

GENERAL DESCRIPTION

COOLING

1. General Description

A: SPECIFICATIONS

Model			Non-turbo	Turbo
Cooling system			Electric fan + Forced engine coolant circulation system	
Total engine coolant capacity ℓ (US qt, Imp qt)			MT: Approx. 7.0 (7.4, 6.2) AT: Approx. 6.9 (7.29, 6.07)	MT: Approx. 7.7 (8.14, 6.78) AT: Approx. 7.6 (8.03, 6.69)
Water pump	Type		Centrifugal impeller type	
	Discharge performance I	Flow rate	20 ℓ (5.3 US gal, 4.4 Imp gal)/min.	
		Pump speed—discharge pressure	700 rpm — 2.9 kPa (0.3 mAq 1.0 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance II	Flow rate	100 ℓ (26.4 US gal, 22.0 Imp gal)/min.	
		Pump speed—discharge pressure	3,000 rpm — 49.0 kPa (5.0 mAq 16.4 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance III	Flow rate	200 ℓ (52.8 US gal, 44.0 Imp gal)/min.	
		Pump speed—discharge pressure	6,000 rpm — 225.4 kPa (23.0 mAq 75.5 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Impeller diameter		76 mm (2.99 in)	
	Number of impeller vanes		8	
	Pump pulley diameter		60 mm (2.36 in)	
	Clearance between impeller and case	Standard	0.5 — 0.7 mm (0.020 — 0.028 in)	
		Limit	1.0 mm (0.039 in)	
	“Thrust” runout of impeller end		0.5 mm (0.020 in)	
Thermostat	Type		Wax pellet type	
	Starts to open		76 — 80°C (169 — 176°F)	
	Fully opened		91°C (196°F)	
	Valve lift		9.0 mm (0.354 in) or more	
	Valve bore		35 mm (1.38 in)	
Radiator fan	Motor	Main fan	70 W	120 W
		Sub fan	70 W	120 W
	Fan diameter × Blade		320 mm (12.60 in) × 5 (main fan) 320 mm (12.60 in) × 7 (sub fan)	
Radiator	Type		Down flow, pressure type	
	Core dimensions		*1 691.5 × 340 × 16 mm (27.22 × 13.39 × 0.63 in)	*2 691.5 × 340 × 27 mm (27.22 × 13.39 × 1.06 in)
	Pressure range in which cap valve is open		Above: 108±15 kPa (1.1±0.15 kg/cm ² , 16±2 psi) Below: -1.0 to -4.9 kPa (-0.01 to -0.05 kg/cm ² , -0.1 to -0.7 psi)	
	Fins		Corrugated fin type	
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)	

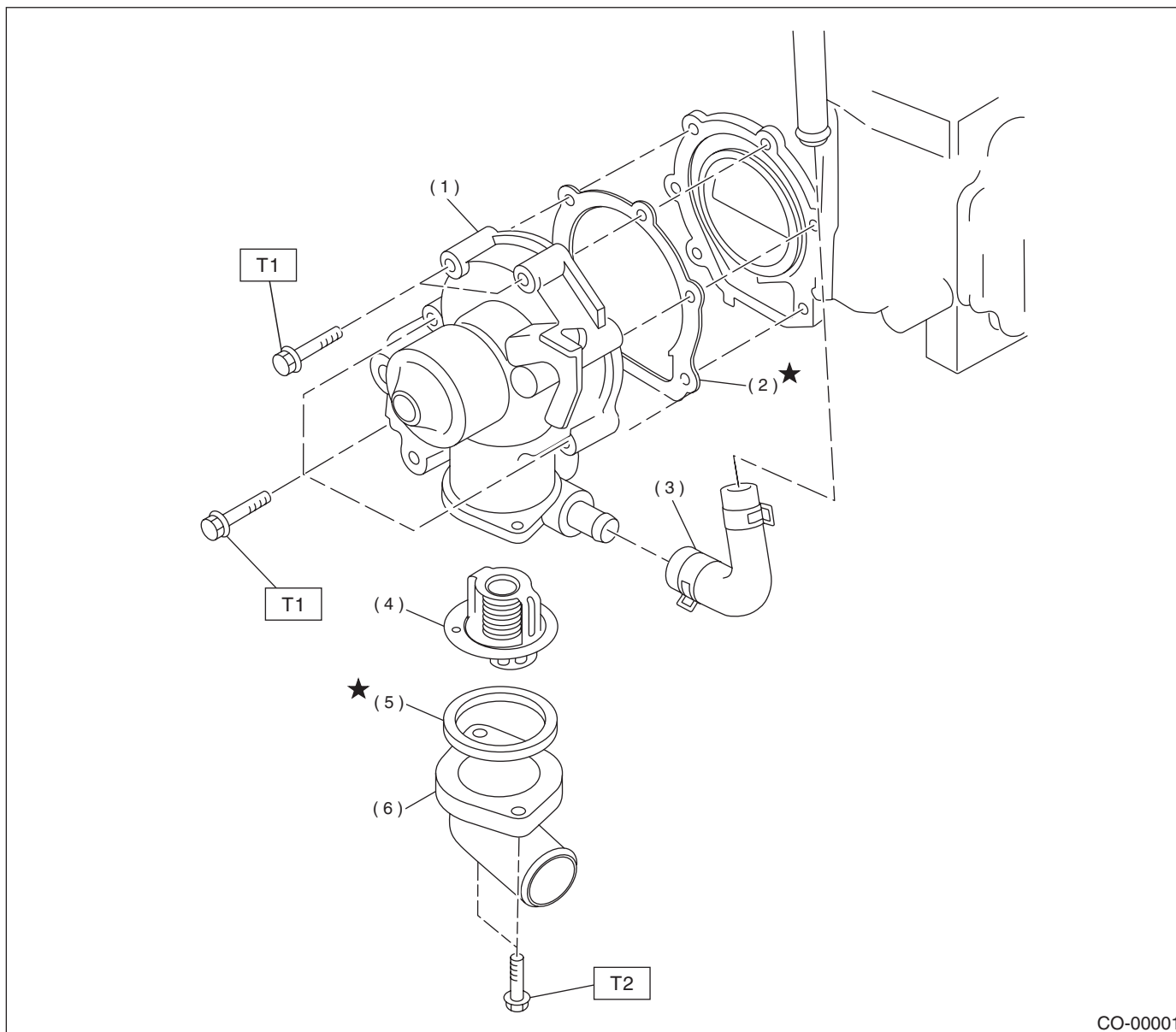
*1: Non-turbo model and turbo AT model

*2: Turbo MT model

B: COMPONENT

1. WATER PUMP

• NON-TURBO MODEL



CO-00001

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

Tightening torque: N·m (kgf-m, ft-lb)

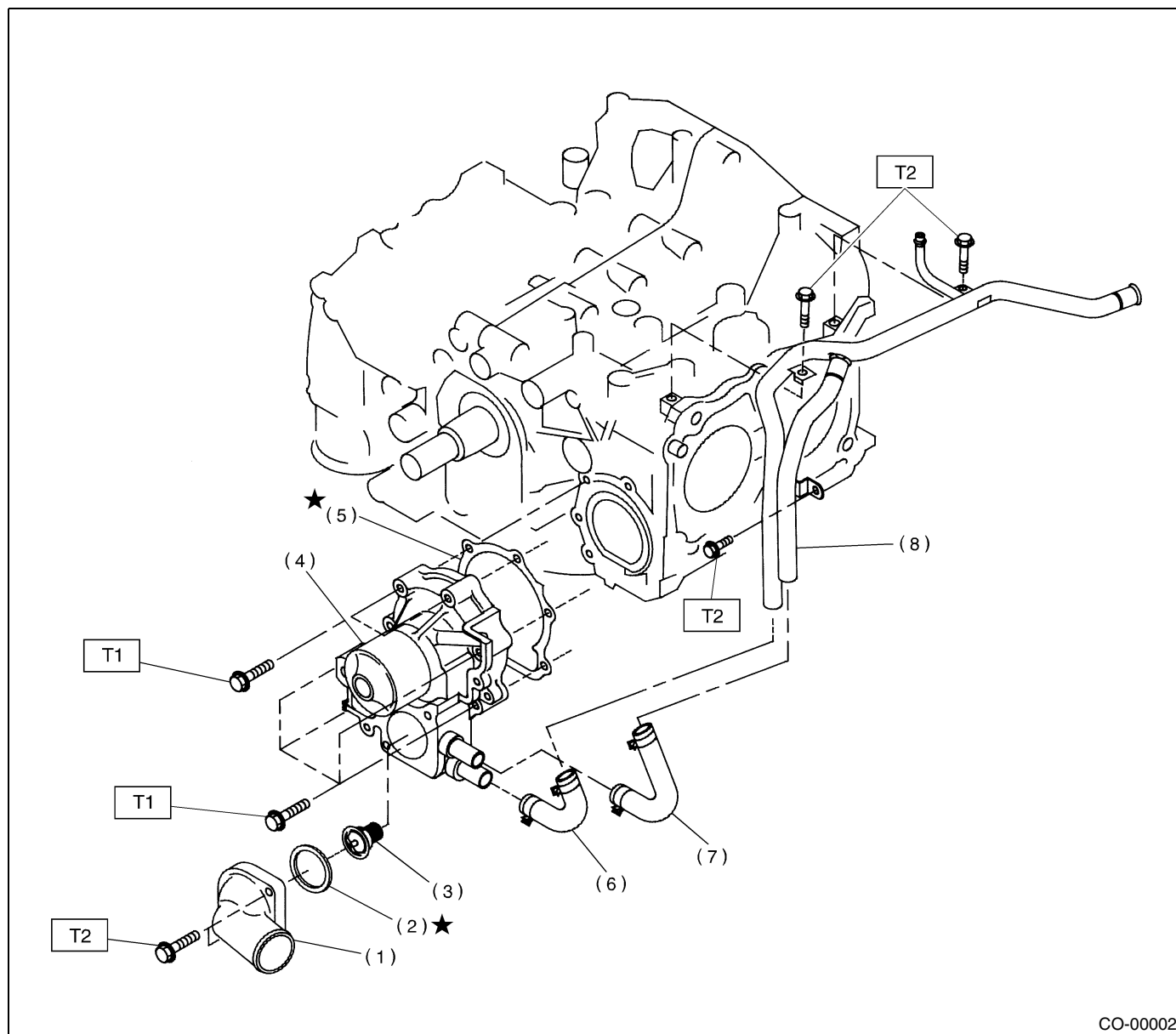
**T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)**

T2: 6.5 (0.66, 4.8)

GENERAL DESCRIPTION

COOLING

• TURBO MODEL



- (1) Thermostat cover
- (2) Gasket
- (3) Thermostat
- (4) Water pump ASSY
- (5) Gasket

- (6) Header by-pass hose
- (7) Coolant filler tank by-pass hose
- (8) Water by-pass pipe

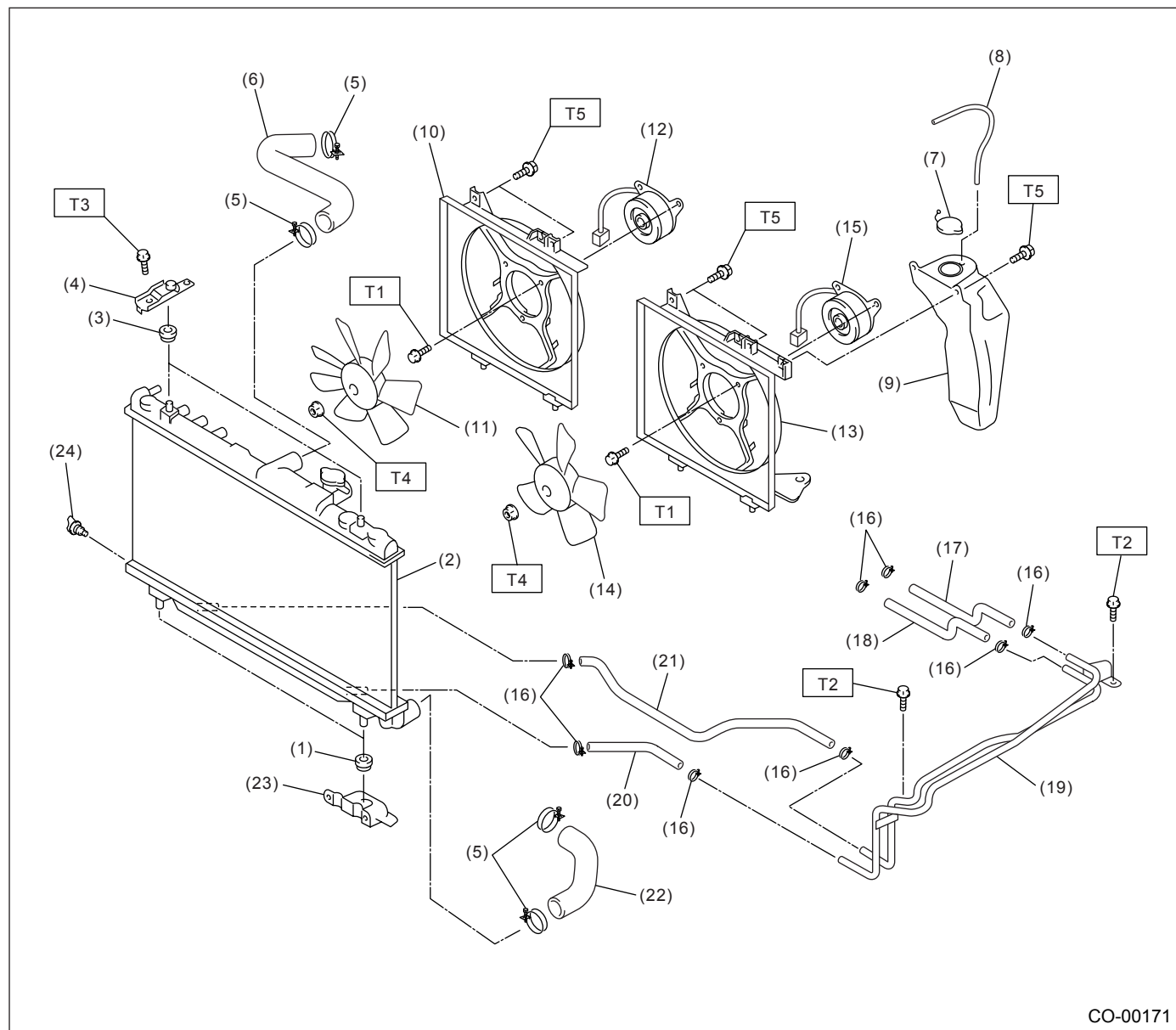
Tightening torque: N·m (kgf-m, ft-lb)

**T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)**

T2: 6.5 (0.66, 4.8)

2. RADIATOR AND RADIATOR FAN

• NON-TURBO MODEL



CO-00171

- | | | |
|---------------------------------------|---|-----------------------------|
| (1) Radiator lower cushion | (13) Main fan shroud | (23) Radiator lower bracket |
| (2) Radiator | (14) Radiator main fan | (24) Radiator drain plug |
| (3) Radiator upper cushion | (15) Main fan motor | |
| (4) Radiator upper bracket | (16) ATF hose clamp (AT vehicles only) | |
| (5) Clamp | (17) ATF inlet hose A (AT vehicles only) | |
| (6) Radiator inlet hose | (18) ATF outlet hose A (AT vehicles only) | |
| (7) Engine coolant reservoir tank cap | (19) ATF pipe (AT vehicles only) | |
| (8) Over flow hose | (20) ATF inlet hose B (AT vehicles only) | |
| (9) Engine coolant reservoir tank | (21) ATF outlet hose B (AT vehicles only) | |
| (10) Sub fan shroud | (22) Radiator outlet hose | |
| (11) Radiator sub fan | | |
| (12) Sub fan motor | | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.45, 3.3)

T2: 12 (1.2, 8.7)

T3: 18 (1.8, 13.0)

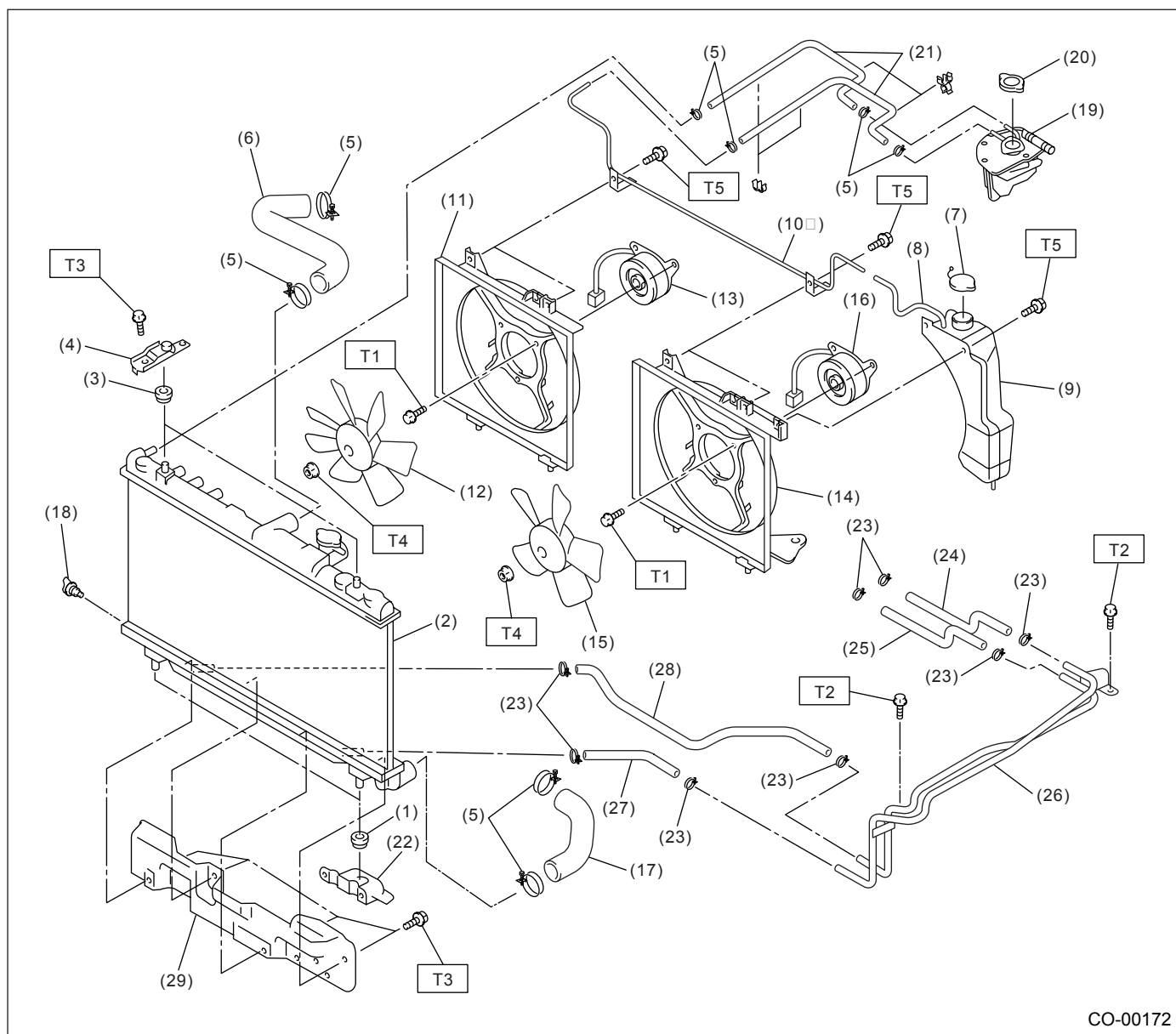
T4: 3.4 (0.35, 2.5)

T5: 4.9 (0.50, 3.6)

GENERAL DESCRIPTION

COOLING

• TURBO MODEL



(1) Radiator lower cushion	(14) Main fan shroud	(26) ATF pipe (AT vehicles only)
(2) Radiator	(15) Radiator main fan	(27) ATF inlet hose B (AT vehicles only)
(3) Radiator upper cushion	(16) Radiator main fan motor	(28) ATF outlet hose B (AT vehicles only)
(4) Radiator upper bracket	(17) Radiator outlet hose	(29) Radiator under cover
(5) Clamp	(18) Radiator drain plug	
(6) Radiator inlet hose	(19) Engine coolant filler tank	
(7) Engine coolant reservoir tank cap	(20) Engine coolant filler tank cap	
(8) Over flow hose	(21) Engine coolant hose	
(9) Engine coolant reservoir tank	(22) Radiator lower bracket	
(10) Over flow pipe	(23) ATF hose clamp (AT vehicles only)	
(11) Sub fan shroud	(24) ATF inlet hose A (AT vehicles only)	
(12) Radiator sub fan	(25) ATF outlet hose A (AT vehicles only)	
(13) Radiator sub fan motor		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.45, 3.3)

T2: 12 (1.2, 8.7)

T3: 18 (1.8, 13.0)

T4: 3.4 (0.35, 2.5)

T5: 4.9 (0.50, 3.6)

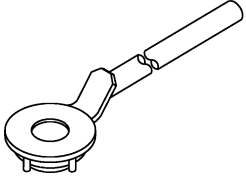
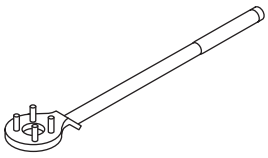
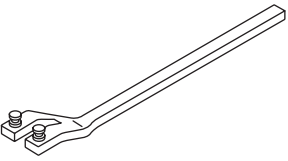
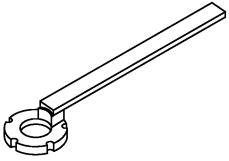
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect negative terminal from battery.

GENERAL DESCRIPTION

COOLING

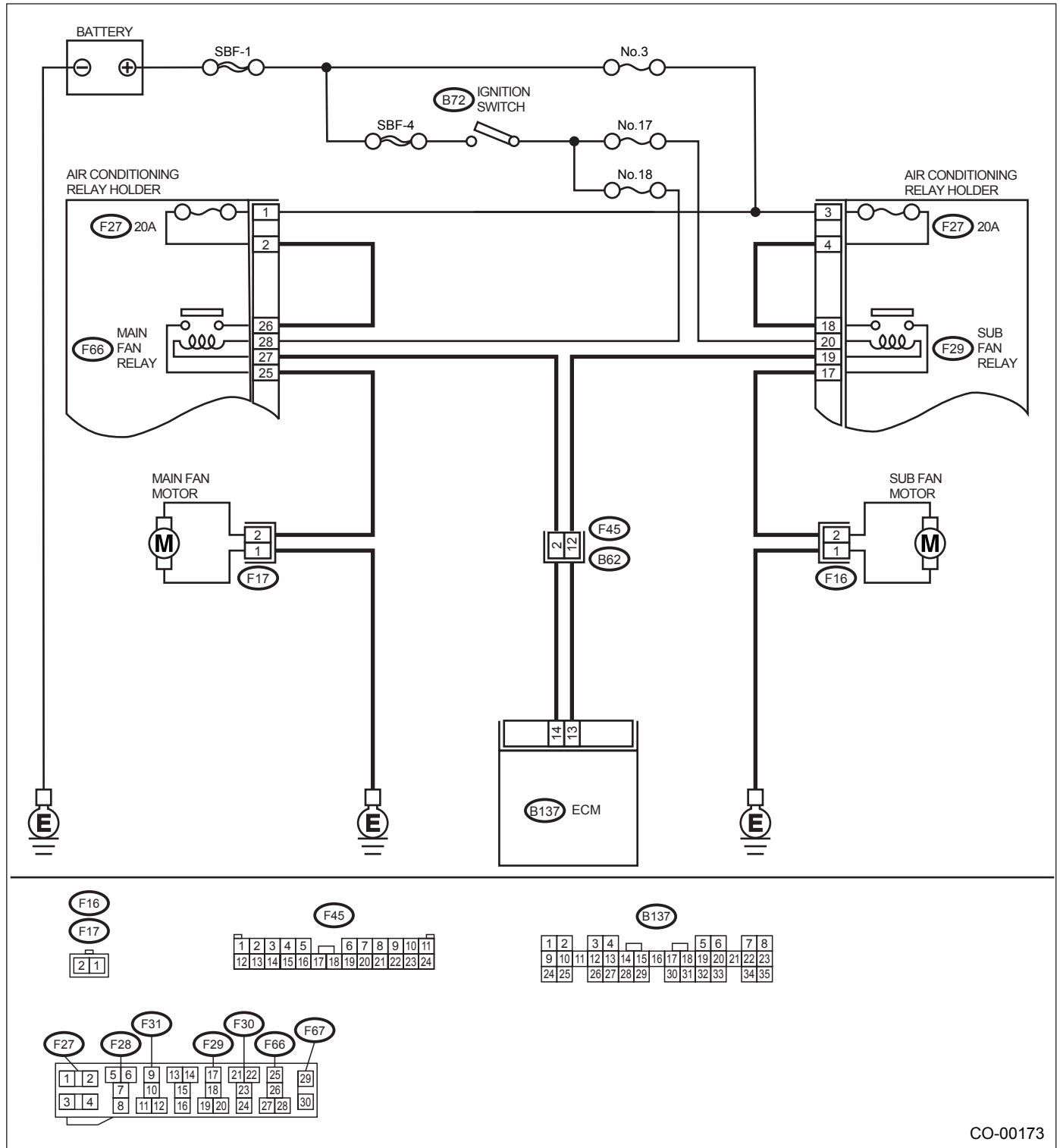
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used for stopping crankshaft pulley when loosening and tightening crankshaft pulley bolts. (Turbo model)
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for stopping crankshaft pulley when loosening and tightening crankshaft pulley bolts. (Non-turbo model)
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket. (Non-turbo LH side and Turbo LH side intake) Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used. (Non-turbo LH side only)
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.

2. Radiator Main Fan System

A: SCHEMATIC

1. NON-TURBO MODEL

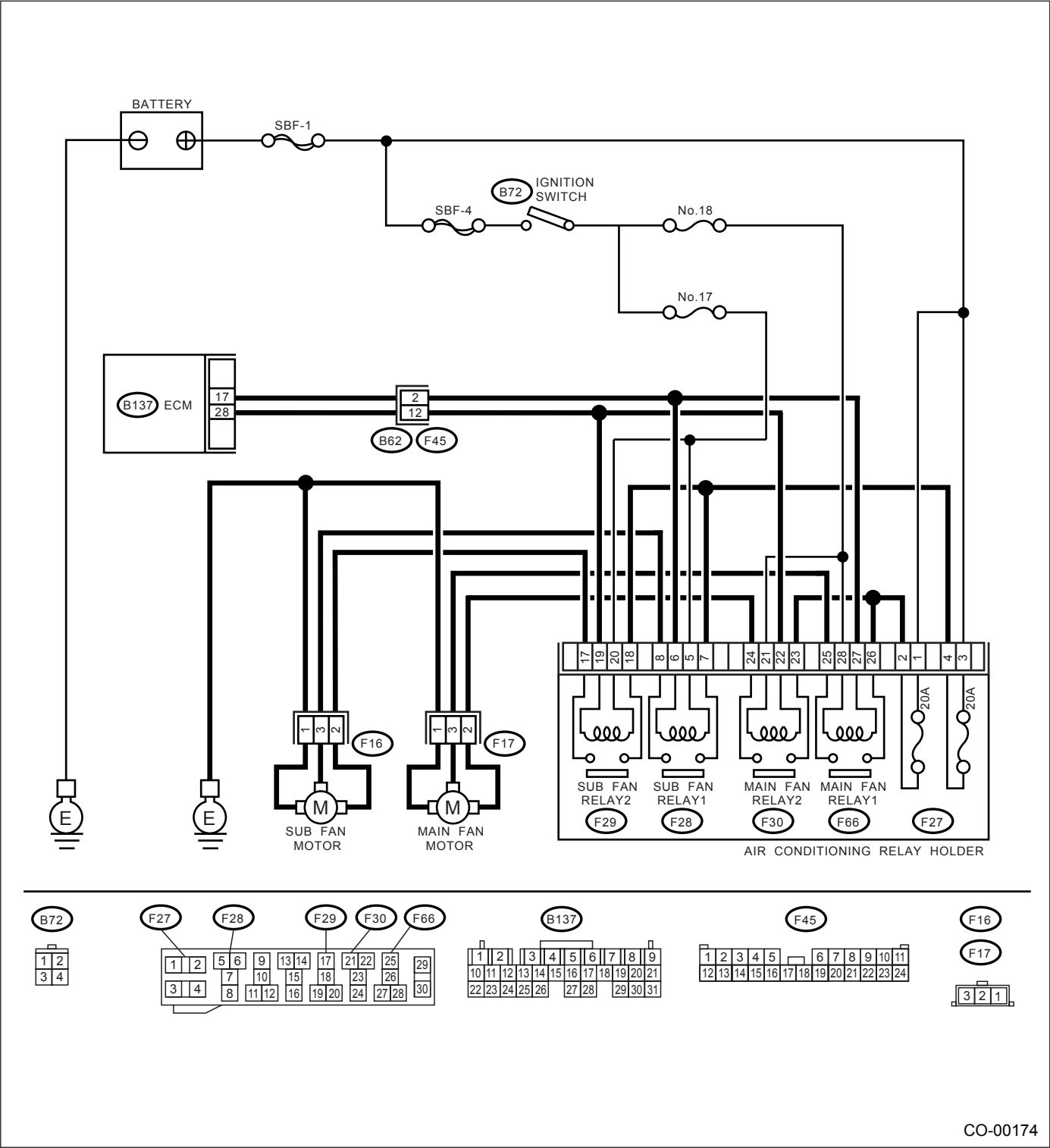


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RADIATOR MAIN FAN SYSTEM

COOLING

2. TURBO MODEL



CO-00174

B: INSPECTION

1. NON-TURBO MODEL

DETECTING CONDITION:

Condition:

- Engine coolant temperature is above 95°C (203°F).
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator main fan does not rotate under the above conditions.

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO MAIN FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the main fan motor. 3) Start the engine, and warm it up until engine coolant temperature increases over 95°C (203°F). 4) Stop the engine and turn the ignition switch to ON. 5) Measure the voltage between main fan motor connector and chassis ground. Connector & terminal (F17) No. 2 (+) — Chassis ground (–): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 5.
2 CHECK GROUND CIRCUIT OF MAIN FAN MOTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between main fan motor connector and chassis ground. Connector & terminal (F17) No. 1 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair the open circuit in harness between main fan motor connector and chassis ground.
3 CHECK POOR CONTACT. Check poor contact in main fan motor connector. Is there poor contact in main fan motor connector?	There is a poor contact.	Repair the poor contact in main fan motor connector.	Go to step 4.
4 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and the negative (–) terminal to terminal No. 1 of main fan motor connector. Does the main fan rotate?	The main fan rotates.	Repair the poor contact in main fan motor connector.	Replace the main fan motor with a new one.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
5 CHECK POWER SUPPLY TO MAIN FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay from A/C relay holder. 3) Measure the voltage between main fan relay terminal and chassis ground. Connector & terminal (F66) No. 26 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 6.	Go to step 7.
6 CHECK POWER SUPPLY TO MAIN FAN RELAY. 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay terminal and chassis ground. Connector & terminal (F66) No. 28 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 10.	Go to step 9.
7 CHECK 20 A FUSE. 1) Remove 20 A fuse from A/C relay holder. 2) Check condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Go to step 8.
8 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and main fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
9 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 18 from joint box. 3) Check condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between main fan relay and ignition switch.
10 CHECK MAIN FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay. 3) Measure the resistance of main fan relay. Terminal No. 26 — No. 25: Is the measured value more than the specified value?	1 MΩ	Go to step 11.	Replace the main fan relay.
11 CHECK MAIN FAN RELAY. 1) Connect the battery to terminals No. 27 and No. 28 of main fan relay. 2) Measure the resistance of main fan relay. Terminal No. 26 — No. 25: Is the measured value less than the specified value?	1 Ω	Go to step 12.	Replace the main fan relay.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
12 CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR. Measure the resistance of harness between main fan motor connector and main fan relay terminal. Connector & terminal (F17) No. 2 — (F66) No. 25: Is the measured value less than the specified value?	1 Ω	Go to step 13.	Repair the open circuit in harness between main fan motor connector and main fan relay terminal.
13 CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between main fan relay connector and ECM connector. Connector & terminal (F66) No. 27 — (B137) No. 14: Is the measured value less than the specified value?	1 Ω	Go to step 14.	Repair the open circuit in harness between main fan relay and ECM.
14 CHECK POOR CONTACT. Check poor contact in connector between main fan and ECM. Is there poor contact in connector between main fan motor and ECM?	There is a poor contact.	Repair the poor contact connector.	Contact with SOA (distributor) service.

NOTE:

Inspection by SOA (distributor) service
 SOA (distributor) service is required, because probable cause is deterioration of multiple parts.

RADIATOR MAIN FAN SYSTEM

COOLING

2. TURBO MODEL

DETECTING CONDITION:

Condition:

- Engine coolant temperature is above 96°C (205°F).
- A/C compressor is rotated.
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator main fan does not rotate under the above conditions.
- Radiator main fan does not rotate at high speed when the following conditions are both met:
 - (1) Engine coolant temperature is above 90°C (194°F)
 - (2) A/C is ON

	Step	Check	Yes	No
1	CHECK OPERATION OF RADIATOR. 1)Run the engine at idle. (Vehicle stationary) 2)Turn the A/C switch to OFF. 3)Warm the engine coolant temperature over 96°C (205°F). Does the main radiator fan rotate?	The fan rotates.	Go to step 2.	Go to step 3.
2	CHECK OPERATION OF RADIATOR. 1)Turn the A/C switch ON at condition of step 1. Does the main radiator fan rotate at high speed when A/C compressor is operated?	The fan rotates at high speed.	Radiator main fan system is okay.	Go to step 17.
3	CHECK POWER SUPPLY TO MAIN FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Stop the engine and turn ignition switch to ON. 5)Measure the voltage between main fan motor connector and chassis ground. Connector & terminal (F17) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Go to step 7.
4	CHECK GROUND CIRCUIT OF MAIN FAN MOTOR. 1)Turn the ignition switch to OFF. 2)Measure the resistance between main fan motor connector and chassis ground. Connector & terminal (F17) No. 1 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Repair the open circuit in harness between main fan motor connector and chassis ground.
5	CHECK POOR CONTACT. Check poor contact in main fan motor connector. Is there poor contact in main fan motor connector?	There is a poor contact.	Repair the poor contact in main fan motor connector.	Go to step 6.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
6 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 3, and the negative (–) terminal to terminal No. 1 of main fan motor connector. Does the main fan rotate?	The main fan rotates.	Repair the poor contact in main fan motor connector.	Replace the main fan motor with a new one.
7 CHECK POWER SUPPLY TO MAIN FAN RELAY1. 1)Turn the ignition switch to OFF. 2)Remove the main fan relay1 from A/C relay holder. 3)Measure the voltage between main fan relay1 terminal and chassis ground. Connector & terminal (F66) No. 26 (+) — Chassis ground (–): Is the measured value more than the specified value?	10 V	Go to step 8.	Go to step 9.
8 CHECK POWER SUPPLY TO MAIN FAN RELAY1. 1)Turn the ignition switch to ON. 2)Measure the voltage between main fan relay1 terminal and chassis ground. Connector & terminal (F66) No. 28 (+) — Chassis ground (–): Is the measured value more than the specified value?	10 V	Go to step 12.	Go to step 11.
9 CHECK 20 A FUSE. 1)Remove the 20 A fuse from A/C relay holder. 2)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace fuse.	Go to step 10.
10 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (–): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and main fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
11 CHECK FUSE. 1)Turn the ignition switch to OFF. 2)Remove the fuse No. 18 from joint box. 3)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between main fan relay and ignition switch.
12 CHECK MAIN FAN RELAY1. 1)Turn the ignition switch to OFF. 2)Remove the main fan relay1. 3)Measure the resistance of main fan relay1. Terminal No. 26 — No. 25: Is the measured value more than the specified value?	1 MΩ	Go to step 13.	Replace the main fan relay1.
13 CHECK MAIN FAN RELAY. 1)Connect the battery to terminals No. 27 and No. 28 of main fan relay1. 2)Measure the resistance of main fan relay1. Terminal No. 26 — No. 25: Is the measured value less than the specified value?	1 Ω	Go to step 14.	Replace the main fan relay1.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
14 CHECK HARNESS BETWEEN MAIN FAN RELAY1 TERMINAL AND MAIN FAN MOTOR CONNECTOR. Measure the resistance of harness between main fan motor connector and main fan relay1 terminal. Connector & terminal (F17) No. 3 — (F66) No. 25: Is the measured value less than the specified value?	1 Ω	Go to step 15.	Repair the open circuit in harness between main fan motor connector and main fan relay1 terminal.
15 CHECK HARNESS BETWEEN MAIN FAN RELAY1 AND ECM. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between main fan relay1 connector and ECM connector. Connector & terminal (F66) No. 27 — (B137) No. 17: Is the measured value less than the specified value?	1 Ω	Go to step 16.	Repair the open circuit in harness between main fan relay1 and ECM.
16 CHECK POOR CONTACT. Check poor contact in connector between main fan and ECM. Is there poor contact in connector between main fan motor and ECM?	There is a poor contact.	Repair the poor contact connector.	Contact with SOA (distributor) service.
17 CHECK POWER SUPPLY TO MAIN FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Turn the A/C switch ON. 5)Measure the voltage while A/C compressor is rotating. 6)Measure the voltage between main fan motor connector and chassis ground. Connector & terminal (F17) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 18.	Go to step 20.
18 CHECK POOR CONTACT. Check poor contact in main fan motor connector. Is there poor contact in main fan motor connector?	There is a poor contact.	Repair the poor contact in main fan motor connector.	Go to step 19.
19 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and negative (-) terminal to terminal No. 1 of main fan motor connector. Does the main fan rotate?	The main fan rotates.	Repair the poor contact in main fan motor connector.	Replace the main fan motor with a new one.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
20 CHECK POWER SUPPLY TO MAIN FAN RELAY2. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay2 from A/C relay holder. 3) Measure the voltage between main fan relay2 terminal and chassis ground. Connector & terminal (F30) No. 23 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 21.	Go to step 22.
21 CHECK POWER SUPPLY TO MAIN FAN RELAY2. 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay2 terminal and chassis ground. Connector & terminal (F30) No. 21 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 25.	Go to step 24.
22 CHECK 20 A FUSE. 1) Remove the 20 A fuse from A/C relay holder. 2) Check condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Go to step 23.
23 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and main fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
24 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 18 from joint box. 3) Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between main fan relay and ignition switch.
25 CHECK MAIN FAN RELAY2. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay2. 3) Measure the resistance of main fan relay2. Terminal No. 23 — No. 24: Is the measured value more than the specified value?	1 MΩ	Go to step 26.	Replace the main fan relay2.
26 CHECK MAIN FAN RELAY2. 1) Connect the battery to terminals No. 21 and No. 22 of main fan relay1. 2) Measure the resistance of main fan relay2. Terminal No. 23 — No. 24: Is the measured value less than the specified value?	1 Ω	Go to step 27.	Replace the main fan relay2.

RADIATOR MAIN FAN SYSTEM

COOLING

Step	Check	Yes	No
27 CHECK HARNESS BETWEEN MAIN FAN RELAY2 TERMINAL AND MAIN FAN MOTOR CONNECTOR. Measure the resistance of harness between main fan motor connector and main fan relay2 terminal. Connector & terminal (F17) No. 2 — (F30) No. 24: Is the measured value less than the specified value?	1 Ω	Go to step 28.	Repair the open circuit in harness between main fan motor connector and main fan relay2 terminal.
28 CHECK HARNESS BETWEEN MAIN FAN RELAY2 AND ECM. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between main fan relay2 connector and ECM connector. Connector & terminal (F30) No. 22 — (B134) No. 28: Is the measured value less than the specified value?	1 Ω	Go to step 29.	Repair the open circuit in harness between main fan relay2 and ECM.
29 CHECK POOR CONTACT. Check poor contact in connector between main fan and ECM. Is there poor contact in connector between main fan motor and ECM?	There is a poor contact.	Repair poor contact connector.	Contact with SOA (distributor) service.

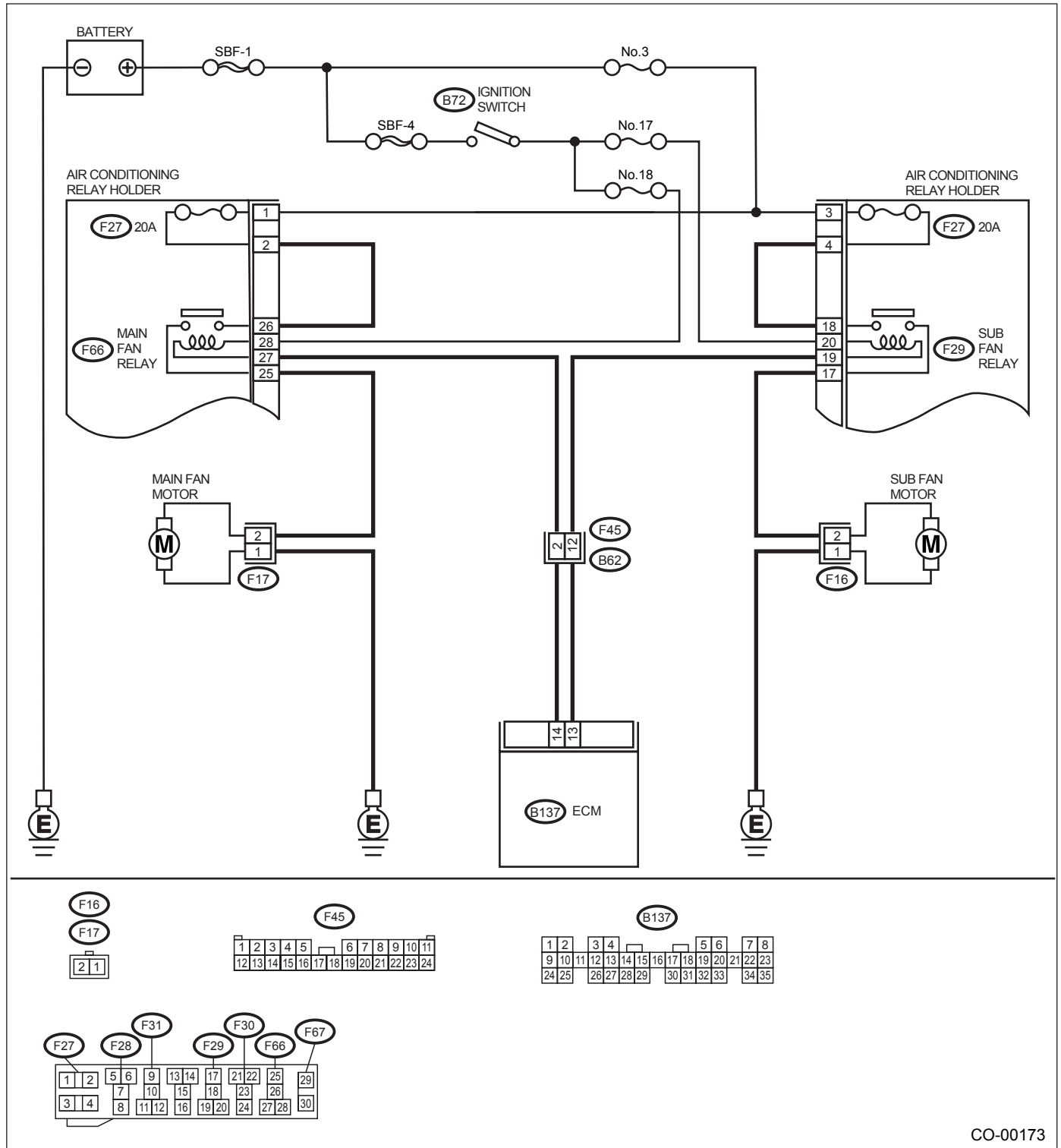
NOTE:

Inspection by SOA (distributor) service is required, because probable cause is deterioration of multiple parts.

3. Radiator Sub Fan System

A: SCHEMATIC

1. NON-TURBO MODEL

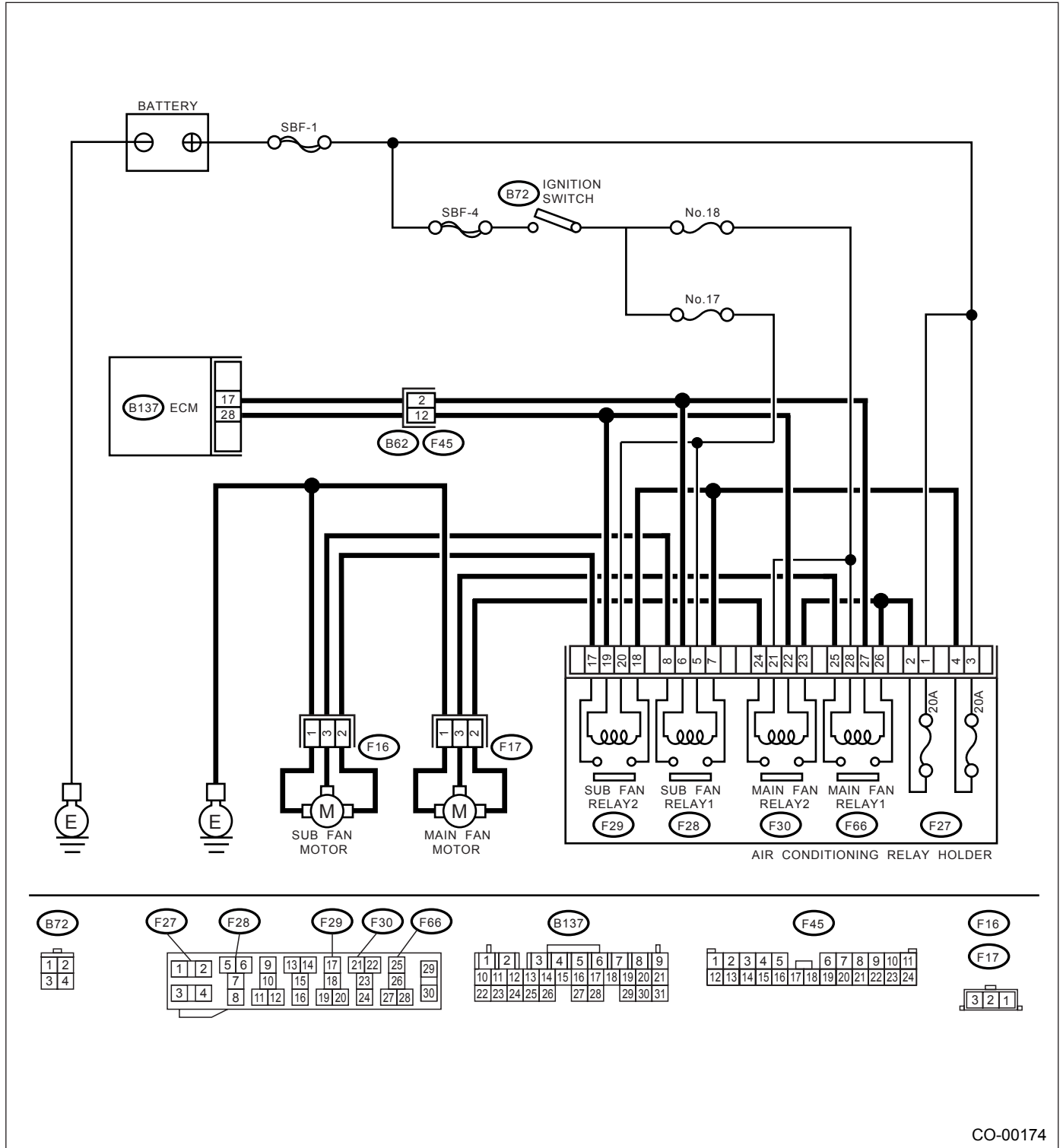


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RADIATOR SUB FAN SYSTEM

COOLING

2. TURBO MODEL



B: INSPECTION

1. NON-TURBO MODEL

NOTE:

System for A/C equipped vehicles only.

DETECTING CONDITION:

Condition (1):

- Engine coolant temperature is below 95°C (203°F).
- A/C switch is turned ON.
- Vehicle speed is below 19 km/h (12 MPH).

Condition (2):

- Engine coolant temperature is above 100°C (212°F).
- A/C switch is turned OFF.
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator sub fan does not rotate under conditions (1) and (2) above.

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO SUB FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the sub fan motor and main fan motor. 3) Start the engine, and warm it up until engine coolant temperature increases over 100°C (212°F). 4) Stop the engine and turn the ignition switch to ON. 5) Measure the voltage between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 5.
2 CHECK GROUND CIRCUIT OF SUB FAN MOTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 1 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair the open circuit in harness between sub fan motor connector and chassis ground.
3 CHECK POOR CONTACT. Check poor contact in sub fan motor connector. Is there poor contact in sub fan motor connector?	There is a poor contact.	Repair the poor contact in sub fan motor connector.	Go to step 4.
4 CHECK SUB FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and negative (-) terminal to terminal No. 1 of sub fan motor connector. Does the sub fan rotate?	The sub fan rotates.	Repair the poor contact in sub fan motor connector.	Replace the sub fan motor with a new one.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
5 CHECK POWER SUPPLY TO SUB FAN RELAY. 1)Turn the ignition switch to OFF. 2)Remove the sub fan relay from A/C relay holder. 3)Measure the voltage between sub fan relay terminal and chassis ground. Connector & terminal (F29) No. 18 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 6.	Go to step 7.
6 CHECK POWER SUPPLY TO SUB FAN RELAY. 1)Turn the ignition switch to ON. 2)Measure the voltage between sub fan relay terminal and chassis ground. Connector & terminal (F29) No. 20 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 10.	Go to step 9.
7 CHECK 20 A FUSE. 1)Remove the 20 A fuse from A/C relay holder. 2)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Go to step 8.
8 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
9 CHECK FUSE. 1)Turn the ignition switch to OFF. 2)Remove the fuse No. 17 from joint box. 3)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between sub fan relay and ignition switch.
10 CHECK SUB FAN RELAY. 1)Turn the ignition switch to OFF. 2)Measure the resistance of sub fan relay. Terminal No. 17 — No. 18: Is the measured value more than the specified value?	1 MΩ	Go to step 11.	Replace the sub fan relay.
11 CHECK SUB FAN RELAY. 1)Connect the battery to terminals No. 20 and No. 19 of sub fan relay. 2)Measure the resistance of sub fan relay. Terminal No. 17 — No. 18: Is the measured value less than the specified value?	1 Ω	Go to step 12.	Replace the sub fan relay.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
12 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR. Measure the resistance of harness between sub fan motor connector and sub fan relay terminal. Connector & terminal (F16) No. 2 — (F29) No. 17: Is the measured value less than the specified value?	1 Ω	Go to step 13.	Repair the open circuit in harness between sub fan motor and sub fan relay connector.
13 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between sub fan relay connector and ECM connector. Connector & terminal (F29) No. 19 — (B137) No. 13: Is the measured value less than the specified value?	1 Ω	Go to step 14.	Repair the open circuit in harness between sub fan relay and ECM.
14 CHECK POOR CONTACT. Check poor contact in connector between sub fan and ECM. Is there poor contact in connector between sub fan motor and ECM?	There is a poor contact.	Repair poor contact connector.	Contact with SOA (distributor) service.

NOTE:

Inspection by SOA (distributor) service is required, because probable cause is deterioration of multiple parts.

RADIATOR SUB FAN SYSTEM

COOLING

2. TURBO MODEL

DETECTING CONDITION:

Condition:

- Engine coolant temperature is above 96°C (205°F).
- A/C compressor is rotated.
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator sub fan does not rotate under the above conditions.
- Radiator sub fan does not rotate at high speed when the following conditions are both met:
 - (1) Engine coolant temperature is above 90°C (194°F)
 - (2) A/C is ON

	Step	Check	Yes	No
1	CHECK OPERATION OF RADIATOR. 1)Run the engine at idle. (Vehicle stationary) 2)Turn the A/C switch to OFF. 3)Warm the engine coolant temperature over 96°C (205°F). Does the radiator sub fan rotate?	The sub fan rotates.	Go to step 2.	Go to step 3.
2	CHECK OPERATION OF RADIATOR. 1)Turn the A/C switch ON at condition of step 1. Does the radiator sub fan rotate at high speed when A/C compressor is operated?	The fan rotates at high speed.	Radiator main fan system is okay.	Go to step 17.
3	CHECK POWER SUPPLY TO SUB FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from sub fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Stop the engine and turn the ignition switch to ON. 5)Measure the voltage between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Go to step 7.
4	CHECK GROUND CIRCUIT OF SUB FAN MOTOR. 1)Turn the ignition switch to OFF. 2)Measure the resistance between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 1 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Repair the open circuit in harness between sub fan motor connector and chassis ground.
5	CHECK POOR CONTACT. Check poor contact in sub fan motor connector. Is there poor contact in sub fan motor connector?	There is a poor contact.	Repair the poor contact in sub fan motor connector.	Go to step 6.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
6 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 3, and negative (-) terminal to terminal No. 1 of sub fan motor connector. Does the main fan rotate?	The main fan rotates.	Repair the poor contact in sub fan motor connector.	Replace the sub fan motor with a new one.
7 CHECK POWER SUPPLY TO SUB FAN RELAY1. 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay1 from A/C relay holder. 3) Measure the voltage between sub fan relay1 terminal and chassis ground. Connector & terminal (F28) No. 7 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 8.	Go to step 9.
8 CHECK POWER SUPPLY TO SUB FAN RELAY1. 1) Turn the ignition switch to ON. 2) Measure the voltage between sub fan relay1 terminal and chassis ground. Connector & terminal (F28) No. 5 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 12.	Go to step 11.
9 CHECK 20 A FUSE. 1) Remove the 20 A fuse from A/C relay holder. 2) Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Go to step 10.
10 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair the open circuit in harness between sub fuse box connector and 20 A fuse terminal.
11 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 17 from joint box. 3) Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between sub fan relay1 and ignition switch.
12 CHECK SUB FAN RELAY1. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay1. 3) Measure the resistance of sub fan relay1. Terminal No. 7 — No. 8: Is the measured value more than the specified value?	1 M Ω	Go to step 13.	Replace the sub fan relay1.
13 CHECK SUB FAN RELAY1. 1) Connect the battery to terminals No. 6 and No. 5 of sub fan relay1. 2) Measure the resistance of sub fan relay. Terminal No. 7 — No. 8: Is the measured value less than the specified value?	1 Ω	Go to step 14.	Replace the sub fan relay1.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
14 CHECK HARNESS BETWEEN SUB FAN RELAY1 TERMINAL AND SUB FAN MOTOR CONNECTOR. Measure the resistance of harness between sub fan motor connector and sub fan relay1 terminal. Connector & terminal (F16) No. 3 — (F28) No. 8: Is the measured value less than the specified value?	1 Ω	Go to step 15.	Repair the open circuit in harness between sub fan motor connector and sub fan relay1 terminal.
15 CHECK HARNESS BETWEEN SUB FAN RELAY1 AND ECM. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between sub fan relay1 connector and ECM connector. Connector & terminal (F28) No. 6 — (B137) No. 17: Is the measured value less than the specified value?	1 Ω	Go to step 16.	Repair the open circuit in harness between sub fan relay1 and ECM.
16 CHECK POOR CONTACT. Check poor contact in connector between sub fan and ECM. Is there poor contact in connector between sub fan motor and ECM?	There is a poor contact.	Repair poor contact connector.	Contact with SOA (distributor) service.
17 CHECK POWER SUPPLY TO SUB FAN MOTOR. CAUTION: Be careful not to overheat engine during repair. 1)Turn the ignition switch to OFF. 2)Disconnect the connector from sub fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Turn the A/C switch ON. 5)Measure the voltage while A/C compressor is rotating. 6)Measure the voltage between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 18.	Go to step 20.
18 CHECK POOR CONTACT. Check the poor contact in sub fan motor connector. Is there poor contact in sub fan motor connector?	There is a poor contact.	Repair the poor contact in sub fan motor connector.	Go to step 19.
19 CHECK SUB FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and negative (-) terminal to terminal No. 1 of sub fan motor connector. Does the main fan rotate?	The main fan rotates.	Repair the poor contact in sub fan motor connector.	Replace the sub fan motor with a new one.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
20 CHECK POWER SUPPLY TO SUB FAN RELAY2. 1)Turn the ignition switch to OFF. 2)Remove the sub fan relay2 from A/C relay holder. 3)Measure the voltage between sub fan relay2 terminal and chassis ground. Connector & terminal (F29) No. 18 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 21.	Go to step 22.
21 CHECK POWER SUPPLY TO SUB FAN RELAY2. 1)Turn the ignition switch to ON. 2)Measure the voltage between sub fan relay2 terminal and chassis ground. Connector & terminal (F29) No. 20 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 23.	Go to step 24.
22 CHECK 20 A FUSE. 1)Remove the 20 A fuse from A/C relay holder. 2)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace fuse.	Go to step 23.
23 CHECK POWER SUPPLY TO A/C RELAY HOLDER 30 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair the open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair the open circuit in harness between sub fuse box connector and 20 A fuse terminal.
24 CHECK FUSE. 1)Turn the ignition switch to OFF. 2)Remove the fuse No. 17 from joint box. 3)Check the condition of fuse. Is the fuse blown-out?	The fuse is blown out.	Replace the fuse.	Repair the open circuit in harness between sub fan relay and ignition switch.
25 CHECK SUB FAN RELAY2. 1)Turn the ignition switch to OFF. 2)Remove the sub fan relay2. 3)Measure the resistance of sub fan relay2. Terminal No. 18 — No. 17: Is the measured value more than the specified value?	1 MΩ	Go to step 26.	Replace the sub fan relay2.
26 CHECK MAIN FAN RELAY2. 1)Connect the battery to terminals No. 19 and No. 20 of sub fan relay2. 2)Measure the resistance of sub fan relay2. Terminal No. 18 — No. 17: Is the measured value less than the specified value?	1 Ω	Go to step 27.	Replace the sub fan relay2.

RADIATOR SUB FAN SYSTEM

COOLING

Step	Check	Yes	No
27 CHECK HARNESS BETWEEN SUB FAN RELAY2 TERMINAL AND SUB FAN MOTOR CONNECTOR. Measure the resistance of harness between sub fan motor connector and sub fan relay2 terminal. Connector & terminal (F16) No. 2 — (F29) No. 17: Is the measured value less than the specified value?	1 Ω	Go to step 28.	Repair the open circuit in harness between sub fan motor connector and sub fan relay2 terminal.
28 CHECK HARNESS BETWEEN SUB FAN RELAY2 AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between sub fan relay2 connector and ECM connector. Connector & terminal (F29) No. 19 — (B137) No. 28: Is the measured value less than the specified value?	1 Ω	Go to step 29.	Repair the open circuit in harness between sub fan relay2 and ECM.
29 CHECK POOR CONTACT. Check the poor contact in connector between sub fan and ECM. Is there poor contact in connector between sub fan motor and ECM?	There is a poor contact.	Repair the poor contact connector.	Contact with SOA (distributor) service.

NOTE:

Inspection by SOA (distributor) service is required, because probable cause is deterioration of multiple parts.

4. Engine Coolant

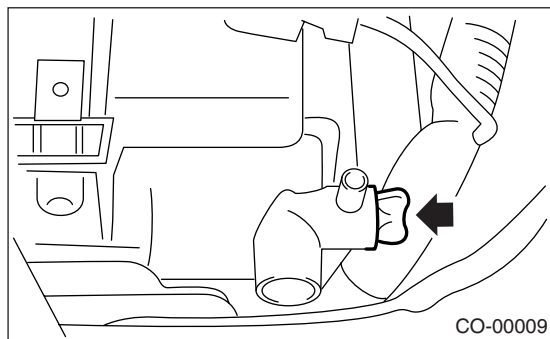
A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

- 1) Lift-up the vehicle.
- 2) Remove the under cover.
- 3) Remove the drain cock to drain engine coolant into container.

NOTE:

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



2. FILLING OF ENGINE COOLANT

- 1) Fill engine coolant into radiator up to the filler neck position.

Coolant capacity (fill up to "FULL" level):

Non-turbo AT model

Approx. 6.9 ℓ (7.29 US qt, 6.07 Imp qt)

Non-turbo MT model

Approx. 7 ℓ (7.4 US qt, 6.2 Imp qt)

Turbo AT model

Approx. 7.6 ℓ (8.03 US qt, 6.69 Imp qt)

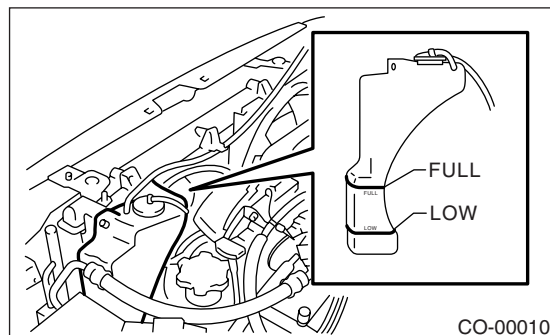
Turbo MT model

Approx. 7.7 ℓ (8.14 US qt, 6.78 Imp qt)

CAUTION:

The SUBARU Genuine Coolant containing anti-freeze and anti-rust agents is especially made for SUBARU engine, which has an aluminum crankcase. Always use SUBARU Genuine Coolant, since other coolant may cause corrosion.

- 2) Fill engine coolant into reservoir tank up to the upper level.



- 3) Warm-up engine completely for more than five minutes at 2,000 to 3,000 rpm.

- 4) If the engine coolant level drops in radiator, add the engine coolant to filler neck position.

- 5) If the engine coolant level drops from upper level of reservoir tank, add the engine coolant to the upper level.

- 6) Attach the radiator cap and reservoir tank cap properly.

B: INSPECTION

1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

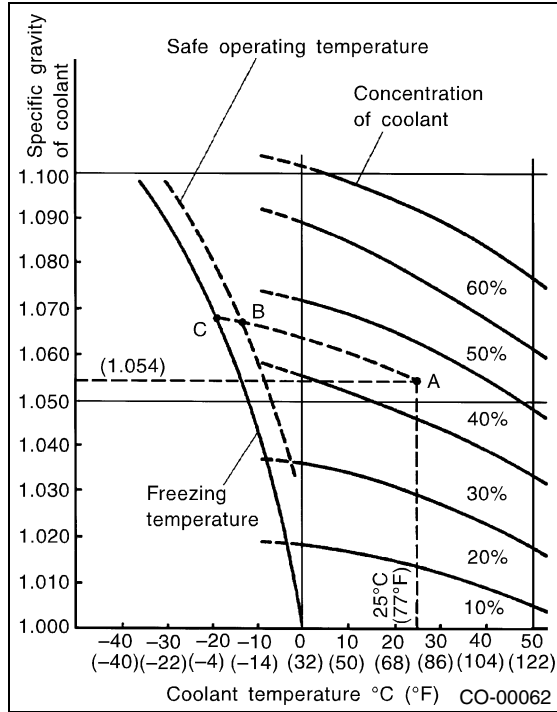
The concentration and safe operating temperature of the SUBARU coolant is shown in the diagram. Measuring the temperature and specific gravity of the coolant will provide this information.

ENGINE COOLANT

COOLING

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 45% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).



2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

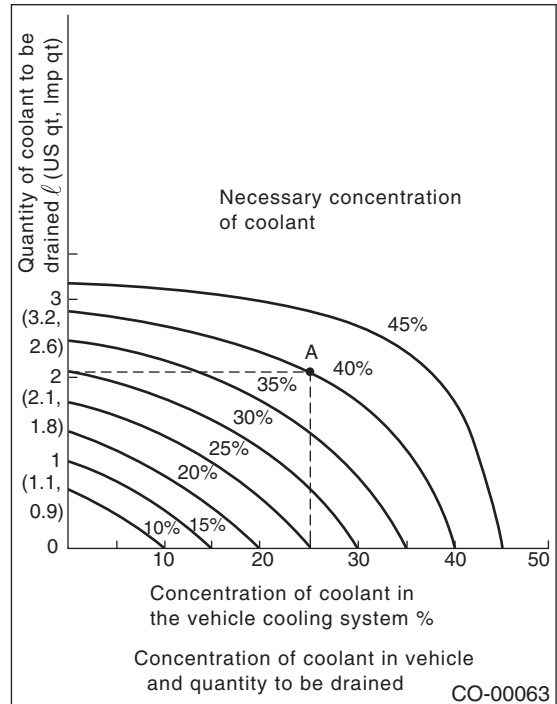
To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50%).

The amount of coolant that should be replaced can be determined using the diagram.

[Example]

Assume that the coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of coolant concentration intersects with the 40% curve of the necessary coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 liters (2.2 US qt, 1.8 Imp qt). Drain 2.1 liters (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 liters (2.2 US qt, 1.8 Imp qt) of the undiluted solution of SUBARU coolant.

If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.

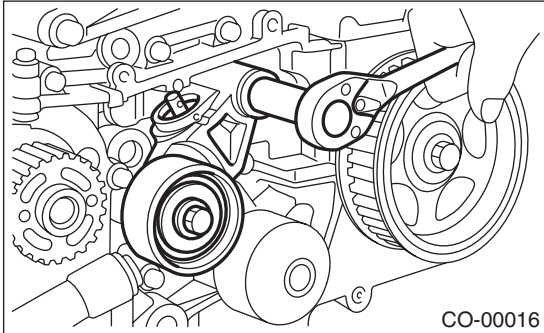


5. Water Pump

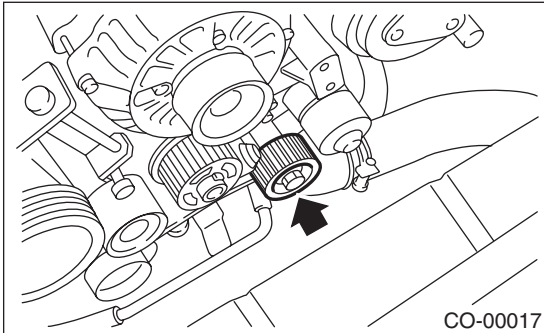
A: REMOVAL

1. NON-TURBO MODEL

- 1) Remove the radiator. <Ref. to CO(H4SO)-38, REMOVAL, Radiator.>
- 2) Remove V-belts.
<Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 3) Remove the timing belt.
<Ref. to ME(H4SO)-46, TIMING BELT, REMOVAL, Timing Belt.>
- 4) Remove the automatic belt tension adjuster.



- 5) Remove the belt idler No. 2.

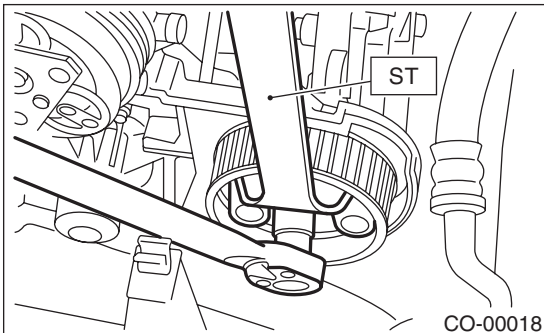


- 6) Remove the left-hand camshaft sprocket by using ST.

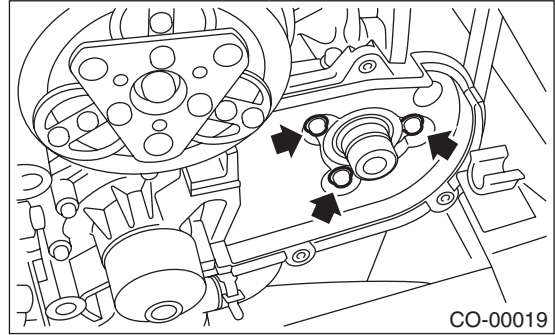
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

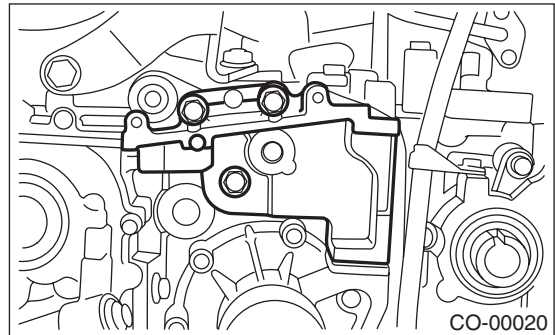
Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.



- 7) Remove the left-hand belt cover No. 2.

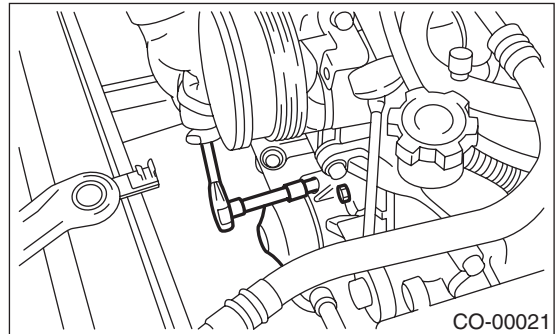


- 8) Remove the tensioner bracket.



- 9) Disconnect the heater hose from the water pump.

- 10) Remove the water pump.

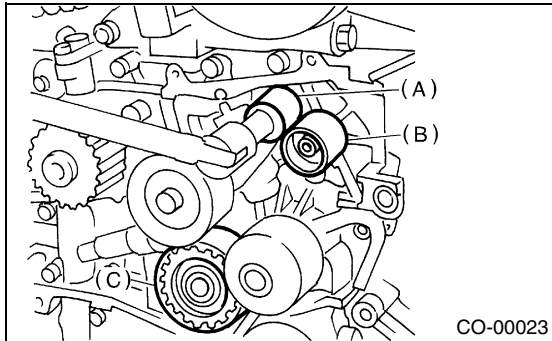


WATER PUMP

COOLING

2. TURBO MODEL

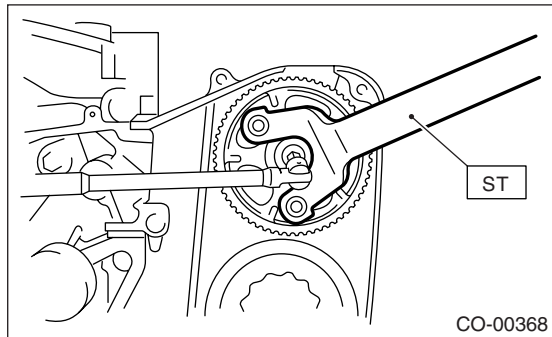
- 1) Remove the radiator. <Ref. to CO(H4SO)-38, Removal, Radiator.>
- 2) Remove the V-belts. <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>
- 3) Remove the timing belt. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Assembly.>
- 4) Remove the automatic belt tension adjuster (A).
- 5) Remove the belt idler (B).
- 6) Remove the belt idler No. 2 (C).



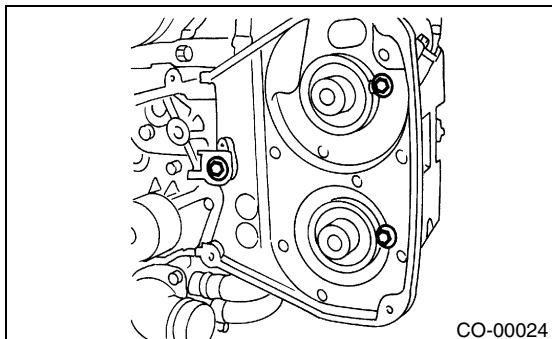
- 7) Remove the camshaft position sensor. <Ref. to FU(H4DOTC)-31, REMOVAL, Camshaft Position Sensor.>

- 8) Remove the left-hand camshaft sprockets by using ST.

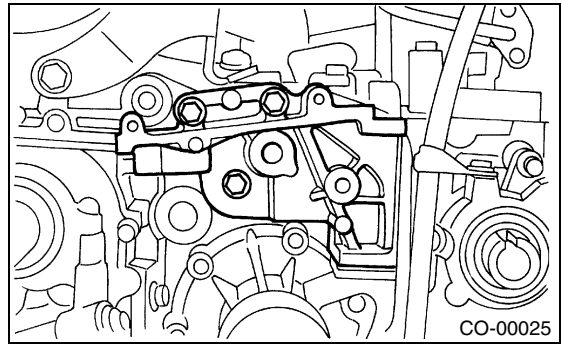
- | | |
|---------------|------------------------------------|
| ST 18231AA010 | CAMSHAFT SPROCKET WRENCH (Intake) |
| ST 499207400 | CAMSHAFT SPROCKET WRENCH (Exhaust) |



- 9) Remove the left-hand belt cover No. 2.

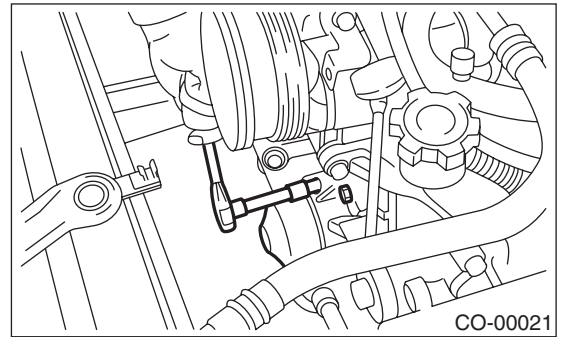


- 10) Remove the tensioner bracket.



- 11) Disconnect the heater hose from the water pump.

- 12) Remove the water pump.



B: INSTALLATION

1. NON-TURBO MODEL

1) Install the water pump onto the left-hand cylinder block.

NOTE:

- Replace gasket with a new one.
- When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.

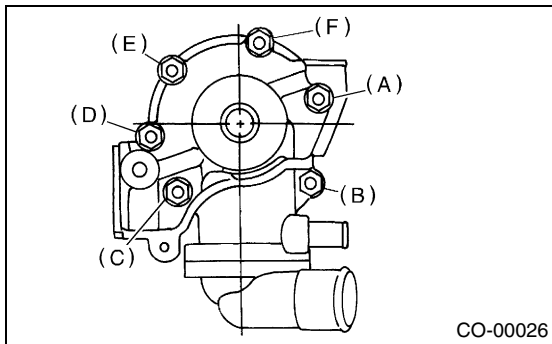
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

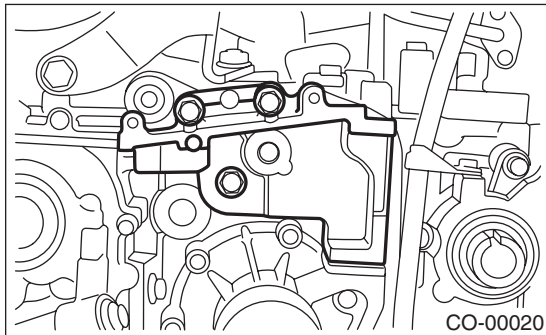


2) Install the hose to the water pump.

3) Install the tensioner bracket.

Tightening torque:

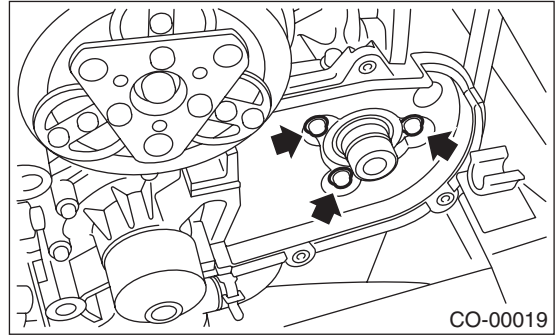
25 N·m (2.5 kgf-m, 18.1 ft-lb)



4) Install the left-hand belt cover No. 2.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



5) Install the left-hand camshaft sprockets by using ST.

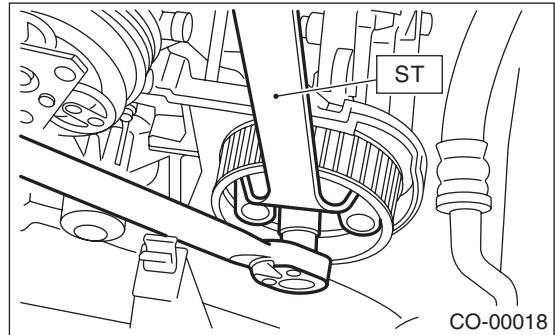
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Tightening torque:

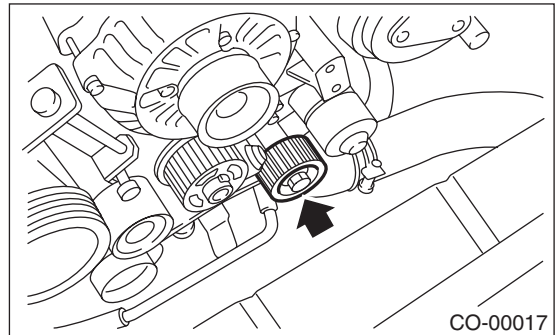
78 N·m (8.0 kgf-m, 57.9 ft-lb)



6) Install the belt idler No. 2.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



WATER PUMP

COOLING

- 7) Install the automatic belt tension adjuster which tension rod is held with pin. <Ref. to ME(H4SO)-47, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
- 8) Install the timing belt. <Ref. to ME(H4SO)-48, TIMING BELT, INSTALLATION, Timing Belt.>
- 9) Install V-belts. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>
- 10) Install the radiator.<Ref. to CO(H4SO)-42, INSTALLATION, Radiator.>

2. TURBO MODEL

- 1) Install the water pump onto the left-hand cylinder block.

NOTE:

- Replace gasket with a new one.
- When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.

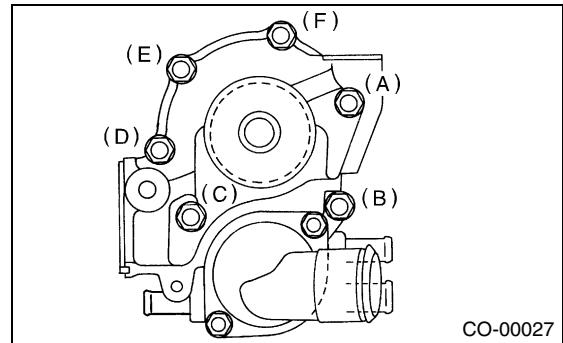
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

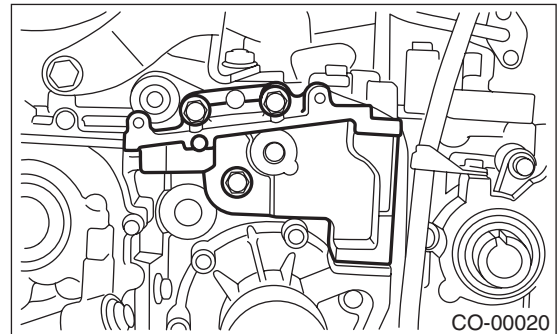
12 N·m (1.2 kgf-m, 8.7 ft-lb)



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

Tightening torque:

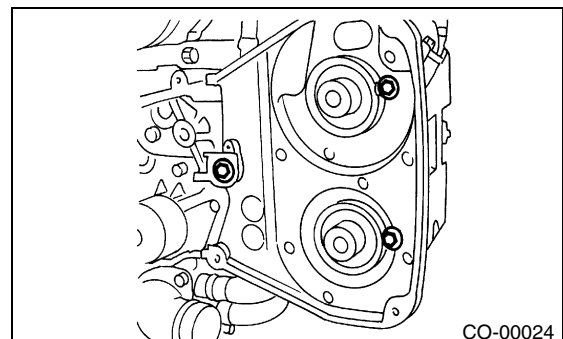
25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 4) Install the left-hand belt cover No. 2.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



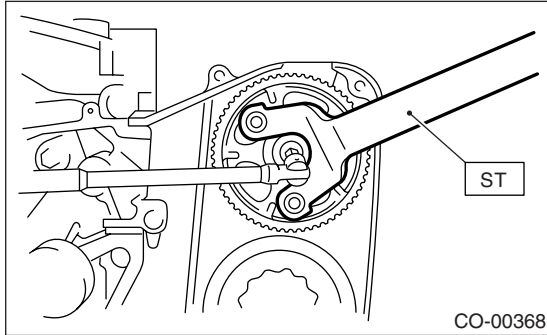
5) Install the left-hand camshaft sprockets by using ST.

ST 18231AA010 CAMSHAFT SPROCKET
WRENCH (Intake)

ST 499207400 CAMSHAFT SPROCKET
WRENCH (Exhaust)

Tightening torque:

98 N·m (10.0 kgf-m, 72.4 ft-lb)



6) Install the camshaft position sensor. <Ref. to FU(H4DOTC)-31, INSTALLATION, Camshaft Position Sensor.>

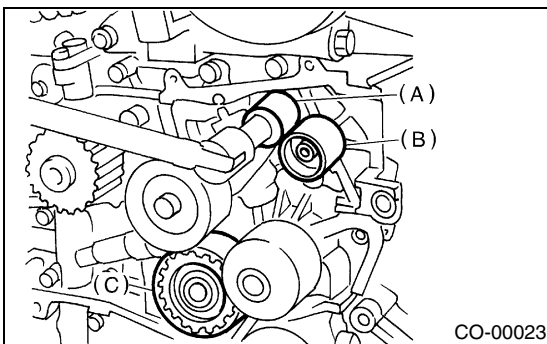
7) Install the belt idler No. 2 (C).

8) Install the belt idler (B).

9) Install the automatic belt tension adjuster (A) which has a tension rod held by a pin. <Ref. to ME(H4DOTC)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



10) Install the timing belt. <Ref. to ME(H4DOTC)-51, TIMING BELT, INSTALLATION, Timing Belt Assembly.>

11) Install the V-belts. <Ref. to ME(H4DOTC)-44, INSTALLATION, V-belt.>

12) Install the radiator. <Ref. to CO(H4SO)-42, INSTALLATION, Radiator.>

C: INSPECTION

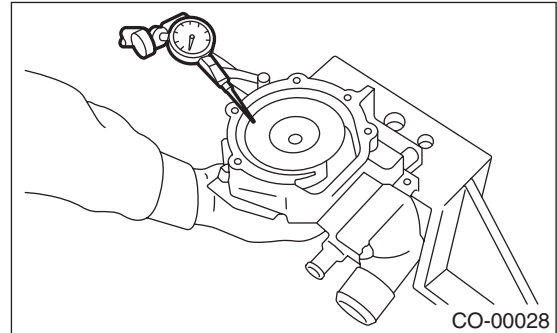
1) Check the water pump bearing for smooth rotation.

2) Check the water pump pulley for abnormalities.

3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

“Thrust” runout limit:

0.5 mm (0.020 in)



4) Check the clearance between impeller and pump case.

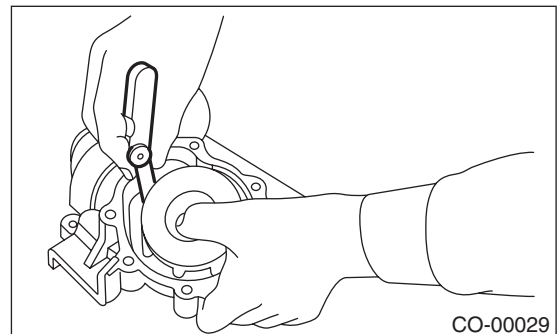
Clearance between impeller and pump case:

Standard

0.5 — 0.7 mm (0.020 — 0.028 in)

Limit

1.0 mm (0.039 in)

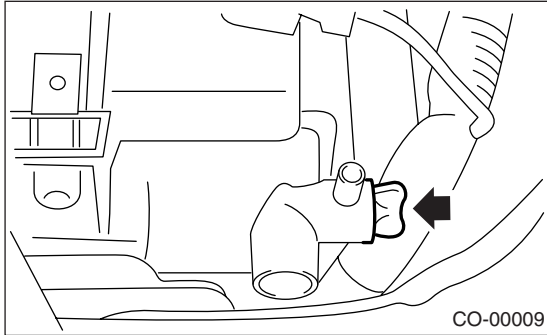


5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace the water pump assembly.

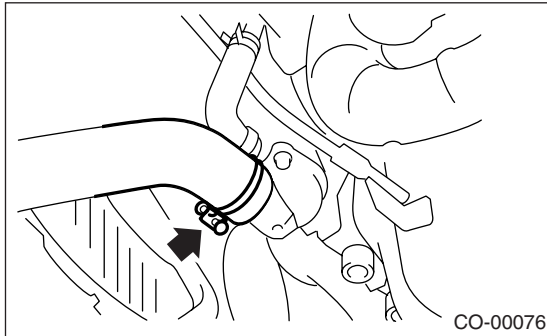
6. Thermostat

A: REMOVAL

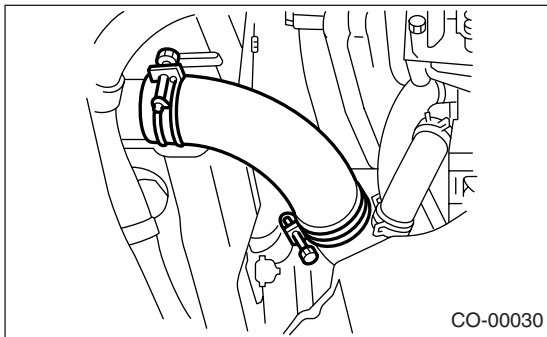
- 1) Lift-up the vehicle.
- 2) Remove the under cover.
- 3) Drain engine coolant completely. <Ref. to CO(H4SO)-29, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



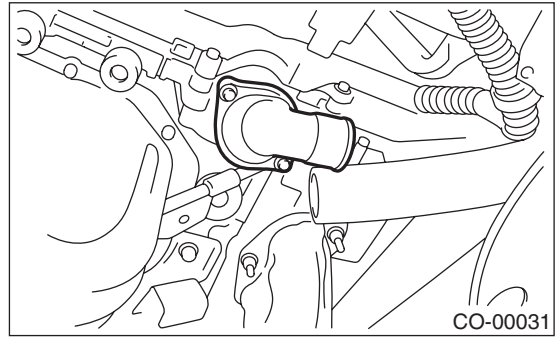
- 4) Disconnect the radiator outlet hose from the thermostat cover.
 - Non-Turbo model



- 5) Disconnect the radiator outlet hose.
 - Turbo model



- 6) Remove the thermostat cover and gasket, and pull out the thermostat.



B: INSTALLATION

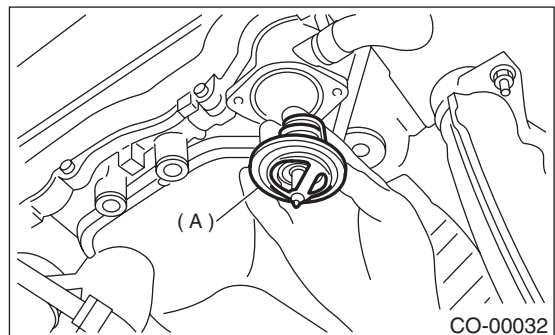
- 1) Install the thermostat in the water pump, and install the thermostat cover together with a gasket.

NOTE:

- When reinstalling the thermostat, use a new gasket.
- The thermostat must be installed with the jiggle pin (A) facing to front side.
- At this time, set the jiggle pin of thermostat for front side.

Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



- 2) Fill coolant. <Ref. to CO(H4SO)-29, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.

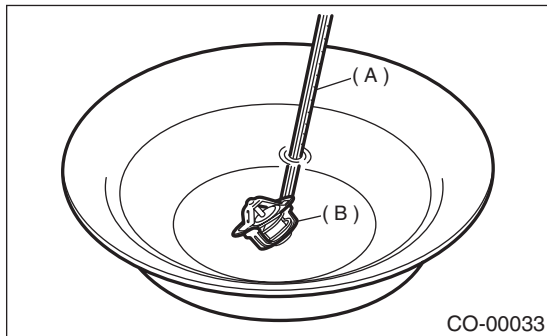
Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be to the specification.

Starts to open:

76 — 80° C (169 — 176° F)

Fully opens:

91° C (196° F)



- (A) Thermometer
- (B) Thermostat

RADIATOR

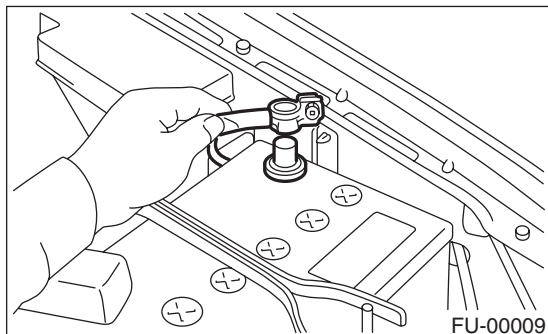
COOLING

7. Radiator

A: REMOVAL

1. NON-TURBO MODEL

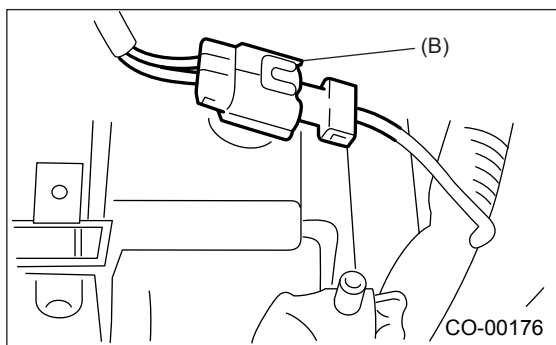
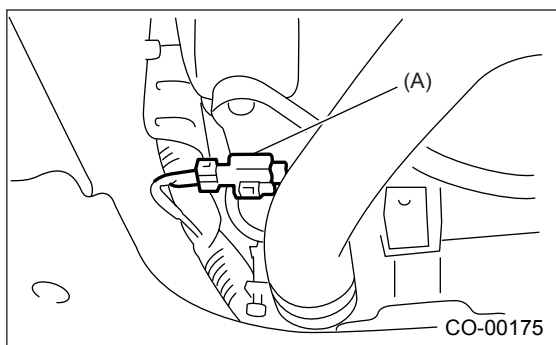
1) Disconnect the battery ground cable.



2) Lift-up the vehicle.

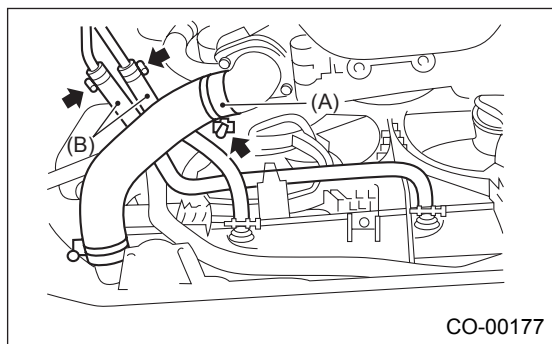
3) Drain engine coolant completely. <Ref. to CO(H4SO)-29, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

4) Disconnect the connectors of radiator main fan (A) and sub fan (B) motor.



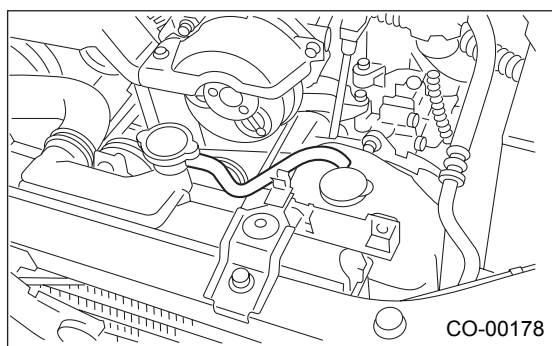
5) Disconnect the radiator outlet hose (A) from thermostat cover.

6) Disconnect the ATF cooler hoses (B) from the radiator. (AT vehicles only)

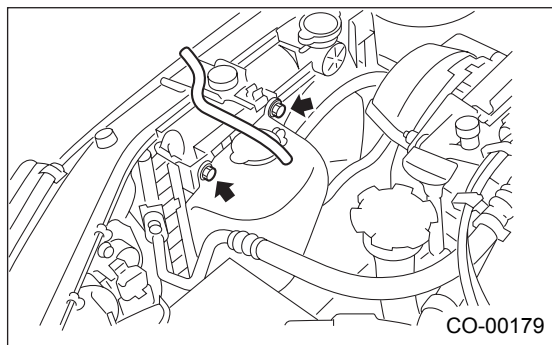


7) Lower the vehicle.

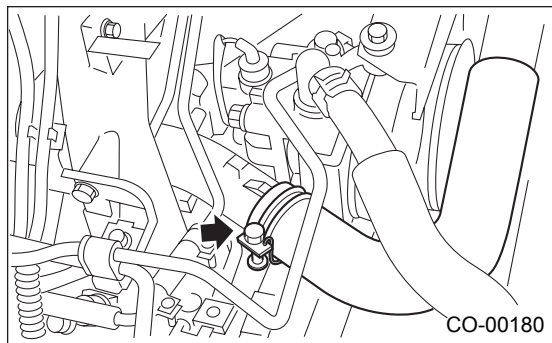
8) Disconnect the over flow hose.



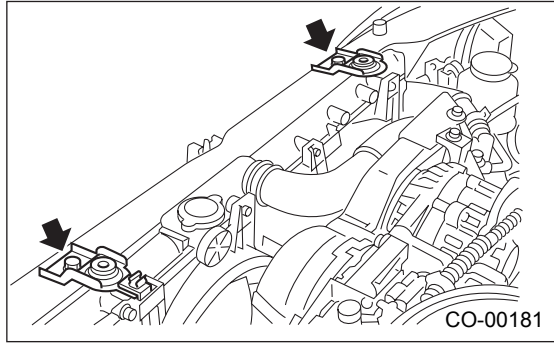
9) Remove the reservoir tank.



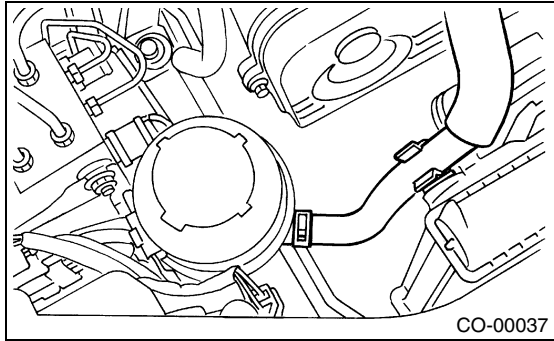
10) Disconnect the radiator inlet hose from the engine.



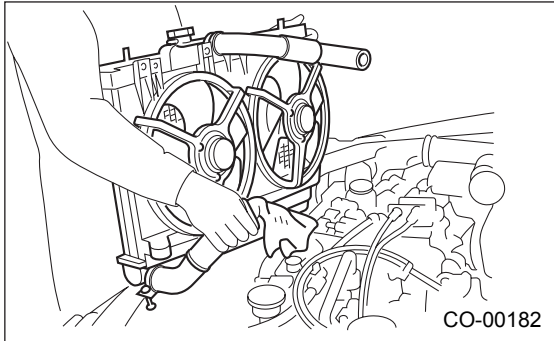
- 11) Remove the radiator upper brackets.



- 12) Detach the power steering hose from the the clip on the radiator.



- 13) While slightly lifting radiator, slide it to left.
14) Lift the radiator up and away from the vehicle.

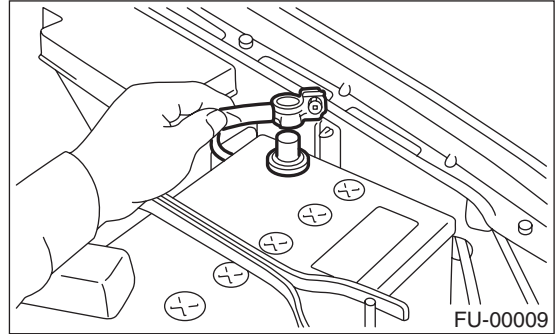


2. TURBO MODEL

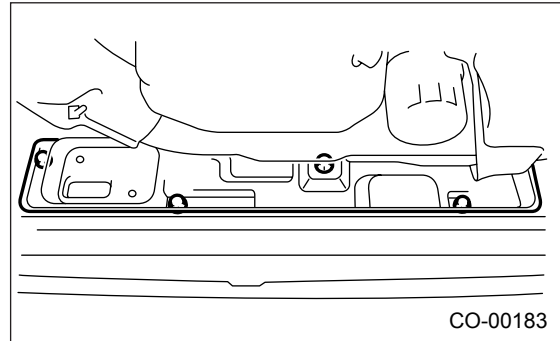
WARNING:

The radiator is pressurized. Wait until engine cools down before working on the radiator.

- 1) Set the vehicle on the lift.
- 2) Disconnect the battery ground cable.



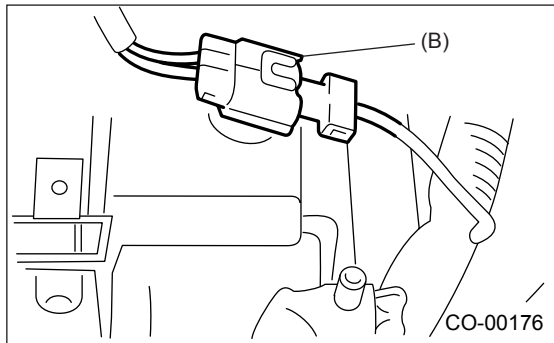
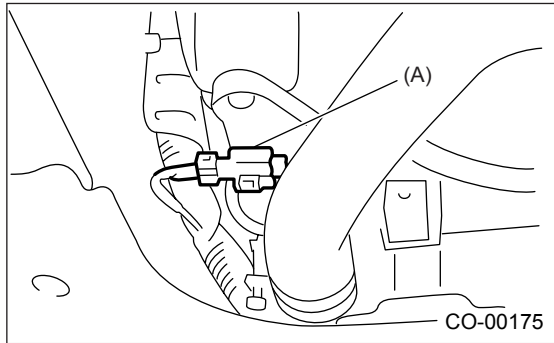
- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Drain the engine coolant completely. <Ref. to CO(H4SO)-29, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 6) Remove the radiator under cover. (AT vehicles only)



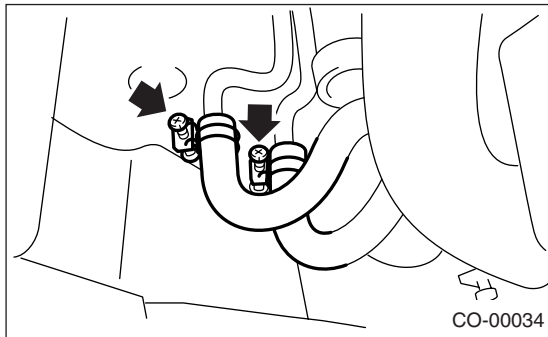
RADIATOR

COOLING

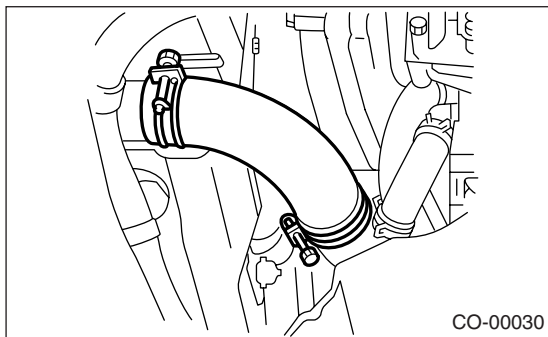
7) Disconnect the connectors of radiator main fan (A) and sub fan motor (B).



8) Disconnect the ATF cooler hoses from the radiator. (AT vehicles only)

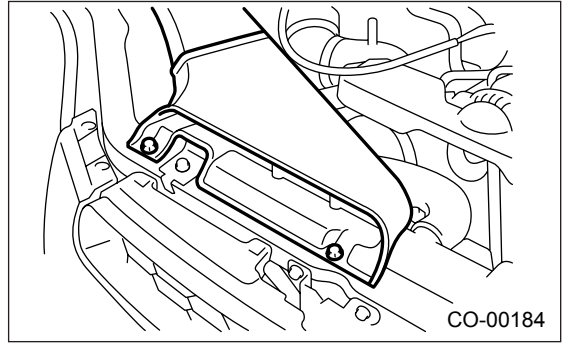


9) Disconnect the radiator outlet hose from the thermostat cover.



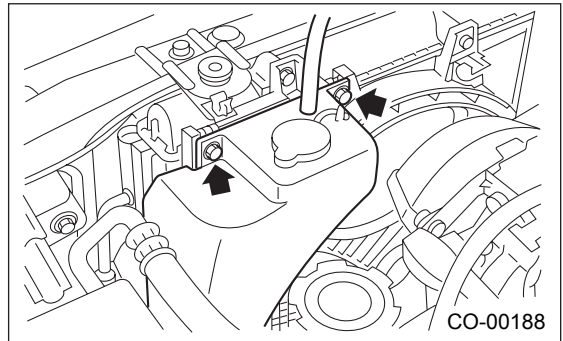
10) Lower the vehicle.

11) Remove the air intake duct.

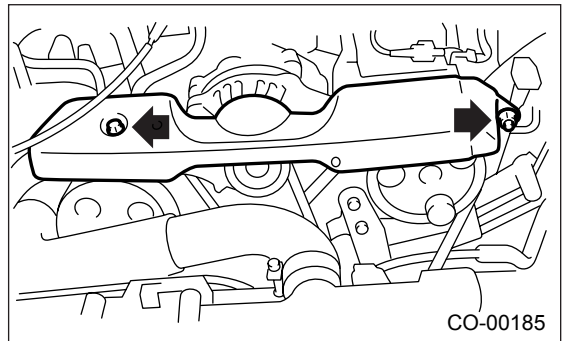


12) Disconnect the over flow hose.

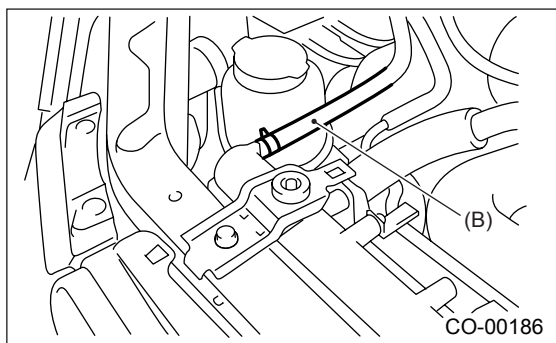
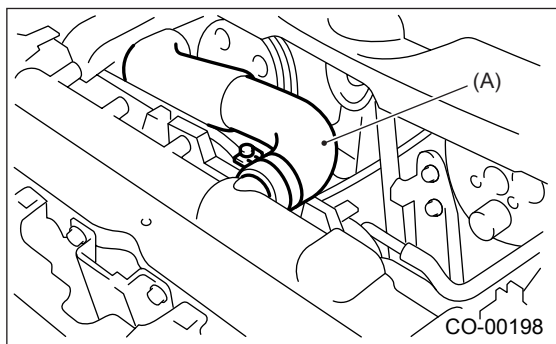
13) Remove the reservoir tank.



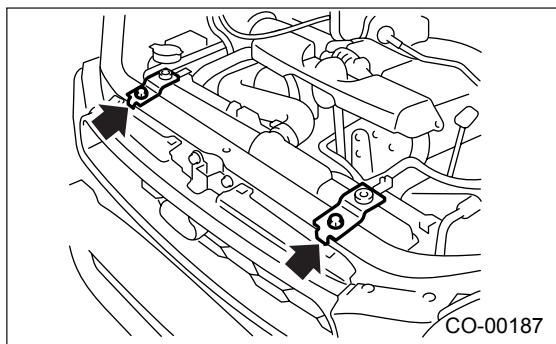
14) Remove the V-belt covers.



- 15) Disconnect the radiator inlet hose (A) and coolant filler tank hose (B) from the radiator.



- 16) Remove the radiator upper brackets.



- 17) While slightly lifting radiator, slide it to left.
18) Lift the radiator up and away from the vehicle.

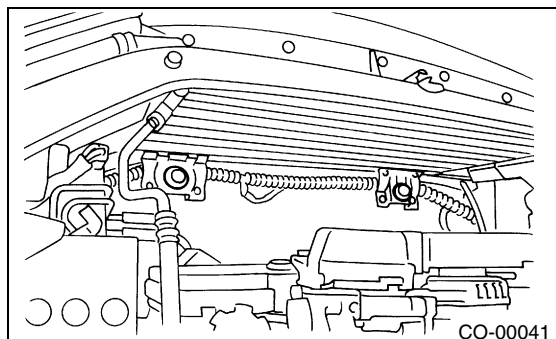
RADIATOR

COOLING

B: INSTALLATION

1. NON-TURBO MODEL

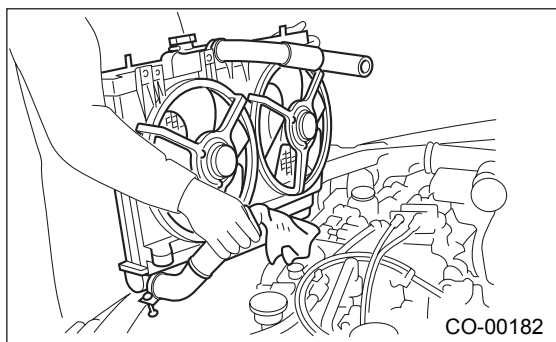
1) Attach the radiator mounting cushions to holes on the vehicle.



2) Install the radiator while fitting radiator pins to cushions.

NOTE:

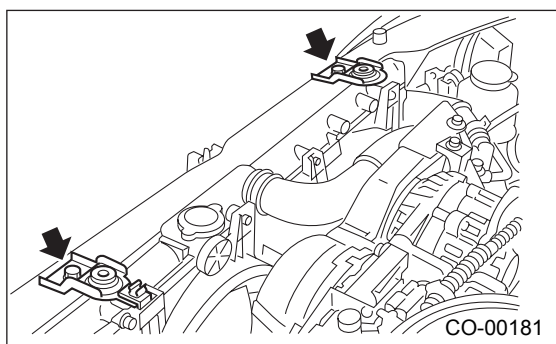
Fit pins on lower side of radiator into cushions on body side.



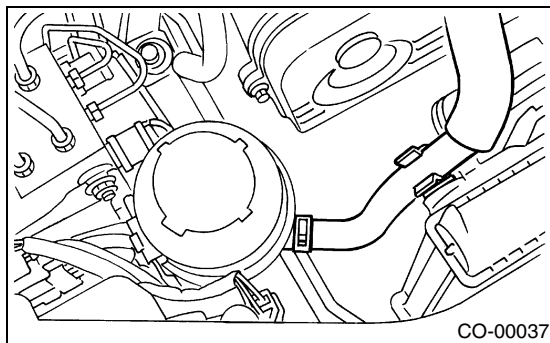
3) Install the radiator brackets and tighten the bolts.

Tightening torque:

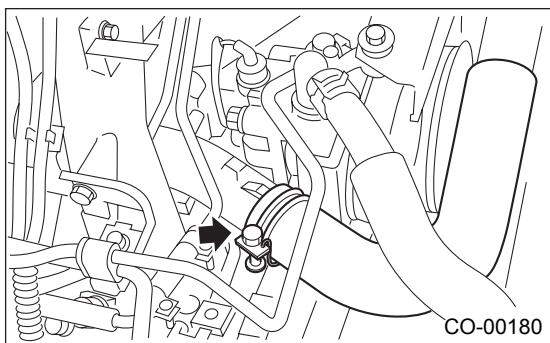
18 N·m (1.8 kgf-m, 13.0 ft-lb)



4) Attach the power steering hose to the radiator.



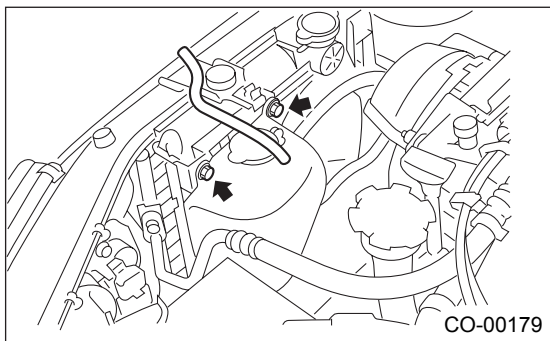
5) Connect the radiator inlet hose.



6) Install the reservoir tank.

Tightening torque:

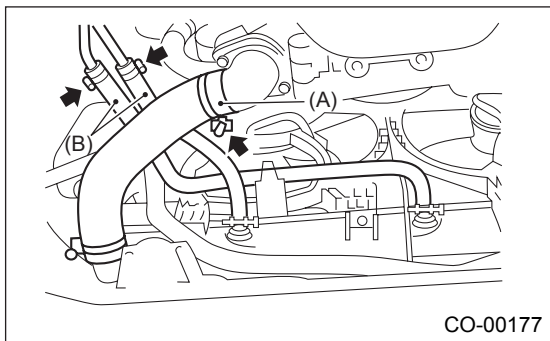
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



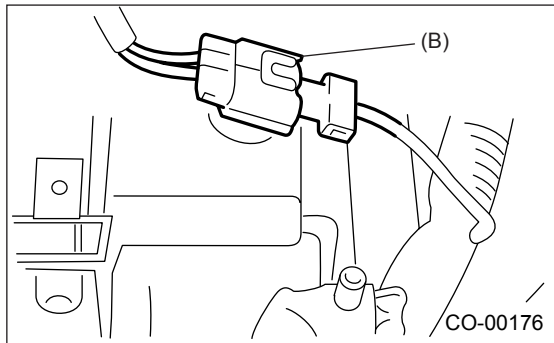
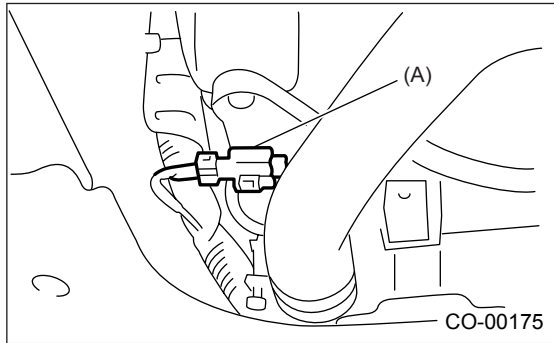
7) Lift-up the vehicle.

8) Connect the radiator outlet hose (A).

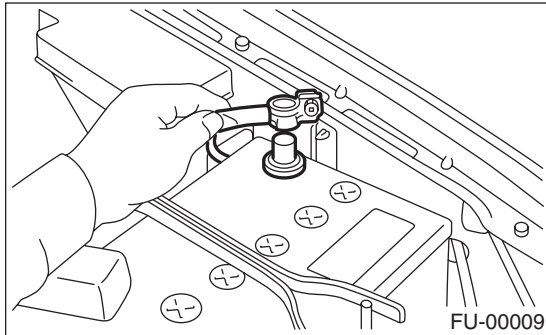
9) Connect the ATF cooler hoses (B). (AT vehicles only)



- 10) Connect the connectors to the radiator main fan motor (A) and sub fan motor (B).



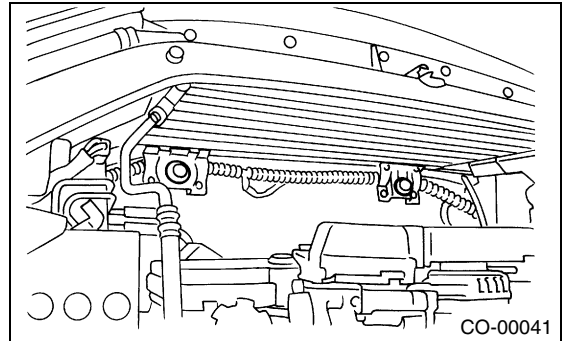
- 11) Install the under cover.
12) Lower the vehicle.
13) Connect the battery ground cable.



- 14) Fill coolant. <Ref. to CO(H4SO)-29, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
15) Check ATF level. <Ref. to AT-30, INSPECTION, ATF.>

2. TURBO MODEL

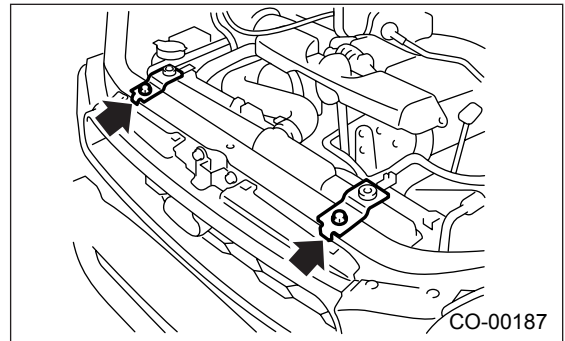
- 1) Attach the radiator mounting cushions to holes on the vehicle.



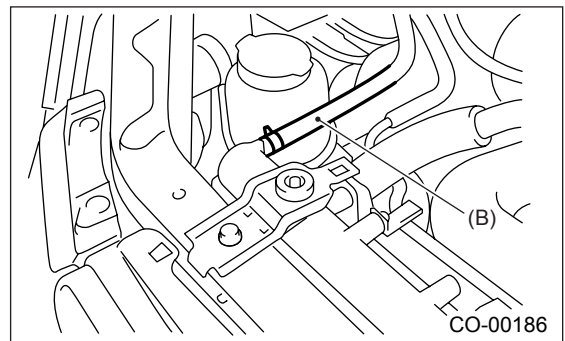
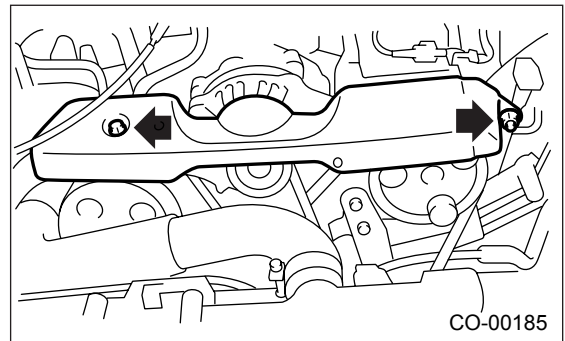
- 2) Install the radiator brackets and tighten bolts.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 3) Connect the radiator inlet hose (A) and coolant filler tank hose (B).



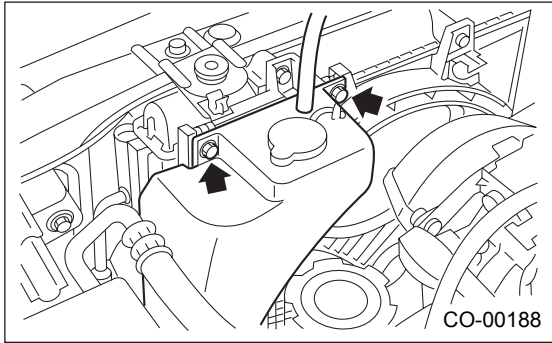
RADIATOR

COOLING

4) Install the reservoir tank.

Tightening torque:

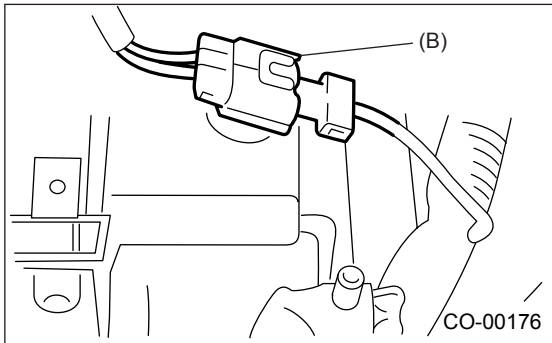
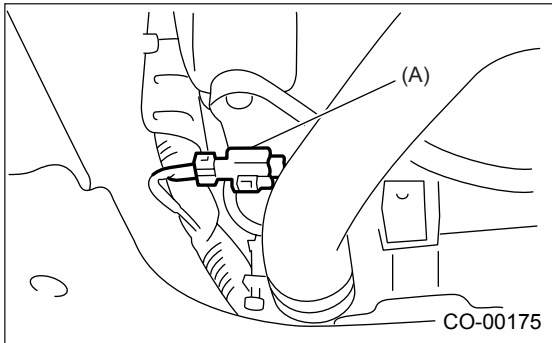
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



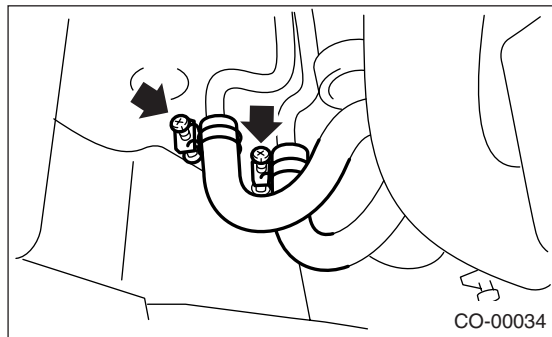
5) Connect the over flow hose.

6) Lift-up the vehicle.

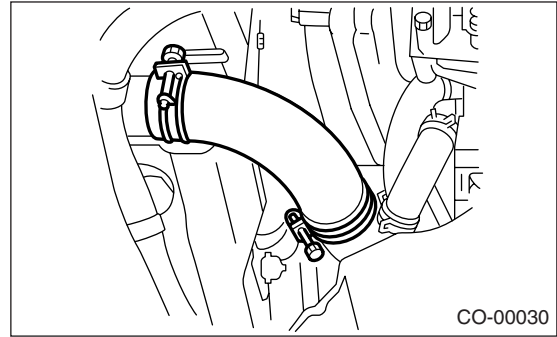
7) Connect the connectors to the radiator main fan motor(A) and sub fan motor(B).



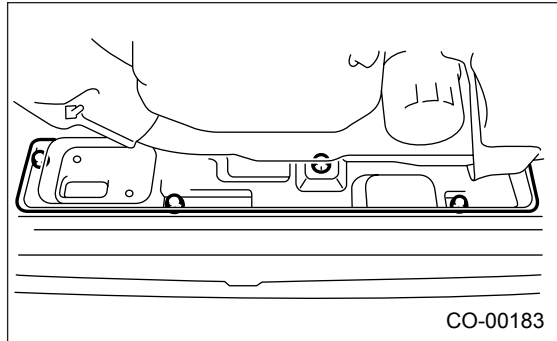
8) Connect the ATF cooler hoses. (AT vehicles only)



9) Connect the radiator outlet hose.



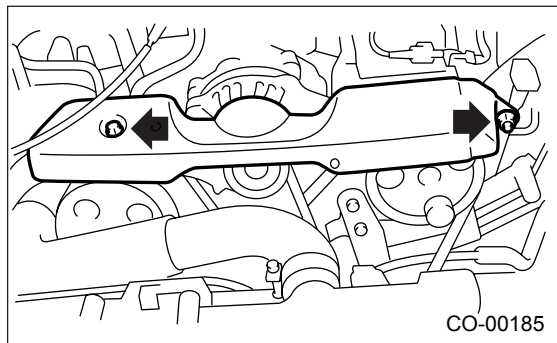
10) Install the radiator under cover. (AT vehicle only)



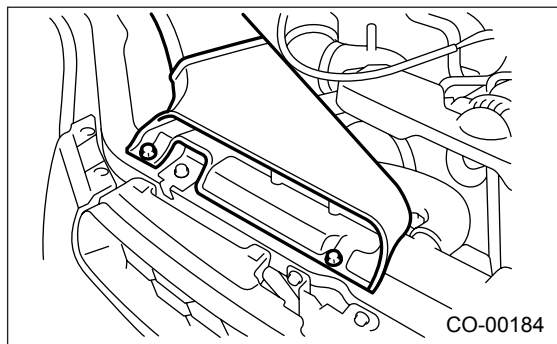
11) Install the under cover.

12) Lower the vehicle.

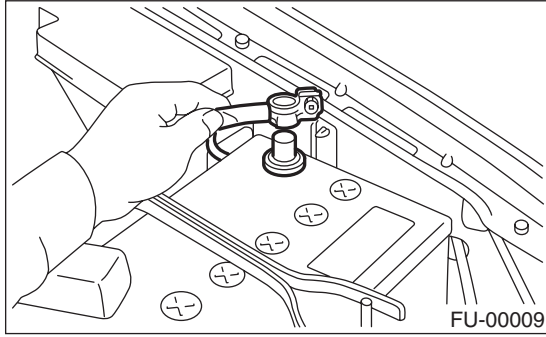
13) Install the V-belt covers.



14) Install the air intake duct.



15) Connect the battery ground cable.

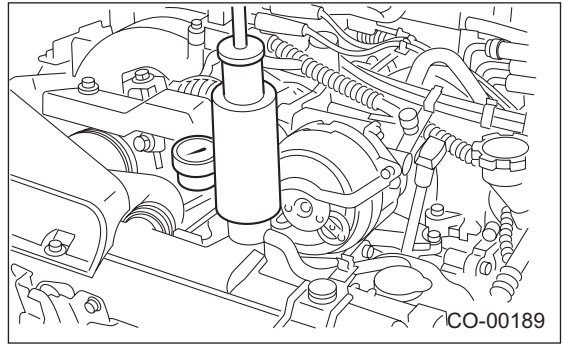


16) Fill coolant. <Ref. to CO(H4SO)-29, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

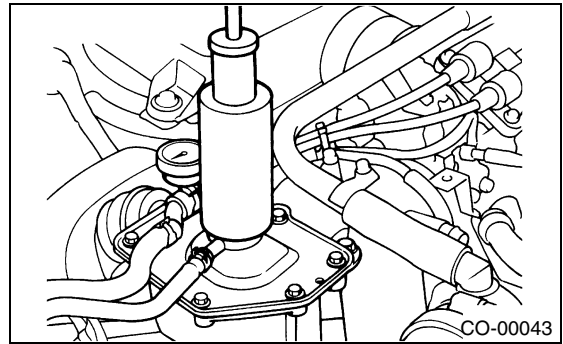
C: INSPECTION

1) Remove the radiator cap, top off radiator, and attach tester to the radiator in place of cap.

- Non-Turbo model



- Turbo model



2) Apply a pressure of 157 kPa (1.6 kg/cm², 23 psi) to the radiator to check if:

- (1) Engine coolant leaks at/around radiator.
- (2) Engine coolant leaks at/around hoses or connections.

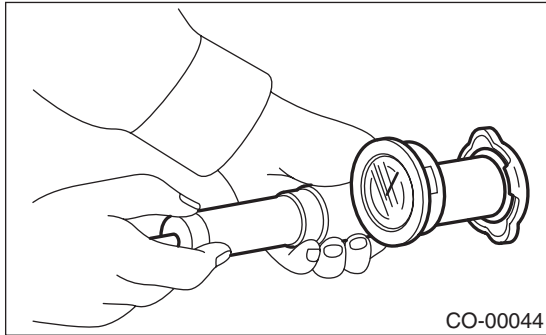
CAUTION:

- Engine should be off.
- Wipe engine coolant from check points in advance.
- Be careful to prevent engine coolant from spurting out when removing tester.
- Be careful also not to deform filler neck of radiator when installing or removing tester.

8. Radiator Cap

A: INSPECTION

1) Attach the radiator cap to the tester.



2) Increase pressure until the tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds.

Standard pressure:

93 — 123 kPa (0.95 — 1.25 kg/cm², 14 — 18 psi)

Service limit pressure:

83 kPa (0.85 kg/cm², 12 psi)

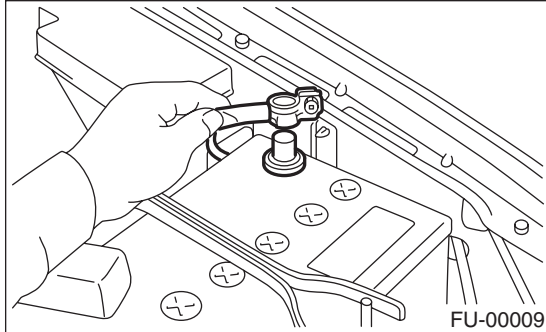
NOTE:

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

9. Radiator Main Fan and Fan Motor

A: REMOVAL

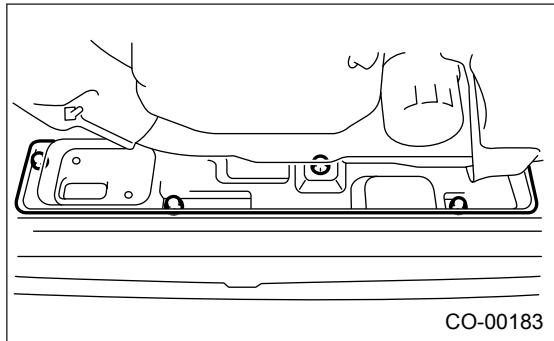
1) Disconnect the battery ground cable.



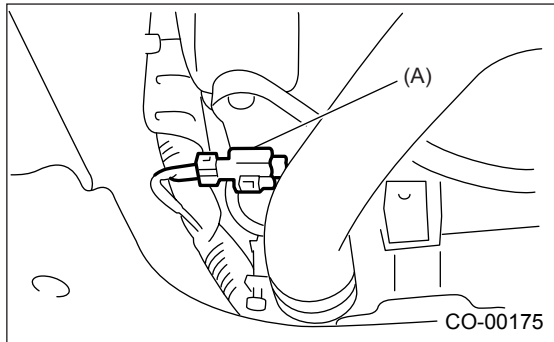
2) Lift-up the vehicle.

3) Remove the under cover.

4) Remove the radiator under cover. (AT vehicle only)

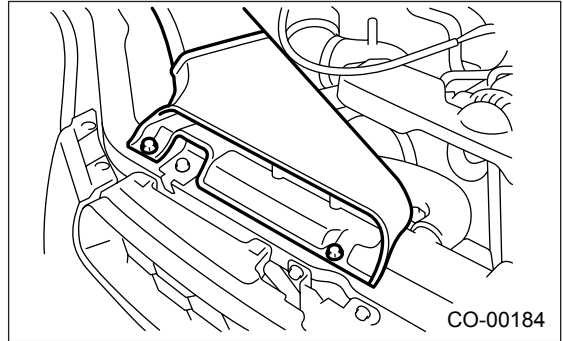


5) Disconnect the connector of main fan motor (A).

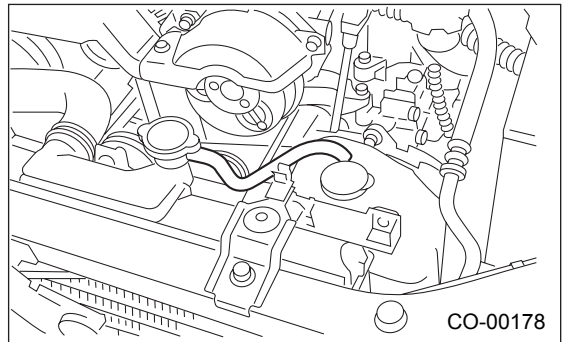


6) Lower the vehicle.

7) Remove the air intake duct. (Turbo model)

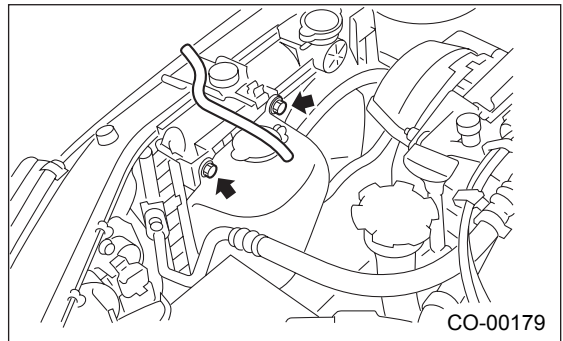


8) Disconnect the over flow hose.

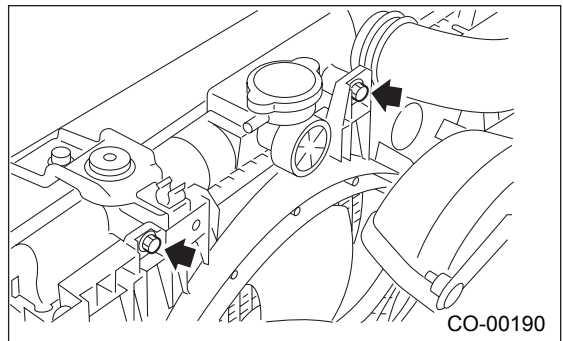


9) Remove the over flow pipe. (Turbo model)

10) Remove the reservoir tank.



11) Remove the radiator main fan motor assembly.



RADIATOR MAIN FAN AND FAN MOTOR

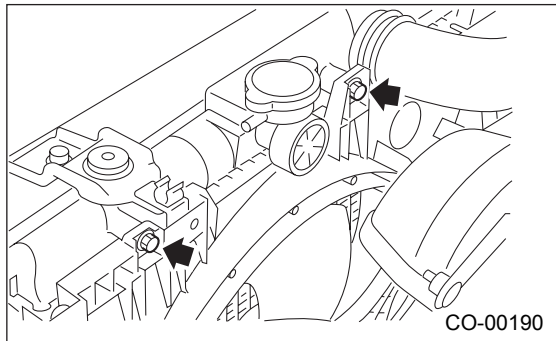
COOLING

B: INSTALLATION

Install in the reverse order of removal.

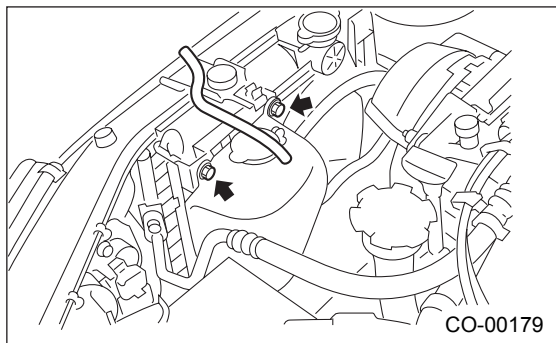
NOTE:

When the main fan motor assembly cannot be installed as is, loosen the sub fan motor assembly securing bolts to install it.



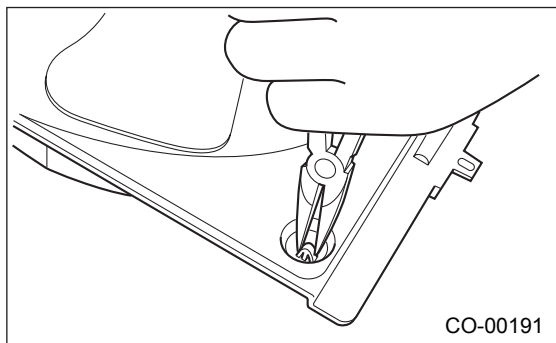
Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

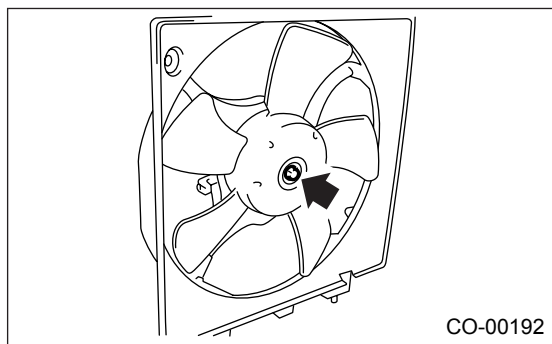


C: DISASSEMBLY

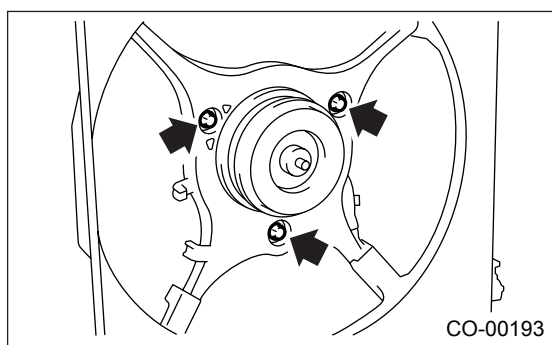
1) Remove the clip which holds motor connector onto the shroud.



2) Remove the nut which holds fan itself onto the fan motor and shroud assembly.



3) Remove the bolts which install fan motor onto the shroud.

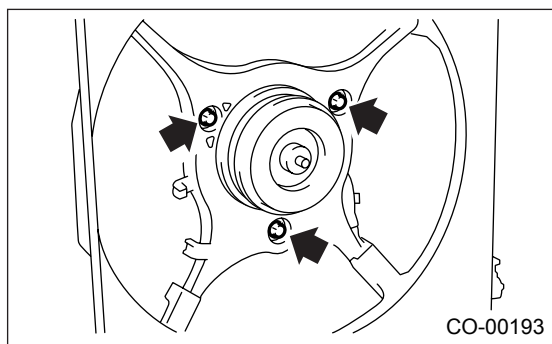


D: ASSEMBLY

Assemble in the reverse order of disassembly.

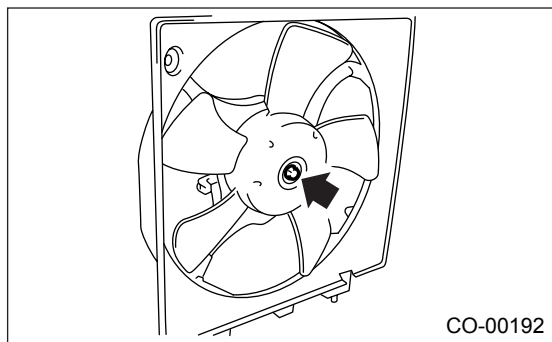
Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



Tightening torque:

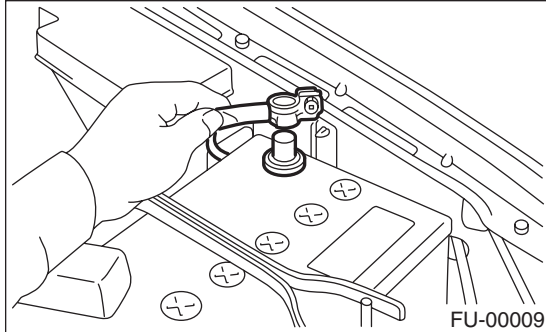
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



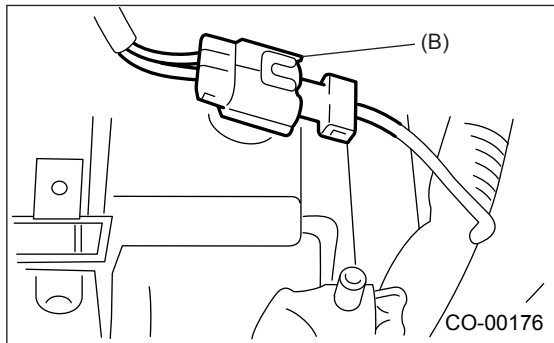
10. Radiator Sub Fan and Fan Motor

A: REMOVAL

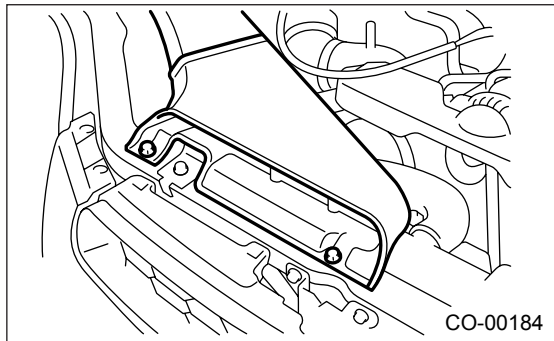
- 1) Disconnect the battery ground cable.



- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Remove the radiator under cover.
- 5) Disconnect the connector of sub fan motor.

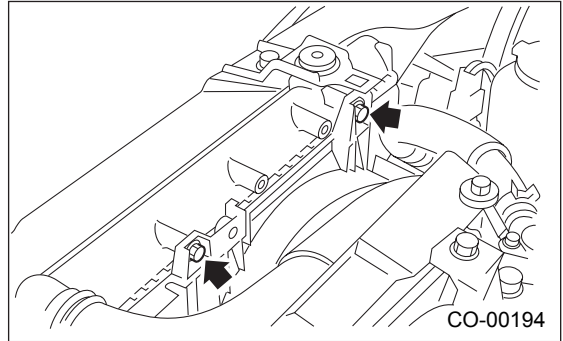


- 6) Lower the vehicle.
- 7) Remove the air intake duct. (Turbo model)



- 8) Remove the bolts which hold sub fan shroud to the radiator.
- 9) Remove the over flow pipe. (Turbo model)

- 10) Remove the radiator sub fan shroud through the under side of vehicle.

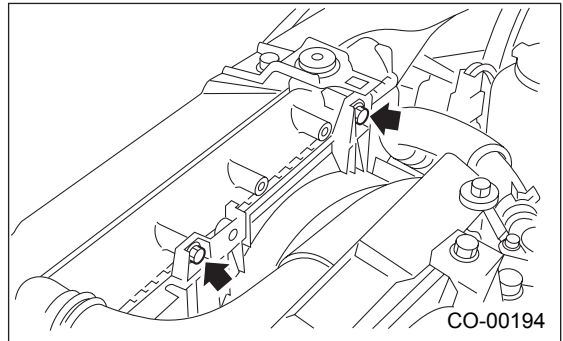


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

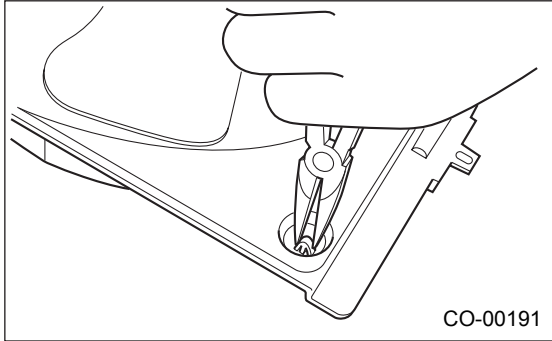


RADIATOR SUB FAN AND FAN MOTOR

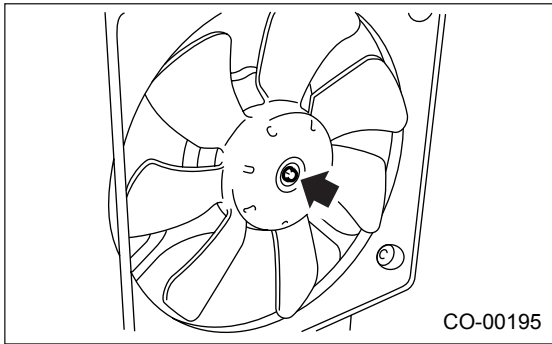
COOLING

C: DISASSEMBLY

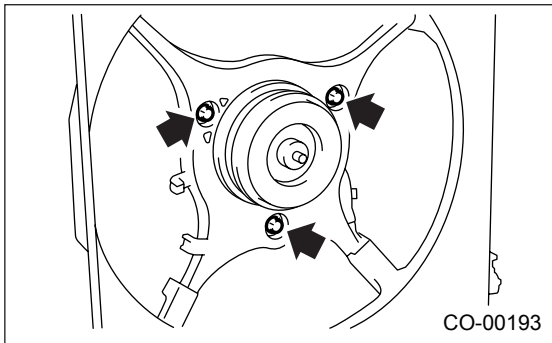
1) Remove the clip which holds motor harness onto the shroud.



2) Remove the nut which holds fan itself onto the fan motor and shroud assembly.



3) Remove the bolts which install fan motor onto the shroud.

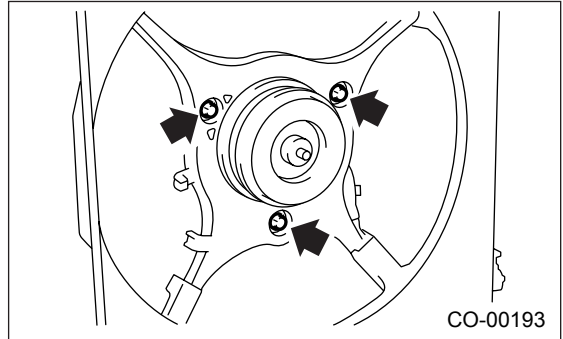


D: ASSEMBLY

Assemble in the reverse order of disassembly.

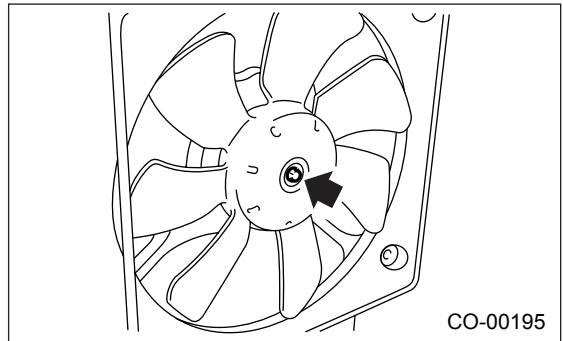
Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



Tightening torque:

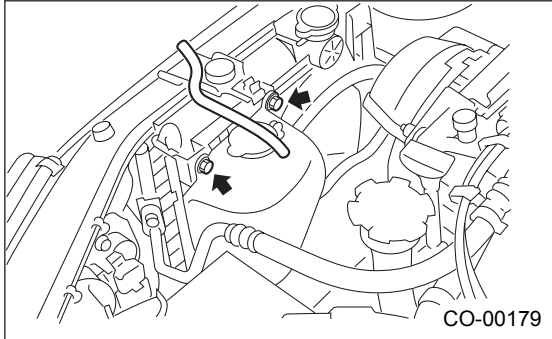
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



11. Reservoir Tank

A: REMOVAL

- 1) Disconnect the over flow hose from the radiator filler neck position.
- 2) Remove the bolts which install reservoir tank onto the radiator main fan shroud.
- 3) Remove the reservoir tank.

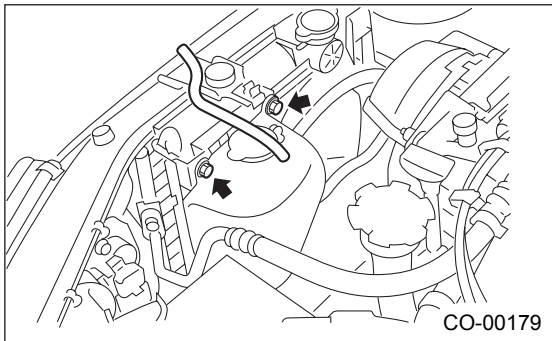


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



C: INSPECTION

Make sure the engine coolant level is between full and low.

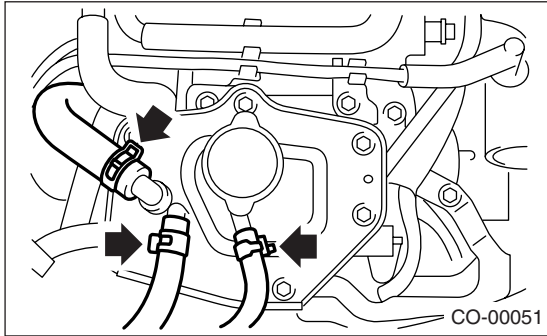
12. Coolant Filler Tank

A: REMOVAL

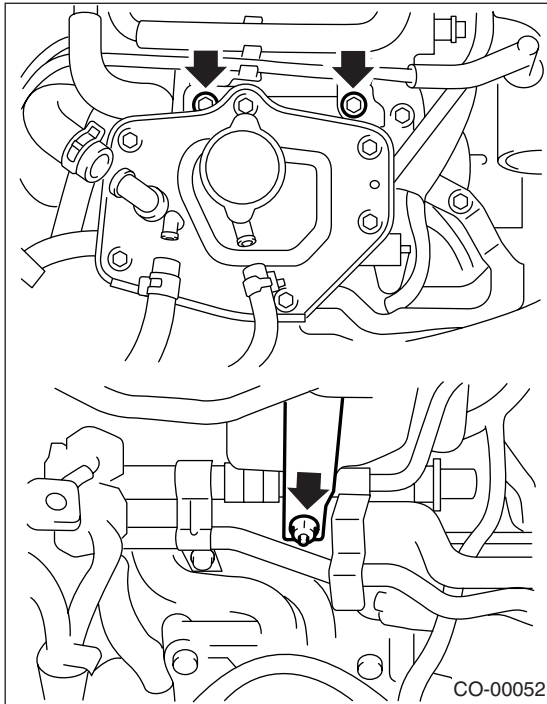
WARNING:

The radiator is pressurized. Wait until engine cools down before working on the radiator.

- 1) Drain the coolant about 3.0 (3.2 US qt, 2.6 Imp qt). <Ref. to CO(H4SO)-29, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 2) Remove the air cleaner upper cover and air intake boot. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
- 3) Remove the air cleaner element.
- 4) Disconnect the engine coolant hoses from the coolant filler tank.



- 5) Remove the bolts and nut which install coolant filler tank.
- 6) Disconnect the engine coolant hose which connects the under side of coolant filler tank.
- 7) Remove the coolant filler tank.



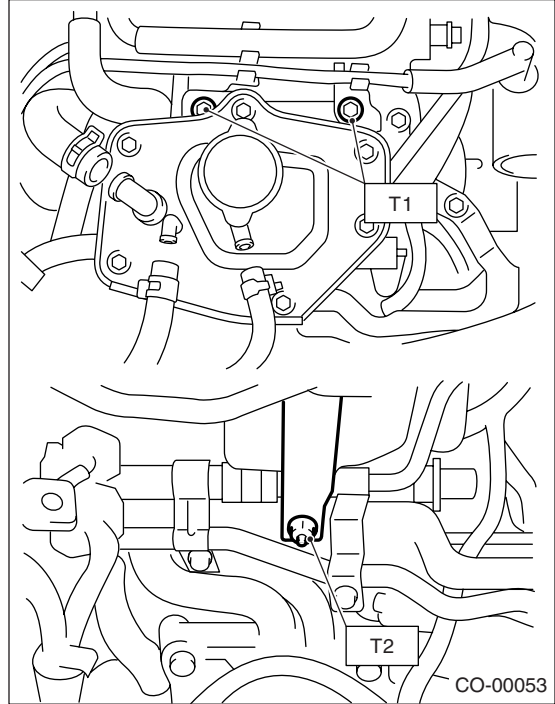
B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

T1: 19 N·m (1.9 kgf-m, 13.7 ft-lb)

T2: 21 N·m (2.1 kgf-m, 15.2 ft-lb)



- 2) Fill engine coolant. <Ref. to CO(H4SO)-29, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

13.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.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive 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)-2, Basic Diagnostic Procedure.> or <Ref. to EN(H4DOTC)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system.<Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.> or <Ref. to EN(H4DOTC)-2, PROCEDURE, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjust.
	o. Improper transmission oil	Replace.
	p. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric 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 gasket.
	e. Damaged or cracked cylinder head and crankcase	Repair or replace.
	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

ENGINE COOLING SYSTEM TROUBLE IN GENERAL

COOLING

GENERAL DESCRIPTION

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

1. General Description

A: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

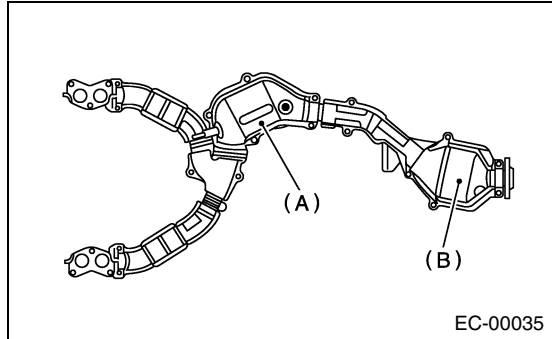
FRONT CATALYTIC CONVERTER

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

2. Front Catalytic Converter

A: REMOVAL

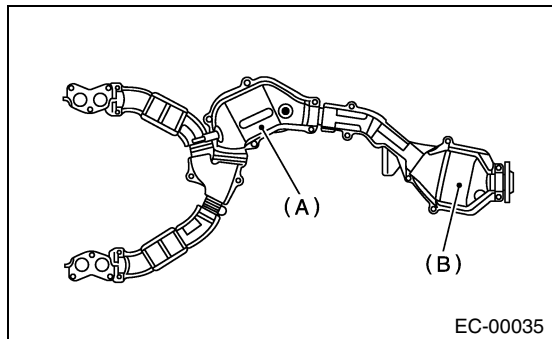
The front and rear catalytic converters and the center exhaust pipe are integrated into one unit. Therefore, the removal procedures are the same as those for the center exhaust pipe. <Ref. to EX(H4SO)-8, REMOVAL, Center Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

B: INSTALLATION

The front and rear catalytic converters and the center exhaust pipe are integrated into one unit. Therefore, the installation procedures are the same as those for the center exhaust pipe. <Ref. to EX(H4SO)-8, INSTALLATION, Center Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

REAR CATALYTIC CONVERTER

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

3. Rear Catalytic Converter

A: REMOVAL

The front and rear catalytic converters and the center exhaust pipe are integrated into one unit. Therefore, the removal procedures are the same as those for the front catalytic converter. <Ref. to EC(H4SO)-3, REMOVAL, Front Catalytic Converter.>

B: INSTALLATION

The front and rear catalytic converters and the center exhaust pipe are integrated into one unit. Therefore, the installation procedures are the same as those for the front catalytic converter. <Ref. to EC(H4SO)-3, INSTALLATION, Front Catalytic Converter.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

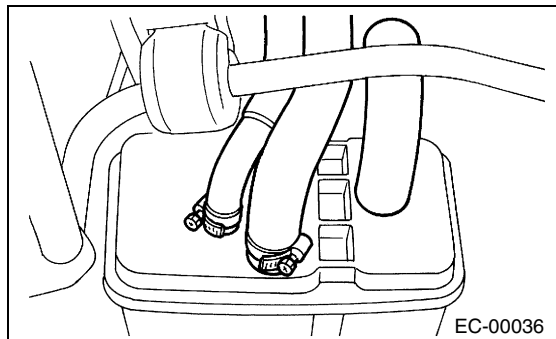
CANISTER

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

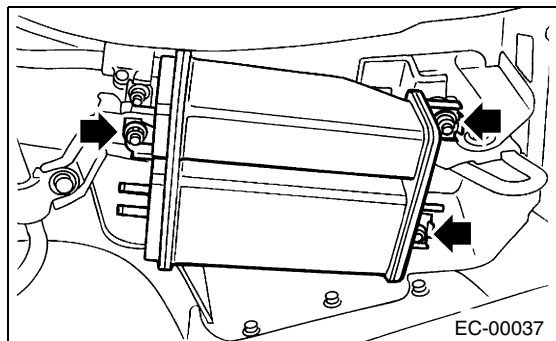
4. Canister

A: REMOVAL

- 1) Lift up the vehicle.
- 2) Loosen the two clamps which hold two canister hoses, and disconnect the evaporation hose from canister.



- 3) Remove the canister from body.

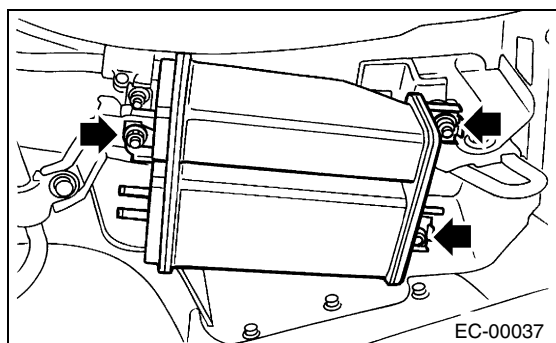


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 17 ft-lb)



C: INSPECTION

Make sure the canister and canister hoses are not cracked or loose.

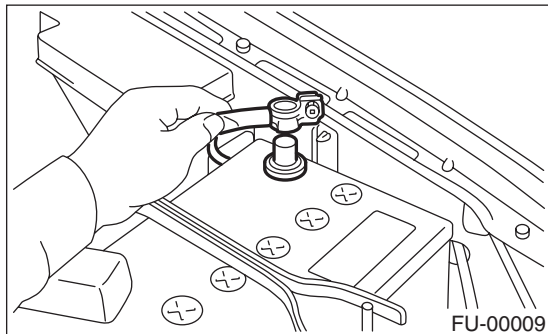
PURGE CONTROL SOLENOID VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

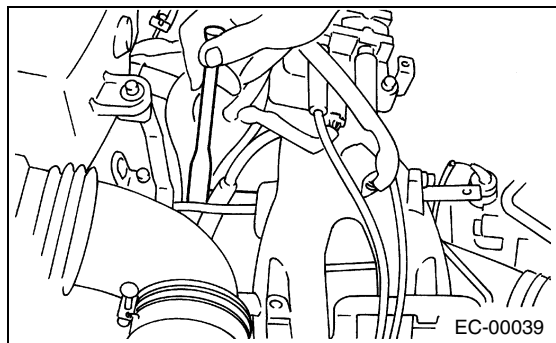
5. Purge Control Solenoid Valve

A: REMOVAL

1) Disconnect the ground cable from battery.

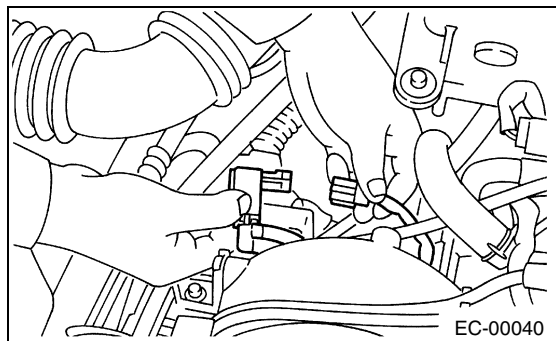


2) Remove the bolt which installs purge control solenoid valve onto intake manifold.



3) Take out purge control solenoid valve through the bottom of the intake manifold.

4) Disconnect the connector and hoses from purge control solenoid valve.

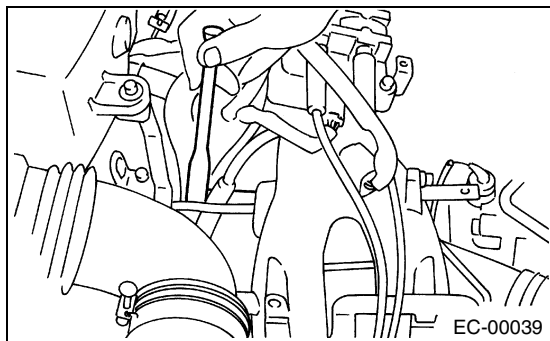


B: INSTALLATION

Install in the reverse order of removal.

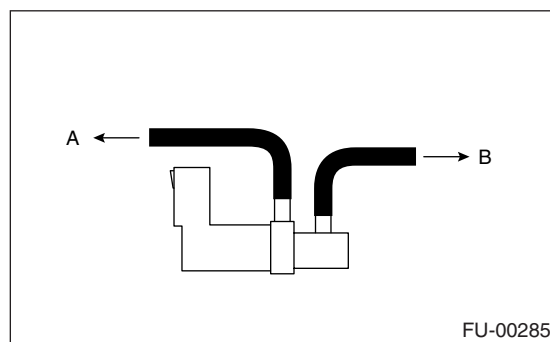
Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



NOTE:

Connect the evaporation hose as shown in the following figure.



(A) To fuel pipe

(B) To intake manifold

C: INSPECTION

Make sure the hoses are not cracked or loose.

FUEL LEVEL SENSOR

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

6. Fuel Level Sensor

A: REMOVAL

For removal procedure, refer to “FU” section. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedure, refer to “FU” section. <Ref. to FU(H4SO)-62, INSTALLATION, Fuel Level Sensor.>

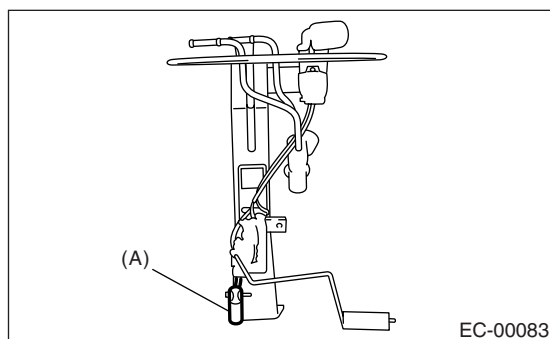
FUEL TEMPERATURE SENSOR

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

7. Fuel Temperature Sensor

A: REMOVAL

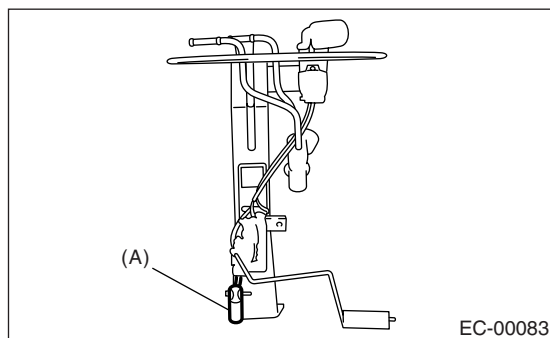
The fuel temperature sensor and fuel level sensor are integrated into one unit. Therefore, the removal procedure is same as that described under fuel level sensor. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Level Sensor.>



(A) Fuel temperature sensor

B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit. Therefore, the installation procedure is same as that described under fuel level sensor. <Ref. to FU(H4SO)-62, INSTALLATION, Fuel Level Sensor.>



(A) Fuel temperature sensor

FUEL SUB LEVEL SENSOR

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

8. Fuel Sub Level Sensor

A: REMOVAL

For removal procedure, refer to “FU” section. <Ref. to FU(H4SO)-63, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedure, refer to “FU” section. <Ref. to FU(H4SO)-64, INSTALLATION, Fuel Sub Level Sensor.>

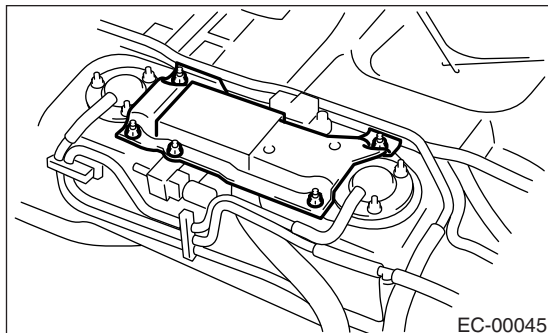
FUEL TANK PRESSURE SENSOR

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

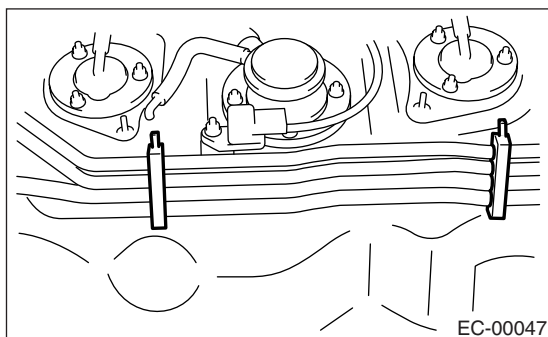
9. Fuel Tank Pressure Sensor

A: REMOVAL

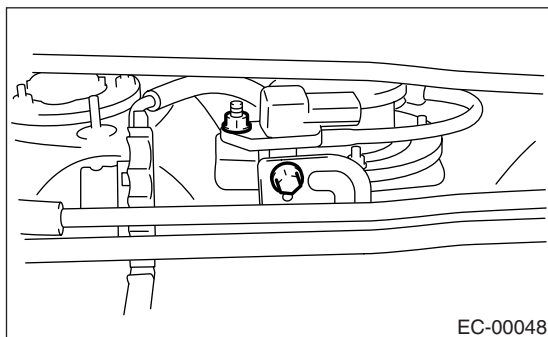
- 1) Remove the fuel tank. <Ref. to FU(H4SO)-52, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



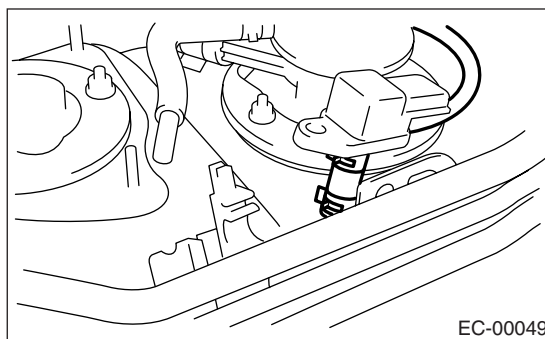
- 3) Disconnect the connector from fuel tank pressure sensor.
- 4) Release the clips which hold fuel pipes onto fuel tank.



- 5) Remove the nuts and bolts which install fuel tank pressure sensor on bracket.



- 6) Disconnect the pressure hose from fuel tank pressure sensor.

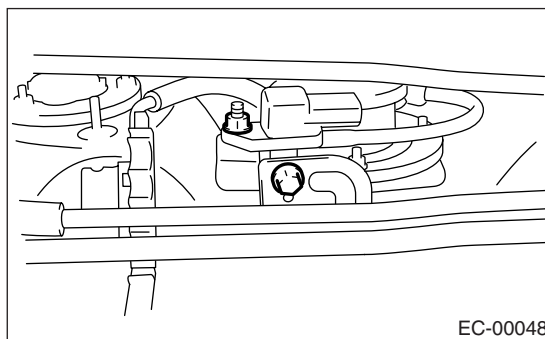


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

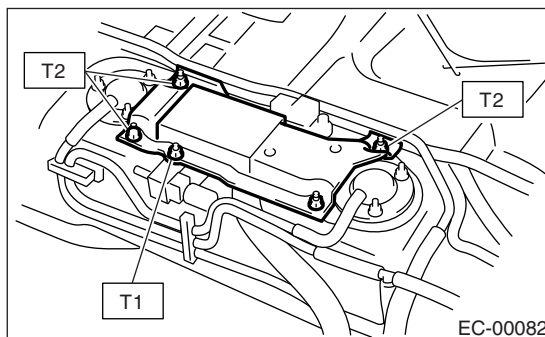
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

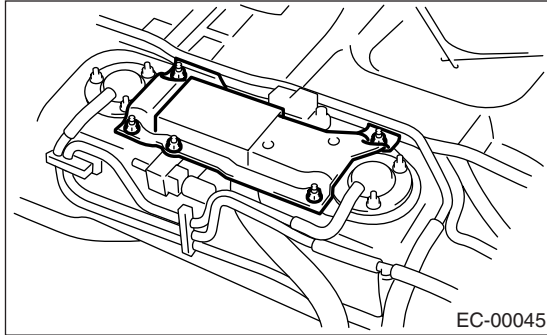
FUEL TANK SENSOR CONTROL VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

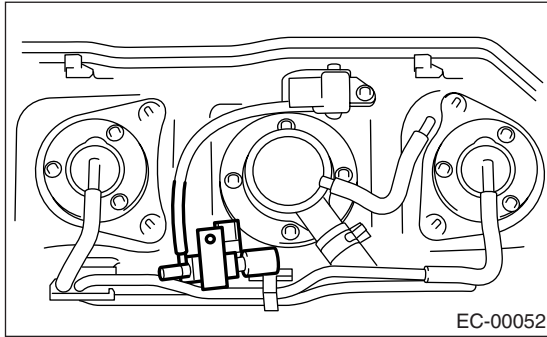
10. Fuel Tank Sensor Control Valve

A: REMOVAL

- 1) Remove the fuel tank. <Ref. to FU(H4SO)-52, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



- 3) Disconnect the connector from fuel tank sensor control valve.
- 4) Disconnect the hose, and then remove the fuel tank sensor control valve.



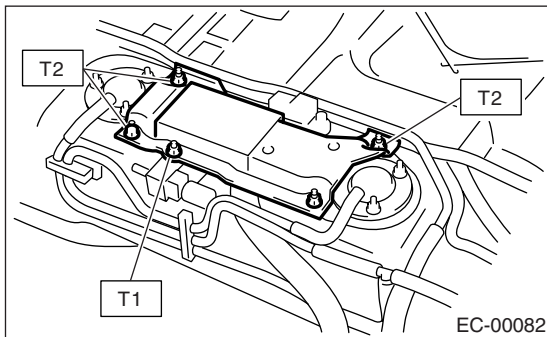
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

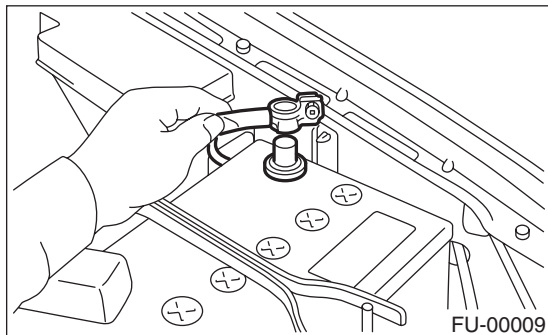
PRESSURE CONTROL SOLENOID VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

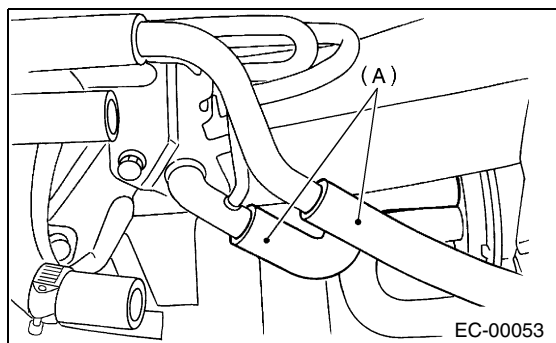
11. Pressure Control Solenoid Valve

A: REMOVAL

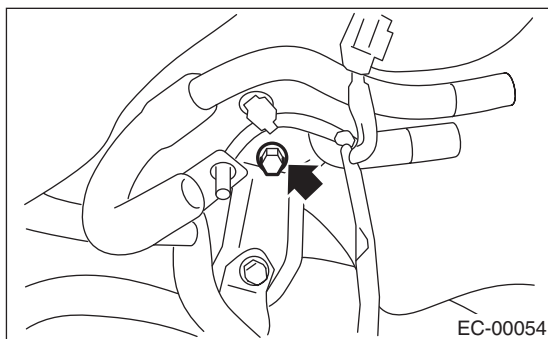
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



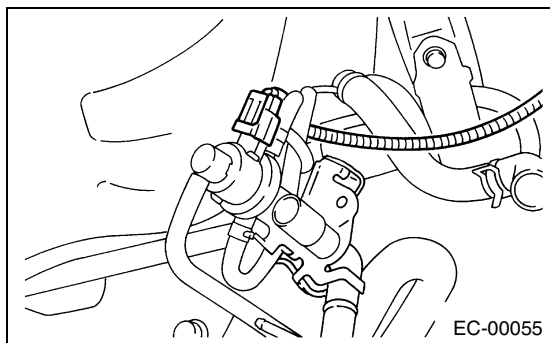
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the evaporation hoses (A) from joint pipes.



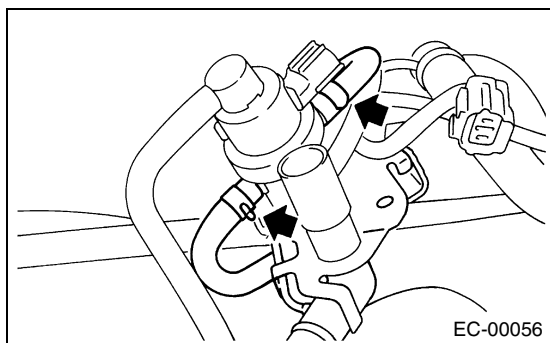
- 6) Remove the bolt which installs pressure control solenoid valve holding bracket on body.



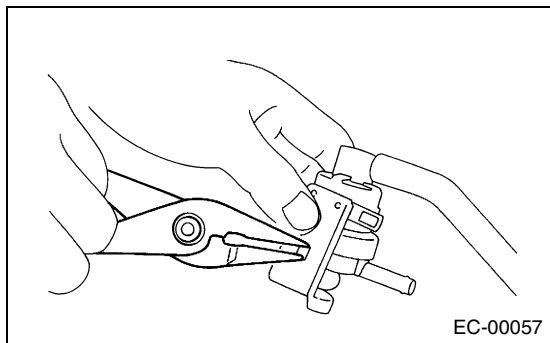
- 7) Disconnect the connector from pressure control solenoid valve.



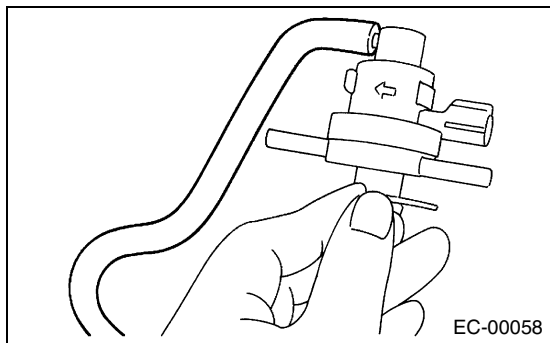
- 8) Disconnect the two evaporation hoses from pressure control solenoid valve.
- 9) Remove the pressure control solenoid valve with bracket.



- 10) Remove the pressure control solenoid valve from bracket.



- 11) Disconnect the vacuum hose from pressure control solenoid valve.



PRESSURE CONTROL SOLENOID VALVE

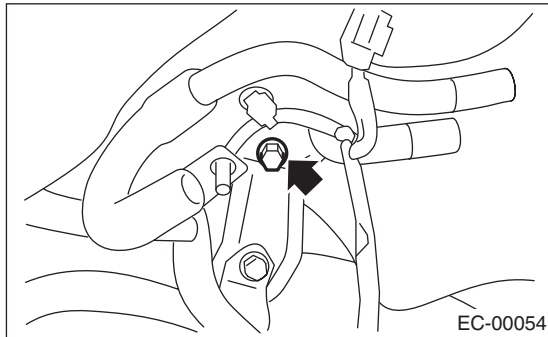
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

17.6 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

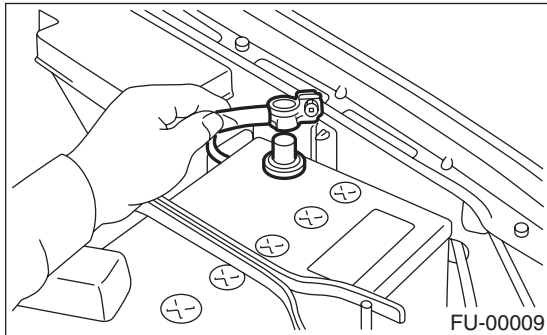
DRAIN FILTER

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

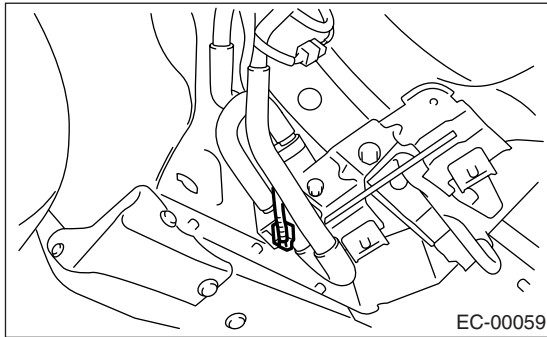
12.Drain Filter

A: REMOVAL

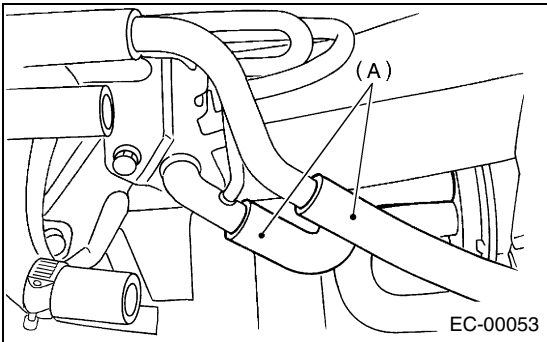
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



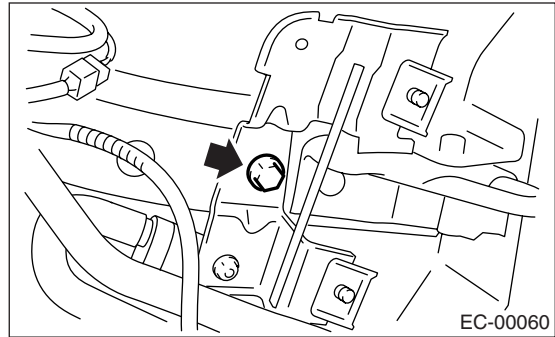
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the connector from drain valve.



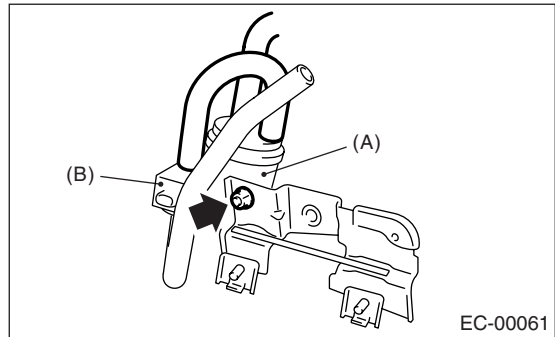
- 6) Disconnect the evaporation hoses (A) from joint pipes.



- 7) Remove the bolt which installs the drain filter and drain valve brackets on body, and remove them as a unit.



- 8) Disconnect the evaporation hoses from drain filter.
- 9) Remove the nuts, and then remove the drain filter.



- (A) Drain filter
(B) Drain valve

DRAIN FILTER

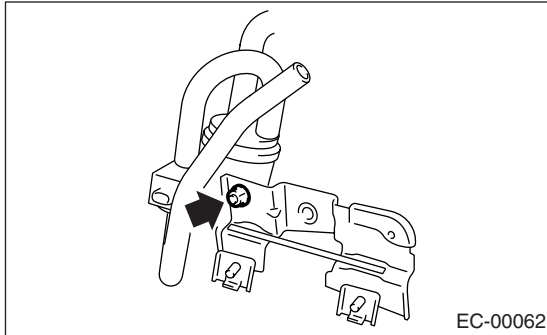
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

B: INSTALLATION

Install in the reverse order of removal.

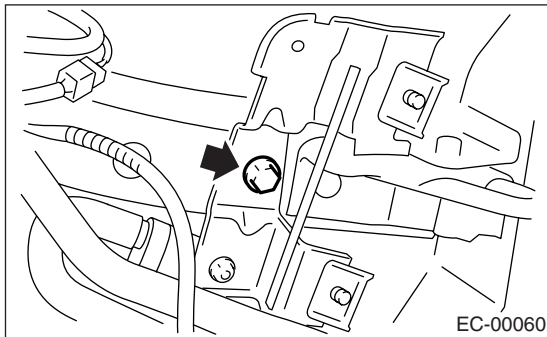
Tightening torque:

23 N·m (2.3 kgf-m, 16.6 ft-lb)



Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



C: INSPECTION

- 1) Make sure all hoses are installed correctly.
- 2) Make sure the hoses are not cracked or loose.

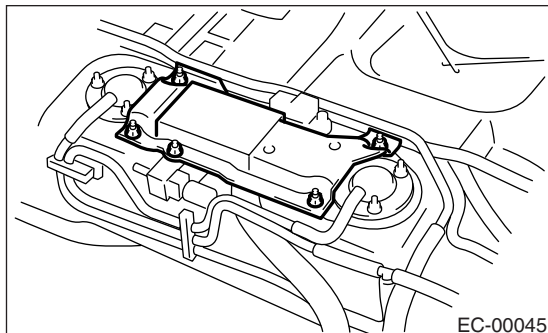
VENT VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

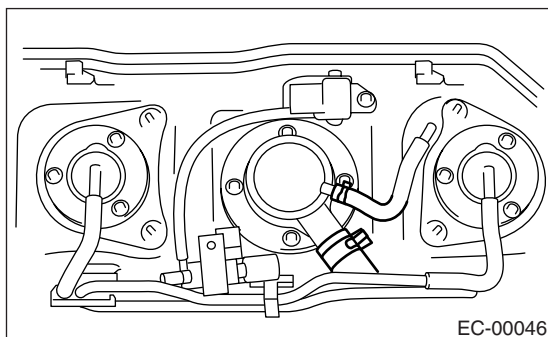
13.Vent Valve

A: REMOVAL

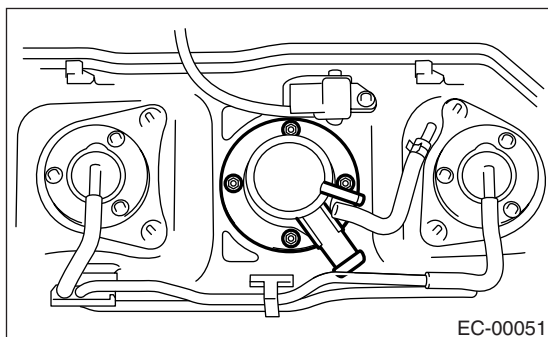
- 1) Remove the fuel tank. <Ref. to FU(H4SO)-52, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



- 3) Remove the clips, and disconnect the hoses from vent valve.



- 4) Remove the nuts, and then remove the vent valve.



B: INSTALLATION

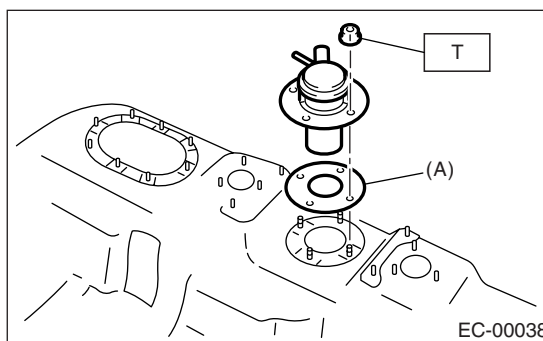
Install in the reverse order of removal.

NOTE:

Replace the rubber seat with a new one.

Tightening torque:

T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

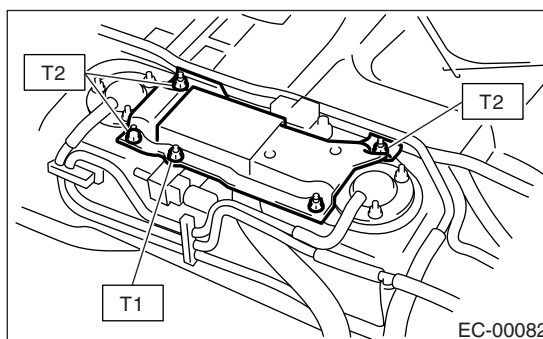


(A) Rubber seat

Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

SHUT VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

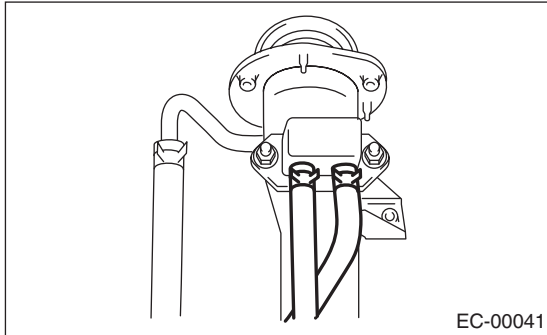
14. Shut Valve

A: REMOVAL

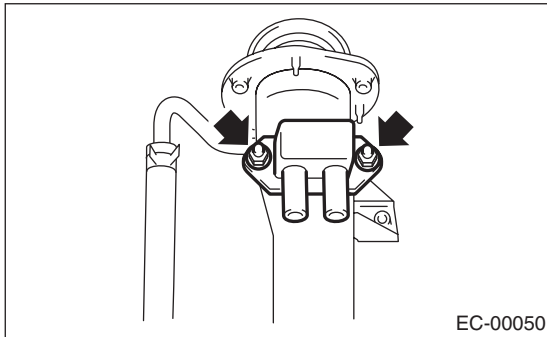
1) Remove the fuel filler pipe.

<Ref. to FU(H4SO)-55, REMOVAL, Fuel Filler Pipe.>

2) Disconnect the evaporation hoses from shut valve.



3) Remove the shut valve from fuel filler pipe.

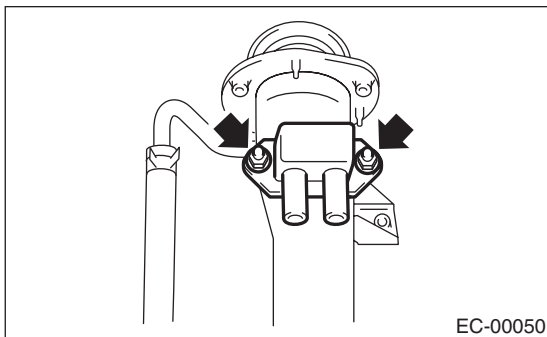


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.5 N·m (0.46 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

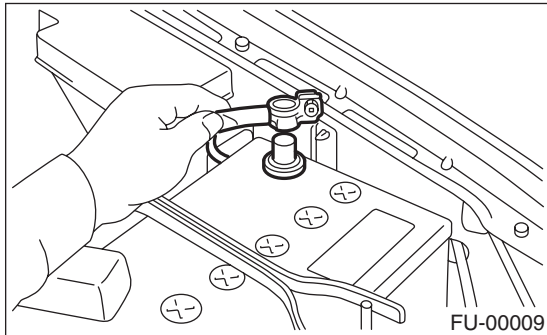
DRAIN VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

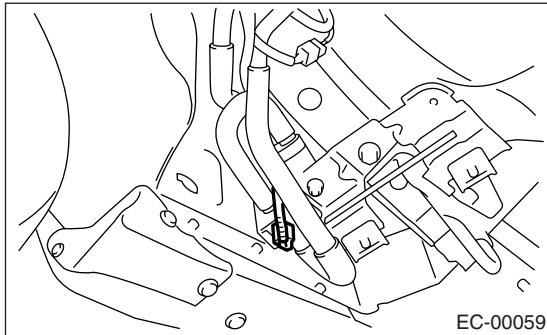
15.Drain Valve

A: REMOVAL

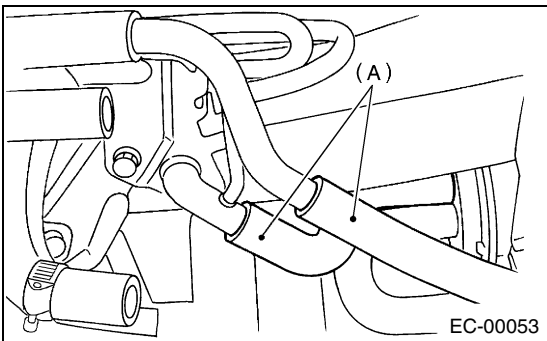
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



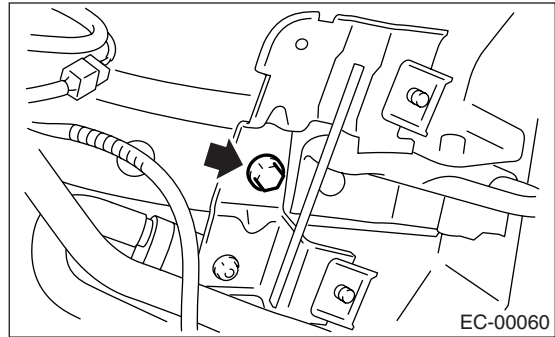
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the connector from drain valve.



