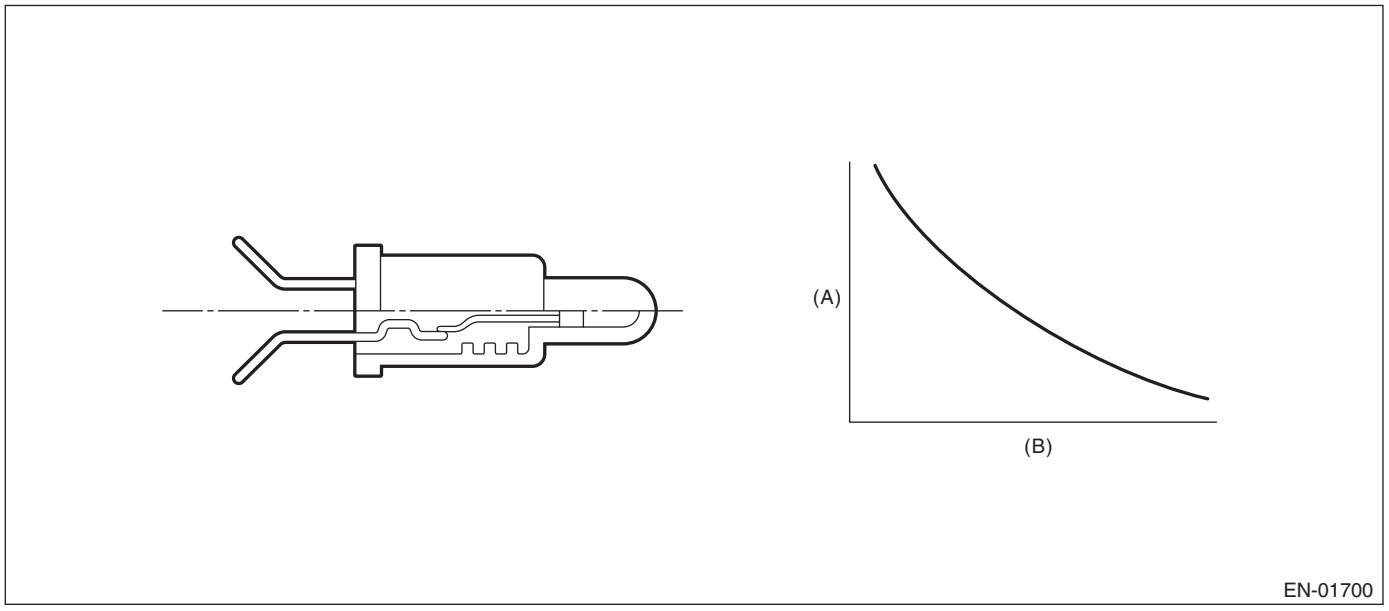
### DRIFT DIAGNOSIS

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and judged as NG.

#### Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (Ω)  (B) Fuel temperature °C (°F)

## 3. ENABLE CONDITIONS

### DRIFT DIAGNOSIS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Elapsed time after starting the engine | ≥ 20 s |
| Engine coolant temperature – Engine coolant temperature at engine start | > 10 °C (18°F) |
| Fuel temperature – Engine coolant temperature | ≥ 10 °C (18°F) |
| Battery voltage | ≥ 10.9 V |

**Time Needed for Diagnosis:** 120 s
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Elapsed time after starting the engine | ≥ 20 s |
| Engine coolant temperature – Engine coolant temperature at engine start | > 10 °C (18°F) |
| Fuel temperature – Engine coolant temperature | < 10 °C (18°F) |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | < 75 °C (167 °F) |

**Time Needed for Diagnosis:** Less than 1 second

## 6. ENABLE CONDITIONS

**Stuck Diagnosis**

| Secondary Parameters | Enable Conditions |
|---|---|
| Elapsed time after starting the engine | ≥ 20000 ms |
| Battery voltage | ≥ 10.9 V |

## 7. GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

## 8. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Accumulated amount of intake air | ≥ 551043 g (19435.29 oz) |
| Fuel temperature difference between Max. and Min. | < 2 °C (3.6°F) |

**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel temperature difference between Max. and Min. | ≥ 2 °C (3.6°F) |

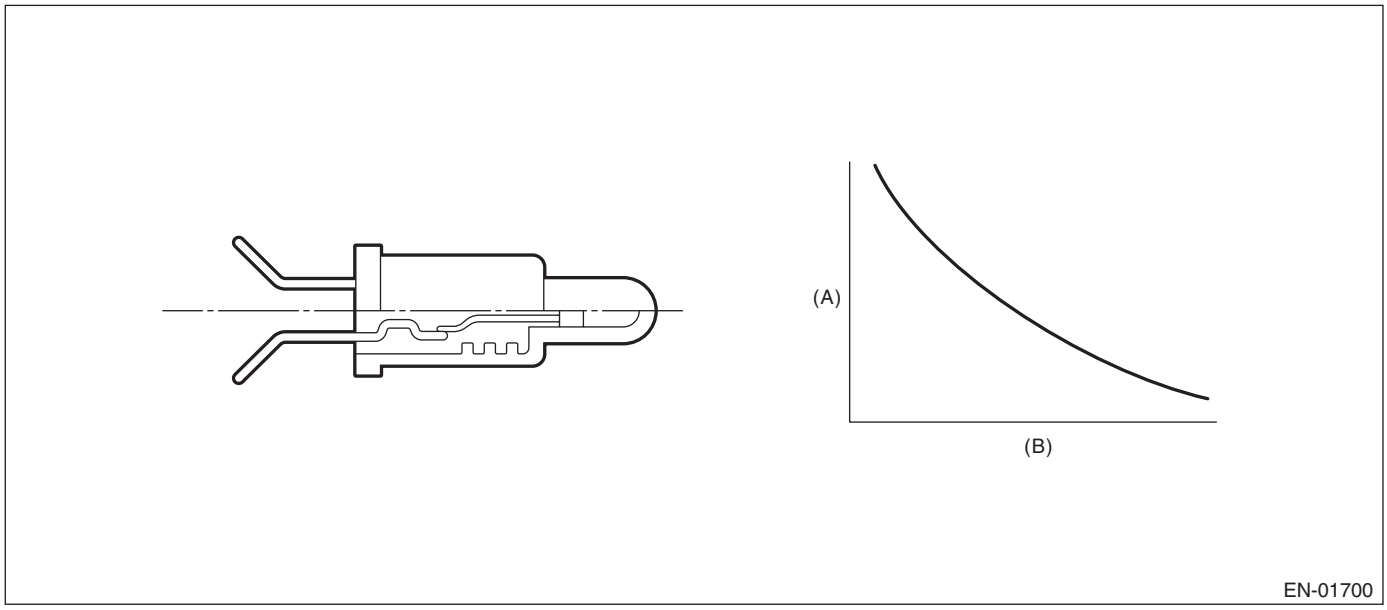
**Time Needed for Diagnosis:** Less than 1 second

# AN:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 0.344 V |
| Battery voltage | ≥ 10.9 V |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 0.344 V |
| Battery voltage | ≥ 10.9 V |

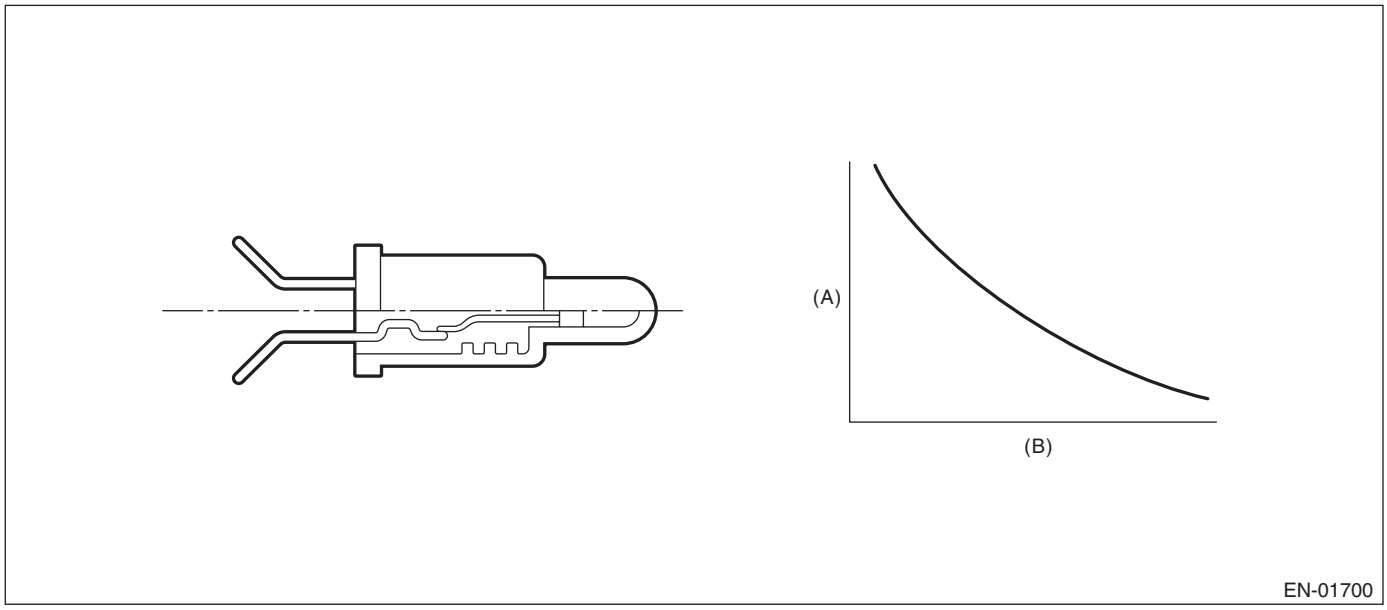
**Time Needed for Diagnosis:** Less than 1 second

# AO:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.716 V |
| Battery voltage | ≥ 10.9 V |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.716 V |
| Battery voltage | ≥ 10.9 V |

**Time Needed for Diagnosis:** Less than 1 second

# AP:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect for abnormal values in the oil temperature sensor output properties.
Judge as NG when the oil temperature does not rise even though the engine is running under a condition where it should rise.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Engine speed | ≥ Value from Map |

**Map**

| Engine coolant temperature °C (°F) | –40 (–40) | –30 (–22) | –20 (–4) | –10 (14) | 0 (32) | 10 (50) | 20 (68) | 30 (86) |
|---|---|---|---|---|---|---|---|---|
| Engine speed rpm | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |

| Engine coolant temperature °C (°F) | 40 (104) | 50 (122) | 60 (140) | 70 (158) | 80 (176) | 90 (194) | 100 (212) | 110 (230) |
|---|---|---|---|---|---|---|---|---|
| Engine speed rpm | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine oil temperature<br>After engine start oil temperature sensor characteristic diagnosis timer. | < 15 °C (59 °F)<br>≥ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer |

After engine start oil temperature sensor characteristic diagnosis timer (timer for diagnosis).

a. Timer stop at fuel cut
b. During the driving conditions except a) above, timer counts up as follows.
64 ms + TOILCNT ms (at 64 ms)
Where, TOILCNT is determined as follows,
TOILCNT = 0 at idle switch ON
For TOILCNT at Idle switch off, refer to the following table.

| | | Vehicle speed km/h (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 (0) | 8 (5) | 16 (9.9) | 24 (14.9) | 32 (19.9) | 40 (24.9) | 48 (29.8) | 56 (34.8) |
| Temperature °C (°F) | –30 (–22) | 64 ms | 73.2 ms | 83.9 ms | 96.3 ms | 113.2 ms | 133.9 ms | 160.2 ms | 194.6 ms |
| | –20 (–4) | 64 ms | 73.3 ms | 84 ms | 96.6 ms | 113.7 ms | 135 ms | 162 ms | 197.4 ms |
| | –10 (14) | 64 ms | 73.4 ms | 84.2 ms | 96.9 ms | 114.5 ms | 136.4 ms | 164.4 ms | 201.5 ms |
| | 0 (32) | 64 ms | 73.5 ms | 84.5 ms | 97.4 ms | 115.6 ms | 138.5 ms | 168 ms | 207.6 ms |
| | 10 (50) | 102.2 ms | 114.8 ms | 129.4 ms | 146.7 ms | 171.7 ms | 203.4 ms | 245.1 ms | 302.1 ms |

After engine start oil temperature characteristic diagnosis timer judgment value (t).
$t = 1882940 \text{ ms} - 43302 \text{ ms} \times Ti$ ($t \geq 2400000$)
Ti = The lowest coolant temperature after starting the engine.
**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine oil temperature | ≥ 15 °C (59 °F) |

**Time Needed for Diagnosis:** Less than 1 second

# AQ:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 0.166 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 0.166 V |

**Time Needed for Diagnosis:** Less than 1 second

# AR:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.716 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.716 V |

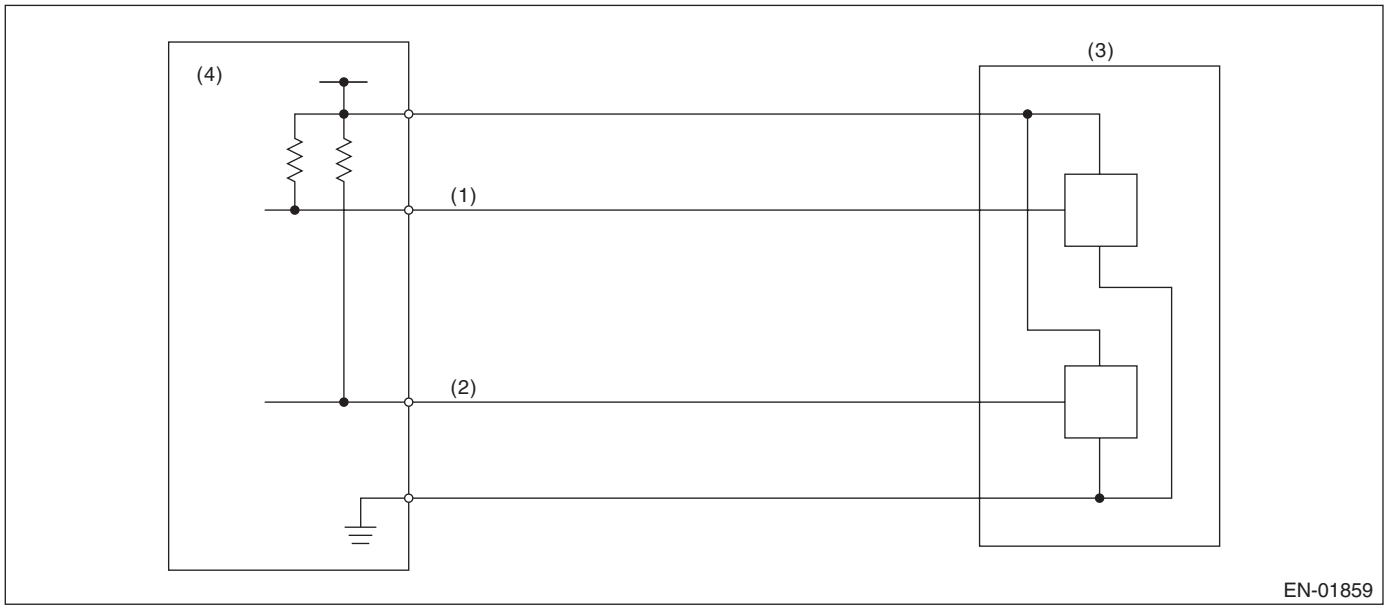
**Time Needed for Diagnosis:** Less than 1 second

# AS:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | ≤ 0.926 V |

**Time Needed for Diagnosis:** 24 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | > 0.926 V |

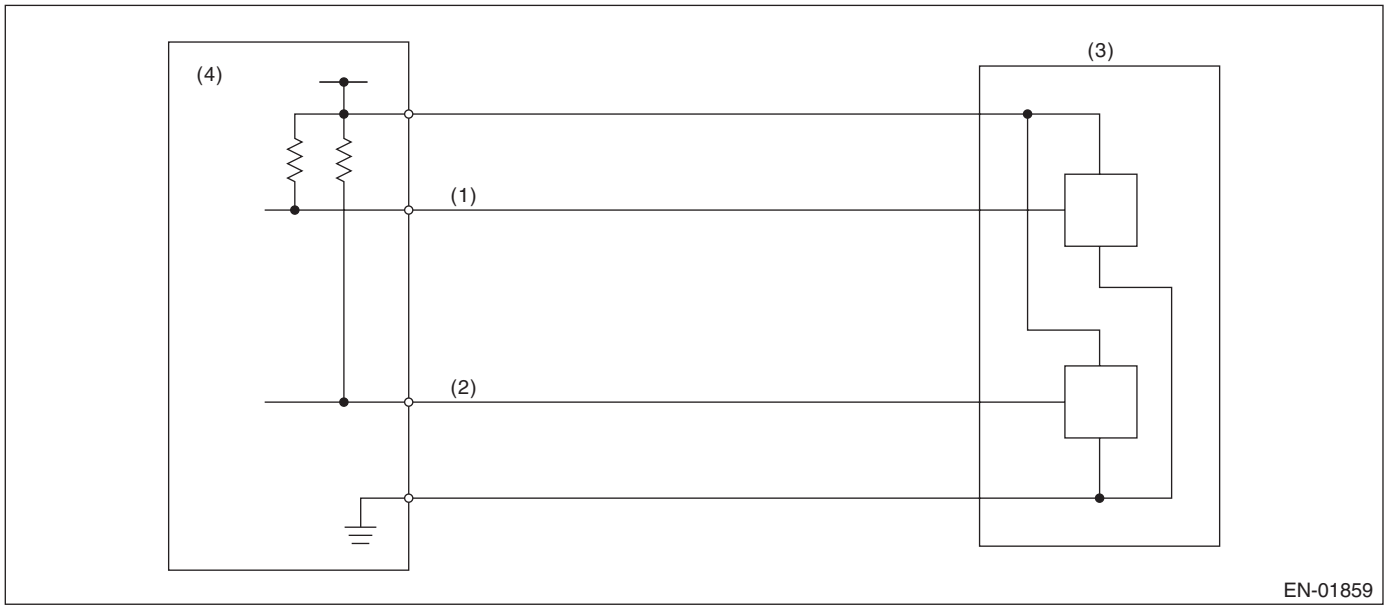
**Time Needed for Diagnosis:** 24 ms

# AT:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | ≥ 4.858 V |

**Time Needed for Diagnosis:** 24 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | < 4.858 V |

**Time Needed for Diagnosis:** 24 ms

# AU:DTC P0301 CYLINDER 1 MISFIRE DETECTED

## 1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)
Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below. :

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.
1) Intermittent misfire: FTP 1.5 times misfire

- 180° Interval Difference Method (MT: 1,800 rpm or less; AT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| All secondary parameters enable conditions | ≥ 1024 ms |
| Intake manifold pressure change at 180°CA | < Value of Map 1 |
| Throttle position change during 16 milliseconds | < 21 ° |
| Fuel shut-off function | Not in operation |
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Vehicle dynamic control or AT torque control | Not in operation |
| Evaporative system leak check | Not in operation |
| Engine speed | 460 rpm — 6300 rpm |
| Intake manifold pressure | ≥ Value of Map 2 |
| Battery voltage | ≥ 8 V |
| Fuel parameter determination | Not extremely low volatility |
| Elapsed time after starting the engine | ≥ 0 ms |
| Engine load change during 32 milliseconds | < 1000 rpm |

**Map 1**

- AT model

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) |

- MT model

| rpm | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) |

**Map 2**

- AT model

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 26 (195.0, 7.7) | 23.9 (179.5, 7.1) | 23.3 (174.7, 6.9) | 23.1 (173.2, 6.8) | 23.6 (176.8, 7) | 25.1 (188.0, 7.4) | 26.2 (196.9, 7.8) | 26.6 (199.6, 7.9) | 26.9 (201.5, 7.9) | 30 (225.0, 8.9) | 33.4 (250.4, 9.9) | 37.8 (283.5, 11.2) | 39.5 (296.0, 11.7) |

- MT model

**Vehicle speed < 64 km/h (39.8 MPH)**

| rpm | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 24.5 (184, 7.2) | 22.7 (170.3, 6.7) | 21.4 (160.2, 6.3) | 21.5 (161.6, 6.4) | 21.5 (161.4, 6.4) | 23.2 (174.4, 6.9) | 24.7 (185.5, 7.3) | 25.8 (193.3, 7.6) | 27.1 (203.2, 8) | 28.8 (216.3, 8.5) | 32.3 (242.2, 9.5) | 36.3 (272, 10.7) | 37.9 (284.5, 11.2) |

**Vehicle speed ≥ 68 km/h (42.3 MPH)**

| rpm | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 31.6 (237, 9.3) | 31.6 (237, 9.3) | 31.6 (237, 9.3) | 31.1 (233, 9.2) | 31.3 (235, 9.3) | 33.1 (248, 9.8) | 33.9 (254, 10) | 28.8 (216, 8.5) | 30.1 (226, 8.9) | 33.3 (250, 9.8) | 36.9 (277, 10.9) | 40.1 (301, 11.9) | 43.2 (324, 12.8) |

## 3. GENERAL DRIVING CYCLE

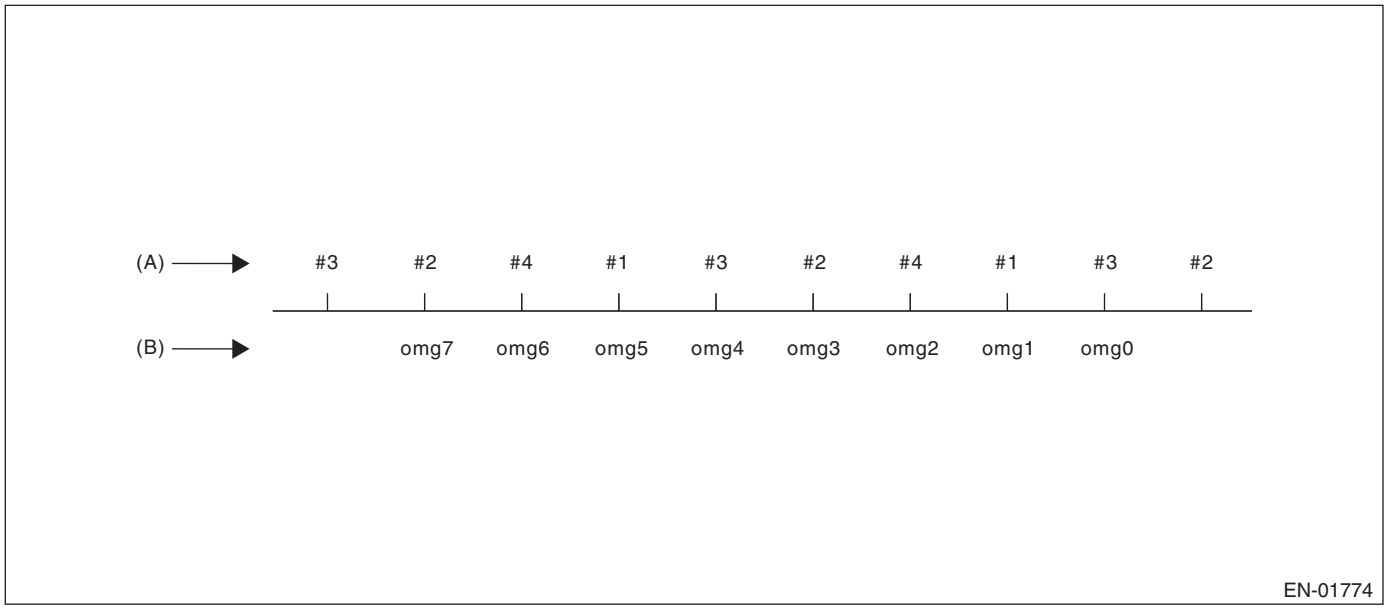
- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, in case any engine load or breakage occurs, perform with the engine at idle.
- Perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decrease and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Count the number of misfires, if the misfire ratio is higher during 1000 revs. or 200 revs., judge corresponding cylinders as NG.

| Diagnostic value calculation (Calculate from angle speed) → | Misfire detection every single ignition (Compare diagnostic value with judgment value) → | NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment) |
|---|---|---|
| | • 180° Interval Difference Method<br>• 360° Interval Difference Method<br>• 720° Interval Difference Method | • FTP 1.5 times misfire NG judgment<br>• Catalyst damage misfire NG judgment |

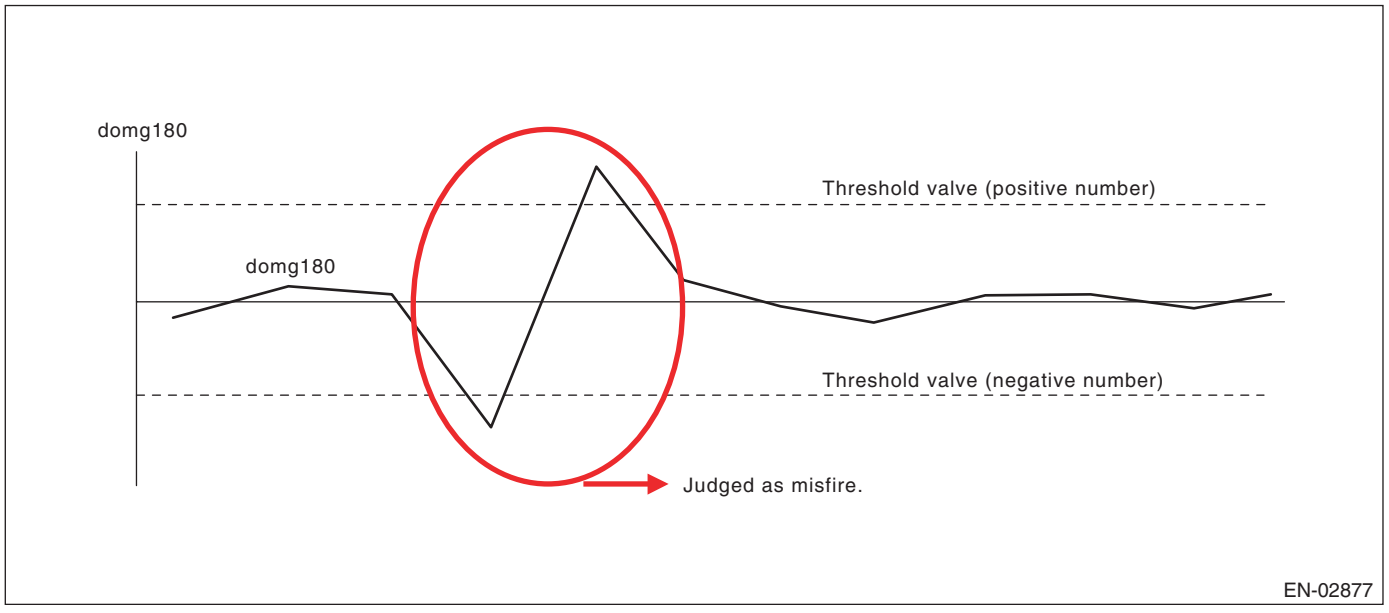
As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.




(A) Ignition order (B) Crankshaft position speed

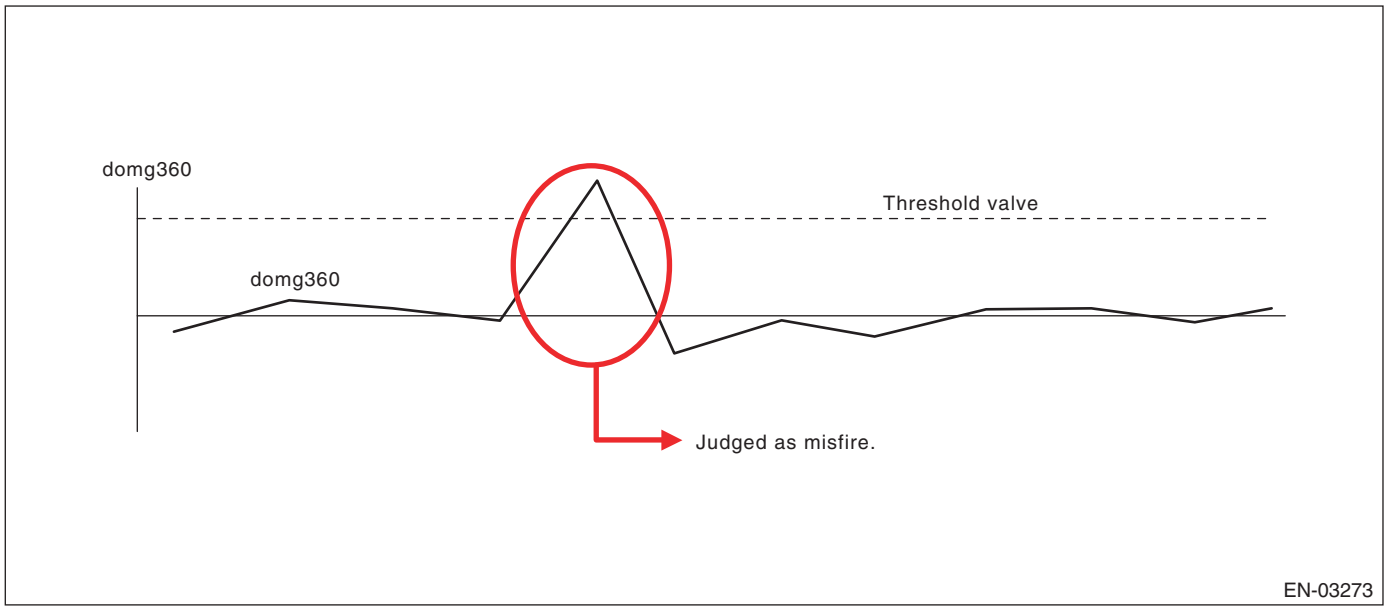
### 180° Interval Difference Method

| | |
|---|---|
| Diagnostic value | domg 180 = (omg 1 – omg 0) – (omg 5 – omg 1)/4 |
| Judge as a misfire in the following cases.<br>• domg 180 > judgment value of positive side<br>• domg 180 ≤ judgment value of negative side<br>(Judgment value before 180° CA) | |



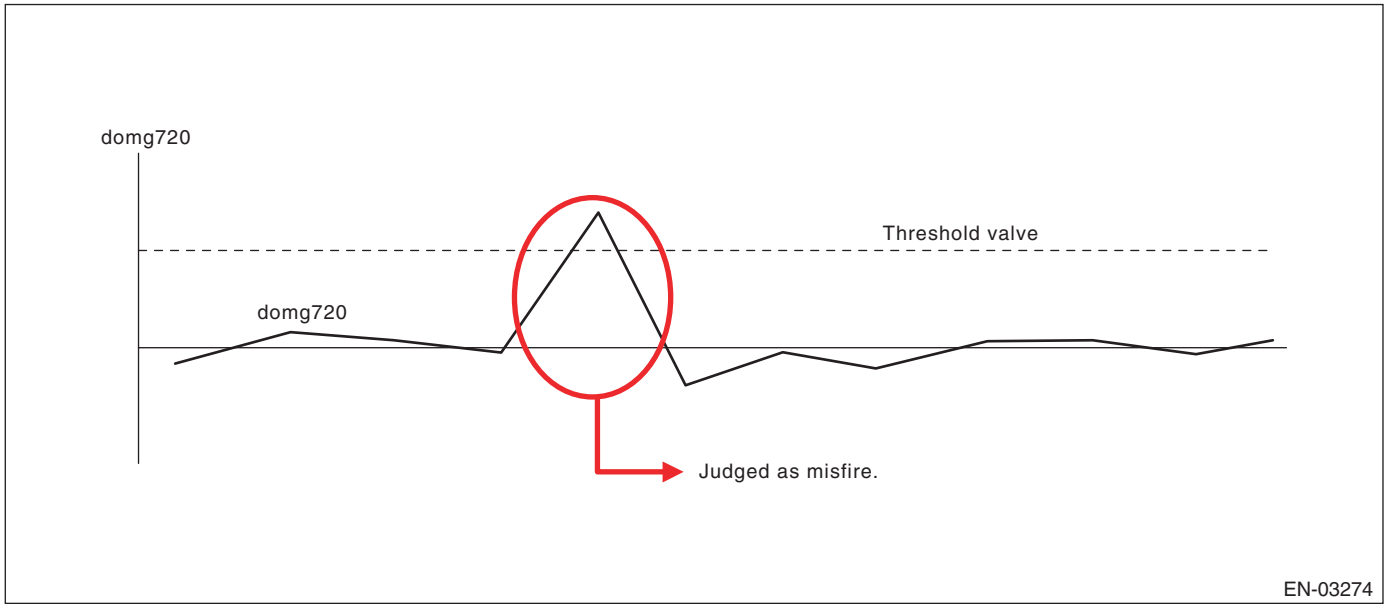
### 360° Interval Difference Method

| | |
|---|---|
| Diagnostic value | domg 360 = (omg 1 – omg 0) – (omg 3 – omg 2) |
| Misfire judgment | domg 360 > Judgment value → Judge as misfire |




### 720° Interval Difference Method

| | |
|---|---|
| Diagnostic value | domg 720 = (omg 1 – omg 0) – (omg 5 – omg 4) |
| Misfire judgment | domg 720 > Judgment value → Judge as misfire |



- **FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)**
- **Abnormality Judgment**

**Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)**

| Malfunction Criteria | Threshold Value |
|---|---|
| FTP emission judgment value | ≥ 20 × 100/2000% in 1000 revs. |

**Time Needed for Diagnosis:** 1000 engine revs.
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| FTP emission judgment value | < 20 × 100/2000% in 1000 revs. |

**Time Needed for Diagnosis:** 1000 engine revs.

- **Catalyst damage misfire (Misfire occurrence level damaging catalyst)**
- **Abnormality Judgment**

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Catalyst damage misfire judgment value | ≥ Value of Map 3 |

**Map 3**

| | | Intake air (g(oz)/rev) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.16 (0.01) | 0.28 (0.01) | 0.4 (0.01) | 0.52 (0.02) | 0.64 (0.02) | 0.76 (0.03) | 0.92 (0.03) | 1.1 (0.04) |
| Engine speed (rpm) | 700 | 100 | 100 | 100 | 100 | 90 | 80 | 64 | 48 |
| | 1000 | 100 | 100 | 100 | 100 | 90 | 80 | 63 | 44 |
| | 1500 | 100 | 100 | 90 | 80 | 73 | 67 | 54 | 40 |
| | 2000 | 80 | 80 | 80 | 80 | 68 | 57 | 51 | 44 |
| | 2500 | 80 | 80 | 73 | 67 | 62 | 57 | 51 | 44 |
| | 3000 | 67 | 67 | 62 | 57 | 51 | 44 | 44 | 44 |
| | 3500 | 67 | 67 | 56 | 44 | 40 | 36 | 34 | 31 |
| | 4000 | 57 | 57 | 44 | 31 | 24 | 20 | 20 | 20 |
| | 4500 | 44 | 44 | 33 | 31 | 20 | 20 | 20 | 20 |
| | 5000 | 44 | 44 | 38 | 31 | 20 | 20 | 20 | 20 |
| | 5500 | 36 | 36 | 31 | 27 | 20 | 20 | 20 | 20 |
| | 6000 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 6300 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |

**Time Needed for Diagnosis:** 200 engine revs.
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Catalyst damage misfire judgment value | < Value of Map 3 |

**Time Needed for Diagnosis:** 200 engine revs.

## AV:DTC P0302 CYLINDER 2 MISFIRE DETECTED

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-84, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## AW:DTC P0303 CYLINDER 3 MISFIRE DETECTED

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-84, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## AX:DTC P0304 CYLINDER 4 MISFIRE DETECTED

### 1. OUTLINE OF DIAGNOSIS

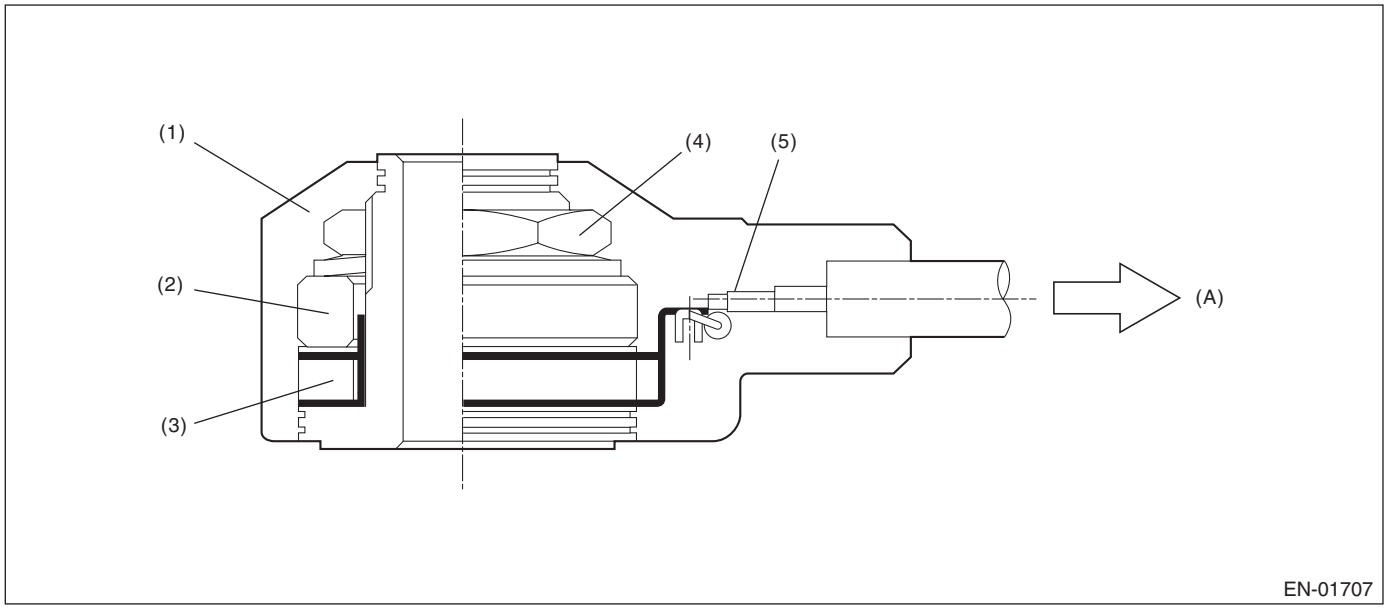
NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-84, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# AY:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 0.243 V |

**Time Needed for Diagnosis:** 1000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 0.243 V |

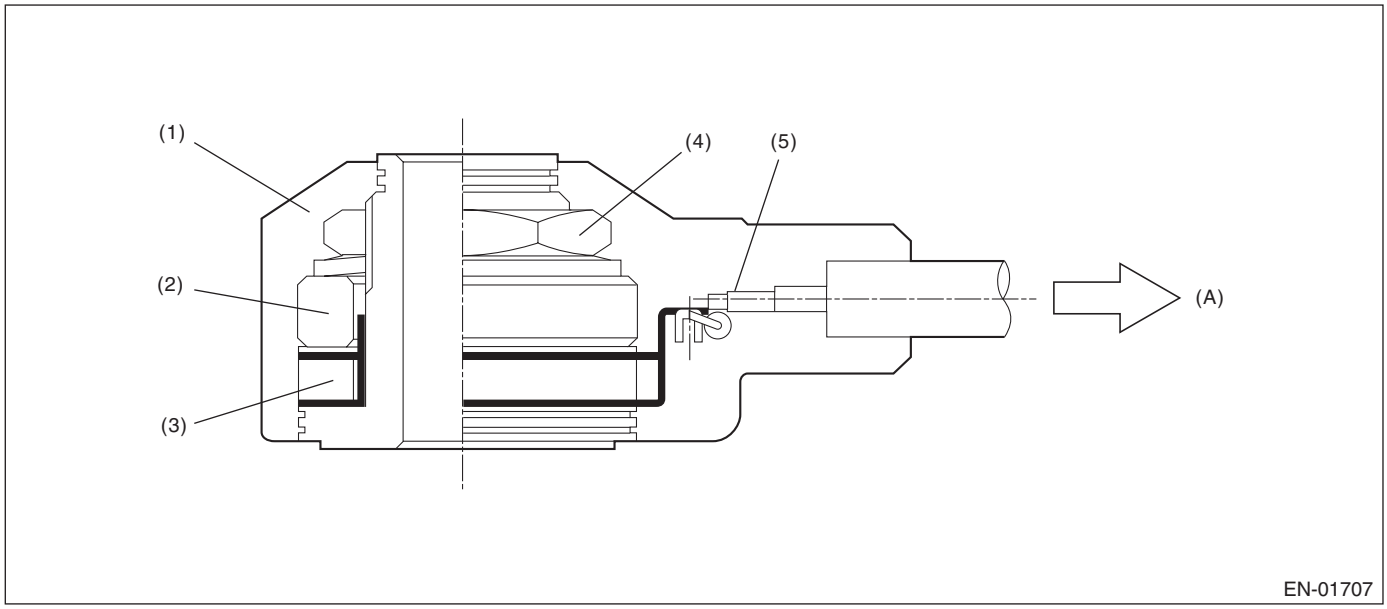
**Time Needed for Diagnosis:** Less than 1 second

# AZ:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.709 V |

**Time Needed for Diagnosis:** 1000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.709 V |

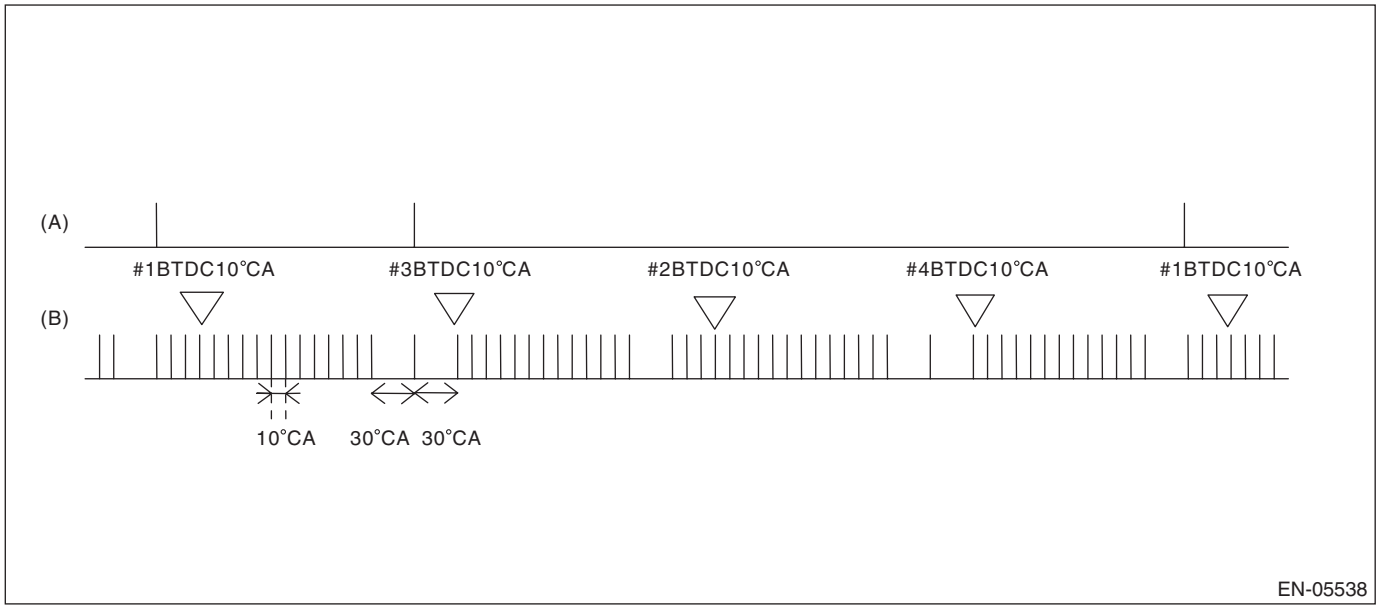
**Time Needed for Diagnosis:** Less than 1 second

# BA:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

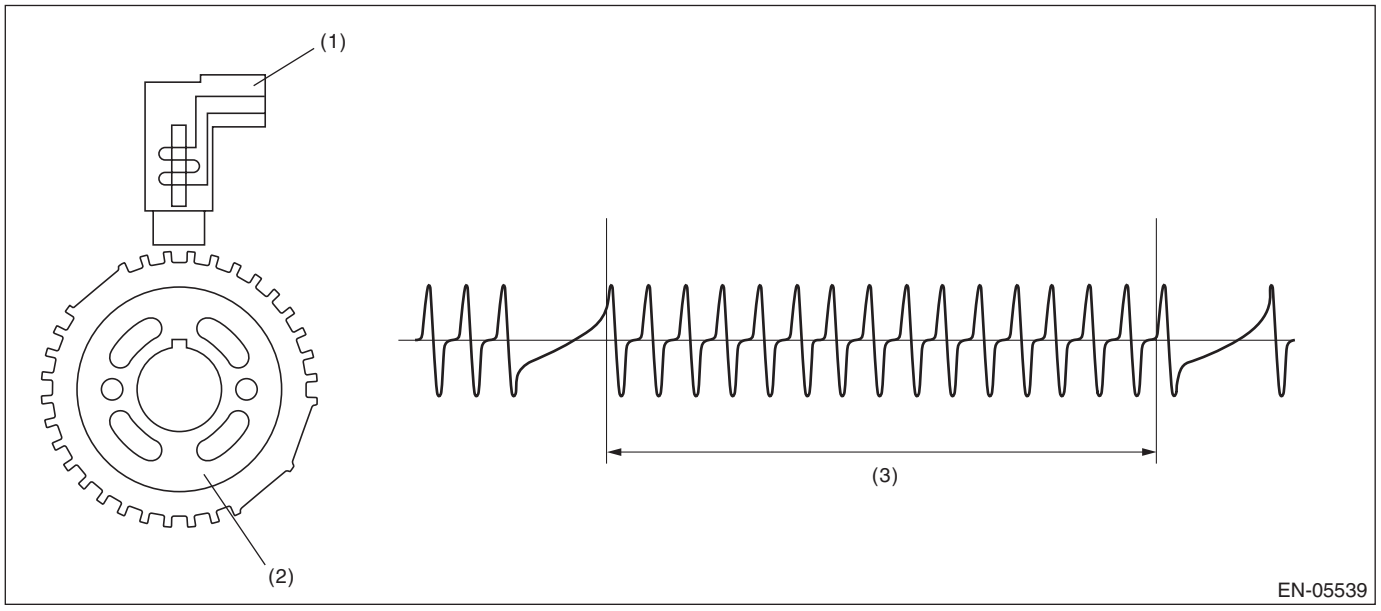
## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.
Judge as NG when the crank signal is not input even though the starter was rotated.

## 2. COMPONENT DESCRIPTION




(A) Cam signal (B) Crankshaft signal




(1) Crankshaft position sensor (2) Crank sprocket (3) Crankshaft half-turn

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Starter switch | ON |
| Crankshaft position sensor signal | Not detected |
| Battery voltage | ≥ 8 V |

**Time Needed for Diagnosis:** 3000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Crankshaft position sensor signal | Input exists |
| Battery voltage | ≥ 8 V |

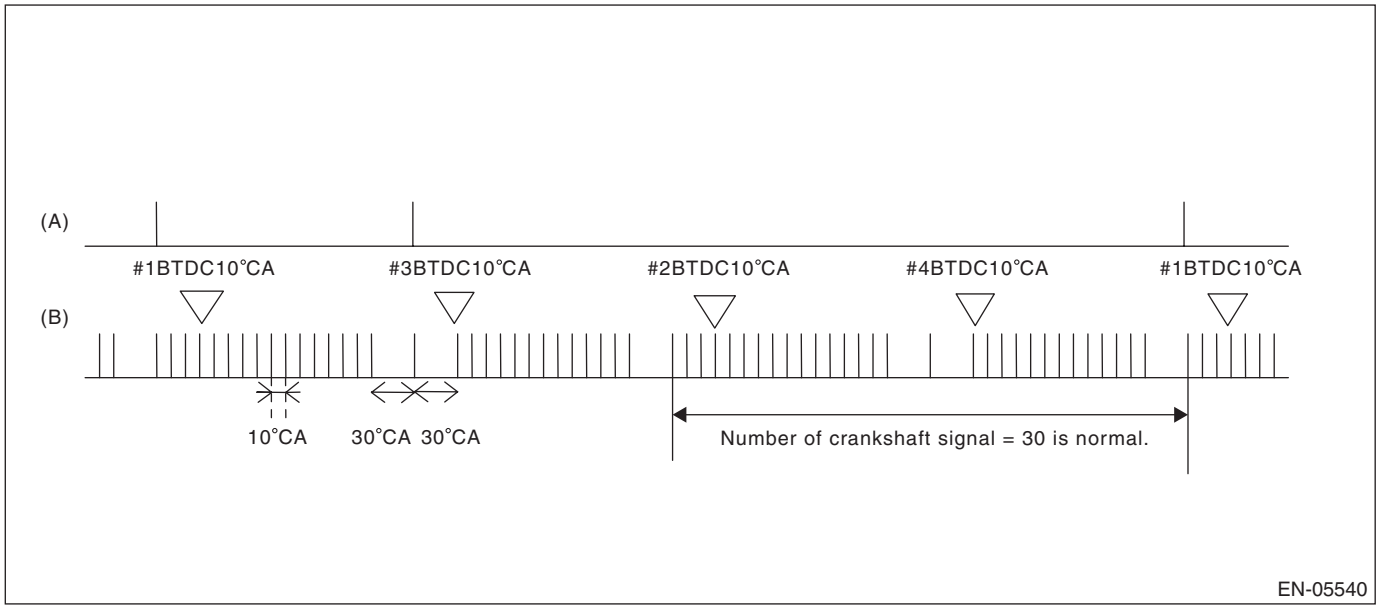
**Time Needed for Diagnosis:** Less than 1 second

# BB:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

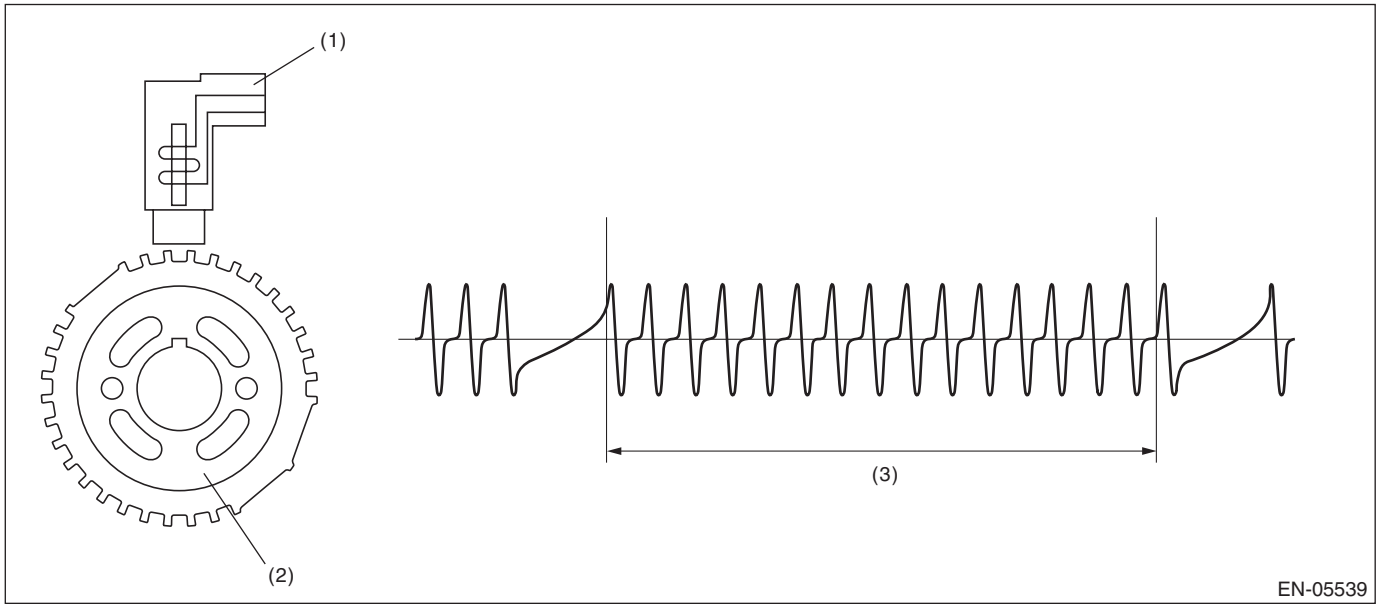
## 1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.
Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

## 2. COMPONENT DESCRIPTION




(A) Cam signal (B) Crankshaft signal




(1) Crankshaft position sensor (2) Crank sprocket (3) Crankshaft half-turn

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 8 V |
| Engine speed | < 4000 rpm |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Cylinder number identification | Completed |
| Amount of crank sensor signal during 1 rev of crankshaft. | Not = 30 |

**Time Needed for Diagnosis:** 10 engine revs.
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Cylinder number identification | Completed |
| Amount of crank sensor signal during 1 rev of crankshaft. | = 30 |

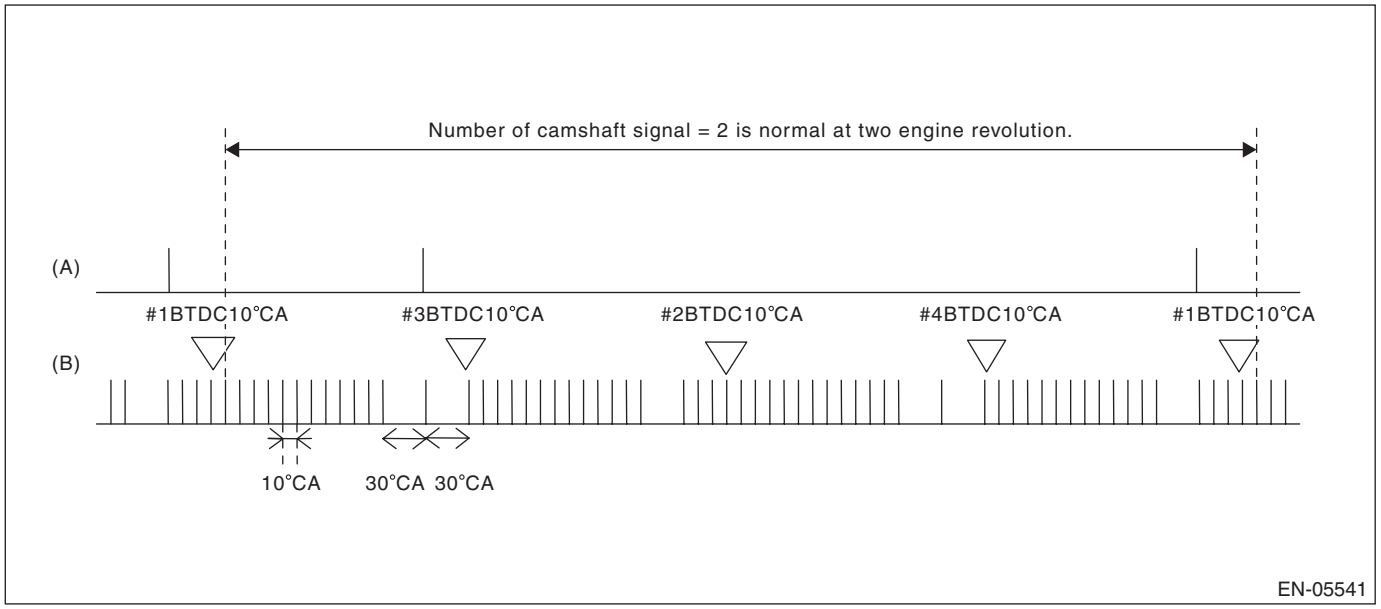
**Time Needed for Diagnosis:** Less than 1 second

# BC:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.
Judge as NG when the number of camshaft signals remains abnormal.

## 2. COMPONENT DESCRIPTION




(A) Cam signal (B) Crankshaft signal

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

### Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 8 V |
| Amount of camshaft sensor signal during 2 revs of crankshaft. | Not = 2 |

**Time Needed for Diagnosis:** Two engine revs. × 4 time(s)
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Voltage | ≥ 8 V |
| Amount of camshaft sensor signal during 2 revs of crankshaft. | = 2 |

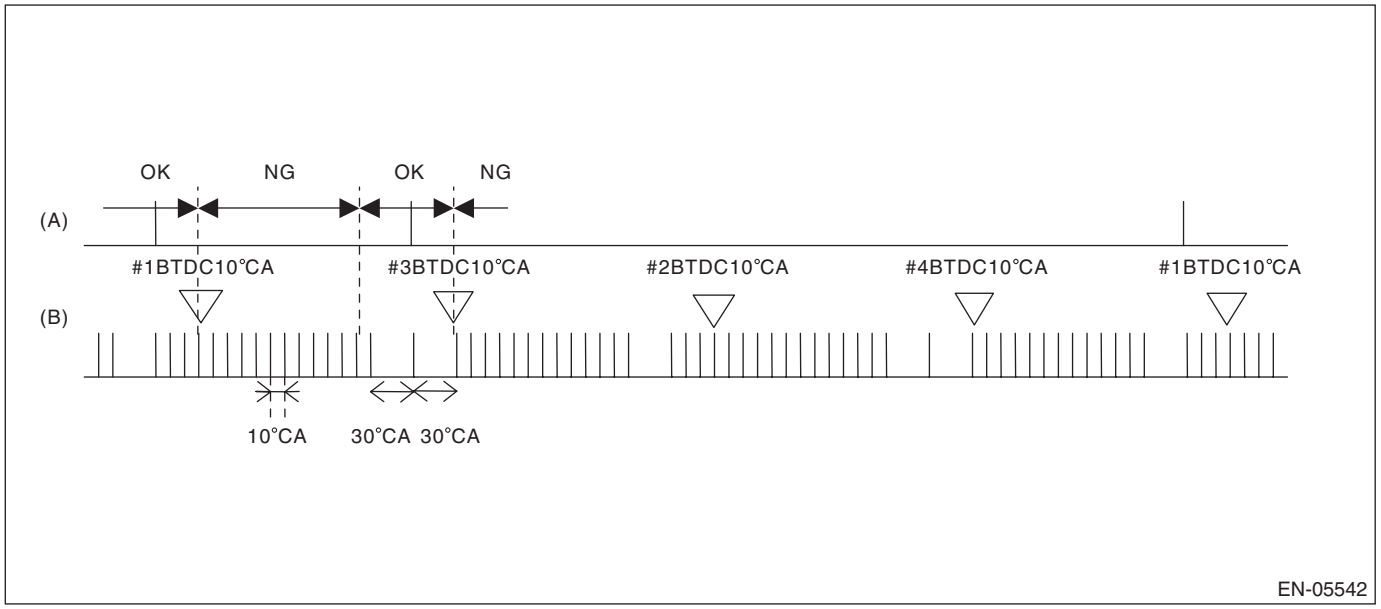
**Time Needed for Diagnosis:** Two engine revs.

# BD:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

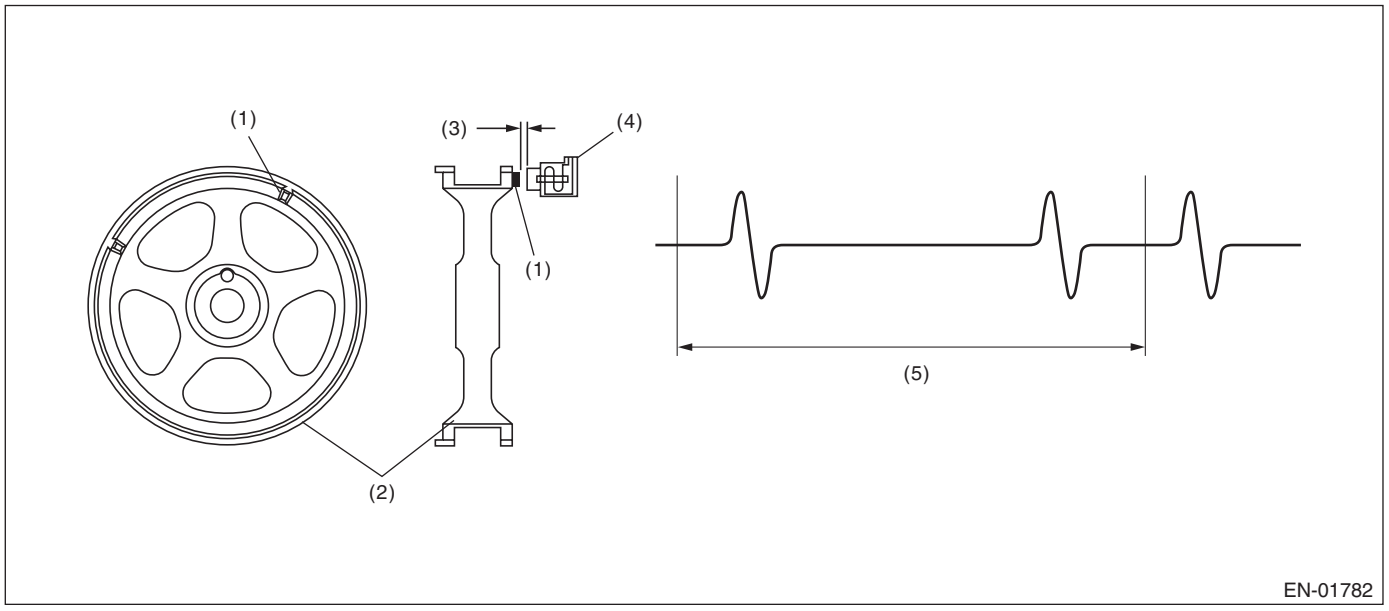
## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor output property.
Judge as NG when the camshaft line signal input timing is shifted from the crankshaft signal because of timing belt tooth chip etc.

## 2. COMPONENT DESCRIPTION




(A) Cam signal
(B) Crankshaft signal




(1) Boss
(2) Cam sprocket
(3) Air gap
(4) Camshaft position sensor
(5) Camshaft one revolution (crankshaft two revolutions)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Cylinder number identification | Completed |
| Battery voltage | ≥ 8 V |
| Engine speed | 550 rpm — 1000 rpm |
| Engine operation | Idling |
| Misfire | Not detected |
| Engine load change during 4 milliseconds | ≤ 12799.8 rpm |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously at idle speed.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Position of camshaft position sensor signal | Not between BTDC 10°CA and BTDC 80°CA |

**Time Needed for Diagnosis:** 10 engine revs.
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Position of camshaft position sensor signal | Between BTDC10°CA and BTDC80°CA |

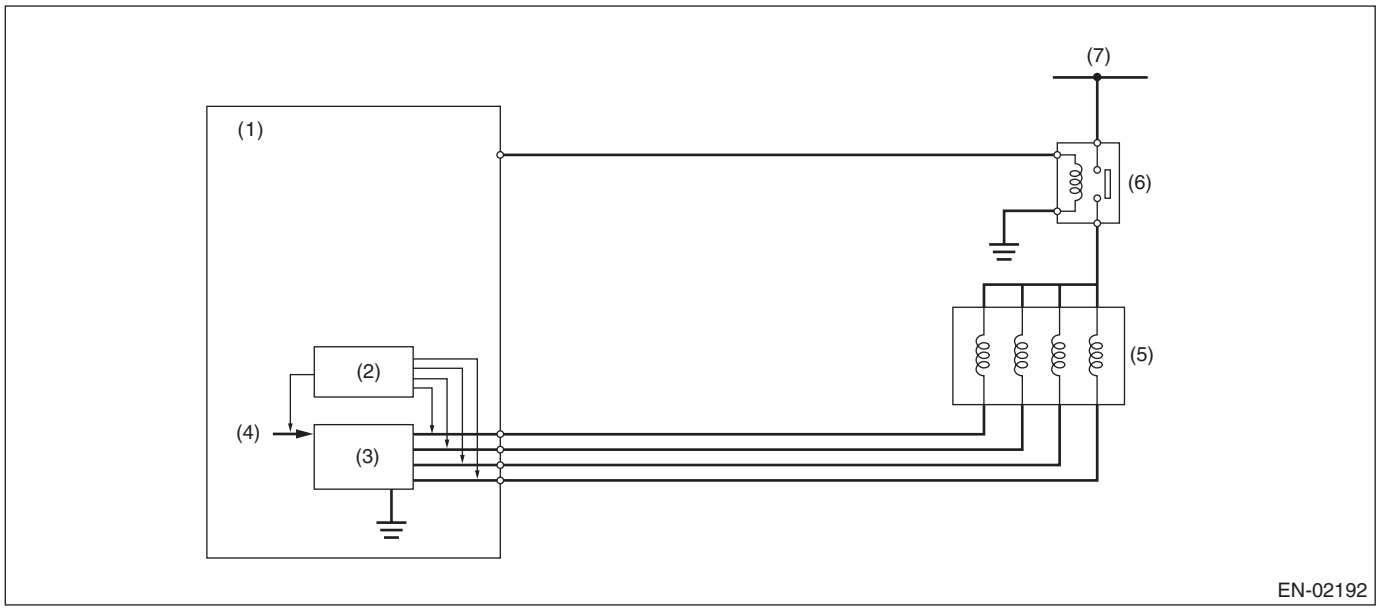
**Time Needed for Diagnosis:** Two engine revs.

# BE:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

## 1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.
Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

## 2. COMPONENT DESCRIPTION




(1) ECM
(2) Detecting circuit
(3) Switching circuit
(4) CPU
(5) EGR valve
(6) Main relay
(7) Battery power supply

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Elapsed time after starting the engine | ≥ 40 s |
| Engine coolant temperature | ≥ 75 °C(167 °F) |
| Engine speed | 1200 rpm — 2950 rpm |
| Intake manifold pressure (absolute pressure) | < 44 kPa (330 mmHg, 13 inHg) |
| Ambient air temperature | ≥ 5 °C(41 °F) |
| Throttle position | < 0.25 ° |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Vehicle speed | ≥58 km/h (36 MPH) |
| Fuel shut-off function | In operation |
| Neutral switch | OFF |
| After neutral switch ON/OFF change | ≥ Value from Map |
| No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan) | ≥ 5000 ms |

**Map**

| Engine coolant temperature °C (°F) | –40 (–40) | –30 (–22) | –20 (–4) | –10 (14) | 0 (32) | 10 (50) | 20 (68) | 30 (86) |
|---|---|---|---|---|---|---|---|---|
| After neutral switch change msec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Engine coolant temperature °C (°F) | 40 (104) | 50 (122) | 60 (140) | 70 (158) | 80 (176) | 90 (194) | 100 (212) | 110 (230) |
|---|---|---|---|---|---|---|---|---|
| After neutral switch change msec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## 4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once.
Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

## 5. DIAGNOSTIC METHOD

Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.
1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 50 steps (nearly full open).
2. Label the intake manifold pressure value as PMON, which is observed after one second has passed since EGR target step was set to 50 steps (when the enable conditions were established), and set the EGR target step to 0.
3. Label the intake manifold pressure as PMOF2, which is observed after one second has passed since EGR target step was set to 0 (after two seconds have passed since the enable conditions were established).

- **Abnormality Judgment**

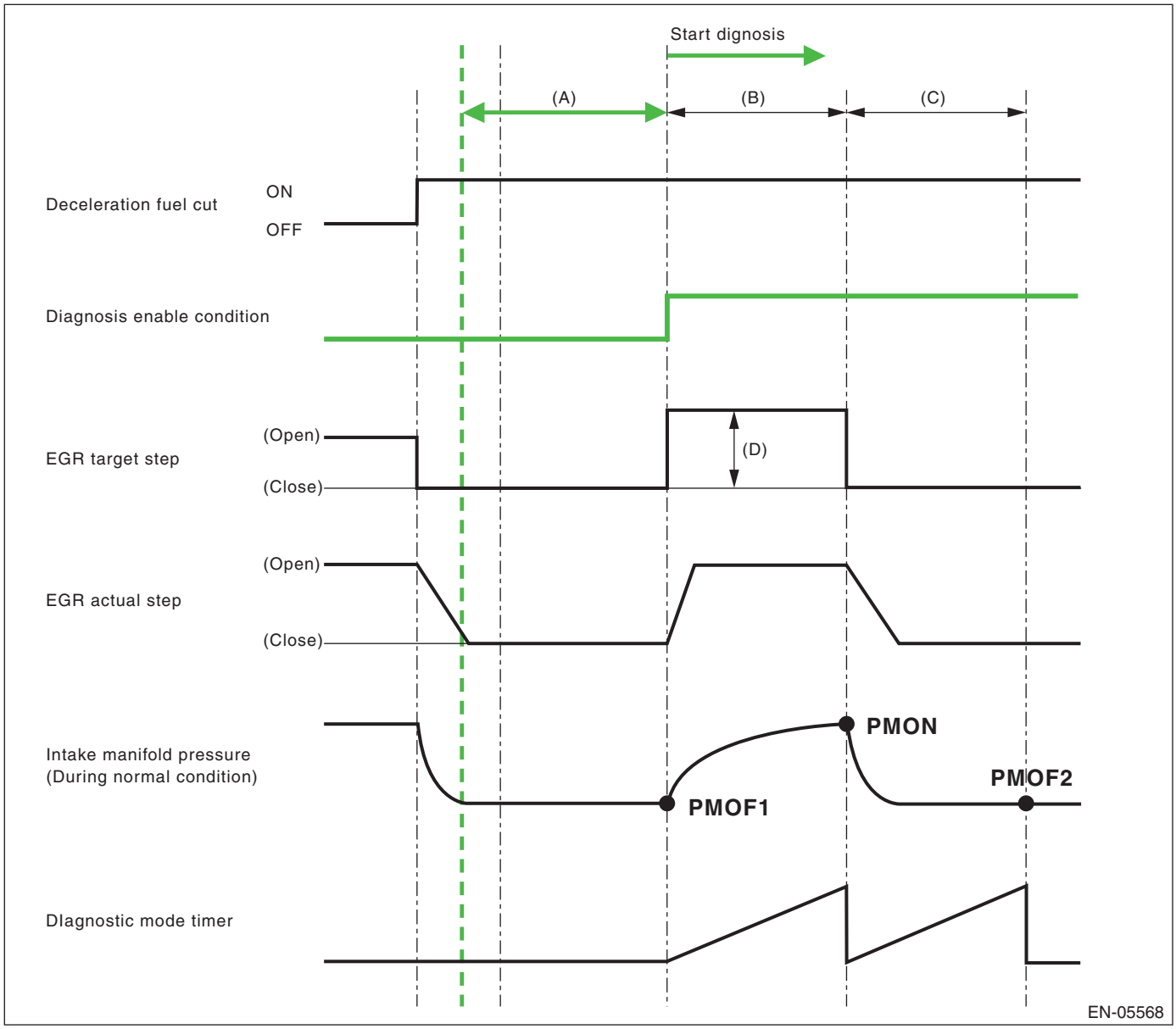
Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| PMON – (PMOF1 + PMOF2)/2 | < 2.5 kPa (18.63 mmHg, 0.7 inHg) |

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.




(A) 3000 ms
(B) 1000 ms
(C) 1000 ms
(D) 45 step(s)

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| PMON – (PMOF1 + PMOF2)/2 | ≥ 2.5 kPa (18.63 mmHg, 0.7 inHg) |

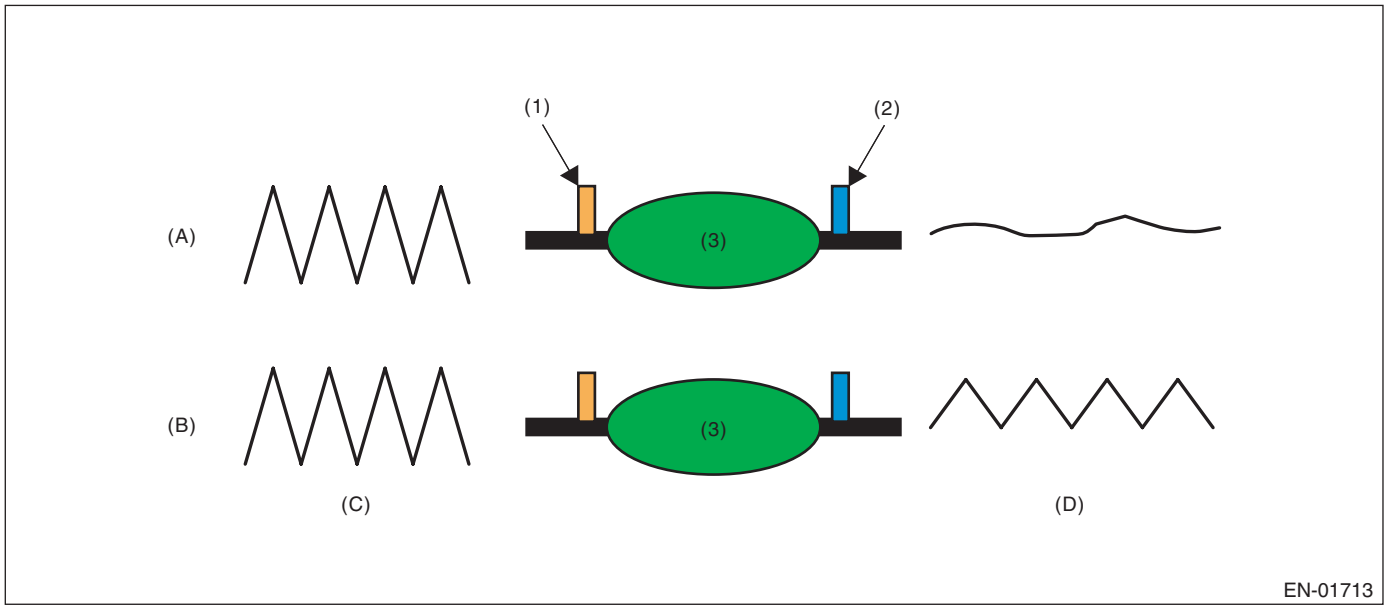
**Time Needed for Diagnosis:** 1 time

# BF:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.
Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.
For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

## 2. COMPONENT DESCRIPTION




(A) Normal
(B) Deterioration
(C) Output waveform from the front oxygen (A/F) sensor
(D) Output waveform from the front oxygen sensor
(1) Front oxygen (A/F) sensor
(2) Front oxygen sensor
(3) Catalytic converter

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Engine coolant temperature | ≥ 70 °C (158 °F) |
| Estimated catalyst temperature | ≥ 540 °C (1004 °F) |
| Misfire detection every 200 rotations | < 5 time(s) |
| Learning value of evaporation gas density | < 0.2 |
| Sub feedback | In operation |
| Evaporative system diagnosis | Not in operation |
| Time of difference (< 0.10) between actual lambda and target lambda | ≥ 1000 ms |
| Vehicle speed | > 70 km/h (43.5 MPH) |
| Amount of intake air | ≥ 10 g/s (0.35 oz/s)<br>and<br>< 40 g/s (1.41 oz/s) |
| Engine load change every 0.5 engine revs. | < 0.02 g/rev (0 oz/rev) |
| Rear oxygen output change from 660 mV or less to 660 mV or more | Experienced after fuel cut |
| Elapsed time after starting the engine | ≥ 205 second |
| Purge execution calculated time | ≥ 0 s |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 70 km/h (43.5 MPH) or higher.

## 5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value per 32 milliseconds × 4 ($\Sigma$ |(sglmd$_n$ – sglmd$_{n-1}$)|) and rear oxygen sensor output voltage deviation cumulative value ($\Sigma$ |(ro2sad$_n$ – ro2sad$_{n-1}$)|), and when the front oxygen (A/F) sensor lambda deviation cumulative value ($\Sigma$ |(sglmd$_n$ – sglmd$_{n-1}$)|) becomes the predetermined value or more, calculate the diagnostic value.

**• Abnormality Judgment**

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| $\Sigma$ \|(ro2sad$_n$ – ro2sad$_{n-1}$)\| / $\Sigma$ \|(sglmd$_n$ – sglmd$_{n-1}$)\| | > 14 |

**Time Needed for Diagnosis:** 30 — 55 seconds
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

**Judgment Value**

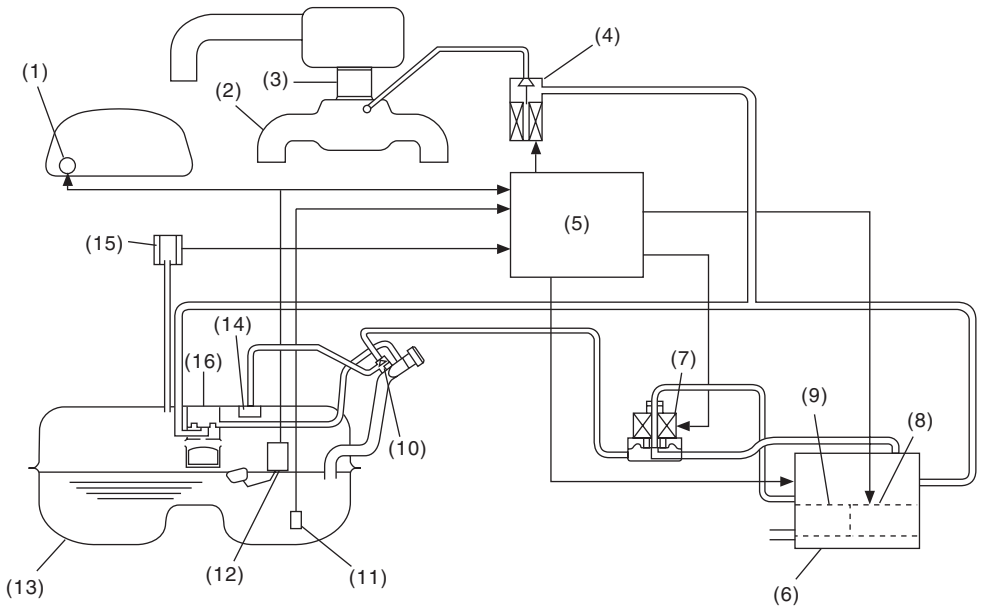
| Malfunction Criteria | Threshold Value |
|---|---|
| $\Sigma$ \|(ro2sad$_n$ – ro2sad$_{n-1}$)\| / $\Sigma$ \|(sglmd$_n$ – sglmd$_{n-1}$)\| | ≤ 14 |

**Time Needed for Diagnosis:** 30 — 55 seconds

# BG:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

## 1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.

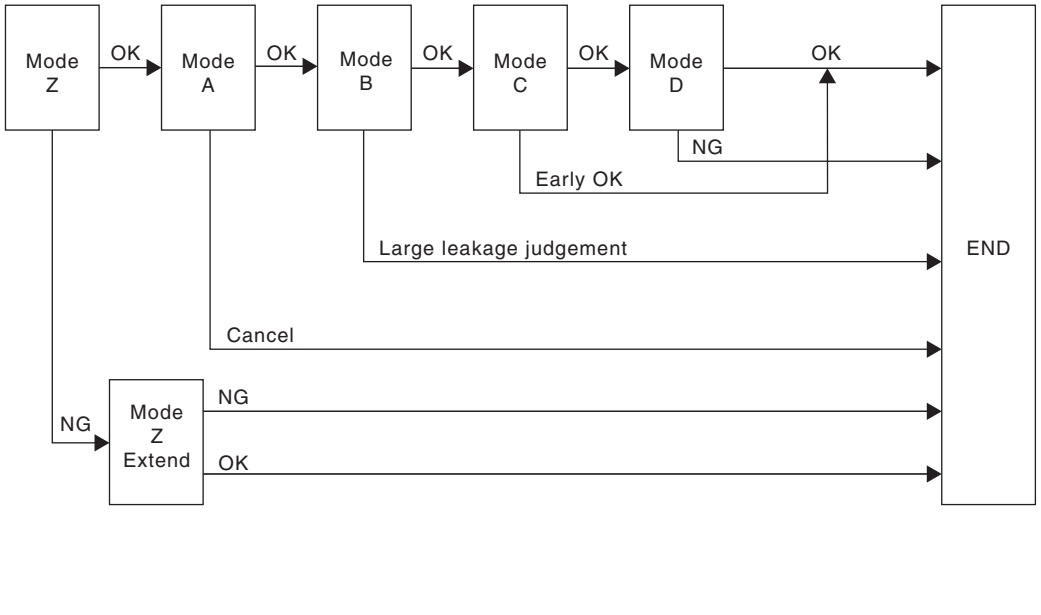



EN-04151

| | | | | | |
|---|---|---|---|---|---|
| (1) | Fuel gauge | (7) | Pressure control valve | (12) | Fuel level sensor |
| (2) | Intake manifold | (8) | Drain valve | (13) | Fuel tank |
| (3) | Throttle body | (9) | Drain filter | (14) | Fuel cut valve |
| (4) | Purge control solenoid valve | (10) | Shut-off valve | (15) | Fuel tank pressure sensor |
| (5) | Engine control module (ECM) | (11) | Fuel temperature sensor | (16) | Vent valve |
| (6) | Canister | | | | |

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

### 0.04-inch Diagnosis



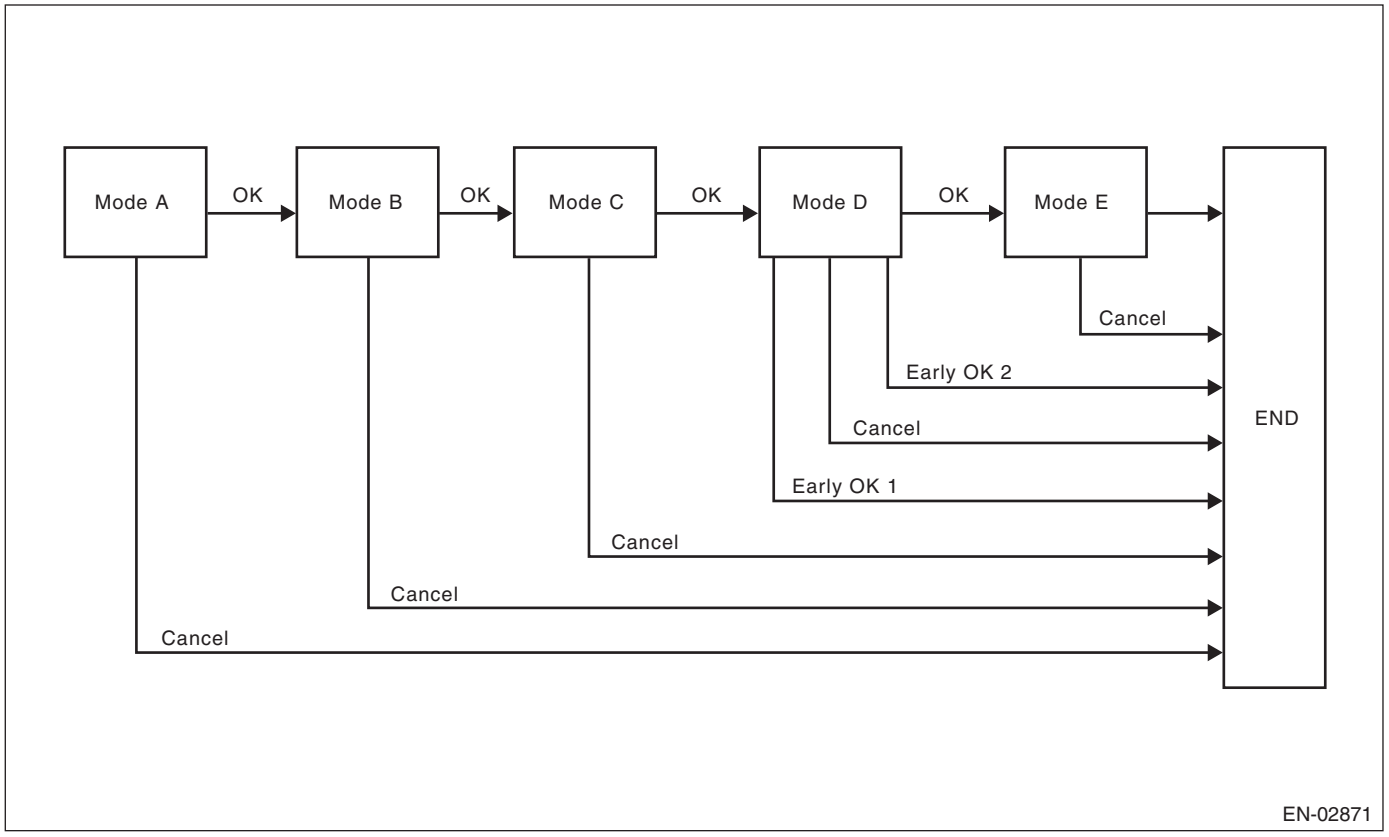

EN-02872

| Mode | Mode Description | Diagnosis Period |
|---|---|---|
| Mode Z (Purge control solenoid valve opening failure diagnosis) | Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start. | 0 ms + 3000 ms — 0 ms + 3000 ms + 13000 ms |
| Mode A (Estimated evaporation amount) | Calculate the tank pressure change amount (P1). | 10000 ms |
| Mode B (Sealed negative pressure, large leakage judgment) | Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak. | 0 — 10000 ms + 25000 ms |
| Mode C (Pressure increase check, advanced OK judgment) | Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment. | 0 — 18600 ms |
| Mode D (Negative pressure variation measurement, evaporation leakage diagnosis) | Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value. | 0 ms + 10000 ms |

### Mode Table for Evaporative Emission Control System Diagnosis

| Mode | Behavior of tank internal pressure under normal conditions | Diagnostic item | DTC |
|---|---|---|---|
| Mode Z | Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg)) | Purge control solenoid valve is judged to be open. | P0457 |
| Mode A | Pressure is in proportion to amount of evaporative emission. | — | None |
| Mode B | Negative pressure is formed due to intake manifold negative pressure | Large leak | P0457 |
| Mode C | Reaches target pressure | — | None |
| Mode D | Pressure change is small. | EVAP system large leak determination. [1.0 mm (0.04 in)] | P0442 |

### 0.02-inch Diagnosis




| Mode | Mode Description | Diagnosis Period |
|---|---|---|
| Mode A<br>(0 point compensation) | When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). | 0 — Value of Map 1 |
| Mode B<br>(Negative pressure introduced) | Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. | 0 — Value of Map 2 |
| Mode C<br>(Negative pressure maintained) | Wait until the tank pressure returns to the target (start level of P2 calculation). | 0 — 25290 ms + 0 + Value of Map 2 |
| Mode D<br>(Negative pressure change calculated) | Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment. | 0 — 0 ms + 200000 ms |
| Mode E<br>(Evaporation generated amount calculation) | Calculate the amount of evaporation (P1). | 0 — 0 ms + 200000 ms + Value of Map 3 |

### Map 1

| Fuel level ( ℓ , US gal, Imp gal) | 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Time Needed for Diagnosis (ms) | 13800 | 13800 | 11400 | 9000 | 7000 | 5000 | 5000 |

### Map 2

| Fuel level ( ℓ , US gal, Imp gal) | 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Time Needed for Diagnosis (ms) | 20030 | 20030 | 20800 | 21580 | 21970 | 22360 | 22360 |

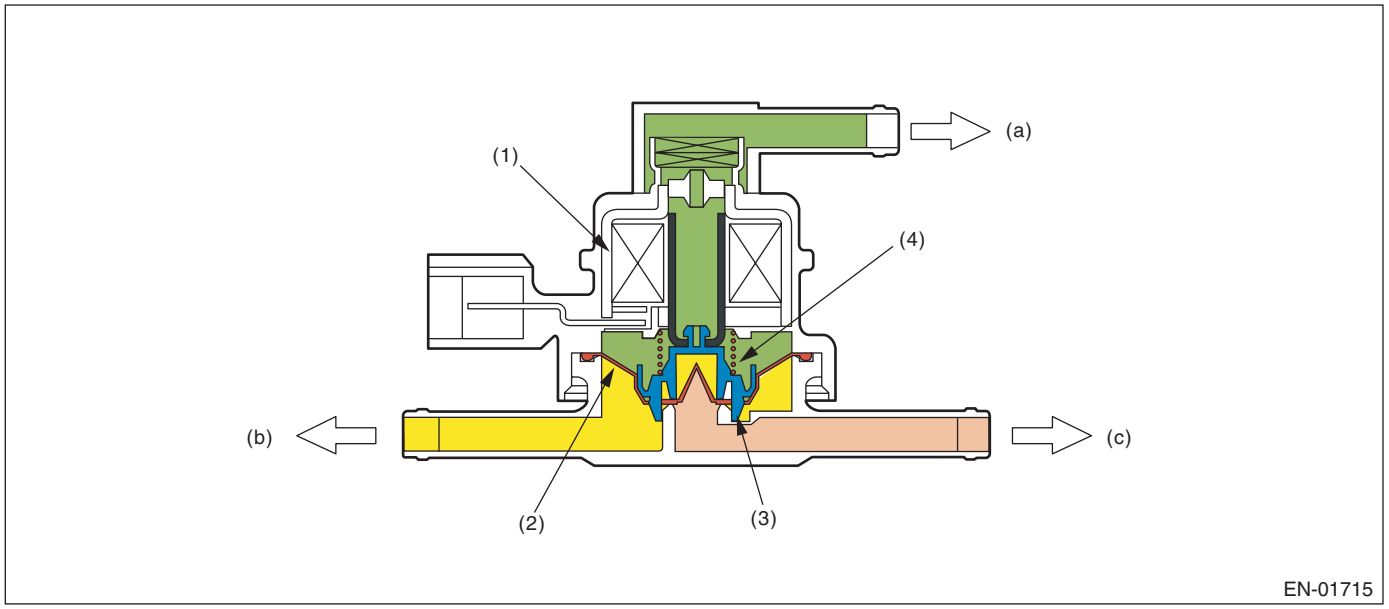
### Map 3

| Fuel level ( ℓ , US gal, Imp gal) | 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Time Needed for Diagnosis (ms) | 80000 | 80000 | 70000 | 60000 | 60000 | 60000 | 60000 |

## 2. COMPONENT DESCRIPTION

### Pressure control solenoid valve

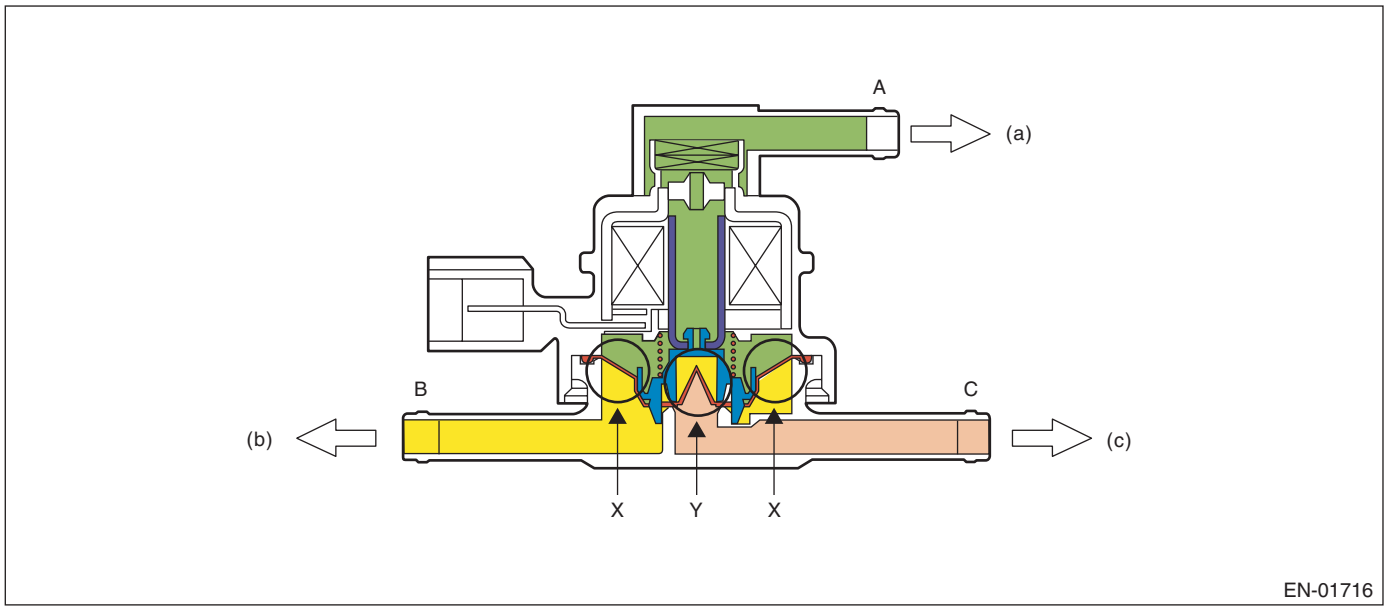
PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.
The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.




| | | | | | |
|---|---|---|---|---|---|
| (a) | Atmospheric pressure | (b) | Fuel tank | (c) | Canister |
| (1) | Solenoid | (3) | Valve | (4) | Spring |
| (2) | Diaphragm | | | | |

### Valve Operation and Air Flow

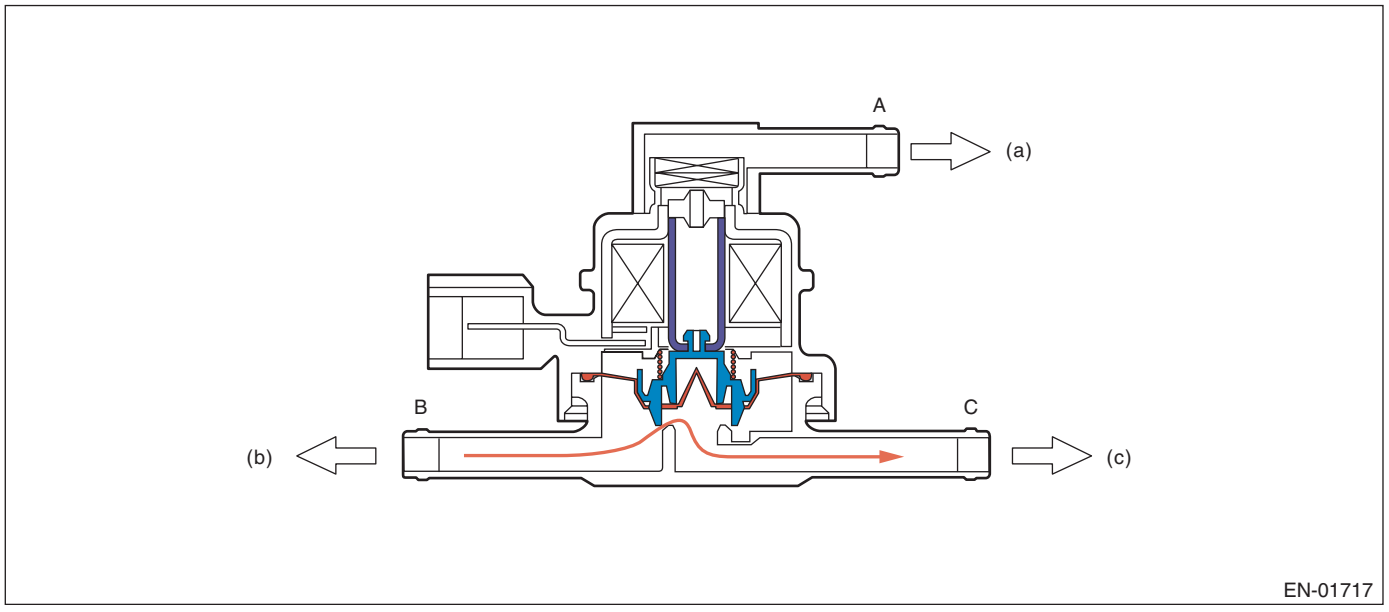
In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.
If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.