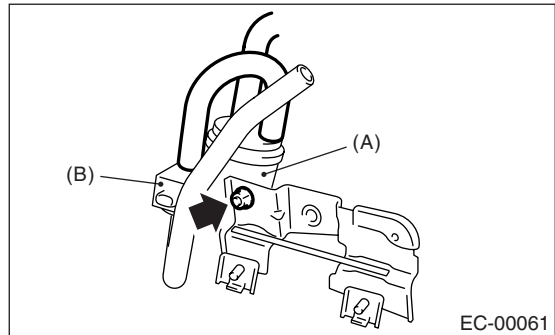
- 6) Disconnect the evaporation hoses (A) from joint pipes.



- 7) Remove the bolt which installs the drain filter and drain valve brackets on body, and remove them as a unit.



- 8) Disconnect the evaporation hoses from drain valve.
- 9) Remove the nuts, and then remove the drain valve.



- (A) Drain filter
(B) Drain valve

DRAIN VALVE

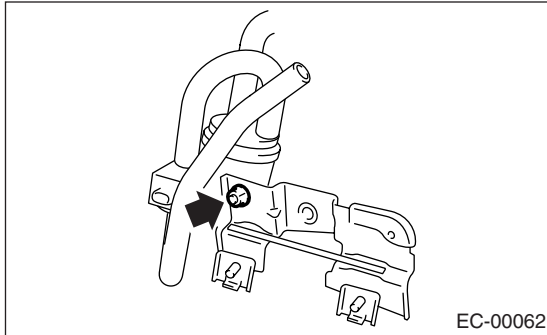
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

B: INSTALLATION

Install in the reverse order of removal.

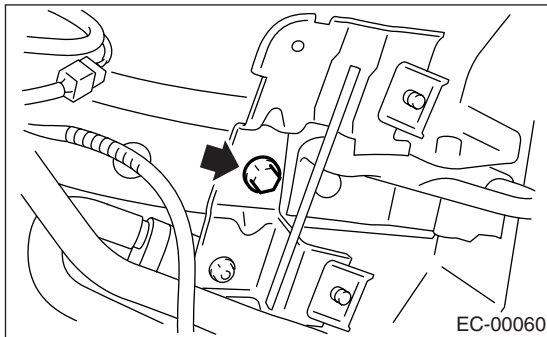
Tightening torque:

23 N·m (2.3 kgf-m, 16.6 ft-lb)



Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



C: INSPECTION

- 1) Make sure all hoses are installed correctly.
- 2) Make sure the hoses are not cracked or loose.

DRAIN VALVE

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

BASIC DIAGNOSTIC PROCEDURE

ENGINE (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

Step	Check	Yes	No
1 CHECK ENGINE START FAILURE. 1)Ask the customer when and how the trouble occurred using the interview check list. <Ref. to EN(H4SO)-4, CHECK, Check List for Interview.> 2)Start the engine. Does the engine start?	Engine starts.	Go to step 2.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4SO)-59, Diagnostics for Engine Starting Failure.>
2 CHECK ILLUMINATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL). Does CHECK ENGINE malfunction indicator lamp illuminate?	CHECK ENGINE malfunction indicator light illuminates.	Go to step 3.	Inspection using "General Diagnostics Table". <Ref. to EN(H4SO)-340, INSPECTION, General Diagnostic Table.>
3 CHECK INDICATION OF DTC ON DISPLAY. 1)Turn ignition switch to OFF. 2)Connect the Subaru Select Monitor or the OBD-II general scan tool to data link connector. 3)Turn ignition switch to ON and the Subaru Select Monitor or OBD-II general scan tool switch to ON. 4)Read the DTC on the Subaru Select Monitor or OBD-II general scan tool. Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	DTC is indicated.	Record the DTC. Repair the cause of the trouble. <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the MIL illuminates, perform diagnostics of MIL (CHECK ENGINE malfunction indicator lamp) circuit or combination meter. <Ref. to EN(H4SO)-49, Engine Malfunction Indicator Lamp (MIL).>
4 PERFORM THE DIAGNOSIS. 1)Perform the clear memory mode. <Ref. to EN(H4SO)-46, Clear Memory Mode.> 2)Perform the inspection mode. <Ref. to EN(H4SO)-39, Inspection Mode.> Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	DTC is indicated.	Inspect using "Diagnostics Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-82, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

2. AUTOMATIC TRANSMISSION

When any diagnostic trouble code (DTC) related to the automatic transmission is shown on the display, carry out the following basic check. After that, carry out the replacement or repair work.

- 1) ATF level check <Ref. to AT-30, ATF.>
- 2) Differential gear oil level check <Ref. to AT-31, Differential Gear Oil.>
- 3) ATF leak check <Ref. to AT-30, ATF.>
- 4) Differential gear oil leak check <Ref. to AT-31, Differential Gear Oil.>
- 5) Stall test <Ref. to AT-33, Stall Test.>
- 6) Line pressure test <Ref. to AT-36, Line Pressure Test.>
- 7) Transfer clutch pressure test <Ref. to AT-38, Transfer Clutch Pressure Test.>
- 8) Time lag test <Ref. to AT-35, Time Lag Test.>
- 9) Road test <Ref. to AT-32, Road Test.>
- 10) Shift characteristics <Ref. to AT-38, Transfer Clutch Pressure Test.>

CHECK LIST FOR INTERVIEW.

ENGINE (DIAGNOSTICS)

2. Check List for Interview.

A: CHECK

1. CHECK LIST NO. 1

Check the following items when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name		Engine no.	
Date of sale		Fuel brand	
Date of repair		Odometer reading	km
VIN			miles
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others:		
Outdoor temperature	°C (°F)		
	☐ Hot ☐ Warm ☐ Cool ☐ Cold		
Place	☐ Highway ☐ Suburbs ☐ Inner city ☐ Uphill ☐ Downhill ☐ Rough road ☐ Others:		
Engine temperature	☐ Cold ☐ Warming-up ☐ After warming-up ☐ Any temperature ☐ Others:		
Engine speed	rpm		
Vehicle speed	MPH		
Driving conditions	☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH)		
Headlight	☐ ON/ ☐ OFF	Rear defogger	☐ ON/ ☐ OFF
Blower	☐ ON/ ☐ OFF	Radio	☐ ON/ ☐ OFF
A/C compressor	☐ ON/ ☐ OFF	CD/cassette tape player	☐ ON/ ☐ OFF
Cooling fan	☐ ON/ ☐ OFF	Car phone	☐ ON/ ☐ OFF
Front wiper	☐ ON/ ☐ OFF	CB	☐ ON/ ☐ OFF
Rear wiper	☐ ON/ ☐ OFF		

CHECK LIST FOR INTERVIEW.

ENGINE (DIAGNOSTICS)

2. CHECK LIST NO. 2

Check the following items about the vehicle's state when MIL turns on.

NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators turn on. ☐ Yes / ☐ No
☐ Low fuel warning light
☐ Charge indicator light
☐ AT diagnostics indicator light
☐ ABS warning light
☐ Engine oil pressure warning light
b) Fuel level
• Lack of fuel: ☐ Yes/ ☐ No
• Indicator position of fuel gauge:
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 parts other than genuine parts: ☐ Yes/ ☐ No
• What:
• Where:
f) Occurrence of noise: ☐ Yes/ ☐ No
• From where:
• What kind:
g) Occurrence of smell: ☐ Yes/ ☐ No
• From where:
• What kind:
h) Intrusion of water into engine compartment or passenger compartment: ☐ Yes/ ☐ No
i) Troubles occurred
☐ Engine does not start.
☐ Engine stalls during idling.
☐ Engine stalls while driving.
☐ Engine speed decreases.
☐ Engine speed does not decrease.
☐ Rough idling
☐ Poor acceleration
☐ Back fire
☐ After fire
☐ No shift
☐ Excessive shift shock

3. General Description

A: CAUTION

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

CAUTION:

- All airbag system wiring harnesses and connectors are colored yellow. Do not use electrical test equipment on these circuits.

- Be careful not to damage the airbag system wiring harness when servicing the engine control module (ECM), transmission control module (TCM), main relay and fuel pump relay.

2) Never connect the battery in reverse polarity.

- The ECM will be destroyed instantly.

- The fuel injector and other parts will be damaged in just a few minutes more.

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 the ECM, etc.

4) Before disconnecting the connectors of each sensor and the ECM, be sure to turn OFF the ignition switch.

5) Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

6) Before removing the ECM from the located position, disconnect the two cables from battery.

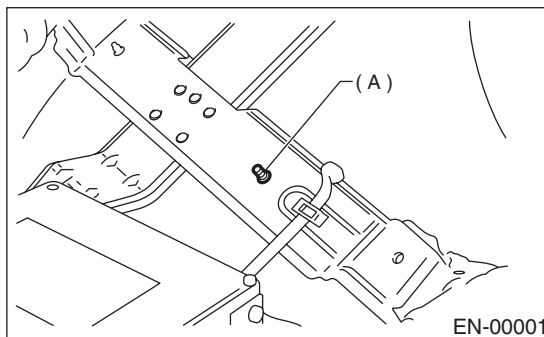
- Otherwise, the ECM may be damaged.

CAUTION:

When replacing the ECM, be careful not to use the wrong version. Avoid any damage on the fuel injection system.

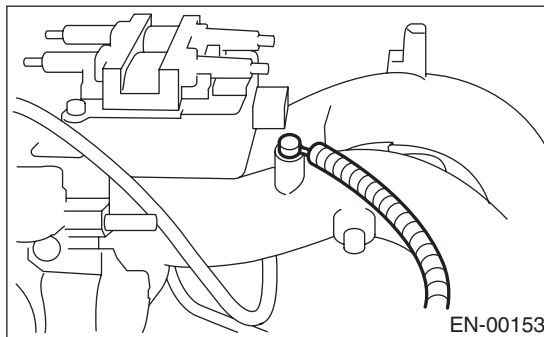
7) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on a rainy day.

8) Use ECM mounting stud bolts at the body head grounding point when measuring voltage and resistance inside the passenger compartment.

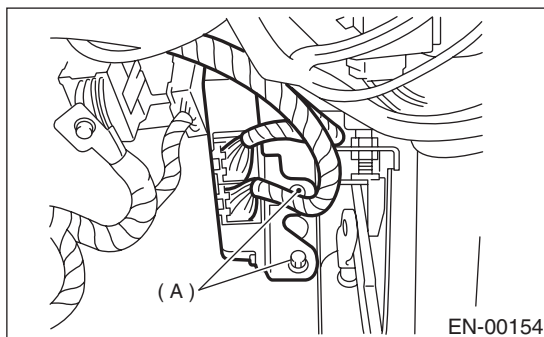


(A) Stud bolt

9) Use the engine grounding terminal or the engine proper as the grounding point to the body when measuring voltage and resistance in the engine compartment.



10) Use TCM mounting stud bolts at the body head grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

11) Every MFI-related part is a precision part. Do not drop them.

12) Observe the following cautions when installing a radio in MFI equipped models.

CAUTION:

- The antenna must be kept as far apart as possible from the control unit.
(The ECM is located under the steering column, inside of the instrument panel lower trim panel.)
- The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.
- Carefully adjust the antenna for correct matching.
- When mounting a large power type radio, pay special attention to the three items above mentioned.
- Incorrect installation of the radio may affect the operation of the ECM.

13) Before disconnecting the fuel hose, disconnect the fuel pump connector and crank the engine for more than five seconds to release pressure in the fuel system. If engine starts during this operation, run it until it stops.

14) Problems in the electronic-controlled automatic transmission may be caused by failure of the engine, the electronic control system, the transmission proper, or by a combination of these. These three causes must be distinguished clearly when performing diagnostics.

15) Diagnostics should be conducted by starting from simple, easy operations and proceeding to complicated, difficult operations. The most important thing in diagnostics is to understand the customer's complaint, and distinguish between the three causes.

16) In AT vehicles, do not continue the stall for more than five seconds at a time (from closed throttle, fully open throttle to stall engine speed).

17) On ABS vehicle, when performing driving test in jacked-up or lifted-up position, sometimes the warning light may be lit, but this is not a malfunction of the system. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clearance procedure of self-diagnosis system.

B: INSPECTION

Before performing diagnostics, check the following items which might affect engine problems:

1. BATTERY

1) Measure battery voltage and specific gravity of electrolyte.

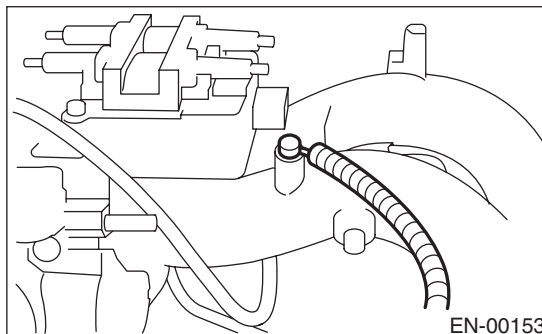
Standard voltage: 12 V

Specific gravity: Above 1.260

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

2. ENGINE GROUNDING

Make sure the engine grounding terminal is properly connected to the engine.

**C: NOTE****1. DESCRIPTION**

- The on-board diagnostics (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter indicates occurrence of a fault or trouble.
- Further, against a sensor failure that may disable the drive, a fail-safe function is provided to ensure the minimal driveability.
- The OBD system incorporated with the vehicles within this engine family complies with Section 1968.1, California Code of Regulations (OBD-II regulation). 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, the MIL illuminates. At the same time of the MIL illumination or blinking, a diagnostic trouble code (DTC) and a freeze frame engine conditions are stored into the 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 the on-board computer when it detects a malfunction first.
- If the OBD system detects malfunctions such as fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
- When the malfunction does not occur again for three consecutive driving cycles, the MIL turns off, but the DTC remains in the on-board computer.
- The OBD-II system is capable of communication with a general scan tool (OBD-II general scan tool) conforming to ISO 9141 CARB.
- The OBD-II diagnostics procedure is different from the usual diagnostics procedure. When troubleshooting OBD-II vehicles, connect a Subaru Select Monitor or an OBD-II general scan tool to the vehicle.

2. ENGINE AND EMISSION CONTROL SYSTEM

- The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.

With this system, fuel is pressurized at a constant pressure and injected into the intake air passage of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where the electro-magnetic injection valve (fuel injector) opens only for a short period of time, depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.

- Further, all the operating conditions of the engine are converted into electric signals, and this results in additional features of the system, such as large improved adaptability, easier addition of compensating element, etc.

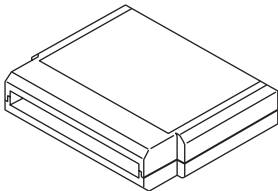
The MFI system also has the following features:

- Reduced emission of harmful exhaust gases.
- Reduced fuel consumption.
- Increased engine output.
- Superior acceleration and deceleration.
- Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.

3. AUTOMATIC TRANSMISSION AND ELECTRONIC-HYDRAULIC CONTROL SYSTEM

The electronic-hydraulic control system consists of various sensors and switches, a transmission control module (TCM) and the hydraulic controller including solenoid valves. The system controls the transmission proper including shift control, lock-up control, overrunning clutch control, line pressure control and shift timing control. It also controls the AWD transfer clutch. In other words, the system detects various operating conditions from various input signals and sends output signals to shift solenoids 1, 2 and low clutch timing solenoid and 2-4 brake timing solenoid, line pressure duty solenoid, lock-up duty solenoid, transfer duty solenoid and 2-4 brake duty solenoid (a total of eight solenoids).

D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA210	24082AA210 (newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (without printer) • German: 22771AA070 (without printer) • French: 22771AA080 (without printer) • Spanish: 22771AA090 (without printer)

ELECTRICAL COMPONENTS LOCATION

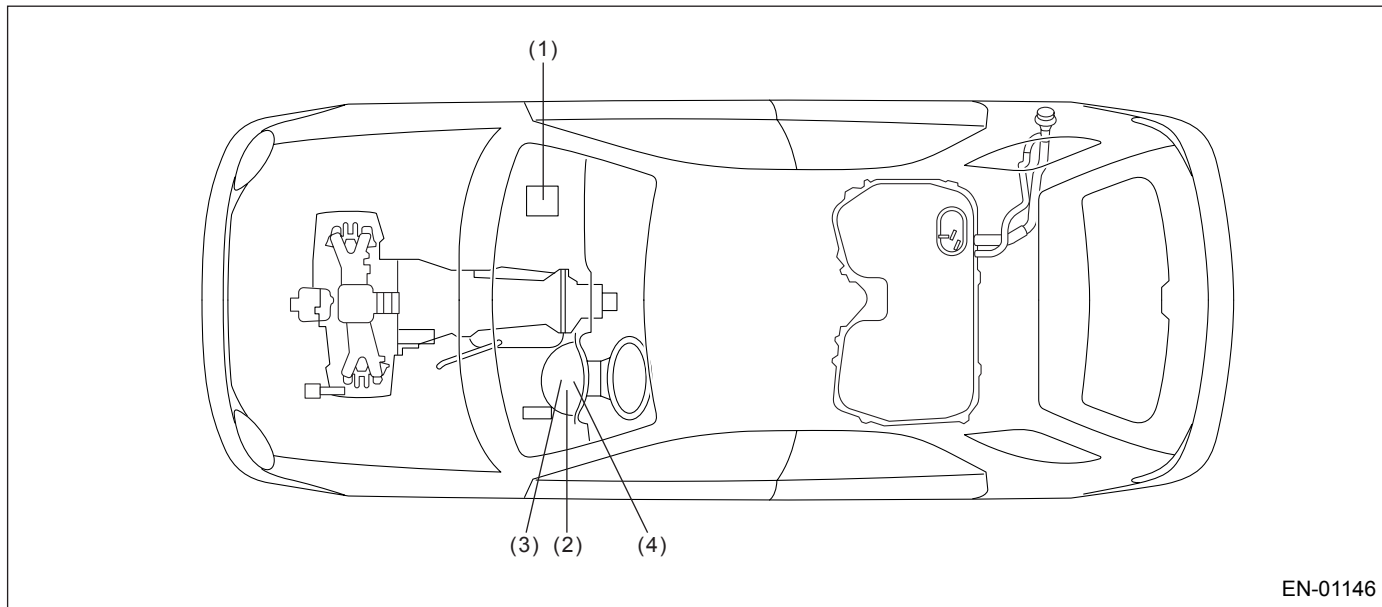
ENGINE (DIAGNOSTICS)

4. Electrical Components Location

A: LOCATION

1. ENGINE

• Module

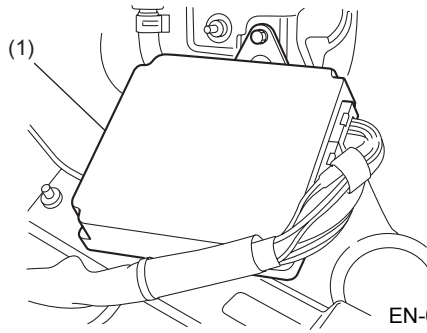


EN-01146

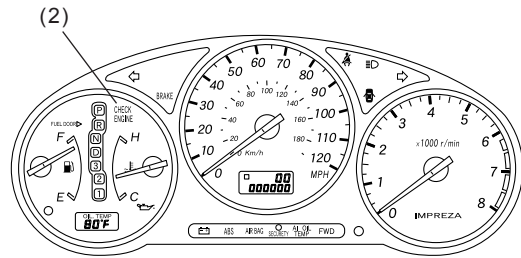
- | | |
|---|-------------------------|
| (1) Engine control module (ECM) | (3) Test mode connector |
| (2) CHECK ENGINE malfunction indicator lamp (MIL) | (4) Data link connector |

ELECTRICAL COMPONENTS LOCATION

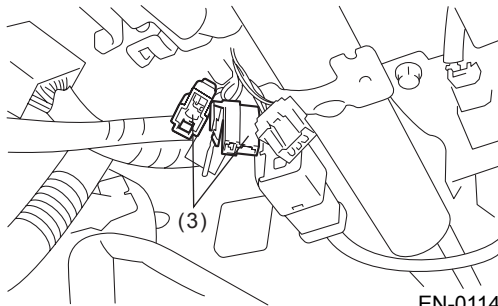
ENGINE (DIAGNOSTICS)



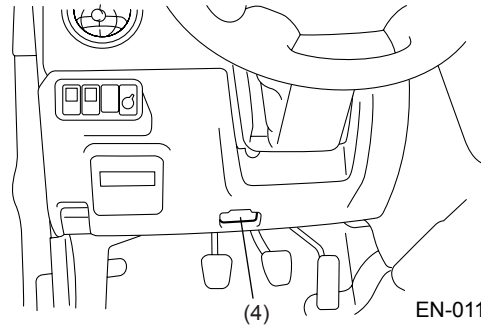
EN-01147



EN-01148



EN-01149

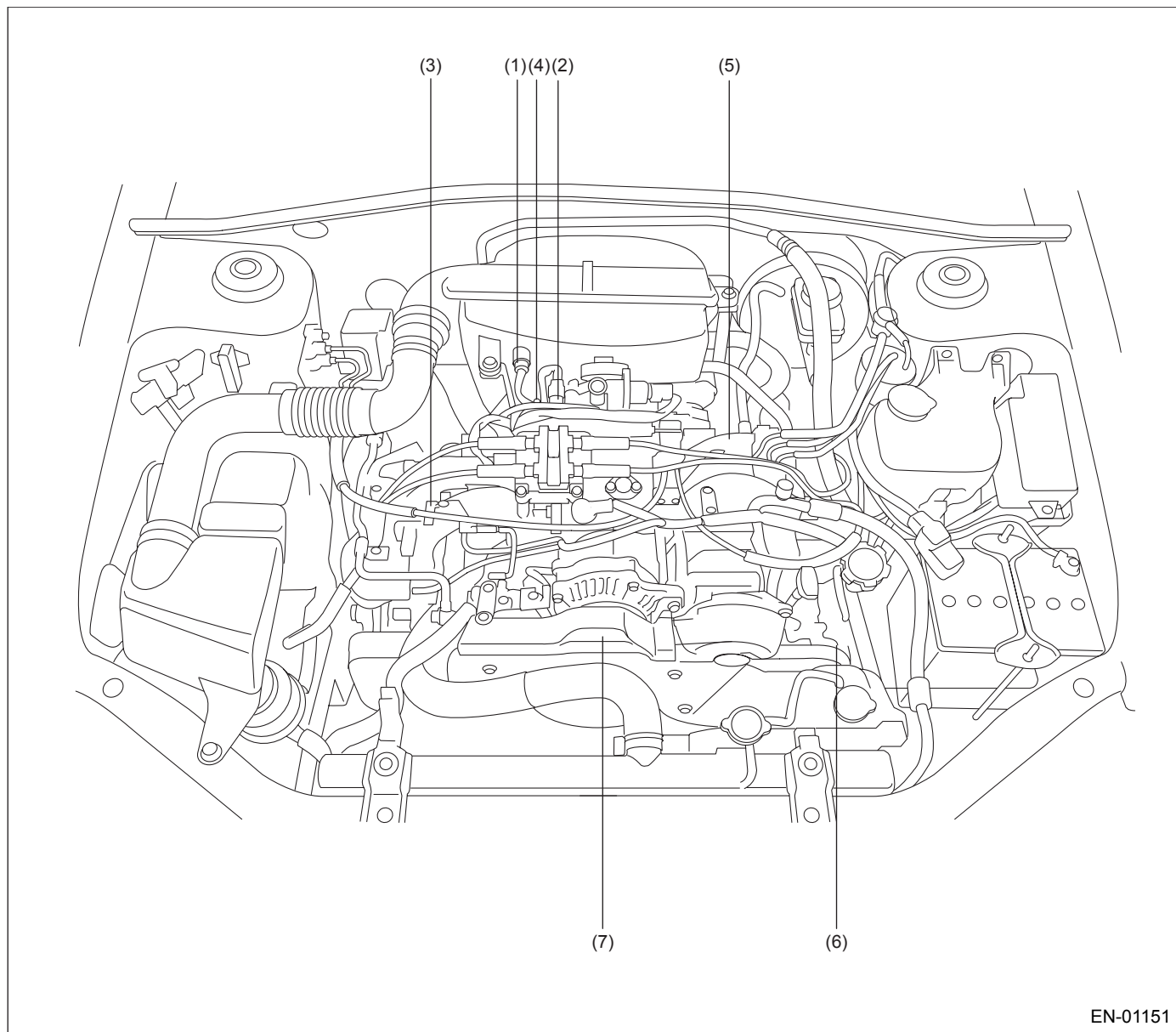


EN-01150

ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)

• Sensor



EN-01151

- (1) Intake air temperature sensor
- (2) Pressure sensor
- (3) Engine coolant temperature sensor

- (4) Throttle position sensor
- (5) Knock sensor
- (6) Camshaft position sensor

- (7) Crankshaft position sensor

ELECTRICAL COMPONENTS LOCATION

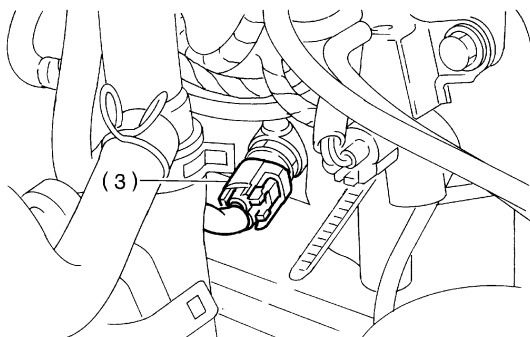
ENGINE (DIAGNOSTICS)



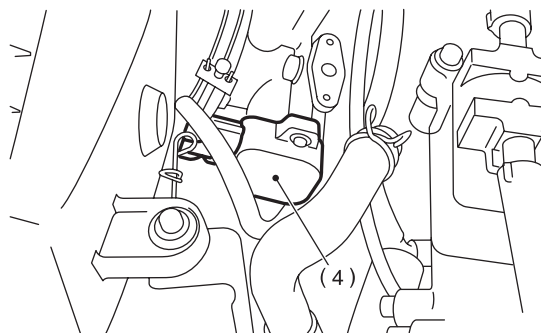
EN-00006



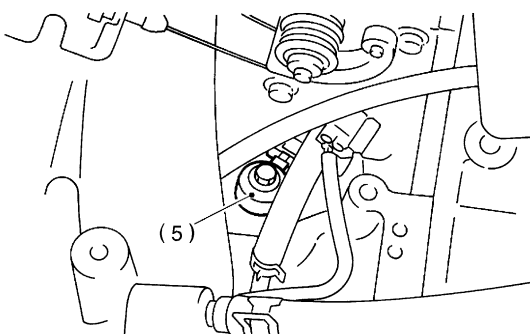
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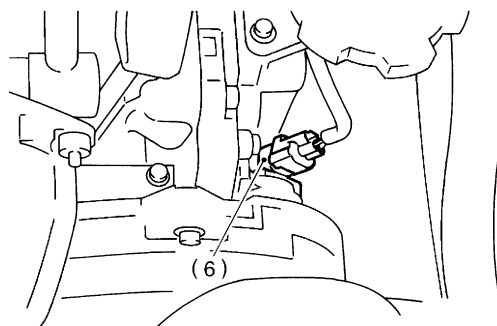
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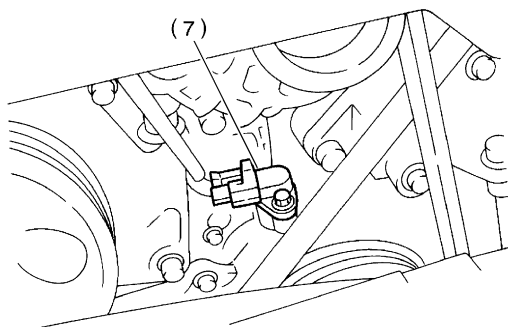
EN-00161



EN-00010



EN-00011

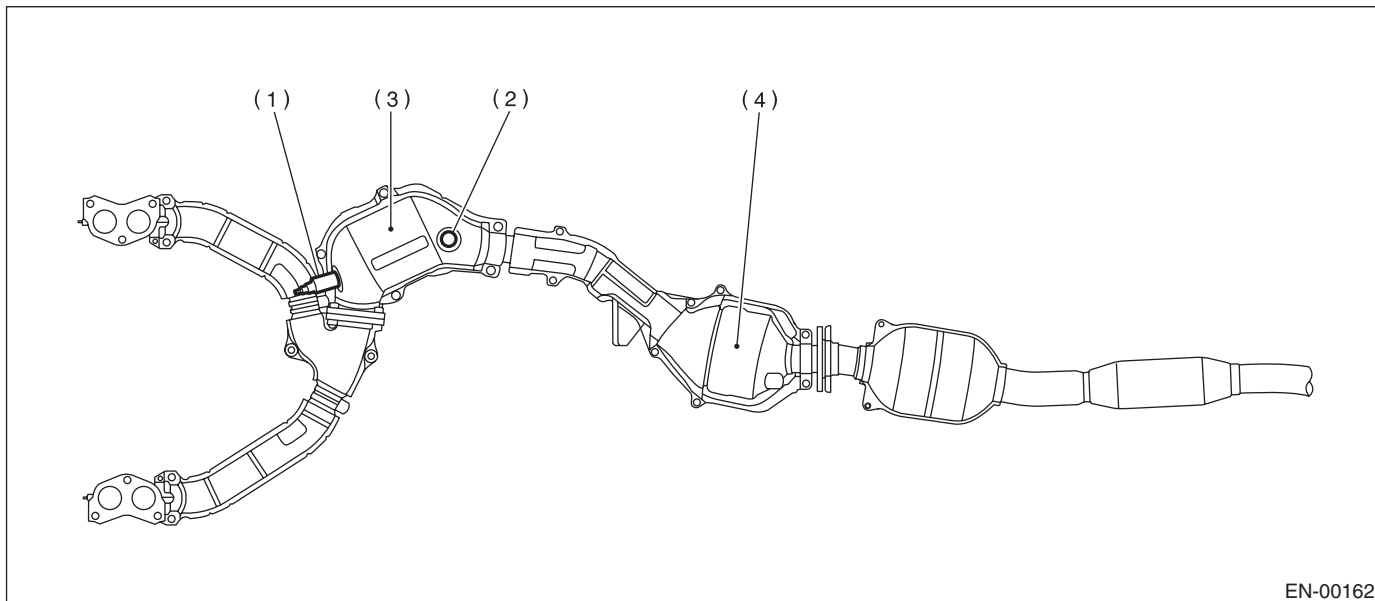


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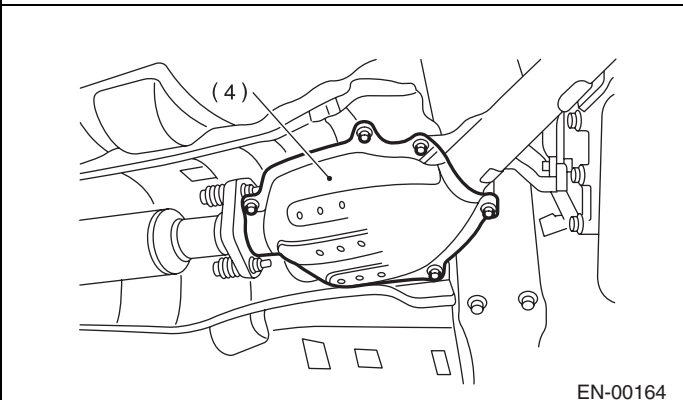
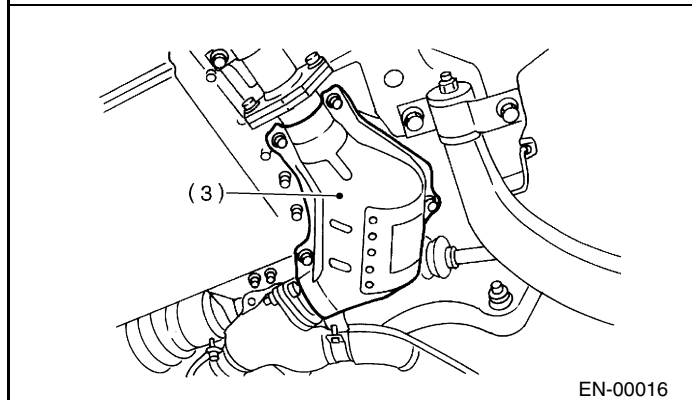
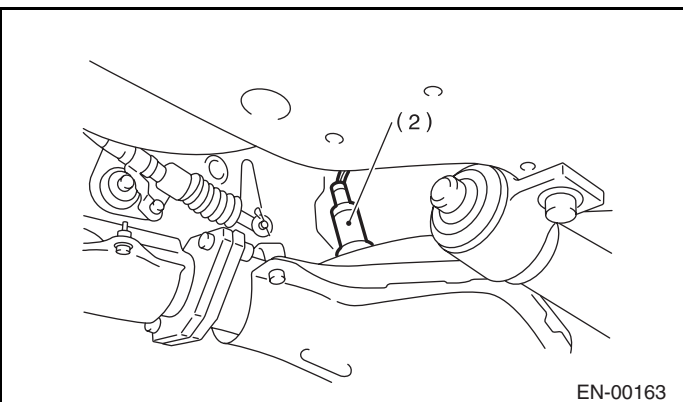
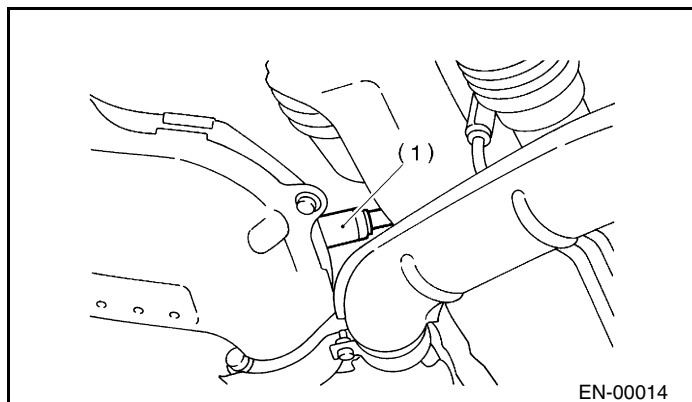
SUBARU.

ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)

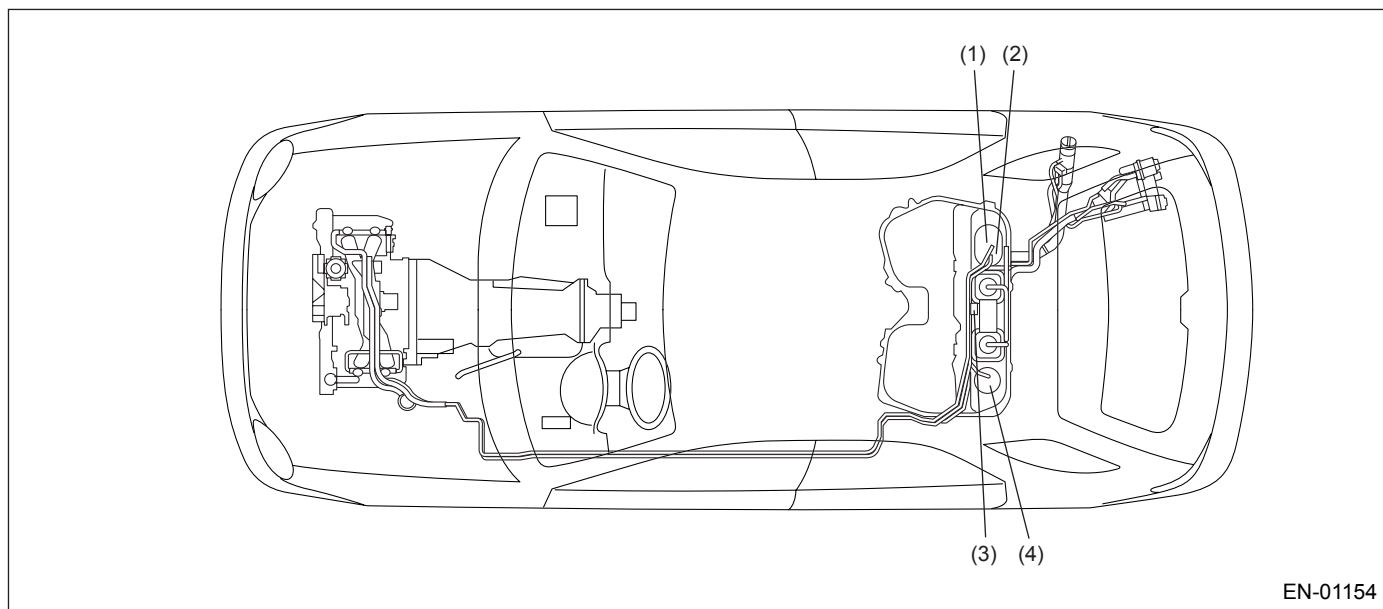


- | | |
|-------------------------------|-------------------------------|
| (1) Front oxygen (A/F) sensor | (3) Front catalytic converter |
| (2) Rear oxygen sensor | (4) Rear catalytic converter |

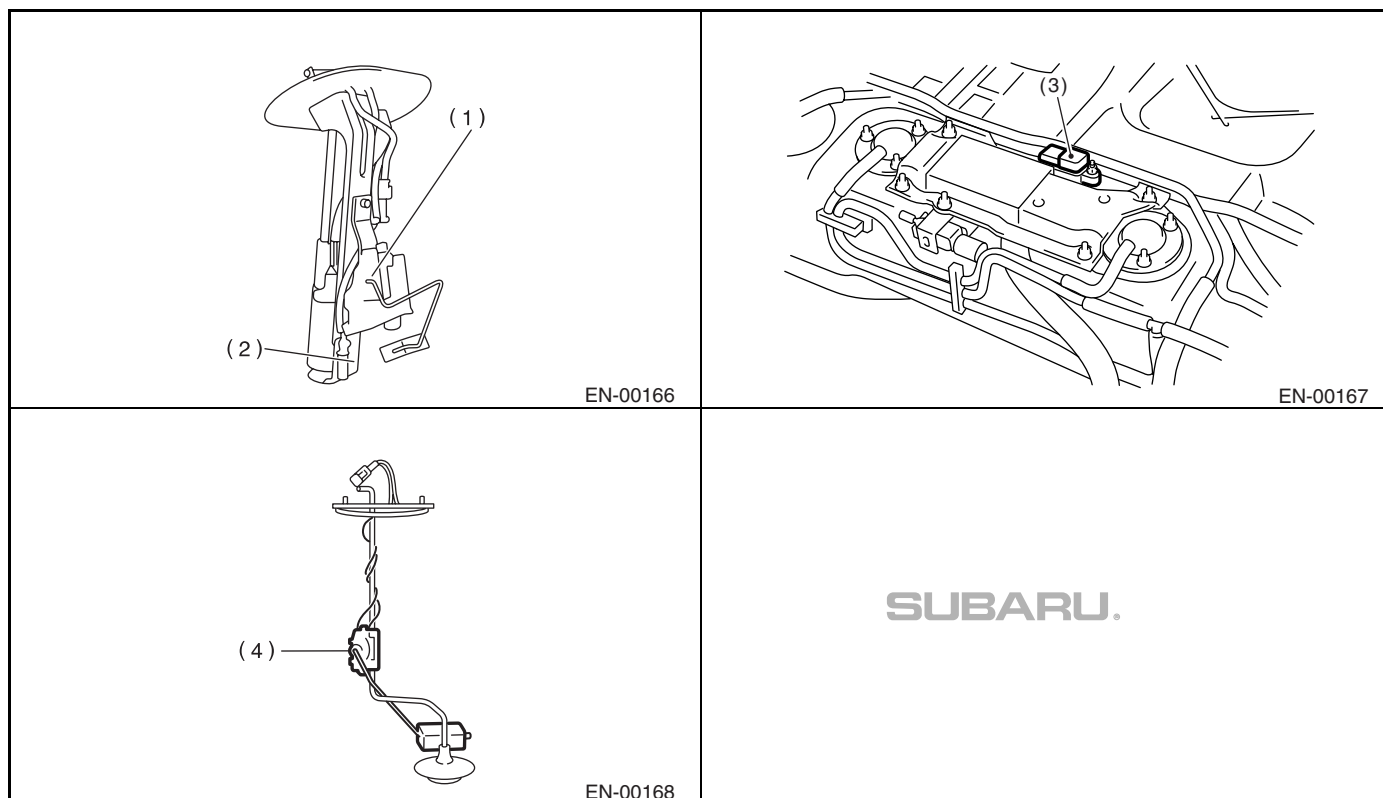


ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)



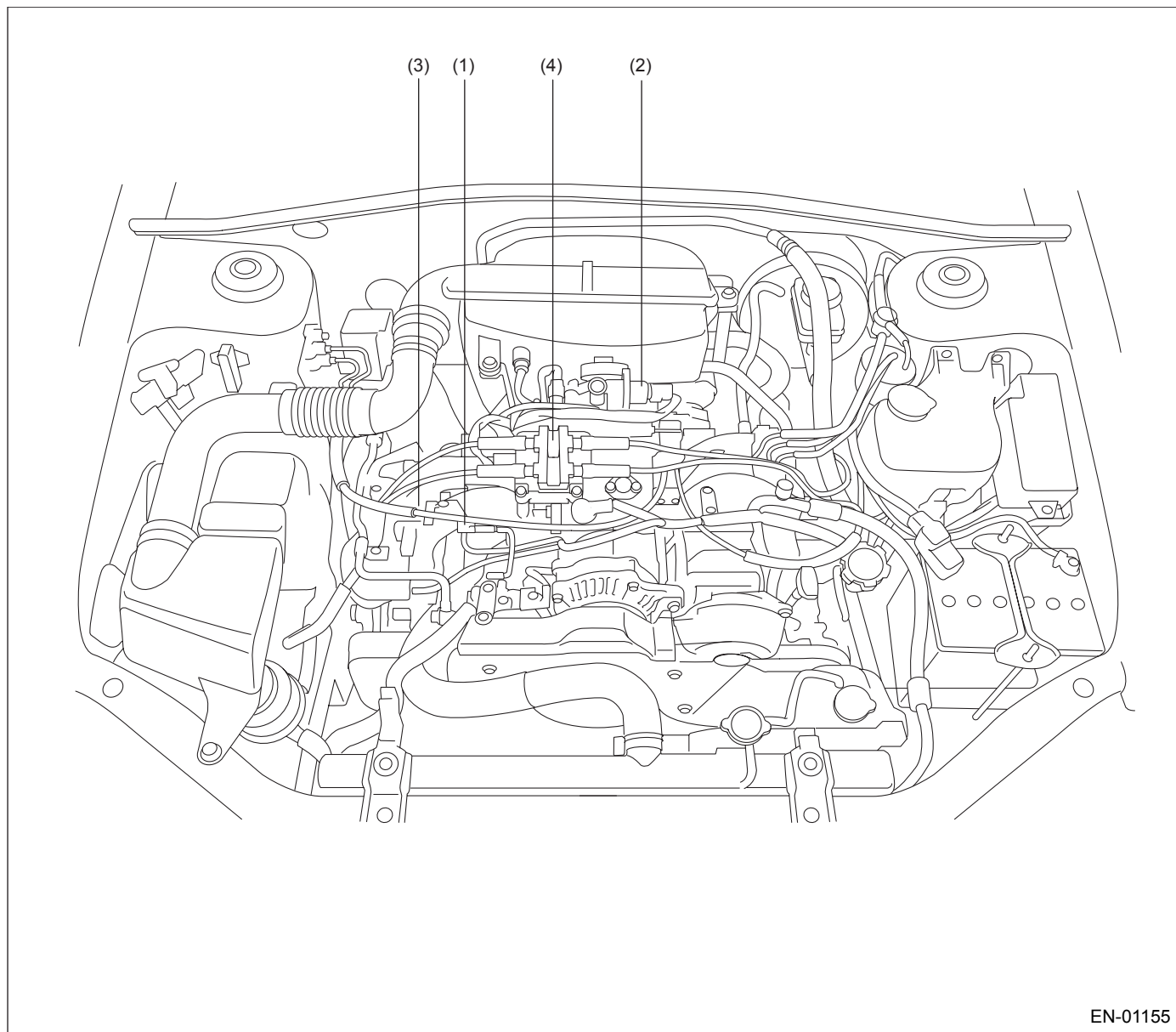
- | | |
|-----------------------------|-------------------------------|
| (1) Fuel level sensor | (3) Fuel tank pressure sensor |
| (2) Fuel temperature sensor | (4) Fuel sub level sensor |



ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)

• Solenoid Valve, Emission Control System Parts and Ignition System Parts

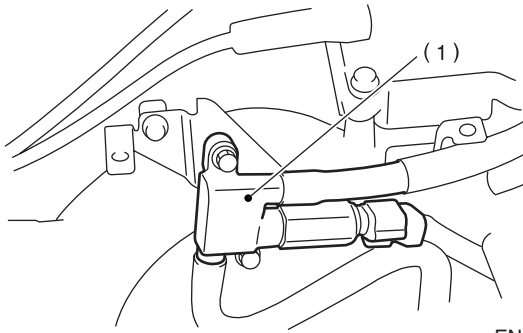


EN-01155

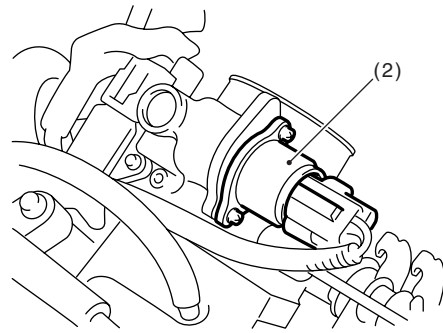
- | | |
|--|--------------------------------------|
| (1) Air assisted injector solenoid valve | (3) Purge control solenoid valve |
| (2) Idle air control solenoid valve | (4) Ignition coil & ignitor assembly |

ELECTRICAL COMPONENTS LOCATION

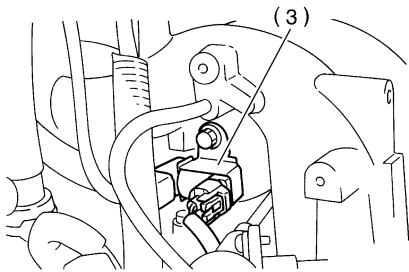
ENGINE (DIAGNOSTICS)



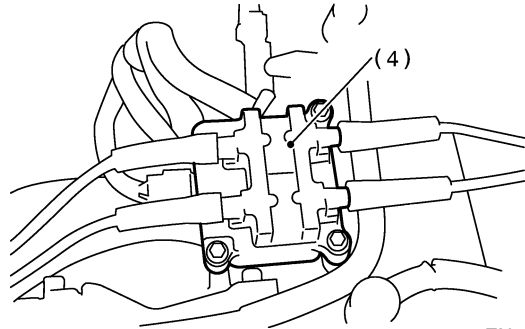
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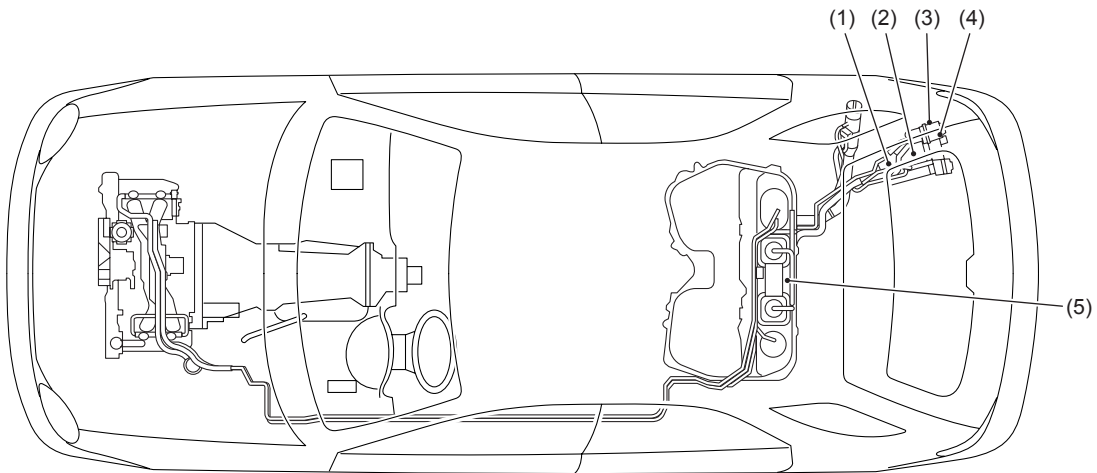
EN-00171



EN-00020



EN-00172



EN-01156

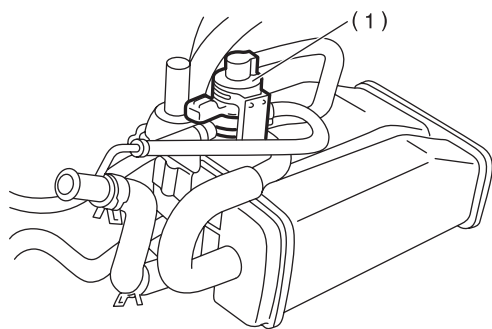
(1) Pressure control solenoid valve
(2) Canister

(3) Drain valve
(4) Drain filter

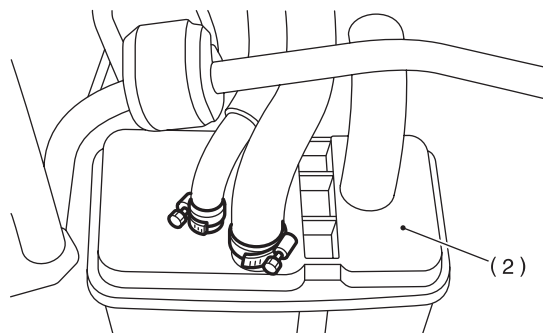
(5) Fuel tank sensor control valve

ELECTRICAL COMPONENTS LOCATION

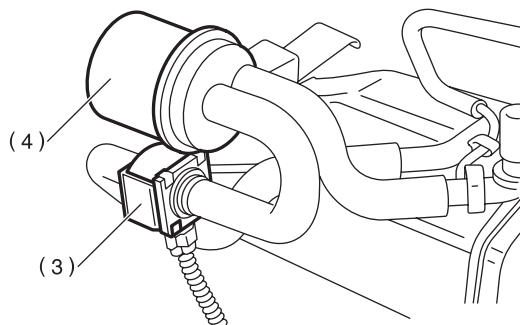
ENGINE (DIAGNOSTICS)



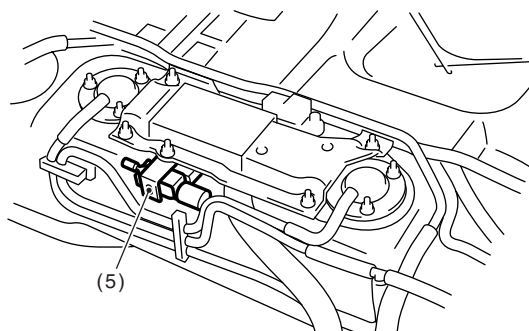
EN-00174



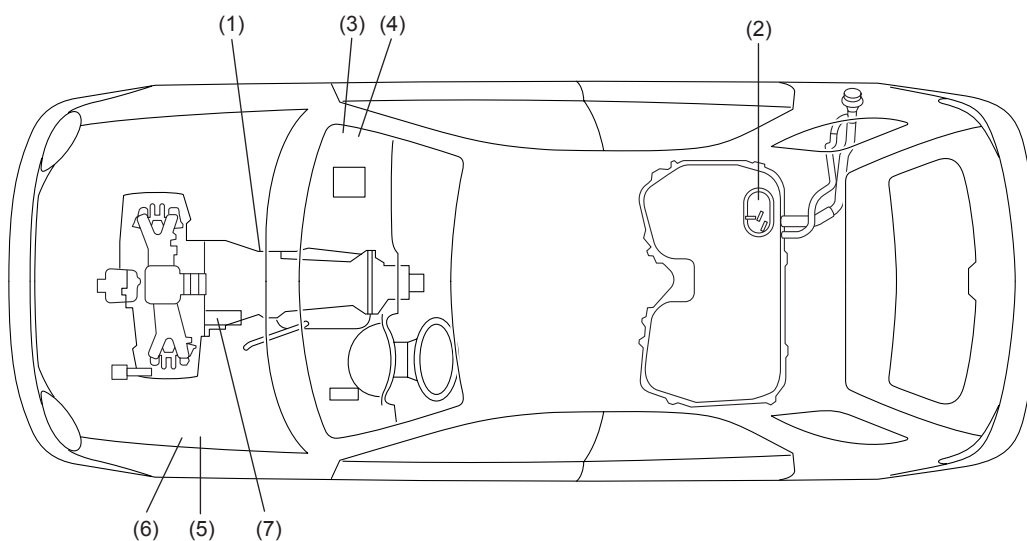
EN-00175



EN-00176



EN-00234

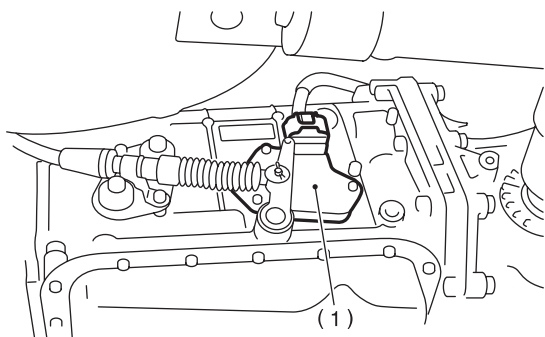


EN-01157

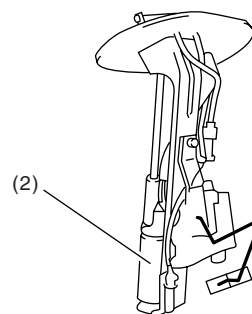
- | | | |
|----------------------|-----------------------------|-------------|
| (1) Inhibitor switch | (4) Fuel pump relay | (7) Starter |
| (2) Fuel pump | (5) Radiator main fan relay | |
| (3) Main relay | (6) Radiator sub fan relay | |

ELECTRICAL COMPONENTS LOCATION

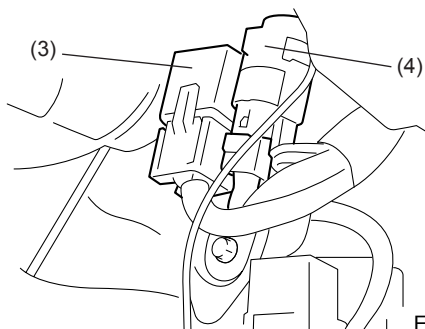
ENGINE (DIAGNOSTICS)



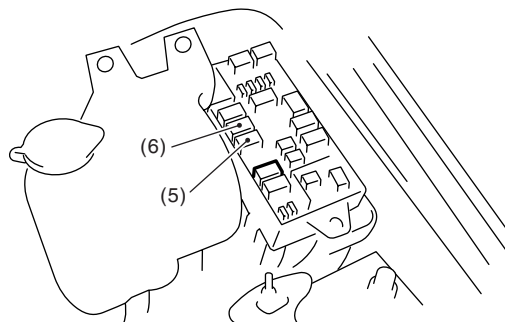
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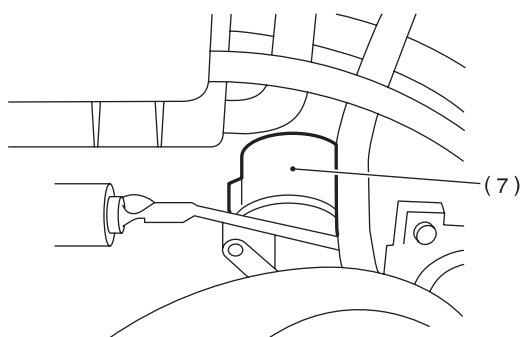
EN-00179



EN-01158



EN-00180



EN-00181

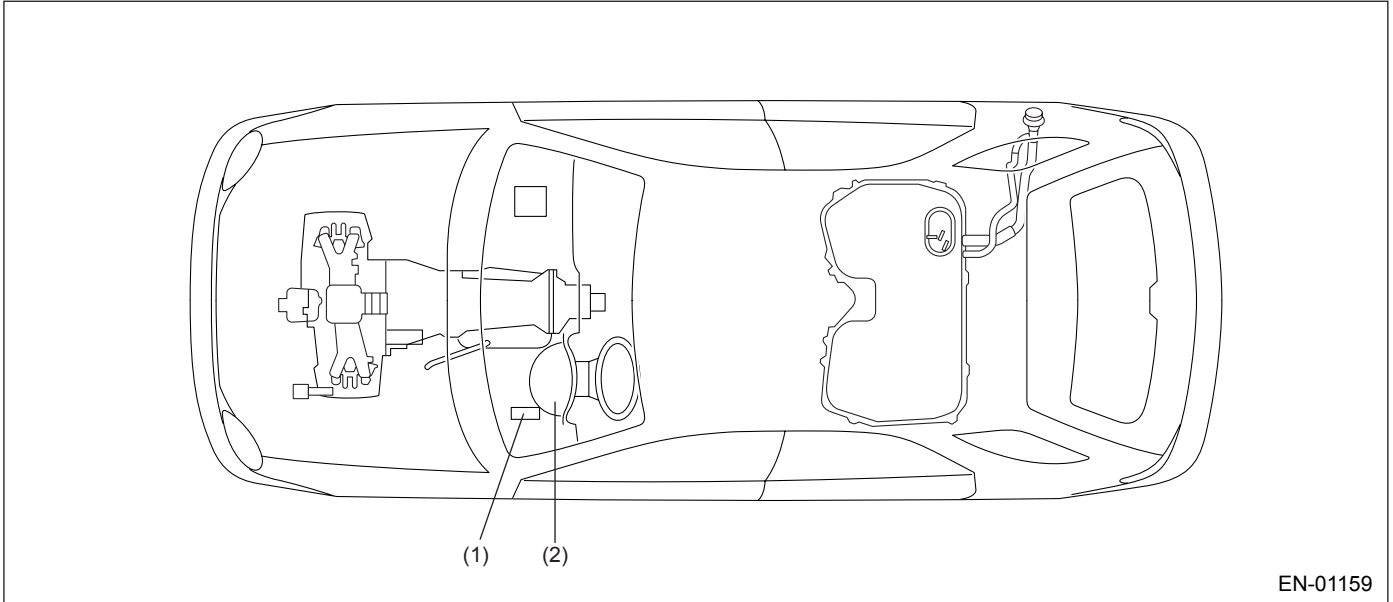
SUBARU.

ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)

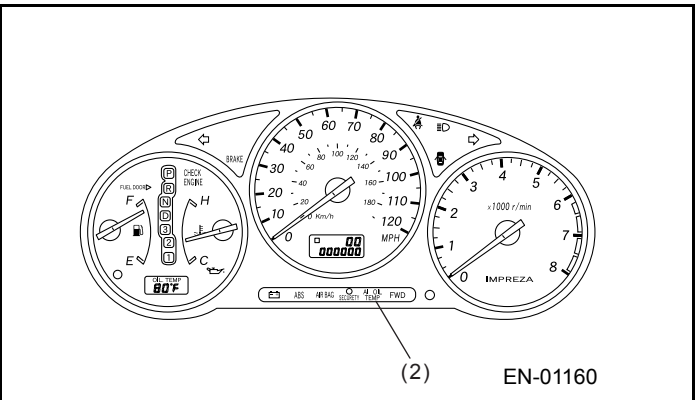
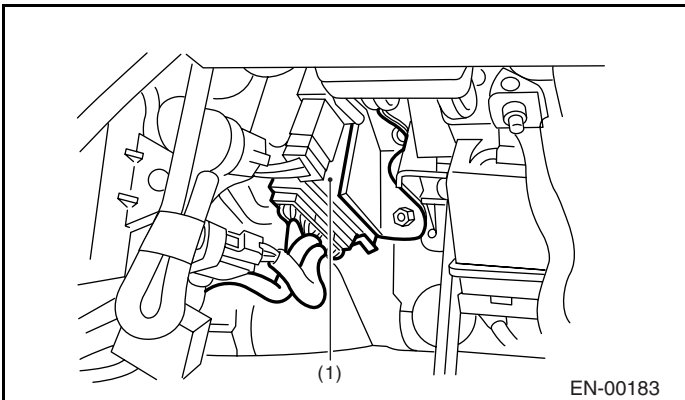
2. TRANSMISSION

• Module



(1) Transmission control module (TCM) (for AT vehicles)

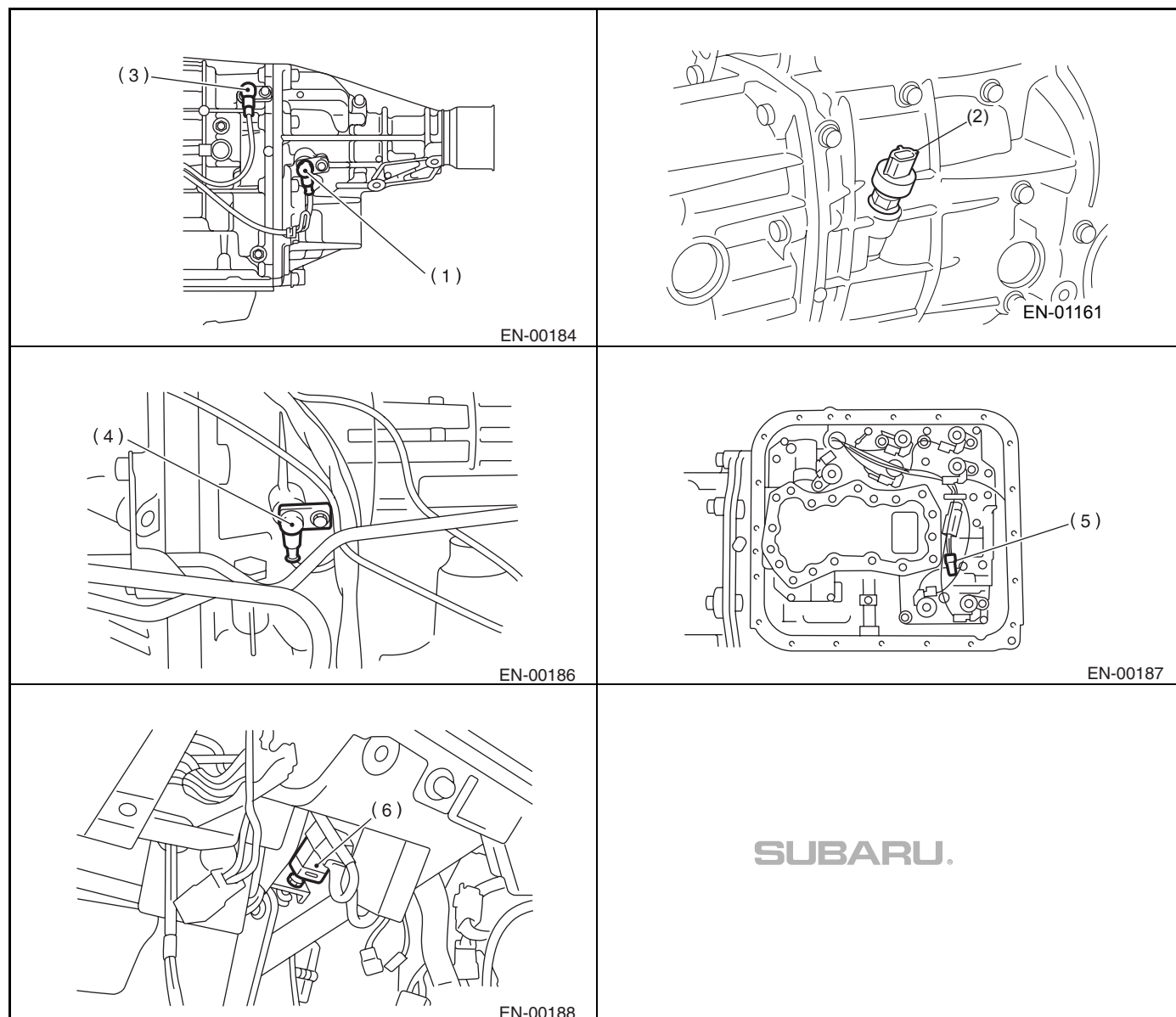
(2) AT diagnostic indicator light (for AT vehicles)



ELECTRICAL COMPONENTS LOCATION

ENGINE (DIAGNOSTICS)

• Sensor

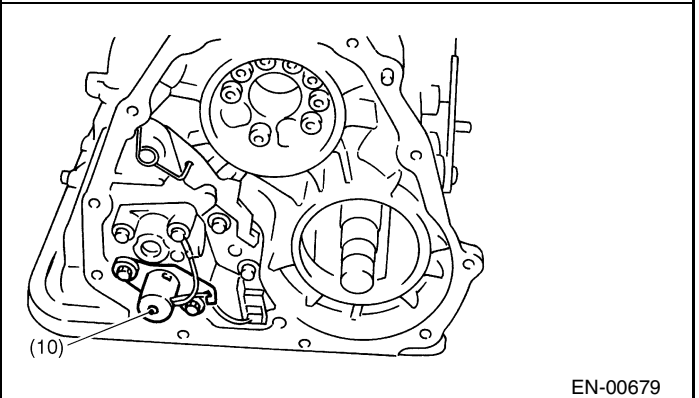
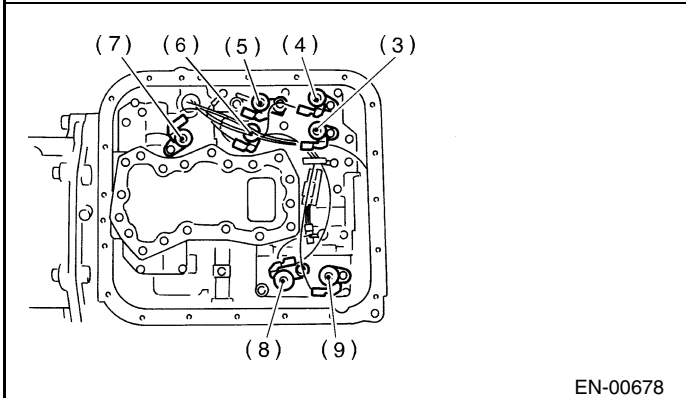
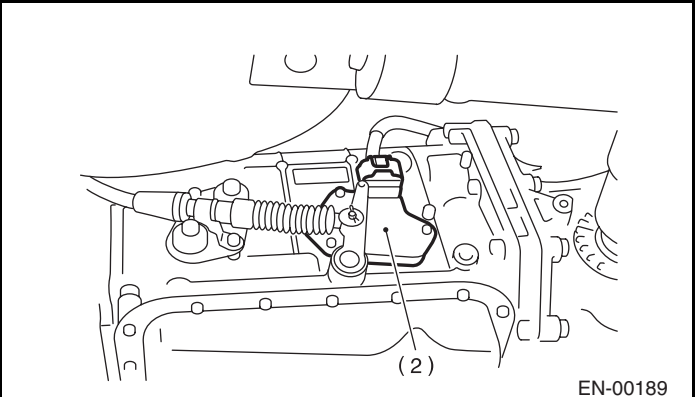
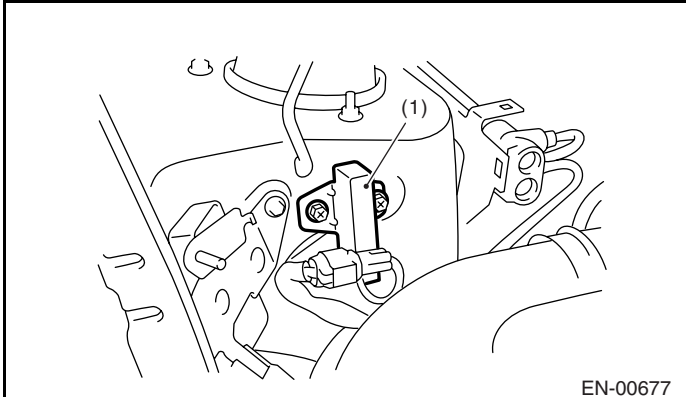


- (1) Rear vehicle speed sensor (for AT vehicles)
- (2) Front vehicle speed sensor (for MT vehicles)
- (3) Front vehicle speed sensor (for AT vehicles)
- (4) Torque converter turbine speed sensor
- (5) ATF temperature sensor (for AT vehicles)
- (6) Brake light switch

ELECTRICAL COMPONENTS LOCATION

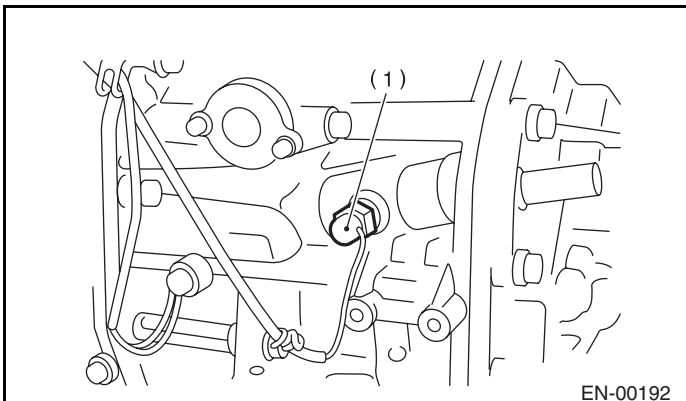
ENGINE (DIAGNOSTICS)

• Solenoid Valve and Switch (AT Vehicles)



- (1) Dropping resistor
- (2) Inhibitor switch
- (3) Shift solenoid valve 1
- (4) Shift solenoid valve 2
- (5) Line pressure duty solenoid
- (6) Low clutch timing solenoid valve
- (7) Lock up duty solenoid
- (8) 2-4 brake duty solenoid
- (9) 2-4 brake timing solenoid valve
- (10) Transfer duty solenoid

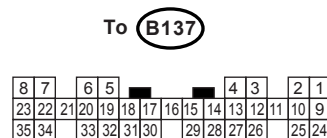
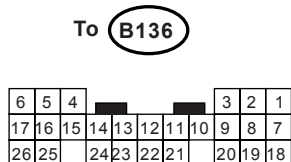
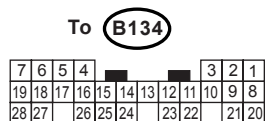
• Solenoid Valve and Switch (MT Vehicles)



- (1) Neutral position switch

5. Engine Control Module (ECM) I/O Signals

A: ELECTRICAL SPECIFICATIONS



EN-01162

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crank- shaft posi- tion sensor	Signal (+)	B134	7	0	-7 — +7	Sensor output waveform
	Signal (-)	B134	17	0	0	—
	Shield	B134	28	0	0	—
Camshaft position sensor	Signal (+)	B134	6	0	-7 — +7	Sensor output waveform
	Signal (-)	B134	18	0	0	—
	Shield	B134	28	0	0	—
Throttle position sensor	Signal	B134	13	Fully closed: 0.2 — 1.0 Wide open: 4.2 — 4.7		—
	Power supply	B134	3	5	5	—
	GND (sen- sor)	B134	19	0	0	—
Rear oxy- gen sen- sor	Signal	B134	14	0	0 — 0.9	—
	Shield	B135	15	0	0	—
	GND (sen- sor)	B134	19	0	0	—
Front oxy- gen (A/F) sensor heater	Signal 1	B136	6	0 — 1.0	0 — 1.0	—
	Signal 2	B136	17	0 — 1.0	0 — 1.0	—
Rear oxygen sensor heater signal		B136	4	0 — 1.0	0 — 1.0	—
Engine coolant tempera- ture sen- sor	Signal	B134	12	1.0 — 1.4	1.0 — 1.4	After engine warmed up.
	GND (sen- sor)	B134	19	0	0	After engine warmed up.
Vehicle speed signal		B135	10	0 or 5	0 or 5	"5" and "0" are repeatedly dis- played when vehicle is driven.
Starter switch		B136	20	0	0	Cranking: 8 — 14

ENGINE CONTROL MODULE (ECM) I/O SIGNALS

ENGINE (DIAGNOSTICS)

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
A/C switch		B136	11	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Ignition switch		B136	10	10 — 13	13 — 14	—
Neutral position switch	MT	B136	21	ON: 12±0.5 OFF: 0		Switch is ON when gear is in neutral position.
	AT	B136	21	ON: 0 OFF: 12±0.5		Switch is ON when shift is in “N” or “P” position.
Test mode connector		B136	3	5	5	When connected: 0
Knock sensor	Signal	B134	16	2.8	2.8	—
	Shield	B134	27	0	0	—
Back-up power supply		B134	9	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power sup- ply		B134	1	10 — 13	13 — 14	—
		B134	2	10 — 13	13 — 14	—
Sensor power supply		B134	3	5	5	—
Ignition control	#1, #2	B137	33	0	1 — 3.4	Waveform
	#3, #4	B137	32	0	1 — 3.4	Waveform
Fuel injec- tor	#1	B137	34	10 — 13	1 — 14	Waveform
	#2	B137	23	10 — 13	1 — 14	Waveform
	#3	B137	22	10 — 13	1 — 14	Waveform
	#4	B137	8	10 — 13	1 — 14	Waveform
Idle air control solenoid valve	Signal 1	B137	20	—	1 — 13	Waveform
	Signal 2	B137	6	—	1 — 13	Waveform
	Signal 3	B137	5	—	1 — 13	Waveform
	Signal 4	B137	19	—	1 — 13	Waveform
Fuel pump relay control		B137	11	ON: 0.5 or less OFF: 10 — 13	0.5 or less	—
A/C relay control		B137	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Main fan relay control		B137	14	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Sub fan relay control		B137	13	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	Vehicles with A/C
Self-shutoff control		B136	12	10 — 13	13 — 14	—
Malfunction indicator lamp		B137	28	—	—	Light “ON”: 1 or less Light “OFF”: 10 — 14
Engine speed output		B137	10	—	0 — 13 or more	Waveform
Torque control 1 signal		B136	1	5	5	—
Torque control 2 signal		B136	18	5	5	—
Torque control cut sig- nal		B136	15	8	8	—
Purge control solenoid valve		B137	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Air assisted injector solenoid valve		B137	12	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Power steering switch		B136	9	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Fuel tank sensor control valve		B137	1	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 10 — 13	—
Fuel temperature sen- sor		B135	5	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Fuel level sensor		B134	25	0.12 — 4.75	0.12 — 4.75	—

ENGINE CONTROL MODULE (ECM) I/O SIGNALS

ENGINE (DIAGNOSTICS)

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Fuel tank pressure sensor	Signal	B134	26	2.3 — 2.7	2.3 — 2.7	The valve obtained after the fuel filler cap was removed once and recapped.
	Power supply	B134	3	5	5	—
	GND (sen- sor)	B134	19	0	0	—
Pressure control sole- noid valve		B137	4	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Drain valve		B137	3	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
AT diagnosis input sig- nal		B135	19	Less than 1 ↔ More than 4	Less than 1 ↔ More than 4	Waveform
Small light switch		B135	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Blower fan switch		B135	13	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Rear defogger switch		B135	4	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sen- sor signal 1		B136	13	—	2.05 — 2.25	—
Front oxygen (A/F) sen- sor signal 2		B136	22	—	1.75 — 1.95	—
Pressure sensor		B134	15	4.0 — 4.8	1.1 — 1.9	—
Intake air temperature sensor		B135	6	3.15 — 3.33	3.15 — 3.33	Intake air temperature: 25°C (75°F)
SSM/GST communica- tion line		B135	16	Less than 1 ↔ More than 4	Less than 1 ↔ More than 4	—
GND (sensor)		B134	19	0	0	—
GND (injectors)		B137	35	0	0	—
GND (ignition system)		B136	26	0	0	—
GND (power supply)		B137	7	0	0	—
GND (control systems)	B135	14	0	0	0	—
	B134	21	0	0	0	—
GND (oxygen sensor heater 1)		B136	5	0	0	—
GND (oxygen sensor heater 2)		B136	16	0	0	—

ENGINE CONDITION DATA

ENGINE (DIAGNOSTICS)

6. Engine Condition Data

A: ELECTRICAL SPECIFICATIONS

Content	Specified data
Engine load	1.6 — 2.9 (%): Idling
	6.4 — 12.8 (%): 2,500 rpm racing

Measuring conditions:

- After engine warmed up.
- Gear in “N” or “P” position.
- A/C turned OFF.
- All accessory switches OFF.

7. Transmission Control Module (TCM) I/O Signals

A: ELECTRICAL SPECIFICATIONS

For electrical specifications of transmission control module (TCM) I/O signals, refer to the AT section. <Ref. to AT-11, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.>

DATA LINK CONNECTOR

ENGINE (DIAGNOSTICS)

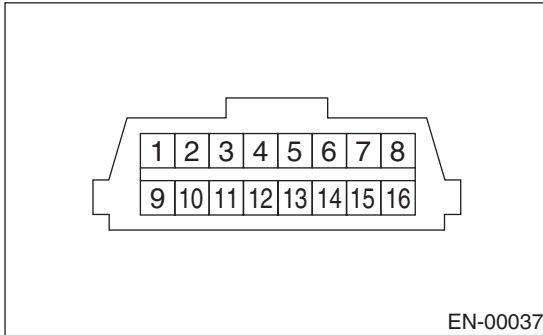
8. Data Link Connector

A: NOTE

This connector is used both for OBD-II general scan tools and the Subaru Select Monitor.

CAUTION:

Do not connect any scan tools other than the OBD-II general scan tools and the Subaru Select Monitor, because the circuit for the Subaru Select Monitor may be damaged.



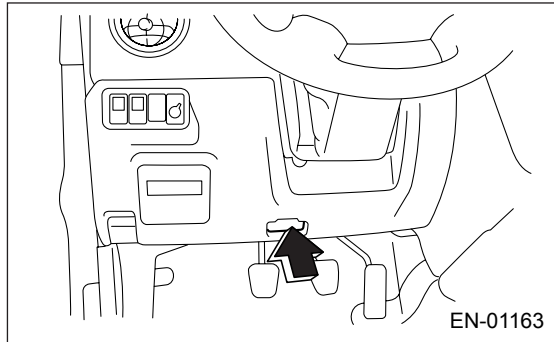
Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	K line of ISO 9141 CARB
3	Blank	11	Blank
4	Blank	12	Ground
5	Blank	13	Ground
6	Line end check signal	14	Blank
7	Blank	15	Blank
8	Blank	16	Blank

9. OBD-II General Scan Tool

A: OPERATION

1. HOW TO USE OBD-II GENERAL SCAN TOOL

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



- 3) Using the OBD-II general scan tool, call up diagnostic trouble code(s) and freeze frame data.

OBD-II general scan tool functions consist of:

- (1) MODE \$01: Current power train diagnostic data
- (2) MODE \$02: Power train freeze frame data
- (3) MODE \$03: Emission-related power train diagnostic trouble codes
- (4) MODE \$04: Clear/Reset emission-related diagnostic information

Read out data according to repair procedures. (For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual.)

NOTE:

For details concerning the diagnostic trouble codes (DTCs), refer to the List of Diagnostic Trouble Codes (DTC). <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>

2. MODE \$01 (CURRENT POWER TRAIN DIAGNOSTIC DATA)

Refers to data denoting the current operating condition of analog input/output, digital input/output and/or the power train 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 power train diagnostic trouble codes and MIL status	ON/OFF
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 revolution	rpm
0D	Vehicle speed	km/h
0E	Ignition timing advance	°
10	Air flow rate from pressure sensor	g/sec
11	Throttle valve opening angle	%
13	Check whether oxygen sensor is installed.	—
14	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor — bank 1	V and %
15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor — bank 2	V and %
1C	On-board diagnostic system	—

NOTE:

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

OBD-II GENERAL SCAN TOOL

ENGINE (DIAGNOSTICS)

3. MODE \$02 (POWER TRAIN FREEZE FRAME DATA)

Refers to data denoting the operating condition when trouble is sensed by the 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	Diagnostic trouble code that caused CARB required freeze frame data storage	—
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 revolution	rpm
0D	Vehicle speed	km/h

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to access freeze frame data (MODE \$02).

4. MODE \$03 (EMISSION-RELATED POWER TRAIN DIAGNOSTIC TROUBLE CODE)

Refer to Read Diagnostic Trouble Code for information about data denoting emission-related power train diagnostic trouble codes. <Ref. to EN(H4SO)-38, Read Diagnostic Trouble Code.>

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

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

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to clear or reset emission-related diagnostic information (MODE \$04).

10. Subaru Select Monitor

A: OPERATION

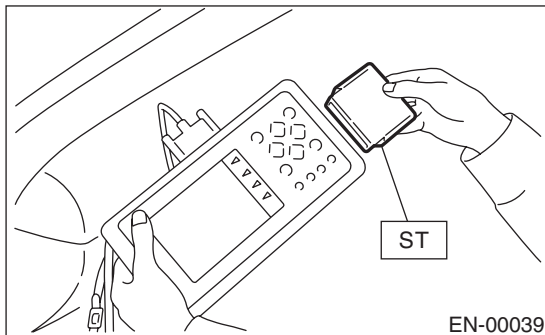
1. HOW TO USE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>



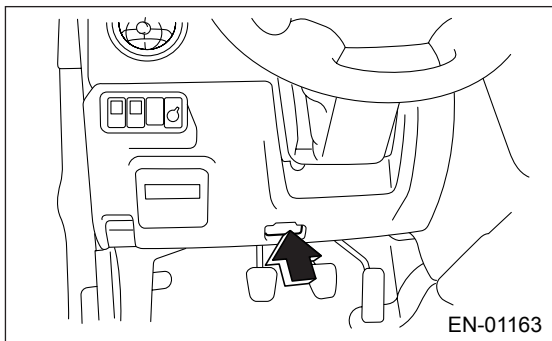
2) Connect the diagnosis cable to Subaru Select Monitor.

3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>



4) Connect the Subaru Select Monitor to data link connector.

(1) The data link connector is located in the lower portion of the instrument panel (on the driver's side).

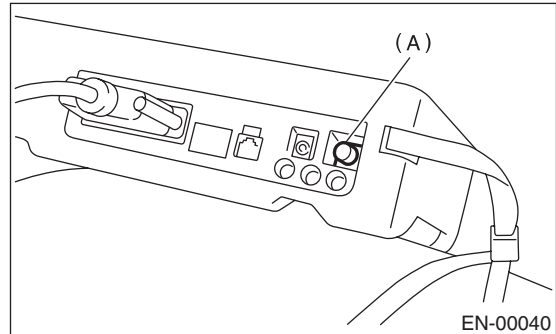


(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

5) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

6) Using the Subaru Select Monitor, call up diagnostic trouble code(s) and various data, then record them.

2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE. (NORMAL MODE)

Refer to Read Diagnostic Trouble Code for information about how to indicate DTCs. <Ref. to EN(H4SO)-38, Read Diagnostic Trouble Code.>

3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE. (OBD MODE)

Refer to Read Diagnostic Trouble Code for information about how to indicate DTCs. <Ref. to EN(H4SO)-38, Read Diagnostic Trouble Code.>

SUBARU SELECT MONITOR

ENGINE (DIAGNOSTICS)

4. READ CURRENT DATA FOR ENGINE. (NORMAL MODE)

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
 - 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the engine type information is displayed.
 - 4) On the «Engine Diagnosis» display screen, select {Current Data Display & Save} and press the [YES] key.
 - 5) On the «Data Display Menu» display screen, select {Data Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Vehicle speed signal	Vehicle Speed	km/h or MPH
Engine speed signal	Engine Speed	rpm
Engine coolant temperature signal	Coolant Temp.	°C or °F
Ignition timing signal	Ignition Timing	deg
Throttle position signal	Throttle Opening Angle	%
Throttle position signal	Throttle Sensor Voltage	V
Injection pulse width	Fuel Injection #1 Pulse	ms
Idle air control signal	ISC Valve Step	STEP
Engine load data	Engine Load	%
Front oxygen (A/F) sensor output signal	A/F Sensor #1	—
Front oxygen (A/F) sensor resistance	A/F Sensor #1 Resistance	ohm
Rear oxygen sensor output signal	Rear O2 Sensor	V
Short term fuel trim	A/F Correction #1	%
Knock sensor signal	Knocking Correction	deg
Atmospheric absolute pressure signal	Atmosphere Pressure	mmHg or kPa or inHg or psi
Intake manifold relative pressure signal	Mani.Relative Pressure	mmHg or kPa or inHg or psi
Intake manifold absolute pressure signal	Mani.Absolute Pressure	mmHg or kPa or inHg or psi
A/F correction (short term fuel trim) by rear oxygen sensor	A/F Correction #3	%
Long term fuel trim	A/F Learning #1	%
Front oxygen (A/F) sensor heater current	Front O2 Heater #1	A
Rear oxygen sensor heater current	Rear O2 Heater Current	A
Canister purge control solenoid valve duty ratio	CPC Valve Duty Ratio	%
Fuel level signal	Fuel Level	V
Fuel temperature signal	Fuel Temp	°C or °F
Fuel tank pressure signal	Fuel Tank Pressure	mmHg or kPa or inHg or psi
Intake air temperature signal	Intake Air Temp.	°C or °F
Learned ignition timing	Learned Ignition Timing	deg
Ignition switch signal	Ignition Switch	ON or OFF
Test mode connector signal	Test Mode Signal	ON or OFF
Neutral position switch signal	Neutral Position Switch	ON or OFF
Air conditioning switch signal	A/C Switch	ON or OFF
Air conditioning signal	A/C Compressor Signal	ON or OFF
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF
Fuel pump relay signal	Fuel Pump Relay	ON or OFF
Knocking signal	Knocking Signal	ON or OFF
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF
Power steering switch signal	P/S Switch	ON or OFF
Engine torque control signal #1	Torque Control Signal #1	ON or OFF

SUBARU SELECT MONITOR

ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure
Engine torque control signal #2	Torque Control Signal #2	ON or OFF
Engine torque control permission signal	Torque Permission Signal	ON or OFF
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF
Starter switch signal	Starter Switch Signal	ON or OFF
Idle switch signal	Idle Switch Signal	ON or OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF
Rear defogger switch signal	Rear Defogger Switch	ON or OFF
Blower fan switch signal	Blower Fan Switch	ON or OFF
Small light switch signal	Light Switch	ON or OFF
Air assisted injector solenoid valve signal	Assist Air Sol. Valve	ON or OFF
AT vehicle ID signal	AT Vehicle ID Signal	ON or OFF
Pressure control solenoid valve signal	PCV Solenoid Valve	ON or OFF
Vent control solenoid valve signal	Vent. Solenoid Valve	ON or OFF
Fuel tank sensor control valve signal	Tank Sensor Cntl Valve	ON or OFF

NOTE:

For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

SUBARU SELECT MONITOR

ENGINE (DIAGNOSTICS)

5. READ CURRENT DATA FOR ENGINE. (OBD MODE)

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
 - 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the engine type information is displayed.
 - 4) On the «Engine Diagnosis» display screen, select {OBD System} and press the [YES] key.
 - 5) On the «OBD Menu» display screen, select {Current Data Display & Save} and press the [YES] key.
 - 6) On the «Data Display Menu» display screen, select {Data Display} and press the [YES] key.
 - 7) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Number of diagnostic trouble code	Number of Diagnosis Code	—
Malfunction indicator lamp status	MI (MIL)	ON or OFF
Monitoring test of misfire	Misfire monitoring	Complete or incomplete
Monitoring test of fuel system	Fuel system monitoring	Complete or incomplete
Monitoring test of comprehensive component	Component monitoring	Complete or incomplete
Test of three-way catalytic converter	Catalyst Diagnosis	Complete or incomplete
Test of heated catalyst	Heated catalyst	No support
Test of evaporative emission purge control system	Evaporative purge system	Complete or incomplete
Test of secondary air system	Secondary air system	No support
Test of air conditioning system refrigerant	A/C system refrigerant	No support
Test of oxygen sensor	Oxygen sensor	Complete or incomplete
Test of oxygen sensor heater	Oxygen Sensor Heater Diagnosis	Complete or incomplete
Test of EGR system	EGR system	No support
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 or kPa or inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing advance for #1 cylinder	Ignition timing adv. #1	°
Intake air temperature signal	Intake Air Temp.	°C or °F
Intake air amount	Mass Air Flow	g/s
Throttle position signal	Throttle Opening Angle	%
Rear oxygen sensor output signal	Oxygen sensor #12	V
Air fuel ratio correction by rear oxygen sensor	Short term fuel trim #12	%
On-board diagnostic system	OBD System	—
Oxygen sensor #11	Oxygen sensor #11	Support
Oxygen sensor #12	Oxygen sensor #12	Support
Front oxygen (A/F) sensor #11	A/F sensor #11	—
Front oxygen (A/F) sensor #11	A/F sensor #11	V

NOTE:

For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

6. READ FREEZE FRAME DATA FOR ENGINE. (OBD MODE)

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
 - 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the engine type information is displayed.
 - 4) On the «Engine Diagnosis» display screen, select {OBD System} and press the [YES] key.
 - 5) On the «OBD Menu» display screen, select {Freeze Frame Data} and press the [YES] key.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Diagnostic trouble code (DTC) for freeze frame data	Freeze frame data	DTC
Air fuel ratio control system for bank 1	Fuel system for Bank1	ON or OFF
Engine load data	Engine Load	%
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 or kPa or inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH

NOTE:

For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

SUBARU SELECT MONITOR

ENGINE (DIAGNOSTICS)

7. LED OPERATION MODE FOR ENGINE

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
 - 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the engine type information is displayed.
 - 4) On the «Engine Diagnosis» display screen, select {Current Data Display & Save} and press the [YES] key.
 - 5) On the «Data Display Menu» display screen, select {Data & LED Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Message	LED "ON" requirements
Ignition switch signal	Ignition Switch	ON or OFF	When ignition switch is turned ON.
Test mode connector signal	Test Mode Signal	ON or OFF	When test mode connector is connected.
Neutral position switch signal	Neutral Position Switch	ON or OFF	When neutral position signal is entered.
Air conditioning switch signal	A/C Switch	ON or OFF	When air conditioning switch is turned ON.
Air conditioning relay signal	A/C Relay	ON or OFF	When air conditioning relay is in function.
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF	When radiator main fan relay is in function.
Fuel pump relay signal	Fuel Pump Relay	ON or OFF	When fuel pump relay is in function.
Knocking signal	Knocking Signal	ON or OFF	When knocking signal is entered.
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF	When radiator sub fan relay is in function.
Engine torque control signal #1	Torque Control Signal #1	ON or OFF	When engine torque control signal 1 is entered.
Engine torque control signal #2	Torque Control Signal #2	ON or OFF	When engine torque control signal 2 is entered.
Engine torque control permission signal	Torque Control Permit	ON or OFF	When engine torque control permission signal is entered.
Front oxygen (A/F) sensor rich signal	Front O2 Rich Signal #1	ON or OFF	When front oxygen (A/F) sensor mixture ratio is rich.
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF	When rear oxygen sensor mixture ratio is rich.
Starter switch signal	Starter Switch Signal	ON or OFF	When starter switch signal is entered.
Idle switch signal	Idle Switch Signal	ON or OFF	When idle switch signal is entered.
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF	When crankshaft position sensor signal is entered.
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF	When camshaft position sensor signal is entered.

NOTE:

For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

8. READ CURRENT DATA FOR AT.

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
 - 2) On the «System Selection Menu» display screen, select the {Transmission Control System} and press the [YES] key.
 - 3) Press the [YES] key after the transmission type information is displayed.
 - 4) On the «Transmission Diagnosis» display screen, select {Current Data Display & Save} and press the [YES] key.
 - 5) On the «Data Display Menu» display screen, select {Data Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Rear vehicle speed sensor signal	Vehicle Speed #1	km/h or MPH
Front vehicle speed sensor signal	Vehicle Speed #2	km/h or MPH
Engine speed signal	Engine Speed	rpm
Automatic transmission fluid temperature signal	ATF Temp.	°C or °F
Throttle position signal	Throttle Sensor Voltage	V
Gear position	Gear Position	—
Line pressure control duty ratio	Line Pressure Duty Ratio	%
Lock up clutch control duty ratio	Lock Up Duty Ratio	%
Transfer clutch control duty ratio	Transfer Duty Ratio	%
Power supply for throttle position sensor	Throttle Sensor Power	V
Torque converter turbine speed signal	AT Turbine Speed	rpm
2-4 brake timing pressure control duty ratio	2-4B Duty Ratio	%
Intake manifold pressure sensor voltage	Mani. Pressure Voltage	V
2 wheel drive switch signal	2WD Switch	ON or OFF
Kick down switch signal	Kick Down Switch	ON or OFF
Stop lamp switch signal	Stop Lamp Switch	ON or OFF
Anti lock brake system signal	ABS Signal	ON or OFF
Cruise control system signal	Cruise Control Signal	ON or OFF
Neutral/Parking range signal	N/P Range Signal	ON or OFF
Reverse range signal	R Range Signal	ON or OFF
Drive range signal	D Range Signal	ON or OFF
3rd range signal	3rd Range Signal	ON or OFF
2nd range signal	2nd Range Signal	ON or OFF
1st range signal	1st Range Signal	ON or OFF
Shift control solenoid A	Shift Solenoid #1	ON or OFF
Shift control solenoid B	Shift Solenoid #2	ON or OFF
Torque control output signal #1	Torque Control Signal #1	ON or OFF
Torque control output signal #2	Torque Control Signal #2	ON or OFF
Torque control cut signal	Torque Control Cut Sig.	ON or OFF
2-4 brake timing control solenoid valve	2-4 Brake Timing Sol.	ON or OFF
Low clutch timing control solenoid valve	Low Clutch Timing Sol.	ON or OFF
Automatic transmission diagnosis indicator lamp	AT Diagnosis Lamp	ON or OFF

NOTE:

For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

11. Read Diagnostic Trouble Code

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select {Each System Check} and press the [YES] key.
- 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the engine type information is displayed.
- 4) On the «Engine Diagnosis» display screen, select {Diagnostic Code(s) Display} and press the [YES] key.
- 5) On the «Diagnostic Code(s) Display» display screen, select {Current Diagnostic Code(s)} or {History Diagnostic Code(s)} and press the [YES] key.

NOTE:

- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
- For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Codes (DTC).
<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>

2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select {2. Each System Check} and press the [YES] key.
- 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the engine type information is displayed.
- 4) On the «Engine Diagnosis» display screen, select {OBD System} and press the [YES] key.
- 5) On the «OBD Menu» display screen, select {Diagnosis Code(s) Display} and press the [YES] key.
- 6) Make sure that a diagnostic trouble code (DTC) is shown on the display screen.

NOTE:

- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
- For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Codes (DTC).
<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>

3. OBD-II GENERAL SCAN TOOL

Refers to data denoting emission-related power train diagnostic trouble codes.

For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Codes (DTC).
<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to access emission-related power train diagnostic trouble codes (MODE \$03).

12. Inspection Mode

A: OPERATION

Carry out trouble diagnosis shown in the following DTC table.

When performing trouble diagnosis which is not shown in the DTC table, refer to the next item Drive Cycle.

<Ref. to EN(H4SO)-44, Drive Cycle.>

DTC No.	Designation
P0031	HO ₂ S heater control circuit low input (bank 1 sensor 1)
P0032	HO ₂ S heater control circuit high input (bank 1 sensor 1)
P0037	HO ₂ S heater control circuit low input (bank 1 sensor 2)
P0038	HO ₂ S heater control circuit high input (bank 1 sensor 2)
P0066	Air assisted injector control circuit low input
P0067	Air assisted injector control circuit high input
P0068	Manifold absolute pressure/barometric pressure circuit range/performance problem
P0107	Manifold absolute pressure/barometric pressure circuit low input
P0108	Manifold absolute pressure/barometric pressure circuit high input
P0112	Intake air temperature circuit low input
P0113	Intake air temperature circuit high input
P0117	Engine coolant temperature circuit low input
P0118	Engine coolant temperature circuit high input
P0122	Throttle/pedal position sensor/switch "A" circuit low input
P0123	Throttle/pedal position sensor/switch "A" circuit high input
P0129	Barometric pressure sensor circuit range/performance problem
P0131	O ₂ sensor circuit low voltage (bank 1 sensor 1)
P0132	O ₂ sensor circuit high voltage (bank 1 sensor 1)
P0134	O ₂ sensor circuit open (bank 1 sensor 1)
P0137	O ₂ sensor circuit low voltage (bank 1 sensor 2)
P0138	O ₂ sensor circuit high voltage (bank 1 sensor 2)
P0182	Fuel temperature sensor "A" circuit low input
P0183	Fuel temperature sensor "A" circuit high input
P0327	Knock sensor 1 circuit low input (bank 1 or single sensor)
P0328	Knock sensor 1 circuit high input (bank 1 or single sensor)
P0335	Crankshaft position sensor "A" circuit
P0336	Crankshaft position sensor "A" circuit range/performance problem
P0340	Camshaft position sensor "A" circuit (bank 1 or single sensor)
P0341	Camshaft position sensor "A" circuit range/performance problem (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
P0458	Evaporative emission control system purge control valve circuit low input
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0502	Vehicle speed sensor circuit low input
P0503	Vehicle speed sensor circuit high input
P0512	Starter request circuit
P0519	Idle control system malfunction (fail-safe)
P0565	Cruise control set signal circuit malfunction (AT)
P0604	Internal control module random access memory (RAM) error
P0691	Cooling fan 1 control circuit low
P0692	Cooling fan 1 control circuit high

INSPECTION MODE

ENGINE (DIAGNOSTICS)

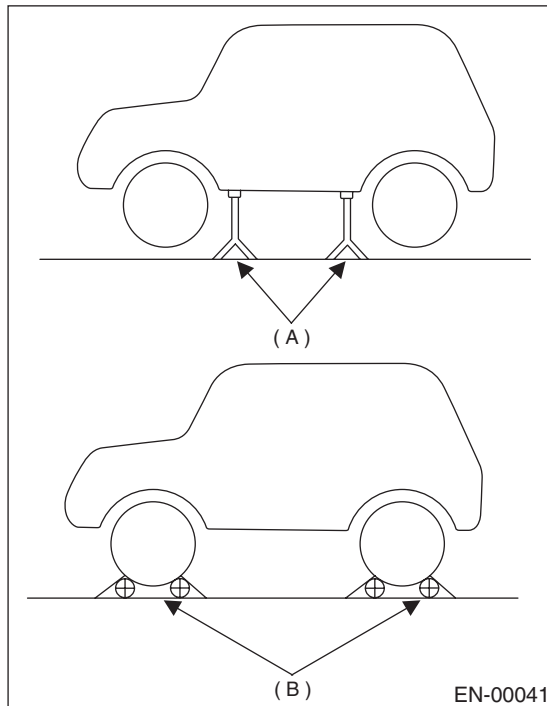
DTC No.	Designation
P0703	Torque converter/brake switch "B" circuit
P0705	Transmission range sensor circuit (PRNDL input)
P0710	Transmission fluid temperature sensor circuit
P0716	Input/turbine speed sensor circuit
P0720	Output speed sensor circuit
P0726	Engine speed input circuit
P0731	1st gear incorrect ratio
P0732	2nd gear incorrect ratio
P0733	3rd gear incorrect ratio
P0734	4th gear incorrect ratio
P0741	Torque converter clutch circuit performance or stuck off
P0743	Torque converter clutch circuit electrical system
P0748	Pressure control solenoid "A" electrical system
P0753	Shift solenoid "A" electrical system
P0758	Shift solenoid "B" electrical system
P0771	AT low clutch timing solenoid valve circuit malfunction
P0778	Pressure control solenoid "B" electrical system
P0785	Shift/timing solenoid
P0851	Neutral switch input circuit low
P0852	Neutral switch input circuit high
P0864	TCM communication circuit range/performance problem
P0865	TCM communication circuit low
P0866	TCM communication circuit high
P1110	Barometric pressure sensor circuit low input
P1111	Barometric pressure sensor circuit high input
P1400	Fuel tank pressure control solenoid valve circuit low
P1420	Fuel tank pressure control solenoid valve circuit high
P1446	Fuel tank sensor control valve circuit low
P1447	Fuel tank sensor control valve circuit high
P1510	ISC solenoid valve signal #1 circuit low input
P1511	ISC solenoid valve signal #1 circuit high input
P1512	ISC solenoid valve signal #2 circuit low input
P1513	ISC solenoid valve signal #2 circuit high input
P1514	ISC solenoid valve signal #3 circuit low input
P1515	ISC solenoid valve signal #3 circuit high input
P1516	ISC solenoid valve signal #4 circuit low input
P1517	ISC solenoid valve signal #4 circuit high input
P1518	Starter switch circuit low input
P1560	Back-up voltage circuit malfunction
P1698	Engine torque control cut signal circuit low input
P1699	Engine torque control cut signal circuit high input
P1700	Throttle position sensor circuit malfunction (AT)
P1711	Engine torque control signal #1 circuit malfunction
P1712	Engine torque control signal #2 circuit malfunction

1. PREPARATION FOR THE INSPECTION MODE

- 1) Make sure that the fuel remains approx. half amount [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)] and the battery voltage is 12 V or more.
- 2) Raise the vehicle using a garage jack and place on safety stands or drive the vehicle onto free rollers.

WARNING:

- Before raising the vehicle, ensure the parking brake is applied.
- Do not use a pantograph jack in place of a safety stand.
- Secure a rope or wire to the front and rear towing or tie-down hooks to prevent lateral runout of front wheels.
- Do not abruptly depress/release the clutch pedal or accelerator pedal during works even when engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the safety stands and the vehicle.
- Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



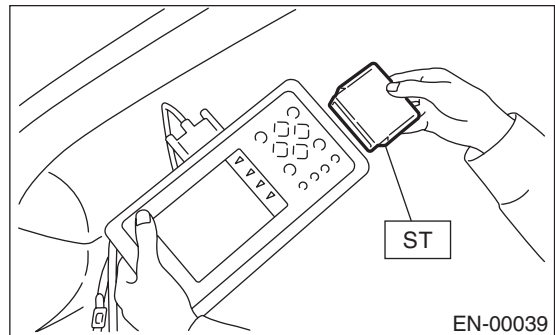
- (A) Safety stand
(B) Free rollers

2. SUBARU SELECT MONITOR

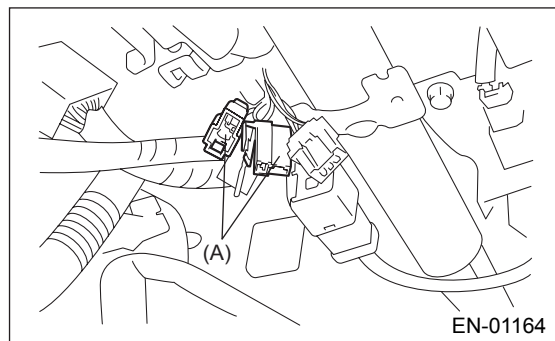
- 1) After performing the diagnostics and clearing the memory, check for any remaining unsolved trouble data. <Ref. to EN(H4SO)-46, Clear Memory Mode.>
- 2) Warm up the engine.
- 3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>



- 4) Connect the diagnosis cable to Subaru Select Monitor.
- 5) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>



- 6) Connect the test mode connector (A) at the lower portion of the instrument panel (on the driver's side).

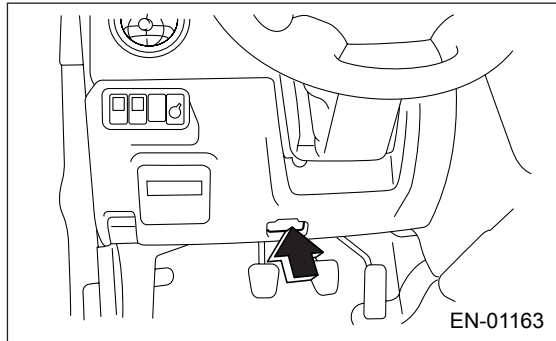


- 7) Connect the Subaru Select Monitor to data link connector.

INSPECTION MODE

ENGINE (DIAGNOSTICS)

- (1) The data link connector is located at the lower portion of the instrument panel (on the driver's side).

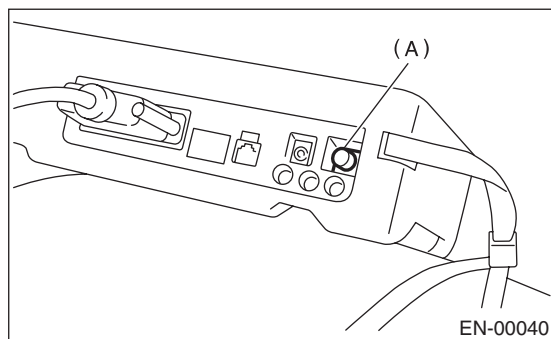


- (2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

- 8) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

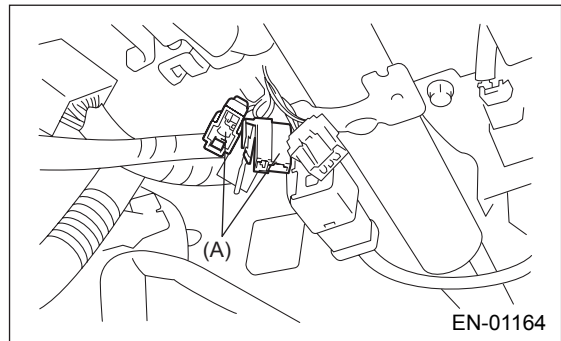
- 9) On the «Main Menu» display screen, select {2. Each System Check} and press the [YES] key.
10) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
11) Press the [YES] key after the engine type information is displayed.
12) On the «Engine Diagnosis» display screen, select {Dealer Check Mode Procedure} and press the [YES] key.
13) When "Perform Inspection (Dealer Check) Mode?" is shown on the display screen, press the [YES] key.
14) Perform subsequent procedures as instructed on the display screen.
- If a trouble still remains in the memory, the corresponding diagnostic trouble code (DTC) appears on the display screen.

NOTE:

- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
- For details concerning the diagnostic trouble codes (DTCs), refer to the List of Diagnostic Trouble Codes (DTC).
<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>
- Release the parking brake.
- The speed difference between front and rear wheels may cause the ABS warning light to turn on, but this does not indicate a malfunction. When the engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

3. OBD-II GENERAL SCAN TOOL

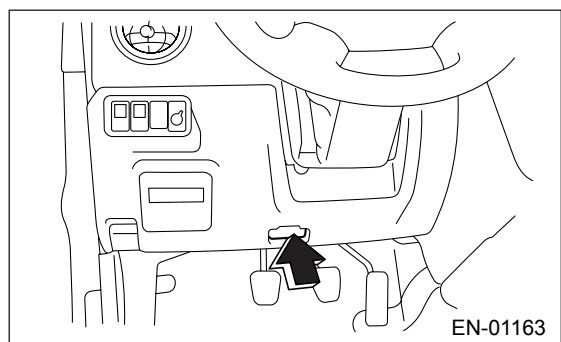
- 1) After performing the diagnostics and clearing the memory, check for any remaining unsolved trouble data. <Ref. to EN(H4SO)-46, Clear Memory Mode.>
2) Warm up the engine.
3) Connect the test mode connector (A) at the lower side of instrument panel (on the driver's side).



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

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.



- 5) Start the engine.

NOTE:

- Ensure the selector lever is placed in “P” position before starting. (AT vehicles)
- Depress the clutch pedal when starting the engine. (MT vehicles)

6) Using the selector lever or shift lever, turn the “P” position switch and “N” position switch to ON.

7) Depress the brake pedal to turn brake switch ON. (AT vehicles)

8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.

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

NOTE:

- On AWD vehicles, release the parking brake.
- The speed difference between front and rear wheels may cause the ABS warning light to turn on, but this does not indicate a malfunction. When the engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

10) Using the OBD-II general scan tool, check for diagnostic trouble code(s) (DTC(s)) and record the result(s).

NOTE:

- For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.
- For details concerning the diagnostic trouble codes (DTCs), refer to the List of Diagnostic Trouble Codes (DTC).

<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>

13. Drive Cycle

A: OPERATION

There are three drive patterns for trouble diagnosis. Driving in the specified pattern allows to diagnose malfunctioning items listed below. After the malfunctioning items listed below are repaired, always check whether they correctly resume their functions by driving in the required drive pattern.

1. PREPARATION FOR THE DRIVE CYCLE

1) Make sure that the fuel remains approx. half amount [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)], and battery voltage is 12V or more.

2. DRIVE AT 80 KM/H (50 MPH) FOR 20 MINUTES AND THEN IDLE THE ENGINE FOR 1 MINUTE.

2) After performing the diagnostics and clearing the memory, check for any remaining unsolved trouble data. <Ref. to EN(H4SO)-46, Clear Memory Mode.>

3) Separate the test mode connector.

NOTE:

- Except for when the water temperature at starting is specified, diagnoses should always be carried out after the engine is warmed up.
- For DTCs marked with a *, carry out the diagnosis twice. After the first diagnosis is finished, stop the engine and carry out the diagnosis for the second time under same conditions.

DTC No.	Designation	Condition
*P0030	HO ₂ S heater control circuit range/performance problem	—
*P0111	Intake air temperature circuit range/performance problem	Coolant temperature at start less than 30°C (86°F).
*P0125	Insufficient coolant temperature for closed loop fuel control	Coolant temperature at start less than 20°C (68°F).
*P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	Coolant temperature at start less than 55°C (131°F).
*P0130	O ₂ sensor circuit (bank 1 sensor 1)	—
*P0133	O ₂ sensor circuit slow response (bank 1 sensor 1)	—
*P0181	Fuel temperature sensor "A" circuit range/performance problem	—
*P0420	Catalytic converter system efficiency below threshold (bank 1)	—
*P0442	Evaporative emission control system leak detected (small leak)	—
*P0451	Evaporative emission control system pressure sensor range/performance problem	—
P0453	Evaporative emission control system pressure sensor high input	—
*P0456	Evaporative emission control system leak detected (very small leak)	—
*P0457	Evaporative emission control system leak detected (fuel cap loose/off)	—
P0459	Evaporative emission control system purge control valve circuit high input	—
*P0461	Fuel level sensor performance problem (travel distance)	—
*P0464	Fuel level sensor circuit intermittent	—
*P1137	O ₂ sensor circuit (bank 1 sensor 1)	—
P1443	Vent control solenoid valve function problem	—
*P1448	Fuel tank sensor control valve range/performance problem	—

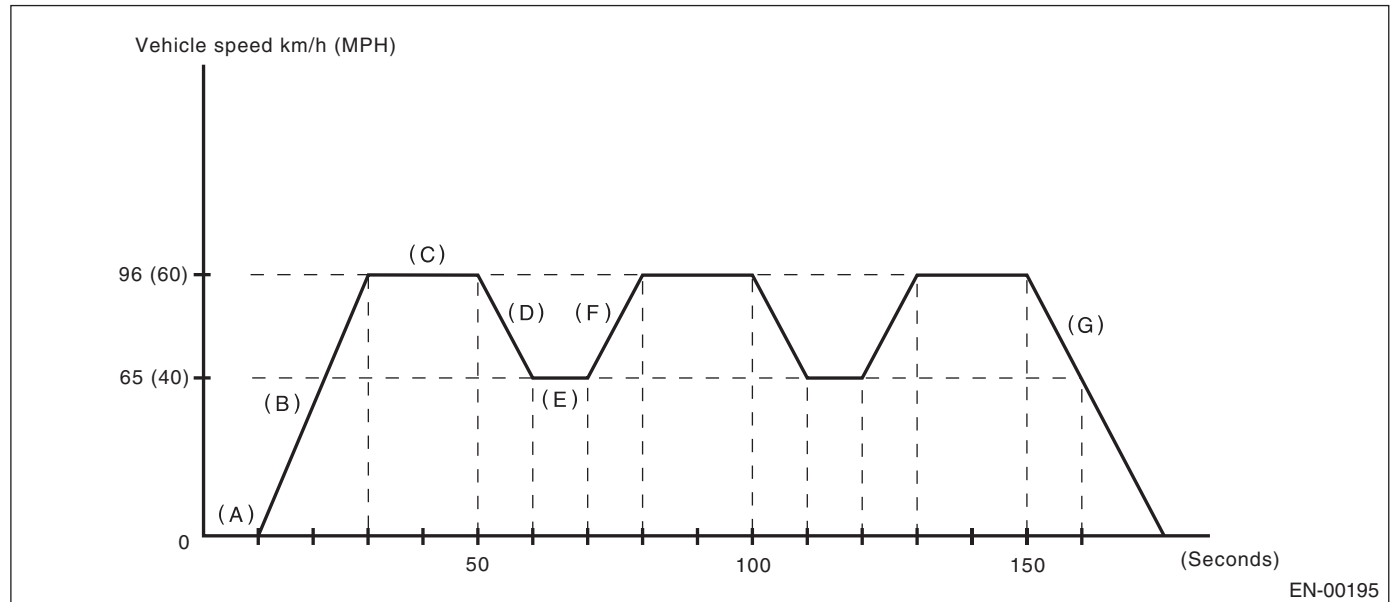
3. IDLE FOR 10 MINUTES

NOTE:

Before the diagnosis, drive the vehicle at 4 km/h (6 MPH) or more.

DTC No.	Designation	Condition
*P0483	Cooling fan rationality check	—
*P0506	Idle control system RPM lower than expected	—
*P0507	Idle control system RPM higher than expected	—

4. DRIVE ACCORDING TO THE FOLLOWING DRIVE PATTERN



- | | | |
|---|--|--|
| (A) Idle engine for 1 minute. | (D) Decelerate with fully closed throttle to 65 km/h (40 MPH). | (G) Stop vehicle with throttle fully closed. |
| (B) Accelerate to 96 km/h (60 MPH) within 20 seconds. | (E) Drive vehicle at 65 km/h (40 MPH) for 10 seconds. | |
| (C) Drive vehicle at 96 km/h (60 MPH) for 20 seconds. | (F) Accelerate to 96 km/h (60 MPH) within 10 seconds. | |

DTC No.	Designation	Condition
*P0065	Air assisted injector control range/performance problem	—
*P0121	Throttle/pedal position sensor/switch "A" circuit range/performance problem	—
*P0139	O ₂ sensor circuit slow response (bank 1 sensor 2)	—
*P0171	System too lean (bank 1)	—
*P0172	System too rich (bank 1)	—
*P0301	Cylinder #1 misfire detected	—
*P0302	Cylinder #2 misfire detected	—
*P0303	Cylinder #3 misfire detected	—
*P0304	Cylinder #4 misfire detected	—

14. Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select {2. Each System Check} and press the [YES] key.
- 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the engine type information is displayed.
- 4) On the «Engine Diagnosis» display screen, select {Clear Memory} and press the [YES] key.
- 5) When 'Done' and 'Turn Ignition Switch OFF' are shown on the display screen, turn the Subaru Select Monitor and ignition switch to OFF.

NOTE:

- After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, Turn ignition switch to the ON position. Wait 3 seconds before starting the engine.
- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select {2. Each System Check} and press the [YES] key.
- 2) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the engine type information is displayed.
- 4) On the «Engine Diagnosis» display screen, select {OBD System} and press the [YES] key.
- 5) On the «OBD Menu» display screen, select {4. Diagnosis Code(s) Cleared} and press the [YES] key.
- 6) When 'Clear Diagnostic Code?' is shown on the display screen, press the [YES] key.
- 7) Turn the Subaru Select Monitor and ignition switch to OFF.

NOTE:

- After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, Turn ignition switch to the ON position. Wait 3 seconds before starting the engine.
- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

3. OBD-II GENERAL SCAN TOOL

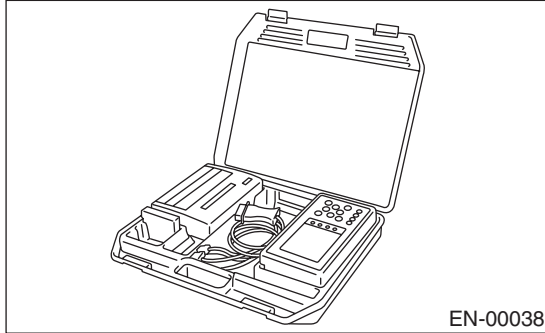
For clear memory procedures using the OBD-II general scan tool, refer to the OBD-II General Scan Tool Instruction Manual.

After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, Turn ignition switch to the ON position. Wait 3 seconds before starting the engine.

15. Compulsory Valve Operation Check Mode

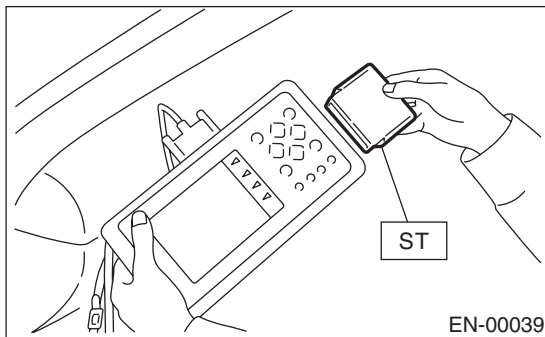
A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>

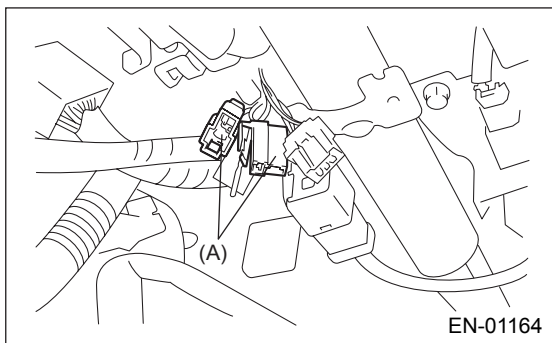


2) Connect the diagnosis cable to Subaru Select Monitor.

3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-9, PREPARATION TOOL, General Description.>

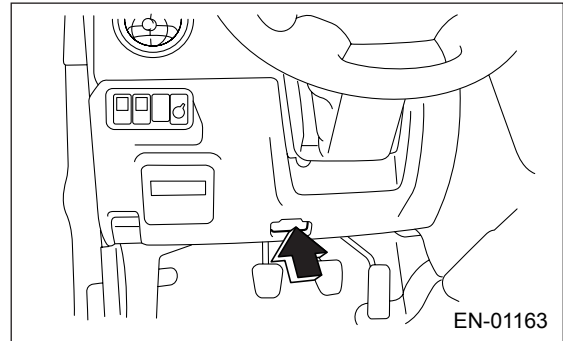


4) Connect the test mode connector (A) at the lower portion of the instrument panel (on the driver's side).



5) Connect the Subaru Select Monitor to data link connector.

(1) The data link connector is located at the lower portion of the instrument panel (on the driver's side).

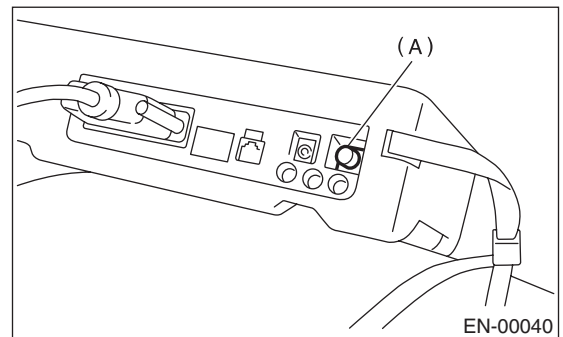


(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

6) Turn ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

7) On the «Main Menu» display screen, select {2. Each System Check} and press the [YES] key.

8) On the «System Selection Menu» display screen, select {Engine Control System} and press the [YES] key.

9) Press the [YES] key after the engine type information is displayed.

10) On the «Engine Diagnosis» display screen, select {System Operation Check Mode} and press the [YES] key.

11) On the «System Operation Check Mode» display screen, select {Actuator ON/OFF Operation} and press the [YES] key.

12) Select the desired compulsory actuator on the «Actuator ON/OFF Operation» display screen and press the [YES] key.

13) Pressing the [NO] key completes the compulsory operation check mode. The display will then return to the «Actuator ON/OFF Operation» screen.

COMPULSORY VALVE OPERATION CHECK MODE

ENGINE (DIAGNOSTICS)

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

Contents	Display
Compulsory fuel pump relay operation check	Fuel Pump Relay
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay
Compulsory purge control solenoid valve operation check	CPC Solenoid Valve
Compulsory air assisted injector solenoid valve operation check	AAI Solenoid Valve
Compulsory pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory vent control solenoid valve operation check	Vent Control Solenoid Valve
Compulsory fuel tank sensor control valve operation check	Fuel Tank Sensor Control Valve

NOTE:

- The following parts will be displayed but not functional because they are not installed on the vehicle.

Display
EGR Solenoid Valve
ASV Solenoid Valve
FICD Solenoid
Pressure Switching Sol. 1
Pressure Switching Sol. 2

- For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

16.Engine Malfunction Indicator Lamp (MIL)

A: PROCEDURE

1. Activation of CHECK ENGINE malfunction indicator lamp (MIL). <Ref. to EN(H4SO)-50, ACTIVATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL), Engine Malfunction Indicator Lamp (MIL).>
↓
2. CHECK ENGINE malfunction indicator lamp (MIL) does not come on. <Ref. to EN(H4SO)-51, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON., Engine Malfunction Indicator Lamp (MIL).>
↓
3. CHECK ENGINE malfunction indicator lamp (MIL) does not go off. <Ref. to EN(H4SO)-54, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT GO OFF., Engine Malfunction Indicator Lamp (MIL).>
↓
4. CHECK ENGINE malfunction indicator lamp (MIL) does not blink at a cycle of 3 Hz. <Ref. to EN(H4SO)-55, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 HZ., Engine Malfunction Indicator Lamp (MIL).>
↓
5. Check engine malfunction indicator lamp (MIL) remains blinking at a cycle of 3 Hz. <Ref. to EN(H4SO)-57, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 HZ., Engine Malfunction Indicator Lamp (MIL).>

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

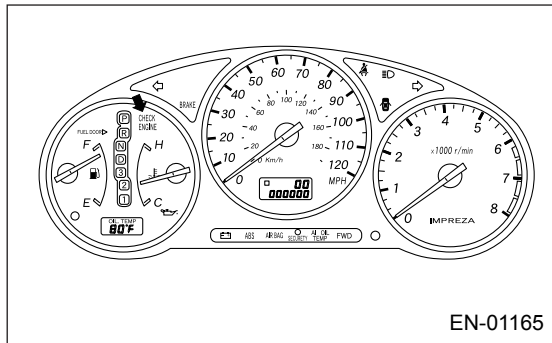
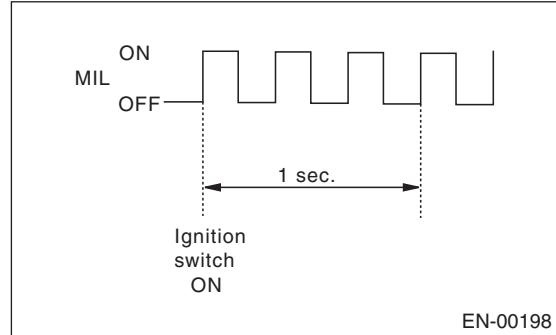
B: ACTIVATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL)

1) When the ignition switch is turned to ON (engine off), the CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter illuminates.

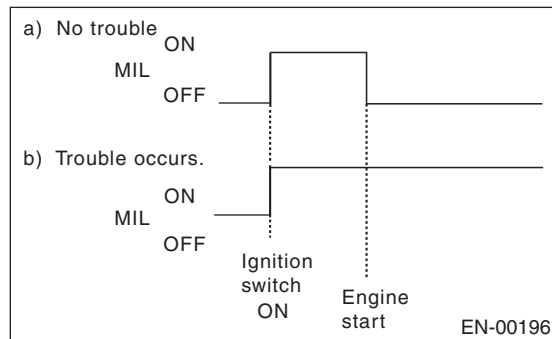
NOTE:

If the MIL does not illuminate, perform diagnostics of the CHECK ENGINE light circuit or the combination meter circuit. <Ref. to EN(H4SO)-51, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON., Engine Malfunction Indicator Lamp (MIL).>

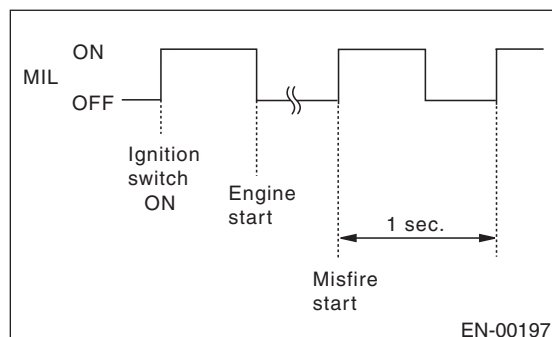
4) When the ignition switch is turned to ON (engine off) or to "START" with the test mode connector connected, the MIL blinks at a cycle of 3 Hz.



2) After starting the engine, the MIL goes out. If it does not, either the engine or the emission control system is malfunctioning.



3) If the diagnosis system senses a misfire which could damage the catalytic converter, the MIL will blink at a cycle of 1 Hz.

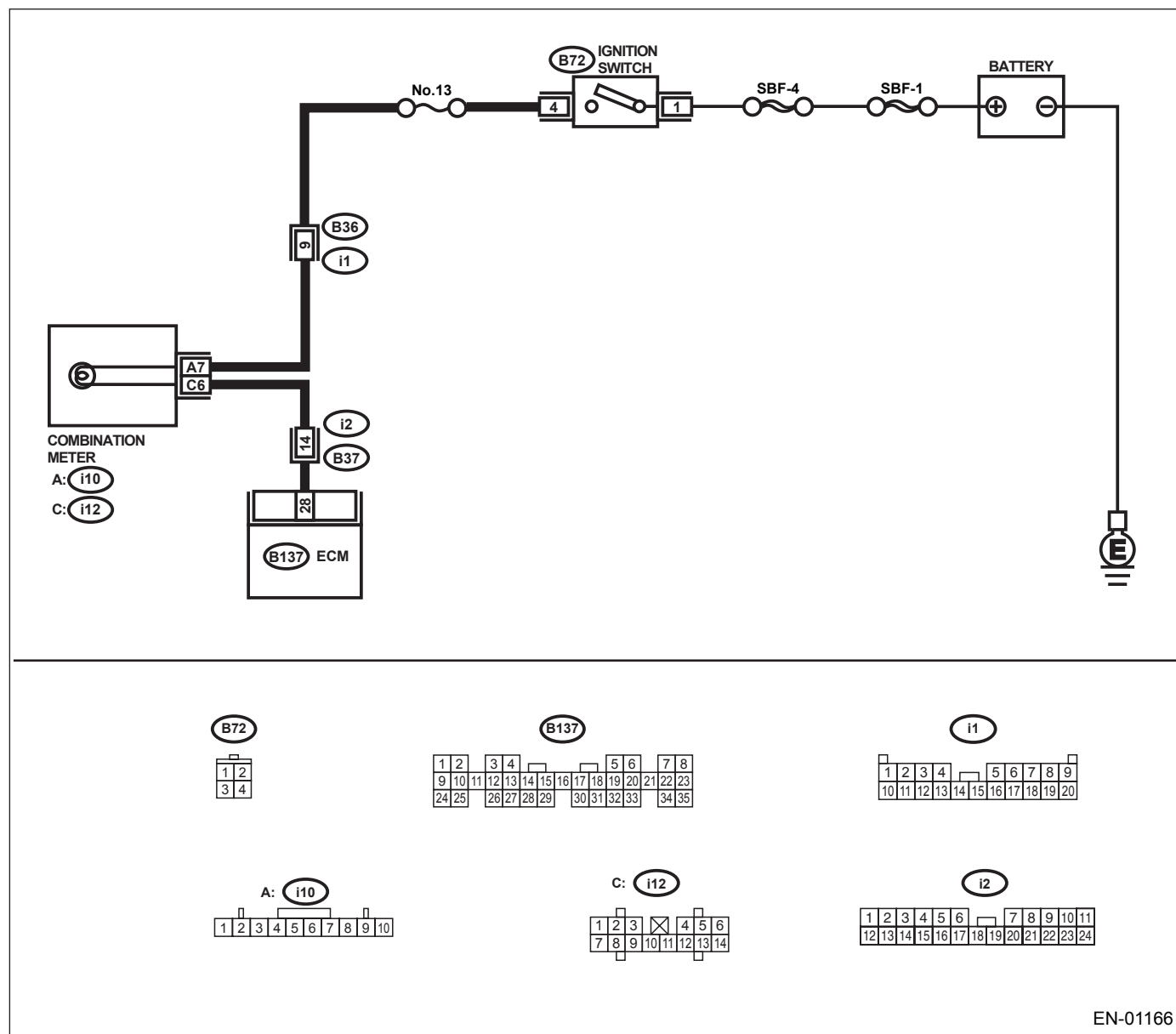


ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

C: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON.

- **DIAGNOSIS:**
 - The CHECK ENGINE malfunction indicator lamp (MIL) circuit is open or shorted.
- **TROUBLE SYMPTOM:**
 - When the ignition switch is turned ON (engine OFF), MIL does not come on.
- **WIRING DIAGRAM:**



EN-01166

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B137) No. 28 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Go to step 4.	Go to step 2.

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK FOR POOR CONTACT. Does the MIL illuminate when shaking or pulling ECM connector and harness?	Illuminates.	Repair poor contact in ECM connector.	Go to step 3.
3 CHECK ECM CONNECTOR. Is the ECM connector correctly connected?	Correctly connected.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Repair connection of ECM connector.
4 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Remove the combination meter. <Ref. to IDI-12, Combination Meter Assembly.> 3)Disconnect the connector from ECM and combination meter. 4)Measure the resistance of harness between ECM and combination meter connector. Connector & terminal (B137) No. 28 — (i12) No. 6: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and combination meter connector • Poor contact in coupling connector
5 CHECK FOR POOR CONTACT. Check for poor contact in combination meter connector. Is there poor contact in combination meter connector?	There is poor contact.	Repair poor contact in combination meter connector.	Go to step 6.
6 CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR. 1)Turn ignition switch to ON. 2)Measure the voltage between combination meter connector and chassis ground. Connector & terminal (i10) No. 7 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Check the following and repair if necessary. NOTE: • Broken down ignition relay. • Blown out fuse (No. 13). • If replaced fuse (No. 13) blows easily, check the harness for short circuit between fuse (No. 13) and ignition relay connector. • Open or short circuit in harness between fuse (No. 13) and battery terminal • Open circuit in harness between fuse (No. 13) and ignition relay connector • Poor contact in ignition relay connector • Poor contact in ignition switch connector

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
7	CHECK LAMP BULB. Remove the engine malfunction indicator lamp bulb. Is the lamp bulb condition OK?	OK.	Repair combination meter connector.	Replace the lamp bulb.

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

D: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT GO OFF.

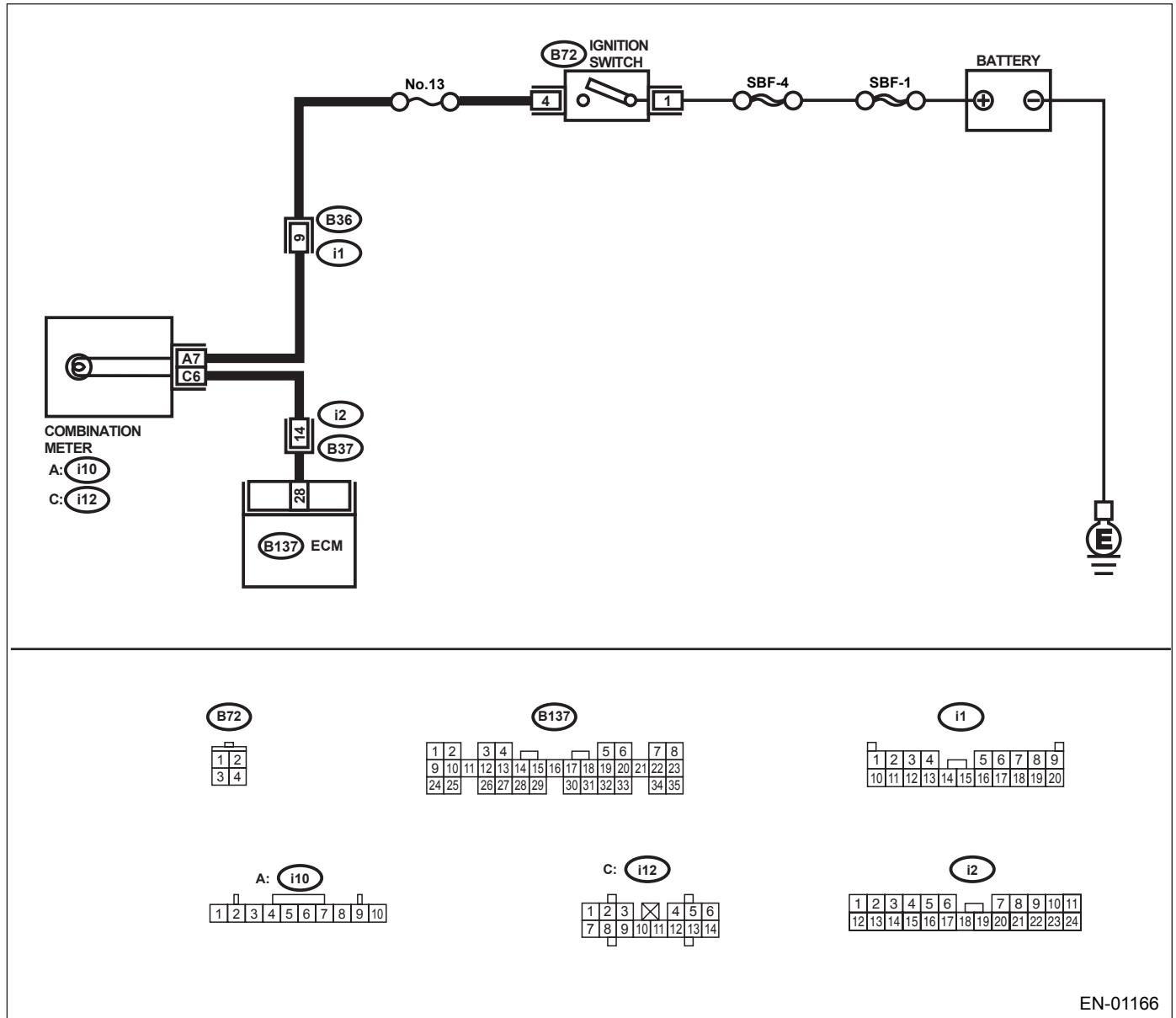
• DIAGNOSIS:

- The CHECK ENGINE malfunction indicator lamp (MIL) circuit is shorted.

• TROUBLE SYMPTOM:

- Although MIL comes on when the engine runs, a diagnostic trouble code is not shown on the Subaru Select Monitor or OBD-II general scan tool display.

• WIRING DIAGRAM:



EN-01166

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn ignition switch to ON. Does the MIL illuminate?	Illuminates.	Repair short circuit in harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

E: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 HZ.

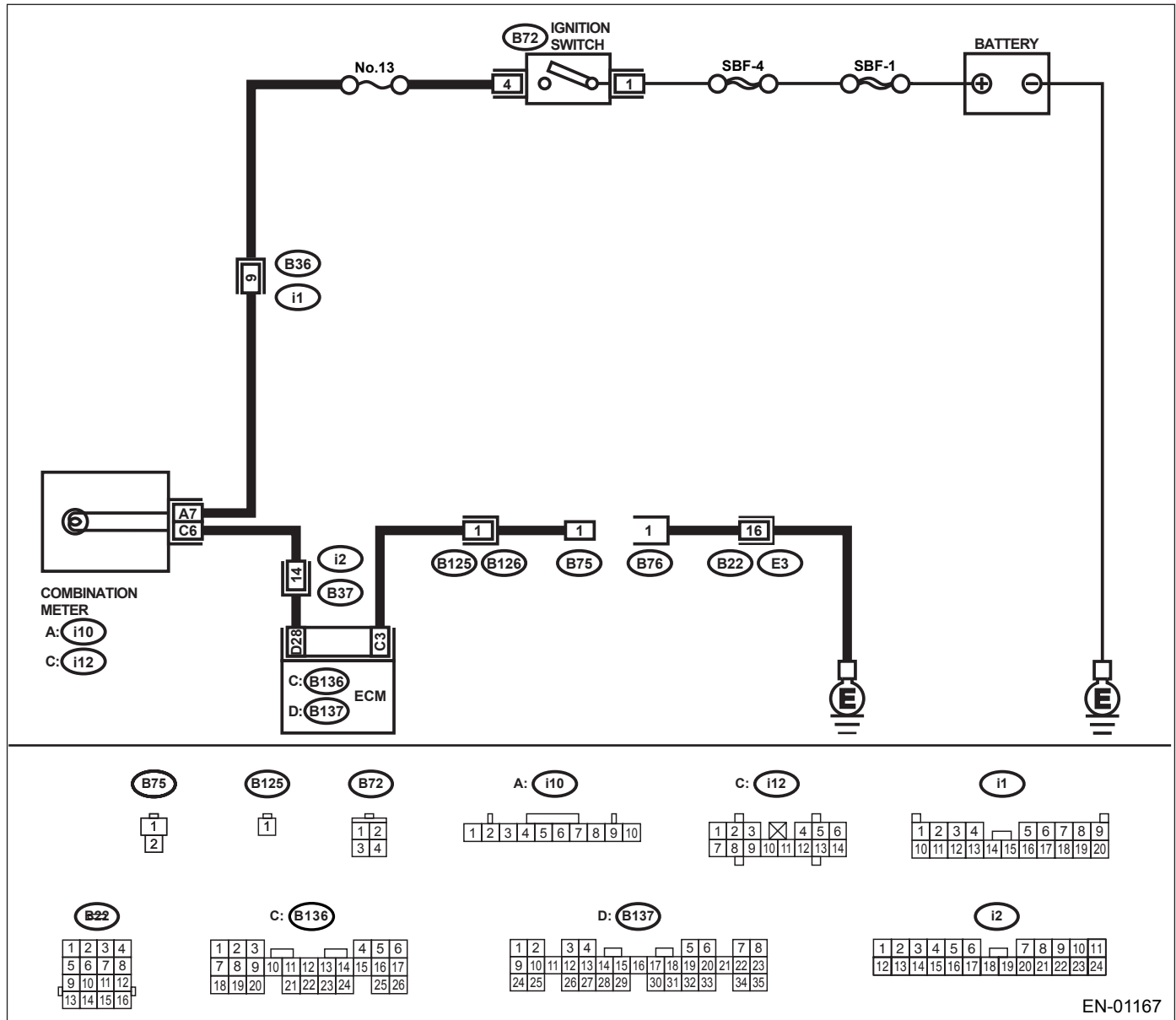
• DIAGNOSIS:

- The CHECK ENGINE malfunction indicator lamp (MIL) circuit is open or shorted.
- Test mode connector circuit is in open.

• TROUBLE SYMPTOM:

- When in inspection mode, MIL does not blink at a cycle of 3 Hz.

• WIRING DIAGRAM:



EN-01167

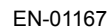
ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL). 1) Turn ignition switch to OFF. 2) Disconnect the test mode connector. 3) Turn ignition switch to ON. (Engine OFF) Does the MIL illuminate?	Illuminates.	Go to step 2.	Repair the MIL circuit. <Ref. to EN(H4SO)-51, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON., Engine Malfunction Indicator Lamp (MIL).>
2 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn ignition switch to ON. Does the MIL illuminate?	Illuminates.	Repair short circuit in harness between combination meter and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN TEST MODE CONNECTOR AND CHASSIS GROUND. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between test mode connector and chassis ground. Connector & terminal (B76) No. 1 — Chassis ground: Is the measured value less than the specified value?	1 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between test mode connector and chassis ground
4 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Go to step 5.
5 CHECK HARNESS BETWEEN ECM AND TEST MODE CONNECTOR. 1) Connect the test mode connector. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 3 — Chassis ground: Is the measured value less than the specified value?	1 Ω	Go to step 6.	Repair open circuit in harness between ECM and test mode connector.
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

ENGINE (DIAGNOSTICS)

- **WIRING DIAGRAM:**



EN(H4SO)-57

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK HARNESS BETWEEN ECM CONNECTOR AND ENGINE GROUNDING TERMINAL. 1)Turn ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 3 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Repair short circuit in harness between ECM and test mode connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

17. Diagnostics for Engine Starting Failure

A: PROCEDURE

1. Inspection of starter motor circuit. <Ref. to EN(H4SO)-60, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
2. Inspection of ECM power supply and ground line. <Ref. to EN(H4SO)-64, CONTROL MODULE POWER SUPPLY AND GROUND LINE, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ignition control system. <Ref. to EN(H4SO)-67, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
4. Inspection of fuel pump circuit. <Ref. to EN(H4SO)-70, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel injector circuit. <Ref. to EN(H4SO)-73, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

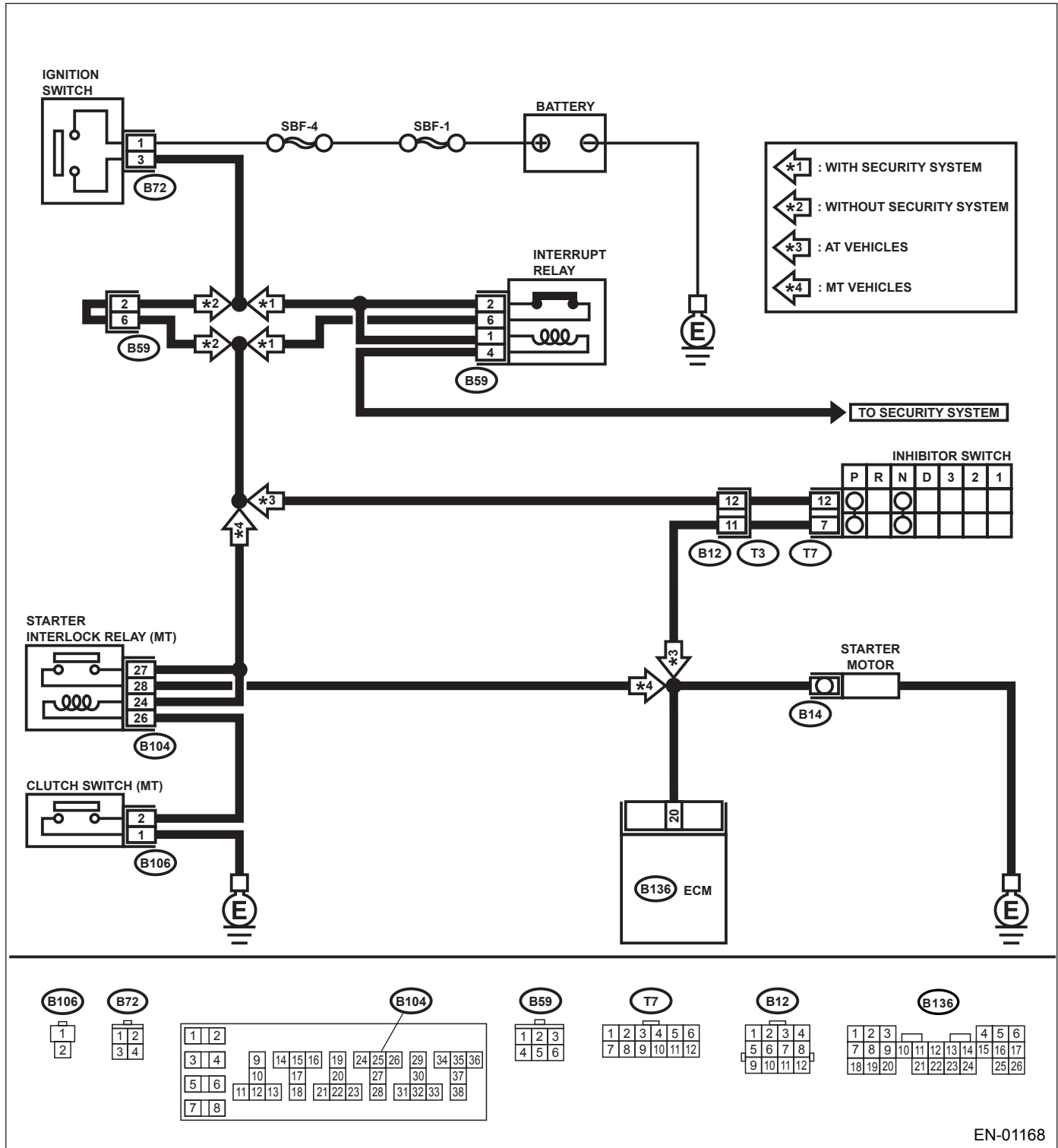
ENGINE (DIAGNOSTICS)

B: STARTER MOTOR CIRCUIT

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, Inspection Mode.>

• WIRING DIAGRAM:



EN-01168

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK BATTERY. Is the measured value more than the specified value?	12 V	Go to step 2.	Charge or replace the battery.
2 CHECK INPUT SIGNAL FOR STARTER MOTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn ignition switch to ST. 4) Measure the power supply voltage between starter motor connector terminal and engine ground. Connector & terminal (B14) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value? NOTE: • On AT vehicles, place the selector lever in the "P" or "N" position. • On MT vehicles, depress the clutch pedal.	10 V	Go to step 3.	Go to step 4.
3 CHECK GROUND CIRCUIT OF STARTER MOTOR. 1) Turn ignition switch to OFF. 2) Disconnect the terminal from starter motor. 3) Measure the resistance of ground cable between ground cable terminal and engine ground. Is the measured value less than the specified value?	5 Ω	Check the starter motor. <Ref. to SC(H4SO)-7, Starter.>	Repair open circuit of ground cable.
4 CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR. 1) Disconnect the connector from ignition switch. 2) Measure the power supply voltage between ignition switch connector and chassis ground. Connector & terminal (B72) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 5.	Repair open circuit in harness between ignition switch and battery, and check fuse SBF No. 4 and SBF No. 1.
5 CHECK IGNITION SWITCH. 1) Disconnect the connector from ignition switch. 2) Measure the resistance between ignition switch terminals while turning ignition switch to the "ST" position. Terminal No. 1 — No. 3: Is the measured value less than the specified value?	5 Ω	Go to step 6.	Replace the ignition switch.
6 CHECK TRANSMISSION TYPE. Is the transmission AT?	AT.	Go to step 7.	Go to step 9.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK INPUT VOLTAGE OF INHIBITOR SWITCH. 1)Turn ignition switch to OFF. 2)Disconnect the connector from inhibitor switch. 3)Connect the connector to ignition switch. 4)Measure the input voltage between inhibitor switch connector terminal and engine ground while turning ignition switch to ST. Connector & terminal (B12) No. 12 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Go to step 8.	Repair open or short circuit to ground in harness between inhibitor switch and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-23, Security System.>
8 CHECK INHIBITOR SWITCH. 1)Place the selector lever in "P" or "N" position. 2)Measure the resistance between inhibitor switch terminals. Connector & terminal (T3) No. 11 — No. 12: Is the measured value less than the specified value?	1 Ω	Repair open or short circuit to ground in harness between inhibitor switch and starter motor.	Replace the inhibitor switch. <Ref. to AT-48, Inhibitor Switch.>
9 CHECK INPUT VOLTAGE OF STARTER INTERLOCK RELAY. 1)Turn ignition switch to OFF. 2)Disconnect the connector from starter interlock relay. 3)Connect the connector to ignition switch. 4)Measure the input voltage between starter interlock relay connector and chassis ground while turning ignition switch to ST. Connector & terminal (B104) No. 24 (+) — Chassis ground (-): (B104) No. 27 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 10.	Repair open or short circuit to ground in harness between starter interlock relay and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-23, Security System.>
10 CHECK STARTER INTERLOCK RELAY. 1)Connect the battery to starter interlock relay terminals No. 26 and No. 24. 2)Measure the resistance between starter interlock relay terminals. Terminal No. 27 — No. 28: Is the measured value less than the specified value?	1 Ω	Go to step 11.	Replace the starter interlock relay.
11 CHECK GROUND CIRCUIT OF CLUTCH SWITCH. 1)Disconnect the connector from clutch switch. 2)Measure the resistance between clutch switch connector and chassis ground. Connector & terminal (B106) No. 1 — Chassis ground: Is the measured value less than the specified value?	1 Ω	Go to step 12.	Repair open circuit of ground cable.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
12 CHECK CLUTCH SWITCH. 1)Measure the resistance between clutch switch terminals while depressing the clutch pedal. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 13.	Replace the clutch switch. <Ref. to CL-30, Clutch Switch.>
13 CHECK CLUTCH SWITCH CIRCUIT. 1)Connect the connector to clutch switch. 2)Measure the resistance between starter interlock relay connector and chassis ground while depressing the clutch pedal. Connector & terminal (B104) No. 26 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 Ω	Repair short circuit to ground in harness between starter interlock relay and starter motor.	Repair open circuit in harness between starter interlock relay and clutch switch.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

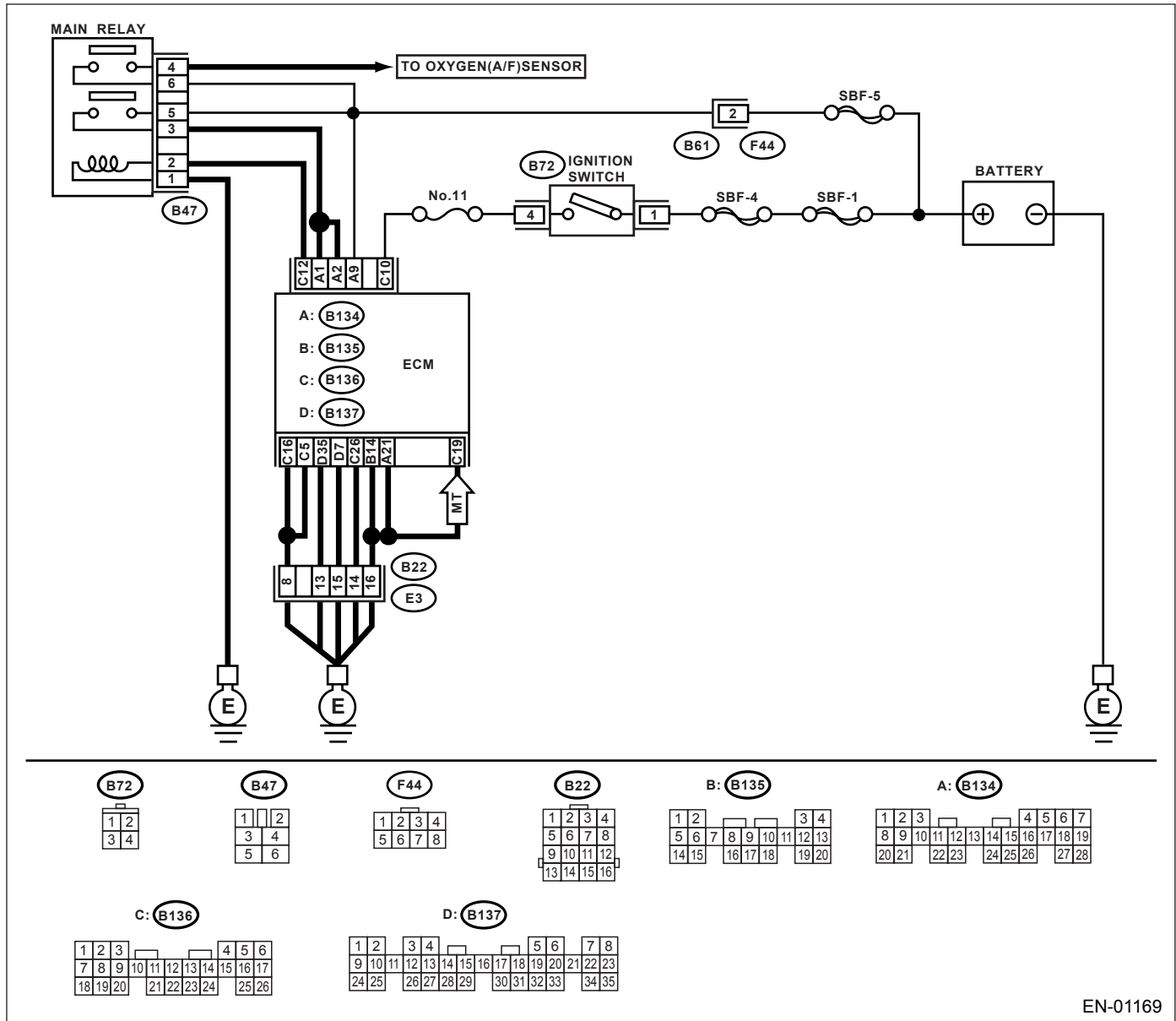
ENGINE (DIAGNOSTICS)

C: CONTROL MODULE POWER SUPPLY AND GROUND LINE

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, Clear Memory Mode.> and INSPECTION MODE. <Ref. to EN(H4SO)-39, Inspection Mode.>

• WIRING DIAGRAM:



EN-01169

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK MAIN RELAY. 1) Turn ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. Terminal No. 3 — No. 5: No. 4 — No. 6: Is the measured value less than the specified value?	10 Ω	Go to step 2.	Replace the main relay.
2 CHECK GROUND CIRCUIT OF ECM. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B134) No. 21 — Chassis ground: (B135) No. 14 — Chassis ground: (B136) No. 5 — Chassis ground: (B136) No. 16 — Chassis ground: (B136) No. 19 — Chassis ground: (MT vehicles) (B136) No. 26 — Chassis ground: (B137) No. 7 — Chassis ground: (B137) No. 35 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair open circuit in harness between ECM connector and engine grounding terminal.
3 CHECK INPUT VOLTAGE OF ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 9 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Repair open or short circuit to ground in power supply circuit.
4 CHECK INPUT VOLTAGE OF ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 10 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 5.	Repair open or short circuit to ground in power supply circuit.
5 CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between ECM and chassis ground. Connector & terminal (B136) No. 12 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 6.	Repair short circuit to ground in harness between ECM connector and main relay connector, then replace the ECM.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

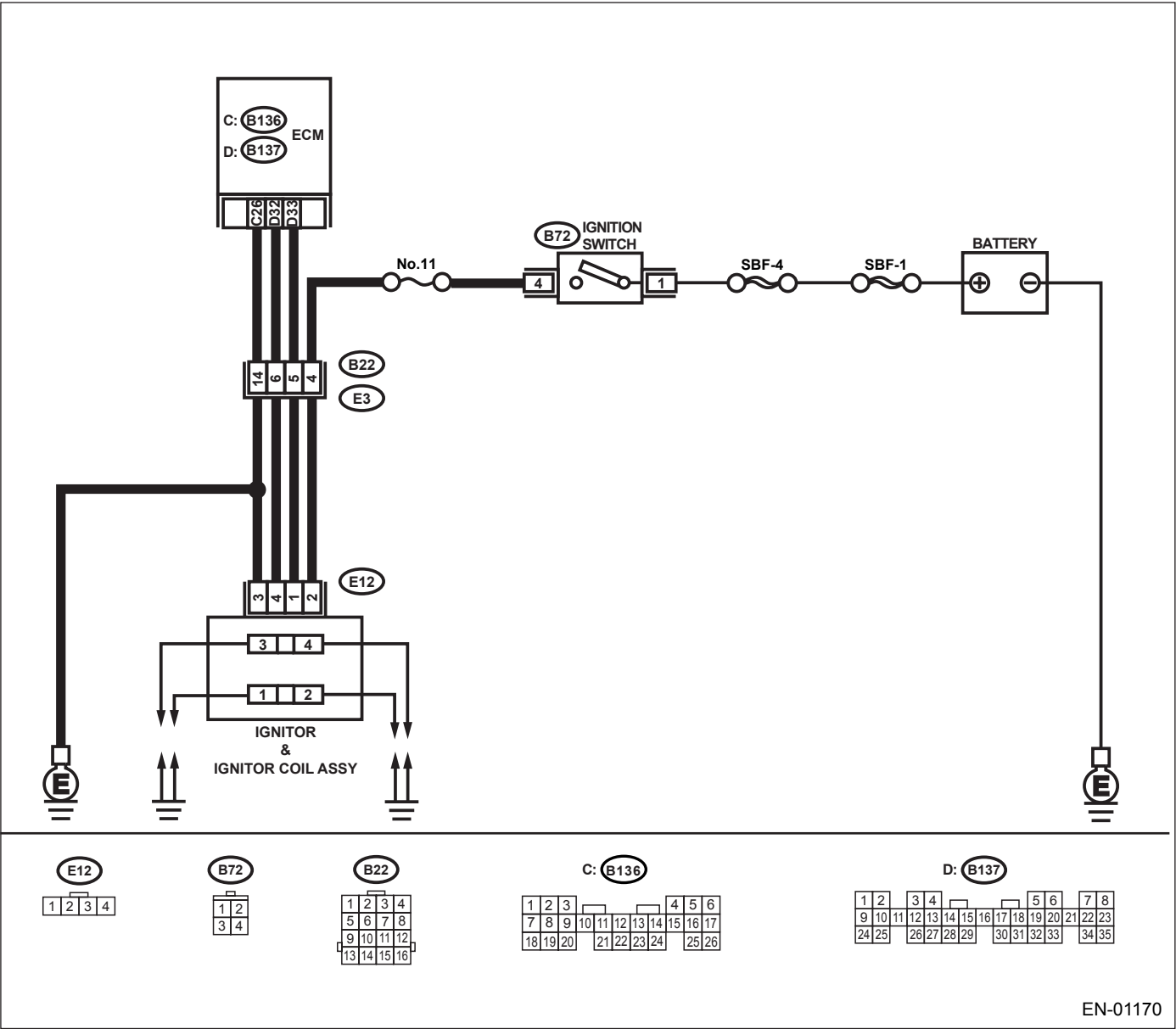
Step	Check	Yes	No
6 CHECK OUTPUT VOLTAGE FROM ECM. 1)Connect the connector to ECM. 2)Turn ignition switch to ON. 3)Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Replace the ECM.
7 CHECK INPUT VOLTAGE OF MAIN RELAY. Check the voltage between main relay connector and chassis ground. Connector & terminal (B47) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 8.	Repair open circuit in harness between ECM connector and main relay connector.
8 CHECK GROUND CIRCUIT OF MAIN RELAY. 1)Turn ignition switch to OFF. 2)Measure the resistance between main relay connector and chassis ground. Connector & terminal (B47) No. 1 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 9.	Repair open circuit between main relay and chassis ground.
9 CHECK INPUT VOLTAGE OF MAIN RELAY. Check the voltage between main relay connector and chassis ground. Connector & terminal (B47) No. 5 (+) — Chassis ground (-): (B47) No. 6 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 10.	Repair open or short circuit to ground in harness of power supply circuit.
10 CHECK INPUT VOLTAGE OF ECM. 1)Connect the main relay connector. 2)Turn ignition switch to ON. 3)Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 1 (+) — Chassis ground (-): (B134) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Check ignition control system. <Ref. to EN(H4SO)-67, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair open or short circuit to ground in harness between ECM connector and main relay connector.