(a) Atmospheric pressure (b) Fuel tank (c) Canister

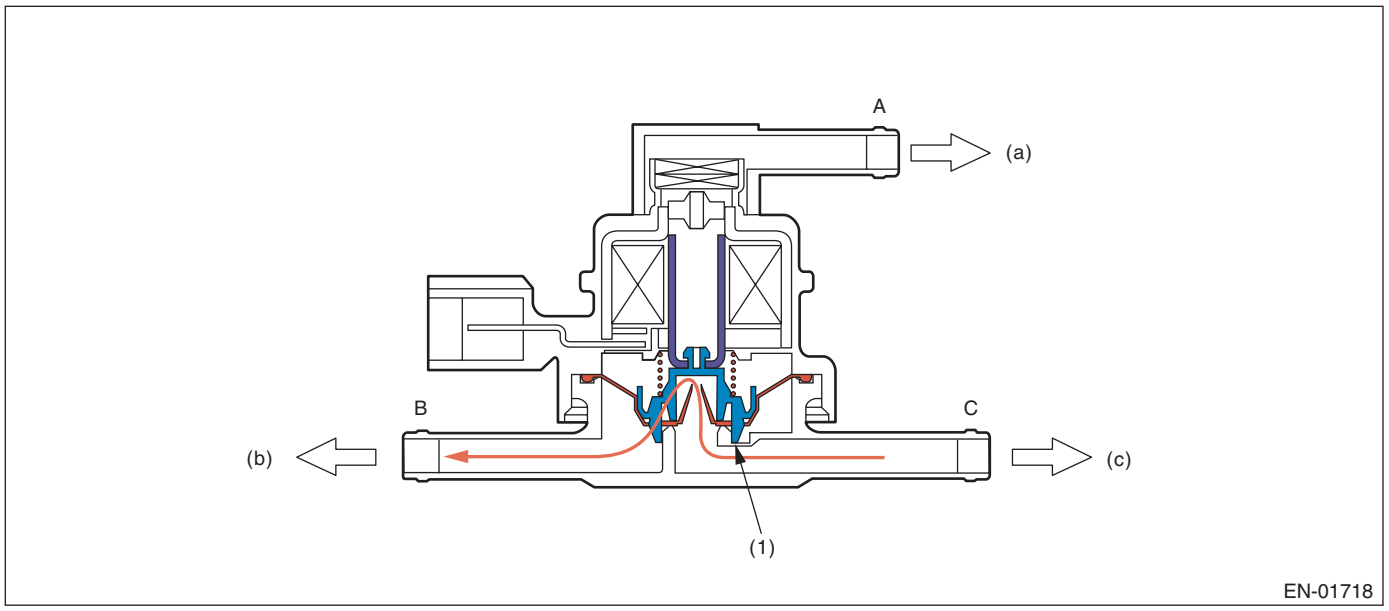
| Condition of pressure | Flow |
|---|---|
| A < B (solenoid OFF) | B → C |
| B < C (solenoid OFF) | C → B |
| Solenoid ON | B ← → C |

### When A < B (solenoid OFF)




(a) Atmospheric pressure (b) Fuel tank (c) Canister

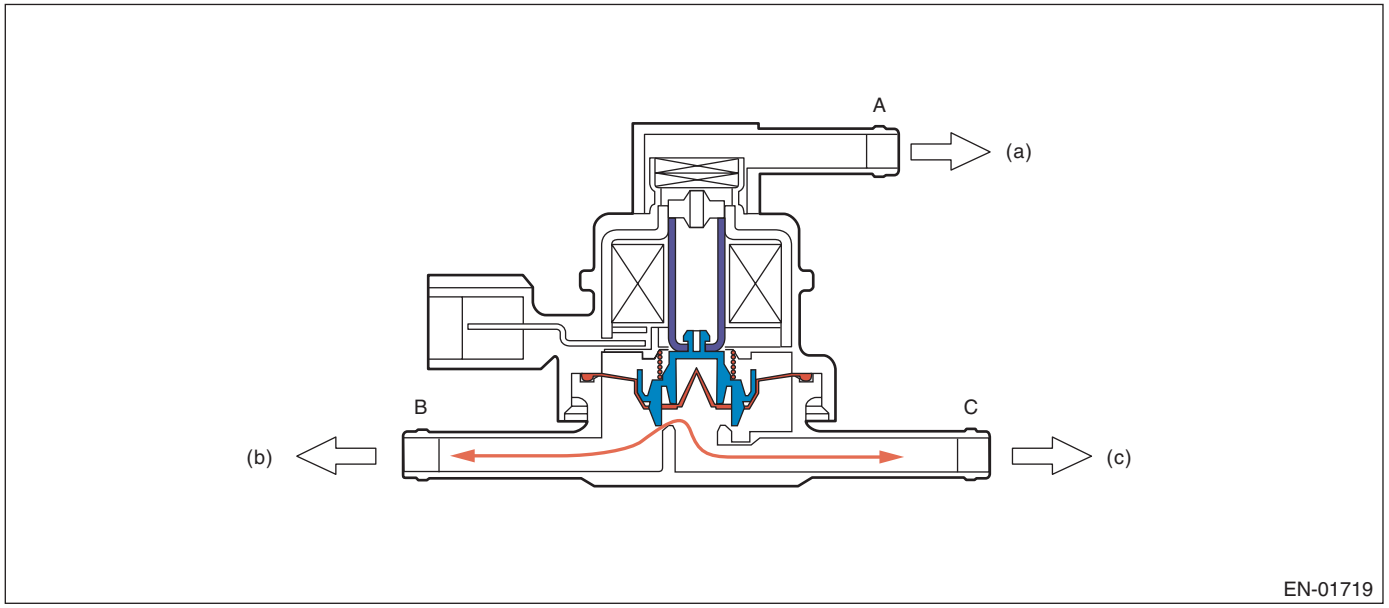
### When B < C (solenoid OFF)




(a) Atmospheric pressure (b) Fuel tank (c) Canister

(1) Valve

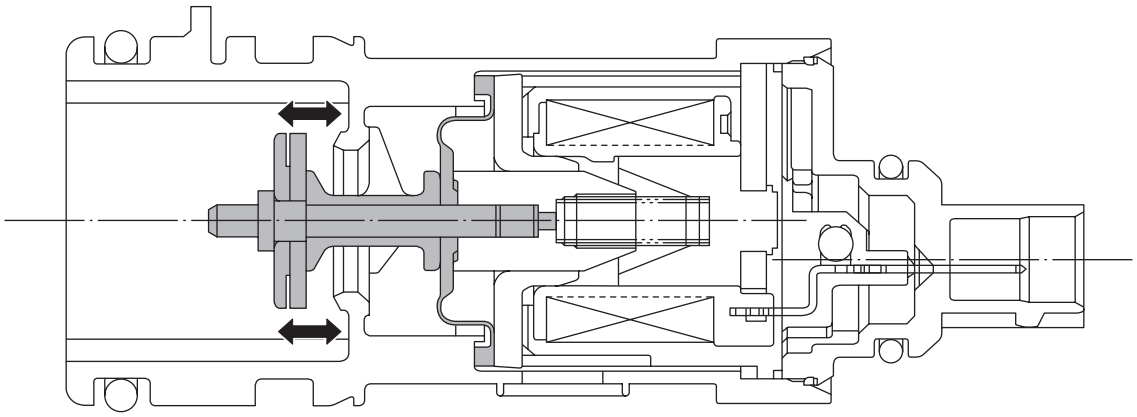
### When Solenoid is ON




(a) Atmospheric pressure (b) Fuel tank (c) Canister

**Drain valve**

Drain valve controls the ambient air to be introduced to the canister.




## 3. ENABLE CONDITIONS

### 0.04-inch Diagnosis

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Total time of canister purge operation | ≥ 120000 ms |
| Elapsed time after starting the engine | ≥ 856 s |
| Learning value of evaporation gas density | < 0.08 |
| Engine speed | 1050 rpm — 6000 rpm |
| Fuel tank pressure | ≥ –4 kPa (–30 mmHg, –1.2 inHg) |
| Intake manifold relative vacuum (relative pressure) | ≥ – 26.7 kPa (– 200 mmHg, – 7.9 inHg) |
| Vehicle speed | ≥ 32 km/h (19.9 MPH) |
| Fuel level | 9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal) |
| Closed air/fuel ratio control | In operation |
| Fuel temperature | –10 °C (14 °F) — 45 °C (113 °F) |
| Intake air temperature | ≥ –10 °C (14 °F) |
| Pressure change every one second | < 1.7 mmHg (Mode A) |
| | < 1.7 mmHg (Mode D) |
| Minimum pressure change value every one second – Maximum pressure change value every one second | < 1.7 mmHg (Mode A) |
| | < 1.7 mmHg (Mode D) |
| Change of fuel level per 128 milliseconds | < 2 ℓ (0.53 US gal, 0.44 Imp gal) |
| Air fuel ratio | 0.76 — 1.25 |

### 0.02-inch Diagnosis

| Secondary Parameters | Enable Conditions |
|---|---|
| **At starting a diagnosis** | |
| Evap. diagnosis | Incomplete |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Time since last incomplete 0.02-inch leakage diagnosis | |
| When cancelling in mode A | > 120000 ms |
| When cancelling in other than mode A | > 600000 ms |
| Total time of canister purge operation | ≥ 120000 ms |
| Elapsed time after starting the engine | ≥ 120 s |
| Fuel temperature | –10 °C (14 °F) — 55 °C (131 °F) |
| Fuel level | 9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal) |
| Intake manifold relative vacuum (relative pressure) | ≥ – 8 kPa (– 60 mmHg, – 2.4 inHg) |
| Fuel tank pressure | –0.7 kPa (–5 mmHg, –0.2 inHg) — 1.4 kPa (10.7 mmHg, 0.4 inHg) |
| Vehicle speed | 50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms |
| Closed air/fuel ratio control | In operation |
| Engine speed | 1050 rpm — 6000 rpm |
| **During diagnosis** | |
| Change of fuel level | ≤ Value of Map 4 |
| Pressure change every one second | < 0.1 kPa (0.44 mmHg, 0 inHg) |
| Minimum pressure change value every one second – Maximum pressure change value every one second | < 0.1 kPa (0.51 mmHg, 0 inHg) (Mode D) |
| \| Pressure change in tank every second \| | ≤ 0.1 kPa (0.75 mmHg, 0 inHg) |
| Barometric pressure change | –0.5 kPa (–3.6 mmHg, –0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode D)<br>–0.3 kPa (–2.4 mmHg, –0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode E) |

### Map 4

| Fuel level ( ℓ , US gal, Imp gal) | 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Change ( ℓ , US gal, Imp gal) | 5, 1.32, 1.1 | 5, 1.32, 1.1 | 5, 1.32, 1.1 | 5, 1.32, 1.1 | 5, 1.32, 1.1 | 5, 1.32, 1.1 | 5, 1.32, 1.1 |

## 4. GENERAL DRIVING CYCLE

### 0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

### 0.02-inch Diagnosis

- Perform the diagnosis 125 seconds or more at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

## 5. DIAGNOSTIC METHOD

**Purge control solenoid valve stuck open fault diagnosis**

DTC
P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

**Purpose of Mode Z**

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

**Diagnostic method**

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

- **Abnormality Judgment**

If OK judgment cannot be made, extend Mode Z, and Judge as NG when the following conditions are established after predetermined amount of time.

**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| evptez – evptezha | > 0.9 kPa (6.5 mmHg, 0.3 inHg) | P0457 |
| evptezini | ≤ 1.4 kPa (10.7 mmHg, 0.4 inHg) | |
| Time of 2 ℓ (0.53 US gal, 0.44 Imp gal) or more fuel no sloshing | ≥ 40000 ms | |

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 13000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

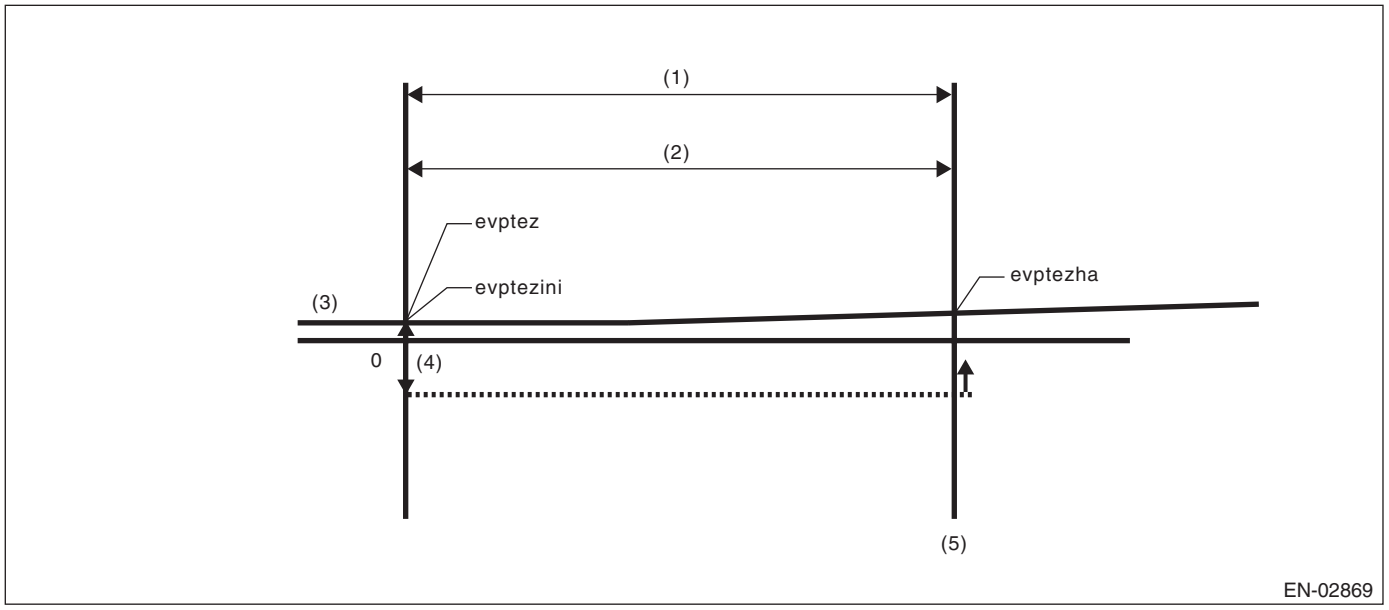
- **Normality Judgment**

Judge as OK and change to Mode A when the following conditions are established after predetermined time has passed since Mode Z started.

**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| evptez – evptezha | ≤ 0.4 kPa (3 mmHg, 0.1 inHg) | P0457 |

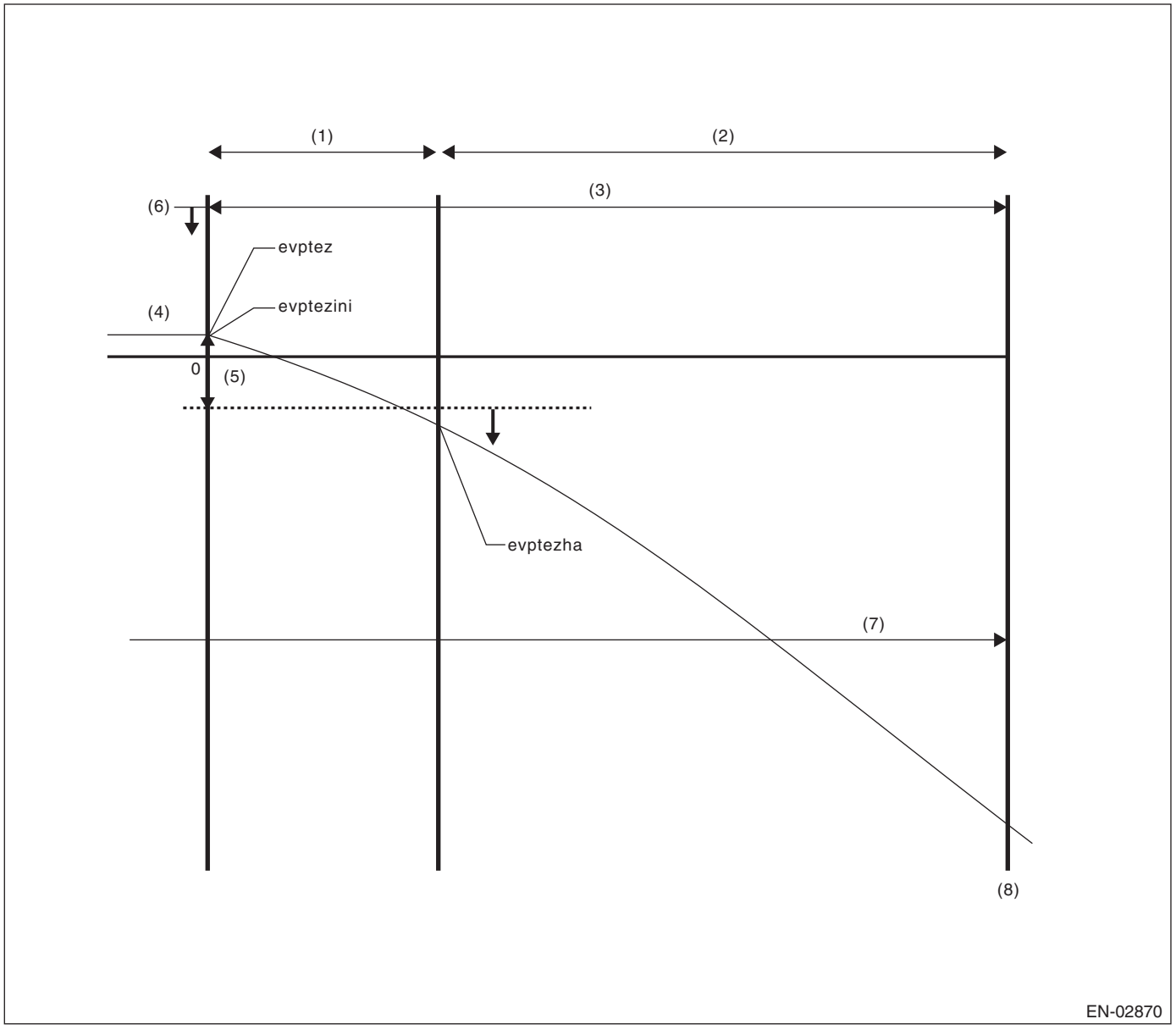
**Normal**




(1) Mode Z
(2) 3000 ms
(3) Fuel tank pressure
(4) 0.4 kPa (3 mmHg, 0.1 inHg)
(5) OK judgment

evptez – evptezha ≤ 0.4 kPa (3 mmHg, 0.1 inHg) Normal when above is established
**Time Needed for Diagnosis:** 0 ms + 3000 ms

**Purge control solenoid valve Open Fixation**




(1) Mode Z
(2) Extended mode Z
(3) 3000 ms + 13000 ms
(4) Fuel tank pressure
(5) 0.9 kPa (6.5 mmHg, 0.3 inHg)
(6) 1.4 kPa (10.7 mmHg, 0.4 inHg)
(7) 40000 ms no fuel sloshing
(8) NG judgment

- evptezini ≤ 1.4 kPa (10.7 mmHg, 0.4 inHg)
- evptez – evptezha > 0.9 kPa (6.5 mmHg, 0.3 inHg)
- No fuel sloshing of over 2 ℓ (0.53 US gal, 0.44 Imp gal) lasts for more than 40000 ms.

Judge as abnormal when all are established.

**Leak Diagnosis**

DTC
P0442 Evaporative Emission Control System Leak Detected (Small Leak)
P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

**Mode A: (Estimated evaporation gas amount)**
Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.
**Mode B: (Negative pressure sealed)**
Introduce negative pressure in the intake manifold to the tank.
Approx. 0 → –1.4 kPa (0 → –10.5 mmHg, 0 → –0.4 inHg)
When the pressure above (desired negative pressure) is reached, enters Mode C.
In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.
**Abnormality Judgment**
Judge as NG (large leakage) when the following conditions are established.
**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| Time to reach target negative pressure | ≥ 10000 ms + 25000 ms | P0457 |
| or | | |
| Mode B time | ≥ 10000 ms | |
| (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started) | > –0.3 kPa (–2.5 mmHg, –0.1 inHg) | |

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms
**Mode C: (Check pressure rise)**
Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)
Change to Mode D when the tank pressure returns to the start level of P2 calculation.
Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

| Tank pressure when starting calculation of P2 | Time for advanced OK judgment |
|---|---|
| –1.4 kPa (–10.5 mmHg, –0.4 inHg) | 18600 ms |

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 ms
**Mode D: (Measure amount of negative pressure change)**
Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.
After calculating P2, perform a small leak diagnosis according to the items below.
**When Mode D is ended**
Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

**Abnormality Judgment**

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value | DTC |
|---|---|---|
| P2 – 1.5 – × P1<br>P2: Tank pressure that changes every 10000 ms in mode D<br>P1: Tank pressure that changes every 10000 ms in mode A | > Value of Map 5 | P0442 |

*1.5 –: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

**Map 5 Malfunction criteria limit for evaporation diagnosis**

| Fuel temperature vs. Fuel level | 25 °C (77 °F) | 30 °C (86 °F) | 35 °C (95 °F) | 40 °C (104 °F) | 45 °C (113 °F) |
|---|---|---|---|---|---|
| 0 ℓ (0 US gal, 0 Imp gal) | 0.3 kPa (2.1 mmHg, 0.1 inHg) | 0.3 kPa (2.2 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0.3 kPa (2.35 mmHg, 0.1 inHg) | 0.3 kPa (2.4 mmHg, 0.1 inHg) |
| 10 ℓ (2.64 US gal, 2.2 Imp gal) | 0.3 kPa (2.1 mmHg, 0.1 inHg) | 0.3 kPa (2.2 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0.3 kPa (2.35 mmHg, 0.1 inHg) | 0.3 kPa (2.4 mmHg, 0.1 inHg) |
| 20 ℓ (5.28 US gal, 4.4 Imp gal) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0.3 kPa (2.4 mmHg, 0.1 inHg) | 0.3 kPa (2.5 mmHg, 0.1 inHg) | 0.3 kPa (2.6 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) |
| 30 ℓ (7.93 US gal, 6.6 Imp gal) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (3.05 mmHg, 0.1 inHg) | 0.4 kPa (3.15 mmHg, 0.1 inHg) | 0.4 kPa (3.25 mmHg, 0.1 inHg) | 0.4 kPa (3.35 mmHg, 0.1 inHg) |
| 40 ℓ (10.57 US gal, 8.8 Imp gal) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (3.15 mmHg, 0.1 inHg) | 0.4 kPa (3.3 mmHg, 0.1 inHg) | 0.5 kPa (3.4 mmHg, 0.1 inHg) | 0.5 kPa (3.5 mmHg, 0.1 inHg) |
| 50 ℓ (13.21 US gal, 11 Imp gal) | 0.4 kPa (3.2 mmHg, 0.1 inHg) | 0.4 kPa (3.3 mmHg, 0.1 inHg) | 0.5 kPa (3.5 mmHg, 0.1 inHg) | 0.5 kPa (3.6 mmHg, 0.1 inHg) | 0.5 kPa (3.7 mmHg, 0.1 inHg) |
| 60 ℓ (15.85 US gal, 13.2 Imp gal) | 0.4 kPa (3.2 mmHg, 0.1 inHg) | 0.4 kPa (3.3 mmHg, 0.1 inHg) | 0.5 kPa (3.5 mmHg, 0.1 inHg) | 0.5 kPa (3.6 mmHg, 0.1 inHg) | 0.5 kPa (3.7 mmHg, 0.1 inHg) |

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 ms + 10000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**Leak Diagnosis**

DTC
P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

**Mode A: (0 point compensation)**
When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.
**Mode B: (Negative pressure introduced)**
Introduce negative pressure in the intake manifold to the tank.
Approx. 0 → –2 kPa (0 → –15 mmHg, 0 → –0.6 inHg)
When the pressure above (desired negative pressure) is reached, enters Mode C.
When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.
**Mode C: (Negative pressure maintained)**
Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)
Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the predetermined amount of time has passed.
**Mode D: (Calculate the amount of negative pressure change)**
Monitor the tank pressure in mode D, calculate the pressure change in the tank (P2), and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis according to the value of P2.
**Normality Judgment**
Judge as OK when the following conditions are established.
**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Advanced OK judgment 1** | |
| Mode D time | ≥ 0 ms + 10000 ms |
| Tank internal pressure | ≤ Value of Map 6 |
| **Advanced OK judgment 2** | |
| Mode D time | ≥ 0 ms + 200000 ms |
| P2 | ≤ Value of Map 7 |

**Map 6**

| Fuel level ( ℓ , US gal, Imp gal) | 0, 0, 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Tank pressure (kPa, mmHg, inHgl) | –1.9, –14.62, –0.6 | –1.9, –14.62, –0.6 | –1.9, –14.59, –0.6 | –1.9, –14.56, –0.6 | –1.9, –14.42, –0.6 | –1.9, –14.28, –0.6 | –1.9, –14.28, –0.6 |

**Map 7**

| Fuel level ( ℓ , US gal, Imp gal) | 0, 0, 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Tank pressure (kPa, mmHg, inHgl) | 0.9, 7, 0.3 | 0.9, 7, 0.3 | 0.9, 7.05, 0.3 | 0.9, 7.1, 0.3 | 1.1, 8.2, 0.3 | 1.3, 9.6, 0.4 | 1.3, 9.6, 0.4 |

**Mode E: (Evaporation occurrence amount calculation)**
Calculate the change of tank pressure with the time evpdset (P1) to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| P1 | < Value of Map 8 |

**Map 8 Malfunction criteria limit for evaporation diagnosis**

| Time (evpdset) vs. Fuel level | 0 ms | 30000 ms | 50000 ms | 100000 ms | 160000 ms | 200000 ms |
|---|---|---|---|---|---|---|
| 0 ℓ (0 US gal, 0 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.2 kPa (1.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) |
| 10 ℓ (2.64 US gal, 2.2 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.2 kPa (1.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) |
| 20 ℓ (5.28 US gal, 4.4 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.2 kPa (1.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) |
| 30 ℓ (7.93 US gal, 6.6 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.2 kPa (1.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) | 0.4 kPa (2.7 mmHg, 0.1 inHg) |
| 40 ℓ (10.57 US gal, 8.8 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.2 kPa (1.85 mmHg, 0.1 inHg) | 0.3 kPa (2.5 mmHg, 0.1 inHg) | 0.3 kPa (2.5 mmHg, 0.1 inHg) | 0.3 kPa (2.5 mmHg, 0.1 inHg) |
| 50 ℓ (13.21 US gal, 11 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.3 kPa (2 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0 kPa (0 mmHg, 0 inHg) |
| 60 ℓ (15.85 US gal, 13.2 Imp gal) | 0 kPa (0 mmHg, 0 inHg) | 0.1 kPa (0.5 mmHg, 0 inHg) | 0.3 kPa (2 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0.3 kPa (2.3 mmHg, 0.1 inHg) | 0 kPa (0 mmHg, 0 inHg) |

**Time Needed for Diagnosis:**Value of Map1 + Value of Map2 + 25290 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| P1 | > Value of Map 9 |

**Map 9 Malfunction criteria limit for evaporation diagnosis**

| Time (evpdset) vs. Fuel level | 0 ms | 30000 ms | 50000 ms | 100000 ms | 160000 ms | 200000 ms |
|---|---|---|---|---|---|---|
| 0 ℓ (0 US gal, 0 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.5 kPa (3.5 mmHg, 0.1 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) |
| 10 ℓ (2.64 US gal, 2.2 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.5 kPa (3.5 mmHg, 0.1 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) | 0.6 kPa (4.2 mmHg, 0.2 inHg) |
| 20 ℓ (5.28 US gal, 4.4 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.4 kPa (3.25 mmHg, 0.1 inHg) | 0.5 kPa (4.1 mmHg, 0.2 inHg) | 0.5 kPa (4.1 mmHg, 0.2 inHg) | 0.5 kPa (4.1 mmHg, 0.2 inHg) | 0.5 kPa (4.1 mmHg, 0.2 inHg) |
| 30 ℓ (7.93 US gal, 6.6 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.4 kPa (3 mmHg, 0.1 inHg) | 0.5 kPa (3.9 mmHg, 0.2 inHg) | 0.5 kPa (3.9 mmHg, 0.2 inHg) | 0.5 kPa (3.9 mmHg, 0.2 inHg) | 0.5 kPa (3.9 mmHg, 0.2 inHg) |
| 40 ℓ (10.57 US gal, 8.8 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.3 kPa (2.25 mmHg, 0.1 inHg) | 0.5 kPa (3.4 mmHg, 0.1 inHg) | 0.5 kPa (3.4 mmHg, 0.1 inHg) | 0.5 kPa (3.4 mmHg, 0.1 inHg) | 0.5 kPa (3.4 mmHg, 0.1 inHg) |
| 50 ℓ (13.21 US gal, 11 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.2 kPa (1.5 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) |
| 60 ℓ (15.85 US gal, 13.2 Imp gal) | 0.1 kPa (1 mmHg, 0 inHg) | 0.2 kPa (1.5 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) | 0.4 kPa (2.9 mmHg, 0.1 inHg) |

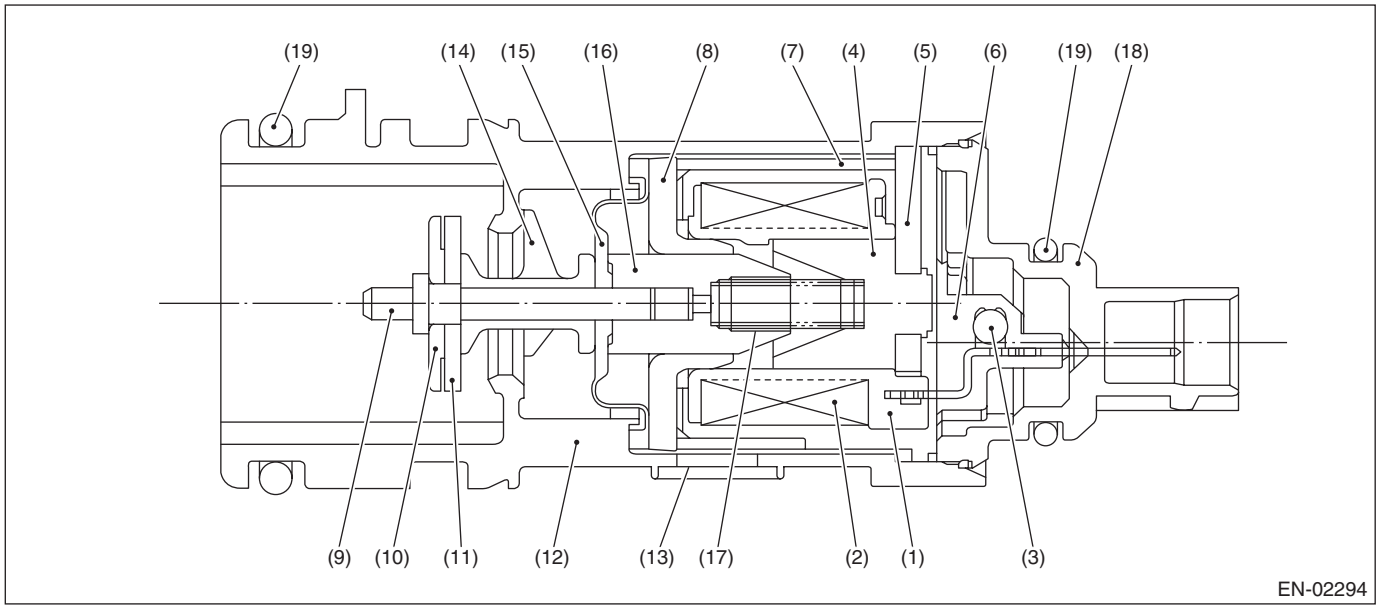
**Time Needed for Diagnosis:**Value of Map1 + Value of Map2 + 25290 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

# BH:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.
Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs OFF signal | Low |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs OFF signal | High |

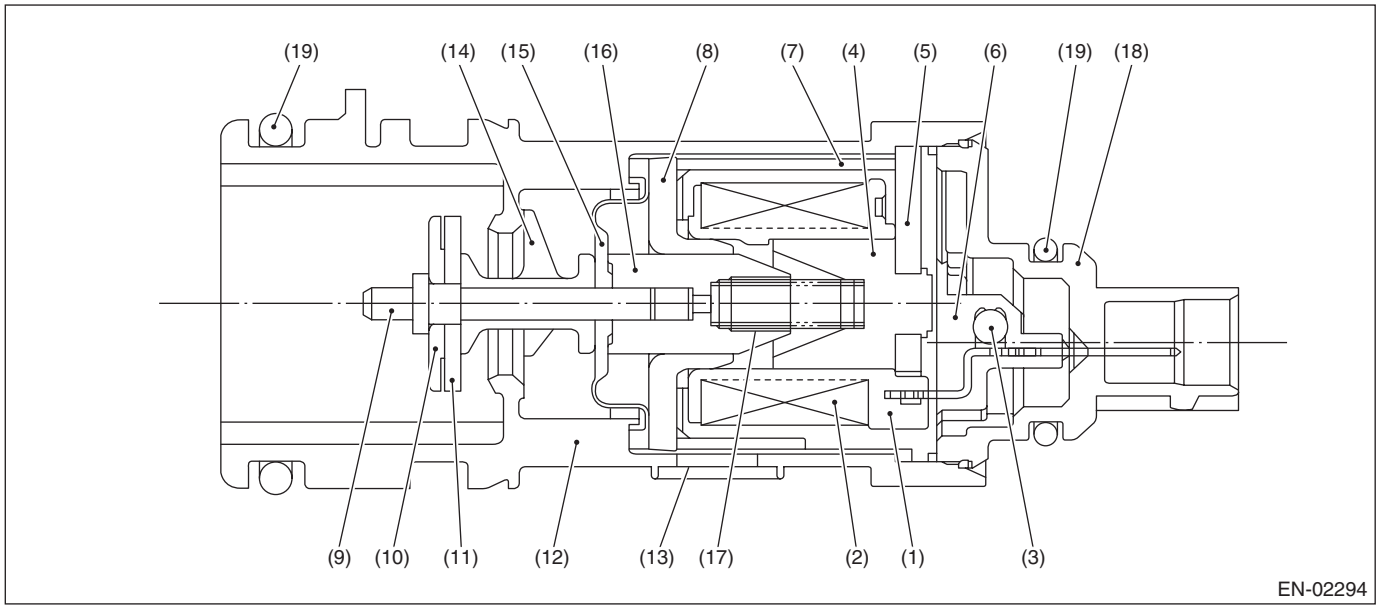
**Time Needed for Diagnosis:** Less than 1 second

# BI: DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.
Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs ON signal | High |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs ON signal | Low |

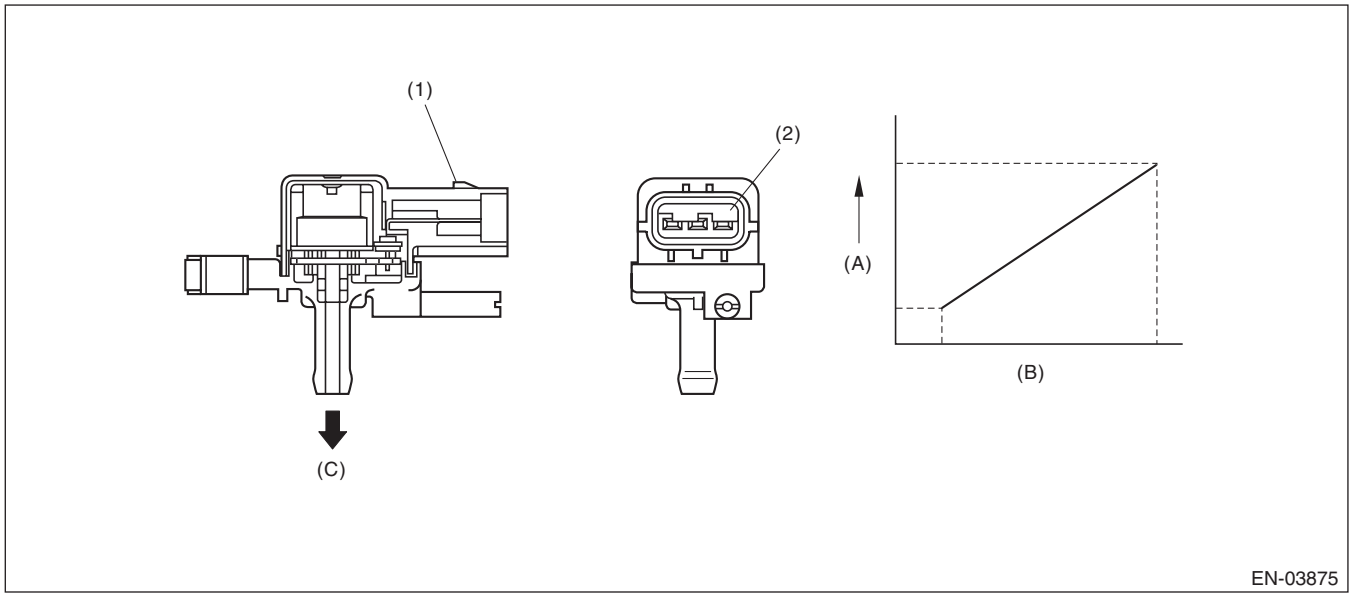
**Time Needed for Diagnosis:** Less than 1 second

# BJ:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

## 1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.
Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

## 2. COMPONENT DESCRIPTION




(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Elapsed time after starting the engine | ≥ 60 s |
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Fuel temperature | < 35 °C (95 °F) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |

## 4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 s have passed since the engine started.
- Pay attention to the fuel level and temperature.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Number of times that the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more (with enable condition established) | ≥ 16 time(s) |
| Maximum – Minimum tank pressure (with enable condition completed) | < 0 kPa (0.375 mmHg, 0 inHg) |
| Maximum – Minimum fuel temperature (with enable condition completed) | ≥ 7 °C (12.6°F) |

If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is less than 2 ℓ (0.53 US gal, 0.44 Imp gal), extend 60 s and make judgment with the Max. and Min. values for the fuel level in 60 s × 2. 60 sIf a difference does not appear, extend the time 60 s × 3, 60 s × 4, 60 s × 5 and continue the judgment. If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

**Time Needed for Diagnosis:** 60 s × 16 time(s) or more

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Maximum minimum tank pressure | ≥ 0 kPa (0.375 mmHg, 0 inHg) |

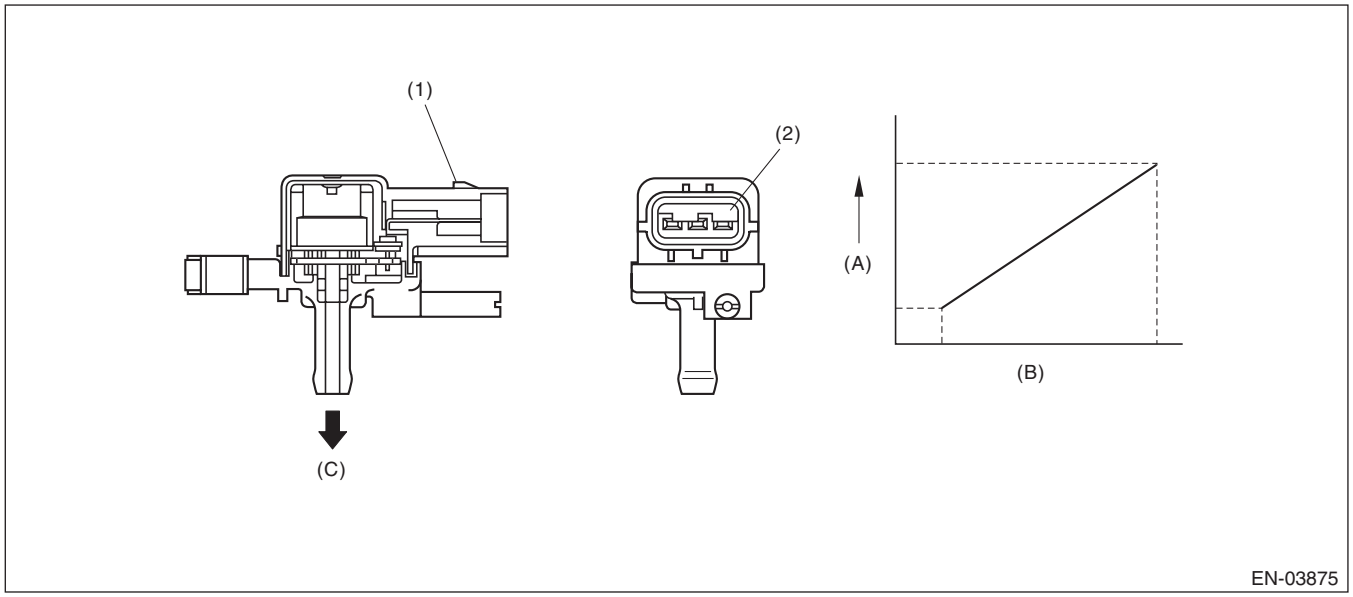
**Time Needed for Diagnosis:** Less than 1 second

# BK:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | < –7.5 kPa (–55.9 mmHg, –2.2 inHg) |
| Battery voltage | ≥ 10.9 V |

**Time Needed for Diagnosis:** 15000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | ≥ –7.5 kPa (–55.9 mmHg, –2.2 inHg) |
| Battery voltage | ≥ 10.9 V |

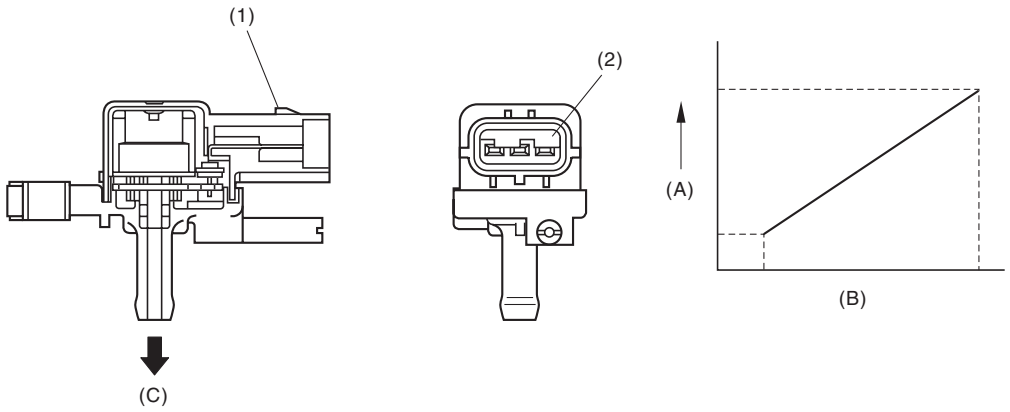
**Time Needed for Diagnosis:** Less than 1 second

# BL:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




EN-03875

(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Time needed for all secondary parameters to be in enable conditions | ≥ 5000 ms |
| Vehicle speed | ≥ 2 km/h (1.2 MPH) |
| All conditions of EVAP canister purge | Completed |
| Learning value of evaporation gas concentration (left and right) | < 0.08 |
| Main feedback compensation coefficient (left and right) | ≥ 0.9 |
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

### 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | ≥ 7.9 kPa (59.6 mmHg, 2.3 inHg) |
| Fuel temperature | < 35 °C (95 °F) |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |

**Time Needed for Diagnosis:** 15000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | < 7.9 kPa (59.6 mmHg, 2.3 inHg) |

**Time Needed for Diagnosis:** Less than 1 second

## BM:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-107, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## BN:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

### 1. OUTLINE OF DIAGNOSIS

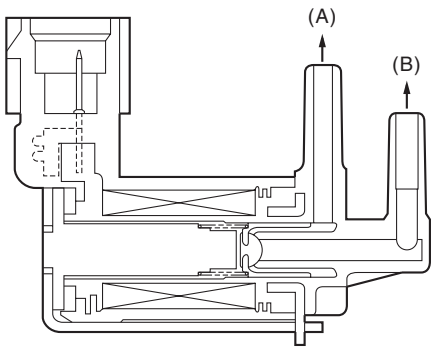
NOTE:
For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-107, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# BO:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




EN-01733

(A) To canister (B) To intake manifold

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duty ratio of “ON” | < 0.75 |
| Terminal output voltage | Low |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal output voltage | High |

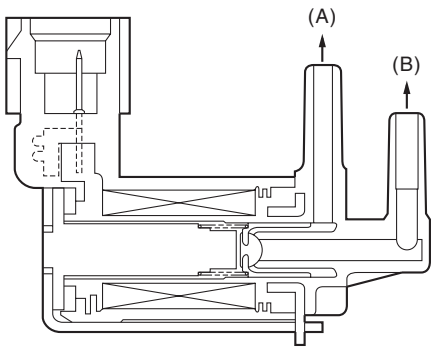
**Time Needed for Diagnosis:** Less than 1 second

# BP:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




EN-01733

(A) To canister (B) To intake manifold

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duty ratio of "ON" | ≥ 0.25 |
| Terminal output voltage | High |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal output voltage | Low |

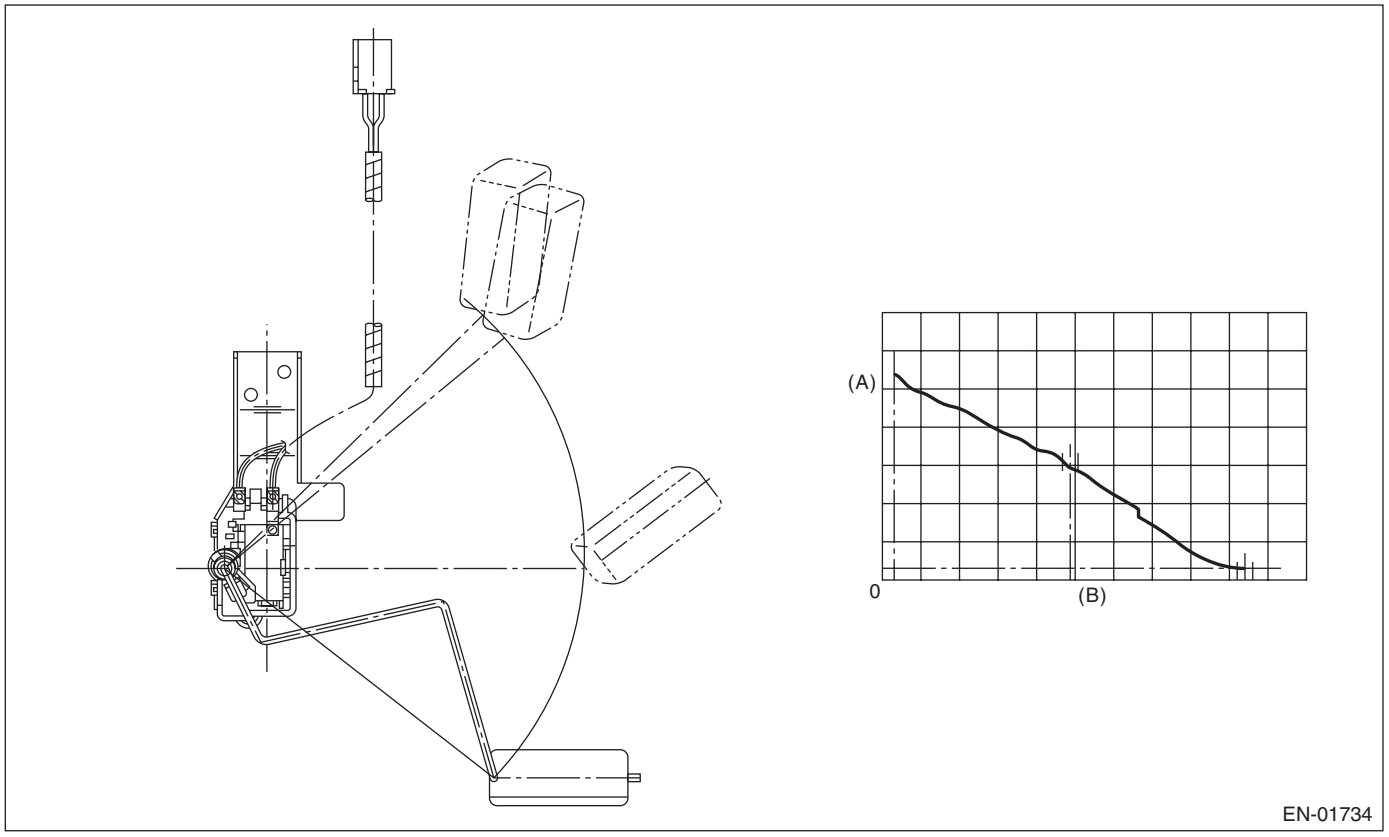
**Time Needed for Diagnosis:** Less than 1 second

# BQ:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.
If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

## 2. COMPONENT DESCRIPTION




(A) Fuel level (B) Resistance

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Accumulated amount of intake air | ≥ 330957 g (11672.85 oz) |
| Max. – min. values of fuel level output | < 2.6 ℓ (0.69 US gal, 0.57 Imp gal) |
| Battery voltage | ≥ 10.9 V |
| Engine speed | < 6000 rpm |
| Elapsed time after starting the engine | ≥ 5000 ms |

**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Accumulated amount of intake air | ≥ 330957 g (11672.85 oz) |
| Max. – min. values of fuel level output | ≥ 2.6 ℓ (0.69 US gal, 0.57 Imp gal) |
| Battery voltage | ≥ 10.9 V |
| Engine speed | < 6000 rpm |
| Elapsed time after starting the engine | ≥ 5000 ms |

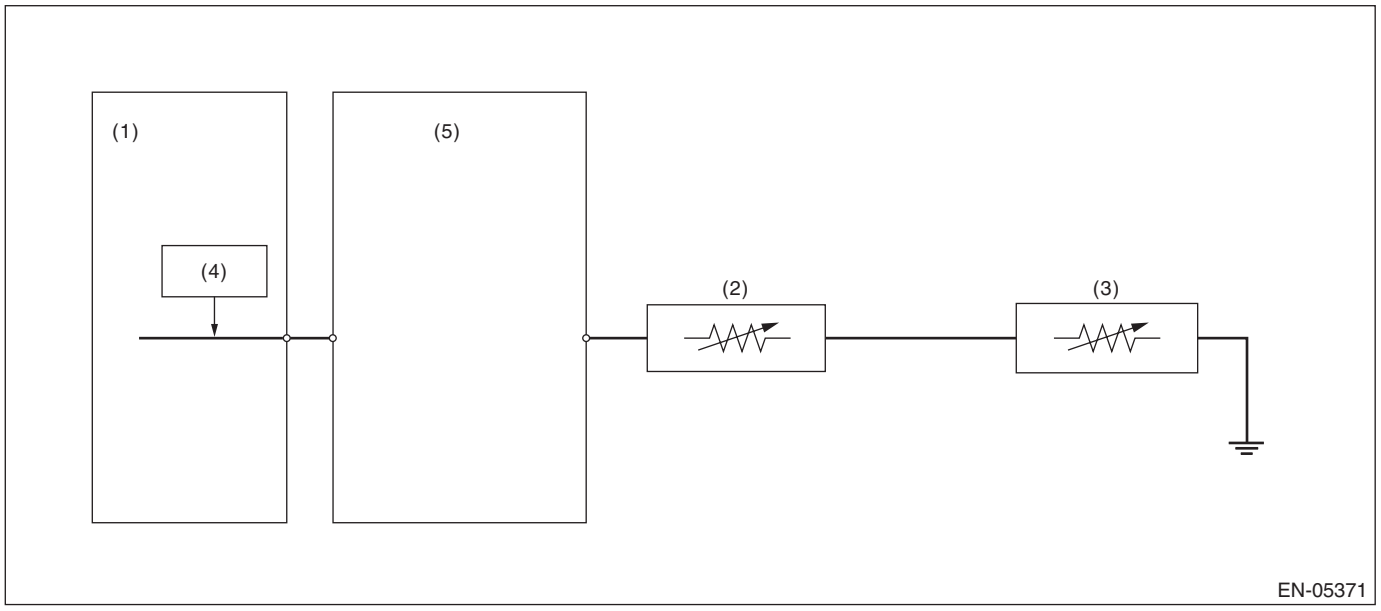
**Time Needed for Diagnosis:** Less than 1 second

# BR:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 3000 ms |
| Output voltage | < 0.173 V |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 3000 ms |
| Output voltage | ≥ 0.173 V |

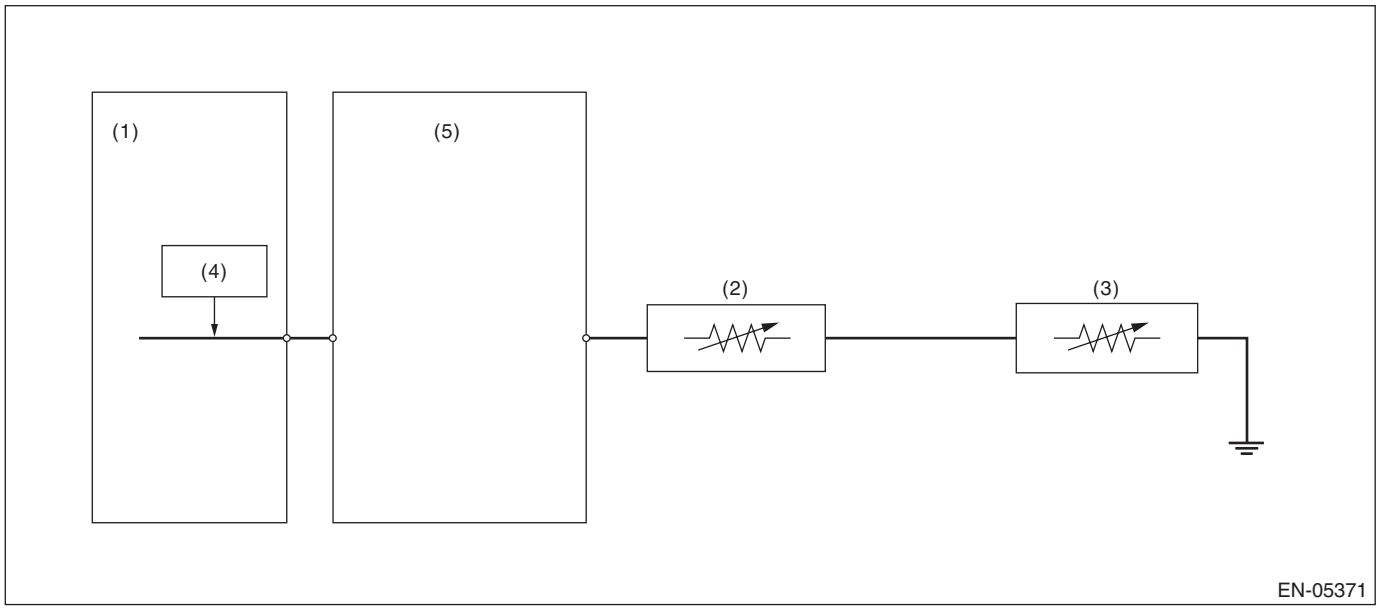
**Time Needed for Diagnosis:** Less than 1 second

# BS:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 3000 ms |
| Output voltage | ≥ 7.212 V |

**Time Needed for Diagnosis:** 1000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 3000 ms |
| Output voltage | < 7.212 V |

**Time Needed for Diagnosis:** Less than 1 second

# BT:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

## 1. OUTLINE OF DIAGNOSIS

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

## 2. ENABLE CONDITIONS

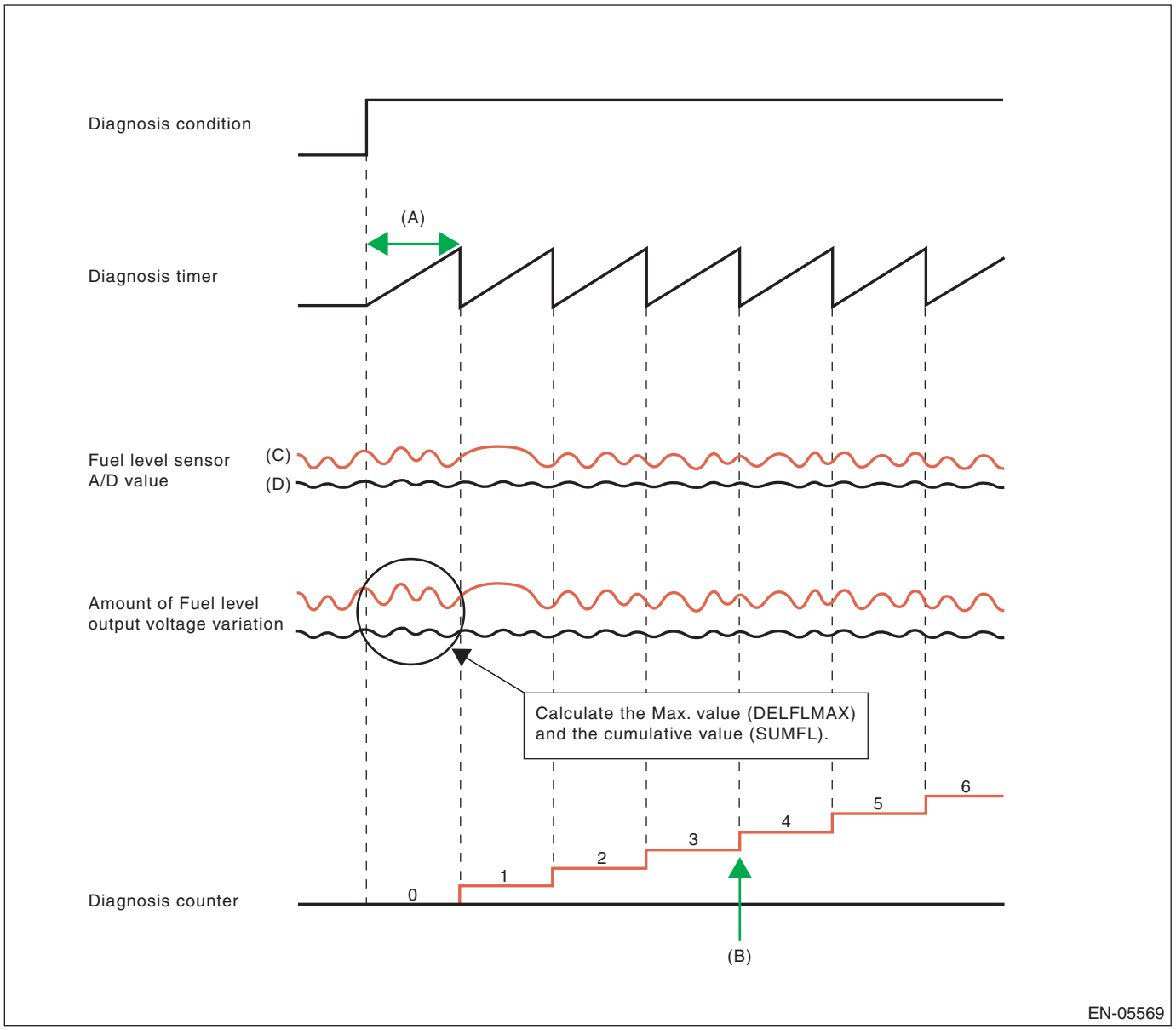
| Malfunction Criteria | Threshold Value |
|---|---|
| Engine speed | ≥ 500 rpm |
| Elapsed time after starting the engine | ≥ 1 second |
| Battery voltage | ≥ 10.9 V |
| Idle switch | ON |
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)<br>and<br>< 54.4 ℓ (14.37 US gal, 11.97 Imp gal) |
| Vehicle speed = 0 km/h (0 MPH) | ≥ 10000 ms |

## 3. GENERAL DRIVING CYCLE

- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

## 4. DIAGNOSTIC METHOD

Calculate the Max. value (DELFLMAX) and cumulative value (SUMFL) of output voltage variation of fuel level sensor during 12.2 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time(s).




(A) 12288 ms
(B) NG at 4 time(s) counts
(C) Malfunction
(D) Normal

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Integrated times of the condition reaching follows, | ≥ 4 time(s) |
| DELFLMAX | ≥ Value from Map |
| or | |
| SUMFL | ≥ 25.92 V |
| At this time,<br>DELFLMAX: Maximum difference of sensor output for 12288 ms<br>SUMFL: Integrated value of the sensor output deviation for12288 ms | |

**Map**

| Fuel level ( ℓ , US gal, Imp gal) | 0, 0, 0 | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
|---|---|---|---|---|---|---|---|
| Measured voltage (V) | 0.27 | 0.27 | 0.426 | 0.582 | 0.738 | 0.894 | 0.894 |

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

| | |
|---|---|
| Maximum value – minimum value of change of tank pressure during 12288 ms | ≥ 0 kPa (0.375 mmHg, 0 inHg) |
| Maximum value – minimum value of battery voltage during 12288 ms | ≥ 1.09 V |

**Time Needed for Diagnosis:** 12288 ms × 4 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| DELFLMAX | < Value from Map |
| SUMFL | < 25.92 V |
| At this time,<br>DELFLMAX: Maximum difference of sensor output for 12288 ms<br>SUMFL: Integrated value of the sensor output deviation for12288 ms | |

**Time Needed for Diagnosis:** 12288 ms

# BU:DTC P0500 VEHICLE SPEED SENSOR “A”

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.
Judge NG when the received data from ABSCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

## 2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the ABS control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the ABS control module and hydraulic control unit.

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after engine starting | ≥ 2000 ms |

## 4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Front ABS wheel speed sensor status | Malfunction |
| Either of the following is established | |
| Front left wheel speed | ≥ 300 km/h (186.4 MPH) |
| Front right wheel speed | ≥ 300 km/h (186.4 MPH) |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Front left wheel speed | > 0 km/h (0 MPH)<br>and<br>< 300 km/h (186.4 MPH) |
| Front right wheel speed | > 0 km/h (0 MPH)<br>and<br>< 300 km/h (186.4 MPH) |

**Time Needed for Diagnosis:** 2500 ms

# BV:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Elapsed time after starting the engine | ≥ 10.49 s |
| Feedback of ISC | In operation |
| Lambda value (left and right) | ≥ 0.81<br>and<br>< 1.1 |
| After switching air conditioner to ON/OFF | ≥ 5.1 s |
| After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more. | > 5.1 s |
| Elapsed time after switching neutral position switch to ON/OFF | > 5.1 s |
| Vehicle speed | 0 km/h (0 MPH) |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Actual engine speed – Targeted engine speed | < –100 rpm |
| Feedback value for ISC | Max. |

**Time Needed for Diagnosis:** 10 s × 3 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Actual engine speed – Targeted engine speed | ≥ –100 rpm |

**Time Needed for Diagnosis:** 10 s

# BW:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Fuel level | ≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) |
| Elapsed time after starting the engine | ≥ 10.49 s |
| Feedback of ISC | In operation |
| Lambda value (left and right) | ≥ 0.81 and < 1.1 |
| After switching air conditioner to ON/OFF | ≥ 5.1 s |
| After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more. | > 5.1 s |
| Elapsed time after switching neutral position switch to ON/OFF | > 5.1 s |
| Vehicle speed | 0 km/h (0 MPH) |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Actual – Target engine speed | ≥ 200 rpm |
| Feedback value for ISC | Min. |

**Time Needed for Diagnosis:** 10 s × 3 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Actual – Target engine speed | < 200 rpm |

**Time Needed for Diagnosis:** 10 s

# BX:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.
Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.
Judge as NG if there is exhaust gas temperature diagnosis and idle speed diagnosis, and if any one of them is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Battery voltage | ≥ 10.9 V |
| Cold start diagnosis | Incomplete |
| Vehicle speed | < 2 km/h (1.2 MPH) |
| Misfire in 200 engine revs. | < 5 |
| Time after starting | = 14 s |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

## 4. DIAGNOSTIC METHOD

- **Exhaust gas temperature diagnosis**

**Abnormality Judgment**
Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Estimated exhaust gas temperature | < Value from Map |

**Map**

| Coolant temperature after starting the engine | –40 °C (–40 °F) | –30 °C (–22 °F) | –20 °C (–4 °F) | –10 °C (14 °F) | 0 °C (32 °F) | 10 °C (50 °F) | 20 °C (68 °F) | 30 °C (86 °F) | 40 °C (104 °F) | 50 °C (122 °F) |
|---|---|---|---|---|---|---|---|---|---|---|
| Threshold value (AT model) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 162 °C (323.6 °F) | 154 °C (309.2 °F) | 142 °C (287.6 °F) | 142 °C (287.6 °F) |
| Threshold value (MT model) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 168 °C (334.4 °F) | 160 °C (320 °F) | 145 °C (293 °F) | 145 °C (293 °F) |

**Time Needed for Diagnosis:** 14 seconds
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**Normality Judgment**
Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Estimated exhaust gas temperature | ≥ Value from Map |

**Time Needed for Diagnosis:** Less than 1 second

- **Idle speed diagnosis**

**Abnormality Judgment**
Judge as NG when the following conditions are established after the predetermined time.
**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Continuous time of (Target engine speed – Actual engine speed > –300 rpm) | ≥ 6000 ms |
| Continuous time of (actual retard amount > 30 °CA) | ≥ 0 ms |

**Time Needed for Diagnosis:** 14 seconds
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.
**Normality Judgment**
Judge as OK and clear the NG if the following conditions are established.
**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Continuous time of (Target engine speed – Actual engine speed > –300 rpm) | < 6000 ms |
| Continuous time of (actual retard amount > 30 °CA) | < 0 ms |

**Time Needed for Diagnosis:** Less than 1 second

# BY:DTC P050B COLD START IGNITION TIMING PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.
Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.
Judge as NG when actual retard amount is under the specified value at cold start.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Battery voltage | ≥ 10.9 V |
| Cold start diagnosis | Incomplete |
| Vehicle speed | < 2 km/h (1.2 MPH) |
| Misfire in 200 engine revs. | < 5 |
| Time after starting | = 14 s |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG when the following conditions are established with diagnosis enable conditions successful.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duration time of (Standard ignition timing – Actual ignition timing ≤ 0 °CA) | > 5000 ms |

**Time Needed for Diagnosis:** 5000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Duration time of (Standard ignition timing – Actual ignition timing > 0 °CA) | > 1000 ms |

**Time Needed for Diagnosis:** 1000 ms

# BZ:DTC P0512 STARTER REQUEST CIRCUIT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.
Judge as ON NG when the starter SW signal remains ON.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Engine condition | After engine starting |
| Starter OFF signal | Not detected |
| Battery voltage | ≥ 8 V |

**Time Needed for Diagnosis:** 180000 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Starter OFF signal | Detected |
| Battery voltage | ≥ 8 V |

**Time Needed for Diagnosis:** Less than 1 second

# CA:DTC P0513 INCORRECT IMMOBILIZER KEY

## 1. OUTLINE OF DIAGNOSIS

| DTC | Item | Outline of Diagnosis |
|---|---|---|
| P0513 | Incorrect Immobilizer Key | Incorrect immobilizer key (Use of unregistered key in body integrated unit) |
| P1570 | Antenna | Faulty antenna |
| P1571 | Reference Code Incompatibility | Reference code incompatibility between body integrated unit and ECM |
| P1572 | IMM Circuit Failure (Except Antenna Circuit) | Communication failure between body integrated unit and ECM |
| P1574 | Key Communication Failure | Failure of body integrated unit to verify key (transponder) ID code or transponder failure |
| P1576 | EGI Control Module EEPROM | ECM malfunctioning |
| P1577 | IMM Control Module EEPROM | Body integrated unit malfunctioning |
| P1578 | Meter Failure | Reference code incompatibility between combination meter and body integrated unit |

## 2. ENABLE CONDITIONS

When starting the engine.

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

## 4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

# CB:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).
When there is a problem in the CPU normal RAM, judge as NG.
If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

Diagnosis with the initial routine.

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Write the specified value into the RAM. | The written value cannot be read. |

**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Write the specified value into the RAM. | The written value can be read. |

**Time Needed for Diagnosis:** Less than 1 second

# CC:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

### Abnormality Judgment

Judge as NG if the criteria below are met.

### Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| SUM value of ROM | Standard |

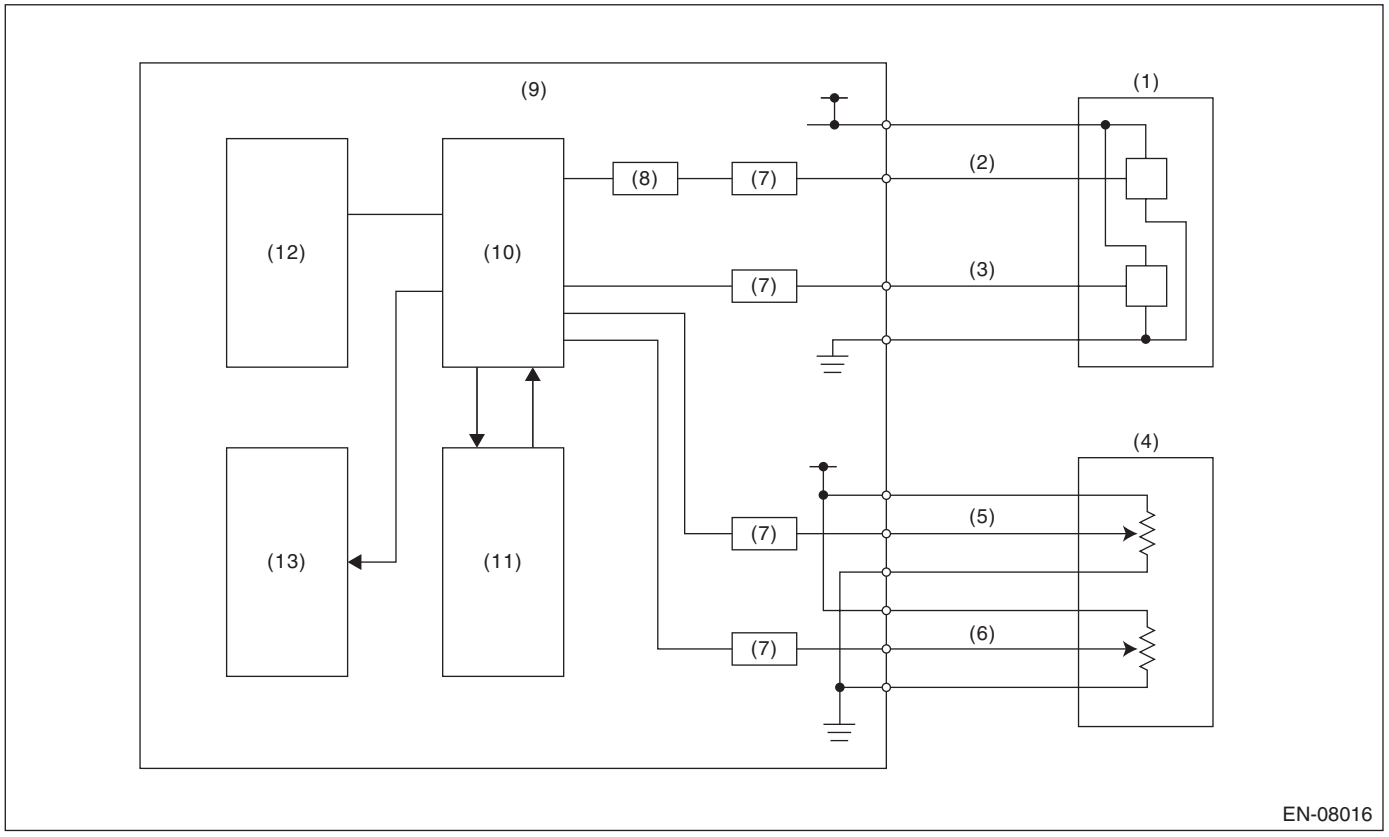
**Time Needed for Diagnosis:** Undetermined
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# CD:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) When the monitoring IC operates abnormally. (monitoring IC abnormal)
(2) When the input amplifier circuit of throttle position sensor 1 operates abnormally. (quadruple amplifier abnormal)
(3) When CPU operates abnormally. (instruction/flow check)
(4) When A/D converter operates abnormally. (ADC abnormal)
(5) When EEPROM operates abnormally. (EEPROM abnormal)
(6) When the output IC operates abnormally. (output driver abnormal)

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (1) | Throttle position sensor | (6) | Accelerator pedal position sensor 2 | (10) | CPU |
| (2) | Throttle position sensor 1 | (7) | I/F circuit | (11) | Monitoring IC |
| (3) | Throttle position sensor 2 | (8) | Amplifier circuit | (12) | EEPROM |
| (4) | Accelerator pedal position sensor | (9) | Engine control module (ECM) | (13) | Output IC |
| (5) | Accelerator pedal position sensor 1 | | | | |

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| (1) Battery voltage | ≥ 6 V |
| (2) Ignition switch | ON |
| (2) Battery voltage | ≥ 6 V |
| (3) Ignition switch | ON |
| (3) ETC control | Permission |
| (4) Ignition switch | ON |
| (4) Battery voltage | ≥ 6 V |
| (5) Starter switch | OFF |
| (5) Battery voltage | > 6 V |
| (6) Ignition switch | ON |
| (6) Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| (1) Operation of monitoring IC | Result and expected value are matched |
| (2) \| Throttle position sensor 1 opening angle – (Throttle position sensor 1 opening angle after passing amplifier /4) \| | < 3 ° |
| (3) Main CPU calculation result | Result and expected value are matched |
| (4) \| Reference voltage – read value of voltage \| | < 0.078125 V |
| (5) Writing EEPROM | Writing completed |
| (6) Communication between output IC | Possible to communicate |

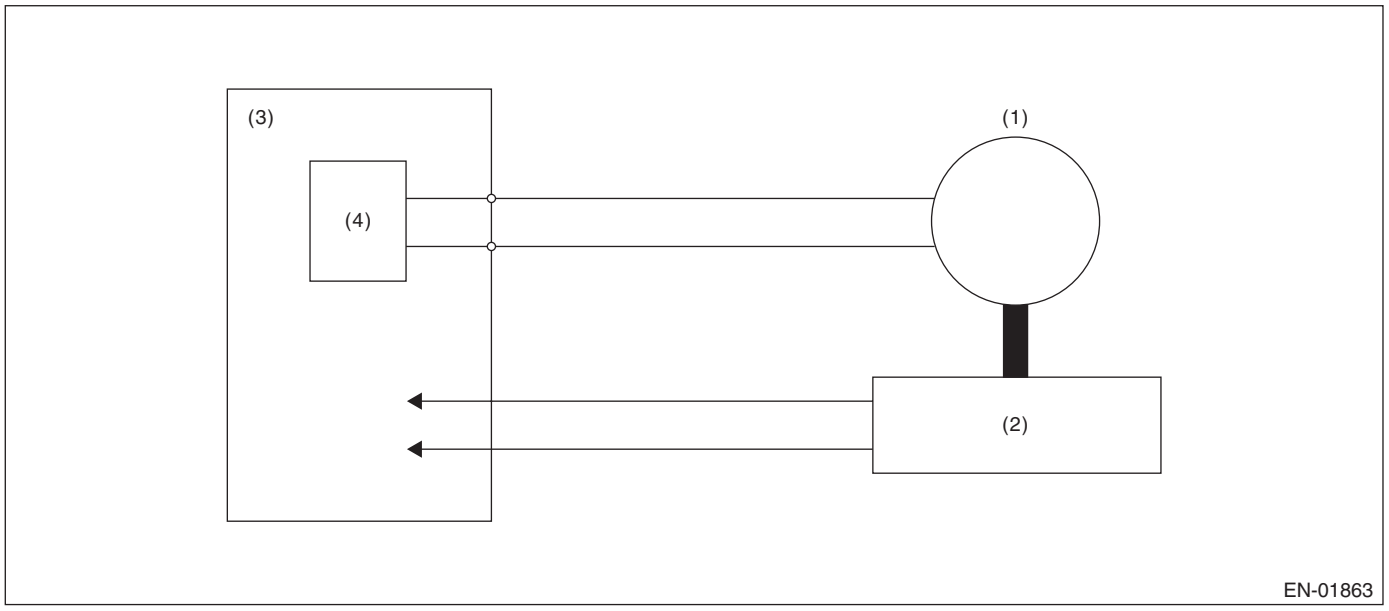
**Time Needed for Diagnosis:**
(1): 200 ms
(2): 24 ms
(3): 192 ms
(4): 200 ms
(5): 48 ms
(6): 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# CE:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

## 2. COMPONENT DESCRIPTION




(1) Motor
(2) Throttle position sensor
(3) Engine control module (ECM)
(4) Drive circuit

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Normal operation of electronic throttle control | ON |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

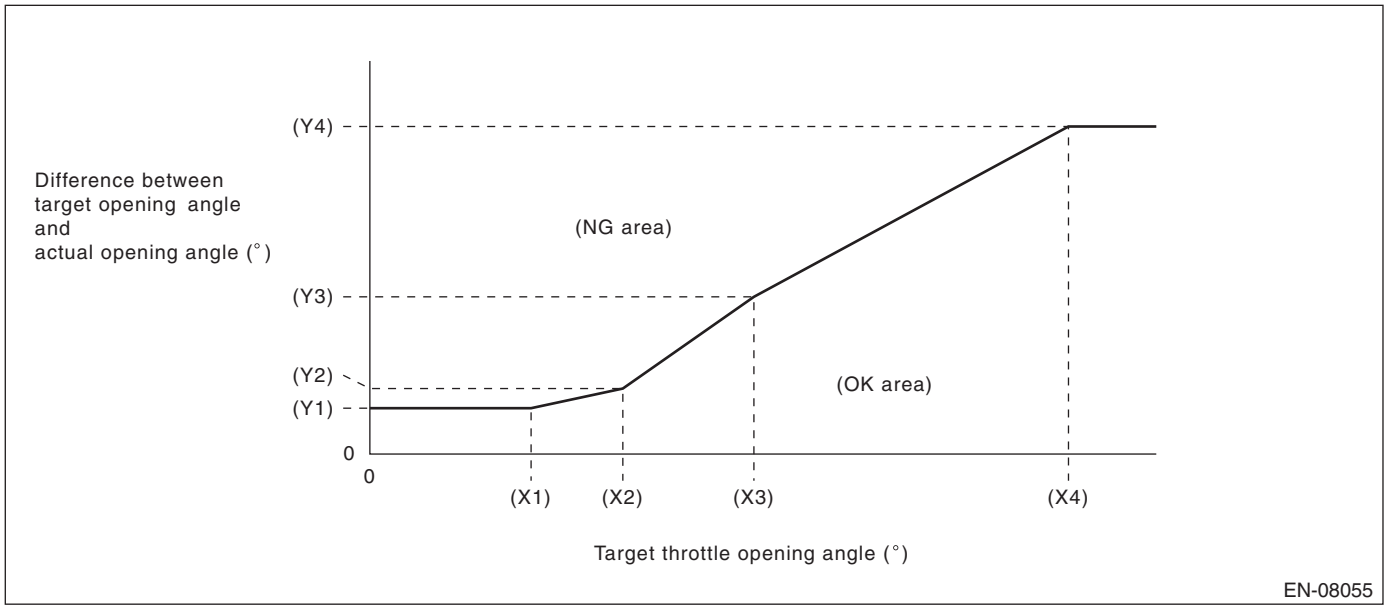
**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Difference between target opening angle and actual opening angle | Within OK area of **details of judgment value** |
| Output duty to drive circuit | < 95 % |

**Time Needed for Diagnosis:**

- Difference between target opening angle and actual opening angle:
  - NG judgment: Refer to **details of judgment value**.
  - OK judgment: 2000 ms
- Output duty to drive circuit: 2000 ms

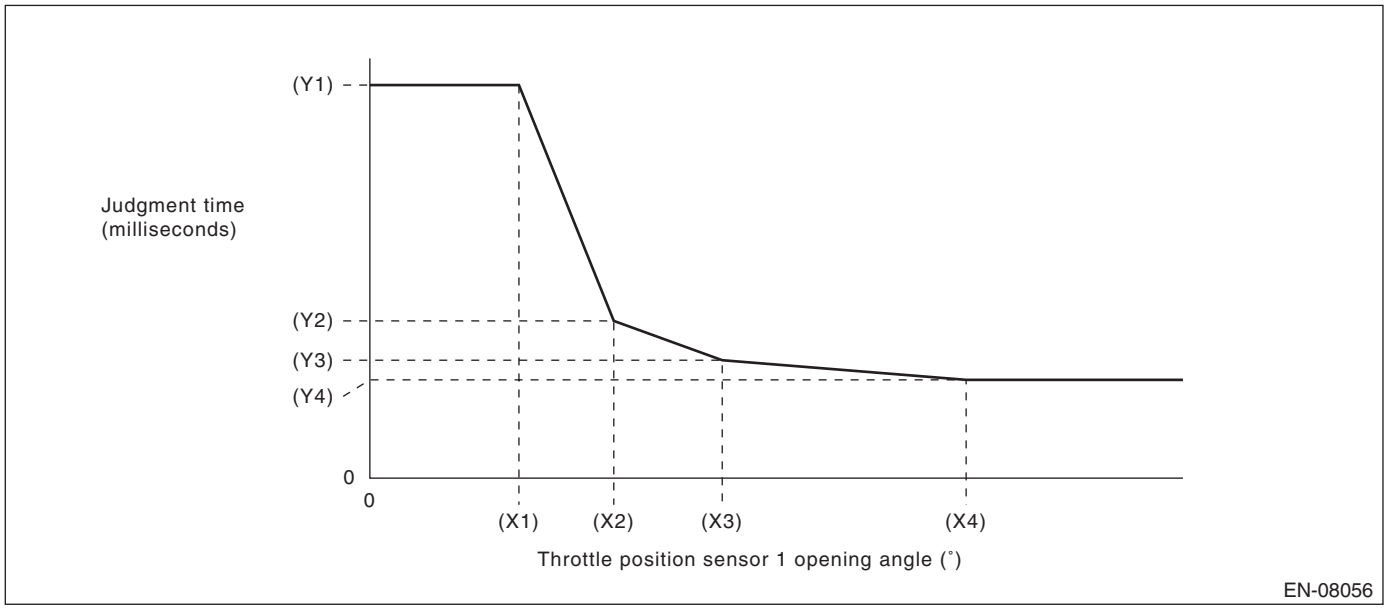
### Details of Judgment Value




(X1) 6.15 °
(X2) 9.65 °
(X3) 14.65 °
(X4) 26.65 °

(Y1) 3.5 °
(Y2) 5 °
(Y3) 12 °
(Y4) 25 °

### Details of Judgment time




(X1) 5.5 °
(X2) 9 °
(X3) 13 °
(X4) 22 °

(Y1) 1000 ms
(Y2) 400 ms
(Y3) 300 ms
(Y4) 250 ms

NOTE:
The judgment time of actual opening angle ≤ target opening angle is always 1000 milliseconds.
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# CF:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the TCM and there is a MIL lighting request.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| MIL lighting request from TCM | Yes |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| MIL lighting request from TCM | None |

**Time Needed for Diagnosis:** Less than 1 second

# CG:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

## 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Starter relay | OFF |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal in ECM when “P”/“N” range in TCM are “OFF” and when the other switches are “ON” | LOW (ON) |

**Time Needed for Diagnosis:** 100 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal in ECM when “P”/“N” range in TCM are “OFF” and when the other switches are “ON” | HIGH (OFF) |

**Time Needed for Diagnosis:** Less than 1 second

# CH:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Starter relay | OFF |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal (while changing from a to b below) | LOW (ON) continues. |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

**Time Needed for Diagnosis:** 3 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear NG when there is change in the neutral SW.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal (while changing from a to b below) | Changes to HIGH (OFF). |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

**Time Needed for Diagnosis:** Less than 1 second

# CI: DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

## 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Starter relay | OFF |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal in ECM when “P”/“N” range in TCM are “ON” and when the other switches are “OFF” | HIGH (OFF) |

**Time Needed for Diagnosis:** 100 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal in ECM when “P”/“N” range in TCM are “ON” and when the other switches are “OFF” | LOW (ON) |

**Time Needed for Diagnosis:** Less than 1 second

# CJ:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Starter relay | OFF |

## 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal (while changing from a to b below) | HIGH (OFF) continues. |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

**Time Needed for Diagnosis:** 3 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear NG when there is change in the neutral SW.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Neutral switch signal (while changing from a to b below) | Changes to LOW (ON). |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

**Time Needed for Diagnosis:** Less than 1 second

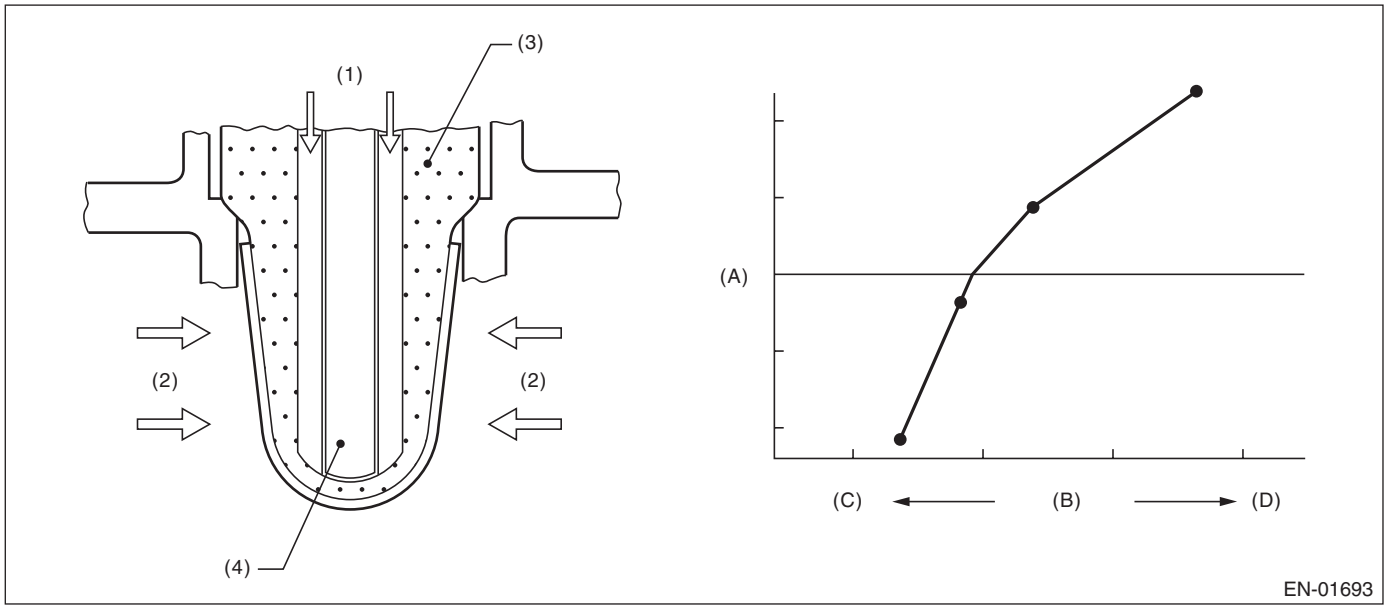
# CK:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

## 1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

| |
|---|
| λ value = Actual air fuel ratio/Theoretical air fuel ratio |
| λ > 1: Lean |
| λ < 1: Rich |

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) $ZrO_2$
(4) Ceramic heater

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Time needed for all secondary parameters to be in enable conditions | ≥ 4096 ms |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Rear oxygen sensor sub feedback | Execution |
| Rear oxygen sensor output voltage – Feedback target voltage | – 0.2 V — 0.1 V |
| or | |
| Rear oxygen sensor sub feedback compensation coefficient | On Min. |
| or | |
| Rear oxygen sensor sub feedback compensation coefficient | On Max. |
| Elapsed time after starting the engine | ≥ 60000 ms |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Vehicle speed | ≥ 20 km/h (12.4 MPH) |
| Amount of intake air | ≥ 6 g/s (0.21 oz/s) |
| Load change at 180° CA | < 0.02 g/rev (0 oz/rev) |
| Front oxygen (A/F) sensor impedance | 0 Ω — 50 Ω |
| Learning value of evaporation gas density | < 0.2 |
| Total time of canister purge operation | ≥ 19.9 s |
| Targeted lambda value load compensation coefficient | –0.03 — 0.000 |

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| λ value | < 0.85 |

**Time Needed for Diagnosis:** 10000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| λ value | ≥ 0.85 |

**Time Needed for Diagnosis:** Less than 1 second

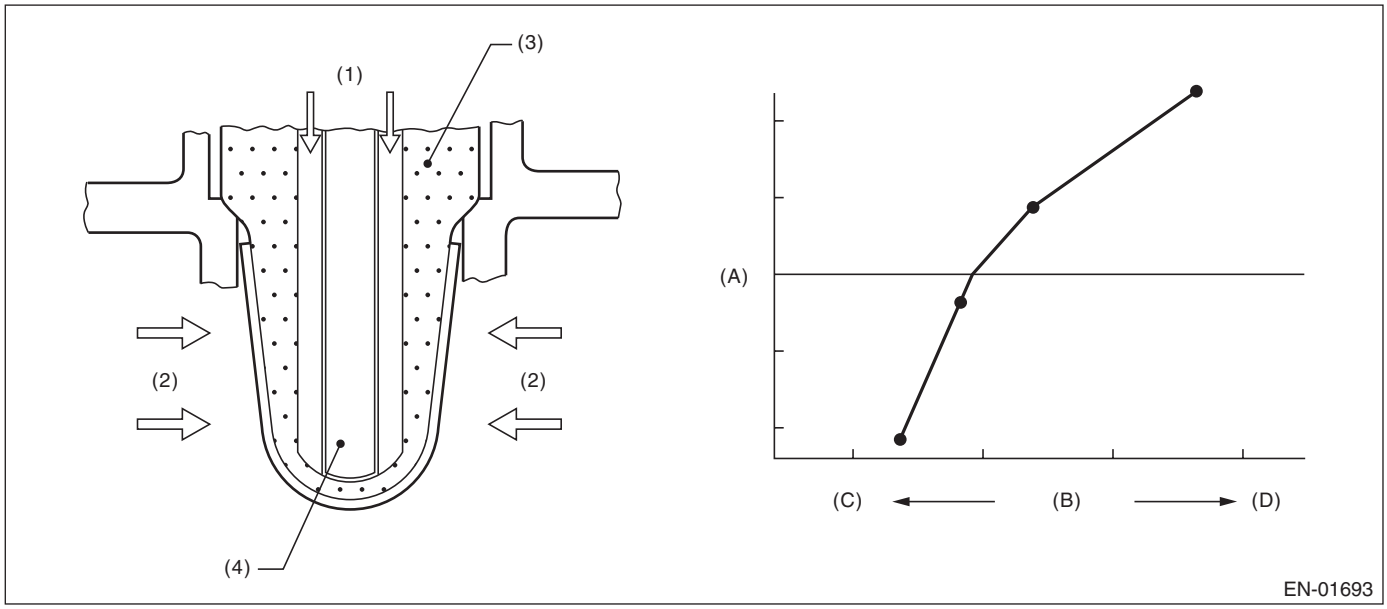
# CL:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

## 1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

| |
|---|
| λ value = Actual air fuel ratio/Theoretical air fuel ratio |
| λ > 1: Lean |
| λ < 1: Rich |

## 2. COMPONENT DESCRIPTION




(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) $ZrO_2$
(4) Ceramic heater

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Time needed for all secondary parameters to be in enable conditions | ≥ 4096 ms |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Rear oxygen sensor sub feedback | Execution |
| Rear oxygen sensor output voltage – Feedback target voltage | – 0.2 V — 0.1 V |
| or | |
| Rear oxygen sensor sub feedback compensation coefficient | On Min. |
| or | |
| Rear oxygen sensor sub feedback compensation coefficient | On Max. |
| Elapsed time after starting the engine | ≥ 60000 ms |
| Engine coolant temperature | ≥ 75 °C (167 °F) |
| Vehicle speed | ≥ 20 km/h (12.4 MPH) |
| Amount of intake air | ≥ 6 g/s (0.21 oz/s) |
| Load change at 180° CA | < 0.02 g/rev (0 oz/rev) |
| Front oxygen (A/F) sensor impedance | 0 Ω — 50 Ω |
| Learning value of evaporation gas density | < 0.2 |
| Total time of canister purge operation | ≥ 19.9 s |
| Targeted lambda value load compensation coefficient | –0.03 — 0.000 |

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| λ value | > 1.15 |

**Time Needed for Diagnosis:** 10000 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| λ value | ≤ 1.15 |

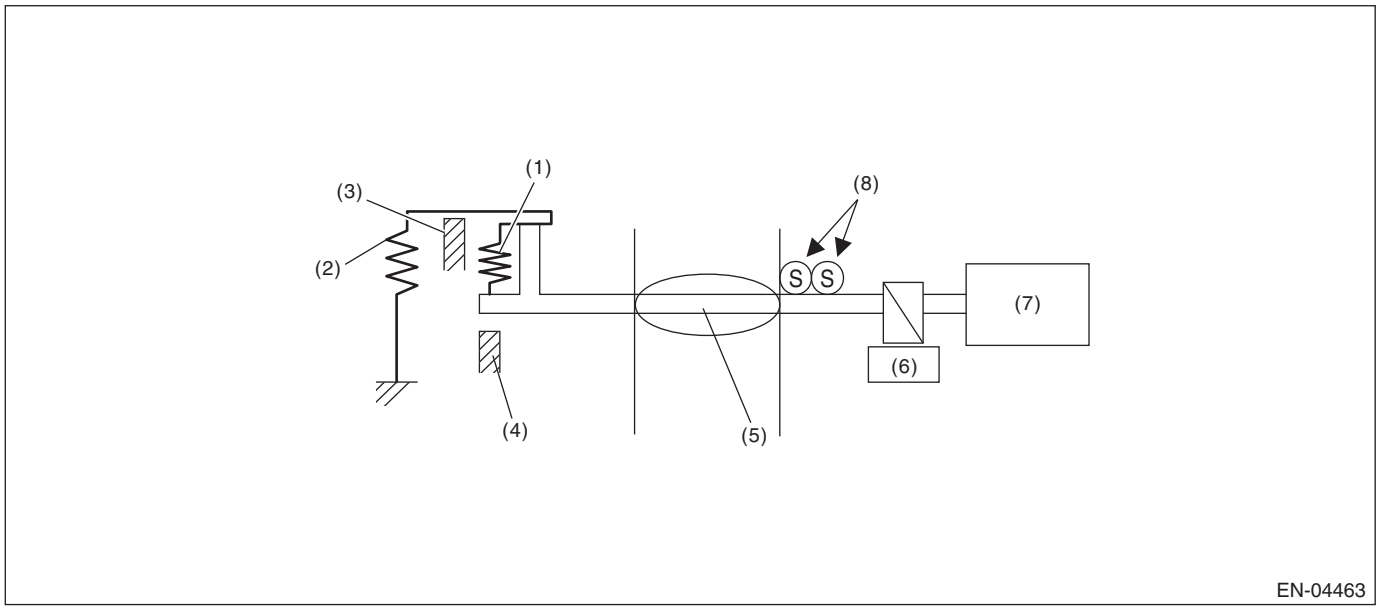
**Time Needed for Diagnosis:** Less than 1 second

# CM:DTC P1160 RETURN SPRING FAILURE

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

## 2. COMPONENT DESCRIPTION




(1) Opener spring
(2) Return spring
(3) Intermediate stopper
(4) Full closed stopper
(5) Throttle valve
(6) Gear
(7) DC motor
(8) Main and sub throttle position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 6 V |
| Throttle position sensor | Normal |

## 4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Opening variation after continuity is set to OFF | < 2 ° |

**Time Needed for Diagnosis:** 24 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Opening variation after continuity is set to OFF | ≥ 2 ° |

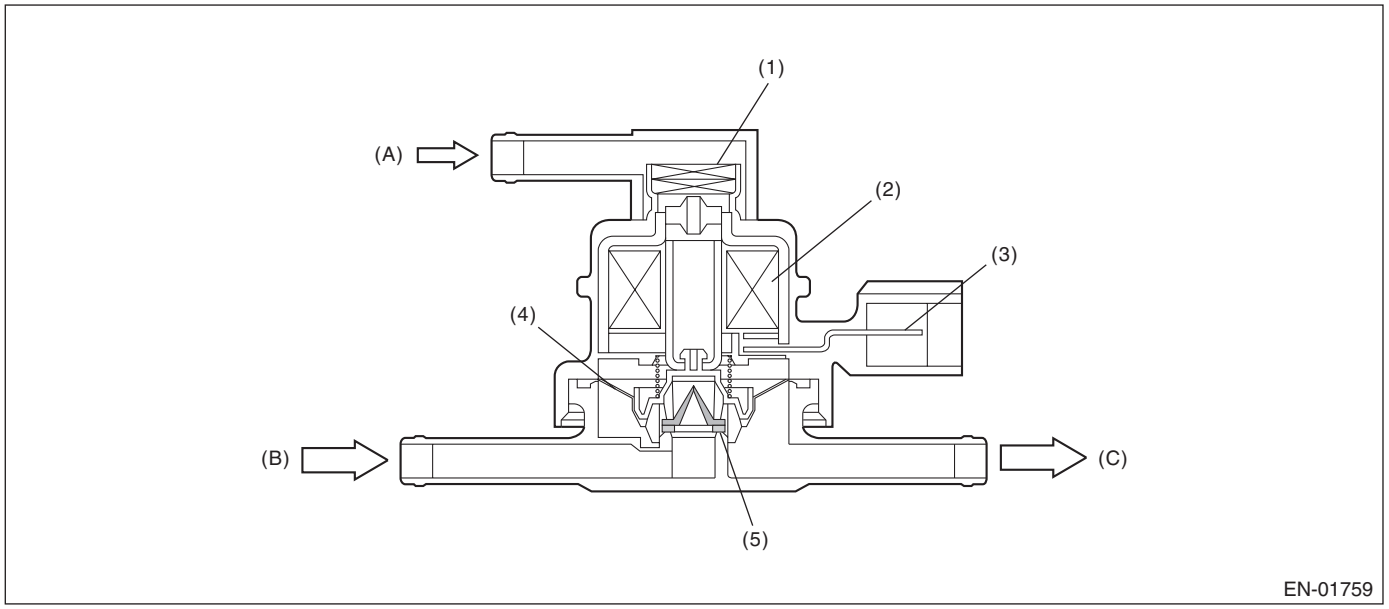
**Time Needed for Diagnosis:** 3400 ms

# CN:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.
Judge as NG when ECM output level is different from actual terminal level.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Atmospheric pressure | (B) | Shut-off valve | (C) | To fuel tank |
| (1) | Filter | (3) | Connector terminal | (5) | Valve |
| (2) | Coil | (4) | Diaphragm | | |