D: IGNITION CONTROL SYSTEM

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, Inspection Mode.>

• WIRING DIAGRAM:



Step	Check	Yes	No
1 CHECK IGNITION SYSTEM FOR SPARKS. 1)Remove the plug cord cap from each spark plug. 2)Install the new spark plug on plug cord cap. CAUTION: Do not remove the spark plug from engine. 3)Bring the spark plug's threaded portion in contact with the engine. 4)With the throttle wide open, crank the engine to check that sparks occur at each cylinder. Do sparks occur at each cylinder?	Sparks occurs.	Check fuel pump system. <Ref. to EN(H4SO)-70, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSEMBLY. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ignition coil & ignitor assembly. 3) Turn ignition switch to ON. 4) Measure the power supply voltage between ignition coil & ignitor assembly connector and engine ground. Connector & terminal (E12) No. 2 (+) — Engine ground (–): Is the measured value more than the specified value?	10 V	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor assembly, and ignition switch connector • Poor contact in coupling connector
3 CHECK HARNESS OF IGNITION COIL & IGNITOR ASSEMBLY GROUND CIRCUIT. 1) Turn ignition switch to OFF. 2) Measure the resistance between ignition coil & ignitor assembly connector and engine ground. Connector & terminal (E12) No. 3 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor assembly connector and engine grounding terminal
4 CHECK IGNITION COIL & IGNITOR ASSEMBLY. 1) Remove the spark plug cords. 2) Measure the resistance between spark plug cord contact points to check secondary coil. Terminal No. 1 — No. 2: No. 3 — No. 4: Is the measured value within the specified range?	10 — 15 kΩ	Go to step 5.	Replace the ignition coil & ignitor assembly. <Ref. to IG(H4SO)-8, Ignition Coil and Ignitor Assembly.>
5 CHECK INPUT SIGNAL FOR IGNITION COIL & IGNITOR ASSEMBLY. 1) Connect the connector to ignition coil & ignitor assembly. 2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil & ignitor assembly connector and engine ground. Connector & terminal (E12) No. 1 (+) — Engine ground (–): (E12) No. 4 (+) — Engine ground (–): Is the measured value more than the specified value?	10 V	Go to step 6.	Replace the ignition coil & ignitor assembly. <Ref. to IG(H4SO)-8, Ignition Coil and Ignitor Assembly.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

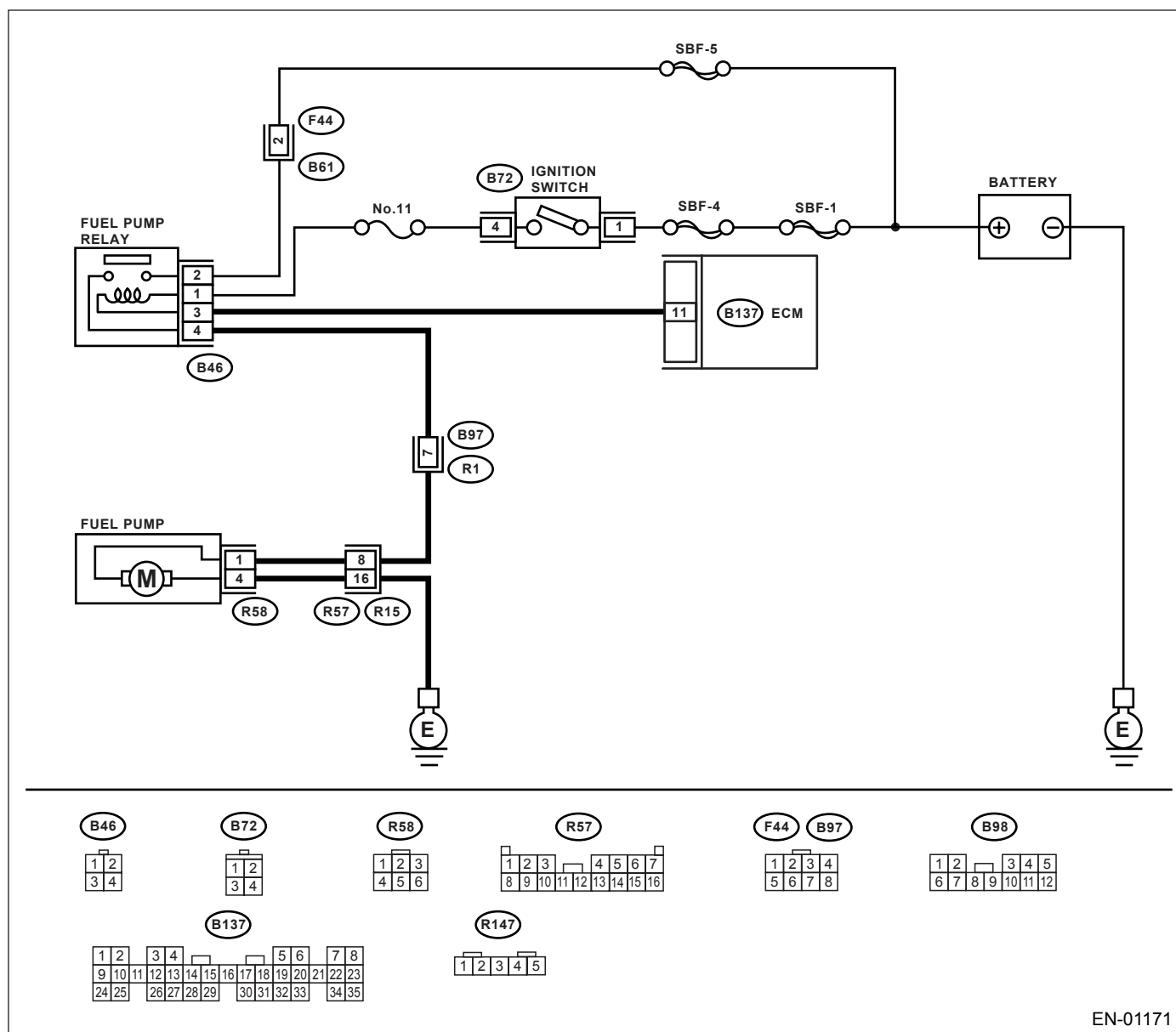
ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from ignition coil & ignitor assembly. 4) Measure the resistance of harness between ECM and ignition coil & ignitor assembly connector. Connector & terminal (B137) No. 33 — (E12) No. 1: (B137) No. 32 — (E12) No. 4: Is the measured value less than the specified value?	1 Ω	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and ignition coil & ignitor assembly connector • Poor contact in coupling connector
7 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR. Measure the resistance of harness between ECM and engine ground. Connector & terminal: (B137) No. 33 — Engine ground: (B137) No. 32 — Engine ground: Is the measured value more than the specified value?	1 M Ω	Go to step 8.	Repair short circuit to ground in harness between ECM and ignition coil & ignitor assembly connector.
8 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Check fuel pump circuit. <Ref. to EN(H4SO)-70, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>

ENGINE (DIAGNOSTICS)

CAUTION:

- **WIRING DIAGRAM:**



DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATING SOUND OF FUEL PUMP. Make sure that the fuel pump operates for two seconds when the ignition switch is turned to ON. Does the fuel pump produce an operating sound? NOTE: Fuel pump operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Fuel pump operates.	Check fuel injector circuit. <Ref. to EN(H4SO)-73, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.
2 CHECK GROUND CIRCUIT OF FUEL PUMP. 1) Turn ignition switch to OFF. 2) Remove the fuel pump access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the resistance of harness connector between fuel pump and chassis ground. Connector & terminal (R58) No. 4 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact in coupling connector
3 CHECK POWER SUPPLY TO FUEL PUMP. 1) Turn ignition switch to ON. 2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground. Connector & terminal (R58) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Replace the fuel pump. <Ref. to FU(H4SO)-60, Fuel Pump.>	Go to step 4.
4 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance of harness connector between fuel pump and fuel pump relay. Connector & terminal (R58) No. 1 — (B46) No. 4: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact in coupling connector
5 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR. Measure the resistance of harness between fuel pump and fuel pump relay connector. Connector & terminal (R58) No. 1 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 6.	Repair short circuit in harness between fuel pump and fuel pump relay connector.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK FUEL PUMP RELAY. 1)Disconnect the connectors from fuel pump relay and main relay. 2)Remove the fuel pump relay and main relay with bracket. 3)Connect the battery to fuel pump relay connector terminals No. 1 and No. 3. 4)Measure the resistance between connector terminals of fuel pump relay. Terminal No. 2 — No. 4: Is the measured value less than the specified value?	10 Ω	Go to step 7.	Replace the fuel pump relay. <Ref. to FU(H4SO)-50, Fuel Pump Relay.>
7 CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR. 1)Disconnect the connector from ECM. 2)Measure the resistance of harness between ECM and fuel pump relay connector. Connector & terminal (B137) No. 11 — (B46) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair open circuit in harness between ECM and fuel pump relay connector.
8 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Check fuel injector circuit. <Ref. to EN(H4SO)-73, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

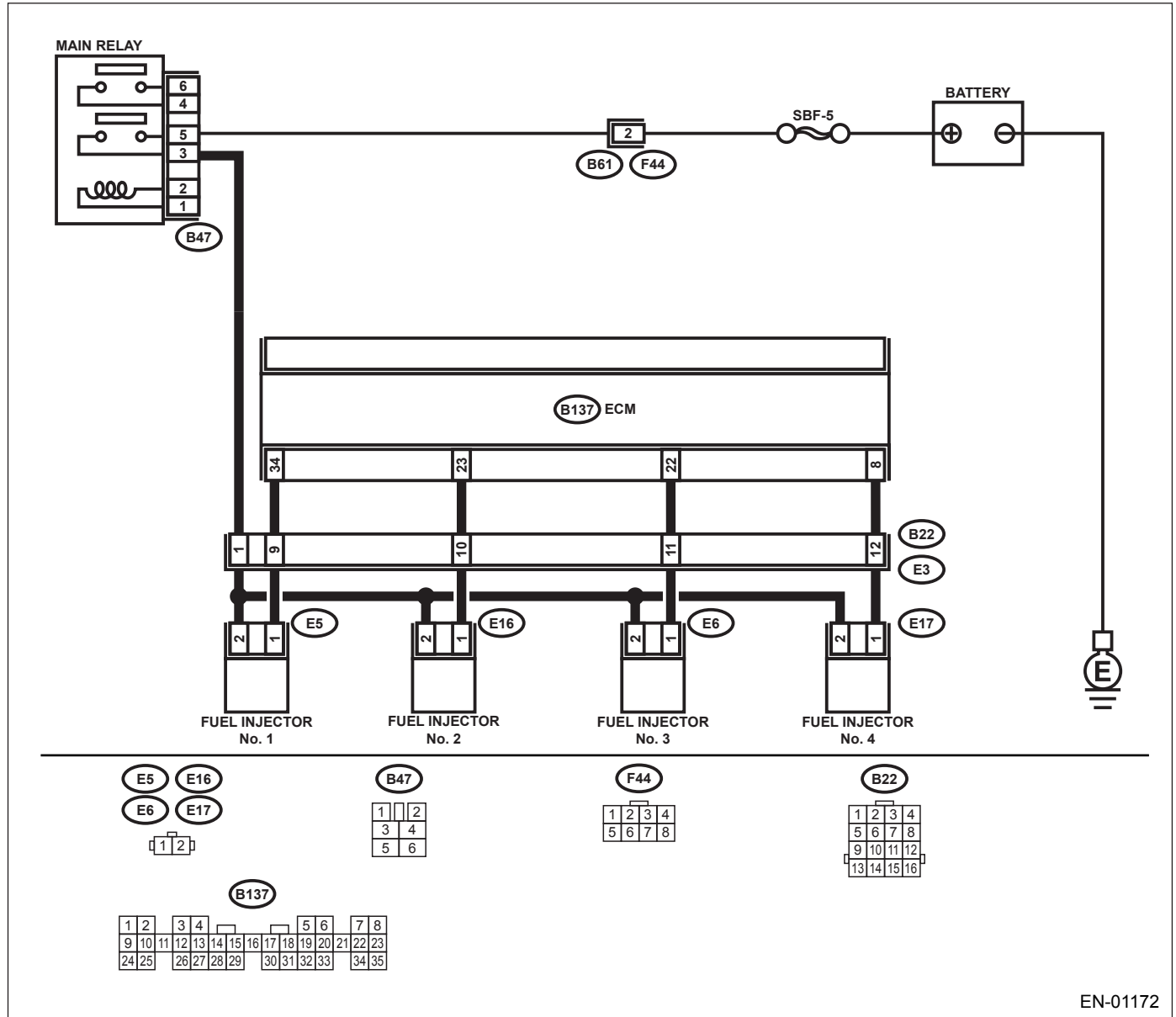
DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

F: FUEL INJECTOR CIRCUIT

CAUTION:

- Check or repair only faulty parts.
- After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, Clear Memory Mode.> and INSPECTION MODE. <Ref. to EN(H4SO)-39, Inspection Mode.>
- WIRING DIAGRAM:



EN-01172

Step	Check	Yes	No
1 CHECK OPERATION OF EACH FUEL INJECTOR. While cranking the engine, check that each fuel injector emits an "operating" sound. Use a sound scope or attach a screwdriver to the injector for this check. Does the fuel injectors operate?	Fuel injectors operate.	Check the fuel pressure. <Ref. to ME(H4SO)-29, INSPECTION, Fuel Pressure.>	Go to step 2.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK POWER SUPPLY TO EACH FUEL INJECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from #1 cylinder fuel injector. 3) Turn ignition switch to ON. 4) Measure the power supply voltage between the fuel injector terminal and engine ground. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector • Poor contact in main relay connector • Poor contact in coupling connector • Poor contact in fuel injector connector
3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. Connector & terminal #1 (B137) No. 34 — (E5) No. 1: #2 (B137) No. 23 — (E16) No. 1: #3 (B137) No. 22 — (E6) No. 1: #4 (B137) No. 8 — (E17) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. Measure the resistance of harness between ECM and fuel injector connector. Connector & terminal #1 (B137) No. 34 — Chassis ground: #2 (B137) No. 23 — Chassis ground: #3 (B137) No. 22 — Chassis ground: #4 (B137) No. 8 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 5.	Repair short circuit to ground in harness between ECM and fuel injector connector.
5 CHECK EACH FUEL INJECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. Terminal No. 1 — No. 2: Is the measured value within the specified range?	5 — 20 Ω	Go to step 6.	Replace the faulty fuel injector.
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Inspection using "General Diagnostic Table". <Ref. to EN(H4SO)-340, INSPECTION, General Diagnostic Table.>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

18. List of Diagnostic Trouble Codes

A: LIST

DTC No.	Item	Index
P0030	HO ₂ S heater control circuit range/performance problem (bank 1 sensor 1)	<Ref. to EN(H4SO)-82, DTC P0030 — HO ₂ S HEATER CONTROL CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO ₂ S heater control circuit low input (bank 1 sensor 1)	<Ref. to EN(H4SO)-85, DTC P0031 — HO ₂ S HEATER CONTROL CIRCUIT LOW INPUT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO ₂ S heater control circuit high input (bank 1 sensor 1)	<Ref. to EN(H4SO)-88, DTC P0032 — HO ₂ S HEATER CONTROL CIRCUIT HIGH INPUT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO ₂ S heater control circuit low input (bank 1 sensor 2)	<Ref. to EN(H4SO)-90, DTC P0037 — HO ₂ S HEATER CONTROL CIRCUIT LOW INPUT (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO ₂ S heater control circuit high input (bank 1 sensor 2)	<Ref. to EN(H4SO)-94, DTC P0038 — HO ₂ S HEATER CONTROL CIRCUIT HIGH INPUT (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0065	Air assisted injector control range/performance problem	<Ref. to EN(H4SO)-96, DTC P0065 — AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0066	Air assisted injector control circuit low input	<Ref. to EN(H4SO)-98, DTC P0066 — AIR ASSISTED INJECTOR CONTROL CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0067	Air assisted injector solenoid valve circuit high input	<Ref. to EN(H4SO)-100, DTC P0067 — AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	Manifold absolute pressure/barometric pressure circuit range/performance problem	<Ref. to EN(H4SO)-102, DTC P0068 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold absolute pressure/barometric pressure circuit low input	<Ref. to EN(H4SO)-104, 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)-108, DTC P0108 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake air temperature circuit range/performance problem	<Ref. to EN(H4SO)-112, DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake air temperature circuit low input	<Ref. to EN(H4SO)-114, DTC P0112 — INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake air temperature circuit high input	<Ref. to EN(H4SO)-116, DTC P0113 — INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine coolant temperature circuit low input	<Ref. to EN(H4SO)-120, DTC P0117 — ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine coolant temperature circuit high input	<Ref. to EN(H4SO)-122, DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0121	Throttle/pedal position sensor/switch "A" circuit range/performance problem	<Ref. to EN(H4SO)-126, DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

DTC No.	Item	Index
P0122	Throttle/pedal position sensor/switch "A" circuit low input	<Ref. to EN(H4SO)-128, DTC P0122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/pedal position sensor/switch "A" circuit high input	<Ref. to EN(H4SO)-132, DTC P0123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient coolant temperature for closed loop fuel control	<Ref. to EN(H4SO)-134, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	<Ref. to EN(H4SO)-136, DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0129	Barometric pressure sensor circuit range/performance problem	<Ref. to EN(H4SO)-137, DTC P0129 — BAROMETRIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0130	O ₂ sensor circuit (bank 1 sensor 1)	<Ref. to EN(H4SO)-138, DTC P0130 — O ₂ SENSOR CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O ₂ sensor circuit low voltage (bank 1 sensor 1)	<Ref. to EN(H4SO)-142, DTC P0131 — O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O ₂ sensor circuit high voltage (bank 1 sensor 1)	<Ref. to EN(H4SO)-144, DTC P0132 — O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O ₂ sensor circuit slow response (bank 1 sensor 1)	<Ref. to EN(H4SO)-146, DTC P0133 — O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O ₂ sensor circuit open (bank 1 sensor 1)	<Ref. to EN(H4SO)-148, DTC P0134 — O ₂ SENSOR CIRCUIT OPEN (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O ₂ sensor circuit low voltage (bank 1 sensor 2)	<Ref. to EN(H4SO)-150, DTC P0137 — O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O ₂ sensor circuit high voltage (bank 1 sensor 2)	<Ref. to EN(H4SO)-154, DTC P0138 — O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O ₂ sensor circuit slow response (bank 1 sensor 2)	<Ref. to EN(H4SO)-158, DTC P0139 — O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System too lean (bank 1)	<Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System too rich (bank 1)	<Ref. to EN(H4SO)-160, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel temperature sensor "A" circuit range/performance problem	<Ref. to EN(H4SO)-162, DTC P0181 — FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel temperature sensor "A" circuit low input	<Ref. to EN(H4SO)-164, 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)-166, DTC P0183 — FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder #1 misfire detected	<Ref. to EN(H4SO)-169, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder #2 misfire detected	<Ref. to EN(H4SO)-169, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

DTC No.	Item	Index
P0303	Cylinder #3 misfire detected	<Ref. to EN(H4SO)-169, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder #4 misfire detected	<Ref. to EN(H4SO)-170, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock sensor 1 circuit low input (bank 1 or single sensor)	<Ref. to EN(H4SO)-176, DTC P0327 — KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock sensor 1 circuit high input (bank 1 or single sensor)	<Ref. to EN(H4SO)-178, DTC P0328 — KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft position sensor “A” circuit	<Ref. to EN(H4SO)-180, DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft position sensor “A” circuit range/performance problem	<Ref. to EN(H4SO)-182, DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft position sensor “A” circuit (bank 1 or single sensor)	<Ref. to EN(H4SO)-184, 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 problem (bank 1 or single sensor)	<Ref. to EN(H4SO)-186, DTC P0341 — CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE PROBLEM (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalytic converter system efficiency below threshold (bank 1)	<Ref. to EN(H4SO)-190, DTC P0420 — CATALYTIC CONVERTER 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)-192, 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)-196, 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)-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 range/performance problem	<Ref. to EN(H4SO)-202, DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative emission control system pressure sensor low input	<Ref. to EN(H4SO)-204, 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)-208, 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)-212, 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)-216, DTC P0457 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative emission control system purge control valve circuit low input	<Ref. to EN(H4SO)-220, DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative emission control system purge control valve circuit high input	<Ref. to EN(H4SO)-224, DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

DTC No.	Item	Index
P0461	Fuel level sensor circuit range/performance problem	<Ref. to EN(H4SO)-228, DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel level sensor circuit low input	<Ref. to EN(H4SO)-230, DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel level sensor circuit high input	<Ref. to EN(H4SO)-234, DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel level sensor circuit intermittent	<Ref. to EN(H4SO)-238, DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0483	Cooling fan rationality check	<Ref. to EN(H4SO)-240, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0502	Vehicle speed sensor circuit low input	<Ref. to EN(H4SO)-243, DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0503	Vehicle speed sensor circuit high input	<Ref. to EN(H4SO)-244, DTC P0503 — VEHICLE SPEED SENSOR HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle control system RPM lower than expected	<Ref. to EN(H4SO)-246, DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle control system RPM higher than expected	<Ref. to EN(H4SO)-248, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter request circuit	<Ref. to EN(H4SO)-250, DTC P0512 — STARTER REQUEST CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0519	Idle control system malfunction (fail-safe)	<Ref. to EN(H4SO)-254, DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0565	Cruise control set signal circuit malfunction (AT)	<Ref. to EN(H4SO)-256, DTC P0565 — CRUISE CONTROL SET SIGNAL CIRCUIT MALFUNCTION (AT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal control module random access memory (RAM) error	<Ref. to EN(H4SO)-258, DTC P0604 — INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0691	Cooling fan 1 control circuit low	<Ref. to EN(H4SO)-260, DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0692	Cooling fan 1 control circuit high	<Ref. to EN(H4SO)-264, DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0703	Torque converter/brake switch “B” circuit	<Ref. to EN(H4SO)-268, DTC P0703 — TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0705	Transmission range sensor circuit (PRNDL input)	<Ref. to AT-127, CHECK INHIBITOR SWITCH., Diagnostic Procedure for No-Diagnostic Trouble Code (DTC).>
P0710	Transmission fluid temperature sensor circuit	<Ref. to AT-50, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0716	Input/turbine speed sensor circuit	<Ref. to AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output speed sensor circuit	<Ref. to AT-61, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0726	Engine speed input circuit	<Ref. to AT-44, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	1st gear incorrect ratio	<Ref. to EN(H4SO)-270, DTC P0731 — GEAR 1 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

DTC No.	Item	Index
P0732	2nd gear incorrect ratio	<Ref. to EN(H4SO)-270, DTC P0732 — GEAR 2 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	3rd gear incorrect ratio	<Ref. to EN(H4SO)-270, DTC P0733 — GEAR 3 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0734	4th gear incorrect ratio	<Ref. to EN(H4SO)-271, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0741	Torque converter clutch circuit performance or stuck off	<Ref. to EN(H4SO)-272, DTC P0741 — TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque converter clutch circuit electrical system	<Ref. to AT-104, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0748	Pressure control solenoid “A” electrical system	<Ref. to AT-92, DTC 75 LINE PRESSURE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0753	Shift solenoid “A” electrical system	<Ref. to AT-76, DTC 71 SHIFT SOLENOID 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift solenoid “B” electrical system	<Ref. to AT-80, DTC 72 SHIFT SOLENOID 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0771	AT low clutch timing solenoid valve circuit malfunction	<Ref. to AT-84, DTC 73 LOW CLUTCH TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0778	Pressure control solenoid “B” electrical system	<Ref. to AT-98, DTC 76 2–4 BRAKE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0785	Shift/timing solenoid	<Ref. to AT-88, DTC 74 2-4 BRAKE TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral switch input circuit low	<Ref. to EN(H4SO)-274, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).><Ref. to EN(H4SO)-276, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral switch input circuit high	<Ref. to EN(H4SO)-280, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).><Ref. to EN(H4SO)-284, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0864	TCM communication circuit range/performance problem	<Ref. to EN(H4SO)-288, DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0865	TCM communication circuit low	<Ref. to EN(H4SO)-290, DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0866	TCM communication circuit high	<Ref. to EN(H4SO)-292, DTC P0866 — TCM COMMUNICATION CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1110	Barometric pressure sensor circuit low input	<Ref. to EN(H4SO)-294, DTC P1110 — BAROMETRIC PRESSURE SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1111	Barometric pressure sensor circuit high input	<Ref. to EN(H4SO)-294, DTC P1111 — BAROMETRIC PRESSURE SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1134	A/F Sensor Micro-Computer Problem	<Ref. to EN(H4SO)-296, DTC P1134 — A/F SENSOR MICROCOMPUTER PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1137	O ₂ sensor circuit (bank 1 sensor 1)	<Ref. to EN(H4SO)-298, DTC P1137 — O ₂ SENSOR CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel tank pressure control solenoid valve circuit low	<Ref. to EN(H4SO)-302, DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel tank pressure control solenoid valve circuit high	<Ref. to EN(H4SO)-306, DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

DTC No.	Item	Index
P1443	Vent control solenoid valve function problem	<Ref. to EN(H4SO)-310, DTC P1443 — VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1446	Fuel tank sensor control valve circuit low	<Ref. to EN(H4SO)-312, DTC P1446 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1447	Fuel tank sensor control valve circuit high	<Ref. to EN(H4SO)-316, DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1448	Fuel tank sensor control valve range/performance problem	<Ref. to EN(H4SO)-318, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1510	ISC solenoid valve signal #1 circuit low input	<Ref. to EN(H4SO)-320, DTC P1510 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1511	ISC solenoid valve signal #1 circuit high input	<Ref. to EN(H4SO)-320, DTC P1511 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1512	ISC solenoid valve signal #2 circuit low input	<Ref. to EN(H4SO)-320, DTC P1512 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1513	ISC solenoid valve signal #2 circuit high input	<Ref. to EN(H4SO)-320, DTC P1513 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1514	ISC solenoid valve signal #3 circuit low input	<Ref. to EN(H4SO)-320, DTC P1514 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1515	ISC solenoid valve signal #3 circuit high input	<Ref. to EN(H4SO)-320, DTC P1515 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1516	ISC solenoid valve signal #4 circuit low input	<Ref. to EN(H4SO)-322, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1517	ISC solenoid valve signal #4 circuit high input	<Ref. to EN(H4SO)-324, DTC P1517 — ISC 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)-326, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up voltage circuit malfunction	<Ref. to EN(H4SO)-330, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1698	Engine torque control cut signal circuit low input	<Ref. to EN(H4SO)-332, DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1699	Engine torque control cut signal circuit high input	<Ref. to EN(H4SO)-334, DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1700	Throttle position sensor circuit malfunction (AT)	<Ref. to AT-54, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1711	Engine torque control signal #1 circuit malfunction	<Ref. to EN(H4SO)-336, DTC P1711 — ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1712	Engine torque control signal #2 circuit malfunction	<Ref. to EN(H4SO)-338, DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODES

ENGINE (DIAGNOSTICS)

19. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P0030 — HO₂S HEATER CONTROL CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

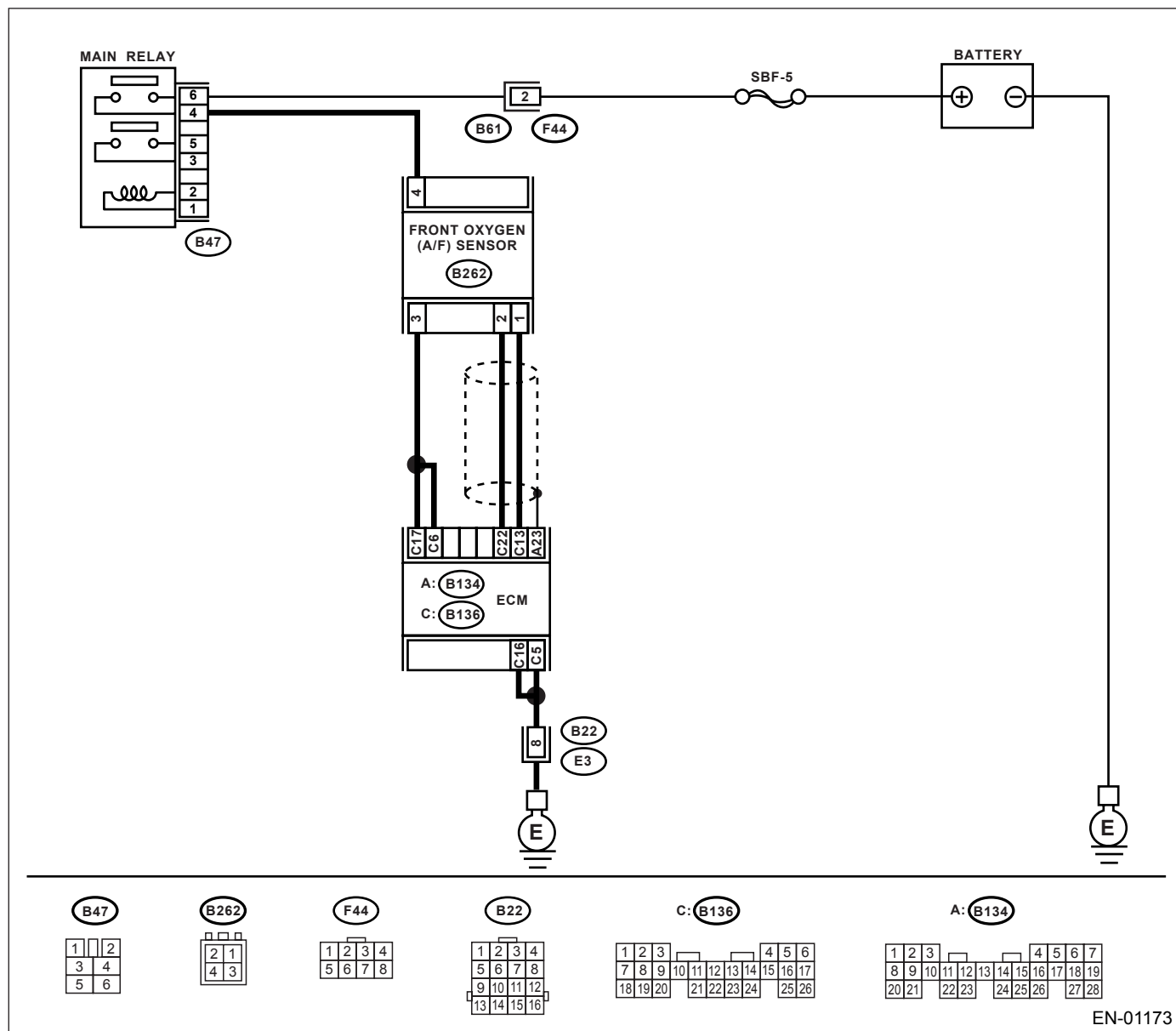
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01173

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Start and warm-up the engine. 2) Turn ignition switch to OFF. 3) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 6 — (B262) No. 3: (B136) No. 17 — (B262) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 2.	Repair the open circuit in harness between ECM and front oxygen (A/F) sensor connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 22 — (B262) No. 2: (B136) No. 13 — (B262) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 3.	Repair the open circuit in harness between ECM and front oxygen (A/F) sensor connector.
3 CHECK HARNESS BETWEEN MAIN RELAY AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. Measure the resistance of harness between main relay and front oxygen (A/F) sensor connector. Connector & terminal (B47) No. 4 — (B262) No. 4: Is the measured value less than the specified value?	1 Ω	Go to step 4.	Repair the open circuit in harness between main relay and front oxygen (A/F) sensor connector.
4 CHECK FRONT OXYGEN (A/F) SENSOR. Measure the resistance between front oxygen (A/F) sensor connector terminals. Terminal No. 2 — No. 1: No. 3 — No. 4: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>
5 CHECK FOR POOR CONTACT. Check for poor contact in ECM and front oxygen (A/F) sensor connectors.	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact in ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

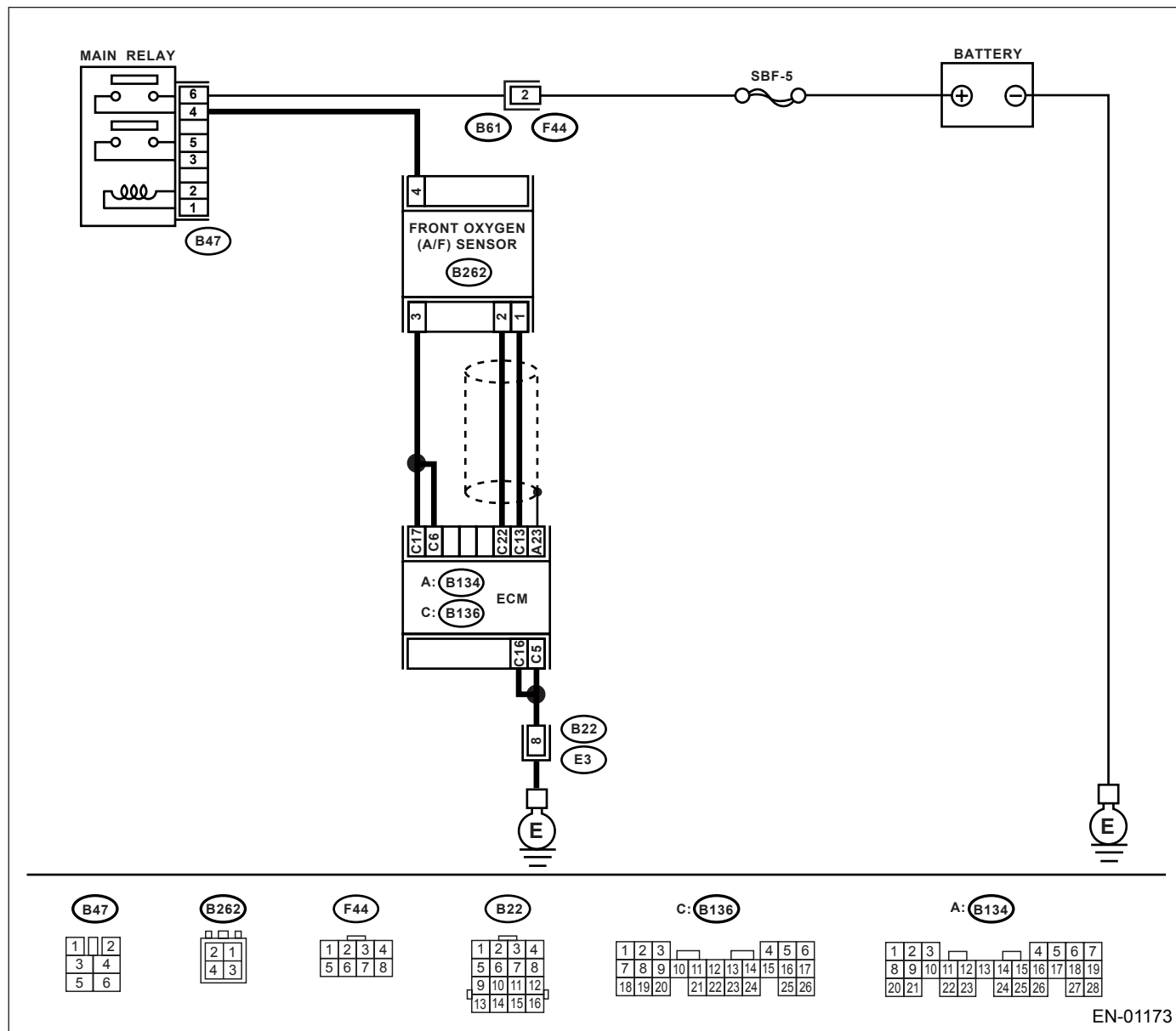
B: DTC P0031 — HO₂S HEATER CONTROL CIRCUIT LOW INPUT (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



Step	Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Does the Subaru Select Monitor or OBD-II general scan tool display DTC P0031 and P0037 at the same time?	Go to step 2.	Go to step 5.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. Connector & terminal (B262) No. 4 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Go to step 3.	Repair power supply line. NOTE: In this case, repair the following: • Open circuit in harness between main relay and front oxygen (A/F) sensor connector • Poor contact in main relay connector • Malfunction in main relay
3 CHECK GROUND CIRCUIT OF ECM. Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 5 — Chassis ground: (B136) No. 16 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground terminal • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II General Scan Tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	0.2 A	Repair poor contact in connector. NOTE: In this case, repair the following: • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. 1) Start and idle the engine. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-): Is the measured value less than the specified value?	1.0 V	Go to step 7.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-): Does the measured value stay less than the specified value while shaking the ECM harness and connector ?	1.0 V	Repair poor contact in ECM connector.	Go to step 7.
7 CHECK FRONT OXYGEN (A/F) SENSOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between front oxygen (A/F) sensor connector terminals. Terminal No. 3 — No. 4: Is the measured value less than the specified value?	10 Ω	Repair harness and connector. NOTE: In this case, repair the following: • Open or short circuit to ground in harness between front oxygen (A/F) sensor and ECM connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-51, Fuel.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

C: DTC P0032 — HO₂S HEATER CONTROL CIRCUIT HIGH INPUT (BANK 1 SENSOR 1) —

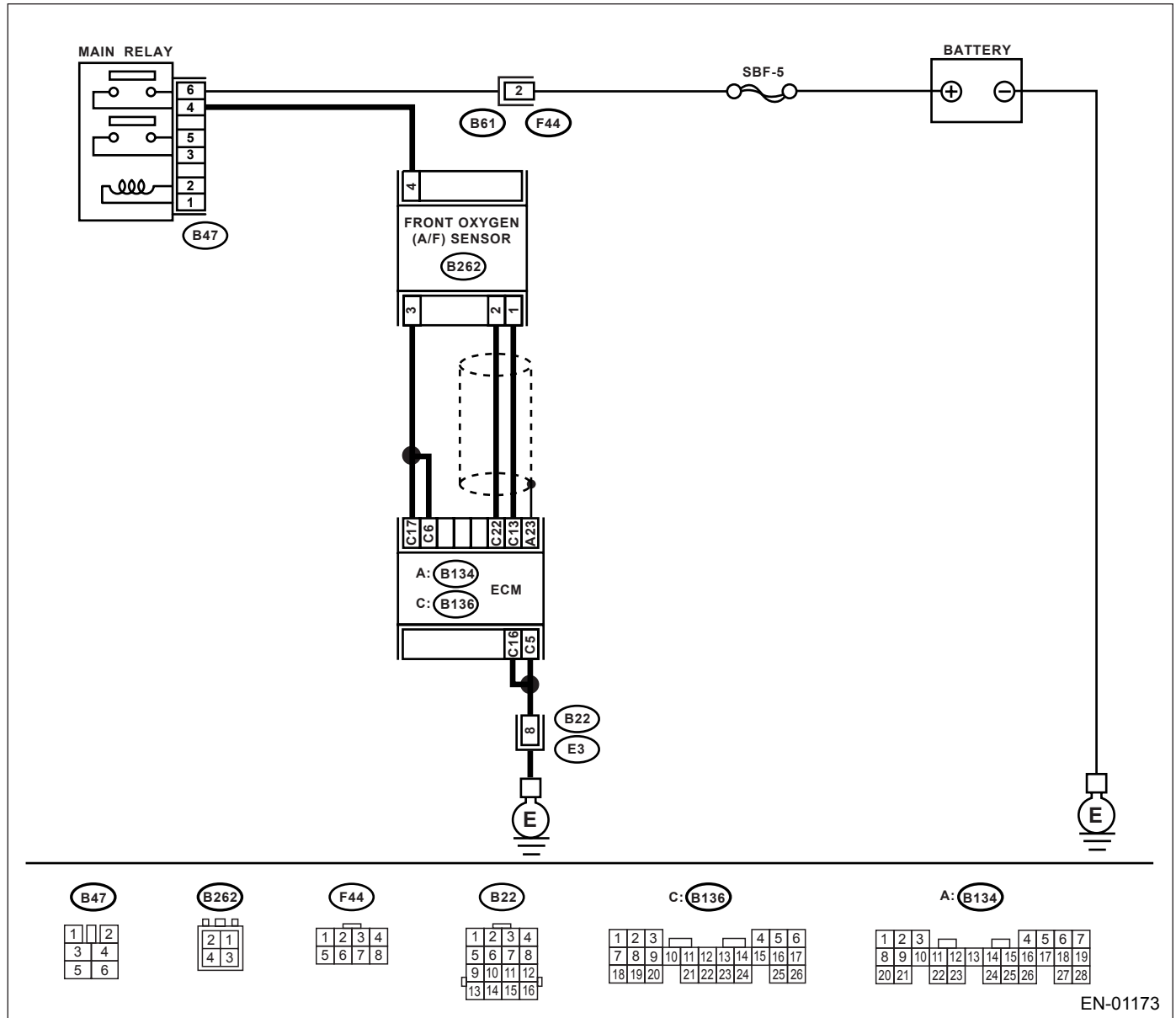
• DTC DETECTING CONDITION:

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>

• WIRING DIAGRAM:



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-): Is the measured value more than the specified value?	8 V	Go to step 2.	Go to step 3.
2 CHECK FRONT OXYGEN (A/F) SENSOR HEATER CURRENT. 1) Turn ignition switch to OFF. 2) Repair the short circuit to battery in harness between ECM and front oxygen (A/F) sensor connector. 3) Turn ignition switch to ON. 4) Read the data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II General Scan Tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	2.3 A	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	END
3 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	8 V	Repair the short circuit to battery in harness between ECM and front oxygen (A/F) sensor connector.	END

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

D: DTC P0037 — HO₂S HEATER CONTROL CIRCUIT LOW INPUT (BANK 1 SENSOR 2) —

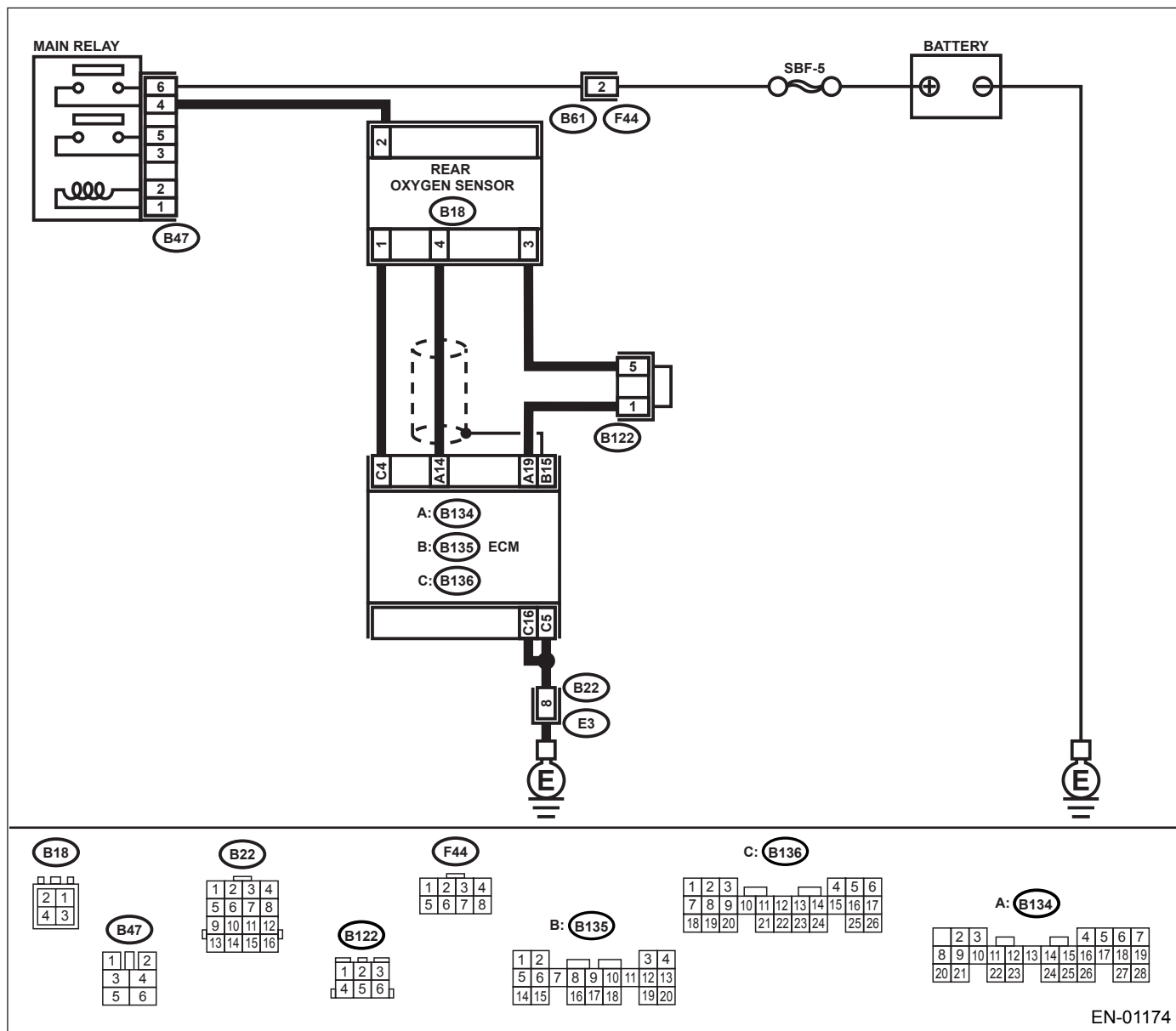
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01174

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT OF ECM. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 16 — Chassis ground: (B136) No. 5 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground terminal • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of rear oxygen sensor heater current using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	0.2 A	Repair the connector. NOTE: In this case, repair the following: • Poor contact in rear oxygen sensor connector • Poor contact in rear oxygen sensor connecting harness connector • Poor contact in ECM connector	Go to step 3.
3 CHECK OUTPUT SIGNAL FROM ECM. 1) Start and idle the engine. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-): Is the measured value less than the specified value?	1.0 V	Go to step 6.	Go to step 4.
4 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-): Does the measured value change within the specified range by shaking the ECM harness and connector?	1.0 V	Repair poor contact in ECM connector.	Go to step 5.
5 CHECK OUTPUT SIGNAL FROM ECM. 1) Disconnect the connector from rear oxygen sensor. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-): Is the measured value less than the specified value?	1.0 V	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Repair short circuit to battery in harness between ECM and rear oxygen sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO REAR OXYGEN SENSOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and engine ground or chassis ground. Connector & terminal (B18) No. 2 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Repair power supply line. NOTE: In this case, repair the following: • Open circuit in harness between main relay and rear oxygen sensor connector • Poor contact in main relay connector • Malfunction in main relay
7 CHECK REAR OXYGEN SENSOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between rear oxygen sensor connector terminals. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	30 Ω	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector • Poor contact in coupling connector	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-46, Rear Oxygen Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

E: DTC P0038 — HO₂S HEATER CONTROL CIRCUIT HIGH INPUT (BANK 1 SENSOR 2) —

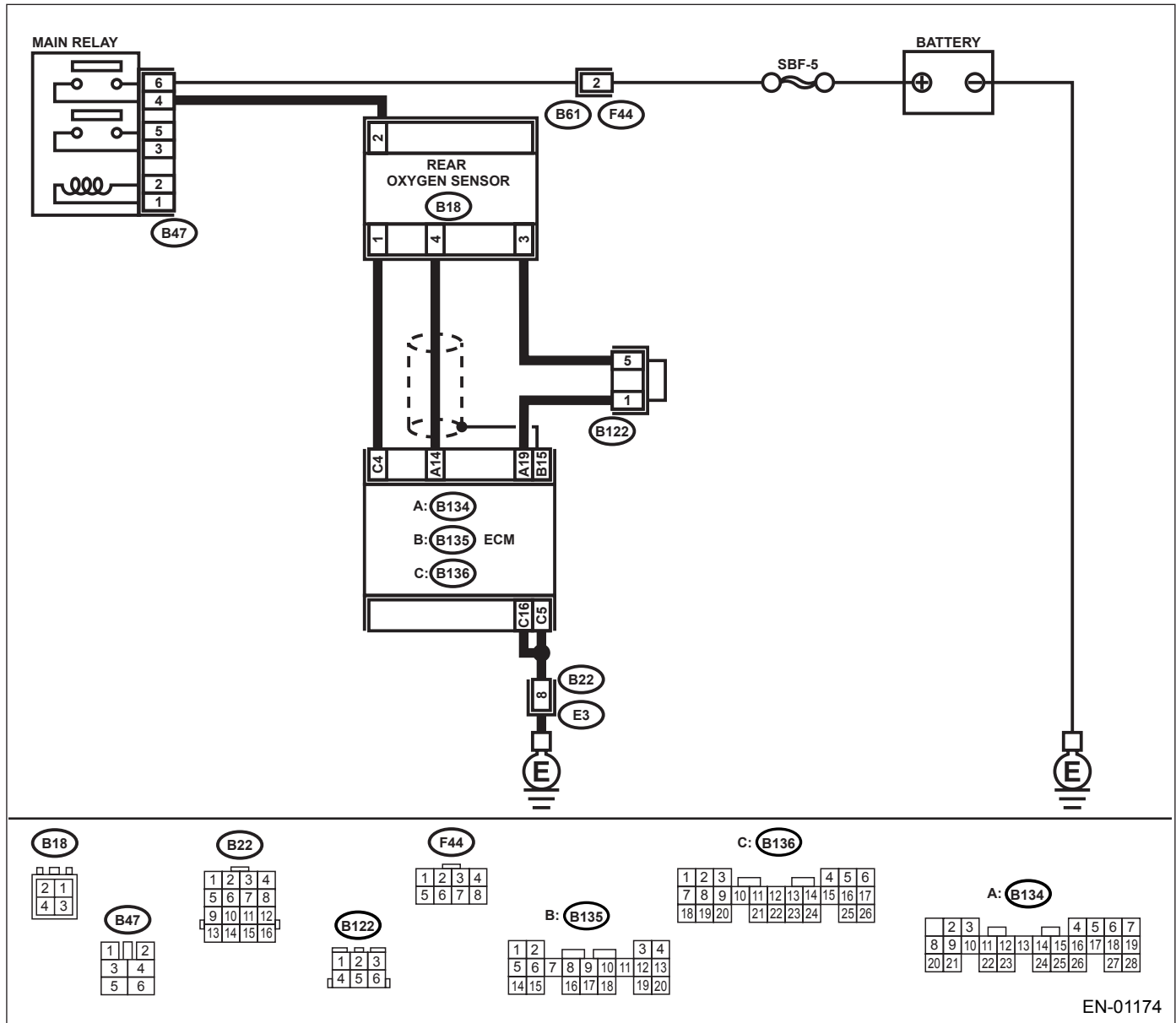
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>

• WIRING DIAGRAM:



EN-01174

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-): Is the measured value more than the specified value?	8 V	Go to step 2.	Go to step 3.
2 CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Repair short circuit to battery in harness between ECM and rear oxygen sensor connector. 3) Turn ignition switch to ON. 4) Read the data of rear oxygen sensor heater current using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	7 A	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	END
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	END

ENGINE (DIAGNOSTICS)

- **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

- Erroneous idling
- Engine stalls.

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>

MAIN RELAY

AIR ASSIST INJECTOR SOLENOID VALVE

ECM

BATTERY

SBF-5

B47

B61

F44

E42

E3

B22

B137

E

1 2 3 4 5 6

1 2 3 4 5 6

1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK AIR ASSISTED INJECTOR SOLENOID VALVE OPERATION. 1)Turn ignition switch to OFF. 2)Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3)Turn ignition switch to ON. 4)Operate the air assisted injector solenoid valve. Does air assisted injector solenoid valve operate? NOTE: Air assisted injector solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Operates.	Go to step 3.	Replace the air assisted injector solenoid valve. <Ref. to FU(H4SO)-37, Air Assist Injector Solenoid Valve.>
3 CHECK AIR BYPASS HOSES. Use your mouth to blow through the air bypass hose to make sure that there is a smooth air flow (no clogging). Is there damage or clog at air bypass hose?	There is damage or clog.	Repair or replace the air bypass hoses.	Go to step 4.
4 CHECK FUEL INJECTOR. 1)Turn ignition switch to OFF. 2)Remove the fuel injector. <Ref. to FU(H4SO)-38, REMOVAL, Fuel Injector.> 3)Check for clogged fuel injectors. Is the fuel injector clogged?	Clogged.	Replace the fuel injector. <Ref. to FU(H4SO)-41, INSTALLATION, Fuel Injector.>	Replace the air assisted injector solenoid valve. <Ref. to FU(H4SO)-37, Air Assist Injector Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

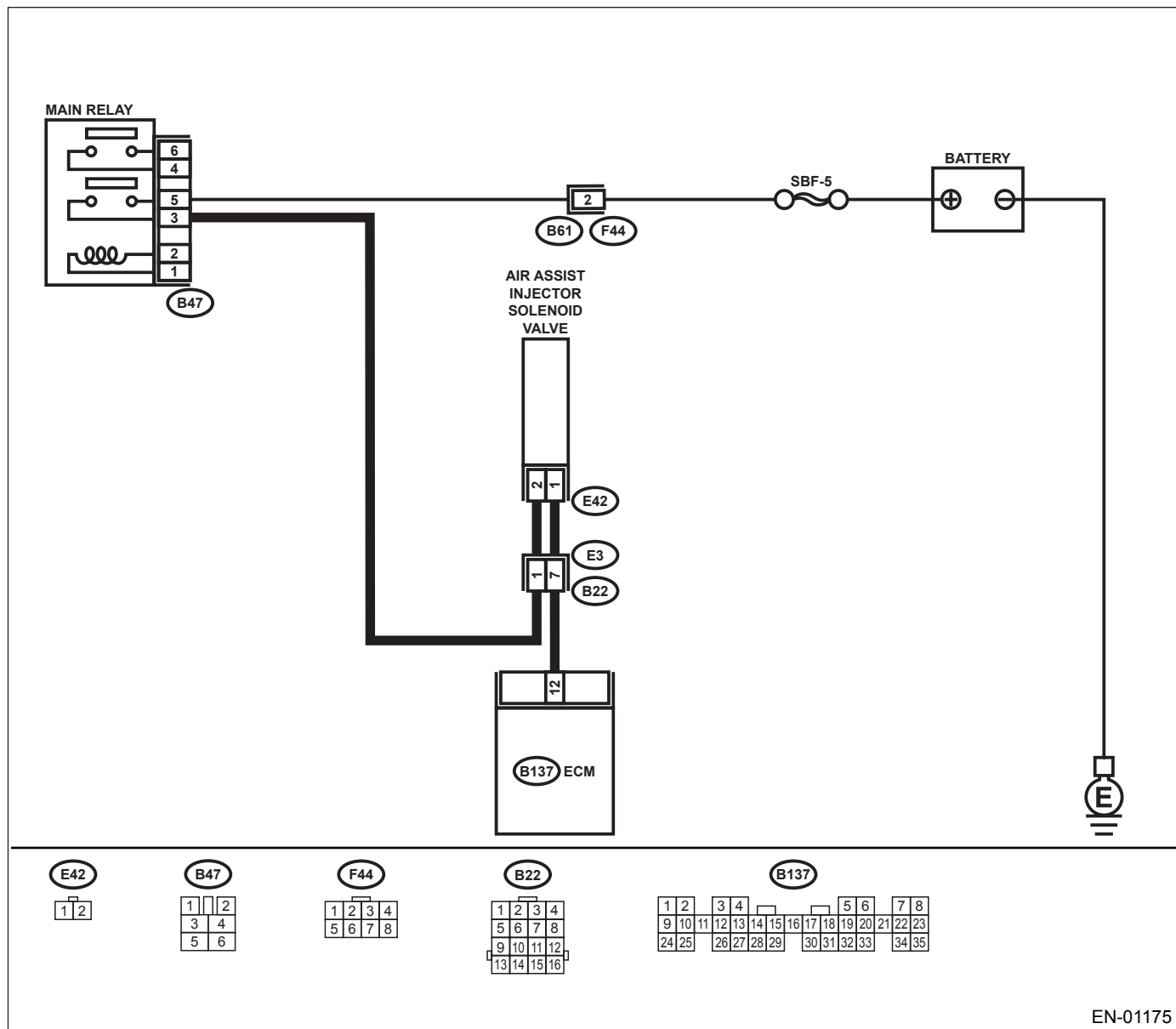
G: DTC P0066 — AIR ASSISTED INJECTOR CONTROL CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>

• WIRING DIAGRAM:



EN-01175

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK POWER SUPPLY TO AIR ASSISTED INJECTOR SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Disconnect the connector from air assisted injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between air assisted injector solenoid valve and engine ground. Connector & terminal (E42) No. 2 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between air assisted injector solenoid valve and main relay connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND AIR ASSISTED INJECTOR SOLENOID VALVE CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and air assisted injector solenoid valve connector. Connector & terminal (B137) No. 12 — (E42) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and air assisted injector solenoid valve connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND AIR ASSISTED INJECTOR SOLENOID VALVE CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B137) No. 12 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 5.	Repair short circuit to ground in harness between ECM and air assisted injector solenoid valve connector.
5 CHECK FOR POOR CONTACT. Check for poor contact in ECM and air assisted injector solenoid valve connectors. Is there poor contact in ECM and air assisted injector solenoid valve connectors?	There is poor contact.	Repair poor contact in ECM and air assisted injector solenoid valve connectors.	Replace the air assisted injector solenoid valve. <Ref. to FU(H4SO)-37, Air Assist Injector Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

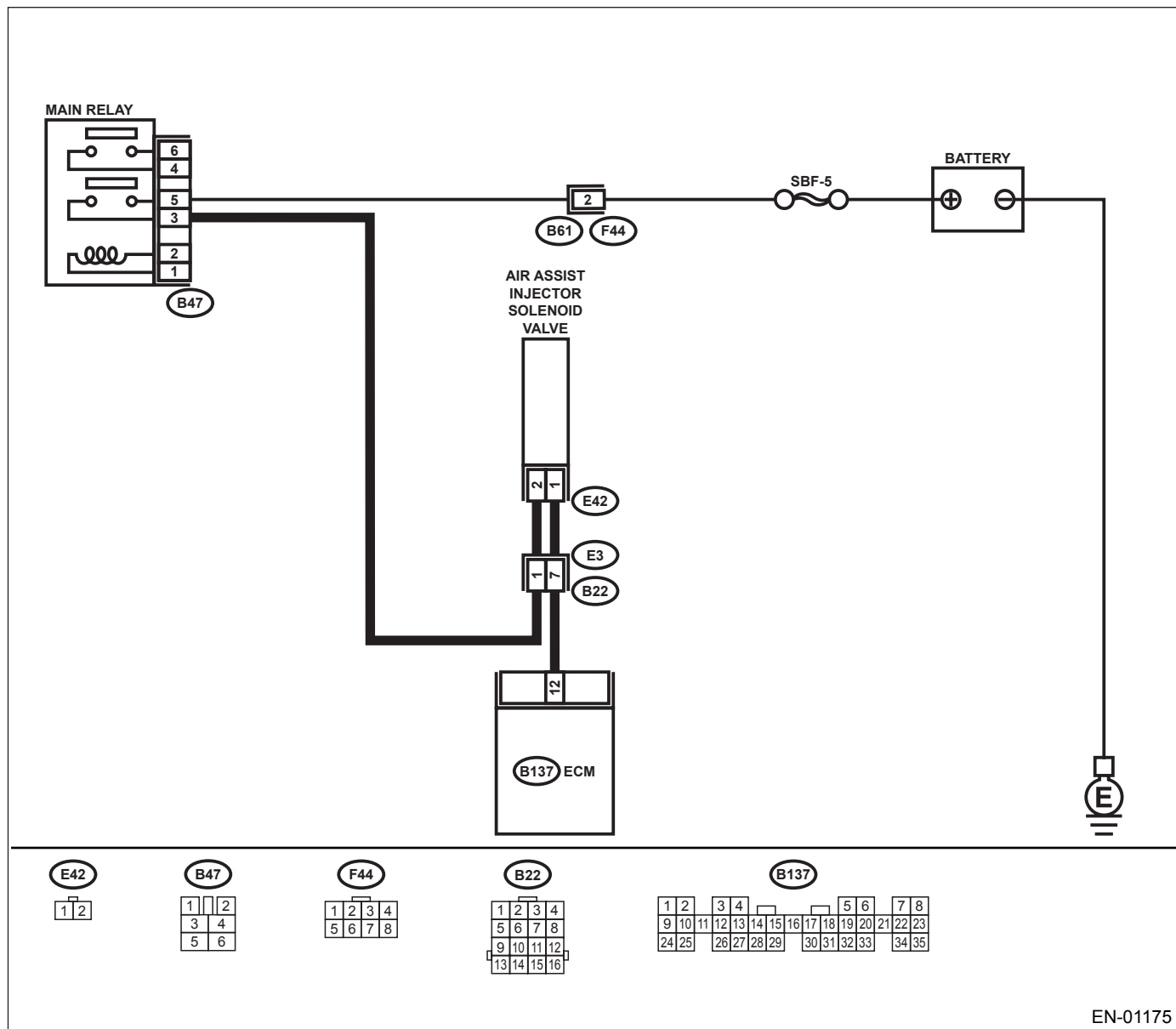
H: DTC P0067 — AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01175

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 3.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Disconnect the connector from air assisted injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and air assisted injector solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Replace the air assisted injector solenoid valve <Ref. to FU(H4SO)-37, Air Assist Injector Solenoid Valve.> and the ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.
3 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 12 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	10 V	Repair short circuit to battery in harness between ECM and air assisted injector solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

I: DTC P0068 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE PROBLEM —

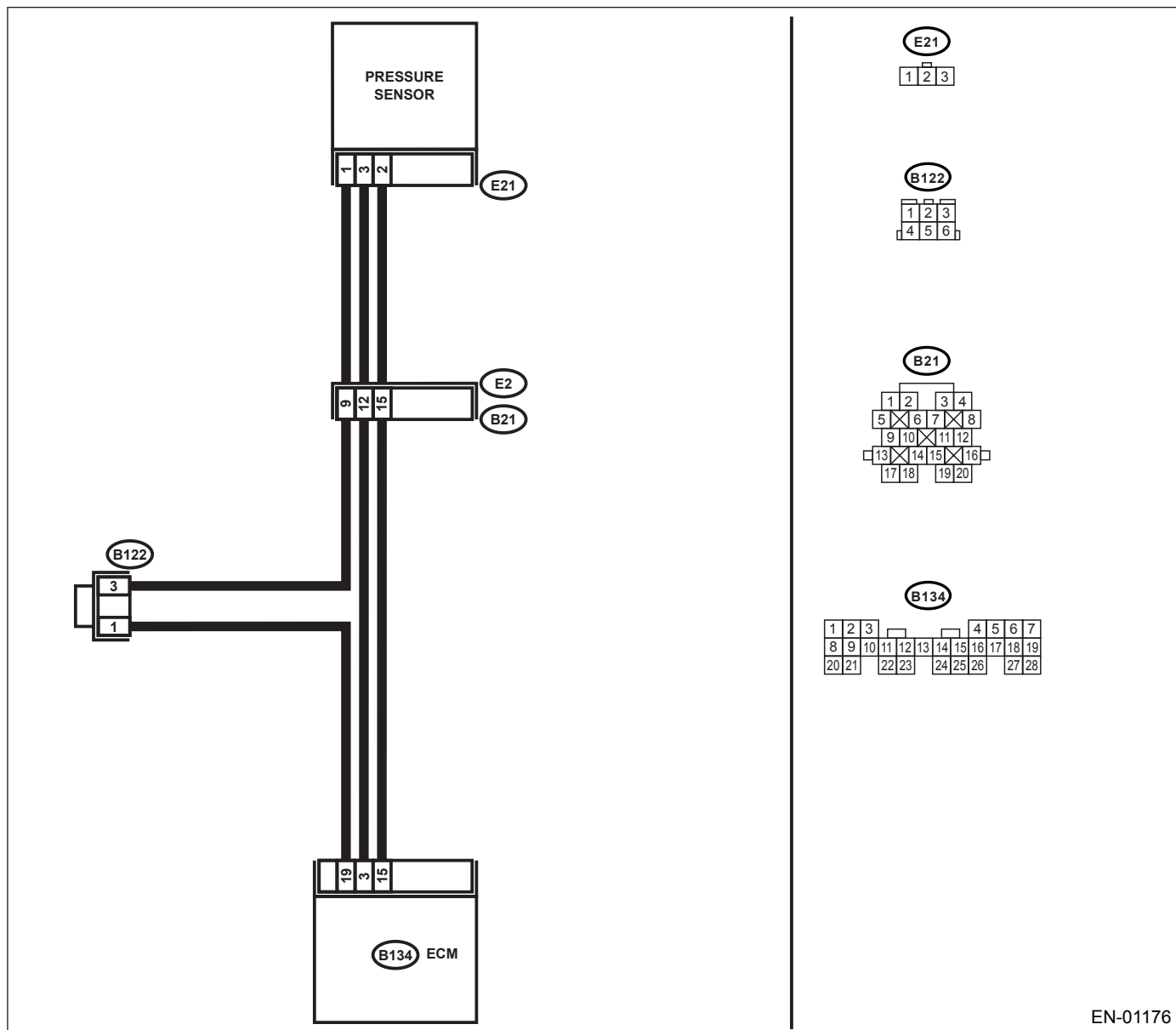
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01176

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>
2	CHECK AIR INTAKE SYSTEM. Are there holes, loose bolts or disconnection of hose on air intake system?	There are holes, loose bolts or disconnection of hose.	Repair air intake system.
3	CHECK PRESSURE SENSOR. 1)Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2)Place the selector lever or shift lever in "P" or "N" position. 3)Turn the A/C switch to OFF. 4)All accessory switches OFF. 5)Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Ignition ON: 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg), Idling: 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg)	Go to step 4.
4	CHECK THROTTLE POSITION. Read the data of throttle position signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than specified value when throttle is fully closed? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	5 %	Go to step 5.
5	CHECK THROTTLE POSITION. Is the measured value more than the specified value when throttle is wide open?	85 %	Replace the pressure sensor. <Ref. to FU(H4SO)-34, Pressure Sensor.>
			Replace the throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

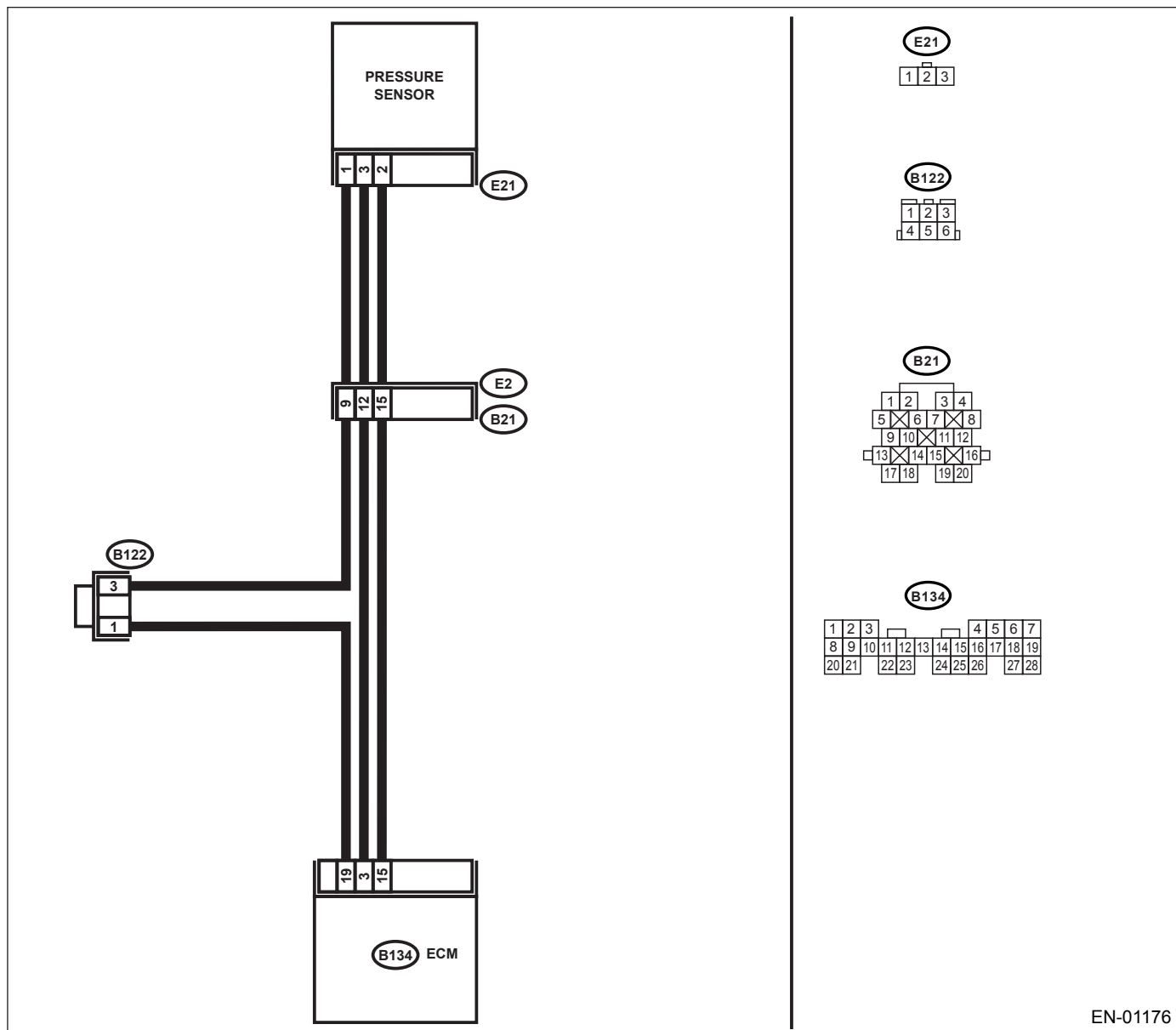
J: DTC P0107 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01176

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	13.3 kPa (100 mmHg, 3.94 inHg)	Go to step 3.	Go to step 2.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM and pressure sensor connector. Is there poor contact in ECM or pressure sensor connector?	There is poor contact.	Repair poor contact in ECM or pressure sensor connector.	The MIL may light up, however, the circuit is returned to the normal status at the moment.
3 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 5.	Go to step 4.
4 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	4.5 V	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 15 (+) — Chassis ground (-): Is the measured value less than the specified value?	0.2 V	Go to step 7.	Go to step 6.
6 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of atmospheric absolute pressure signal using Subaru Select Monitor. Does the measured value exceed the specified value by shaking the ECM harness and connector? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.>	13.3 kPa (100 mmHg, 3.94 inHg)	Repair poor contact in ECM connector.	Go to step 7.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from pressure sensor. 3)Turn ignition switch to ON. 4)Measure the voltage between pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 8.	Repair open circuit in harness between ECM and pressure sensor connector.
8 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between ECM and pressure sensor connector. Connector & terminal (B134) No. 19 — (E21) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 9.	Repair open circuit in harness between ECM and pressure sensor connector.
9 CHECK FOR POOR CONTACT. Check for poor contact in pressure sensor connector. Is there poor contact in pressure sensor connector?	There is poor contact.	Repair poor contact in pressure sensor connector.	Replace the pressure sensor. <Ref. to FU(H4SO)-34, Pressure Sensor.>

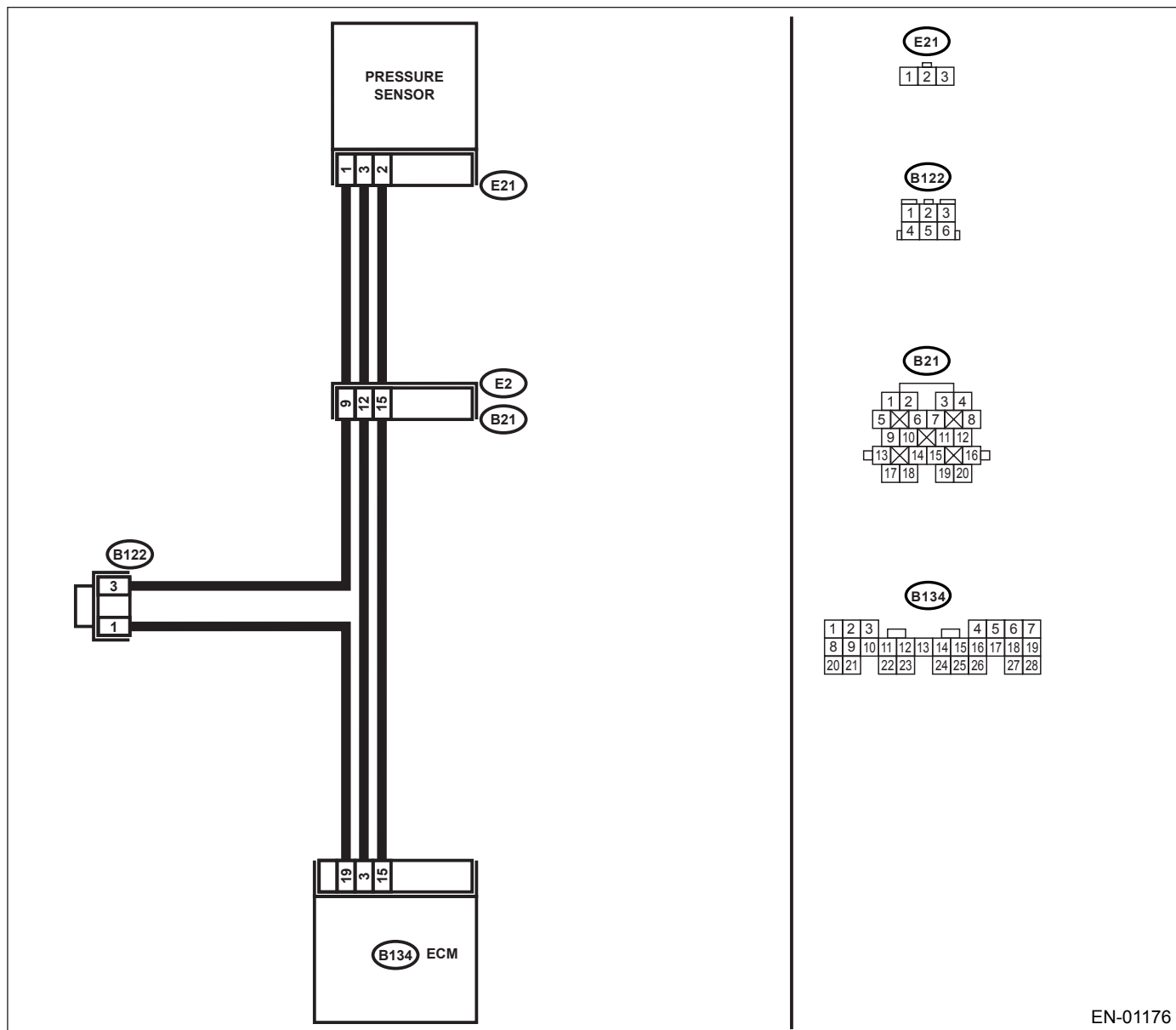
K: DTC P0108 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01176

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	119.5 kPa (896.5 mmHg, 35.29 inHg)	Go to step 10.	Go to step 2.
2 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 4.	Go to step 3.
3 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	4.5 V	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 15 (+) — Chassis ground (-): Is the measured value less than the specified value?	0.2 V	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of atmospheric absolute pressure signal using Subaru Select Monitor. Does the measured value exceed the specified value by shaking the ECM harness and connector? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.>	13.3 kPa (100 mmHg, 3.94 inHg)	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from pressure sensor. 3)Turn ignition switch to ON. 4)Measure the voltage between pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 7.	Repair open circuit in harness between ECM and pressure sensor connector.
7 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from ECM. 3)Measure the resistance of harness between ECM and pressure sensor connector. Connector & terminal (B134) No. 15 — (E21) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair open circuit in harness between ECM and pressure sensor connector.
8 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. Measure the resistance of harness between ECM and pressure sensor connector. Connector & terminal (B134) No. 19 — (E21) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 9.	Repair open circuit in harness between ECM and pressure sensor connector.
9 CHECK FOR POOR CONTACT. Check for poor contact in pressure sensor connector. Is there poor contact in pressure sensor connector?	There is poor contact.	Repair poor contact in pressure sensor connector.	Replace the pressure sensor. <Ref. to FU(H4SO)-34, Pressure Sensor.>
10 CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR. 1)Turn ignition switch to OFF and Subaru Select Monitor or the OBD-II general scan tool switch to OFF. 2)Disconnect the connector from pressure sensor. 3)Turn ignition switch to ON and the Subaru Select Monitor or OBD-II general scan tool switch to ON. 4)Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subary Select Monitor For detailed operation procedures, refer to to “READ CURENT DATA FOR ENGINE”. <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	119.5 kPa (896.5 mmHg, 35.29 inHg)	Repair short circuit to battery in harness between ECM and pressure sensor connector.	Replace the pressure sensor. <Ref. to FU(H4SO)-34, Pressure Sensor.>

L: DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE PROBLEM —

• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

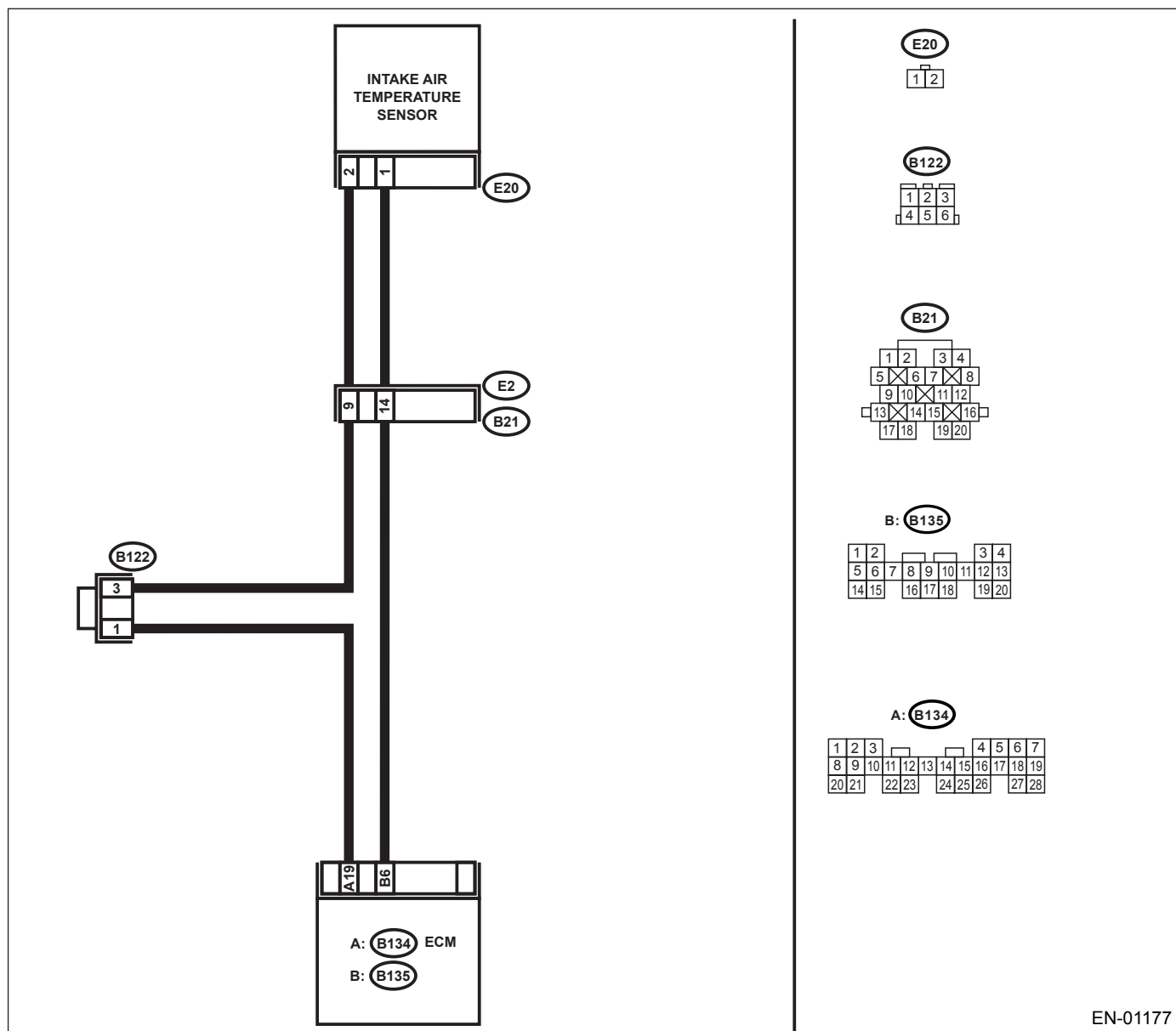
• **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4SO)-75, List of Diagnostic Trou- ble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0111.	Replace intake air temperature sen- sor .<Ref. to FU(H4SO)-35, Intake Air Temper- ature Sensor.>

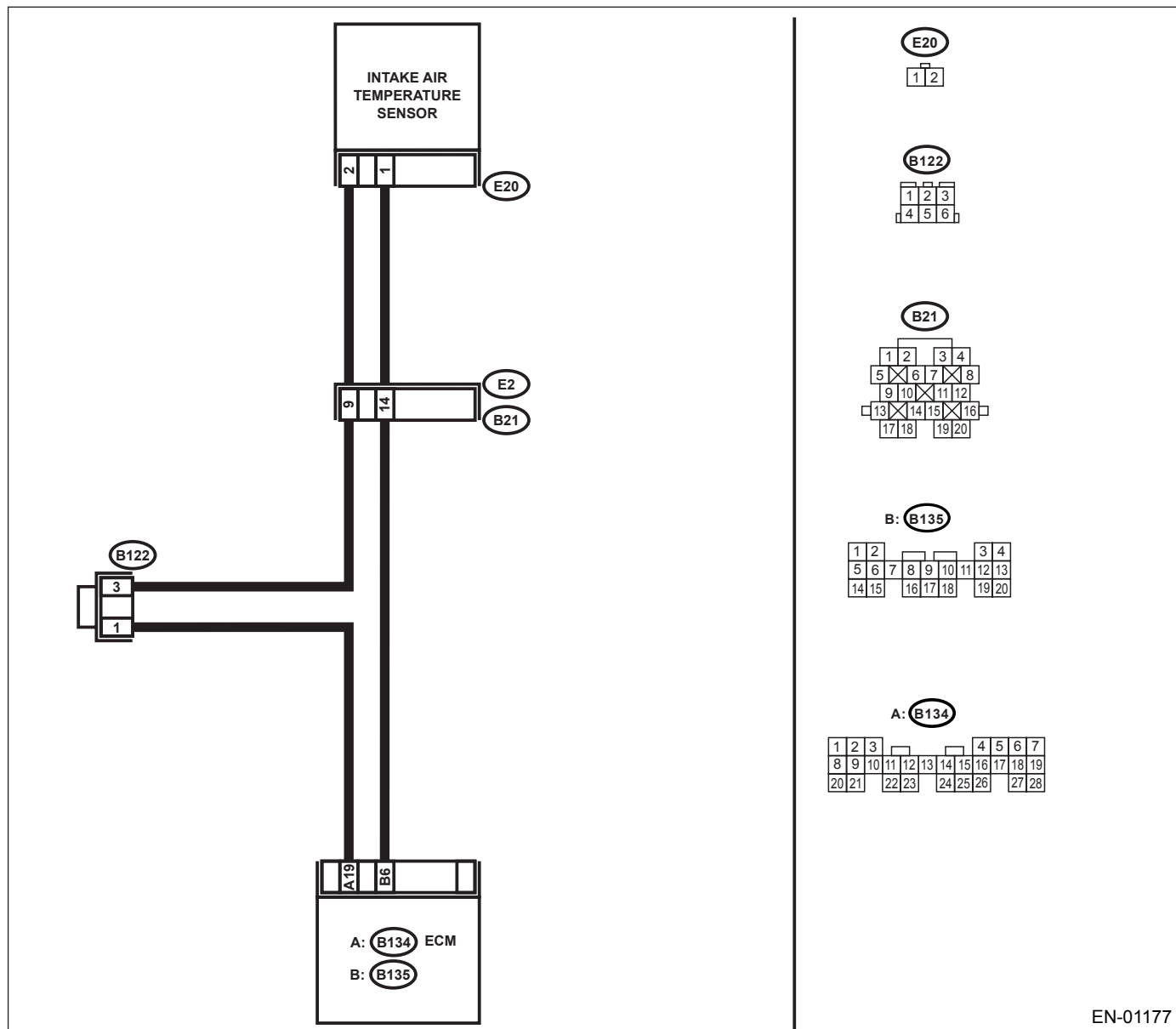
M: DTC P0112 — INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01177

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	120°C (248°F)	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from intake air temperature sensor. 3)Turn ignition switch to ON. 4)Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Replace the intake air temperature sensor. <Ref. to FU(H4SO)-35, Intake Air Temperature Sensor.>	Repair short circuit to ground in harness between intake air temperature sensor and ECM connector.

ENGINE (DIAGNOSTICS)

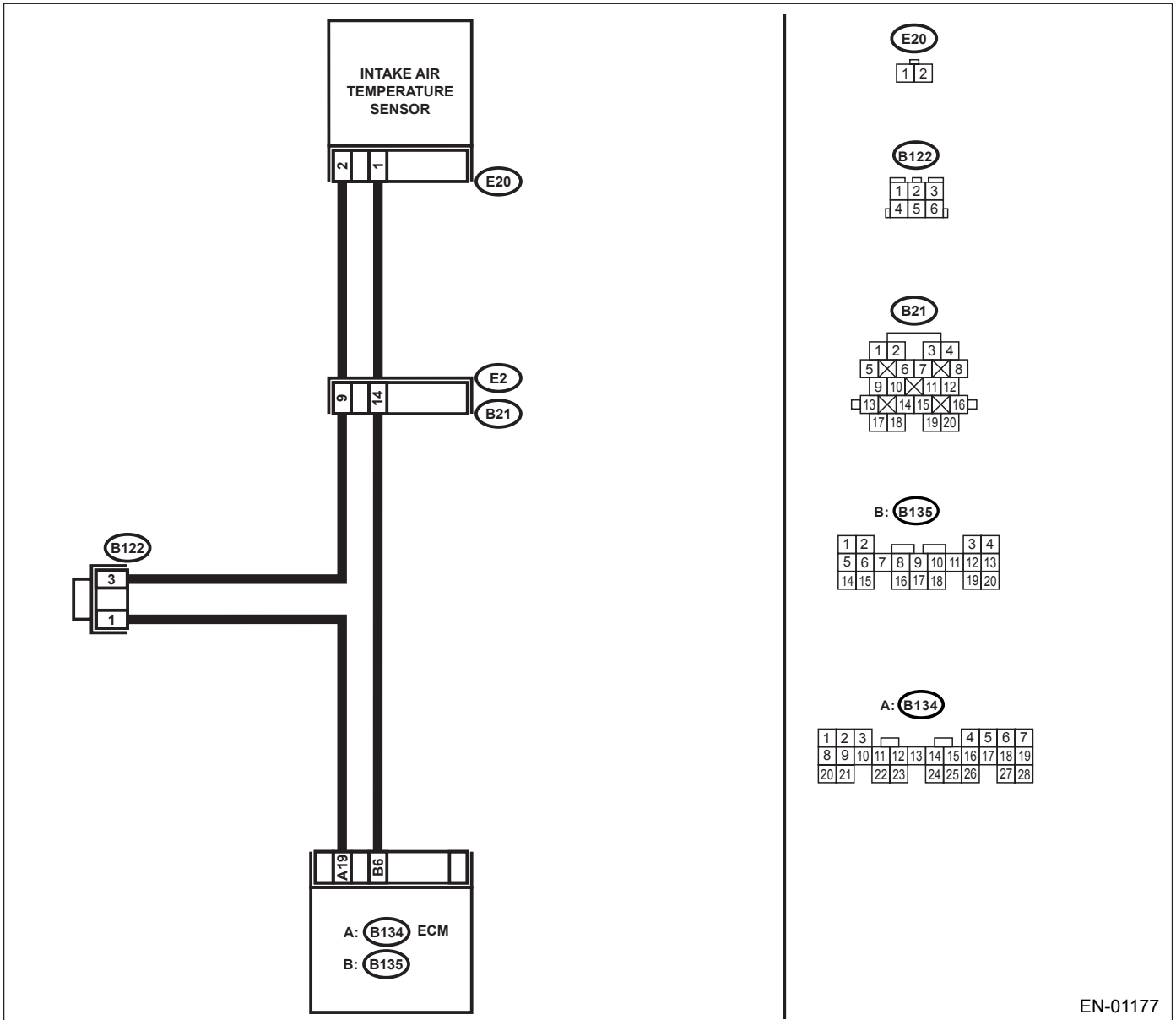
N: DTC P0113 — INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value less than the specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from intake air temperature sensor. 3) Measure the voltage between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between intake air temperature sensor and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure the voltage between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between intake air temperature sensor and ECM connector.	Go to step 4.
4 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value?	3 V	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between intake air temperature sensor and ECM connector • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance of harness between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Replace the intake air temperature sensor. <Ref. to FU(H4SO)-35, Intake Air Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between intake air temperature sensor and ECM connector • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

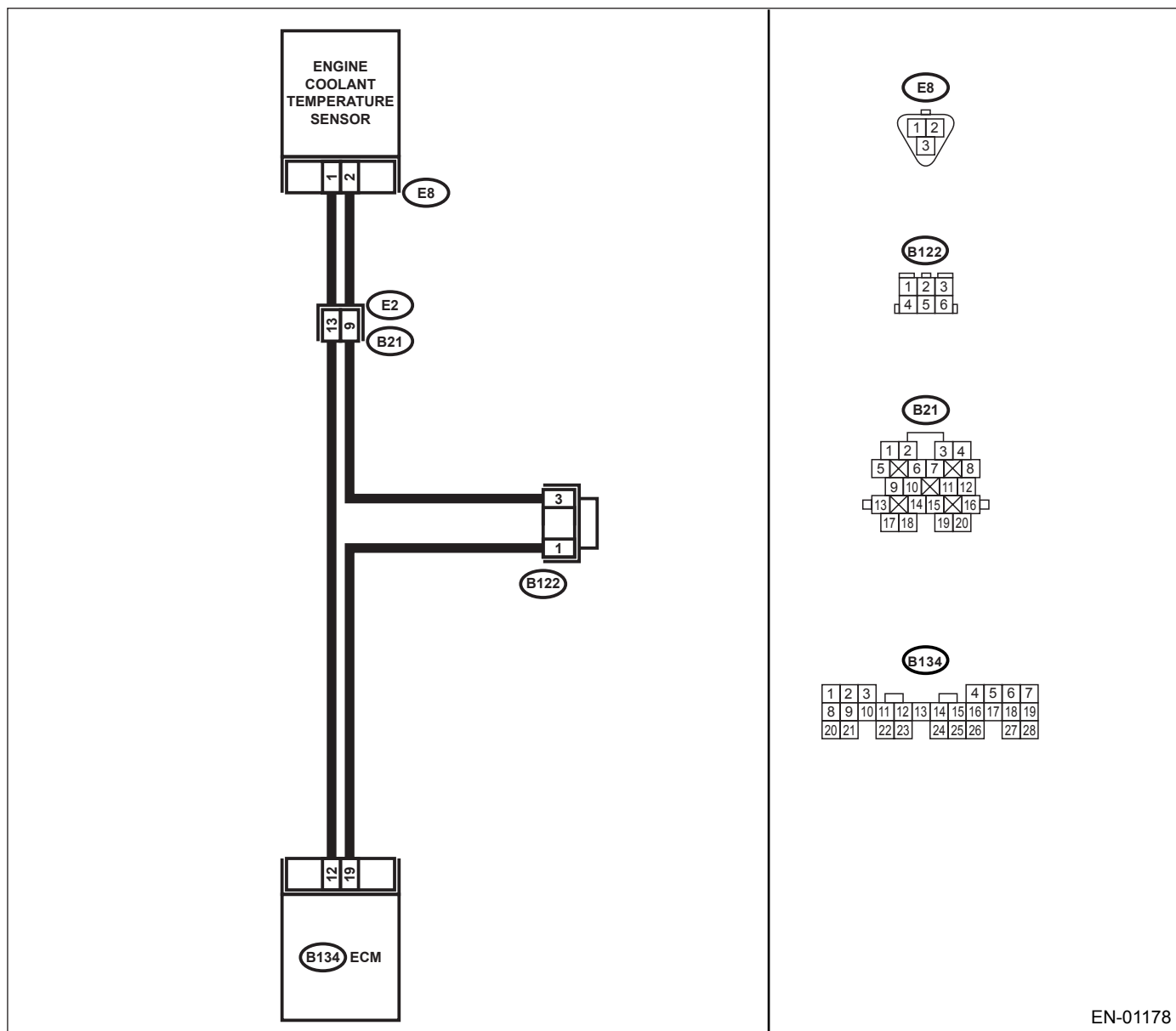
O: DTC P0117 — ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Hard to start
 - Erroneous idling
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01178

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	150 °C (302°F)	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from engine coolant temperature sensor. 3)Turn ignition switch to ON. 4)Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>	Repair short circuit to ground in harness between engine coolant temperature sensor and ECM connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

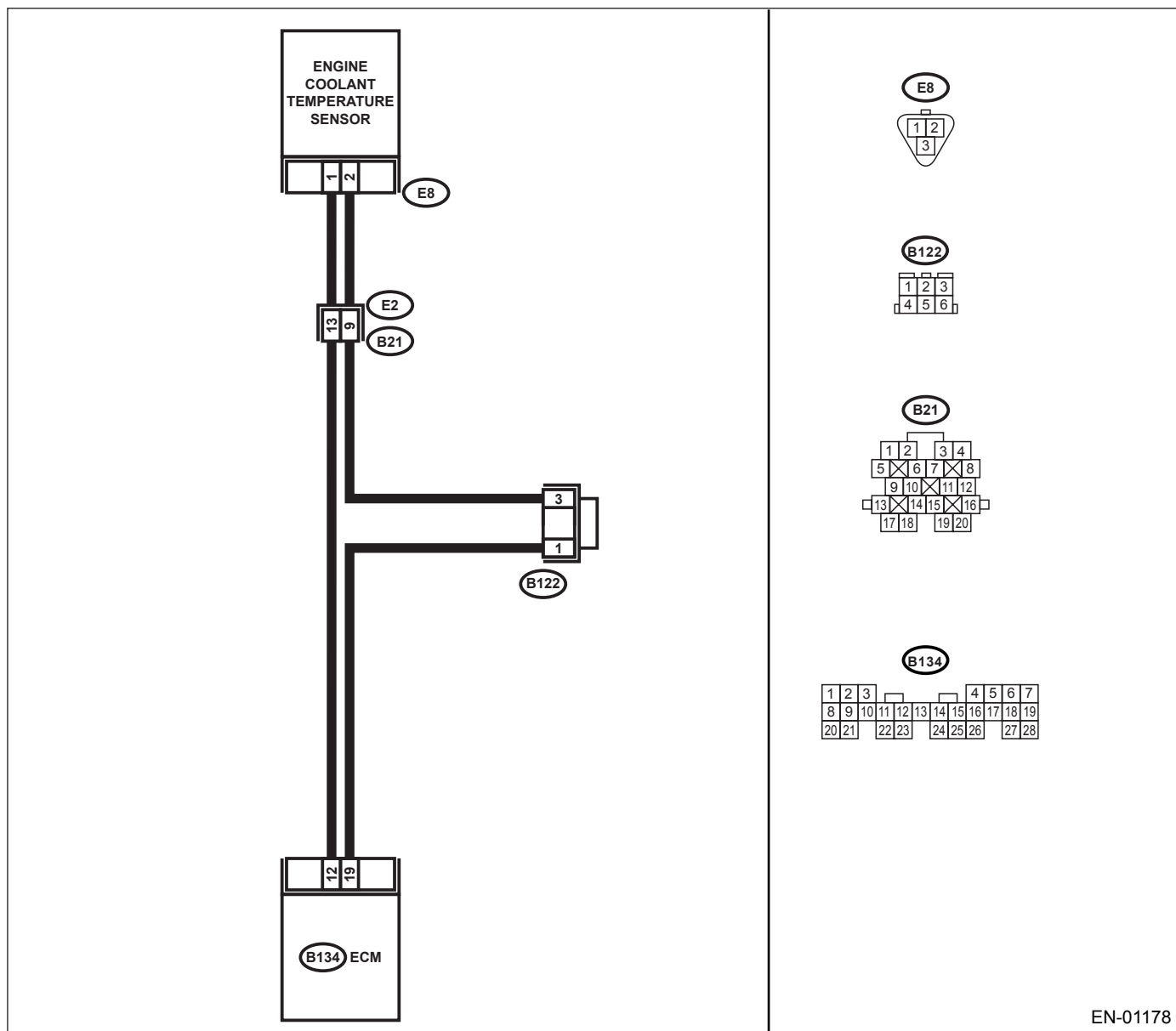
P: DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Hard to start
 - Erroneous idling
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01178

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from engine coolant temperature sensor. 3)Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and engine coolant temperature sensor connector.	Go to step 3.
3 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to ON. 2)Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and engine coolant temperature sensor connector.	Go to step 4.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
4 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (–): Is the measured value more than the specified value?	4 V	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
5 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance of harness between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

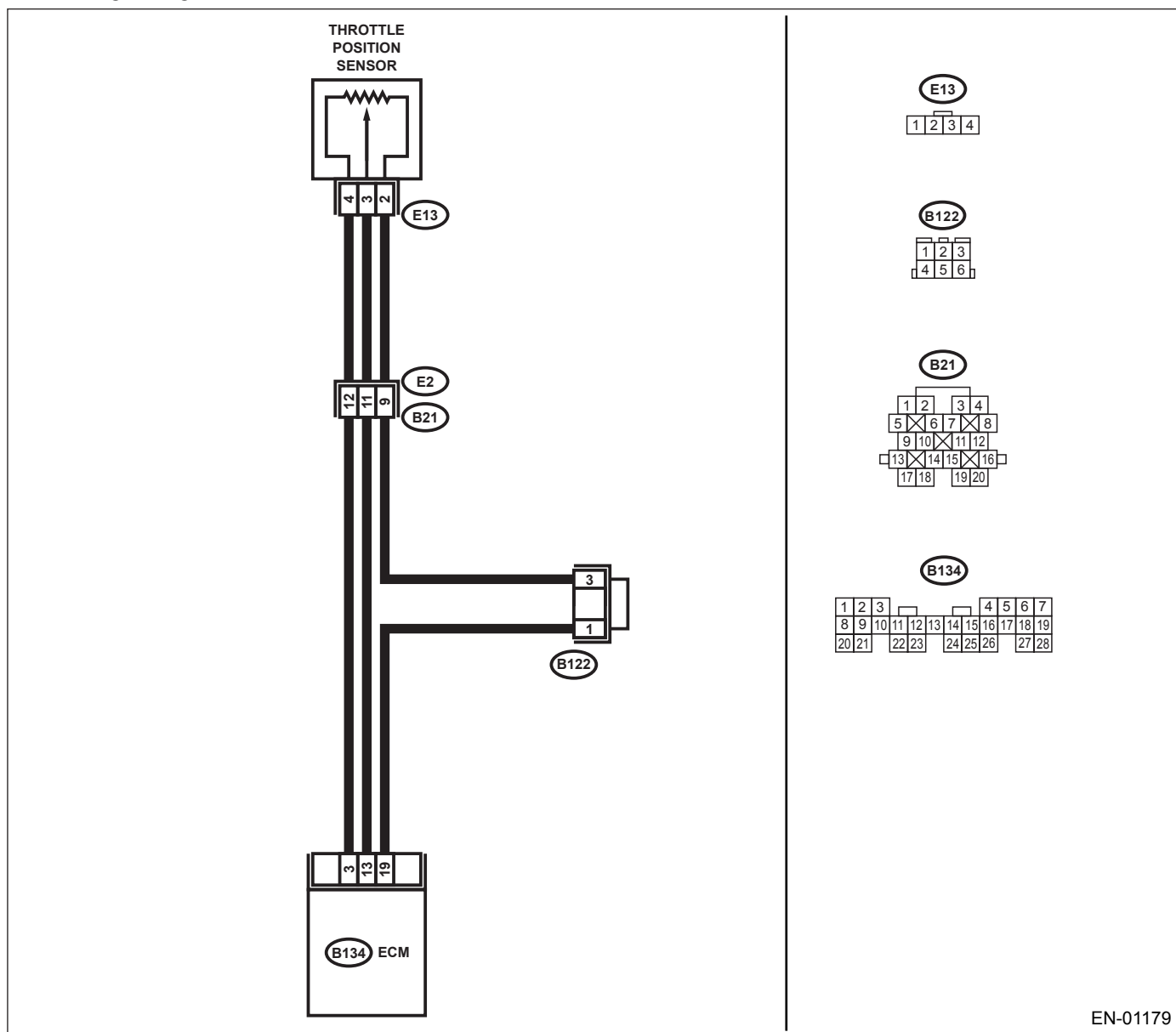
Q: DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC P0122 or P0123 using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0121.	Replace the throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

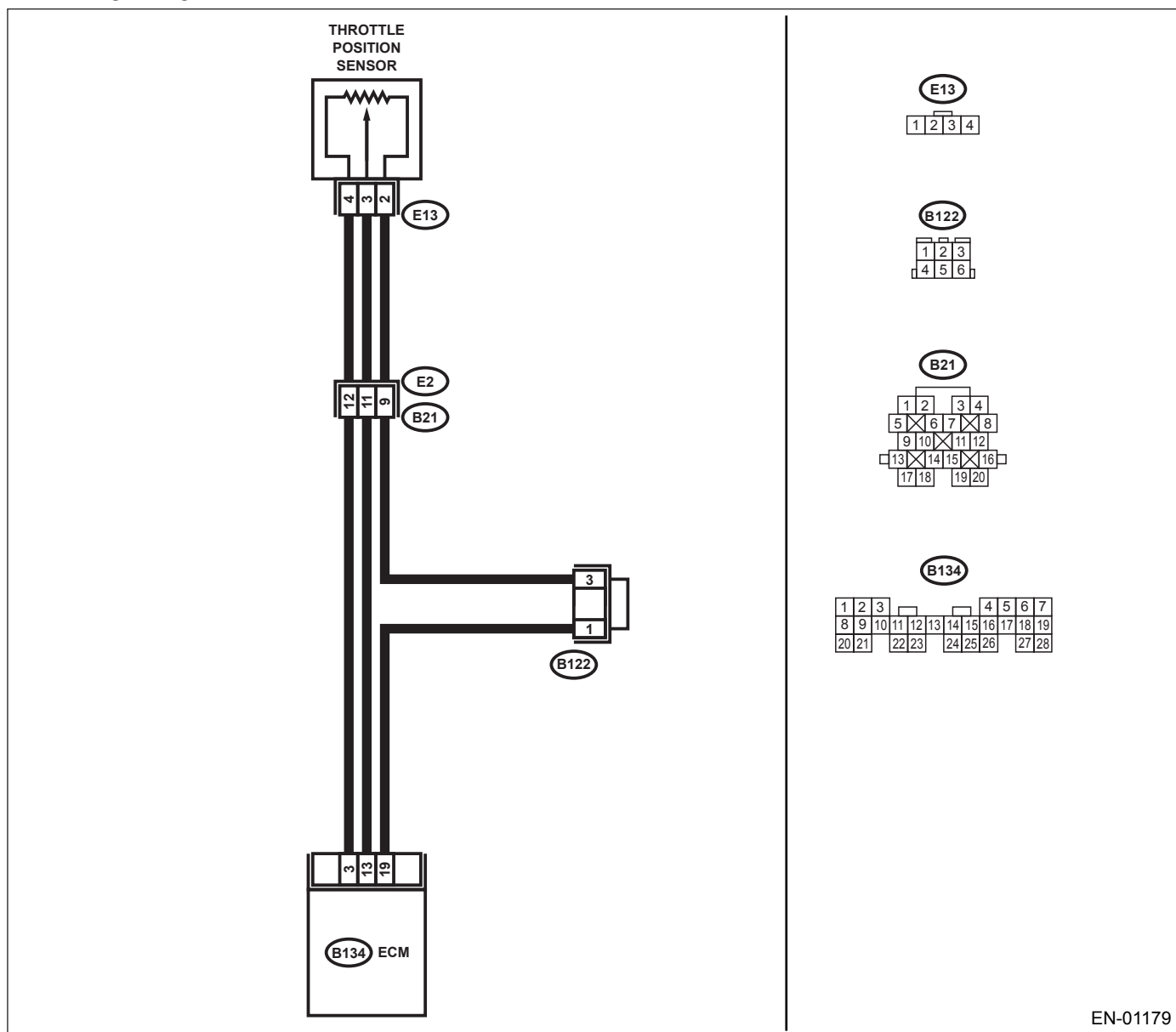
R: DTC P0122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	0.1 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground while throttle valve is fully closed. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 4.	Go to step 3.
3 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	4.5 V	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 13 (+) — Chassis ground (-): Is the measured value less than the specified value?	0.1 V	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 13 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	0.1 V	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from throttle position sensor. 3) Turn ignition switch to ON. 4) Measure the voltage between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 4 (+) — Engine ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
7 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance of harness between ECM connector and throttle position sensor connector. Connector & terminal (B134) No. 13 — (E13) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in ECM connector • Poor contact in throttle position sensor connector • Poor contact in coupling connector
8 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. Measure the resistance of harness between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 3 — Engine ground: Is the measured value more than the specified value?	1 M Ω	Go to step 9.	Repair short circuit to ground in harness between throttle position sensor and ECM connector.
9 CHECK FOR POOR CONTACT. Check for poor contact in throttle position sensor connector. Is there poor contact in throttle position sensor connector?	There is poor contact.	Repair poor contact in throttle position sensor connector.	Replace the throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

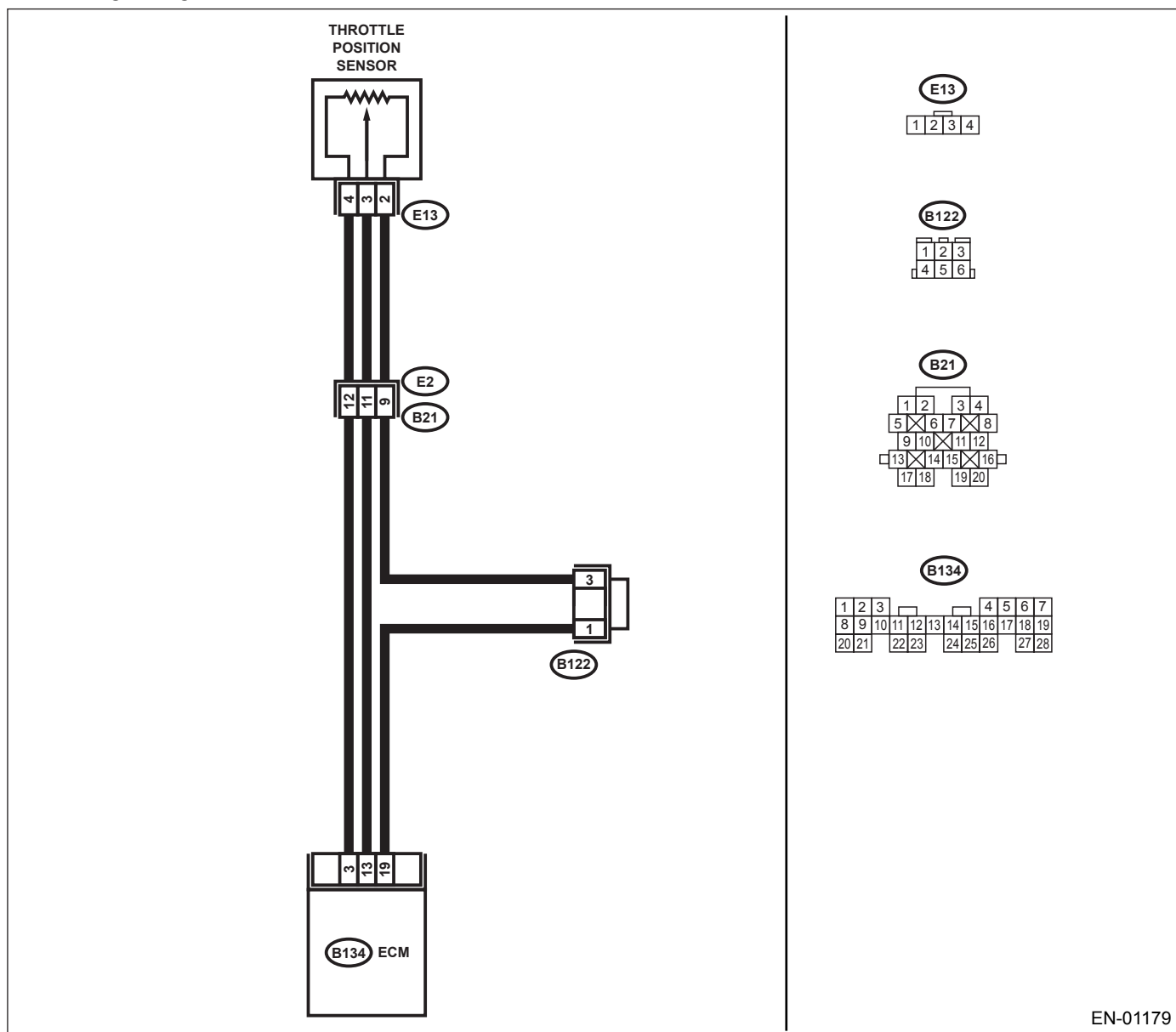
S: DTC P0123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.
 - Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01179

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	4.9 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connectors from throttle position sensor. 3)Measure the resistance of harness between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in coupling connector • Poor contact in joint connector
3 CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to ON. 2)Measure the voltage between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 3 (+) — Engine ground (-): Is the measured value more than the specified value?	4.9 V	Repair short circuit to battery in harness between throttle position sensor and ECM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Replace the throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

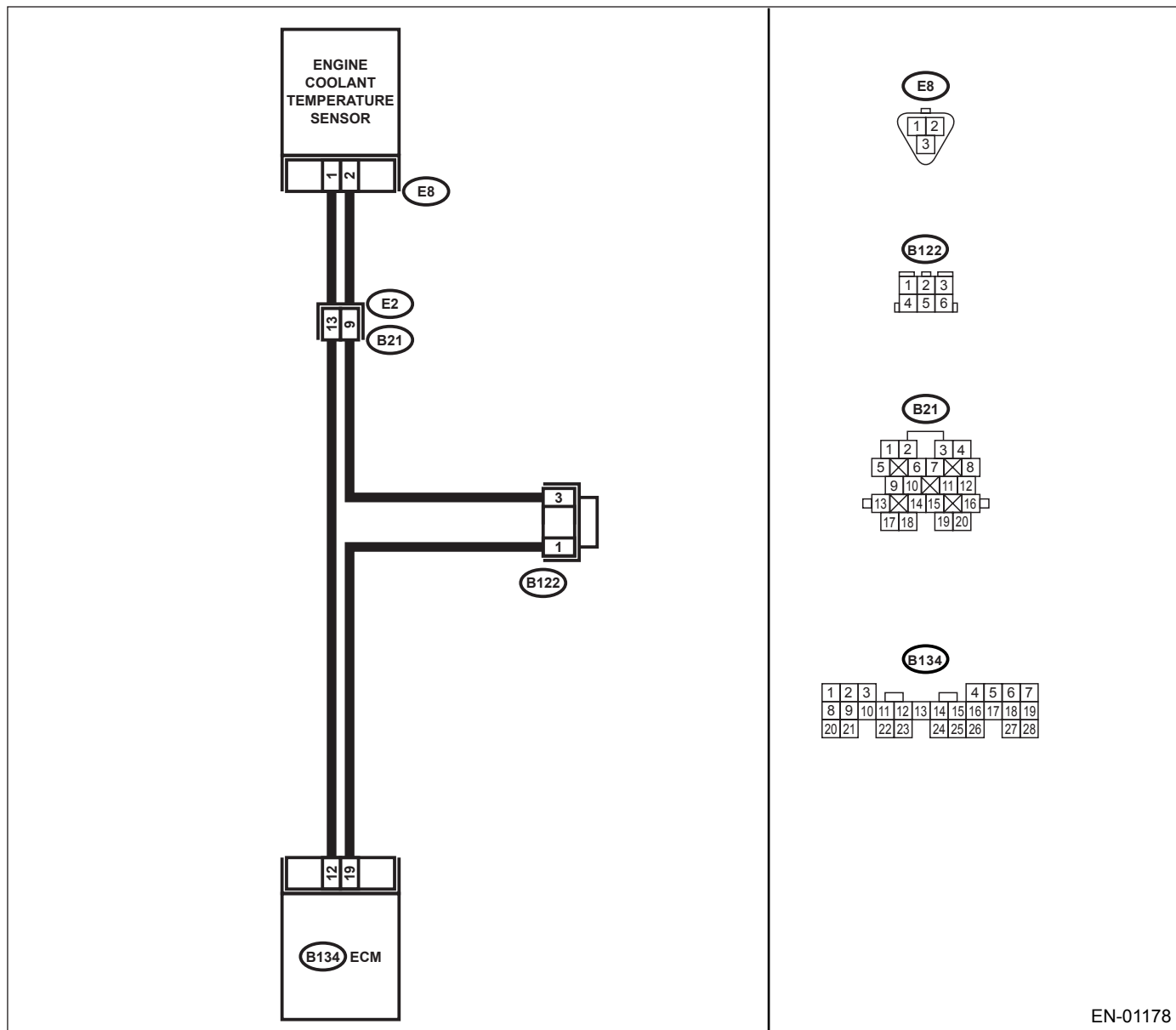
T: DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Engine would not return to idling.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01178

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0125.	Go to step 2.
2 CHECK THERMOSTAT. Does the thermostat remain open?	Remains open.	Replace the thermostat. <Ref. to CO(H4SO)-36, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

U: DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Thermostat remains open.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK VEHICLE CONDITION. Was the vehicle driven or idled with the engine partially submerged under water?	Vehicle was driven or idled with part of engine submerged under water.	In this case, it is not necessary to inspect DTC P0128.	Go to step 2.
2 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 3.
3 CHECK ENGINE COOLANT. Are coolant level and mixture ratio of cooling water to anti-freeze solution correct?	Level and mixture ratio are correct.	Go to step 4.	Replace the engine coolant. <Ref. to CO(H4SO)-29, REPLACEMENT, Engine Coolant.>
4 CHECK RADIATOR FAN. 1)Start the engine. 2)Check radiator fan operation. Does the radiator fan continuously rotate for more than 3 minutes during idling?	Radiator fan rotates.	Repair radiator fan circuit. <Ref. to CO(H4SO)-47, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-49, Radiator Sub Fan and Fan Motor.>.	Replace the thermostat. <Ref. to CO(H4SO)-36, Thermostat.>

V: DTC P0129 — BAROMETRIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step		Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	DTC is indicated.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Replace the ECM.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

W:DTC P0130 — O₂ SENSOR CIRCUIT (BANK 1 SENSOR 1) —

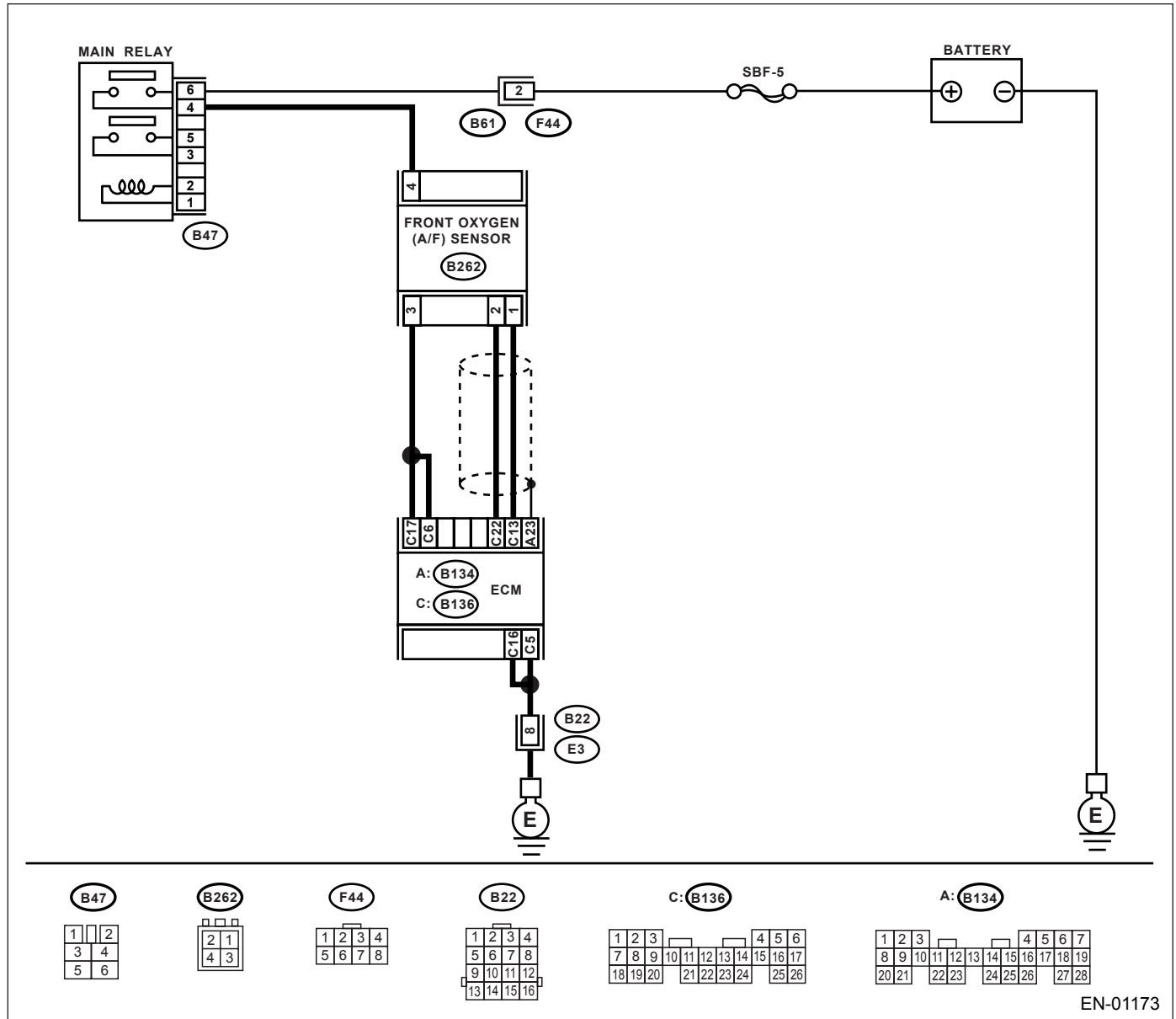
- DTC DETECTING CONDITION:

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1)Start the engine. 2)While observing the Subaru Select Monitor or OBD-II general scan tool screen, warm-up the engine until coolant temperature is above 70°C (160°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3)Read the data of front oxygen (A/F) sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	0.85 — 1.15	Go to step 3.	Go to step 4.
3 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1)Race up the engine from idling to 5,000 rpm for a total of 5 cycles. 2)Read the data of front oxygen (A/F) sensor signal using Subaru Select Monitor or OBD-II general scan tool during engine racing. Is the measured value more than the specified value? NOTE: •In normal condition, A/F is rich during engine racing. •To increase engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approximately 5 seconds, and quickly release accelerator pedal to decrease engine speed.	1.1 V	Go to step 6.	Go to step 4.
4 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3)Measure the resistance between ECM and front oxygen (A/F) sensor. Is the measured value less than the specified value? Connector & terminal (B136) No. 13 — (B262) No. 1: (B136) No. 22 — (B262) No. 2:	5 Ω	Go to step 5.	Repair open circuit between ECM and front oxygen (A/F) sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. Measure the resistance between ECM and chassis ground. Is the measured value more than the specified value? Connector & terminal (B136) No. 13 (+) — Chassis ground: (B136) No. 22 — Chassis ground:	1 MΩ	Go to step 6.	Repair short circuit to ground between ECM and front oxygen (A/F) sensor.
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. Is there a fault in exhaust system? NOTE: Check the following items. •Loose installation of portions •Damage (crack, hole etc.) of parts •Looseness of front oxygen (A/F) sensor •Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	There is a fault.	Repair or replace faulty parts.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

X: DTC P0131 — O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —

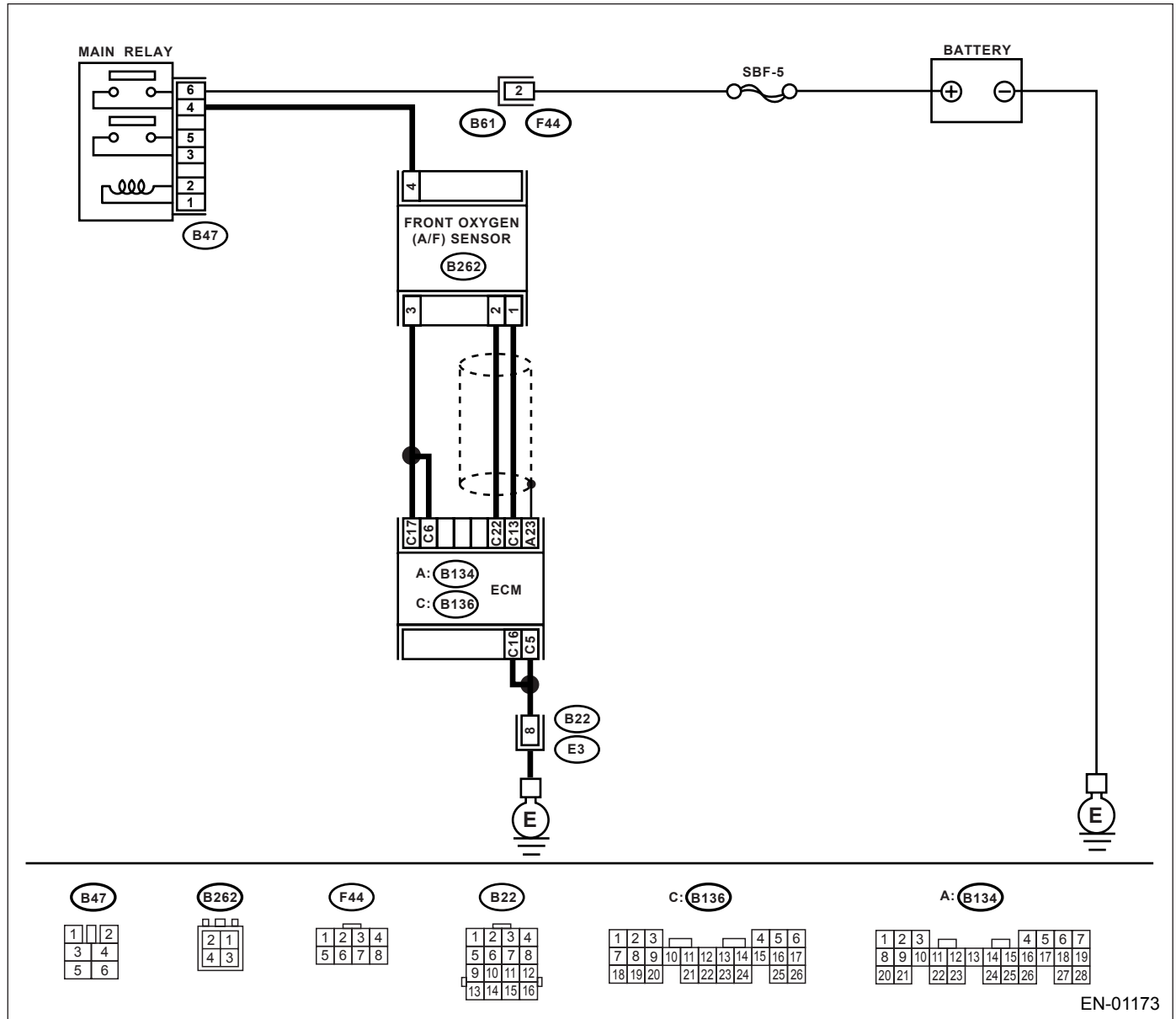
• DTC DETECTING CONDITION:

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 13 — Chassis ground: (B136) No. 22 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>	Repair the short circuit to ground in harness between ECM and front oxygen (A/F) sensor connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Y: DTC P0132 — O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —

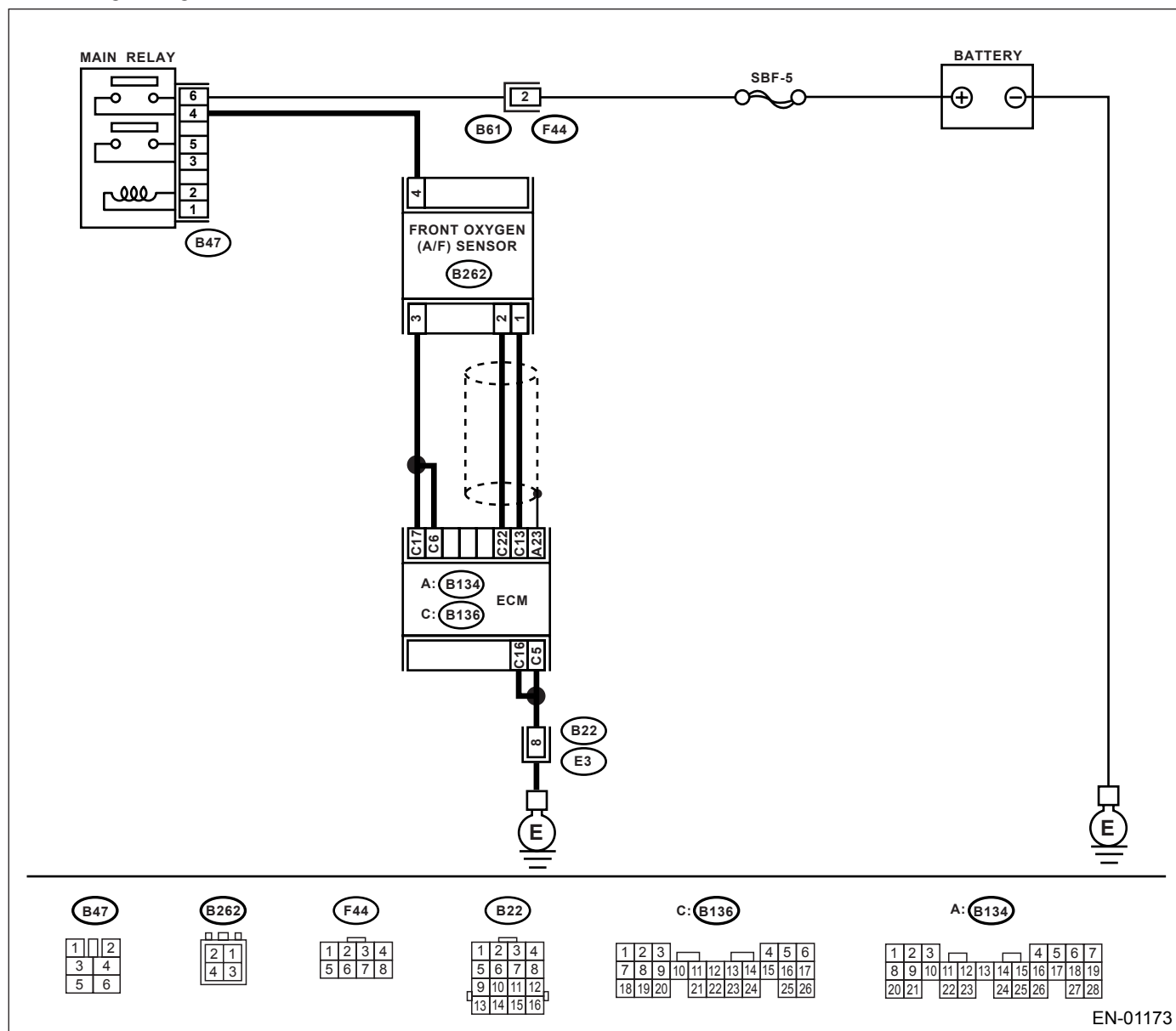
• DTC DETECTING CONDITION:

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn ignition switch to ON. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Measure the voltage of harness between ECM connector and chassis ground. Is the measured value more than the specified value? Connector & terminal (B136) No. 13 (+) — Chassis ground (–): (B136) No. 22 (+) — Chassis ground (–):	8 V	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>	Repair the short circuit to battery in harness between ECM and front oxygen (A/F) sensor connector.

Z: DTC P0133 — O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

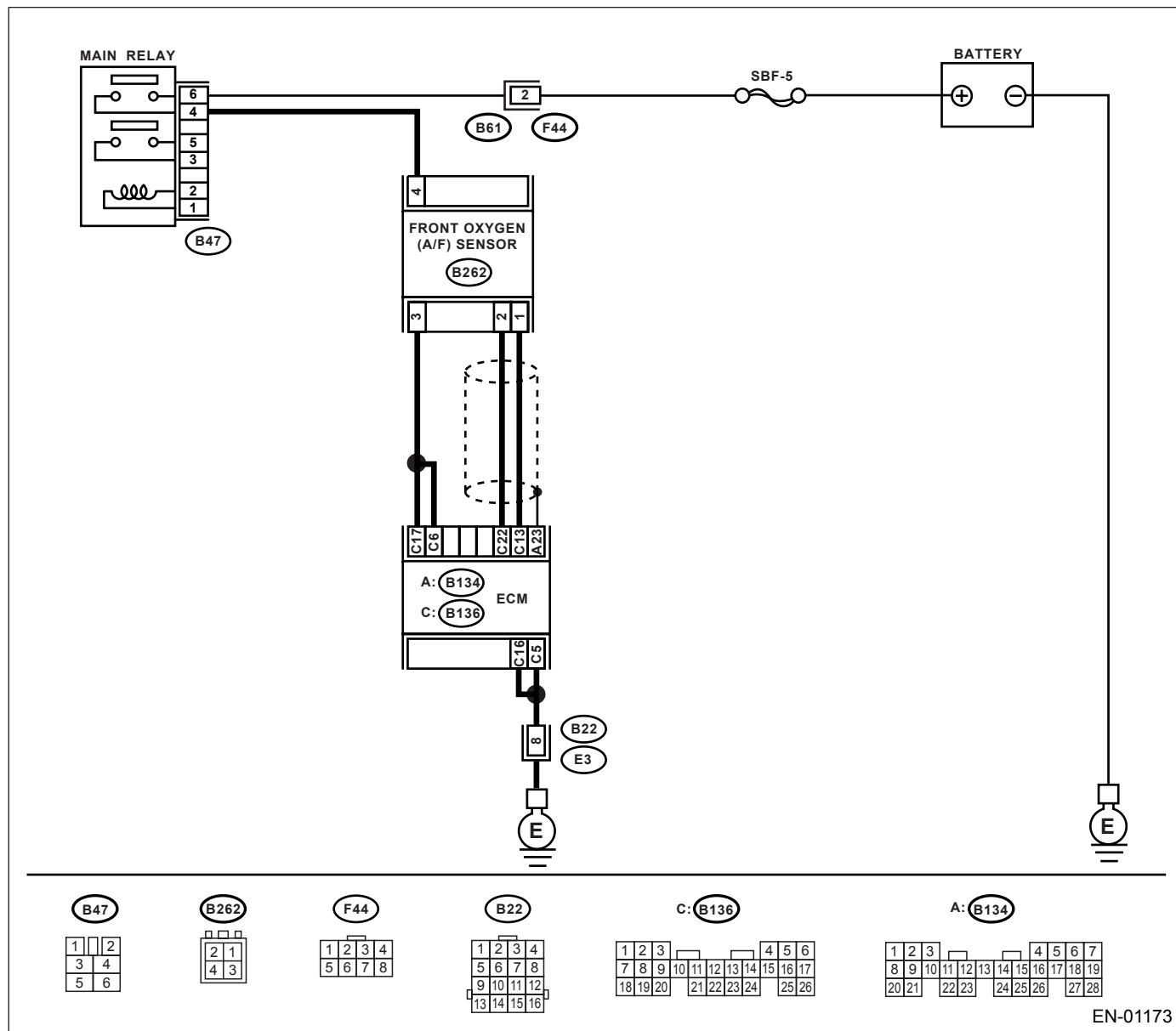
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0133.	Go to step 2.
2 CHECK EXHAUST SYSTEM. Is there a fault in exhaust system? NOTE: Check the following items. •Loose installation of front portion of exhaust pipe onto cylinder heads •Loose connection between front exhaust pipe and front catalytic converter •Damage of exhaust pipe resulting in a hole	There is a fault.	Repair exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

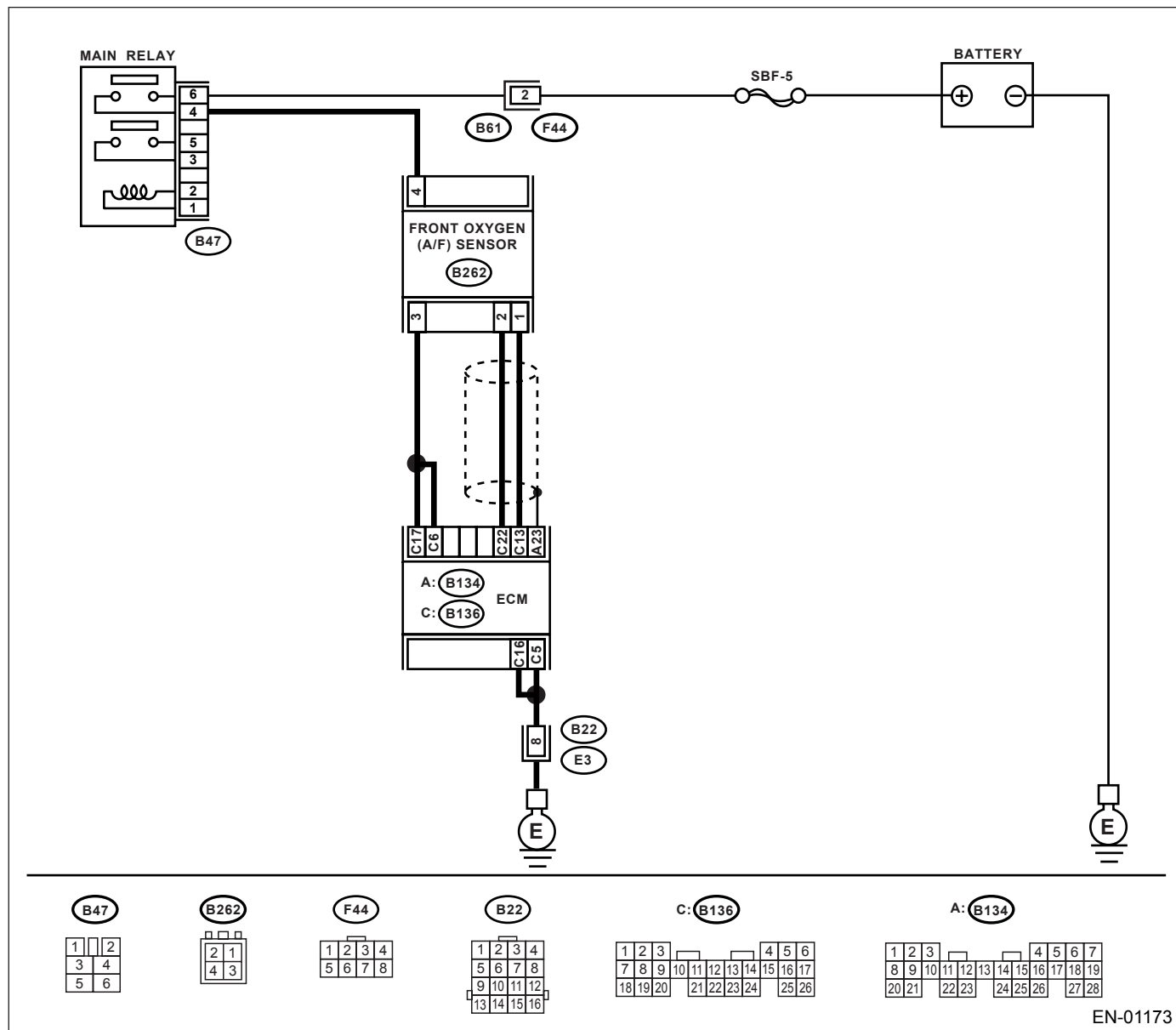
AA:DTC P0134 — O₂ SENSOR CIRCUIT OPEN (BANK 1 SENSOR 1) —

- DTC DETECTING CONDITION:
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 13 — (B262) No. 1: (B136) No. 22 — (B262) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector
2 CHECK FOR POOR CONTACT. Check for poor contact in front oxygen (A/F) sensor connector. Is there poor contact in front oxygen (A/F) sensor connector?	There is poor contact.	Repair poor contact in front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

AB:DTC P0137 — O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —

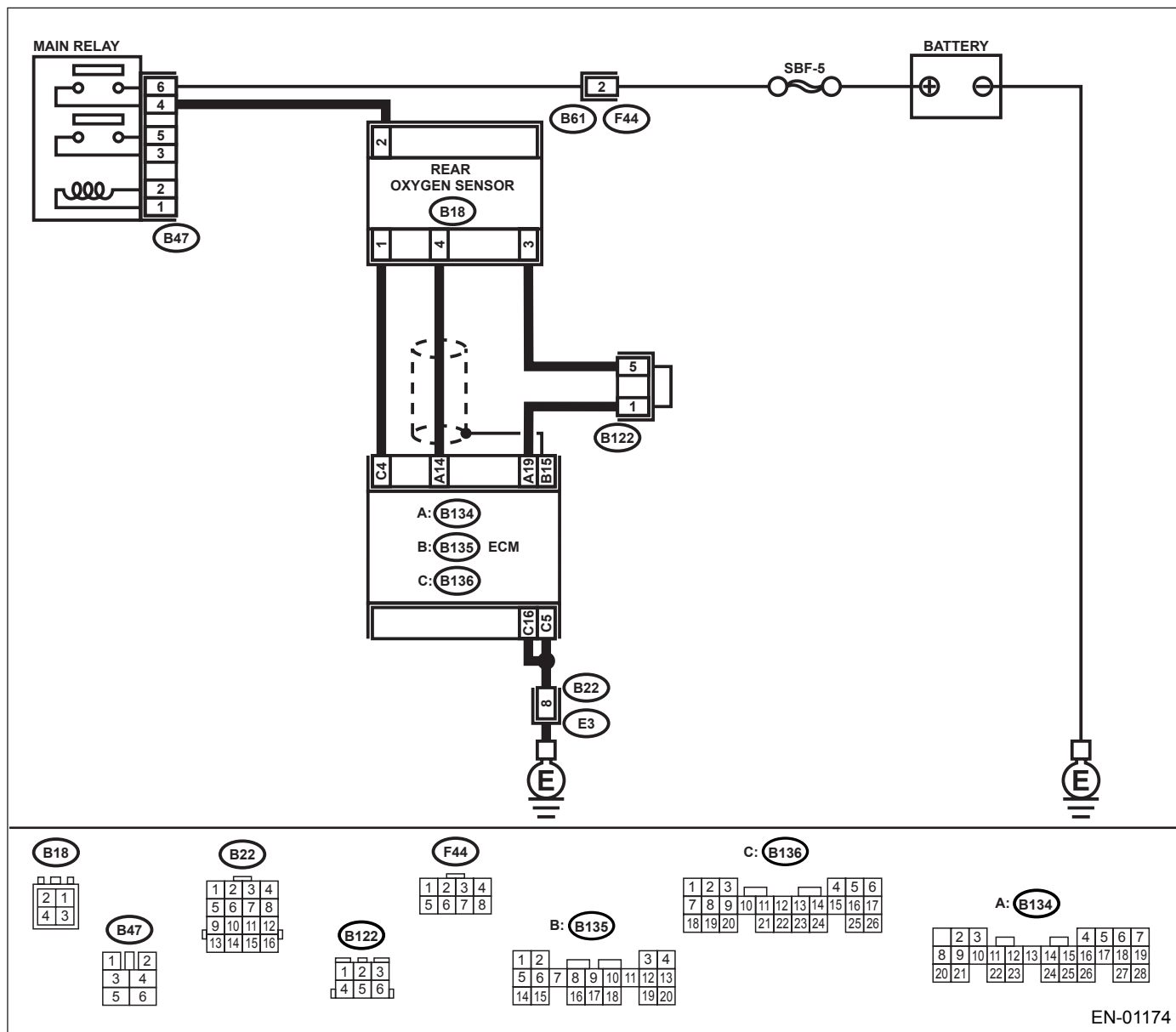
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0137.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value same as specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	490 mV	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B134) No. 14 — (B18) No. 4: (B134) No. 19 — (B18) No. 3: Is the measured value more than the specified value?	3 Ω	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (E18) No. 4 (+) — Engine ground (-): Is the measured value within the specified range?	0.2 — 0.5 V	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

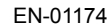
Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. Is there a fault in exhaust system? NOTE: Check the following items. •Loose installation of portions •Damage (crack, hole etc.) of parts •Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	There is a fault.	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

ENGINE (DIAGNOSTICS)

- **DTC DETECTING CONDITION:**

- CAUTION:**

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0138.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and then release the accelerator pedal suddenly from 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value same as the specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	250 mV	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B134) No. 14 — (B18) No. 4: (B134) No. 19 — (B18) No. 3: Is the measured value more than the specified value?	3 Ω	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (B18) No. 4 (+) — Engine ground (-): Is the measured value more than the specified value?	0.2 — 0.5 V	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. Is there a fault in exhaust system? NOTE: Check the following items. •Loose installation of portions •Damage (crack, hole etc.) of parts •Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	There is a fault.	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

AD:DTC P0139 — O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

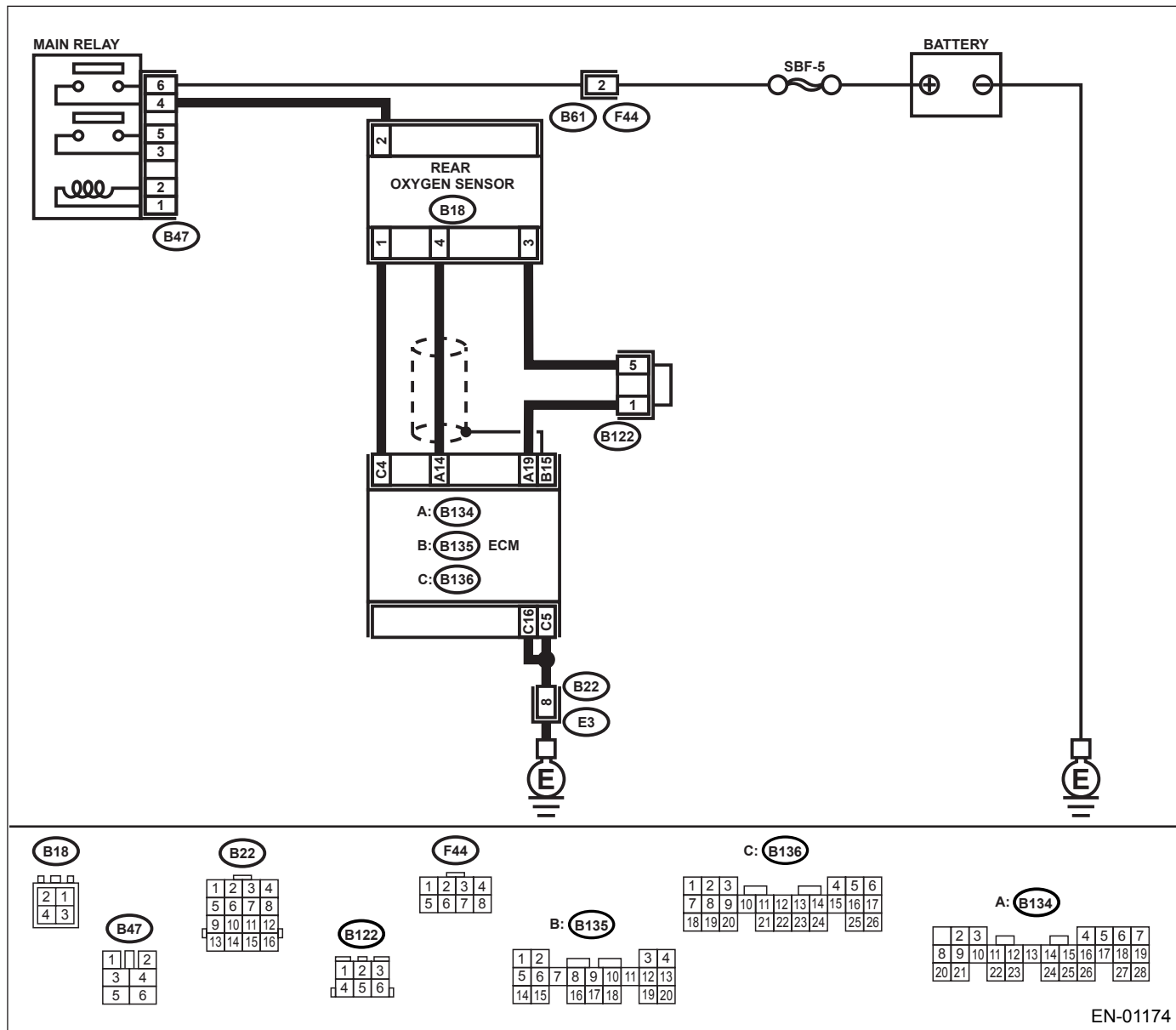
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01174

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0139.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

AE:DTC P0171 — SYSTEM TOO LEAN (BANK 1) —

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4SO)-160, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

AF:DTC P0172 — SYSTEM TOO RICH (BANK 1) —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

• TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK EXHAUST SYSTEM. Are there holes or loose bolts on exhaust system?	There are holes or loose bolts.	Repair exhaust system.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. Are there holes, loose bolts or disconnection of hose on air intake system?	There are holes, loose bolts or disconnection of hose.	Repair air intake system.	Go to step 3.
3 CHECK PURGE CONTROL SOLENOID VALVE AND PRESSURE CONTROL VALVE. Is there a fault in purge control solenoid valve and pressure control solenoid valve?	There is a fault in purge control solenoid valve and pressure control solenoid valve.	Replace the purge control solenoid valve and pressure control solenoid valve.	Go to step 4.
4 CHECK FUEL PRESSURE. Warning: •Place “NO FIRE” signs near the working area. •Be careful not to spill fuel on the floor. 1)Release the fuel pressure. (1) Disconnect the connector from fuel pump relay. (2) Start the engine and run it until it stalls. (3) After the engine stalls, crank it for five more seconds. (4) Turn ignition switch to OFF. 2)Connect the connector to fuel pump relay. 3)Disconnect the fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4)Install the fuel filler cap. 5)Start the engine and idle while gear position is neutral. 6)Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. Is the measured value within the specified range? Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	284 — 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)	Go to step 5.	Repair the following items. Fuel pressure too high: • Clogged fuel return line or bent hose Fuel pressure too low: • Improper fuel pump discharge • Clogged fuel supply line

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK FUEL PRESSURE. After connecting the pressure regulator vacuum hose, measure fuel pressure. Is the measured value within the specified range? Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: •If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. •If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose.	206 — 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)	Go to step 6.	Repair the following items. Fuel pressure too high: - Faulty pressure regulator - Clogged fuel return line or bent hose Fuel pressure too low: - Faulty pressure regulator - Improper fuel pump discharge - Clogged fuel supply line
6 CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1)Start the engine and warm it up completely. 2)Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	70°C (158°F) — 100°C (212°F)	Go to step 7.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>
7 CHECK PRESSURE SENSOR SIGNAL. 1)Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2)Place the selector lever in "N" or "P" position. 3)Turn the A/C switch to OFF. 4)All accessory switches OFF. 5)Read the data of pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Idling: 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg), Ignition ON: 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the pressure sensor. <Ref. to FU(H4SO)-34, Pressure Sensor.>

AG:DTC P0181 — FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE PROBLEM —

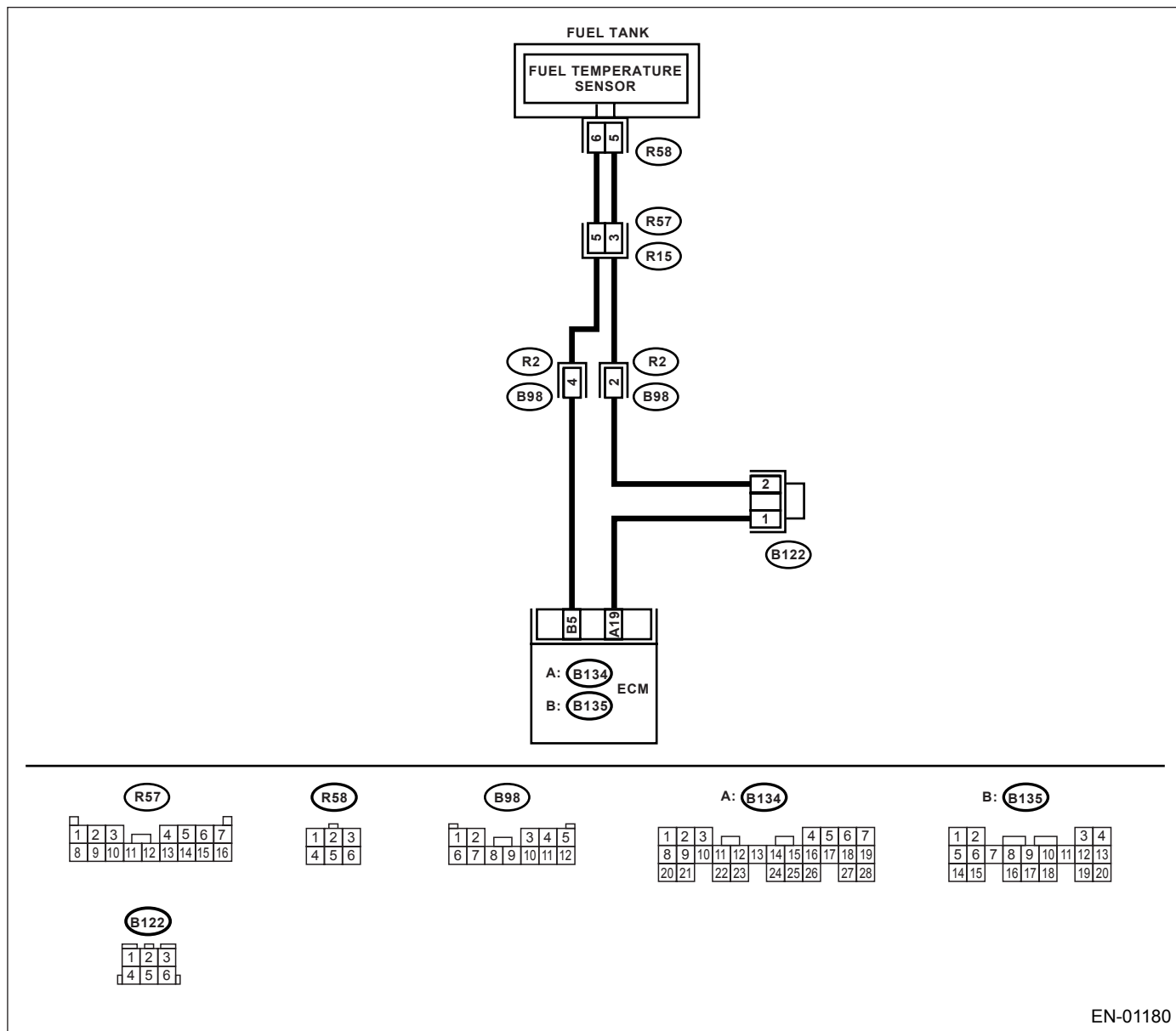
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01180

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4SO)-75, List of Diagnostic Trou- ble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0181.	Replace the fuel temperature sen- sor. <Ref. to EC(H4SO)-8, Fuel Temperature Sen- sor.>

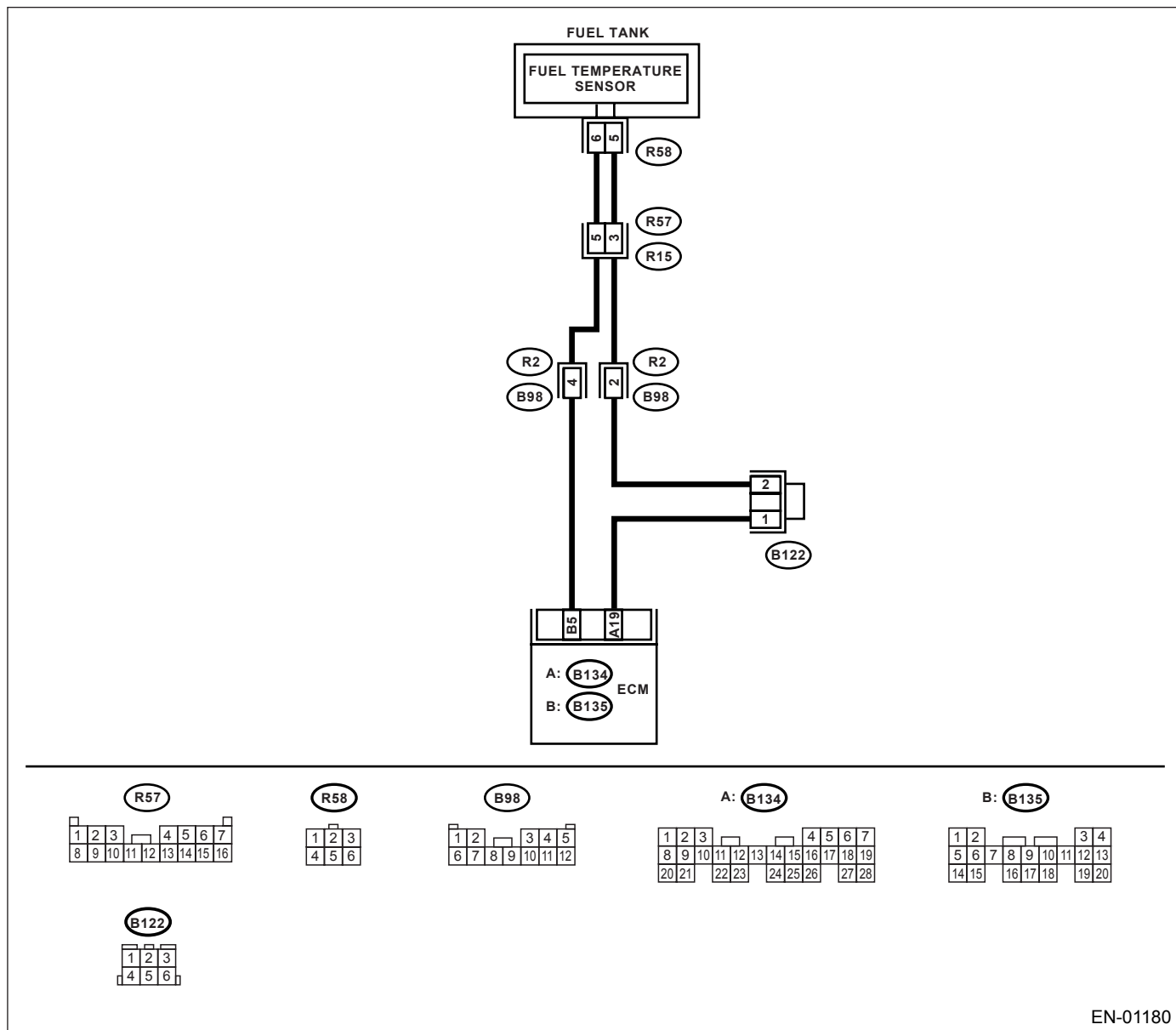
AH:DTC P0182 — FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1)Start the engine. 2)Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	150°C (302°F)	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment.
2 CHECK CURRENT DATA. 1)Turn ignition switch to OFF. 2)Remove the access hole lid. 3)Disconnect the connector from fuel pump. 4)Turn ignition switch to ON. 5)Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair short circuit to ground in harness between fuel pump and ECM connector.

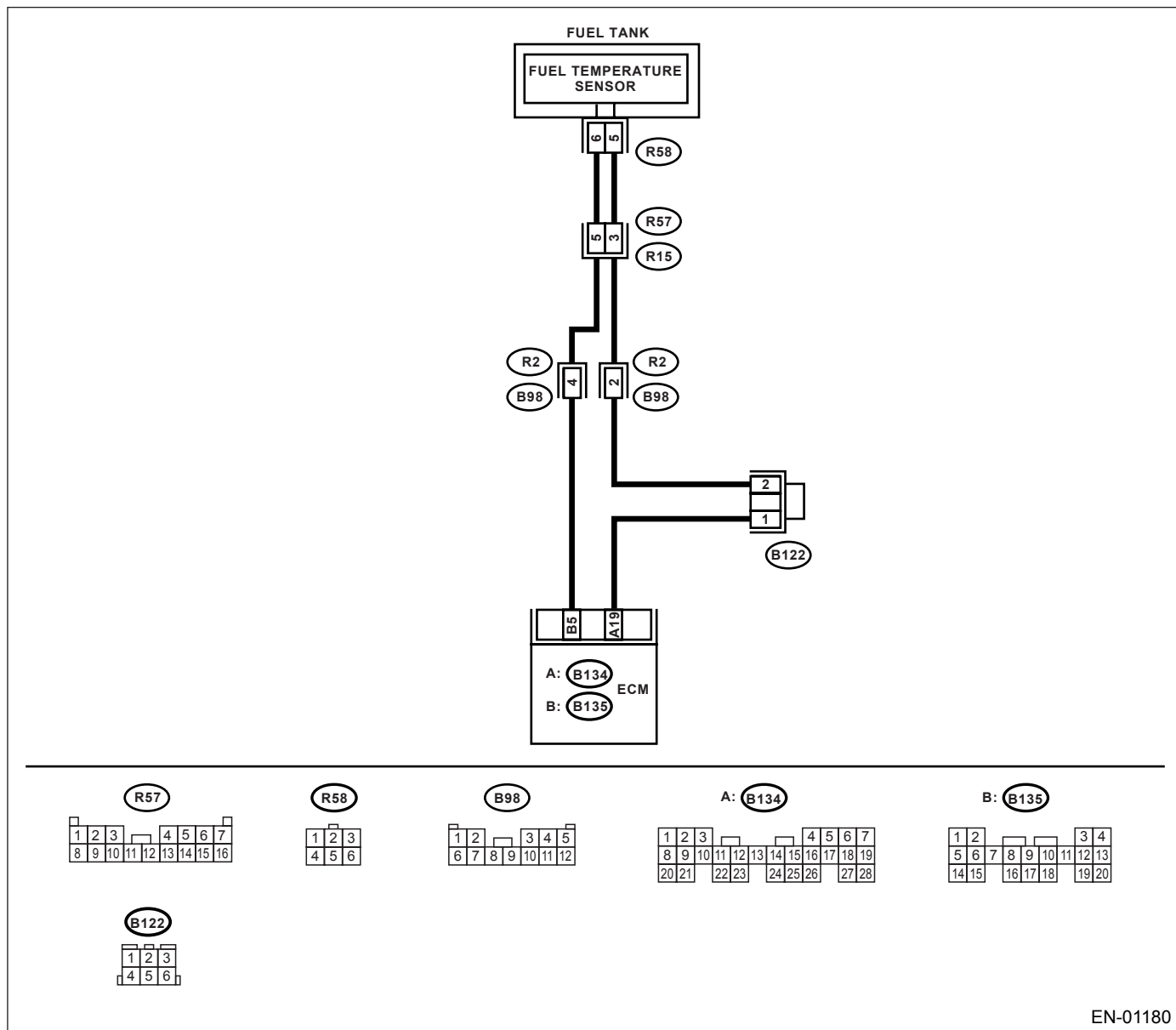
AI: DTC P0183 — FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. Is the measured value less than the specified value? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-40°C (-40°F)	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Remove the access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and fuel pump connector.	Go to step 3.
3 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and fuel pump connector.	Go to step 4.
4 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-): Is the measured value more than the specified value?	4 V	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel pump connector • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between fuel pump connector and ECM. Connector & terminal (R58) No. 5 — (B134) No. 19: Is the measured value less than the specified value?	1 Ω	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel pump connector • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

AJ:DTC P0301 — CYLINDER 1 MISFIRE DETECTED —

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)-170, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AK:DTC P0302 — CYLINDER 2 MISFIRE DETECTED —

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)-170, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AL:DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)-170, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AM:DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles
- Immediately at fault recognition (when a misfire which could damage catalyst occurs.)

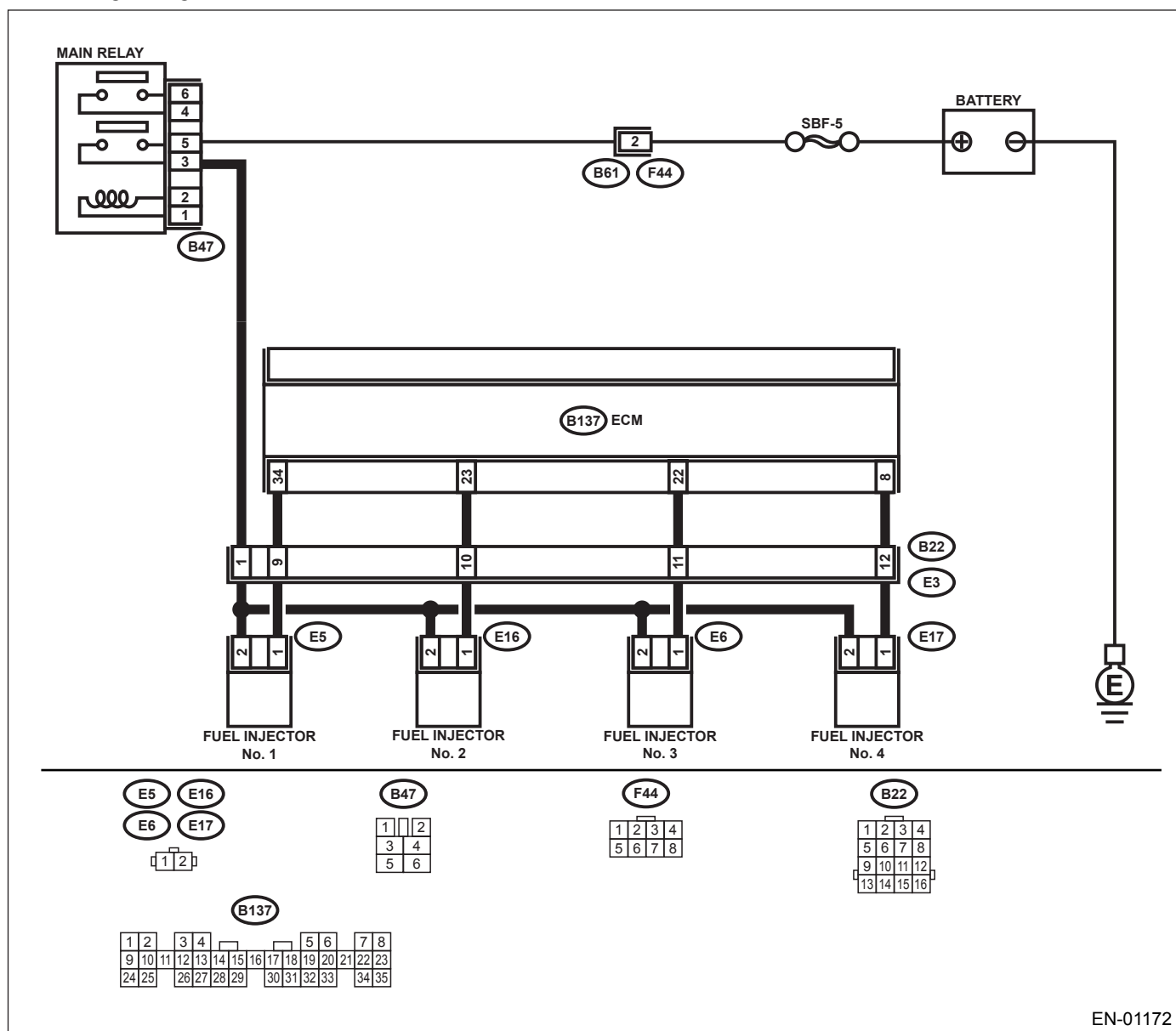
• **TROUBLE SYMPTOM:**

- Engine stalls.
- Erroneous idling
- Rough driving

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01172

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0301, P0302, P0303 and P0304.	Go to step 2.
2 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal #1 (B137) No. 34 (+) — Chassis ground (-): #2 (B137) No. 23 (+) — Chassis ground (-): #3 (B137) No. 22 (+) — Chassis ground (-): #4 (B137) No. 8 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Go to step 3.
3 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the voltage between ECM connector and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 1 — Engine ground: #2 (E16) No. 1 — Engine ground: #3 (E6) No. 1 — Engine ground: #4 (E17) No. 1 — Engine ground: Is the measured value more than the specified value?	1 MΩ	Go to step 4.	Repair short circuit to ground in harness between fuel injector and ECM connector.
4 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. Measure the resistance of harness connector between ECM connector and fuel injector on faulty cylinders. Connector & terminal #1 (B137) No. 34 — (E5) No. 1: #2 (B137) No. 23 — (E16) No. 1: #3 (B137) No. 22 — (E6) No. 1: #4 (B137) No. 8 — (E17) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
5 CHECK FUEL INJECTOR. Measure the resistance between fuel injector terminals on faulty cylinder. Terminal No. 1 — No. 2: Is the measured value within the specified range?	5 — 20 Ω	Go to step 6.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-38, Fuel Injector.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY LINE. 1) Turn ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Repair poor contact in all connectors in fuel injector circuit.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector on faulty cylinders • Poor contact in coupling connector • Poor contact in main relay connector • Poor contact in fuel injector connector on faulty cylinders
7 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinder. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal #1 (B137) No. 34 (+) — Chassis ground (-): #2 (B137) No. 23 (+) — Chassis ground (-): #3 (B137) No. 22 (+) — Chassis ground (-): #4 (B137) No. 8 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and fuel injector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 8.
8 CHECK FUEL INJECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Replace the faulty fuel injector <Ref. to FU(H4SO)-38, Fuel Injector.> and the ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.	Go to step 9.
9 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR. Is the camshaft position sensor or crankshaft position sensor loosely installed?	Sensor is loosely installed.	Tighten camshaft position sensor or crankshaft position sensor.	Go to step 10.
10 CHECK CRANKSHAFT SPROCKET. Remove the timing belt cover. Is the crankshaft sprocket rusted or does it have broken teeth?	Abnormality found.	Replace the crankshaft sprocket. <Ref. to ME(H4SO)-53, Crankshaft Sprocket.>	Go to step 11.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block. ST 499987500CRANKSHAFT SOCKET Is the timing belt dislocated from its proper position?	Timing belt is dislocated.	Repair installation condition of timing belt. <Ref. to ME(H4SO)-46, Timing Belt.>	Go to step 12.
12 CHECK FUEL LEVEL. Is the fuel meter indication higher than the "Lower" level?	Higher than the "Lower" level.	Go to step 13.	Replenish fuel so fuel meter indication becomes higher than the "Lower" level. After replenishing fuel, Go to step 13.
13 CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL). 1) Clear the memory using Subaru Select Monitor. <Ref. to EN(H4SO)-46, Clear Memory Mode.> 2) Start the engine, and drive the vehicle for more than 10 minutes. Does the MIL illuminate or blink?	Illuminates or blinks.	Go to step 16.	Go to step 14.
14 CHECK CAUSE OF MISFIRE DIAGNOSED. Was the cause of misfire identified when the engine is running? Ex. Disconnection of spark plug cord.	Cause of misfire is identified.	Finish diagnostics operation, if the engine has no abnormality.	Go to step 15.
15 CHECK FOR POOR CONTACT. Is there poor contact in the ignition coil, fuel injector, ECM and coupling connector?	There is poor contact.	Repair poor contact.	Contact with your SOA (distributor) service after checking followings. NOTE: In this case, check the following: • Condition of fuel • Fuel additive used or not • Visually check spark plug • Visually check spark plug cord • Condition of engine oil
16 CHECK AIR INTAKE SYSTEM. Is there a fault in air intake system?	There is a fault.	Repair air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step 17.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
17 CHECK MISFIRE SYMPTOM. 1) Turn ignition switch to ON. 2) Read the diagnostic trouble code (DTC). • Subaru Select Monitor <Ref. to EN(H4SO)-31, Subaru Select Monitor.> • OBD-II general scan tool Does the Subaru Select Monitor or OBD-II general scan tool display only one DTC? For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual. NOTE: Perform diagnosis according to the items listed below.	Only one DTC is displayed.	Go to step 22 .	Go to step 18 .
18 CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Go to step 23 .	Go to step 19 .
19 CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Go to step 24 .	Go to step 20 .
20 CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Go to step 25 .	Go to step 21 .
21 CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Go to step 26 .	Go to step 27 .
22 ONLY ONE CYLINDER Is there a fault in that cylinder?	There is a fault.	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Spark plug cord • Fuel injector • Compression ratio	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23 GROUP OF #1 AND #2 CYLINDERS Are there any faults in #1 and #2 cylinders?	There is a fault.	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plug • Fuel injector • Ignition coil • Compression ratio • If no abnormality is discovered, check for "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)-67, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
24 GROUP OF #3 AND #4 CYLINDERS Are there any faults in #3 and #4 cylinders?	There is a fault.	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plug • Fuel injector • Ignition coil • If no abnormality is discovered, check for "16. D: IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)-67, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25 GROUP OF #1 AND #3 CYLINDERS Are there any faults in #1 and #3 cylinders?	There is a fault.	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Skipping timing belt teeth	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
26 GROUP OF #2 AND #4 CYLINDERS Are there any faults in #2 and #4 cylinders?	There is a fault.	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
27 CYLINDER AT RANDOM Is the engine idle rough?	Engine idle is rough.	Go to DTC P0170. <Ref. to EN(H4SO)-159, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression ratio

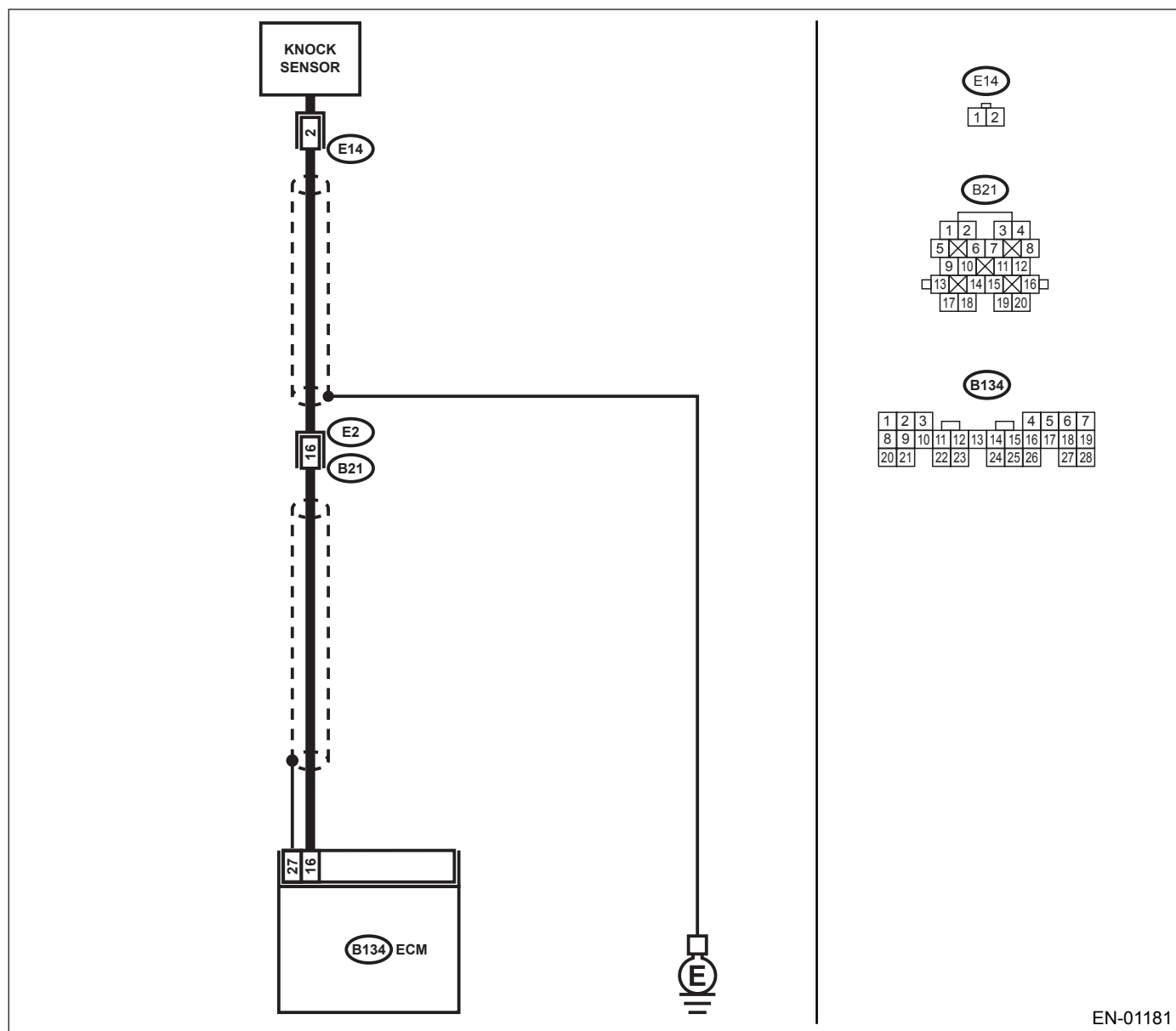
AN:DTC P0327 — KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Poor driving performance
 - Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01181

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM harness connector and chassis ground. Connector & terminal (B134) No. 16 — Chassis ground: Is the measured value more than the specified value?	700 k Ω	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between knock sensor and ECM connector • Poor contact in knock sensor connector • Poor contact in coupling connector
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminal No. 2 — Engine ground: Is the measured value more than the specified value?	700 k Ω	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Poor contact in knock sensor connector
3 CHECK CONDITION OF KNOCK SENSOR INSTALLATION. Is the knock sensor installation bolt tightened securely?	Tightened securely.	Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.>	Tighten knock sensor installation bolt securely.

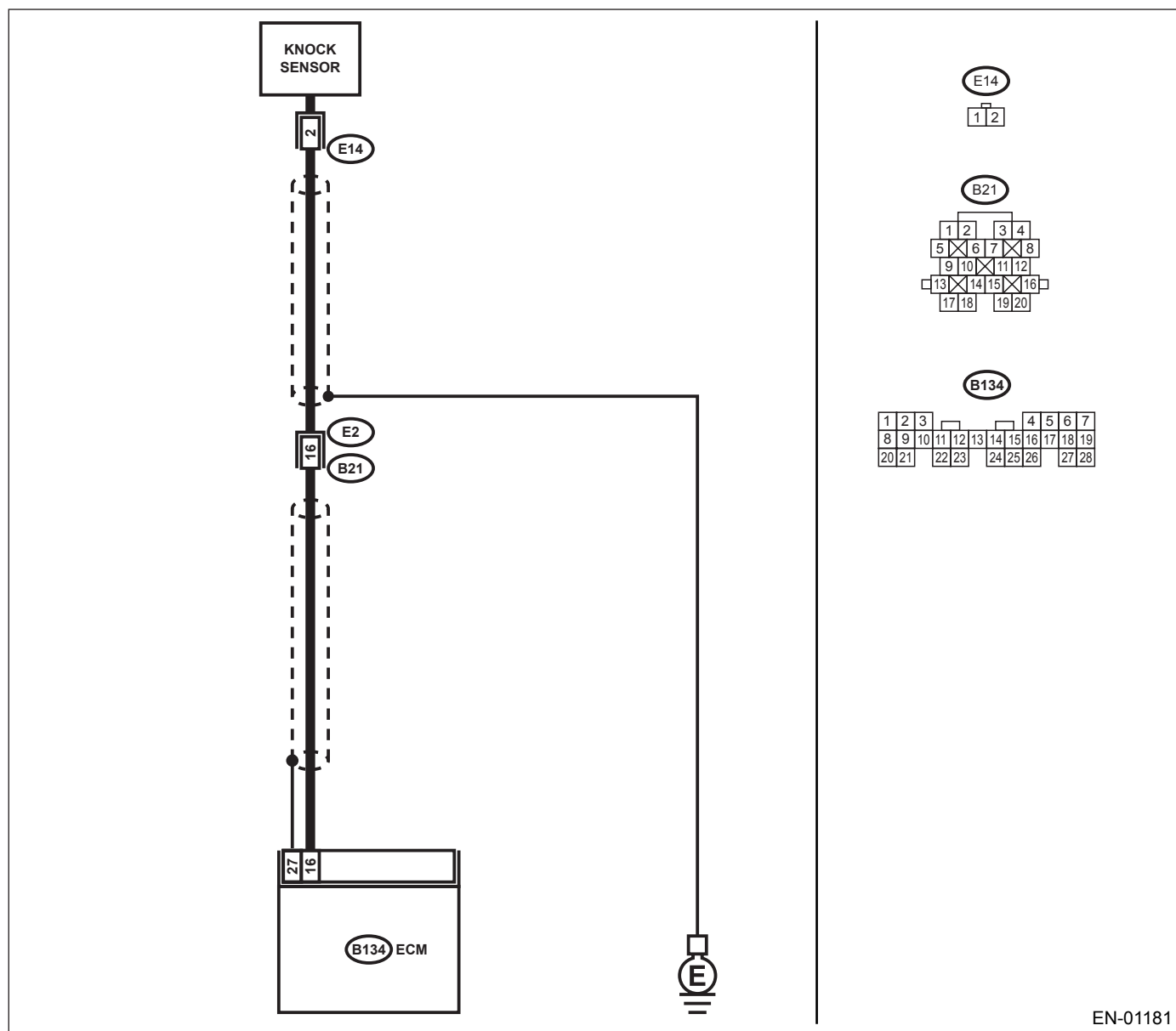
AO:DTC P0328 — KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Poor driving performance
 - Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 16 — Chassis ground: Is the measured value less than the specified value?	400 k Ω	Go to step 2.	Go to step 3.
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminal No. 2 — Engine ground: Is the measured value less than the specified value?	400 k Ω	Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.>	Repair short circuit to ground in harness between knock sensor connector and ECM connector. NOTE: The harness between both connectors are shielded. Repair short circuit of harness together with shield.
3 CHECK INPUT SIGNAL FOR ECM. 1) Connect the connectors to ECM and knock sensor. 2) Turn ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 16 (+) — Chassis ground (-): Is the measured value more than the specified value?	2 V	The MIL may light up, however, the circuit is returned to the normal status at the moment. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in knock sensor connector • Poor contact in ECM connector • Poor contact in coupling connector	Repair poor contact in ECM connector.

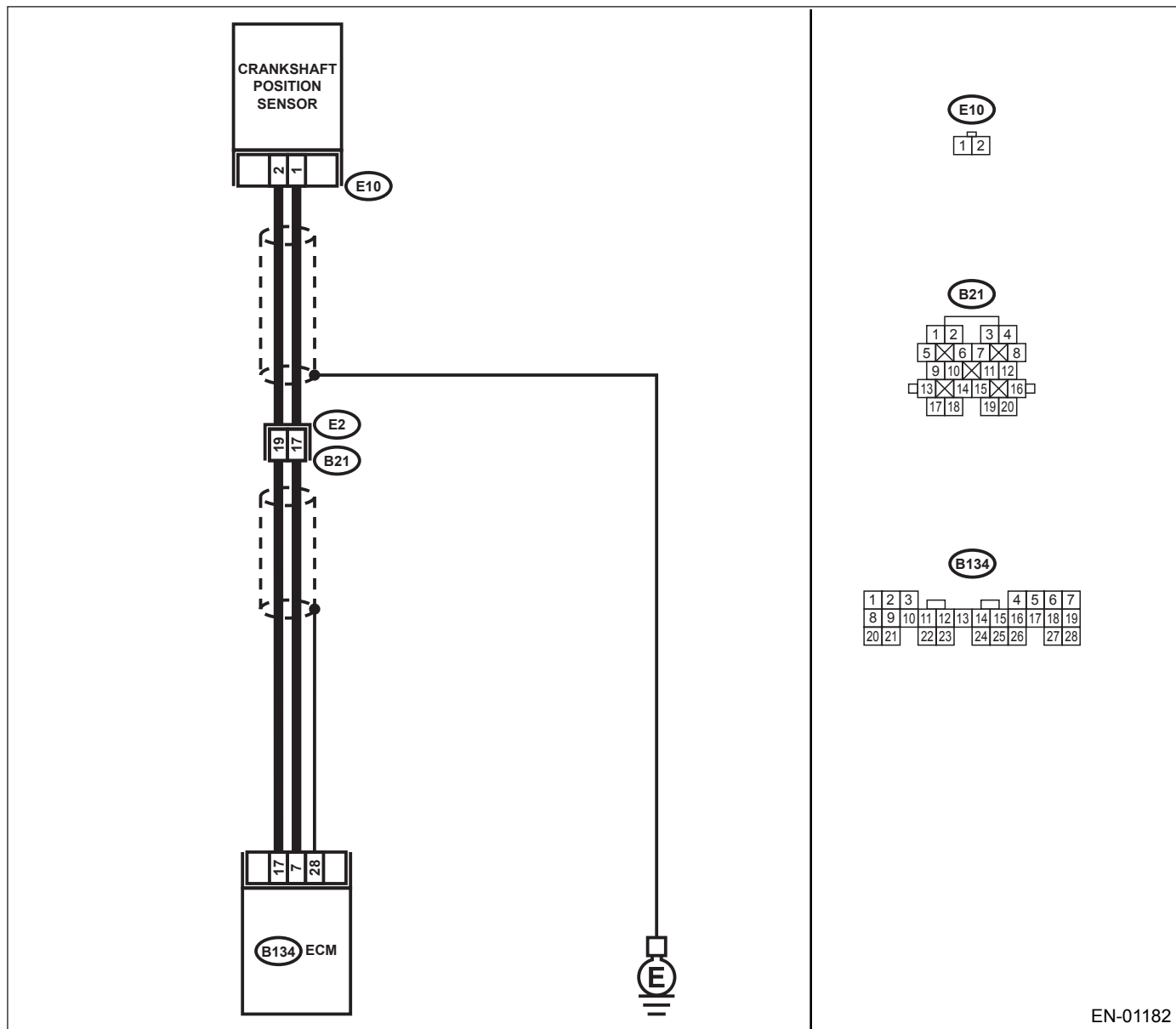
AP:DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Engine stalls.
 - Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01182

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from crankshaft position sensor. 3) Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground: Is the measured value more than the specified value?	100 k Ω	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between crankshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 2.
2 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in harness between crankshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair short circuit to ground in harness together with shield.	Go to step 3.
3 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between crankshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK CONDITION OF CRANKSHAFT POSITION SENSOR. Is the crankshaft position sensor installation bolt tightened securely?	Tightened securely.	Go to step 5.	Tighten crankshaft position sensor installation bolt securely.
5 CHECK CRANKSHAFT POSITION SENSOR. 1) Remove the crankshaft position sensor. 2) Measure the resistance between connector terminals of crankshaft position sensor. Terminal No. 1 — No. 2: Is the measured value within the specified range?	1 — 4 k Ω	Repair poor contact in crankshaft position sensor connector.	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-28, Crankshaft Position Sensor.>

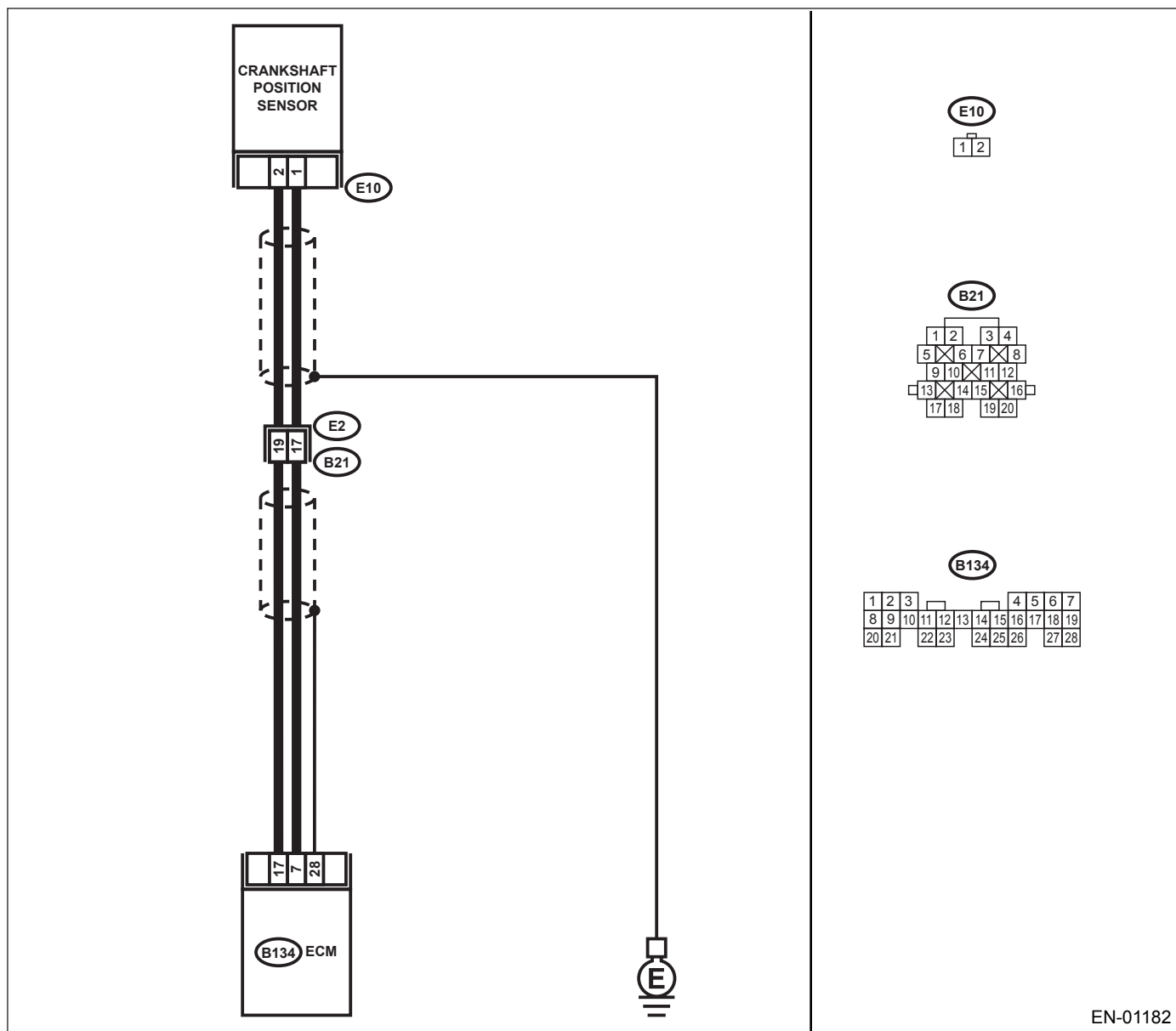
**AQ:DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/
PERFORMANCE PROBLEM —**

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Engine stalls.
 - Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC P0335 using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK CONDITION OF CRANKSHAFT POSITION SENSOR. Turn ignition switch to OFF. Is the crankshaft position sensor installation bolt tightened securely?	Tightened securely.	Go to step 3.	Tighten crankshaft position sensor installation bolt securely.
3 CHECK CRANKSHAFT SPROCKET. Remove the front belt cover. Are crankshaft sprocket teeth cracked or damaged?	There is a crack or damage.	Replace the crankshaft sprocket. <Ref. to ME(H4SO)-53, Crankshaft Sprocket.>	Go to step 4.
4 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block. ST 499987500CRANKSHAFT SOCKET Is the timing belt dislocated from its proper position?	Belt is dislocated.	Repair installation condition of timing belt. <Ref. to ME(H4SO)-46, Timing Belt.>	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-28, Crankshaft Position Sensor.>

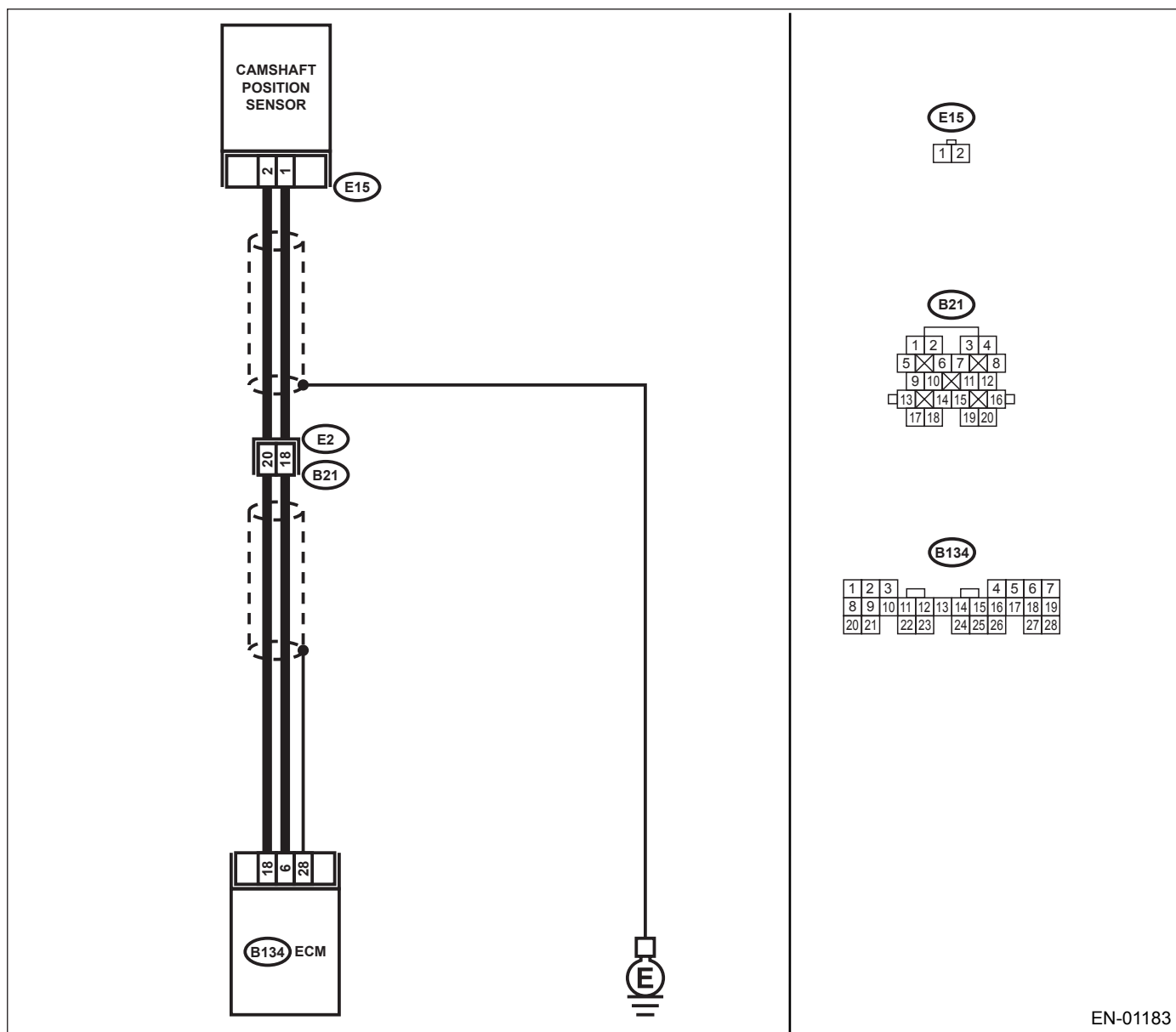
AR:DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Engine stalls.
 - Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground: Is the measured value more than the specified value?	100 kΩ	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 2.
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair short circuit to ground in harness together with shield.	Go to step 3.
3 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK CONDITION OF CAMSHAFT POSITION SENSOR. Is the camshaft position sensor installation bolt tightened securely?	Tightened securely.	Go to step 5.	Tighten camshaft position sensor installation bolt securely.
5 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminal No. 1 — No. 2: Is the measured value within the specified range?	1 — 4 kΩ	Repair poor contact in camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-29, Camshaft Position Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

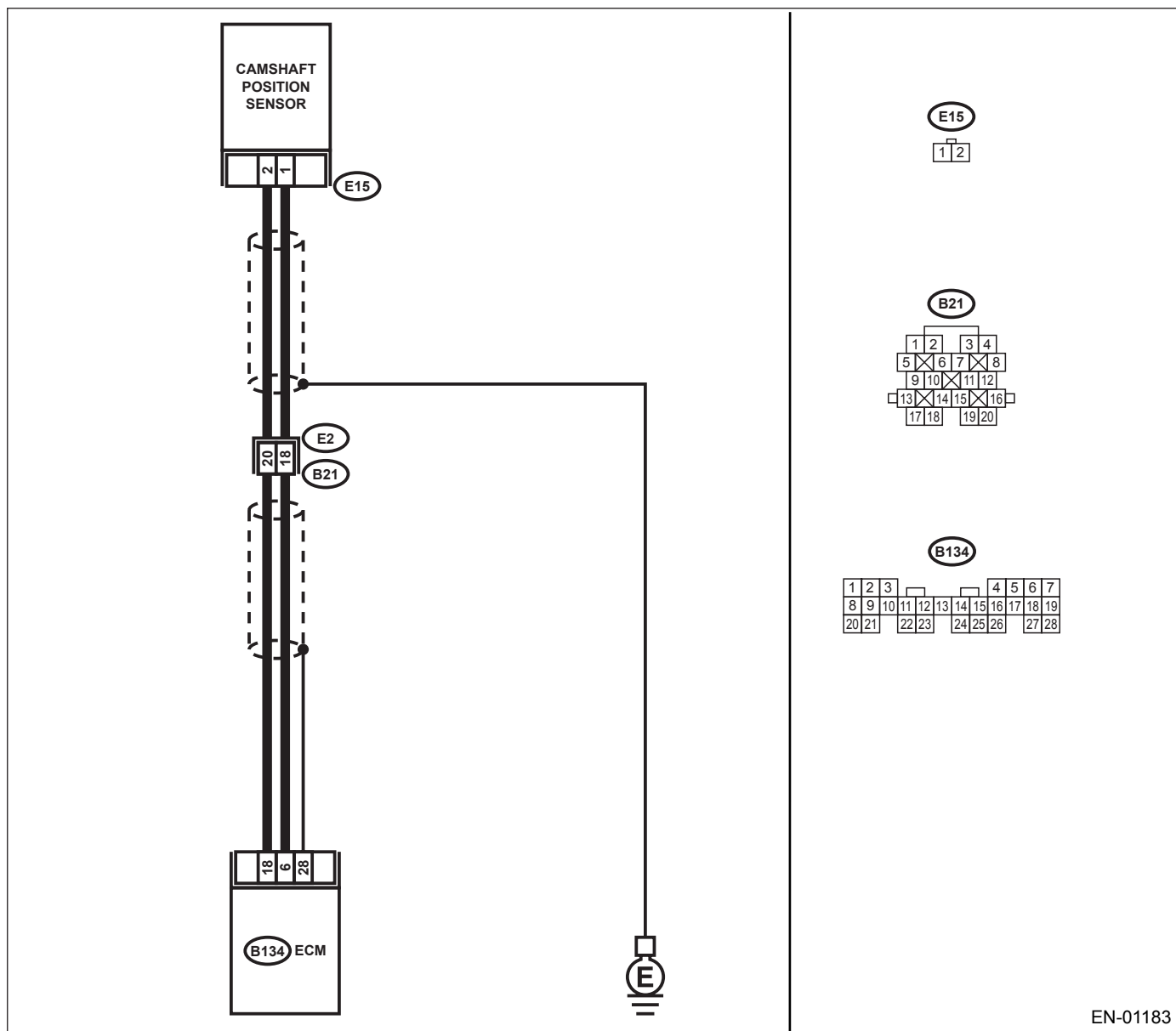
AS:DTC P0341 — CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE PROBLEM (BANK 1 OR SINGLE SENSOR) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Engine stalls.
 - Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01183

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground: Is the measured value more than the specified value?	100 kΩ	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 3.
3 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair short circuit to ground in harness together with shield.	Go to step 4.
4 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
5 CHECK CONDITION OF CAMSHAFT POSITION SENSOR. Is the camshaft position sensor installation bolt tightened securely?	Tightened securely.	Go to step 6.	Tighten camshaft position sensor installation bolt securely.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminal No. 1 — No. 2: Is the measured value within the specified range?	1 — 4 kΩ	Go to step 7.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-29, Camshaft Position Sensor.>
7 CHECK CONDITION OF CAMSHAFT POSITION SENSOR. Turn ignition switch to OFF. Is the camshaft position sensor installation bolt tightened securely?	Tightened securely.	Go to step 8.	Tighten camshaft position sensor installation bolt securely.
8 CHECK CAMSHAFT SPROCKET. Remove the front belt cover. <Ref. to ME(H4SO)-45, Timing Belt Cover.> Are camshaft sprocket teeth cracked or damaged?	There is a crack or damage.	Replace the camshaft sprocket. <Ref. to ME(H4SO)-51, Camshaft Sprocket.>	Go to step 9.
9 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the camshaft using ST, and align alignment mark on camshaft sprocket with alignment mark on timing belt cover LH. ST1 499987500CRANKSHAFT SOCKET Is the timing belt dislocated from its proper position?	Belt is dislocated.	Repair installation condition of timing belt. <Ref. to ME(H4SO)-46, Timing Belt.>	Replace the camshaft position sensor. <Ref. to FU(H4SO)-29, Camshaft Position Sensor.>

AT:DTC P0420 — CATALYTIC CONVERTER SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

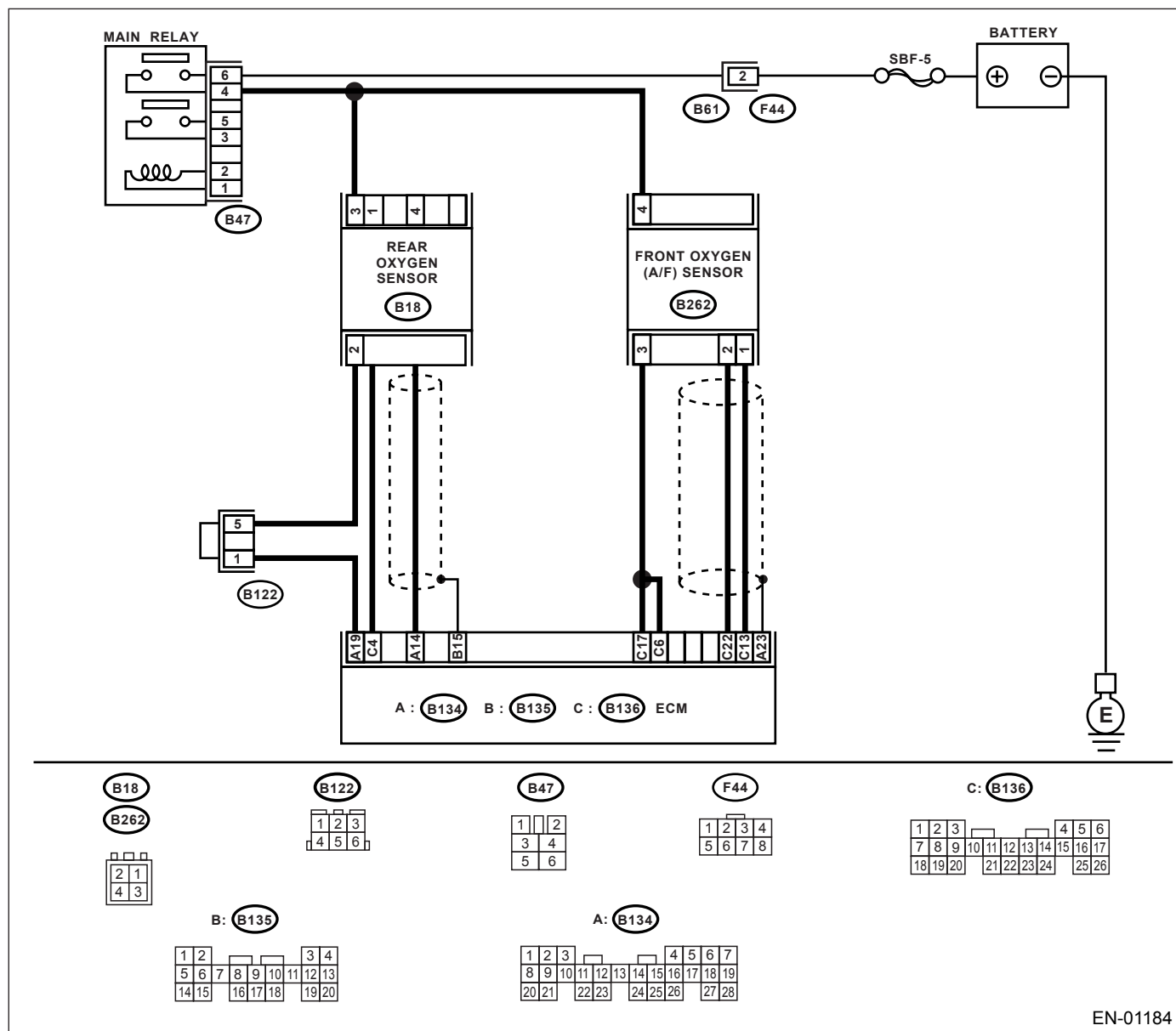
• TROUBLE SYMPTOM:

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

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01184

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0420.
2	CHECK EXHAUST SYSTEM. Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes. Is there a fault in exhaust system? NOTE: Check the following positions. •Between cylinder head and front exhaust pipe •Between front exhaust pipe and front catalytic converter •Between front catalytic converter and rear catalytic converter	There is a fault.	Repair or replace the exhaust system. <Ref. to EX(H4SO)-2, General Description.>
3	CHECK FRONT OR REAR CATALYTIC CONVERTER. Is there any damage at rear face or front face of front or rear catalytic converter?	There is damage.	Replace the front or rear catalytic converter. <Ref. to EC(H4SO)-3, Front Catalytic Converter.>
4	CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connectors from the rear oxygen sensor and ECM. 3)Measure the resistance of harness between rear oxygen sensor connector and ECM connector. Connector & terminal (B18) No. 3 — (B134) No. 19: Is the measured value less than the specified value?	1 Ω	Go to step 5.
5	CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. Measure the resistance between rear oxygen sensor connector and chassis ground. Connector & terminal (B18) No. 3 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 6.
6	CHECK SHIELD HARNESS. Is the rear oxygen sensor shield harness connected to (B135) No.15?	Connected.	Contact SOA (distributor) service.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

AU:DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —

- **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

- **TROUBLE SYMPTOM:**

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

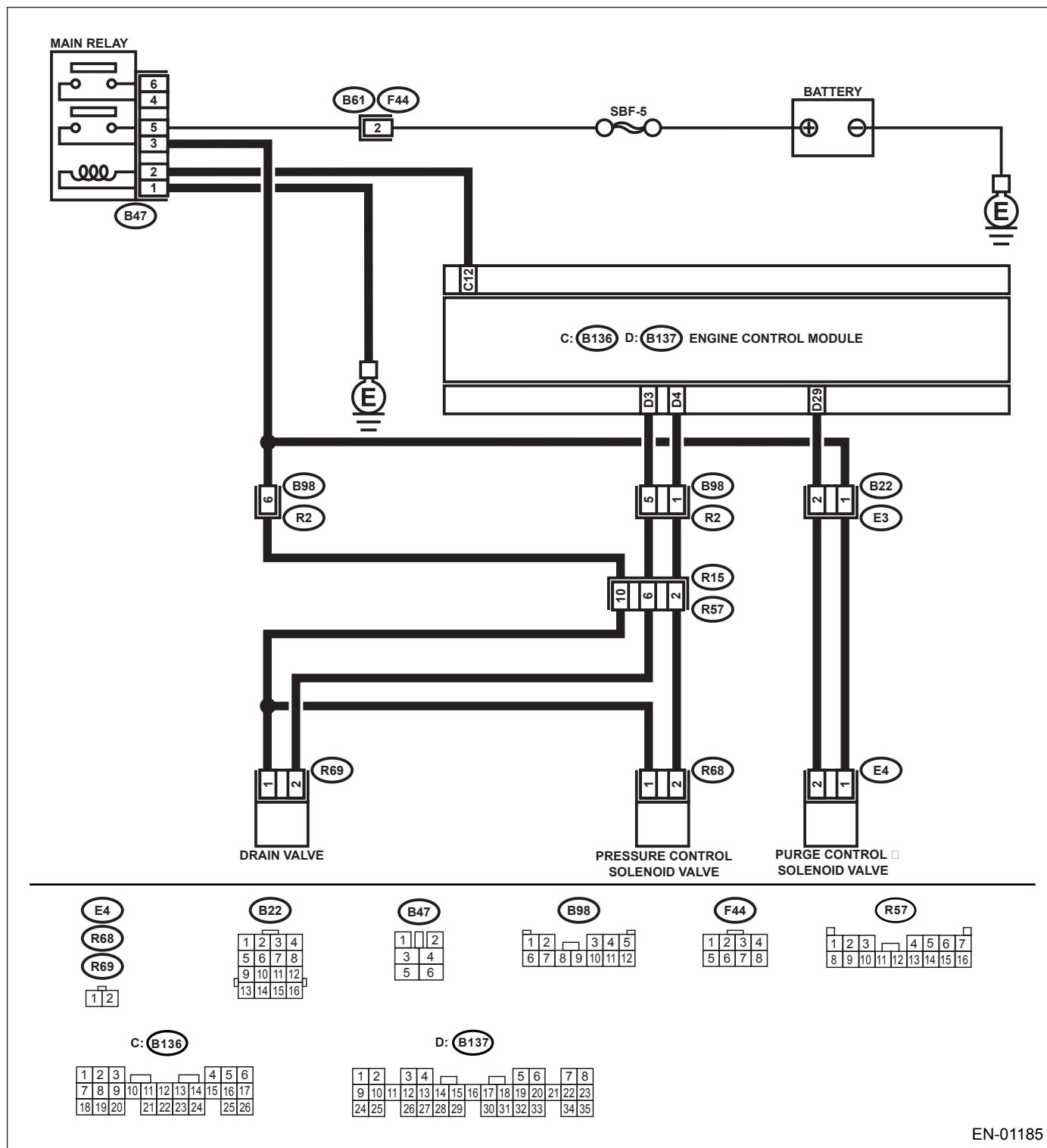
CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01185

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1)Turn ignition switch to OFF. 2)Check the fuel filler cap. Is the fuel filler cap tightened securely? NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Tightened securely.	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP. Is the fuel filler cap SUBARU genuine?	The SUBAU genuine fuel filler cap is used.	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING. Is there any damage to the seal between fuel filler cap and fuel filler pipe?	There is damage.	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-55, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1)Connect the test mode connector. 2)Turn ignition switch to ON. 3)Operate the drain valve. Does the drain valve operate? NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. Does the purge control solenoid valve operate? NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. Does the pressure control solenoid valve operate? NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE. Turn ignition switch to OFF. Is there a hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	There is a hole.	Repair or replace the evaporation line. <Ref. to FU(H4SO)-68, Fuel Delivery, Return and Evaporation lines.>	Go to step 9.
9 CHECK CANISTER. Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	There is damage or a hole.	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 10.
10 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.> Is the fuel tank damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	There is damage or a hole.	Repair or replace the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.>	Go to step 11.
11 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM. Are there holes of more than 1.0 mm (0.04 in) dia., cracks, clogging, disconnections or bend of hoses or pipes in evaporative emission control system?	There are holes, cracks, clogging, disconnection or bend of hoses or pipes.	Repair or replace the hoses or pipes.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AV:DTC P0447 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN —

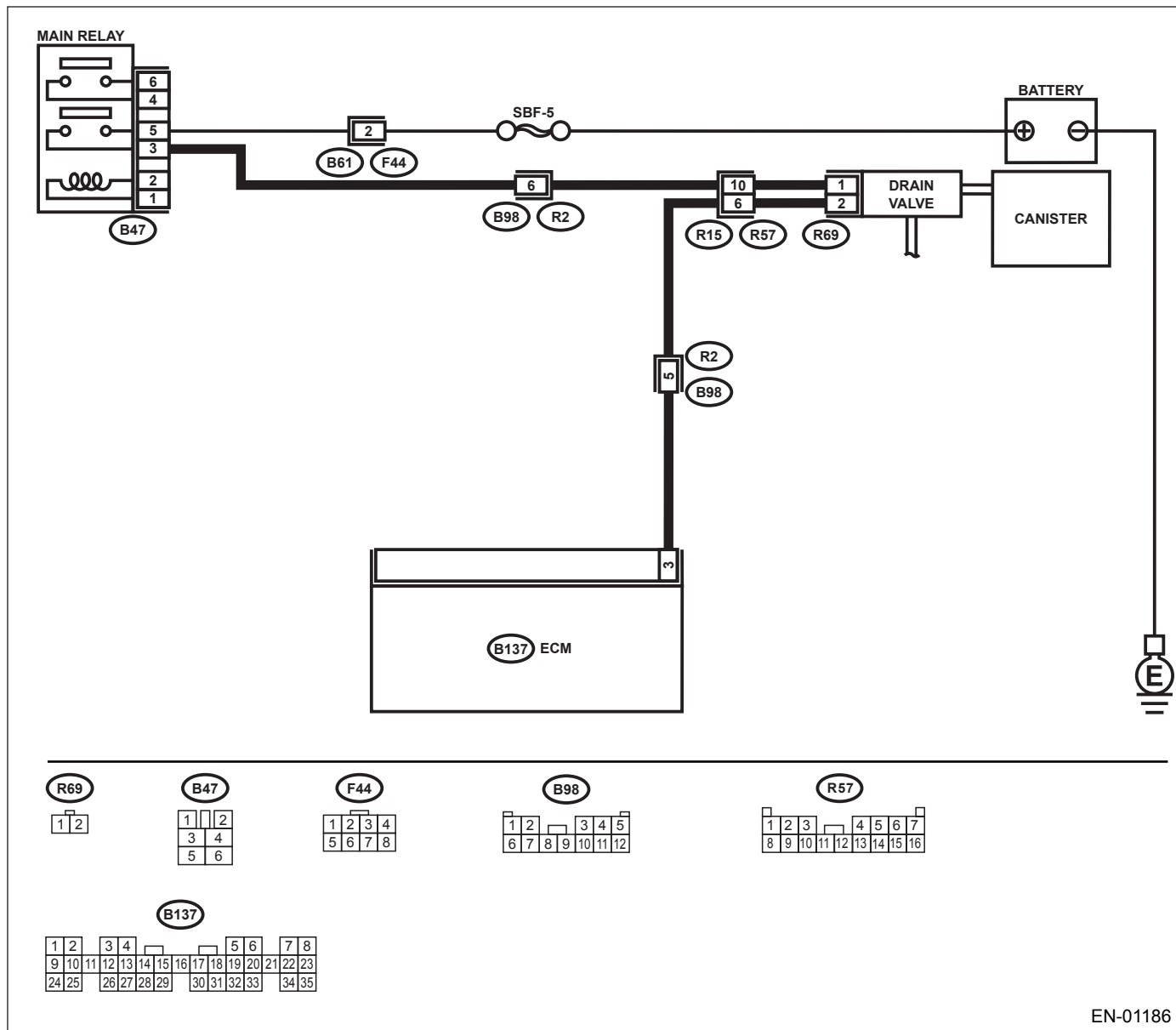
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01186

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 3.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	The MIL may light up, however, the circuit is returned to the normal status at the moment. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in drain valve connector • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from drain valve and ECM. 3) Measure the resistance of harness between drain valve connector and chassis ground. Connector & terminal (R69) No. 2 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 4.	Repair short circuit to ground in harness between ECM and drain valve connector.
4 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and drain valve connector. Connector & terminal (B137) No. 3 — (R69) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and drain valve connector • Poor contact in coupling connector
5 CHECK DRAIN VALVE. Measure the resistance between drain valve terminals. Terminal No. 1 — No. 2: Is the measured value within the specified range?	10 — 100 Ω	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO DRAIN VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between drain valve and chassis ground. Connector & terminal (R69) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and drain valve • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in drain valve connector. Is there poor contact in drain valve connector?	There is poor contact.	Repair poor contact in drain valve connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

ENGINE (DIAGNOSTICS)

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

MAIN RELAY

BATTERY

CANISTER

DRAIN VALVE

ECM

SBF-5

F44

B61

B47

B98

R2

R15

R57

R69

R2

B98

B137

R69

B47

F44

B98

R57

B137

EN-01186

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the drain valve, measure voltage between ECM and chassis ground. NOTE: Drain valve operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.> Connector & terminal (B137) No. 3 (+) — Chassis ground (-): Does the measured value change within the specified range?	0 — 10 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from drain valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and drain valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between drain valve terminals. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Replace the drain valve <Ref. to EC(H4SO)-18, Drain Valve.> and ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.	Go to step 6.
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

**AX:DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE
SENSOR RANGE/PERFORMANCE PROBLEM**

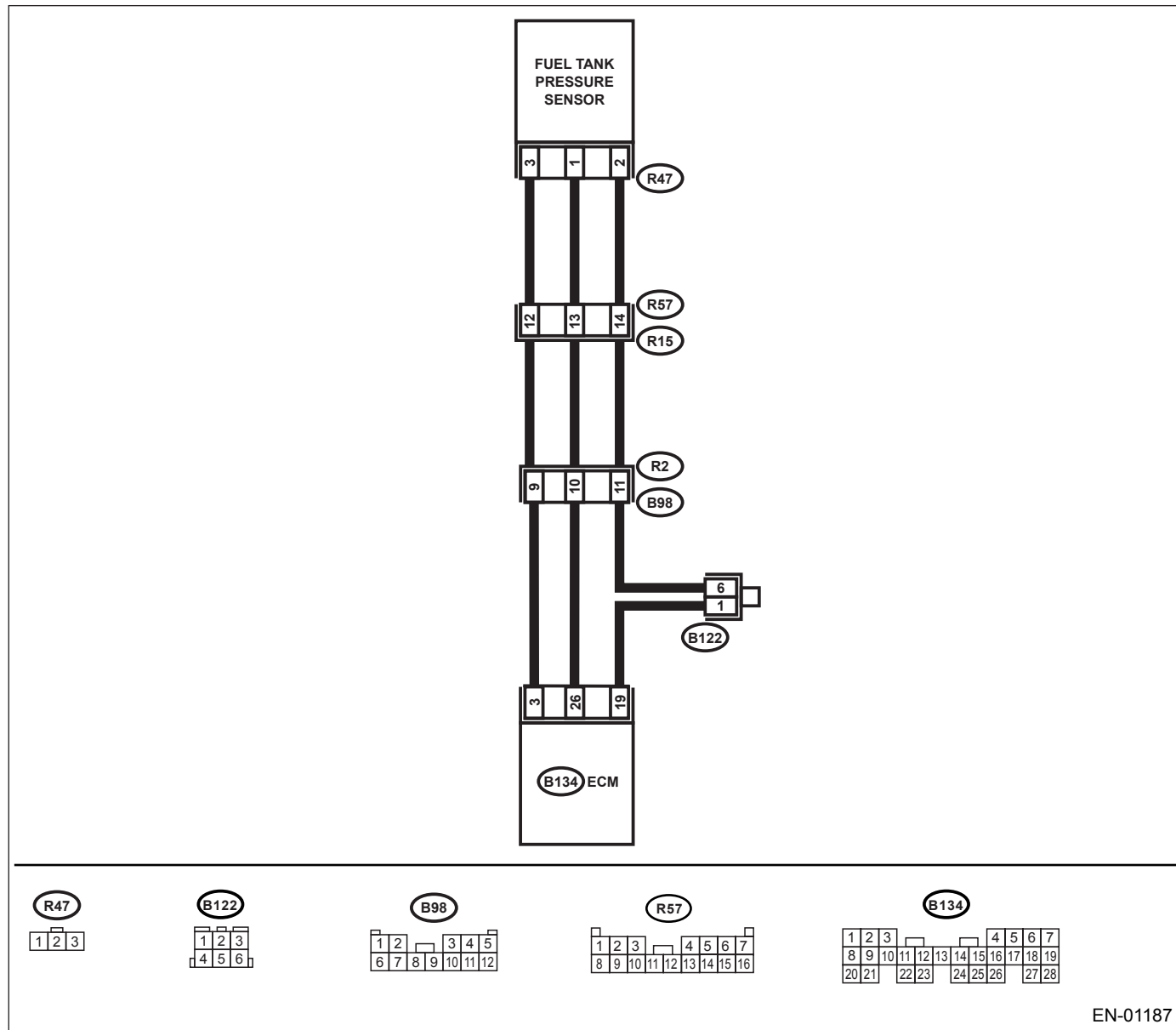
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01187

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Open the fuel flap. Is the fuel filler cap tightened securely?	Tightened securely.	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK PRESSURE/VACUUM LINE. Is there a fault in pressure/vacuum line? NOTE: Check the following items. • Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank • Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank	There is a fault.	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

**AY:DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE
SENSOR LOW INPUT —**

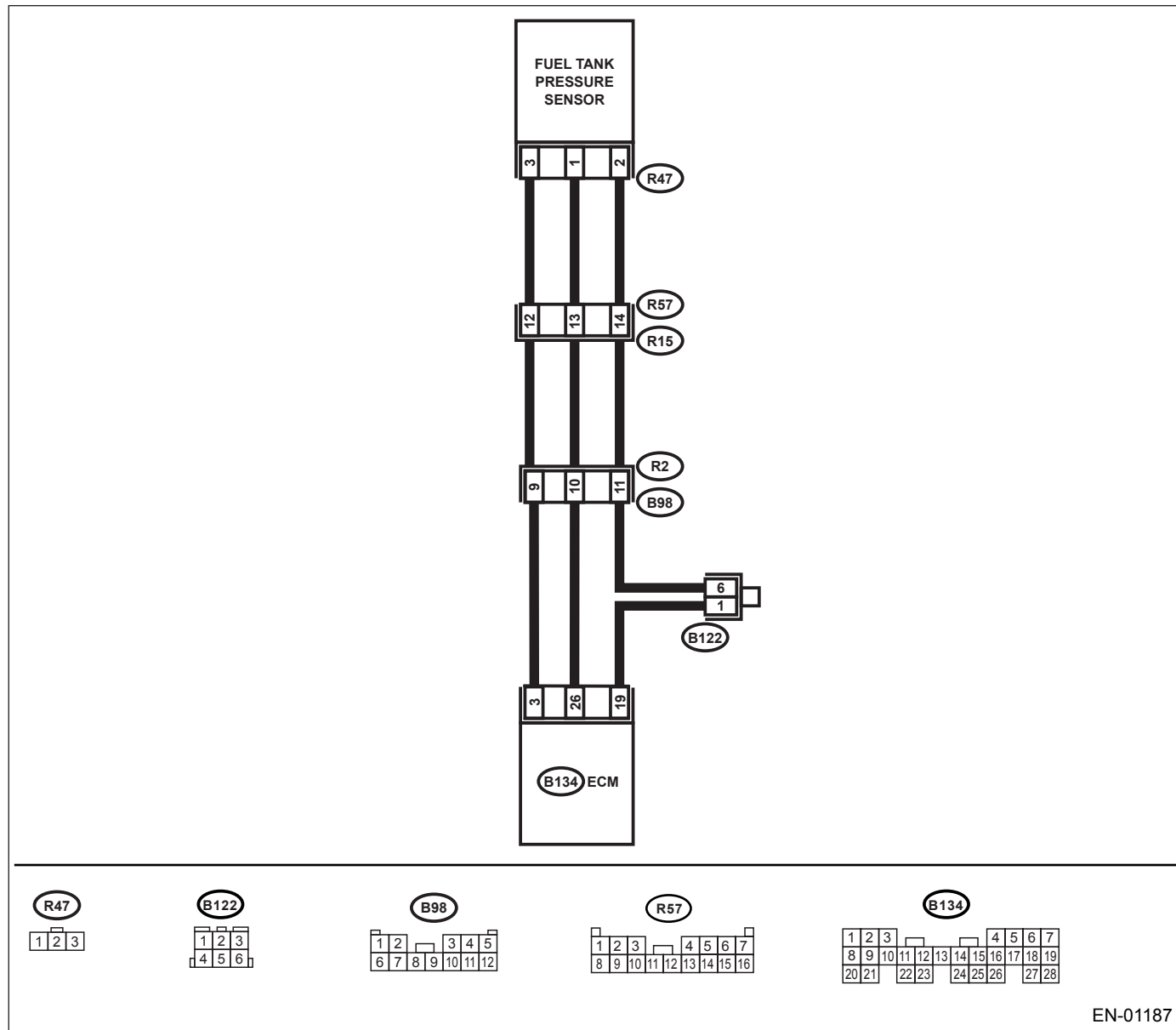
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01187

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Remove the fuel filler cap. 3) Install the fuel filler cap. 4) Turn ignition switch to ON. 5) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value less than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	-2.8 kPa (-21.0 mmHg, -0.827 inHg)	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment.
2 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 4.	Go to step 3.
3 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 26 (+) — Chassis ground (-): Is the measured value less than the specified value?	0.2 V	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor. Does the measured value exceed the specified value by shaking the ECM harness and connector? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.>	- 2.8 kPa (-21.0 mmHg, -0.827 inHg)	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Remove the rear seat cushion. 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure the voltage between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector
7 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and rear wiring harness connector. Connector & terminal (B134) No. 19 — (R15) No. 14: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector • Poor contact in joint connector
8 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. Measure the resistance of harness between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 14 (+) — Chassis ground: Is the measured value more than the specified value?	500 k Ω	Go to step 9.	Repair short circuit to ground in harness between ECM and rear wiring harness connector.
9 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel tank pressure sensor. 2) Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 12 — (R47) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 10.	Repair open circuit in fuel tank cord.
10 CHECK FUEL TANK CORD. Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 14 — (R47) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 11.	Repair open circuit in fuel tank cord.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK FUEL TANK CORD. Measure the resistance of harness between fuel tank pressure sensor connector and engine ground. Connector & terminal (R47) No. 1 — Chassis ground: Is the measured value more than the specified value?	500 kΩ	Go to step 12.	Repair short circuit to ground in fuel tank cord.
12 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank pressure sensor connector. Is there poor contact in fuel tank pressure sensor connector?	There is poor contact.	Repair poor contact in fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

**AZ:DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE
SENSOR HIGH INPUT —**

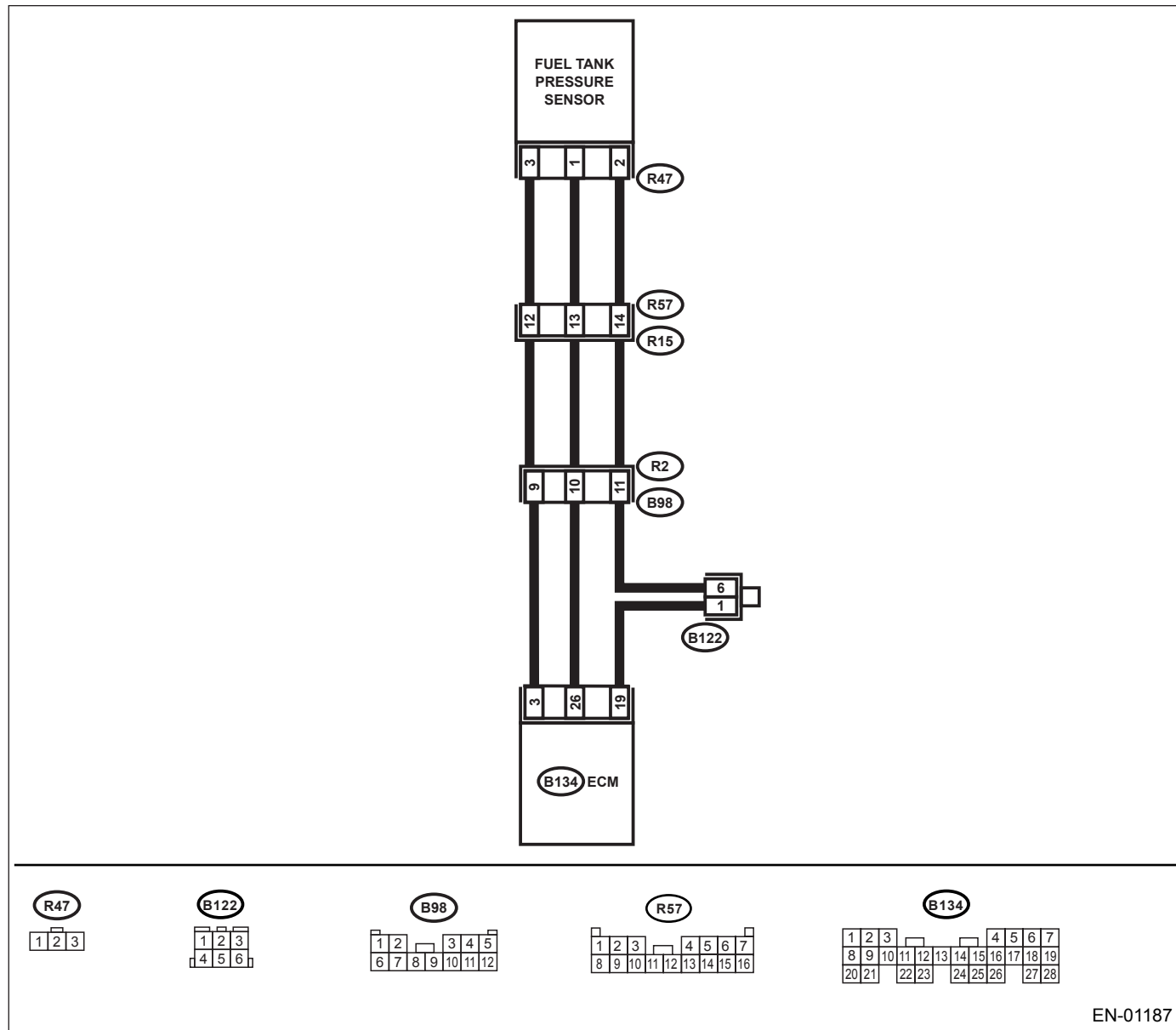
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01187

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Remove the fuel filler cap. 3) Install the fuel filler cap. 4) Turn ignition switch to ON. 5) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	2.8 kPa (21.0 mmHg, 0.827 inHg)	Go to step 11.	Go to step 2.
2 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (–): Is the measured value more than the specified value?	4.5 V	Go to step 4.	Go to step 3.
3 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (–): Does the measured value exceed the specified value by shaking the ECM harness and connector?	4.5 V	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 26 (+) — Chassis ground (–): Is the measured value less than the specified value?	0.2 V	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor. Does the measured value exceed the specified value by shaking the ECM harness and connector? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.>	– 2.8 kPa (–21.0 mmHg, – 0.827 inHg)	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Remove the rear seat cushion. 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure the voltage between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 12 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector
7 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and rear wiring harness connector. Connector & terminal (B134) No. 26 — (R15) No. 13: (B134) No. 19 — (R15) No. 14: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector
8 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel tank pressure sensor. 2) Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 13 — (R47) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 9.	Repair open circuit in fuel tank cord.
9 CHECK FUEL TANK CORD. Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 14 — (R47) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 10.	Repair open circuit in fuel tank cord.
10 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank pressure sensor connector. Is there poor contact in fuel tank pressure sensor connector?	There is poor contact.	Repair poor contact in fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
11 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel tank pressure sensor. 3) Turn ignition switch to ON. 4) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. Is the measured value more than the specified value? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	2.8 kPa (21.0 mmHg, 0.827 inHg)	Repair short circuit to battery in harness between ECM and fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BA:DTC P0456 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK) —

- **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

- **TROUBLE SYMPTOM:**

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

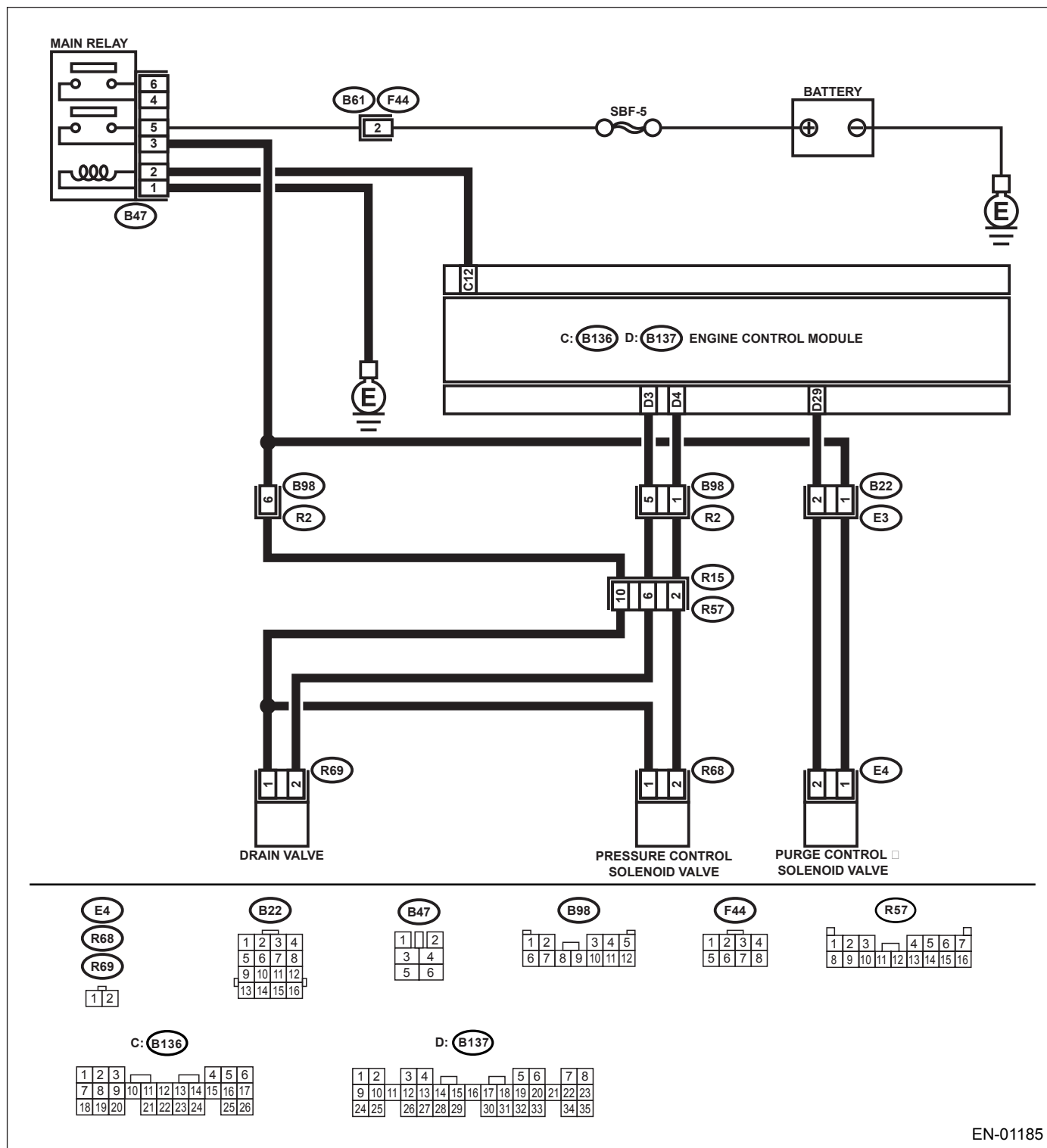
CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01185

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. Is the fuel filler cap tightened securely? NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Tightened securely.	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP. Is the fuel filler cap SUBARU genuine?	The SUBARU genuine fuel filler cap is used.	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING. Is there any damage to the seal between fuel filler cap and fuel filler pipe?	There is damage.	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-55, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Connect the test mode connector. 2) Turn ignition switch to ON. 3) Operate the drain valve. Does the drain valve operate? NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. Does the purge control solenoid valve operate? NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. Does the pressure control solenoid valve operate? NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE. Turn ignition switch to OFF. Is there a hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	There is a hole.	Repair or replace the evaporation line. <Ref. to FU(H4SO)-68, Fuel Delivery, Return and Evaporation lines.>	Go to step 9.
9 CHECK CANISTER. Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	There is damage or a hole.	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 10.
10 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.> Is the fuel tank damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	There is damage or a hole.	Repair or replace the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.>	Go to step 11.
11 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM. Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging, disconnections or bend of hoses or pipes in evaporative emission control system?	There are holes, cracks, clogging, disconnection or bend of hoses or pipes.	Repair or replace the hoses or pipes.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

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

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Fuel odor
 - Fuel filler cap is loose or not installed.

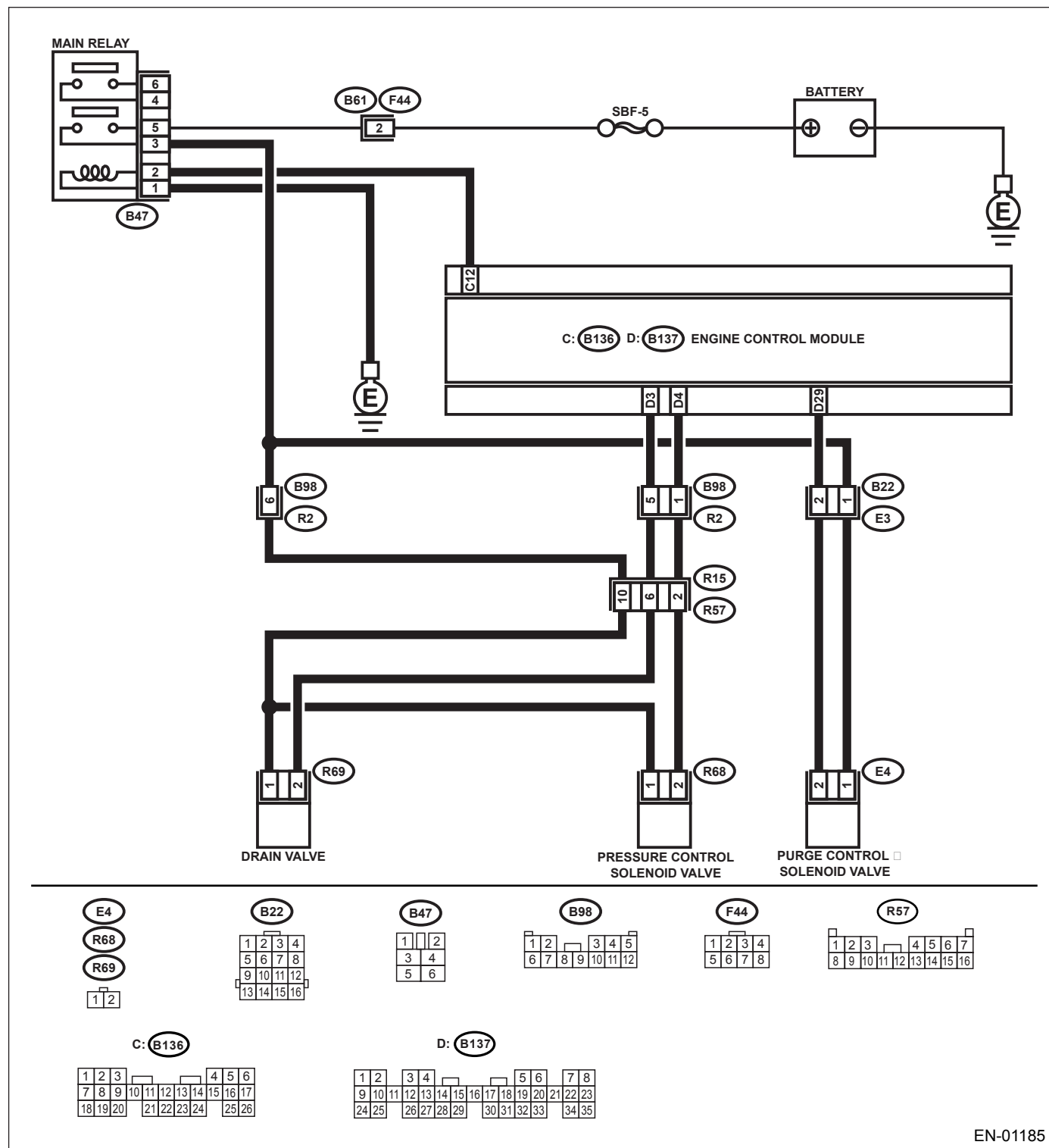
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01185

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. Is the fuel filler cap tightened securely? NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Tightened securely.	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP. Is the fuel filler cap SUBARU genuine?	The SUBARU genuine fuel filler cap is used.	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING. Is there any damage to the seal between fuel filler cap and fuel filler pipe?	There is damage.	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-55, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Connect the test mode connector. 2) Turn ignition switch to ON. 3) Operate the drain valve. Does the drain valve operate? NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. Does the purge control solenoid valve operate? NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. Does the pressure control solenoid valve operate? NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK CANISTER. Is the canister damaged?	There is damage.	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 9 .
9 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.> Is the fuel tank damaged?	There is damage.	Repair or replace the fuel tank. <Ref. to FU(H4SO)-52, Fuel Tank.>	Go to step 10 .
10 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM. Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging or disconnections of hoses or pipes in evaporative emission control system?	There are holes, cracks, clogging or disconnection of hoses or pipes.	Repair or replace the hoses or pipes.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

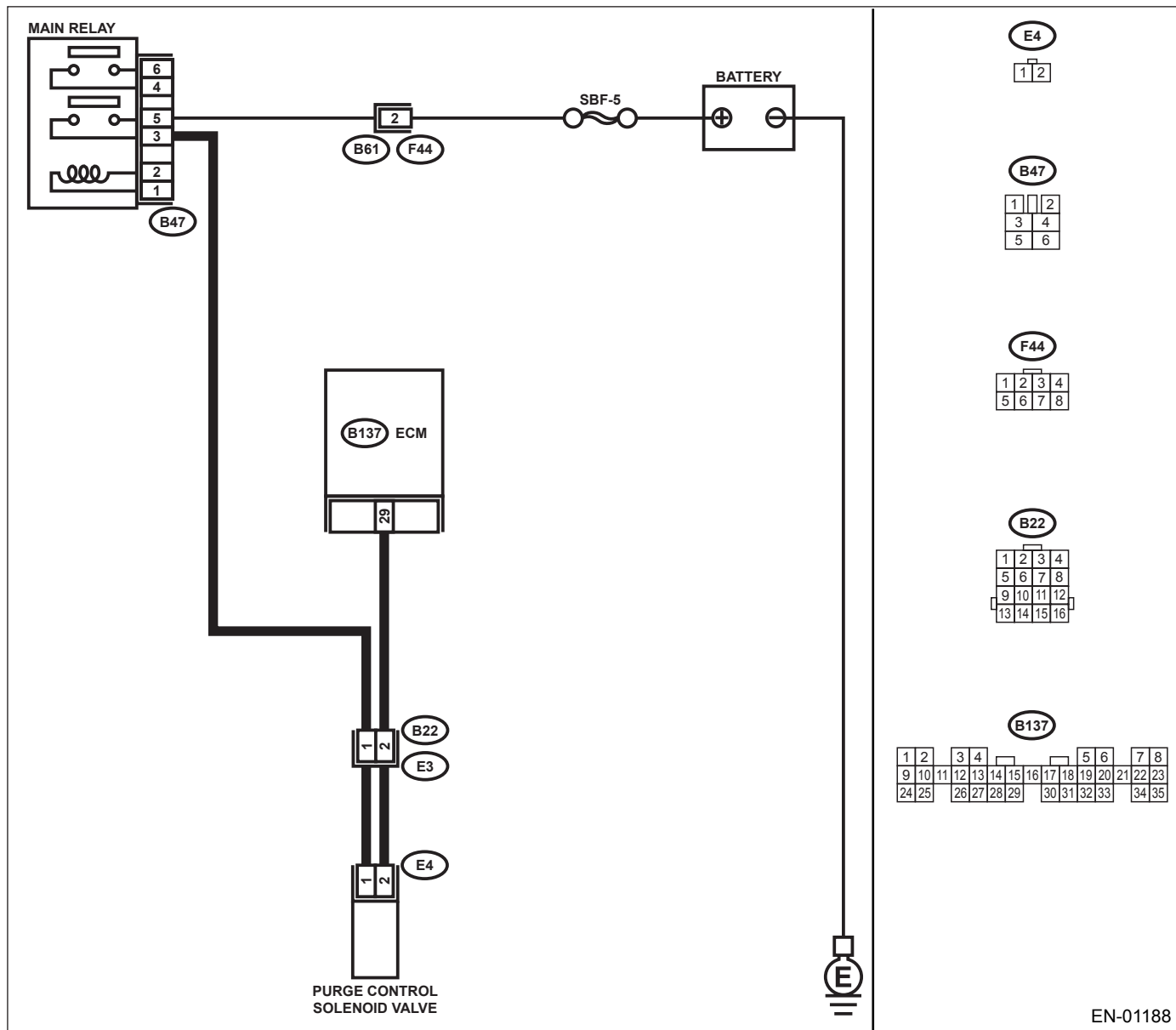
BC:DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01188

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 29 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	The MIL may light up, however, the circuit is returned to the normal status at the moment. Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Go to step 2.
2 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from purge control solenoid valve and ECM. 3) Measure the resistance of harness between purge control solenoid valve connector and engine ground. Connector & terminal (E4) No. 2 — Engine ground: Is the measured value less than the specified value?	1 M Ω	Go to step 3.	Repair short circuit to ground in harness between ECM and purge control solenoid valve connector.
3 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and purge control solenoid valve. Connector & terminal (B137) No. 29 — (E4) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 4.	Repair open circuit in harness between ECM and purge control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and purge control solenoid valve connector • Poor contact in coupling connector
4 CHECK PURGE CONTROL SOLENOID VALVE. 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. Terminal No. 1 — No. 2: Is the measured value within the specified range?	10 — 100 Ω	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. Connector & terminal (E4) No. 1 (+) — Engine ground (–): Is the measured value more than the specified value?	10 V	Go to step 6.	Repair open circuit in harness between main relay and purge control solenoid valve connector.
6 CHECK FOR POOR CONTACT. Check for poor contact in purge control solenoid valve connector. Is there poor contact in purge control solenoid valve connector?	There is poor contact.	Repair poor contact in purge control solenoid valve connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

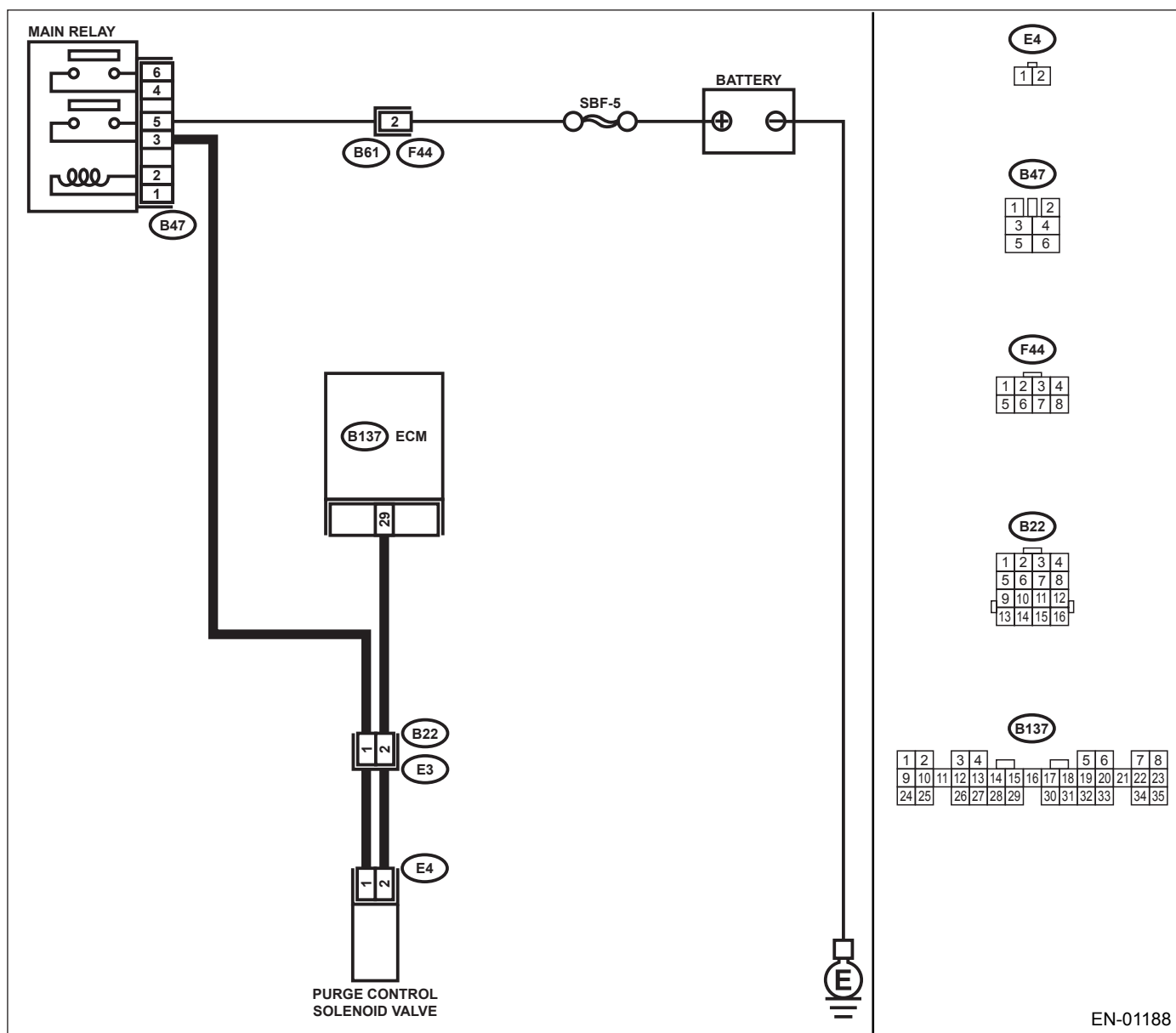
BD:DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01188

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the purge control solenoid valve, measure voltage between ECM and chassis ground. Does the measured value change within the specified range? NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.> Connector & terminal (B137) No. 29 (+) — Chassis ground (-):	0 — 10 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.
2 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 29 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from purge control solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 29 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and purge control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 5.
5 CHECK PURGE CONTROL SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Replace the purge control solenoid valve <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.> and the ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
6	CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

BE:DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —

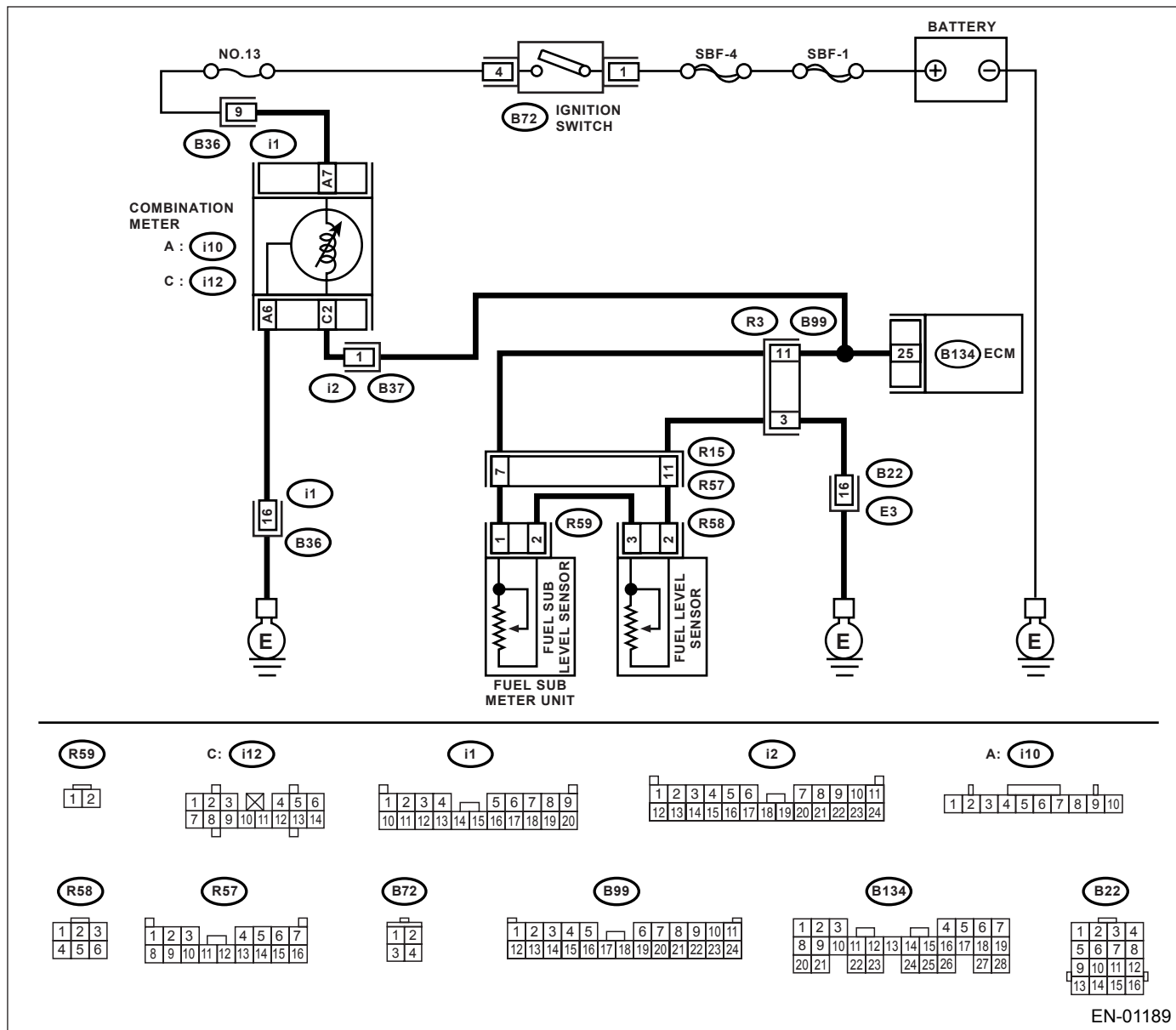
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01189

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect this trouble.	Replace the fuel level sensor <Ref. to FU(H4SO)-62, Fuel Level Sensor.> and fuel sub level sensor. <Ref. to FU(H4SO)-62, Fuel Level Sensor.>

BF:DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —

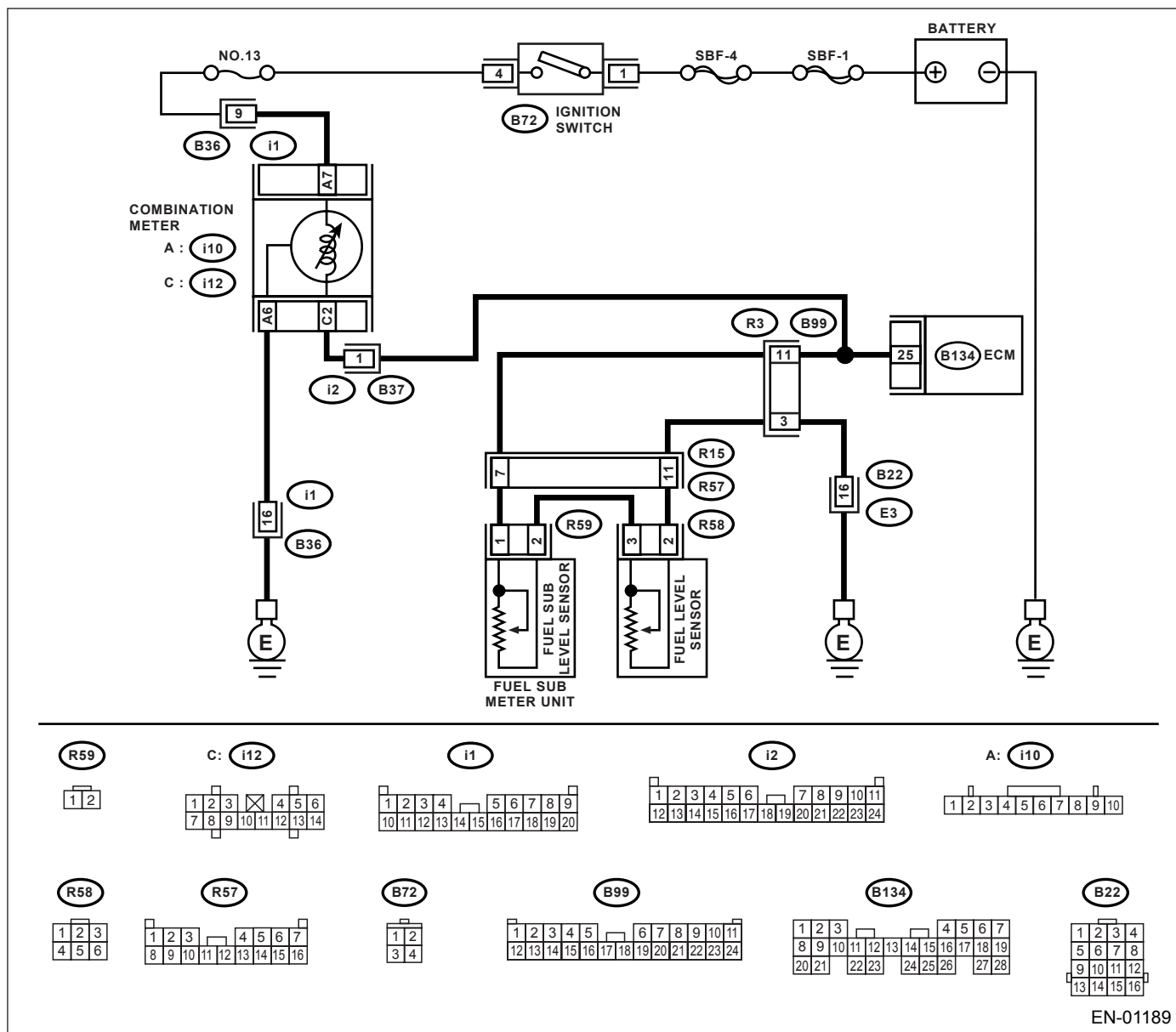
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01189

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER. Does the speedometer and tachometer operate normally?	They operate normally.	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-4, Combination Meter System.>
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. (Engine OFF) 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 25 (+) — Chassis ground (-): Is the measured value less than the specified value?	0.12 V	Go to step 4.	Go to step 3.
3 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel level sensor signal using Subaru Select Monitor. Does the measured value stay less than the specified value while shaking the ECM harness and connector? NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.>	0.12 V	Repair poor contact in ECM connector.	The MIL may light up, however, the circuit is returned to the normal status at the moment. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in combination meter connector • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK INPUT VOLTAGE OF ECM. 1) Turn ignition switch to OFF. 2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15). 3) Turn ignition switch to ON. 4) Measure the voltage of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 25 (+) — Chassis ground (-): Is the measured value more than the specified value?	0.12 V	Go to step 5.	Go to step 6.
5 CHECK HARNESS BETWEEN ECM AND COMBINATION METER. 1) Turn ignition switch to OFF. 2) Disconnect the connector from connector (i12) and ECM connector. 3) Measure the resistance between ECM and chassis ground. Connector & terminal (B134) No. 25 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 7.	Repair short circuit to ground in harness between ECM and combination meter connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND COMBINATION METER. Measure the resistance between ECM and combination meter connector. Connector & terminal (B134) No. 25 — (E12) No. 2: Is the measured value less than the specified value?	10 Ω	Repair or replace the combination meter. <Ref. to IDI-4, Combination Meter System.>	Repair open circuit between ECM and combination meter connector. NOTE: In this case, repair the following: Poor contact in coupling connector
7 CHECK FUEL TANK CORD. 1)Turn ignition switch to OFF. 2)Disconnect the connector from fuel sub level sensor. 3)Measure the resistance between fuel sub level sensor and chassis ground. Connector & terminal (R59) No. 1 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 8.	Repair short circuit to ground in fuel tank cord.
8 CHECK FUEL TANK CORD. 1)Disconnect the connector from fuel pump assembly. 2)Measure the resistance between fuel pump assembly and chassis ground. Connector & terminal (R59) No. 2 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 9.	Repair short circuit to ground in fuel tank cord.
9 CHECK FUEL LEVEL SENSOR. 1)Remove the fuel pump assembly. <Ref. to FU(H4SO)-60, Fuel Pump.> 2)Measure the resistance between fuel level sensor and terminals with its float set to the full position. Terminal No. 3 — No. 2: Is the measured value within the specified range?	0.5 — 2.5 Ω	Go to step 10.	Replace the fuel level sensor.
10 CHECK FUEL SUB LEVEL SENSOR. 1)Remove the fuel sub level sensor. <Ref. to FU(H4SO)-63, Fuel Sub Level Sensor.> 2)Measure the resistance between fuel sub level sensor and terminals with its float set to the full position. Terminal No. 1 — No. 2: Is the measured value within the specified range?	0.5 — 2.5 Ω	Repair poor contact in harness between ECM and combination meter connector.	Replace the fuel sub level sensor.

BG:DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —

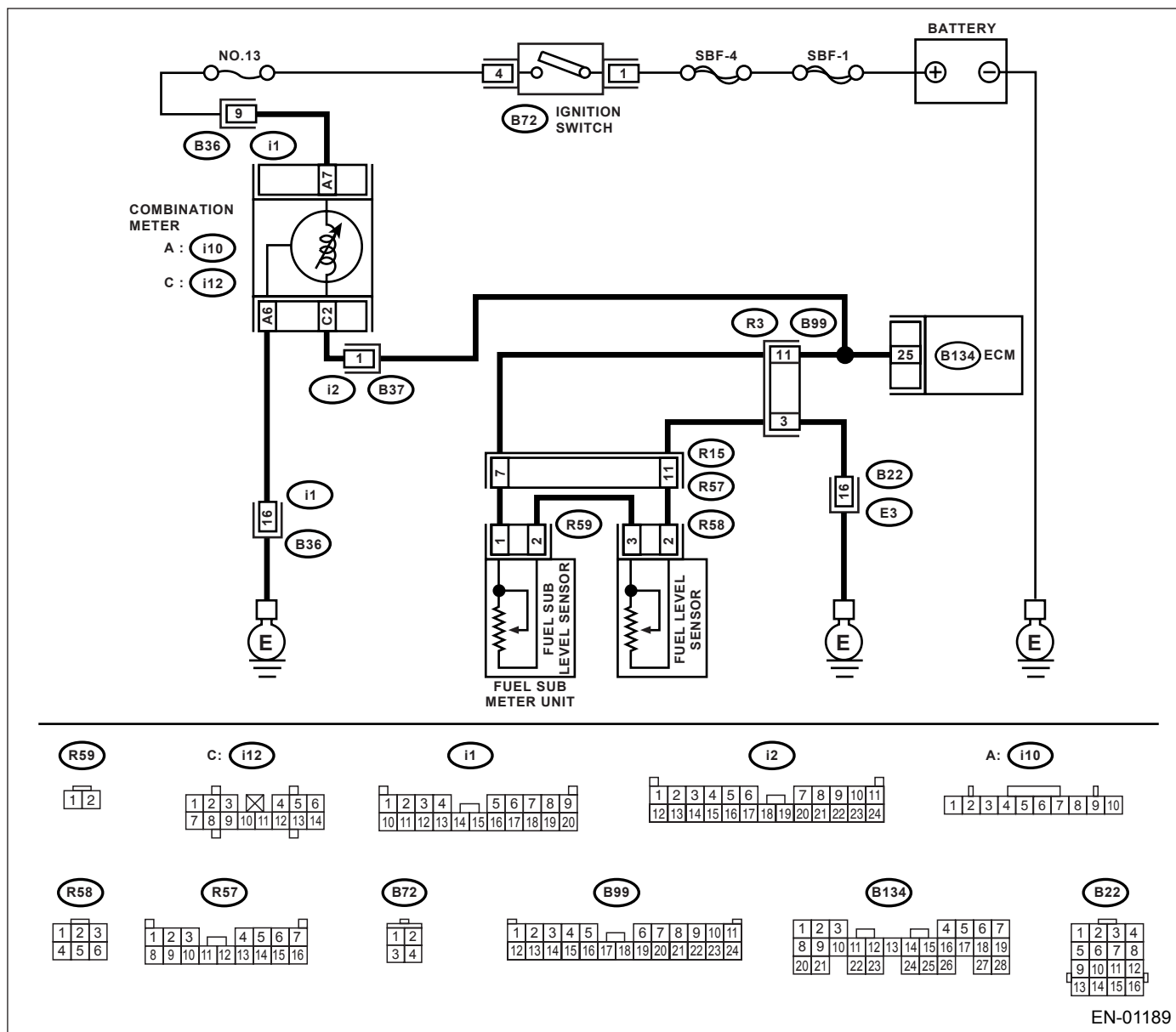
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01189

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER. Does the speedometer and tachometer operate normally?	They operate normally.	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-4, Combination Meter System.>
2 CHECK INPUT SIGNAL FOR ECM. 1)Turn ignition switch to ON. (Engine OFF) 2)Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 25 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.75 V	Go to step 3.	The MIL may light up, however, the circuit is returned to the normal status at the moment. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in fuel pump connector • Poor contact in coupling connector
3 CHECK INPUT VOLTAGE OF ECM. 1)Turn ignition switch to OFF. 2)Disconnect the combination meter connector (i12) and ECM connector. 3)Turn ignition switch to ON. 4)Measure the voltage of harness between ECM and chassis ground. Connector & terminal (B134) No. 25 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.75 V	Go to step 4.	Repair short circuit to battery between ECM and combination meter connector.
4 CHECK HARNESS BETWEEN ECM AND FUEL TANK CORD. 1)Turn ignition switch to OFF. 2)Separate fuel tank cord connector (R57) and rear wiring harness connector (R15). 3)Measure the resistance between ECM and fuel tank cord. Connector & terminal (B134) No. 25 — (R15) No. 7: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Repair open circuit between ECM and fuel tank cord.
5 CHECK HARNESS BETWEEN FUEL TANK CORD AND CHASSIS GROUND. Measure the resistance between fuel tank cord and chassis ground. Connector & terminal (R15) No. 11 — Chassis ground: Is the measured value less than the specified value?	5 Ω	Go to step 6.	Repair open circuit between fuel tank cord and chassis ground. NOTE: In this case, repair the following: Poor contact in coupling connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel level sensor. 2) Measure the resistance between fuel level sensor and coupling connector. Connector & terminal (R57) No. 11 — (R58) No. 2: Is the measured value less than the specified value?	10 Ω	Go to step 7.	Repair open circuit between coupling connector and fuel level sensor.
7 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel sub level sensor. 2) Measure the resistance between fuel level sensor and fuel sub level sensor. Connector & terminal (R58) No. 3 — (R59) No. 2: Is the measured value less than the specified value?	10 Ω	Go to step 8.	Repair open circuit between fuel level sensor and fuel sub level sensor.
8 CHECK FUEL TANK CORD. Measure the resistance between fuel sub level sensor and coupling connector. Connector & terminal (R57) No. 7 — (R59) No. 1: Is the measured value less than the specified value?	10 Ω	Go to step 9.	Repair open circuit between coupling connector and fuel sub level sensor.
9 CHECK FUEL LEVEL SENSOR. 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-60, Fuel Pump.> 2) While moving the fuel level sensor float up and down, measure resistance between fuel level sensor terminals. Terminal No. 3 — No. 2: Is the measured value more than the specified value?	54.5 Ω	Replace the fuel level sensor. <Ref. to FU(H4SO)-62, Fuel Level Sensor.>	Go to step 10.
10 CHECK FUEL SUB LEVEL SENSOR. 1) Remove the fuel sub level sensor. <Ref. to FU(H4SO)-63, Fuel Sub Level Sensor.> 2) While moving the fuel sub level sensor float up and down, measure resistance between fuel sub level sensor terminals. Terminal No. 1 — No. 2: Is the measured value more than the specified value?	41.5 Ω	Replace the fuel sub level sensor. <Ref. to FU(H4SO)-63, Fuel Sub Level Sensor.>	Replace the combination meter. <Ref. to IDI-12, Combination Meter Assembly.>

BH:DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —

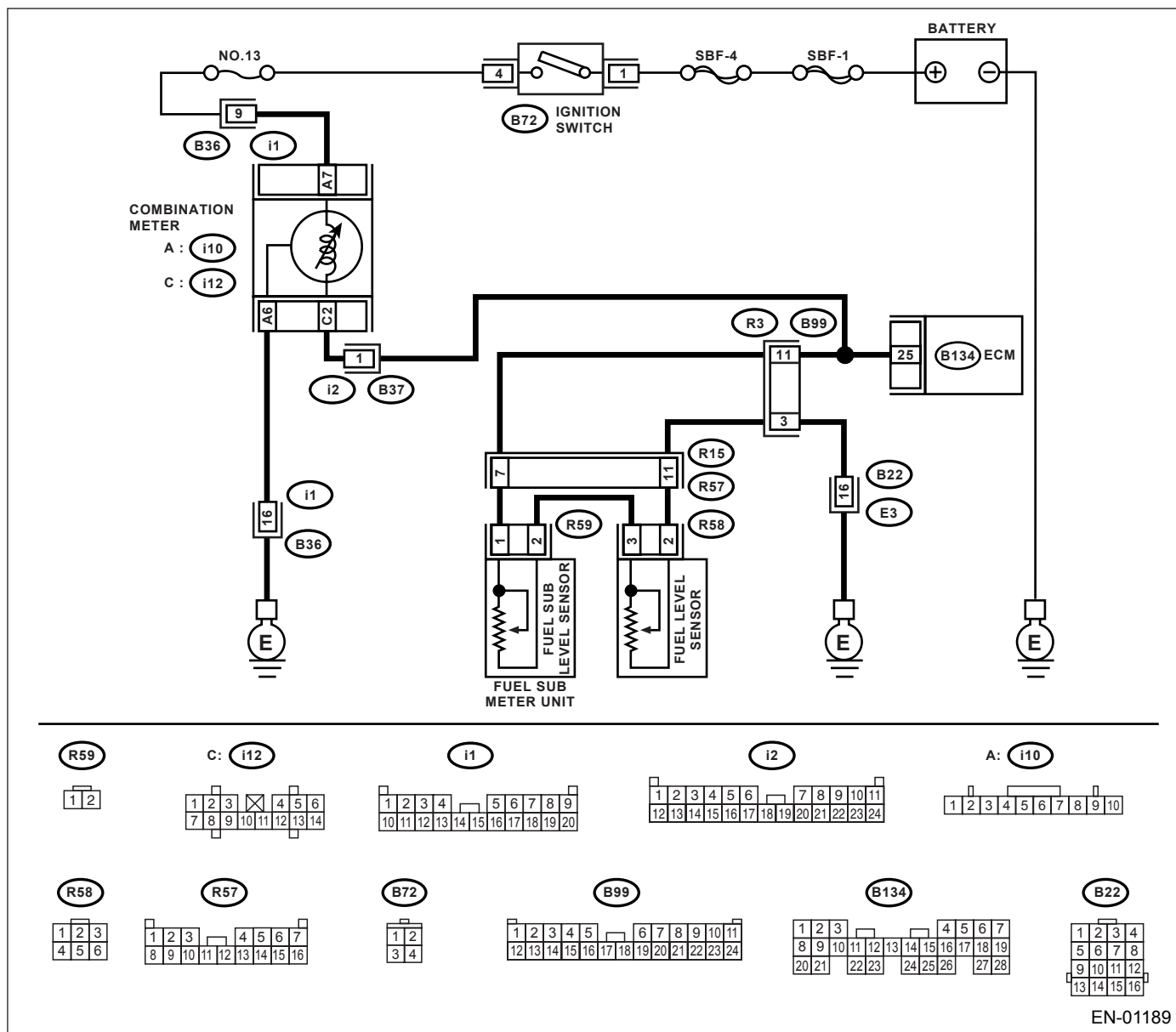
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01189

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC P0462 or P0463 using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL LEVEL SENSOR. 1)Remove the fuel pump assembly. <Ref. to FU(H4SO)-60, Fuel Pump.> 2)While moving the fuel level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. <i>Terminal</i> No. 3 — No. 2: Does the resistance change smoothly?	Changes smoothly.	Go to step 3.	Replace the fuel level sensor. <Ref. to FU(H4SO)-62, Fuel Level Sensor.>
3 CHECK FUEL SUB LEVEL SENSOR. 1)Remove the fuel sub level sensor. <Ref. to FU(H4SO)-62, Fuel Level Sensor.> 2)While moving the fuel sub level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. <i>Terminal</i> No. 1 — No. 2: Does the resistance change smoothly?	Changes smoothly.	Repair poor contact in ECM, combination meter and coupling connectors.	Replace the fuel sub level sensor. <Ref. to FU(H4SO)-62, Fuel Level Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BI: DTC P0483 — COOLING FAN RATIONALITY CHECK —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Occurrence of noise
 - Overheating

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

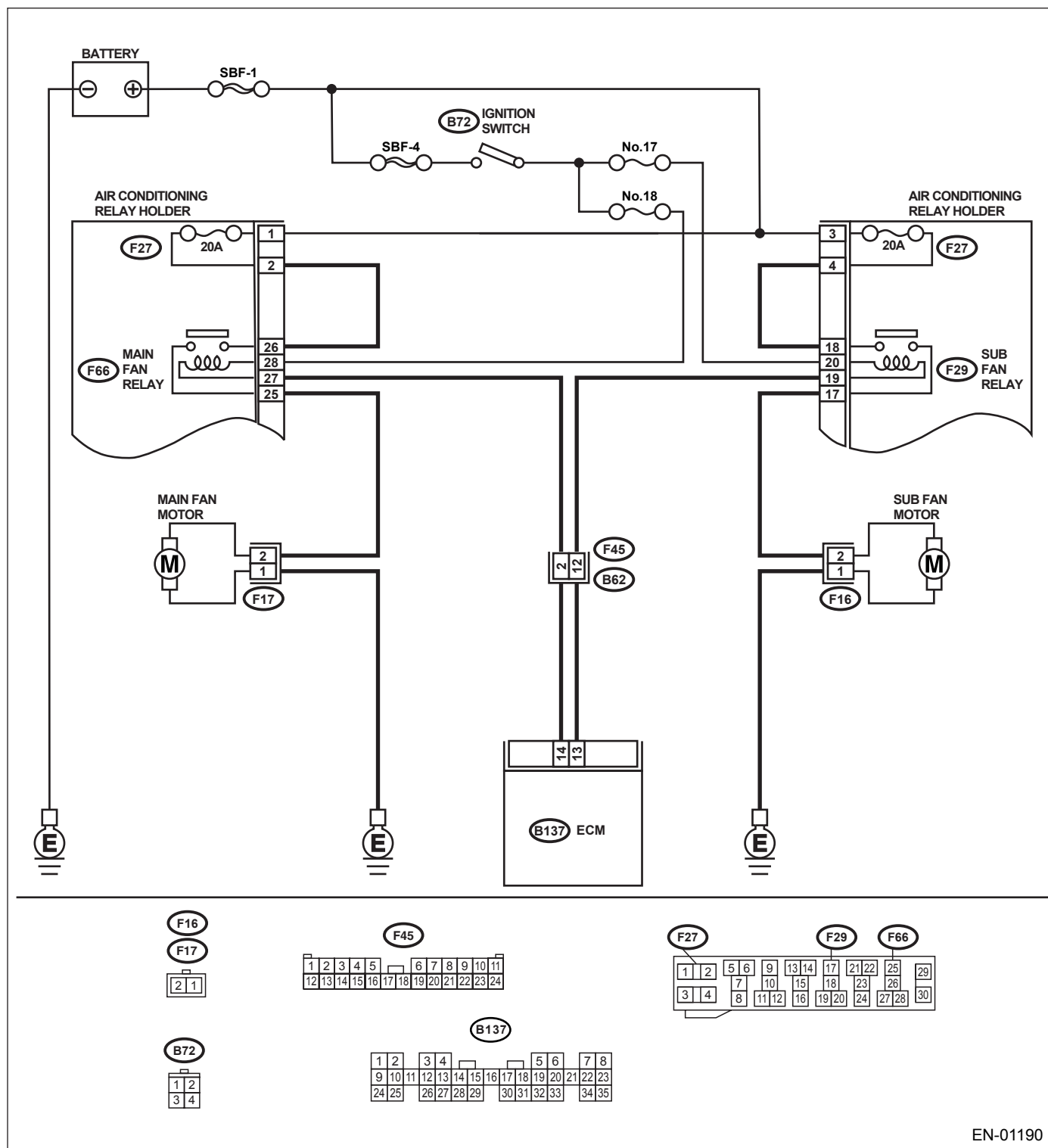
NOTE:

If the vehicle is placed very close to a wall or another vehicle with the engine idling, the normal cooling function may be impeded causing the OBD system to interpret as a malfunction.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01190

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Check radiator fan and fan motor. <Ref. to CO(H4SO)-47, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-49, Radiator Sub Fan and Fan Motor.>

BJ:DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —

NOTE:

For the diagnostic procedure, refer to DTC P0503. <Ref. to EN(H4SO)-244, DTC P0503 — VEHICLE SPEED SENSOR HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

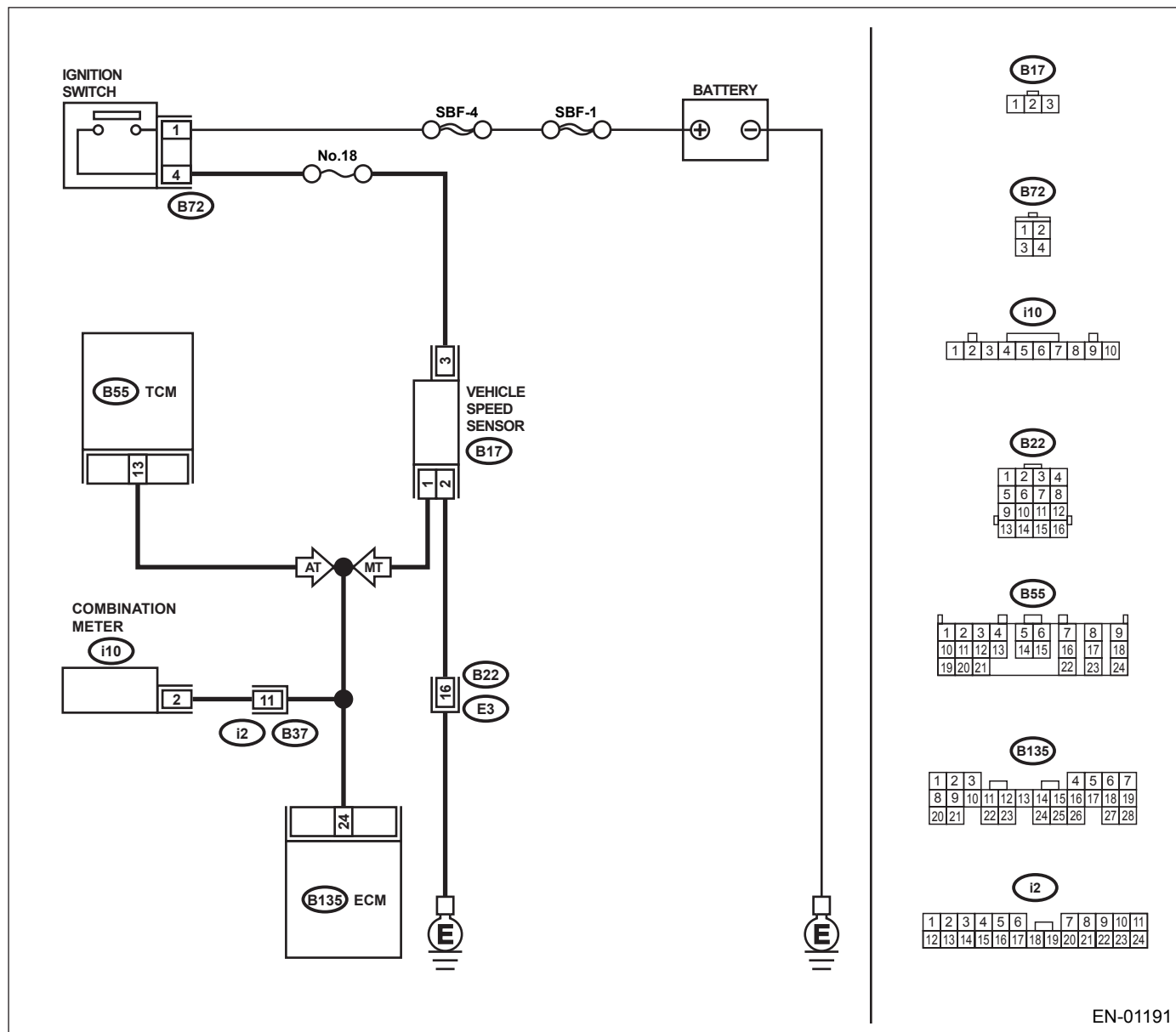
BK:DTC P0503 — VEHICLE SPEED SENSOR HIGH INPUT —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01191

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK TRANSMISSION TYPE. Is the transmission AT?	AT.	Go to step 2.	Go to step 3.
2	CHECK DTC P0720 ON DISPLAY. Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?	DTC P0720 is indicated.	Check front vehicle speed sensor signal circuit. <Ref. to AT-61, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Go to step 3.
3	CHECK SPEEDOMETER OPERATION IN COMBINATION METER. Does the speedometer operate normally?	Operates normally.	Go to step 4.	Check speedometer and vehicle speed sensor. <Ref. to IDI-14, Speedometer.> and <Ref. to AT-52, Front Vehicle Speed Sensor.> and <Ref. to AT-56, Rear Vehicle Speed Sensor.> and <Ref. to AT-57, Torque Converter Turbine Speed Sensor.>.
4	CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from combination meter. 3) Measure the resistance between ECM and combination meter. Connector & terminal (B135) No. 24 — (i10) No. 2: Is the measured value less than the specified value?	10 Ω	Repair poor contact in ECM connector.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and combination meter connector • Poor contact in ECM connector • Poor contact in combination meter connector • Poor contact in coupling connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

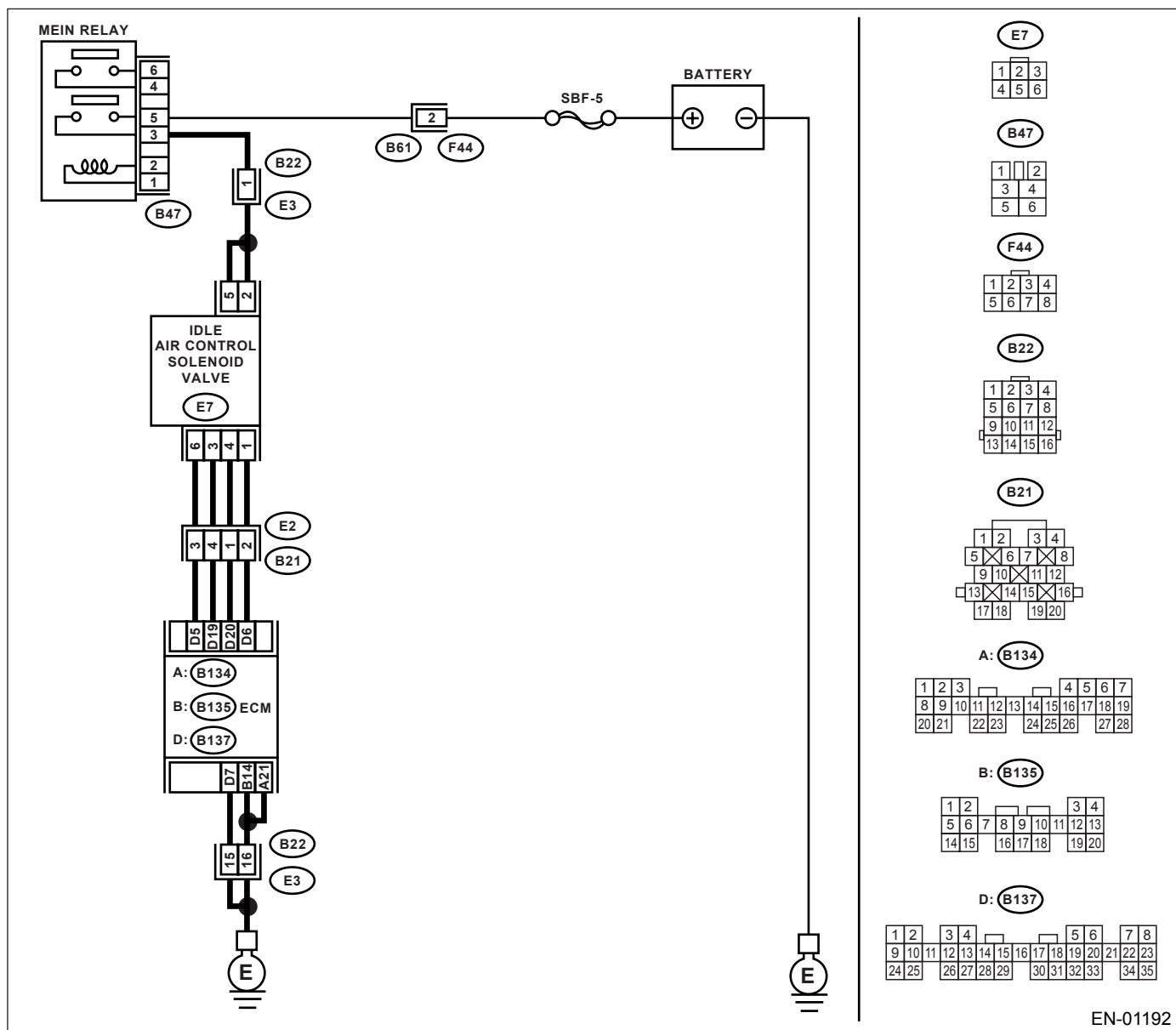
BL:DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Engine is difficult to start.
 - Engine does not start.
 - Erroneous idling
 - Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0506.	Go to step 2.
2 CHECK AIR BYPASS LINE. 1)Turn ignition switch to OFF. 2)Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-36, REMOVAL, Idle Air Control Solenoid Valve.> 3)Remove the throttle body from intake manifold. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> 4)Using an air gun, force air into the idle air control solenoid valve installation area. Confirm that forced air subsequently escapes from throttle body interior. Does air flow out?	Air flows out.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-36, INSTALLATION, Idle Air Control Solenoid Valve.>	Replace the throttle body. <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BM:DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

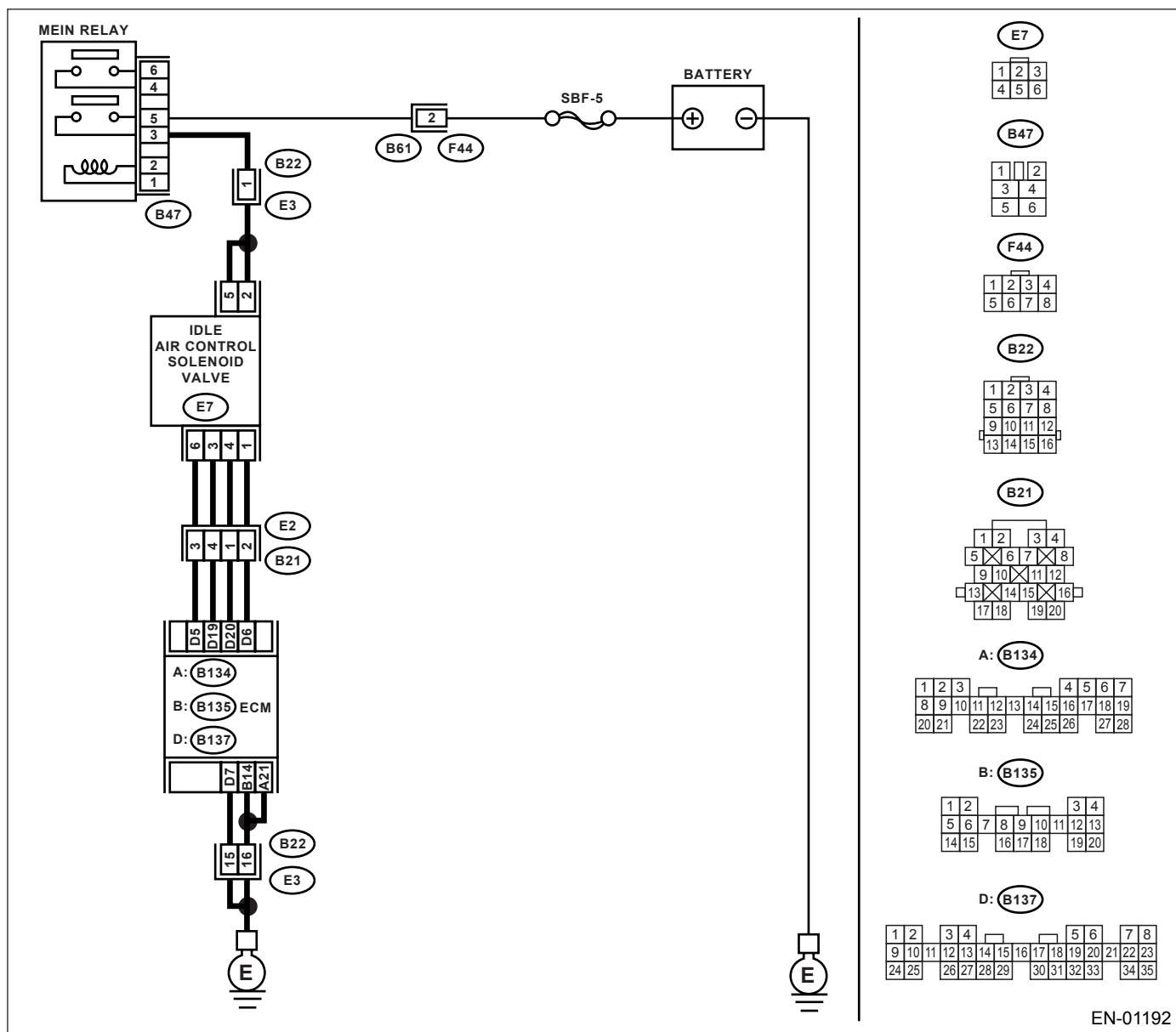
• TROUBLE SYMPTOM:

- Engine keeps running at higher revolution than specified idling revolution.

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01192

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0507.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. 1)Turn ignition switch to ON. 2)Start and idle the engine. 3)Check the following items. •Loose installation of intake manifold, idle air control solenoid valve and throttle body •Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket •Disconnections of vacuum hoses Is there a fault in air intake system?	There is a fault.	Repair air suction and leaks.	Go to step 3.
3 CHECK THROTTLE CABLE. Is throttle cable play correct?	Play is correct.	Go to step 4.	Adjust throttle cable. <Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>
4 CHECK AIR BYPASS LINE. 1)Turn ignition switch to OFF. 2)Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-36, REMOVAL, Idle Air Control Solenoid Valve.> 3)Confirm that there are no foreign particles in bypass air line. Is bypass air line clogged by foreign partides?	Clogged.	Remove foreign particles from bypass air line.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-36, INSTALLATION, Idle Air Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BN:DTC P0512 — STARTER REQUEST CIRCUIT —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Failure of engine to start

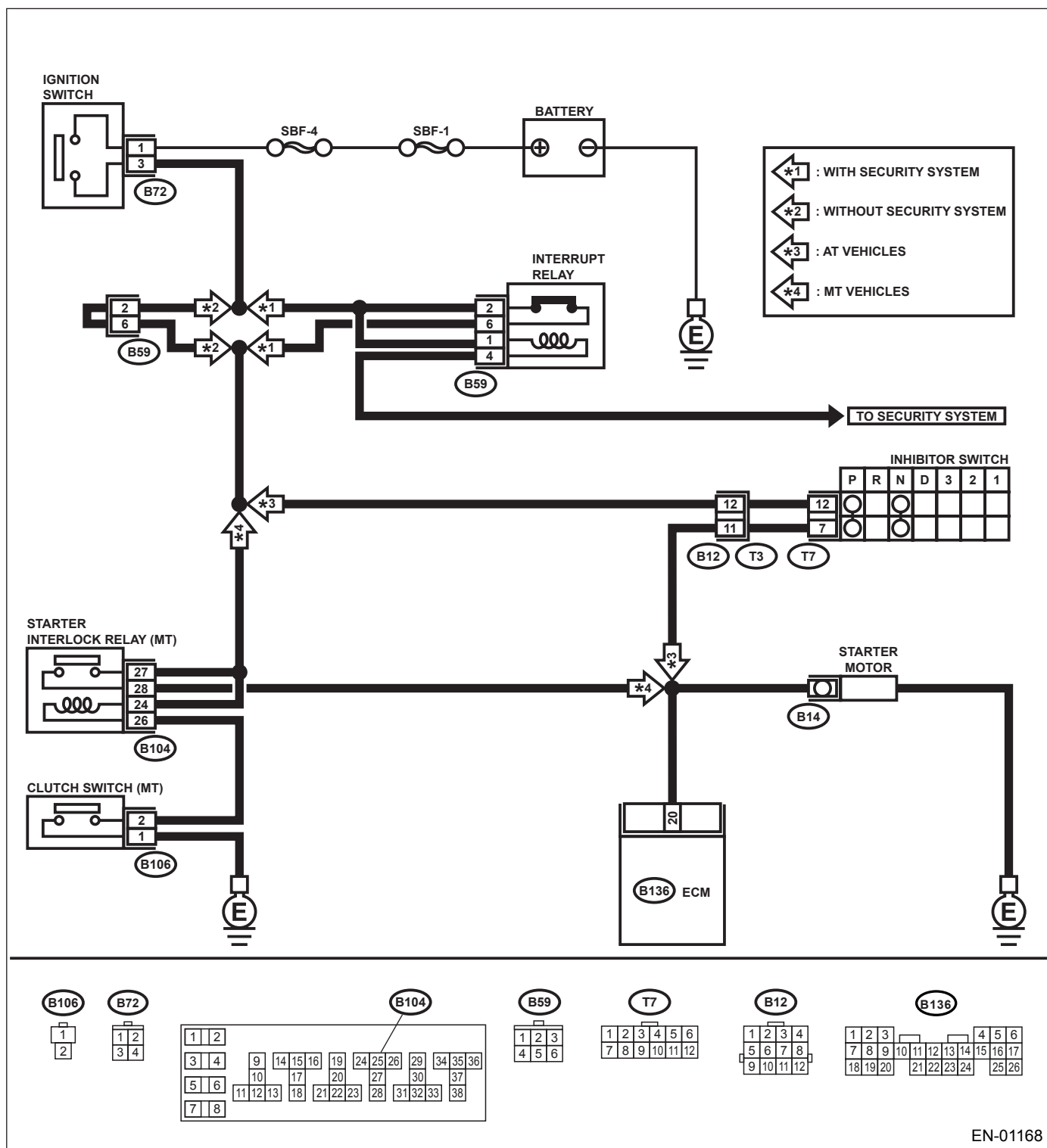
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01168

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF STARTER MOTOR. Does the starter motor operate when ignition switch is turned to ON? NOTE: Place the inhibitor switch in each position. (AT model) Depress or release the clutch pedal. (MT model)	Operates.	Repair short circuit to battery in starter motor circuit.	Check starter motor circuit. <Ref. to EN(H4SO)-60, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BO:DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —

• DTC DETECTING CONDITION:

- Immediately at fault recognition

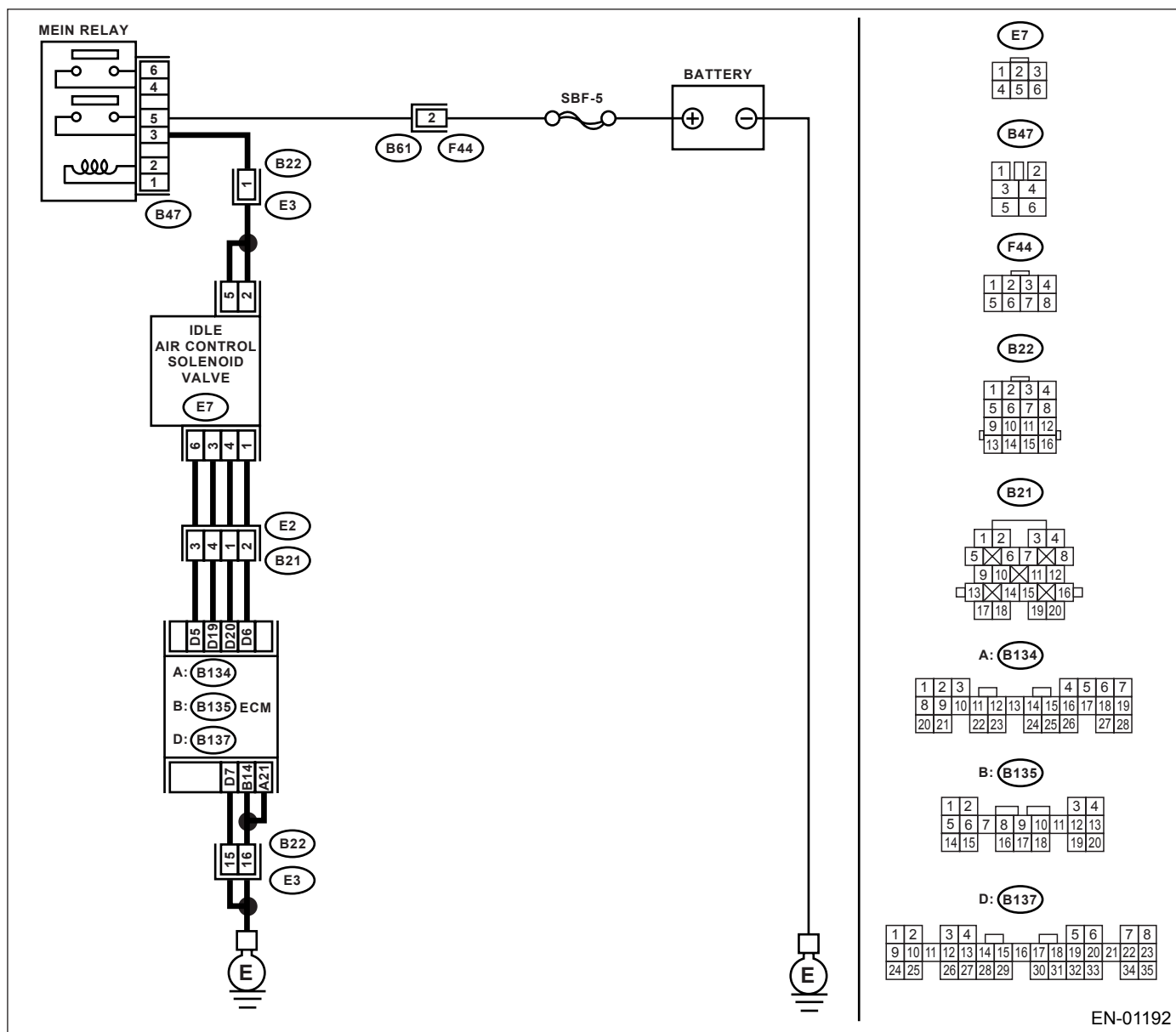
• TROUBLE SYMPTOM:

- Engine keeps running at higher revolution than specified idling revolution.

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01192

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.> NOTE: In this case, it is not necessary to inspect DTC P0519.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. 1)Turn ignition switch to ON. 2)Start and idle the engine. 3)Check the following items. •Loose installation of intake manifold, idle air control solenoid valve and throttle body •Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket •Disconnections of vacuum hoses Is there a fault in air intake system?	There is a fault.	Repair air suction and leaks.	Go to step 3.
3 CHECK THROTTLE CABLE. Is throttle cable play correct?	Play is correct.	Go to step 4.	Adjust throttle cable. <Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>
4 CHECK AIR BYPASS LINE. 1)Turn ignition switch to OFF. 2)Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-36, Idle Air Control Solenoid Valve.> 3)Confirm that there are no foreign particles in bypass air line. Is bypass air line clogged by foreign particles?	Line is clogged.	Remove foreign particles from bypass air line.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-36, Idle Air Control Solenoid Valve.>

BP:DTC P0565 — CRUISE CONTROL SET SIGNAL CIRCUIT MALFUNCTION (AT) —

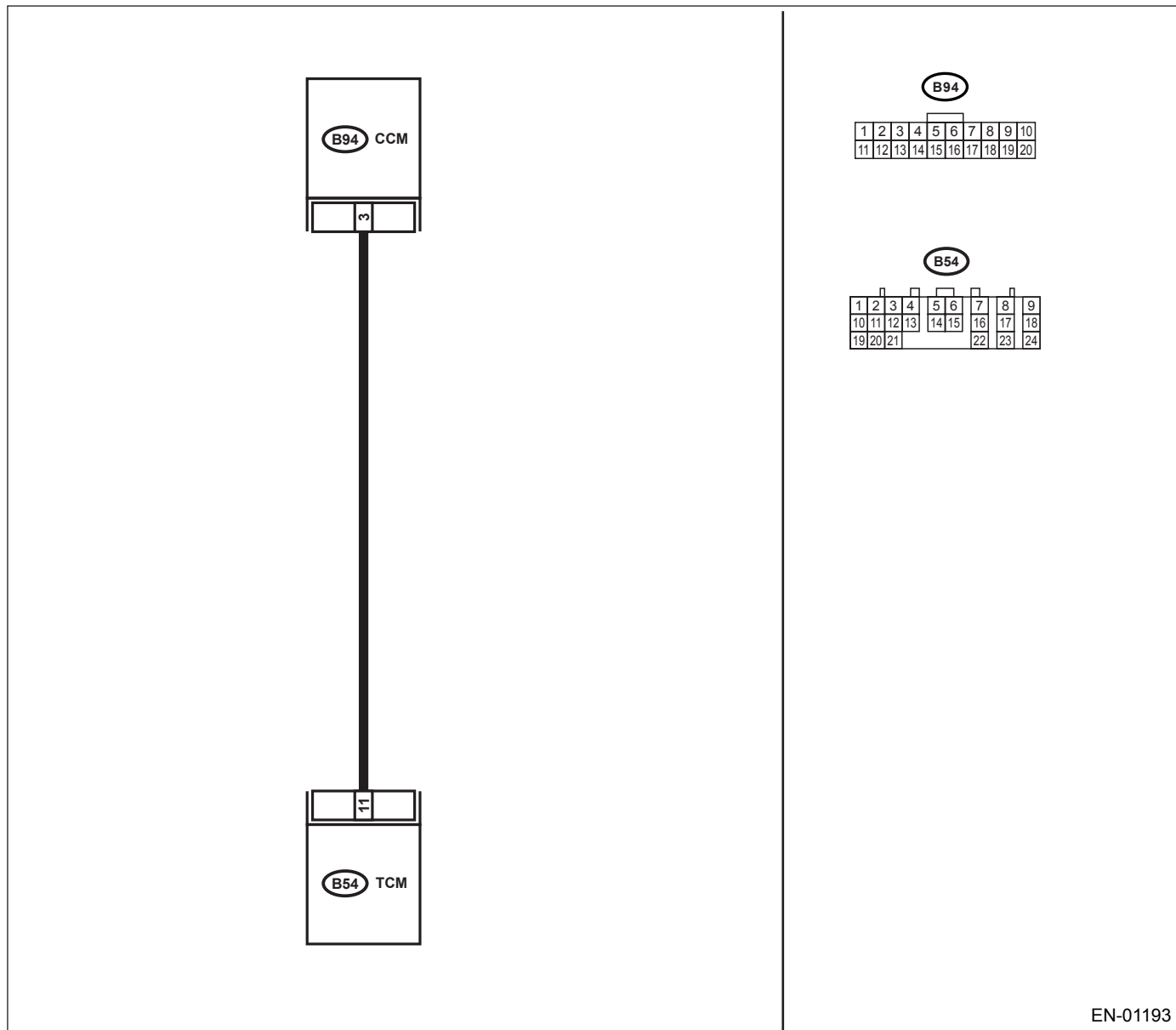
• **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01193

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from TCM and CCM. 3) Measure the resistance of harness between TCM and CCM connector. Connector & terminal (B54) No. 11 — (B94) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 2.	Repair open circuit in harness between CCM and TCM connector.
2 CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR. Measure the resistance of harness between TCM and chassis ground. Connector & terminal (B54) No. 11 (+) — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 3.	Repair short circuit in harness between TCM and CCM connector.
3 CHECK INPUT SIGNAL FOR TCM. 1) Connect the connector to TCM and CCM. 2) Lift-up the vehicle or set the vehicle on free rollers. CAUTION: On AWD models, raise all wheels off ground. 3) Start the engine. 4) Turn the cruise control main switch to ON. 5) Slowly increase vehicle speed to 50 km/h (31 MPH). 6) Turn the cruise control command switch to ON. 7) Measure the voltage between TCM and chassis ground. Connector & terminal (B54) No. 11 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Go to step 4.	Check cruise control command switch circuit. <Ref. to CC-7, INSPECTION, Cruise Control Command Switch.>
4 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

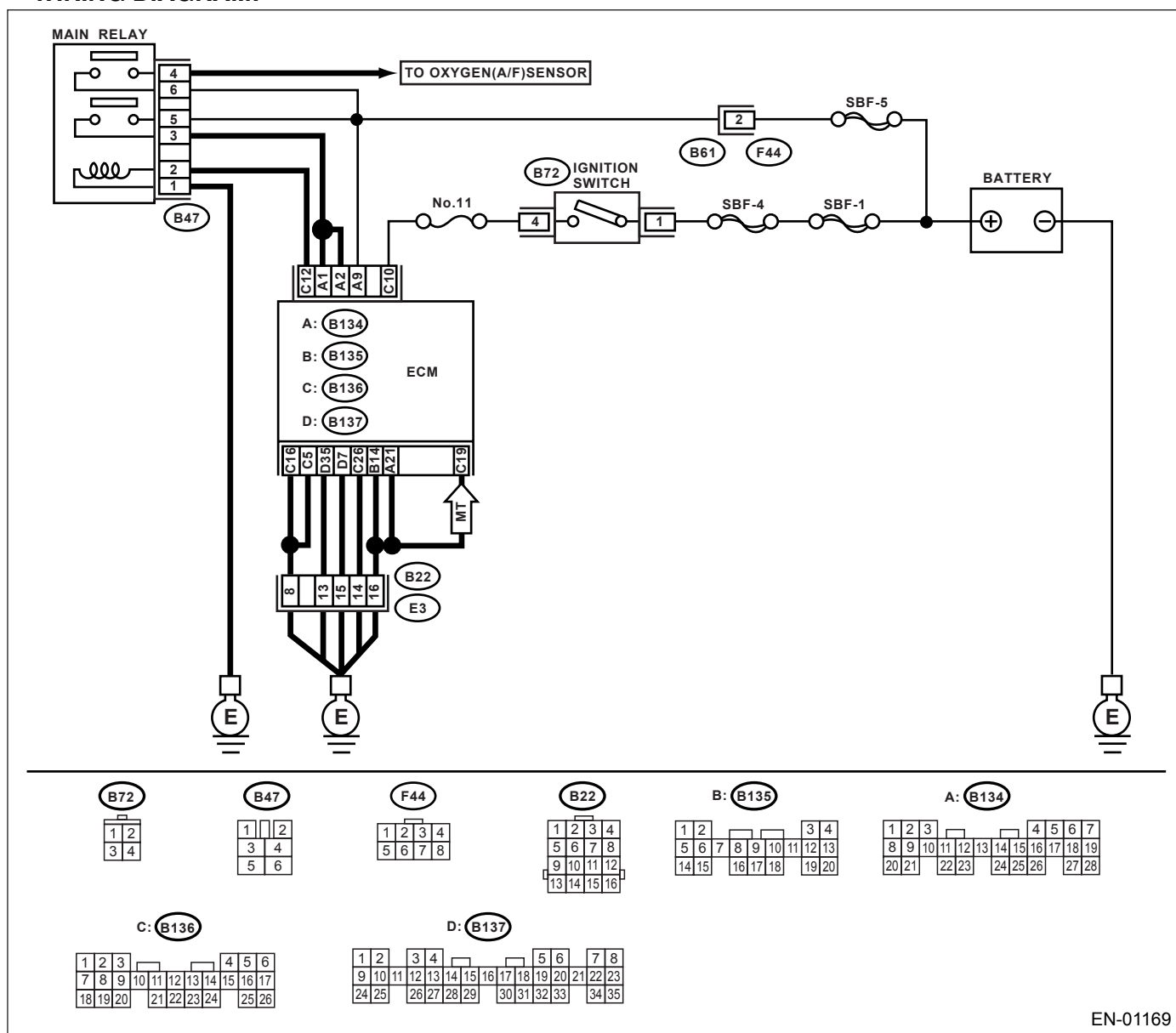
BQ:DTC P0604 — INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Engine does not start.
 - Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	There is temporary poor contact.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BR:DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Radiator fan does not operate properly.
 - Overheating

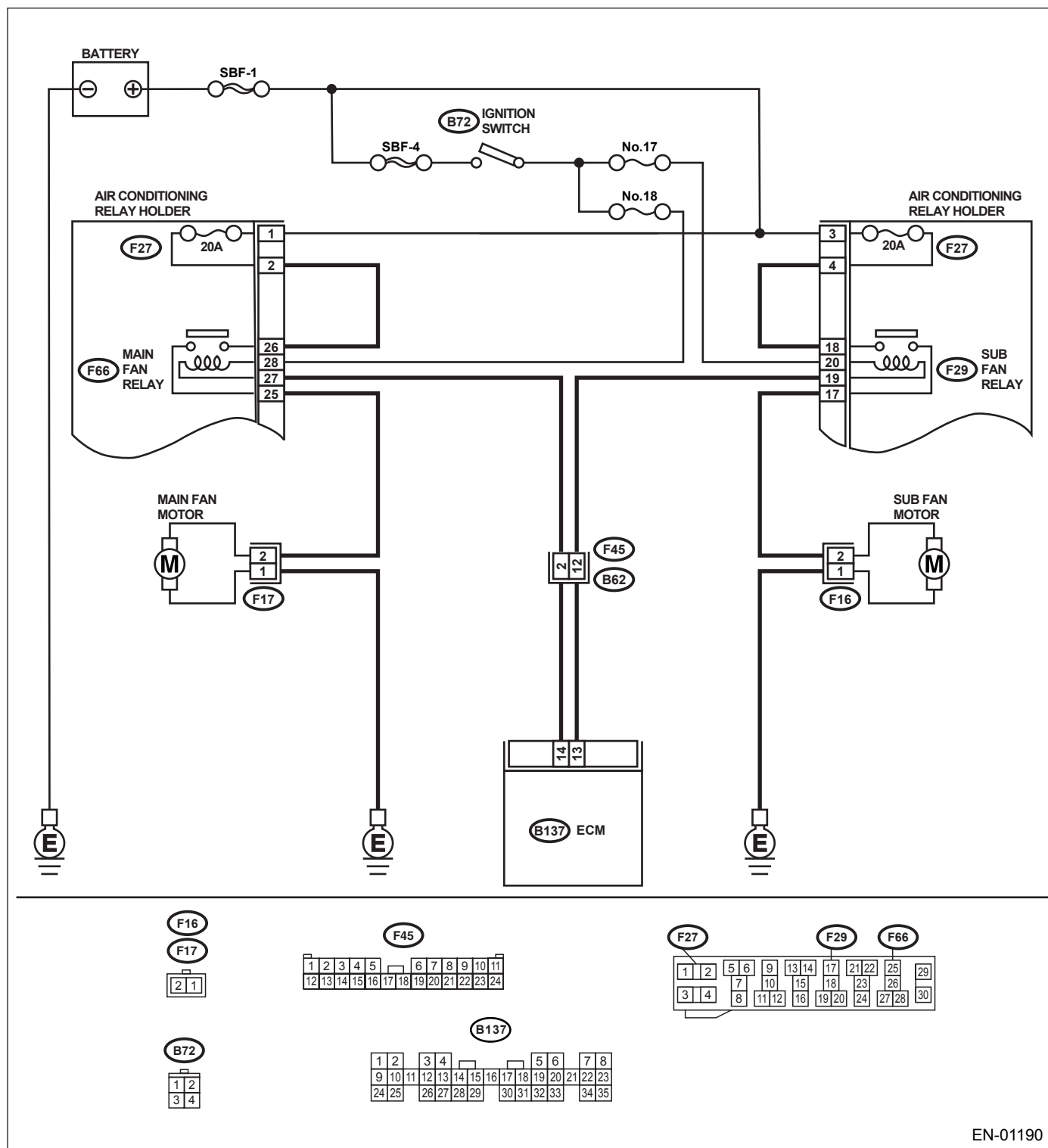
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01190

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the radiator fan relay, measure voltage between ECM terminal and ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> Connector & terminal (B137) No. 14 (+) — Chassis ground (-): (B137) No. 13 (+) — Chassis ground (-): Does the measured value change within the specified range?	0 — 10 V	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK FOR SHORT CIRCUIT TO GROUND IN RADIATOR FAN RELAY CONTROL CIRCUIT. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B137) No. 14 — Chassis ground: (B137) No. 13 — Chassis ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in radiator fan relay control circuit.	Go to step 3.
3 CHECK POWER SUPPLY FOR RELAY. 1) Remove the main fan relay from A/C relay holder. 2) Turn ignition switch to ON. 3) Measure the voltage between fuse and relay box (F/B) connector and chassis ground. Connector & terminal (F66) No. 28 (+) — Chassis ground (-): (F29) No. 20 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Repair open circuit in harness between ignition switch and fuse and relay box (F/B) connector.
4 CHECK RADIATOR FAN RELAY. 1) Turn ignition switch to OFF. 2) Measure the resistance between radiator fan relay terminals. Terminal No. 27 — No. 28: No. 19 — No. 20: Is the measured value within the specified range?	87 — 107 Ω	Go to step 5.	Replace the radiator fan relay.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK FOR OPEN CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT. Measure the resistance of harness between ECM and radiator fan relay connector. Connector & terminal (B137) No. 14 — (F66) No. 27: (B137) No. 13 — (F29) No. 19: Is the measured value less than the specified value?	1 Ω	Go to step 6.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and radiator fan relay connector • Poor contact in coupling connector
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM or radiator fan relay connector. Is there poor contact in ECM or radiator fan relay connector?	There is poor contact.	Repair poor contact in ECM or radiator fan relay connector.	Contact SOA (distributor) service.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BS:DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Radiator fan does not operate properly.
 - Overheating

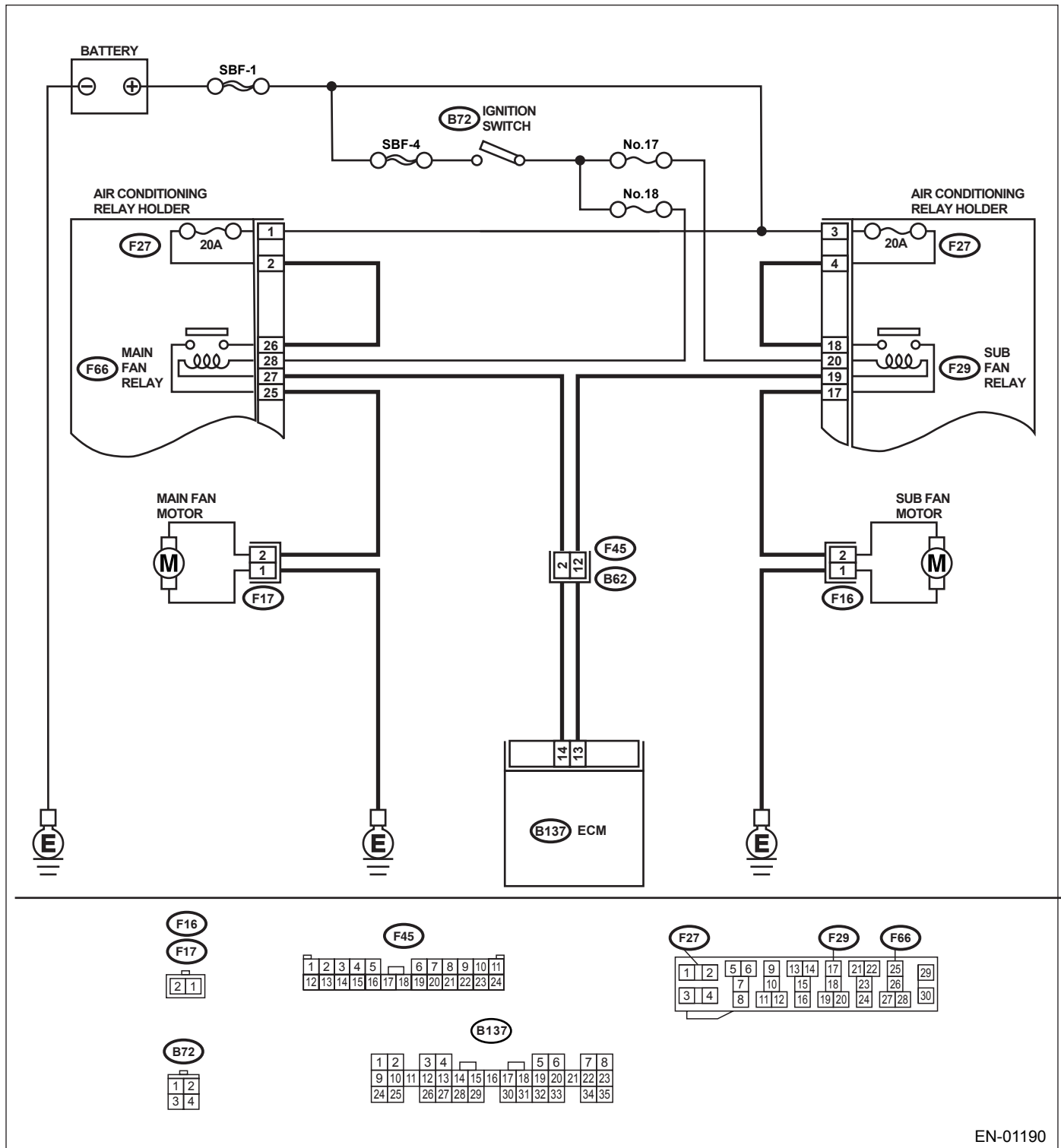
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01190

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the radiator fan relay, measure voltage between ECM and chassis ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.> Connector & terminal (B137) No. 14 (+) — Chassis ground (-): (B137) No. 13 (+) — Chassis ground (-): Does the measured value change within the specified range?	0 — 10 V	The MIL may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.	Go to step 2.
2 CHECK FOR SHORT CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT. 1) Turn ignition switch to OFF. 2) Remove the main fan relay and sub fan relay. (vehicles with A/C) 3) Disconnect the test mode connector. 4) Turn ignition switch to ON. 5) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 14 (+) — Chassis ground (-): (B137) No. 13 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in radiator fan relay control circuit. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 3.
3 CHECK MAIN FAN RELAY. 1) Turn ignition switch to OFF. 2) Remove the main fan relay. 3) Measure the resistance between main fan relay terminals. Terminal No. 25 — No. 26: Is the measured value less than the specified value?	1 Ω	Replace the main fan relay and ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 4.
4 CHECK SUB FAN RELAY. 1) Remove the sub fan relay. 2) Measure the resistance between sub fan relay terminals. Terminal No. 17 — No. 18: Is the measured value less than the specified value?	1 Ω	Replace the sub fan relay and ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 5.
5 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BT:DTC P0703 — TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT —

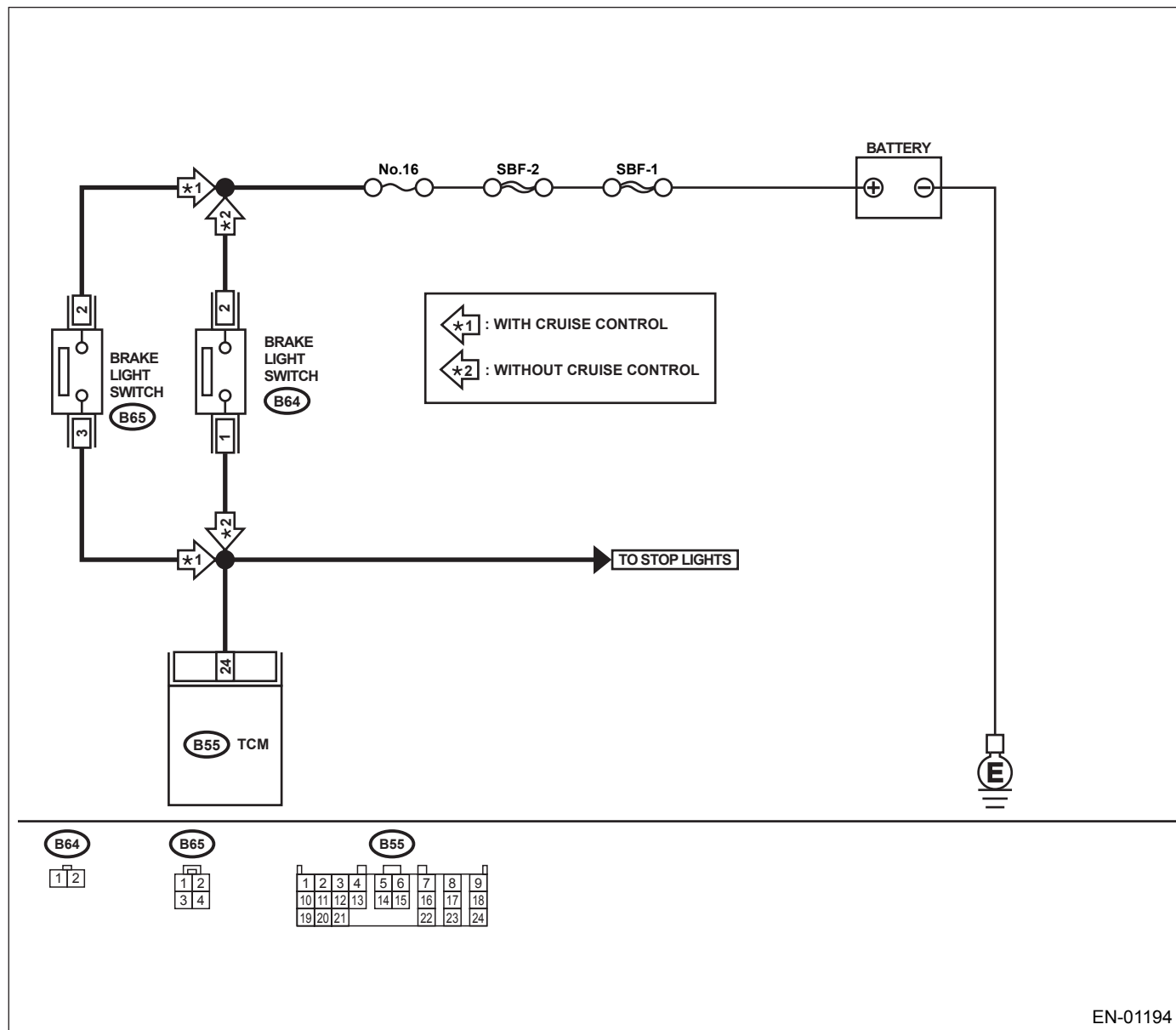
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01194

Step	Check	Yes	No
1	CHECK OPERATION OF BRAKE LIGHT. Does the brake light illuminate when depressing the brake pedal?	Illuminates.	Go to step 2.
			Repair or replace the brake light circuit.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR. 1) Disconnect the connectors from TCM and brake light switch. 2) Measure the resistance of harness between TCM and brake light switch connector. Connector & terminal Without cruise control (B55) No. 24 — (B64) No. 1: With cruise control (B55) No. 24 — (B65) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 3.	Repair or replace the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between TCM and brake light switch connector • Poor contact in TCM connector • Poor contact in brake light switch connector
3 CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR. Measure the resistance of harness between TCM and chassis ground. Connector & terminal (B55) No. 24 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 4.	Repair short circuit to ground in harness between TCM and brake light switch connector.
4 CHECK INPUT SIGNAL FOR TCM. 1) Connect the connectors to TCM and brake light switch. 2) Measure the voltage between TCM and chassis ground. Connector & terminal (B55) No. 24 (+) — Chassis ground (-): Is the measured value less than specified value when the brake pedal is released?	1 V	Go to step 5.	Adjust or replace the brake light switch. <Ref. to LI-7, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
5 CHECK INPUT SIGNAL FOR TCM. Measure the voltage between TCM and chassis ground. Connector & terminal (B55) No. 24 (+) — Chassis ground (-): Is the measured value more than specified value when the brake pedal is depressed?	10 V	Go to step 6.	Adjust or replace the brake light switch. <Ref. to LI-7, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
6 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BU:DTC P0731 — GEAR 1 INCORRECT RATIO —

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-271, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BV:DTC P0732 — GEAR 2 INCORRECT RATIO —

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-271, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BW:DTC P0733 — GEAR 3 INCORRECT RATIO —

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-271, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BX:DTC P0734 — GEAR 4 INCORRECT RATIO —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

• TROUBLE SYMPTOM:

- Shift point too high or too low; engine brake not effected in “3” range; excessive shift shock; excessive tight corner “braking”

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK THROTTLE POSITION SENSOR CIRCUIT. Check throttle position sensor circuit. <Ref. to AT-54, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in throttle position sensor circuit?	There is a fault.	Repair or replace the throttle position sensor circuit.	Go to step 3.
3 CHECK FRONT VEHICLE SPEED SENSOR CIRCUIT. Check front vehicle speed sensor circuit. <Ref. to AT-61, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in front vehicle speed sensor circuit?	There is a fault.	Repair or replace the front vehicle speed sensor circuit.	Go to step 4.
4 CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT. Check torque converter turbine speed sensor circuit. <Ref. to AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in torque converter turbine speed sensor circuit?	There is a fault.	Repair or replace the torque converter turbine speed sensor circuit.	Go to step 5.
5 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Go to step 6.
6 CHECK FOR MECHANICAL TROUBLE. Check for mechanical trouble in automatic transmission. Is there any mechanical trouble in automatic transmission?	There is a mechanical trouble.	Repair or replace the automatic transmission. <Ref. to AT-32, INSPECTION, Road Test.>	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BY:DTC P0741 — TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

• TROUBLE SYMPTOM:

- No lock-up (after engine warm-up)
- No shift or excessive tight corner “braking”

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No	
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2	CHECK LOCK-UP DUTY SOLENOID CIRCUIT. Check lock-up duty solenoid circuit. <Ref. to AT-104, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in lock-up duty solenoid circuit?	There is a fault.	Repair or replace the lock-up duty solenoid circuit.	Go to step 3.
3	CHECK THROTTLE POSITION SENSOR CIRCUIT. Check throttle position sensor circuit. <Ref. to AT-54, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in throttle position sensor circuit?	There is a fault.	Repair or replace the throttle position sensor circuit.	Go to step 4.
4	CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT. Check torque converter turbine speed sensor circuit. <Ref. to AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in torque converter turbine speed sensor circuit?	There is a fault.	Repair or replace the torque converter turbine speed sensor circuit.	Go to step 5.
5	CHECK ENGINE SPEED INPUT CIRCUIT. Check engine speed input circuit. <Ref. to AT-44, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in engine speed input circuit?	There is a fault.	Repair or replace the engine speed input circuit.	Go to step 6.
6	CHECK INHIBITOR SWITCH CIRCUIT. Check inhibitor switch circuit. <Ref. to AT-127, CHECK INHIBITOR SWITCH., Diagnostic Procedure for No-Diagnostic Trouble Code (DTC).> Is there any trouble in inhibitor switch circuit?	There is a fault.	Repair or replace the inhibitor switch circuit.	Go to step 7.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK BRAKE LIGHT SWITCH CIRCUIT. Check brake light switch circuit. <Ref. to AT-125, CHECK BRAKE SWITCH., Diagnostic Procedure for No-Diagnostic Trouble Code (DTC).> Is there any trouble in brake light switch circuit?	There is a fault.	Repair or replace the brake light switch circuit.	Go to step 8.
8 CHECK ATF TEMPERATURE SENSOR CIRCUIT. Check ATF temperature sensor circuit. <Ref. to AT-50, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> Is there any trouble in ATF temperature sensor circuit?	There is a fault.	Repair or replace the ATF temperature sensor circuit.	Go to step 9.
9 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Go to step 10.
10 CHECK FOR MECHANICAL TROUBLE. Check for mechanical trouble in automatic transmission. Is there any mechanical trouble in automatic transmission?	There is a mechanical trouble.	Repair or replace the automatic transmission. <Ref. to AT-32, INSPECTION, Road Test.>	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

BZ:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT) —

• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

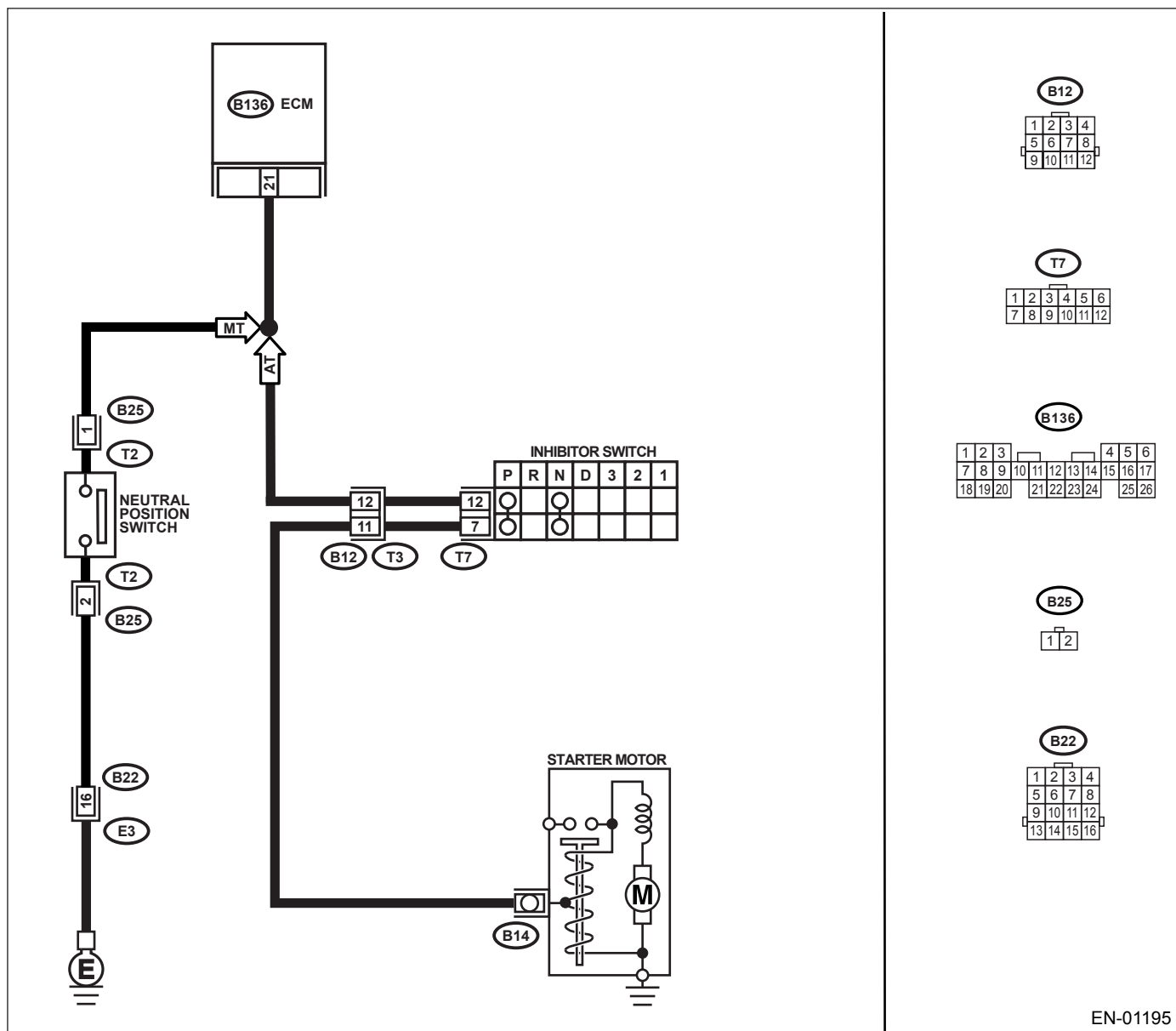
• TROUBLE SYMPTOM:

- Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01195

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK IF DTC P0705 IS INDICATED ON DISPLAY. Is DTC P0705 indicated?	DTC P0705 is indicated.	Inspect DTC P0705 using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Place the select lever to other than "N" and "P" positions. 3) Measure the voltage between ECM and chassis ground. <i>Connector & terminal</i> <i>(B136) No. 21 (+) — Chassis ground (-):</i> Is the measured value within the specified range?	4.5 — 5.5 V	The MIL may light up, however, the circuit is returned to the normal status at the moment.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from ECM and transmission harness connector (T3). 3) Measure the resistance of harness between ECM connector and chassis ground. <i>Connector & terminal</i> <i>(B136) No. 21 — Chassis ground:</i> Is the measured value more than the specified value?	1 MΩ	Go to step 4.	Repair short circuit to ground in harness between ECM and transmission harness connector.
4 CHECK TRANSMISSION HARNESS CONNECTOR. 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance of harness between transmission harness connector and engine ground. <i>Connector & terminal</i> <i>(T3) No. 12 — Engine ground:</i> Is the measured value more than the specified value?	1 MΩ	Go to step 5.	Repair short circuit to ground in harness between transmission harness connector and inhibitor switch connector.
5 CHECK INHIBITOR SWITCH. Measure the resistance between inhibitor switch connector the receptacle's terminals with the selector lever in other than "N" position. <i>Terminal</i> <i>No. 7 — No. 12:</i> Is the measured value more than the specified value?	1 MΩ	Go to step 6.	Replace the inhibitor switch. <Ref. to AT-48, Inhibitor Switch.>
6 CHECK SELECTOR CABLE CONNECTION. Is there any fault in selector cable connection to inhibitor switch?	There is a fault.	Repair selector cable connection. <Ref. to CS-30, INSPECTION, Select Cable.>	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

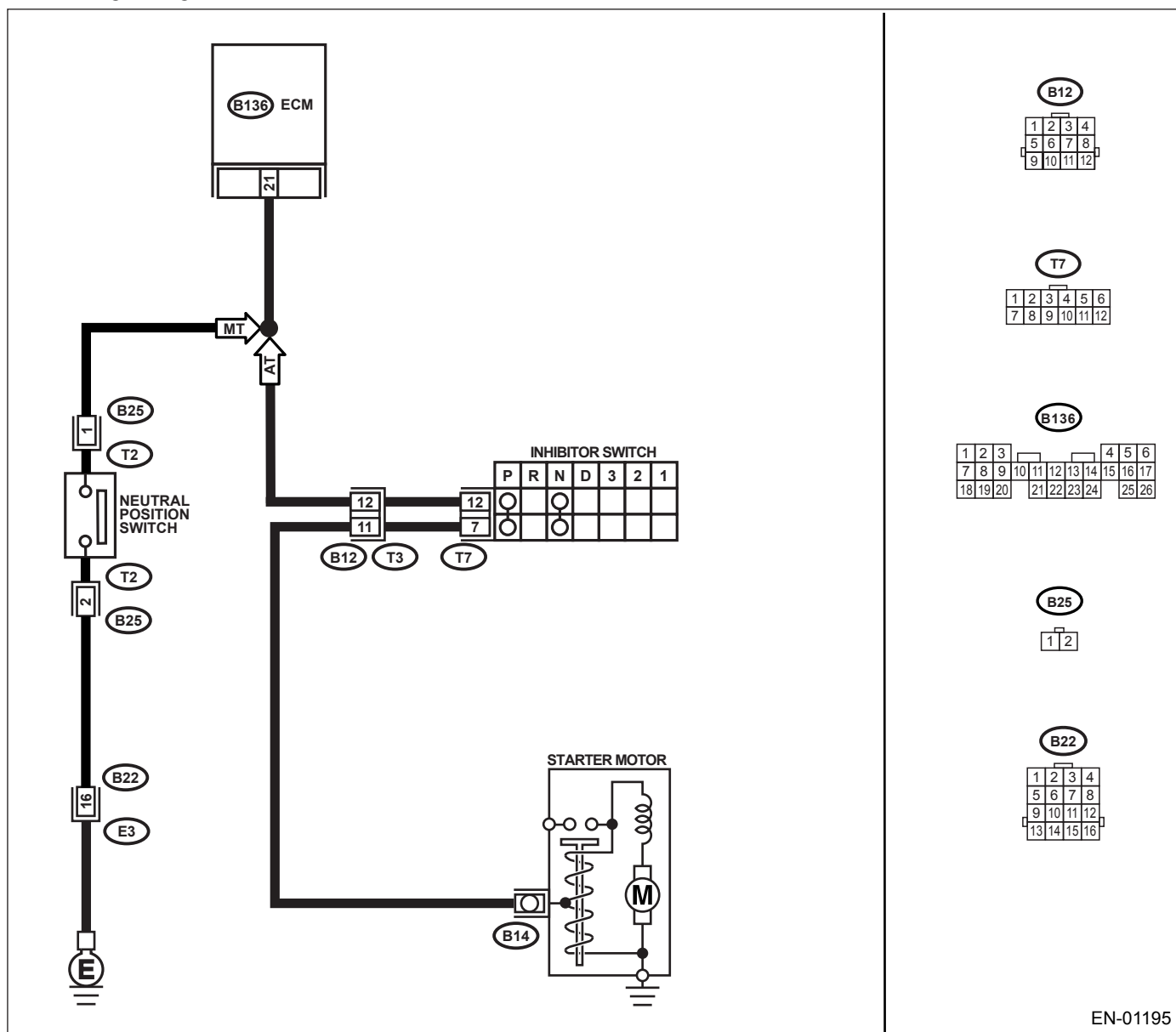
CA:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT) —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01195

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. 1) Place the shift lever in a position other than neutral. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Go to step 3.	Go to step 4.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Contact SOA (distributor) service.
4 CHECK NEUTRAL POSITION SWITCH. 1) Turn ignition switch to OFF. 2) Disconnect the connector from transmission harness. 3) Place the shift lever in neutral. 4) Measure the resistance between transmission harness and connector terminals. Connector & terminal (T2) No. 1 — No. 2: Is the measured value more than the specified value?	1 M Ω	Go to step 5.	Repair short circuit in transmission harness or replace neutral position switch.
5 CHECK NEUTRAL POSITION SWITCH. 1) Place the shift lever in a position other than neutral. 2) Measure the resistance between transmission harness connector terminals. Is the measured value less than the specified value?	1 Ω	Go to step 6.	Repair short circuit in transmission harness or replace neutral position switch.
6 CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. Measure the resistance between ECM and chassis ground. Connector & terminal (B136) No. 21 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 7.	Repair short circuit to ground in harness between ECM and transmission harness connector.
7 CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and transmission harness connector. Connector & terminal (B136) No. 21 — (B25) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Repair open circuit in harness between ECM and transmission harness connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. Measure the resistance of harness between transmission harness connector and engine ground. Connector & terminal (B25) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 9.	Repair open circuit between transmission harness connector and engine ground terminal.
9 CHECK FOR POOR CONTACT. Check for poor contact in transmission harness connector. Is there poor contact in transmission harness connector?	There is poor contact.	Repair poor contact in transmission harness connector.	Contact SOA (distributor) service.

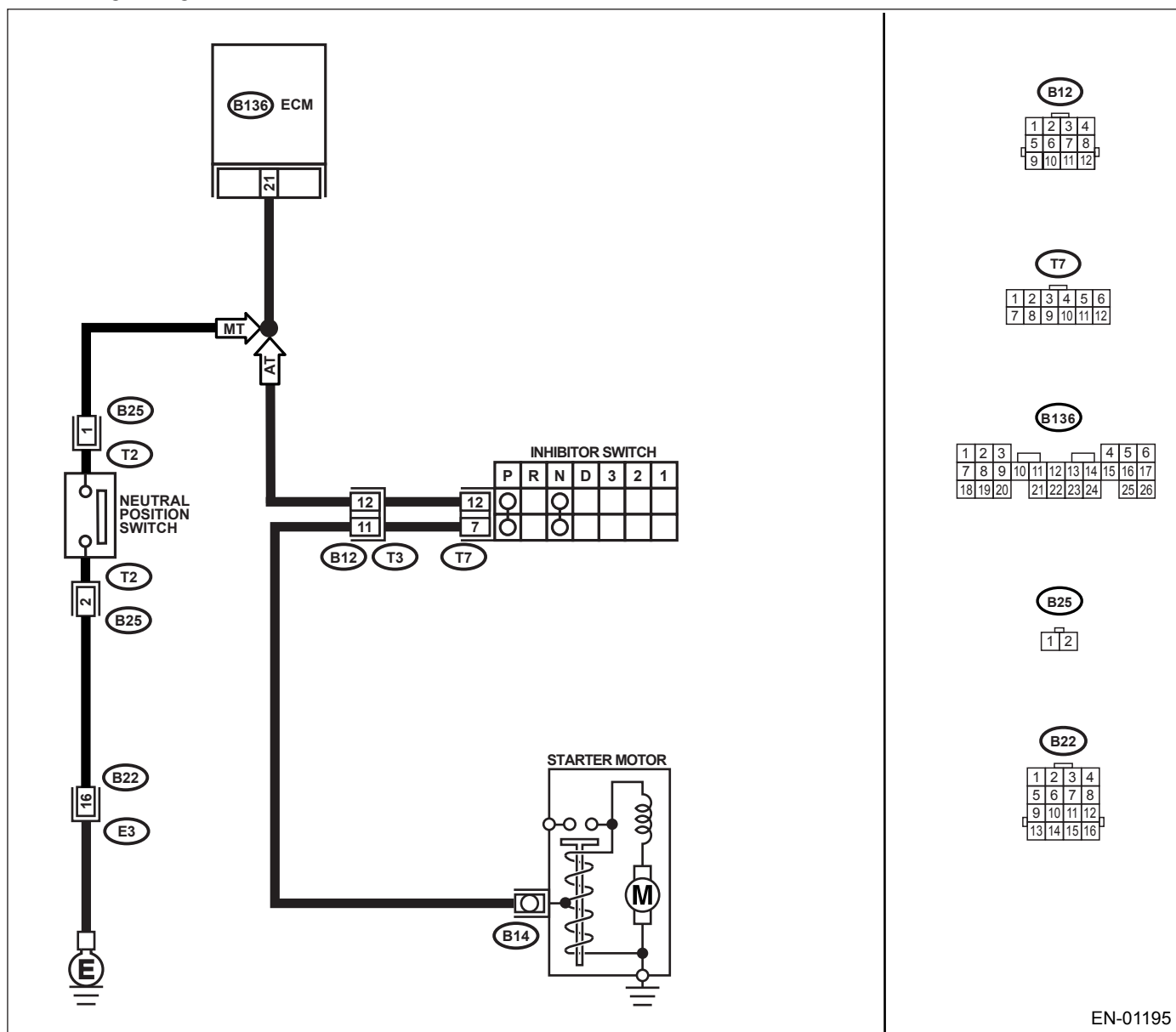
CB:DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT) —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	DTC is indicated.	Inspect the related DTC using "List of Diagnostic Trouble Codes (DTC)".<Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK INPUT SIGNAL FOR ECM. 1)Turn ignition switch to ON. 2)Measure the voltage between ECM and chassis ground with the selector lever in "N" and "P" positions. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Go to step 3.	Go to step 5.
3 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground with the selector lever in positions other than "N" and "P" positions. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value within the specified range?	4.5 — 5.5 V	Go to step 4.	Go to step 5.
4 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connectors from ECM and inhibitor switch. 3)Measure the resistance of harness between ECM and inhibitor switch connector. Connector & terminal (B136) No. 21 — (T7) No. 12: Is the measured value less than the specified value?	1 Ω	Go to step 6.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and inhibitor switch connector • Poor contact in coupling connector • Poor contact in inhibitor switch connector • Poor contact in ECM connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK INHIBITOR SWITCH GROUND LINE. Measure the resistance of harness between inhibitor switch connector and engine ground. Connector & terminal (T7) No. 12 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 7.	Repair open circuit in harness between inhibitor switch connector and starter motor ground line. NOTE: In this case, repair the following: • Open circuit in harness between inhibitor switch connector and starter motor ground line • Poor contact in starter motor connector • Poor contact in starter motor ground • Starter motor
7 CHECK INHIBITOR SWITCH. Measure the resistance between inhibitor switch connector receptacle's terminals with the selector lever in "N" and "P" positions. Terminal No. 7 — No. 12: Is the measured value less than the specified value?	1 Ω	Go to step 8.	Replace the inhibitor switch. <Ref. to AT-48, Inhibitor Switch.>
8 CHECK SELECTOR CABLE CONNECTION. Is there any fault in selector cable connection to inhibitor switch?	There is a fault.	Repair selector cable connection. <Ref. to CS-29, Select Cable.>	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

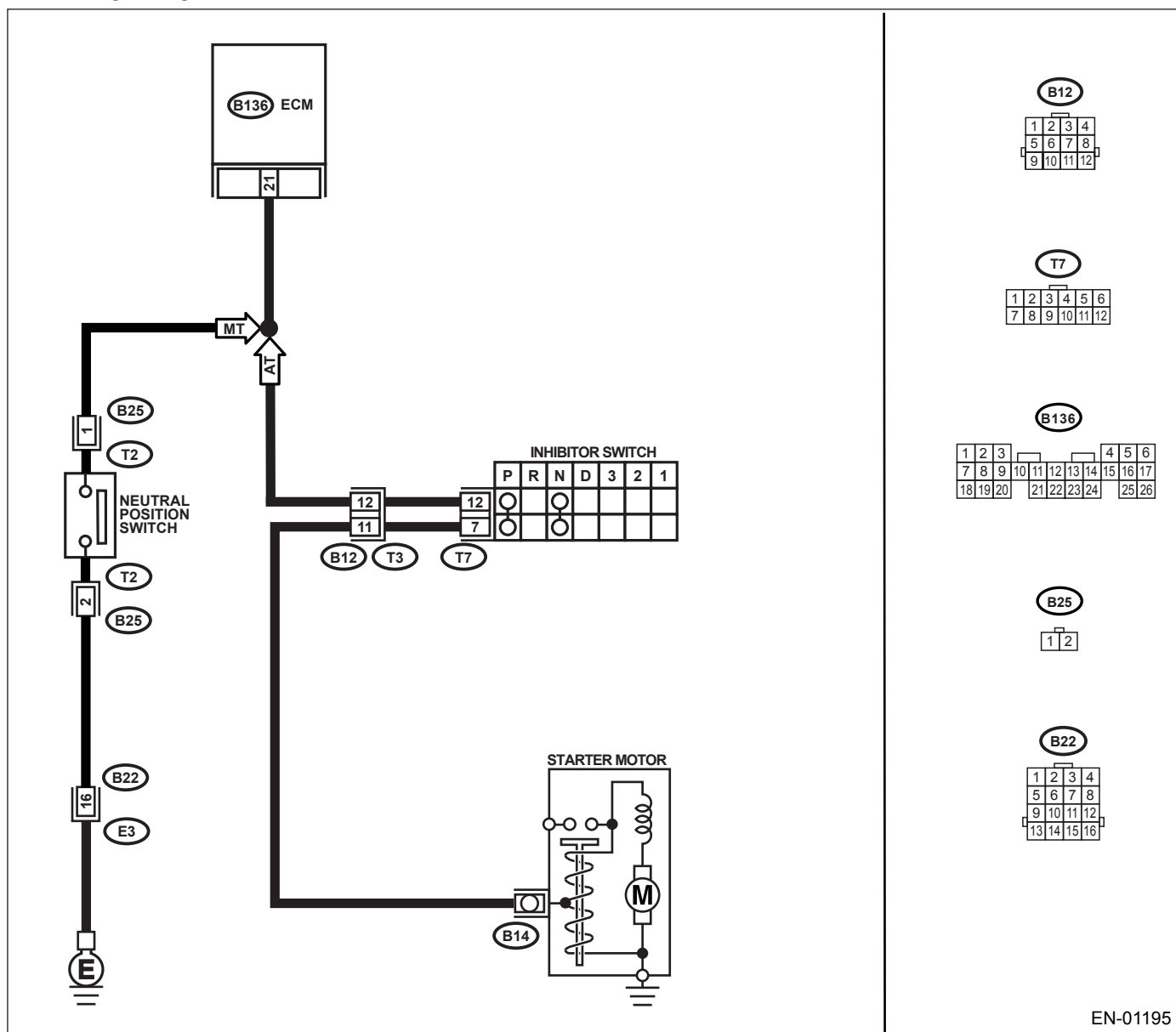
CC:DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT) —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01195

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value more than specified value when the transmission is in neutral?	5V	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-): Is the measured value less than the specified value when the transmission is in other position than neutral?	1V	Go to step 3.	Go to step 5.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK NEUTRAL SWITCH. Measure the resistance between transmission harness connector terminals. Connector & terminal (T2) No. 1 — No. 2: Is the measured value less than the specified value when the transmission is in other position than neutral?	1 Ω	Go to step 5.	Repair open circuit in transmission harness or replace neutral switch.
5 CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and transmission harness connector. Connector & terminal (B136) No. 21 — (B25) No. 1: Is the measured value less than the specified value?	1 Ω	Go to step 6.	Repair open circuit in harness between ECM and transmission harness connector.
6 CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR. Measure the resistance of harness between transmission harness connector and engine ground. Connector & terminal (B25) No. 2 — Engine ground: Is the measured value less than the specified value?	5 Ω	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between transmission harness connector and engine ground. • Poor contact in coupling connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK FOR POOR CONTACT. Check for poor contact in transmission harness connector. Is there a poor contact in the transmission harness connector?	There is poor contact.	Repair poor contact in transmission harness connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

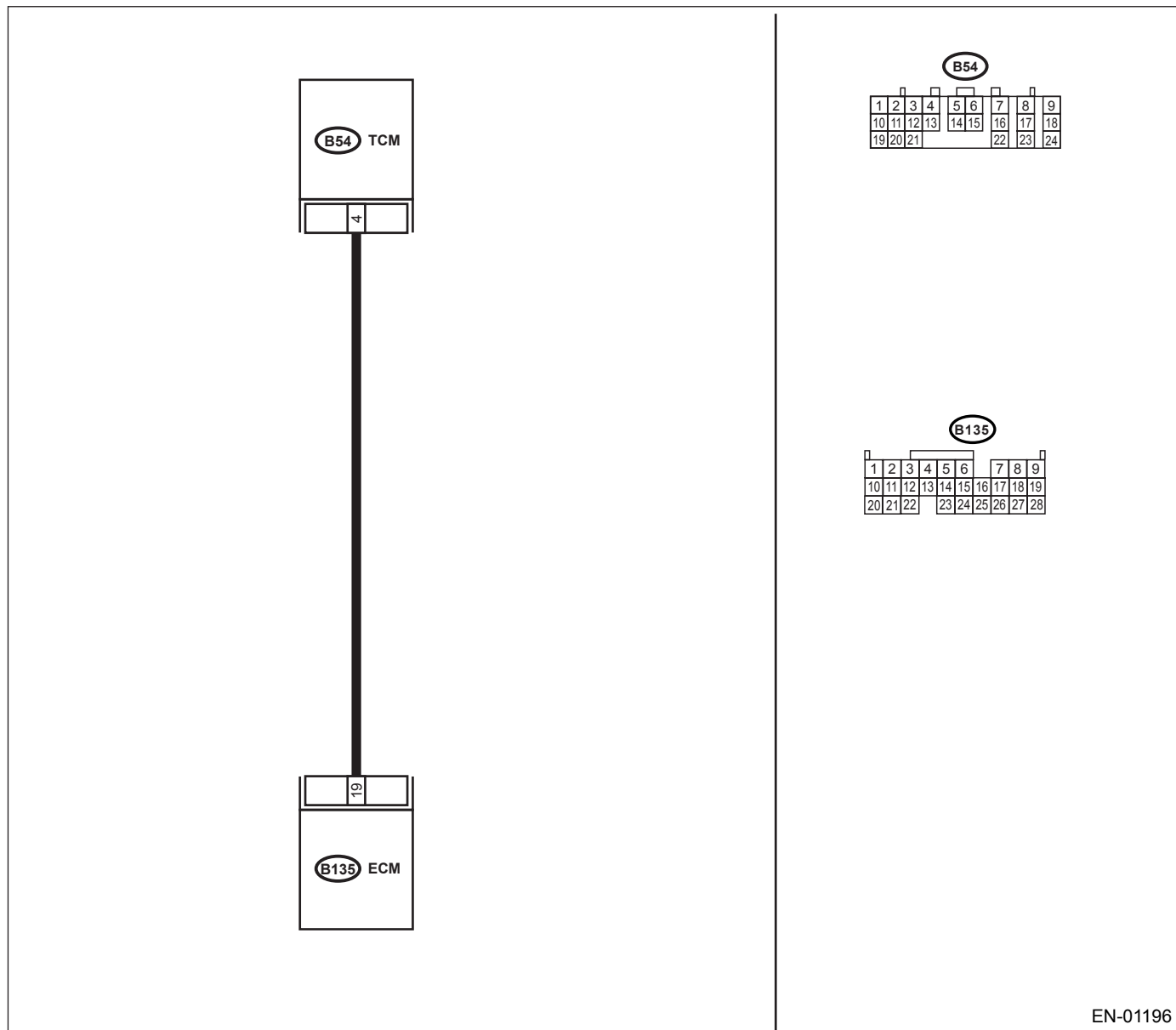
**CD:DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE
PROBLEM —**

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01196

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK DRIVING CONDITION. 1)Start and warm-up the engine until the radiator fan operates. 2)Drive the vehicle. Is the AT shift control functioning properly?	Functioning properly.	Go to step 2.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>
2 CHECK ACCESSORY. Are car phone and/or CB installed on vehicle?	Installed.	Repair grounding line of car phone or CB system.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CE:DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —

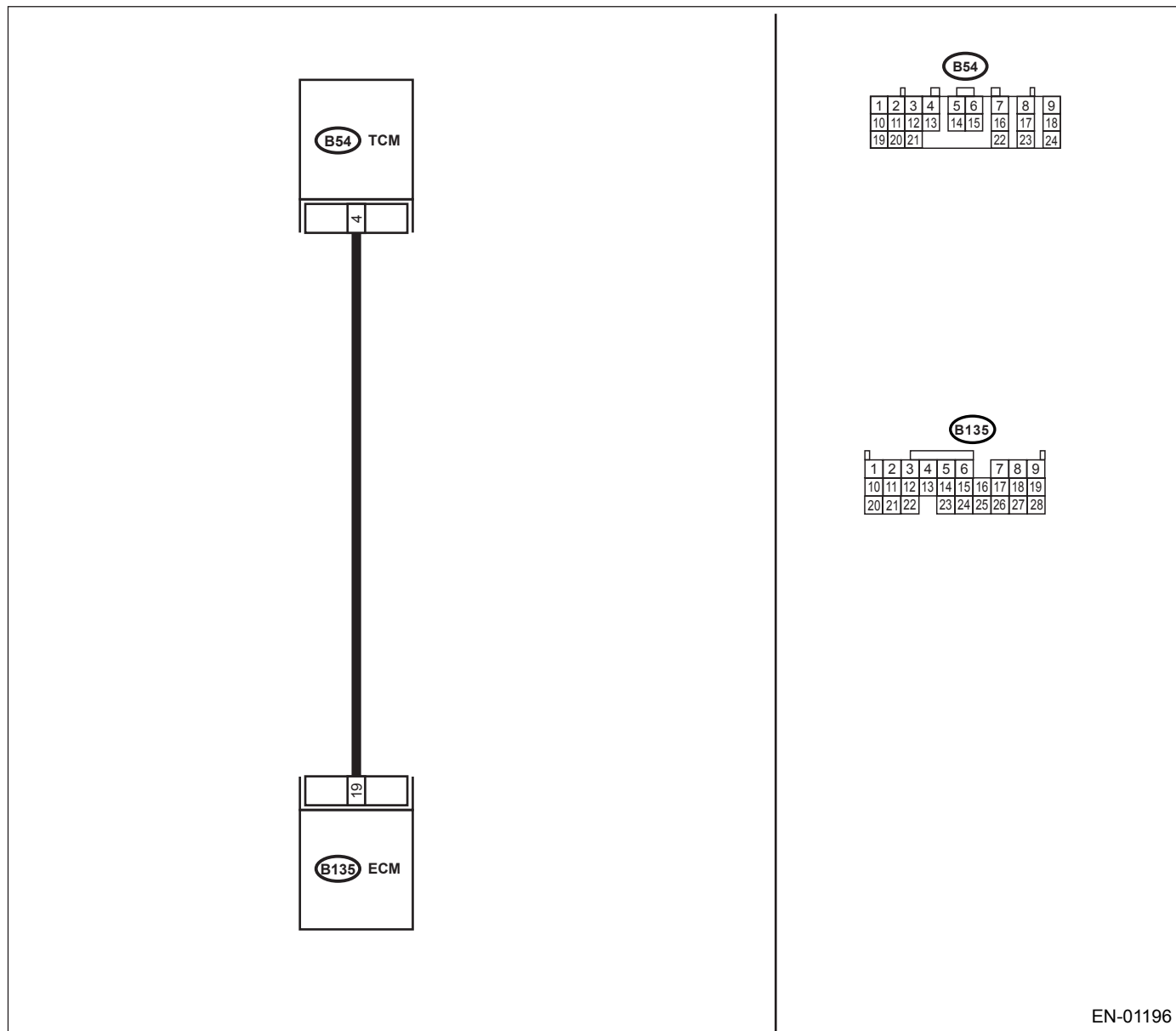
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-01196

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. NOTE: In this case, repair the following: • Poor contact in ECM connector • Poor contact in TCM connector
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM and TCM. 3) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 3.	Repair short circuit to ground in harness between ECM and TCM connector.
3 CHECK OUTPUT SIGNAL FROM ECM. 1) Connect the connector to ECM. 2) Turn ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Is the measured value more than the specified value?	5 V	Go to step 4.	Repair poor contact in ECM connector.
4 CHECK DTC FOR AUTOMATIC TRANSMISSION. Read the DTC for automatic transmission. <Ref. to AT-24, Read Diagnostic Trouble Code (DTC).> Is the DTC for automatic transmission indicated?	DTC is indicated.	Inspect DTC for automatic transmission. <Ref. to AT-44, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

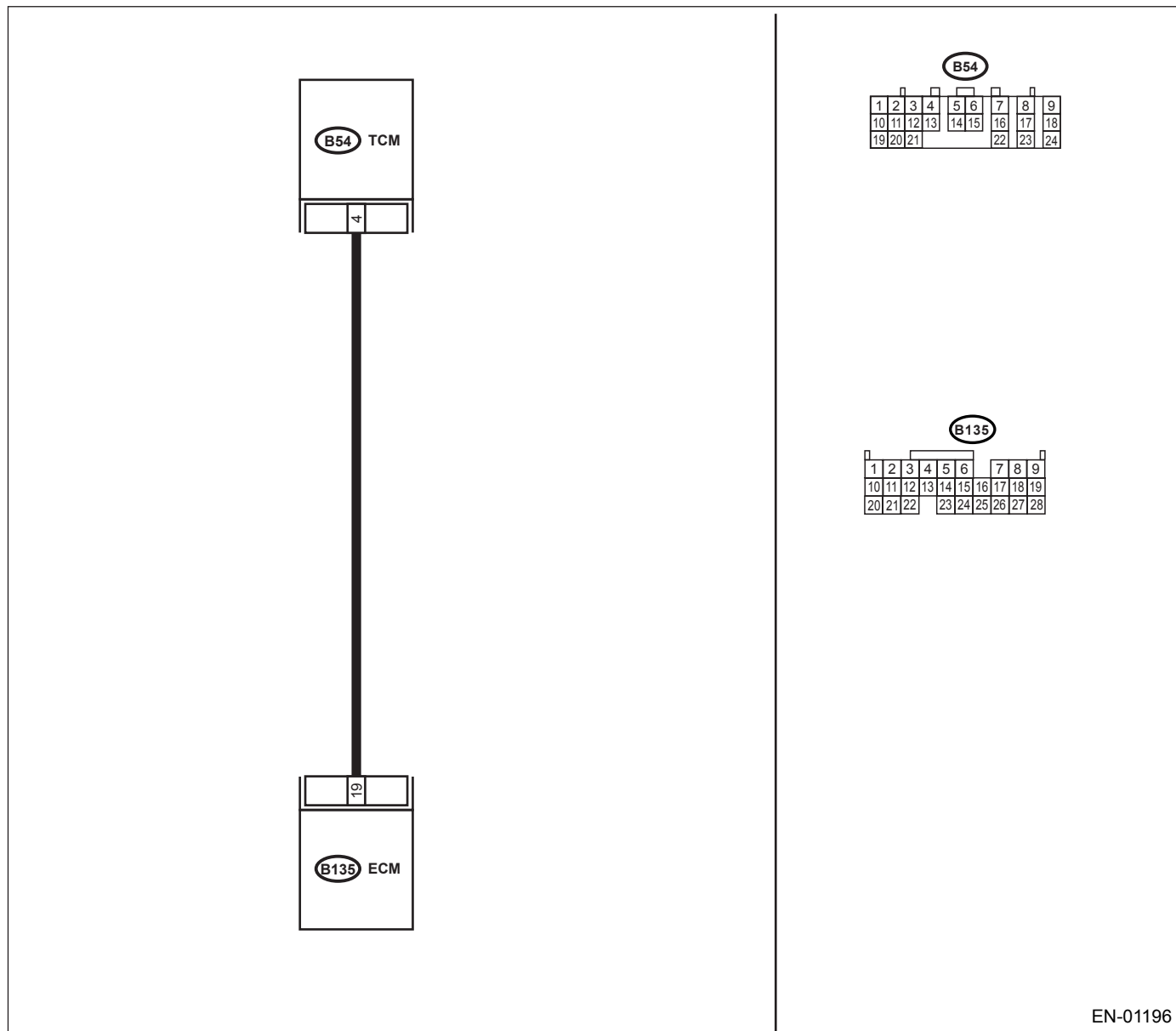
CF:DTC P0866 — TCM COMMUNICATION CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01196

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and TCM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Is the measured value more than the specified value?	4 V	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Is the measured value less than the specified value?	1 V	Repair poor contact in ECM connector.	Go to step 4.
4 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-): Does the measured value change within the specified range?	1 V — 4 V	The MIL may light up, however, the circuit is returned to the normal status at the moment. NOTE: In this case, repair the following: • Poor contact in ECM connector • Poor contact in TCM connector	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between TCM and chassis ground. Connector & terminal (B54) No. 4 (+) — Chassis ground (-): Is the measured value more than the specified value?	4 V	Go to step 6.	Repair open circuit in harness between ECM and TCM connector.
6 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Check TCM power supply line and grounding line.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CG:DTC P1110 — BAROMETRIC PRESSURE SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Replace the ECM.

CH:DTC P1111 — BAROMETRIC PRESSURE SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Replace the ECM.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

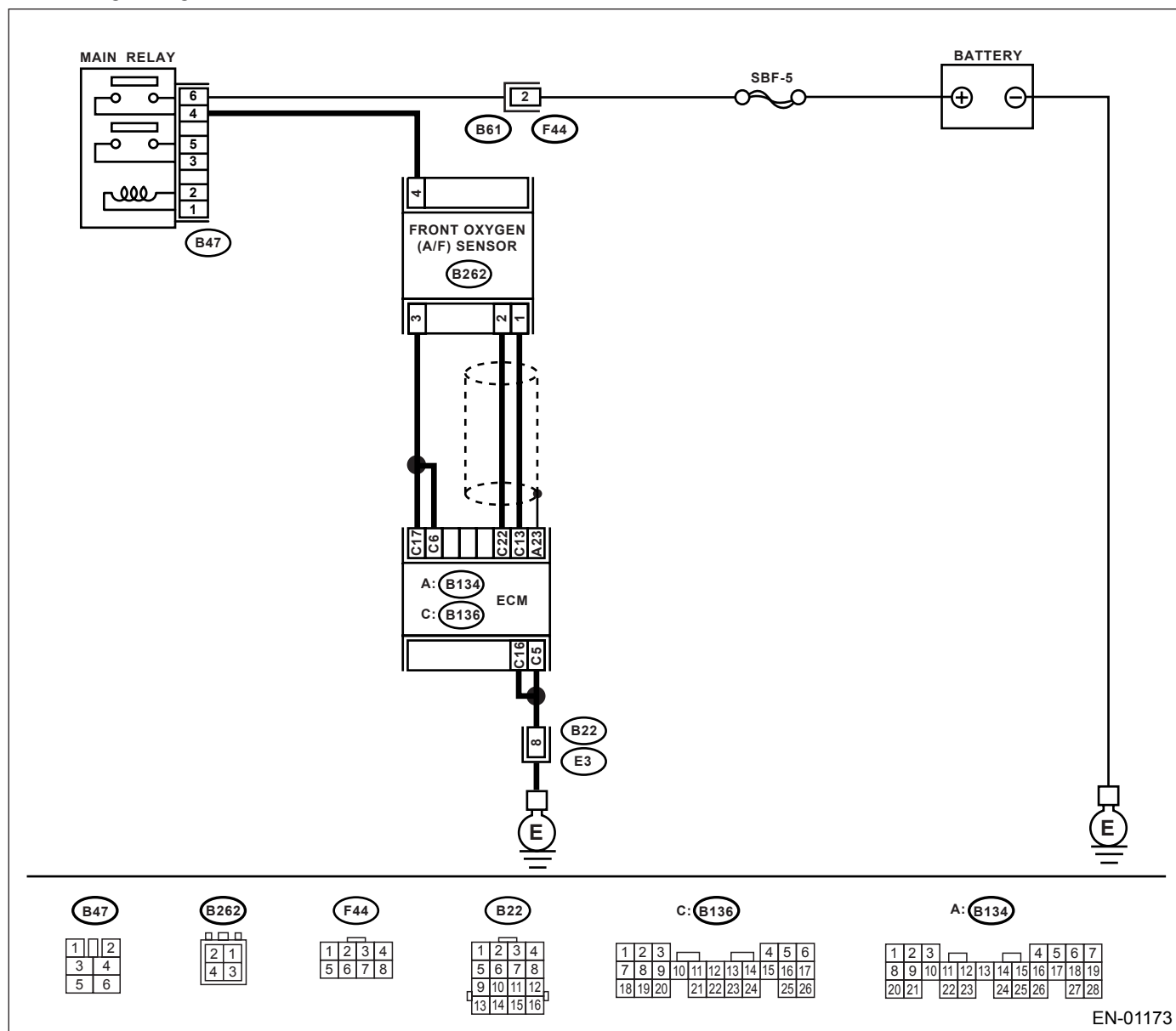
CI: DTC P1134 — A/F SENSOR MICROCOMPUTER PROBLEM —

- DTC DETECTING CONDITION:
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



EN-01173

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	DTC P1134 is displayed.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	It is not necessary to inspect DTC P1134.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CJ:DTC P1137 — O₂ SENSOR CIRCUIT (BANK 1 SENSOR 1) —

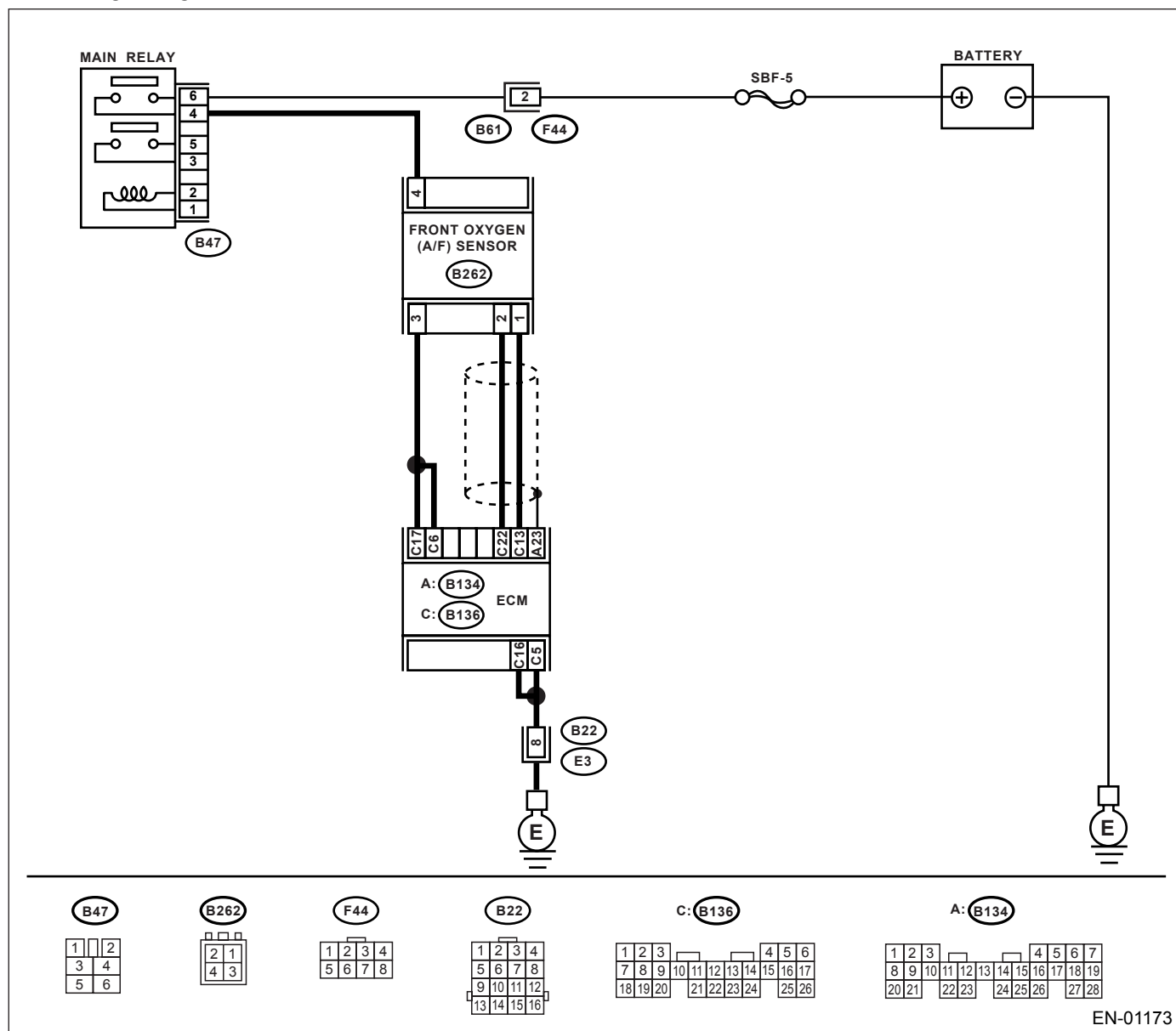
- DTC DETECTING CONDITION:

- Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1)Start the engine. 2)While observing the Subaru Select Monitor or OBD-II general scan tool screen, warm-up the engine until coolant temperature is above 70°C (160°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3)Read the data of front oxygen (A/F) sensor signal during idling using Subaru Select Monitor or OBD-II general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-31, Subaru Select Monitor.> •OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	0.85 — 1.15	Go to step 3.	Go to step 4.
3 CHECK FRONT OXYGEN (A/F) SENSOR DATA. Race up the engine from idling to 5,000 rpm for a total of 5 cycles. Is the measured value more than the specified value during engine racing? NOTE: •In normal condition, A/F is rich during engine racing. •To increase engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approximately 5 seconds, and quickly release accelerator pedal to decrease engine speed.	1.1 V	Go to step 6.	Go to step 4.
4 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. 1)Turn ignition switch to OFF. 2)Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3)Measure the resistance between ECM and front oxygen (A/F) sensor. Connector & terminal (B136) No. 13 — (B262) No. 1: (B136) No. 22 — (B262) No. 2: Is the measured value less than the specified value?	5 Ω	Go to step 5.	Repair open circuit between ECM and front oxygen (A/F) sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. Measure the resistance between ECM and chassis ground. Connector & terminal (B136) No. 13 — Chassis ground: (B136) No. 22 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 6.	Repair short circuit to ground between ECM and front oxygen (A/F) sensor.
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. Is there a fault in exhaust system? NOTE: Check the following items. •Loose installation of portions •Damage (crack, hole etc.) of parts •Looseness of front oxygen (A/F) sensor •Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	There is a fault.	Repair or replace faulty parts.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-44, Front Oxygen (A/F) Sensor.>

CK:DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —

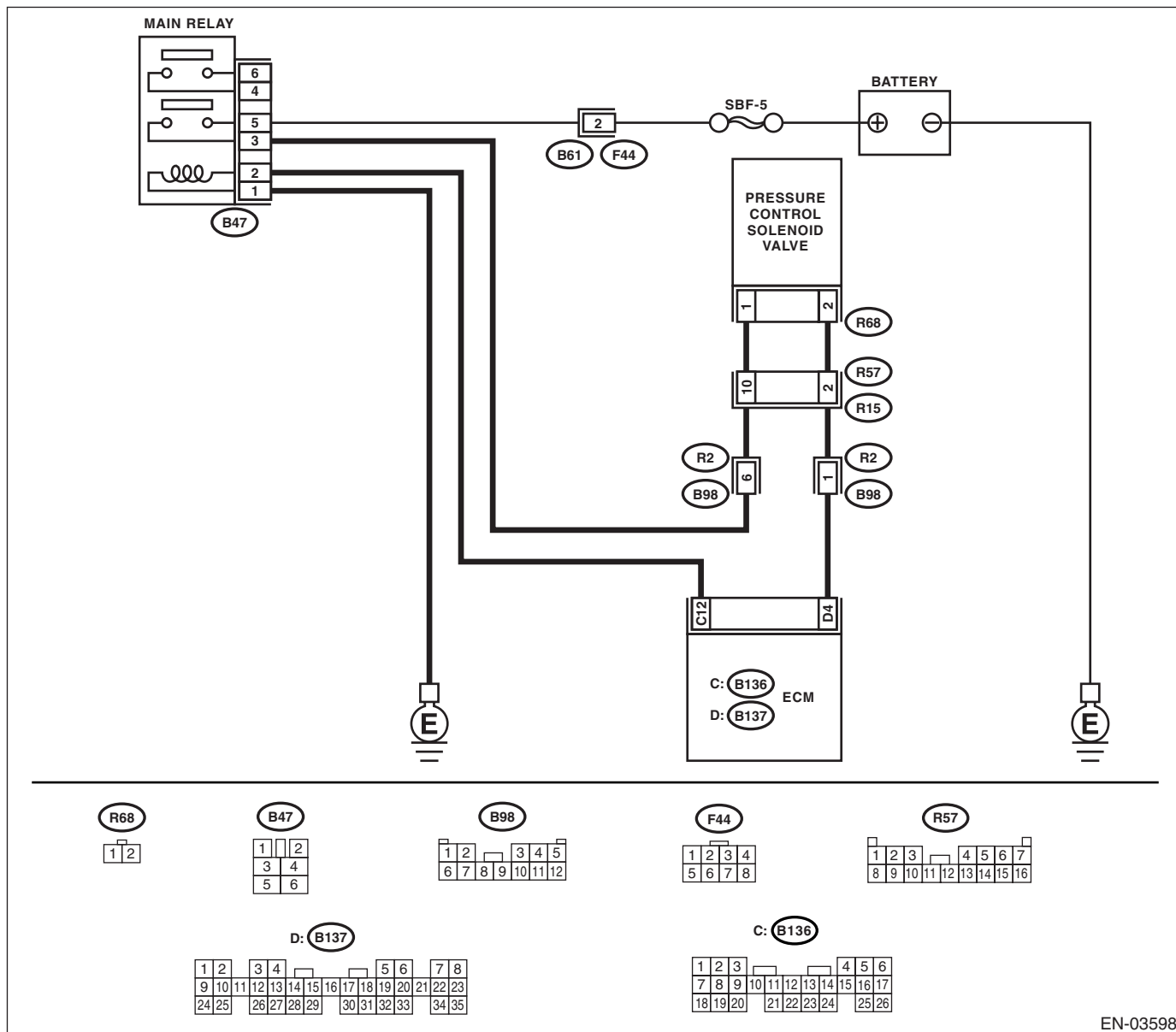
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-03598

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 4 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 3.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
3 CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from pressure control solenoid valve and ECM. 3) Measure the resistance of harness between pressure control solenoid valve connector and chassis ground. Connector & terminal (R68) No. 2 — Chassis ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in harness between ECM and pressure control solenoid valve connector.	Go to step 4.
4 CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and pressure control solenoid valve connector. Connector & terminal (B137) No. 4 — (R68) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and pressure control solenoid valve connector • Poor contact in coupling connector
5 CHECK PRESSURE CONTROL SOLENOID VALVE. Measure the resistance between pressure control solenoid valve terminals. Terminal No. 1 — No. 2: Is the measured value within the specified range?	10 — 100 Ω	Go to step 6.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between pressure control solenoid valve and chassis ground. Connector & terminal (R68) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and pressure control solenoid valve connector • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in pressure control solenoid valve connector. Is there poor contact in pressure control solenoid valve connector?	There is poor contact.	Repair poor contact in pressure control solenoid valve connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CL:DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**

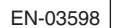
- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

ENGINE (DIAGNOSTICS)

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the pressure control solenoid valve, measure voltage between ECM and chassis ground. NOTE: Pressure control solenoid valve operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.> Connector & terminal (B137) No. 4 (+) — Chassis ground (-): Does the measured value change within the specified range?	0 — 10 V	Go to step 2.	The MIL may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 4 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 4.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from pressure control solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 4 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and pressure control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 5.
5 CHECK PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Replace the pressure control solenoid valve <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.> and the ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
6	CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CM:DTC P1443 — VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM —

- **DTC DETECTING CONDITION:**

- Immediately after fault occurrence

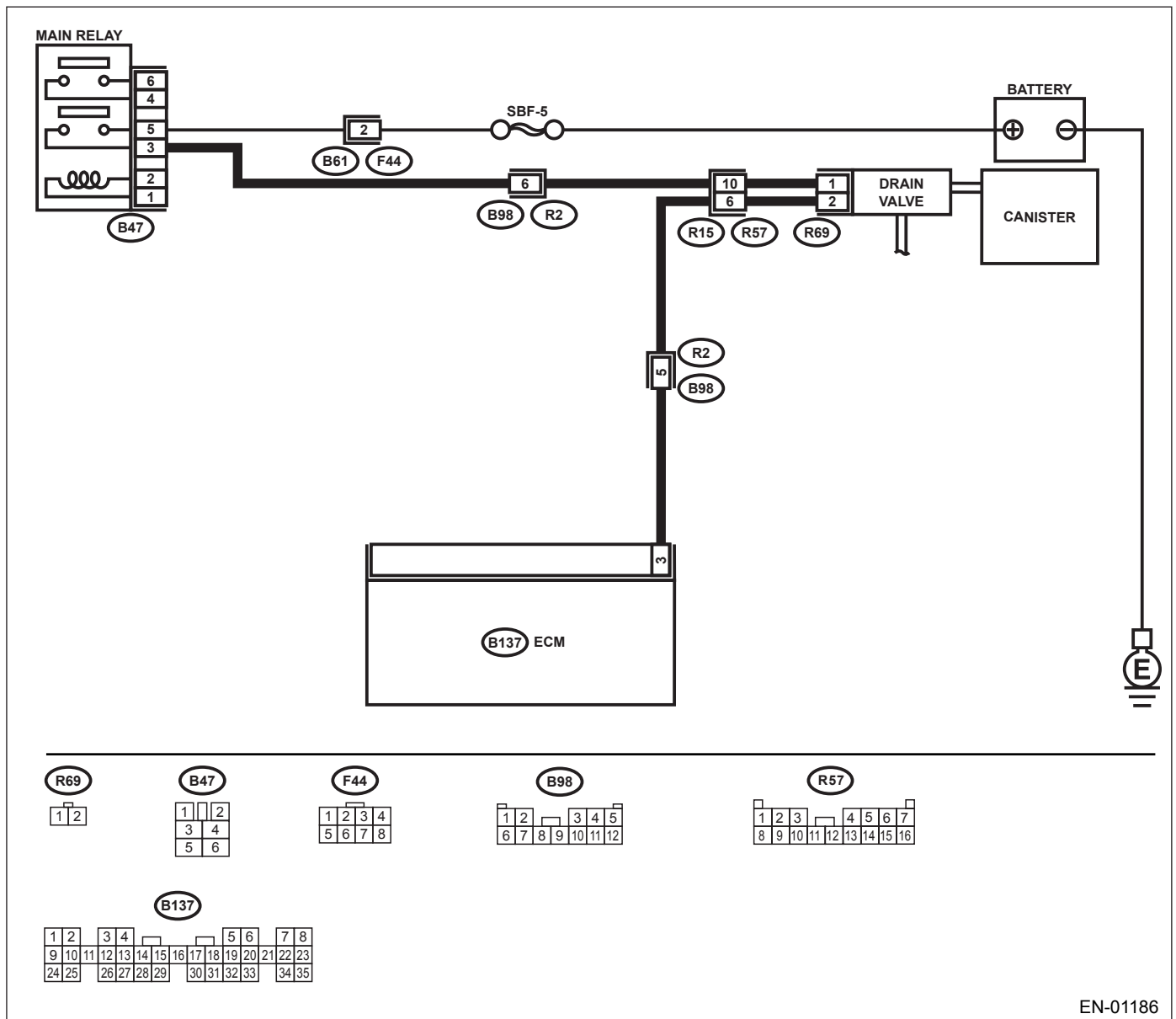
- **TROUBLE SYMPTOM:**

- Improper fuel supply

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01186

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK VENT LINE HOSES. Check the following items. •Clogging of vent hoses between canister and drain valve •Clogging of vent hose between drain valve and air filter •Clogging of drain filter Is there a fault in vent line?	There is a fault.	Repair or replace faulty parts.	Go to step 3.
3 CHECK DRAIN VALVE OPERATION. 1)Turn ignition switch to OFF. 2)Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3)Turn ignition switch to ON. 4)Operate the drain valve. Does the drain valve operate? NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-47, Compulsory Valve Operation Check Mode.>	Operates.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CN:DTC P1446 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW —

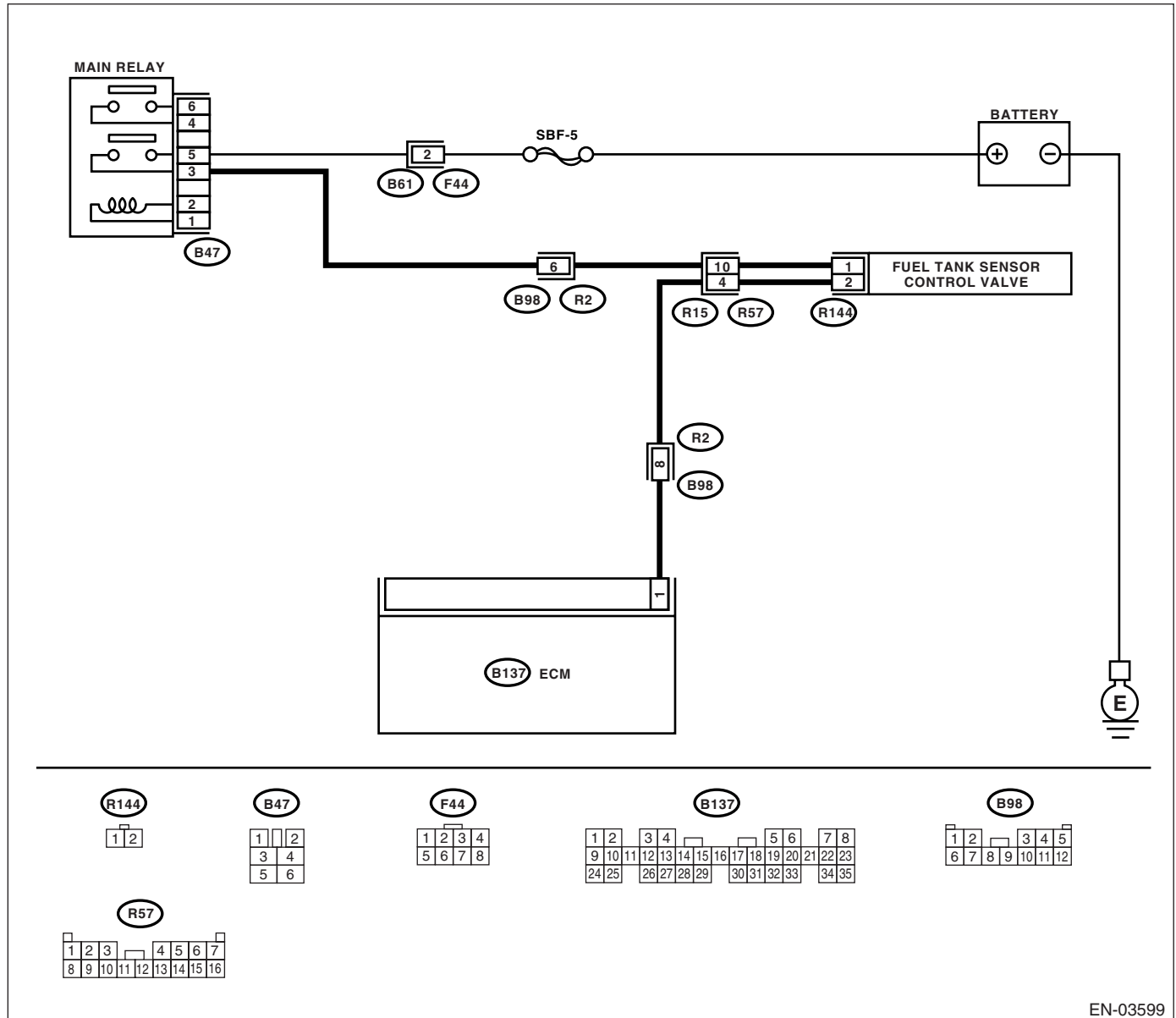
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-03599

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Go to step 3.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	The MIL may light up, however, the circuit is returned to the normal status at the moment. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in fuel tank sensor control valve connector • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from fuel tank sensor control valve and ECM. 3) Measure the resistance of harness between fuel tank sensor control valve connector and chassis ground. Connector & terminal (R144) No. 2 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 4.	Repair short circuit to ground in harness between ECM and fuel tank sensor control valve connector.
4 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and fuel tank sensor control valve connector. Connector & terminal (B137) No. 1 — (R144) No. 2: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel tank sensor control valve connector • Poor contact in coupling connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK FUEL TANK SENSOR CONTROL VALVE. Measure the resistance between fuel tank sensor control valve terminals. <i>Terminal</i> <i>No. 1 — No. 2:</i> Is the measured value within the specified range?	10 — 100 Ω	Go to step 6.	Replace the fuel tank sensor control valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK POWER SUPPLY TO FUEL TANK SENSOR CONTROL VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between fuel tank sensor control valve and chassis ground. <i>Connector & terminal</i> <i>(R144) No. 1 (+) — Chassis ground (-):</i> Is the measured value more than the specified value?	10 V	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel tank sensor control valve • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank sensor control valve connector. Is there poor contact in fuel tank sensor control valve connector?	There is poor contact.	Repair poor contact in fuel tank sensor control valve connector.	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CO:DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —

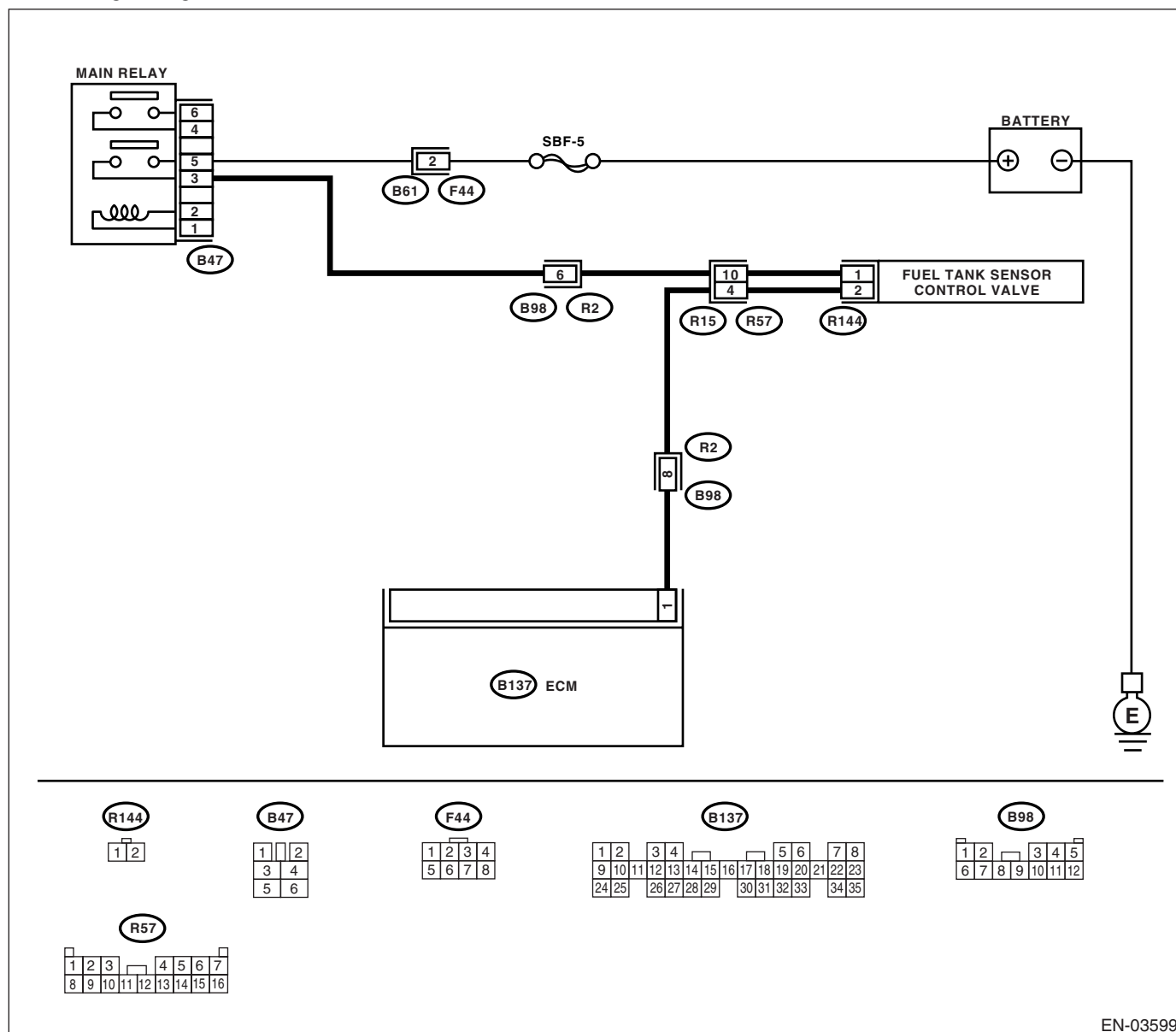
• DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



EN-03599

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Go to step 3.	Go to step 2.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
3 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel tank sensor control valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and fuel tank sensor control valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Go to step 4.
4 CHECK FUEL TANK SENSOR CONTROL VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between fuel tank sensor control valve terminals. Terminal No. 1 — No. 2: Is the measured value less than the specified value?	1 Ω	Replace the fuel tank sensor control valve <Ref. to EC(H4SO)-18, Drain Valve.> and the ECM <Ref. to FU(H4SO)-48, Engine Control Module.>.	Go to step 5.
5 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

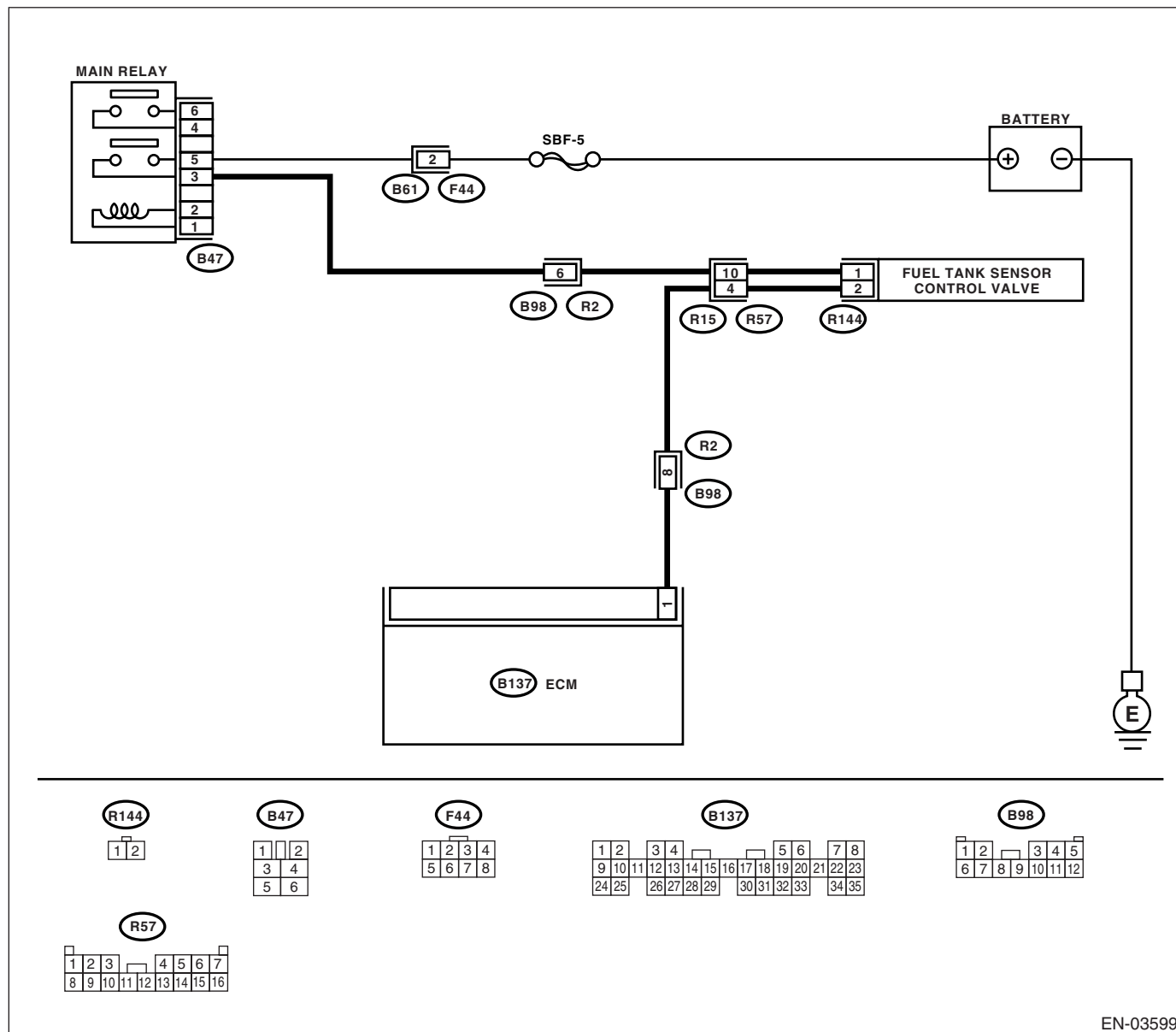
ENGINE (DIAGNOSTICS)

- **DTC DETECTING CONDITION:**

- Fault occurs in two consecutive driving cycles

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Inspect the relevant DTC using the "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4SO)-75, List of Diagnostic Trouble Codes.>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Open the fuel flap. Is the fuel filler cap tightened securely?	Cap is tightened securely.	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK EVAPORATIVE EMISSION LINE. Is there any trouble in evaporation line? NOTE: Check the following items. • Disconnection, leakage and clogging of hoses between fuel tank pressure sensor and fuel tank. • Disconnection, leakage and clogging of hoses and pipes between fuel filler pipe and fuel tank.	There is trouble in evaporative emission line.	Repair the hoses and pipes.	Replace the fuel tank pressure sensor.