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs OFF signal | Low |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs OFF signal | High |

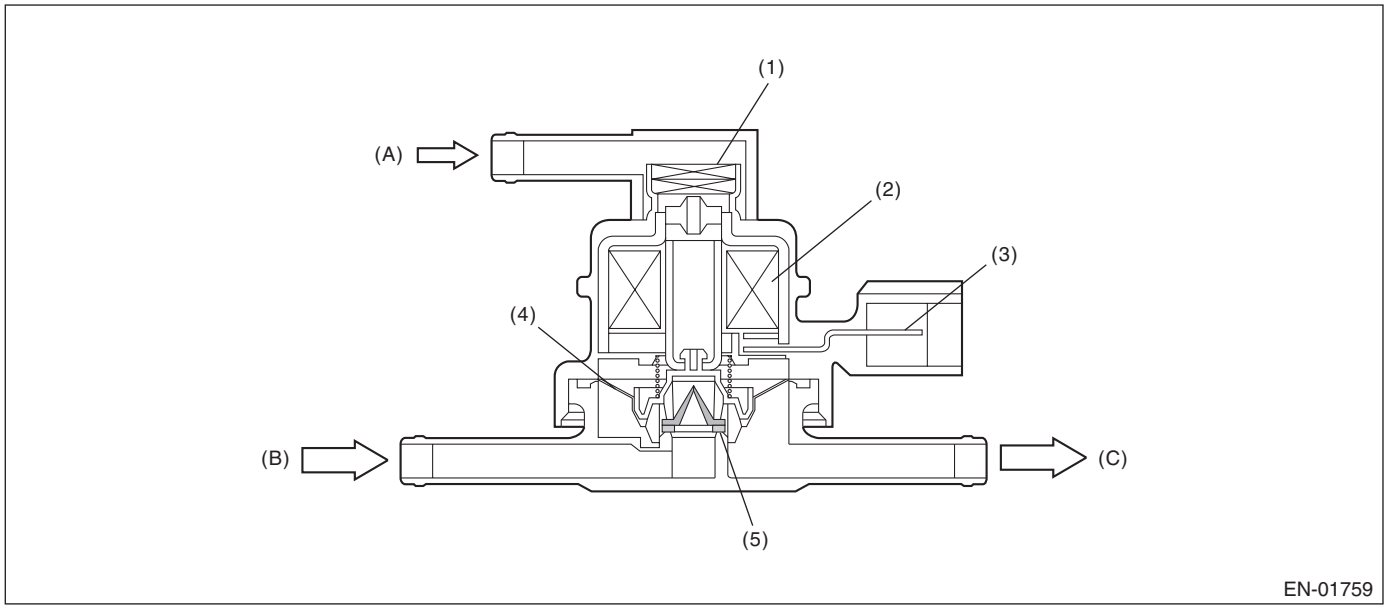
**Time Needed for Diagnosis:** Less than 1 second

# CO:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.
Judge as NG when ECM output level is different from actual terminal level.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Atmospheric pressure | (B) | Shut-off valve | (C) | To fuel tank |
| (1) | Filter | (3) | Connector terminal | (5) | Valve |
| (2) | Coil | (4) | Diaphragm | | |

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs ON signal | High |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |
| Terminal output voltage when ECM outputs ON signal | Low |

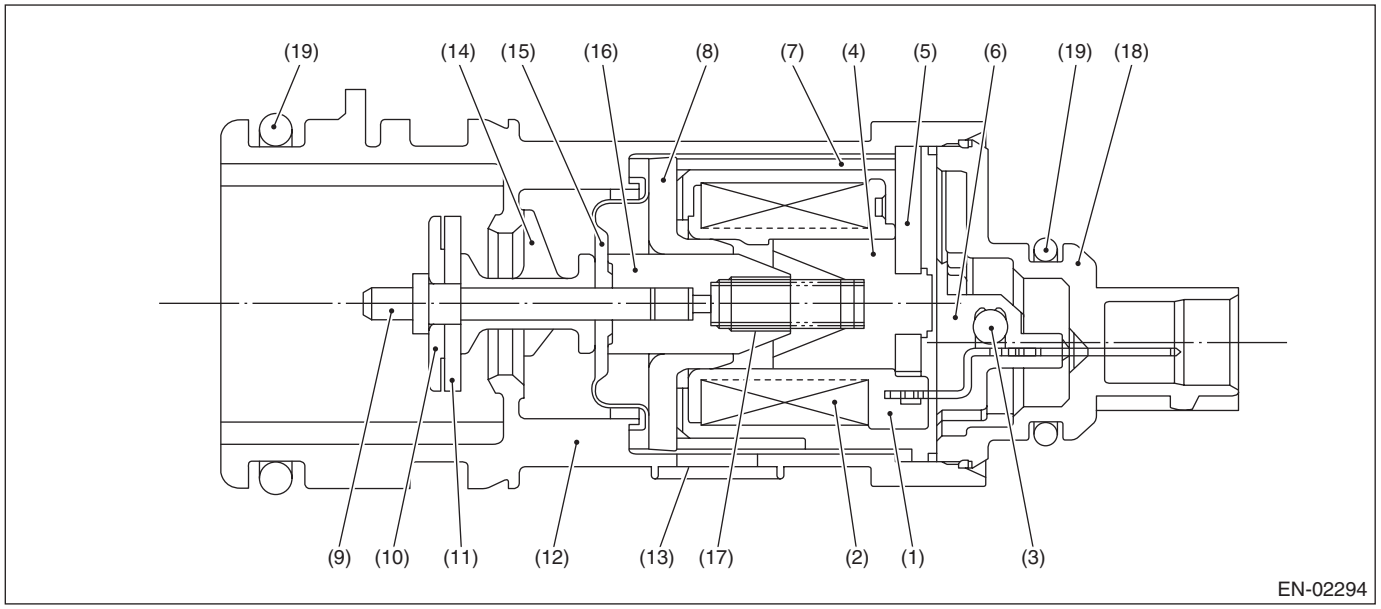
**Time Needed for Diagnosis:** Less than 1 second

# CP:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

## 1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.
Judge as NG when fuel tank pressure is low.

## 2. COMPONENT DESCRIPTION




(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Drain valve | Open |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Tank pressure when starter is OFF → ON | –0.4 kPa (–3.2 mmHg, –0.1 inHg)<br>and<br>1.4 kPa (10.7 mmHg, 0.4 inHg) |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | ≤ –4 kPa (–30 mmHg, –1.2 inHg) |

**Time Needed for Diagnosis:** 3000 s
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel tank pressure | > –4 kPa (–30 mmHg, –1.2 inHg) |
| Cumulative time when all the malfunction criteria below are met. | ≥ 30000 s |
| Purge control solenoid valve duty | Not = 0 |
| Fuel temperature | –10 °C (14 °F) — 70 °C (158 °F) |
| Intake manifold relative pressure | ≥ – 26.7 kPa (– 200 mmHg, – 7.9 inHg) |

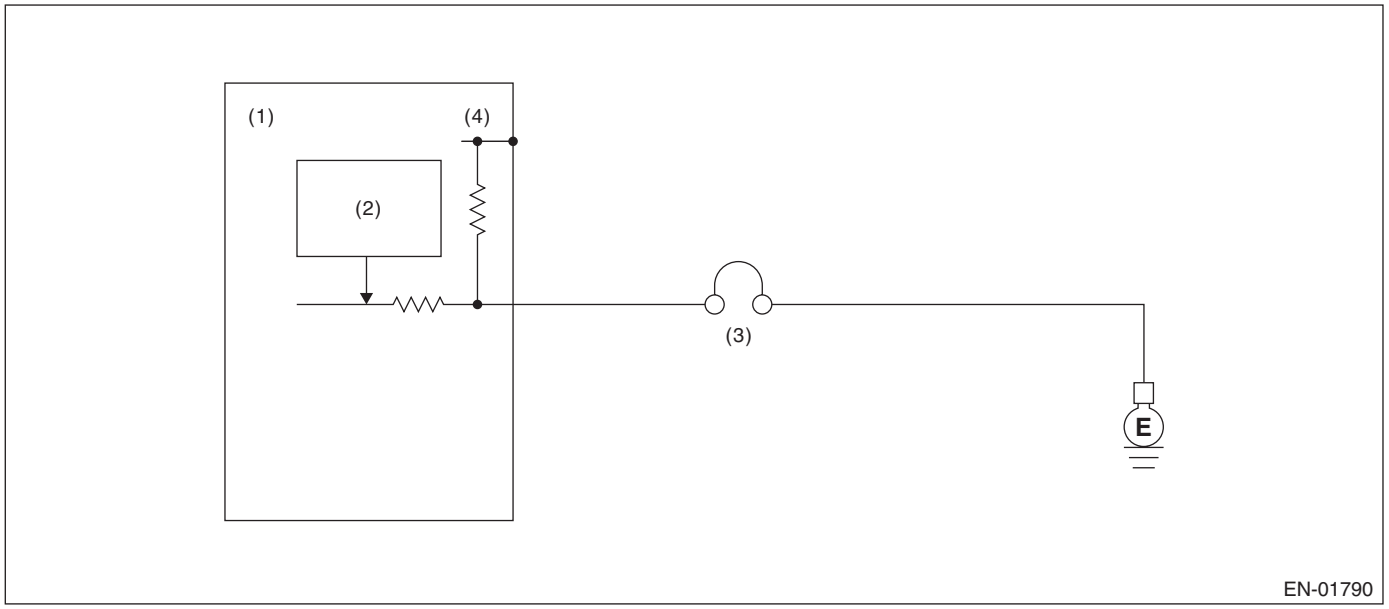
**Time Needed for Diagnosis:** Less than 1 second

# CQ:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

## 1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose disconnection abnormality.
Judge as NG when the diagnosis terminal voltage is high.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Detecting circuit
(3) PCV diagnosis connector
(4) 5 V

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Engine condition | After engine starting |
| Positive crankcase ventilation diagnosis voltage | High |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Engine condition | After engine starting |
| Positive crankcase ventilation diagnosis voltage | Low |

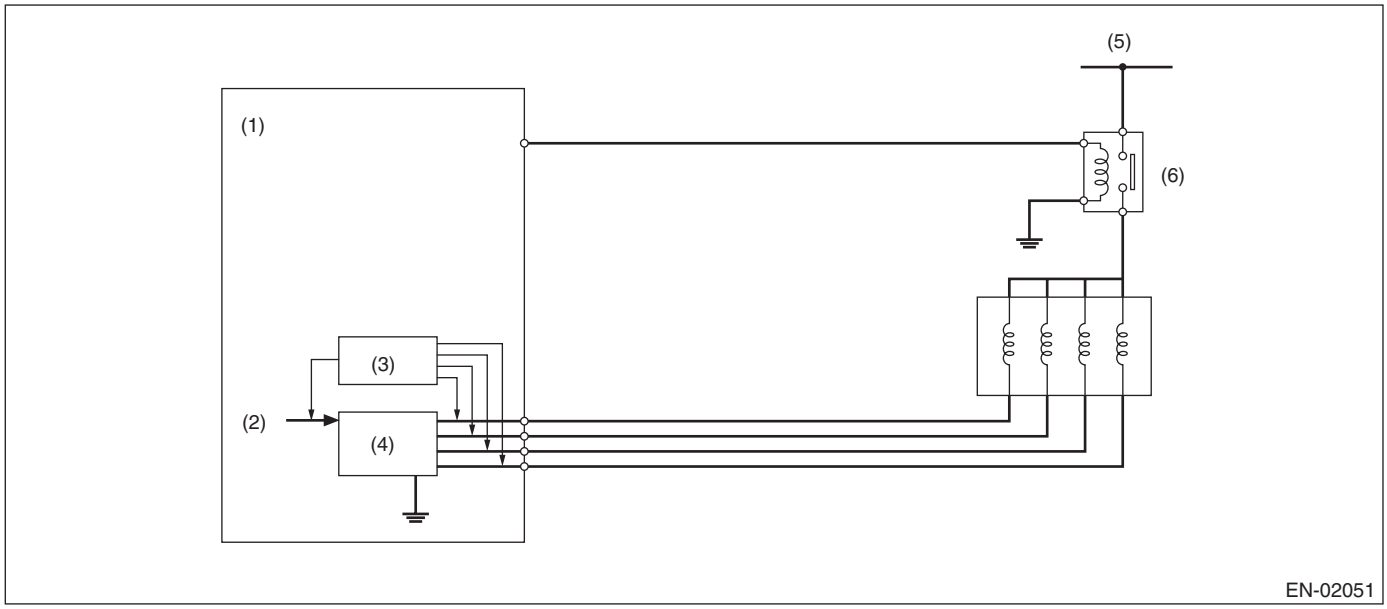
**Time Needed for Diagnosis:** Less than 1 second

# CR:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

## 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Elapsed time after starting the engine | ≥ 1 second |
| EGR valve target position | > 0 step |
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal voltage level when ECM outputs OFF signal<br>or<br>Terminal voltage level when EGR operates | Low level<br><br>Low level |

**Time Needed for Diagnosis**: 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal voltage level when ECM outputs OFF signal | High level |
| Terminal voltage level when EGR operates | High level |

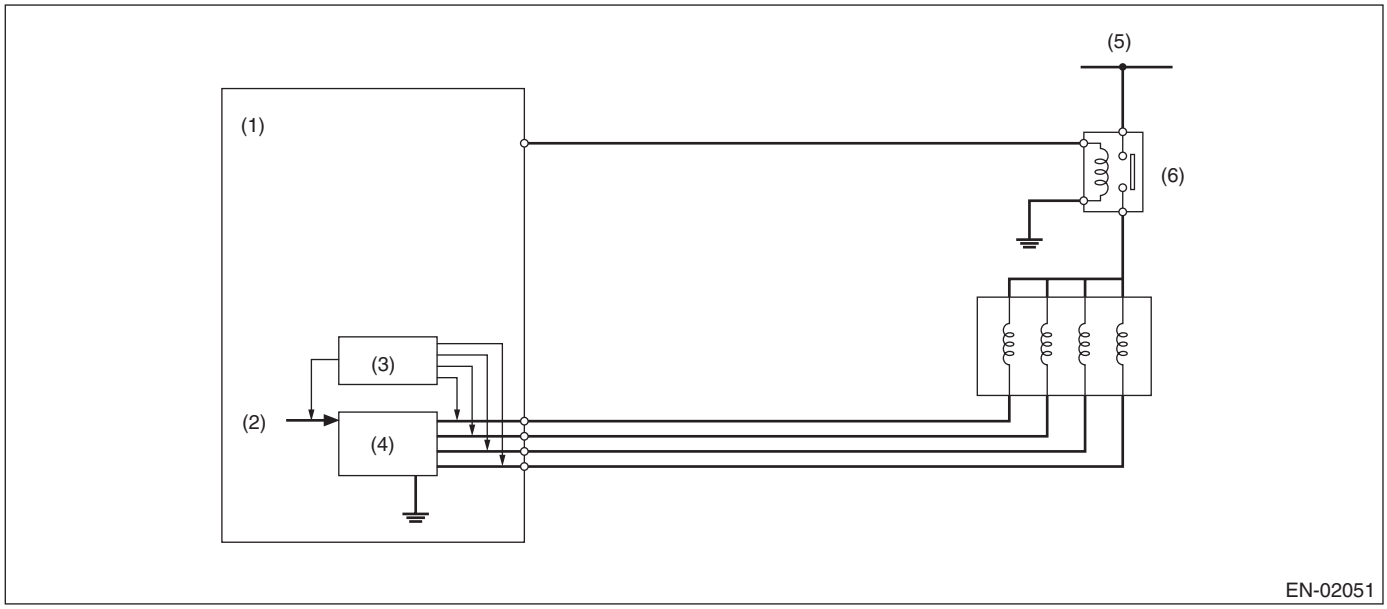
**Time Needed for Diagnosis**: 128 ms

# CS:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

## 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Elapsed time after starting the engine | ≥ 1 second |
| EGR valve target position | > 0 step |
| Battery voltage | ≥ 10.9 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal voltage level when ECM outputs OFF signal<br>or<br>Terminal voltage level when EGR operates | High level<br><br>High level |

**Time Needed for Diagnosis**: 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Terminal voltage level when ECM outputs OFF signal | Low level |
| Terminal voltage level when EGR operates | Low level |

**Time Needed for Diagnosis**: 128 ms

## CT:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-179, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CU:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-181, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CV:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-179, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CW:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-181, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CX:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-179, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CY:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-181, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# CZ:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.
If the status becomes post engine start although the starter has not been turned to ON, judge as OFF NG.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as OFF NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Vehicle speed | < 1 km/h (0.6 MPH) |
| Starter ON signal | Not detected |
| Engine condition | Change from pre-start to post-start |
| Battery voltage | ≥ 8 V |

**Time Needed for Diagnosis:** Less than 1 second
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OFF OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Starter ON | Experienced |
| Starter ON diagnosis | No diagnosis experience |
| Battery voltage | ≥ 8 V |

**Time Needed for Diagnosis:** Less than 1 second

# DA:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

## 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.
Judge as NG when the backup power voltage is low.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Voltage of back-up power supply | Low |
| Battery voltage | ≥ 10.9 V |
| Engine condition | After engine starting |

**Time Needed for Diagnosis:** 2500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Voltage of back-up power supply | High |
| Battery voltage | ≥ 10.9 V |
| Engine condition | After engine starting |

**Time Needed for Diagnosis:** Less than 1 second

## DB:DTC P1570 ANTENNA

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DC:DTC P1571 REFERENCE CODE INCOMPATIBILITY

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DD:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DE:DTC P1574 KEY COMMUNICATION FAILURE

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DF:DTC P1576 EGI CONTROL MODULE EEPROM

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DG:DTC P1577 IMM CONTROL MODULE EEPROM

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DH:DTC P1578 METER FAILURE

### 1. OUTLINE OF DIAGNOSIS

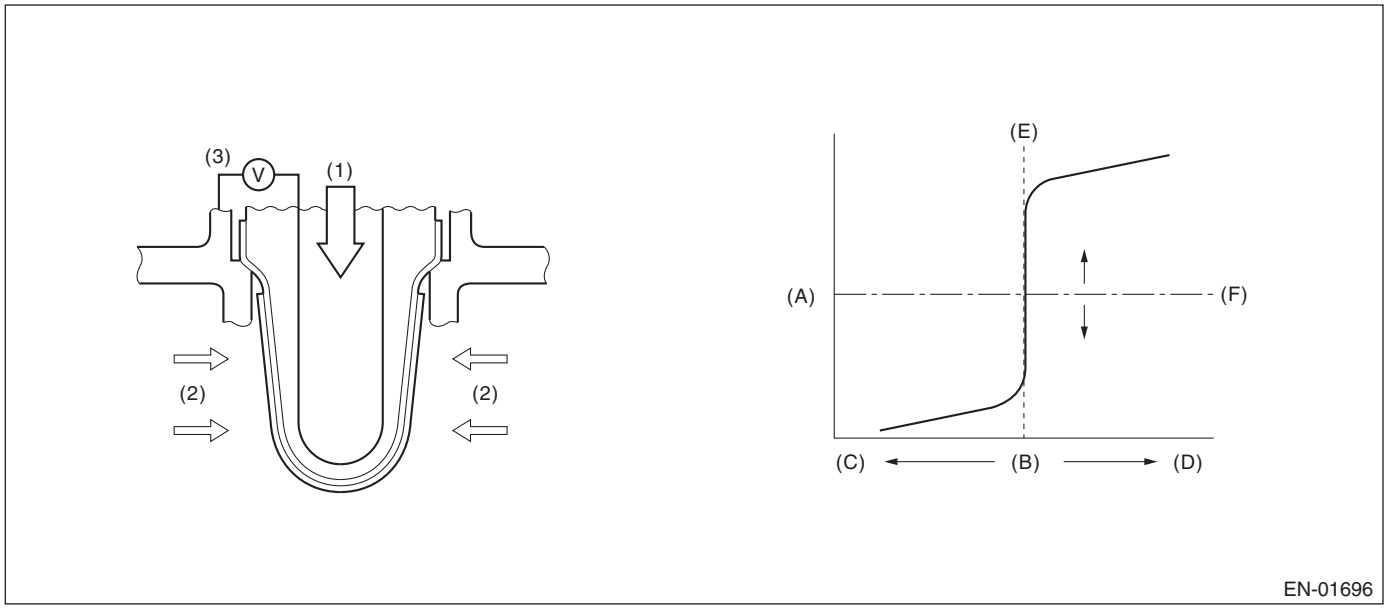
NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-153, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# DI: DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Electromotive force | (B) | Air fuel ratio | (C) | Rich |
| (D) | Lean | (E) | Theoretical air fuel ratio | (F) | Comparative voltage |
| (1) | Atmosphere | (2) | Exhaust gas | (3) | Electromotive force |

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Conditions for carrying out the sub feedback learning | Completed |
| Continuous time when all conditions are established. | ≥ 1 s |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sub feedback learning value | < –0.04 |

**Time Needed for Diagnosis:** 5 s × 1 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sub feedback learning value | ≥ –0.04 + 0 |

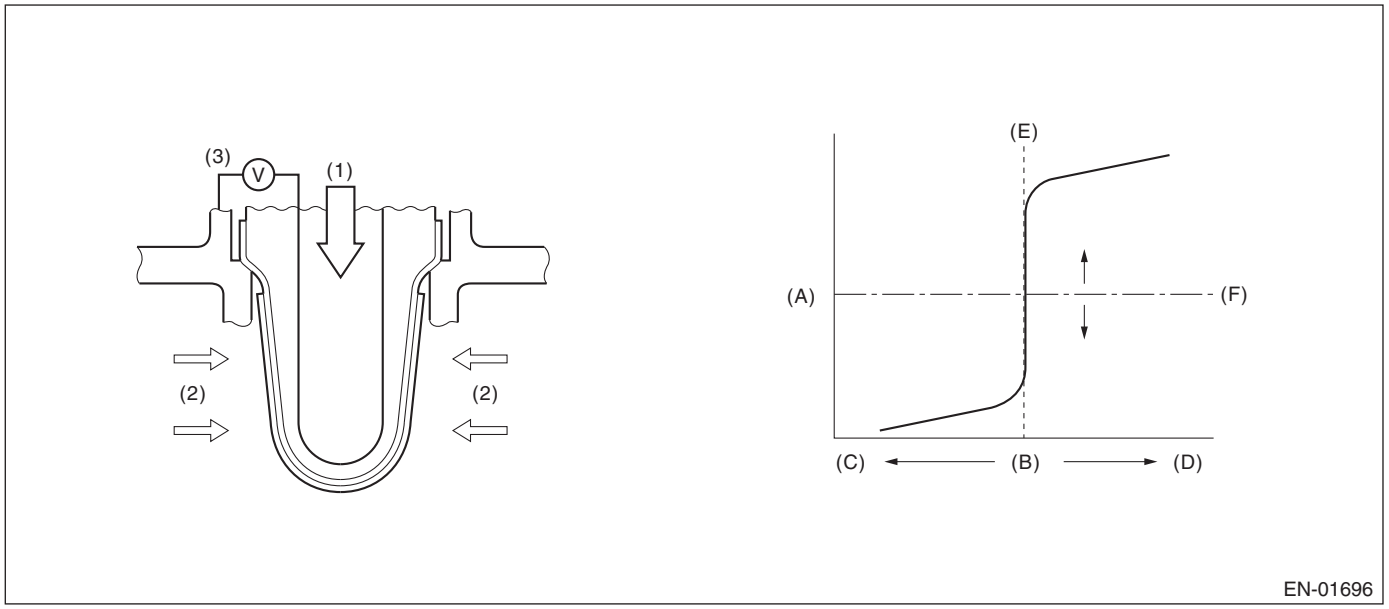
**Time Needed for Diagnosis:** 5 s

# DJ:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

## 2. COMPONENT DESCRIPTION




| | | | | | |
|---|---|---|---|---|---|
| (A) | Electromotive force | (B) | Air fuel ratio | (C) | Rich |
| (D) | Lean | (E) | Theoretical air fuel ratio | (F) | Comparative voltage |
| (1) | Atmosphere | (2) | Exhaust gas | (3) | Electromotive force |

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Conditions for carrying out the sub feedback learning | Completed |
| Continuous time when all conditions are established. | ≥ 1 s |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

## 5. DIAGNOSTIC METHOD

**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sub feedback learning value | ≥ 0.04 |

**Time Needed for Diagnosis:** 5 s × 1 time(s)
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sub feedback learning value | < 0.04 + –0.002 |

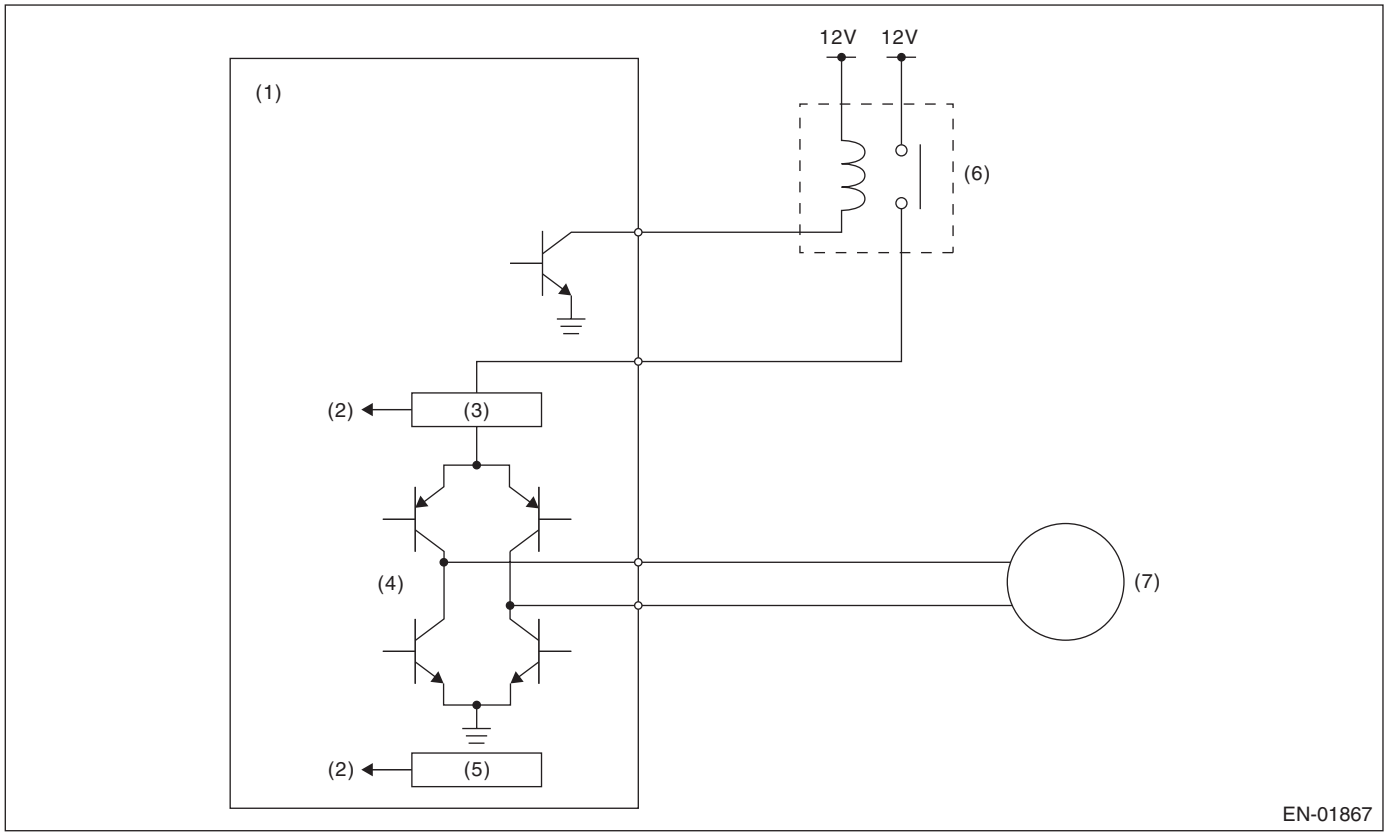
**Time Needed for Diagnosis:** 5 s

# DK:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Detecting circuit
(3) Overcurrent detection circuit
(4) Drive circuit
(5) Temperature detection circuit
(6) Electronic throttle control relay
(7) Motor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Under control of electronic throttle control | ON |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Motor current | ≤ 8 A |
| Drive circuit inner temperature | ≤ 175°C (347°F) |

**Time Needed for Diagnosis:**

- 500 ms (NG judgment)
- 2000 ms (OK judgment)

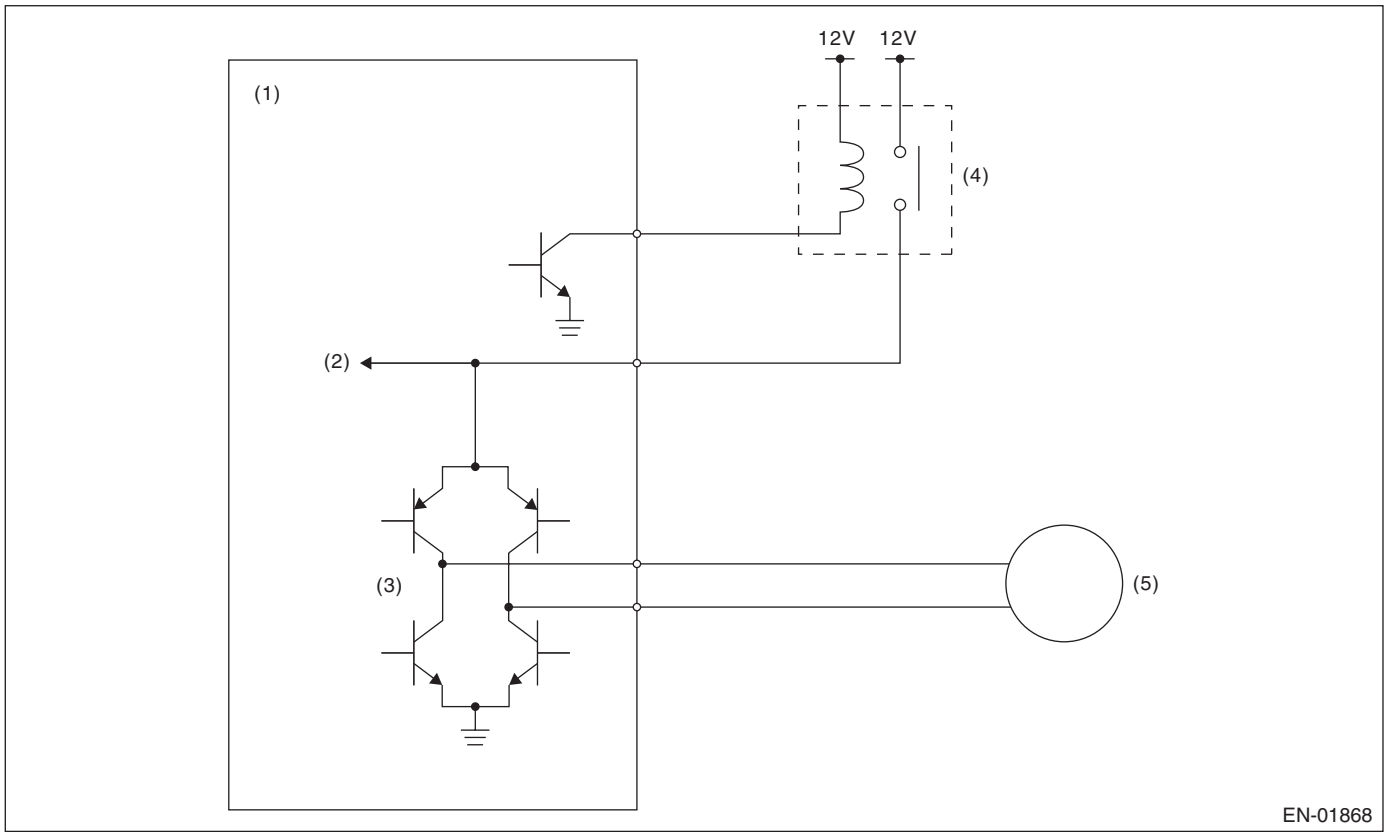
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# DL:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electric control throttle relay to ON.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic throttle control relay
(5) Motor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Electronic throttle control relay output | ON |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Motor power voltage | ≥ 5 V |

**Time Needed for Diagnosis:**

- 400 ms (NG judgment)
- 2000 ms (OK judgment)

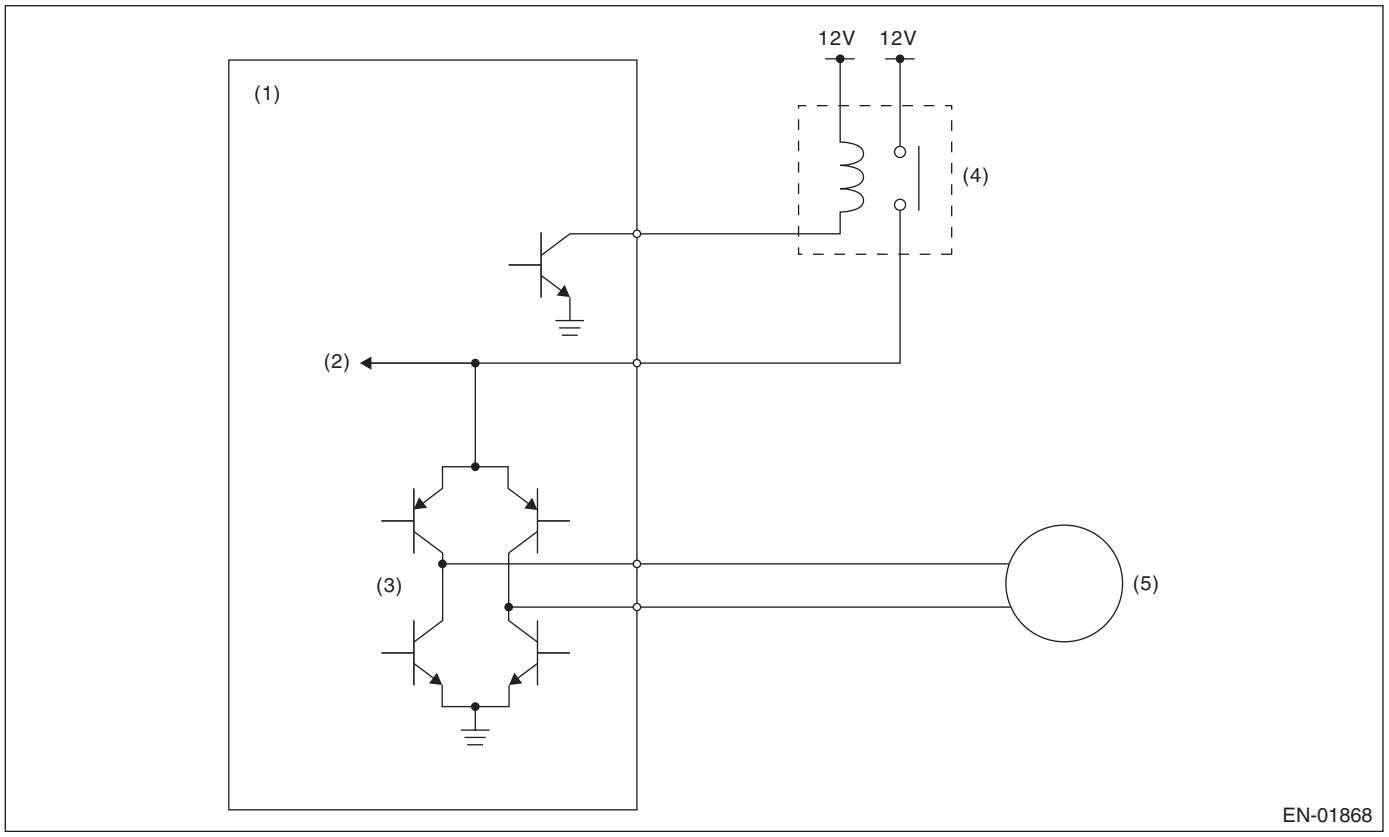
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# DM:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic throttle control relay
(5) Motor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Electronic throttle control relay output | OFF |

## 4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Motor power voltage | ≤ 5 V |

**Time Needed for Diagnosis:**

- 600 ms (NG judgment)
- 400 ms (OK judgment)

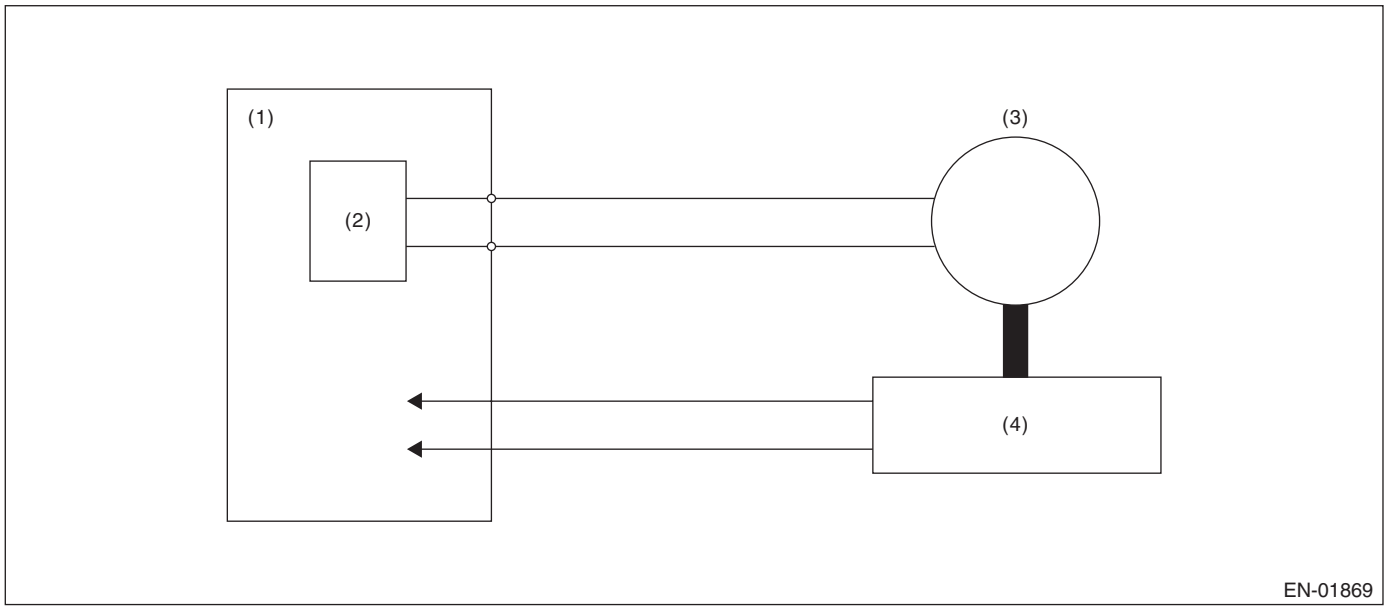
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# DN:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot conducted or abnormal value is detected.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Drive circuit
(3) Motor
(4) Throttle position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON → OFF |
| Ignition switch (only after clear memory) | OFF → ON |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

## 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Throttle sensor opening angle at full close point learning | 10.127° or more, 19.872° or less |
| Throttle opening angle when the ignition switch is ON – Throttle minimum stop position | ≥ 1.683° |

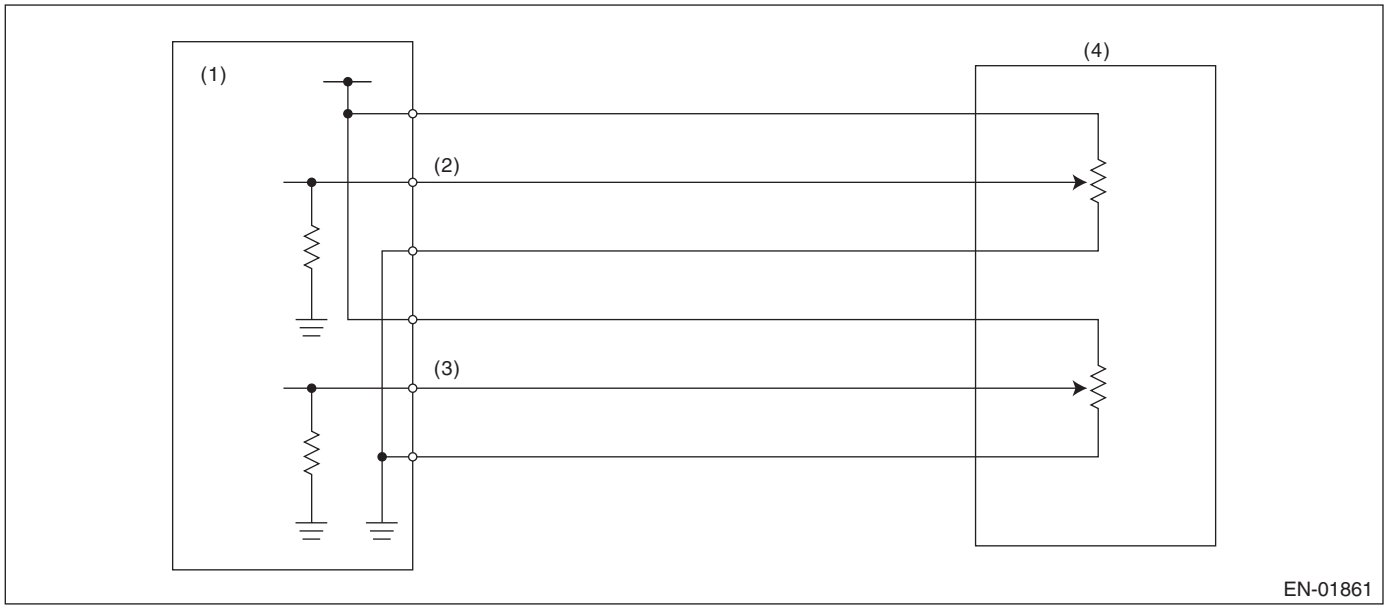
**Time Needed for Diagnosis:**8 — 80 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# DO:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | < 0.217 V |

**Time Needed for Diagnosis**: 100 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | ≥ 0.217 V |

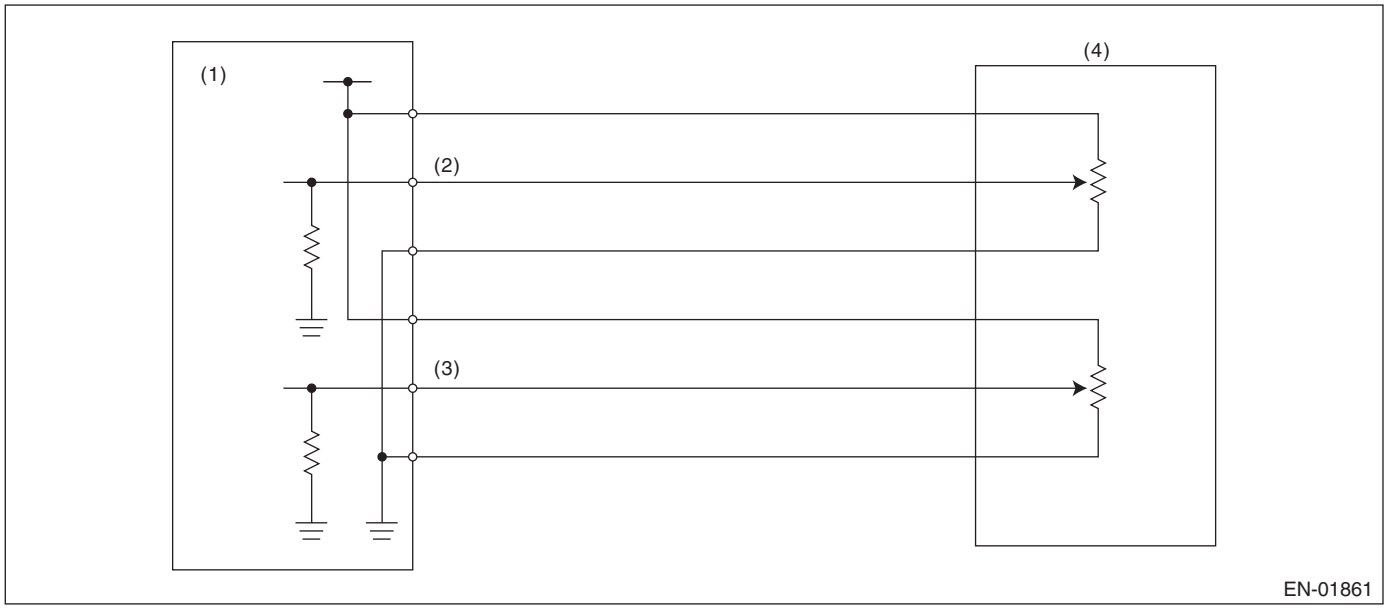
**Time Needed for Diagnosis**: 100 ms

# DP:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | ≥ 4.783 V |

**Time Needed for Diagnosis**: 32 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 1 input voltage | < 4.783 V |

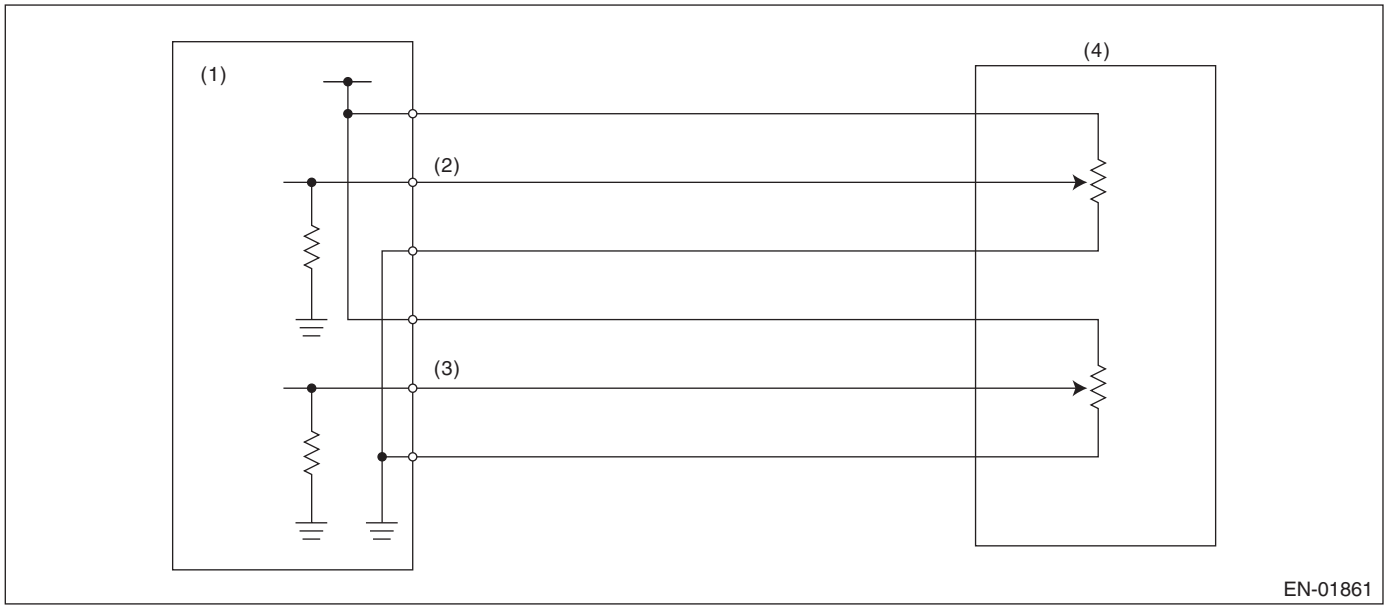
**Time Needed for Diagnosis**: 32 ms

# DQ:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | < 0.217 V |

**Time Needed for Diagnosis**: 100 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | ≥ 0.217 V |

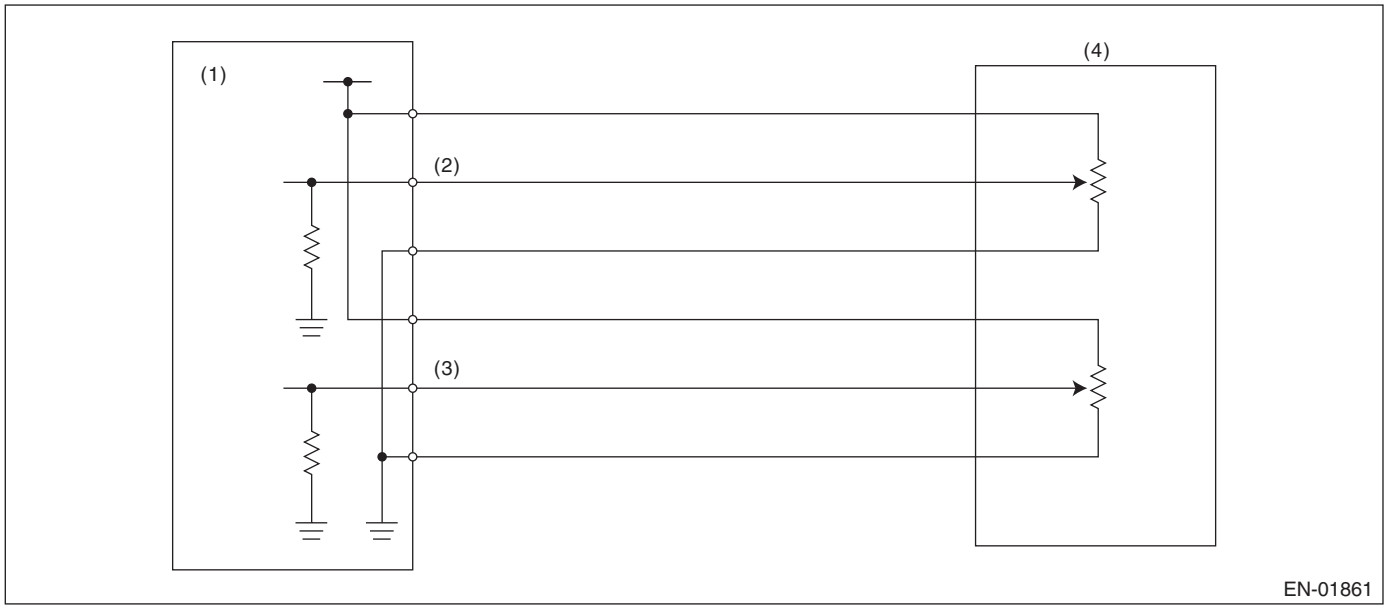
**Time Needed for Diagnosis**: 100 ms

# DR:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

## 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | ≥ 4.783 V |

**Time Needed for Diagnosis**: 100 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Sensor 2 input voltage | < 4.783 V |

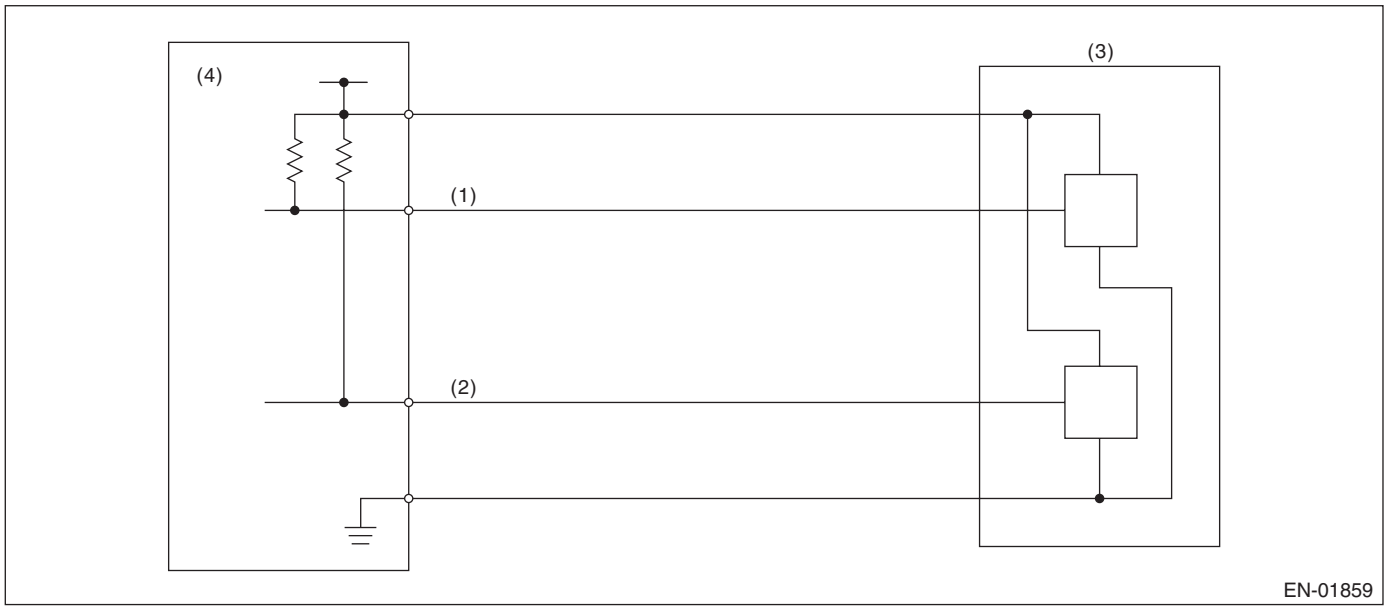
**Time Needed for Diagnosis**: 100 ms

# DS:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

## 2. COMPONENT DESCRIPTION




(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

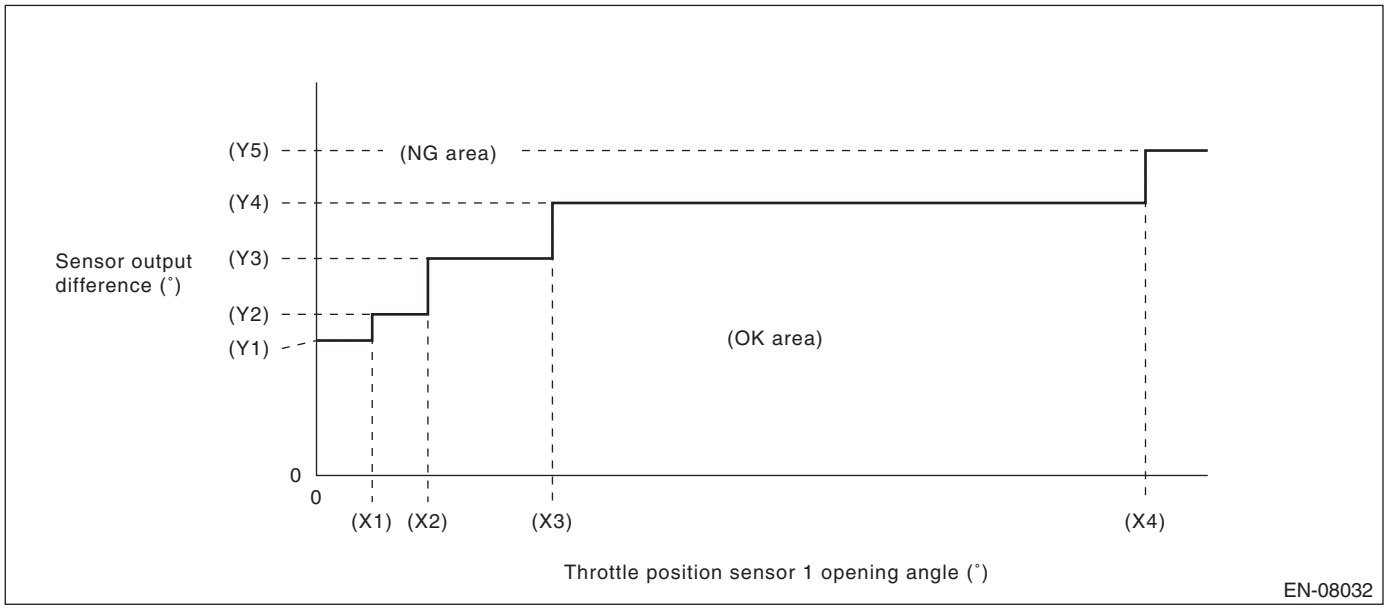
**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Signal difference between two sensors | Within NG area of **details of judgment value** |

**Details of Judgment Value**




(X1) 2.125 °
(X2) 4.25 °
(X3) 9 °
(X4) 31.625 °

(Y1) 5.15 °
(Y2) 6.15 °
(Y3) 8.28 °
(Y4) 10.4 °
(Y5) 12.4 °

**Time Needed for Diagnosis**: 212 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Signal difference between two sensors | Within OK area of **details of judgment value** |

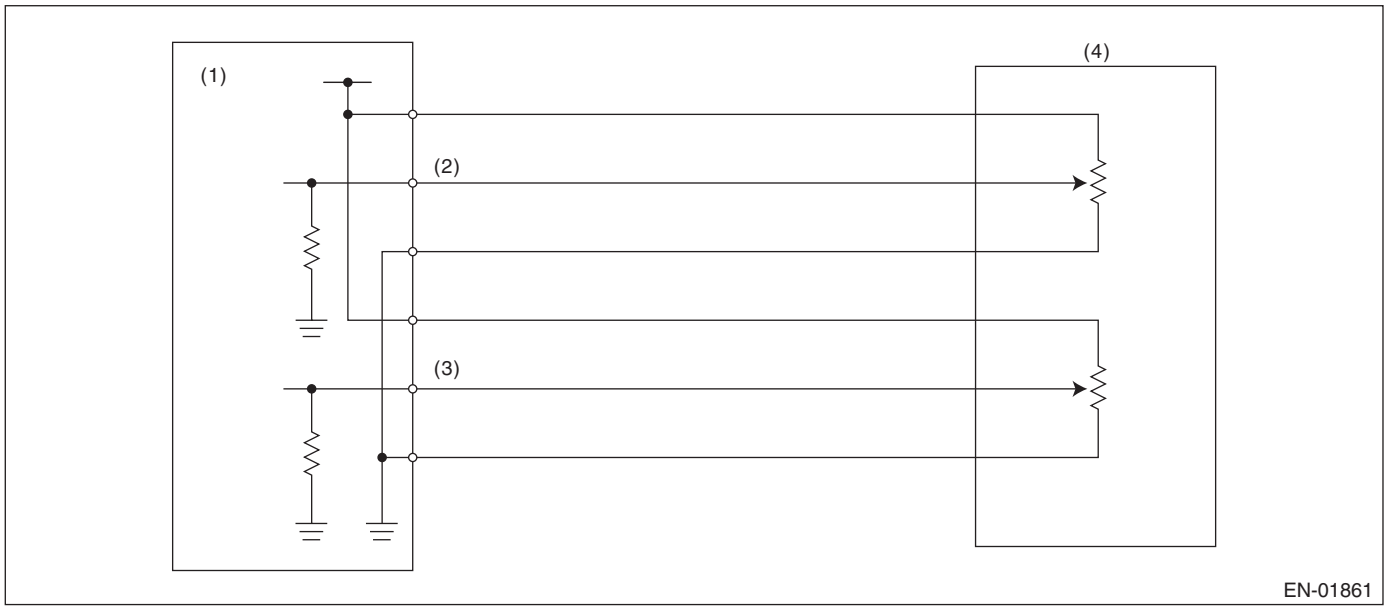
**Time Needed for Diagnosis**: 24 ms

# DT:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

## 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

## 2. COMPONENT DESCRIPTION




(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Ignition switch | ON |
| Battery voltage | ≥ 6 V |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

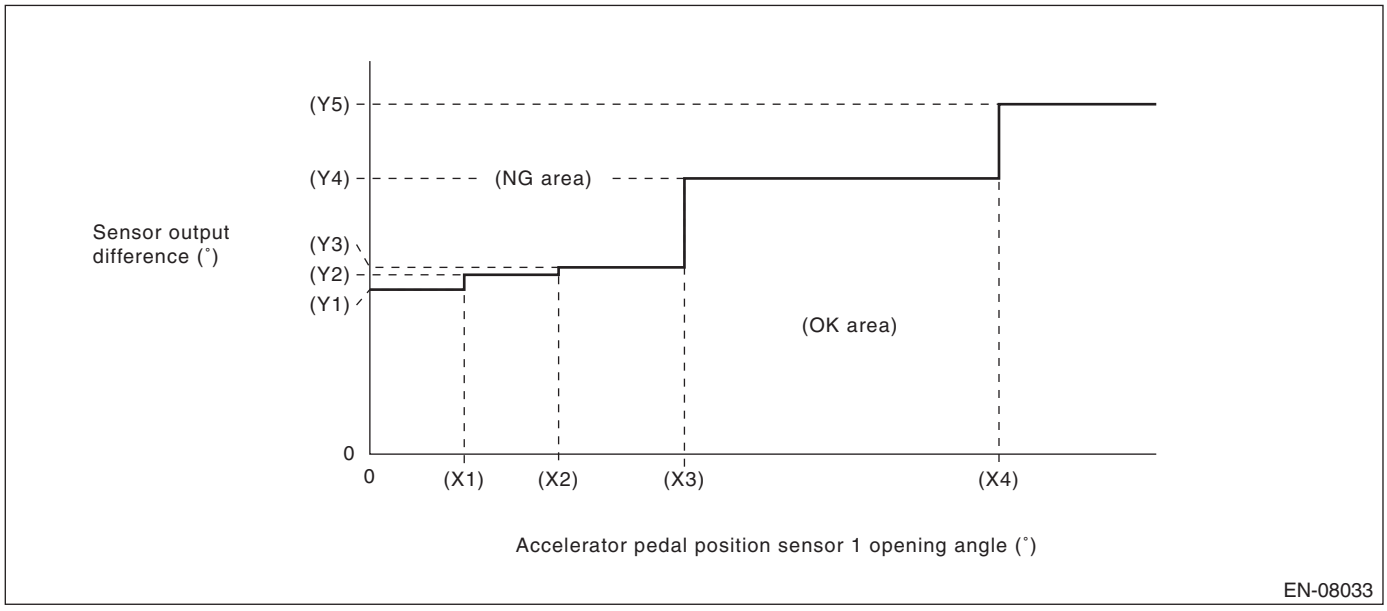
**• Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Signal difference between two sensors | Within NG area of **details of judgment value** |

**Details of Judgment Value**




(X1) 0.6 °
(X2) 1.2 °
(X3) 2 °
(X4) 4 °

(Y1) 1.465 °
(Y2) 1.597 °
(Y3) 1.663 °
(Y4) 2.455 °
(Y5) 3.116 °

**Time Needed for Diagnosis**: 116 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

**• Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Signal difference between two sensors | Within OK area of **details of judgment value** |

**Time Needed for Diagnosis**: 116 ms

# DU:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

## 1. OUTLINE OF DIAGNOSIS

Detect malfunction of air fuel ratio deviation between cylinders from main feedback learning value, sub feedback learning value and engine speed variation.

## 2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | > 10.9 V |
| Atmospheric pressure | > 75 kPa (563 mmHg, 22.2 inHg) |
| A/F main learning function | In operation |
| Engine speed | > 500 rpm |
| Engine coolant temperature | > 200 °C (392 °F) |
| Intake air temperature | < 100 °C (212 °F) |
| Engine load | > Value of Map 1 |
| Engine load change | < 0.02 g/rev (0 oz/rev) |
| Evaporative system leak check | Not in operation |
| Cumulative time of canister purge after engine start | ≥ 20.48 s |
| Learning value of evaporation gas density | < 0.07 |
| Vehicle dynamic control or AT torque control | Not in operation |
| Intake manifold pressure change at 180°CA | < Value of Map 2 |
| Throttle position change during 16 milliseconds | < 21 ° (AT model)<br>< 21 ° (MT model) |
| Fuel shut-off function | Not in operation |

**Map 1**

| Engine speed (rpm) | Idling | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 |
|---|---|---|---|---|---|---|---|---|---|---|
| Measured value (g(oz)/rev) | na | 0.208 (0.01) | 0.201 (0.01) | 0.185 (0.01) | 0.183 (0.01) | 0.193 (0.01) | 0.206 (0.01) | 0.206 (0.01) | 0.225 (0.01) | 0.245 (0.01) |

**Map 2**

- AT model

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) |

- MT model

| rpm | 650 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kPa (mmHg, inHg) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) | 13.3 (100, 3.9) |

## 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

**• Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Rich** | |
| Main feedback learning value | < –0.15 |
| Sub feedback learning value | < –1 |
| When any one of the followings is established. | |
| • any one of the rich side misfire counters for each cylinder when in idling | > 10000 time(s) |
| • total of the rich side misfire counters for each cylinder when in idling | > 10000 time(s) |
| • any one of the rich side misfire counters for each cylinder when not in idling | > 10000 time(s) |
| • total of the rich side misfire counters for each cylinder when not in idling | > 10000 time(s) |
| **Lean** | |
| Main feedback learning value | > –0.1 |
| Sub feedback learning value | < –1 |
| When any one of the followings is established. | |
| • any one of the lean side misfire counters for each cylinder when in idling | > 10000 time(s) |
| • total of the lean side misfire counters for each cylinder when in idling | > 10000 time(s) |
| • any one of the lean side misfire counters for each cylinder when not in idling | > 10000 time(s) |
| • total of the lean side misfire counters for each cylinder when not in idling | > 10000 time(s) |

**Time Needed for Diagnosis:** 1000 engine revs.
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| **Rich** | |
| Main feedback learning value | ≥ –0.15 |
| or | |
| Sub feedback learning value | ≥ –1 |
| or | |
| All following conditions are established. | |
| • any one of the rich side misfire counters for each cylinder when in idling | ≤ 10000 time(s) |
| • total of the rich side misfire counters for each cylinder when in idling | ≤ 10000 time(s) |
| • any one of the rich side misfire counters for each cylinder when not in idling | ≤ 10000 time(s) |
| • total of the rich side misfire counters for each cylinder when not in idling | ≤ 10000 time(s) |
| **Lean** | |
| Main feedback learning value | ≤ –0.1 |
| or | |
| Sub feedback learning value | ≥ –1 |
| or | |
| All following conditions are established. | |
| • any one of the lean side misfire counters for each cylinder when in idling | ≤ 10000 time(s) |
| • total of the lean side misfire counters for each cylinder when in idling | ≤ 10000 time(s) |
| • any one of the lean side misfire counters for each cylinder when not in idling | ≤ 10000 time(s) |
| • total of the lean side misfire counters for each cylinder when not in idling | ≤ 10000 time(s) |

**Time Needed for Diagnosis:** 1000 engine revs.

# DV:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

## 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of barometric pressure sensor output property.
Judge as NG when the barometric pressure sensor output is largely different from the intake manifold pressure at engine start.

## 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| Engine speed | < 300 rpm |
| Vehicle speed | < 1 km/h (0.6 MPH) |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| \|Barometric pressure – Intake manifold pressure\| | ≥ 26.7 kPa (200 mmHg, 7.9 inHg) |
| \|Intake manifold pressure at engine start – Intake manifold pressure\| | < 1.3 kPa (9.99 mmHg, 0.4 inHg) |

**Time Needed for Diagnosis:** 328 ms
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| \|Barometric pressure – Intake manifold pressure\| | < 26.7 kPa (200 mmHg, 7.9 inHg) |

**Time Needed for Diagnosis:** 262 ms

# DW:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

## 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 1.707 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 1.707 V |

**Time Needed for Diagnosis:** Less than 1 second

# DX:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

## 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

## 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | ≥ 4.234 V |

**Time Needed for Diagnosis:** 500 ms
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Output voltage | < 4.234 V |

**Time Needed for Diagnosis:** Less than 1 second

# DY:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

## 1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
When CAN communications is not possible, and CAN communications with TCM, VDC CM and body integrated unit is not possible, judge as NG if data from the TCM, VDC CM and body integrated unit are not normal.

## 2. COMPONENT DESCRIPTION

ECM, TCM, VDC CM and body integrated unit are connected by high speed CAN.

***(Common Specifications)***
***CAN Protocol 2.0 B (Active)***
***Frame Format: 11 Bit ID Frame (Standard Frame)***

***(High speed CAN)***
***Conforms to ISO11898***
***Communication Speed: 500 kbps***

## 3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|---|
| None | |

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

## 5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | > 10.9 V |
| Starter switch | OFF |
| Engine | run |
| bus off flag or error warning flag | set (error) |
| or | |
| ID received from control module connected to driving system CAN | None during 500 milliseconds |
| or | |
| Data updated from control module connected to driving system CAN | None during 2000 milliseconds |

**Time Needed for Diagnosis:** 2 seconds
**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

**Judgment Value**

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | > 10.9 V |
| Starter switch | OFF |
| Engine | run |
| bus off flag or error warning flag | clear (No error) |
| ID received from control module connected to driving system CAN | Yes |
| Data updated from control module connected to driving system CAN | Yes |

**Time Needed for Diagnosis:** 1000 ms

## DZ:DTC U0101 CAN (TCU) DATA NOT LOADED

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## EA:DTC U0122 CAN (VDC) DATA NOT LOADED

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## EB:DTC U0140 CAN (BCU) DATA NOT LOADED

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## EC:DTC U0402 CAN (TCU) DATA ABNORMAL

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## ED:DTC U0416 CAN (VDC) DATA ABNORMAL

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## EE:DTC U0422 CAN (BCU) DATA ABNORMAL

### 1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-213, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# TRANSMISSION SECTION


| | |
|---|---|
| CONTROL SYSTEMS | CS |
| AUTOMATIC TRANSMISSION | 4AT |
| AUTOMATIC TRANSMISSION (DIAGNOSTICS) | 4AT(diag) |
| MANUAL TRANSMISSION AND DIFFERENTIAL | 5MT |
| CLUTCH SYSTEM | CL |


This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

# CONTROL SYSTEMS

# CS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5. AT Shift Lock Solenoid and “P” Range Switch .....27
6. Body Integrated Unit .....30
7. MT Gear Shift Lever .....31
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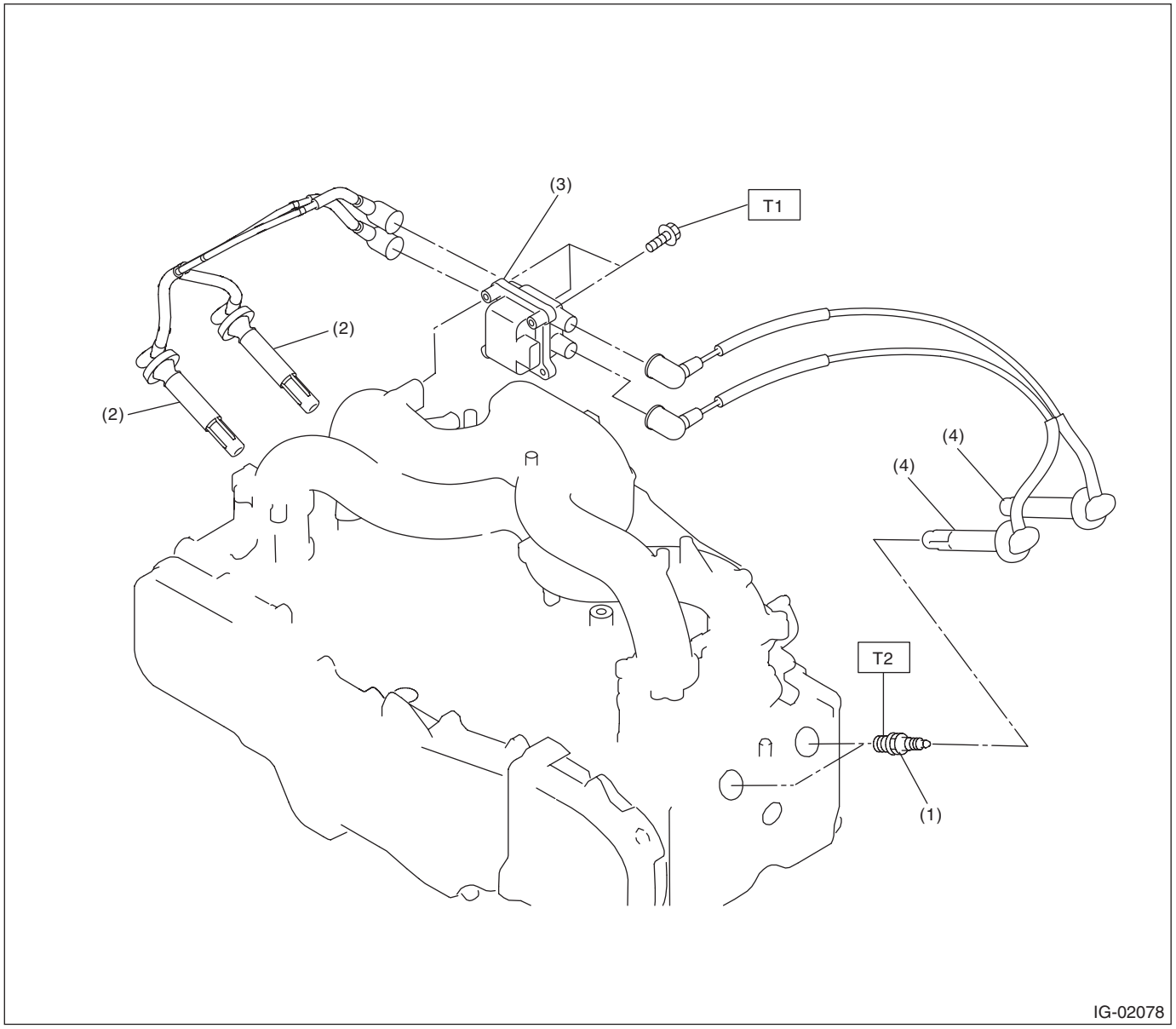
# 1. General Description

## A: SPECIFICATION

| Item | | | | Specifications |
|---|---|---|---|---|
| Ignition coil & ignitor assembly | Type | | | FH 0363 |
| | Manufacturer | | | Diamond Electric |
| | Secondary coil resistance | | | 11.2 kΩ±15% |
| Spark plug | Manufacturer and type | | | NGK: FR5AP-11 |
| | Thread size (diameter, pitch, length) | mm | | 14, 1.25, 19 |
| | Spark plug gap | mm (in) | Standard | 1.0 — 1.1 (0.039 — 0.043) |
| | Electrode | | | Platinum |

## B: COMPONENT




(1) Spark plug
(2) Spark plug cord (#1, #3)
(3) Ignition coil and ignitor ASSY
(4) Spark plug cord (#2, #4)

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 8 (0.8, 5.9)***
***T2: 21 (2.1, 15.5)***

## C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

## D: PREPARATION TOOL

### 1. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring resistance. |

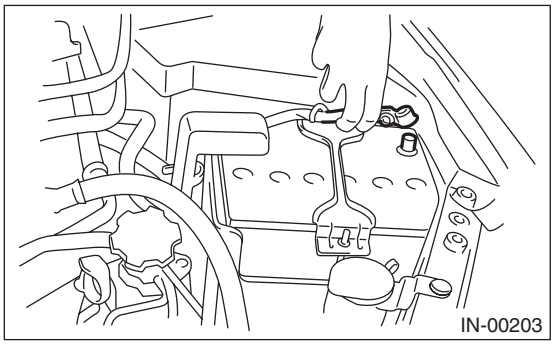
# 2. Spark Plug

## A: REMOVAL

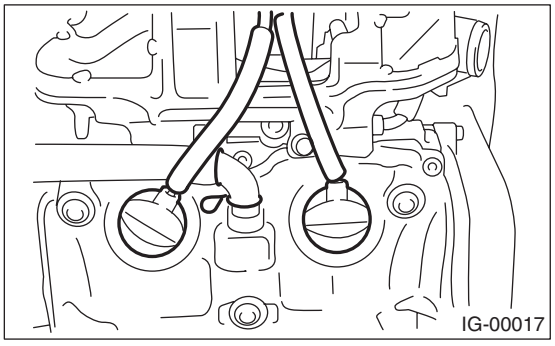
***Spark plug:***
***Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(H4SO)-2, SPECIFICATION, General Description.>***

### 1. RH SIDE

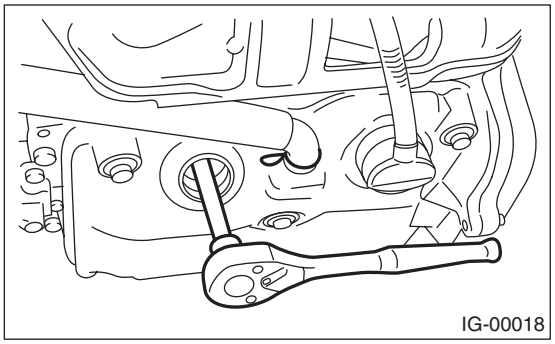
1) Disconnect the ground cable from the battery.


IN-00203

2) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
3) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)

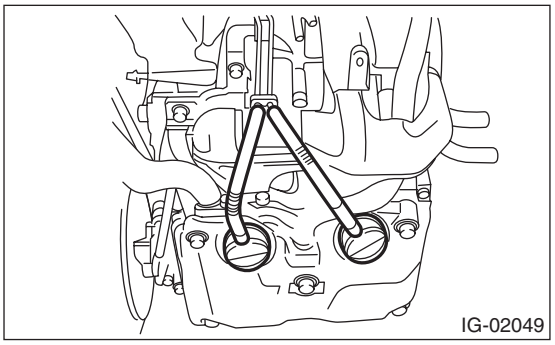

IG-00017

4) Remove the spark plug with a spark plug socket.

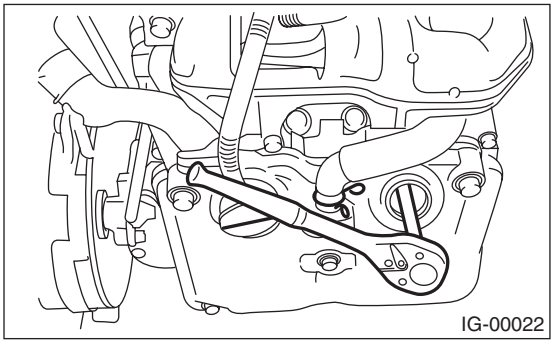

IG-00018

### 2. LH SIDE

1) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
2) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)


IG-02049

3) Remove the spark plug with a spark plug socket.


IG-00022

## B: INSTALLATION

### 1. RH SIDE

Install in the reverse order of removal.

***Tightening torque:***
***21 N·m (2.1 kgf-m, 15.5 ft-lb)***

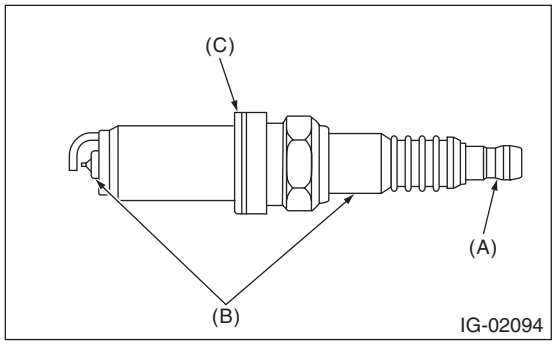
### 2. LH SIDE

Install in the reverse order of removal.

***Tightening torque:***
***21 N·m (2.1 kgf-m, 15.5 ft-lb)***

## C: INSPECTION

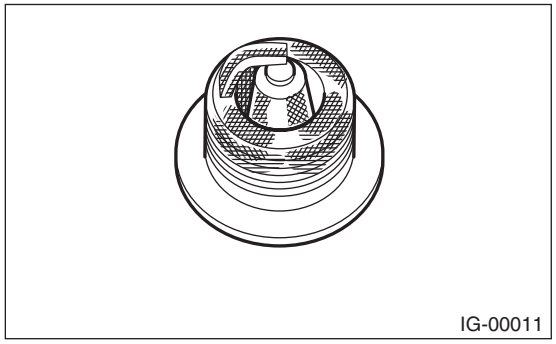
1) Check the spark plug for abnormalities. If defective, replace the spark plug.



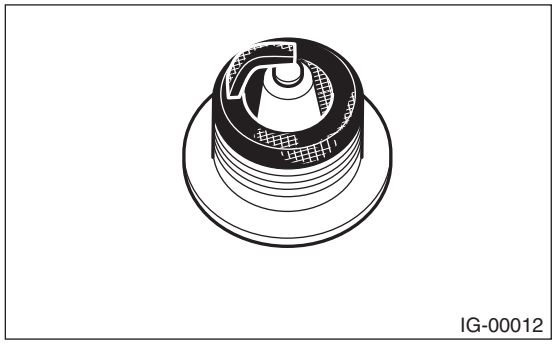

(A) Terminal damage
(B) Crack or damage in insulator
(C) Damaged gasket

2) Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

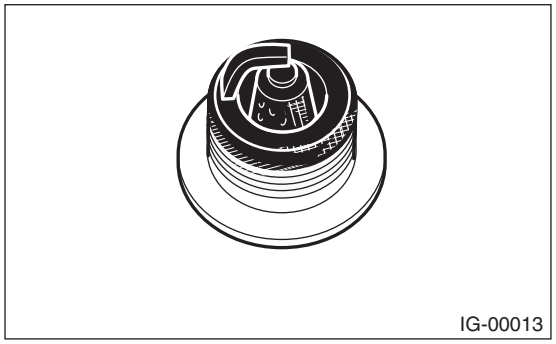
(1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



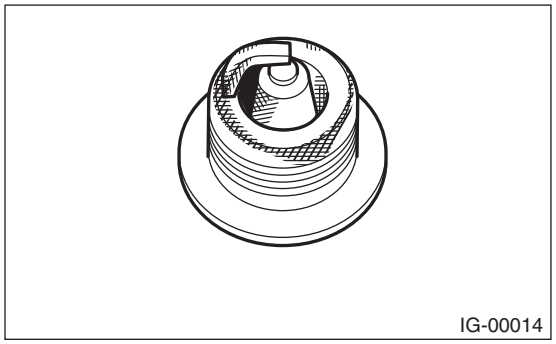

(2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture, etc.




(3) Oil fouled:
Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



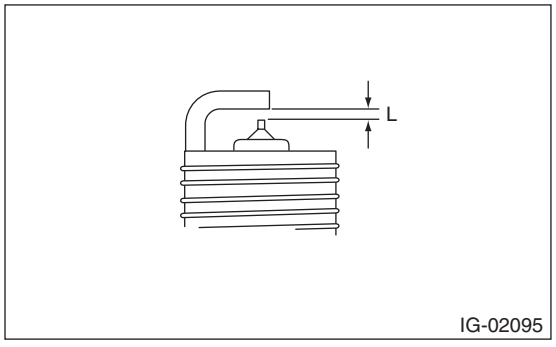

(4) Overheating:
A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.




3) Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap “L” using a gap gauge. If it is not within the standard, replace the spark plug.

NOTE:
- Never use a plug cleaner.
- Do not use a metal brush as it may damage the electrode area.

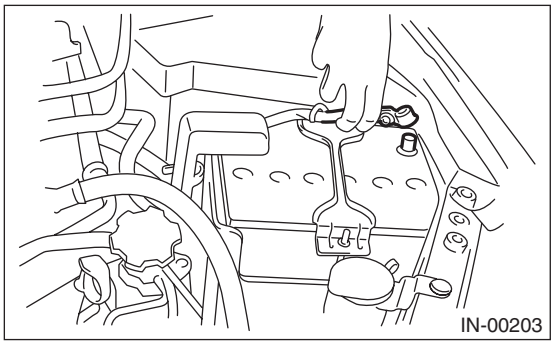
***Spark plug gap L:***
***Standard***
***1.0 — 1.1 mm (0.039 — 0.043 in)***



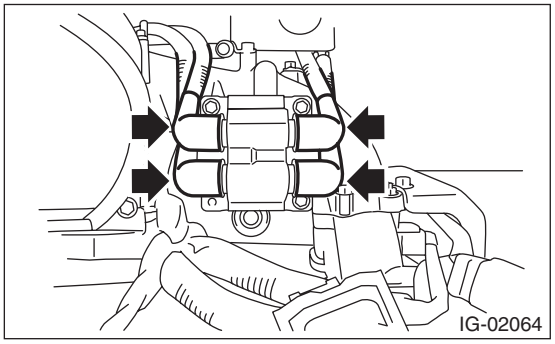
# 3. Ignition Coil and Ignitor Assembly

## A: REMOVAL

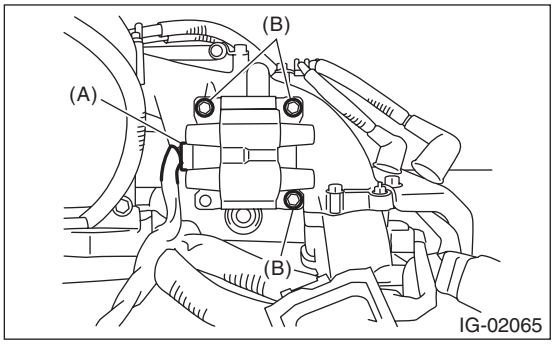
1) Disconnect the ground cable from battery.




2) Disconnect the spark plug cords from ignition coil and ignitor assembly.




3) Disconnect connector (A) from the ignition coil and ignitor assembly.
4) Remove the bolt (B) which secures the ignition coil and ignitor assembly to intake manifold.




## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***8 N·m (0.8 kgf-m, 5.9 ft-lb)***

**CAUTION:**
**Connect the spark plug cords to correct positions. Failure to do so will damage the unit.**

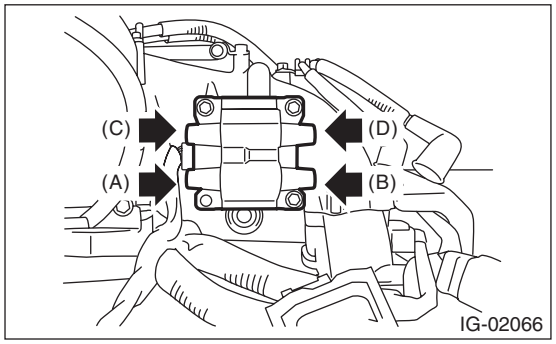
## C: INSPECTION

Check the secondary coil resistance using a tester. Replace if defective.

**CAUTION:**
**• If the resistance is extremely low, it indicates the presence of a short-circuit.**
**• Ignitor is integrated with the coil. Therefore the resistance of primary side coil cannot be measured.**

***Standard:***

***[Secondary side]***
***Between (A) and (B)***
***11.2 kΩ±15%***
***Between (C) and (D)***
***11.2 kΩ±15%***



# 4. Spark Plug Cord

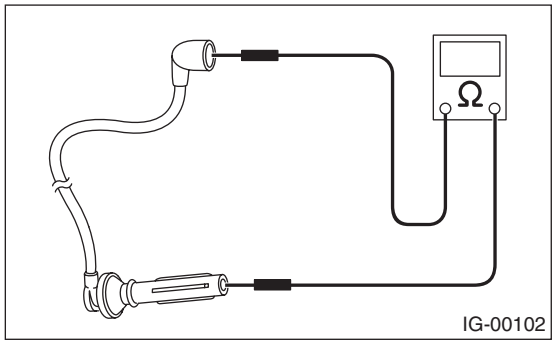
## A: INSPECTION

Check the following items.

- Damage, deformation, seizure of spark plug cords or rust formation of terminals
- Resistance of spark plug cords

***Standard:***

***#1 spark plug code: 5.0 — 12.1 kΩ***
***#2 spark plug code: 8.5 — 19.9 kΩ***
***#3 spark plug code: 5.4 — 13.0 kΩ***
***#4 spark plug code: 8.6 — 20.2 kΩ***



# STARTING/CHARGING SYSTEMS

# *SC(H4SO)*


**Page**

1. General Description .....2
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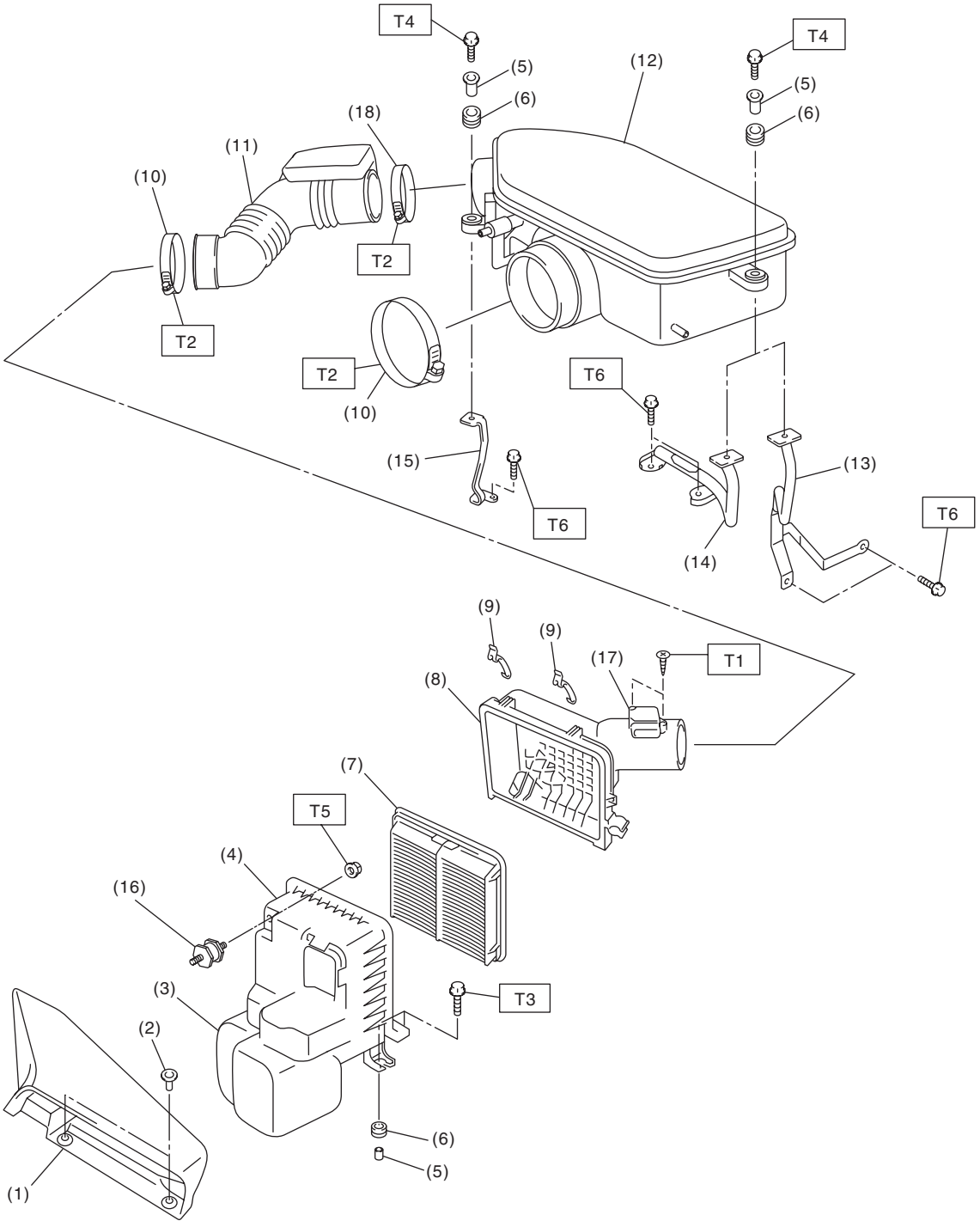
# 1. General Description

## A: COMPONENT




IN-02543

(1) Air intake duct
(2) Clip
(3) Resonator chamber
(4) Air cleaner case (Front)
(5) Spacer
(6) Cushion
(7) Air cleaner element
(8) Air cleaner case (Rear)
(9) Clip
(10) Clamp
(11) Intake boot
(12) Air intake chamber
(13) Stay LH (MT model)
(14) Stay LH (AT model)
(15) Stay RH
(16) Cushion
(17) Mass air flow and intake air temperature sensor
(18) Clamp

| *Tightening torque:N·m (kgf-m, ft-lb)* |
|---|
| ***T1: 1 (0.1, 0.7)*** |
| ***T2: 3 (0.3, 2.2)*** |
| ***T3: 6 (0.6, 4.4)*** |
| ***T4: 6.5 (0.7, 4.8)*** |
| ***T5: 7.5 (0.8, 5.5)*** |
| ***T6: 16 (1.6, 11.8)*** |

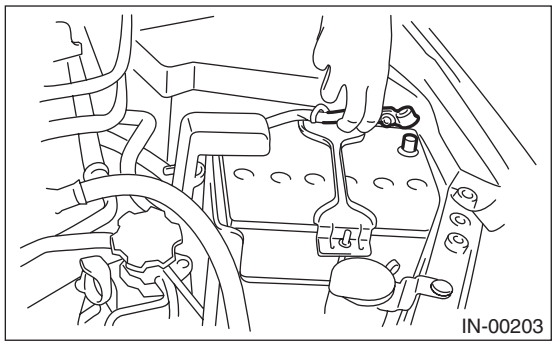
## B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

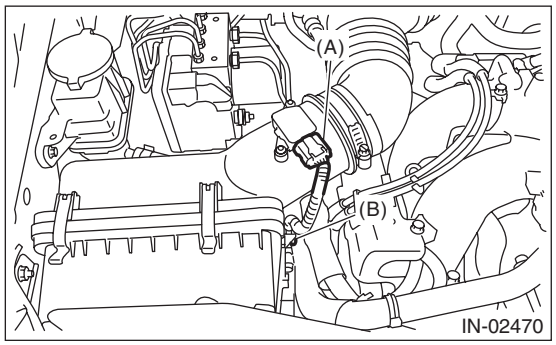
# 2. Air Cleaner Element

## A: REMOVAL

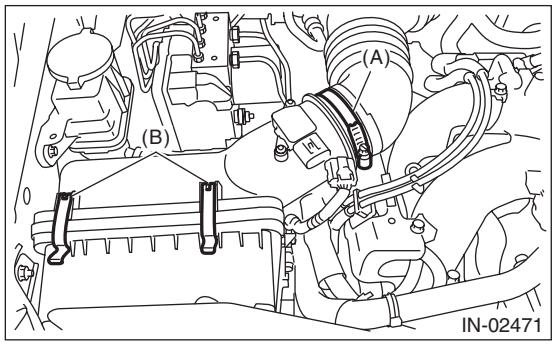
1) Disconnect the ground cable from battery.



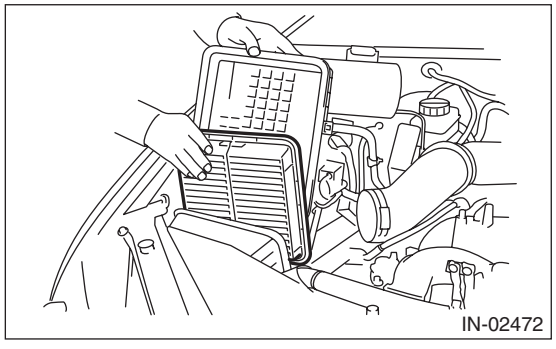

2) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).




3) Loosen the clamp (A) which connects the air cleaner case to intake boot.
4) Remove the clips (B) securing the upper side of air cleaner case.




5) Remove the air cleaner case (rear) and air cleaner element.