CQ:DTC P1510 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-322, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CR:DTC P1511 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-324, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CS:DTC P1512 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-322, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CT:DTC P1513 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-324, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CU:DTC P1514 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-322, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CV:DTC P1515 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-324, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

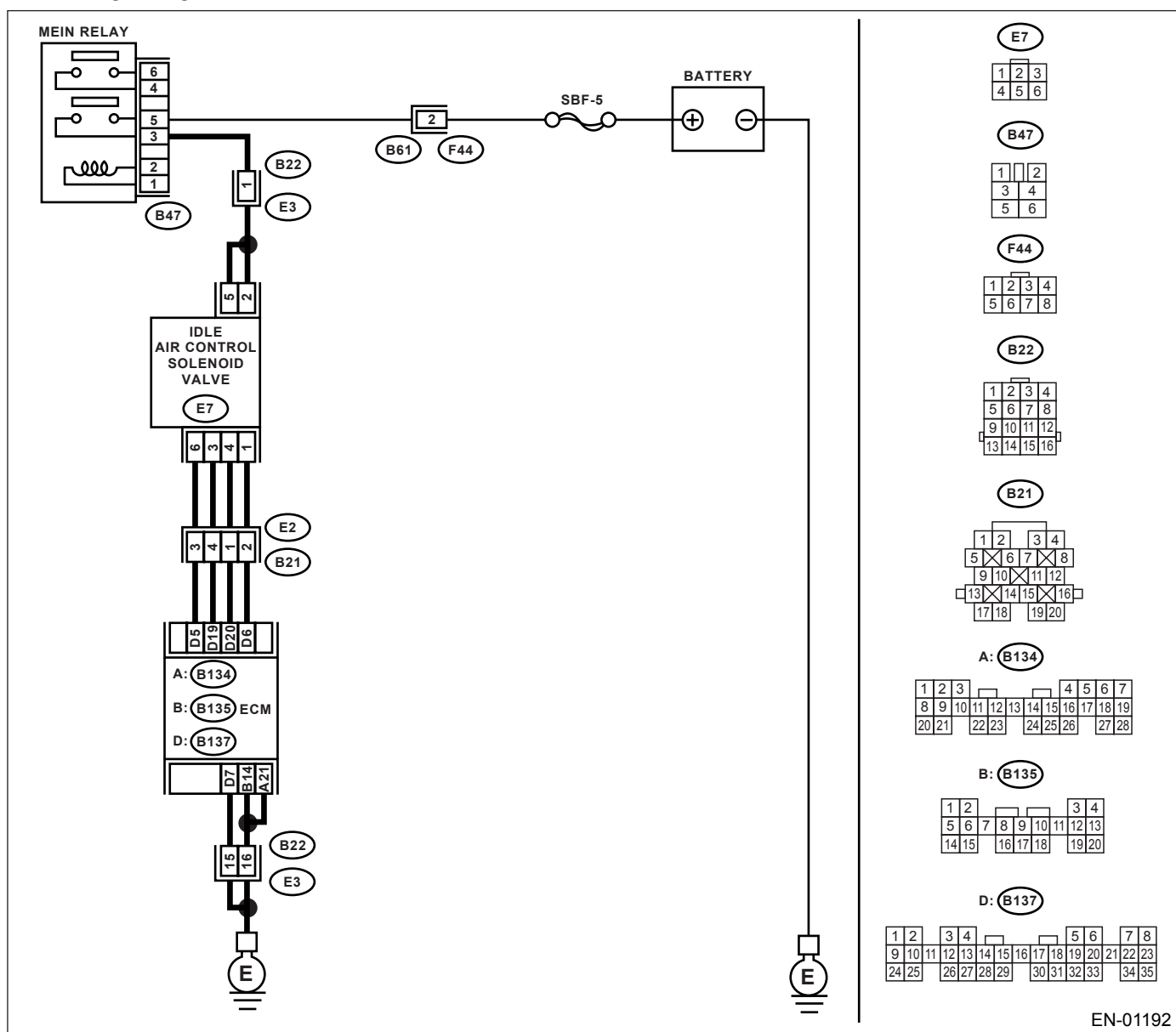
CW:DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.
 - Engine breathing

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



EN-01192

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Disconnect the connector from idle air control solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between idle air control solenoid valve connector and engine ground. Connector & terminal (E7) No. 2 (+) — Engine ground (-): (E7) No. 5 (+) — Engine ground (-): Is the measured value more than the specified value?	10 V	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between idle air control solenoid valve and main relay connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Turn ignition switch to OFF. 2) Measure the resistance between ECM and idle air control solenoid valve connector. Connector & terminal DTC P1510; (B137) No. 20 — (E7) No. 4: DTC P1512; (B137) No. 6 — (E7) No. 1: DTC P1514; (B137) No. 5 — (E7) No. 6: DTC P1516; (B137) No. 19 — (E7) No. 3: Is the measured value less than the specified value?	1 Ω	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and idle air control solenoid valve connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. Connector & terminal DTC P1510; (B137) No. 20 — Chassis ground: DTC P1512; (B137) No. 6 — Chassis ground: DTC P1514; (B137) No. 5 — Chassis ground: DTC P1516; (B137) No. 19 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 4.	Repair short circuit to ground in harness between ECM and idle air control solenoid valve connector.
4 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector and idle air control solenoid valve connector. Is there poor contact in ECM connector or idle air control solenoid valve connector?	There is poor contact.	Repair poor contact in ECM connector or idle air control solenoid valve connector.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-36, Idle Air Control Solenoid Valve.>

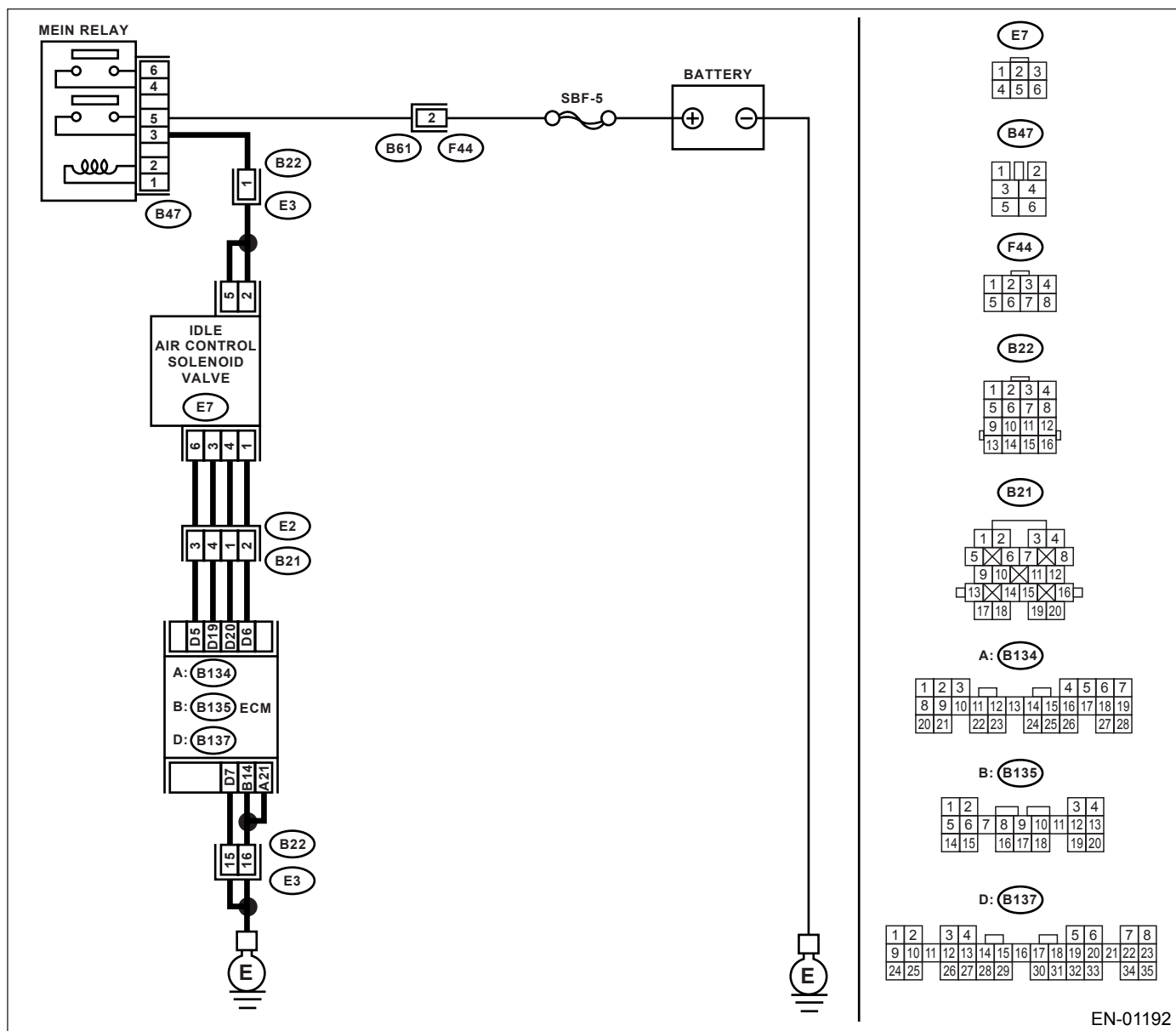
CX:DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
 - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
 - Erroneous idling
 - Engine stalls.
 - Engine breathing

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY. Is any other DTC displayed?	Other DTC is displayed.	Go to step 2.	Go to step 3.
2 CHECK GROUND CIRCUIT OF ECM. 1) Turn ignition switch to OFF. 2) Measure the resistance between ECM connector and chassis ground. Connector & terminal <i>(B137) No. 7 — Chassis ground:</i> <i>(B135) No. 14 — Chassis ground:</i> <i>(B134) No. 21 — Chassis ground:</i> Is the measured value less than the specified value?	5 Ω	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM connector and engine ground terminal • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from idle air control solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. Connector & terminal <i>DTC P1511; (B137) No. 20 (+) — Chassis ground (-):</i> <i>DTC P1513; (B137) No. 6 (+) — Chassis ground (-):</i> <i>DTC P1515; (B137) No. 5 (+) — Chassis ground (-):</i> <i>DTC P1517; (B137) No. 19 (+) — Chassis ground (-):</i> Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and idle air control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

CY:DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Failure of engine to start

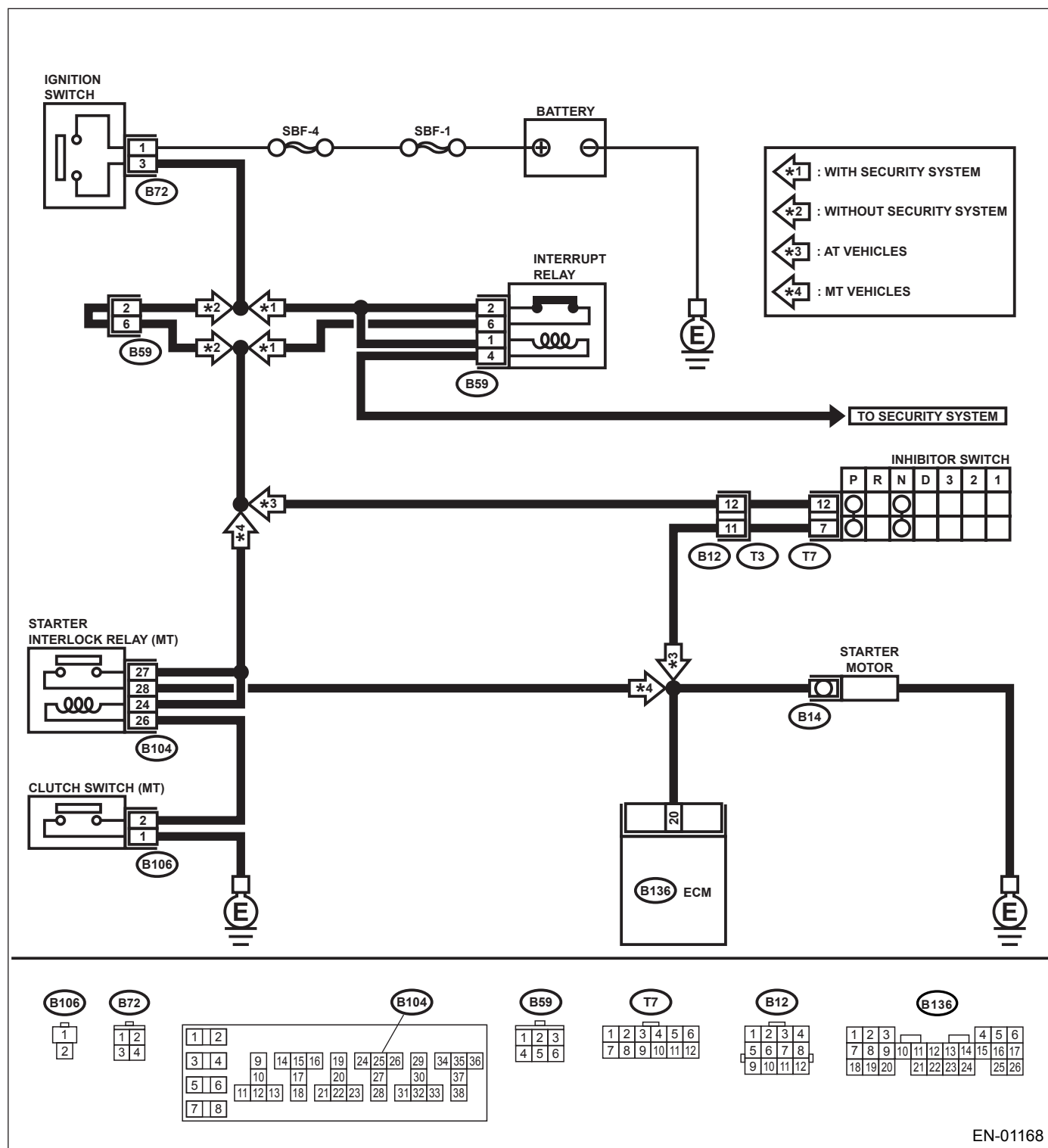
CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

• WIRING DIAGRAM:



EN-01168

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF STARTER MOTOR. Does the starter motor operate when ignition switch is turned to "ST"? NOTE: Place the inhibitor switch in the "P" or "N" position.(AT vehicles) Depress the clutch pedal. (MT vehicles)	Operates.	Repair harness and connector. NOTE: In this case, repair the following: • Open or short circuit to ground in harness between ECM and starter motor connector. • Poor contact in ECM connector	Check starter motor circuit. <Ref. to EN(H4SO)-60, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

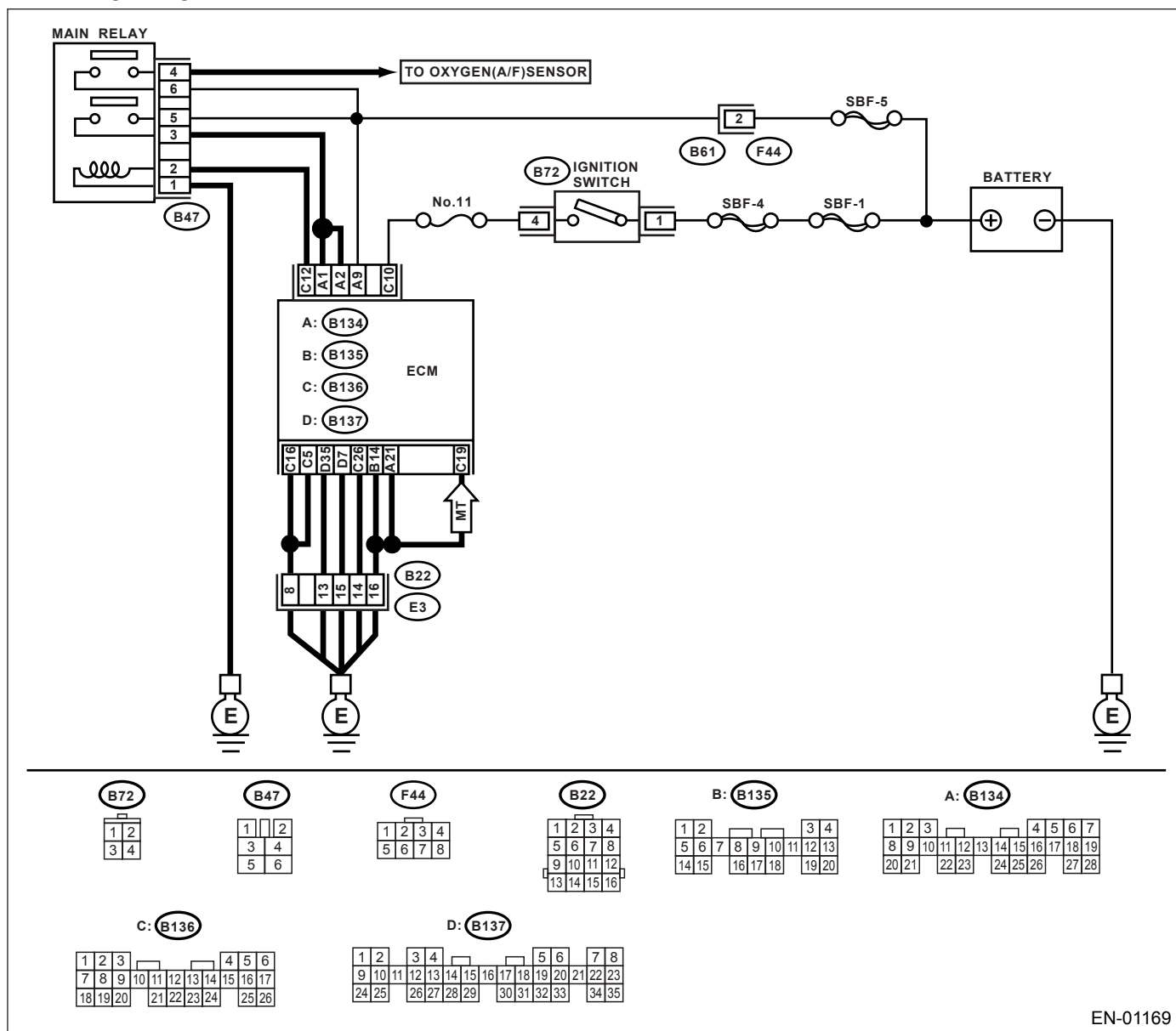
CZ:DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —

- DTC DETECTING CONDITION:
 - Immediately at fault recognition

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



EN-01169

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 9 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B134) No. 9 — Chassis ground: Is the measured value less than the specified value?	10 Ω	Repair short circuit to ground in harness between ECM connector and battery terminal.	Go to step 3.
3 CHECK FUSE SBF-5. Is the fuse blown?	Fuse is blown out.	Replace the fuse.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and battery • Poor contact in ECM connector • Poor contact in battery terminal

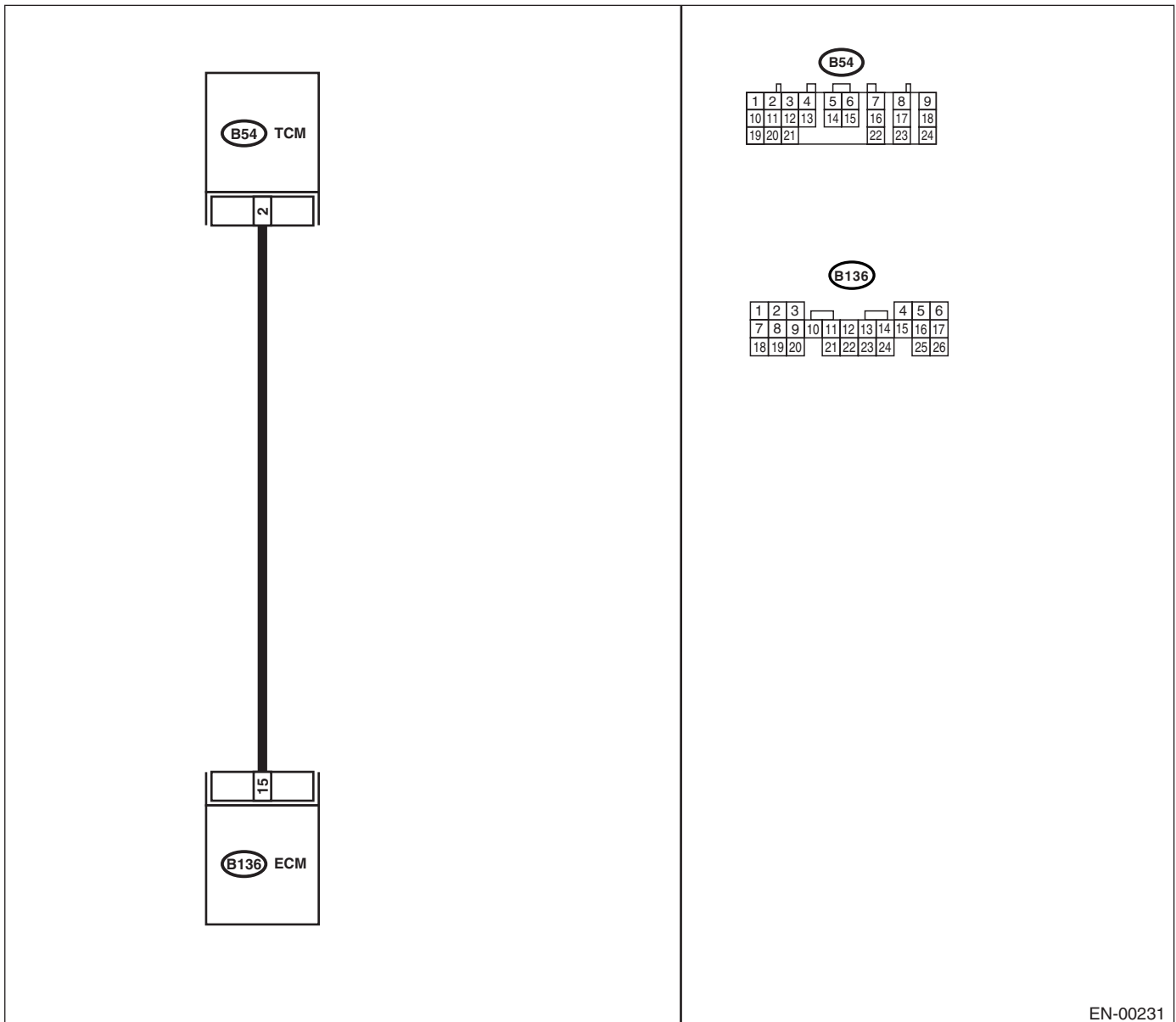
**DA:DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MAL-
FUNCTION (LOW INPUT) —**

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-00231

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1)Start and warm-up the engine. 2)Turn ignition switch to OFF. 3)Turn ignition switch to ON. 4)Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 15 (+) — Chassis ground (–): Is the measured value more than the specified value?	3 V	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1)Turn ignition switch to OFF. 2)Disconnect the connectors from ECM and TCM. 3)Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 15 — Chassis ground: Is the measured value more than the specified value?	1 MΩ	Go to step 3.	Repair short circuit to ground in harness between ECM and TCM connector.
3 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 15 — (B54) No. 2: Is the measured value less than the specified value?	1 Ω	Repair poor contact in ECM or TCM connector.	Repair open circuit in harness between ECM and TCM connector.

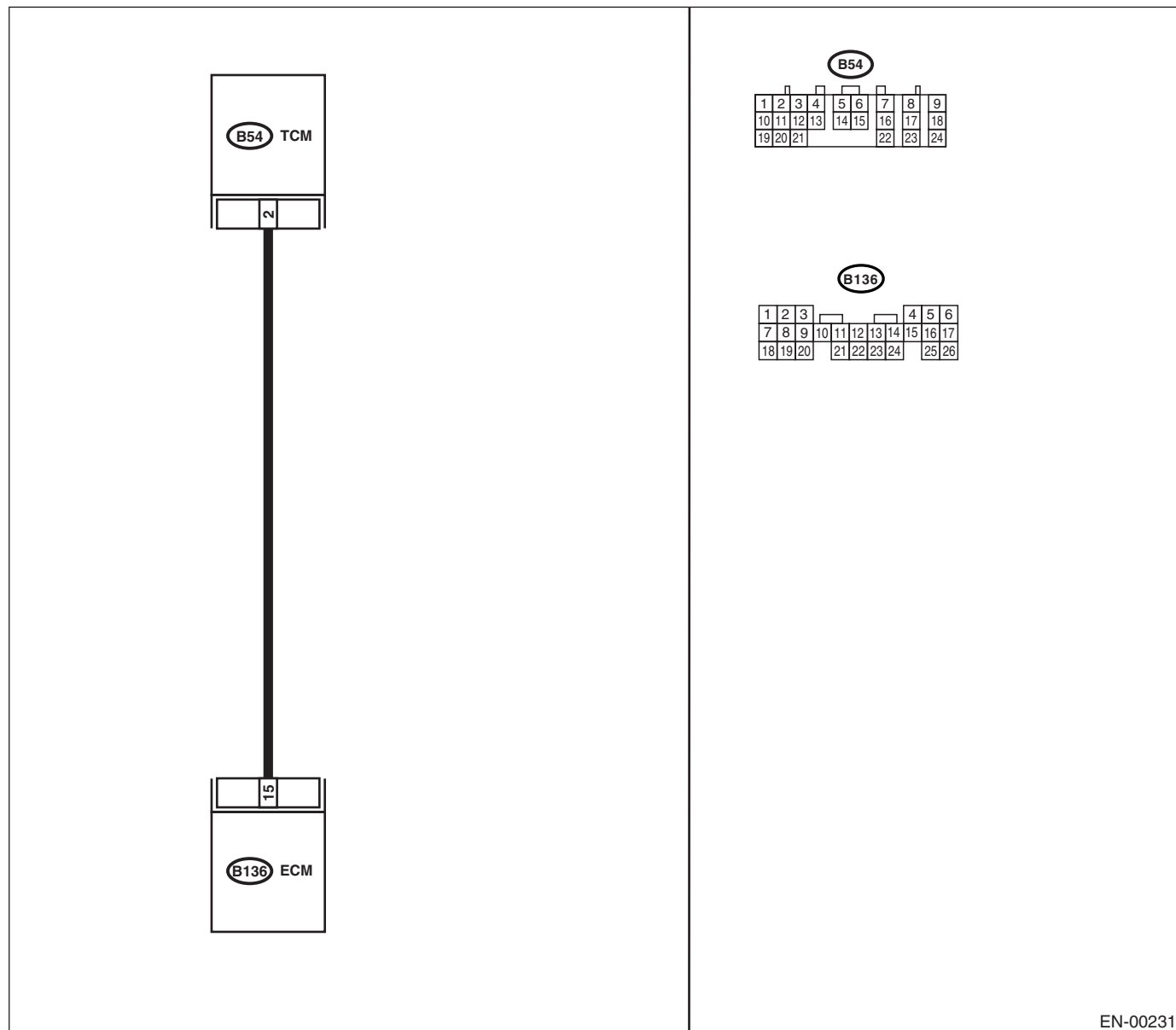
DB:DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MAL-FUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-00231

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1)Start and warm-up the engine. 2)Turn ignition switch to OFF. 3)Disconnect the connector from TCM. 4)Turn ignition switch to ON. 5)Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 15 (+) — Chassis ground (-): Is the measured value less than the specified value?	3 V	Go to step 2.	Repair short circuit to battery in harness between ECM and TCM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1)Turn ignition switch to OFF. 2)Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 15 (+) — Chassis ground (-): Does the measured value exceed the specified value by shaking the ECM harness and connector?	10 V	Repair short circuit to battery in harness between ECM and TCM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>	Contact SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

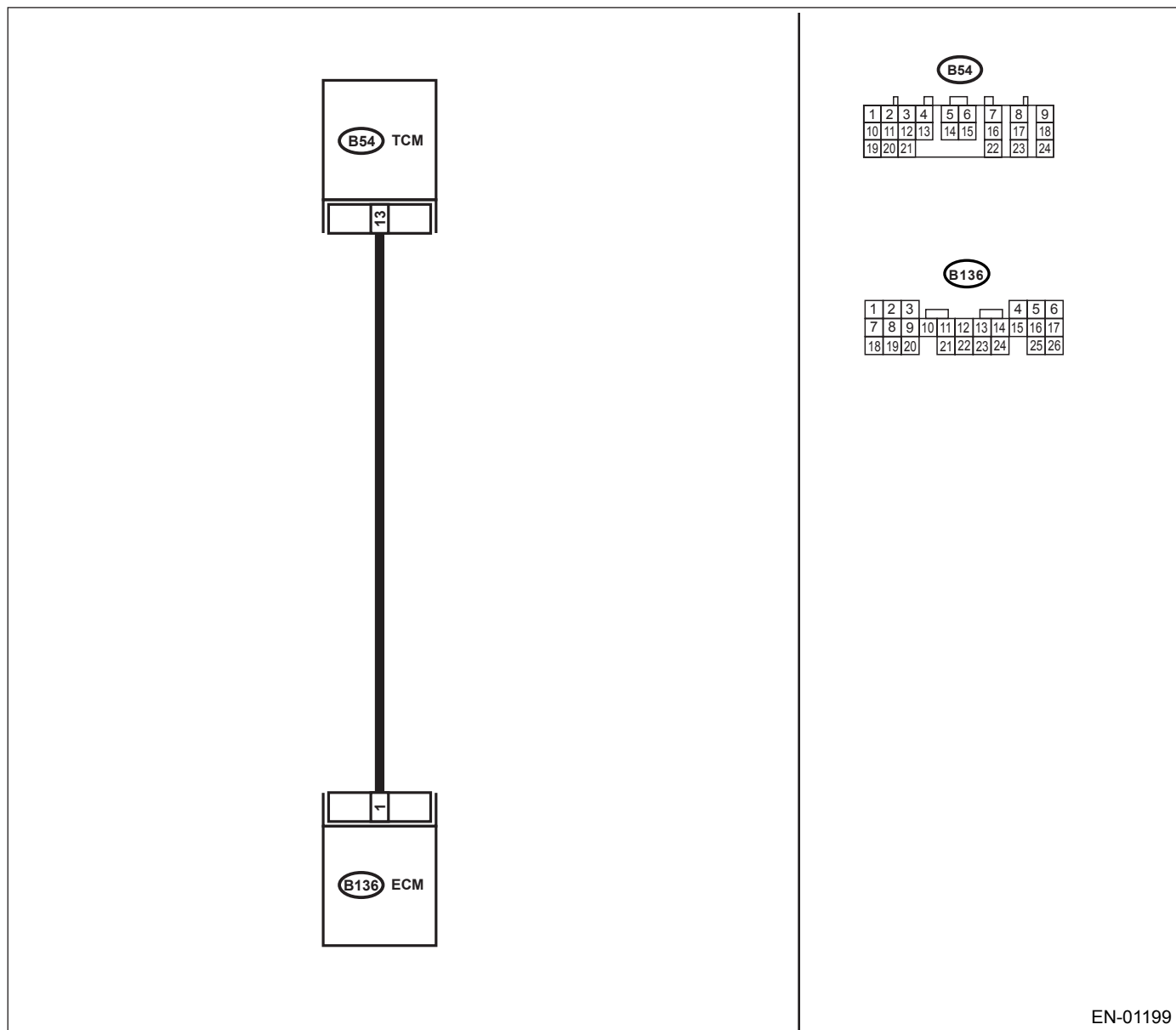
DC:DTC P1711 — ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01199

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and TCM connector.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from ECM and TCM. 3) Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 1 — (B54) No. 13: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair open circuit in harness between ECM and TCM connector.
5 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 1 — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 6.	Repair short circuit to ground in harness between ECM and TCM connector.
6 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

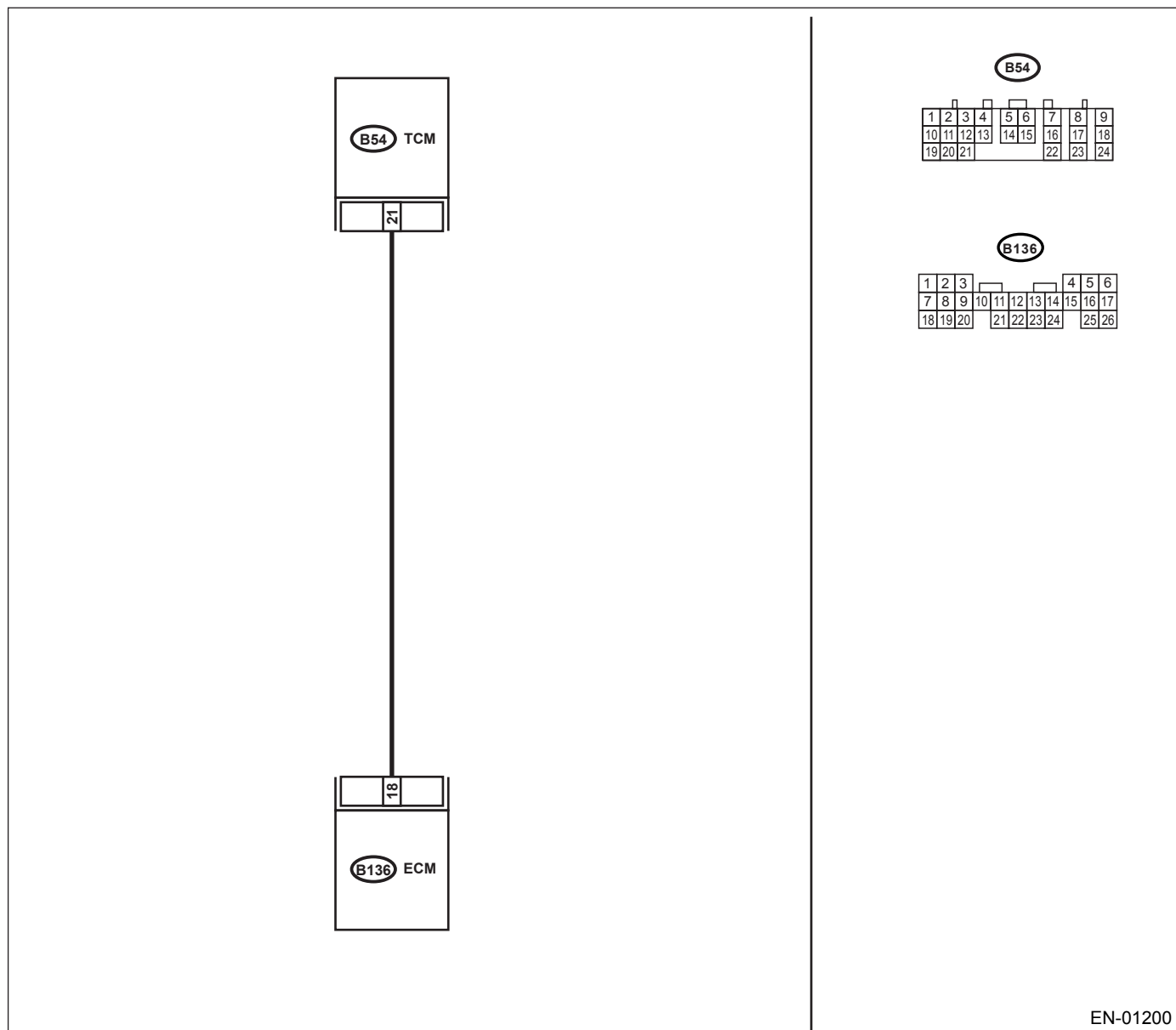
DD:DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
 - Fault occurs in two consecutive driving cycles
- **TROUBLE SYMPTOM:**
 - Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-01200

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 18 (+) — Chassis ground (-): Is the measured value more than the specified value?	4.5 V	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 18 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Repair short circuit to battery in harness between ECM and TCM connector.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector. Is there poor contact in ECM connector?	There is poor contact.	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-48, Engine Control Module.>
4 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM and TCM. 3) Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 18 — (B54) No. 21: Is the measured value less than the specified value?	1 Ω	Go to step 5.	Repair open circuit in harness between ECM and TCM connector.
5 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 18 (+) — Chassis ground: Is the measured value more than the specified value?	1 M Ω	Go to step 6.	Repair short circuit to ground in harness between ECM and TCM connector.
6 CHECK FOR POOR CONTACT. Check for poor contact in TCM connector. Is there poor contact in TCM connector?	There is poor contact.	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to AT-71, Transmission Control Module (TCM).>

GENERAL DIAGNOSTIC TABLE

ENGINE (DIAGNOSTICS)

20. General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:

Malfunction of parts other than those listed is also possible. <Ref. to ME(H4SO)-88, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Idle air control solenoid valve 2) Pressure sensor 3) Intake air temperature sensor 4) Ignition parts (*1) 5) Engine coolant temperature sensor (*2) 6) Crankshaft position sensor (*3) 7) Camshaft position sensor (*3) 8) Fuel injection parts (*4)
2. Rough idling	1) Idle air control solenoid valve 2) Pressure sensor 3) Intake air temperature sensor 4) Engine coolant temperature sensor (*2) 5) Ignition parts (*1) 6) Air intake system (*5) 7) Fuel injection parts (*4) 8) Throttle position sensor 9) Crankshaft position sensor (*3) 10) Camshaft position sensor (*3) 11) Oxygen sensor 12) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Idle air control solenoid valve 2) Engine coolant temperature sensor 3) Accelerator cable (*6) 4) Throttle position sensor 5) Pressure sensor 6) Intake air temperature sensor
4. Poor acceleration	1) Pressure sensor 2) Intake air temperature sensor 3) Throttle position sensor 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) A/C switch and A/C cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1)
5. Engine stalls or engine sags or hesitates at acceleration.	1) Pressure sensor 2) Intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Throttle position sensor 9) Fuel pump and fuel pump relay

GENERAL DIAGNOSTIC TABLE

ENGINE (DIAGNOSTICS)

Symptom	Problem parts
6. Surging	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Pressure sensor 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4) 8) Throttle position sensor 9) Fuel pump and fuel pump relay
7. Spark knock	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Pressure sensor 4) Engine coolant temperature sensor 5) Knock sensor 6) Fuel injection parts (*4) 7) Fuel pump and fuel pump relay
8. After burning in exhaust system	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Pressure sensor 4) Engine coolant temperature sensor (*2) 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay

*1: Check ignition coil & 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 for air leak in air intake system.

*6: Adjust accelerator cable.

2. AUTOMATIC TRANSMISSION

NOTE:

Check general diagnostics table with non-conformity symptom for automatic transmission. <Ref. to AT-2, Basic Diagnostic Procedure.>

GENERAL DIAGNOSTIC TABLE

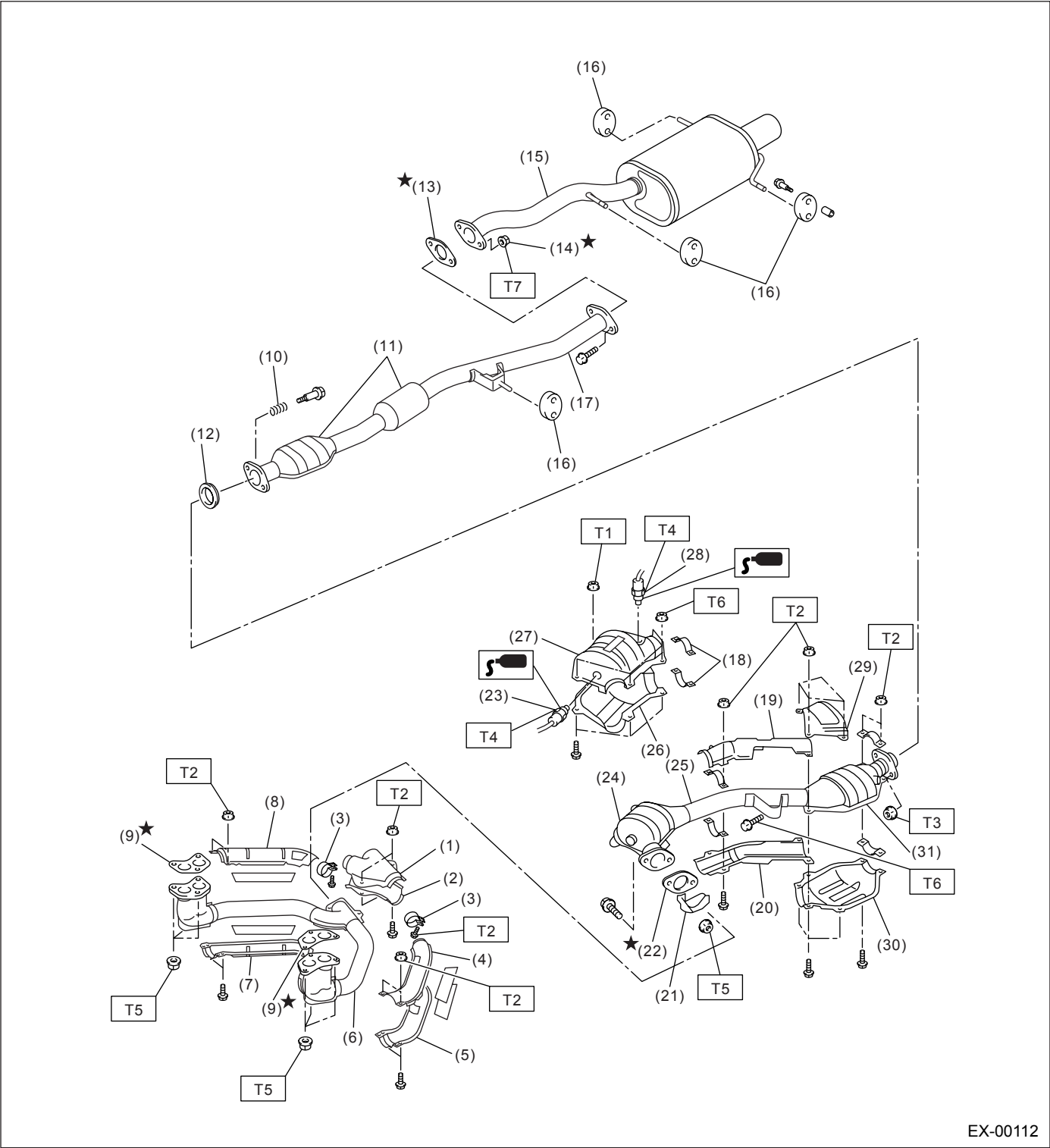
ENGINE (DIAGNOSTICS)

GENERAL DESCRIPTION

EXHAUST

1. General Description

A: COMPONENT



EX-00112

GENERAL DESCRIPTION

EXHAUST

(1) Upper front exhaust pipe cover CTR	(15) Muffler	(29) Upper rear catalytic converter cover
(2) Lower front exhaust pipe cover CTR	(16) Cushion rubber	(30) Lower rear catalytic converter cover
(3) Clamp	(17) Rear exhaust pipe	(31) Rear catalytic converter
(4) Upper front exhaust pipe cover LH	(18) Clamp	
(5) Lower front exhaust pipe cover LH	(19) Upper center exhaust pipe cover	
(6) Front exhaust pipe	(20) Lower center exhaust pipe cover	
(7) Lower front exhaust pipe cover RH	(21) Protector	
(8) Upper front exhaust pipe cover RH	(22) Gasket	
(9) Gasket	(23) Front oxygen (A/F) sensor	
(10) Spring	(24) Front catalytic converter	
(11) Chamber	(25) Center exhaust pipe	
(12) Gasket	(26) Lower front catalytic converter cover	
(13) Gasket	(27) Upper front catalytic converter cover	
(14) Self-locking nut	(28) Rear oxygen sensor	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 8 (0.8, 5.8)

T2: 13 (1.3, 9.4)

T3: 18 (1.8, 13.0)

T4: 21 (2.1, 15.2)

T5: 30 (3.1, 22.4)

T6: 35 (3.6, 26.0)

T7: 48 (4.9, 35.4)

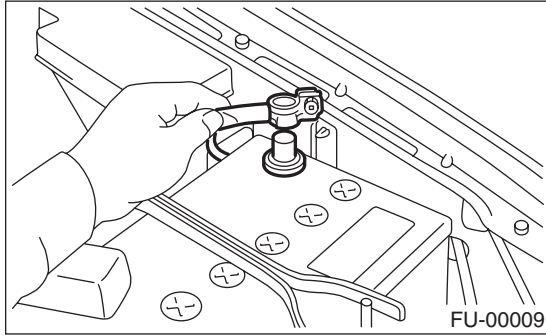
B: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

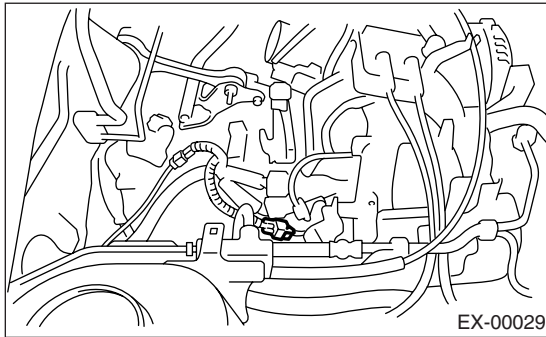
2. Front Exhaust Pipe

A: REMOVAL

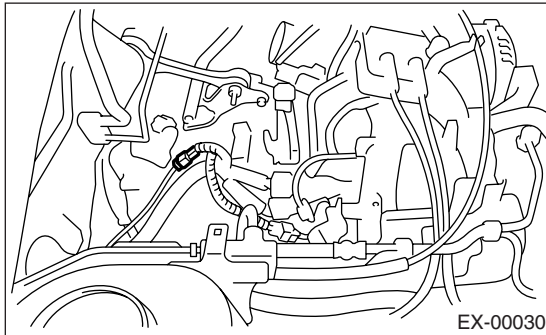
1) Disconnect the ground cable from battery.



2) Disconnect the front oxygen (A/F) sensor connector.



3) Disconnect the rear oxygen sensor connector.

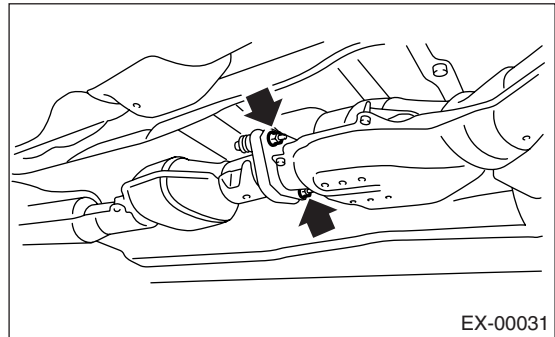


4) Lift up the vehicle.

5) Separate the front and center exhaust pipe assembly from rear exhaust pipe.

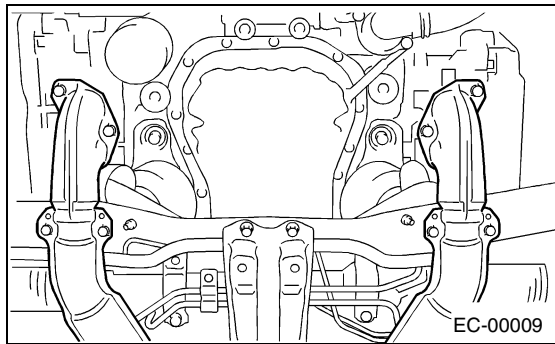
CAUTION:

Be careful, the exhaust pipe is hot.

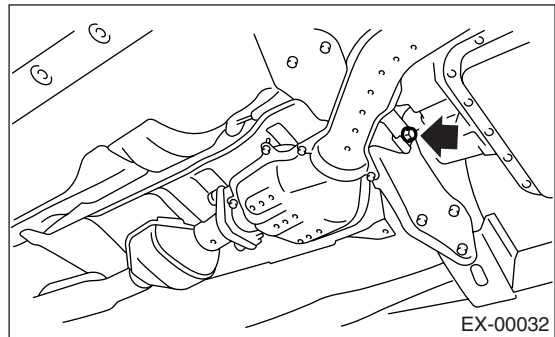


6) Remove the under cover.

7) Remove the nuts which hold the front exhaust pipe onto cylinder heads.



8) Remove the bolt which installs front and center exhaust pipe assembly to hanger bracket.



FRONT EXHAUST PIPE

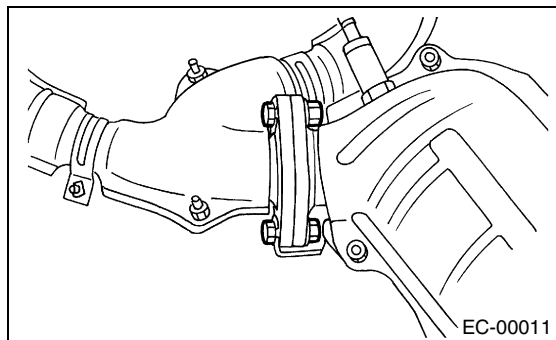
EXHAUST

9) Remove the front and center exhaust pipe assembly from vehicle.

CAUTION:

- Be careful not to let the front and center exhaust pipe assembly fall off when removing as it is quite heavy.
- After removing the front and center exhaust pipe assembly, do not apply excessive pulling force on the rear exhaust pipe.

10) Separate the front exhaust pipe from center exhaust pipe.



11) Remove the front oxygen (A/F) sensor and the rear oxygen sensor. <Ref. to FU(H4SO)-44, REMOVAL, Front Oxygen (A/F) Sensor.> A <Ref. to FU(H4SO)-46, REMOVAL, Rear Oxygen Sensor.>

B: INSTALLATION

1) Install the front oxygen (A/F) sensor and the rear oxygen sensor. <Ref. to FU(H4SO)-44, INSTALLATION, Front Oxygen (A/F) Sensor.> A <Ref. to FU(H4SO)-46, INSTALLATION, Rear Oxygen Sensor.>

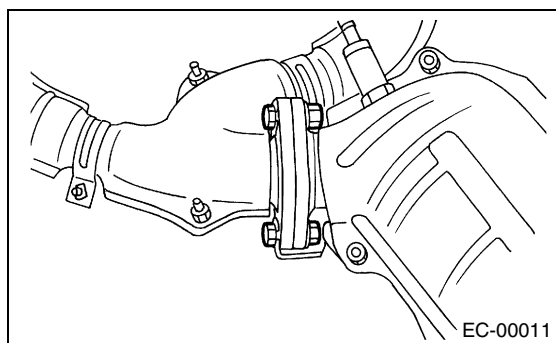
2) Install the front exhaust pipe to center exhaust pipe.

NOTE:

Replace the gaskets with new ones.

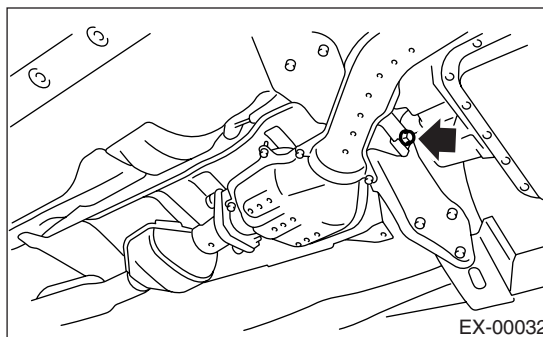
Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



3) Install the front and center exhaust pipe assembly to vehicle.

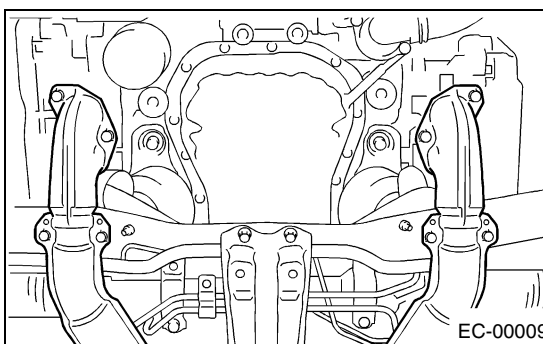
4) Temporarily tighten the bolt which installs front and center exhaust pipe assembly to hanger bracket.



5) Tighten the nuts which hold front exhaust pipe onto cylinder heads.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)

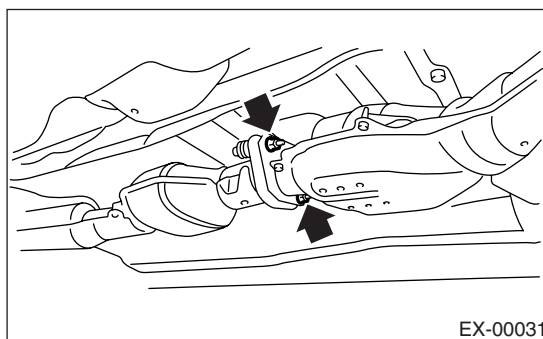


6) Install the under cover.

7) Tighten the bolts which install front and center exhaust pipe assembly to rear exhaust pipe.

Tightening torque:

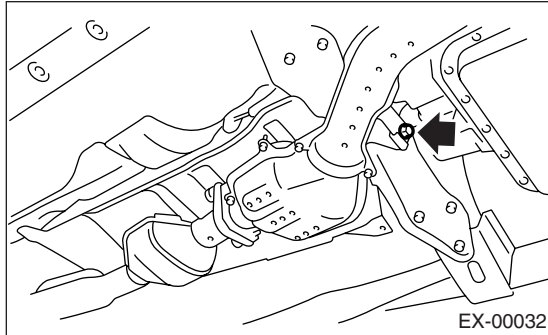
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 8) Tighten the bolt which holds front and center exhaust pipe assembly to hanger bracket.

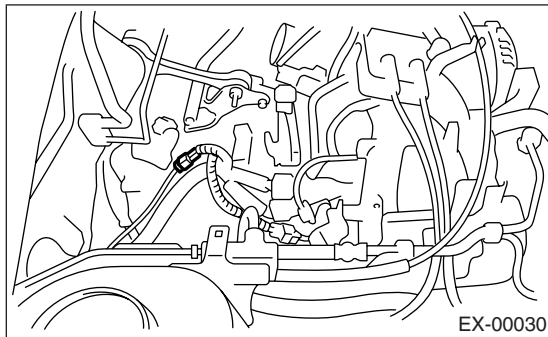
Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)

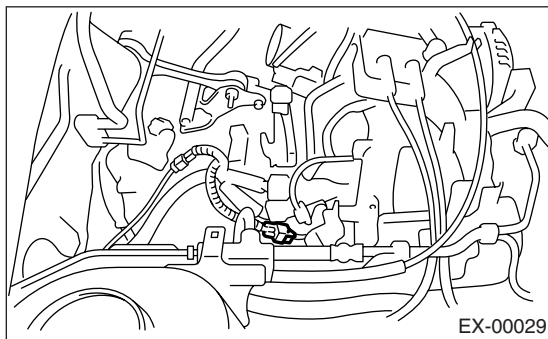


- 9) Lower the vehicle.

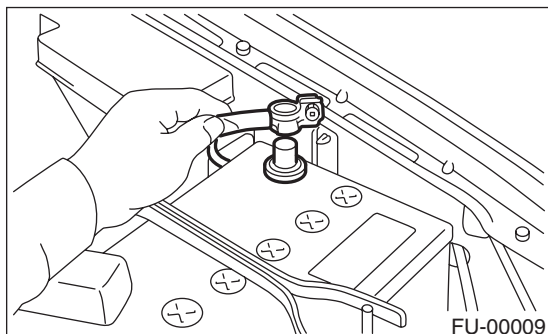
- 10) Connect the rear oxygen sensor connector.



- 11) Connect the front oxygen (A/F) sensor connector.



- 12) Connect the battery ground cable to battery.



C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

3. Center Exhaust Pipe

A: REMOVAL

After removing the center and front exhaust pipes as one unit, separate them. Refer to the procedure for removing the front exhaust pipe. <Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION

Install the center exhaust pipe and front exhaust pipe as one unit. Refer to the procedure for installing the front exhaust pipe. <Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

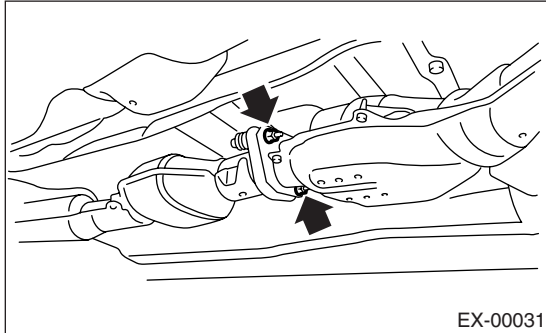
4. Rear Exhaust Pipe

A: REMOVAL

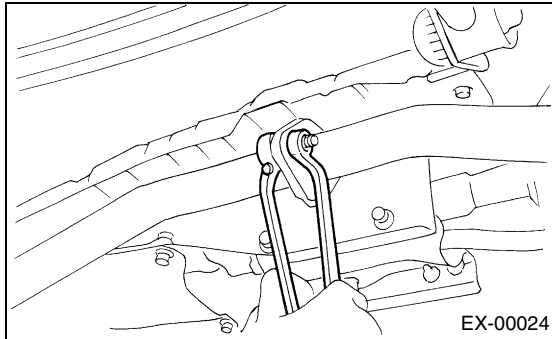
1) Separate the rear exhaust pipe from center exhaust pipe.

CAUTION:

Be careful, the exhaust pipe is hot.



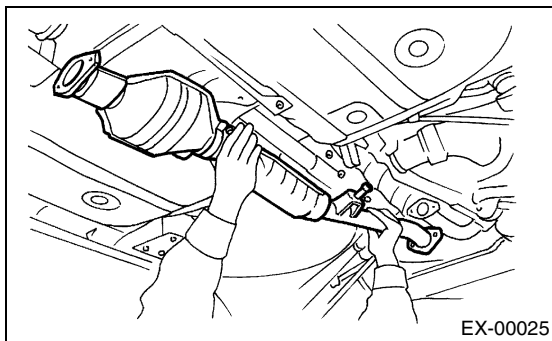
2) Separate the rear exhaust pipe from muffler.



3) Apply a coat of SUBARU CRC to mating area of the cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)

4) Remove the rear exhaust pipe bracket from the cushion rubber.

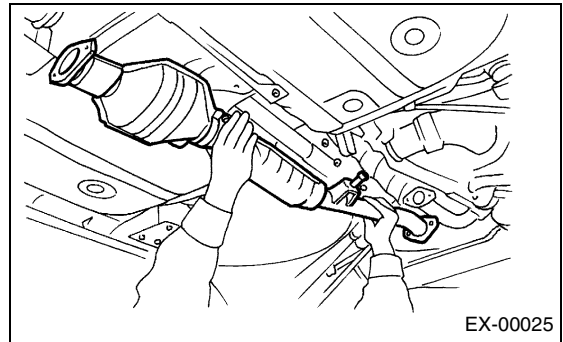


B: INSTALLATION

1) Apply a coat of SUBARU CRC to mating area of the cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)

2) Install the rear exhaust pipe bracket to cushion rubber.



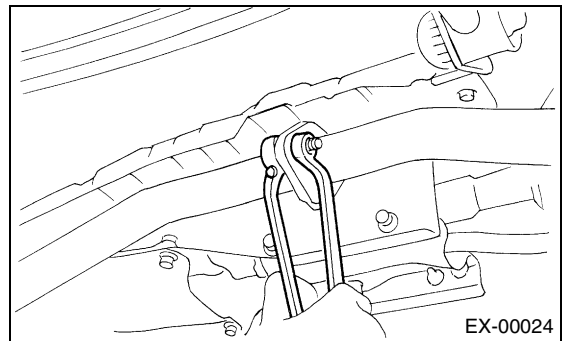
NOTE:

Replace the gaskets with new ones.

3) Install the rear exhaust pipe to muffler.

Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



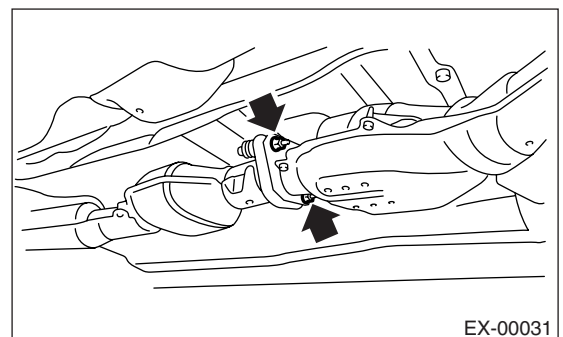
NOTE:

Replace the self-locking nuts with new ones.

4) Install the rear exhaust pipe to center exhaust pipe.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

1) Make sure there are no exhaust leaks from connections and welds.

2) Make sure there are no holes or rusting.

3) Make sure the cushion rubber is not worn or cracked.

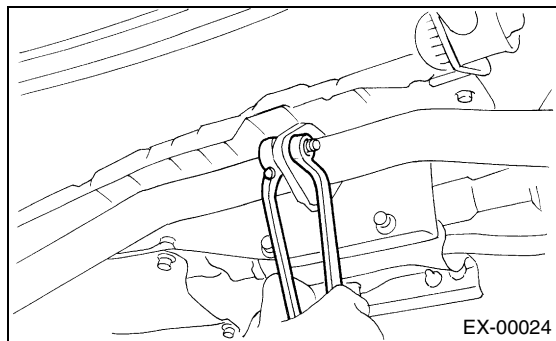
5. Muffler

A: REMOVAL

1) Separate the muffler from rear exhaust pipe.

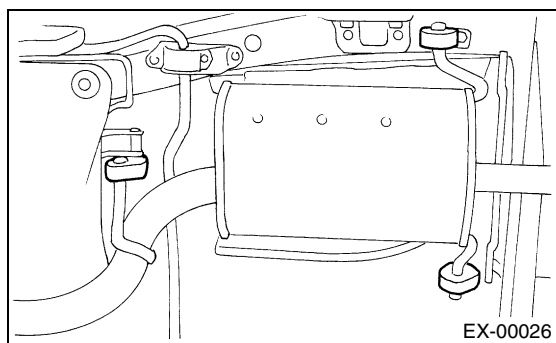
CAUTION:

Be careful, the exhaust pipe is hot.



2) Apply a coat of SUBARU CRC to mating area of the cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)



3) Remove the front, right and left cushion rubber, and detach the muffler assembly.

B: INSTALLATION

1) Install in the reverse order of removal.

NOTE:

- Replace the gasket and self-locking nuts with new ones.
- For tightening torques, refer to "COMPONENT". <Ref. to EX(H4SO)-2, COMPONENT, General Description.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.
- 3) Make sure the cushion rubber is not worn or cracked.

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

1. General Description

A: SPECIFICATIONS

Item		Specification
Fuel tank	Capacity	60 ℓ (15.9 US gal, 13.2 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	370 — 677 kPa (3.77 — 6.9 kg/cm ² , 53.6 — 98 psi)
	Discharge flow	More than 65 ℓ (17.2 US gal, 14.3 Imp gal)/h [12 V at 300 kPa (3.06 kg/cm ² , 43.5 psi)]
Fuel filter		Cartridge type

FUEL INJECTION (FUEL SYSTEMS)

1. INTAKE MANIFOLD



GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

- (1) Intake manifold gasket RH
- (2) Fuel injector pipe
- (3) Fuel injector
- (4) O-ring
- (5) O-ring
- (6) O-ring
- (7) Plug
- (8) Nipple
- (9) Purge control solenoid valve
- (10) Nipple
- (11) Intake manifold

- (12) Intake manifold gasket LH
- (13) Fuel pipe protector LH
- (14) Plug cord holder LH
- (15) Fuel pipe protector RH
- (16) Fuel pipe assembly
- (17) Fuel hose
- (18) Clip
- (19) Clip
- (20) Air assist injector solenoid valve
- (21) Air assist injector solenoid valve bracket

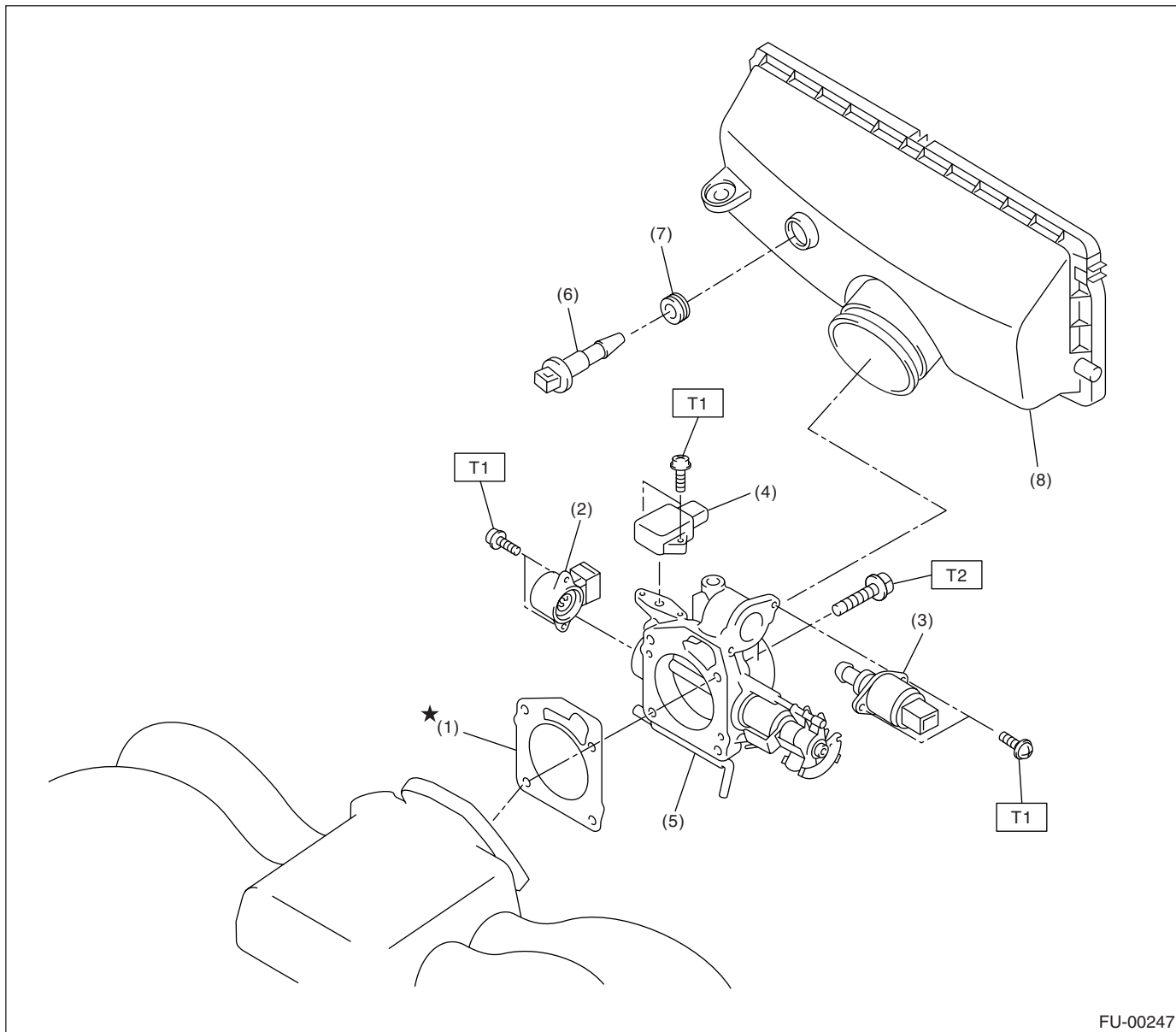
- (22) Guide pin
- (23) Plug cord holder RH
- (24) Accelerator cable bracket

Tightening torque: N·m (kgf-m, ft-lb)***T1: 1.5 (0.15, 1.1)******T2: 5.0 (0.51, 3.7)******T3: 17 (1.7, 12.5)******T4: 19 (1.9, 13.7)******T5: 25 (2.5, 18.1)***

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

2. AIR INTAKE SYSTEM



- (1) Gasket
- (2) Throttle position sensor
- (3) Idle air control solenoid valve
- (4) Pressure sensor

- (5) Throttle body
- (6) Intake air temperature sensor
- (7) Grommet
- (8) Air cleaner case

Tightening torque: N·m (kgf-m, ft-lb)

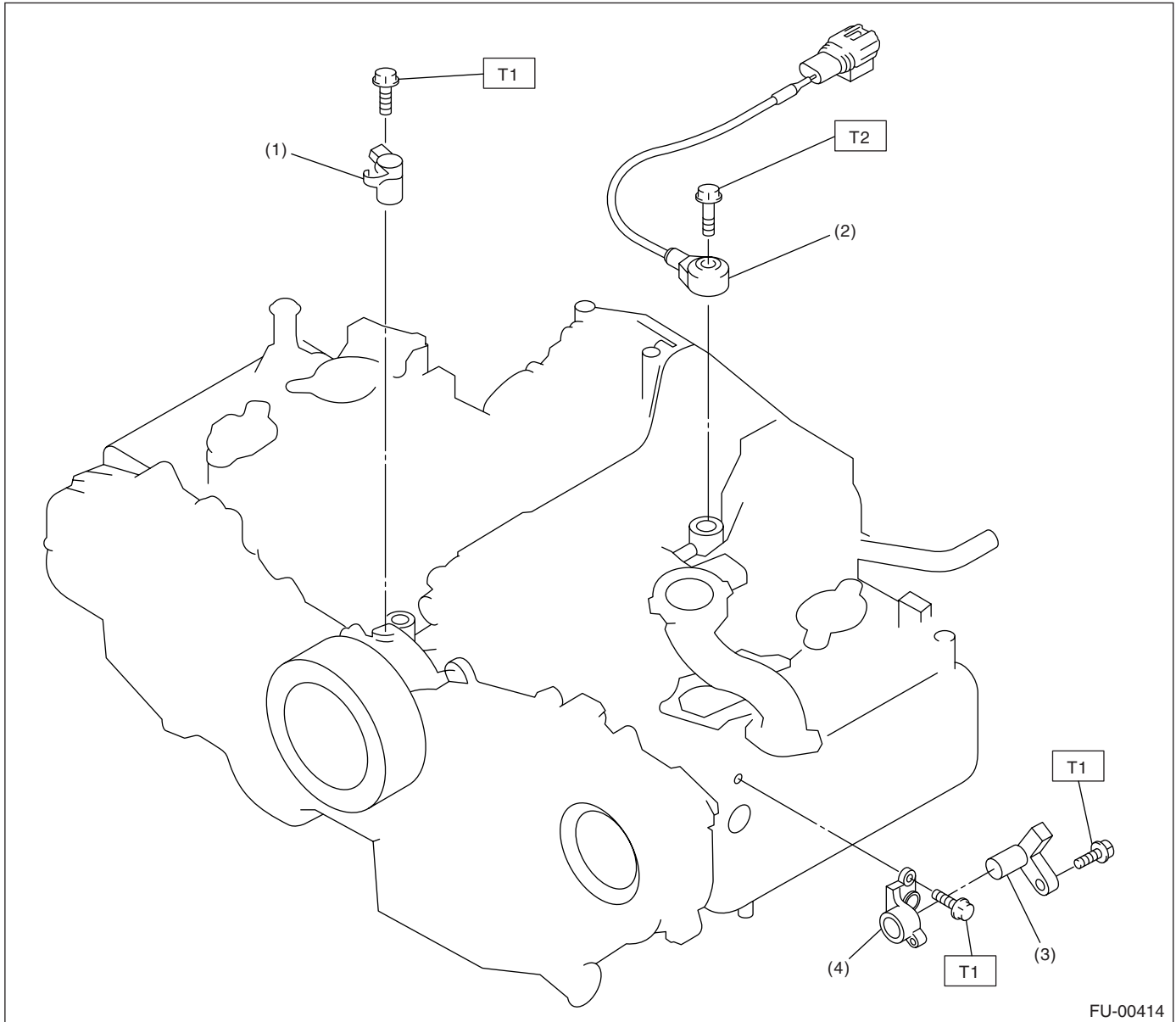
T1: 1.6 (0.16, 1.2)

T2: 22 (2.2, 15.9)

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

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)

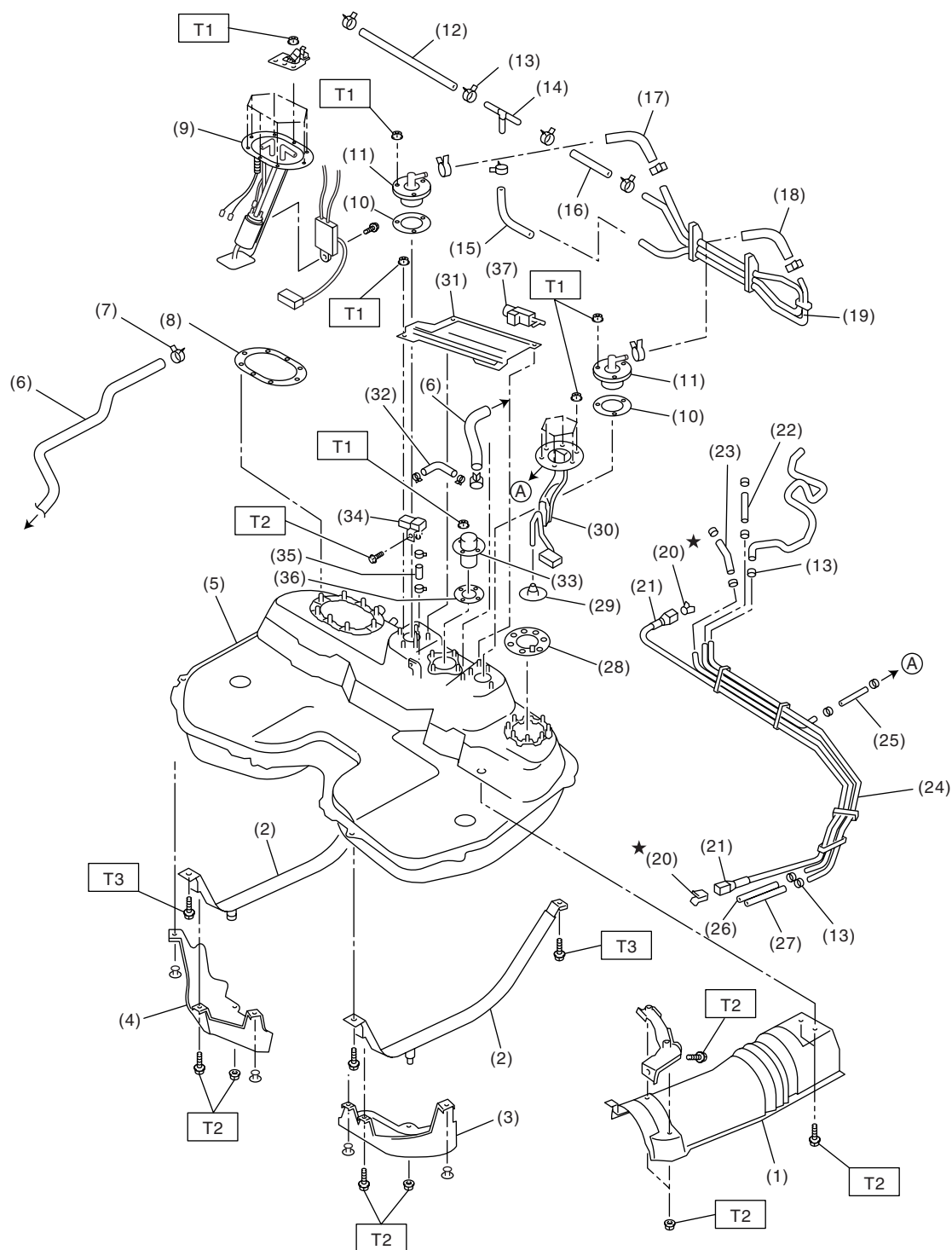
T1: 6.4 (0.65, 4.7)

T2: 24 (2.4, 17.4)

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

4. FUEL TANK



FU-00249

GENERAL DESCRIPTION

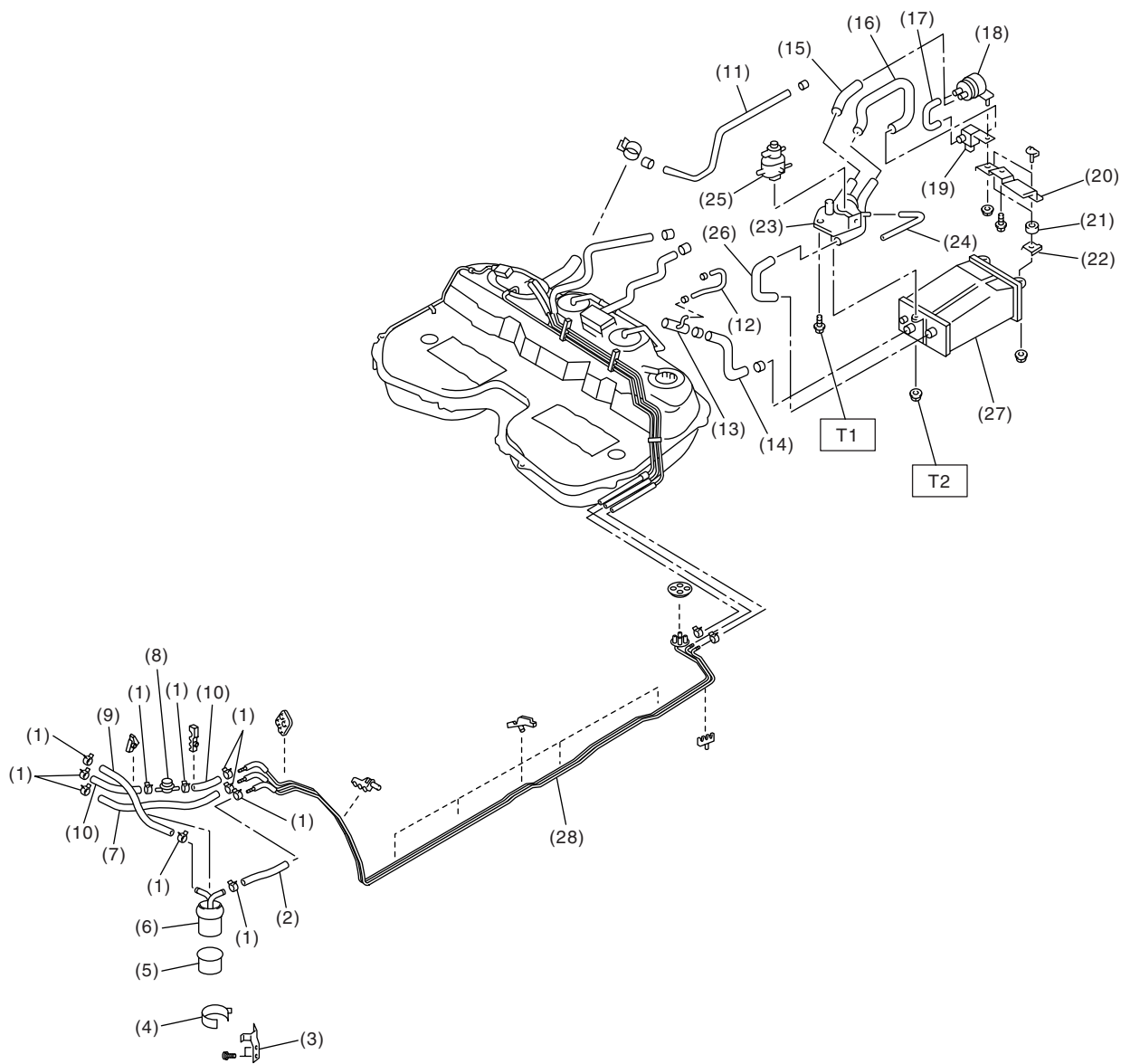
FUEL INJECTION (FUEL SYSTEMS)

(1) Heat shield cover	(16) Evaporation hose B	(31) Protector cover
(2) Fuel tank band	(17) Evaporation hose D	(32) Vent valve hose
(3) Protector LH	(18) Evaporation hose E	(33) Vent valve
(4) Protector RH	(19) Evaporation pipe assembly	(34) Fuel tank pressure sensor
(5) Fuel tank	(20) Retainer	(35) Fuel tank pressure sensor hose
(6) Canister hose A	(21) Quick connector	(36) Vent valve gasket
(7) Clamp	(22) Jet pump hose A	(37) Fuel tank sensor control valve
(8) Fuel pump gasket	(23) Fuel return hose A	
(9) Fuel pump assembly	(24) Fuel pipe assembly	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(10) Fuel cut valve gasket	(25) Jet pump hose B	<i>T1: 4.4 (0.45, 3.3)</i>
(11) Fuel cut valve	(26) Fuel return hose B	<i>T2: 7.4 (0.75, 5.4)</i>
(12) Evaporation hose A	(27) Evaporation hose F	<i>T3: 33 (3.4, 25)</i>
(13) Clip	(28) Fuel sub level sensor gasket	
(14) Joint pipe	(29) Jet pump filter	
(15) Evaporation hose C	(30) Fuel sub level sensor	

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

5. FUEL LINE



FU-00250

GENERAL DESCRIPTION

FUEL INJECTION (FUEL SYSTEMS)

(1) Clip	(12) Evaporation hose B	(23) Canister holder
(2) Fuel delivery hose A	(13) Joint pipe	(24) Evaporation hose C
(3) Fuel filter bracket	(14) Canister hose A	(25) Pressure control solenoid valve
(4) Fuel filter holder	(15) Drain filter hose A	(26) Canister hose B
(5) Fuel filter cup	(16) Drain valve hose	(27) Canister
(6) Fuel filter	(17) Drain filter hose B	(28) Fuel pipe assembly
(7) Evaporation hose	(18) Drain filter	
(8) Fuel damper	(19) Drain valve	
(9) Fuel delivery hose B	(20) Canister upper bracket	
(10) Fuel return hose	(21) Cushion rubber	
(11) Evaporation hose A	(22) Canister lower bracket	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 25 (2.5, 18.1)

T2: 23 (2.3, 16.6)

FUEL INJECTION (FUEL SYSTEMS)

This diagram illustrates the assembly of a vehicle's rear suspension and steering components. The main parts are labeled with numbers in parentheses: (1) for the upper control arm, (2) for the lower control arm, (3) for the steering knuckle, (4) for the rear wheel hub, (5) for the rear axle, (6) for the rear suspension arm, (7) for the rear suspension bracket, (8) for the upper control arm bush, (9) for the upper control arm nut, (10) for the upper control arm bolt, (11) for the lower control arm bush, (12) for the lower control arm, (13) for the lower control arm bracket, (14) for the rear suspension arm, (15) for the rear suspension bracket. The diagram also shows various fasteners and components labeled T1, T2, and C. Dashed lines indicate the assembly points for these components.

- (15) Fuel filler pipe protector

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.45, 3.3)

T2: 7.5 (0.76, 5.53)

GENERAL DESCRIPTION

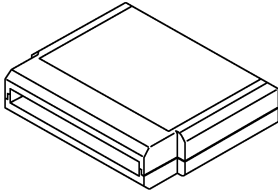
FUEL INJECTION (FUEL SYSTEMS)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA210	24082AA210 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)

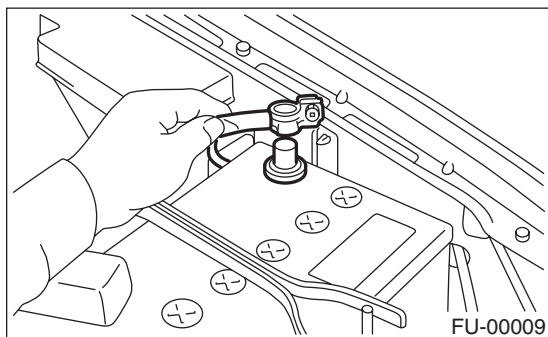
THROTTLE BODY

FUEL INJECTION (FUEL SYSTEMS)

2. Throttle Body

A: REMOVAL

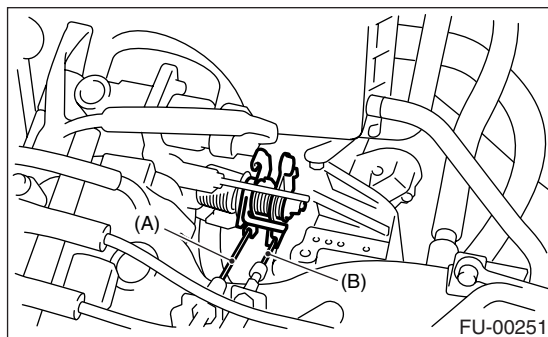
1) Disconnect the ground cable from battery.



2) Remove the air cleaner case. <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>

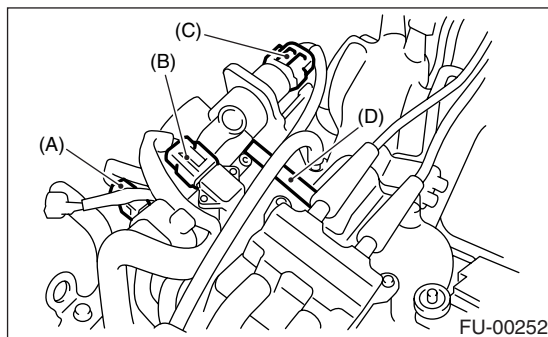
3) Disconnect the accelerator cable (A).

4) Disconnect the cruise control cable (B). (vehicles with cruise control)



5) Disconnect the connectors from idle air control solenoid valve, throttle position sensor and pressure sensor.

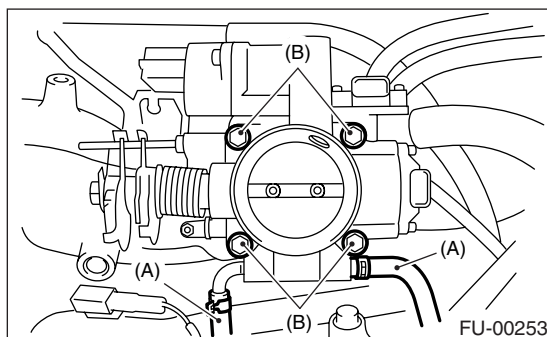
6) Disconnect the air by-pass hose from the throttle body.



- (A) Throttle position sensor
- (B) Pressure sensor
- (C) Idle air control solenoid valve
- (D) Air by-pass hose

7) Disconnect the engine coolant hoses (A) from the throttle body.

8) Remove the bolts (B) which install throttle body to the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Replace the gaskets with new ones.

Tightening torque:

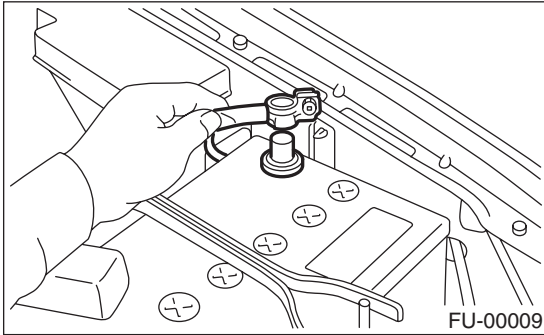
Throttle body:

22 N·m (2.2 kgf-m, 15.9 ft-lb)

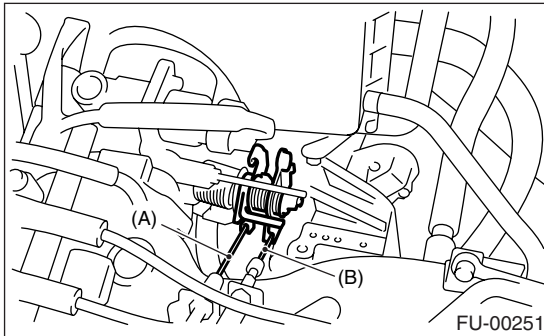
3. Intake Manifold

A: REMOVAL

- 1) Release fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



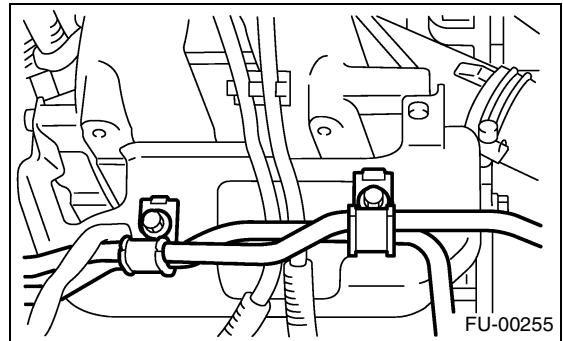
- 4) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> A <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 5) Disconnect the accelerator cable (A).
- 6) Disconnect the cruise control cable (B). (vehicles with cruise control)



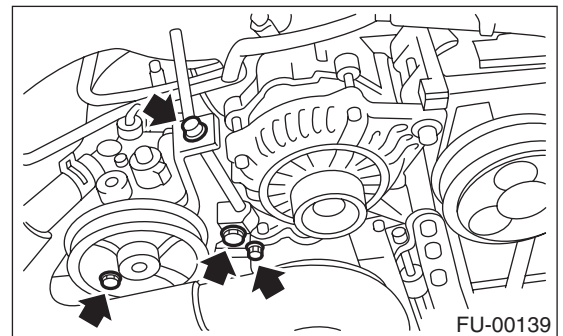
- 7) Remove the power steering pump and reservoir tank from bracket.
 - (1) Remove the resonator chamber. <Ref. to IN(H4SO)-8, REMOVAL, Resonator Chamber.>
 - (2) Remove the front side V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
 - (3) Remove the bolts which hold power steering pipes onto the intake manifold protector.

NOTE:

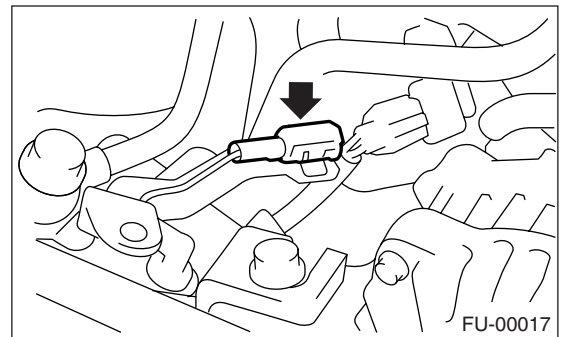
Do not disconnect the power steering hose.



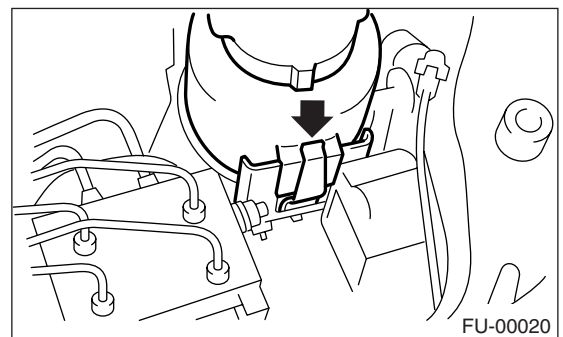
- (4) Remove the bolts which install power steering pump bracket.



- (5) Disconnect the connector from the power steering pump switch.



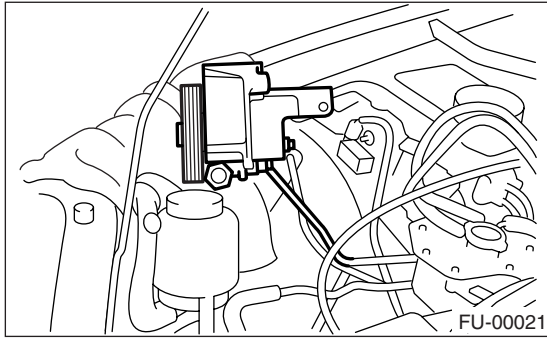
- (6) Remove the reservoir tank from the bracket by pulling it upwards.



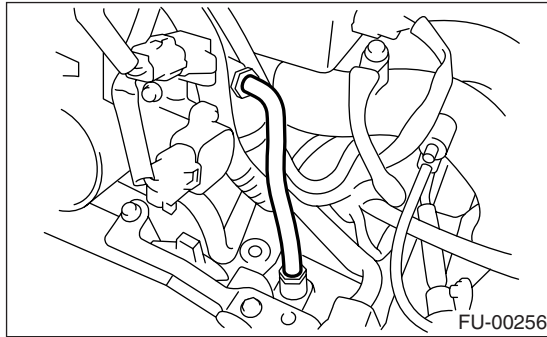
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

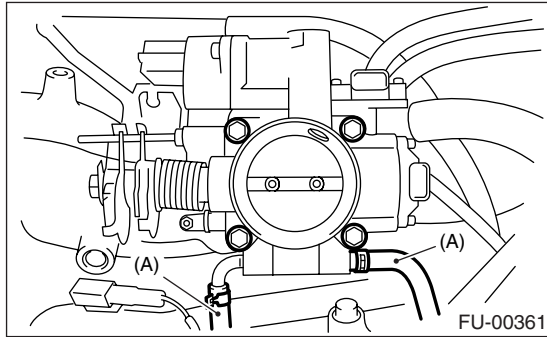
- (7) Place the power steering pump on the right side wheel apron.



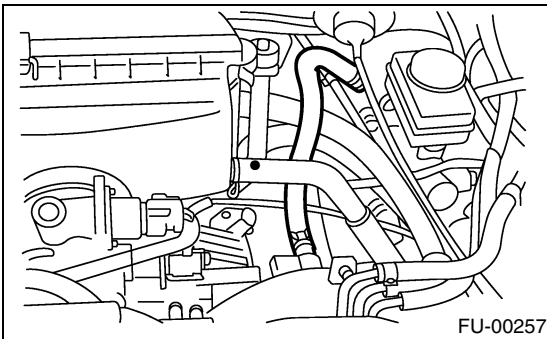
- 8) Disconnect the spark plug cords from the spark plugs.
9) Disconnect the PCV hose from the intake manifold.



- 10) Disconnect the engine coolant hoses (A) from the throttle body.



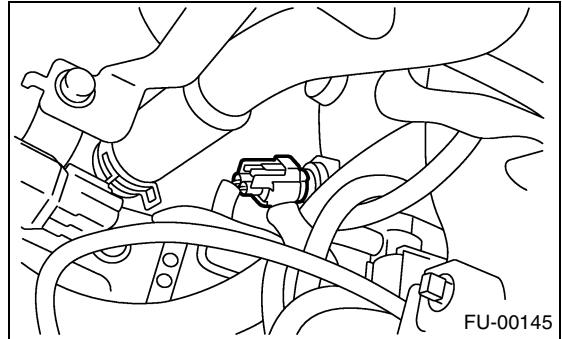
- 11) Disconnect the brake booster hose.



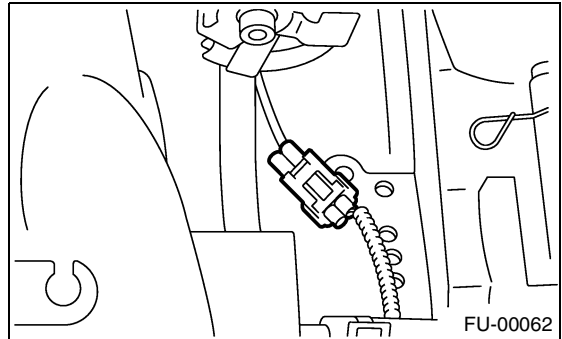
- 12) Remove the air cleaner case stay RH and engine harness bracket, and disconnect the engine harness connectors from the bulkhead harness connectors.



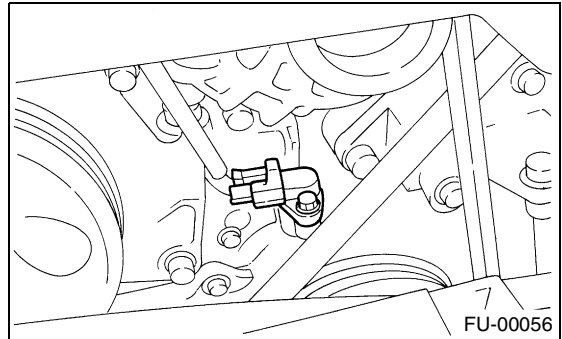
- 13) Disconnect the connector from engine coolant temperature sensor.



- 14) Disconnect the knock sensor connector.



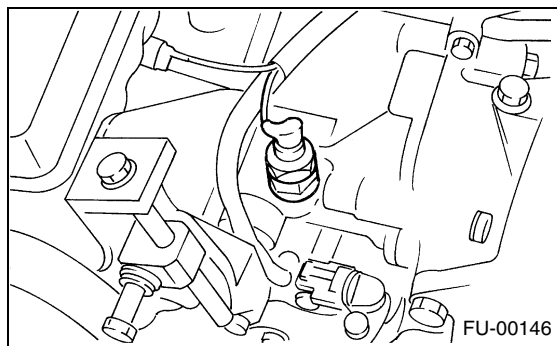
- 15) Disconnect the connector from crankshaft position sensor.



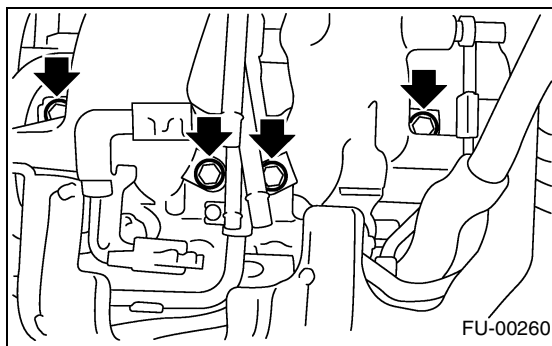
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

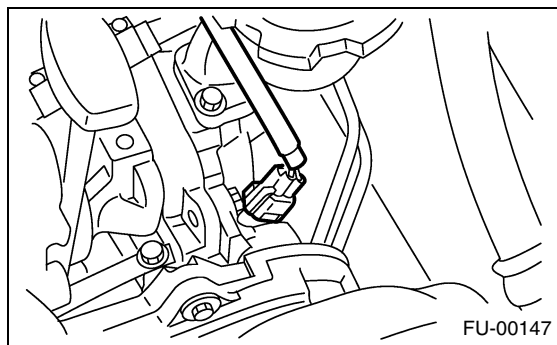
16) Disconnect the connector from oil pressure switch.



19) Remove the bolts which hold intake manifold onto the cylinder heads.



17) Disconnect the connector from the camshaft position sensor.

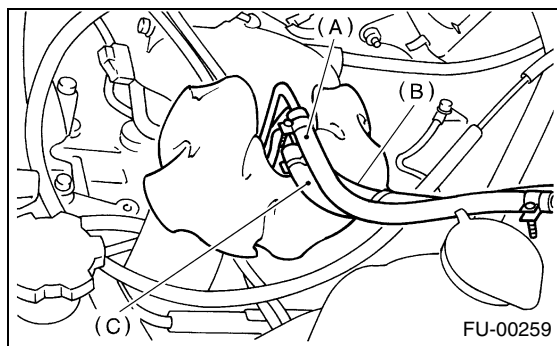


20) Remove the intake manifold.

18) Disconnect the fuel hoses from the fuel pipes.

WARNING:

- Do not spill fuel.
- Catch fuel from hoses in a container or cloth.



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

B: INSTALLATION

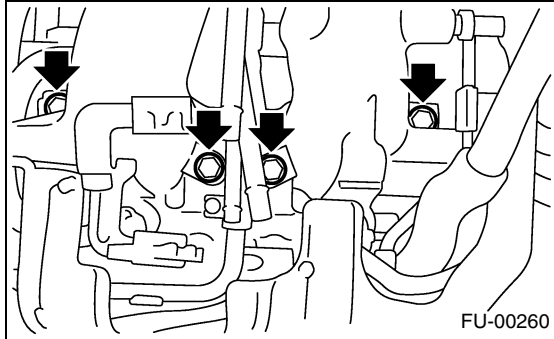
1) Install the intake manifold onto the cylinder heads.

NOTE:

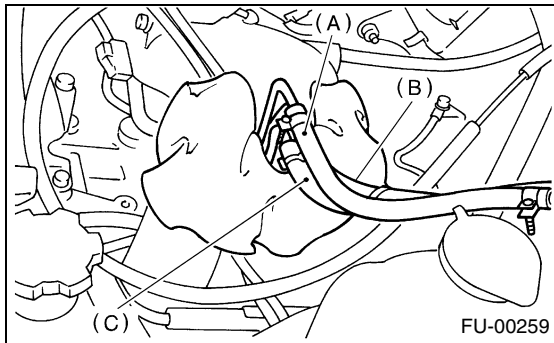
Replace the gaskets with new ones.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

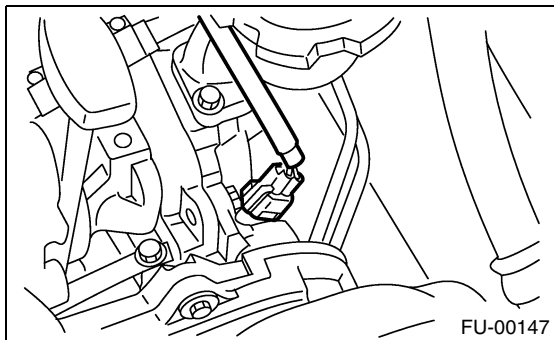


2) Connect the fuel hoses.

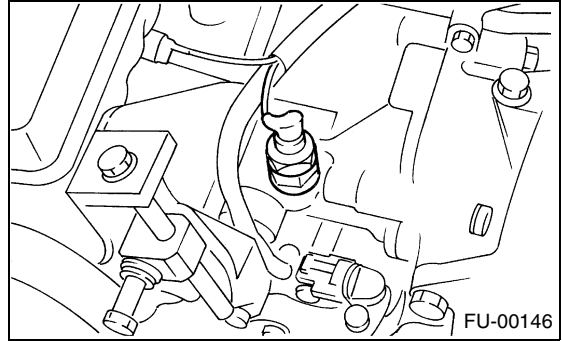


- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

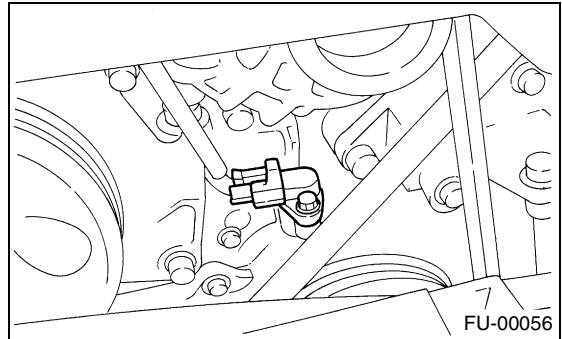
3) Connect the connector to the camshaft position sensor.



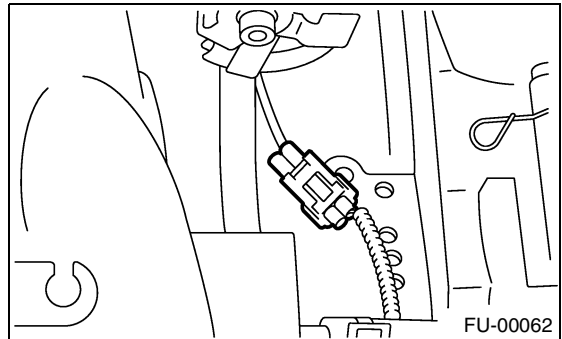
4) Connect the connector to the oil pressure switch.



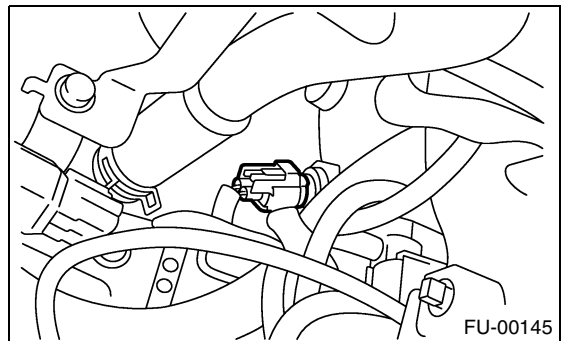
5) Connect the connector to the crankshaft position sensor.



6) Connect the knock sensor connector.



7) Connect the connectors to the engine coolant temperature sensor.



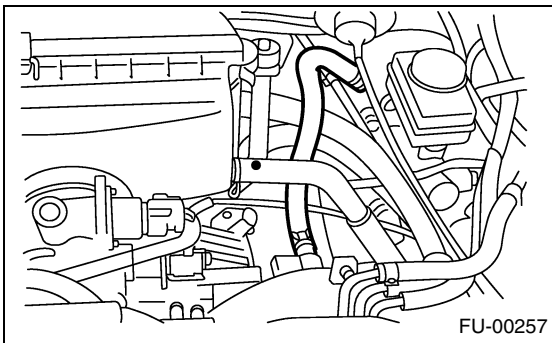
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

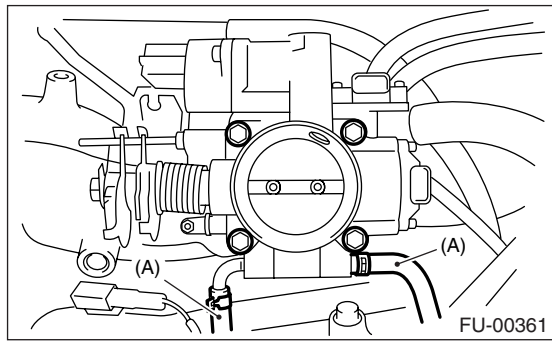
8) Install the air cleaner case stay RH and engine harness bracket, and connect the engine harness connectors to the bulkhead connectors.



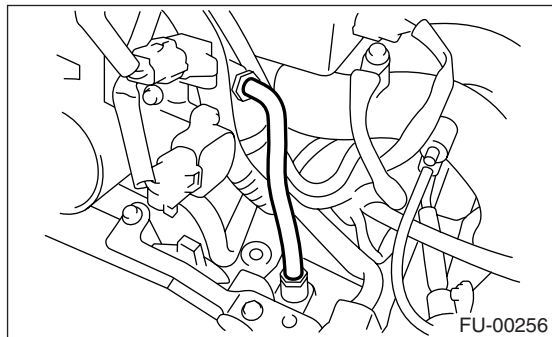
9) Connect the brake booster hose.



10) Connect the engine coolant hose (A) to the throttle body.



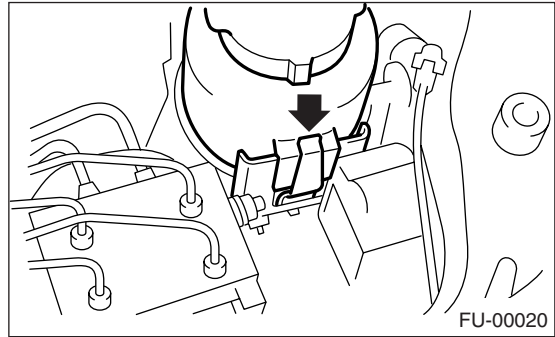
11) Connect the PCV hose to the intake manifold.



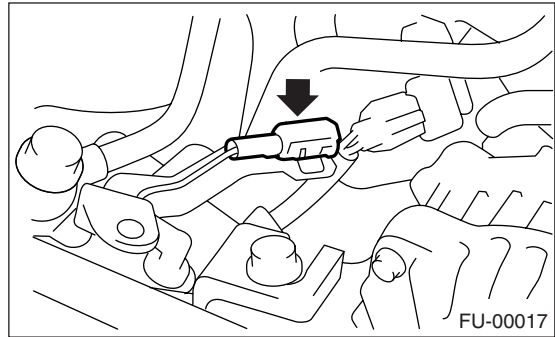
12) Connect the spark plug cords to the spark plugs.

13) Install the power steering pump and reservoir tank to bracket.

(1) Install the reservoir tank to bracket.



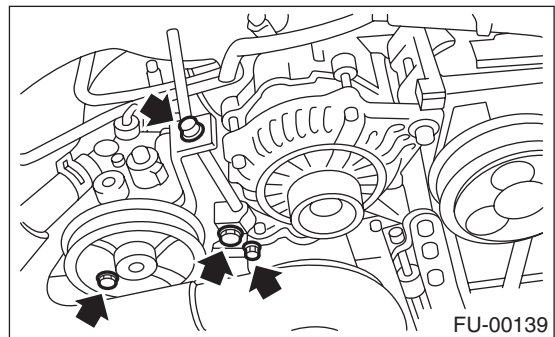
(2) Connect the connector to the power steering pump switch.



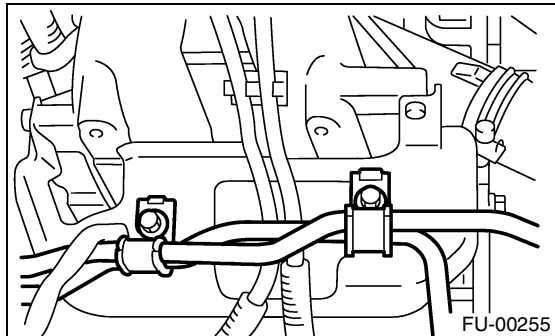
(3) Tighten the bolts which install power steering pump bracket.

Tightening torque:

22 N·m (2.2 kgf-m, 15.9 ft-lb)



(4) Install the power steering pipes onto the right side intake manifold protector.



INTAKE MANIFOLD

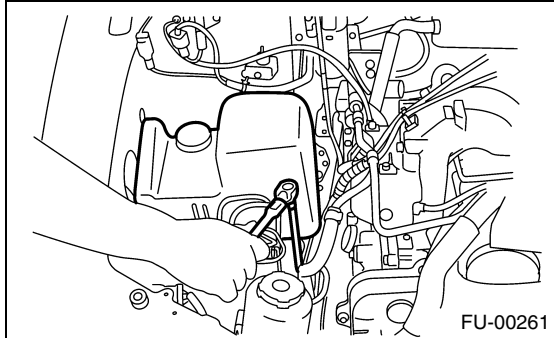
FUEL INJECTION (FUEL SYSTEMS)

(5) Install the front side V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

(6) Install the resonator chamber.

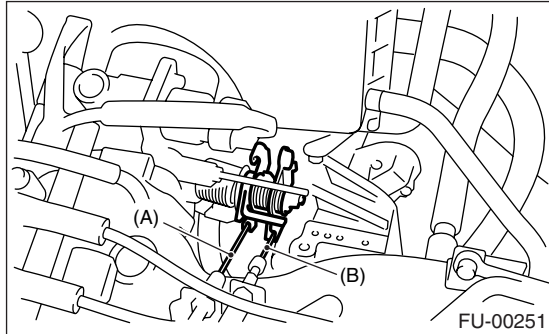
Tightening torque:

33 N·m (3.4 kgf-m, 24.6 ft-lb)



14) Connect the accelerator cable (A).

15) Connect the cruise control cable (B). (vehicles with cruise control)

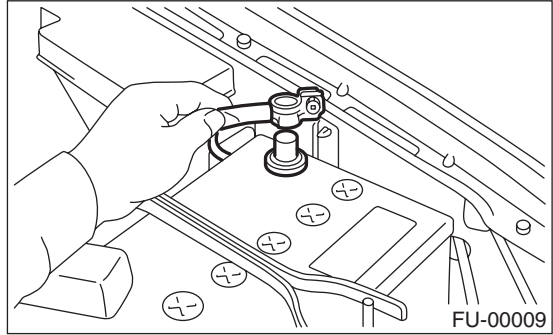


16) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.>, <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>

17) Connect the connector to the fuel pump relay.

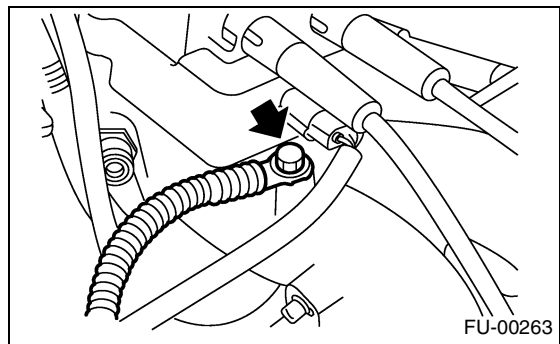


18) Connect the battery ground cable to battery.

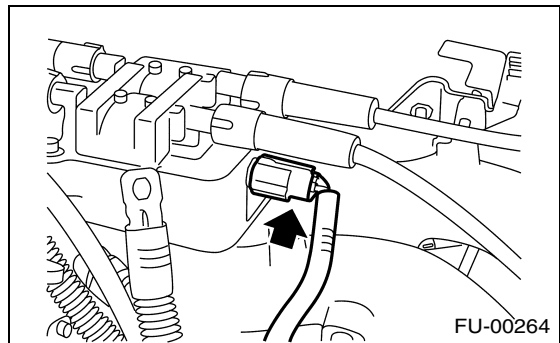


C: DISASSEMBLY

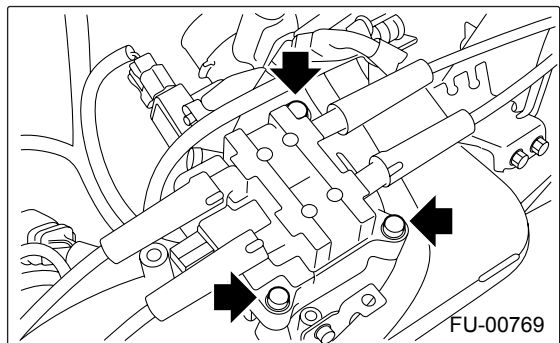
1) Disconnect the engine ground terminal from the intake manifold.



2) Disconnect the connector from the ignition coil and ignitor assembly.



3) Remove the ignition coil and ignitor assembly.

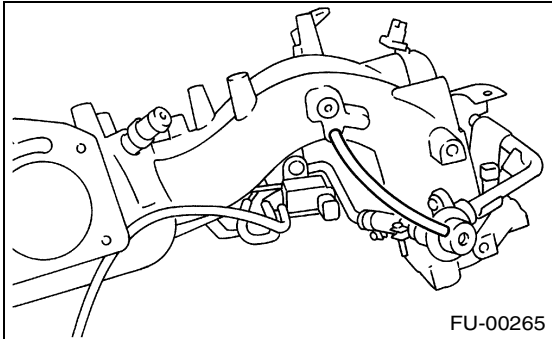


4) Remove the throttle body. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.>

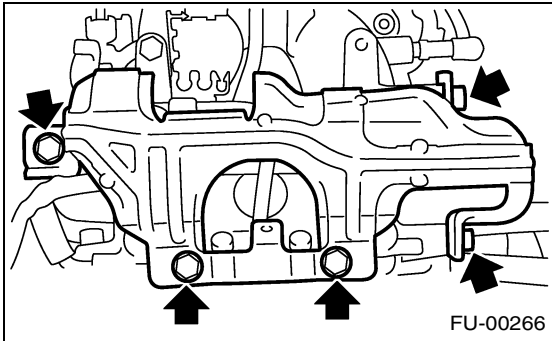
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

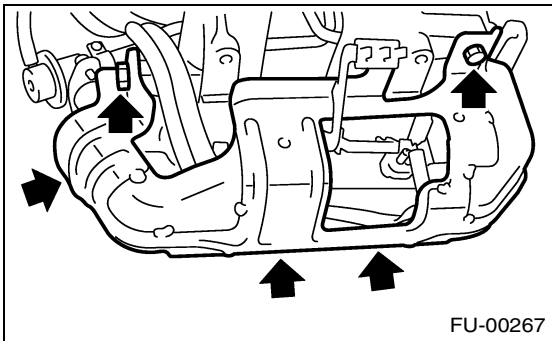
- 5) Remove the air assist injector solenoid valve from the intake manifold. <Ref. to FU(H4SO)-37, REMOVAL, Air Assist Injector Solenoid Valve.>
- 6) Disconnect the pressure regulator vacuum hose from the intake manifold.



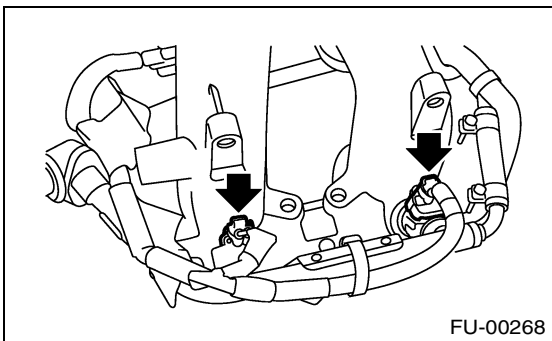
- 7) Remove the fuel pipe protector LH.



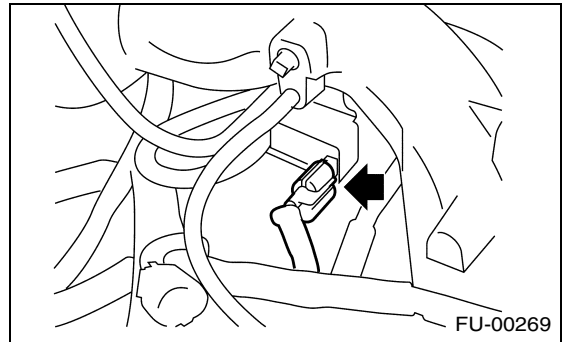
- 8) Remove the fuel pipe protector RH.



- 9) Disconnect the connectors from the fuel injectors.

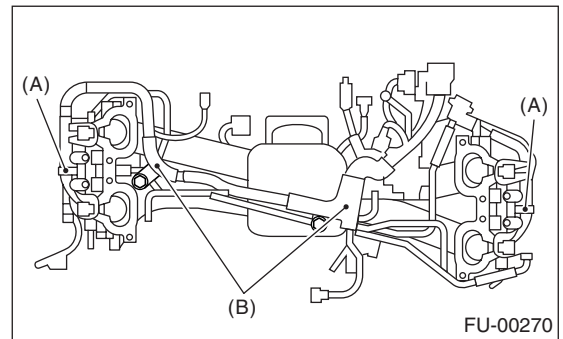


- 10) Disconnect the connector from the purge control solenoid valve.



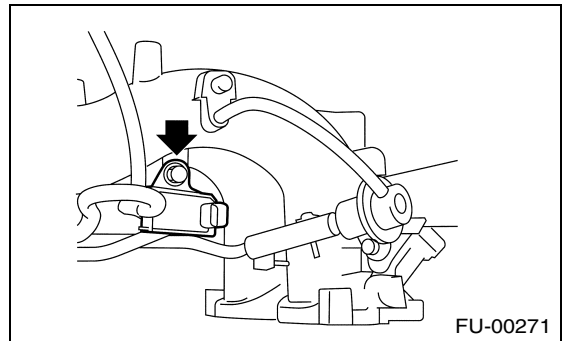
- 11) Disconnect the air by-pass hose from the purge control solenoid valve.

- 12) Remove the harness bands (A) and harness bracket (B) which hold engine harness onto the intake manifold.



- 13) Remove the engine harness from the intake manifold.

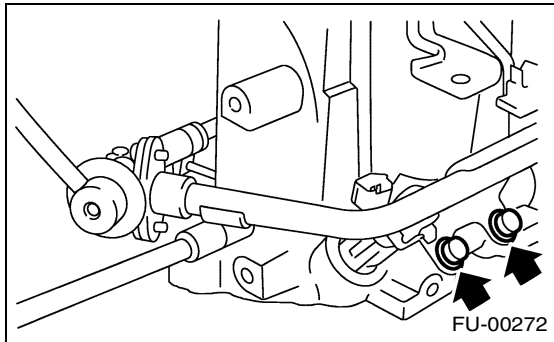
- 14) Remove the purge control solenoid valve.



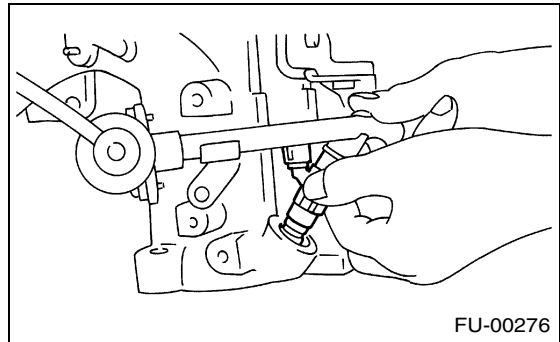
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

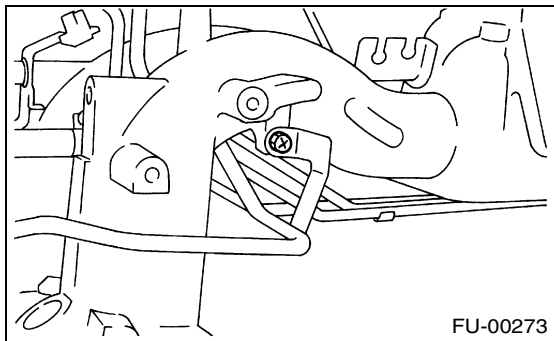
15) Remove the bolt which installs injector pipe on the intake manifold as shown in figure.



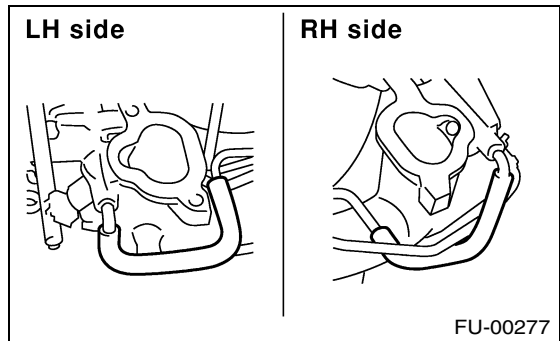
(2) Remove the fuel injector while lifting up the fuel injector pipe.



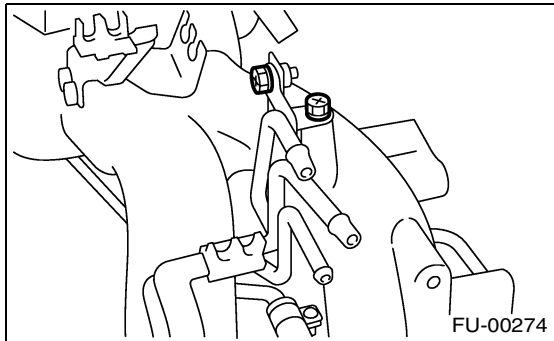
16) Remove the bolt which installs injector pipe on the intake manifold.



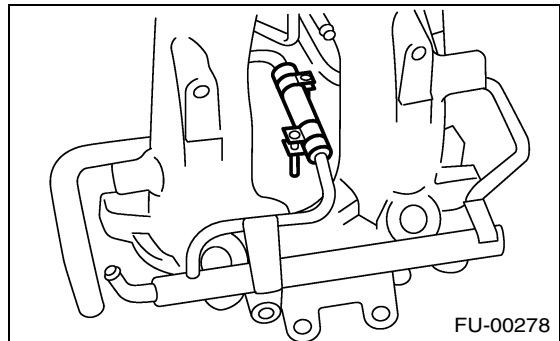
19) Disconnect the air by-pass hoses from the intake manifold.



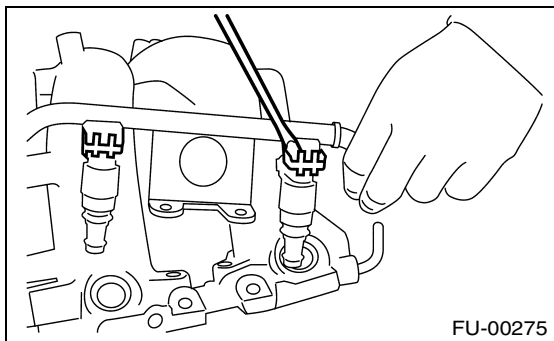
17) Remove the two bolts which hold fuel pipes on the left side of intake manifold.



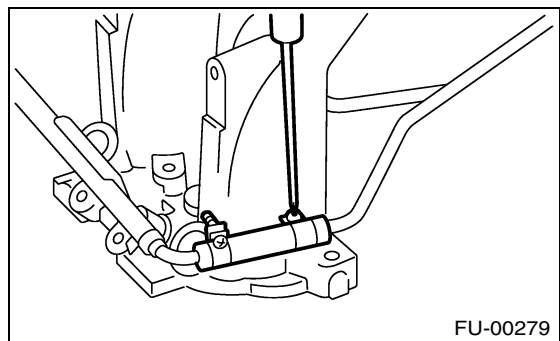
20) Loosen the clamp which holds the front left side fuel hose to the injector pipe and remove the pipe.



18) Remove the fuel injector.
(1) Remove the fuel injector securing clip.



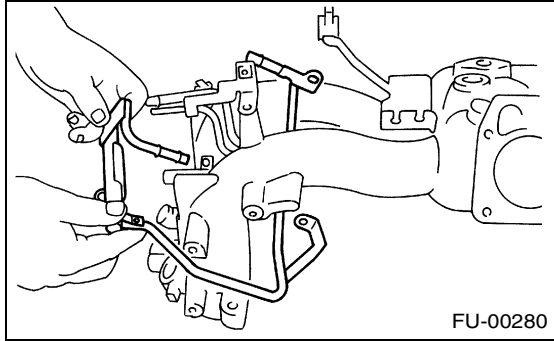
21) Loosen the clamp which holds the front right side fuel hose to the injector pipe and remove the pipe from fuel hose.



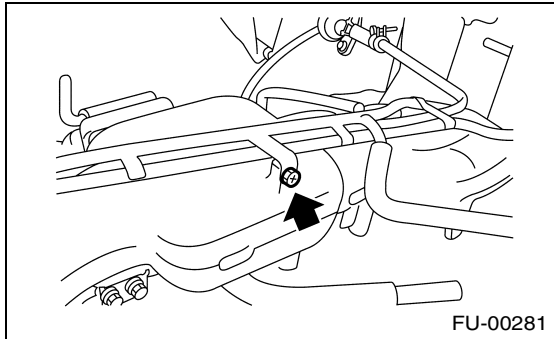
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

22) Remove the fuel injector pipe.



23) Remove the bolt which installs the fuel pipes on the intake manifold.



24) Remove the fuel pipe assembly and pressure regulator, from the intake manifold.

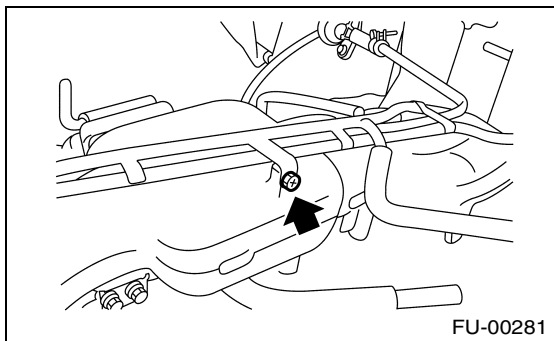
D: ASSEMBLY

1) Install the fuel pipe assembly and pressure regulator, etc. to the intake manifold.

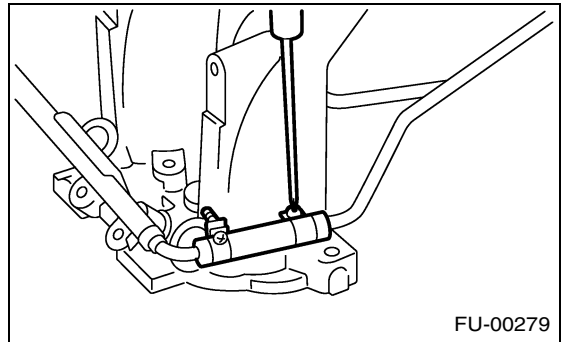
2) Tighten the bolt which installs the fuel pipes on the intake manifold.

Tightening torque:

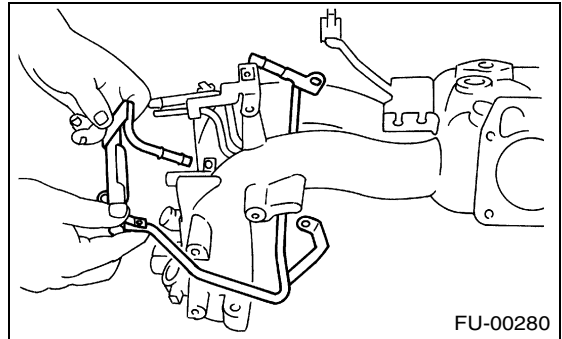
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



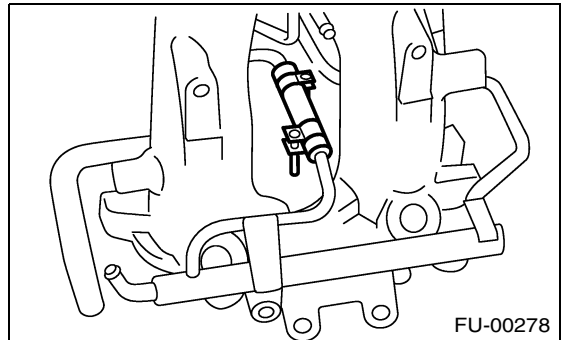
3) Connect the right side fuel hose to the injector pipe, and tighten the clamp screw.



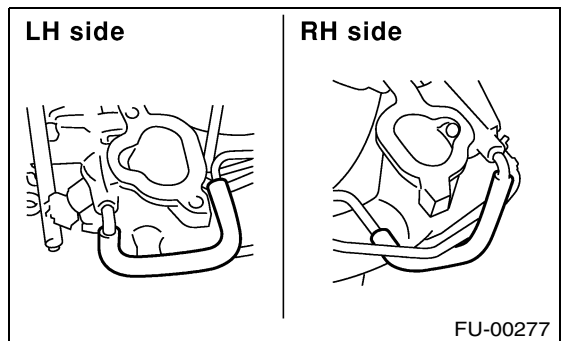
4) Install the fuel injector pipe.



5) Connect the left side fuel hose to the injector pipe, and tighten the clamp screw.



6) Connect the air assist hoses.



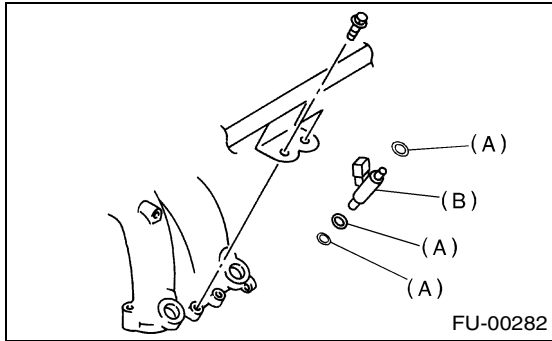
INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

7) Install the fuel injectors.

NOTE:

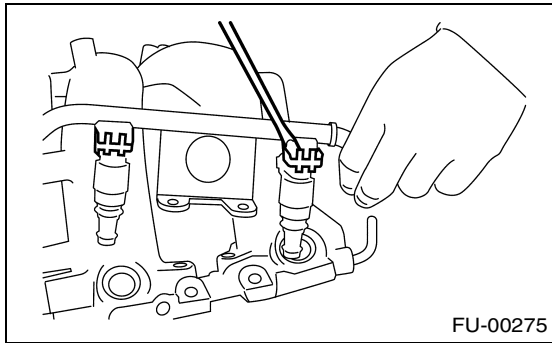
Replace the O-rings with new ones.



- (A) O-ring
- (B) Fuel injector

NOTE:

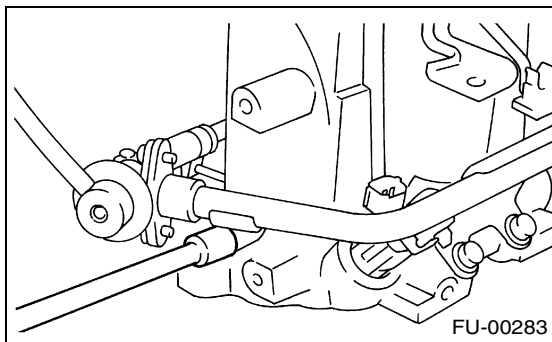
Do not forget to install the fuel injector securing clip.



8) Tighten the bolt which installs the injector pipe on the intake manifold.

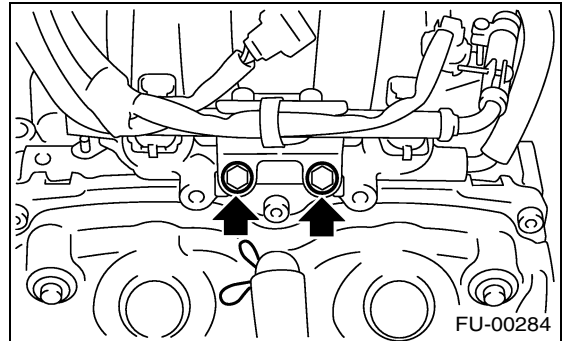
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:

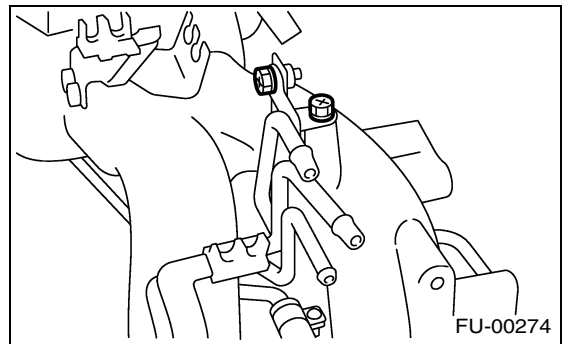
19 N·m (1.9 kgf-m, 13.7 ft-lb)



9) Tighten the two bolts which install the fuel pipes on the left side of intake manifold.

Tightening torque:

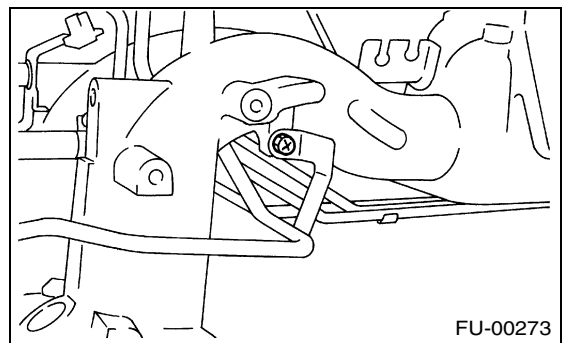
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



10) Tighten the bolt which installs the injector pipe on the intake manifold.

Tightening torque:

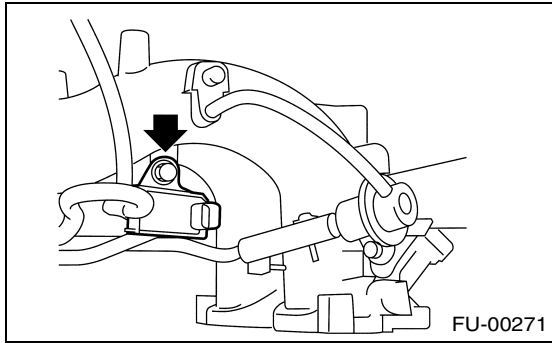
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



11) Install the purge control solenoid valve.

Tightening torque:

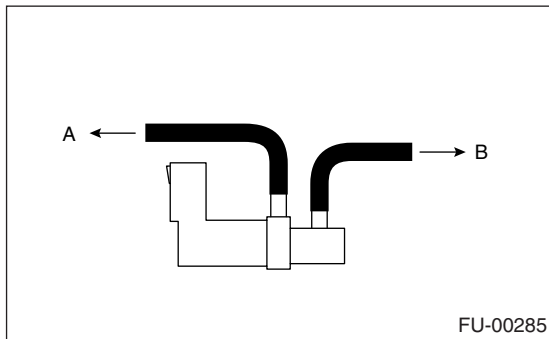
19 N·m (1.9 kgf-m, 13.7 ft-lb)



12) Connect the hoses to the purge control solenoid valve.

CAUTION:

Connect the evaporation hose as shown in the figure.



(A) To fuel pipe

(B) To intake manifold

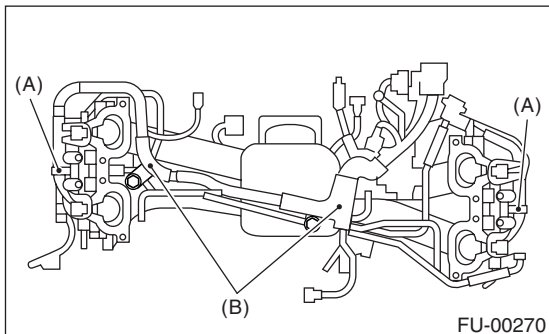
13) Install the engine harness onto the intake manifold.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)

14) Connect the connectors to the fuel injectors and purge control solenoid valve.

15) Hold the engine harness by harness band (A) and harness bracket (B).



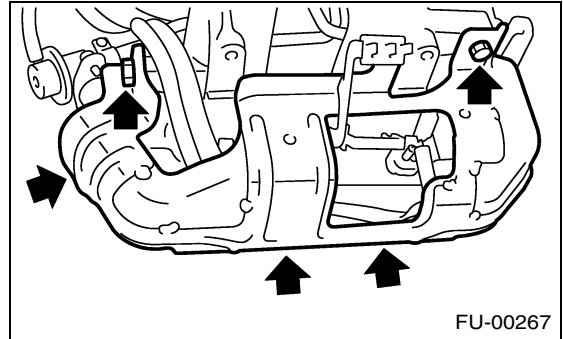
NOTE:

Do not use harness band on harnesses where they are supposed to be protected by the fuel pipe protector.

16) Install the fuel pipe protector RH.

Tightening torque:

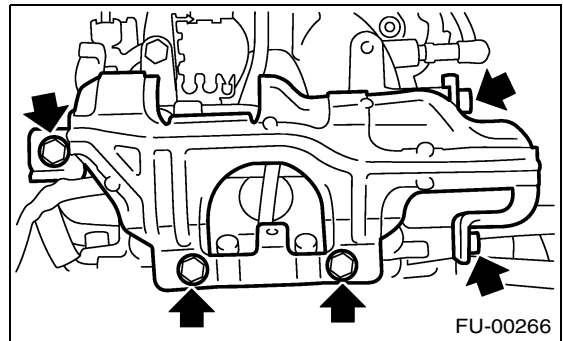
19 N·m (1.9 kgf-m, 13.7 ft-lb)



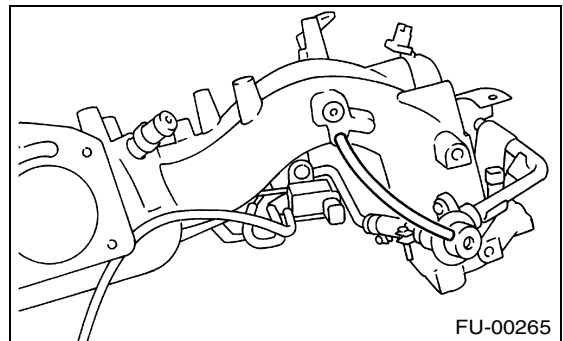
17) Install the fuel pipe protector LH.

Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



18) Connect the pressure regulator vacuum hose to the intake manifold.



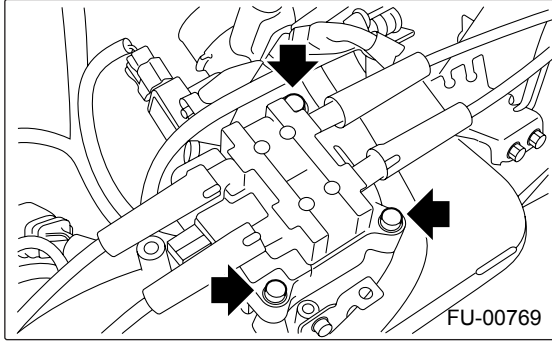
19) Install the air assist injector solenoid valve to the bracket. <Ref. to FU(H4SO)-37, INSTALLATION, Air Assist Injector Solenoid Valve.>

20) Install the throttle body to the intake manifold. <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>

INTAKE MANIFOLD

FUEL INJECTION (FUEL SYSTEMS)

21) Install the ignition coil and ignitor assembly.

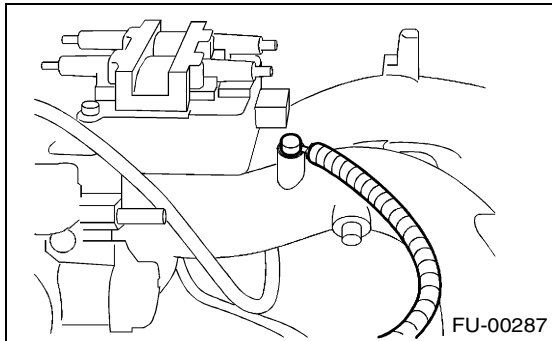


22) Connect the connector to the ignition coil and ignitor assembly.

23) Install the engine ground terminal to the intake manifold.

Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



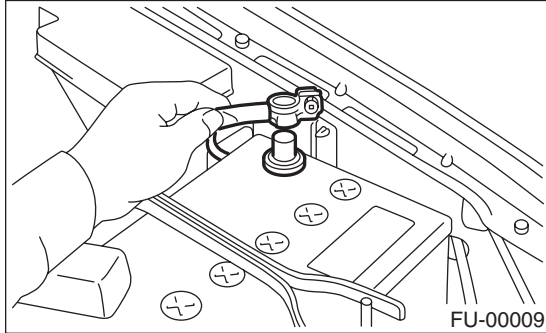
E: INSPECTION

Make sure the fuel pipe and fuel hoses are not cracked and that connections are tight.

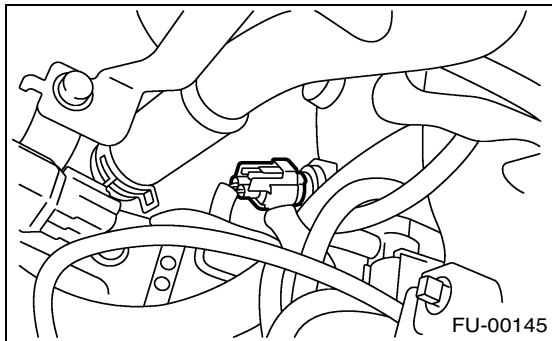
4. Engine Coolant Temperature Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the air intake duct and air cleaner assembly. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> , <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 3) Disconnect the connector from engine coolant temperature sensor.



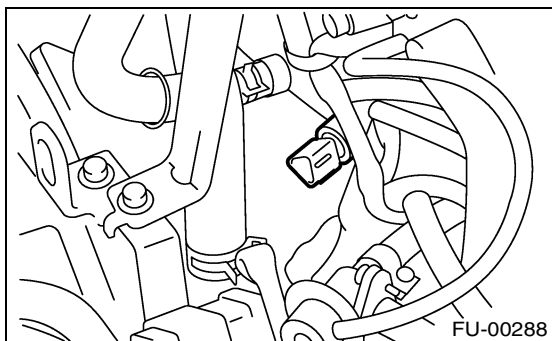
- 4) Remove the engine coolant temperature sensor.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



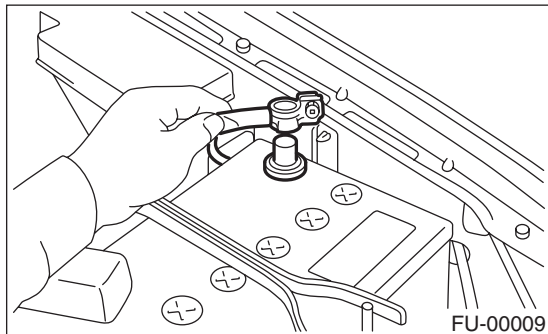
CRANKSHAFT POSITION SENSOR

FUEL INJECTION (FUEL SYSTEMS)

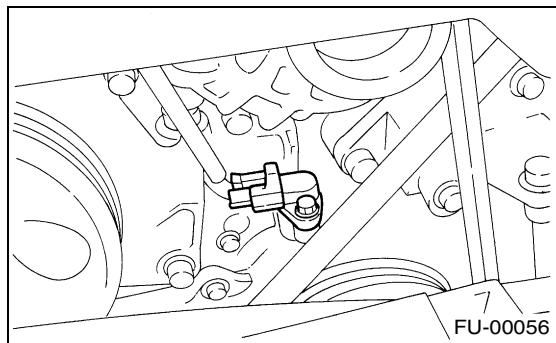
5. Crankshaft Position Sensor

A: REMOVAL

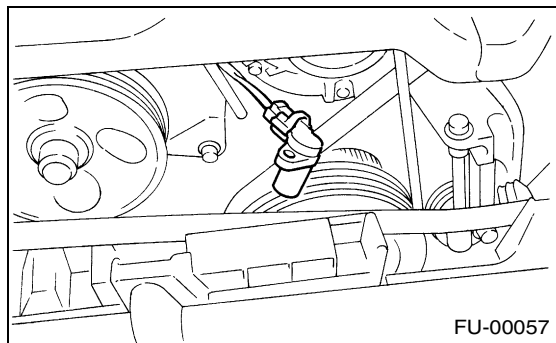
1) Disconnect the ground cable from battery.



2) Remove the bolt which install crankshaft position sensor to the cylinder block.



3) Remove the crankshaft position sensor, and disconnect the connector from the sensor.

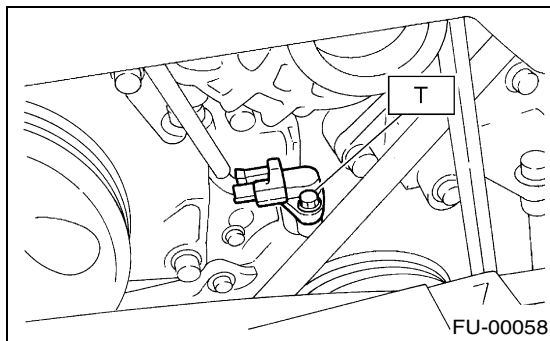


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



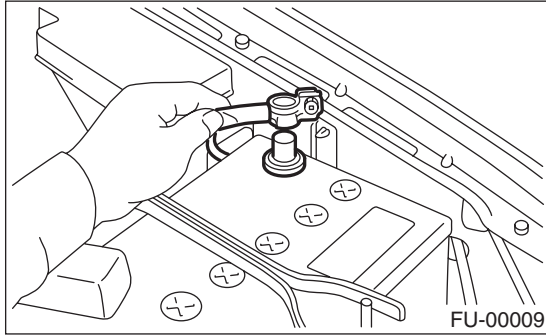
CAMSHAFT POSITION SENSOR

FUEL INJECTION (FUEL SYSTEMS)

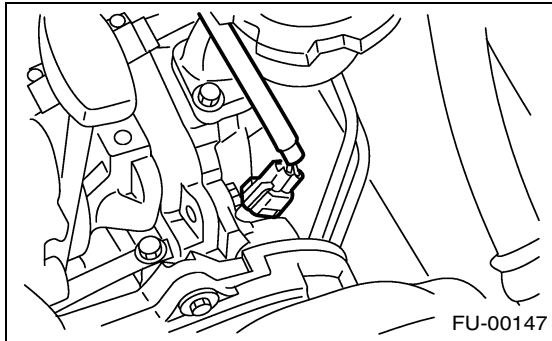
6. Camshaft Position Sensor

A: REMOVAL

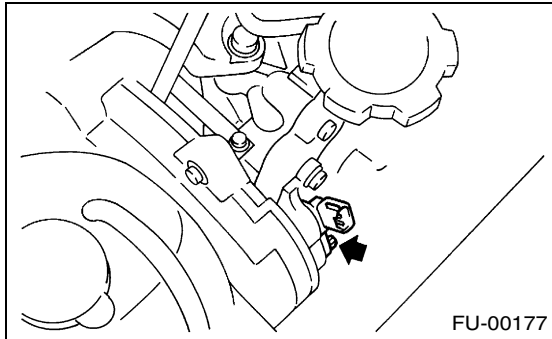
1) Disconnect the ground cable from battery.



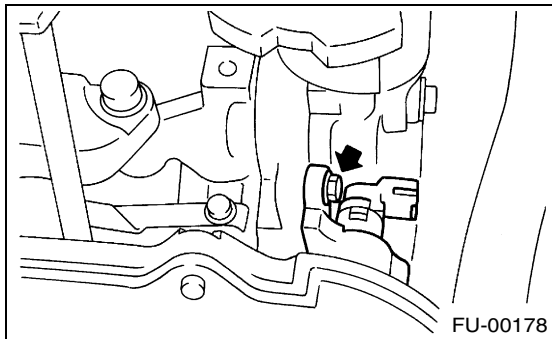
2) Disconnect the connector from the camshaft position sensor.



3) Remove the bolt which installs camshaft position sensor to the camshaft position sensor support.

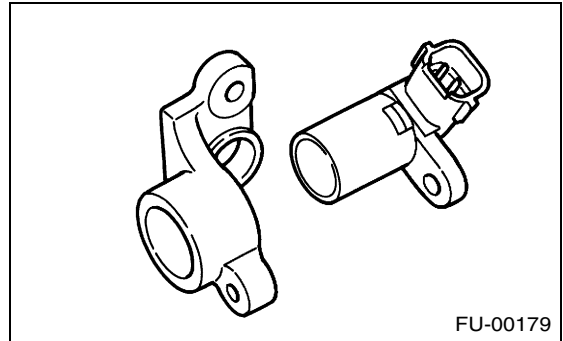


4) Remove the bolt which installs camshaft position sensor support to the camshaft cap LH.



5) Remove the camshaft position sensor and camshaft position sensor support as a unit.

6) Remove the camshaft position sensor itself.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

- **Camshaft position sensor support**
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)
- **Camshaft position sensor**
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

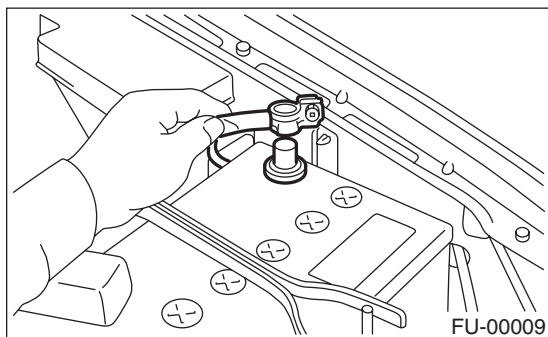
KNOCK SENSOR

FUEL INJECTION (FUEL SYSTEMS)

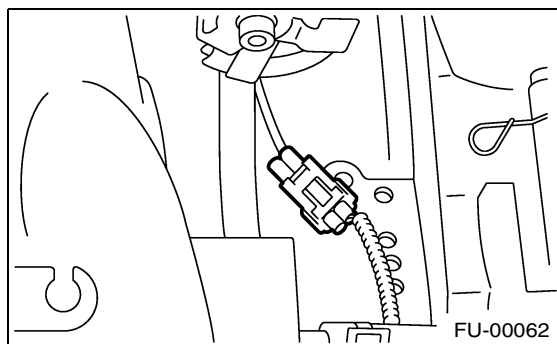
7. Knock Sensor

A: REMOVAL

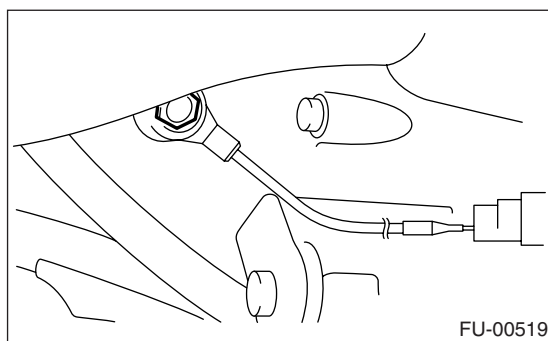
- 1) Disconnect the ground cable from battery.



- 2) Remove the air cleaner case. <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 3) Disconnect the knock sensor connector.



- 4) Remove the knock sensor from the cylinder block.



B: INSTALLATION

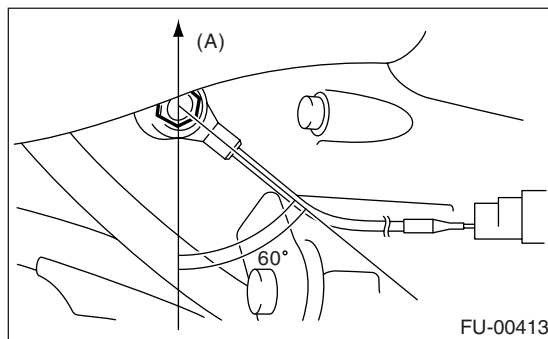
- 1) Install the knock sensor to the cylinder block.

Tightening torque:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

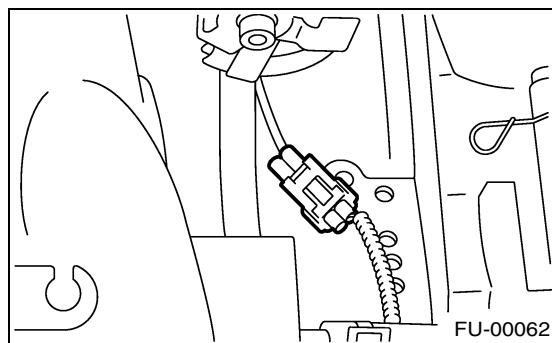
NOTE:

The extraction area of the knock sensor cord must be positioned at a 60° angle relative to the engine rear.

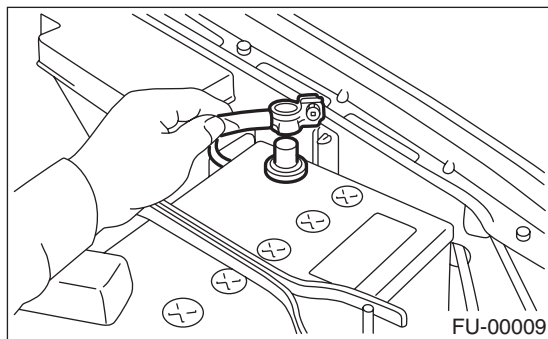


(A) Front

- 2) Connect the knock sensor connector.



- 3) Install the air cleaner case.
<Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 4) Connect the battery ground cable to battery.



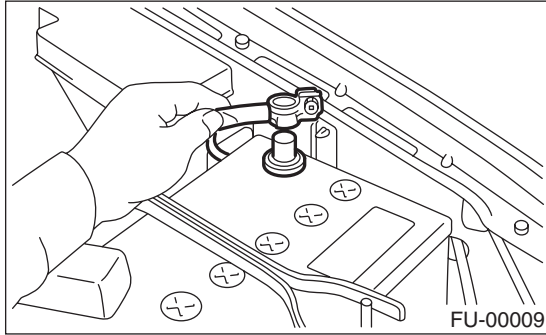
THROTTLE POSITION SENSOR

FUEL INJECTION (FUEL SYSTEMS)

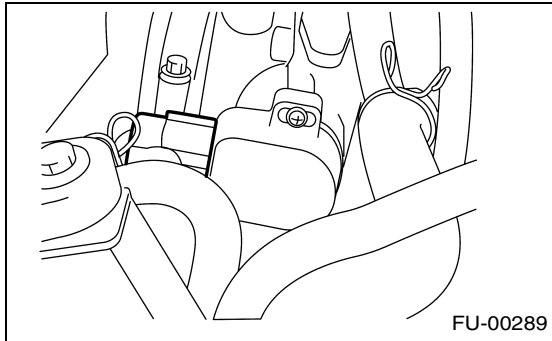
8. Throttle Position Sensor

A: REMOVAL

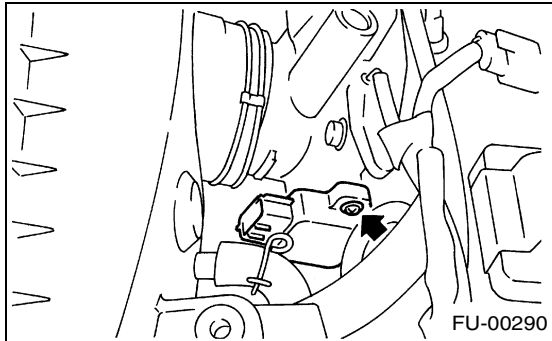
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connectors from throttle position sensor.



- 3) Remove the throttle position sensor holding screws, and remove it.



B: INSTALLATION

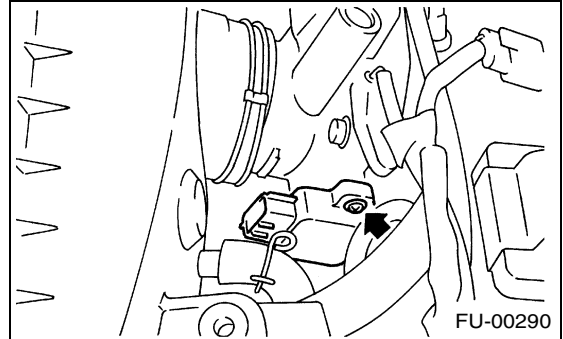
Install in the reverse order of removal.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)

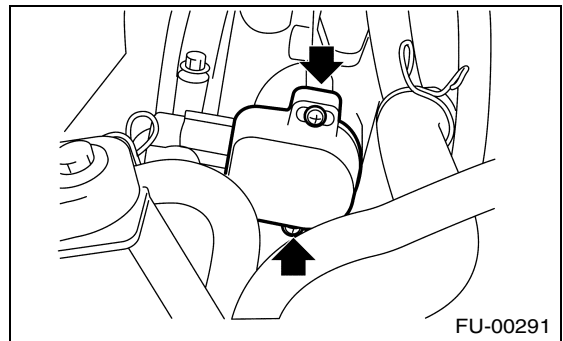
CAUTION:

When installing throttle position sensor, adjust to the specified data.



C: ADJUSTMENT

- 1) Turn the ignition switch to OFF.
- 2) Loosen the throttle position sensor holding screws.

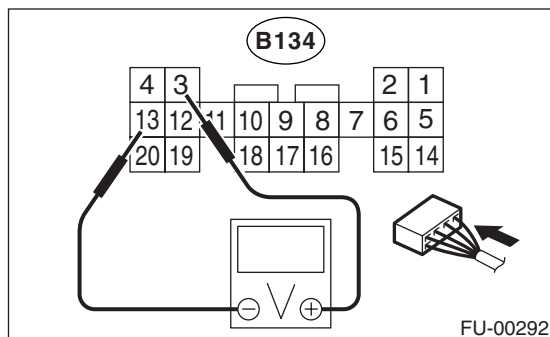


- 3) When using a voltmeter;
 - (1) Take out the ECM.
 - (2) Turn the ignition switch to ON.
 - (3) Adjust the throttle position sensor to the proper position to allow the voltage signal to the ECM to be in specification.

THROTTLE POSITION SENSOR

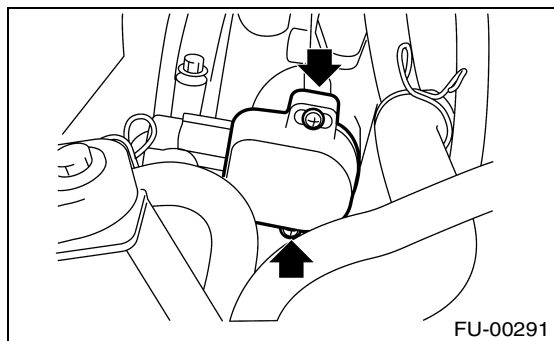
FUEL INJECTION (FUEL SYSTEMS)

Connector & terminal / Specified voltage
(B134) No. 3 (+) — (B134) No. 13 (–) /0.45 —
0.55 V
[Fully closed.]

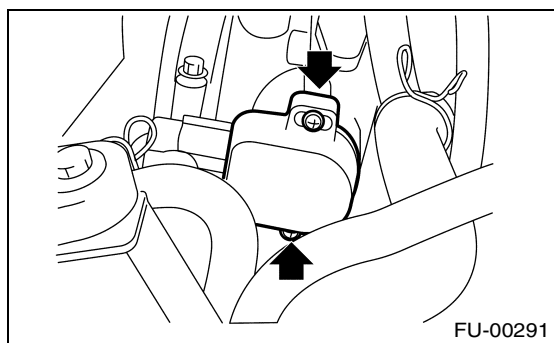


(4) Tighten the throttle position sensor holding screws.

Tightening torque:
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



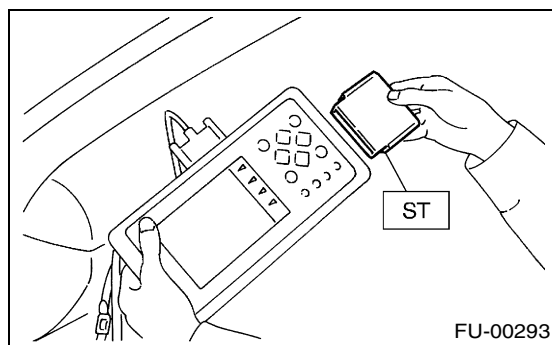
- 4) When using Subaru Select Monitor;
- (1) Turn the ignition switch to OFF.
 - (2) Loosen the throttle position sensor holding screws.



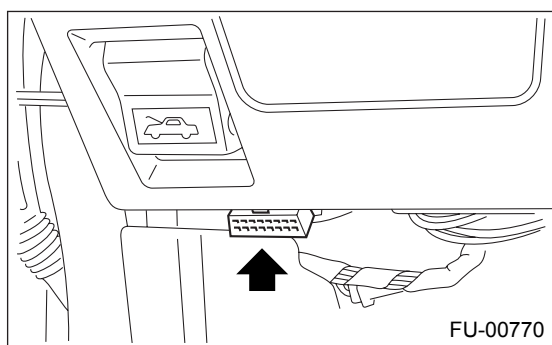
NOTE:

For detailed operation procedures, refer to the Subaru Select Monitor Operation Manual.

(3) Insert the cartridge to the Subaru Select Monitor.



(4) Connect the Subaru Select Monitor to the data link connector.



(5) Turn the ignition switch to ON, and the Subaru Select Monitor switch to ON.

(6) Select {2. Each System Check} in Main Menu.

(7) Select {Engine Control System} in Selection Menu.

(8) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.

(9) Select {1.12 Data Display} in Data Display Menu.

(10) Adjust the throttle position sensor to the proper position to match with the following specifications.

Condition: Throttle fully closed
Throttle opening angle 0.00%
Throttle sensor voltage 0.50 V

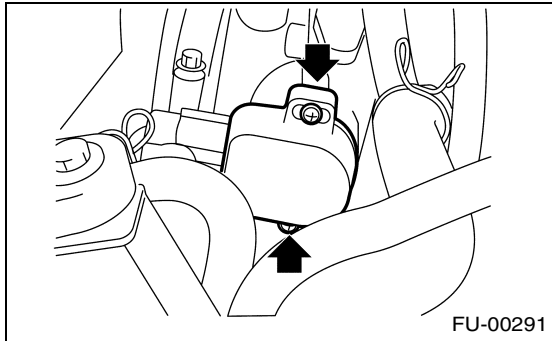
THROTTLE POSITION SENSOR

FUEL INJECTION (FUEL SYSTEMS)

(11) Tighten the throttle position sensor holding screws.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



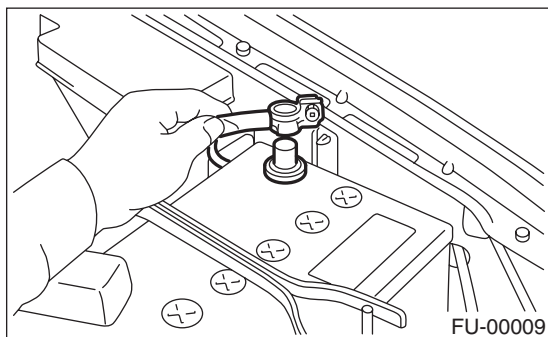
PRESSURE SENSOR

FUEL INJECTION (FUEL SYSTEMS)

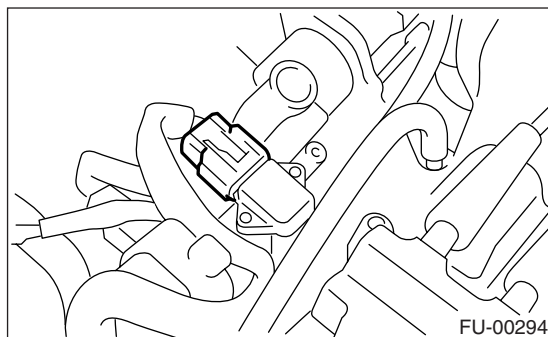
9. Pressure Sensor

A: REMOVAL

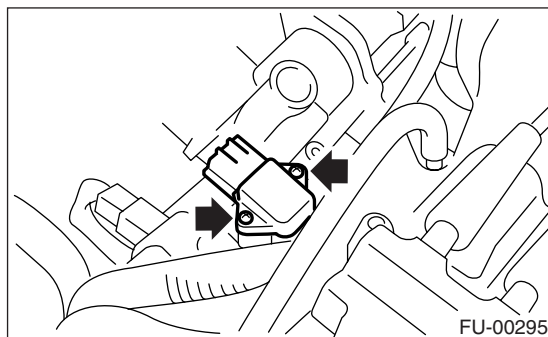
1) Disconnect the ground cable from battery.



2) Disconnect the connector from the pressure sensor.



3) Remove the pressure sensor.

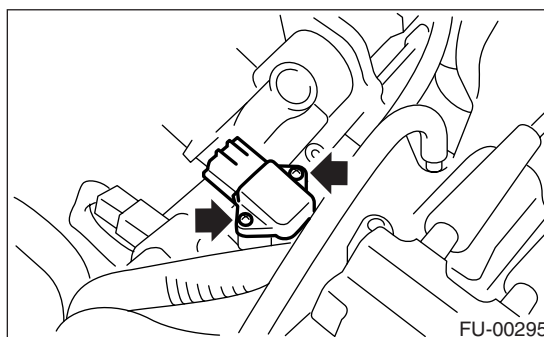


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



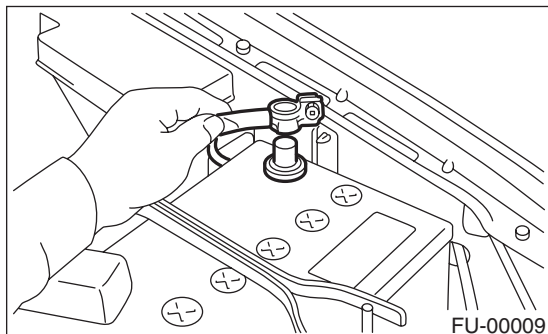
NOTE:

Replace the O-rings with new ones.

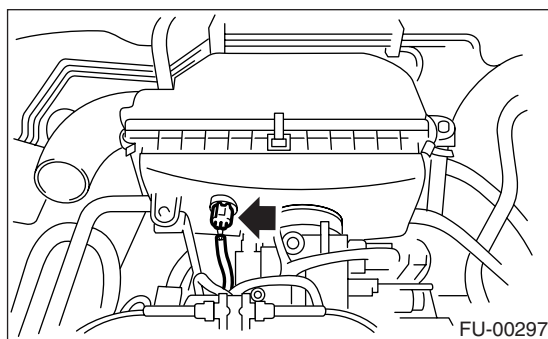
10. Intake Air Temperature Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from intake air temperature sensor.
- 3) Remove the intake air temperature sensor from air cleaner case.



B: INSTALLATION

Install in the reverse order of removal.

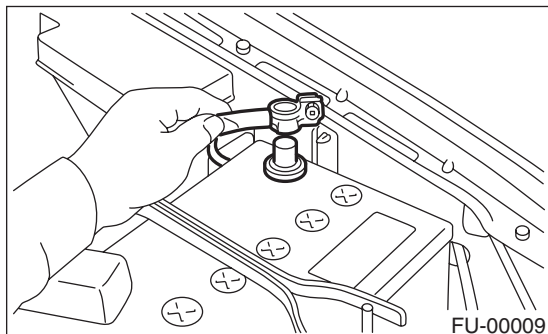
IDLE AIR CONTROL SOLENOID VALVE

FUEL INJECTION (FUEL SYSTEMS)

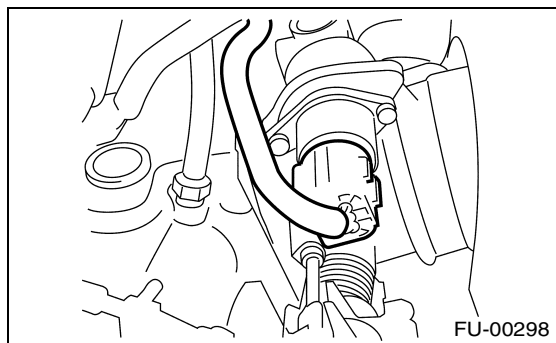
11. Idle Air Control Solenoid Valve

A: REMOVAL

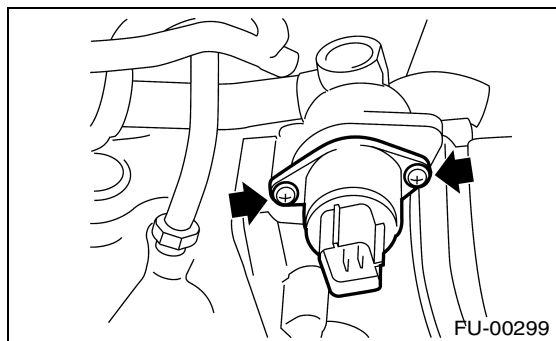
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from idle air control solenoid valve.



- 3) Remove the idle air control solenoid valve from throttle body.



B: INSTALLATION

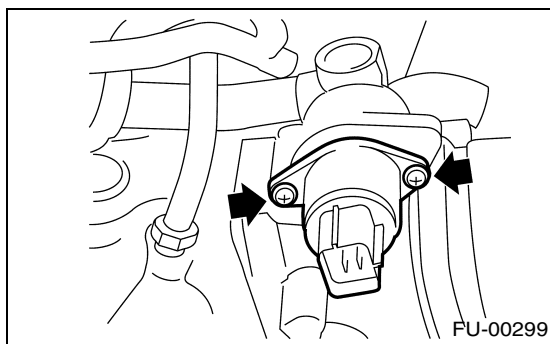
Install in the reverse order of removal.

NOTE:

Replace the gaskets with new ones.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



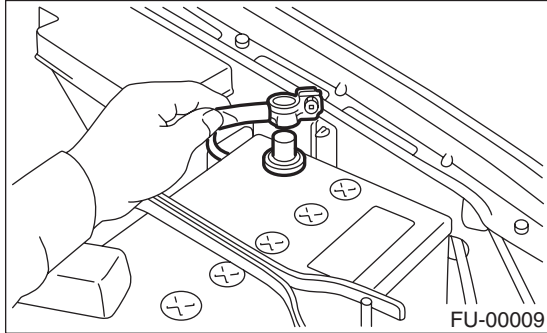
AIR ASSIST INJECTOR SOLENOID VALVE

FUEL INJECTION (FUEL SYSTEMS)

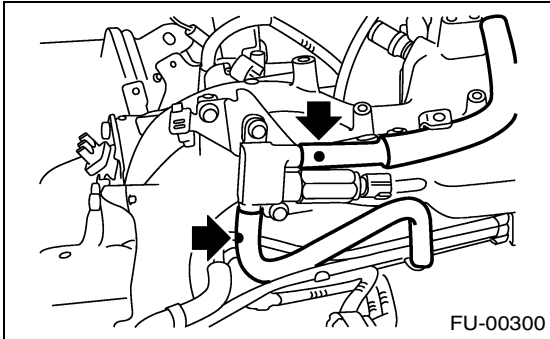
12. Air Assist Injector Solenoid Valve

A: REMOVAL

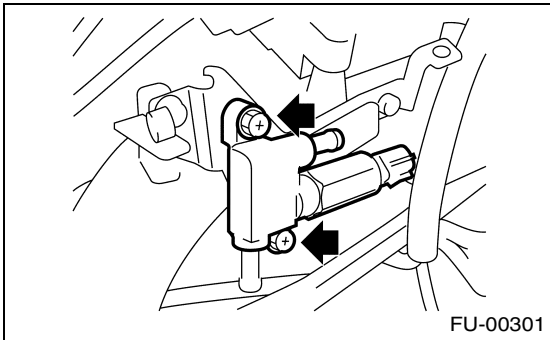
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from the air assist injector solenoid valve and disconnect the air bypass hoses.



- 3) Remove the air assist injector solenoid valve from the intake manifold.

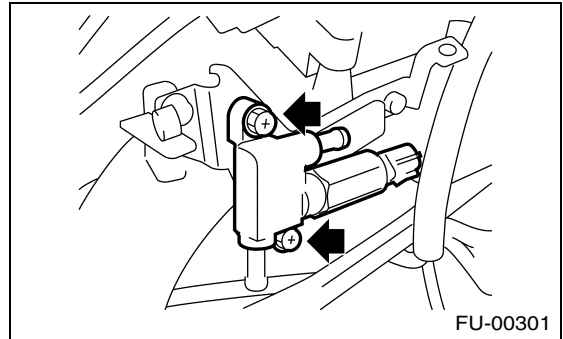


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

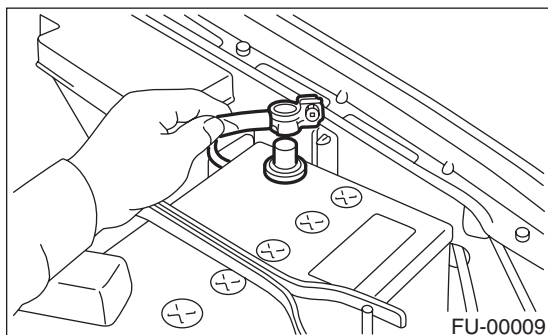


13. Fuel Injector

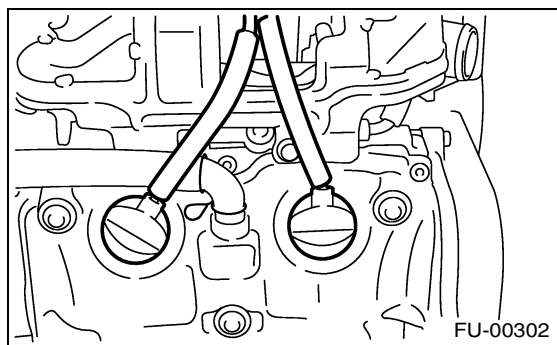
A: REMOVAL

1. RH SIDE

- 1) Release fuel pressure.
<Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.

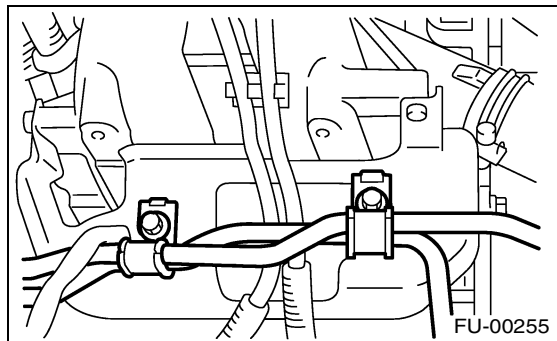


- 4) Remove the resonator chamber. <Ref. to IN(H4SO)-8, REMOVAL, Resonator Chamber.>
- 5) Remove the spark plug cords from the spark plugs (#1 and #3 cylinders).