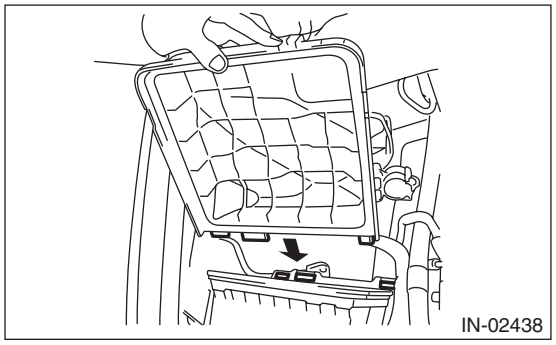



## B: INSTALLATION

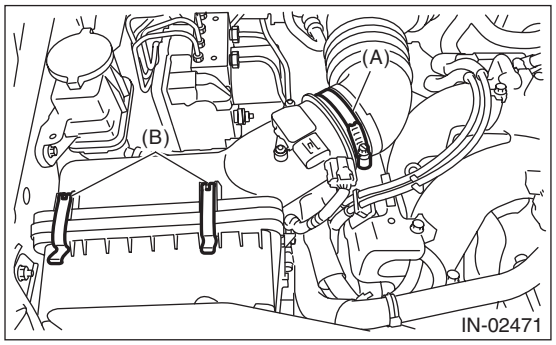
Install in the reverse order of removal.

**CAUTION:**
**Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.**

NOTE:
• Check that there are no foreign objects in the air cleaner case.
• When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.




***Tightening torque:***
***Clamp (A)***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***



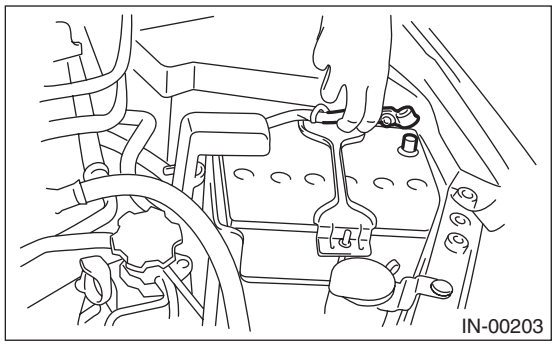

## C: INSPECTION

1) Check that the air cleaner element has no deformation, cracks or other damages.
2) Check the air cleaner element for excessive dirt.

# 3. Air Cleaner Case

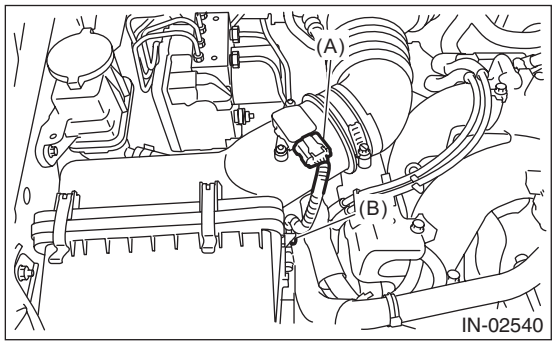
## A: REMOVAL

1) Disconnect the ground cable from battery.



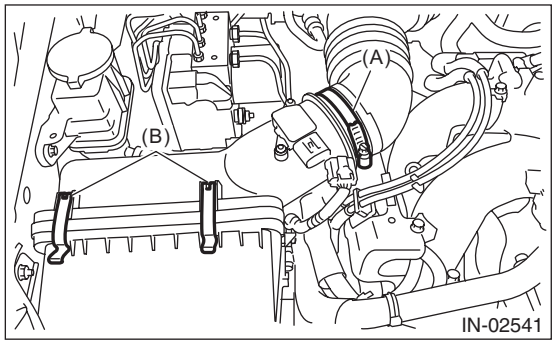

2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

3) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).

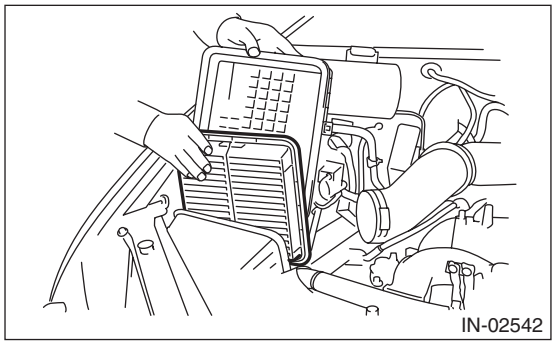



4) Loosen the clamp (A) which connects the air cleaner case to intake boot.

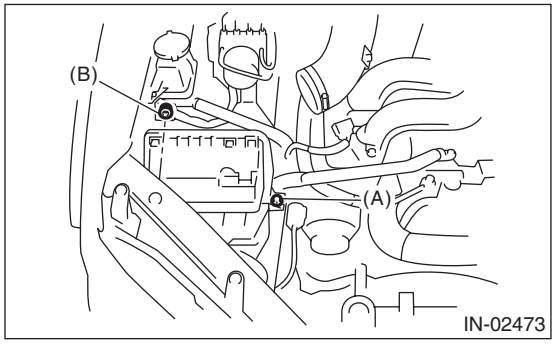
5) Remove the clips (B) from the air cleaner case (front).




6) Remove the air cleaner case (rear) and air cleaner element.




7) Remove the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

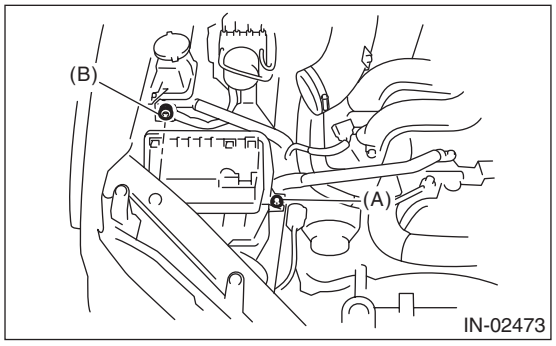



8) Remove the air cleaner case (front).

## B: INSTALLATION

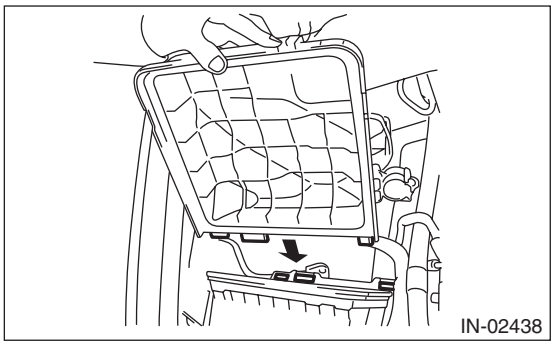
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

***Tightening torque:***
***Bolt (A)***
***6 N·m (0.6 kgf-m, 4.4 ft-lb)***
***Nut (B)***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***



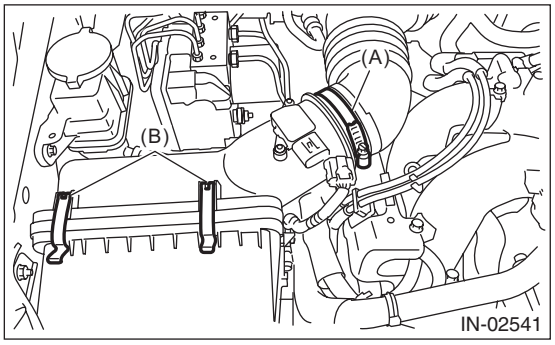
2) Install the air cleaner case (rear) and air cleaner element.

NOTE:
When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.

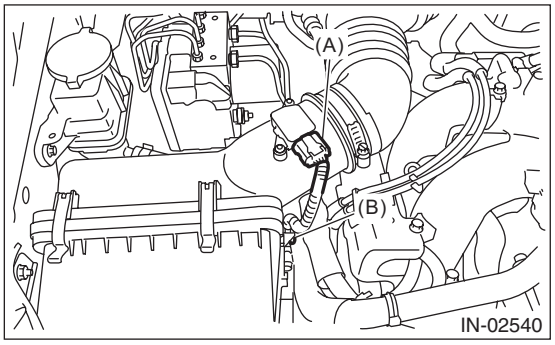



3) Install the clips (B) to the air cleaner case (front), then tighten the clamp (A) that connects the air cleaner case (rear) to the intake boot.

***Tightening torque:***
***Clamp (A)***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***

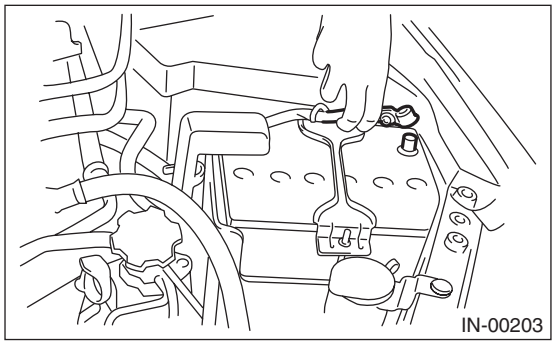



4) Connect the connector (A) to the mass air flow and intake air temperature sensor, and fasten the harness to clip (B).




5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

6) Connect the ground cable to battery.



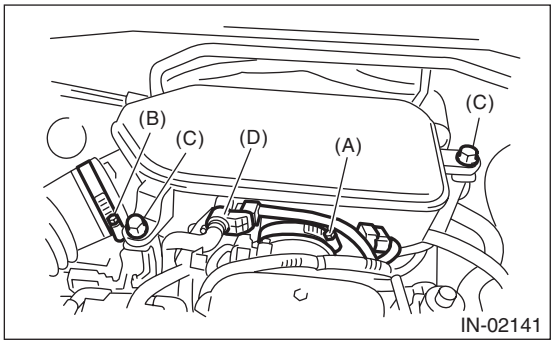

## C: INSPECTION

1) Check that the air cleaner case has no deformation, cracks or other damages.
2) Check that the air intake boot has no cracks, damage or loose part.

# 4. Air Intake Chamber

## A: REMOVAL

1) Loosen the clamp (A) which connects air intake chamber to throttle body.
2) Loosen the clamp (B) which connects intake boot to air intake chamber.
3) Remove the bolt (C) which secures air intake chamber to the air intake chamber stay.
4) Disconnect the connector (D).

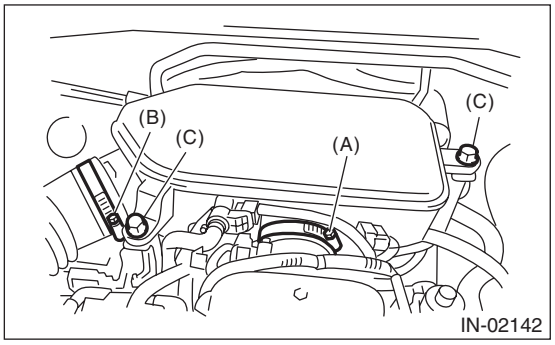



5) Disconnect the blow-by hoses, and then remove air intake chamber.

## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***Clamp (A), (B)***
***3 N·m (0.3 kgf-m, 2.2 ft-lb)***
***Bolt (C)***
***6.5 N·m (0.7 kgf-m, 4.8 ft-lb)***




## C: INSPECTION

1) Check that the air intake chamber has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake chamber.

# 5. Air Intake Duct

## A: REMOVAL

Remove the clip which secures the air intake duct, and remove the air intake duct.

## B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

1) Check that the air intake duct has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake duct.

# 6. Resonator Chamber

## A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for the removal procedure. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

## B: INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for installation procedure. <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>

## C: INSPECTION

Check that the resonator chamber has no deformation, cracks or other damages.

# MECHANICAL

# ME(H4SO)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| 17. | Crank Sprocket | 56 |
| 18. | Valve Rocker Assembly | 57 |
| 19. | Camshaft | 60 |
| 20. | Cylinder Head | 65 |
| 21. | Cylinder Block | 74 |
| 22. | Oil Switching Solenoid Valve | 95 |
| 23. | Intake and Exhaust Valve | 97 |
| 24. | Piston | 98 |
| 25. | Connecting Rod | 99 |
| 26. | Crankshaft | 100 |
| 27. | Engine Trouble in General | 101 |
| 28. | Engine Noise | 107 |

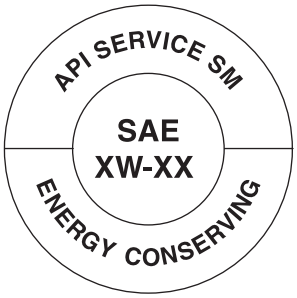
# 1. General Description

## A: SPECIFICATION

| | | | | | |
|---|---|---|---|---|---|
| Lubrication method | | | | | Forced lubrication |
| Oil pump | Pump type | | | | Trochoid type |
| | Number of teeth | Inner rotor | | | 9 |
| | | Outer rotor | | | 10 |
| | Outer rotor diameter × thickness mm (in) | | | | 76 × 10 (2.99 × 0.39) |
| | Tip clearance between inner and outer rotors mm (in) | | | Standard | 0.04 — 0.14 (0.0016 — 0.0055) |
| | Side clearance between inner rotor and pump case mm (in) | | | Standard | 0.02 — 0.07 (0.0008 — 0.0028) |
| | Case clearance between outer rotor and pump case mm (in) | | | Standard | 0.10 — 0.175 (0.0039 — 0.0069) |
| | Relief valve spring | Free length mm (in) | | | 73.7 (2.902) |
| | | Installed length mm (in) | | | 54.7 (2.154) |
| | | Load when installed N (kgf, lbf) | | | 93.1 (9.49, 20.93) |
| | Performance (Oil temperature 80°C (176°F)) | 600 rpm | Discharge pressure kPa (kg/cm$^2$, psi) | | 98 (1.0, 14) |
| | | | Discharge rate ℓ (US qt, Imp qt)/min. | | 4.6 (4.9, 4.0) or more |
| | | 5,000 rpm | Discharge pressure kPa (kg/cm$^2$, psi) | | 294 (3.0, 43) |
| | | | Discharge rate ℓ (US qt, Imp qt)/min. | | 47.0 (49.7, 41.4) or more |
| | Relief valve working pressure kPa (kg/cm$^2$, psi) | | | | 588 (6.0, 85) |
| Oil filter | Filter type | | | | Full-flow filter type |
| | Filtration area cm$^2$ (sq in) | Outer diameter: 68 mm (2.68 in) (Black) | | | 800 (124) |
| | | Outer diameter: 67.4 mm (2.65 in) (Blue) | | | 555 (86) |
| | By-pass valve opening pressure kPa (kg/cm$^2$, psi) | | | | 160 (1.63, 23.2) |
| | Outer diameter × width mm (in) | Outer diameter: 68 mm (2.68 in) (Black) | | | 68 × 65 (2.68 × 2.56) |
| | | Outer diameter: 67.4 mm (2.65 in) (Blue) | | | 67.4 × 65.3 (2.65 × 2.57) |
| | Installation screw specifications | | | | M 20 × 1.5 |
| Oil pressure switch | Type | | | | Immersed contact point type |
| | Operating voltage — power consumption | | | | 12 V — 3.4 W or less |
| | Warning light operating pressure kPa (kg/cm$^2$, psi) | | | | 14.7 (0.15, 2.1) |
| | Proof pressure kPa (kg/cm$^2$, psi) | | | | 981 (10, 142) or more |
| Engine oil | Total capacity (at overhaul) ℓ (US qt, Imp qt) | | | | 5.0 (5.3, 4.4) |
| | When replacing engine oil and oil filter ℓ (US qt, Imp qt) | | | | 4.2 (4.4, 3.7) |
| | When replacing engine oil only ℓ (US qt, Imp qt) | | | | 4.0 (4.2, 3.5) |

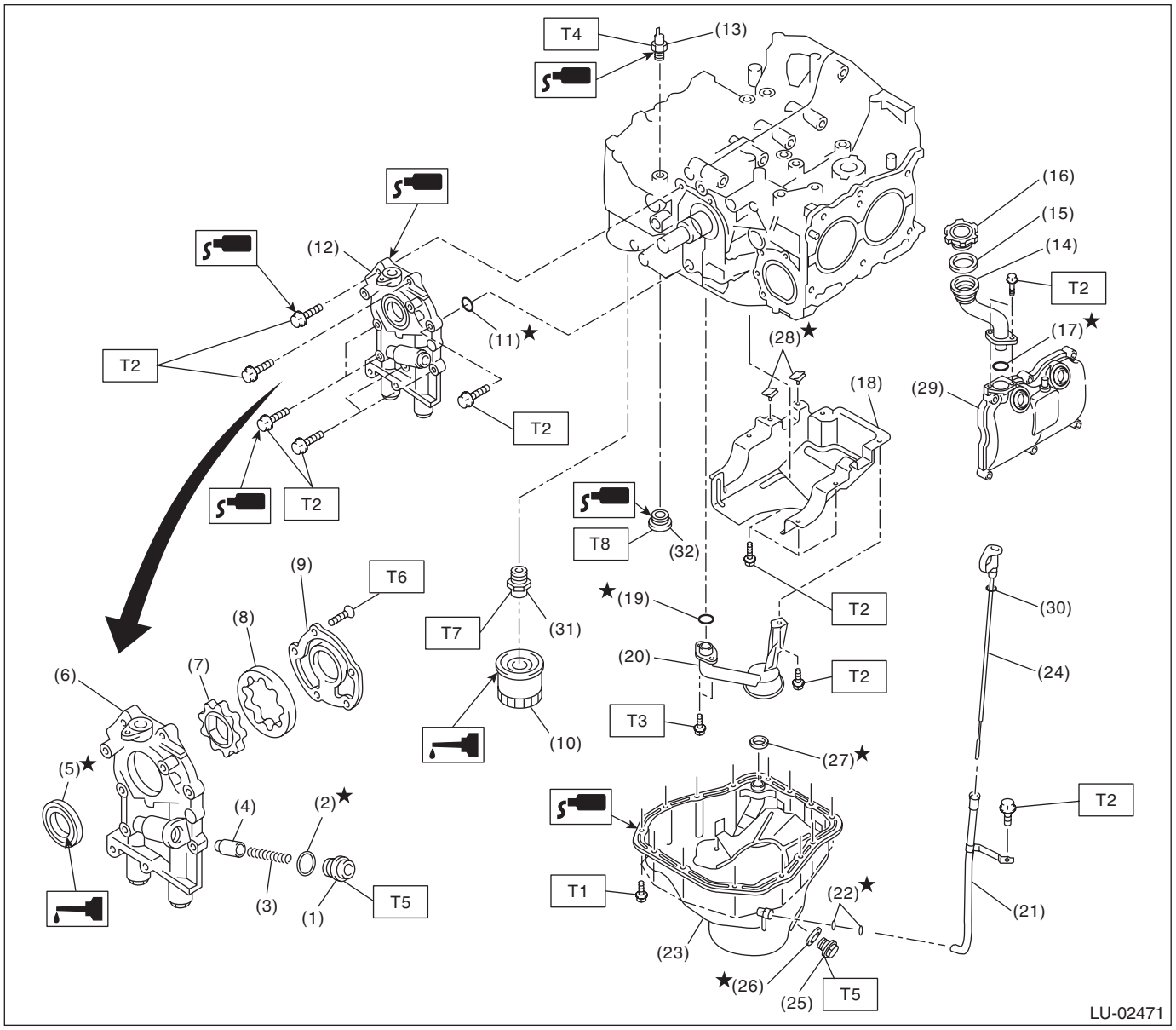
***Recommended oil:***

**CAUTION:**
**It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use following oil specified by Subaru.**

| Engine oil standard | | SAE viscosity No. |
|---|---|---|
|  <br>RM-00076<br>For API standard, oil with SM "Energy Conserving" or SN "Resource Conserving" logo. | or | <br>RM-00002<br>Those with the ILSAC standard GF-4 or GF-5 "starburst mark" displayed on top of the container. | 5W-30 (synthetic oil) |

NOTE:
The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

## B: COMPONENT




(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Front oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) O-ring
(12) Oil pump ASSY
(13) Oil pressure switch
(14) Oil filler duct
(15) Gasket
(16) Oil filler cap
(17) O-ring
(18) Baffle plate
(19) O-ring
(20) Oil strainer
(21) Oil level gauge guide
(22) O-ring
(23) Oil pan
(24) Oil level gauge
(25) Drain plug
(26) Drain plug gasket
(27) Gasket
(28) Seal
(29) Rocker cover
(30) O-ring
(31) Oil filter connector
(32) Plug

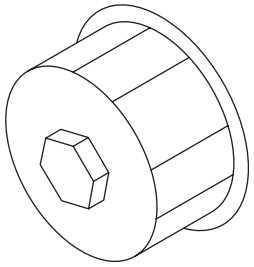
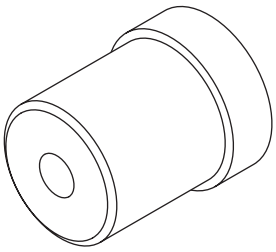
***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 5 (0.5, 3.7)***
***T2: 6.4 (0.7, 4.7)***
***T3: 10 (1.0, 7.4)***
***T4: 25 (2.5, 18.4)***
***T5: 44 (4.5, 32.5)***
***T6: 5.4 (0.6, 4.0)***
***T7: 45 (4.6, 33.2)***
***T8: 70 (7.1, 51.6)***

## C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
• Prepare a container and cloth to prevent scattering of oil when performing work where oil can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
• Follow all government and local regulations concerning disposal of refuse when disposing of oil.

# D: PREPARATION TOOL

## 1. SPECIAL TOOL

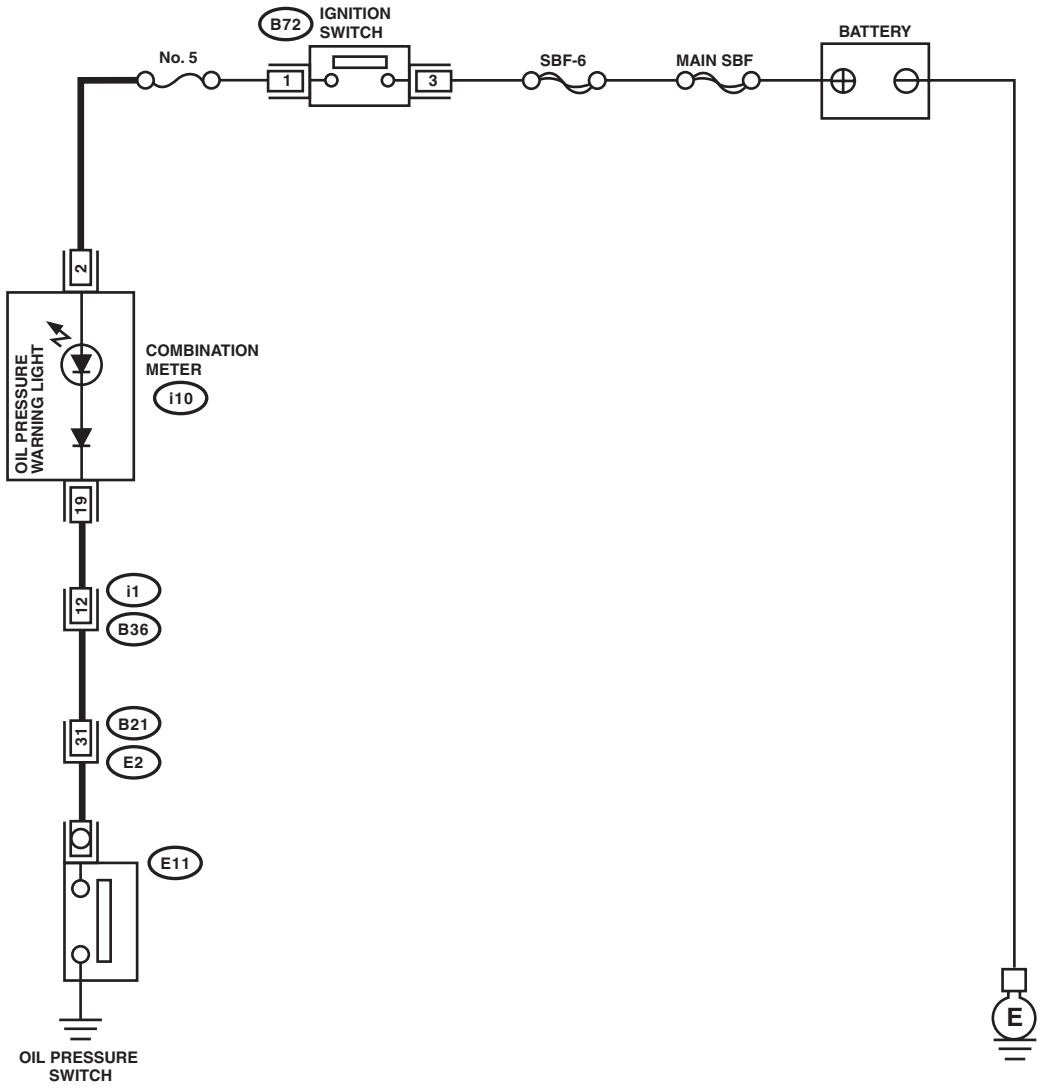
| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST18332AA000 | 18332AA000 | OIL FILTER WRENCH | Used for removing and installing oil filter (Black). (Outer diameter: 68 mm (2.68 in)) |
|  ST-499587100 | 499587100 | OIL SEAL INSTALLER | Used for installing oil seal into oil pump. |

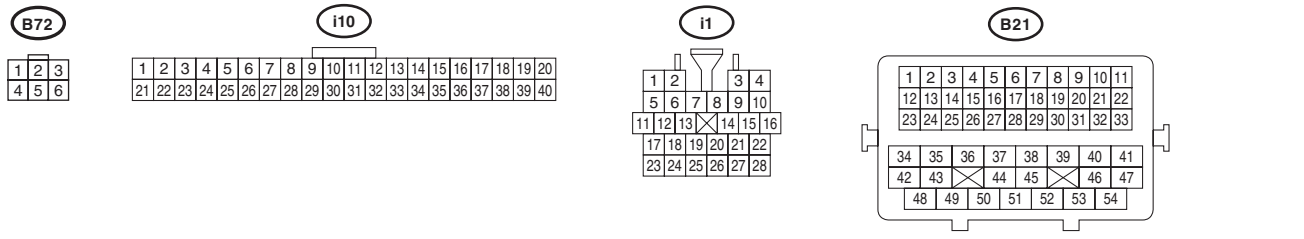
## 2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Oil filter wrench (65/67 mm 14 Flutes) | Used for removing and installing oil filter (Blue). (Outer diameter: 67.4 mm (2.65 in)) |
| Circuit tester | Used for measuring resistance and voltage. |

# 2. Oil Pressure System

## A: WIRING DIAGRAM




LU-02671

## B: INSPECTION

| Step | | Check | Yes | No |
|---|---|---|---|---|
| 1 | **CHECK COMBINATION METER.**<br>1) Turn the ignition switch to ON. (engine OFF)<br>2) Check the warning light in the combination meter. | Does the warning light illuminate? | Go to step **2**. | Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.> |
| 2 | **CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.**<br>1) Turn the ignition switch to OFF.<br>2) Disconnect the connector from oil pressure switch.<br>3) Turn the ignition switch to ON.<br>4) Measure the voltage of harness between oil pressure switch connector and chassis ground.<br>***Connector & terminal***<br>***(E11) No. 1 (+) — Chassis ground (–):*** | Is the voltage 10 V or more? | Replace the oil pressure switch. <Ref. to LU(H4SO)-19, Oil Pressure Switch.> | Go to step **3**. |
| 3 | **CHECK COMBINATION METER.**<br>1) Turn the ignition switch to OFF.<br>2) Remove the combination meter.<br>3) Measure the resistance of combination meter.<br>***Terminals***<br>***No. 2 — No. 19:*** | Is the resistance less than 10 Ω? | Repair the harness and connector.<br>NOTE:<br>In this case, repair the following item:<br>• Open circuit of harness between combination meter and oil pressure switch<br>• Poor contact of combination meter connector<br>• Poor contact of oil pressure switch connector<br>• Poor contact of coupling connector | Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.> |

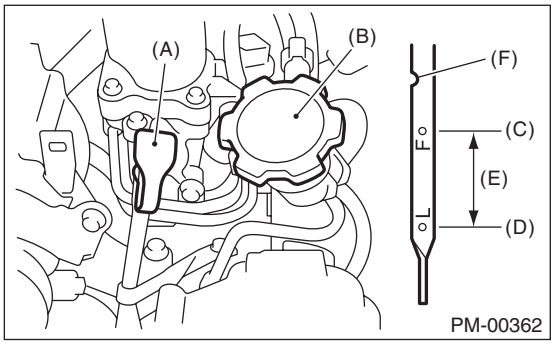
# 3. Engine Oil

## A: INSPECTION

**CAUTION:**
**If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

1) Park the vehicle on a level surface.
2) Remove the oil level gauge and wipe away the oil.
3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
4) Pull out the oil level gauge again, and check the oil level. If the engine oil level is below "L" line, make sure that there is no oil leakage from the engine, then add oil to raise the level up to the "F" line.
5) Start the engine to circulate the oil in engine room.
6) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.

NOTE:
• Just after driving or while the engine is warm, engine oil level shows in the range between the F line and the notch mark. This is caused by thermal expansion of engine oil.
• To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
• As the oil level gauge is used for daily maintenance, "F" line and "L" line is set assuming that the engine is cold.



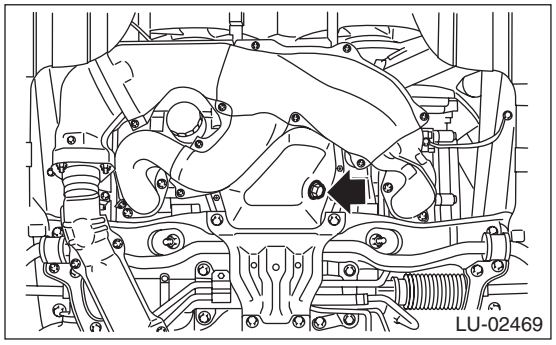

(A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

## B: REPLACEMENT

**CAUTION:**
**If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

1) Open the engine oil filler cap for quick draining of engine oil.
2) Lift up the vehicle.
3) Drain engine oil by loosening the engine oil drain plug.

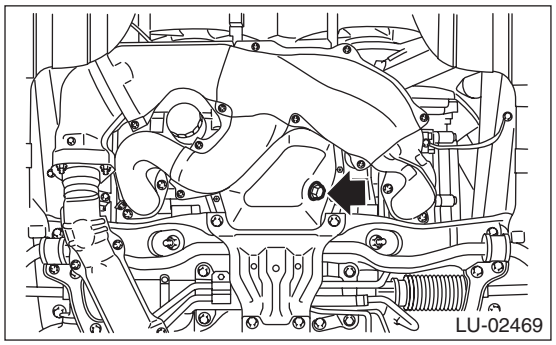
NOTE:
Prepare the container for draining of engine oil.




4) Tighten the engine oil drain plug after draining engine oil.

NOTE:
Use a new drain plug gasket.

***Tightening torque:***
***44 N·m (4.5 kgf-m, 32.5 ft-lb)***



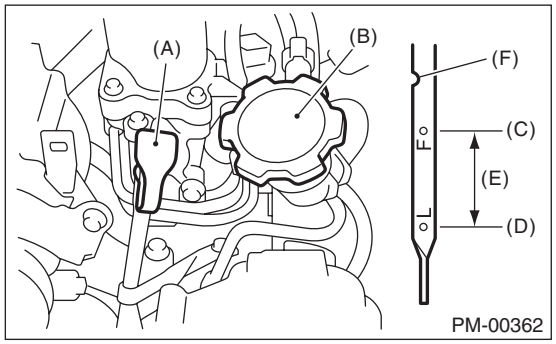

5) Lower the vehicle.

6) Using engine oil of proper quality and viscosity, fill engine oil through the filler duct to the “F” line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

***Recommended oil:***
***Refer to “SPECIFICATION” for recommended oil. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>***

***Engine oil capacity:***
***Refer to “SPECIFICATION” for engine oil capacity. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>***

7) Close the engine oil filler cap.
8) Start the engine to circulate the oil in engine room.
9) After stopping the engine, recheck the oil level. If necessary, add engine oil up to the “F” line on oil level gauge.

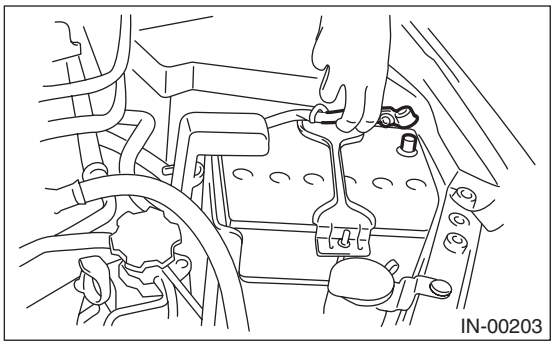



(A) Oil level gauge
(B) Engine oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

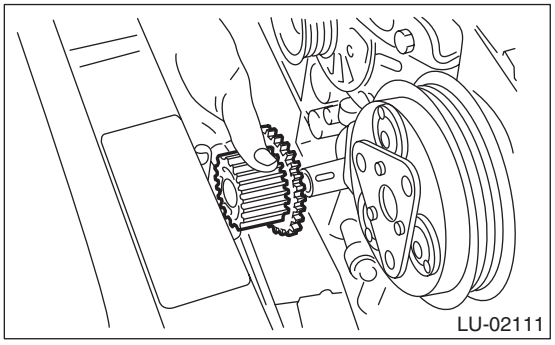
# 4. Oil Pump

## A: REMOVAL

1) Disconnect the ground cable from battery.

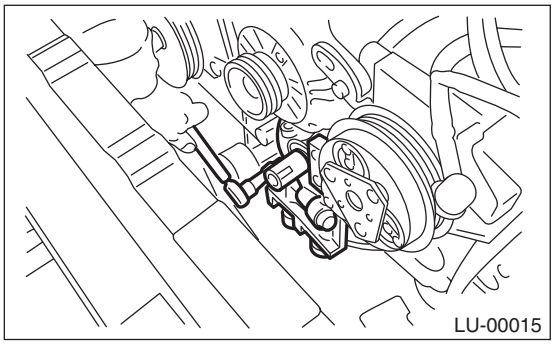



2) Remove the radiator. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
3) Remove the crankshaft position sensor.
<Ref. to FU(H4SO)-26, REMOVAL, Crankshaft Position Sensor.>
4) Remove the water pump. <Ref. to CO(H4SO)-15, REMOVAL, Water Pump.>
5) Remove the crank sprocket. <Ref. to ME(H4SO)-56, REMOVAL, Crank Sprocket.>



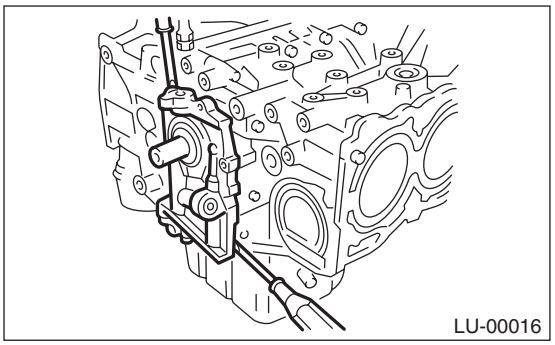

6) Remove the bolts which secure oil pump to cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.




7) Remove the oil pump by using flat tip screwdriver.

**CAUTION:**
**Be careful not to scratch the mating surface of the cylinder block and oil pump.**

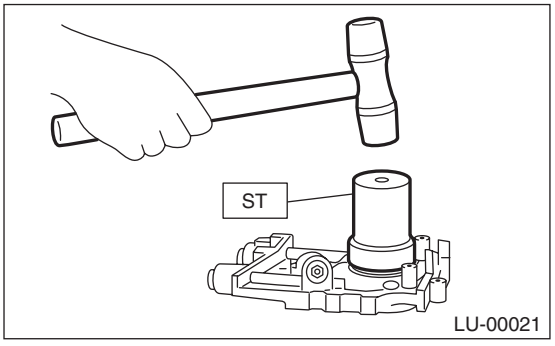



8) Remove the front oil seal from the oil pump.

## B: INSTALLATION

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

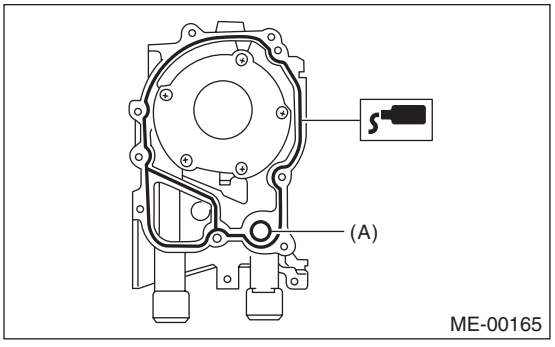
NOTE:
Use a new front oil seal.




2) Apply liquid gasket to the mating surfaces of oil pump.

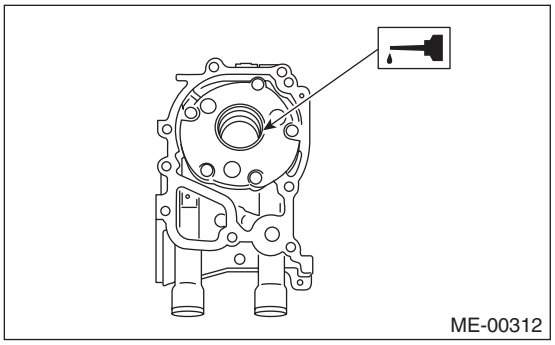
NOTE:
Install within 5 min. after applying liquid gasket.

***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***




(A) O-ring

3) Apply a coat of engine oil to the inside of front oil seal.




4) Install the oil pump to cylinder block.

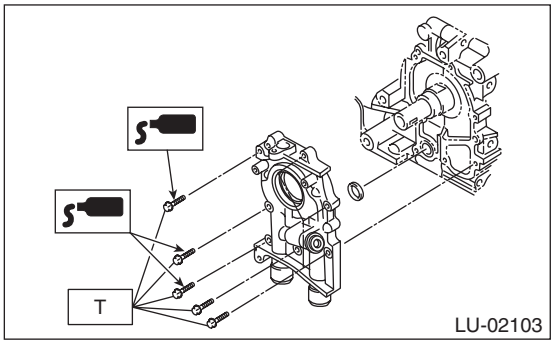
**CAUTION:**
**• Be careful not to damage the front oil seal during installation.**
**• Make sure the front oil seal lip is not folded.**

NOTE:
• Align the flat surface of oil pump's inner rotor with that of crankshaft before installation.
• Use new O-rings.
• Do not forget to assemble O-rings.

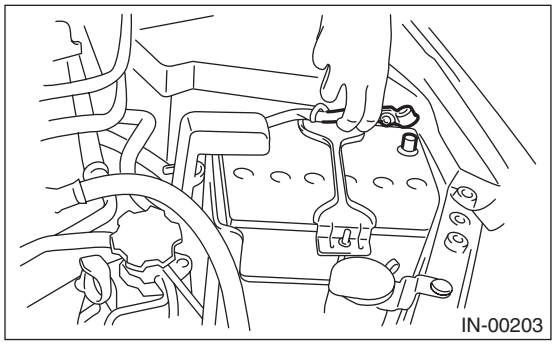
5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***



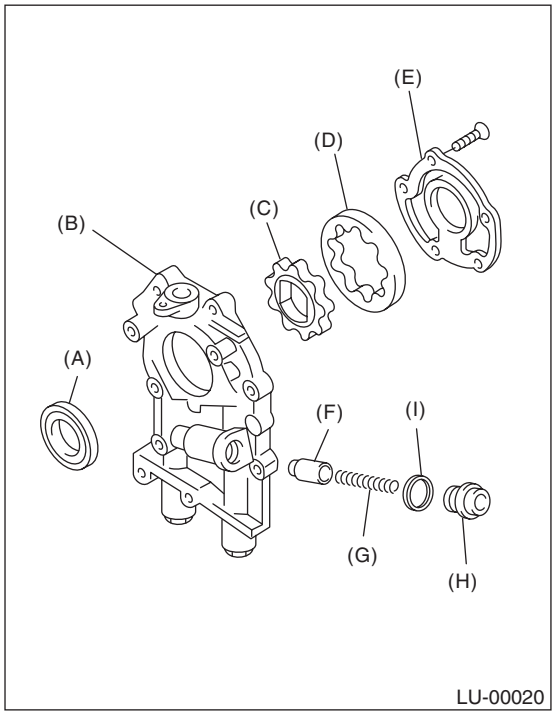

6) Install the crank sprocket. <Ref. to ME(H4SO)-56, INSTALLATION, Crank Sprocket.>
7) Install the water pump. <Ref. to CO(H4SO)-15, INSTALLATION, Water Pump.>
8) Install the crankshaft position sensor. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.>
9) Install the radiator. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>
10) Connect the battery ground terminal.




## C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

NOTE:
Before disassembling the oil pump, remove the relief valve.

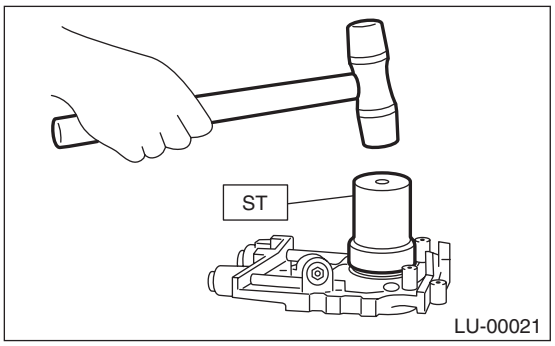



(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

## D: ASSEMBLY

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

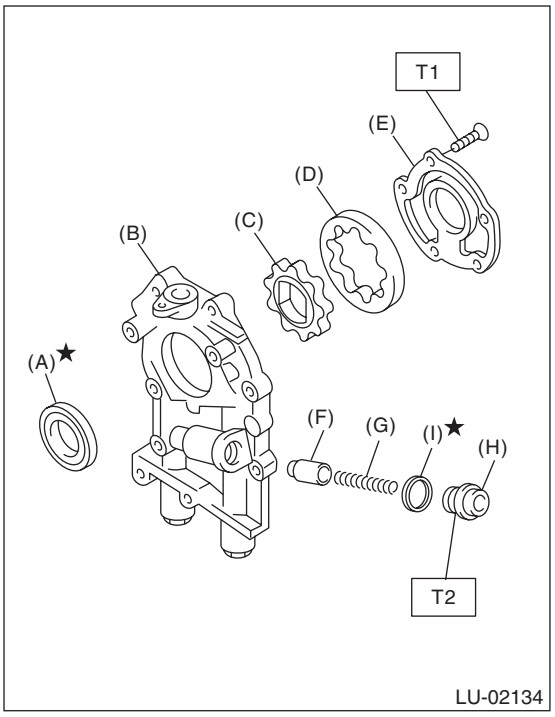
NOTE:
Use a new front oil seal.




2) Apply a coat of engine oil to inner and outer rotors.
3) Install the inner and outer rotors.
4) Assemble the oil relief valve and install relief valve spring and plug.

NOTE:
Use a new gasket.
5) Install the oil pump cover.

***Tightening torque:***
***T1: 5.4 N·m (0.6 kgf-m, 4.0 ft-lb)***
***T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)***



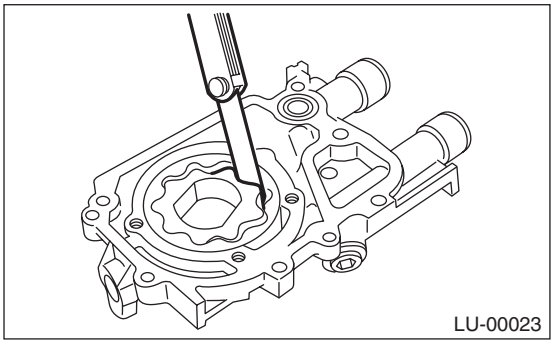

(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

## E: INSPECTION

### 1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance is out of standard, replace the rotors as a set.

***Tip clearance between inner and outer rotors:***
***Standard:***
***0.04 — 0.14 mm (0.0016 — 0.0055 in)***



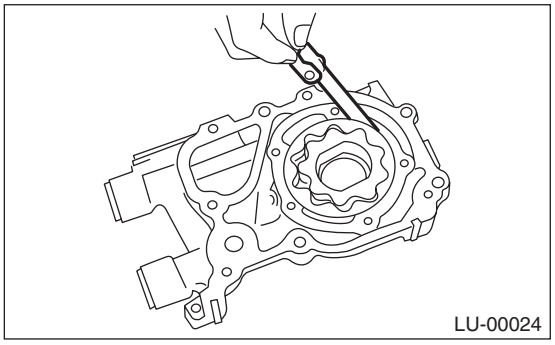
## 2. CASE CLEARANCE

Measure the clearance between outer rotor and oil pump case. If clearance is out of standard, replace the oil pump case.

***Case clearance between outer rotor and pump case:***

***Standard:***

***0.10 — 0.175 mm (0.0039 — 0.0069 in)***



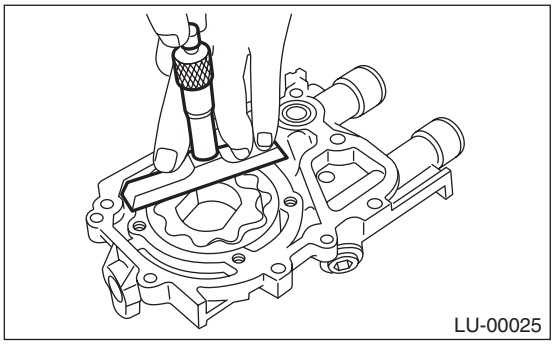

## 3. SIDE CLEARANCE

Measure the gap between the inner rotor and the oil pump case to measure the clearance between the inner rotor and the oil pump cover as shown in the figure. If clearance is out of standard, replace the rotor or the oil pump case.

***Side clearance between inner rotor and pump case:***

***Standard:***

***0.02 — 0.07 mm (0.0008 — 0.0028 in)***




## 4. OIL RELIEF VALVE

Check the valve for assembly condition and damage, and the relief valve spring for damage and deterioration.

Replace the parts if defective.

***Relief valve spring:***

***Free length***

***73.7 mm (2.902 in)***

***Installed length***

***54.7 mm (2.154 in)***

***Load when installed***

***93.1 N (9.49 kgf, 20.93 lbf)***

## 5. OIL PUMP CASE

Check for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

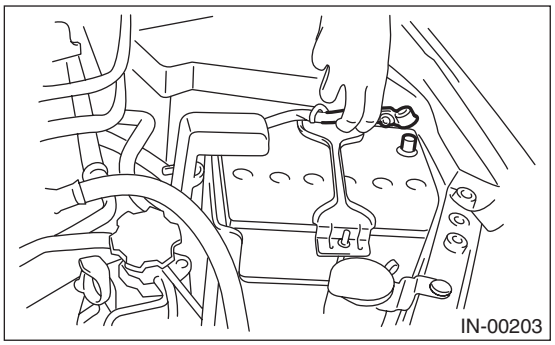
## 6. FRONT OIL SEAL

Check the front oil seal lips for deformation and hardening, wear.

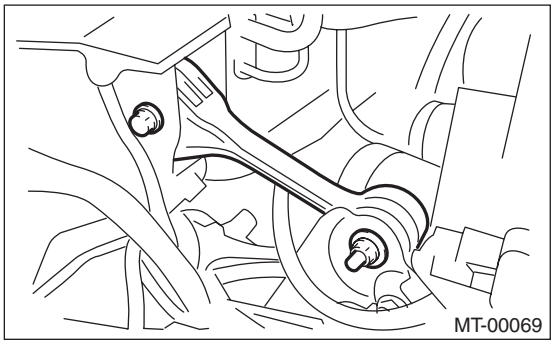
# 5. Oil Pan and Strainer

## A: REMOVAL

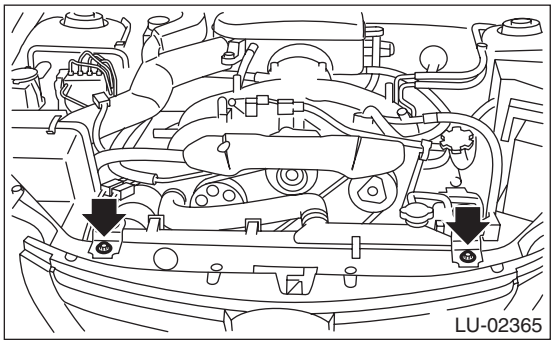
1) Disconnect the ground cable from battery.


IN-00203

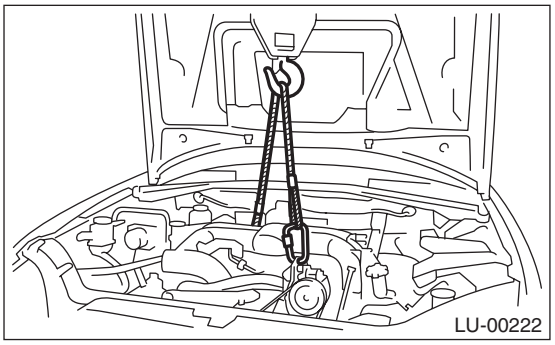
2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
3) Disconnect the connectors from the mass air flow and intake air temperature sensor.
4) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
5) Remove the pitching stopper.


MT-00069

6) Remove the radiator upper brackets.


LU-02365

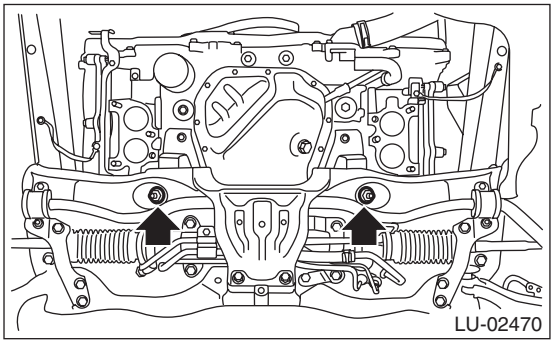
7) Support the engine with a lifting device and wire ropes.


LU-00222

8) Lift up the vehicle.

**CAUTION:**
**When lifting up the vehicle, raise up wire ropes at the same time.**

9) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
10) Drain the engine oil. <Ref. to LU(H4SO)-9, REPLACEMENT, Engine Oil.>
11) Remove the front exhaust pipe. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
12) Remove the nuts which secure the engine mounting to the front crossmember.

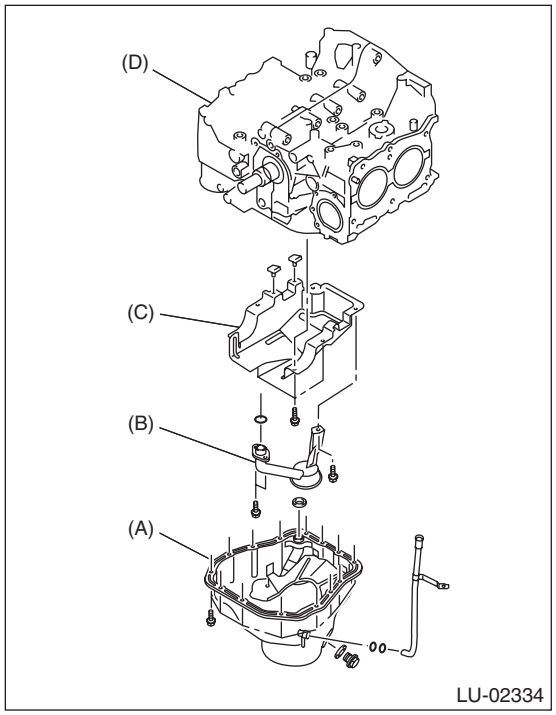

LU-02470

13) Remove the bolts which secure oil pan on cylinder block with the engine raised up.
14) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

**CAUTION:**
**Do not use a screwdriver or similar tool in place of oil pan cutter.**

15) Remove the oil strainer.

16) Remove the baffle plate.



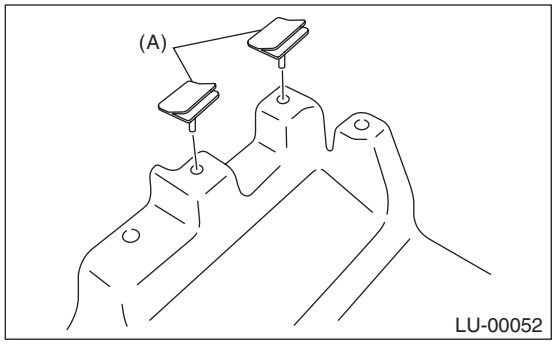

(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

## B: INSTALLATION

NOTE:
Before installing the oil pan, clean the mating surface of oil pan and cylinder block.

1) Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.

NOTE:
Use a new seal.




2) Install the baffle plate.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

3) Install the oil strainer to cylinder block.

NOTE:
Use new O-rings.

***Tightening torque:***
***10 N·m (1.0 kgf-m, 7.4 ft-lb)***

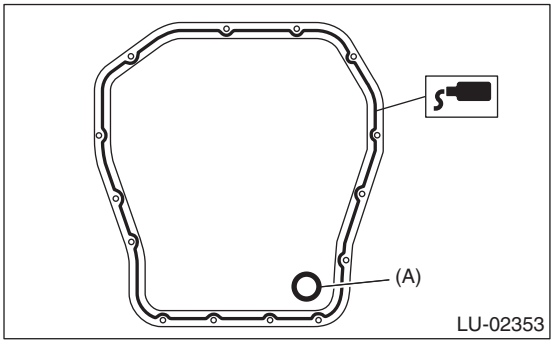
4) Tighten the oil strainer stay together with the baffle plate.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

5) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
- Use a new gasket.
- Install within 5 min. after applying liquid gasket.

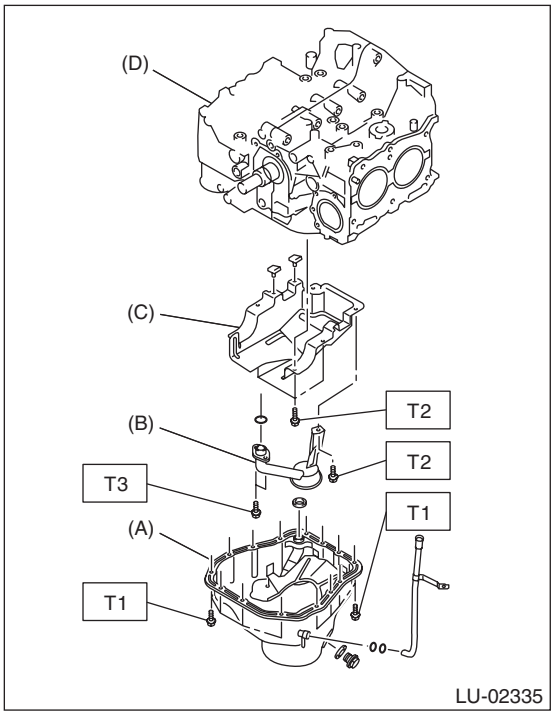
***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***




(A) Gasket

6) Tighten the bolts which install oil pan to cylinder block.

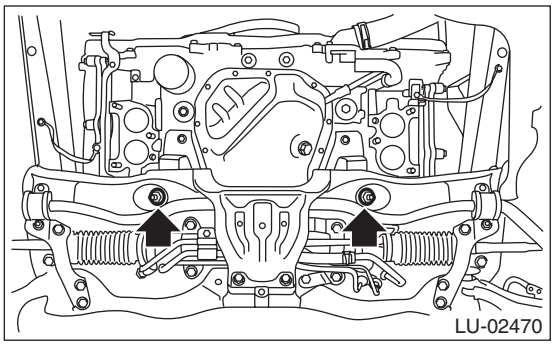
***Tightening torque:***
***T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)***
***T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***T3: 10 N·m (1.0 kgf-m, 7.4 ft-lb)***




(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

7) Lower the engine onto front crossmember.
8) Tighten the nuts which install engine mounting onto front crossmember.

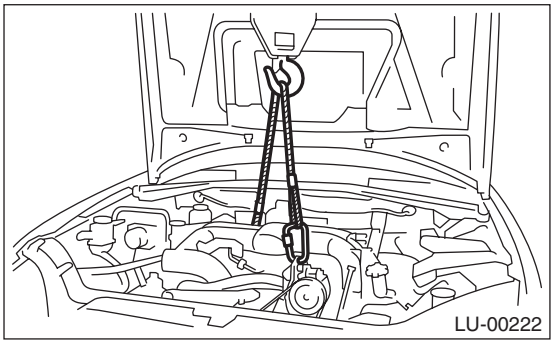
***Tightening torque:***
***85 N·m (8.7 kgf-m, 62.7 ft-lb)***




9) Install the front exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

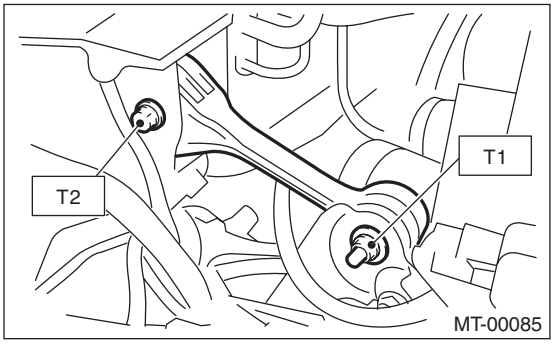
10) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
11) Lower the vehicle.

**CAUTION:**
**When lowering the vehicle, lower the lift up device and wire ropes at the same time.**
12) Remove the lifting device and wire ropes.



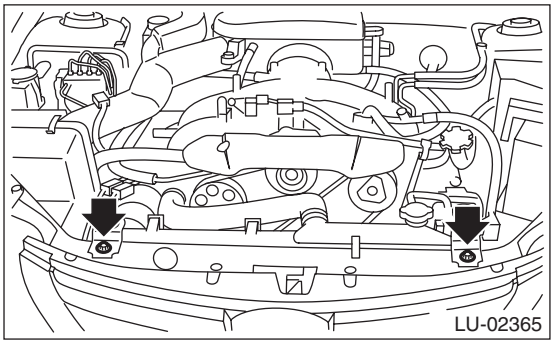

13) Install the pitching stopper.

***Tightening torque:***
***T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)***
***T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)***

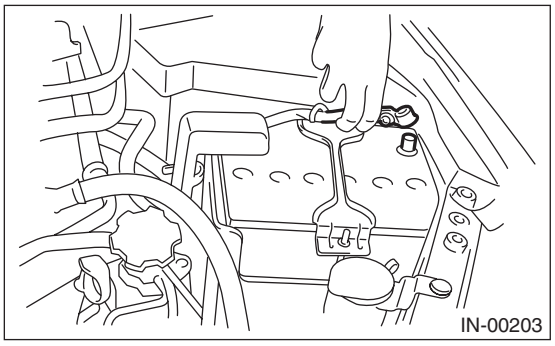



14) Install the radiator upper brackets.

***Tightening torque:***
***12 N·m (1.2 kgf-m, 8.9 ft-lb)***



15) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
16) Connect the connector to the mass air flow and intake air temperature sensor.
17) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
18) Connect the battery ground terminal.




19) Refill the engine oil. <Ref. to LU(H4SO)-9, INSPECTION, Engine Oil.>

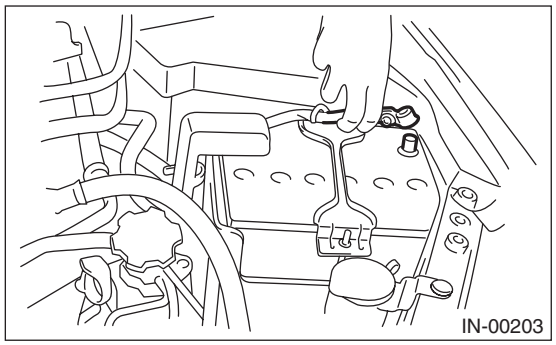
## C: INSPECTION

Check that the oil pan, oil strainer and baffle plate do not have deformation, cracks or damage.

# 6. Oil Pressure Switch

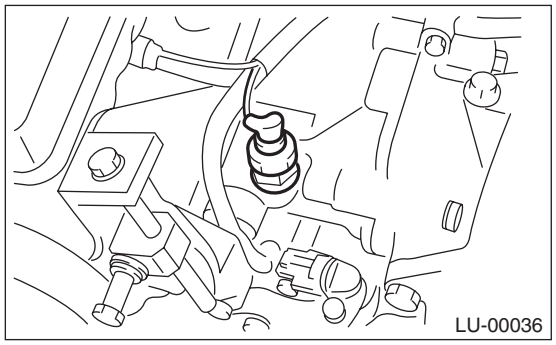
## A: REMOVAL

1) Disconnect the ground cable from battery.

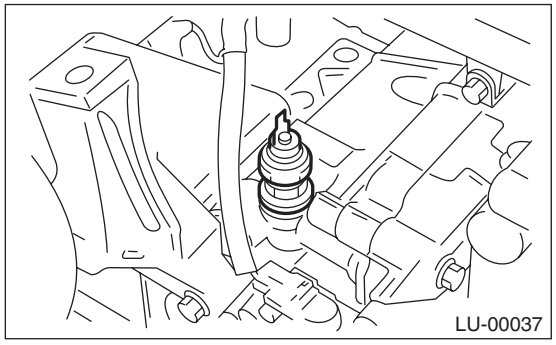



2) Remove the generator from the bracket. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>

3) Disconnect the terminal from oil pressure switch.



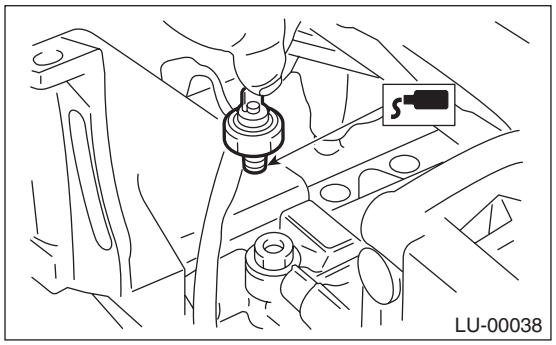

4) Remove the oil pressure switch.




## B: INSTALLATION

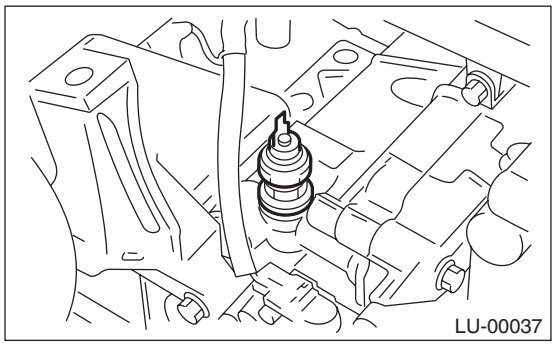
1) Apply liquid gasket to the oil pressure switch threads.

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***

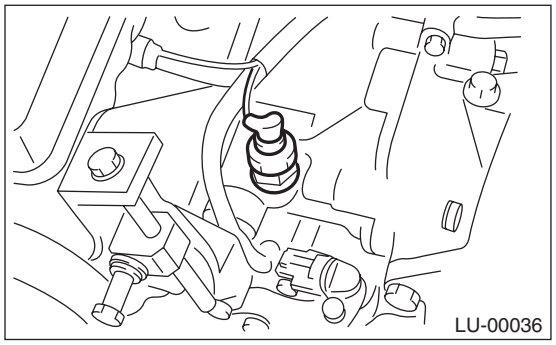



2) Install the oil pressure switch to cylinder block.

***Tightening torque:***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***

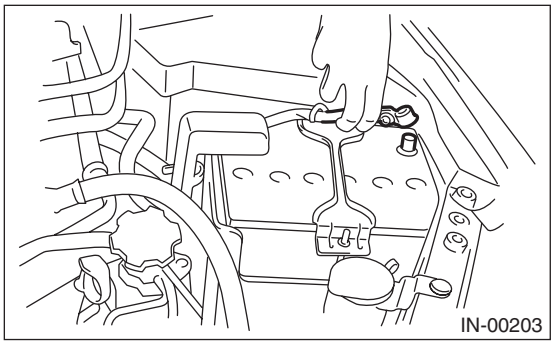



3) Connect the terminal to the oil pressure switch.




4) Install the generator to the bracket. <Ref. to SC(H4SO)-16, INSTALLATION, Generator.>

5) Connect the ground cable to battery.




## C: INSPECTION

1) Check that the oil pressure switch does not have deformation, cracks or damage.
2) Check the oil pressure switch installation portion for oil leakage and oil seepage.

# 7. Engine Oil Filter

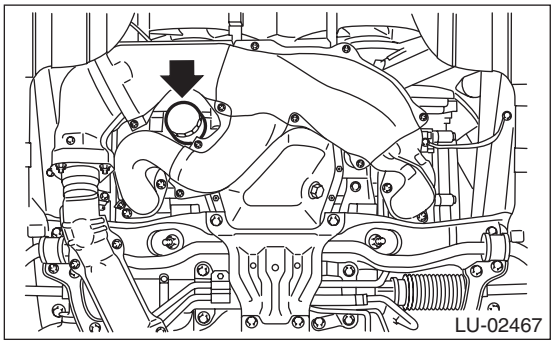
## A: REMOVAL

**CAUTION:**
**If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

1) Lift up the vehicle.
2) Remove the oil filter.
• Oil filter (Black)
Remove using the ST.

ST 18332AA000 OIL FILTER WRENCH (OUTER DIAMETER: 68 MM (2.68 IN) FOR OIL FILTER)

• Oil filter (Blue)
Remove using a general tool (65/67 mm 14 Flutes).




## B: INSTALLATION

**CAUTION:**
**Do not tighten excessively, or oil may leak.**

1) Clean the oil filter installing surface of cylinder block.
2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
3) Install the oil filter turning it by hand, being careful not to damage the seal rubber of the oil filter.
• Tighten the oil filter (Black) with an outer diameter of 68 mm (2.68 in) (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with cylinder block. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
• Tighten the oil filter (Blue) with an outer diameter of 67.4 mm (2.65 in) (approx. 7/8 rotation) after the seal rubber of the oil filter comes in contact with cylinder block. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.9 ft-lb).
4) Lower the vehicle.
5) After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(H4SO)-9, INSPECTION, Engine Oil.>

## C: INSPECTION

1) After installing the oil filter, run the engine and check for oil leakage around seal rubber.

NOTE:
The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

2) Check the engine oil level. <Ref. to LU(H4SO)-9, INSPECTION, Engine Oil.>

# 8. Engine Lubrication System Trouble in General

## A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

| Trouble | Possible cause | Corrective action |
|---|---|---|
| Warning light remains ON. | a. Oil pressure switch failure | |
| | ❍ Cracked diaphragm or oil leakage within switch | Replace. |
| | ❍ Broken spring or seized contacts | Replace. |
| | b. Low oil pressure | |
| | ❍ Clogging of oil filter | Replace. |
| | ❍ Malfunction of oil by-pass valve in oil filter | Replace. |
| | ❍ Malfunction of oil relief valve in oil pump | Clean or replace. |
| | ❍ Clogged oil passage | Clean. |
| | ❍ Excessive tip clearance and side clearance of oil pump rotor | Replace. |
| | ❍ Clogged oil strainer or broken pipe | Clean or replace. |
| | c. No oil pressure | |
| | ❍ Insufficient engine oil (degradation, etc.) | Replace. |
| | ❍ Broken pipe of oil strainer | Replace. |
| | ❍ Stuck oil pump rotor | Replace. |
| Warning light does not illuminate. | a. Malfunction of combination meter | Replace. |
| | b. Poor contact of switch contact points | Replace. |
| | c. Disconnection of wiring | Repair. |
| Warning light flickers momentarily. | a. Defective terminal contact | Repair. |
| | b. Defective wiring harness | Repair. |
| | c. Oil pressure switch failure | |
| | ❍ Cracked diaphragm or oil leakage within switch | Replace. |
| | ❍ Broken spring or seized contacts | Replace. |
| | d. Low oil pressure | |
| | ❍ Clogging of oil filter | Replace. |
| | ❍ Malfunction of oil by-pass valve in oil filter | Replace. |
| | ❍ Malfunction of oil relief valve in oil pump | Clean or replace. |
| | ❍ Clogged oil passage | Clean. |
| | ❍ Excessive tip clearance and side clearance of oil pump rotor | Replace. |
| | ❍ Clogged oil strainer or broken pipe | Clean or replace. |

# SPEED CONTROL SYSTEMS

# *SP(H4SO)*


**Page**

1. General Description .....2
2. Accelerator Pedal .....4

# 1. General Description

## A: SPECIFICATION

| | | | | |
|---|---|---|---|---|
| Engine | Model | | | 2.5 L |
| | Cylinder arrangement | | | Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine |
| | Valve system mechanism | | | Belt driven, single overhead camshaft, 4 valve/cylinder |
| | Bore × Stroke | mm (in) | | 99.5 × 79.0 (3.92 × 3.11) |
| | Displacement | $cm^3$ (cu in) | | 2,457 (149.94) |
| | Compression ratio | | | 10.0 |
| | Compression pressure (at 200 — 300 rpm) | kPa ($kg/cm^2$, psi) | Standard | 1,020 — 1,275 (10.4 — 13.0, 148 — 185) |
| | Number of piston rings | | | Pressure ring: 2, Oil ring: 1 |
| | Intake valve timing | Constant | Open | BTDC 0° |
| | | | Close | ABDC 58° |
| | | Low speed | Open | BTDC 0° |
| | | | Close | ABDC –10° |
| | | High speed | Open | BTDC 14° |
| | | | Close | ABDC 62° |
| | Exhaust valve timing | | Open | BBDC30° |
| | | | Close | ATDC14° |
| | Valve clearance | mm (in) | Intake | 0.20±0.04 (0.0079±0.0016) |
| | | | Exhaust | 0.25±0.04 (0.0098±0.0016) |
| | Idling speed (Select lever is in “P” or “N” range on AT model; Gear shift lever is in neutral position on MT model.) | rpm | No load | Standard | AT model: 700±100 |
| | | | | | MT model: 650±100 |
| | | | A/C ON | Standard | 850±100 |
| | Ignition order | | | $1 \rightarrow 3 \rightarrow 2 \rightarrow 4$ |
| | Ignition timing | BTDC/rpm | Standard | AT model: 15°±10°/700 |
| | | | | MT model: 10°±8°/650 |

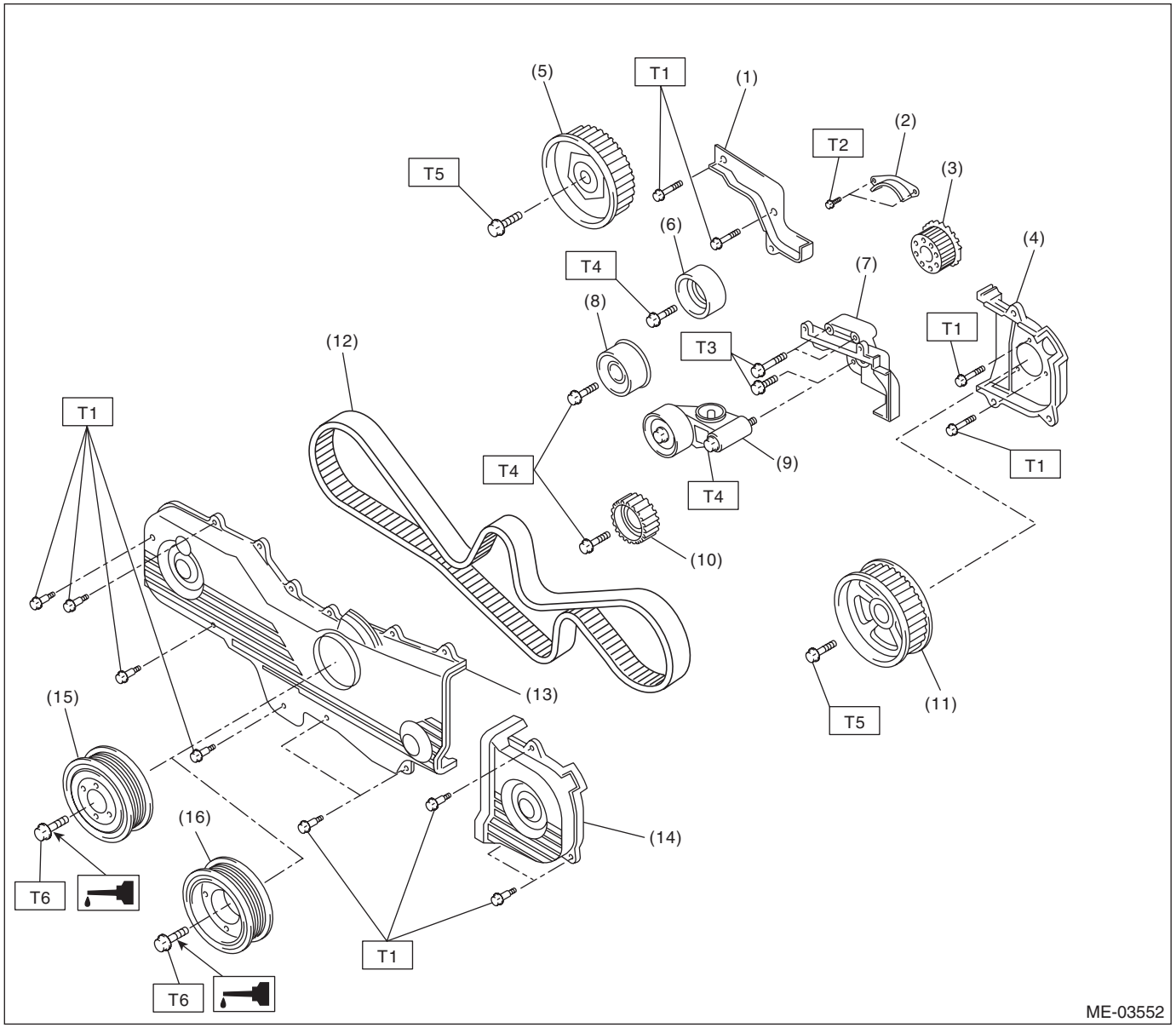
NOTE:
US: Undersize OS: Oversize

| | | | | | |
|---|---|---|---|---|---|
| Belt tension adjuster | Adjuster rod protrusion amount | | | mm (in) | 5.2 — 6.2 (0.205 — 0.244) |
| Valve rocker arm | Clearance between arm and shaft | | | mm (in) Standard | 0.020 — 0.054 (0.0008 — 0.0021) |
| | Rocker arm inside diameter | | | mm (in) Standard | 22.020 — 22.041 (0.8669 — 0.8678) |
| | Rocker shaft diameter | | | mm (in) Standard | 21.987 — 22.000 (0.8656 — 0.8661) |
| Camshaft | Bending limit | | | mm (in) | 0.025 (0.00098) |
| | Cam lobe height mm (in) | Intake | Constant | Standard | 40.075 — 40.175 (1.5778 — 1.5817) |
| | | | Low speed | Standard | 35.496 — 35.596 (1.3975 — 1.4014) |
| | | | High speed | Standard | 40.315 — 40.415 (1.5872 — 1.5911) |
| | | Exhaust | | Standard | 39.289 — 39.389 (1.5468 — 1.5507) |
| | Cam base circle diameter | | | mm (in) Standard | 34.00 (1.3386) |
| | Base circle step of adjacent intake cams (low speed and high speed) | | | mm (in) Standard | 0.03 (0.001) or less |
| | Oil clearance | | | mm (in) Standard | 0.055 — 0.090 (0.0022 — 0.0035) |
| | Journal O.D. | | | mm (in) Standard | 31.928 — 31.945 (1.2570 — 1.2577) |
| | Cylinder head journal I.D. | | | mm (in) Standard | 32.000 — 32.018 (1.2598 — 1.2605) |
| | Thrust clearance | | | mm (in) Standard | 0.030 — 0.090 (0.0012 — 0.0035) |
| Cylinder head | Warping limit (mating surface with cylinder block) | | | mm (in) | 0.035 (0.0014) |
| | Grinding limit | | | mm (in) | 0.1 (0.004) |
| | Standard height | | | mm (in) | 97.5 (3.84) |
| Valve seat | Seating angle between valve and valve seat | | | | 90° |
| | Contacting width between valve and valve seat mm (in) | | Intake | Standard | 0.8 — 1.4 (0.03 — 0.055) |
| | | | Exhaust | Standard | 1.2 — 1.8 (0.047 — 0.071) |
| Valve guide | Clearance between the valve guide and valve stem mm (in) | | Intake | Standard | 0.035 — 0.062 (0.0014 — 0.0024) |
| | | | Exhaust | Standard | 0.040 — 0.067 (0.0016 — 0.0026) |
| | Inside diameter | | | mm (in) | 6.000 — 6.012 (0.2362 — 0.2367) |
| | Valve stem outer diameters | | | mm (in) Intake | 5.950 — 5.965 (0.2343 — 0.2348) |
| | | | | Exhaust | 5.945 — 5.960 (0.2341 — 0.2346) |
| | Valve guide protrusion amount | | | mm (in) Intake | 20.3 — 20.7 (0.799 — 0.815) |
| | | | | Exhaust | 16.8 — 17.2 (0.661 — 0.677) |
| Valve | Head edge thickness mm (in) | | Intake | Standard | 0.8 — 1.2 (0.03 — 0.047) |
| | | | Exhaust | Standard | 1.0 — 1.4 (0.039 — 0.055) |
| | Overall length | | | mm (in) Intake | 120.6 (4.75) |
| | | | | Exhaust | 121.7 (4.79) |
| Valve spring | Free length | | | mm (in) | 55.2 (2.173) |
| | Tension/spring height N (kgf, lb)/mm (in) | | | Set | 235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/ 45.0 (1.772) |
| | | | | Lift | 578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/34.7 (1.366) |
| | Squareness | | | | 2.5°, 2.4 mm (0.094 in) or less |
| Cylinder block | Warping limit (mating surface with cylinder head) | | | mm (in) | 0.025 (0.00098) |
| | Grinding limit | | | mm (in) | 0.1 (0.004) |
| | Standard height | | | mm (in) | 201.0 (7.91) |
| | Cylindricality | | | mm (in) Standard | 0.015 (0.0006) |
| | Out-of-roundness | | | mm (in) Standard | 0.010 (0.0004) |
| | Clearance between cylinder and piston at 20°C (68°F) | | | mm (in) Standard | –0.010 — 0.010 (–0.00039 — 0.00039) |
| | Cylinder inner diameter boring limit (diameter) | | | mm (in) | To 100.005 (3.9372) |

| | | | | |
|---|---|---|---|---|
| Piston | Piston grade point mm (in) | | | 38.2 (1.504) |
| | Outer diameter mm (in) | Standard | A | 99.505 — 99.515 (3.9175 — 3.9179) |
| | | | B | 99.495 — 99.505 (3.9171 — 3.9175) |
| | | 0.25 (0.0098) OS | | 99.745 — 99.765 (3.9270 — 3.9277) |
| | | 0.50 (0.0197) OS | | 99.995 — 100.015 (3.9368 — 3.9376) |
| Piston pin | Degree of fit | | | Piston pin must be fitted into position with thumb at 20°C (68°F). |
| | Clearance between piston pin hole and piston pin mm (in) | | Standard | 0.004 — 0.008 (0.0002 — 0.0003) |
| Piston ring | Piston ring gap mm (in) | Top ring | Standard | 0.20 — 0.35 (0.0079 — 0.0138) |
| | | Second ring | Standard | 0.37 — 0.52 (0.0146 — 0.0205) |
| | | Oil ring | Standard | 0.20 — 0.50 (0.0079 — 0.0197) |
| | Clearance between piston ring and piston ring groove mm (in) | Top ring | Standard | 0.040 — 0.080 (0.0016 — 0.0031) |
| | | Second ring | Standard | 0.030 — 0.070 (0.0012 — 0.0028) |
| Connecting rod and connecting rod bearing | Bend or twist per 100 mm (3.94 in) in length mm (in) | | Limit | 0.10 (0.0039) |
| | Thrust clearance mm (in) | | Standard | 0.070 — 0.330 (0.0028 — 0.0130) |
| | Oil clearance mm (in) | | Standard | 0.016 — 0.044 (0.0006 — 0.0017) |
| | Bearing size (Thickness at center) mm (in) | Standard | | 1.492 — 1.501 (0.0587 — 0.0591) |
| | | 0.03 (0.0012) US | | 1.510 — 1.513 (0.0594 — 0.0596) |
| | | 0.05 (0.0020) US | | 1.520 — 1.523 (0.0598 — 0.0600) |
| | | 0.25 (0.0098) US | | 1.620 — 1.623 (0.0638 — 0.0639) |
| Bushing of small end | Clearance between piston pin and bushing mm (in) | | Standard | 0 — 0.022 (0 — 0.0009) |
| Crankshaft and crankshaft bearing | Bending limit mm (in) | | | 0.035 (0.0014) |
| | Crank pin | Out-of-roundness mm (in) | Standard | 0.003 (0.0001) |
| | | Cylindricality mm (in) | Standard | 0.004 (0.0002) |
| | | Grinding limit (dia.) mm (in) | | To 51.750 (2.0374) |
| | Crank journal | Out-of-roundness mm (in) | Standard | 0.005 (0.0002) |
| | | Cylindricality mm (in) | Standard | 0.006 (0.0002) |
| | | Grinding limit (dia.) mm (in) | | To 59.758 (2.3527) |
| | Crank pin outer diameter mm (in) | Standard | | 51.984 — 52.000 (2.0466 — 2.0472) |
| | | 0.03 (0.0012) US | | 51.954 — 51.970 (2.0454 — 2.0461) |
| | | 0.05 (0.0020) US | | 51.934 — 51.950 (2.0446 — 2.0453) |
| | | 0.25 (0.0098) US | | 51.734 — 51.750 (2.0368 — 2.0374) |
| | Crank journal outer diameter mm (in) | Standard | | 59.992 — 60.008 (2.3619 — 2.3625) |
| | | 0.03 (0.0012) US | | 59.962 — 59.978 (2.3607 — 2.3613) |
| | | 0.05 (0.0020) US | | 59.942 — 59.958 (2.3599 — 2.3605) |
| | | 0.25 (0.0098) US | | 59.742 — 59.758 (2.3520 — 2.3527) |
| | Bearing size (Thickness at center) mm (in) | #1, #3 Standard | | 1.998 — 2.011 (0.0787 — 0.0792) |
| | | #1, #3 0.03 (0.0012) US | | 2.017 — 2.020 (0.0794 — 0.0795) |
| | | #1, #3 0.05 (0.0020) US | | 2.027 — 2.030 (0.0798 — 0.0799) |
| | | #1, #3 0.25 (0.0098) US | | 2.127 — 2.130 (0.0837 — 0.0839) |
| | | #2, #4, #5 Standard | | 2.000 — 2.013 (0.0787 — 0.0793) |
| | | #2, #4, #5 0.03 (0.0012) US | | 2.019 — 2.022 (0.0795 — 0.0796) |
| | | #2, #4, #5 0.05 (0.0020) US | | 2.029 — 2.032 (0.0799 — 0.0800) |
| | | #2, #4, #5 0.25 (0.0098) US | | 2.129 — 2.132 (0.0838 — 0.0839) |
| | Thrust clearance mm (in) | | Standard | 0.030 — 0.115 (0.0012 — 0.0045) |
| | Oil clearance mm (in) | | Standard | 0.010 — 0.030 (0.0004 — 0.0012) |

# B: COMPONENT

## 1. TIMING BELT

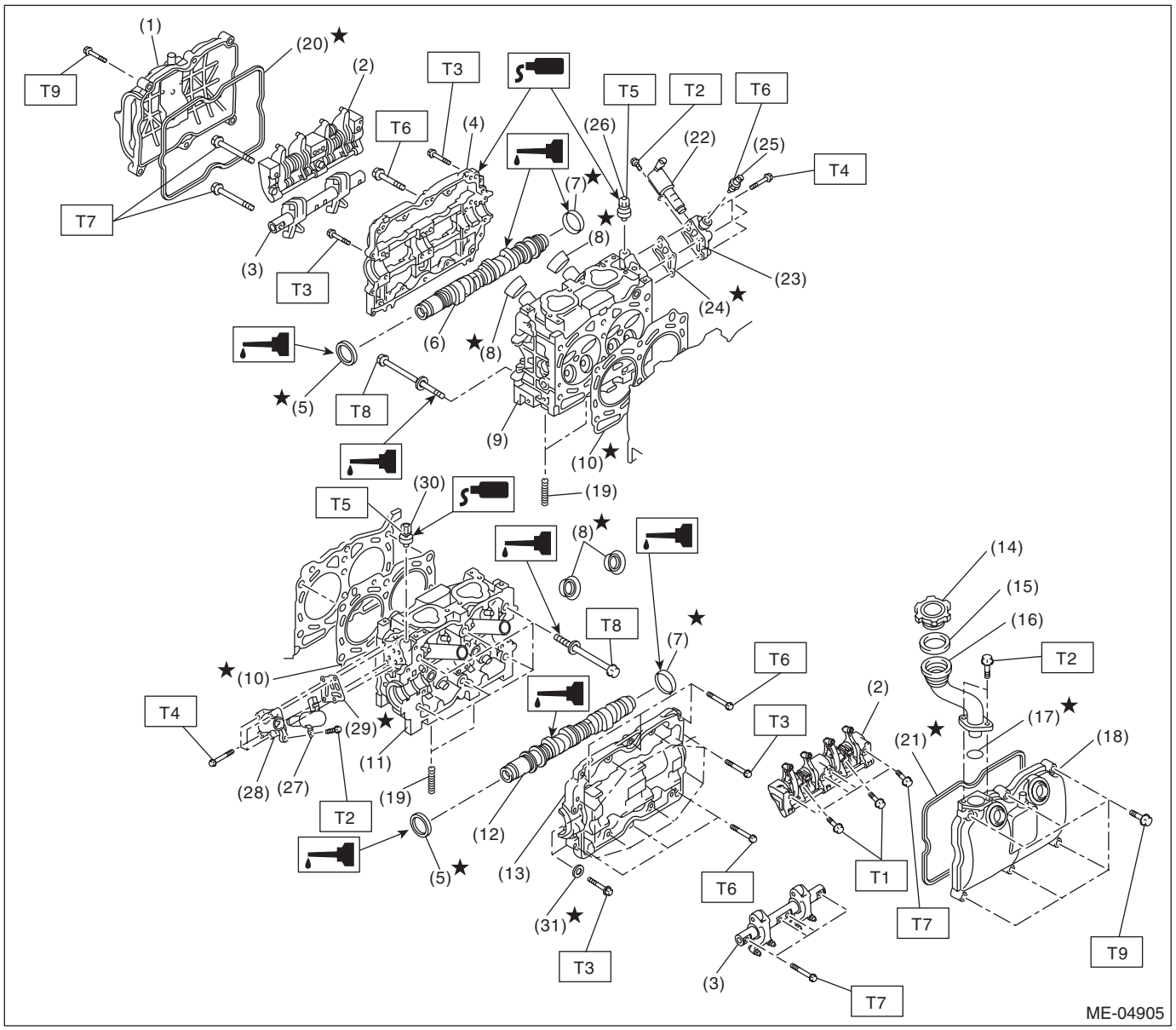



| | | | |
|---|---|---|---|
| (1) | Timing belt cover No. 2 RH | (9) | Automatic belt tension adjuster ASSY |
| (2) | Timing belt guide (MT model) | (10) | Belt idler No. 2 |
| (3) | Crank sprocket | (11) | Cam sprocket No. 2 |
| (4) | Timing belt cover No. 2 LH | (12) | Timing belt |
| (5) | Cam sprocket No. 1 | (13) | Front timing belt cover |
| (6) | Belt idler (A) | (14) | Timing belt cover LH |
| (7) | Tensioner bracket | (15) | Crank pulley (MT model) |
| (8) | Belt idler (B) | (16) | Crank pulley (AT model) |

***Tightening torque: N·m (kgf-m, ft-lb)***

- ***T1: 5 (0.5, 3.7)***
- ***T2: 9.75 (1.0, 7.2)***
- ***T3: 24.5 (2.5, 18.1)***
- ***T4: 39 (4.0, 28.8)***
- ***T5: 78 (8.0, 57.5)***
- ***T6: <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>***

## 2. CYLINDER HEAD AND CAMSHAFT

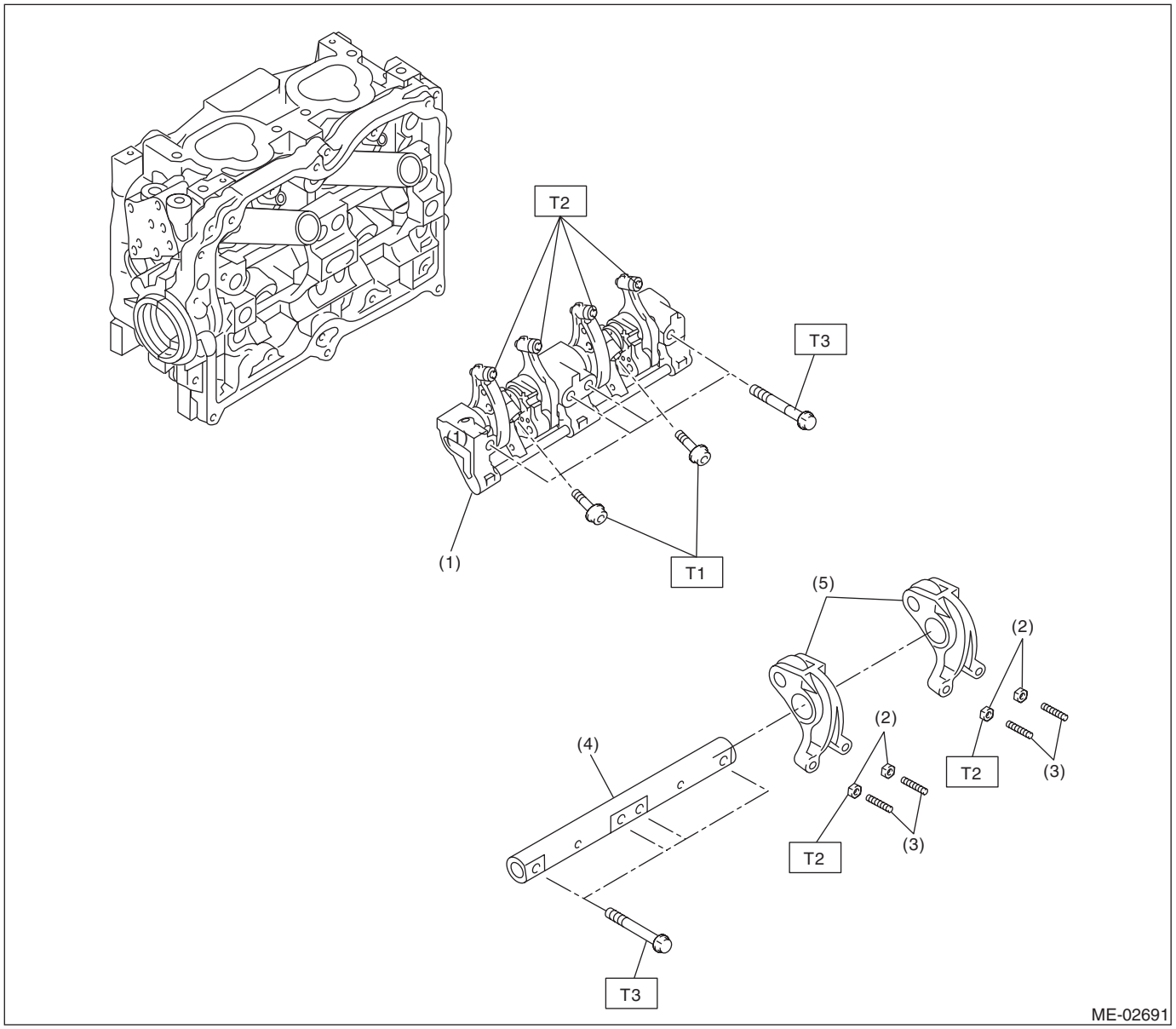


(1) Rocker cover RH
(2) Intake valve rocker ASSY
(3) Exhaust valve rocker ASSY
(4) Camshaft cap RH
(5) Oil seal
(6) Camshaft RH
(7) Plug
(8) Spark plug pipe gasket
(9) Cylinder head RH
(10) Cylinder head gasket
(11) Cylinder head LH
(12) Camshaft LH
(13) Camshaft cap LH
(14) Oil filler cap
(15) Gasket
(16) Oil filler duct
(17) O-ring
(18) Rocker cover LH
(19) Stud bolt
(20) Rocker cover gasket RH
(21) Rocker cover gasket LH
(22) Oil switching solenoid valve RH
(23) Oil switching solenoid valve holder RH
(24) Gasket
(25) Oil temperature sensor
(26) Variable valve lift diagnosis oil pressure switch RH
(27) Oil switching solenoid valve LH
(28) Oil switching solenoid valve holder LH
(29) Gasket
(30) Variable valve lift diagnosis oil pressure switch LH
(31) Seal washer

***Tightening torque:N·m (kgf-m, ft-lb)***

***T1: 6 (0.6, 4.4)***
***T2: 6.4 (0.7, 4.7)***
***T3: 9.75 (1.0, 7.2)***
***T4: 10 (1.0, 7.4)***
***T5: 17 (1.7, 12.5)***
***T6: 18 (1.8, 13.3)***
***T7: 25 (2.5, 18.4)***
***T8: <Ref. to ME(H4SO)-66, INSTALLATION, Cylinder Head.>***
***T9: <Ref. to ME(H4SO)-57, INSTALLATION, Valve Rocker Assembly.>***

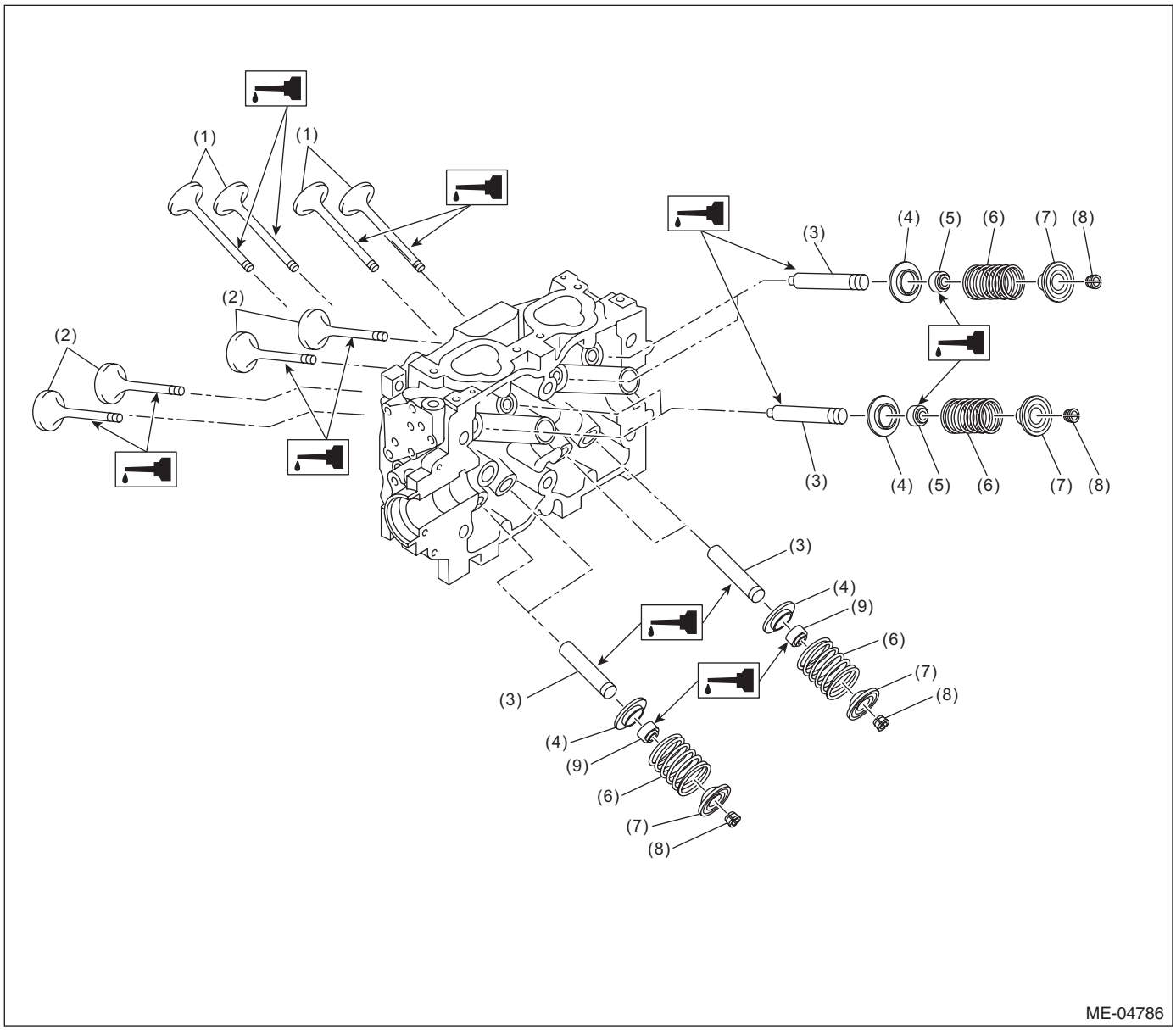
## 3. VALVE ROCKER ASSY




(1) Intake valve rocker ASSY
(2) Valve rocker nut
(3) Valve rocker adjusting screw
(4) Exhaust rocker shaft
(5) Exhaust valve rocker arm

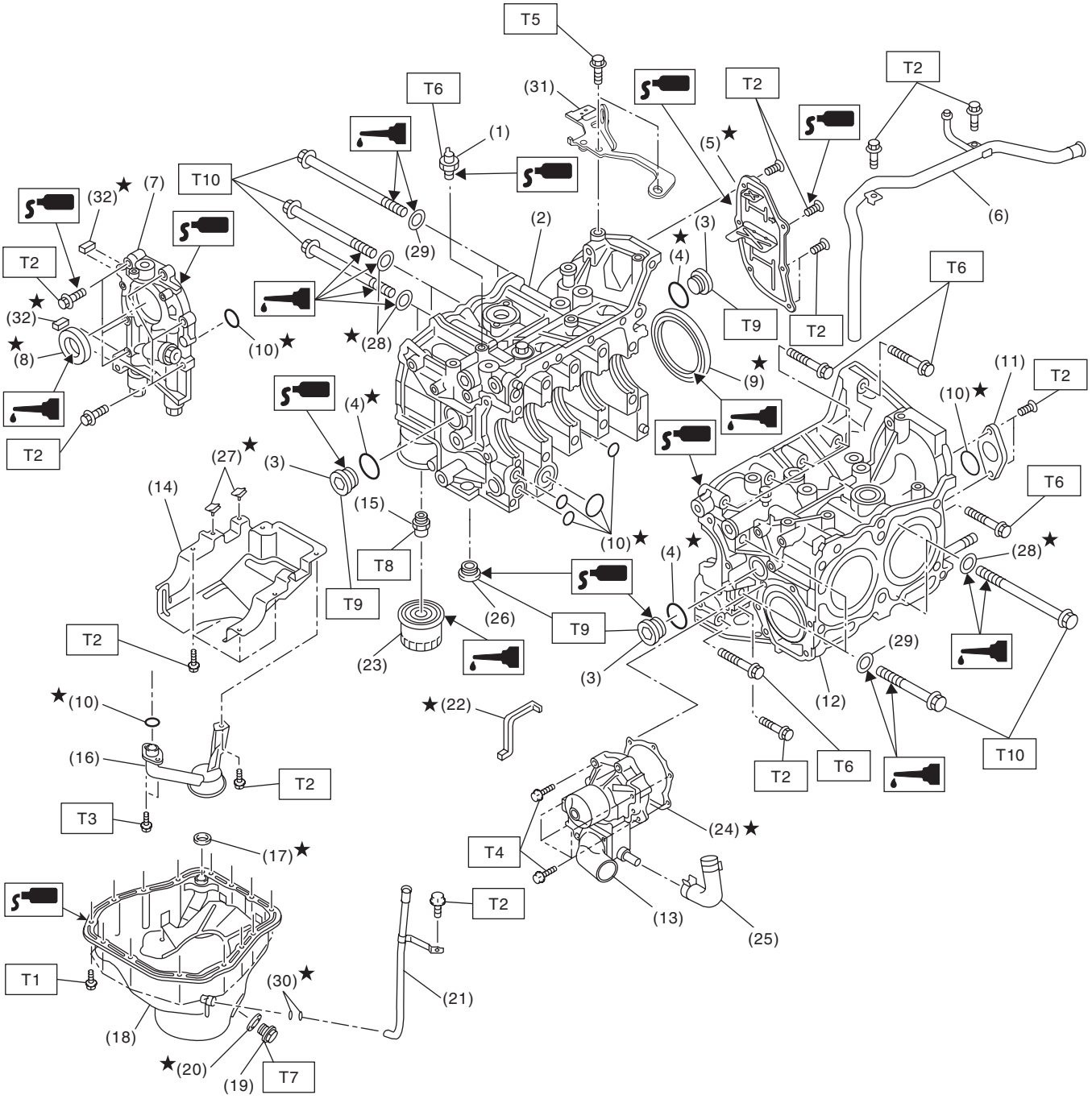
***Tightening torque: N·m (kgf-m, ft-lb)***
***T1: 6 (0.6, 4.4)***
***T2: 9.75 (1.0, 7.2)***
***T3: 25 (2.5, 18.4)***

## 4. CYLINDER HEAD AND VALVE ASSEMBLY




(1) Exhaust valve
(2) Intake valve
(3) Valve guide
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Retainer key
(9) Exhaust valve oil seal

## 5. CYLINDER BLOCK



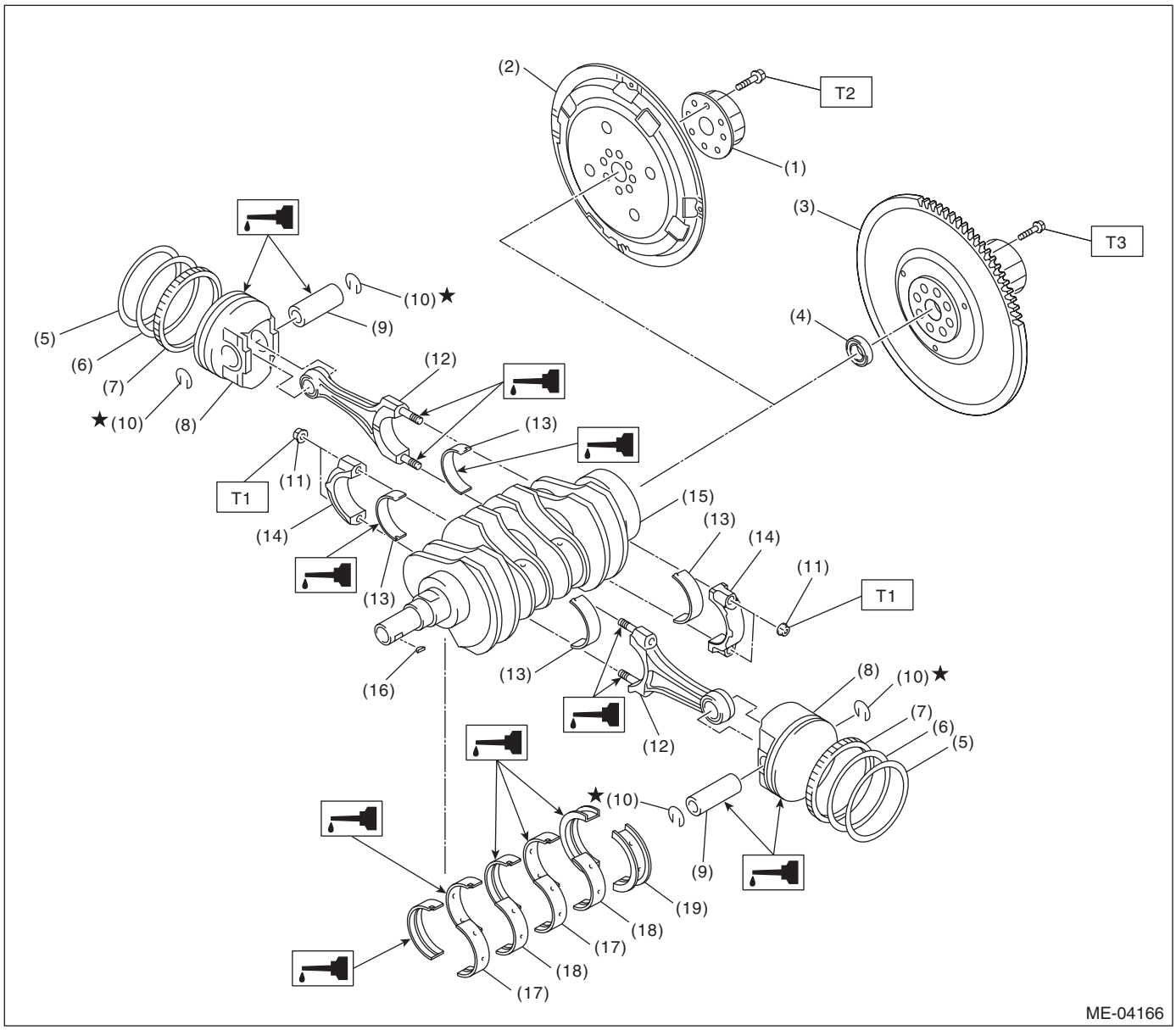

ME-04824

(1) Oil pressure switch
(2) Cylinder block RH
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block LH
(13) Water pump
(14) Baffle plate
(15) Oil filter connector
(16) Oil strainer
(17) Gasket
(18) Oil pan
(19) Drain plug
(20) Drain plug gasket
(21) Oil level gauge guide
(22) Water pump sealing
(23) Oil filter
(24) Gasket
(25) Water pump hose
(26) Plug
(27) Seal
(28) Seal washer
(29) Washer
(30) O-ring
(31) Engine rear hanger
(32) Oil pump seal

***Tightening torque:N·m (kgf-m, ft-lb)***

| | |
|---|---|
| ***T1:*** | ***5 (0.5, 3.7)*** |
| ***T2:*** | ***6.4 (0.7, 4.7)*** |
| ***T3:*** | ***10 (1.0, 7.4)*** |
| ***T4:*** | ***First 12 (1.2, 8.9)<br>Second 12 (1.2, 8.9)*** |
| ***T5:*** | ***16 (1.6, 11.8)*** |
| ***T6:*** | ***25 (2.5, 18.4)*** |
| ***T7:*** | ***44 (4.5, 32.5)*** |
| ***T8:*** | ***45 (4.6, 33.2)*** |
| ***T9:*** | ***70 (7.1, 51.6)*** |
| ***T10:*** | ***<Ref. to ME(H4SO)-78, INSTALLATION, Cylinder Block.>*** |

## 6. CRANKSHAFT AND PISTON

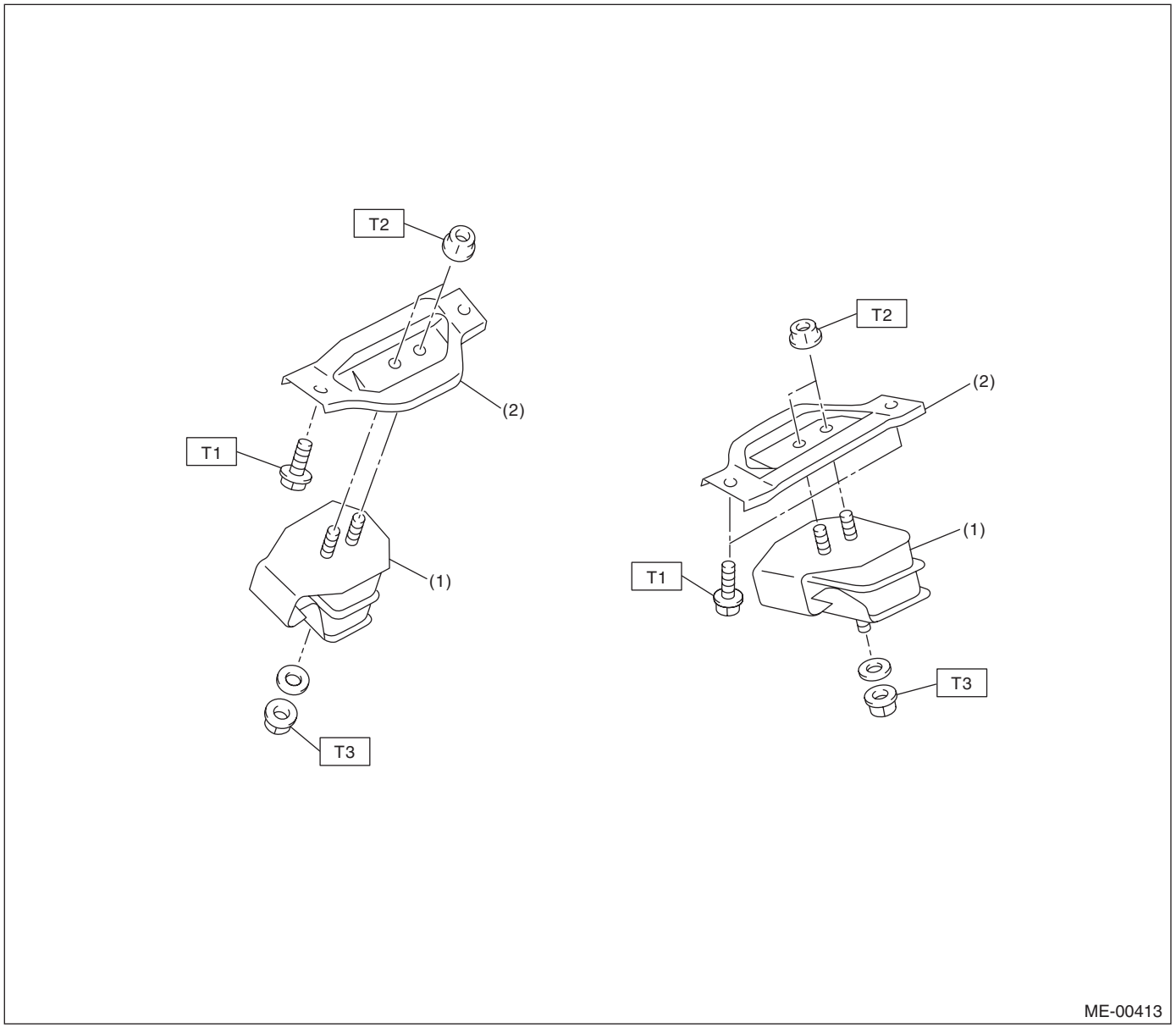



(1) Reinforcement (AT model)
(2) Drive plate (AT model)
(3) Flywheel (MT model)
(4) Ball bearing (MT model)
(5) Top ring
(6) Second ring
(7) Oil ring
(8) Piston
(9) Piston pin
(10) Snap ring
(11) Connecting rod nut
(12) Connecting rod
(13) Connecting rod bearing
(14) Connecting rod cap
(15) Crankshaft
(16) Woodruff key
(17) Crankshaft bearing #1, #3
(18) Crankshaft bearing #2, #4
(19) Crankshaft bearing #5

***Tightening torque: N·m (kgf-m, ft-lb)***

***T1: 45 (4.6, 33.2)***
***T2: <Ref. to 4AT-64, INSTALLATION, Drive Plate.>***
***T3: <Ref. to CL-11, INSTALLATION, Flywheel.>***

## 7. ENGINE MOUNTING




(1) Front cushion rubber
(2) Front engine mounting bracket

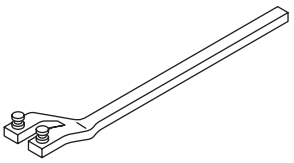
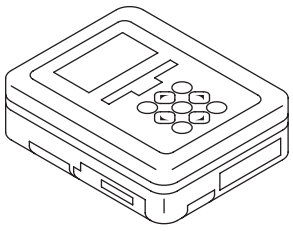
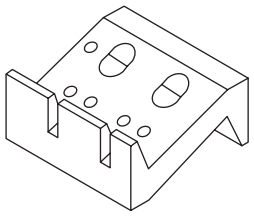
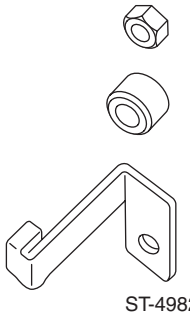
***Tightening torque: N·m (kgf-m, ft-lb)***
***T1: 35 (3.6, 25.8)***
***T2: 42 (4.3, 31.0)***
***T3: 85 (8.7, 62.7)***

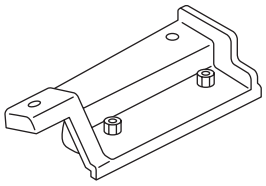
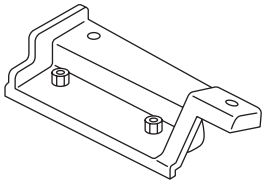
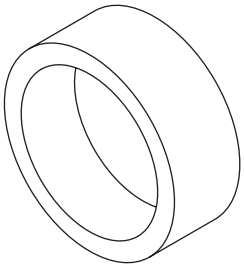
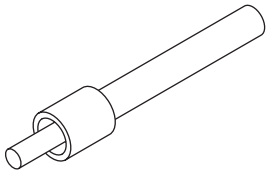
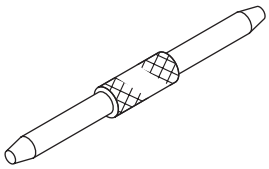
## C: CAUTION

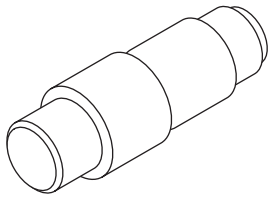
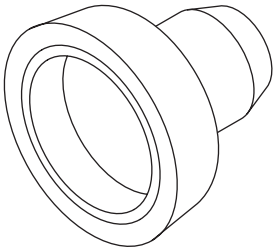
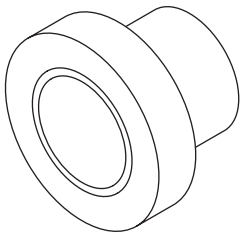
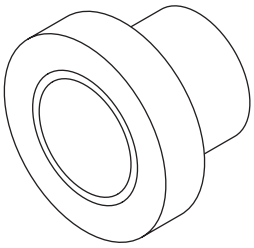
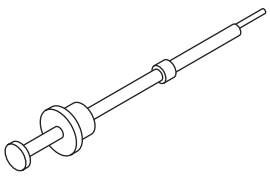
• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.
• Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
• Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
• All removed parts, if to be reused, should be reinstalled in the original positions and directions.
• Bolts, nuts and washers should be replaced with new parts as required.
• Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
• Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
• Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
• Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
• Lift up or lower the vehicle when necessary. Make sure to support the correct positions.

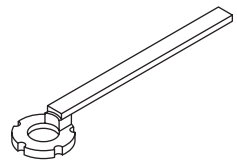
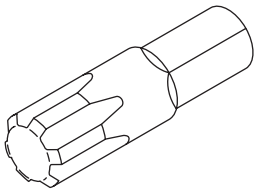
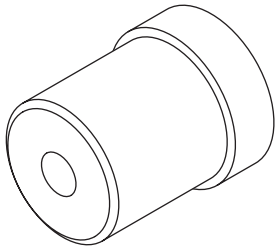
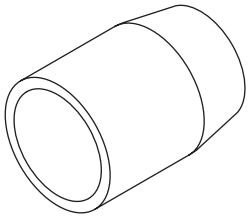
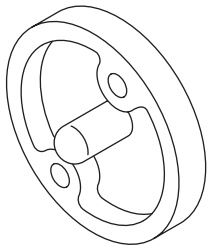
# D: PREPARATION TOOL

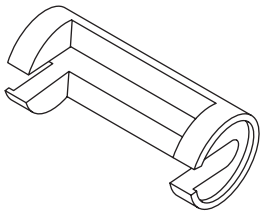
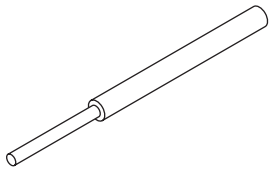
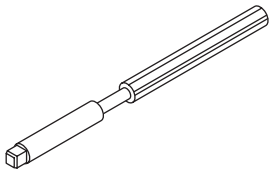
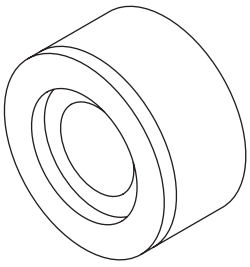
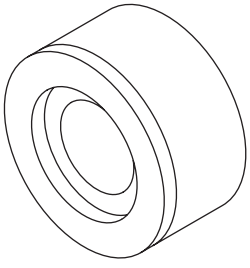
## 1. SPECIAL TOOL

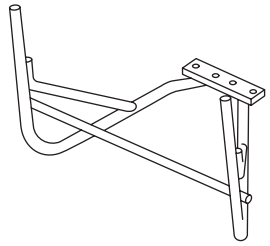
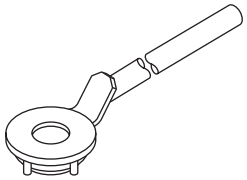
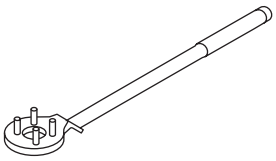
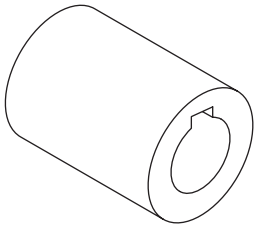
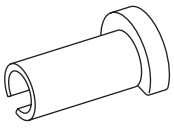
| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST18231AA010 | 18231AA010 | CAM SPROCKET WRENCH | • Used for removing and installing cam sprocket. (LH side)<br>• CAM SPROCKET WRENCH (499207100) can also be used. |
|  ST1B022XU0 | 1B022XU0 | SUBARU SELECT MONITOR III KIT | Used for various inspections. |
|  ST-498267800 | 498267800 | CYLINDER HEAD TABLE | • Used for replacing valve guides.<br>• Used for removing and installing valve spring. |
|  ST-498277200 | 498277200 | STOPPER SET | Used for installing automatic transmission assembly to engine. |

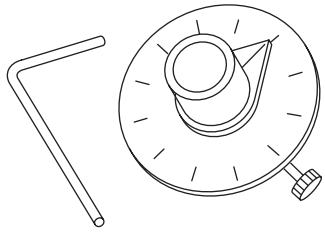
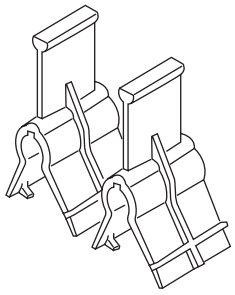
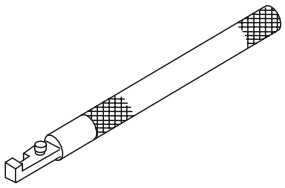
| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-498457000 | 498457000 | ENGINE STAND ADAPTER RH | Used together with ENGINE STAND (499817100). |
|  ST-498457100 | 498457100 | ENGINE STAND ADAPTER LH | Used together with ENGINE STAND (499817100). |
|  ST-498747300 | 498747300 | PISTON GUIDE | Used for installing piston in cylinder. |
|  ST-498857100 | 498857100 | VALVE OIL SEAL GUIDE | Used for press-fitting of intake and exhaust valve guide oil seals. |
|  ST-499017100 | 499017100 | PISTON PIN GUIDE | Used for installing piston pin, piston and connecting rod. |

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-499037100 | 499037100 | CONNECTING ROD BUSHING REMOVER AND INSTALLER | Used for removing and installing connecting rod bushing. |
|  ST-499587200 | 499587200 | CRANKSHAFT OIL SEAL INSTALLER | • Used for installing crankshaft oil seal.<br>• Used together with CRANKSHAFT OIL SEAL GUIDE (499597100). |
|  ST-499587500 | 499587500 | OIL SEAL INSTALLER | • Used for installing the camshaft oil seal.<br>• Used together with OIL SEAL GUIDE (499597000). |
|  ST-499587700 | 499587700 | CAMSHAFT OIL SEAL INSTALLER | Used for installing cylinder head plug. |
|  ST18320AA010 | 18320AA010 | PISTON PIN REMOVER ASSY | • Used for removing piston pin.<br>• PISTON PIN REMOVER ASSY (499097700) can also be used. |

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-499207400 | 499207400 | CAM SPROCKET WRENCH | Used for removing and installing cam sprocket. (RH side) |
|  ST-499497000 | 499497000 | TORX® PLUS | Used for removing and installing camshaft cap. |
|  ST-499587100 | 499587100 | OIL SEAL INSTALLER | Used for installing oil pump oil seal. |
|  ST-499597000 | 499597000 | OIL SEAL GUIDE | • Used for installing the camshaft oil seal.<br>• Used together with CAMSHAFT OIL SEAL INSTALLER (499587500). |
|  ST-499597100 | 499597100 | CRANKSHAFT OIL SEAL GUIDE | • Used for installing crankshaft oil seal.<br>• Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200). |

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-499718000 | 499718000 | VALVE SPRING REMOVER | Used for removing and installing valve spring. |
|  ST-499767200 | 499767200 | VALVE GUIDE REMOVER | Used for removing valve guides. |
|  ST-499767400 | 499767400 | VALVE GUIDE REAMER | Used for reaming valve guides. |
|  ST-499767700 | 499767700 | VALVE GUIDE ADJUSTER | Used for installing valve guides. (Intake side) |
|  ST-499767800 | 499767800 | VALVE GUIDE ADJUSTER | Used for installing valve guides. (Exhaust side) |

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST-499817100 | 499817100 | ENGINE STAND | • Stand used for engine disassembly and assembly.<br>• Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100). |
|  ST-499977400 | 499977400 | CRANK PULLEY WRENCH | Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model) |
|  ST-499977100 | 499977100 | CRANK PULLEY WRENCH | Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (MT model) |
|  ST-499987500 | 499987500 | CRANKSHAFT SOCKET | Used for rotating crankshaft. |
|  ST42099AE000 | 42099AE000 | QUICK CONNECTOR RELEASE | Used for removing the quick connector. |

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST18854AA000 | 18854AA000 | ANGLE GAUGE | Used for installing the crank pulley. |
|  ST18354AA000 | 18354AA000 | VALVE ROCKER HOLDER | Used for installing the valve rocker assembly (intake). (2-piece set) |
|  ST18258AA000 | 18258AA000 | SPRING INSTALLER | Used for installing the valve rocker assembly (intake). |

## 2. GENERAL TOOL

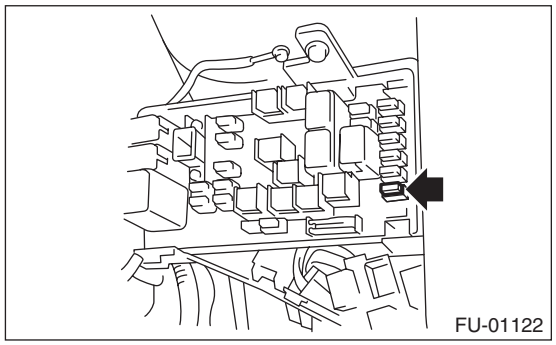
| TOOL NAME | REMARKS |
|---|---|
| Compression gauge | Used for measuring compression. |
| Vacuum gauge | Used for measuring intake manifold vacuum. |
| Oil pressure gauge | Used for measuring engine oil pressure. |
| Fuel pressure gauge | Used for measuring fuel pressure. |
| Timing light | Used for measuring ignition timing. |

# 2. Compression

## A: INSPECTION

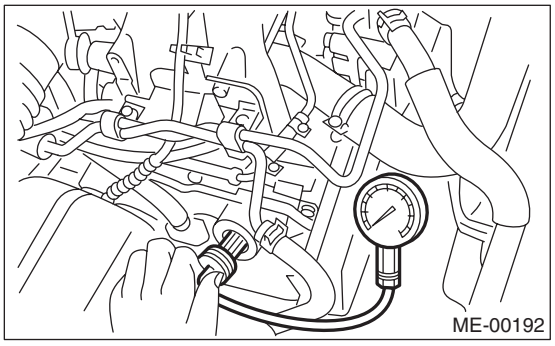
**CAUTION:**
**After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.**

1) After warming-up the engine, turn the ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Remove the fuse of fuel pump from main fuse box.




4) Start the engine and run it until it stalls.
5) After the engine stalls, crank it for five more seconds.
6) Turn the ignition switch to OFF.
7) Remove all spark plugs. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
8) Fully open the throttle valve.
9) Check the starter motor for satisfactory performance and operation.
10) Install the compression gauge to the spark plug hole.

NOTE:
When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.




11) Crank the engine by starter motor and read the value when the needle of the compression gauge becomes stable.

NOTE:
- Perform at least two measurements per cylinder, and make sure that the values are correct.
- If the compression pressure is out of standard, check or adjust the pistons, valves and cylinders.

***Compression (fully open throttle):***
***Standard***
***1,020 — 1,275 kPa (10.4 — 13.0 kgf/cm$^2$, 148 — 185 psi)***
***Difference between cylinders***
***49 kPa (0.5 kgf/cm$^2$, 7 psi) or less***

12) After inspection, install the related parts in the reverse order of removal.

# 3. Idle Speed

## A: INSPECTION

1) Before checking the idle speed, check the following item:
   (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-34, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
• Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.
• If idle speed is out of standard, refer to the General Diagnosis Table under “Engine Control System”. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>
   (1) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

***Idling speed (At no load; Select lever is in “P” or “N” range on AT model; Gear shift lever is in neutral position on MT model.):***
***Standard***
***700±100 rpm (AT model)***
***650±100 rpm (MT model)***

   (2) Check the idle speed when loaded. (Turn the A/C switch to “ON” and operate the compressor for at least one minute before measurement.)

***Idling speed (With A/C “ON”; Select lever is in “P” or “N” range on AT model; Gear shift lever is in neutral position on MT model.):***
***Standard***
***850±100 rpm***

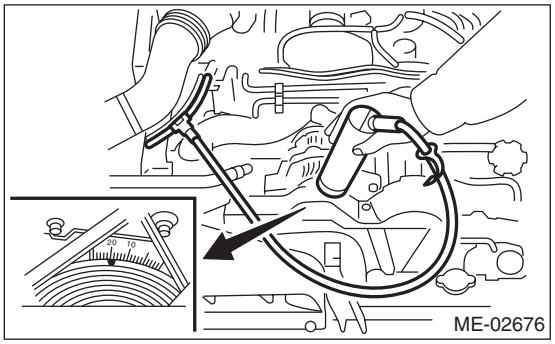
# 4. Ignition Timing

## A: INSPECTION

**CAUTION:**
**After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.**

1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Stop the engine, and turn the ignition switch to OFF.
4) Connect the timing light to #1 cylinder spark plug cord, and then light the timing mark with the timing light.
5) Start the engine and check the ignition timing at idle speed as shown below.

***Ignition timing [BTDC/rpm]:***
***Standard***
***15°±10°/700 (AT model)***
***10°±8°/650 (MT model)***

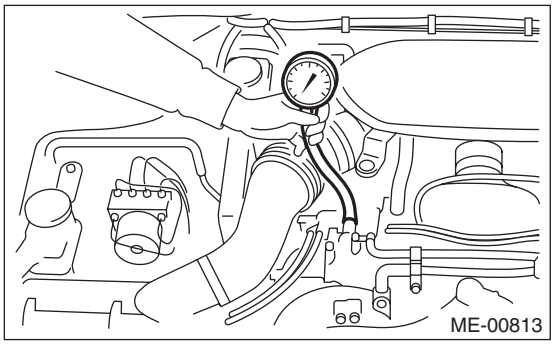



NOTE:
If ignition timing is out of standard, check the ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

# 5. Intake Manifold Vacuum

## A: INSPECTION

1) Warm up the engine.
2) Disconnect the brake booster vacuum hose from the intake manifold, and install the vacuum gauge.




3) Keep the engine at idle speed and read the vacuum gauge indication.

NOTE:
Condition of engine inside can be diagnosed by observing the behavior of the vacuum gauge needle as described in table below.

***Intake manifold vacuum (at idling, A/C OFF):***
***–60.0 kPa (–450 mmHg, –17.72 inHg) or more***

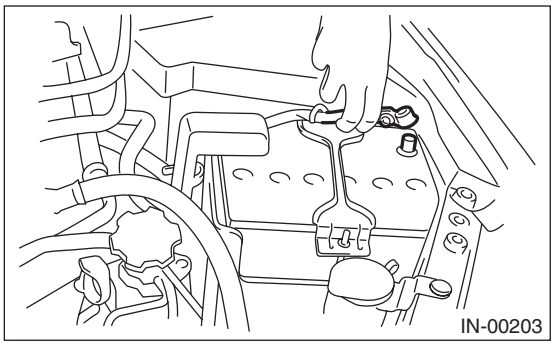
4) After inspection, install the related parts in the reverse order of removal.

| Diagnosis of engine condition by inspection of intake manifold vacuum | |
|---|---|
| Vacuum gauge needle behavior | Possible engine condition |
| 1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises. | Leakage around intake manifold gasket, disconnection or damage of vacuum hose |
| 2. Needle intermittently drops to position lower than standard value. | Leakage around cylinder |
| 3. Needle drops suddenly and intermittently from standard value. | Sticky valve |
| 4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases. | Weak or broken valve springs |
| 5. Needle vibrates above and below standard value in narrow range. | Defective ignition system |

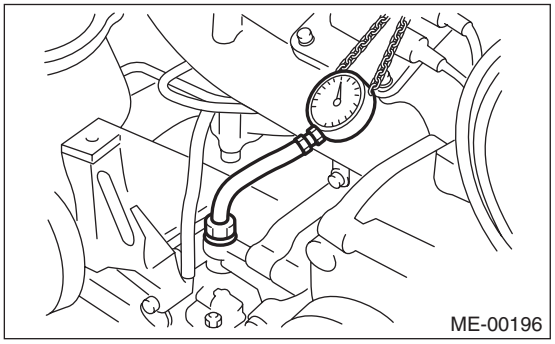
# 6. Engine Oil Pressure

## A: INSPECTION

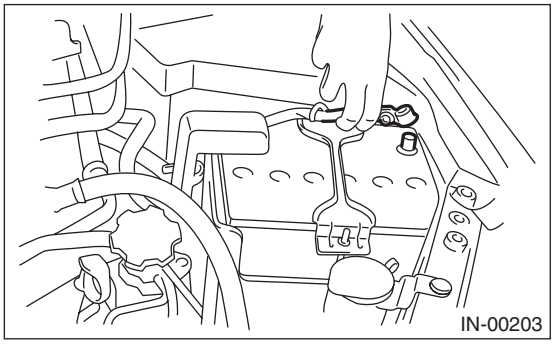
1) Disconnect the ground cable from battery.




2) Remove the oil pressure switch. <Ref. to LU(H4SO)-19, REMOVAL, Oil Pressure Switch.>
3) Install the oil pressure gauge to cylinder block.




4) Connect the battery ground terminal.




5) Start the engine, and check the oil pressure.

NOTE:
• Standard value is based on an engine oil temperature of 80°C (176°F).
• If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-22, INSPECTION, Engine Lubrication System Trouble in General.>
• If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H4SO)-22, INSPECTION, Engine Lubrication System Trouble in General.>

***Engine oil pressure:***
***Standard***
***98 kPa (1.0 kgf/cm$^2$, 14 psi) or more (at 600 rpm)***
***294 kPa (3.0 kgf/cm$^2$, 43 psi) or more (at 5,000 rpm)***

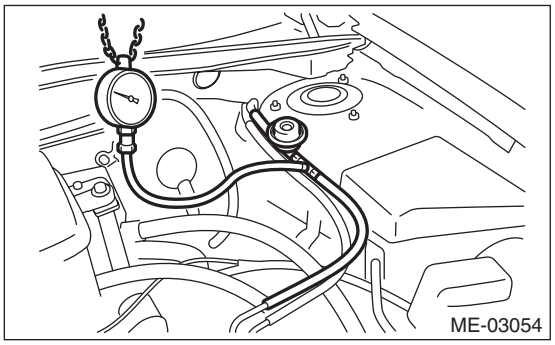
6) After inspection, install the related parts in the reverse order of removal.

# 7. Fuel Pressure

## A: INSPECTION

**CAUTION:**
**• Before removing the fuel pressure gauge, release the fuel pressure.**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the fuel delivery hose from fuel damper, and connect fuel pressure gauge.




4) Start the engine.
5) Check the fuel pressure after warming up the engine.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm$^2$, 1 to 3 psi) higher than standard values during high-altitude operations.
• Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

***Fuel pressure:***
***Standard***
***340 — 400 kPa (3.5 — 4.1 kgf/cm$^2$, 49 — 58 psi)***

6) After inspection, install the related parts in the reverse order of removal.

***Tightening torque:***
***1.25 N·m (0.1 kgf-m, 0.9 ft-lb)***

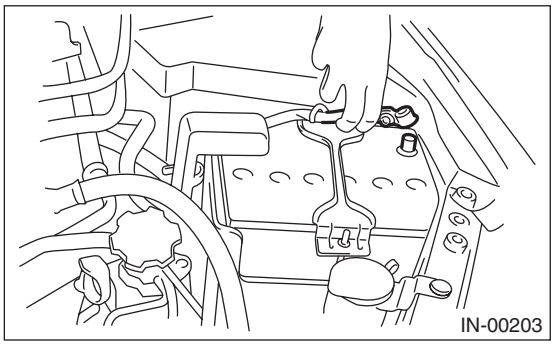
# 8. Valve Clearance

## A: INSPECTION

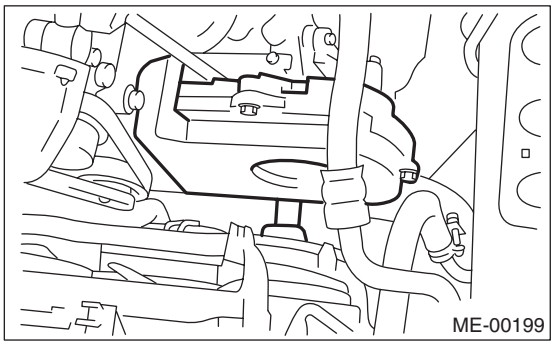
**CAUTION:**
**If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.**

NOTE:
Inspection of valve clearance should be performed while engine is cold.

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
3) Lower the vehicle.
4) Disconnect the ground cable from battery.

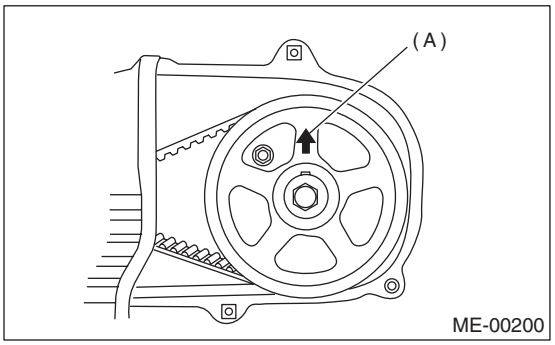



5) Remove the timing belt cover LH.




6) Remove the fuel injector. <Ref. to FU(H4SO)-37, REMOVAL, Fuel Injector.>
7) When inspecting #1 and #3 cylinders
   (1) Disconnect the spark plug cords from spark plugs on RH side. <Ref. to IG(H4SO)-4, RH SIDE, REMOVAL, Spark Plug.>
   (2) Place a suitable container under the vehicle.
   (3) Disconnect the PCV hose from the rocker cover RH.
   (4) Remove the bolts, then remove the rocker cover RH.
8) When inspecting #2 and #4 cylinders
   (1) Disconnect the spark plug cords from spark plugs on LH side. <Ref. to IG(H4SO)-4, LH SIDE, REMOVAL, Spark Plug.>
   (2) Place a suitable container under the vehicle.
   (3) Disconnect the PCV hose from the rocker cover LH.
   (4) Remove the bolts, then remove the rocker cover LH.
9) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

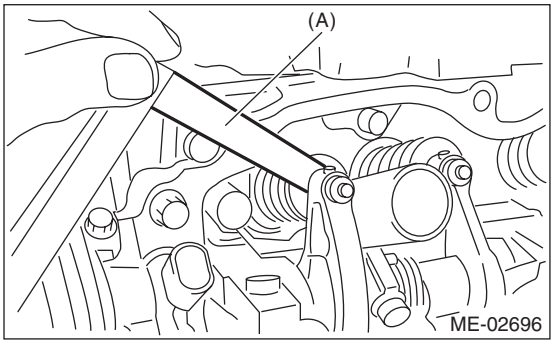
NOTE:
When the arrow mark (A) on cam sprocket LH is at the top position, the #1 cylinder piston is at top dead center of the compression stroke.




10) Measure #1 cylinder valve clearance by using thickness gauge (A).

NOTE:
• Insert the thickness gauge (A) in as horizontally as possible with respect to the valve stem end face.
• Lift up the vehicle, and then measure the exhaust valve clearances.
• If the measured value is not within the inspection value, take notes of the value in order to adjust the valve clearance later on.

***Valve clearance (inspection value):***
***Intake***
***0.20±0.04 mm (0.0079±0.0016 in)***
***Exhaust***
***0.25±0.04 mm (0.0098±0.0016 in)***



11) Measure the valve clearance in #3, #2 and #4 cylinder in the same measurement procedure as #1 cylinder in this order.

NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
• By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.

12) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
13) After inspection, install the related parts in the reverse order of removal.

NOTE:
Use a new rocker cover gasket.

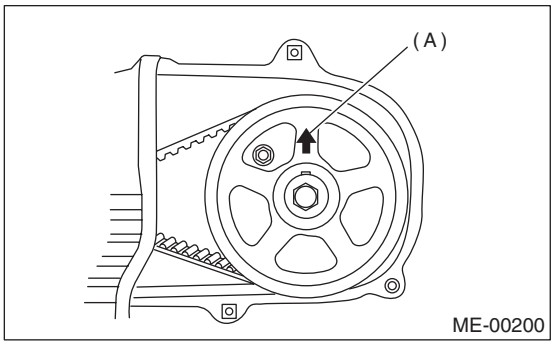
## B: ADJUSTMENT

**CAUTION:**
**If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.**

NOTE:
Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

NOTE:
When the arrow mark (A) on cam sprocket LH is at the top position, the #1 cylinder piston is at top dead center of the compression stroke.

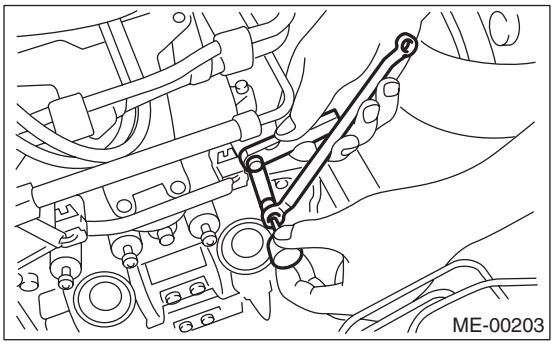



2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Set a suitable thickness gauge.
(3) While noting the valve clearance, tighten the valve rocker adjusting screw.
(4) When the specified valve clearance is obtained, tighten the valve rocker nut.

NOTE:
• Insert a thickness gauge in a direction as horizontal as possible with respect to the valve stem end face.
• Lift up the vehicle and adjust the exhaust valve clearances.

***Valve clearance (adjustment value):***
***Intake***
***0.20±0.04 mm (0.0079±0.0016 in)***
***Exhaust***
***0.25±0.04 mm (0.0098±0.0016 in)***

***Tightening torque:***
***9.75 N·m (1.0 kgf-m, 7.2 ft-lb)***




3) Adjust the valve clearance in #3, #2 and #4 cylinder in the same adjustment procedure as #1 cylinder in this order.

NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
• By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.

4) Ensure the valve clearances of each cylinder are within specifications. If necessary, readjust the valve clearances.
5) After adjustment, install the related parts in the reverse order of removal.

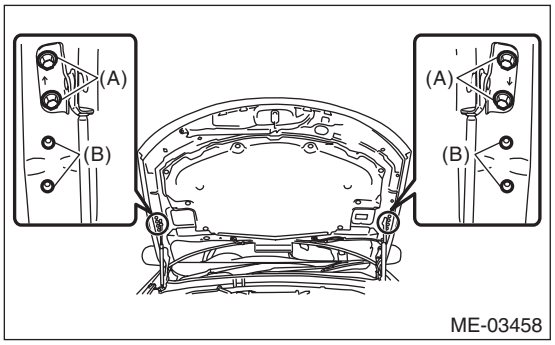
NOTE:
Use a new rocker cover gasket.

# 9. Engine Assembly

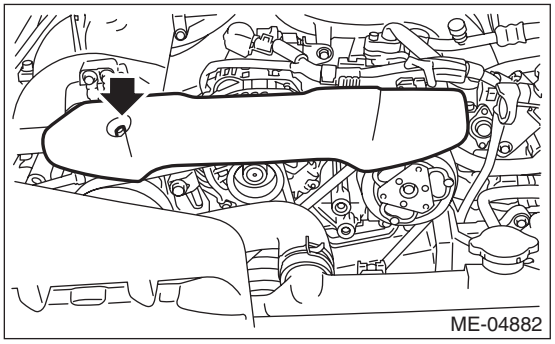
## A: REMOVAL

1) Change the bolt installation position from (A) to (B), then open the front hood completely.

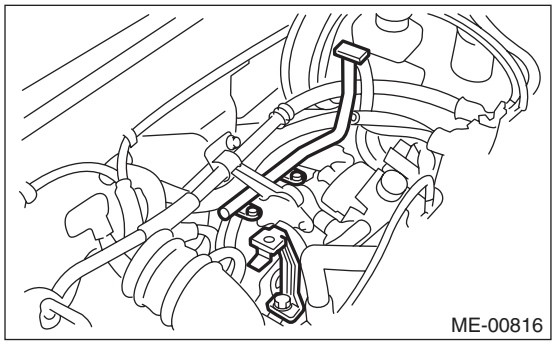
***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***



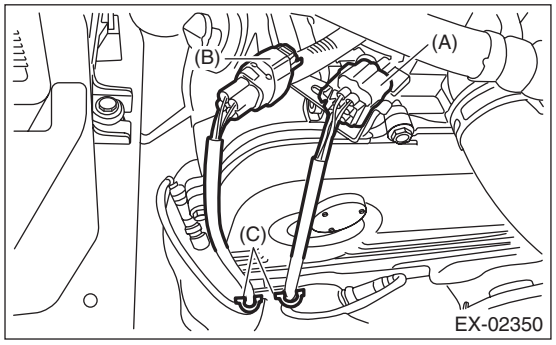

2) Remove the V-belt covers.



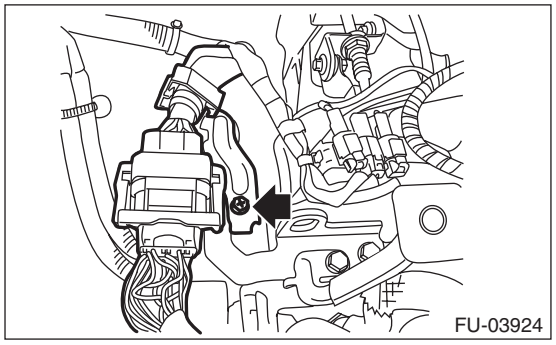

3) Collect the refrigerant from A/C system. <Ref. to AC-19, PROCEDURE, Refrigerant Recovery Procedure.>
4) Release the fuel pressure. <Ref. to FU(H4SO)-53, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
5) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
6) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
7) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
8) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
9) Remove the under cover. <Ref. to EI-24, REMOVAL, Front Under Cover.>
10) Remove the radiator from vehicle. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
11) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-37, REMOVAL, Hose and Pipe.>
12) Remove the air intake chamber stay.



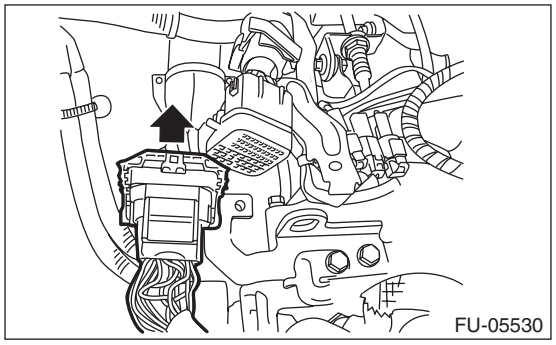

13) Disconnect the following connectors and cables.
(1) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.



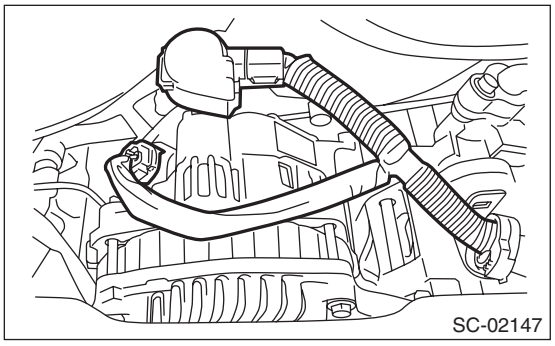

(2) Remove the bolt, and disconnect the engine harness connector from the bulkhead harness connector and rear engine hanger.



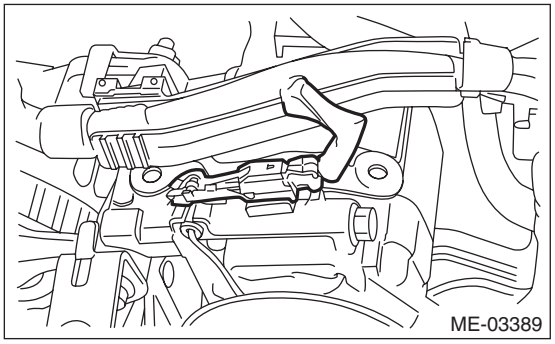

(3) Slide the engine harness connector in the direction of the arrow and remove it from the rear engine hanger.



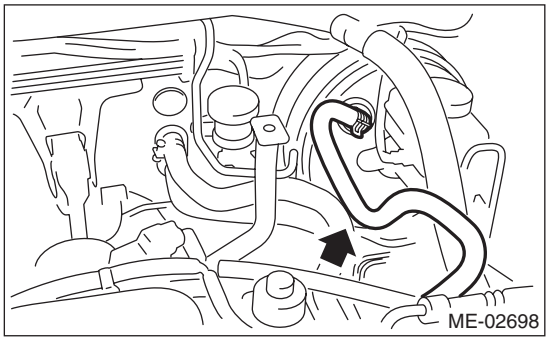
(4) Generator connector and terminal




(5) A/C compressor connector

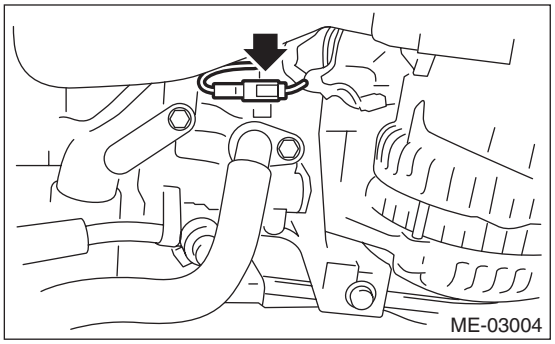



14) Disconnect the following hoses.
(1) Brake booster vacuum hose

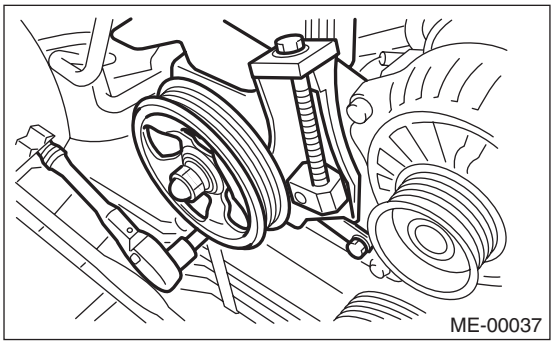



(2) Heater inlet and outlet hoses

15) Remove the power steering pump from the engine.
(1) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Power steering pump switch connector

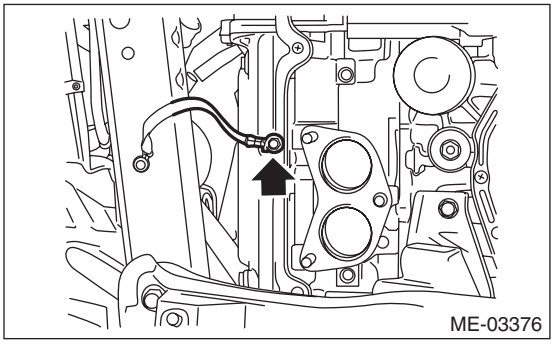


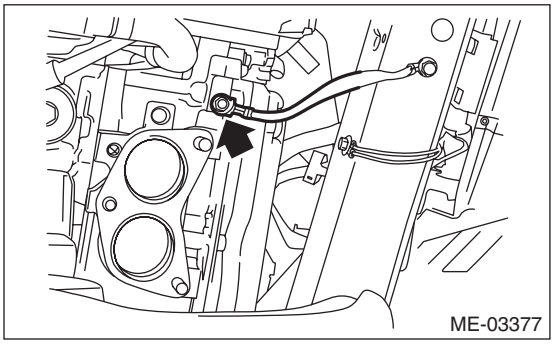

(3) Remove the bolts which secure the power steering pump to the bracket.



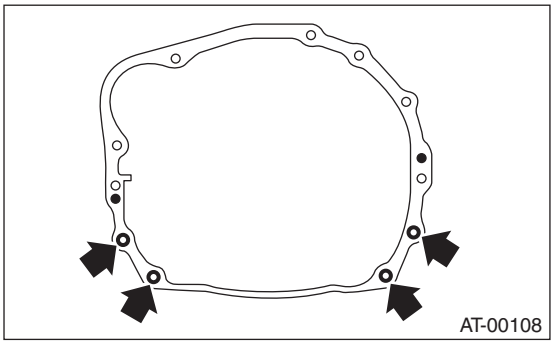

(4) Place the power steering pump on the right side wheel apron.

16) Lift up the vehicle.
17) Remove the front and center exhaust pipes. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
18) Disconnect the ground cable on the engine side.

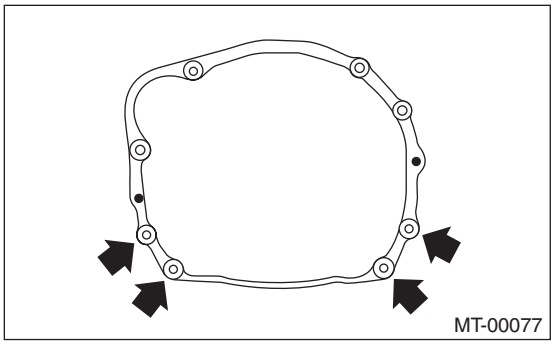


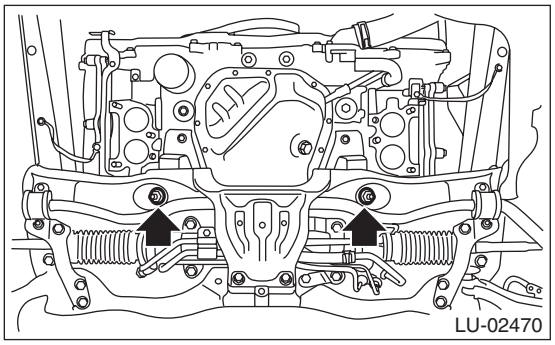

19) Remove the bolts and nuts which hold the lower side of transmission to the engine.
• AT model



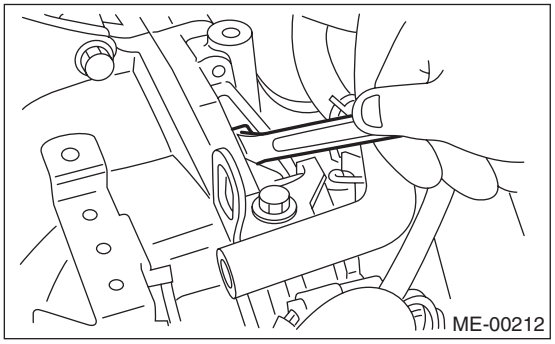
• MT model



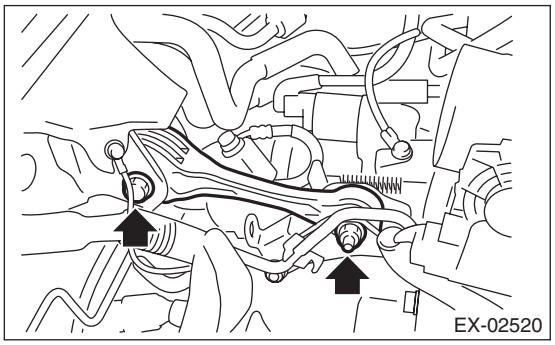

20) Remove the nuts which secure the engine mounting to the front crossmember.




21) Separate the torque converter clutch from the drive plate. (AT model)
(1) Lower the vehicle.
(2) Remove the service hole plug.
(3) Insert the wrench into the crank pulley bolt and rotate the crank pulley to remove the bolts which hold torque converter clutch to drive plate.




22) Remove the pitching stopper.

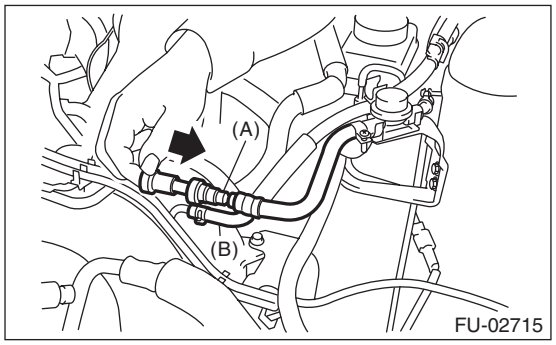



23) Disconnect the fuel delivery hose (A) and evaporation hose (B).

**CAUTION:**
**• Be careful not to spill fuel.**
**• Catch the fuel from hoses using a container or cloth.**
(1) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

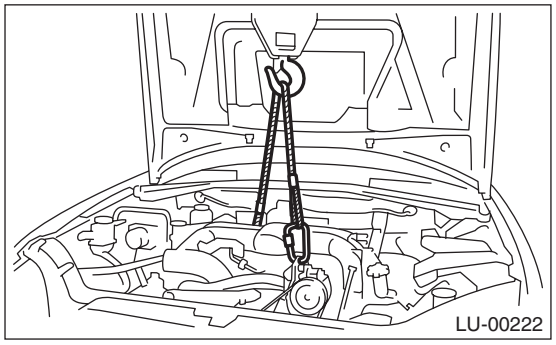
ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Remove the clip and disconnect the evaporation hose from the pipe.



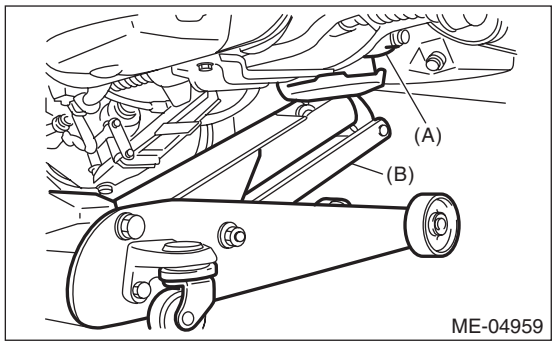

(A) Fuel delivery hose
(B) Evaporation hose

24) Support the engine with a lifting device and wire ropes.



25) Support the transmission with a garage jack.

**CAUTION:**
**Be sure to always perform this work, in order to prevent the transmission from lowering for its own weight.**



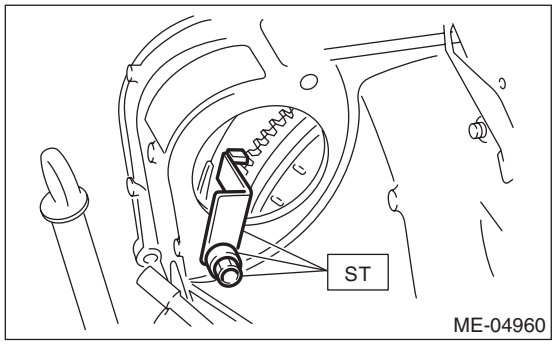

(A) Transmission
(B) Garage jack

26) Separation of engine and transmission

**CAUTION:**
**Before removing the engine away from transmission, check to be sure no work has been overlooked.**

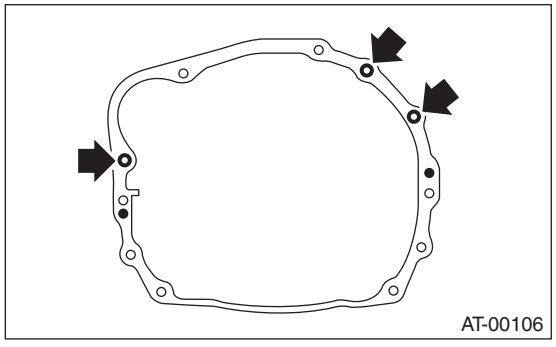
(1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>
(2) Attach the ST to the torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

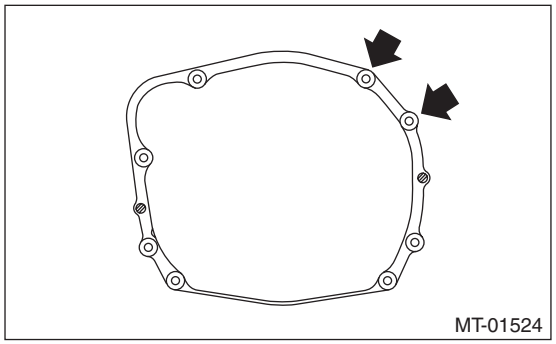



(3) Remove the bolts which hold the upper side of the transmission to the engine.

- AT model




- MT model




27) Remove the engine from vehicle.
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover. (MT model)
(4) Slowly move the engine away from engine compartment.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

28) Remove the engine mounting from the engine.

## B: INSTALLATION

1) Install the engine mounting onto the engine.

***Tightening torque:***
***35 N·m (3.6 kgf-m, 25.8 ft-lb)***

2) Apply a small amount of grease to splines of main shaft. (MT model)

***Grease:***
***NICHIMOLY N-130 or equivalent***

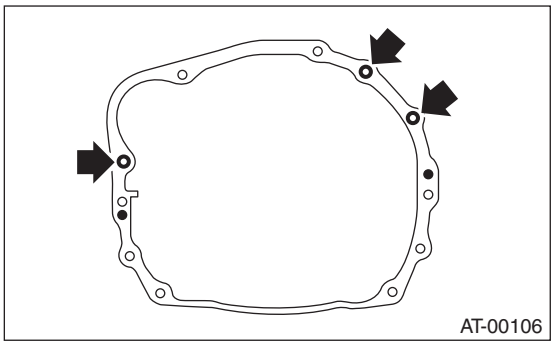
3) Position the engine in engine compartment and align it with transmission.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

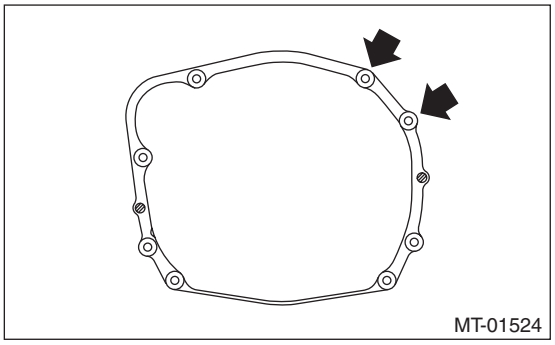
4) Tighten the bolts which hold upper side of transmission to engine.

***Tightening torque:***
***50 N·m (5.1 kgf-m, 36.9 ft-lb)***

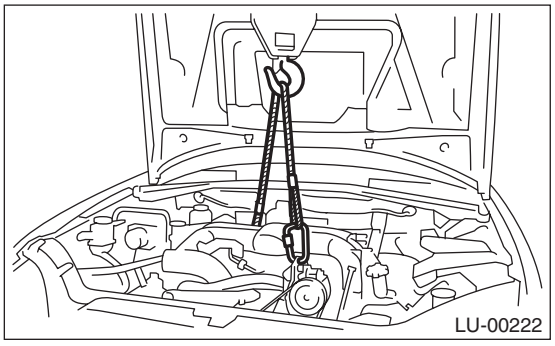
- AT model




- MT model

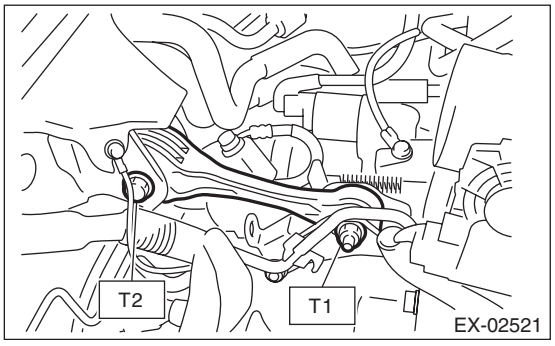



5) Remove the lifting device and wire ropes.



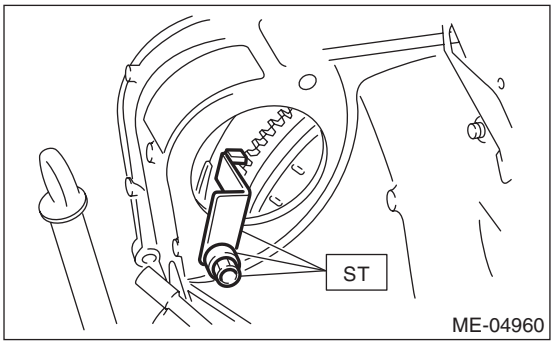

6) Remove the garage jack.
7) Install the pitching stopper.

***Tightening torque:***
***T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)***
***T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)***




8) Remove the ST from torque converter clutch case. (AT model)

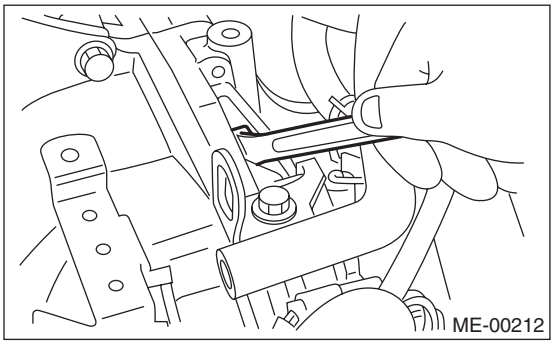
NOTE:
Be careful not to drop the ST into the torque converter clutch case when removing the ST.
ST 498277200 STOPPER SET




9) Install the starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>
10) Install the torque converter clutch to drive plate. (AT model)
(1) Insert the wrench into the crank pulley bolt and rotate the crank pulley to install the bolts which hold torque converter clutch to drive plate.

NOTE:
Be careful not to drop bolts into the torque converter clutch case.

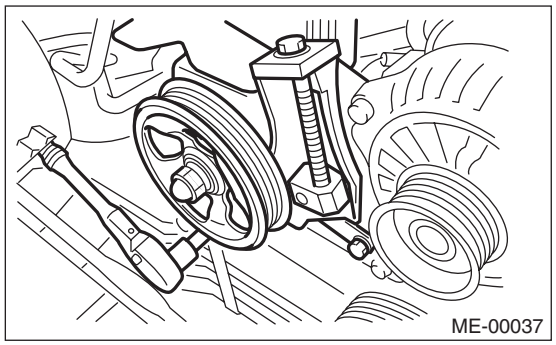
***Tightening torque:***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***



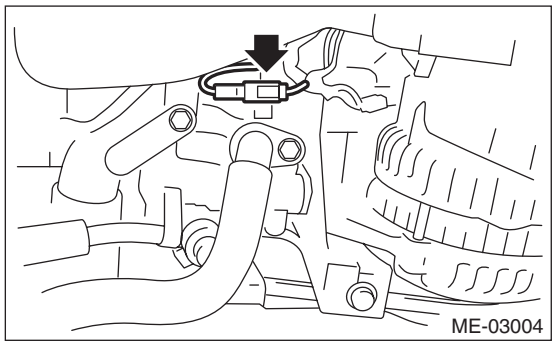

(2) Install the service hole plug.

11) Install the power steering pump onto the engine.
(1) Install the power steering pump.

***Tightening torque:***
***Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-3, COMPONENT, General Description.>***


ME-00037

(2) Connect the power steering pump switch connector.


ME-03004

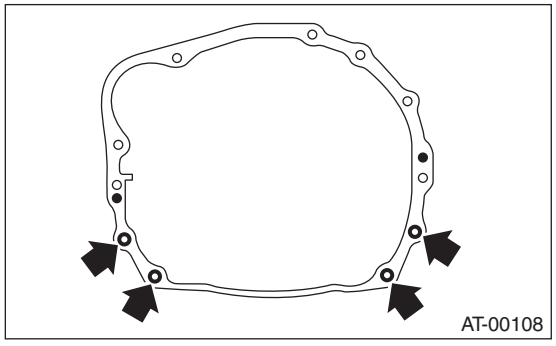
(3) Install and adjust the front side belt. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

12) Lift up the vehicle.

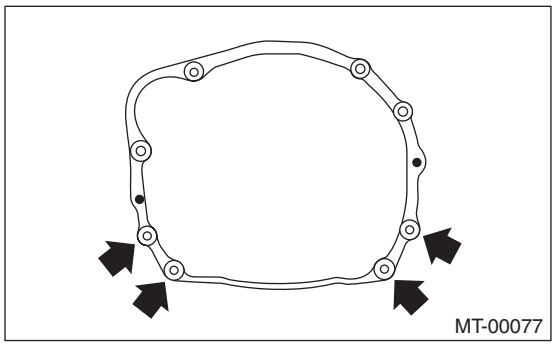
13) Install the bolts and nuts which hold lower side of the transmission to engine.

***Tightening torque:***
***50 N·m (5.1 kgf-m, 36.9 ft-lb)***

- AT model

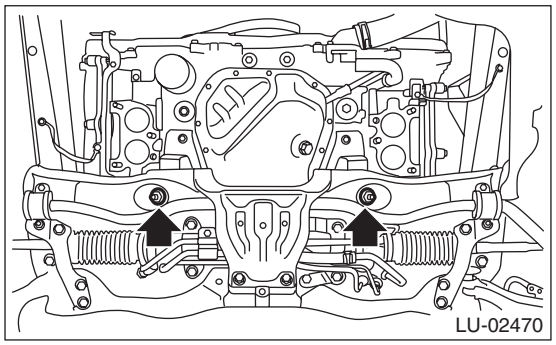

AT-00108

- MT model


MT-00077

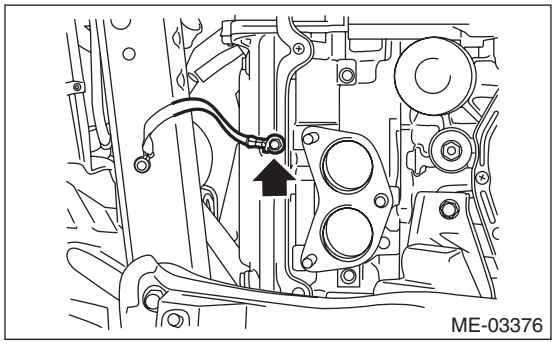
14) Install the nuts which hold the engine mounting to the crossmember.

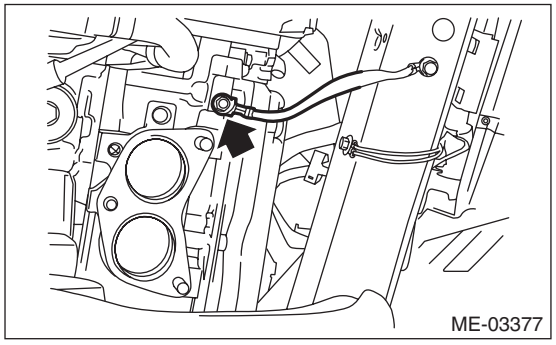
***Tightening torque:***
***85 N·m (8.7 kgf-m, 62.7 ft-lb)***


LU-02470

15) Connect the ground cable.

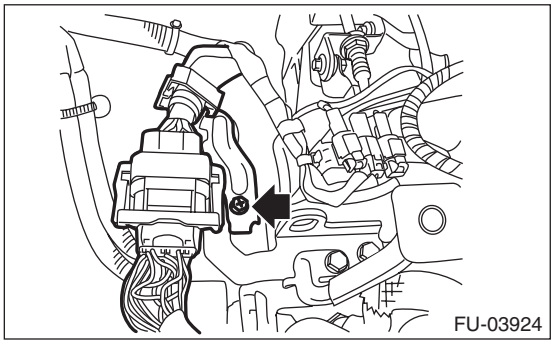
***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***


ME-03376


ME-03377

16) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>
17) Lower the vehicle.
18) Connect the following hoses.
(1) Fuel delivery hose and evaporation hose
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose
19) Connect the following connectors and terminals.
(1) Front oxygen (A/F) sensor connector
(2) Rear oxygen sensor connector
(3) Engine harness connectors

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

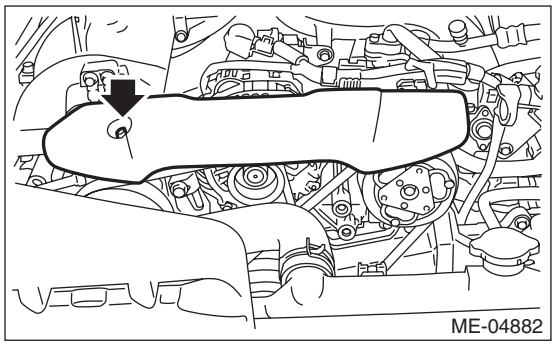



(4) Generator connector and terminal

***Tightening torque:***
***15 N·m (1.5 kgf-m, 11.1 ft-lb)***
(5) A/C compressor connector
20) Install the air intake chamber stay.

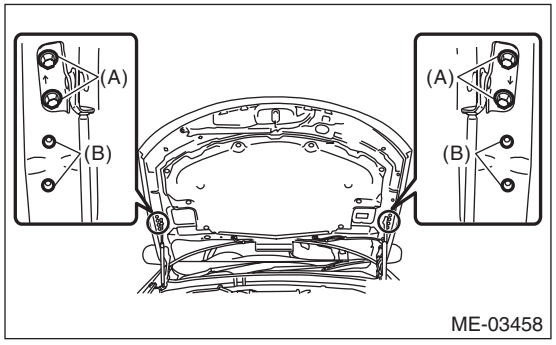
***Tightening torque:***
***16 N·m (1.6 kgf-m, 11.8 ft-lb)***
21) Install the A/C pressure hoses. <Ref. to AC-37, INSTALLATION, Hose and Pipe.>
22) Install the radiator to vehicle. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>
23) Install the air cleaner case. <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>
24) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
25) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
26) Install the under cover. <Ref. to EI-24, INSTALLATION, Front Under Cover.>
27) Install the battery. <Ref. to SC(H4SO)-22, INSTALLATION, Battery.>
28) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
29) Check the ATF level and replenish it if necessary. (AT model) <Ref. to 4AT-26, INSPECTION, Automatic Transmission Fluid.>
30) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>
31) Install the V-belt cover.

***Tightening torque:***
***13 N·m (1.3 kgf-m, 9.6 ft-lb)***




32) Change the bolt installation position from (B) to (A), then close the front hood.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***




## C: INSPECTION

1) Check that pipes, hoses, connectors and clamps are installed firmly.
2) Check the engine coolant is at specified level.
3) Check that the ATF is at specified level. (AT model)
4) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

# 10.Engine Mounting

## A: REMOVAL

1) Remove the engine assembly. <Ref. to ME(H4SO)-30, REMOVAL, Engine Assembly.>
2) Remove the engine mounting from the engine assembly.

## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***Engine mounting***
***35 N·m (3.6 kgf-m, 25.8 ft-lb)***

## C: INSPECTION

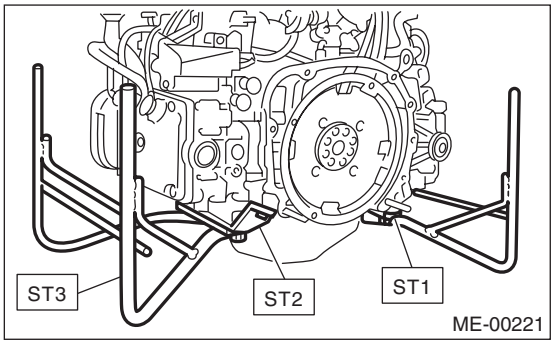
Check that the engine mounting does not have deformation, cracks and any other damage.

# 11.Preparation for Overhaul

## A: PROCEDURE

1) After removing the engine from body, secure the engine to ST as shown in the figure.

| | | |
|---|---|---|
| ST1 | 498457000 | ENGINE STAND ADAPTER RH |
| ST2 | 498457100 | ENGINE STAND ADAPTER LH |
| ST3 | 499817100 | ENGINE STAND |




2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

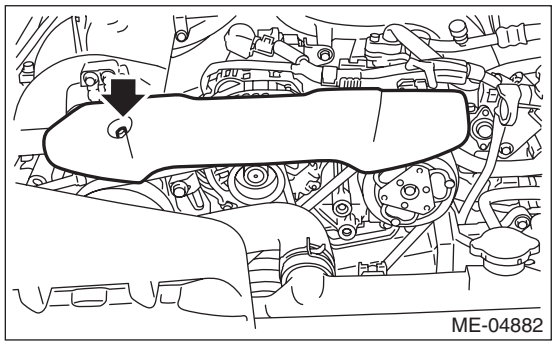
# 12.V-belt

## A: REMOVAL

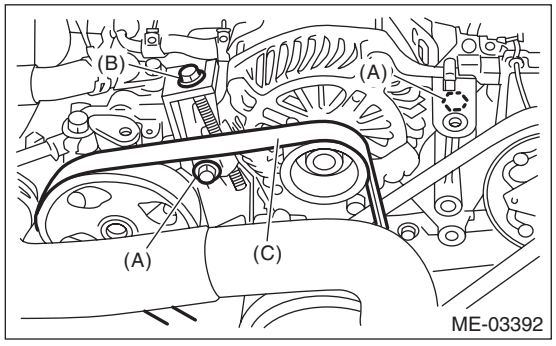
NOTE:
When replacing a single part, perform the work with the engine installed to body.

### 1. FRONT SIDE BELT

1) Remove the V-belt covers.

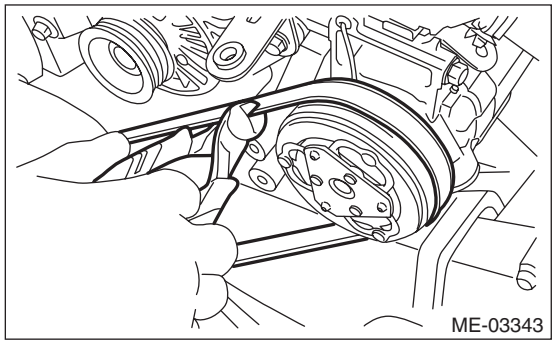



2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
3) Loosen the bolt (A).
4) Loosen the slider bolt (B).
5) Remove the front side belt (C).




### 2. REAR SIDE BELT

1) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
2) Cut the rear side belt with a wire cutter, etc., and discard.

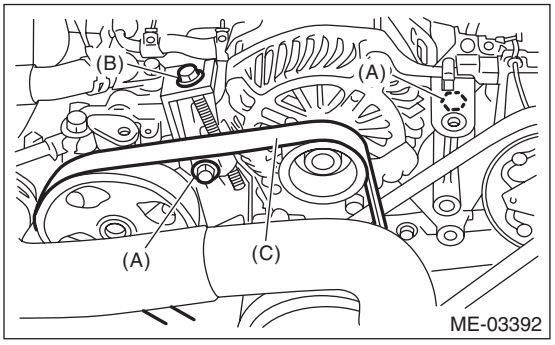



## B: INSTALLATION

### 1. FRONT SIDE BELT

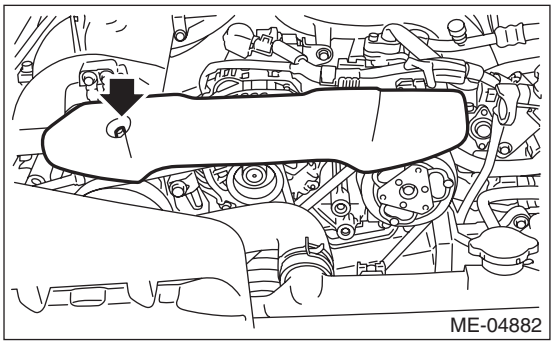
**CAUTION:**
**• When reusing the front side belt, wipe off dust and water with cloth.**
**• Do not use the front side belt if there is any oil, grease or coolant on the belt.**
**• Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Install the front side belt (C), and adjust the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-45, INSPECTION, V-belt.>
3) Tighten the bolt (A).
4) Tighten the slider bolt (B).

***Tightening torque:***
***Bolt (A)***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***
***Slider bolt (B)***
***8 N·m (0.8 kgf-m, 5.9 ft-lb)***



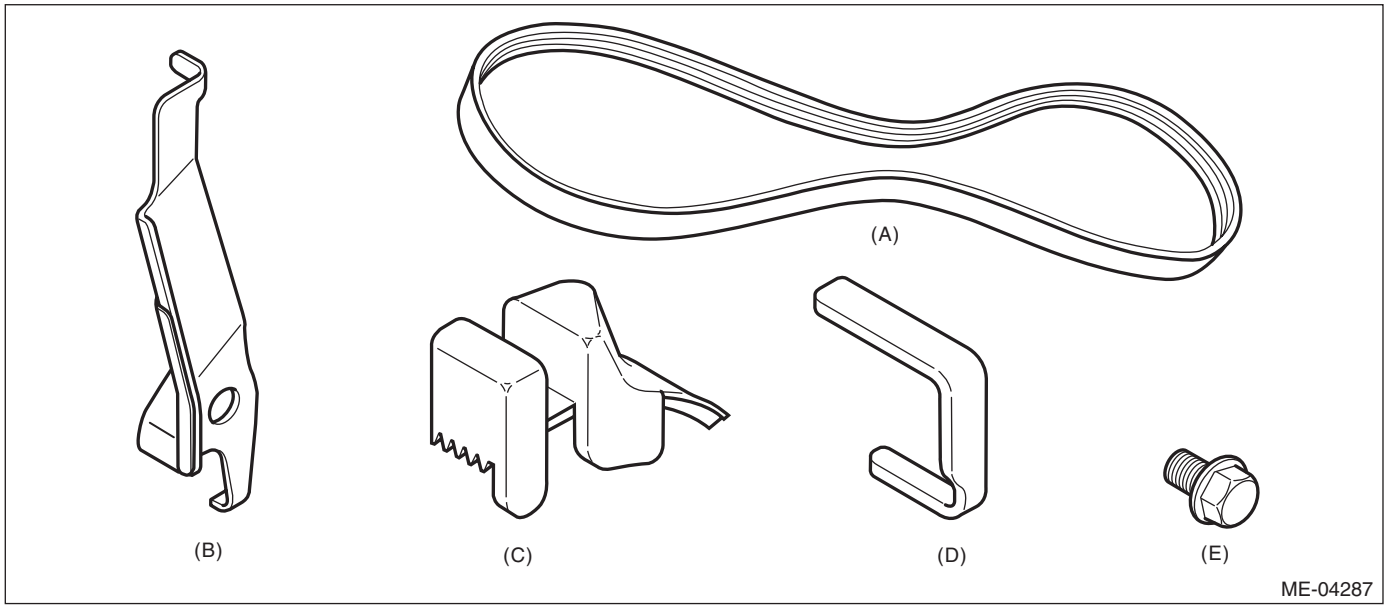

5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
6) Install the V-belt cover.

***Tightening torque:***
***13 N·m (1.3 kgf-m, 9.6 ft-lb)***



## 2. REAR SIDE BELT

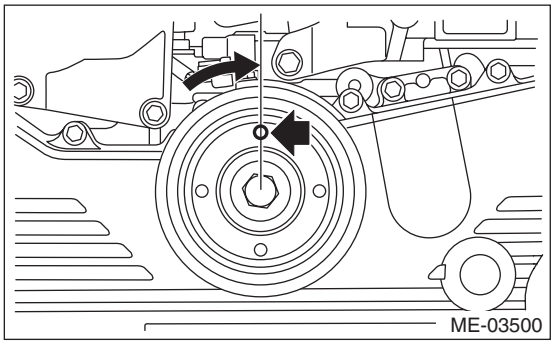
**CAUTION:**
- **Do not re-use the rear side belt.**
- **Be careful not to let oil, grease or coolant contact a new rear side belt.**
- **Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
- **To install the rear side belt, always use the provided tools (belt stopper, belt guide, belt guide holder, and bolt).**



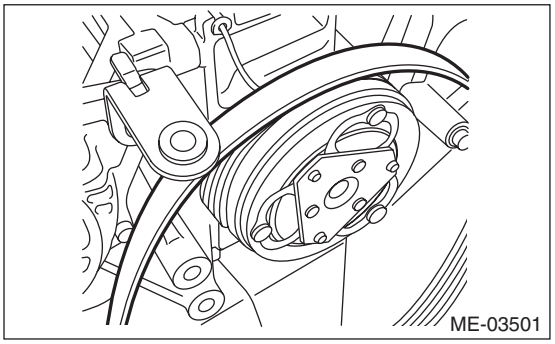

(A) Rear side belt
(B) Belt stopper
(C) Belt guide
(D) Belt guide holder
(E) Bolt

1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Wipe off any oil, water, dirt, and rust on the front of the crank pulley with cloth.
3) Slowly turn the crank pulley clockwise so that the service hole of the crank pulley comes around the top.

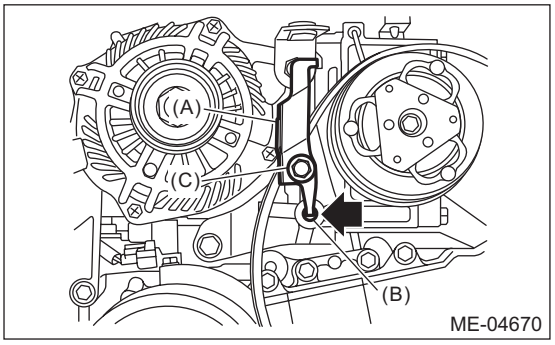
**CAUTION:**
**Do not turn the crank pulley counterclockwise.**



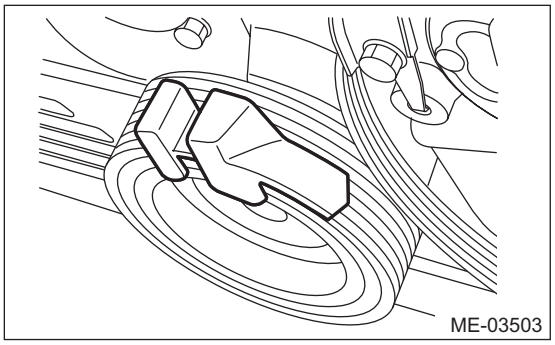

4) Hook a new rear side belt on the A/C compressor pulley.




5) As shown in the figure, insert the claw of the belt stopper (A) to the lower hole (B) of the compressor bracket, then attach with bolt (C).

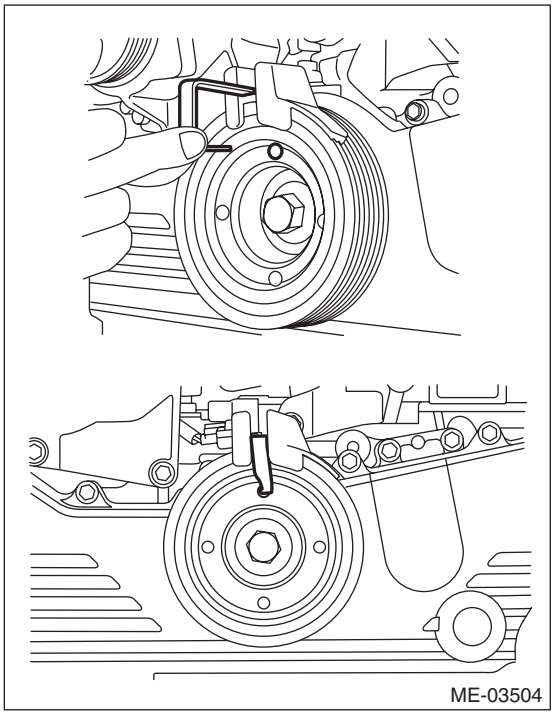


6) Place the belt guide while aligning it with the belt line of the crank pulley on the front side belt side.

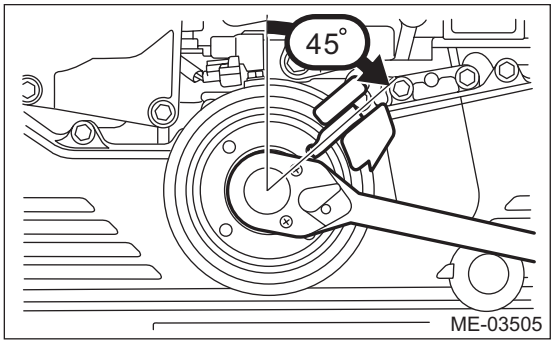



7) Insert the belt guide holder into the service hole of the crank pulley so that the belt guide comes in between.

NOTE:
Place the belt guide holder with the longer side up.

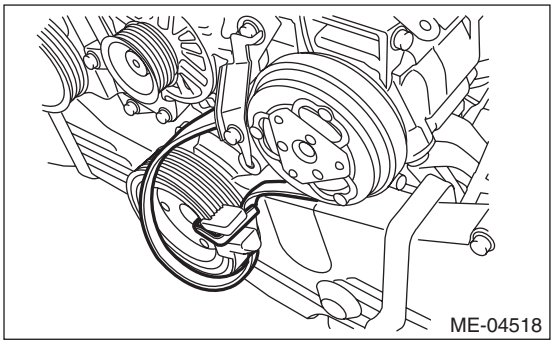



8) Slowly turn the crank pulley clockwise until the belt guide comes to approximately 45°.

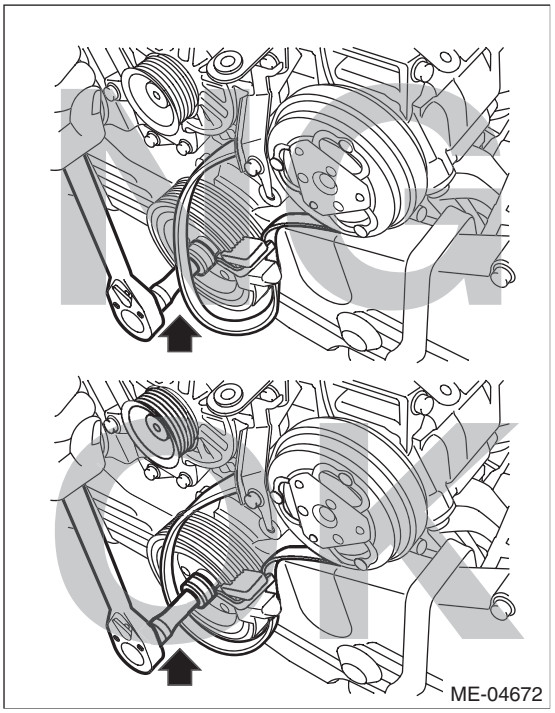



9) Place the rib surface of the rear side belt into the crank pulley groove, so that the rear side belt comes in between the belt guide holder.

**CAUTION:**
**When it is difficult to place the rear side belt to the crank pulley groove, pull out the belt guide holder half way, then place the rear side belt into the groove so that it comes in between the belt guide holder.**

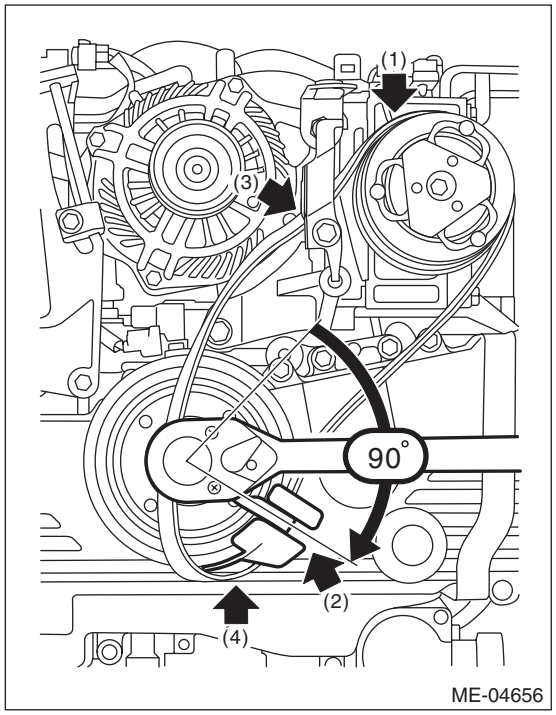



10) Place the tool through the loop of the rear side belt, and set on the crank pulley bolt.

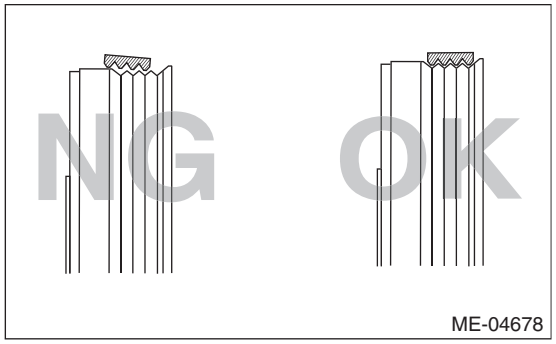


11) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.

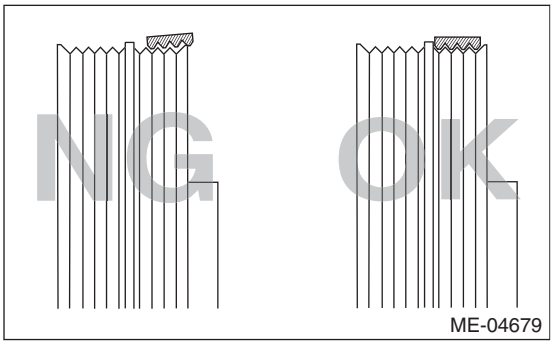
**CAUTION:**
**When turning the crank pulley, always make sure that the belt guide is not off from the crank pulley groove.**



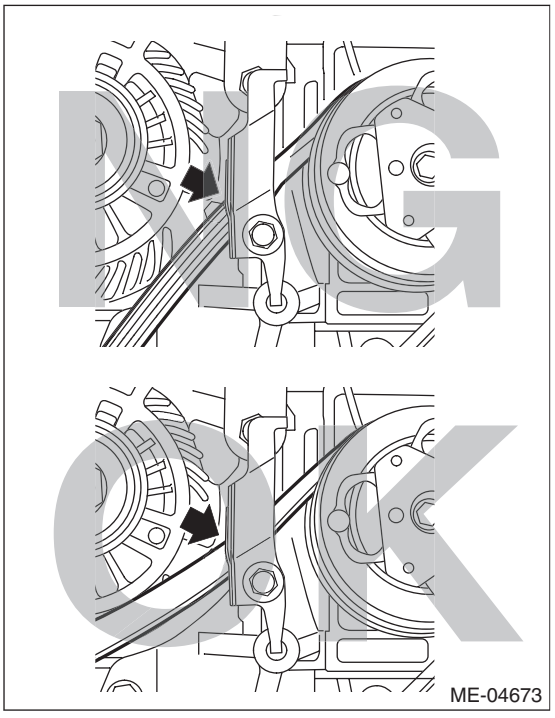

(1) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



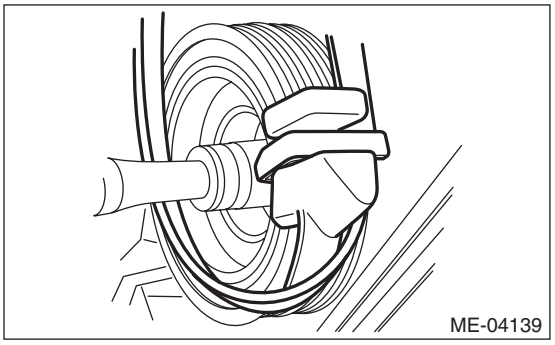

(2) The rib of the rear side belt is securely placed on the groove of the crank pulley.