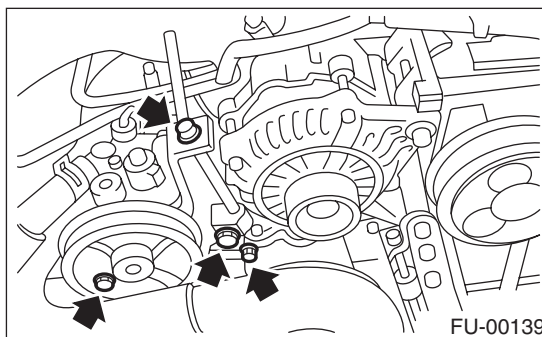


- 6) Remove the power steering pump and tank from the brackets.

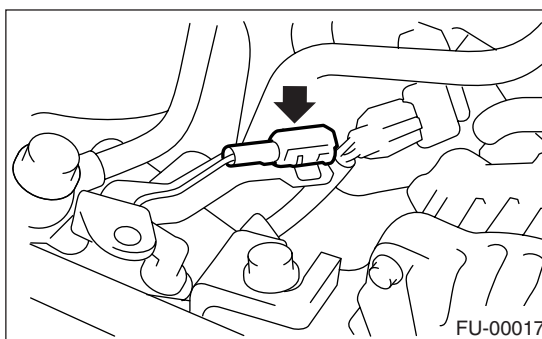
- (1) Remove the front side V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- (2) Remove the bolts which hold the power steering pipes onto the intake manifold protector.



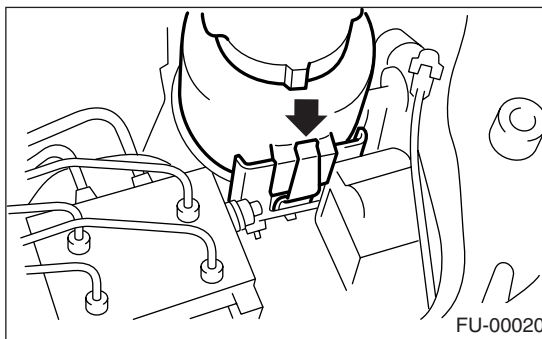
- (3) Remove the bolts which install the power steering pump to the bracket.



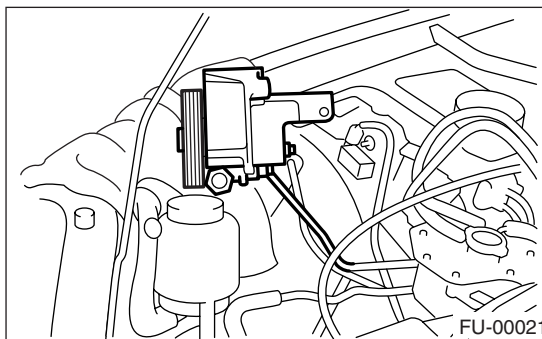
- (4) Disconnect the connector from the power steering pump switch.



- (5) Remove the reservoir tank from the bracket by pulling it upwards.



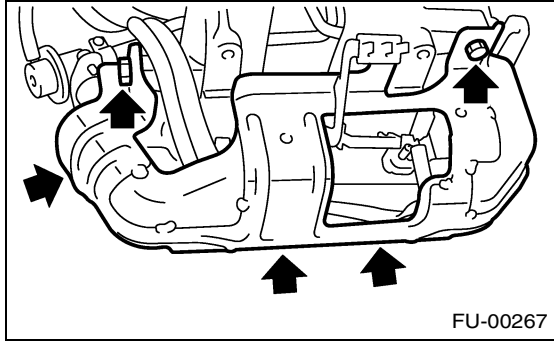
- (6) Place the power steering pump and tank on the right side wheel apron.



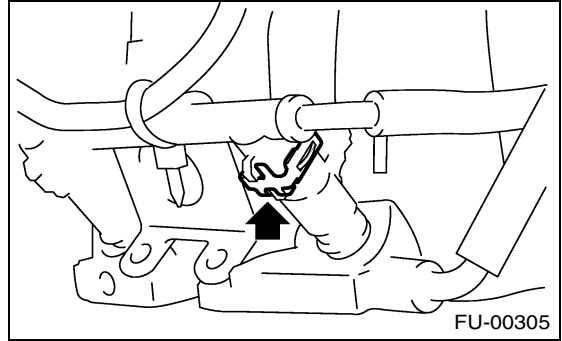
FUEL INJECTOR

FUEL INJECTION (FUEL SYSTEMS)

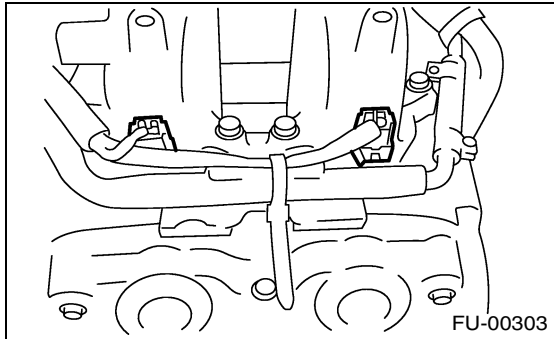
7) Remove the fuel pipe protector RH.



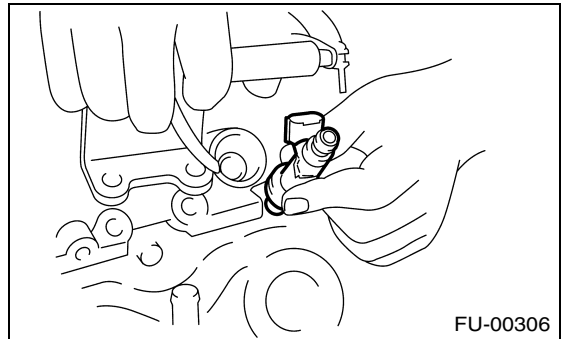
(1) Remove the fuel injector securing clip.



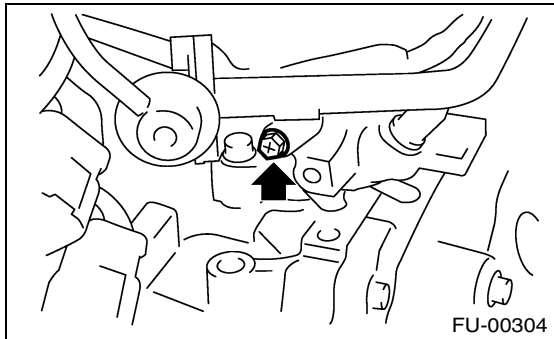
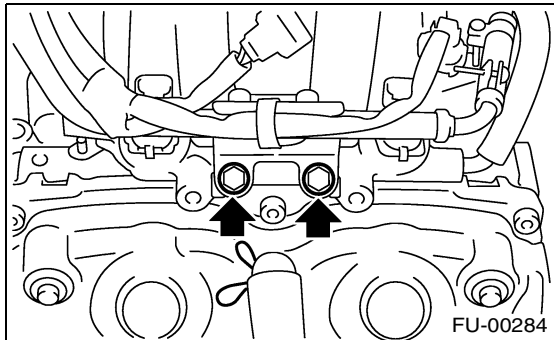
8) Disconnect the connectors from the fuel injectors.



(2) Remove the fuel injector while lifting up the fuel injector pipe.



9) Remove the bolt which holds the injector pipe to the intake manifold.



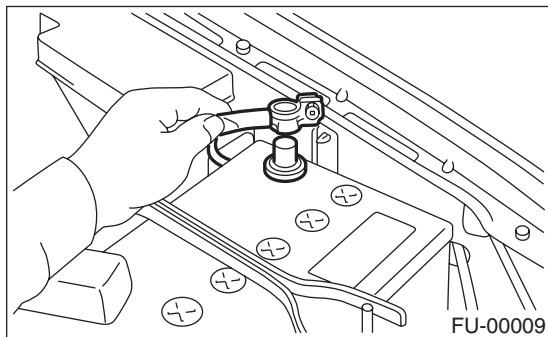
10) Remove the fuel injector from the intake manifold.

FUEL INJECTOR

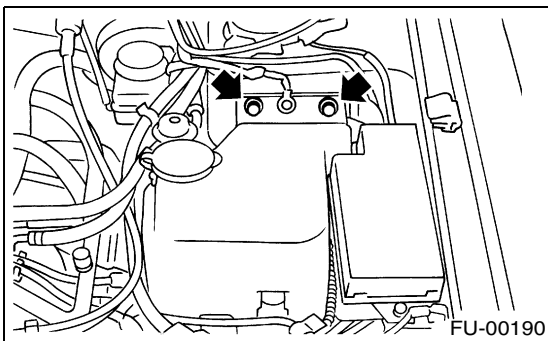
FUEL INJECTION (FUEL SYSTEMS)

2. LH SIDE

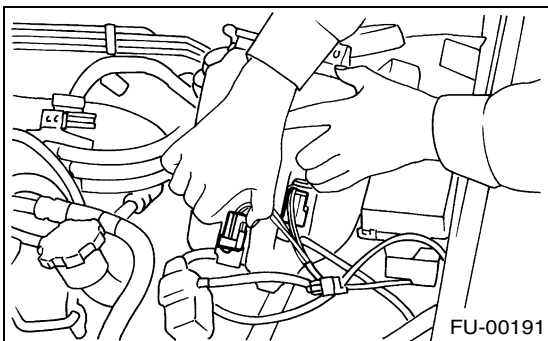
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



- 4) Remove the two bolts which install the washer tank on the body.

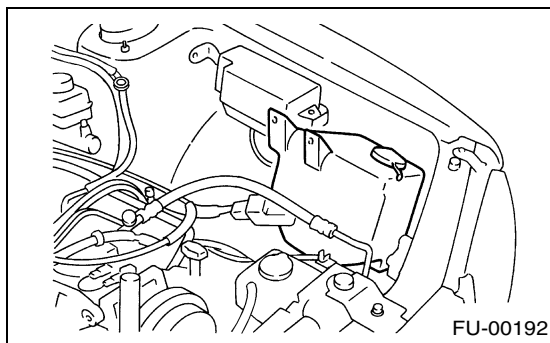


- 5) Disconnect the connector from the front window washer motor.
- 6) Disconnect the connector from the rear gate glass washer motor.

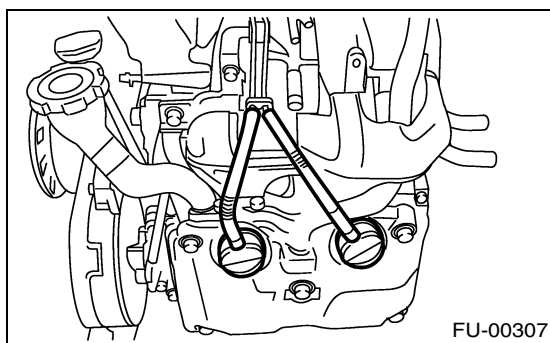


- 7) Disconnect the rear window glass washer hose from the washer motor, then plug the connection with a suitable cap.

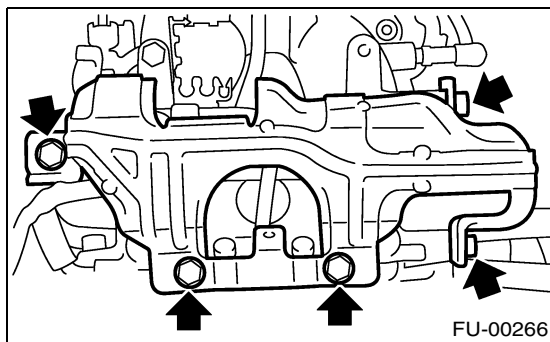
- 8) Move the washer tank, and secure it away from the working area.



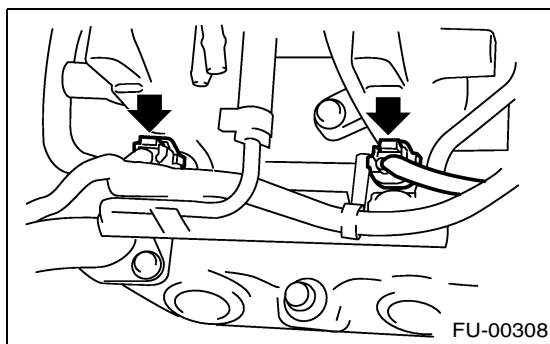
- 9) Remove the spark plug cords from the spark plugs (#2 and #4 cylinders).



- 10) Remove the fuel pipe protector LH.



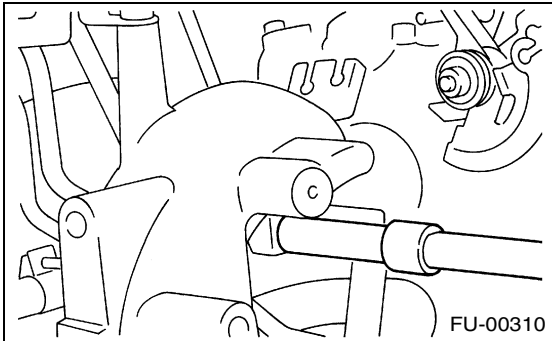
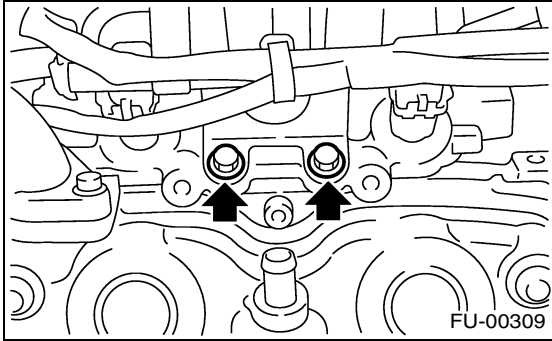
- 11) Disconnect the connectors from the fuel injectors.



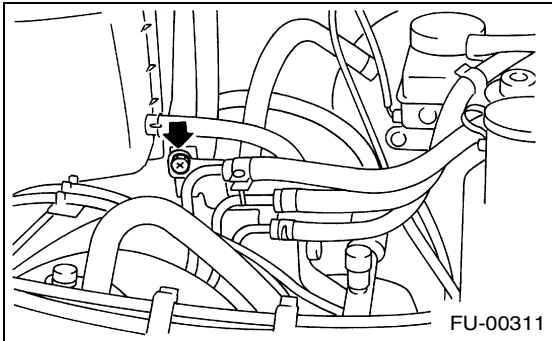
FUEL INJECTOR

FUEL INJECTION (FUEL SYSTEMS)

12) Remove the bolt which holds the injector pipe to the intake manifold.

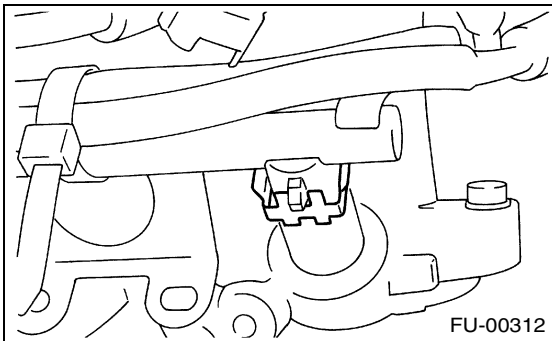


13) Remove the bolt which holds the fuel pipe on the left side intake manifold.

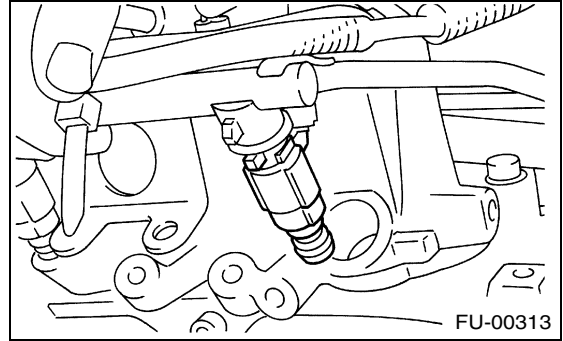


14) Remove the fuel injector from the intake manifold.

(1) Remove the fuel injector securing clip.



(2) Remove the fuel injector while lifting up the fuel injector pipe.



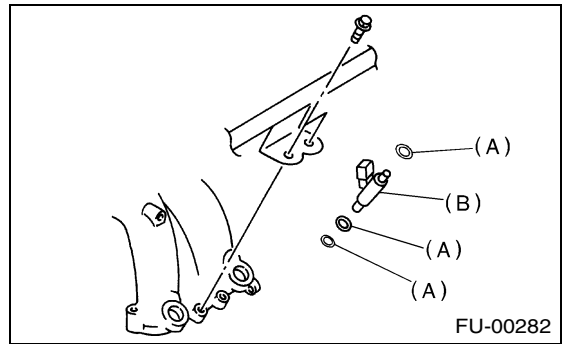
B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

CAUTION:

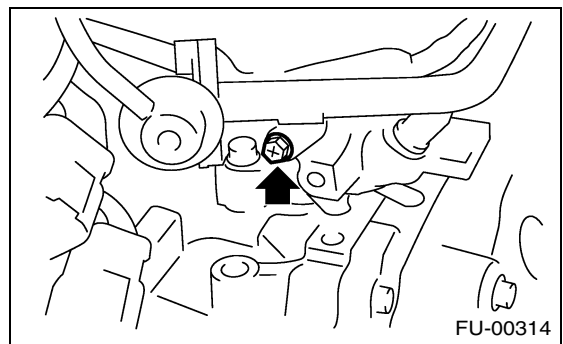
Replace the O-rings with new ones.



- (A) O-ring
- (B) Fuel injector

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

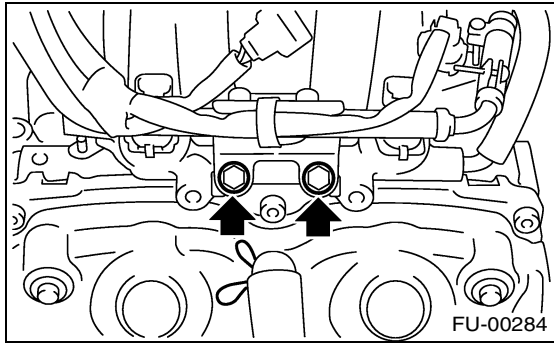


FUEL INJECTOR

FUEL INJECTION (FUEL SYSTEMS)

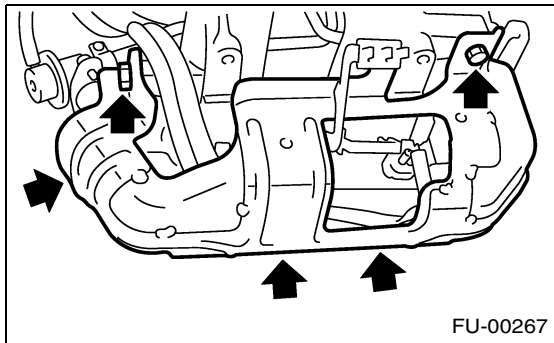
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



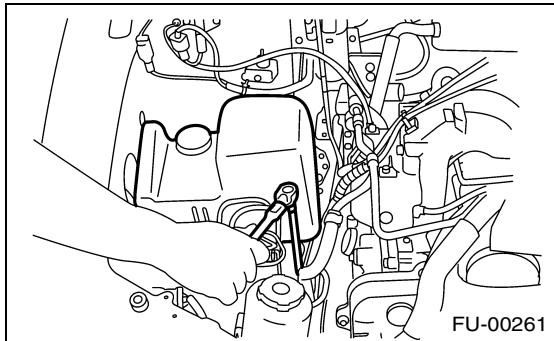
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

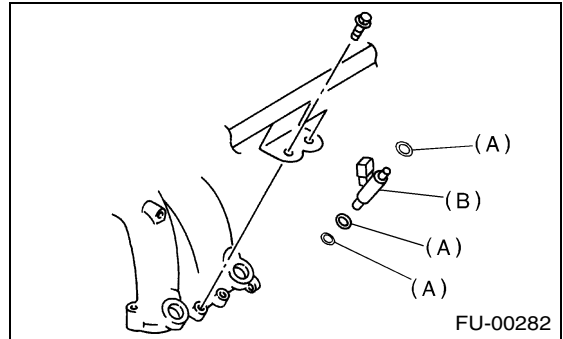


2. LH SIDE

Install in the reverse order of removal.

CAUTION:

Replace the O-rings with new ones.

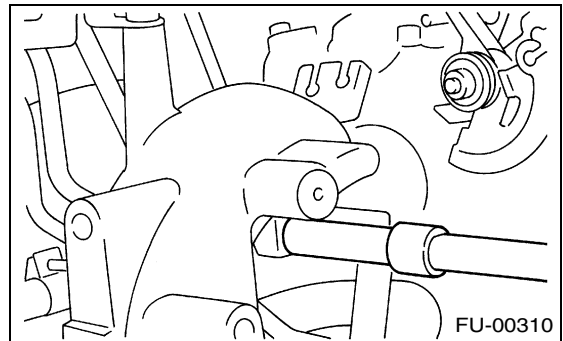


(A) O-ring

(B) Fuel injector

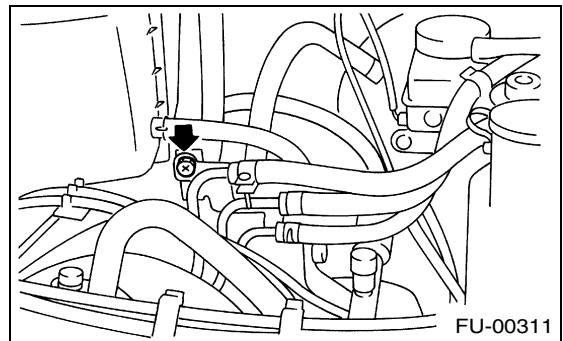
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

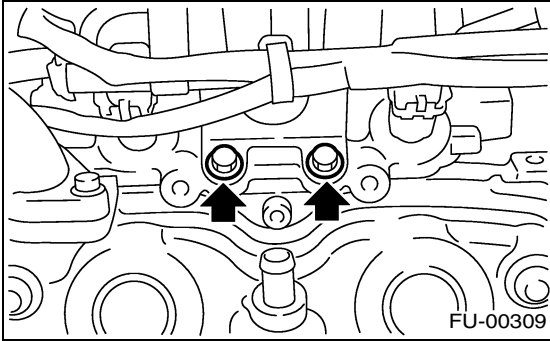


Tightening torque:

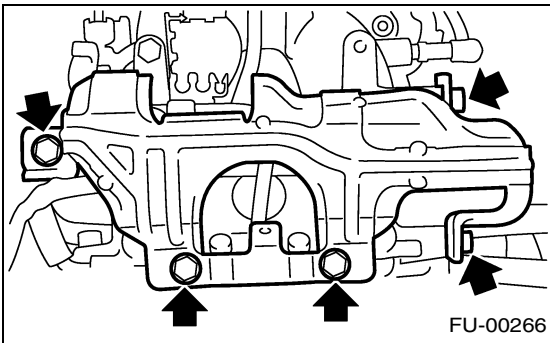
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



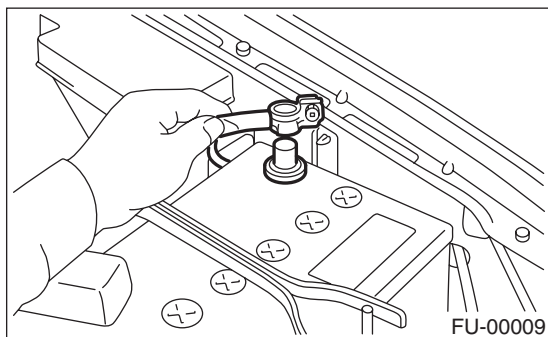
FRONT OXYGEN (A/F) SENSOR

FUEL INJECTION (FUEL SYSTEMS)

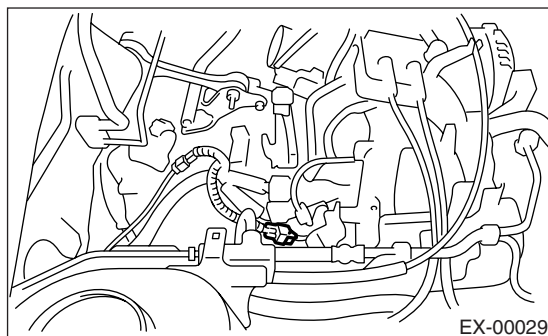
14. Front Oxygen (A/F) Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from engine hanger, and then disconnect the front oxygen (A/F) sensor connector.



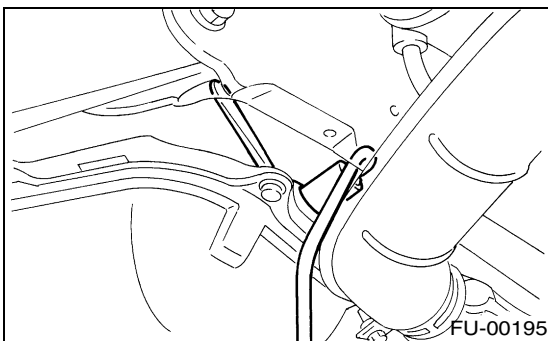
- 3) Lift up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove the front oxygen (A/F) sensor.

CAUTION:

When removing the oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage exhaust pipe.



B: INSTALLATION

- 1) Before installing front oxygen (A/F) sensor, apply the anti-seize compound only to the threaded

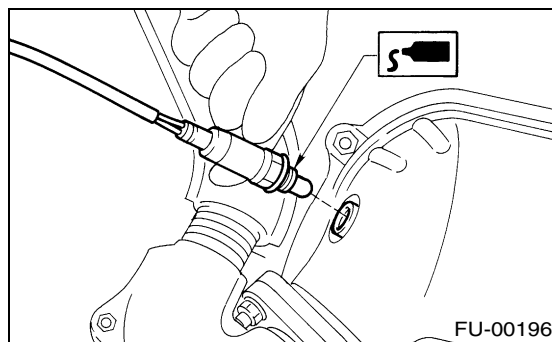
portion of front oxygen (A/F) sensor to make the next removal easier.

Anti-seize compound:

SS-30 by JET LUBE

CAUTION:

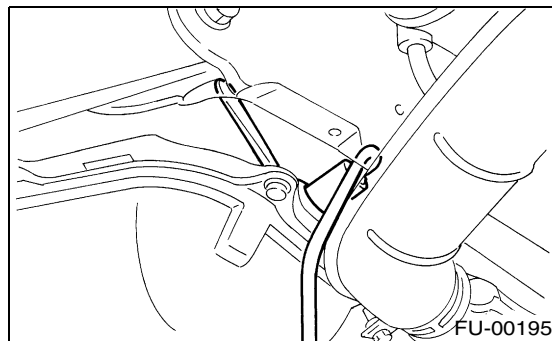
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.



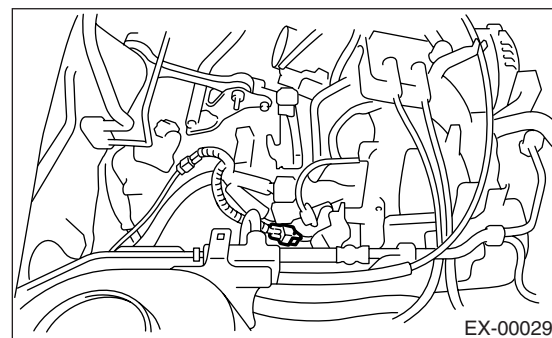
- 2) Install the front oxygen (A/F) sensor.

Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)



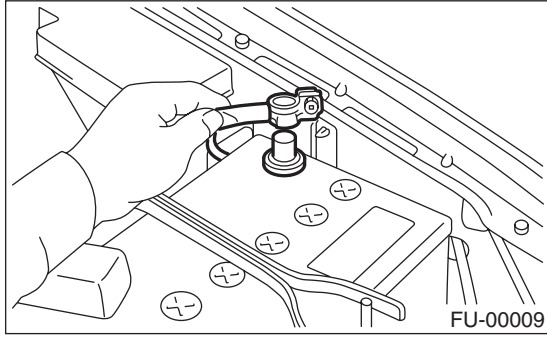
- 3) Lower the vehicle.
- 4) Connect the connector to front oxygen (A/F) sensor, and then connect the connector to engine hanger.



FRONT OXYGEN (A/F) SENSOR

FUEL INJECTION (FUEL SYSTEMS)

5) Connect the battery ground cable to battery.



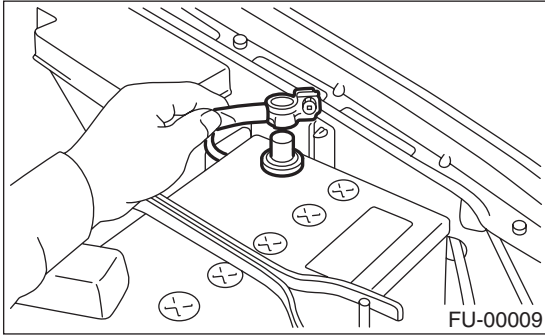
REAR OXYGEN SENSOR

FUEL INJECTION (FUEL SYSTEMS)

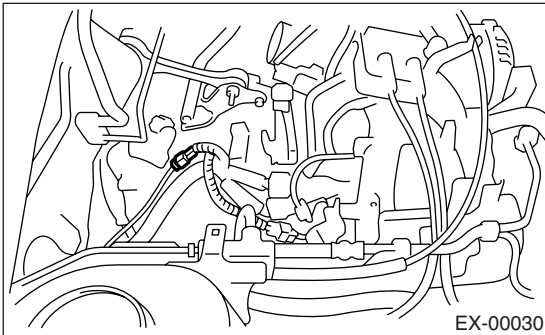
15.Rear Oxygen Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Lift up the vehicle.
- 3) Disconnect the connector from the rear oxygen sensor.



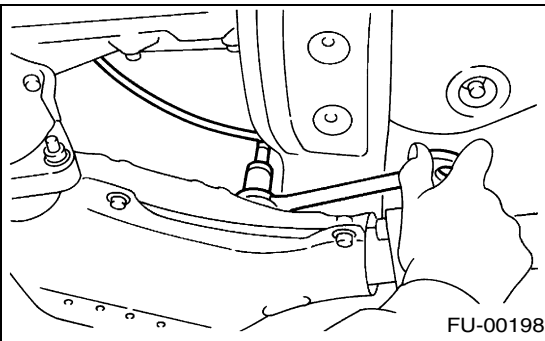
- 4) Apply SUBARU CRC or its equivalent to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove the rear oxygen sensor.

CAUTION:

When removing the rear oxygen sensor, wait until the exhaust pipe cools, otherwise it will damage the exhaust pipe.



B: INSTALLATION

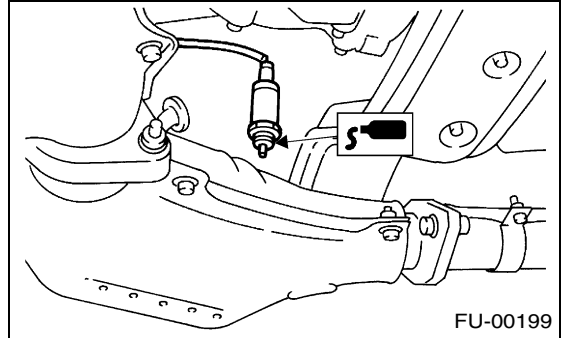
- 1) Before installing the rear oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of the rear oxygen (A/F) sensor to make the next removal easier.

CAUTION:

Never apply anti-seize compound to protector of rear oxygen sensor.

Anti-seize compound:

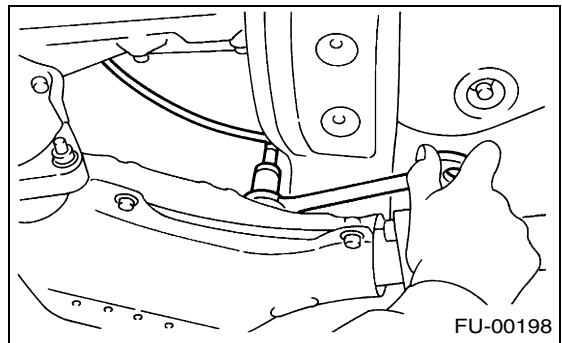
SS-30 by JET LUBE



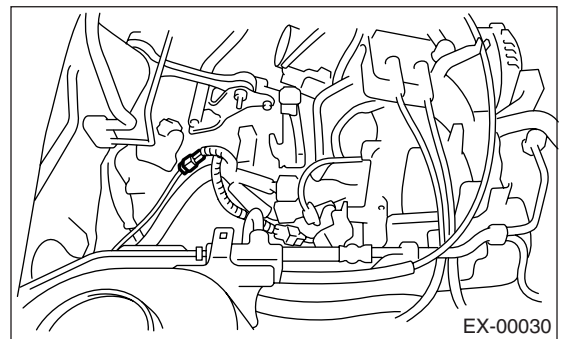
- 2) Install the rear oxygen sensor.

Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)



- 3) Connect the connector to the rear oxygen sensor.

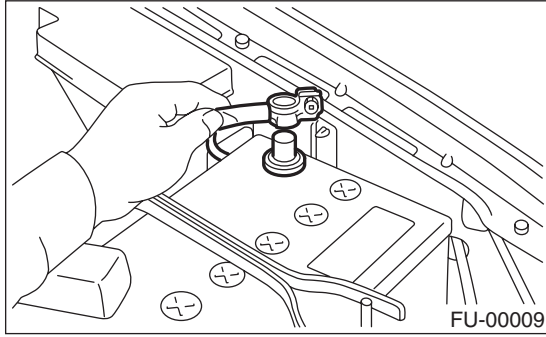


- 4) Lower the vehicle.

REAR OXYGEN SENSOR

FUEL INJECTION (FUEL SYSTEMS)

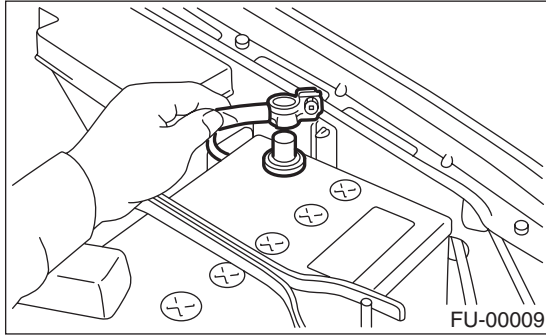
5) Connect the battery ground cable to battery.



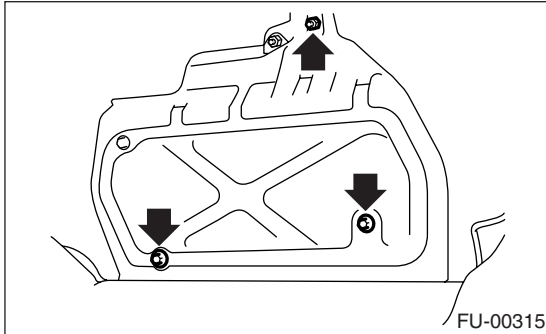
16.Engine Control Module

A: REMOVAL

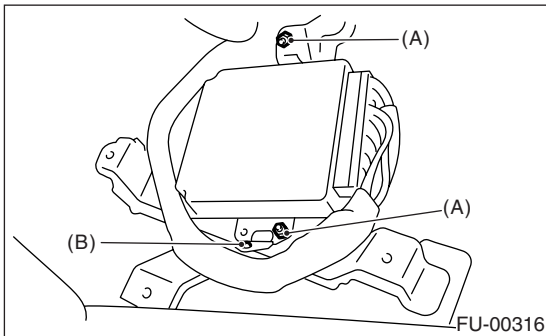
- 1) Disconnect the ground cable from battery.



- 2) Remove the lower inner trim of passenger side.
<Ref. to EI-47, REMOVAL, Lower Inner Trim.>
- 3) Detach the floor mat of front passenger seat.
- 4) Remove the protect cover.



- 5) Remove the nuts (A) which hold ECM to the bracket.
- 6) Remove the clip (B) from the bracket.



- 7) Disconnect the ECM connectors and take out the ECM.

B: INSTALLATION

Install in the reverse order of removal.

CAUTION:

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

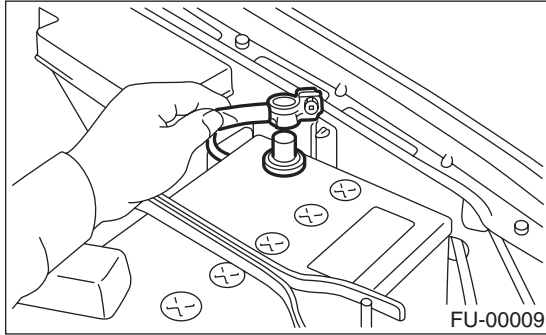
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

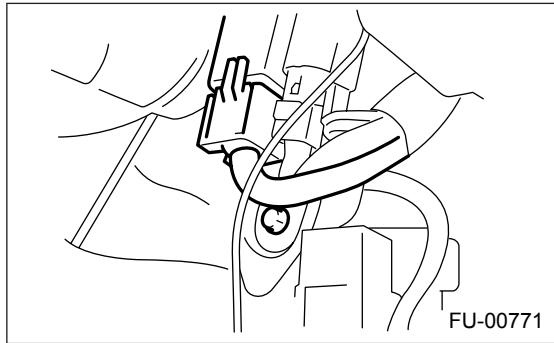
17.Main Relay

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the passenger's side front side sill cover.
- 3) Remove the bolt which holds main bracket on the body.
- 4) Disconnect the connectors from the main relay.



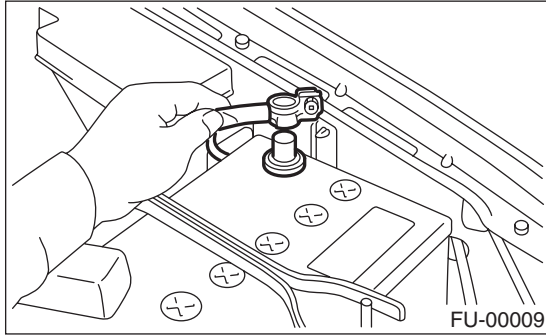
B: INSTALLATION

Install in the reverse order of removal.

18. Fuel Pump Relay

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the passenger's side front side sill cover.
- 3) Remove the bolt which holds fuel pump relay bracket on the body.
- 4) Disconnect the connector from fuel pump.



- 5) Remove the fuel pump relay from the mounting bracket.

B: INSTALLATION

Install in the reverse order of removal.

19. Fuel

A: OPERATION

1. RELEASING OF FUEL PRESSURE

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

1) Disconnect the connector from the fuel pump relay.



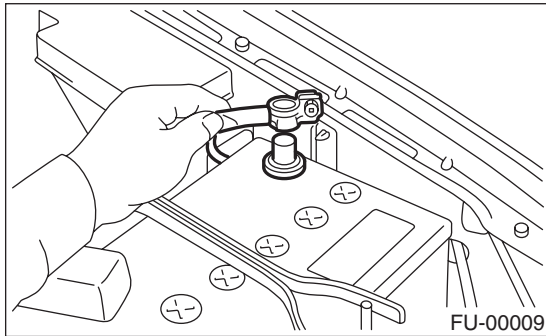
- 2) Start the engine and run it until it stalls.
 3) After the engine stalls, crank it for five more seconds.
 4) Turn the ignition switch to OFF.

2. DRAINING FUEL

WARNING:

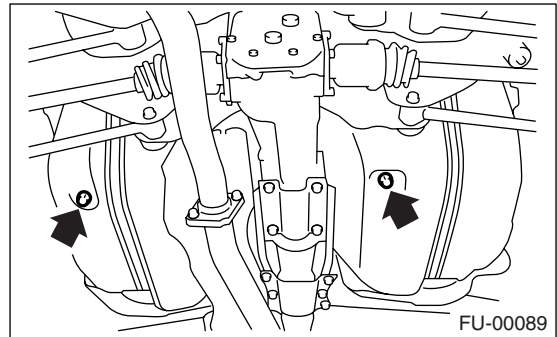
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Set the vehicle on a lift.
 2) Disconnect the ground cable from battery.



- 3) Open the fuel filler flap lid, and then remove the fuel filler cap.
 4) Lift up the vehicle.

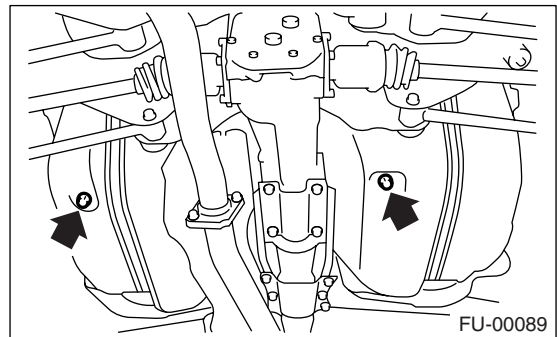
- 5) Drain the fuel from the fuel tank.
 Set a container under the vehicle and remove the drain plug from the fuel tank.



- 6) Tighten the fuel drain plug.

Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



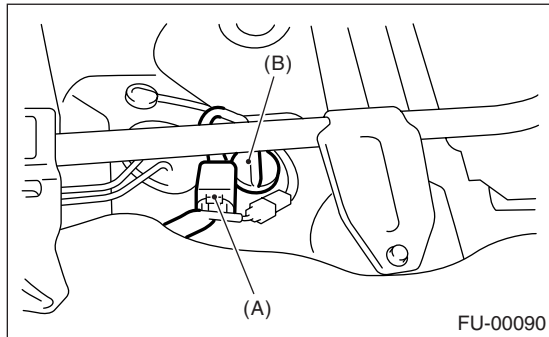
20. Fuel Tank

A: REMOVAL

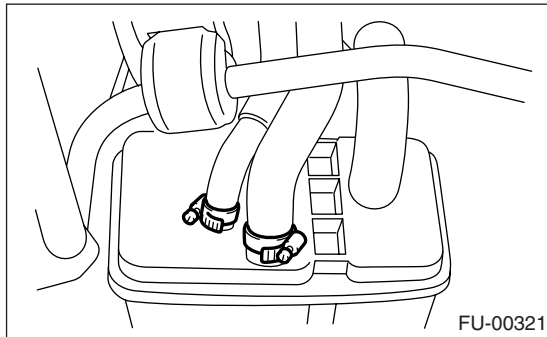
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Drain the fuel from the fuel tank. <Ref. to FU(H4SO)-51, DRAINING FUEL, OPERATION, Fuel.>
- 4) Remove the rear seat.
- 5) Disconnect the connector (A) of fuel tank cord to the rear harness.
- 6) Push the grommet (B) which holds the fuel tank cord on the floor panel into under the body.

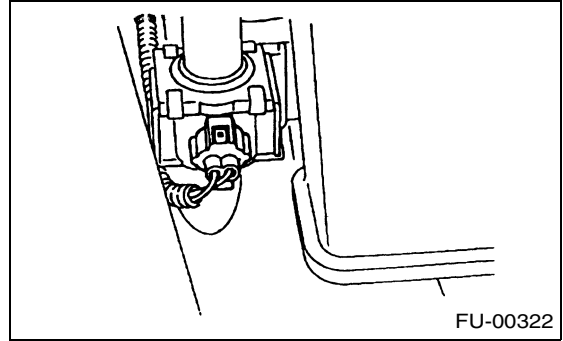


- 7) Remove the rear crossmember. <Ref. to RS-20, REMOVAL, Rear Crossmember.>
- 8) Move the clamp, and disconnect the evaporation hose from the canister.

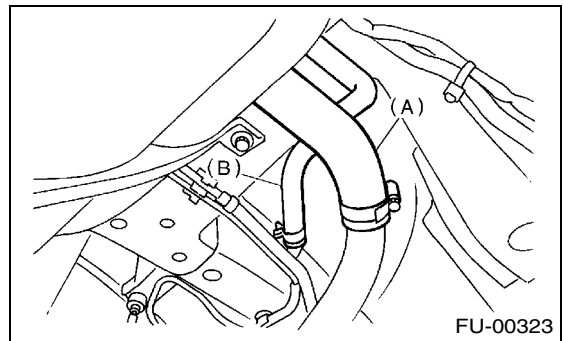


- 9) Disconnect the connector from pressure control solenoid valve.

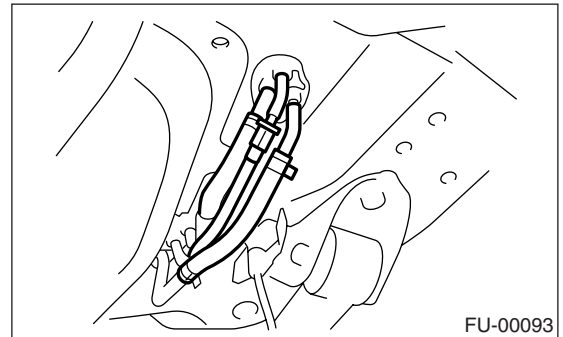
- 10) Disconnect the connector from drain valve.



- 11) Loosen the clamp and disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe.



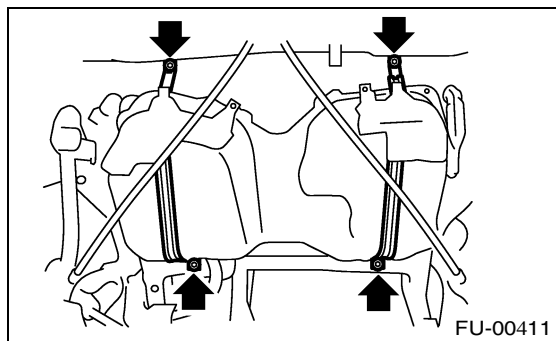
- 12) Move the clips, and disconnect the quick connector. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Delivery, Return and Evaporation lines.>
- 13) Disconnect the fuel hoses.



14) Support the fuel tank with a transmission jack, remove the bolts from bands and dismount the fuel tank from the vehicle.

WARNING:

An assistant is required to perform this work.



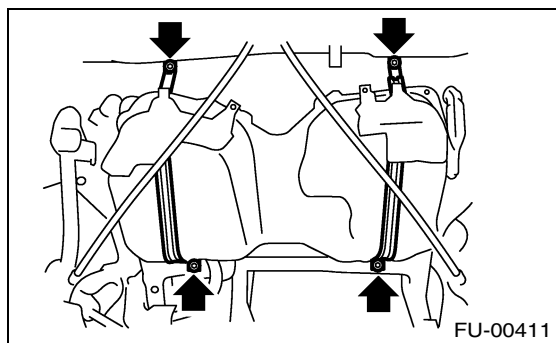
B: INSTALLATION

1) Support the fuel tank with a transmission jack and push the fuel tank harness into the access hole with the grommet.

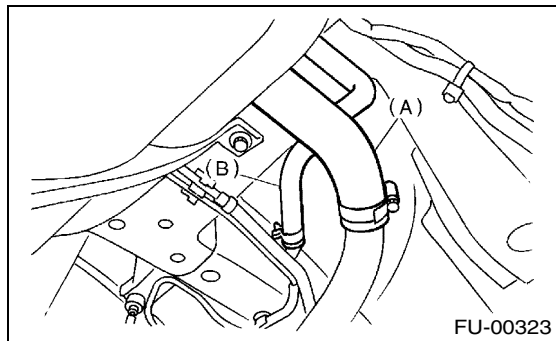
2) Set the fuel tank and temporarily tighten the bolts of fuel tank bands.

WARNING:

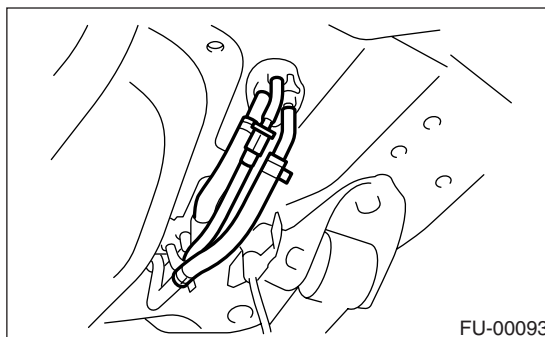
An assistant is required to perform this work.



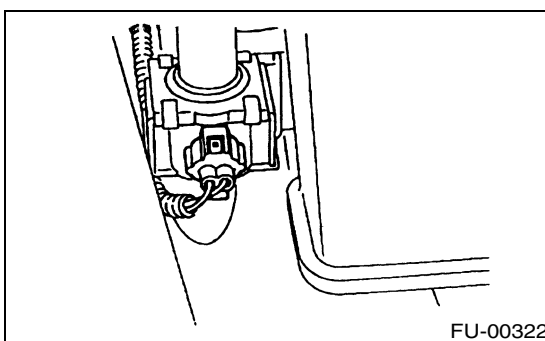
3) Connect the fuel filler hose (A) and air vent hose (B).



4) Connect the fuel hoses, and hold them with clips and quick connector. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Delivery, Return and Evaporation lines.>

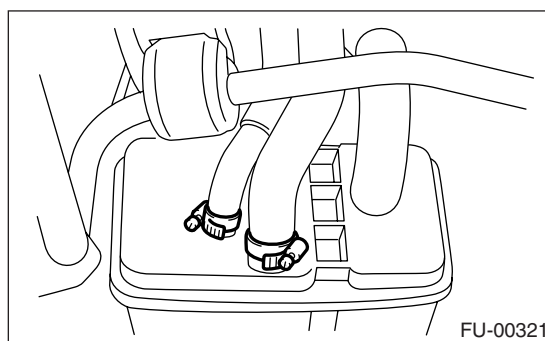


5) Connect the connector to the drain valve.



6) Connect the connector to the pressure control solenoid valve.

7) Connect the evaporation hose to the canister and secure with the clamp.



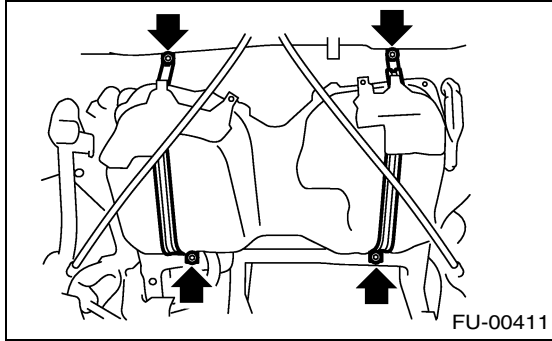
FUEL TANK

FUEL INJECTION (FUEL SYSTEMS)

8) Tighten the band mounting bolts.

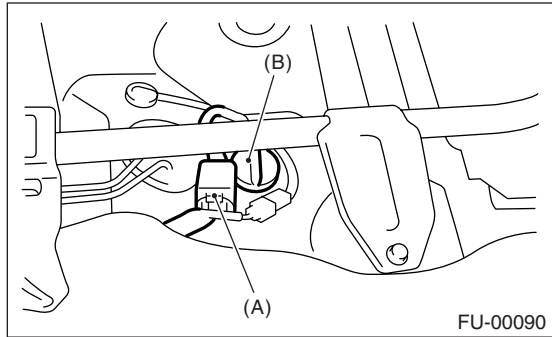
Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



9) Install the rear crossmember. <Ref. to RS-20, INSTALLATION, Rear Crossmember.>

10) Connect the connectors (A) to the fuel tank cord and plug the service hole with grommet (B).



11) Set the rear seat and floor mat.

12) Connect the connector to the fuel pump relay.



C: INSPECTION

- 1) Make sure there are no cracks, holes, or other damage on the fuel tank.
- 2) Make sure that the fuel hoses and fuel pipes are not cracked and the connections are tight.

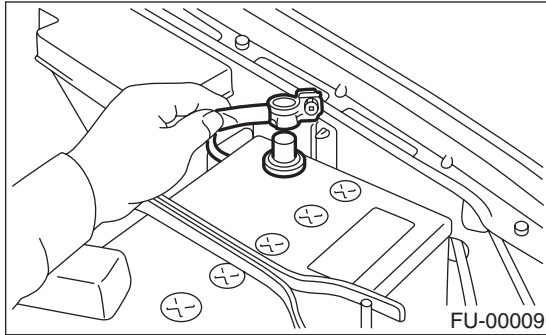
21. Fuel Filler Pipe

A: REMOVAL

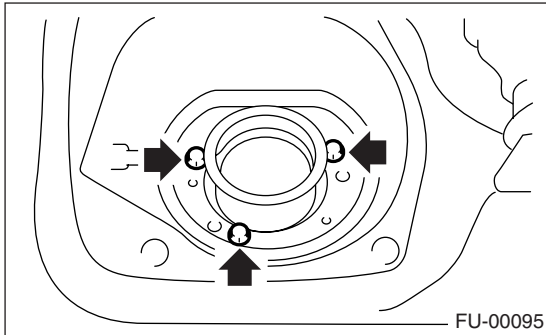
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

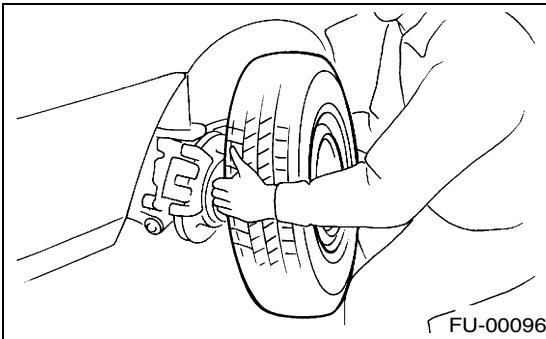
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel filler flap lid and remove the filler cap.
- 3) Disconnect the ground cable from battery.



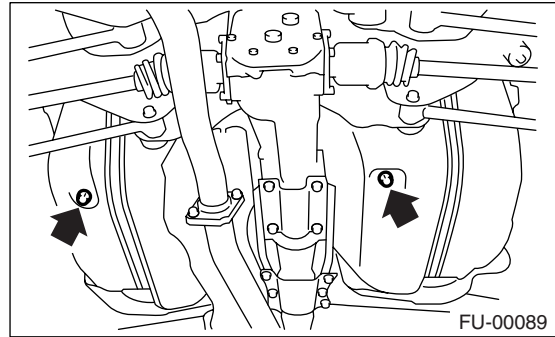
- 4) Remove the screws holding packing in place.



- 5) Lift up the vehicle.
- 6) Remove the rear right side wheel nuts.
- 7) Remove the rear right side wheel.



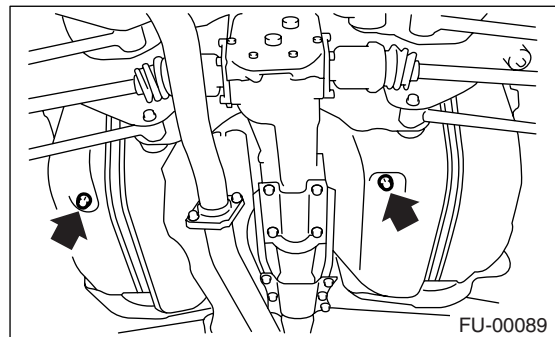
- 8) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.



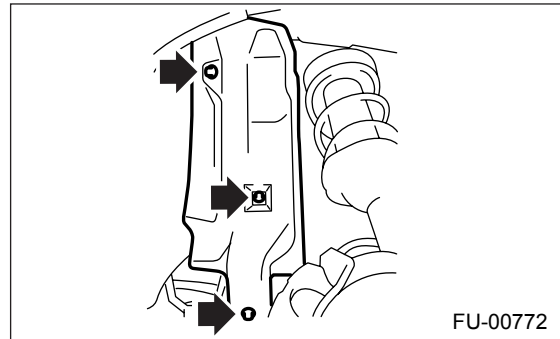
- 9) Tighten the fuel drain plug.

Tightening torque:

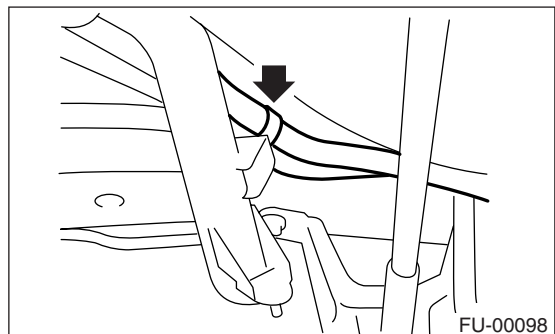
26 N·m (2.65 kgf·m, 19.2 ft·lb)



- 10) Remove the fuel filler pipe protector.



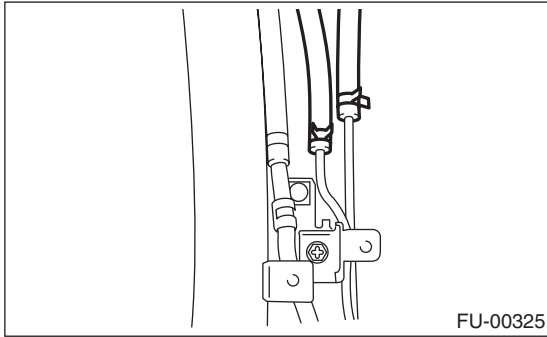
- 11) Separate the evaporation hoses from the clip of fuel filler pipe.



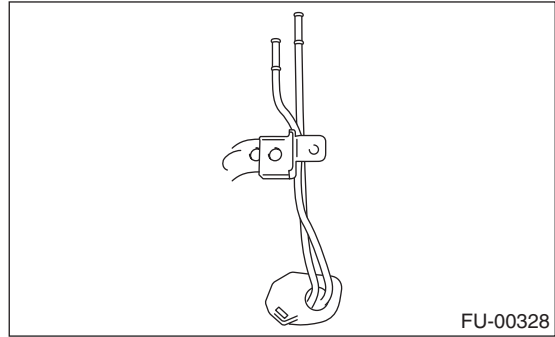
FUEL FILLER PIPE

FUEL INJECTION (FUEL SYSTEMS)

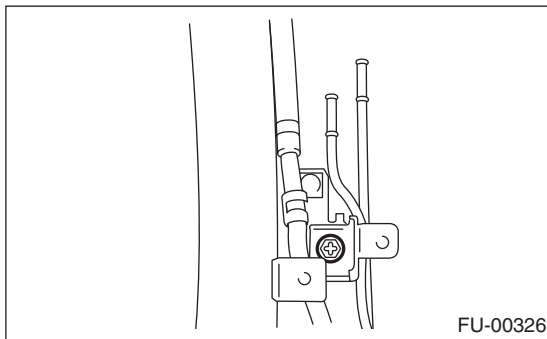
12) Disconnect the evaporation hoses from the pipes.



17) Remove the evaporation pipe together with clip from the body.

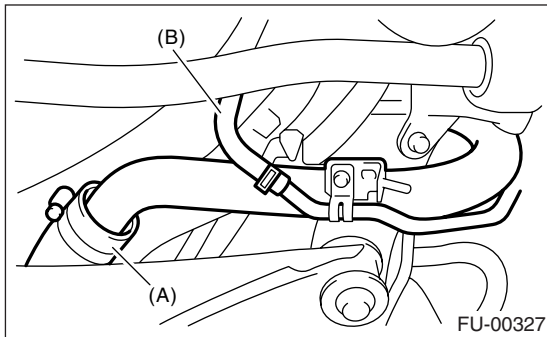


13) Remove the bolts which hold the fuel filler pipe bracket on the body.



14) Loosen the clamp and separate the fuel filler hose (A) from the fuel filler pipe.

15) Move the clip and separate the evaporation hose (B).

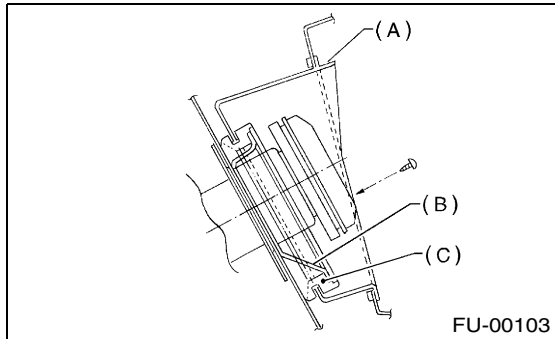


16) Remove the fuel filler pipe to under side of the vehicle.

B: INSTALLATION

1) Hold the fuel filler flap open.

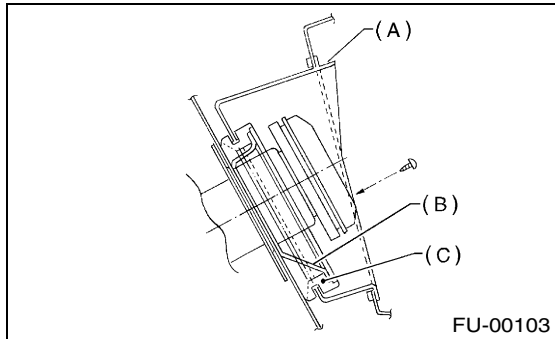
2) Set the fuel saucer (A) with rubber packing (C) and insert the fuel filler pipe into hole from the inner side of apron.



3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

NOTE:

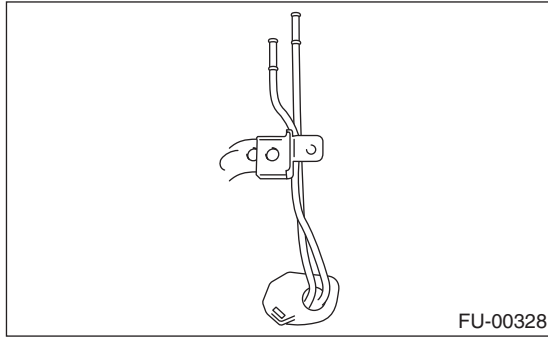
If the edges of rubber packing are folded toward the inside, straighten it with a screwdriver.



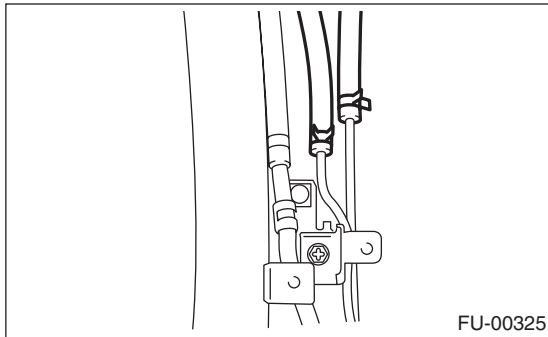
FUEL FILLER PIPE

FUEL INJECTION (FUEL SYSTEMS)

4) Install the evaporation pipe.

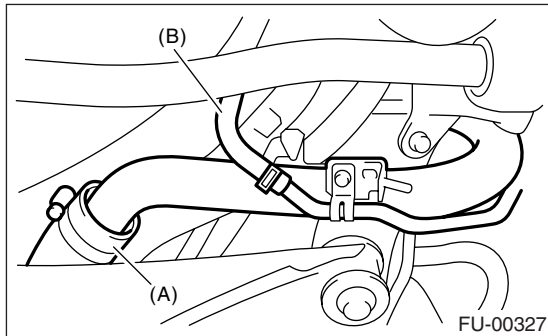


5) Connect the evaporation hose to the pipe.



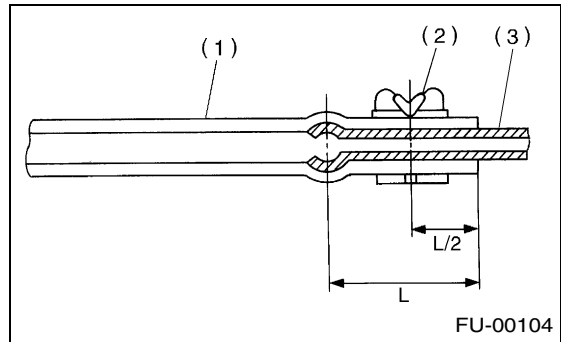
6) Insert the fuel filler hose (A) approximately 35 to 40 mm (1.38 to 1.57 in) over the lower end of fuel filler pipe and tighten the clamp.

CAUTION:
Do not allow clips to touch evaporation hose (B) and rear suspension crossmember.



7) Insert the evaporation hose approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe and hold the clip.

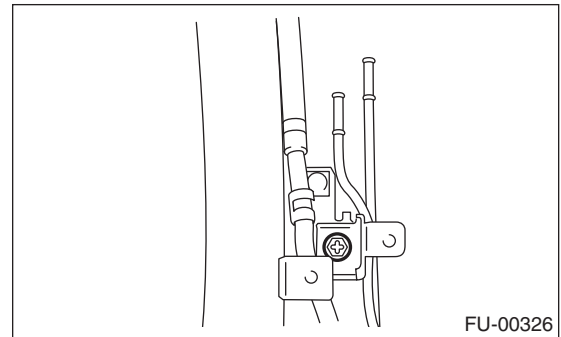
$L = 27.5 \pm 2.5 \text{ mm (1.083 \pm 0.098 in)}$



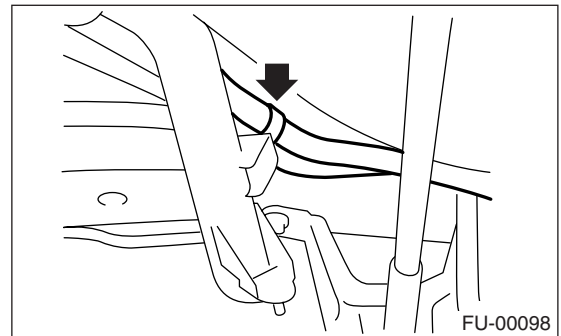
- (1) Hose
- (2) Clip
- (3) Pipe

8) Tighten the bolt which holds the fuel filler pipe bracket on the body.

Tightening torque:
 $7.5 \text{ N}\cdot\text{m (0.75 kgf}\cdot\text{m, 5.4 ft}\cdot\text{lb)}$



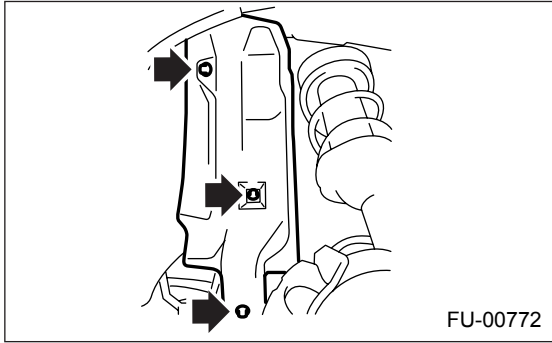
9) Secure the evaporation hose to clip of fuel filler pipe.



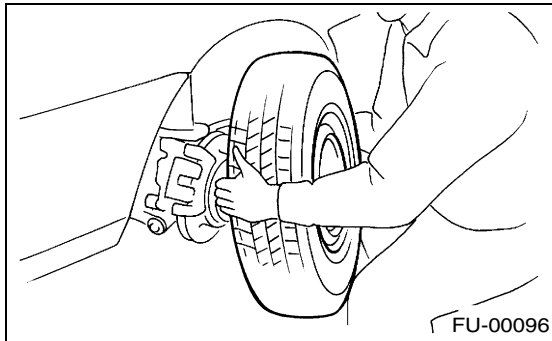
FUEL FILLER PIPE

FUEL INJECTION (FUEL SYSTEMS)

10) Install the fuel filler pipe protector.



11) Install the rear right wheel.



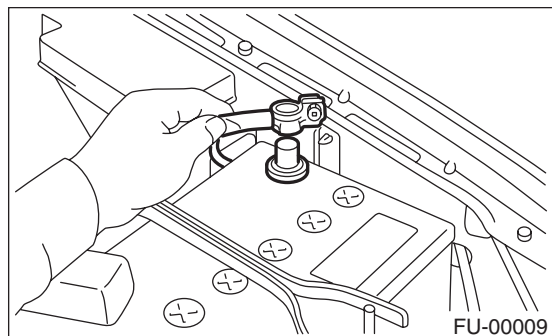
12) Lower the vehicle.

13) Tighten the wheel nuts.

14) Connect the connector to the fuel pump relay.

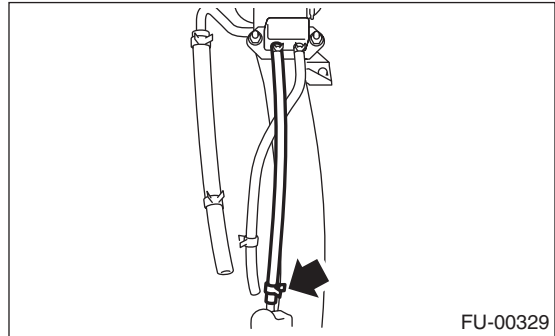


15) Connect the battery ground cable to battery.

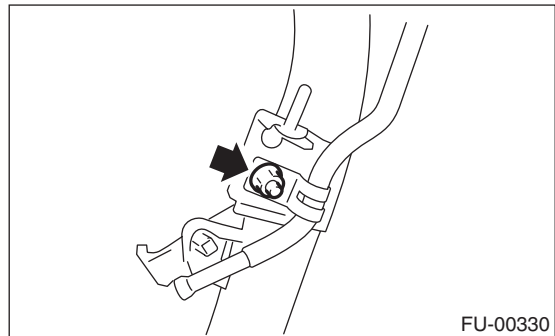


C: DISASSEMBLY

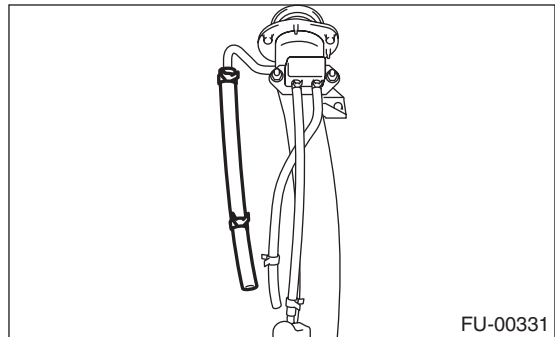
1) Move the clamp, and disconnect the evaporation hose from the joint pipe.



2) Remove the bolt which installs the joint pipe on the fuel filler pipe.



3) Disconnect the evaporation hose from the fuel filler pipe.

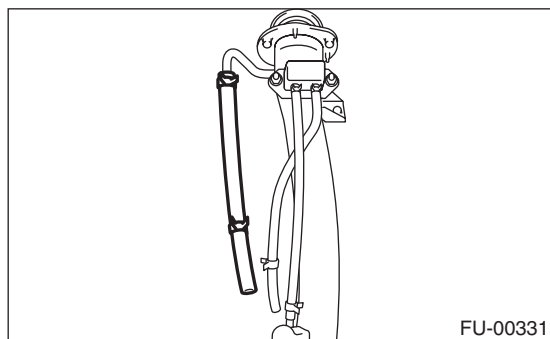


4) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-17, REMOVAL, Shut Valve.>

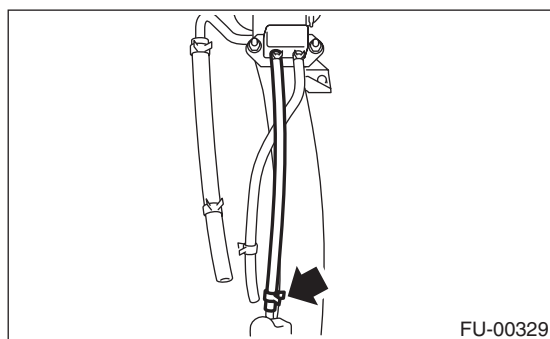
D: ASSEMBLY

1) Install the shut valve on the fuel filler pipe. <Ref. to EC(H4SO)-17, INSTALLATION, Shut Valve.>

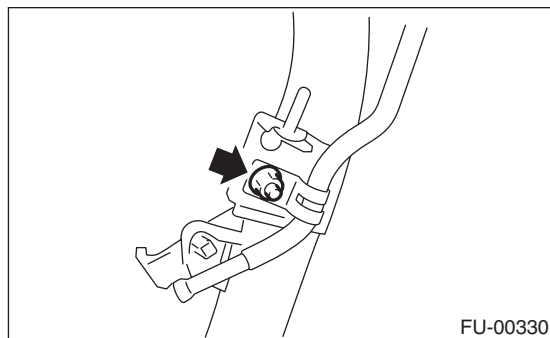
- 2) Connect the evaporation hose to the fuel filler pipe.



- 3) Connect the evaporation hose to the evaporation pipe.



- 4) Install the evaporation pipe to the fuel filler pipe.



FUEL PUMP

FUEL INJECTION (FUEL SYSTEMS)

22. Fuel Pump

A: REMOVAL

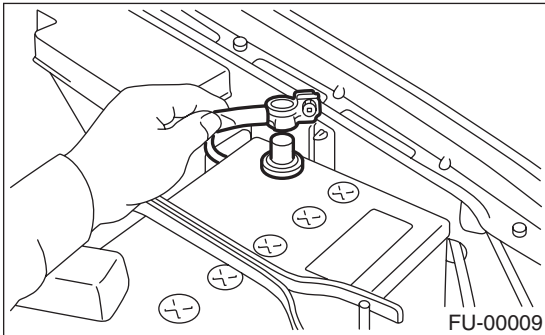
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

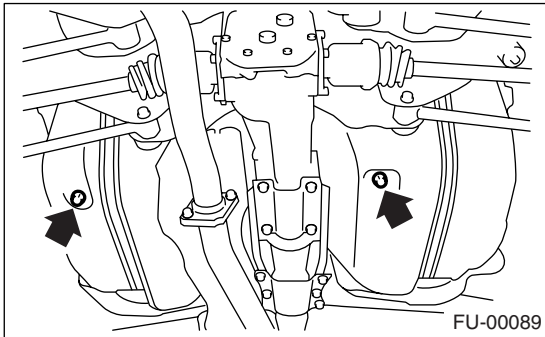
NOTE:

The fuel pump assembly consists of a fuel pump and a fuel level sensor.

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel filler lid and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



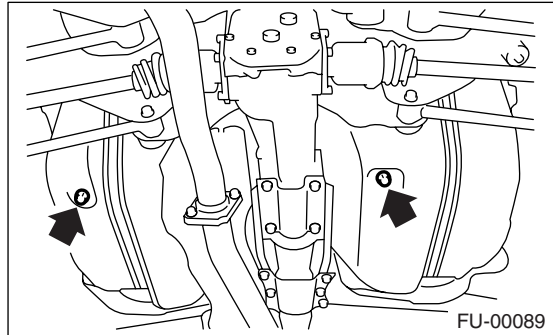
- 4) Lift up the vehicle.
- 5) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.



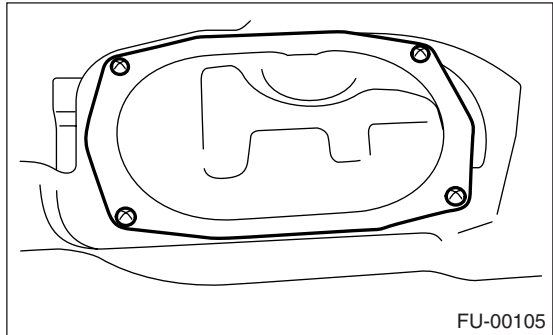
- 6) Tighten the fuel drain plug.

Tightening torque:

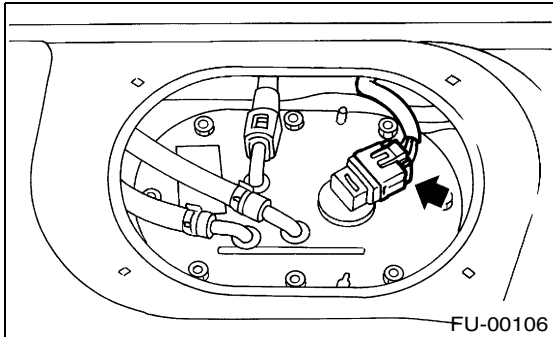
26 N·m (2.65 kgf-m, 19.2 ft-lb)



- 7) Raise the rear seat and turn the floor mat up.
- 8) Remove the access hole lid.

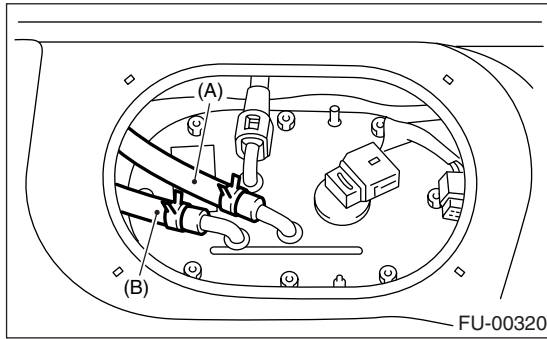


- 9) Disconnect the connector from fuel pump.

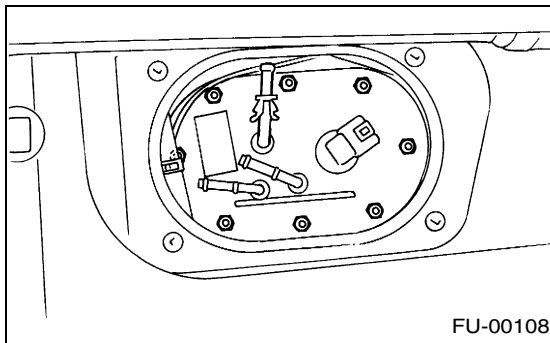


- 10) Disconnect the quick connector and then disconnect the fuel delivery hose. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Delivery, Return and Evaporation lines.>

- 11) Move the clip and then disconnect the fuel return hose (A) and jet pump hose (B).



- 12) Remove the nuts which install the fuel pump assembly onto the fuel tank.



- 13) Take off the fuel pump assembly from the fuel tank.

B: INSTALLATION

Install in the reverse order of removal. Do the following:

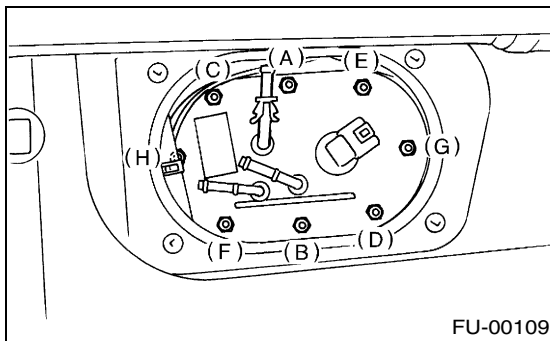
NOTE:

Replace the gaskets with new ones.

- (1) Ensure the sealing portion is free from fuel or foreign particles before installation.
- (2) Tighten the nuts in alphabetical sequence shown in figure to specified torque.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

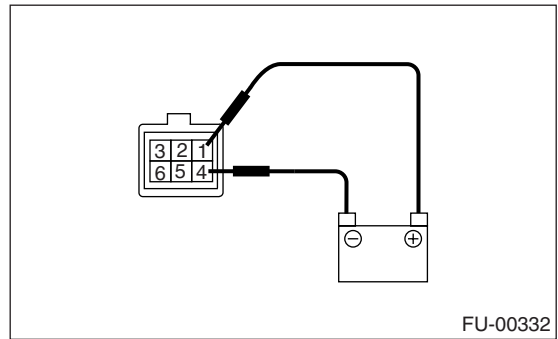


C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump and apply the battery power supply to check whether the pump operates.

WARNING:

- Wipe off the fuel completely.
- Keep battery as far apart from fuel pump as possible.
- Be sure to turn the battery supply ON and OFF on the battery side.
- Do not run fuel pump for a long time under non-load condition.



23. Fuel Level Sensor

A: REMOVAL

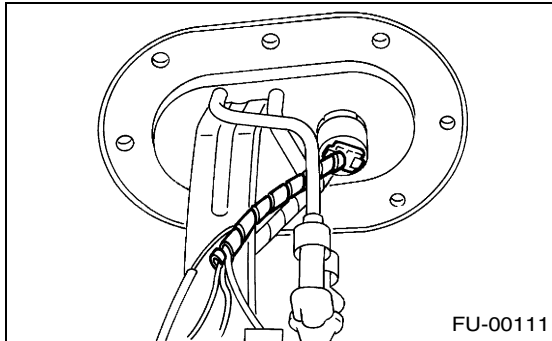
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

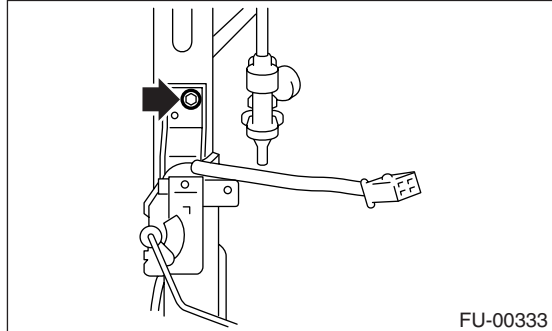
NOTE:

The fuel level sensor is built in the fuel pump assembly.

- 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-60, REMOVAL, Fuel Pump.>
- 2) Disconnect the connector from the fuel pump bracket.



- 3) Remove the bolt which installs the fuel level sensor on the mounting bracket.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

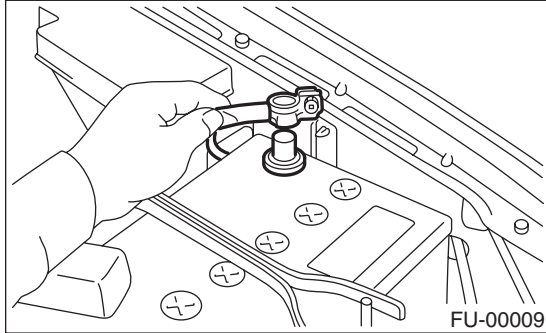
24. Fuel Sub Level Sensor

A: REMOVAL

WARNING:

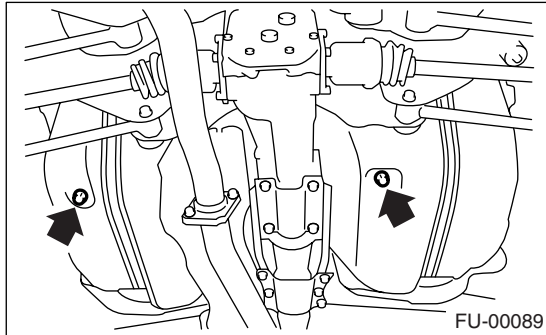
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.

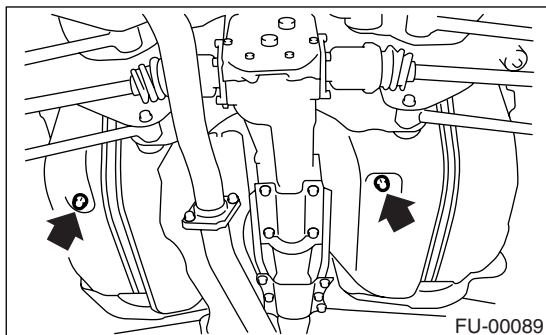
3) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.



4) Tighten the fuel drain plug.

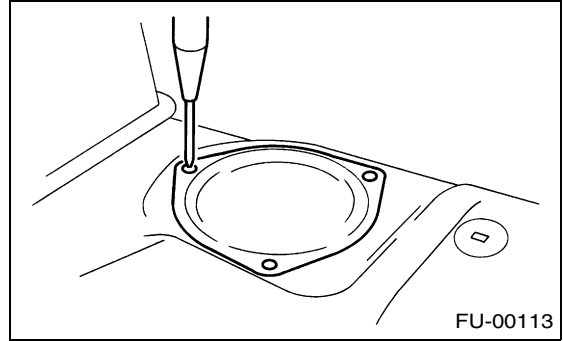
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



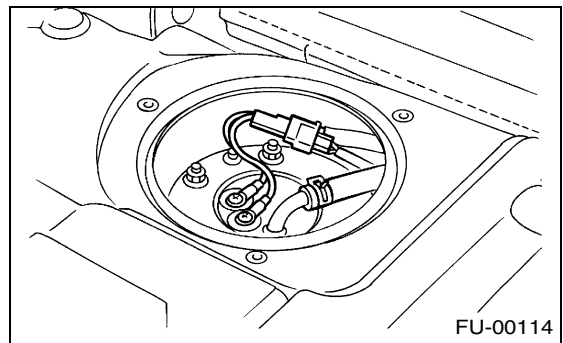
5) Remove the rear seat.

6) Remove the service hole cover.

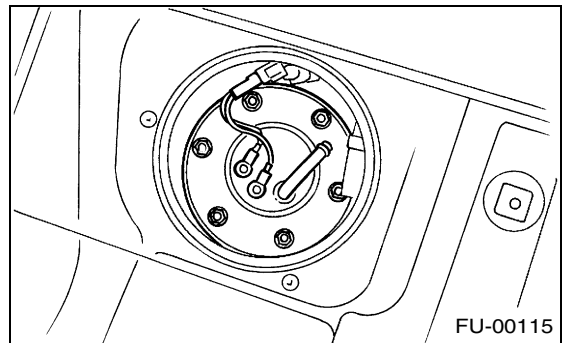


7) Disconnect the connector from the fuel sub meter.

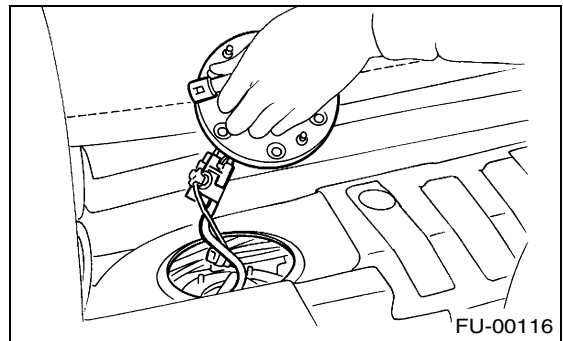
8) Disconnect the fuel jet pump hose.



9) Remove the bolts which install the fuel sub meter unit on the fuel tank.



10) Remove the fuel sub meter unit.



FUEL SUB LEVEL SENSOR

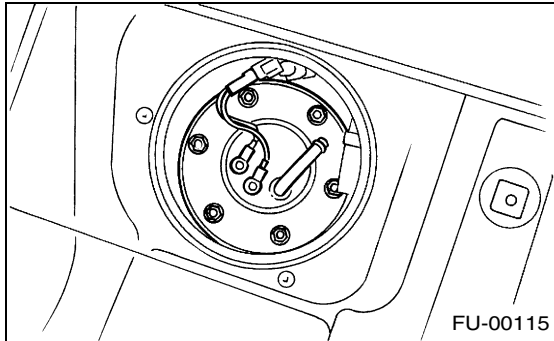
FUEL INJECTION (FUEL SYSTEMS)

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



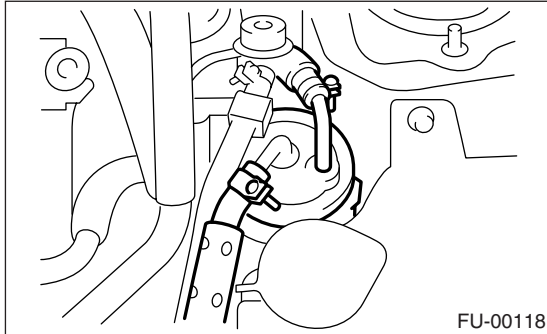
25. Fuel Filter

A: REMOVAL

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Disconnect the fuel delivery hoses from the fuel filter.



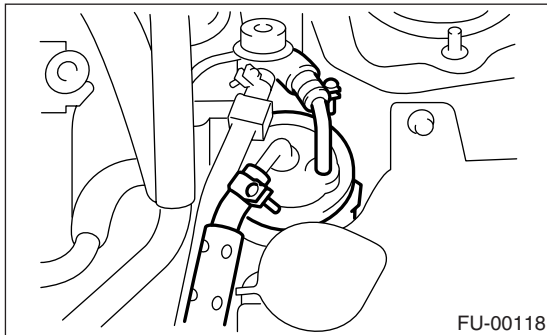
- 3) Remove the filter from the holder.

B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Tighten the hose clamp screws.

Tightening torque:

1.25 N·m (0.13 kgf-m, 0.94 ft-lb)



C: INSPECTION

- 1) Check the inside of fuel filter for dirt and water sediment.
- 2) If it is clogged, or if the replacement interval has been reached, replace it.
- 3) If the water is found in it, shake and expel the water from the inlet port.
- 4) If fuel hoses are damaged at the connecting portion, replace it with a new one.
- 5) If clamps are badly damaged, replace with new ones.

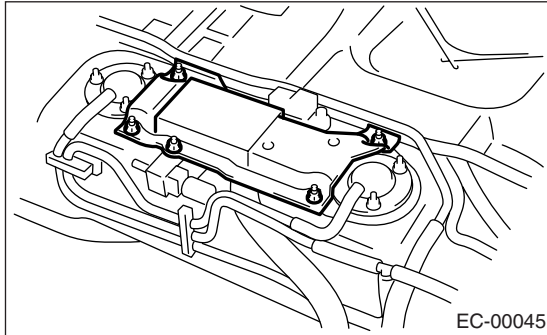
26. Fuel Cut Valve

A: REMOVAL

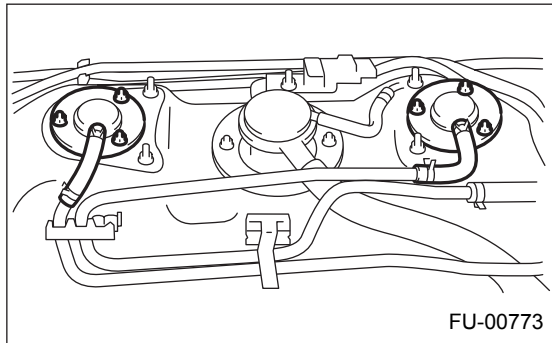
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Remove the fuel tank. <Ref. to FU(H4SO)-52, REMOVAL, Fuel Tank.>
- 2) Remove the protect cover.



- 3) Move the clip and disconnect the evaporation hose from the fuel cut valve.



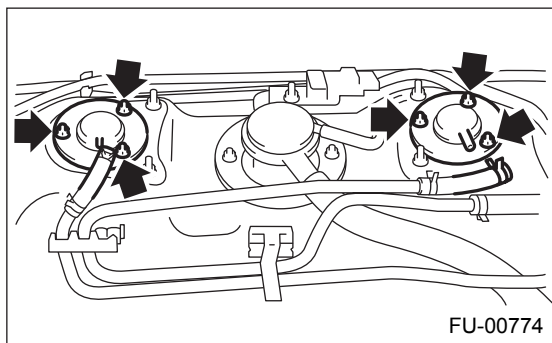
- 4) Remove the bolts which install the fuel cut valve.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

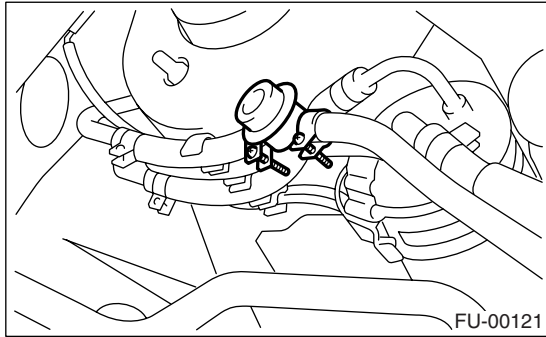
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



27. Fuel Damper Valve

A: REMOVAL

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Remove the fuel damper valve from the fuel return line.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

1.25 N·m (0.13 kgf-m, 0.94 ft-lb)

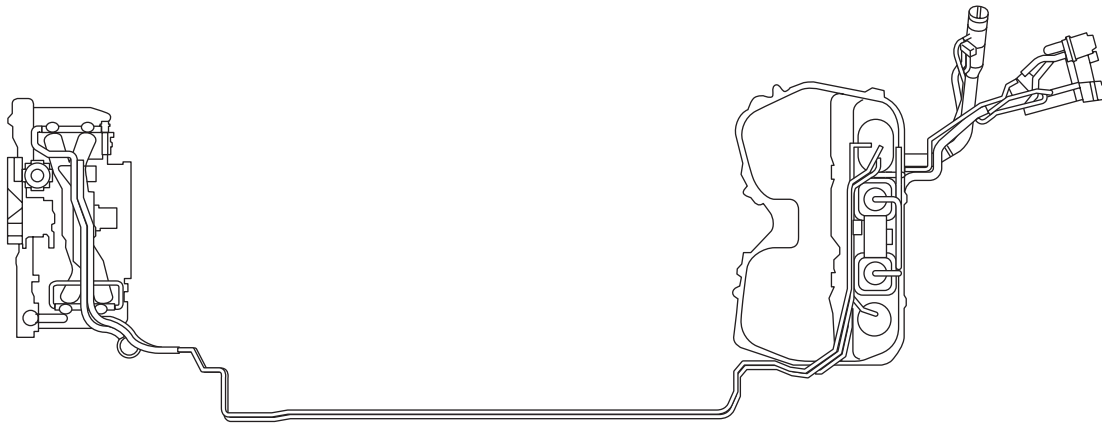
FUEL DELIVERY, RETURN AND EVAPORATION LINES

FUEL INJECTION (FUEL SYSTEMS)

28.Fuel Delivery, Return and Evaporation lines

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Open the fuel filler lid and remove the fuel filler cap.
- 4) Remove the floor mat. <Ref. to EI-56, REMOVAL, Floor Mat.>
- 5) Remove the fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.

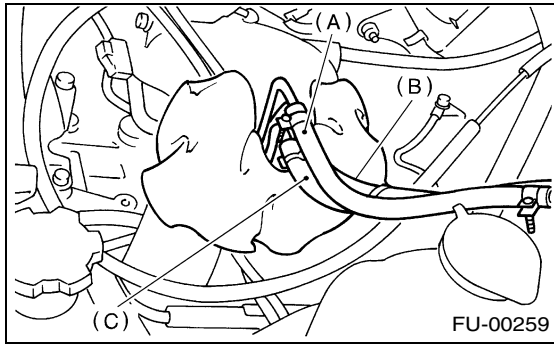


FU-00337

FUEL DELIVERY, RETURN AND EVAPORATION LINES

FUEL INJECTION (FUEL SYSTEMS)

6) In engine compartment, detach the fuel delivery hoses, return hoses and evaporation hose.



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

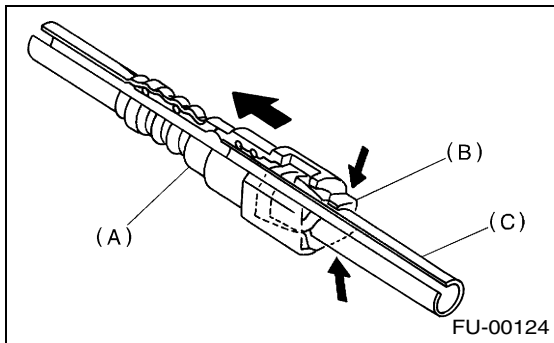
7) Lift up the vehicle.

8) Separate the quick connector on the fuel delivery and return line.

- (1) Clean the pipe and connector, if they are covered with dust.
- (2) Hold the connector (A) and push retainer (B) down.
- (3) Pull out the connector (A) from retainer (B).

CAUTION:

Always use a new retainer.



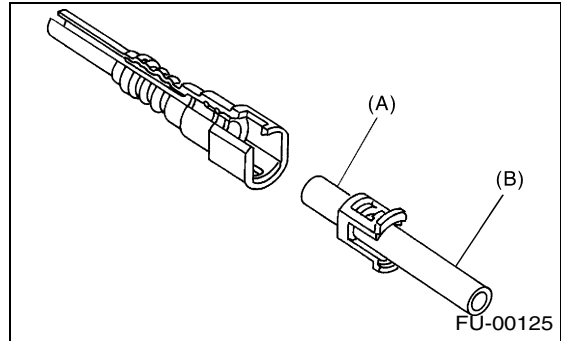
- (A) Connector
- (B) Retainer
- (C) Pipe

B: INSTALLATION

1) Connect the quick connector on fuel delivery line.

CAUTION:

- **Always use a new retainer.**
- **Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface of pipe.**

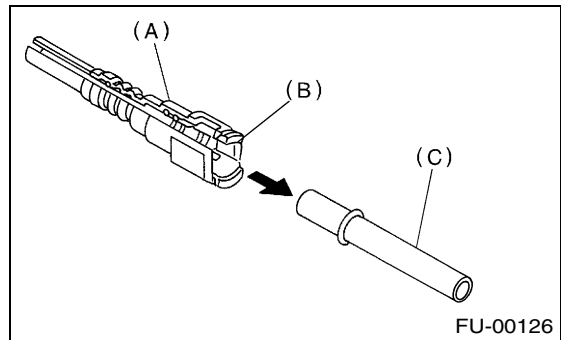


- (A) Seal surface
- (B) Pipe

- (1) Set the new retainer (B) to connector (A).
- (2) Push the pipe into the connector completely.

NOTE:

At this time, two clicking sounds are heard.



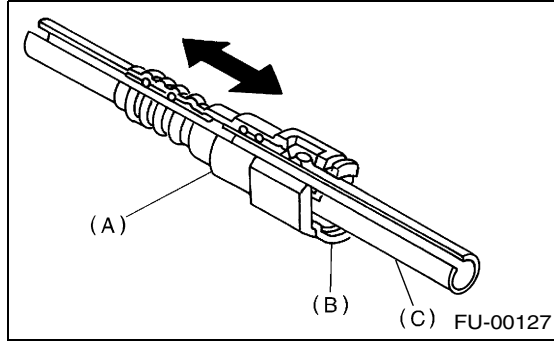
- (A) Connector
- (B) Retainer
- (C) Pipe

FUEL DELIVERY, RETURN AND EVAPORATION LINES

FUEL INJECTION (FUEL SYSTEMS)

CAUTION:

- Pull the connector to ensure it is connected securely.
- Ensure the two retainer pawls are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
(B) Retainer
(C) Pipe

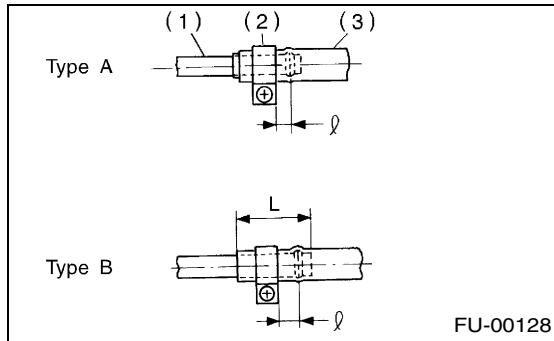
2) Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the fitting length is specified.

Type B: When the fitting length is not specified.

$$\varnothing : 2.5 \pm 1.5 \text{ mm } (0.098 \pm 0.059 \text{ in})$$

$$L: 22.5 \pm 2.5 \text{ mm } (0.886 \pm 0.098 \text{ in})$$



- (1) Pipe
(2) Clamp
(3) Hose

3) Connect the return hose and evaporation hose to pipe by approx. 15 mm (0.59 in) from the hose end.

Fuel return hose:

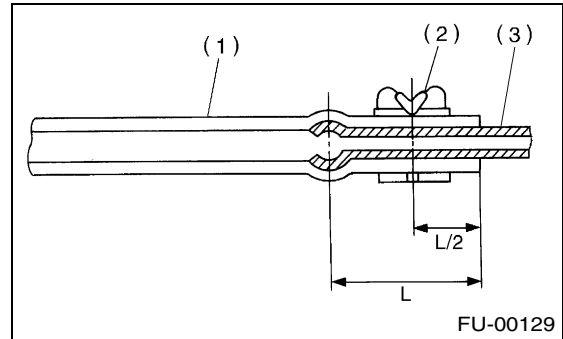
$$L = 22.5 \pm 2.5 \text{ mm } (0.885 \pm 0.098 \text{ in})$$

Fuel evaporation hose:

$$L = 17.5 \pm 2.5 \text{ mm } (0.689 \pm 0.098 \text{ in})$$

CAUTION:

Be sure to inspect hoses and their connections for any leakage of fuel.



- (1) Hose
(2) Clip
(3) Pipe

C: INSPECTION

1) Make sure that there are no cracks on the fuel pipes and fuel hoses.

2) Make sure that the fuel pipe and fuel hose connections are tight.

FUEL SYSTEM TROUBLE IN GENERAL

FUEL INJECTION (FUEL SYSTEMS)

29. Fuel System Trouble in General

A: INSPECTION

Trouble and possible cause		Corrective action
1. Insufficient fuel supply to the injector		
1)	Fuel pump will not operate.	
	○ Defective terminal contact.	Inspect connections, especially ground, and tighten securely.
	○ Trouble in electromagnetic or electronic circuit parts.	Replace the fuel pump.
2)	Lowering of fuel pump function.	Replace the fuel pump.
3)	Clogged dust or water in the fuel filter.	Replace fuel filter, clean or replace fuel tank.
4)	Clogged or bent fuel pipe or hose.	Clean, correct or replace fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent breather tube or pipe.	Clean, correct or replace air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator.	Replace.
2. Leakage or blow out fuel		
1)	Loosened joints of the fuel pipe.	Retighten.
2)	Cracked fuel pipe, hose and fuel tank.	Replace.
3)	Defective welding part on the fuel tank.	Replace.
4)	Defective drain packing of the fuel tank.	Replace.
5)	Clogged or bent air breather tube or air vent tube.	Clean, correct or replace air breather tube or air vent tube.
3. Gasoline odor inside compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retighten.
2)	Defective packing air tightness on the fuel saucer.	Correct or replace packing.
3)	Cracked fuel separator.	Replace separator.
4)	Inoperative fuel pump modulator or circuit.	Replace.
4. Defective fuel meter indicator		
1)	Defective operation of fuel level sensor.	Replace.
2)	Defective operation of fuel meter.	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump.	Replace.

NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank.

To prevent water condensation,

- (1) Top off the fuel tank or drain the fuel completely.
 - (2) Drain the water condensation from the fuel filter.
- Refilling the fuel tank.
- Refill the fuel tank while there is still some fuel left in the tank.
- Protecting the fuel system against freezing and water condensation.

(3) Cold areas

In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use an anti-freeze solution in the cooling system. Refueling will also complement the effect of anti-freeze solution each time the fuel

level drops to about one-half. After the winter season, drain the water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under Affected areas below.

(4) Affected areas

When the water condensation is notched in the fuel filter, drain the water from both the fuel filter and fuel tank or use a water removing agent (or anti-freeze solution) in the fuel tank.

- Observe the instructions, notes, etc., indicated on the label affixed to the anti-freeze solution (water removing agent) container before use.

FUEL SYSTEM TROUBLE IN GENERAL

FUEL INJECTION (FUEL SYSTEMS)

GENERAL DESCRIPTION

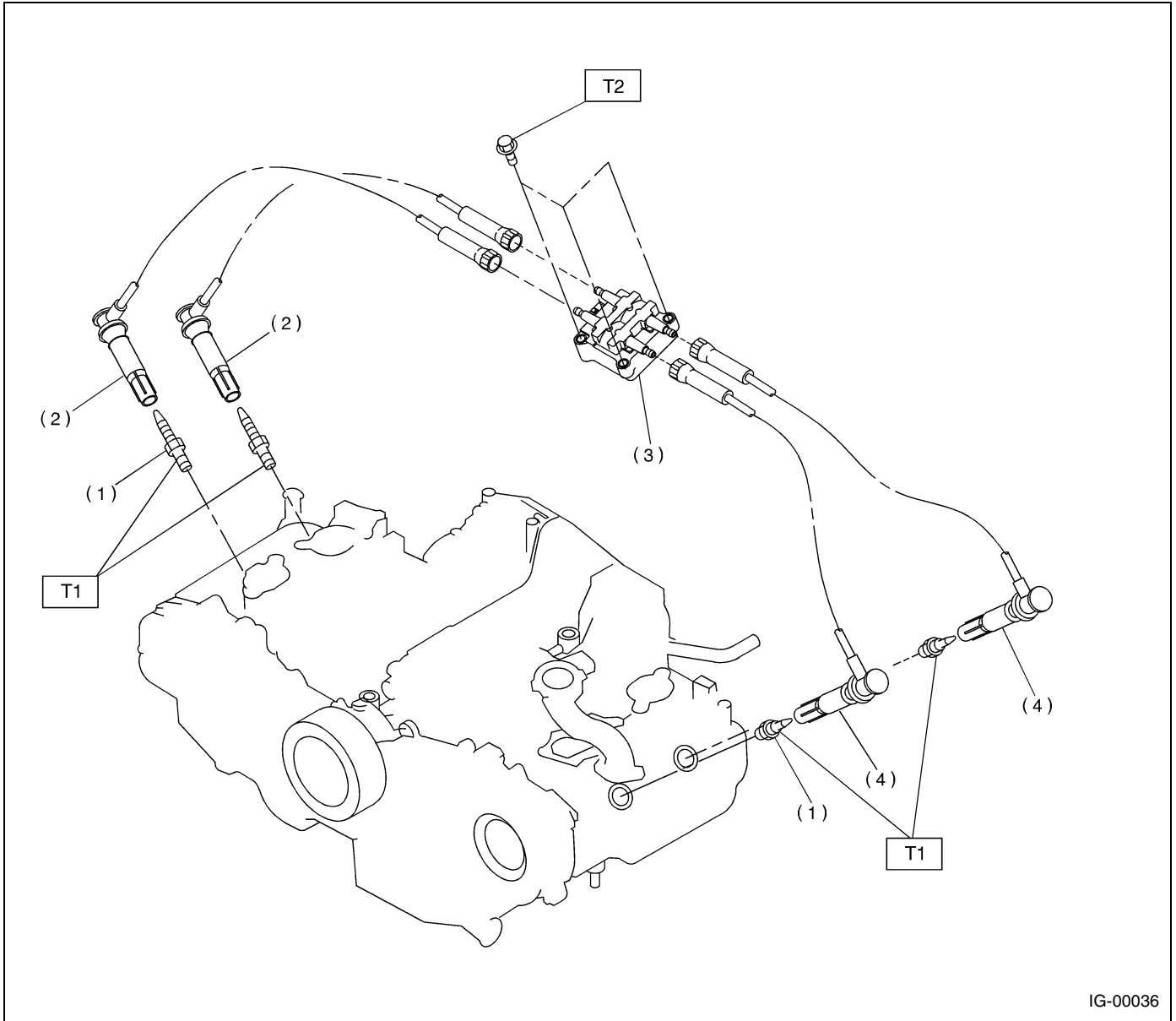
IGNITION

1. General Description

A: SPECIFICATIONS

Item		Designation	
Ignition coil and ignitor assembly	Model	FH0137	
	Manufacturer	DIAMOND	
	Primary coil resistance	0.73 $\Omega \pm 10\%$	
	Secondary coil resistance	12.8 k $\Omega \pm 15\%$	
	Insulation resistance between primary terminal and case	More than 100 M Ω	
Spark plug	Type and manufacturer	CHAMPION: RC10YC4	
		Alter-nate	NGK: BKR5E-11
			NGK: BKR6E-11
	Thread size	mm	14, P = 1.25
	Spark gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)

B: COMPONENT



- (1) Spark plug
- (2) Spark plug cord (#1, #3)
- (3) Ignition coil and ignitor assembly

- (4) Spark plug cord (#2, #4)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 21 (2.1, 15.2)

T2: 6.4 (0.65, 4.7)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Spark Plug

A: REMOVAL

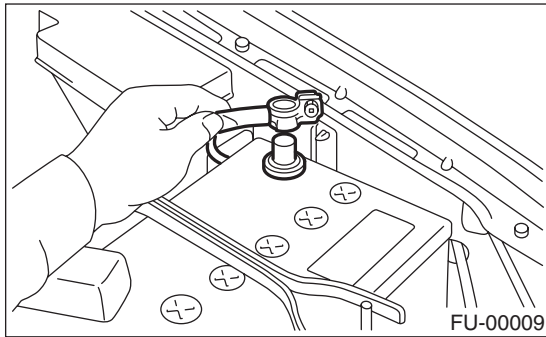
CAUTION:

All spark plugs installed on an engine, must be of the same heat range.

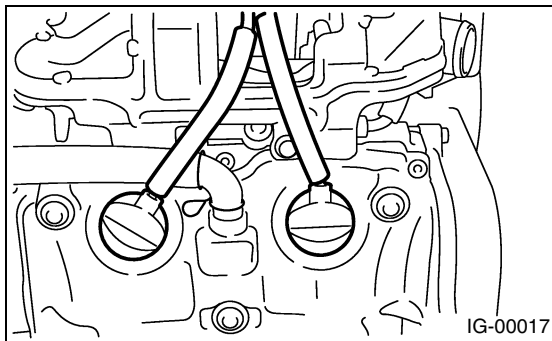
Spark plug
CHAMPION: RC10YC4
NGK: BKR5E-11 (Alternate)
NGK: BKR6E-11 (Alternate)

1. RH SIDE

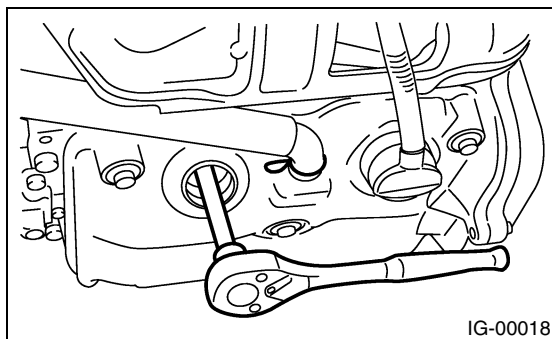
- 1) Disconnect the ground cable from battery.



- 2) Remove the resonator chamber.<Ref. to IN(H4SO)-8, REMOVAL, Resonator Chamber.>
- 3) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself)

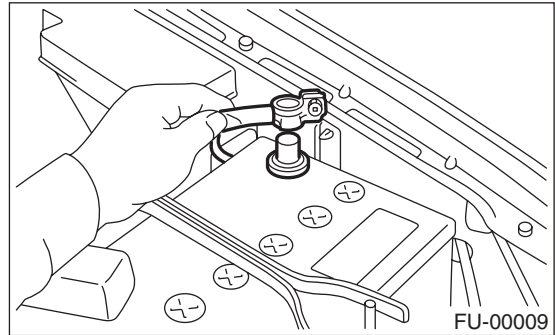


- 4) Remove the spark plugs with spark plug sockets.

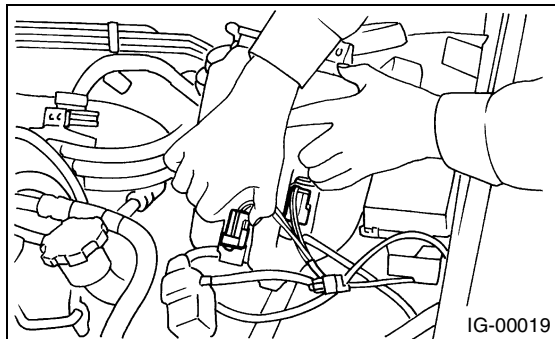


2. LH SIDE

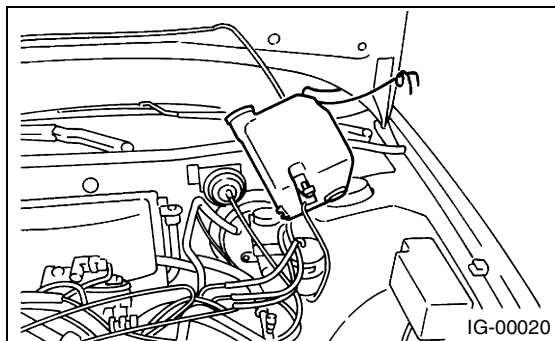
- 1) Disconnect the ground cable from battery.



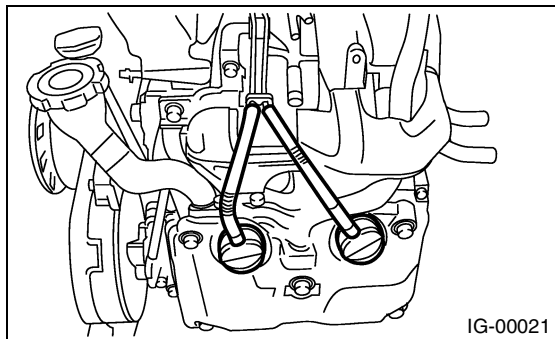
- 2) Remove the two bolts which hold washer tank, and then disconnect the washer motor connector.



- 3) Disconnect the rear window glass washer hose from washer motor, then plug connection with a suitable cap.
- 4) Hang the washer tank away from working area.



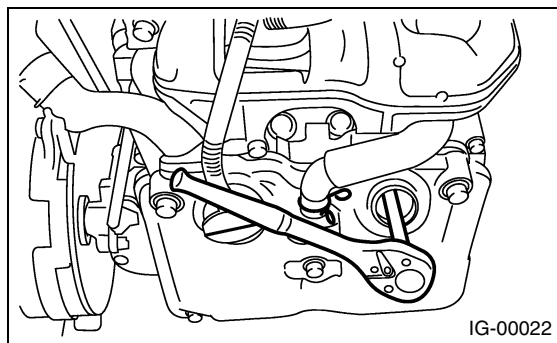
- 5) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself)



SPARK PLUG

IGNITION

6) Remove the spark plugs with spark plug sockets.



B: INSTALLATION

1. RH SIDE

1) Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.2 ft-lb)

NOTE:

The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approx. 1/3 of the specified torque in order to avoid over-stressing.

2. LH SIDE

1) Install in the reverse order of removal.

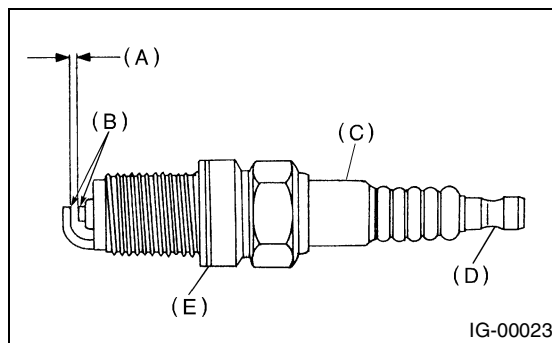
Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.2 ft-lb)

NOTE:

The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approx. 1/3 of the specified torque in order to avoid over-stressing.

C: INSPECTION

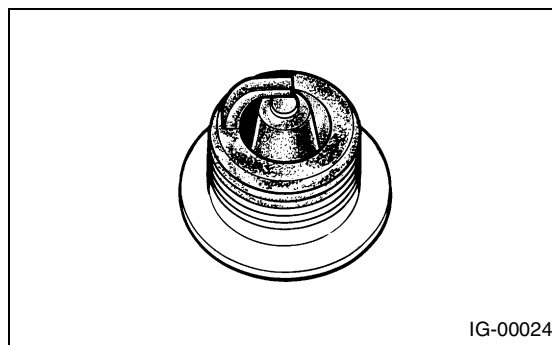
Check the electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Spark gap
- (B) Carbon accumulation or wear
- (C) Cracks
- (D) Damage
- (E) Damaged gasket

1) Normal:

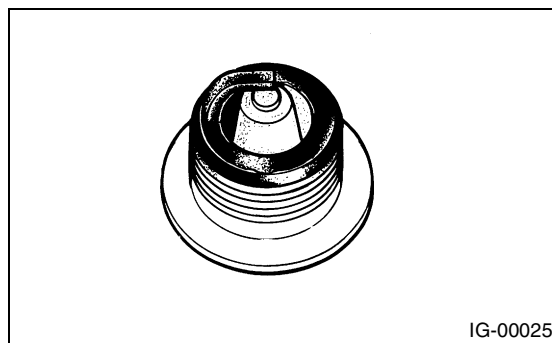
Brown to grayish-tan deposits and slight electrode wear indicates correct spark plug heat range.



2) Carbon fouled:

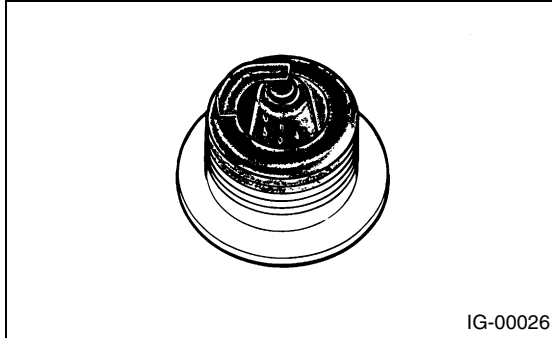
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.

In this case, replace with plugs having a hotter heat range.



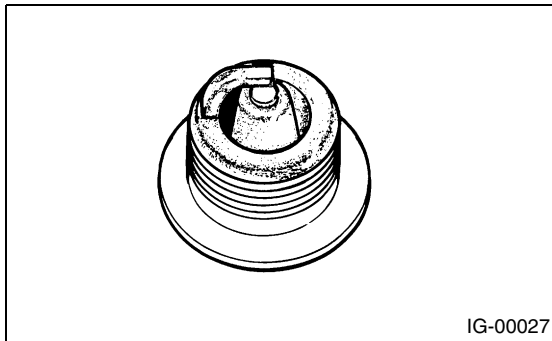
3) Oil fouled:

Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If the same condition remains after repair, use a hotter plug.



4) Overheating:

White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicates engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. In this case, replace with plugs having a hotter heat range.

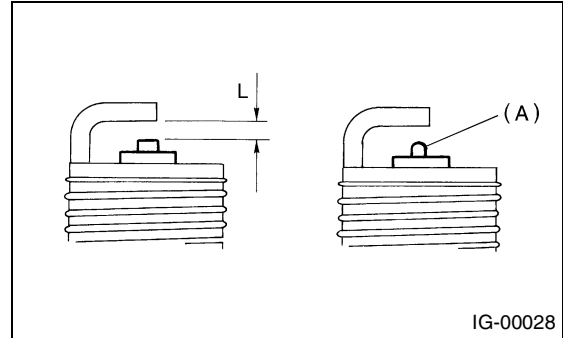


E: ADJUSTMENT

Measure the spark plug gap with a gap gauge, and adjust if necessary.

Spark plug gap: L

1.0 — 1.1 mm (0.039 — 0.043 in)



NOTE:

Replace with a new spark plug if area (A) is worn to a rounded shape.

D: CLEANING

Clean the spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove the carbon or oxide deposits. When doing this, do not wear away the ceramic part.

If deposits cannot be removed, replace the spark plugs.

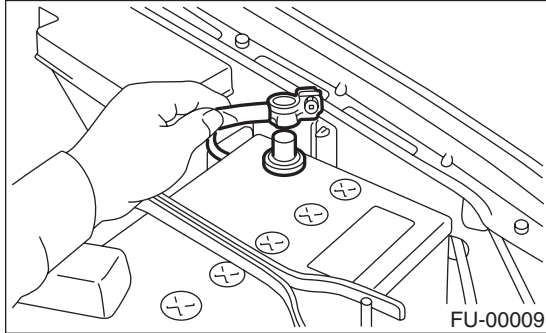
IGNITION COIL AND IGNITOR ASSEMBLY

IGNITION

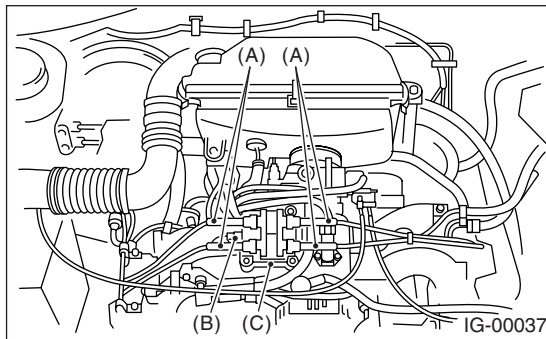
3. Ignition Coil and Ignitor Assembly

A: REMOVAL

- 1) Disconnect the ground cable from battery.

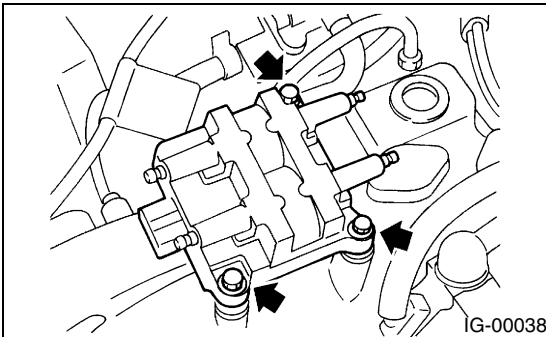


- 2) Disconnect spark plug cords from the ignition coil and ignitor assembly.
- 3) Disconnect connector from the ignition coil and ignitor assembly.



- (A) Spark plug cord
- (B) Connector
- (C) Ignition coil and ignitor assembly

- 4) Remove the ignition coil and ignitor assembly.



B: INSTALLATION

- 1) Install in the reverse order of removal.
- For tightening torques, refer to "COMPONENT".<Ref. to IG(H4SO)-3, COMPONENT, General Description.>

C: INSPECTION

Using a tester, inspect the following items. Replace if defective.

- 1) Primary resistance
- 2) Secondary coil resistance

CAUTION:

If the resistance is extremely low, this indicates the presence of a short-circuit.

Specified resistance:

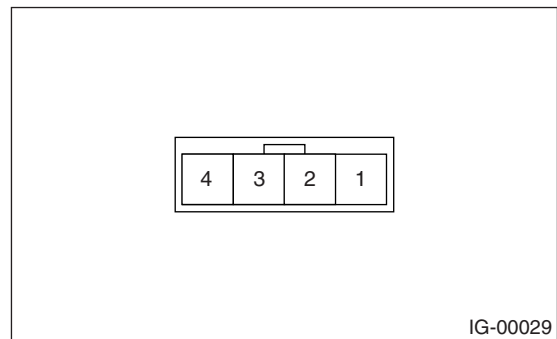
[Primary side]

Between terminal No. 2 and No. 4

$0.73 \Omega \pm 10\%$

Between terminal No. 1 and No. 2

$0.73 \Omega \pm 10\%$



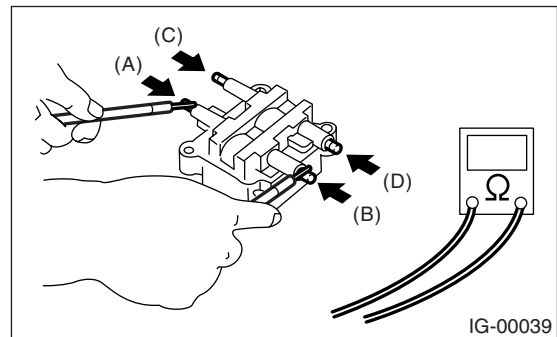
[Secondary side]

Between (A) and (B)

$12.8 k\Omega \pm 15\%$

Between (C) and (D)

$12.8 k\Omega \pm 15\%$



- 3) Insulation between primary terminal and case: 100 MΩ or more.

4. Spark Plug Cord

A: INSPECTION

Check for:

- 1) Damage to cords, deformation, burning or rust on terminals
- 2) Resistance value of cords

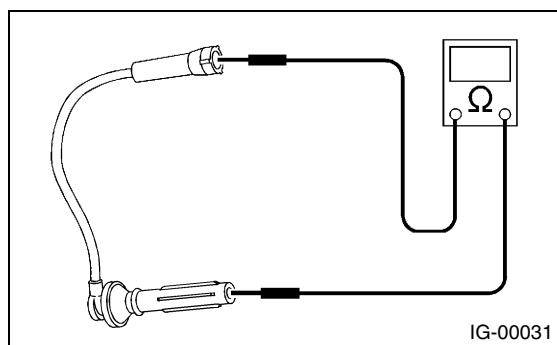
Resistance values:

#1 cord: 5.6 — 10.6 k Ω

#2 cord: 7.3 — 13.7 k Ω

#3 cord: 5.9 — 11.1 k Ω

#4 cord: 7.3 — 13.7 k Ω



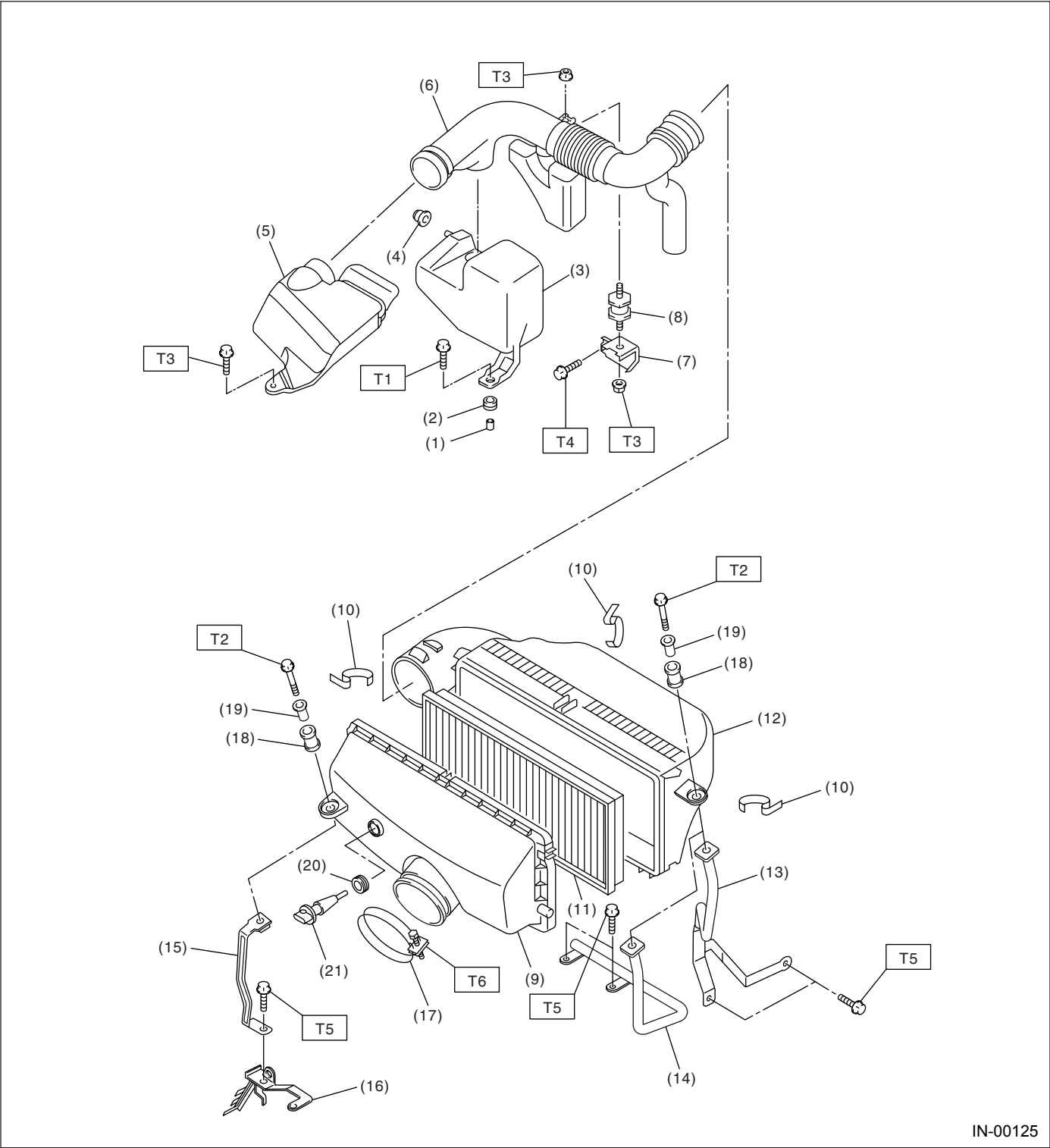
SPARK PLUG CORD

IGNITION

GENERAL DESCRIPTION

INTAKE (INDUCTION)

1. General Description
A: COMPONENT



IN-00125

GENERAL DESCRIPTION

INTAKE (INDUCTION)

(1) Spacer	(11) Air cleaner element	(21) Intake air temperature sensor
(2) Bushing	(12) Air cleaner case B	
(3) Resonator chamber	(13) Stay LH (MT vehicles)	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(4) Cushion	(14) Stay LH (AT vehicles)	<i>T1: 33 (3.4, 24.6)</i>
(5) Air intake duct A	(15) Stay RH	<i>T2: 6.5 (0.66, 4.8)</i>
(6) Air intake duct B	(16) Engine harness bracket	<i>T3: 7.5 (0.76, 5.5)</i>
(7) Bracket	(17) Clamp	<i>T4: 14 (1.4, 10)</i>
(8) Cushion	(18) Bushing	<i>T5: 16 (1.6, 11.6)</i>
(9) Air cleaner case A	(19) Spacer	<i>T6: 3 (0.3, 2.2)</i>
(10) Clip	(20) Grommet	

GENERAL DESCRIPTION

INTAKE (INDUCTION)

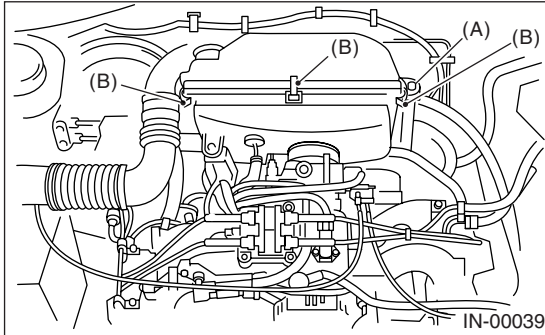
B: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Air Cleaner Element

A: REMOVAL

- 1) Remove the air intake duct from air cleaner case.
- 2) Remove bolt (A) which secures air cleaner case to stay.
- 3) Remove clip (B) from above the air cleaner case.



- 4) Remove the air cleaner element.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

- Fasten with the clip after inserting the lower tab of the case.
- For tightening torques, refer to "COMPONENT".
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

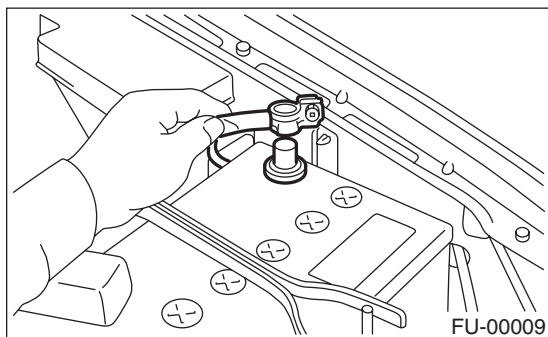
C: INSPECTION

Replace if excessively damaged or dirty.

3. Air Cleaner Case

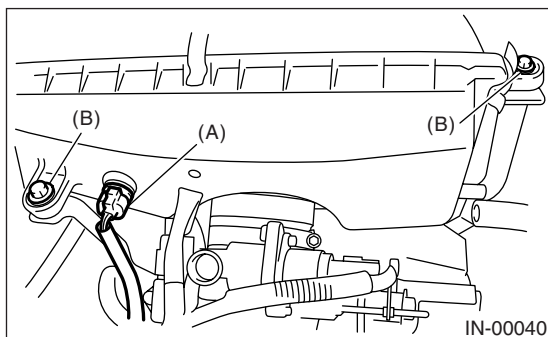
A: REMOVAL

1) Disconnect the ground cable from battery.



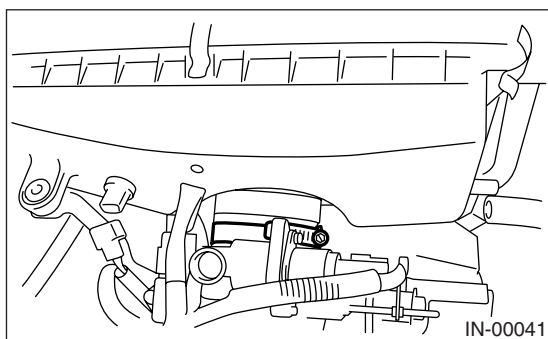
2) Disconnect the connector (A) of intake air temperature sensor.

3) Remove bolts (B) which install air cleaner case to stay.



4) Disconnect the hoses and intake duct from air cleaner case.

5) Loosen the clamp which connects air cleaner case to throttle body.



6) Remove the air cleaner case.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

For tightening torques, refer to "COMPONENT".
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

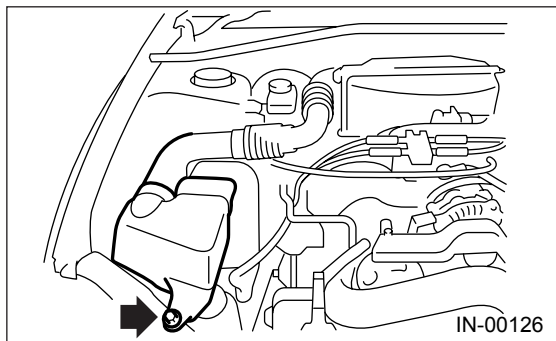
C: INSPECTION

Inspect for cracks and loose connections.

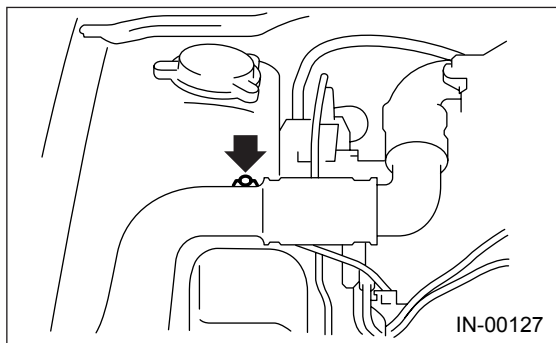
4. Air Intake Duct

A: REMOVAL

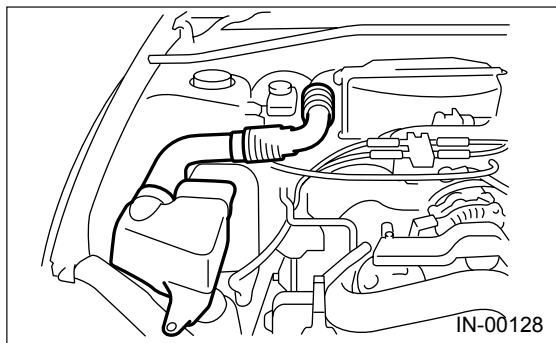
1) Remove the bolt which installs air intake duct A on the front side of body.



2) Remove the bolt which installs air intake duct B on the body.



3) Remove the air intake duct as a unit.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

For tightening torques, refer to "COMPONENT".
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

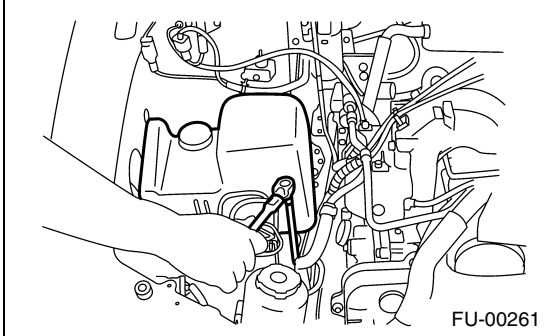
C: INSPECTION

- 1) Inspect for cracks and loose connections.
- 2) Inspect that no foreign objects are mixed in the air intake duct.

5. Resonator Chamber

A: REMOVAL

- 1) Remove the air intake duct. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.>
- 2) Remove the resonator chamber.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

For tightening torques, refer to "COMPONENT".
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

C: INSPECTION

Inspect for cracks and loose connections.

GENERAL DESCRIPTION

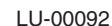
LUBRICATION

1. General Description

A: SPECIFICATIONS

Lubrication method					Forced lubrication	
Oil pump	Pump type				Trochoid type	
	Number of teeth		Inner rotor		9	
			Outer rotor		10	
	Outer rotor diameter × thickness		Non-turbo		78 × 7 mm (3.07 × 0.28 in)	
			Turbo		78 × 10 mm (3.07 × 0.39 in)	
	Tip clearance between inner and outer rotors			STD	0.04 — 0.14 mm (0.0016 — 0.0055 in)	
				Limit	0.18 mm (0.0071 in)	
	Side clearance between inner rotor and pump case			STD	0.02 — 0.07 mm (0.0008 — 0.0028 in)	
				Limit	0.12 mm (0.0047 in)	
	Case clearance between outer rotor and pump case			STD	0.10 — 0.175 mm (0.0039 — 0.0069 in)	
				Limit	0.20 mm (0.0079 in)	
	Capacity at oil temp. 80°C (176°F)		Non-turbo	600 rpm	Discharge pressure	98 kPa (1.0 kg/cm ² , 14 psi)
				5,000 rpm	Discharge flow	3.2 ℓ (3.4 US qt, 2.8 Imp qt)/min.
					Discharge pressure	294 kPa (3.0 kg/cm ² , 43 psi)
				Discharge flow	32.6 ℓ (34.4 US qt, 28.7 Imp qt)/min.	
			Turbo	600 rpm	Discharge pressure	98 kPa (1.0 kg/cm ² , 14 psi)
				5,000 rpm	Discharge flow	4.6 ℓ (4.9 US qt, 4.0 Imp qt)/min.
					Discharge pressure	294 kPa (3.0 kg/cm ² , 43 psi)
				Discharge flow	47.0 ℓ (49.7 US qt, 41.4 Imp qt)/min.	
Relief valve operation pressure		Non-turbo		490 kPa (5.0 kg/cm ² , 71 psi)		
		Turbo		588 kPa (6.0 kg/cm ² , 85 psi)		
Oil filter	Type				Full-flow filter type	
	Filtration area				910 cm ² (141 sq in)	
	Bypass valve opening pressure				157 kPa (1.60 kg/cm ² , 22.8 psi)	
	Outer diameter × width				80 × 70 mm (3.15 × 2.76 in)	
	Oil filter to engine thread size				M 20 × 1.5	
Oil pres- sure switch	Type				Immersed contact point type	
	Working voltage — wattage				12 V — 3.4 W or less	
	Warning light activation pressure				14.7 kPa (0.15 kg/cm ² , 2.1 psi)	
	Proof pressure				More than 981 kPa (10 kg/cm ² , 142 psi)	
Oil capacity (at replacement)			Non-turbo		4.0 ℓ (4.2 US qt, 3.5 Imp qt)	
			Turbo		4.5 ℓ (4.8 US qt, 4.0 Imp qt)	

1. NON-TURBO MODEL

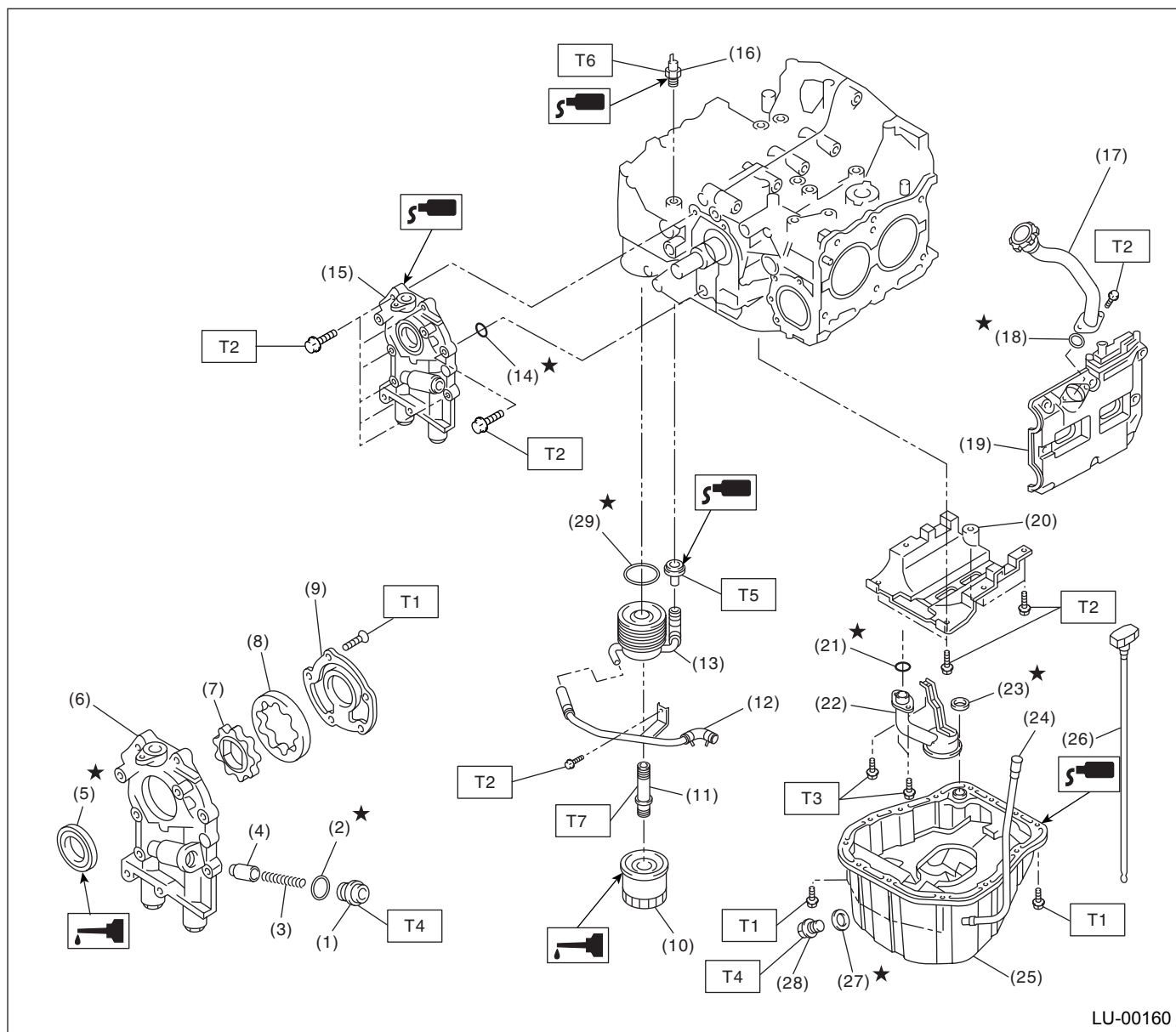


- T5: 44 (4.5, 32.5)**

GENERAL DESCRIPTION

LUBRICATION

2. TURBO MODEL



- | | |
|---------------------------|----------------------------|
| (1) Plug | (16) Oil pressure switch |
| (2) Gasket | (17) Oil filler duct |
| (3) Relief valve spring | (18) O-ring |
| (4) Relief valve | (19) Rocker cover |
| (5) Oil seal | (20) Baffle plate |
| (6) Oil pump case | (21) O-ring |
| (7) Inner rotor | (22) Oil strainer |
| (8) Outer rotor | (23) Gasket |
| (9) Oil pump cover | (24) Oil level gauge guide |
| (10) Oil filter | (25) Oil pan |
| (11) Oil cooler connector | (26) Oil level gauge |
| (12) Water bypass pipe | (27) Metal gasket |
| (13) Oil cooler | (28) Drain plug |
| (14) O-ring | (29) O-ring |
| (15) Oil pump assembly | |

Tightening torque: N·m (kgf·m, ft·lb)

- | | |
|------------|------------------------|
| T1: | 5 (0.5, 3.6) |
| T2: | 6.4 (0.65, 4.7) |
| T3: | 10 (1.0, 7.0) |
| T4: | 44 (4.5, 32.5) |
| T5: | 69 (7.0, 50.9) |
| T6: | 25 (2.5, 18.1) |
| T7: | 54 (5.5, 40) |

LU(H4SO)-4

C: CAUTION

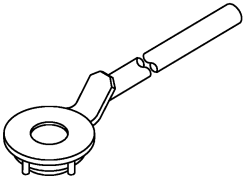
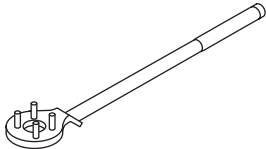
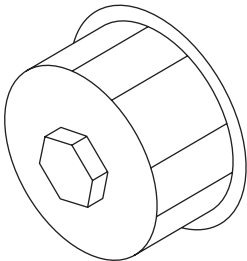
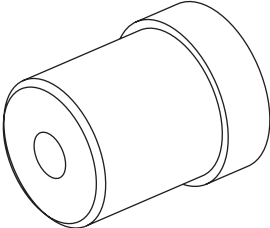
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

GENERAL DESCRIPTION

LUBRICATION

D: PREPARATION TOOL

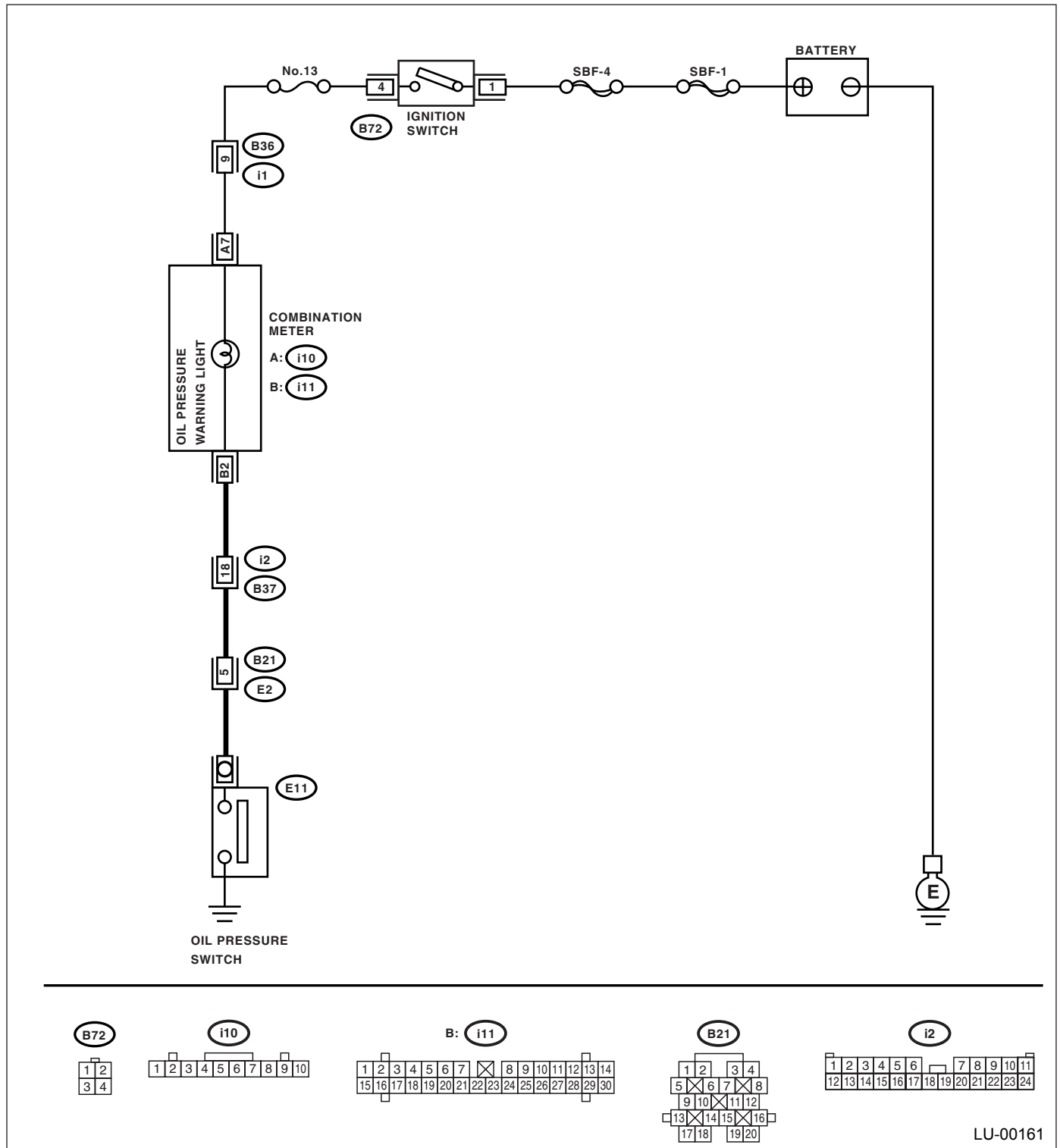
1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977400	499977400 (2000 cc model)	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST-499977100	499977100 (2500 cc model)	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

2. Oil Pressure System

A: SCHEMATIC

1. NON-TURBO MODEL



B: INSPECTION

	Step	Check	Yes	No
1	CHECK COMBINATION METER. 1) Turn ignition switch to ON. (engine OFF) 2) Check other warning lights. Do the warning lights go on?	Warning lights go on.	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. 1) Turn ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn ignition switch to ON. 4) Measure the voltage of harness between the combination meter connector and chassis ground. Connector & terminal (E11) No. 1 (+) — Chassis ground (-): Is the measured value more than the specified value?	10 V	Replace the oil pressure switch.	Go to step 3.
3	CHECK COMBINATION METER. 1) Turn ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. Terminal No. B2 — No. A7: Is the measured value less than the specified value?	10 Ω	Replace the harness connector between combination meter and oil pressure switch.	Repair or replace the combination meter and the oil pressure switch warning light bulb.

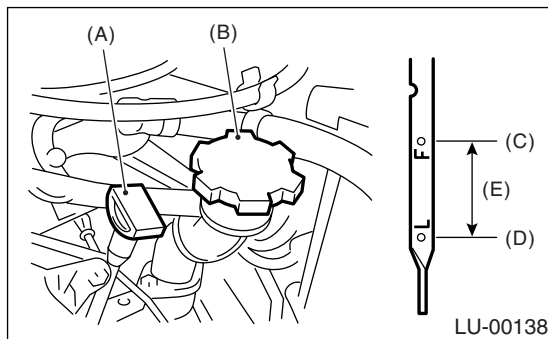
3. Engine Oil

A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
- 4) Remove it again and note the reading. If the engine oil level is below the "L" line, add oil to bring the level up to "F" line.
- 5) After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.
- 6) Just after driving or while the engine is warm, engine oil level may show in the range between the "F" line and notch mark. This is caused by thermal expansion of the engine oil.

NOTE:

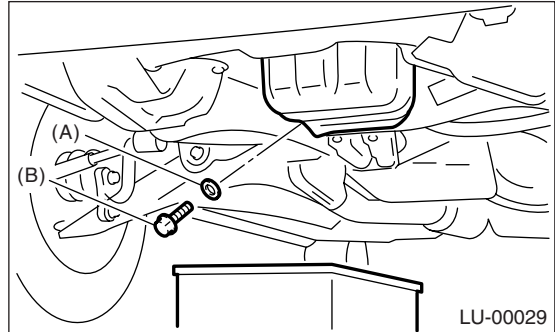
To prevent overfilling the engine oil, do not add oil above the "F" line when the engine is cold.



- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 l (1.1 Us qt, 0.9 Imp qt)

B: REPLACEMENT

- 1) Open the engine oil filler cap for quick draining of the engine oil.
- 2) Drain the engine oil by loosening engine oil drain plug.

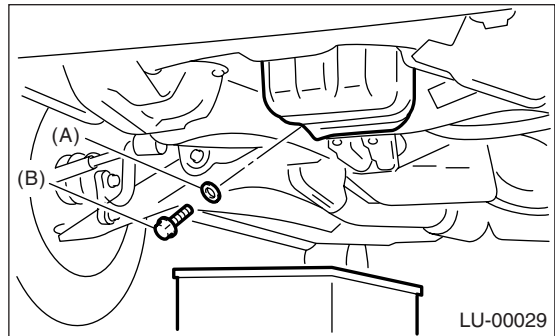


- (A) Gasket
- (B) Drain plug

- 3) Replace the drain plug gasket.
- 4) Tighten the engine oil drain plug after draining engine oil.

Tightening torque:

44 N·m (4.5 kgf-m, 32.5 ft-lb)



- (A) Gasket
- (B) Drain plug

- 5) Fill engine oil through the filler pipe up to upper point on level gauge. Make sure that the vehicle is placed level when checking oil level. Use the engine oil of proper quality and viscosity, selected in accordance with the table in figure.

Recommended oil

API classification

SL, SJ or SH grade oil with the words "Energy Conserving" or "Energy Conserving II", or the new API mark indicated on the container (if SL or SJ grade oil is unavailable, use SH or SG grade oil).

Engine oil capacity: (Non-turbo model)

Upper level

4.0 ℓ (4.2 US qt, 3.5 Imp qt)

Lower level

3.0 ℓ (3.2 US qt, 2.6 Imp qt)

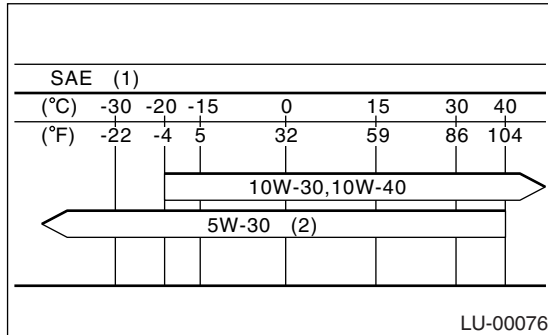
Engine oil capacity: (Turbo model)

Upper level

4.5 ℓ (4.8 US qt, 4.0 Imp qt)

Lower level

3.5 ℓ (3.7 US qt, 3.1 Imp qt)



- (1) SAE viscosity No. and applicable temperature
- (2) Preferred

Oil of a proper viscosity ensures good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

CAUTION:

When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. specified by SUBARU.

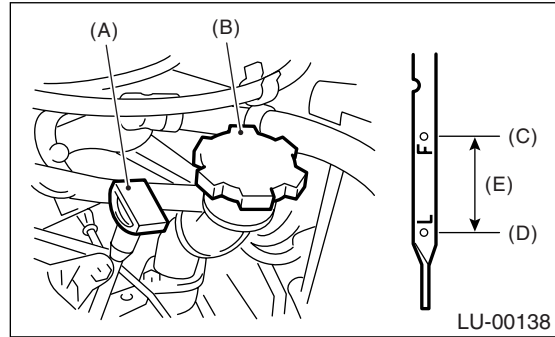
NOTE:

If the vehicle is used in areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: API classification: SL, SJ or SH
SAE viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

6) Close the engine oil filler cap.

7) Start the engine and warm it up for a while.

8) After the engine stops, recheck the oil level. If necessary, add engine oil up to the upper level on level gauge.

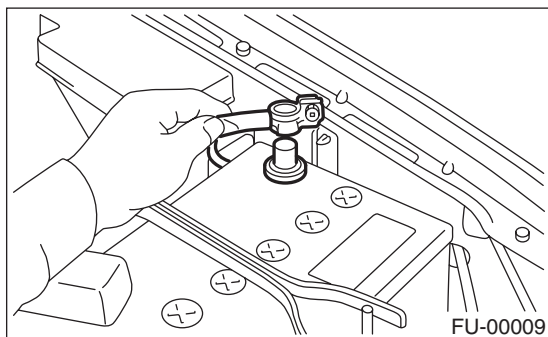


- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 Us qt, 0.9 Imp qt)

4. Oil Pump

A: REMOVAL

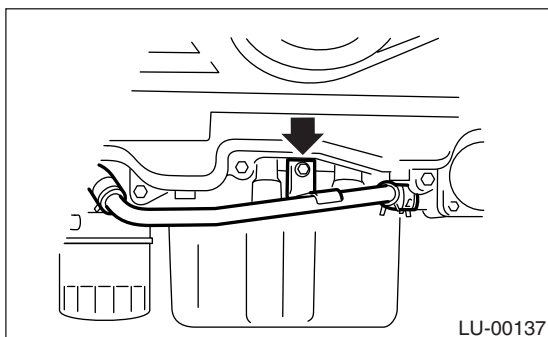
1) Disconnect the ground cable from battery.



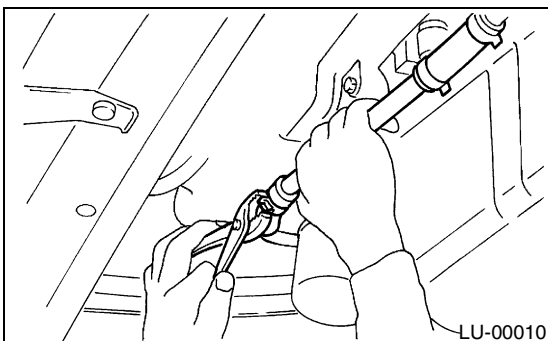
2) Lift up the vehicle.

3) Remove the under cover.

4) Remove the bolts which install water pipe of oil cooler to oil pump. (Turbo model)

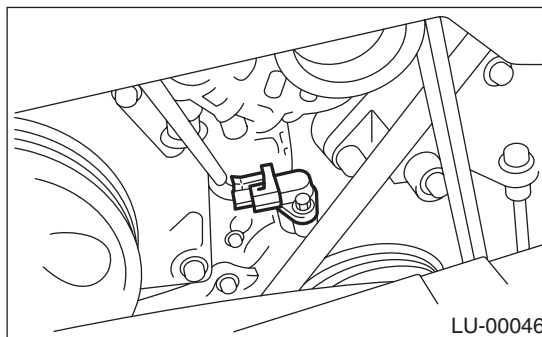


5) Remove the water pipe and hoses between oil cooler and water pump. (Turbo model)



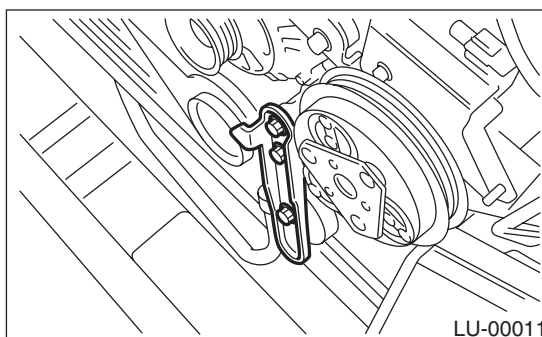
6) Remove the radiator. <Ref. to CO(H4SO)-38, REMOVAL, Radiator.>

7) Remove the crankshaft position sensor.



8) Remove the V-belts. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-44, REMOVAL, V-belt.>

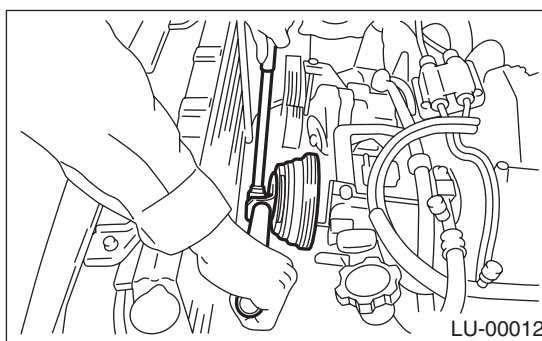
9) Remove the rear side V-belt tensioner.



10) Remove the crankshaft pulley by using ST.

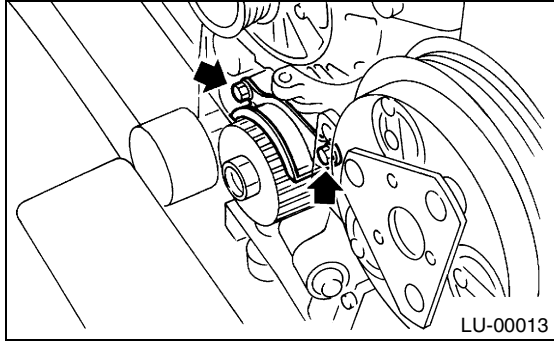
ST 499977400 CRANKSHAFT PULLEY WRENCH (2000 cc model)

ST 499977100 CRANKSHAFT PULLEY WRENCH (2500 cc model)

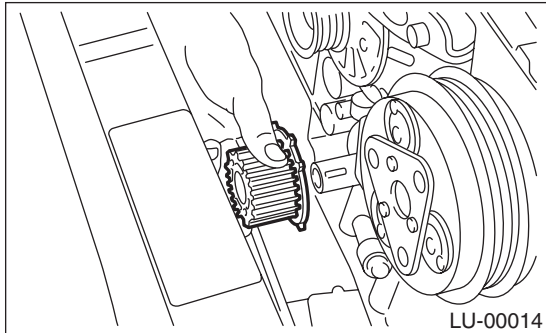


11) Remove the water pump. <Ref. to CO(H4SO)-31, REMOVAL, Water Pump.>

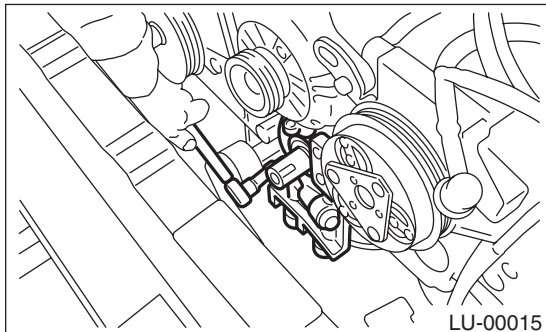
12) Remove the timing belt guide. (MT vehicles)



13) Remove the crankshaft sprocket.



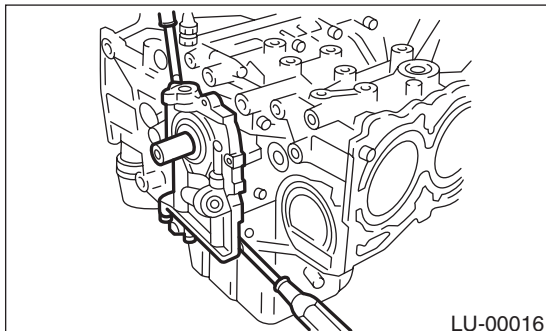
14) Remove the bolts which install oil pump onto cylinder block.



15) Remove the oil pump by using a flat tip screwdriver.

CAUTION:

Be careful not to scratch the mating surfaces of cylinder block and oil pump.



B: INSTALLATION

Install in the reverse order of removal.

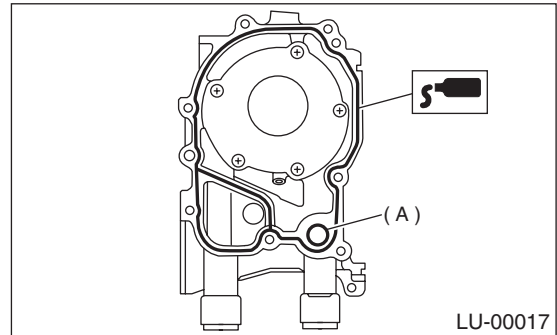
Do the following:

1) Apply liquid gasket to the mating surfaces of oil pump.

Liquid gasket:

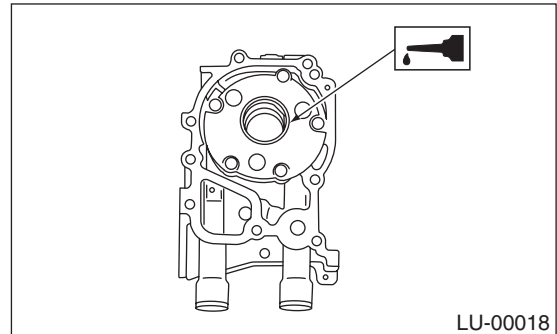
Part No. 004403007

ThreeBond 1215 or equivalent



2) Replace the O-ring (A) with a new one.

3) Apply a coat of engine oil to the inside of oil seal.



4) Be careful not to scratch the oil seal when installing oil pump on cylinder block.

5) Position the oil pump, aligning the notched area with crankshaft, and push the oil pump straight.

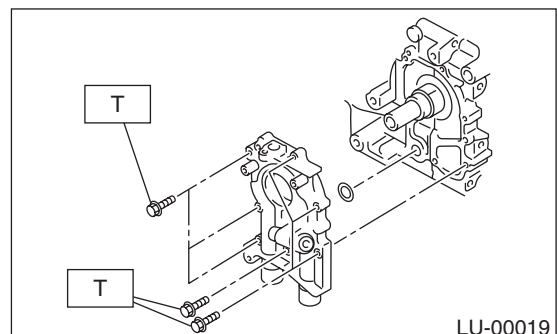
CAUTION:

Make sure the oil seal lip is not folded.

6) Install the oil pump.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



OIL PUMP

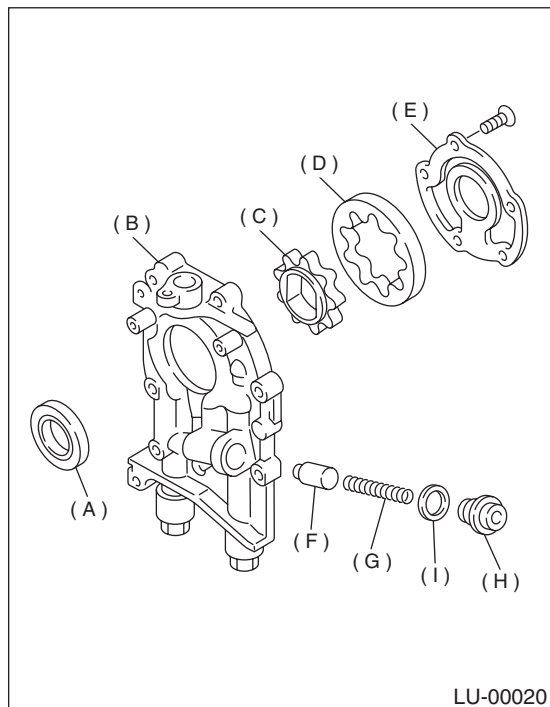
LUBRICATION

C: DISASSEMBLY

Remove the screws which secure oil pump cover and disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

CAUTION:

Before disassembling the oil pump, remove the relief valve.



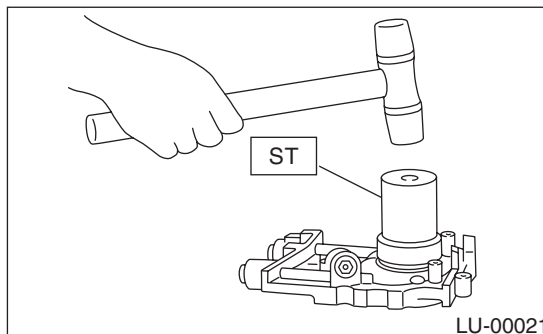
- (A) Oil seal
- (B) Pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

D: ASSEMBLY

1) Install the front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new oil seal.



2) Apply a coat of engine oil to the inner and outer rotors.

3) Install the inner and outer rotors in their original positions.

4) Install the oil relief valve and relief valve spring and plug.

NOTE:

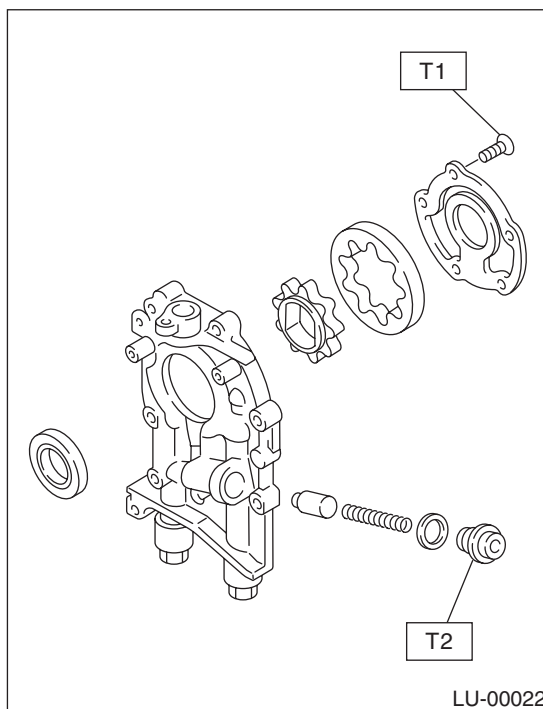
Use a new gasket.

5) Install the oil pump cover.

Tightening torque:

T1: 5 N·m (0.5 kgf-m, 3.6 ft-lb)

T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)



E: INSPECTION**1. TIP CLEARANCE**

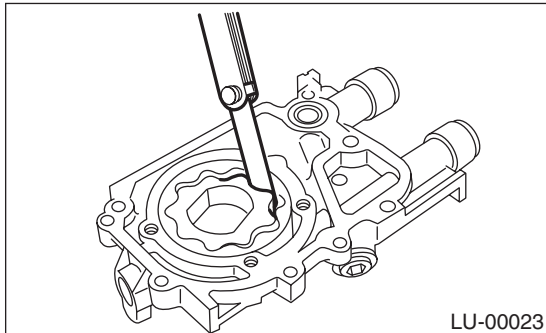
Measure the tip clearance of rotors. If clearance exceeds the limit, replace the rotors as a matched set.

Tip clearance:**Standard**

0.04 — 0.14 mm (0.0016 — 0.0055 in)

Limit

0.18 mm (0.0071 in)



LU-00023

2. CASE CLEARANCE

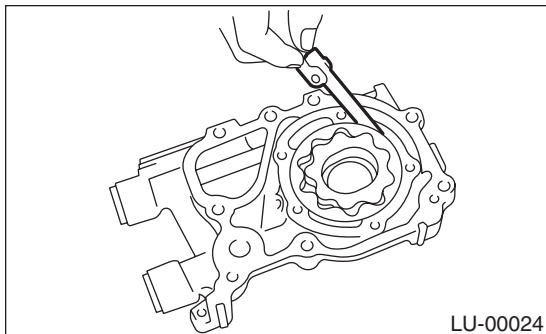
Measure the clearance between the outer rotor and oil pump rotor housing. If clearance exceeds the limit, replace the rotor.

Case clearance:**Standard**

0.10 — 0.175 mm (0.0039 — 0.0069 in)

Limit

0.20 mm (0.0079 in)



LU-00024

3. SIDE CLEARANCE

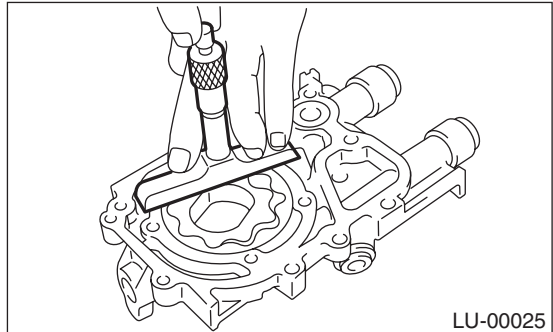
Measure the clearance between the oil pump inner rotor and pump cover. If clearance exceeds the limit, replace the rotor or pump body.

Side clearance:**Standard**

0.02 — 0.07 mm (0.0008 — 0.0028 in)

Limit

0.12 mm (0.0047 in)



LU-00025

4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

Relief valve spring:**Non-turbo model****Free length**

72.8 mm (2.866 in)

Installed length

54.7 mm (2.154 in)

Load when installed

81.3 N (8.29 kgf, 18.24 lb)

Turbo model**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, 20.88 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

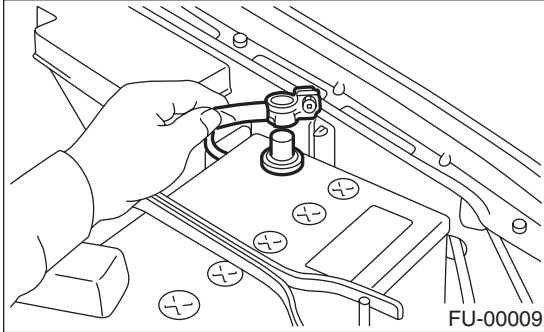
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

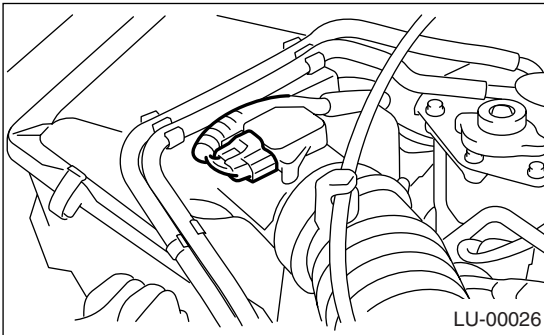
5. Oil Pan and Strainer

A: REMOVAL

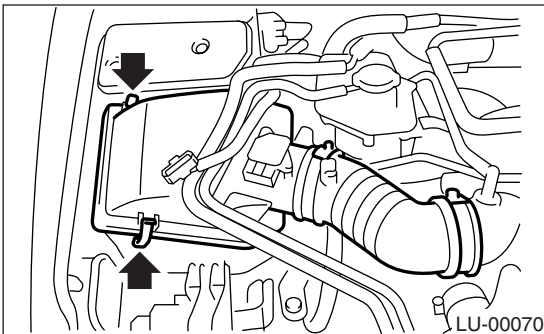
- 1) Set the vehicle on a lift.
- 2) Remove the front wheels.
- 3) Disconnect the ground cable from battery.



- 4) Remove the air intake duct and air cleaner case. (Non-turbo model)
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.>and<Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 5) Disconnect the connector from mass air flow sensor. (Turbo model)

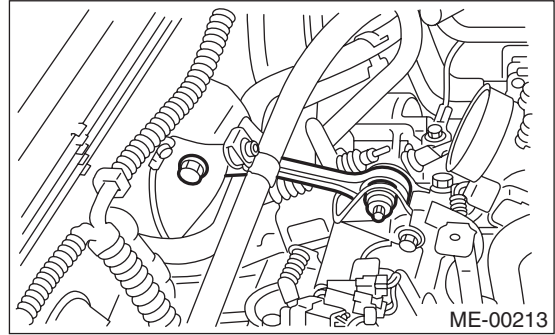


- 6) Remove the air intake boot and air cleaner upper cover. (Turbo model)

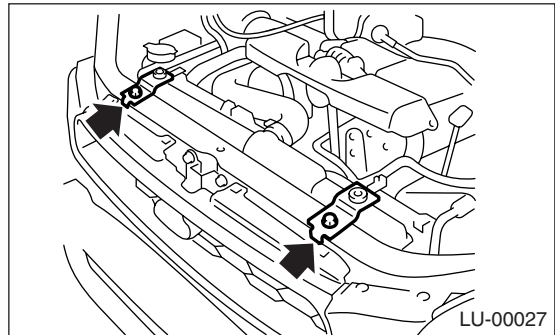


- 7) Remove the intercooler. (Turbo model)
<Ref. to IN(H4DOTC)-11, REMOVAL, Intercooler.>

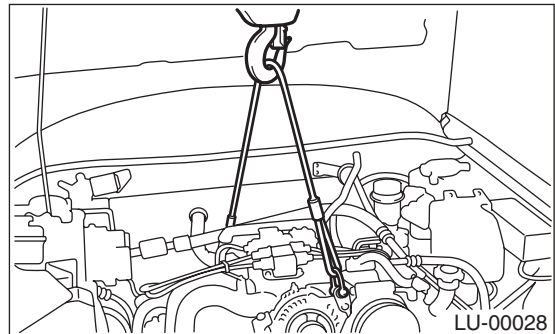
- 8) Remove the pitching stopper.



- 9) Remove the radiator upper brackets.



- 10) Support the engine with a lifting device and wire ropes.



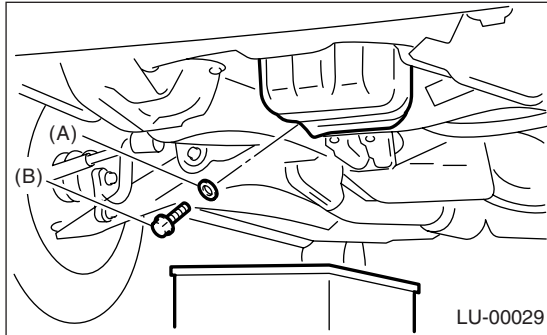
- 11) Lift up the vehicle.

CAUTION:
When lifting up the vehicle, raise the wire ropes together.

- 12) Remove the under cover.

13) Drain the engine oil.

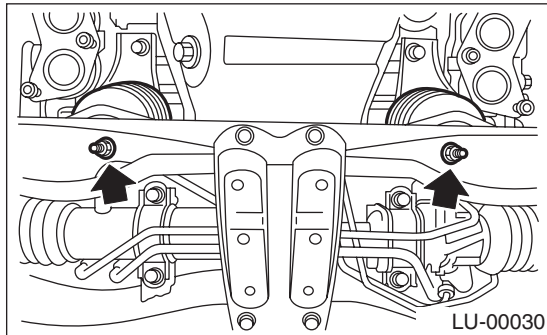
Set a container under the vehicle, and remove the drain plug from oil pan.



- (A) Gasket
- (B) Drain plug

14) Remove the front and center exhaust pipes.(Non-turbo model) <Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

15) Remove the nuts which install front cushion rubber onto front crossmember.

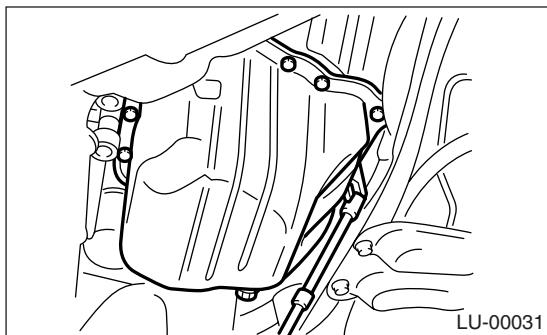


16) Remove the bolts which install oil pan on cylinder block while raising up engine.

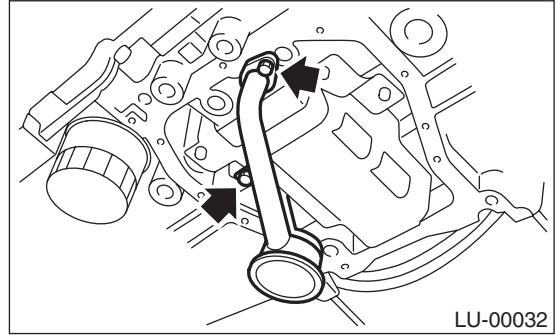
17) Insert the oil pan cutter blade between the cylinder block and oil pan.

NOTE:

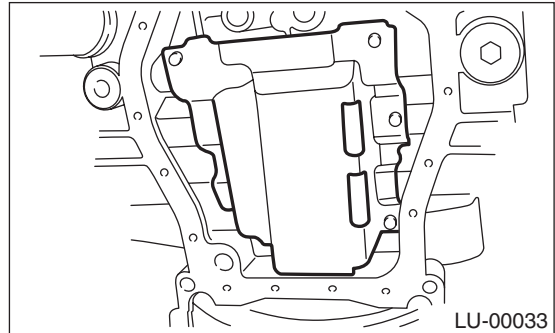
Do not use a screwdriver or similar tool in place of oil pan cutter.



18) Remove the oil strainer.



19) Remove the baffle plate.

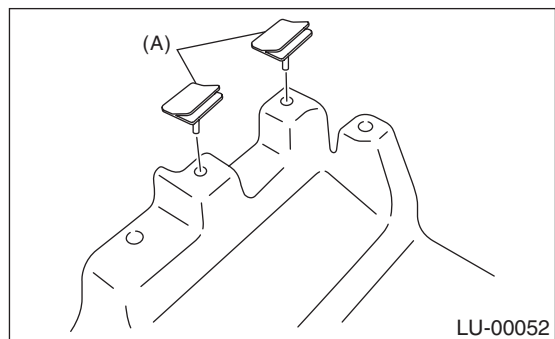


B: INSTALLATION

CAUTION:

Before installing the oil pan, clean sealant from oil pan and engine block.

1) Check the seal (A) is securely installed in baffle plate in the direction as shown in the figure.



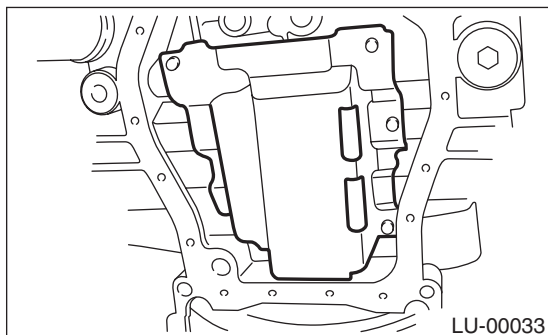
OIL PAN AND STRAINER

LUBRICATION

2) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



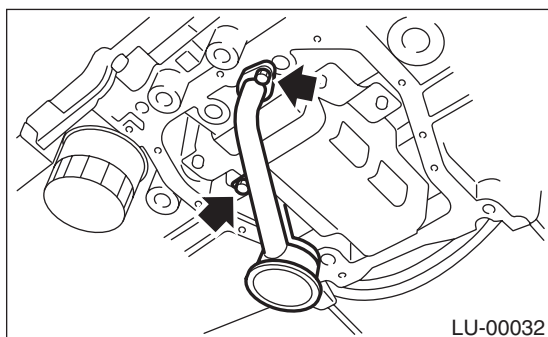
3) Install the oil strainer onto baffle plate.

NOTE:

Replace the O-ring with a new one.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

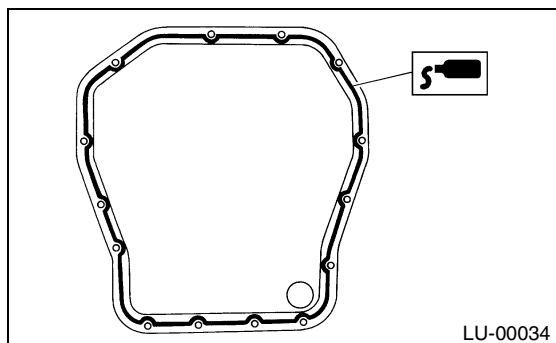


4) Apply liquid gasket to the mating surfaces and install oil pan.

Liquid gasket:

Part No. 004403007

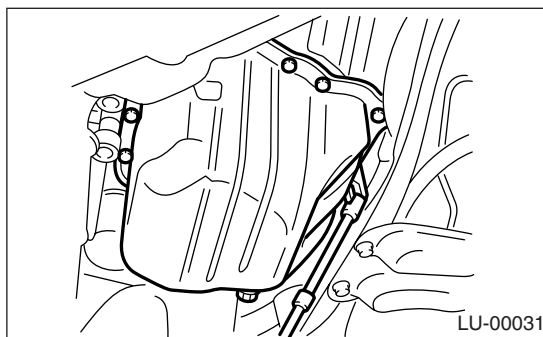
ThreeBond 1215 or equivalent



5) Tighten the bolts which install the oil pan onto engine block.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

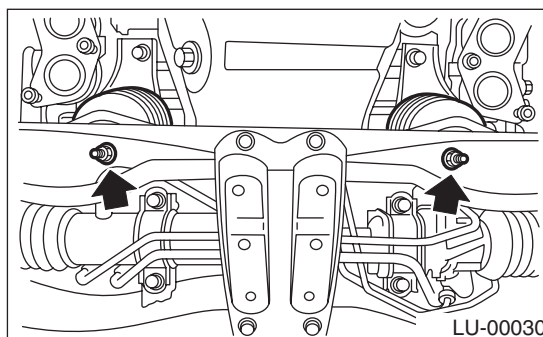


6) Lower the engine onto front crossmember.

7) Tighten the nuts which install front cushion rubber onto front crossmember.

Tightening torque:

69 N·m (7.0 kgf-m, 50.9 ft-lb)

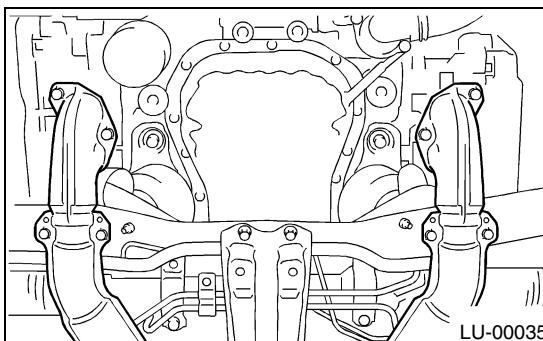


8) Install the front and center exhaust pipe. (Non-turbo model)

<Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>

NOTE:

Use a new gasket.



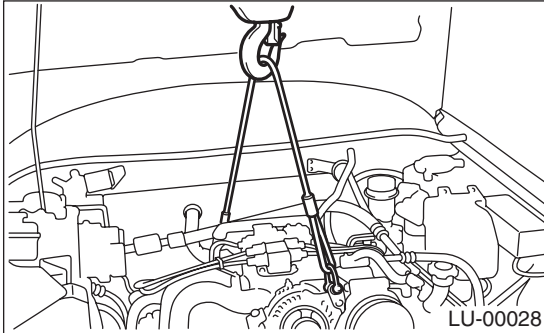
9) Install the under cover.

10) Lower the vehicle.

CAUTION:

When lowering the vehicle, lower the lifting device and wire ropes together.

11) Remove the lifting device and wire ropes.

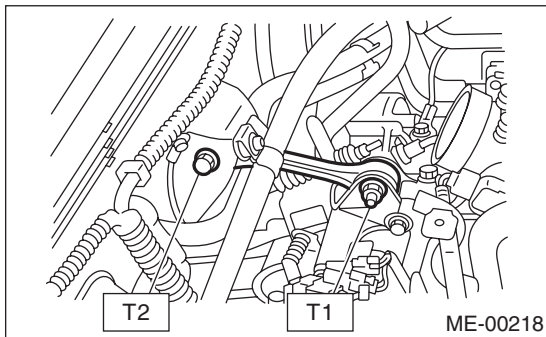


12) Install the pitching stopper.

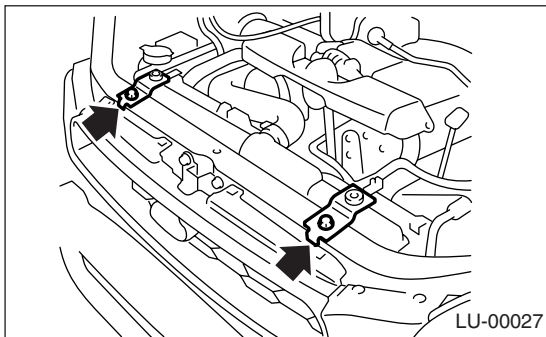
Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



13) Install the radiator upper brackets.

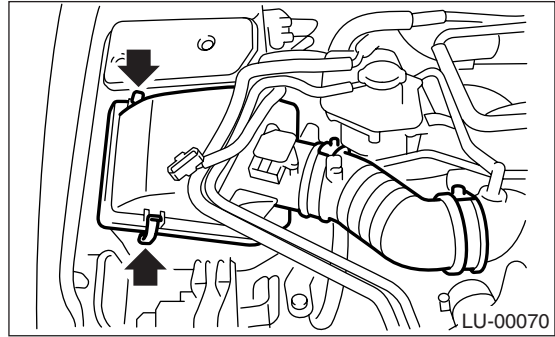


14) Install the air intake duct and air cleaner case. (Non-turbo model)

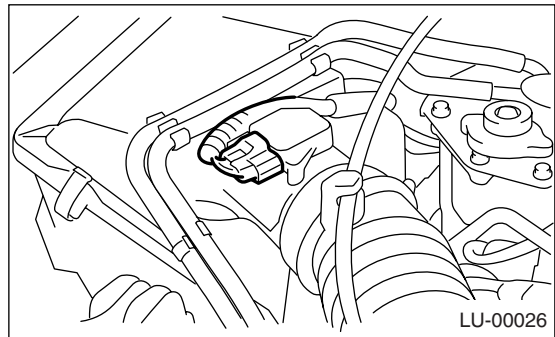
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>

15) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

16) Install the air intake boot and air cleaner upper cover. (Turbo model)

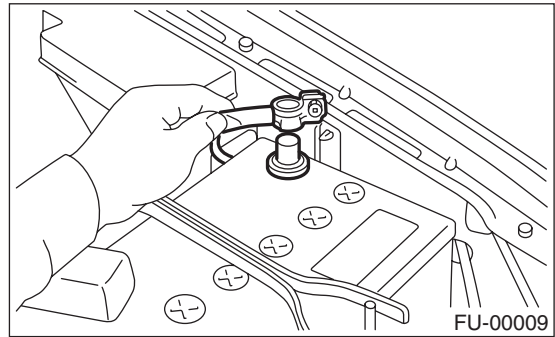


17) Connect the mass air flow sensor connector. (Turbo model)



18) Install the front wheels.

19) Connect the battery ground cable to battery.



20) Fill engine oil. <Ref. to LU(H4SO)-10, INSPECTION, Engine Oil.>

C: INSPECTION

By visual check make sure the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

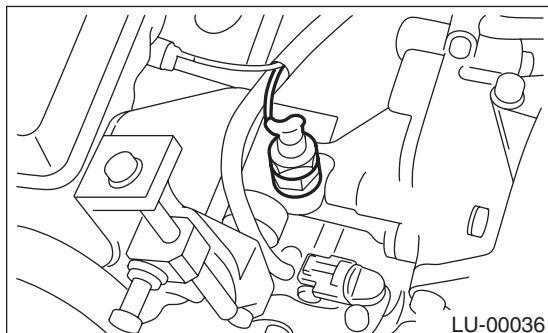
OIL PRESSURE SWITCH

LUBRICATION

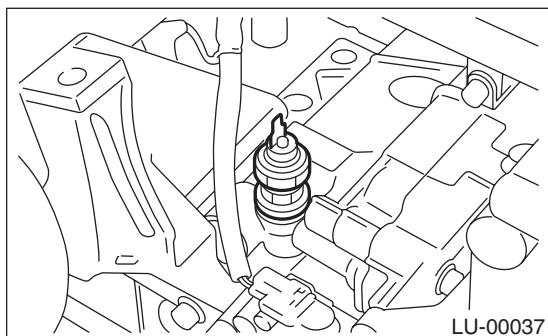
6. Oil Pressure Switch

A: REMOVAL

- 1) Remove the generator from bracket. <Ref. to SC(H4SO)-13, REMOVAL, Generator.>
- 2) Disconnect the terminal from oil pressure switch.



- 3) Remove the oil pressure switch.



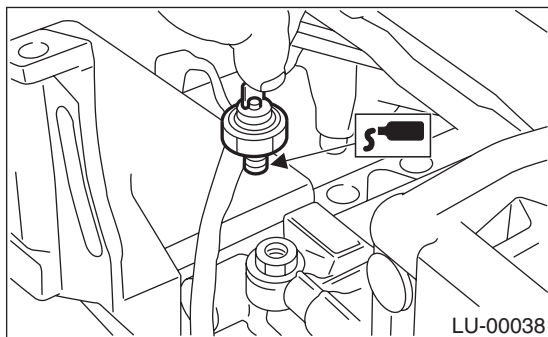
B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:

Part No. 004403007

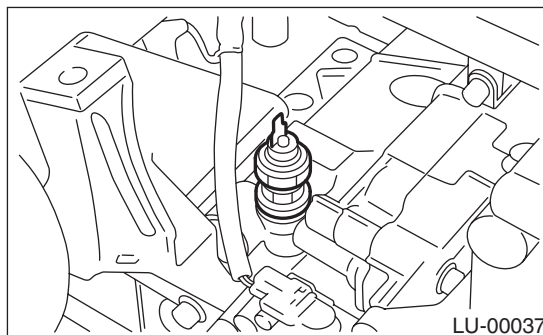
ThreeBond 1324 or equivalent



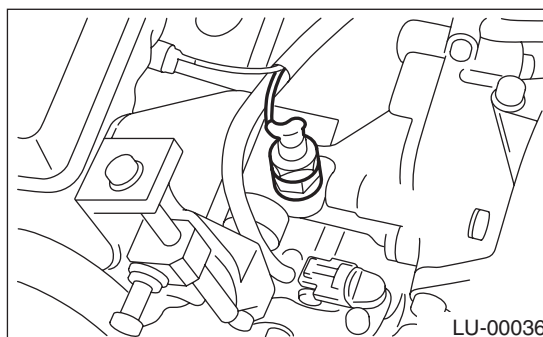
- 2) Install the oil pressure switch onto engine block.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 3) Connect the terminal of oil pressure switch.



- 4) Install the generator on bracket. <Ref. to SC(H4SO)-13, INSTALLATION, Generator.>

C: INSPECTION

Make sure oil does not leak or seep from where the oil pressure switch is installed.

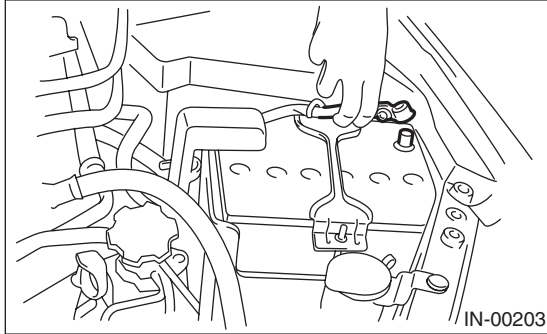
7. Oil Pipe

A: REMOVAL

NOTE:

The oil pipe is installed on turbo models.

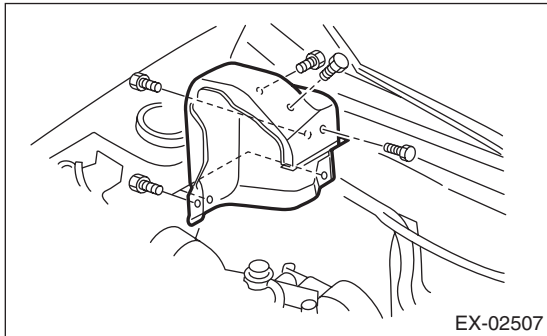
1) Disconnect the ground cable from battery.



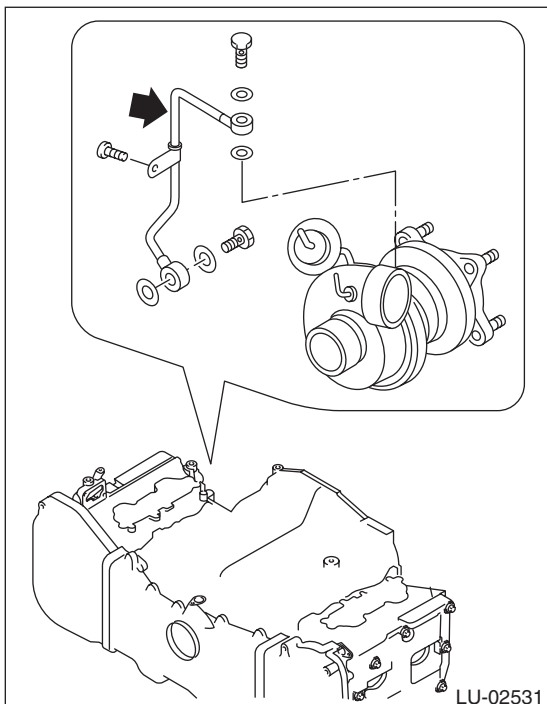
2) Remove the intercooler. <Ref. to IN(H4DOTC)-11, REMOVAL, Intercooler.>

3) Remove the intercooler bracket RH.

4) Remove the turbocharger upper cover.



5) Remove the oil inlet pipe from the turbocharger.



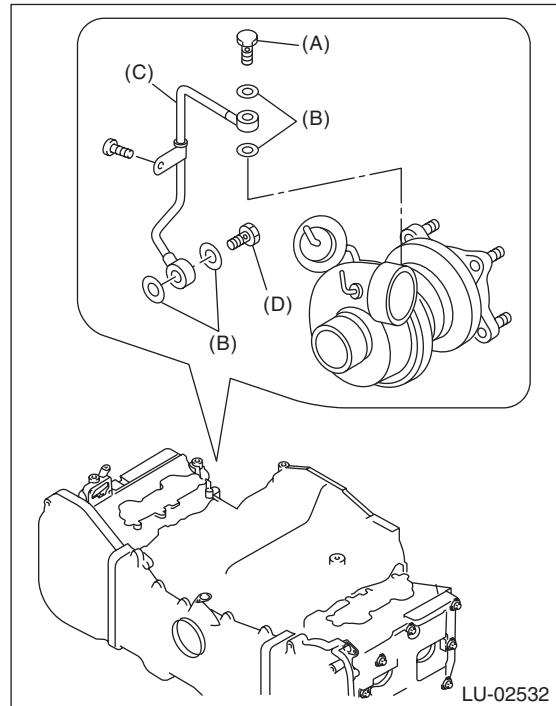
B: INSTALLATION

1) Inspect the union screw with filter. <Ref. to LU(H4SO)-22, INSPECTING UNION SCREW WITH FILTER, INSPECTION, Oil Pipe.>

2) Temporarily install the oil pipe.

NOTE:

- Make sure not to mix up the union screws with filter and without filter as their installation positions are different.
- Use a new gasket.



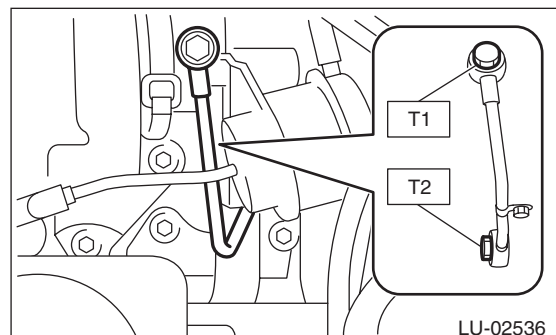
- (A) Union screw without filter (without protrusion)
- (B) Gasket
- (C) Oil inlet pipe
- (D) Union screw with filter (with protrusion)

3) Tighten the union screws of oil inlet pipe.

Tightening torque:

T1: 16 N·m (1.6 kgf-m, 11.6 ft-lb)

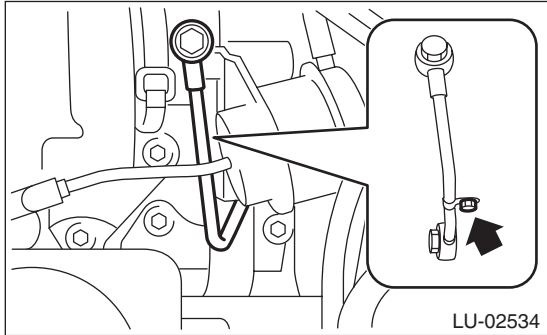
T2: 29 N·m (3.0 kgf-m, 21.7 ft-lb)



4) Tighten the bolts which hold the oil inlet pipe stay to the turbocharger.

Tightening torque:

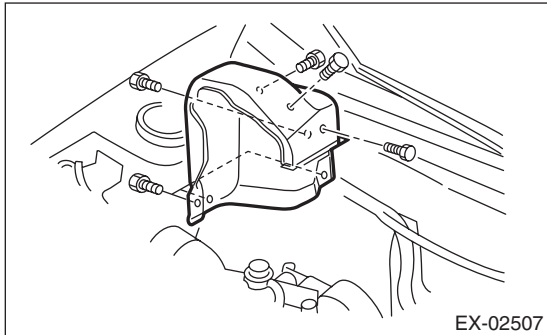
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



5) Install the turbocharger upper cover.

Tightening torque:

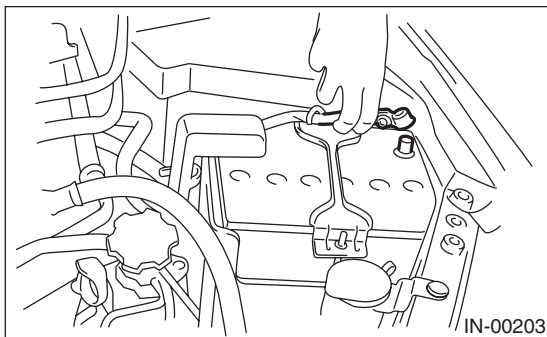
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



6) Install the intercooler bracket RH.

7) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

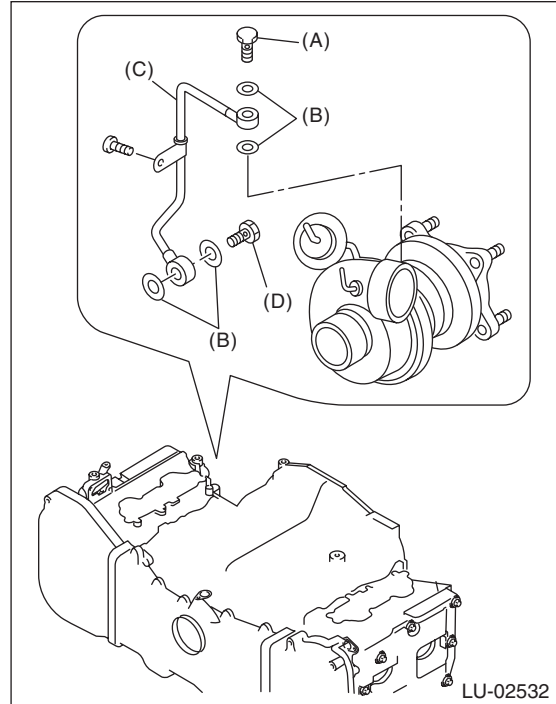
8) Connect the ground cable to battery.



C: INSPECTION

1. INSPECTING UNION SCREW WITH FILTER

Check the filter part of union screw for clogging or damage, and if defective, replace the union screw with filter with a new part.



(A) Union screw without filter (without protrusion)

(B) Gasket

(C) Oil inlet pipe

(D) Union screw with filter (with protrusion)

2. OTHER INSPECTIONS

1) Check that the oil pipe and union screw have no deformation, cracks and other damages.

2) Check that there are no oil leaks or oil oozing from the oil pipe attachment section.

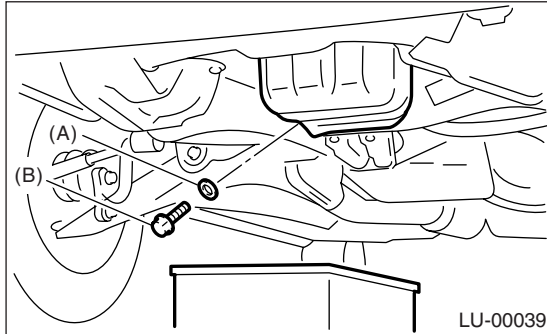
8. Engine Oil Cooler

A: REMOVAL

NOTE:

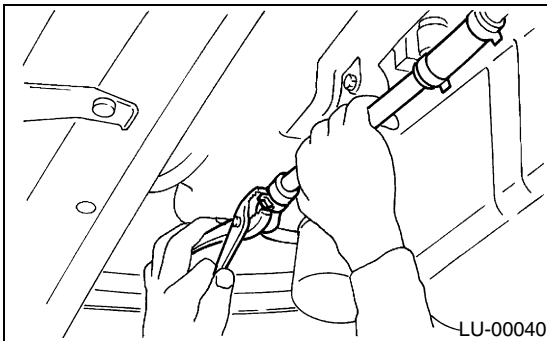
The engine oil cooler is installed on turbo models only.

- 1) Lift up the vehicle.
- 2) Remove the under cover.
- 3) Drain the engine oil.
Set a container under the vehicle, and remove the drain plug from oil pan.



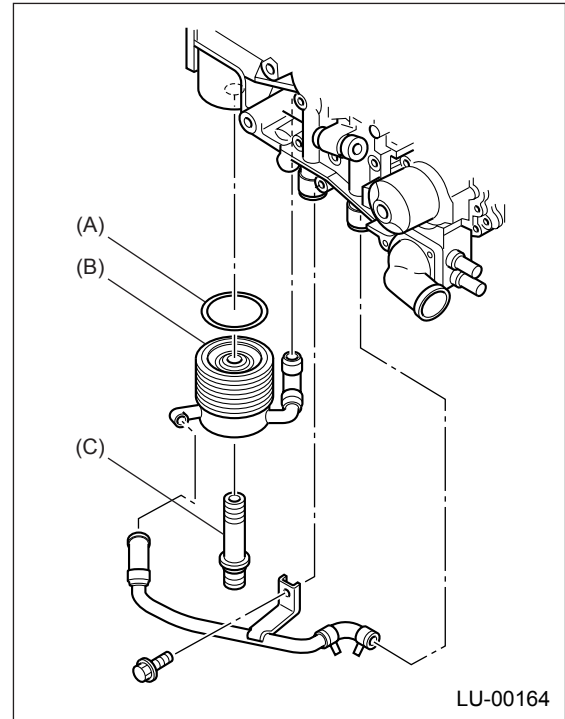
- (A) Gasket
- (B) Drain plug

- 4) Drain the engine coolant.
- 5) Remove the water bypass pipe between oil cooler and water pump.



- 6) Remove the engine oil filter. <Ref. to LU(H4SO)-25, REMOVAL, Engine Oil Filter.>

- 7) Disconnect the connector and remove oil cooler.



- (A) O-ring
- (B) Oil cooler
- (C) Oil cooler connector

ENGINE OIL COOLER

LUBRICATION

B: INSTALLATION

NOTE:

The engine oil cooler is installed on turbo models only.

1) Install in the reverse order of removal.

Tightening torque:

T: 54 N·m (5.5 kgf-m, 40 ft-lb)

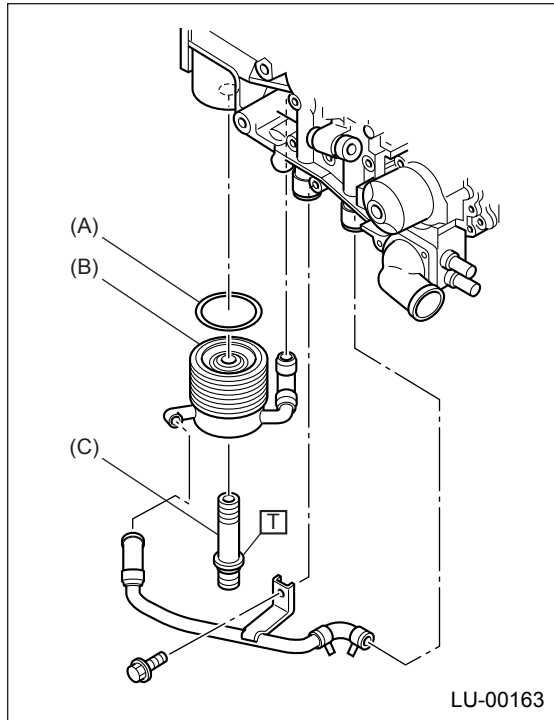
NOTE:

Use new O-rings.

C: INSPECTION

1) Check that the coolant passages are not clogged using air blow method.

2) Check the mating surfaces of cylinder block, O-ring groove and oil filter for damage.



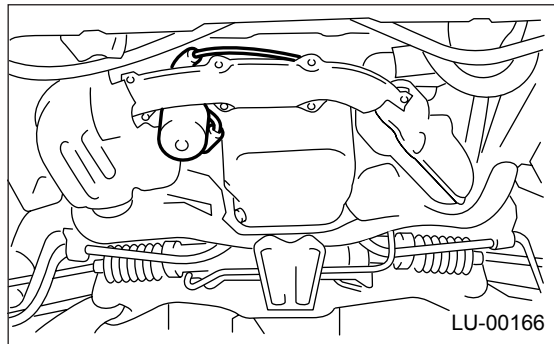
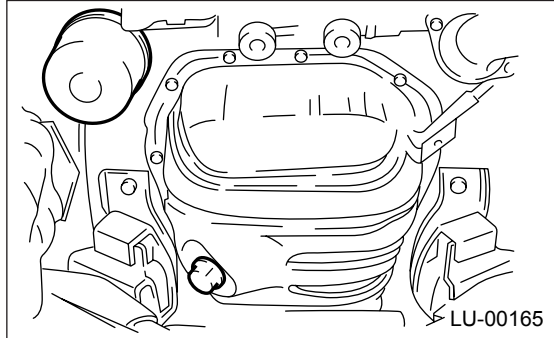
- (A) O-ring
- (B) Oil cooler
- (C) Oil cooler connector

9. Engine Oil Filter

A: REMOVAL

- 1) Remove the under cover.
- 2) Remove the oil filter with ST.

ST 498547000 OIL FILTER WRENCH



B: INSTALLATION

- 1) Use a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 2) Install the oil filter by turning it by hand, being careful not to damage seal rubber.
- 3) Tighten more (approx. 2/3 to 3/4 turn) after the seal rubber contacts the cylinder block. Do not tighten excessively, or oil may leak.

C: INSPECTION

- 1) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

NOTE:

The filter element and filter case are permanently joined; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level. <Ref. to LU(H4SO)-10, INSPECTION, Engine Oil.>

ENGINE LUBRICATION SYSTEM TROUBLES

LUBRICATION

10.Engine Lubrication System Troubles

A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogged oil filter	Replace.
		Malfunction of oil bypass valve of oil filter	Clean or replace.
		Malfunction of oil relief valve of oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance between oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
Stuck oil pump rotor		Replace.	
2. Warning light does not go on.	1) Blown out bulb		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Open circuit in wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1. — 2.

GENERAL DESCRIPTION

MECHANICAL

1. General Description

A: SPECIFICATIONS

Engine	Type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve arrangement		Belt driven, single over-head camshaft, 4-valve/cylinder	
	Bore × Stroke		mm (in)	
	Displacement		cm ³ (cu in)	
	Compression ratio		10.0	
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm ² , psi)	
	Number of piston rings		Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Opening	1° BTDC	
		Closing	51° ABDC	
	Exhaust valve timing	Opening	50° BBDC	
		Closing	6° ATDC	
	Valve clearance	Intake	mm (in)	0.20±0.02 (0.0079±0.0008)
		Exhaust	mm (in)	0.25±0.02 (0.0098±0.0008)
	Idling speed [At neutral position on MT, or “P” or “N” position on AT]		rpm	No load A/C ON

NOTE:

US: Undersize OS: Oversize

Belt tension adjuster	Protrusion of adjuster rod			5.2 — 6.2 mm (0.205 — 0.244 in)		
Belt tensioner	Spacer O.D.			17.955 — 17.975 mm (0.7069 — 0.7077 in)		
	Tensioner bushing I.D.			18.00 — 18.08 mm (0.7087 — 0.7118 in)		
	Clearance between spacer and bushing		STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)		
			Limit	0.175 mm (0.0069 in)		
	Side clearance of spacer		STD	0.20 — 0.55 mm (0.0079 — 0.0217 in)		
			Limit	0.81 mm (0.0319 in)		
Valve rocker arm	Clearance between shaft and arm		STD	0.020 — 0.054 mm (0.0008 — 0.0021 in)		
			Limit	0.10 mm (0.0039 in)		
Camshaft	Bend limit			0.025 mm (0.00098 in)		
	Thrust clearance		STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)		
			Limit	0.10 mm (0.0039 in)		
	Cam lobe height		Intake	STD	39.485 — 39.585 mm (1.5545 — 1.5585 in)	
				Limit	39.385 mm (1.5506 in)	
			Exhaust	STD	39.257 — 39.357 mm (1.5455 — 1.5495 in)	
				Limit	39.157 mm (1.5416 in)	
	Camshaft journal O.D.			31.928 — 31.945 mm (1.2570 — 1.2577 in)		
	Camshaft journal hole I.D. (cylinder head)			32.000 — 32.018 mm (1.2598 — 1.2605 in)		
	Oil clearance		STD	0.055 — 0.090 mm (0.0022 — 0.0035 in)		
			Limit	0.10 mm (0.0039 in)		
Cylinder head	Surface warpage limit (mating with cylinder block)			0.05 mm (0.0020 in)		
	Surface grinding limit			0.1 mm (0.004 in)		
	Standard height			97.5 mm (3.84 in)		

GENERAL DESCRIPTION

MECHANICAL

Valve seat	Refacing angle			90°
	Contacting width	Intake	STD	1.1 mm (0.043 in)
			Limit	1.8 mm (0.071 in)
		Exhaust	STD	1.5 mm (0.059 in)
			Limit	2.2 mm (0.087 in)
Valve guide	Inner diameter			6.000 — 6.012 mm (0.2362 — 0.2367 in)
	Protrusion above head		Intake	20.0 — 20.5 mm (0.787 — 0.807 in)
			Exhaust	16.5 — 17.0 mm (0.650 — 0.669 in)
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)
			Limit	0.6 mm (0.024 in)
		Exhaust	STD	1.2 mm (0.047 in)
			Limit	0.6 mm (0.024 in)
	Stem diameter		Intake	5.950 — 5.965 mm (0.2343 — 0.2348 in)
			Exhaust	5.945 — 5.960 mm (0.2341 — 0.2346 in)
	Stem oil clearance	STD	Intake	0.035 — 0.062 mm (0.0014 — 0.0024 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	120.6 mm (4.75 in)
			Exhaust	121.7 mm (4.79 in)
Valve spring	Free length			54.30 mm (2.1378 in)
	Squareness			2.5°, 2.4 mm (0.094 in)
	Tension/spring height		Set	214 — 246 N (21.8 — 25.1 kgf, 48.1 — 55.3 lb)/ 45.0 mm (1.772 in)
			Lift	526 — 582 N (53.6 — 59.3 kgf, 118 — 130.8 lb)/ 34.7 mm (1.366 in)
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Inner diameter	A		99.505 — 99.515 mm (3.9175 — 3.9179 in)
			B	99.495 — 99.505 mm (3.9171 — 3.9175 in)
	Taper	STD		0.015 mm (0.0006 in)
			Limit	0.050 mm (0.0020 in)
	Out-of-roundness	STD		0.010 mm (0.0004 in)
			Limit	0.050 mm (0.0020 in)
	Piston clearance	STD		0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.050 mm (0.0020 in)
Boring limit			0.5 mm (0.020 in)	
Piston	Outer diameter	STD	A	99.485 — 99.495 mm (3.9167 — 3.9171 in)
			B	99.475 — 99.485 mm (3.9163 — 3.9167 in)
		0.25 mm (0.0098 in) OS		99.725 — 99.735 mm (3.9262 — 3.9266 in)
		0.50 mm (0.0197 in) OS		99.975 — 99.985 mm (3.9360 — 3.9364 in)
		Standard inner diameter of piston pin hole		
Piston pin	Outer diameter			22.994 — 23.000 mm (0.9053 — 0.9055 in)
	Standard clearance between piston pin and piston			0.004 — 0.008 mm (0.0002 — 0.0003 in)
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).

GENERAL DESCRIPTION

MECHANICAL

Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.37 — 0.52 mm (0.0146 — 0.0205 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.50 mm (0.0079 — 0.0197 in)
			Limit	1.5 mm (0.059 in)
	Clearance between piston ring and piston ring groove	Top ring	STD	0.040 — 0.080 mm (0.0016 — 0.0031 in)
			Limit	0.15 mm (0.0059 in)
		Second ring	STD	0.030 — 0.070 mm (0.0012 — 0.0028 in)
			Limit	0.15 mm (0.0059 in)
Connecting rod	Bend or twist per 100 mm (3.94 in) in length		Limit	0.10 mm (0.0039 in)
	Side clearance at large end	STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)	
		Limit	0.4 mm (0.016 in)	
Connecting rod bearing	Oil clearance		STD	0.012 — 0.038 mm (0.0005 — 0.0014 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.490 — 1.502 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in) US	1.504 — 1.512 mm (0.0592 — 0.0595 in)
			0.05 mm (0.0020 in) US	1.514 — 1.522 mm (0.0596 — 0.0599 in)
			0.25 mm (0.0098 in) US	1.614 — 1.622 mm (0.0635 — 0.0639 in)
Connecting rod bushing	Clearance between piston pin and bushing		STD	0 — 0.022 mm (0 — 0.0009 in)
			Limit	0.030 mm (0.0012 in)

GENERAL DESCRIPTION

MECHANICAL

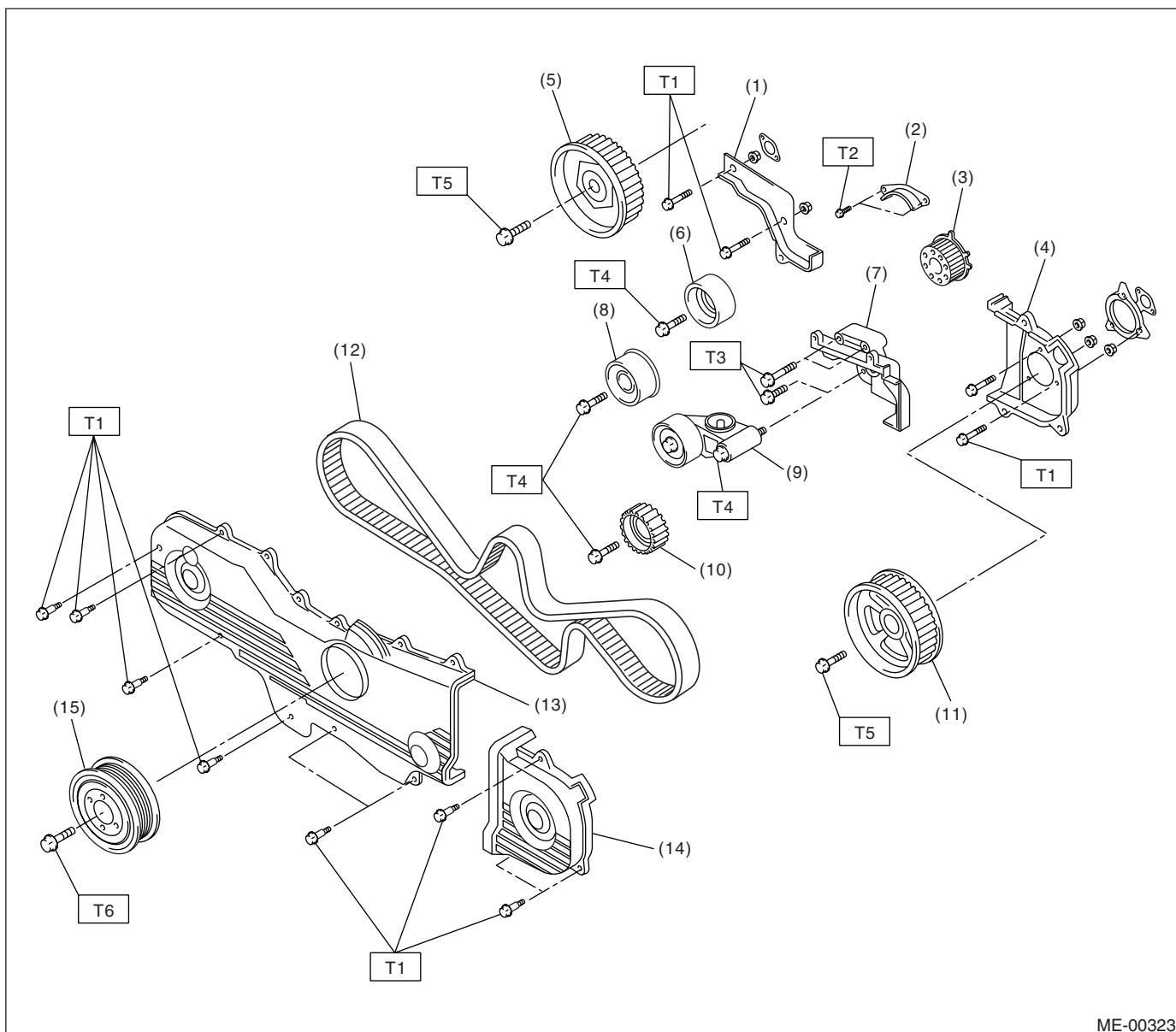
Crankshaft	Bend limit		0.035 mm (0.0014 in)		
	Crank pin and crank journal	Out-of-roundness		Less than 0.020 mm (0.0008 in)	
		Surface grinding limit		0.250 mm (0.0098 in)	
	Crank pin outer diameter		STD	51.984 — 52.000 mm (2.0466 — 2.0472 in)	
			0.03 mm (0.0012 in) US	51.954 — 51.970 mm (2.0454 — 2.0461 in)	
			0.05 mm (0.0020 in) US	51.934 — 51.950 mm (2.0446 — 2.0453 in)	
			0.25 mm (0.0098 in) US	51.734 — 51.750 mm (2.0368 — 2.0374 in)	
	Crank journal outer diameter	#1, #3	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)	
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)	
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
		#2, #4, #5	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)	
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)	
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
	Thrust clearance		STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)	
			Limit	0.25 mm (0.0098 in)	
	Oil clearance		#1	STD	0.003 — 0.030 mm (0.0001 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
			#2	STD	0.012 — 0.033 mm (0.0005 — 0.0013 in)
				Limit	0.045 mm (0.0018 in)
			#3	STD	0.003 — 0.030 mm (0.0001 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
			#4	STD	0.012 — 0.033 mm (0.0005 — 0.0013 in)
				Limit	0.045 mm (0.0018 in)
			#5	STD	0.010 — 0.031 mm (0.0004 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
Crankshaft bearing	Crankshaft bearing	#1, #3	STD	1.998 — 2.011 mm (0.0787 — 0.0792 in)	
			0.03 mm (0.0012 in) US	2.017 — 2.020 mm (0.0794 — 0.0795 in)	
			0.05 mm (0.0020 in) US	2.027 — 2.030 mm (0.0798 — 0.0799 in)	
			0.25 mm (0.0098 in) US	2.127 — 2.130 mm (0.0837 — 0.0839 in)	
		#2, #4, #5	STD	2.000 — 2.013 mm (0.0787 — 0.0793 in)	
			0.03 mm (0.0012 in) US	2.019 — 2.022 mm (0.0795 — 0.0796 in)	
			0.05 mm (0.0020 in) US	2.029 — 2.032 mm (0.0799 — 0.0800 in)	
			0.25 mm (0.0098 in) US	2.129 — 2.132 mm (0.0838 — 0.0839 in)	

GENERAL DESCRIPTION

MECHANICAL

B: COMPONENT

1. TIMING BELT



ME-00323

- | | |
|----------------------------------|---------------------------------------|
| (1) Timing belt cover No. 2 (RH) | (9) Automatic belt tensioner assembly |
| (2) Timing belt guide (MT) | (10) Belt idler No. 2 |
| (3) Crankshaft sprocket | (11) Camshaft sprocket No. 2 |
| (4) Timing belt cover No. 2 (LH) | (12) Timing belt |
| (5) Camshaft sprocket No. 1 | (13) Front timing belt cover |
| (6) Belt idler (No. 1) | (14) Timing belt cover (LH) |
| (7) Tensioner bracket | (15) Crankshaft pulley |
| (8) Belt idler (No. 2) | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

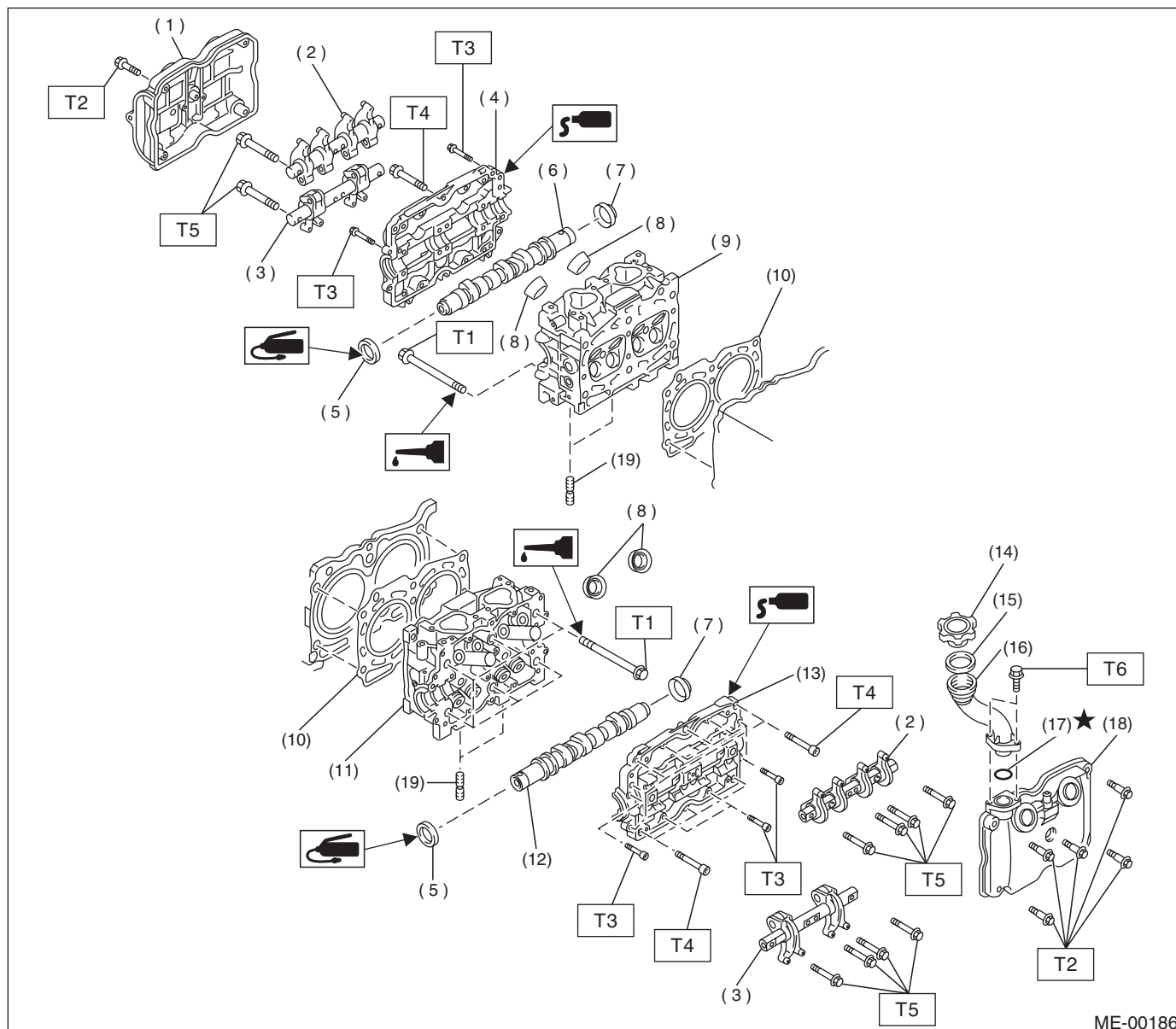
T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

T5: 78 (8.0, 57.9)

T6: <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

2. CYLINDER HEAD AND CAMSHAFT



ME-00186

- | | |
|-----------------------------------|-------------------------|
| (1) Rocker cover (RH) | (11) Cylinder head (LH) |
| (2) Intake valve rocker assembly | (12) Camshaft (LH) |
| (3) Exhaust valve rocker assembly | (13) Camshaft cap (LH) |
| (4) Camshaft cap (RH) | (14) Oil filler cap |
| (5) Oil seal | (15) Gasket |
| (6) Camshaft (RH) | (16) Oil filler duct |
| (7) Plug | (17) O-ring |
| (8) Spark plug pipe gasket | (18) Rocker cover (LH) |
| (9) Cylinder head (RH) | (19) Stud bolt |
| (10) Cylinder head gasket | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to ME(H4SO)-60, INSTALLATION, Cylinder Head.>

T2: 5 (0.5, 3.6)

T3: 10 (1.0, 7.2)

T4: 18 (1.8, 13.0)

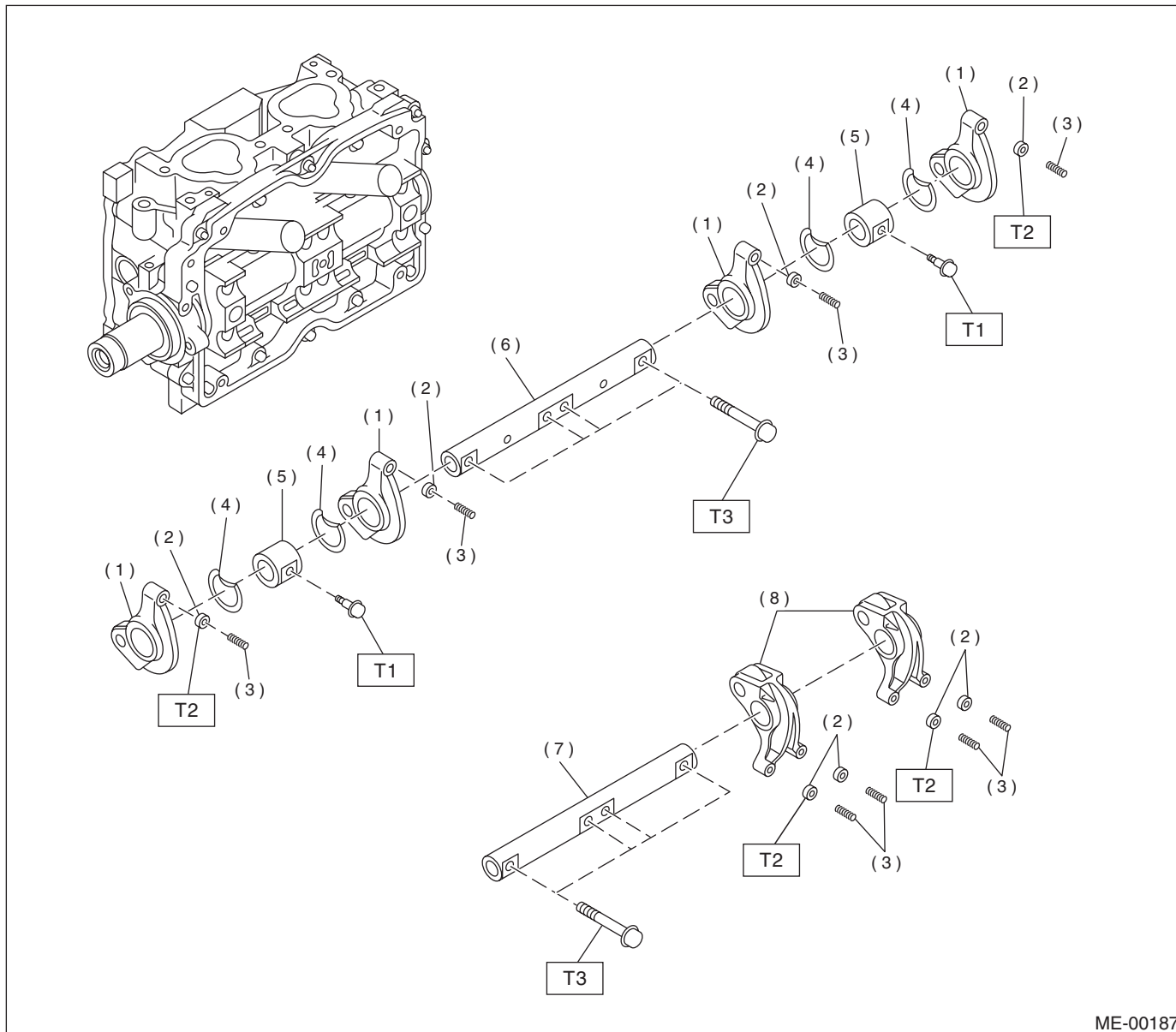
T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

GENERAL DESCRIPTION

MECHANICAL

3. VALVE ROCKER ASSEMBLY



- | | |
|-------------------------------|------------------------------|
| (1) Intake valve rocker arm | (5) Rocker shaft support |
| (2) Valve rocker nut | (6) Intake rocker shaft |
| (3) Valve rocker adjust screw | (7) Exhaust rocker shaft |
| (4) Spring | (8) Exhaust valve rocker arm |

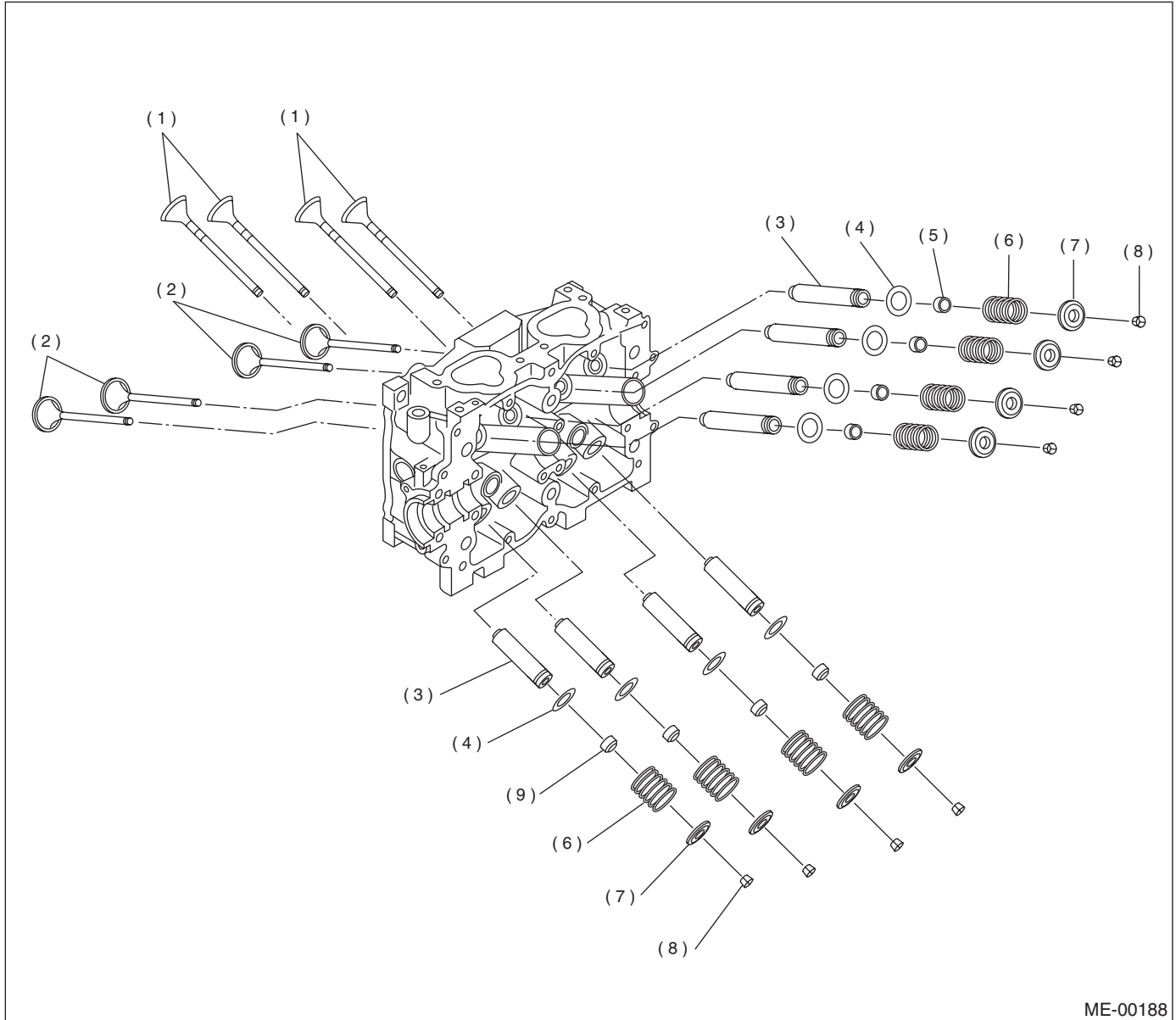
Tightening torque: N·m (kgf·m, ft·lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY



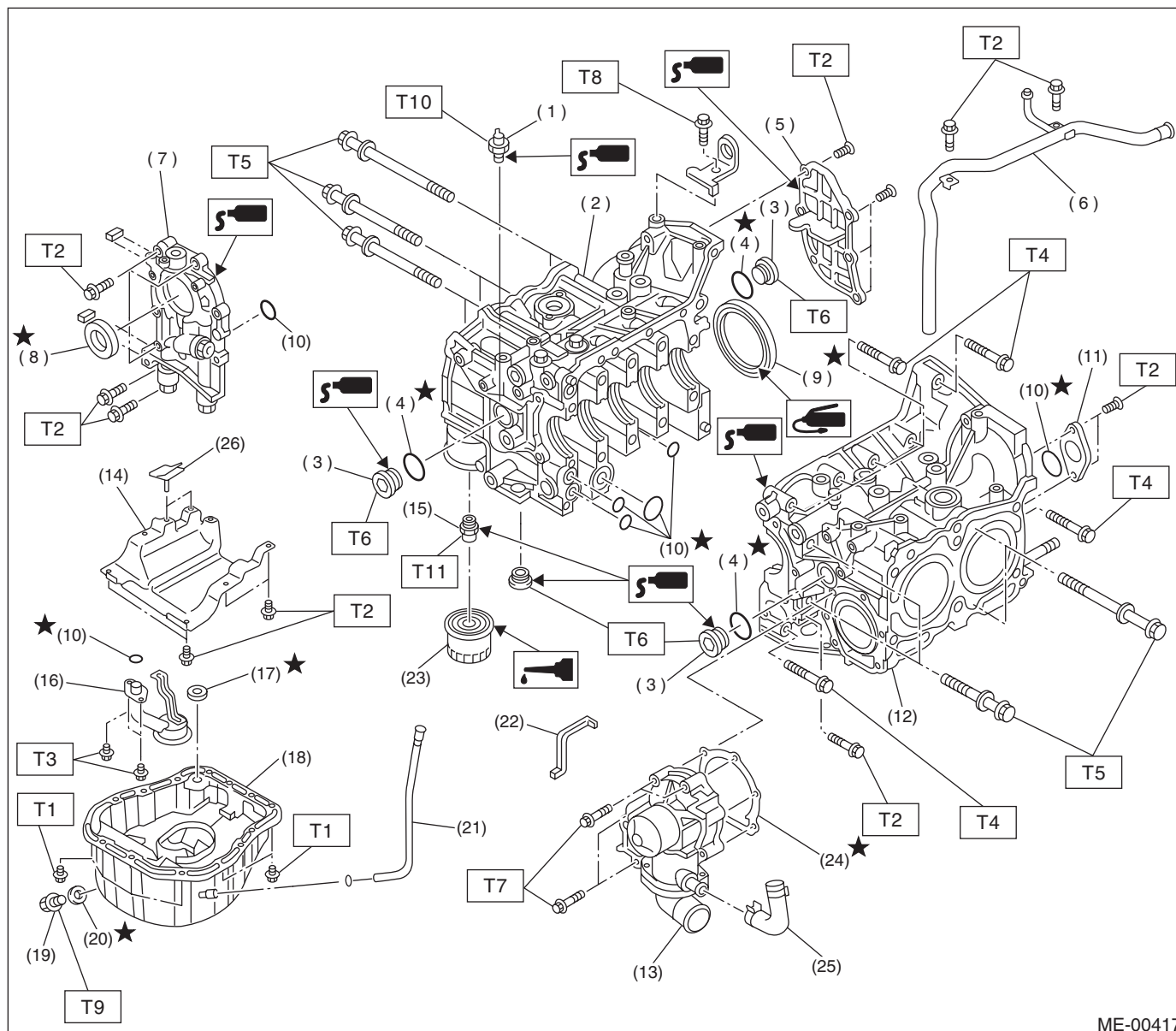
ME-00188

- | | | |
|-------------------|---------------------------|----------------------------|
| (1) Exhaust valve | (4) Valve spring seat | (7) Retainer |
| (2) Intake valve | (5) Intake valve oil seal | (8) Retainer key |
| (3) Valve guide | (6) Valve spring | (9) Exhaust valve oil seal |

GENERAL DESCRIPTION

MECHANICAL

5. CYLINDER BLOCK



ME-00417

- | | |
|---------------------------|----------------------------|
| (1) Oil pressure switch | (16) Oil strainer |
| (2) Cylinder block (RH) | (17) Gasket |
| (3) Service hole plug | (18) Oil pan |
| (4) Gasket | (19) Drain plug |
| (5) Oil separator cover | (20) Metal gasket |
| (6) Water by-pass pipe | (21) Oil level gauge guide |
| (7) Oil pump | (22) Water pump sealing |
| (8) Front oil seal | (23) Oil filter |
| (9) Rear oil seal | (24) Gasket |
| (10) O-ring | (25) Water pump hose |
| (11) Service hole cover | (26) Seal |
| (12) Cylinder block (LH) | |
| (13) Water pump | |
| (14) Baffle plate | |
| (15) Oil filter connector | |

Tightening torque: N-m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 6.4 (0.65, 4.7)

T3: 10 (1.0, 7.2)

T4: 25 (2.5, 18.1)

T5: <Ref. to ME(H4SO)-72, INSTALLATION, Cylinder Block.>

T6: 70 (7.1, 51.6)

T7: First 12 (1.2, 8.7)

Second 12 (1.2, 8.7)

T8: 45 (4.6, 33.2)

T9: 44 (4.5, 33)

T10: 25 (2.5, 18.1)

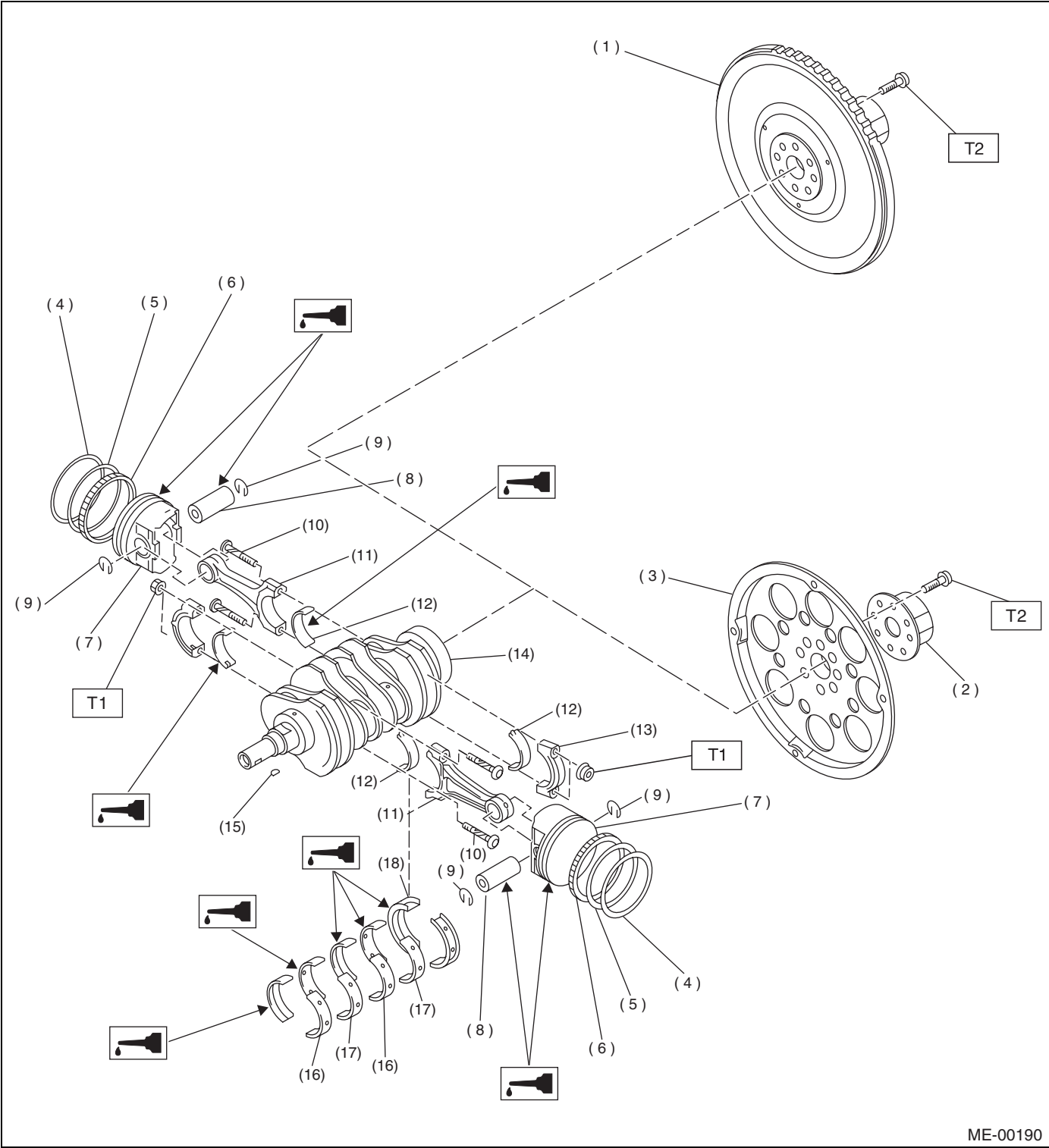
T11: 54 (5.6, 41)

ME(H4SO)-10

GENERAL DESCRIPTION

MECHANICAL

6. CRANKSHAFT AND PISTON



ME-00190

GENERAL DESCRIPTION

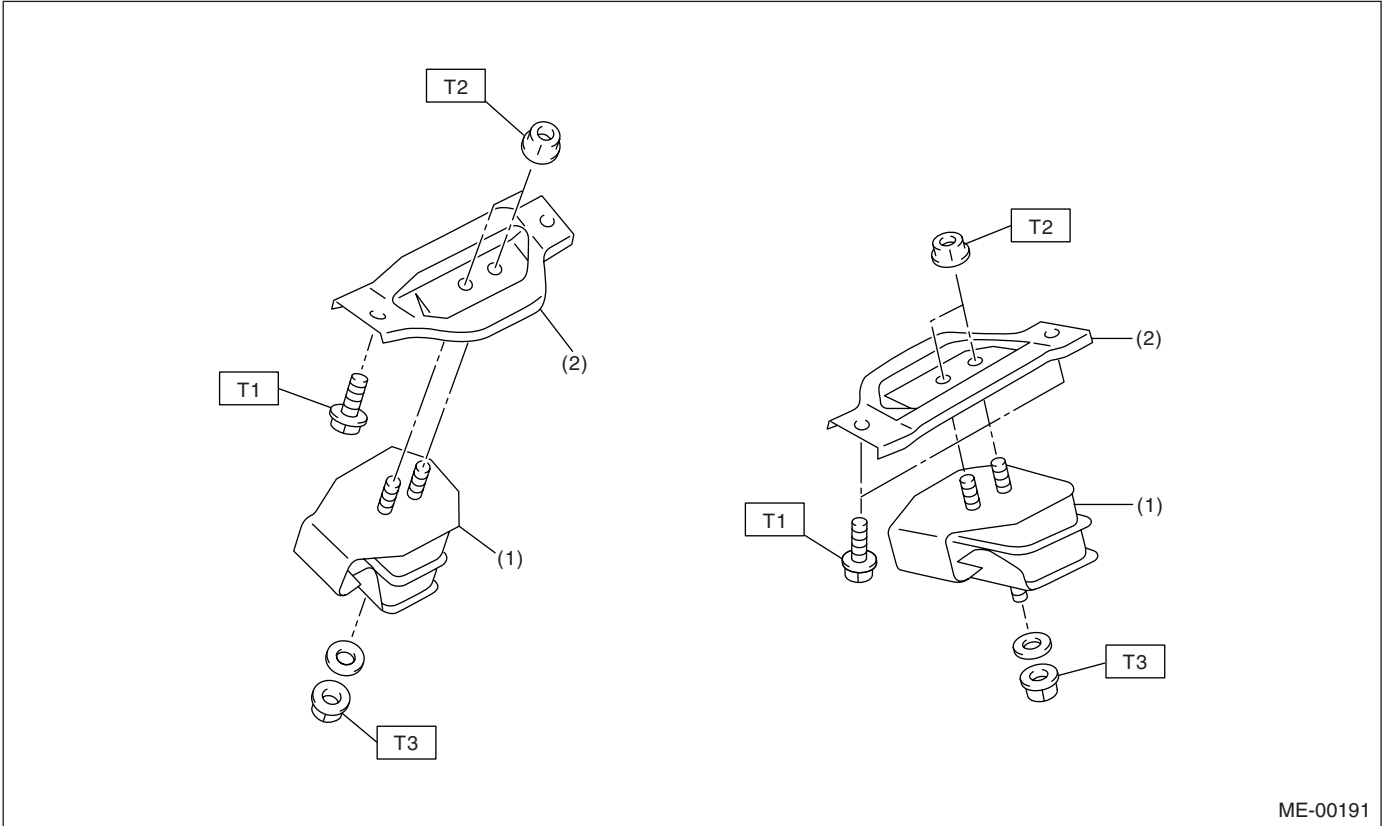
MECHANICAL

(1) Flywheel (MT)	(9) Snap ring	(17) Crankshaft bearing #2, #4
(2) Reinforcement (AT)	(10) Connecting rod bolt	(18) Crankshaft bearing #5
(3) Drive plate (AT)	(11) Connecting rod	
(4) Top ring	(12) Connecting rod bearing	Tightening torque: N·m (kgf-m, ft-lb)
(5) Second ring	(13) Connecting rod cap	T1: 45 (4.6, 33.2)
(6) Oil ring	(14) Crankshaft	T2: 72 (7.3, 52.8)
(7) Piston	(15) Woodruff key	
(8) Piston pin	(16) Crankshaft bearing #1, #3	

GENERAL DESCRIPTION

MECHANICAL

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, 63)

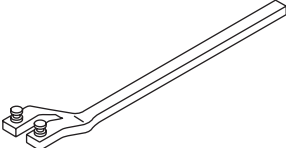
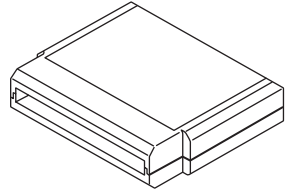
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to the 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 re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new ones as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install 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 stain seats and windows with coolant or oil. Place a cover over fenders, 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.

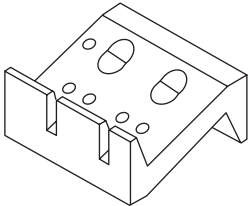
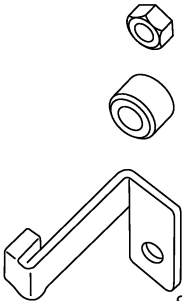
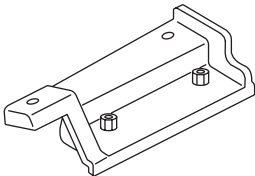
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	• Used for removing and installing camshaft sprocket. (LH side) • Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.
 ST24082AA210	24082AA210 (newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.

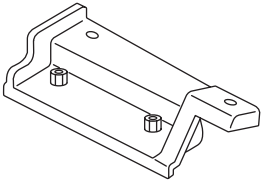
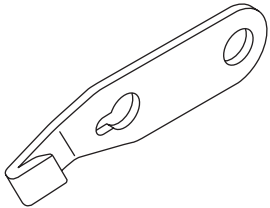
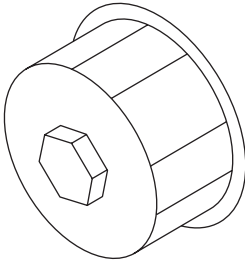
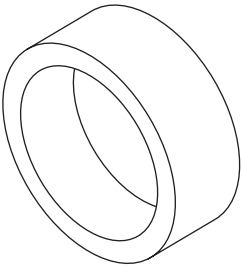
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST22771AA30	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.
 ST-498267800	498267800	CYLINDER HEAD TABLE	- Used for replacing valve guides. - Used for removing and installing valve springs.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

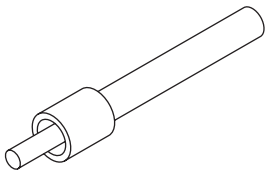
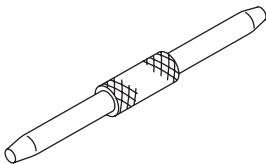
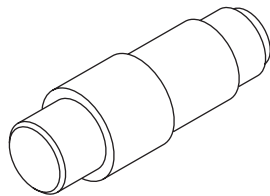
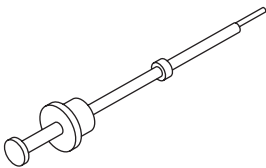
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder of a 2500 cc engine.

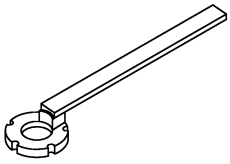
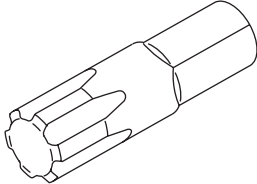
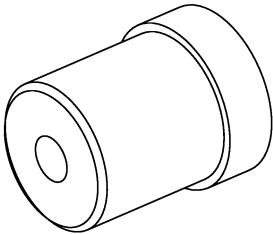
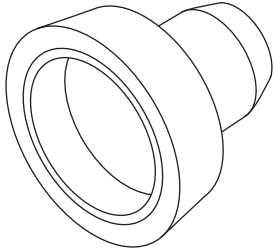
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499097700	499097700	PISTON PIN REMOVER ASSEMBLY	Used for removing piston pin.

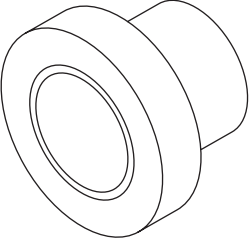
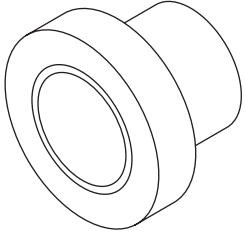
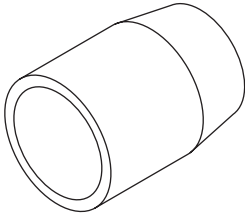
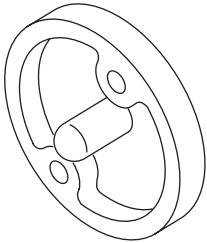
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft 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-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).

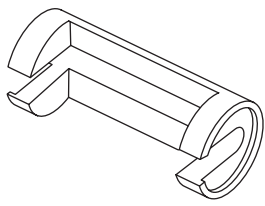
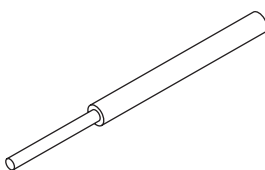
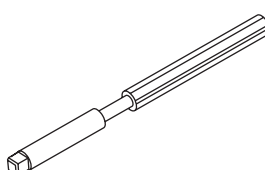
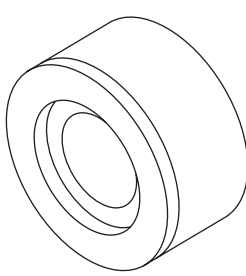
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587500	499587500	OIL SEAL INSTALLER	Used for installing camshaft oil seal.
 ST-499587700	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.
 ST-499597000	499597000	OIL SEAL GUIDE	• Used for installing camshaft oil seal. • Used with CAMSHAFT OIL SEAL INSTALLER (499587500).
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

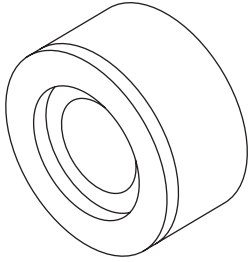
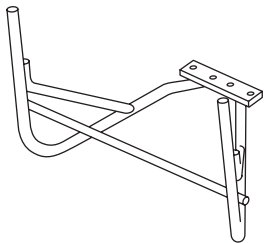
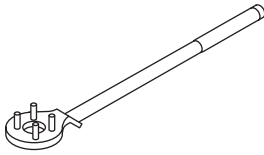
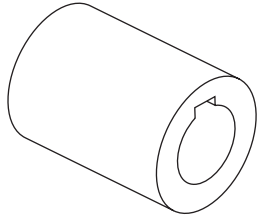
GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve springs.
 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 (Intake side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.

GENERAL DESCRIPTION

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767800	499767800 (Exhaust side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.
 ST-499817100	499817100	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Tachometer (secondary pick-up type)	Used for measuring idle speed.
Timing light	Used for measuring ignition timing.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on the vehicle, however, the procedures described in this section are based on the condition that the engine is removed from the vehicle.

- V-belt
- Timing belt
- Valve rocker assembly
- Camshaft
- Cylinder head

2. Compression

A: INSPECTION

CAUTION:

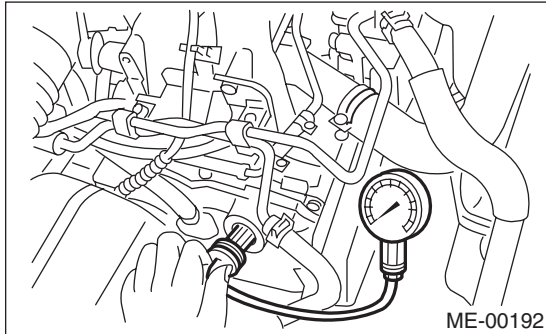
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) After warming-up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Lower the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG(H4SO)-5, REMOVAL, Spark Plug.>
- 5) Throttle valve should be wide open.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tight against spark plug hole.

NOTE:

When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be shorter than 18 mm (0.71 in).

- 8) Crank the engine by means of starter motor, and then read the maximum value on the gauge when the pointer is steady.



- 9) Take at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm at wide open throttle):

Standard;

1,275 kPa (13.0 kgf/cm², 185 psi)

Limit;

1,079 kPa (11.0 kgf/cm², 148 psi)

Difference between cylinders;

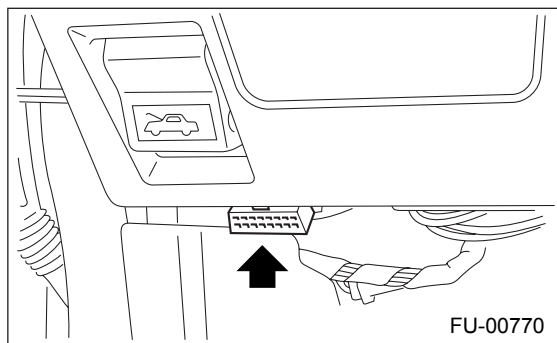
49 kPa (0.5 kgf/cm², 7 psi), or less

3. Idle Speed

A: INSPECTION

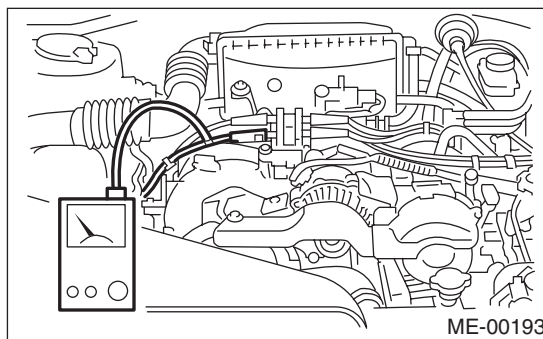
- 1) Before checking idle speed, check the following:
 - (1) Ensure the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and the hoses are connected properly.
 - (2) Ensure the CHECK ENGINE malfunction indicator light does not illuminate.
- 2) Warm up the engine.
- 3) Stop the engine, and then turn the ignition switch to OFF.
- 4) When using the SUBARU SELECT MONITOR, refer to the following. <Ref. to ME(H4SO)-15, SPECIAL TOOLS, PREPARATION TOOL, General Description.>

- (1) Insert the cartridge to SUBARU SELECT MONITOR.
- (2) Connect the SUBARU SELECT MONITOR to data link connector.



- (3) Turn the ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
 - (4) Select {2. Each System Check} in Main Menu.
 - (5) Select {Engine Control System} in Selection Menu.
 - (6) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
 - (7) Select {1.12 Data Display} in Data Display Menu.
 - (8) Start the engine, and then read the engine idle speed.
- 5) When using the tachometer (secondary pick-up type).
- (1) Attach the pick-up clip to No. 1 cylinder spark plug cord.

- (2) Start the engine, and then read the engine idle speed.



NOTE:

- When using an OBD-II general scan tool, carefully read its operation manual.
- This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.

6) Check the idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed [(no load and gears in neutral (MT vehicles), or N or P (AT vehicles) position)]:

650±100 rpm (MT vehicles)

700±100 rpm (AT vehicles)

7) Check the idle speed when loaded. (Turn the air conditioning switch to "ON" and operate the compressor for at least 1 minute before measurement.)

Idle speed [A/C ON, no load and gears in neutral (MT vehicles) or N or P (AT vehicles) position]:

850±100 rpm

NOTE:

Idle speed is automatically adjusted and can not be adjusted manually. If the specified idle speed can not be maintained, refer to General On-board Diagnosis Tabel under "Engine Control System". <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>

4. Ignition Timing

A: INSPECTION

CAUTION:

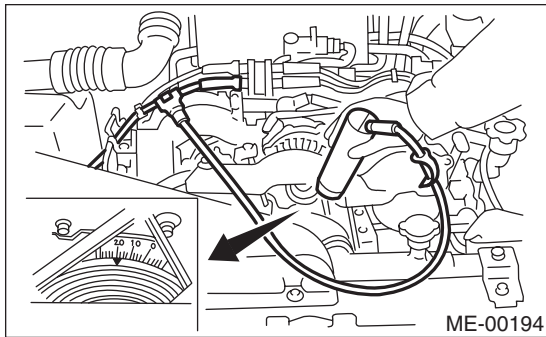
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) Warm-up the engine.
- 2) To check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with timing light.
- 3) Start the engine and check the ignition timing at idle speed.

Ignition timing [BTDC/rpm]:

$10^{\circ} \pm 8^{\circ} / 650$ (MT vehicles)

$15^{\circ} \pm 8^{\circ} / 700$ (AT vehicles)



If the timing is not correct, check the ignition control system.

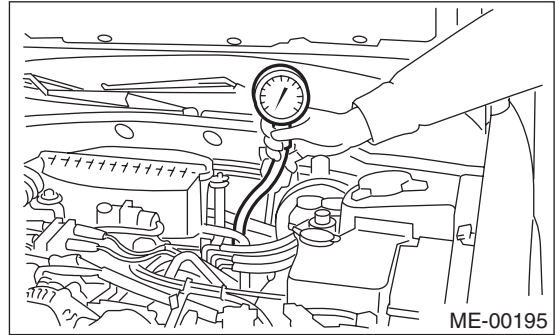
Refer to Engine Control System.<Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

- 1) Warm up the engine.
- 2) Disconnect the brake vacuum hose from the manifold and install a vacuum gauge.
- 3) Keep the engine at idle speed, and then read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of engine can be diagnosed as described below.



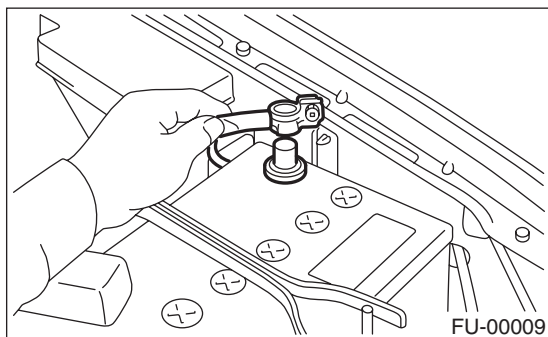
Vacuum pressure (at idling, A/C “OFF”):
Less than –60.0 kPa (–450 mmHg, –17.72 in-Hg)

Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket or disconnection or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at a certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system

6. Engine Oil Pressure

A: INSPECTION

1) Disconnect the ground cable from battery.



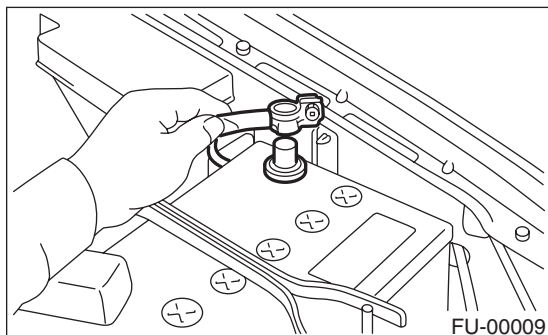
2) Remove the generator from bracket. <Ref. to SC(H4SO)-13, REMOVAL, Generator.>

3) Disconnect the connector from oil pressure switch.

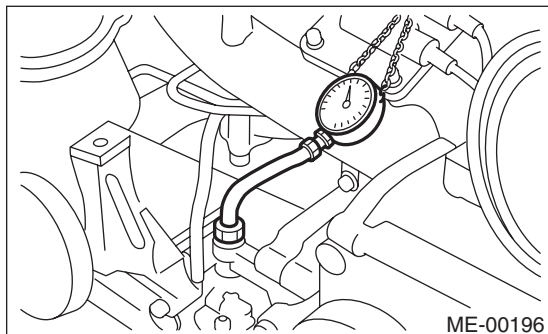
4) Remove the oil pressure switch from engine cylinder block. <Ref. to LU(H4SO)-20, REMOVAL, Oil Pressure Switch.>

5) Connect the oil pressure gauge hose to cylinder block.

6) Connect the battery ground cable to battery.



7) Start the engine, and then measure the oil pressure.



Oil pressure:

88 kPa (0.9 kg/cm², 13 psi) or more at 800 rpm
294 kPa (3.0 kg/cm², 43 psi) or more at 5,000 rpm

CAUTION:

- If the oil pressure is out of specification, check the oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-26, INSPECTION, Engine Lubrication System Troubles.>
- If the oil pressure warning light is turned ON and oil pressure is in specification, replace the oil pressure switch. <Ref. to LU(H4SO)-26, INSPECTION, Engine Lubrication System Troubles.>

NOTE:

The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4SO)-20, INSTALLATION, Oil Pressure Switch.>

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

9) Install the generator and V-belt in the reverse order of removal, and then adjust the V-belt deflection. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

7. Fuel Pressure

A: INSPECTION

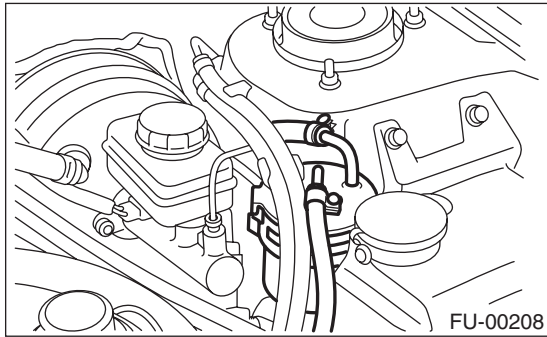
WARNING:

Before removing the fuel pressure gauge, lower the fuel pressure.

NOTE:

If the fuel pressure is out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

- 1) Lower the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open the fuel flap lid, and then remove the fuel filler cap.
- 3) Disconnect the fuel delivery hoses from fuel filter, and then connect the fuel pressure gauge.



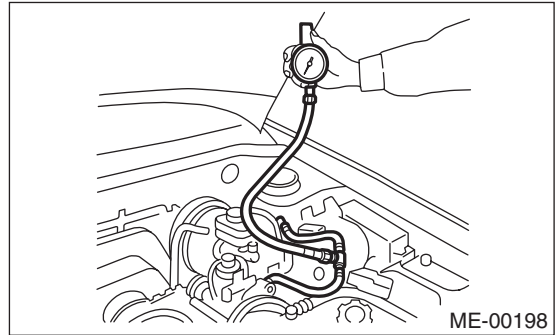
- 4) Connect the connector of fuel pump relay.



- 5) Start the engine.
- 6) Measure the fuel pressure while disconnecting the pressure regulator vacuum hose from intake manifold.

Fuel pressure:

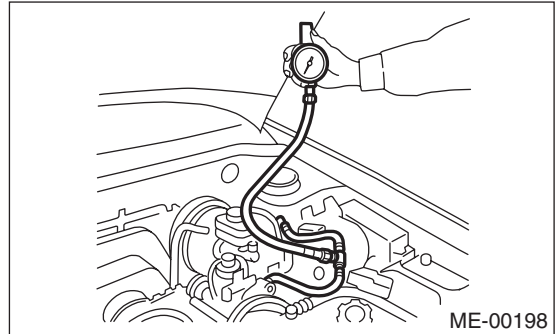
Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm², 41 — 46 psi)



- 7) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

Fuel pressure:

Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm², 30 — 34 psi)



NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm², 1 to 3 psi) higher than standard values during high-altitude operations.

VALVE CLEARANCE

MECHANICAL

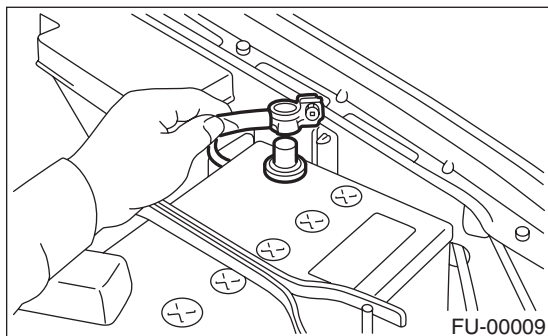
8. Valve Clearance

A: INSPECTION

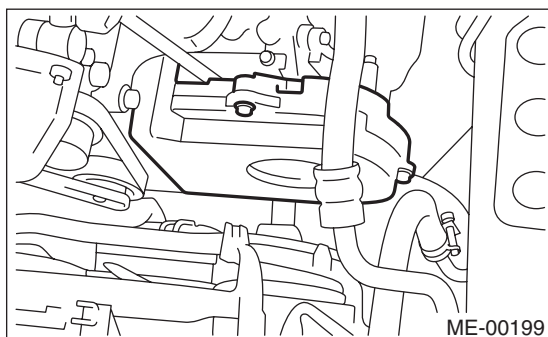
NOTE:

Inspection and adjustment of the valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Lower the vehicle.
- 5) Disconnect the ground cable from battery.



- 6) Remove the timing belt cover (LH).



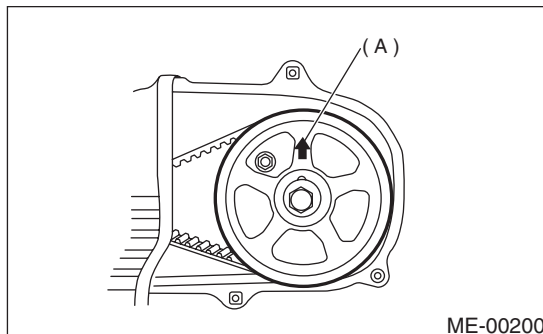
- 7) When inspecting #1 and #3 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs on RH side. <Ref. to IG(H4SO)-5, RH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (RH).
 - (3) Remove the bolts, and then remove the rocker cover (RH).
- 8) When inspecting #2 and #4 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs on LH Side. <Ref. to IG(H4SO)-5, LH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (LH).
 - (3) Remove the bolts, and then remove the rocker cover (LH).

- 9) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is at the top dead center of compression stroke.



- 10) Measure the #1 cylinder valve clearance by using a thickness gauge.

CAUTION:

- Insert the thickness gauge (A) as parallel as possible with respect to the valve stem end face.
- Measure the exhaust valve clearances while lifting-up the vehicle.

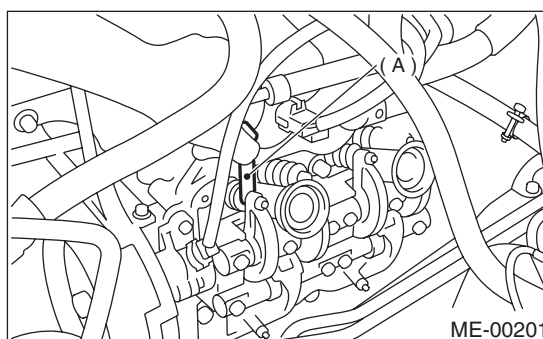
Valve clearance

Intake;

$0.20 \pm 0.02 \text{ mm } (0.0079 \pm 0.0008 \text{ in})$

Exhaust;

$0.25 \pm 0.02 \text{ mm } (0.0098 \pm 0.0008 \text{ in})$

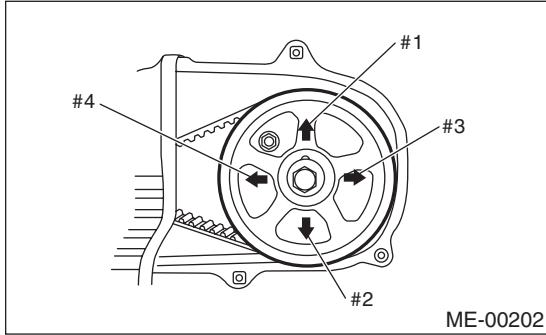


- 11) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-31, ADJUSTMENT, Valve Clearance.>

- 12) Similar to measurement procedures used for the #1 cylinder, measure the #2, #3 and #4 cylinder valve clearances.

NOTE:

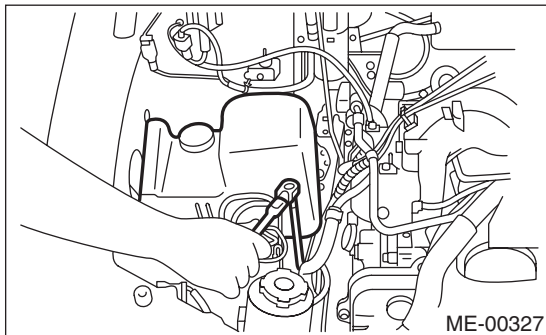
- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
- To set the #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn the crankshaft pulley clockwise 90° at a time starting with arrow mark on camshaft sprocket (LH) facing up.



13) After inspection, install the related parts in the reverse order of removal.

Tightening torque:

**Resonator chamber;
33 N·m (3.4 kgf-m, 25 ft-lb)**



B: ADJUSTMENT

NOTE:

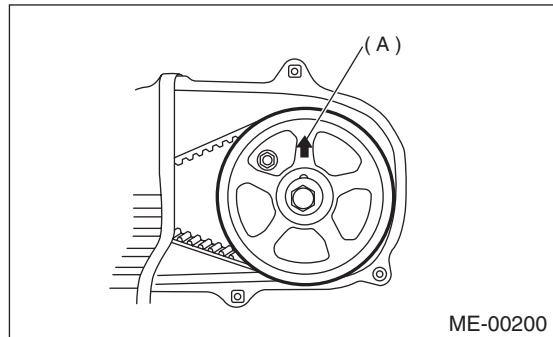
Adjustment of the valve clearance should be performed while engine is cold.

1) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using ST.

ST 499977100 CRANKSHAFT PULLEY
WRENCH

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is at the top dead center of compression stroke.



2) Adjust the #1 cylinder valve clearance.

- (1) Loosen the valve rocker nut and screw.
- (2) Place a suitable thickness gauge.
- (3) While noting the valve clearance, tighten the valve rocker adjust screw.
- (4) When specified valve clearance is obtained, tighten the valve rocker nut.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

CAUTION:

- Insert the thickness gauge as parallel as possible with respect to the valve stem end face.
- Adjust the exhaust valve clearances while lifting up the vehicle.

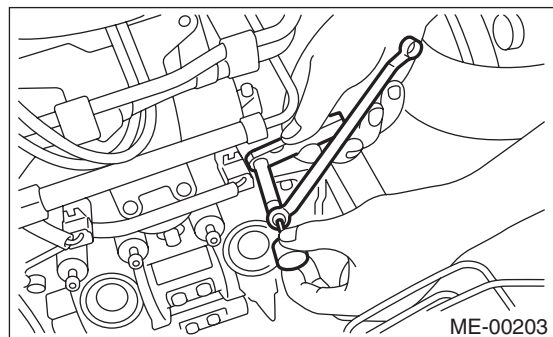
Valve clearance

Intake;

0.20±0.02 mm (0.0079±0.0008 in)

Exhaust;

0.25±0.02 mm (0.0098±0.0008 in)



3) Ensure the valve clearances are within specifications.

4) Turn the crankshaft two complete rotations until #1 cylinder piston is set again to the top dead center on compression stroke.

5) Ensure the valve clearances are within specifications. If necessary, readjust the valve clearances.

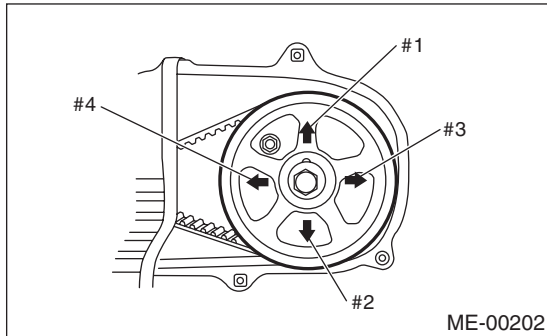
VALVE CLEARANCE

MECHANICAL

6) Similar to adjustment procedures used for the #1 cylinder, adjust the #2, #3 and #4 cylinder valve clearances.

NOTE:

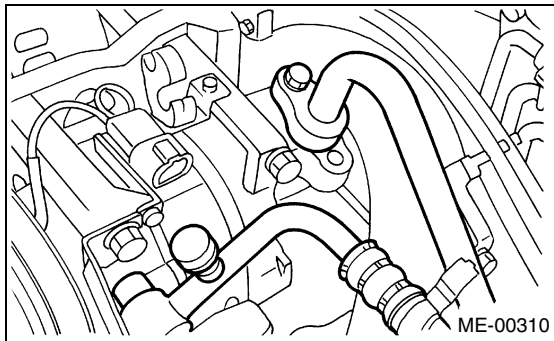
- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
- To set the #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn the crankshaft pulley clockwise 90° at a time starting with arrow mark on camshaft sprocket (LH) facing up.



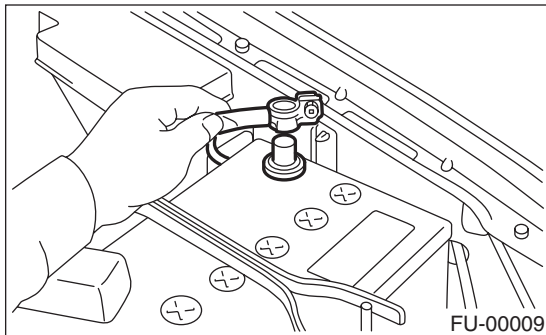
9. Engine Assembly

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully, and then support with the hood stay.
- 3) Lower the fuel pressure. <Ref. to FU(H4SO)-51, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 4) Collect the refrigerant, and then remove the pressure hoses.
 - (1) Place and connect the attachment hose to refrigerant recycle system.
 - (2) Collect the refrigerant from A/C system.
 - (3) Disconnect the A/C pressure hoses from A/C compressor.

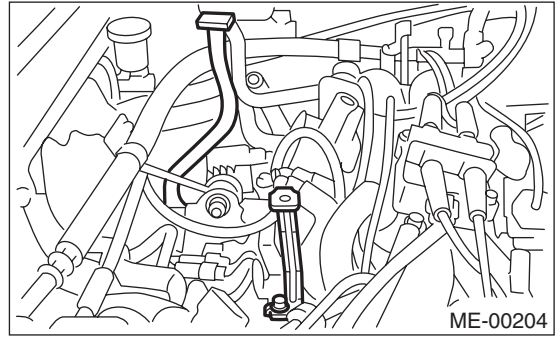


- 5) Remove the fuel filler cap.
- 6) Disconnect the ground cable from battery.

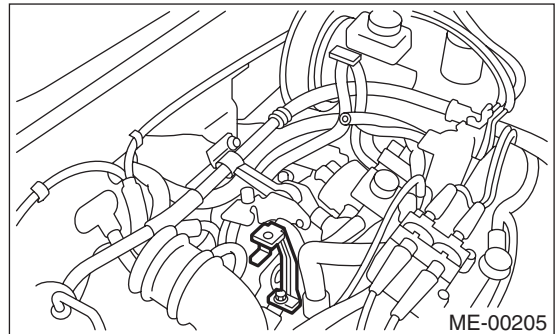


- 7) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> A <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
- 8) Remove the under cover.
- 9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-38, REMOVAL, Radiator.>

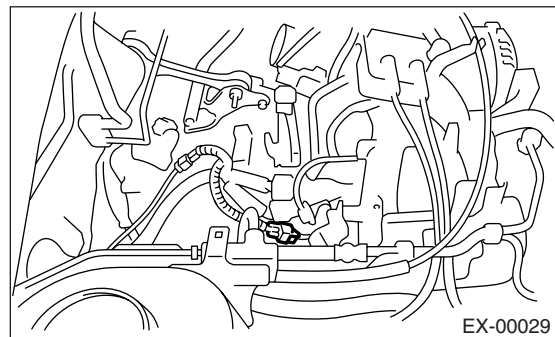
- 10) Remove the air cleaner case stay.
 - MT model



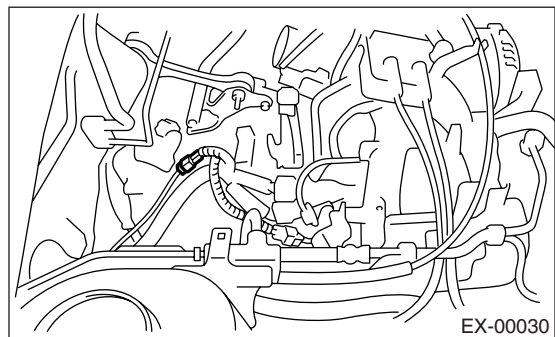
- AT model



- 11) Disconnect the following connectors and cables.
 - (1) Front oxygen (A/F) sensor connector



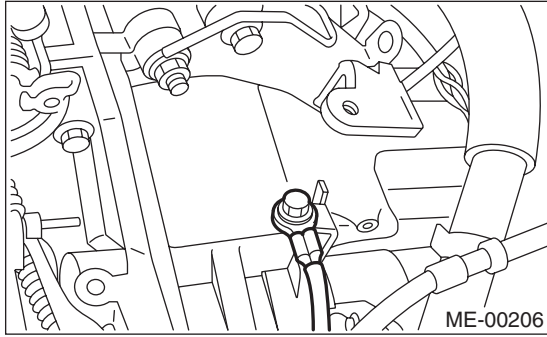
- (2) Rear oxygen sensor connector



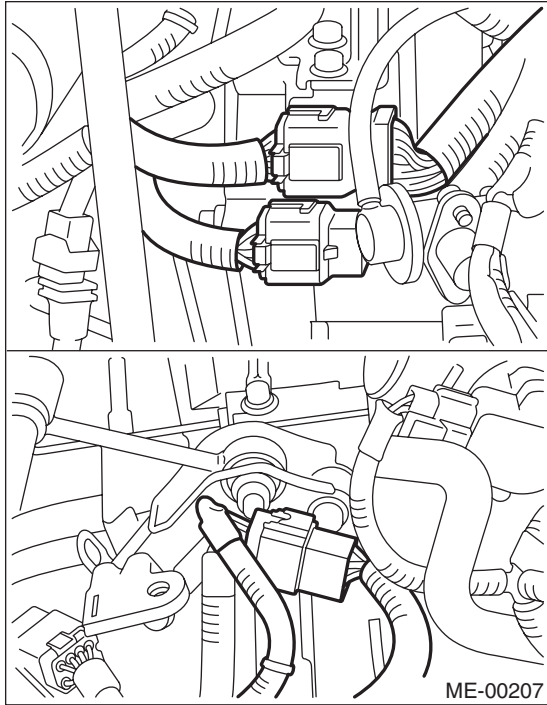
ENGINE ASSEMBLY

MECHANICAL

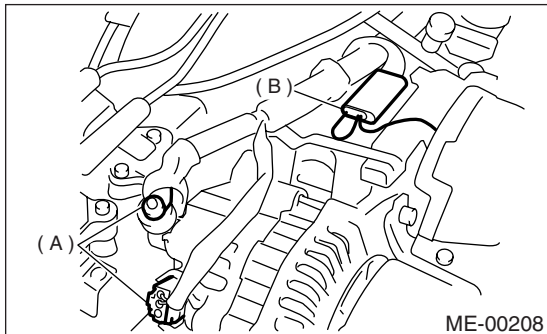
(3) Engine ground cable



(4) Engine harness connectors

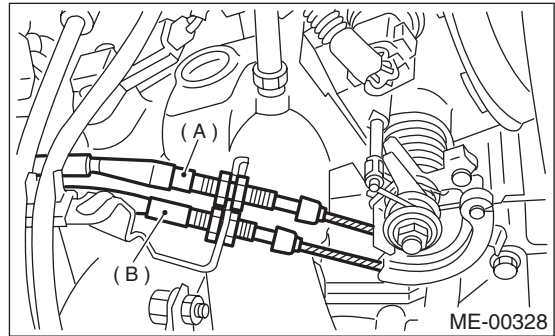


(5) Generator connector, terminal and A/C compressor connector

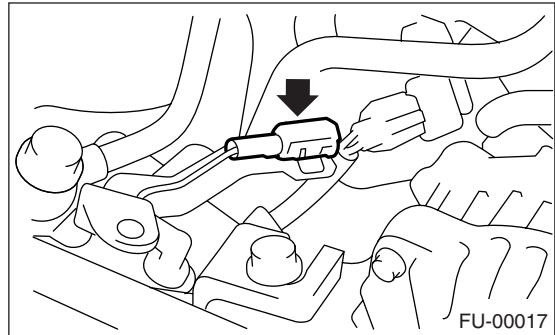


- (A) Generator connector and terminal
- (B) A/C compressor connector

(6) Accelerator cable (A) and cruise control cable (B)

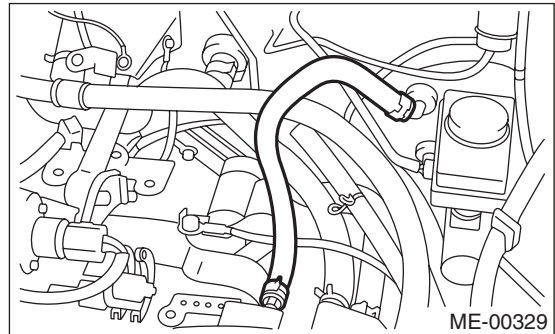


(7) Pressure switch

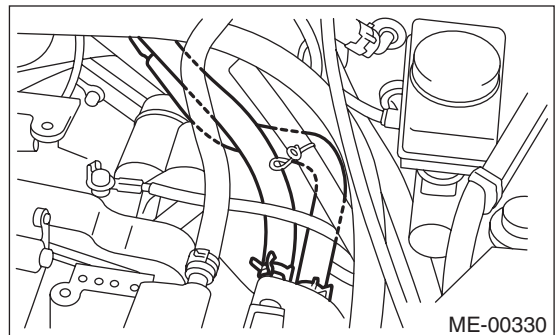


12) Disconnect the following hoses.

(1) Brake booster vacuum hose

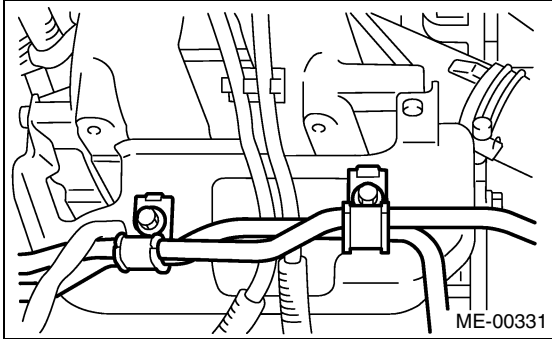


(2) Heater inlet and outlet hoses

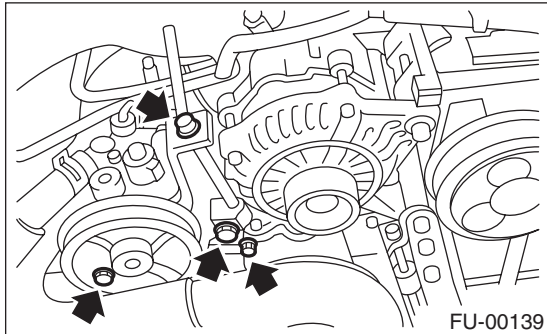


13) Remove the power steering pump from bracket.

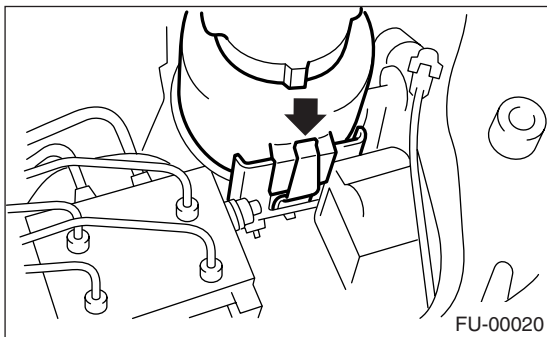
- (1) Remove the resonator chamber.
- (2) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4SO)-42, FRONT SIDE BELT, REMOVAL, V-belt.>
- (3) Remove the pipe with bracket.



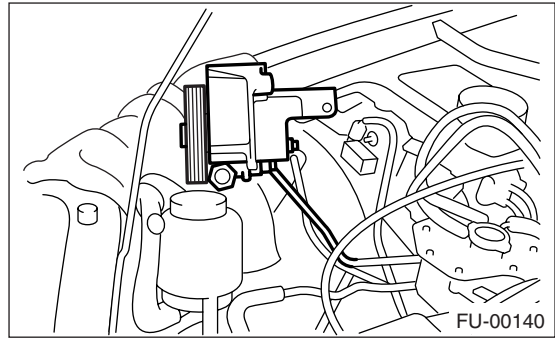
(4) Remove the bolts which install power steering pump bracket.



(5) Remove the power steering tank from bracket by pulling it upward.

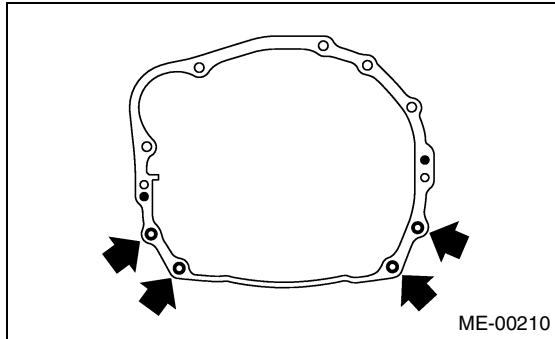


(6) Place the power steering pump on right side wheel apron.

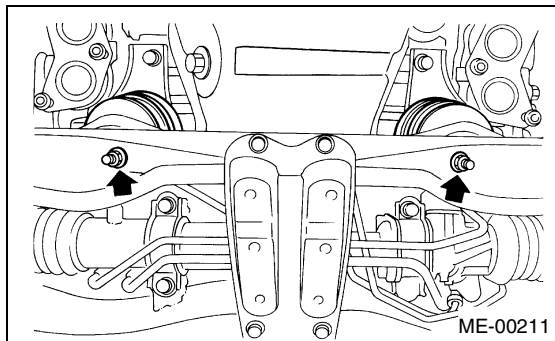


14) Remove the front and center exhaust pipe. <Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

15) Remove the nuts which hold lower side of transmission to engine.



16) Remove the nuts which install front cushion rubber onto front crossmember.



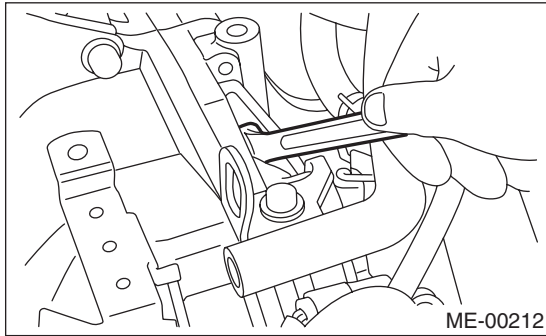
17) Separate the torque converter clutch from drive plate. (AT vehicles)

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold torque converter clutch to drive plate.
- (4) Remove other bolts while rotating the engine using ST.

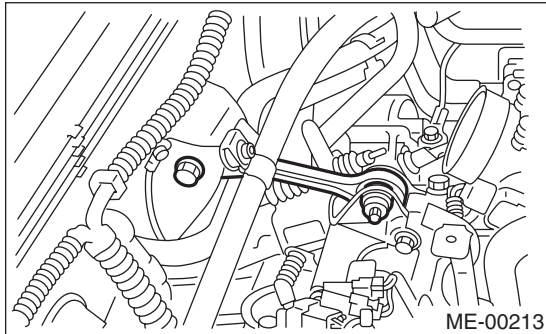
ENGINE ASSEMBLY

MECHANICAL

ST 499977100 CRANKSHAFT PULLEY
WRENCH



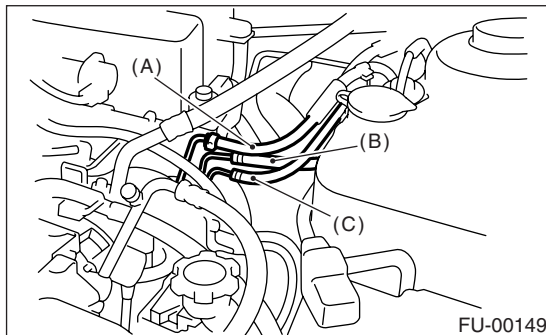
18) Remove the pitching stopper.



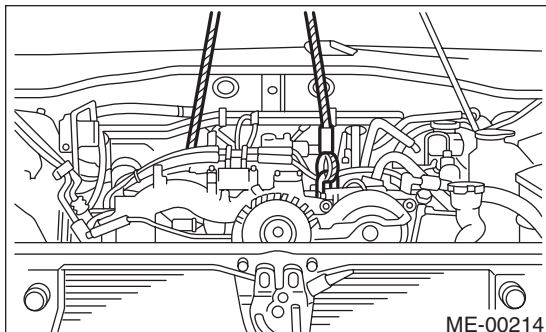
19) Disconnect fuel delivery hose (A), return hose (B) and evaporation hose (C).

CAUTION:

- Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.
- Catch fuel from the hose into container.



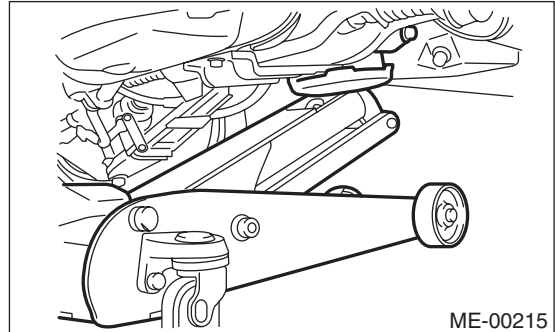
20) Support the engine with a lifting device and wire ropes.



21) Support the transmission with a garage jack.

CAUTION:

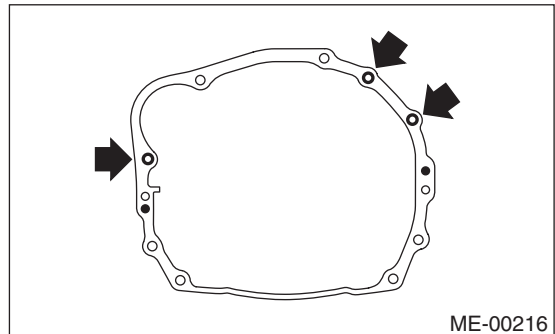
Before moving the engine away from the transmission, check to be sure no work has been overlooked. Doing this is very important because the transmission lowers under its own weight. This is also very important in order to facilitate re-installation.



- (A) Transmission
(B) Garage jack

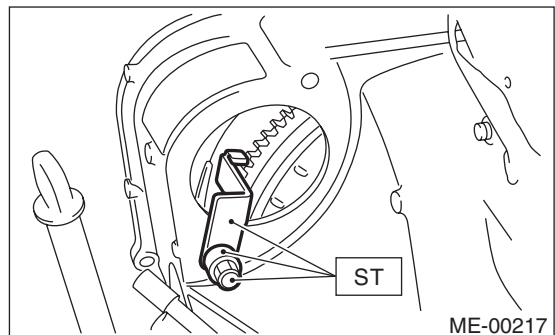
22) Separation of the engine and transmission.

- (1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>
- (2) Remove the bolts which hold upper side of transmission to engine.



23) Install ST to torque converter clutch case. (AT vehicles)

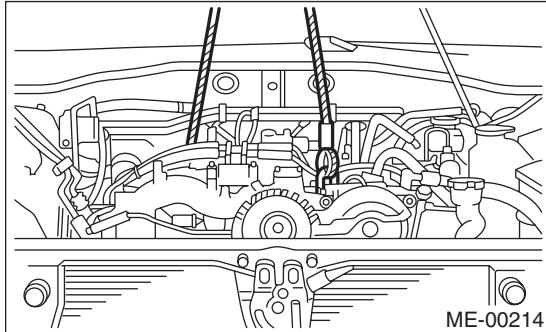
ST 498277200 STOPPER SET



- 24) 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.
 - (4) Slowly move the engine away from engine compartment.

NOTE:

Be careful not to damage the adjacent parts or body panels with crankshaft pulley, oil level gauge, etc.



- 25) Remove front cushion rubbers.

B: INSTALLATION

- 1) Install the front cushion rubbers.

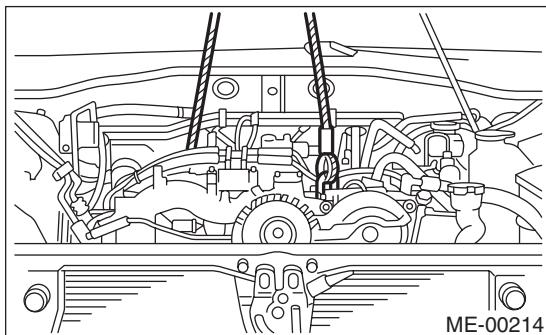
Tightening torque:

34 N·m (3.5 kgf-m, 25.3 ft-lb)

- 2) Install the engine onto transmission.
 - (1) Position the engine in engine compartment and align it with transmission.

NOTE:

Be careful not to damage the adjacent parts or body panels with crankshaft pulley, oil level gauge, etc.

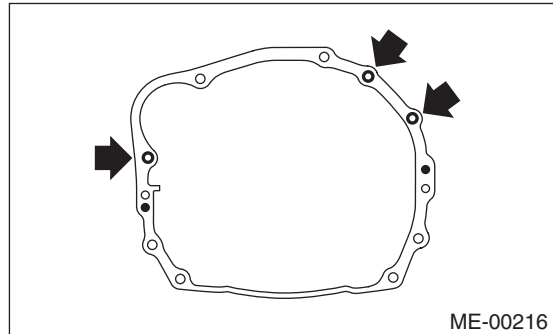


- (2) Apply a small amount of grease to the splines of main shaft. (MT vehicles)

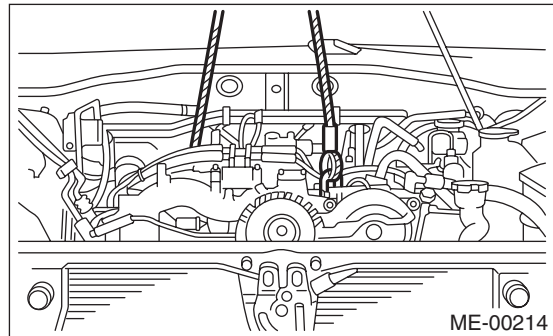
- 3) Tighten the bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



- 4) Remove the lifting device and wire ropes.

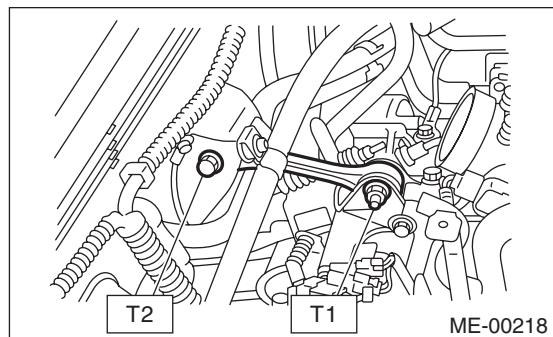


- 5) Remove the garage jack.
- 6) Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 37 ft-lb)

T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



- 7) Remove the ST from torque converter clutch case. (AT vehicles)

NOTE:

Be careful not to drop the ST into torque converter clutch case when removing ST.

ST 498277200 STOPPER SET

- 8) Install the starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>

ENGINE ASSEMBLY

MECHANICAL

9) Install the torque converter clutch onto drive plate. (AT vehicles)

(1) Tighten the bolts which hold torque converter clutch to drive plate.

(2) Tighten other bolts while rotating the engine by using ST.

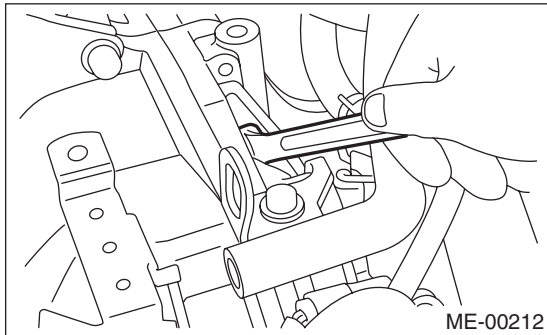
NOTE:

Be careful not to drop the bolts into torque converter clutch housing.

ST 499977100 CRANKSHAFT PULLEY WRENCH

Tightening torque:

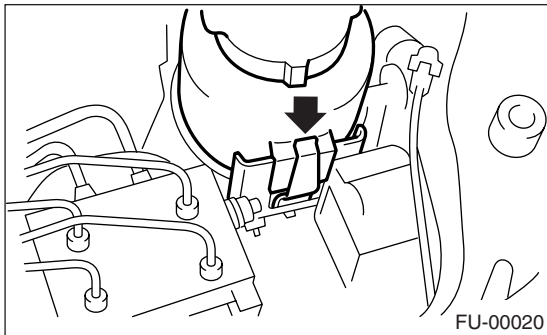
25 N·m (2.5 kgf-m, 18.1 ft-lb)



(3) Plug the service hole to prevent entry of foreign substances.

10) Install the power steering pump on bracket.

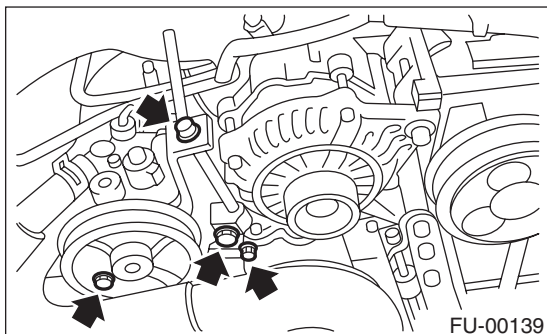
(1) Install the power steering tank on bracket.



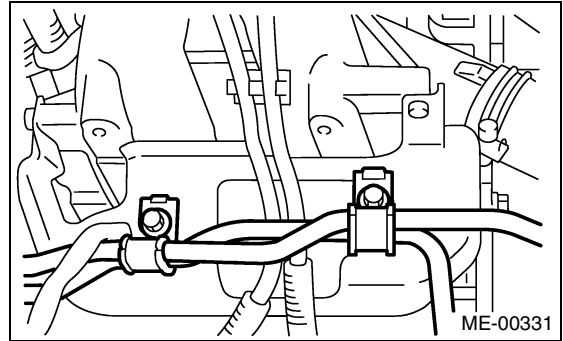
(2) Install the power steering pump on bracket, and then tighten the bolts.

Tightening torque:

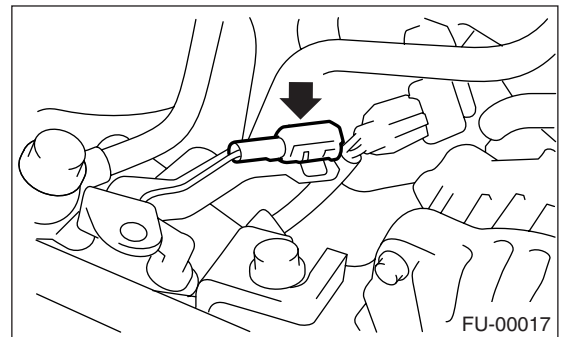
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(3) Tighten the bolts which install power steering pump bracket, and then install the spark plug cords.



(4) Connect the power steering switch connector.

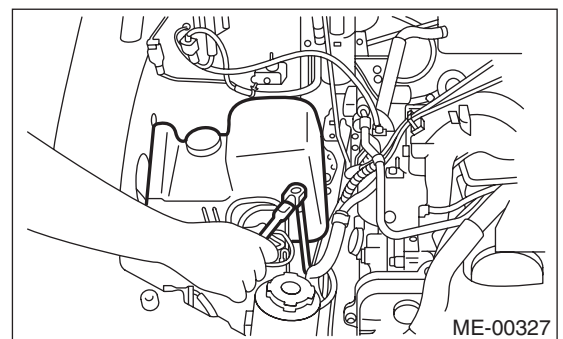


(5) Install the front side V-belt, and adjust it. <Ref. to ME(H4SO)-42, FRONT SIDE BELT, INSTALLATION, V-belt.>

(6) Install the resonator chamber.

Tightening torque:

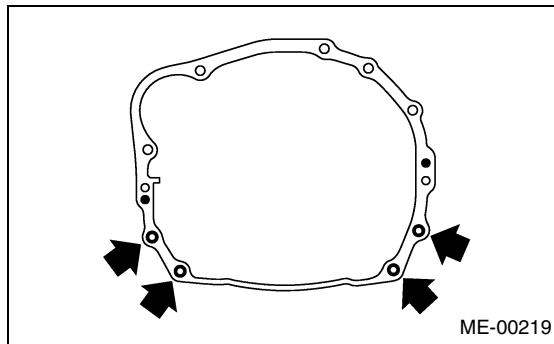
33 N·m (3.4 kgf-m, 24.6 ft-lb)



- 11) Tighten the nuts which hold lower side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



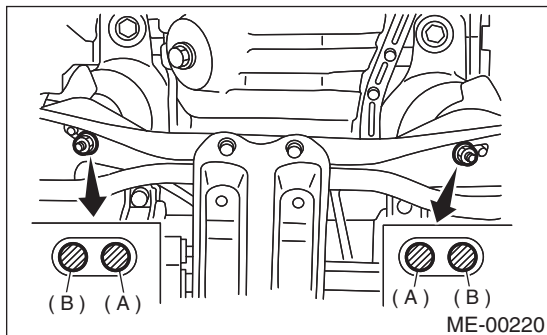
- 12) Tighten the nuts which install front cushion rubber onto crossmember.

Tightening torque:

85 N·m (8.7 kgf-m, 63 ft-lb)

NOTE:

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



- 13) Install the front and center exhaust pipe.
<Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>

- 14) Connect the following hoses.

- (1) Fuel delivery hose, return hose and evaporation hose
- (2) Heater inlet and outlet hoses
- (3) Brake booster vacuum hose

- 15) Connect the following connectors.

- (1) Engine ground cable

Tightening torque:

14 N·m (1.4 kgf-m, 10.1 ft-lb)

- (2) Engine harness connectors
- (3) Generator connector and terminal
- (4) A/C compressor connector
- (5) Power steering pressure switch

- 16) Connect the following cables.

- (1) Accelerator cable
- (2) Cruise control cable (vehicles with cruise control)

- 17) Adjust each connected cable.

- 18) Install the air cleaner case stay.

Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)

- 19) Install the A/C pressure hoses.

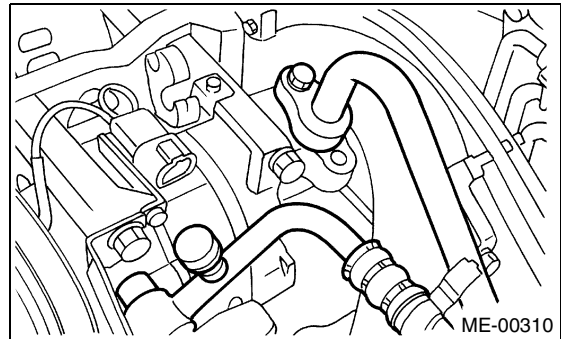
<Ref. to AC-31, INSTALLATION, Hose and Tube.>

NOTE:

Use new O-rings.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 20) Install the radiator to vehicle. <Ref. to CO(H4SO)-42, INSTALLATION, Radiator.>

- 21) Install the air intake duct and air cleaner case.
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.>A<Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>

- 22) Install the under cover.

- 23) Install battery in the vehicle, and then connect the cables.

- 24) Fill engine coolant.

<Ref. to CO(H4SO)-29, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

- 25) Check the ATF level and correct if necessary. (AT vehicles)

<Ref. to AT-30, INSPECTION, ATF.>

- 26) Charge the A/C system with refrigerant. <Ref. to AC-17, OPERATION, Refrigerant Charging Procedure.>

- 27) Remove the front hood stay, and then close the front hood.

- 28) Take off the vehicle from lift arms.

C: INSPECTION

- 1) Make sure the pipes and hoses are installed correctly.

- 2) Make sure the engine coolant and ATF are at specified levels.

10.Engine Mounting

A: REMOVAL

- 1) Remove the engine assembly. <Ref. to ME(H4SO)-33, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Engine mounting:

34 N·m (3.5 kgf-m, 25.3 ft-lb)

C: INSPECTION

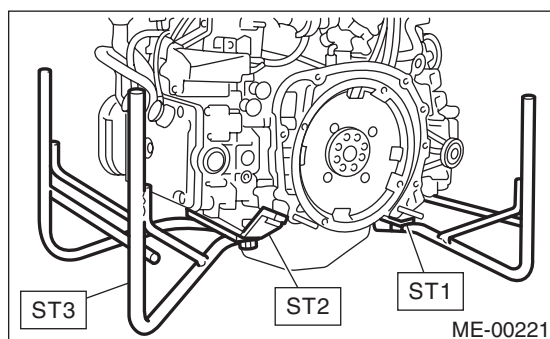
Make sure that no cracks or other damage exists.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it in the ST as shown below.

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. It will be the complete procedure for overhauling of the engine itself 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

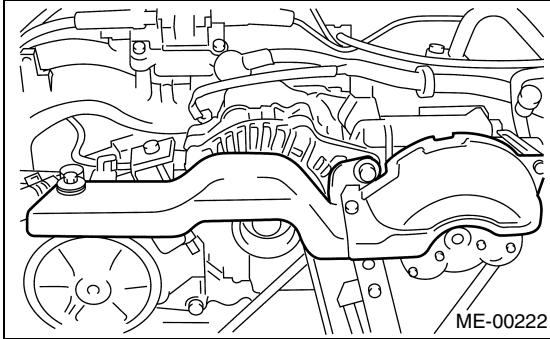
A: REMOVAL

1. FRONT SIDE BELT

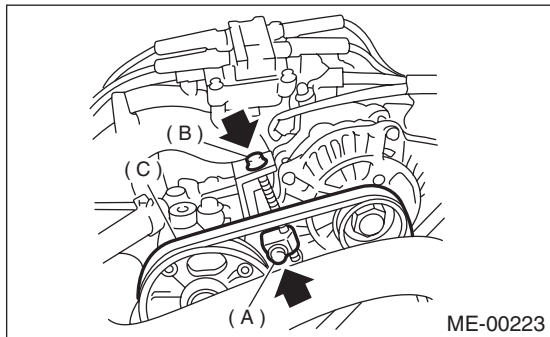
NOTE:

Perform the following procedures 1) to 4) with the engine installed to body.

- 1) Remove the V-belt cover.

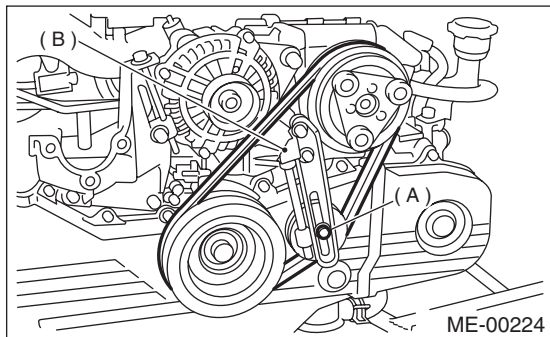


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).



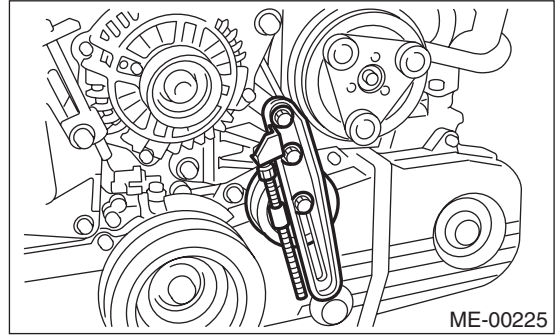
2. REAR SIDE BELT

- 1) Loosen the lock nut (A).
- 2) Loosen the slider bolt (B).



- 3) Remove the A/C belt.

- 4) Remove the A/C belt tensioner.



B: INSTALLATION

1. FRONT SIDE BELT

- 1) Wipe off any oil or water on the belt and pulley.
- 2) Install the belt (C), and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-43, INSPECTION, V-belt.>
- 3) Tighten the lock bolt (A).
- 4) Tighten the slider bolt (B).

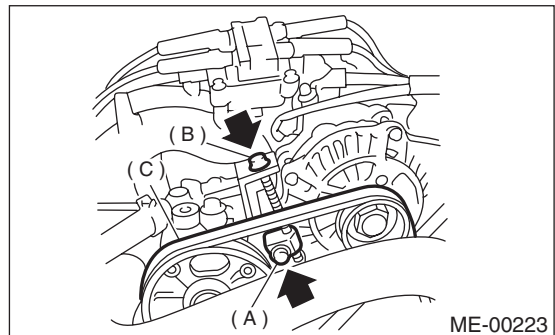
Tightening torque:

Lock bolt through bolt:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

Slider bolt:

8 N·m (0.8 kgf-m, 5.5 ft-lb)



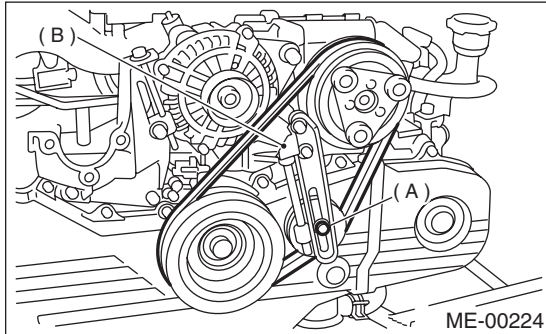
2. REAR SIDE BELT

- 1) Install the belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-43, INSPECTION, V-belt.>
- 2) Tighten the lock nut (A).

Tightening torque:

Lock nut (A);

22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION

- 1) Replace the belts, if cracks, fraying or wear is found.
- 2) Check the drive belt tension and adjust it if necessary by changing the generator installing position and/or idler pulley installing position.

Belt tension

(A)

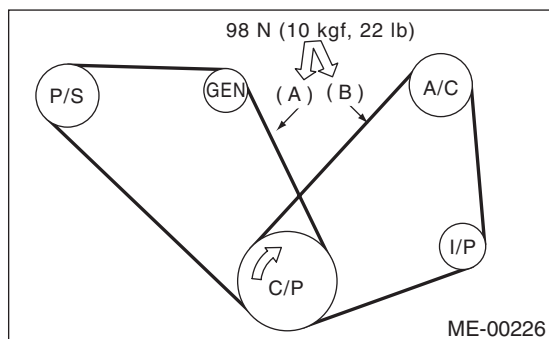
New: 7 — 9 mm (0.276 — 0.354 in)

Reused: 9 — 11 mm (0.354 — 0.433 in)

(B)*

New: 7.5 — 8.5 mm (0.295 — 0.335 in)

Reused: 9.0 — 10.0 mm (0.354 — 0.394 in)



- C/P Crankshaft pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley

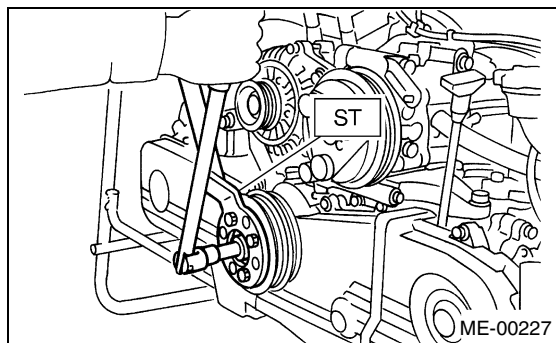
13.Crankshaft Pulley

A: REMOVAL

1) Remove the V-belt.<Ref. to ME(H4SO)-42, REMOVAL, V-belt.>

2) Remove the crankshaft pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH



3) Remove the crankshaft pulley.

B: INSTALLATION

1) Install the crankshaft pulley.

2) Install the pulley bolt.

To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley threads using an air gun.

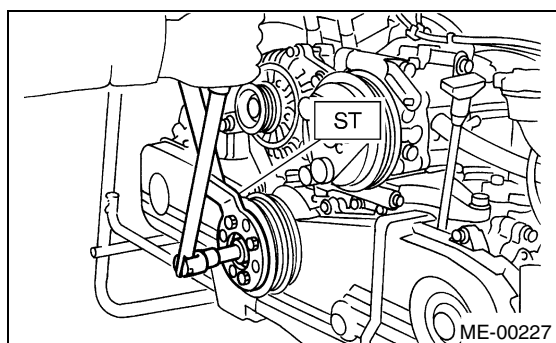
(2) Apply engine oil to the crankshaft pulley bolt seat and threads.

(3) Tighten the bolts temporarily to a torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crankshaft pulley bolts.

Tightening torque:

177 N·m (18.0 kgf-m, 130.2 ft-lb)



3) Confirm that the tightening angle of crankshaft pulley bolt is 65° or more. If the tightening angle of crankshaft pulley bolt is less than 65°, conduct the following procedures.

(1) Replace the crankshaft pulley bolts.

Crankshaft pulley bolt:

12369AA011

(2) Clean the crankshaft threads using an air gun.

(3) Apply engine oil to the crankshaft pulley bolt seat and threads.

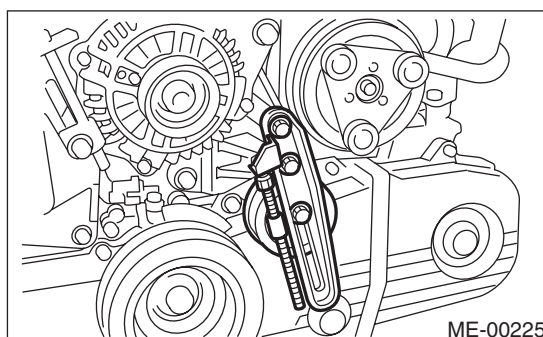
(4) Tighten the bolts temporarily to a torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(5) Tighten the crankshaft pulley bolts for a further angle of 65° — 75°.

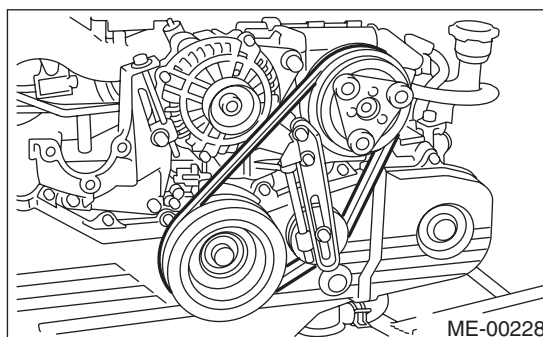
NOTE:

Conduct the tightening procedures by confirming the turning angle of crankshaft pulley bolt referring to the gauge indicated on timing belt cover.

4) Install the A/C belt tensioner.



5) Install the A/C belt.



C: INSPECTION

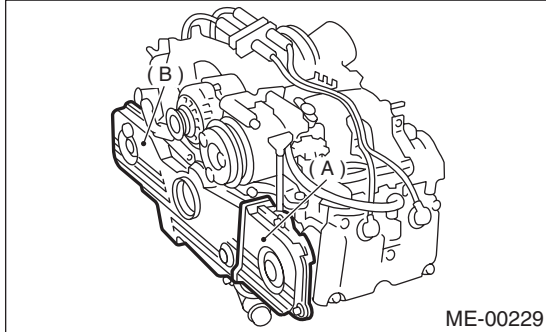
1) Make sure the V-belt is not worn or otherwise damaged.

2) Check the tension of the belt.<Ref. to ME(H4SO)-43, INSPECTION, V-belt.>

14. Timing Belt Cover

A: REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover (LH).
- 4) Remove the front timing belt cover.



- (A) Timing belt cover (LH)
(B) Front timing belt cover

B: INSTALLATION

- 1) Install the front timing belt cover.

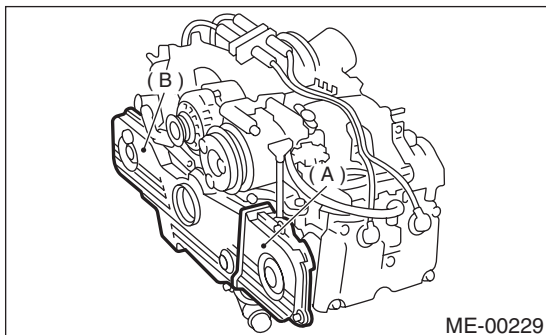
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 2) Install the timing belt cover (LH).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



- (A) Timing belt cover (LH)
(B) Front timing belt cover

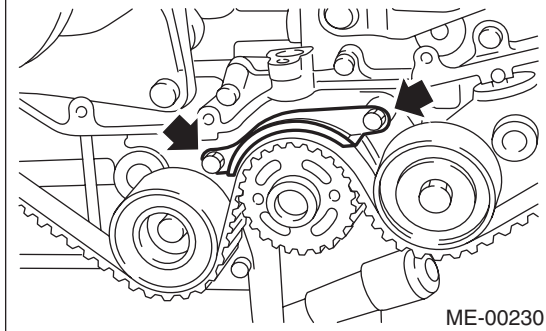
- 3) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>
- 4) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

15. Timing Belt

A: REMOVAL

1. TIMING BELT

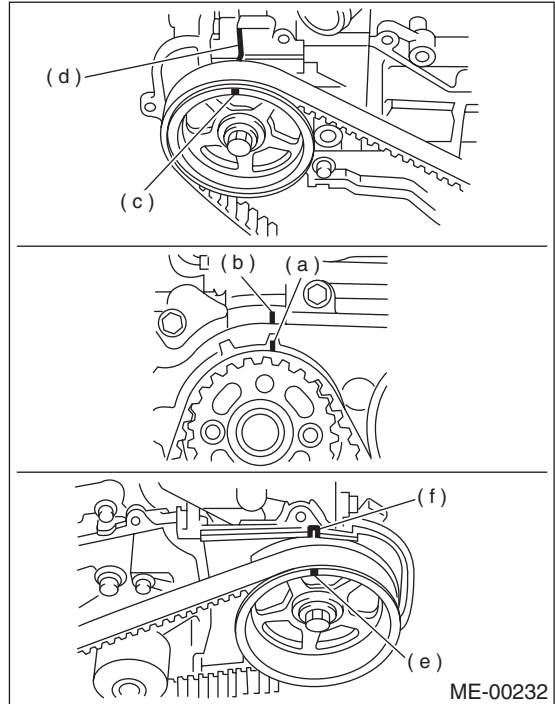
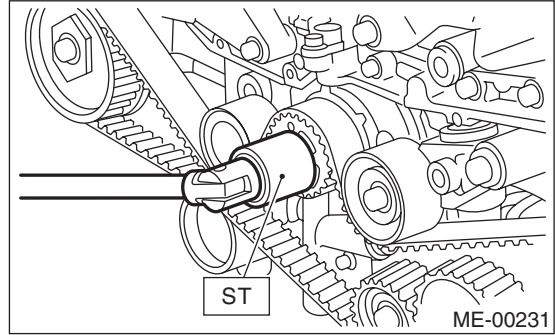
- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt guide. (MT vehicles)



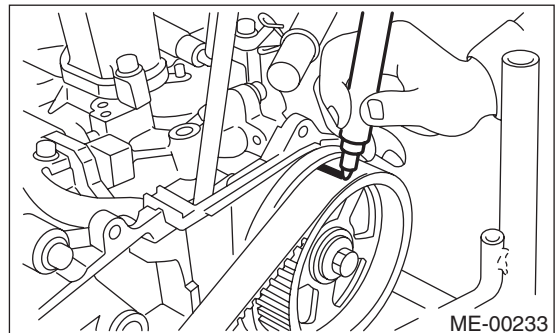
- 5) If the alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt are faded away, put new marks before removing the timing belt as shown in procedures below.

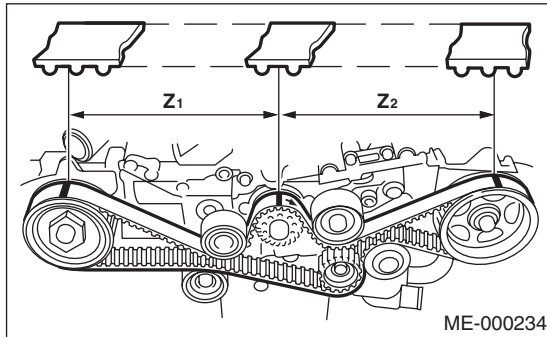
- (1) Turn the crankshaft by using ST. Align the mark (a) of sprocket to cylinder block notch (b) and ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) and/or left side cam sprocket mark (e) and belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET



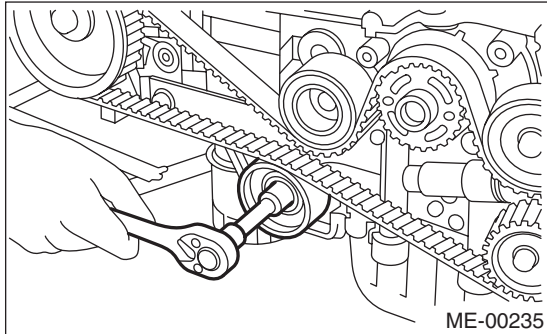
- (2) Using white paint, put alignment and/or arrow marks on the timing belts in relation to crankshaft sprocket and camshaft sprockets.



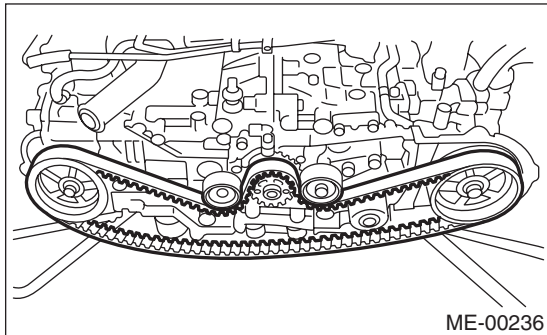
Specified data: **Z_1 : 46.8 tooth length** **Z_2 : 43.7 tooth length**

6) Remove belt idler (No. 2).

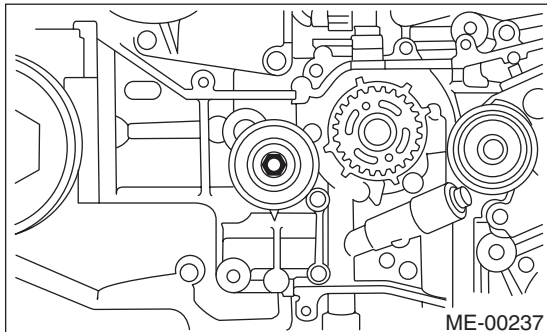
7) Remove belt idler No. 2.



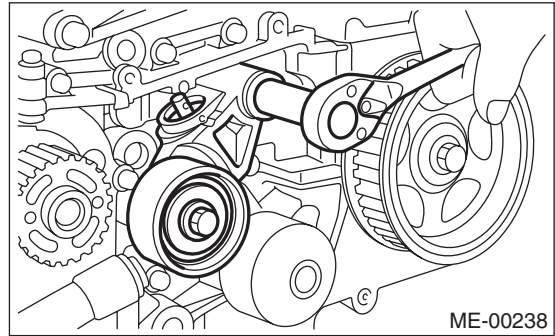
8) Remove the timing belt.

**2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY**

1) Remove belt idler (No. 1).



2) Remove the automatic belt tension adjuster assembly.

**B: INSTALLATION****1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER**

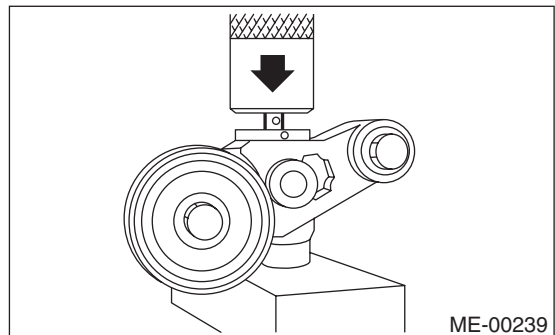
1) Preparation for installation of automatic belt tension adjuster assembly:

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 more than 3 minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into 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 the vertical pressing tool.

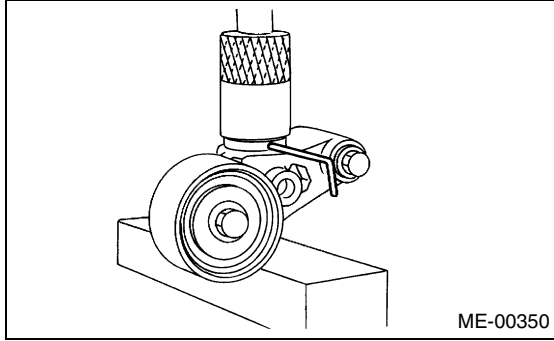
(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



TIMING BELT

MECHANICAL

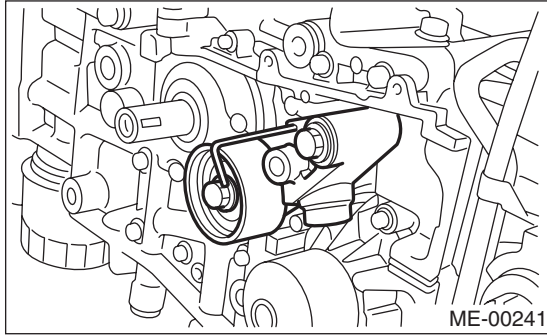
(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



2) Install the automatic belt tension adjuster assembly.

Tightening torque:

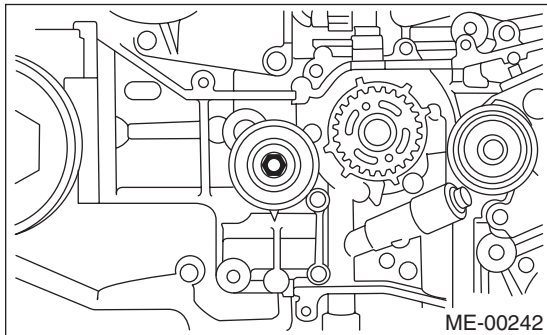
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install belt idler (No. 1).

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



2. TIMING BELT

1) Preparation for installation of automatic belt tension adjuster assembly: <Ref. to ME(H4SO)-47, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

2) Installation of timing belt

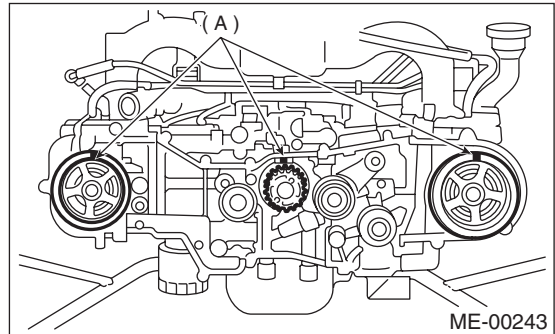
(1) Turn the camshaft sprocket No. 2 using ST1, and then turn the camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

ST1 18231AA010 CAMSHAFT SPROCKET WRENCH

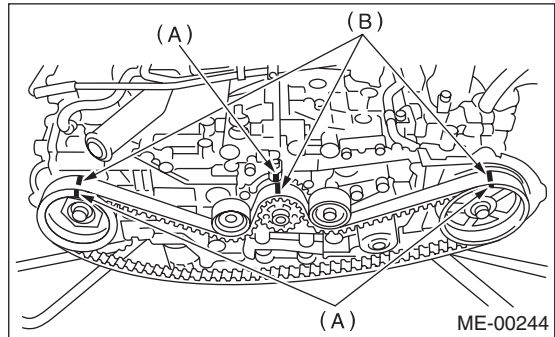
NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

ST2 499207400 CAMSHAFT SPROCKET WRENCH



(2) While aligning alignment mark on the timing belt (B) with marks on sprockets (A), position the timing belt properly.



3) Install belt idler No. 2.

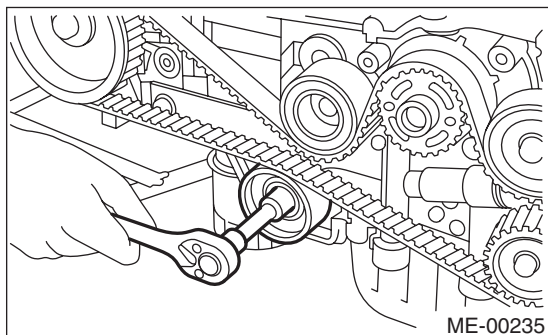
Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

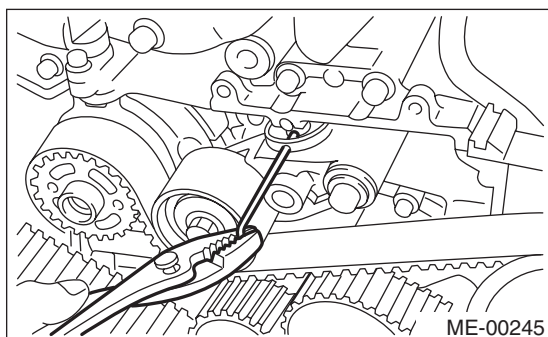
4) Install belt idler (No. 2).

Tightening torque:

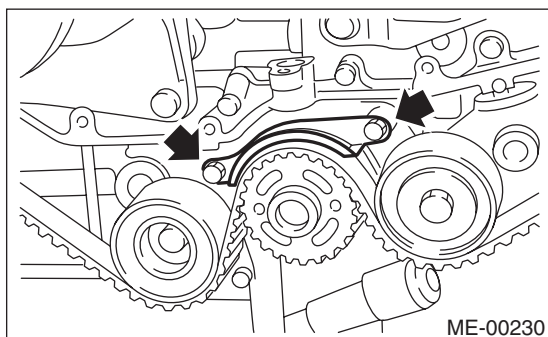
39 N·m (4.0 kgf-m, 28.9 ft-lb)



5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tension adjuster.



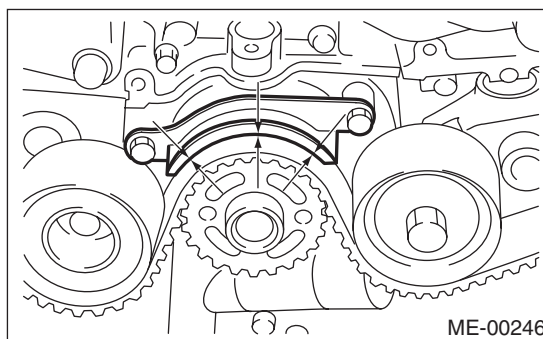
6) Install the timing belt guide. (MT vehicles)
(1) Temporarily tighten the remaining bolts.



(2) Check and adjust the clearance between timing belt and timing belt guide by using a thickness gauge.

Clearance:

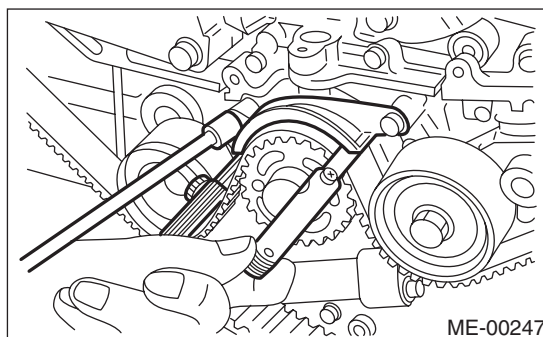
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten the remaining bolts.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)



7) Install the timing belt cover.

<Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

8) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

9) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: INSPECTION

1. TIMING BELT

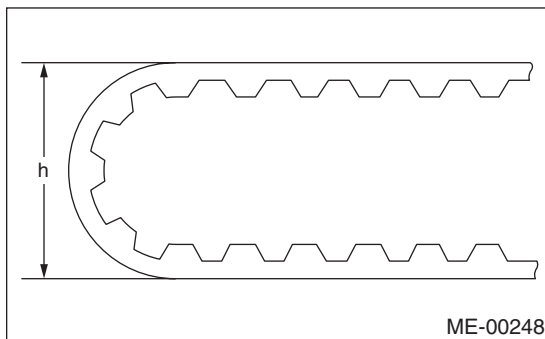
- 1) Check the timing belt teeth for breaks, cracks, and wear. If any fault is found, replace the belt.
- 2) Check the condition of back side of the belt. If any cracks are found, replace the belt.

CAUTION:

- Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
- Do not bend the belt sharply.

Bending radius: *h*

60 mm (2.36 in) or more



2. AUTOMATIC BELT TENSION ADJUST-ER

- 1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.
- 2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod's stiffness.
- 3) If the adjuster rod is not stiff enough and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:

- (1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this motion 2 or 3 times.
- (2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kgf, 66 lb) to it. Check adjuster rod's stiffness.
- (3) If the adjuster rod is not stiff enough and moves down, replace the automatic belt tension adjuster assembly with a new one.

CAUTION:

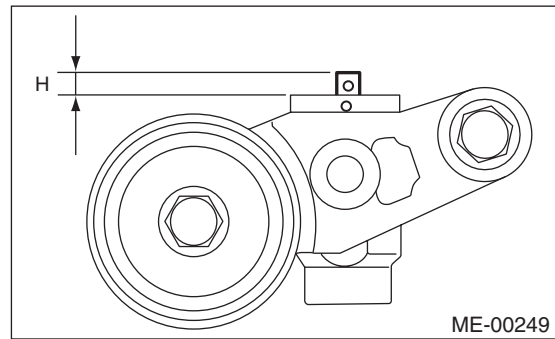
- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking more than 3 minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).

- Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.

- 4) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension: *H*

5.7±0.5 mm (0.224±0.020 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 if faulty.
- 2) Check the tension pulley for smooth rotation. Replace if noise or excessive play is noted.
- 3) Check the tension pulley for grease leakage.

4. BELT IDLER

- 1) Check the belt idler for smooth rotation. Replace if noise or excessive play is noted.
- 2) Check the belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
- 3) Check the belt idler for grease leakage.

16. Camshaft Sprocket

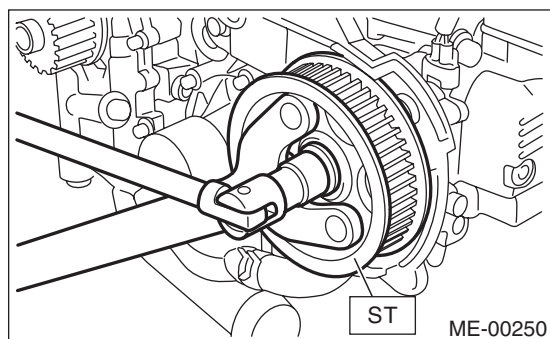
A: REMOVAL

1. REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
 - 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
 - 3) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
 - 4) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
 - 5) Remove the camshaft position sensor. <Ref. to FU(H4SO)-29, REMOVAL, Camshaft Position Sensor.>
 - 6) Remove camshaft sprocket No. 2. To lock the camshaft, use ST.
- ST 18231AA010 CAMSHAFT SPROCKET WRENCH

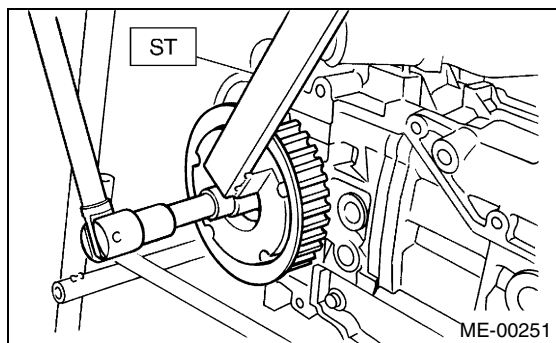
NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.



- 7) Remove camshaft sprocket No. 1. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH



B: INSTALLATION

- 1) Install camshaft sprocket No. 1. To lock the camshaft, use ST.

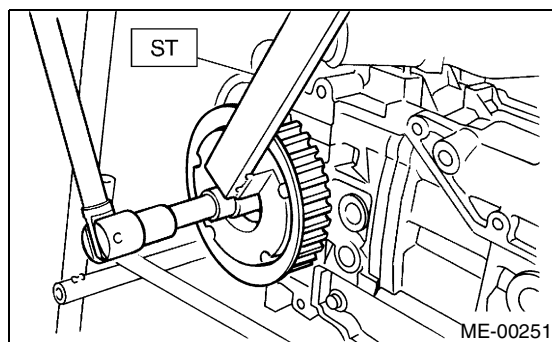
ST 499207400 CAMSHAFT SPROCKET WRENCH

Tightening torque:

78 N·m (8.0 kgf-m, 57.9 ft-lb)

NOTE:

Do not confuse the right and left side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor the camshaft position sensor.



- 2) Install camshaft sprocket No. 2. To lock the camshaft, use ST.

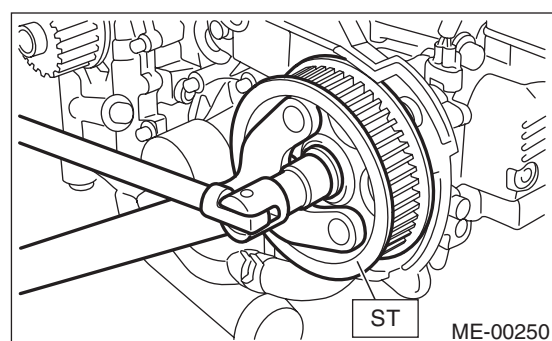
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Tightening torque:

78 N·m (8.0 kgf-m, 57.9 ft-lb)



- 3) Install the camshaft position sensor. <Ref. to FU(H4SO)-29, INSTALLATION, Camshaft Position Sensor.>

- 4) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>

- 5) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

- 6) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

CAMSHAFT SPROCKET

MECHANICAL

7) Install the V-belt.<Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

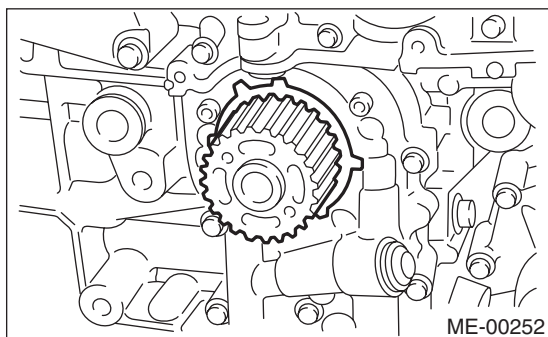
C: INSPECTION

- 1) Check the sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between sprocket and key.
- 3) Check the camshaft sprocket notch for sensor for damage and contamination of foreign matter.

17.Crankshaft Sprocket

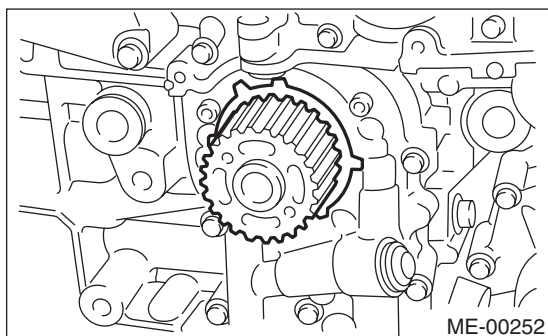
A: REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover.<Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
- 5) Remove the camshaft sprocket.<Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove the crankshaft sprocket.



B: INSTALLATION

- 1) Install the crankshaft sprocket.



- 2) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>
- 3) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>
- 4) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>
- 5) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>
- 6) Install the V-belt.<Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: INSPECTION

- 1) Check the sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between sprocket and key.

- 3) Check the crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

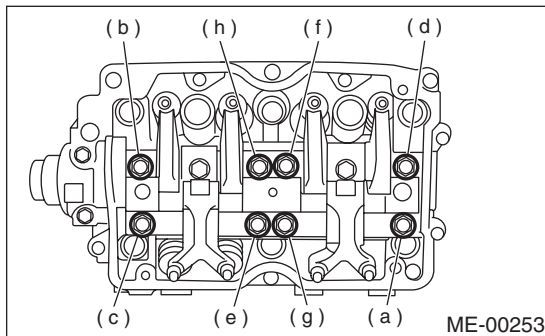
18. Valve Rocker Assembly

A: REMOVAL

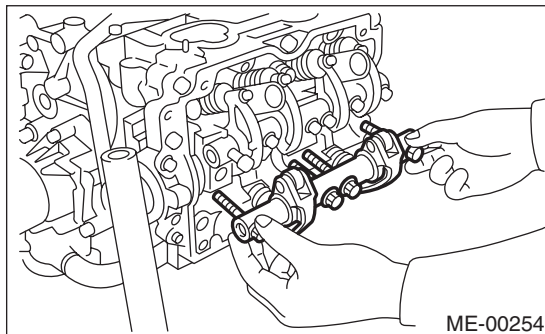
- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
- 6) Disconnect the PCV hose and remove rocker cover.
- 7) Removal of valve rocker assembly
 - (1) Remove bolts (a) through (h) in alphabetical sequence.

NOTE:

Leave two or three threads of bolts (g and h) engaged to retain the valve rocker assembly.



- (2) Remove the valve rocker assembly.



B: INSTALLATION

- 1) Installation of valve rocker assembly
 - (1) Temporarily tighten bolts (a) through (d) equally as shown in the figure.

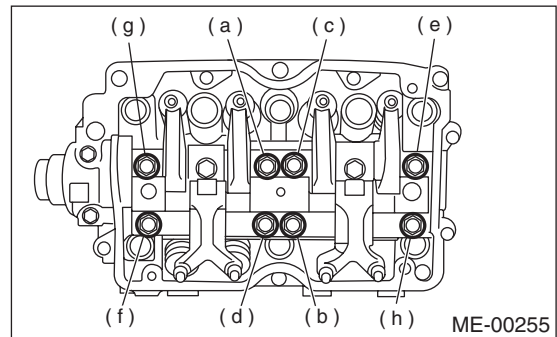
NOTE:

Do not allow the valve rocker assembly to gouge knock pins.

- (2) Tighten bolts (e) through (h) to specified torque.
- (3) Tighten bolts (a) through (d) to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 2) Adjust the valve clearance. <Ref. to ME(H4SO)-31, ADJUSTMENT, Valve Clearance.>
- 3) Install the rocker cover and connect PCV hose.
- 4) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>
- 5) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>
- 6) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>
- 7) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>
- 8) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: DISASSEMBLY

- 1) Remove the bolts which secure rocker shaft.
- 2) Extract the rocker shaft. Remove the valve rocker arms, springs and shaft supports from rocker shaft.

NOTE:

Arrange all removed parts in order so that they can be installed in their original positions.

- 3) Remove the nut and adjuster screw from valve rocker.

D: ASSEMBLY

- 1) Install the adjuster screw and nut to valve rocker.
- 2) Arrange the valve rocker arms, springs and shaft supports in assembly order and insert valve rocker shaft.

Tightening torque (shaft supports installing bolts):

5 N·m (0.5 kgf-m, 3.6 ft-lb)

NOTE:

Valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure the parts with same markings are properly assembled.

- 3) Install the valve rocker shaft securing bolts.

E: INSPECTION

1. VALVE ROCKER ARM

- 1) Measure the inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

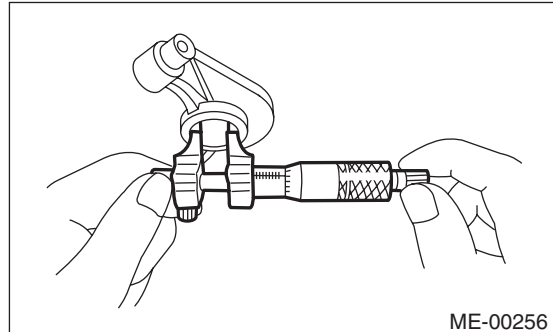
Clearance between arm and shaft:

Standard

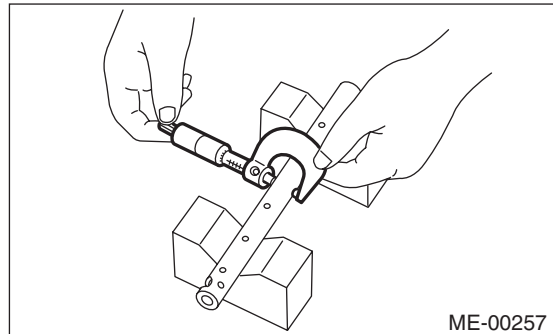
0.020 — 0.054 mm (0.0008 — 0.0021 in)

Limit

0.10 mm (0.0039 in)



ME-00256



ME-00257

- 2) If oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows 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 cam or valve contact surface of valve rocker arm is excessively worn or dented, replace the valve rocker arm.
- 4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

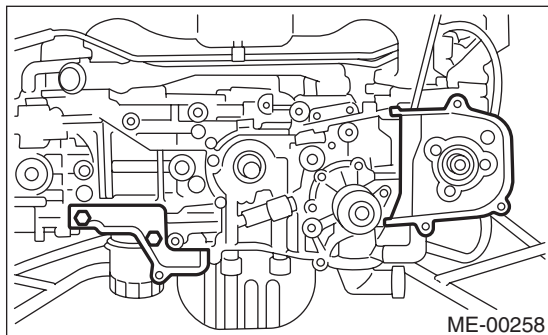
19. Camshaft

A: REMOVAL

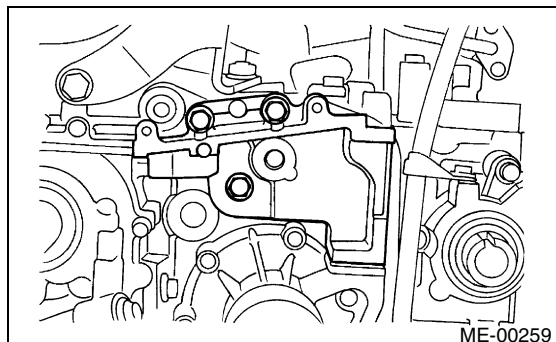
- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove the crankshaft sprocket. <Ref. to ME(H4SO)-53, REMOVAL, Crankshaft Sprocket.>
- 7) Remove timing belt cover No. 2 (LH).
- 8) Remove timing belt cover No. 2 (RH).

NOTE:

Do not damage or lose the seal rubber when removing timing belt covers.

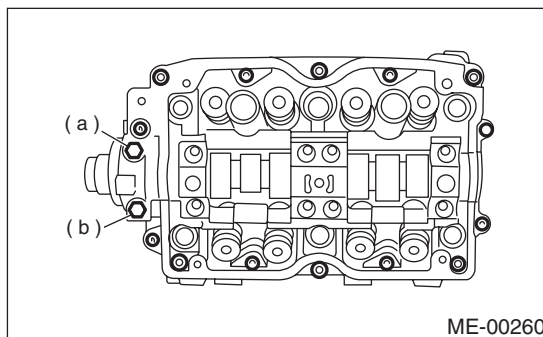


- 9) Remove the tensioner bracket.

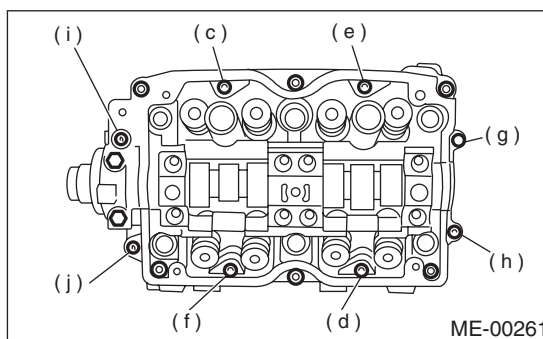


- 10) Remove the camshaft position sensor support. (LH side only)
- 11) Remove the oil level gauge guide. (LH side only)
- 12) Remove the valve rocker assembly. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
- 13) Remove the camshaft cap.

- (1) Remove bolts (a) through (b) in alphabetical sequence.

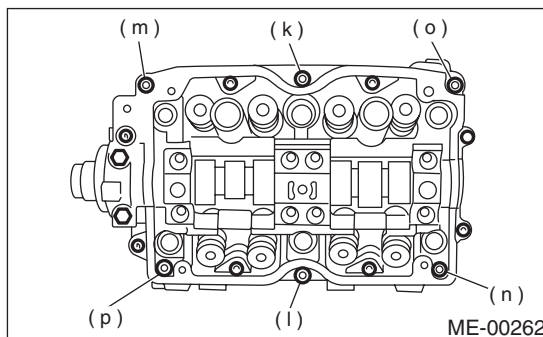


- (2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.

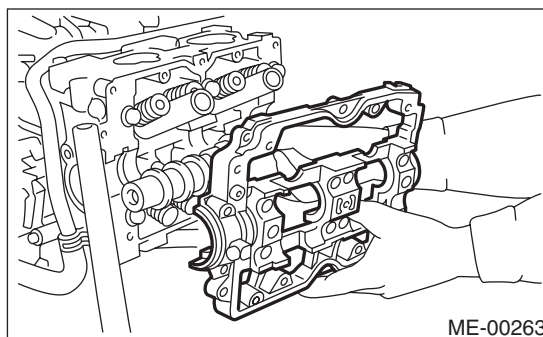


- (3) Remove bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX PLUS



- (4) Remove the camshaft cap.



- 14) Remove the camshaft.
- 15) Remove the oil seal.
- 16) Remove the plug from rear side of camshaft.

CAUTION:

- Do not remove the oil seal unless necessary.
- Do not scratch the journal surface when removing oil seal.

B: INSTALLATION

1) Apply a thin coat of engine oil to the camshaft journals, and then install the camshaft.

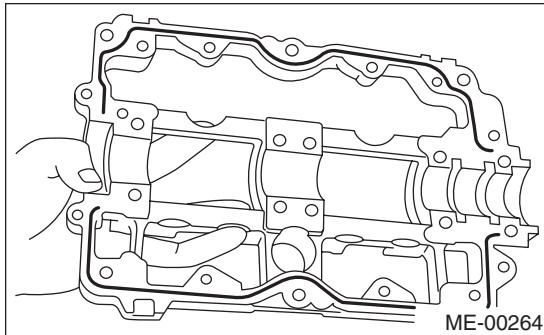
2) Install the camshaft cap.

(1) Apply liquid gasket on the around of camshaft cap.

Liquid gasket:

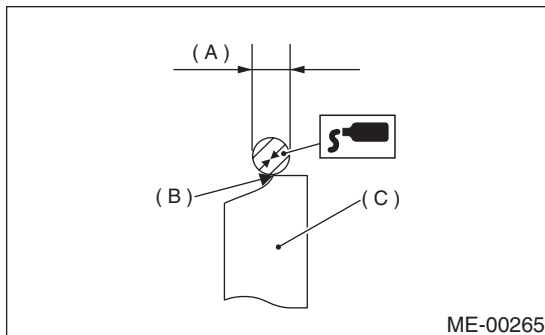
ThreeBond 1280B

P/N K0877YA018

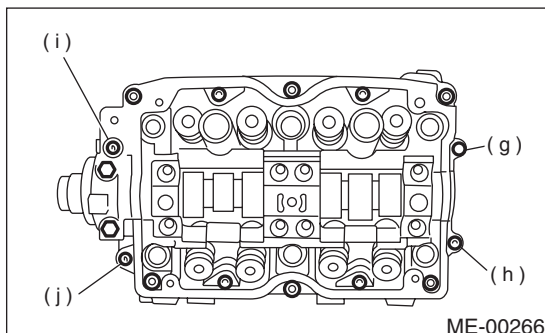


NOTE:

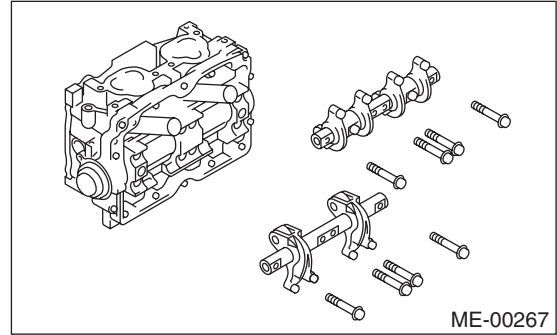
Apply a 3 mm (0.12 in) dia. (A) bead of liquid gasket along edge (B) of the camshaft cap (C) mating surface.



(2) Temporarily tighten bolts (g) through (j) in alphabetical sequence.



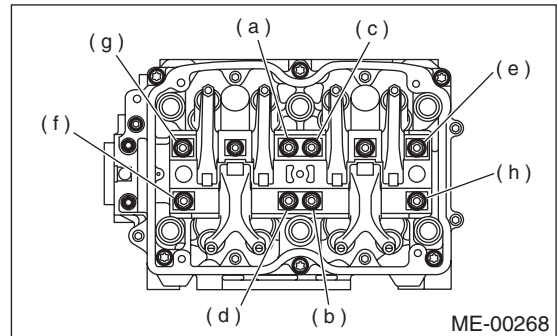
(3) Install the valve rocker assembly.



(4) Tighten bolts (a) through (h) in alphabetical sequence.

Tightening torque:

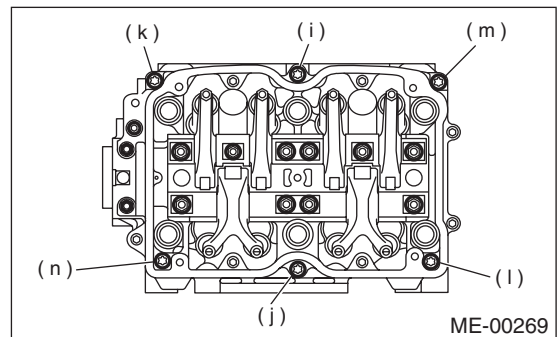
25 N·m (2.5 kgf-m, 18.1 ft-lb)



(5) Tighten the TORX bolts (i) through (n) in alphabetical sequence using ST. 499497000 TORX PLUS

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



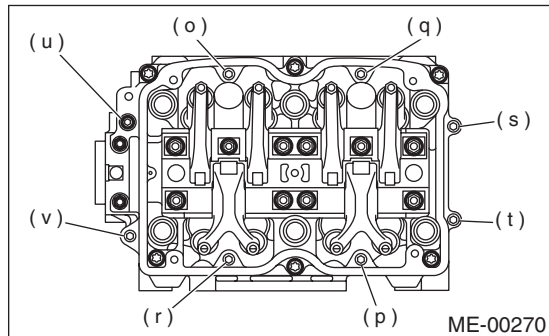
CAMSHAFT

MECHANICAL

- (6) Tighten bolts (o) through (v) in alphabetical sequence.

Tightening torque:

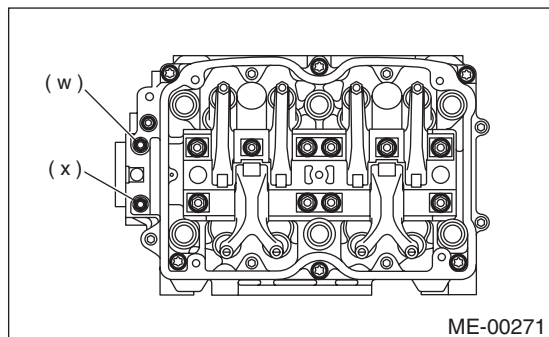
10 N·m (1.0 kgf-m, 7.2 ft-lb)



- (7) Tighten bolts (w) through (x) in alphabetical sequence.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

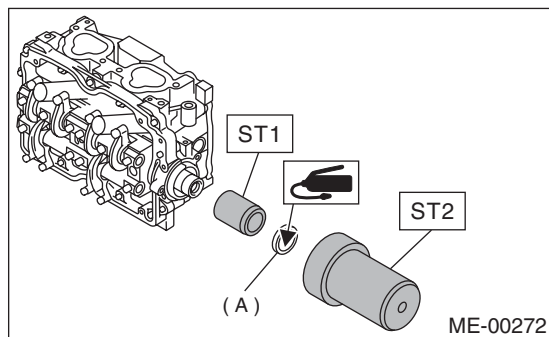


- 3) Apply a thin coat of grease to oil seal lips, and then install the oil seal (A) on camshaft using ST1 and ST2.

NOTE:

Use a new oil seal.

ST1	499597000	OIL SEAL GUIDE
ST2	499587500	OIL SEAL INSTALLER



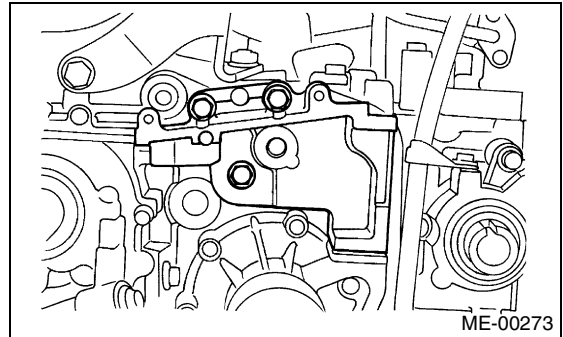
- 4) Install the plug using ST.
ST 499587700 CAMSHAFT OIL SEAL INSTALLER

- 5) Adjust valve clearances. <Ref. to ME(H4SO)-31, ADJUSTMENT, Valve Clearance.>

- 6) Install the rocker cover and connect PCV hose.
7) Install the oil level gauge guide. (LH side only)
8) Install the camshaft position sensor support. (LH side only)
9) Install the tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 10) Install timing belt cover No. 2 (RH).

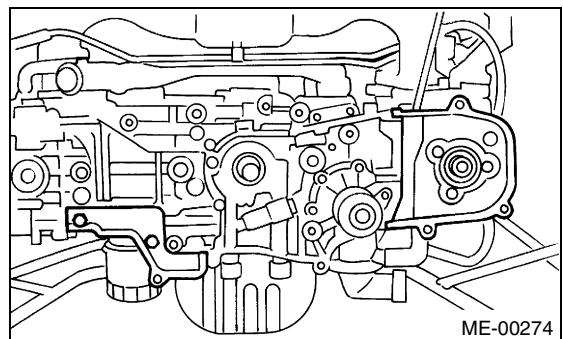
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 11) Install timing belt cover No. 2 (LH).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



- 12) Install the crankshaft sprocket. <Ref. to ME(H4SO)-53, INSTALLATION, Crankshaft Sprocket.>

- 13) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>

- 14) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>

- 15) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

- 16) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

- 17) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

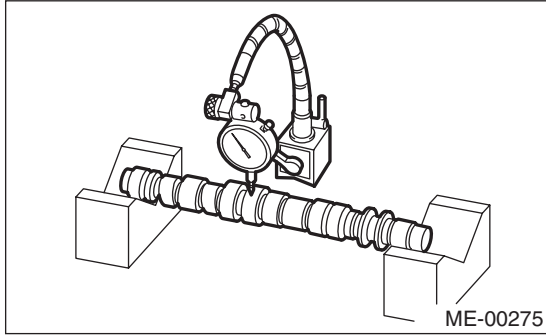
C: INSPECTION

1. CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:

0.025 mm (0.00098 in)



2) Check the journal for damage and wear. Replace if defective.

3) Measure the outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between the two (= oil clearance). If the oil clearance exceeds specifications, replace the camshaft or cylinder head as necessary.

Unit: mm (in)		
Clear- ance at journal	STD	0.055 — 0.090 (0.0022 — 0.0035)
	Limit	0.10 (0.0039)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

4) Check the cam face condition and remove minor faults by grinding with oil stone. Measure cam height H. Replace if the value exceeds the specified limit.

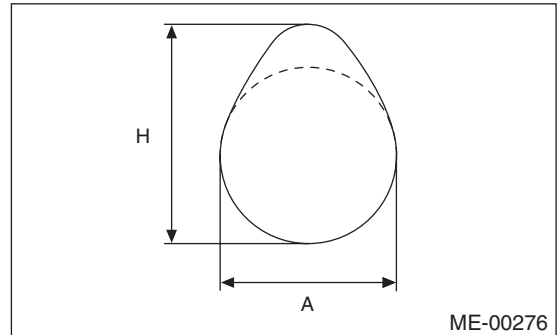
Cam height: H

Unit: mm (in)		
Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
	Limit	39.385 (1.5506)
Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
	Limit	39.157 (1.5416)

Cam base circle diameter A:

Intake; 34.00 mm (1.3386 in)

Exhaust; 34.00 mm (1.3386 in)



2. CAMSHAFT SUPPORT

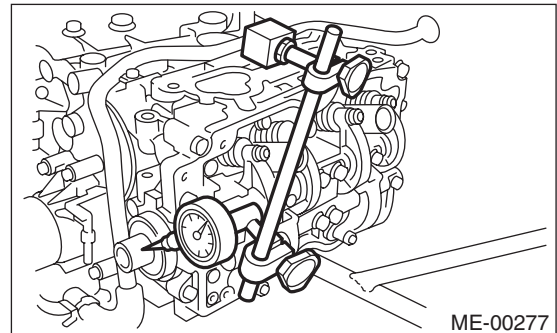
Measure the thrust clearance of camshaft with a dial gauge. If the clearance exceeds the limit, replace the camshaft support.