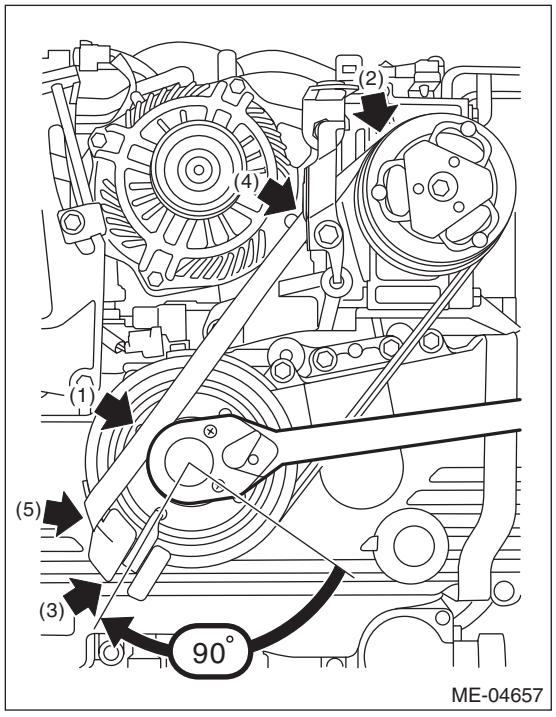

(3) The surface of the rear side belt is held by the belt stopper.



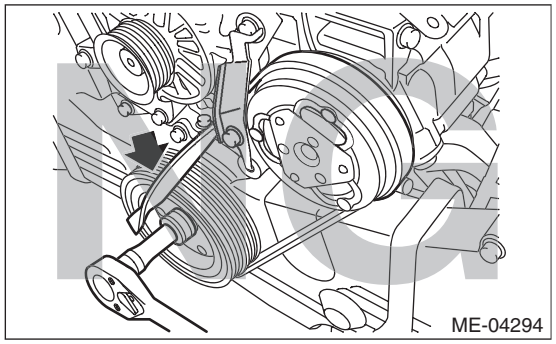

(4) The rear side belt is securely placed on the belt guide.



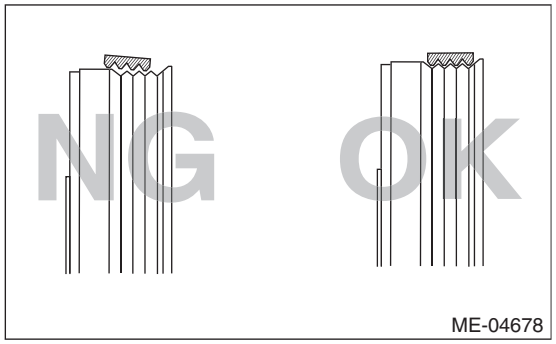
12) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.



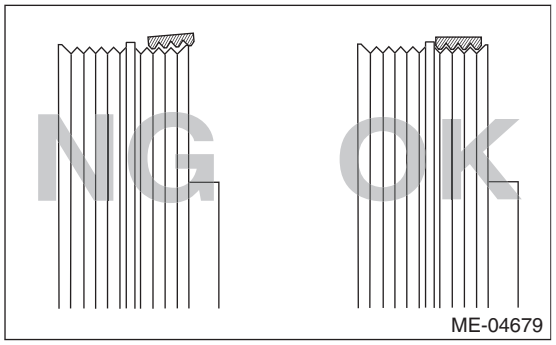

(1) The rear side belt is not twisted.



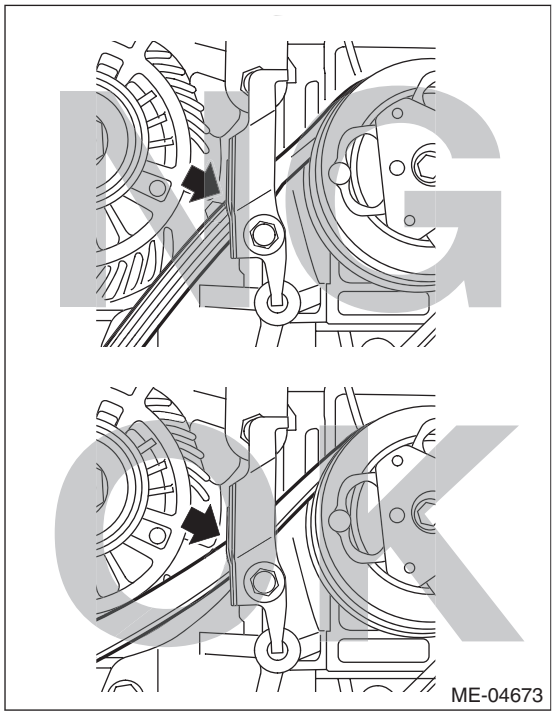

(2) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



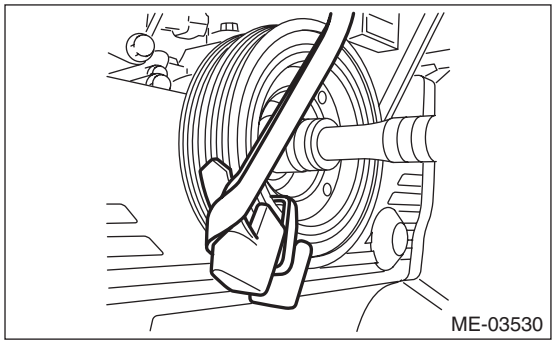

(3) The rib of the rear side belt is securely placed on the groove of the crank pulley.




(4) The surface of the rear side belt is held by the belt stopper.

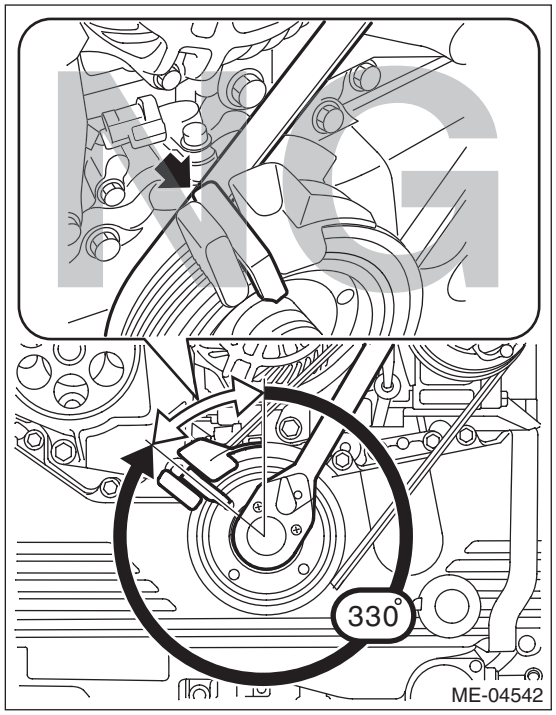



(5) The rear side belt is securely placed on the belt guide.

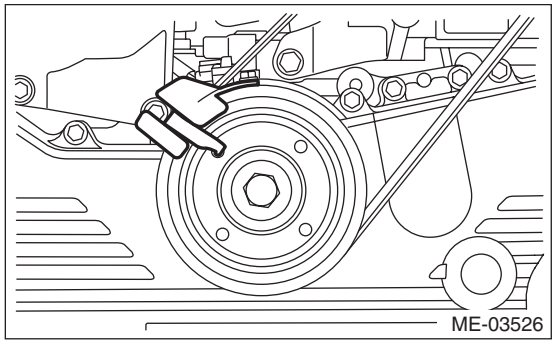


13) Slowly turn the crank pulley clockwise, and install the rear side belt.

**CAUTION:**
**Be careful that the total of procedures 8), 11), 12) and 13) does not exceed 330°; failure to do so may cause damage to the rear side belt and fall of the belt guide holder.**

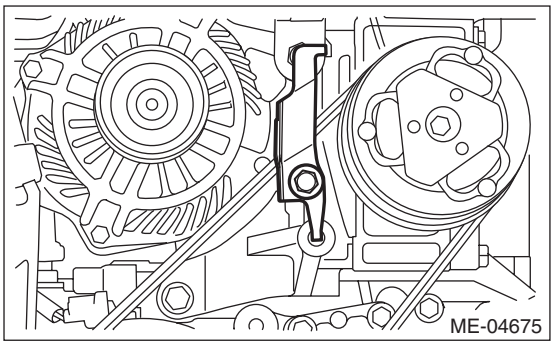



14) Remove the belt guide and belt guide holder from the crank pulley.

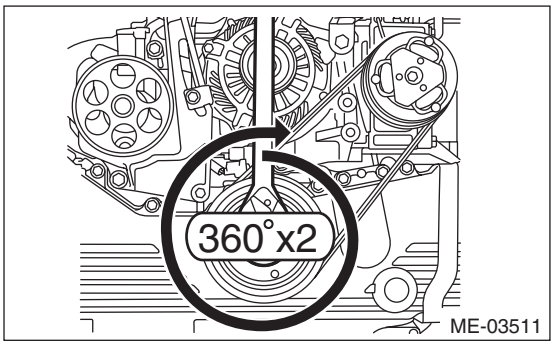



15) Remove the belt stopper from the compressor bracket.

**CAUTION:**
**Always remove the belt stopper; failure to do so may cause smoke, fire, or belt cutting.**




16) Make sure that the belt rib is securely installed on the groove of each pulley, then turn the crank pulley slowly, twice in the clockwise direction, to seat the rear side belt properly.



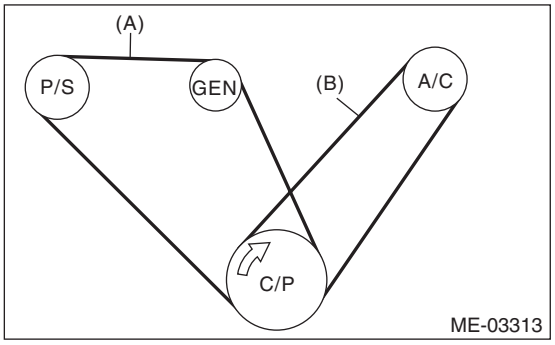

17) Discard the provided tools (belt stopper, belt guide, belt guide holder, and bolt) that are used.
18) Install the front side belt. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

# C: INSPECTION

## 1. FRONT SIDE BELT

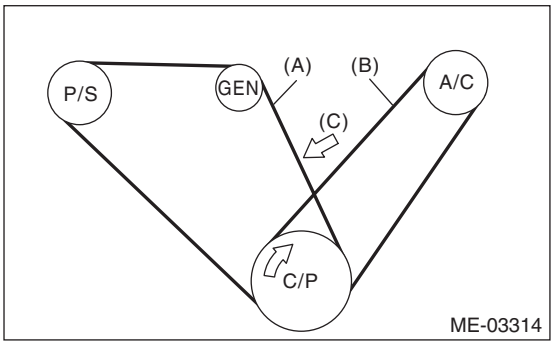
**CAUTION:**
**Check and adjust the front side belt tension so that it is within the specified range. Using the belt with a tension out of the specified range may result in a fault such as the following:**
**• If the front side belt tension is higher, unexpected force is generated at the power steering oil pump, generator and crankshaft bearing, causing abnormal noise due to abnormal wear of the bearing.**
**• If the front side belt tension is lower, the front side belt and crank pulley slip, causing abnormally high temperature on the crank pulley due to frictional heat. If this condition repeatedly occurs, the front side belt may abnormally wear, causing abnormal noise, front side belt damage or crank pulley damage.**
1) Replace the front side belt, if crack, fraying or wear is found.
2) Check the front side belt tension and adjust it if necessary by changing the generator installing position.

***Front side belt tension (with belt tension gauge):***
***When installing new parts***
***640 — 780 N (65 — 80 kgf, 144 — 175 lbf)***
***At inspection***
***490 — 640 N (50 — 65 kgf, 110 — 144 lbf)***




(A) Front side belt
(B) Rear side belt
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

***Front side belt tension (without belt tension gauge):***
***When installing new parts***
***7 — 9 mm (0.276 — 0.354 in)***
***At inspection***
***9 — 11 mm (0.354 — 0.433 in)***




(A) Front side belt
(B) Rear side belt
(C) 98 N (10 kgf, 22 lbf)
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

## 2. REAR SIDE BELT

Replace the rear side belt, if crack, fraying or wear is found, or noise is emitted.

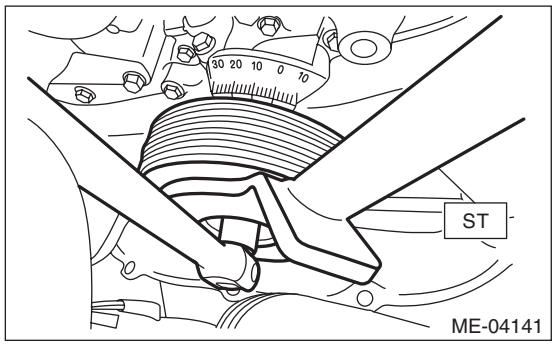
NOTE:
For the rear side belt, a stretch type belt is used, and therefore, it is not necessary to check deflection nor tension.

# 13.Crank Pulley

## A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Use the ST to lock the crank pulley, and remove the crank pulley bolt.

ST 499977400 CRANK PULLEY WRENCH (AT MODEL)
ST 499977100 CRANK PULLEY WRENCH (MT MODEL)




3) Remove the crank pulley.

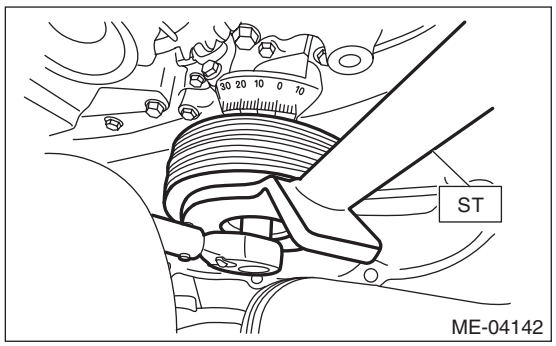
## B: INSTALLATION

### 1. METHOD WITHOUT ANGLE GAUGE

1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.

ST 499977400 CRANK PULLEY WRENCH (AT MODEL)
ST 499977100 CRANK PULLEY WRENCH (MT MODEL)

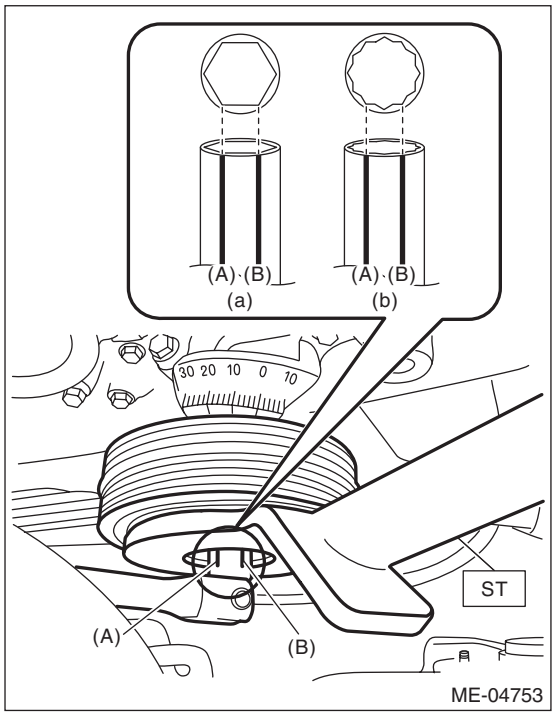
***Tightening torque:***
***47 N·m (4.8 kgf-m, 34.7 ft-lb)***




(2) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

ST 499977400 CRANK PULLEY WRENCH (AT MODEL)
ST 499977100 CRANK PULLEY WRENCH (MT MODEL)

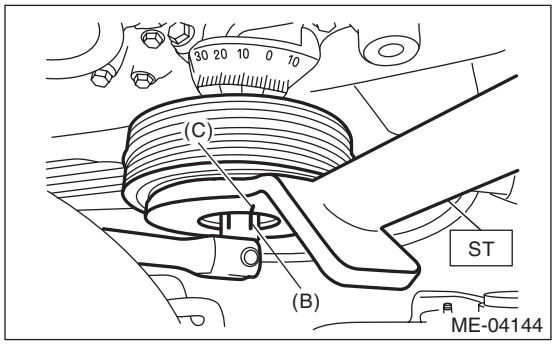
NOTE:
Set the socket onto the crank pulley bolt so that reference lines (A) and (B) is visible.




(a) When using 6-point socket
(b) When using 12-point socket

(3) Draw end line (C) on ST using a marker at the same position as reference line (B) was drawn on the socket in step (2).

ST 499977400 CRANK PULLEY WRENCH (AT MODEL)
ST 499977100 CRANK PULLEY WRENCH (MT MODEL)

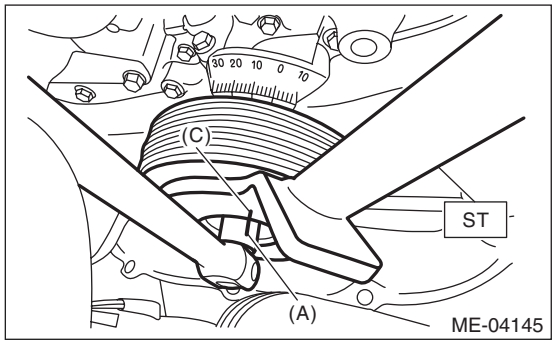


(4) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (C) are aligned.

| | | |
|---|---|---|
| ST | 499977400 | CRANK PULLEY WRENCH (AT MODEL) |
| ST | 499977100 | CRANK PULLEY WRENCH (MT MODEL) |

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.

***Tightening angle:***
***60°±5°***




5) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

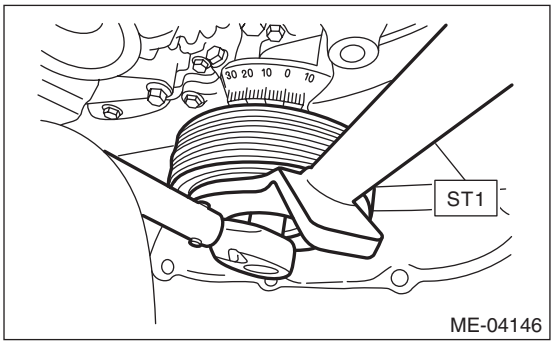
## 2. METHOD WITH ANGLE GAUGE

1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Remove the radiator main fan motor assembly and radiator sub motor assembly. <Ref. to CO(H4SO)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4SO)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>

(2) Use the ST1 to lock the crank pulley, and temporarily tighten the crank pulley bolt.

| | | |
|---|---|---|
| ST1 | 499977400 | CRANK PULLEY WRENCH (AT MODEL) |
| ST1 | 499977100 | CRANK PULLEY WRENCH (MT MODEL) |

***Tightening torque:***
***47 N·m (4.8 kgf-m, 34.7 ft-lb)***

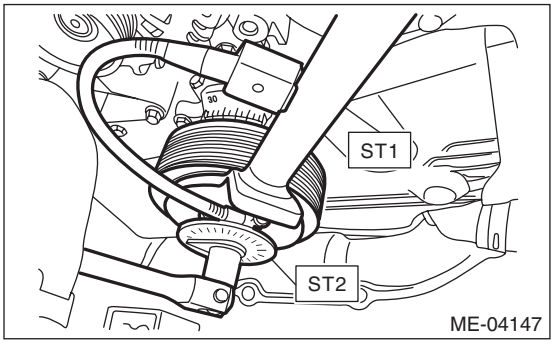



(3) Set the ST2, use the ST1 to lock the crank pulley, and tighten the crank pulley bolt to the specified angle.

| | | |
|---|---|---|
| ST1 | 499977400 | CRANK PULLEY WRENCH (AT MODEL) |
| ST1 | 499977100 | CRANK PULLEY WRENCH (MT MODEL) |
| ST2 | 18854AA000 | ANGLE GAUGE |

NOTE:
Attach the magnet used for securing the ST2 (ANGLE GAUGE) to ST1.

***Tightening angle:***
***60°±5°***




(4) Install the radiator main fan motor assembly and radiator sub motor assembly. <Ref. to CO(H4SO)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4SO)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>

5) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

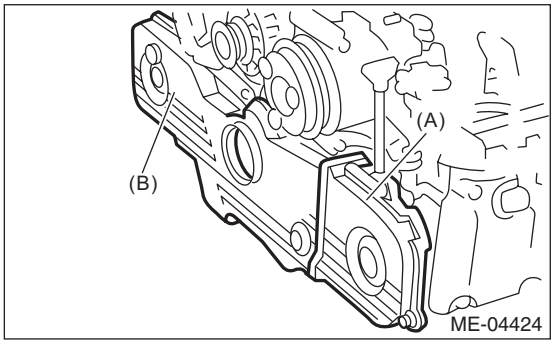
## C: INSPECTION

1) Check that the crank pulley has no deformation, cracks or other damages.
2) Make sure the V-belt is not worn or otherwise damaged.
3) Check the tension of the front side belt. <Ref. to ME(H4SO)-45, INSPECTION, V-belt.>

# 14.Timing Belt Cover

## A: REMOVAL

1) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover LH (A).
3) Remove the front timing belt cover (B).




(A) Timing belt cover LH
(B) Front timing belt cover

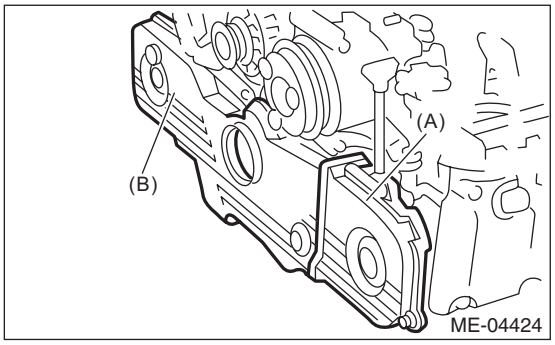
## B: INSTALLATION

1) Install the front timing belt cover (B).

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***

2) Install the timing belt cover LH (A).

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***




(A) Timing belt cover LH
(B) Front timing belt cover

3) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>

## C: INSPECTION

Check the timing belt cover for damage.

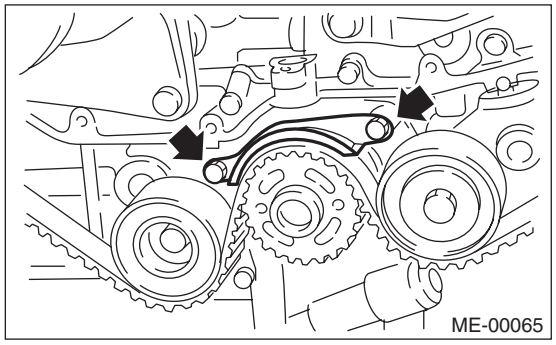
# 15.Timing Belt

## A: REMOVAL

NOTE:
• When replacing a single part, perform the work with the engine installed to body.
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
  • Radiator main fan motor assembly <Ref. to CO(H4SO)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4SO)-23, INSTALLATION, Radiator Main Fan and Fan Motor.>
  • Radiator sub fan motor assembly <Ref. to CO(H4SO)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(H4SO)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
• When performing the work with the engine installed to body, protect the radiator with cardboards or blankets.

### 1. TIMING BELT

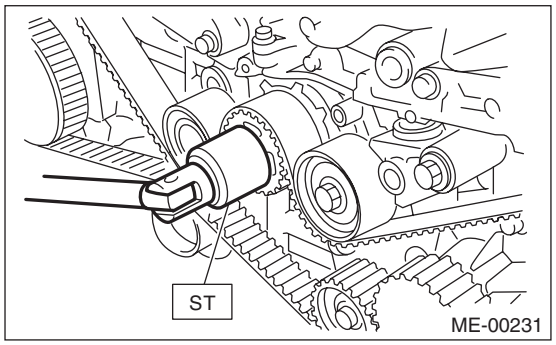
1) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt guide. (MT model)

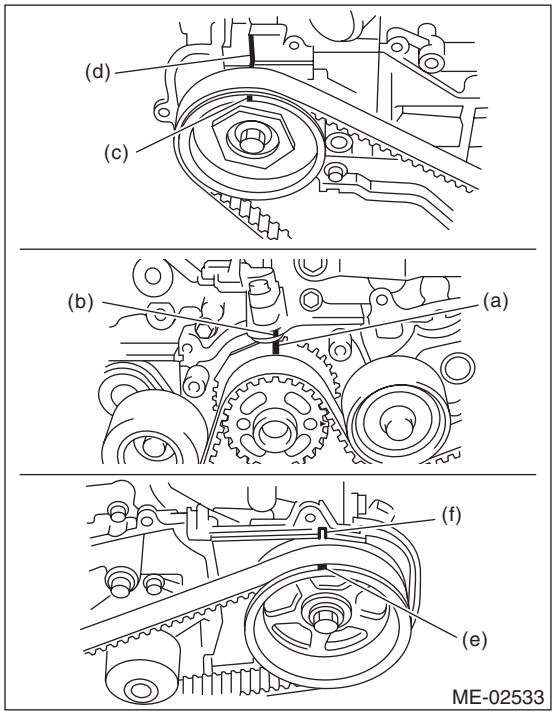



4) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.

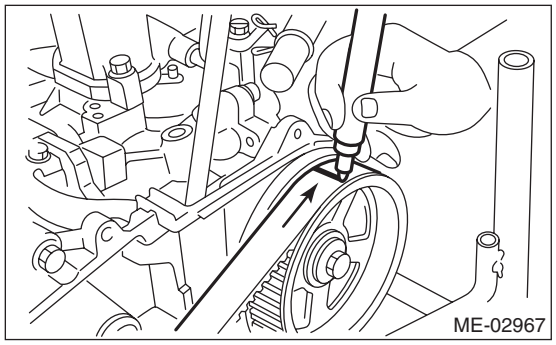
(1) Use the ST to turn crankshaft. Align the mark (a) of sprocket to the mark (b) of oil pump, and then ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) or left side cam sprocket mark (e), timing belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET

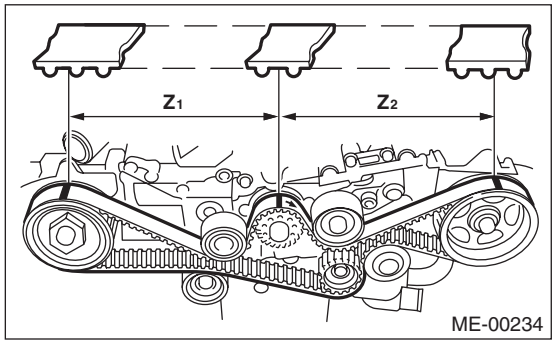


(2) Using white paint, put an alignment mark or an arrow mark on timing belts in relation to the crank sprocket and cam sprockets.

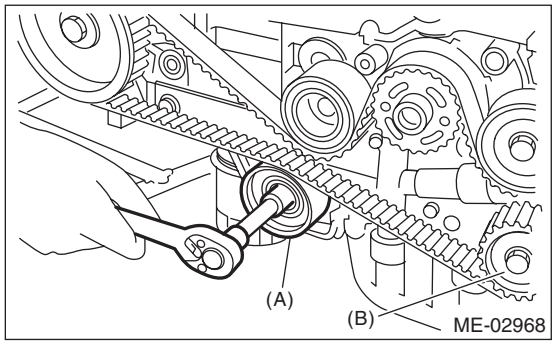

ME-02967

***$Z_1$: 46.8 teeth***
***$Z_2$: 43.7 teeth***



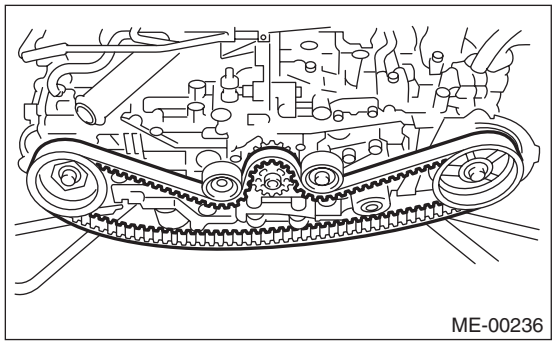
ME-00234

5) Remove the belt idler (A).
6) Remove the belt idler No. 2 (B).



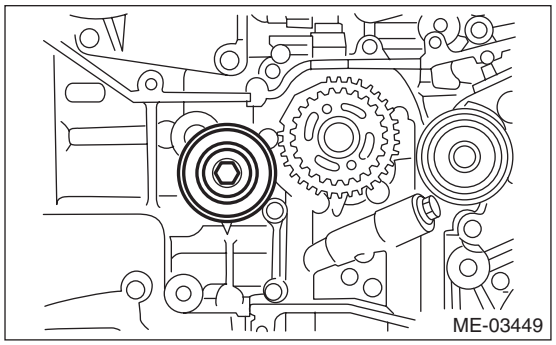
ME-02968

7) Remove the timing belt.

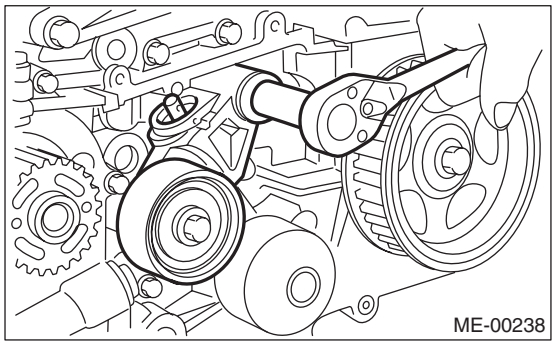

ME-00236

### 2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove the belt idler.


ME-03449

2) Remove the automatic belt tension adjuster assembly.


ME-00238

## B: INSTALLATION

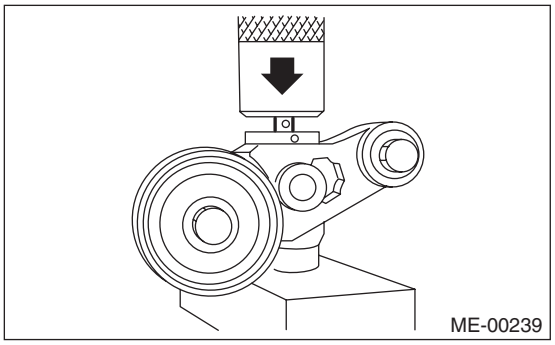
### 1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Prepare for installation of the automatic belt tension adjuster assembly.

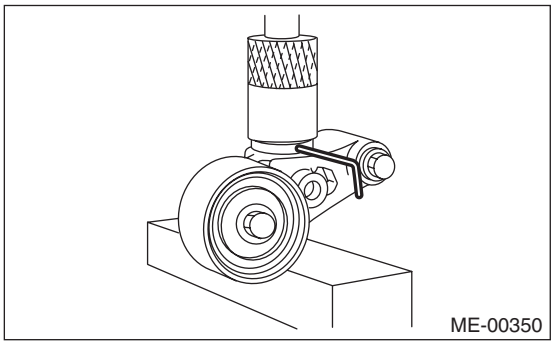
**CAUTION:**
**• Always use a vertical type pressing tool to move the adjuster rod down.**
**• Do not use a lateral type vise.**
**• Push the adjuster rod vertically.**
**• Press-in the push adjuster rod gradually taking three minutes or more.**
**• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).**
**• Push in the adjuster rod to the end face of the cylinder. However, do not push in the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.**
**• Do not release the press pressure until stopper pin is completely inserted.**

(1) Attach the automatic belt tension adjuster assembly to vertical pressing tool.

(2) Slowly push in the adjuster rod with a pressure of 165 N (16.8 kgf, 37.1 lbf) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

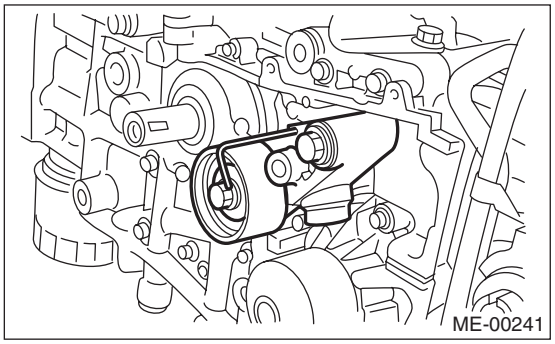

ME-00239

(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.


ME-00350

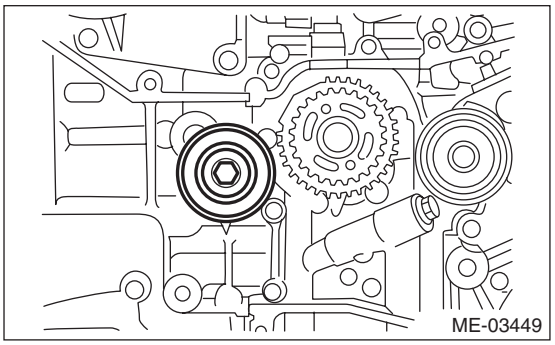
2) Install the automatic belt tension adjuster assembly.

***Tightening torque:***
***39 N·m (4.0 kgf-m, 28.8 ft-lb)***


ME-00241

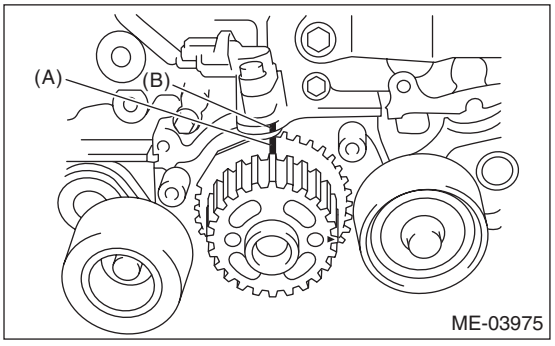
3) Install the belt idlers.

***Tightening torque:***
***39 N·m (4.0 kgf-m, 28.8 ft-lb)***


ME-03449

## 2. TIMING BELT

1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-51, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
2) Align the mark (B) on oil pump with the mark (A) on crank sprocket.



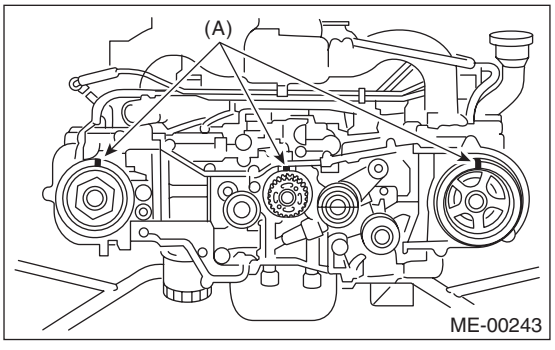
ME-03975

3) Turn the camshaft sprocket No. 2 using ST1, and turn the camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

ST1 18231AA010 CAM SPROCKET WRENCH

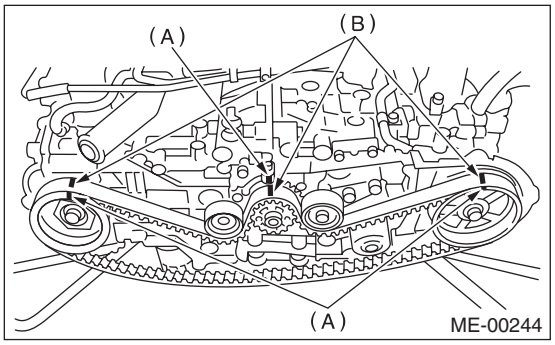
NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.

ST2 499207400 CAM SPROCKET WRENCH



ME-00243

4) While aligning the alignment mark (B) on timing belt with the mark (A) on sprockets, position the timing belt properly.

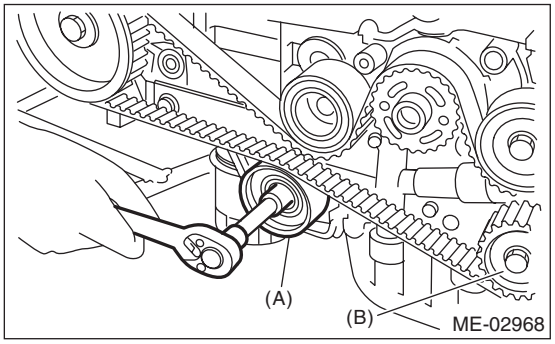



5) Install the belt idler No. 2 (B).

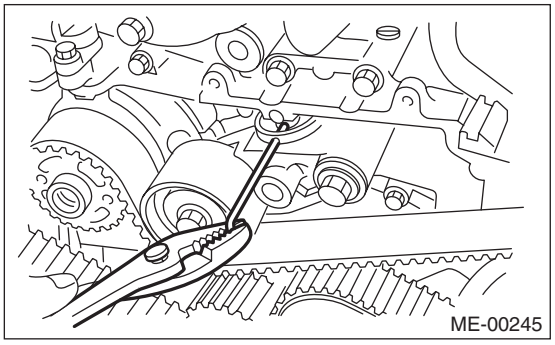
***Tightening torque:***
***39 N·m (4.0 kgf-m, 28.8 ft-lb)***

6) Install the belt idler (A).

***Tightening torque:***
***39 N·m (4.0 kgf-m, 28.8 ft-lb)***

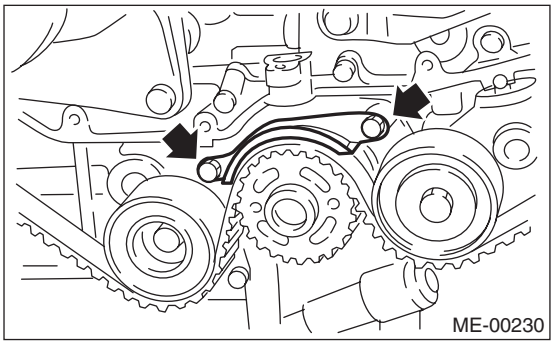



7) After ensuring the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tension adjuster.



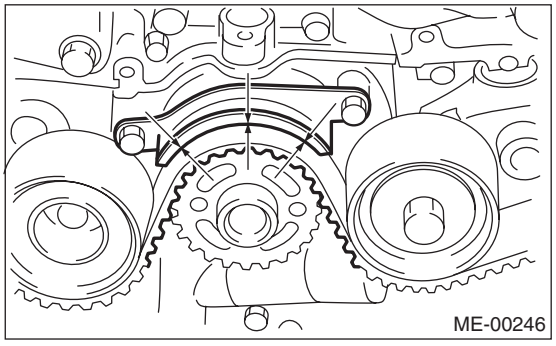

8) Install the timing belt guide. (MT model)

(1) Temporarily tighten the bolts mounting the timing belt guide.



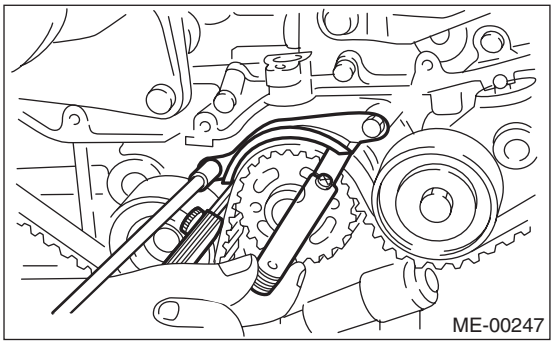

(2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

***Clearance:***
***1.0±0.5 mm (0.039±0.020 in)***




(3) Tighten the bolts mounting the timing belt guide.

***Tightening torque:***
***9.75 N·m (1.0 kgf-m, 7.2 ft-lb)***




9) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
10) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>

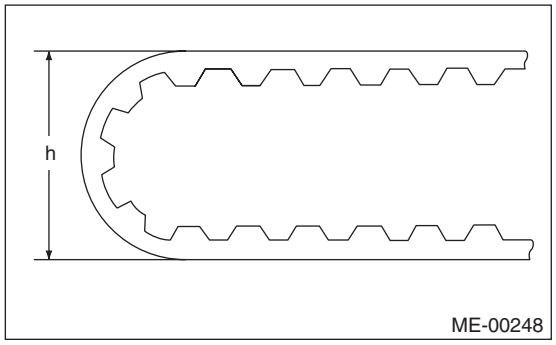
# C: INSPECTION

## 1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.
2) Check the condition on the back surface of the timing belt. If cracks are found, replace the timing belt.

**CAUTION:**
**• Be careful not to let oil, grease or coolant contact the timing belt. Remove quickly and thoroughly if this happens.**
**• Do not bend the timing belt sharply.**

***In radial diameter h:***
***60 mm (2.36 in) or more***



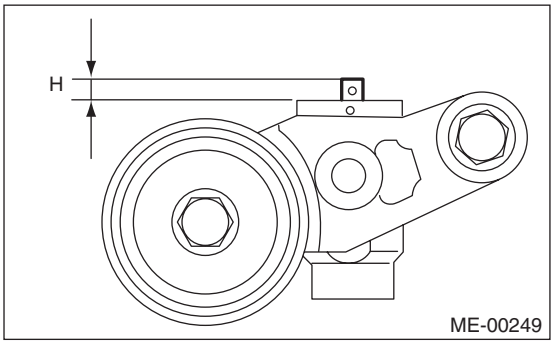

## 2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check the oil seals for leaks, and rod ends for abnormal wear and scratches. If necessary, replace the automatic belt tension adjuster assembly.

NOTE:
Slight traces of oil at rod's oil seal does not indicate a problem.
2) Check that the adjuster rod does not move when a pressure of 165 N (16.8 kgf, 37.1 lb) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff and moves freely when applying 165 N (16.8 kgf, 37.1 lb), check it using the following procedures:
(1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.
(2) With the adjuster rod moved all the way up, apply a pressure of 165 N (16.8 kgf, 37.1 lb) to it, and check the adjuster rod stiffness.
(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new part.

**CAUTION:**
**• Always use a vertical type pressing tool to move the adjuster rod down.**
**• Do not use a lateral type vise.**
**• Push the adjuster rod vertically.**
**• Press the adjuster rod gradually taking three minutes or more.**
**• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).**
**• Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.**
4) Measure the amount of adjuster rod protrusion "H" from the end surface of the cylinder. If it is not within specifications, replace the automatic belt tension adjuster assembly with a new part.

***Amount of adjuster rod protrusion H:***
***5.2 — 6.2 mm (0.205 — 0.244 in)***




## 3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly with a new part if faulty.
2) Check the belt tension pulley for smooth rotation. Replace the automatic belt tension adjuster assembly with a new part if abnormal noise or excessive play occurs.
3) Check the belt tension pulley for grease leakage.

## 4. BELT IDLER

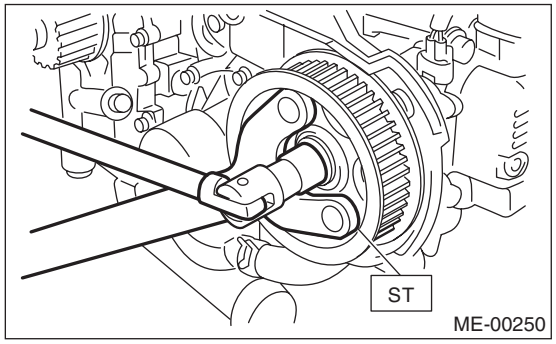
1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.
2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.

# 16.Cam Sprocket

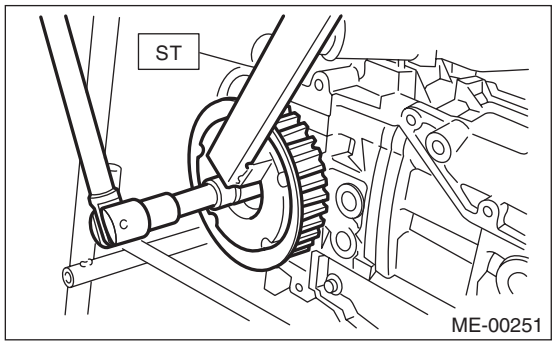
## A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine installed to body.
1) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
4) Remove the camshaft position sensor. <Ref. to FU(H4SO)-28, REMOVAL, Camshaft Position Sensor.>
5) Use the ST to lock the cam sprocket, and remove the cam sprocket bolt.
ST 18231AA010 CAM SPROCKET WRENCH

NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.




ST 499207400 CAM SPROCKET WRENCH




6) Remove the cam sprocket.

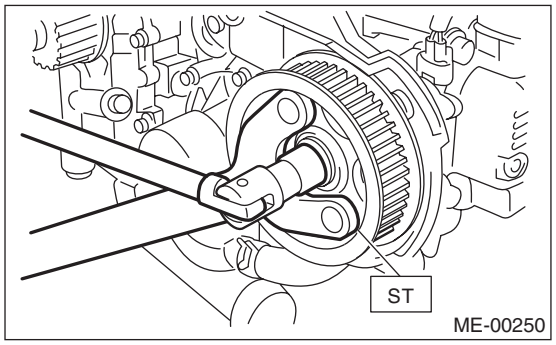
## B: INSTALLATION

1) Install the cam sprocket.
2) Use the ST to lock the cam sprocket, and install the cam sprocket bolt.

NOTE:
• Do not confuse cam sprockets (LH) and (RH) during installation.
• They should be distinguished by the L or R indication.
ST 18231AA010 CAM SPROCKET WRENCH

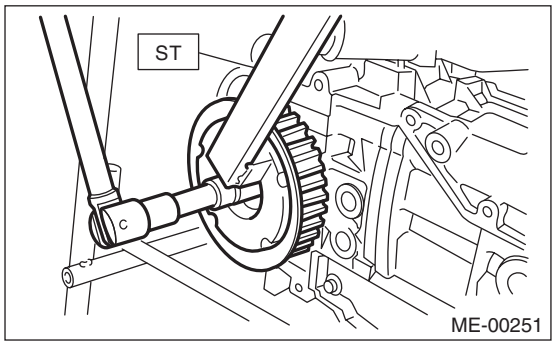
NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.

***Tightening torque:***
***78 N·m (8.0 kgf-m, 57.5 ft-lb)***




ST 499207400 CAM SPROCKET WRENCH

***Tightening torque:***
***78 N·m (8.0 kgf-m, 57.5 ft-lb)***




3) Install the camshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
4) Install the timing belt. <Ref. to ME(H4SO)-51, INSTALLATION, Timing Belt.>
5) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
6) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>

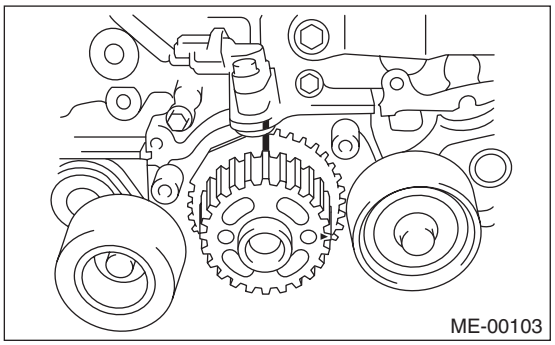
## C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between cam sprocket and key.
3) Check the cam sprocket protrusion used for sensor for damage and contamination of foreign matter.

# 17.Crank Sprocket

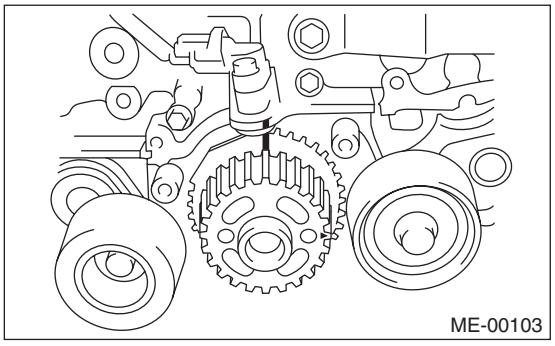
## A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine installed to body.
1) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
4) Remove the crank sprocket.




## B: INSTALLATION

1) Install the crank sprocket.




2) Install the timing belt. <Ref. to ME(H4SO)-51, INSTALLATION, Timing Belt.>
3) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
4) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>

## C: INSPECTION

1) Check the crank sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between crank sprocket and key.
3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

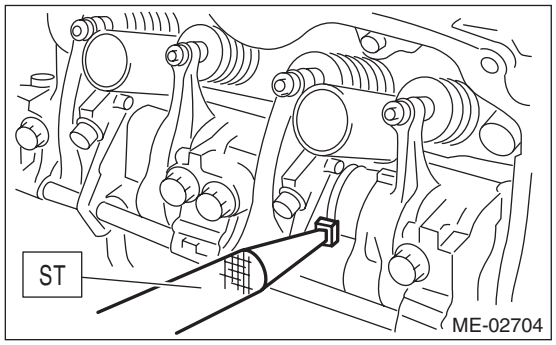
# 18.Valve Rocker Assembly

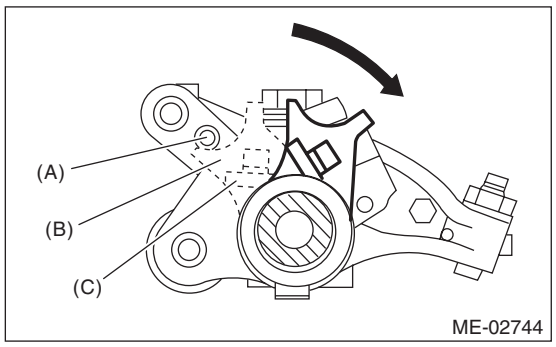
## A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine installed to body. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>

1) Remove the spark plug cords.
2) Disconnect the PCV hose and remove the rocker cover.
3) Remove the valve rocker assembly.
   (1) Use the ST to rotate the spring stopper in the direction of the arrow to remove it from adjuster pin.

ST 18258AA000 SPRING INSTALLER

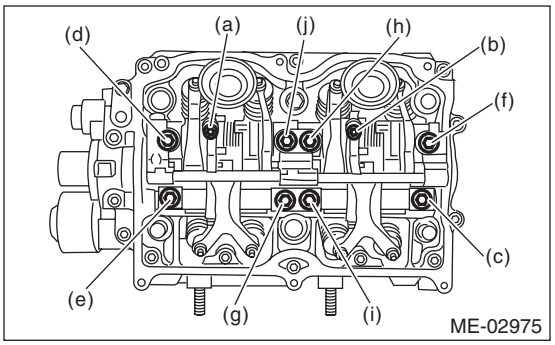



(A) Adjuster pin
(B) Spring stopper
(C) Spring

   (2) Remove the bolts (a) through (j) in alphabetical sequence.

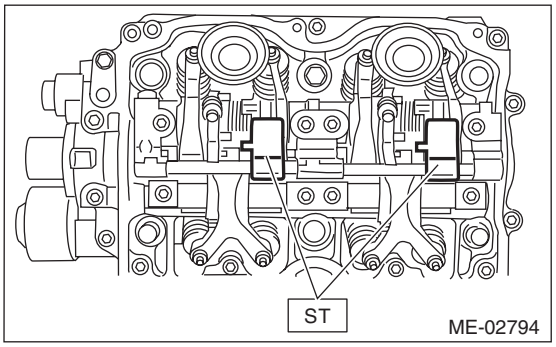
NOTE:
Leave two or three threads of bolts (i) and (j) engaged in order to retain the valve rocker assembly.




   (3) Remove the valve rocker assembly.

NOTE:
Set the ST in the position shown in the drawing to remove the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER

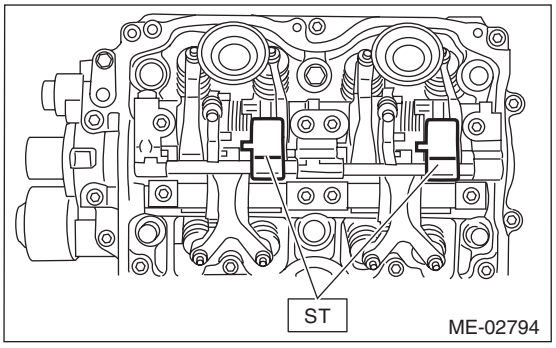



## B: INSTALLATION

1) Install the valve rocker assembly.
   (1) Temporarily tighten the bolts equally in alphabetical order as shown in the figure.

NOTE:
- Do not temporarily tighten the bolts (i) and (j).
- Set the ST in the position shown in the drawing to mount the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER

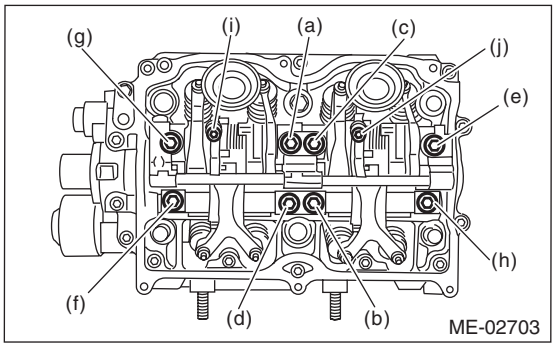


(2) Tighten the bolts (a) through (h) to specified torque.

***Tightening torque:***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***

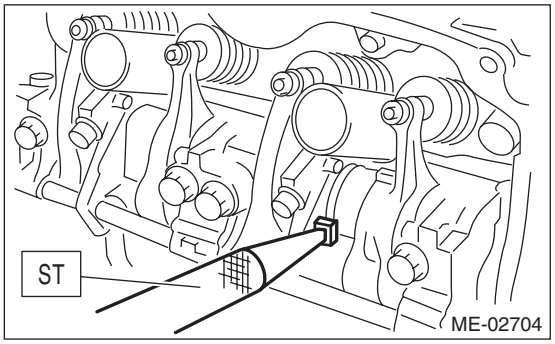
(3) Tighten the bolts (i) through (j) to specified torque.

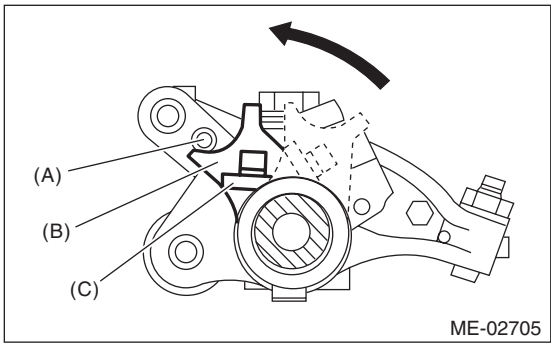
***Tightening torque:***
***6 N·m (0.6 kgf-m, 4.4 ft-lb)***




(4) Use the ST to rotate the spring stopper in the direction of the arrow to fasten the adjuster pin.

ST 18258AA000 SPRING INSTALLER




(A) Adjuster pin
(B) Spring stopper
(C) Spring

2) Remove the timing belt cover LH.
3) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
4) Install the timing belt cover LH.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***

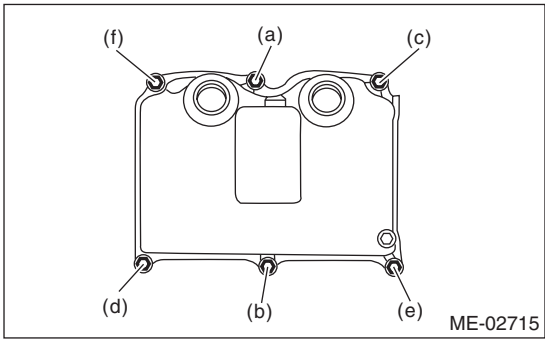
5) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

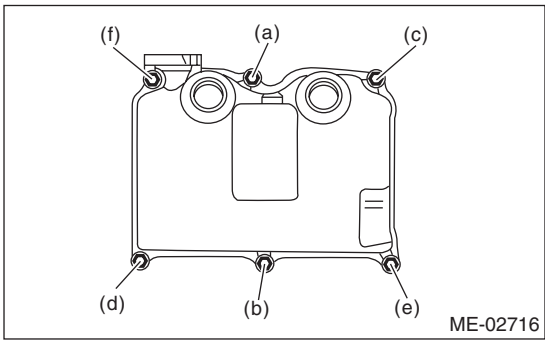
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

***Tightening torque:***
***1st***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***Second (only (a) and (b) are tightened)***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

RH side




LH side




(3) Connect the PCV hose.
6) Install the spark plug cords.

## C: DISASSEMBLY

NOTE:
Intake valve rocker assembly cannot be disassembled.

1) Remove the exhaust valve rocker arm from the rocker shaft.

NOTE:
Keep all the removed parts in order for re-installing in their original positions.

2) Remove the nut and adjusting screw from exhaust valve rocker.

## D: ASSEMBLY

NOTE:
Intake valve rocker assembly cannot be disassembled.
1) Install the adjusting screw and nut to the exhaust valve rocker.
2) Insert the exhaust valve rocker arm to rocker shaft.

NOTE:
Valve rocker arms, and rocker shaft have identification marks. Make sure the parts with same markings are properly assembled.

## E: INSPECTION

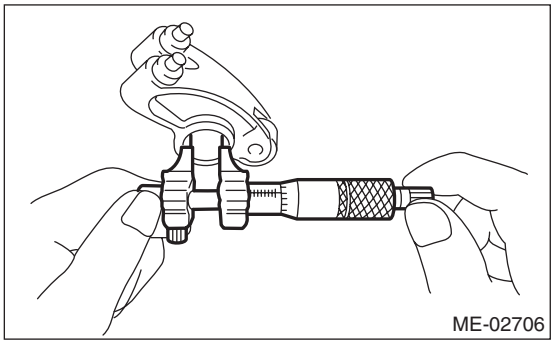
### 1. INTAKE VALVE ROCKER ASSY

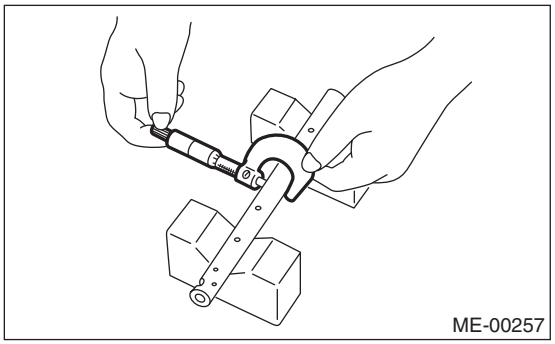
1) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker assembly.
2) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker assembly.

### 2. EXHAUST VALVE ROCKER ASSY

1) Measure the inner diameter of valve rocker arm and outer diameter of valve rocker shaft, and confirm the difference (oil clearance) between the two values.

***Clearance between arm and shaft:***
***Standard***
***0.020 — 0.054 mm (0.0008 — 0.0021 in)***


ME-02706


ME-00257

2) If the oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows the greater amount of wear.

***Rocker arm inside diameter:***
***22.020 — 22.041 mm (0.8669 — 0.8678 in)***

***Rocker shaft diameter:***
***21.987 — 22.000 mm (0.8656 — 0.8661 in)***

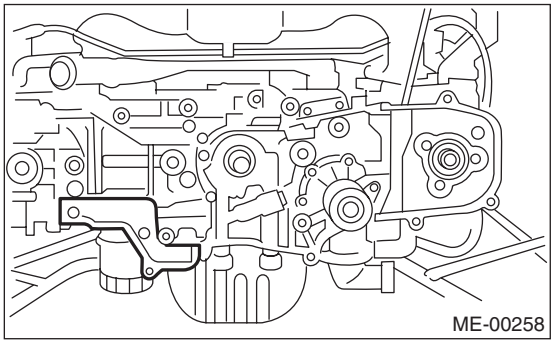
3) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm.
4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

# 19.Camshaft

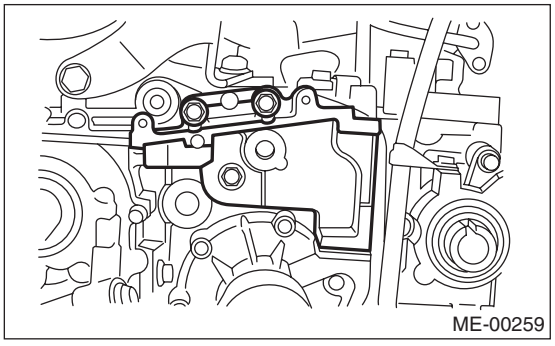
## A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine installed to body. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>
1) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
4) Remove the cam sprocket. <Ref. to ME(H4SO)-55, REMOVAL, Cam Sprocket.>
5) Remove the timing belt cover No. 2 LH.
6) Remove the timing belt cover No. 2 RH.

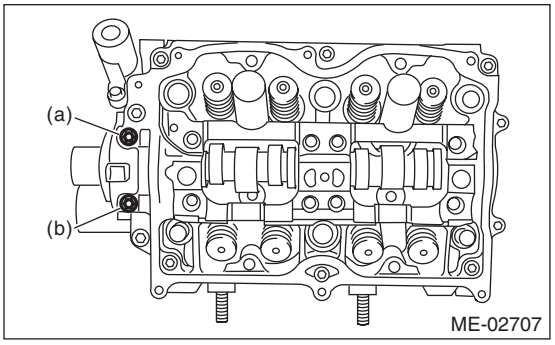
NOTE:
Do not damage or lose the seal rubber when removing the timing belt covers.


ME-00258

7) Remove the tensioner bracket.

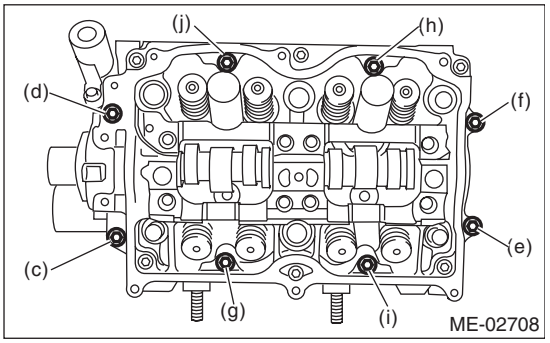

ME-00259

8) Remove the camshaft position sensor support. (LH side only)
9) Remove the valve rocker assembly. <Ref. to ME(H4SO)-57, REMOVAL, Valve Rocker Assembly.>
10) Remove the camshaft cap.
(1) Remove the bolts (a) and (b) in alphabetical sequence.



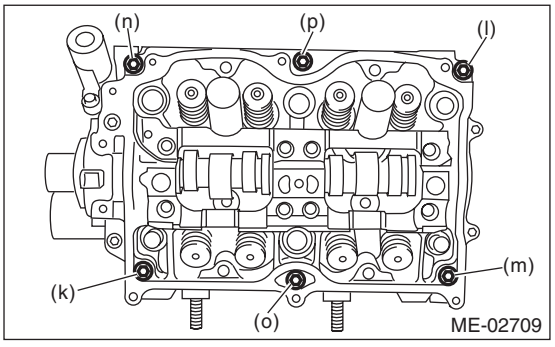
ME-02707

(2) Equally loosen the bolts (c) through (j) all the way in alphabetical sequence.



ME-02708

(3) Remove the bolts (k) through (p) in alphabetical sequence using ST.
ST 499497000 TORX® PLUS



ME-02709

(4) Remove the camshaft cap.
11) Remove the camshaft.
12) Remove the oil seal.
13) Remove the plug from rear side of camshaft.

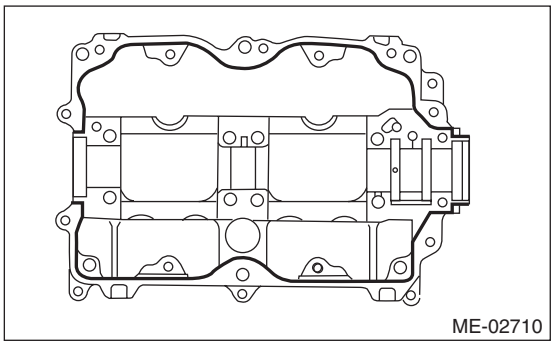
**CAUTION:**
**Do not scratch the journal surface when removing the oil seal.**
14) Similarly, remove the camshaft RH and related parts.

## B: INSTALLATION

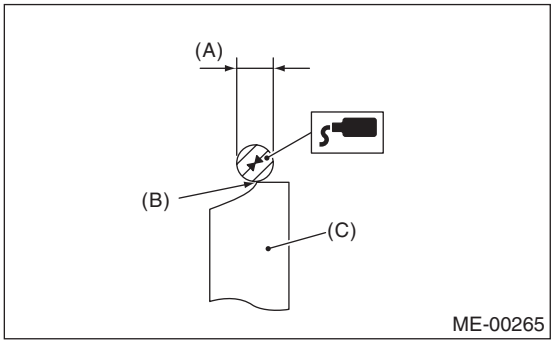
1) Apply a thin coat of engine oil to camshaft journals, and install the camshaft.
2) Install the camshaft cap.
(1) Apply liquid gasket to the mating surfaces of camshaft cap.

NOTE:
Install within 5 min. after applying liquid gasket.

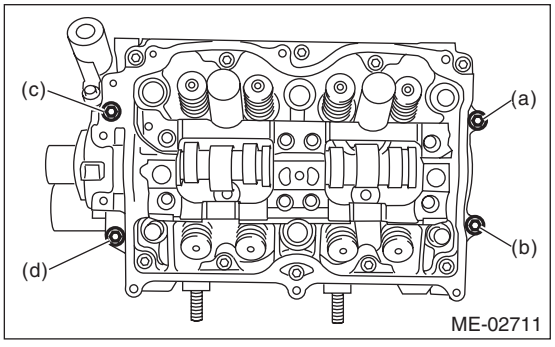
***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***




NOTE:
Apply a coat of liquid gasket of 3 mm (0.12 in) in diameter (A) along the edge (B) of camshaft cap (C) mating surface.



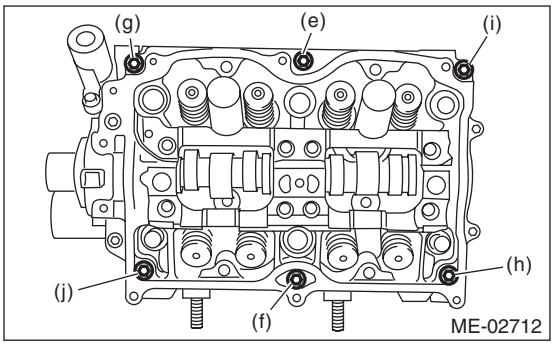

(2) Temporarily tighten the bolts (a) through (d) in alphabetical sequence.




(3) Install the valve rocker assembly. <Ref. to ME(H4SO)-57, INSTALLATION, Valve Rocker Assembly.>

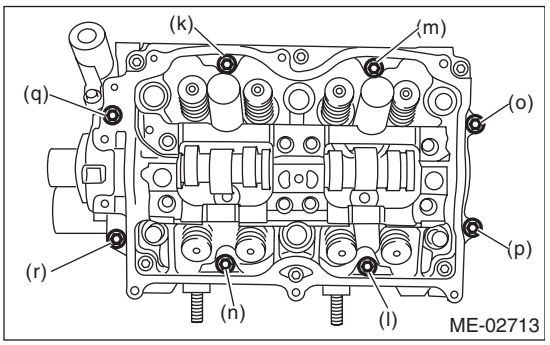
(4) Tighten the TORX® bolts (e) through (j) in alphabetical sequence using the ST.
ST 499497000 TORX® PLUS

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***




(5) Tighten the bolts (k) through (r) in alphabetical sequence.

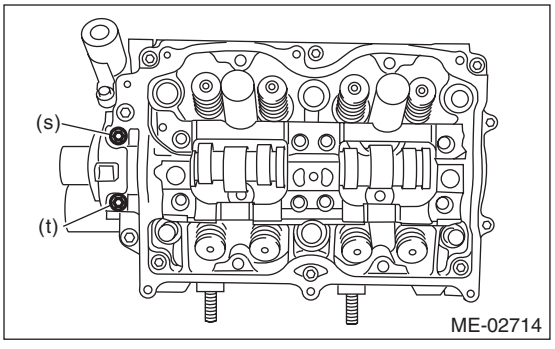
***Tightening torque:***
***9.75 N·m (1.0 kgf-m, 7.2 ft-lb)***




(6) Tighten the bolts (s) and (t) in alphabetical sequence.

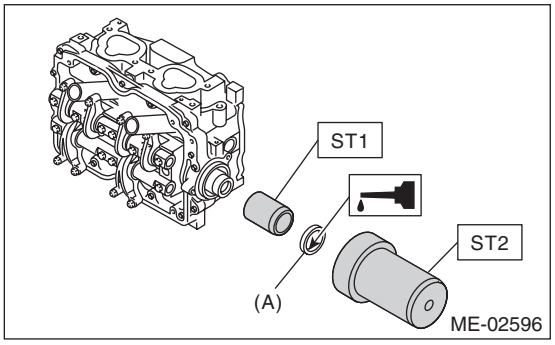
NOTE:
- Use a new seal washer.
- Install and tighten the seal washer to the bolt.

***Tightening torque:***
***9.75 N·m (1.0 kgf-m, 7.2 ft-lb)***

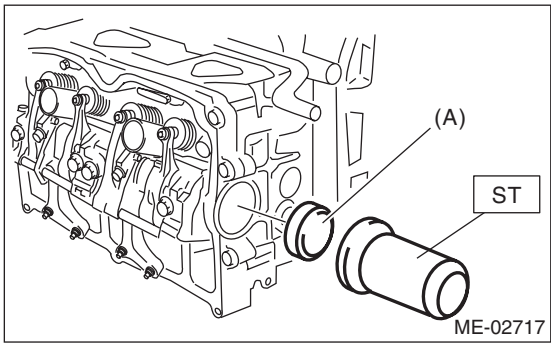


3) Apply a coat of engine oil to camshaft oil seal periphery and oil seal lips and install the oil seal (A) on camshaft using ST1 and ST2.

NOTE:
Use a new oil seal.
ST1 499597000 OIL SEAL GUIDE
ST2 499587500 OIL SEAL INSTALLER




4) Apply a coat of engine oil to plug periphery and install the plug (A) using ST.
ST 499587700 CAMSHAFT OIL SEAL INSTALLER

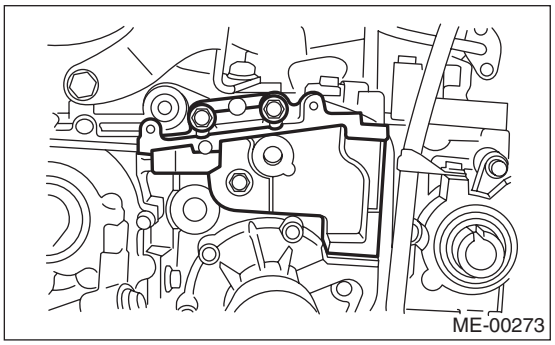



5) Install the camshaft position sensor support. (LH side only)

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

6) Similarly, install the parts on right-hand side.
7) Install the tensioner bracket.

***Tightening torque:***
***24.5 N·m (2.5 kgf-m, 18.1 ft-lb)***

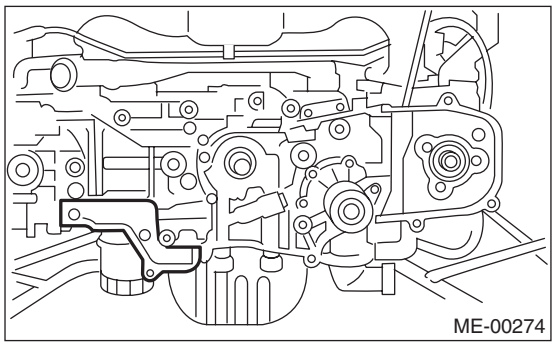



8) Install the timing belt cover No. 2 RH.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***

9) Install the timing belt cover No. 2 LH.

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***



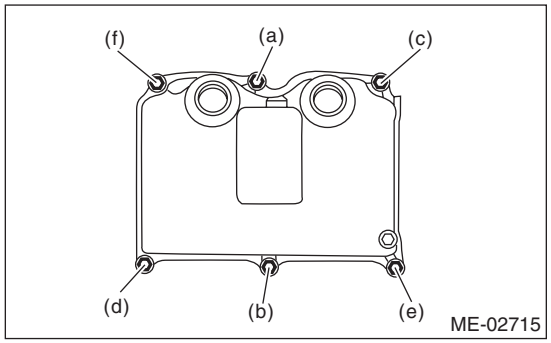

10) Install the cam sprocket. <Ref. to ME(H4SO)-55, INSTALLATION, Cam Sprocket.>
11) Install the timing belt. <Ref. to ME(H4SO)-51, INSTALLATION, Timing Belt.>
12) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
13) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

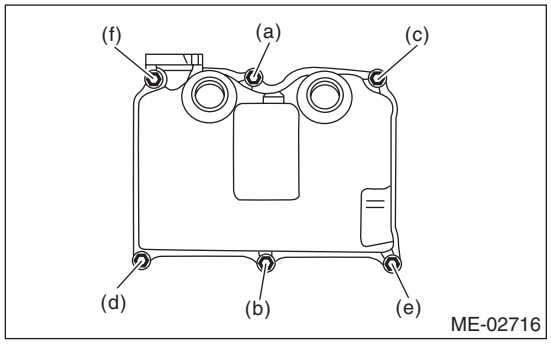
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

***Tightening torque:***
***1st***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***Second (only (a) and (b) are tightened)***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

RH side




LH side




(3) Connect the PCV hose.

14) Install the spark plug cords.

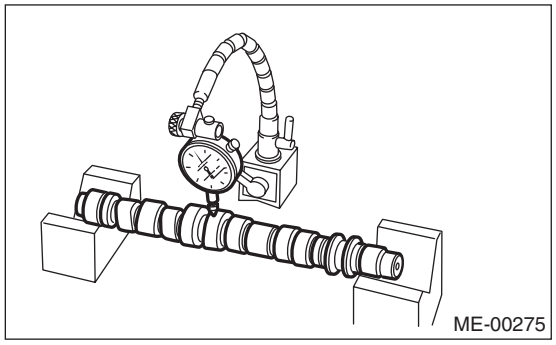
15) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>

16) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>

## C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

***Camshaft bend limit:***
***0.025 mm (0.00098 in)***




2) Check the journal for damage and wear. Replace if faulty.

3) Check the cam face condition, and remove the minor faults by grinding with oil stone. If offset wear occurs, replace it.

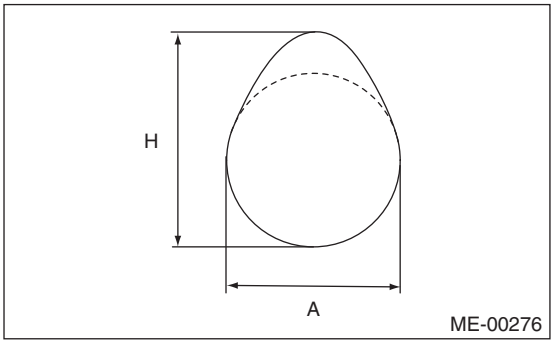
4) Measure the Cam height “H”, Cam base circle diameter “A”, and base circle step of adjacent intake cams (low speed and high speed). If it exceeds the standard or offset wear occurs, replace it.

***Cam lobe height H:***

| | | | Unit: mm (in) |
|---|---|---|---|
| Intake | Constant | Standard | 40.075 — 40.175 (1.5778 — 1.5817) |
| | Low speed | Standard | 35.496 — 35.596 (1.3975 — 1.4014) |
| | High speed | Standard | 40.315 — 40.415 (1.5872 — 1.5911) |
| Exhaust | | Standard | 39.289 — 39.389 (1.5468 — 1.5507) |

***Cam base circle diameter A:***
***Standard***
***34.00 mm (1.3386 in)***

***Base circle step of adjacent intake cams (low speed and high speed):***
***Standard***
***0.03 mm (0.001 in) or less***



5) Measure the outer diameter of camshaft journal and inner diameter of cylinder head journal, and check the difference (oil clearance) between the two values. If the oil clearance is not within the standard, replace the camshaft or cylinder head as necessary.

| | | Unit: mm (in) |
|---|---|---|
| Oil clearance | Standard | 0.055 — 0.090<br>(0.0022 — 0.0035) |
| Camshaft journal O.D. | Standard | 31.928 — 31.945<br>(1.2570 — 1.2577) |
| Journal hole I.D. | Standard | 32.000 — 32.018<br>(1.2598 — 1.2605) |

6) Measure the thrust clearance with setting the dial gauge at end surface of camshaft. If the thrust clearance is not within the standard or there is offset wear, replace the camshaft caps and cylinder head as a set. If necessary, replace the camshaft.

***Camshaft thrust clearance:***
***Standard***
***0.030 — 0.090 mm (0.0012 — 0.0035 in)***

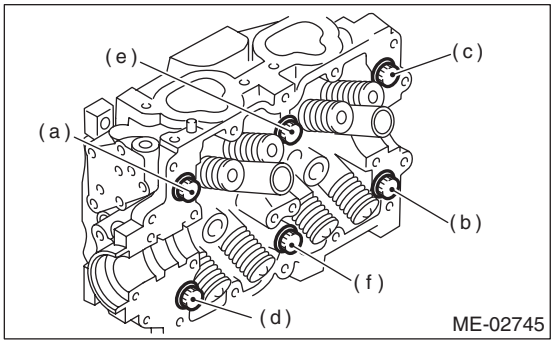
# 20.Cylinder Head

## A: REMOVAL

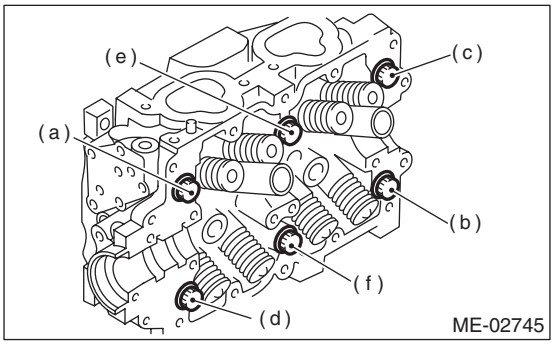
NOTE:
• When replacing a single part, perform the work with the engine installed to body. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
Front exhaust pipe <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

1) Remove the intake manifold. <Ref. to FU(H4SO)-16, REMOVAL, Intake Manifold.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
5) Remove the cam sprocket. <Ref. to ME(H4SO)-55, REMOVAL, Cam Sprocket.>
6) Remove the bolts which secure A/C compressor bracket to cylinder head.
7) Remove the valve rocker assembly. <Ref. to ME(H4SO)-57, REMOVAL, Valve Rocker Assembly.>
8) Remove the camshaft. <Ref. to ME(H4SO)-60, REMOVAL, Camshaft.>
9) Remove the oil level gauge guide. (LH side)
10) Remove the cylinder head bolts in alphabetical sequence as shown in the figure.

NOTE:
Leave bolts (a) and (c) engaged by three or four threads to prevent the cylinder head from falling.




11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (a) and (c) to remove cylinder head.



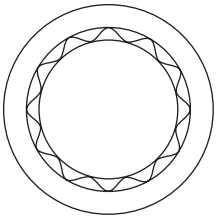
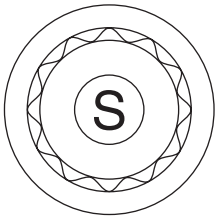
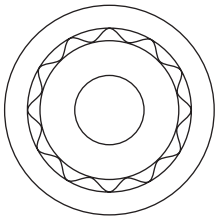
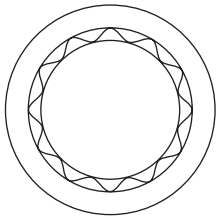

12) Remove the cylinder head gasket.

**CAUTION:**
**Be careful not to scratch the mating surface of cylinder head and cylinder block.**
13) Similarly, remove the right side cylinder head.

## B: INSTALLATION

1) Install the cylinder head to the cylinder block.

**CAUTION:**
- **Be careful not to scratch the mating surface of cylinder head and cylinder block.**
- **Be aware that the center bolts and corner bolts are different.**

| Bolt type | Center bolt | Corner bolt |
|---|---|---|
| Silver bolt |  FU-05486 Flat |   FU-05487 Indent + S |
| Black bolt |  FU-05488 $\phi$7 indent |  FU-05486 Flat |

NOTE:
Use a new cylinder head gasket.

(1) Clean the bolt threads and the bolt holes in the cylinder block

**CAUTION:**
**To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.**

(2) Apply a sufficient coat of engine oil to the washer and bolt thread.

(3) Tighten all bolts to 40 N·m (4.1 kgf-m, 29.5 ft-lb) in alphabetical order.

(4) Retighten all bolts to 95 N·m (9.7 kgf-m, 70.1 ft-lb) in alphabetical order.

**CAUTION:**
**If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be reused.**

(5) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.

(6) Tighten all bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in alphabetical order.

(7) Retighten all bolts to 30 N·m (3.1 kgf-m, 22.1 ft-lb) in alphabetical order.

(8) Retighten all bolts to 60 N·m (6.1 kgf-m, 44.3 ft-lb) in alphabetical order.

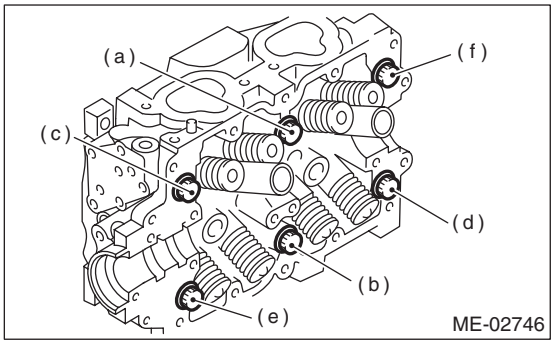
(9) Retighten all bolts by 80 — 90° in alphabetical order.

(10) Retighten all bolts by 40 — 45° in alphabetical order.

**CAUTION:**
**The tightening angle of the bolt should not exceed 45°.**

(11) Retighten bolts (a) and (b) by 40 — 45°.

**CAUTION:**
**Make sure the total "tightening angle" of steps (10) and (11) does not exceed 90°.**




2) Install the oil level gauge guide. (LH side)

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

3) Install the camshaft. <Ref. to ME(H4SO)-61, INSTALLATION, Camshaft.>
4) Install the valve rocker assembly. <Ref. to ME(H4SO)-57, INSTALLATION, Valve Rocker Assembly.>
5) Install the A/C compressor bracket on cylinder head.

***Tightening torque:***
***36 N·m (3.7 kgf-m, 26.6 ft-lb)***

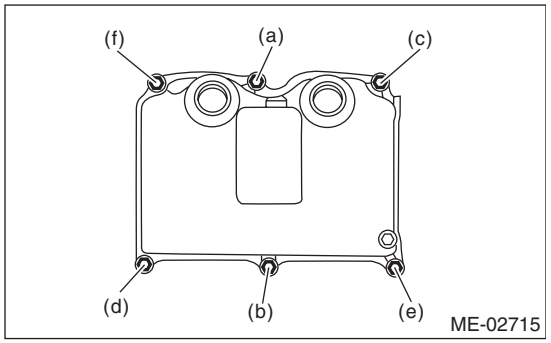
6) Install the cam sprocket. <Ref. to ME(H4SO)-55, INSTALLATION, Cam Sprocket.>
7) Install the timing belt. <Ref. to ME(H4SO)-51, INSTALLATION, Timing Belt.>
8) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
9) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

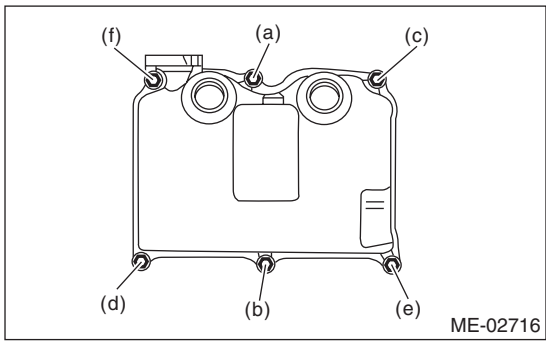
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

***Tightening torque:***
***1st***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***Second (only (a) and (b) are tightened)***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

RH side




LH side



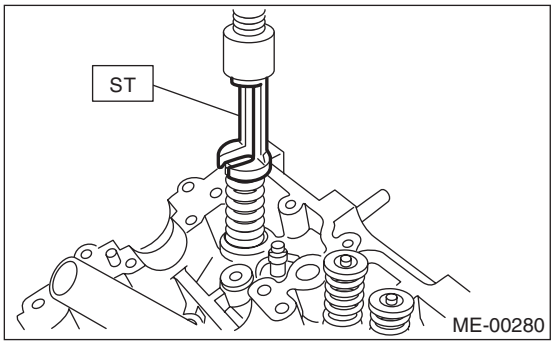

10) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
11) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
12) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>

## C: DISASSEMBLY

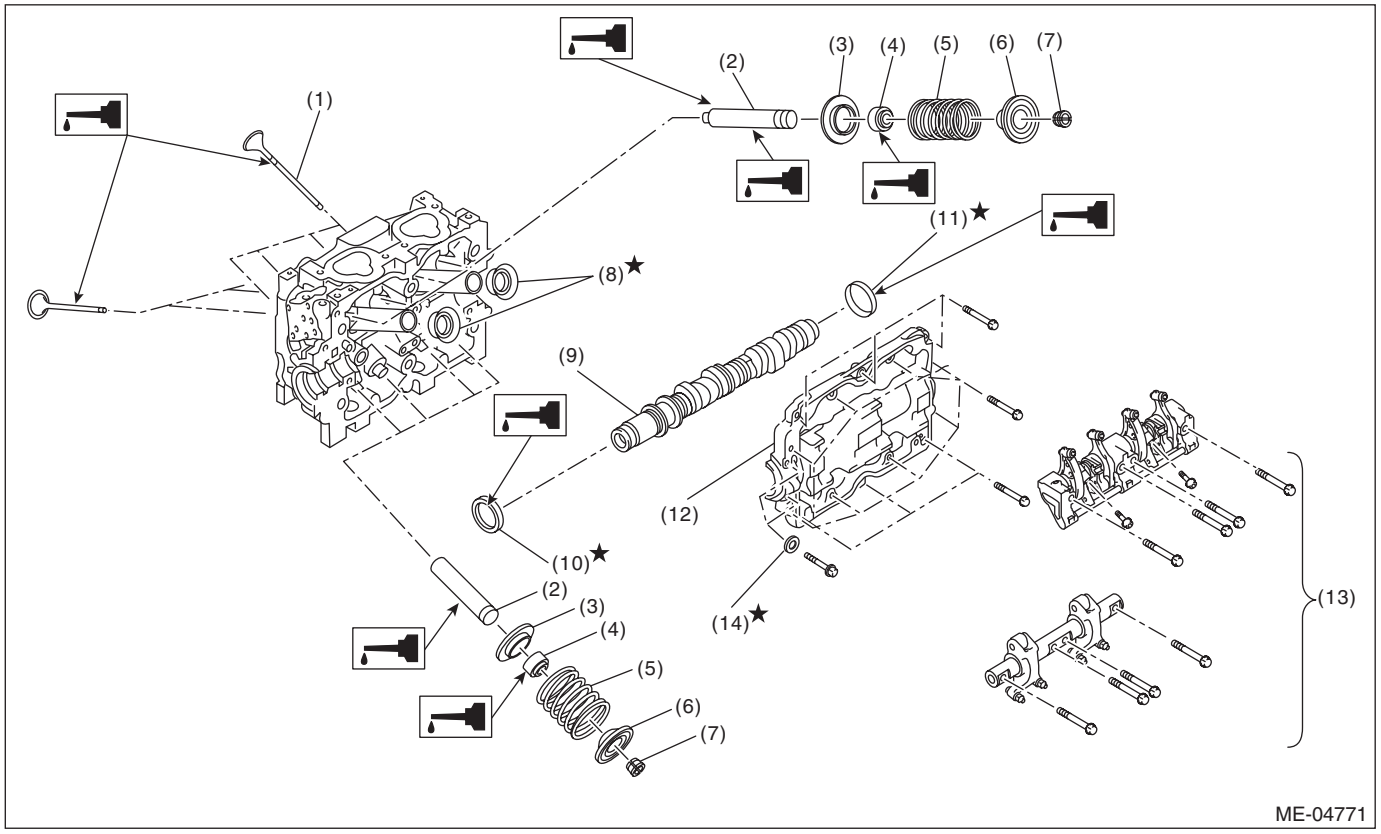
1) Place the cylinder head on the ST.
ST 498267800 CYLINDER HEAD TABLE
2) Compress the valve spring and remove the valve spring retainer key using ST. Remove each valve and valve spring.
ST 499718000 VALVE SPRING REMOVER

NOTE:
- Keep all the removed parts in order for re-installing in their original positions.
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.

• For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to “INSPECTION”. <Ref. to ME(H4SO)-70, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(H4SO)-73, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>




## D: ASSEMBLY




(1) Valve
(2) Valve guide
(3) Valve spring seat
(4) Oil seal
(5) Valve spring
(6) Retainer
(7) Retainer key
(8) Spark plug pipe gasket
(9) Camshaft
(10) Oil seal
(11) Plug
(12) Camshaft cap
(13) Valve rocker ASSY
(14) Seal washer

1) Install the valve spring and valve.
(1) Coat the stem of each valve with engine oil and insert the valve into valve guide.

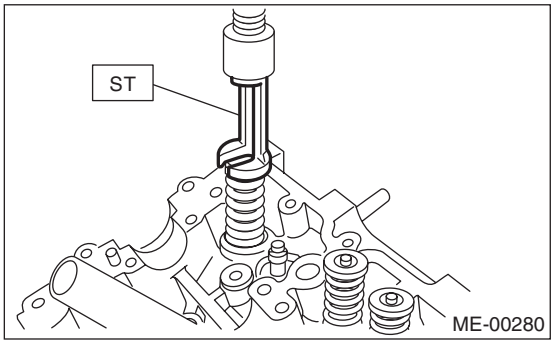
NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(2) Set the cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE

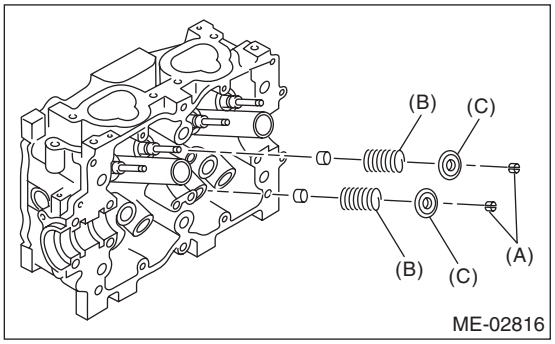
(3) Install the valve spring and retainer.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(4) Set the ST on valve spring.
ST 499718000 VALVE SPRING REMOVER




(5) Compress the valve spring and fit the valve spring retainer key.




(A) Retainer key
(B) Valve spring
(C) Retainer

(6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

# E: INSPECTION

## 1. CYLINDER HEAD

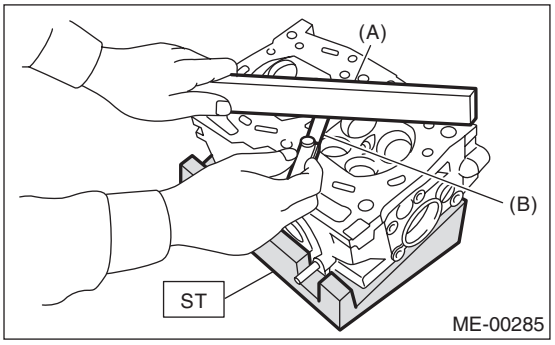
1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures.
Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Place the cylinder head on the ST.
ST 498267800 CYLINDER HEAD TABLE
3) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B).
If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

***Warping limit:***
***0.035 mm (0.0014 in)***

***Grinding limit:***
***0.1 mm (0.004 in)***

***Standard height of cylinder head:***
***97.5 mm (3.84 in)***

NOTE:
Uneven torque for the cylinder head bolts can cause warpage. When reassembling, pay special attention to the torque so as to tighten evenly.

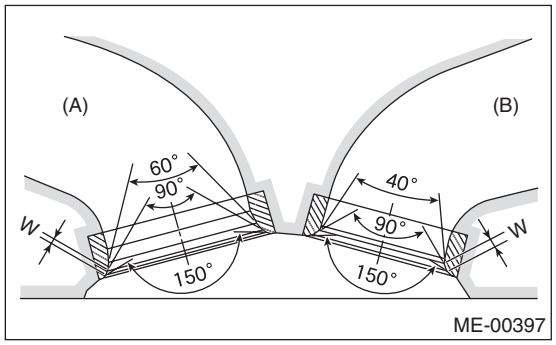


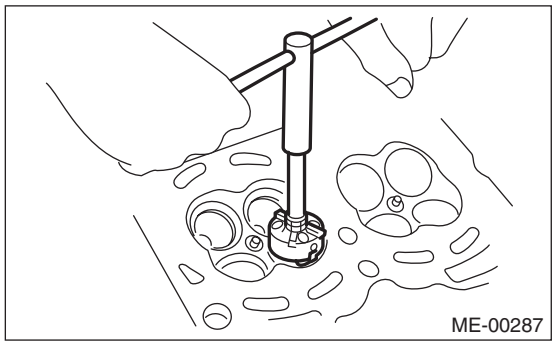
## 2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

***Contacting width W between valve and valve seat:***

***Standard***
***Intake (A)***
***0.8 — 1.4 mm (0.03 — 0.055 in)***
***Exhaust (B)***
***1.2 — 1.8 mm (0.047 — 0.071 in)***



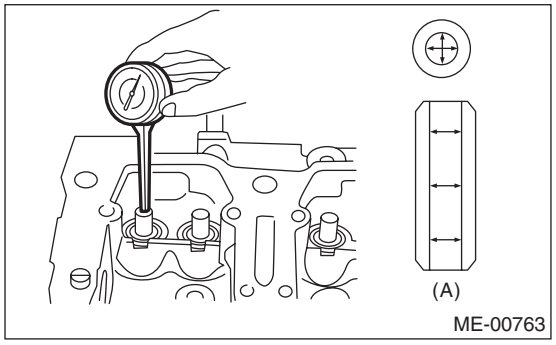




## 3. VALVE GUIDE

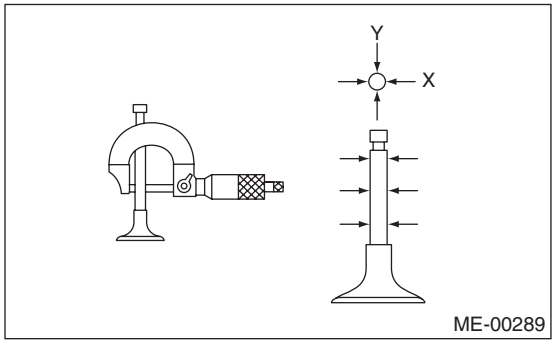
1) Check the clearance between valve guide and valve stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

***Clearance between the valve guide and valve stem:***

***Standard***
***Intake***
***0.035 — 0.062 mm (0.0014 — 0.0024 in)***
***Exhaust***
***0.040 — 0.067 mm (0.0016 — 0.0026 in)***




(A) Valve guide




2) If the clearance between the valve guide and valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows greater amount of wear or damage. See the following procedure for valve guide replacement.

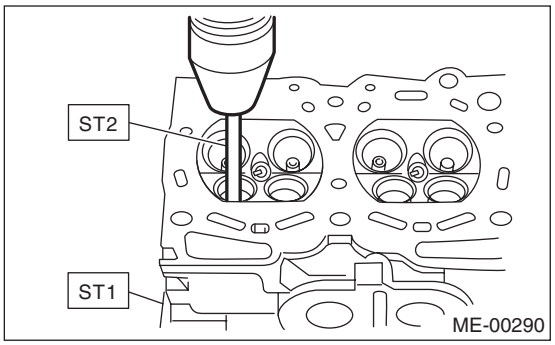
***Valve guide inner diameter:***
***6.000 — 6.012 mm (0.2362 — 0.2367 in)***

***Valve stem outer diameters:***
***Intake***
***5.950 — 5.965 mm (0.2343 — 0.2348 in)***
***Exhaust***
***5.945 — 5.960 mm (0.2341 — 0.2346 in)***

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

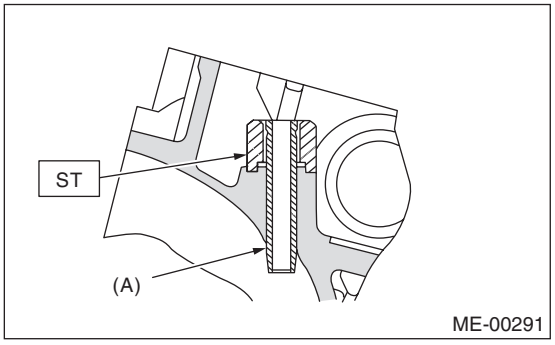
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267800 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER




(3) Turn the cylinder head upside down and place the ST as shown in the figure.