Standard:

0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:

0.10 mm (0.0039 in)



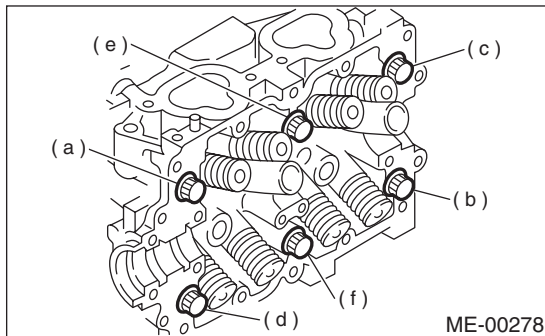
20. Cylinder Head

A: REMOVAL

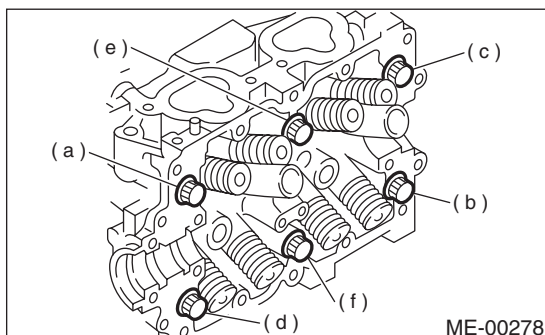
- 1) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove the intake manifold. <Ref. to FU(H4SO)-15, REMOVAL, Intake Manifold.>
- 7) Remove the bolt which installs A/C compressor bracket on cylinder head.
- 8) Remove the valve rocker assembly. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
- 9) Remove the camshaft. <Ref. to ME(H4SO)-56, REMOVAL, Camshaft.>
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

NOTE:

Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



- 11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.
- 12) Remove bolts (a) and (c) to remove cylinder head.



- 13) Remove the cylinder head gasket.

CAUTION:

Do not scratch the mating surface of cylinder head and cylinder block.

- 14) Similarly, remove the right side cylinder head.

B: INSTALLATION

- 1) Install the cylinder head and gaskets on cylinder block.

CAUTION:

- Use new cylinder head gaskets.
- Be careful not to scratch the mating surface of cylinder block and cylinder head.

- 2) Tighten the cylinder head bolts.
 - (1) Apply a coat of engine oil to the washers and bolt threads.
 - (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence. Then tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
 - (3) Back off all bolts in reverse order of assembly by 180° first; back them off by 180° again.
 - (4) Tighten the bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb).
 - (5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).
 - (6) Tighten all bolts by 80 to 90° in alphabetical sequence.

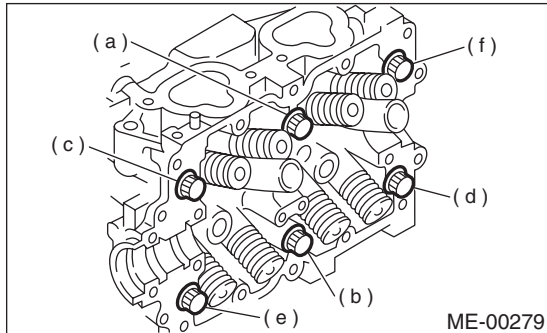
CAUTION:

Do not tighten bolts more than 90°.

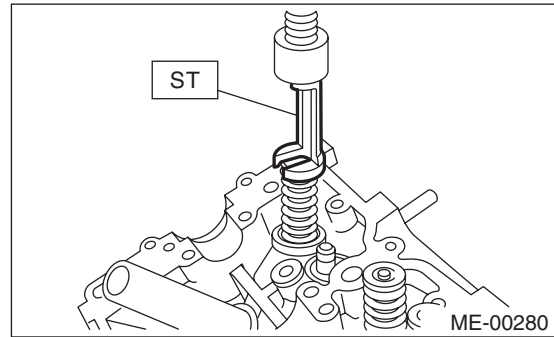
(7) Further tighten all bolts by 80 to 90° in alphabetical sequence shown in figure below.

CAUTION:

Ensure that the total “re-tightening angle” [in the former two steps], do not exceed 180°.



- Use extreme care not to damage the lips of intake valve oil seals and exhaust valve oil seals.



3) Install the camshaft. <Ref. to ME(H4SO)-57, INSTALLATION, Camshaft.>

4) Install the valve rocker assembly. <Ref. to ME(H4SO)-54, INSTALLATION, Valve Rocker Assembly.>

5) Install the A/C compressor bracket on cylinder head.

6) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>

7) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>

8) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>

9) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

10) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

11) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

C: DISASSEMBLY

1) Place the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

2) Set the ST on valve spring. Compress the valve spring, and then remove the valve spring retainer key. Remove each valve and valve spring.

ST 499718000 VALVE SPRING REMOVER

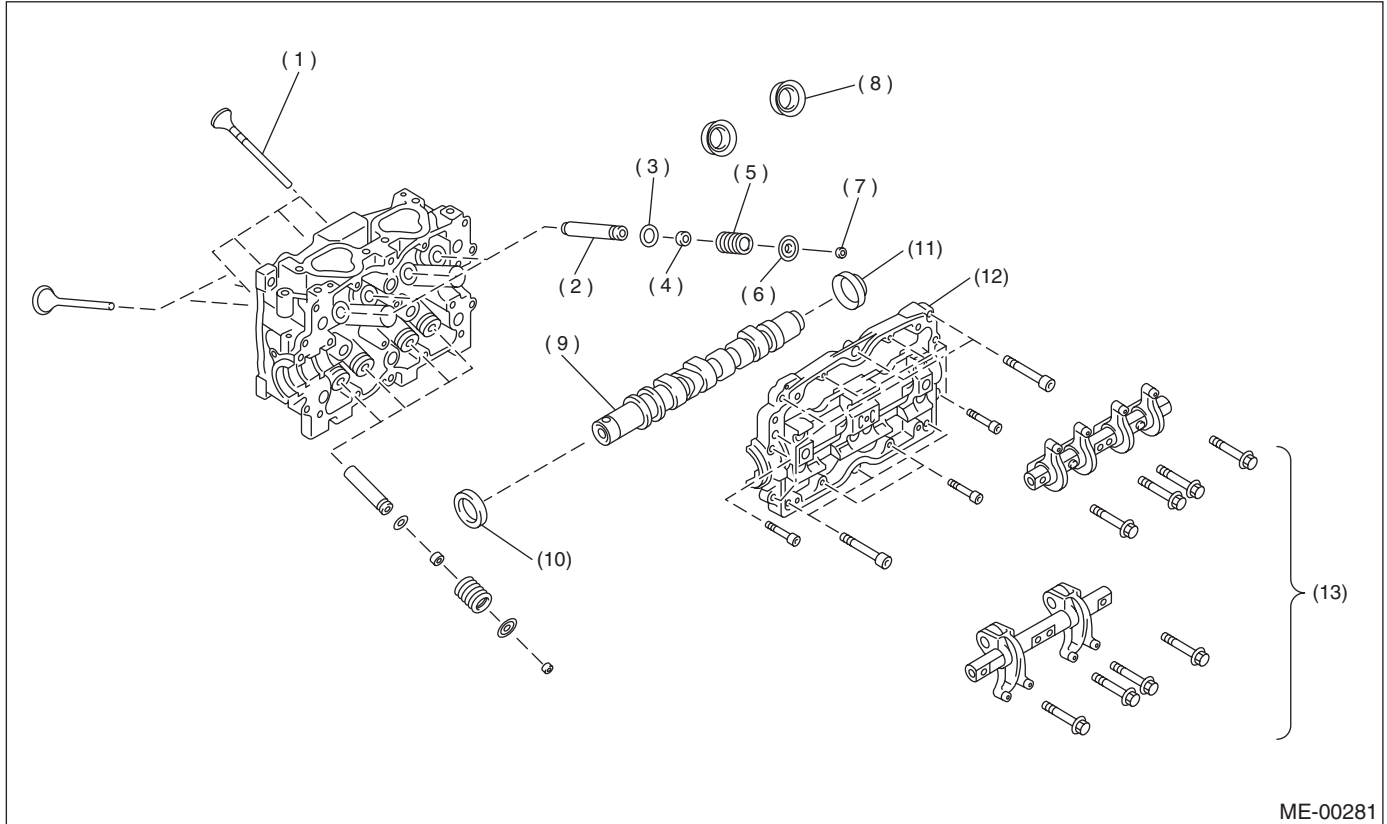
CAUTION:

- Mark each valve to prevent confusion.

CYLINDER HEAD

MECHANICAL

D: ASSEMBLY



ME-00281

- | | | |
|-----------------------|-----------------------|----------------------------|
| (1) Valve | (6) Retainer | (11) Plug |
| (2) Valve guide | (7) Retainer key | (12) Camshaft cap |
| (3) Valve spring seat | (8) Spark plug gasket | (13) Valve rocker assembly |
| (4) Oil seal | (9) Camshaft | |
| (5) Valve spring | (10) Oil seal | |

1) Installation of valve spring and valve

- (1) Place the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

- (2) Coat the stem of each valve with engine oil and insert valve into valve guide.

NOTE:

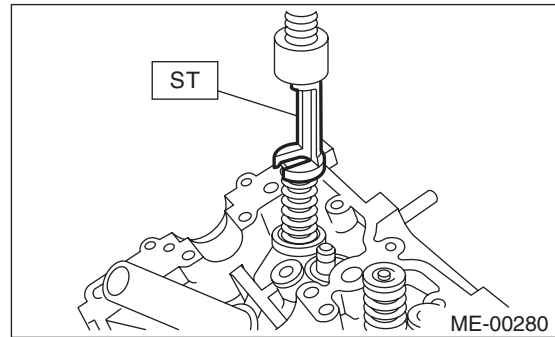
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (3) Install the valve spring and retainer.

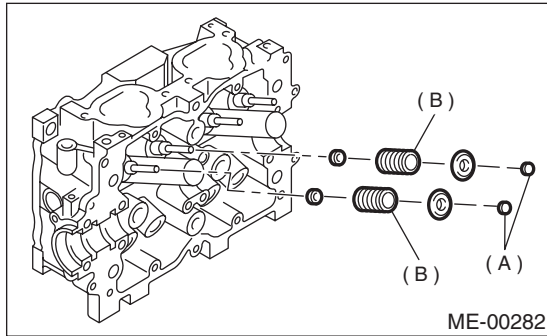
NOTE:

Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

- (4) Set the ST on valve spring.
ST 499718000 VALVE SPRING REMOVER



- (5) Compress the valve spring, and then fit the valve spring retainer key.



- (A) Retainer
(B) Painted face

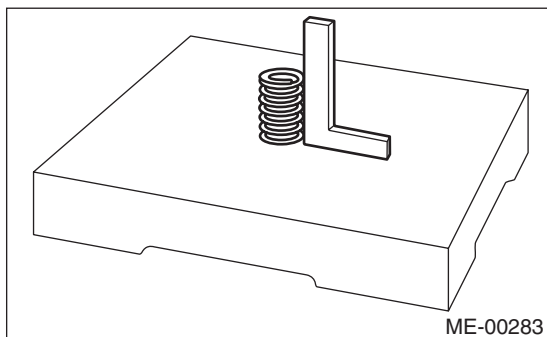
- (6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

E: INSPECTION

1. VALVE SPRING

- 1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not to the specifications presented below.
- 2) To measure the squareness of valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

Free length	54.30 mm (2.1378 in)
Squareness	2.5°, 2.4 mm (0.094 in)
Tension/spring height	214 — 246 N (21.8 — 25.1 kgf, 48.1 — 55.3 lb)/ 45.0 mm (1.772 in)
	526 — 582 N (53.6 — 59.3 kgf, 118.3 — 130.8 lb)/ 34.7 mm (1.366 in)



2. INTAKE AND EXHAUST VALVE OIL SEAL

In the following cases, replace the oil seal with a new one using pliers to pinch and remove the seal from the valve.

- The lip is damaged.
- The spring is out of place.
- Valve and valve seat need reconditioning.
- Valve guide needs replacement.

- 1) Place the cylinder head on ST1.
- 2) Press-fit oil seal to the specified dimension indicated in the figure using ST2.

CAUTION:

- **Apply engine oil to oil seal before press-fitting.**
- **When press-fitting oil seal, do not use a hammer or drive the seal.**
- **Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.**

ST1 498267800 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

Color of rubber part:

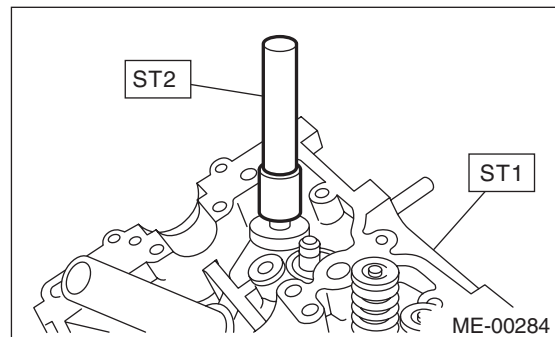
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]



CYLINDER HEAD

MECHANICAL

F: ADJUSTMENT

1. CYLINDER HEAD

1) Make sure that no cracks or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.

Also make sure that gasket installing surface shows no trace of fuel and water leaks.

2) Place the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

3) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge and thickness gauge.

If the warping exceeds 0.05 mm (0.0020 in), regrind the surface with a surface grinder.

Warping limit:

0.05 mm (0.0020 in)

Grinding limit:

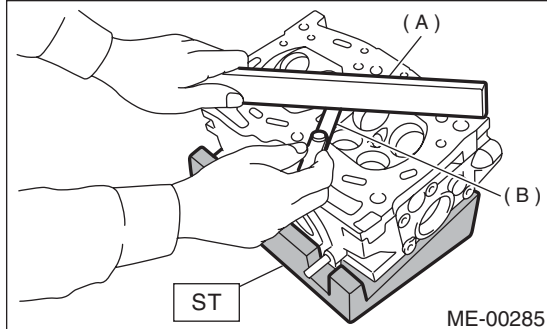
0.1 mm (0.004 in)

Standard height of cylinder head:

97.5 mm (3.839 in)

NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.



(A) Straight edge

(B) Thickness gauge

2. VALVE SEAT

Inspect the intake and exhaust valve seats, and then correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width: W

Intake (A)

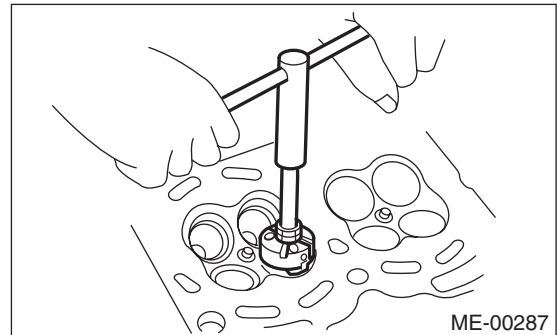
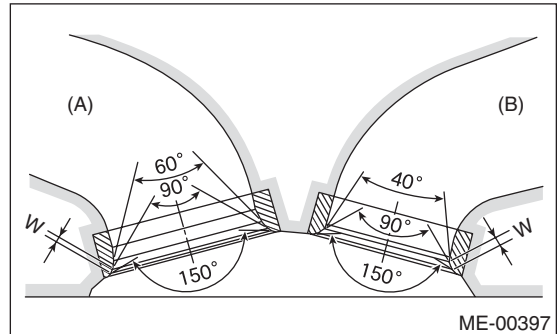
Standard 1.1 mm (0.043 in)

Limit 1.8 mm (0.071 in)

Exhaust (B)

Standard 1.5 mm (0.059 in)

Limit 2.2 mm (0.087 in)



3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Clearance between the valve guide and valve stem:

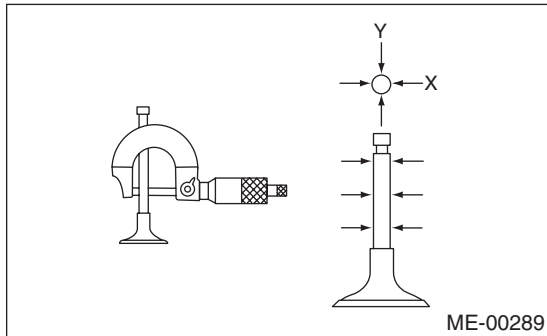
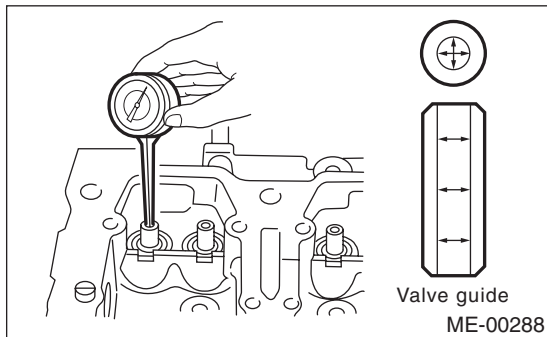
Standard

Intake 0.035 — 0.062 mm (0.0014 — 0.0024 in)

Exhaust 0.040 — 0.067 mm (0.0016 — 0.0026 in)

Limit

0.15 mm (0.0059 in)



2) If the clearance between valve guide and stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. 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)

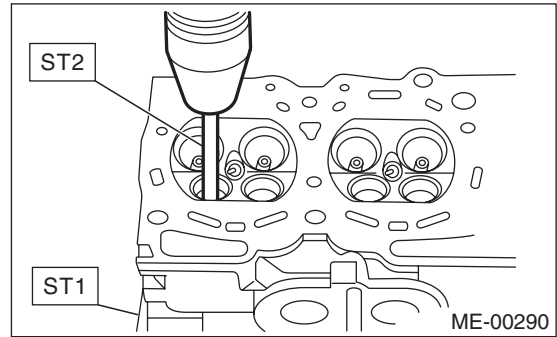
Exhaust

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 enter the holes in ST1.

(2) Insert the ST2 into valve guide and press it down to remove valve guide.

ST1 498267800 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



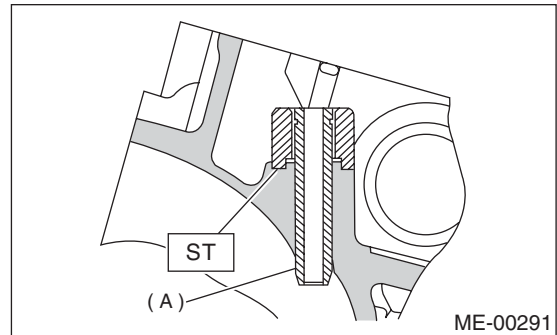
(3) Turn the cylinder head upside down and place ST as shown in the figure.

Intake side:

ST 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST 499767800 VALVE GUIDE ADJUSTER



(A) Valve guide

(4) Before installing new oversize valve guide, make sure that neither scratches nor damages exist on the inside surface of valve guide holes in cylinder head.

(5) Put new valve guide, coated with sufficient oil, in the cylinder, and then insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

CYLINDER HEAD

MECHANICAL

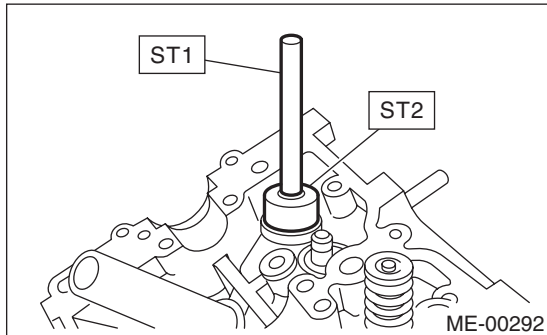
ST1 499767200 VALVE GUIDE REMOVER

Intake side:

ST2 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

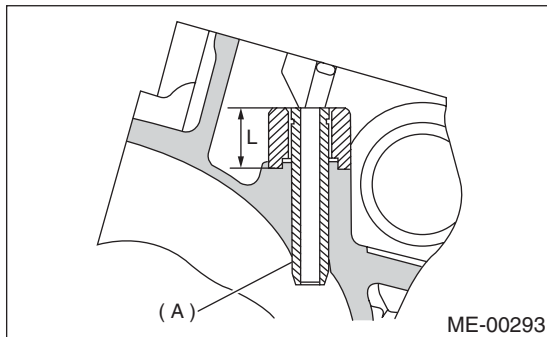
Valve guide protrusion: L

Intake

20.0 — 20.5 mm (0.787 — 0.807 in)

Exhaust

16.5 — 17.0 mm (0.650 — 0.669 in)



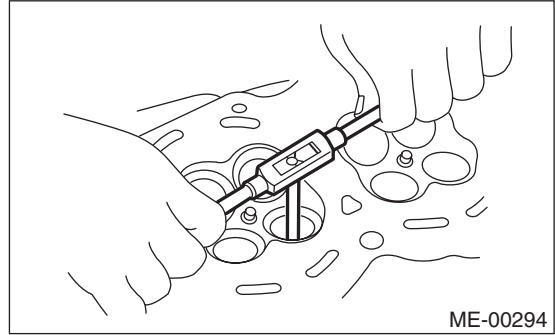
(A) Valve guide

(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into the valve guide. Return the reamer by also rotating it clockwise. After reaming, clean the valve guide to remove chips.

CAUTION:

- Apply engine oil to the reamer when reaming.
- If the inner surface of the valve guide is scored, the edge of the reamer should be slightly ground with an oil stone.
- If the inner surface of the valve guide becomes shiny and the reamer does not produce chips, use a new reamer or repair the reamer.

ST 499767400 VALVE GUIDE REAMER



(8) Recheck the contact condition between valve and valve seat after replacing valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if dimension "H" is less than the specified limit.

H:

Intake

Standard 1.0 mm (0.039 in)

Limit 0.6 mm (0.024 in)

Exhaust

Standard 1.2 mm (0.047 in)

Limit 0.6 mm (0.024 in)

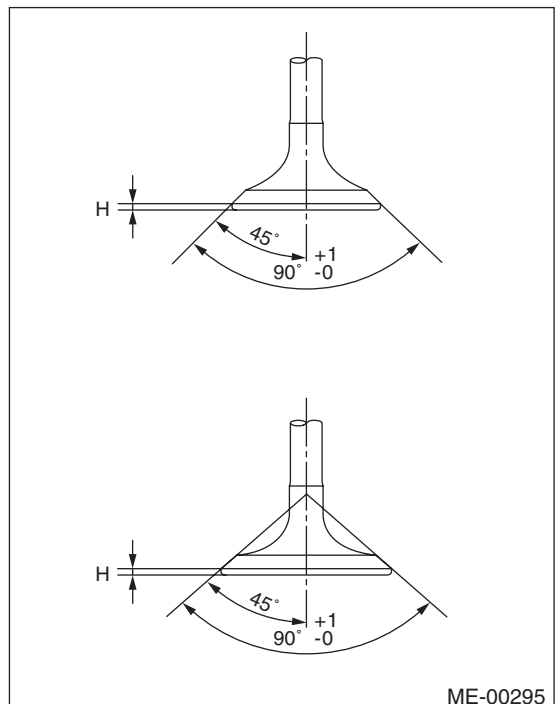
Valve overall length:

Intake

120.6 mm (4.75 in)

Exhaust

121.7 mm (4.79 in)



2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface.
<Ref. to ME(H4SO)-64, VALVE SEAT, ADJUSTMENT, Cylinder Head.> Install a new intake valve oil seal after lapping.

21. Cylinder Block

A: REMOVAL

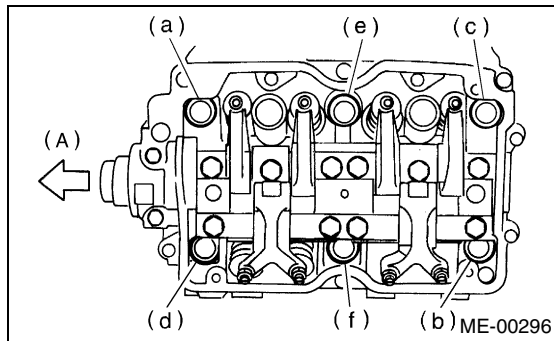
NOTE:

Before conducting this procedure, drain the engine oil completely if applicable .

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-15, REMOVAL, Intake Manifold.>
- 2) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 3) Remove the crankshaft pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt.>
- 6) Remove the camshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Camshaft Sprocket.>
- 7) Remove the crankshaft sprocket. <Ref. to ME(H4SO)-44, REMOVAL, Crankshaft Pulley.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the rocker cover.
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

NOTE:

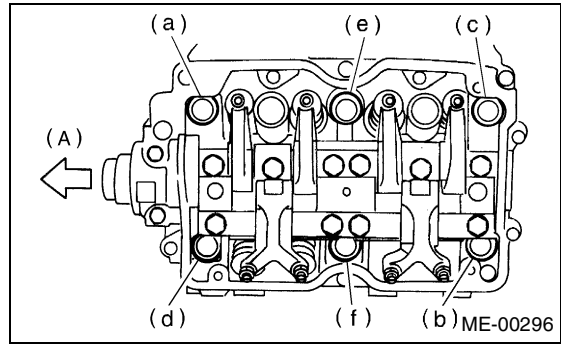
Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



(A) Front

- 11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.

- 12) Remove bolts (a) and (c) to remove cylinder head.



(A) Front

- 13) Remove the cylinder head gasket.

NOTE:

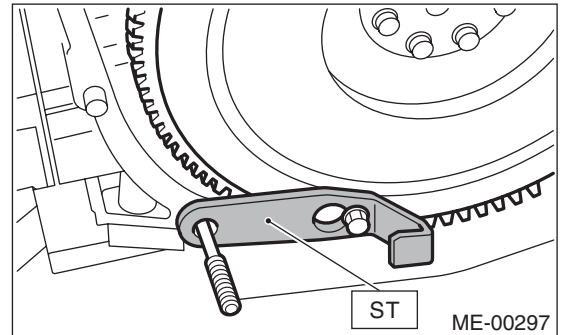
Do not scratch the mating surface of cylinder head and cylinder block.

- 14) Similarly, remove the right side cylinder head.
- 15) Remove the clutch housing cover. (MT vehicles)
- 16) Remove the flywheel (MT vehicles) or drive plate (AT vehicles).

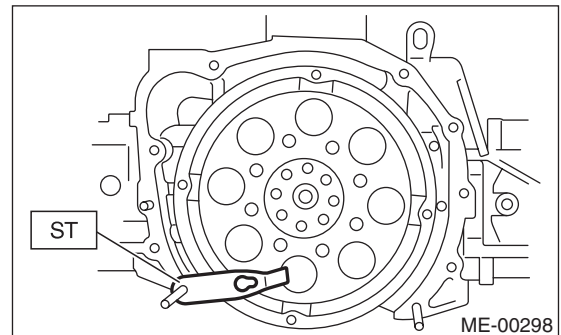
Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER

- MT model

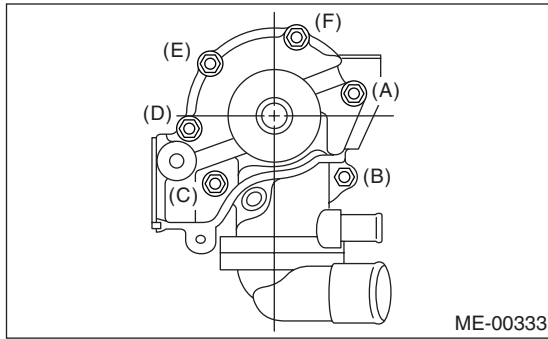


- AT model



- 17) Remove the oil separator cover.
- 18) Remove the water by-pass pipe for heater.

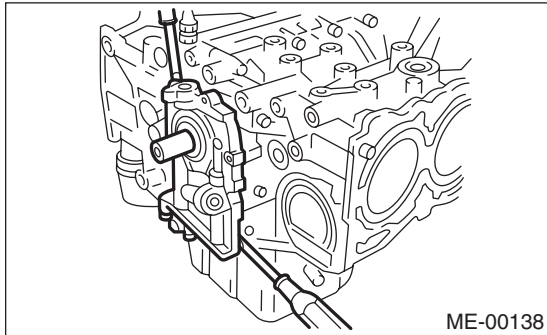
19) Loosen the bolts in alphabetical sequence as shown in the figure, and then remove water pump.



20) Remove the oil pump from cylinder block. Use a flat-bladed screwdriver as shown in the figure when removing oil pump.

NOTE:

Be careful not to scratch the mating surface of cylinder block and oil pump.

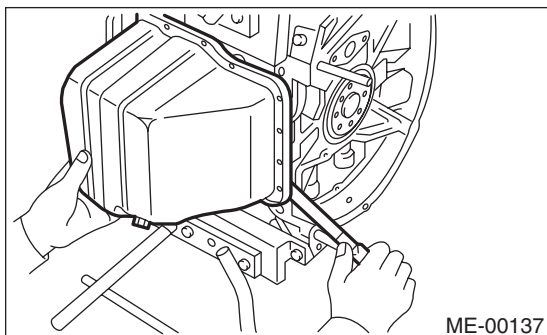


21) Removal of oil pan

- (1) Turn the cylinder block to face the #2 and #4 piston sides upward.
- (2) Remove the bolts which secure oil pan to cylinder block.
- (3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance, and then remove the oil pan.

NOTE:

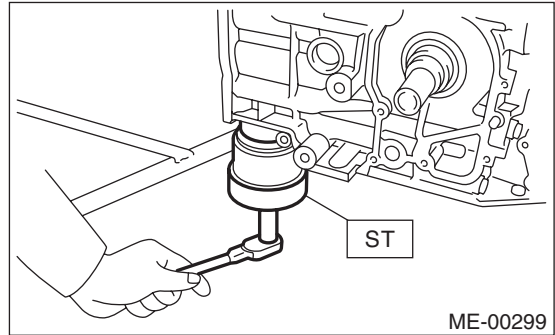
Do not use a screwdriver or similar tool in place of oil pan cutter.



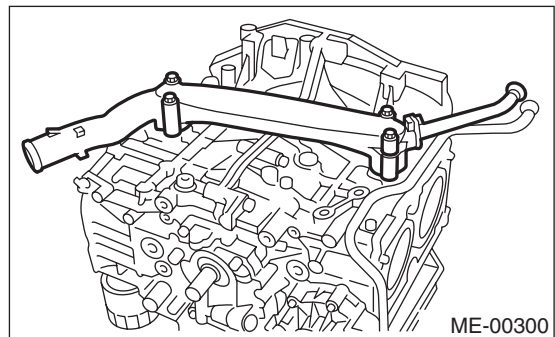
24) Remove the baffle plate.

25) Remove the oil filter with ST.

ST 498547000 OIL FILTER WRENCH



26) Remove the water pipe.

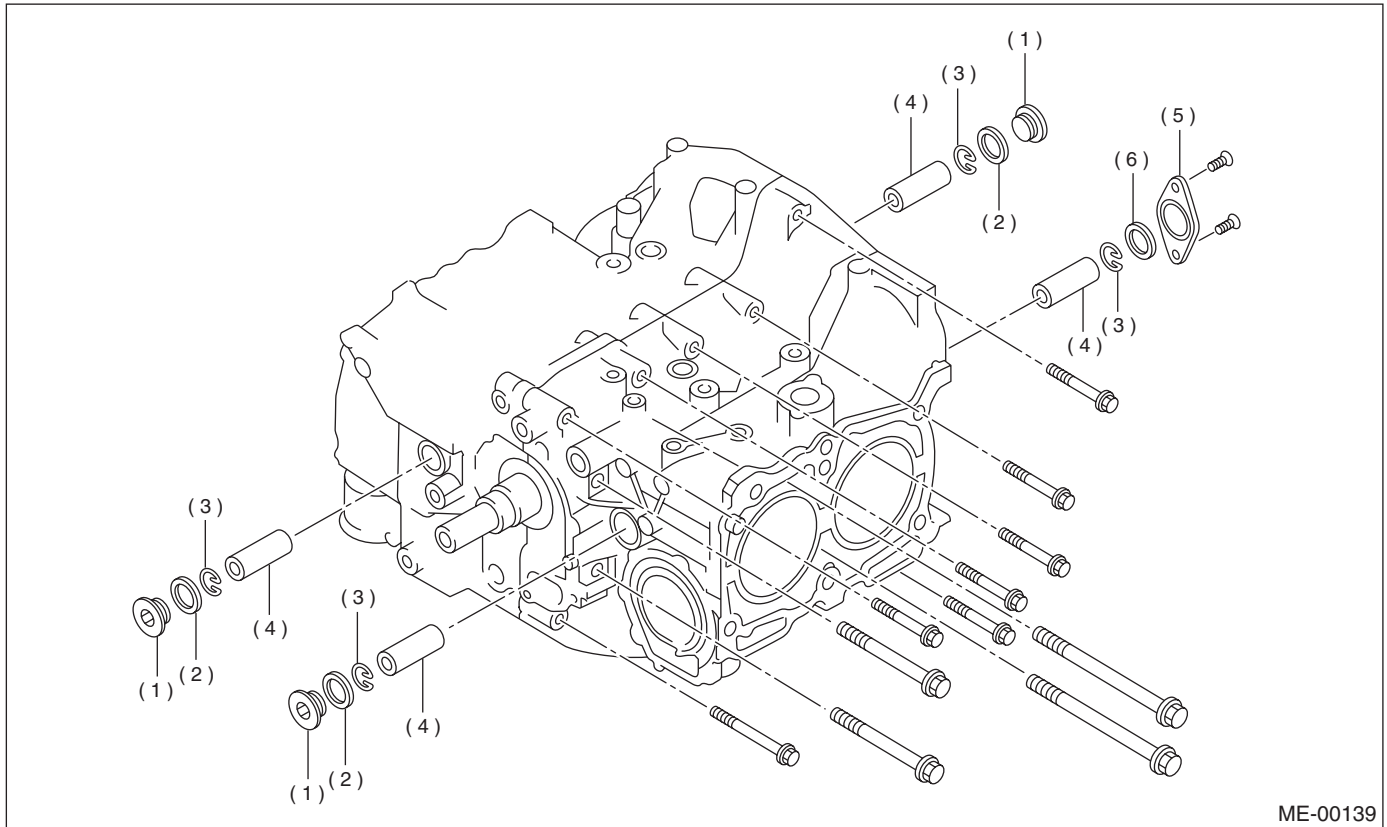


22) Remove the oil strainer stay.

23) Remove the oil strainer.

CYLINDER BLOCK

MECHANICAL



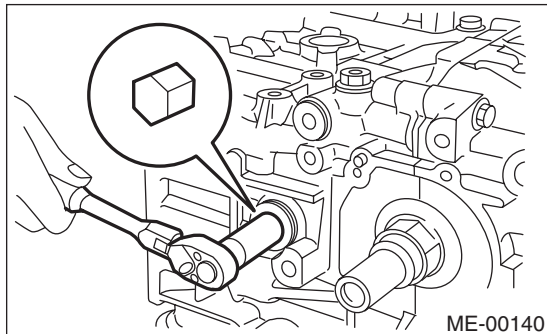
ME-00139

- (1) Service hole plug
- (2) Gasket

- (3) Snap ring
- (4) Piston pin

- (5) Service hole cover
- (6) O-ring

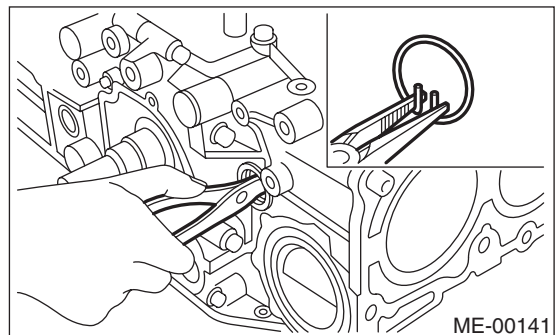
27) Remove the service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].



ME-00140

28) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, and then remove the piston snap ring through service hole of #1 and #2 cylinders.

ST 499897200 PISTON SNAP RING PLIER



ME-00141

CYLINDER BLOCK

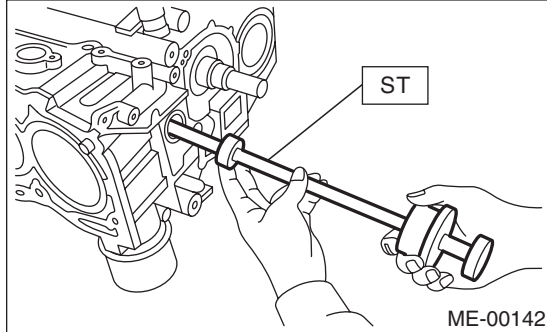
MECHANICAL

29) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



30) Similarly remove the piston pins from #3 and #4 pistons.

31) Remove the bolts which connect cylinder block on the side of #2 and #4 cylinders.

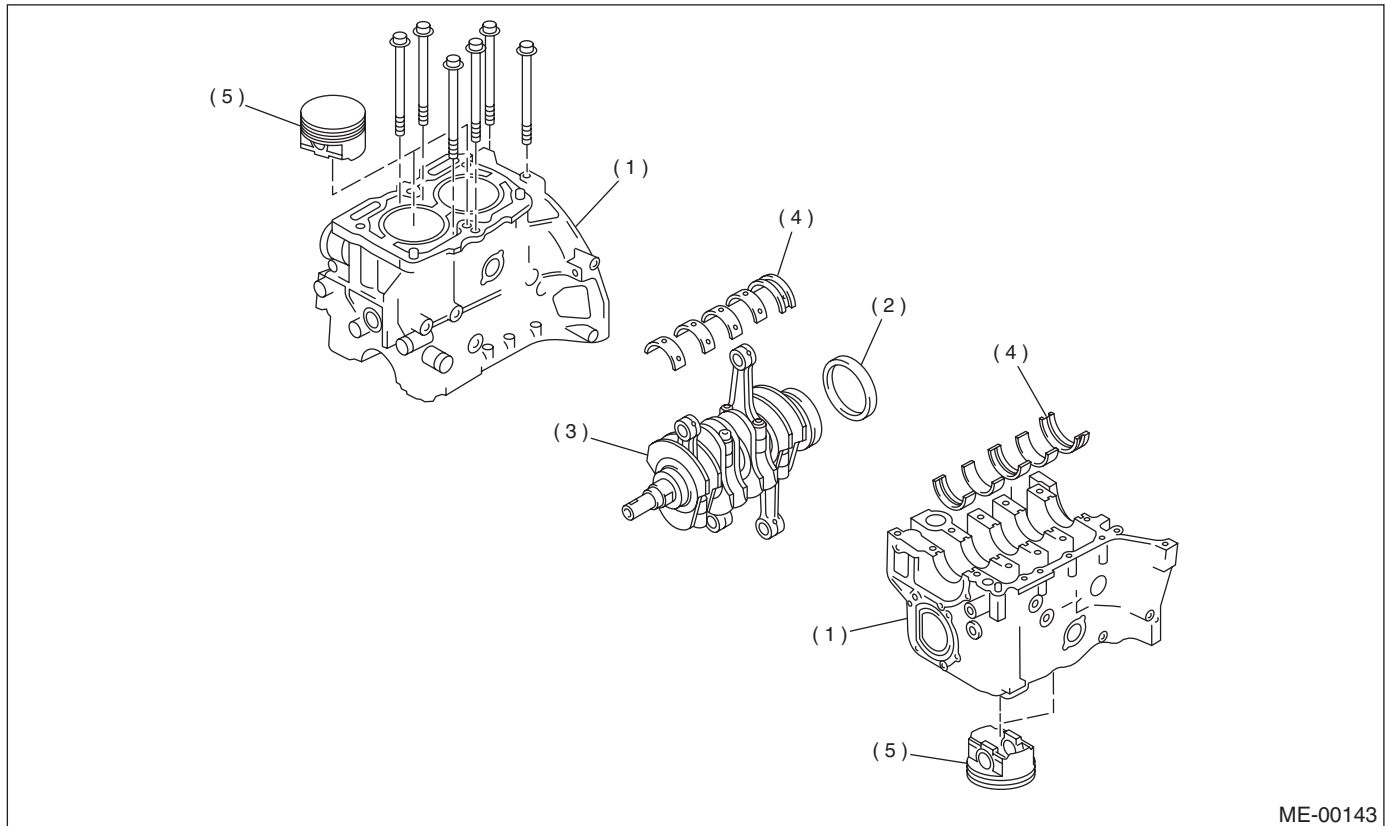
32) Back off the bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

33) Set up the cylinder block so that #1 and #3 cylinders are on the upper side, and then remove the cylinder block connecting bolts.

34) Separate the cylinder blocks (RH) and (LH).

NOTE:

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



(1) Cylinder block

(2) Rear oil seal

(3) Crankshaft

(4) Crankshaft bearing

(5) Piston

35) Remove the rear oil seal.

36) Remove the crankshaft together with connecting rod.

37) Remove the crankshaft bearings from cylinder block using a hammer's handle.

NOTE:

Do not confuse the combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

38) Draw out each piston from cylinder block using a wooden bar or a hammer's handle.

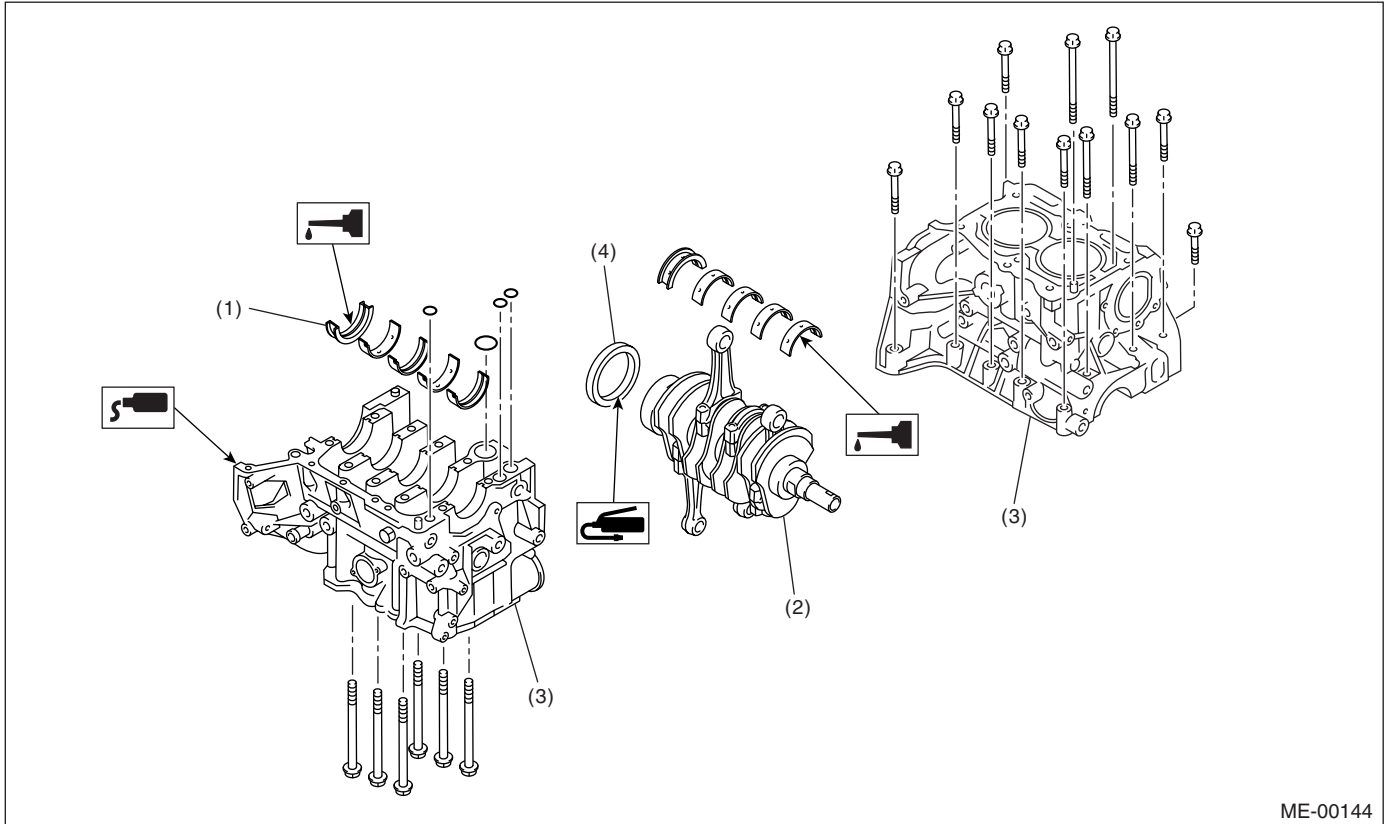
NOTE:

Do not confuse the combination of piston and cylinder.

CYLINDER BLOCK

MECHANICAL

B: INSTALLATION



- | | |
|------------------------|--------------------|
| (1) Crankshaft bearing | (3) Cylinder block |
| (2) Crankshaft | (4) Rear oil seal |

NOTE:

Remove oil from the mating surface of bearing and cylinder block before installation. Also apply a thin coat of engine oil to crankshaft pins.

1) Position the crankshaft on #2 and #4 cylinder block.

2) Apply liquid gasket to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

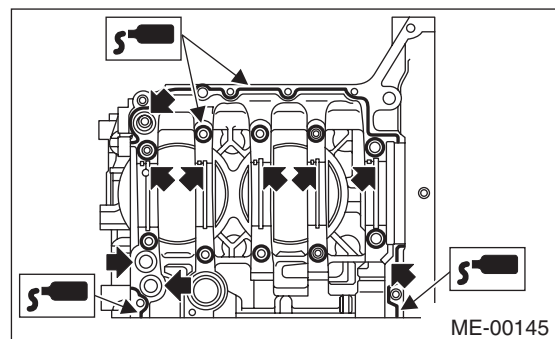
Liquid gasket:

Part No. 004403007

ThreeBond 1215 or equivalent

NOTE:

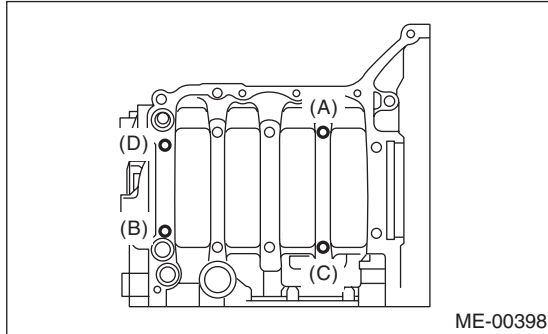
Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.



3) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

Tightening torque:

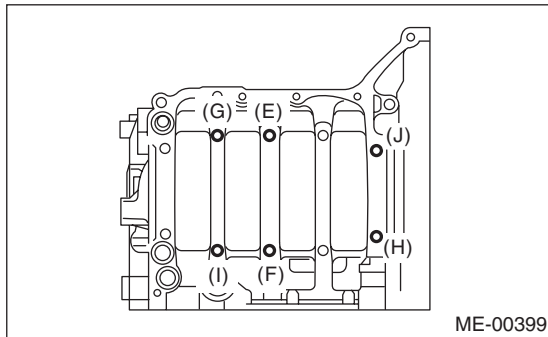
15 N·m (1.5 kgf-m, 11.1 ft-lb)



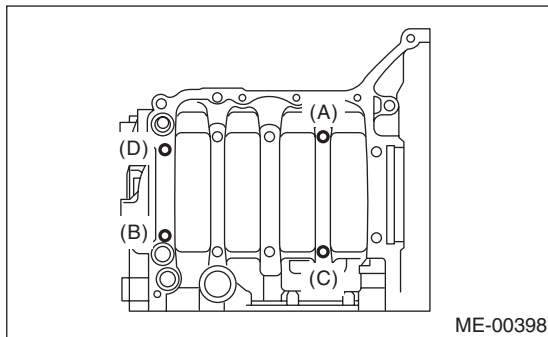
4) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (RH side)

Tightening torque:

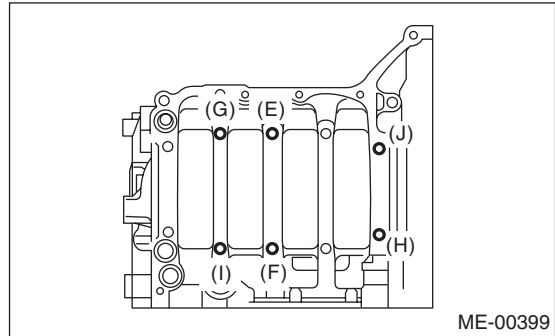
15 N·m (1.5 kgf-m, 11.1 ft-lb)



5) Further tighten LH side bolts (A) — (D) by 90° in alphabetical sequence.



6) Further tighten RH side bolts (E) — (J) by 90° in alphabetical sequence.

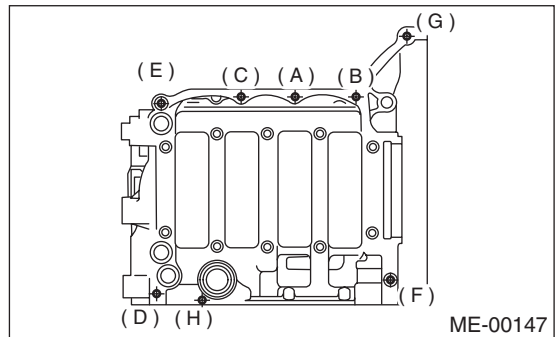


7) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

Tightening torque:

(A) — (G): 25 N·m (2.5 kgf-m, 18.1 ft-lb)

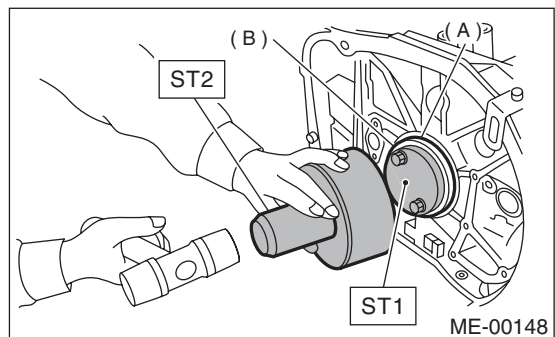
(H): 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



8) Install the rear oil seal using ST1 and ST2.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER



(A) Rear oil seal

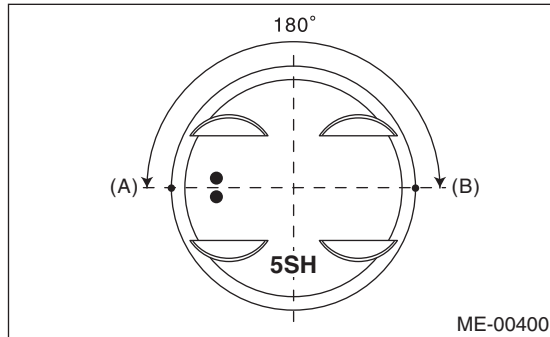
(B) Fly wheel attaching bolt

CYLINDER BLOCK

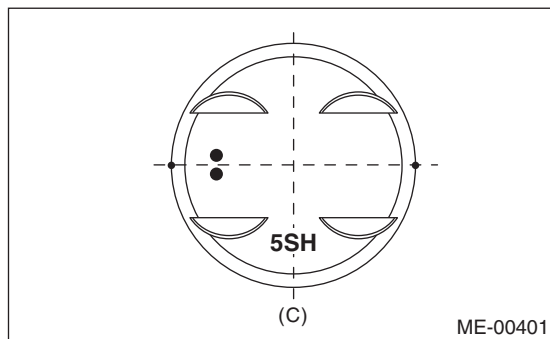
MECHANICAL

9) Position the top ring gap at (A) or (B) in the figure.

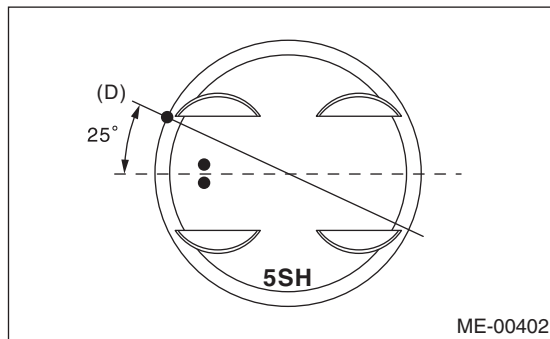
10) Position the second ring gap at 180° on the reverse side for top ring gap.



11) Position the expander gap at (C) in the figure.

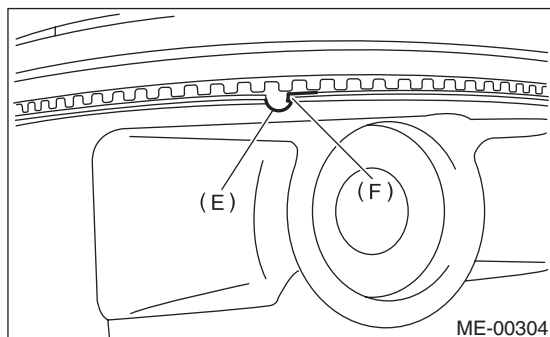


12) Position the lower rail gap at (D) in the figure.

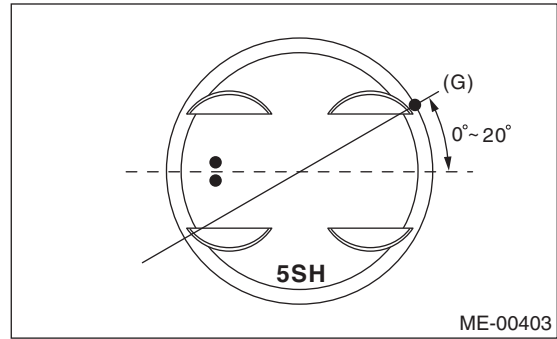


NOTE:

Align the lower rail stopper (F) to the lateral hole (E) on the piston.



13) Position the upper rail gap within (G) in the figure.



CAUTION:

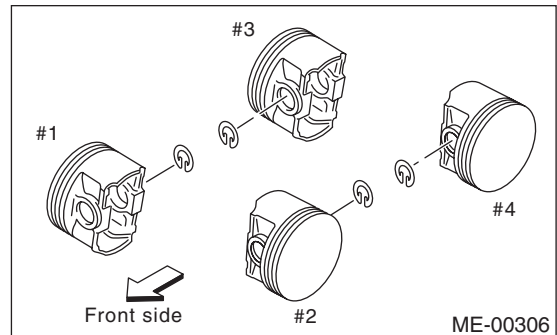
- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.

14) Install snap ring.

Install snap rings in the piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

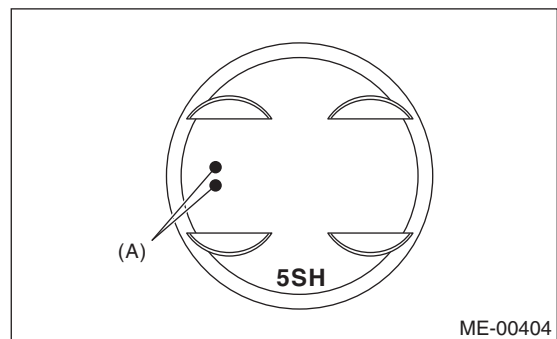
NOTE:

Use new snap rings.

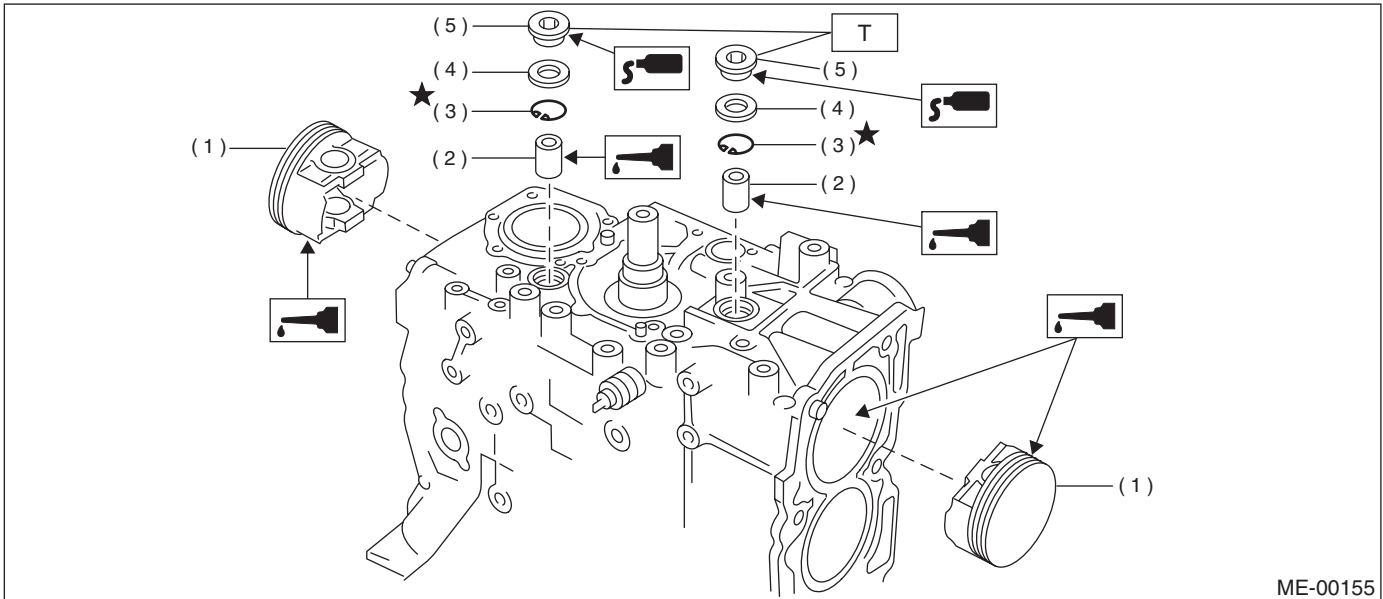


CAUTION:

Piston front mark faces towards the front of the engine.



(A) Front mark



ME-00155

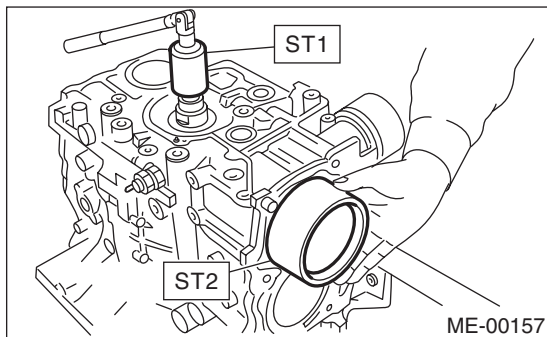
- | | |
|----------------|-----------------------|
| (1) Piston | (4) Gasket |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring | |

Tightening torque: N·m (kgf-m, ft-lb)**T: 70 (7.1, 51.6)****15) Installing piston**

- (1) Turn the cylinder block to face the #1 and #2 piston side upward.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

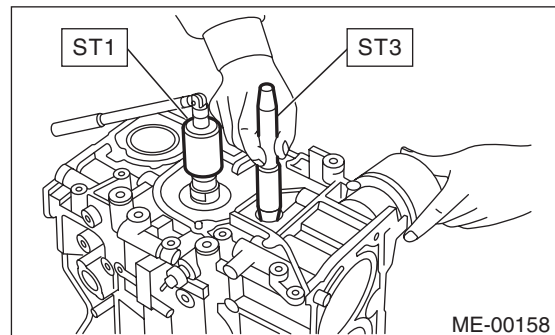
- (3) Apply a thin coat of engine oil to pistons and cylinders, and then insert the pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE

ME-00157

16) Installing piston pin

- (1) Apply a thin coat of engine oil to the ST3 before insertion.
- (2) Insert the ST3 into service hole to align piston pin hole with connecting rod small end.

ST1 499017100 PISTON GUIDE

ME-00158

- (3) Apply a thin coat of engine oil to the piston pin, and then insert the piston pin into piston and connecting rod through service hole.
- (4) Install snap ring.

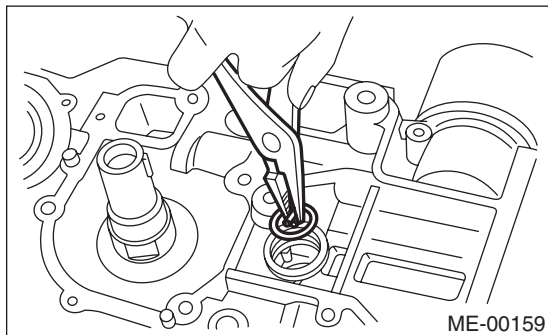
NOTE:

Use new snap rings.

CYLINDER BLOCK

MECHANICAL

ST 499897200 PISTON SNAPRING PLIER

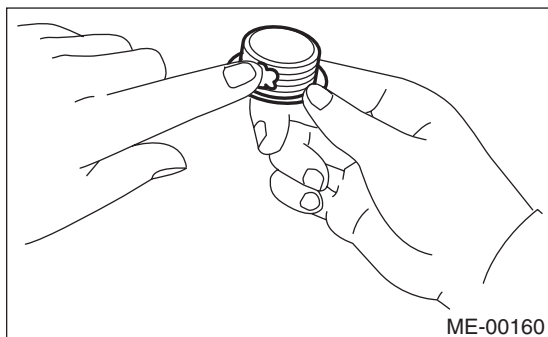


(5) Apply liquid gasket around the service hole plug.

Liquid gasket:

Part No. 004403007

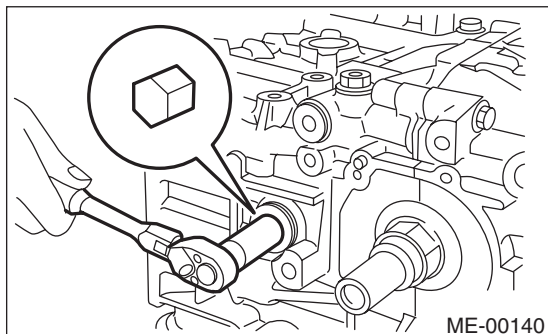
ThreeBond 1215 or equivalent

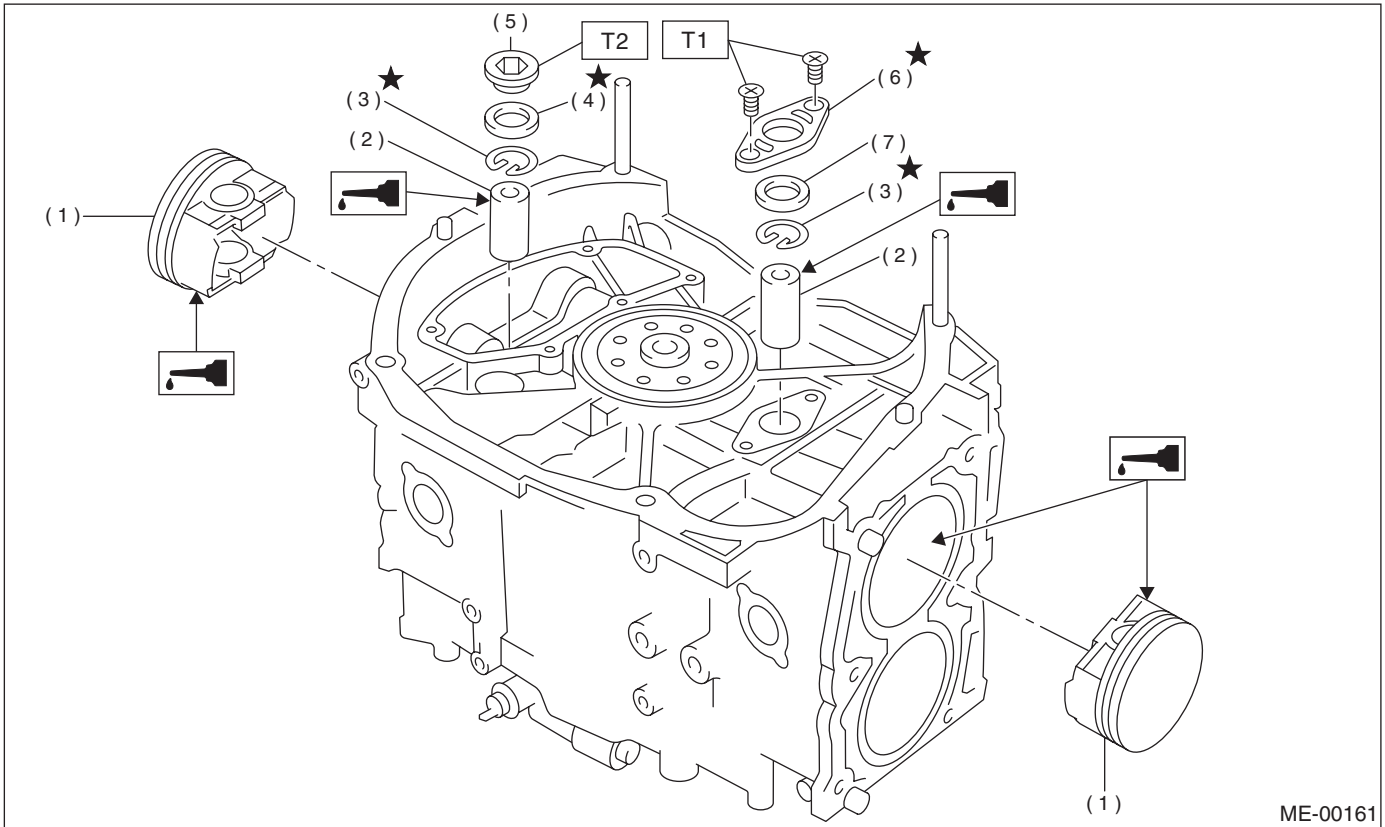


(6) Install the service hole plug and gasket.

NOTE:

Use a new gasket.





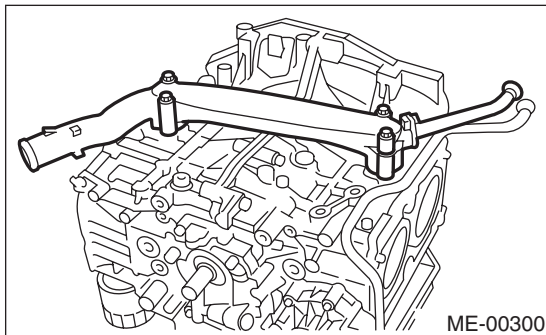
ME-00161

- | | |
|----------------|------------------------|
| (1) Piston | (5) Service hole plug |
| (2) Piston pin | (6) Service hole cover |
| (3) Snap ring | (7) O-ring |
| (4) Gasket | |

Tightening torque: N·m (kgf-m, ft-lb)**T1: 6.4 (0.65, 4.7)****T2: 70 (7.1, 51.6)**

(7) Turn the cylinder block to face the #3 and #4 piston side upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

17) Install the water pipe.



ME-00300

18) Install the baffle plate.

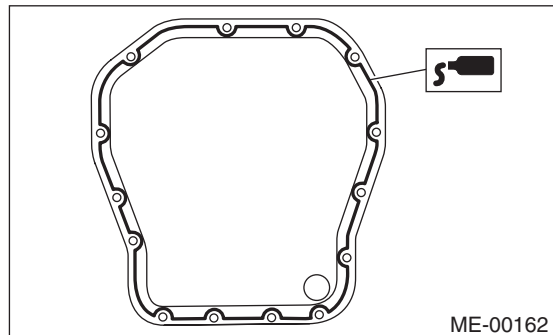
Tightening torque:**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

19) Install the oil strainer and O-ring.

Tightening torque:**10 N·m (1.0 kgf-m, 7 ft-lb)**

20) Install the oil strainer stay.

21) Apply liquid gasket to the matching surfaces, and then install the oil pan.

Liquid gasket:**Part No. 004403007****ThreeBond 1215 or equivalent**

ME-00162

CYLINDER BLOCK

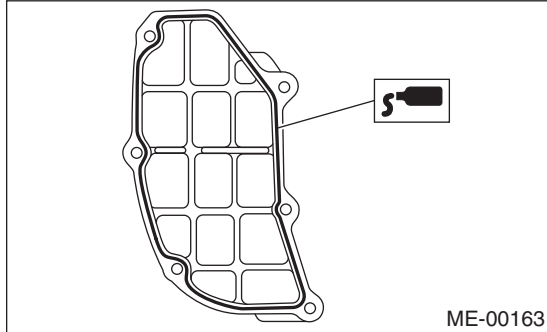
MECHANICAL

22) Apply liquid gasket to the matching surfaces, and then install the oil separator cover.

Liquid gasket:

Part No. 004403007

ThreeBond 1215 or equivalent



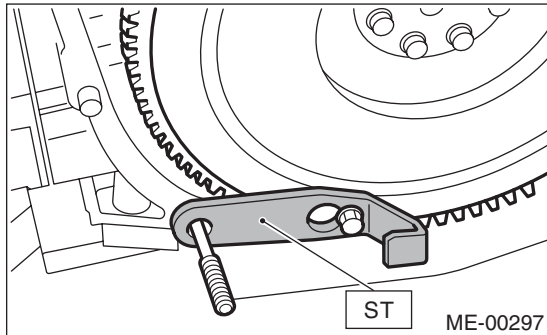
23) Install the flywheel or drive plate.
To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

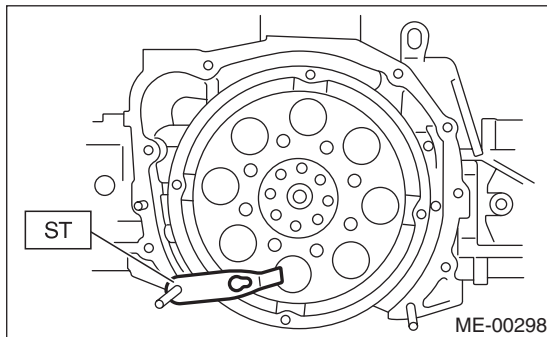
Tightening torque:

72 N·m (7.3 kgf-m, 52.8 ft-lb)

- MT model



- AT model

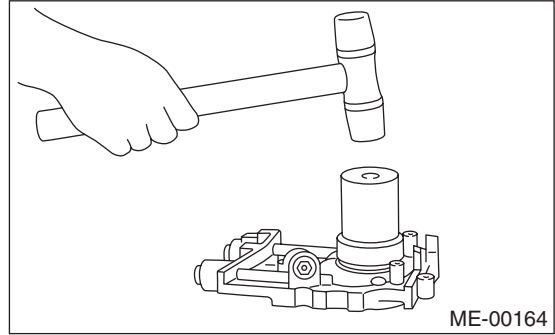


24) Install the housing cover.

25) Installation of oil pump

- (1) Discard the front oil seal after removal. Replace with a new one using the ST.

ST 499587100 OIL SEAL INSTALLER

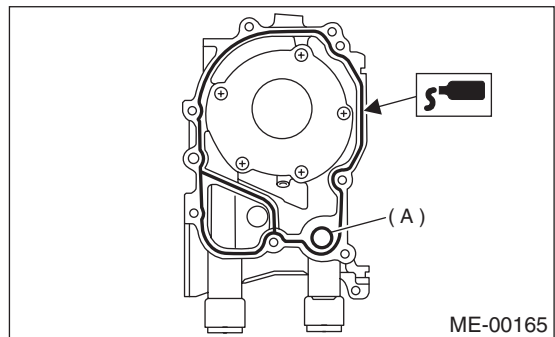


- (2) Apply liquid gasket to the matching surface of oil pump.

Liquid gasket:

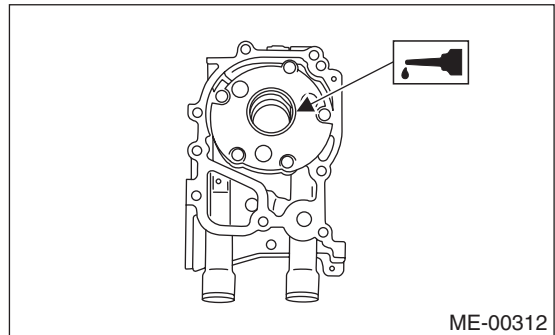
Part No. 004403007

ThreeBond 1215 or equivalent



(A) O-ring

- (3) Apply a thin coat of engine oil to the inside of oil seal.



- (4) Install the oil pump on cylinder block. Be careful not to damage the oil seal during installation.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

CAUTION:

- Do not forget to install the O-ring and seal when installing oil pump.
- Align flat surface of oil pump's inner rotor with crankshaft before installation.

26) Install the water pump and gasket.

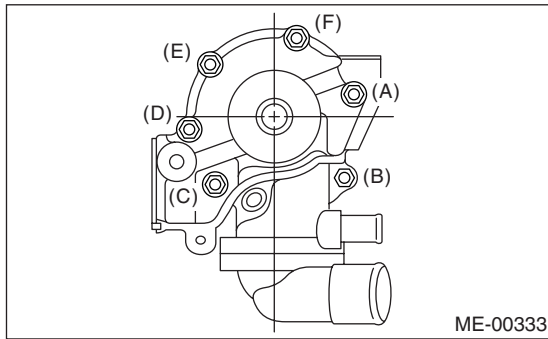
Tightening torque:

First; 12 (1.2 kgf-m, 8.7 ft-lb)

Second; 12 (1.2 kgf-m, 8.7 ft-lb)

CAUTION:

- Be sure to use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.



27) Install the water by-pass pipe for heater.

28) Install the oil filter using ST.

ST 498547000 OIL FILTER WRENCH

29) Tighten the cylinder head bolts.

- (1) Apply a thin coat of engine oil to the washers and bolt threads.
- (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.
Then tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
- (3) Back off all bolts by 180° first; back them off by 180° again.
- (4) Tighten the bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb).
- (5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).
- (6) Tighten all bolts by 80 to 90° in alphabetical sequence.

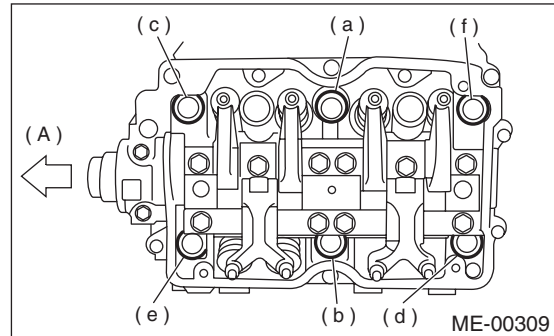
CAUTION:

Do not tighten bolts more than 90°.

- (7) Further tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:

Ensure that the total “re-tightening angle” [in the former two steps], do not exceed 180°.



(A) Front

30) Install the oil level gauge guide, and then tighten the attaching bolt (left side only).

31) Install the rocker cover.

32) Install the crankshaft sprocket. <Ref. to ME(H4SO)-53, INSTALLATION, Crankshaft Sprocket.>

33) Install the camshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Camshaft Sprocket.>

34) Install the timing belt. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt.>

35) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

36) Install the crankshaft pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crankshaft Pulley.>

37) Install the generator and A/C compressor brackets on cylinder head.

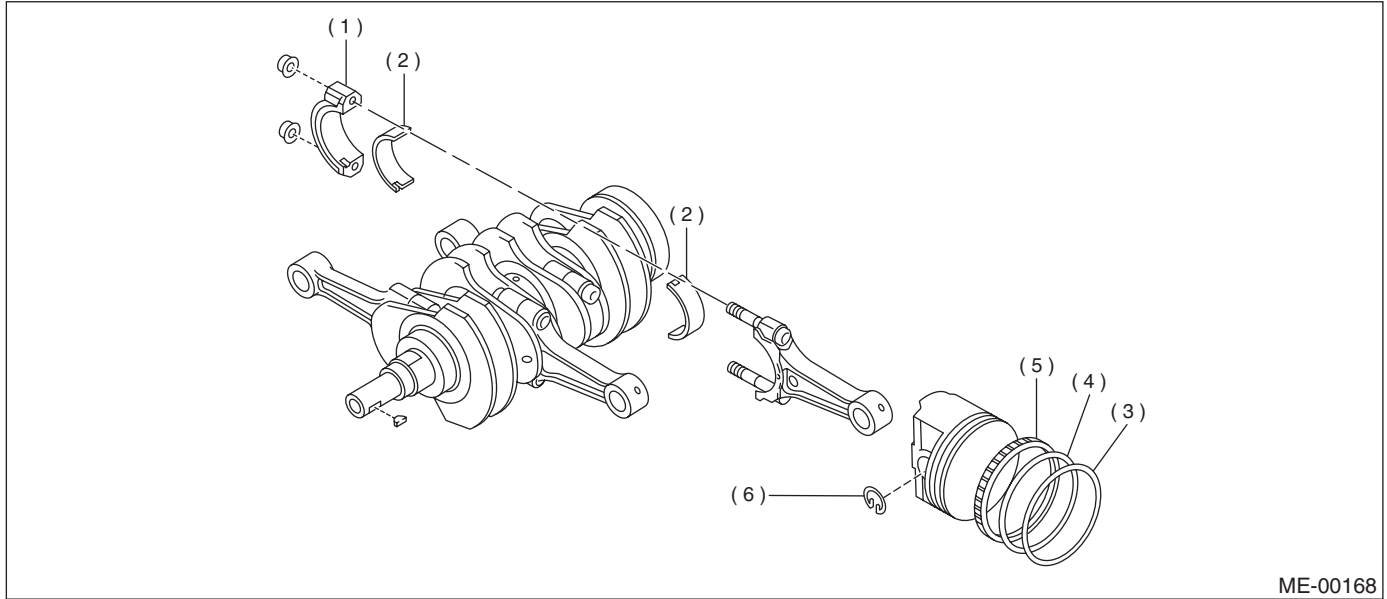
38) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

39) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>

CYLINDER BLOCK

MECHANICAL

C: DISASSEMBLY



ME-00168

- (1) Connecting rod cap
- (2) Connecting rod bearing

- (3) Top ring
- (4) Second ring

- (5) Oil ring
- (6) Snap ring

- 1) Remove the connecting rod cap.
- 2) Remove the connecting rod bearing.

NOTE:

Arrange the removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

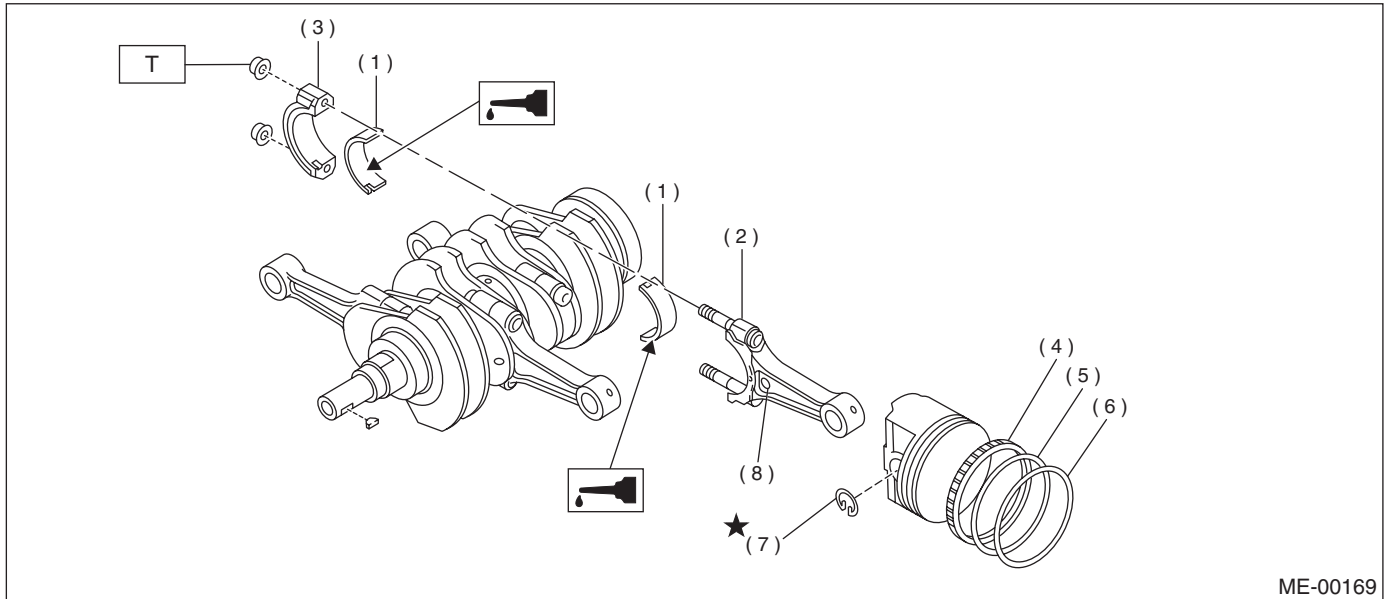
- 3) Remove the piston rings using a piston ring expander.

- 4) Remove the oil ring by hand.

NOTE:

Arrange the removed piston rings in good order to prevent confusion.

- 5) Remove the snap ring.

D: ASSEMBLY

ME-00169

- | | |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod | (6) Top ring |
| (3) Connecting rod cap | (7) Snap ring |
| (4) Oil ring | (8) Side mark |

Tightening torque: N·m (kgf-m, ft-lb)
T: 45 (4.6, 33.2)

1) Apply oil to the surfaces of the connecting rod bearings.

2) Install the connecting rod bearings on connecting rods and connecting rod caps.

3) Position each connecting rod with the marked side facing forward, and then install them.

4) Install the connecting rod cap with connecting rod nut.

Ensure the arrow on connecting rod cap faces the front during installation.

CAUTION:

- 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.

5) Install the expander, lower rail and upper rail in this order by hand. Then install the second ring and top ring with a piston ring expander.

E: INSPECTION**1. CYLINDER BLOCK**

1) Visually check for cracks and damage. Especially, inspect the important parts by means of red lead check.

2) Check the oil passages for clogging.

3) Inspect the crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:

0.05 mm (0.0020 in)

Grinding limit

0.1 mm (0.004 in)

Standard height of cylinder block:

201.0 mm (7.91 in)

CYLINDER BLOCK

MECHANICAL

2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on cylinder block's front upper surface.

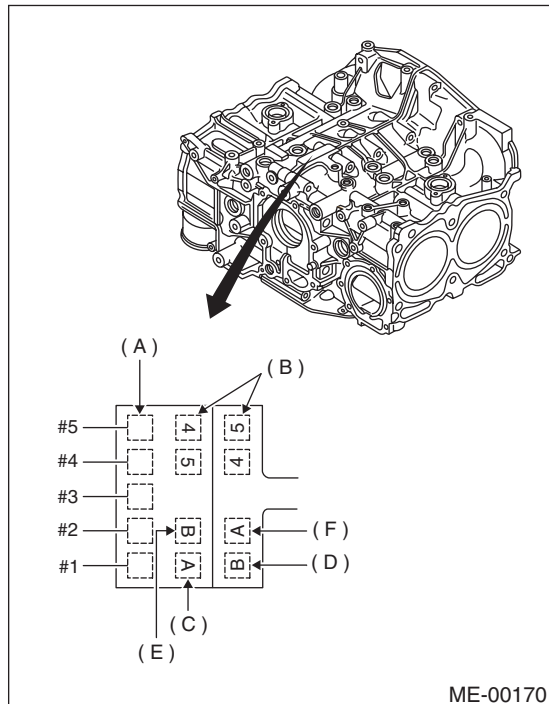
NOTE:

- Measurement should be performed at a temperature 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as a guideline 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) How to measure the inner diameter of each cylinder

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the figure, using a cylinder bore gauge.

NOTE:

Measurement should be performed at a temperature 20°C (68°F).

Taper:

Standard

0.015 mm (0.0006 in)

Limit

0.050 mm (0.0020 in)

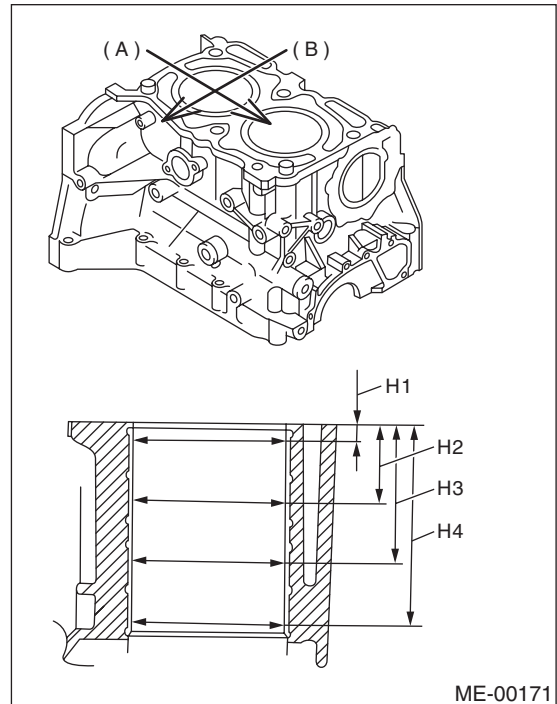
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 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)

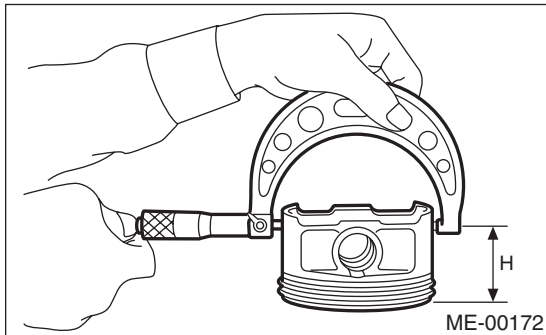
3) When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

4) How to measure the outer diameter of each piston

Measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

NOTE:

Measurement should be performed at a temperature 20°C (68°F).

Piston grade point H:**37.0 mm (1.457 in)****Standard****A: 99.485 — 99.495 mm****(3.9167 — 3.9171 in)****B: 99.475 — 99.485 mm****(3.9163 — 3.9167 in)****0.25 mm (0.0098 in) oversize****99.725 — 99.735 mm****(3.9262 — 3.9266 in)****0.50 mm (0.0197 in) oversize****99.975 — 99.985 mm****(3.9360 — 3.9364 in)**

5) Calculate the clearance between cylinder and piston.

NOTE:

Measurement should be performed at a temperature 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):**Standard****0.010 — 0.030 mm (0.0004 — 0.0012 in)****Limit****0.050 mm (0.0020 in)**

6) Boring and honing

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebores it to use an oversize piston.

CAUTION:

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only. Also, do not use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the crankcase.

NOTE:

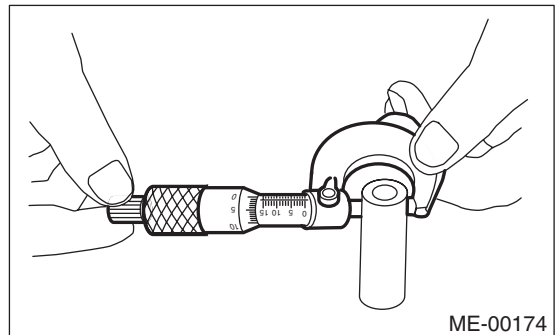
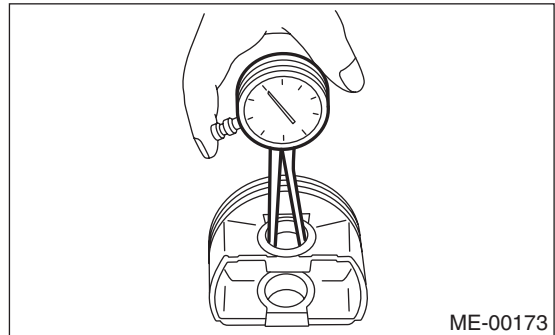
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

Limit of cylinder enlarging (boring):**0.5 mm (0.020 in)****3. PISTON AND PISTON PIN**

1) Check the pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.

2) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4SO)-82, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.

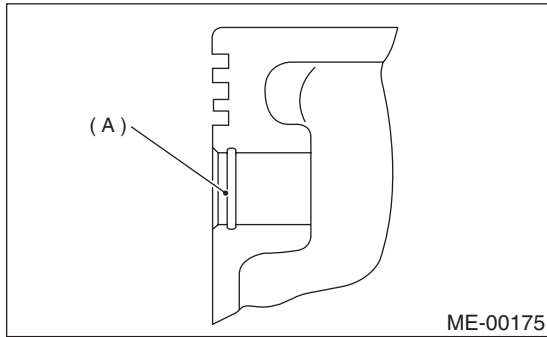
3) Make the sure that piston pin can be inserted into piston pin hole with a thumb at 20°C (68°F). Replace if defective.

Standard clearance between piston pin and hole in piston:**Standard****0.004 — 0.008 mm (0.0002 — 0.0003 in)****Limit****0.020 mm (0.0008 in)**

CYLINDER BLOCK

MECHANICAL

4) Check the snap ring installation groove on piston for burrs (A). If necessary, remove the burr from groove so that piston pin can lightly move.



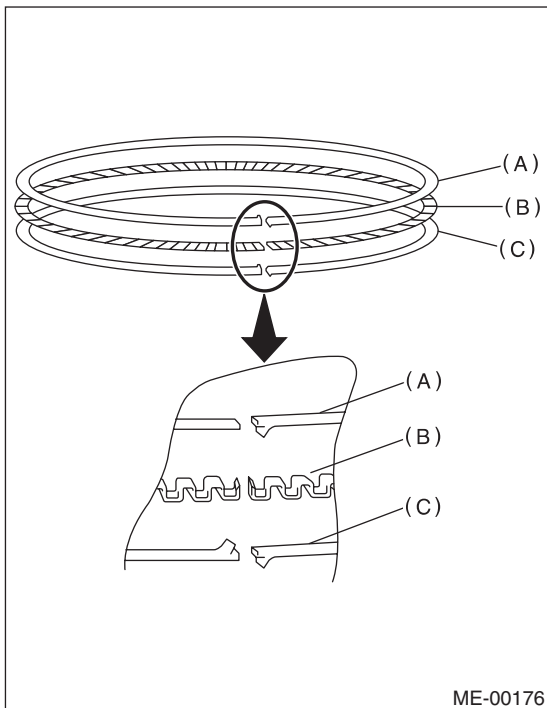
5) Check the piston pin snap ring for distortion, cracks and wear.

4. PISTON RING

1) If the piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new one of the same size as the piston.

CAUTION:

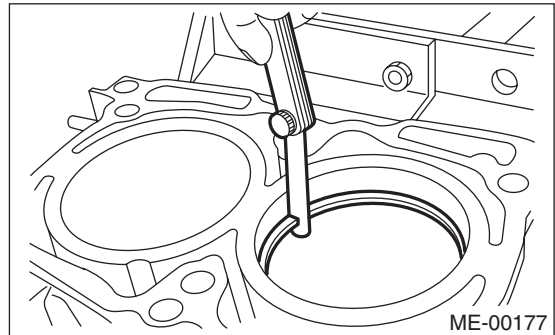
- Marks are shown on the end of top and second rings. When installing the rings to piston, face these marks upward.
- Oil ring is composed of upper rail, expander and lower rail. Be careful of the rail direction when installing oil ring to the piston.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

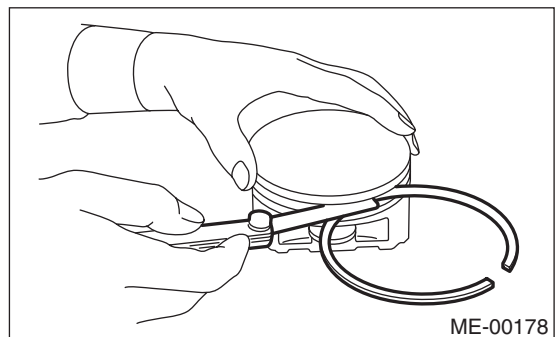
2) Clean the piston ring groove and piston ring.
3) Squarely place the piston ring and oil ring in cylinder, and then measure the piston ring gap with a thickness gauge.

Unit: mm (in)			
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.0146 — 0.0205)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)



4) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

Unit: mm (in)			
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)

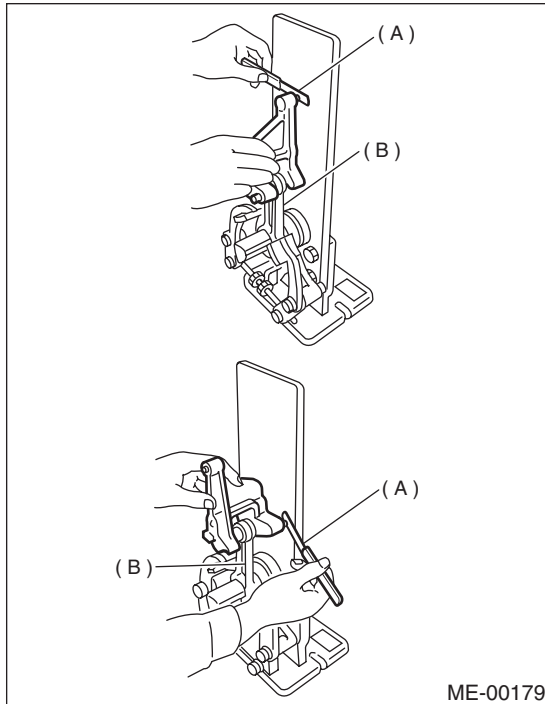


5. CONNECTING ROD

- 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 fitted with bearing to crankshaft, and then measure the side clearance (thrust clearance). Replace the connecting rod if the side clearance exceeds the specified limit.

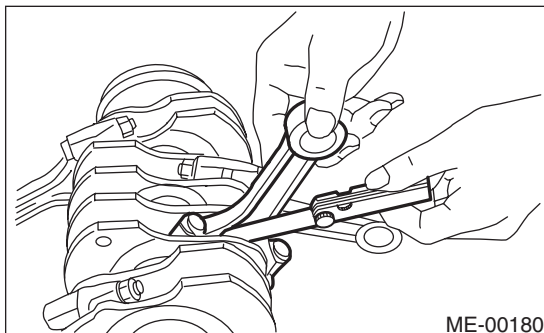
Connecting rod side clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)

Limit

0.4 mm (0.016 in)



- 4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

- 5) Measure the oil clearance on individual connecting rod bearings by means of plastigauge. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

Connecting rod oil clearance:

Standard

0.012 — 0.038 mm (0.0005 — 0.0015 in)

Limit

0.05 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

- 6) Inspect the bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at connecting rod small end.

CYLINDER BLOCK

MECHANICAL

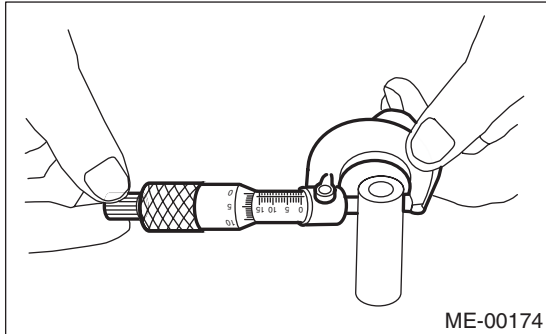
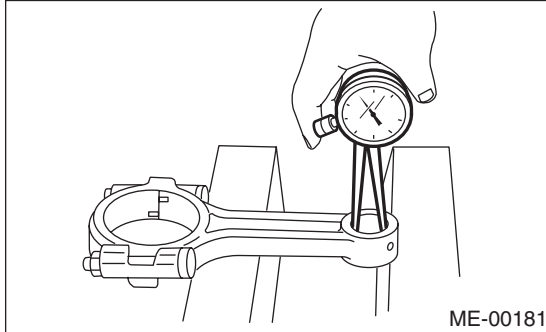
Clearance between piston pin and bushing:

Standard

0 — 0.022 mm (0 — 0.0009 in)

Limit

0.030 mm (0.0012 in)

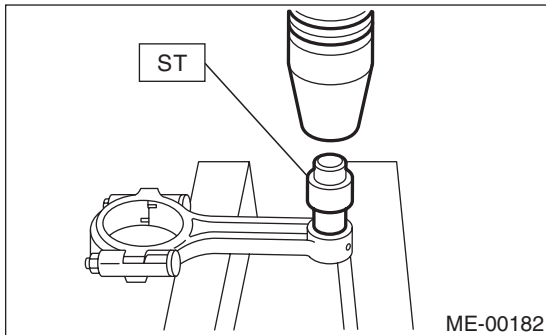


7) Replacement procedure is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.

(4) After the completion of reaming, clean the bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely and check for cracks by means of red lead check etc., and replace if defective. Replace if defective.

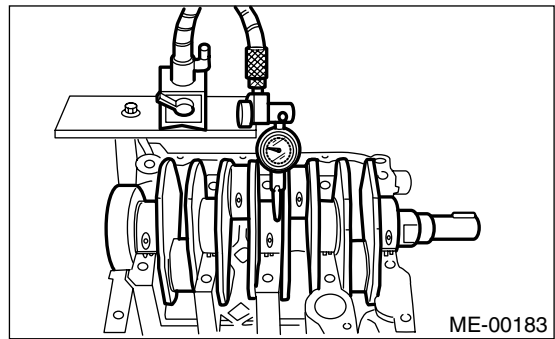
2) Measure the crankshaft bend. Repair or place if the value exceeds the specified limit.

NOTE:

If a suitable V-block is not available, install the #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on these bearings and 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 specifications, replace the bearing with a suitable (undersize) one, and then replace or recondition the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:

Out-of-roundness

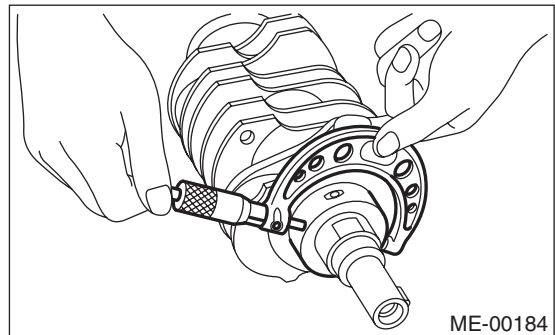
Less than 0.020 mm (0.0008 in)

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



		Unit: mm (in)		
		Crank journal diameter		Crank pin diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.490 — 1.502 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

- 4) Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace bearing.

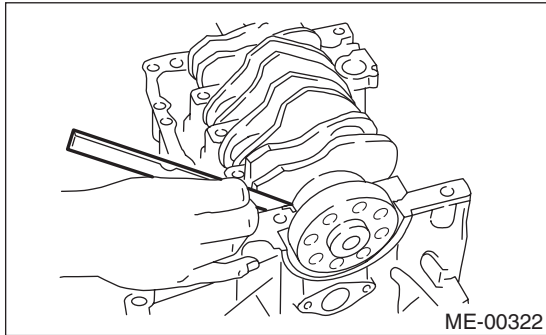
Crankshaft thrust clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)

Limit

0.25 mm (0.0098 in)



Unit: mm (in)		
Crankshaft oil clearance		
#1	Standard	0.003 — 0.030 (0.0001 — 0.0012)
	Limit	0.040 (0.0016)
#2	Standard	0.012 — 0.033 (0.0005 — 0.0013)
	Limit	0.045 (0.0018)
#3	Standard	0.003 — 0.030 (0.0001 — 0.0012)
	Limit	0.040 (0.0016)
#4	Standard	0.012 — 0.033 (0.0005 — 0.0013)
	Limit	0.045 (0.0018)
#5	Standard	0.010 — 0.031 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)

- 5) Inspect the individual crankshaft bearings for signs of flaking, seizure, melting, and wear.
- 6) Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specified range, replace the defective bearing with an undersize one, and then replace or recondition the crankshaft as necessary.

ENGINE TROUBLE IN GENERAL

MECHANICAL

22.Engine Trouble in General

A: INSPECTION

NOTE:

“RANK” shown in the chart refer to the possibility of reason for the trouble in order (“Very often” to “Rarely”)

A — Very often

B — Sometimes

C — Rarely

SYMPTOM	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	• Starter	• Defective battery-to-starter harness	B
		• Defective starter switch	C
		• Defective inhibitor switch or neutral switch	C
		• Defective starter switch	B
	• Battery	• Defective terminal contact	A
		• Battery drained	A
		• Defective charging system	B
	• Friction	• Seizure of crankshaft and connecting rod bearing	C
		• Seized camshaft	C
		• Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	• Starter	• Defective starter switch	C
	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Fuel line	• Defective fuel pump and relay	A
		• No fuel or insufficient fuel	B
	• Belt Idler	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Faulty valve stem	C
		• Weak or broken valve springs	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
3) Initial combustion occurs.	• Engine control system <Ref. to EN(H4SO)-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
		• No fuel or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Faulty valve stem	C
		• Weak or broken valve springs	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B

ENGINE TROUBLE IN GENERAL

MECHANICAL

SYMPTOM	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	• Engine control system <Ref. to EN(H4SO)-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
		• No fuel or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Faulty valve stem	C
		• Weak or broken valve springs	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
2. Rough idle and engine stall	• Engine control system <Ref. to EN(H4SO)-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
		• No fuel or insufficient fuel	B
	• Belt	• Defective timing	C
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Faulty valve stem	C
		• Weak or broken valve springs	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	• Overheating	C
	• Others	• Malfunction of evaporative emission control system	A
		• Stuck or damaged throttle valve	B
		• Accelerator cable out of adjustment	C

ENGINE TROUBLE IN GENERAL

MECHANICAL

SYMPTOM	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	• Engine control system <Ref. to EN(H4SO)-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
		• No fuel or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Faulty valve stem	C
		• Weak or broken valve springs	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	• Overheating	C
		• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	A
4. Surging	• Engine control system <Ref. to EN(H4SO)-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
		• No fuel or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Faulty valve stem	C
		• Weak or broken valve springs	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	C

ENGINE TROUBLE IN GENERAL

MECHANICAL

SYMPTOM	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked vacuum hose	A
	• Others	• Stuck or damaged throttle valve	A
		• Accelerator cable out of adjustment	B
6. Dieseling (Run-on)	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	B
7. After burning in exhaust system	• Engine control system <Ref. to EN(H4SO)-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
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Faulty valve stem	C
		• Weak or broken valve springs	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	• Malfunction of evaporative emission control system	C
8. Knocking	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened oil filler cap	B
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Incorrect valve timing	B
	• Cooling system	• Overheating	A
9. Excessive engine oil consumption	• Intake system	• Loosened or cracked PCV hose	A
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Compression	• Faulty 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 seal	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

ENGINE TROUBLE IN GENERAL

MECHANICAL

SYMPTOM	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Dirty air cleaner element	A
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Faulty valve stem	C
		• Weak or broken valve springs	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
	• Others	• Accelerator cable out of adjustment	B

23.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	- Valve mechanism is defective - Incorrect valve clearance - Worn valve rocker - Worn camshaft - Broken valve spring
Heavy and dull clank	Oil pressure is low.	- Worn crankshaft main bearing - Worn connecting rod bearing (big end)
	Oil pressure is normal.	- Loose flywheel mounting bolts - Damaged engine mounting
High-pitched clank (knocking)	Sound is noticeable when accelerating with an overload.	- Ignition timing advanced - Accumulation of carbon inside combustion chamber - Wrong spark plug - Improper fuel
Clank when engine speed is medium (1,000 to 2,000 rpm)	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn crankshaft main bearing - Worn bearing at crankshaft end of connecting rod
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 - Broken or stuck piston ring - 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*)	- Unusually worn valve lifter - Worn cam gear - Worn camshaft journal bore in crankcase
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Defective generator brush and rotor contact
Gear scream when starting engine	—	- Defective ignition starter switch - Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	- Loose drive belt - Defective water pump shaft
Hissing sound	—	- Loss of compression - Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	- Loose timing belt - Belt contacting case/adjacent part
Valve tappet noise	—	Incorrect valve clearance

NOTE*)

When disconnecting fuel injector connector, CHECK ENGINE malfunction indicator light illuminates and a diagnostic trouble code is stored in the ECM memory.

Therefore, carry out the CLEAR MEMORY MODE <Ref. to EN(H4SO)-46, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-39, OPERATION, Inspection Mode.> after connecting the fuel injector connector.

ENGINE NOISE

MECHANICAL

GENERAL DESCRIPTION

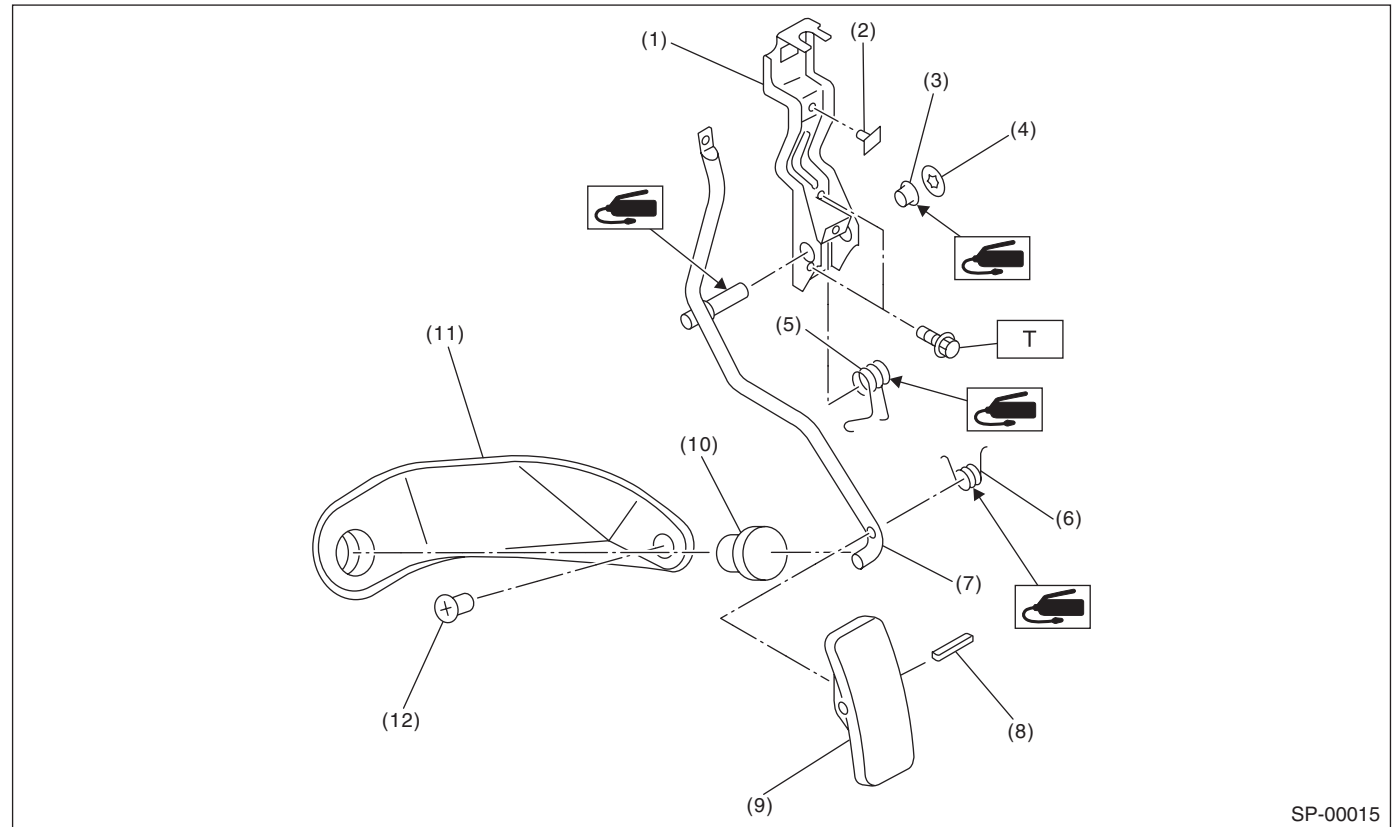
SPEED CONTROL SYSTEMS

1. General Description

A: SPECIFICATIONS

Accelerator pedal	Free play	At pedal pad	0 — 4 mm (0 — 0.16 in)
	Stroke	At pedal pad	52 — 57 mm (2.05 — 2.24 in)

B: COMPONENT



- | | | |
|-------------------------|------------------------------|------------------------|
| (1) Accelerator bracket | (6) Accelerator pedal spring | (11) Accelerator plate |
| (2) Stopper | (7) Accelerator pedal lever | (12) Clip |
| (3) Bushing | (8) Spring pin | |
| (4) Clip | (9) Accelerator pedal | |
| (5) Accelerator spring | (10) Accelerator stopper | |

Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.0)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Accelerator Pedal

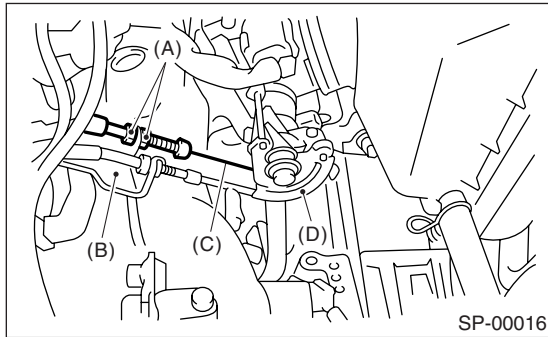
A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the lock nut from accelerator cable bracket.
- 3) Separate the accelerator cable from bracket.
- 4) Remove the accelerator cable end from throttle cam.

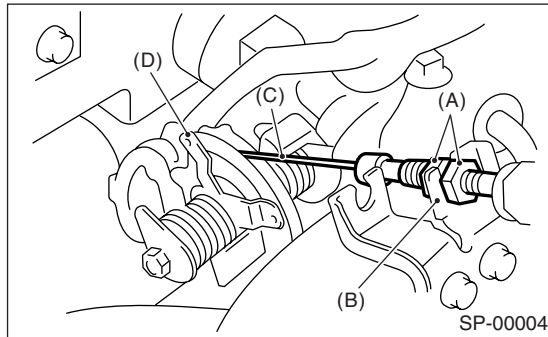
NOTE:

Be careful not to kink the accelerator cable.

• Non-turbo model



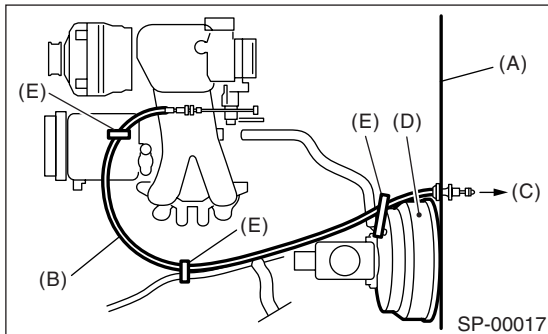
• Turbo model



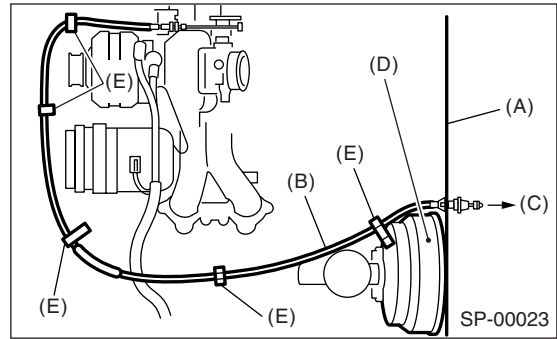
- (A) Lock nut
- (B) Accelerator cable bracket
- (C) Accelerator cable
- (D) Throttle cam

- 5) Remove the clip inside engine compartment.

• Non-turbo model



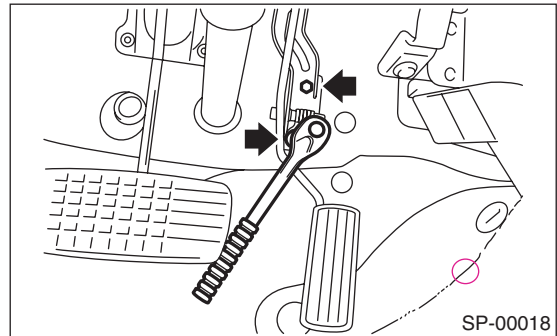
• Turbo model



- (A) Toe board
- (B) Accelerator cable
- (C) To accelerator pedal
- (D) Brake booster
- (E) Clip

- 6) Remove the instrument panel lower cover from instrument panel.

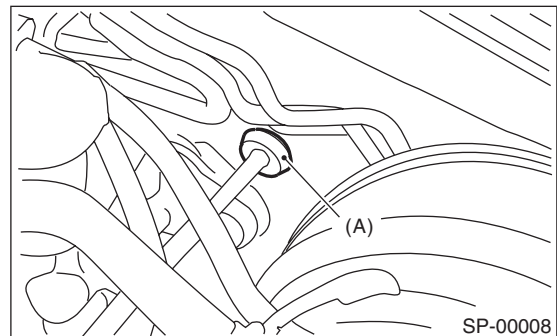
- 7) Remove the accelerator pedal connecting bolt from accelerator pedal bracket.



- 8) Disconnect the grommet from toe board.

NOTE:

From the engine compartment side, push the grommet (A) into hole.

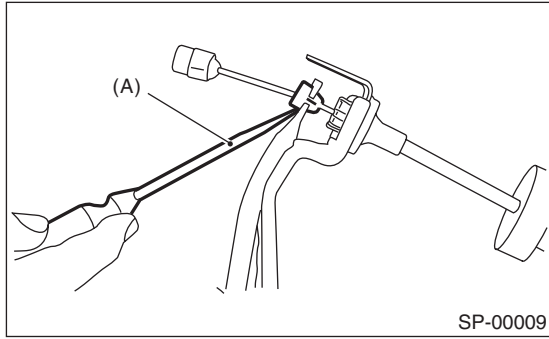


- 9) Pull out the cable from toe board hole.

ACCELERATOR PEDAL

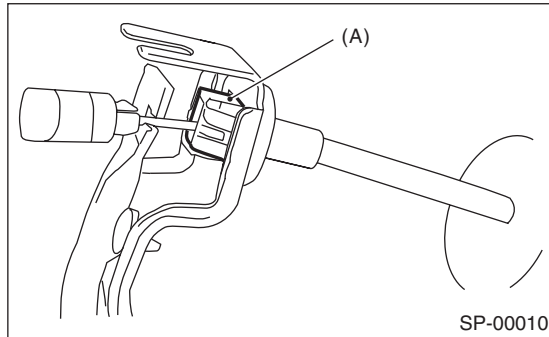
SPEED CONTROL SYSTEMS

10) Disconnect the accelerator cable bushing from accelerator pedal lever.



(A) Flat tip screwdriver

11) Disconnect the accelerator cable stopper (A) from bracket.



12) Separate the accelerator cable and bracket.

B: INSTALLATION

1) Install in the reverse order of removal.

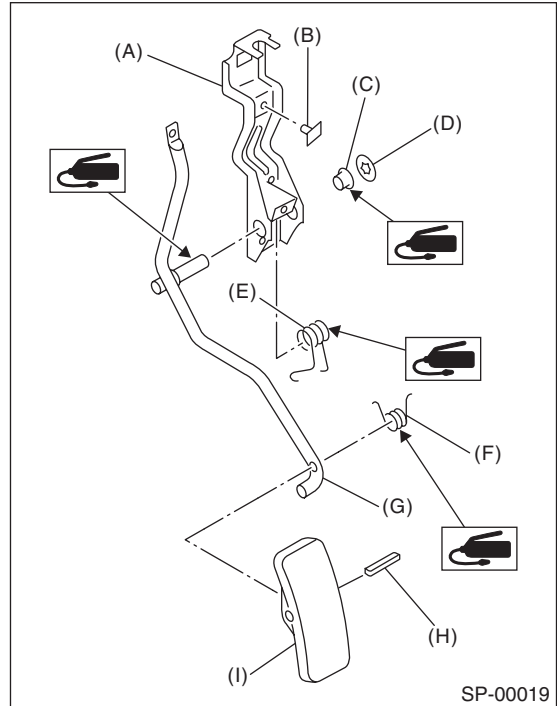
NOTE:

- If the cable clamp is damaged, replace it with a new one.
- Never fail to cover the outer cable end with boot.
- Be careful not to kink the accelerator cable.

2) Install the pedal and then adjust it. <Ref. to SP(H4SO)-5, ADJUSTMENT, Accelerator Pedal.>

C: DISASSEMBLY

- 1) Remove the clip, and then remove the accelerator pedal lever from bracket.
- 2) Pull out the spring pin, and then remove the accelerator pedal from accelerator pedal lever.



- (A) Accelerator bracket
- (B) Stopper
- (C) Bushing
- (D) Clip
- (E) Accelerator spring
- (F) Accelerator pedal spring
- (G) Accelerator pedal lever
- (H) Spring pin
- (I) Accelerator pedal

D: ASSEMBLY

Assemble in the reverse order of disassembly .

NOTE:

Clean and apply grease to the portions indicated in the figure.

Grease:

Part No. 003602010

SUNLIGHT No.2 or equivalent

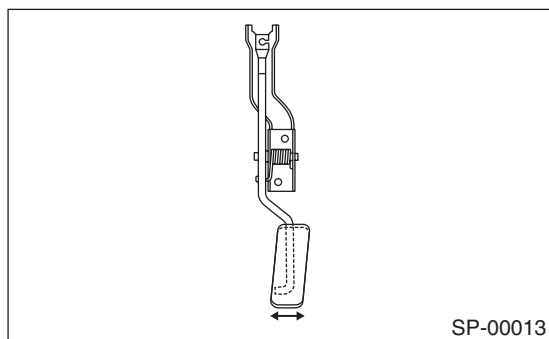
E: INSPECTION

- 1) Lightly move the pedal pad in lateral direction to ensure that pedal deflection is within the specified range.
- 2) If excessive deflection is noted, replace the bushing and clip with new ones.

Deflection of accelerator pedal:

Service limit

$\pm 2.0 \text{ mm } (\pm 0.079 \text{ in})$ or less



F: ADJUSTMENT

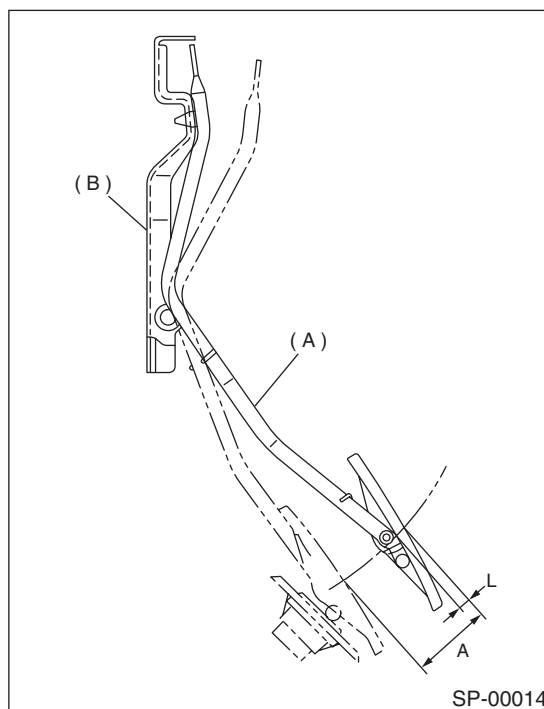
- 1) Check the pedal stroke and free play by operating accelerator pedal by hand.
- 2) If it is not within the specified values, adjust it by turning the accelerator cable locknut.

Free play at pedal pad: L

$0 - 4 \text{ mm } (0 - 0.16 \text{ in})$

Stroke at pedal pad: A

$52 - 57 \text{ mm } (2.05 - 2.24 \text{ in})$



(A) Accelerator pedal

(B) Accelerator pedal bracket

Accelerator cable lock nut tightening torque:

$12 \text{ N}\cdot\text{m } (1.2 \text{ kgf}\cdot\text{m}, 9 \text{ ft}\cdot\text{lb})$

3. Accelerator Control Cable

A: REMOVAL

- 1) Remove the accelerator pedal. <Ref. to SP(H4SO)-3, REMOVAL, Accelerator Pedal.>
- 2) Separate the accelerator cable and accelerator pedal.

B: INSTALLATION

- 1) Install in the reverse order of removal.

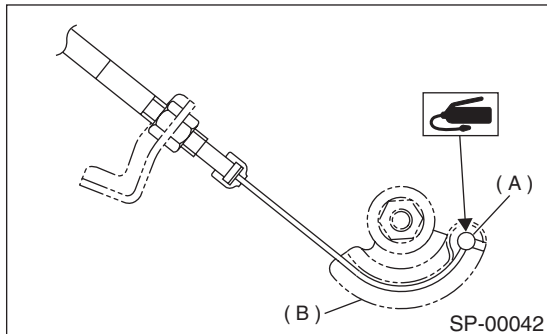
NOTE:

- If the cable clamp is damaged, replace it with a new one.
 - Never fail to cover the outer cable end with boot.
 - Be careful not to kink the accelerator cable.
 - Do not apply grease to the throttle cable on engine side.
 - Grease should not be applied to places other than specified.
- 2) Apply grease to the throttle cable end at the engine side.

Grease:

Parts No. 004404002

Slicolube G-30M



- 3) Install the pedal and then adjust it. <Ref. to SP(H4SO)-5, ADJUSTMENT, Accelerator Pedal.>

C: INSPECTION

- 1) Make sure the inner cable is not twisted or frayed.
- 2) Make sure the outer cable is not cracked.

GENERAL DESCRIPTION

STARTING/CHARGING SYSTEMS

1. General Description

A: SPECIFICATIONS

1. NON-TURBO MODEL

Item		Designation	
Starter	Type	Reduction type	
	Vehicle model	MT vehicles	AT vehicles
	Model	M000T83981	M000T86481
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation	Counterclockwise (when observed from pinion)	
	Number of pinion teeth	8	9
	No-load characteristics	Voltage	11 V
		Current	90 A or less
		Rotating speed	2,800 rpm or more
	Load characteristics		2,400 rpm or more
		Voltage	7.5 V
		Current	300 A
		Torque	8.6 N·m (0.88 kgf-m, 6.3 ft-lb) or more
		Rotating speed	16.0 N·m (1.63 kgf-m, 11.8 ft-lb) or more
Generator	Lock characteristics		740 rpm or more
		Voltage	4 V
		Current	3.5 V
	Torque		650 A or less
			940 A or less
			14.7 N·m (1.50 kgf-m, 10.8 ft-lb) or more
	Regulated voltage		28.9 N·m (2.95 kgf-m, 21.3 ft-lb) or more
	Type		
	Model	A2TB6291	
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12V — 90A	
	Polarity on ground side	Negative	
	Direction of rotation	Clockwise (when observed from pulley side)	
	Armature connection	3-phase Y-type	
	Output current	1,500 rpm — 36 A or more	
		2,500 rpm — 65 A or more	
		5,000 rpm — 86 A or more	
	Regulated voltage	14.1 — 14.8 V [20°C (68 °F)]	

GENERAL DESCRIPTION

STARTING/CHARGING SYSTEMS

2. TURBO MODEL

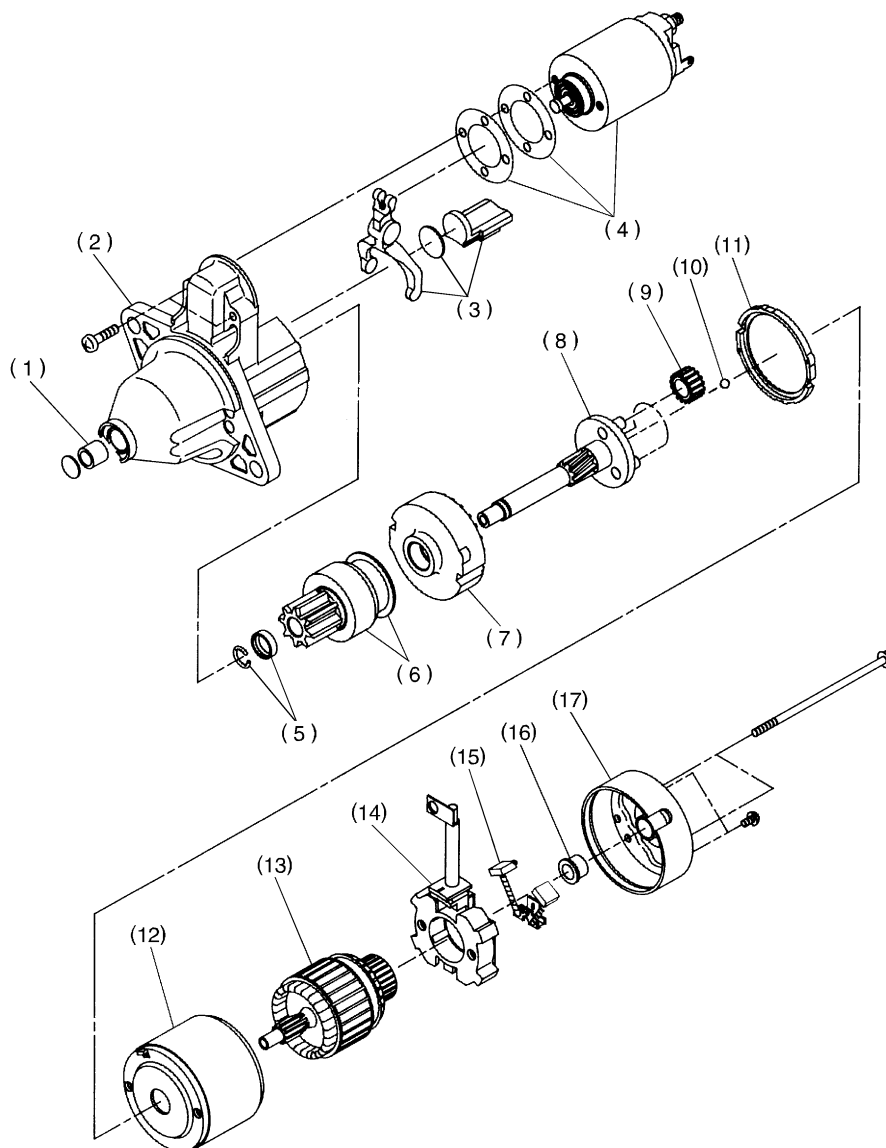
Item		Designation	
Starter	Type	Reduction type	
	Vehicle type	MT vehicles	AT vehicles
	Type	228000 — 9270	M001T86381
	Manufacturer	DENSO	Mitsubishi Electric
	Voltage and output	12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation	Counterclockwise (when observed from pinion)	
	Number of pinion teeth	9	
	No-load characteristics	Voltage	11 V
		Current	90 A or less
		Rotating speed	2,860 rpm or more 2,400 rpm or more
	Load characteristics	Voltage	8 V 7.7 V
		Current	280 A 400 A
		Torque	9.3 N·m (0.95 kgf-m, 6.9 ft-lb) or more 16.0 N·m (1.63 kgf-m, 11.8 ft-lb) or more
		Rotating speed	860 rpm or more 740 rpm or more
	Lock characteristics	Voltage	5 V 3.5 V
		Current	515 A or less 940 A or less
		Torque	16 N·m (1.63 kgf-m, 11.8 ft-lb) or more 28.9 N·m (2.95 kgf-m, 21.3 ft-lb) or more
Generator	Type	Rotating-field three-phase, voltage regulator built-in type, with load response control system	
	Type	A2TB6291	
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12 V — 75 A	
	Polarity on ground side	Negative	
	Direction of rotation	Clockwise (when observed from pulley side)	
	Armature connection	3-phase Y-type	
	Output current	1,500 rpm — 30 A or more 2,500 rpm — 64 A or more 5,000 rpm — 76 A or more	
	Regulated voltage	14.1 — 14.8 V [20 °C (68 °F)]	

GENERAL DESCRIPTION

STARTING/CHARGING SYSTEMS

B: COMPONENT

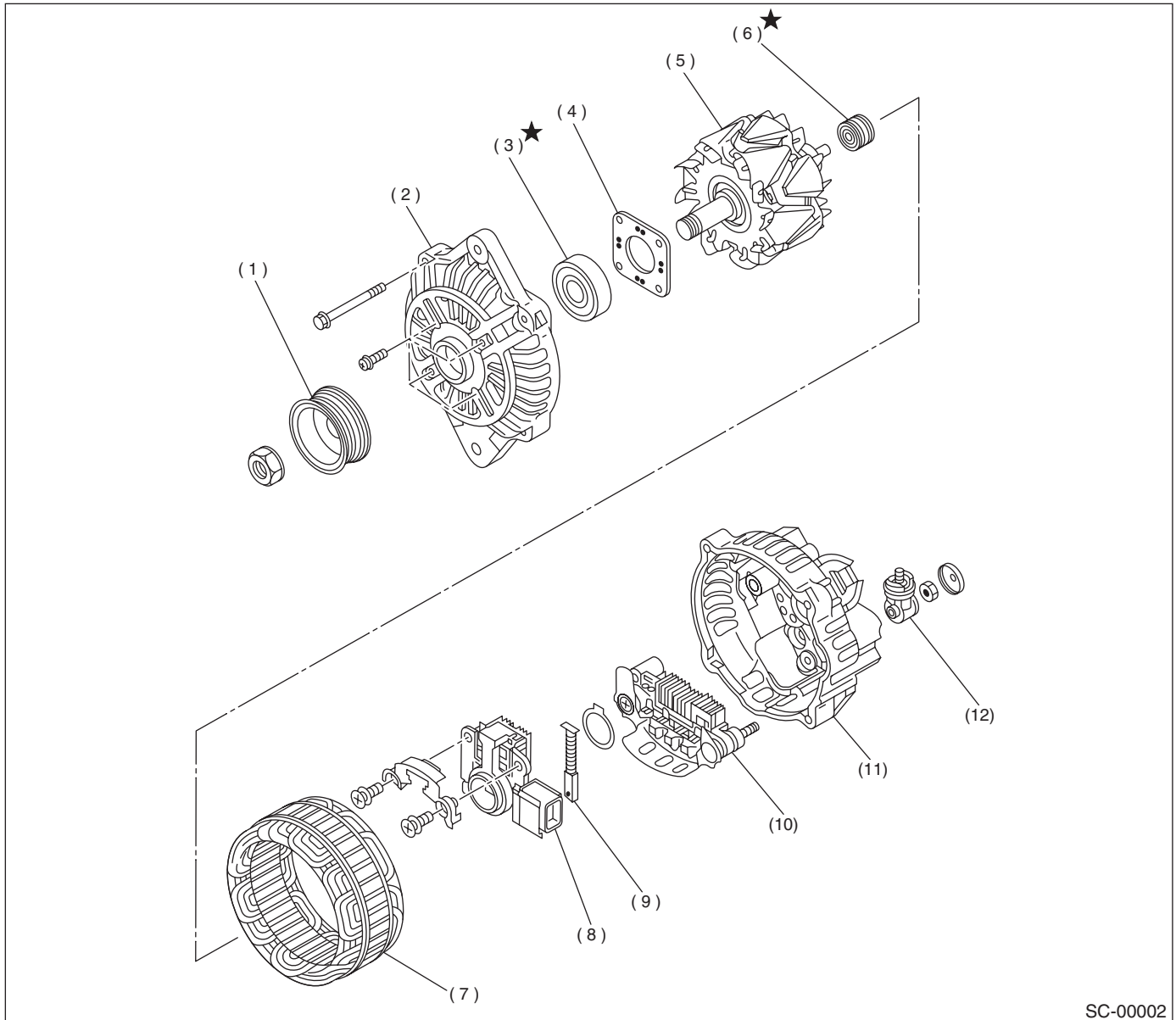
1. STARTER



SC-00168

- | | | |
|----------------------------|----------------------------|----------------------------|
| (1) Sleeve bearing | (7) Internal gear assembly | (13) Armature |
| (2) Front bracket | (8) Shaft assembly | (14) Brush holder assembly |
| (3) Lever set | (9) Gear assembly | (15) Brush |
| (4) Magnet switch assembly | (10) Ball | (16) Sleeve bearing |
| (5) Stopper set | (11) Packing | (17) Rear bracket |
| (6) Overrunning clutch | (12) Yoke assembly | (18) Rear cover set |

2. GENERATOR



SC-00002

- | | | |
|----------------------|-----------------------------|-----------------|
| (1) Pulley | (5) Rotor | (9) Brush |
| (2) Front cover | (6) Bearing | (10) Rectifier |
| (3) Ball bearing | (7) Stator coil | (11) Rear cover |
| (4) Bearing retainer | (8) IC regulator with brush | (12) Terminal |

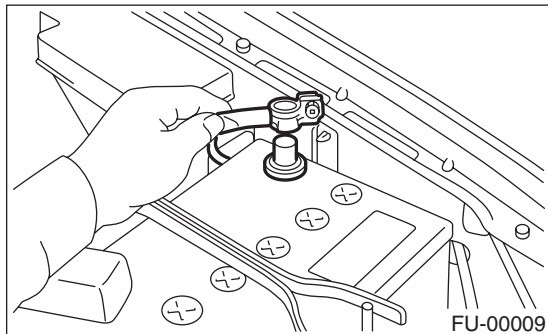
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Starter

A: REMOVAL

1) Disconnect the ground cable from battery.

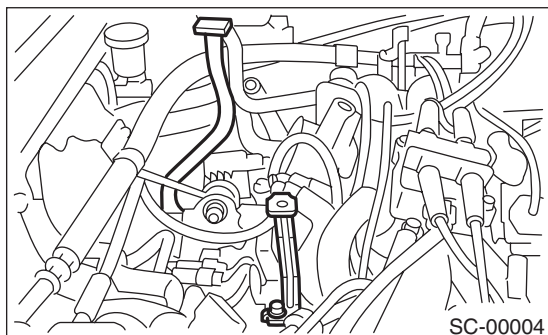


2) Remove the air cleaner case. (Non-turbo model)
<Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>

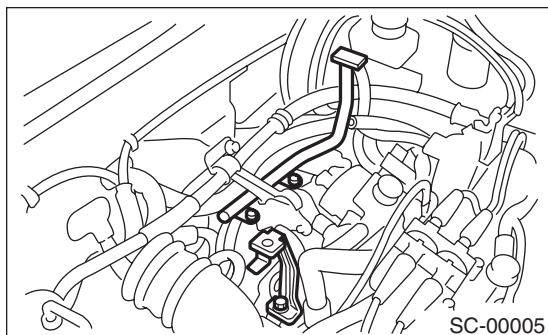
3) Remove the intercooler. (Turbo model)
<Ref. to IN(H4DOTC)-11, REMOVAL, Intercooler.>

4) Remove the air cleaner case stay. (Non-turbo model)

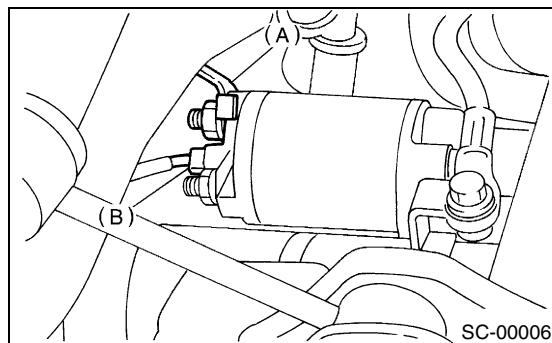
- MT model



- AT model

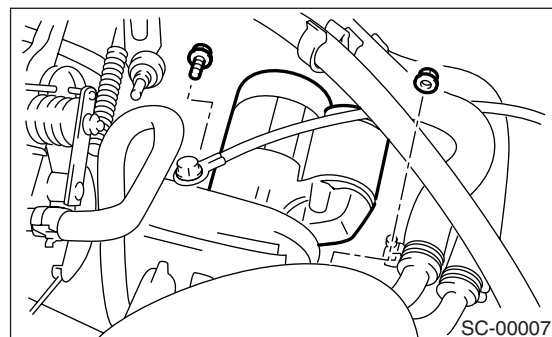


5) Disconnect the connector and terminal from starter.



- (A) Terminal
- (B) Connector

6) Remove the starter from transmission.

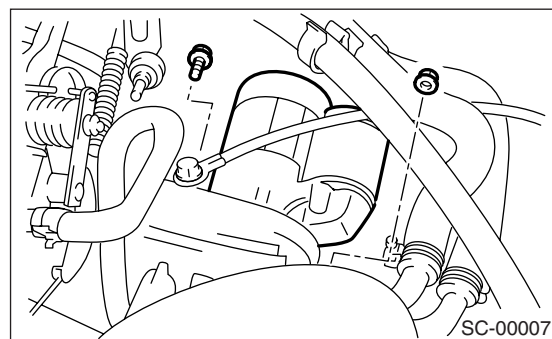


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

50 N·m (5.1 kgf-m, 37 ft-lb)



STARTER

STARTING/CHARGING SYSTEMS

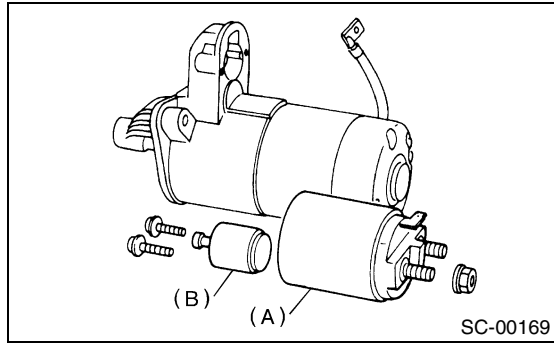
C: DISASSEMBLY

1. STARTER ASSEMBLY

- 1) Loosen the nut which holds terminal M of switch assembly, and then disconnect the connector.
- 2) Remove the bolts which hold the switch assembly, and then remove switch assembly, plunger and plunger spring from starter as a unit.

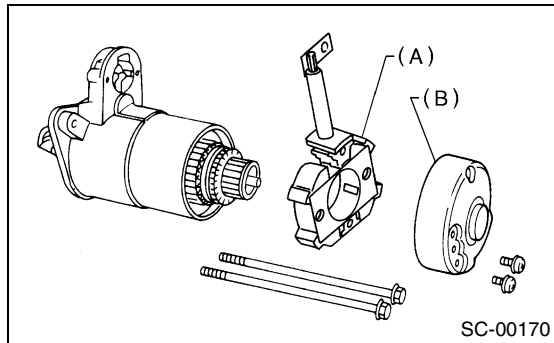
NOTE:

Be careful because the pinion gap adjustment washer may sometimes be used on the mounting surface of switch assembly.



- (A) Switch assembly
- (B) Plunger

- 3) Remove both through-bolts and brush holder screws, and then detach the rear cover and brush holder.

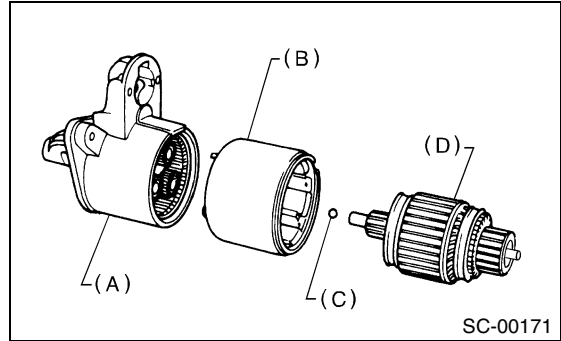


- (A) Brush holder
- (B) Rear cover

- 4) Remove the armature and yoke from front bracket. The ball used as a bearing will come off from the armature end.

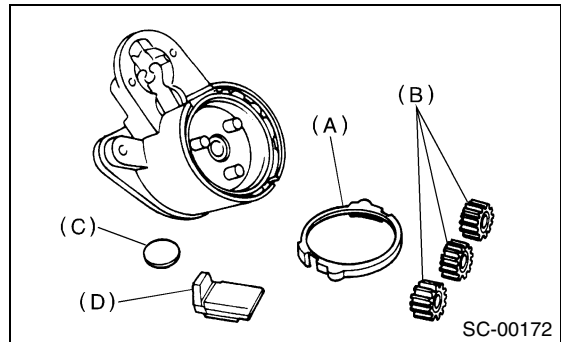
NOTE:

Before removal of the yoke, put alignment marks on the yoke and front bracket.



- (A) Front bracket
- (B) Yoke
- (C) Ball
- (D) Armature

- 5) Remove packing A, planetary gears, packing B and plate.

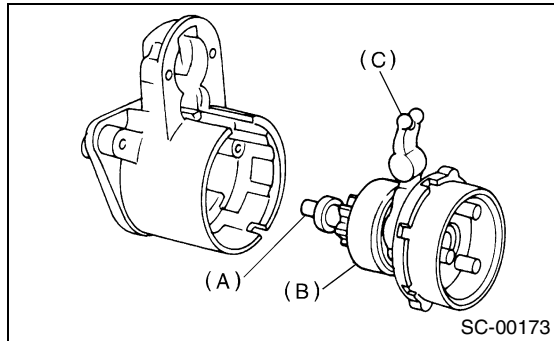


- (A) Packing A
- (B) Planetary gear
- (C) Plate
- (D) Packing B

6) Remove the shaft assembly and overrunning clutch as a unit.

NOTE:

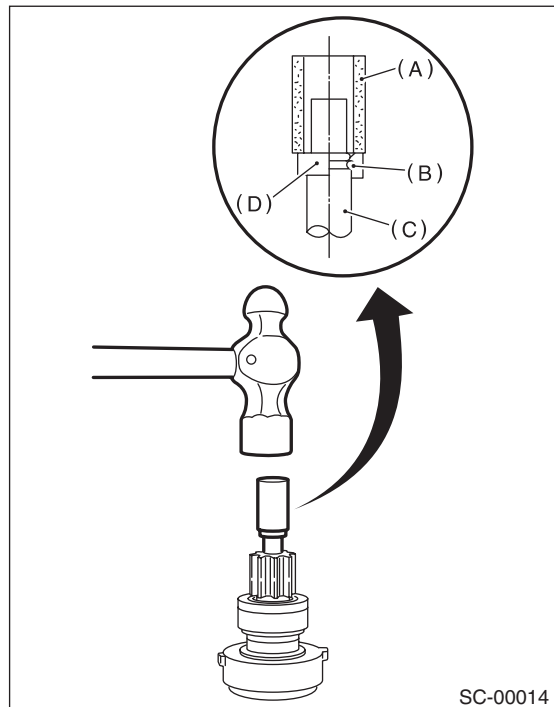
Note the direction of the lever before removing.



- (A) Shaft assembly
- (B) Overrunning clutch
- (C) Lever

7) Remove the overrunning clutch from shaft assembly as follows:

- (1) Remove the stopper from ring by lightly tapping the stopper with an appropriate tool (such as a fit socket wrench).
- (2) Remove the ring, stopper and clutch from shaft.



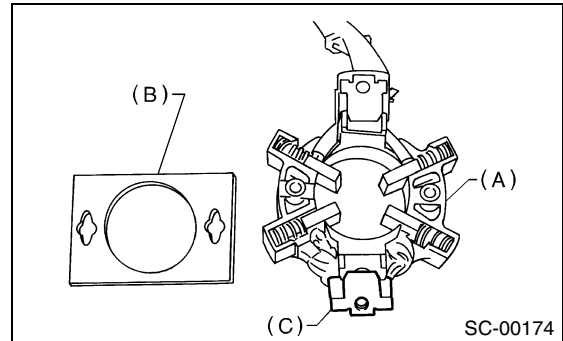
- (A) Socket wrench
- (B) Ring
- (C) Shaft
- (D) Stopper

2. BRUSH HOLDER

Slightly open the metal fitting while holding the insulating plate against the brush holder. Remove the insulating plate.

NOTE:

The brush and spring can be easily removed from the brush holder at this time.



- (A) Brush holder
- (B) Insulating plate
- (C) Metal fitting

D: ASSEMBLY

- 1) To assemble, reverse order of disassembly.
- 2) Apply grease to the following parts before assembly.
 - Front and rear bracket sleeve bearings
 - Armature shaft gear
 - Outer periphery of plunger
 - Mating surfaces of plunger and lever
 - Gear shaft splines
 - Mating surfaces of lever and clutch
 - Ball at armature shaft end
 - Planetary gear

STARTER

STARTING/CHARGING SYSTEMS

E: INSPECTION

1. ARMATURE

1) Check the commutator for any sign of burns or rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

2) Run-out test

Check the commutator run-out, and then replace if it exceeds the limit.

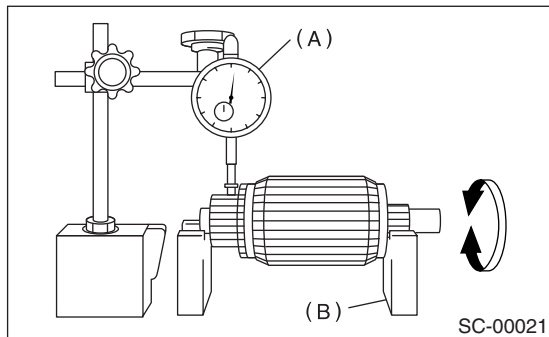
Commutator run-out:

Standard

0.05 mm (0.0020 in)

Service limit

Less than 0.10 mm (0.0039 in)



(A) Dial gauge

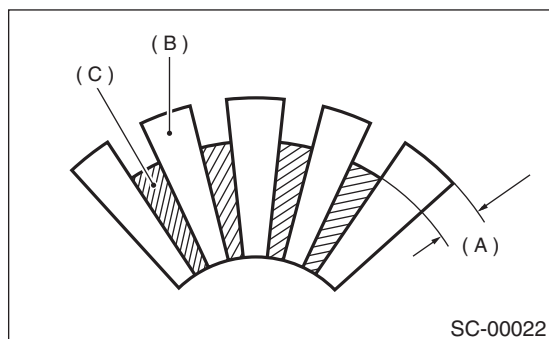
(B) V-block

3) Depth of segment mold

Check the depth of segment mold.

Depth of segment mold:

0.5 mm (0.020 in)



(A) Depth of mold

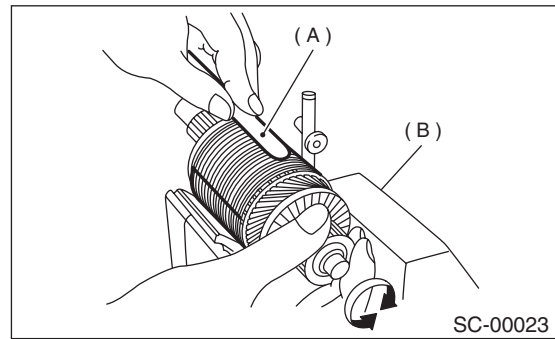
(B) Segment

(C) Mold

4) Armature short-circuit test

Check the armature for short-circuit by placing it on a growler tester. Hold an iron sheet against the armature core while slowly rotating armature. A short-circuited armature will cause the iron sheet to vibrate and to be attracted to core. If the iron sheet

is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.



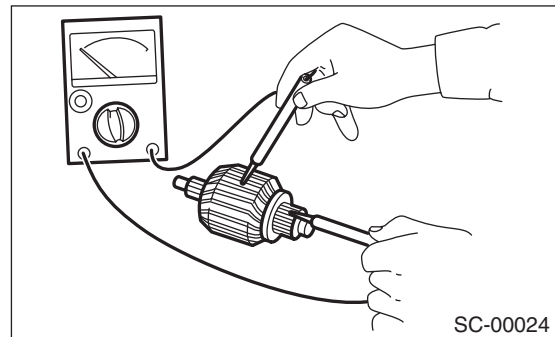
(A) Iron sheet

(B) Growler tester

5) Armature ground test

Using a circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is continuity, the armature is grounded.

Replace the armature if it is grounded.



2. YOKE

Make sure the pole is set in position.

3. OVERRUNNING CLUTCH

Inspect the teeth of pinion for wear and damage. Replace if it is damaged. It is normal if the pinion rotates smoothly in direction of rotation (counterclockwise) and does not rotate in the opposite direction.

CAUTION:

Do not clean the overrunning clutch with oil to prevent grease from flowing out.

4. BRUSH AND BRUSH HOLDER

1) Brush length

Measure the brush length, and then replace if it is worn down to under the service limit.

Replace if abnormal wear or cracks are noticed.

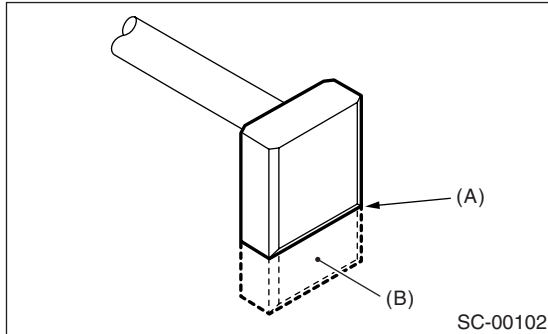
Brush length:

Standard

12.3 mm (0.484 in)

Service limit

7.0 mm (0.276 in)



(A) Service limit line
(B) Brush

2) Brush movement

Be sure the brush moves smoothly inside brush holder.

3) Brush spring force

Measure the brush spring force with a spring scale. If it is less than the service limit, replace the brush holder.

Brush spring force:

Standard

21.6 N (2.2 kgf, 4.9 lb) (when new)

Service limit

5.9 N (0.6 kgf, 1.3 lb)

5. SWITCH ASSEMBLY

Using a circuit tester (set in "ohm"), check if there is continuity between terminals S and M, and between terminal S and ground.

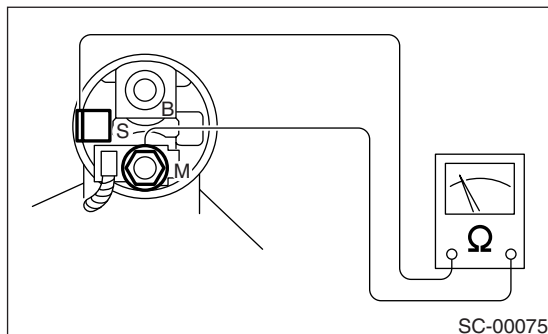
Also check to be sure there is no continuity between terminals M and B.

Terminal / Specified resistance:

S — M / Less than 1 Ω

S — Ground / Less than 1 Ω

M — B / More than 1 MΩ



SC-00075

6. SWITCH ASSEMBLY OPERATION

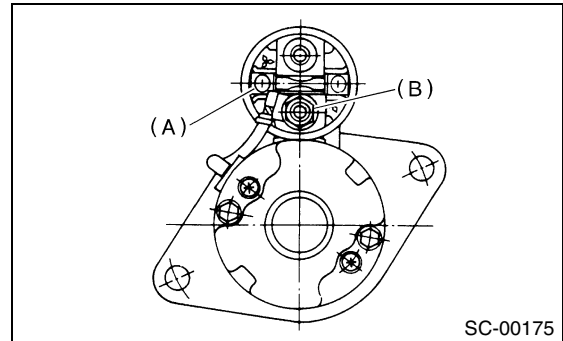
1) Connect the terminal S of switch assembly to positive terminal of battery with a lead wire, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

CAUTION:

With the pinion forced endwise on shaft, the starter motor may rotate because current flows through the pull-in coil to motor, however, this is not a problem.

2) Disconnect the connector from terminal M, and then connect the positive terminal of battery and terminal M using a lead wire 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.



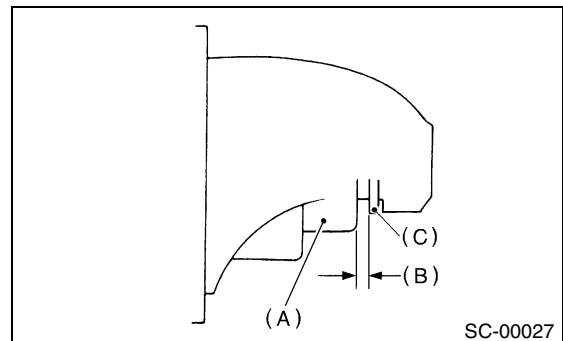
(A) Terminal S
(B) Terminal M

7. PINION GAP

1) Measure the pinion gap while the pinion is pulled out as shown in the figure.

Pinion gap:

0.5 — 2.0 mm (0.020 — 0.079 in)



(A) Pinion
(B) Gap
(C) Stopper

If the motor is running with the pinion forced endwise on shaft, disconnect the connector from termi-

STARTER

STARTING/CHARGING SYSTEMS

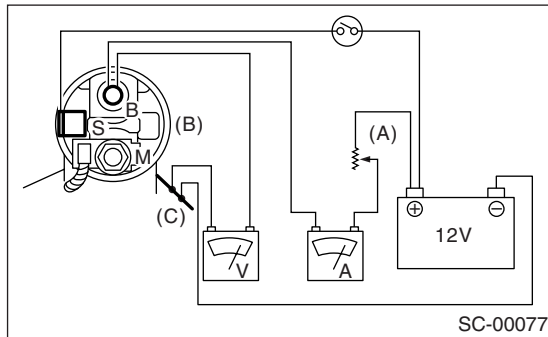
nal M of switch assembly, and then connect terminal M to ground terminal (–) of battery with a lead wire. Next, gently push the pinion back with your fingertips, and then measure the pinion gap.
2) If the pinion gap is outside specified range, remove or add number of adjustment washers used on the mounting surface of switch assembly until correct pinion gap is obtained.

8. 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 resistor
- (B) Magnetic switch
- (C) Starter body

1) No-load test

With switch on, adjust the variable resistor to obtain 11 V, take the ammeter reading, and then measure the starter speed. Compare these values with the specifications.

No-load test (standards):

Voltage / Current

11 V / 90 A max.

Rotating speed

Non-turbo MT vehicles

2,800 rpm or more

Turbo MT vehicles

2,860 rpm or more

AT vehicles

2,400 rpm or more

2) Load test

Apply the specified braking torque to starter. The condition is satisfactory if the current draw and starter speed are within the specifications.

Load test (standards):

Voltage / Load

Non-turbo MT vehicles

7.5 V/8.6 N·m (0.88 kgf-m, 6.3 ft-lb)

Turbo MT vehicles

8 V/9.3 N·m (0.95 kgf-m, 6.9 ft-lb)

AT vehicles

7.7 V/16.0 N·m (1.63 kgf-m, 11.8 ft-lb)

Current / Speed

Non-turbo MT vehicles

300 A/920 rpm or more

Turbo MT vehicles

280 A/860 rpm or more

AT vehicles

400 A/740 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 the specified voltage.

Lock test (standards):

Voltage / Current

Non-turbo MT vehicles

4 V/650 A or less

Turbo MT vehicles

5 V/515 A or less

AT vehicles

3.5 V/940 A or less

Torque

Non-turbo MT vehicles

14.7 N·m (1.50 kgf-m, 10.8 ft-lb) or more

Turbo MT vehicles

16 N·m (1.63 kgf-m, 11.8 ft-lb) or more

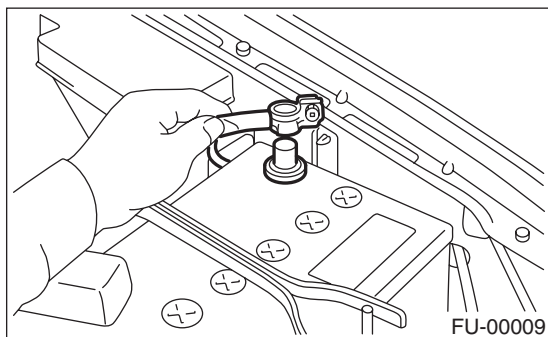
AT vehicles

28.9 N·m (2.95 kgf-m, 21.3 ft-lb) or more

3. Generator

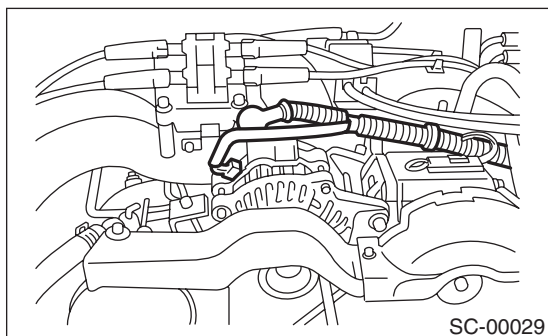
A: REMOVAL

1) Disconnect the ground cable from battery.

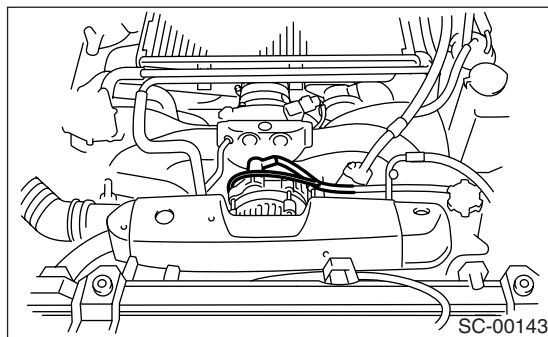


2) Disconnect the connector and terminal from generator.

- Non-turbo model



- Turbo model

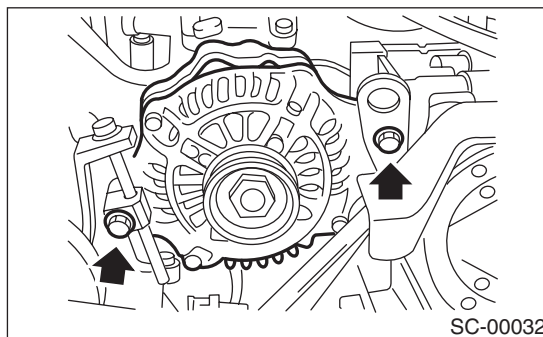


3) Remove the V-belt cover.

4) Remove the front side V-belt.

<Ref. to ME(H4SO)-42, FRONT SIDE BELT, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-44, FRONT SIDE BELT, REMOVAL, V-belt.>

5) Remove the bolts which install generator onto bracket.

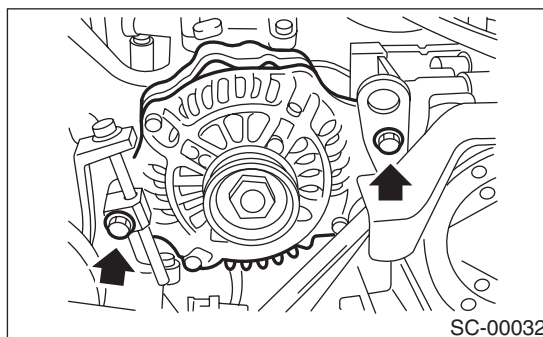


B: INSTALLATION

Install in the reverse order of removal.

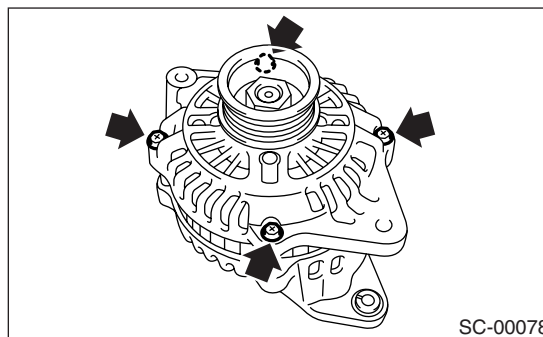
CAUTION:

Check and adjust the V-belt tension. <Ref. to ME(H4SO)-43, INSPECTION, V-belt.> or <Ref. to ME(H4DOTC)-45, INSPECTION, V-belt.>



C: DISASSEMBLY

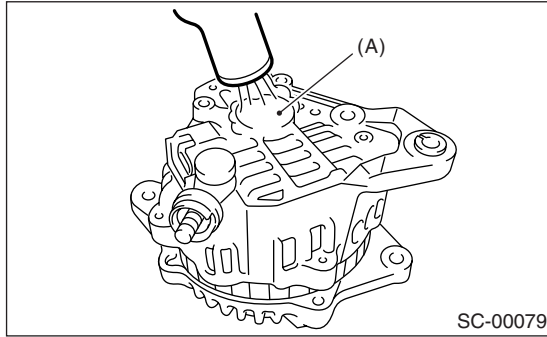
1) Remove the four through-bolts.



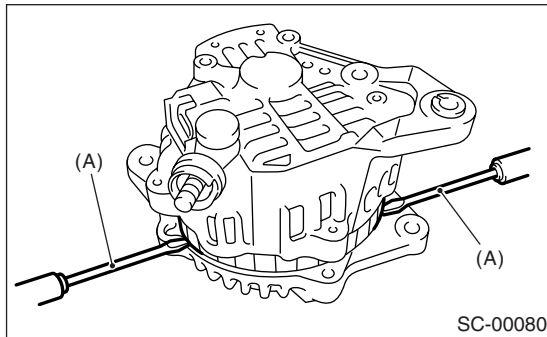
GENERATOR

STARTING/CHARGING SYSTEMS

2) Heat portion (A) of rear cover to 50°C (122°F) with a heater drier.

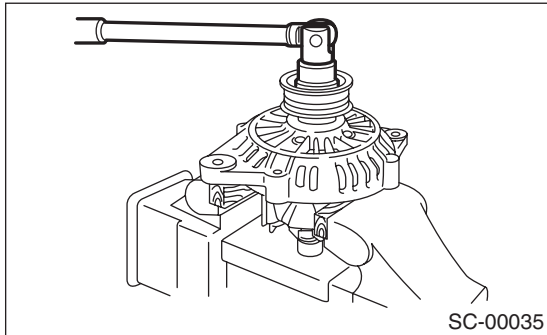


3) Then insert the tip of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.



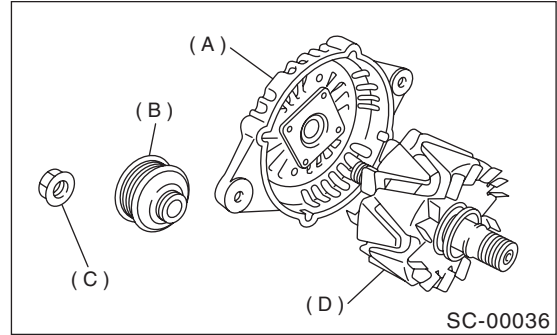
(A) Screwdriver

4) Hold the rotor with a vise and remove pulley nut.



CAUTION:

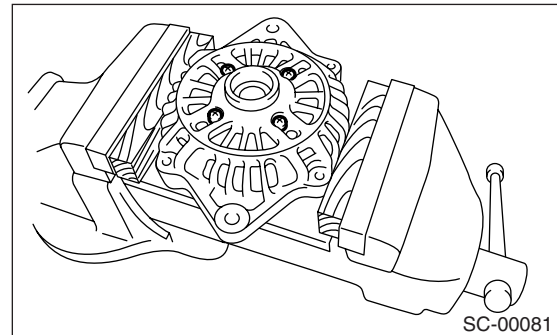
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



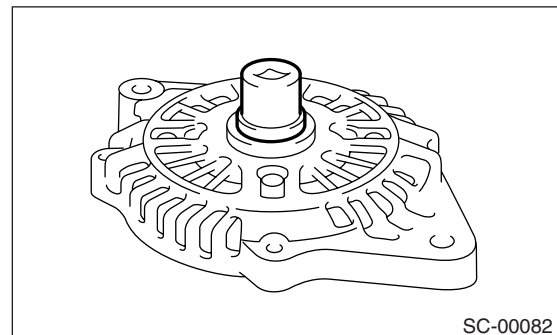
- (A) Front cover
- (B) Pulley
- (C) Nut
- (D) Rotor

5) Remove the ball bearing as follows.

(1) Remove the bolt, and then remove the bearing retainer.

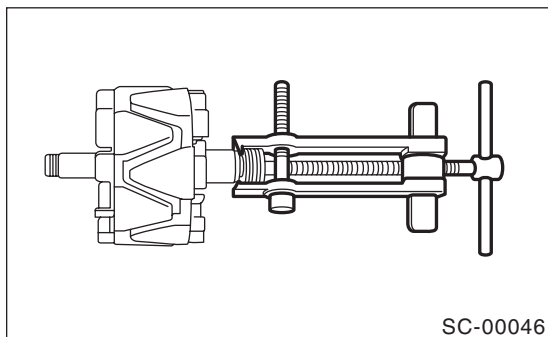


(2) Firmly install an appropriate tool (such as a fit socket wrench) to bearing inner race.



(3) Push the ball bearing off the front cover using a press.

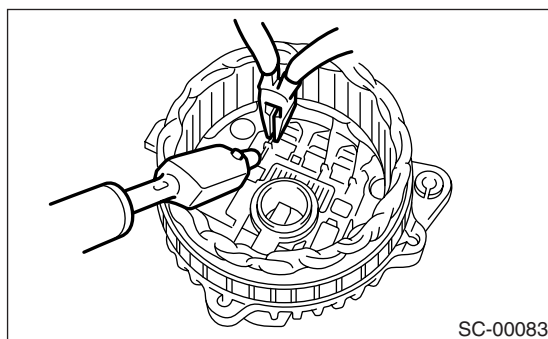
- 6) Remove the bearing from rotor using a bearing puller.



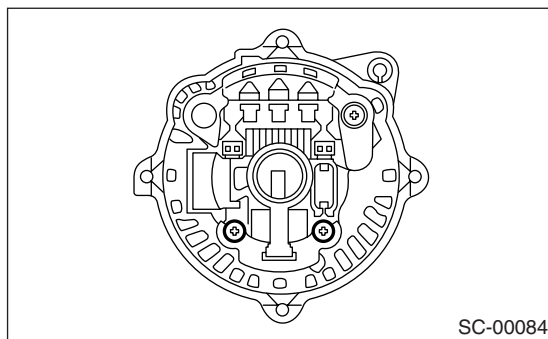
- 7) Unsolder connection between rectifier and stator coil to remove the stator coil.

CAUTION:

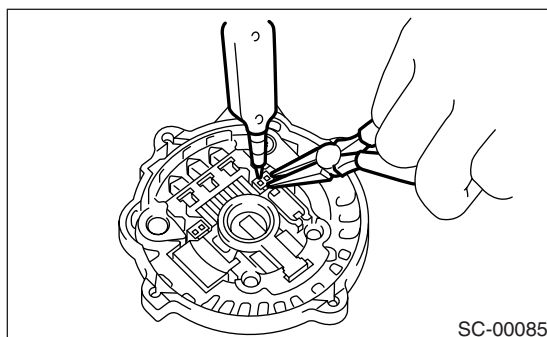
Do not allow a 180 — 270 W soldering iron to contact the terminals for more than 5 seconds at once because the rectifier cannot withstand so much heat.



- 8) Remove the IC regulator as follows.
(1) Remove the screws which secure IC regulator to rear cover.

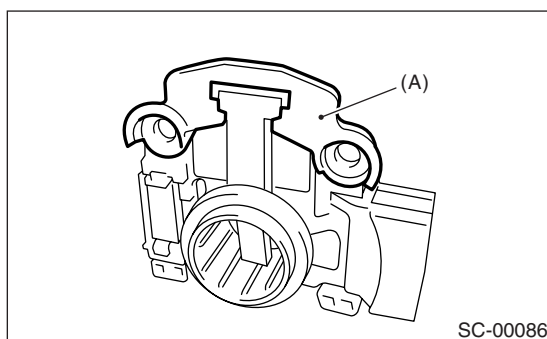


- (2) Unsolder the connection between IC regulator and rectifier to remove the IC regulator.



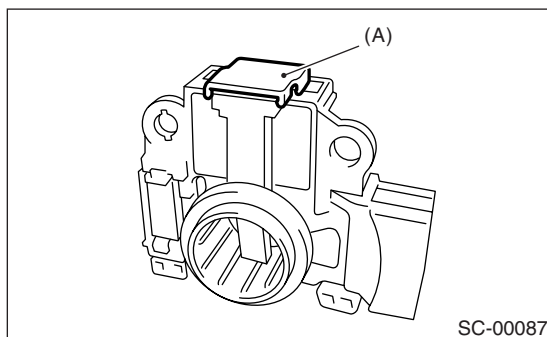
- 9) Remove the brush as follows.

- (1) Remove cover A.



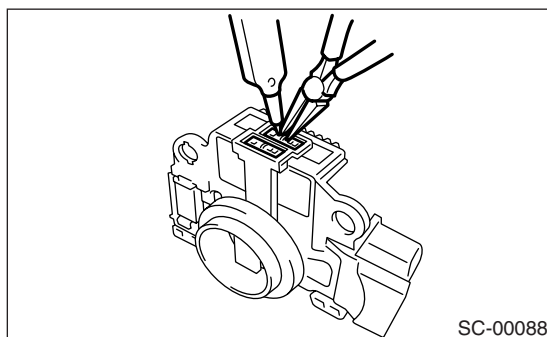
(A) Cover A

- (2) Remove cover B.



(A) Cover B

- (3) Separate the brush from connection to remove.

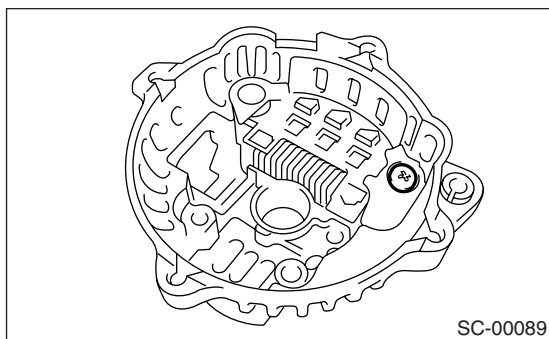


GENERATOR

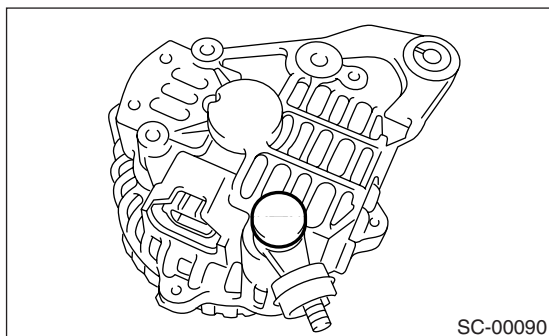
STARTING/CHARGING SYSTEMS

10) Remove the rectifier as follows.

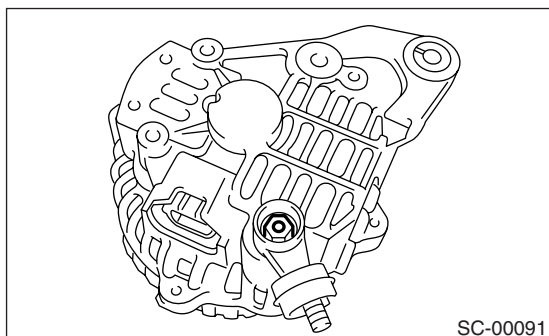
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover of terminal B.



(3) Remove the nut of terminal B, and then remove the rectifier.



D: ASSEMBLY

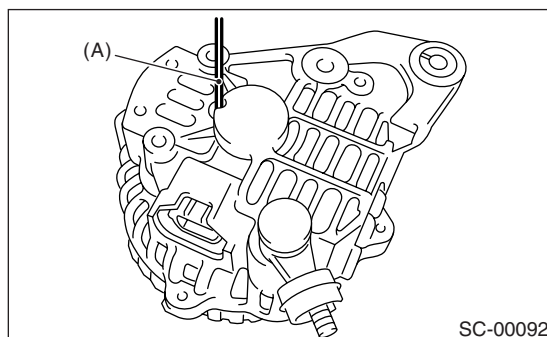
To assemble, reverse order of disassembly.

1) Pulling up brush

Before assembling, press the brush down into brush holder, and then fix them in that position by passing a [1 mm (0.08 in) dia. 4 to 5 cm (1.6 to 2.0 in) long] wire through the hole as shown in the figure.

CAUTION:

Be sure to remove the wire after reassembly.



(A) Wire

2) Install the ball bearing.

(1) Set the ball bearing on the front cover, and then securely install an appropriate tool (such as a fit socket wrench) to the bearing outer race.

(2) Press the ball bearing into the specified position using a press.

(3) Install the bearing retainer.

3) Press the bearing (rear side) into the rotor shaft using a press to install.

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:

Grease should not be applied to rear bearing. Remove the oil completely if it is found on bearing box.

5) After reassembly, turn the pulley by hand to check that rotor turns smoothly.

E: INSPECTION

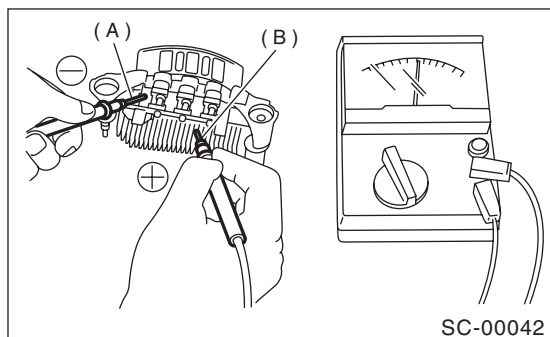
1. DIODE

CAUTION:

Never use a mega tester (designed for reading high voltage) or any other similar instrument for this test; otherwise, the diodes may be damaged.

1) Checking positive diode

Check for continuity between the diode lead and positive side heat sink. The positive diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the diode lead to heat sink.

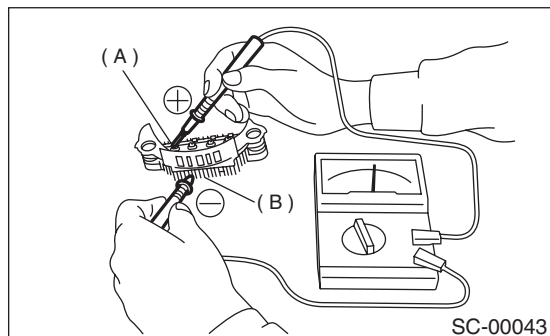


(A) Diode lead

(B) Heat sink (positive side)

2) Checking negative diode

Check for continuity between the negative side heat sink and diode lead. The negative diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the heat sink to diode lead.



(A) Diode lead

(B) Heat sink (negative side)

2. ROTOR

1) Slip ring surface

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) Slip ring outer diameter

Measure the slip ring outer diameter. If the slip ring is worn, replace the rotor assembly.

Slip ring outer diameter:

Standard

22.7 mm (0.894 in)

Limit

22.1 mm (0.870 in)

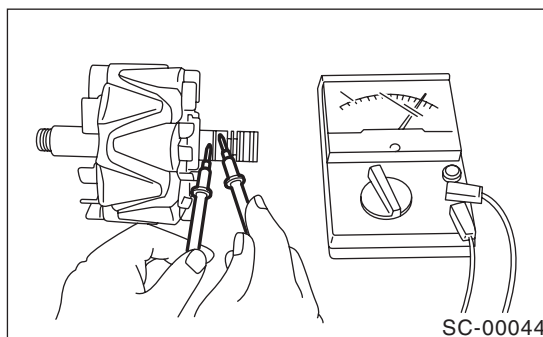
3) Continuity test

Check the resistance between slip rings using circuit tester.

If the resistance is not within the specified range, replace the rotor assembly.

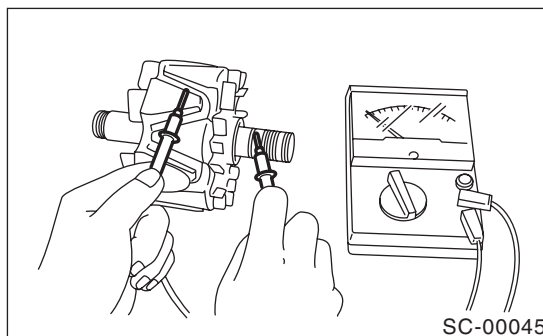
Specified resistance:

Approx. 1.8 — 2.2 Ω



4) Insulation test

Check the continuity between slip ring and rotor core or shaft. If resistance is $1\ \Omega$ or less, the rotor coil is grounded, and so replace the rotor assembly.



5) Ball bearing (rear side)

Check the rear ball bearing. Replace if it is noisy or if the rotor does not turn smoothly.

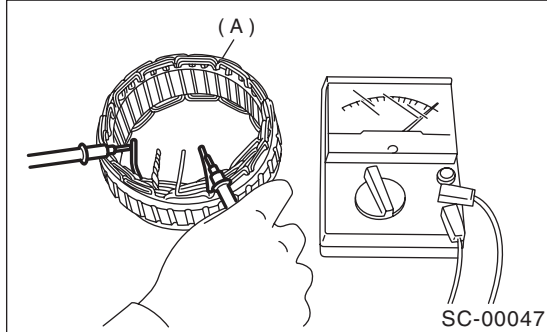
GENERATOR

STARTING/CHARGING SYSTEMS

3. STATOR

1) Continuity test

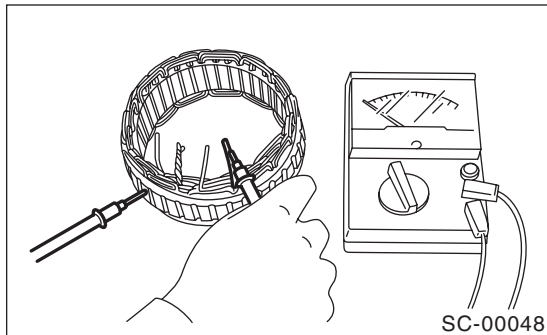
Inspect the stator coil for continuity between each end of the lead wires. If resistance is 1 M Ω or more, the lead wire is broken, and so replace the stator assembly.



(A) Stator

2) Insulation test

Inspect the stator coil for continuity between stator core and each end of lead wire. If resistance is 1 Ω or less, the stator coil is grounded, and so replace the stator assembly.



4. BRUSH

1) Measure the length of each brush. If wear exceeds the service limit, replace the brush. Each brush has the service limit mark (A) on it.

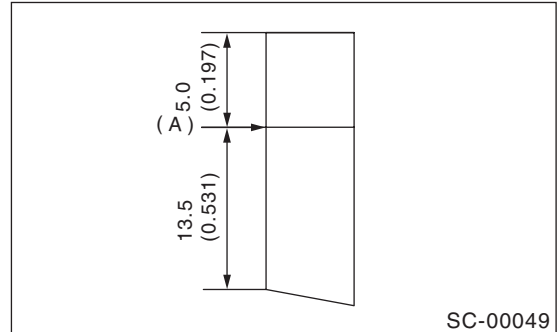
Brush length:

Standard

18.5 mm (0.728 in)

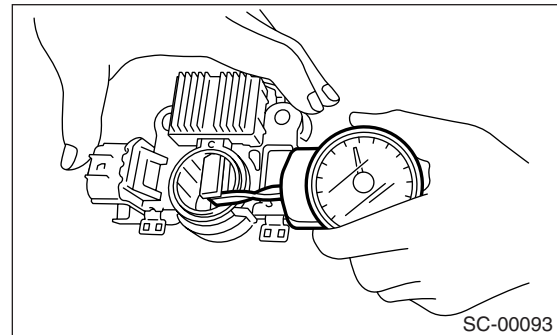
Service limit

5.0 mm (0.197 in)



2) Checking brush spring for proper pressure

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 less than 2.648 N (270 g, 9.52 oz), replace the brush spring with a new one. The new spring must have a pressure of 4.609 to 5.786 N (470 to 590 g, 16.58 to 20.810 oz).



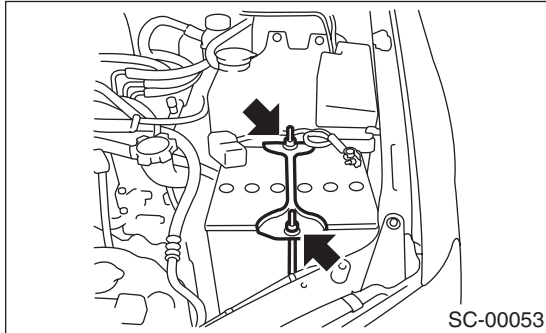
5. BEARING (FRONT SIDE)

Check the front ball bearing. If the resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

4. Battery

A: REMOVAL

- 1) Disconnect the positive (+) cable after disconnecting the ground (–) cable of battery.
- 2) Remove the flange nuts from battery rods, and then take off the battery holder.



- 3) Remove the battery.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)

NOTE:

- Clean the battery cable terminals, and then apply grease to retard formation of corrosion.
- Connect the positive (+) cable of battery and then the ground (–) cable of battery.

C: INSPECTION

WARNING:

- Electrolyte has toxicity; be careful handling the fluid.
- Avoid contact with skin, eyes or clothing. Especially at contact with eyes, flush with running water for 15 minutes and get prompt medical attention.
- Batteries produce explosive gasses. Keep sparks, flame, cigarettes away.
- Ventilate when charging or using in enclosed space.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. Never lean over a battery.
- Do not let the battery fluid contact eyes, skin, fabrics, or paint-work because battery fluid is corrosive acid.
- To lessen the risk of sparks, 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. This may cause a short circuit.

1. EXTERNAL PARTS:

Check for the existence of dirt or cracks on battery case, top cover, vent plugs, and terminal posts. 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 the 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 equation:

$$S_{20} = S_t + 0.0007 \times (t - 20)$$

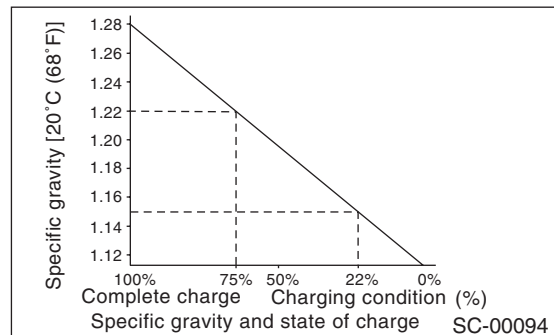
S₂₀: Specific gravity corrected at electrolyte temperature of 20°C

S_t: Measured specific gravity

t: Measured temperature (°C)

Determine whether or not battery must be charged, 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 battery will disclose the state of charge of 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 at this time.

CAUTION:

- Prior to charging, corroded terminals should be cleaned with a brush and common baking soda solution.

BATTERY

STARTING/CHARGING SYSTEMS

- Be careful since the battery electrolyte overflows while charging the battery.
- Observe the instructions when handling battery charger.
- Before charging the battery on vehicle, disconnect battery ground terminal to prevent damage of generator diodes or other electrical units.

1. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte is held within the specified range from 1.250 to 1.290 for more than one hour.

2) Voltage per battery cell is held at the specified range from 2.5 to 2.8 volts for more than one hour.

2. STATE OF CHARGE CHECK USING A HYDROMETER

Hydrometer indicator	State of charge	Corrective action
Green dot	Above 65%	Load test
Dark dot	Below 65%	Charge battery
Clear dot	Low electrolyte	Replace battery* (If cranking is difficult)
*: Check electrical system before replacement.		

3. NORMAL CHARGING

Charge the battery at current value specified by manufacturer or at approx. 1/10 of the battery's ampere-hour rating.

4. QUICK CHARGING

Quick charging is a method in which 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 large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not increase the electrolyte temperature above 40°C (104°F).

It should be also remembered that the quick charging is a temporary means to bring battery voltage up to a fair value and, as a rule, a battery should be charged slowly with a low current.

CAUTION:

- Observe the items in 3. NORMAL CHARGING.
- Never use more than 10 amperes when charging the battery because that will shorten battery life.