Intake side
ST 499767700 VALVE GUIDE ADJUSTER
Exhaust side
ST 499767800 VALVE GUIDE ADJUSTER

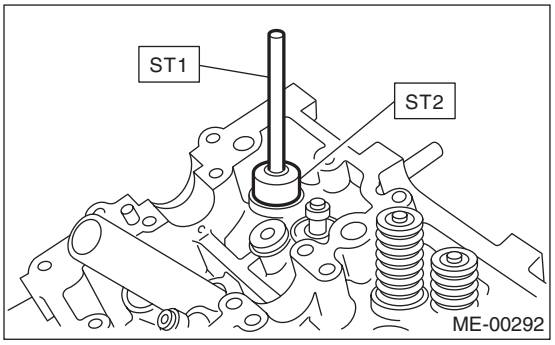



(A) Valve guide

(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

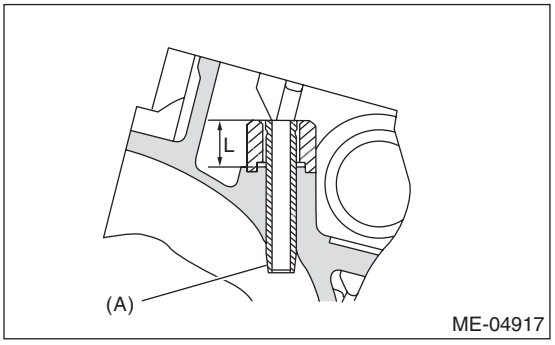
(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
Intake side
ST2 499767700 VALVE GUIDE ADJUSTER
Exhaust side
ST2 499767800 VALVE GUIDE ADJUSTER




(6) Check the valve guide protrusion amount "L".

***Amount of valve guide protrusion L:***
***Intake***
***20.3 — 20.7 mm (0.799 — 0.815 in)***
***Exhaust***
***16.8 — 17.2 mm (0.661 — 0.677 in)***

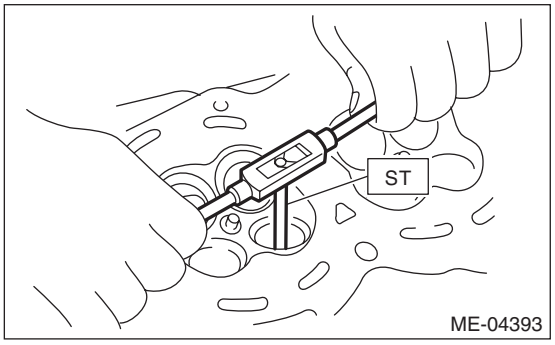



(A) Valve guide

(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

NOTE:
• Apply engine oil to the ST when reaming.
• If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.

• If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.
ST 499767400 VALVE GUIDE REAMER




(8) After reaming, clean the valve guide to remove chips.
(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

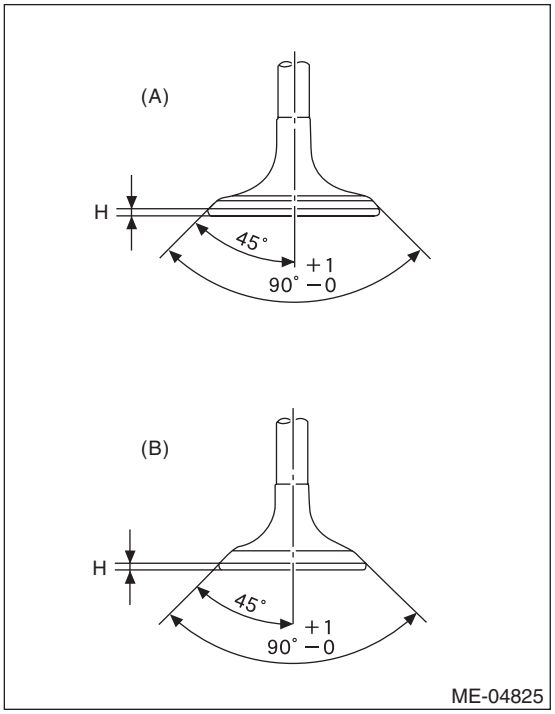
## 4. INTAKE AND EXHAUST VALVE

1) Inspect the flange of valve and valve stem, and replace the valve with a new part if damaged, worn, deformed, or if dimension "H" in the figure is outside of the specified limit.

***Head edge thickness H:***

***Intake (A)***
***Standard***
***0.8 — 1.2 mm (0.03 — 0.047 in)***

***Exhaust (B)***
***Standard***
***1.0 — 1.4 mm (0.039 — 0.055 in)***




2) Put a small amount of grinding compound on the valve seat surface, and lap the valve and valve seat surface. Replace with a new valve oil seal after lapping.

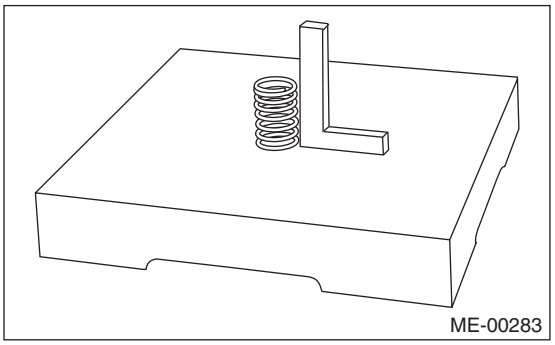
NOTE:
It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

***Valve overall length:***
***Intake***
***120.6 mm (4.75 in)***
***Exhaust***
***121.7 mm (4.79 in)***

## 5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.
2) To measure the squareness of the valve spring, stand the valve spring on a surface plate and measure its deflection at the top of the valve spring using a try square.

| | | |
|---|---|---|
| Free length mm (in) | | 55.2 (2.173) |
| Tension/ spring height N (kgf, lb)/mm (in) | Set | 235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/45.0 (1.772) |
| | Lift | 578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/34.7 (1.366) |
| Squareness | | 2.5°, 2.4 mm (0.094 in) or less |



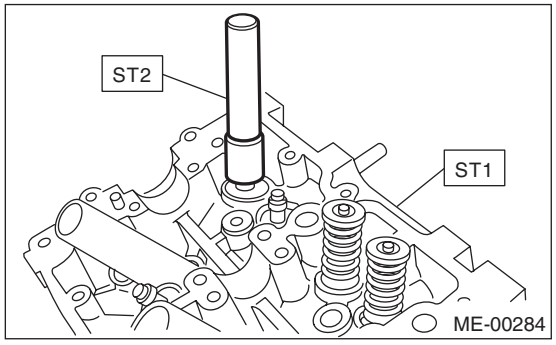
## 6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part.
See the procedure 2) and subsequent for replacement procedures.
- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.
ST1 498267800 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

NOTE:
- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

***Color of rubber part:***
***Intake [Gray]***
***Exhaust [Green]***

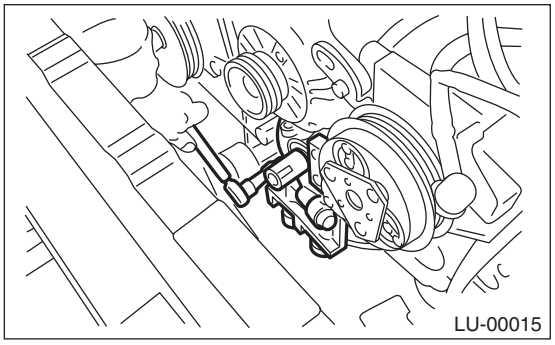


# 21.Cylinder Block

## A: REMOVAL

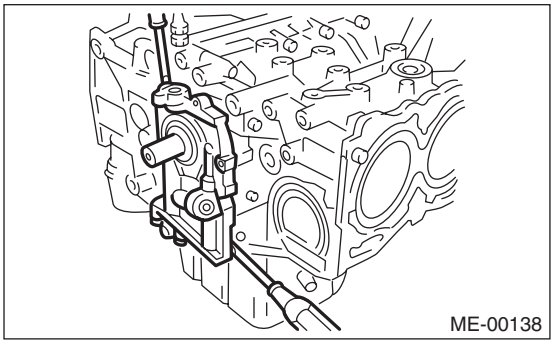
NOTE:
Before conducting this procedure, drain the engine oil completely.
1) Remove the engine from the vehicle. <Ref. to ME(H4SO)-30, REMOVAL, Engine Assembly.>
2) Remove the intake manifold. <Ref. to FU(H4SO)-16, REMOVAL, Intake Manifold.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
6) Remove the crank sprocket. <Ref. to ME(H4SO)-56, REMOVAL, Crank Sprocket.>
7) Remove the generator and A/C compressor with their brackets.
8) Remove the cylinder head. <Ref. to ME(H4SO)-65, REMOVAL, Cylinder Head.>
9) Remove the drive plate. (AT model) <Ref. to 4AT-64, REMOVAL, Drive Plate.>
10) Remove the clutch disc and cover. (MT model) <Ref. to CL-9, REMOVAL, Clutch Disc and Cover.>
11) Remove the flywheel. (MT model) <Ref. to CL-11, REMOVAL, Flywheel.>
12) Remove the oil separator cover.
13) Remove the water by-pass pipe for heater.
14) Remove the water pump. <Ref. to CO(H4SO)-15, REMOVAL, Water Pump.>
15) Remove the bolts which secure oil pump to cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.




16) Remove the oil pump from cylinder block using a flat tip screwdriver.

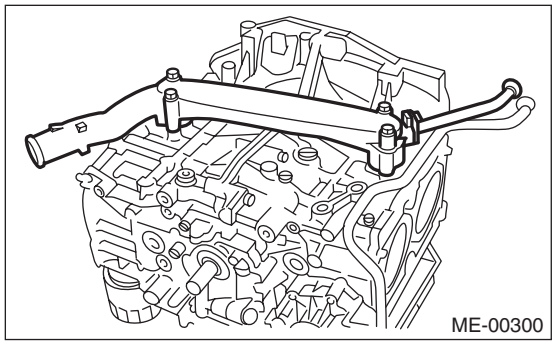
**CAUTION:**
**Be careful not to scratch the mating surface of cylinder block and oil pump.**

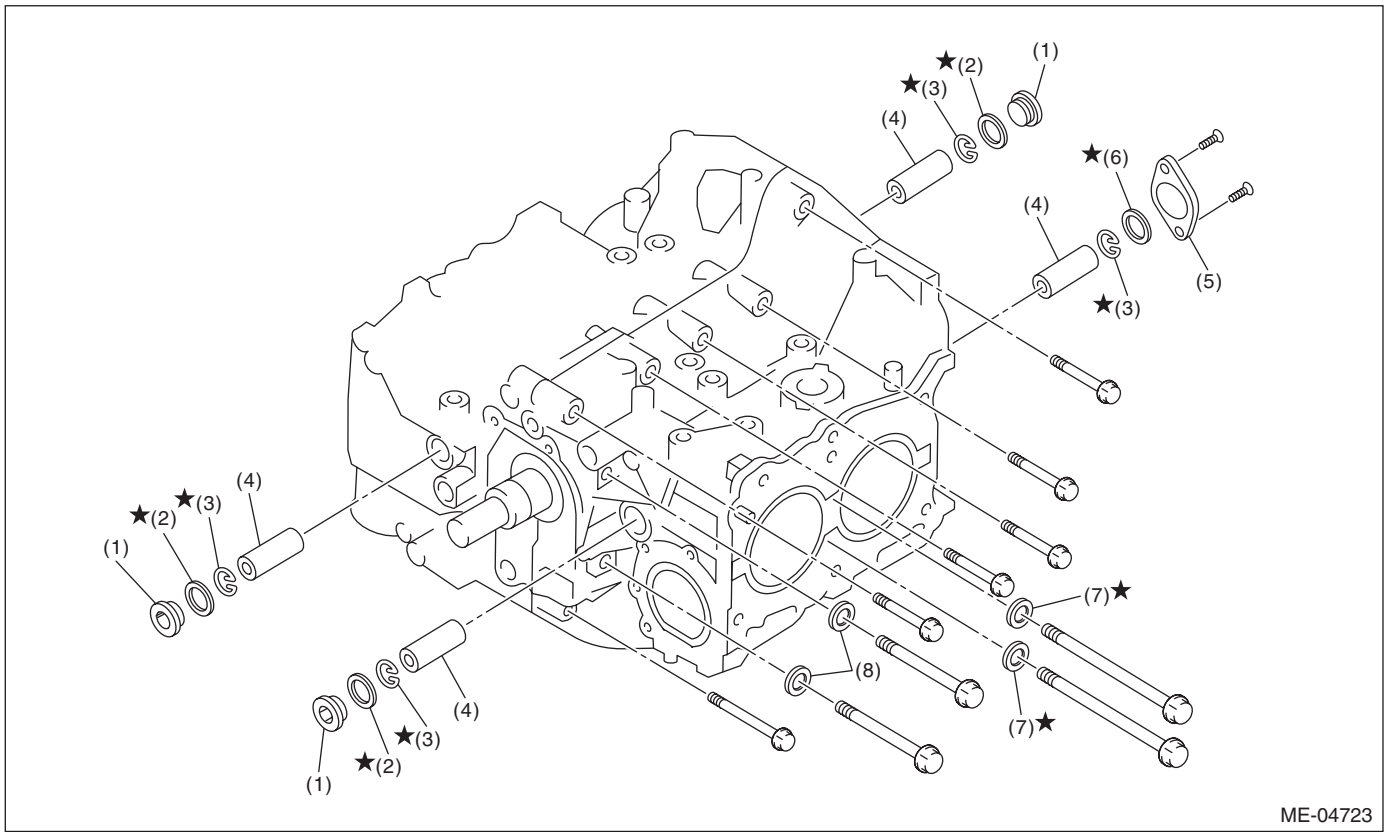



17) Remove the front oil seal from the oil pump.
18) Remove the oil pan.
(1) Set the part so that the cylinder block LH is on the upper side.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

**CAUTION:**
**Do not use a screwdriver or similar tools in place of oil pan cutter.**
19) Remove the oil strainer.
20) Remove the baffle plate.
21) Remove the oil filter. <Ref. to LU(H4SO)-21, REMOVAL, Engine Oil Filter.>

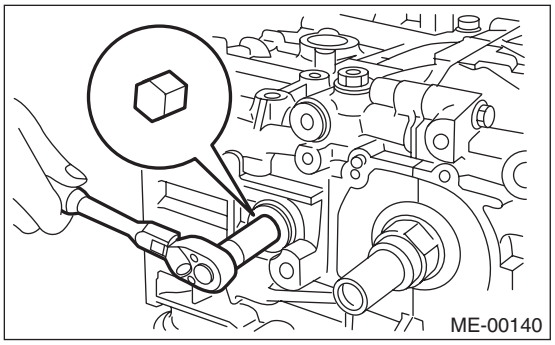
22) Remove the water pipe assembly.



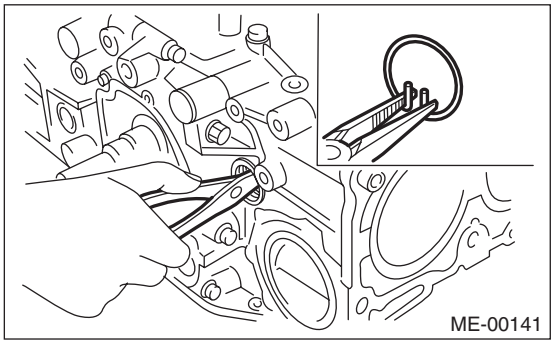




(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring
(7) Seal washer
(8) Washer

23) Remove the service hole plugs using a hexagon wrench [14 mm].



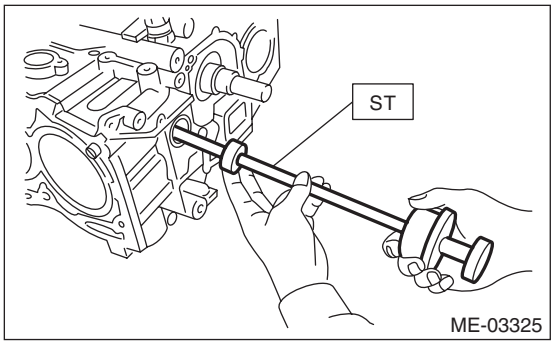

24) Remove the service hole cover.
25) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.




26) Draw out the piston pin from #1 and #2 pistons using ST.

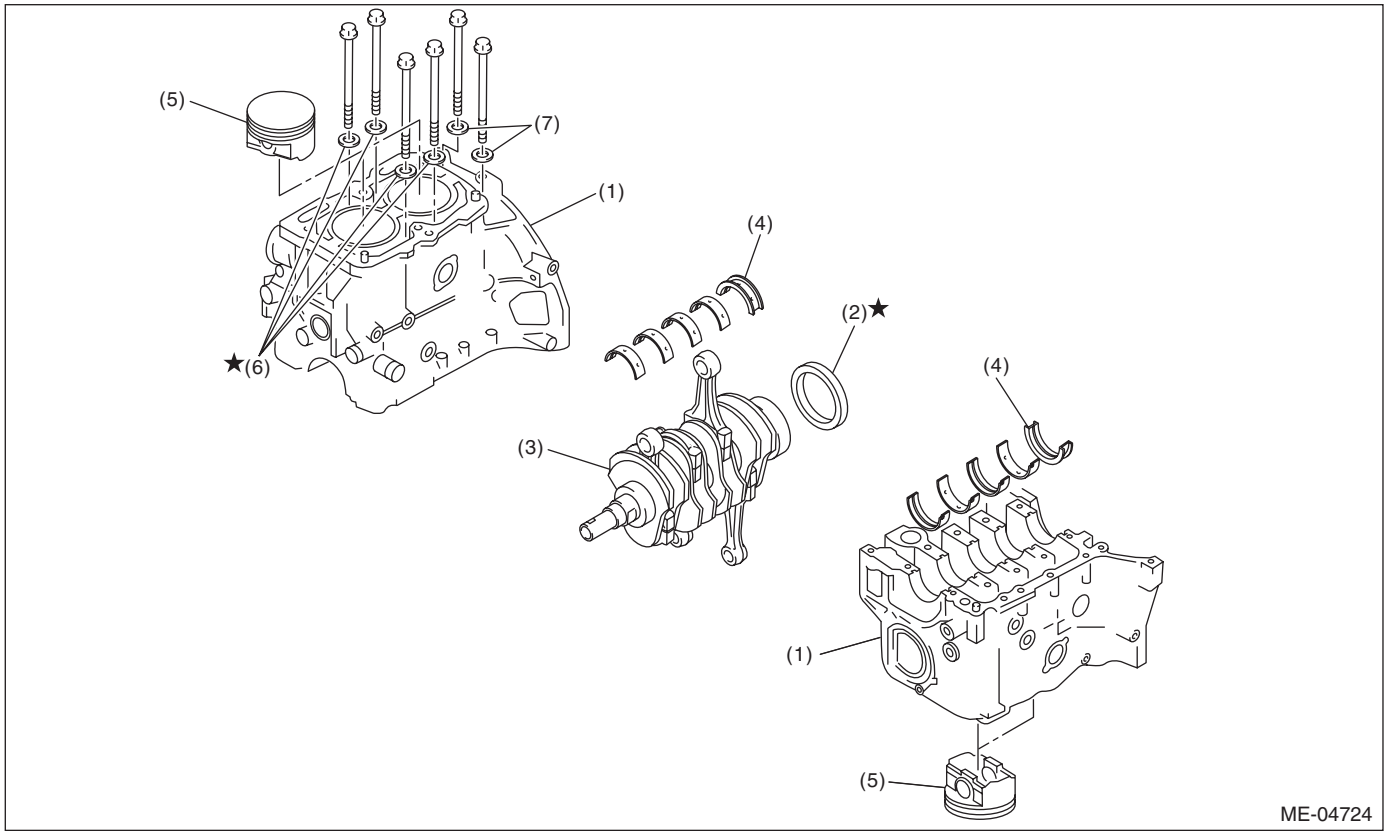
ST 18320AA010 PISTON PIN REMOVER ASSY

NOTE:
• PISTON PIN REMOVER ASSY (499097700) can also be used.
• Be careful not to confuse the original combination of piston, piston pin and cylinder.




27) Similarly draw out the piston pins from #3 and #4 pistons.
28) Remove the cylinder block connecting bolt on the RH side.
29) Loosen the cylinder block connecting bolt on the LH side by 2 to 3 turns.
30) Set the part so that the cylinder block LH is on the upper side, and remove the cylinder block connecting bolt.
31) Separate the cylinder block LH and RH.

NOTE:
When separating the cylinder block, do not allow the connecting rod to fall or damage the cylinder block.




(1) Cylinder block
(2) Rear oil seal
(3) Crankshaft
(4) Crankshaft bearing
(5) Piston
(6) Seal washer
(7) Washer

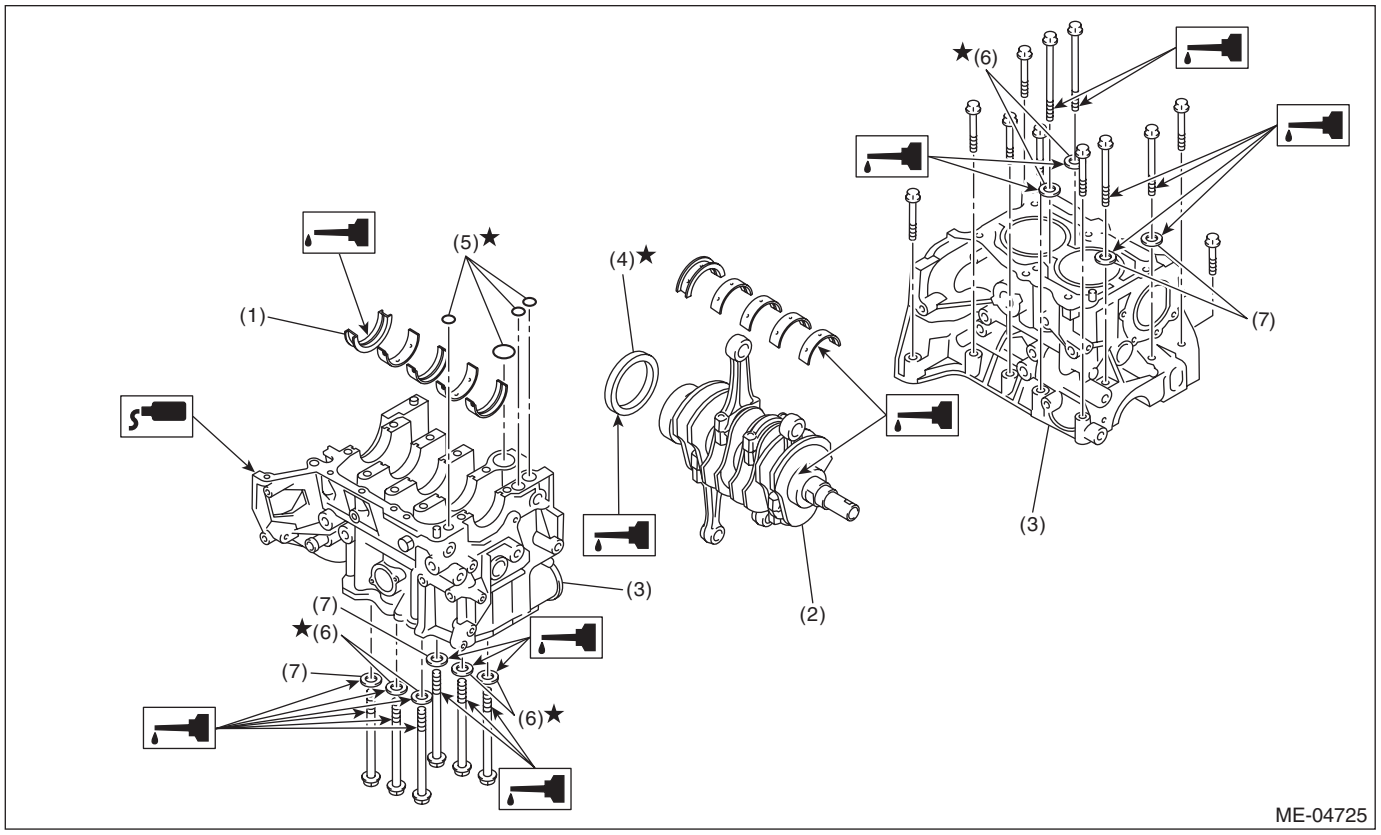
32) Remove the rear oil seal.
33) Remove the crankshaft together with connecting rod.
34) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:
• Press the crankshaft bearing at the end opposite to locking lip to remove.
• Be careful not to confuse the crankshaft bearing combination.

35) Remove each piston from the cylinder block using a wooden bar or hammer handle.

NOTE:
Be careful not to confuse the original combination of piston and cylinder.

## B: INSTALLATION



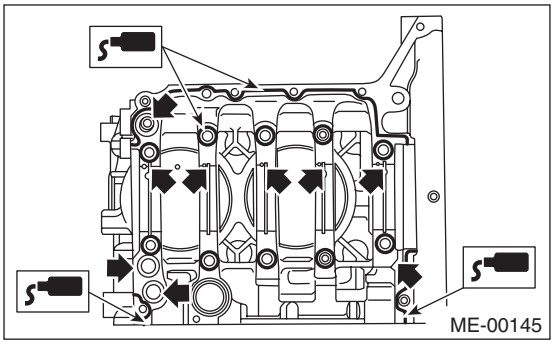

(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal
(5) O-ring
(6) Seal washer
(7) Washer

1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
2) Position the crankshaft and O-ring on cylinder block RH.

NOTE:
Use new O-rings.
3) Apply liquid gasket to the mating surfaces of cylinder block RH, and position cylinder block LH.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.

***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***

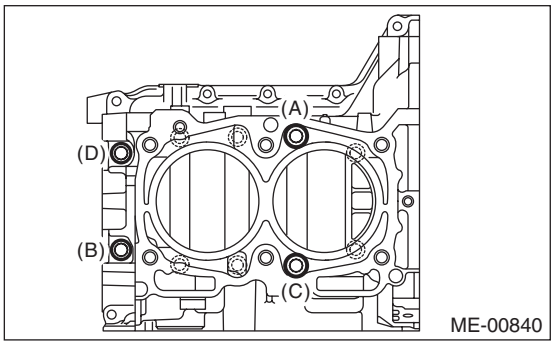



4) Apply a coat of engine oil to the washer and bolt thread.

NOTE:
Use a new seal washer.

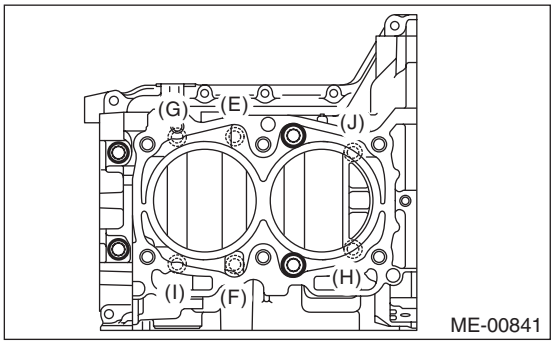
5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

***Tightening torque:***
***10 N·m (1.0 kgf-m, 7.4 ft-lb)***



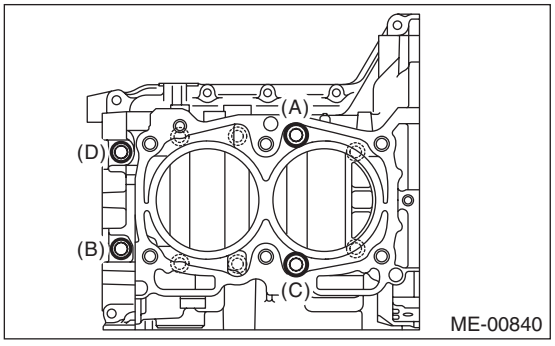

6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

***Tightening torque:***
***10 N·m (1.0 kgf-m, 7.4 ft-lb)***



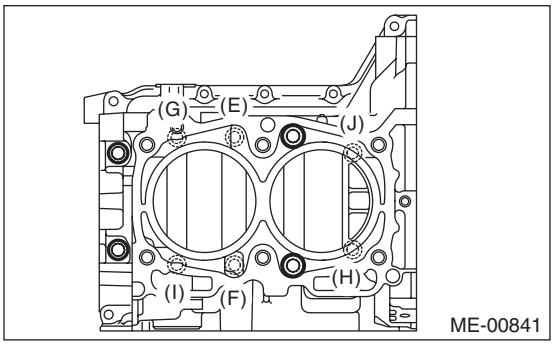

7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***




8) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***



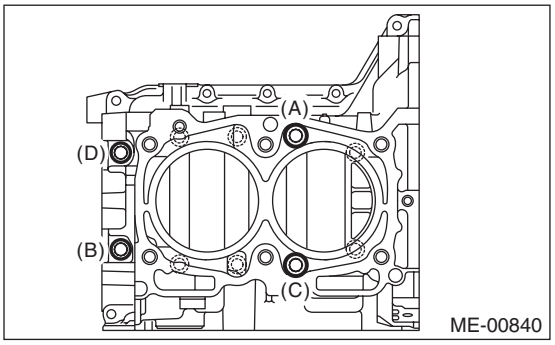

9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

***Tightening angle:***
***90°***

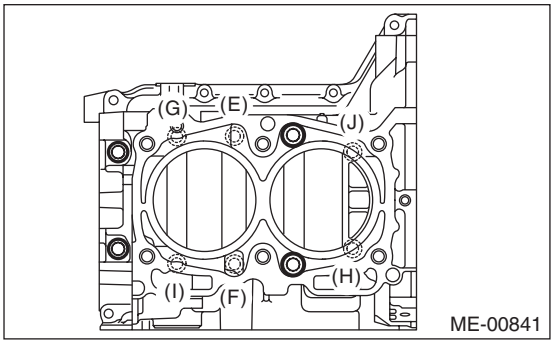
- (B), (D): Torque tightening

***Tightening torque:***
***40 N·m (4.1 kgf-m, 29.5 ft-lb)***



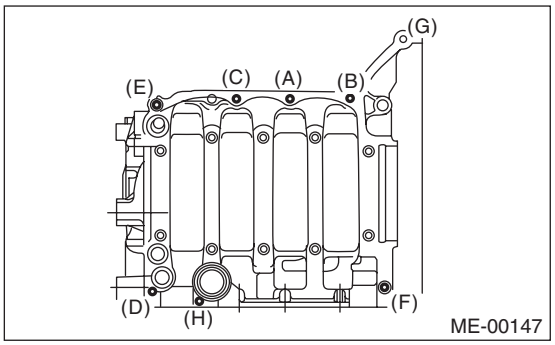

10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

***Tightening angle:***
***90°***



11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

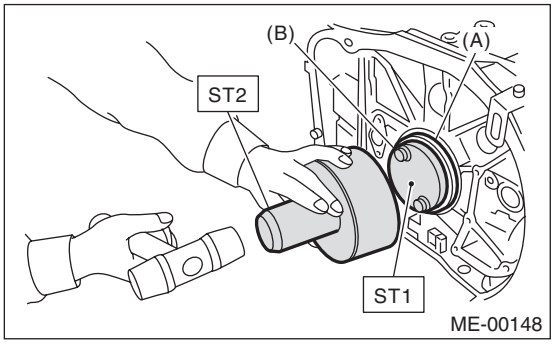
***Tightening torque:***
***(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)***
***(H): 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




12) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

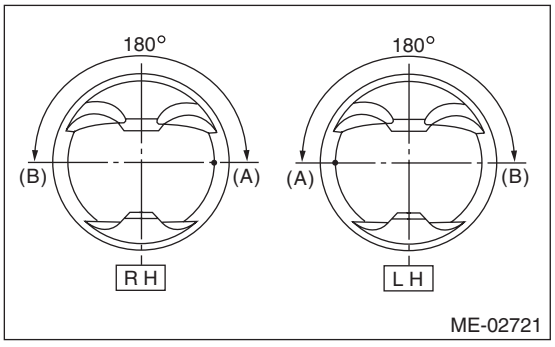
NOTE:
Use a new rear oil seal.

| | | |
|---|---|---|
| ST1 | 499597100 | CRANKSHAFT OIL SEAL GUIDE |
| ST2 | 499587200 | CRANKSHAFT OIL SEAL INSTALLER |

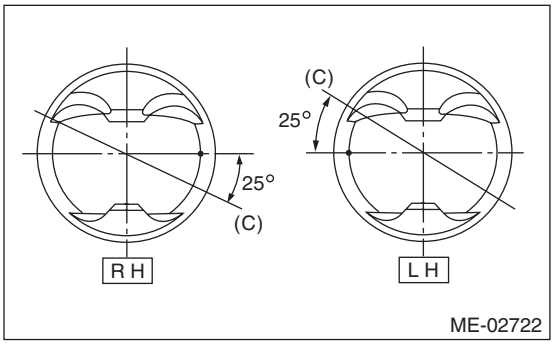



(A) Rear oil seal
(B) Flywheel attaching bolt

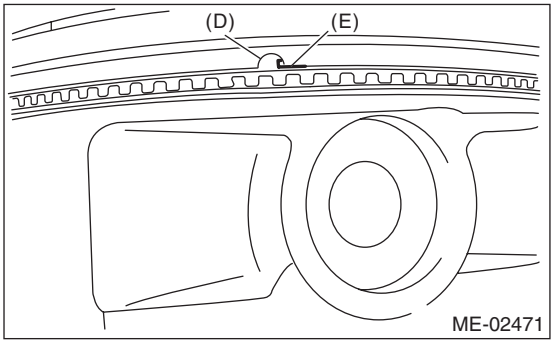
13) Position the top ring gap at (A) or (B) in the figure.
14) Position the second ring gap at 180° on the reverse side the top ring gap.



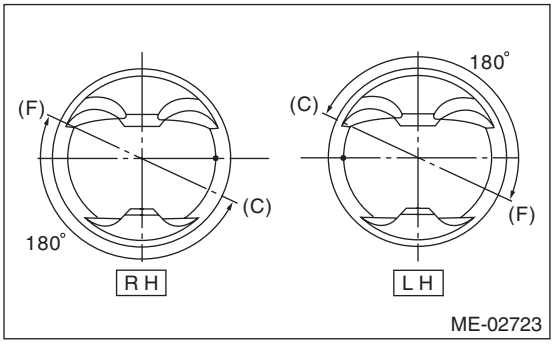

15) Position the upper rail gap at (C) in the figure.



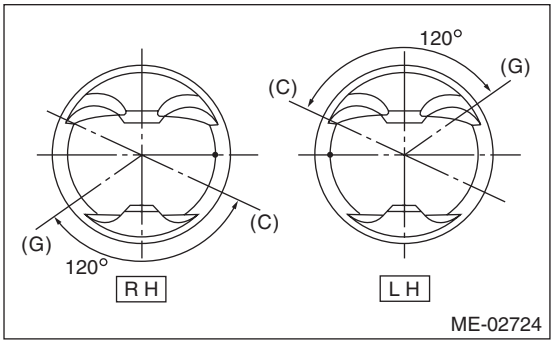

16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.




17) Position the expander gap at (F) on the 180° opposite direction of (C) in the figure.



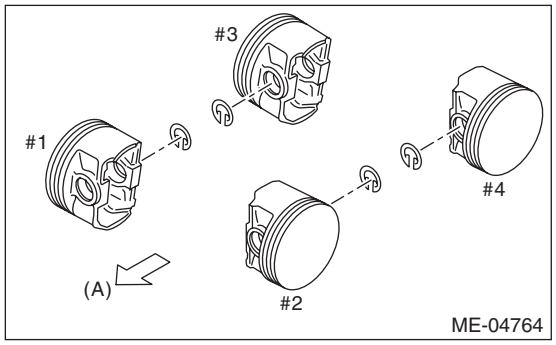

18) Set the lower rail gap at position (G), located 120° clockwise from (C).



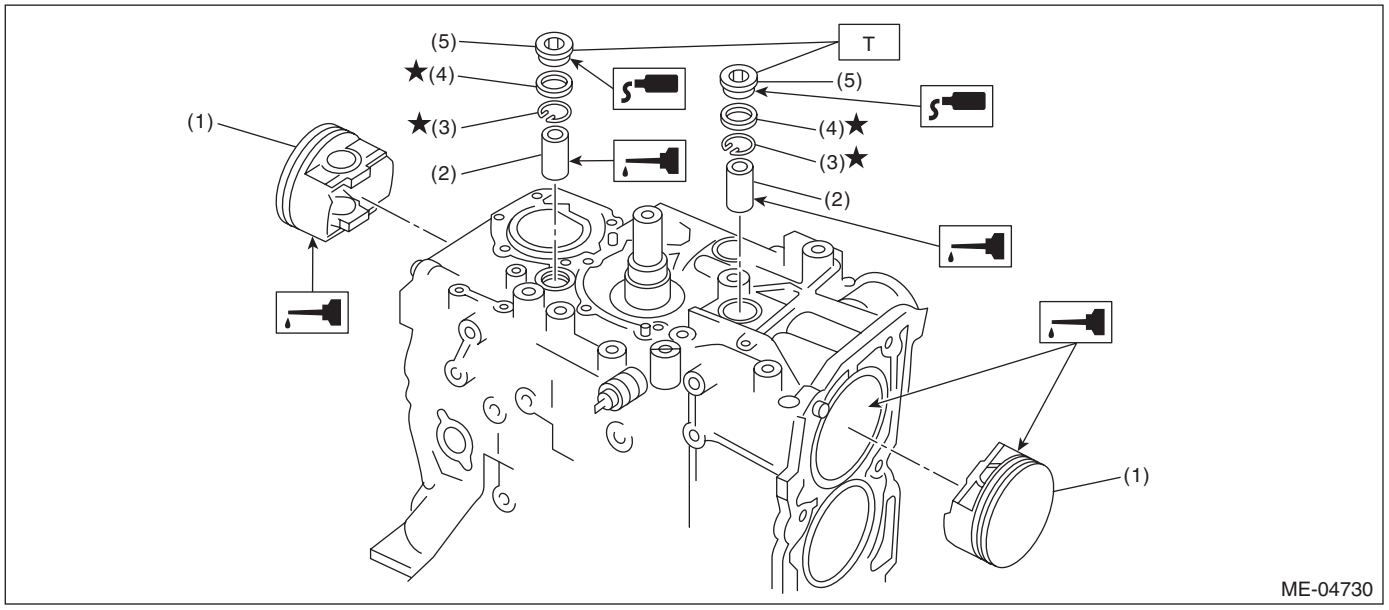

NOTE:
• Make sure ring gaps do not face the same direction.
• Make sure ring gaps are not within the piston skirt area.

19) Install the snap ring.
Before positioning the piston on the cylinder block, attach the snap ring in the service hole of the cylinder block, and the piston hole on the opposite side.

NOTE:
Use new snap rings.




(A) Front side




(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug

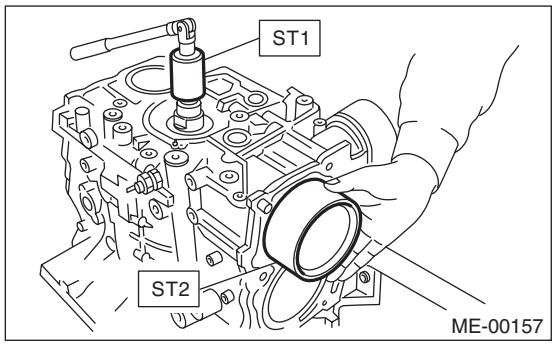
***Tightening torque:N·m (kgf-m, ft-lb)***
***T: 70 (7.1, 51.6)***

20) Install the piston.
(1) Set the parts so that the #1 and #2 cylinders are on the upper side.
(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

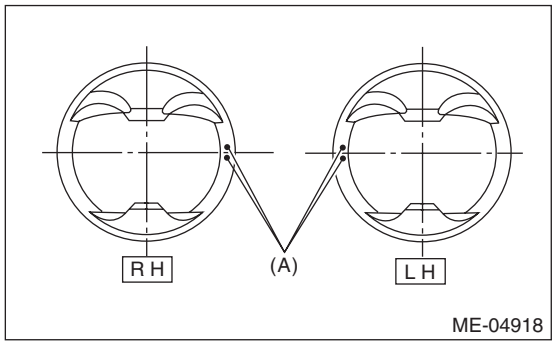
ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



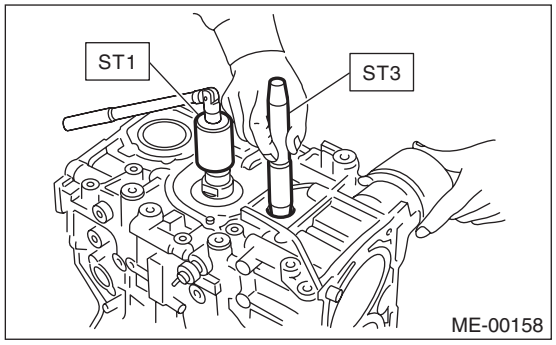

NOTE:
Face the piston front mark towards the front of the engine.




(A) Front mark

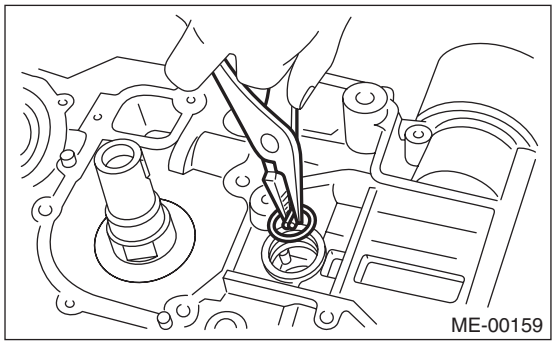
21) Install the piston pin.
(1) Apply a coat of engine oil to ST3.
(2) Insert ST3 into the service hole to align piston pin hole with connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



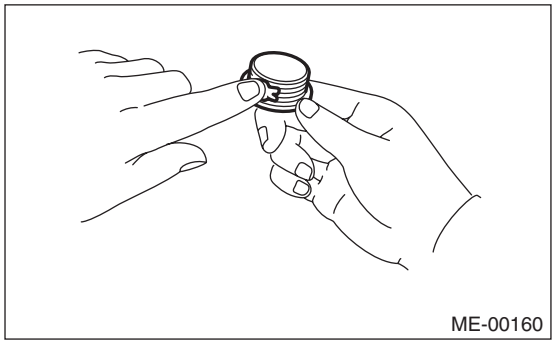

(3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
(4) Install the snap ring.

NOTE:
Use new snap rings.




(5) Apply liquid gasket to the threaded portion of the service hole plug.

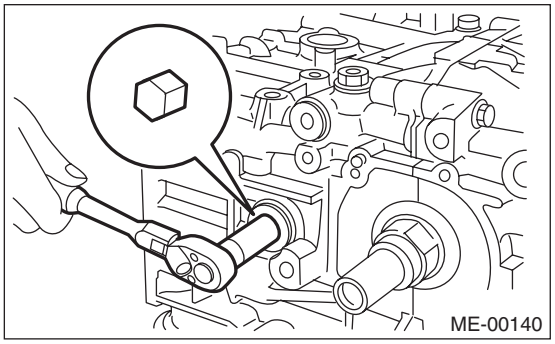
***Liquid gasket:***
***THREE BOND 1105 (Part No. 004403010) or equivalent***

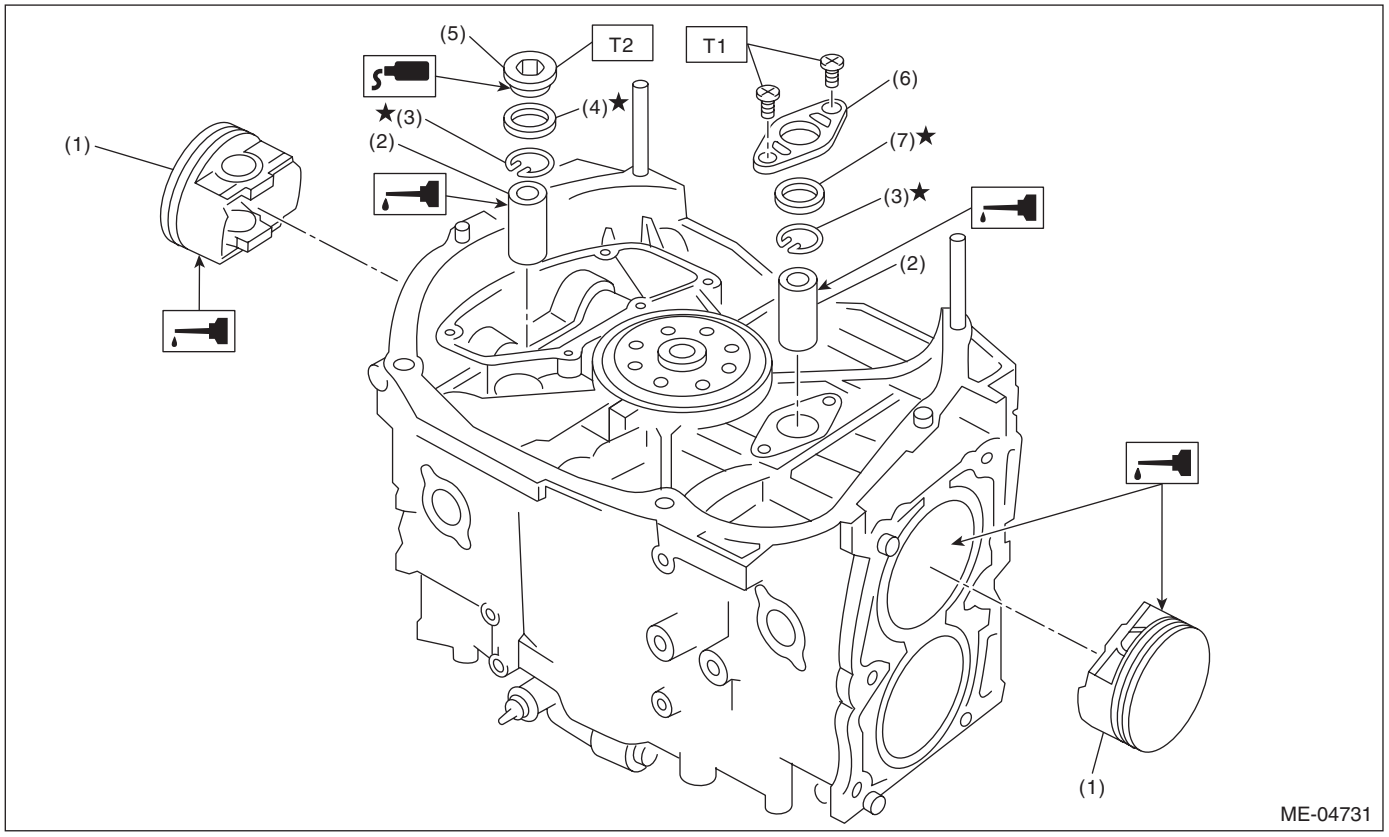



(6) Install the service hole plug and gasket.

NOTE:
Use a new gasket.

***Tightening torque:***
***70 N·m (7.1 kgf-m, 51.6 ft-lb)***




(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug
(6) Service hole cover
(7) O-ring

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 6.4 (0.7, 4.7)***
***T2: 70 (7.1, 51.6)***

(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
(8) Install the service hole cover.

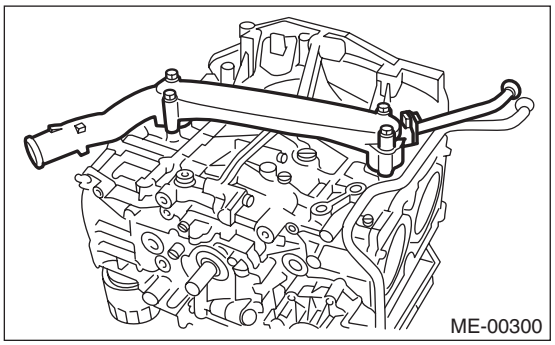
NOTE:
Use new O-rings.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

22) Install the water pipe assembly.

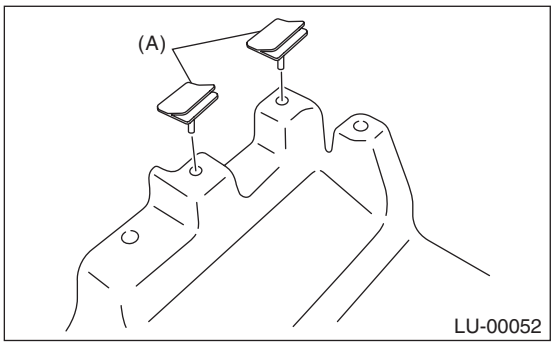
NOTE:
Use new O-rings.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




23) Install the baffle plate.

NOTE:
- Use a new seal.
- Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.




***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

24) Install the oil strainer.

NOTE:
Use new O-rings.

***Tightening torque:***
***10 N·m (1.0 kgf-m, 7.4 ft-lb)***

25) Tighten the oil strainer stay together with the baffle plate.

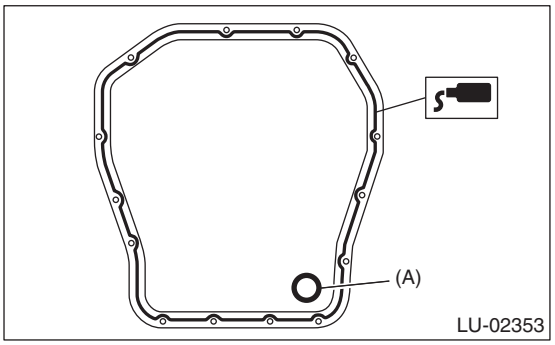
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

26) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
Install within 5 min. after applying liquid gasket.

***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***

***Tightening torque:***
***5 N·m (0.5 kgf-m, 3.7 ft-lb)***



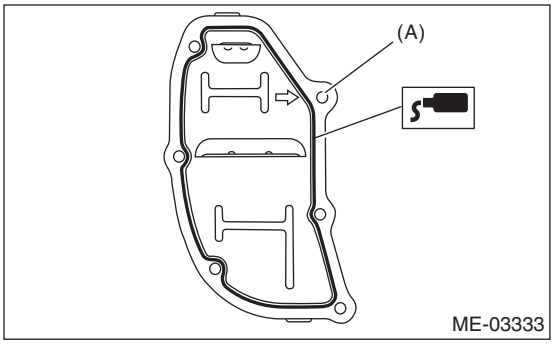

(A) Gasket

27) Apply liquid gasket to the mating surfaces of the oil separator cover and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Use new oil separator cover.

***Liquid gasket:***
- ***Mating surface***
  ***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***
- ***(A) bolt thread (when reusing bolts)***
  ***THREE BOND 1324 (Part No. 004403042) or equivalent***

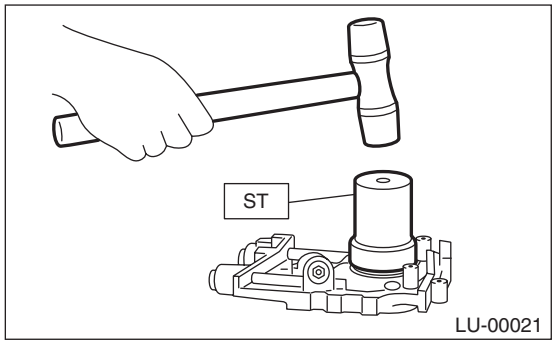
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




28) Install the drive plate. (AT model) <Ref. to 4AT-64, INSTALLATION, Drive Plate.>
29) Install the flywheel. (MT model) <Ref. to CL-11, INSTALLATION, Flywheel.>

30) Install the clutch disc and cover. (MT model) <Ref. to CL-9, INSTALLATION, Clutch Disc and Cover.>
31) Install the oil pump.
(1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

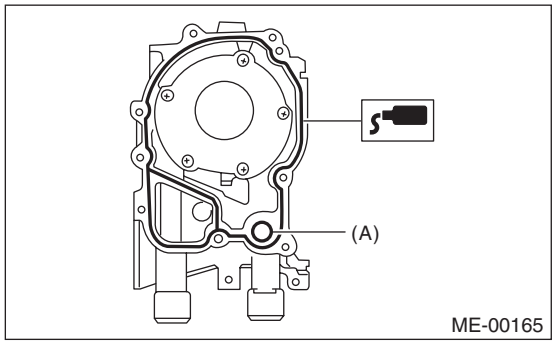
NOTE:
Use a new front oil seal.




(2) Apply liquid gasket to the mating surfaces of oil pump.

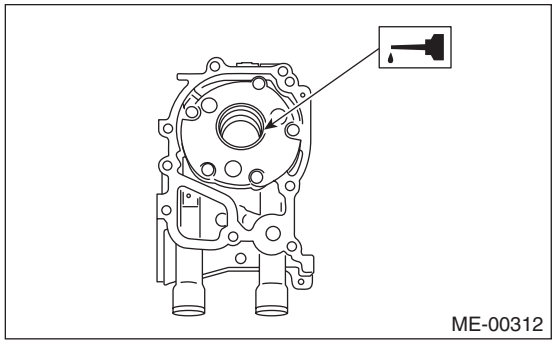
NOTE:
Install within 5 min. after applying liquid gasket.

***Liquid gasket:***
***THREE BOND 1217G (Part No. K0877Y0100) or equivalent***




(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



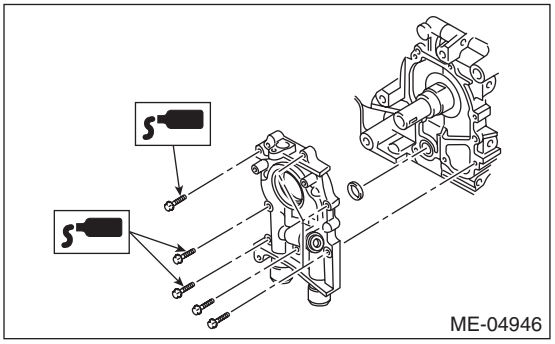

(4) Install the oil pump to cylinder block.

**CAUTION:**
**• Be careful not to damage the front oil seal during installation.**
**• Make sure the front oil seal lip is not folded.**

NOTE:
• Align the flat surface of oil pump's inner rotor with crankshaft before installation.
• Use new O-rings.
• Do not forget to assemble O-rings.
(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***

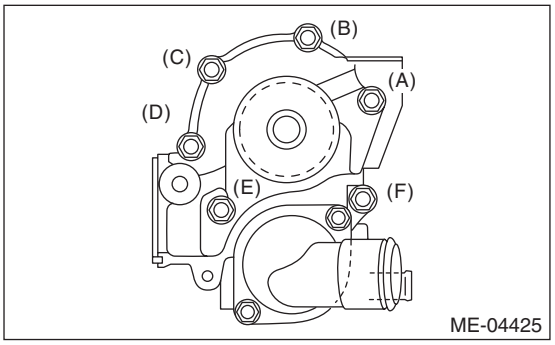
***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***




32) Install the water pump and gasket.

NOTE:
• When installing the water pump, tighten bolts in two stages in alphabetical order as shown in the figure.
• Use a new gasket.

***Tightening torque:***
***First: 12 N·m (1.2 kgf-m, 8.9 ft-lb)***
***Second: 12 N·m (1.2 kgf-m, 8.9 ft-lb)***




33) Install the water by-pass pipe for heater.

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

34) Install the oil filter.
<Ref. to LU(H4SO)-21, INSTALLATION, Engine Oil Filter.>
35) Install the cylinder head. <Ref. to ME(H4SO)-66, INSTALLATION, Cylinder Head.>
36) Install the generator and A/C compressor with their brackets.

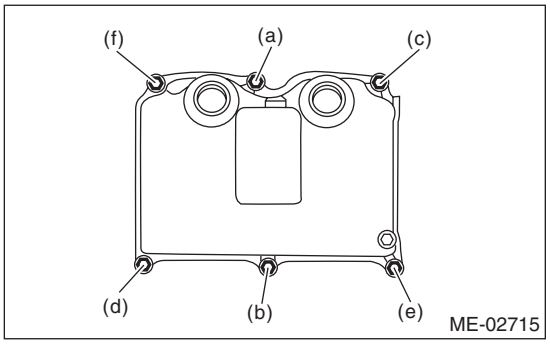
***Tightening torque:***
***36 N·m (3.7 kgf-m, 26.6 ft-lb)***
37) Install the crank sprocket. <Ref. to ME(H4SO)-56, INSTALLATION, Crank Sprocket.>
38) Install the timing belt. <Ref. to ME(H4SO)-51, INSTALLATION, Timing Belt.>
39) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
40) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

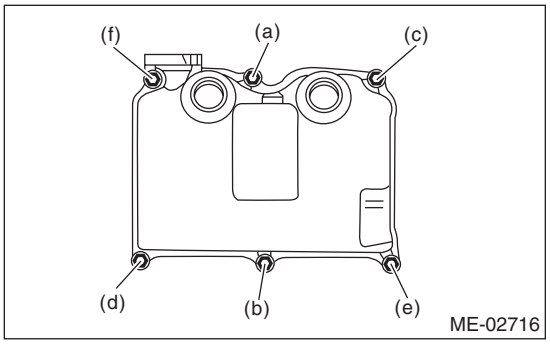
(2) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order in two steps.

***Tightening torque:***
***1st***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***Second (only (a) and (b) are tightened)***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***

RH side

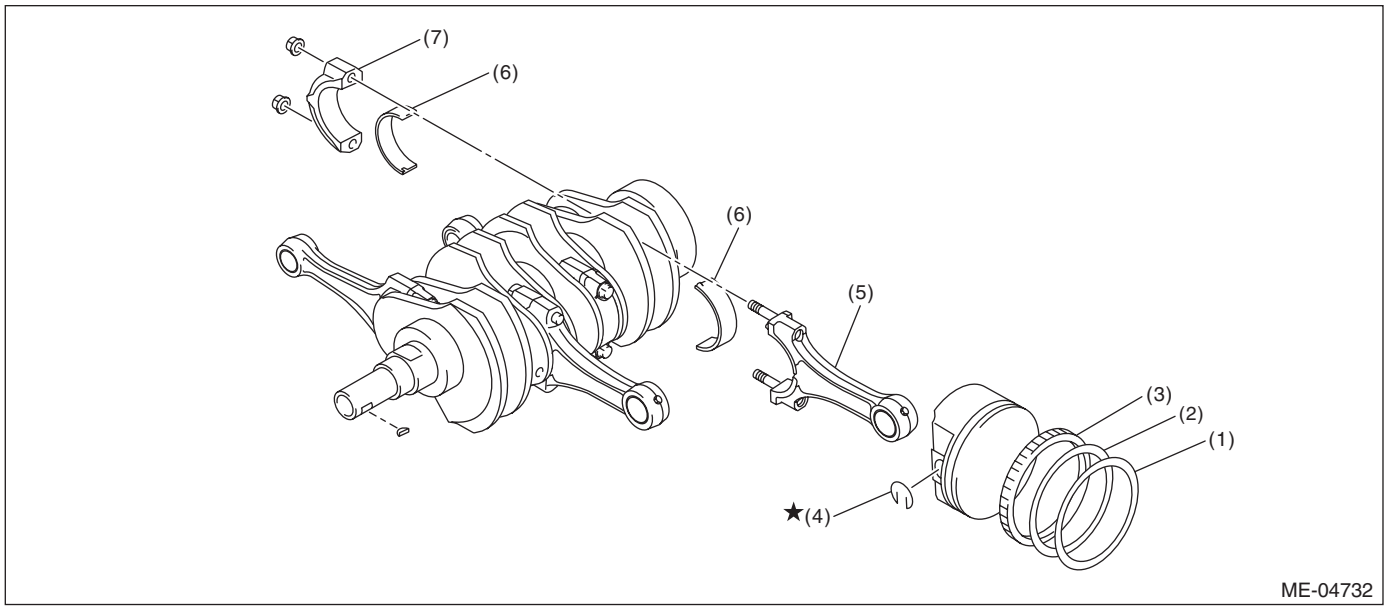



LH side




41) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>
42) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
43) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>
44) Install the engine to the vehicle. <Ref. to ME(H4SO)-33, INSTALLATION, Engine Assembly.>

## C: DISASSEMBLY




(1) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Connecting rod
(6) Connecting rod bearing
(7) Connecting rod cap

1) Remove the connecting rod cap.
2) Remove the connecting rod bearing.

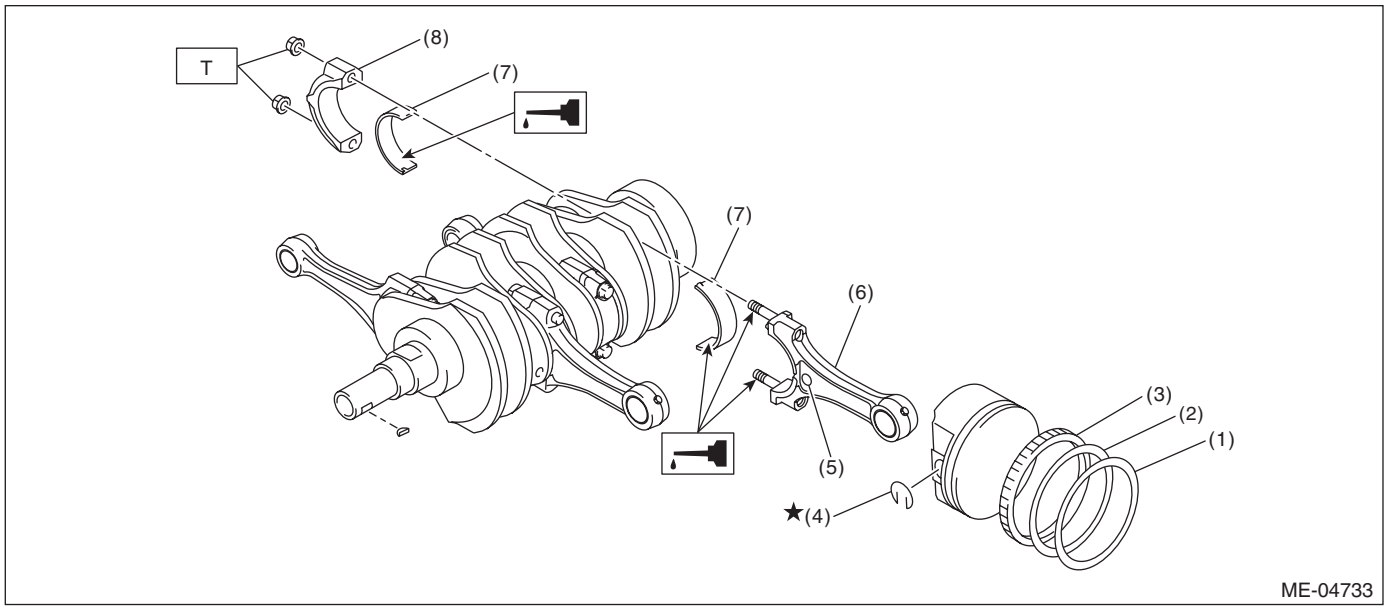
NOTE:
Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

3) Remove the piston rings using piston ring expander.
4) Remove the oil ring by hand.

NOTE:
Arrange the removed piston rings in proper order, to prevent confusion.

5) Remove the snap ring.

## D: ASSEMBLY




(1) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Side mark
(6) Connecting rod
(7) Connecting rod bearing
(8) Connecting rod cap

***Tightening torque:N·m (kgf-m, ft-lb)***
***T: 45 (4.6, 33.2)***

1) Apply engine oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
2) Position each connecting rod with the side with a side mark facing forward, and install it.
3) Attach the connecting rod cap, and tighten with connecting rod nut.
Make sure the arrow on connecting rod cap faces the front during installation.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
• When tightening the connecting rod nuts, apply oil on the threads.

***Tightening torque:***
***45 N·m (4.6 kgf-m, 33.2 ft-lb)***
4) Install the oil ring upper rail, expander and lower rail by hand.
5) Install the second ring and top ring using piston ring expander.

NOTE:
Assemble so that the piston ring mark “R” faces the top side of the piston.

## E: INSPECTION

### 1. CYLINDER BLOCK

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Check the oil passages for clogging.
3) Inspect the cylinder head surface that mates with cylinder block for warping by using a straight edge, and correct by grinding if necessary.

***Warping limit:***
***0.025 mm (0.00098 in)***

***Grinding limit:***
***0.1 mm (0.004 in)***

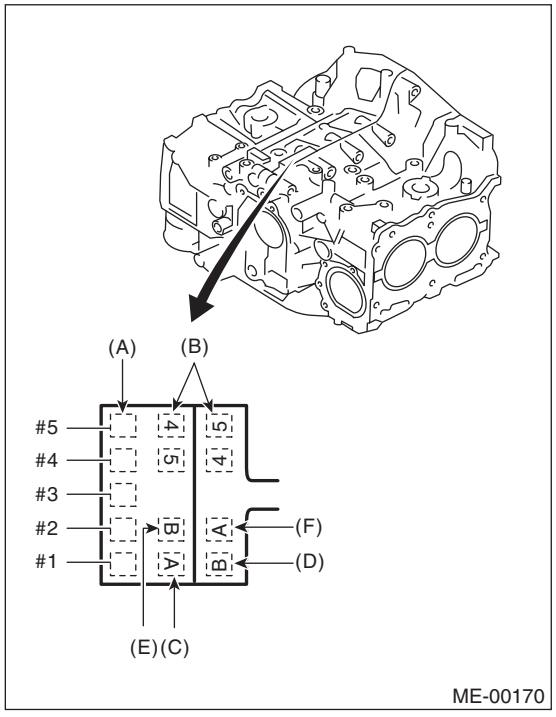
***Standard height of cylinder block:***
***201.0 mm (7.91 in)***

## 2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the front upper face of the cylinder block.

NOTE:
• Measurement should be performed at a temperature of 20°C (68°F).
• Standard sized pistons are classified into two grades, “A” and “B”. These grades should be used as guide lines in selecting a standard piston.

***Standard diameter:***
***A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)***
***B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)***



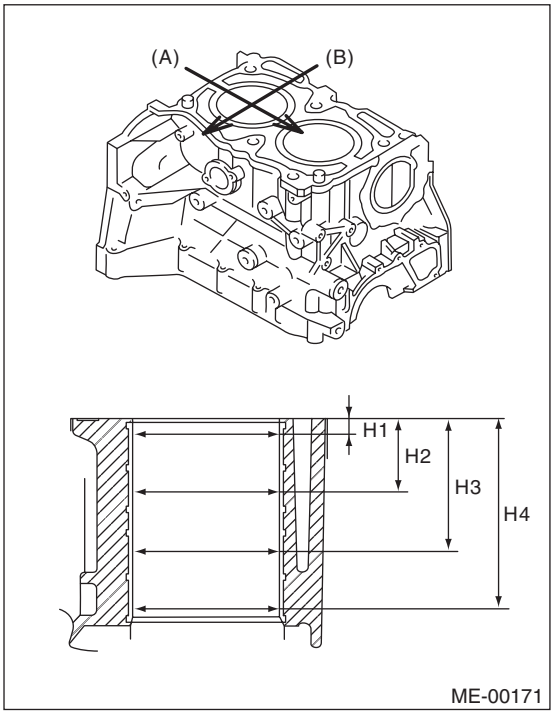

(A) Main journal size mark
(B) Cylinder block (RH) — (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

2) Measure inner diameter of each cylinder.
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

***Cylindricality:***
***Standard***
***0.015 mm (0.0006 in)***

***Out-of-roundness:***
***Standard***
***0.010 mm (0.0004 in)***




(A) Piston pin direction
(B) Thrust direction
H1 10 mm (0.39 in)
H2 45 mm (1.77 in)
H3 80 mm (3.15 in)
H4 115 mm (4.53 in)

3) When the piston is to be replaced due to general or cylinder wear, select a suitable sized piston by measuring the piston clearance.

4) Measure outer diameter of each piston.
Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

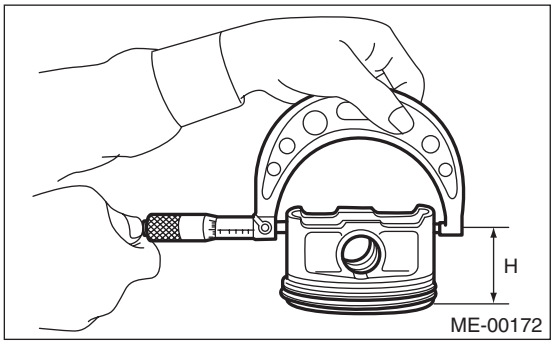
***Piston grade point H:***
***38.2 mm (1.504 in)***

***Piston outer diameter:***

***Standard***
***A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)***
***B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)***

***0.25 mm (0.0098 in) oversize***
***99.745 — 99.765 mm (3.9270 — 3.9277 in)***

***0.50 mm (0.0197 in) oversize***
***99.995 — 100.015 mm (3.9368 — 3.9376 in)***




5) Calculate the clearance between cylinder and piston.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

***Clearance between cylinder and piston at 20°C (68°F):***
***Standard***
***–0.010 — 0.010 mm (–0.00039 — 0.00039 in)***

6) Boring and honing
(1) If any of the measured value of cylindricality, out-of-roundness or cylinder-to-piston clearance is out of standard or if there is any damage on the cylinder wall, rebore it to replace with an oversize piston.

**CAUTION:**
**When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and replaced with oversize pistons.**

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

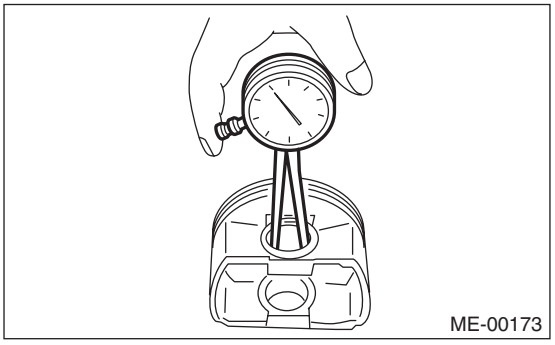
NOTE:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

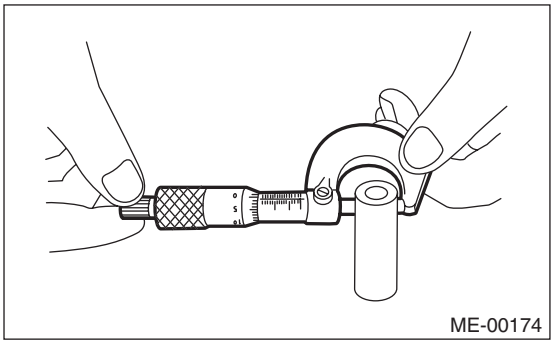
***Cylinder inner diameter boring limit:***
***To 100.005 mm (3.9372 in)***

## 3. PISTON AND PISTON PIN

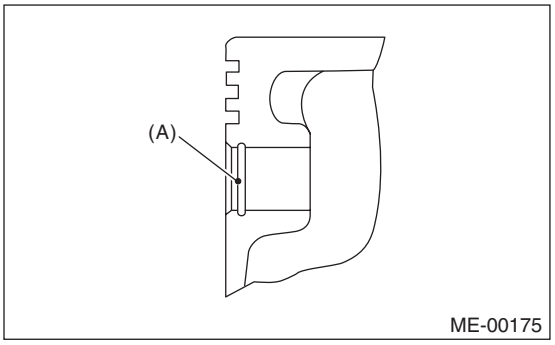
1) Check the piston and piston pin for damage, cracks or wear. Replace if faulty.
2) Check the piston ring groove for wear or damage. Replace if faulty.
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

***Clearance between piston pin hole and piston pin:***
***Standard***
***0.004 — 0.008 mm (0.0002 — 0.0003 in)***




4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.

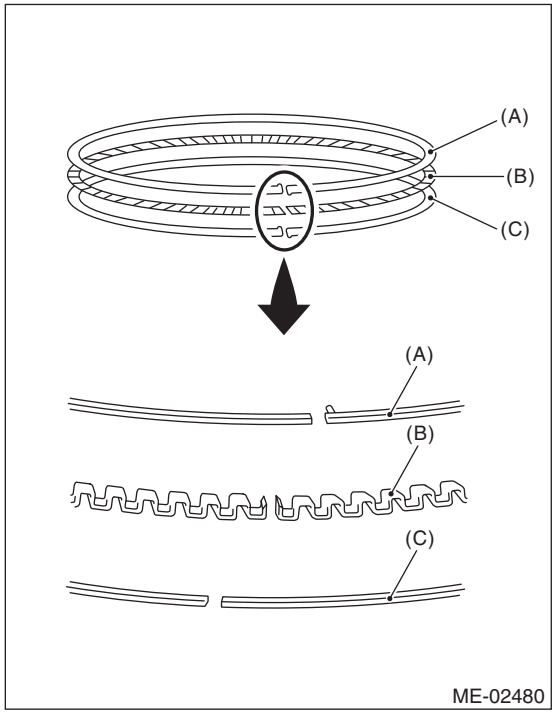


5) Check the piston pin snap ring for distortion, cracks and wear.

## 4. PISTON RING

1) If the piston ring is broken, damaged and worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new part of the same size as the piston.

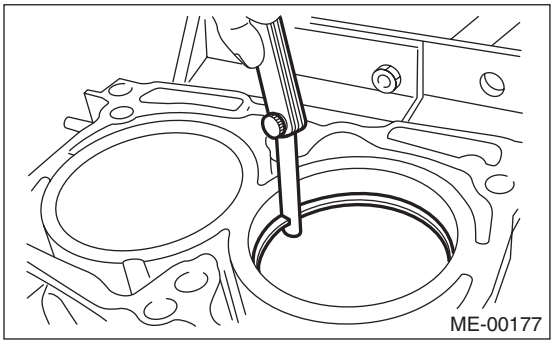
NOTE:
• The top ring and second ring have the mark to determine the direction for installing. When installing the ring to piston, face marks to the top side.
• Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.




(A) Upper rail
(B) Expander
(C) Lower rail

2) Using the piston, insert the piston ring and oil ring into the cylinder so that they are perpendicular to the cylinder wall, and measure the piston ring gap with a thickness gauge.

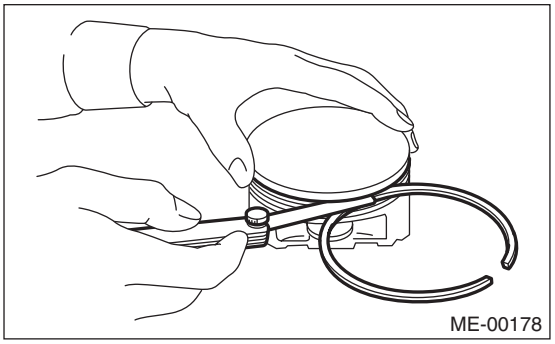
| | | Standard<br>mm (in) |
|---|---|---|
| Piston ring gap | Top ring | 0.20 — 0.35<br>(0.0079 — 0.0138) |
| | Second ring | 0.37 — 0.52<br>(0.0146 — 0.0205) |
| | Oil ring rail | 0.20 — 0.50<br>(0.0079 — 0.0197) |




3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

NOTE:
Before measuring the clearance, clean the piston ring groove and piston ring.

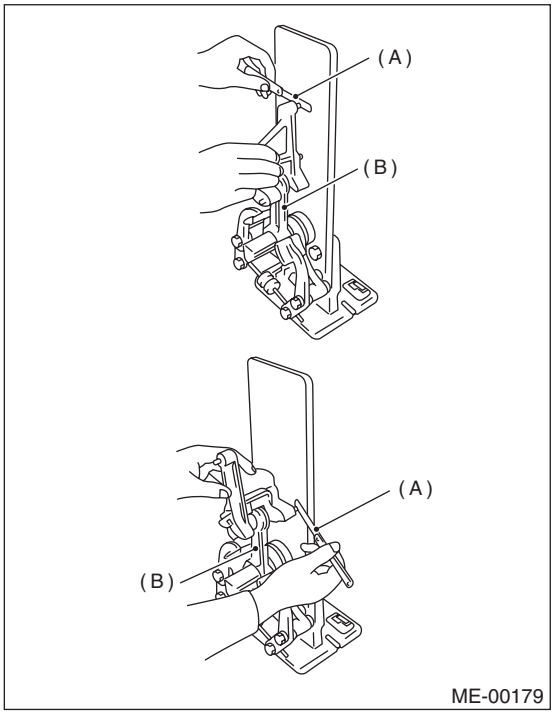
| | | Standard<br>mm (in) |
|---|---|---|
| Clearance between piston ring and piston ring groove | Top ring | 0.040 — 0.080<br>(0.0016 — 0.0031) |
| | Second ring | 0.030 — 0.070<br>(0.0012 — 0.0028) |



## 5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.
2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

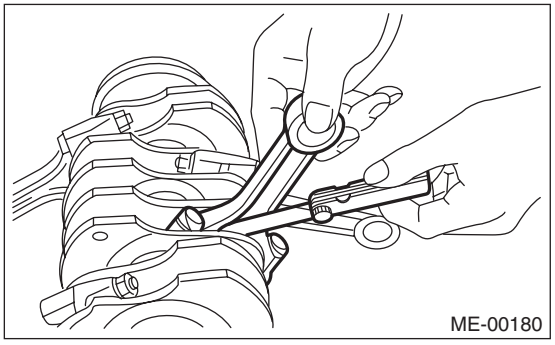
***Limit of bend or twist per 100 mm (3.94 in) in length:***
***0.10 mm (0.0039 in)***




(A) Thickness gauge
(B) Connecting rod

3) Install the connecting rod with bearings attached to the crankshaft, and measure the thrust clearance using a thickness gauge. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

***Connecting rod thrust clearance:***
***Standard***
***0.070 — 0.330 mm (0.0028 — 0.0130 in)***




4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or undersize as necessary.

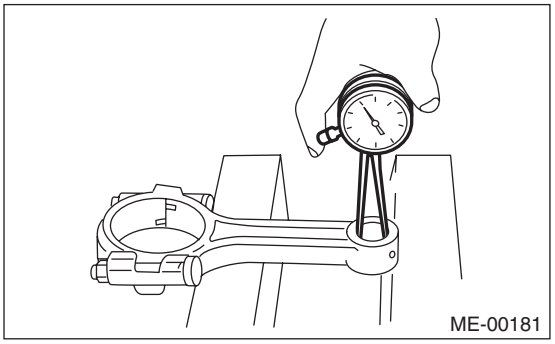
***Connecting rod oil clearance:***
***Standard***
***0.016 — 0.044 mm (0.0006 — 0.0017 in)***

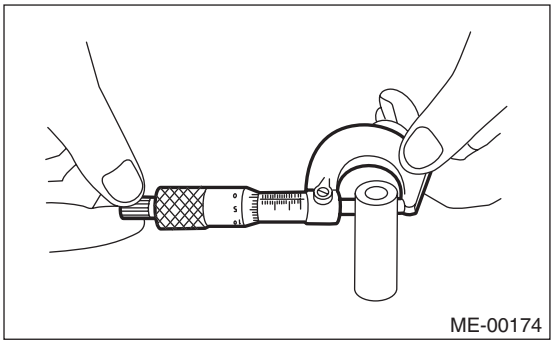
Unit: mm (in)

| Bearing | Bearing size (Thickness at center) | Outer diameter of crank pin |
|---|---|---|
| Standard | 1.492 — 1.501 (0.0587 — 0.0591) | 51.984 — 52.000 (2.0466 — 2.0472) |
| 0.03 (0.0012) undersize | 1.510 — 1.513 (0.0594 — 0.0596) | 51.954 — 51.970 (2.0454 — 2.0461) |
| 0.05 (0.0020) undersize | 1.520 — 1.523 (0.0598 — 0.0600) | 51.934 — 51.950 (2.0446 — 2.0453) |
| 0.25 (0.0098) undersize | 1.620 — 1.623 (0.0638 — 0.0639) | 51.734 — 51.750 (2.0368 — 2.0374) |

6) Inspect the bushing at connecting rod small end, and replace with a new part if worn or damaged.
7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace it with a new part.

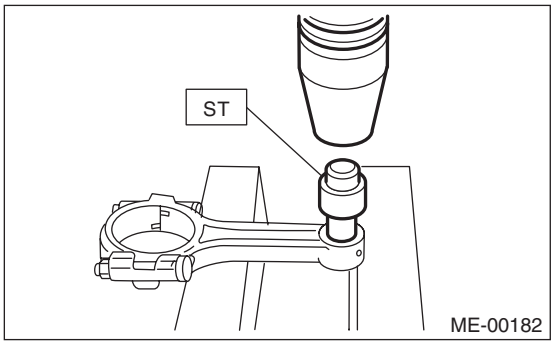
***Clearance between piston pin and bushing:***
***Standard***
***0 — 0.022 mm (0 — 0.0009 in)***



8) The replacement procedure for the connecting rod small end bushing is as follows.
(1) Remove the bushing from connecting rod with ST and press.
(2) Press the bushing with the ST after applying oil on the periphery of new bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



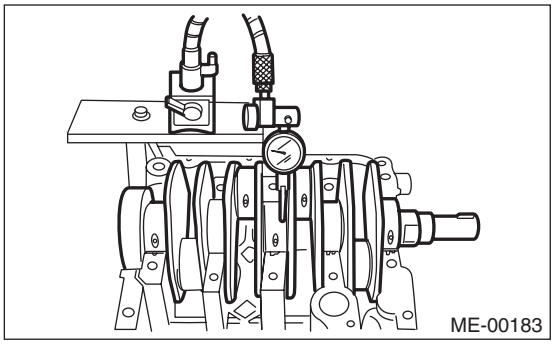

(3) Make two 3 mm (0.12 in) holes in the pressed bushing to match the pre-manufactured holes on the connecting rod, then ream the inside of the bushing.
(4) After completion of reaming, clean the bushing to remove chips.

## 6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. If defective, replace the crankshaft.
2) Measure warping of the crankshaft. If it exceeds the limit, correct or replace it.

NOTE:
If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

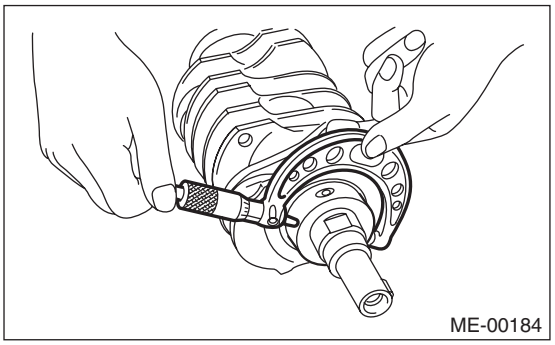
***Crankshaft bend limit:***
***0.035 mm (0.0014 in)***




3) Inspect the crank journal and crank pin for wear. If they are not within the standard, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

***Crank pin:***
***Out-of-roundness***
***Standard***
***0.003 mm (0.0001 in)***
***Cylindricality***
***Standard***
***0.004 mm (0.0002 in)***
***Grinding limit (dia.)***
***To 51.750 mm (2.0374 in)***

***Crank journal:***
***Out-of-roundness***
***Standard***
***0.005 mm (0.0002 in)***
***Cylindricality***
***Standard***
***0.006 mm (0.0002 in)***
***Grinding limit (dia.)***
***To 59.758 mm (2.3527 in)***

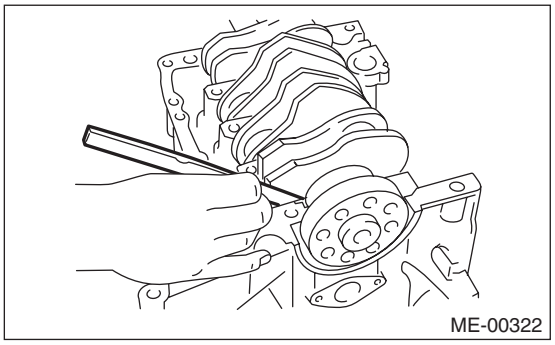


Unit: mm (in)

| | | Crank journal outer diameter | | Crank pin outer diameter |
|---|---|---|---|---|
| | | #1, #3 | #2, #4, #5 | |
| Standard | Journal O.D. | 59.992 — 60.008<br>(2.3619 — 2.3625) | 59.992 — 60.008<br>(2.3619 — 2.3625) | 51.984 — 52.000<br>(2.0466 — 2.0472) |
| | Bearing size<br>(Thickness at center) | 1.998 — 2.011<br>(0.0787 — 0.0792) | 2.000 — 2.013<br>(0.0787 — 0.0793) | 1.492 — 1.501<br>(0.0587 — 0.0591) |
| 0.03 (0.0012)<br>undersize | Journal O.D. | 59.962 — 59.978<br>(2.3607 — 2.3613) | 59.962 — 59.978<br>(2.3607 — 2.3613) | 51.954 — 51.970<br>(2.0454 — 2.0461) |
| | Bearing size<br>(Thickness at center) | 2.017 — 2.020<br>(0.0794 — 0.0795) | 2.019 — 2.022<br>(0.0795 — 0.0796) | 1.510 — 1.513<br>(0.0594 — 0.0596) |
| 0.05 (0.0020)<br>undersize | Journal O.D. | 59.942 — 59.958<br>(2.3599 — 2.3605) | 59.942 — 59.958<br>(2.3599 — 2.3605) | 51.934 — 51.950<br>(2.0446 — 2.0453) |
| | Bearing size<br>(Thickness at center) | 2.027 — 2.030<br>(0.0798 — 0.0799) | 2.029 — 2.032<br>(0.0799 — 0.0800) | 1.520 — 1.523<br>(0.0598 — 0.0600) |
| 0.25 (0.0098)<br>undersize | Journal O.D. | 59.742 — 59.758<br>(2.3520 — 2.3527) | 59.742 — 59.758<br>(2.3520 — 2.3527) | 51.734 — 51.750<br>(2.0368 — 2.0374) |
| | Bearing size<br>(Thickness at center) | 2.127 — 2.130<br>(0.0837 — 0.0839) | 2.129 — 2.132<br>(0.0838 — 0.0839) | 1.620 — 1.623<br>(0.0638 — 0.0639) |

4) Use a thickness gauge to measure the thrust clearance of crankshaft at #5 crank journal bearing. If clearance exceeds the standard, replace the bearing.

***Crankshaft thrust clearance:***
***Standard***
***0.030 — 0.115 mm (0.0012 — 0.0045 in)***


ME-00322

5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.
6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or grind to correct the crankshaft as necessary.

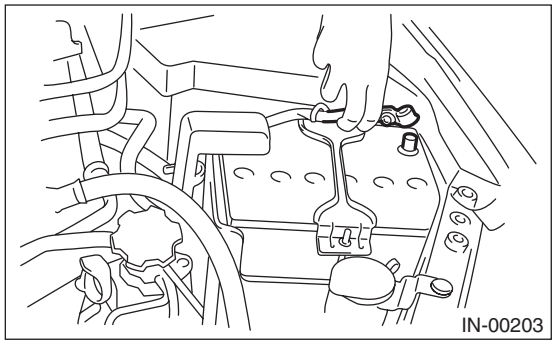
***Crankshaft oil clearance:***
***Standard***
***0.010 — 0.030 mm (0.0004 — 0.0012 in)***

# 22.Oil Switching Solenoid Valve

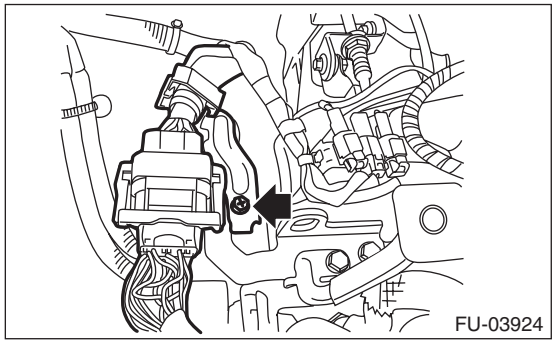
## A: REMOVAL

### 1. RH SIDE

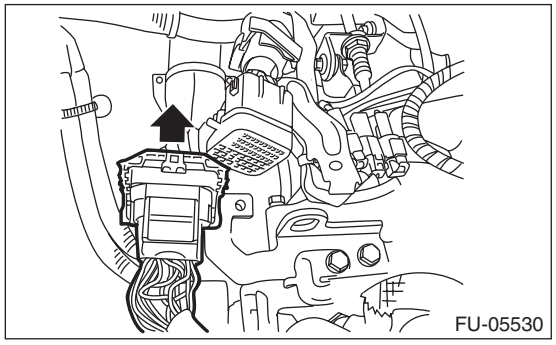
1) Disconnect the ground cable from battery.



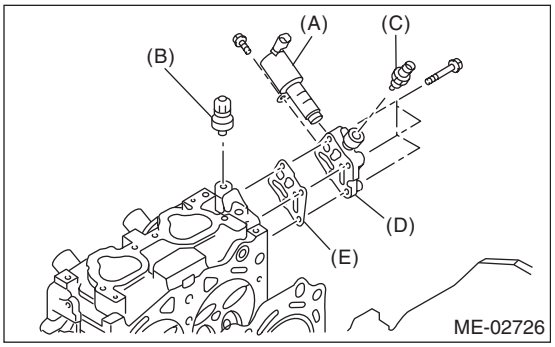

2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Remove the bolt, and disconnect the engine harness connector from the bulkhead harness connector and rear engine hanger.




4) Slide the bulkhead harness connector in the direction of the arrow and remove it from the rear engine hanger.



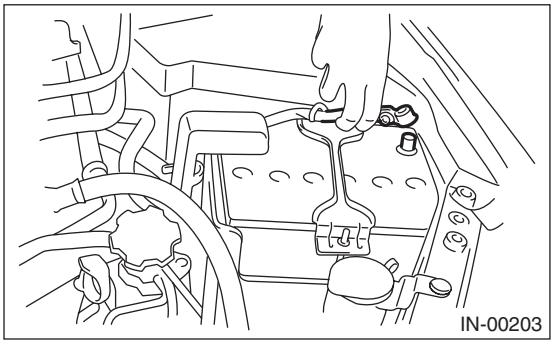

5) Disconnect the connector from the oil switching solenoid valve.
6) Remove the oil switching solenoid valve.
7) Remove the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H4SO)-40, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>
8) Remove the oil temperature sensor. <Ref. to FU(H4SO)-41, REMOVAL, Oil Temperature Sensor.>
9) Remove the oil switching solenoid valve holder from the cylinder head.




(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil temperature sensor
(D) Oil switching solenoid valve holder
(E) Gasket

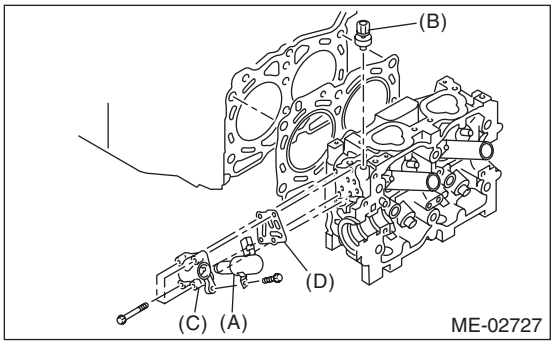
### 2. LH SIDE

1) Disconnect the ground cable from battery.




2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt. <Ref. to ME(H4SO)-50, REMOVAL, Timing Belt.>
5) Remove the cam sprocket. <Ref. to ME(H4SO)-55, REMOVAL, Cam Sprocket.>
6) Remove the timing belt cover No. 2 (LH).
7) Disconnect the connector from the oil switching solenoid valve.
8) Remove the oil switching solenoid valve.
9) Remove the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H4SO)-40, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>

10) Remove the oil switching solenoid valve holder from the cylinder head.




(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil switching solenoid valve holder
(D) Gasket

## B: INSTALLATION

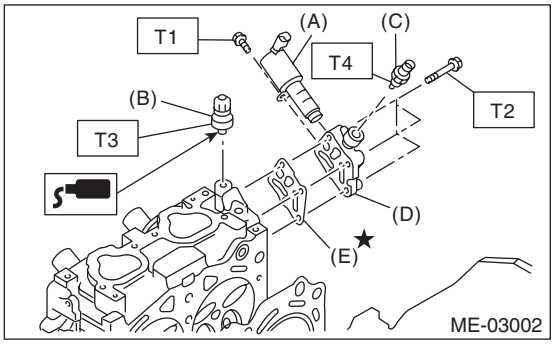
### 1. RH SIDE

Install in the reverse order of removal.

NOTE:
• Use a new gasket.
• Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
• Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

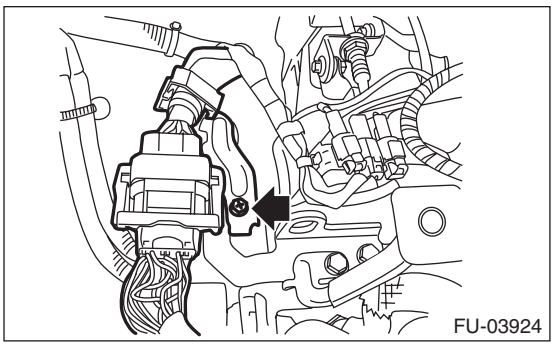
***Tightening torque:***
***T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)***
***T3: 17 N·m (1.7 kgf-m, 12.5 ft-lb)***
***T4: 18 N·m (1.8 kgf-m, 13.3 ft-lb)***

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***




(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil temperature sensor
(D) Oil switching solenoid valve holder
(E) Gasket

***Tightening torque:***
***6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***



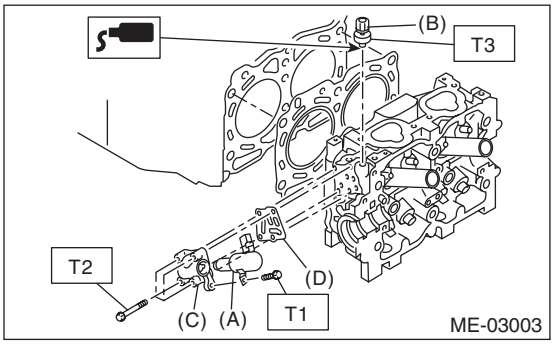

### 2. LH SIDE

Install in the reverse order of removal.

NOTE:
• Use a new gasket.
• Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
• Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

***Tightening torque:***
***T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)***
***T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)***
***T3: 17 N·m (1.7 kgf-m, 12.5 ft-lb)***

***Liquid gasket:***
***THREE BOND 1324 (Part No. 004403042) or equivalent***




(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil switching solenoid valve holder
(D) Gasket

# 23.Intake and Exhaust Valve

## A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(H4SO)-65, REMOVAL, Cylinder Head.> <Ref. to ME(H4SO)-66, INSTALLATION, Cylinder Head.>

# 24.Piston

## A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(H4SO)-74, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-78, INSTALLATION, Cylinder Block.>

# 25.Connecting Rod

## A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(H4SO)-74, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-78, INSTALLATION, Cylinder Block.>

# 26.Crankshaft

## A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(H4SO)-74, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-78, INSTALLATION, Cylinder Block.>

# 27.Engine Trouble in General

## A: INSPECTION

NOTE:
The “RANK” shown in the chart shows the possibilities of the cause of trouble in order from “Very often” to “Rarely”.
A — Very often
B — Sometimes
C — Rarely

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 1. Engine does not start. | | | |
| 1) Starter does not turn. | Starter | Defective battery-to-starter harness | B |
| | | Defective starter switch | C |
| | | Defective inhibitor switch | C |
| | | Defective starter | B |
| | Battery | Improper connection of terminal | A |
| | | Run-down battery | A |
| | | Defective charging system | B |
| | Friction | Seizure of crankshaft and connecting rod bearing | C |
| | | Seized camshaft | C |
| | | Seized or stuck piston and cylinder | C |
| | Immobilizer system <Ref. to IM(diag)-2, Basic Diagnostic Procedure.> | | A |
| 2) Initial combustion does not occur. | Starter | Defective starter | C |
| | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Fuel line | Defective fuel pump and relay | A |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing belt | Degradation, etc. | B |
| | | Defective timing | B |
| | Compression | Incorrect valve clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 3) Initial combustion occurs. | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing belt | Degradation, etc. | B |
| | | Defective timing | B |
| | Compression | Incorrect valve clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 4) Engine stalls after initial combustion. | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked intake duct | B |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | C |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing belt | Degradation, etc. | B |
| | | Defective timing | B |
| | Compression | Incorrect valve clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 2. Rough idle and engine stall | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | C |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing belt | Defective timing | C |
| | Compression | Incorrect valve clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | B |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | | Defective rocker cover gasket | C |
| | Cooling system | Over-heating | C |
| | Others | Evaporative emission control system malfunction | A |
| | | Stuck or damaged throttle valve | B |

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 3. Low output, hesitation and poor acceleration | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | B |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | A |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing belt | Defective timing | B |
| | Compression | Incorrect valve clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | Cooling system | Over-heating | C |
| | | Over-cooling | C |
| | Others | Evaporative emission control system malfunction | A |

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 4. Surging | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | B |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing belt | Defective timing | B |
| | Compression | Incorrect valve clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Cooling system | Over-heating | B |
| | Others | Evaporative emission control system malfunction | C |
| 5. Engine does not return to idle. | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked vacuum hose | A |
| | Others | Stuck or damaged throttle valve | A |
| 6. Dieseling (Run-on) | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Cooling system | Over-heating | B |
| | Others | Evaporative emission control system malfunction | B |
| 7. After burning in exhaust system | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened or cracked intake duct | C |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | C |
| | Timing belt | Defective timing | B |
| | Compression | Incorrect valve clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | Lubrication system | Incorrect oil pressure | C |
| | Cooling system | Over-cooling | C |
| | Others | Evaporative emission control system malfunction | C |

| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|---|---|---|
| 8. Knocking | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Loosened oil filler cap | B |
| | Timing belt | Defective timing | B |
| | Compression | Incorrect valve clearance | C |
| | | Incorrect valve timing | B |
| | Cooling system | Over-heating | A |
| 9. Excessive engine oil consumption | Intake system | Loosened or cracked PCV hose | A |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | C |
| | Compression | Defective valve stem | A |
| | | Worn or stuck piston rings, cylinder and piston | A |
| | Lubrication system | Loosened oil pump attaching bolts and defective gasket | B |
| | | Defective oil filter gasket | B |
| | | Defective crankshaft oil seal | B |
| | | Defective rocker cover gasket | B |
| | | Loosened oil drain plug or defective gasket | B |
| | | Loosened oil pan fitting bolts or defective oil pan | B |
| 10. Excessive fuel consumption | Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> | | A |
| | Intake system | Dirty air cleaner element | A |
| | Timing belt | Defective timing | B |
| | Compression | Incorrect valve clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | B |
| | | Incorrect valve timing | B |
| | Lubrication system | Incorrect oil pressure | C |
| | Cooling system | Over-cooling | C |

# 28.Engine Noise

## A: INSPECTION

| Type of sound | Condition | Possible cause |
|---|---|---|
| Regular clicking sound | Sound increases as engine speed increases. | • Valve mechanism is defective.<br>• Incorrect valve clearance<br>• Worn valve rocker<br>• Worn camshaft<br>• Broken valve spring |
| Heavy and dull clank | Oil pressure is low. | • Worn crankshaft main bearing<br>• Worn connecting rod bearing (large end) |
| | Oil pressure is normal. | • Damaged engine mounting<br>• Loosened flywheel mounting bolt |
| High-pitched clank (Spark knock) | Sound is noticeable when accelerating with an overload condition. | • Ignition timing advanced<br>• Accumulation of carbon inside combustion chamber<br>• Wrong heat range of spark plug<br>• Improper octane value gasoline |
| Clank when engine speed is 1,000 to 2,000 rpm | Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*) | • Worn crankshaft main bearing<br>• Worn connecting rod bearing (large end) |
| Knocking sound when engine is operating under idling speed and engine is warm | Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*) | • Worn cylinder liner and piston ring<br>• Broken or stuck piston ring<br>• Worn piston pin and hole at piston end of connecting rod |
| | Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*) | • Worn cam sprocket<br>• Worn camshaft journal bore in cylinder head |
| Squeaky sound | — | Insufficient generator lubrication |
| Rubbing sound | — | Poor contact of generator brush and rotor |
| Gear scream when starting engine | — | • Defective ignition starter switch<br>• Worn gear and starter pinion |
| Sound like polishing glass with a dry cloth | — | • Loose V-belt<br>• Defective water pump shaft |
| Hissing sound | — | • Insufficient compression<br>• Air leakage in air intake system, hose, connection or manifold |
| Timing belt noise | — | • Loose timing belt<br>• Timing belt contacting with adjacent part |
| Valve noise | — | Incorrect valve clearance |

(NOTE*)
When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-43, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

# EXHAUST

# EX(H4SO)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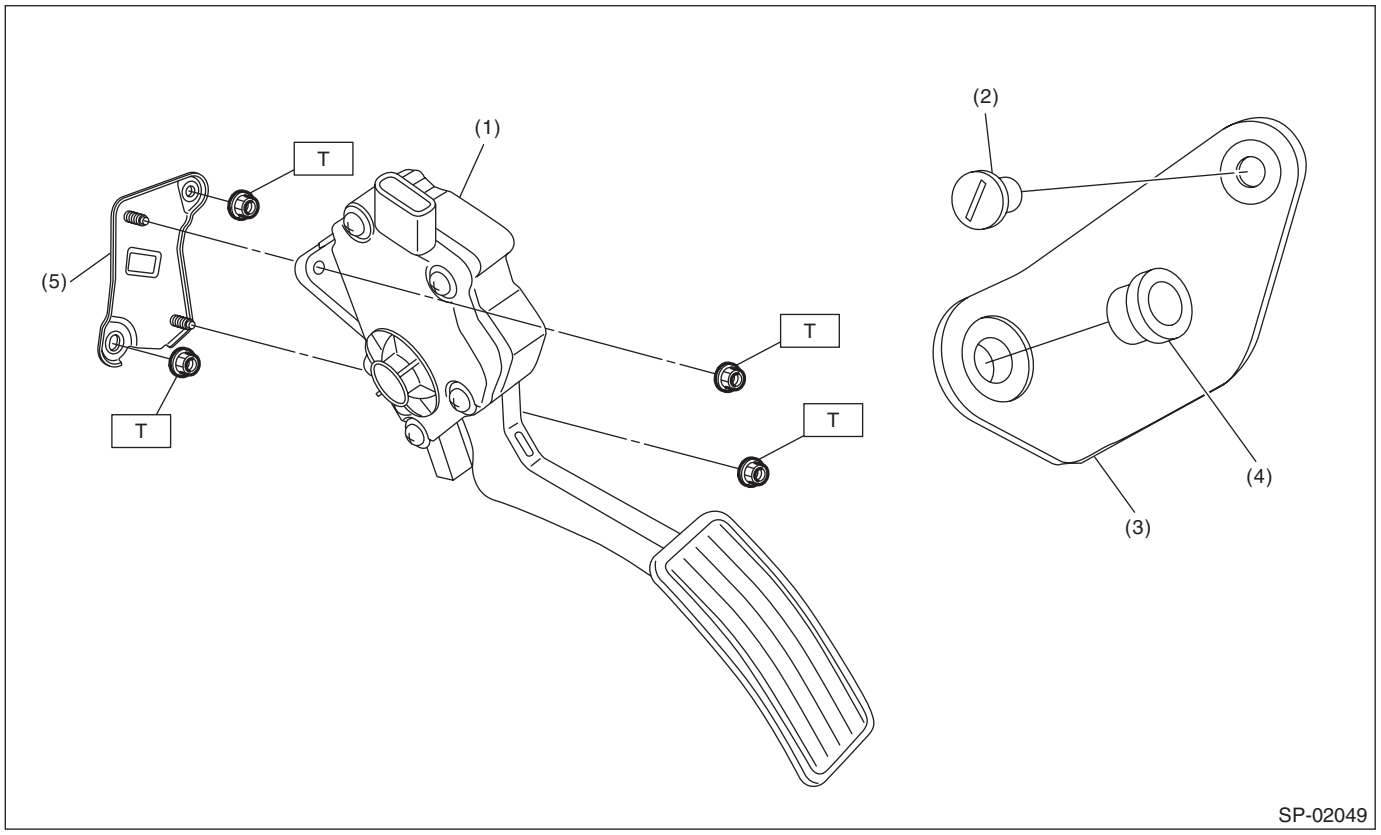
1. General Description .....2
2. Front Exhaust Pipe .....6
3. Center Exhaust Pipe .....9
4. Rear Exhaust Pipe .....10
5. Muffler .....12

# 1. General Description

## A: SPECIFICATION

| | | | |
|---|---|---|---|
| Accelerator pedal | Stroke | At pedal pad | 50 — 59 mm (1.97 — 2.32 in) |

## B: COMPONENT




(1) Accelerator pedal ASSY
(2) Clip
(3) Accelerator plate
(4) Accelerator stopper
(5) Accelerator pedal bracket

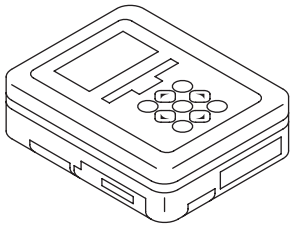
***Tightening torque:N·m (kgf-m, ft-lb)***
***T: 18 (1.8, 13.3)***

## C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal or installation.
• Keep the parts in order and protect them from dust and dirt.
• Before removal or installation, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

## D: PREPARATION TOOL

### 1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---|---|---|
|  ST1B022XU0 | 1B022XU0 | SUBARU SELECT MONITOR III KIT | Used for inspecting the accelerator pedal. |

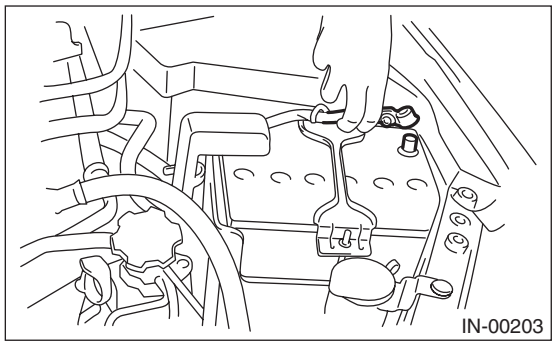
### 2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring voltage. |

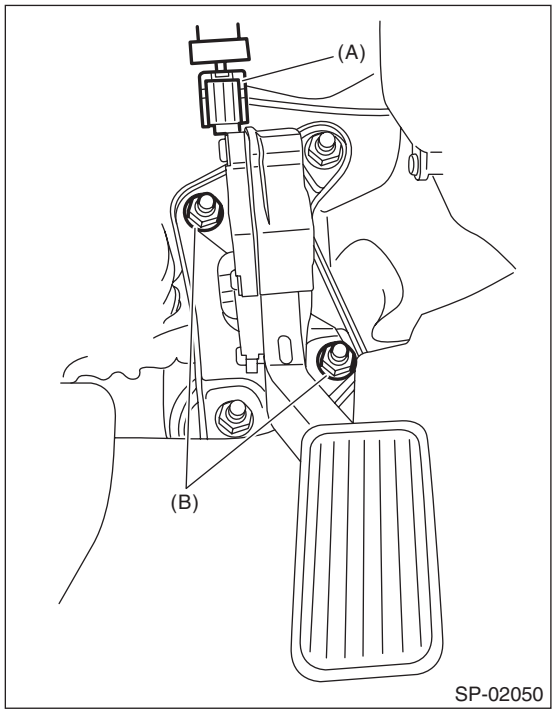
# 2. Accelerator Pedal

## A: REMOVAL

1) Disconnect the ground cable from battery.




2) Disconnect the connector (A).
3) Remove the nut (B) securing accelerator pedal assembly, and remove the accelerator pedal assembly.




## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***18 N·m (1.8 kgf-m, 13.3 ft-lb)***

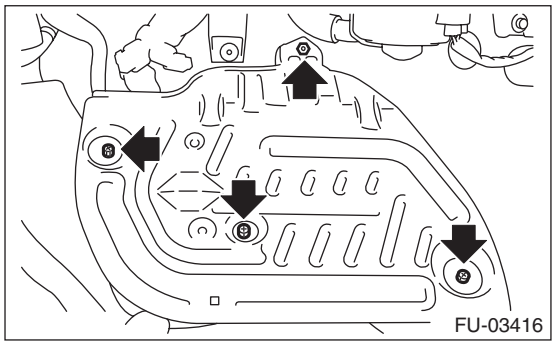
## C: DISASSEMBLY

NOTE:
The accelerator pedal cannot be disassembled.

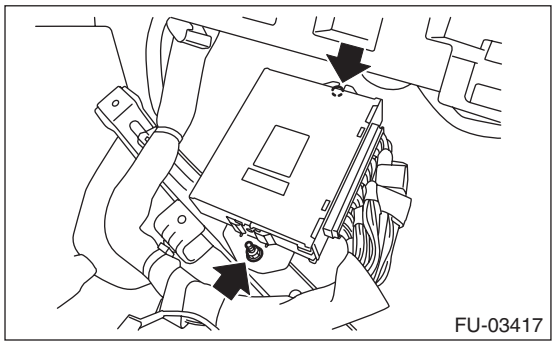
## D: INSPECTION

### 1. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side.
<Ref. to EI-53, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

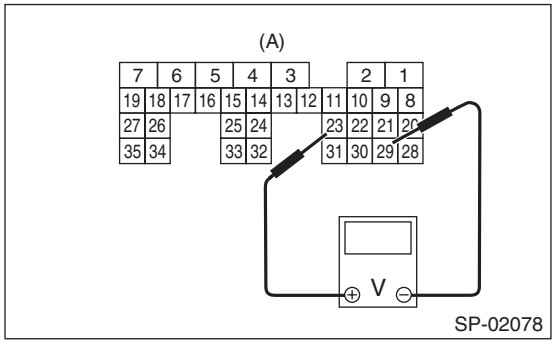



4) Remove the nuts and bolts which hold the ECM to the bracket.



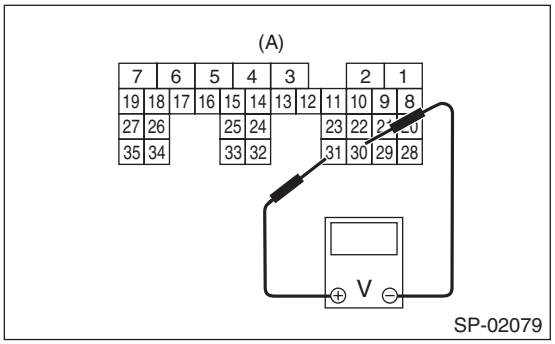

5) Turn the ignition switch to ON. (engine OFF)
6) Measure the voltage between ECM connector terminals.

- Main sensor side




(A) To ECM connector

- Sub sensor side




(A) To ECM connector

| Accelerator pedal sensor | Accelerator pedal | Terminal No. | Standard |
|---|---|---|---|
| Main | Not depressed (Full closed) | 23 (+) and 29 (–) | 1 V |
| | Depressed (Full opened) | | 3.5 V |
| Sub | Not depressed (Full closed) | 31 (+) and 30 (–) | 1 V |
| | Depressed (Full opened) | | 3.5 V |

## 2. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the accelerator pedal opening angle signal and voltage of accelerator pedal sensor using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-34, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

| Accelerator pedal sensor | Accelerator pedal opening angle signal | Standard |
|---|---|---|
| Main | 0.0 % | 1 V |
| | 100.0 % | 3.5 V |
| Sub | 0.0 % | 1 V |
| | 100.0 % | 3.5 V |

## 3. OTHER INSPECTIONS

1) Check that the accelerator pedal does not have deformation, cracks or damage.
2) Check for smooth operation when the accelerator pedal is depressed.
3) Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

# IGNITION

# IG(H4SO)


Page

1. General Description .....2
2. Spark Plug .....4
3. Ignition Coil and Ignitor Assembly .....6
4. Spark Plug Cord .....7

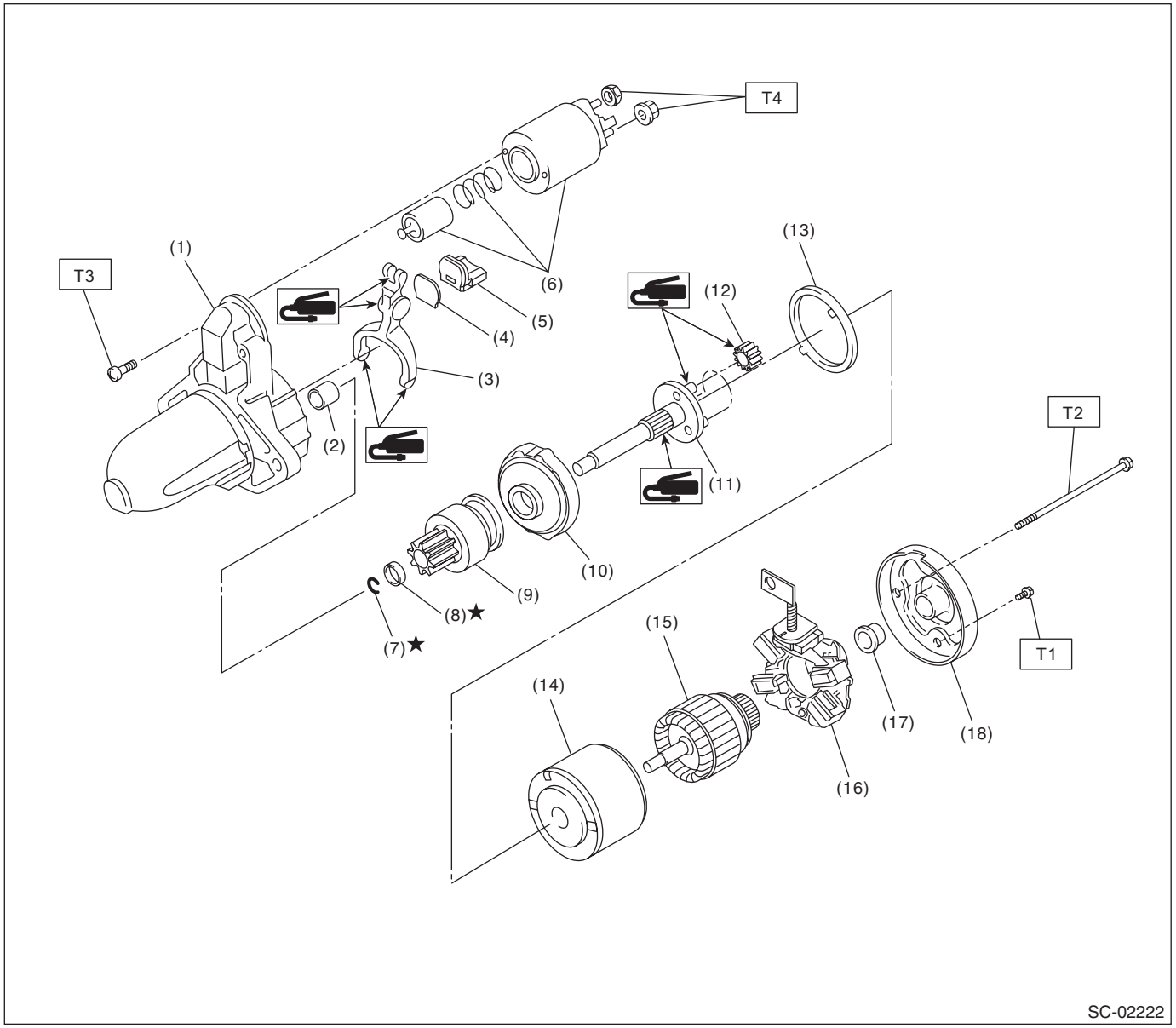
# 1. General Description

## A: SPECIFICATION

| Item | | | Specifications | |
|---|---|---|---|---|
| Starter | Type | | Reduction type | |
| | Vehicle model | | AT | MT |
| | Model | | M000T20175 | M000T30475 |
| | Manufacturer | | Mitsubishi Electric | |
| | Voltage and output | | 12 V — 1.4 kW | 12 V — 1.0 kW |
| | Direction of rotation | | Counterclockwise (when observed from pinion) | |
| | Number of pinion teeth | | 9 | 8 |
| | Armature commutator runout | Standard | 0.05 mm (0.0020 in) | |
| | | Limit | 0.10 mm (0.0039 in) | |
| | Armature depth of segment mold | Standard | 0.5 mm (0.020 in) | |
| | Brush length | Standard | 12.3 mm (0.484 in) | |
| | | Limit | 7.0 mm (0.276 in) | |
| | Brush spring force | Standard | 15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) | |
| | | Limit | 2.5 N (0.25 kgf, 0.56 lbf) | |
| | No-load characteristics | Voltage | 11 V | |
| | | Current | 90 A or less | 95 A or less |
| | | Rotating speed | 2,000 rpm or more | 2,500 rpm or more |
| | Load characteristics | Voltage | 7.7 V | 7.5 V |
| | | Current | 400 A | 300 A |
| | | Torque | 16.7 N·m (1.7 kgf-m, 12.3 ft-lb) or more | 8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more |
| | | Rotating speed | 710 rpm or more | 870 rpm or more |
| | Lock characteristics | Voltage | 3.5 V | 4 V |
| | | Current | 960 A or less | 680 A or less |
| | | Torque | 31 N·m (3.2 kgf-m, 22.9 ft-lb) or more | 17 N·m (1.7 kgf-m, 12.5 ft-lb) or more |
| Generator | Type | | Rotating-field three-phase type, voltage regulator built-in type, with load response control system | |
| | Model | | A2TG1891 | |
| | Manufacturer | | Mitsubishi Electric | |
| | Voltage and output | | 12 V — 90 A | |
| | Polarity on ground side | | Negative | |
| | Direction of rotation | | Clockwise (when observed from pulley side) | |
| | Stator connection | | 3-phase Y-type | |
| | Output current | | 1,500 rpm — 40 A or more<br>2,500 rpm — 74 A or more<br>5,000 rpm — 84 A or more | |
| | Regulated voltage | | 14.1 — 14.8 V [20°C (68°F)] | |
| | Rotor slip ring outer diameter | Standard | 22.7 mm (0.894 in) | |
| | | Limit | 22.1 mm (0.870 in) | |
| | Brush length | Standard | 18.5 mm (0.728 in) | |
| | | Limit | 5.0 mm (0.197 in) | |
| Battery | Type and capacity | | 12 V — 52 AH (65D 23L) | 12 V — 48 AH (55D 23L) |

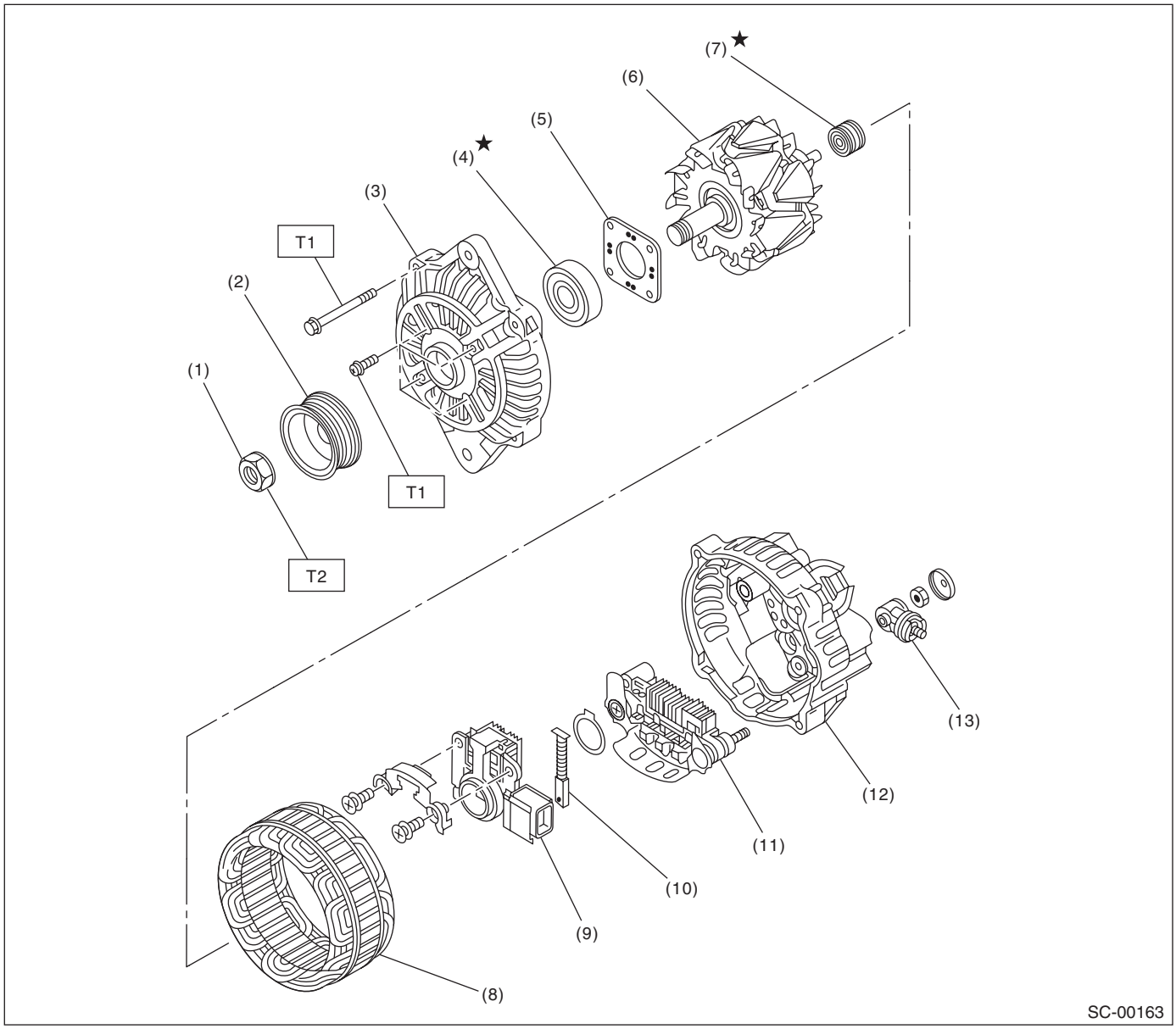
# B: COMPONENT

## 1. STARTER




| | | | | | |
|---|---|---|---|---|---|
| (1) | Starter housing ASSY | (9) | Overrunning clutch | (17) | Sleeve bearing |
| (2) | Sleeve bearing | (10) | Internal gear ASSY | (18) | Starter cover ASSY |
| (3) | Shift lever | (11) | Shaft | | |
| (4) | Plate | (12) | Pinion gear | ***Tightening torque:N·m (kgf-m, ft-lb)*** | |
| (5) | Seal rubber | (13) | Seal rubber | ***T1:*** | ***1.4 (0.1, 1.0)*** |
| (6) | Magnet switch ASSY | (14) | Yoke ASSY | ***T2:*** | ***6 (0.6, 4.4)*** |
| (7) | Snap ring | (15) | Armature ASSY | ***T3:*** | ***7.5 (0.8, 5.5)*** |
| (8) | Stopper | (16) | Brush holder ASSY | ***T4:*** | ***10 (1.0, 7.4)*** |

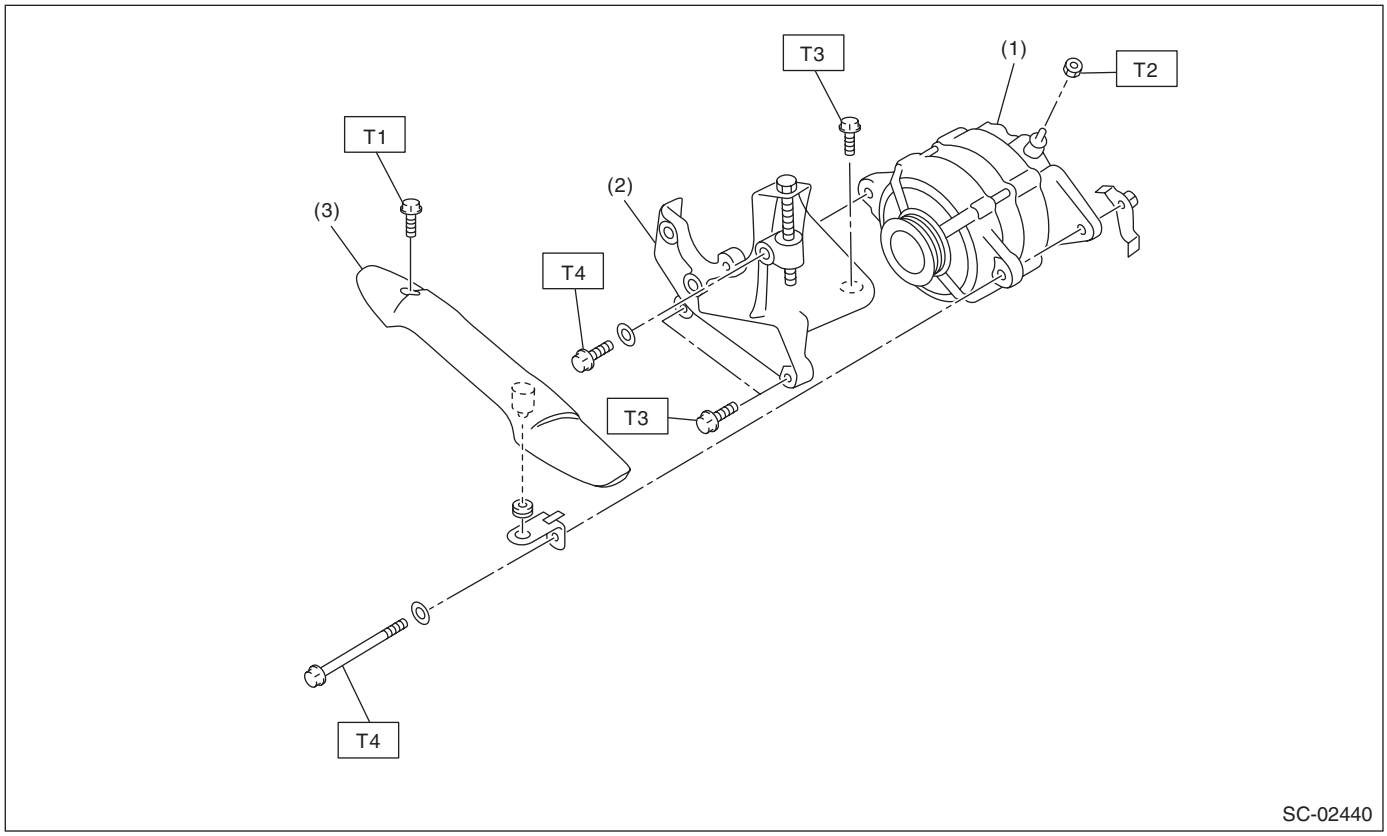
## 2. GENERATOR




(1) Pulley nut
(2) Pulley
(3) Front cover
(4) Ball bearing
(5) Bearing retainer
(6) Rotor
(7) Bearing
(8) Stator coil
(9) IC regulator with brush
(10) Brush
(11) Rectifier
(12) Rear cover
(13) Terminals

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 4.7 (0.5, 3.5)***
***T2: 108 (11.0, 79.8)***

## 3. GENERATOR BRACKET




(1) Generator
(2) Power steering pump bracket
(3) V-belt cover

***Tightening torque:N·m (kgf-m, ft-lb)***
***T1: 13 (1.3, 9.6)***
***T2: 16 (1.6, 11.8)***
***T3: 22 (2.2, 16.2)***
***T4: 25 (2.5, 18.4)***

## C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

## D: PREPARATION TOOL

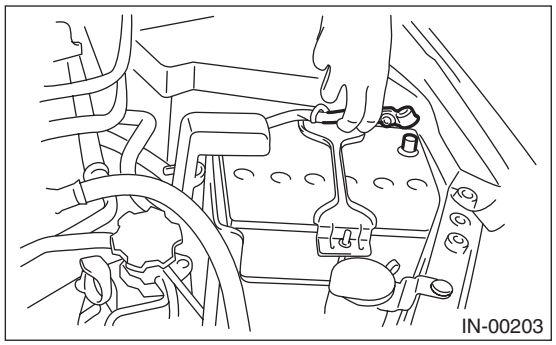
### 1. GENERAL TOOL

| TOOL NAME | REMARKS |
|---|---|
| Circuit tester | Used for measuring resistance, voltage and current. |

# 2. Starter

## A: REMOVAL

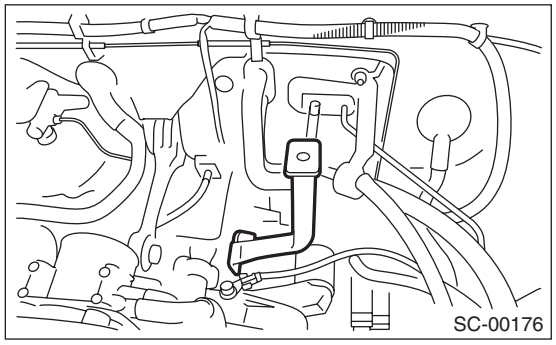
1) Disconnect the ground cable from battery.



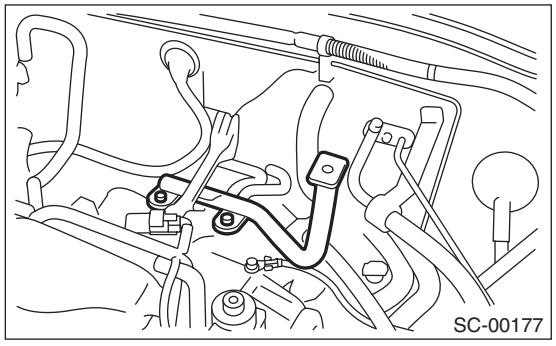

2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>

3) Remove the air intake chamber stay LH.

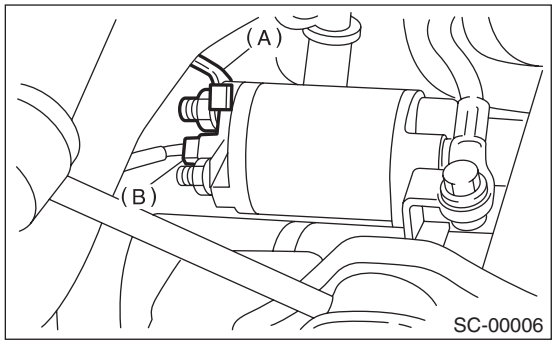
- MT model




- AT model

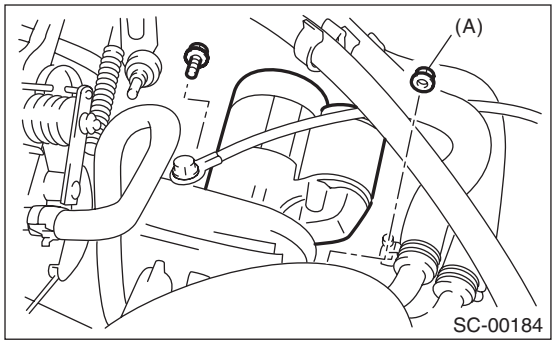



4) Disconnect the connector (B) and terminal (A) from starter.




5) Remove the starter from transmission.

NOTE:
For the MT model, a bolt is used in place (A).

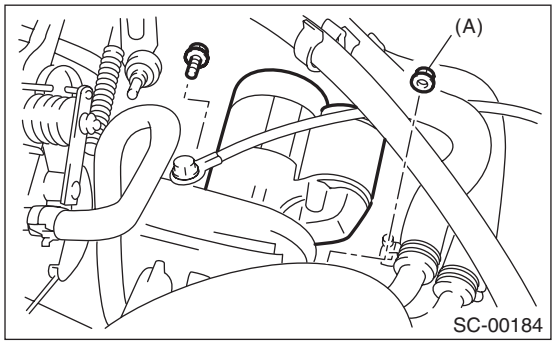



## B: INSTALLATION

Install in the reverse order of removal.

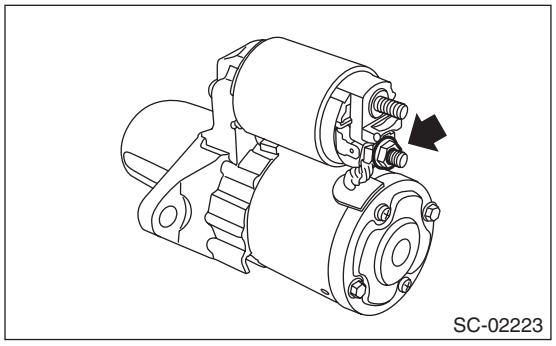
NOTE:
For the MT model, a bolt is used in place (A).

***Tightening torque:***
***50 N·m (5.1 kgf-m, 36.9 ft-lb)***

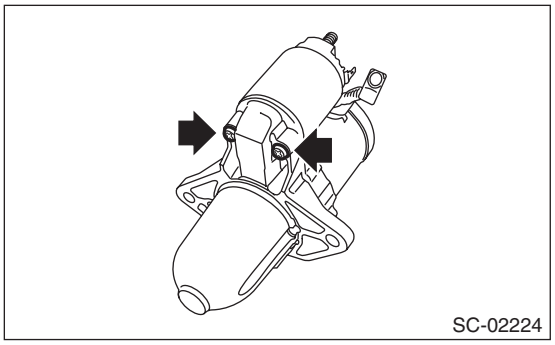



## C: DISASSEMBLY

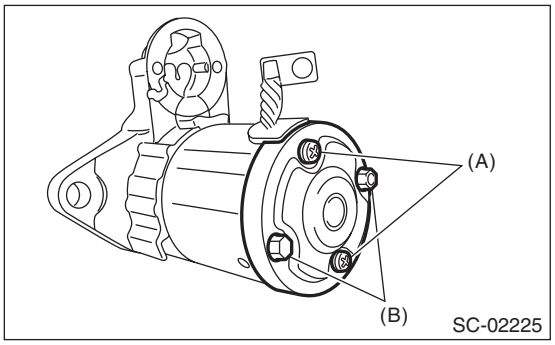
1) Remove the nuts fastening the terminal M of the magnet switch assembly, and disconnect the cable from the terminal M.



2) Remove the screws fastening the magnet switch assembly, then remove the magnet switch assembly from the starter housing assembly.

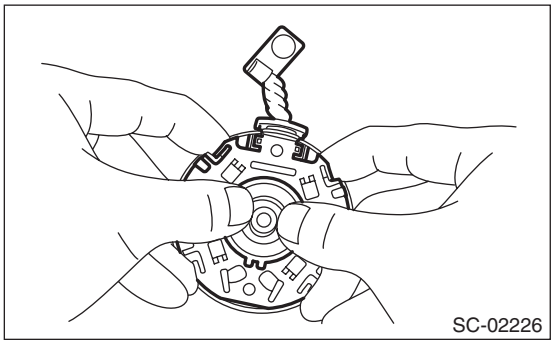



3) Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.

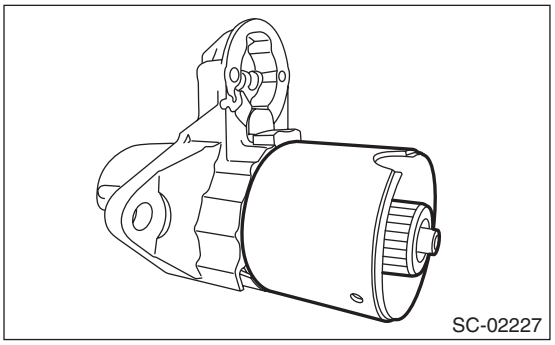



4) Remove the brush holder assembly from the armature assembly.

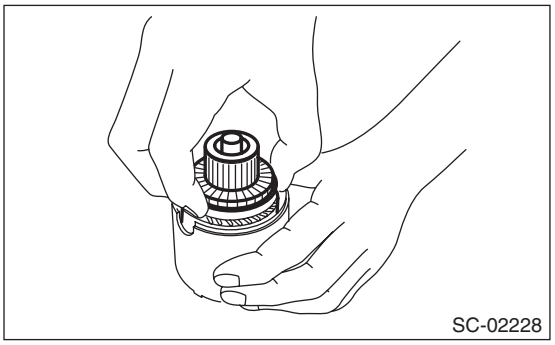
NOTE:
Hold the brush with your fingers so that the brush spring does not come flying out.



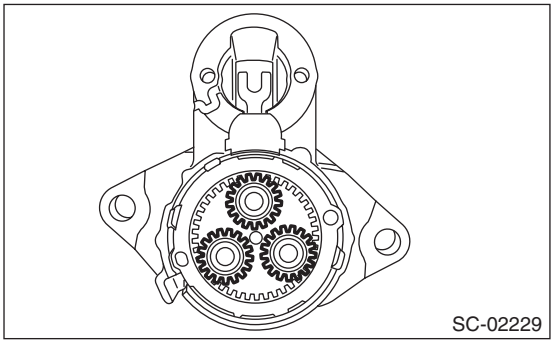

5) Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.



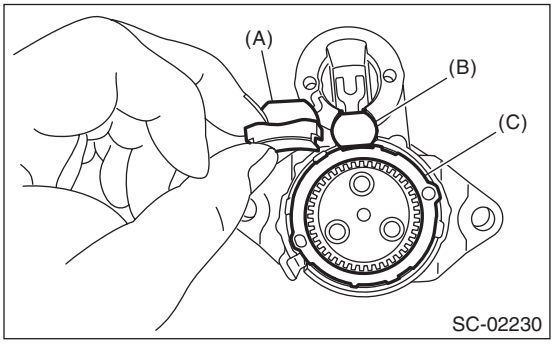

6) Separate the armature assembly and yoke assembly.



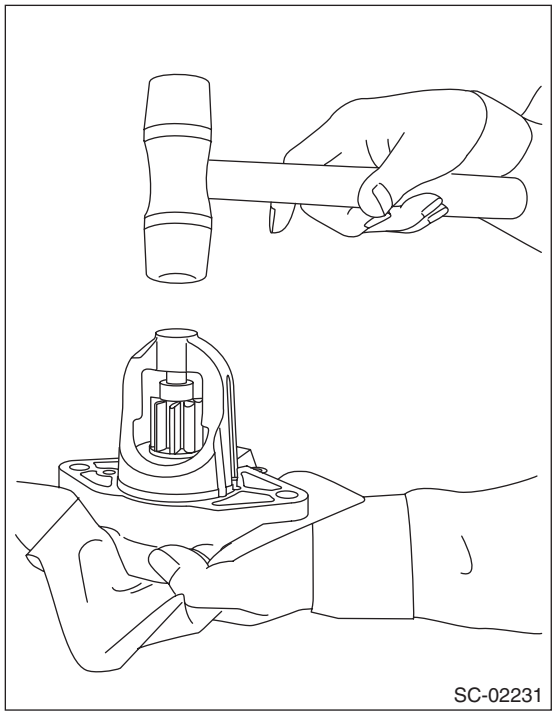

7) Remove the pinion gear from the internal gear assembly.

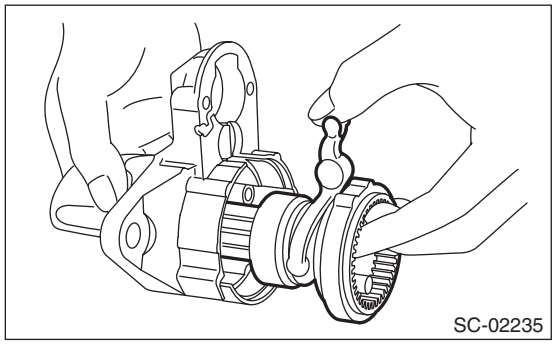



8) Remove seal rubber (A), plate (B), and seal rubber (C).



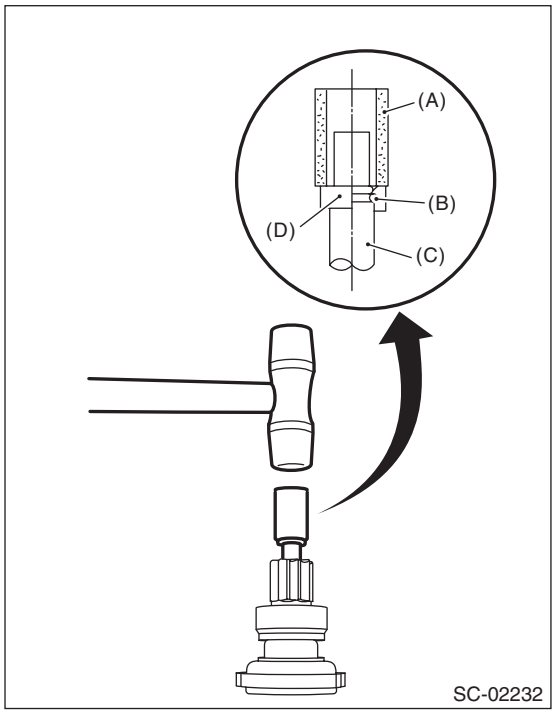
9) Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.


SC-02231


SC-02235

10) Use the following procedures to remove the overrunning clutch from the shaft.

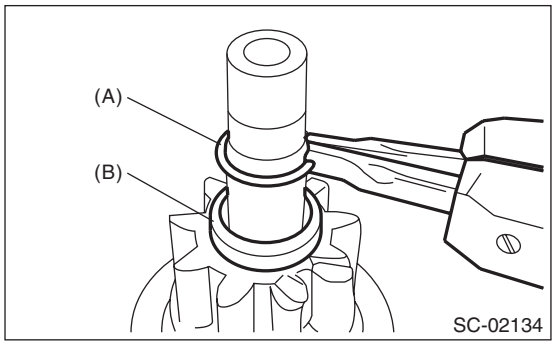
(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.



SC-02232

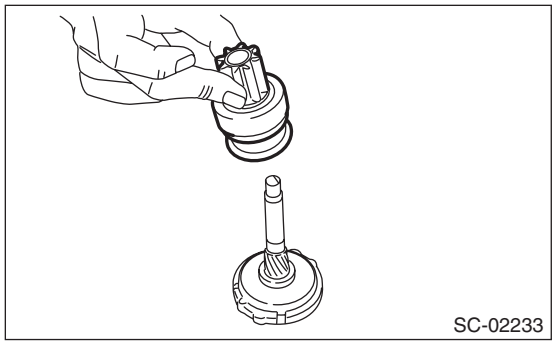
(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

(2) Remove snap ring (A) from the shaft, and remove stopper (B).

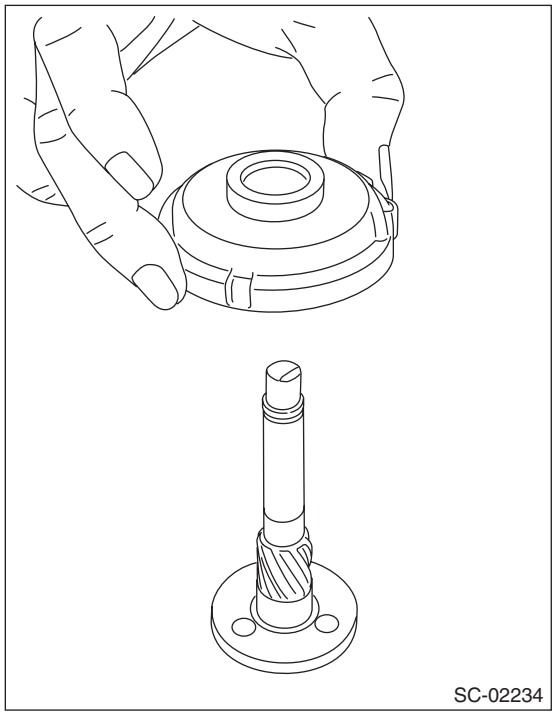


SC-02134

(3) Remove the overrunning clutch from the shaft.




11) Separate the internal gear assembly and shaft.

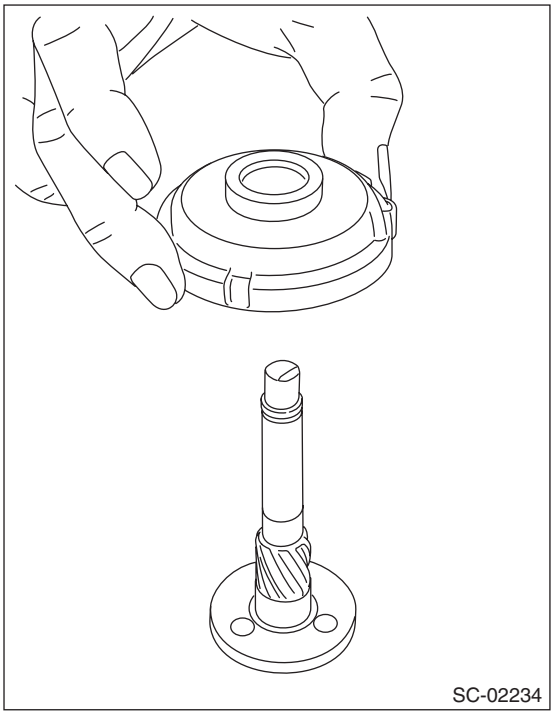



## D: ASSEMBLY

1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

***Grease:***
***Multemp #6129 or equivalent***

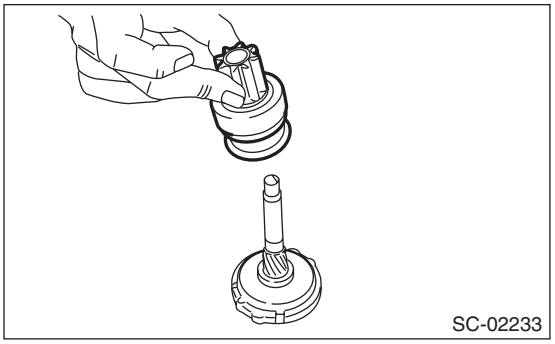
2) Assemble the shaft to the internal gear assembly.




3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

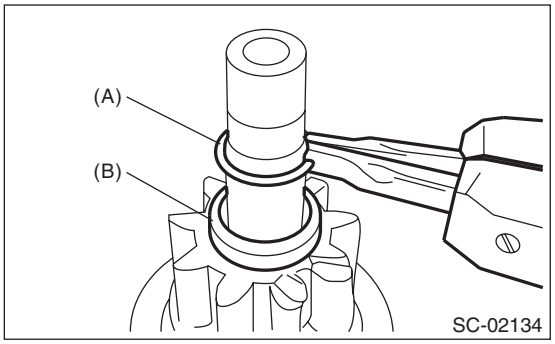
***Grease:***
***Multemp #6129 or equivalent***

(2) Install the overrunning clutch to shaft.

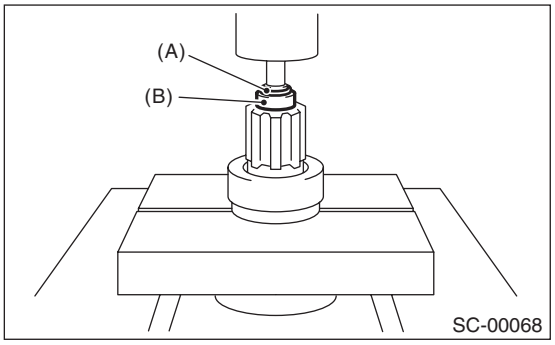


(3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).

NOTE:
Use new stoppers and snap rings.



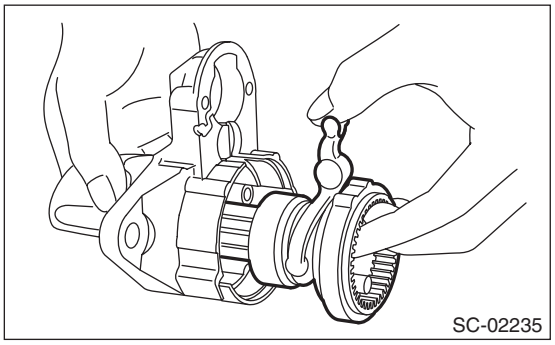

(4) Using a press, pressure fit stopper (B) into snap ring (A).




4) Assemble the overrunning clutch, internal gear assembly, shaft and shift lever as a single unit into the starter housing assembly.

NOTE:
Apply grease to the moving parts of the shift lever.

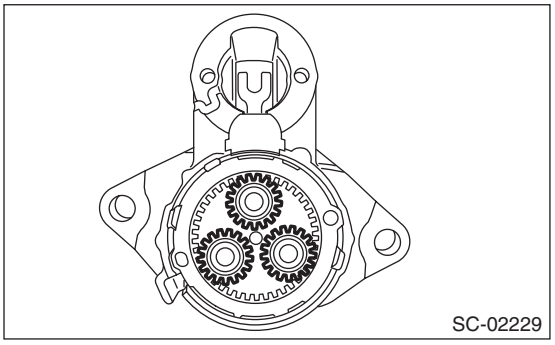
***Grease:***
***Multemp #6129 or equivalent***



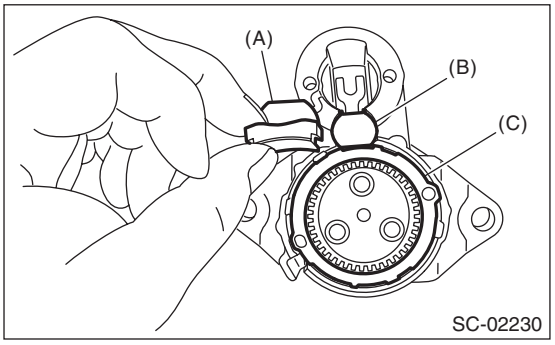

5) Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

NOTE:
- Apply grease evenly to the contact surfaces of each gear.
- Be careful that no debris becomes attached.

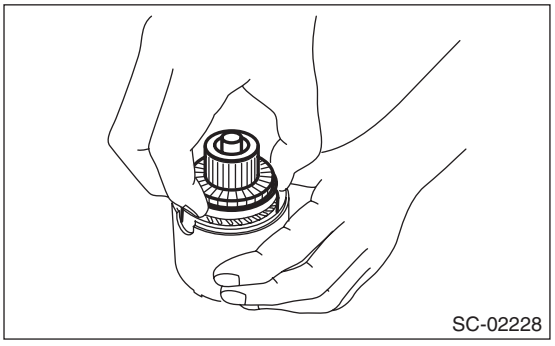
***Grease:***
***Molykote® AG650 or equivalent***




6) Install seal rubber (A), plate (B), and seal rubber (C).

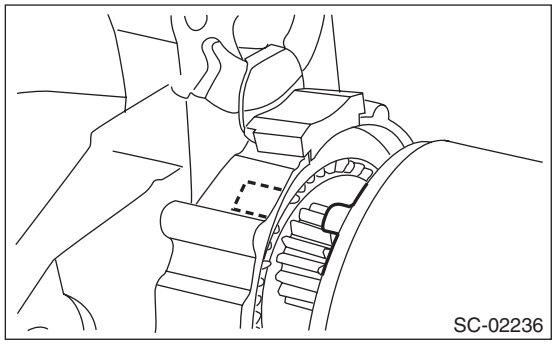


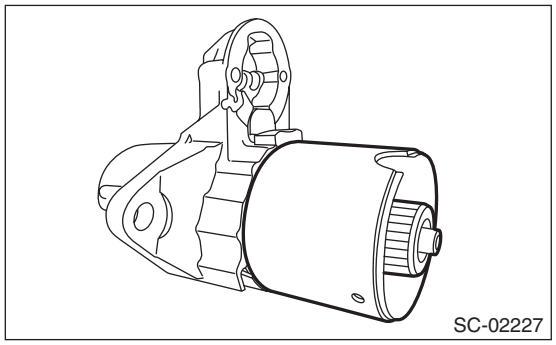

7) Assemble the armature assembly to the yoke assembly.



8) Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

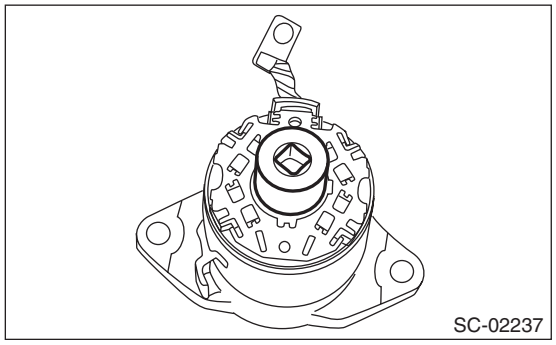
NOTE:
As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.


SC-02236


SC-02227

9) Use an appropriate tool (such as correctly sized socket wrenches) and attach the brush holder assembly to the armature assembly.

NOTE:
Be careful not to damage the brushes.

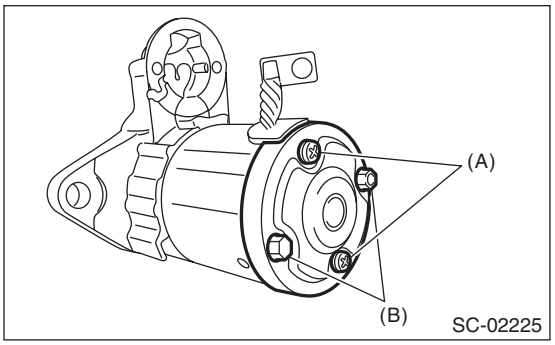

SC-02237

10) Secure starter cover assembly to the brush holder assembly with screws (A).

***Tightening torque:***
***1.4 N·m (0.1 kgf-m, 1.0 ft-lb)***

11) Install through bolts (B) on both sides.

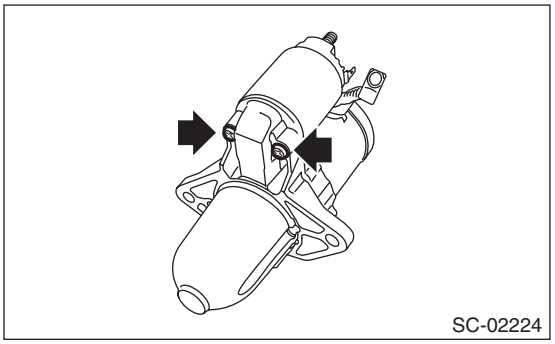
***Tightening torque:***
***6 N·m (0.6 kgf-m, 4.4 ft-lb)***



SC-02225

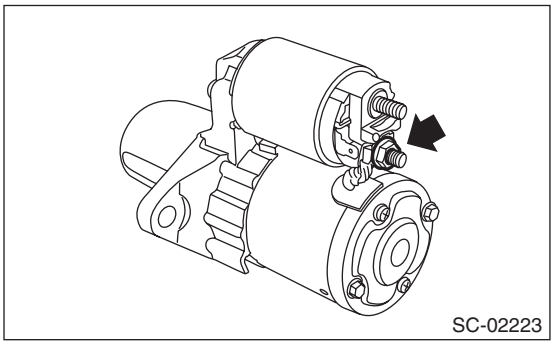
12) Attach the magnet switch assembly to the starter housing assembly.

***Tightening torque:***
***7.5 N·m (0.8 kgf-m, 5.5 ft-lb)***


SC-02224

13) Attach the cable to the terminal M of the magnet switch assembly, and secure with nuts.

***Tightening torque:***
***10 N·m (1.0 kgf-m, 7.4 ft-lb)***

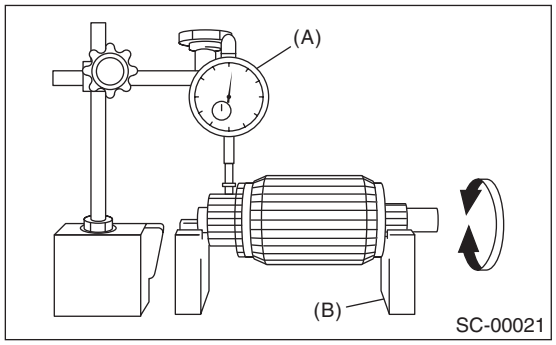

SC-02223

# E: INSPECTION

## 1. ARMATURE

1) Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
2) Runout test
Check for runout on the commutator. If excessive, replace it.

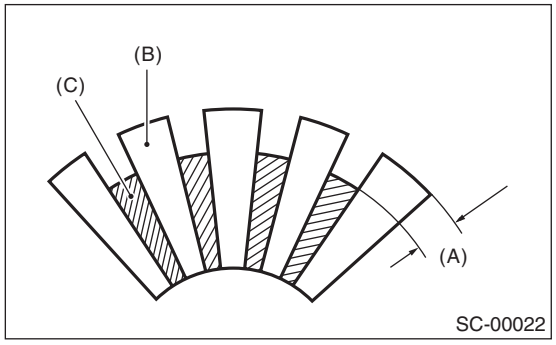
***Commutator runout:***
***Standard***
***0.05 mm (0.0020 in)***
***Limit***
***0.10 mm (0.0039 in)***




(A) Dial gauge
(B) V-block

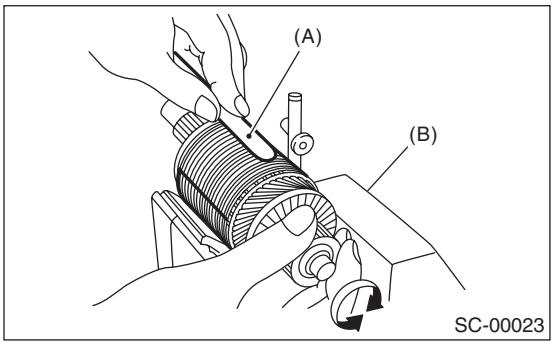
3) Depth of segment mold
Check the depth of the segment mold.

***Depth of segment mold:***
***0.50 mm (0.020 in)***



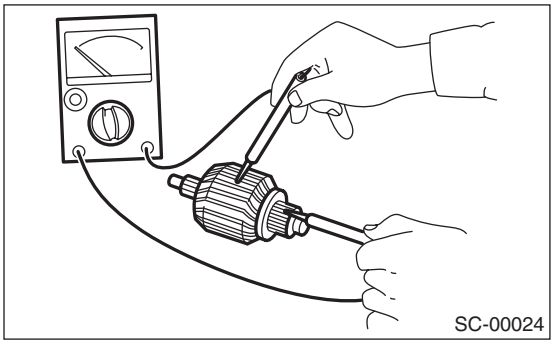

(A) Depth of mold
(B) Segment
(C) Mold

4) Armature short-circuit test
Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace or repair the armature with the shorted circuit.




(A) Steel sheet
(B) Growler tester

5) Armature ground test
Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is no continuity, it is normal. If there is continuity, the armature is grounded.
If grounded, replace the armature.




## 2. YOKE

Make sure that the pole is set at the predetermined position.

## 3. OVERRUNNING CLUTCH

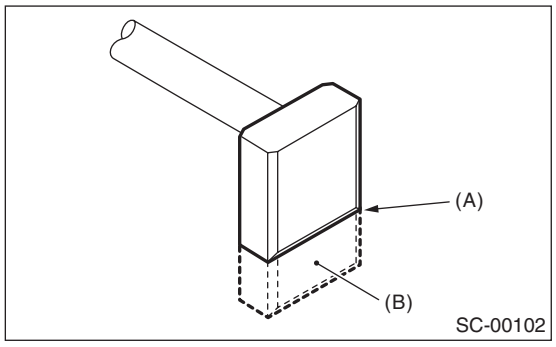
Check that there is no wear or damage to the piston teeth. Replace if it is damaged. If it rotates smoothly when rotated in the correct direction (counterclockwise) and does not return to the other direction, it is normal.

**CAUTION:**
**To prevent spilling of grease, do not clean the overrunning clutch with oil.**

## 4. BRUSH AND BRUSH HOLDER

1) Brush length
Measure the length of the brush. If it exceeds the limit, replace it.
Replace if there is abnormal wear or cracks.

***Brush length:***
***Standard***
***12.3 mm (0.484 in)***
***Limit***
***7.0 mm (0.276 in)***




(A) Service limit line
(B) Brush

2) Brush movement
Check that the brush moves smoothly in the brush holder.
3) Brush spring force
Measure the brush spring force with a spring scale.
Replace the brush holder if below the service limit.

***Brush spring force:***

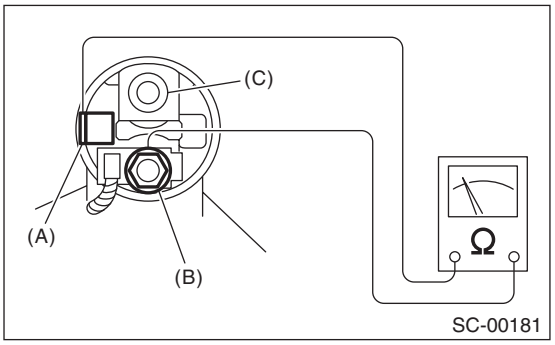
***Standard***
***15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (When new)***

***Limit***
***2.5 N (0.25 kgf, 0.56 lbf)***

## 5. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground.
Also check to be sure there is no continuity between M terminal and B.

***Terminal/Resistance:***
***S — M/1 Ω or less***
***S — Ground/1 Ω or less***
***M — B/1 MΩ or more***

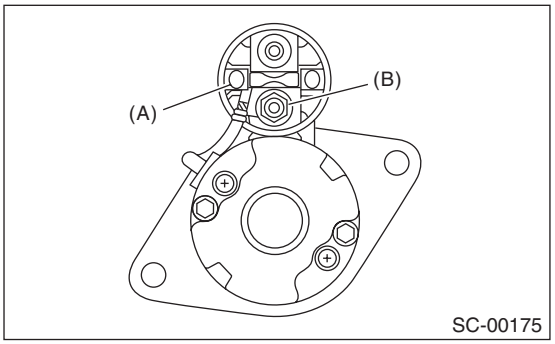



(A) S terminal
(B) M terminal
(C) B terminal

## 6. SWITCH ASSEMBLY OPERATION

1) Using a lead wire, connect the S terminal of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

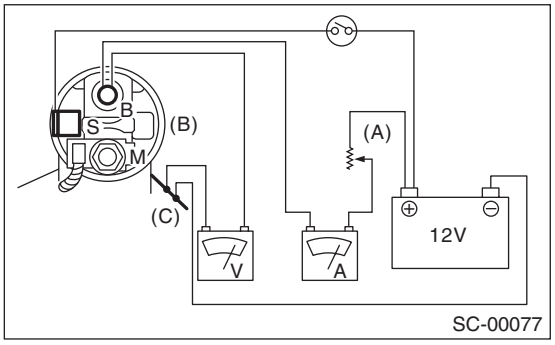
NOTE:
With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.
2) Disconnect the connector from M terminal. Then using a lead wire, connect the positive terminal of battery and M terminal and ground terminal to starter body.
In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.




(A) S terminal
(B) M terminal

## 7. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.




(A) Variable resistance
(B) Magnet switch
(C) Starter body

1) No-load test
Adjust the variable resistance with the switch on until the voltage is 11 V, and read the value displayed by the ammeter to measure starter speed. Compare these values with the standard.

***No-load test (standard):***

***Voltage/Current***
***AT model***
***Max. 11 V/90 A or less***
***MT model***
***Max. 11 V/95 A or less***

***Rotating speed***
***AT model***
***2,000 rpm or more***
***MT model***
***2,500 rpm or more***

2) Load test
Apply the specified braking torque to starter. The condition is normal if the current draw and starter speed are within standard.

***Load test (standard):***

***Voltage/Load***
***AT model***
***7.7 V/16.7 N·m (1.7 kgf-m, 12.3 ft-lb)***
***MT model***
***7.5 V/8.84 N·m (0.9 kgf-m, 6.5 ft-lb)***

***Current/Speed***
***AT model***
***400 A/710 rpm or more***
***MT model***
***300 A/870 rpm or more***

3) Lock test
With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

***Lock test (standard):***

***Voltage/Current***
***AT model***
***3.5 V/960 A or less***
***MT model***
***4 V/680 A or less***

***Torque***
***AT model***
***31 N·m (3.2 kgf-m, 22.9 ft-lb) or more***
***MT model***
***17 N·m (1.7 kgf-m, 12.5 ft-lb) or more***

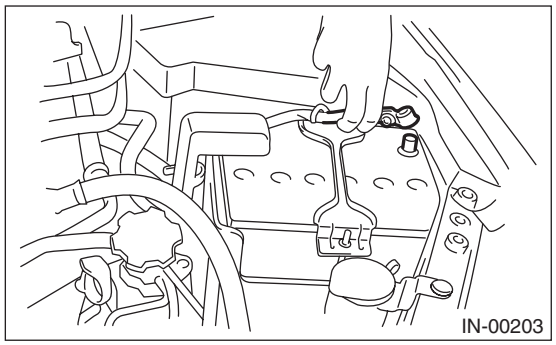
## 8. OTHER INSPECTIONS

Check that the starter does not have deformation, cracks and any other damage.

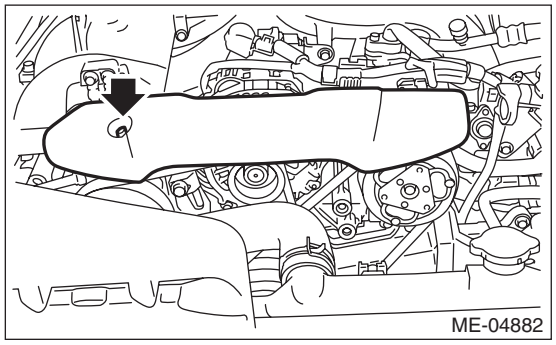
# 3. Generator

## A: REMOVAL

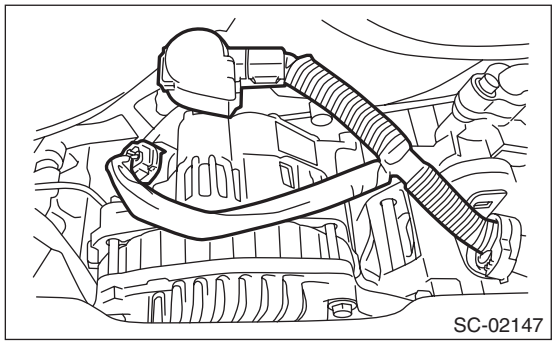
1) Disconnect the ground cable from battery.




2) Remove the V-belt covers.

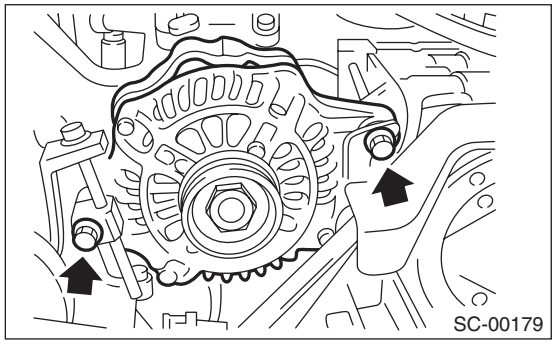



3) Disconnect the connector and terminal from generator.




4) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>

5) Remove the bolts which secure the generator to the bracket.

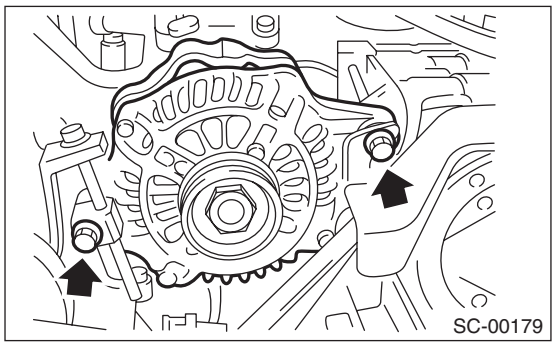



## B: INSTALLATION

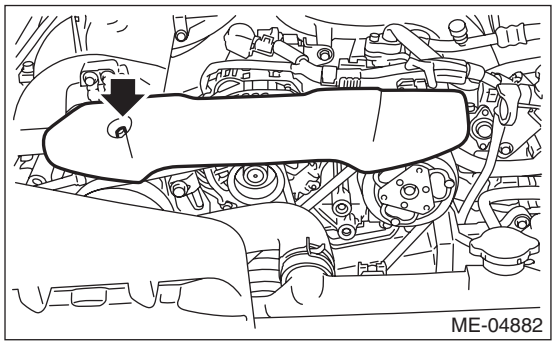
Install in the reverse order of removal.

**CAUTION:**
**Check and adjust the front side belt tension. <Ref. to ME(H4SO)-45, FRONT SIDE BELT, INSPECTION, V-belt.>**

***Tightening torque:***
***25 N·m (2.5 kgf-m, 18.4 ft-lb)***

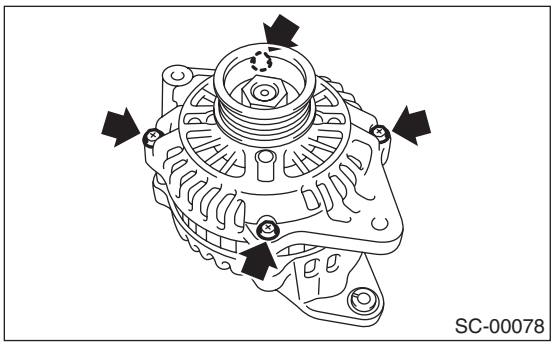



***Tightening torque:***
***13 N·m (1.3 kgf-m, 9.6 ft-lb)***

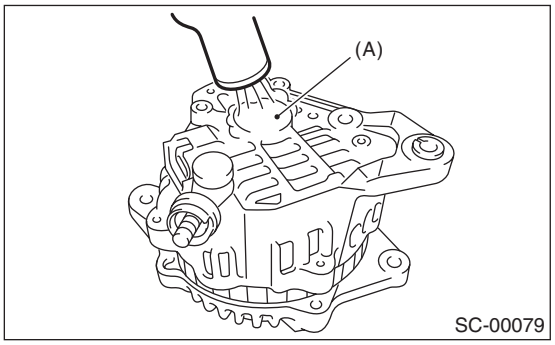


## C: DISASSEMBLY

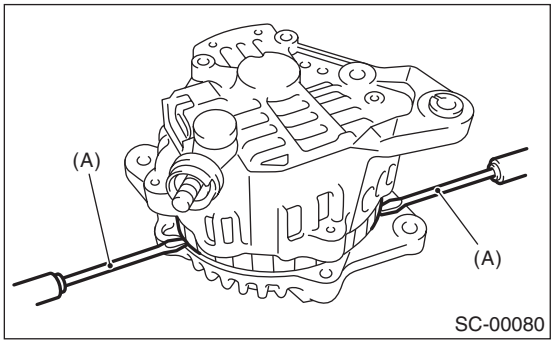
1) Remove the four through-bolts.




2) Use a drier to heat the rear cover (A) portion to 50°C (122°F).

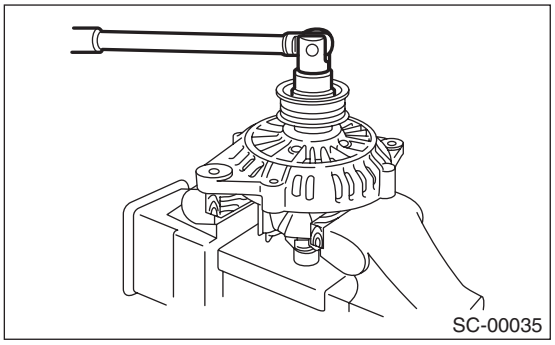



3) Insert the end of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

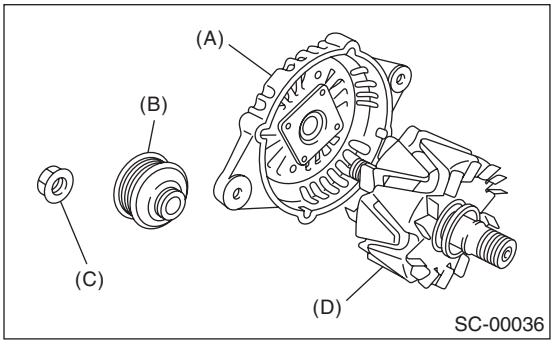



(A) Screwdriver

4) Using a vise, support the rotor and remove the pulley nut.



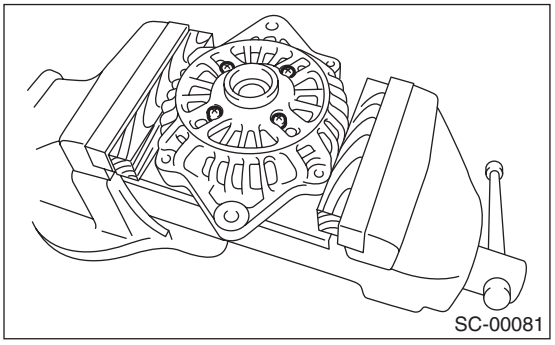

**CAUTION:**
**When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.**



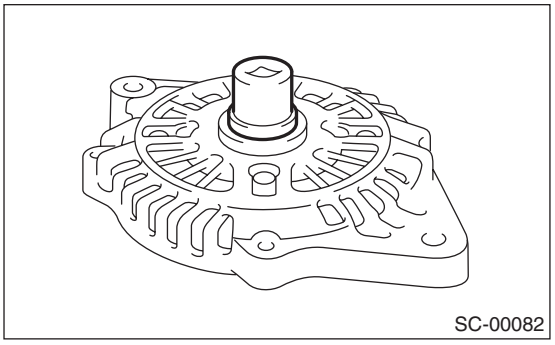

(A) Front cover
(B) Pulley
(C) Nut
(D) Rotor

5) Use the following procedures to remove the ball bearings.

(1) Remove the bolt, and then detach the bearing retainer.

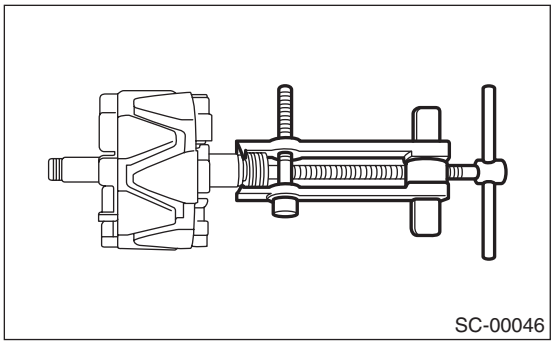



(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.



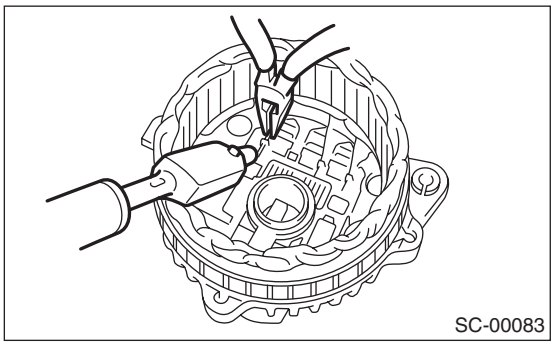

(3) Use the press to push the ball bearings out from the front cover.

6) Using the bearing puller, remove the bearings from the rotor.



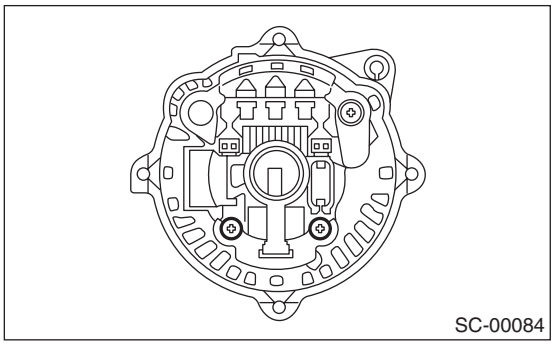

7) Disconnect the connection between the rectifier and stator coil, then remove the stator coil.

**CAUTION:**
**The rectifier is easily damaged by heat. Do not allow a 180 — 270 W soldering iron to contact the terminals for 5 seconds or more at a time.**

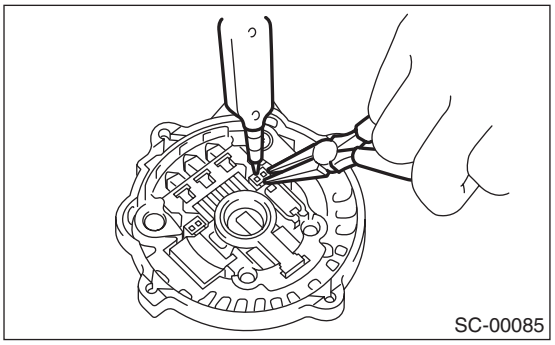



8) Use the following procedures to remove the IC regulator.

(1) Remove the screws which secure the IC regulator to the rear cover.

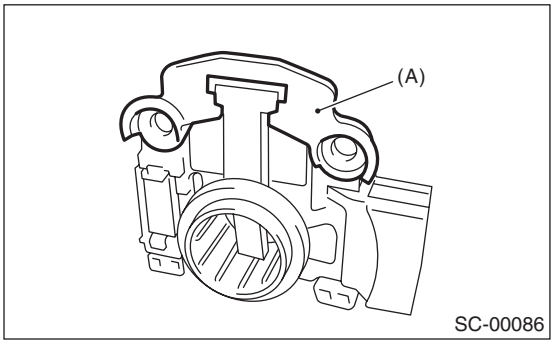



(2) Disconnect the connection between the IC regulator and rectifier, then remove the IC regulator.



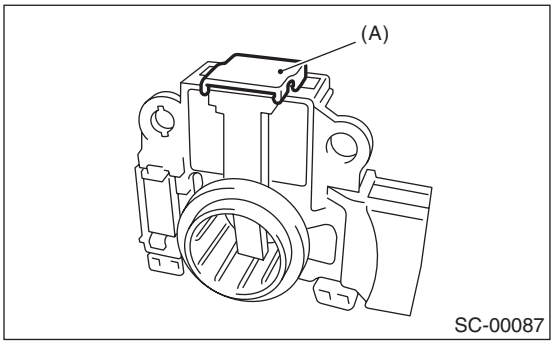

9) Use the following procedures to remove the brush.

(1) Remove the cover A.



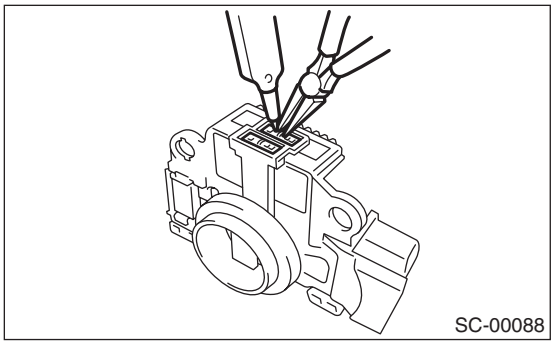

(A) Cover A

(2) Remove the cover B.

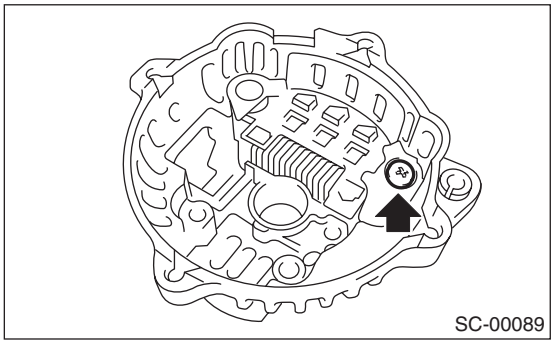



(A) Cover B

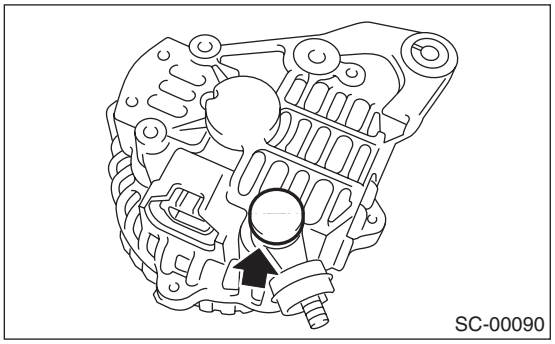
(3) Disconnect the connection and remove the brush.


SC-00088

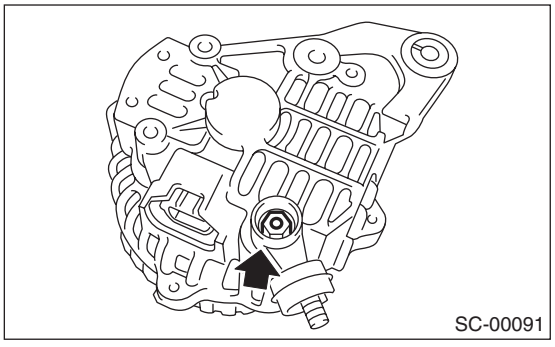
10) Remove the rectifier as follows.
(1) Remove the bolts which secure the rectifier.


SC-00089

(2) Remove the cover on B terminal.


SC-00090

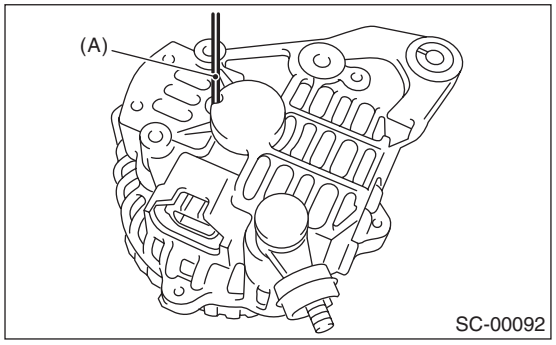
(3) Remove the nuts of B terminal, then remove the rectifier.


SC-00091

## D: ASSEMBLY

Assemble in the reverse order of disassembly.
1) Pull-out of the brush
Before assembling, press the brush down into the brush holder, then fix the brush in that position by inserting a [1 mm (0.04 in) dia., 40 — 50 mm (1.6 — 2.0 in) long] wire through the hole as shown in the figure.

**CAUTION:**
**After re-assembling, remove the wire.**



SC-00092

(A) Wire

2) Install the ball bearings.
(1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
(2) Using a press to press the ball bearings into the specified location.
(3) Install the bearing retainer.
3) Using a press to install the bearings (rear side) to the rotor shaft.
4) Heat the bearing box in rear cover [50 to 60°C (122 to 140°F)], and then press the rear bearing into rear cover.

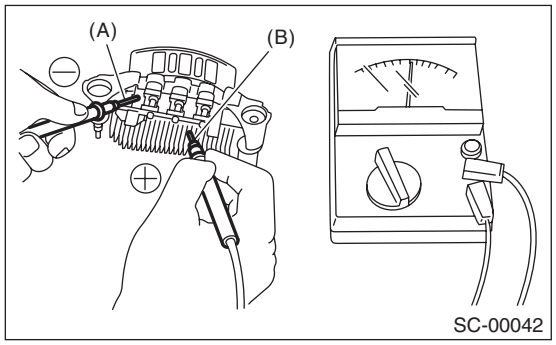
**CAUTION:**
**Do not apply grease to the rear bearings. If there is any oil on the bearing box, remove it completely.**
5) After re-assembling, manually turn the pulley to check that the rotor rotates smoothly.

# E: INSPECTION

## 1. DIODE

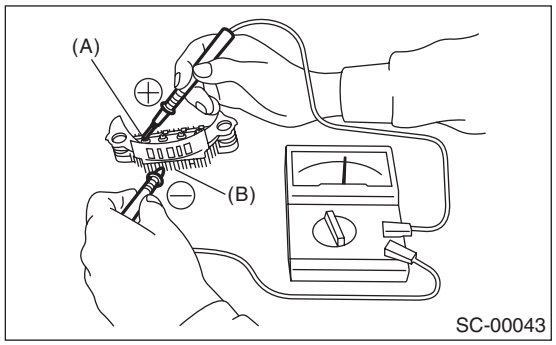
**CAUTION:**
**There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.**

1) Check for continuity between the diode lead and positive side heat sink. If resistance is 1 Ω or more only in the direction from the diode lead to the heat sink, replace the rectifier.




(A) Diode lead
(B) Heat sink (positive side)

2) Check for continuity between the negative side heat sink and diode lead. If resistance is 1 Ω or more only in the direction from the heat sink to the diode lead, replace the rectifier.




(A) Diode lead
(B) Heat sink (negative side)

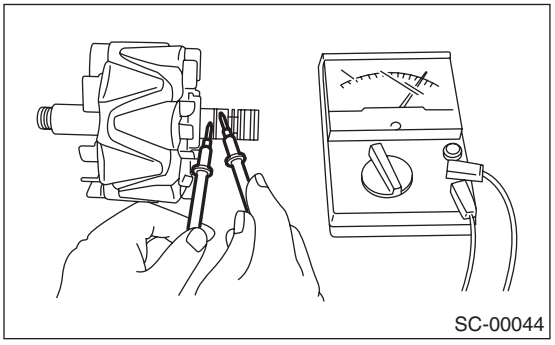
## 2. ROTOR

1) Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.
2) Measure the slip ring outer diameter. Replace the rotor assembly if the slip ring is worn.

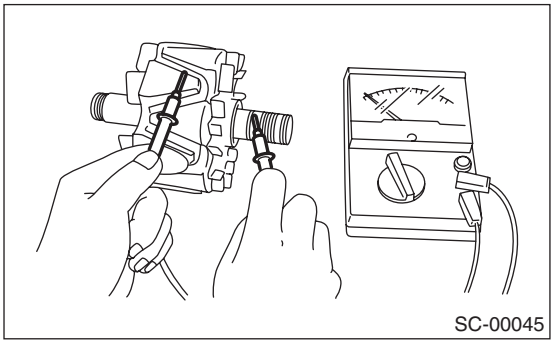
***Slip ring outer diameter:***
***Standard***
***22.7 mm (0.894 in)***
***Limit***
***22.1 mm (0.870 in)***

3) Using a circuit tester, check the resistance between slip rings. If resistance exceeds the standard, replace the rotor assembly.

***Standard:***
***Approx. 1.8 — 2.2 Ω***



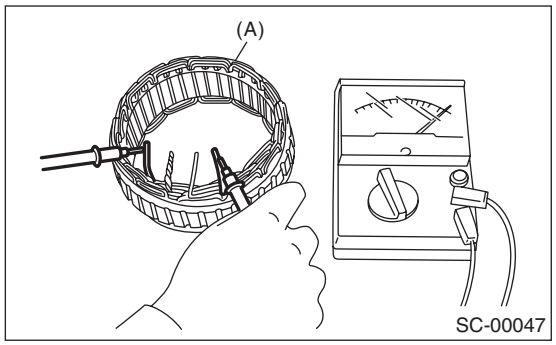

4) Check the continuity between slip ring and rotor core or shaft. If the resistance is 1 Ω or less, replace the rotor assembly.




5) Check the rear ball bearing. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

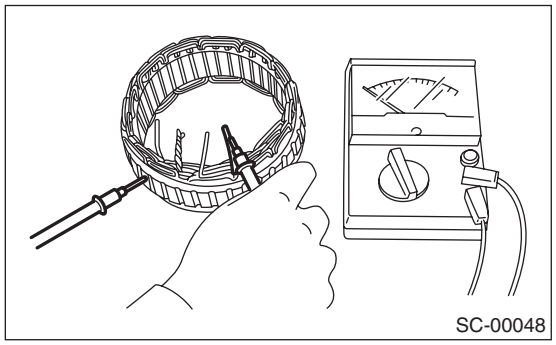
## 3. STATOR COIL

1) Inspect continuity between the stator coil lead wire terminals. If the resistance is 1 Ω or more, replace the stator assembly.




(A) Stator coil

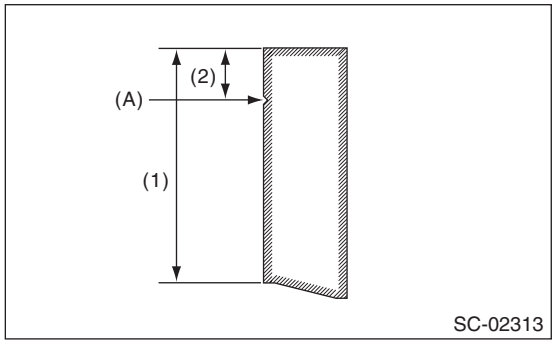
2) Inspect the continuity between the stator coil stator core and lead wire terminals. If the resistance is 1 Ω or less, replace the stator assembly.



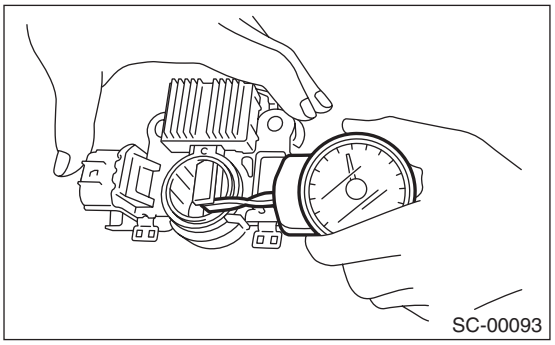

## 4. BRUSH

1) Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

***Brush length:***
***Standard (1)***
***18.5 mm (0.728 in)***
***Limit (2)***
***5.0 mm (0.197 in)***




2) Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is 2.648 N (270 g, 9.52 oz) or less, replace the brush spring with a new part. 4.609 — 5.786 N (470 — 590 g, 16.58 — 20.810 oz) pressure is required on the new spring.




## 5. BALL BEARING (FRONT SIDE)

Check the front ball bearing. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

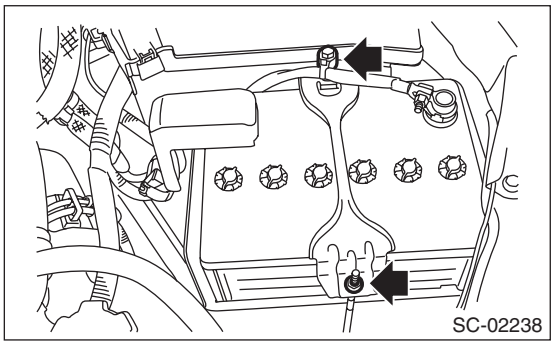
## 6. OTHER INSPECTIONS

Check that the generator does not have deformation, cracks and any other damage.

# 4. Battery

## A: REMOVAL

1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
2) Remove the harness clip from the battery rod.
3) Remove the flange nut from battery rod and remove battery holder.




4) Remove the battery.

## B: INSTALLATION

Install in the reverse order of removal.

***Tightening torque:***
***3.5 N·m (0.4 kgf-m, 2.6 ft-lb)***

NOTE:
• Clean the battery cable terminals and apply grease to retard the formation of corrosion.
• Connect the positive (+) terminal, and then connect the negative (–) terminal of the battery.
• After the battery is installed, initial diagnosis of the electronic throttle control is performed. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

## C: INSPECTION

**WARNING:**
**• Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.**
**• Make sure the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.**
**• In addition, be careful not to let the electrode contact with the coated parts.**
**• Be careful when handling the batteries because they produce explosive gases.**
**• Be sure to keep battery away from any fire.**
**• For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.**
**• Ventilate sufficiently when using or charging battery in enclosed space.**
**• Before starting work, remove rings, metal watch-bands, and other metal jewelry.**
**• Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle.**

### 1. EXTERNAL PARTS

Check the battery case, top cover, vent plugs, and terminal posts for dirt or cracks. If necessary, clean with water and wipe with a dry cloth.
Apply a thin coat of grease on the terminal posts to prevent corrosion.

### 2. ELECTROLYTE LEVEL

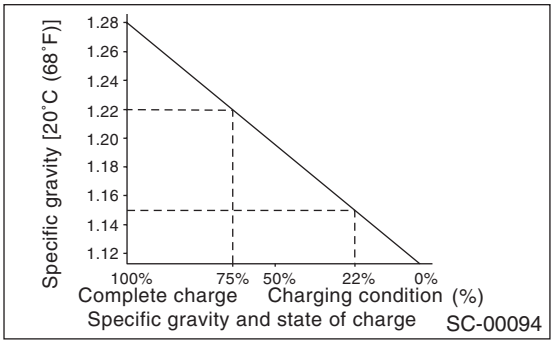
Check the electrolyte level in each cell. If the level is below MIN level, bring the level to MAX level by pouring distilled water into the battery cell. Do not fill beyond MAX level.

### 3. SPECIFIC GRAVITY OF ELECTROLYTE

1) Measure specific gravity of electrolyte using a hydrometer and a thermometer.
Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following calculation:

***$S_{20}$ = St + 0.0007 × (t – 20)***
***$S_{20}$: Specific gravity corrected at electrolyte temperature of 20°C (68°F)***
***St: Measured specific gravity***
***t: Measured temperature (°C)***
***Judge whether or not the battery requires charging according to corrected specific gravity.***
***Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]***

2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



## D: MEASUREMENT

**WARNING:**
**Do not bring an open flame close to the battery when working.**

**CAUTION:**
**• Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.**
**• Be careful since battery electrolyte overflows while charging the battery.**
**• Observe instructions when handling the battery charger.**
**• Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.**

### 1. JUDGEMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte should be held within the specific range of 1.250 — 1.290 for one hour or more.
2) Voltage per battery cell should be held at a specific value in a range of 2.5 — 2.8 V for one hour or more.

### 2. CHECK CONDITION OF CHARGE WITH HYDROMETER

| Hydrometer indicator | State of charge | Corrective action |
|---|---|---|
| Green dot | 65% or more | Load test |
| Dark dot | 65% or less | Charge battery |
| Clear dot | Low electrolyte | Replace the battery* (If cranking is difficult) |
| * Check electrical system before replacement. | | |

### 3. NORMAL CHARGING

Charge the battery at the current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

### 4. QUICK CHARGING

**CAUTION:**
**• Observe the items in "3. NORMAL CHARGING".**
**• Never use 10 A or more when charging the battery because it will shorten the battery life.**

Quick charging is a method that the battery is charged in a short period of time with a relatively large current by using a quick charger.
Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, quick charging must be carried out within a current range that will not raise the electrolyte temperature to 40°C (104°F) or more.
Also the quick charging is a temporary mean to bring battery voltage up to some level, and battery should be charged slowly with low current as a rule.

# ENGINE (DIAGNOSTICS)

# EN(H4SO)(diag)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